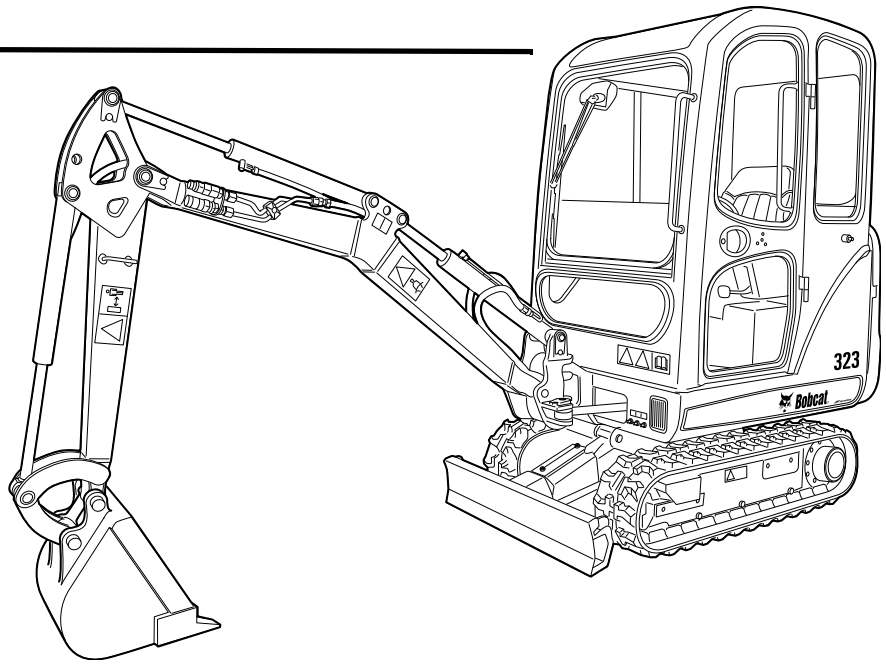
EN

321
323

Bobcat®

Service Manual

321 - S/N A76511001 and Above
323 - S/N A01711001 and Above



6986731-EN (08-08)
Bobcat
Printed in EUROPE
© Bobcat Company 2008


Bobcat®

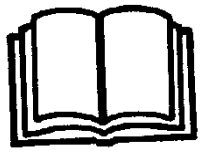
MAINTENANCE SAFETY

WARNING

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual, Operator's Handbook and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments, repairs or service. Untrained operators and failure to follow instructions can cause injury or death. W-2003-0903

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

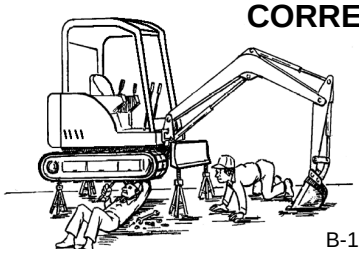
CORRECT



B-10731A

Never service the Bobcat Compact Excavator without instructions.

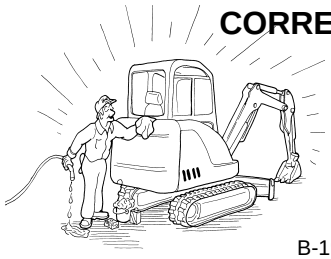
CORRECT



B-19964

Use the correct procedure to lift and support the excavator.

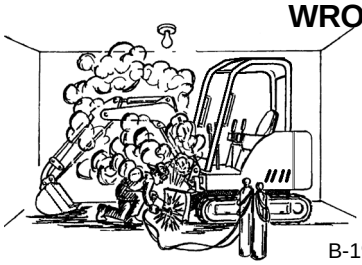
CORRECT



B-19959

Cleaning and maintenance are required daily.

WRONG

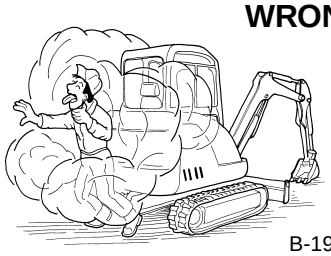


B-19965

Have good ventilation when welding or grinding painted parts.

Wear dust mask when grinding painted parts. Toxic dust and gas can be produced.

WRONG

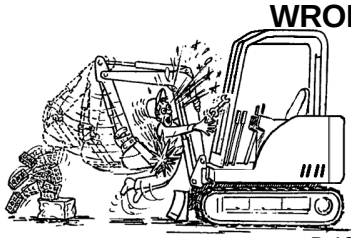


B-19960

Vent exhaust to outside when engine must be run for service.

Exhaust system must be tightly sealed. Exhaust fumes can kill without warning.

WRONG

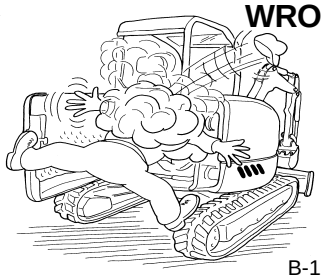


B-19966

Always lower the bucket and blade to the ground before doing any maintenance.

Never modify equipment or add attachments not approved by Bobcat Company.

WRONG



B-19962

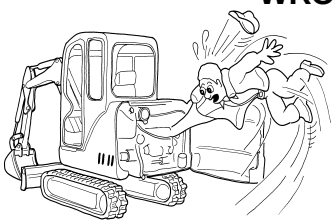
Stop, cool and clean engine of flammable materials before checking fluids.

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

Avoid contact with leaking hydraulic fluid or diesel fuel under pressure. It can penetrate the skin or eyes.

Never fill fuel tank with engine running, while smoking, or when near open flame.

WRONG



B-19958

Keep body, jewelry and clothing away from moving parts, electrical contact, hot parts and exhaust.

Wear eye protection to guard from battery acid, compressed springs, fluids under pressure and flying debris when engines are running or tools are used. Use eye protections approved for type of welding.

Keep tailgate closed except for service. Close and latch tailgate before operating the excavator.

WRONG



B-19798

Lead-acid batteries produce flammable and explosive gases.

Keep arcs, sparks, flames and lighted tobacco away from batteries.

Batteries contain acid which burns eyes or skin on contact.

Wear protective clothing. If acid contacts body, flush well with water. For eye contact flush well and get immediate medical attention.

Maintenance procedures which are given in the Operation & Maintenance Manual can be performed by the owner / operator without any specific technical training. Maintenance procedures which are **not** in the Operation & Maintenance Manual must be performed **ONLY BY QUALIFIED BOBCAT SERVICE PERSONNEL. Always use genuine Bobcat replacement parts.** The Service Safety Training Course is available from your Bobcat dealer.

MSW28-0805


Bobcat®

ALPHABETICAL INDEX

ACCUMULATORS 20-01
AIR CLEANER 60-01
AIRCLEANER SERVICE 10-01
ALTERNATOR 50-01
ALTERNATOR BELT 10-01
ARM 40-01
ARM CYLINDER 20-01

BATTERY 50-01
BLADE 30-01
BLADE CONTROL 40-01
BLADE CYLINDER 20-01
BLADE / TRACK EXPANSION SOLENOID BLOCK 20-01
BOOM 40-01
BOOM CYLINDER 20-01
BOOM SWING CYLINDER 20-01
BUCKET 40-01
BUCKET CYLINDER 20-01

CAB 40-01
CAB FILTER 10-01
CONTROL CONSOLE LOCKOUTS 10-01
CONTROL LINKAGE ASSEMBLY 40-01
CONVERSIONS SPEC-01
CROSSPORT RELIEF VALVES 20-01

ELECTRICAL SYSTEM INFORMATION 50-01
ENGINE 60-01
ENGINE COMPONENTS AND TESTING 60-01
ENGINE COOLING SYSTEM 10-01
ENGINE FLYWHEEL 60-01
ENGINE LUBRICATION SYSTEM 10-01
ENGINE SPEED CONTROL 40-01

FLOORMAT AND FLOORPLATES 40-01
FLYWHEEL AND HOUSING 60-01
FUEL LEVEL SENDER 50-01
FUEL SYSTEM 10-01
FUEL TANK 40-01

HEATER COIL 70-01
HEATER FAN 70-01
HEATER SYSTEM 70-01
HEATER UNIT 70-01
HEATER VALVE 70-01
HORN 40-01
HYDRAULIC CONNECTION SPECIFICATIONS SPEC-01
HYDRAULIC CONTROL VALVE 20-01
HYDRAULIC FILTER MOUNT 20-01
HYDRAULIC FLUID SPECIFICATIONS SPEC-01
HYDRAULIC PUMP 20-01
HYDRAULIC RESERVOIR 20-01
HYDRAULIC SYSTEM 10-01
HYDRAULIC SYSTEM INFORMATION 20-01

LEFT CONSOLE 40-01
LEFT CONTROL LEVER (JOYSTICK) 20-01
LEFT PEDAL 40-01
LIFTING AND BLOCKING THE EXCAVATOR 10-01
LIFTING THE EXCAVATOR 10-01
LIGHTS 50-01
LUBRICATION OF THE HYD. EXCAVATOR 10-01

MAIN RELIEF VALVE 20-01
MANIFOLD ASSEMBLY / ACCUMULATOR 20-01
MICROSWITCH 50-01

OIL COOLER 20-01
OPERATOR CAB (ROPS / TOPS) 10-01

PORT RELIEF VALVES 20-01
PRESSURE REDUCING VALVE 20-01

RADIATOR 60-01
RECONDITIONING THE ENGINE 60-01
REGULATOR MAINTENANCE 70-01
RIGHT CONSOLE 40-01
RIGHT CONTROL LEVER (JOYSTICK) 20-01
RIGHT PEDAL 40-01
ROPS CANOPY 40-01

SEAT AND SEAT MOUNT 40-01
SEAT BELT 10-01
SERVICE SCHEDULE 10-01
SPARK ARRESTOR MUFFLER ..... 10-01 & 60-01
SPECIFICATIONS 321 EXCAVATOR SPEC-01
SPECIFICATIONS 323 EXCAVATOR SPEC-01
STARTER 50-01
SWING CIRCLE GEAR 30-01
SWING FRAME 40-01
SWING MOTOR 20-01
SWIVEL JOINT 20-01

TAILGATE ..... 10-01 & 40-01
TORQUE SPECIFICATIONS FOR BOLTS SPEC-01
TRACK DAMAGE IDENTIFICATION 30-01
TRACK FRAME 30-01
TRACK IDLER 30-01
TRACK FRAME EXPANSION CYLINDER 20-01
TRACK ROLLER 30-01
TRACKS 30-01
TRANSPORTING THE EXCAVATOR 10-01
TRAVEL CONTROLS 40-01
TRAVEL MOTOR ..... 10-01 & 20-01
TROUBLESHOOTING 60-01
TWO-SPEED BOOST SWITCH 50-01

UPPERSTRUCTURE 40-01
UPPERSTRUCTURE SLEW LOCK ..... 10-01 & 40-01


Bobcat®

CONTENTS

FOREWORD iii

SAFETY INSTRUCTIONS v

SERIAL NUMBER LOCATIONS x

DELIVERY REPORT xi

BOBCAT EXCAVATOR IDENTIFICATION xii

SAFETY AND MAINTENANCE 10-01

HYDRAULIC SYSTEM 20-01

UNDERCARRIAGE 30-01

UPPERSTRUCTURE AND SWING SECTION. 40-01

ELECTRICAL SYSTEM AND ANALYSIS 50-01

ENGINE SERVICE 60-01

HEATER 70-01

SPECIFICATIONS SPEC-01

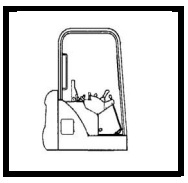

Bobcat®

FOREWORD

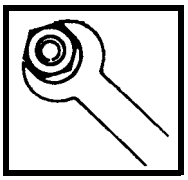
This manual is for the Bobcat Hydraulic Excavator mechanic. It provides necessary servicing and adjustment procedures for the hydraulic excavator and its component parts and systems. Refer to the Operation & Maintenance Manual for operating instructions, starting procedure, daily checks, etc.

A general inspection of the following items must be made after the hydraulic excavator has had service or repair:

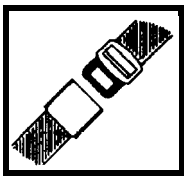
1. Check that the ROPS / TOPS / FOGS is in good condition and is not modified.



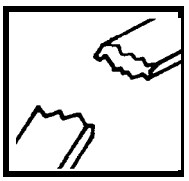
2. Check that ROPS / TOPS mounting hardware is tightened and is Bobcat approved.



3. The seat belt must be correctly installed, functional and in good condition.



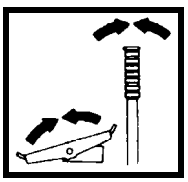
4. Inspect for loose or broken parts or connections.



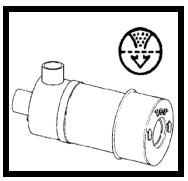
5. Machine signs must be legible and in the correct location.



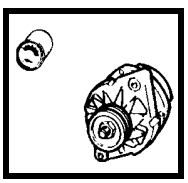
6. Steering levers, control levers and foot pedals must return to neutral. Check that foot pedals lock and control lever locks are in working order.



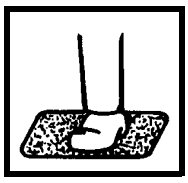
7. Inspect the air cleaner for damage or leaks. Check the condition of the element.



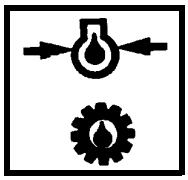
8. Check the electrical charging system.



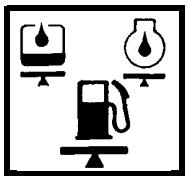
9. Safety treads must be in good condition.



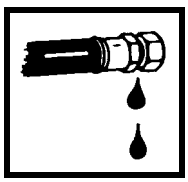
10. Check for correct function of indicator lamps (Optional on some models).



11. Check hydraulic fluid level, engine oil level and fuel supply.



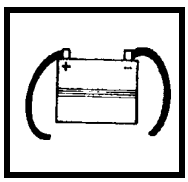
12. Inspect for fuel, oil or hydraulic fluid leaks.



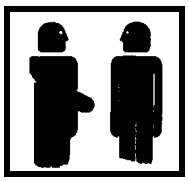
13. Lubricate the excavator.



14. Check the condition of the battery and cables.



15. Recommend to the owner that all necessary corrections be made before the machine is returned to service.




Bobcat®

Safety Alert Symbol

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

WARNING

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

W-2003-0903

IMPORTANT

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

I-2019-0284

DANGER

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

D-1002-1107

WARNING

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

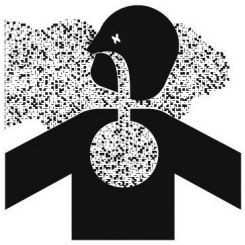
W-2044-1107

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

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

SI EXC-0308 SM

The dealer and owner / operator review the recommended uses of the product when delivered. If the owner / operator will be using the machine for a different application(s) he or she must ask the dealer for recommendations on the new use.



Cutting or drilling concrete containing sand or rock containing quartz may result in exposure to silica dust. Do not exceed Permissible Exposure Limits (PEL) to silica dust as determined by OSHA or other job site Rules and Regulations. Use a respirator, water spray or other means to control dust. Silica dust can cause lung disease and is known to the state of California to cause cancer.

SI EXC-0308 SM

FIRE PREVENTION



Maintenance

The machine and some attachments have components that are at high temperatures under normal operating conditions. The primary source of high temperatures is the engine and exhaust system. The electrical system, if damaged or incorrectly maintained, can be a source of arcs or sparks.

Flammable debris (leaves, straw, etc.) must be removed regularly. If flammable debris is allowed to accumulate, it can cause a fire hazard. Clean often to avoid this accumulation. Flammable debris in the engine compartment is a potential fire hazard.

The operator's area, engine compartment and engine cooling system must be inspected every day and cleaned if necessary to prevent fire hazards and overheating.

All fuels, most lubricants and some coolants mixtures are flammable. Flammable fluids that are leaking or spilled onto hot surfaces or onto electrical components can cause a fire.

Operation

Do not use the machine where exhaust, arcs, sparks or hot components can contact flammable material, explosive dust or gases.

Electrical



Check all electrical wiring and connections for damage. Keep the battery terminals clean and tight. Repair or replace any damaged part or wires that are loose or frayed.

Battery gas can explode and cause serious injury. Use the procedure in the Operation & Maintenance Manual for connecting the battery and for jump starting. Do not jump start or charge a frozen or damaged battery. Keep any open flames or sparks away from batteries. Do not smoke in battery charging area.

Hydraulic System

Check hydraulic tubes, hoses and fittings for damage and leakage. Never use open flame or bare skin to check for leaks. Hydraulic tubes and hoses must be properly routed and have adequate support and secure clamps. Tighten or replace any parts that show leakage.

Always clean fluid spills. Do not use gasoline or diesel fuel for cleaning parts. Use commercial nonflammable solvents.

Fueling



Stop the engine and let it cool before adding fuel. No smoking! Do not refuel a machine near open flames or sparks. Fill the fuel tank outdoors.

Starting

Do not use ether or starting fluids on any engine that has glow plugs. These starting aids can cause explosion and injure you or bystanders.

Use the procedure in the Operation & Maintenance Manual for connecting the battery and for jump starting.

SI EXC-0308 SM

FIRE PREVENTION (CONT'D)

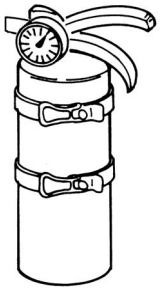
Welding And Grinding

Always clean the machine and attachment, disconnect the battery, and disconnect the wiring from the Bobcat controllers before welding. Cover rubber hoses, battery and all other flammable parts. Keep a fire extinguisher near the machine when welding.

Have good ventilation when grinding or welding painted parts. Wear dust mask when grinding painted parts. Toxic dust or gas can be produced.

Dust generated from repairing nonmetallic parts such as hoods, fenders or covers can be flammable or explosive. Repair such components in a well ventilated area away from open flames or sparks.

Fire Extinguishers



Know where fire extinguishers and first aid kits are located and how to use them. Inspect the fire extinguisher and service the fire extinguisher regularly. Obey the recommendations on the instructions plate.

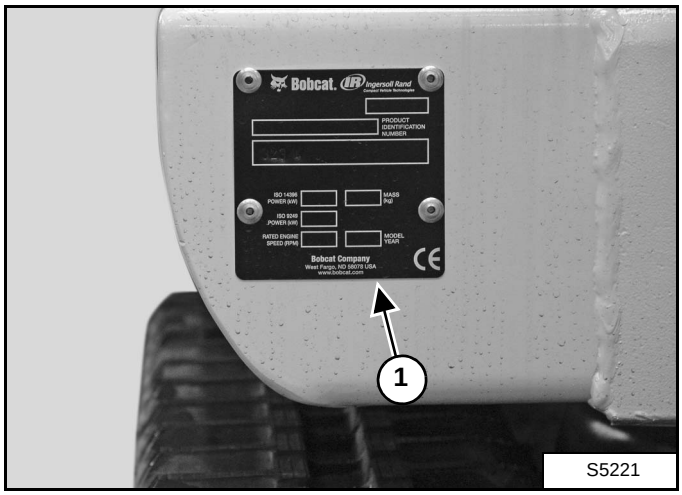
SI EXC-0308 SM

SERIAL NUMBER LOCATIONS

Always use the serial number of the excavator when requesting service information or when ordering parts. Early or later models (identification made by serial number) may use different parts, or it may be necessary to use a different procedure in doing a specific service operation.

Excavator Serial Number

Figure 1



The excavator serial number plate (Item 1) **[Figure 1]** is located on the front right hand corner of the frame.

Explanation of Excavator Serial Number:

XXXX XXXXX

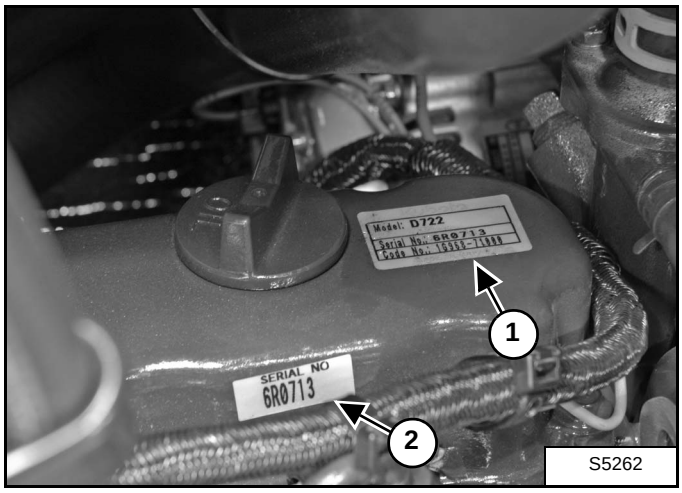
- XXXXX — Module 2. - Production Sequence (Series)
- XXXX — Module 1. - Model / Engine Combination

1. The four-digit Model / Engine Combination Module number identifies the model number and engine combination.

2. The five-digit Production Sequence Number identifies the order in which the excavator is produced.

Engine Serial Number

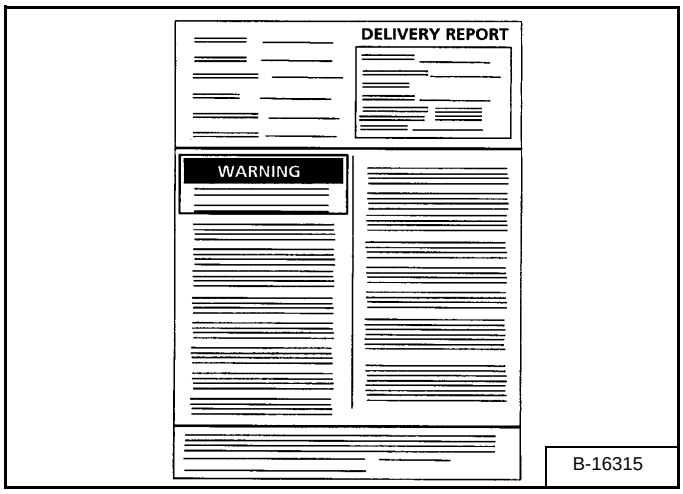
Figure 2



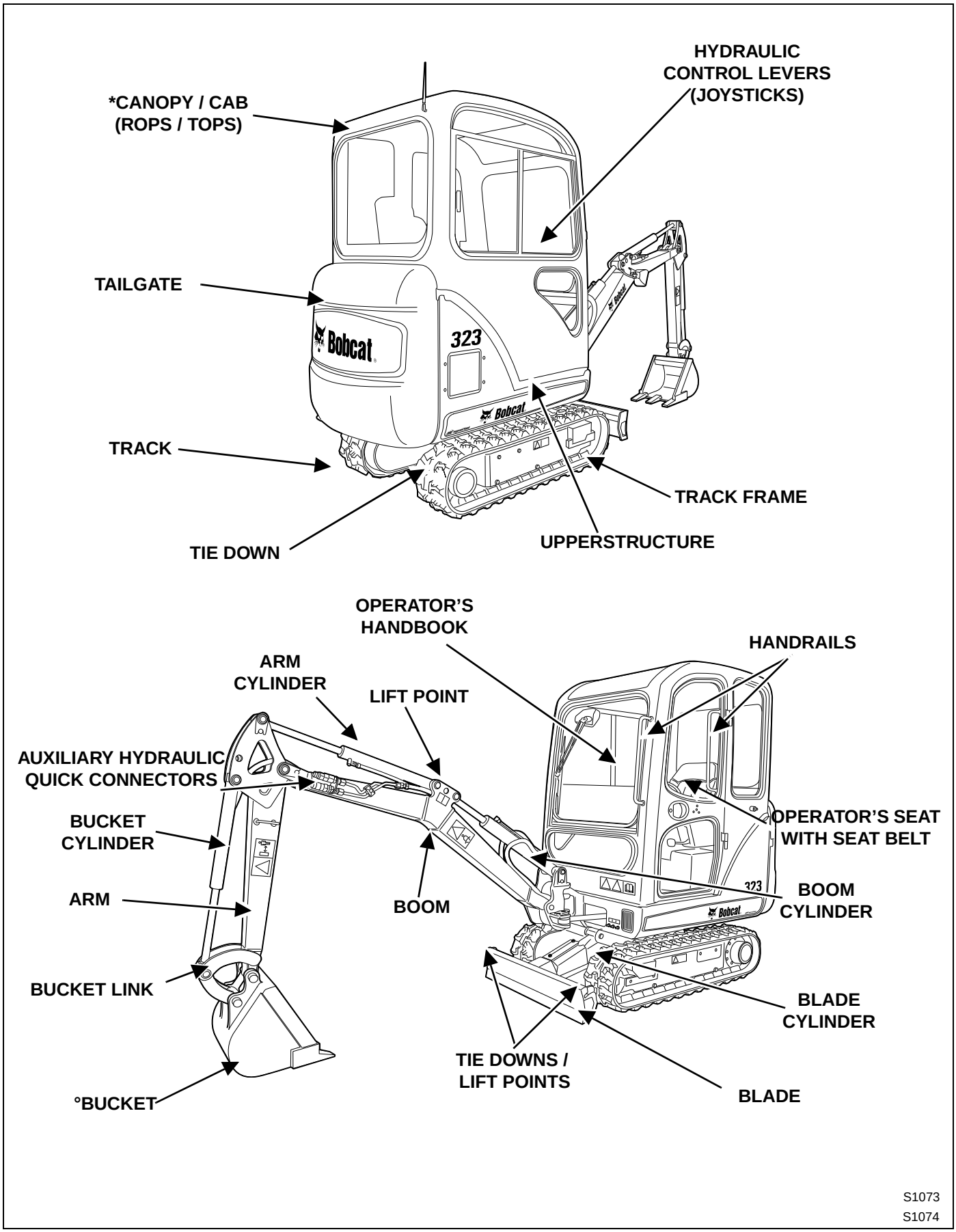
The engine serial number plate (Item 1) and the engine serial number sticker (Item 2) **[Figure 2]** are located on top of the engine.

DELIVERY REPORT

Figure 3



The Delivery Report items must be explained to the owner / operator by the dealer. The dealer is to complete the form and the owner / operator signs the form to indicate his understanding **[Figure 3]**.



*ROPS, TOPS - (Roll Over Protective Structure - Tip Over Protective Structure) as standard equipment. The ROPS / TOPS meets ISO 3471 and ISO 12117. FOGS (Falling Object Guards) is available from your Bobcat Excavator dealer.
° BUCKET - Several different buckets and other attachments are available from the Bobcat Loader.


Bobcat®

SAFETY AND MAINTENANCE

AIR CLEANER SERVICE 10-60-1
Daily Check 10-60-1
Replacing The Filters 10-60-1

ALTERNATOR BELT 10-140-1
Adjusting The Alternator Belt 10-140-1

CAB FILTER 10-61-1
Cleaning And Maintenance 10-61-1

CONTROL CONSOLE LOCKOUTS 10-160-1
Inspection And Maintenance 10-160-1

ENGINE COOLING SYSTEM. 10-70-1
Checking The Coolant Level 10-70-1
Cleaning The Cooling System. 10-70-1
Replacing The Coolant 10-70-1

ENGINE LUBRICATION SYSTEM 10-90-1
Checking Engine Oil 10-90-1
Replacing Oil And Filter. 10-90-1

FUEL SYSTEM. 10-80-1
Draining The Fuel Tank 10-80-2
Filling The Fuel Tank 10-80-1
Fuel Specifications 10-80-1
Removing Air From The Fuel System 10-80-2
Removing Water From The Fuel Filter 10-80-1
Replacing The Fuel Filter 10-80-1

HYDRAULIC SYSTEM 10-100-1
Checking And Adding Hydraulic Oil 10-100-1
Diagnostic Connectors 10-100-1
Replacing Hydraulic Oil. 10-100-2
Replacing The Hydraulic Filter 10-100-2

LIFTING AND BLOCKING THE EXCAVATOR 10-10-1
Procedure 10-10-1

LIFTING THE EXCAVATOR 10-12-1

LUBRICATION OF THE HYDRAULIC EXCAVATOR 10-110-1
Blade 10-110-1
Boom And Arm 10-110-3
Boom, Middle 10-110-3
Boom Swing And Boom Base 10-110-2
Frame Fittings 10-110-4
Rear Door Hinges 10-110-1
Track Expansion Tube 10-110-4

Continued On Next Page

OPERATOR CAB (ROPS / TOPS) (IF EQUIPPED) 10-20-1
Cab Door 10-20-1
Emergency Exits 10-20-1
Front Window. 10-20-2
Front Window Wiper 10-20-3
Right Side Windows 10-20-3
Window Washer Reservoir 10-20-3

SEAT BELT 10-150-1
Inspection And Maintenance 10-150-1

SERVICE SCHEDULE 10-50-1
Chart 10-50-1

SPARK ARRESTER MUFFLER 10-130-1
Cleaning Procedure. 10-130-1

TAILGATE 10-40-1
Adjusting the Bumper 10-40-1
Adjusting The Tailgate Catch. 10-40-1
Opening And Closing The Tailgate 10-40-1

TRANSPORTING THE EXCAVATOR 10-30-1

TRAVEL MOTOR 10-120-1
Checking Oil Level. 10-120-1
Draining The Drive Motor 10-120-1

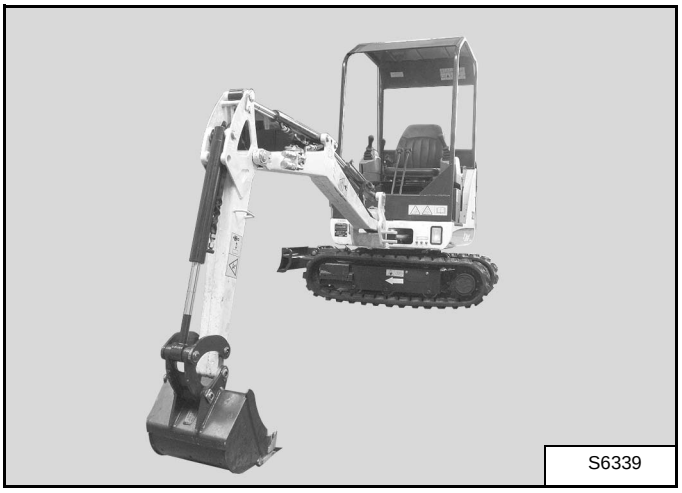
UPPERSTRUCTURE SLEW LOCK 10-11-1

LIFTING AND BLOCKING THE EXCAVATOR

Procedure

Always park the machine on a level surface.

Figure 10-10-1



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

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

Stop the engine.

⚠ WARNING

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

W-2218-1195

⚠ WARNING

AVOID INJURY

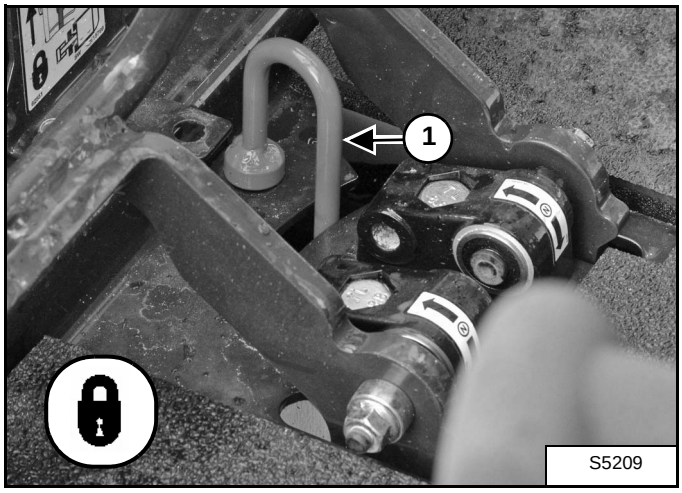
Keep fingers and hands out of pinch points when checking the track tension.

W-2142-0903


Bobcat®

UPPERSTRUCTURE SLEW LOCK

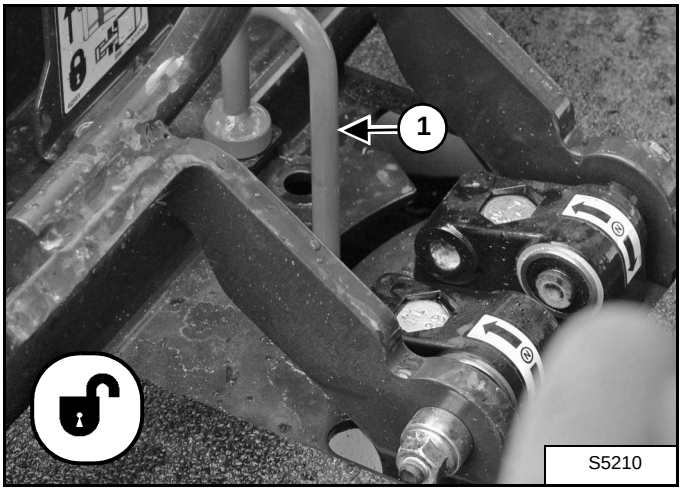
Figure 10-11-1



Move the lever (Item 1) **[Figure 10-11-1]** to the right and down to engage the Upperstructure Slew Lock. Fit the lever properly to fully engage the Slew Lock. When the Slew Lock is engaged (locked), the upperstructure of the excavator is locked to the track frame and will not rotate.

NOTE: The upperstructure must be in the straight forward or straight backward position for the upperstructure to lock.

Figure 10-11-2



Move the lever (Item 1) **[Figure 10-11-2]** up and to the left to disengage the upperstructure from the track frame. Fit the lever properly to fully disengage the Slew Lock.

⚠ WARNING

AVOID INJURY

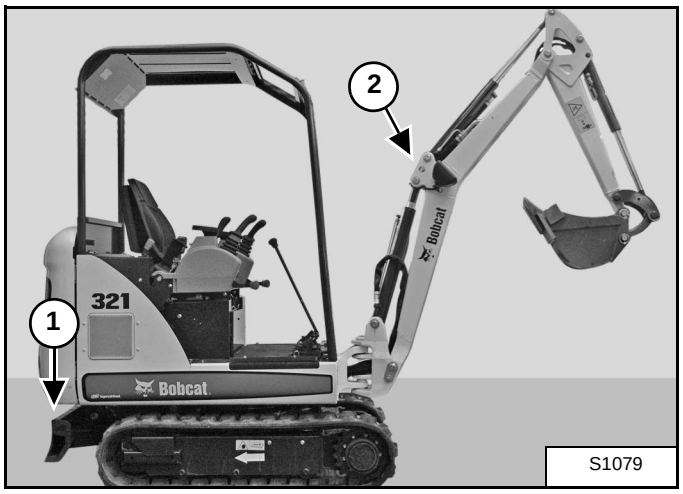
The upperstructure slew lock lever must be engaged when transporting the machine.

W-2197-0904


Bobcat®

LIFTING THE EXCAVATOR

Figure 10-12-1



Fully extend the cylinders of the bucket, arm, and boom, and rotate the upperstructure, so that the excavator is in the position as shown **[Figure 10-12-1]**.

Engage the upperstructure slew lock (See UPPERSTRUCTURE SLEW LOCK on Page 10-11-1.)

Raise the blade fully.

Put all the control levers in neutral.

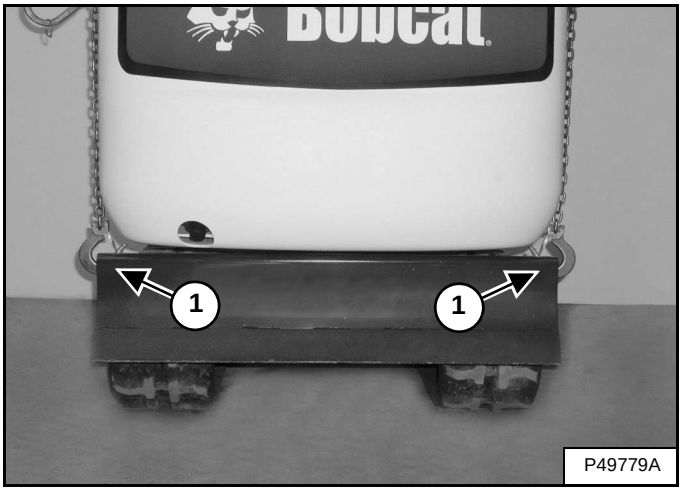
⚠ WARNING

AVOID INJURY OR DEATH

- **Use a lifting fixture with sufficient capacity for the weight of the excavator plus any added attachments.**
- **Maintain center of gravity and balance when lifting.**
- **Do not swing boom or upperstructure. Engage the swing locking lever.**
- **Never lift with operator on machine.**

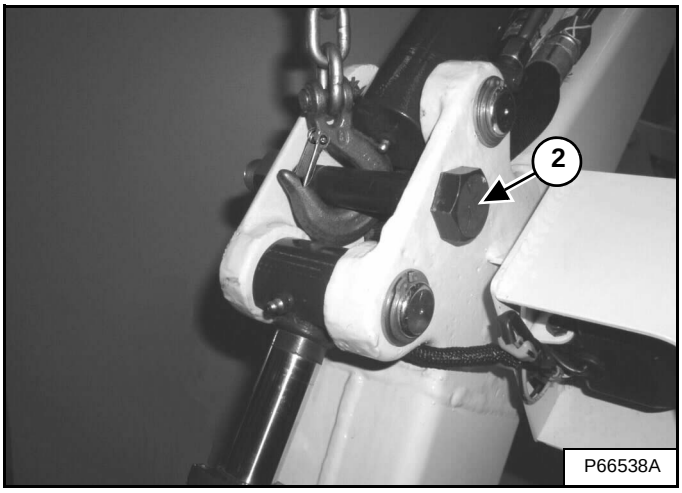
W-2202-0595

Figure 10-12-2



Attach chains to the ends of the blade (Item 1) **[Figure 10-12-1]** and **[Figure 10-12-2]** and up to a lifting fixture above the canopy / cab. The lifting fixture must extend over the sides of the canopy / cab to prevent the chains from hitting the ROPS / TOPS.

Figure 10-12-3



Install a 25 mm bolt and nut (Grade 5 or 8) through the holes at the boom (Item 2) **[Figure 10-12-1]** and **[Figure 10-12-3]**. Attach a chain from the bolt to the lift fixture.


Bobcat®

OPERATOR CAB (ROPS / TOPS) (IF EQUIPPED)

Emergency Exits

The left door, front window, and right side rear window provide emergency exits.

Figure 10-20-1



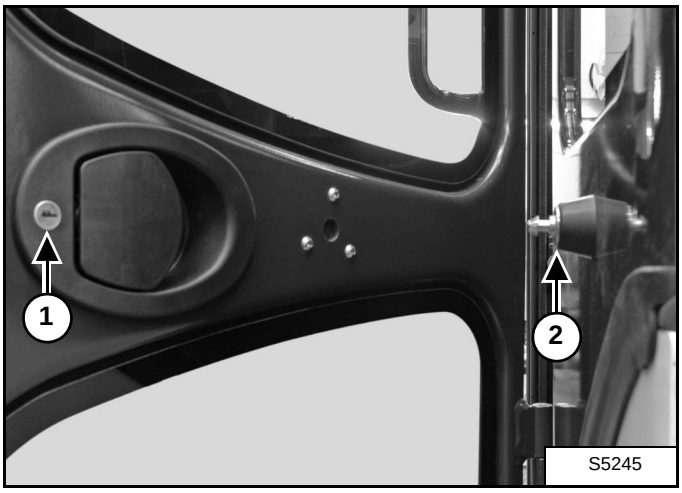
Figure 10-20-2



Slide the right side rear window to the front of the excavator and dismount through the side **[Figure 10-20-1]**, or open the front window and dismount **[Figure 10-20-2]**.

Cab Door

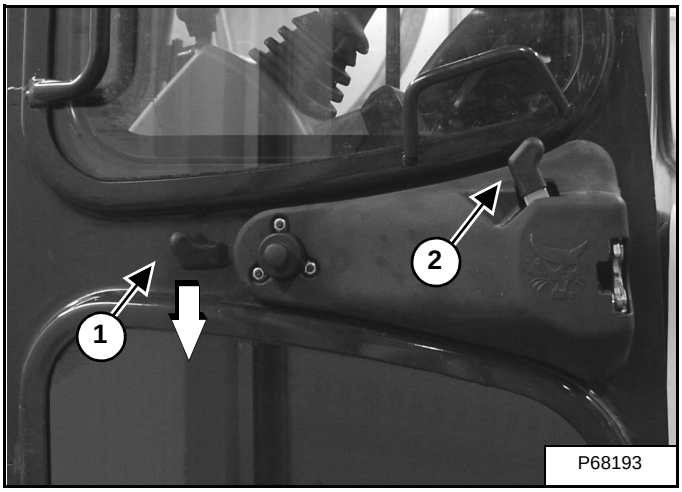
Figure 10-20-3



The cab door can be locked (Item 1) **[Figure 10-20-3]** with the same key as the starter switch.

Push the door fully open until the latch (Item 2) **[Figure 10-20-3]** engages to hold the door in the open position.

Figure 10-20-4



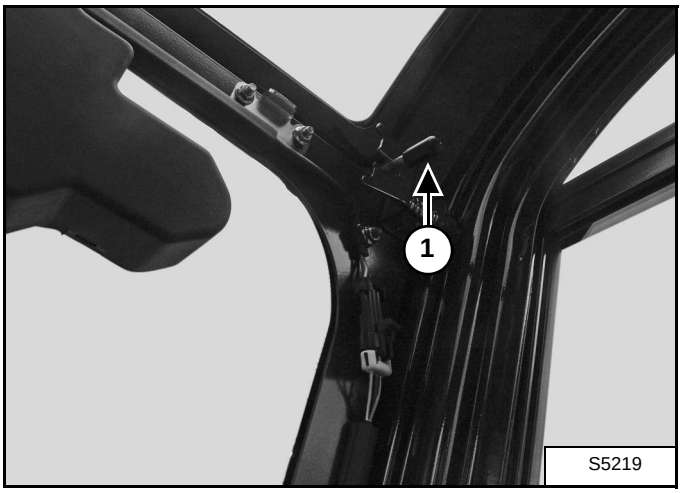
When the door is in the open position, push down on the latch (Item 1) **[Figure 10-20-4]** to close the door.

From inside the cab, open the door using the lever (Item 2) **[Figure 10-20-4]**.

Front Window

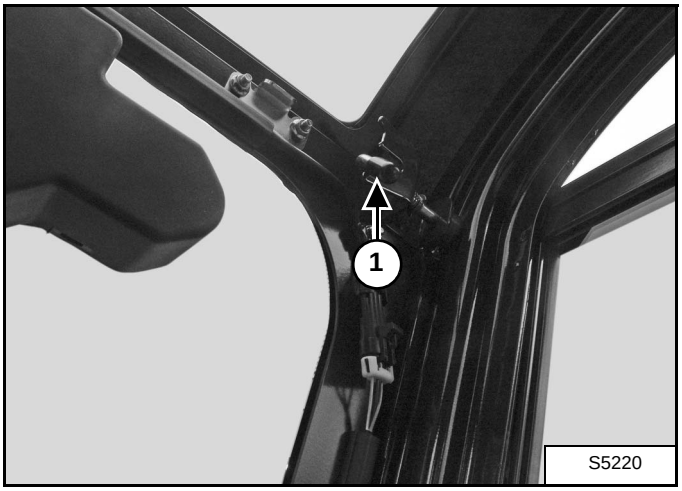
Opening The Front Window

Figure 10-20-5



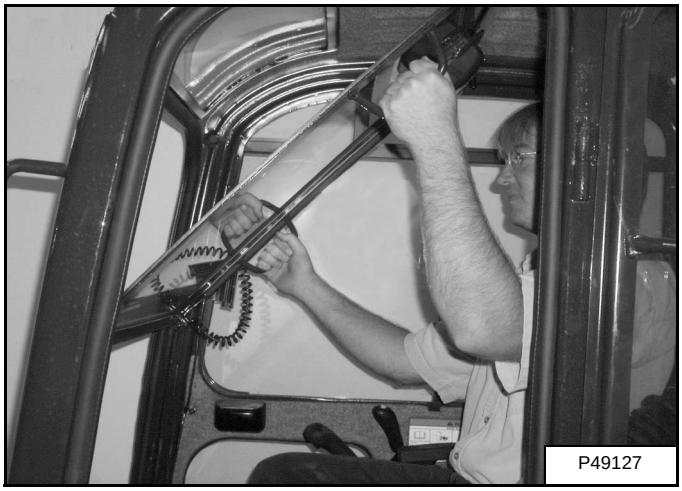
Retract the two top latches (Item 1) **[Figure 10-20-5]**.

Figure 10-20-6



Turn the two top latches (Item 1) **[Figure 10-20-6]** to the unlocked position.

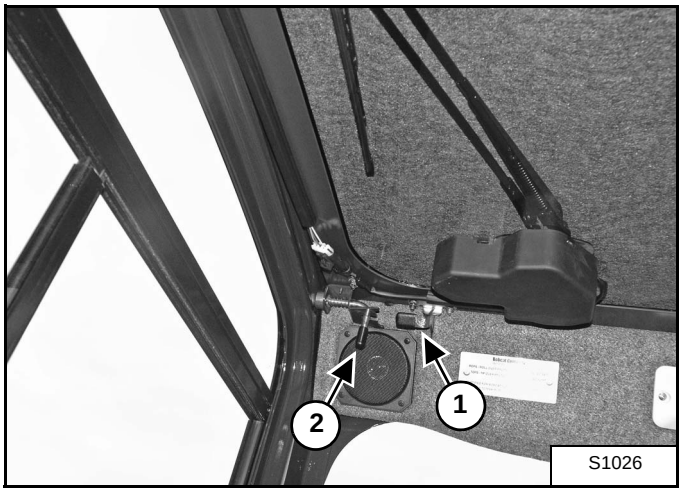
Figure 10-20-7



Use both window handrails to pull the top of the window in **[Figure 10-20-7]**.

Continue moving the window in and up over the operator's head until the window is fully raised.

Figure 10-20-8



When the window is fully raised, the latch (Item 1) will close on the bracket. Turn the two top latches (Item 2) **[Figure 10-20-8]** to the locked position.

Closing The Front Window

Support the window while releasing both window latch pins (Item 2) **[Figure 10-20-8]** and placing the pins in the unlocked position.

Support the window using the left handrail and pull down on the latch (Item 1) **[Figure 10-20-8]** to release the window.

Use both window handrails to pull the window down **[Figure 10-20-7]**.

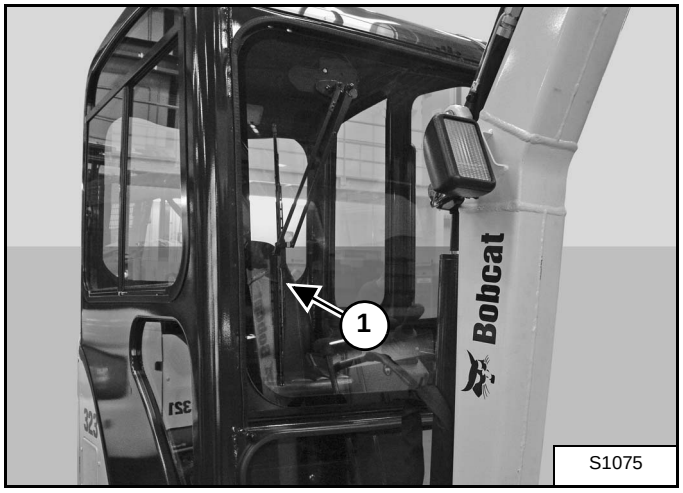
Front Window (Cont'd)

Closing The Front Window (Cont'd)

Rotate the top latches (Item 1) **[Figure 10-20-5]** to the locked position.

Front Window Wiper

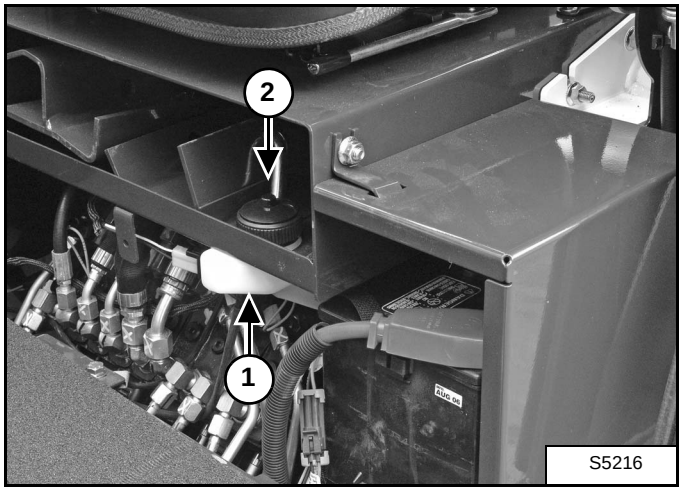
Figure 10-20-9



The front window is equipped with a wiper (Item 1) **[Figure 10-20-9]** and washer.

Window Washer Reservoir

Figure 10-20-10



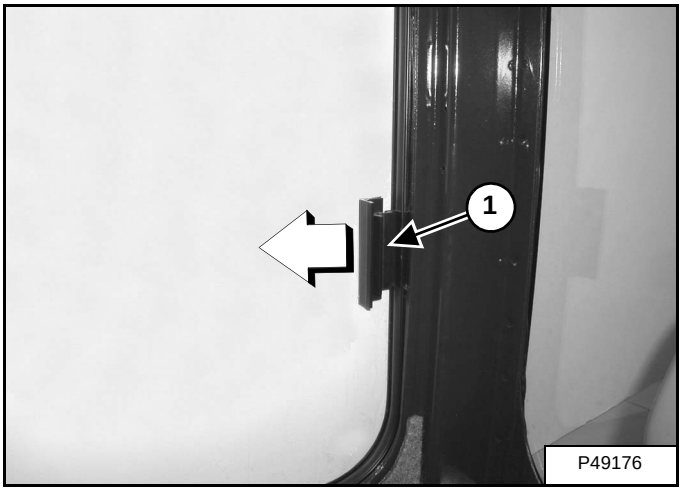
The window washer reservoir (Item 1) **[Figure 10-20-10]** is located on the inside of the storage compartment door.

The reservoir can be filled by removing the cap (Item 2) **[Figure 10-20-10]** in the storage compartment.

Right Side Windows

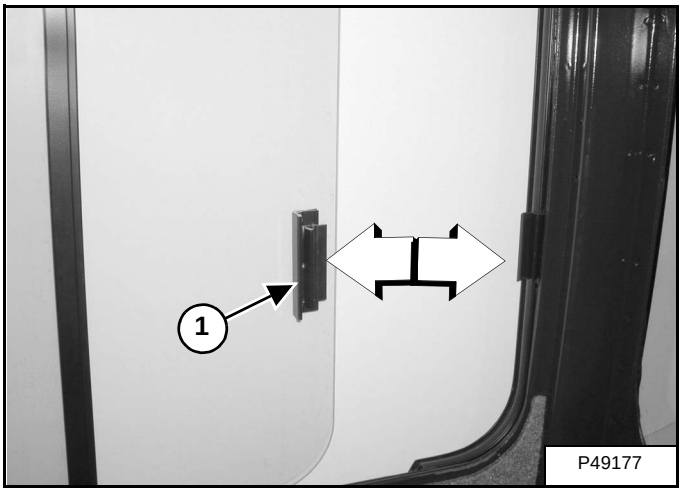
Opening the right rear window

Figure 10-20-11



Pull forward on the latch (Item 1) **[Figure 10-20-11]**.

Figure 10-20-12



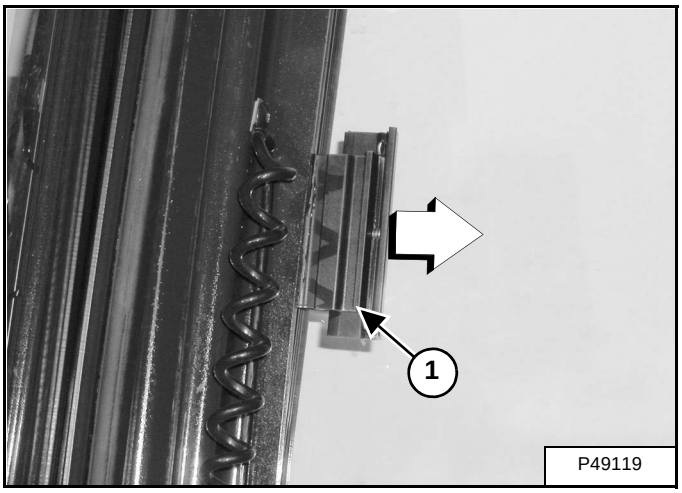
Pull the latch / handle (Item 1) **[Figure 10-20-12]** forward to open the window.

Push the handle back to close the window.

Right Side Windows (Cont'd)

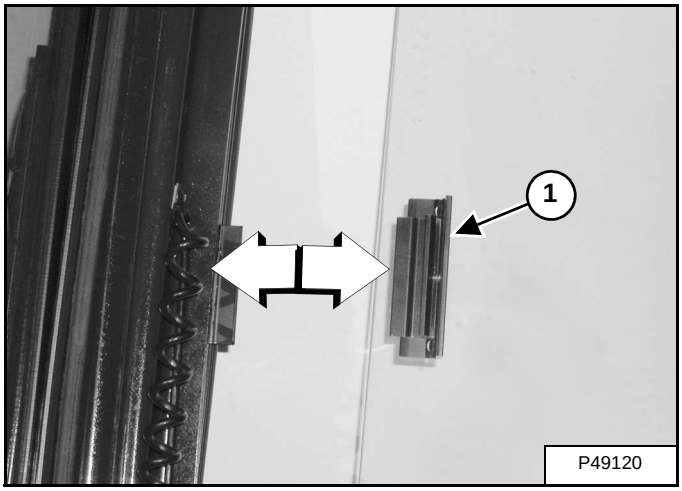
Opening the right front window

Figure 10-20-13



Pull back on the latch (Item 1) **[Figure 10-20-13]**.

Figure 10-20-14



Pull the latch / handle (Item 1) **[Figure 10-20-14]** back to open the window.

Push the handle forward to close the window.

TRANSPORTING THE EXCAVATOR

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

Secure the hand brakes and block the wheels of the transportation vehicle.

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

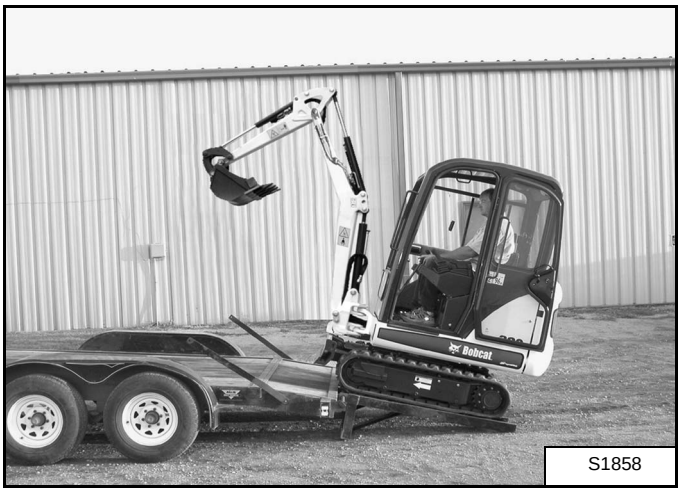
Retract the track frame if required (See Removal And Installation on Page 30-20-4.) Align the ramps with the centre of the transportation vehicle. Secure the ramps to the truck bed and be sure ramp angle does not exceed 15 degrees.

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

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

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

Figure 10-30-1



Move the machine forward onto the transportation vehicle **[Figure 10-30-1]**.

Do not change direction of the machine while it is on the ramps.

Lower the boom, arm, and bucket to the transportation vehicle.

Stop the engine and remove the key.

Put blocks under the front and rear of the tracks.

Figure 10-30-2



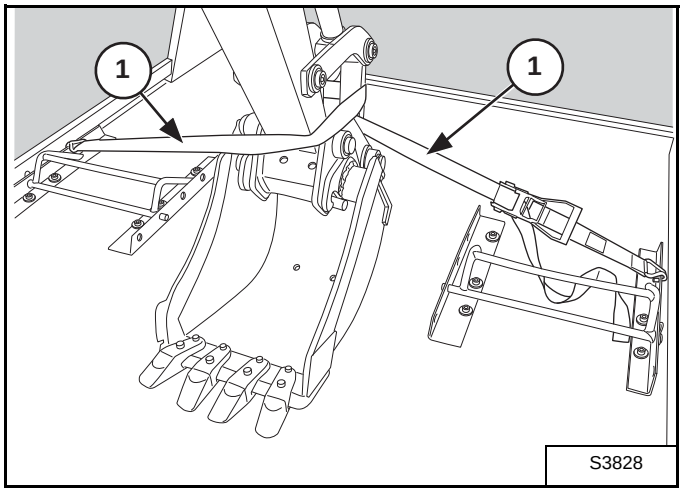
Figure 10-30-3



Attach chains to the front corners of the blade and to the tie down loop at the rear **[Figure 10-30-2]** and **[Figure 10-30-3]** to prevent it from moving when going up or down slopes, or during sudden stops.

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

Figure 10-30-4



When on the transport vehicle, loop the chains through the holes in the mounting frame.

Loop the chain (Item 1) **[Figure 10-30-4]** around the bucket link.

WARNING

AVOID SERIOUS INJURY OR DEATH

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

W-2058-0807

TAILGATE

Opening And Closing The Tailgate

WARNING

AVOID INJURY OR DEATH

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

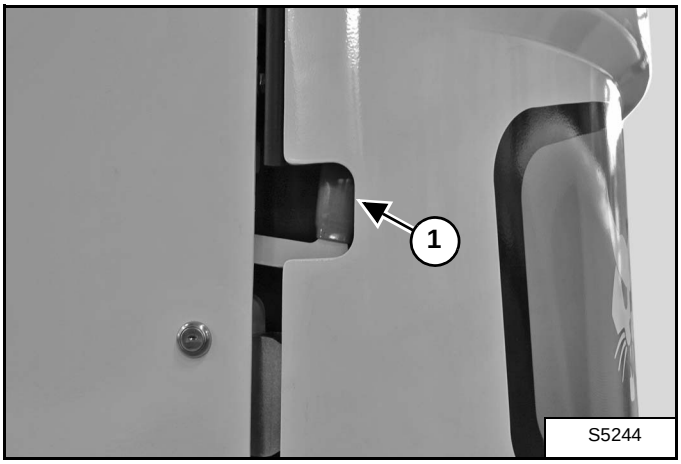
W-2012-0497

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



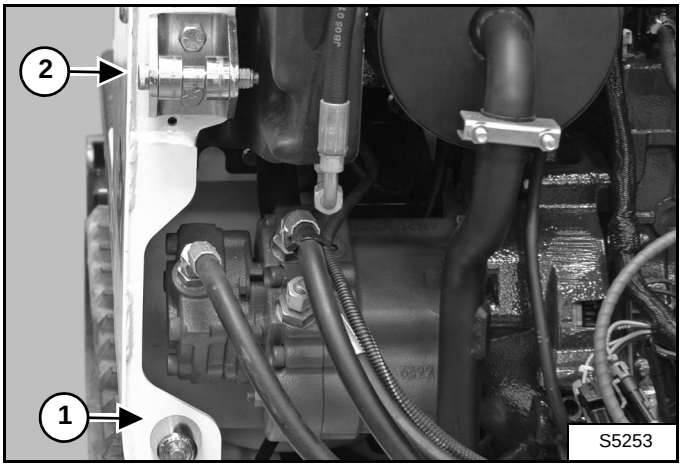
Release the latch (Item 1) **[Figure 10-40-1]** and pull the tailgate open.

Push firmly to close the tailgate.

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

Adjusting the Bumper

Figure 10-40-2



The door bumper (Item 1) **[Figure 10-40-2]** can be adjusted for alignment with the tailgate.

Close the tailgate before operating the excavator.

Adjusting The Tailgate Catch

The door catch (Item 2) **[Figure 10-40-2]** can be adjusted by loosening the two bolts, moving the catch, and tightening the two bolts.

Close the tailgate before operating the excavator.


Bobcat®

SERVICE SCHEDULE

Chart

Maintenance work must be done at regular intervals. Failure to do so will result in excessive wear and early failures. The service schedule is a guide for correct maintenance of the Bobcat Excavator.

⚠ 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

SERVICE SCHEDULE		HOURS					
ITEM	SERVICE REQUIRED	8-10	50	100	250	500	■ 1000
Engine Coolant	Check coolant level. Add premixed coolant as needed.						
Engine Oil	Check the engine oil level and add as needed.						
Hydraulic Fluid, Hoses and Tubelines	Check the hydraulic fluid level and add as needed. Check for damage and leaks. Repair or replace as needed.						
Engine Air Filter and Air System	Check condition indicator and empty dust cup as needed. Check air system for leaks.						
Tracks	Check and adjust track tension as needed.						
Indicators and Lights	Check for correct operation of all indicators and lights.						
Control Console Lockout	Check for proper function. Repair or replace as needed.						
Operator Canopy / Cab	Check condition. Check mounting hardware.						
Seat Belt	Check condition. Check mounting hardware.						
Safety Signs and Safety Treads	Check for damaged signs (decals) and safety treads. Replace any signs or safety treads that are damaged or worn.						
Pivot Points	Grease all machinery pivot points.						
Cab Heater Air Filter (Option)	Clean the filter as needed.						
Swing Circle and Pinion	Grease two fittings.						
Fuel Tank and Filter	Drain water and sediment from fuel tank and fuel filter.						
Battery	Check battery, cables, connections and electrolyte level. Add distilled water as needed.						
Alternator / Fan Belt	Check condition of belt and adjust as needed.		•				
Spark Arrestor Muffler	Clean the spark chamber.						
Fuel Filter	Replace fuel filter.						
Drive Motor	Check lubricant level in both travel motors.						
Engine Oil and Filter	Replace oil and filter. Use CD or better grade oil and Bobcat filter.		•				
Radiator, and Oil Cooler	Clean debris from the radiator fins.						
Hydraulic Filter	Replace the filter.			••			
Alternator and Starter	Check the alternator and starter connections.			••			
Engine Valves	Check and adjust the engine valve clearance.						
Drive Motor	Replace lubricant in both travel motors.			••			
Engine Cooling System	Drain and flush the cooling system. Replace premixed coolant.						
Hydraulic System	Replace the hydraulic fluid and filters. Clean the reservoir.						

• Also at first 50 hours
•• Also at *first* 100 Hours
■ Or every 6 months.


Bobcat®

AIR CLEANER SERVICE

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

Daily Check

Figure 10-60-1



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

Replacing The Filters

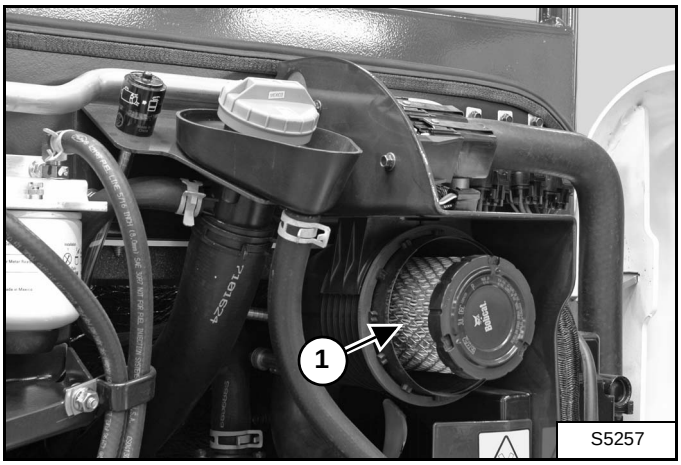
Outer Filter

Pull out the locking tab (Item 2) **[Figure 10-60-1]**.

Turn the dust cup (Item 3) **[Figure 10-60-1]** counter-clockwise about 1/8 turn.

Remove and clean the dust cup.

Figure 10-60-2



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

Check the housing for damage.

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

Install a new outer filter.

Install the dust cup (Item 3) **[Figure 10-60-1]** and turn it clockwise about 1/8 turn.

Push the locking tab in (Item 2) **[Figure 10-60-1]**.

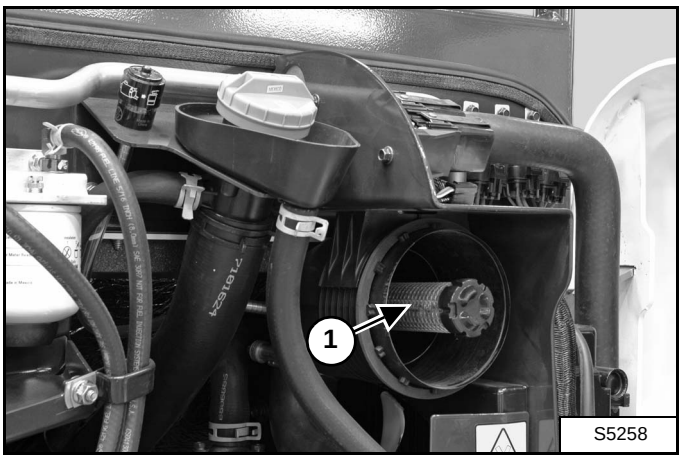
Check the air intake hose and the air cleaner housing for damage. Make sure all connections are tight.

Inner Filter

Only replace the inner filter under the following conditions:

- Replace the inner filter every third time the outer filter is replaced.
- After the outer filter has been replaced, press the button on the top of the condition indicator (Item 1) **[Figure 10-60-1]** and start the engine. Run at full RPM, then reduce engine speed and stop the engine. If the red ring shows in the condition indicator, replace the inner filter.

Figure 10-60-3



Remove the dust cup (Item 3) **[Figure 10-60-1]**, the outer filter (Item 1) **[Figure 10-60-2]** and the inner filter (Item 1) **[Figure 10-60-3]**.

NOTE: Make sure all sealing surfaces are free of dirt and debris.

Install the new inner filter.

Install the outer filter and the dust cup.

Press the button on the condition indicator to reset the condition indicator (Item 1) **[Figure 10-60-1]** (the red ring will not show anymore).

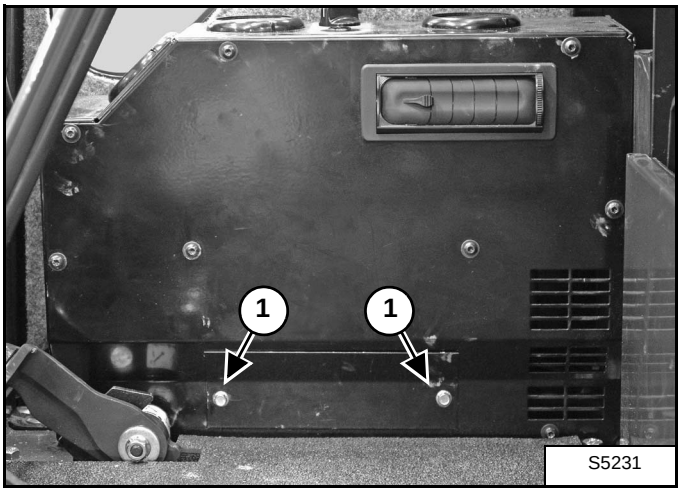

Bobcat®

CAB FILTER

Cleaning And Maintenance

The recirculation filter must be cleaned regularly. The filter is located at the right of the operator seat.

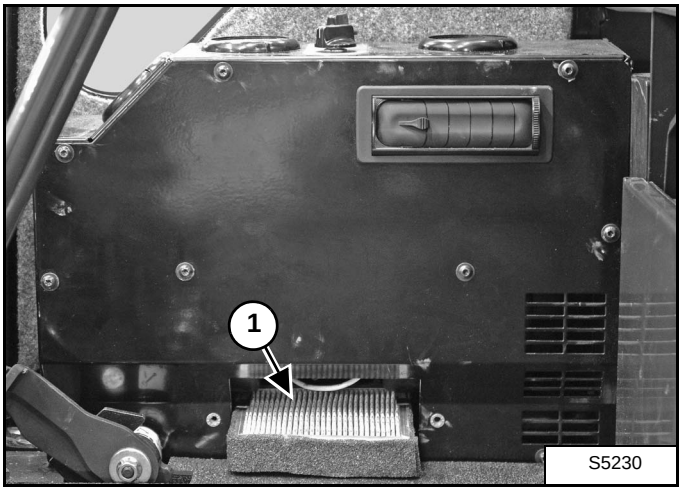
Figure 10-61-1



The recirculation filter is located at the bottom of the heater **[Figure 10-61-1]**.

Loosen the 2 bolts (Item 1) **[Figure 10-61-1]** to remove the fresh air filter cover.

Figure 10-61-2



Remove the filter (Item 1) **[Figure 10-61-2]**. Shake the filter or use low air pressure to remove debris. Replace the filter after 3 cleanings or if the filter becomes damaged or too dirty to clean.

Reinstall the filter, cover and bolts.


Bobcat®

ENGINE COOLING SYSTEM

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

Cleaning The Cooling System

Open the tailgate.

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

Checking The Coolant Level

WARNING

AVOID BURNS

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

W-2070-1203

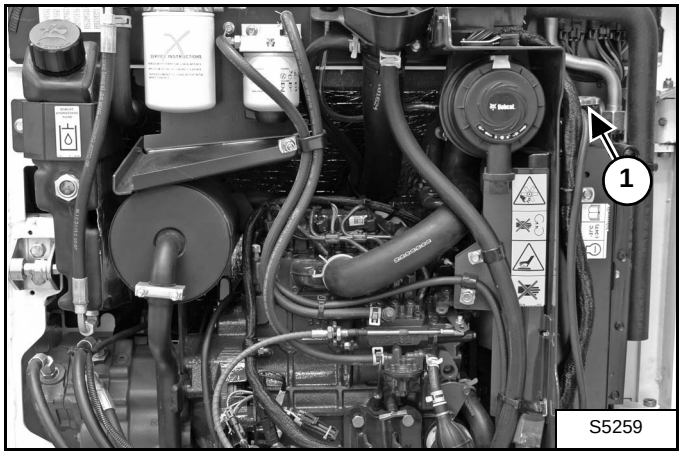
WARNING

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

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

W-2019-1285

Figure 10-70-1



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

The coolant level must be 20-25 mm below the filler neck

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

IMPORTANT

AVOID ENGINE DAMAGE

Always use the correct ratio of water to antifreeze.

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

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

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

I-2124-0497

Replacing The Coolant

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

WARNING

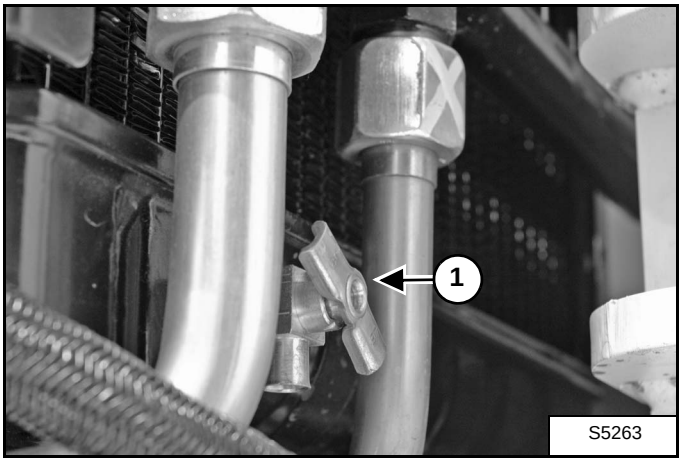
AVOID BURNS

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

W-2070-1203

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

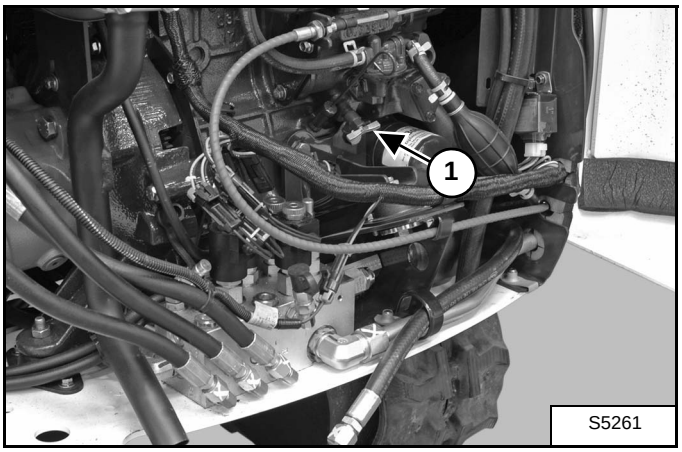
Figure 10-70-2



Open the drain valve (Item 1) **[Figure 10-70-2]** at the bottom of the radiator and drain the coolant into a container.

Replacing The Coolant (Cont'd)

Figure 10-70-3



Open the drain valve (Item 1) **[Figure 10-70-3]** on the engine block and drain the coolant into a container.

After all the coolant is removed, close the drain valve.

Recycle or dispose of the used coolant in an environmentally safe manner.

Mix the coolant in a separate container.

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

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

4.3 liters of propylene glycol mixed with 3.8 liters of water is the correct mixture of coolant to provide a - 34°F (-37°C) freeze protection.

IMPORTANT

AVOID ENGINE DAMAGE

Always use the correct ratio of water to antifreeze.

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

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

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

I-2124-0497

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. Install the radiator cap and tighten.

Add coolant to the recovery tank as needed.

Close the tailgate.

FUEL SYSTEM

Fuel Specifications

Use only clean, high quality diesel fuel, Grade No. 2 or Grade No. 1.

The following is a suggested blending guideline which should prevent fuel gelling problems during freezing temperature.

Temp. F° (C°)	No. 2	No. 1
+15° (9°)	100%	0%
Down to -20° (-29°)	50%	50%
Below -20° (-29°)	0%	100%

See your fuel supplier for local recommendations.

⚠ WARNING

AVOID INJURY OR DEATH

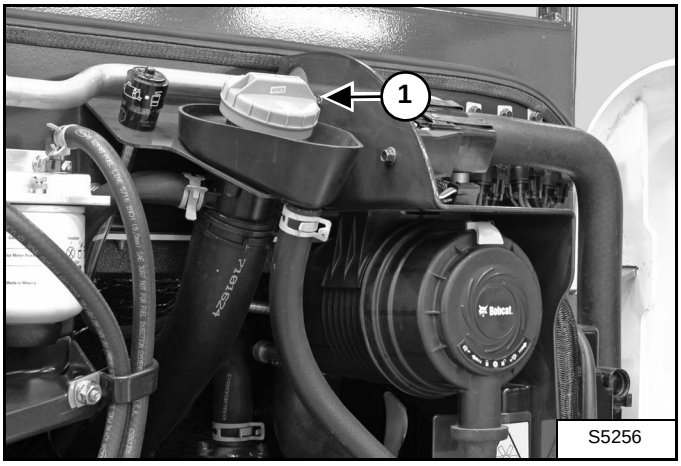
Stop and cool the engine before adding fuel. NO SMOKING! Failure to obey warnings can cause an explosion or fire.

W-2063-0807

Filling The Fuel Tank

Open the tailgate.

Figure 10-80-1



Remove the fuel fill cap (Item 1) **[Figure 10-80-1]**

Use a clean, approved safety container to add fuel. Add fuel only in an area that has a free movement of air and no flames or sparks. NO SMOKING!

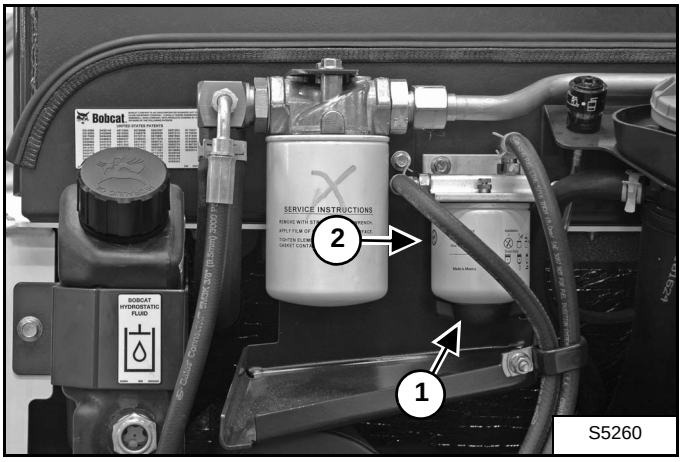
Install and tighten the fuel fill cap. Close the tailgate.

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

Removing Water From The Fuel Filter

Open the tailgate.

Figure 10-80-2



Loosen the drain (Item 1) **[Figure 10-80-2]** at the bottom of the filter to drain water from the filter.

Replacing The Fuel Filter

Remove the filter (Item 2) **[Figure 10-80-2]**.

Clean the area around the filter housing. Put clean oil on the seal of the new filter. Install the fuel filter and tighten by hand.

Remove the air from the fuel system (See Removing Air From The Fuel System on Page 10-80-2.)

Draining The Fuel Tank

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

Turn the upperstructure until the fuel tank drain is centered between the rear tracks.

Figure 10-80-3

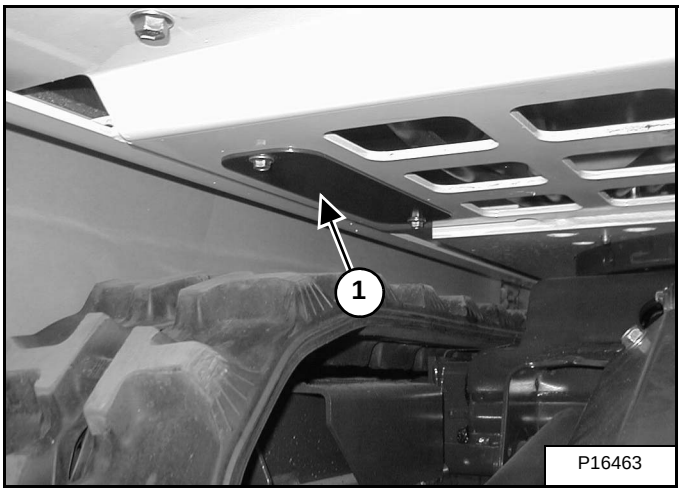
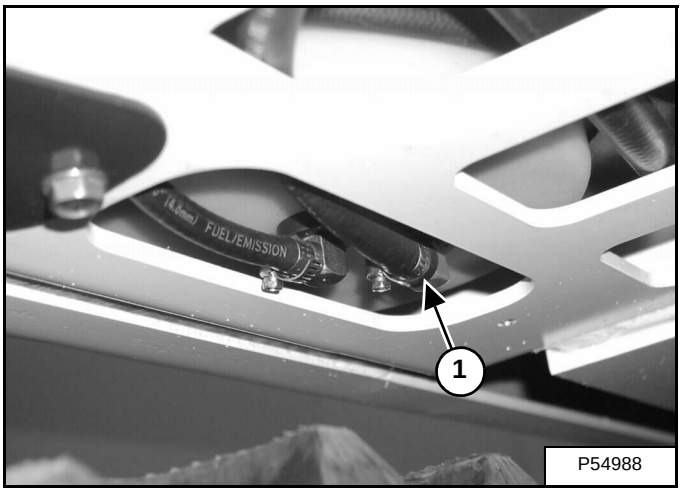


Figure 10-80-4



Remove the access panel (Item 1) **[Figure 10-80-3]** on the bottom of the engine compartment. Loosen the clamp (Item 1) **[Figure 10-80-4]** and disconnect the fuel hose.

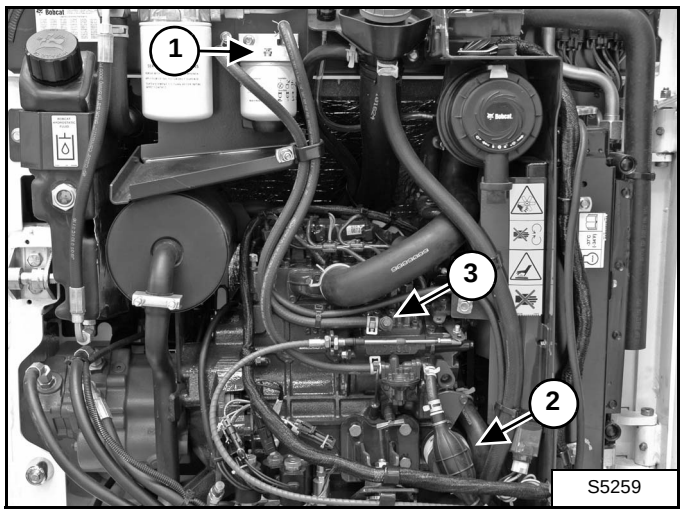
Drain the fuel into a container.

Reuse, recycle or dispose of fuel in an environmentally safe manner.

Removing Air From The Fuel System

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

Figure 10-80-5



Open the fuel filter vent (Item 1) **[Figure 10-80-5]**.

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

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

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

⚠ WARNING

AVOID INJURY OR DEATH

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

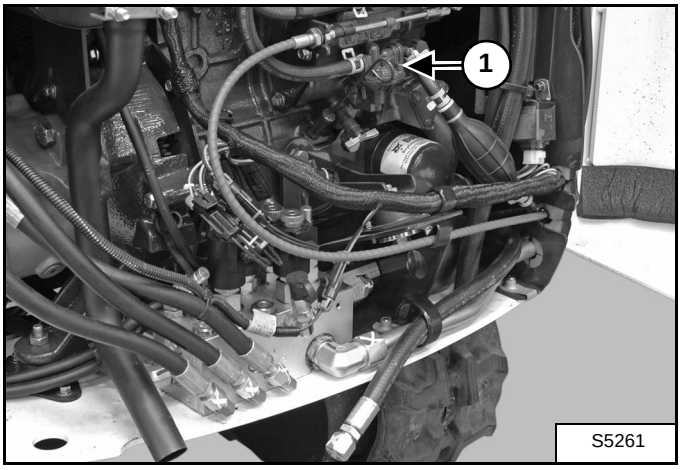
W-2072-0807

ENGINE LUBRICATION SYSTEM

Checking Engine Oil

Check the engine oil every day before starting the engine for the work shift.

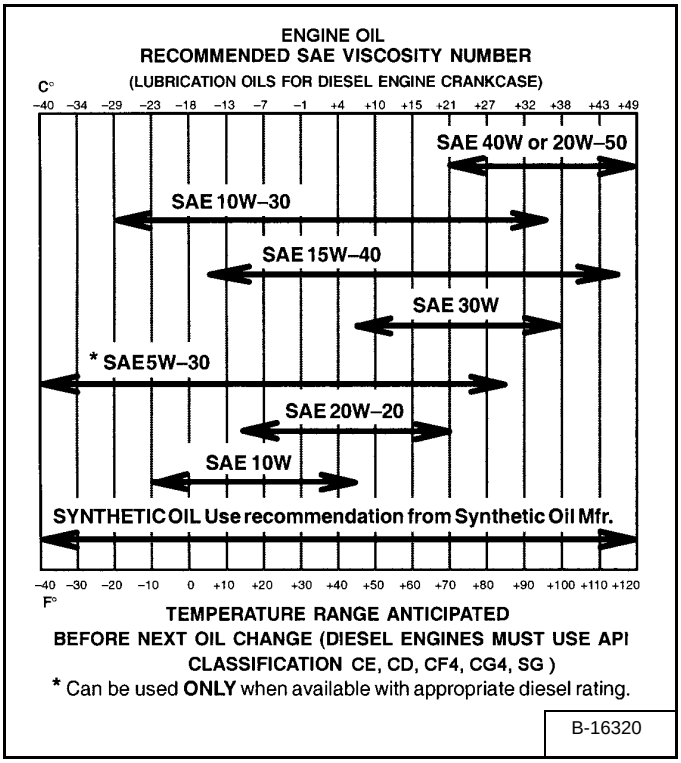
Figure 10-90-1



Open the rear door and remove the dipstick (Item 1) **[Figure 10-90-1]**.

Keep the oil level between the marks on the dipstick.

Figure 10-90-2



Use a good quality motor oil that meets the correct API Service Classification **[Figure 10-90-2]**.

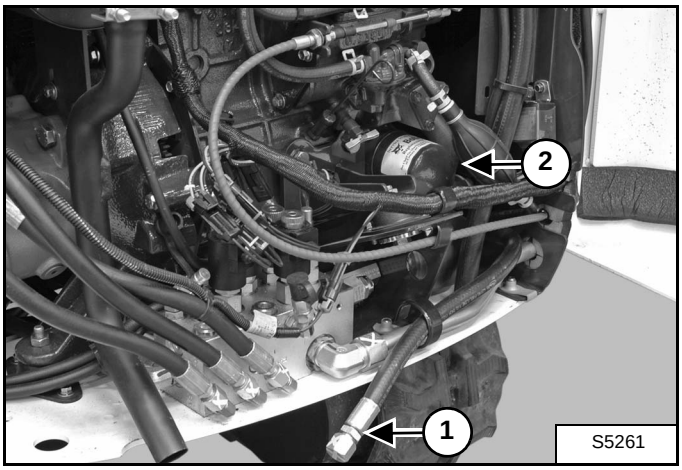
Replacing Oil And Filter

See the SERVICE SCHEDULE (See SERVICE SCHEDULE on Page 10-50-1.) for the service interval for replacing the engine oil and filter.

Run the engine until it is at operating temperature. Stop the engine.

Open the tailgate.

Figure 10-90-3



Remove the drain plug (Item 1) **[Figure 10-90-3]** from the drain hose. Drain the oil into a container and recycle or dispose of used oil in an environmentally safe manner.

Remove the oil filter (Item 2) **[Figure 10-90-3]** and clean the filter housing surface.

Use a genuine Bobcat filter.

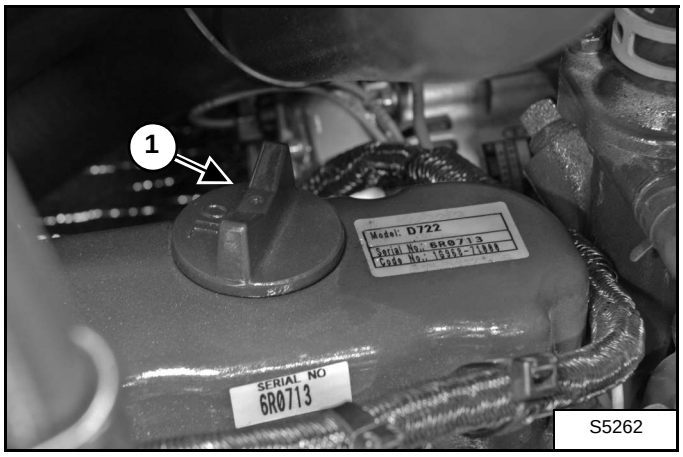
Put clean oil on the filter gasket.

Install the filter and tighten by hand.

Install and tighten the oil drain plug

Replacing Oil And Filter (Cont'd)

Figure 10-90-4



Remove the fill cap (Item 1) **[Figure 10-90-4]**.

Put 3.5 L of oil into the engine.

Use a good quality motor oil that meets the correct API Service Classification **[Figure 10-90-2]**.

Install the fill cap.

Start the engine and let it run for several minutes.

Stop the engine. Check for leaks at the oil filter. Check the oil level.

Add oil as needed if it is not at the top mark on the dipstick.

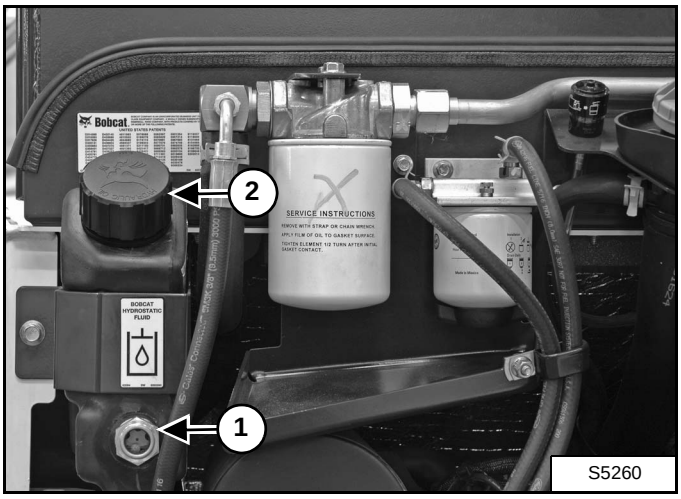
HYDRAULIC SYSTEM

Checking And Adding Hydraulic Oil

Put the machine on a level surface.

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

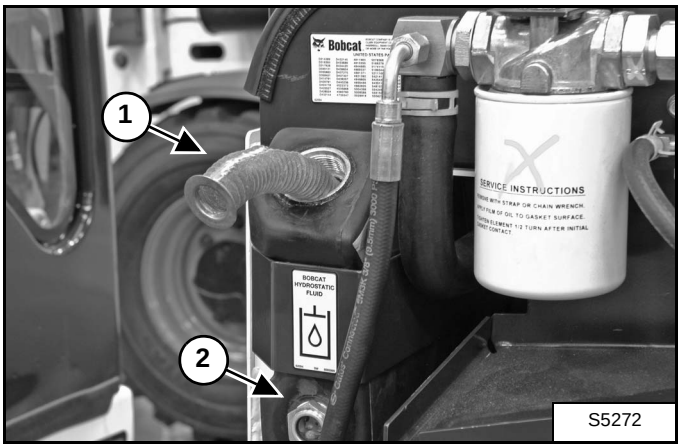
Figure 10-100-1



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

Remove the oil fill cap (Item 2) **[Figure 10-100-1]**.

Figure 10-100-2



Check the condition of the screen (Item 1) **[Figure 10-100-2]** in the fill neck of the reservoir. The screen must be installed in the fill neck when adding oil.

Add the correct fluid to the reservoir until it is at the center of the sight gauge (Item 2) **[Figure 10-100-2]**. (See Fluid specifications on Page SPEC-10-8.)(See Fluid specifications on Page SPEC-20-8.) Install the cap. Close the tailgate.

⚠ WARNING

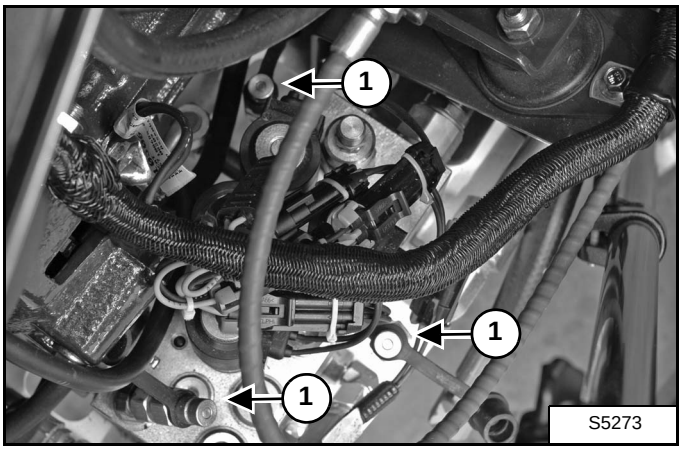
AVOID INJURY OR DEATH

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

W-2103-0807

Diagnostic Connectors

Figure 10-100-3



The 3 diagnostic connectors (Item 1) **[Figure 10-100-3]** are located on the hydraulic manifold block.

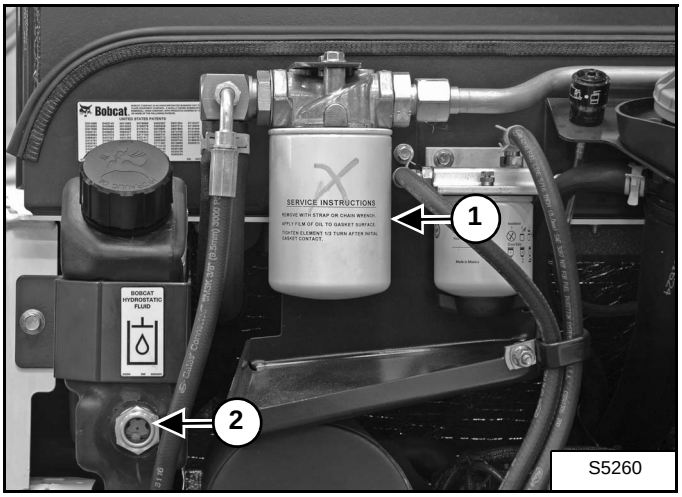
The connectors can be used by your Bobcat dealer to check circuit pressures.

Replacing The Hydraulic Filter

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

Open the tailgate.

Figure 10-100-4



Remove the filter (Item 1) **[Figure 10-100-4]**.

Clean the housing where the filter gasket makes contact.

Put clean hydraulic fluid on the gasket. Install the new filter and tighten by hand only.

Start the engine. Run the excavator through the hydraulic functions. Stop the engine. Check the fluid level at the sight gauge (Item 2) **[Figure 10-100-4]** and add as needed. Check the filter area for leaks.

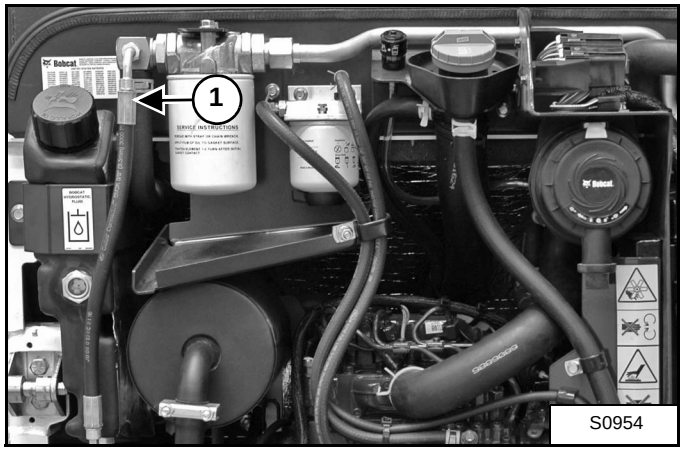
Replacing Hydraulic Oil

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

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

Remove and replace the hydraulic filter.

Figure 10-100-5



Loosen the hose (Item 1) **[Figure 10-100-5]** 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, state and federal regulations for the correct disposal.

I-2067-0499

IMPORTANT

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

I-2045-0788

Install the hose again.

Add fluid to the reservoir until it is at the center of the sight gauge (Item 2) **[Figure 10-100-4]**. (See Fluid specifications on Page SPEC-10-8.)(See Fluid specifications on Page SPEC-20-8.) Run the excavator through the hydraulic functions. Stop the engine. Check the fluid level and add as needed.

LUBRICATION OF THE HYDRAULIC EXCAVATOR

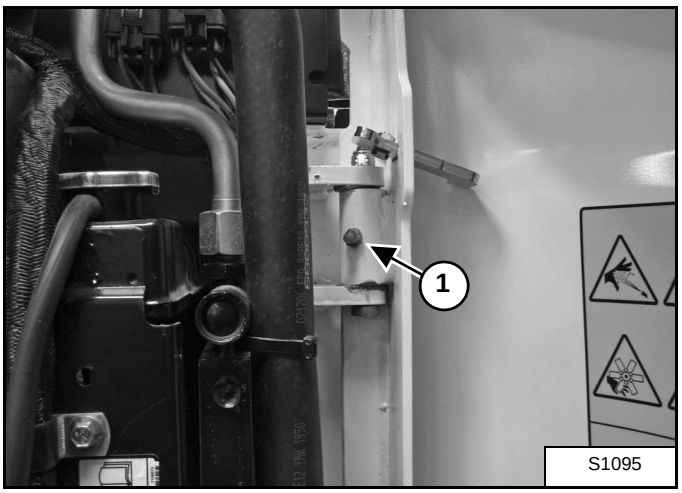
Lubricate the Hydraulic Excavator as specified in the SERVICE SCHEDULE (See SERVICE SCHEDULE on Page 10-50-1.) for the best performance of the machine.

Record the operating hours each time you lubricate the Hydraulic Excavator.

Always use a good quality lithium based multi-purpose grease when lubricating the excavator. Apply the lubricant until extra grease shows.

Rear Door Hinges

Figure 10-110-1

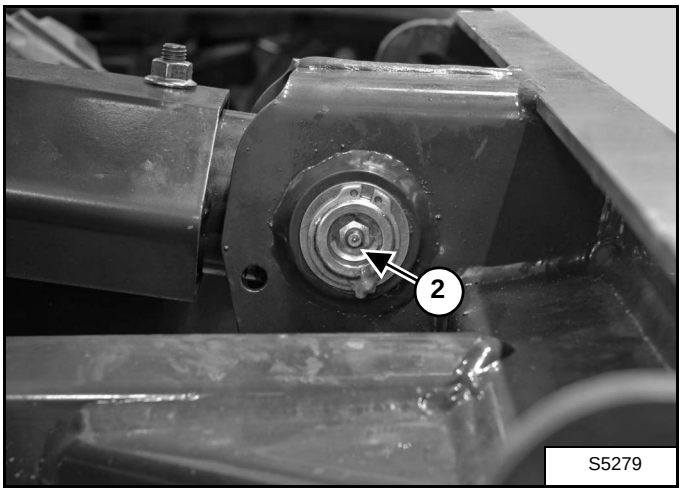


Ref Description (# of Fittings)

1. Rear door hinge, every 8-10 hours (Item 1) **[Figure 10-110-1]**.

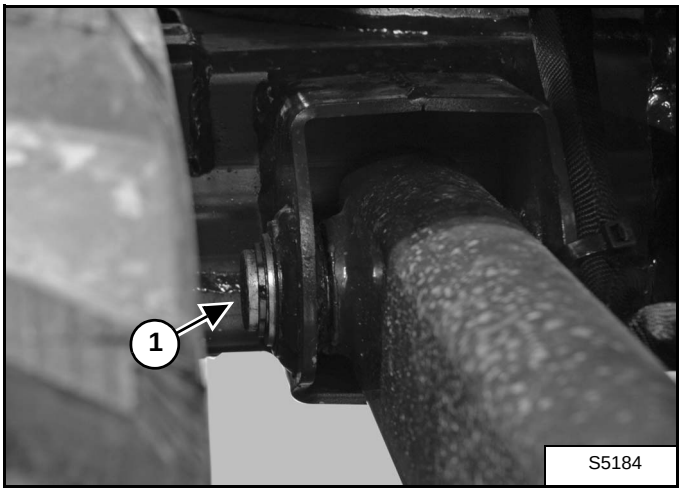
Blade

Figure 10-110-2



2. Blade Cylinder-Base End, every 8-10 hours (Item 1) **[Figure 10-110-2]**.

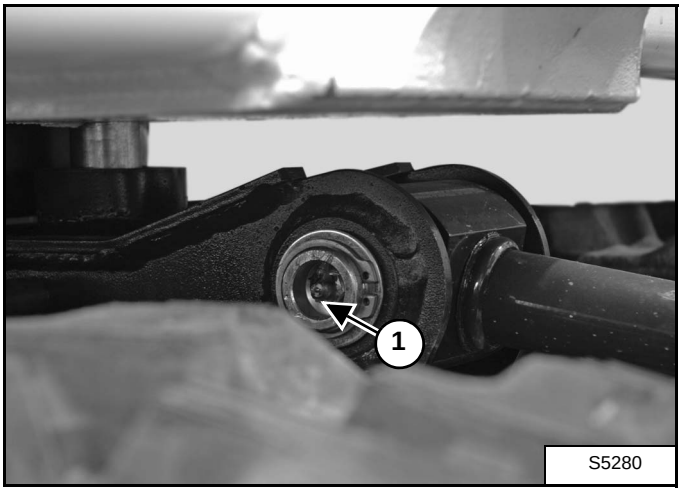
Figure 10-110-3



3. Blade Pivots, every 8-10 hours (Item 1) **[Figure 10-110-3]**.

Blade (Cont'd)

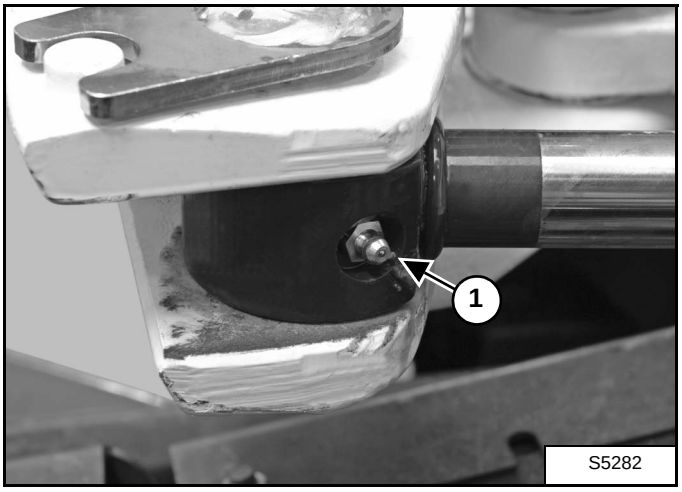
Figure 10-110-4



4. Blade Cylinder-Rod End, every 8-10 hours (Item 1) **[Figure 10-110-4]**.

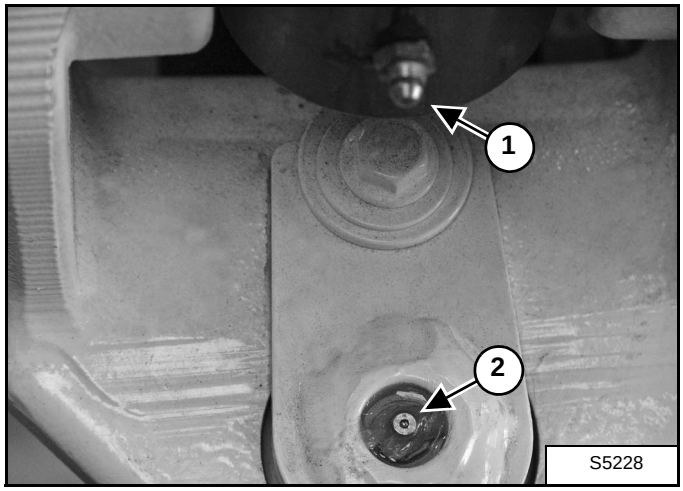
Boom Swing And Boom Base

Figure 10-110-5



5. Boom Swing Cylinder, Rod End, every 8-10 hours (Item 1) **[Figure 10-110-5]**.

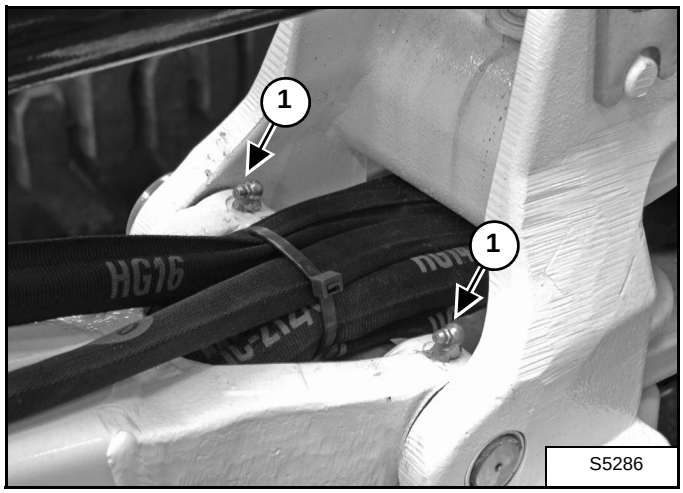
Figure 10-110-6



6. Boom Cylinder, Base End (Item1) **[Figure 10-110-6]**.

7. Boom Swing Pivot, every 8-10 hours (Item 2) **[Figure 10-110-6]**.

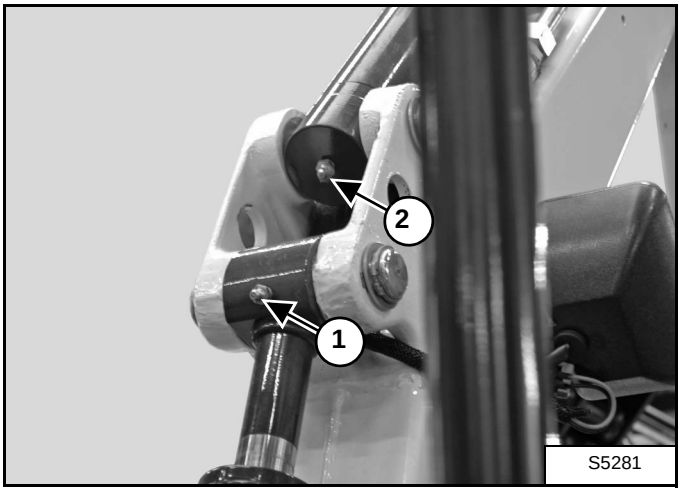
Figure 10-110-7



8. Boom, Base Pivot, every 8-10 hours (Item 1) **[Figure 10-110-7]**.

Boom, Middle

Figure 10-110-8

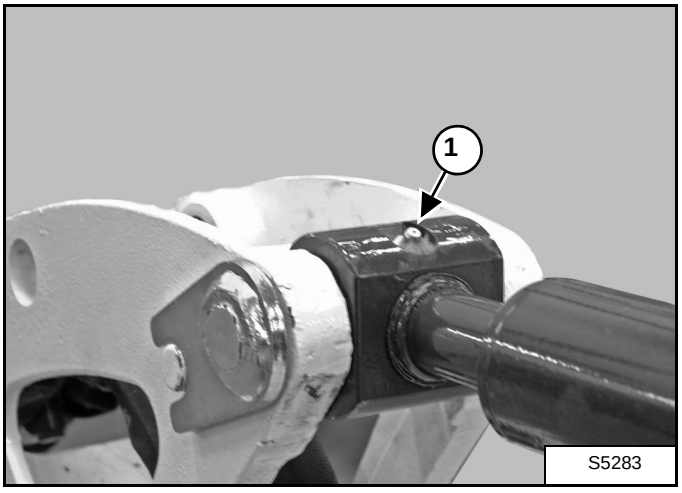


9. Boom Cylinder, Rod End, every 8-10 hours (Item 1) **[Figure 10-110-8]**.

10. Arm Cylinder, Base End, every 8-10 hours (Item 2) **[Figure 10-110-8]**.

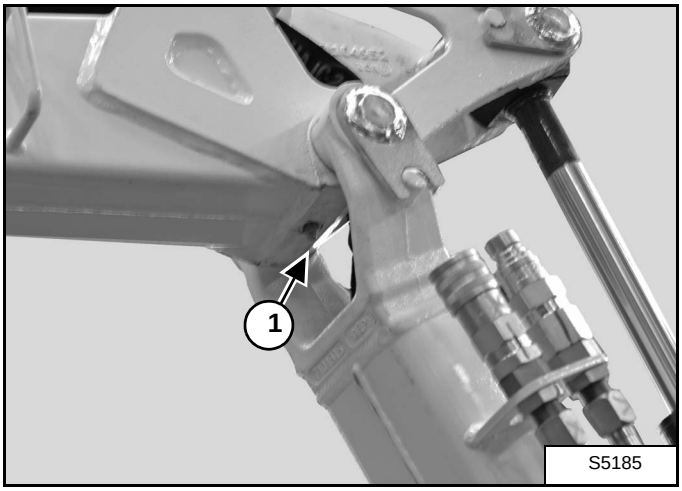
Boom And Arm

Figure 10-110-9



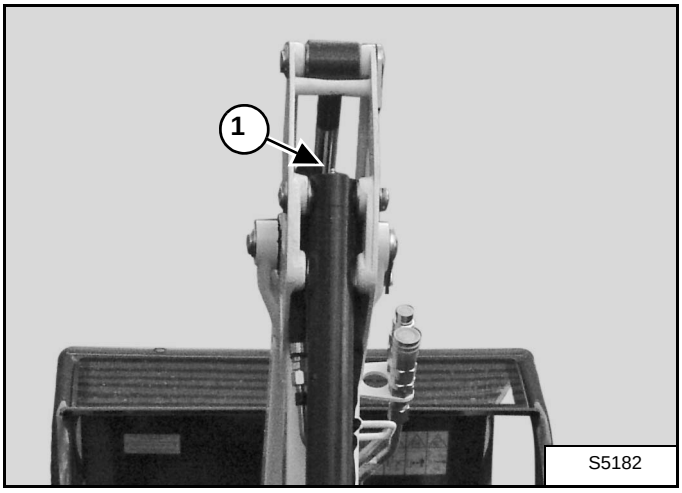
11. Arm Cylinder, Rod End, every 8-10 hours (Item 1) **[Figure 10-110-9]**.

Figure 10-110-10



12. Arm Pivot, every 8-10 hours (Item 1) **[Figure 10-110-10]**.

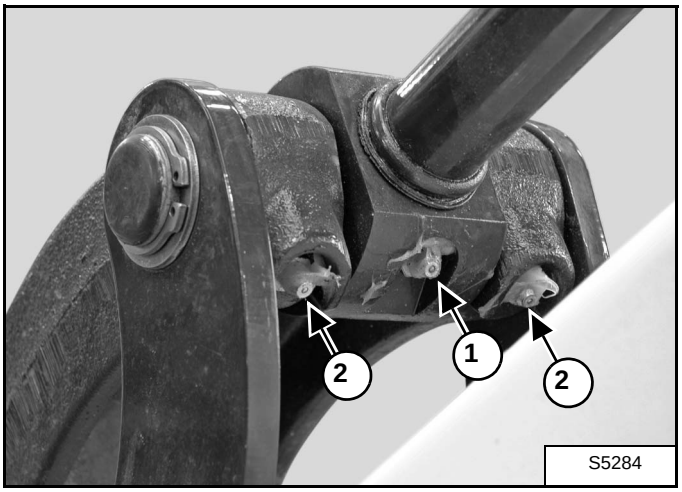
Figure 10-110-11



13. Bucket Cylinder, Base end, every 8-10 hours (Item 1) **[Figure 10-110-11]**.

Boom And Arm (Cont'd)

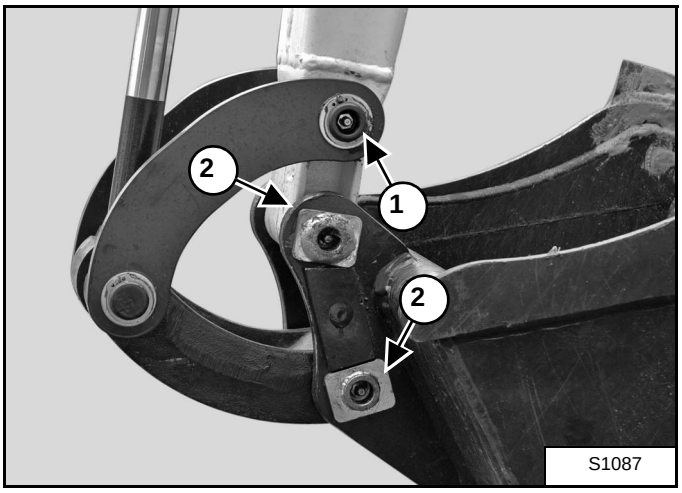
Figure 10-110-12



14. Bucket Cylinder, Rod end, every 8-10 hours (Item 1) **[Figure 10-110-12]**.

15. Bucket Link, Bucket Cylinder Pivot, every 8-10 hours (Item 2) **[Figure 10-110-12]**.

Figure 10-110-13

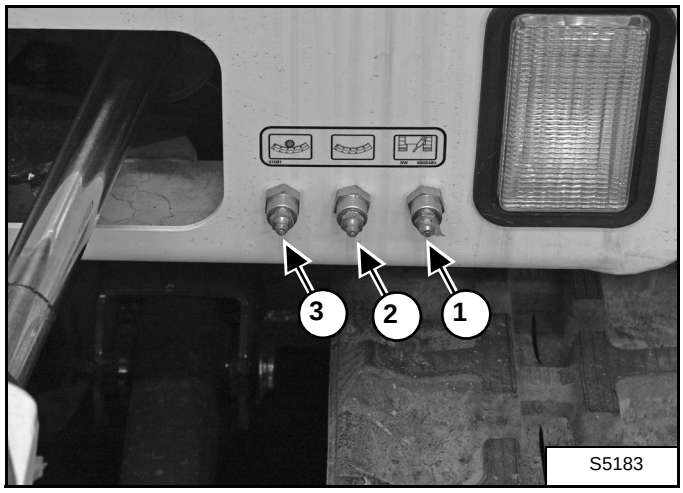


16. Bucket Link Pivot, every 8-10 hours (Item 1) **[Figure 10-110-13]**.

17. Bucket Pivots, every 8-10 hours (Item 2) **[Figure 10-110-13]**.

Frame Fittings

Figure 10-110-14



18. Boom Swing Cylinder, Base End (Item 1) **[Figure 10-110-14]**.

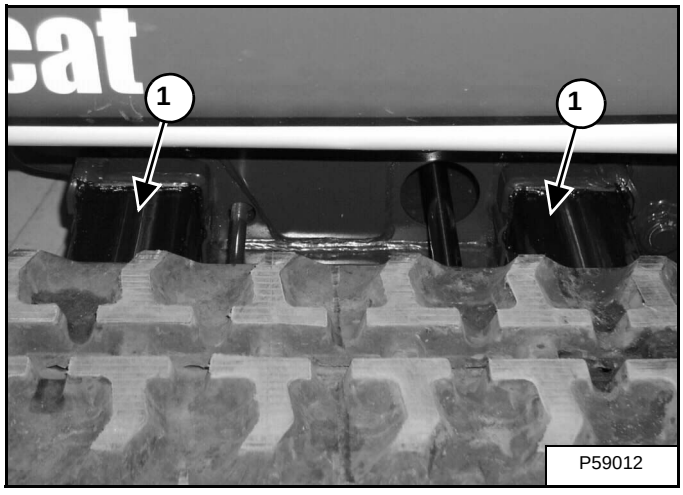
19. Swing Circle Bearing, every 50 hours (Item 2) **[Figure 10-110-14]**.

20. Swing Circle Pinion, every 50 hours (Item 3) **[Figure 10-110-14]**. Pump 4 times with a grease gun. Rotate the upper structure 180° and repeat.

NOTE: Do not over-grease the swing circle; damage to the seal could result. Pump 4-5 times with a grease gun. Rotate the upperstructure 90° and repeat three more times.

Track Expansion Tube

Figure 10-110-15



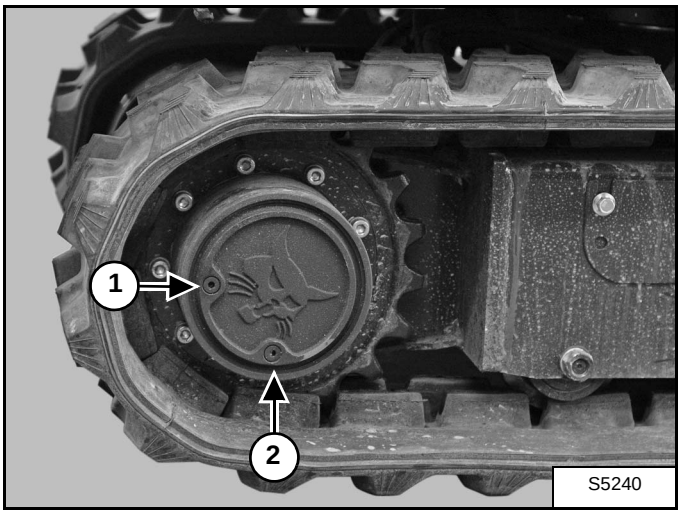
21. Track Expansion Tube, as required (Item 1) **[Figure 10-110-15]** (both sides).

NOTE: Spread lubricate gearshield extra heavy grease evenly on wear surfaces on both sides of excavator as required.

TRAVEL MOTOR

Checking Oil Level

Figure 10-120-1



Put the machine on a level surface with the plugs positioned as shown (Items 1 and 2) **[Figure 10-120-1]**.

Remove the top plug (Item 1) **[Figure 10-120-1]**. The oil level should be at the bottom edge of the plug hole.

Add gear lube through the plug hole if the oil level is below the hole. See Chart for capacity and type. (See Fluid specifications on Page SPEC-10-8.)(See Fluid specifications on Page SPEC-20-8.) Install and tighten the top plug.

Repeat the procedure for the other side.

Draining The Drive Motor

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

Put the machine on a level surface with the plugs positioned as shown (Items 1 and 2) **[Figure 10-120-1]**.

Remove the bottom plug (Item 2) and top plug (Item 1) **[Figure 10-120-1]** and drain into a container. Recycle or dispose of the used lubricant in an environmentally safe manner.

After all the gear lube is removed, install the bottom plug (Item 2) **[Figure 10-120-1]**.

Add gear lube to the top plug hole (Item 1) **[Figure 10-120-1]** until the gear lube level is at the bottom edge of the plug hole. See Chart for capacity and type. (See Fluid specifications on Page SPEC-10-8.)(See Fluid specifications on Page SPEC-20-8.) Install and tighten the top plug.

Repeat the procedure for the other side.


Bobcat®

SPARK ARRESTER MUFFLER

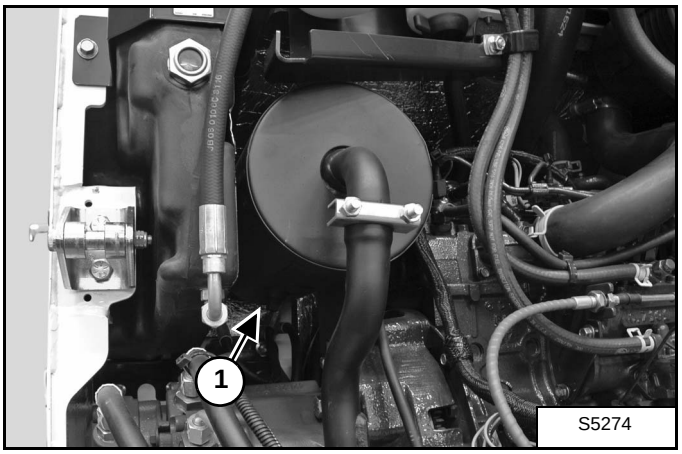
Cleaning Procedure

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

Do not operate the excavator with a defective exhaust system.

Stop the engine. Open the tailgate

Figure 10-130-1



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

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

Stop the engine. Install and tighten the plug.

Close the tailgate.

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

WARNING

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

W-2011-1285

WARNING

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

W-2068-1285

WARNING

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

Failure to do so can cause injury or death.

W-2203-0595


Bobcat®

ALTERNATOR BELT

Adjusting The Alternator Belt

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

Stop the engine.

Remove the blade extensions stored below the seat.

Use the start key to remove the access cover at the front below the seat.

Figure 10-140-1

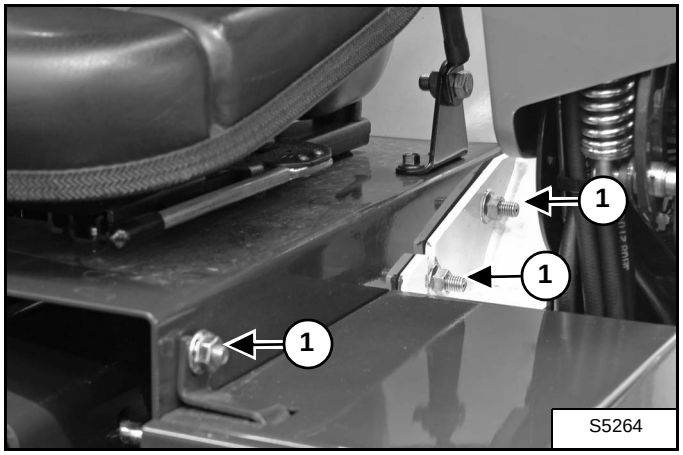
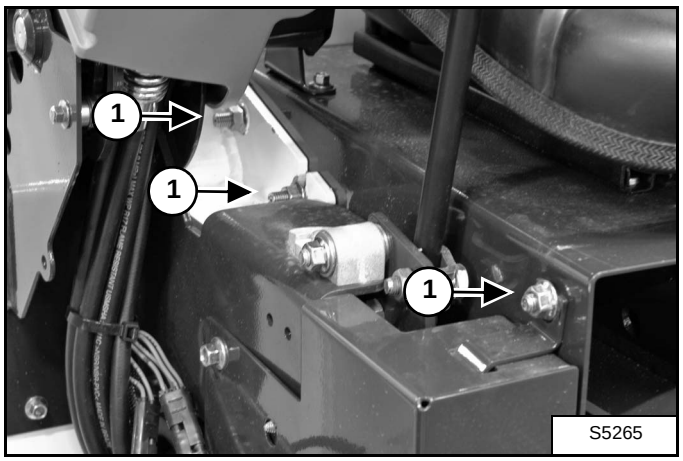
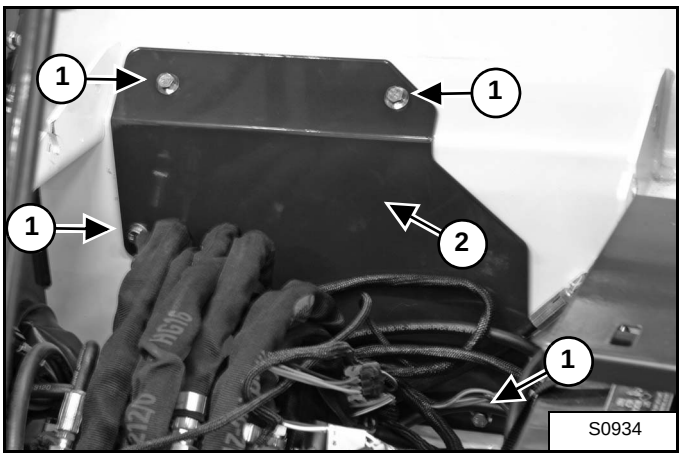


Figure 10-140-2



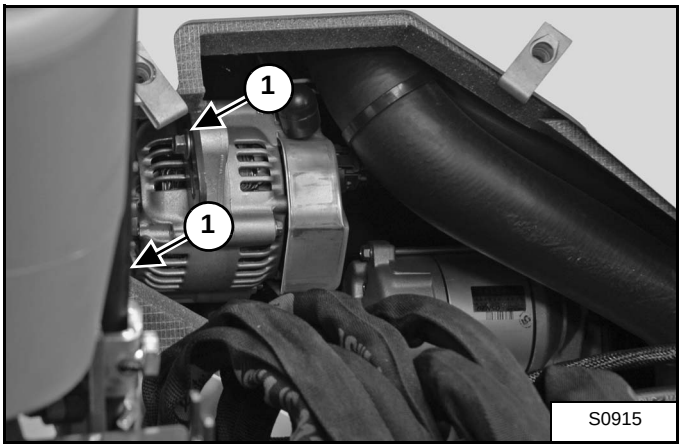
Remove the 6 bolts (Item 1) **[Figure 10-140-1]** and **[Figure 10-140-2]** (3 on each side of the seat) and remove the seat and seat mount.

Figure 10-140-3



Remove the 4 bolts (Item 1) and remove the access panel (Item 2) **[Figure 10-140-3]**.

Figure 10-140-4



Loosen the alternator mounting and adjustment bolts (Item 1) **[Figure 10-140-4]**.

If a belt tension tool is available, move the alternator toward the front of the machine until the belt has 250-267 N•m (new belt) or 214-231 N•m (used belt) tension.

If a belt tension tool is not available, move the alternator toward the front of the machine until the belt has 13 mm movement at the middle of the belt span with 58 N of force.

Tighten the mounting and adjustment bolts.

Install the access panel and install the seat and the storage compartment.


Bobcat®

SEAT BELT

Inspection And Maintenance

WARNING

Failure to properly inspect and maintain the seat belt can cause lack of operator restraint resulting in serious injury or death.

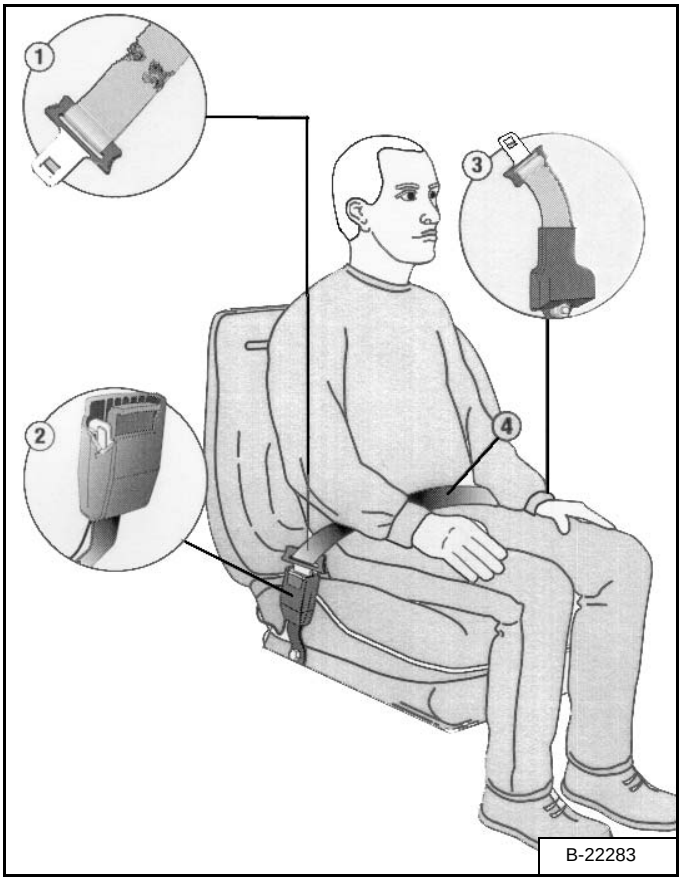
W-2466-0703

Check the seat belt daily for correct function.

Inspect the seat belt system thoroughly yearly or more often if the machine is exposed to severe environmental conditions or applications.

The seat belt system should be repaired or replaced if it shows cuts, fraying, extreme or unusual wear, significant discolorations due to ultraviolet (UV) rays from the sun, dusty / dirty conditions, abrasion to the seat belt webbing, or damage to the buckle, latch plate, retractor (if equipped), or hardware.

Figure 10-150-1



The items below are referenced in **[Figure 10-150-1]**.

1. Check the seat belt webbing. If the system is equipped with a retractor, pull the webbing completely out and inspect the full length of the webbing. Look for cuts, wear, fraying, dirt and stiffness.

2. Check the buckle and latch for proper function. Make sure latch plate is not excessively worn, deformed or buckle is not damaged.

3. Check the retractor web storage device (if equipped) by extending the seat belt webbing to determine if it extends and retracts the webbing correctly.

4. Check webbing in areas exposed to ultraviolet (UV) rays from the sun or extreme dust or dirt. If the original colour of the webbing in these areas is extremely faded and / or the webbing is packed with dirt, the webbing strength may have weakened.

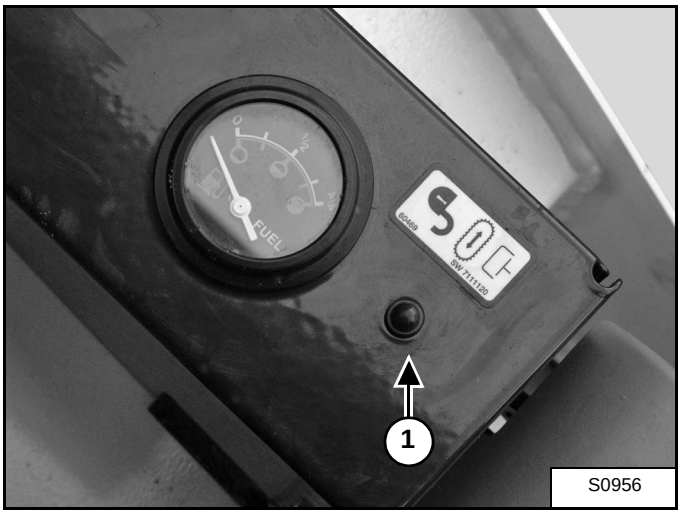
See your Bobcat dealer for approved seat belt system replacement parts for your machine.


Bobcat®

CONTROL CONSOLE LOCKOUTS

Inspection And Maintenance

Figure 10-160-1



When a console is raised **[Figure 10-160-1]**, the hydraulic control levers (joysticks) and traction system must not function.

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

Raise the left console. The green light (Item 1) **[Figure 10-160-1]** on the console will go off.

Move the joystick control levers. There should be no movement of the boom, arm, slew or bucket.

Move the steering control levers. There should be no movement of the excavator tracks.

Lower the left console. Raise the right console and repeat the inspection procedure.

The joystick control levers and traction system must be deactivated when either console is raised.

Service the system if these controls do not deactivate when a control console is raised. (See your Bobcat® dealer for service.)


Bobcat®

HYDRAULIC SYSTEM

ACCUMULATORS 20-61-1
Removal And Installation 20-61-1

ARM CYLINDER 20-21-1
Assembly 20-21-7
Disassembly 20-21-5
Parts Identification 20-21-4
Removal and Installation 20-21-3
Testing 20-21-1

BLADE CYLINDER 20-24-1
Assembly 20-24-7
Disassembly 20-24-5
Parts Identification 20-24-4
Removal and Installation 20-24-2
Testing 20-24-1

BLADE / TRACK EXPANSION SOLENOID BLOCK 20-150-1
Block Disassembly And Assembly 20-150-3
Block Removal and Installation 20-150-1
Description 20-150-1
Solenoid Removal and Installation 20-150-2

BOOM CYLINDER 20-20-1
Assembly 20-20-7
Disassembly 20-20-5
Parts Identification 20-20-4
Removal and Installation 20-20-2
Testing 20-20-1

BOOM SWING CYLINDER 20-22-1
Assembly 20-22-7
Disassembly 20-22-5
Parts Identification 20-22-4
Removal and Installation 20-22-2
Testing 20-22-1

BUCKET CYLINDER 20-23-1
Assembly 20-23-7
Disassembly 20-23-5
Parts Identification 20-23-4
Removal and Installation 20-23-2
Testing 20-23-1

Continued On Next Page

HYDRAULIC SYSTEM (CONT'D)

CROSSPORT RELIEF VALVES 20-32-1
Testing And Adjusting The Crossport Relief Valve 20-32-1

HYDRAULIC CONTROL VALVE 20-40-1
Assembly 20-40-37
Arm Valve Section Disassembly and Assembly 20-40-12
Auxiliary Valve Section Disassembly And Assembly 20-40-18
Blade Valve Section Disassembly And Assembly 20-40-33
Boom Swing Valve Section Disassembly And Assembly. 20-40-9
Boom Valve Section Disassembly And Assembly 20-40-23
Bucket Valve Section Disassembly And Assembly 20-40-15
Description. 20-40-1
Disassembly 20-40-4
Left Travel Valve Section Disassembly And Assembly 20-40-26
Parts Identification 20-40-3
Right Travel Valve Section Disassembly And Assembly 20-40-5
Removal And Installation 20-40-1
Swing (Slew) Valve Section Disassembly And Assembly 20-40-30

HYDRAULIC FILTER MOUNT 20-120-1
Description. 20-120-1
Removal And Installation 20-120-1

HYDRAULIC PUMP 20-50-1
Assembly 20-50-33
Description. 20-50-1
Disassembly 20-50-10
Gear Pump Assembly 20-50-31
Gear Pump Disassembly 20-50-11
Parts Identification 20-50-9
Piston Pump Assembly 20-50-22
Piston Pump Disassembly 20-50-13
Removal And Installation 20-50-6
Testing Auxiliary Hydraulic Flow 20-50-5
Testing The Gear Pump. 20-50-4
Testing The Piston Pump. 20-50-2
Torque Adjustment. 20-50-1

HYDRAULIC RESERVOIR 20-130-1
Description. 20-130-1
Removal And Installation 20-130-1

HYDRAULIC SYSTEM INFORMATION 20-10-1
Glossary Of Hydraulic / Hydrostatic Symbols 20-10-1
Troubleshooting The Cylinder Circuit. 20-10-6
Troubleshooting The Hydraulic Circuit 20-10-5
Troubleshooting The Travel Circuit. 20-10-8
Troubleshooting The Swing (Upperstructure Slew) Circuit 20-10-7

Continued On Next Page

HYDRAULIC SYSTEM (CONT'D)

LEFT CONTROL LEVER (JOYSTICK) 20-111-1
- Assembly 20-111-12
- Description 20-111-1
- Disassembly 20-111-7
- Handle Removal And Installation 20-111-3
- Parts Identification 20-111-6
- Removal And Installation 20-111-5
- Testing 20-111-1

MAIN RELIEF VALVE 20-30-1
- Testing And Adjusting The Main Relief Valve 20-30-1

MANIFOLD ASSEMBLY / ACCUMULATOR 20-60-1
- Assembly 20-60-16
- Description 20-60-1
- Disassembly 20-60-5
- Parts Identification 20-60-4
- Removal And Installation 20-60-1

OIL COOLER 20-140-1
- Description 20-140-1
- Removal And Installation 20-140-1

PORT RELIEF VALVES 20-31-1
- Testing And Adjusting The Port Relief Valve Pressure 20-31-1

PRESSURE REDUCING VALVE 20-33-1
- Testing And Adjusting The Pressure Reducing Valve 20-33-1

RIGHT CONTROL LEVER (JOYSTICK) 20-110-1
- Assembly 20-110-11
- Description 20-110-1
- Disassembly 20-110-6
- Handle Removal And Installation 20-110-3
- Parts Identification 20-110-5
- Removal And Installation 20-110-4
- Testing 20-110-1

SWING MOTOR 20-90-1
- Assembly 20-90-9
- Description 20-90-1
- Disassembly 20-90-3
- Parts Identification 20-90-2
- Removal And Installation 20-90-1

Continued On Next Page

SWIVEL JOINT 20-80-1
Assembly 20-80-7
Description 20-80-1
Disassembly 20-80-5
Parts Identification 20-80-4
Removal And Installation 20-80-1

TRACK FRAME EXPANSION CYLINDER 20-25-1
Assembly 20-25-9
Disassembly 20-25-7
Parts Identification 20-25-6
Removal And Installation 20-25-2
Testing 20-25-1

TRAVEL MOTOR 20-70-1
Assembly 20-70-10
Description 20-70-1
Disassembly 20-70-3
Parts Identification 20-70-2
Removal And Installation 20-70-1

Glossary Of Hydraulic / Hydrostatic Symbols

SYMBOL DESCRIPTION

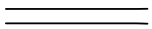
FLOW LINES and CONNECTIONS

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

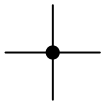
PILOT PRESSURE - Dashed Line - Pilot Line (Line which conducts control fluid).

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

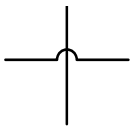
COMPONENTS - Long Chain Line - Enclosure outline for several components assembled in one unit.



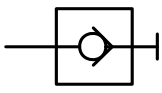
MECHANICAL CONNECTIONS - Double Line (Shaft, Lever, Piston Rod).



CONNECTED JUNCTION OF OIL LINES (Flow Line Connection).



OIL LINES CROSSING (NOT Connected).



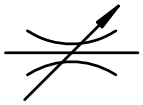
COUPLER - Quick - Acting Coupling (uncoupled, closed by non-return valve).

SYMBOL DESCRIPTION

BASIC and MISCELLANEOUS SYMBOLS



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



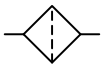
VARIABLE ADJUSTMENT RESTRICTION - Regulated or Variable Restriction.



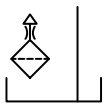
TEMPERATURE CONTROL - (Indication of temperature).



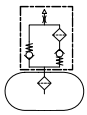
TEMPERATURE INDICATOR - (temperature measurement - thermometer).



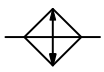
FILTER (strainer or screen) - For fluid conditioning.



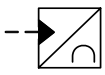
VENTED AND FILTERED RESERVOIR (reservoir open to atmosphere).



PRESSURIZED, VENTED AND FiLTERED RESERVOIR (Reservoir uses a pressured cap).



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



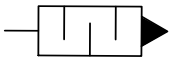
PRESSURE SENSOR - Varies electric signal with pressure.



DIFFERENTIAL PRESSURE SWITCH - Switch activates when pressure difference reaches specified level.



PRESSURE SWITCH - Switch activates when pressure reaches specified level.



MUFFLER (silencer) - Reduces noise.

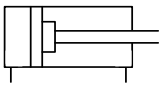
Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

SYMBOL DESCRIPTION

CYLINDER: Equipment to convert hydraulic energy into linear energy and in which the fluid pressure operates alternately in both directions (forward and backward strokes).

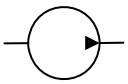


DOUBLE ACTING HYDRAULIC CYLINDER, UNEQUAL DISPLACEMENT - With single piston rod.

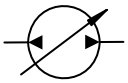


DOUBLE ACTING HYDRAULIC CYLINDER, UNEQUAL DISPLACEMENT and CUSHION ON ONE END - With single piston rod.

PUMP: To convert mechanical energy into hydraulic energy.

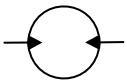


FIXED CAPACITY DISPLACEMENT HYDRAULIC PUMP - With one direction of flow.



VARIABLE CAPACITY DISPLACEMENT BIDIRECTIONAL HYDRAULIC PUMP - With two directions of flow (bidirectional).

MOTOR: To convert hydraulic energy into rotary mechanical energy.



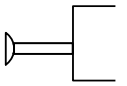
FIXED CAPACITY DISPLACEMENT BIDIRECTIONAL HYDRAULIC MOTOR - With two directions of flow (bidirectional.

SYMBOL DESCRIPTION

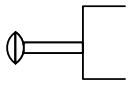
CONTROL MECHANISMS



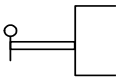
CONTROL VALVE WITH DETENT (Holds Valve in Position) - device for maintaining a given position (mechanical).



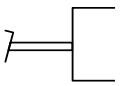
CONTROL VALVE ACTIVATED BY A PULL BUTTON (manual).



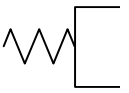
CONTROL VALVE ACTIVATED BY A PUSH-PULL BUTTON (manual).



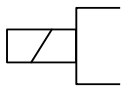
CONTROL VALVE ACTIVATED BY A LEVER (manual).



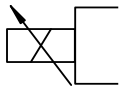
CONTROL VALVE ACTIVATED BY A PEDAL (manual).



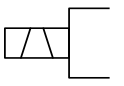
CONTROL VALVE WITH SPRING RETURN (mechanical).



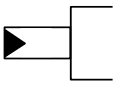
CONTROL VALVE ACTIVATED BY AN ELECTRIC SOLENOID (electrical).



CONTROL VALVE ACTIVATED BY A PROPORTIONAL ELECTRICAL SOLENOID (electrical).



CONTROL VALVE ACTIVATED BY DUAL ELECTRICAL SOLENOID (electrical).



CONTROL VALVE ACTIVATED BY PILOT PRESSURE (indirect control, pilot actuated by application of pressure).

Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

SYMBOL DESCRIPTION

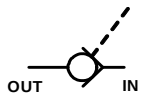
NON-RETURN VALVE, SHUTTLE VALVE: Valve which allows free flow in one direction only.



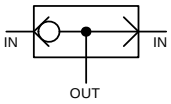
NON-RETURN VALVE (Check Valve) - Used as Replenishing Valve, Lock Check Valve or Anticavitation Valve - Opens if the Inlet pressure is higher than the Outlet pressure. Often contains internal spring which has NO significant pressure value.



SPRING LOADED VALVE (bypass Valve) - Opens if the Inlet pressure is greater than the Outlet pressure plus the spring pressure.



PILOT CONTROLLED NON-RETURN VALVE- It is possible to open the valve by pilot pressure.



SHUTTLE VALVE - The Inlet port connected to the higher pressure is automatically connected to the Outlet port while the other Inlet port is closed.

SYMBOL DESCRIPTION

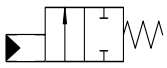
DIRECTIONAL CONTROL VALVE: Valve providing for the opening (fully or restricted) or the closing of one or more flow paths (represented by several squares).



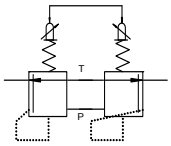
TWO PORTS and CLOSED FLOW PATHS



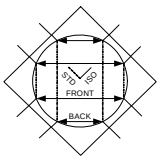
SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (Two Position) - controlled by an electric solenoid (with return spring).



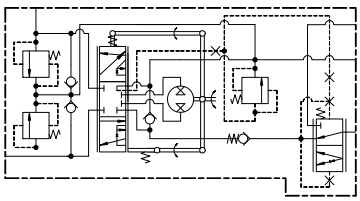
PILOT ACTIVATED DIRECTIONAL CONTROL VALVE (Two Position) - controlled by pressure (with return spring).



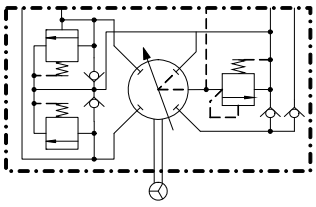
MANUALLY ACTIVATED DIRECTION CONTROL VALVE (Variable Position) Joystick Controlled, variable pressure to shift the pilot activated directional control valve spool.

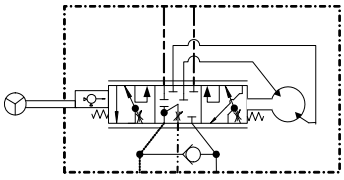


MANUALLY ACTIVATED FLOW CONTROL VALVE (Two Position) allows for changing pilot flow to control switching joystick functions for STD / ISO Control (Excavators Only).

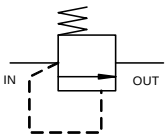
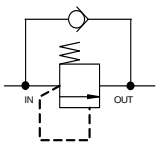
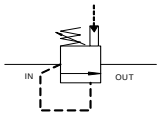
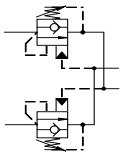
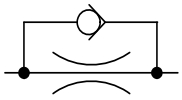
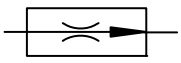


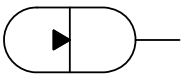
STEERING CONTROL VALVE (Variable Position) - Used for controlling the hydraulic flow for the steering cylinders in relationship to the amount the steering wheel is rotated.





Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

SYMBOL	DESCRIPTION
PRESSURE CONTROL VALVE: Valve ensuring the control of pressure.	
	RELIEF VALVE - When the Inlet pressure overcomes the opposing force of the spring, the valve opens permitting flow from the Outlet port.
	RELIEF / REPLENISHING VALVE or RELIEF / ANTICAVITATION VALVE - When the Inlet pressure overcomes the opposing force of the spring, the valve opens permitting flow from the Outlet port - Allows free flow in the opposite direction.
	DUAL PRESSURE RELIEF VALVE - When the Inlet pressure overcomes the opposing force of the spring, the valve opens permitting flow from the Outlet port. Pilot pressure provides a second pressure value.
	LOCK VALVE - hydraulic pressure is applied to open the valve to allow the hydraulic cylinder to move.
FLOW CONTROL VALVE: Valve controlling the flow in one or both directions.	
	ONE WAY RESTRICTOR VALVE (Non-Return Valve with Restriction) - Unit allowing free flow in one direction but restricted flow in the other direction.
	TOW VALVE - Normally in closed position.
	LOAD SENSE BLEED VALVE - Regulates small amount of fluid flow (leakage).

SYMBOL	DESCRIPTION
MISCELLANEOUS	
	ACCUMULATOR - Supplies temporary reserve pressure to the hydraulic system when the engine has been stopped.

Troubleshooting The Hydraulic Circuit

TROUBLESHOOTING THE HYDRAULIC CIRCUIT		
PROBLEM	**CAUSE**	**CORRECTION**
No hydraulic operation at 1 or more circuits.	Hydraulic oil level low.	Refill with correct oil.
	Hydraulic pump drive coupling damaged.	Replace.
	Hydraulic pump defective.	Check, repair or replace.
	Main relief valve defective.	Readjust or replace.
Hydraulic power insufficient to 1 or more circuits.	Main relief valve pressure setting incorrect.	Readjust or replace.
Hydraulic speed too slow.	Hydraulic oil level or viscosity incorrect.	Refill or replace.
	Engine RPM reduced.	Readjust or replace.
	Control valve linkage defective.	Check, repair or replace
	Hydraulic pump volume low.	Check, repair or replace.
Oil temperature too high.	Oil cooler or radiator fins plugged.	Clean oil cooler external surface.
	Hydraulic oil level low.	Refill or replace.
	Non recommended hydraulic oil	Replace.
	Relief valve excessively activated.	Use proper operating procedures.
	1 or more relief valves not set correctly.	Test, readjust or replace.
	Extreme operating conditions. High ambient temperature (IE: enclosed structure).	
	Alternator belt loose.	Tighten alternator belt.

Troubleshooting The Cylinder Circuit

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

Troubleshooting The Swing (Upperstructure Slew) Circuit

TROUBLESHOOTING THE SWING (UPPERSTRUCTURE SLEW) CIRCUIT		
PROBLEM	**CAUSE**	**CORRECTION**
Swing not operating.	Control console(s) raised.	Lower control console(s).
	Control console lockout switch defective.	Readjust or replace.
	Swing lock pin engaged.	Disengage lock pin.
	Control lever (joystick) manifold pressure reducing valve defective.	Repair or replace.
	Control lever (joystick) manifold solenoid coil defective.	Replace.
	Control lever (joystick) manifold solenoid valve defective.	Repair or replace.
	Swing motor gear defective.	Repair or replace.
	Control lever (joystick) internal leakage excessive.	Repair or replace
	Swing motor defective.	Repair or replace.
Swing force.	Main relief valve set too low.	Readjust or replace.
	Swing motor relief valve pressure too low.	Readjust or replace.
Swing speed too slow.	Pump flow low.	Check, repair or replace.
	Blocked or restricted line to swing motor.	Replace.
	Control lever (joystick) internal leakage excessive.	Repair or replace.
	Control valve internal leakage excessive.	Repair or replace.
	Swing motor internal leakage excessive.	Repair or replace.
Swing over run excessive.	Control valve spool sticking.	Repair or replace.
	Control lever (joystick) spool sticking.	Repair or replace.
	Swing motor relief valve set too low.	Repair or replace.
	Swing motor internal leakage excessive.	Repair or replace.

Troubleshooting The Travel Circuit

TROUBLESHOOTING THE TRAVEL CIRCUIT		
PROBLEM	**CAUSE**	**CORRECTION**
Travel system inoperable.	Lever linkage incorrectly adjusted.	Readjust.
	Track tension too tight.	Readjust.
	Defective pump.	Check, repair or replace.
	Travel motor counterbalance spool sticking.	Repair or replace.
	Travel motor internal leakage excessive.	Repair or replace.
	Travel motor defective.	Repair or replace.
	Travel motor gears defective.	Repair or replace.
	Swivel joint defective.	Repair or replace.
	Main relief valve pressure too low.	Readjust or replace.
Travel power.	Track tension too tight.	Readjust.
	Main relief valve pressure too low.	Readjust or replace.
	Travel motor counterbalance spool sticking.	Repair or replace.
Speed too slow.	Lever linkage incorrectly adjusted.	Readjust.
	Swivel joint internal leakage excessive.	Repair or replace.
	Control valve internal leakage excessive.	Repair or replace.
	Low pump pressure.	Check, repair or replace.
	Travel motor internal leakage excessive.	Repair or replace.
Machine not running straight.	Lever linkage incorrectly adjusted.	Readjust.
	Track tension not equal.	Readjust.
	Pump output not equal.	Repair or replace.
	Travel motor internal leakage not equal.	Repair or replace.
	Travel motor counterbalance spool sticking.	Repair or replace.
	Main relief valve pressure set too low.	Repair or replace.
	Swivel joint internal leakage excessive.	Repair or replace.
	Control valve internal leakage not equal.	Repair or replace.
Machine will not hold on slope or while digging.	Travel motor counterbalance valve leakage excessive.	Repair or replace.
	Hose damage.	Replace.
Blade drops while machine is moving.	Lever linkage misadjusted.	Readjust.
	Cylinder internal leakage excessive.	Repair or replace.
	Control valve internal leakage excessive.	Repair or replace.
	Swivel joint internal leakage from travel motor pressure circuit into blade cylinder circuit.	Repair or replace.

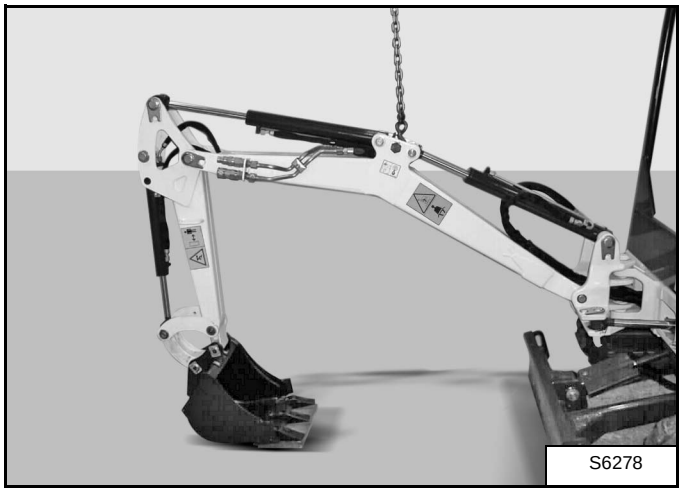
BOOM CYLINDER

Testing

Lower the boom / bucket and blade to the ground.

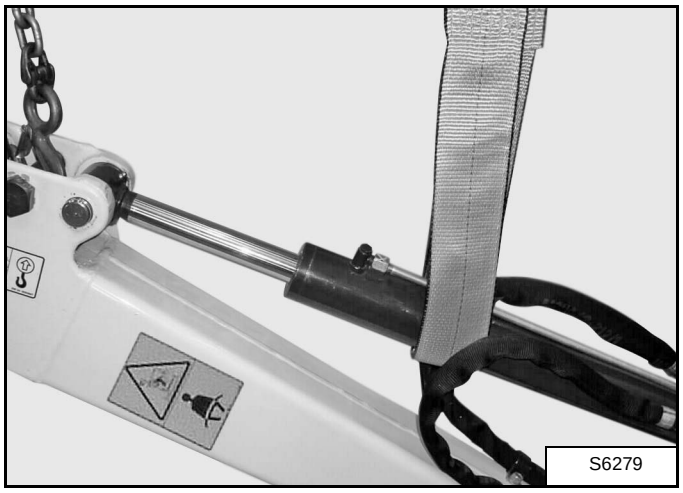
Stop the engine. Raise the control console.

Figure 20-20-1



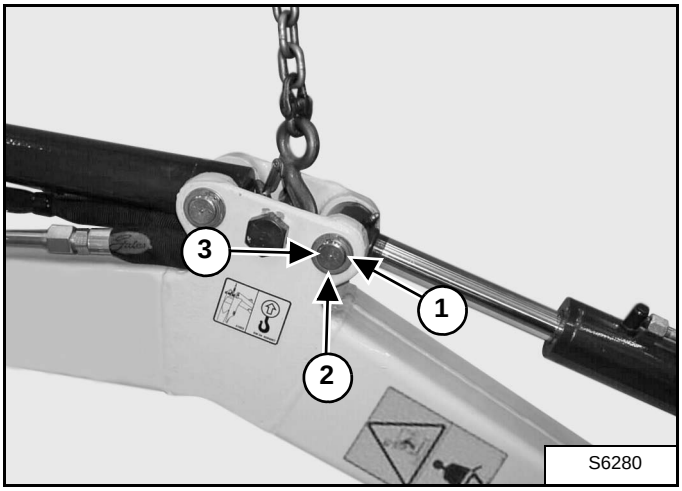
Support the boom using a chain hoist **[Figure 20-20-1]**.

Figure 20-20-2



Support the boom cylinder **[Figure 20-20-2]**.

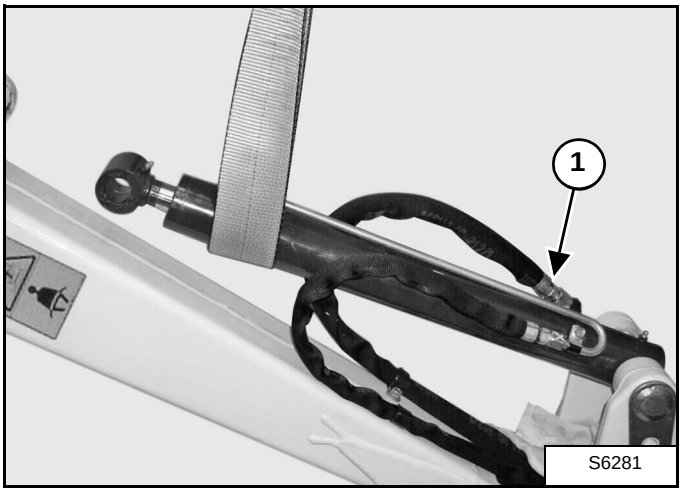
Figure 20-20-3



Remove the retaining ring (Item 1) and washer (Item 2) **[Figure 20-20-3]** from the rod end pivot pin.

Remove the pivot pin (Item 3) **[Figure 20-20-3]**.

Figure 20-20-4



Lower control console and fasten the seat belt. Start the engine and retract the boom cylinder **[Figure 20-20-4]**.

With the key in the ON position and the engine stopped, move the hydraulic controls to release the hydraulic pressure. Raise the control console.

Disconnect the boom cylinder base end hose (Item 1) **[Figure 20-20-4]** at the hose tubeline connection.

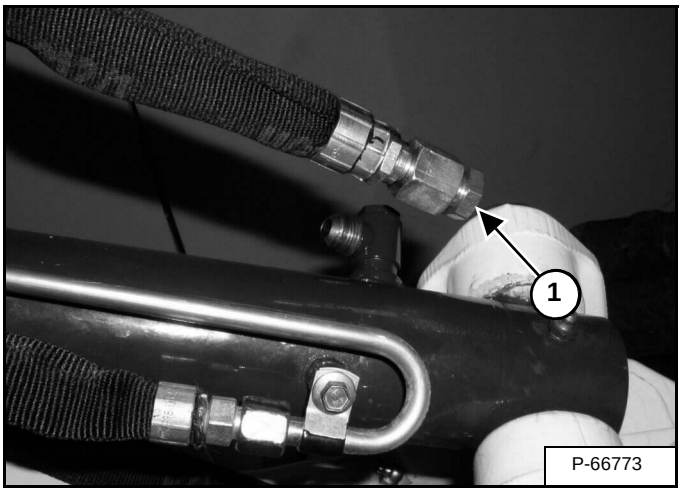
Testing (Cont'd)

WARNING

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

W-2145-0290

Figure 20-20-5



Install a cap (Item 1) **[Figure 20-20-5]** on the hose fitting and tighten.

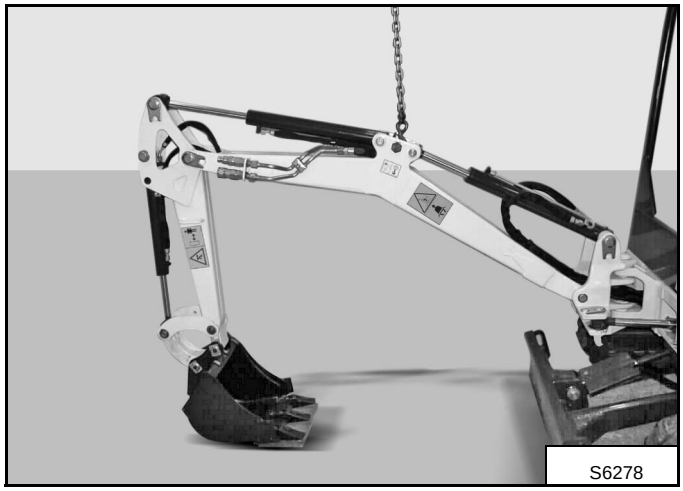
Lower control console and fasten seat belt. Start the engine and retract the boom cylinder.

If there is any leakage from the base end fitting on the boom cylinder, remove the cylinder for repair or replacement.

Removal and Installation

Lower the boom / bucket and blade to the ground. Stop the engine.

Figure 20-20-6



Support the boom using a chain hoist **[Figure 20-20-6]**.

With the key in the ON position, move the hydraulic controls to release the hydraulic pressure.

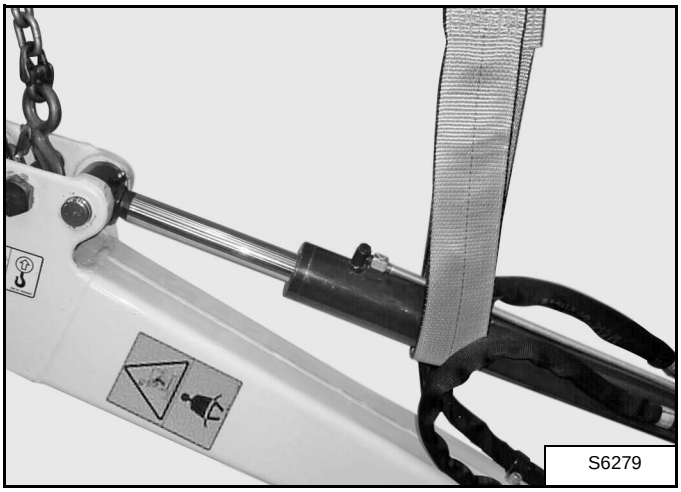
IMPORTANT

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.

I-2003-0888

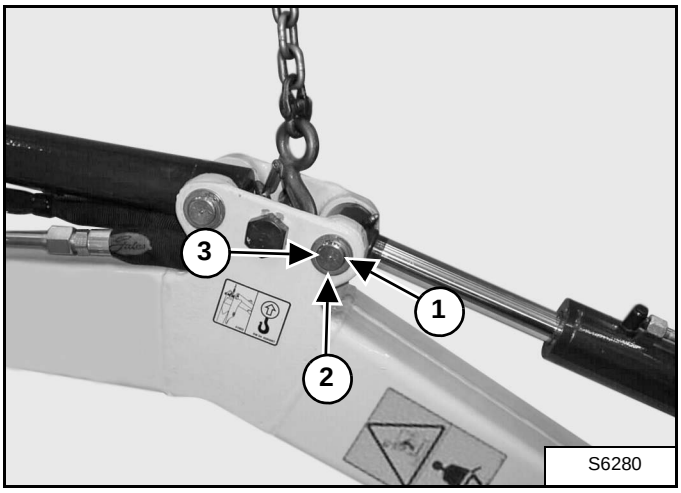
Removal and Installation (Cont'd)

Figure 20-20-7



Support the boom cylinder **[Figure 20-20-7]**.

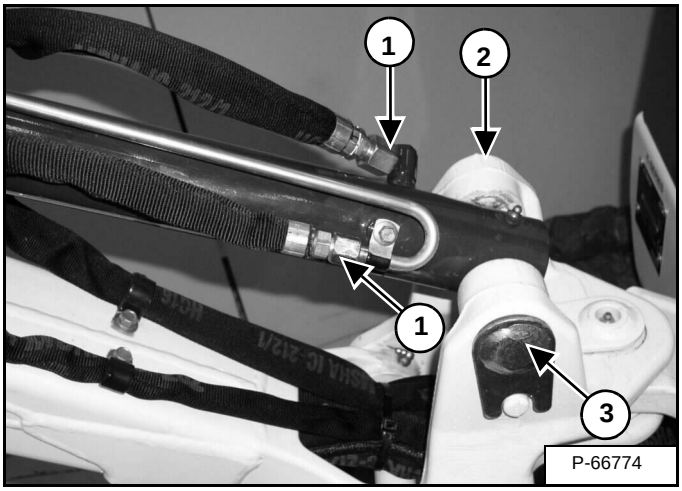
Figure 20-20-8



Remove the retaining ring (Item 1) and washer (Item 2) **[Figure 20-20-8]** from the rod end pivot pin.

Remove the pivot pin (Item 3) **[Figure 20-20-8]**.

Figure 20-20-9



Disconnect and cap the two hoses (Item 1) **[Figure 20-20-9]** from the boom cylinder.

Remove the snap ring and washers (Item 2) **[Figure 20-20-9]** from the boom cylinder base end pin.

Remove the cylinder base end pin (Item 3) **[Figure 20-20-9]**.

Remove the boom cylinder.

⚠ WARNING

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

W-2145-0290

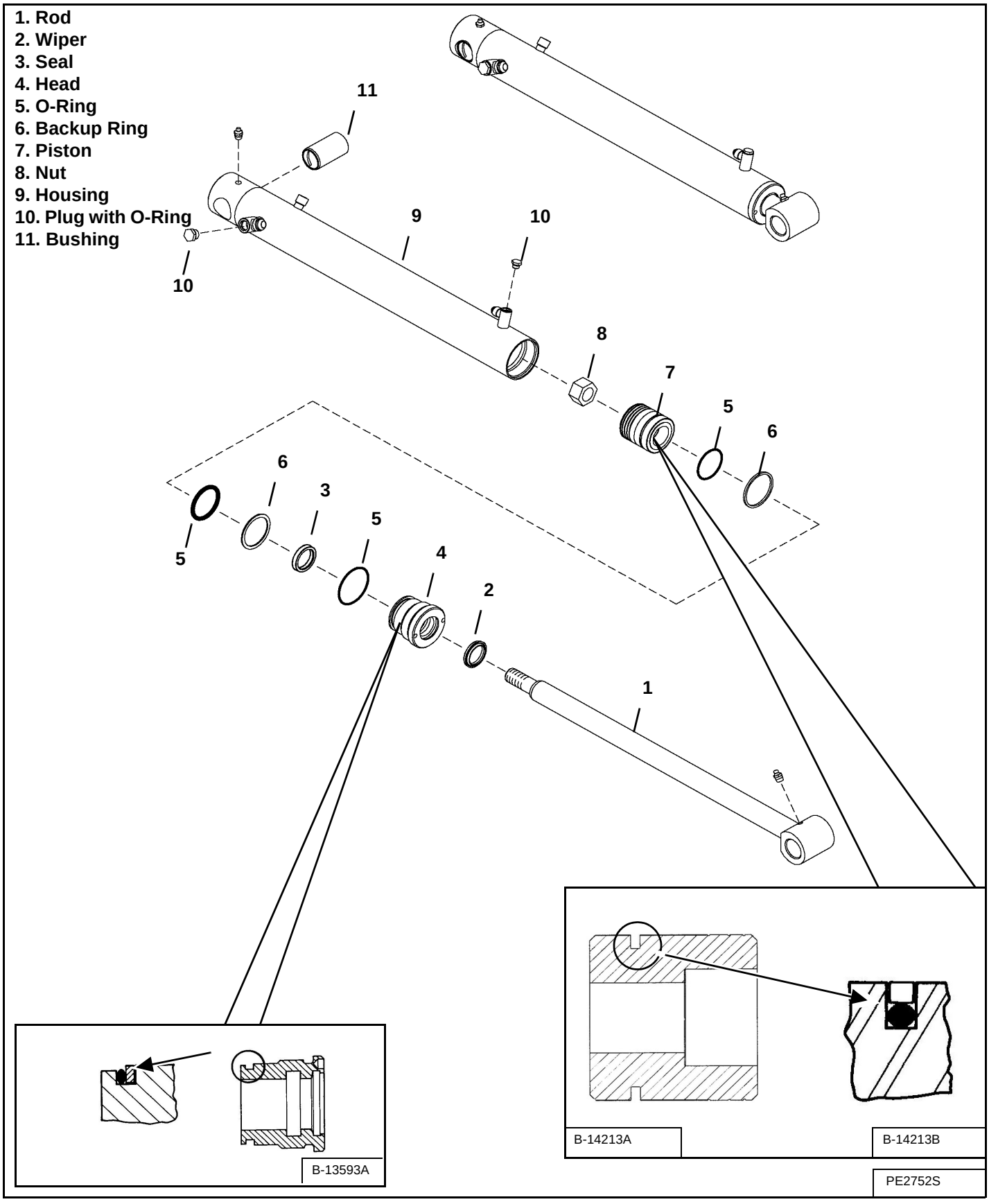
⚠ WARNING

AVOID INJURY OR DEATH

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

W-2103-0807

Parts Identification



Disassembly

Clean the outside of the boom cylinder before disassembly.

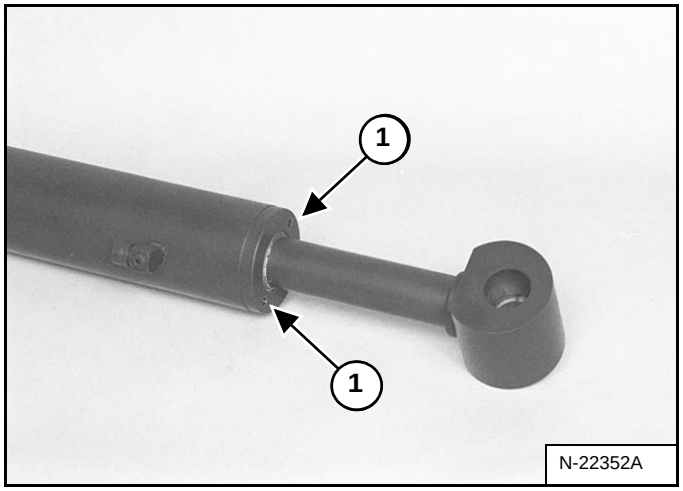
Use the following tools to disassemble the cylinder:

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

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

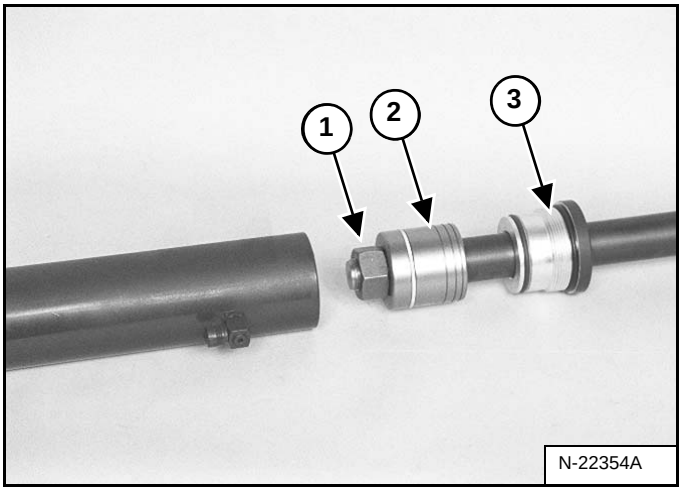
Put the base end of the cylinder in a vise.

Figure 20-20-10



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-20-10]** to loosen the head.

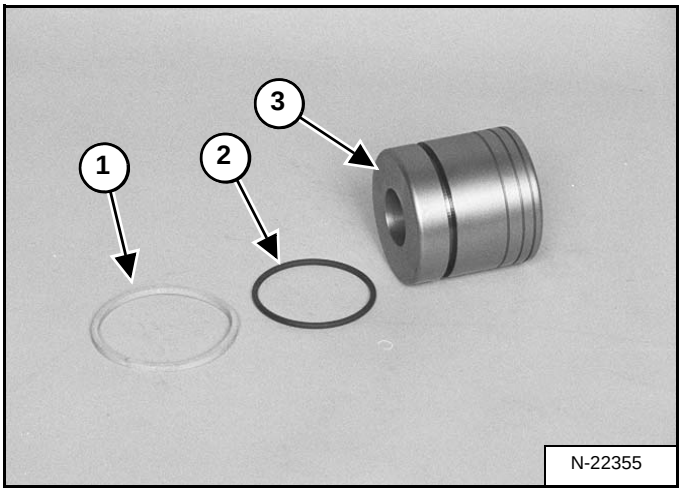
Figure 20-20-11



Remove the head and the rod assembly from the cylinder **[Figure 20-20-11]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-20-11]**.

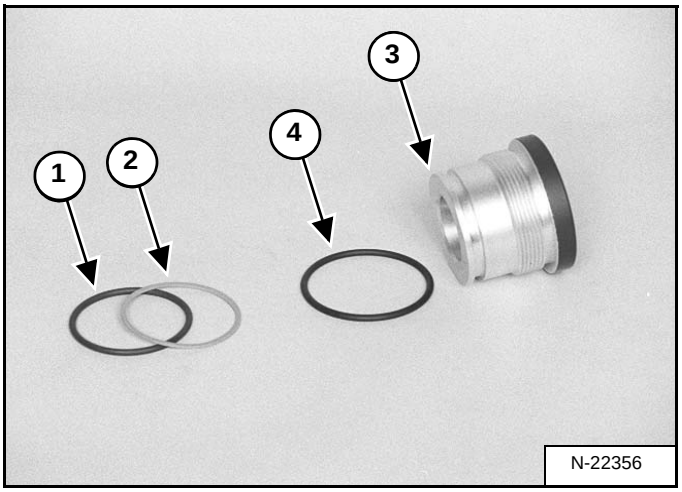
Figure 20-20-12



Cushion Piston: Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-20-12]**.

Disassembly (Cont'd)

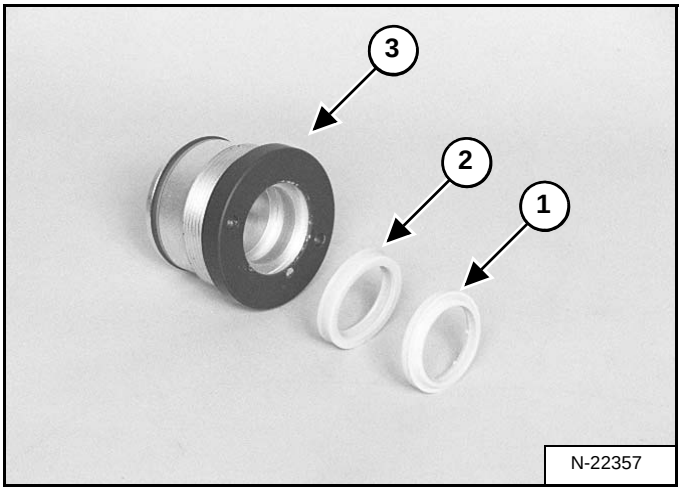
Figure 20-20-13



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

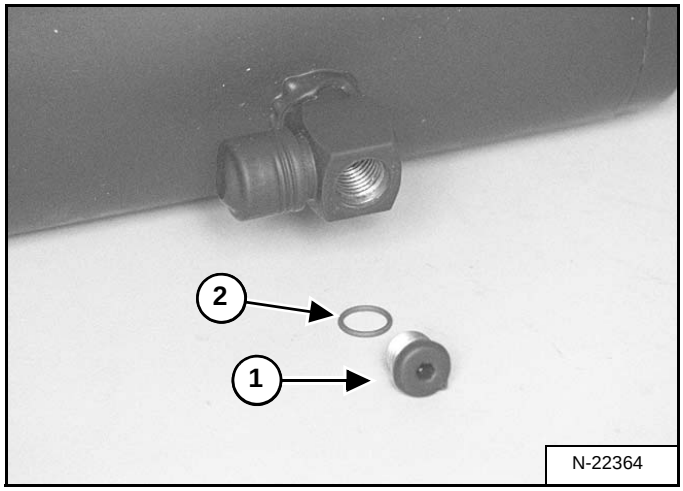
Remove the O-ring (Item 4) **[Figure 20-20-13]**.

Figure 20-20-14



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-20-14]**.

Figure 20-20-15



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-20-15]**.

Assembly

Use the following tools to assemble the cylinder:

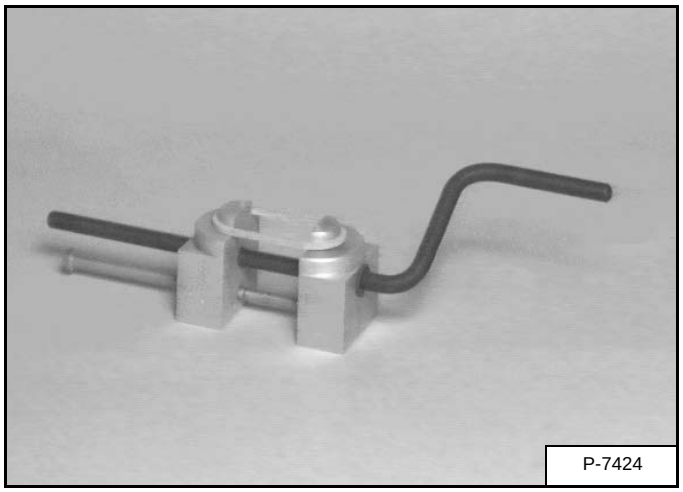
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

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.

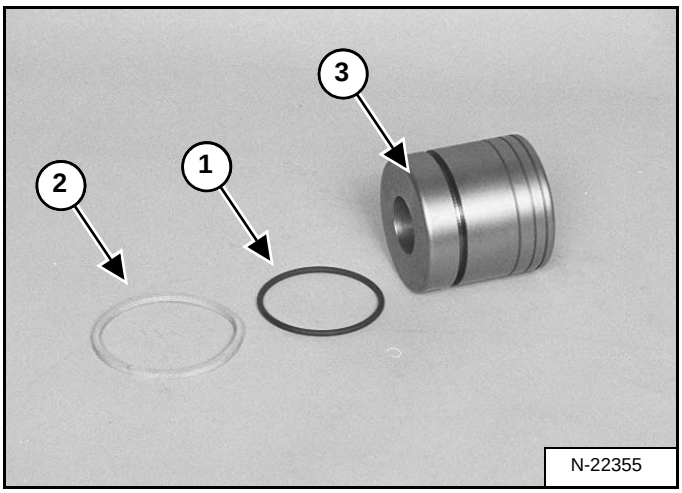
Figure 20-20-16



Install new seal on the tool and slowly stretch it until it fits the piston **[Figure 20-20-16]**.

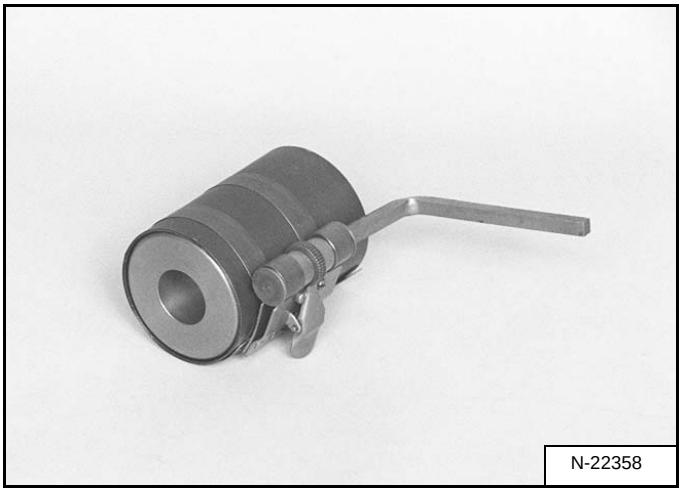
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-20-17



Cushion Piston: Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-20-17]**.

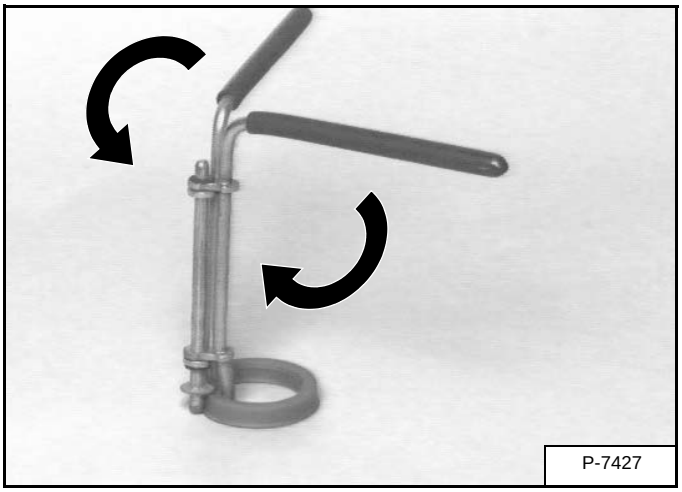
Figure 20-20-18



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-20-18]**.

Assembly (Cont'd)

Figure 20-20-19

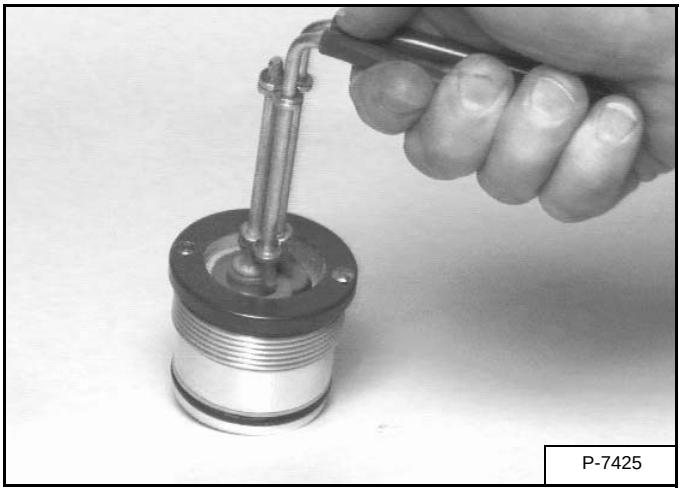


Install the rod seal on the rod seal tool **[Figure 20-20-19]**.

NOTE: During installation the spring side of the seal must be toward the inside of the cylinder.

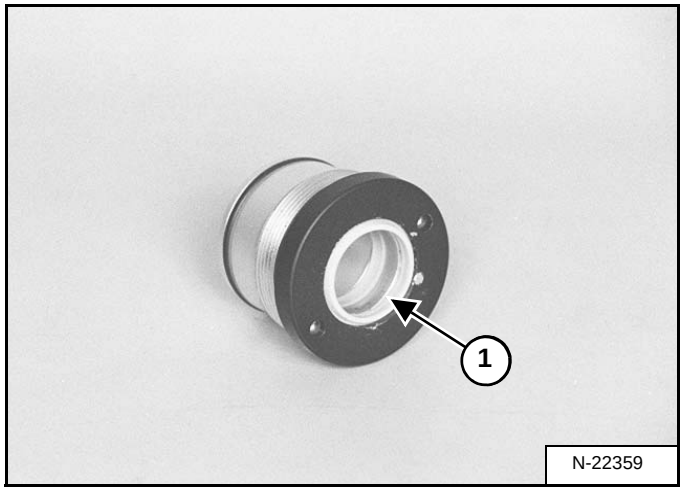
Rotate the handles to collapse the rod seal **[Figure 20-20-19]**.

Figure 20-20-20



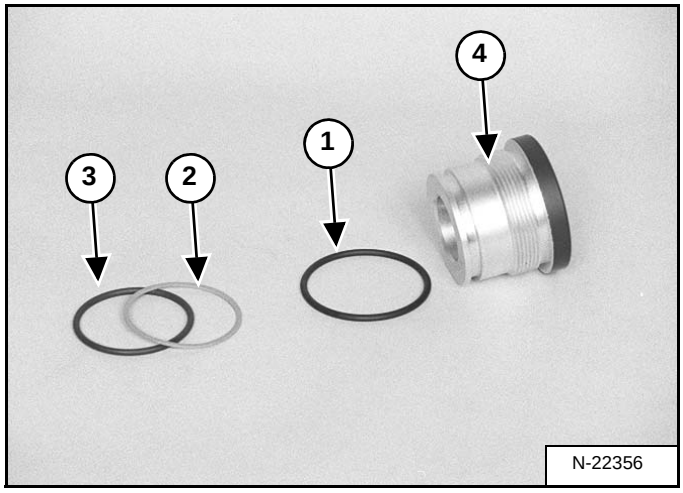
Install the rod seal in the head **[Figure 20-20-20]**.

Figure 20-20-21



Install the wiper seal with the wiper (Item 1) **[Figure 20-20-21]** toward the outside of the head.

Figure 20-20-22

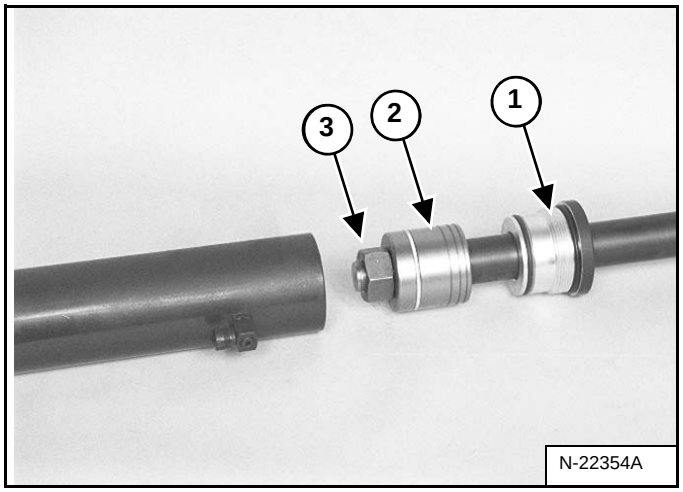


Install the O-ring (Item 1) **[Figure 20-20-22]**.

Install the back-up ring (Item 2) and O-ring (Item 3) into the groove on the head (Item 4) **[Figure 20-20-22]**.

Assembly (Cont'd)

Figure 20-20-23



Install the head (Item 1) and the piston (Item 2) **[Figure 20-20-23]** on the rod as shown.

Grease the piston where the nut contacts the piston. Do not get grease on the threads.

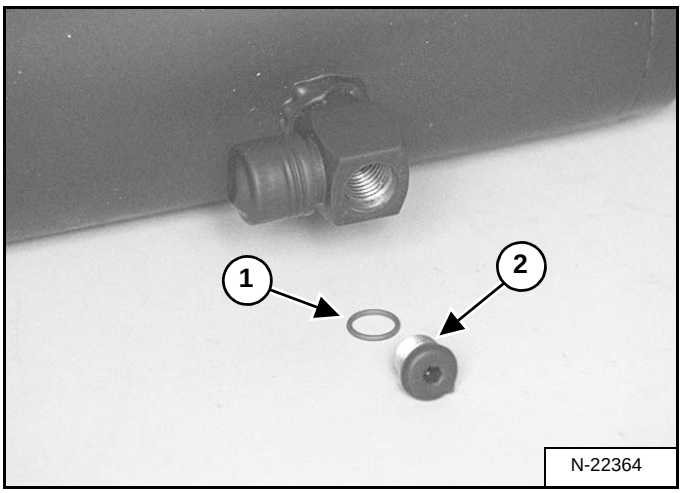
Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-20-23]**.

NOTE: Clean and dry the rod threads, from the kit install a NEW NUT with pre-applied Loctite®.

Tighten the nut to 300 ft.-lb. (406 N•m) torque.

Figure 20-20-24



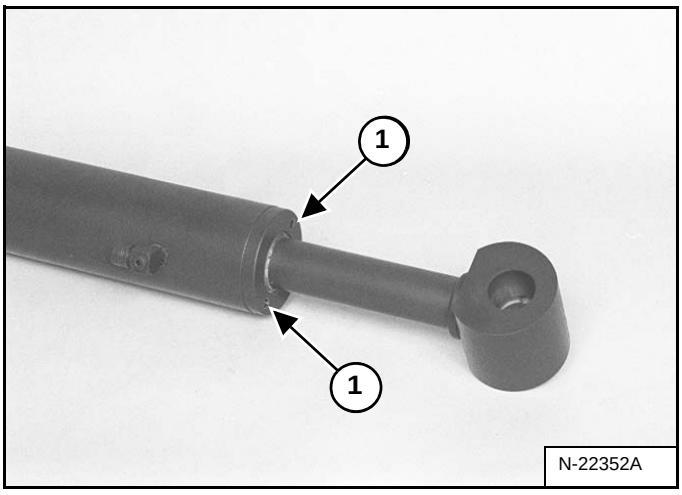
Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-20-24]**.

Tighten the base end fitting plug to 37 ft.-lb. (50 N•m) torque.

Tighten the rod end fitting plug to 15 ft.-lb. (20 N•m) torque.

Put the base end of the hydraulic cylinder in a vise.

Figure 20-20-25



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-20-25]** to tighten the head. Head to be torqued until flush with end of the housing.


Bobcat®

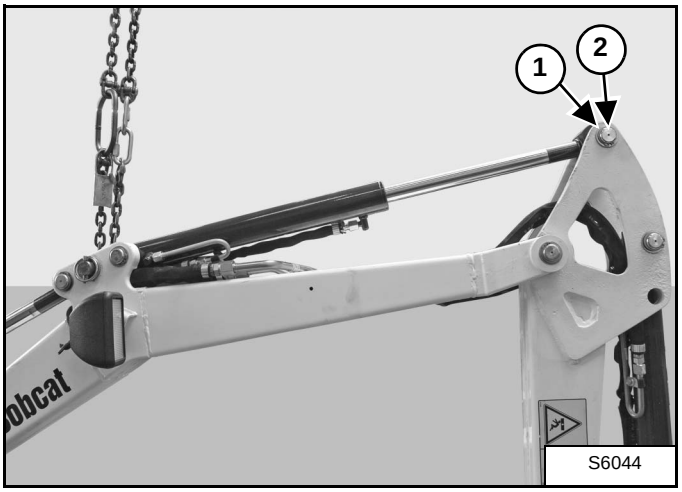
ARM CYLINDER

Testing

Lower the boom / bucket and blade to the ground.

Stop the engine. Raise the control console.

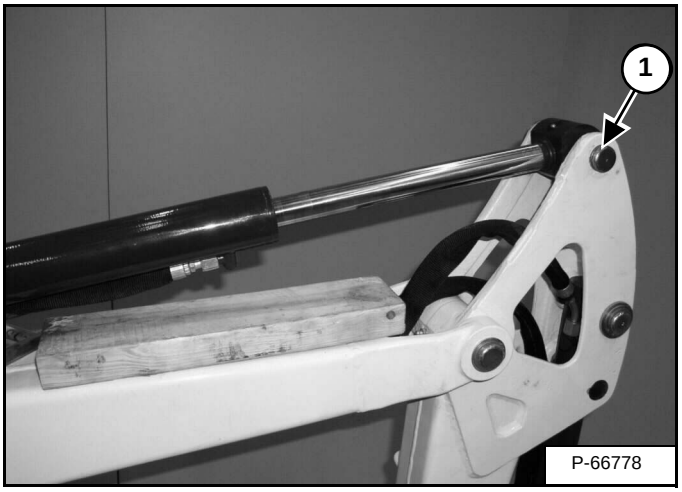
Figure 20-21-1



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

Remove the retaining ring (Item 1) and washer (Item 2) **[Figure 20-21-1]** from the rod end pivot pin.

Figure 20-21-2



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

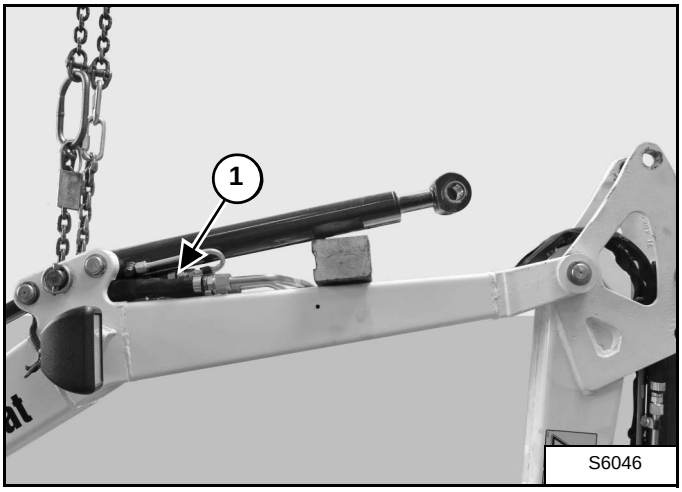
Remove the pivot pin (Item 1) **[Figure 20-21-2]**.

⚠ WARNING

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

W-2145-0290

Figure 20-21-3



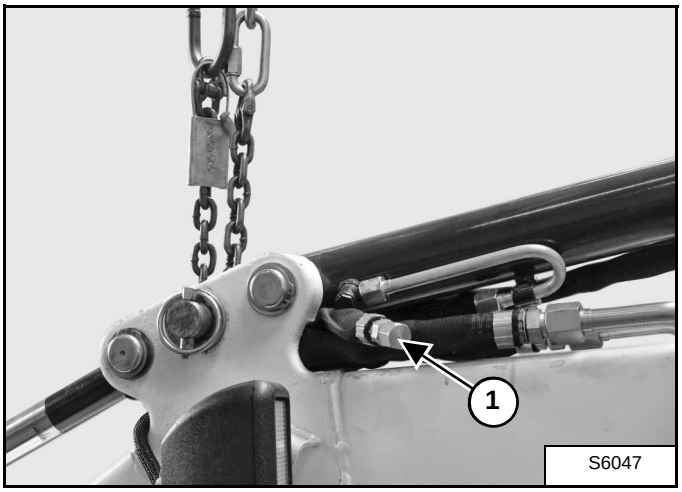
Lower control console and fasten the seat belt. Start the engine and retract the arm cylinder **[Figure 20-21-3]**.

Stop the engine. With the key in the ON position, move the hydraulic controls to release the hydraulic pressure. Raise the control console.

Disconnect the arm cylinder base end hose (Item 1) **[Figure 20-21-3]** back at the hose tubeline connection.

Testing (Cont'd)

Figure 20-21-4



Install a plug (Item 1) **[Figure 20-21-4]** on the tubeline and tighten.

Lower control console and fasten the seat belt. Start the engine and retract the arm cylinder.

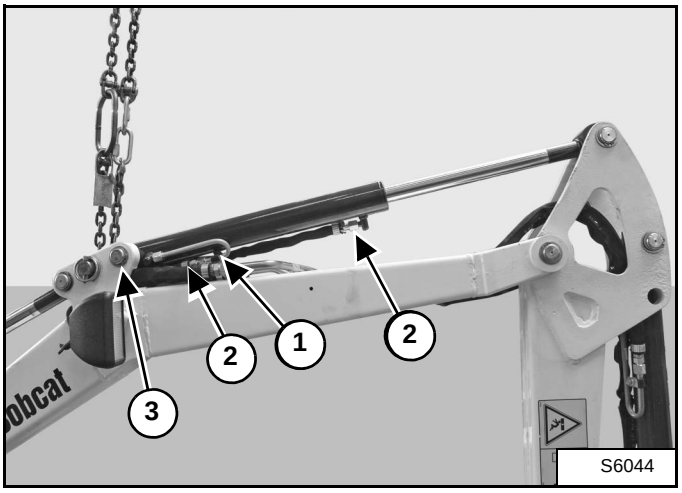
If there is any leakage from the base end hose on the arm cylinder, remove the cylinder for repair or replacement.

ARM CYLINDER (CONT'D)

Removal and Installation

Lower the boom / bucket and blade to the ground. Stop the engine.

Figure 20-21-5



Support the boom using a chain hoist **[Figure 20-21-5]**.

With the key in the ON position, move the hydraulic controls to release the 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.

I-2003-0888

Remove the hose clamp (Item 1) **[Figure 20-21-5]** from the arm cylinder.

Remove and plug the two hoses (Item 2) **[Figure 20-21-5]** from the arm cylinder.

Remove the snap ring and washer (Item 3) **[Figure 20-21-5]** from the boom cylinder base end pin.

Remove the cylinder base end pin.

⚠ WARNING

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

W-2145-0290

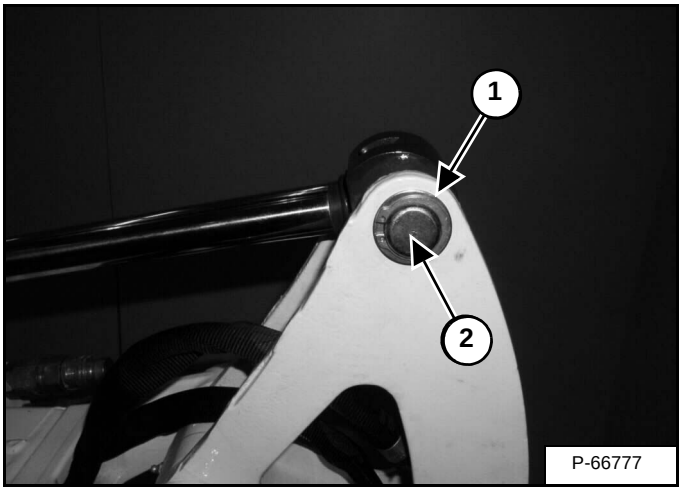
⚠ WARNING

AVOID INJURY OR DEATH

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

W-2103-0807

Figure 20-21-6



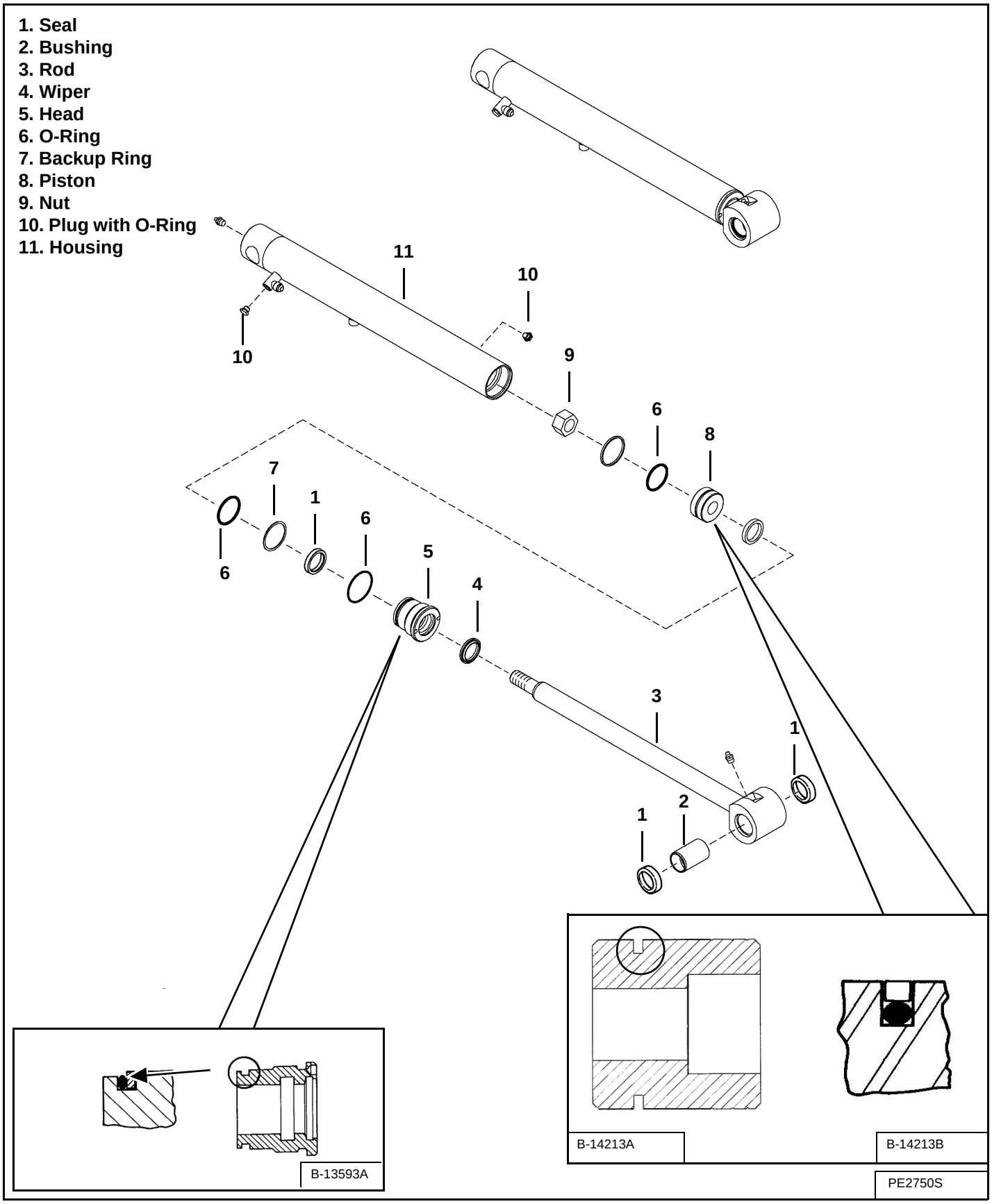
Remove the snap ring and washer (Item 1) **[Figure 20-21-6]** from the cylinder rod end pin.

Remove the cylinder rod end pin (Item 2) **[Figure 20-21-6]**.

Remove the cylinder from the arm.

Parts Identification

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



Disassembly

Clean the outside of the arm cylinder before disassembly.

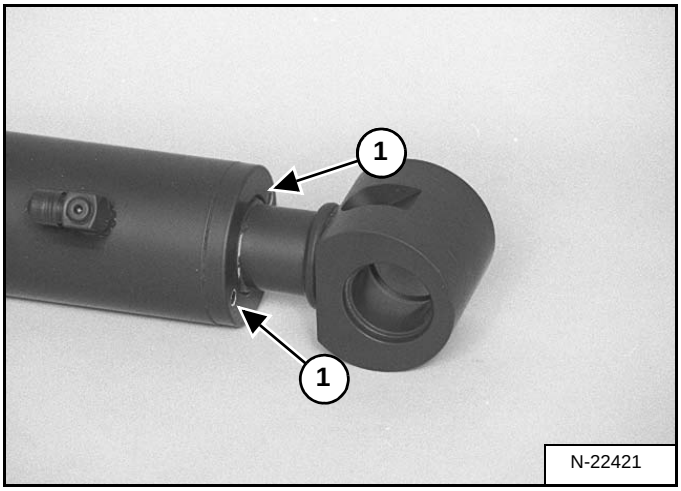
Use the following tools to disassemble the cylinder:

MEL1074 - O-ring Seal Hook
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

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

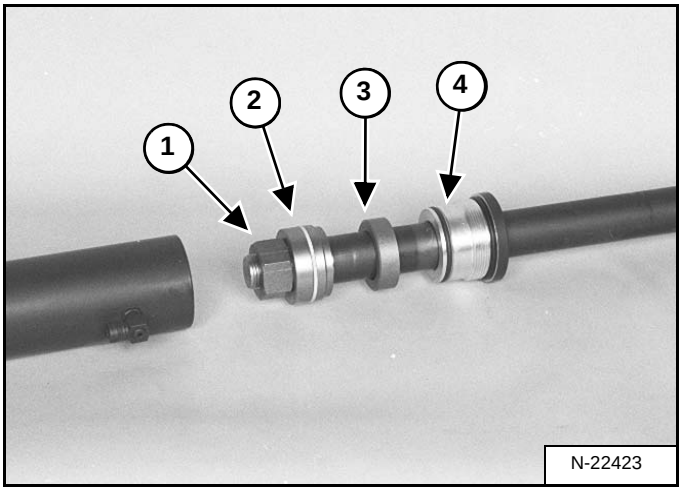
Put the base end of the cylinder in a vise.

Figure 20-21-7



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-21-7]** to loosen the head.

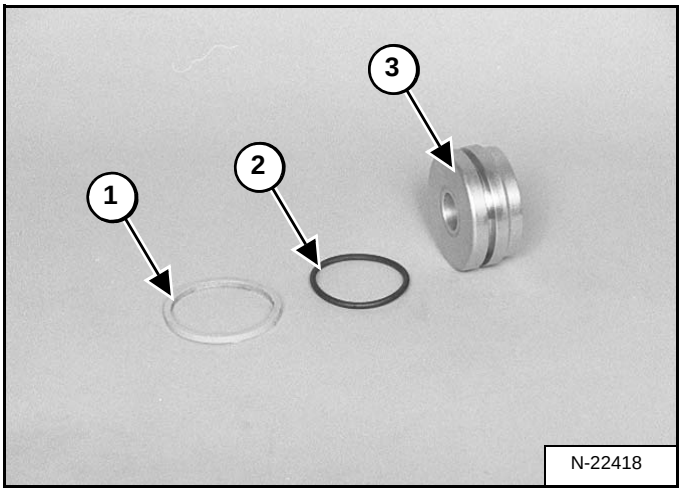
Figure 20-21-8



Remove the head and the rod assembly from the cylinder **[Figure 20-21-8]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2), spacer (Item 3) and head (Item 4) **[Figure 20-21-8]**.

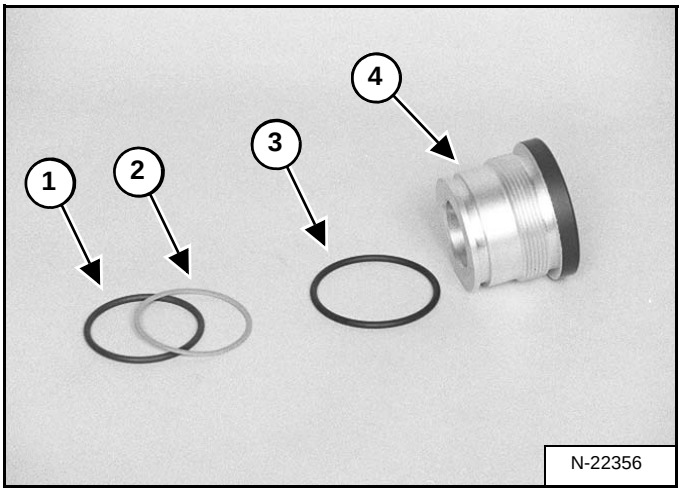
Figure 20-21-9



Standard Piston: Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-21-9]**.

Disassembly (Cont'd)

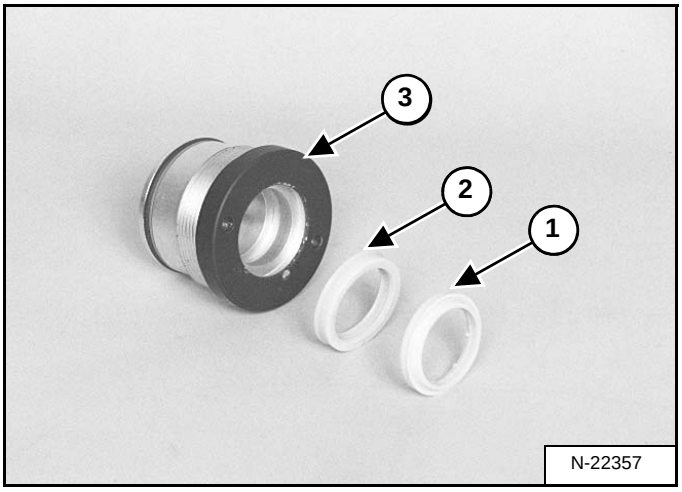
Figure 20-21-10



Remove the O-ring (Item 1) and the back-up ring (Item 2) from the groove in the head (Item 3) **[Figure 20-21-10]**.

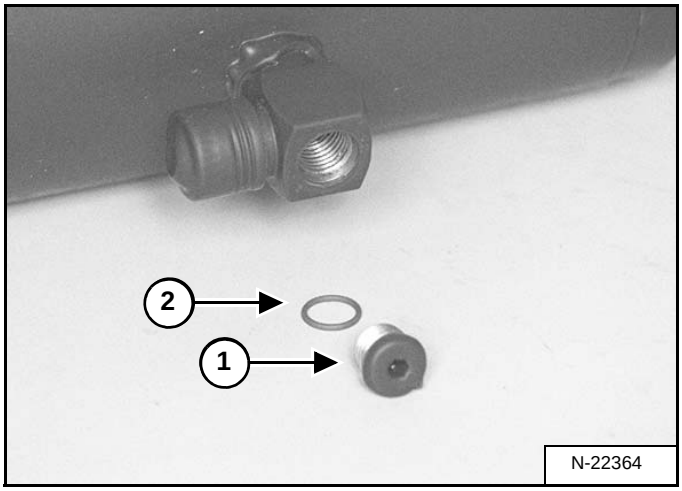
Remove the O-ring (Item 4) **[Figure 20-21-10]**.

Figure 20-21-11



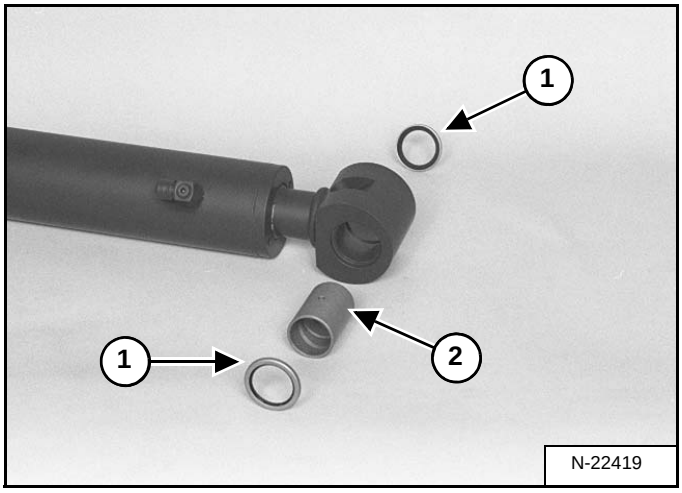
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-21-11]**.

Figure 20-21-12



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-21-12]**.

Figure 20-21-13



Remove the seals (Item 1) and bushing (Item 2) **[Figure 20-21-13]**.

Assembly

Use the following tools to assemble the cylinder:

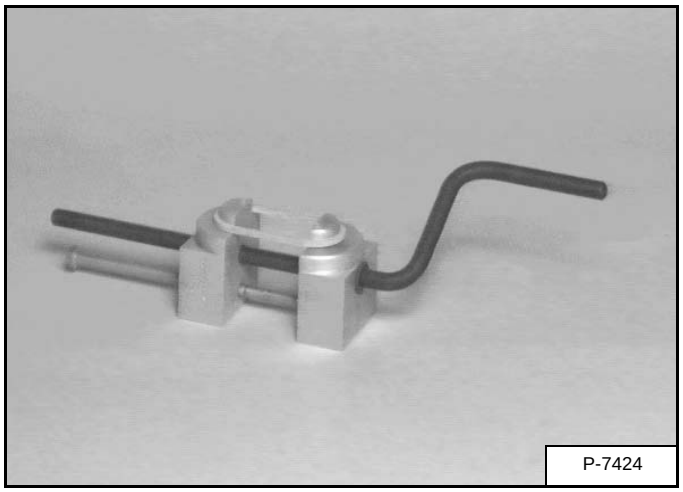
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

Clean all parts in solvent and dry with compressed air.

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

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

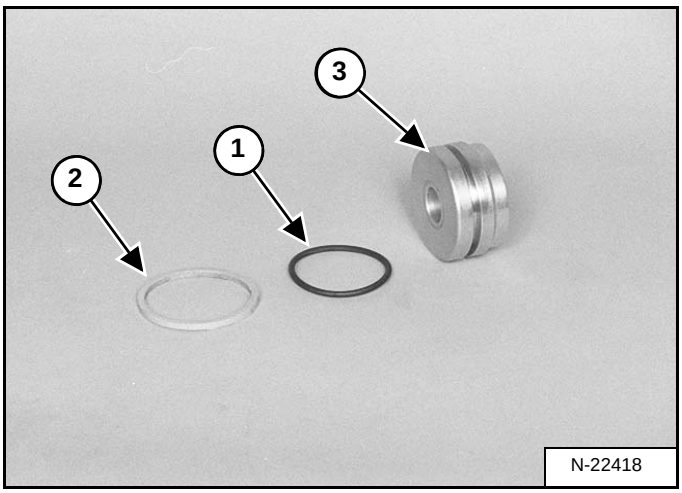
Figure 20-21-14



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

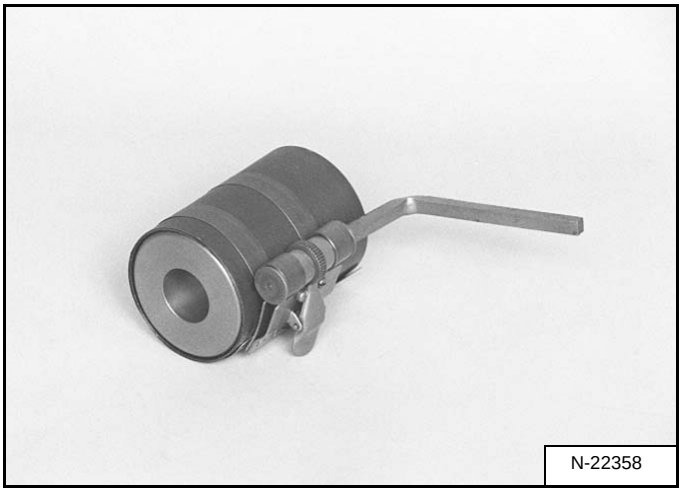
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-21-15



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

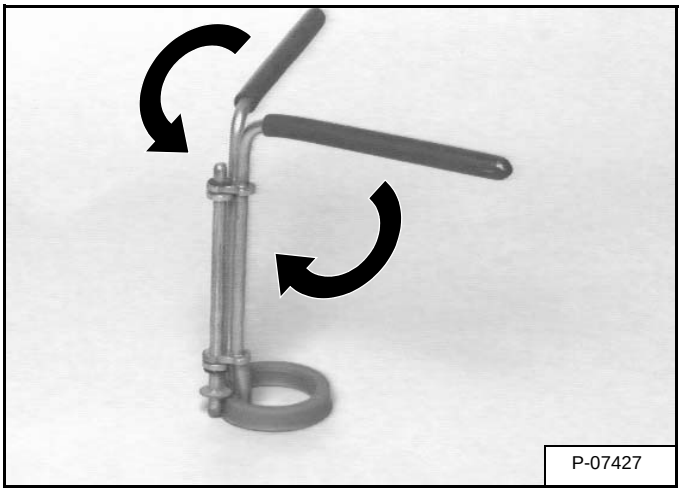
Figure 20-21-16



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-21-16]**.

Assembly (Cont'd)

Figure 20-21-17

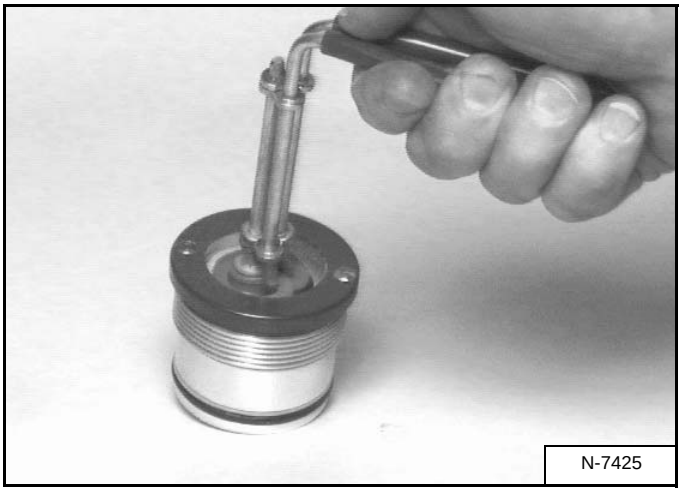


Install the rod seal on the rod seal tool **[Figure 20-21-17]**.

NOTE: During installation the spring side of the seal must be toward the inside of the cylinder.

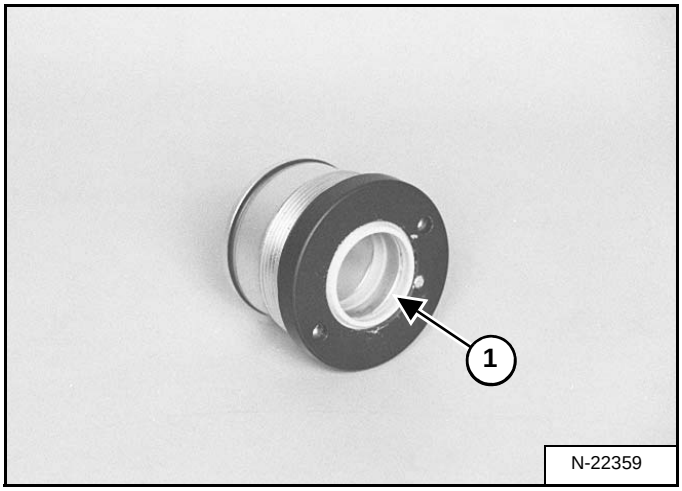
Rotate the handles to collapse the rod seal **[Figure 20-21-17]**.

Figure 20-21-18



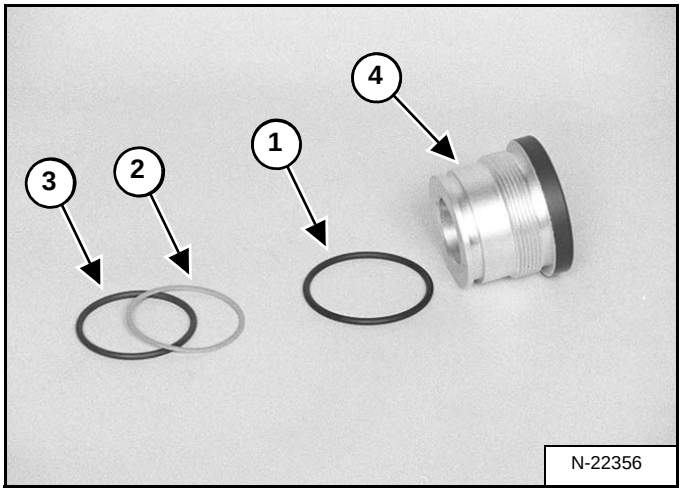
Install the rod seal in the head **[Figure 20-21-18]**.

Figure 20-21-19



Install the wiper seal with the wiper (Item 1) **[Figure 20-21-19]** toward the outside of the head.

Figure 20-21-20

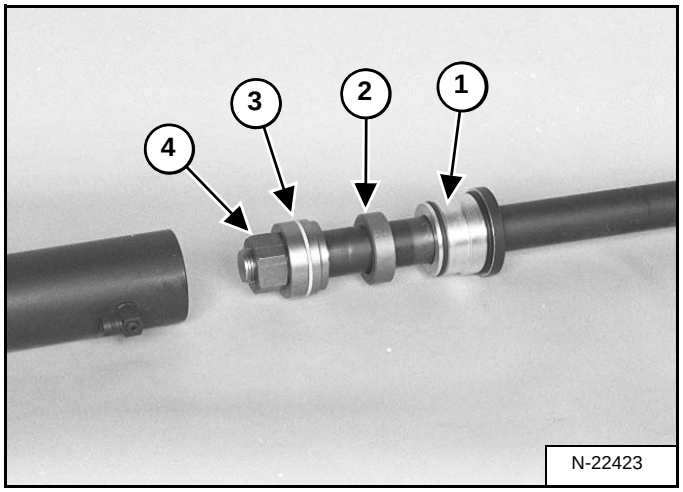


Install the O-ring (Item 1) **[Figure 20-21-20]**.

Install the back-up ring (Item 2) and O-ring (Item 3) into the groove on the head (Item 4) **[Figure 20-21-20]**.

Assembly (Cont'd)

Figure 20-21-21



Install the head (Item 1), spacer (Item 2) and the piston (Item 3) **[Figure 20-21-21]** on the rod.

Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

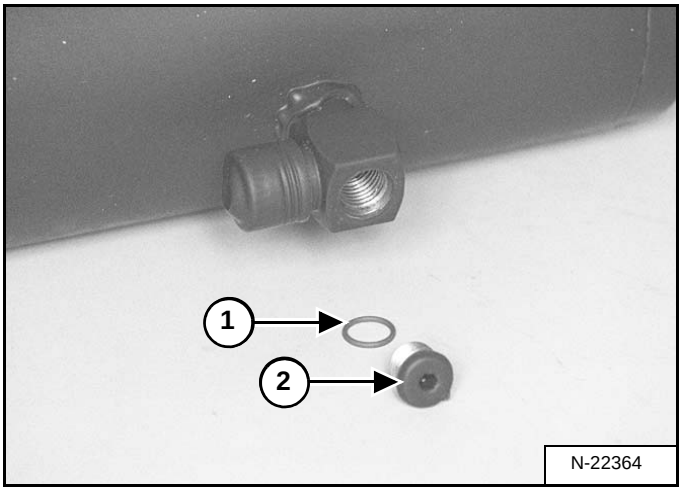
Install the nut (Item 4) **[Figure 20-21-21]**.

NOTE: Clean and dry the rod threads, from the kit install a NEW NUT with pre-applied Loctite®.

Reclean thread area for Loctite® residue.

Tighten the nut to 300 ft.-lb. (410 N•m) torque.

Figure 20-21-22

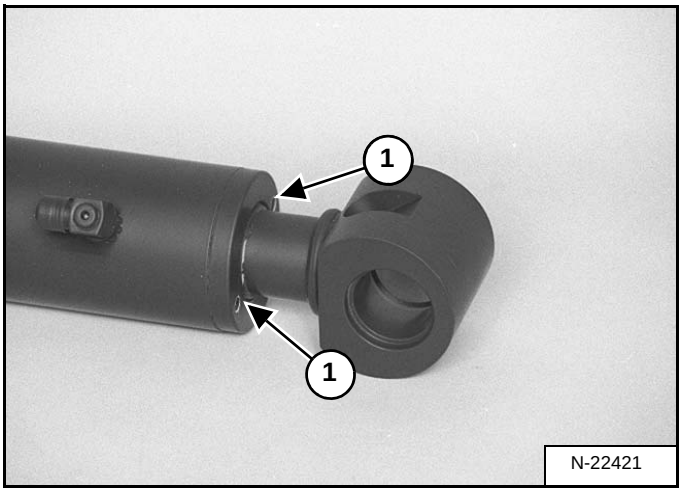


Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-21-22]**.

Tighten the plug to 15 ft.-lb. (20 N•m) torque.

Put the base end of the hydraulic cylinder in a vise.

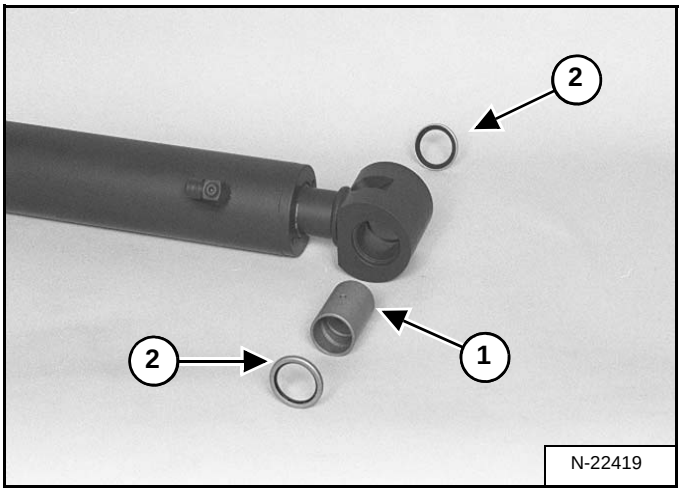
Figure 20-21-23



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-21-23]** to tighten the head. Head to be torqued until flush with end of the housing.

Assembly (Cont'd)

Figure 20-21-24



Install the bushing (Item 1) **[Figure 20-21-24]**. The bushing must be aligned with the grease channel in the rod end of the cylinder.

Install the seals (Item 2) **[Figure 20-21-24]** with the lips facing out.

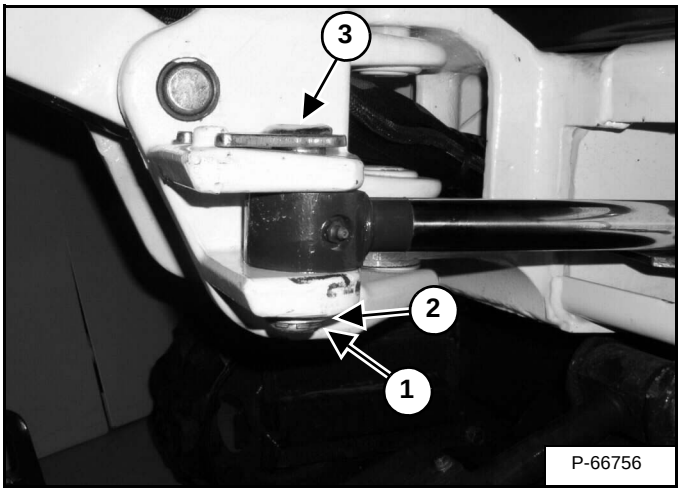
BOOM SWING CYLINDER

Testing

Lower the boom / bucket and blade to the ground.

Stop the engine. Raise the control console.

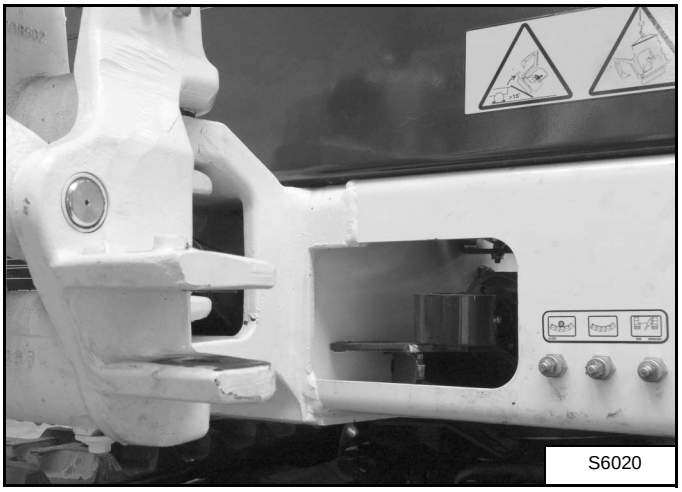
Figure 20-22-1



Remove the retaining ring (Item 1) and washers (Item 2) from the rod end pivot pin (Item 3) **[Figure 20-22-1]**.

Remove the pivot pin.

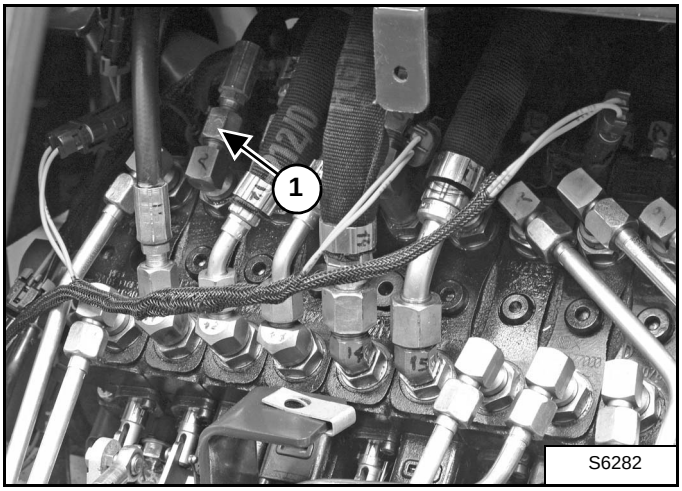
Figure 20-22-2



Lower the control console and fasten the seat belt. Start the engine and retract the swing cylinder **[Figure 20-22-2]**.

Stop the engine. With the key in the ON position, move the hydraulic controls to release the hydraulic pressure. Raise the control console.

Figure 20-22-3



Remove the base end hose (Item 1) **[Figure 20-22-3]** at the control valve assembly connection.

Install a cap on the control valve assembly fitting and tighten.

Lower control console and fasten the seat belt. Start the engine and retract the cylinder.

If there is any leakage from the base end hose (Item 1) **[Figure 20-22-3]** on the cylinder, remove the cylinder for repair or replacement.

Removal and Installation

IMPORTANT

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

I-2003-0888

⚠ WARNING

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

W-2145-0290

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2103-0807

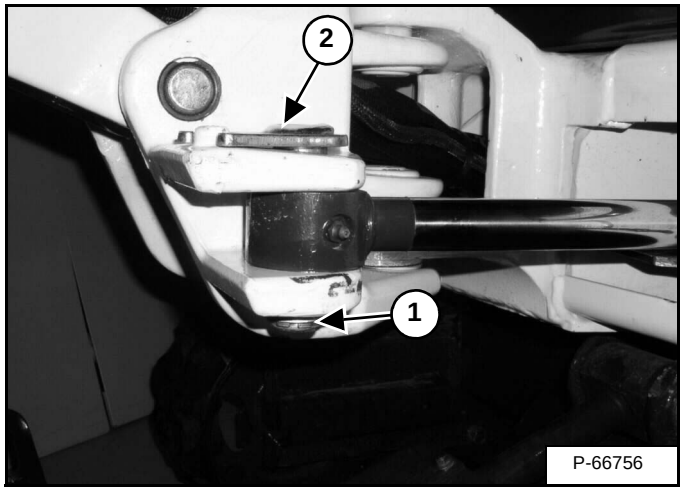
Swing the upperstructure so the pin in the base end of the cylinder is located between the tracks.

Offset the boom slightly for additional working space.

Lower the boom / bucket and blade to the ground. Stop the engine.

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

Figure 20-22-4

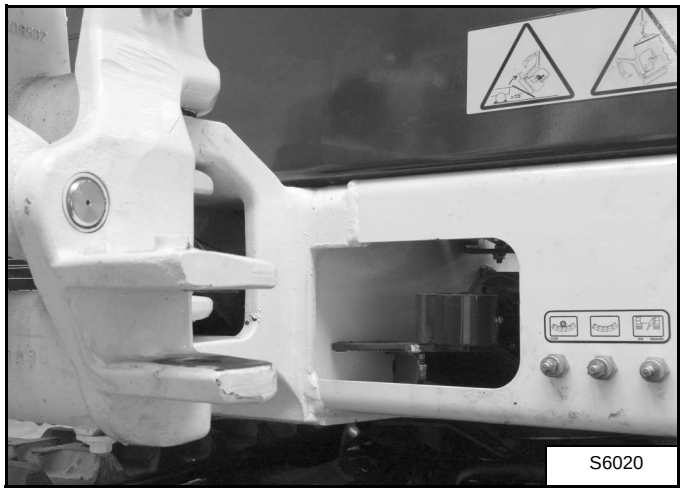


Remove the snap ring and washers (Item 1) **[Figure 20-22-4]** from the rod end pin.

Remove the pivot pin (Item 2) **[Figure 20-22-4]**.

Lower the control console and fasten the seat belt.

Figure 20-22-5

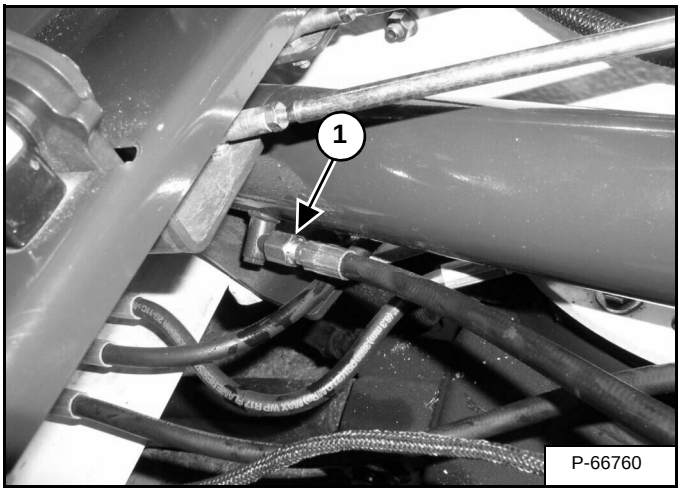


Start the excavator and fully retract the cylinder **[Figure 20-22-5]**.

Stop the engine.

Removal and Installation (Cont'd)

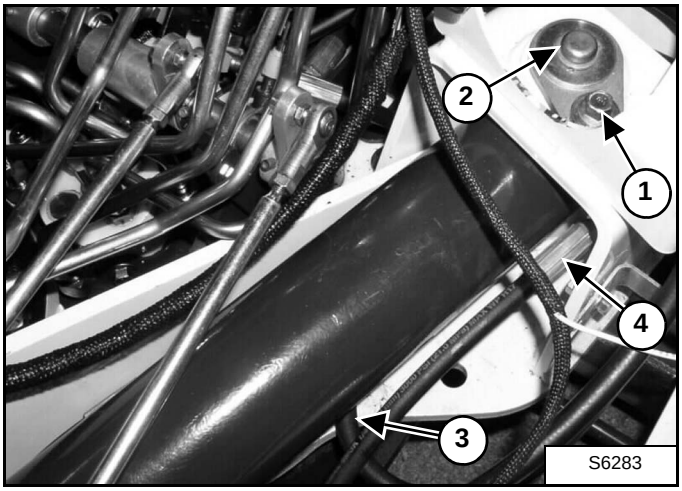
Figure 20-22-6



Remove the hose (Item 1) **[Figure 20-22-6]**.

Remove the battery (See Removal and Installation on Page 50-20-2.)

Figure 20-22-7



Remove the base end pin retainer bolt, washer and spacer (Item 1) **[Figure 20-22-7]** from under the upperstructure.

Remove the pivot pin (Item 2) **[Figure 20-22-7]**.

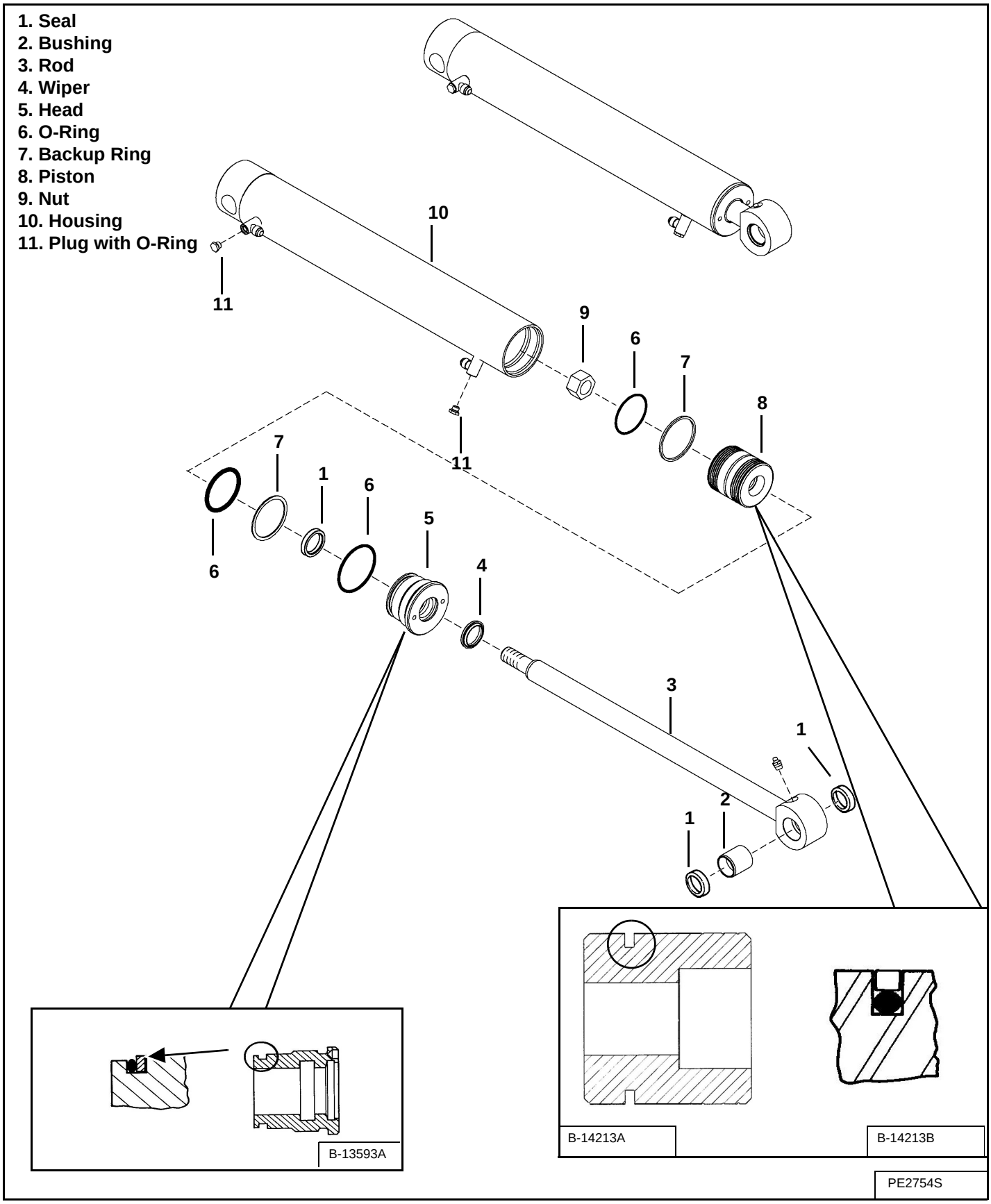
Slide the boom swing cylinder forward.

Remove the base end hydraulic hose (Item 3) **[Figure 20-22-7]**.

Remove the grease hose (Item 4) **[Figure 20-22-7]**.

Slide the cylinder out the front of the excavator frame.

Parts Identification



Disassembly

Clean the outside of the boom swing cylinder before disassembly.

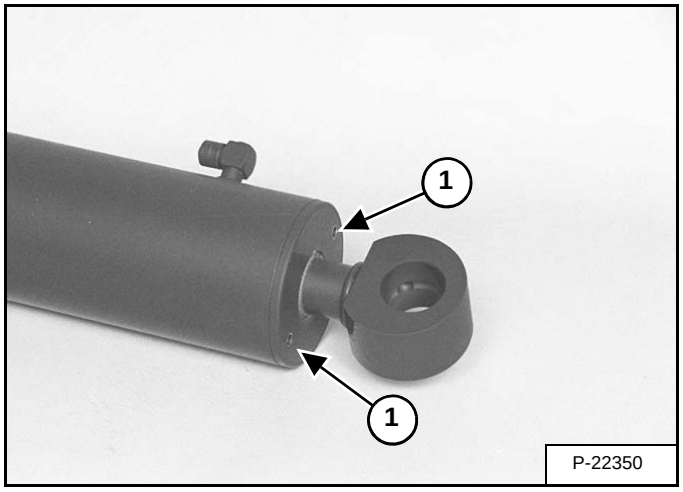
Use the following tools to disassemble the cylinder:

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

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

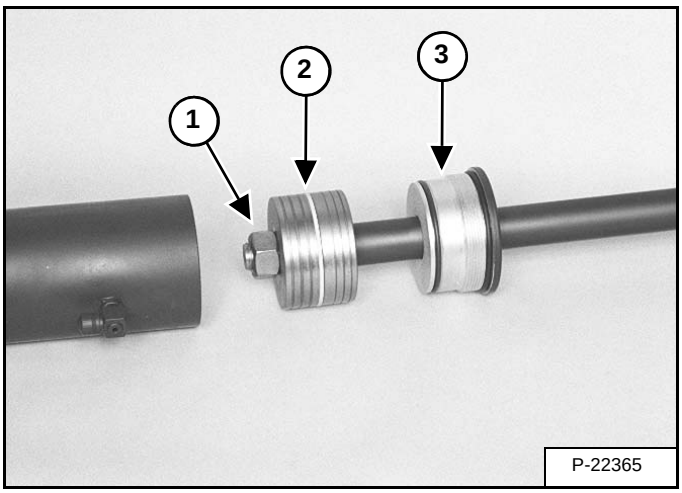
Put the base end of the cylinder in a vise.

Figure 20-22-8



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-22-8]** to loosen the head.

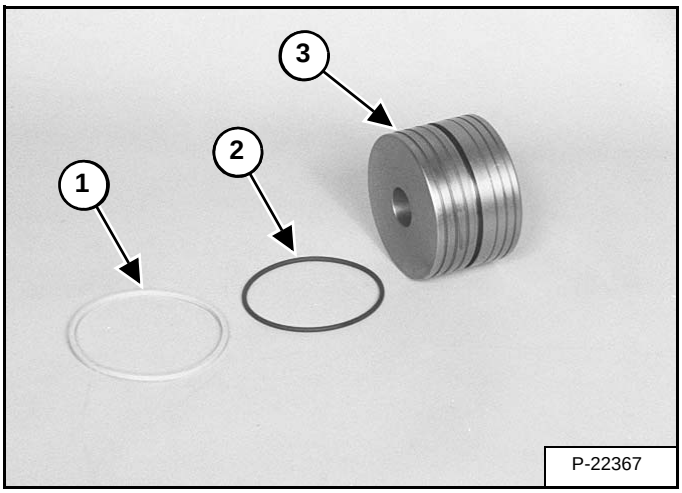
Figure 20-22-9



Remove the head and the rod assembly from the cylinder **[Figure 20-22-9]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-22-9]**.

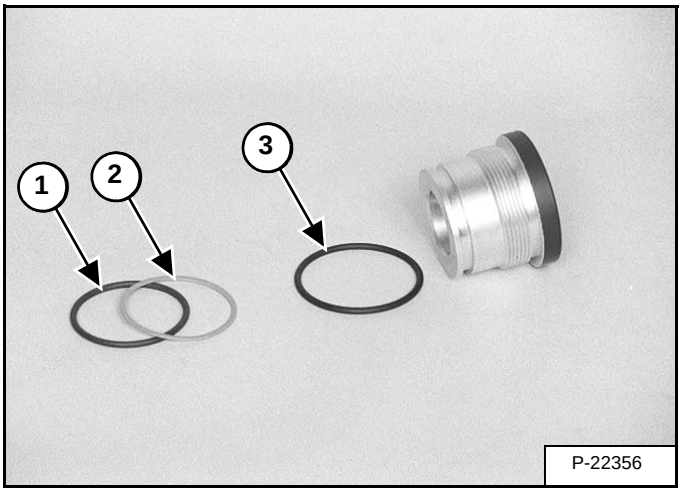
Figure 20-22-10



Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-22-10]**.

Disassembly (Cont'd)

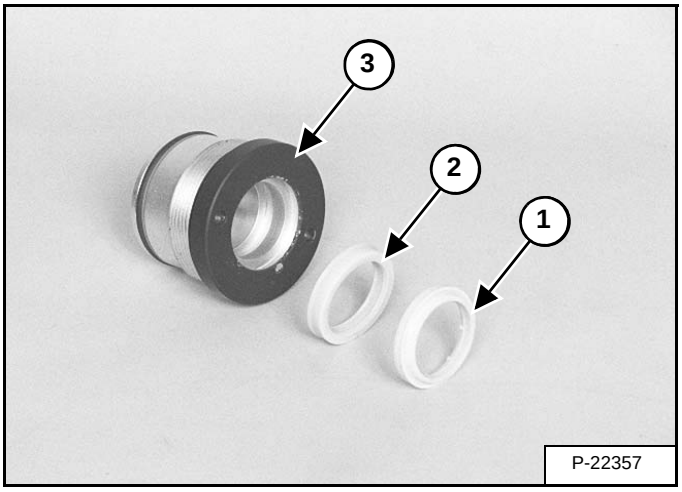
Figure 20-22-11



Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-22-11]**.

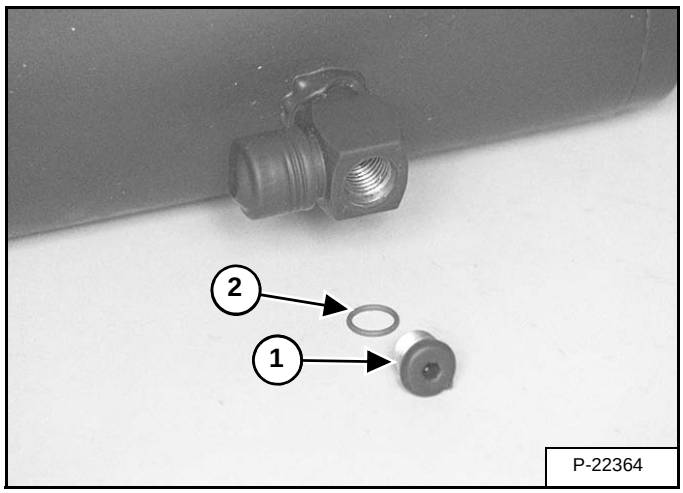
Remove the O-ring (Item 3) **[Figure 20-22-11]**.

Figure 20-22-12



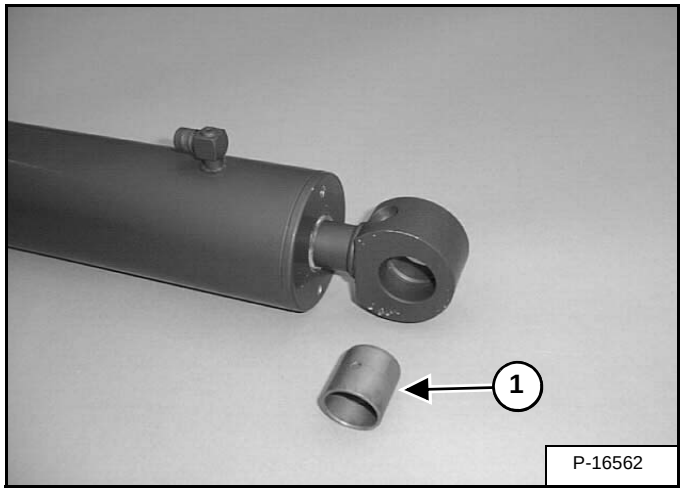
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-22-12]**.

Figure 20-22-13



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-22-13]**.

Figure 20-22-14



Remove the bushing (Item 1) **[Figure 20-22-14]**.

Assembly

Use the following tools to assemble the cylinder:

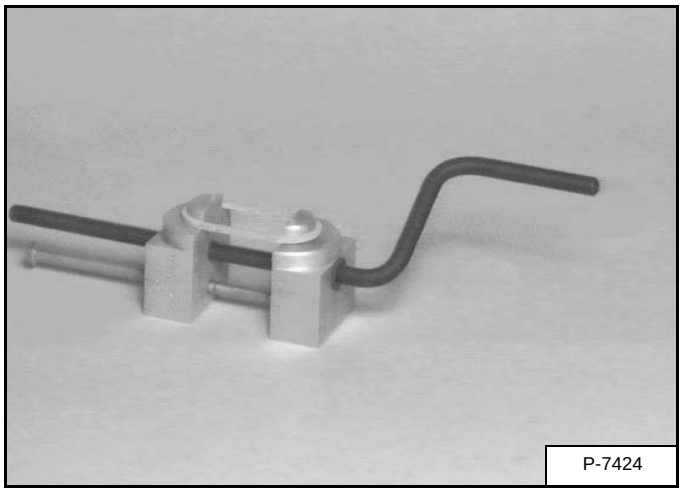
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

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.

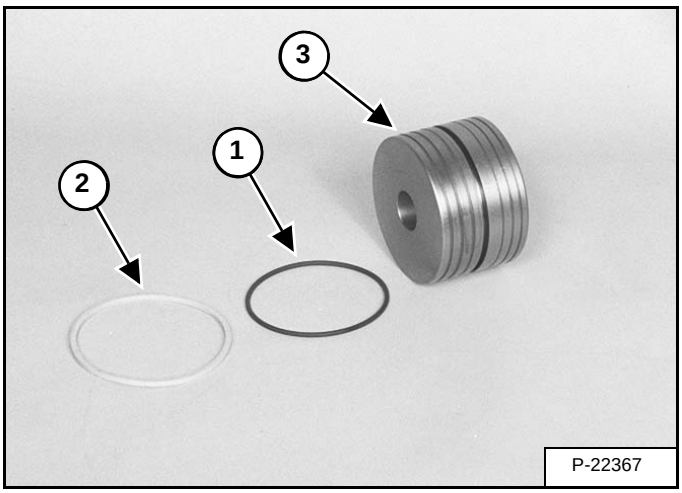
Figure 20-22-15



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

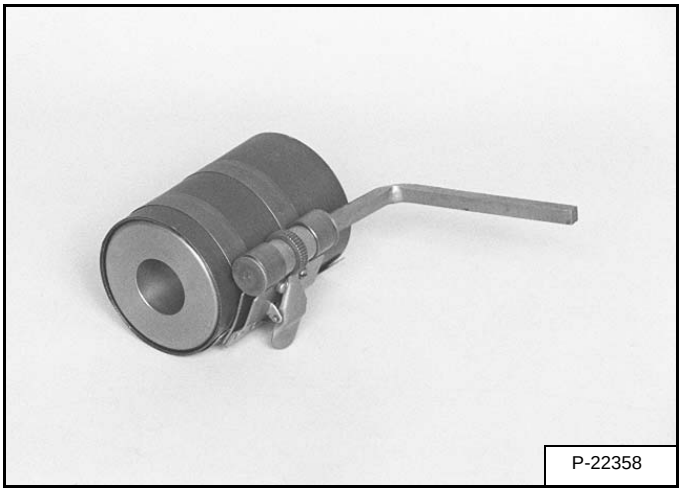
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-22-16



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

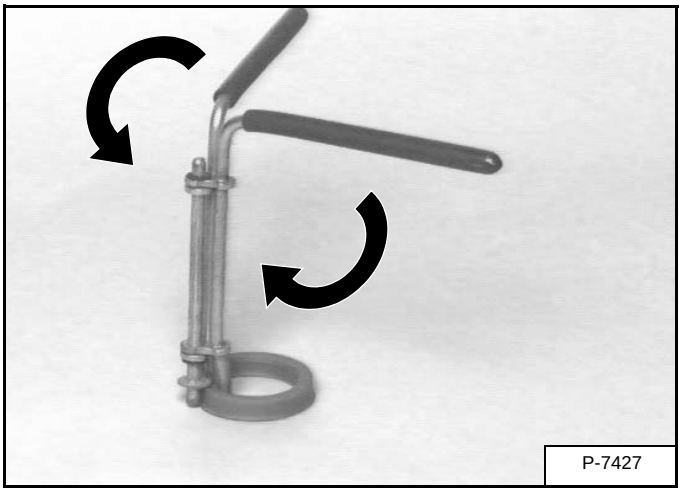
Figure 20-22-17



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 (Cont'd)

Figure 20-22-18

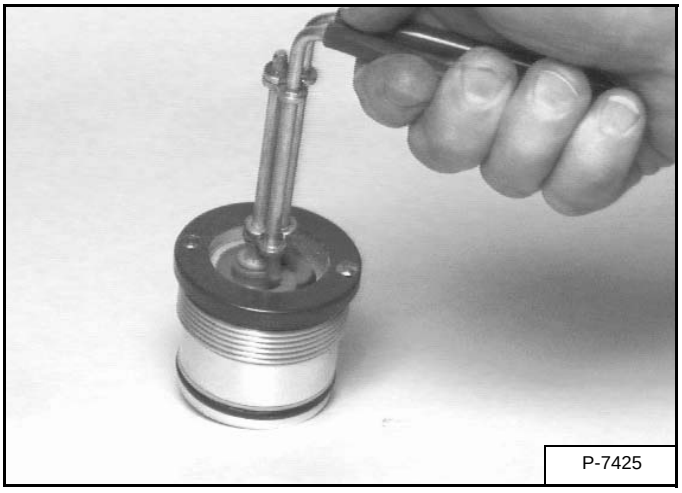


Install the rod seal on the rod seal tool **[Figure 20-22-18]**.

NOTE: During installation the spring side of the seal must be toward the inside of the cylinder.

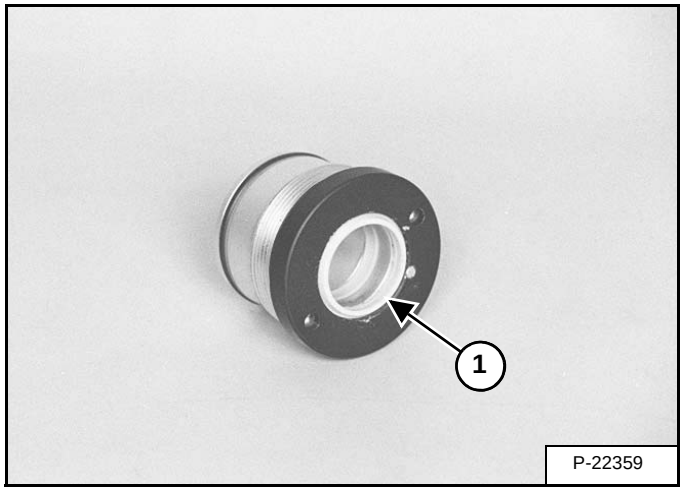
Rotate the handles to collapse the rod seal **[Figure 20-22-18]**.

Figure 20-22-19



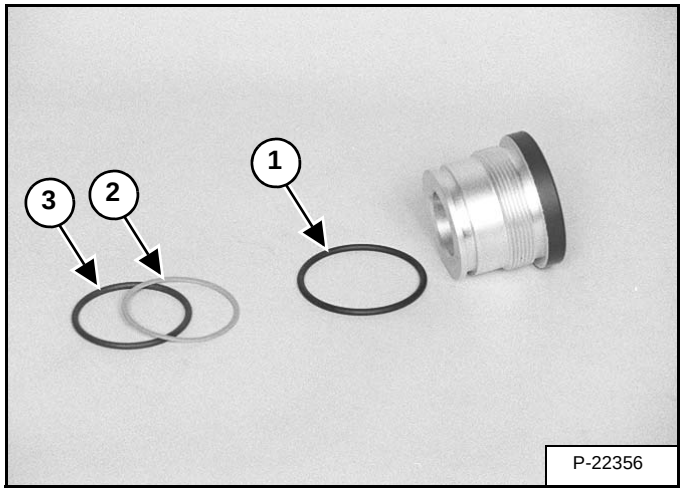
Install the rod seal in the head **[Figure 20-22-19]**.

Figure 20-22-20



Install the wiper seal with the wiper (Item 1) **[Figure 20-22-20]** toward the outside of the head.

Figure 20-22-21

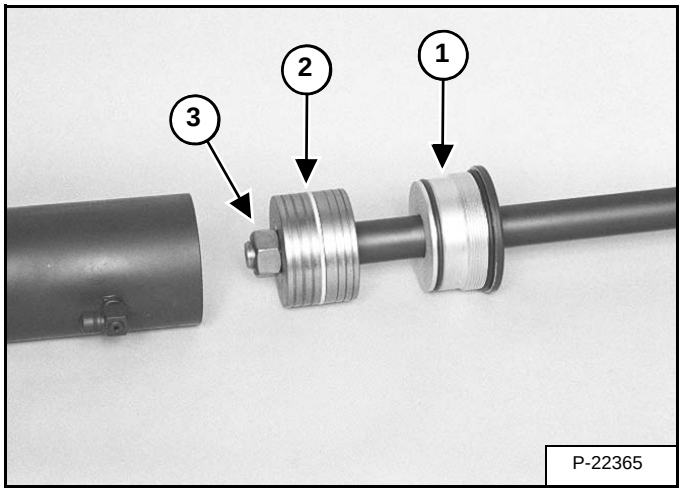


Install the O-ring (Item 1) **[Figure 20-22-21]**.

Install the back-up ring (Item 2) and O-ring (Item 3) **[Figure 20-22-21]**.

Assembly (Cont'd)

Figure 20-22-22



Install the head (Item 1) and the piston (Item 2) **[Figure 20-22-22]** on the rod.

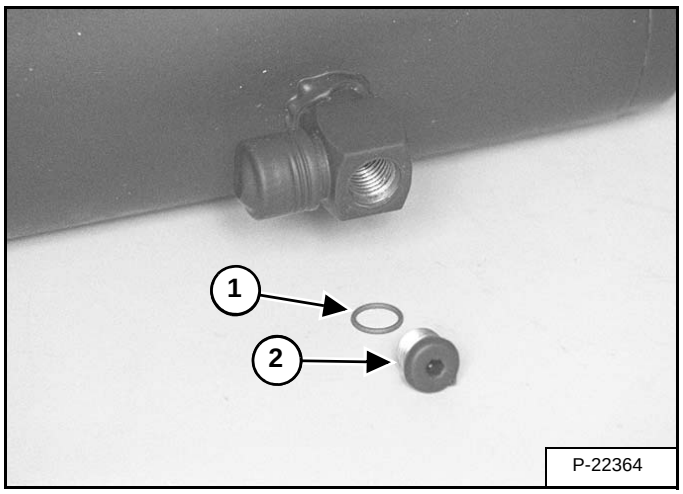
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-22-22]**.

Tighten the nut to 300 ft.-lb. (407 N•m) torque.

Figure 20-22-23

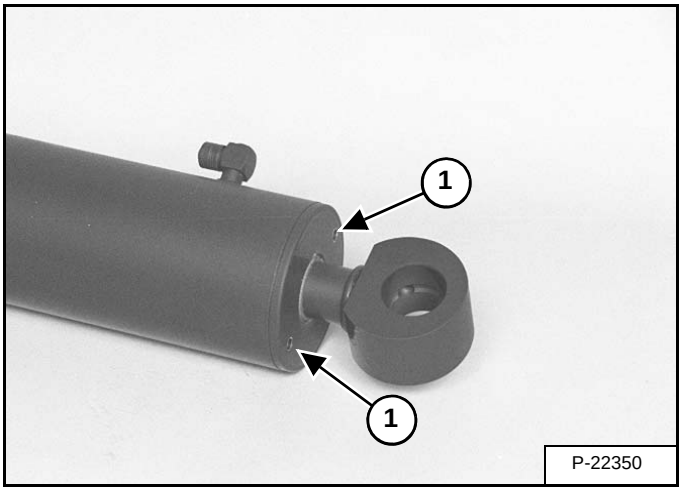


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-22-23]**.

Tighten the plug to 15 ft.-lb. (20 N•m) torque.

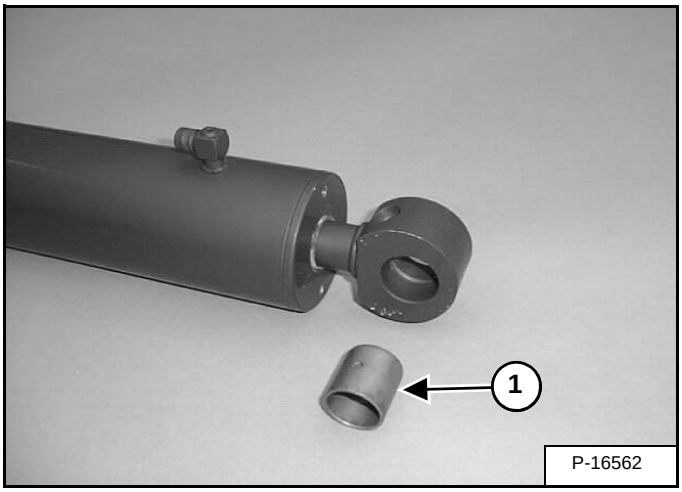
Put the base end of the hydraulic cylinder in a vise.

Figure 20-22-24



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-22-24]** to tighten the head. Head to be torqued until flush with end of the housing.

Figure 20-22-25



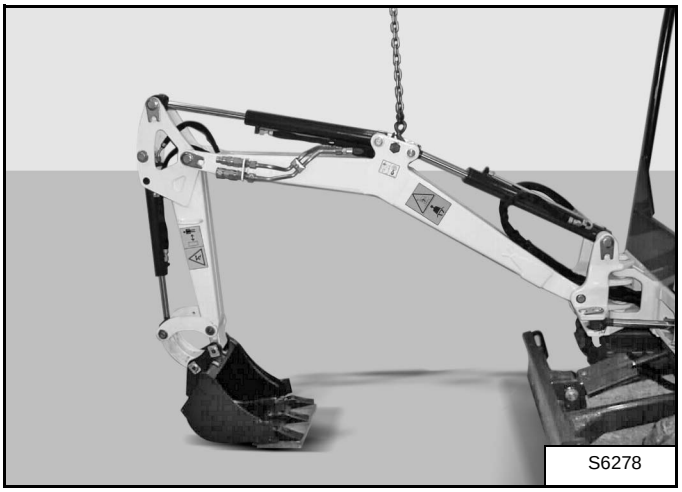
Install the bushing (Item 1) **[Figure 20-22-25]**. The bushing must be aligned with the grease channel in the rod end of the cylinder.


Bobcat®

BUCKET CYLINDER

Testing

Figure 20-23-1

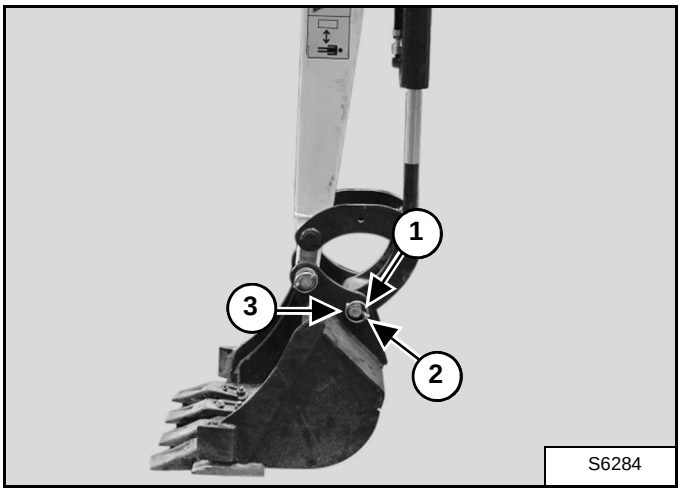


Lower the boom / bucket and blade to the ground **[Figure 20-23-1]**.

Stop the engine. Raise the control console.

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

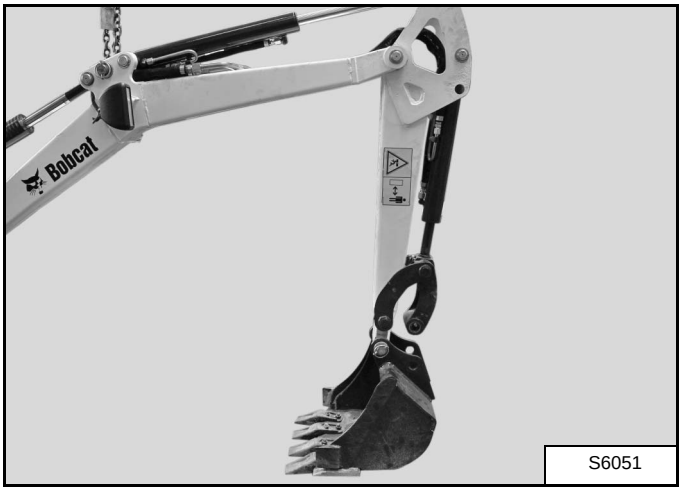
Figure 20-23-2



Remove the retaining pin (Item 1) and washers (Item 2) **[Figure 20-23-2]** from the outside pivot pin.

Remove the pivot pin (Item 3) **[Figure 20-23-2]**.

Figure 20-23-3



Lower control console and fasten the seat belt. Start the engine and retract the bucket cylinder **[Figure 20-23-3]**.

Stop the engine. With the key in the ON position, move the hydraulic controls to release the hydraulic pressure. Raise the control console.

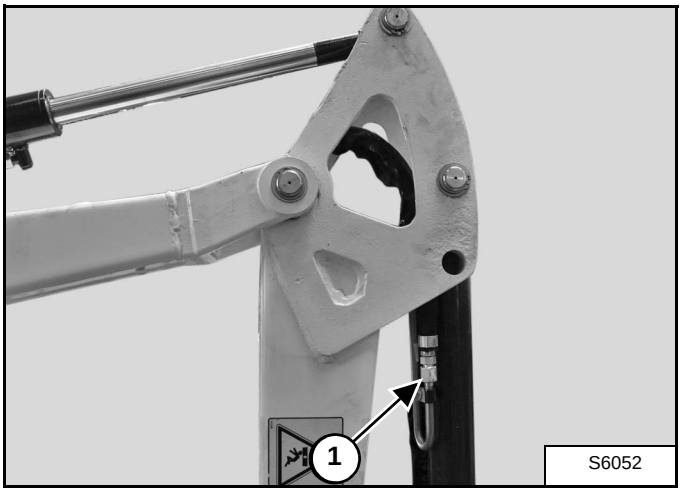
⚠ WARNING

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

W-2145-0290

Testing (Cont'd)

Figure 20-23-4



Remove the bucket cylinder base end hose (Item 1) **[Figure 20-23-4]** and install a plug on the hose fitting and tighten.

Lower control console and fasten the seat belt. Start the engine and retract the bucket cylinder.

If there is any leakage from the base end fitting on the bucket cylinder, remove the cylinder for repair or replacement.

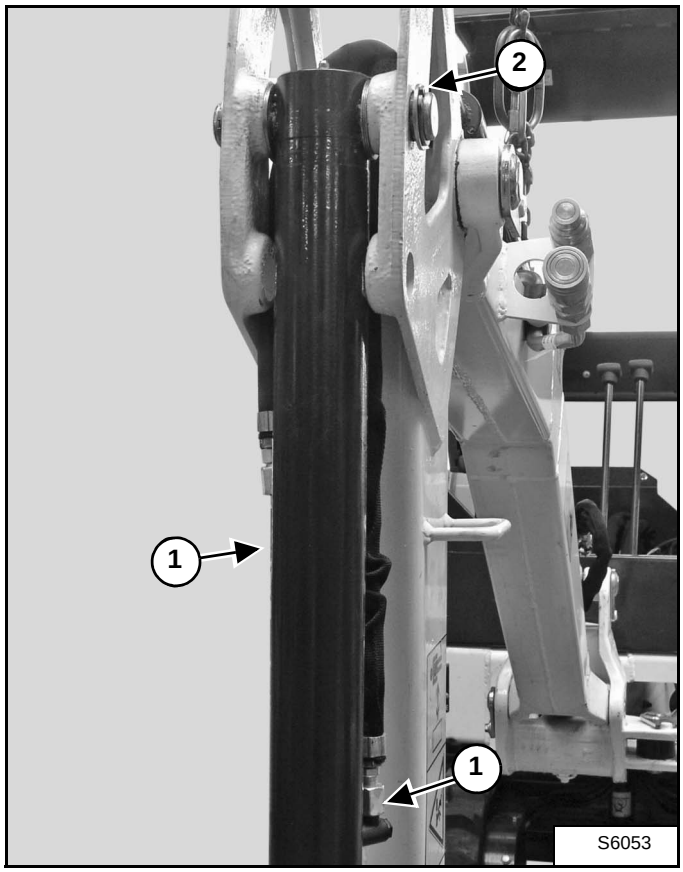
Removal and Installation

Lower the boom / bucket and blade to the ground. Stop the engine.

Support the boom using a chain hoist.

With the key in the ON position, move the hydraulic controls to release the hydraulic pressure.

Figure 20-23-5



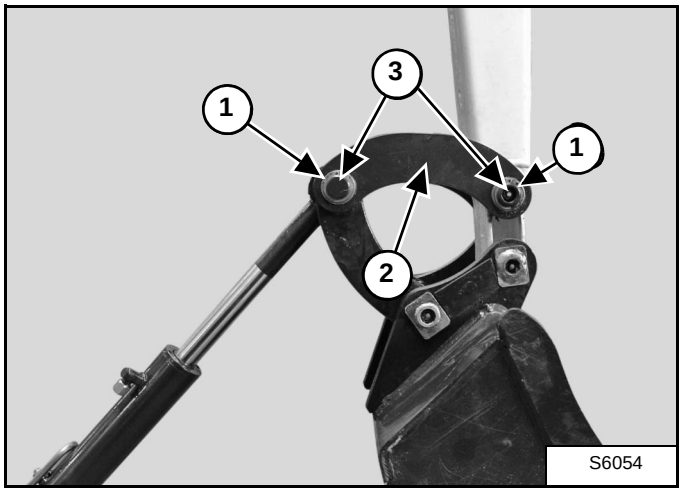
Remove and plug the two hoses (Item 1) **[Figure 20-23-5]** from the bucket cylinder.

Remove the snap ring (Item 2) **[Figure 20-23-5]** and washer from the cylinder base end pin.

Remove the base end pin and lower the base end to the floor.

Removal and Installation (Cont'd)

Figure 20-23-6



Remove the two snap rings and two washers (Item 1) **[Figure 20-23-6]**.

Remove the bucket link (Item 2) **[Figure 20-23-6]**.

Remove the bucket link pins (Item 3) **[Figure 20-23-6]**.

Remove the bucket cylinder.

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

⚠ WARNING

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

W-2145-0290

⚠ WARNING

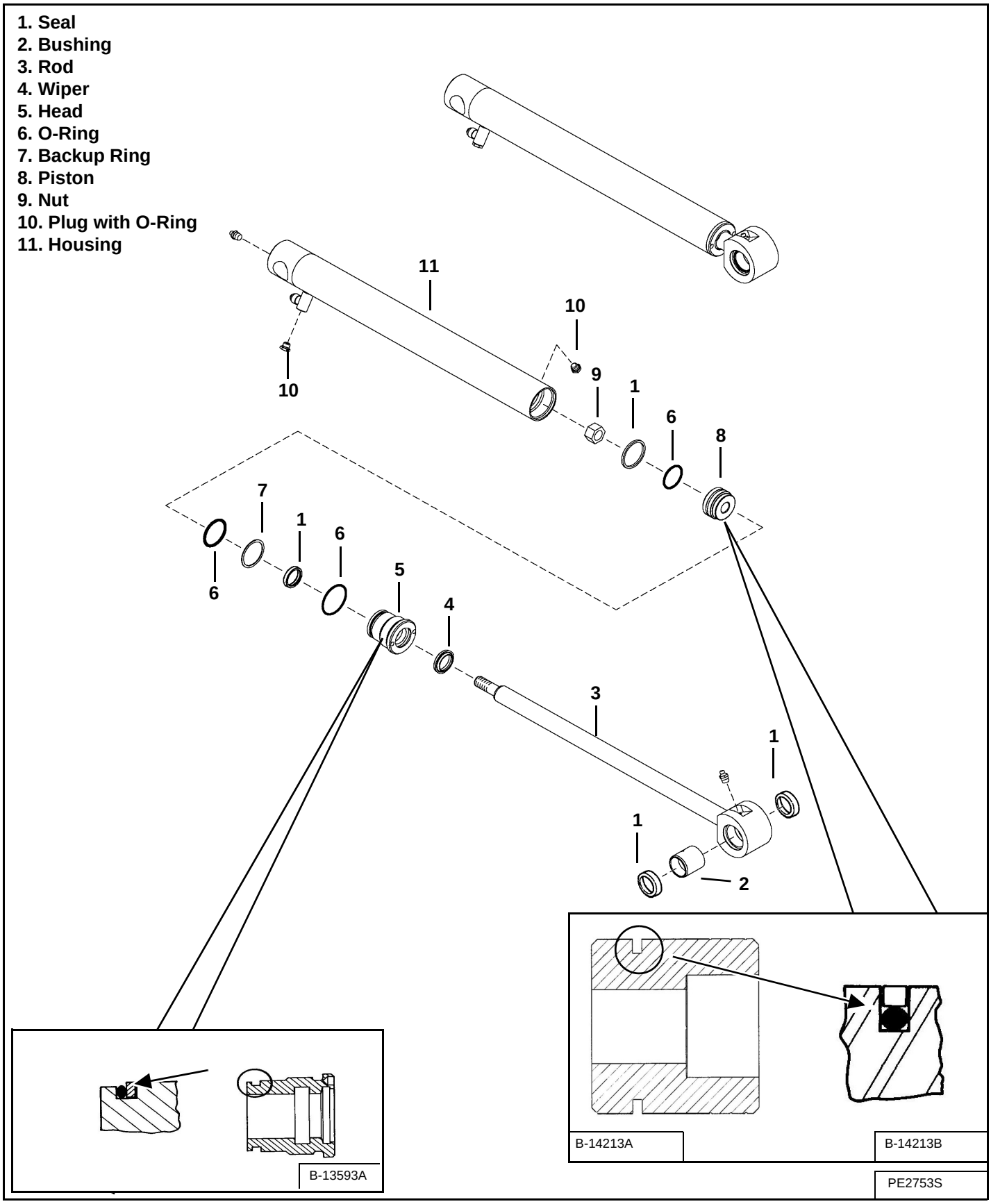
AVOID INJURY OR DEATH

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

W-2103-0807

Parts Identification

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



Disassembly

Clean the outside of the bucket cylinder before disassembly.

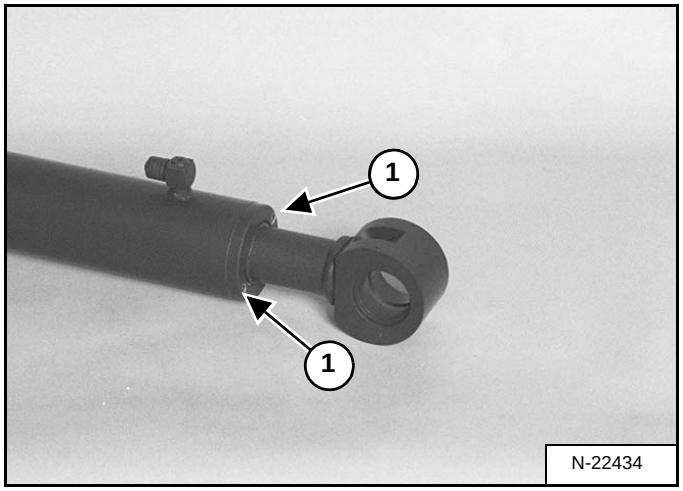
Use the following tools to disassemble the cylinder:

MEL1074 - O-ring Seal Hook
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

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

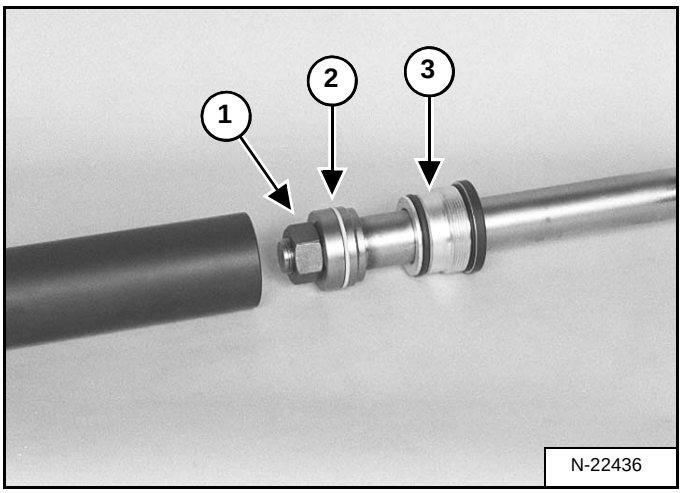
Put the base end of the cylinder in a vise.

Figure 20-23-7



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-23-7]** to loosen the head.

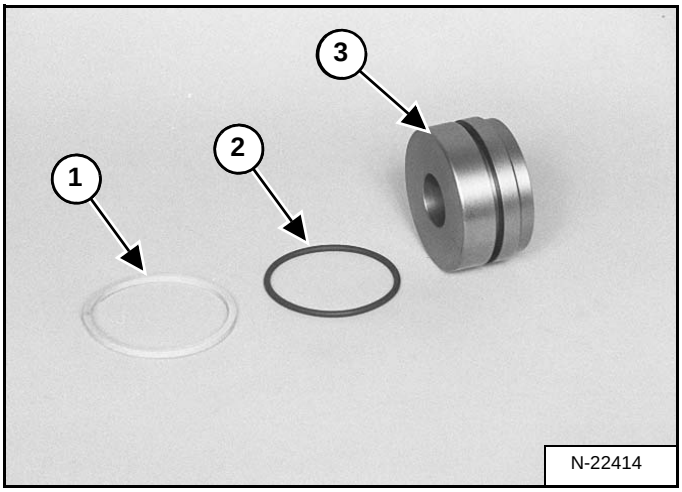
Figure 20-23-8



Remove the head and the rod assembly from the cylinder **[Figure 20-23-8]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-23-8]**.

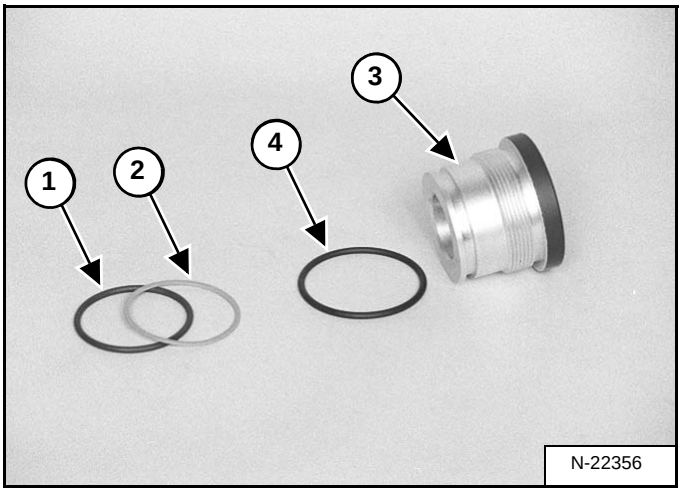
Figure 20-23-9



Standard Piston: Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-23-9]**.

Disassembly (Cont'd)

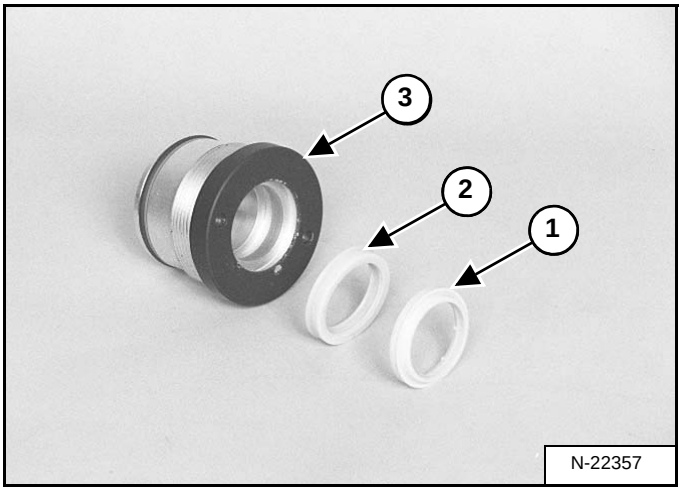
Figure 20-23-10



Remove the O-ring (Item 1) and the back-up ring (Item 2) from the groove in the head (Item 3) **[Figure 20-23-10]**.

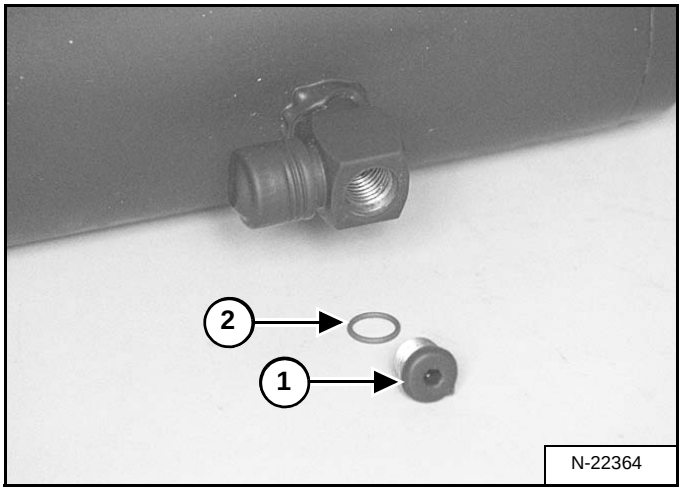
Remove the O-ring (Item 4) **[Figure 20-23-10]**.

Figure 20-23-11



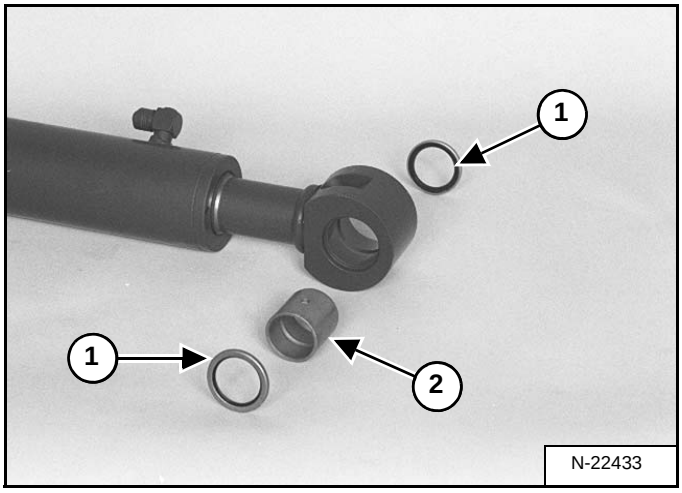
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-23-11]**.

Figure 20-23-12



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-23-12]**.

Figure 20-23-13



Remove the seals (Item 1) and bushing (Item 2) **[Figure 20-23-13]**.

Assembly

Use the following tools to assemble the cylinder:

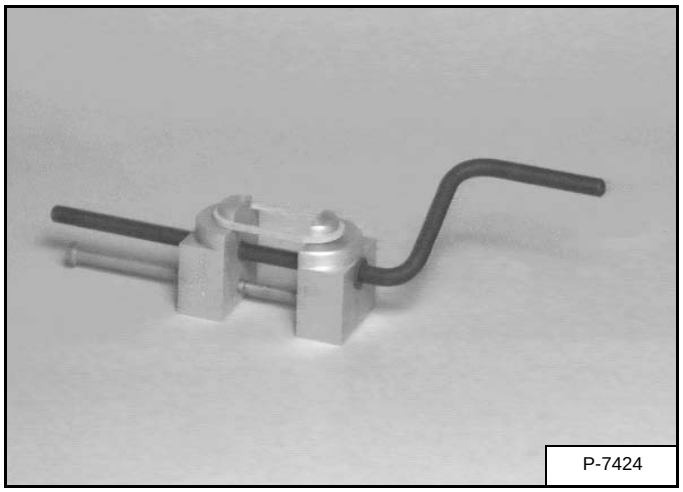
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

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.

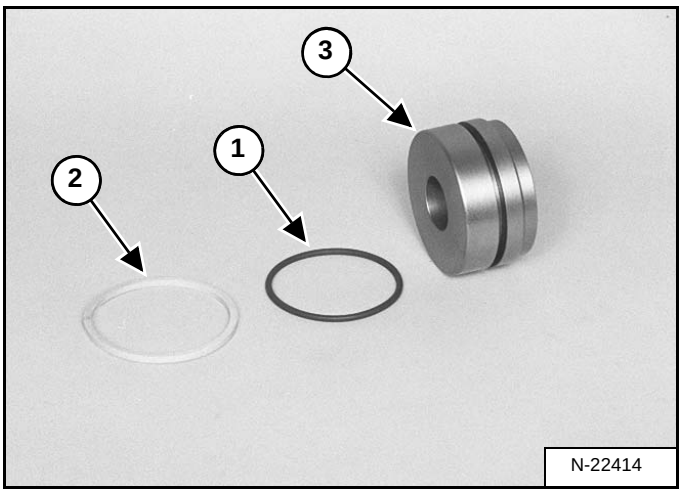
Figure 20-23-14



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-23-14]**.

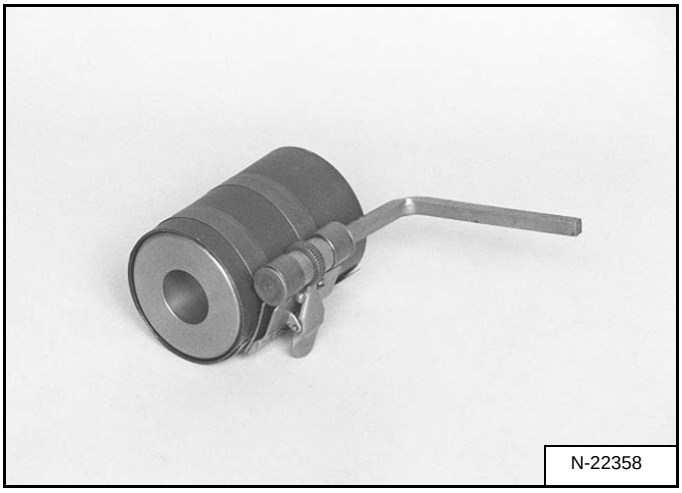
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-23-15



Standard Piston: Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-23-15]**.

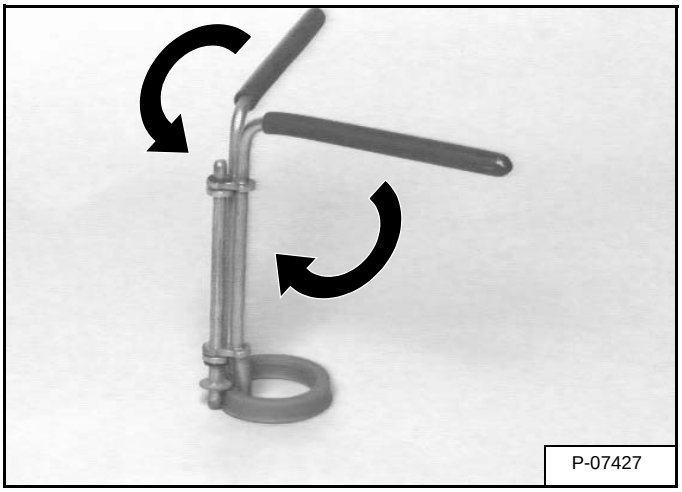
Figure 20-23-16



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-23-16]**.

Assembly (Cont'd)

Figure 20-23-17

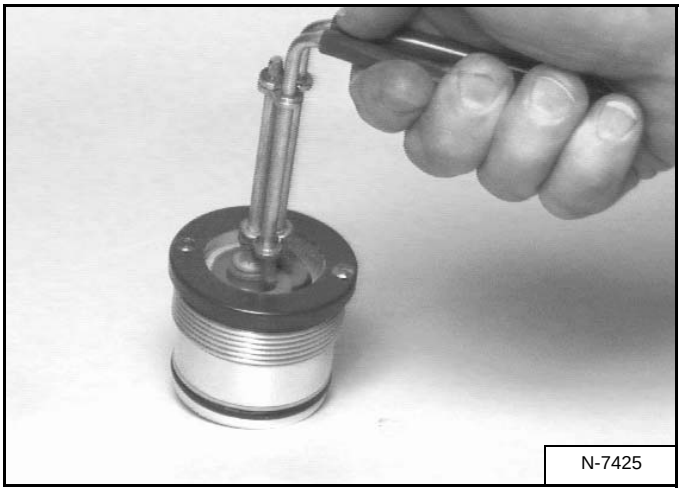


Install the rod seal on the rod seal tool **[Figure 20-23-17]**.

NOTE: During installation the spring side of the seal must be toward the inside of the cylinder.

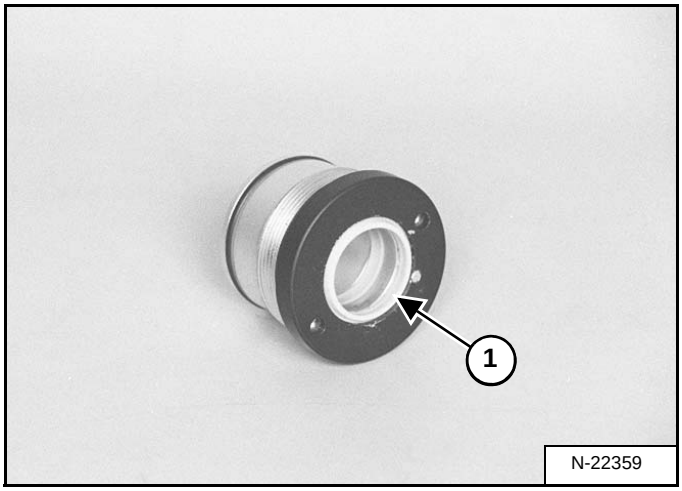
Rotate the handles to collapse the rod seal **[Figure 20-23-17]**.

Figure 20-23-18



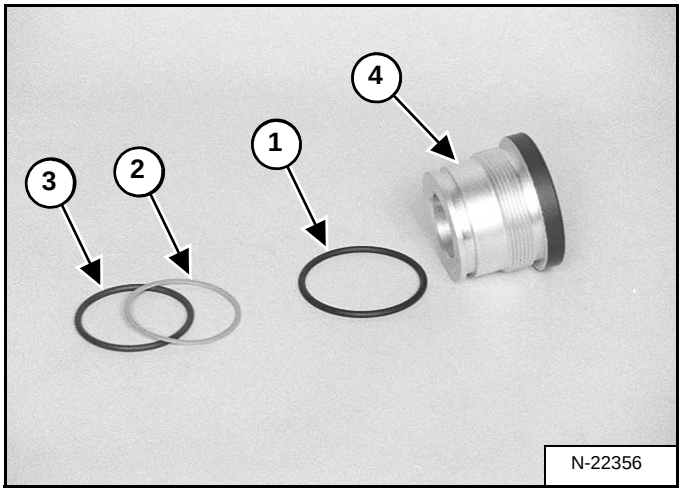
Install the rod seal in the head **[Figure 20-23-18]**.

Figure 20-23-19



Install the wiper seal with the wiper (Item 1) **[Figure 20-23-19]** toward the outside of the head.

Figure 20-23-20

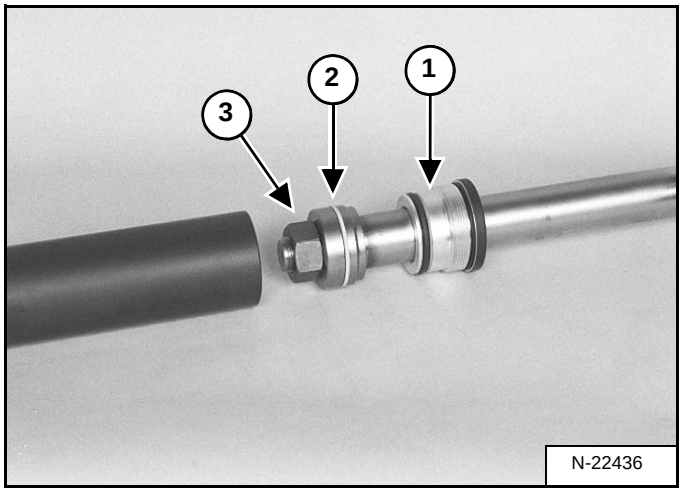


Install the O-ring (Item 1) **[Figure 20-23-20]**.

Install the back-up ring (Item 2) and O-ring (Item 3) into the groove on the head (Item 4) **[Figure 20-23-20]**.

Assembly (Cont'd)

Figure 20-23-21



Install the head (Item 1) and the piston (Item 2) **[Figure 20-23-21]** on the rod.

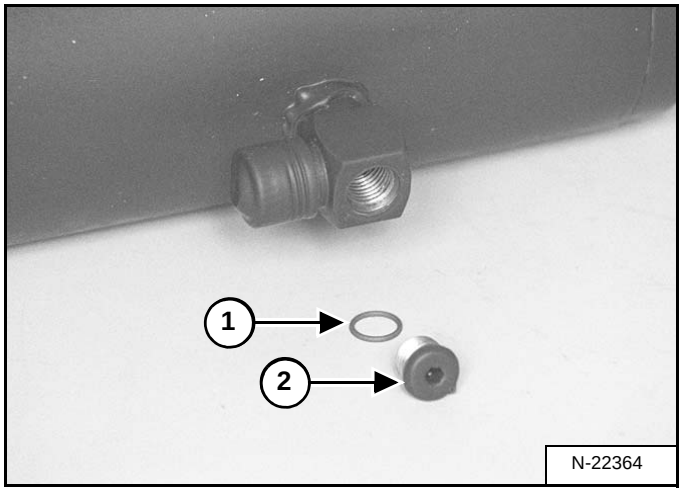
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-23-21]**.

Tighten the nut to 90 ft.-lb. (122 N•m) torque.

Figure 20-23-22



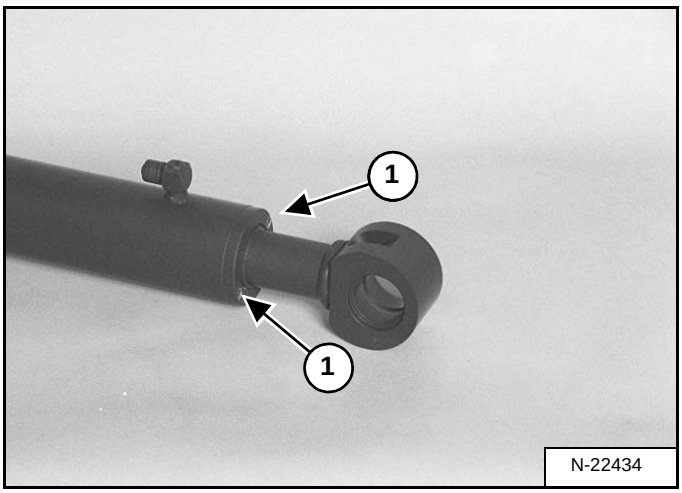
Install O-ring (Item 1) and plug (Item 2) **[Figure 20-23-22]**.

Tighten the plug to 15 ft.-lb. (20 N•m) torque.

Put the base end of the hydraulic cylinder in a vise.

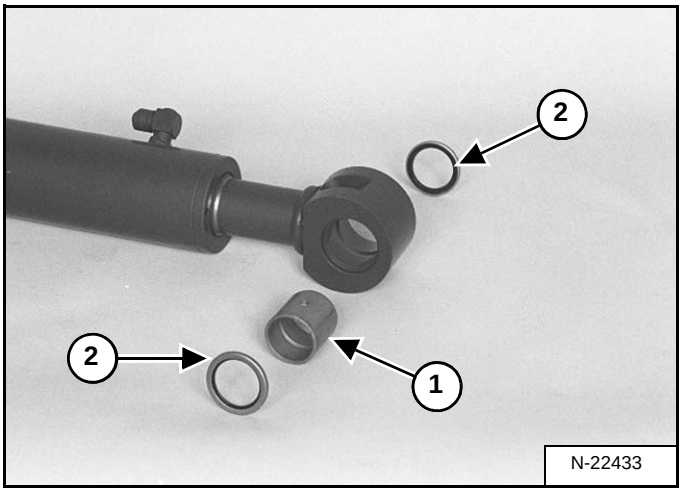
Be careful no to damage the cylinder tube.

Figure 20-23-23



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-23-23]** to tighten the head. Head to be torqued until flush with end of cylinder housing.

Figure 20-23-24



Install the bushing (Item 1) **[Figure 20-23-24]**. The bushing must be aligned with the grease channel in the rod end of the cylinder.

Install the seals (Item 2) **[Figure 20-23-24]** with the lips facing out.


Bobcat®

BLADE CYLINDER

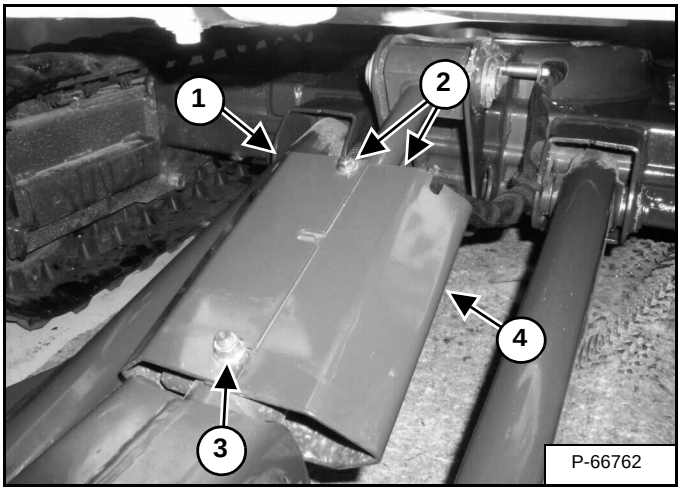
Testing

Swing the upperstructure out of the way. Lower the boom / bucket to the ground. Raise the blade up until it stops.

Stop the engine.

Support the blade. With the key in the ON position, move the blade control to release the hydraulic pressure. Raise the control console.

Figure 20-24-1



Loosen and slide the hose clamp (Item 1) **[Figure 20-24-1]** off the shield.

Remove the top and bottom bolts / nuts (Item 2) **[Figure 20-24-1]** fastening the two shields together.

Loosen the top nut (Item 3) and the bottom nut (Item 4) **[Figure 20-24-1]** fastening the shield to the blade cylinder.

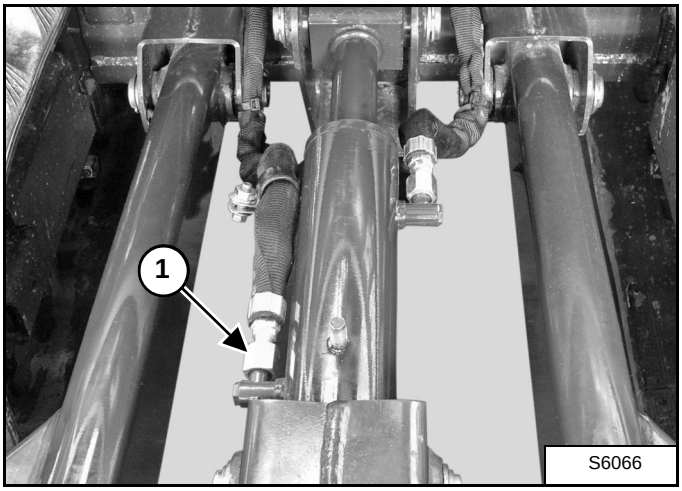
Remove the blade cylinder shields from the blade cylinder.

⚠ WARNING

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

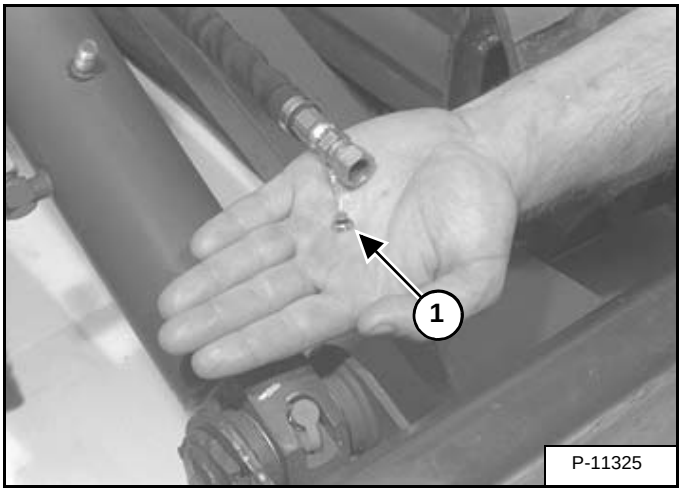
W-2145-0290

Figure 20-24-2



Remove the blade cylinder base end hose (Item 1) **[Figure 20-24-2]**.

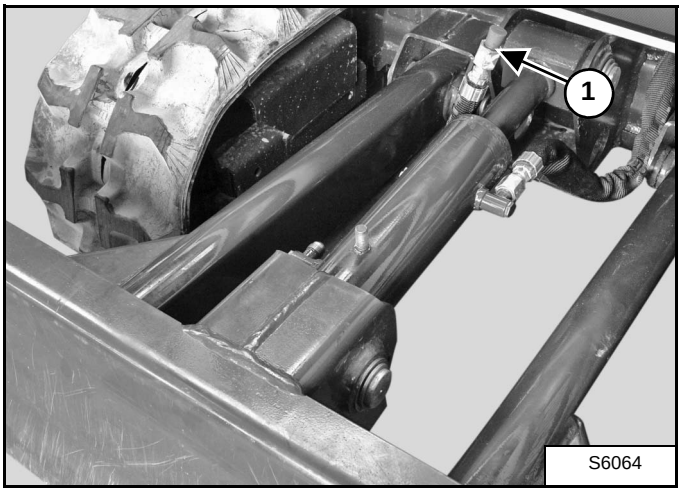
Figure 20-24-3



NOTE: Use care not to lose the orifice (Item 1) [Figure 20-24-3] located in the blade cylinder rod end hose.

Testing (Cont'd)

Figure 20-24-4



Install a plug (Item 1) **[Figure 20-24-4]** on the hose fitting and tighten.

Lower control console. Start the engine and retract the blade cylinder.

If there is any leakage from the base end fitting on the blade cylinder, remove the cylinder for repair or replacement.

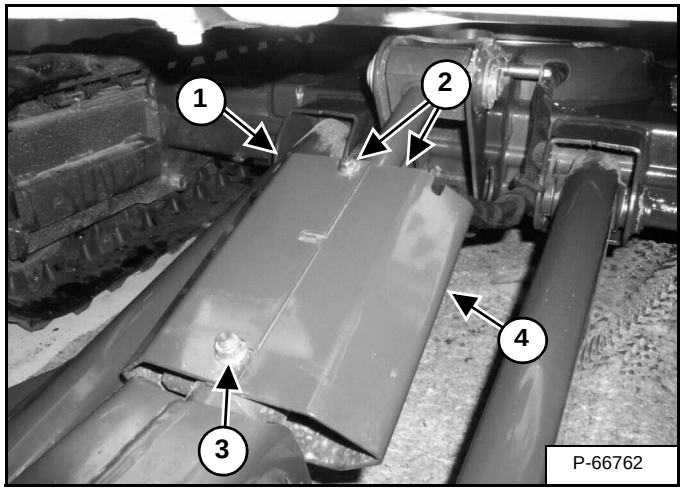
Removal and Installation

Lower the boom / bucket and blade to the ground. Stop the engine.

With the key in the ON position, move the blade control to release the hydraulic pressure.

Support the blade. With the key in the ON position, move the blade control to release the hydraulic pressure. Raise the control console.

Figure 20-24-5



Loosen and slide the hose clamp (Item 1) **[Figure 20-24-5]** off the shield.

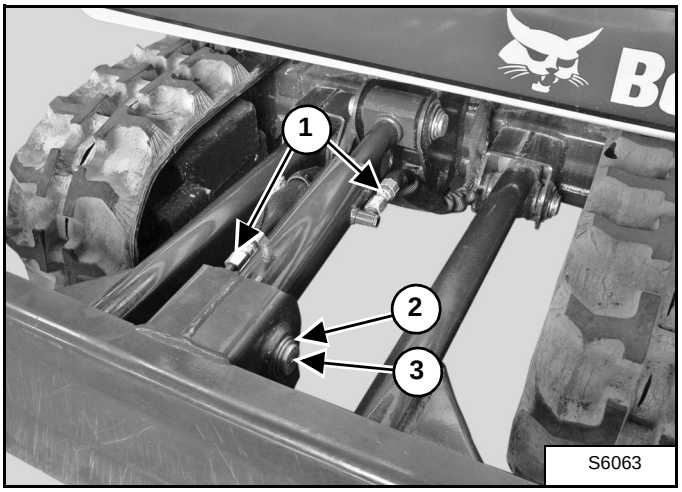
Remove the top and bottom bolts / nuts (Item 2) **[Figure 20-24-5]** fastening the two shields together.

Loosen the top nut (Item 3) and the bottom nut (Item 4) **[Figure 20-24-5]** fastening the shield to the blade cylinder.

Remove the blade cylinder shields from the blade cylinder.

Removal and Installation (Cont'd)

Figure 20-24-6



Remove and plug the blade cylinder hoses (Item 1) **[Figure 20-24-6]**.

Remove the snap ring and washers (Item 2) **[Figure 20-24-6]** from the cylinder base end.

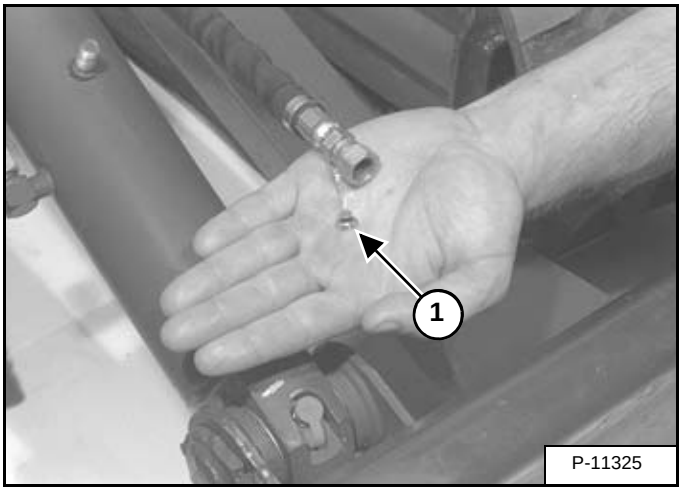
Remove the cylinder base end retaining pin (Item 3) **[Figure 20-24-6]**.

IMPORTANT

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

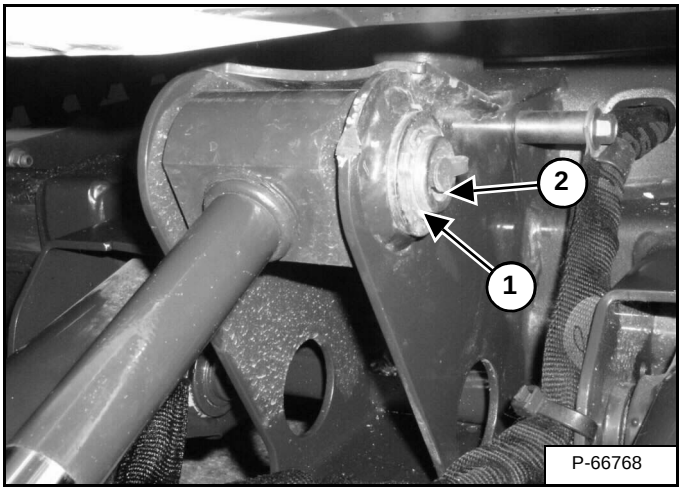
I-2003-0888

Figure 20-24-7



NOTE: Use care not to lose the orifice (Item 1) [Figure 20-24-7] located in the cylinder rod end hose.

Figure 20-24-8



Remove the snap ring and washer (Item 1) **[Figure 20-24-8]** from the cylinder rod end.

Remove the cylinder rod end retaining pin (Item 2) **[Figure 20-24-8]**.

Remove the blade cylinder.

⚠ WARNING

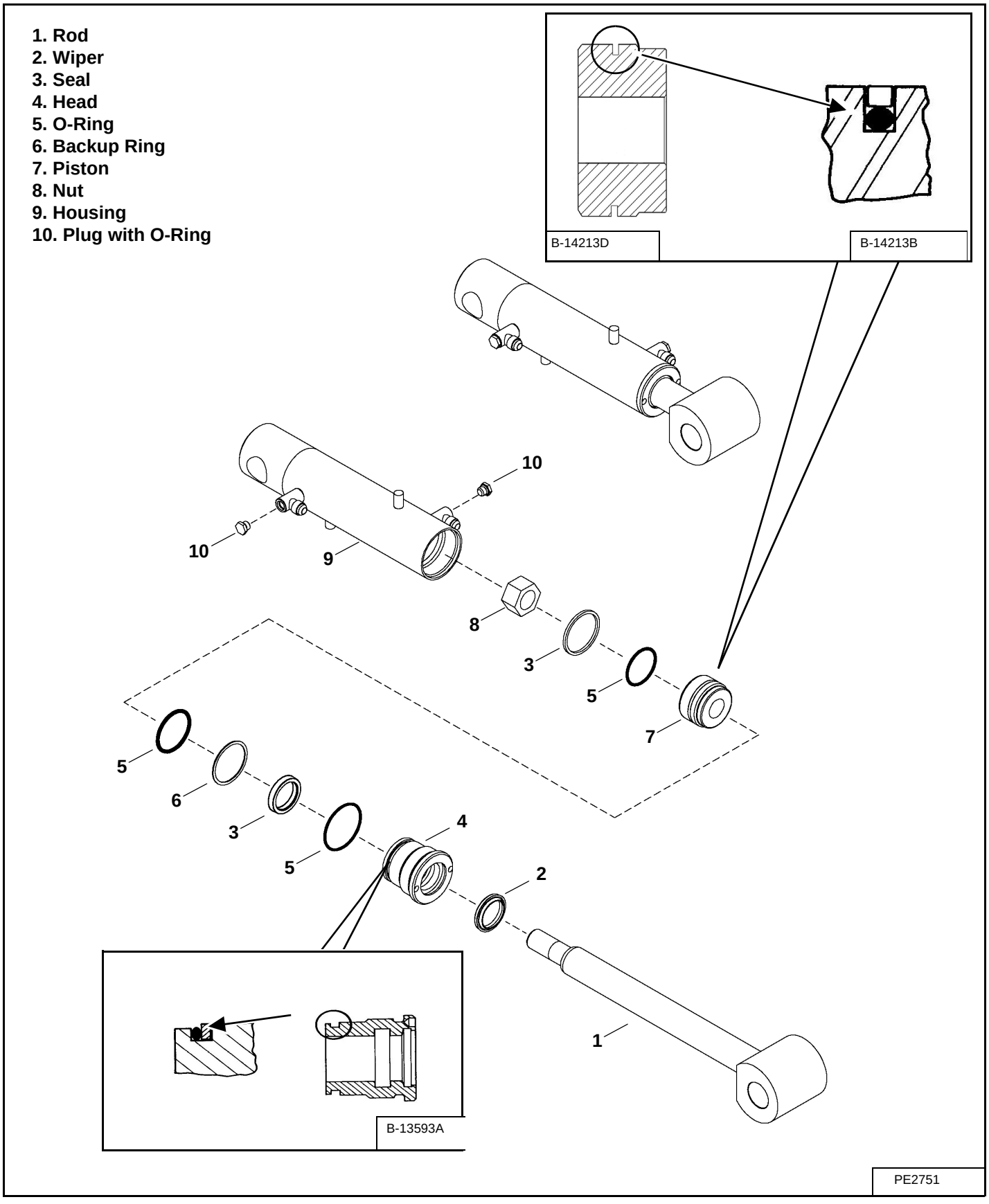
AVOID INJURY OR DEATH

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

W-2103-0807

Parts Identification

1. Rod
2. Wiper
3. Seal
4. Head
5. O-Ring
6. Backup Ring
7. Piston
8. Nut
9. Housing
10. Plug with O-Ring



Disassembly

Clean the outside of the blade cylinder before disassembly.

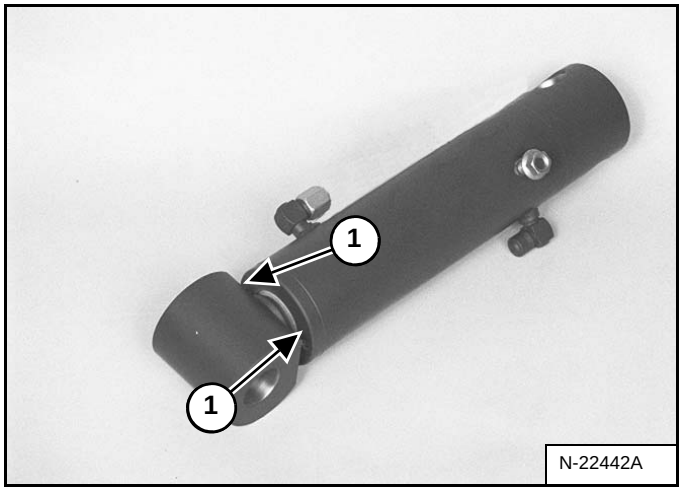
Use the following tools to disassemble the cylinder:

MEL1074 - O-ring Seal Hook
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

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

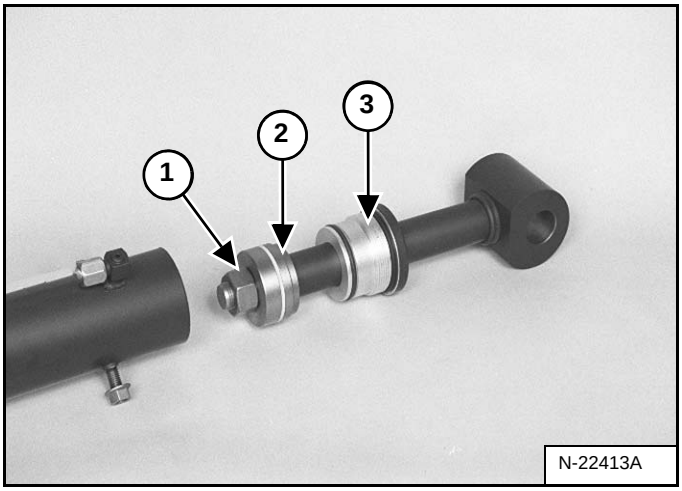
Put the base end of the cylinder in a vise.

Figure 20-24-9



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-24-9]** to loosen the head.

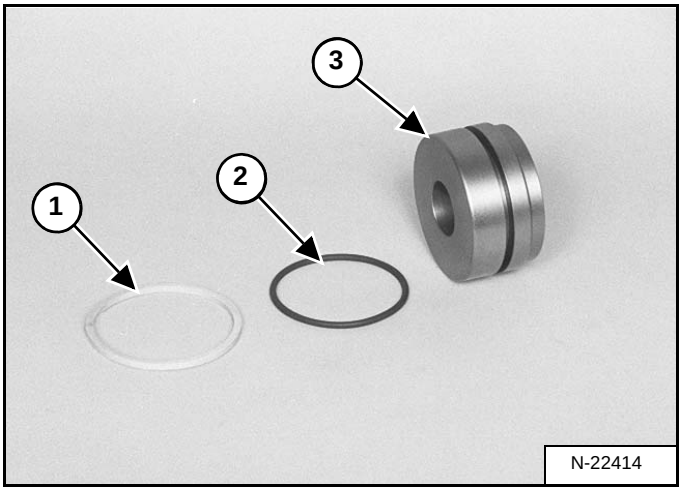
Figure 20-24-10



Remove the head and the rod assembly from the cylinder **[Figure 20-24-10]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-24-10]**.

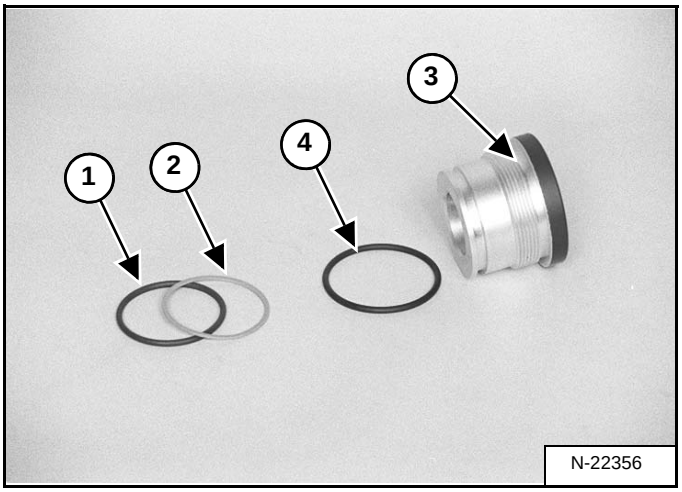
Figure 20-24-11



Standard Piston: Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-24-11]**.

Disassembly (Cont'd)

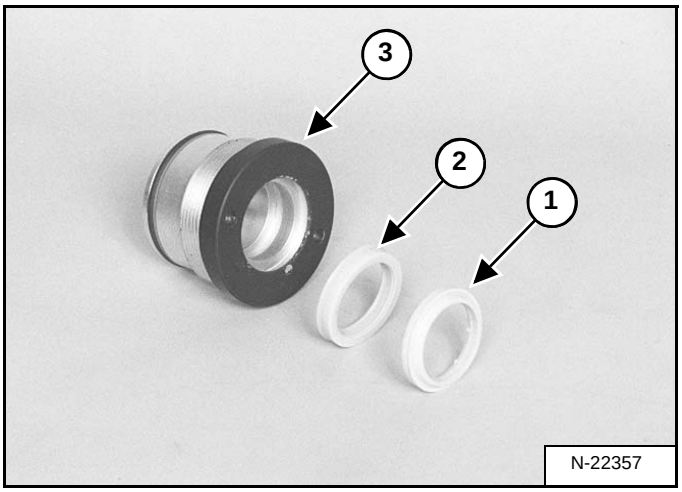
Figure 20-24-12



Remove the O-ring (Item 1) and the back-up ring (Item 2) from the groove in the head (Item 3) **[Figure 20-24-12]**.

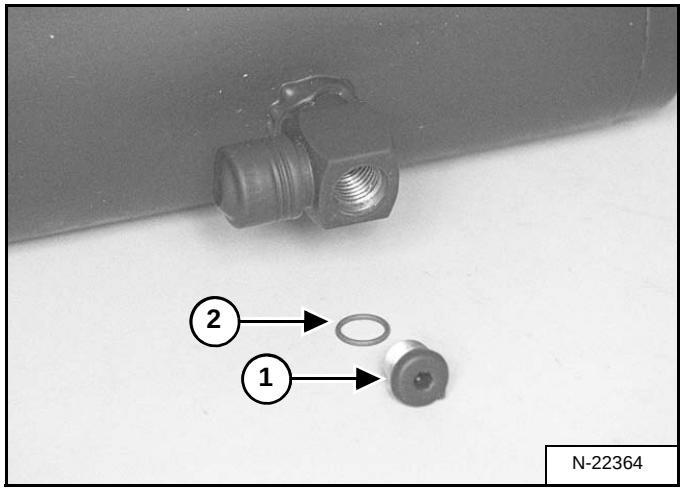
Remove the O-ring (Item 4) **[Figure 20-24-12]**.

Figure 20-24-13



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-24-13]**.

Figure 20-24-14



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-24-14]**.

Assembly

Use the following tools to assemble the cylinder:

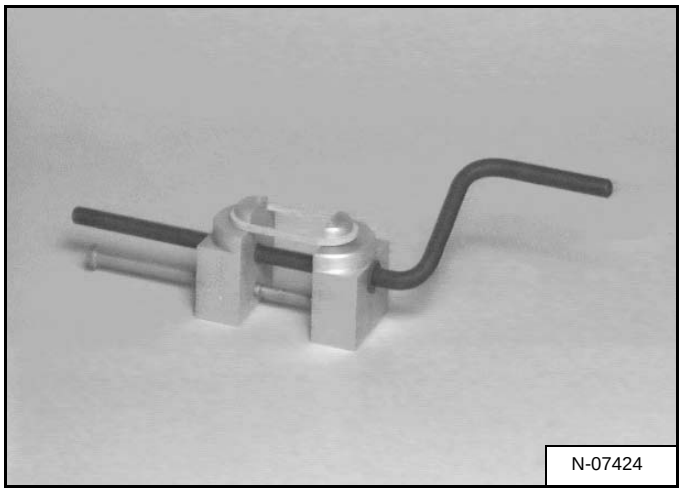
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

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.

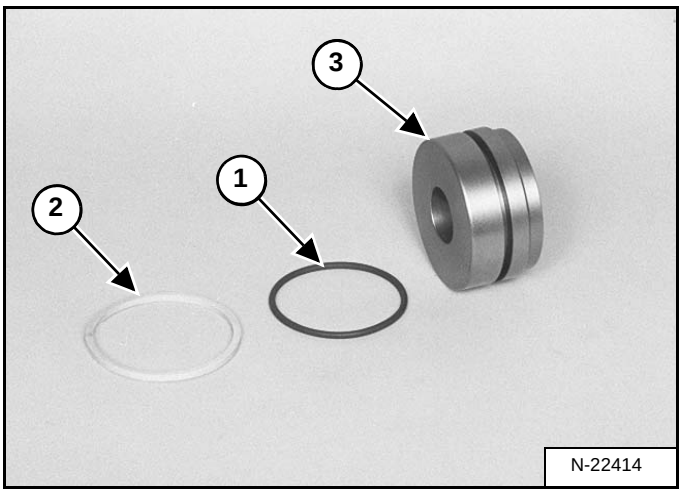
Figure 20-24-15



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-24-15]**.

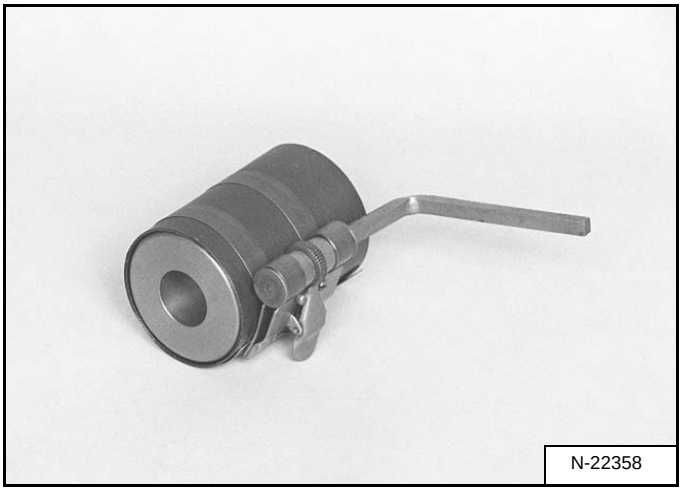
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-24-16



Standard Piston: Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-24-16]**.

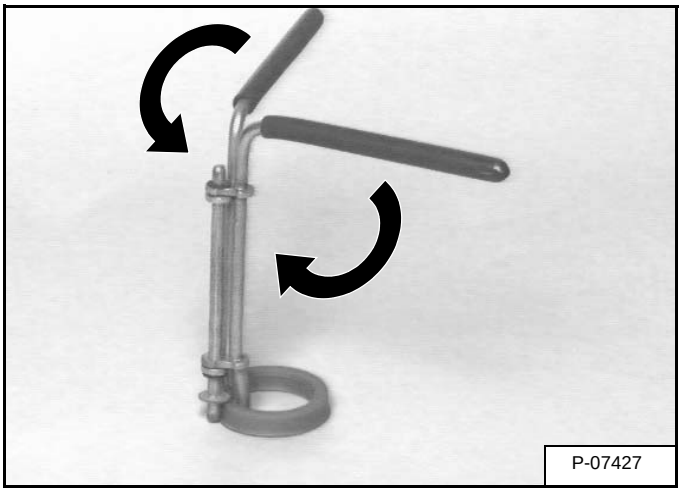
Figure 20-24-17



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-24-17]**.

Assembly (Cont'd)

Figure 20-24-18

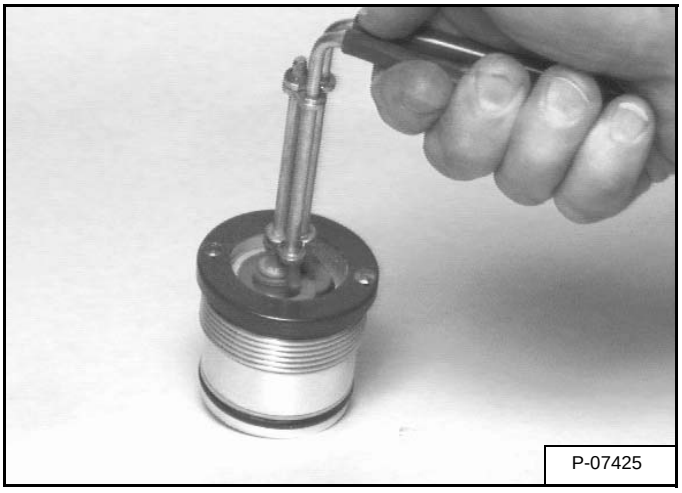


Install the rod seal on the rod seal tool **[Figure 20-24-18]**.

NOTE: During installation the spring side of the seal must be toward the inside of the cylinder.

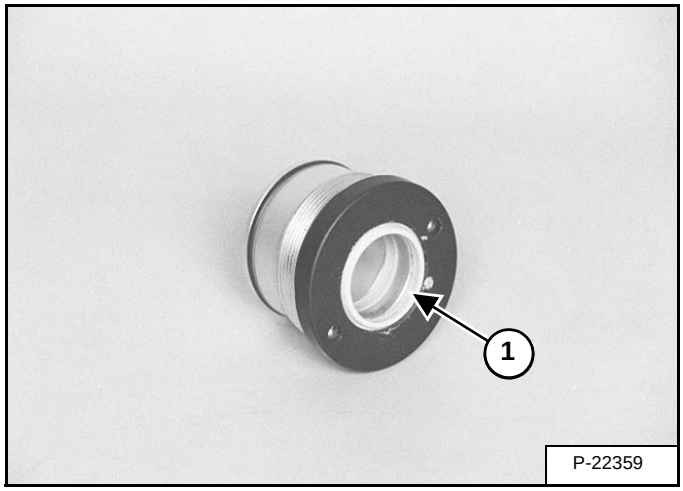
Rotate the handles to collapse the rod seal **[Figure 20-24-18]**.

Figure 20-24-19



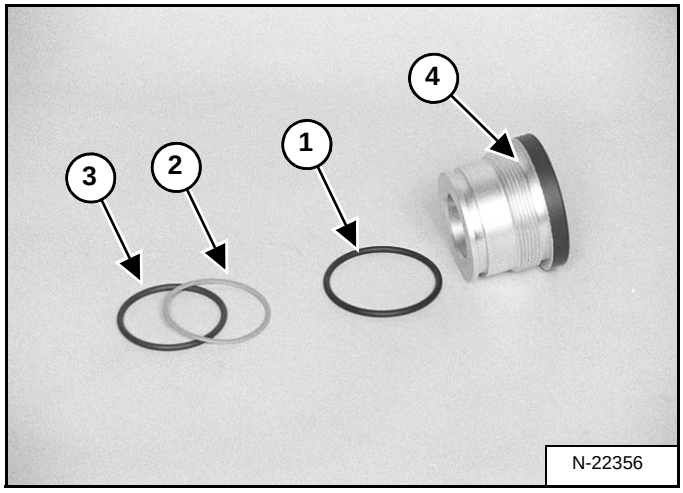
Install the rod seal in the head **[Figure 20-24-19]**.

Figure 20-24-20



Install the wiper seal with the wiper (Item 1) **[Figure 20-24-20]** toward the outside of the head.

Figure 20-24-21

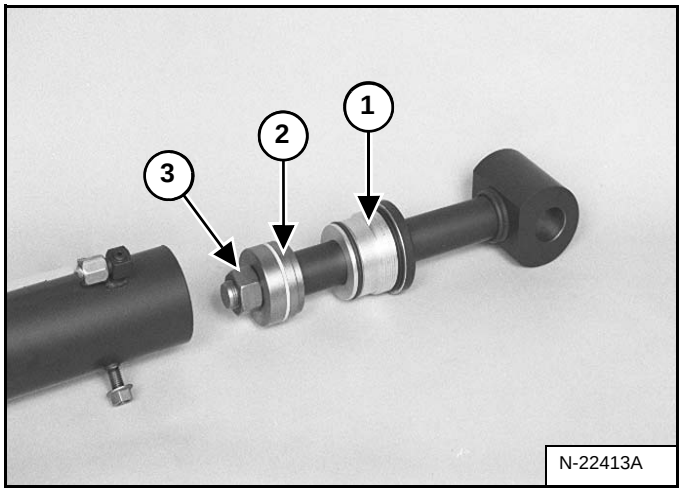


Install the O-ring (Item 1) **[Figure 20-24-21]**.

Install the back-up ring (Item 2) and O-ring (Item 3) into the groove on the head (Item 4) **[Figure 20-24-21]**.

Assembly (Cont'd)

Figure 20-24-22



Install the head (Item 1) and piston (Item 2) **[Figure 20-24-22]** on the rod.

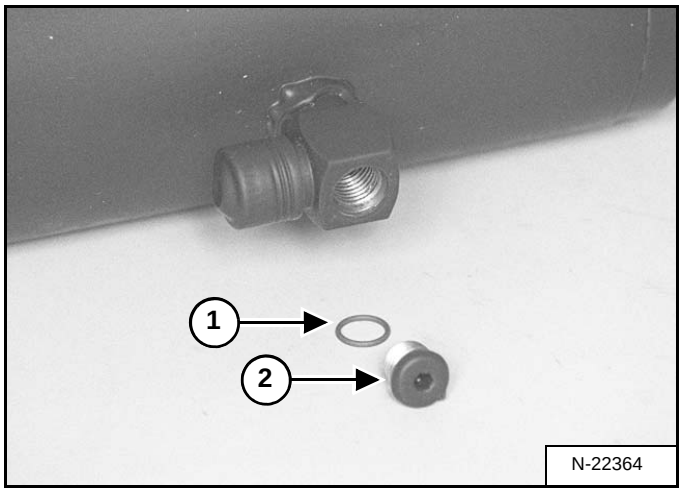
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-24-22]**.

Tighten the nut to 250 ft.-lb. (339 N•m) torque.

Figure 20-24-23

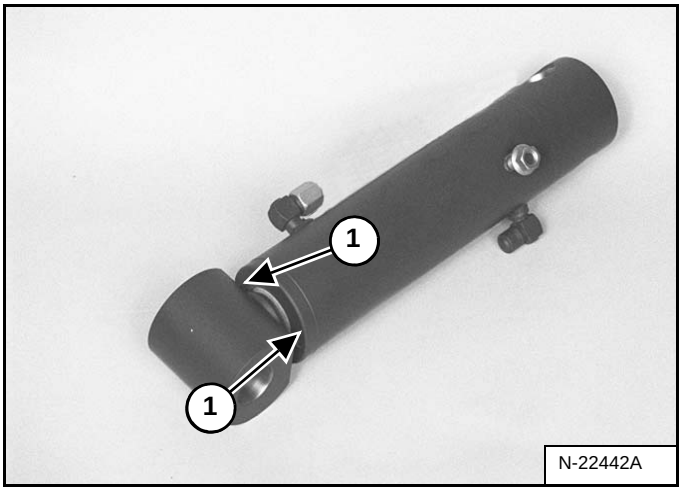


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-24-23]**.

Tighten the plug to 15 ft.-lb. (20 N•m) torque.

Put the base end of the hydraulic cylinder in a vise.

Figure 20-24-24



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-24-24]** to tighten the head. Head to be torqued until flush with end of the housing.

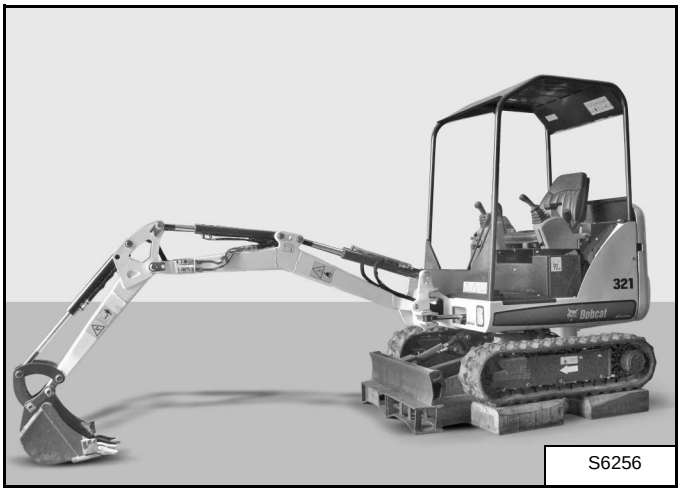

Bobcat®

TRACK FRAME EXPANSION CYLINDER

Testing

Retract the track frame fully.

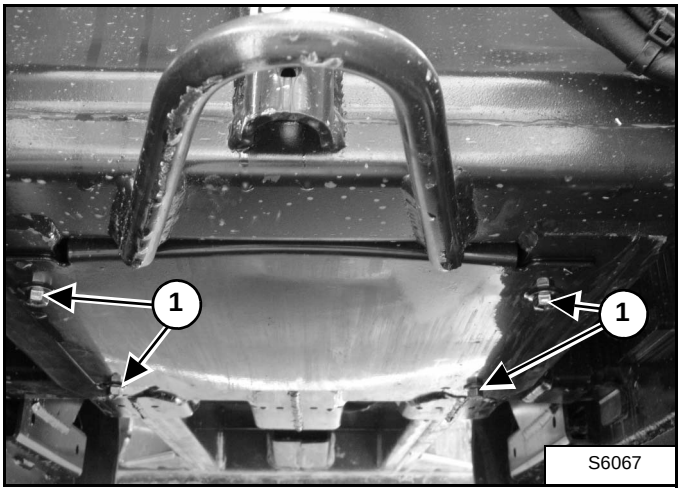
Figure 20-25-1



Place blocks under the excavator tracks. Lower the bucket to the ground and the blade on the blocks **[Figure 20-25-1]**.

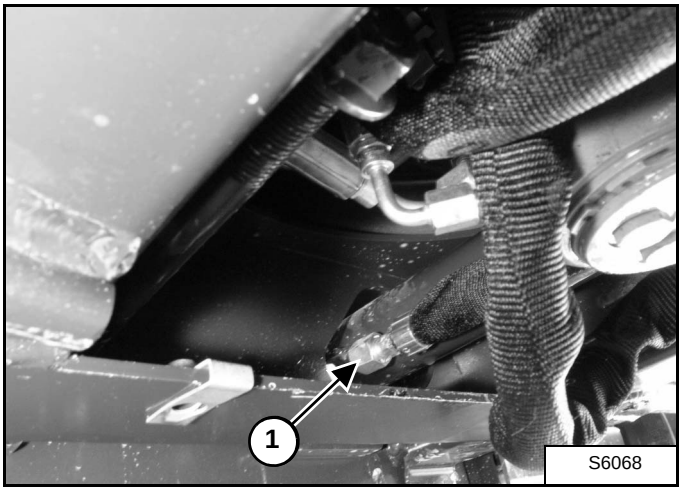
Stop the engine. Raise the control console.

Figure 20-25-2



Remove the four bolts (Item 1) **[Figure 20-25-2]** fastening the cover to the bottom side of the undercarriage. Remove the cover.

Figure 20-25-3



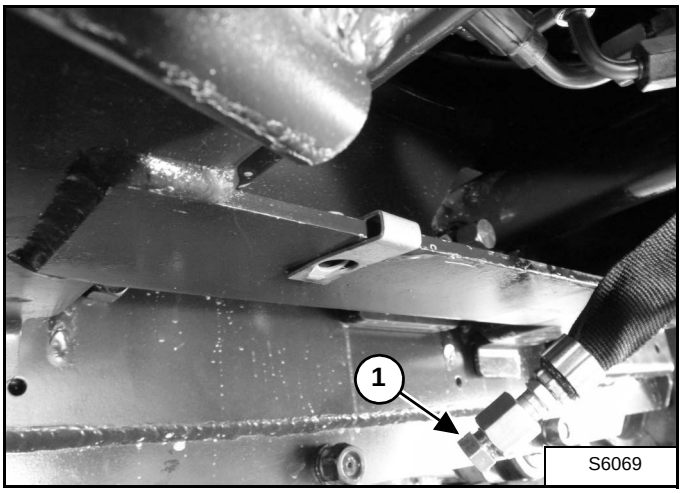
Remove the expansion cylinder base end hose (Item 1) **[Figure 20-25-3]**.

⚠ WARNING

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

W-2145-0290

Figure 20-25-4



Install a plug (Item 1) **[Figure 20-25-4]** on the hose fitting and tighten.

Lower control console and fasten the seat belt. Start the engine and retract the expansion cylinder.

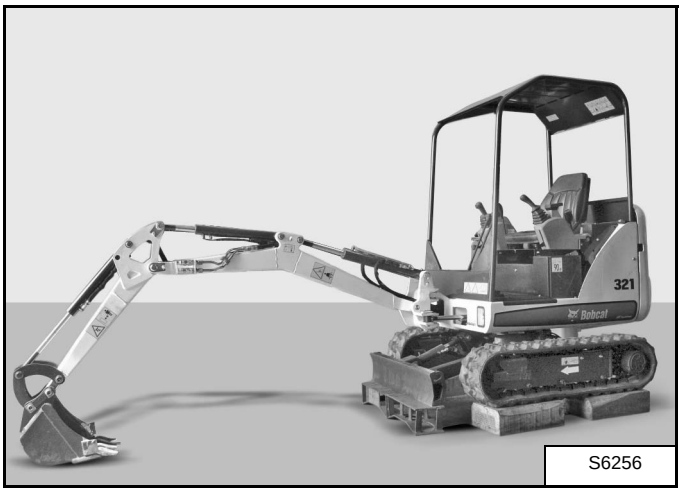
Testing (Cont'd)

If there is any leakage from the base end fitting on the expansion cylinder, remove the cylinder for repair or replacement.

Removal And Installation

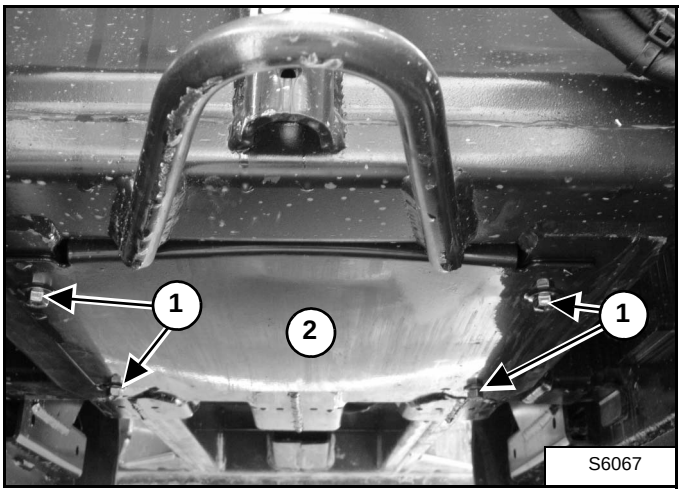
Expand the track frame fully.

Figure 20-25-5



Place blocks under the excavator tracks for increased access to the expansion cylinder **[Figure 20-25-5]**.

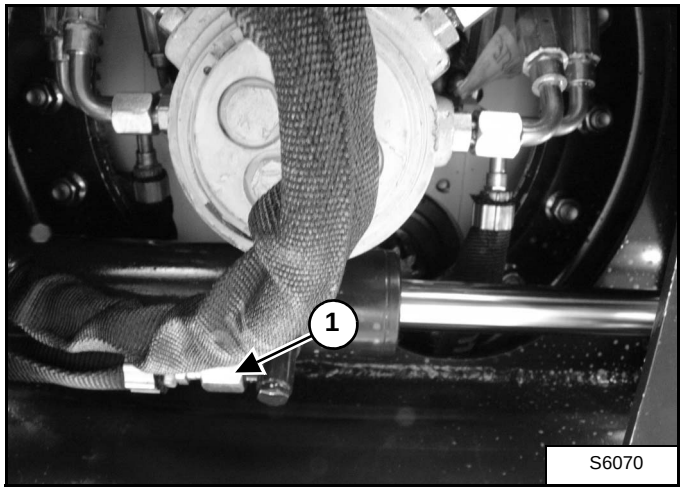
Figure 20-25-6



Remove the four bolts (Item 1) **[Figure 20-25-6]**.

Remove the access plate (Item 2) **[Figure 20-25-6]**.

Figure 20-25-7



Remove the hose (Item 1) **[Figure 20-25-7]** from the cylinder rod end.

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

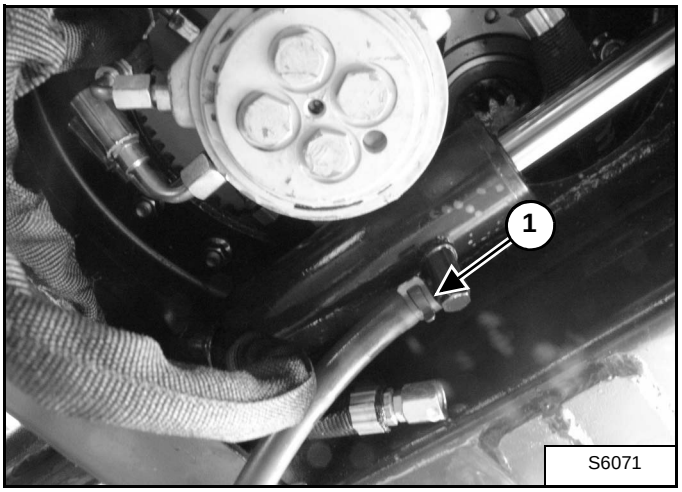
⚠ WARNING

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

W-2145-0290

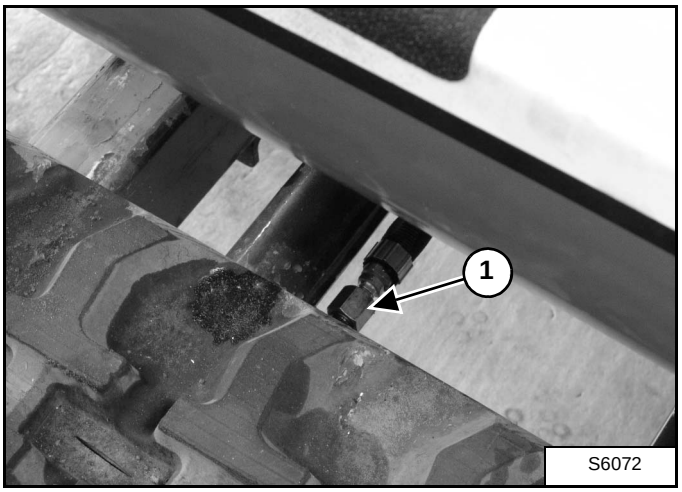
Removal And Installation (Cont'd)

Figure 20-25-8



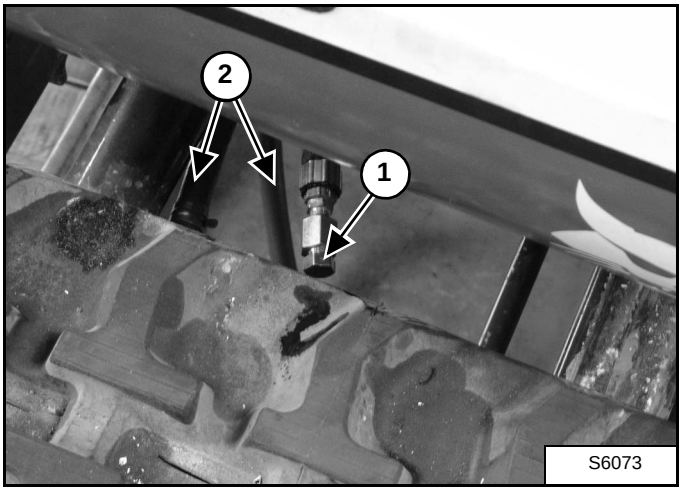
Install a hose (Item 1) **[Figure 20-25-8]** on the cylinder rod end. Place the other end of the hose in a drain pan.

Figure 20-25-9



Remove the hose (Item 1) **[Figure 20-25-9]** from the cylinder base end.

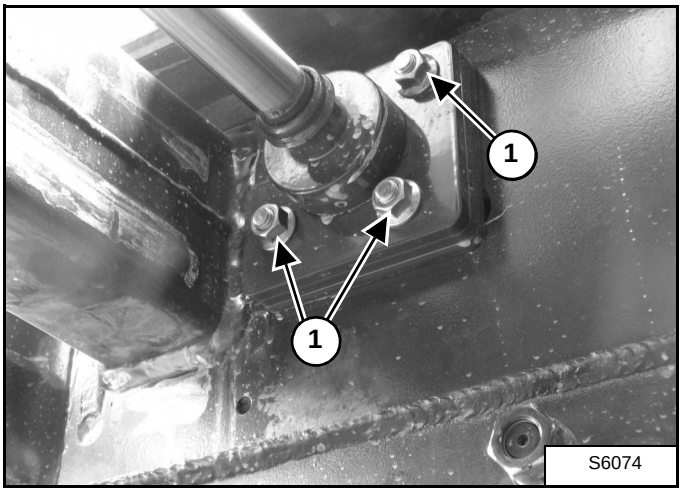
Figure 20-25-10



Plug the base end hose (Item 1) **[Figure 20-25-10]**.

Install a hose (Item 2) **[Figure 20-25-10]** on the cylinder base end. Place the other end of the hose in a drain pan.

Figure 20-25-11

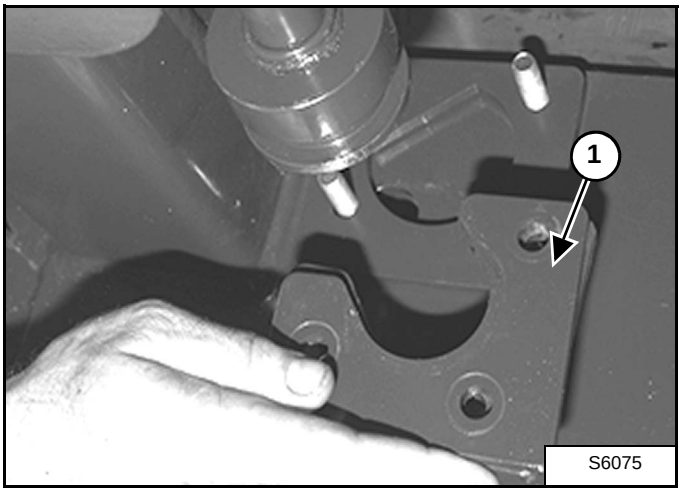


Remove the three nuts (Item 1) **[Figure 20-25-11]** from the rod end of the cylinder.

Installation: Tighten the nuts to 32-35 ft.-lb. (43-47 N•m) torque.

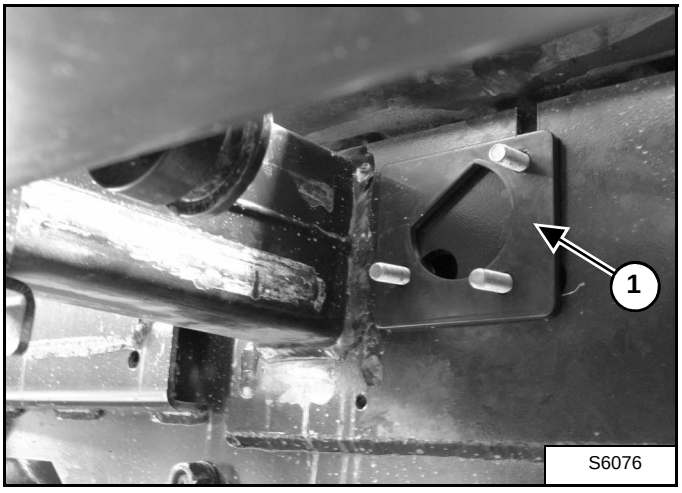
Removal And Installation (Cont'd)

Figure 20-25-12



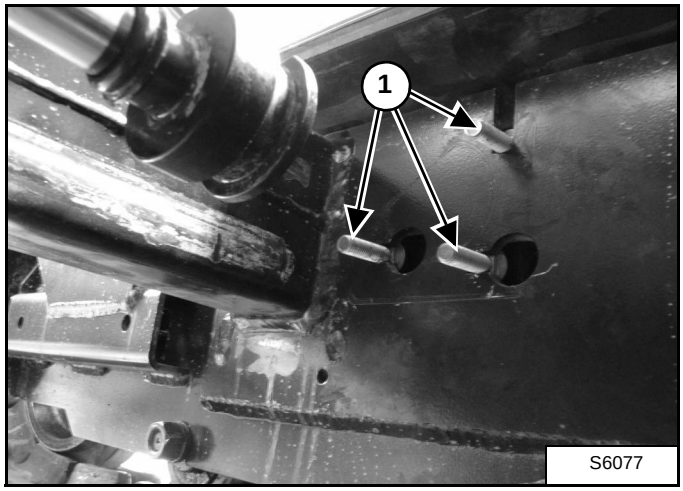
Slightly compress the cylinder. Remove the two plates (Item 1) **[Figure 20-25-12]** from the rod end of the cylinder.

Figure 20-25-13



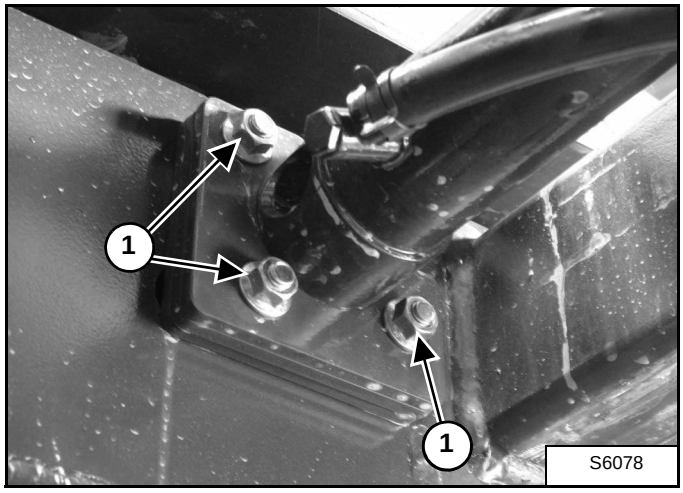
Remove the mount plate (Item 1) **[Figure 20-25-13]** from the track frame.

Figure 20-25-14



Remove the three bolts (Item 1) **[Figure 20-25-14]** and retaining clips from the track frame.

Figure 20-25-15

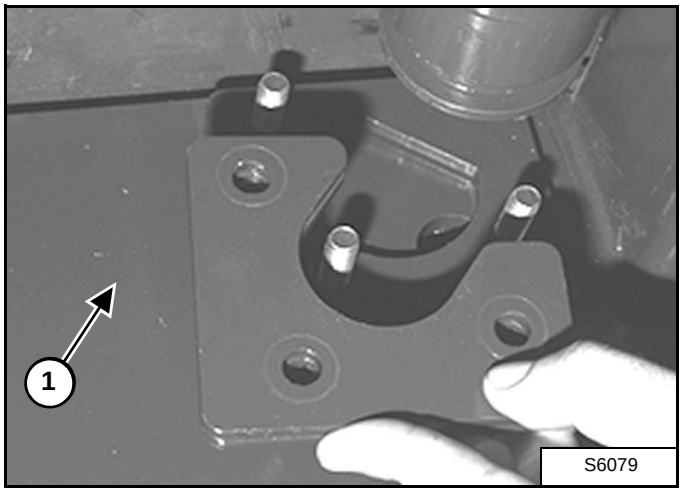


Remove the three nuts (Item 1) **[Figure 20-25-15]** from the base end of the cylinder.

Installation: Tighten the nuts to 32-35 ft.-lb. (43-47 N•m) torque.

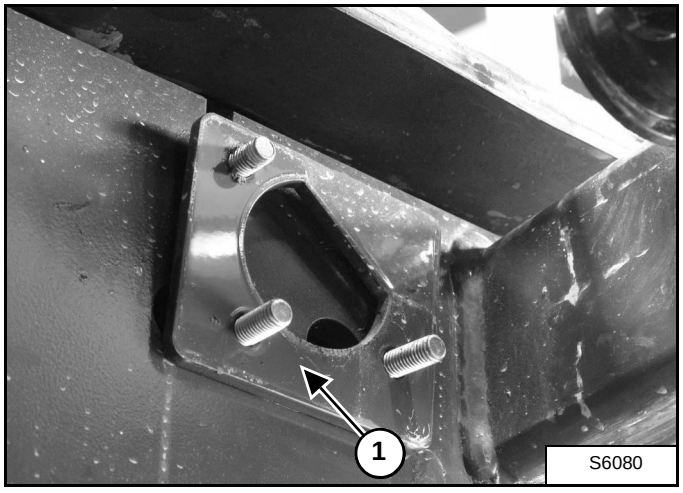
Removal And Installation (Cont'd)

Figure 20-25-16



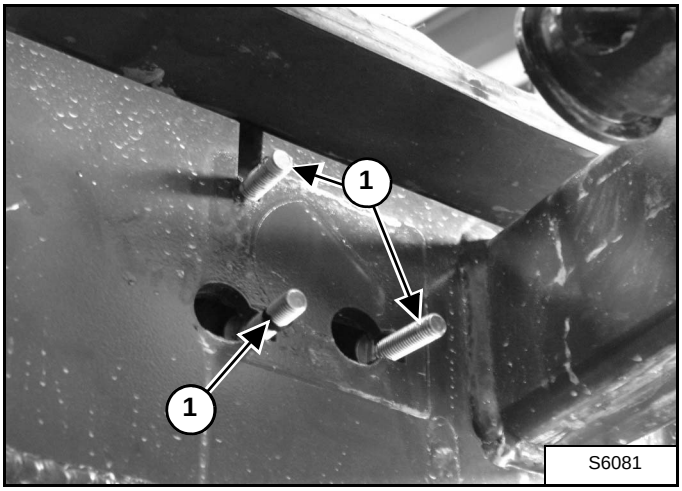
Pull the cylinder out of the mount. Remove the two plates (Item 1) **[Figure 20-25-16]** from the base end of the cylinder.

Figure 20-25-17



Remove the mount plate (Item 1) **[Figure 20-25-17]** from the track frame.

Figure 20-25-18

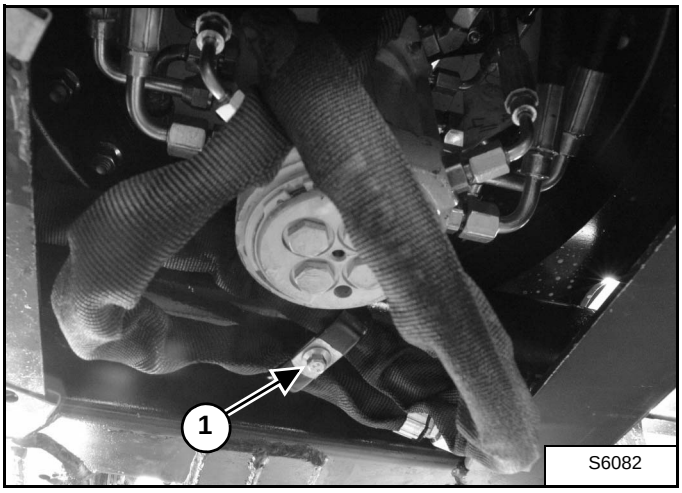


Remove the three bolts (Item 1) **[Figure 20-25-18]** and retaining clips from the track frame.

Compress the cylinder.

Rotate the cylinder until the hose clamp is accessible.

Figure 20-25-19



Remove the bolt (Item 1) **[Figure 20-25-19]**.

Remove the cylinder.

⚠ WARNING

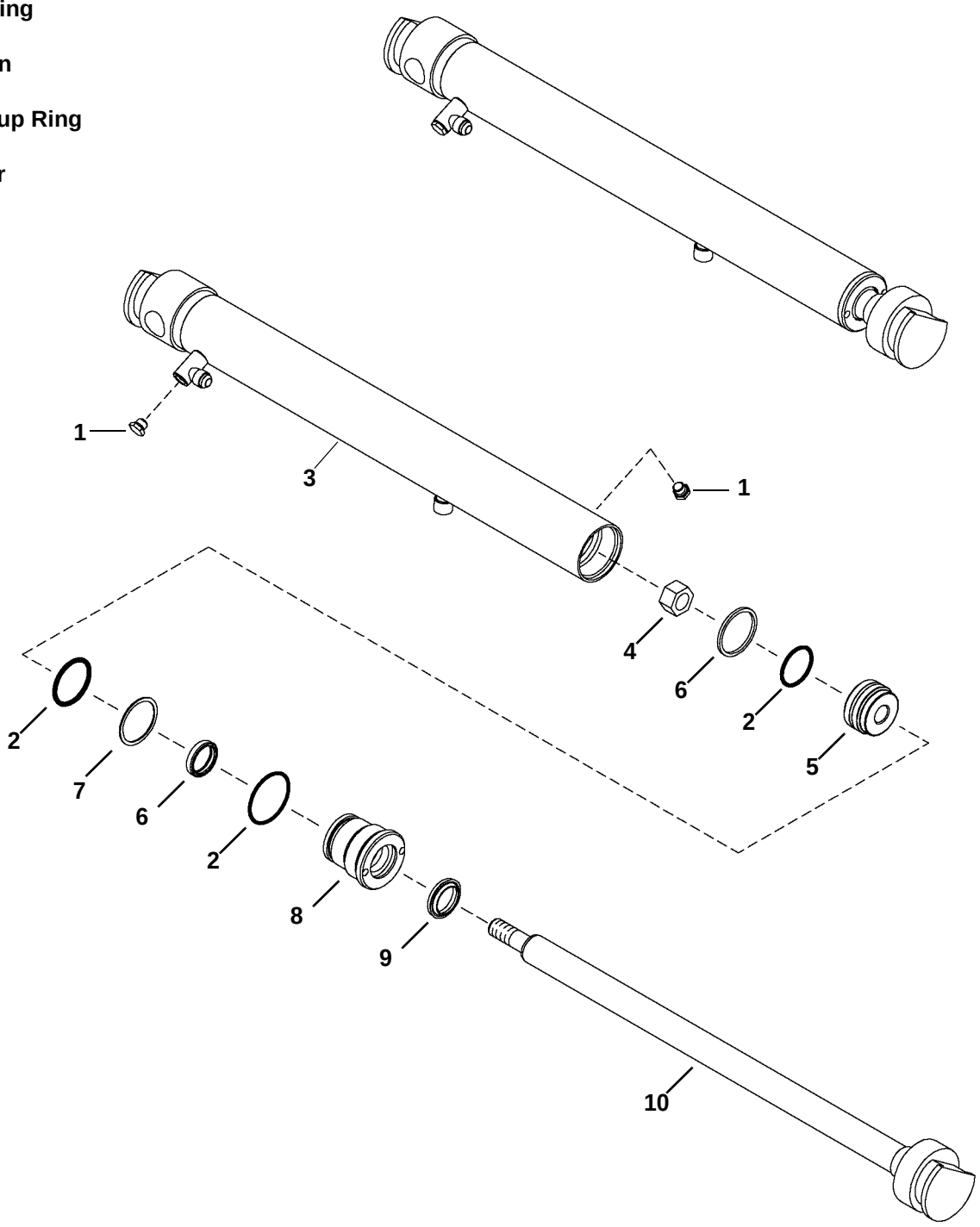
AVOID INJURY OR DEATH

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

W-2103-0807

Parts Identification

1. Plug with O-Ring
2. O-Ring
3. Housing
4. Nut
5. Piston
6. Seal
7. Backup Ring
8. Head
9. Wiper
10. Rod



PE2755

Disassembly

Clean the outside of the expansion cylinder before disassembly.

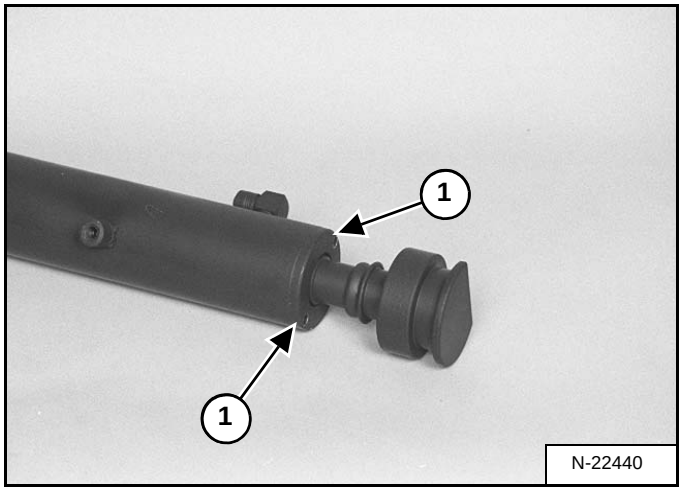
Use the following tools to disassemble the cylinder:

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

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

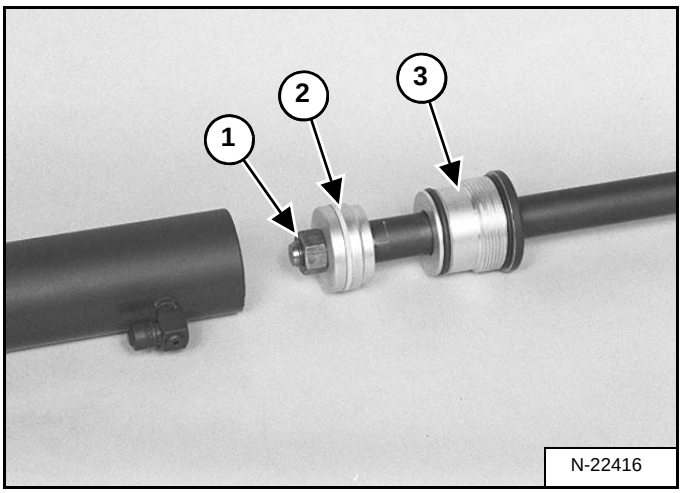
Put the base end of the cylinder in a vise.

Figure 20-25-20



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

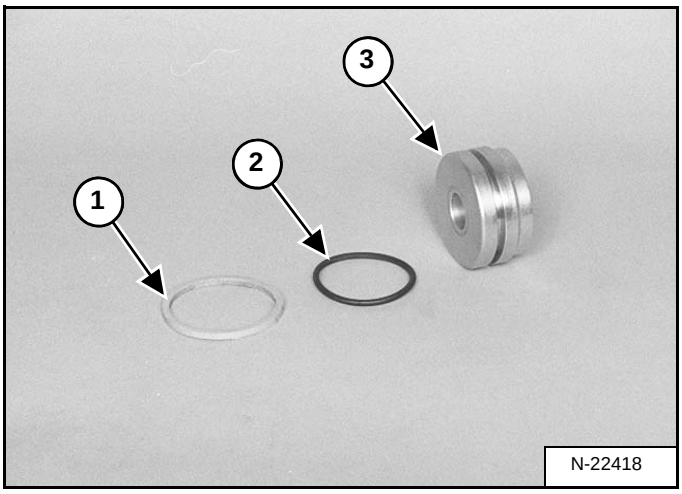
Figure 20-25-21



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

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

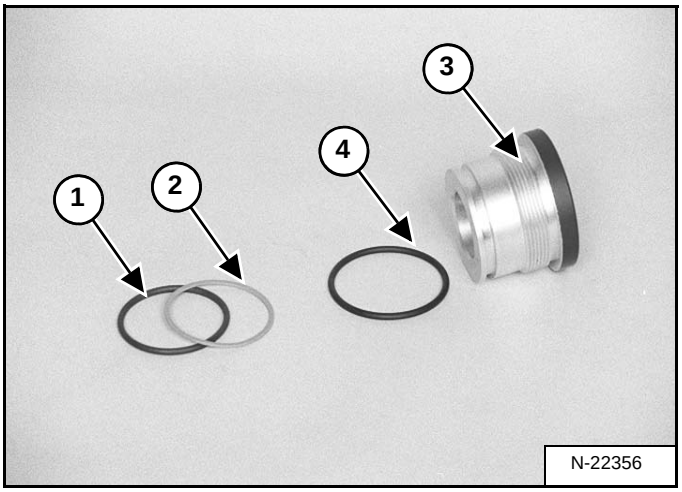
Figure 20-25-22



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

Disassembly (Cont'd)

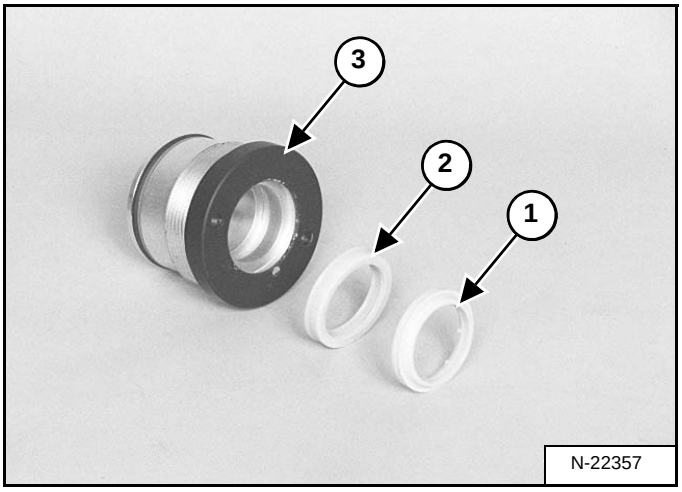
Figure 20-25-23



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

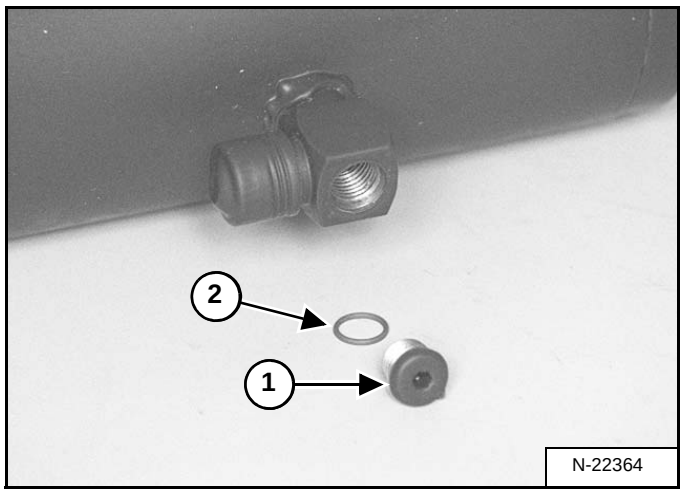
Remove the thin O-ring (Item 4) **[Figure 20-25-23]**.

Figure 20-25-24



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-25-24]**.

Figure 20-25-25



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-25-25]**.

Assembly

Use the following tools to assemble the cylinder:

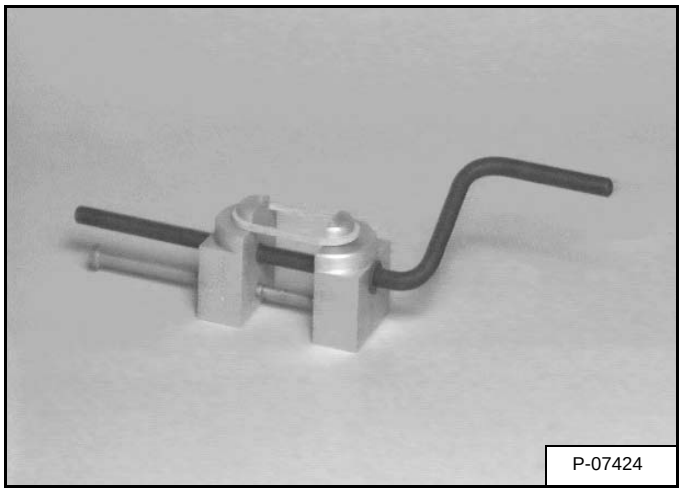
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

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.

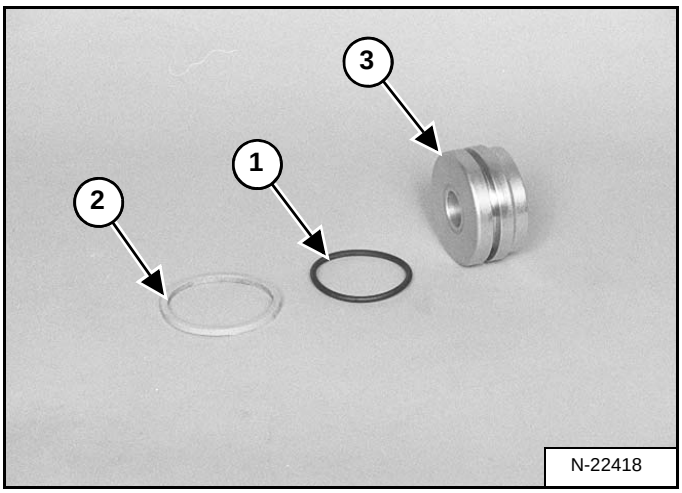
Figure 20-25-26



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-25-26]**.

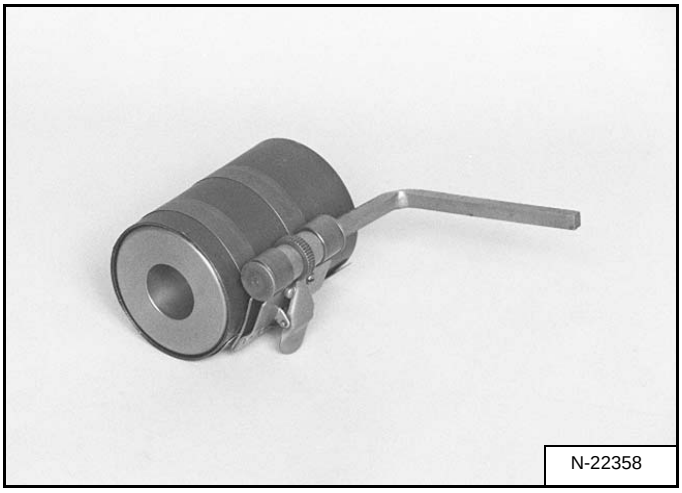
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-25-27



Standard Piston: Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-25-27]**.

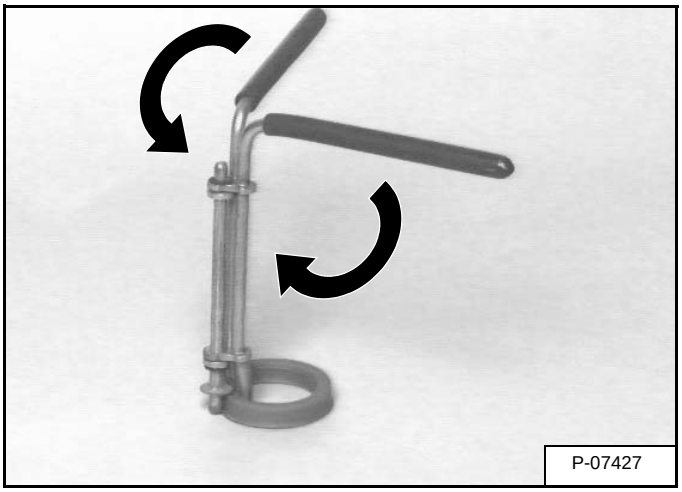
Figure 20-25-28



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-25-28]**.

Assembly (Cont'd)

Figure 20-25-29

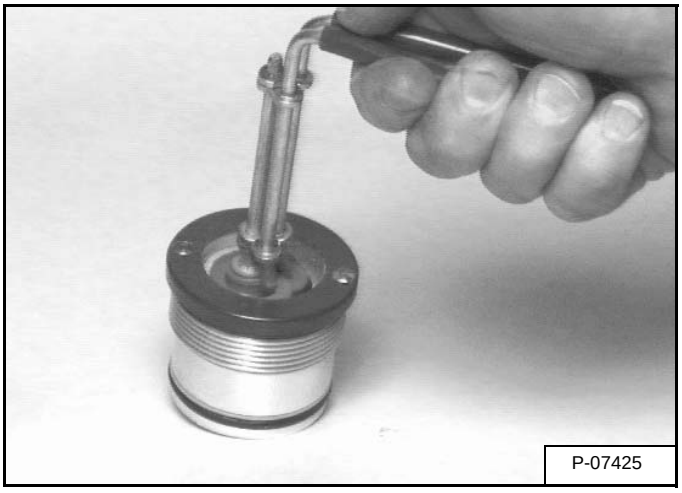


Install the rod seal on the rod seal tool **[Figure 20-25-29]**.

NOTE: During installation the spring side of the seal must be toward the inside of the cylinder.

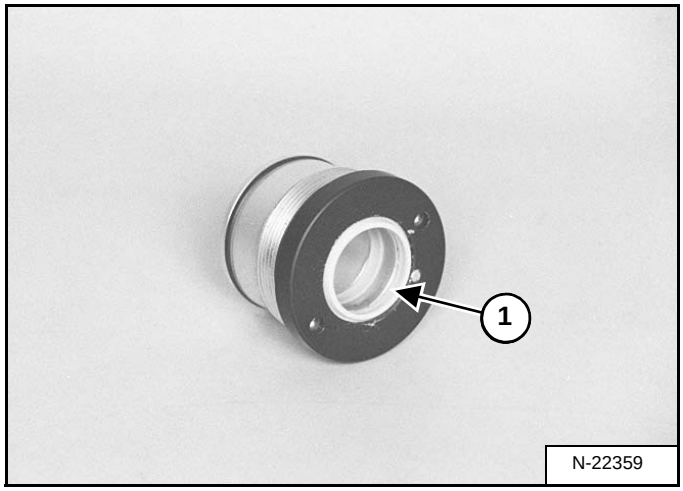
Rotate the handles to collapse the rod seal **[Figure 20-25-29]**.

Figure 20-25-30



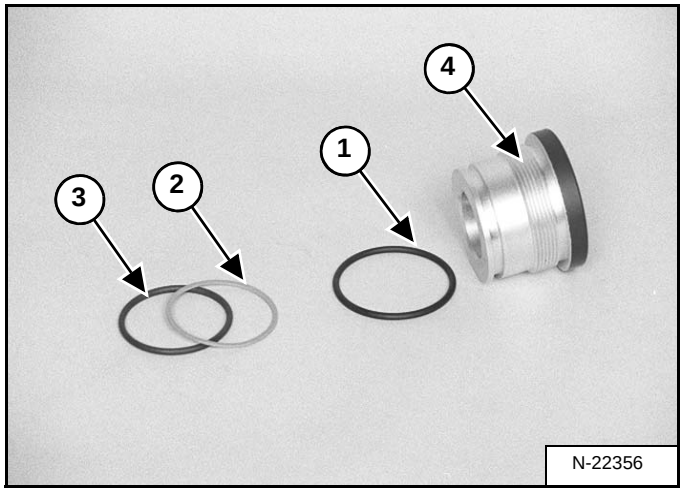
Install the rod seal in the head **[Figure 20-25-30]**.

Figure 20-25-31



Install the wiper seal with the wiper (Item 1) **[Figure 20-25-31]** toward the outside of the head.

Figure 20-25-32

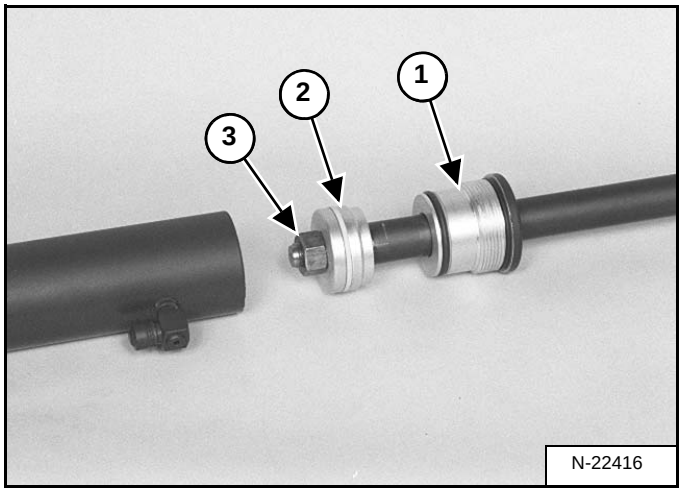


Install the O-ring (Item 1) **[Figure 20-25-32]**.

Install the back-up ring (Item 2) and thick O-ring (Item 3) into the groove on the head (Item 4) **[Figure 20-25-32]**.

Assembly (Cont'd)

Figure 20-25-33



Install the head (Item 1) and the piston (Item 2) **[Figure 20-25-33]** on the rod.

Grease the piston where the nut contacts the piston. Do not get grease on the threads.

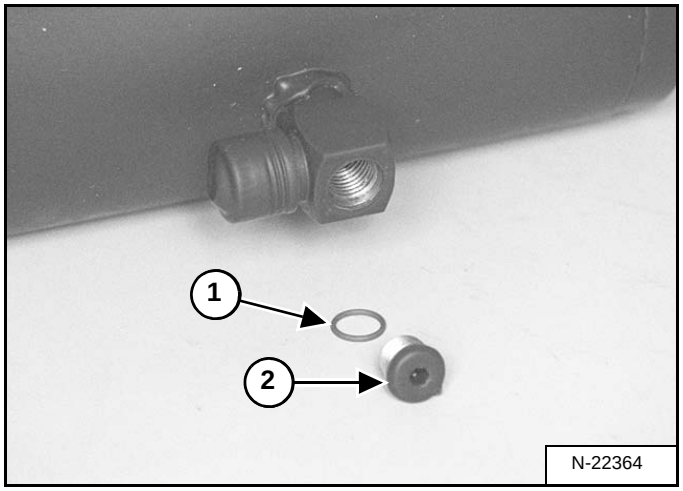
Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-25-33]**.

NOTE: Clean and dry the rod threads, from the kit install a NEW NUT with pre-applied Loctite®.

Tighten the nut to 90 ft.-lb. (122 N•m) torque.

Figure 20-25-34

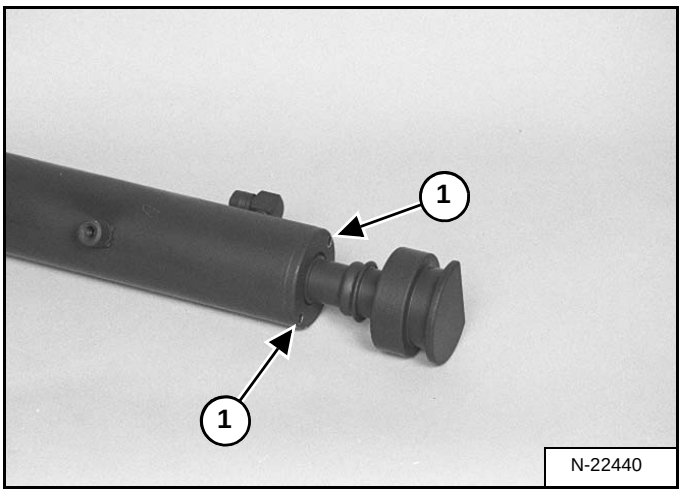


Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-25-34]**.

Tighten the plug to 8 ft.-lb. (11 N•m) torque.

Put the base end of the hydraulic cylinder in a vise.

Figure 20-25-35



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-25-35]** to tighten the head. Head to be torqued until flush with end of the housing.

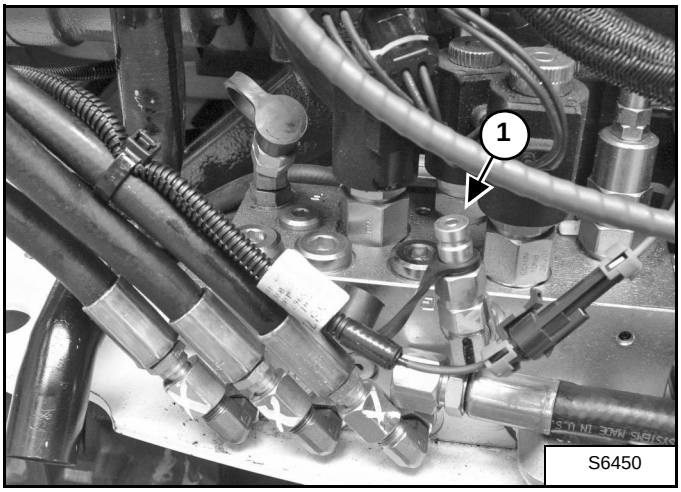

Bobcat®

MAIN RELIEF VALVE

Testing And Adjusting The Main Relief Valve

All testing is done with the hydraulic oil at operating temperature and the engine at high speed setting of 2500 RPM Maximum.

Figure 20-30-1



There is one diagnostic coupler (Item 1) **[Figure 20-30-1]** on the manifold assembly for checking each of the pump section pressure.

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

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

System Pressures At Gauge Port Specifications

TEST CONDITIONS

1. Engine High Idle Speed

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

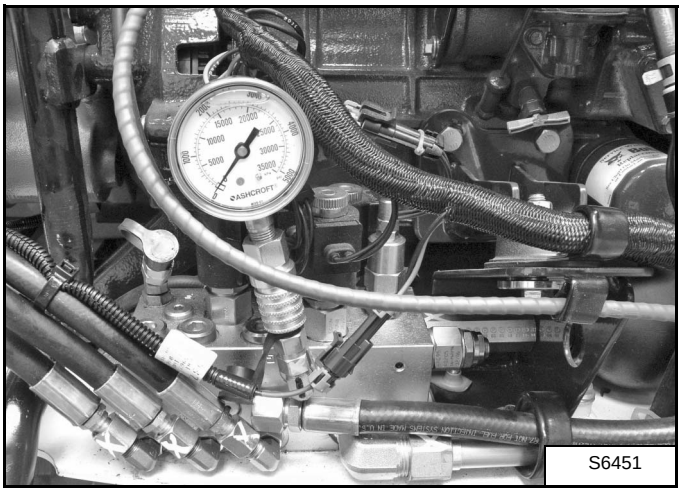
3. Activate function until cylinder movement stops. Hold over relief for 5-10 seconds.
   Record pressure.

SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET kPa (PSI)	ACCEPTABLE RANGE kPa (PSI)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	PSI	3000 (435)	2800 - 3100 (406 - 450)
PRESSURE BUILD - UP VALVE	NONE - CONSOLE DOWN	P1 and P2	G	2861 (415)	2380 - 3340 (345-485)
SYSTEM BY - PASS	NONE - CONSOLE UP	DUMP TO TANK	G	790 (115)	MAX ALLOWABLE 1070 (155)
MAIN RELIEF ON MANIFOLD BLOCK	BOOM	P2	G	22680 (3290)	22000 - 23370 (3190-3390)
MAIN RELIEF ON MANIFOLD BLOCK	AUXILIARY	P1 and P2	G	22680 (3290)	22000 - 23370 (3190-3390)
MAIN RELIEF ON MANIFOLD BLOCK	ARM	P1 and P2	G	22680 (3290)	22000 - 23370 (3190-3390)
SWING MOTOR - CROSS PORT RELIEF	SLEW RIGHT	P3	G	20680 (3000)	20340 - 21030 (2950-3050)
SWING MOTOR - CROSS PORT RELIEF	SLEW LEFT	P3	G	20680 (3000)	20340 - 21030 (2950-3050)

**** Under seat at Bulkhead***

Testing And Adjusting The Main Relief Valve (Cont'd)

Figure 20-30-2



Connect the test gauge coupler from the test kit to the "G" diagnostic port **[Figure 20-30-2]**.

Lower the control console and fasten seat belt.

Start the engine and run at low RPM until hydraulic fluid is at operating temperatures 150° F (66° C).

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

Operate the following circuits over relief and record the pressure for each circuit.

NOTE: Do not operate the blade circuit due to a by-pass orifice in spool.

The main relief valve pressure at "G" diagnostic port **[Figure 20-30-2]** should be as follows:

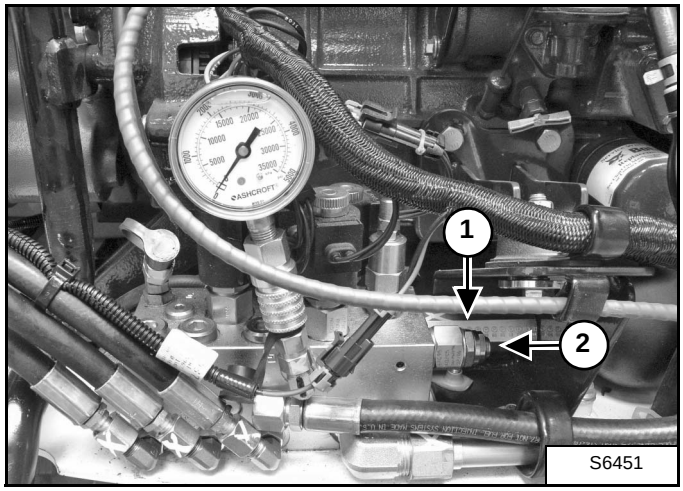
Boom up:
3200 - 3400 PSI (221 - 234 bar)

Arm in:
3200 - 3400 PSI (221 - 234 bar)

Auxiliary:
2945 - 3145 PSI (203 - 217 bar)

Stop the engine.

Figure 20-30-3



If adjustment is needed, loosen the nut (Item 1) **[Figure 20-30-3]**.

Turn the adjustment bolt (Item 2) **[Figure 20-30-3]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

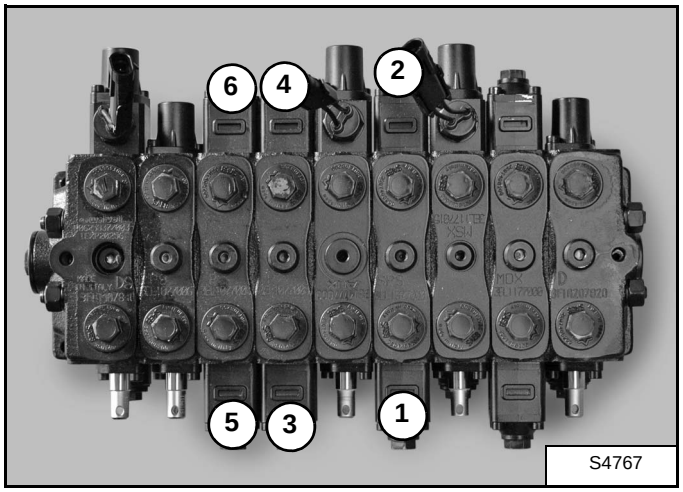
Tighten the nut (Item 1) **[Figure 20-30-3]**.

Retest the main relief valve after adjustment.

PORT RELIEF VALVES

Testing And Adjusting The Port Relief Valve Pressure

Figure 20-31-1



Boom Port Relief set at:

Rod End (Item 1) **[Figure 20-31-1]**	3626 PSI (250 bar)
Base End (Item 2) **[Figure 20-31-1]**	3046 PSI (210 bar)

Bucket Port Relief set at:

Rod End (Item 3) **[Figure 20-31-1]**	3625 PSI (250 bar)
Base End (Item 4) **[Figure 20-31-1]**	3626 PSI (250 bar)

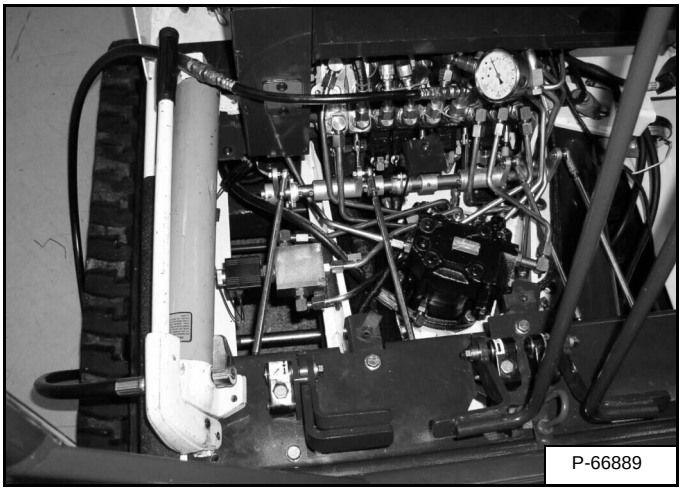
Arm Port Relief set at:

Rod End (Item 5) **[Figure 20-31-1]**	3626 PSI (250 bar)
Base End (Item 6) **[Figure 20-31-1]**	3626 PSI (250 bar)

NOTE: The reliefs are located below the spool covers on the valve sections.

A portable hydraulic hand pump will be used to test the work port relief valves. The hand pump must have clean Bobcat hydraulic fluid.

Figure 20-31-2



Install the hand pump hose and a pressure gauge (minimum of 5000 PSI) into the valve section work port in which the port relief valve is located **[Figure 20-31-2]**. Slowly pressurize this section with the hand pump until the port relief valve opens and make a note of the pressure reading.

NOTE: Pumping the hand pump too fast will alter the pressure readings up to 50 PSI (3,4 bar).

If the port relief pressure setting is incorrect, replace the port relief valve.

⚠ WARNING

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

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

W-2019-1285


Bobcat®

CROSSPORT RELIEF VALVES

Testing And Adjusting The Crossport Relief Valve

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

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

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

System Pressures At Gauge Port Specifications

TEST CONDITIONS

1. Engine High Idle Speed

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

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

Open the tailgate.

Figure 20-32-1

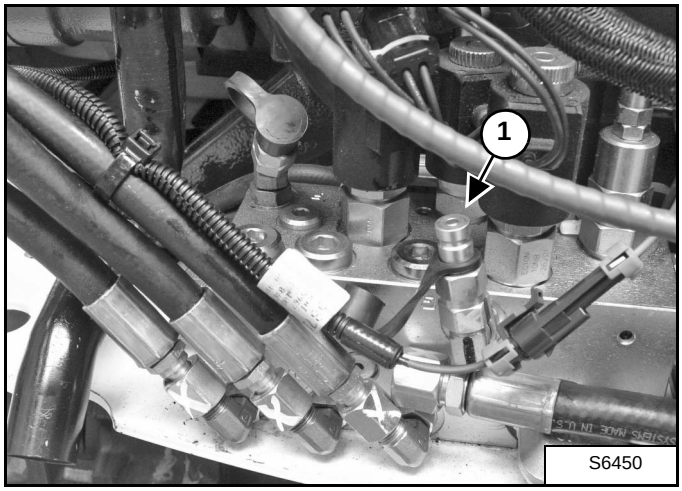
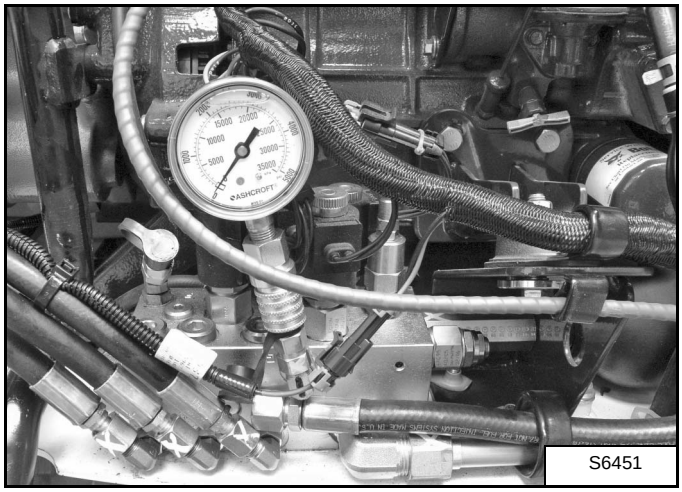


Figure 20-32-2



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

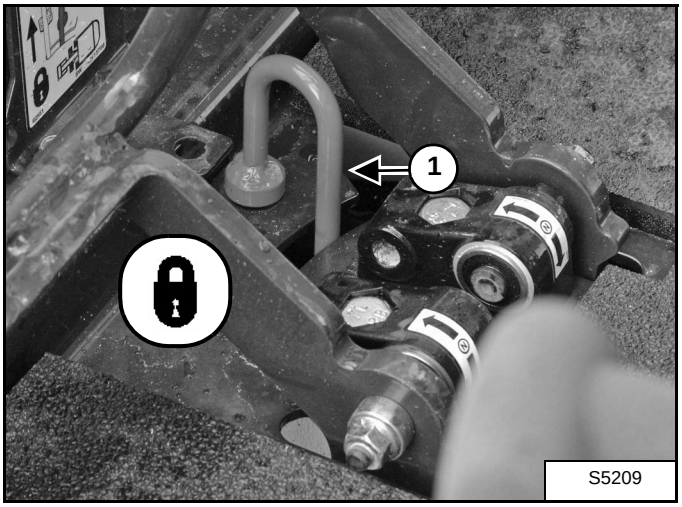
Lower the control console and fasten the seat belt.

SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET (PSI)	ACCEPTABLE RANGE (PSI)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	PSI	3000 (435)	2800 - 3100 (406 - 450)
PRESSURE BUILD - UP VALVE	NONE - CONSOLE DOWN	P1 and P2	G	2861 (415)	2380 - 3340 (345-485)
SYSTEM BY - PASS	NONE - CONSOLE UP	DUMP TO TANK	G	790 (115)	MAX ALLOWABLE 1070 (155)
MAIN RELIEF ON MANIFOLD BLOCK	BOOM	P2	G	22680 (3290)	22000 - 23370 (3190-3390)
MAIN RELIEF ON MANIFOLD BLOCK	AUXILIARY	P1 and P2	G	22680 (3290)	22000 - 23370 (3190-3390)
MAIN RELIEF ON MANIFOLD BLOCK	ARM	P1 and P2	G	22680 (3290)	22000 - 23370 (3190-3390)
SWING MOTOR - CROSS PORT RELIEF	SLEW RIGHT	P3	G	20680 (3000)	20340 - 21030 (2950-3050)
SWING MOTOR - CROSS PORT RELIEF	SLEW LEFT	P3	G	20680 (3000)	20340 - 21030 (2950-3050)

**** Under seat at Bulkhead***

Testing And Adjusting The Crossport Relief Valve (Cont'd)

Figure 20-32-3



Start the engine and run at low RPM until the hydraulic fluid is at operating temperature 150° F (66° C).

Move the swing lock lever (Item 1) **[Figure 20-32-3]** to the locked position.

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

Move the left control lever (joystick) to engage the swing circuit in the clockwise direction. Record the pressure.

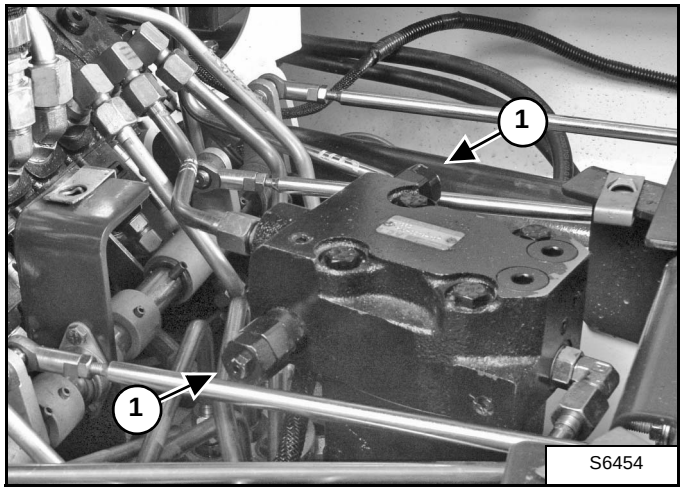
Move the left control lever (joystick) to engage the swing circuit in the counterclockwise direction. Record the pressure.

The swing (Slew) crossport relief valve pressure at the "G" diagnostic port **[Figure 20-32-2]** should be as follows:

3250 - 3350 PSI (224 - 231 bar).

The swing (Slew) crossport relief valve is factory set at 2000 PSI (138 bar) at 3.96 GPM.

Figure 20-32-4



If the pressure is incorrect, remove the two crossport relief valves (Item 1) **[Figure 20-32-4]**.

Clean the two crossport relief valves.

Install the two crossport relief valves and tighten to 72 ft.-lb. (98 N•m).

Retest the crossport relief valves after cleaning.

If pressure is still incorrect, replace the crossport relief valves.

PRESSURE REDUCING VALVE

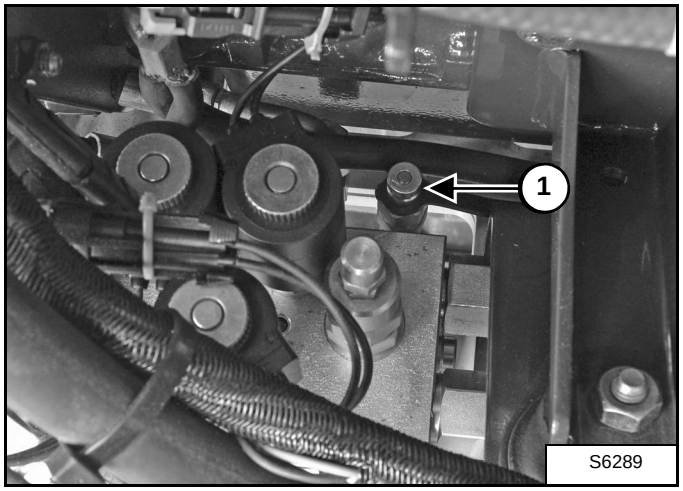
Testing And Adjusting The Pressure Reducing Valve

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

MEL1355 - Test Kit includes the following:
MEL1355-2 - 1000 PSI Gauge
MEL1355-9 - Thermometer

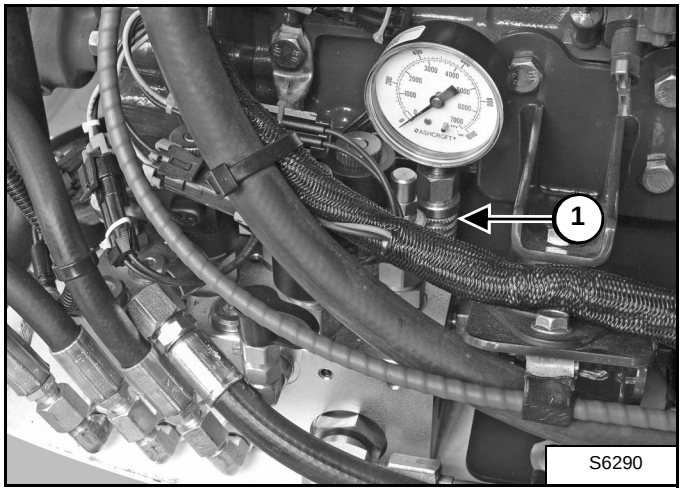
Open the tailgate.

Figure 20-33-1



Locate the test port (PS1) **[Figure 20-33-1]** on the back side of the manifold.

Figure 20-33-2



Install a 1000 PSI (69 bar) gauge (Item 1) **[Figure 20-33-2]** on the test port (PS1).

Lower control console and fasten seat belt.

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

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

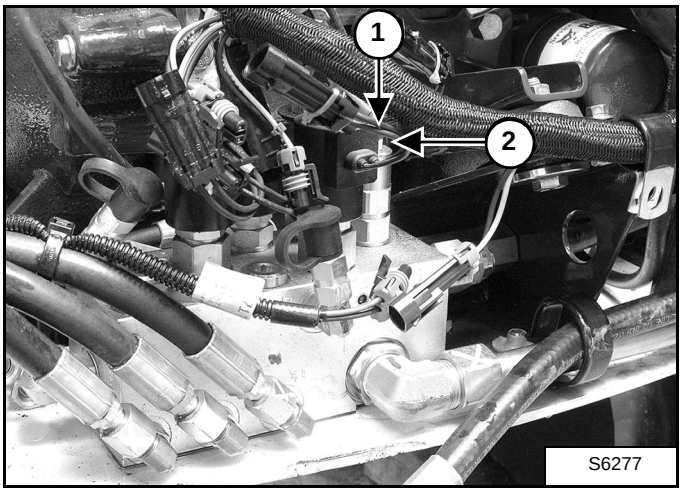
Operate the circuit over relief and record the pressure.

The pressure reducing valve pressure at the test port (PS1) **[Figure 20-33-2]** should be as follows:

435 PSI (30 bar) with an acceptable range of 406 to 450 PSI (28 to 31 bar)

Stop the engine.

Figure 20-33-3



If adjustment is needed, remove the cap (Item 1) and loosen the nut (Item 2) **[Figure 20-33-3]**.

Turn the adjustment screw under the cap (Item 1) **[Figure 20-33-3]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

Tighten the nut (Item 2) **[Figure 20-33-3]**.

Retest the pressure reducing valve after adjustment.

If pressure is still incorrect, remove the pressure reducing valve from the manifold assembly and inspect.

Testing And Adjusting The Pressure Reducing Valve (Cont'd)

Inspect the port of the pressure reducing valve on the manifold assembly to verify no damage. If damaged replace manifold assembly.

Figure 20-33-4

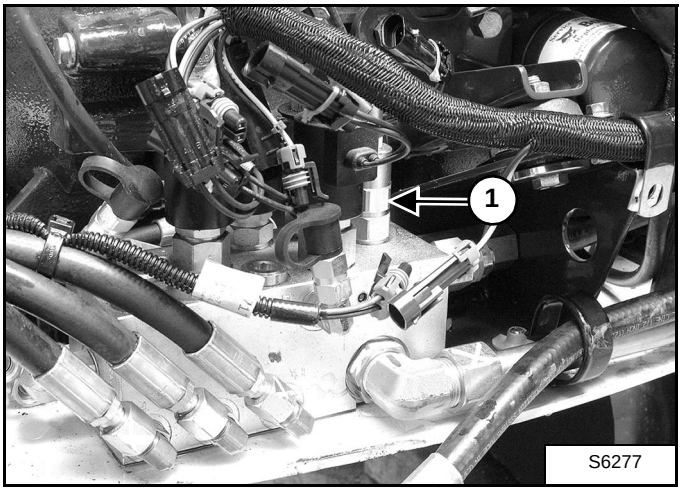
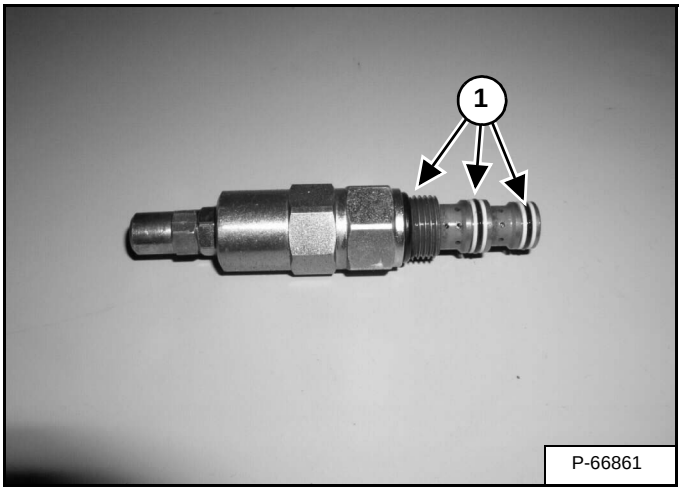


Figure 20-33-5



Inspect the O-rings and back-up rings on the pressure reducing valve (Item 1) **[Figure 20-33-4]** and **[Figure 20-33-5]**. If O-rings and back-up rings are worn or damaged, replace O-rings and back-up rings.

Re-install the pressure reducing valve in the manifold assembly.

Repeat pressure reducing valve test.

If the O-rings and back-up rings were not worn or damaged and the pressures at the bulkhead fitting could not be achieved, replace pressure reducing valve.

HYDRAULIC CONTROL VALVE

Description

The hydraulic control valve has 3625 PSI (250 bar) work port relief valves for the bucket, arm and boom (rod end) sections. The hydraulic control valve has 3045 PSI (210 bar) work port relief valve for the boom (base end) section.

The 218 PSI (15 bar) buildup valve is located in the auxiliary section.

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 both hydraulic control levers to relieve hydraulic pressure.

IMPORTANT

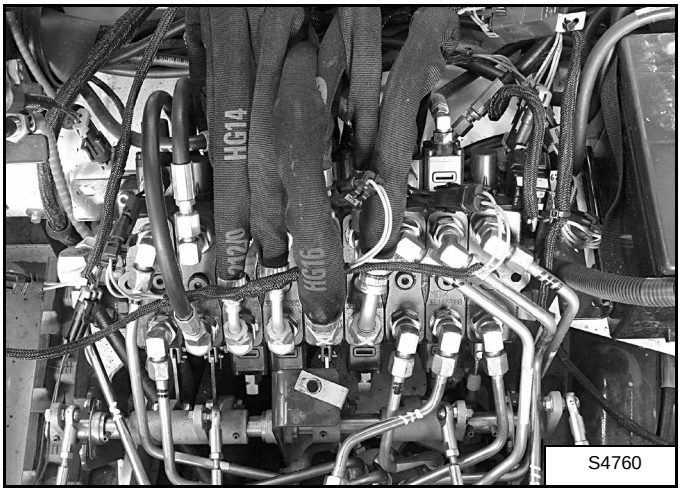
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

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

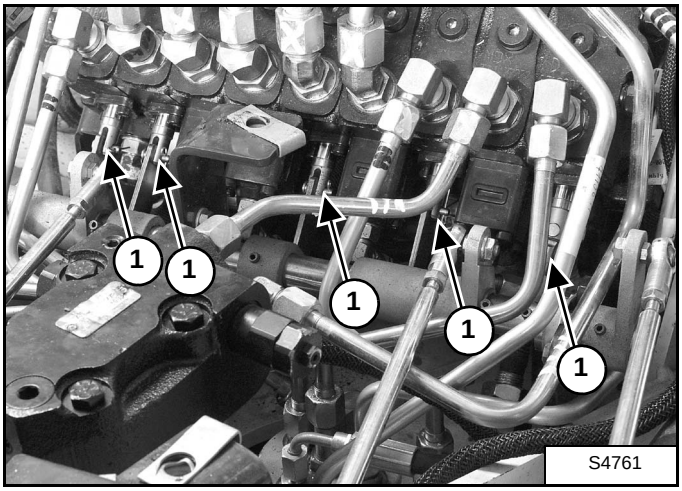
Remove the seat and seat mount (See Removal And Installation on Page 40-40-1.)

Figure 20-40-1



Mark all tubes and hoses for ease of assembly **[Figure 20-40-1]**.

Figure 20-40-2



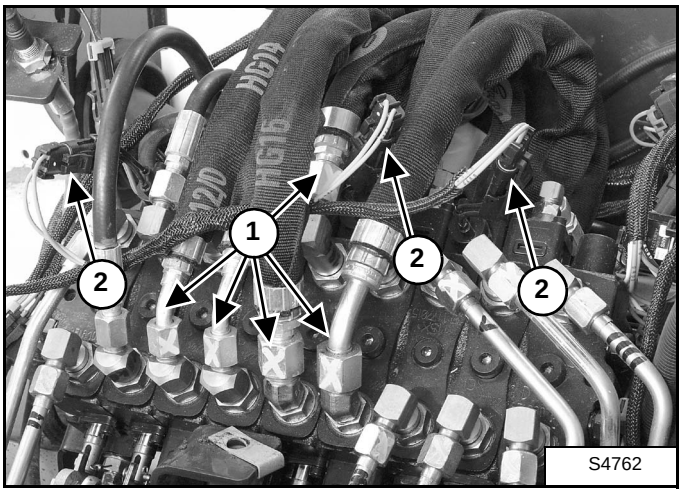
Remove the clevis pins and cotter pins (Item 1) **[Figure 20-40-2]**.

WARNING

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

W-2145-0290

Figure 20-40-3

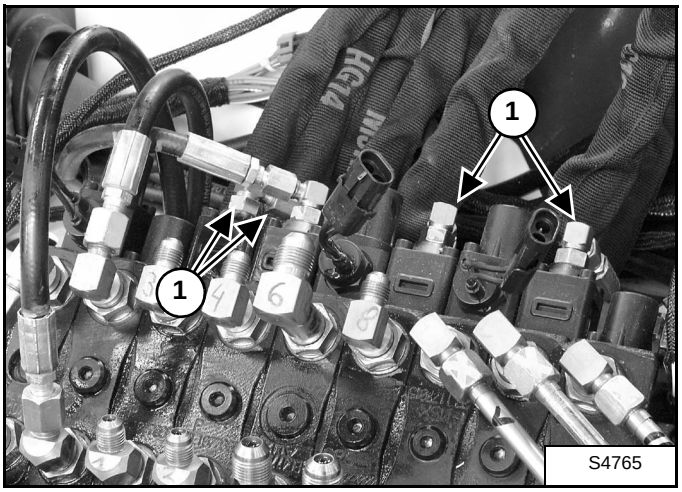


Remove the hoses (Item 1) **[Figure 20-40-3]** from the top of the control valve.

Disconnect the wire harnesses (Item 2) **[Figure 20-40-2]**.

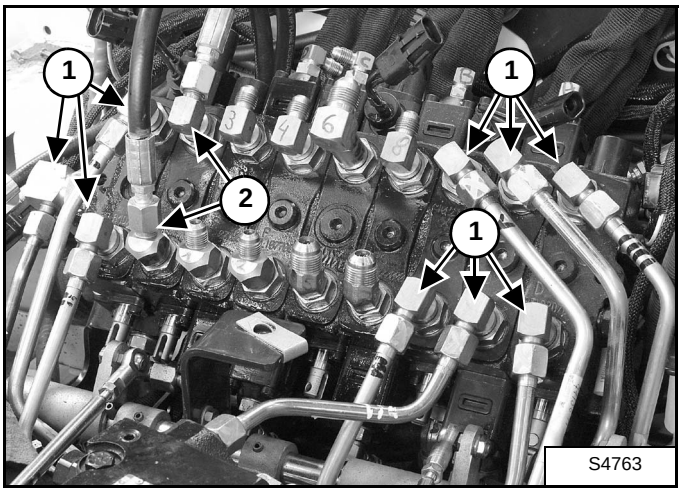
Removal And Installation (Cont'd)

Figure 20-40-4



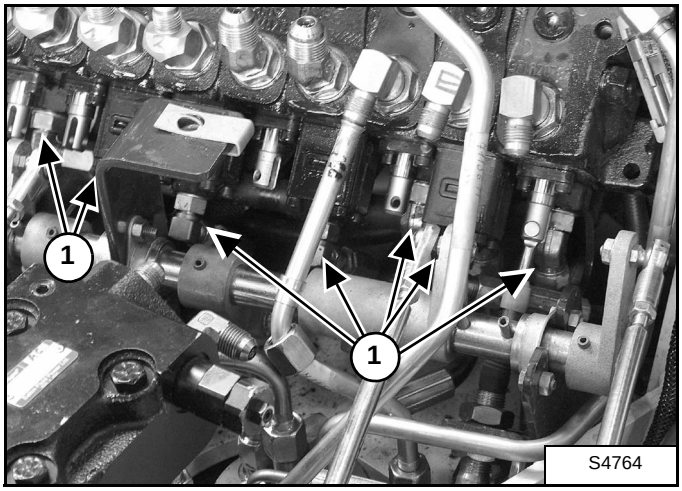
Remove the hoses (Item 1) **[Figure 20-40-4]**.

Figure 20-40-5



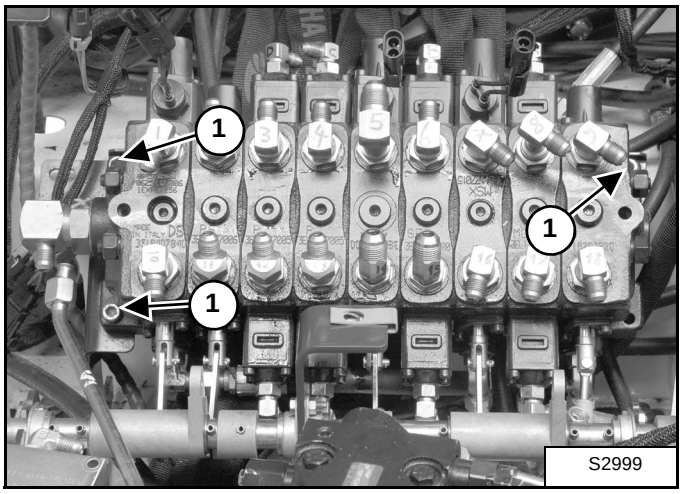
Remove the tubelines (Item 1) and hoses (Item 2) **[Figure 20-40-5]**.

Figure 20-40-6



Disconnect the hoses (Item 1) **[Figure 20-40-6]**.

Figure 20-40-7



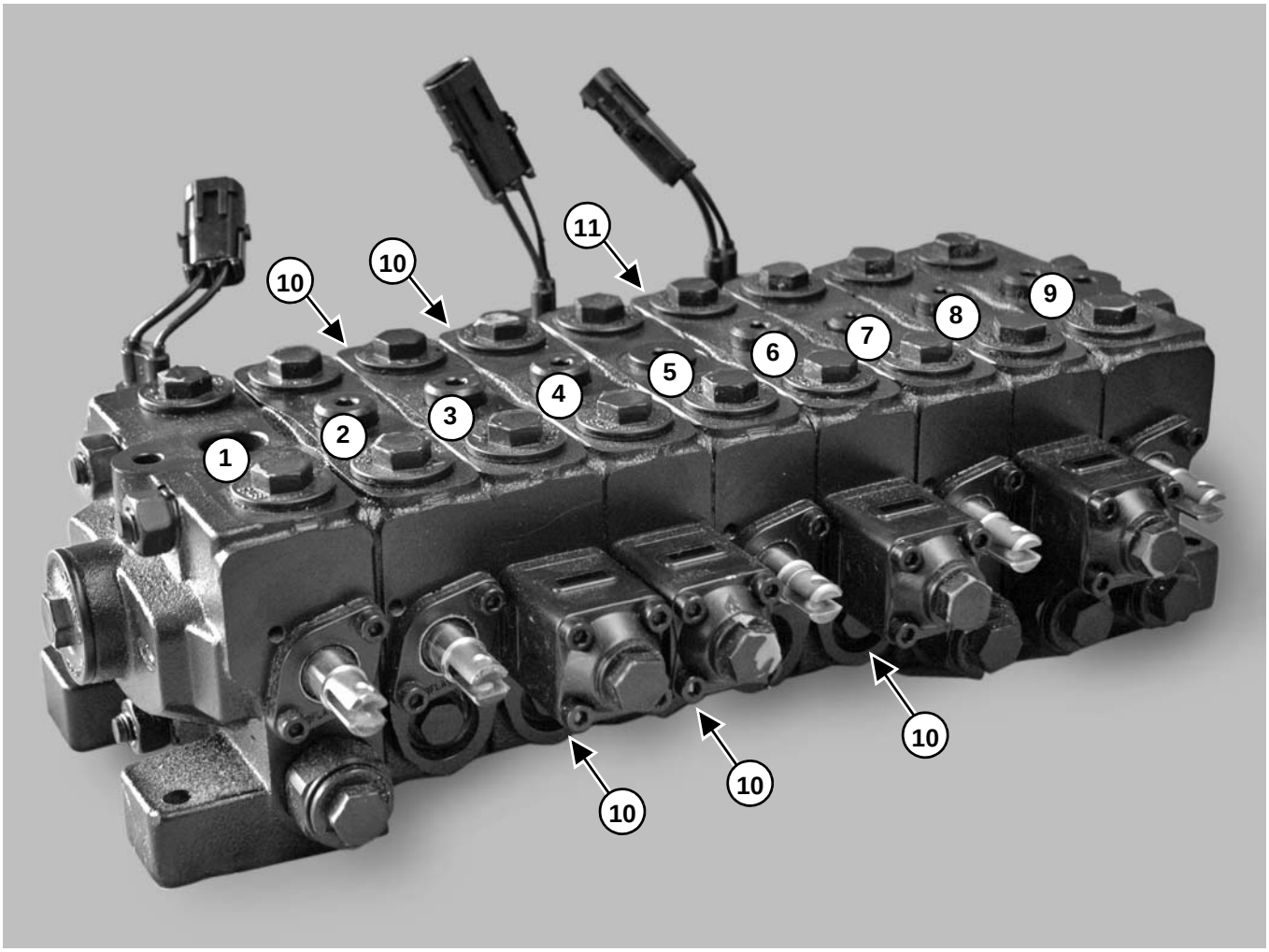
Remove the three bolts and nuts (Item 1) **[Figure 20-40-7]**.

Remove the control valve.

HYDRAULIC CONTROL VALVE (CONT'D)

Parts Identification

Item	Description
1.	RIGHT TRAVEL SECTION
2.	BOOM SWING SECTION
3.	ARM SECTION
4.	BUCKET SECTION
5.	AUXILIARY SECTION
6.	BOOM SECTION
7.	LEFT TRAVEL SECTION
8.	SWING (SLEW) SECTION
9.	BLADE SECTION
10.	PORT RELIEF - 3625 PSI (250 bar) (Below Spool Cover)
11.	PORT RELIEF - 3045 PSI (210 bar) (Below Spool Cover)



S4766

Disassembly

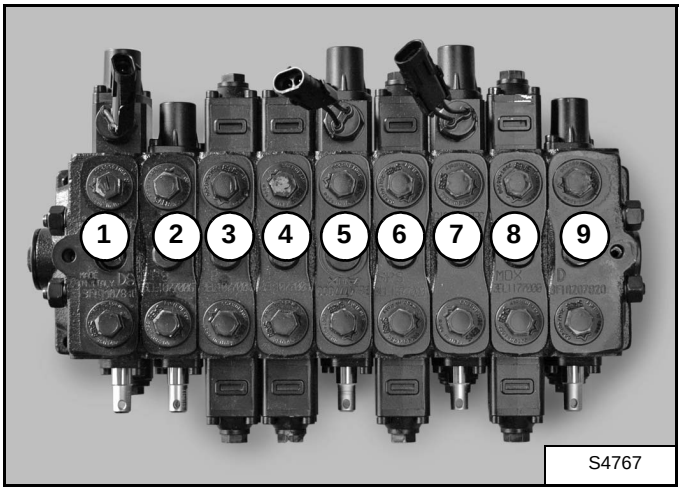
Clean the outside of the hydraulic control valve before disassembly.

IMPORTANT

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

I-2003-0888

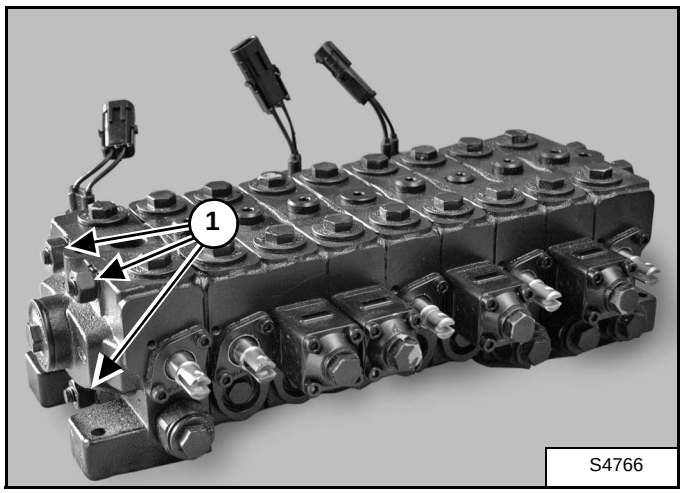
Figure 20-40-8



Mark the valve sections for ease of assembly **[Figure 20-40-8]**.

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

Figure 20-40-9



Remove the tie rod nuts and lock washers (Item 1) **[Figure 20-40-9]**.

Right 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.

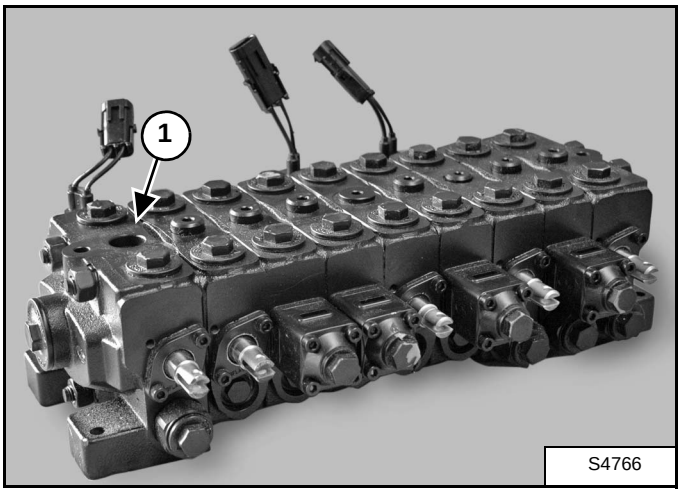
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

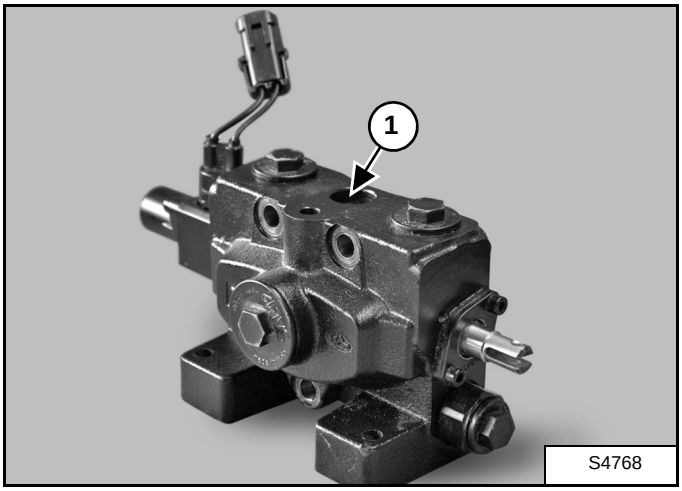
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-10



Remove the right travel valve (Item 1) **[Figure 20-40-10]** from the valve assembly.

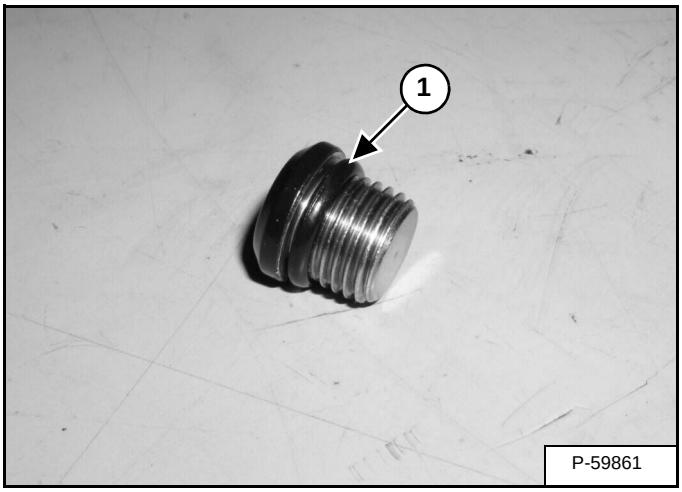
Figure 20-40-11



Remove the plug (Item 1) **[Figure 20-40-11]** from the right travel valve section.

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

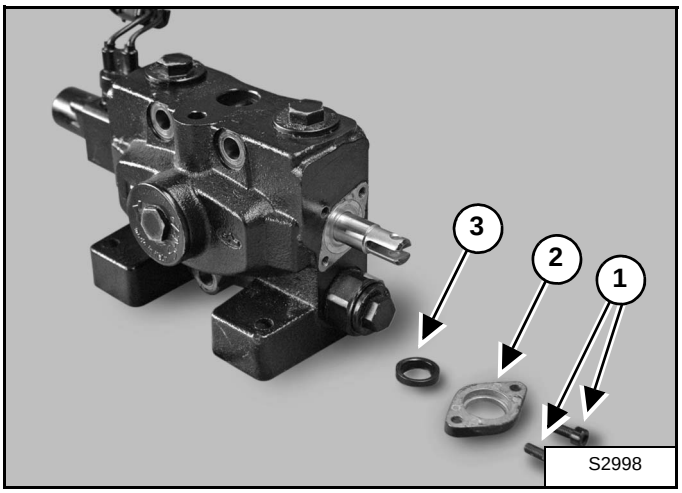
Figure 20-40-12



Remove the O-ring (Item 1) **[Figure 20-40-12]** from the plug.

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

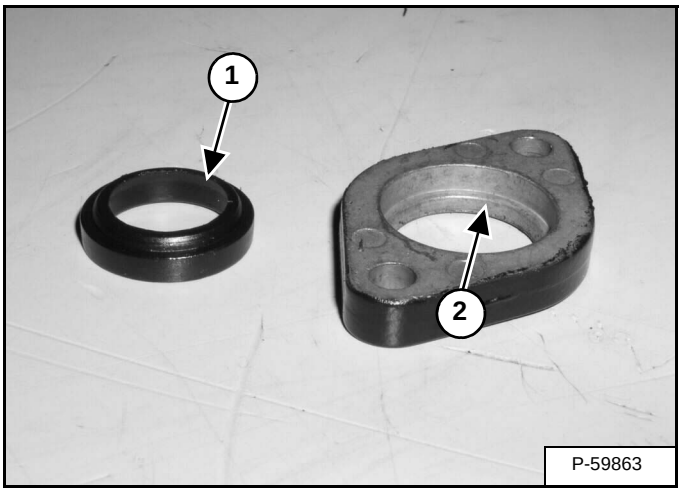
Figure 20-40-13



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

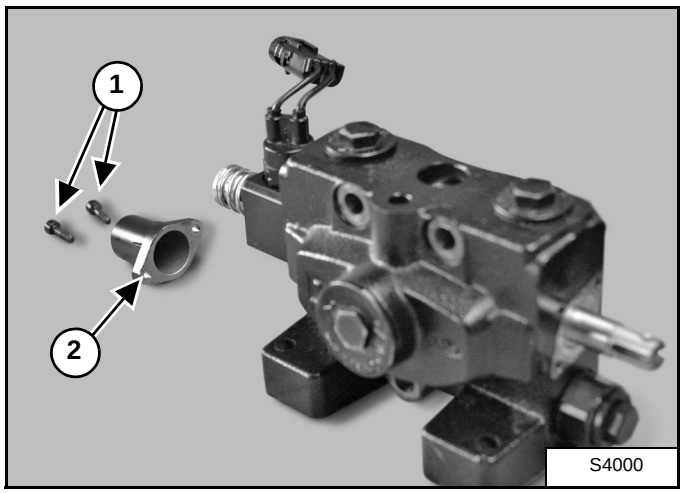
Installation: Tighten the bolts to 5 ft.-lb. (6,6 N•m) torque.

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]**.

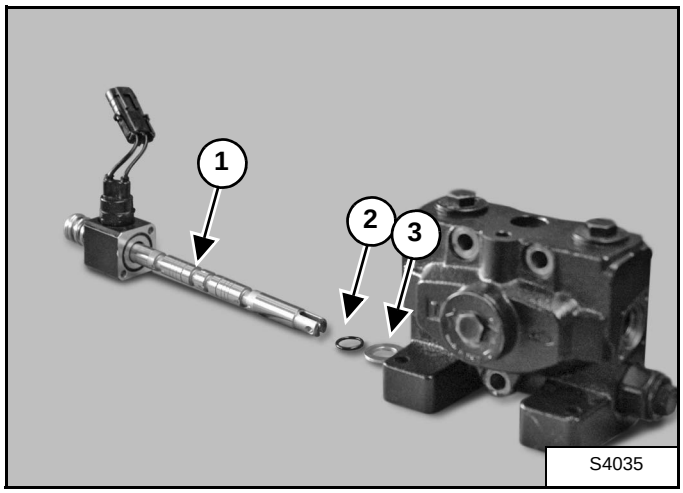
Figure 20-40-15



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

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

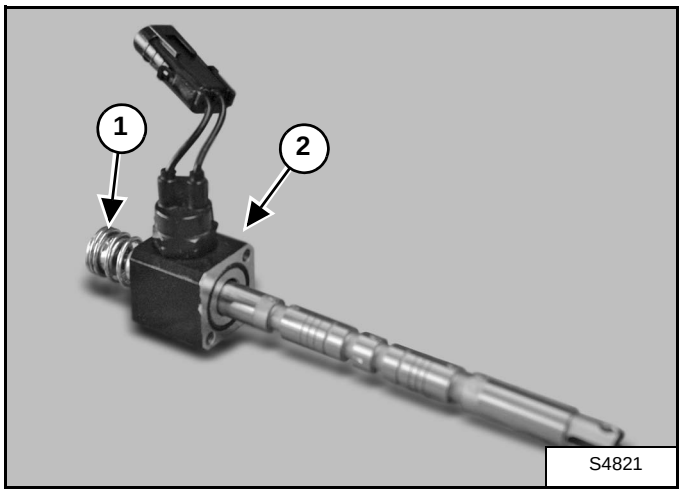
Figure 20-40-16



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

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

Figure 20-40-17



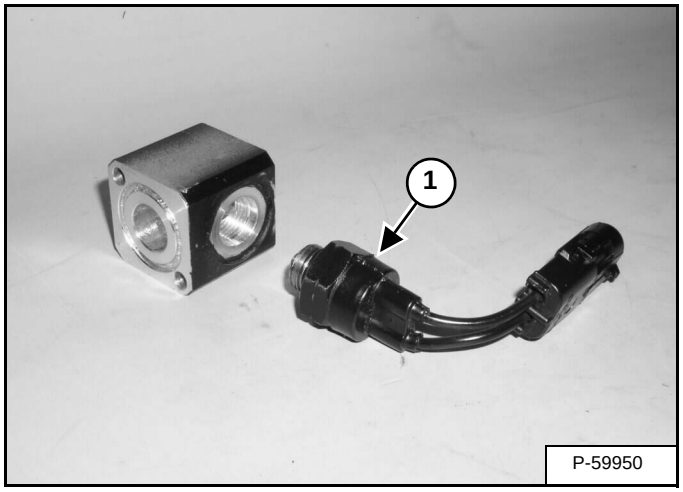
Remove the spring assembly (Item 1) and spool cover (Item 2) **[Figure 20-40-17]** from the spool.

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.

Installation: Tighten the spring assembly retaining screw to 7 ft.-lb. (9.8 N•m) torque.

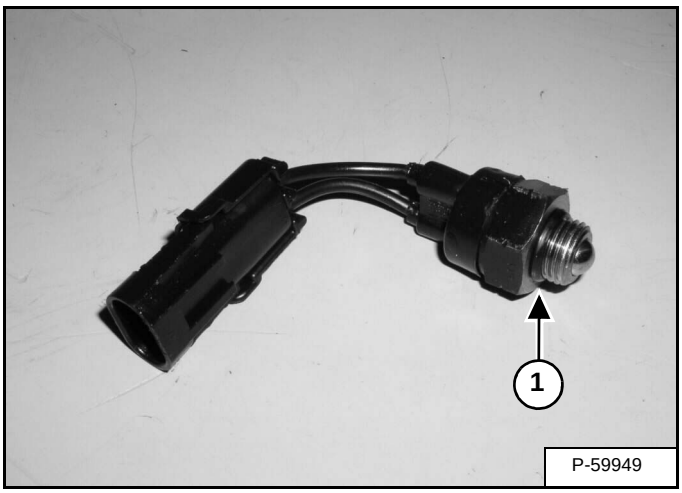
Figure 20-40-18



Remove the switch (Item 1) **[Figure 20-40-18]** from the spool cover.

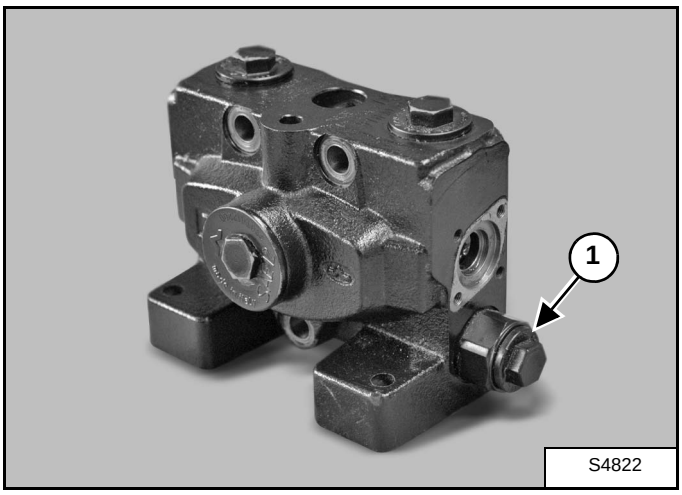
Installation: Tighten the switch to 31 ft.-lb. (42 N•m) torque.

Figure 20-40-19



Remove the O-ring (Item 1) **[Figure 20-40-19]** from the switch.

Figure 20-40-20

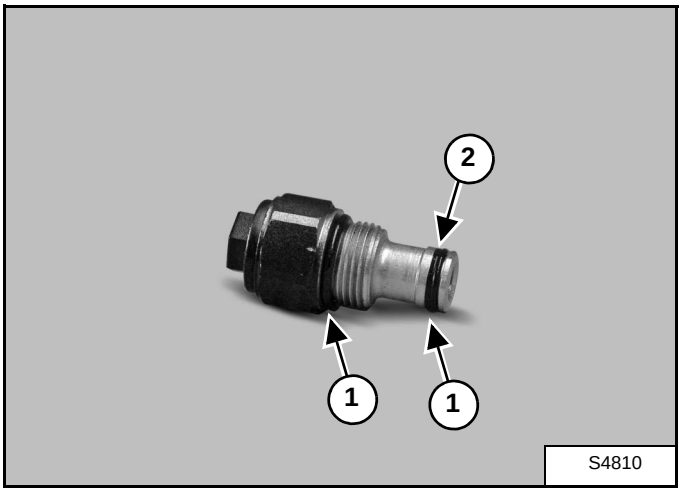


Remove the fitting (Item 1) **[Figure 20-40-20]**.

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

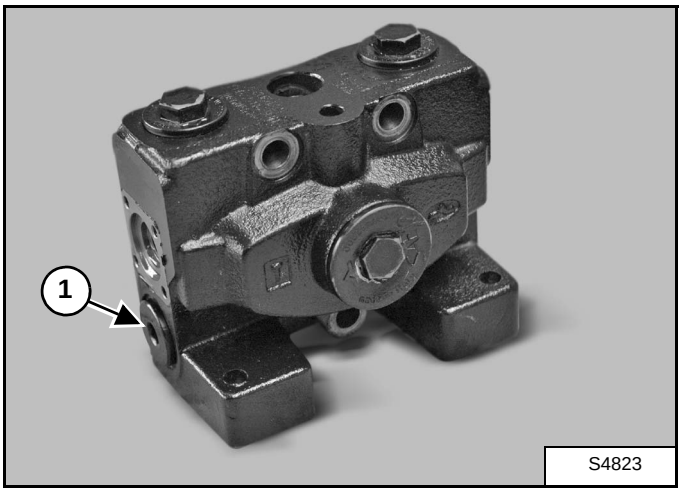
Right Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-21



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-21]** from the fitting.

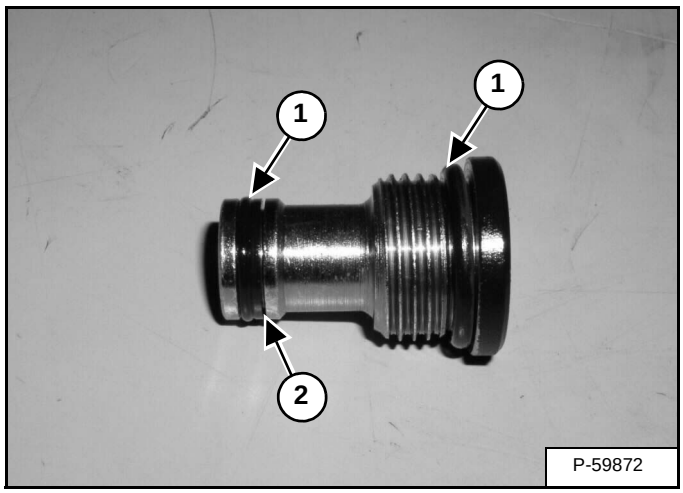
Figure 20-40-22



Remove the plug (Item 1) **[Figure 20-40-22]**.

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

Figure 20-40-23



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-23]** from the plug.

Boom Swing 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.

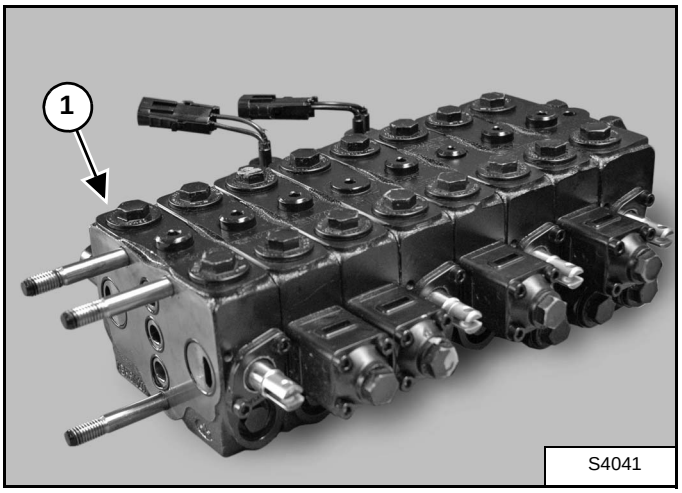
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

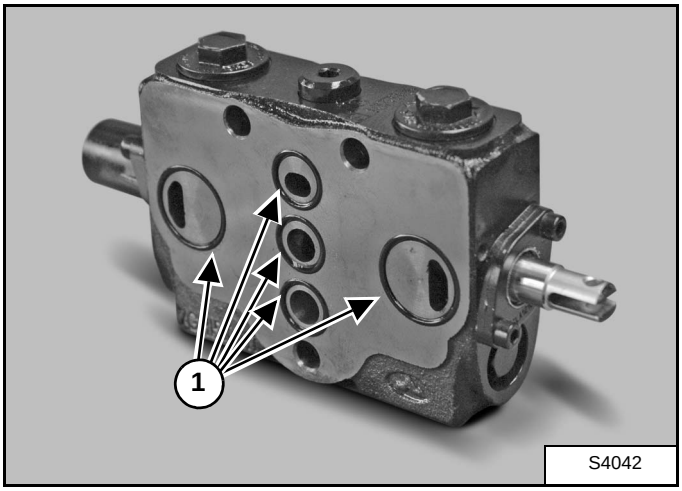
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-24



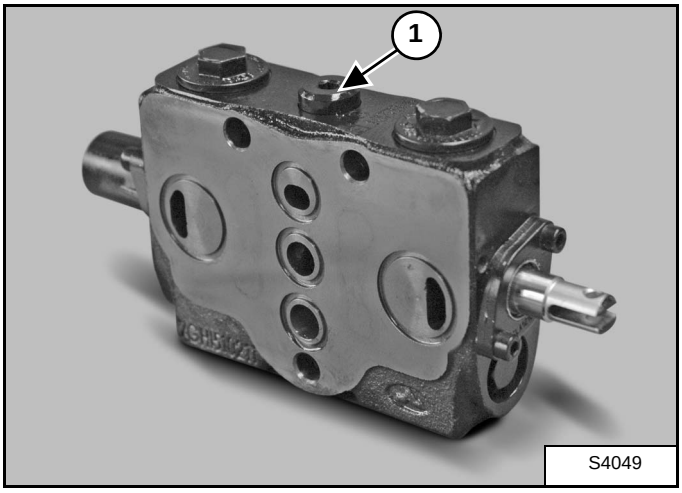
Remove the boom swing valve section (Item 1) **[Figure 20-40-24]** from the valve assembly.

Figure 20-40-25



Remove the O-rings (Item 1) **[Figure 20-40-25]** from the boom swing valve section.

Figure 20-40-26

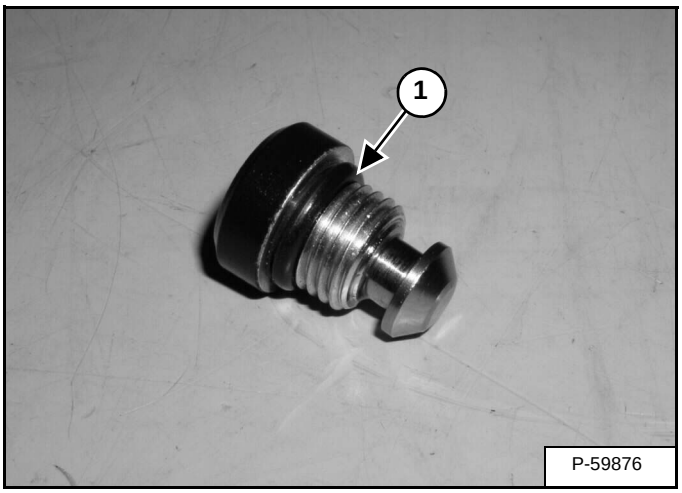


Remove the load check valve (Item 1) **[Figure 20-40-26]**.

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

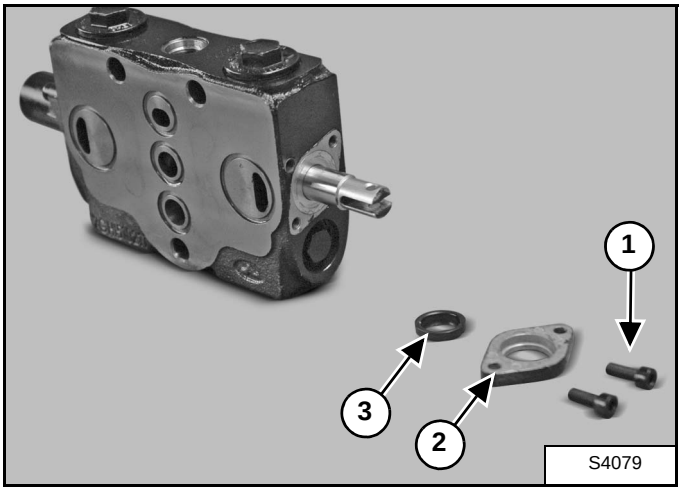
Boom Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-27



Remove the O-ring (Item 1) **[Figure 20-40-27]** from the load check valve.

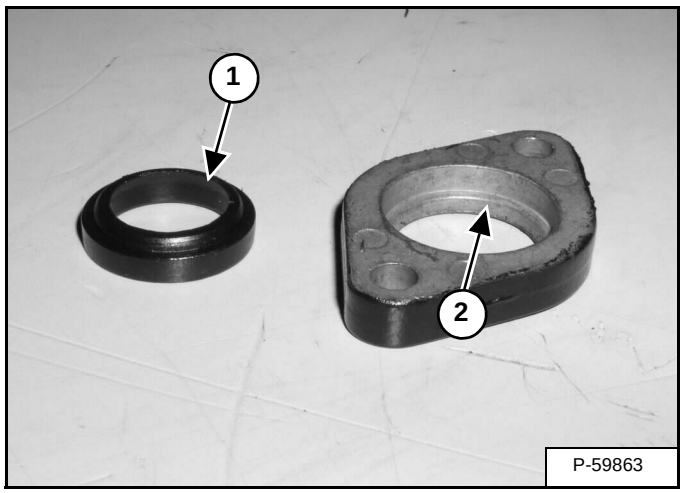
Figure 20-40-28



Remove the bolts (Item 1), retainer (Item 2) and seal (Item 3) **[Figure 20-40-28]**.

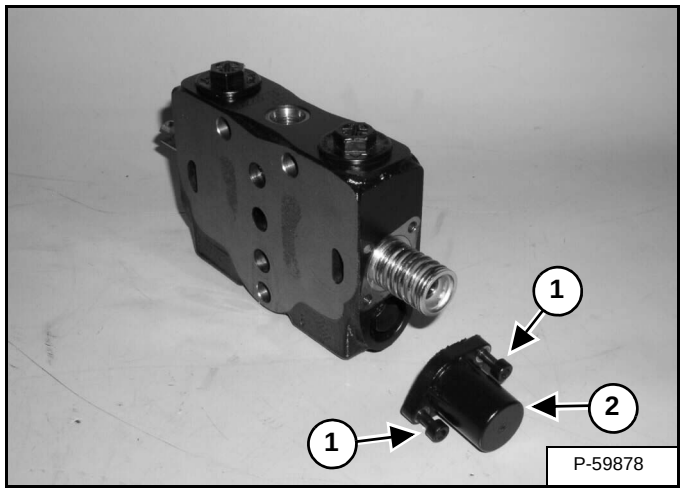
Installation: Tighten the bolts to 5 ft.-lb. (6,6 N•m) torque.

Figure 20-40-29



Installation: Make sure the lip (Item 1) of the seal fits inside the retaining plate (Item 2) **[Figure 20-40-29]**.

Figure 20-40-30

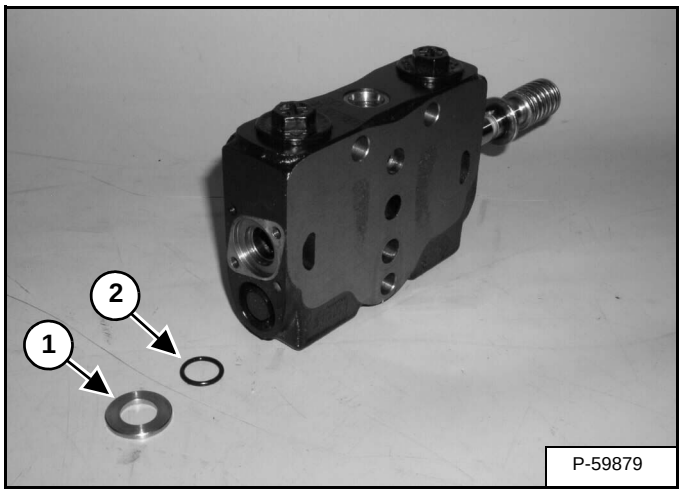


Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-30]**.

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

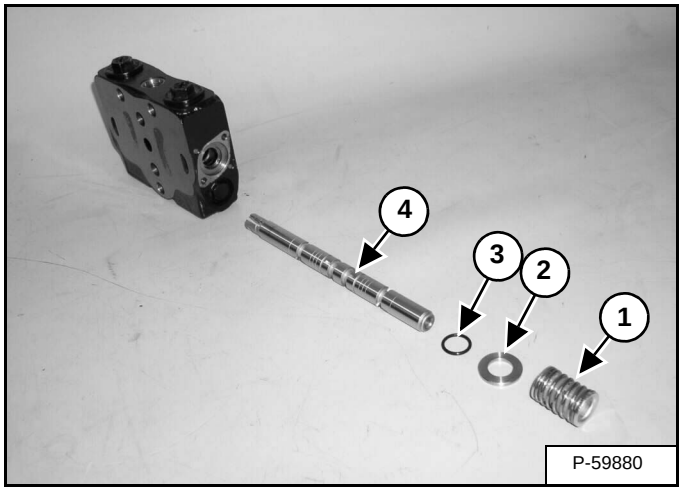
Boom Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-31



Remove the washer (Item 1) and O-ring (Item 2) **[Figure 20-40-31]** from the valve section.

Figure 20-40-32



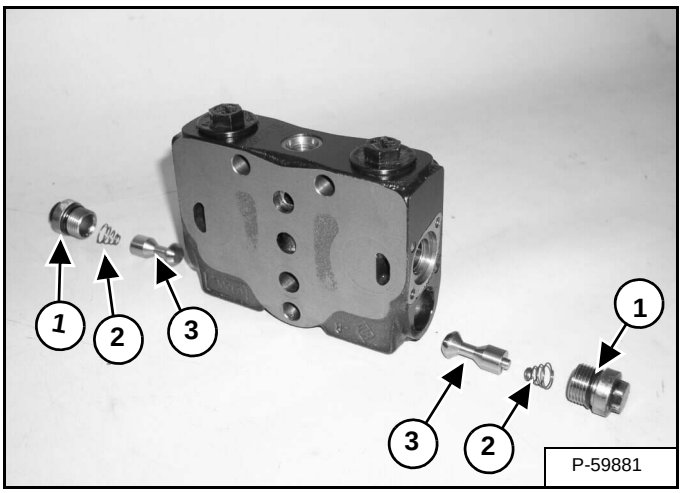
Remove the spring assembly (Item 1), washer (Item 2), O-ring (Item 3) and spool (Item 4) **[Figure 20-40-32]**.

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.

Installation: Tighten the spring retaining screw to 7 ft.-lb. (9,8 N•m) torque.

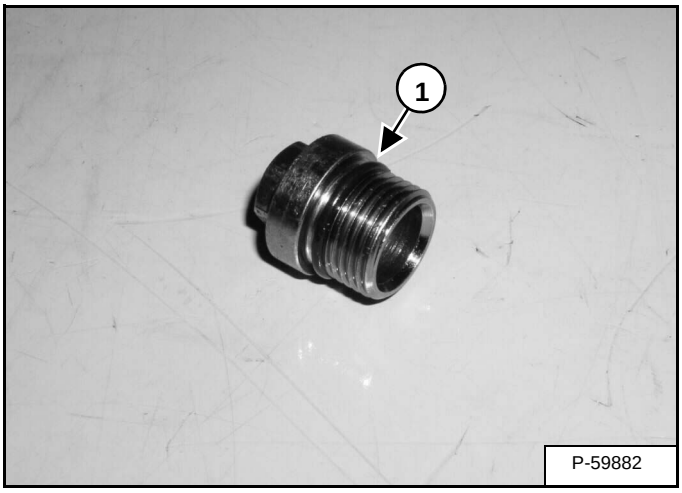
Figure 20-40-33



Remove the plug (Item 1), spring (Item 2) and valve assembly (Item 3) **[Figure 20-40-33]** from both relief valves.

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

Figure 20-40-34



Remove the O-ring (Item 1) **[Figure 20-40-34]** from the plugs.

Arm Valve Section Disassembly and Assembly

IMPORTANT

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

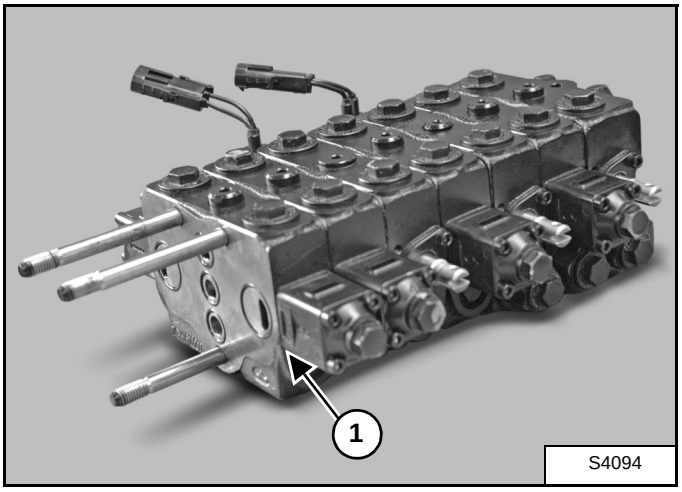
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

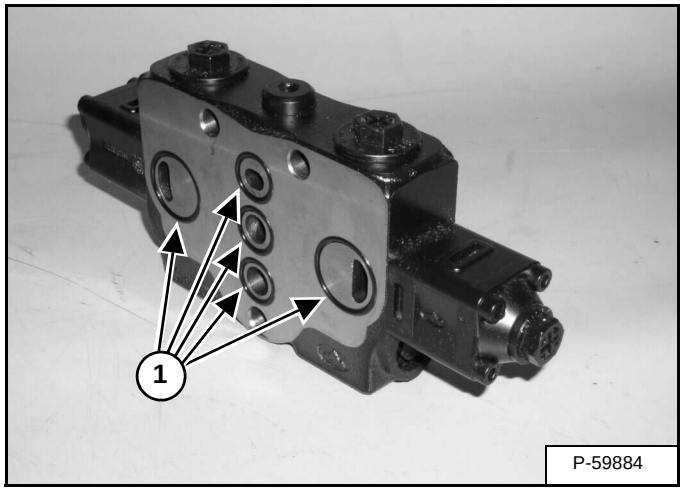
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-35



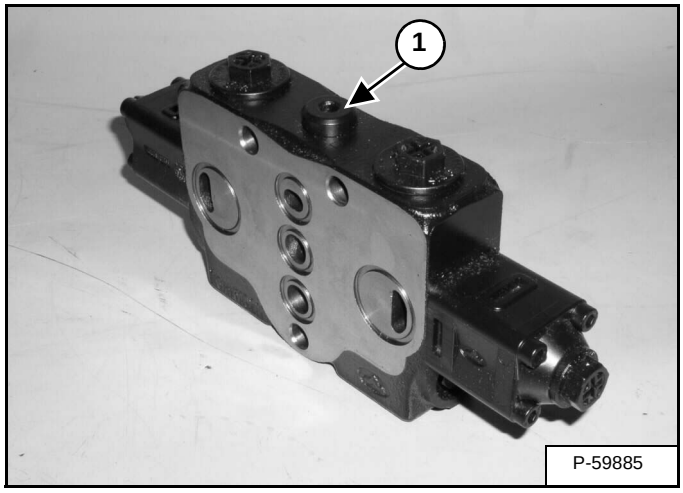
Remove the arm valve section (Item 1) **[Figure 20-40-35]** from the valve assembly.

Figure 20-40-36



Remove the O-rings (Item 1) **[Figure 20-40-36]** from the arm valve section.

Figure 20-40-37

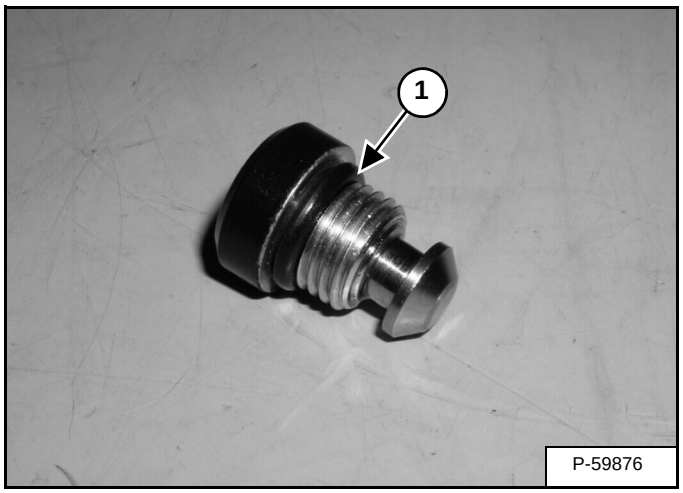


Remove the load check valve (Item 1) **[Figure 20-40-37]**.

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

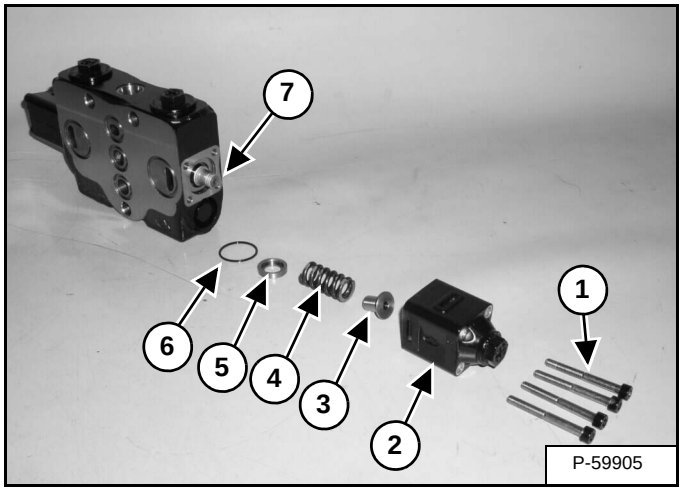
Arm Valve Section Disassembly and Assembly (Cont'd)

Figure 20-40-38



Remove the O-ring (Item 1) **[Figure 20-40-38]** from the load check valve.

Figure 20-40-39

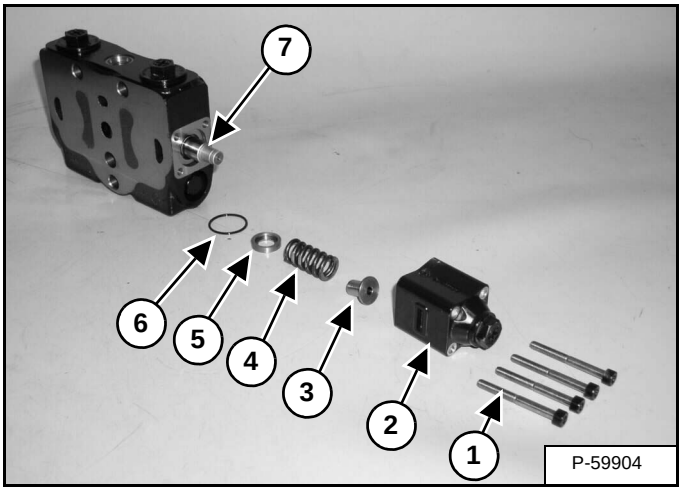


Remove the bolts (Item 1) spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-39]**.

Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 7) **[Figure 20-40-39]**.

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

Figure 20-40-40

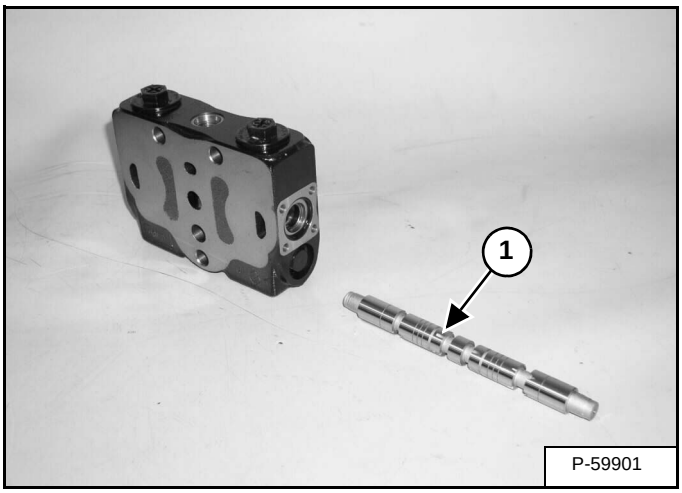


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-40]**.

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

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

Figure 20-40-41



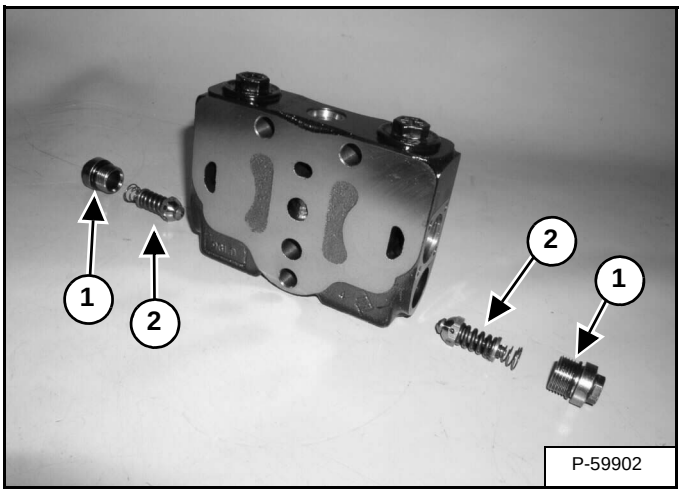
Remove the spool (item 1) **[Figure 20-40-41]**.

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.

Arm Valve Section Disassembly and Assembly (Cont'd)

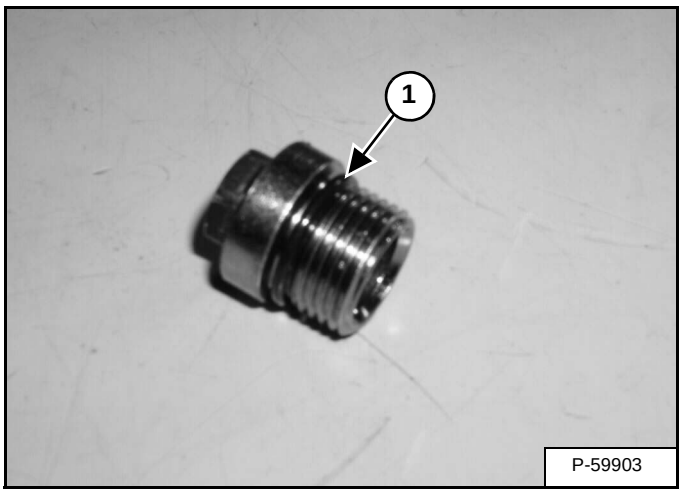
Figure 20-40-42



Remove the plug (Item 1) and relief valve assemblies (Item 2) **[Figure 20-40-42]** from both relief valves.

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

Figure 20-40-43



Remove the O-ring (Item 1) **[Figure 20-40-43]** from the plugs.

Bucket 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.

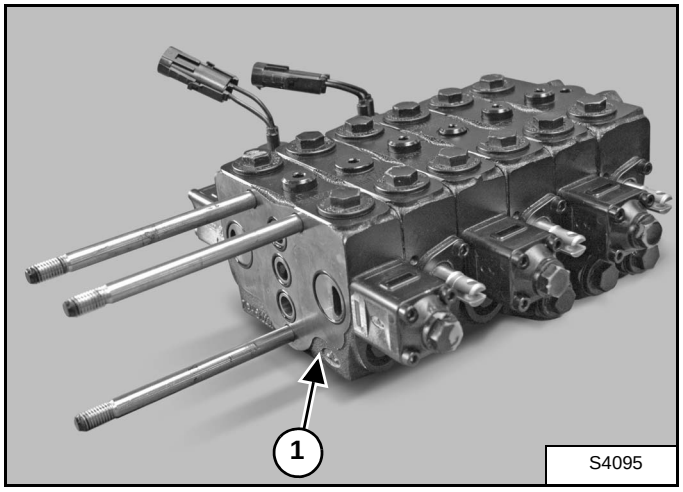
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

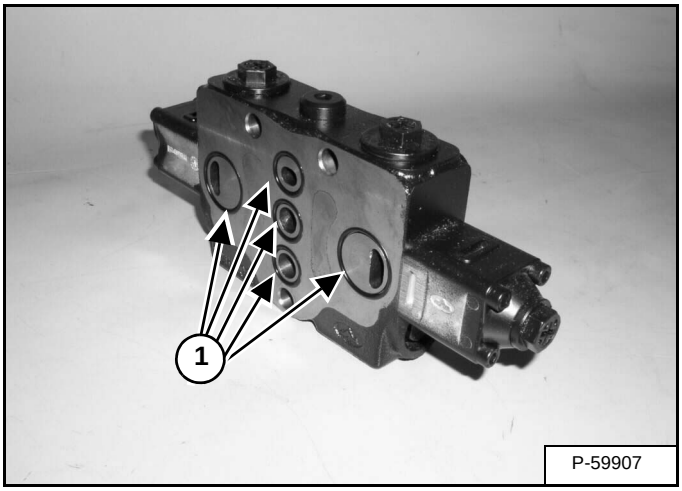
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-44



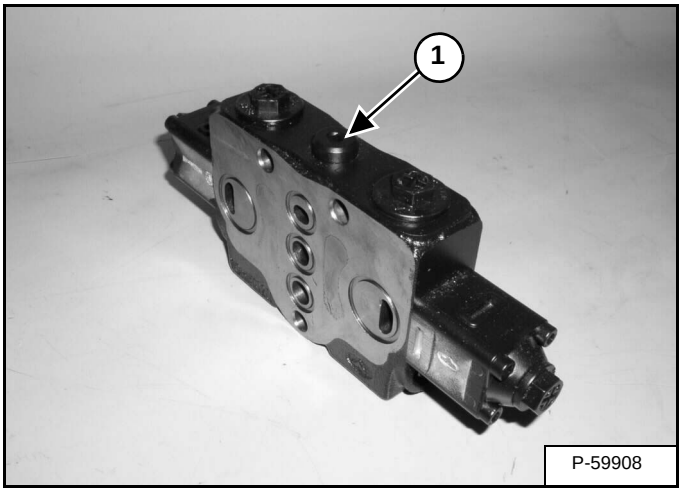
Remove the bucket valve section (Item 1) **[Figure 20-40-44]** from the valve assembly.

Figure 20-40-45



Remove the O-rings (Item 1) **[Figure 20-40-45]** from the side of the bucket valve section.

Figure 20-40-46

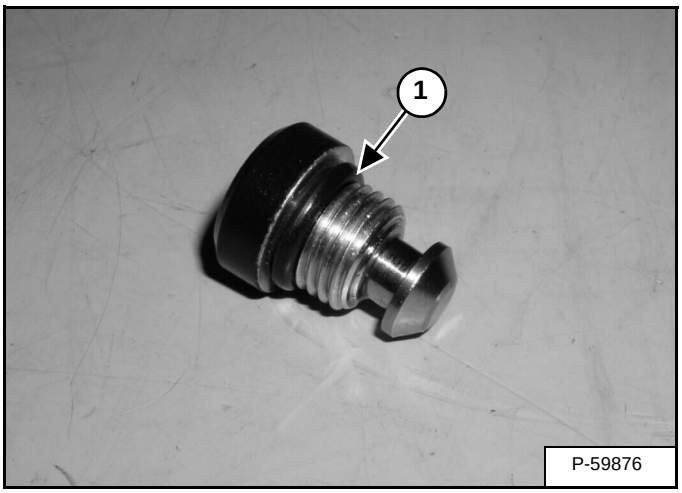


Remove the load check valve (Item 1) **[Figure 20-40-46]**.

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

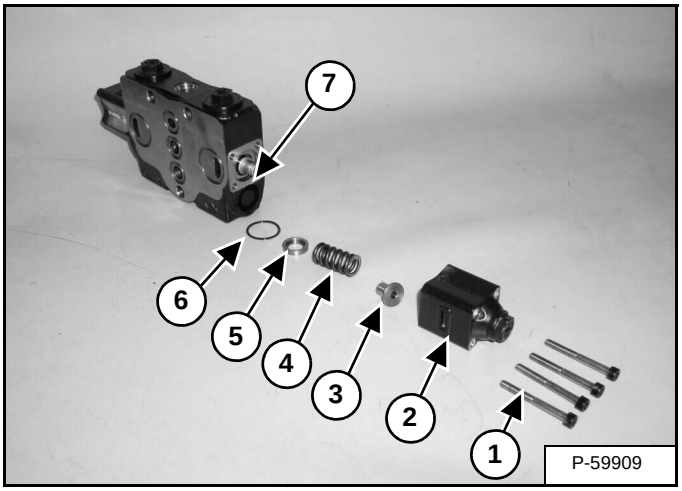
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-47



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

Figure 20-40-48

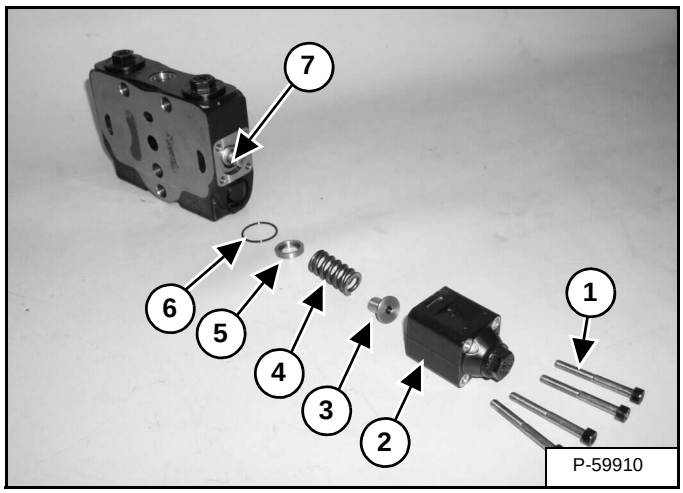


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-48]**.

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

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

Figure 20-40-49

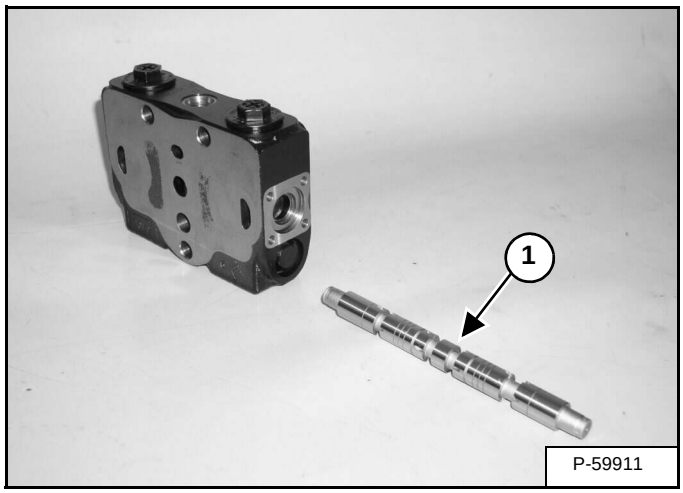


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-49]**.

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

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

Figure 20-40-50



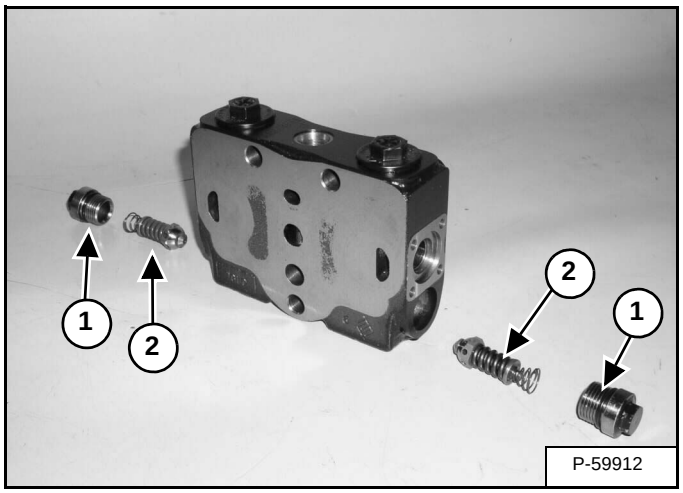
Remove the spool (Item 1) **[Figure 20-40-50]**.

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.

Bucket Valve Section Disassembly And Assembly (Cont'd)

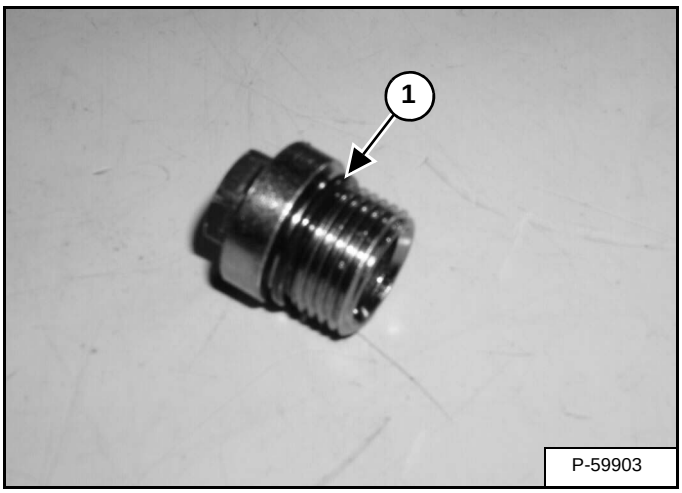
Figure 20-40-51



Remove the plug (Item 1) and valve assembly (Item 2) **[Figure 20-40-51]** from both relief valves.

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

Figure 20-40-52



Remove the O-ring (Item 1) **[Figure 20-40-52]** from both plugs.

Auxiliary 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.

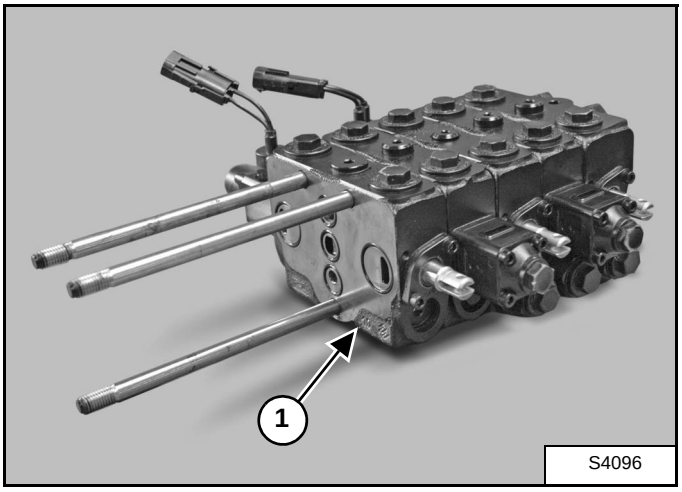
I-2003-0888

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.

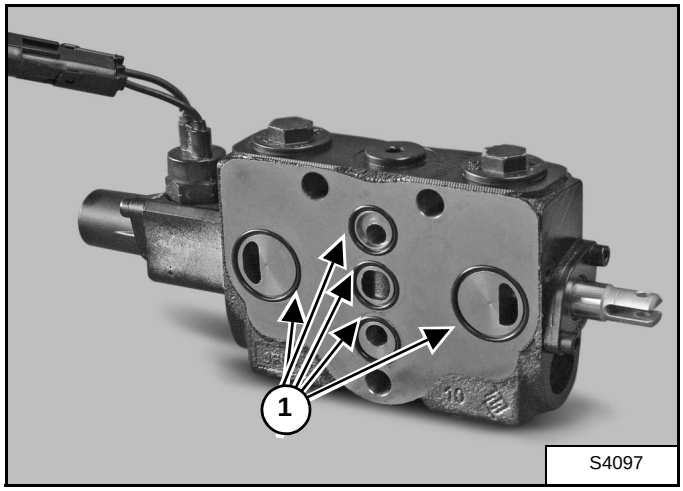
Figure 20-40-53



Remove the auxiliary valve section (Item 1) **[Figure 20-40-53]** from the valve assembly.

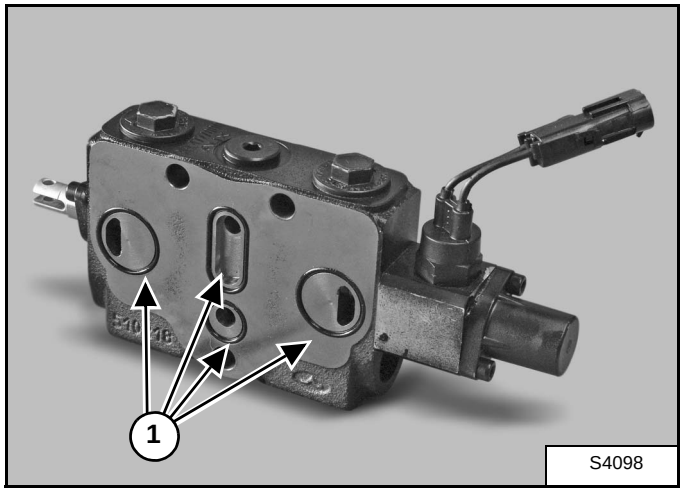
NOTE: Use care while removing the auxiliary valve section. The buildup valve (Item 1) [Figure 20-40-65] is spring loaded.

Figure 20-40-54



Remove the O-rings (Item 1) **[Figure 20-40-54]** from the auxiliary valve section.

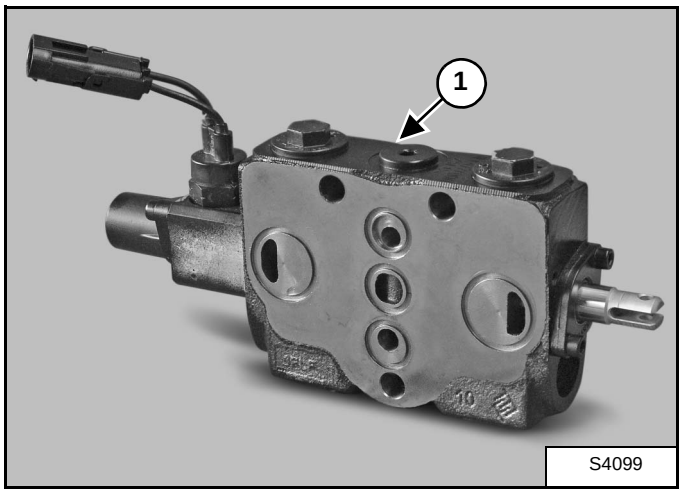
Figure 20-40-55



Remove the O-rings (Item 1) **[Figure 20-40-55]** from the auxiliary valve section.

Auxiliary Valve Section Disassembly And Assembly (Cont'd)

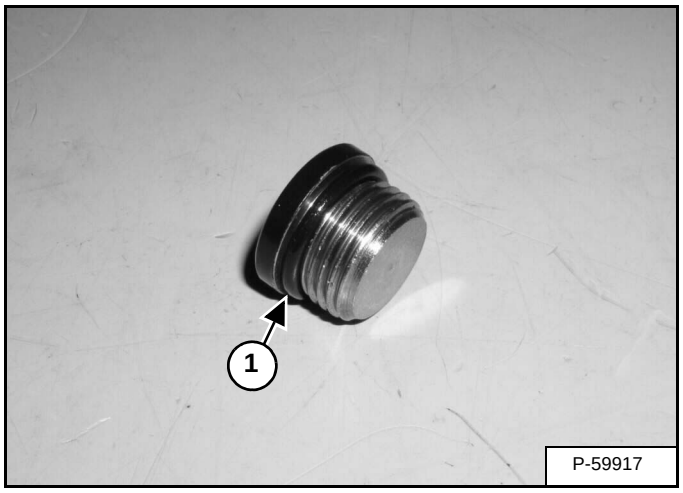
Figure 20-40-56



Remove the load check valve (Item 1) **[Figure 20-40-56]**.

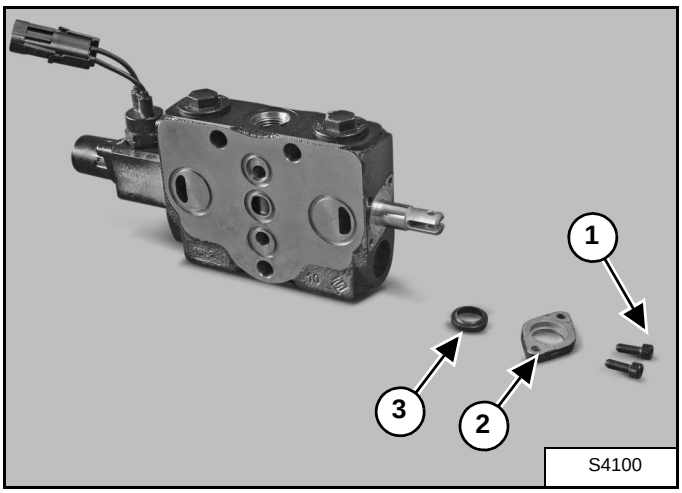
Installation: Tighten the load check valve to 26 ft.-lb. (35 N•m) torque.

Figure 20-40-57



Remove the O-ring (Item 1) **[Figure 20-40-57]** from the plug.

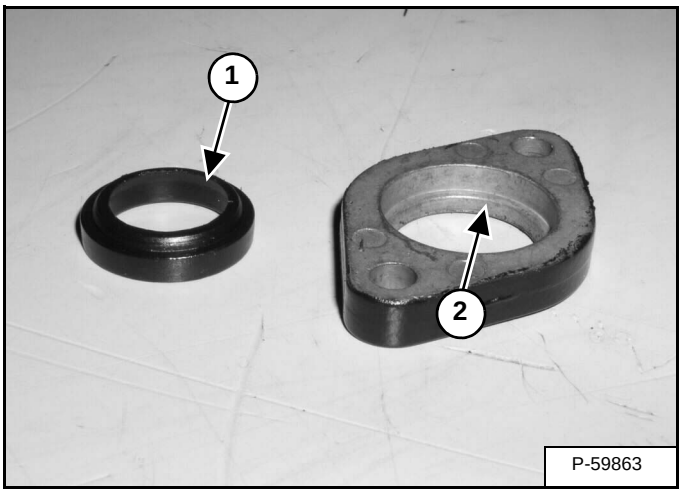
Figure 20-40-58



Remove the bolts (Item 1), retainer (Item 2) and seal (Item 3) **[Figure 20-40-58]**.

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

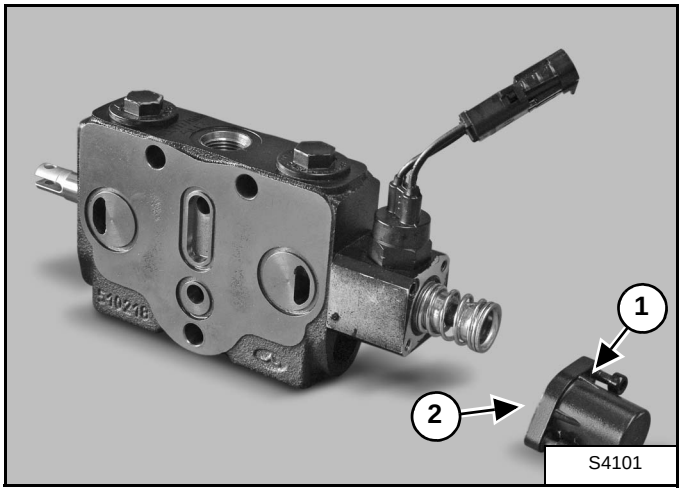
Figure 20-40-59



Installation: Make sure the lip (Item 1) of the seal fits inside the retaining plate (Item 2) **[Figure 20-40-59]**.

Auxiliary Valve Section Disassembly And Assembly (Cont'd)

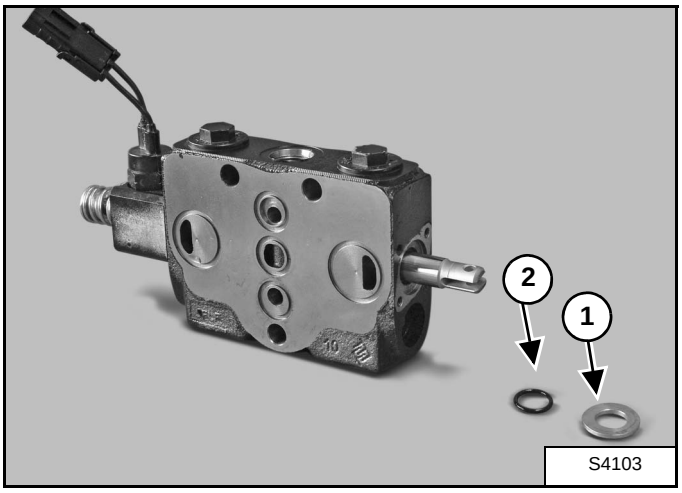
Figure 20-40-60



Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-60]**.

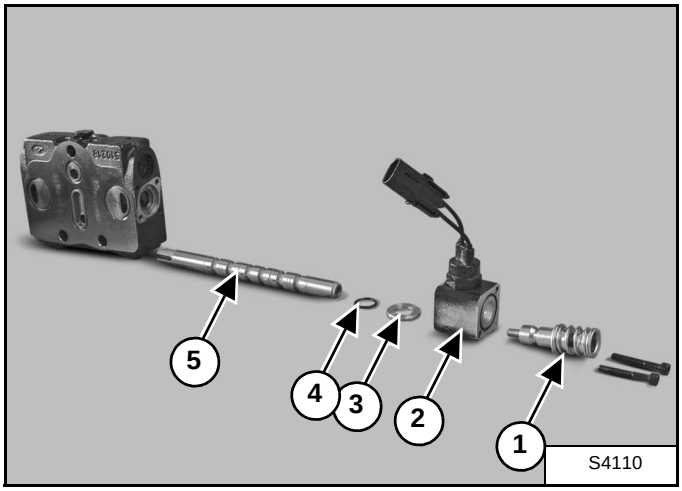
Installation: Tighten the bolts to 5 ft.-lb. (6,6 N•m) torque.

Figure 20-40-61



Remove the washer (Item 1) and O-ring (Item 2) **[Figure 20-40-61]** from the valve section.

Figure 20-40-62



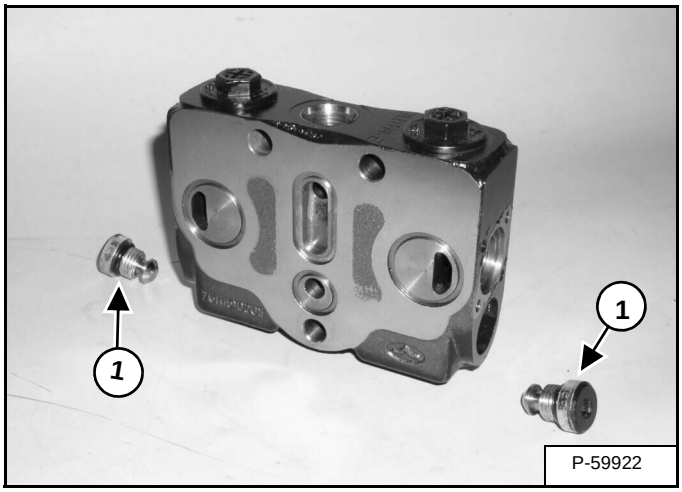
Remove the spring assembly (Item 1), spool cover (Item 2), washer (Item 3), O-ring (Item 4) and spool (Item 5) **[Figure 20-40-62]**.

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.

Installation: Tighten the spring retaining screw to 7 ft.-lb. (9,8 N•m) torque.

Figure 20-40-63

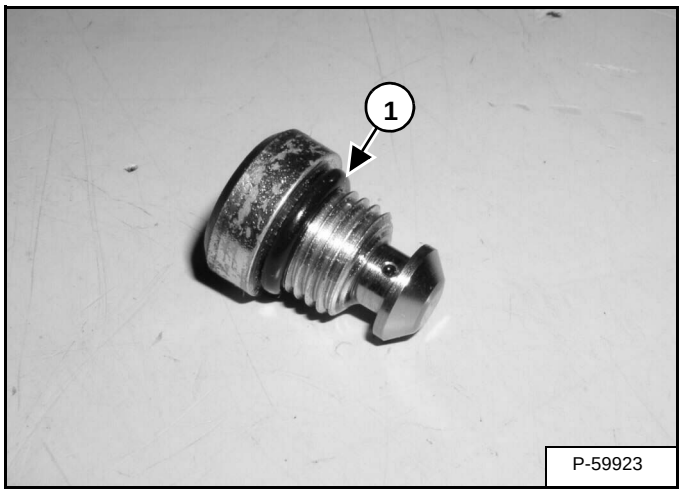


Remove the load checks (Item 1) **[Figure 20-40-63]** from valve section.

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

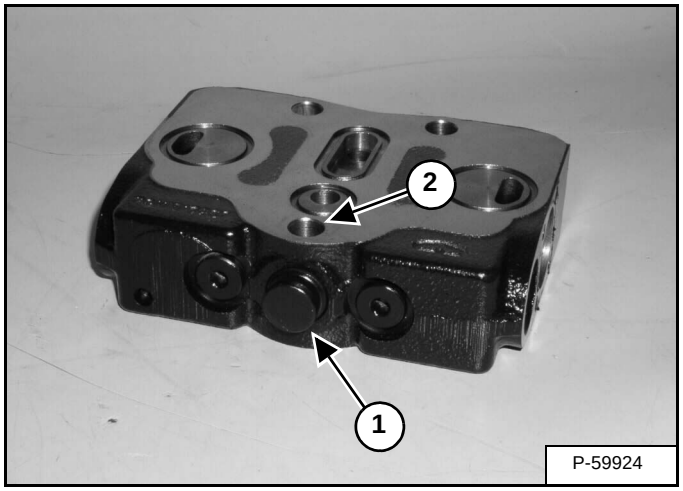
Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-64



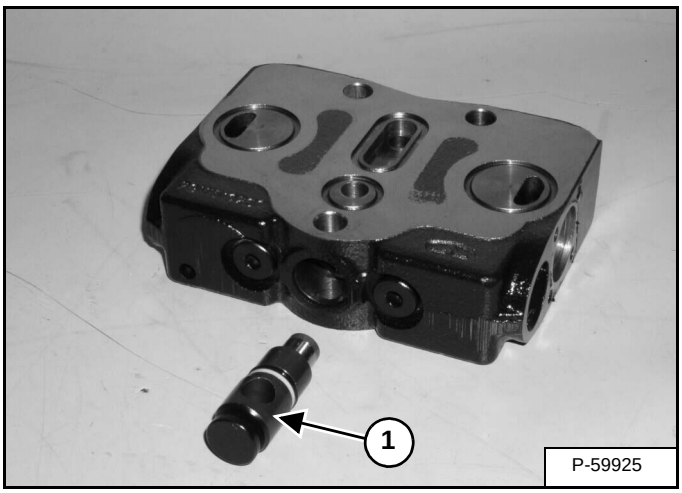
Remove the O-ring (Item 1) **[Figure 20-40-64]** from the load checks.

Figure 20-40-65



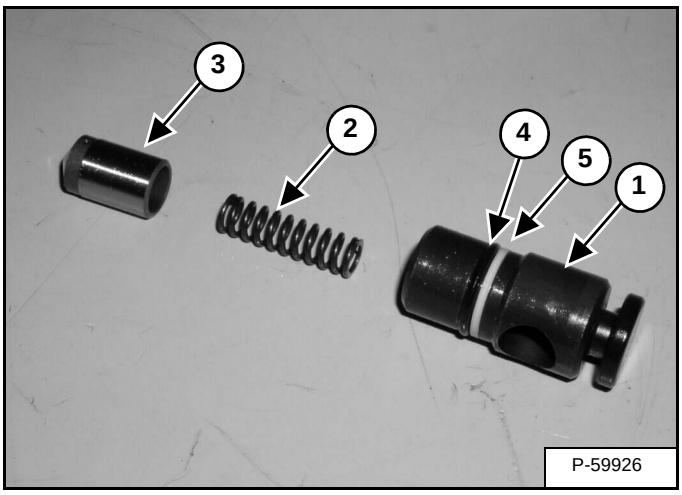
Installation: Align the hole in the buildup valve (Item 1) with the hole (Item 2) **[Figure 20-40-65]** in the auxiliary valve section. Fully depress the buildup valve and slide the auxiliary valve section on the tie rods.

Figure 20-40-66



Remove the buildup valve assembly (Item 1) **[Figure 20-40-65]** and **[Figure 20-40-66]**.

Figure 20-40-67

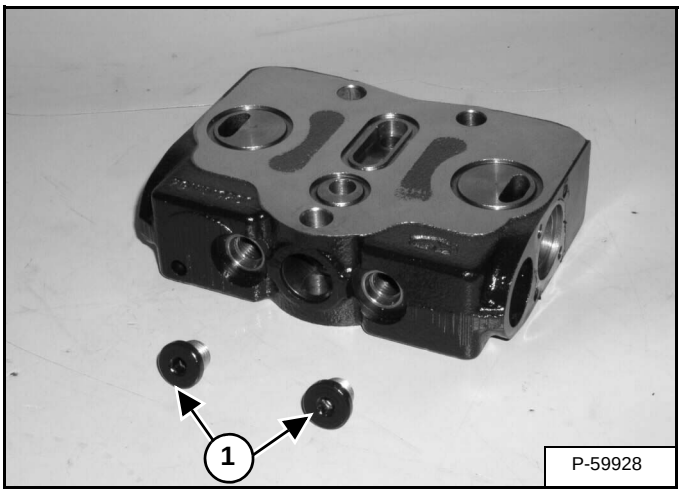


Remove the buildup valve (Item 1), spring (Item 2) and piston (Item 3) **[Figure 20-40-67]**.

Remove the O-ring (Item 4) and backup seal (Item 5) **[Figure 20-40-67]**.

Auxiliary Valve Section Disassembly And Assembly (Cont'd)

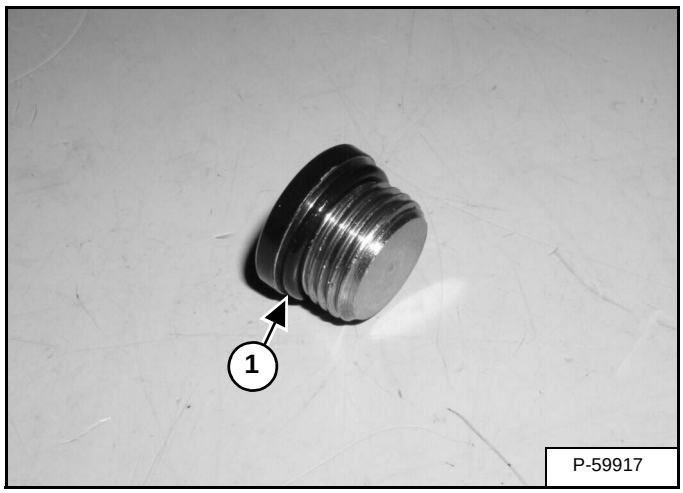
Figure 20-40-68



Remove the plug (Item 1) **[Figure 20-40-68]**.

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

Figure 20-40-69



Remove the O-ring (Item 1) **[Figure 20-40-69]** from the plug.

Boom 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.

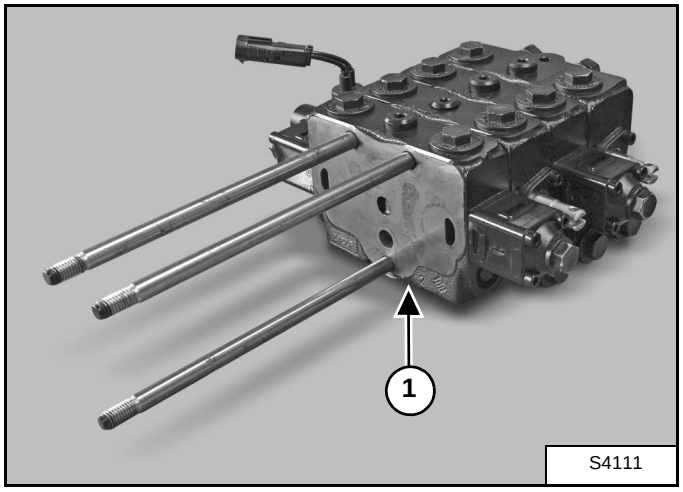
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

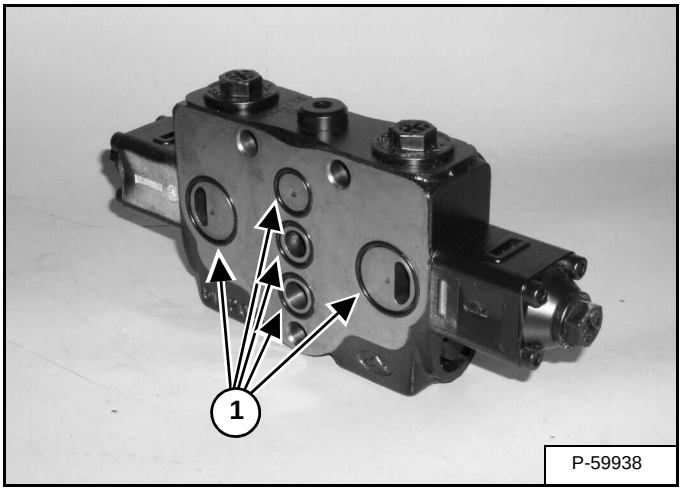
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-70



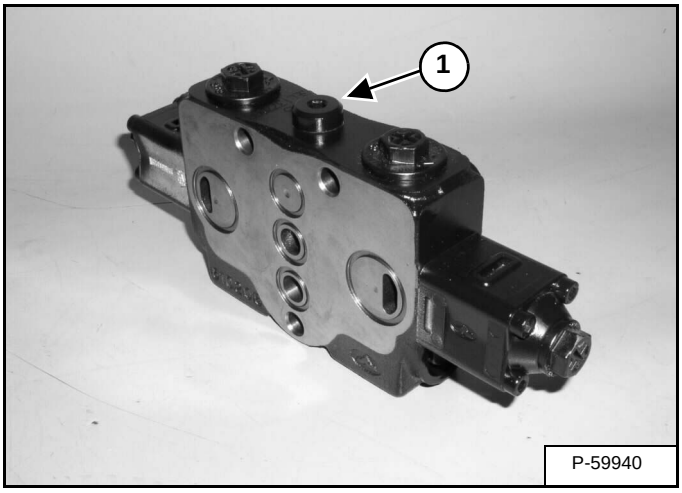
Remove the boom valve section (Item 1) **[Figure 20-40-70]** from the valve assembly.

Figure 20-40-71



Remove the O-rings (Item 1) **[Figure 20-40-71]** from the boom valve section.

Figure 20-40-72

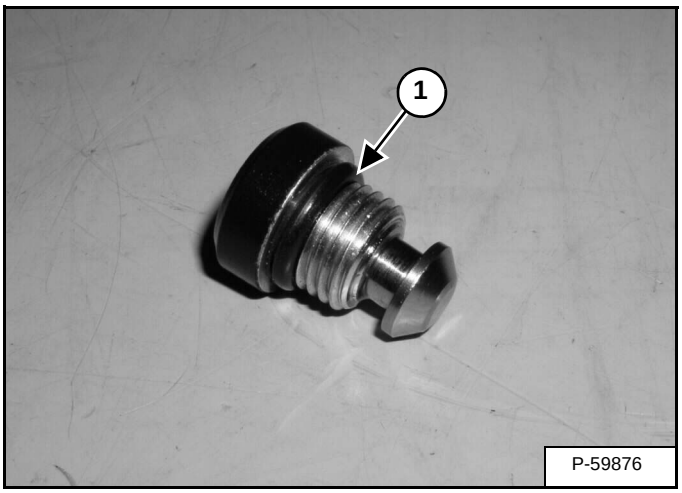


Remove the load check valve (Item 1) **[Figure 20-40-72]**.

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

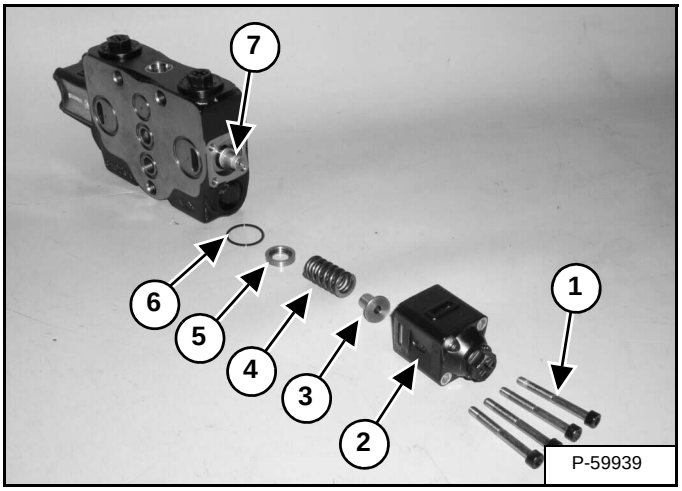
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-73



Remove the O-ring (Item 1) **[Figure 20-40-73]** from the load check valve.

Figure 20-40-74

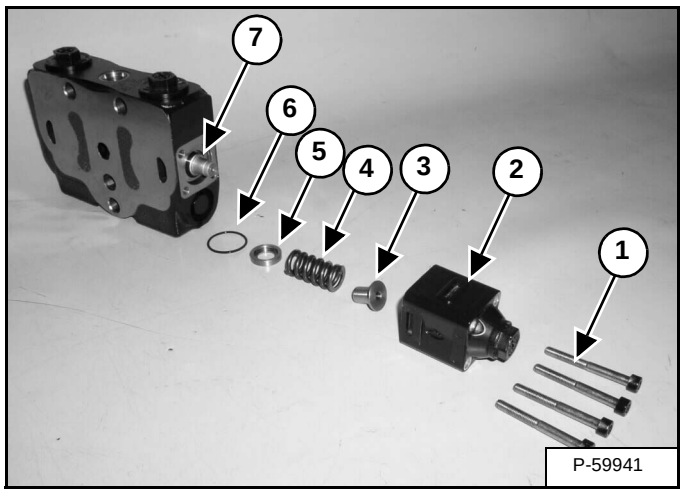


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-74]**.

Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 7) **[Figure 20-40-74]**.

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

Figure 20-40-75

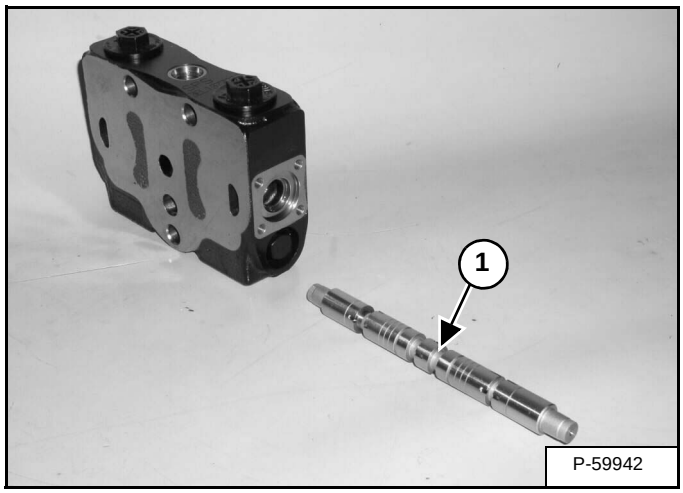


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-75]**.

Installation: Make sure the lip on the spring retainer (Item 5) fits over the spool (Item 7) **[Figure 20-40-75]**.

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

Figure 20-40-76



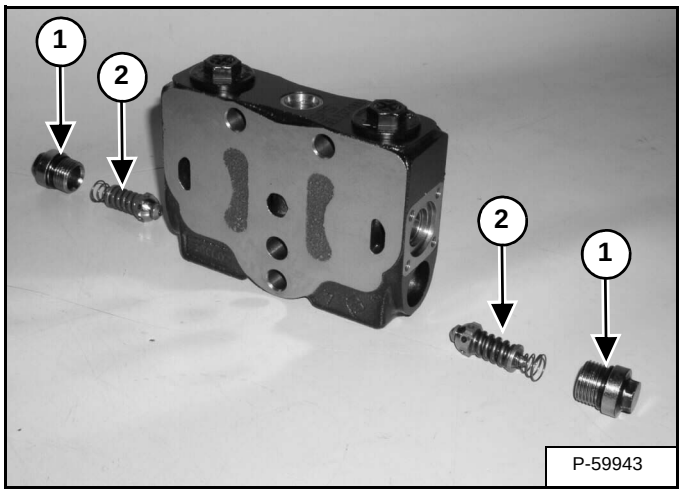
Remove the spool (Item 1) **[Figure 20-40-76]**.

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.

Boom Valve Section Disassembly And Assembly (Cont'd)

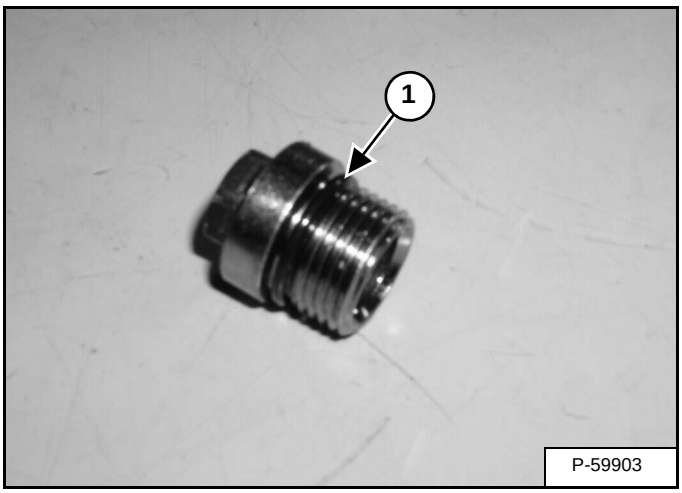
Figure 20-40-77



Remove the plug (Item 1) and valve assembly (Item 2) **[Figure 20-40-77]** from both relief valves.

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

Figure 20-40-78



Remove the O-ring (Item 1) **[Figure 20-40-78]** from both plugs.

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.

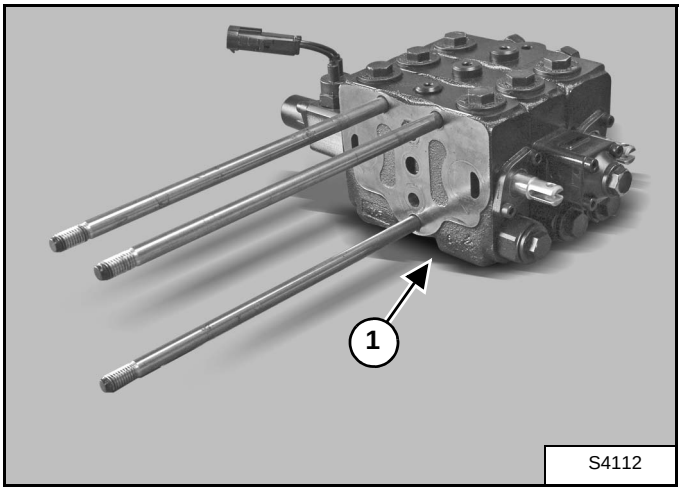
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

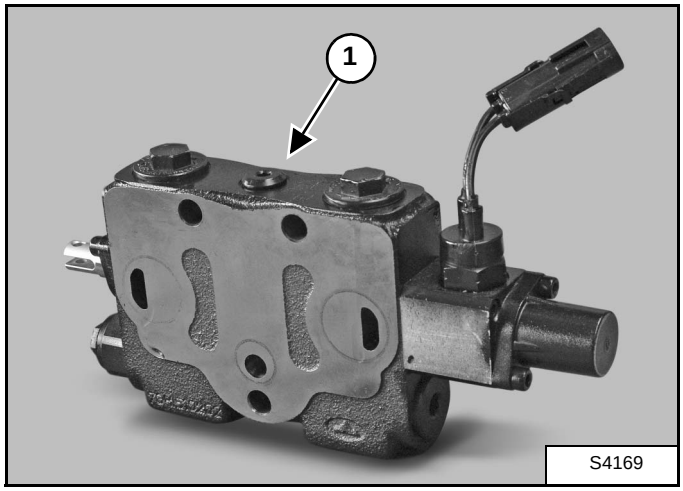
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-79



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

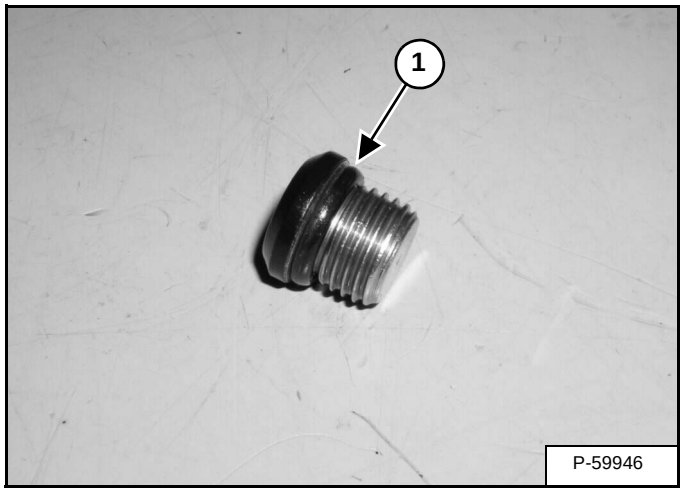
Figure 20-40-80



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

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

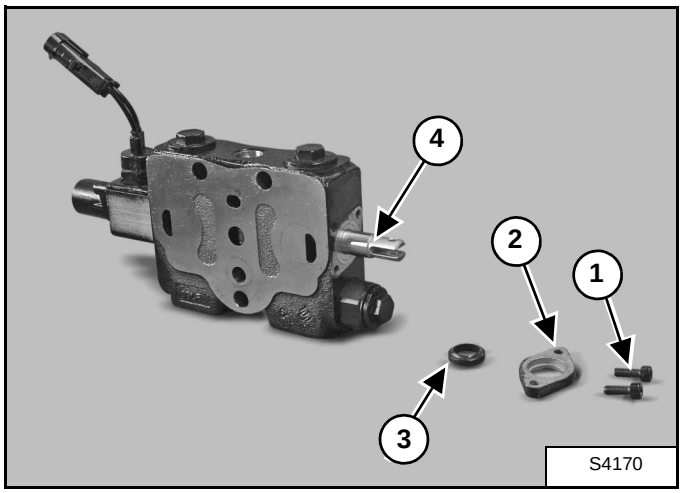
Figure 20-40-81



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

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

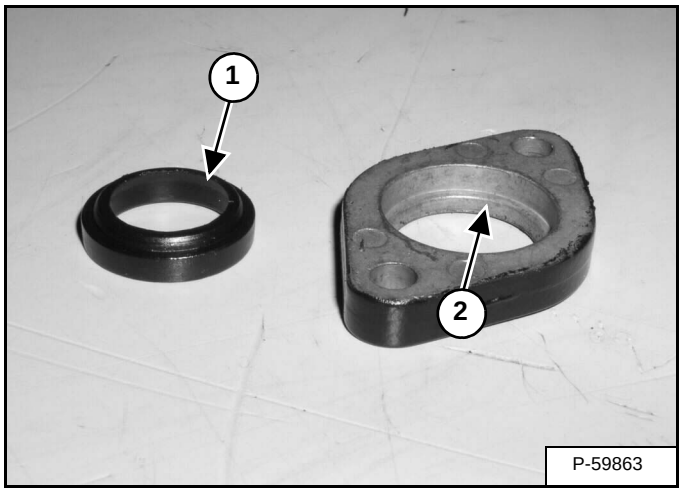
Figure 20-40-82



Remove the bolts (Item 1), retainer (Item 2) and seal (Item 3) from the spool (Item 4) **[Figure 20-40-82]**.

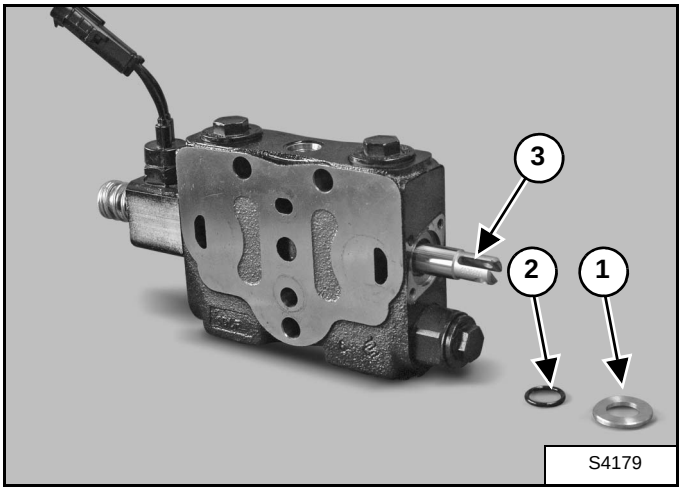
Installation: Tighten the bolts to 5 ft.-lb. (6,6 N•m) torque.

Figure 20-40-83



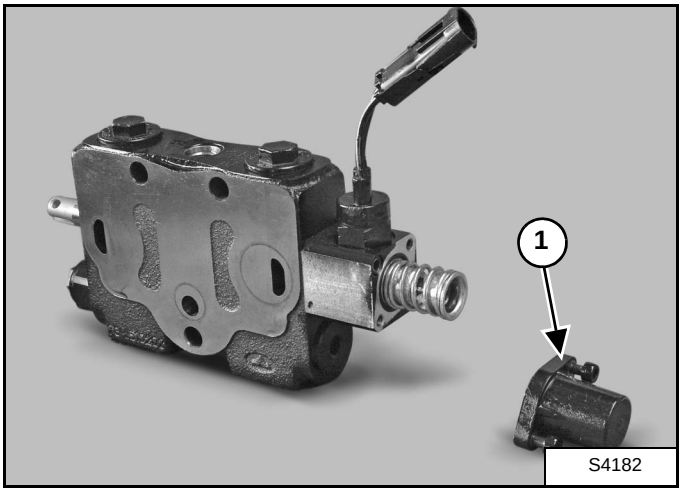
Installation: Make sure the lip (Item 1) of the seal fits inside the retaining plate (Item 2) **[Figure 20-40-83]**.

Figure 20-40-84



Remove the washer (Item 1) and O-ring (Item 2) from the actuating end of the spool (Item 3) **[Figure 20-40-84]**.

Figure 20-40-85

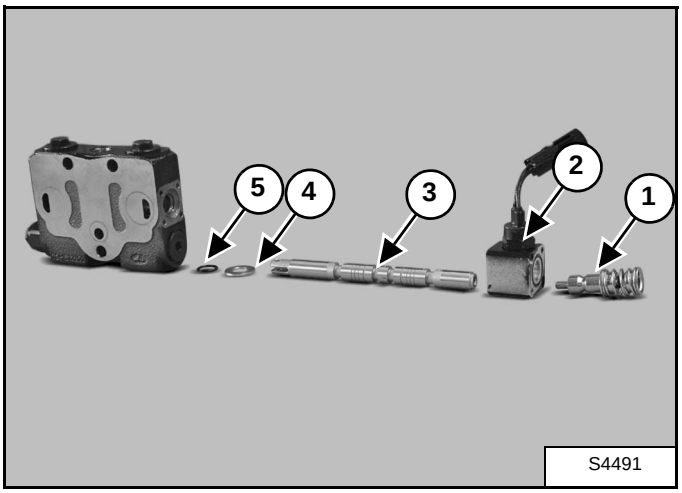


Remove the cap (Item 1) **[Figure 20-40-85]**.

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

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

Figure 20-40-86



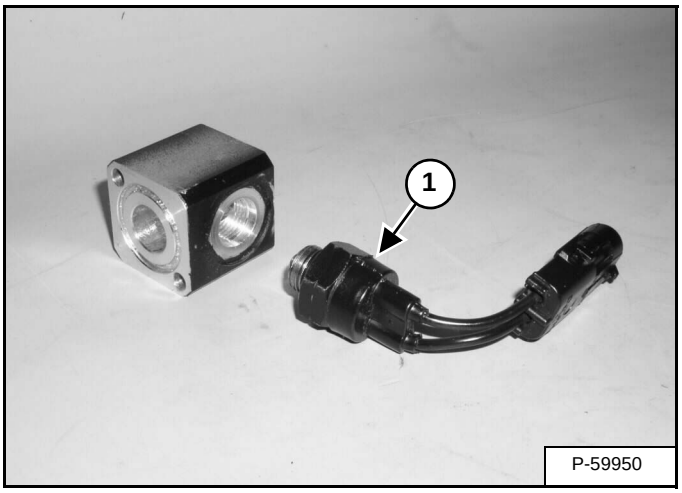
Remove the spring assembly (Item 1), spool cover (Item 2), spool (Item 3), washer (Item 4) and O-ring (Item 5) **[Figure 20-40-86]**.

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.

Installation: Tighten the spring assembly (Item 1) **[Figure 20-40-86]** to 7 ft.-lb. (9.8 N•m) torque.

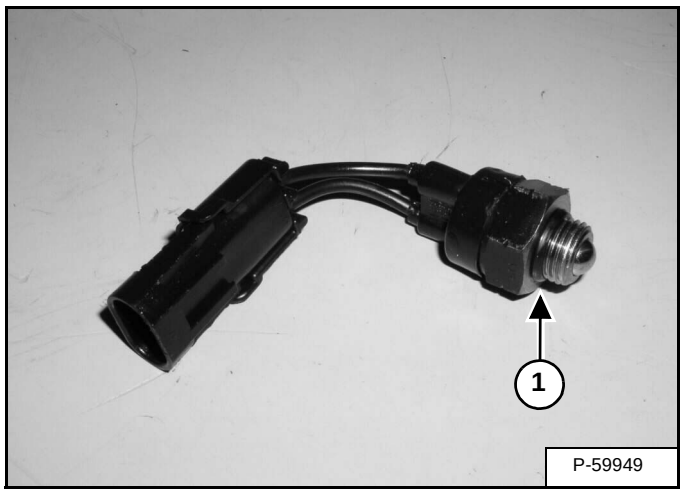
Figure 20-40-87



Remove the switch (Item 1) **[Figure 20-40-87]** from the spool cover.

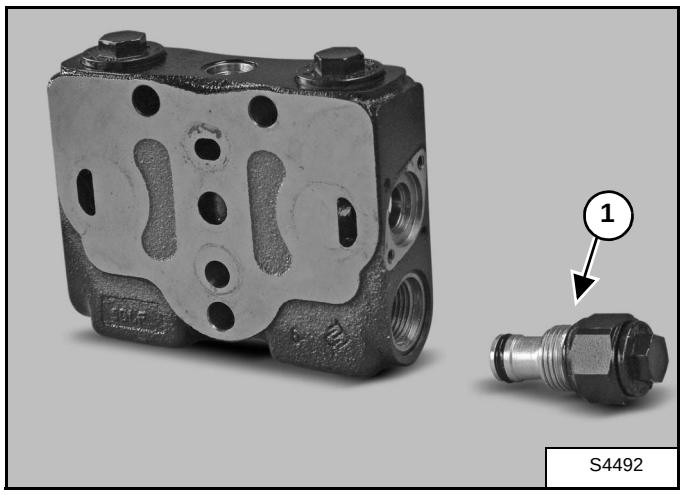
Installation: Tighten the bolts to 31 ft.-lb. (42 N•m) torque.

Figure 20-40-88



Remove the O-ring (Item 1) **[Figure 20-40-88]** from the switch.

Figure 20-40-89

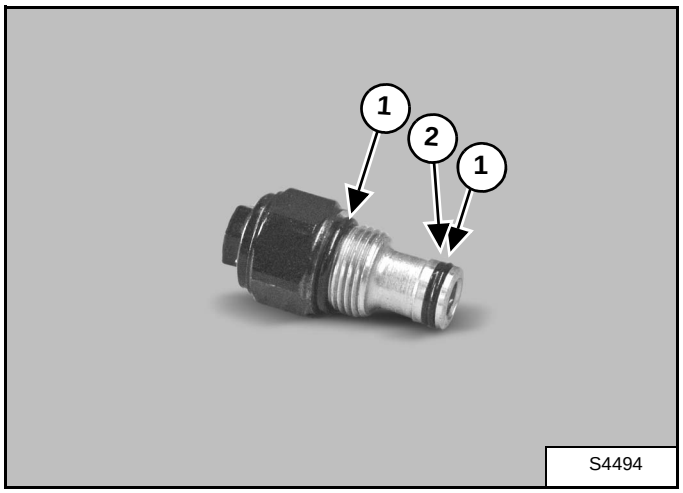


Remove the fitting (Item 1) **[Figure 20-40-89]**.

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

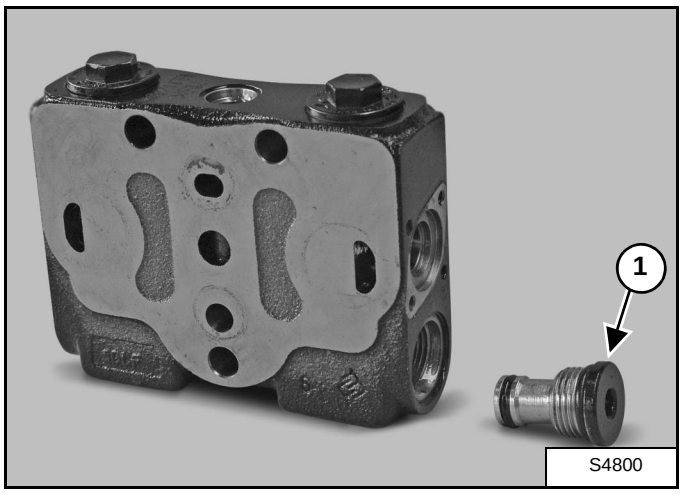
Left Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-90



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-90]** from the fitting.

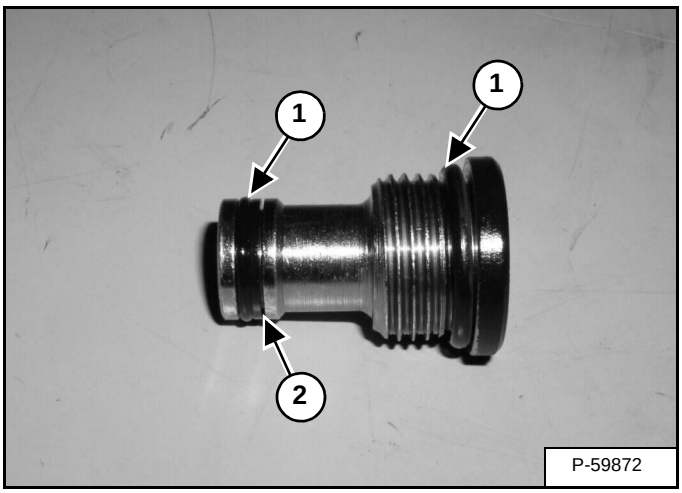
Figure 20-40-91



Remove the plug (Item 1) **[Figure 20-40-91]**.

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

Figure 20-40-92



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-92]** from the plug.

Swing (Slew) 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.

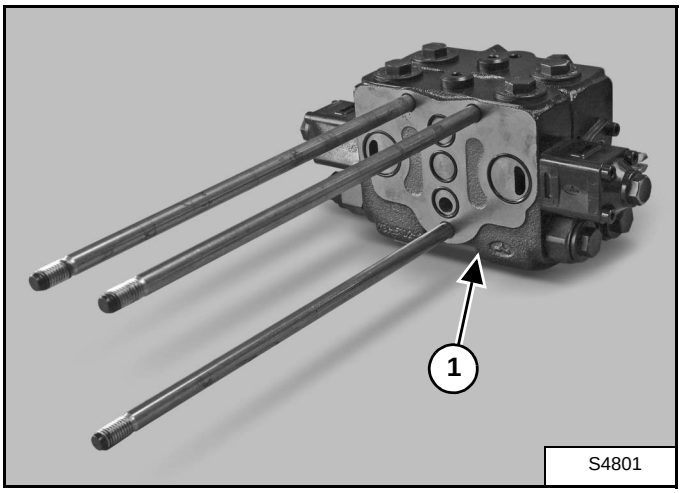
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

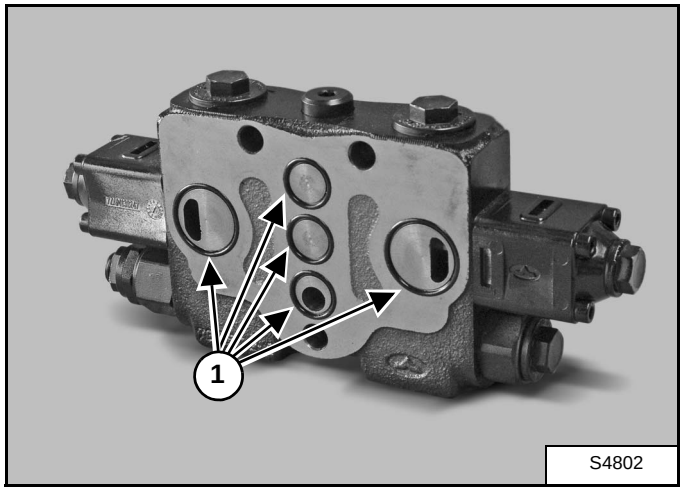
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-93



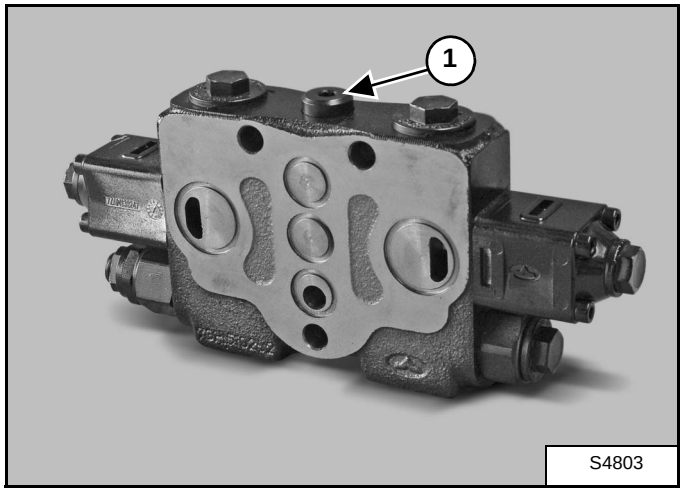
Remove the swing (slew) valve section (Item 1) **[Figure 20-40-93]** from the valve assembly.

Figure 20-40-94



Remove the O-rings (Item 1) **[Figure 20-40-94]** from the swing (slew) valve section.

Figure 20-40-95

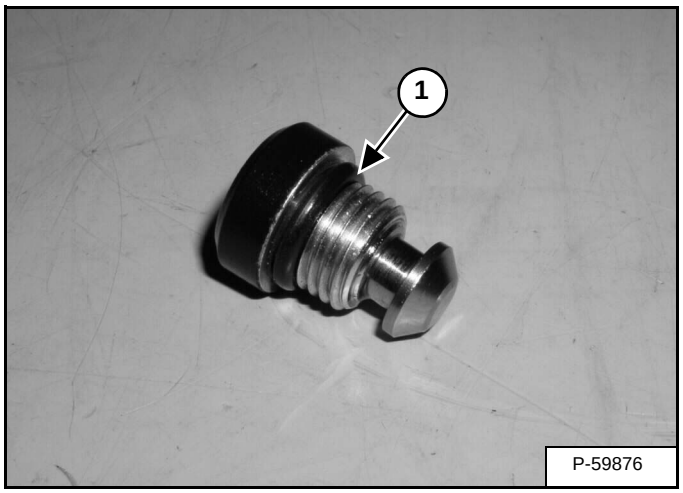


Remove the load check valve (Item 1) **[Figure 20-40-95]**.

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

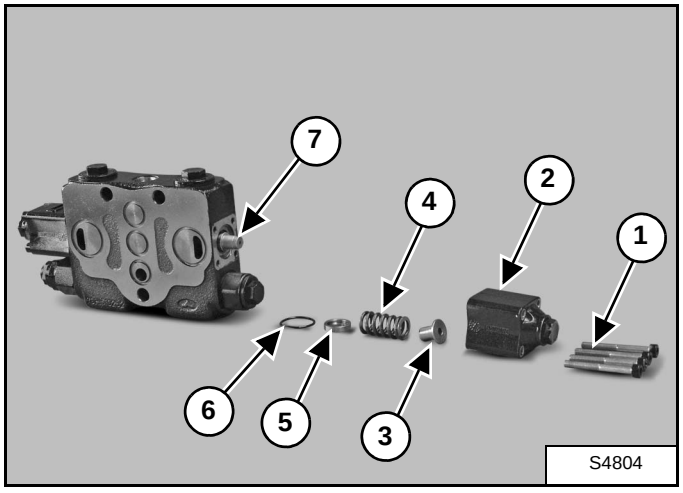
Swing (Slew) Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-96



Remove the O-ring (Item 1) **[Figure 20-40-96]** from the load check valve.

Figure 20-40-97

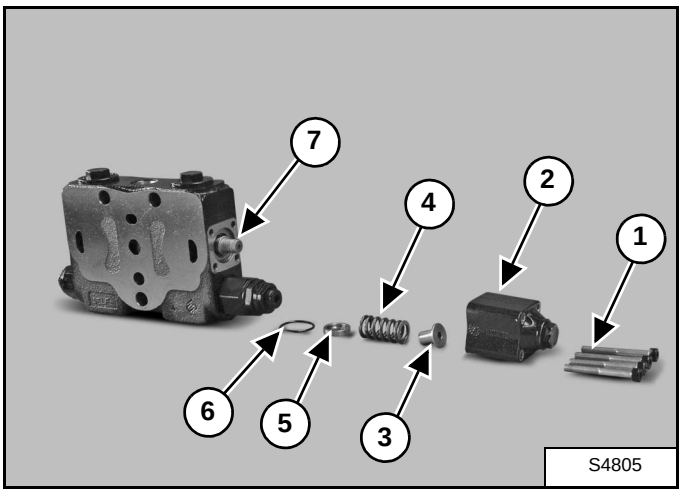


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-97]**.

Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 7) **[Figure 20-40-97]**.

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

Figure 20-40-98

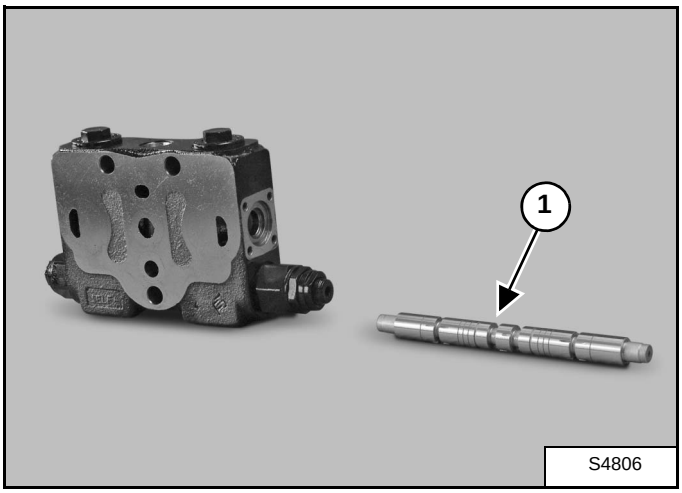


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-98]**.

Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 7) **[Figure 20-40-98]**.

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

Figure 20-40-99



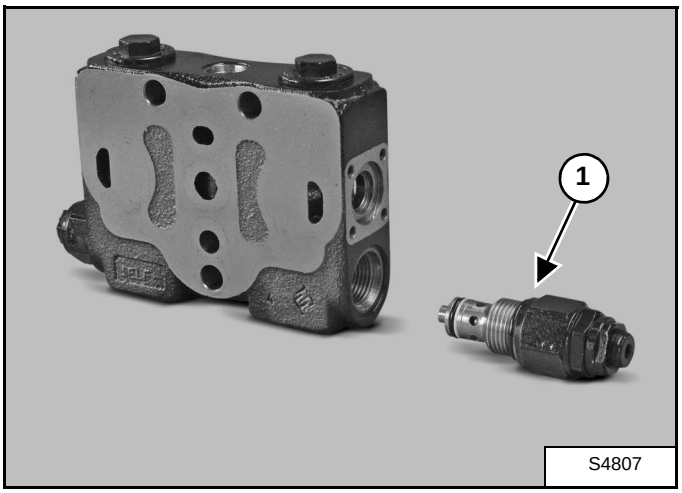
Remove the spool (Item 1) **[Figure 20-40-99]**.

The spool and valve section are not serviced separately.

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

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

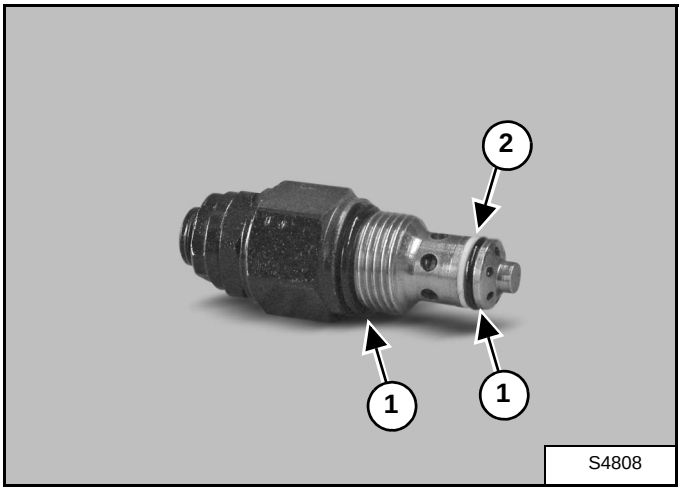
Figure 20-40-100



Remove the relief valve (Item 1) **[Figure 20-40-100]**.

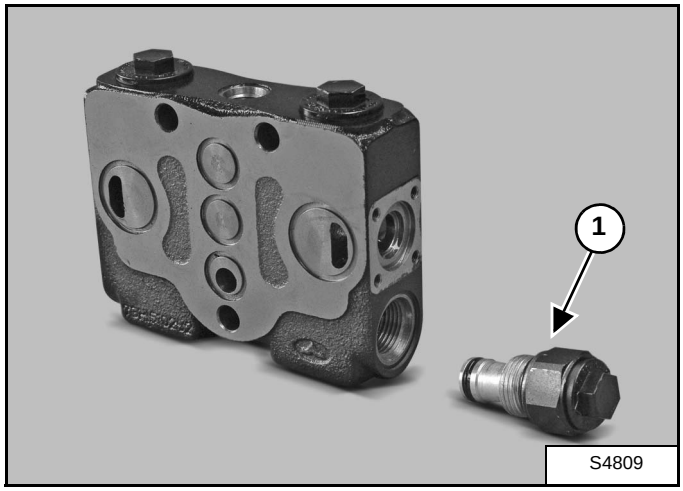
Installation: Tighten the to 31 ft.-lb. (42 N•m) torque.

Figure 20-40-101



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-101]** from the relief valve.

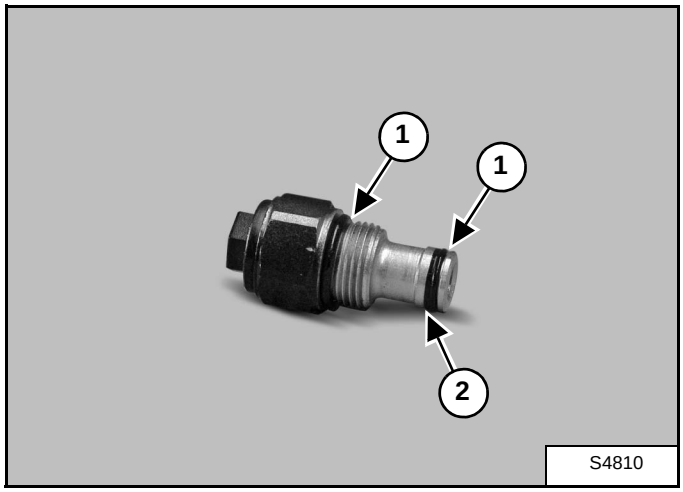
Figure 20-40-102



Remove the fitting (Item 1) **[Figure 20-40-102]**.

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

Figure 20-40-103



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-103]** from the fitting.

Blade 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.

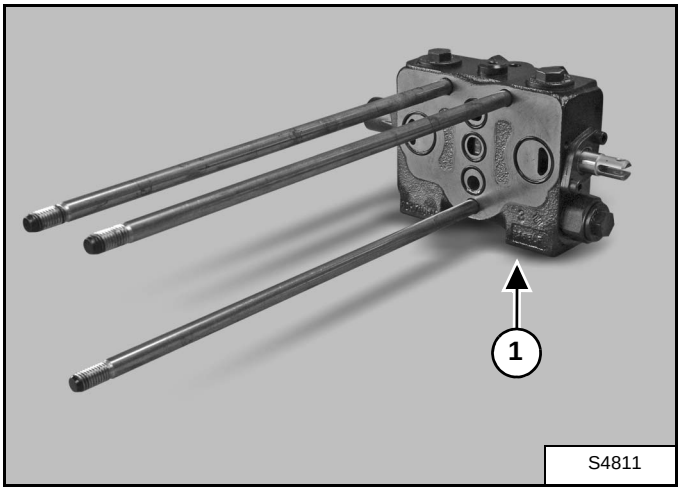
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

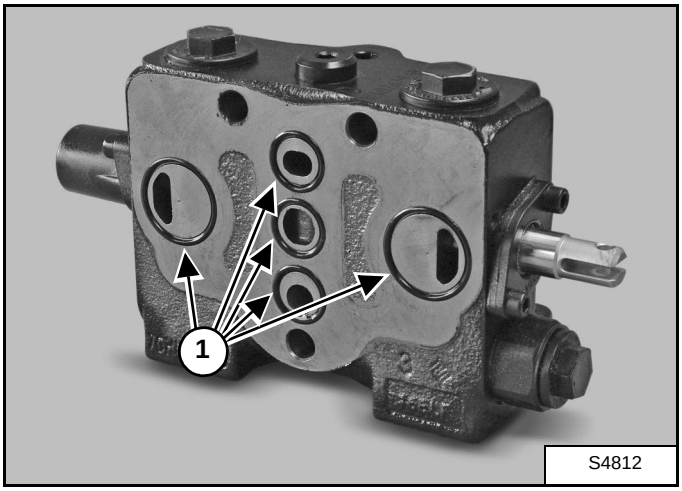
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-104



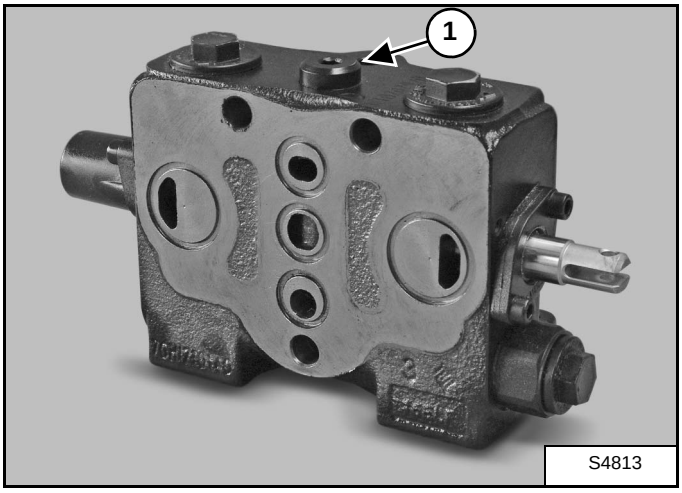
Remove the blade valve section (Item 1) **[Figure 20-40-104]** from the tie rods.

Figure 20-40-105



Remove the O-rings (Item 1) **[Figure 20-40-105]** from the blade valve section.

Figure 20-40-106

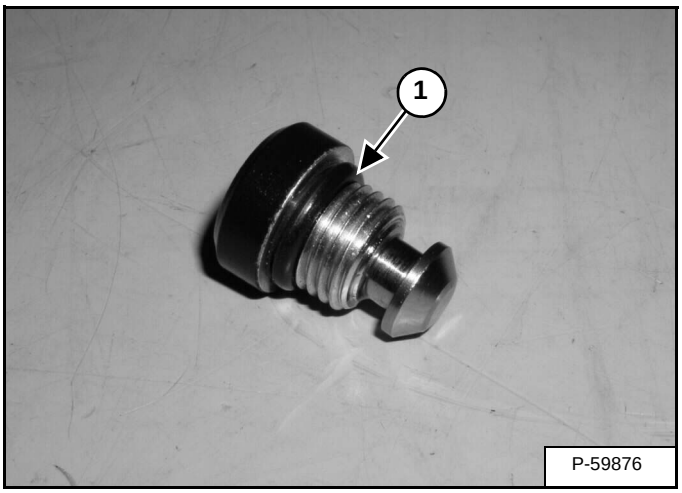


Remove the load check valve (Item 1) **[Figure 20-40-106]**.

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

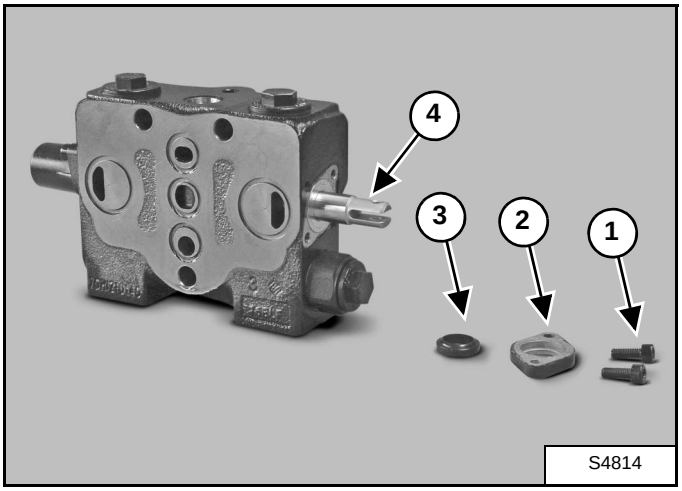
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-107



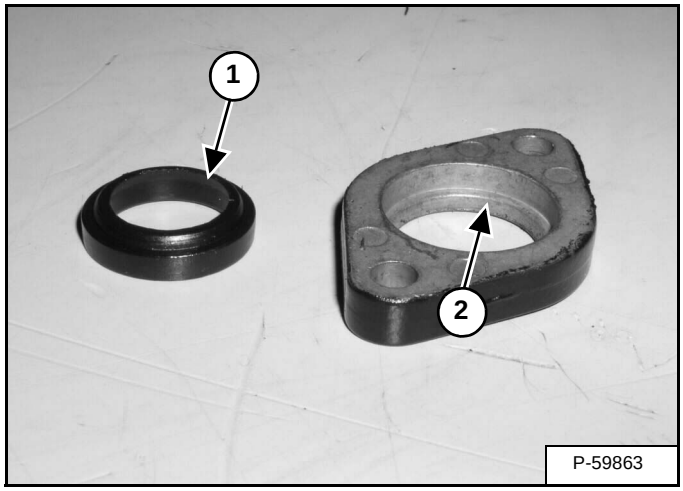
Remove the O-ring (Item 1) **[Figure 20-40-107]** from the load check valve.

Figure 20-40-108



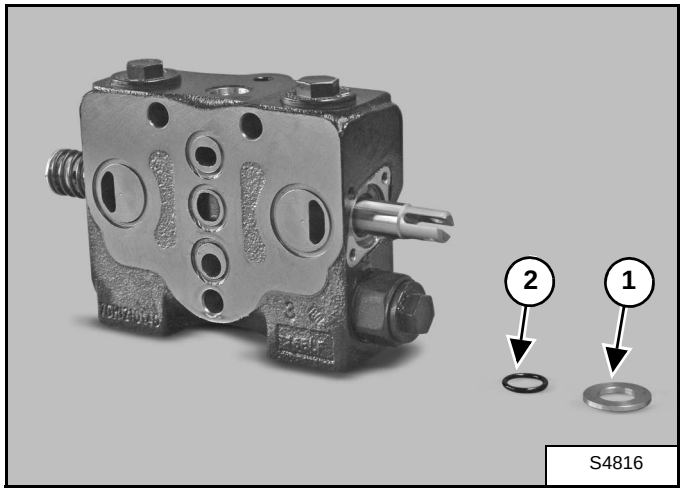
Remove the bolts (Item 1), spool retainer (Item 2) and seal (Item 3) from the actuating end of the spool (Item 4) **[Figure 20-40-108]**.

Figure 20-40-109



Installation: Make sure the lip (Item 1) of the seal fits inside the retaining plate (Item 2) **[Figure 20-40-109]**.

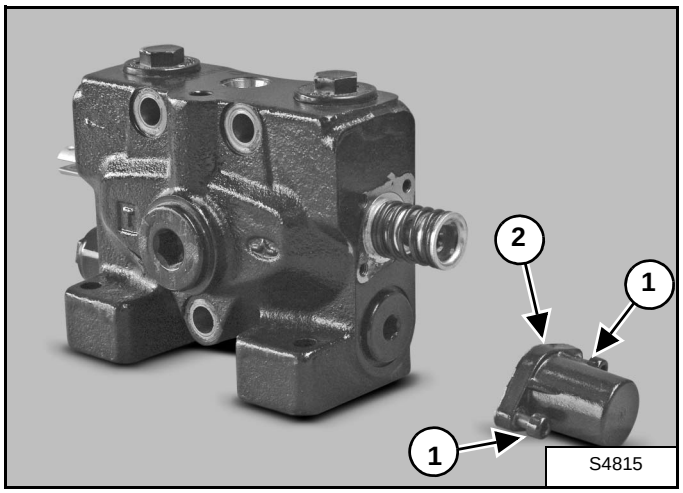
Figure 20-40-110



Remove the washer (Item 1) and O-ring (Item 2) **[Figure 20-40-110]**.

Blade Valve Section Disassembly And Assembly (Cont'd)

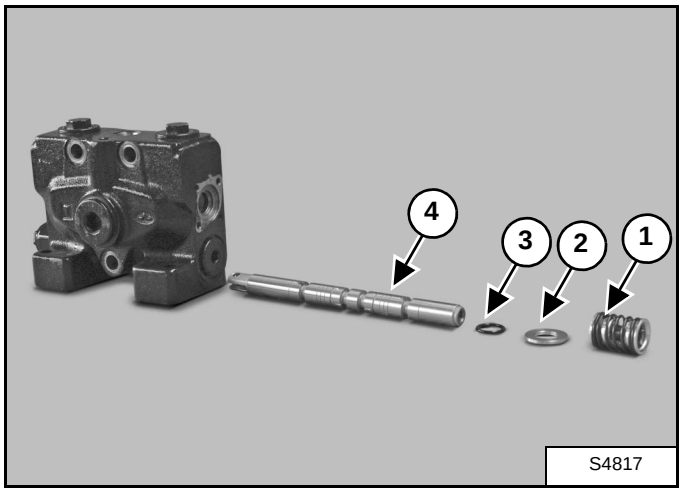
Figure 20-40-111



Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-111]**.

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

Figure 20-40-112



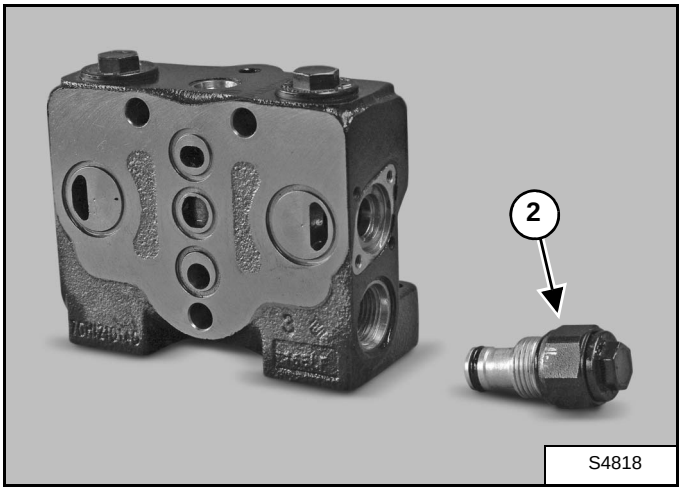
Remove the spring assembly (Item 1), washer (Item 2), O-ring (Item 3) and spool (Item 4) **[Figure 20-40-112]**.

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.

Installation: Tighten the spring retaining bolt to 7 ft.-lb. (9,8 N•m) torque.

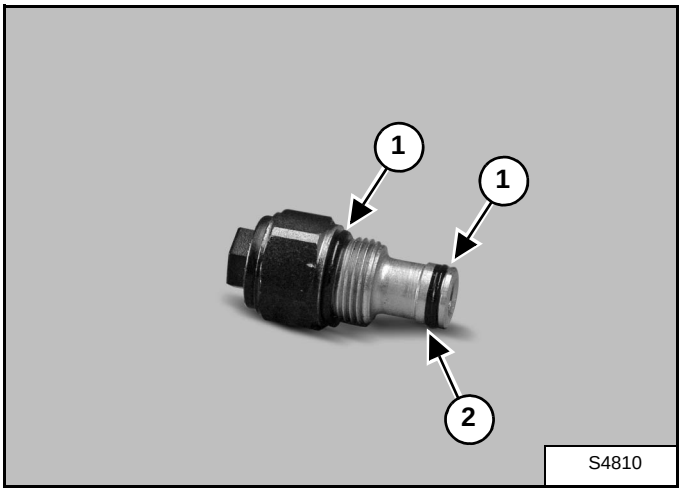
Figure 20-40-113



Remove the fitting (Item 1) [**[Figure 20-40-113]**

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

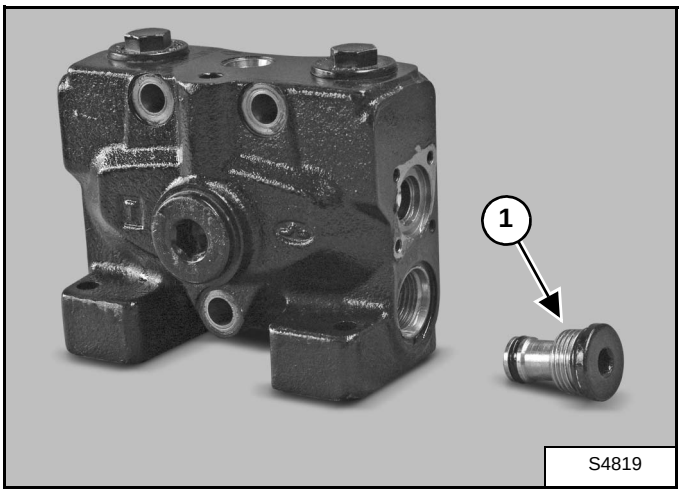
Figure 20-40-114



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-114]** from the fitting.

Blade Valve Section Disassembly And Assembly (Cont'd)

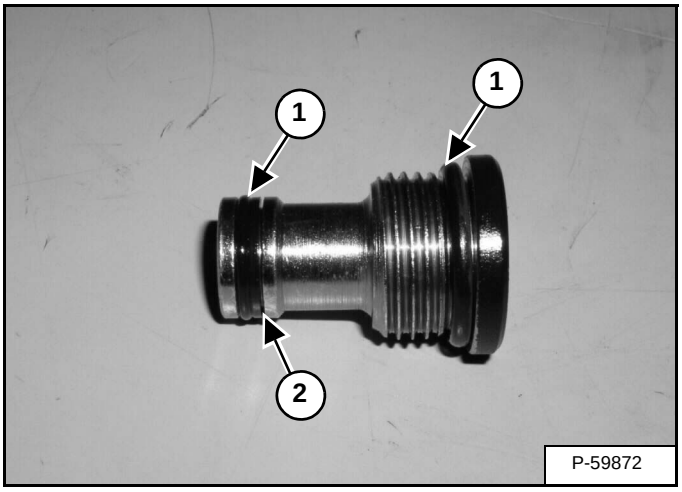
Figure 20-40-115



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

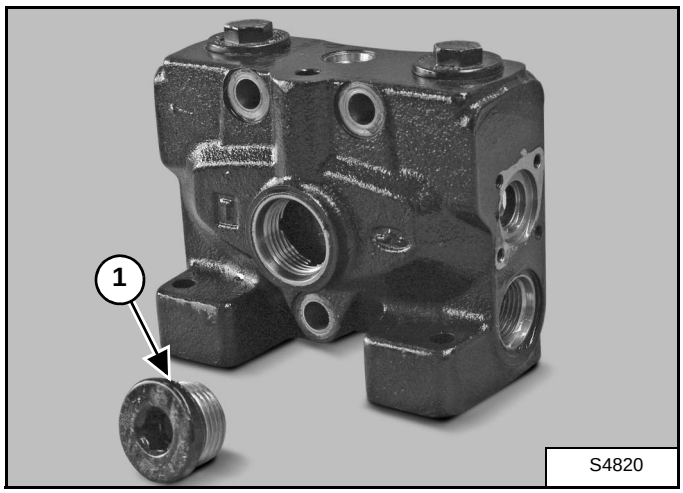
Installation: Tighten the plug to 31 ft.-lb. (42 N•m) torque.

Figure 20-40-116



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

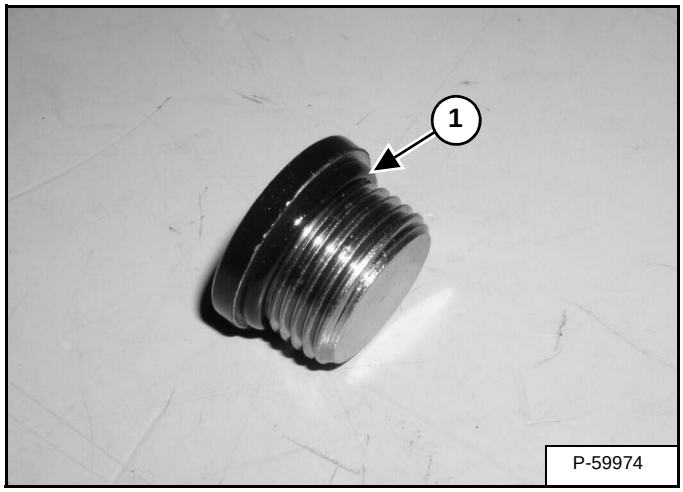
Figure 20-40-117



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

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

Figure 20-40-118



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

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.

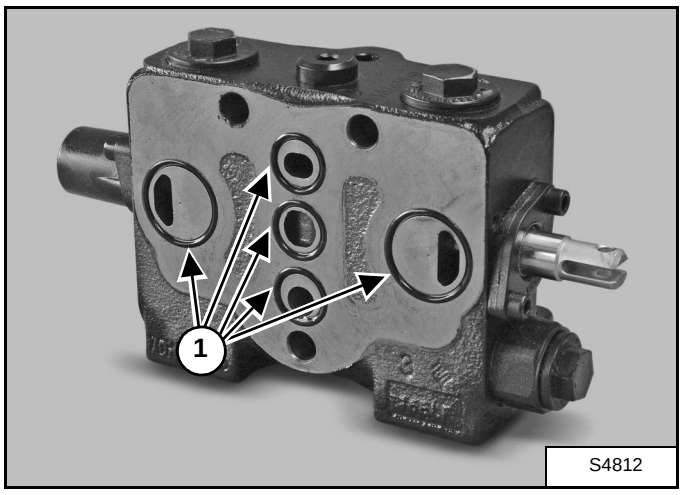
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

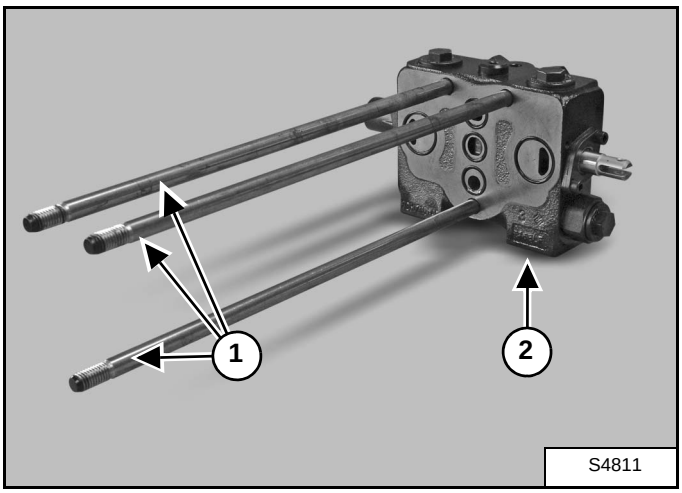
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-119



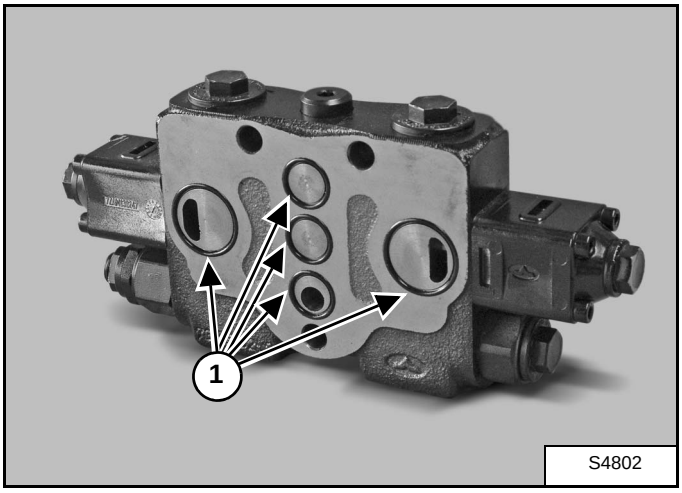
Install the O-rings (Item 1) **[Figure 20-40-119]** on the blade valve section.

Figure 20-40-120



Install the tie rods (Item 1) on the blade valve section (Item 2) **[Figure 20-40-120]**.

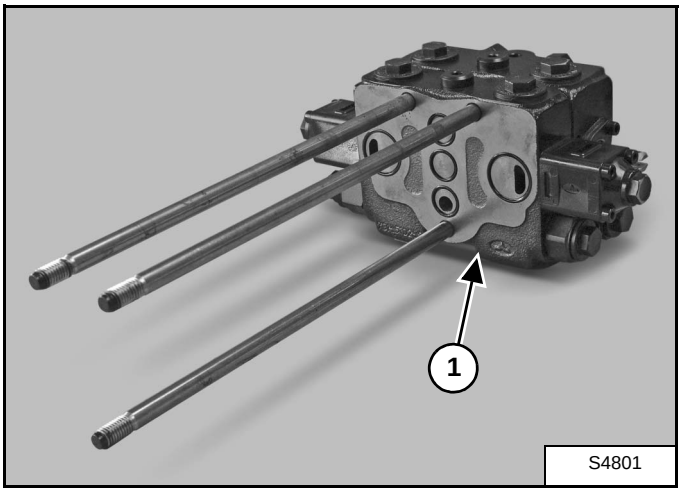
Figure 20-40-121



Install the O-rings (Item 1) **[Figure 20-40-121]** on the swing (slew) valve section.

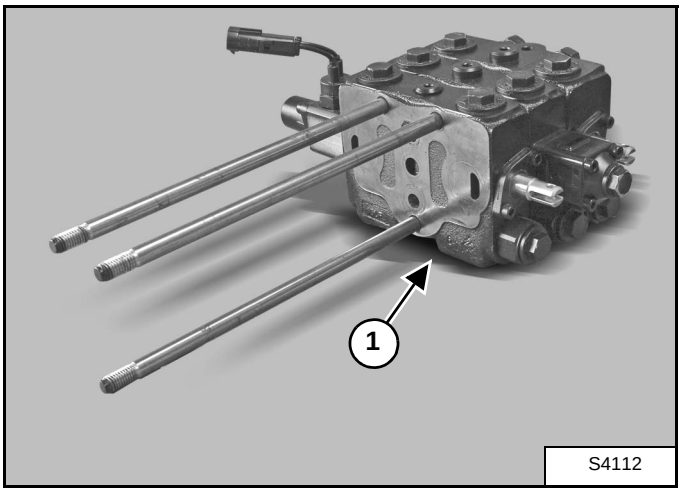
Assembly (Cont'd)

Figure 20-40-122



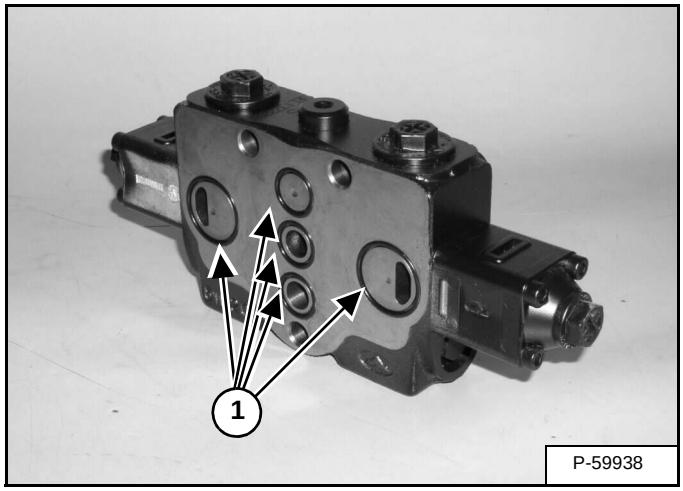
Install the swing (slew) valve section (Item 1) **[Figure 20-40-122]** on the tie rods.

Figure 20-40-123



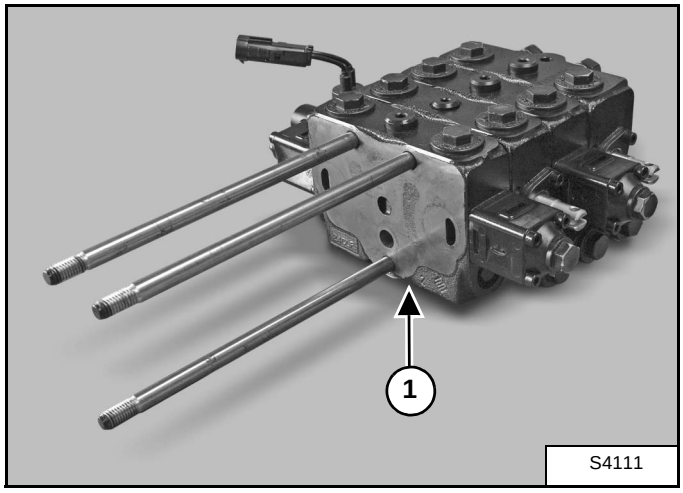
Install the left travel valve section (Item 1) **[Figure 20-40-123]** on the tie rods.

Figure 20-40-124



Install the O-rings (Item 1) **[Figure 20-40-124]** on the boom valve section.

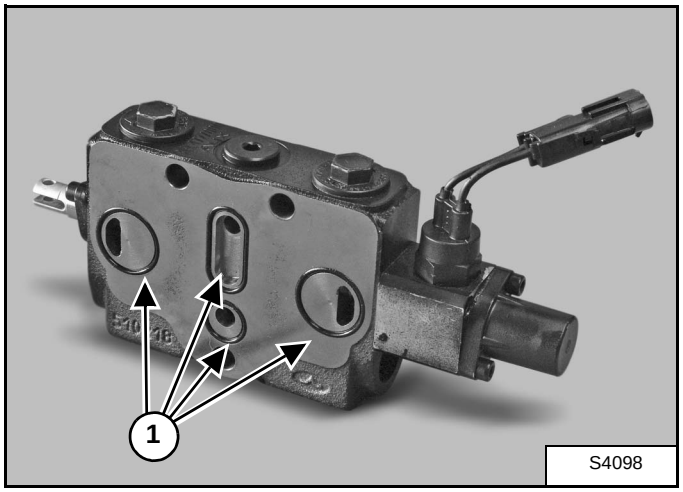
Figure 20-40-125



Install the boom valve section (Item 1) **[Figure 20-40-125]** on the tie rods.

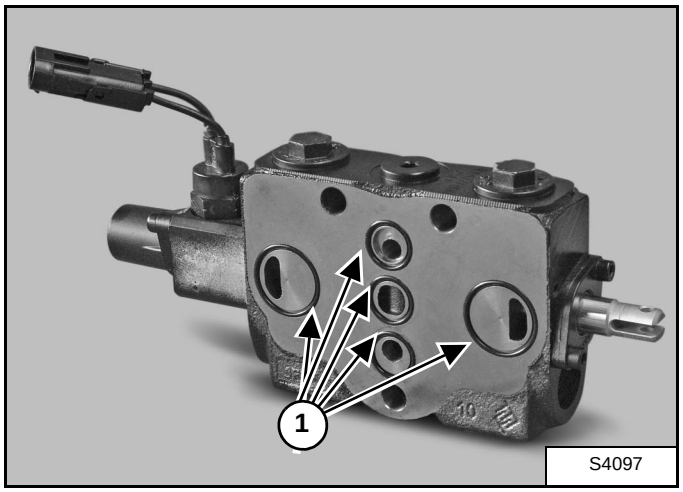
Assembly (Cont'd)

Figure 20-40-126



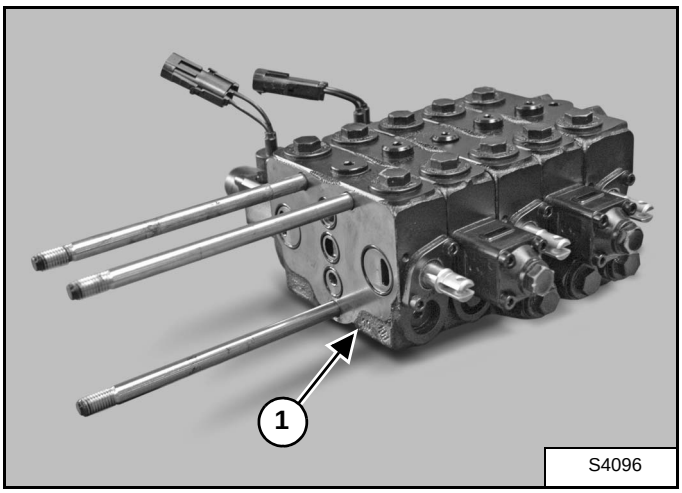
Install the O-rings (Item 1) **[Figure 20-40-126]** on the auxiliary valve section.

Figure 20-40-127



Install the O-rings (Item 1) **[Figure 20-40-127]** on the auxiliary valve section.

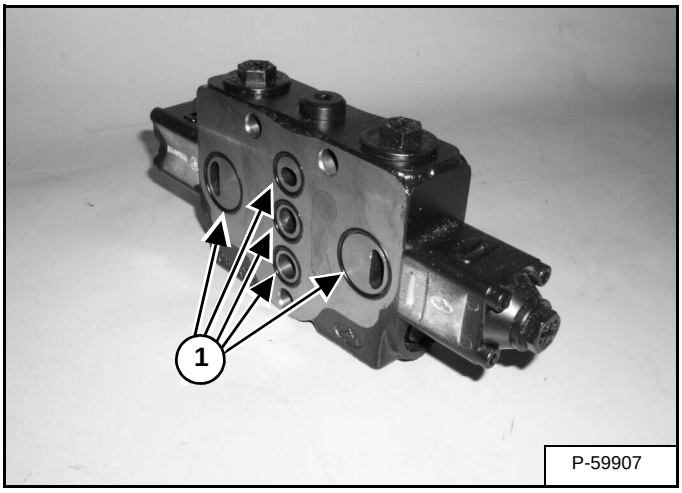
Figure 20-40-128



Install the auxiliary valve section (Item 1) **[Figure 20-40-128]** on the tie rods.

NOTE: Use care while installing the auxiliary valve section. The buildup valve is spring loaded and the hole in the buildup valve must be aligned with the hole in the auxiliary valve section (Item 2) [Figure 20-40-128] before installing the bottom tie rod.

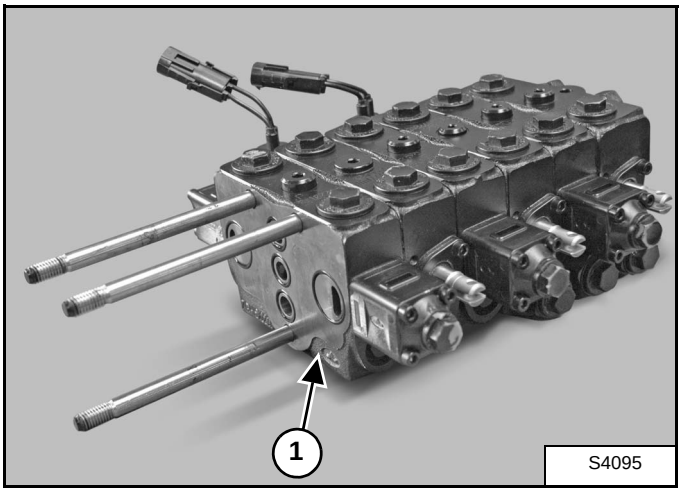
Figure 20-40-129



Install the O-rings (Item 1) **[Figure 20-40-129]** on the side of the bucket valve section.

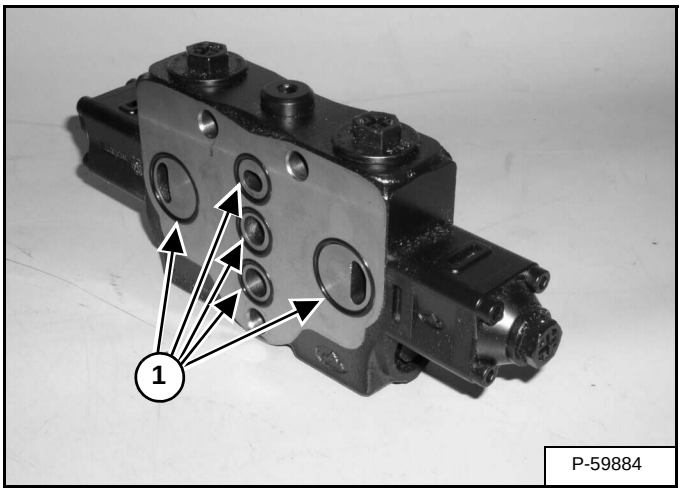
Assembly (Cont'd)

Figure 20-40-130



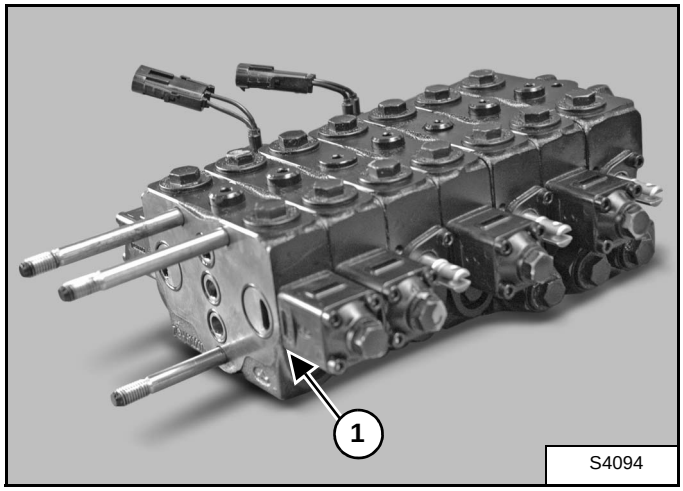
Install the bucket valve section (Item 1) **[Figure 20-40-130]** on the tie rods.

Figure 20-40-131



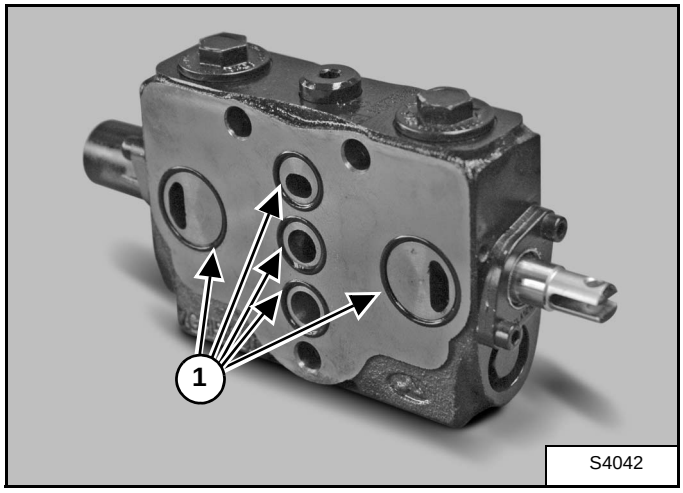
Install the O-rings (Item 1) **[Figure 20-40-131]** on the arm valve section.

Figure 20-40-132



Install the arm valve section (Item 1) **[Figure 20-40-132]** on the tie rods.

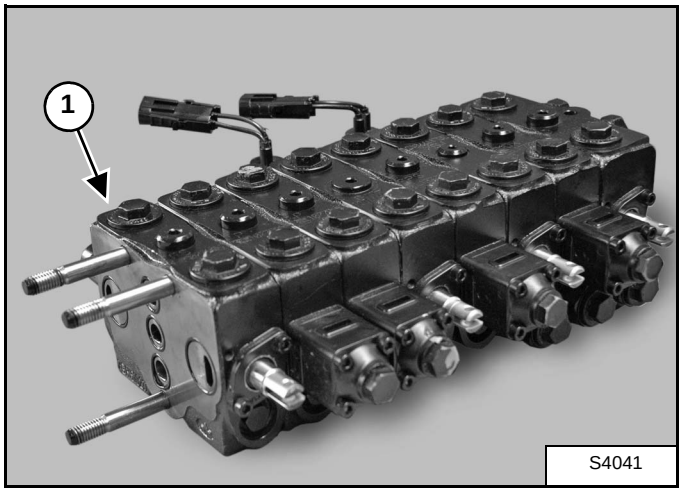
Figure 20-40-133



Install the O-rings (Item 1) **[Figure 20-40-133]** on the boom swing (slew) valve section.

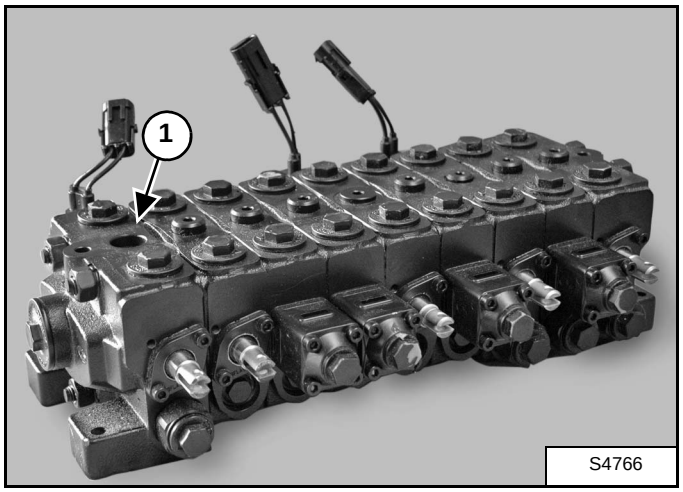
Assembly (Cont'd)

Figure 20-40-134



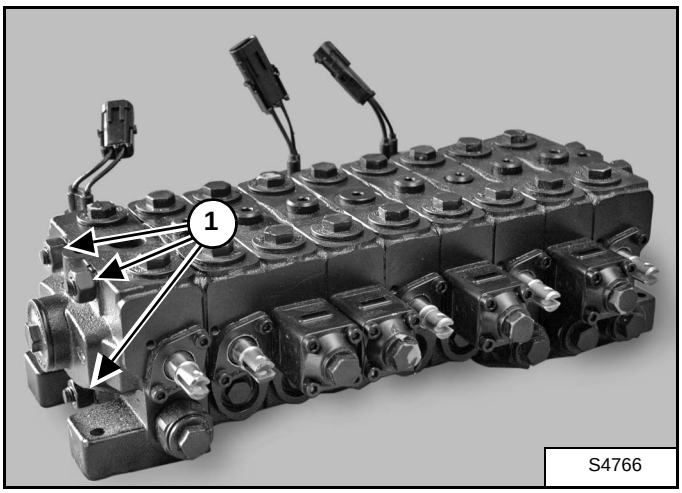
Install the boom swing valve section (Item 1) **[Figure 20-40-134]** on the tie rods.

Figure 20-40-135



Install the right travel valve (Item 1) **[Figure 20-40-135]** on the tie rods.

Figure 20-40-136



Install the washers and nuts (Item 1) **[Figure 20-40-136]** on the tie rods, finger tight.

Be sure the valve assembly does not rock on a flat surface.

Initially tighten the tie rod nuts (Item 1) **[Figure 20-40-136]** to 10 ft.-lb. (13 N•m) torque in a crisscross manner.

Final tighten the tie rod nuts (Item 1) **[Figure 20-40-136]** to 26 ft.-lb. (35 N•m) torque.

The valve assembly must not have any spacing between the valve sections and the spools must be free when pushed in and released.

The spools must not stick, if the spools do stick, loosen the tie rod nuts and tighten per above information.

Recheck the control valve assembly for level settings.

Install the hoses and fittings.


Bobcat®

HYDRAULIC PUMP

Description

IMPORTANT

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

I-2003-0888

Figure 20-50-1

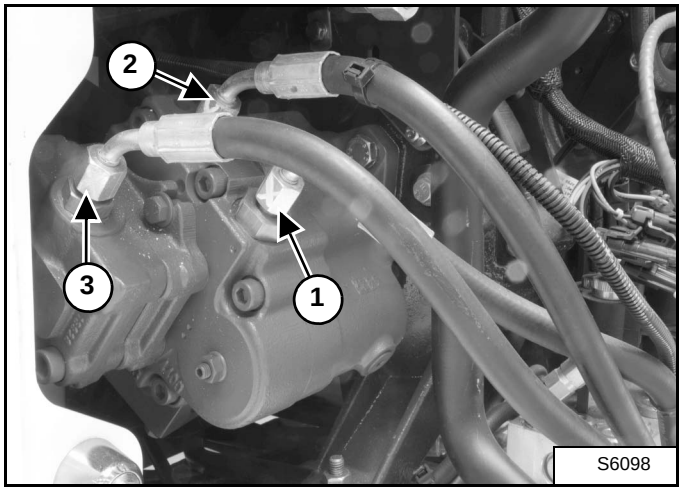
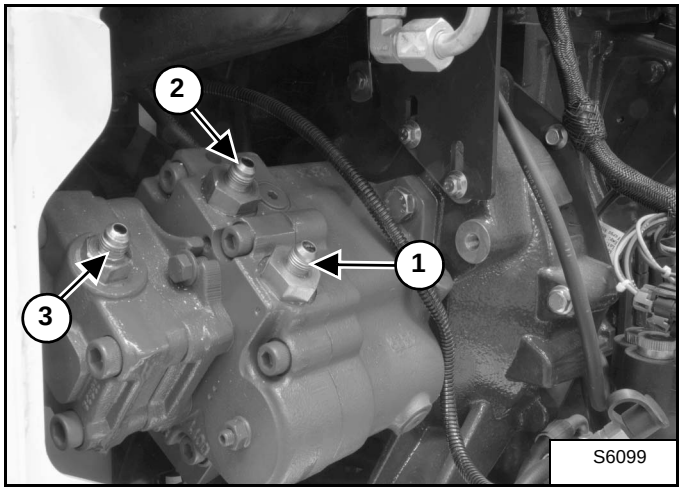


Figure 20-50-2



Pump outlet one (Item 1) **[Figure 20-50-1]** and **[Figure 20-50-2]** provides hydraulic fluid to the right hand travel, boom swing, arm, bucket and auxiliary valve sections.

Pump outlet two (Item 2) **[Figure 20-50-1]** and **[Figure 20-50-2]** provides hydraulic fluid flow to the left hand travel and boom valve sections.

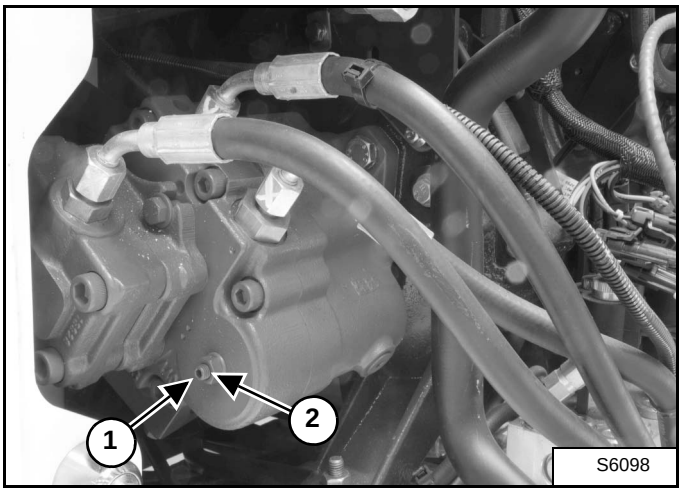
Pump outlet three (gear pump) (Item 3) **[Figure 20-50-1]** and **[Figure 20-50-2]** provides hydraulic fluid flow to the upperstructure swing and blade valve sections.

Torque Adjustment

Prior to making any torque adjustment, insure all piston and gear pump tests have been completed and they are to rated specifications. (See the following pages for pump tests.)

Prior to making any torque adjustment, make sure the no load engine RPM is correct.

Figure 20-50-3



The adjustment screw (Item 1) **[Figure 20-50-3]** is used to match the maximum hydraulic horsepower of the pump to the maximum rated engine horsepower.

Remove any auxiliary hydraulic attachments from the excavator.

Engage the swing lock.

Start the engine and move the speed control to the high RPM position.

Engage the following hydraulic functions, and continue to engage the functions.

Engage the auxiliary hydraulics.
Extend the bucket cylinder.
Extend the arm cylinder.
Extend the boom cylinder.
Extend the boom swing cylinder.
Engage the upperstructure swing.

With all the above hydraulic functions engaged, the engine speed must maintain 2500 RPM.

To adjust the hydraulic pump torque, loosen the lock nut (Item 2) **[Figure 20-50-3]** and turn the adjustment screw clockwise to increase pump torque. counterclockwise to decrease pump torque.

Tighten the locknut and retest the pump.

Increase or decrease pump torque until correct engine RPM is maintained.

Testing The Piston Pump

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

The following tool will be needed for the hydraulic pump test:

MEL10003 - Hydraulic Tester

Stop the engine.

Open the tailgate.

Figure 20-50-4

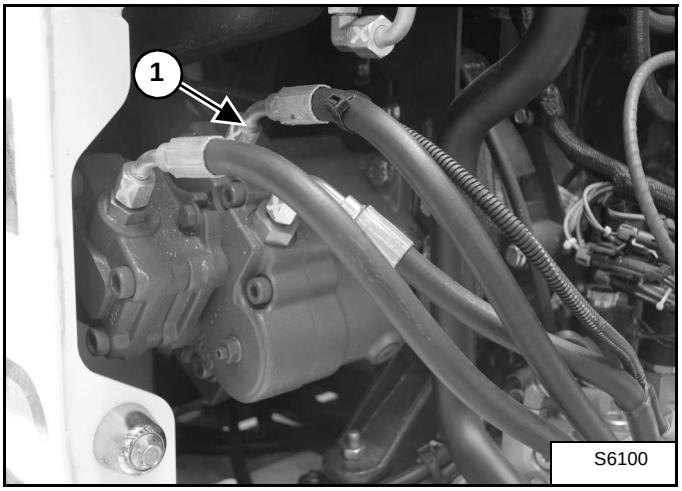
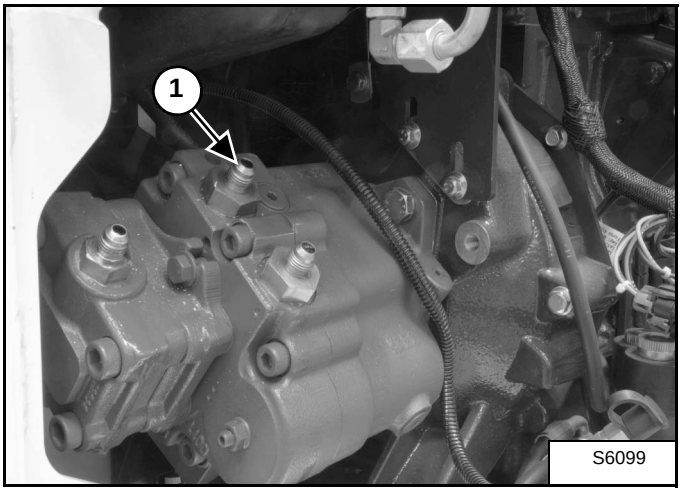
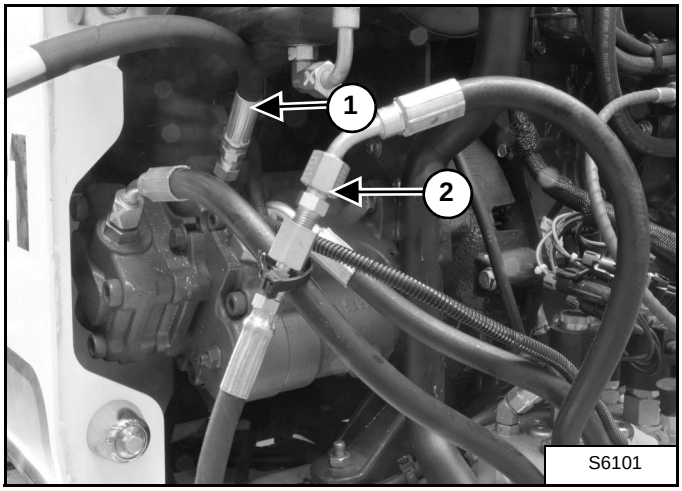


Figure 20-50-5



Remove the outlet hose (Item 1) **[Figure 20-50-5]** and **[Figure 20-50-5]** from the hydraulic pump being tested.

Figure 20-50-6

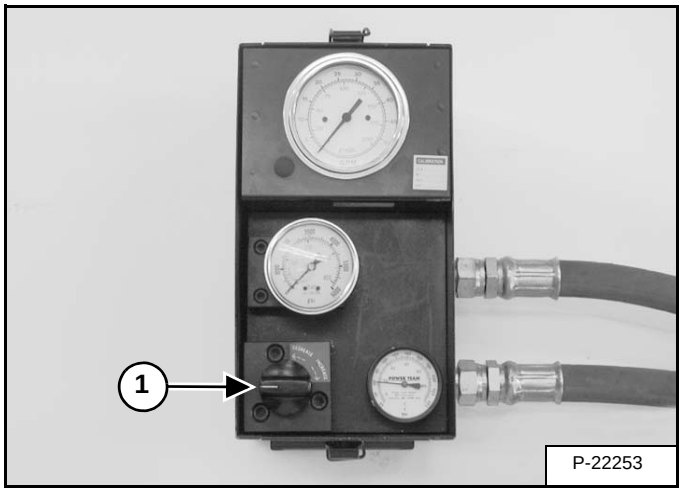


Connect the inlet (Item 1) **[Figure 20-50-6]** of the tester to the pump.

Connect the outlet of the tester to the hose (Item 2) **[Figure 20-50-6]** that was removed from the pump.

Testing The Piston Pump (Cont'd)

Figure 20-50-7



NOTE: Open the flow control knob (Item 1) [Figure 20-50-7] 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 150° F (66° C) by turning the restrictor valve until the gauge reads about 1000 PSI (69 bar). Do not exceed system pressure.

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

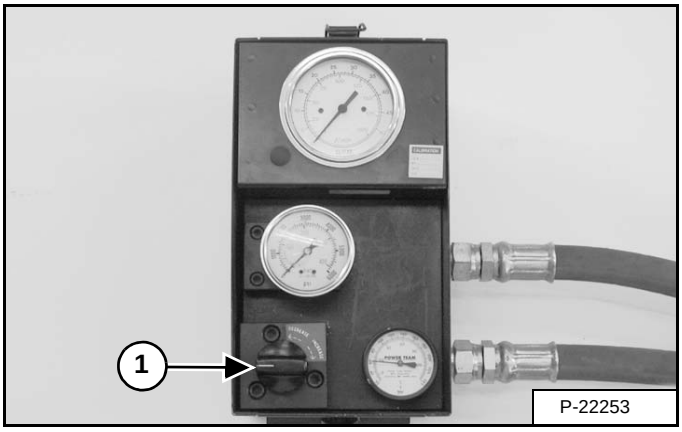
Record the pump free flow GPM (L/min.).

Pump flow on a new piston pump is 3.96 GPM (15,0 L/min.) @ 2500 RPM.

Repeat the procedure for pump outlet two.

The pump flow must be equal between outlet one and two.

Figure 20-50-8



Close the flow control knob (Item 1) **[Figure 20-50-8]** slowly to 100 PSI below the relief valve setting 3300 PSI (228 bar).

Record the pump high pressure flow GPM (L/min.).

NOTE: The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \text{ x100}$$

If the high pressure flow is less than 80% of free flow, remove the hydraulic pump for repair or replacement.

Repeat the procedure for pump outlet two.

The pump flow must be equal between outlet one and two.

Testing The Gear Pump

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

Figure 20-50-9

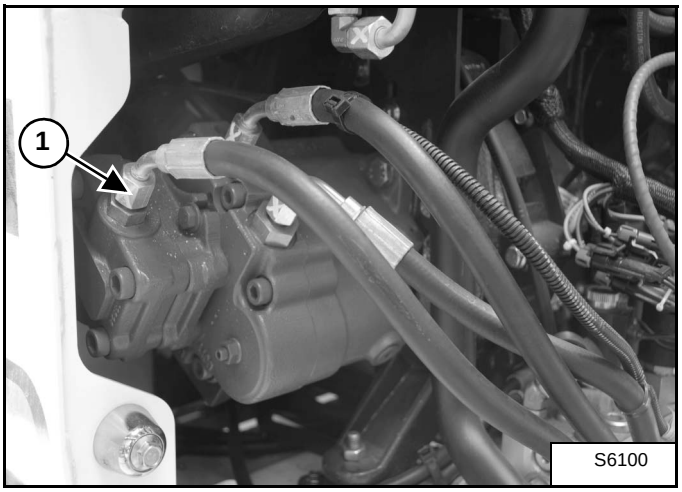
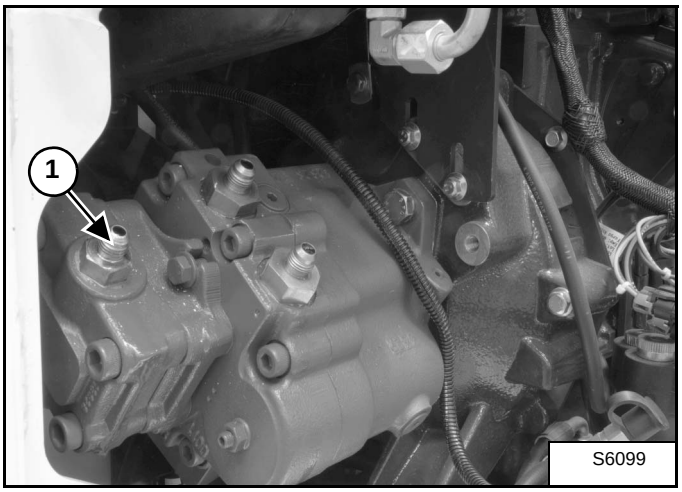
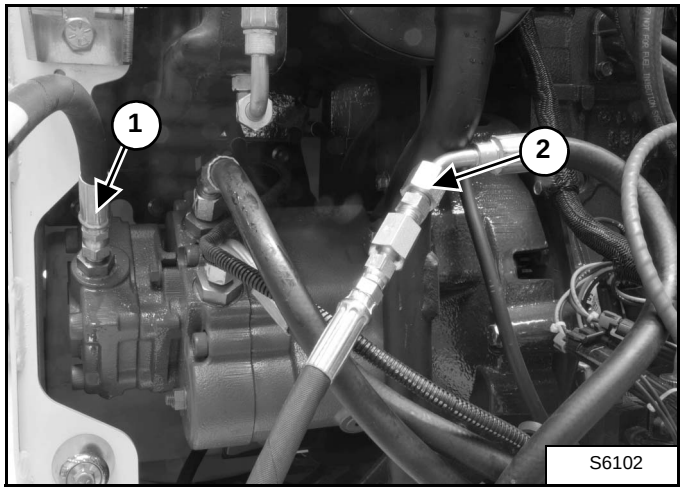


Figure 20-50-10



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

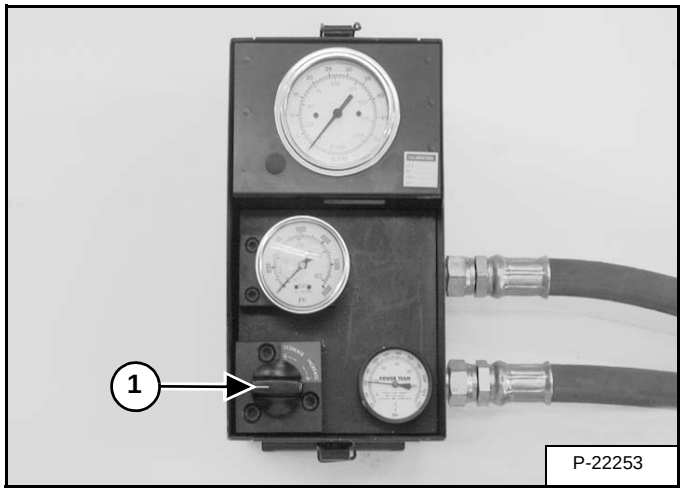
Figure 20-50-11



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 150° F (66° C) by turning the restrictor valve until the gauge reads about 1000 PSI (69 bar). Do not exceed system pressure.

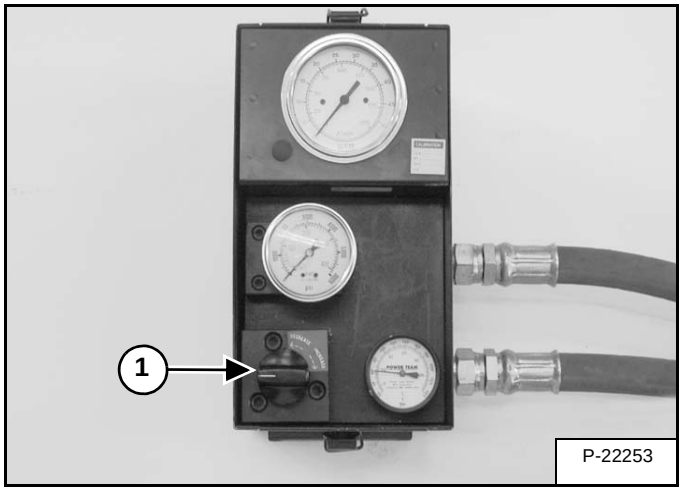
After the temperature is correct, open the restrictor valve fully.

Testing The Gear Pump (Cont'd)

Record the pump free flow GPM (L/min.).

Pump flow on a new gear pump is 3.43 GPM (13,0 L/min.) @ 2500 RPM.

Figure 20-50-13



Close the flow control knob (Item 1) **[Figure 20-50-13]** slowly to 100 PSI below the relief valve setting 3300 PSI (228 bar).

Record the pump high pressure flow GPM (L/min.).

NOTE: The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \text{ x100}$$

If the high pressure flow is less than 80% of free flow, remove the hydraulic pump for repair or replacement.

Testing Auxiliary Hydraulic Flow

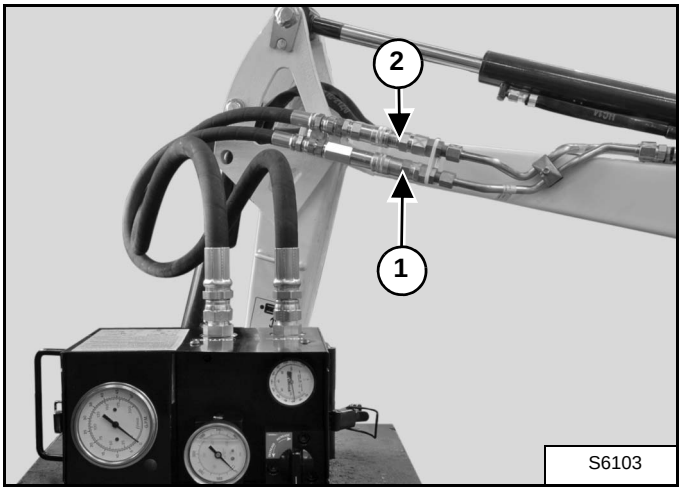
All testing is done with the hydraulic oil at operating temperature and the engine high speed setting.

The following tool will be needed for the auxiliary hydraulic flow test:

MEL10003-Hydraulic Tester.

Stop the engine.

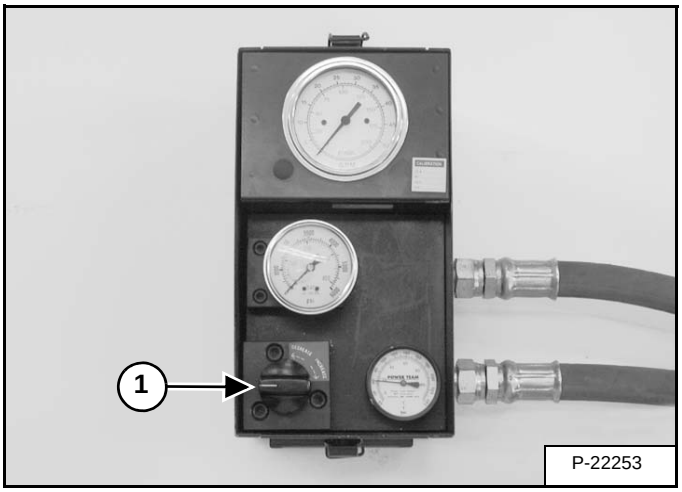
Figure 20-50-14



Connect the inlet side of the tester to the female coupler (Item 1) **[Figure 20-50-14]**. Connect the outlet side of the tester to the male coupler (Item 2) **[Figure 20-50-14]**.

Testing The Auxiliary Hydraulic Flow (Cont'd)

Figure 20-50-15



NOTE: Open the flow control knob (Item 1) [Figure 20-50-15] fully.

Start the engine, and run at low RPM. Engage the auxiliary hydraulic circuit.

NOTE: When engaging the auxiliary hydraulic circuit, make sure the female coupler is pressure and the male coupler is return.

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 150° F (66° C) by turning the restrictor valve until the gauge reads about 1000 PSI (69 bar). Do not exceed system pressure.

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

Record the auxiliary hydraulic free flow GPM (L/min.).

Removal And Installation

Lower the boom / bucket and blade to the ground.

Relieve hydraulic pressure.

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

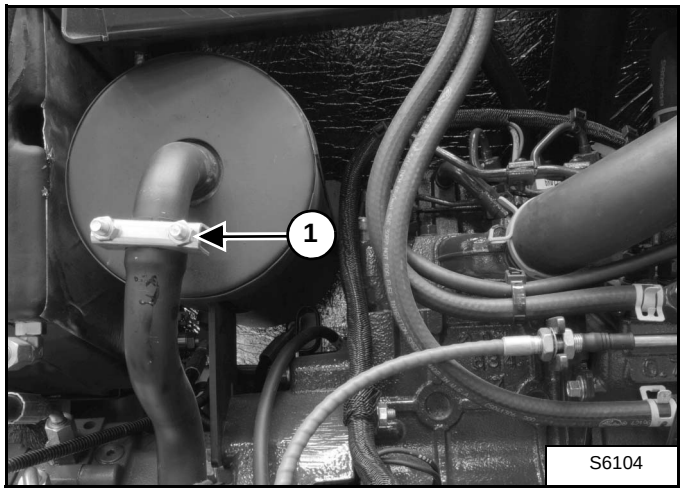
Drain the pump.

IMPORTANT

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

I-2003-0888

Figure 20-50-16

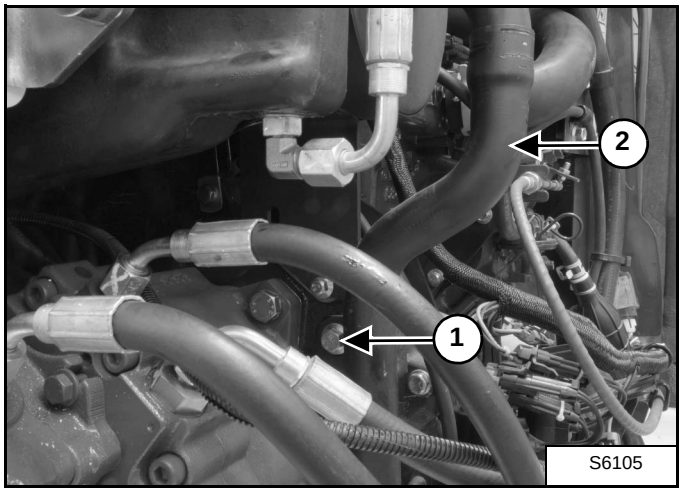


Loosen the exhaust extension clamp (Item 1) **[Figure 20-50-16]**.

Installation: Tighten clamp to 5.90-7.37 ft.-lb. (8-10 N•m) torque.

Removal And Installation (Cont'd)

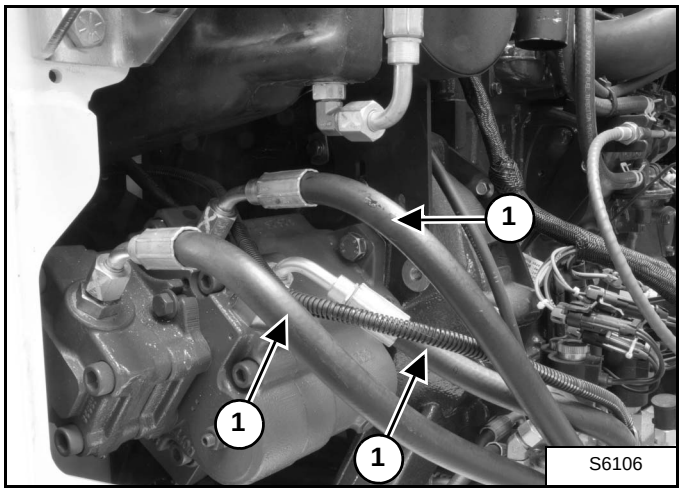
Figure 20-50-17



Remove the bolt (Item 1) **[Figure 20-50-17]** from the exhaust extension mounting bracket.

Slide exhaust extension (Item 2) **[Figure 20-50-17]** off the muffler and remove from excavator.

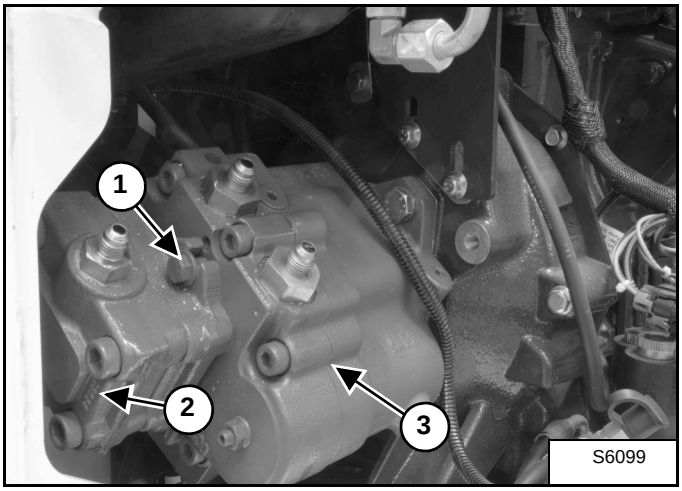
Figure 20-50-18



Mark and remove the three pressure hoses (Item 1) **[Figure 20-50-18]**.

Cap and plug the hoses and fittings.

Figure 20-50-19

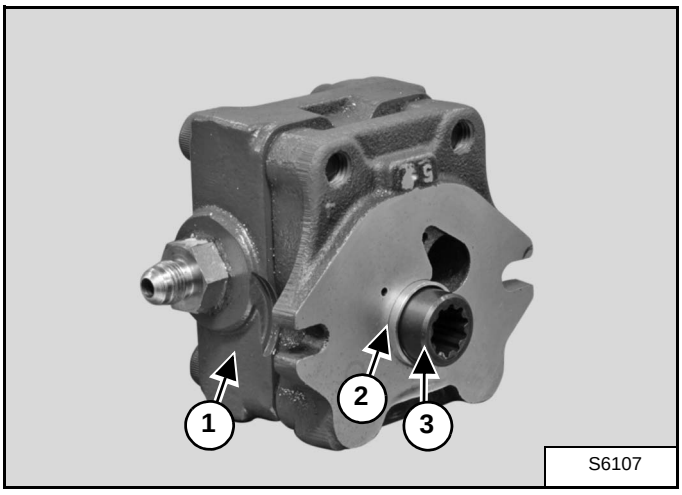


Remove the two bolts (Item 1) **[Figure 20-50-19]** from the gear pump.

Installation: Tighten bolts to 15.2-18.1 ft.-lb. (20,6-24,5 N•m) torque.

Remove the gear pump (Item 2) from the end of the piston pump (Item 3) **[Figure 20-50-19]**.

Figure 20-50-20

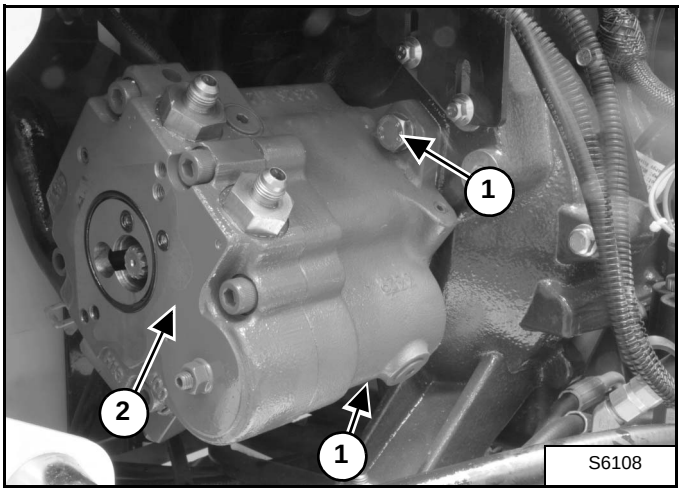


Once the gear pump (Item 1) has been removed, there is a set collar (Item 2), coupling (Item 3) **[Figure 20-50-20]** and O-rings (Item 4) **[Figure 20-50-22]** on the piston pump.

NOTE: The seals for the gear pump (Item 1) [Figure 20-50-20] are the only serviceable parts in the gear pump. Order new gear pump seals from Bobcat Parts.

Removal And Installation (Cont'd)

Figure 20-50-21

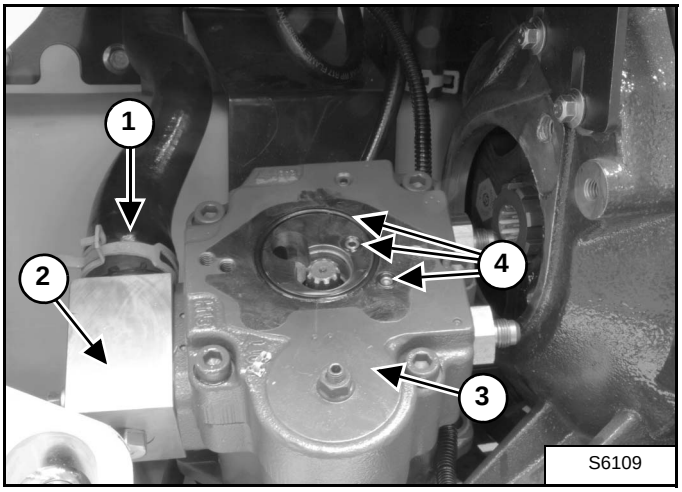


Remove the hydraulic pump mounting bolts and washers (Item 1) **[Figure 20-50-21]**.

Remove the piston pump (Item 2) **[Figure 20-50-21]** from the side of the flywheel housing.

Installation: Tighten bolts to 85-78 ft.-lb. (105-115 N•m) torque.

Figure 20-50-22

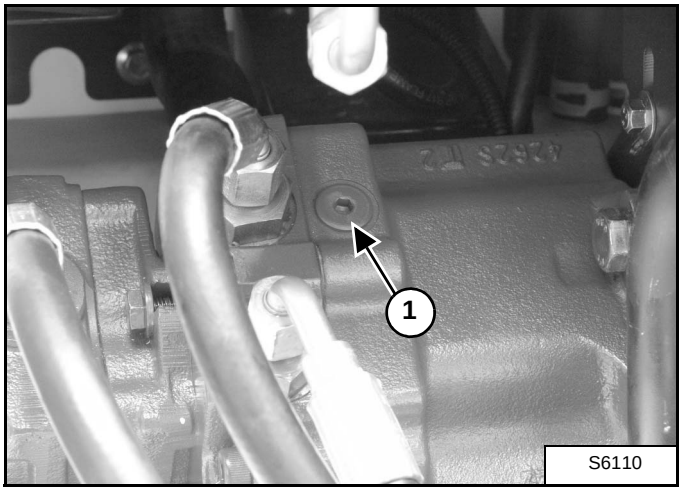


Remove the pump inlet hose (Item 1) from the pump block (Item 2) **[Figure 20-50-22]**.

Remove the piston pump (Item 3) **[Figure 20-50-22]** from the excavator.

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

Figure 20-50-23

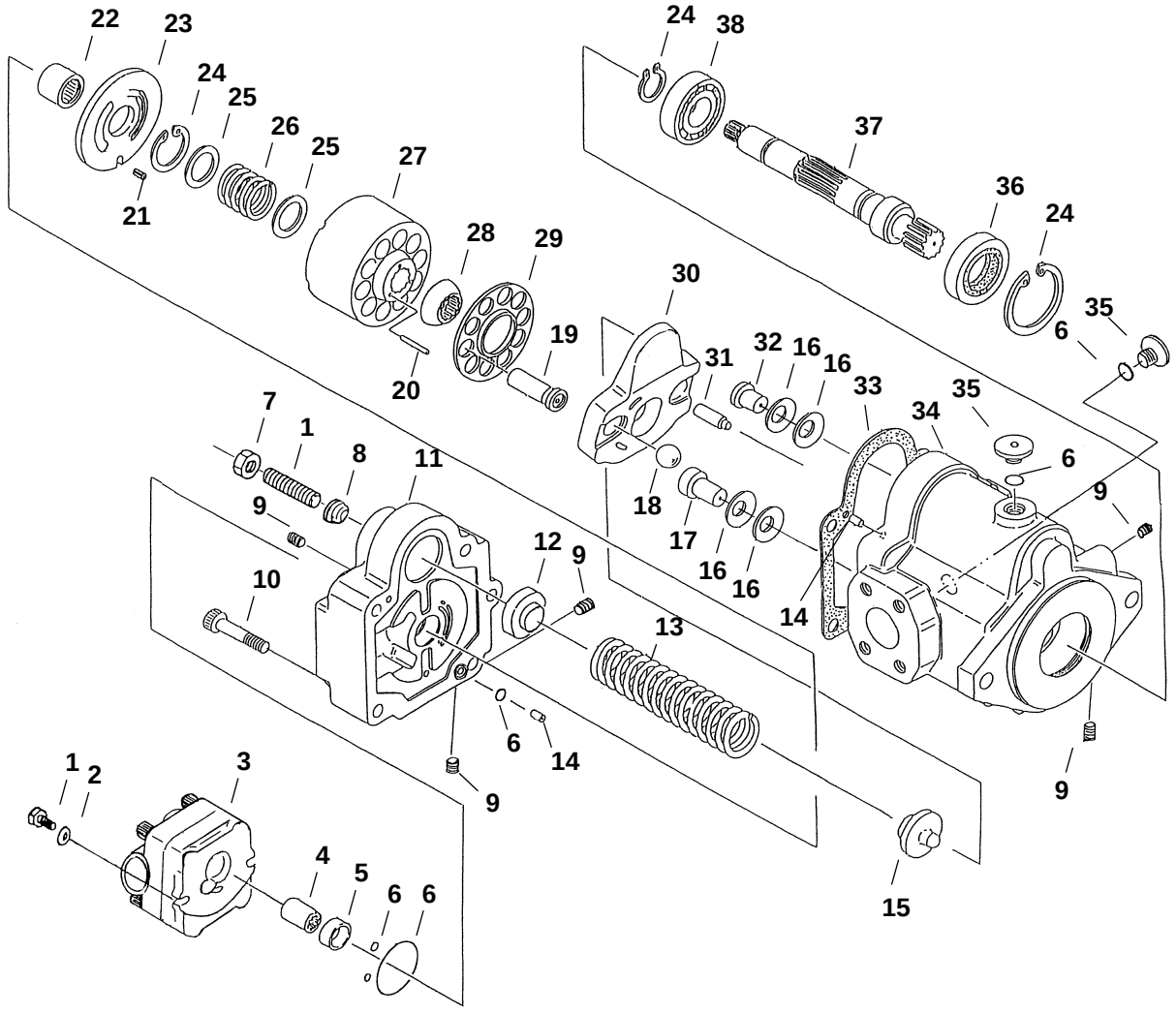


Installation: Remove the oil supply plug (Item 1) **[Figure 20-50-23]** on the hydraulic pump. Install the oil supply plug after a steady stream of hydraulic fluid free of any air drains from the hydraulic pump.

Installation: Tighten plug to 21.7-25.3 ft.-lb. (29,4-34,3 N•m) torque.

Parts Identification

1. Screw
2. Washer
3. Gear Pump
4. Coupler
5. Collar
6. O-Ring
7. Nut
8. Seal Washer
9. Plug
10. Screw
11. Pump Housing
12. Spring Guide
13. Spring
14. Pin
15. Spring Holder
16. Dish Washer
17. Stopper Pin B
18. Ball
19. Piston / Shoe
20. Needle
21. Spring Pin
22. Needle Bearing
23. Valve Plate
24. Snap Ring
25. Retainer
26. Spring
27. Cylinder Barrel
28. Barrel Holder
29. Shoe Holder
30. Swash Plate
31. Rod
32. Stopper Pin A
33. Packing
34. Pump Housing
35. Plug
36. Oil Seal
37. Shaft
38. Bearing



P-62409

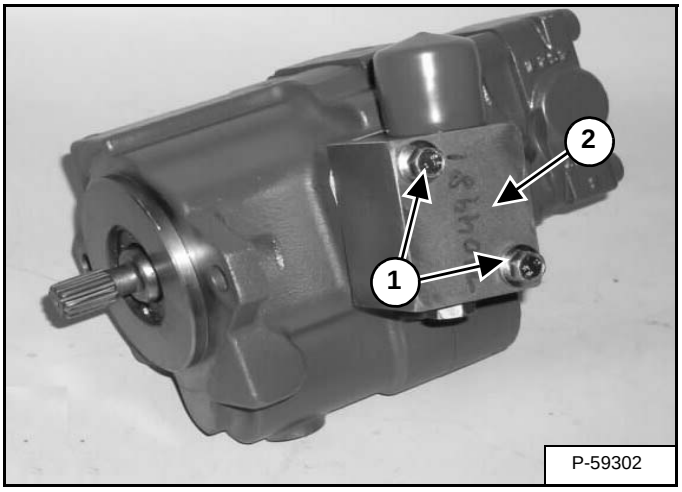
Disassembly

IMPORTANT

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

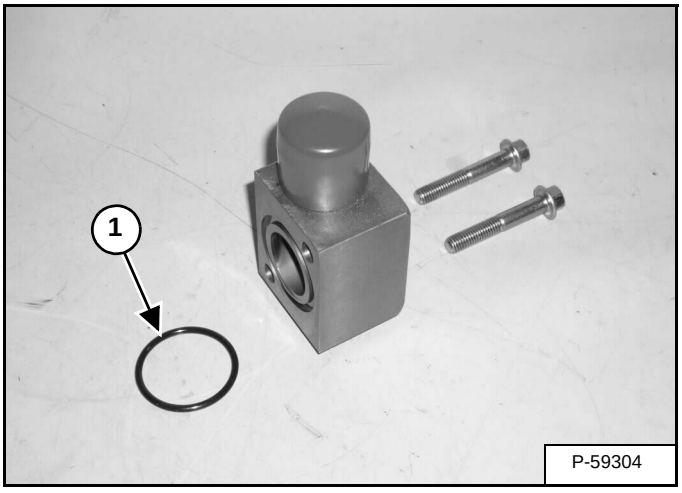
I-2003-0888

Figure 20-50-24



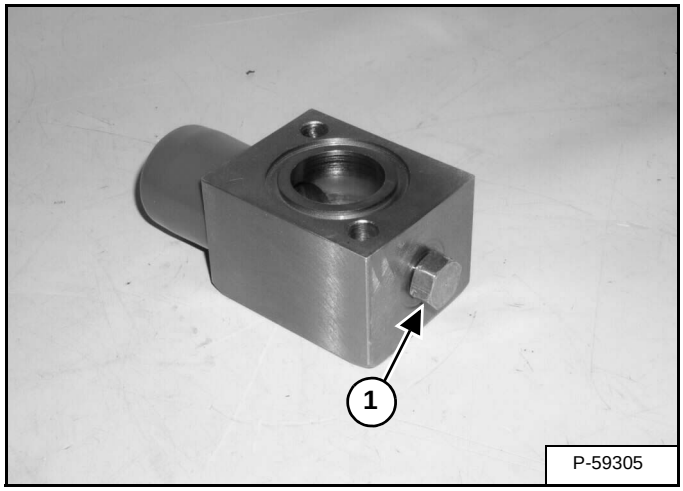
Remove the two bolts (Item 1) and pump block (Item 2) **[Figure 20-50-24]** from the back of the piston pump.

Figure 20-50-25



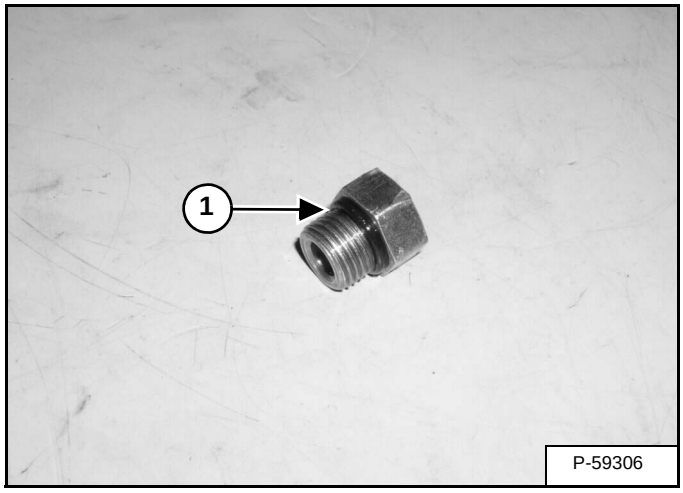
Remove the O-ring (Item 1) **[Figure 20-50-25]** from the pump block.

Figure 20-50-26



Remove the plug (Item 1) **[Figure 20-50-26]** from the pump block.

Figure 20-50-27



Remove the O-ring (Item 1) **[Figure 20-50-27]** from the plug.

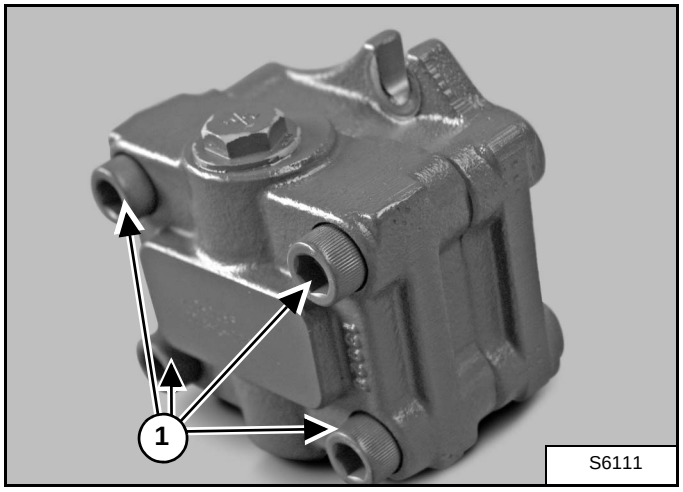
Gear Pump Disassembly

IMPORTANT

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

I-2003-0888

Figure 20-50-28



Mark the halves of the gear pump to aid in the assembly process.

Remove the four bolts (Item 1) **[Figure 20-50-28]** from the gear pump.

Figure 20-50-29

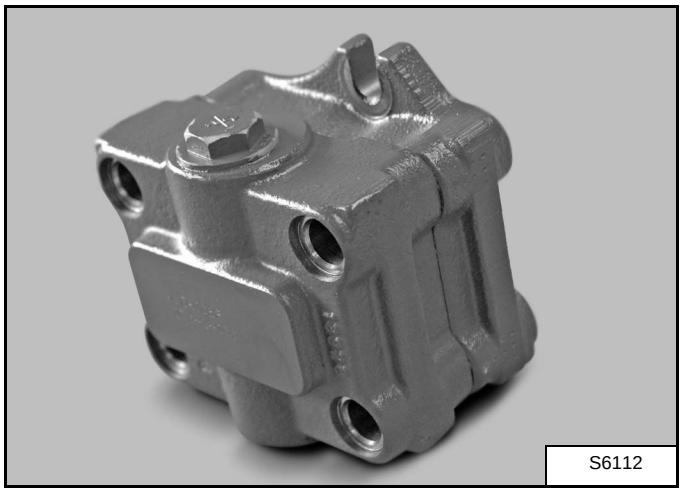
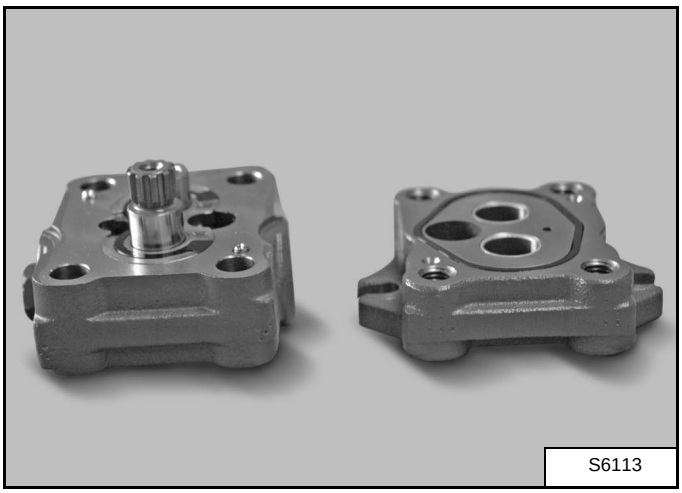
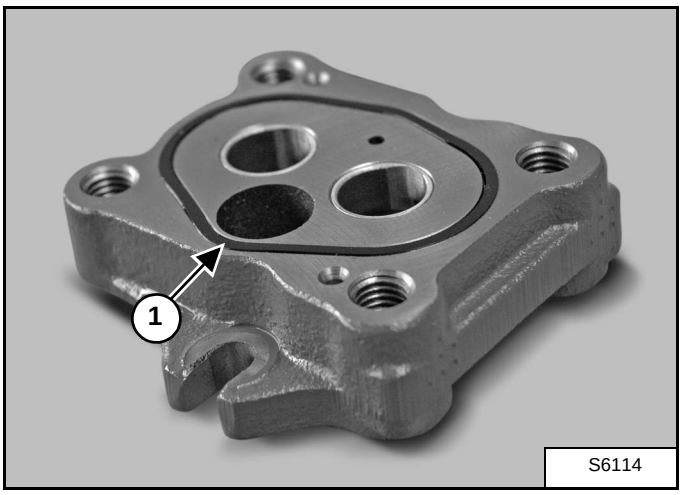


Figure 20-50-30



Separate the two halves of the gear pump **[Figure 20-50-29]** and **[Figure 20-50-30]**.

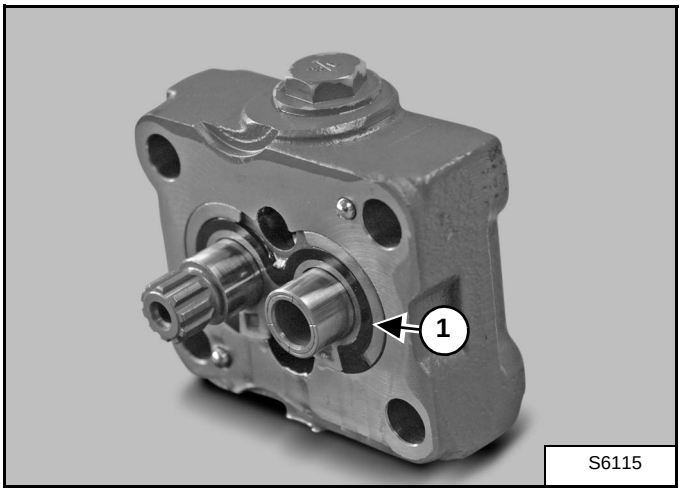
Figure 20-50-31



Remove the seal (Item 1) **[Figure 20-50-31]**.

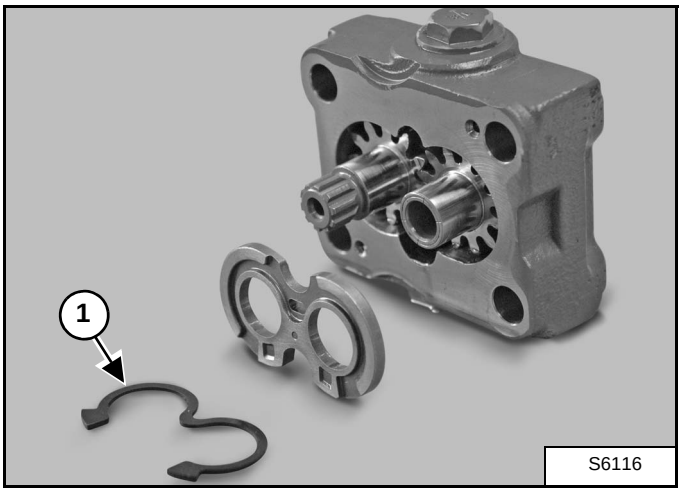
Gear Pump Disassembly (Cont'd)

Figure 20-50-32



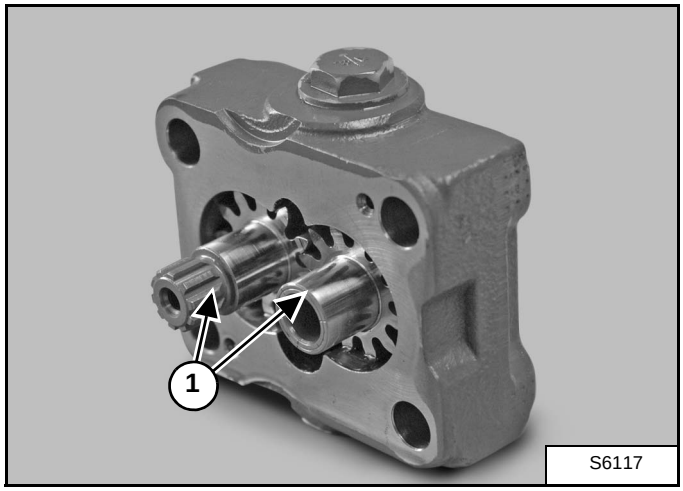
Remove the bearing (Item 1) **[Figure 20-50-32]**.

Figure 20-50-33



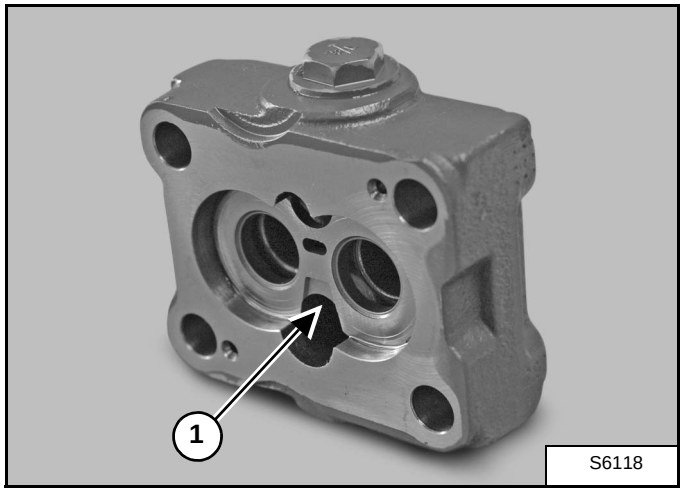
Remove the seal (Item 1) **[Figure 20-50-33]**.

Figure 20-50-34



Remove the drive and idler gears (Item 1) **[Figure 20-50-34]**.

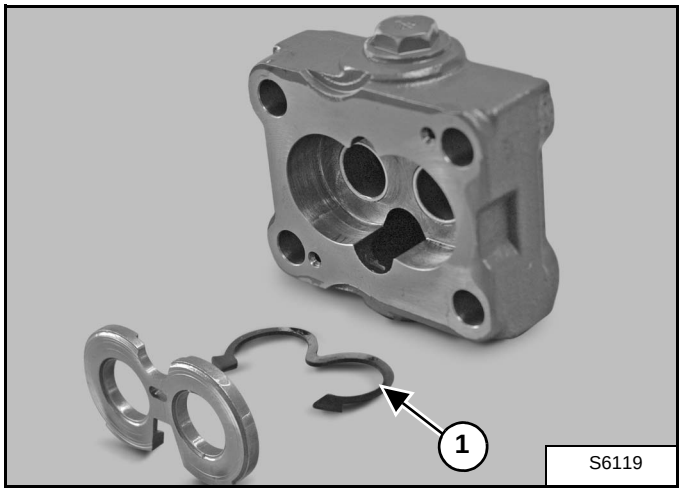
Figure 20-50-35



Remove the bearing (Item 1) **[Figure 20-50-35]**.

Gear Pump Disassembly (Cont'd)

Figure 20-50-36

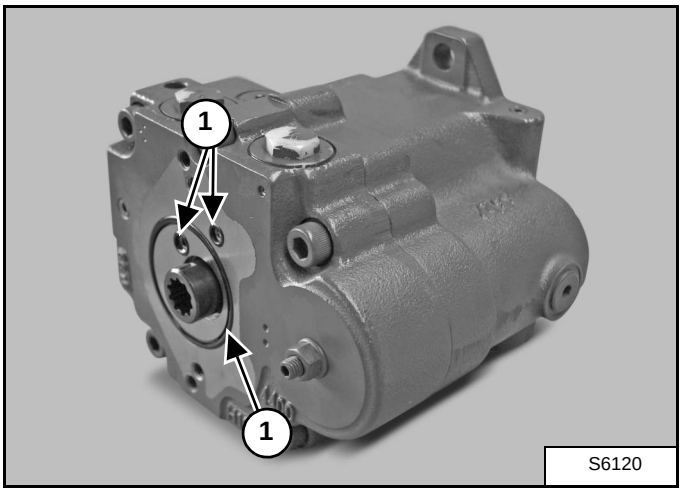


Remove the seal (Item 1) **[Figure 20-50-36]**.

NOTE: The gear housing, two bearings, drive and idler gears are not serviced separately. If any part is damaged, the entire gear pump assembly must be replaced.

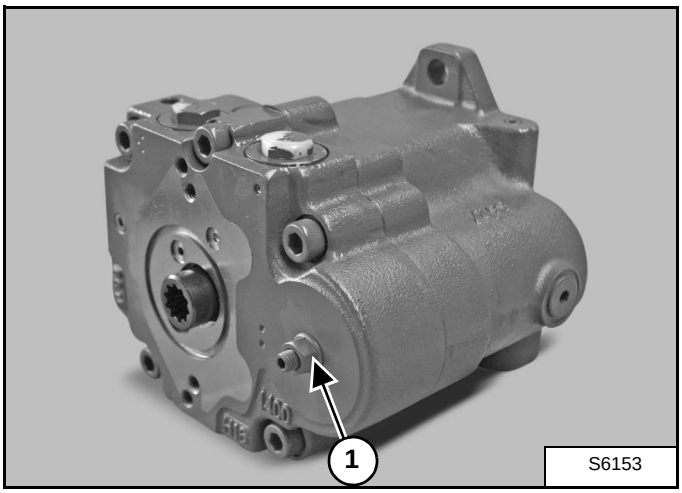
Piston Pump Disassembly

Figure 20-50-37



Remove the three O-rings (Item 1) **[Figure 20-50-37]** from the pump housing.

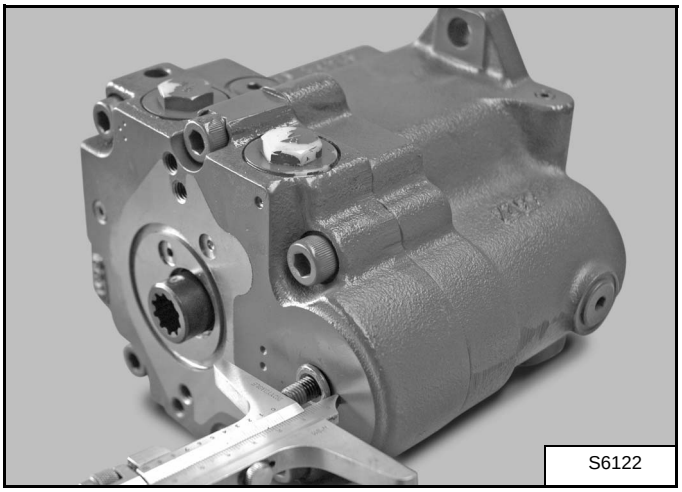
Figure 20-50-38



Remove the pressure adjustment nut (Item 1) **[Figure 20-50-38]** from the pump housing.

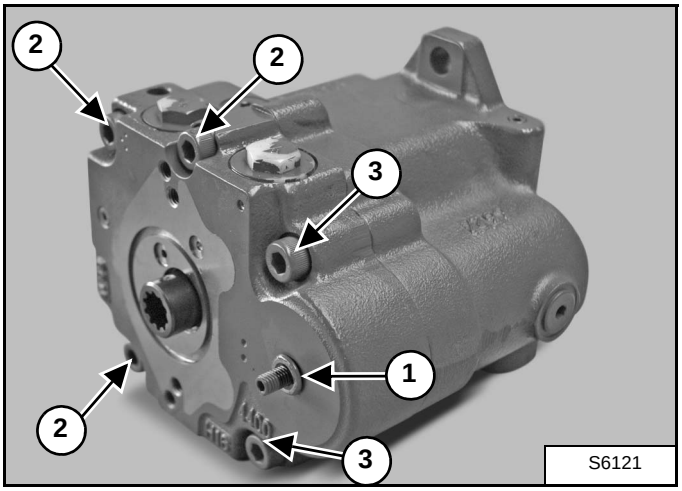
Piston Pump Disassembly (Cont'd)

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

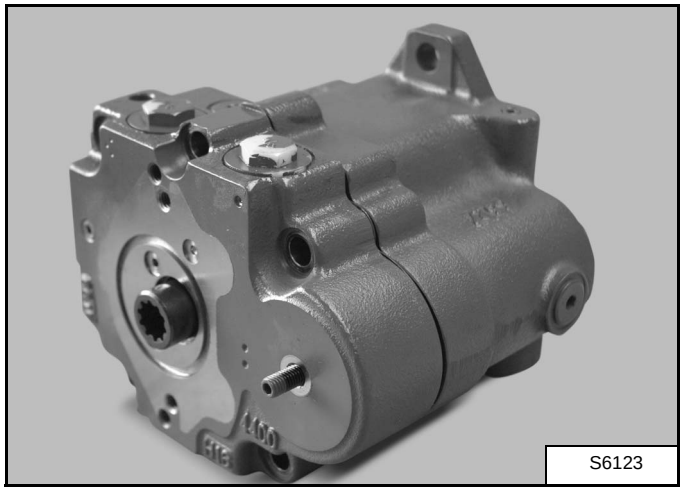


Remove the seal washer (Item 1) **[Figure 20-50-40]** from the pump housing.

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

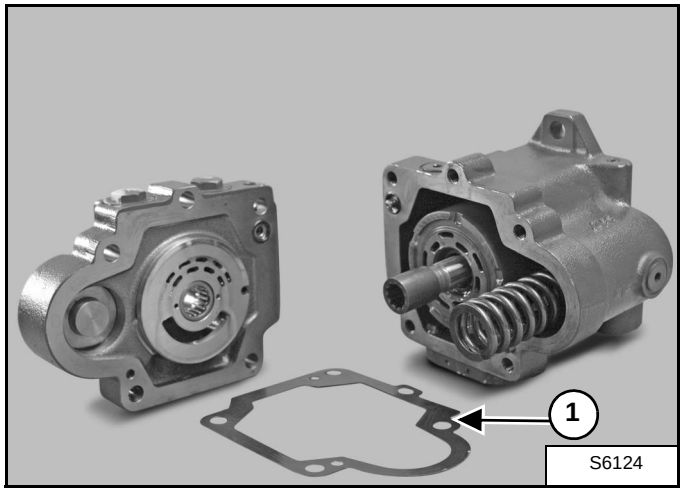
Remove the two bolts (Item 3) **[Figure 20-50-40]** from either side of the pressure adjusting spring in the pump housing.

Figure 20-50-41



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

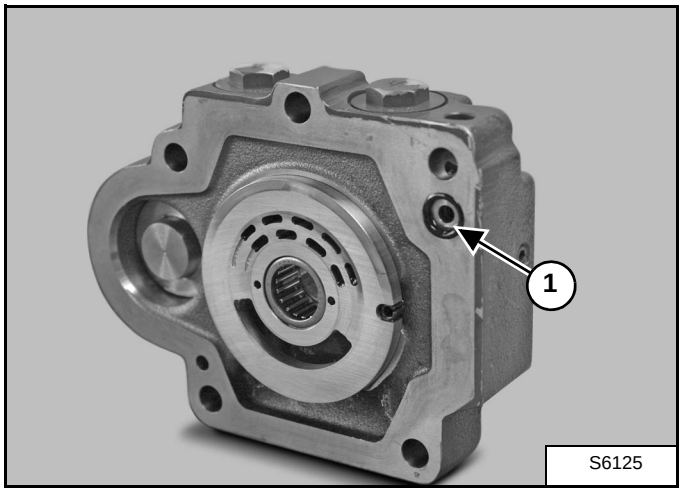
Figure 20-50-42



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

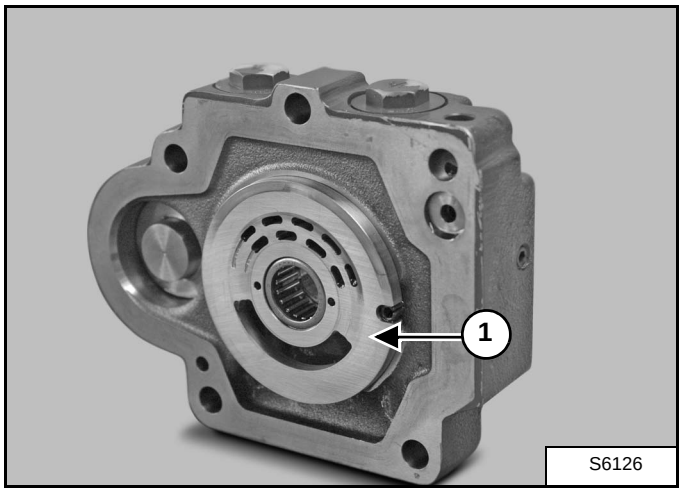
Piston Pump Disassembly (Cont'd)

Figure 20-50-43



Remove the O-ring (Item 1) **[Figure 20-50-43]** from the pump housing.

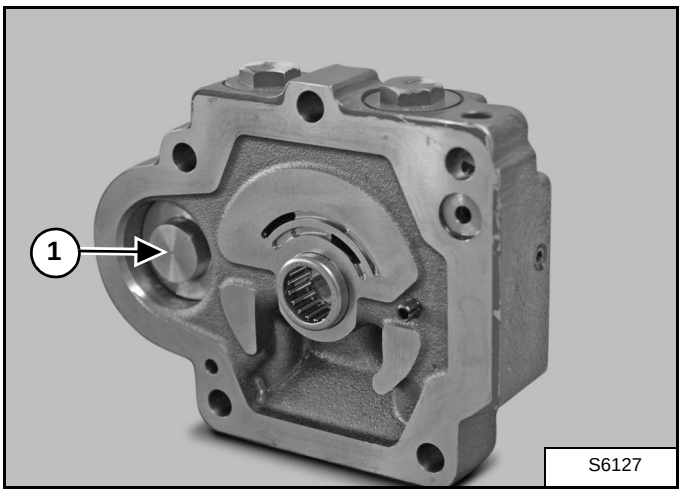
Figure 20-50-44



Remove the valve plate (Item 1) **[Figure 20-50-44]** from the pump housing.

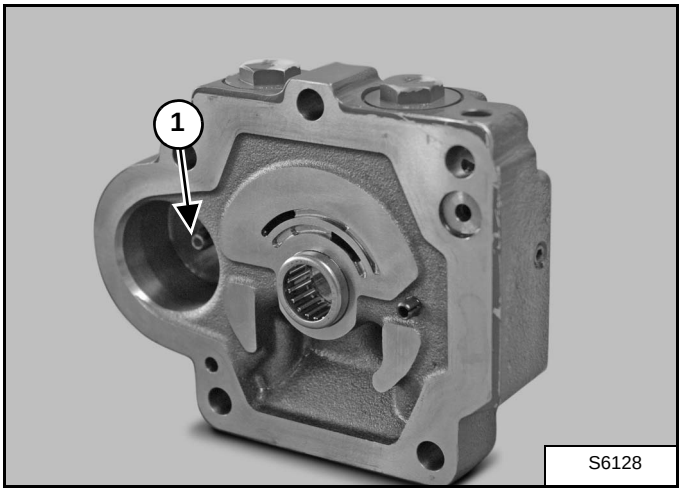
NOTE: Visually inspect valve plate for scratches, abnormal wear or damage.

Figure 20-50-45



Remove the spring guide (Item 1) **[Figure 20-50-45]** from the pump housing.

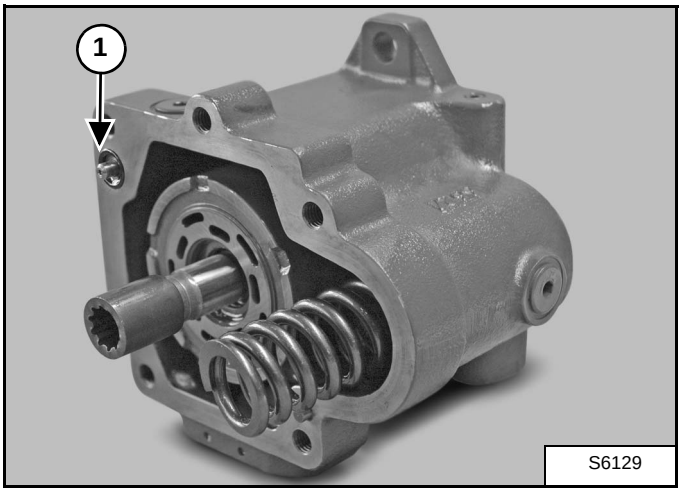
Figure 20-50-46



Remove the screw (Item 1) **[Figure 20-50-46]** from the pump housing.

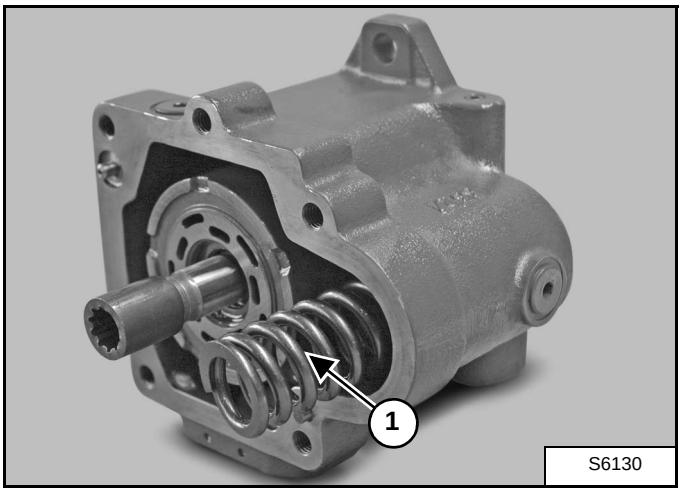
Piston Pump Disassembly (Cont'd)

Figure 20-50-47



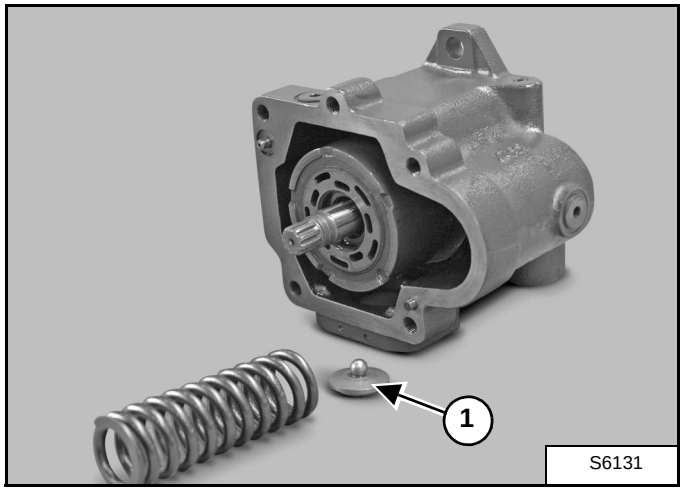
Remove the O-ring (Item 1) **[Figure 20-50-47]**.

Figure 20-50-48



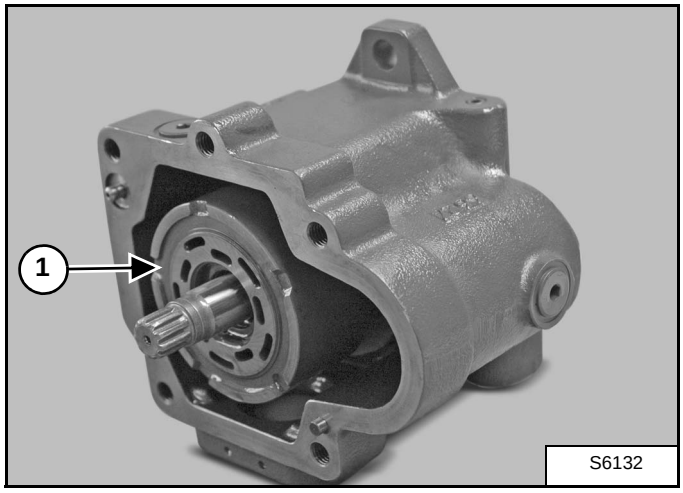
Remove the spring (Item 1) **[Figure 20-50-48]** from the pump housing.

Figure 20-50-49



Remove the spring seat (Item 1) **[Figure 20-50-49]** from the pump housing.

Figure 20-50-50

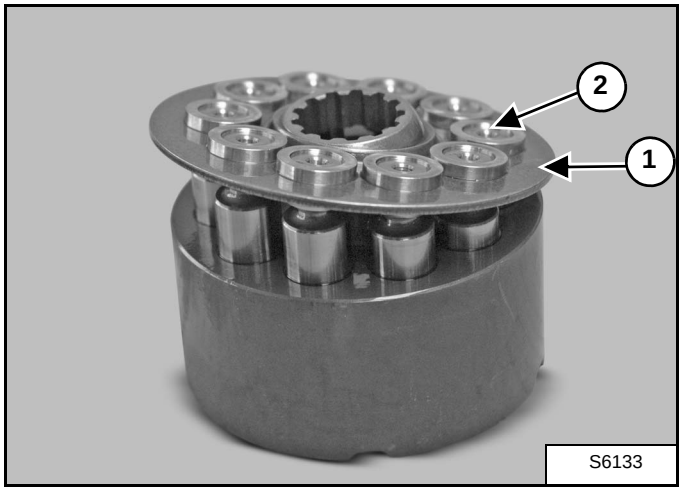


Remove the cylinder barrel assembly (Item 1) **[Figure 20-50-50]** from the pump housing.

Piston Pump Disassembly (Cont'd)

NOTE: The following procedure shown is to disassemble the rotating group for inspection only. The rotating group parts cannot be ordered separately and must be ordered as an assembly.

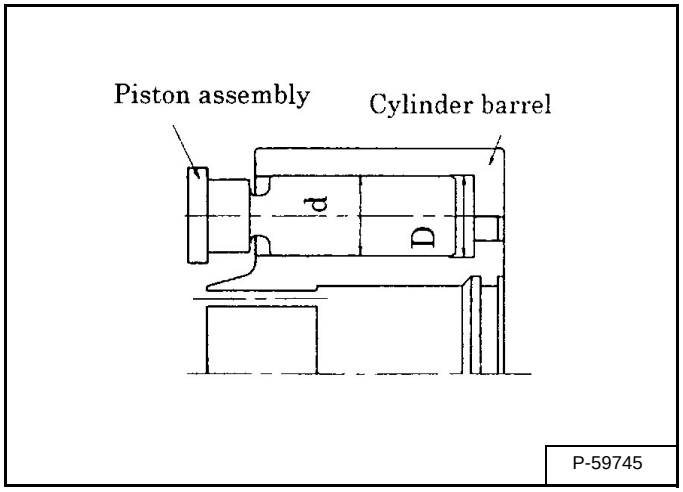
Figure 20-50-51



Remove the shoe holder (Item 1) and piston assemblies (Item 2) **[Figure 20-50-51]** from the cylinder barrel.

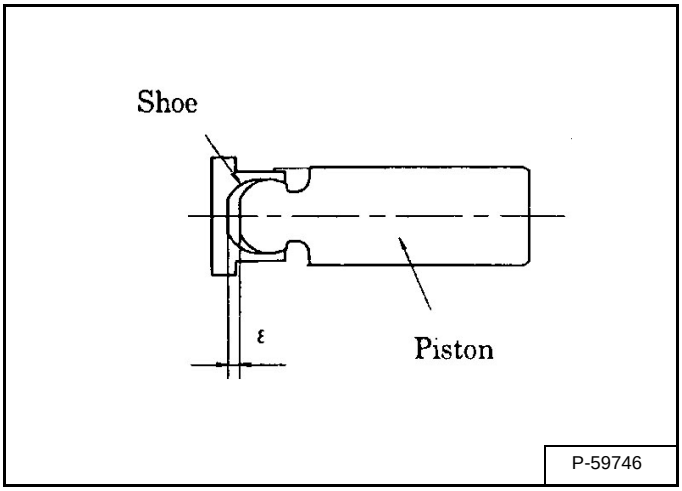
NOTE: Visually inspect piston assemblies and cylinder barrel for scratches, abnormal wear or damage.

Figure 20-50-52



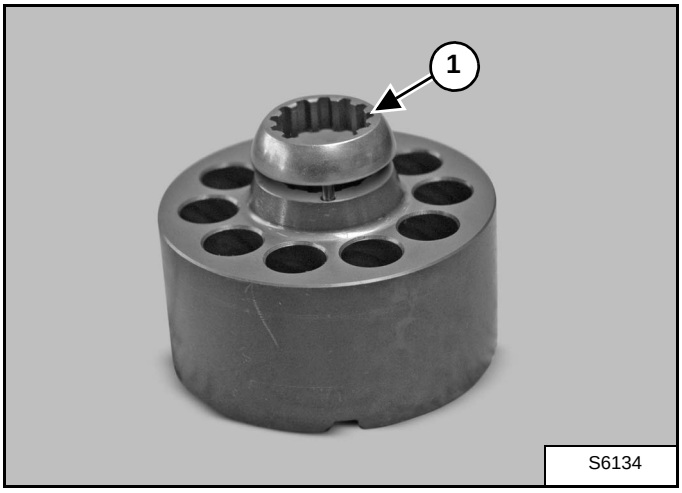
Inspect the difference between the inner diameter of cylinder barrel (D) and the outer diameter of piston (d) **[Figure 20-50-52]**. The difference should be less than 0.002 in. (0.05 mm).

Figure 20-50-53



The clearance between the piston and shoe **[Figure 20-50-53]** should be less than 0.008 in. (0.2 mm).

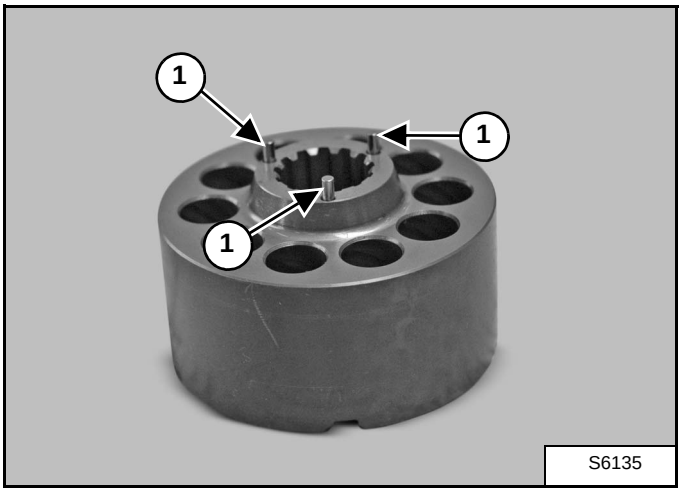
Figure 20-50-54



Remove the barrel holder (Item 1) **[Figure 20-50-54]**.

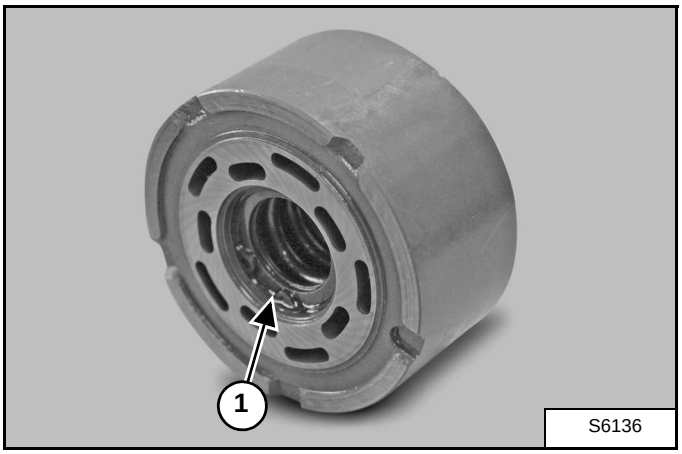
Piston Pump Disassembly (Cont'd)

Figure 20-50-55



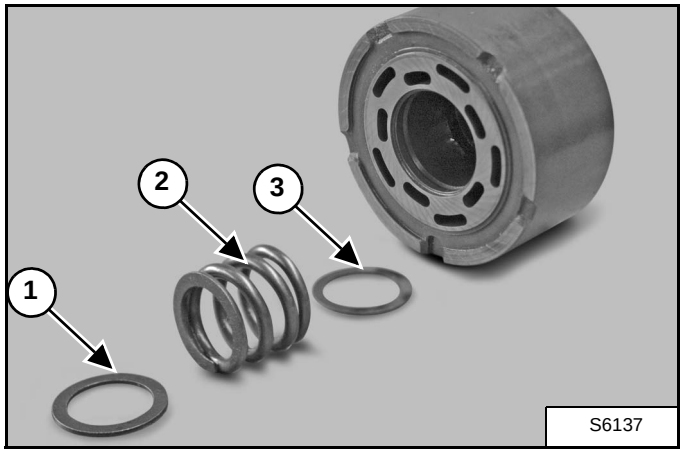
Remove the three needles (Item 1) **[Figure 20-50-55]**.

Figure 20-50-56



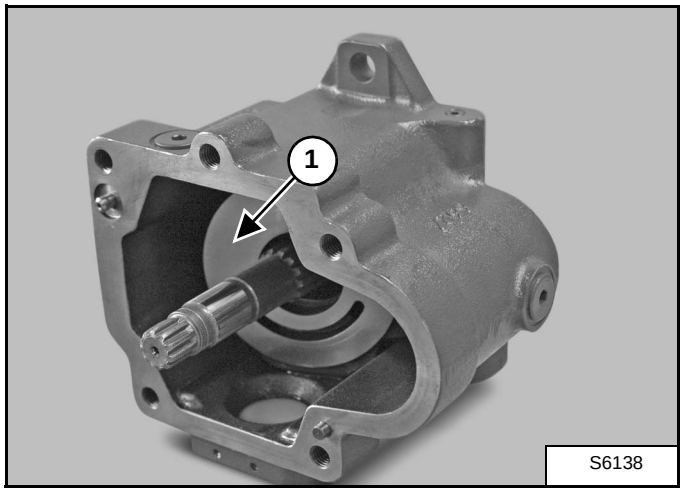
Remove the snap ring (Item 1) **[Figure 20-50-56]** in the cylinder barrel.

Figure 20-50-57



Remove the retainer (Item 1), spring (Item 2) and retainer (Item 3) **[Figure 20-50-57]**.

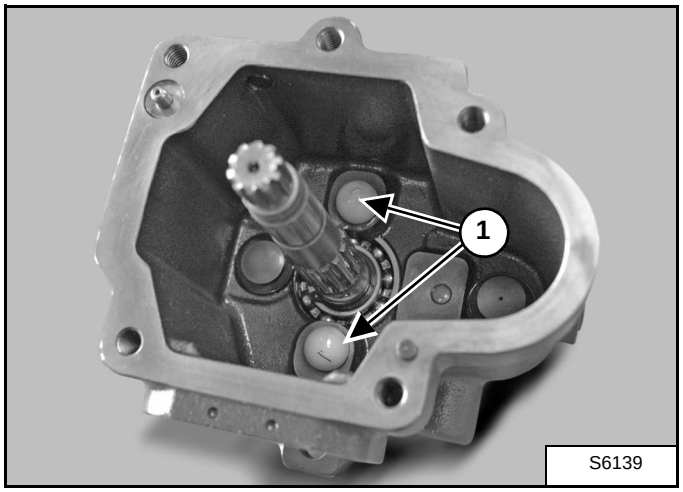
Figure 20-50-58



Remove the swash plate (Item 1) **[Figure 20-50-58]** from the pump housing.

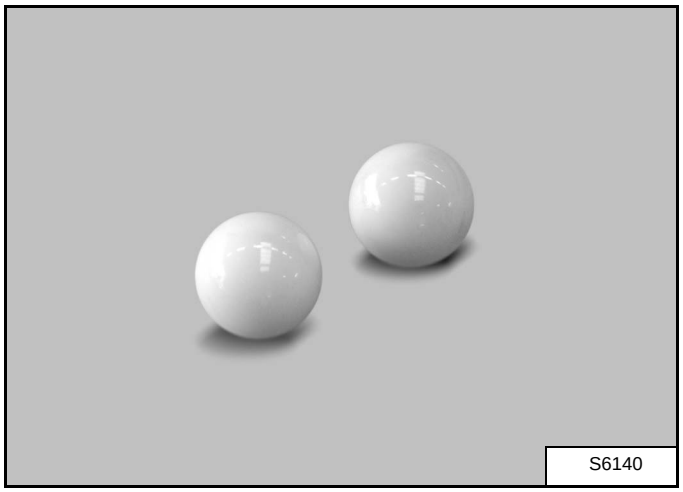
Piston Pump Disassembly (Cont'd)

Figure 20-50-59



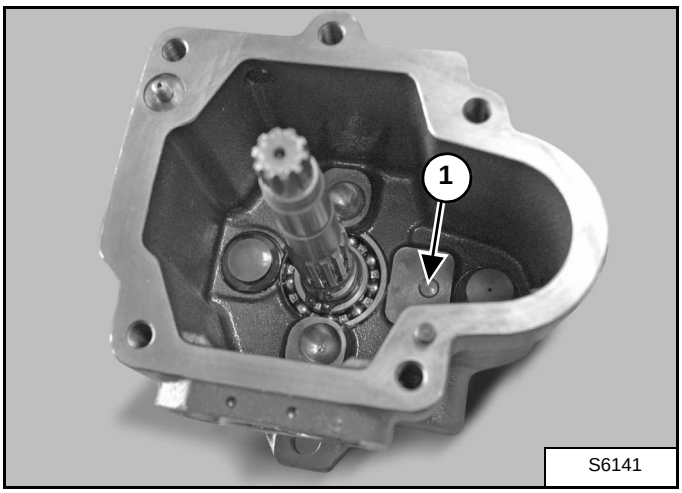
Remove the balls (Item 1) **[Figure 20-50-59]** from the pump housing.

Figure 20-50-60



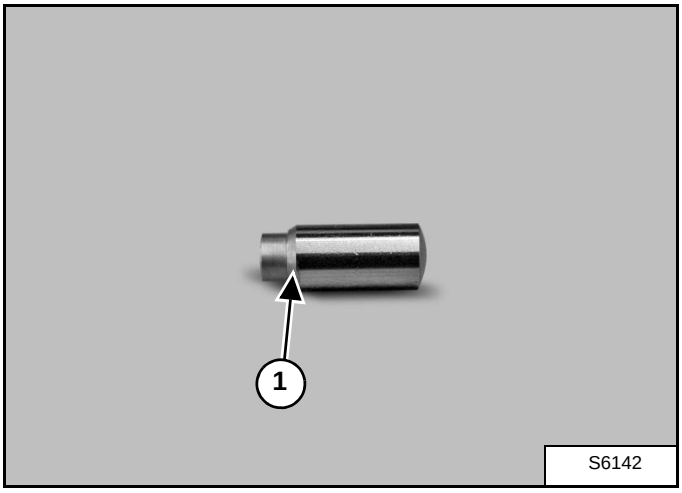
Visually inspect the balls for scratches, abnormal wear or damage **[Figure 20-50-60]**.

Figure 20-50-61



Remove the rod (Item 1) **[Figure 20-50-61]** from the pump housing.

Figure 20-50-62



The step in the rod (Item 1) **[Figure 20-50-62]** must be inserted into the pump housing first.

Piston Pump Disassembly (Cont'd)

Figure 20-50-63

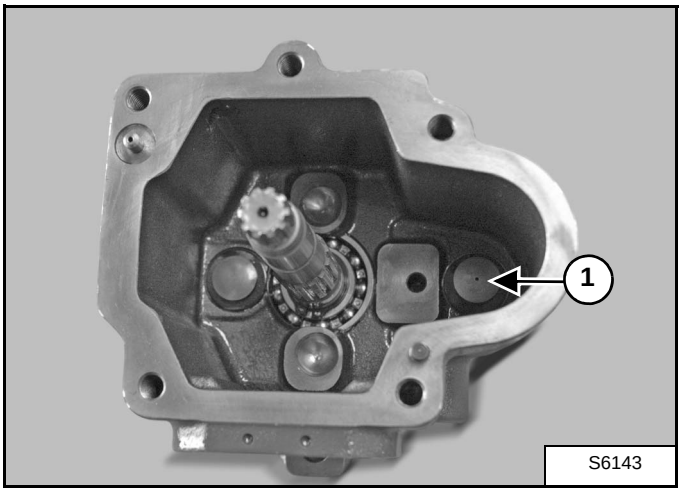
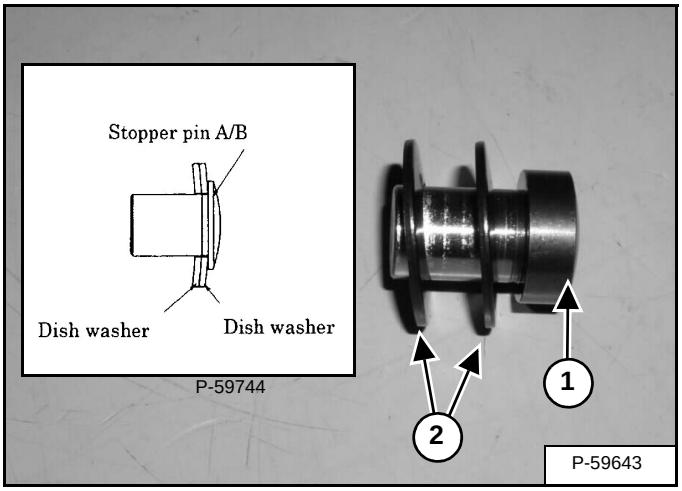


Figure 20-50-64



Remove the stopper pin A (Item 1) **[Figure 20-50-63]** and **[Figure 20-50-64]** and the two dish washers (Item 2) **[Figure 20-50-64]** from the pump housing.

Figure 20-50-65

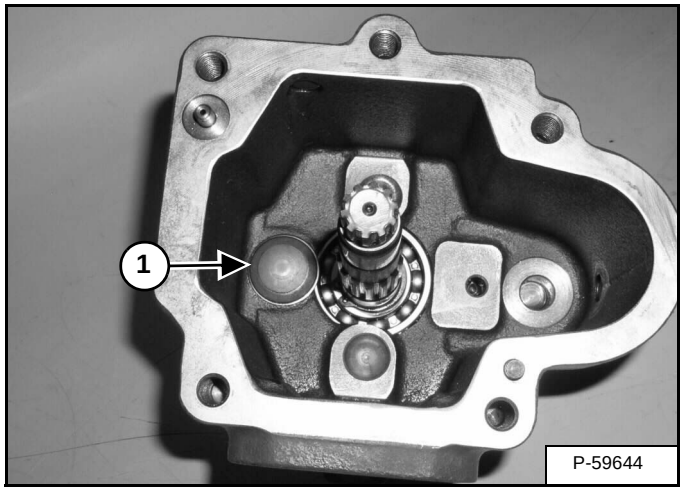
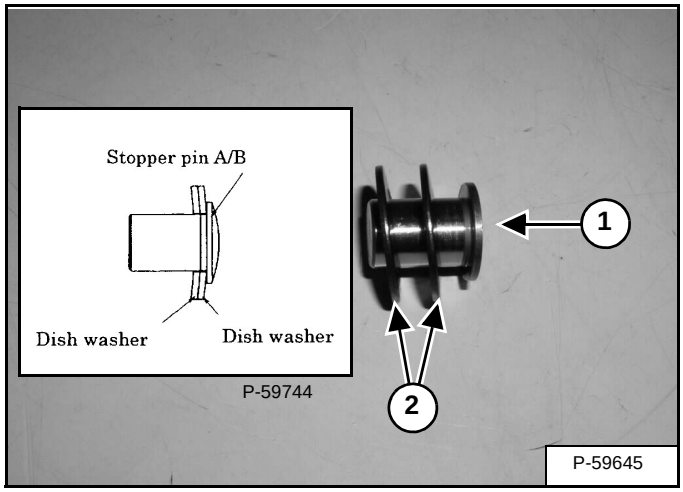


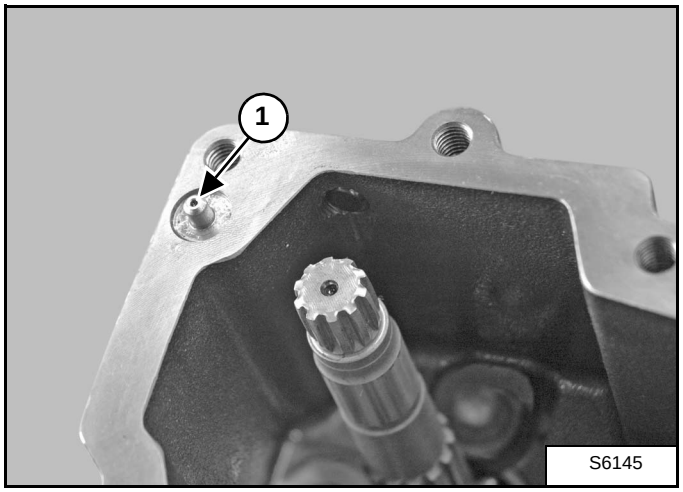
Figure 20-50-66



Remove the stopper pin B (Item 1) **[Figure 20-50-65]** and **[Figure 20-50-66]** and the two dish washers (Item 2) **[Figure 20-50-66]** from the pump housing.

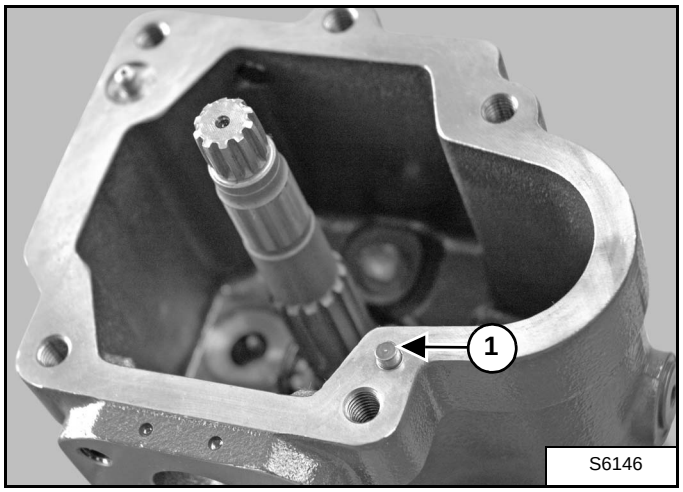
Piston Pump Disassembly (Cont'd)

Figure 20-50-67



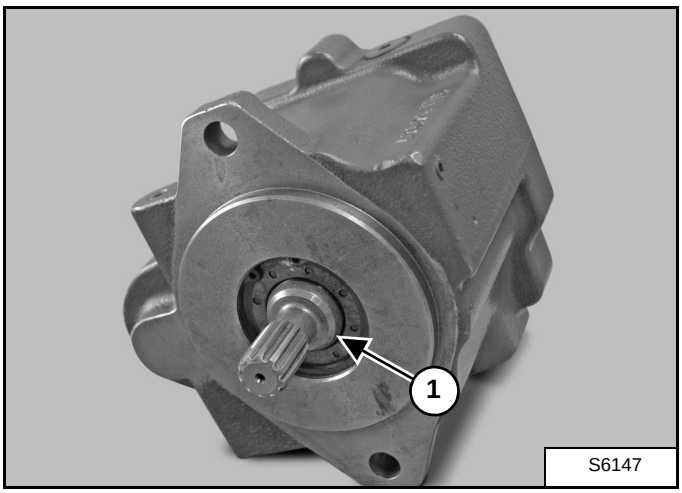
Remove the pin (Item 1) **[Figure 20-50-67]** from the pump housing.

Figure 20-50-68



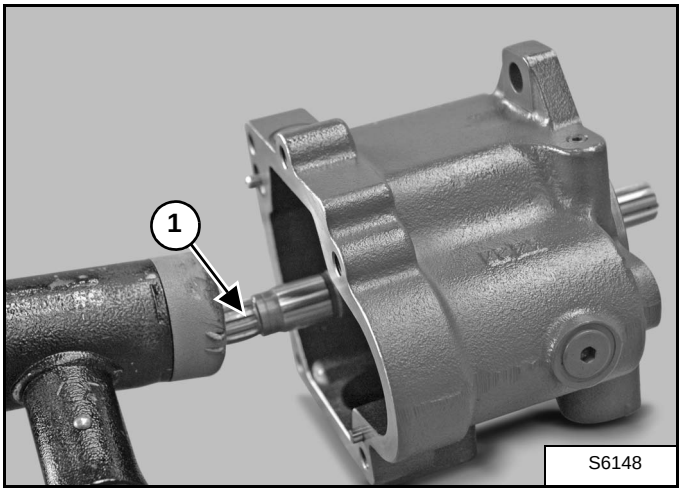
Remove the pin (Item 1) **[Figure 20-50-68]** from the pump housing.

Figure 20-50-69



Remove the snap ring (Item 1) **[Figure 20-50-69]** from the pump housing.

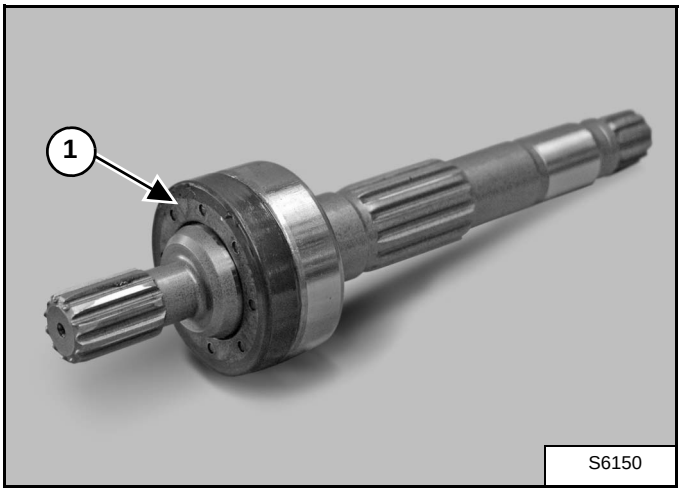
Figure 20-50-70



Remove the shaft and bearing assembly (Item 1) **[Figure 20-50-70]** from the pump housing by tapping the other end of the shaft.

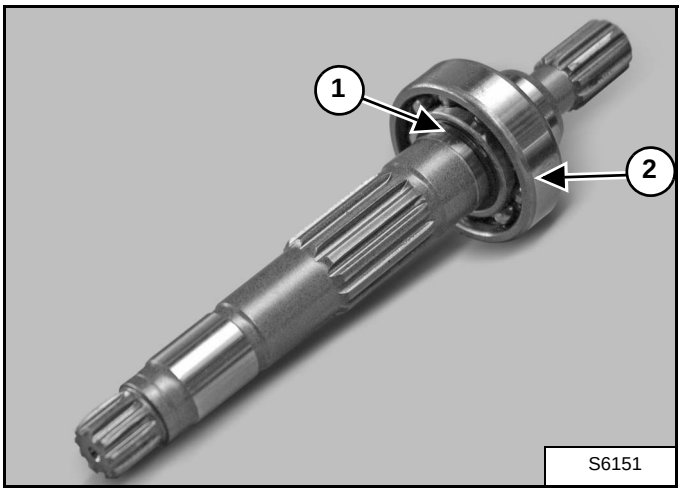
Piston Pump Disassembly (Cont'd)

Figure 20-50-71



Remove the oil seal (Item 1) **[Figure 20-50-71]** from the shaft.

Figure 20-50-72



Remove the snap ring (Item 1) **[Figure 20-50-72]** from the shaft.

Remove the bearing (Item 2) **[Figure 20-50-72]** from the shaft.

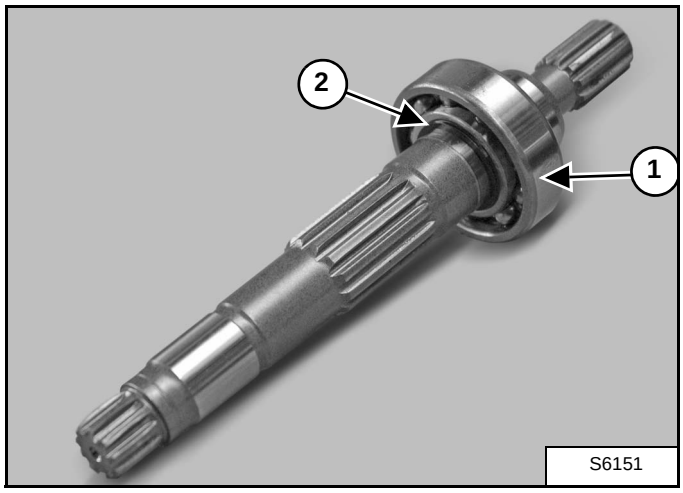
Piston Pump Assembly

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

Always install new seals and O-rings.

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

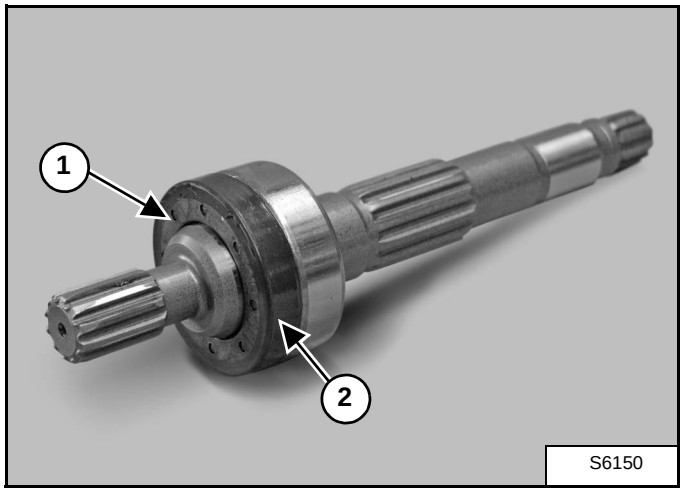
Figure 20-50-73



Install the bearing (Item 1) **[Figure 20-50-73]** on the shaft.

Install the snap ring (Item 2) **[Figure 20-50-73]** on the shaft.

Figure 20-50-74

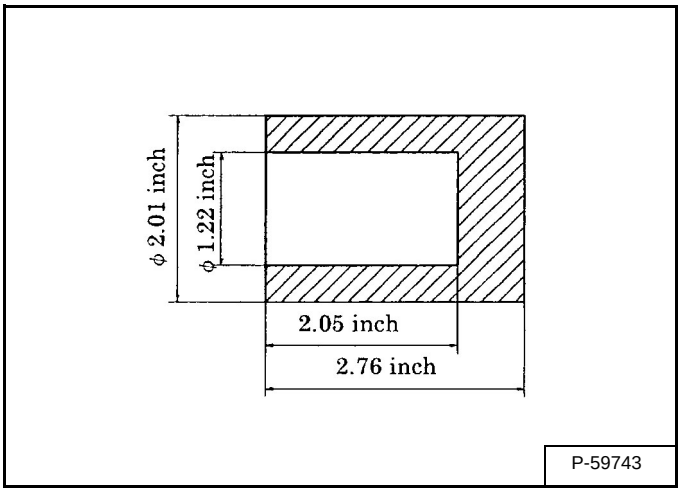


Install the oil seal (Item 1) **[Figure 20-50-74]** on the shaft.

Apply a small quantity of grease to the perimeter of the oil seal lip (Item 2) **[Figure 20-50-74]**.

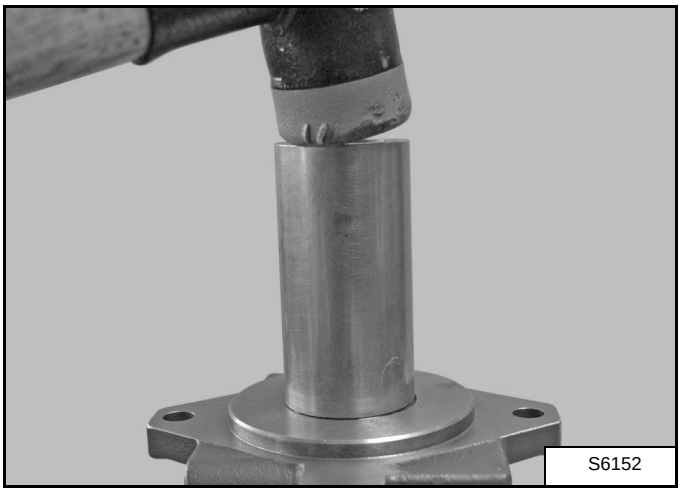
Piston Pump Assembly (Cont'd)

Figure 20-50-75



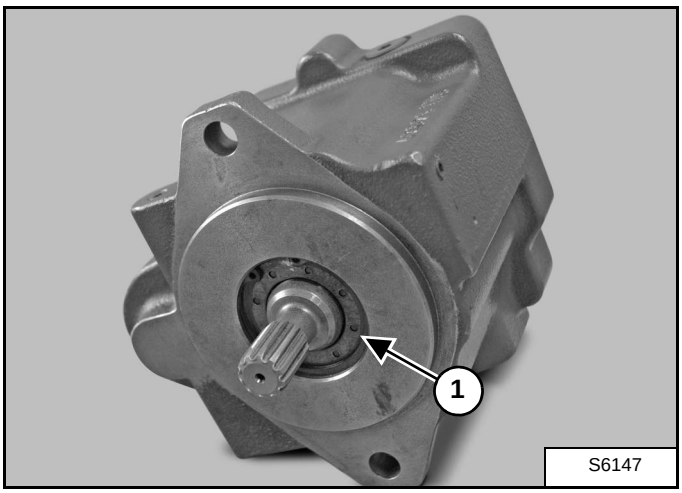
Manufacture the special tool **[Figure 20-50-75]** needed to install the oil seal into the pump housing.

Figure 20-50-76



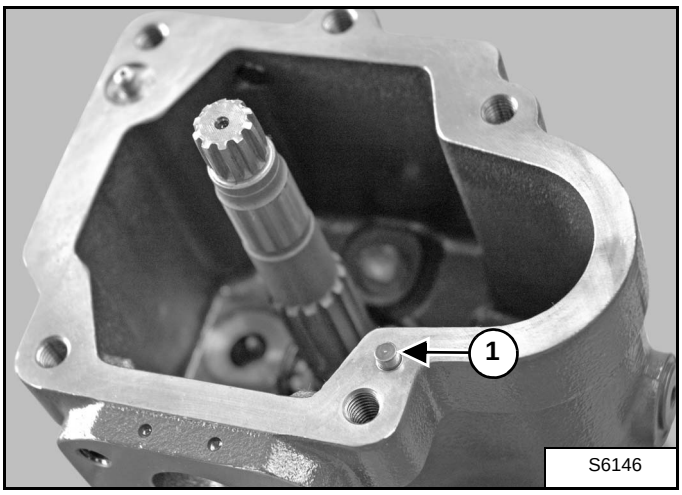
Install the shaft, bearing, and oil seal assembly **[Figure 20-50-74]** into the pump housing by using the special tooling **[Figure 20-50-75]**.

Figure 20-50-77



Install the snap ring (Item 1) **[Figure 20-50-77]** in the pump housing.

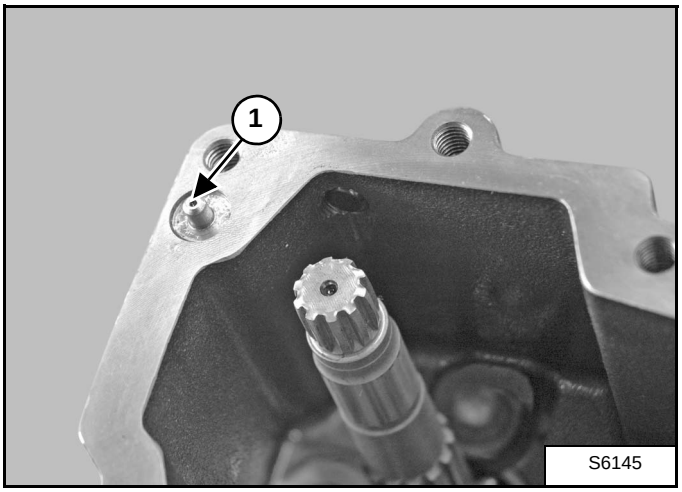
Figure 20-50-78



Install the pin (Item 1) **[Figure 20-50-78]** in the pump housing.

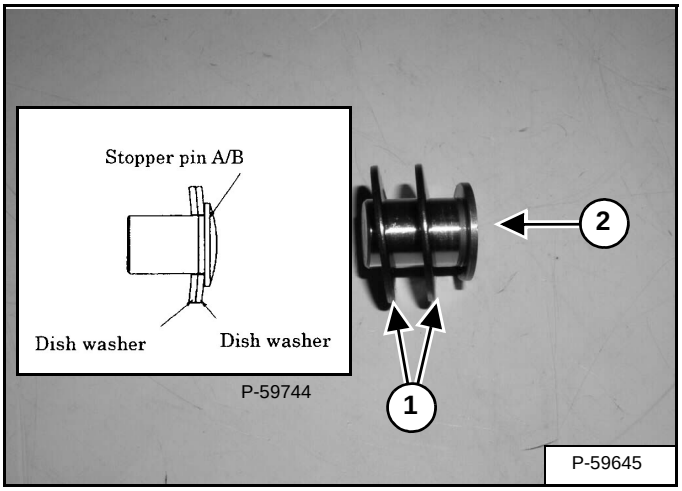
Piston Pump Assembly (Cont'd)

Figure 20-50-79



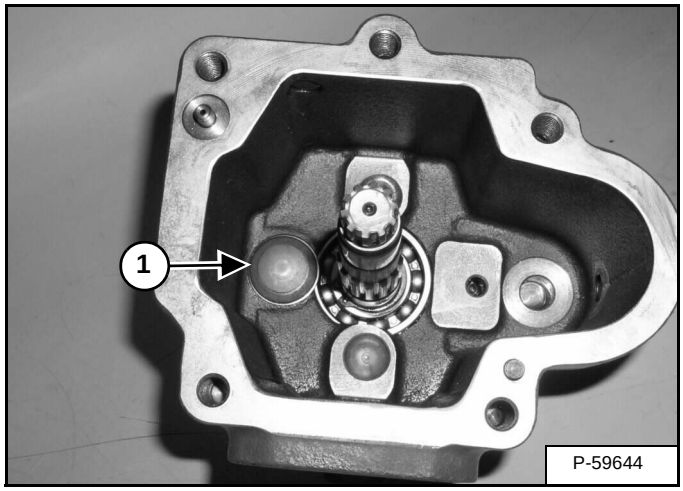
Install the pin (Item 1) **[Figure 20-50-79]** in the pump housing.

Figure 20-50-80



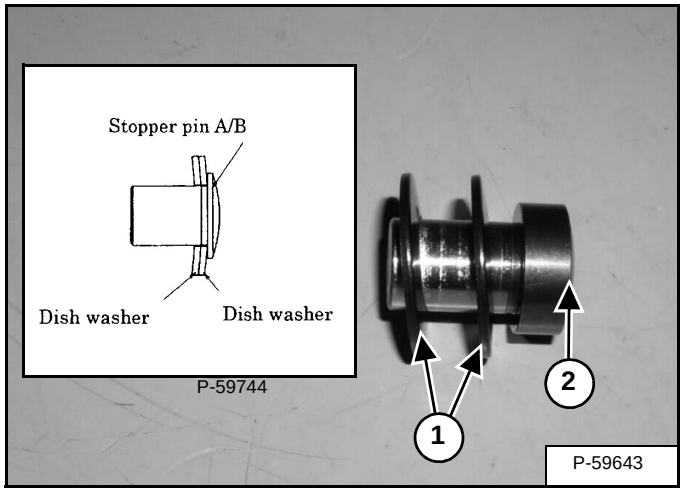
Install the two dish washers (Item 1) **[Figure 20-50-80]** on the stopper pin B (Item 2) **[Figure 20-50-80]**.

Figure 20-50-81



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

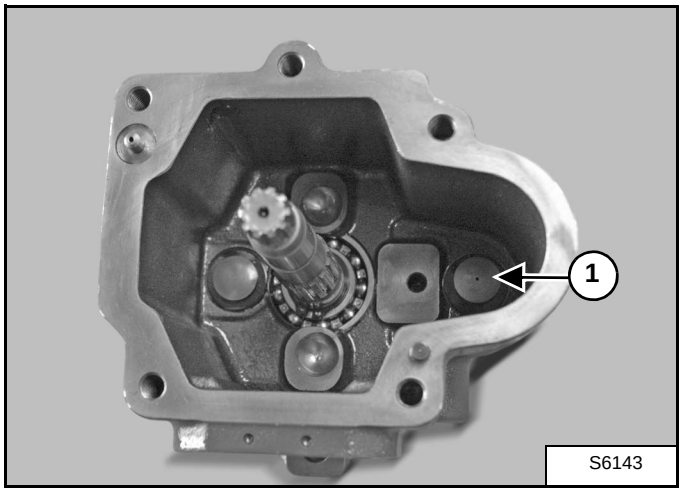
Figure 20-50-82



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

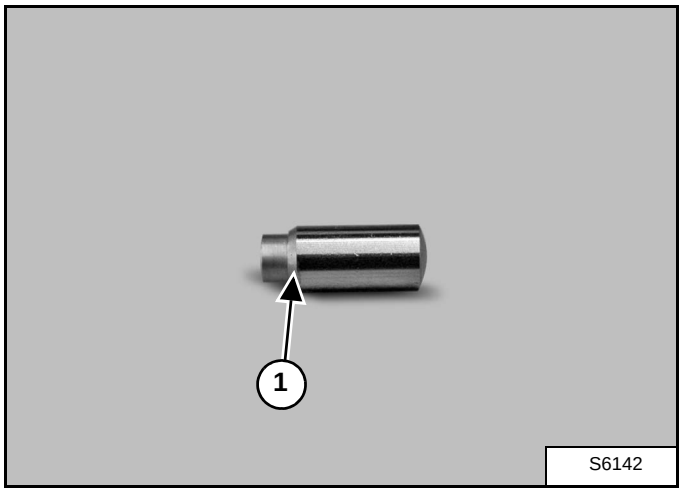
Piston Pump Assembly (Cont'd)

Figure 20-50-83



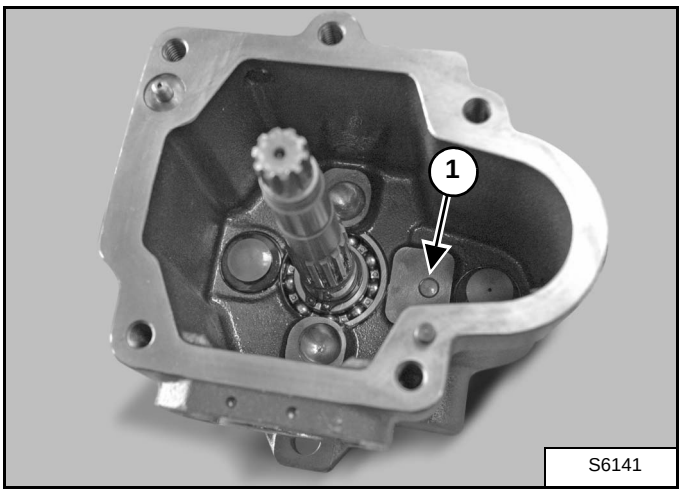
Install stopper pin A and washers (Item 1) **[Figure 20-50-83]** into pump housing.

Figure 20-50-84



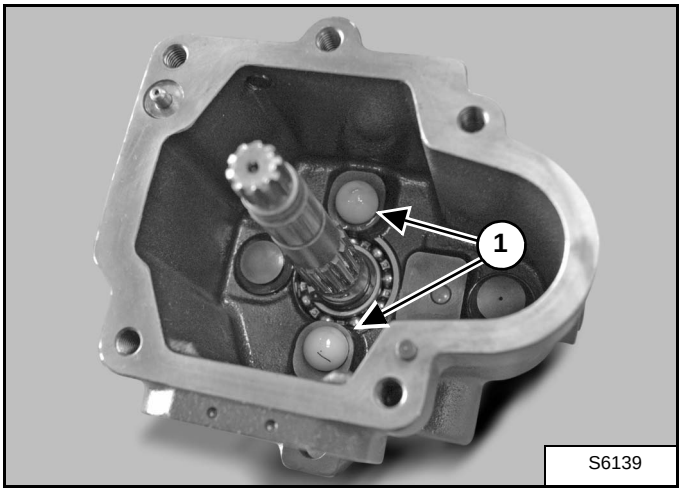
The step in the rod (Item 1) **[Figure 20-50-84]** must be inserted into the pump housing first.

Figure 20-50-85



Install the rod (Item 1) **[Figure 20-50-85]** in the pump housing.

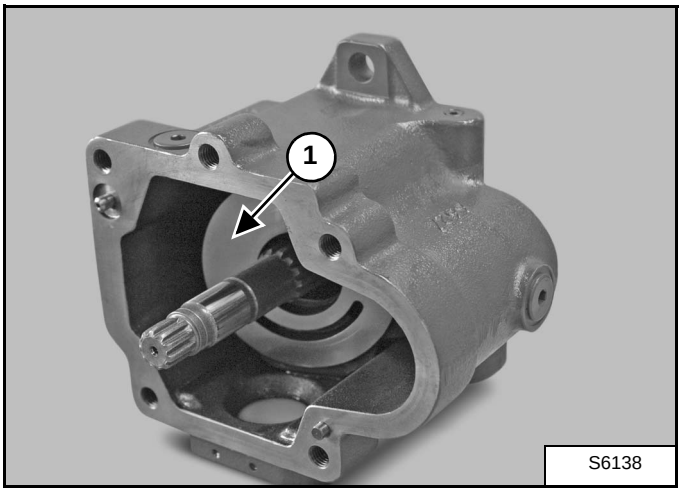
Figure 20-50-86



Install the balls (Item 1) **[Figure 20-50-86]** in the pump housing.

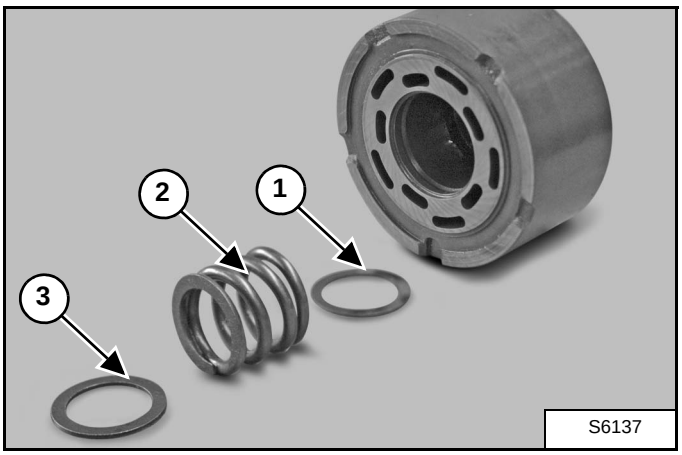
Piston Pump Assembly (Cont'd)

Figure 20-50-87



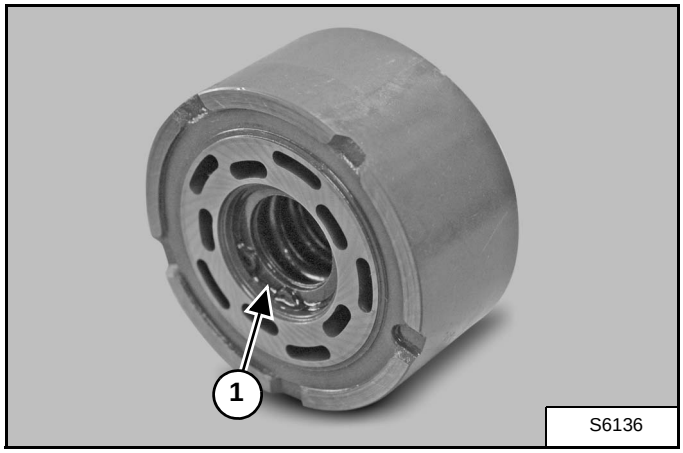
Install the swash plate (Item 1) **[Figure 20-50-87]** in the pump housing.

Figure 20-50-88



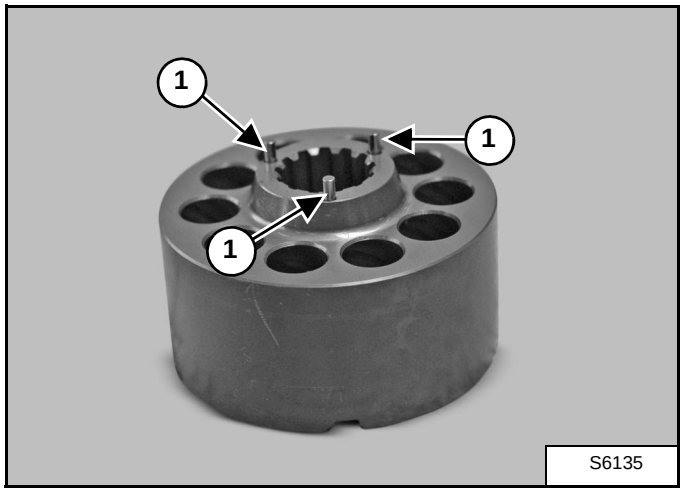
Install the retainer (Item 1), spring (Item 2) and retainer (Item 3) **[Figure 20-50-88]**.

Figure 20-50-89



Install the snap ring (Item 1) **[Figure 20-50-89]** in the cylinder barrel.

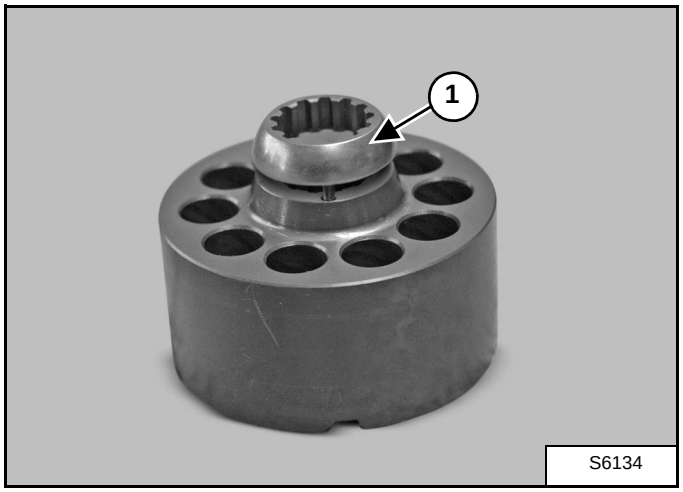
Figure 20-50-90



Install the three needles (Item 1) **[Figure 20-50-90]**.

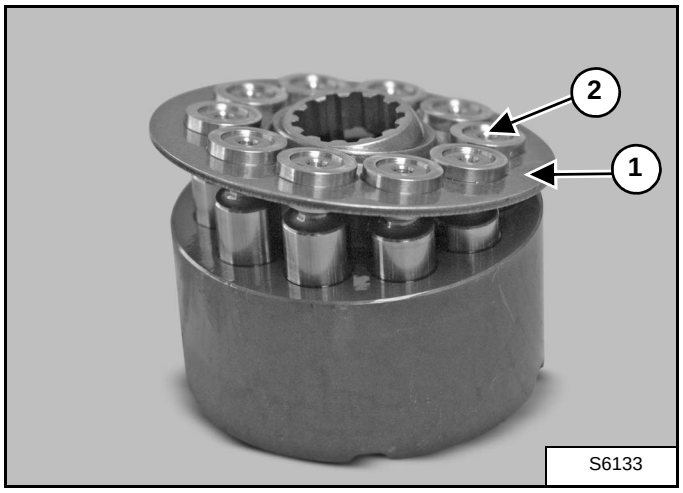
Piston Pump Assembly (Cont'd)

Figure 20-50-91



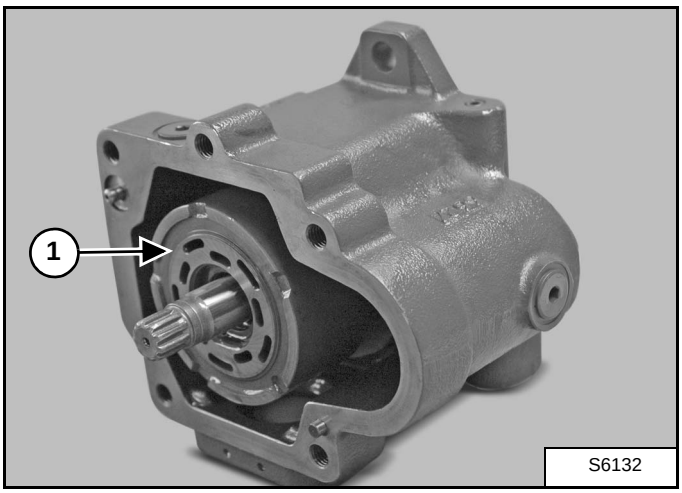
Install the barrel holder (Item 1) **[Figure 20-50-91]**.

Figure 20-50-92



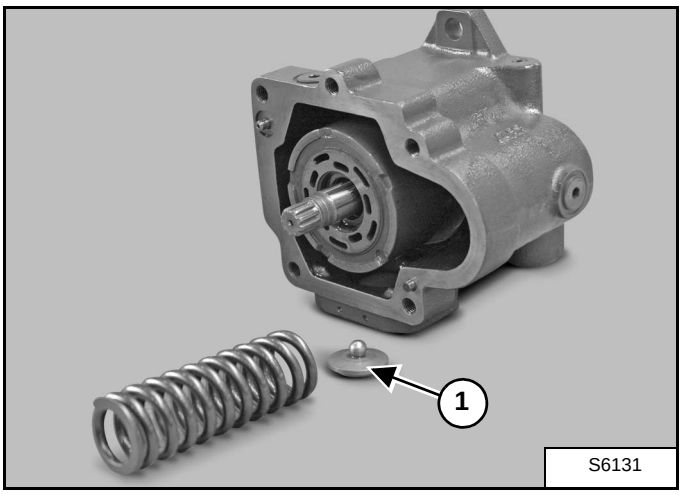
Install the shoe holder (Item 1) and piston assemblies (Item 2) **[Figure 20-50-92]** into the cylinder barrel.

Figure 20-50-93



Install the cylinder barrel assembly (Item 1) **[Figure 20-50-93]** in the pump housing.

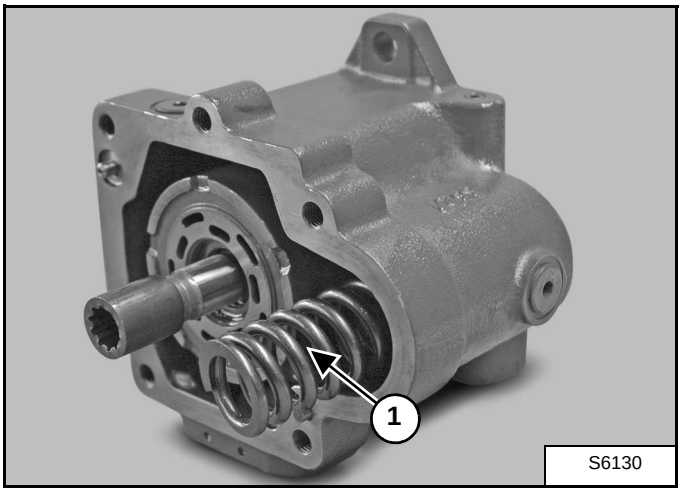
Figure 20-50-94



Install the spring seat (Item 1) **[Figure 20-50-94]** into the pump housing.

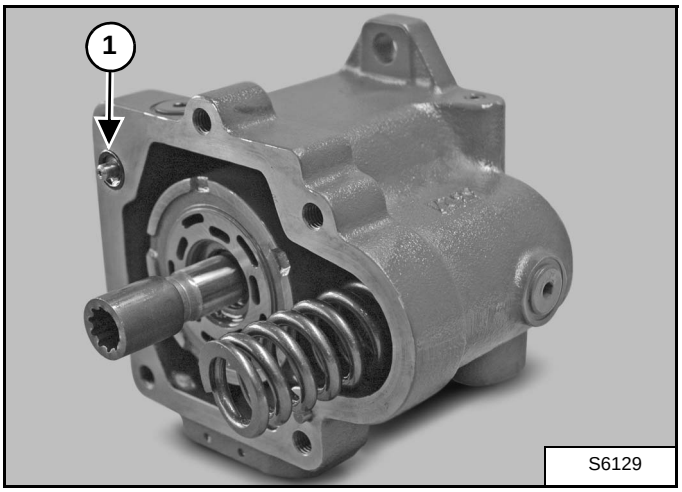
Piston Pump Assembly (Cont'd)

Figure 20-50-95



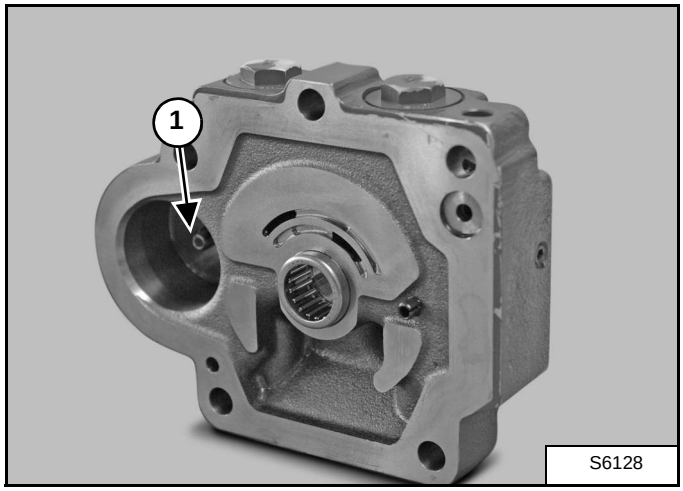
Install the spring (Item 1) **[Figure 20-50-95]** into the pump housing.

Figure 20-50-96



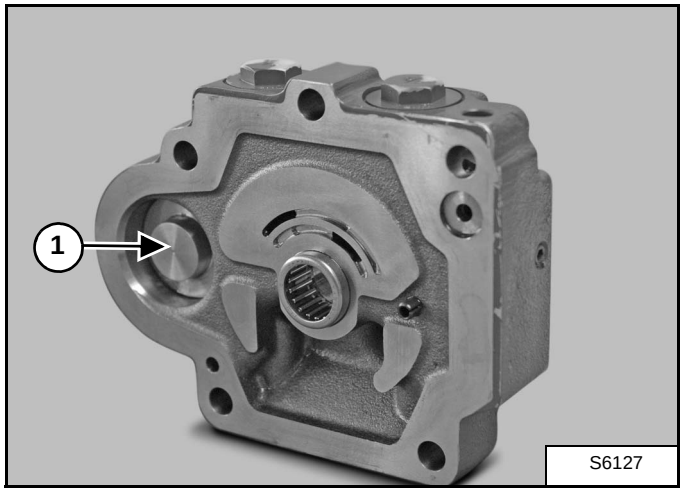
Install the O-ring (Item 1) **[Figure 20-50-96]**.

Figure 20-50-97



Install the screw (Item 1) **[Figure 20-50-97]** in the pump housing.

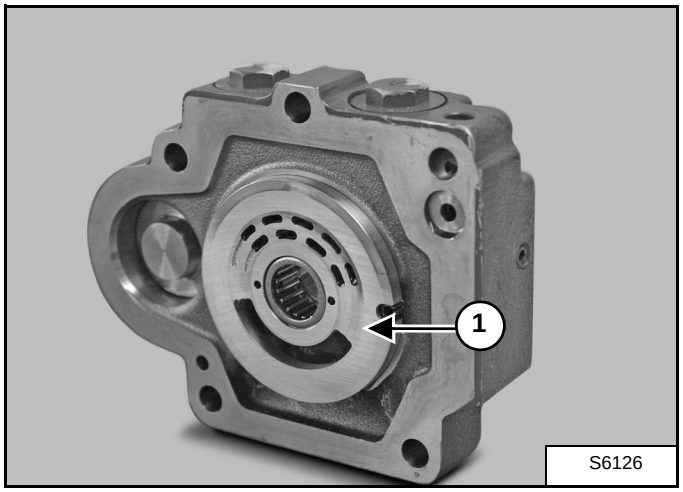
Figure 20-50-98



Install the spring guide (Item 1) **[Figure 20-50-98]** in the pump housing.

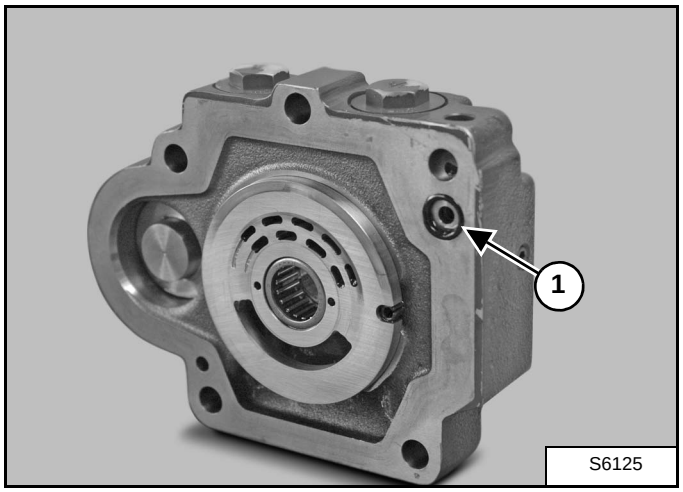
Piston Pump Assembly (Cont'd)

Figure 20-50-99



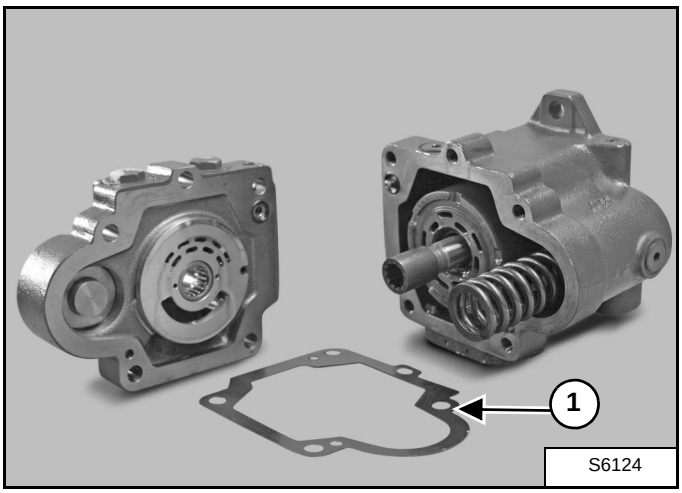
Install the valve plate (Item 1) **[Figure 20-50-99]** in the pump housing.

Figure 20-50-100



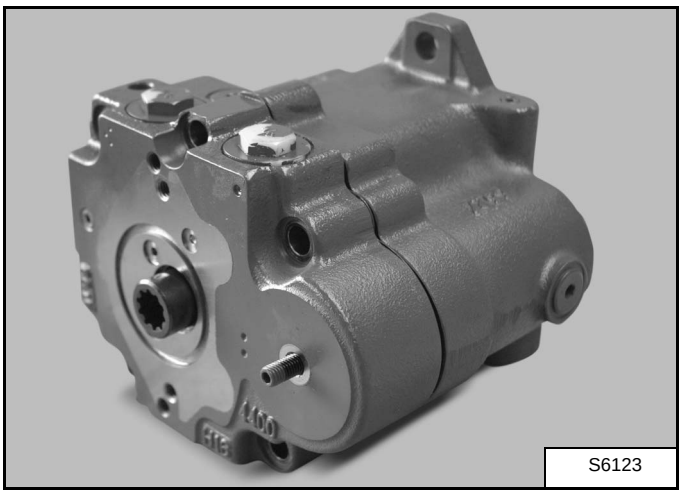
Install the O-ring (Item 1) **[Figure 20-50-100]** in the pump housing.

Figure 20-50-101



Install the packing (Item 1) **[Figure 20-50-101]** in between the pump housings.

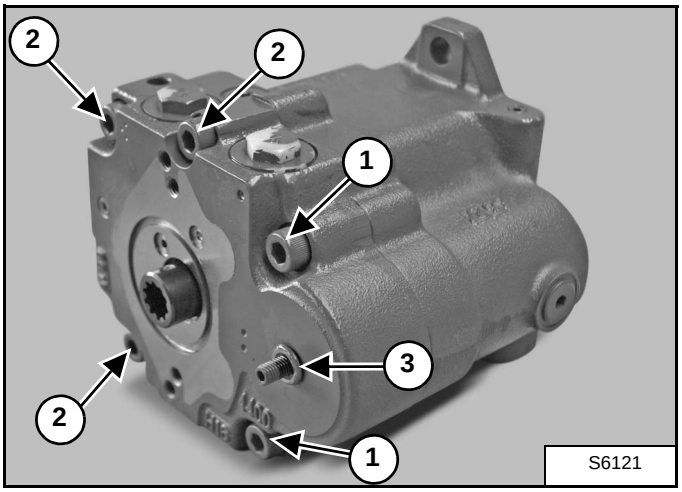
Figure 20-50-102



Install the two halves of pump housings **[Figure 20-50-102]** together.

Piston Pump Assembly (Cont'd)

Figure 20-50-103



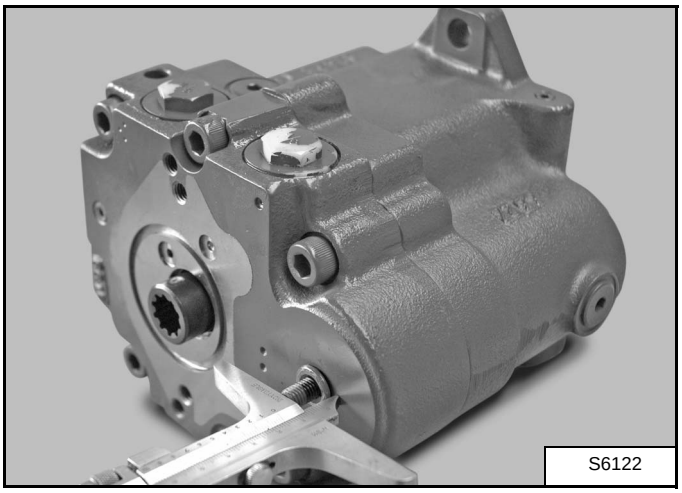
Install the two bolts (Item 1) **[Figure 20-50-103]** on either side of the pressure adjusting spring in the pump housing. Alternate tightening each bolt until both pump housings are assembled.

Install the remaining three bolts (Item 2) **[Figure 20-50-103]** in the pump housing.

Installation: Tighten bolts to 39.8-47.0 ft.-lb. (54-63,7 N•m) torque.

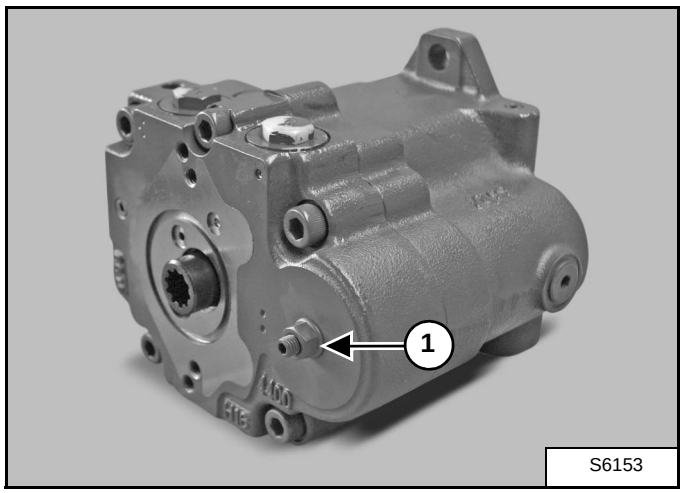
Install the seal washer (Item 3) **[Figure 20-50-103]** on the pump housing.

Figure 20-50-104



Set the measurement of the outside length of the pressure adjustment screw **[Figure 20-50-104]** taken before disassembly. Final adjustment may need to be made after installation in excavator.

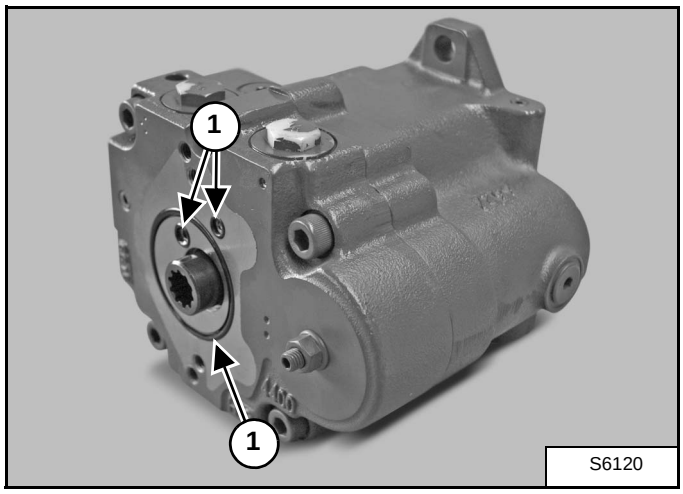
Figure 20-50-105



Install the pressure adjustment nut (Item 1) **[Figure 20-50-105]** on the pump housing.

Installation: Tighten the nut to 10.9-14.5 ft.-lb. (14,8-19,7 N•m) torque.

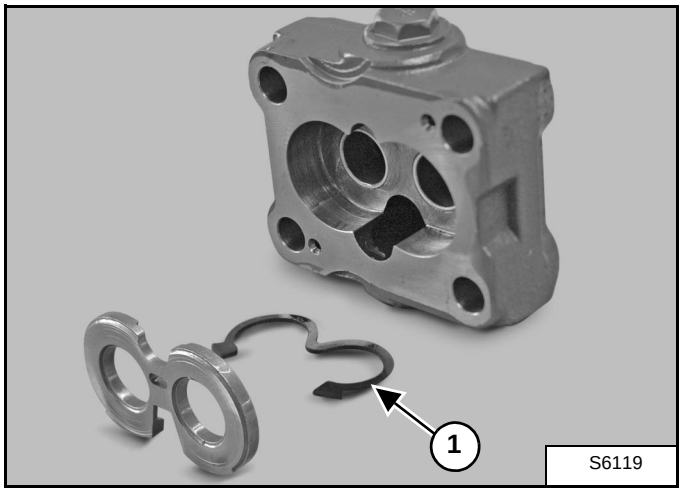
Figure 20-50-106



Install the three O-rings (Item 1) **[Figure 20-50-106]** on the pump housing.

Gear Pump Assembly

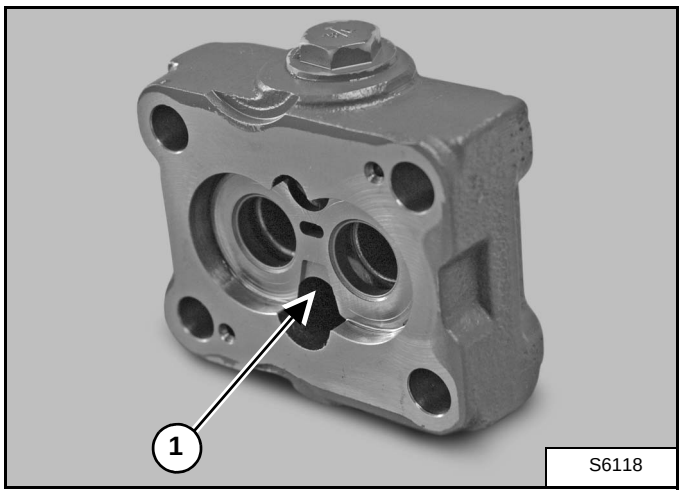
Figure 20-50-107



Install the seal (Item 1) **[Figure 20-50-107]** on the bearing.

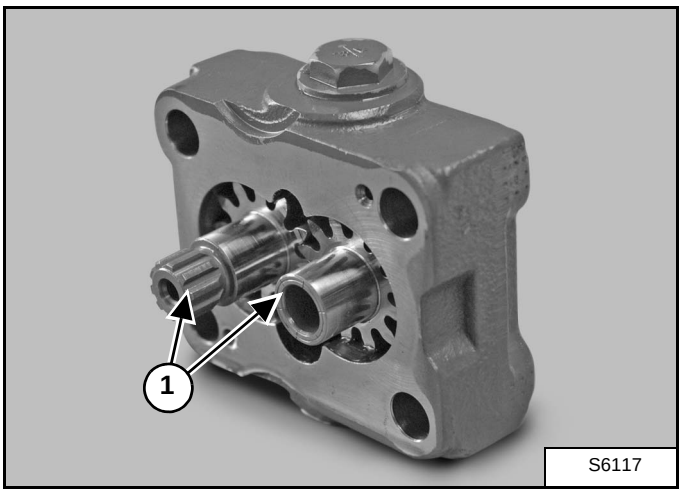
NOTE: The gear housing, two bearings, drive and idler gears are not serviced separately. If any part is damaged, the entire gear pump assembly must be replaced.

Figure 20-50-108



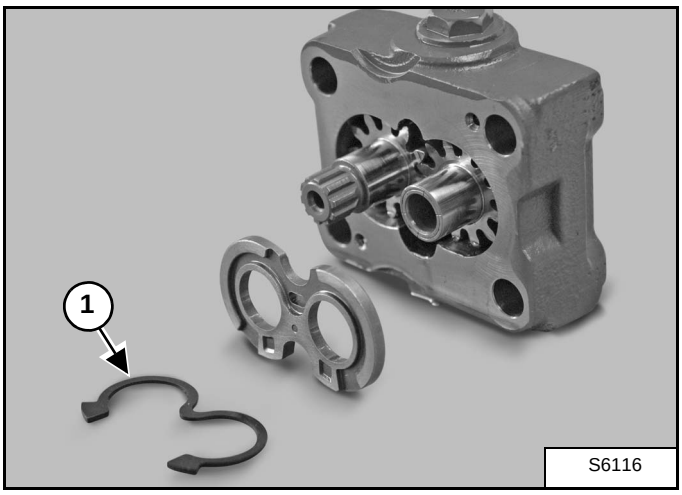
Install the bearing (Item 1) **[Figure 20-50-108]**.

Figure 20-50-109



Install the drive and idler gears (Item 1) **[Figure 20-50-109]**.

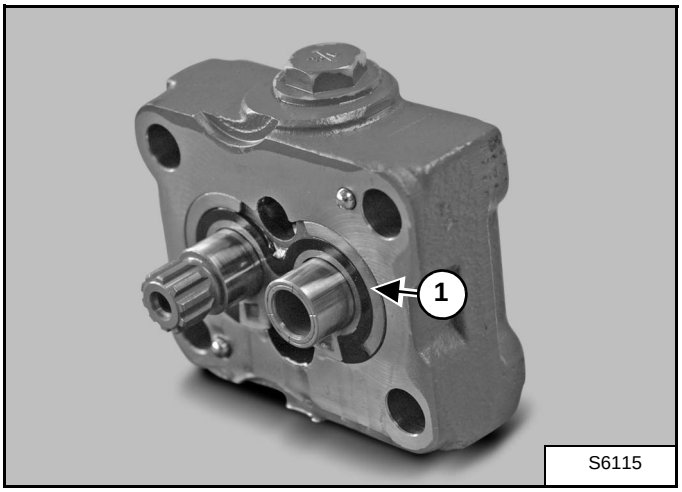
Figure 20-50-110



Install the seal (Item 1) **[Figure 20-50-110]** on the bearing.

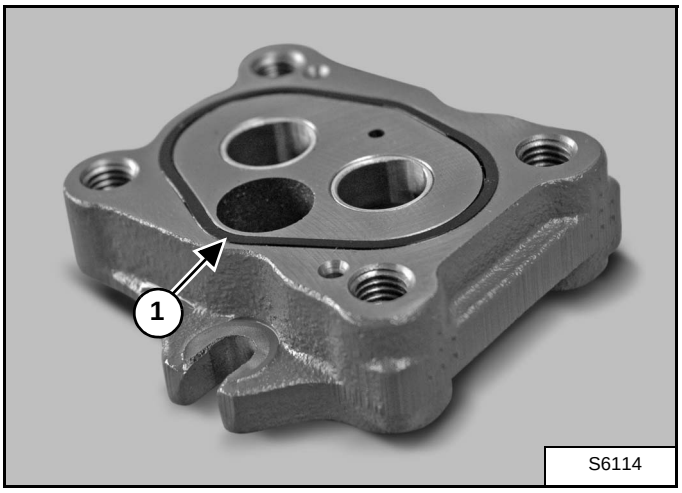
Gear Pump Assembly (Cont'd)

Figure 20-50-111



Install the bearing (Item 1) **[Figure 20-50-111]**.

Figure 20-50-112



Install the seal (Item 1) **[Figure 20-50-112]**.

Figure 20-50-113

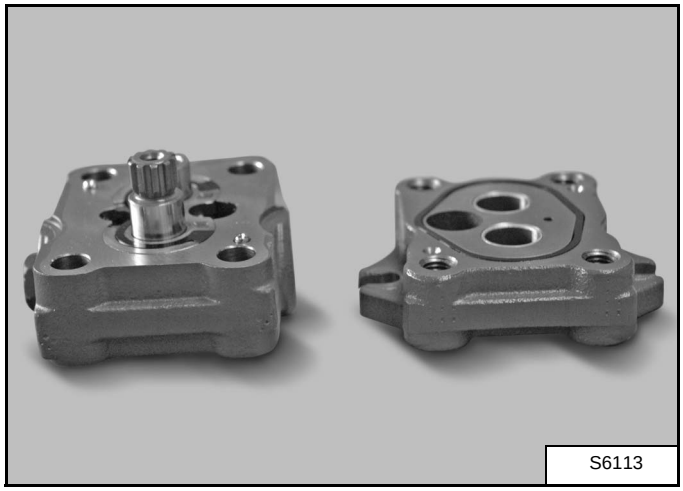
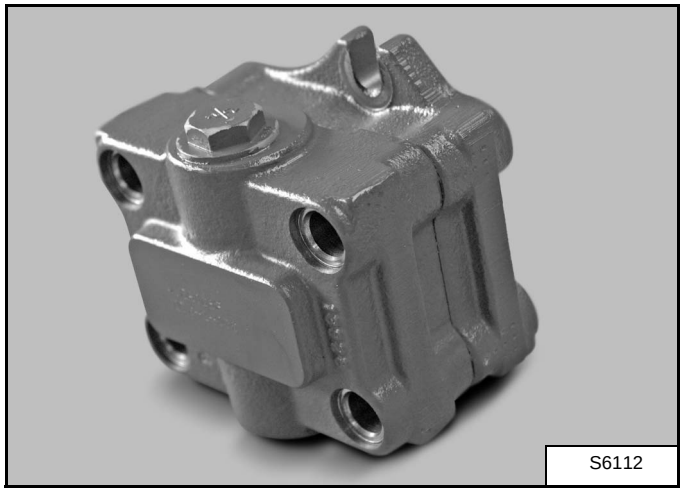


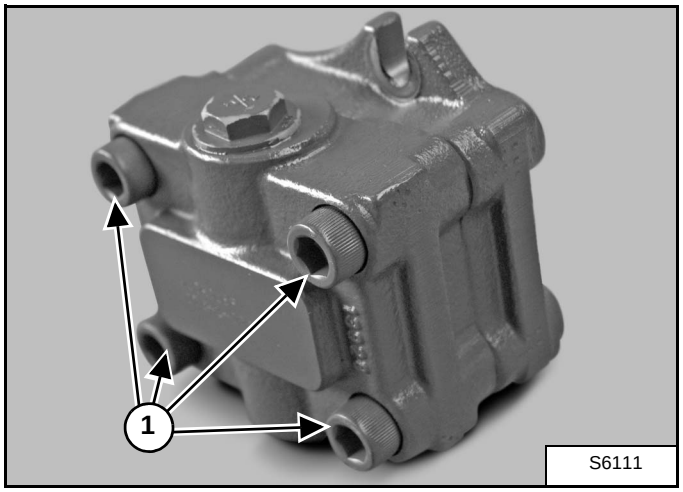
Figure 20-50-114



Assemble the two halves of the gear pump **[Figure 20-50-113]** and **[Figure 20-50-114]**.

Gear Pump Assembly (Cont'd)

Figure 20-50-115

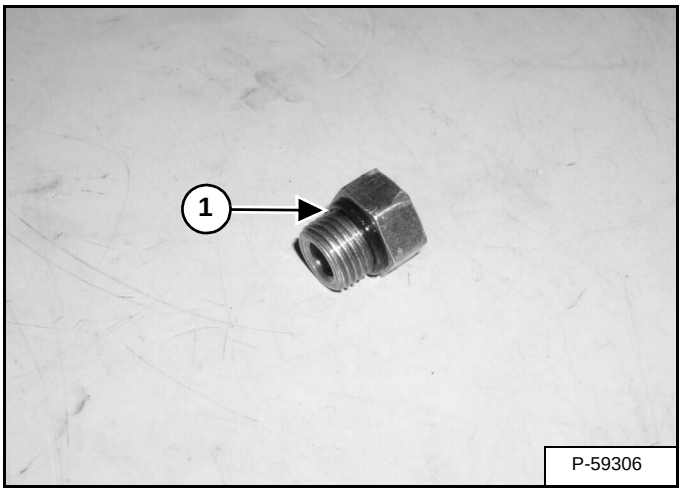


Install the four bolts (Item 1) **[Figure 20-50-115]** in the gear pump.

Tighten the bolts to 65.1-68.7 ft.-lb. (88,3-93,1 N•m) torque.

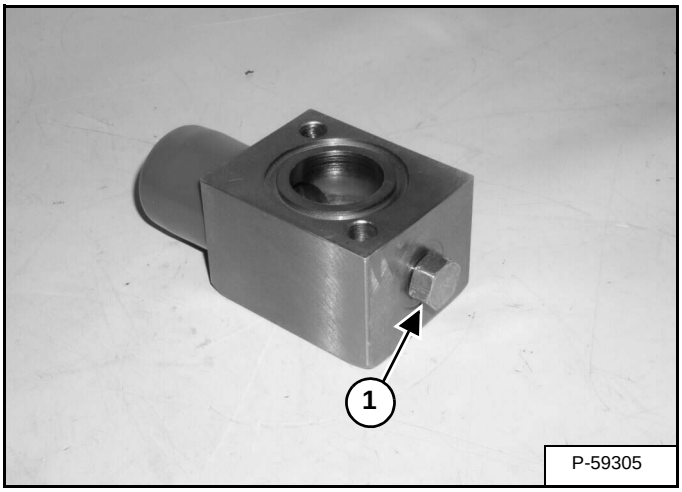
Assembly

Figure 20-50-116



Install the O-ring (Item 1) **[Figure 20-50-116]** on the plug.

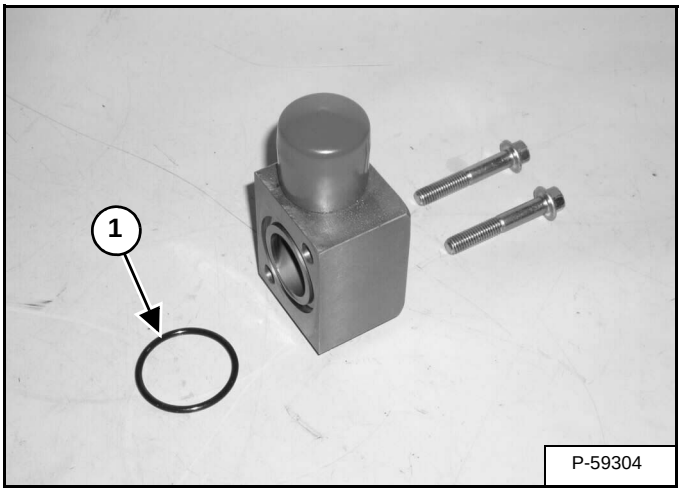
Figure 20-50-117



Install the plug (Item 1) **[Figure 20-50-117]** in the pump block.

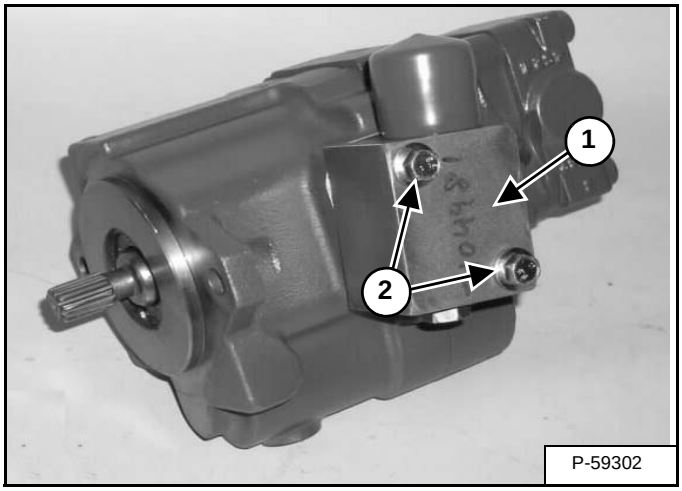
Assembly (Cont'd)

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]**.

MANIFOLD ASSEMBLY / ACCUMULATOR

Description

The manifold body contains a two speed solenoid valve, a two speed boost solenoid valve, a system bypass valve, a console (joystick) lockout solenoid valve, a pressure reducing valve and a safety relief valve.

The body is connected to the accumulator.

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

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

Removal And Installation

Lower the boom / bucket and blade to the ground.

WARNING

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

W-2145-0290

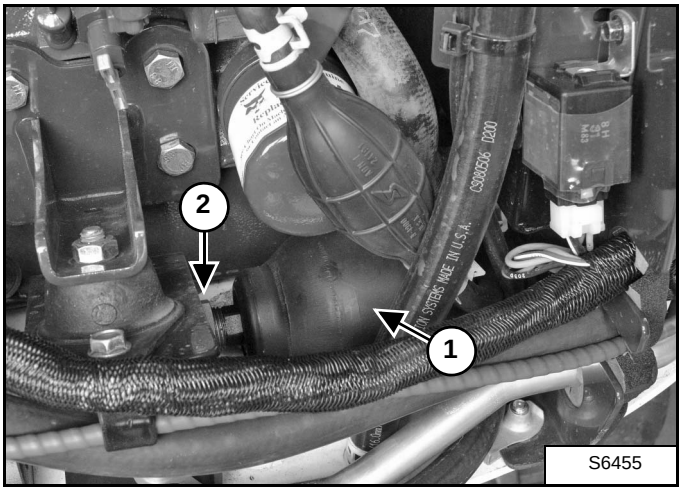
IMPORTANT

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

I-2003-0888

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

Figure 20-60-1



Open the tailgate.

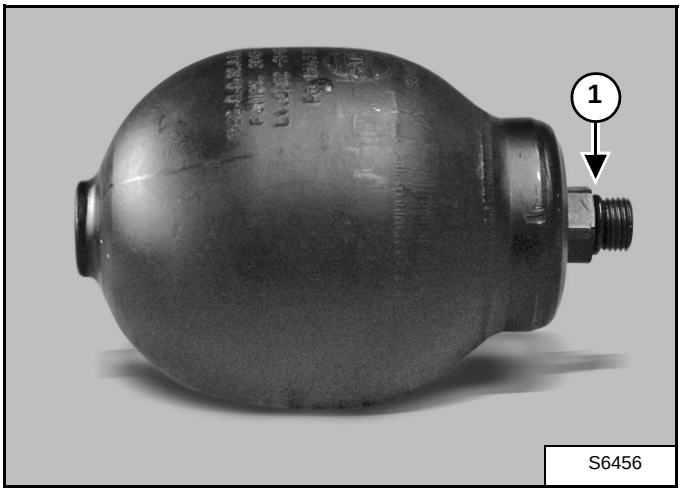
Remove the accumulator (Item 1) **[Figure 20-60-1]** from the manifold.

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

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

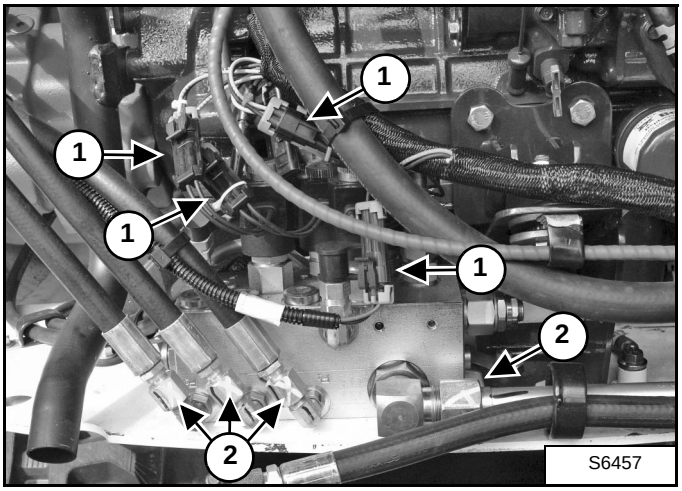
Removal And Installation (Cont'd)

Figure 20-60-2



Remove the O-ring (Item 1) **[Figure 20-60-2]** from the accumulator.

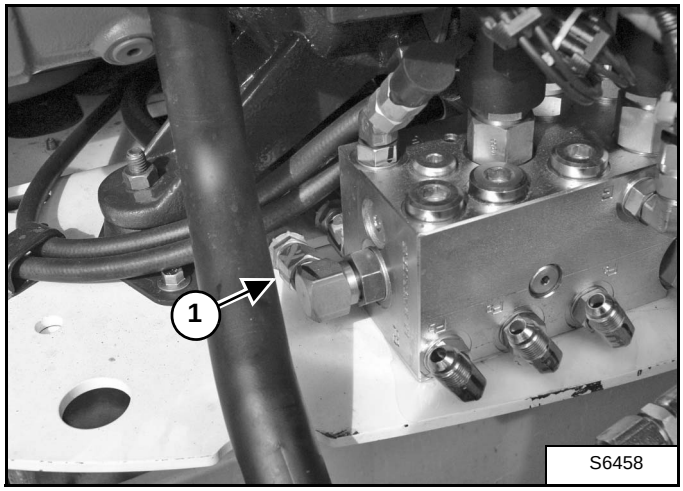
Figure 20-60-3



Disconnect the wire harnesses (Item 1) **[Figure 20-60-3]** from the coils.

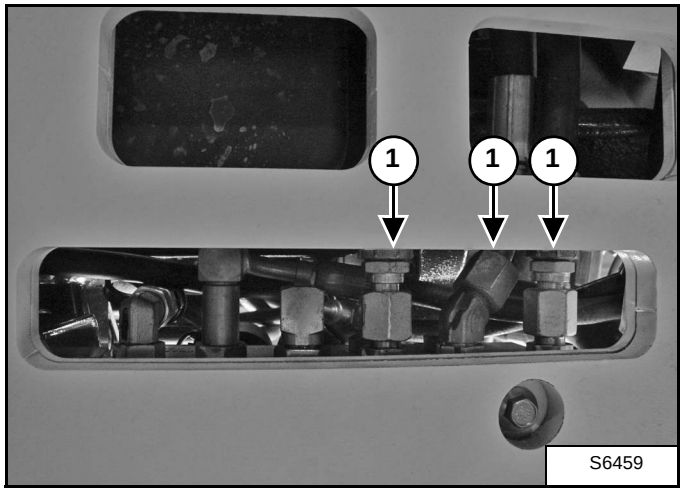
Mark and remove the hoses and tubelines (Item 2) **[Figure 20-60-3]** from the manifold.

Figure 20-60-4



Mark and remove the hose (Item 1) **[Figure 20-60-4]** from the manifold.

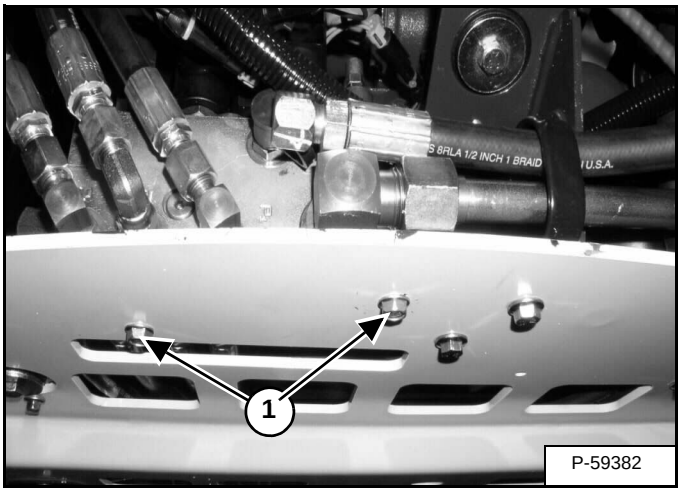
Figure 20-60-5



Mark and remove the hoses (Item 1) **[Figure 20-60-5]** from under the upperstructure.

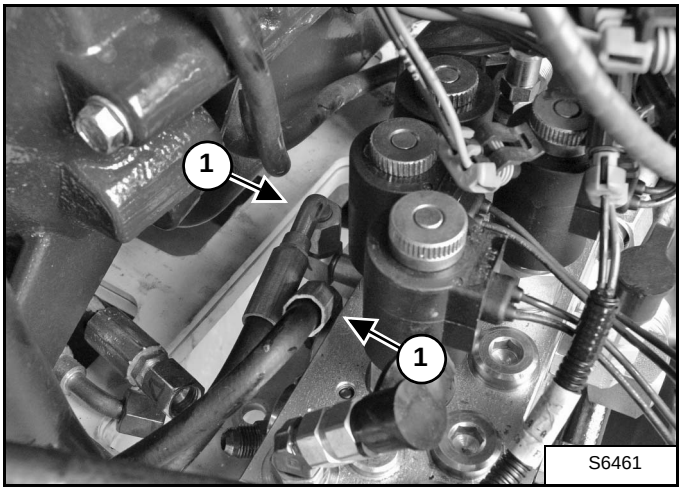
Removal And Installation (Cont'd)

Figure 20-60-6



Remove the bolts (Item 1) **[Figure 20-60-6]** from under the upperstructure.

Figure 20-60-7

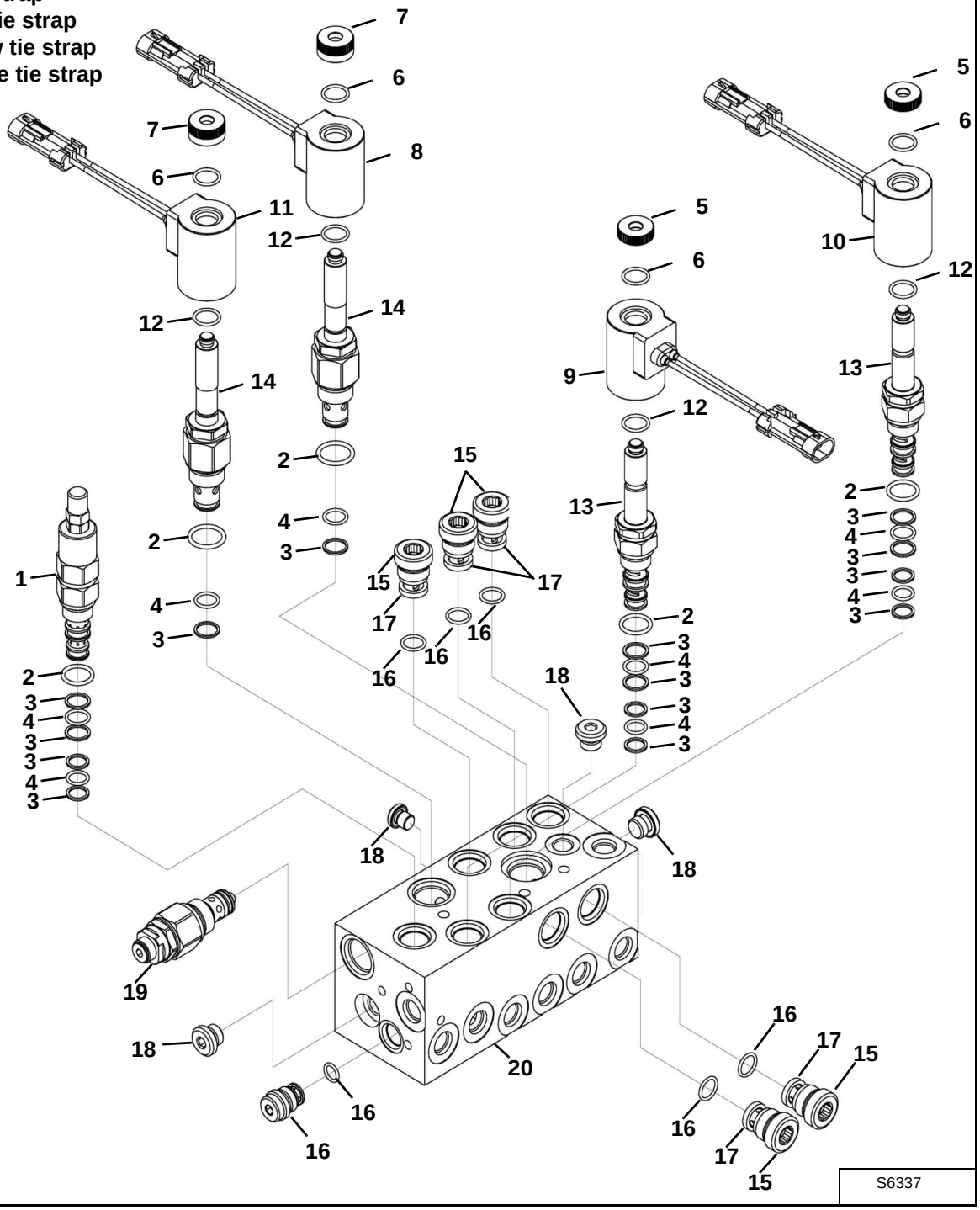


Slide the manifold assembly towards the tailgate to expose the hoses. Mark and remove the hoses (Item 1) **[Figure 20-60-7]** from the manifold.

Remove the manifold.

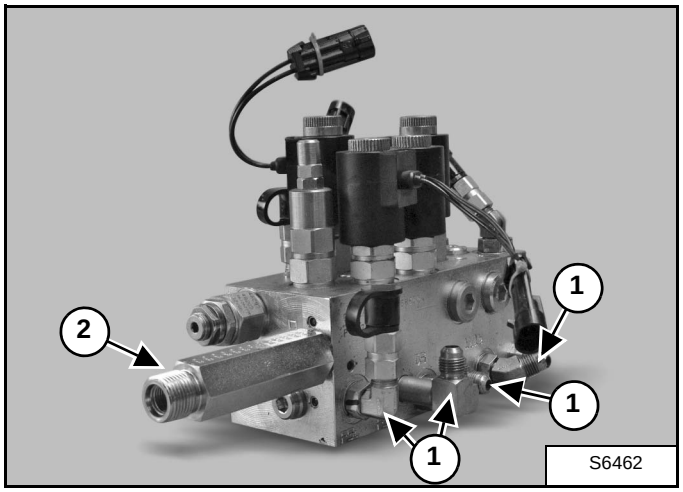
Parts Identification

1. Pressure Reducing Valve
2. O-Ring
3. Backup Ring
4. O-Ring
5. Nut
6. O-Ring
7. Nut
8. Coil without tie strap
9. Coil with green tie strap
10. Coil with yellow tie strap
11. Coil with orange tie strap
12. O-Ring
13. Solenoid Stem
14. Solenoid Stem
15. Plug
16. O-Ring
17. Seat
18. Plug
19. Relief Valve
20. Valve Body



Disassembly

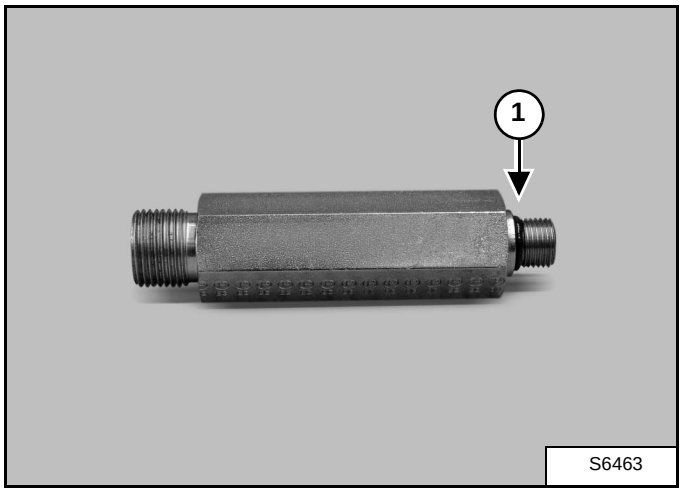
Figure 20-60-8



Remove the twelve fittings (Item 1) **[Figure 20-60-8]** from the manifold.

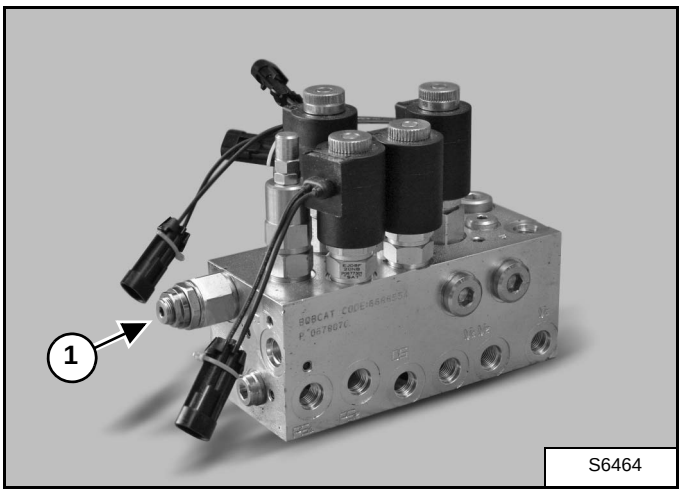
Remove the accumulator extension (Item 2) **[Figure 20-60-8]** from the manifold.

Figure 20-60-9



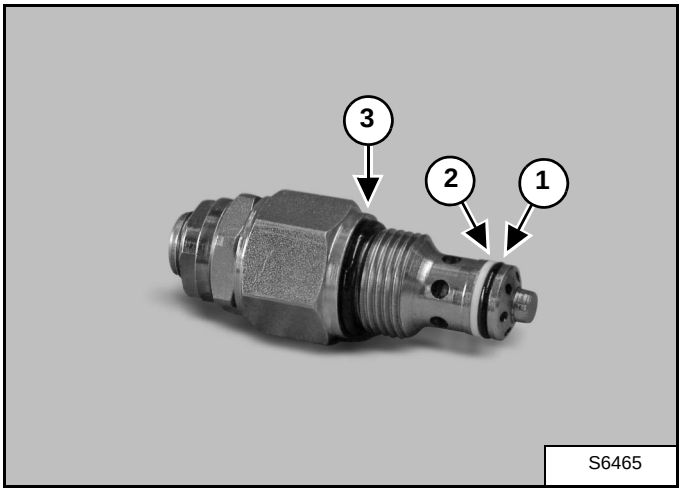
Remove the O-ring (Item 1) **[Figure 20-60-9]** from the accumulator extension.

Figure 20-60-10



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

Figure 20-60-11

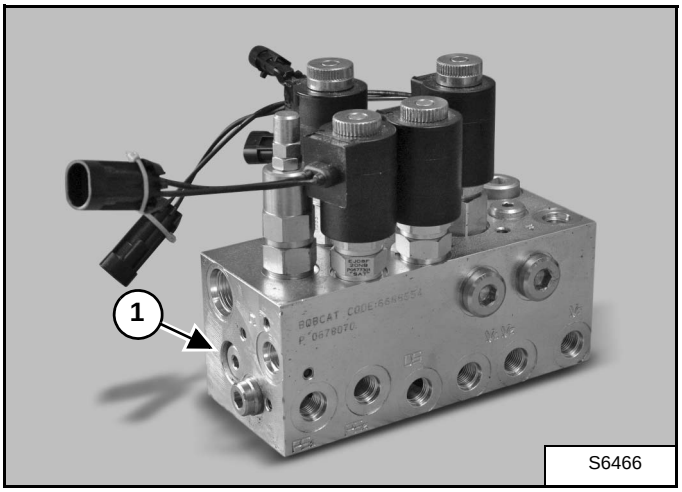


Remove the O-ring (Item 1) and the backup ring (Item 2) **[Figure 20-60-11]** from the relief valve.

Remove the O-ring (Item 3) **[Figure 20-60-11]** from the relief valve.

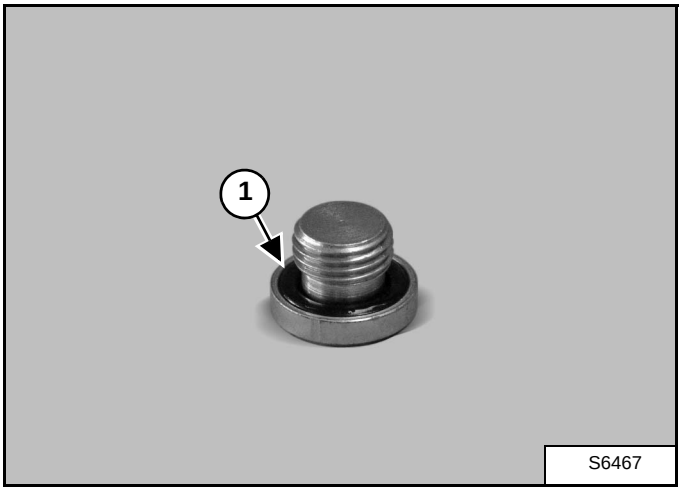
Disassembly (Cont'd)

Figure 20-60-12



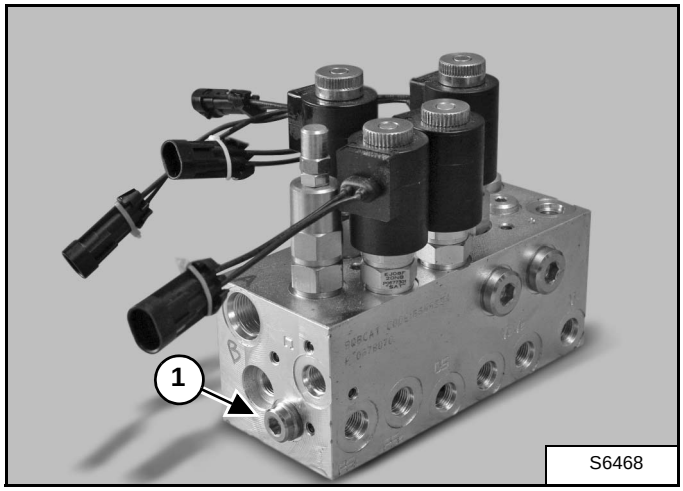
Remove the plug (Item 1) **[Figure 20-60-12]** from the manifold.

Figure 20-60-13



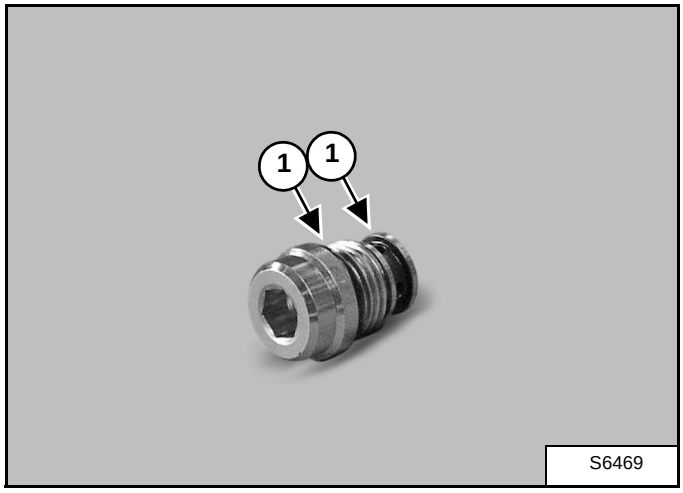
Remove the O-ring (Item 1) **[Figure 20-60-13]** from the plug.

Figure 20-60-14



Remove the plug (Item 1) **[Figure 20-60-14]** from the manifold.

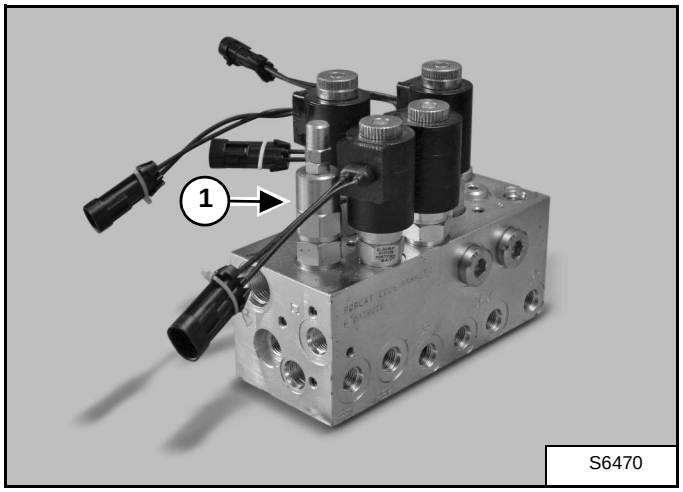
Figure 20-60-15



Remove the two O-rings (Item 1) **[Figure 20-60-15]** from the plug.

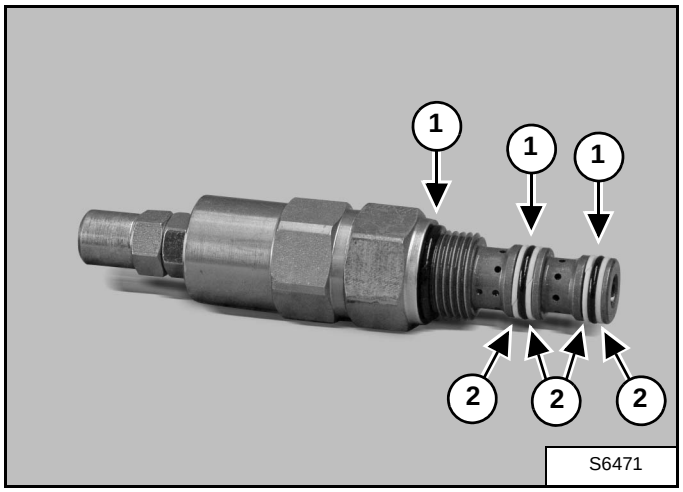
Disassembly (Cont'd)

Figure 20-60-16



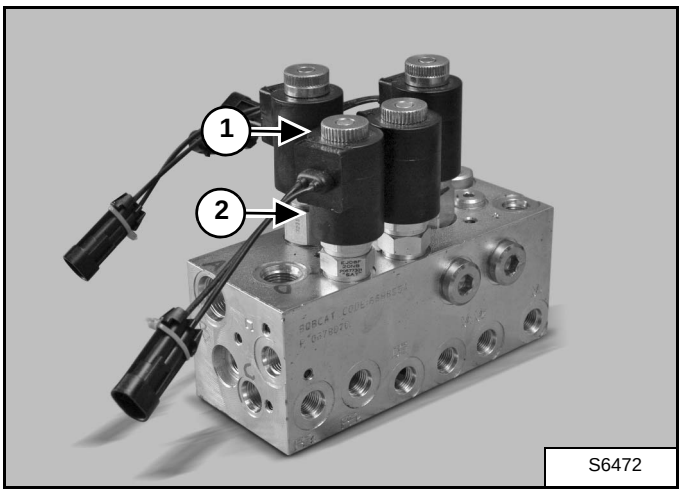
Remove the pressure reducing valve (Item 1) **[Figure 20-60-16]** from the manifold.

Figure 20-60-17



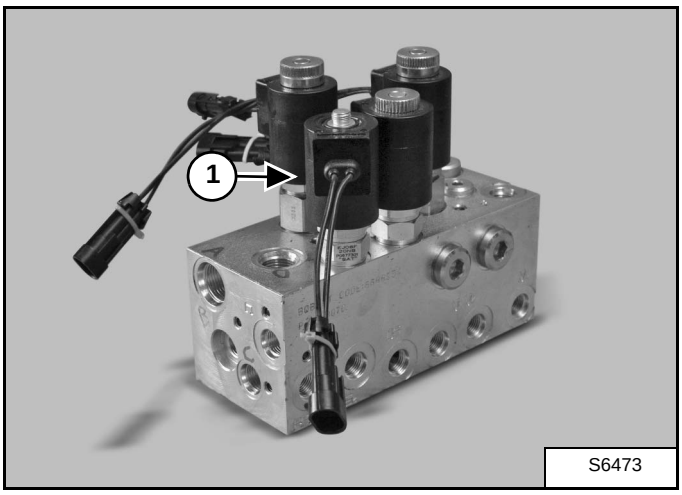
Remove the three O-rings (Item 1) and the four backup rings (Item 2) **[Figure 20-60-17]** from the pressure reducing valve.

Figure 20-60-18



Remove the nut (Item 1) from the console (joystick) lockout solenoid (Item 2) **[Figure 20-60-18]**.

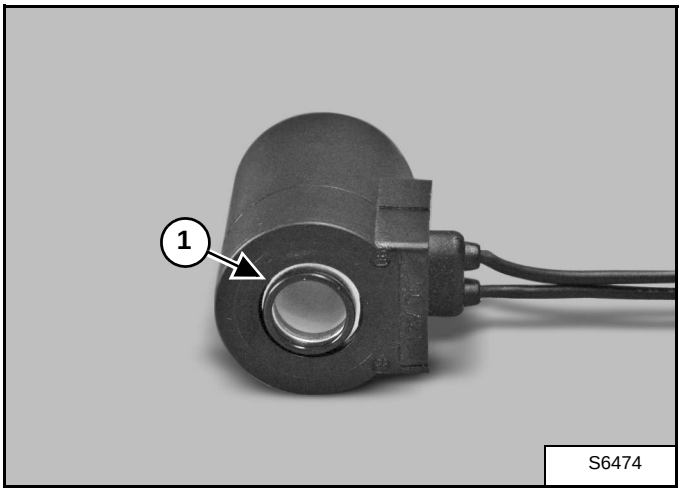
Figure 20-60-19



Remove the coil with the green tie strap (Item 1) **[Figure 20-60-19]** from the solenoid stem.

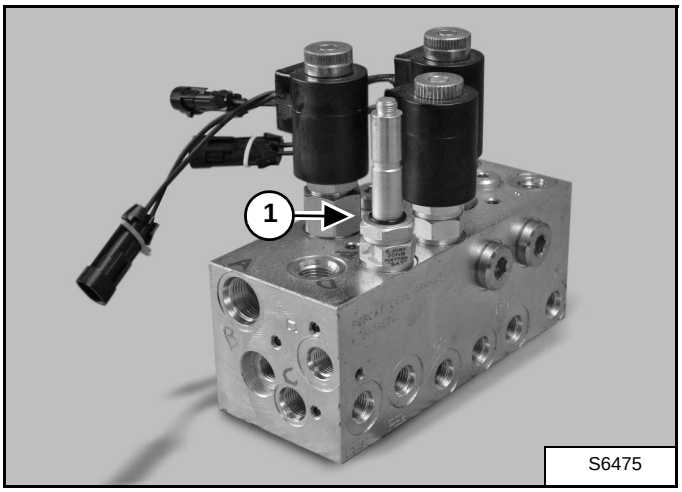
Disassembly (Cont'd)

Figure 20-60-20



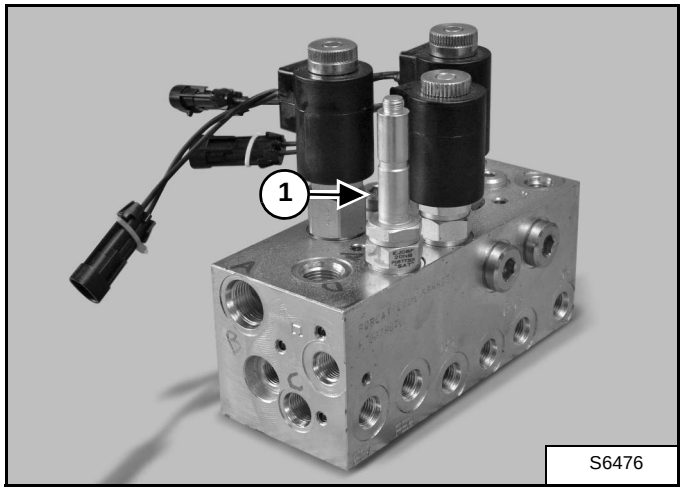
Remove the O-ring (Item 1) **[Figure 20-60-20]** from the coil.

Figure 20-60-21



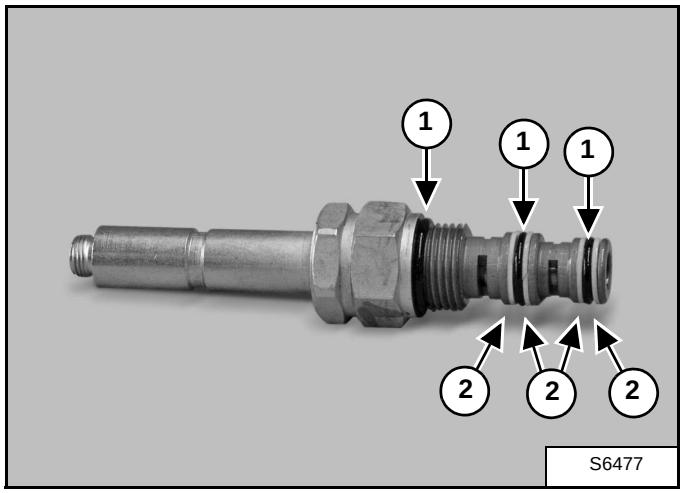
Remove the O-ring (Item 1) **[Figure 20-60-21]** from the solenoid stem.

Figure 20-60-22



Remove the solenoid stem (Item 1) **[Figure 20-60-22]**.

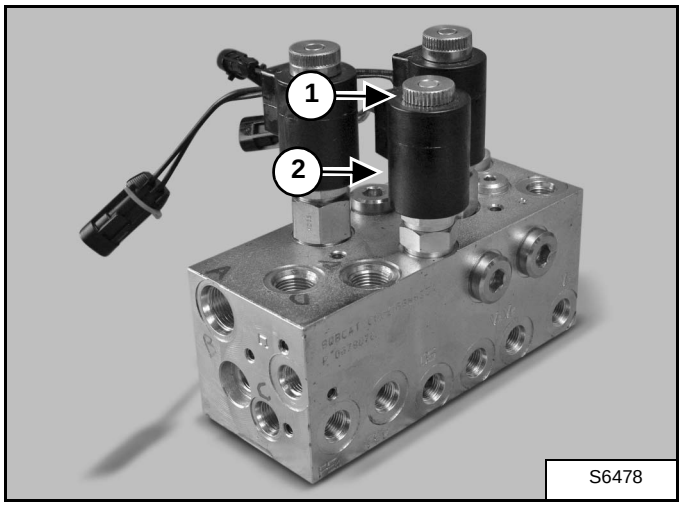
Figure 20-60-23



Remove the three O-rings (Item 1) and the four backup rings (Item 2) **[Figure 20-60-23]** from the solenoid stem.

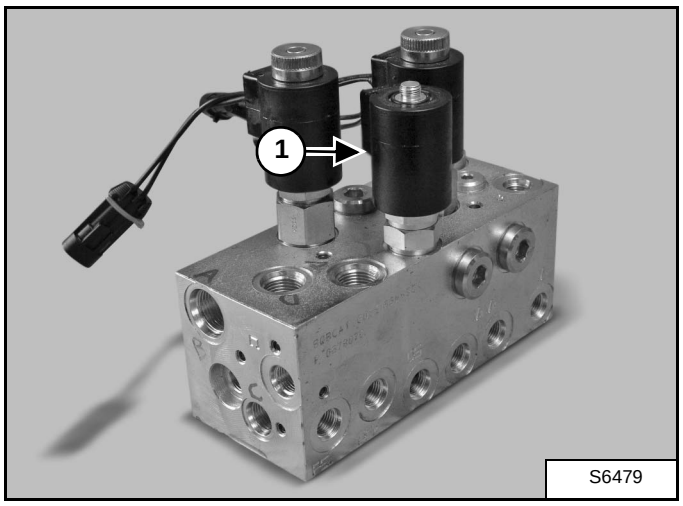
Disassembly (Cont'd)

Figure 20-60-24



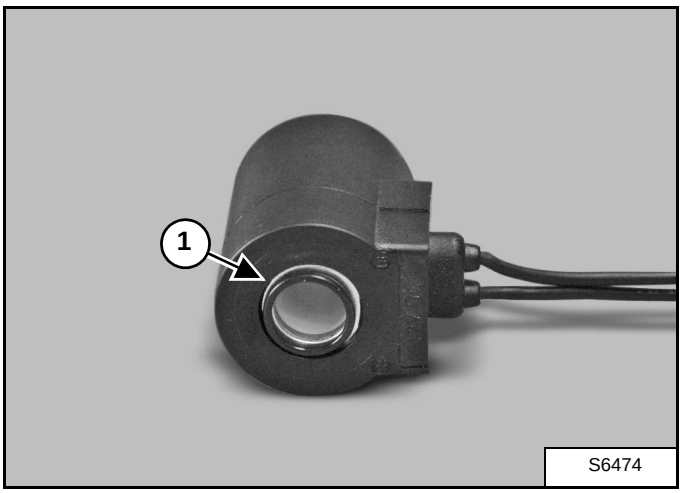
Remove the nut (Item 1) from the two speed boost solenoid (Item 2) **[Figure 20-60-24]**.

Figure 20-60-25



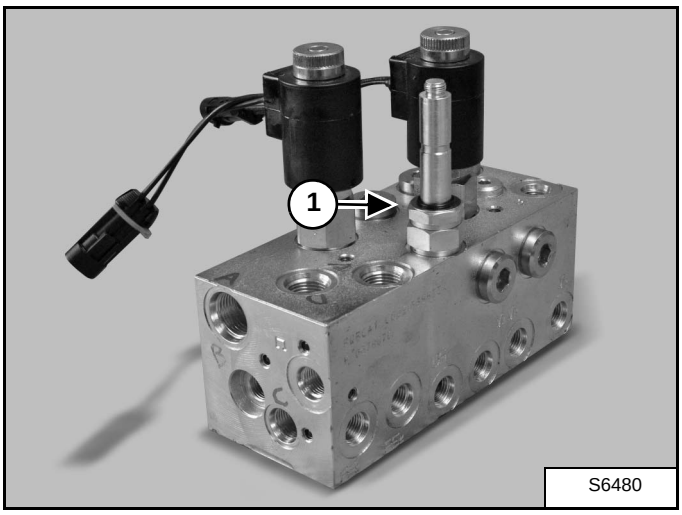
Remove the coil with yellow tie strap (Item 1) **[Figure 20-60-25]** from the solenoid stem.

Figure 20-60-26



Remove the O-ring (Item 1) **[Figure 20-60-26]** from the coil.

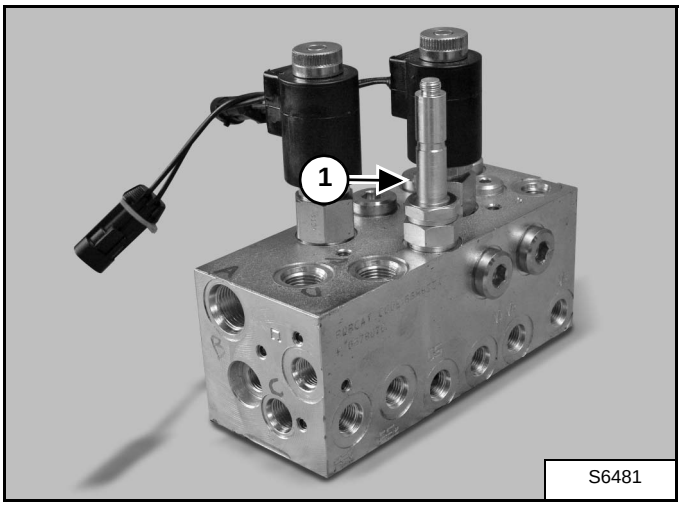
Figure 20-60-27



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

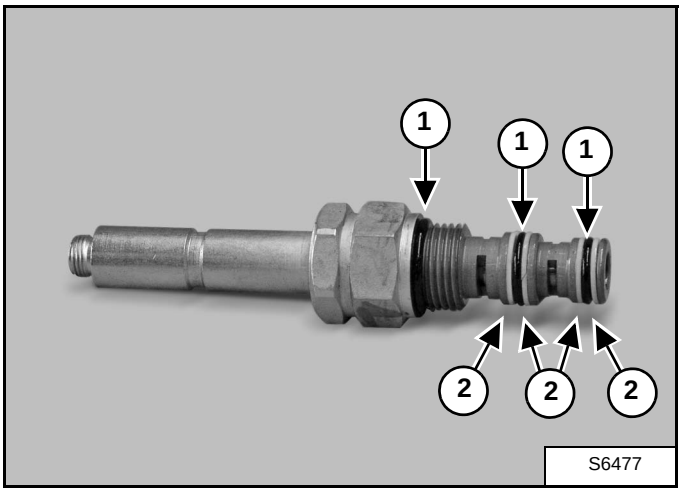
Disassembly (Cont'd)

Figure 20-60-28



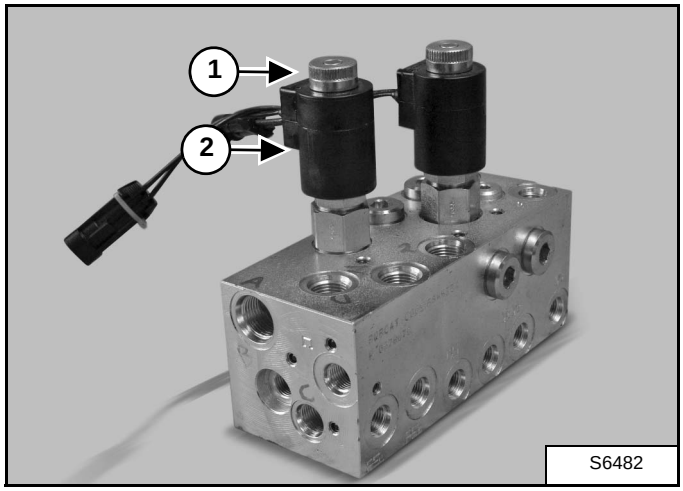
Remove the solenoid stem (Item 1) **[Figure 20-60-28]**.

Figure 20-60-29



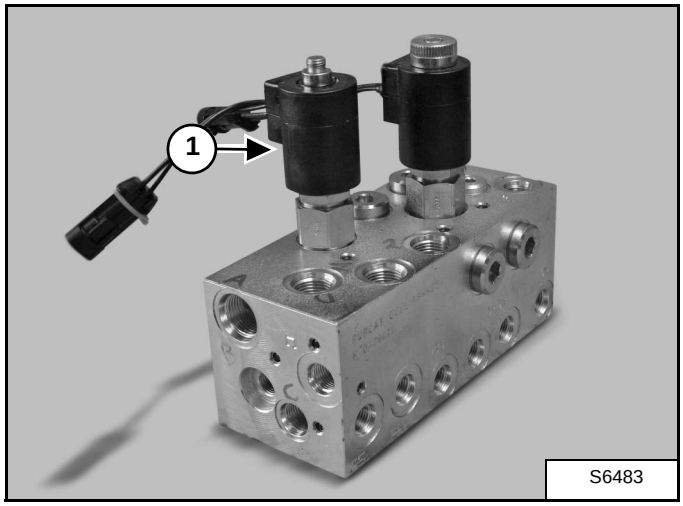
Remove the three O-rings (Item 1) and the four backup rings (Item 2) **[Figure 20-60-29]** from the solenoid stem.

Figure 20-60-30



Remove the nut (Item 1) from the system by-pass solenoid (Item 2) **[Figure 20-60-30]**.

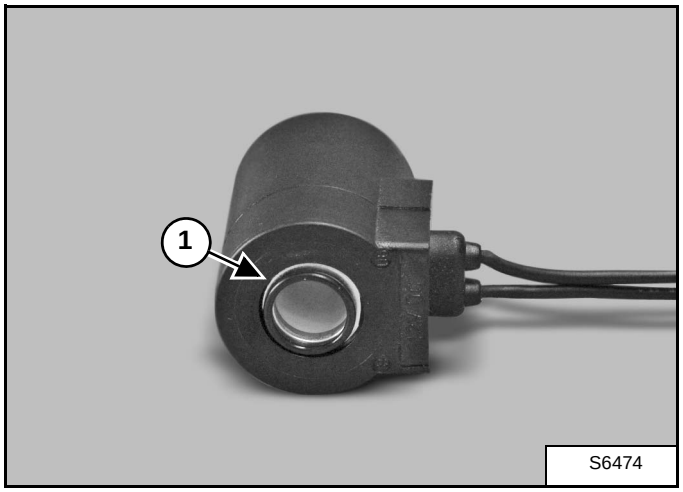
Figure 20-60-31



Remove the coil with orange strap (Item 1) **[Figure 20-60-31]** from the solenoid stem.

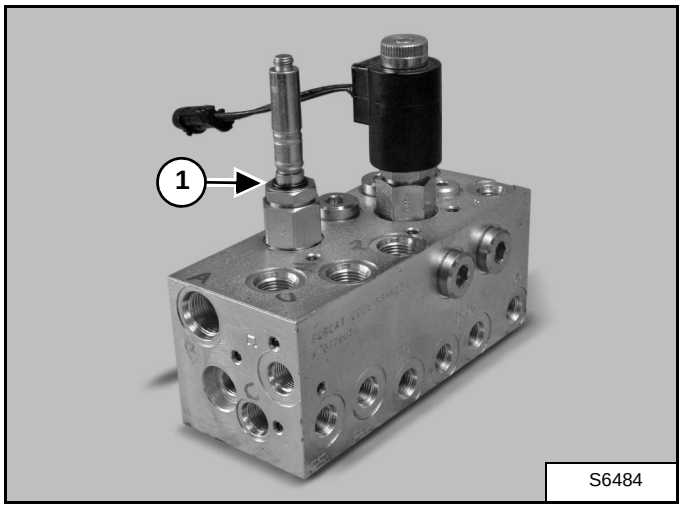
Disassembly (Cont'd)

Figure 20-60-32



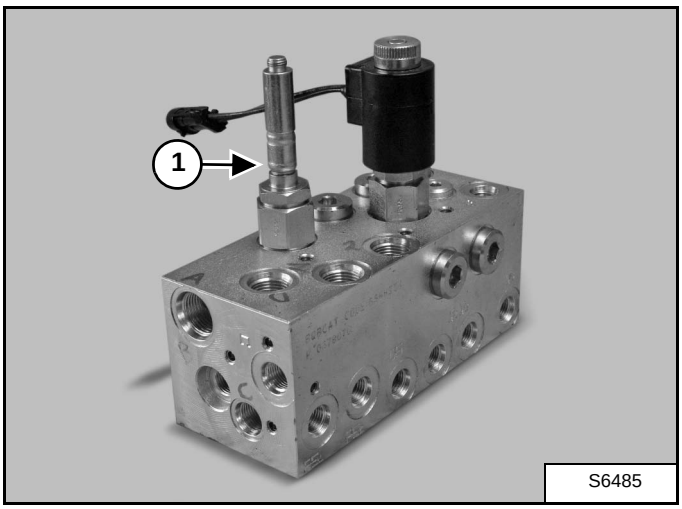
Remove the O-ring (Item 1) **[Figure 20-60-32]** from the coil.

Figure 20-60-33



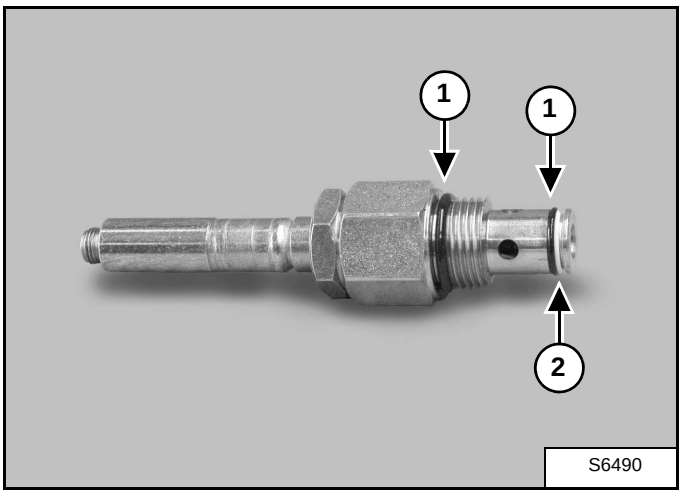
Remove the O-ring (Item 1) **[Figure 20-60-33]** from the solenoid stem.

Figure 20-60-34



Remove the solenoid stem (Item 1) **[Figure 20-60-34]**.

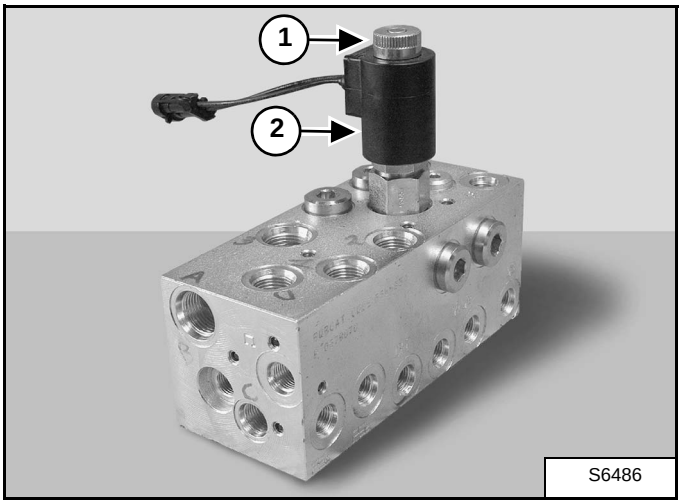
Figure 20-60-35



Remove the two O-rings (Item 1) and the backup ring (Item 2) **[Figure 20-60-35]** from the solenoid stem.

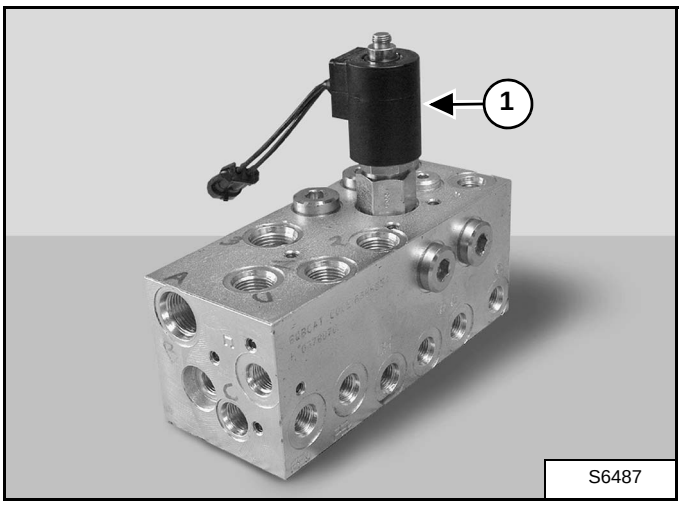
Disassembly (Cont'd)

Figure 20-60-36



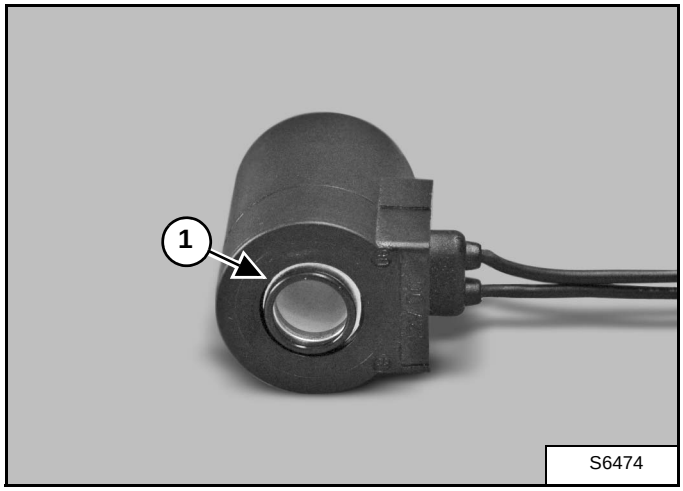
Remove the nut (Item 1) from the two speed solenoid (Item 2) **[Figure 20-60-36]**.

Figure 20-60-37



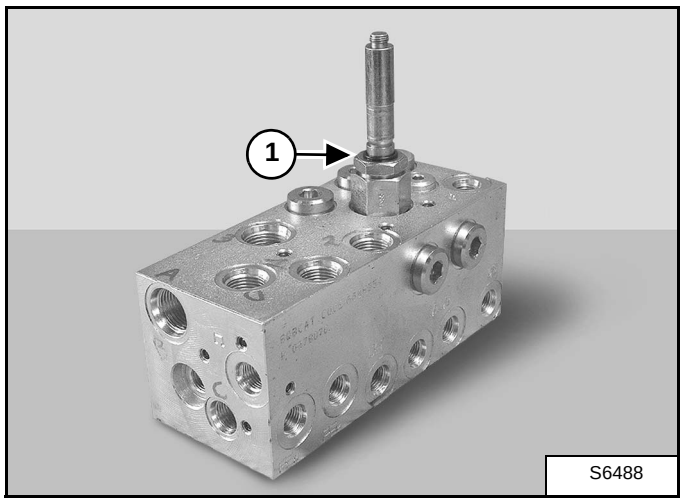
Remove the coil with no strap (Item 1) **[Figure 20-60-37]** from the solenoid stem.

Figure 20-60-38



Remove the O-ring (Item 1) **[Figure 20-60-38]** from the coil.

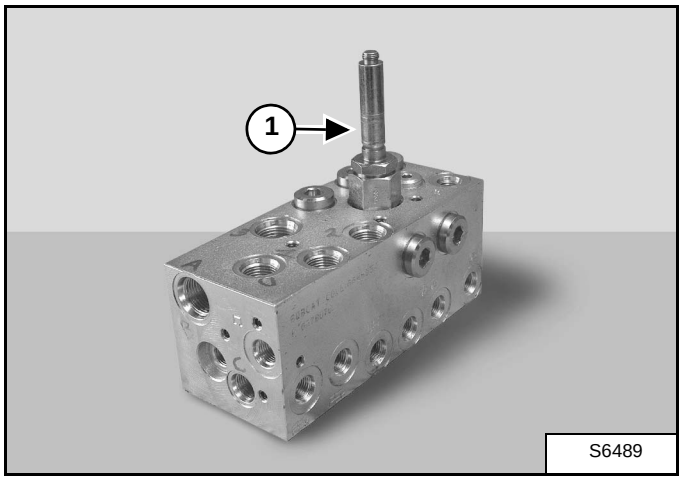
Figure 20-60-39



Remove the O-ring (Item 1) **[Figure 20-60-39]** from the solenoid stem.

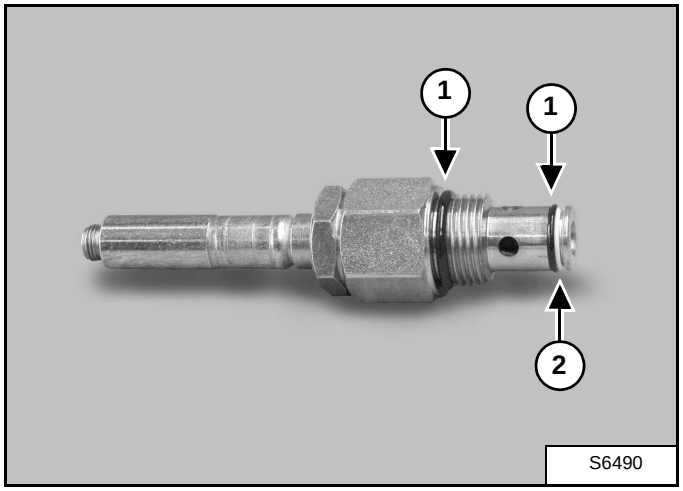
Disassembly (Cont'd)

Figure 20-60-40



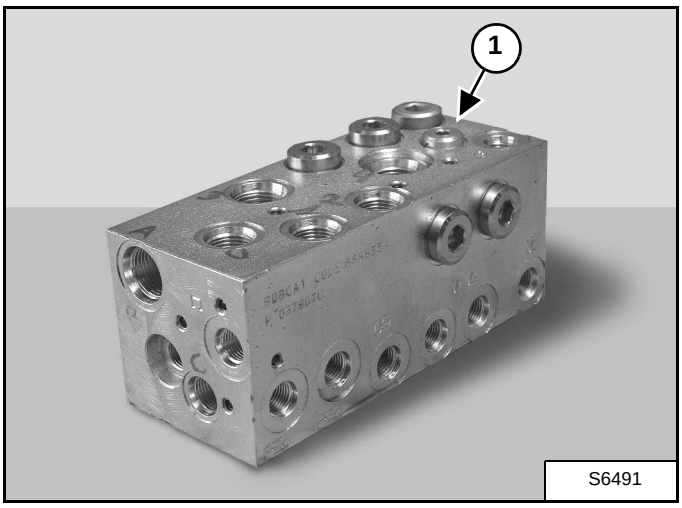
Remove the solenoid stem (Item 1) **[Figure 20-60-40]**.

Figure 20-60-41



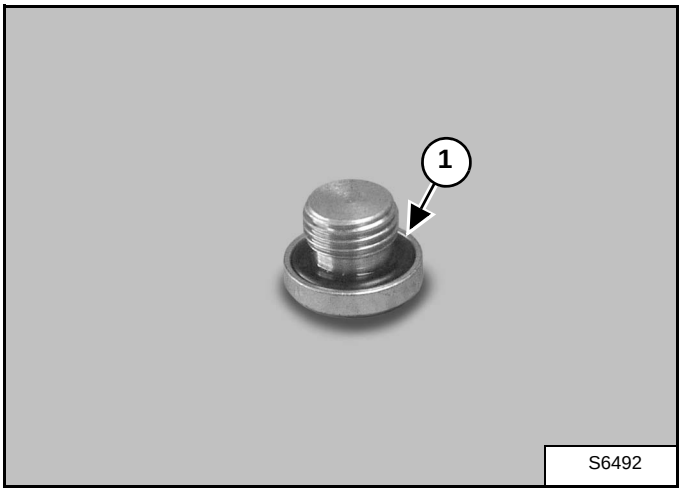
Remove the two O-rings (Item 1) and the backup ring (Item 2) **[Figure 20-60-41]** from the solenoid stem.

Figure 20-60-42



Remove the plug (Item 1) **[Figure 20-60-42]** from the top of the manifold.

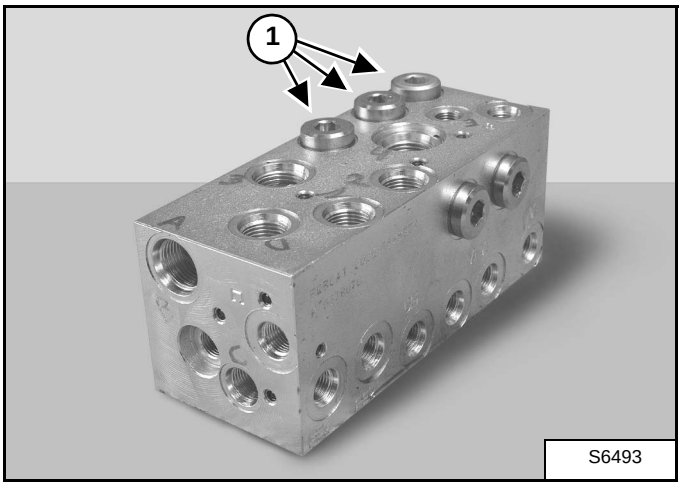
Figure 20-60-43



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

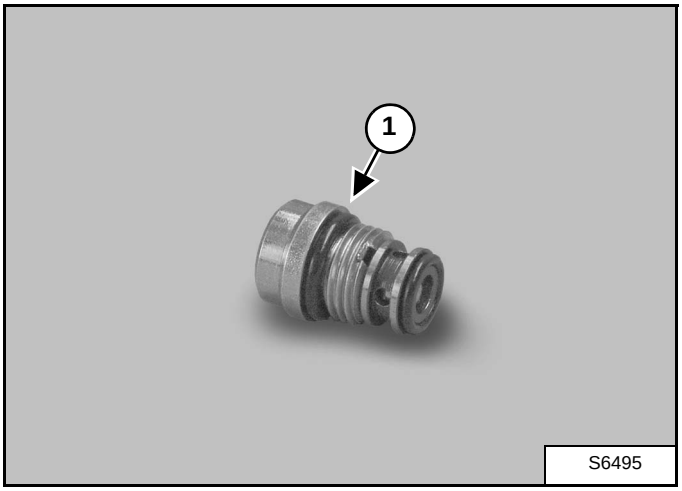
Disassembly (Cont'd)

Figure 20-60-44



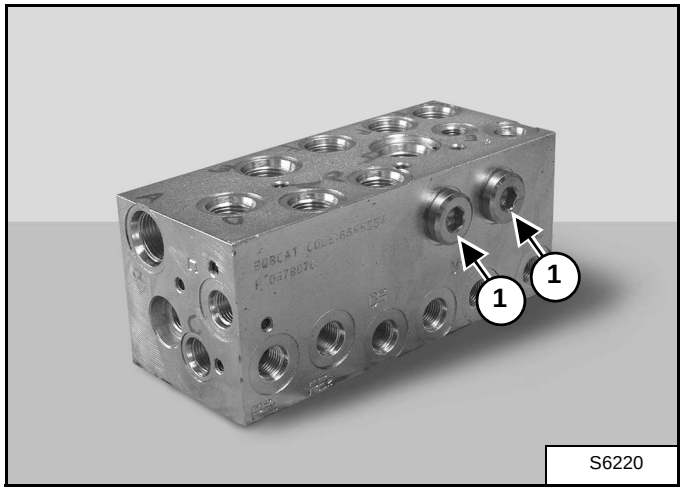
Remove the three plugs (Item 1) **[Figure 20-60-44]** from the top of the manifold.

Figure 20-60-45



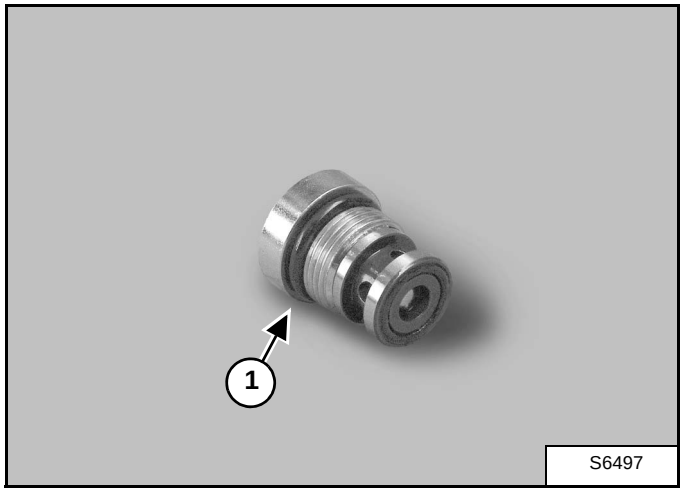
Remove the O-ring (Item 1) **[Figure 20-60-45]** from the plugs.

Figure 20-60-46



Remove the two plugs (Item 1) **[Figure 20-60-46]** from the side of the manifold.

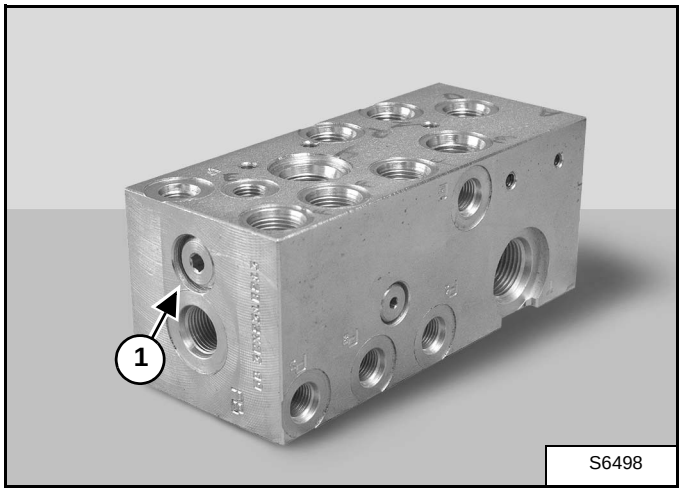
Figure 20-60-47



Remove the O-ring (Item 1) **[Figure 20-60-47]** from the plugs.

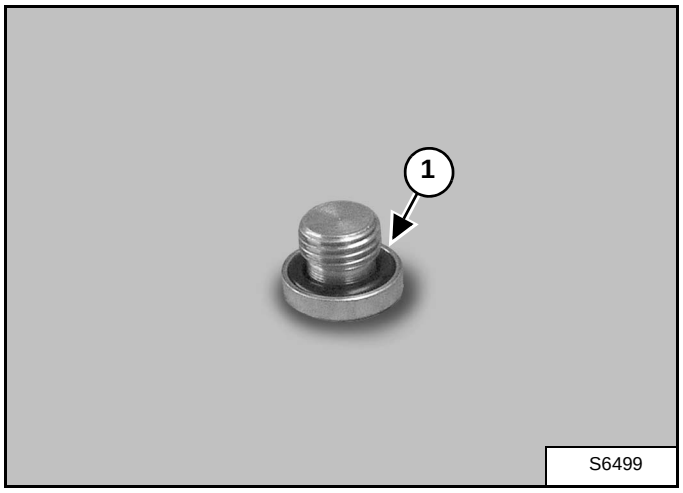
Disassembly (Cont'd)

Figure 20-60-48



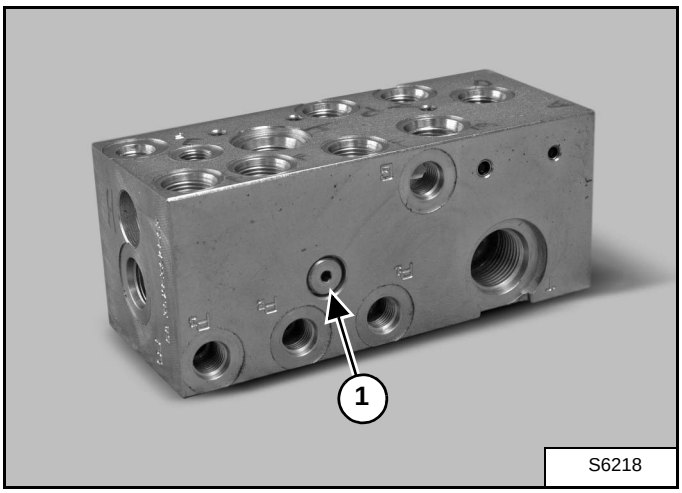
Remove the plug (Item 1) **[Figure 20-60-48]**.

Figure 20-60-49



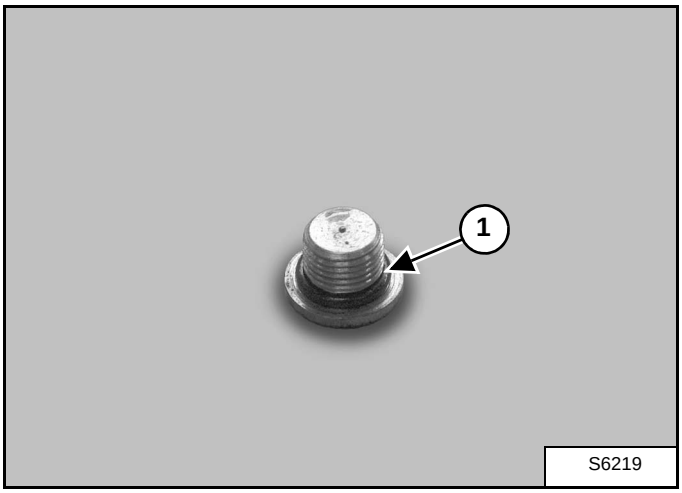
Remove the O-ring (Item 1) **[Figure 20-60-49]** from the plug.

Figure 20-60-50



Remove the plug (Item 1) **[Figure 20-60-50]**.

Figure 20-60-51



Remove the O-ring (Item 1) **[Figure 20-60-51]** from the plug.

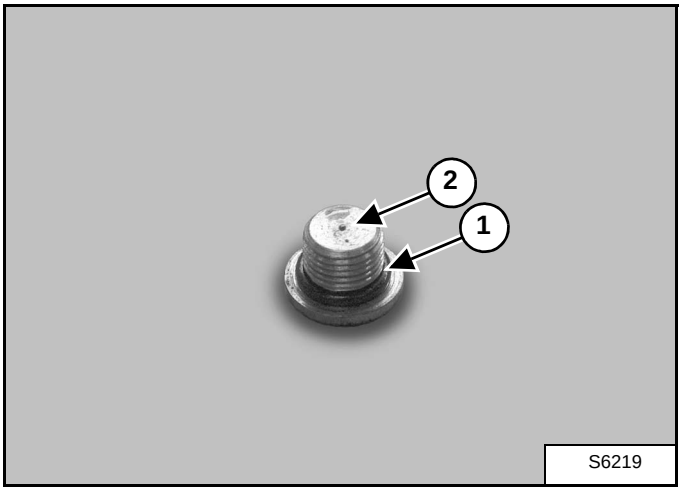
Assembly

Clean all parts in solvent and dry with compressed air.

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

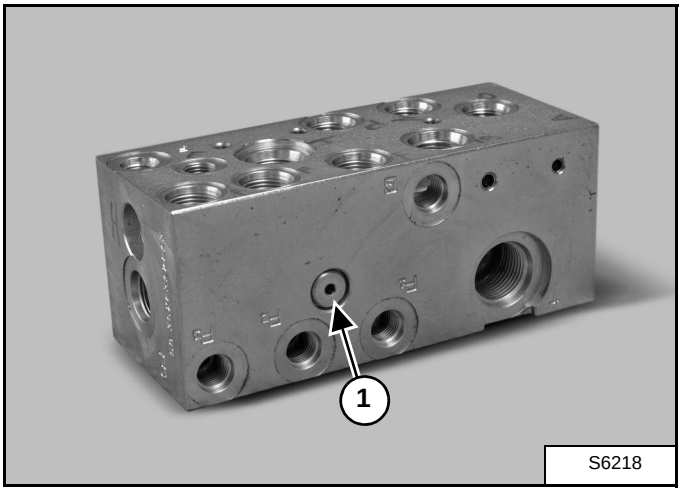
Always install new backup rings and O-rings. Lubricate all backup rings and O-rings with clean hydraulic fluid before installation.

Figure 20-60-52



Install the O-ring (Item 1) on the plug (Item 2) **[Figure 20-60-52]**.

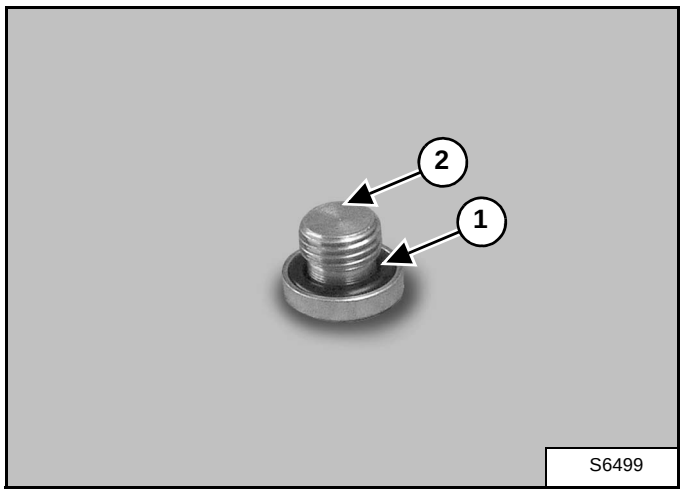
Figure 20-60-53



Install the plug (Item 1) **[Figure 20-60-53]**.

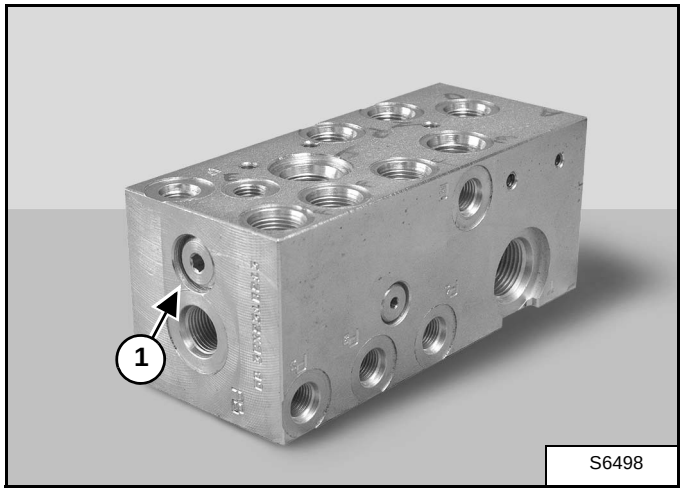
Tighten the plug to 11 ft.-lb. (15 N•m) torque.

Figure 20-60-54



Install the O-ring (Item 1) on the plug (Item 2) **[Figure 20-60-54]**.

Figure 20-60-55

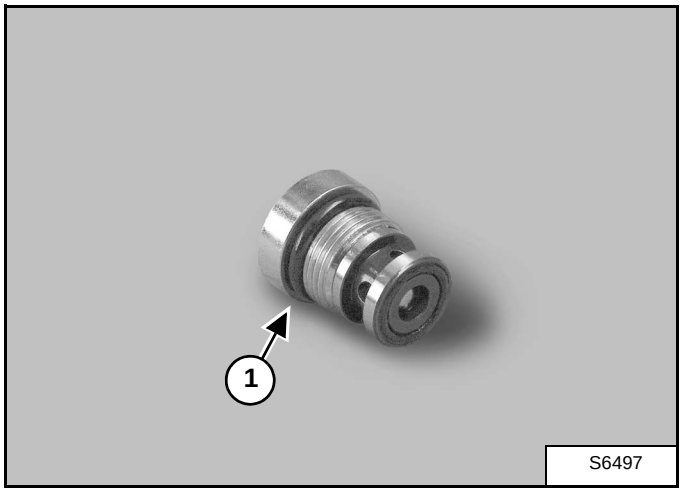


Install the plug (Item 1) **[Figure 20-60-55]**.

Tighten the plug to 22 ft.-lb. (30 N•m) torque.

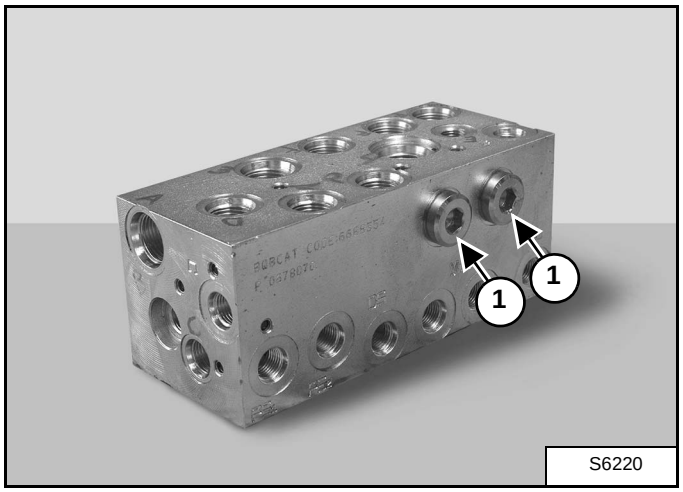
Assembly (Cont'd)

Figure 20-60-56



Install the O-rings (Item 1) **[Figure 20-60-56]** on the two plugs.

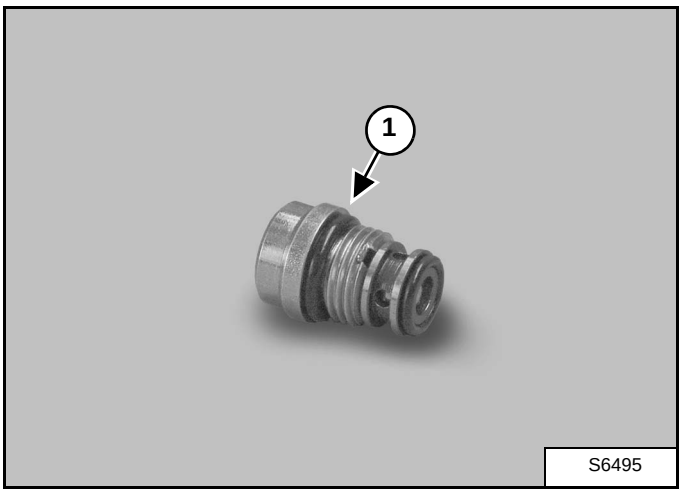
Figure 20-60-57



Install the two plugs (Item 1) **[Figure 20-60-57]** in the side of the manifold.

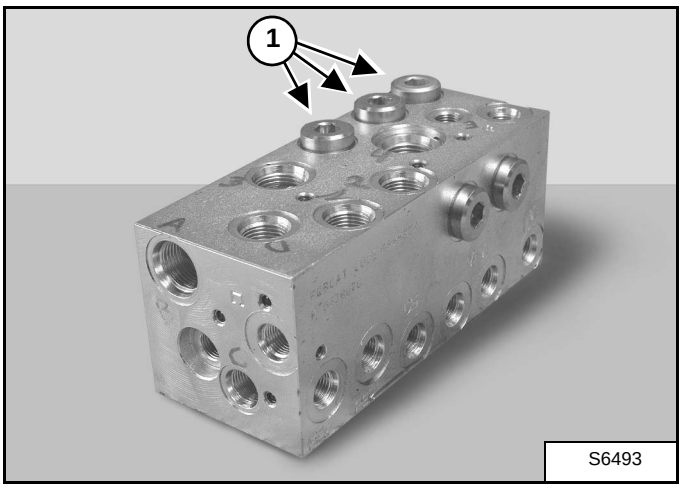
Tighten the plugs to 44 ft.-lb. (60 N•m) torque.

Figure 20-60-58



Install the O-rings (Item 1) **[Figure 20-60-58]** on the three plugs.

Figure 20-60-59

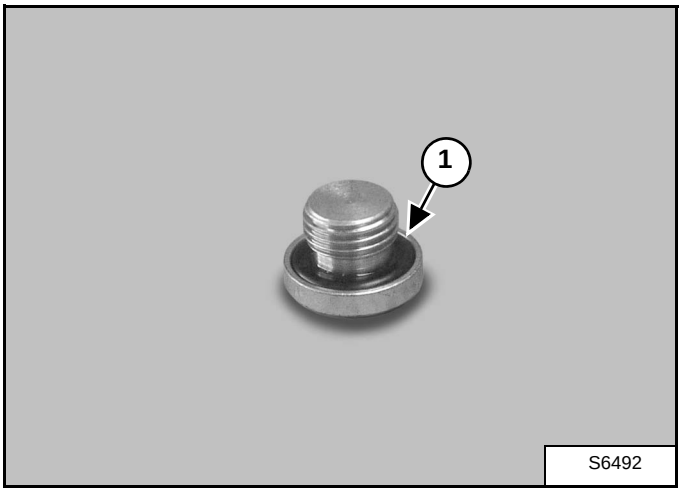


Install the three plugs (Item 1) **[Figure 20-60-59]**.

Tighten the plugs to 44 ft.-lb. (60 N•m) torque.

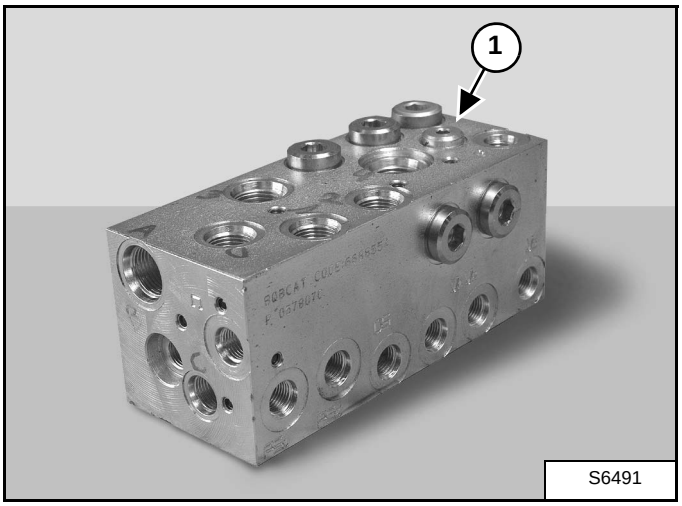
Assembly (Cont'd)

Figure 20-60-60



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

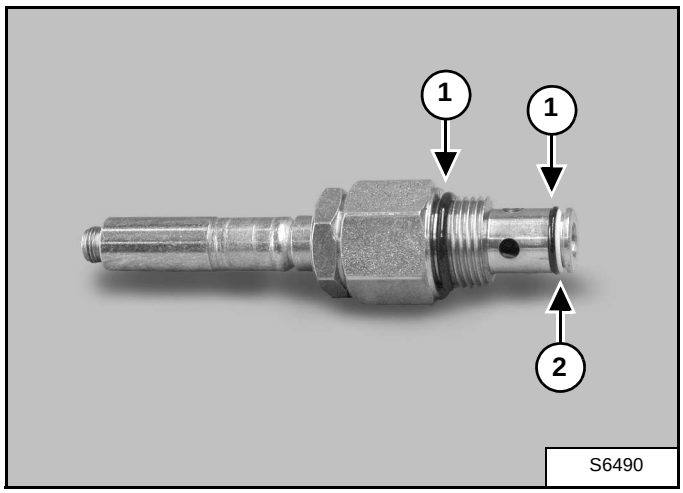
Figure 20-60-61



Install the plug (Item 1) **[Figure 20-60-61]**.

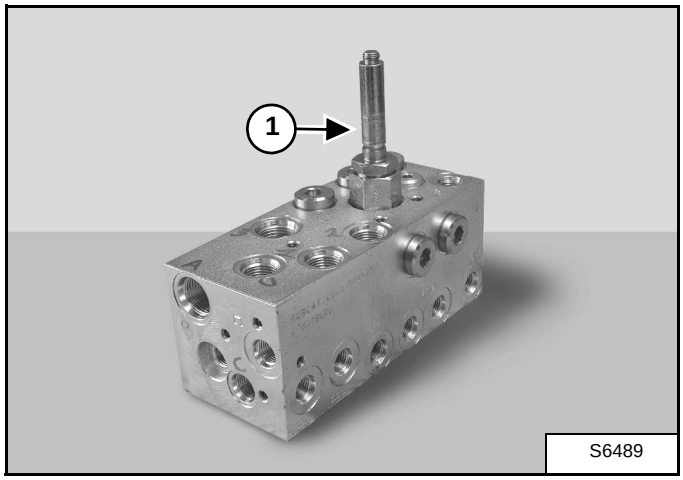
Tighten the plug to 22 ft.-lb. (30 N•m) torque.

Figure 20-60-62



Install the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-60-62]**.

Figure 20-60-63

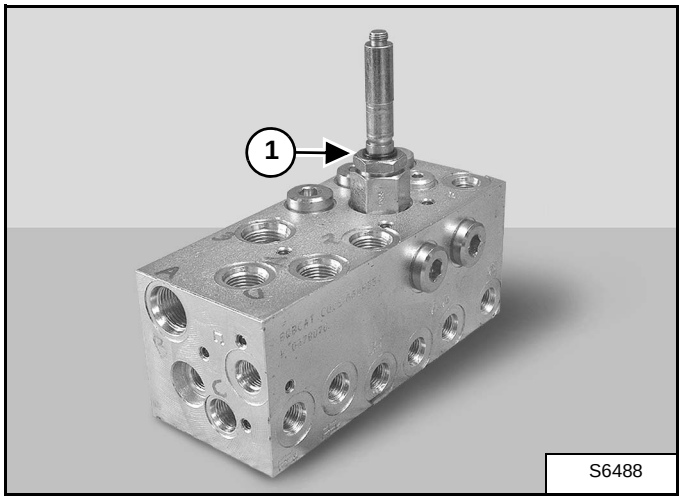


Install the solenoid stem (Item 1) **[Figure 20-60-63]**.

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

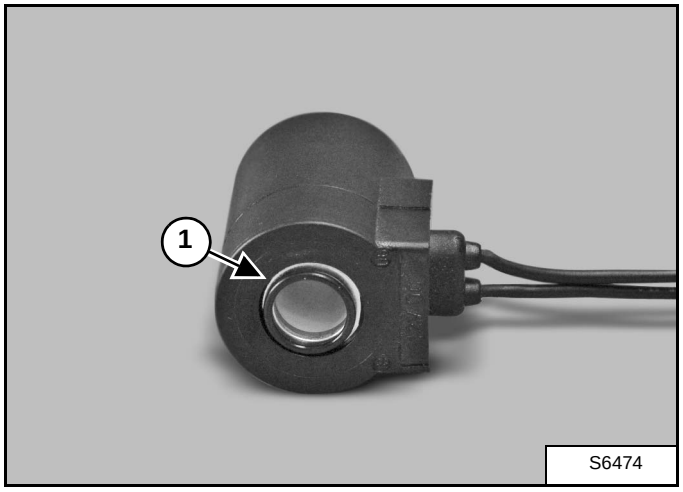
Assembly (Cont'd)

Figure 20-60-64



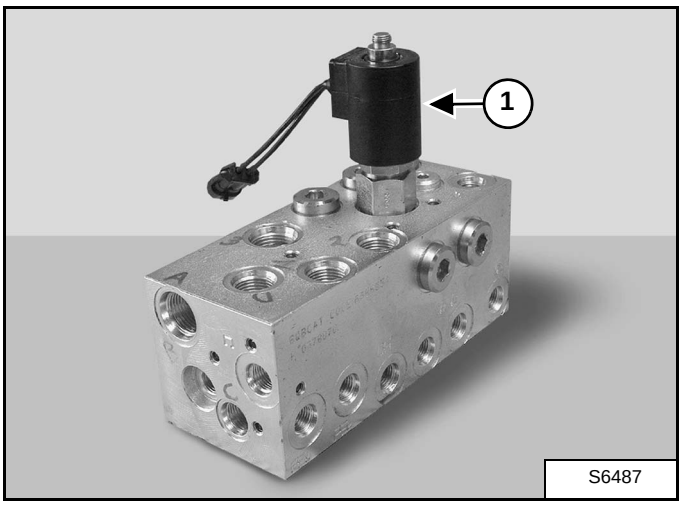
Install the O-ring (Item 1) **[Figure 20-60-64]** on the solenoid stem.

Figure 20-60-65



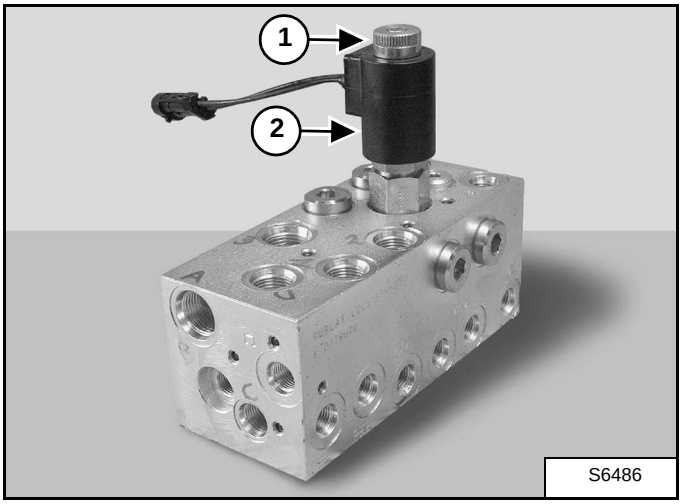
Install the O-ring (Item 1) **[Figure 20-60-65]** on the coil.

Figure 20-60-66



Install the coil with no strap (Item 1) **[Figure 20-60-66]** on the solenoid stem.

Figure 20-60-67



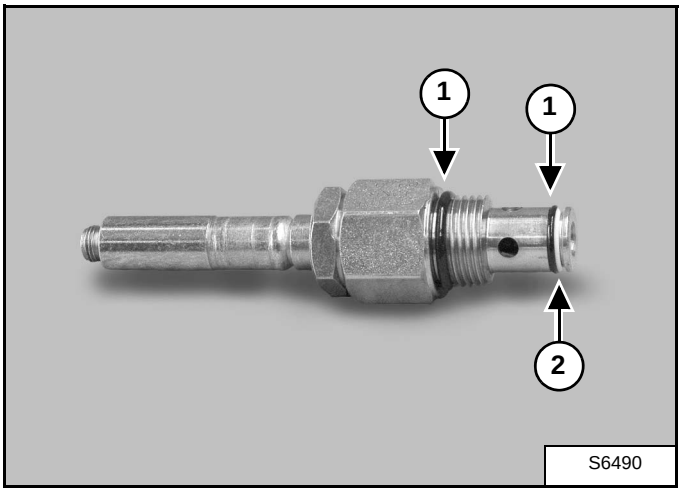
Install the nut (Item 1) on the two speed solenoid (Item 2) **[Figure 20-60-67]**.

Tighten the nuts to 4.4 ft.-lb. (6 N•m) torque.

NOTE: Overtightening the nut (Item 1) [Figure 20-60-67] may cause solenoid or coil failure.

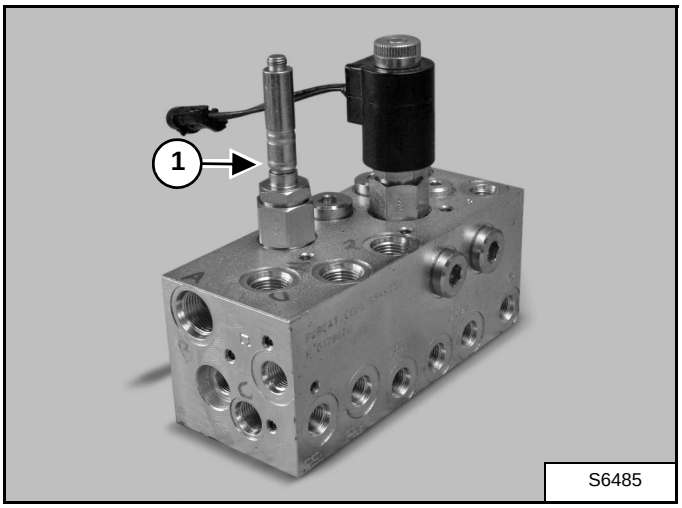
Assembly (Cont'd)

Figure 20-60-68



Install the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-60-68]**.

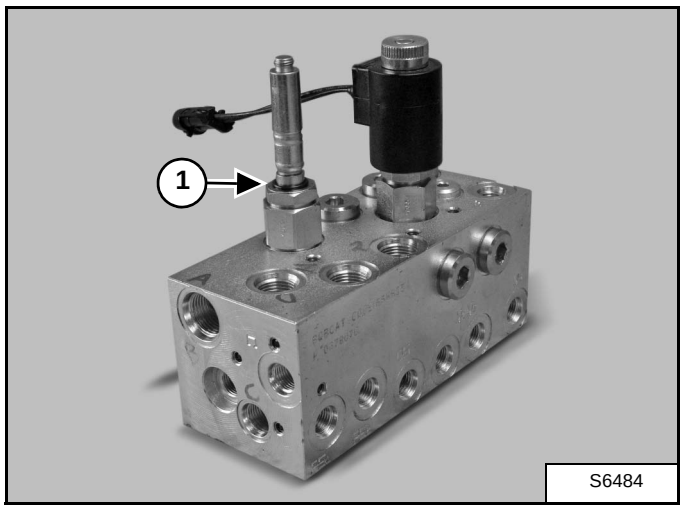
Figure 20-60-69



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

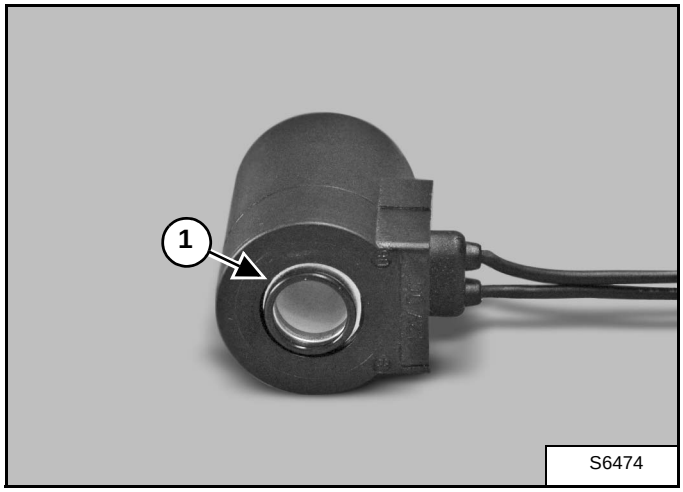
Tighten the solenoid stem to 37 ft.-lb. (50 N•m) torque.

Figure 20-60-70



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

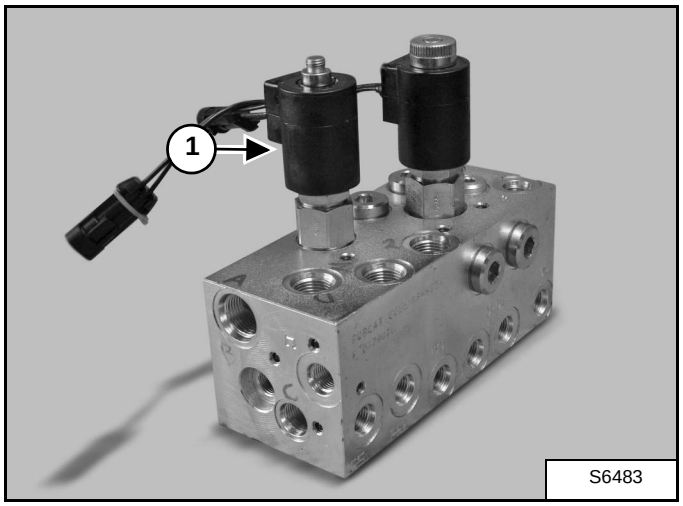
Figure 20-60-71



Install the O-ring (Item 1) **[Figure 20-60-71]** on the coil.

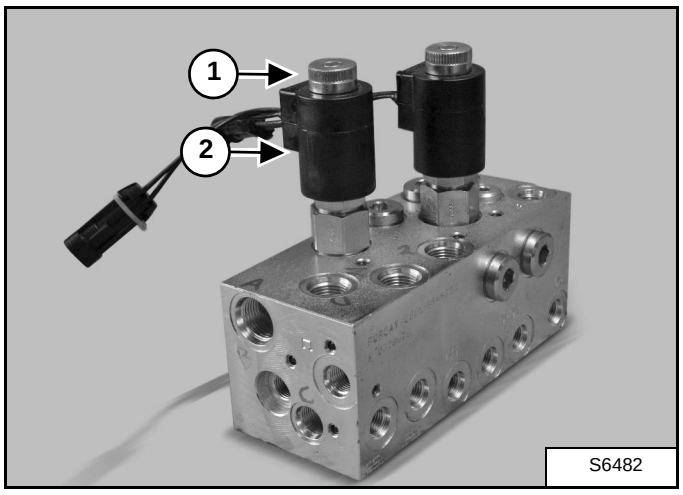
Assembly (Cont'd)

Figure 20-60-72



Install the coil with the orange tie strap (Item 1) **[Figure 20-60-72]** on the system by-pass solenoid stem.

Figure 20-60-73

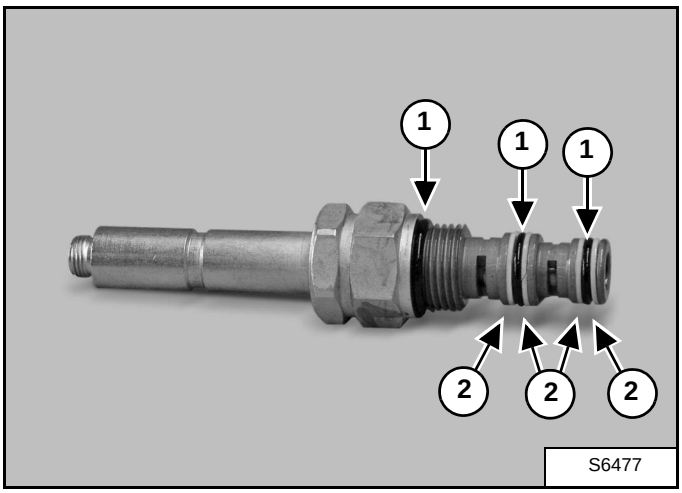


Install the nut (Item 1) on the system by-pass solenoid (Item 2) **[Figure 20-60-73]**.

Tighten the nuts to 4.4 ft.-lb. (6 N•m) torque.

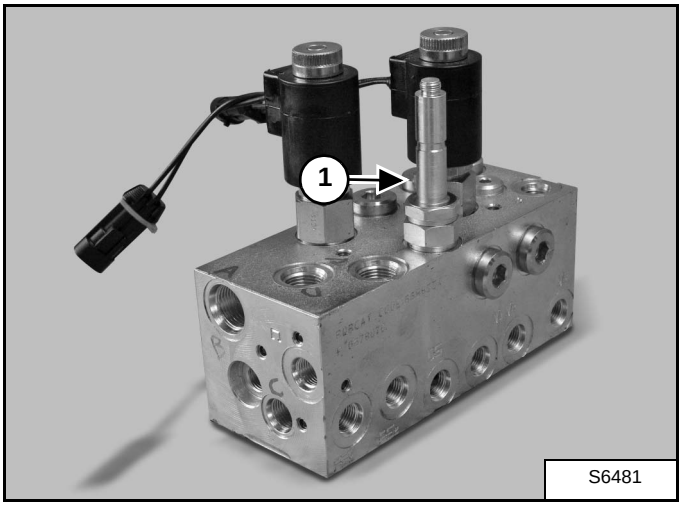
NOTE: Overtightening the nut (Item 1) [Figure 20-60-73] may cause solenoid or coil failure.

Figure 20-60-74



Install the O-rings (Item 1) and backup rings (Item 2) **[Figure 20-60-74]**.

Figure 20-60-75

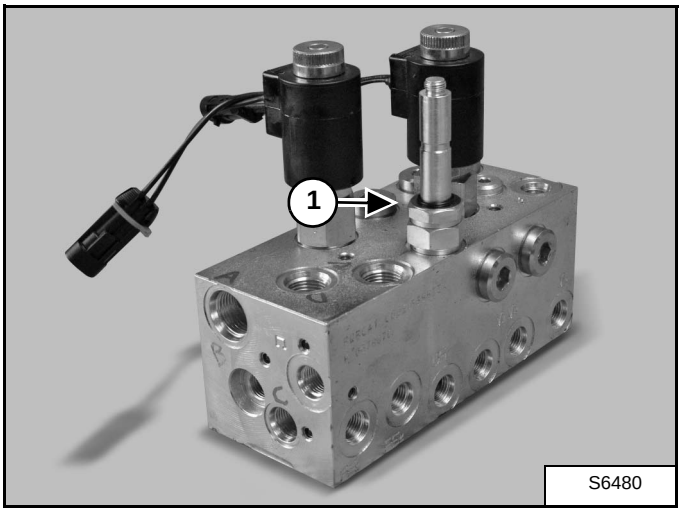


Install the solenoid stem (Item 1) **[Figure 20-60-75]**.

Tighten the solenoid stem to 22 ft.-lb. (30 N•m) torque.

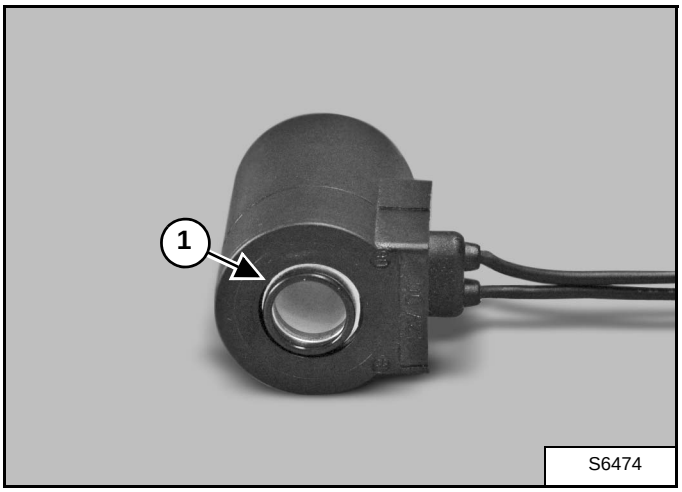
Assembly (Cont'd)

Figure 20-60-76



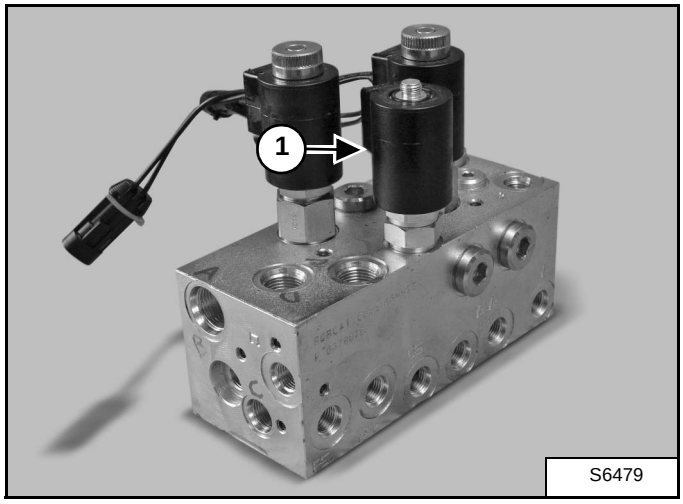
Install the O-ring (Item 1) **[Figure 20-60-76]** on the solenoid stem.

Figure 20-60-77



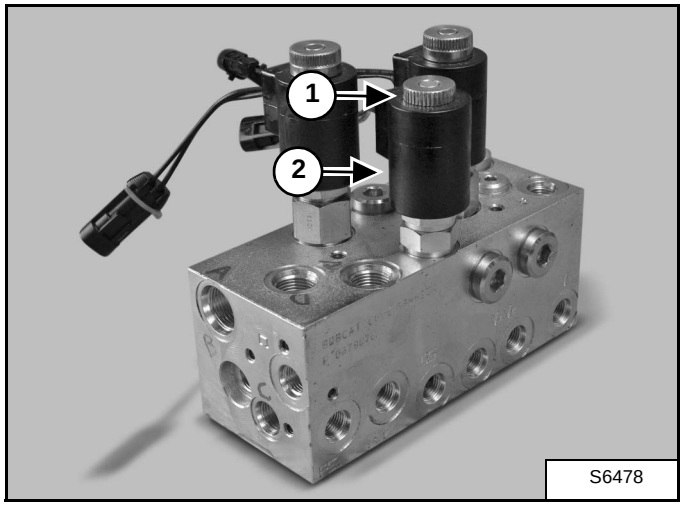
Install the O-ring (Item 1) **[Figure 20-60-77]** on the coil.

Figure 20-60-78



Install the coil with yellow tie strap (Item 1) **[Figure 20-60-78]** on the two speed boost solenoid stem.

Figure 20-60-79



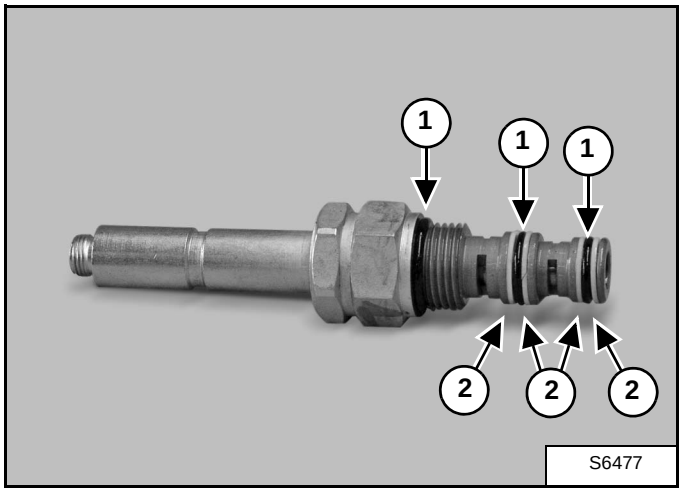
Install the nut (Item 1) on the two speed boost solenoid (Item 2) **[Figure 20-60-79]**.

Tighten the nuts to 4.4 ft.-lb. (6 N•m) torque.

NOTE: Overtightening the nut (Item 1) [Figure 20-60-79] may cause solenoid or coil failure.

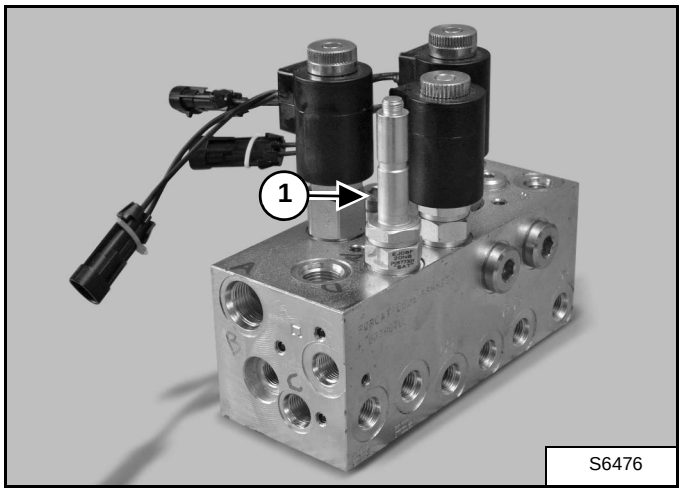
Assembly (Cont'd)

Figure 20-60-80



Install the O-rings (Item 1) and backup rings (Item 2) **[Figure 20-60-80]**.

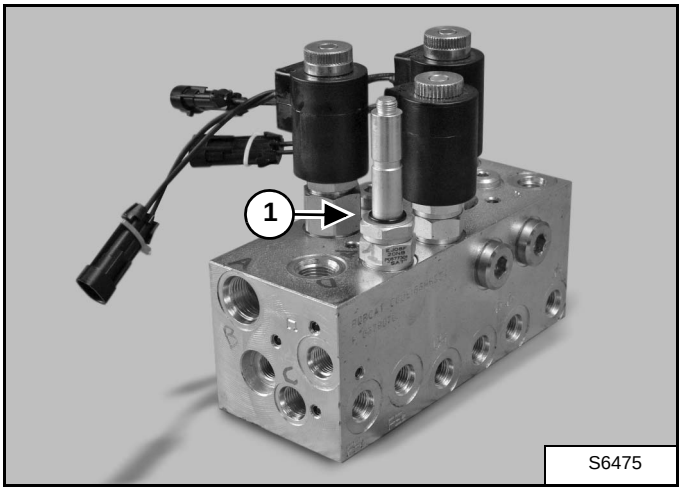
Figure 20-60-81



Install the solenoid stem (Item 1) **[Figure 20-60-81]**.

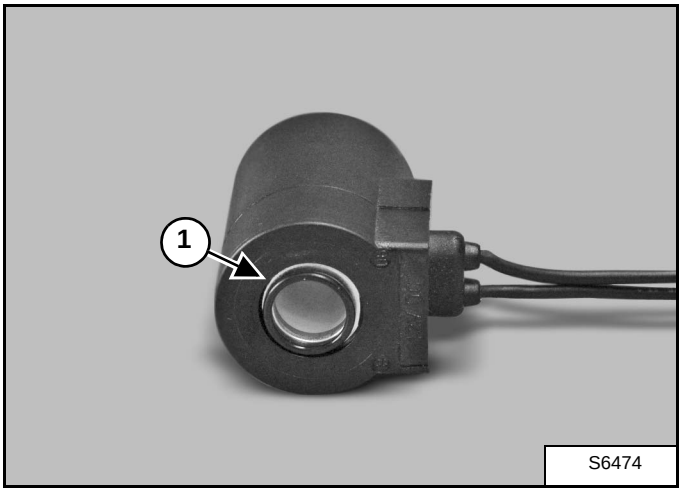
Tighten the solenoid stem to 22 ft.-lb. (30 N•m) torque.

Figure 20-60-82



Install the O-ring (Item 1) **[Figure 20-60-82]** on the solenoid stem.

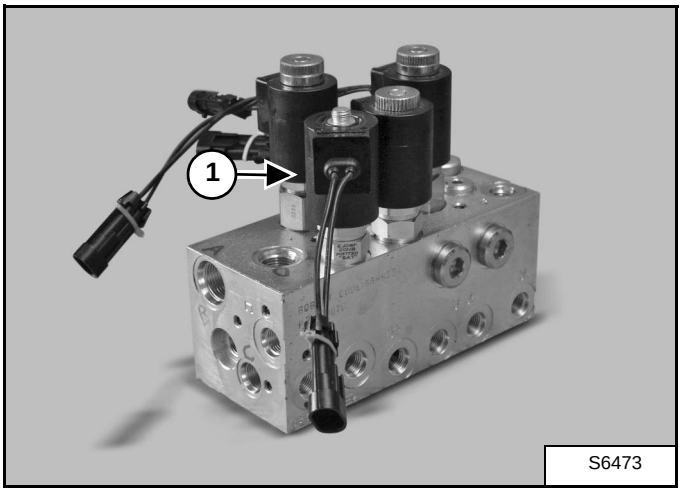
Figure 20-60-83



Install the O-ring (Item 1) **[Figure 20-60-83]** on the coil.

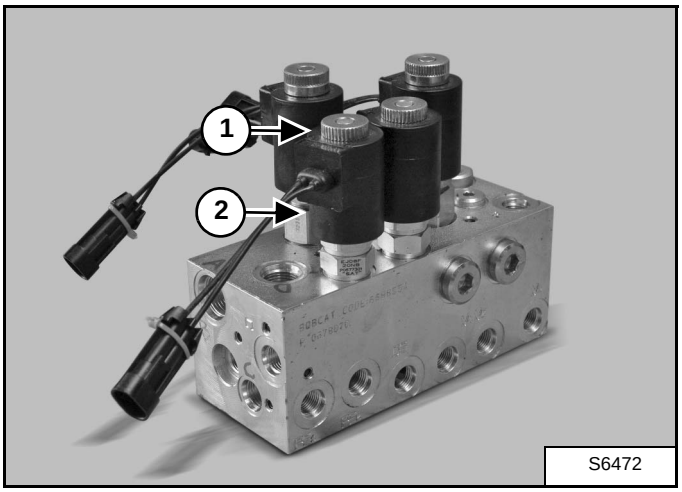
Assembly (Cont'd)

Figure 20-60-84



Install the coil with the green tie strap (Item 1) **[Figure 20-60-84]** on the console (joystick) lockout solenoid stem.

Figure 20-60-85

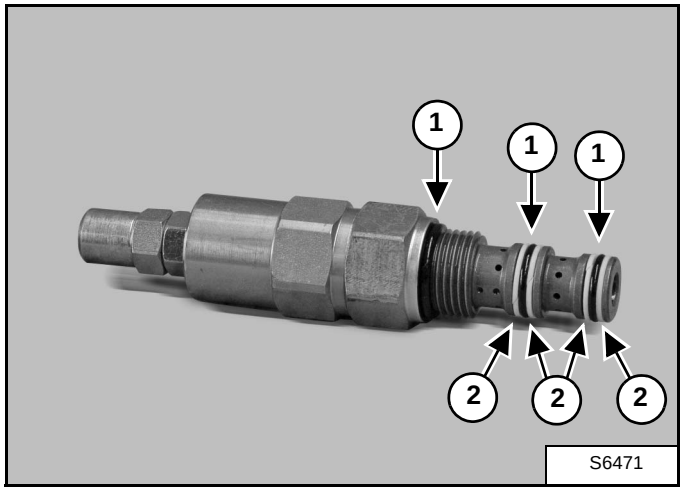


Install the nut (Item 1) on the console (joystick) lockout solenoid (Item 2) **[Figure 20-60-85]**.

Tighten the nuts to 4.4 ft.-lb. (6 N•m) torque.

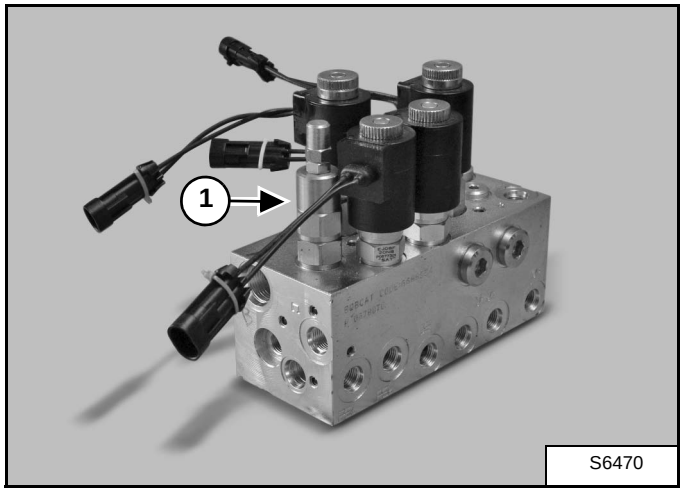
NOTE: Overtightening the nut (Item 1) [Figure 20-60-85] may cause solenoid or coil failure.

Figure 20-60-86



Remove the O-rings (Item 1) and backup rings (Item 2) **[Figure 20-60-86]**.

Figure 20-60-87

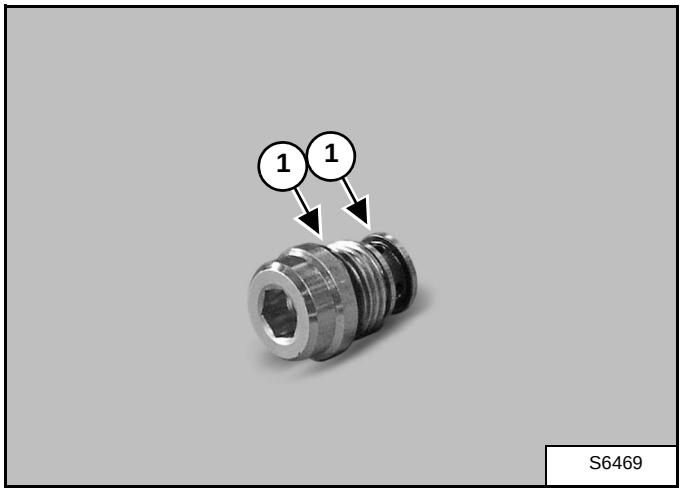


Install the pressure reducing valve (Item 1) **[Figure 20-60-87]** from the manifold.

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

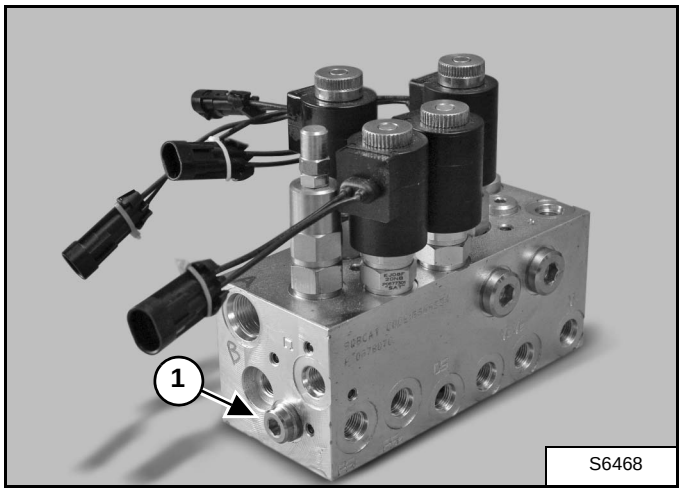
Assembly (Cont'd)

Figure 20-60-88



Install the two O-rings (Item 1) **[Figure 20-60-88]** on the plug.

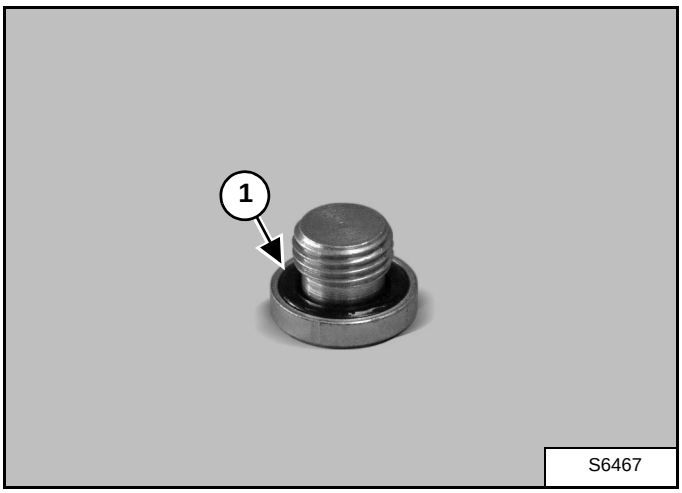
Figure 20-60-89



Install the plug (Item 1) **[Figure 20-60-89]** in the manifold.

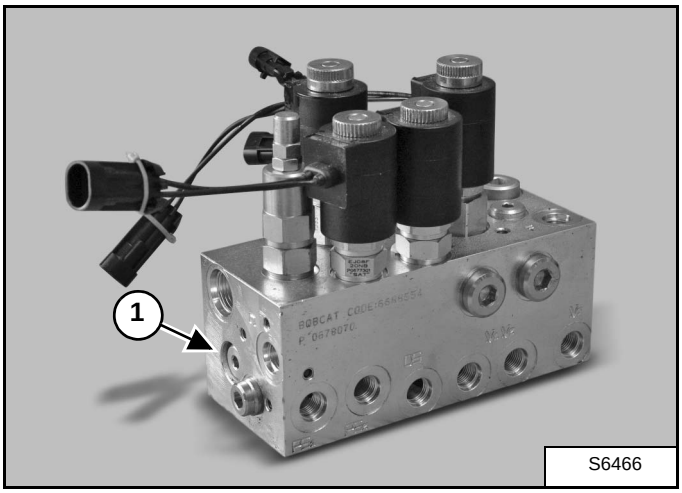
Tighten the plug to 30 ft.-lb. (40 N•m) torque.

Figure 20-60-90



Install the O-ring (Item 1) **[Figure 20-60-90]** on the plug.

Figure 20-60-91

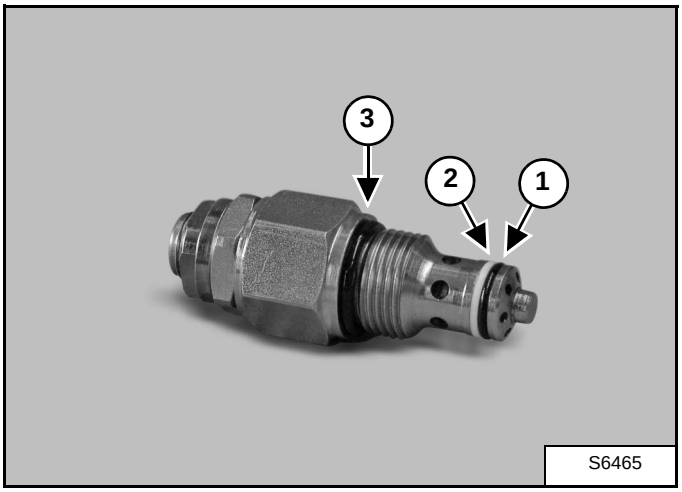


Install the plug (Item 1) **[Figure 20-60-91]** in the manifold.

Tighten the plug to 22 ft.-lb. (30 N•m) torque.

Assembly (Cont'd)

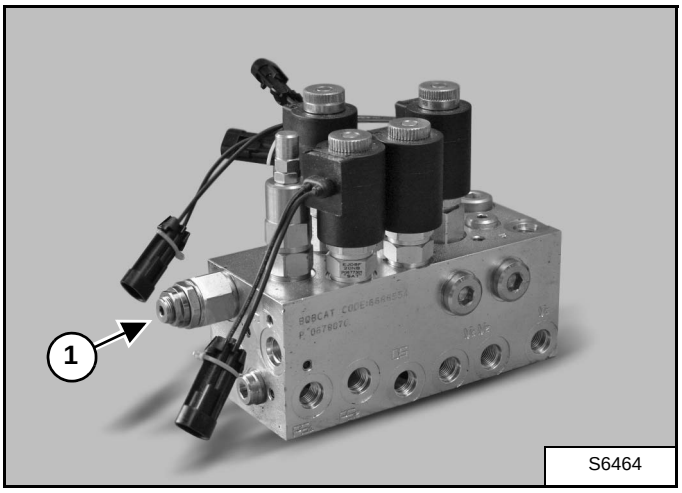
Figure 20-60-92



Install the backup ring (Item 1) O-ring (Item 2) **[Figure 20-60-92]** on the relief valve.

Install the O-ring (Item 3) **[Figure 20-60-92]** on the relief valve.

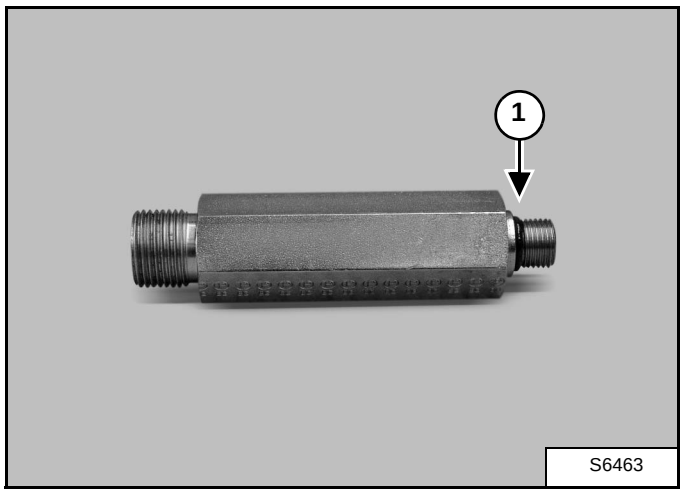
Figure 20-60-93



Install the relief valve (Item 1) **[Figure 20-60-93]** in the manifold.

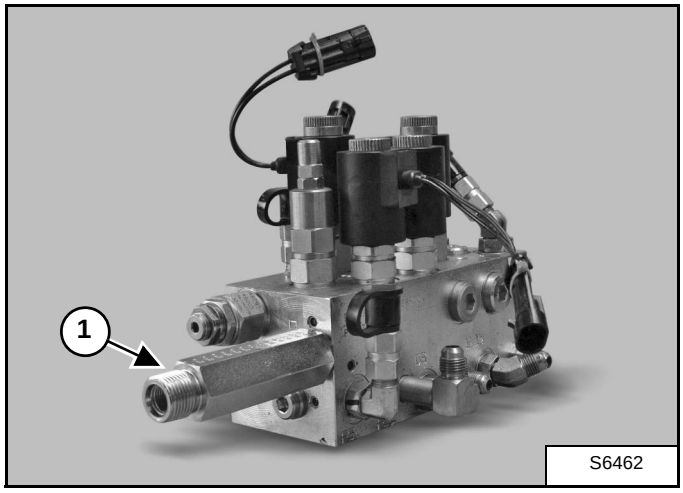
Tighten the valve to 44 ft.-lb. (60 N•m) torque.

Figure 20-60-94



Install the O-ring (Item 1) **[Figure 20-60-94]** on the accumulator extension.

Figure 20-60-95



Install the accumulator extension (Item 1) **[Figure 20-60-95]** on the manifold.

Tighten the extension to 21-24 ft.-lb. (29-33 N•m) torque.

ACCUMULATORS

Removal And Installation

Lower the boom / bucket and blade to the ground.

⚠ WARNING

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

W-2145-0290

IMPORTANT

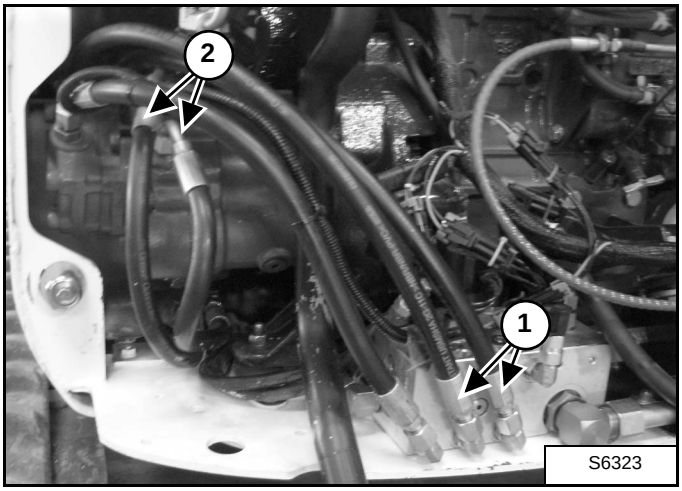
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

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

Open the tailgate.

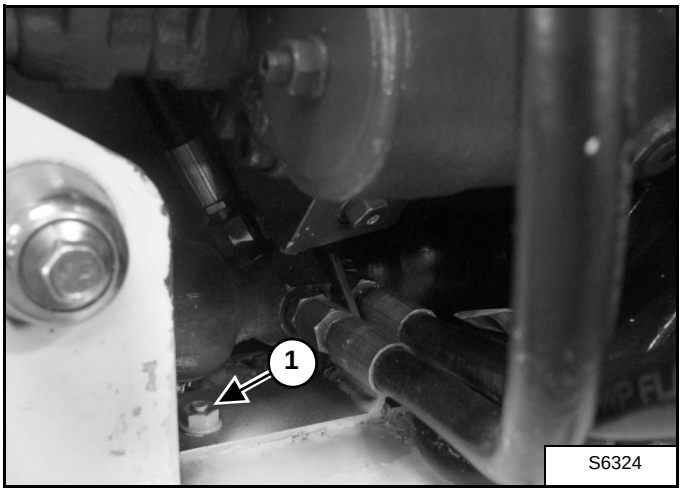
Figure 20-61-1



Remove the two hoses (Item 1) **[Figure 20-61-1]** from the manifold assembly.

Remove the two hoses (Item 2) **[Figure 20-61-1]** from the piston pump.

Figure 20-61-2



Remove the two bolts (Item 1) **[Figure 20-61-2]** from the excavator frame.

Remove the accumulators assembly from the excavator.


Bobcat®

TRAVEL MOTOR

Description

The travel motor is a hydraulic motor which receives hydraulic fluid from the hydraulic pump through the hydraulic control valve. The speed that the travel motor rotates is related to the amount of hydraulic fluid it receives. This travel motor is not equipped with two-speed.

Removal And Installation

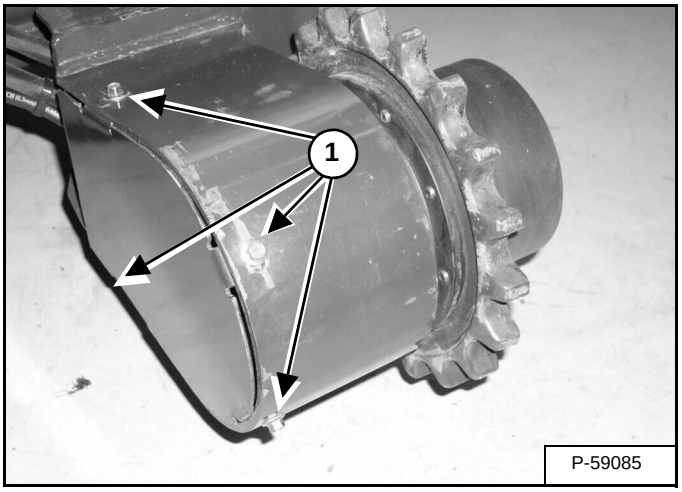
Remove the track (See Removal And Installation on Page 30-20-4.)

IMPORTANT

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

I-2003-0888

Figure 20-70-1



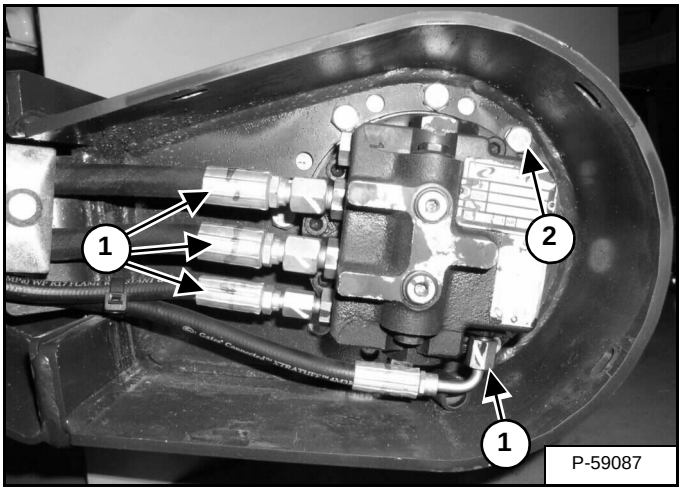
Remove the bolts (Item 1) **[Figure 20-70-1]** from the track frame cover.

Installation: Tighten the bolts to 15-18 ft.-lb. (20-25 N•m) torque.

Remove the cover.

Mark the hoses for correct installation.

Figure 20-70-2



Remove the hoses (Item 1) **[Figure 20-70-2]** from the travel motor.

Remove the travel motor mounting bolts (Item 2) **[Figure 20-70-2]**.

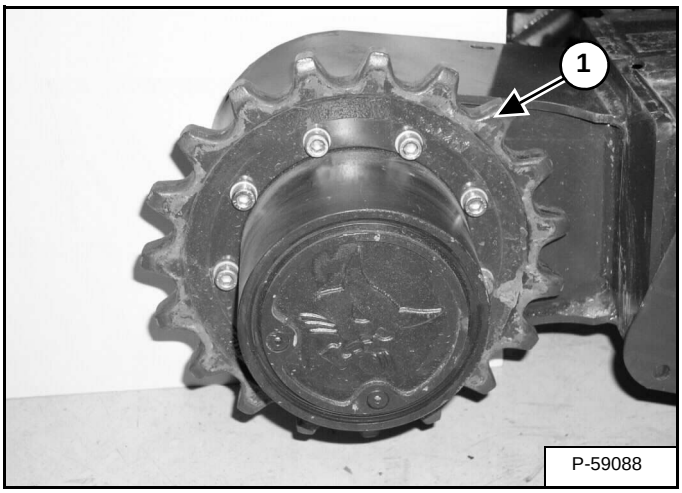
Installation: Tighten the bolts to 29-37 ft.-lb. (40-50 N•m) torque.

Remove the travel motor.

The drive sprocket can be removed without removing the travel motor.

If removing the sprocket from a travel motor that has been removed from the track frame, clamp the motor in a vise.

Figure 20-70-3

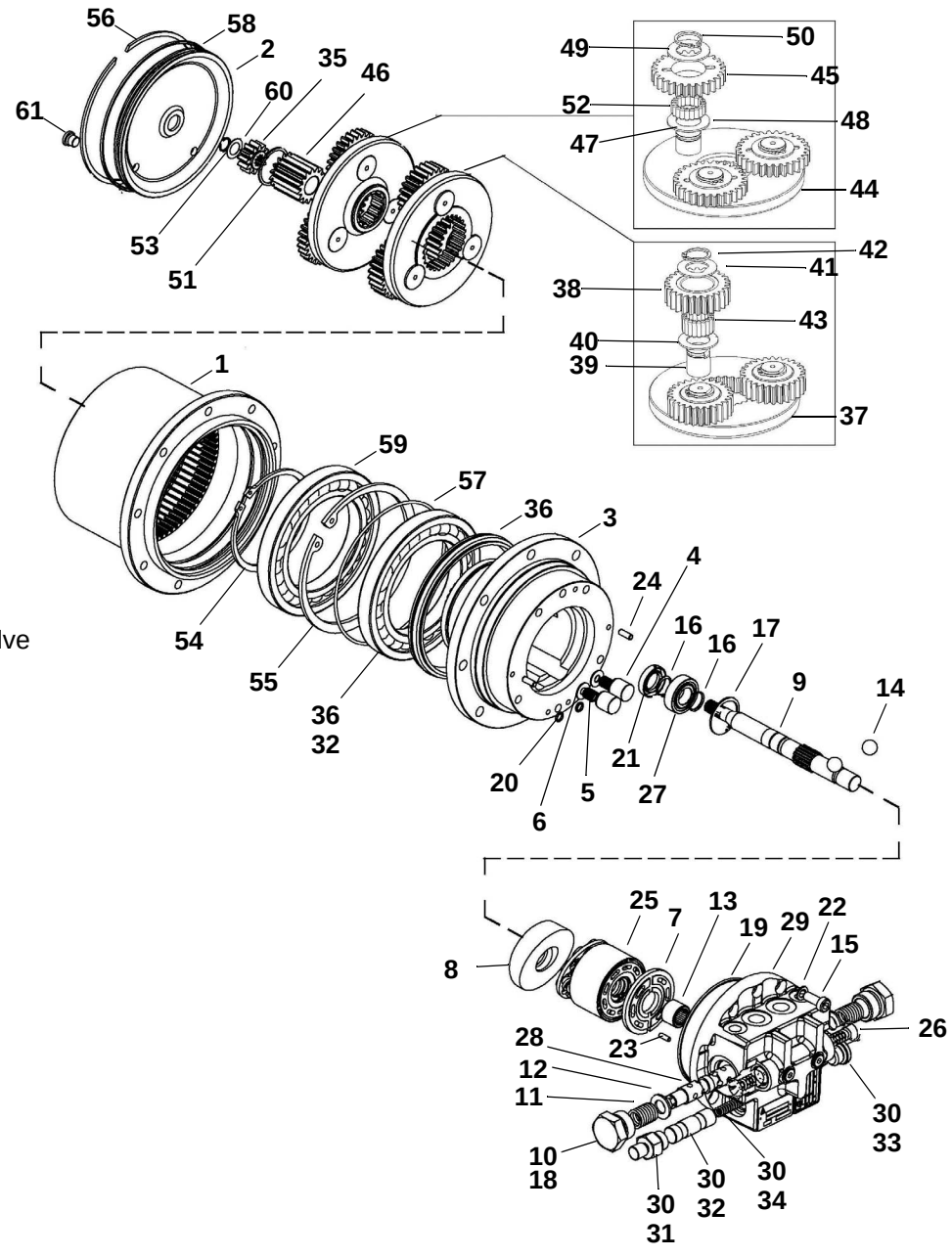


Remove the sprocket bolts. Remove the sprocket (Item 1) **[Figure 20-70-3]**.

Installation: Tighten the bolts to 48-55 ft.-lb. (65-75 N•m) torque.

Parts Identification

1. Housing
2. Cover
3. Hub
4. Change Disposition Piston
5. Change Disposition Spring
6. Change Disposition Washer
7. Distributor
8. Swash Plate
9. Motor Shaft
10. Plug
11. Spring
12. Washer
13. Needle Bearing
14. Sphere
15. Screw
16. Retaining Ring
17. Retaining Ring
18. O-Ring
19. O-Ring
20. O-Ring
21. Seal
22. Washer
23. Pin
24. Pin
25. Rotating Pump Assy
26. Shockproof Valve
27. Ball Bearing
28. Counterbalance Valve
29. Cover
30. Change Displacement Valve
31. Fitting
32. Valve Piston
33. Plug
34. Spring
35. Gear
36. Bearing and Seal
37. Planetary Carrier
38. Planet Gear
39. Pin
40. Washer
41. Anti-Rotation Washer
42. Retaining Ring
43. Needle Bearing
44. Planetary Carrier
45. Planetary Gear
46. Sun Gear
47. Pin
48. Washer
49. Anti-Rotation Washer
50. Retaining Ring
51. Snap Ring
52. Needle Bearing
53. Retaining Ring
54. Retaining Ring
55. Retaining Ring
56. Snap Ring
57. O-Ring
58. O-Ring
59. Ball Bearing
60. Shim
61. Plug



P-62564

Disassembly

IMPORTANT

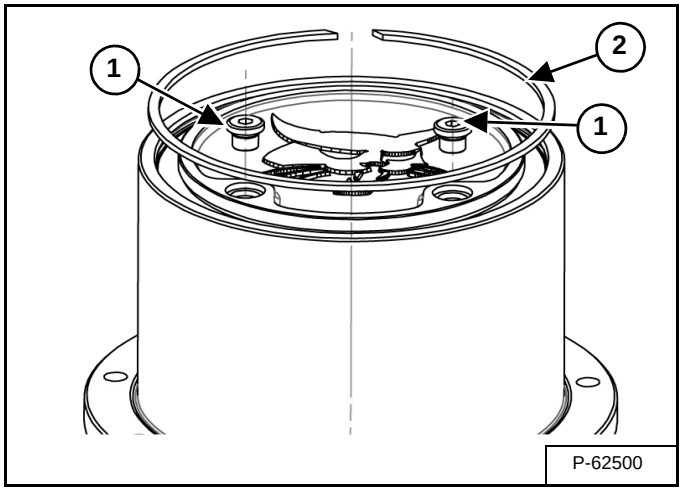
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

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

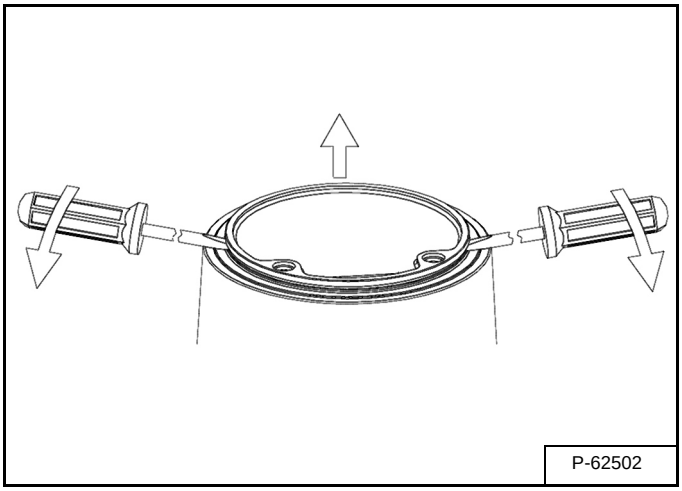
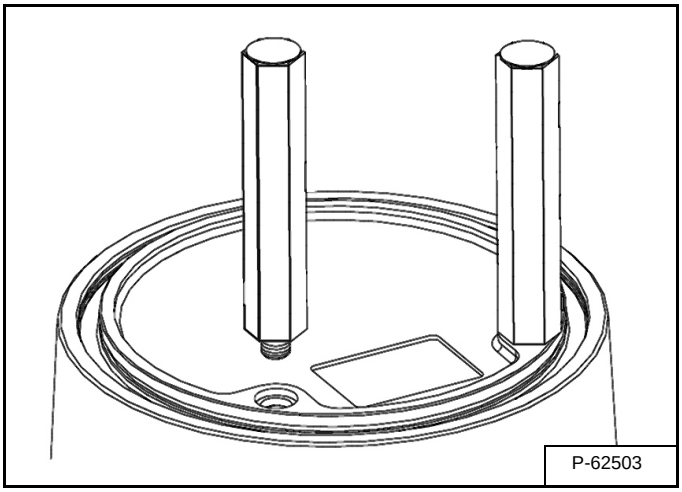


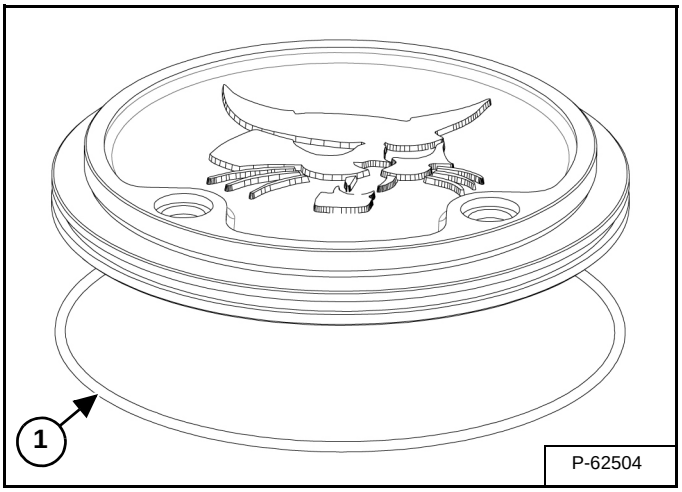
Figure 20-70-6



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]**.

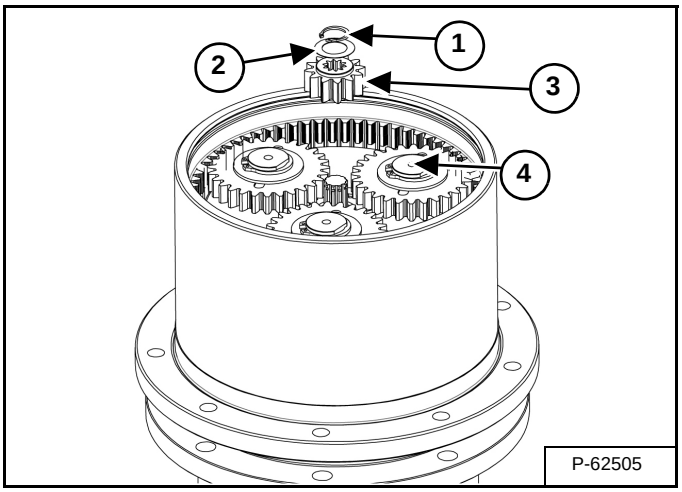
Disassembly (Cont'd)

Figure 20-70-7



Remove the O-Ring (Item 1) **[Figure 20-70-7]** from the cover.

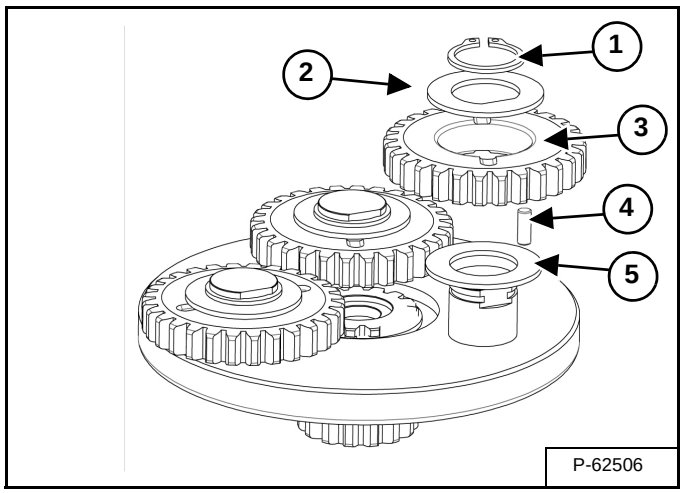
Figure 20-70-8



Remove the retaining ring (Item 1), shims (Item 2) and sun gear (Item 3) **[Figure 20-70-8]**.

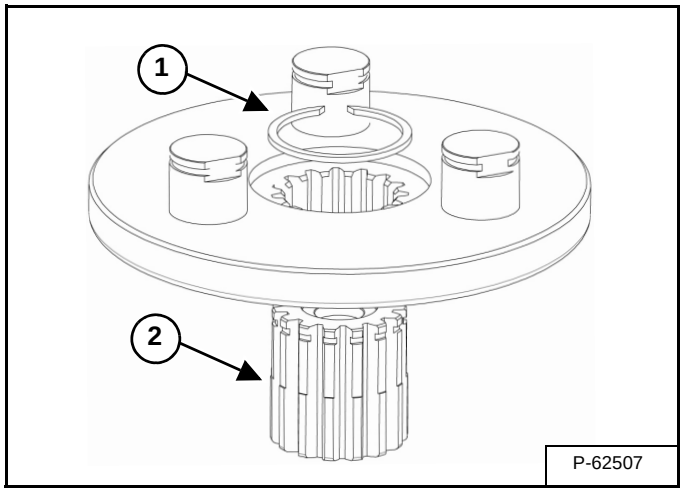
Remove the first stage planetary carrier (Item 4) **[Figure 20-70-8]** using your hands.

Figure 20-70-9



Remove the retaining rings (Item 1), anti-rotation washer (Item 2), planetary gears (Item 3), needle bearings (Item 4) and thrust washer (Item 5) **[Figure 20-70-9]** from the first stage planetary carrier assembly.

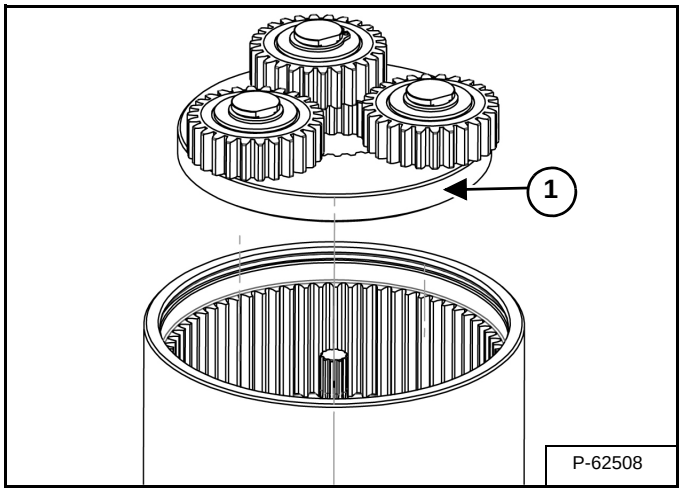
Figure 20-70-10



Remove the retaining ring (Item 1) from the second reduction sun gear (Item 2) **[Figure 20-70-10]** and push the gear down to remove from planetary carrier.

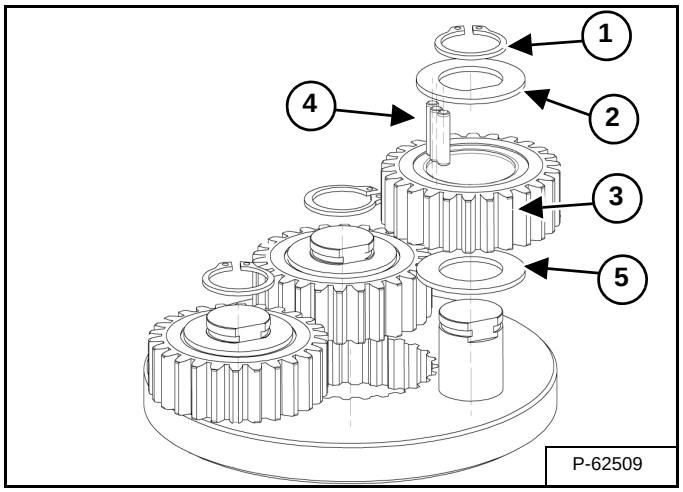
Disassembly (Cont'd)

Figure 20-70-11



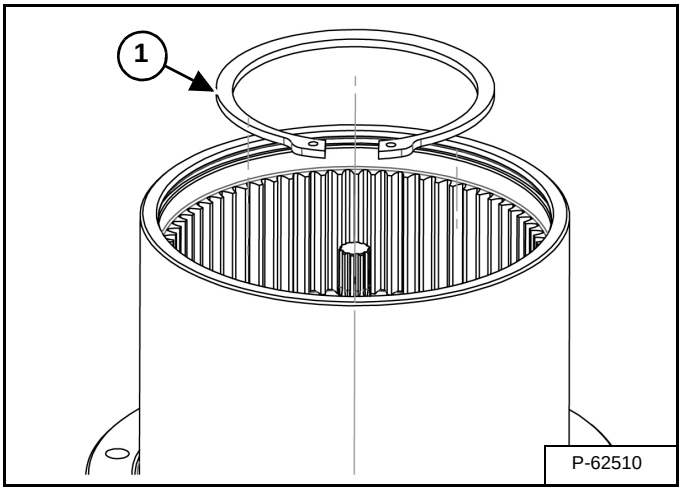
Remove the second stage planetary carrier (Item 1) **[Figure 20-70-11]** using your hands.

Figure 20-70-12



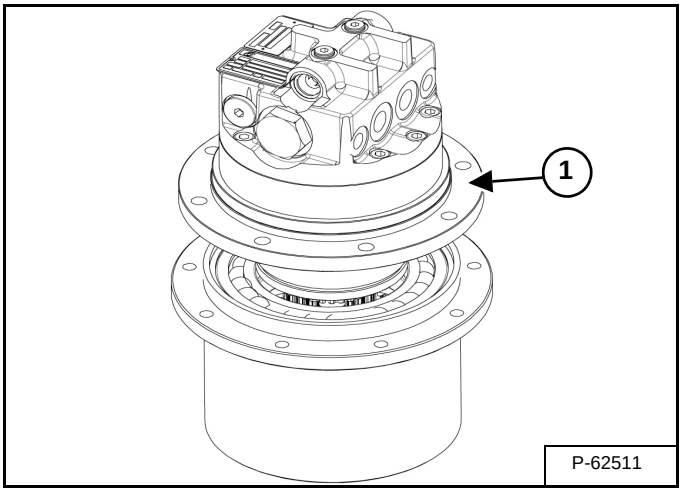
Remove the retaining rings (Item 1), anti-rotation washer (Item 2), planetary gears (Item 3), needle bearings (Item 4) and thrust washer (Item 5) **[Figure 20-70-12]** from the first stage planetary carrier assembly.

Figure 20-70-13



Remove the retaining ring (Item 1) **[Figure 20-70-13]** from the hub to free the two bearings, ring gear and motor.

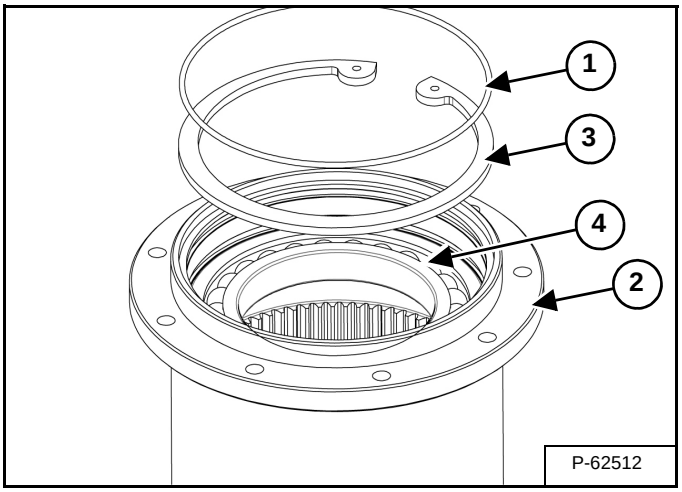
Figure 20-70-14



Remove the hub (Item 1) **[Figure 20-70-14]** from the ring gear.

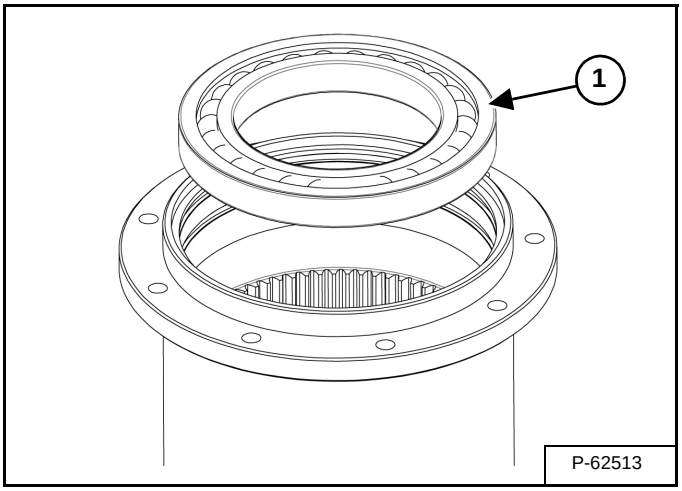
Disassembly (Cont'd)

Figure 20-70-15



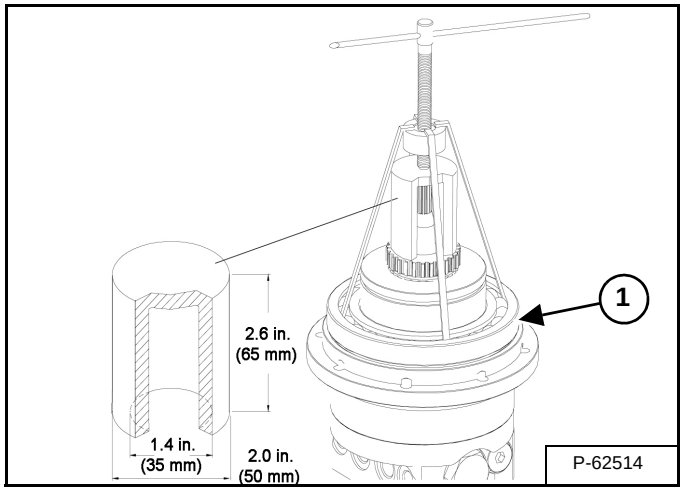
Remove the O-Ring (Item 1) from the ring gear (Item 2) and the retaining ring (Item 3) securing the bearing (Item 4) **[Figure 20-70-15]**.

Figure 20-70-16



Remove the bal bearing (Item 1) **[Figure 20-70-16]** by pushing from underneath.

Figure 20-70-17

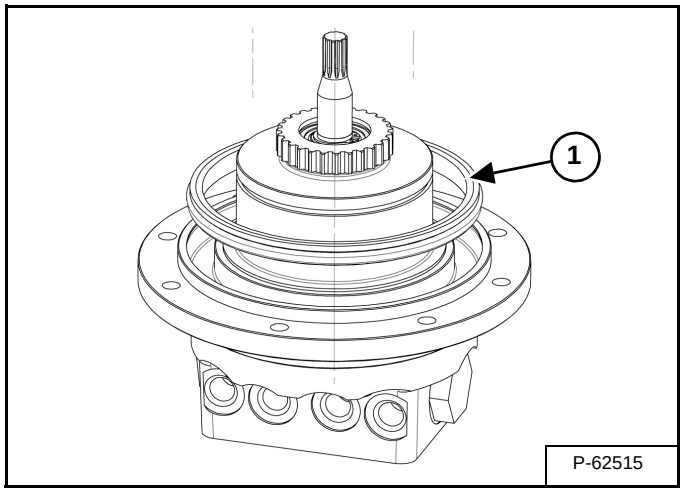


Remove the lapped bearing / front seal (Item 1) **[Figure 20-70-17]**.

NOTE: Be careful not to damage the bottom polished / lapped surface of the bearing [Figure 20-70-17].

NOTE: A commercial bearing extractor and supporting cap, as shown, will be required for bearing removal [Figure 20-70-17]. Be careful not to damage the bottom polished / lapped surface of the bearing.

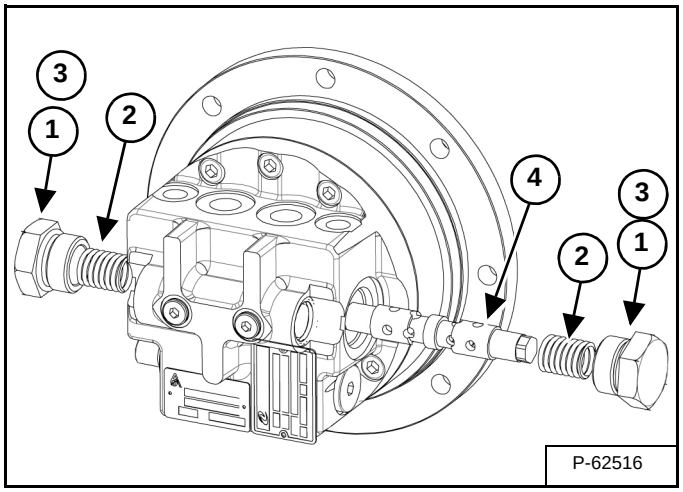
Figure 20-70-18



Remove the front seal ring (Item 1) **[Figure 20-70-18]**.

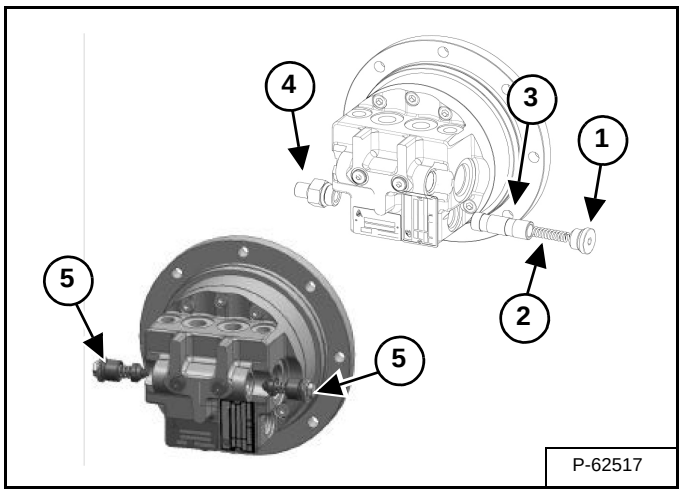
Disassembly (Cont'd)

Figure 20-70-19



Remove the plugs (Item 1), springs (Item 2), washers (Item 3) and counterbalance valve (Item 4) **[Figure 20-70-19]**.

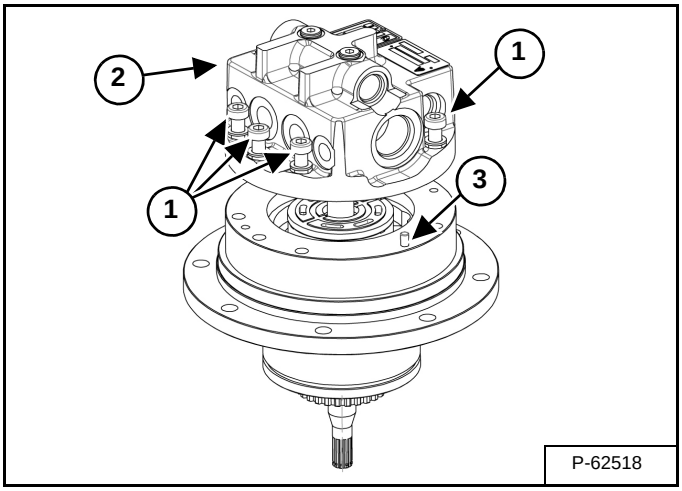
Figure 20-70-20



Remove the plug (Item 1), springs (Item 2), piston valve (Item 3) and plug (Item 4) **[Figure 20-70-20]**.

Remove the valves (Item 5) **[Figure 20-70-20]** from the motor cover.

Figure 20-70-21

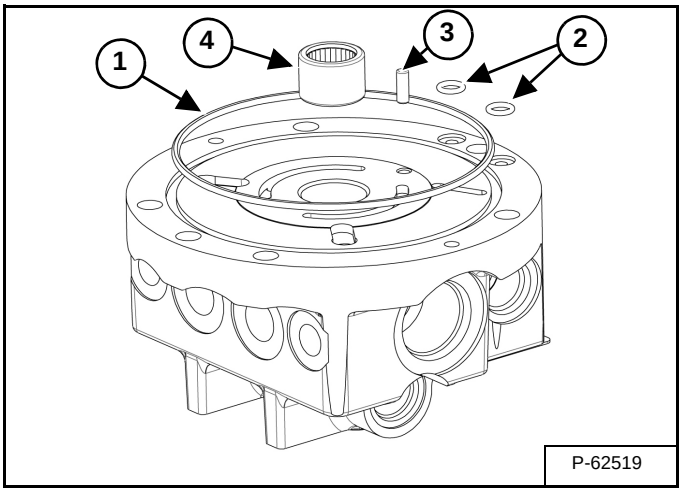


Remove the six screws and washers (Item 1) **[Figure 20-70-21]**.

Remove the cover (Item 2) **[Figure 20-70-21]**.

NOTE: Removal of pin (Item 3) [Figure 20-70-21] is optional.

Figure 20-70-22

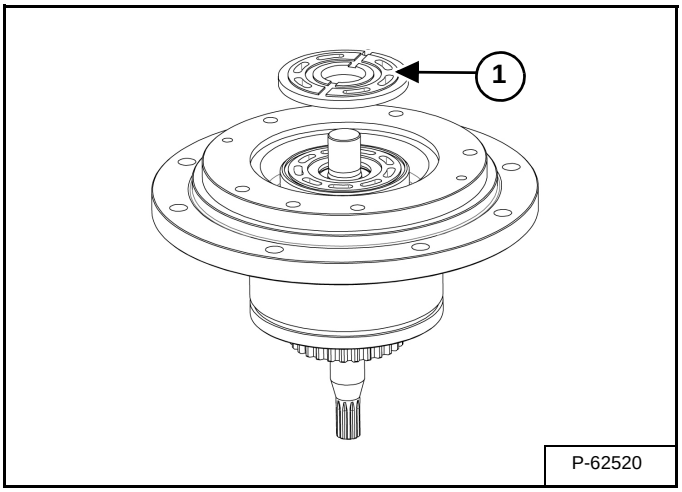


Remove large O-Ring (Item 1), small O-Rings (Item 2), pin (Item 3) and needle bearing (Item 4) **[Figure 20-70-22]** from the cover.

NOTE: Removal of pin (Item 3) [Figure 20-70-22] is optional.

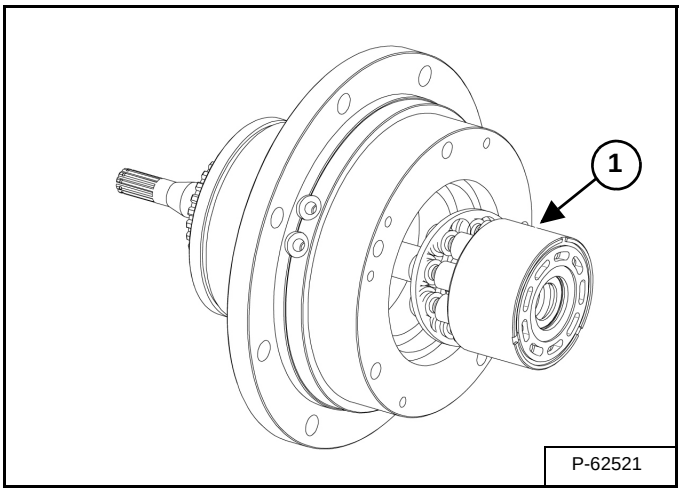
Disassembly (Cont'd)

Figure 20-70-23



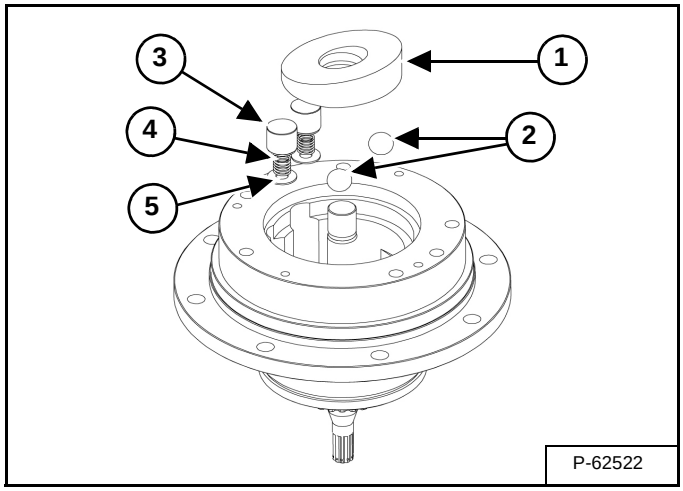
Remove the valve plate (Item 1) **[Figure 20-70-23]**.

Figure 20-70-24



Remove the rotating pump assembly (Item 1) **[Figure 20-70-24]**.

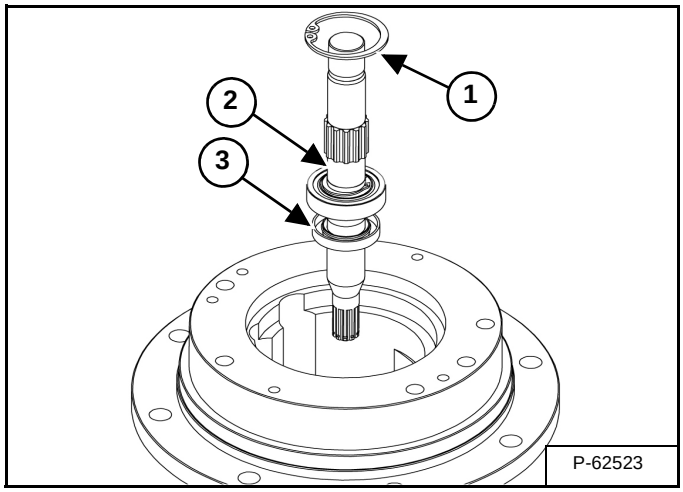
Figure 20-70-25



Remove the swash plate (Item 1) **[Figure 20-70-25]**.

Remove the sphere (Item 2), pistons (Item 3), springs (Item 4) and washers (Item 5) **[Figure 20-70-25]**.

Figure 20-70-26

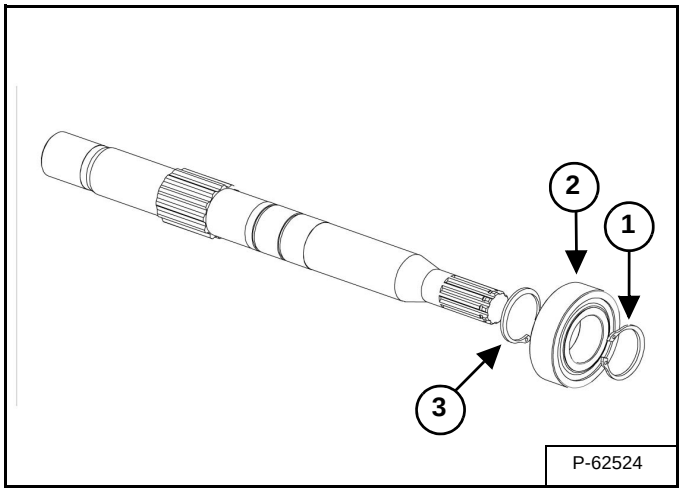


Remove the retaining ring (Item 1) and bearing / drive shaft assembly (Item 2) **[Figure 20-70-26]**.

Remove the oil seal (Item 3) **[Figure 20-70-26]**.

Disassembly (Cont'd)

Figure 20-70-27

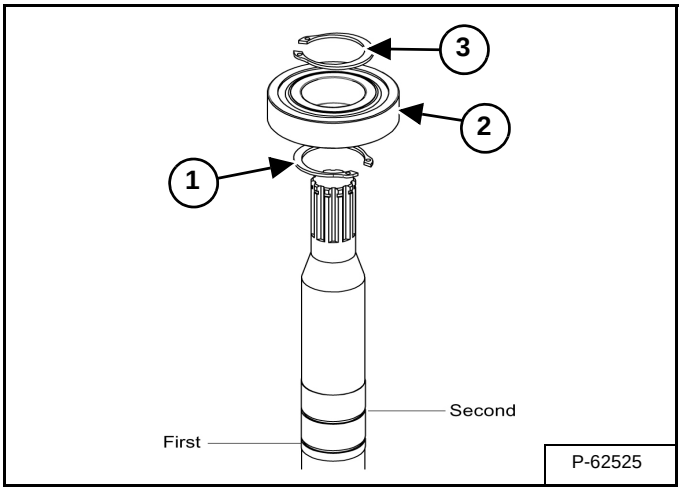


Remove the retaining ring (Item 1), ball bearing (Item 2) and the second retaining ring (Item 3) **[Figure 20-70-27]**.

Assembly

Clean all parts in solvent and dry with compressed air. Inspect all parts and replace any that are damaged. If any of the planetary gears (first or second) are damaged, replace the damaged planetary stage assembly (first or second) complete with the sun gear that the damaged gear is from. One damaged gear can cause microscopic fatigue cracks in mating gear teeth and cause premature failure after servicing. Apply oil to all O-rings and light grease to the ball and roller bearings before installation.

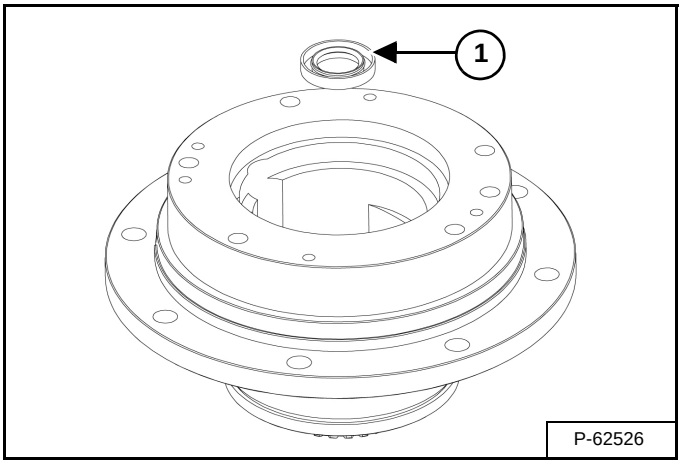
Figure 20-70-28



Install the retaining ring (Item 1) **[Figure 20-70-28]** on the drive shaft.

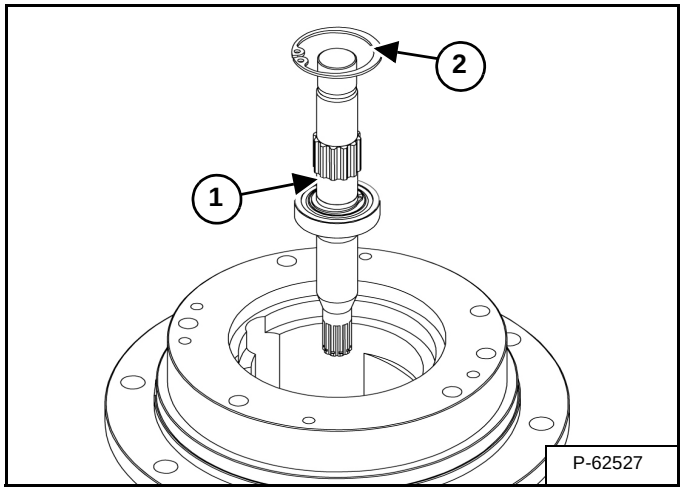
Install the ball bearing (Item 2) and the retaining ring (Item 3) **[Figure 20-70-28]**.

Figure 20-70-29



Install the oil seal (Item 1) **[Figure 20-70-29]** in the hub.

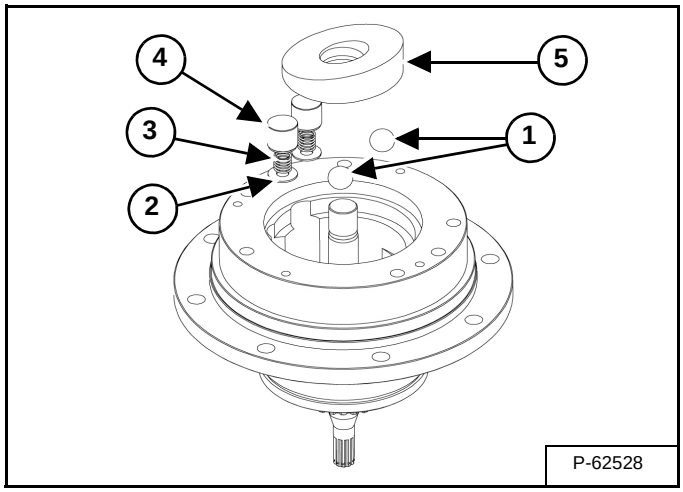
Figure 20-70-30



Install the bearing / drive shaft assembly (Item 1) **[Figure 20-70-30]**.

Install the retaining ring (Item 2) **[Figure 20-70-30]**.

Figure 20-70-31

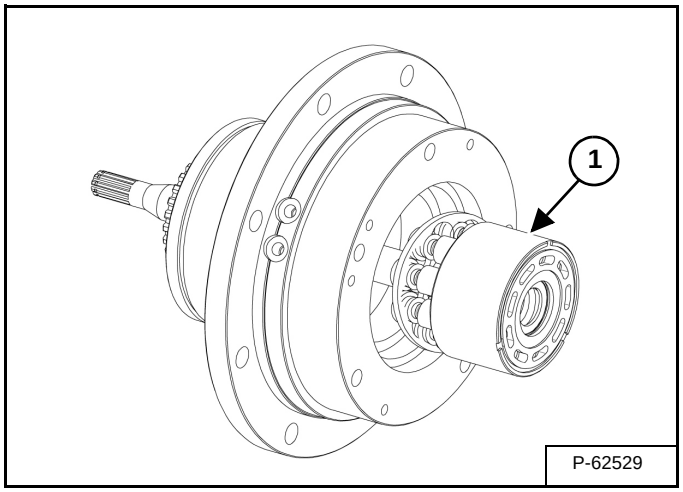


Install the sphere (Item 1), washers (Item 2), springs (Item 3) and pistons (Item 4) **[Figure 20-70-31]**.

Install the swash plate (Item 5) **[Figure 20-70-31]**.

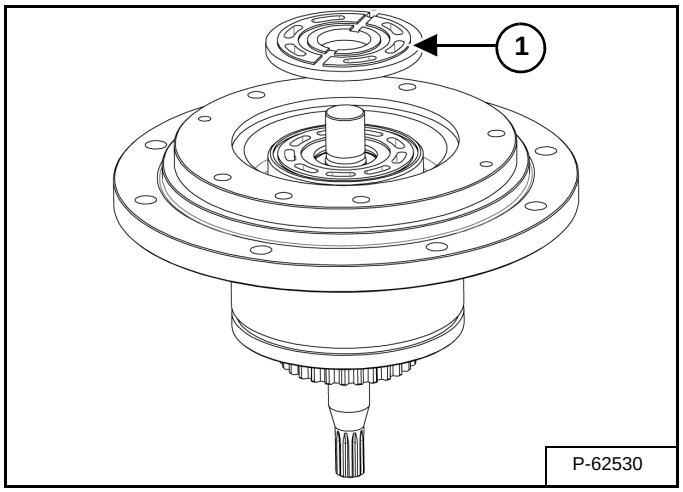
Assembly (Cont'd)

Figure 20-70-32



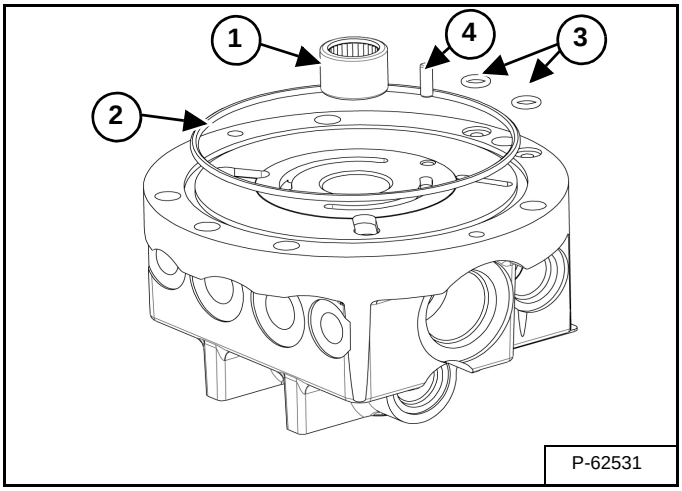
Install the rotating pump assembly (Item 1) **[Figure 20-70-32]**.

Figure 20-70-33



Install the valve plate (Item 1) **[Figure 20-70-33]**.

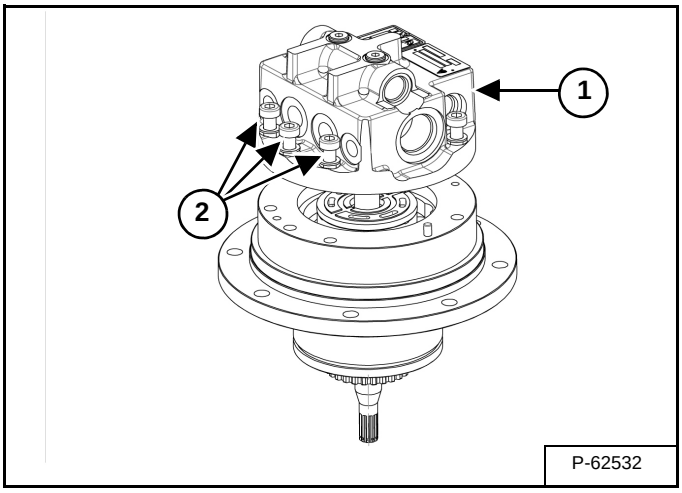
Figure 20-70-34



Install the needle bearing (Item 1) **[Figure 20-70-34]** in the cover so the bearing edge extends from the face of the cover 0.98-0.110 in. (2,5-2,8 mm).

Install the large O-Ring (Item 2), small O-Rings (Item 3) and pin (Item 4) **[Figure 20-70-34]** in the cover.

Figure 20-70-35



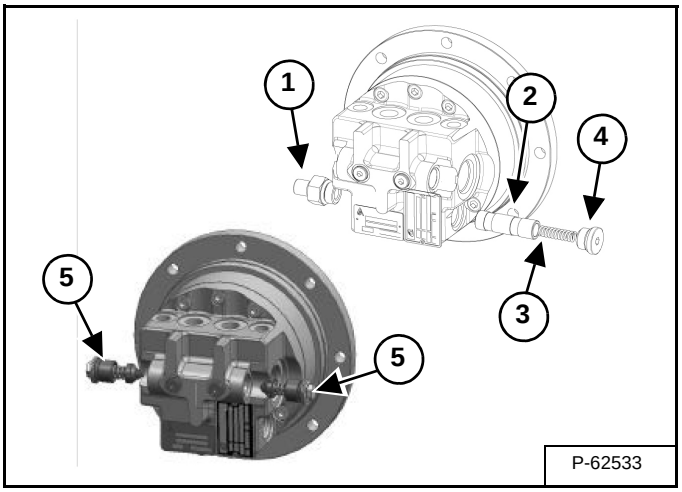
Install the cover (Item 1) **[Figure 20-70-35]**.

Install the six screws and washers (Item 2) **[Figure 20-70-35]**.

Tighten the screws in a crisscross manner to 30-37 ft.-lb. (40-50 N•m) torque.

Assembly (Cont'd)

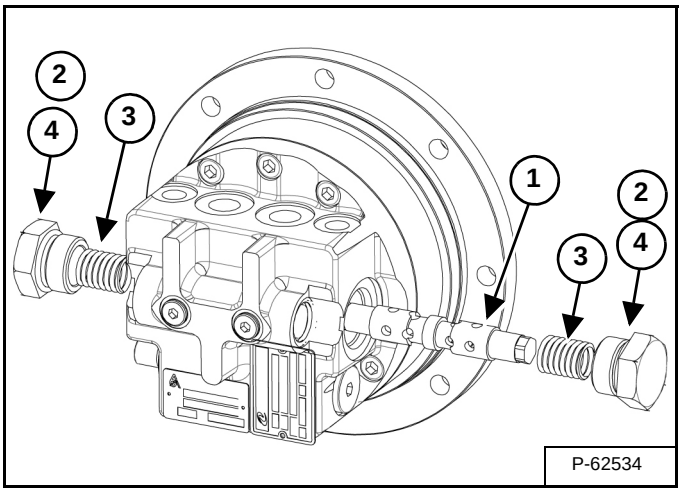
Figure 20-70-36



Install the plug (Item 1), piston valve (Item 2), springs (Item 3) and plug (Item 4) **[Figure 20-70-36]**.

Install the valves (Item 5) **[Figure 20-70-36]** in the motor cover.

Figure 20-70-37



Install the counterbalance valve (Item 1), washers (Item 2), springs (Item 3) and plugs (Item 4) **[Figure 20-70-37]**.

Figure 20-70-38

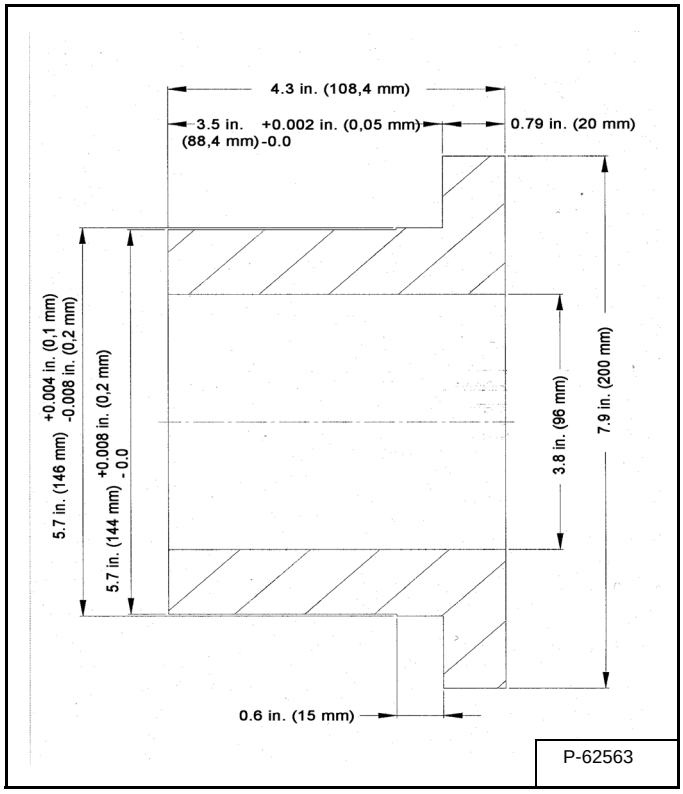
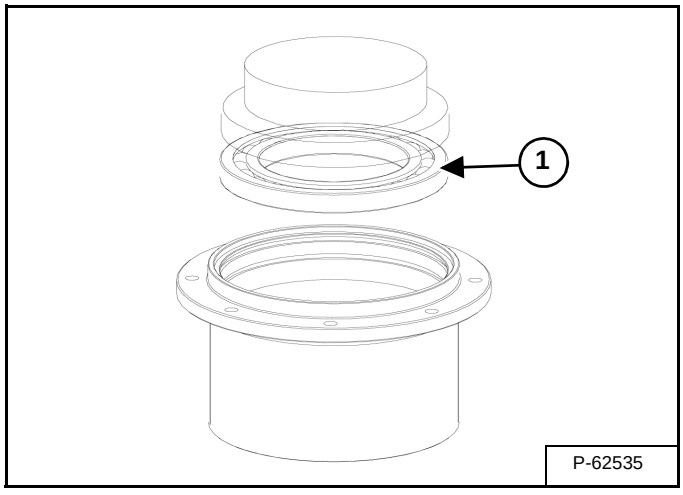


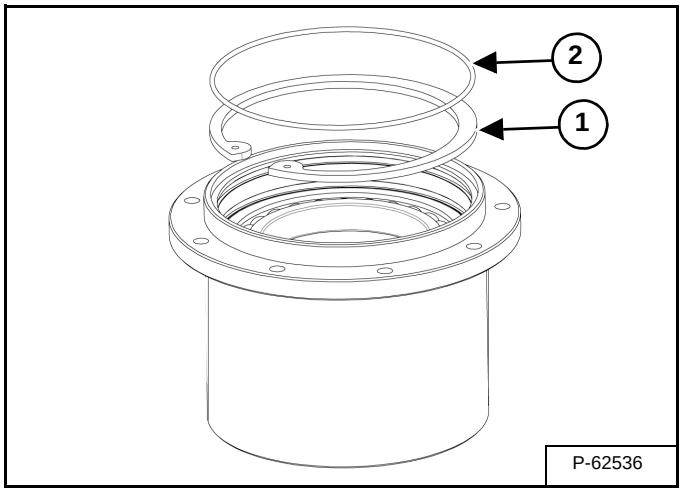
Figure 20-70-39



Install the ball bearing (Item 1) **[Figure 20-70-39]** using the bearing installation tool **[Figure 20-70-38]**.

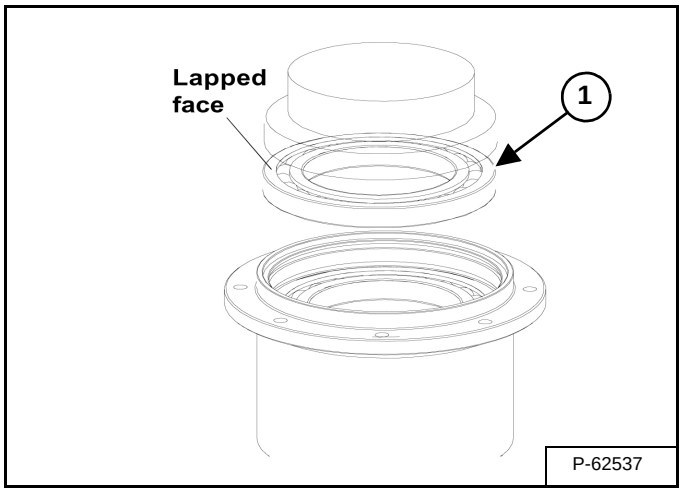
Assembly (Cont'd)

Figure 20-70-40



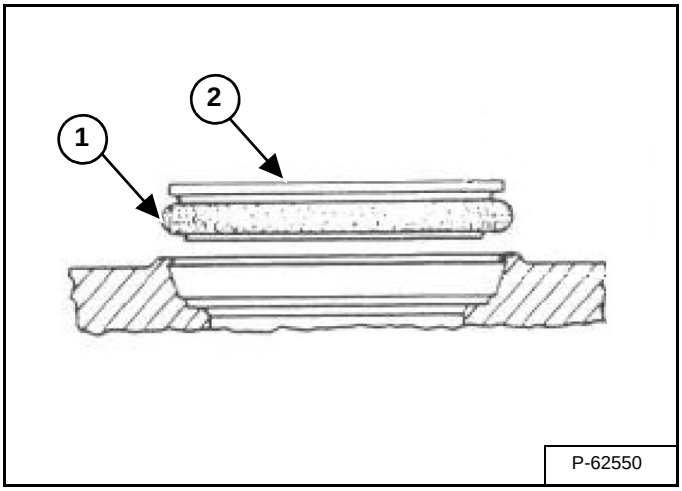
Install the retaining ring (Item 1) and O-Ring (Item 2) **[Figure 20-70-40]**.

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

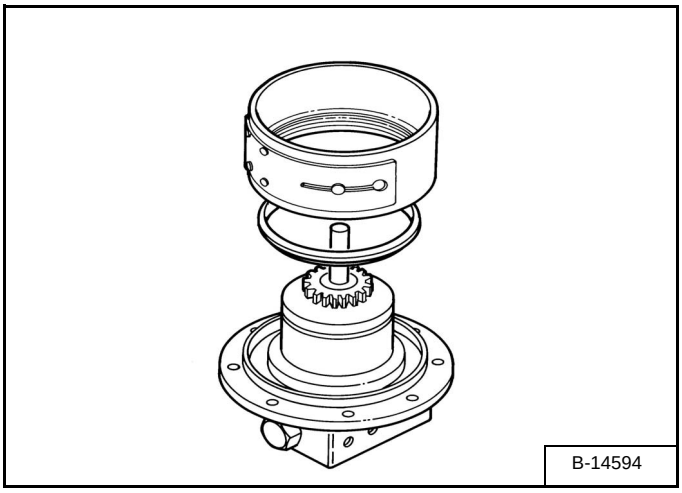


Install the O-ring (Item 1) **[Figure 20-70-42]** on the seal ring (Item 2) **[Figure 20-70-42]**.

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.

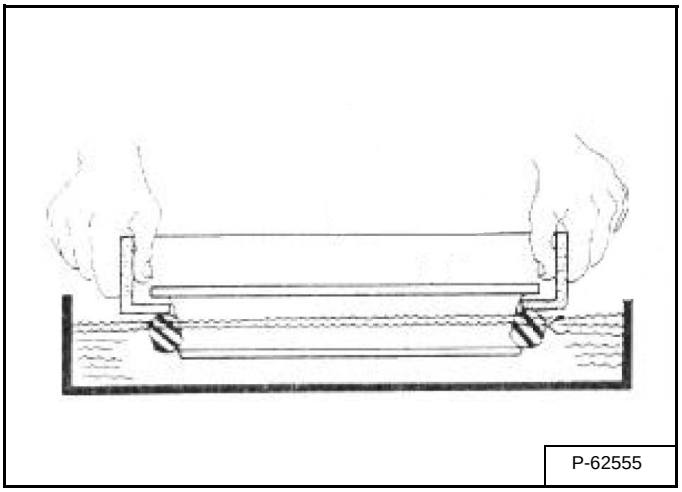
Figure 20-70-43



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

Assembly (Cont'd)

Figure 20-70-44



The seal ring assembly **[Figure 20-70-44]** must be lubricated with alcohol, so the O-ring will slip past the housing retaining ring and seal uniform in the motor housing radius .

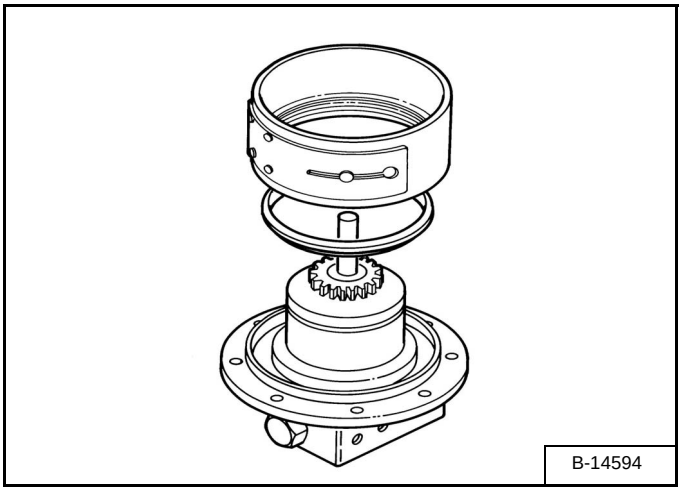
The O-Ring **[Figure 20-70-44]** on the seal ring assembly must be lubricated with alcohol.

This will allow the O-ring to slide on the motor housing sealing surface without twisting .

Dip the O-Ring **[Figure 20-70-44]** and seal ring assembly in a pan of alcohol.

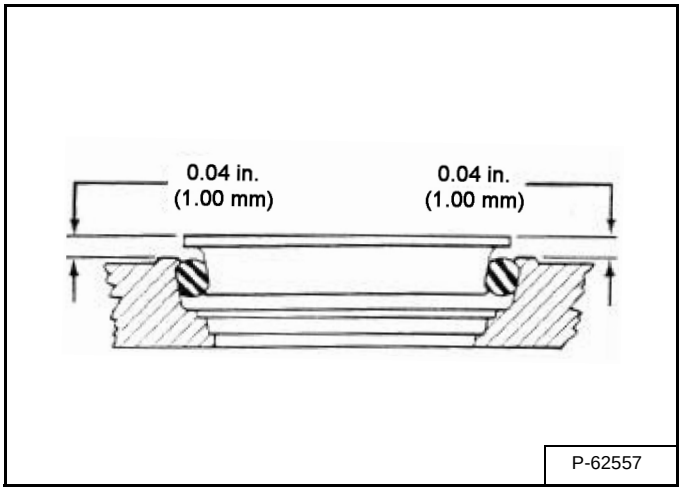
Shake off the excess alcohol and install the seal ring assembly on the motor **[Figure 20-70-44]**.

Figure 20-70-45



Use firm even pressure on the installation tool (MEL1468) to pop the O-ring into the motor housing **[Figure 20-70-45]**.

Figure 20-70-46



After the seal ring is installed, check the stand out height **[Figure 20-70-46]** in four places, 90° apart.

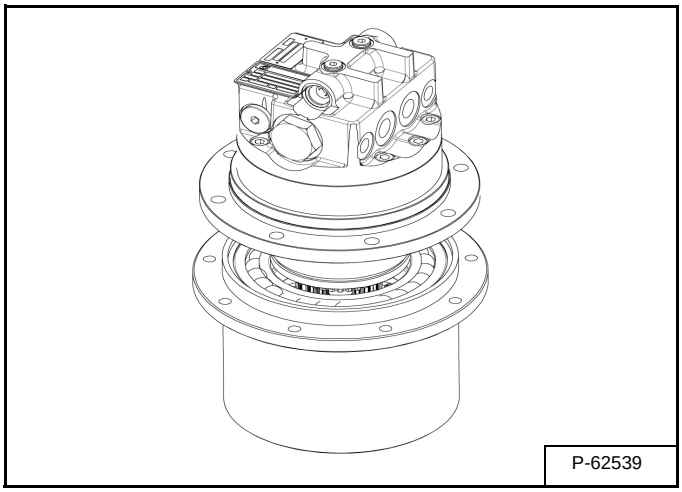
The stand out height is 0.04 inches (1,00 mm).

NOTE: If the seal ring does not meet the height specifications inspect the torque ring for twists or obvious bulges.

Apply a light film of oil to the seal ring and lapped face of the bearing.

NOTE: Do not get any oil on the O-ring.

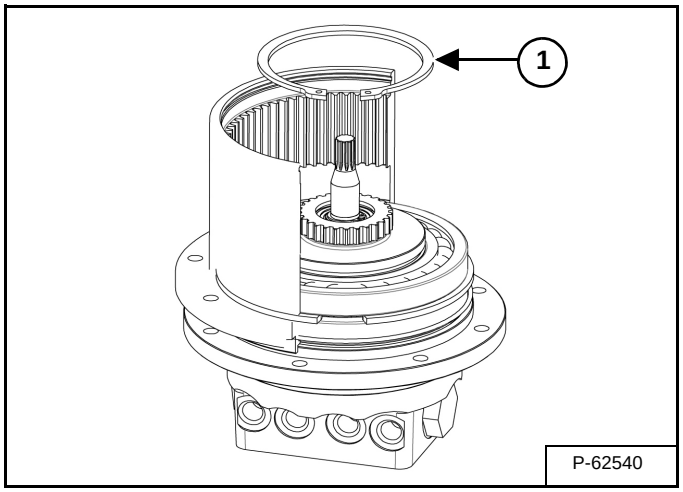
Figure 20-70-47



Press the reduction unit and motor assembly into the seat of the bearings **[Figure 20-70-47]**.

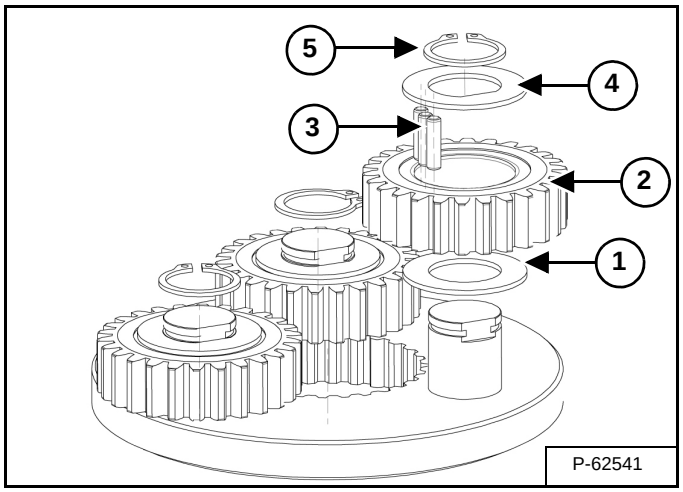
Assembly (Cont'd)

Figure 20-70-48



Install the external snap ring (Item 1) **[Figure 20-70-48]** in the motor reduction unit.

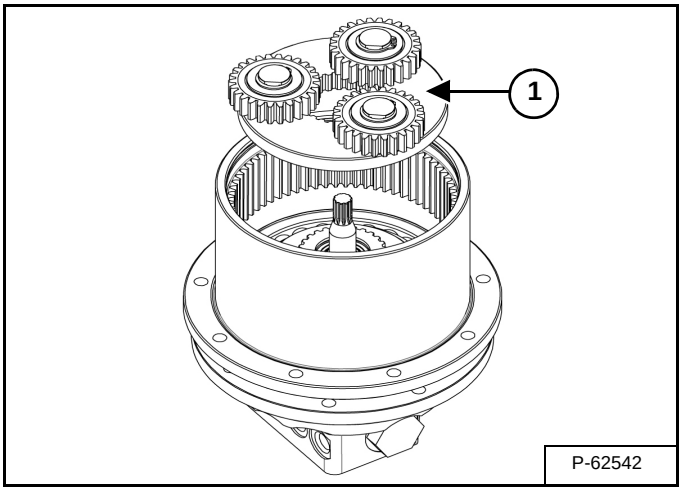
Figure 20-70-49



Install the thrust washers (Item 1), planetary gears (Item 2), needle bearing (Item 3) anti-rotation washers (Item 4) and external snap rings (Item 5) **[Figure 20-70-49]**.

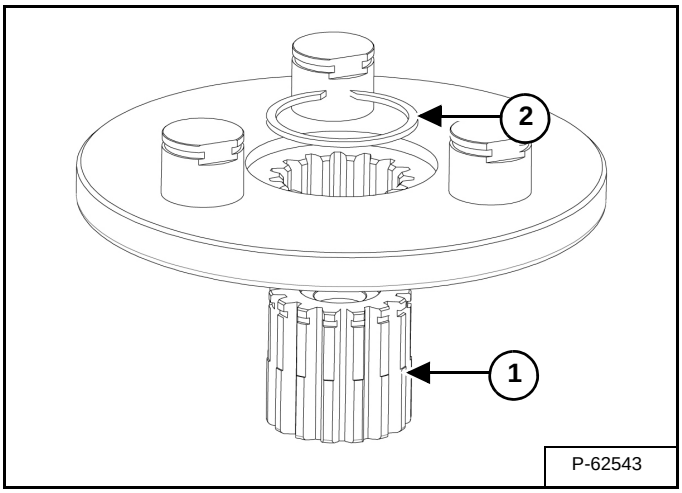
NOTE: Install the snap rings so the opening of the snap ring is towards the outside.

Figure 20-70-50



Install the planetary assembly (Item 1) **[Figure 20-70-50]**.

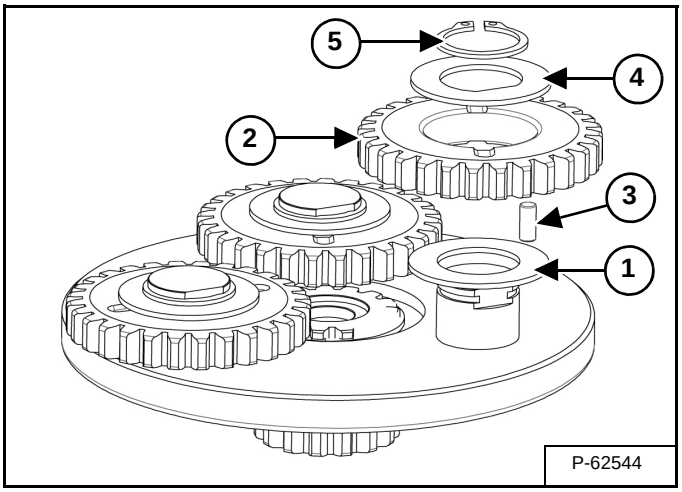
Figure 20-70-51



Install the sun gear (Item 1) into the planetary carrier and lock with the retaining ring (Item 2) **[Figure 20-70-51]**.

Assembly (Cont'd)

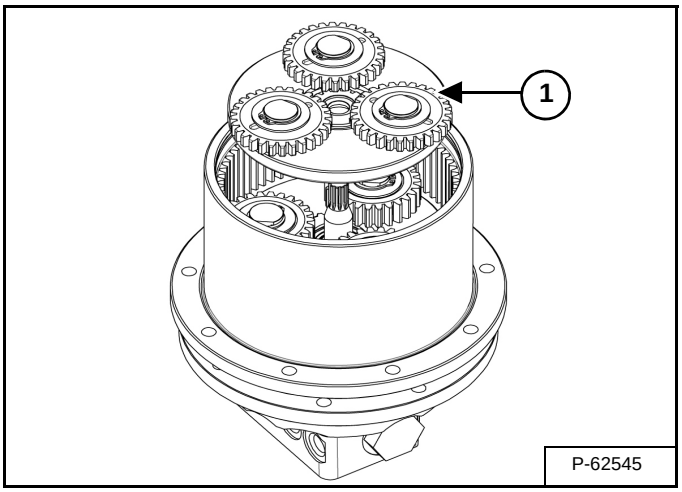
Figure 20-70-52



Install the thrust washers (Item 1), planetary gears (Item 2), needle bearings (Item 3), anti-rotation washers (Item 4) and external snap rings (Item 5) **[Figure 20-70-52]**.

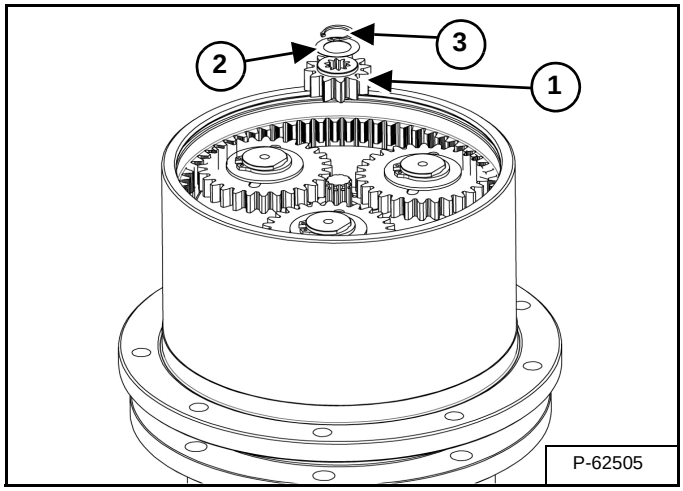
NOTE: Install the snap rings so the opening of the snap ring is towards the outside.

Figure 20-70-53



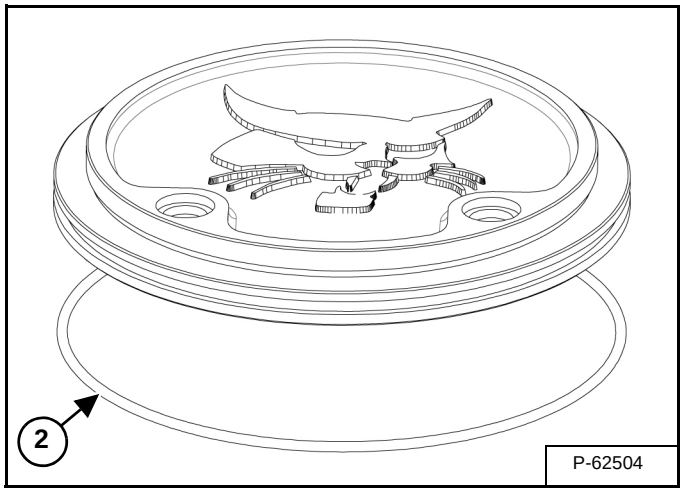
Install the outer planetary assembly (Item 1) **[Figure 20-70-53]**.

Figure 20-70-54



Install the sun gear (Item 1), shims (theoretical shimming 0.02 in. (0,5 mm) (Item 2) and retaining ring (Item 3) **[Figure 20-70-54]**.

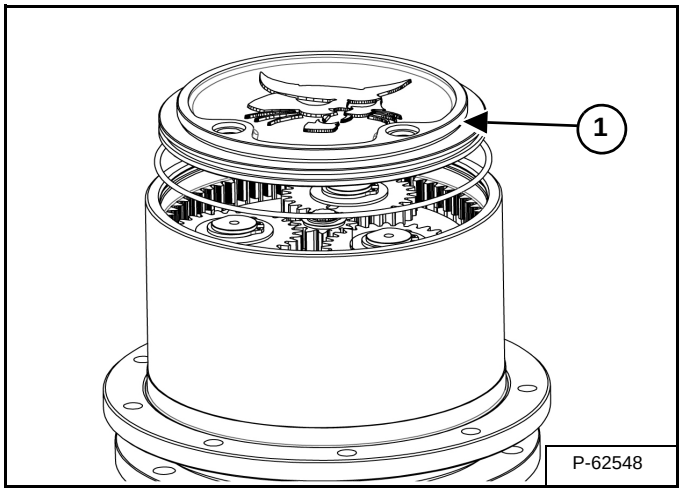
Figure 20-70-55



Install the O-Ring (Item 1) **[Figure 20-70-55]** on the cover .

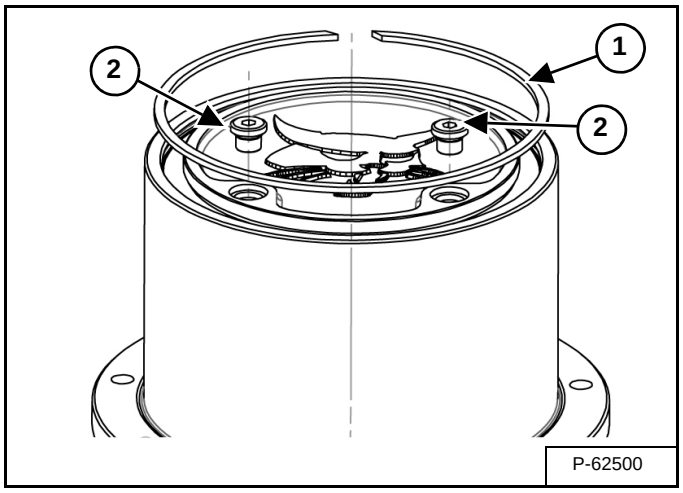
Assembly (Cont'd)

Figure 20-70-56



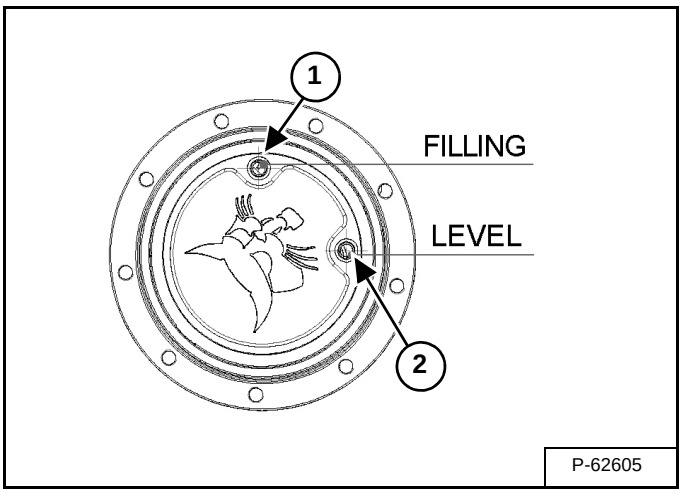
Install the cover (Item 1) **[Figure 20-70-56]** in the housing.

Figure 20-70-57



Install the snap ring (Item 1) **[Figure 20-70-57]** securing the reduction gear cover.

Figure 20-70-58



Add 0.42 qt. (0,4 L) of gear lube 90W to the top plug hole (Item 1) until the gear lube is at the bottom of the plug hole (Item 2) **[Figure 20-70-58]**.

Install and tighten the two plugs (Item 2) **[Figure 20-70-57]**.


Bobcat®

SWIVEL JOINT

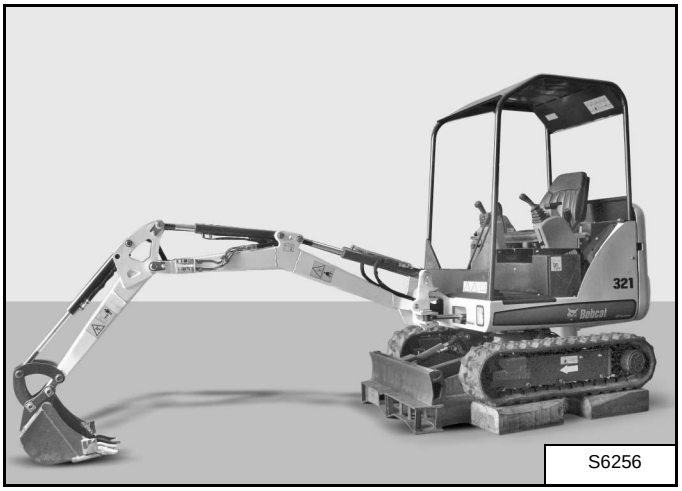
Description

The swivel joint is located under the floor panels and mounted to the upperstructure. The swivel joint directs hydraulic fluid to the undercarriage components while allowing the upperstructure to rotate.

Removal And Installation

Expand the track frame fully.

Figure 20-80-1



Place blocks under the excavator tracks **[Figure 20-80-1]**.

Lower the boom / bucket and blade to the ground.

Relieve hydraulic pressure.

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

Remove the floormat and floor panels (See “Removal and Installation” on page 40-140-1).

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

⚠ WARNING

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

W-2145-0290

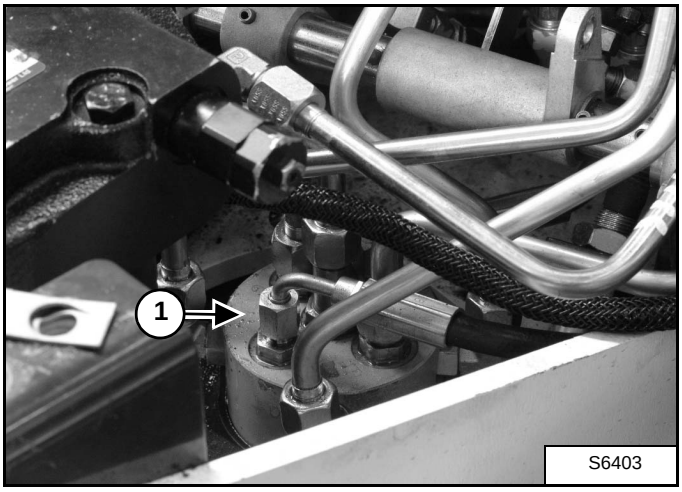
IMPORTANT

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

I-2003-0888

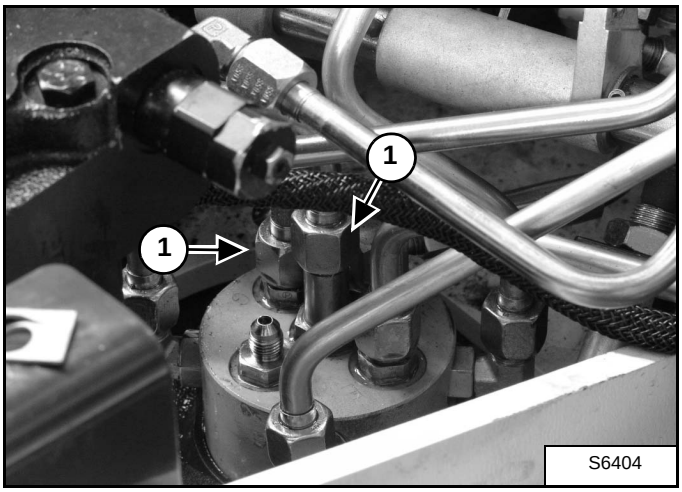
Mark all hoses and tubelines for ease of assembly.

Figure 20-80-2



Remove the hose (Item 1) **[Figure 20-80-2]** from the top of the swivel joint.

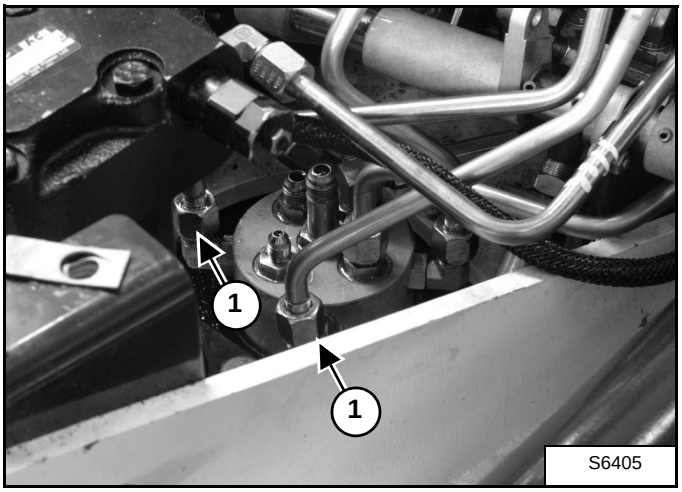
Figure 20-80-3



Remove the tubelines (Item 1) **[Figure 20-80-3]** from the top of the swivel joint and blade / track expansion solenoid block.

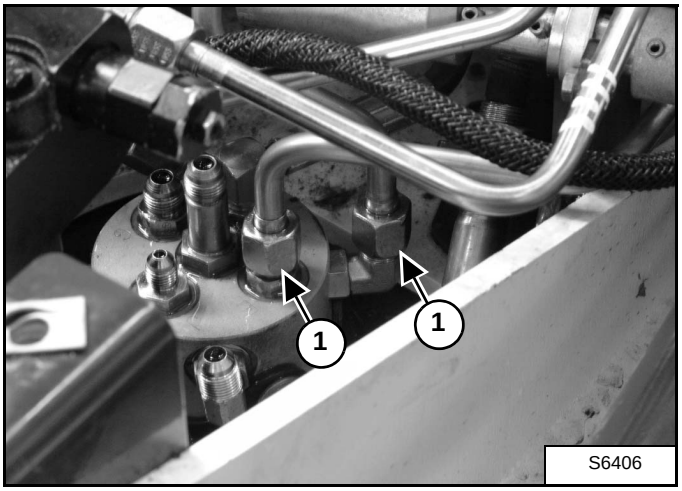
Removal And Installation (Cont'd)

Figure 20-80-4



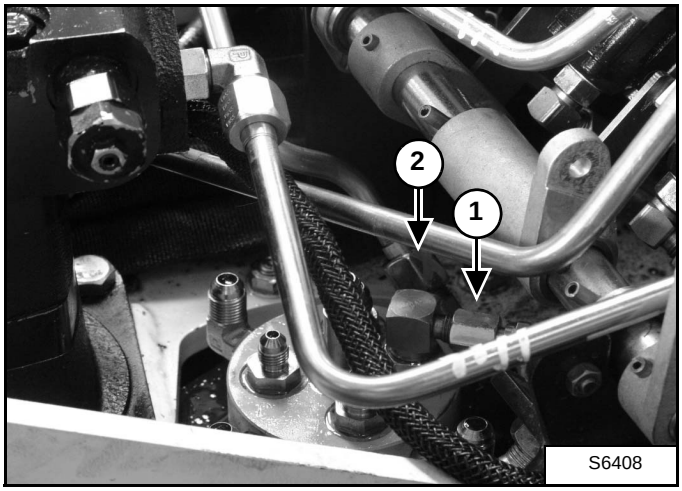
Remove the tubelines (Item 1) **[Figure 20-80-4]** from the swivel joint and valve assembly.

Figure 20-80-5



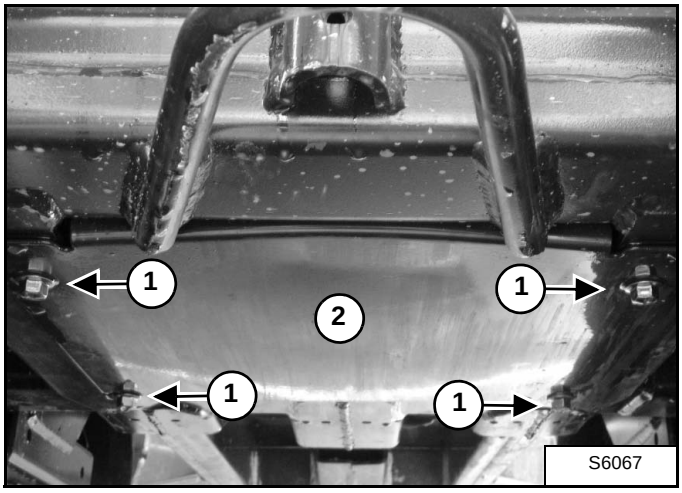
Remove the tubelines (Item 1) **[Figure 20-80-5]** from the swivel joint and valve assembly.

Figure 20-80-6



Remove the hose (Item 1) and tubeline (Item 2) **[Figure 20-80-6]**.

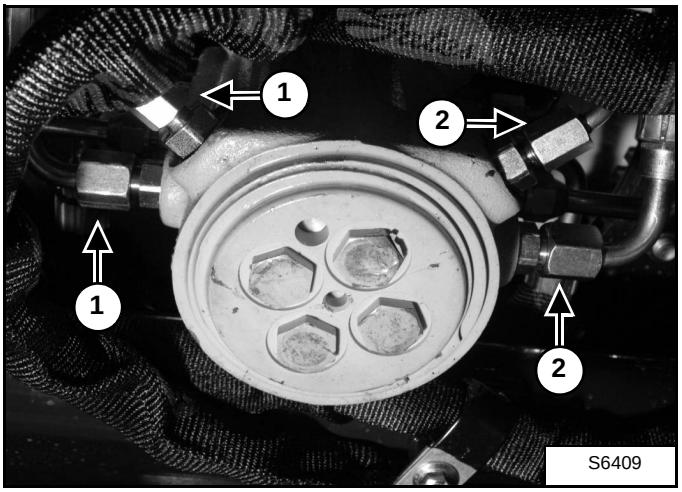
Figure 20-80-7



Remove the bolts (Item 1) and the access plate (Item 2) **[Figure 20-80-7]** from the bottom side of the excavator.

Removal And Installation (Cont'd)

Figure 20-80-8

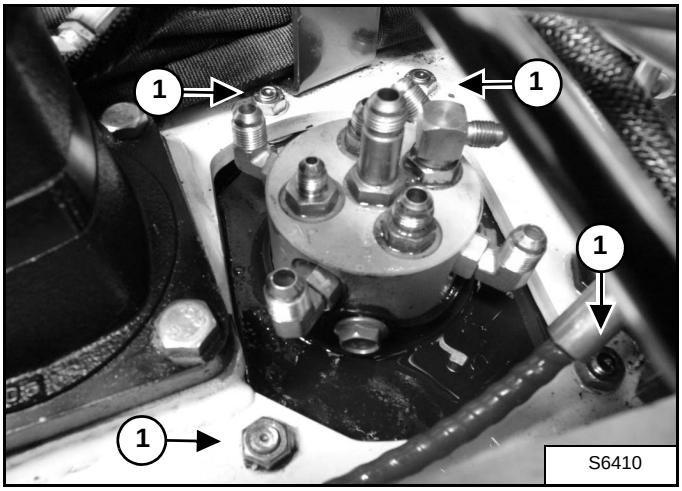


Remove the six hoses (Item 1) **[Figure 20-80-8]** from the left side of the swivel joint.

Remove the six hoses (Item 2) **[Figure 20-80-8]** from the right side of the swivel joint.

NOTE: Support the swivel joint on the bottom side of the excavator to prevent the swivel joint from falling when the four nuts are being removed.

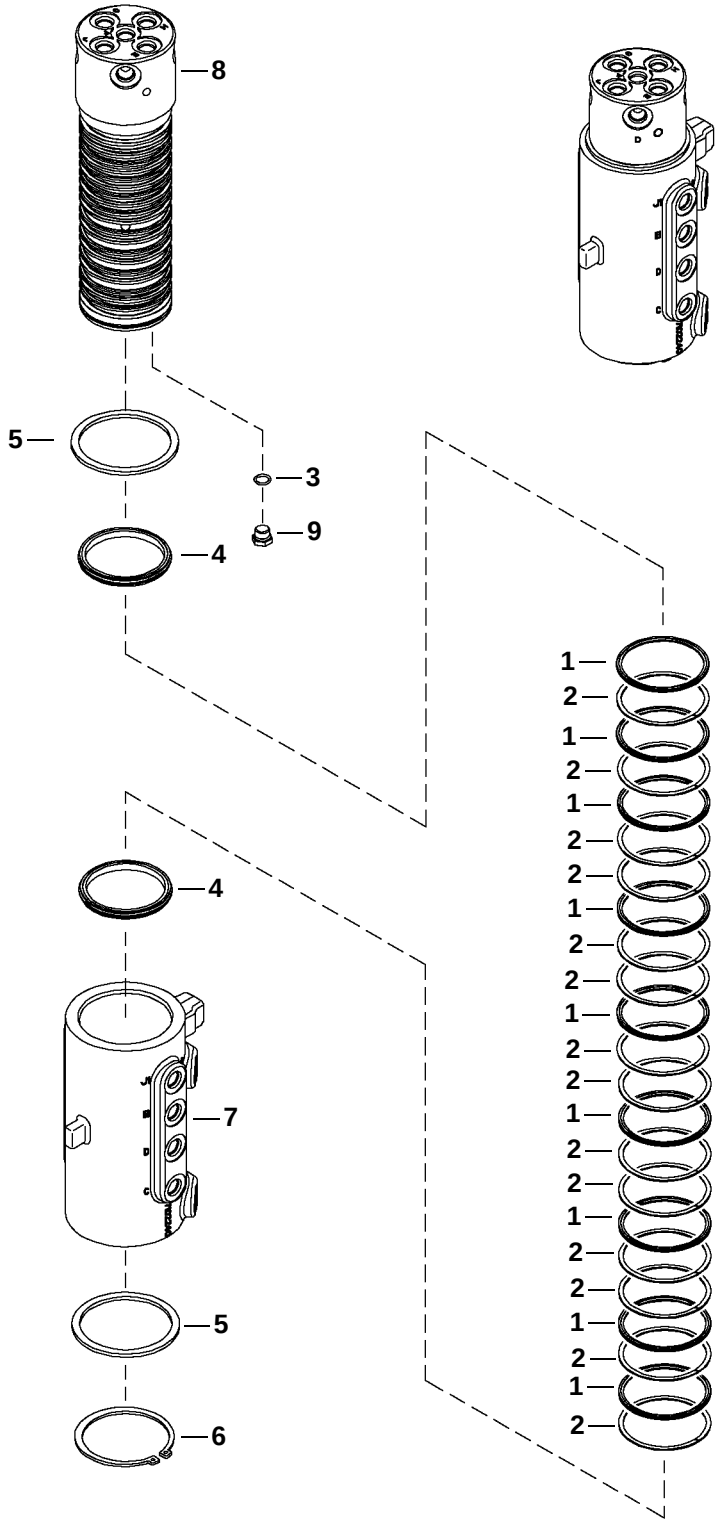
Figure 20-80-9



Remove the four nuts (Item 1) **[Figure 20-80-9]** and slide the swivel joint out through the bottom of the excavator.

Parts Identification

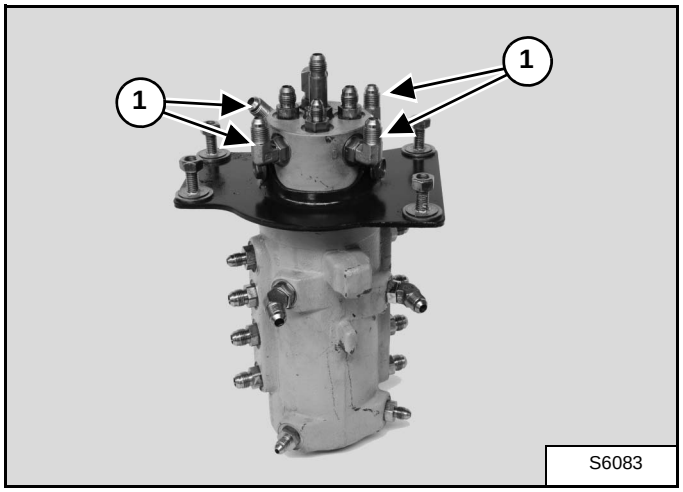
1. Seal and O-Ring
2. Backup Seal
3. O-Ring
4. Inner / Outer Seals
5. Washer
6. Snap Ring
7. Housing
8. Rotor
9. Plug



MS-2041

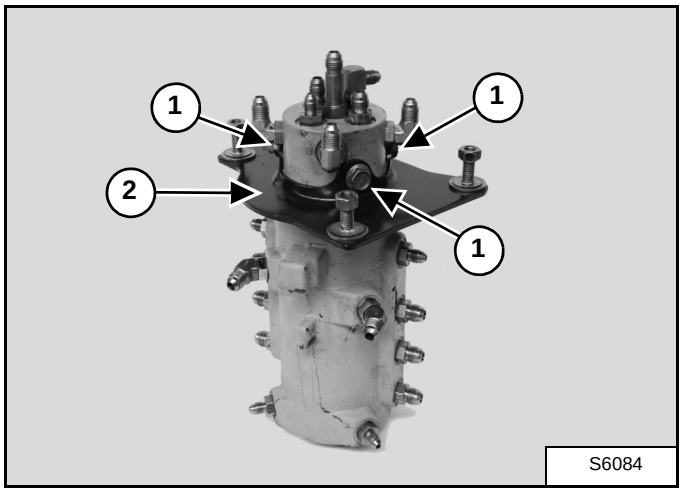
Disassembly

Figure 20-80-10



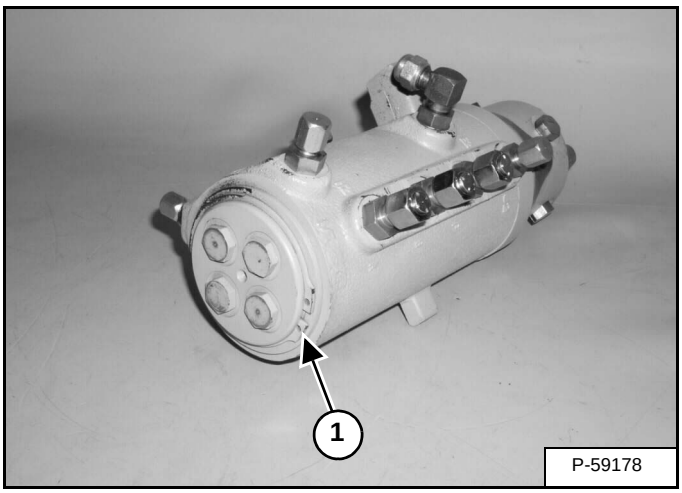
Mark fitting orientation. Remove the fittings (Item 1) **[Figure 20-80-10]**.

Figure 20-80-11



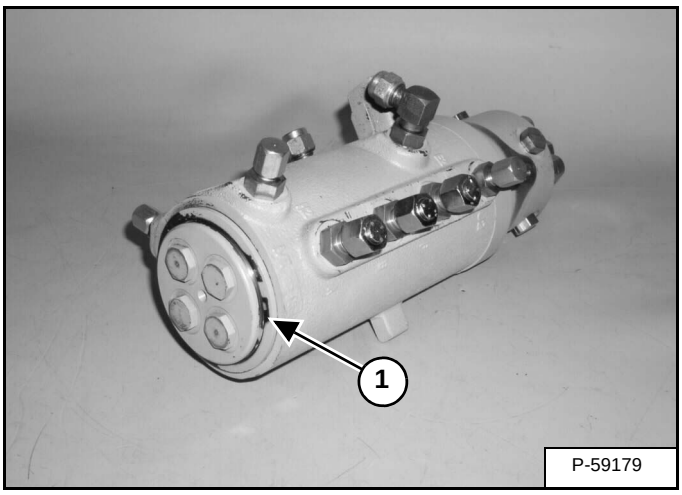
Remove the three bolts (Item 1). Remove the mount (Item 2) **[Figure 20-80-11]**.

Figure 20-80-12



Remove the snap ring (Item 1) **[Figure 20-80-12]** from the bottom of the swivel joint.

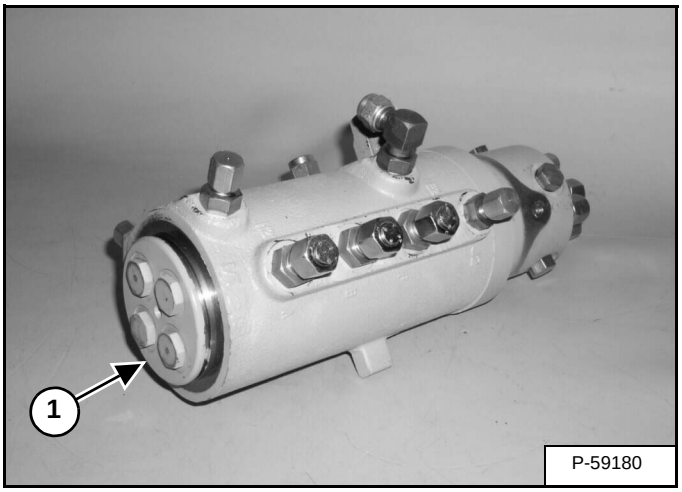
Figure 20-80-13



Remove the nylon washer (Item 1) **[Figure 20-80-13]**.

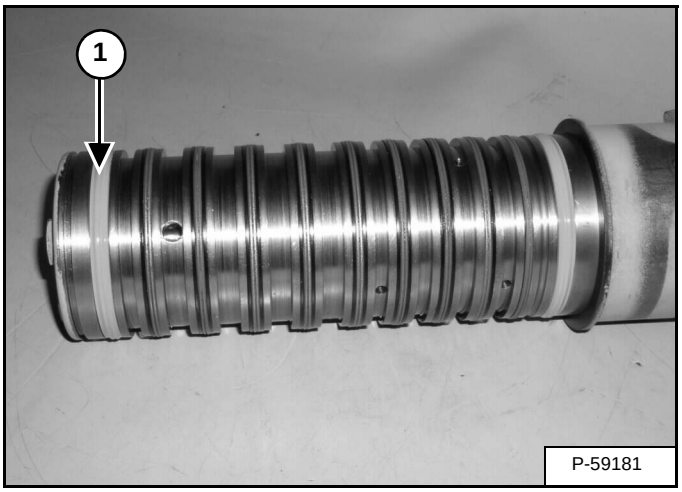
Disassembly (Cont'd)

Figure 20-80-14



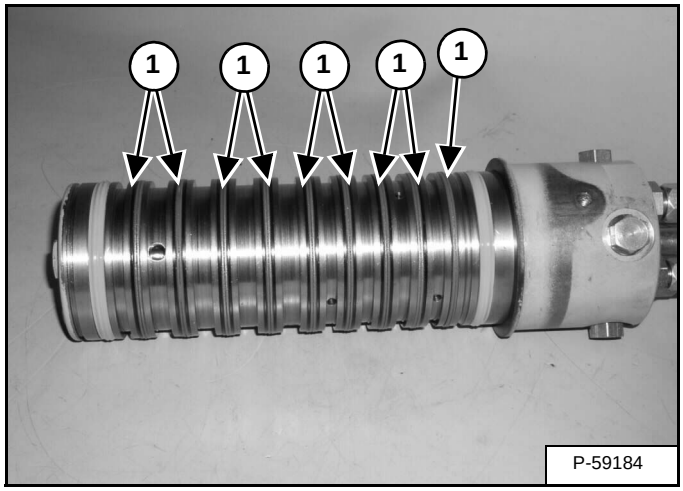
Tap the end of the rotor (Item 1) **[Figure 20-80-14]** with a rubber mallet to drive the rotor out of the housing.

Figure 20-80-15



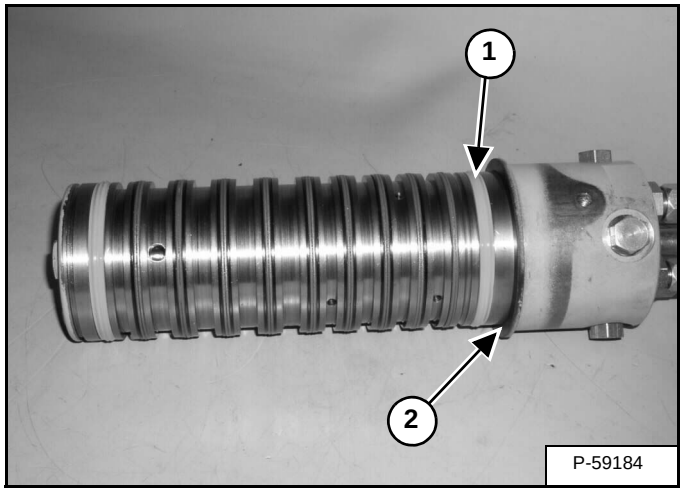
Remove the outer and inner seals (Item 1) **[Figure 20-80-15]**.

Figure 20-80-16



Remove the seals, backup seals and O-rings (Item 1) **[Figure 20-80-16]**.

Figure 20-80-17



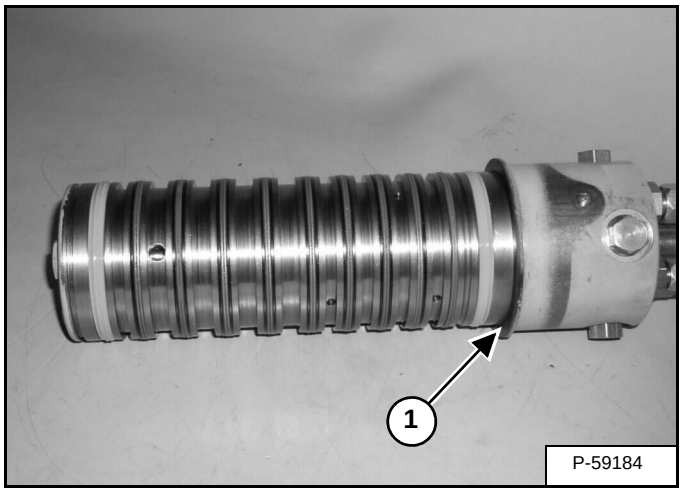
Remove the outer and inner seals (Item 1). Remove the nylon washer (Item 2) **[Figure 20-80-17]**.

Assembly

Clean all parts in solvent and dry with compressed air.

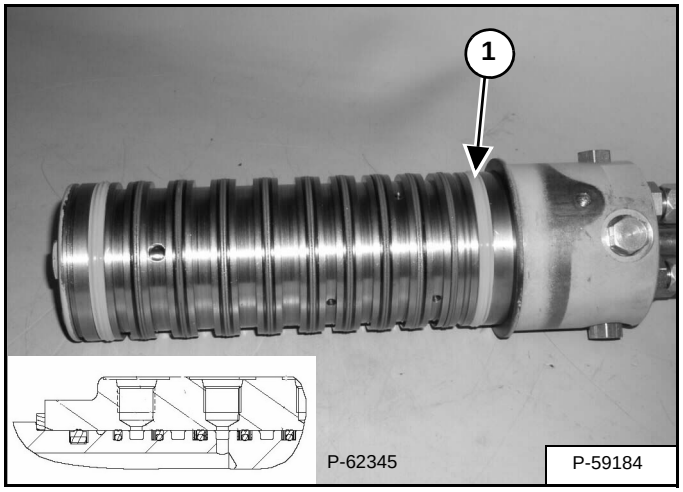
Inspect the rotor and housing for scratches or wear that could cause internal leakage. Always install new seals and backup seals. Lubricate all seals and backup seals with clean hydraulic fluid before installation.

Figure 20-80-18



Install the nylon washer (Item 1) **[Figure 20-80-18]**.

Figure 20-80-19

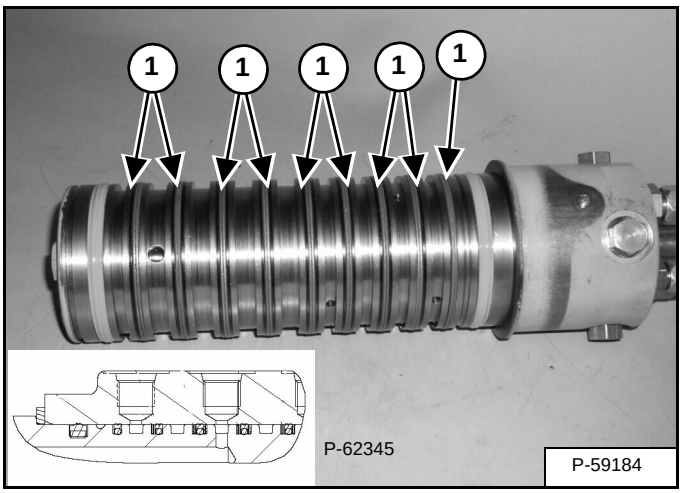


Heat the seals in hydraulic fluid for three minutes at 130°F (54°C).

Install the inner and outer seals (Item 1) **[Figure 20-80-19]**.

NOTE: The inner and outer seal are serviceable as one part number.

Figure 20-80-20



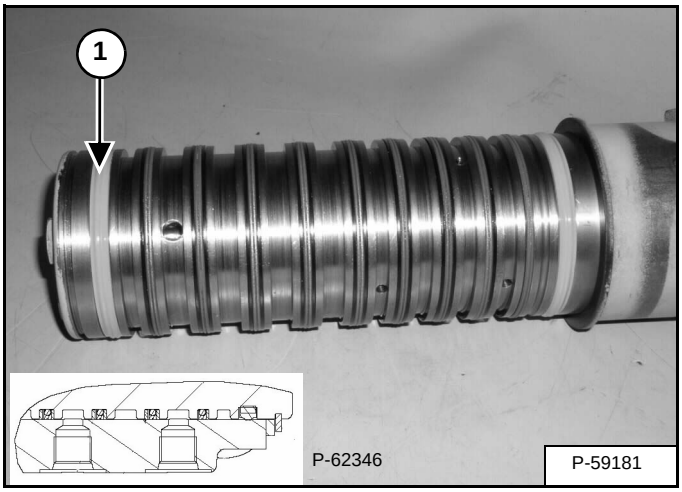
Install the O-rings under the seals (Item 1) **[Figure 20-80-20]**.

Heat the seals in hydraulic fluid for three minutes at 130°F (54°C).

Install the seals and backup seals (Item 1) **[Figure 20-80-20]**.

NOTE: The seal and O-ring are serviceable as one part number.

Figure 20-80-21



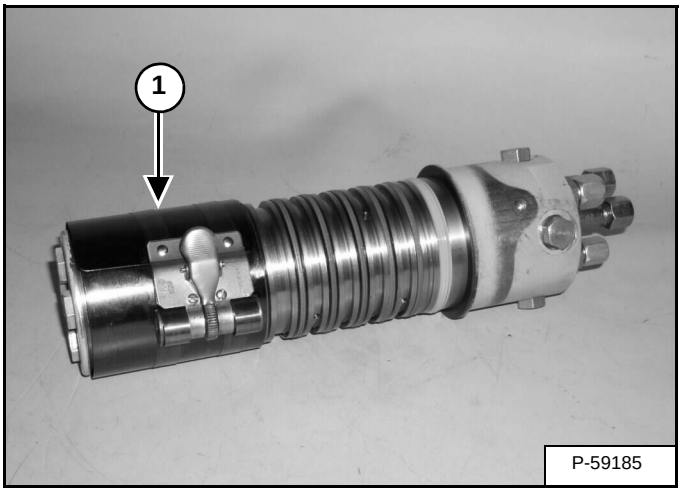
Heat the seals in hydraulic fluid for three minutes at 130°F (54°C).

Install the inner and outer seals (Item 1) **[Figure 20-80-21]**.

NOTE: The inner and outer seal are serviceable as one part number.

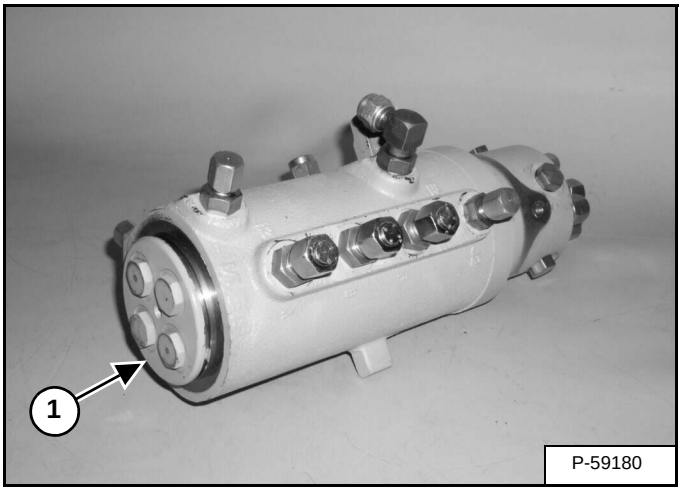
Assembly (Cont'd)

Figure 20-80-22



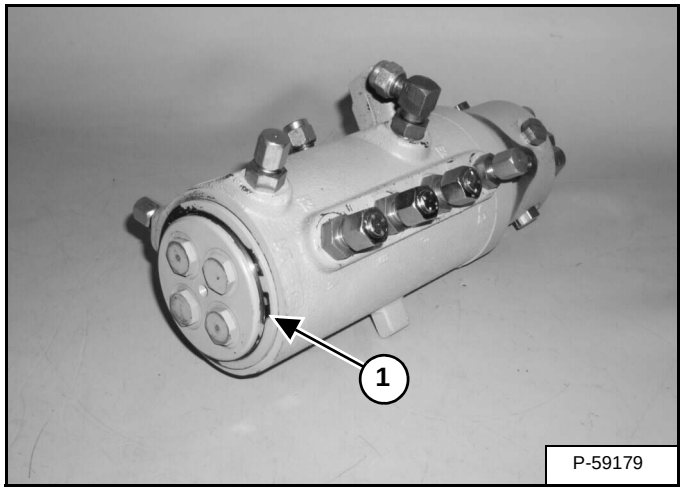
NOTE: A ring compressor (Item 1) [Figure 20-80-22] may be used to fit the seals into the seal grove. Compress the seals for three minutes.

Figure 20-80-23



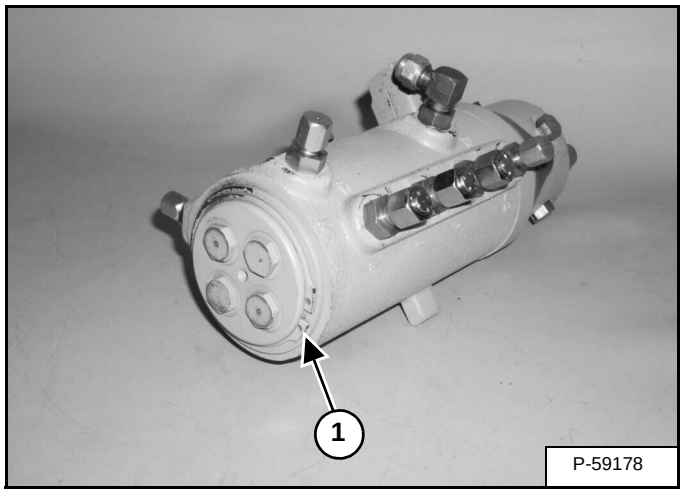
Apply hydraulic fluid to the rotor. Install the rotor (Item 1) **[Figure 20-80-23]** in the housing.

Figure 20-80-24



Install the nylon washer (Item 1) **[Figure 20-80-24]**.

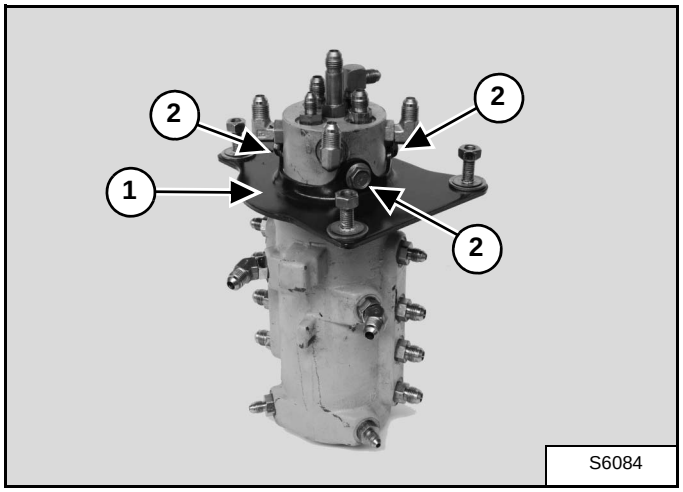
Figure 20-80-25



Remove the snap ring (Item 1) **[Figure 20-80-25]** from the bottom of the swivel joint.

Assembly (Cont'd)

Figure 20-80-26

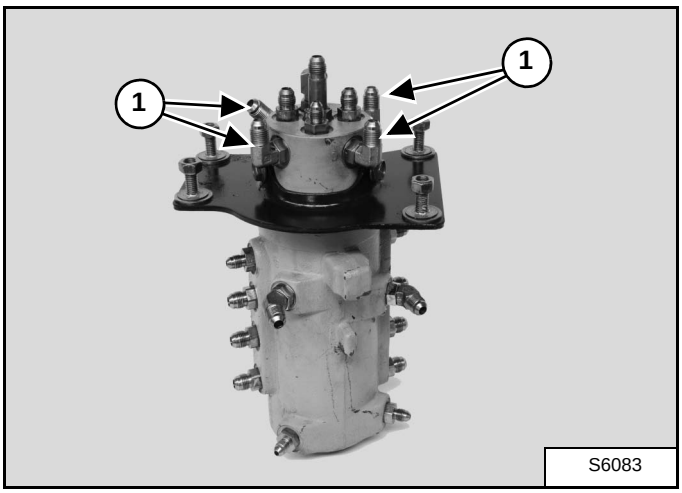


Install the mount (Item 1) **[Figure 20-80-26]** on the swivel joint.

Apply Loctite® 242 to each bolt (Item 2) **[Figure 20-80-26]**.

Install the bolts (Item 2) **[Figure 20-80-26]**. Tighten the bolts to 32-35 ft.-lb. (43-47 N•m) torque.

Figure 20-80-27



Install the fittings (Item 1) **[Figure 20-80-27]** and orientate accordingly.


Bobcat®

SWING MOTOR

Description

The swing motor is a hydraulic motor that receives hydraulic fluid from the gear pump through the control valve to swing the upperstructure left or right. The speed that the swing motor rotates is related to the amount of hydraulic fluid it receives.

Removal And Installation

IMPORTANT

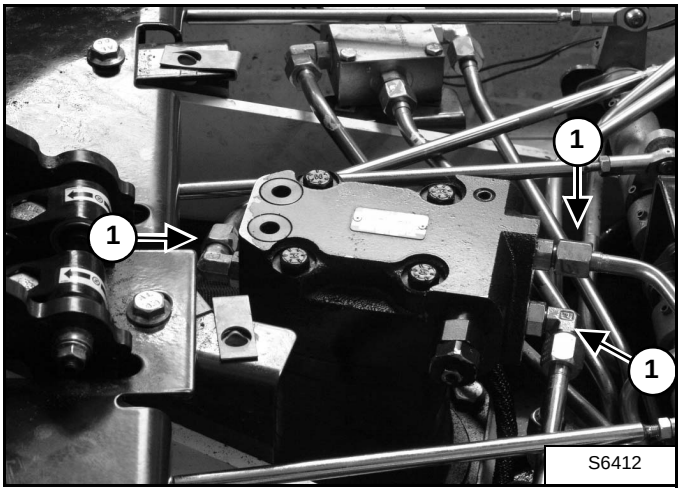
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

Remove the floormat and floorplate (See “Removal and Installation” on page 40-140-1).

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

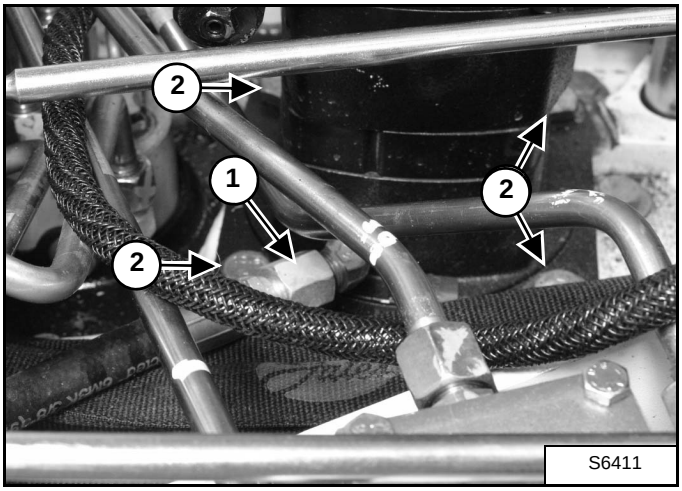
Figure 20-90-1



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

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

Figure 20-90-2



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

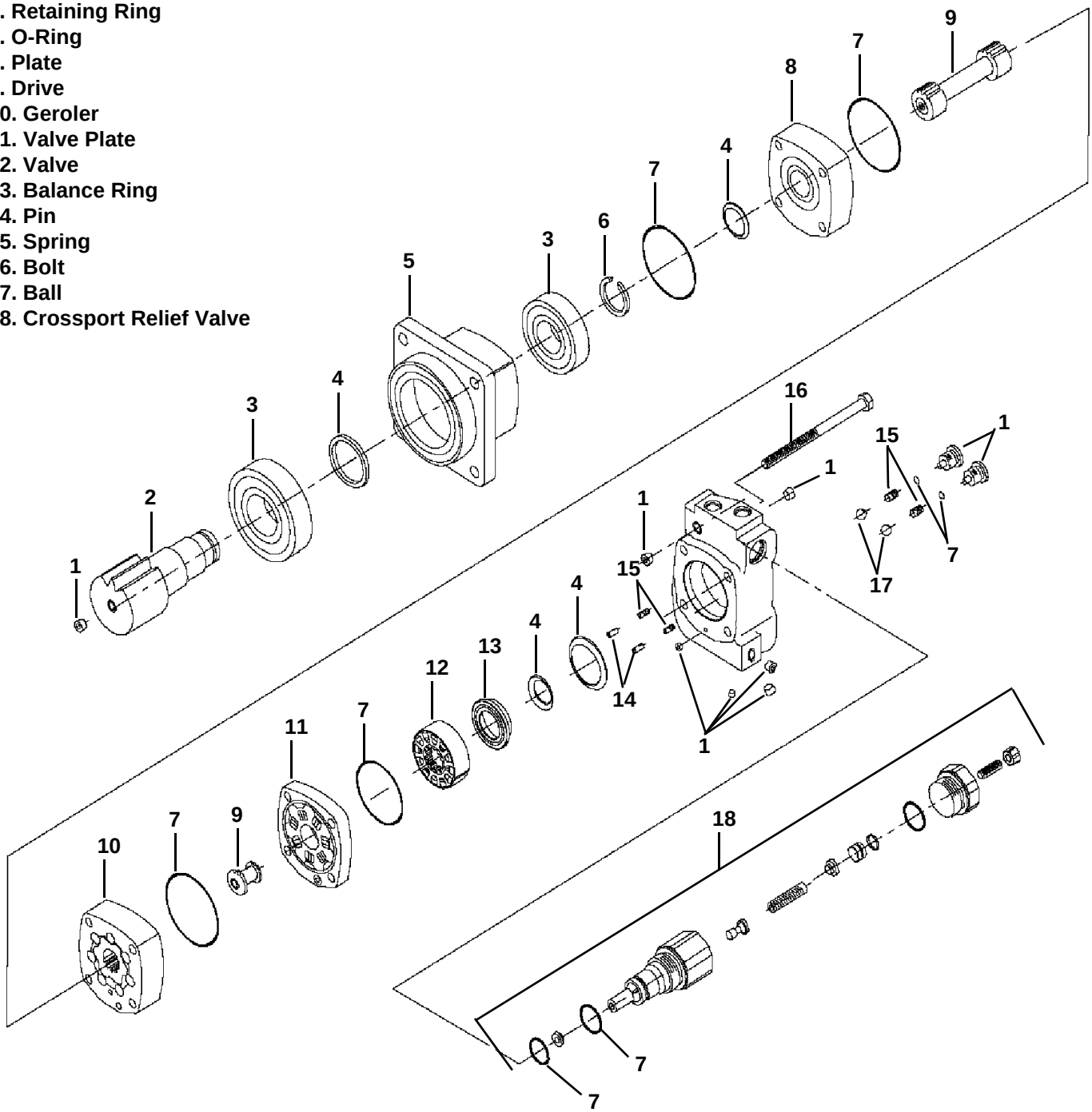
Remove the four bolts (Item 2) **[Figure 20-90-2]** from the swing motor.

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

Remove the swing motor from the excavator.

Parts Identification

1. Plug
2. Shaft
3. Bearing
4. Seal
5. Housing
6. Retaining Ring
7. O-Ring
8. Plate
9. Drive
10. Geroler
11. Valve Plate
12. Valve
13. Balance Ring
14. Pin
15. Spring
16. Bolt
17. Ball
18. Crossport Relief Valve

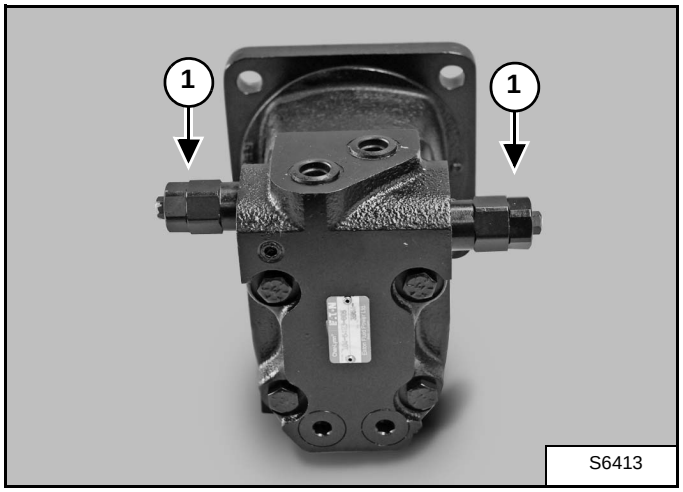


Disassembly

Clean the outside of the swing motor before disassembly.

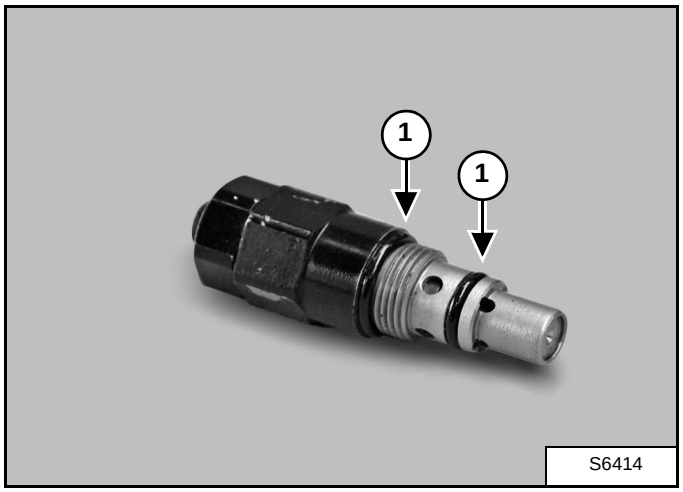
Mark the outside of the swing motor for ease of assembly.

Figure 20-90-3



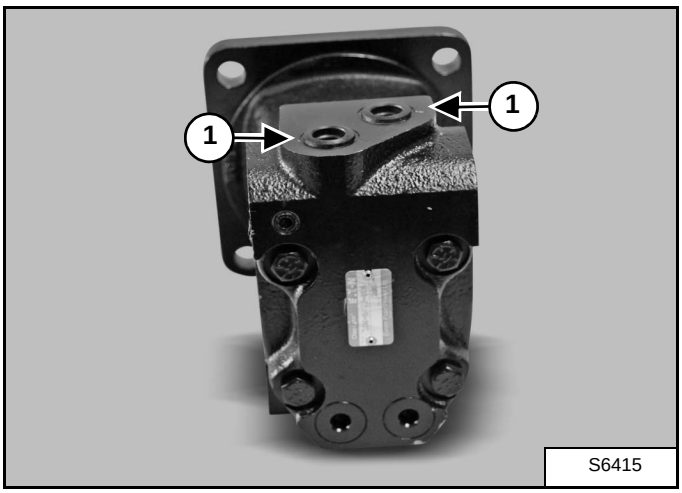
Remove the crossport relief valves (Item 1) **[Figure 20-90-3]**.

Figure 20-90-4



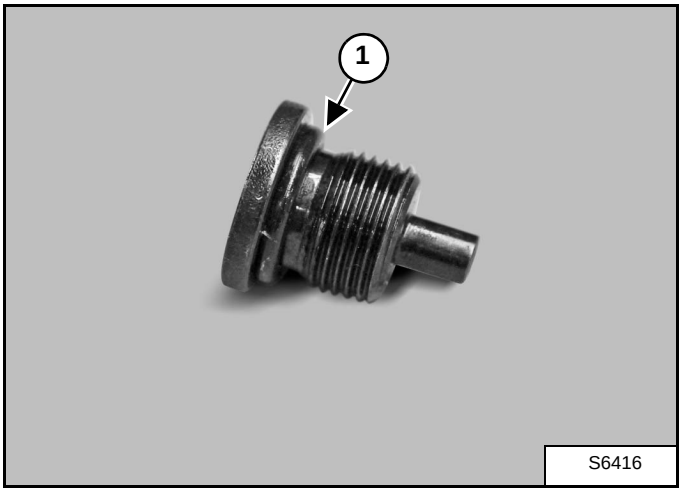
Remove the O-rings (Item 1) **[Figure 20-90-4]** from the crossport relief valves.

Figure 20-90-5



Remove the plugs (Item 1) **[Figure 20-90-5]** from the swing motor.

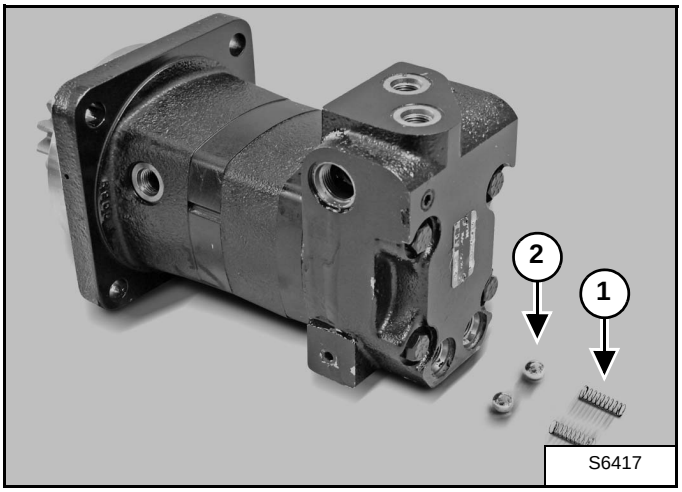
Figure 20-90-6



Remove the O-ring (Item 1) **[Figure 20-90-6]** from the plug.

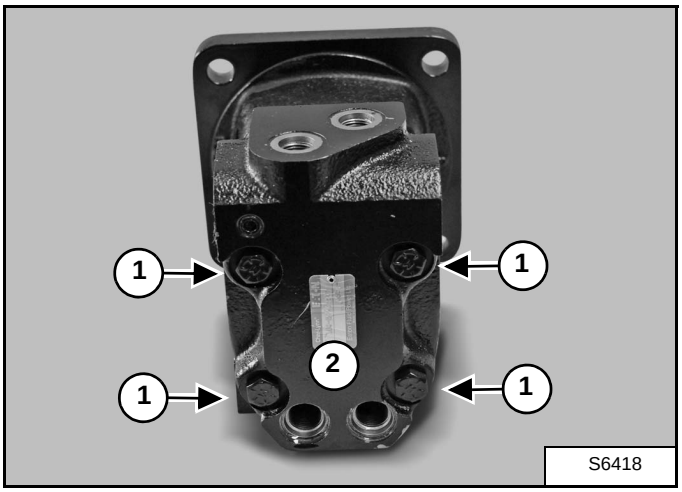
Disassembly (Cont'd)

Figure 20-90-7



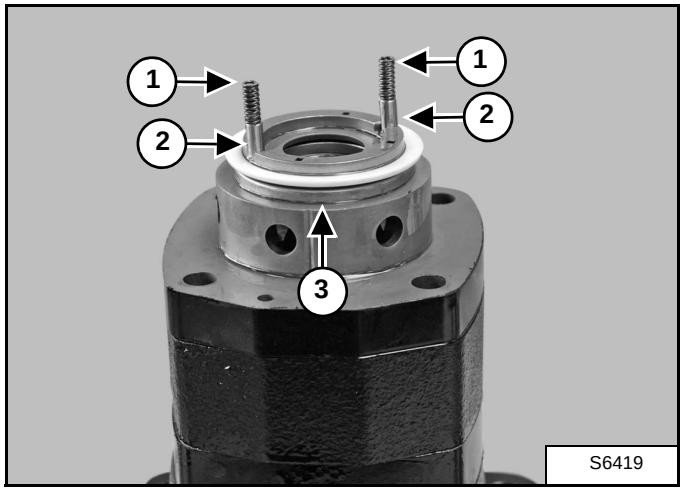
Remove the springs (Item 1) and balls (Item 2) **[Figure 20-90-7]**.

Figure 20-90-8



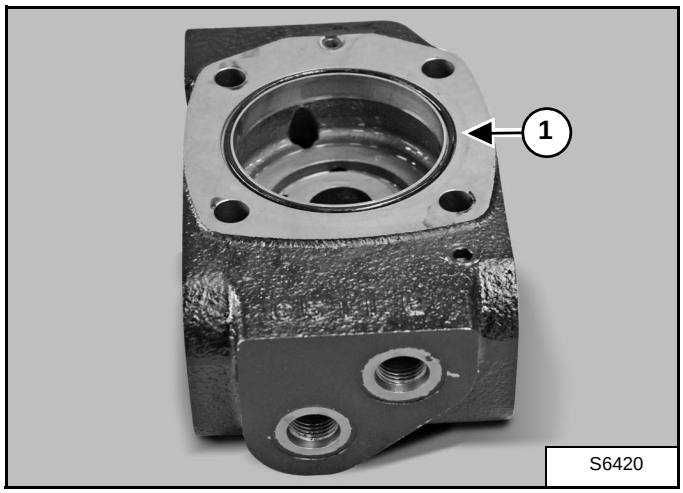
Remove the bolts (Item 1) **[Figure 20-90-8]**.

Figure 20-90-9



Remove the top of the motor (Item 2) **[Figure 20-90-8]** by lifting straight up. If done carefully, the springs (Item 1), pins (Item 2) and balbalance ring assembly (Item 3) **[Figure 20-90-9]** will remain on the valve for easy removal.

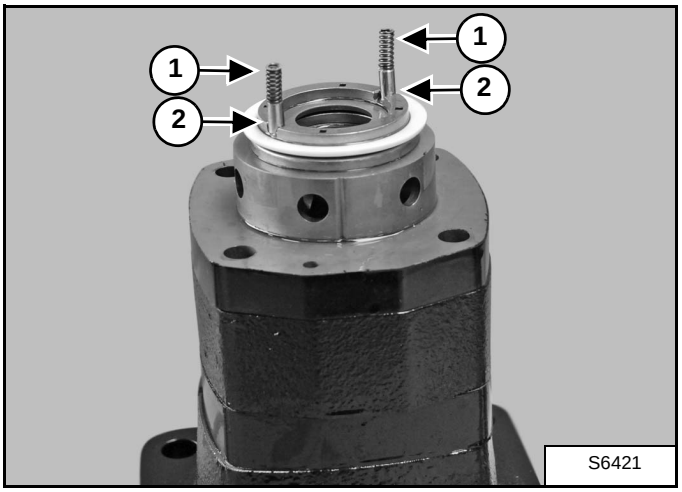
Figure 20-90-10



Remove the O-ring (Item 1) **[Figure 20-90-10]**.

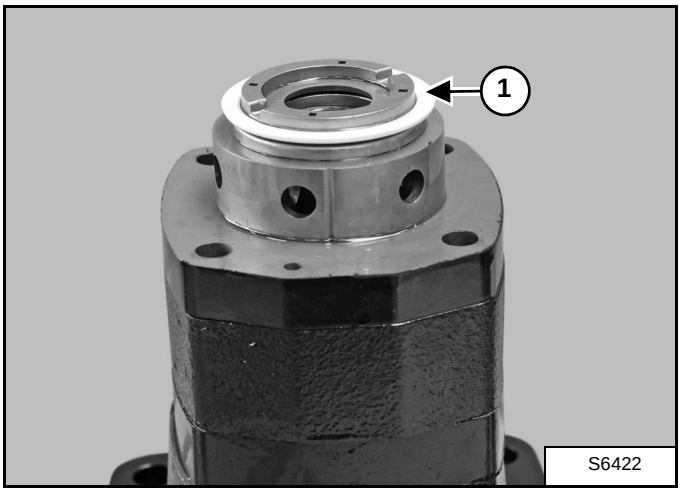
Disassembly (Cont'd)

Figure 20-90-11



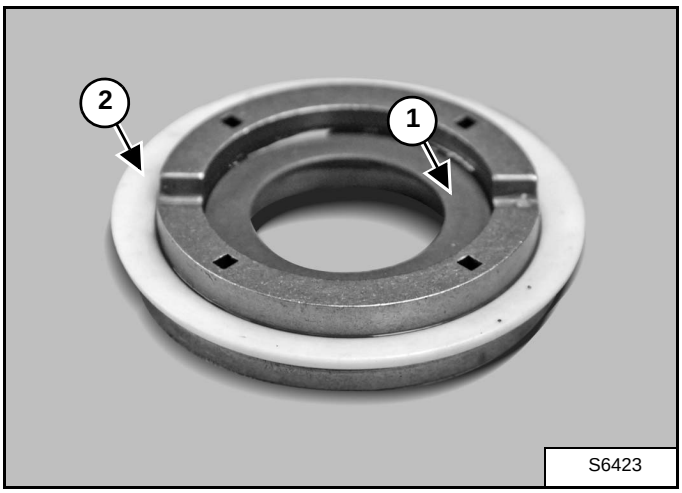
Remove the springs (Item 1) and pins (Item 2) **[Figure 20-90-11]**.

Figure 20-90-12



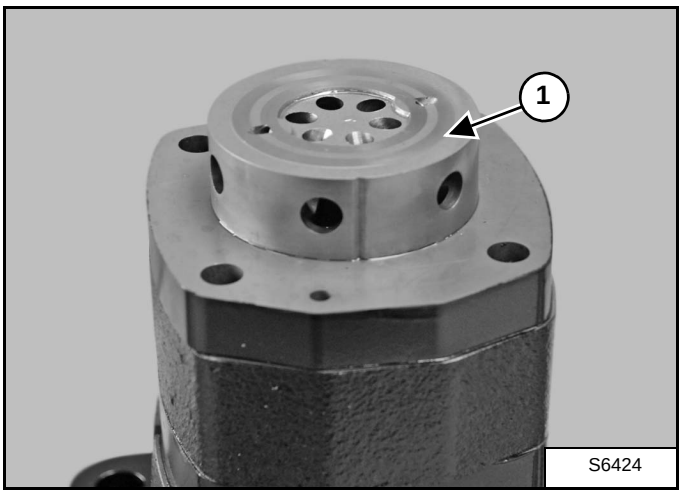
Remove the balance ring (Item 1) **[Figure 20-90-12]**.

Figure 20-90-13



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

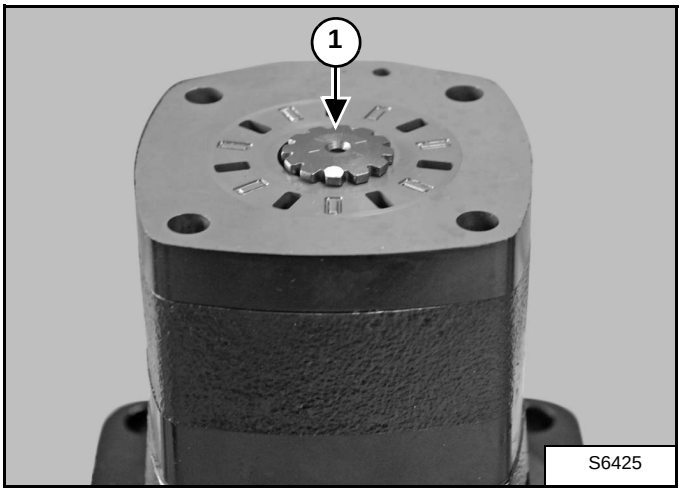
Figure 20-90-14



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

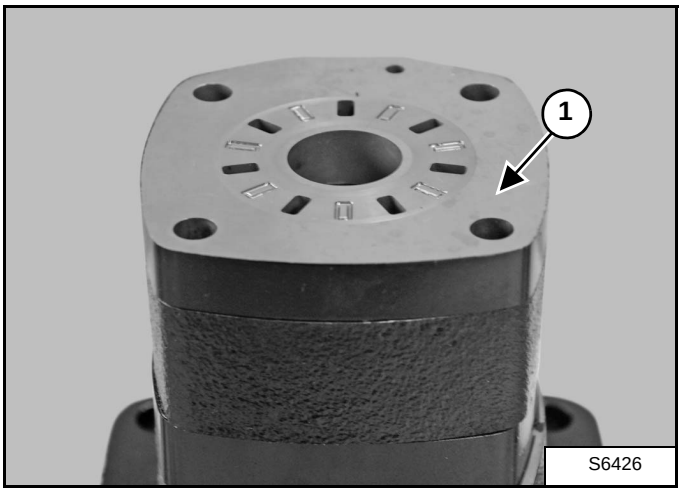
Disassembly (Cont'd)

Figure 20-90-15



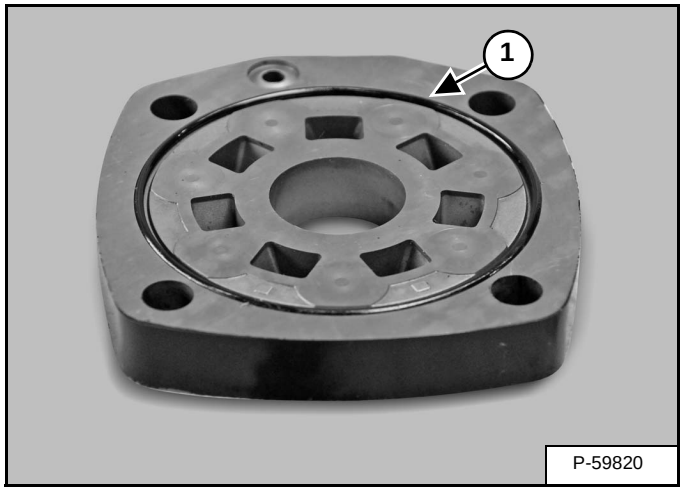
Remove the drive (Item 1) **[Figure 20-90-15]**.

Figure 20-90-16



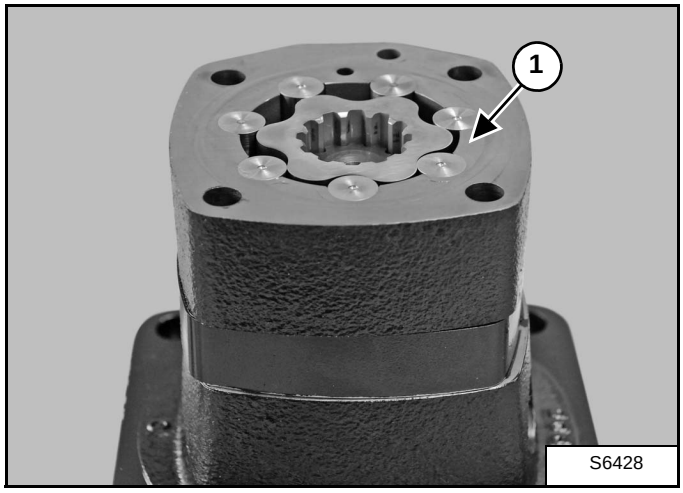
Remove the valve plate (Item 1) **[Figure 20-90-16]**.

Figure 20-90-17



Remove the O-ring (Item 1) **[Figure 20-90-17]** from the valve plate.

Figure 20-90-18

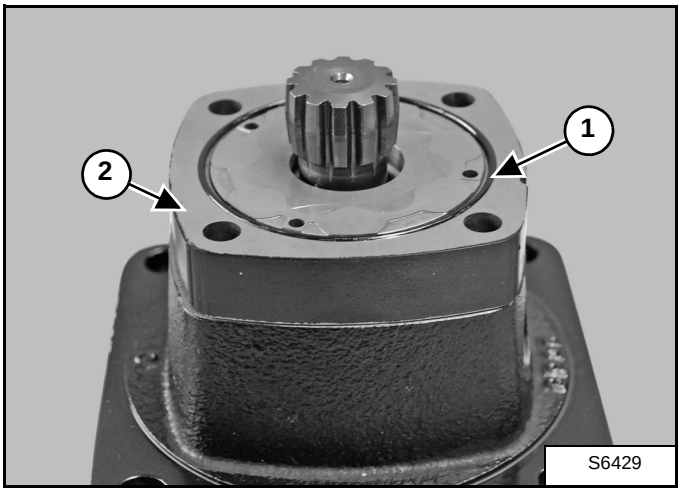


Remove the geroler (Item 1) **[Figure 20-90-18]**.

NOTE: Do not disassemble the geroler.

Disassembly (Cont'd)

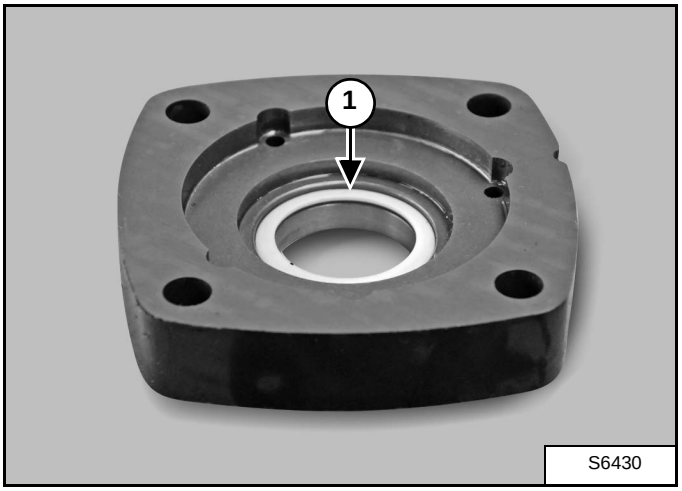
Figure 20-90-19



Remove the O-ring (Item 1) **[Figure 20-90-19]**.

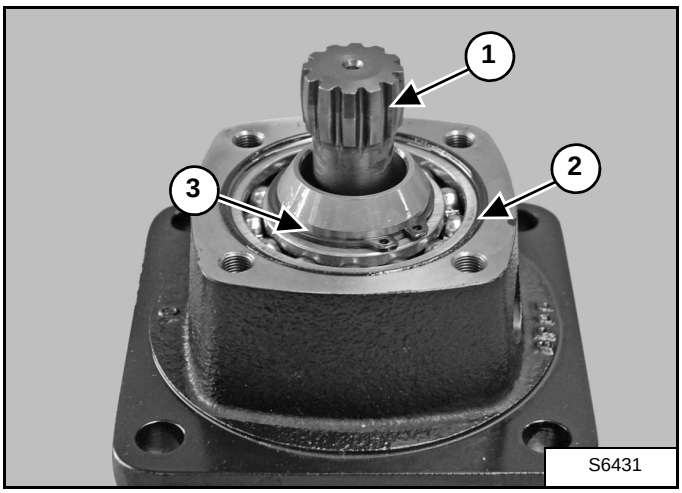
Remove the valve plate (Item 2) **[Figure 20-90-19]**.

Figure 20-90-20



Remove the seal (Item 1) **[Figure 20-90-20]** from the valve plate.

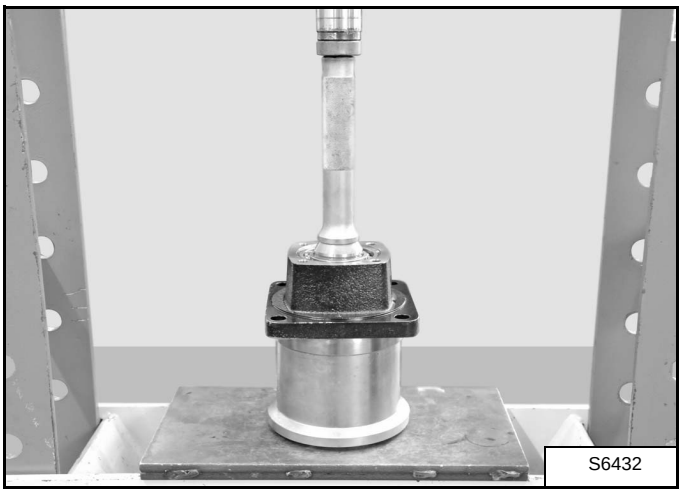
Figure 20-90-21



Remove the drive (Item 1) and O-ring (Item 2) **[Figure 20-90-21]**.

Remove the retaining ring (Item 3) **[Figure 20-90-21]**.

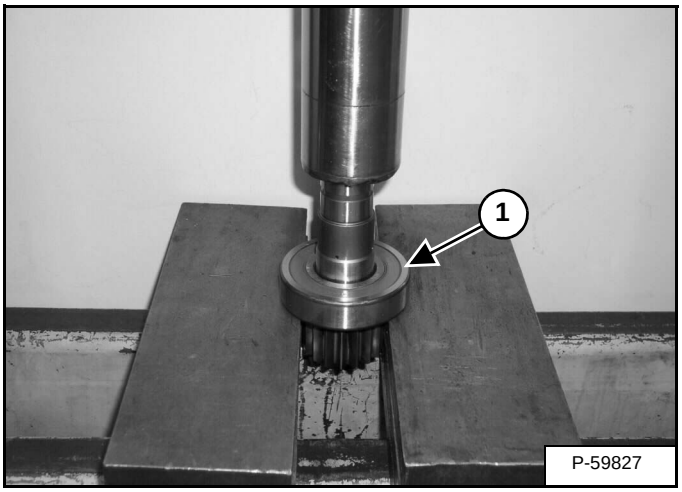
Figure 20-90-22



Press the shaft out of the housing **[Figure 20-90-22]**.

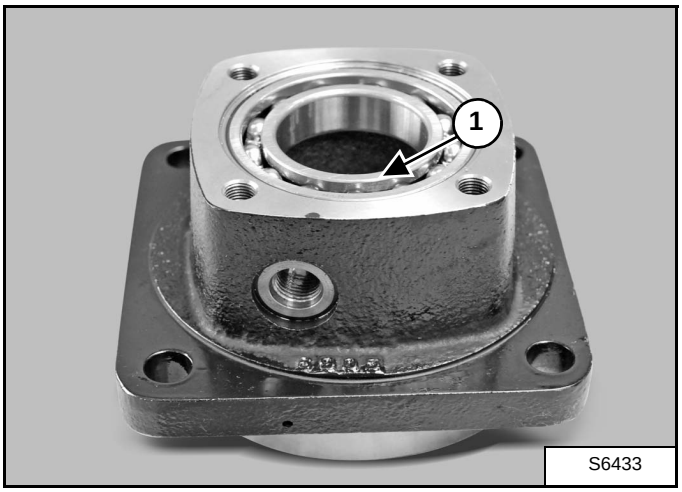
Disassembly (Cont'd)

Figure 20-90-23



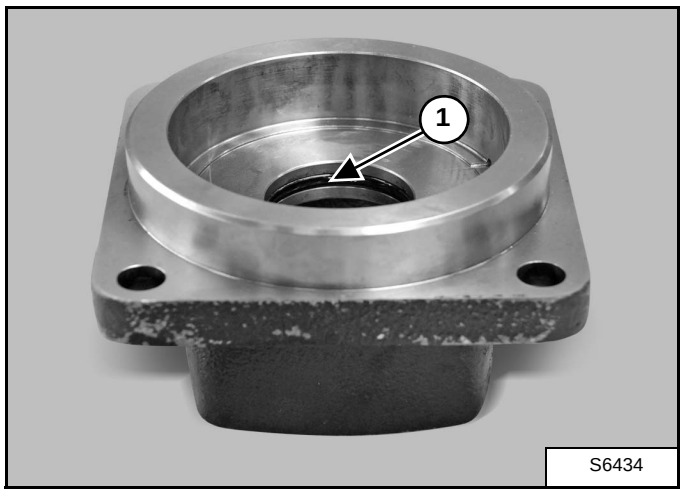
Press the bearing (Item 1) **[Figure 20-90-23]** off of the shaft.

Figure 20-90-24



Remove the bearing (Item 1) **[Figure 20-90-24]** from the housing.

Figure 20-90-25



Remove the seal (Item 1) **[Figure 20-90-25]** from the housing.

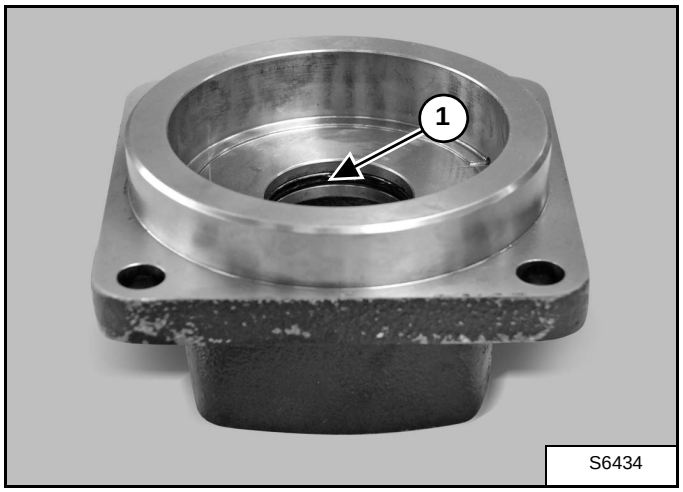
Assembly

Clean all parts in solvent and dry with compressed air.

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

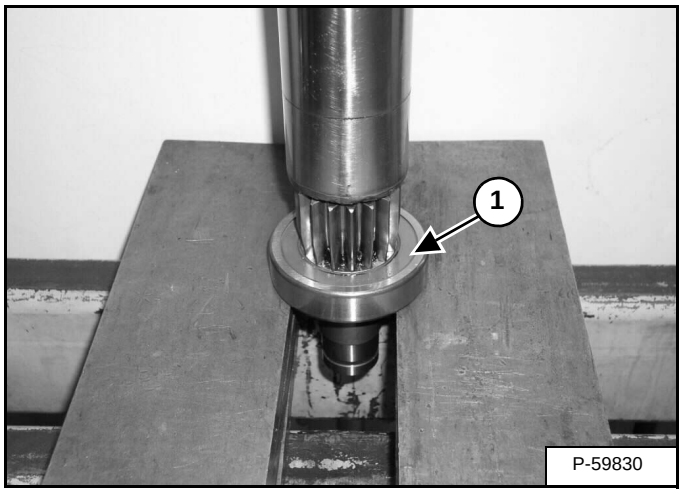
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-90-26



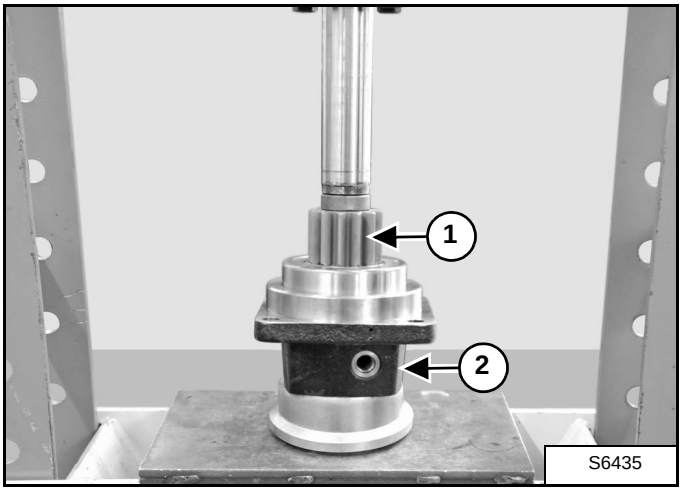
Install the seal (Item 1) **[Figure 20-90-26]** in the housing.

Figure 20-90-27



Press the bearing (Item 1) **[Figure 20-90-27]** on the shaft.

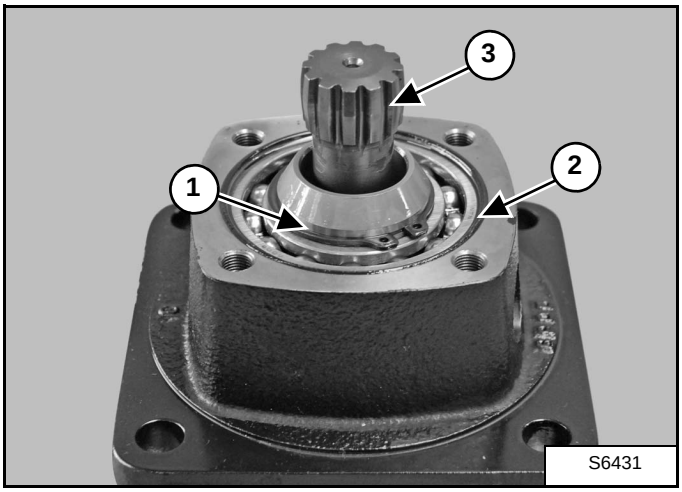
Figure 20-90-28



Press the shaft (Item 1) **[Figure 20-90-28]** in the housing.

Apply assembly lube to the bearing and press the bearing (Item 2) **[Figure 20-90-28]** in the housing.

Figure 20-90-29

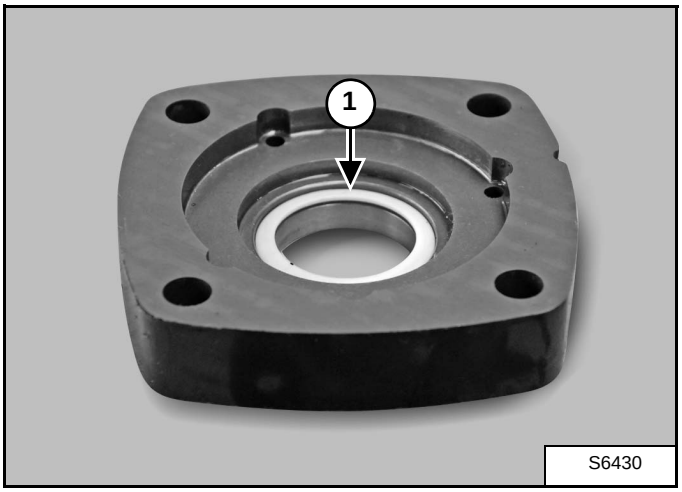


Install the retaining ring (Item 1) and O-ring (Item 2) **[Figure 20-90-29]**.

Install the drive (Item 3) **[Figure 20-90-29]**.

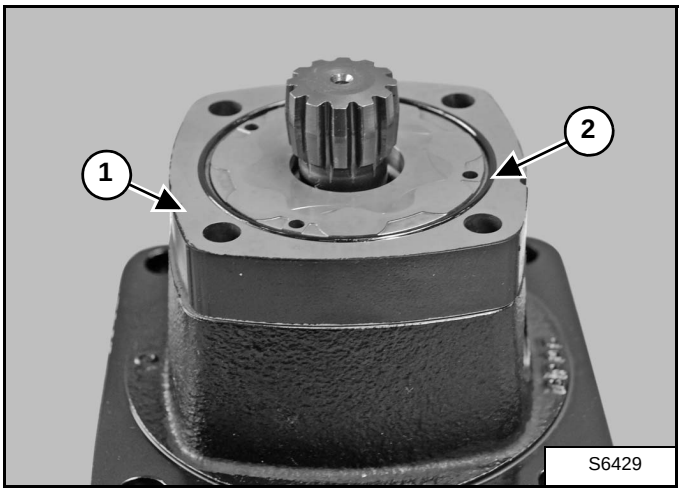
Assembly (Cont'd)

Figure 20-90-30



Install the seal (Item 1) **[Figure 20-90-30]** in the valve plate.

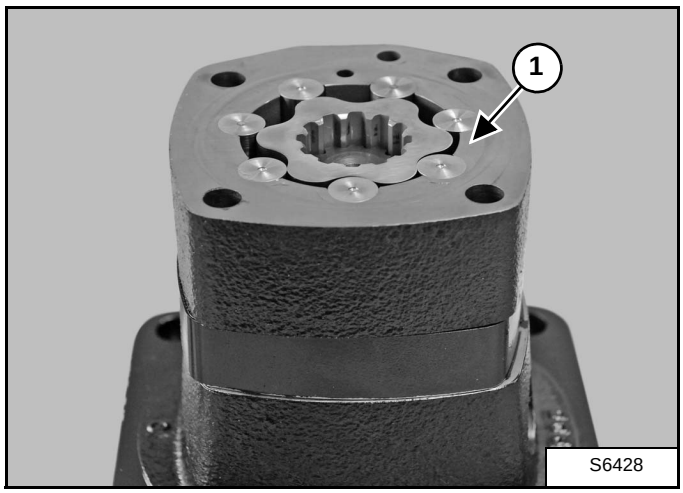
Figure 20-90-31



Install the valve plate (Item 1) **[Figure 20-90-31]**.

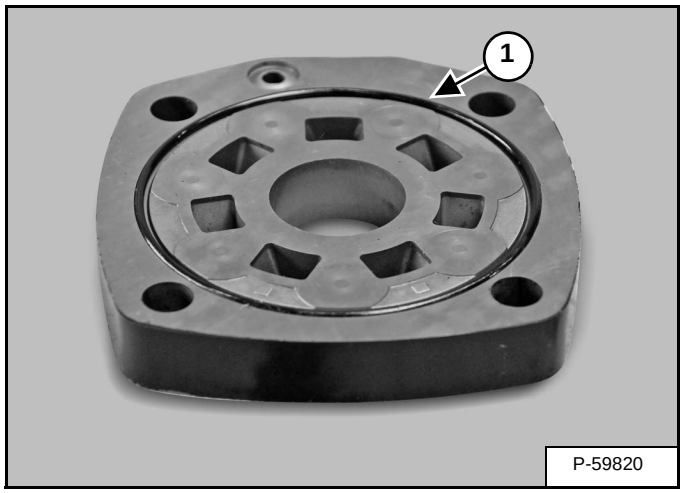
Install the O-ring (Item 2) **[Figure 20-90-31]**.

Figure 20-90-32



Install the geroler (Item 1) **[Figure 20-90-32]**.

Figure 20-90-33



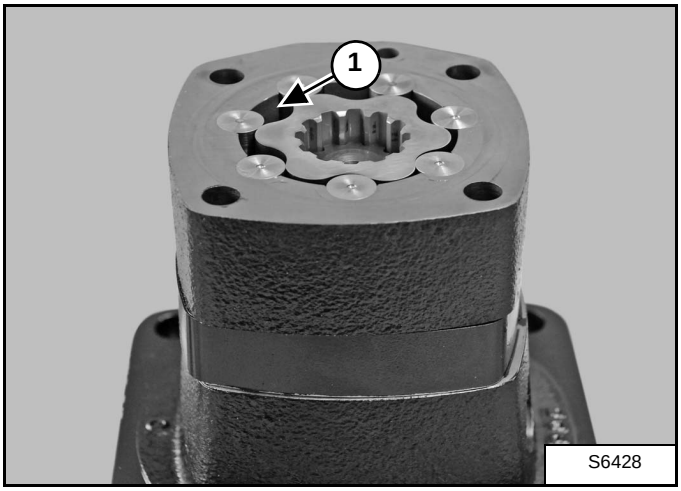
Install the O-ring (Item 1) **[Figure 20-90-33]** on the valve plate.

Assembly (Cont'd)

Motor Timing

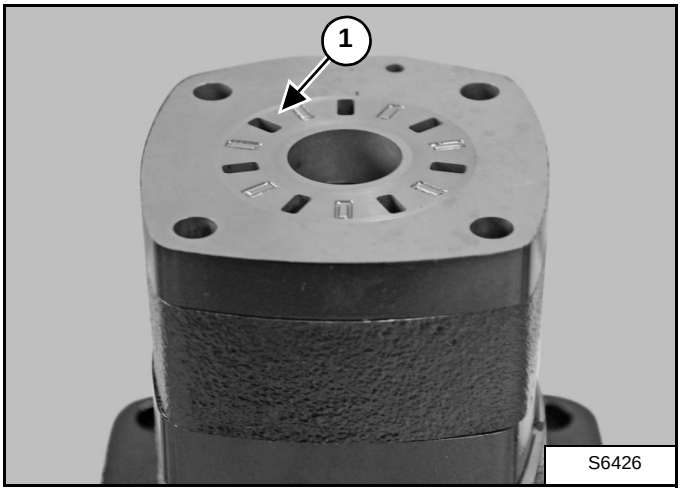
The direction that the output shaft rotates is determined by timing. Time the motor as follows:

Figure 20-90-34



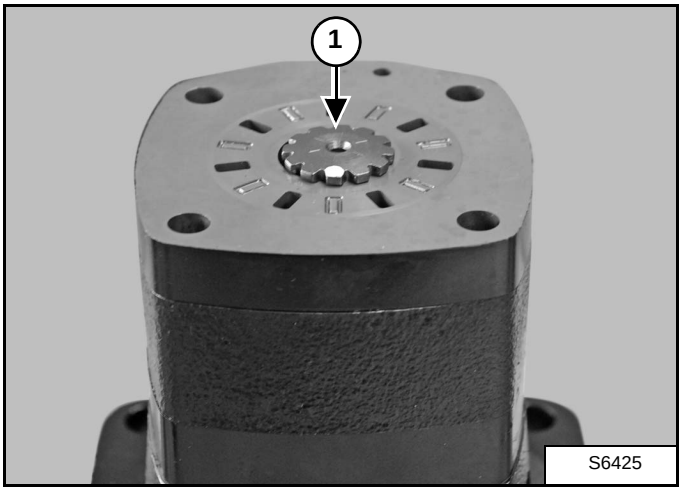
Locate the largest open pocket in the geroler (Item 1) **[Figure 20-90-34]**.

Figure 20-90-35



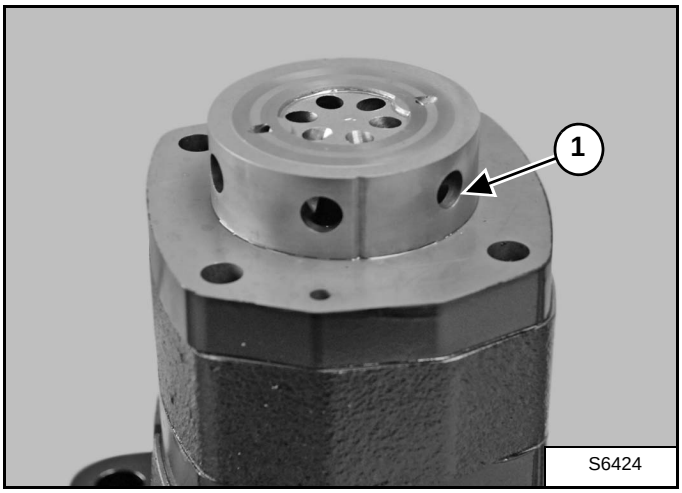
Install the valve plate and locate the open slot (Item 1) **[Figure 20-90-35]** that is over the largest open Geroler pocket.

Figure 20-90-36



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

Figure 20-90-37



NOTE: Picture position has changed 180°.

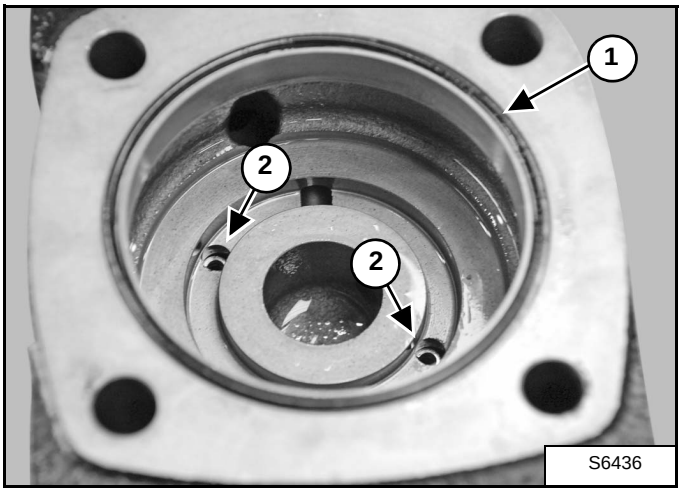
Align one of the side openings (Item 1) **[Figure 20-90-37]** in the valve with the valve plate slot that is over the largest open Geroler pocket.

Engage the valve with the valve drive by rotating it 15° clockwise until the spline teeth mesh.

NOTE: If the valve is turned clockwise the motor will rotate in the opposite direction.

Assembly (Cont'd)

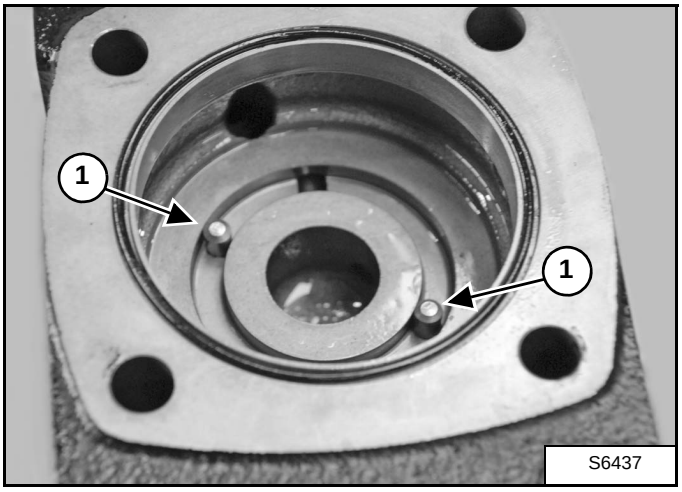
Figure 20-90-38



Install the O-ring (Item 1) **[Figure 20-90-38]**.

Apply assembly lube to the springs, and install the springs (Item 2) **[Figure 20-90-38]**.

Figure 20-90-39



Install the pins (Item 1) **[Figure 20-90-39]**.

Figure 20-90-40

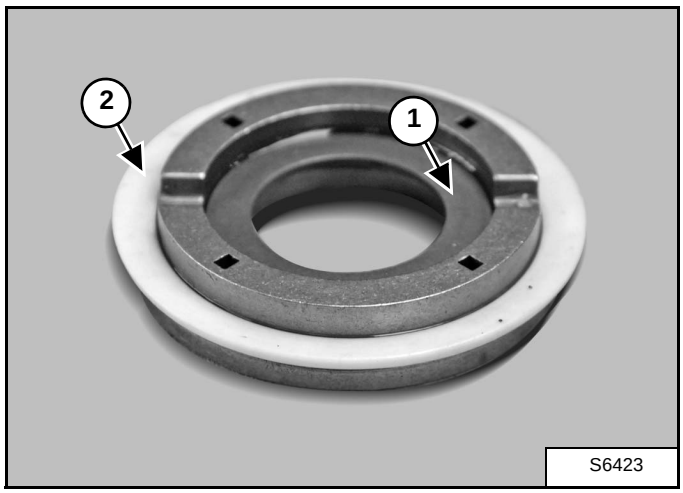
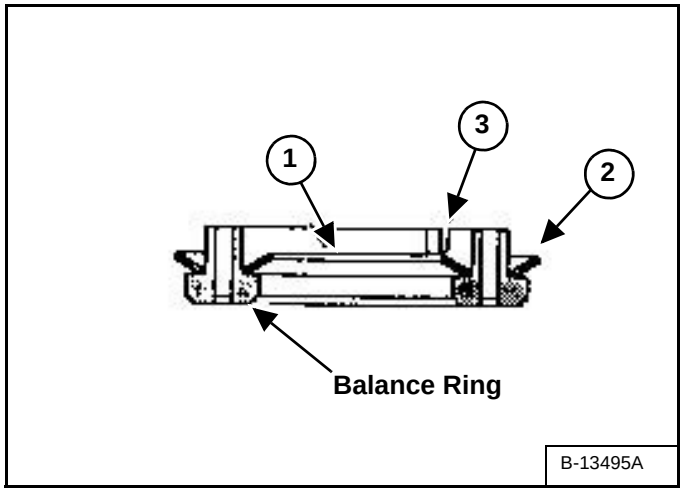


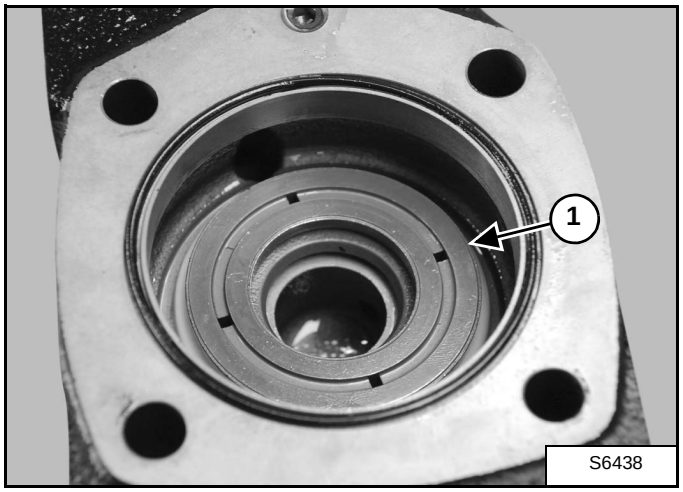
Figure 20-90-41



Install the inner (Item 1) and outer (Item 2) **[Figure 20-90-40]** and **[Figure 20-90-41]** face seals on the balance ring as shown.

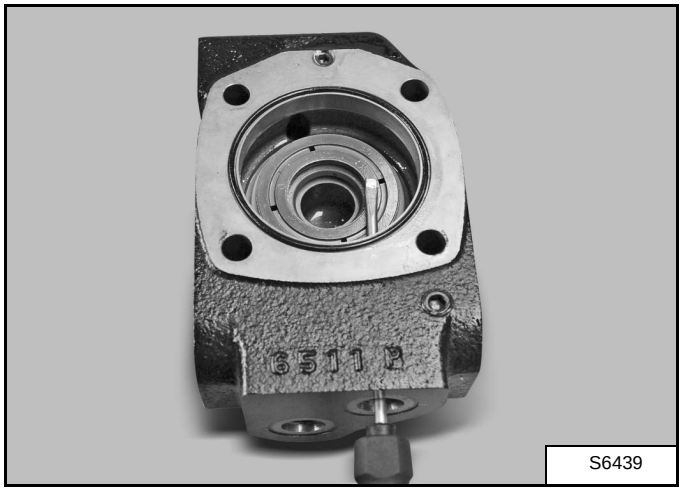
Assembly (Cont'd)

Figure 20-90-42



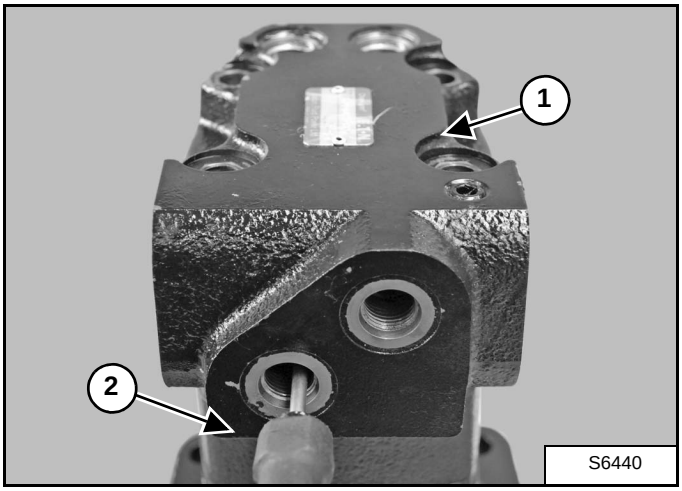
Install the balance ring (Item 1) **[Figure 20-90-42]**. Make sure the pins engage the pin notches (Item 3) **[Figure 20-90-41]** in the balance ring.

Figure 20-90-43



Insert a small screw driver through the port in the housing. Apply pressure to the side of the balance ring assembly until the valve housing is in place **[Figure 20-90-43]**.

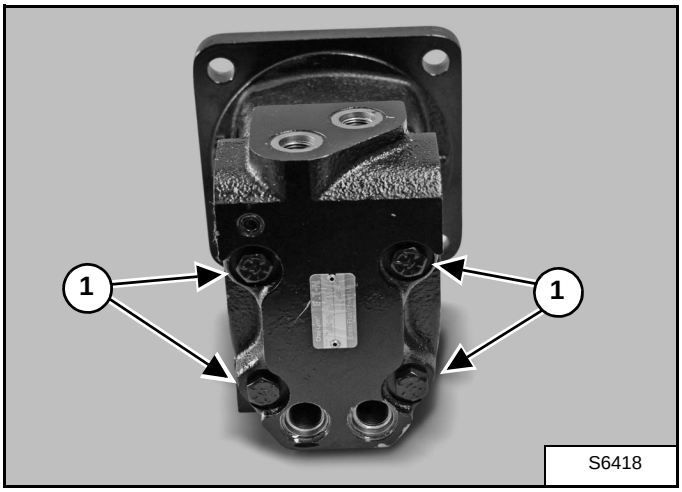
Figure 20-90-44



Install the housing (Item 1) **[Figure 20-90-44]** on the motor.

Remove the screwdriver (Item 2) **[Figure 20-90-44]**.

Figure 20-90-45

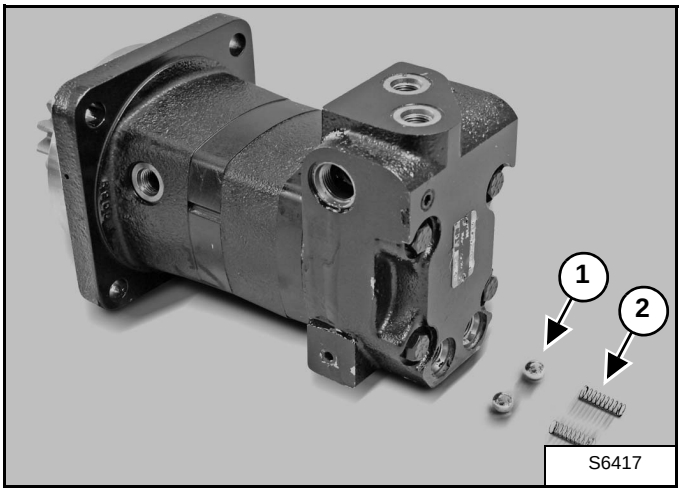


Install the bolts (Item 1) **[Figure 20-90-45]**. Tighten the bolts to 37 ft.-lb. (50 N•m) torque in a crisscross pattern.

Installation: Tighten bolts to 39.1 ft.-lb. (53 N•m) torque.

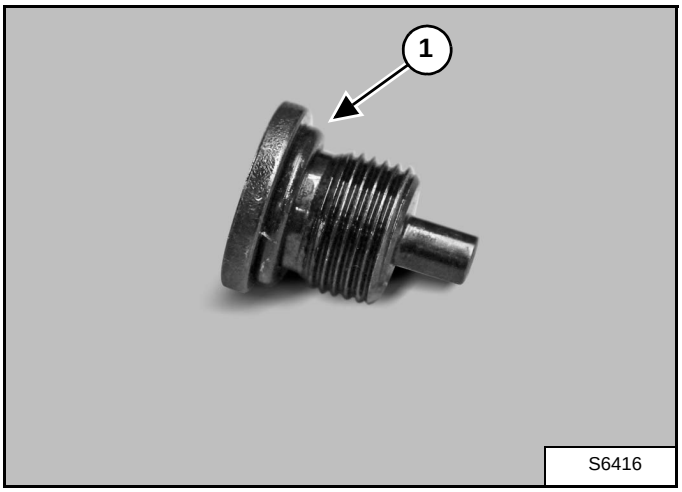
Assembly (Cont'd)

Figure 20-90-46



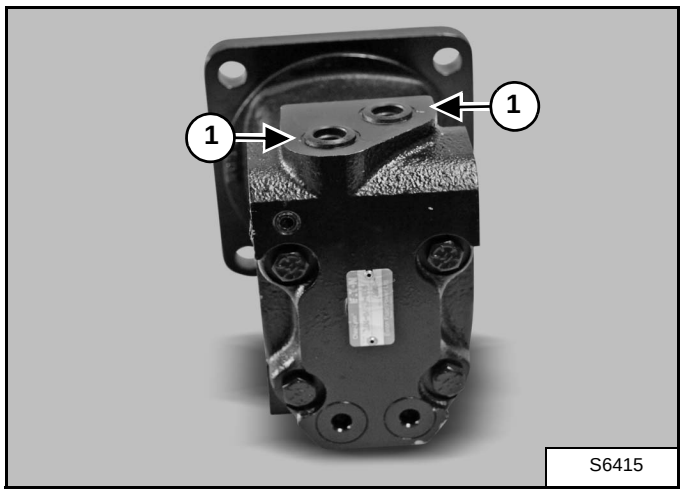
Install the balls (Item 1) and springs (Item 2) **[Figure 20-90-46]**.

Figure 20-90-47



Install the O-ring (Item 1) **[Figure 20-90-47]** on the plugs.

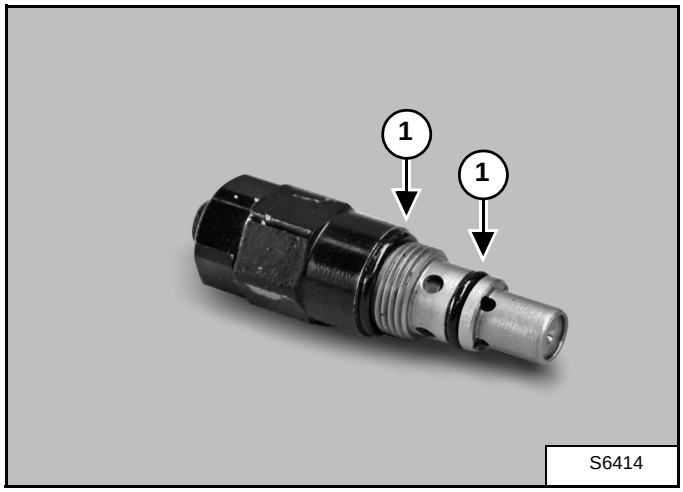
Figure 20-90-48



Install the plugs (Item 1) **[Figure 20-90-48]**.

Installation: Tighten bolts to 43.5 ft.-lb. (59 N•m) torque.

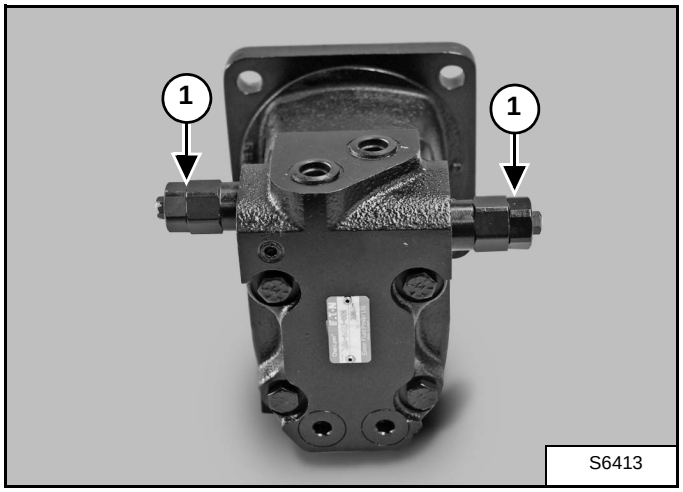
Figure 20-90-49



Install the O-rings (Item 1) **[Figure 20-90-49]** on the crossport relief valves.

Assembly (Cont'd)

Figure 20-90-50

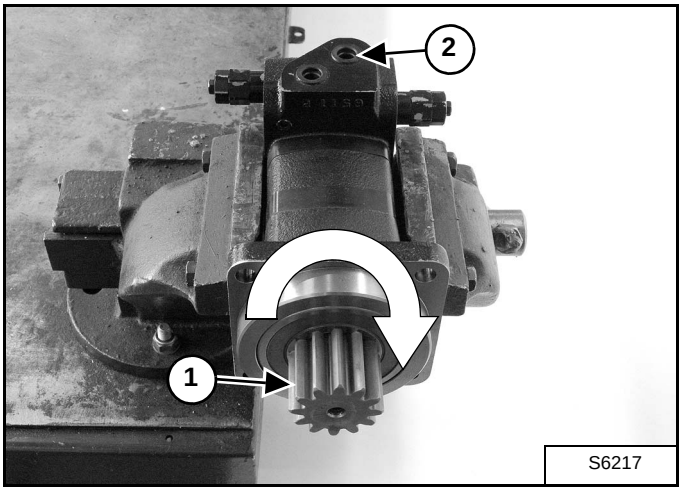


Install the crossport relief valves (Item 1) **[Figure 20-90-50]**.

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


Bobcat®

RIGHT CONTROL LEVER (JOYSTICK)

Description

The right control lever (joystick) operates using pilot pressure to move the boom and / or bucket spools in the control valve. The right control lever (joystick) will be locked in the down position in a cab equipped excavator and moveable in a canopy equipped excavator. The right control lever (joystick), in a canopy equipped excavator, has a microswitch that will lockout the hydraulic functions in the raised position and enable the hydraulic functions in the down (locked) position.

Testing

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

The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

Lower the boom / bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

Remove the bottom half of the right console cover.

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.

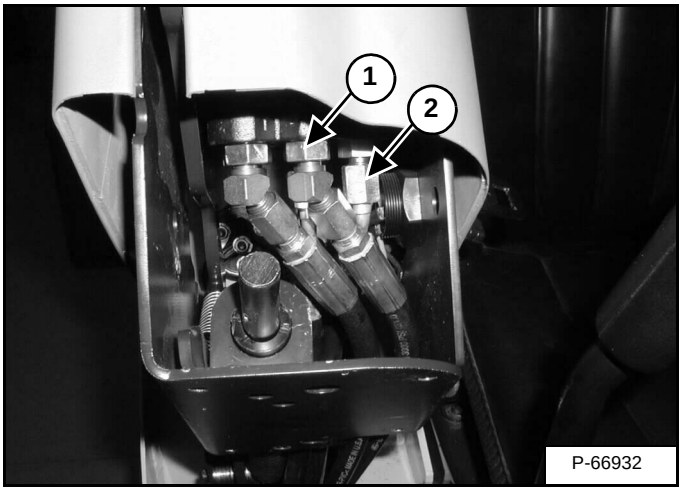
I-2003-0888

⚠ WARNING

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

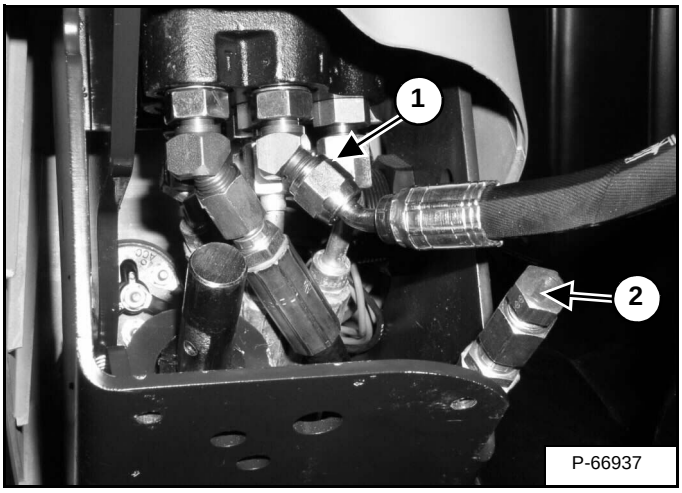
W-2145-0290

Figure 20-100-1



At the bottom of the right control lever (joystick), find the pilot hose connected to Port 1 (Item 1) and Port 4 (Item 2) **[Figure 20-100-1]** labeled on the side of the right control lever (joystick) casting. Port 1 is the pilot pressure for the Boom function and Port 4 is the pilot pressure for the Bucket function.

Figure 20-110-2



Remove the pilot hose **[Figure 20-110-2]** from the bottom of the control lever (joystick) that is to be checked.

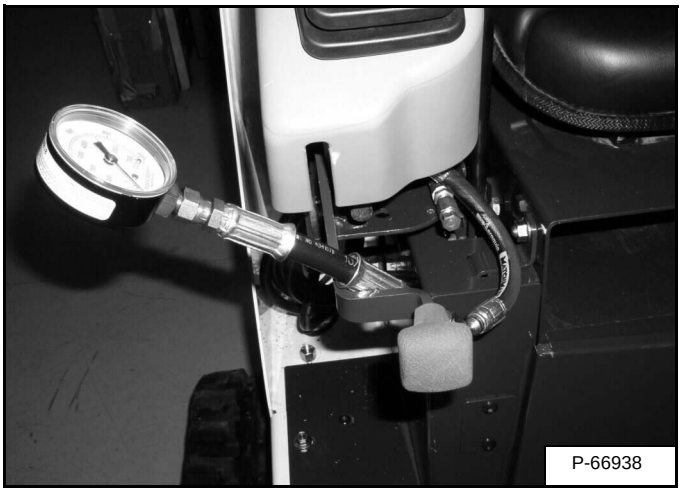
From the test kit, install a fitting and gauge hose (Item 1) **[Figure 20-110-2]** to the control lever (joystick) fitting.

Cap the pilot hose (Item 2) **[Figure 20-110-2]**.

RIGHT CONTROL LEVER (JOYSTICK) (CONT'D)

Testing (Cont'd)

Figure 20-110-3



Install a 1000 PSI (69 bar) gauge on the hose **[Figure 20-110-3]**.

Lower the right console to the locked position **[Figure 20-110-3]**. Also lower the left console to the locked position if in the vertical position.

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

Check the gauge with the control levers (joystick) in neutral. The hydraulic pressure should be 0 PSI (0 bar).

Engage the circuit to be tested. Record the operating pressure.

The operating pressure should be as follows:

435 PSI (30 bar) with an acceptable range of 406 to 450 PSI (28 to 31 bar).

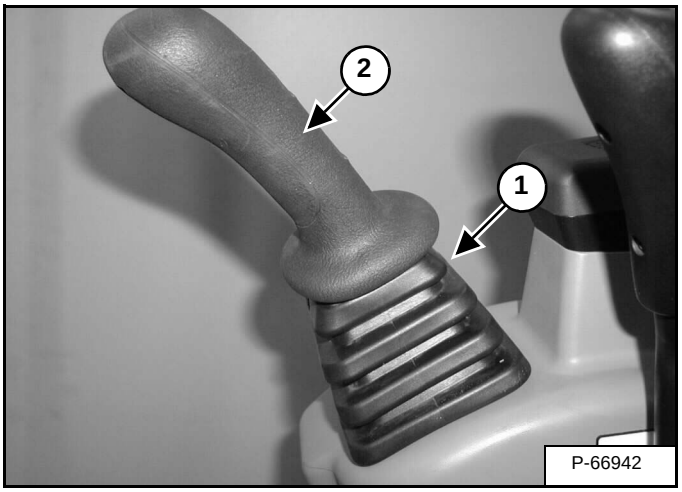
If the operating pressure is correct, check the valve section spool for proper operation.

If the operating pressure is incorrect, remove the pressure reducing valve, clean, install and retest (See Testing And Adjusting The Pressure Reducing Valve on Page 20-33-1.)

If the pressure is still incorrect replace the pressure reducing valve (See Testing And Adjusting The Pressure Reducing Valve on Page 20-33-1.)

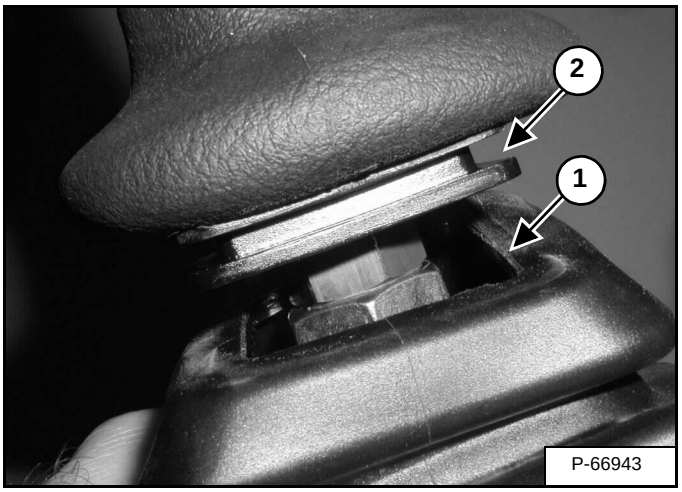
Handle Removal And Installation

Figure 20-110-4



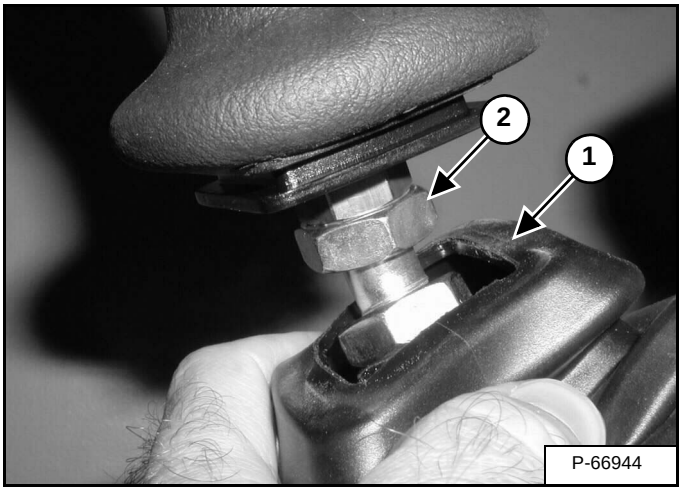
Remove the dust boot (Item 1) from the handle (Item 2) **[Figure 20-110-4]**.

Figure 20-110-5



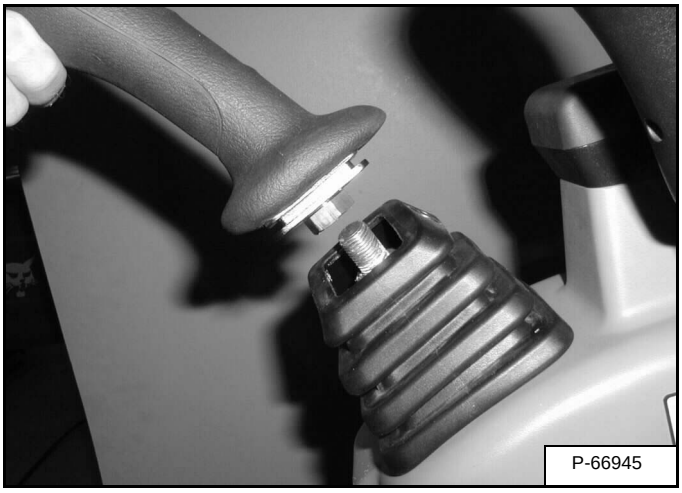
Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-110-5]** in the control handle.

Figure 20-110-6



Hold the dust boot (Item 1) down and loosen the jam nut (Item 2) **[Figure 20-110-6]**.

Figure 20-110-7



Remove the handle **[Figure 20-110-7]**.

Removal And Installation

Lower the boom / bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

Remove the console cover (See Right Rear Console Cover Removal And Installation on Page 40-50-10.)

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.

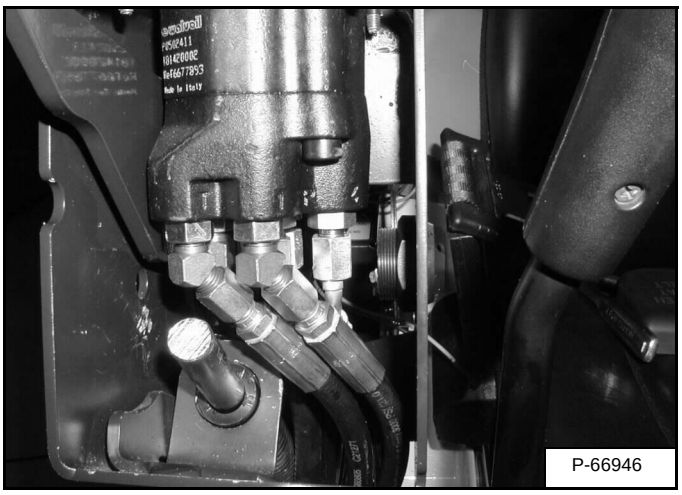
I-2003-0888

⚠ WARNING

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

W-2145-0290

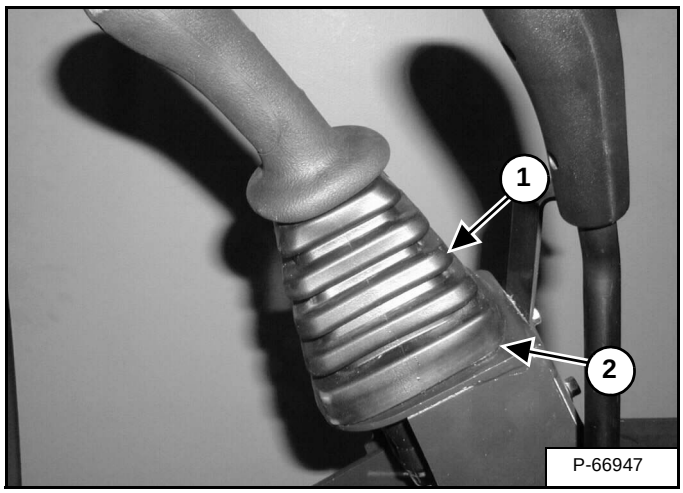
Figure 20-100-8



Mark the hoses for ease of assembly **[Figure 20-100-8]**.

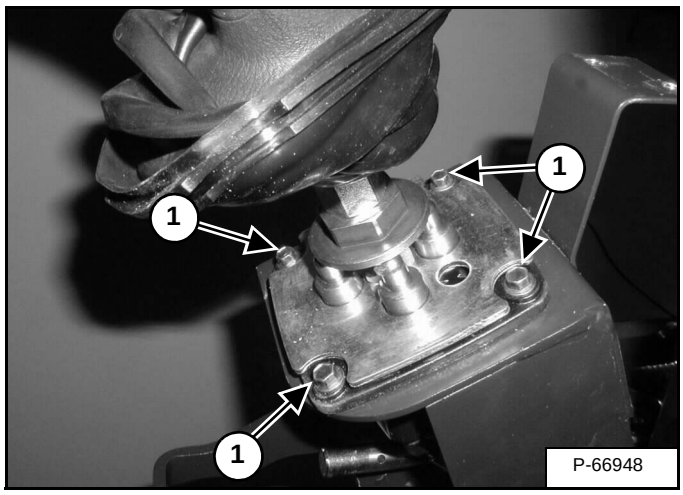
Remove the hoses while the control lever (joystick) is bolted to the console **[Figure 20-100-8]**.

Figure 20-110-9



Raise the dust boot (Item 1) up from the mounting plate (Item 2) **[Figure 20-110-9]**.

Figure 20-110-10

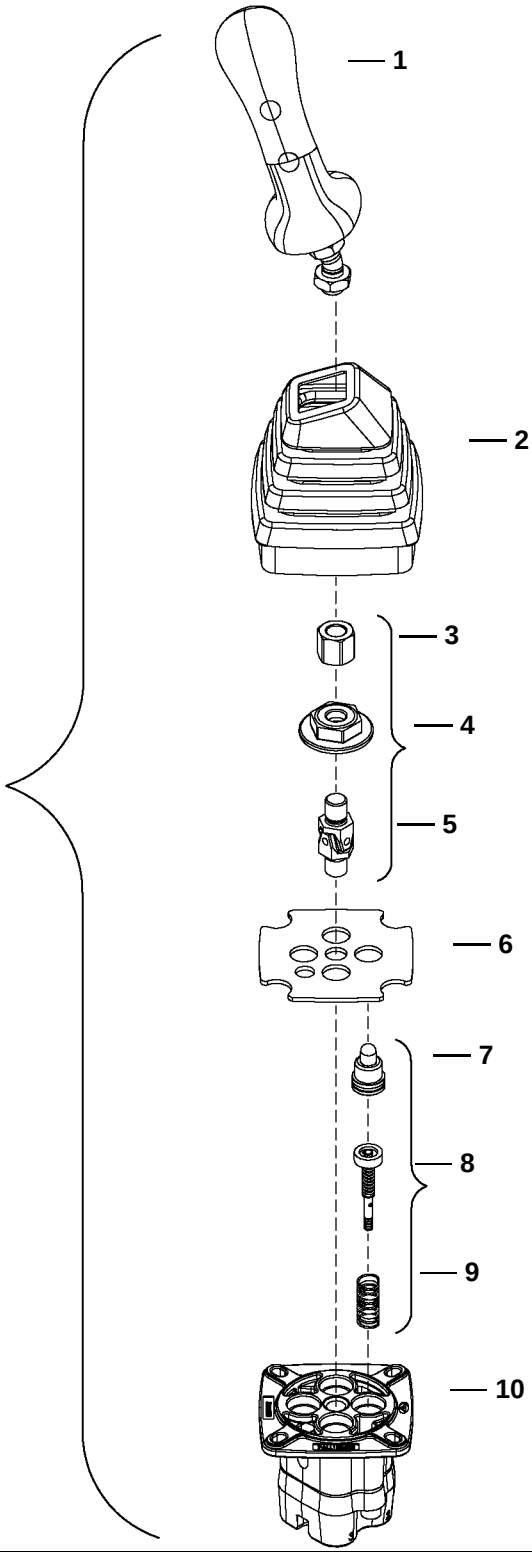


Remove the bolts (Item 1) **[Figure 20-110-10]** from the control lever (joystick) mounting plate.

Remove the control lever (joystick) from the console frame.

Parts Identification

1. Handle
2. Dust Boot
3. Coupler
4. Actuator Control Plate
5. U-Joint
6. Plate
7. Plunger Assembly
8. Spool
9. Spring
10. Housing



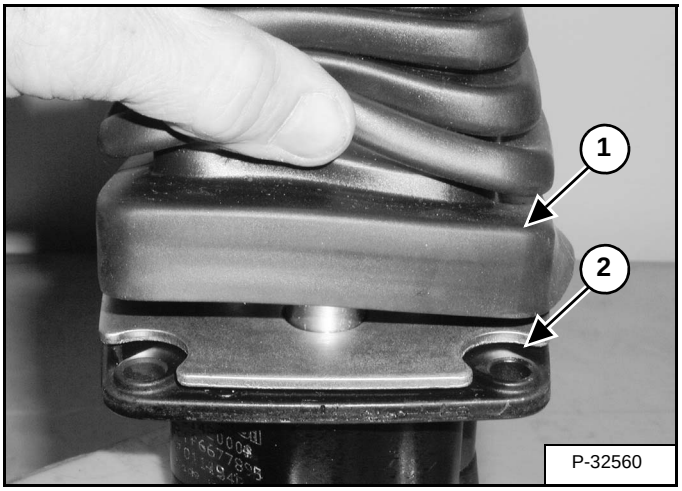
MS1353

Disassembly

Remove the right handle (See Handle Removal And Installation on Page 20-110-3.)

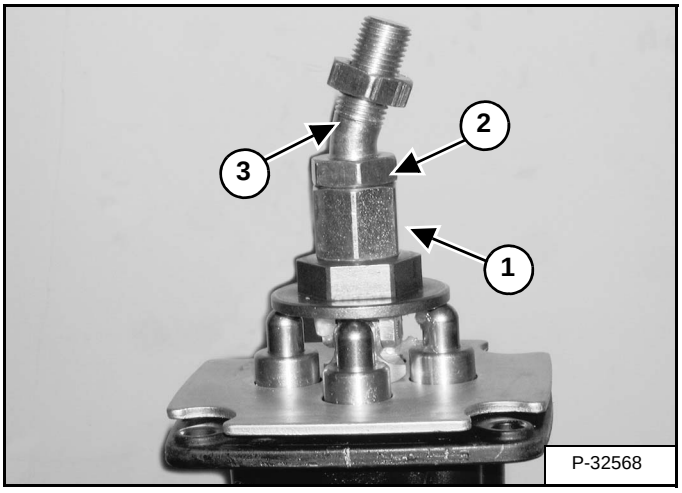
Clean the outside of the control lever before disassembly.

Figure 20-110-11



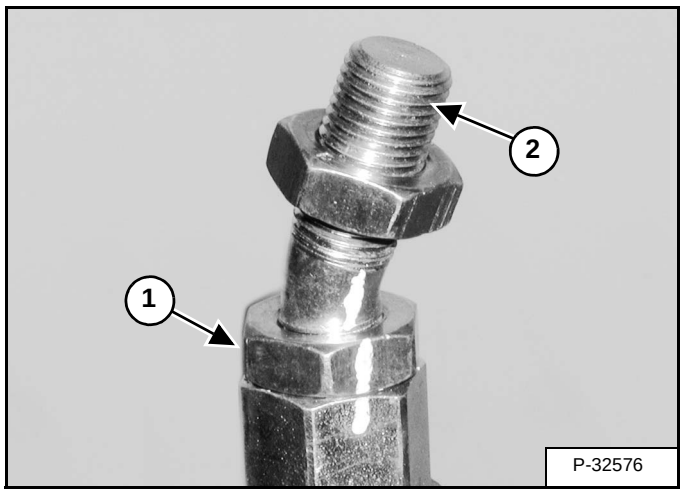
Remove the boot (Item 1) from the control lever (joystick) (Item 2) **[Figure 20-110-11]**.

Figure 20-110-12



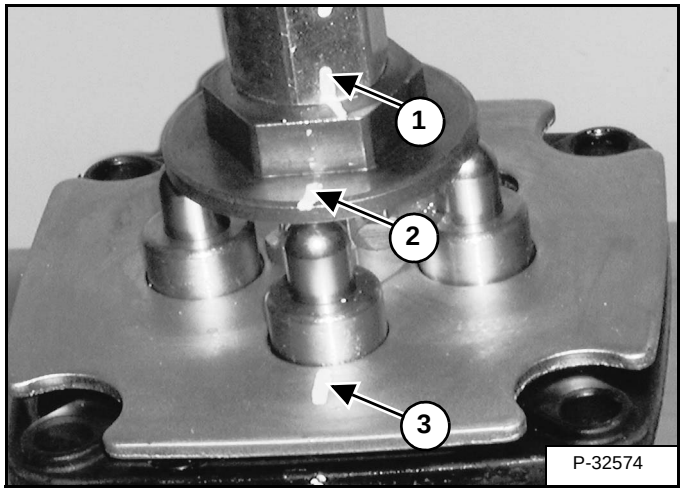
Mark the coupler (Item 1) nut (Item 2), and connector (Item 3) **[Figure 20-110-12]** for correct assembly.

Figure 20-110-13



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-110-13]**.

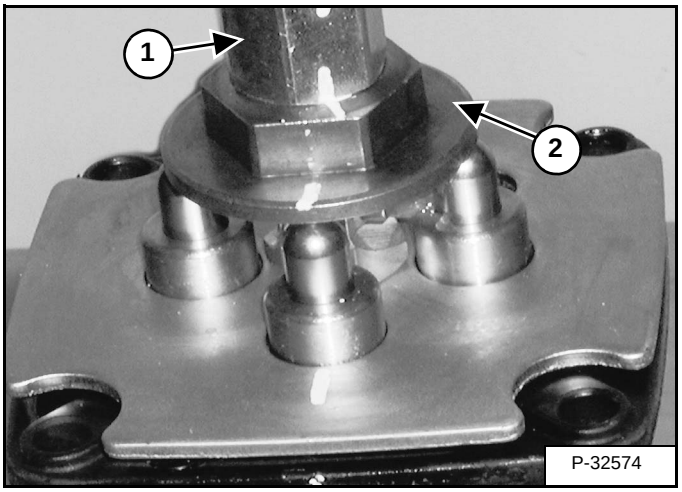
Figure 20-110-14



Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-110-14]** for correct installation.

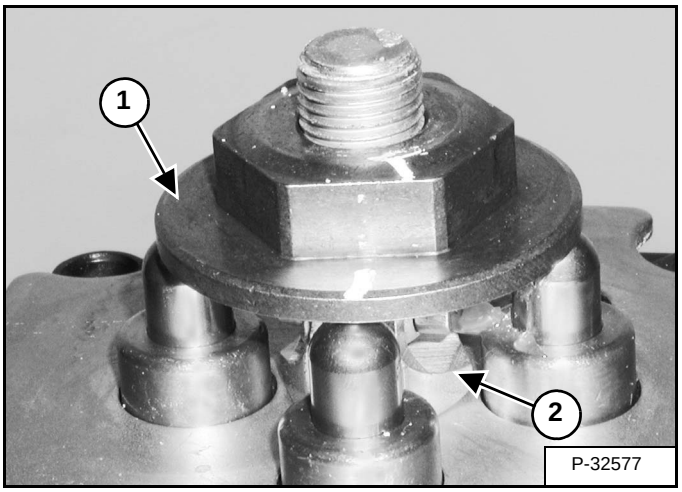
Disassembly (Cont'd)

Figure 20-110-15



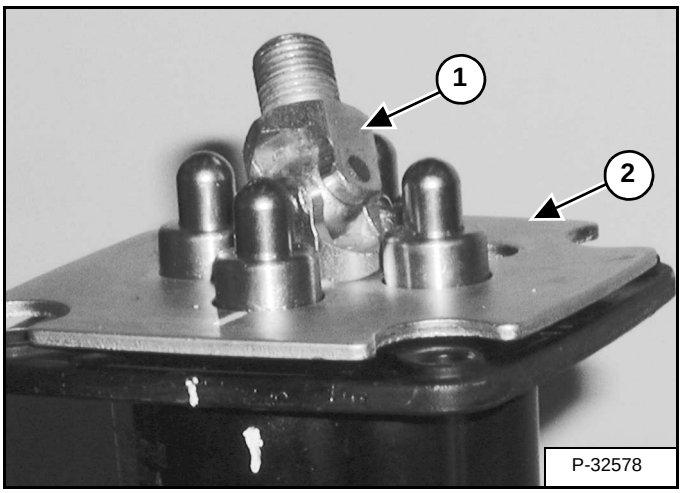
Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-110-15]**.

Figure 20-110-16



Remove the control plate (Item 1) from the U-Joint (Item 2) **[Figure 20-110-16]**.

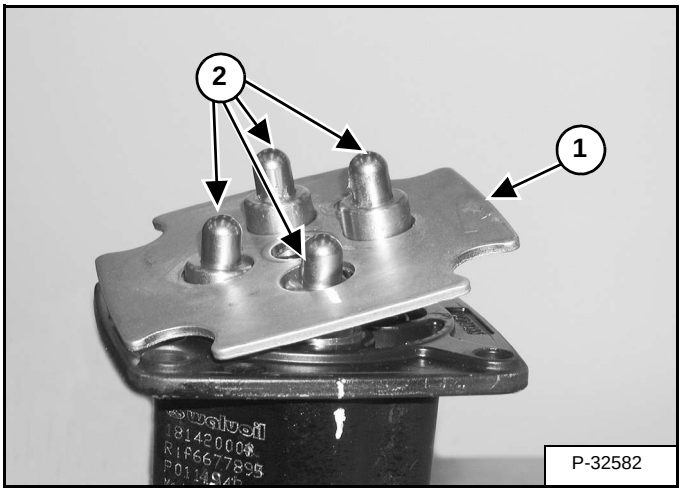
Figure 20-110-17



Mark the plate and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-110-17]**.

NOTE: The plate (Item 2) [Figure 20-110-17] is spring loaded and will come up as the U-joint is removed.

Figure 20-110-18

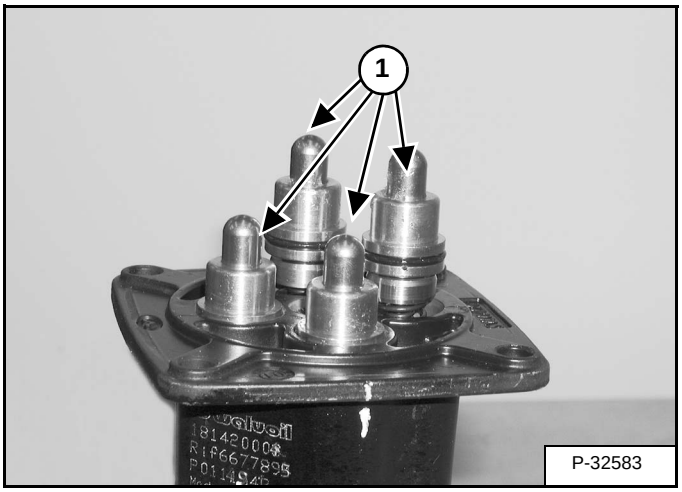


Remove the plate (Item 1) **[Figure 20-110-18]**.

NOTE: Use care while removing the plate. The plungers (Item 2) [Figure 20-110-18] are spring loaded.

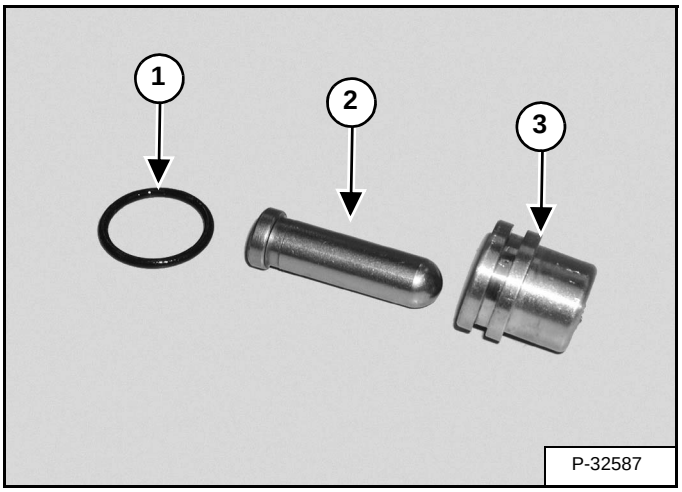
Disassembly (Cont'd)

Figure 20-110-19



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

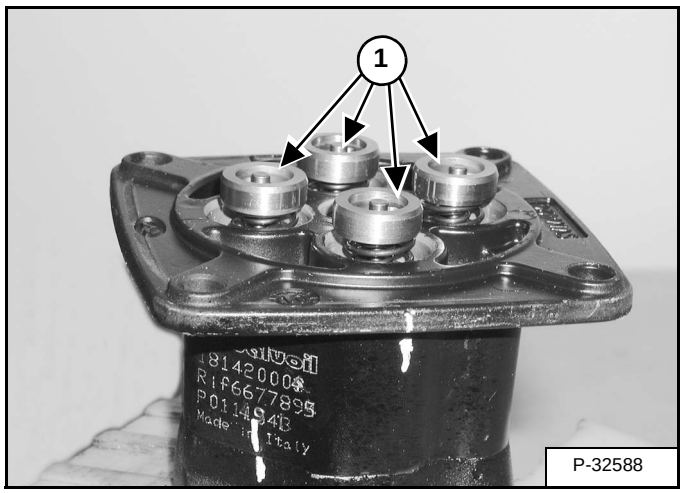
Figure 20-110-20



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

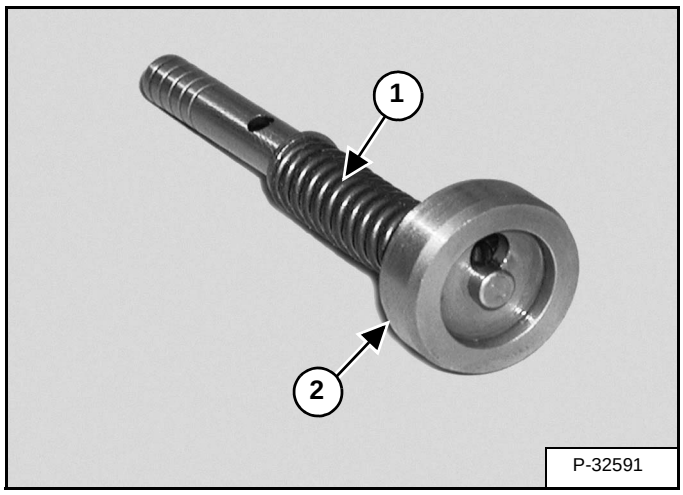
NOTE: Mark the spool assemblies for installation in their original location.

Figure 20-110-21



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

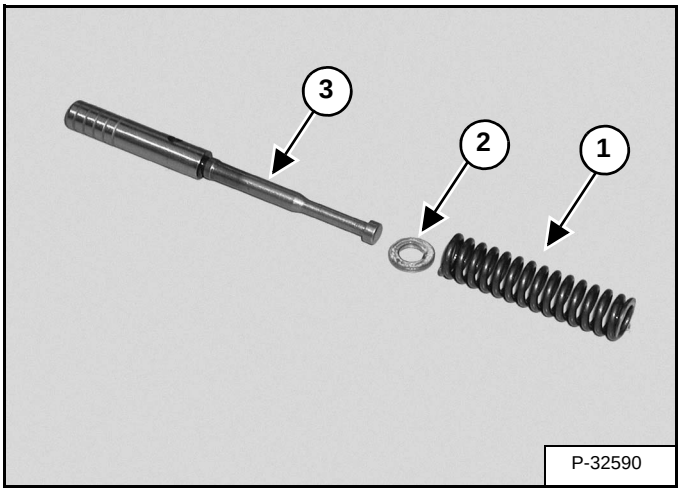
Figure 20-110-22



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

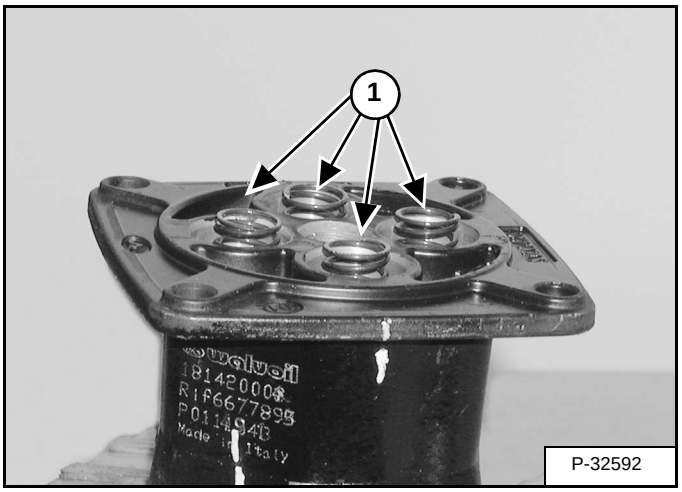
Disassembly (Cont'd)

Figure 20-110-23



Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-110-23]**.

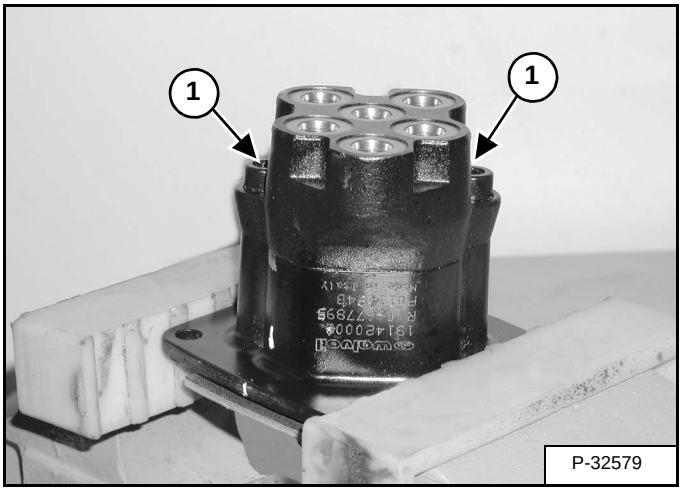
Figure 20-110-24



Remove the springs (Item 1) **[Figure 20-110-24]** from the housing.

Clamp the housing in a vise that is equipped with padded jaws.

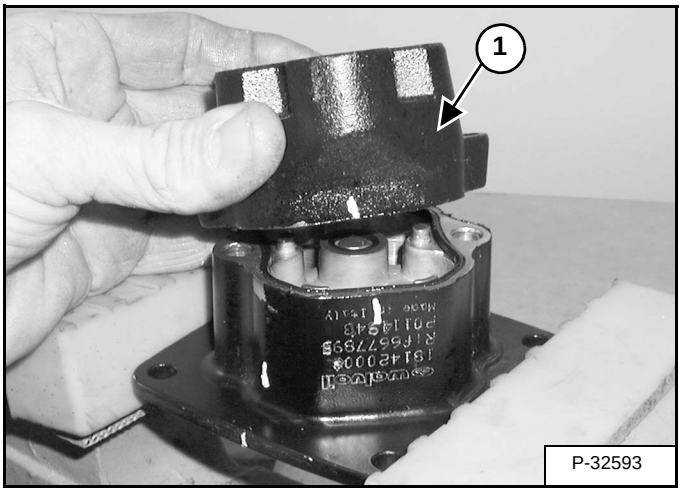
Figure 20-110-25



Remove the bolts (Item 1) **[Figure 20-110-25]**.

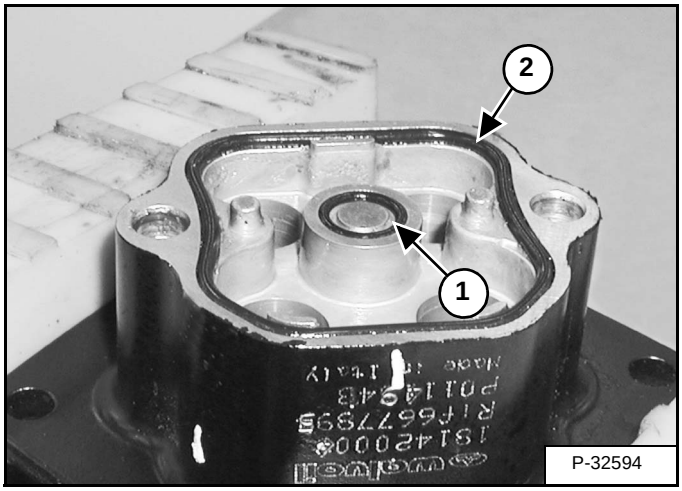
Disassembly (Cont'd)

Figure 20-110-26



Remove the end cap (Item 1) **[Figure 20-110-26]**.

Figure 20-110-27



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-110-27]**.

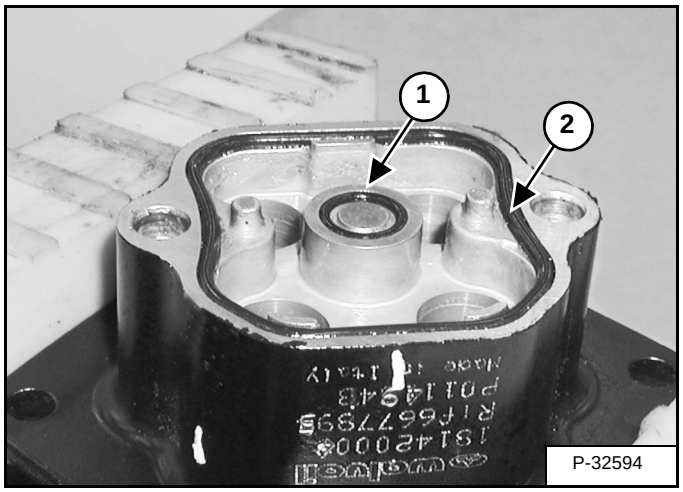
Assembly

Clean all parts in solvent and dry with compressed air.

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

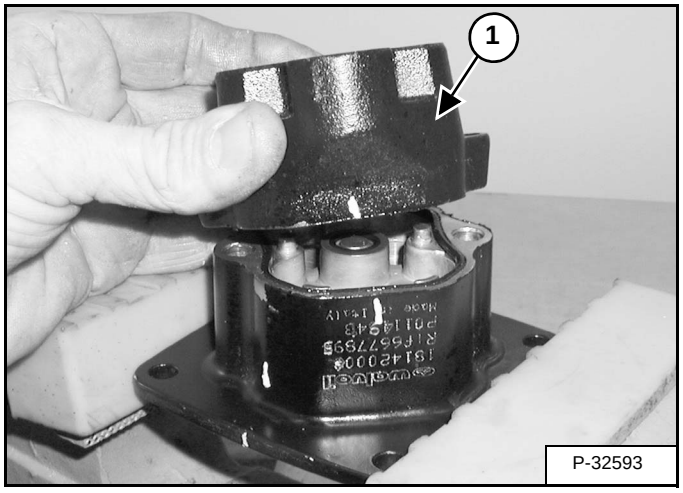
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-110-28



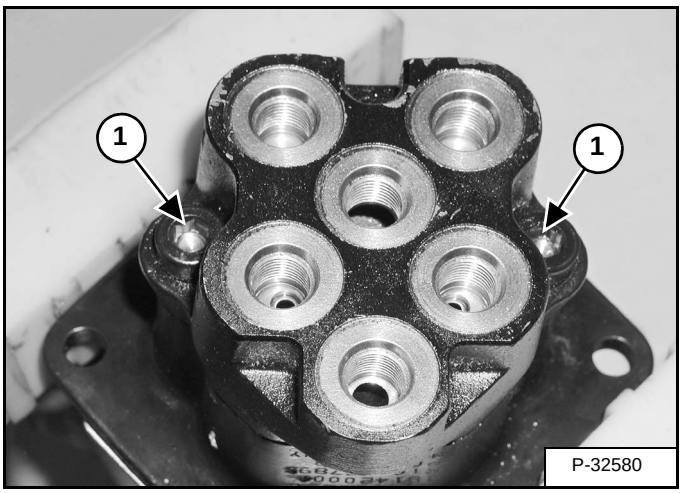
Clamp the housing in a vise equipped with padded jaws. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-110-28]**.

Figure 20-110-29



Install the end cap (Item 1) **[Figure 20-110-29]**.

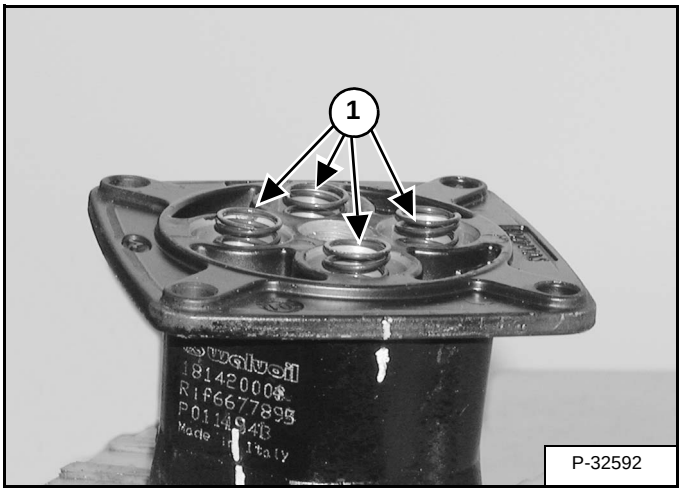
Figure 20-110-30



Install the bolts (Item 1) **[Figure 20-110-30]**.

Turn the housing over.

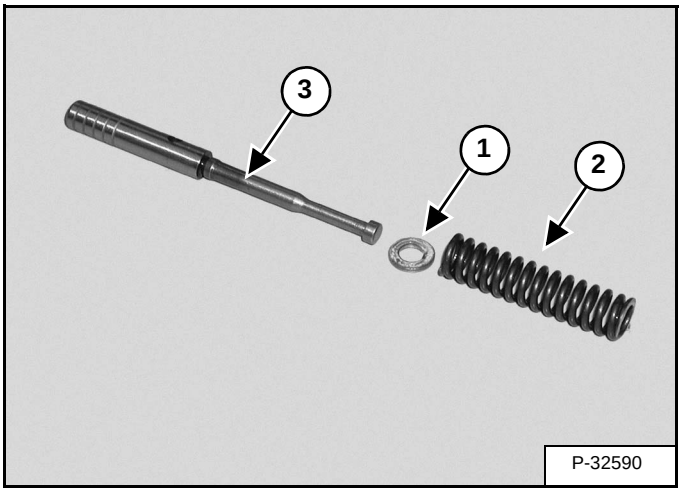
Figure 20-110-31



Install the springs (Item 1) **[Figure 20-110-31]**.

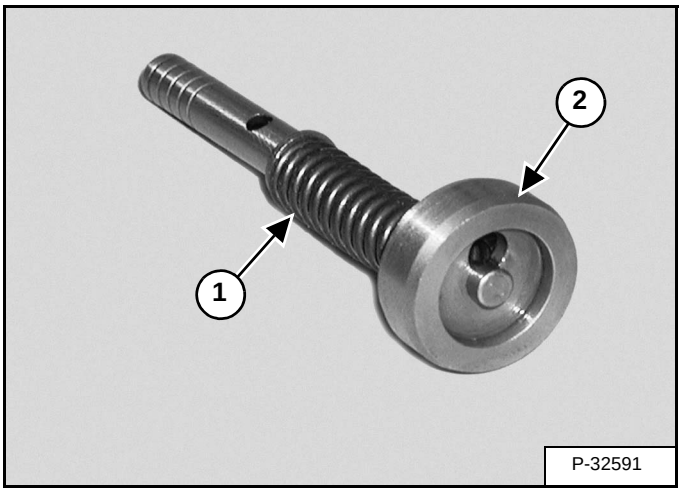
Assembly (Cont'd)

Figure 20-110-32



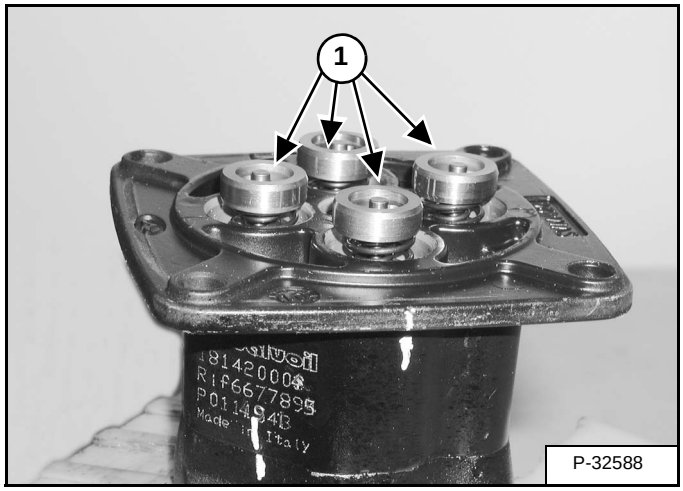
Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-110-32]**.

Figure 20-110-33



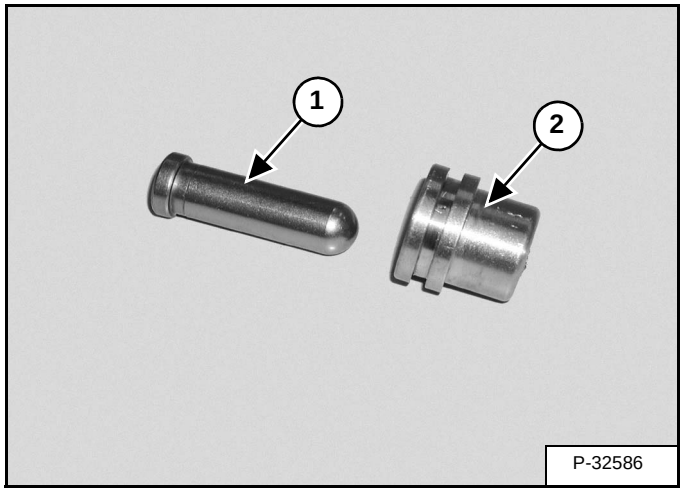
Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-110-33]**.

Figure 20-110-34



Install the spool assemblies (Item 1) **[Figure 20-110-34]** into the housing.

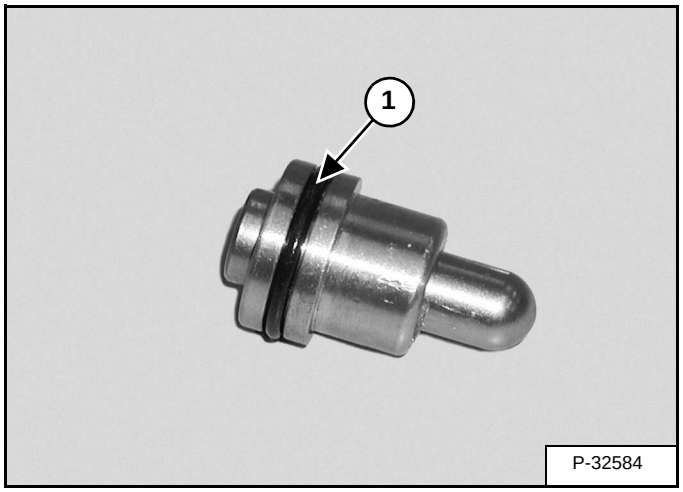
Figure 20-110-35



Install the plunger (Item 1) into the bushing (Item 2) **[Figure 20-110-35]**.

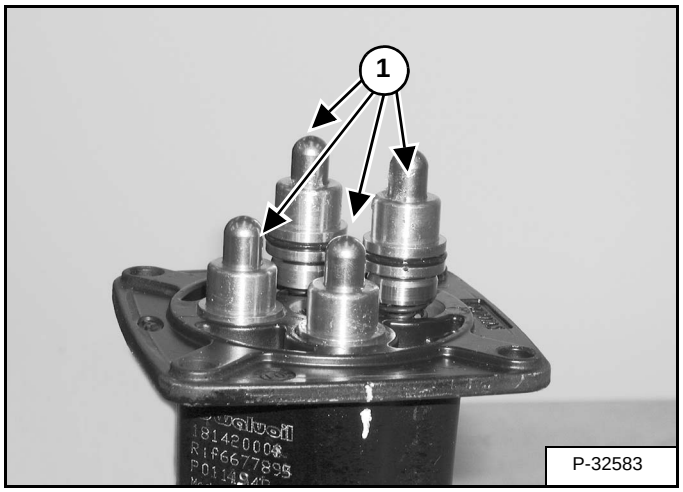
Assembly (Cont'd)

Figure 20-110-36



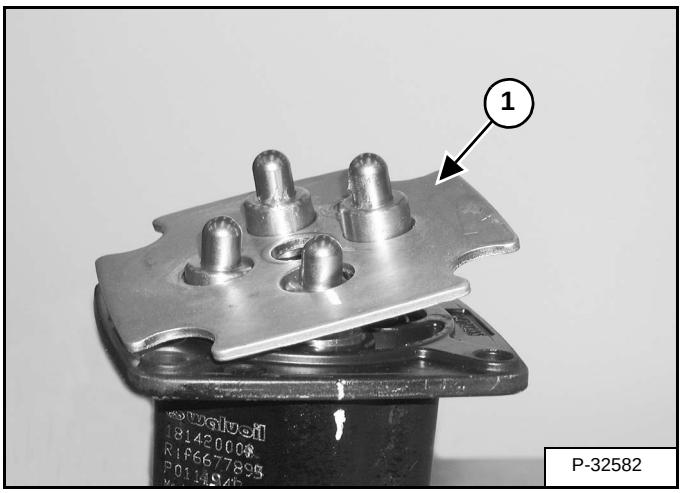
Install the O-ring (Item 1) **[Figure 20-110-36]** on the bushing.

Figure 20-110-37



Install the plunger assemblies (Item 1) **[Figure 20-110-37]** into the housing.

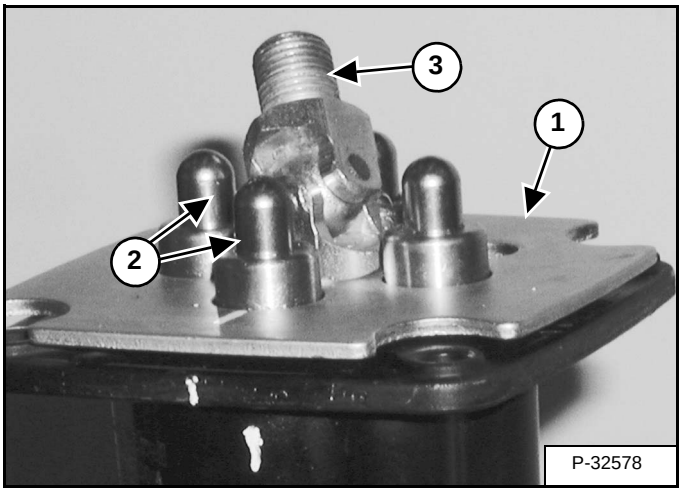
Figure 20-110-38



Install the plate (Item 1) **[Figure 20-110-38]**.

NOTE: Spring pressure can dislodge the plunger assemblies until the plate (Item 1) [Figure 20-110-38] is secured in place.

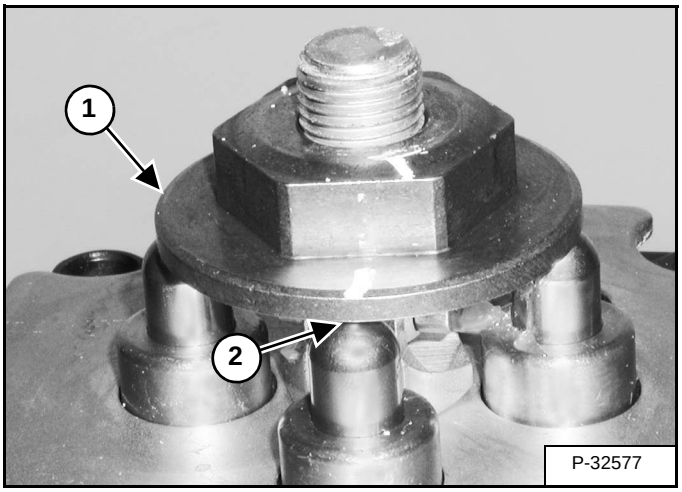
Figure 20-110-39



Press down on the plate (Item 1) to seat the plunger assemblies (Item 2). Install the U-joint (Item 3) **[Figure 20-110-39]**.

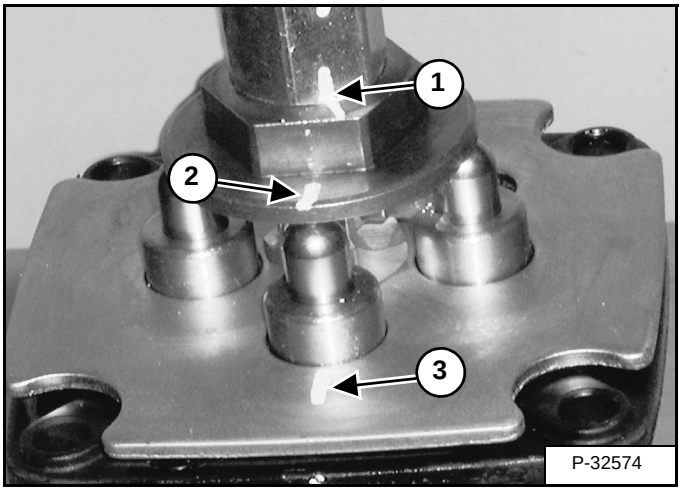
Assembly (Cont'd)

Figure 20-110-40



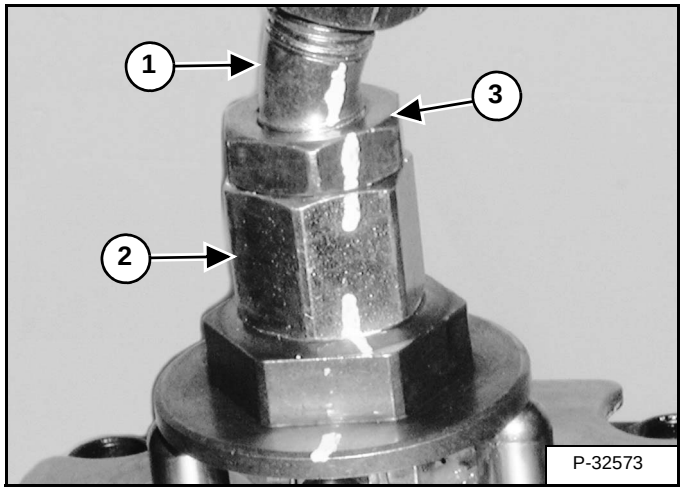
Install the control plate (Item 1) until the plate makes light contact with all 4 plungers (Item 2) **[Figure 20-110-40]**.

Figure 20-110-41



Align the coupler (Item 1) with the control plate (Item 2) and plate (Item 3) **[Figure 20-110-41]**. Tighten the coupler.

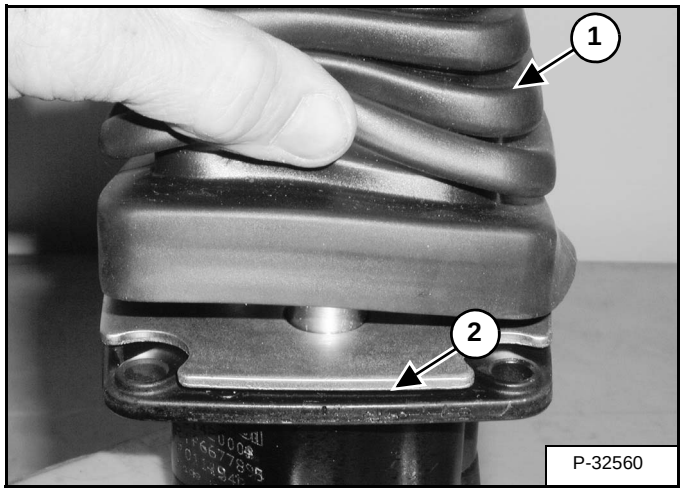
Figure 20-110-42



Install the connector (Item 1) **[Figure 20-110-42]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-110-42]**.

Figure 20-110-43



Install the tabs of the boot (Item 1) in between the joystick flange and mounting plate (Item 2) **[Figure 20-110-43]**.

Install the handle (See Handle Removal And Installation on Page 20-110-3.)

LEFT CONTROL LEVER (JOYSTICK)

Description

The left control lever (joystick) operates using pilot pressure to move the arm and / or slew spools in the control valve. The left control lever (joystick) will be moveable in a canopy or cab equipped excavator. The left control lever (joystick) has a microswitch which will lockout the hydraulic functions in the raised position and enable the hydraulic functions in the down (locked) position.

Testing

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

The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

Lower the boom / bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

Remove the bottom half of the right console cover.

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.

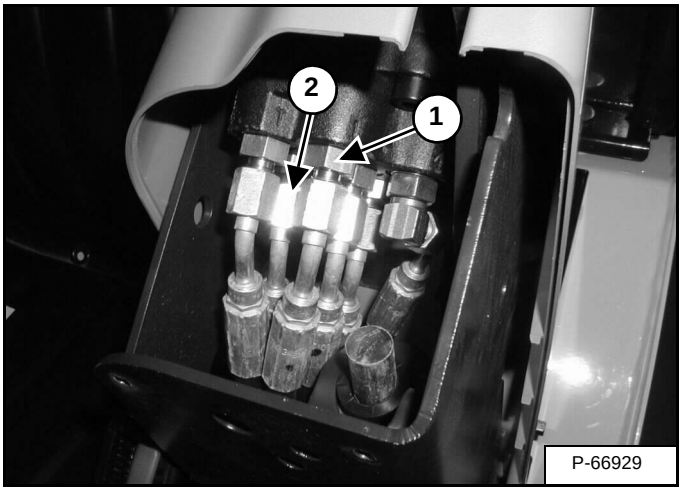
I-2003-0888

⚠ WARNING

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

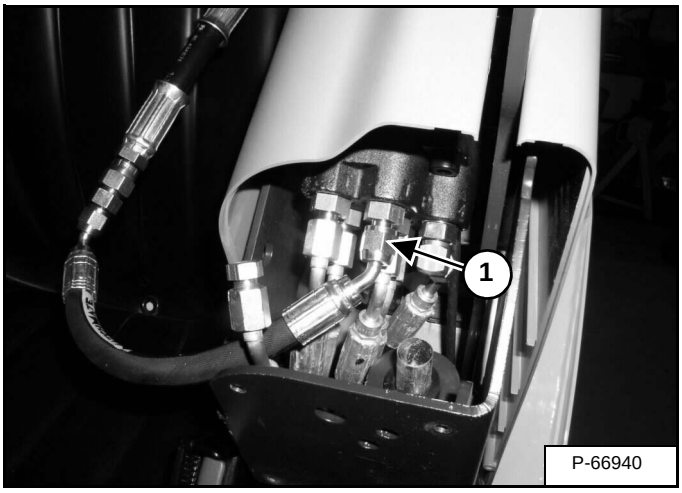
W-2145-0290

Figure 20-101-1



At the bottom of the left control lever (joystick), find the pilot hose connected to Port 1 (Item 1) and Port 2 (Item 2) **[Figure 20-101-1]** labeled on the side of the left control lever (joystick) casting. Port 1 is the pilot pressure for the Arm function and Port 2 is the pilot pressure for the Swing (Slew) function.

Figure 20-111-2



Remove the pilot hose **[Figure 20-111-2]** from the bottom of the control lever (joystick) that is to be checked.

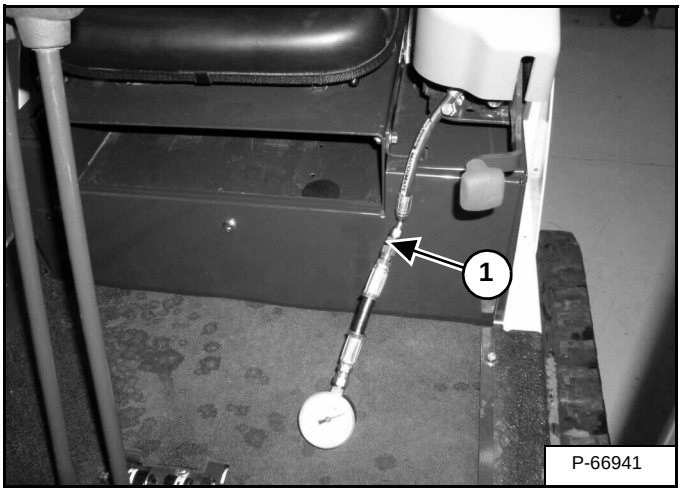
From the test kit, install a fitting and gauge hose (Item 1) **[Figure 20-111-2]** to the control lever (joystick) fitting.

Cap the pilot hose (Item 2) **[Figure 20-111-2]**.

LEFT CONTROL LEVER (JOYSTICK) (CONT'D)

Testing (Cont'd)

Figure 20-111-3



Install a 1000 PSI (69 bar) gauge on the hose **[Figure 20-111-3]**.

Lower the left console to the locked position **[Figure 20-111-3]**. Also lower the right console to the locked position if in the vertical position.

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

Check the gauge with the control levers (joystick) in neutral. The hydraulic pressure should be 0 PSI (0 bar).

Engage the circuit to be tested. Record the operating pressure.

The operating pressure should be as follows:

435 PSI (300 bar) with an acceptable range of 406 to 450 PSI (28 to 31 bar).

If the operating pressure is correct, check the valve section spool for proper operation.

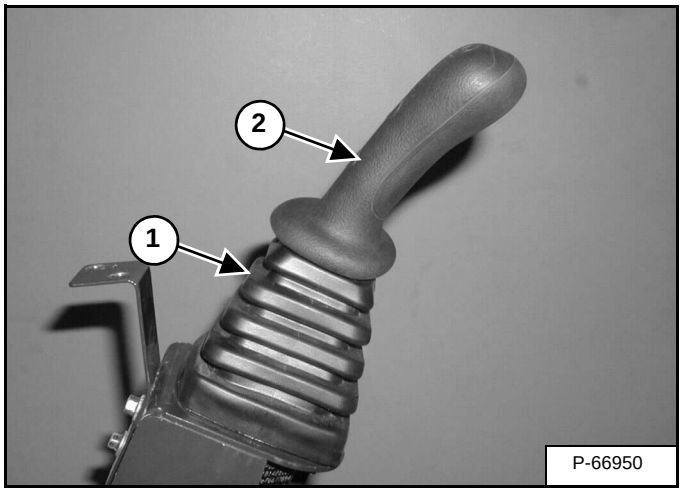
If the operating pressure is incorrect, remove the pressure reducing valve, clean, install and retest (See Testing And Adjusting The Pressure Reducing Valve Page 20-33-1.)

If the pressure is still incorrect replace the pressure reducing valve (See Testing And Adjusting The Pressure Reducing Valve Page 20-33-1.)

Handle Removal And Installation

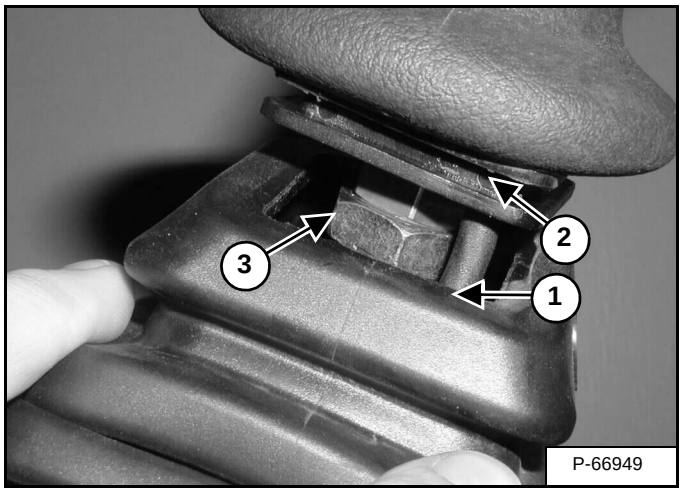
Remove the console cover. (See Left Rear Console Cover Removal And Installation Page 40-60-8.)

Figure 20-111-4



Remove the dust boot (Item 1) from the handle (Item 2) **[Figure 20-111-4]**.

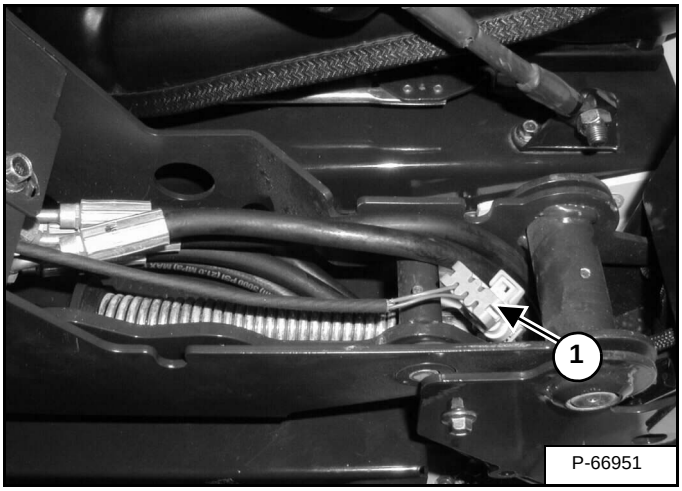
Figure 20-111-5



Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-111-5]**.

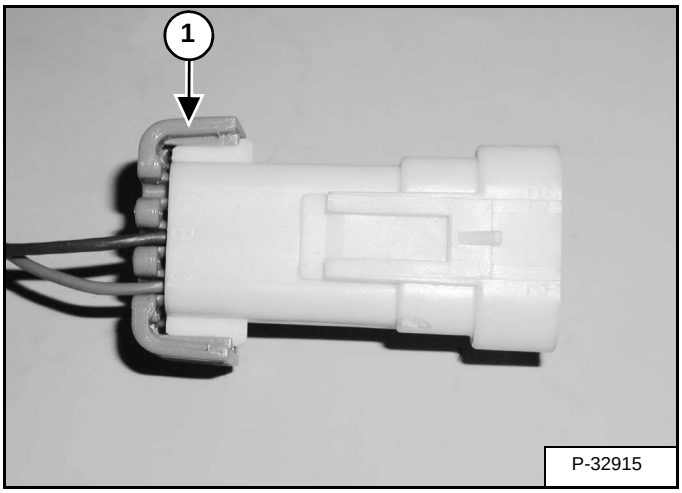
Hold the dust boot (Item 1) down and loosen the nut (Item 3) **[Figure 20-111-5]**.

Figure 20-111-6



Disconnect the wire harness (Item 1) **[Figure 20-111-6]**.

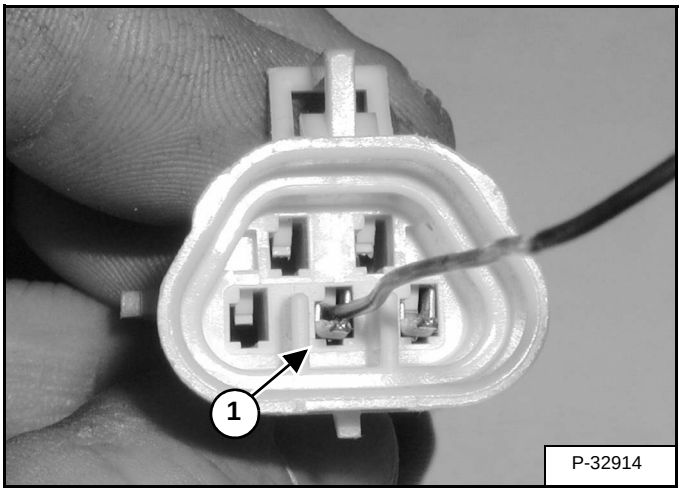
Figure 20-111-7



Remove the lock (Item 1) **[Figure 20-111-7]** from the electrical connector.

Handle Removal And Installation (Cont'd)

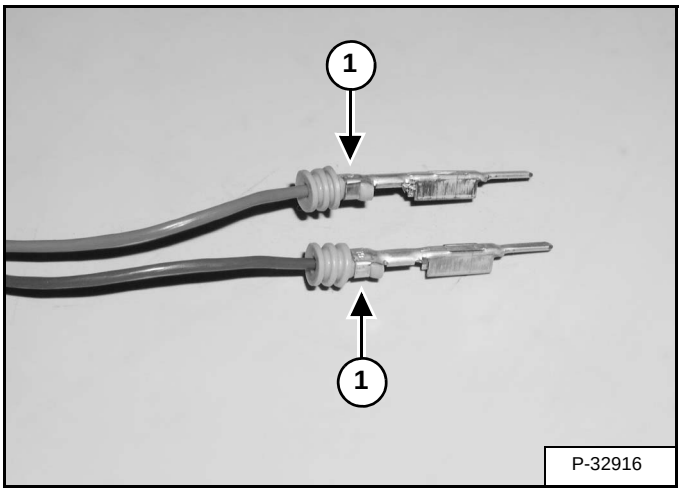
Figure 20-111-8



With a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 20-111-8]**.

Remove the individual wires from the back of the electrical connector.

Figure 20-111-9



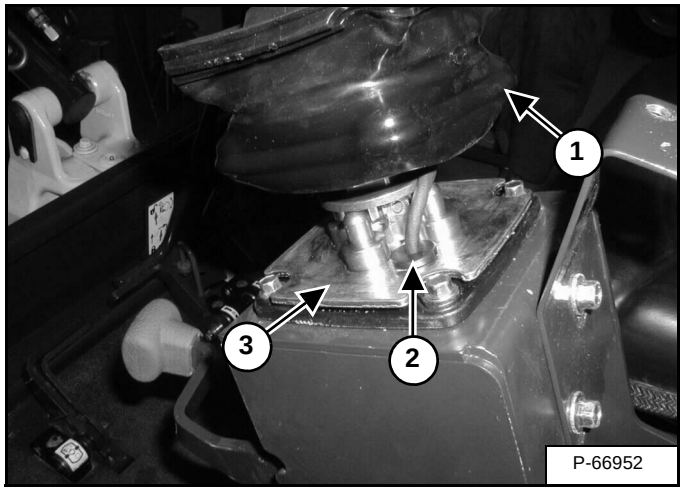
Installation: Use a small piece of wire and rebend the tab (Item 1) **[Figure 20-111-9]** on each wire before installing in the electrical connector.

Installation: The wires must be installed in the proper locations in the wire connector, listed below.

C Red
D Black

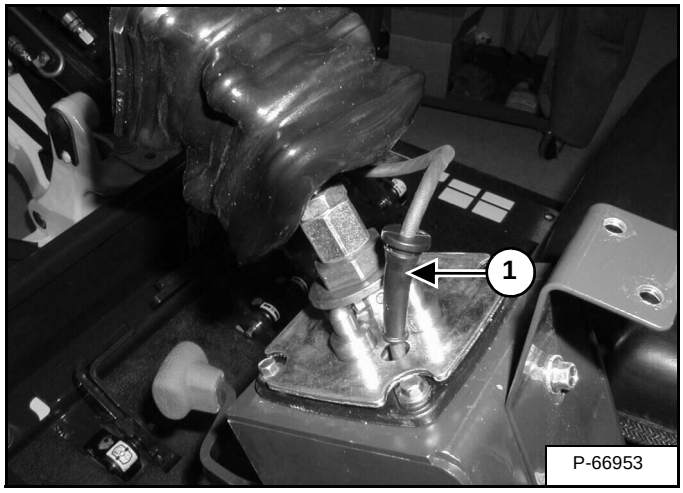
Check each wire to be certain the tab locks into position.

Figure 20-111-10



Raise the dust boot (Item 1) and pull the grommet (Item 2) up through the plate (Item 3) **[Figure 20-111-10]**.

Figure 20-111-11



Remove the grommet and wire (Item 1) **[Figure 20-111-11]** from the mount plate.

Remove the handle from the control lever.

LEFT CONTROL LEVER (JOYSTICK) (CONT'D)

Removal And Installation

Lower the boom / bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

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

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.

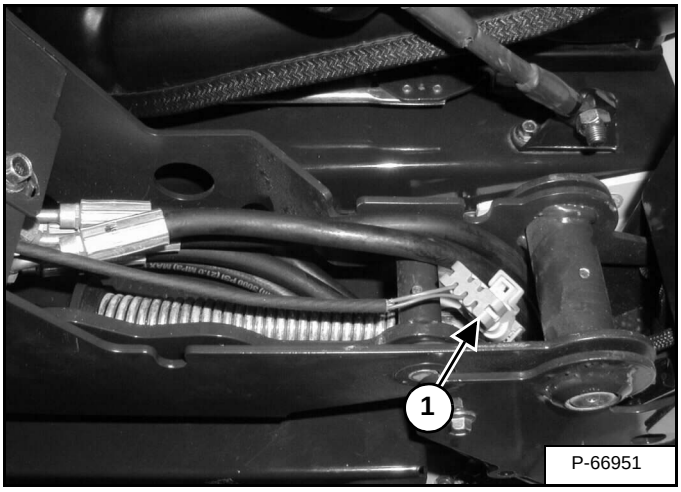
I-2003-0888

⚠ WARNING

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

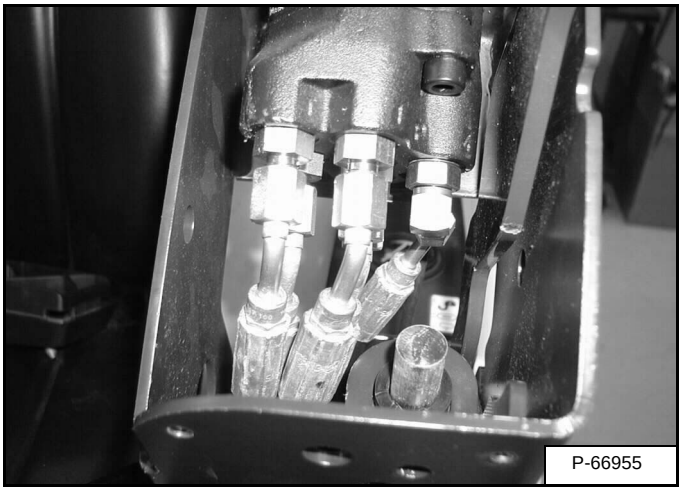
W-2145-0290

Figure 20-101-12



Disconnect the wire connector (Item 1) **[Figure 20-101-12]**.

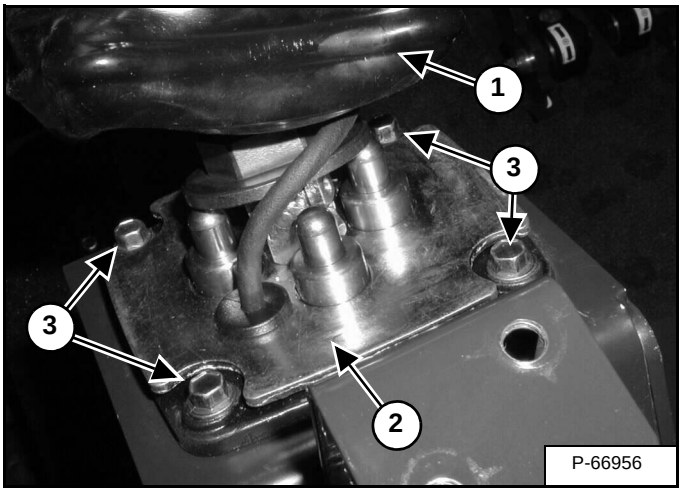
Figure 20-111-13



Mark the hoses for ease of assembly **[Figure 20-111-13]**.

Remove the hoses while the control lever (joystick) is bolted to the console **[Figure 20-111-13]**.

Figure 20-111-14



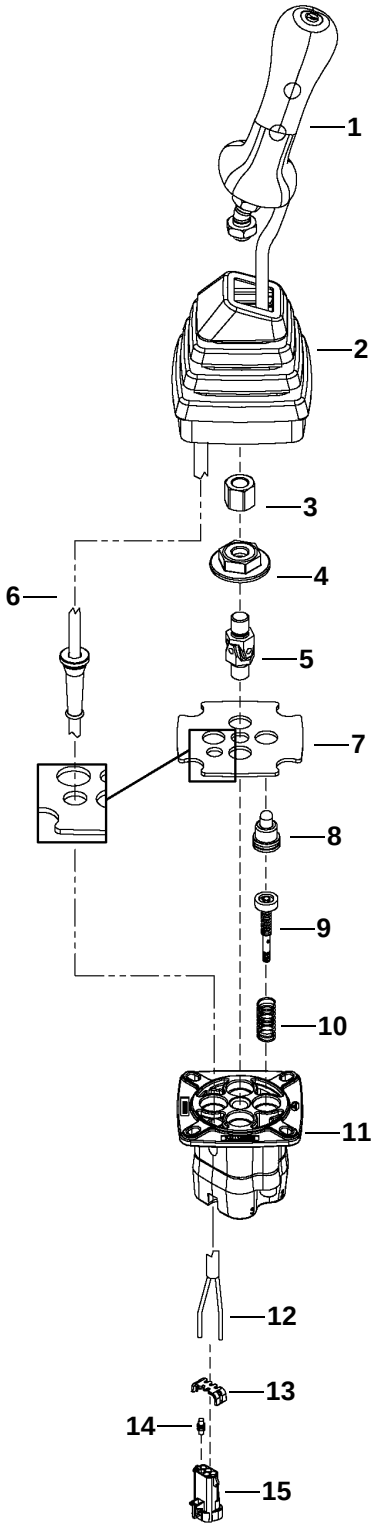
Raise the dust boot (Item 1) up from the plate (Item 2) **[Figure 20-111-14]**.

Remove the bolts (Item 3) **[Figure 20-111-14]** from the joystick plate.

Remove the joystick.

Parts Identification

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



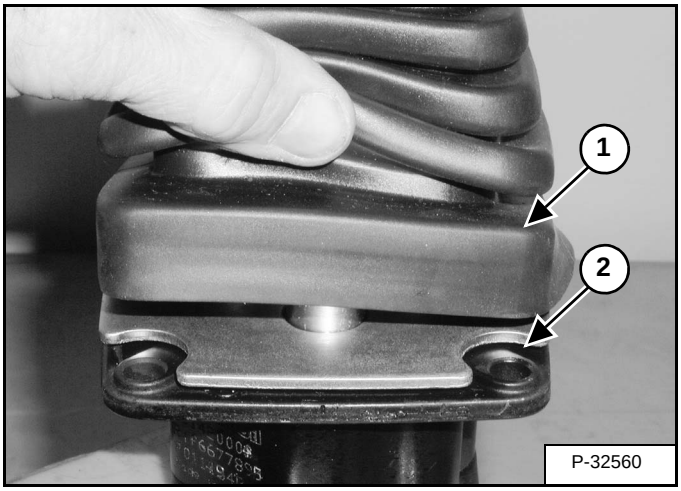
MS-1354

Disassembly

Remove the left handle (See Handle Removal And Installation Page 20-111-3.)

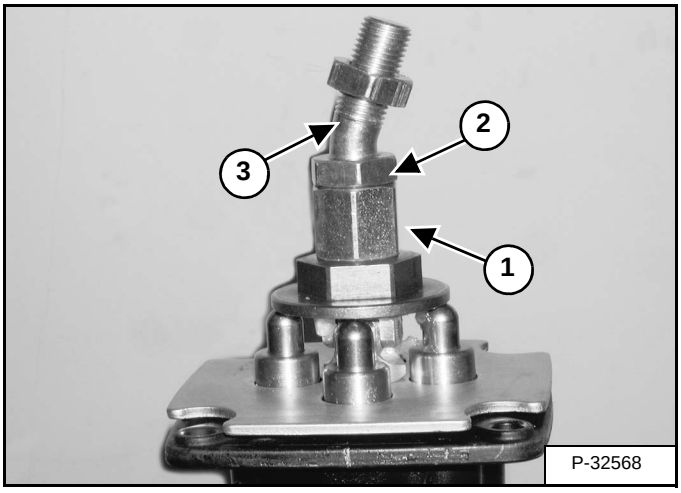
Clean the outside of the control lever before disassembly.

Figure 20-111-15



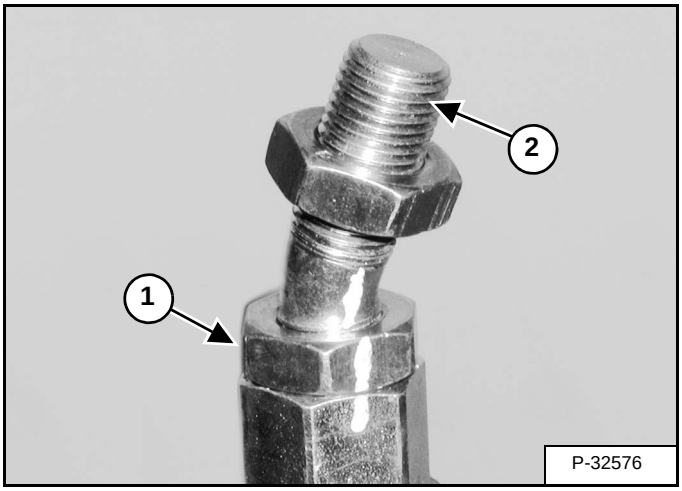
Remove the boot (Item 1) from the control lever (joystick) (Item 2) **[Figure 20-111-15]**.

Figure 20-111-16



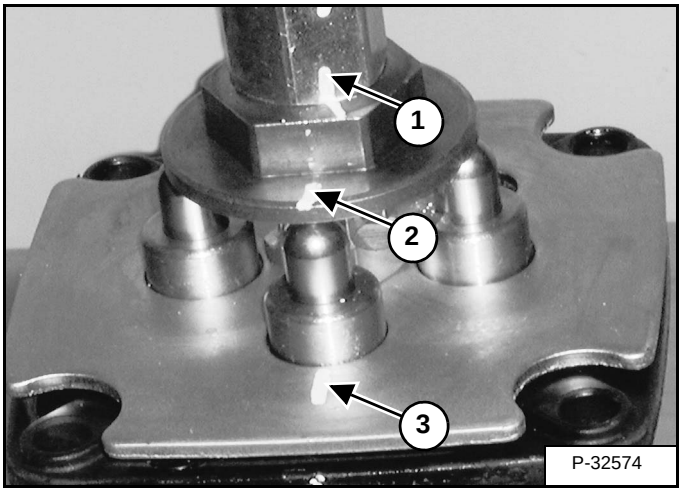
Mark the coupler (Item 1) nut (Item 2), and connector (Item 3) **[Figure 20-111-16]** for correct assembly.

Figure 20-111-17



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-111-17]**.

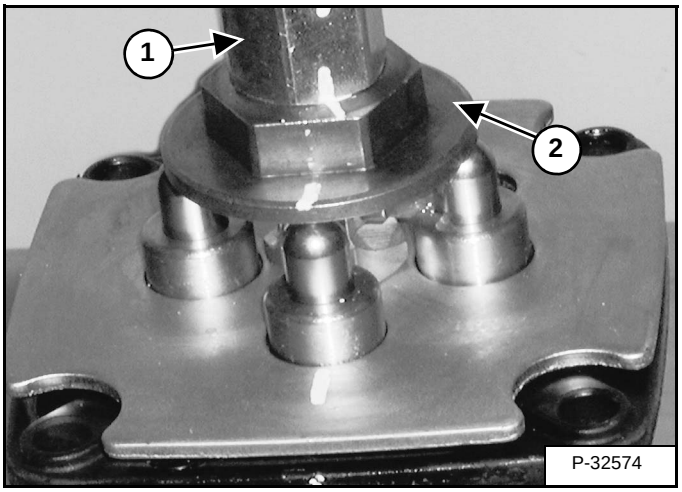
Figure 20-111-18



Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-111-18]** for correct installation.

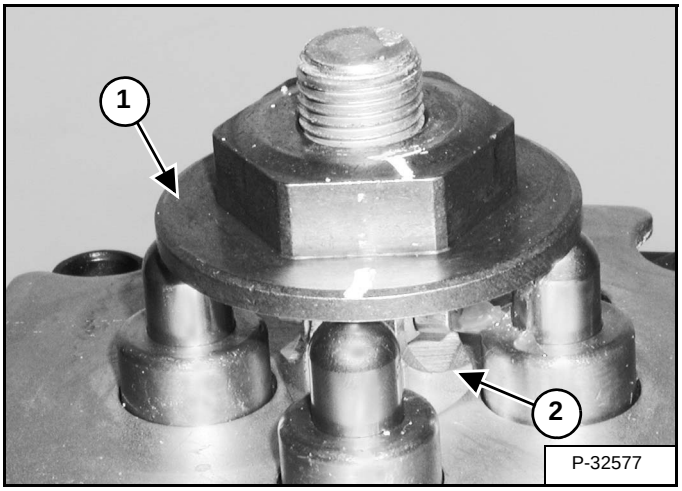
Disassembly (Cont'd)

Figure 20-111-19



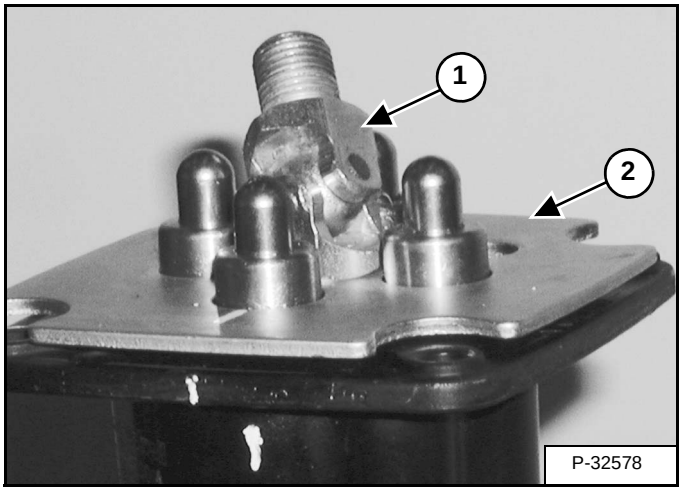
Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-111-19]**.

Figure 20-111-20



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

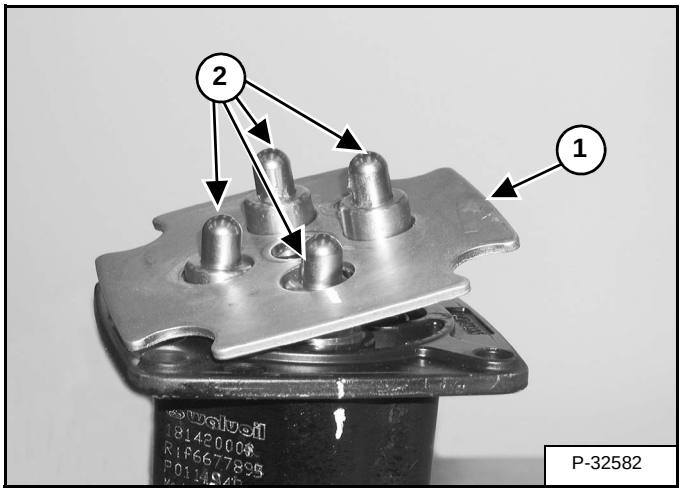
Figure 20-111-21



Mark the plate and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-111-21]**.

NOTE: The plate (Item 2) [Figure 20-111-21] is spring loaded and will come up as the U-joint is removed.

Figure 20-111-22

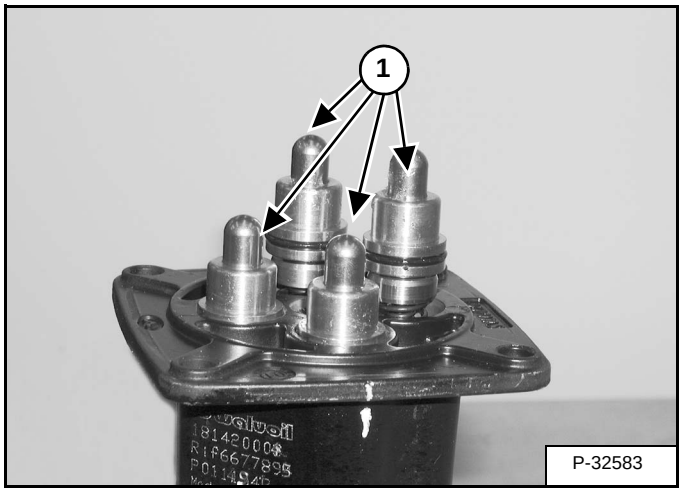


Remove the plate (Item 1) **[Figure 20-111-22]**.

NOTE: Use care while removing the plate. The plungers (Item 2) [Figure 20-111-22] are spring loaded.

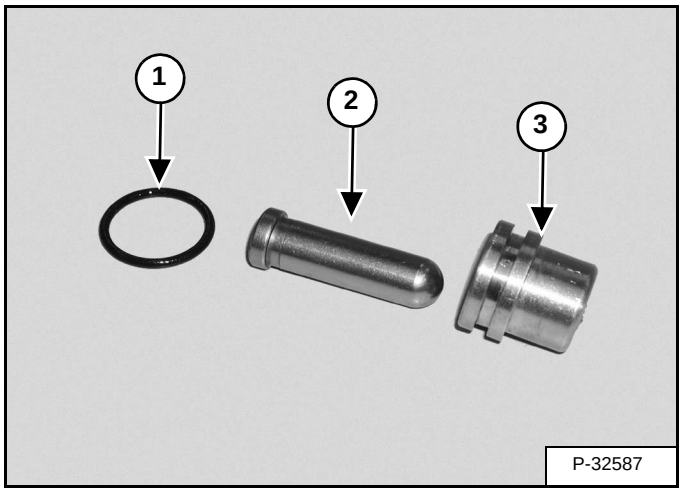
Disassembly (Cont'd)

Figure 20-111-23



Remove the plunger assemblies (Item 1) **[Figure 20-111-23]**.

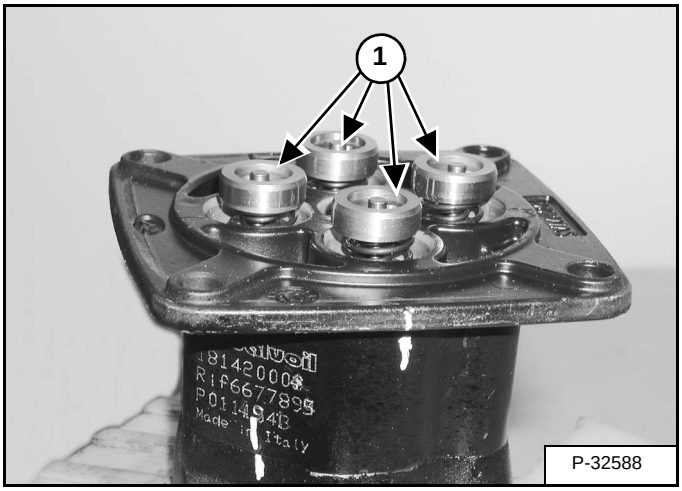
Figure 20-111-24



Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-111-24]**.

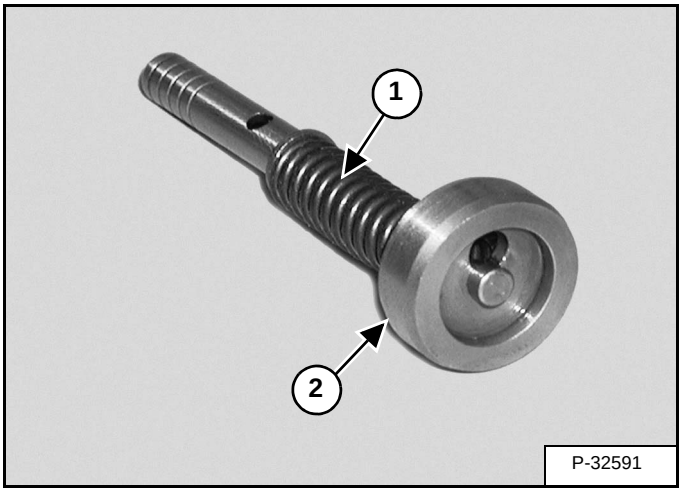
NOTE: Mark the spool assemblies for installation in their original location.

Figure 20-111-25



Remove the spool assemblies (Item 1) **[Figure 20-111-25]**.

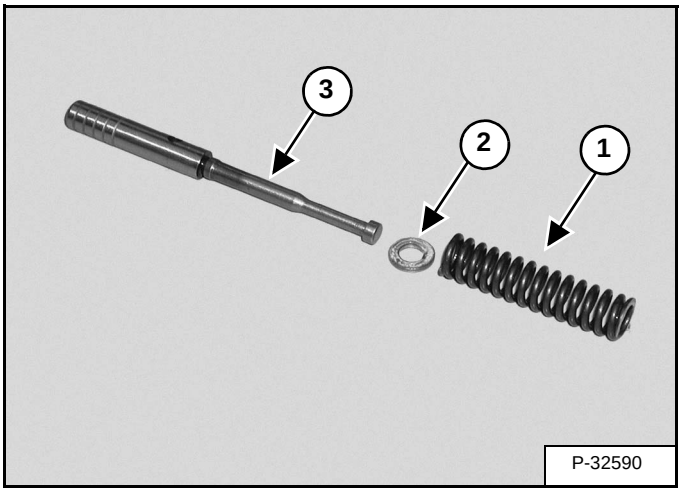
Figure 20-111-26



Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-111-26]**.

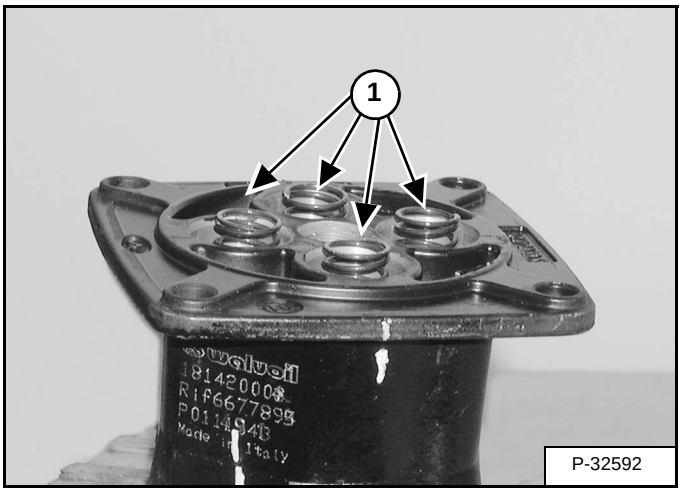
Disassembly (Cont'd)

Figure 20-111-27



Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-111-27]**.

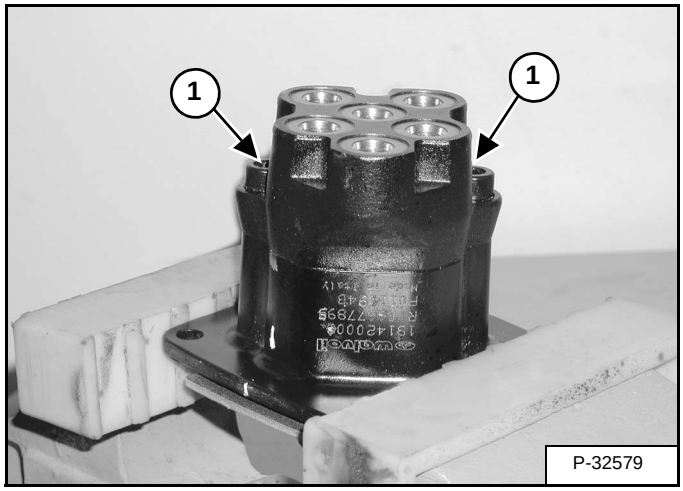
Figure 20-111-28



Remove the springs (Item 1) **[Figure 20-111-28]** from the housing.

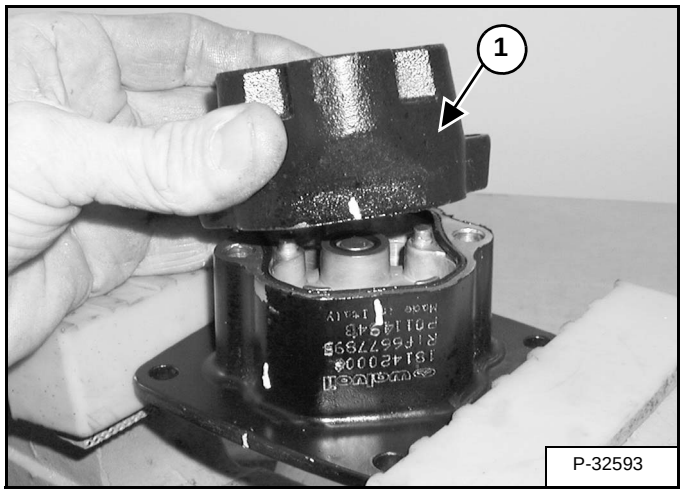
Clamp the housing in a vise that is equipped with padded jaws.

Figure 20-111-29



Remove the bolts (Item 1) **[Figure 20-111-29]**.

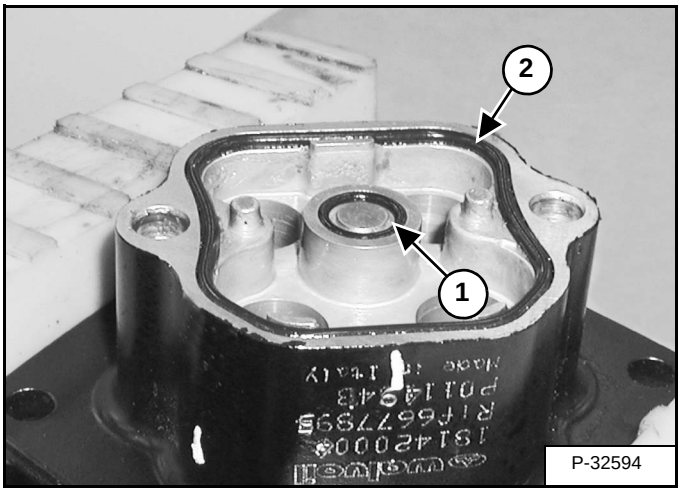
Figure 20-111-30



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

Disassembly (Cont'd)

Figure 20-111-31



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-111-31]**.

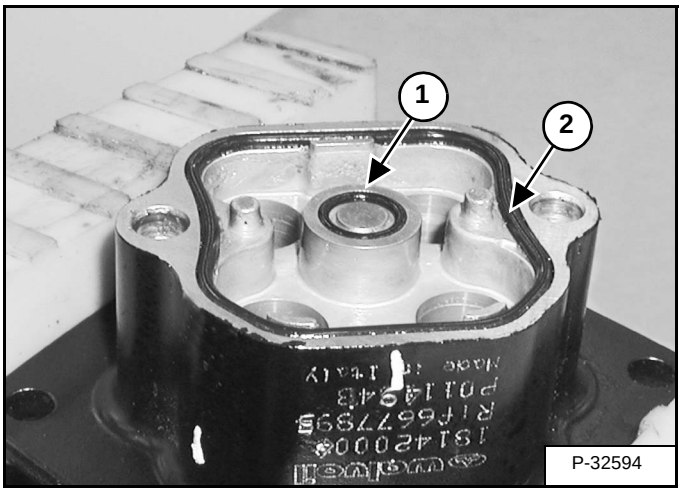
Assembly

Clean all parts in solvent and dry with compressed air.

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

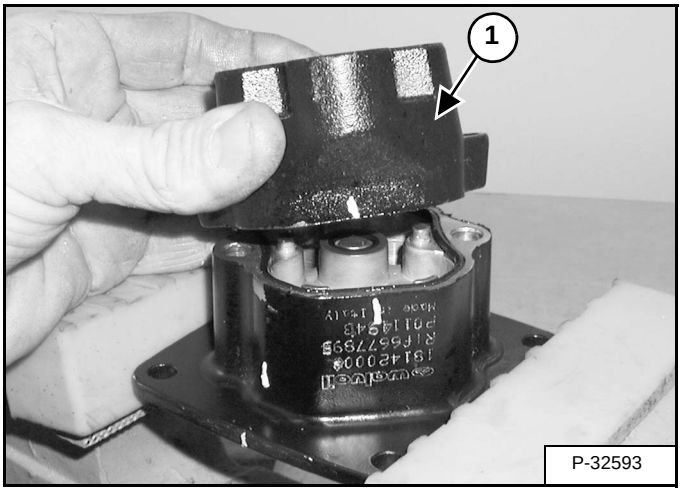
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-111-32



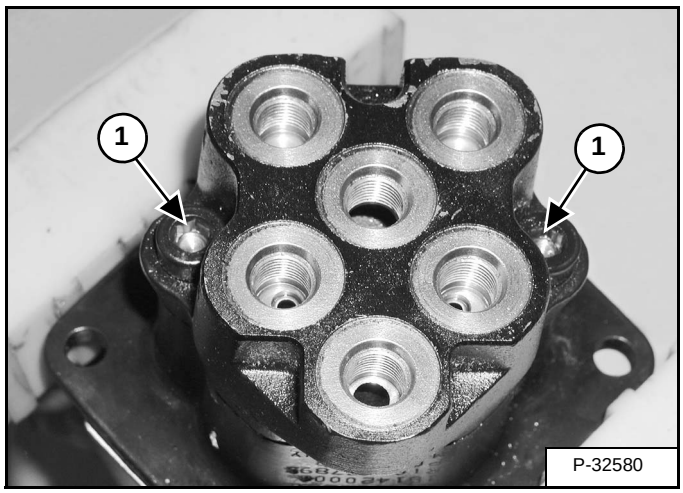
Clamp the housing in a vise equipped with padded jaws. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-111-32]**.

Figure 20-111-33



Install the end cap (Item 1) **[Figure 20-111-33]**.

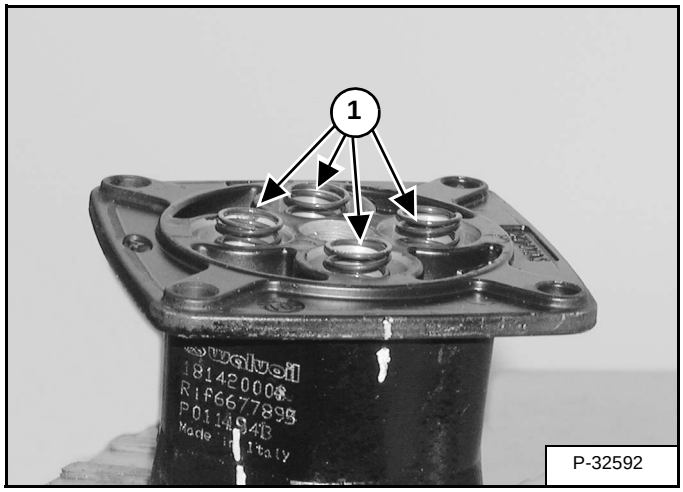
Figure 20-111-34



Install the bolts (Item 1) **[Figure 20-111-34]**.

Turn the housing over.

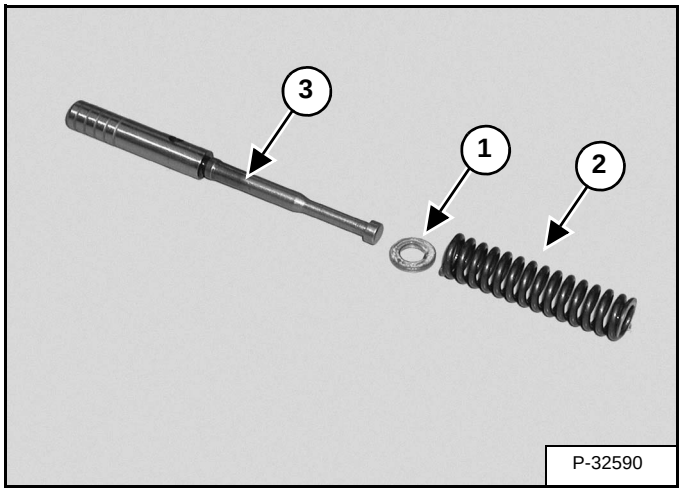
Figure 20-111-35



Install the springs (Item 1) **[Figure 20-111-35]**.

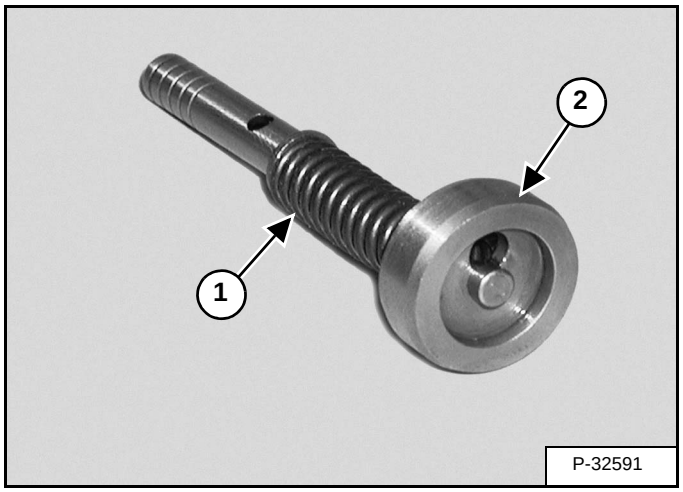
Assembly (Cont'd)

Figure 20-111-36



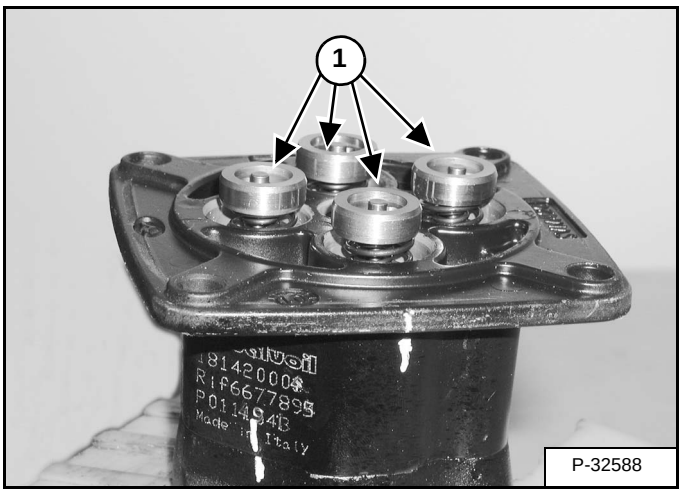
Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-111-36]**.

Figure 20-111-37



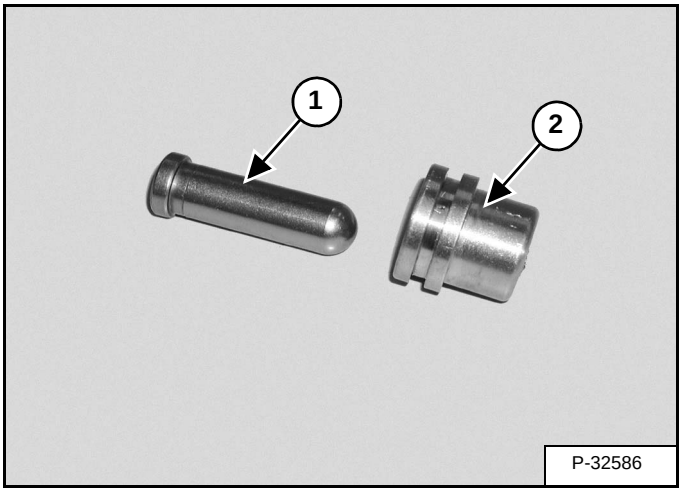
Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-111-37]**.

Figure 20-111-38



Install the spool assemblies (Item 1) **[Figure 20-111-38]** into the housing.

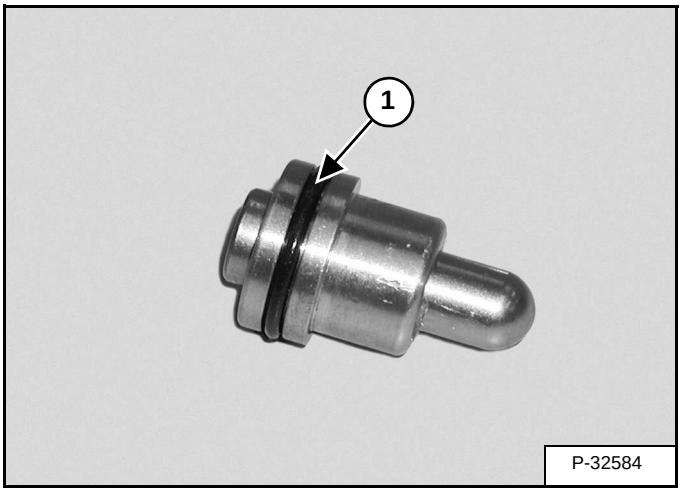
Figure 20-111-39



Install the plunger (Item 1) into the bushing (Item 2) **[Figure 20-111-39]**.

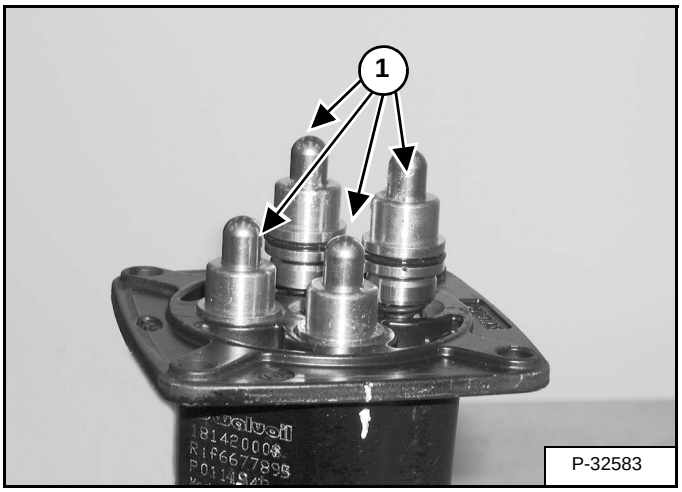
Assembly (Cont'd)

Figure 20-111-40



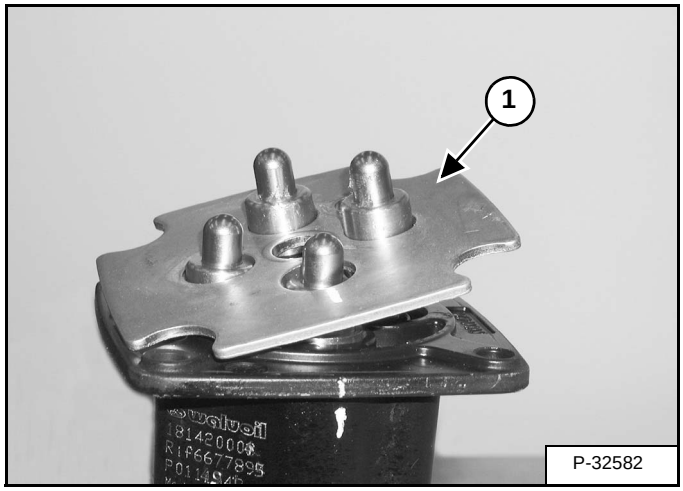
Install the O-ring (Item 1) **[Figure 20-111-40]** on the bushing.

Figure 20-111-41



Install the plunger assemblies (Item 1) **[Figure 20-111-41]** into the housing.

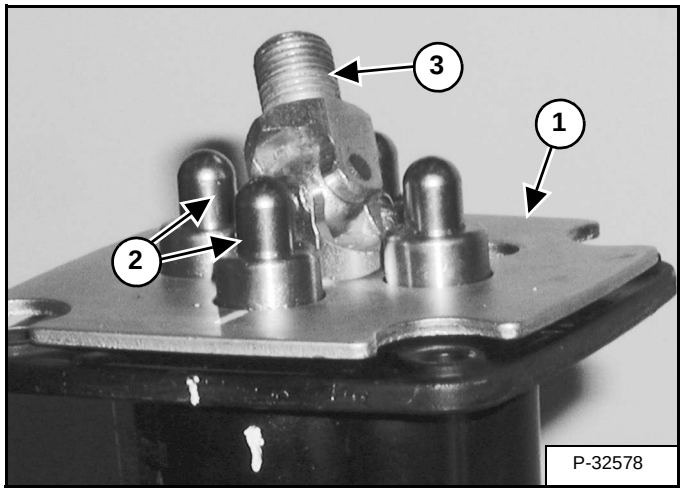
Figure 20-111-42



Install the plate (Item 1) **[Figure 20-111-42]**.

NOTE: Spring pressure can dislodge the plunger assemblies until the plate (Item 1) [Figure 20-111-42] is secured in place.

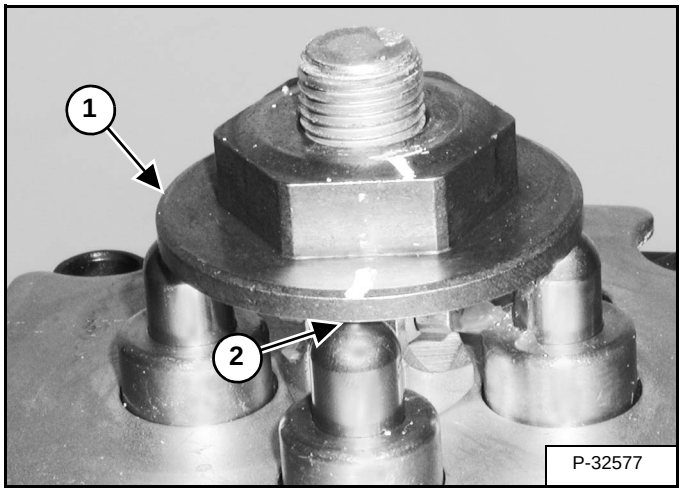
Figure 20-111-43



Press down on the plate (Item 1) to seat the plunger assemblies (Item 2). Install the U-joint (Item 3) **[Figure 20-111-43]**.

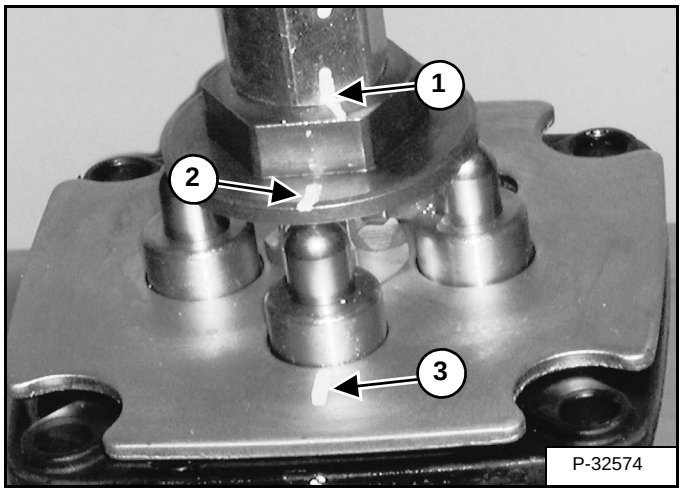
Assembly (Cont'd)

Figure 20-111-44



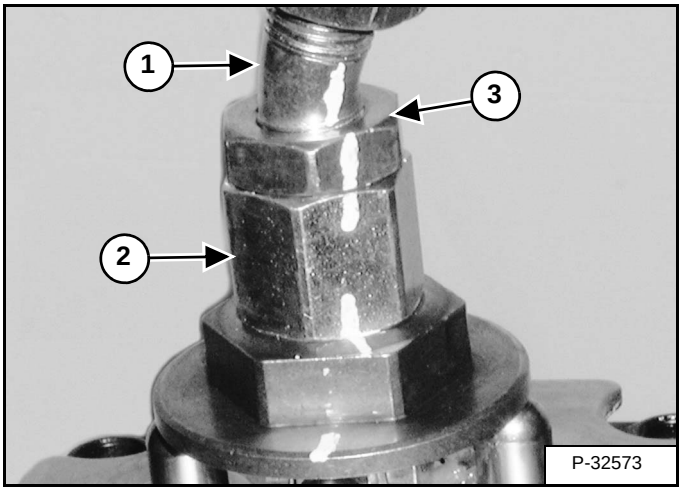
Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-111-44]**.

Figure 20-111-45



Align the coupler (Item 1) with the control plate (Item 2) and plate (Item 3) **[Figure 20-111-45]**. Tighten the coupler.

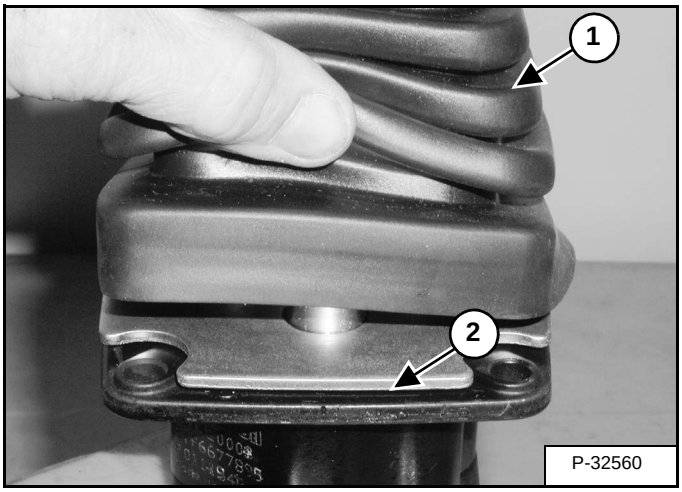
Figure 20-111-46



Install the connector (Item 1) **[Figure 20-111-46]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-111-46]**.

Figure 20-111-47



Install the tabs of the boot (Item 1) in between the joystick flange and mounting plate (Item 2) **[Figure 20-111-47]**.

Install the handle (See Handle Removal And Installation Page 20-111-3.)


Bobcat®

HYDRAULIC FILTER MOUNT

Description

The hydraulic filter removes contaminants from the hydraulic fluid when the hydraulic systems are operating.

The hydraulic filter system consists of one main hydraulic filter located behind the tailgate and removes the contaminants after the oil cooler.

Removal And Installation

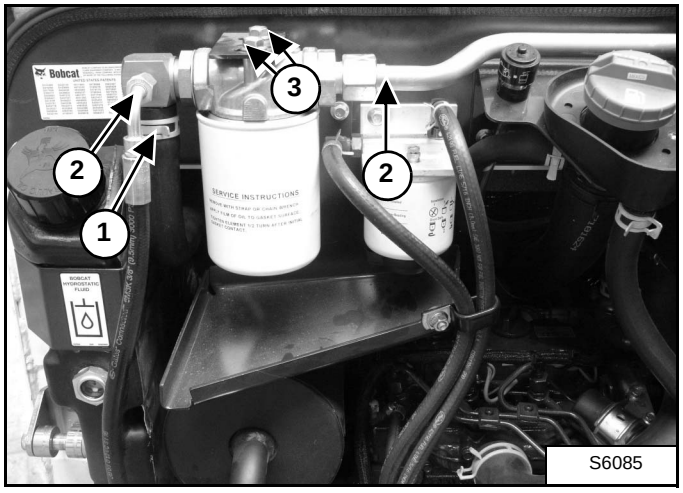
IMPORTANT

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

I-2003-0888

Open the tailgate.

Figure 20-120-1



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

NOTE: Support the hose in approximately the same position as when attached to the filter mount to avoid any hydraulic fluid from draining out of the hydraulic reservoir.

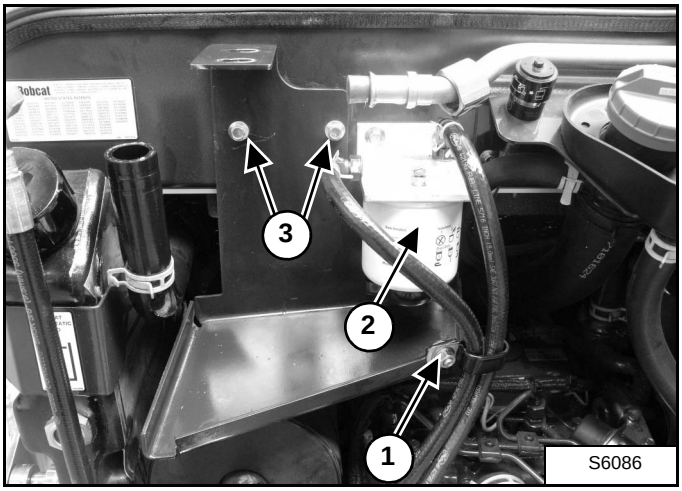
Remove the two tubelines (Item 2) **[Figure 20-120-1]**.

Remove the bolts (Item 3) **[Figure 20-120-1]**.

Remove the filter and filter mount.

Installation: Tighten the bolts to 28 ft.-lb. (38 N•m) torque.

Figure 20-120-2



Remove the two hoses from the filter mount by removing the bolt and nut (Item 1) **[Figure 20-120-2]**.

Remove the fuel filter (Item 2) **[Figure 20-120-2]** from its housing by screwing it out.

Remove the screws (Item 3) **[Figure 20-120-2]** from the filter mount bracket.

Remove the bracket.


Bobcat®

HYDRAULIC RESERVOIR

Description

The hydraulic reservoir is a storage container for the excavators hydraulic fluid. The reservoir contains a vented fill cap with a fluid screen to prevent contaminants from entering the reservoir while adding fluid.

The hydraulic reservoir is located behind the tailgate on the left side of the excavator.

Removal And Installation

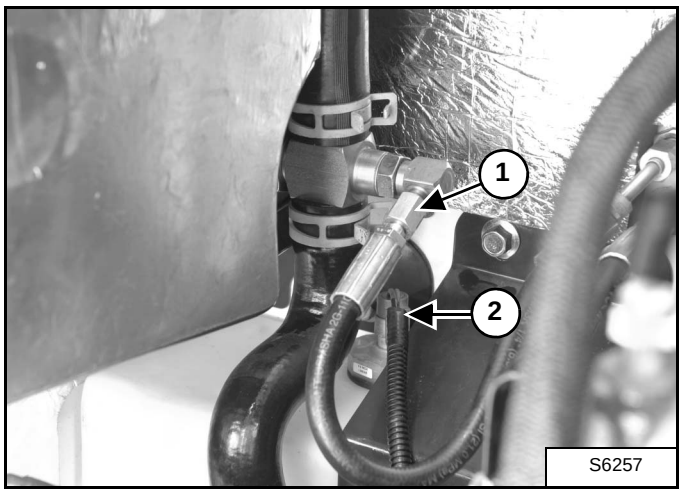
Open tailgate.

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

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

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

Figure 20-130-1



Remove the hose (Item 1) **[Figure 20-130-1]** from the hydraulic reservoir tee fitting.

Disconnect the fuel level sender harness (Item 2) **[Figure 20-130-1]** from the fuel level sender.

Figure 20-130-2

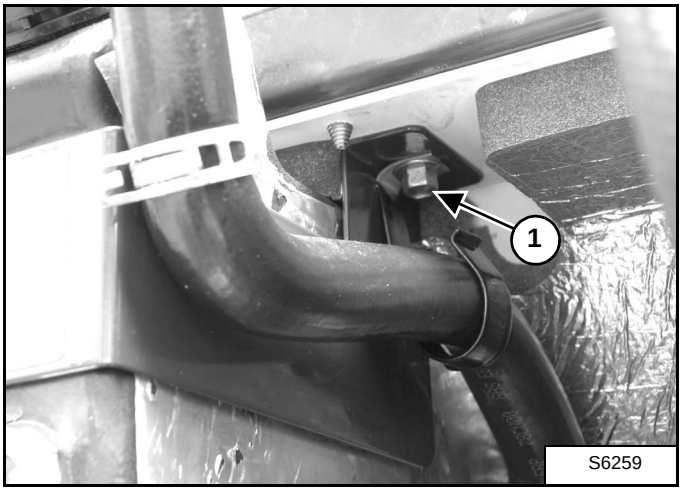
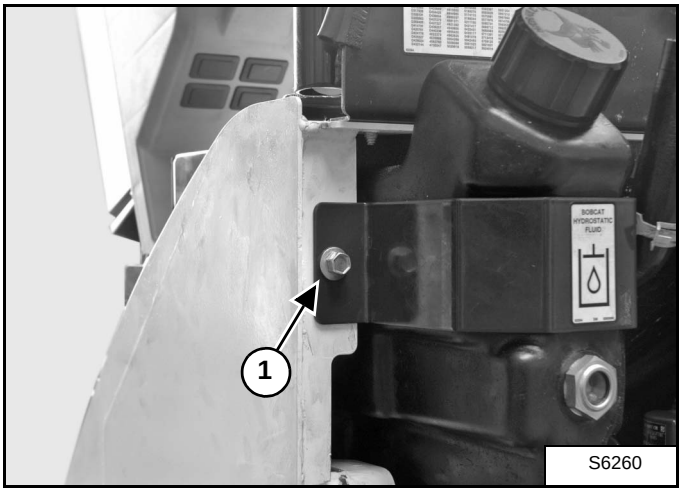


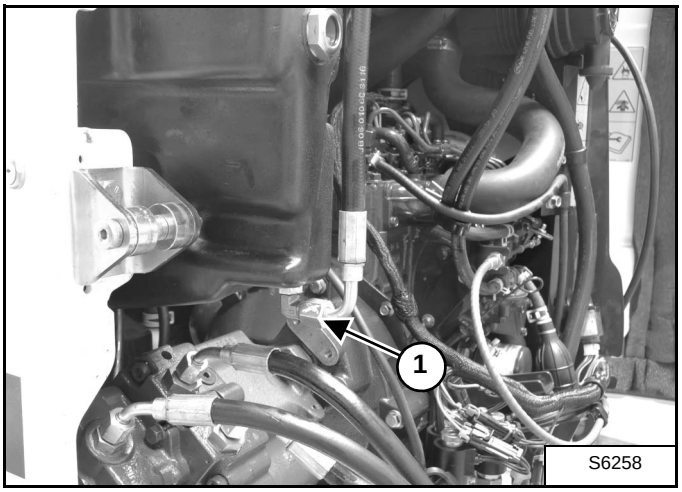
Figure 20-130-3



Remove the two bolts (Item 1) **[Figure 20-130-2]** and **[Figure 20-130-3]** from the hydraulic reservoir bracket.

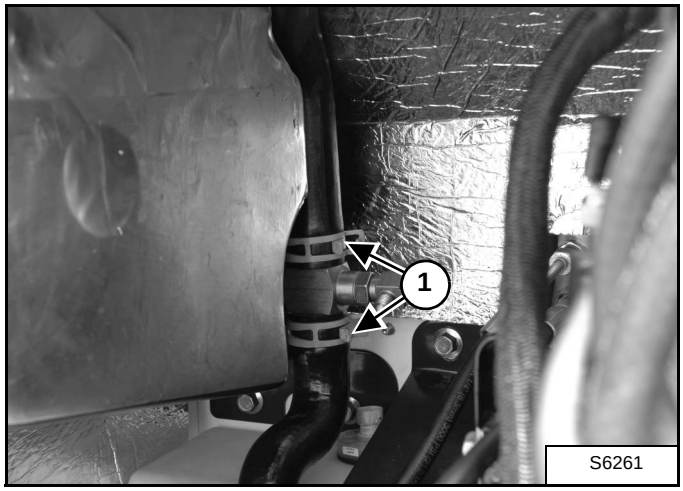
Removal And Installation (Cont'd)

Figure 20-130-4



Remove the hose (Item 1) **[Figure 20-130-4]** from the hydraulic reservoir.

Figure 20-130-5



Release the hose clamps (Item 1) **[Figure 20-130-5]** and remove hoses from tee fitting on reservoir.

Tilt hydraulic reservoir towards engine and slide reservoir out **[Figure 20-130-5]**.

OIL COOLER

Description

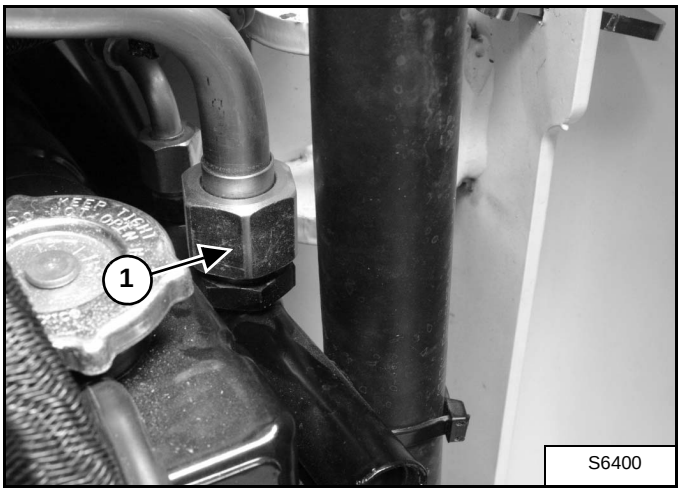
The oil cooler is used to cool the excavators hydraulic fluid. Oil passages are coiled into a heat exchanger. The air is forced around these passages cooling the oil.

Removal And Installation

Open tailgate.

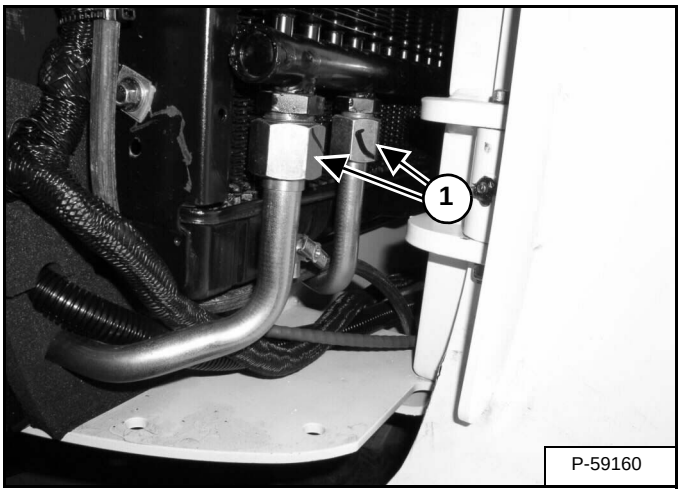
Drain hydraulic reservoir (See “Replacing Hydraulic Oil” on page 10-100-2).

Figure 20-140-1



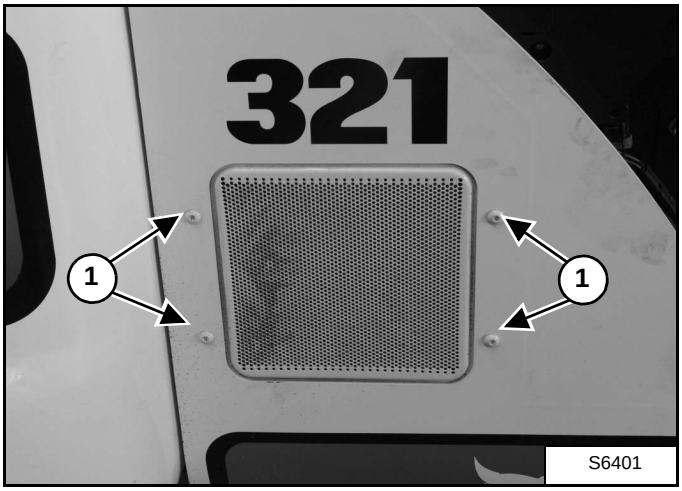
Remove the tubeline (Item 1) **[Figure 20-140-1]** from the top of the oil cooler.

Figure 20-140-2



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

Figure 20-140-3



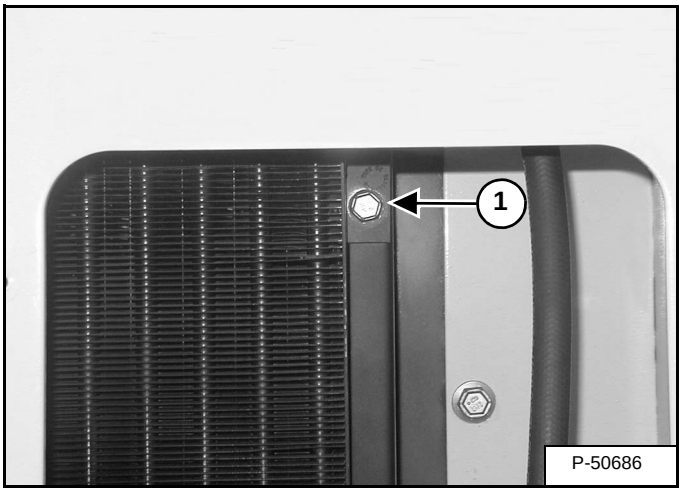
Remove the four bolts (Item 1) **[Figure 20-140-3]** holding the grill to the side frame.

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

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

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

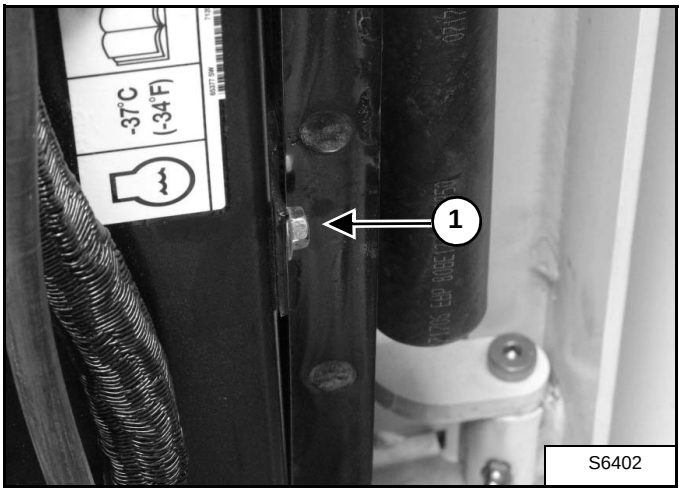
Figure 20-140-4



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

Removal And Installation (Cont'd)

Figure 20-140-5



Remove the bolt (Item 1) **[Figure 20-140-5]** mounting the oil cooler to the radiator.

Remove the oil cooler from rear of excavator.

BLADE / TRACK EXPANSION SOLENOID BLOCK

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.

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 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.

I-2003-0888

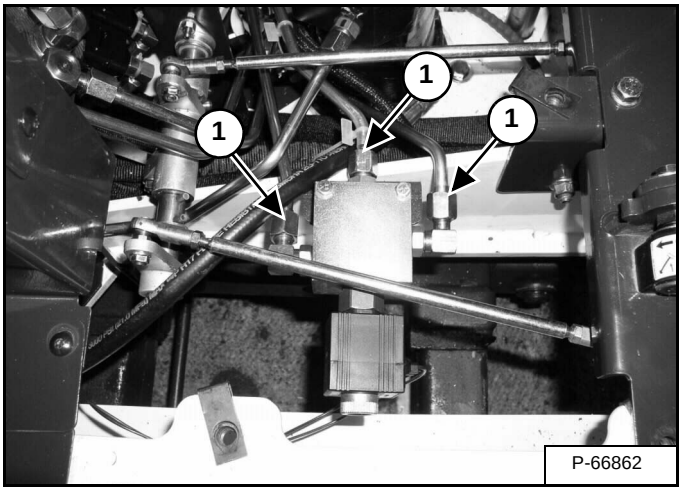
Remove the floor mat and floor panel (See Removal and Installation on Page 40-140-1.)

⚠ 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 physician familiar with this injury is not received immediately.

W-2145-0290

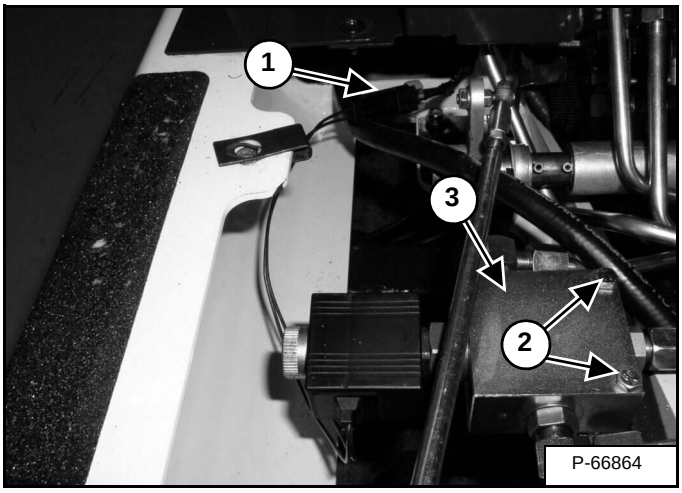
Figure 20-140-1



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

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

Figure 20-150-2



Disconnect the wire harness (Item 1) **[Figure 20-150-2]** from the excavator harness.

Remove the bolts (Item 2) **[Figure 20-150-2]**.

Remove the blade / track expansion solenoid block (Item 3) **[Figure 20-150-2]** form the excavator.

Solenoid 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 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.

I-2003-0888

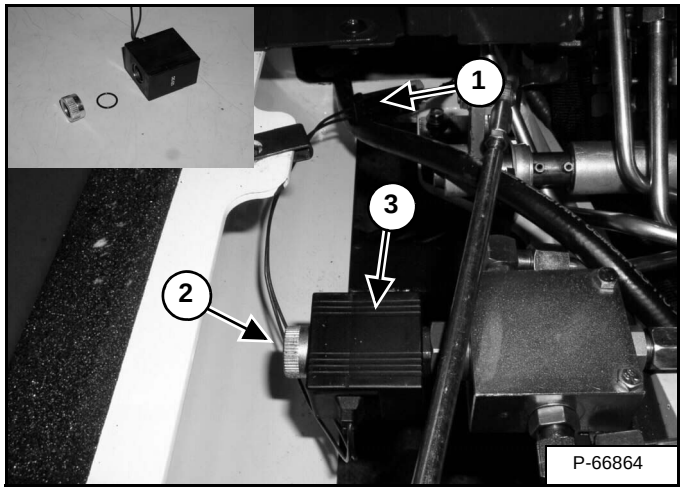
Remove the floormat and floor panel (See Removal and Installation on Page 40-140-1.)

⚠ 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 physician familiar with this injury is not received immediately.

W-2145-0290

Figure 20-140-3

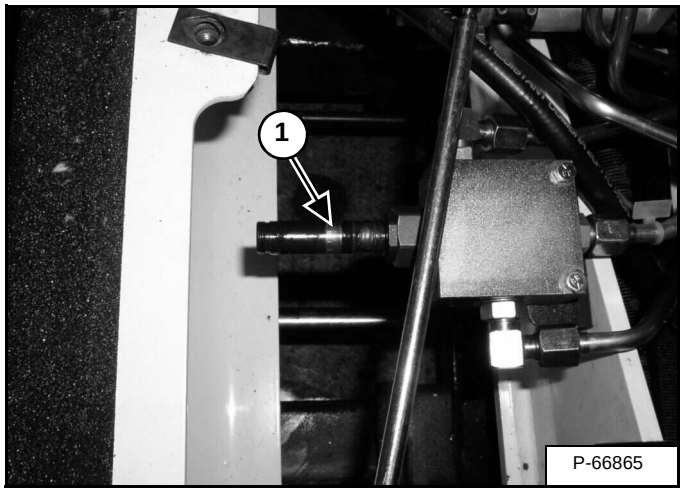


Disconnect the wire harness (Item 1) **[Figure 20-140-3]** from the excavator harness.

Remove the solenoid nut (Item 2) **[Figure 20-140-3]**.

Remove the O-ring and coil (Item 3) **[Figure 20-140-3]** from the solenoid stem.

Figure 20-150-4

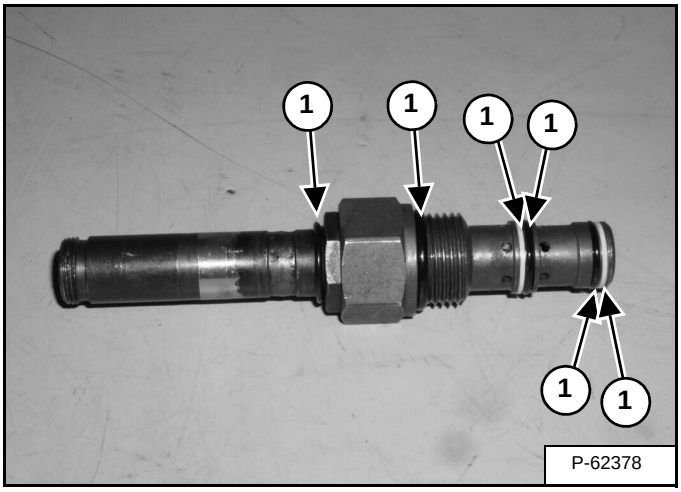


Remove the solenoid stem (Item 1) **[Figure 20-150-4]**.

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

Solenoid Removal and Installation (Cont'd)

Figure 20-150-5



Remove the O-rings and backup rings (Item 1) **[Figure 20-150-5]** from the solenoid stem.

Block 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.

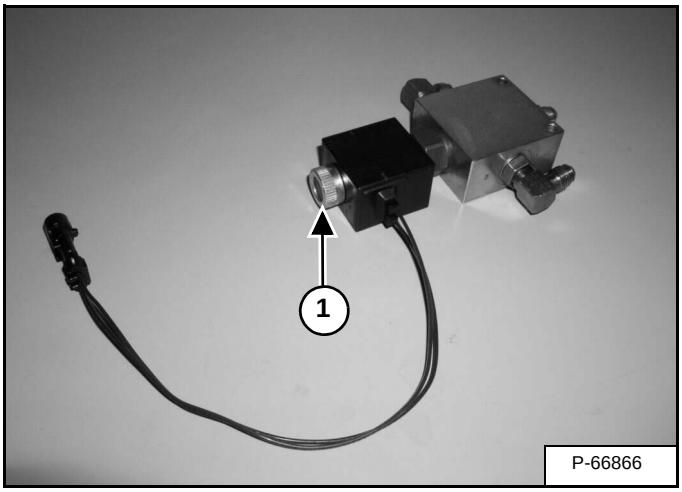
I-2003-0888

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

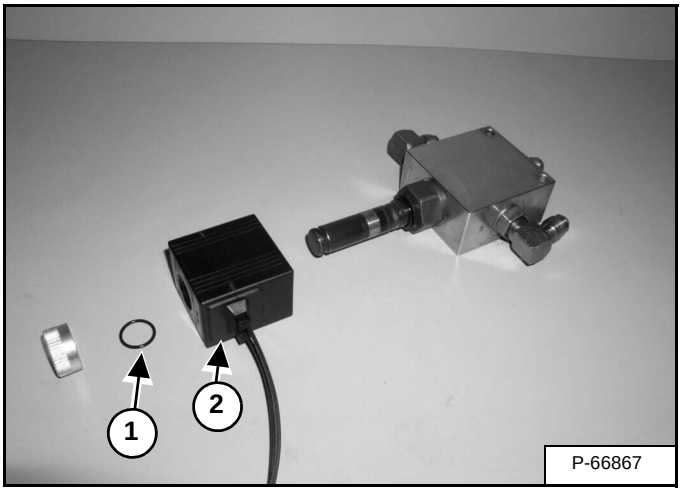
Figure 20-150-6



Remove the nut (Item 1) **[Figure 20-150-6]** from the solenoid.

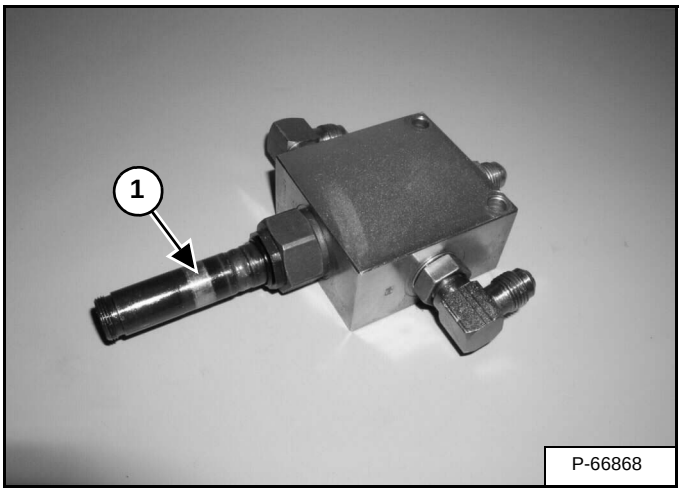
Block Disassembly And Assembly (Cont'd)

Figure 20-150-7



Remove the O-ring (Item 1) and solenoid (Item 2) **[Figure 20-150-7]**.

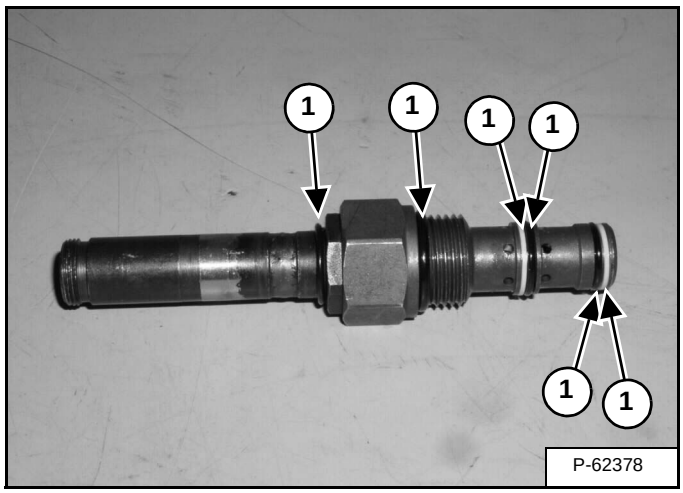
Figure 20-150-8



Remove the solenoid stem (Item 1) **[Figure 20-150-8]**.

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

Figure 20-150-9



Remove the O-rings and backup rings (Item 1) **[Figure 20-150-9]** from the solenoid stem.

UNDERCARRIAGE

BLADE 30-10-1
Blade Removal And Installation. 30-10-2
Description 30-10-1
Extension Removal And Installation 30-10-1

SWING CIRCLE GEAR 30-70-1
Removal and Installation 30-70-1

TRACK DAMAGE IDENTIFICATION 30-40-1
Abrasion Of Embedded Metals 30-40-2
Abrasion Of The Track Roller Side 30-40-9
Causes Of The Damage 30-40-1
Cracks And Cuts On The Lug Side Rubber. 30-40-8
Cracks On The Lug Side Rubber Due To Fatigue 30-40-6
Cuts On The Edges Of The Track Roller Side. 30-40-10
Cuts On The Lug Side Rubber 30-40-5
Cutting Of The Steel Cords 30-40-1
Lug Abrasion 30-40-7
Separation Of Embedded Metals 30-40-3
Separation Of Embedded Metals Due To Corrosion 30-40-4

TRACK FRAME 30-30-1
Disassembly And Assembly 30-30-1
Removal And Installation Of Expandable Track Frame 30-30-2

TRACK IDLER 30-50-1
Assembly. 30-50-4
Disassembly 30-50-2
Parts Identification. 30-50-1

TRACK ROLLER 30-60-1
Assembly. 30-60-4
Disassembly 30-60-2
Parts Identification. 30-60-1

TRACKS 30-20-1
Removal And Installation. 30-20-4
Track Lug Height 30-20-1
Track Tension Adjustment 30-20-1

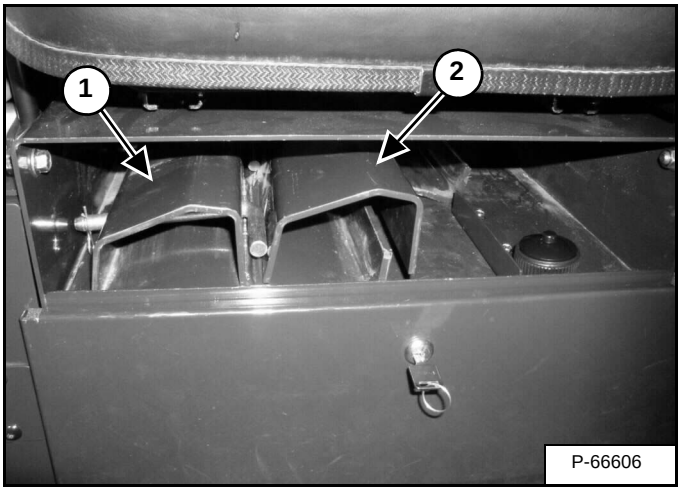

Bobcat®

BLADE

Description

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

Figure 30-10-1

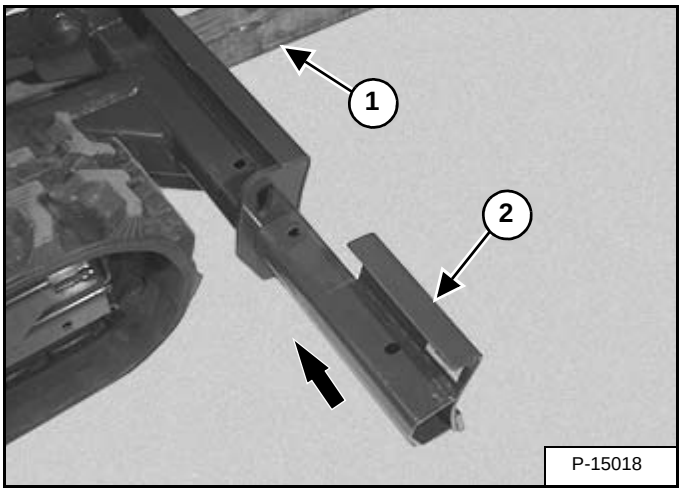


The blade extensions (Items 1 and 2) **[Figure 30-10-1]** are stored under the operator seat.

NOTE: The blade extensions needed to be installed under the operator seat as shown for cab models. Both mounting pins must be installed in the left blade extension (Item 1) [Figure 30-10-1]. If the blade extensions are installed differently, breakage to the water bottle and cap could result.

Extension Removal And Installation

Figure 30-10-2



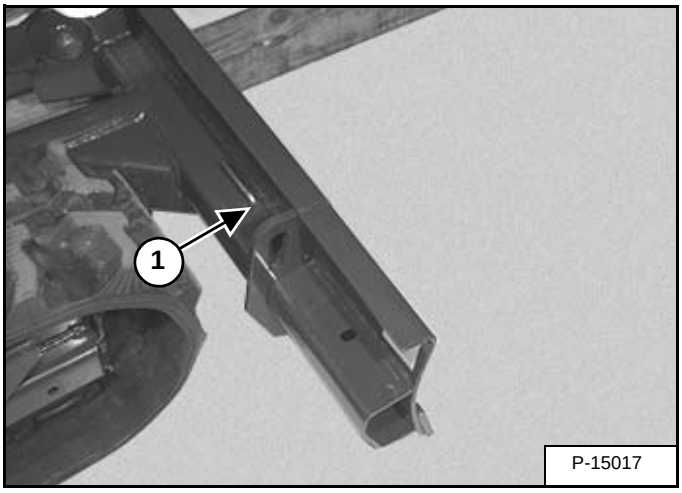
Put a block (Item 1) **[Figure 30-10-2]** under the blade.

Fully lower the blade to the block.

Stop the engine.

Slide the extension (Item 2) **[Figure 30-10-2]** into the blade frame.

Figure 30-10-3



Install the pin (Item 1) **[Figure 30-10-3]**.

Remove the blade extensions when transporting the excavator, or when a narrow operating width is needed. Under normal operating conditions, the blade width should match the track width.

Blade Removal And Installation

Expand the tracks. (See the correct Operation & Maintenance Manual for the Proper procedure.)

Lower the blade to the ground.

Remove the blade cylinder (See Removal and Installation on Page 20-24-2.)

Figure 30-10-4

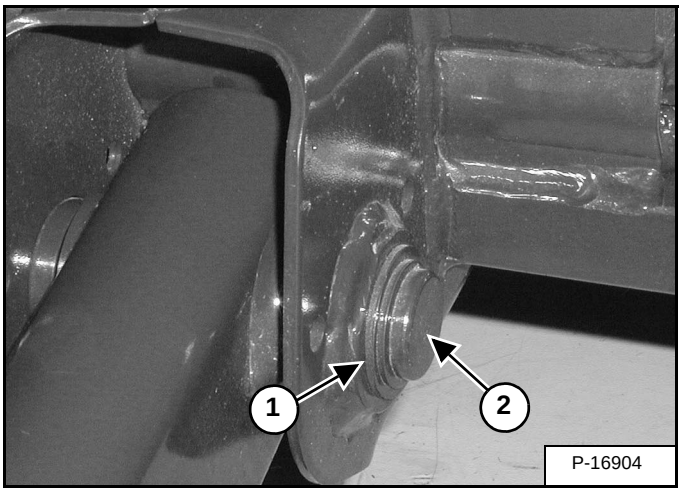
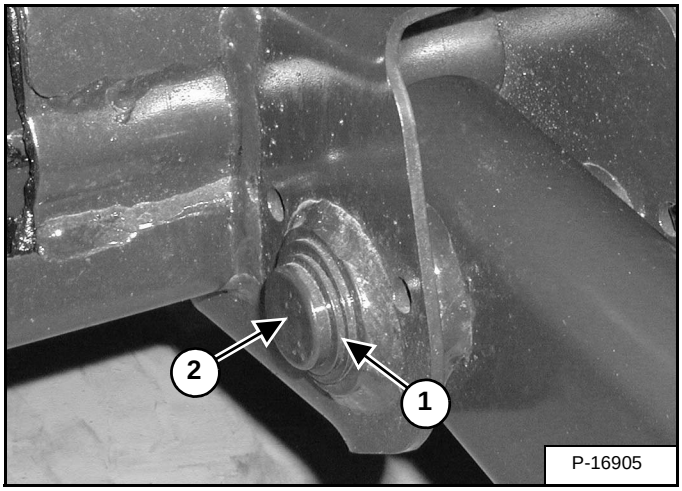


Figure 30-10-5



Remove the snap ring (Item 1) **[Figure 30-10-4]** and **[Figure 30-10-5]** and washer from the blade arm pivot pins (both sides).

Remove the blade arm pivot pins (Item 2) **[Figure 30-10-4]** and **[Figure 30-10-5]**.

Remove the blade from the excavator.

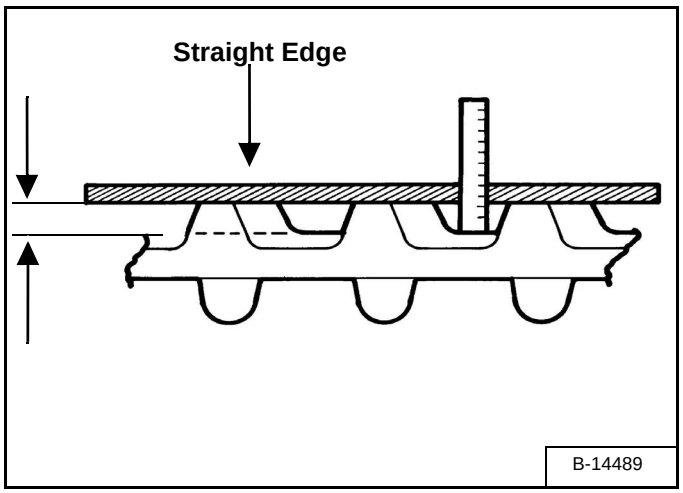
TRACKS

Track Lug Height

Rubber Track

The lug height of a new rubber track is 0.984 inch (25,0 mm).

Figure 30-20-1



To find the percentage of wear on an excavator track, measure the height of the lug by placing a straight edge across the top of three lugs and measure the distance from the base of the track to the bottom of the straight edge **[Figure 30-20-1]**.

Divide this measurement by the new track height and multiply by 100. This will give the percentage of track lug left.

Example: lug height 0.787 in. (20,0 mm)

$$\frac{0.787}{0.984} \times 100 = 80$$

80% of the track lug is remaining with 20% wear on the track lugs.

The rubber track should be replaced when lug height measures 0.246 in. (6,25 mm) from the base of the track to the top of the lug.

Track Tension Adjustment

NOTE: The wear of undercarriage parts vary with working conditions and types of soil conditions. Maintain the correct track tension by inspecting regularly (See SERVICE SCHEDULE on Page 10-50-1).

Figure 30-20-2



Raise one side of the machine (approximately four inches [102 mm]) using the boom and arm as shown in **[Figure 30-20-2]**.

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

Stop the engine.

⚠ WARNING

AVOID INJURY

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

W-2142-0903

Track Tension Adjustment (Cont'd)

Figure 30-20-3

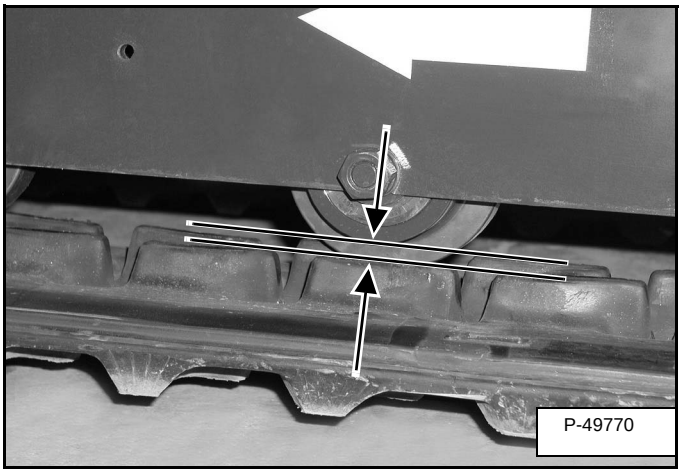


Figure 30-20-4

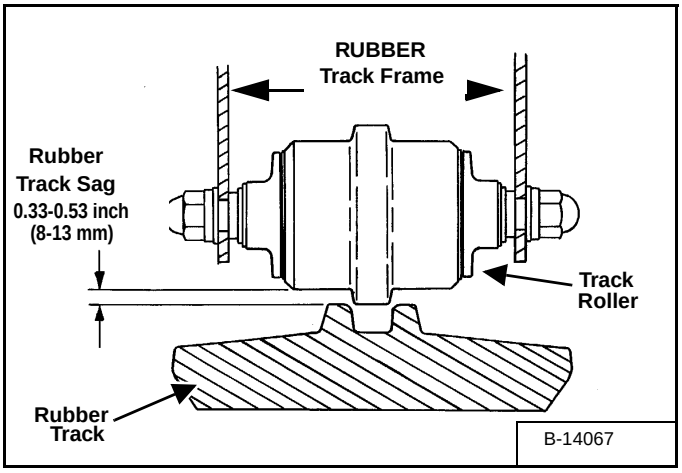
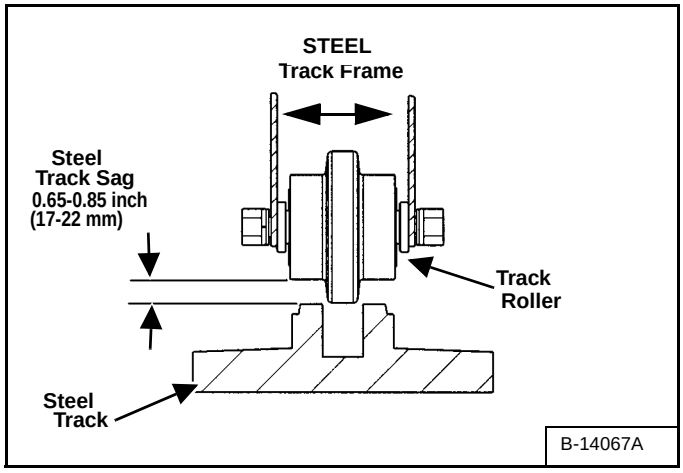
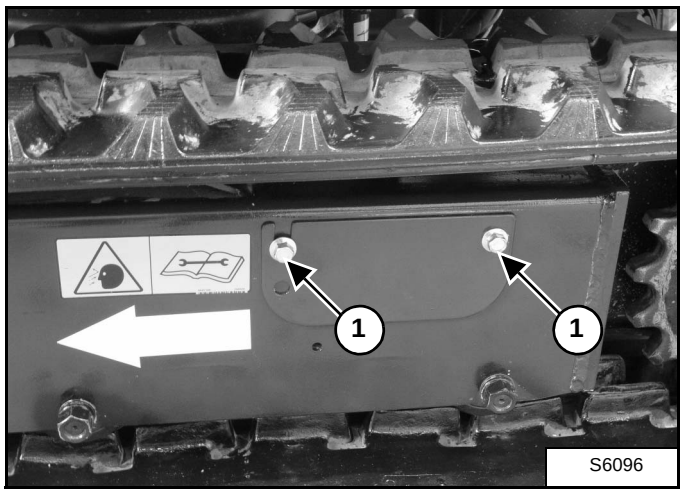


Figure 30-20-5



Measure the rubber or steel track sag at the middle track roller **[Figure 30-20-3]**. Do not get your fingers into pinch points between the track and the track roller. Use material of appropriate size to check the gap between the contact edge of the roller and top edge of the track guide lug **[Figure 30-20-3]**, **[Figure 30-20-4]**, and **[Figure 30-20-5]**.

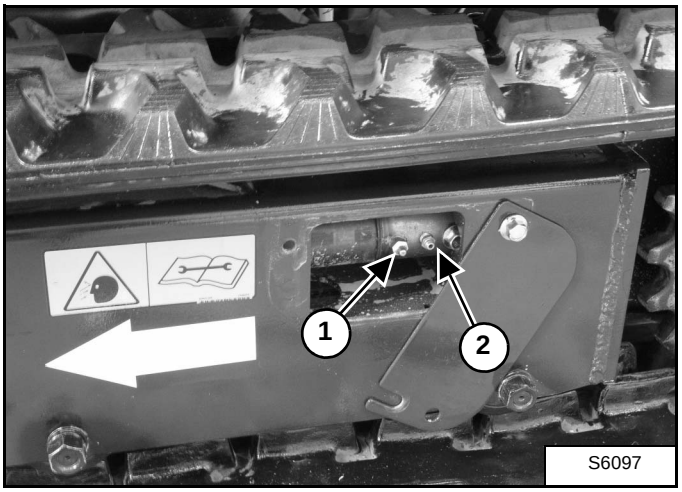
Figure 30-20-6



Loosen the two bolts (Item 1) **[Figure 30-20-6]** on the cover. Pivot the cover downward.

Track Tension Adjustment (Cont'd)

Figure 30-20-7



Add grease to the fitting (Item 1) **[Figure 30-20-7]** until the track tension is correct.

If tension is too tight, loosen the bleed screw (Item 2) **[Figure 30-20-7]** (1 turn maximum) and let grease flow out of the bleed screw. When tension is correct, tighten the bleed screw.

Repeat the procedure for the other side.

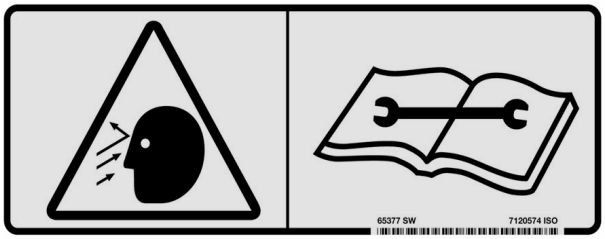
If the track tension is still loose after adjusting to the mentioned limit, it indicates the track is worn.

⚠ WARNING

AVOID INJURY OR DEATH

Do not loosen the grease fitting more than one complete rotation. Also, be careful not to loosen any part other than the grease fitting. If the grease fitting or any part is loosened too much, it can fly off under high pressure. If the grease does not ooze smoothly, try moving the machine back and forth for a short distance.

W-2143-0189

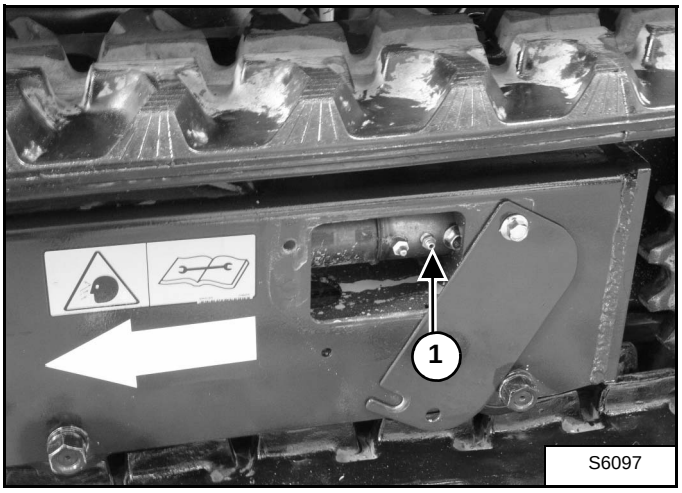


7120574

Removal And Installation

Lift and block the side of the machine where the track will be removed (See Procedure on Page 10-10-1).

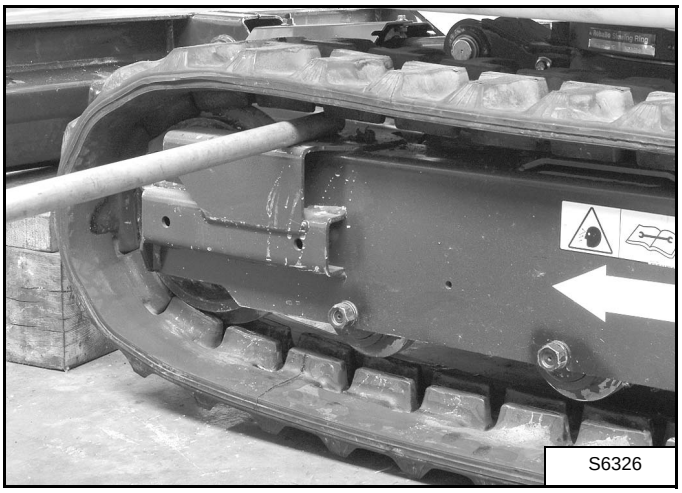
Figure 30-20-8



Slowly loosen the bleed screw fitting (Item 1) **[Figure 30-20-8]** (one turn maximum) to remove track tension.

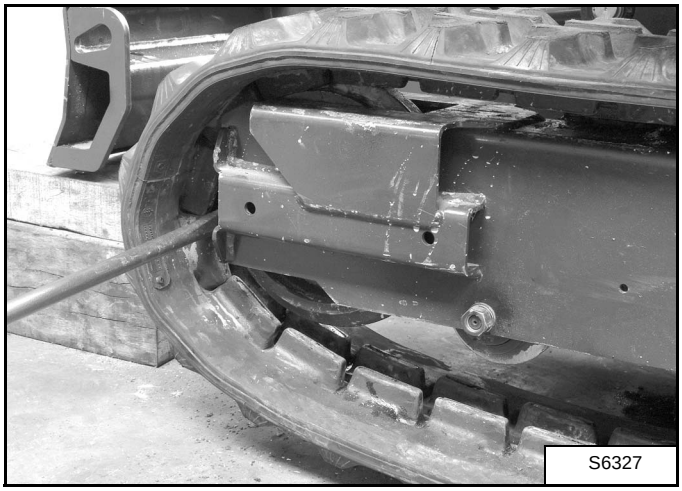
NOTE: Apply additional pressure to the track by standing on the lower track span so all the tension is released from the grease cylinder for easier removal of the track.

Figure 30-20-9



Install a round bar (Approximately 1.25 inch [30 mm] diameter) between the drive lugs **[Figure 30-20-9]**.

Figure 30-20-10



Turn the track until the bar contacts the frame **[Figure 30-20-10]**.

Pry the track off the idler wheel.

Remove the track from the drive sprocket.

To install the rubber track:

Put the track over the rear drive sprocket lugs.

Put the front of the track onto the front idler wheel.

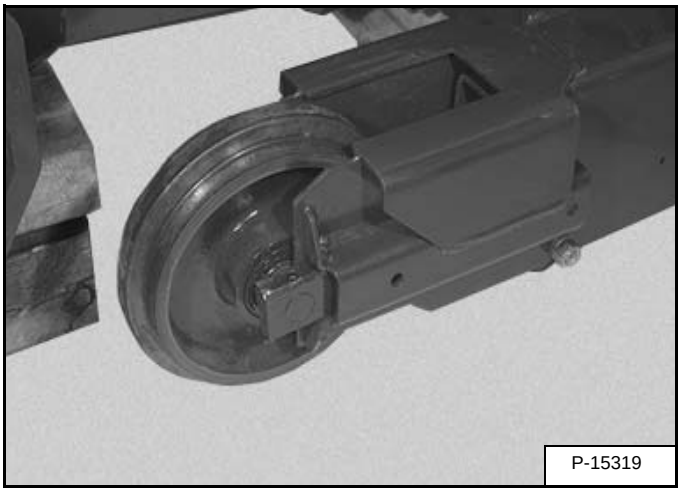
(See Track Tension Adjustment on Page 30-20-1) for adding grease to the grease spring and for checking track tension.

TRACK FRAME

Disassembly And Assembly

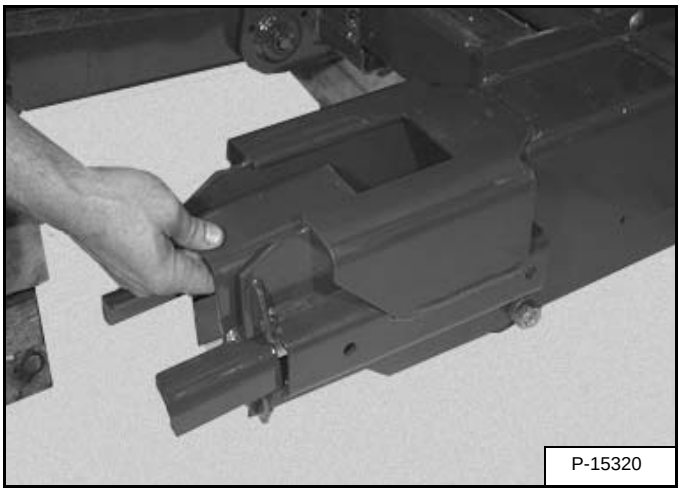
Remove the track (See Removal And Installation on Page 30-20-4.)

Figure 30-30-1



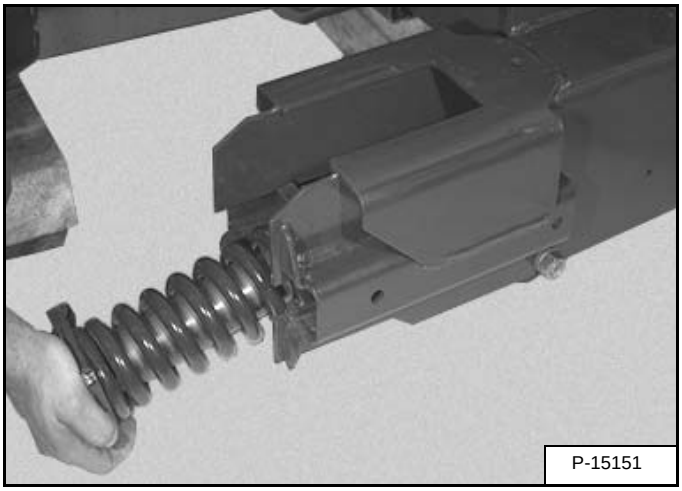
Slide the front track idler out of the track frame to remove it **[Figure 30-30-1]**.

Figure 30-30-2



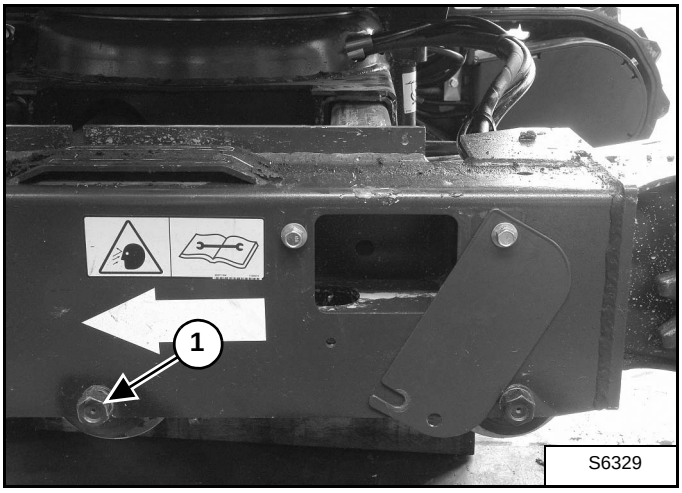
Remove the sliding plate **[Figure 30-30-2]**.

Figure 30-30-3



Slide the recoil spring cylinder forward and remove it from the track frame **[Figure 30-30-3]**.

Figure 30-30-4



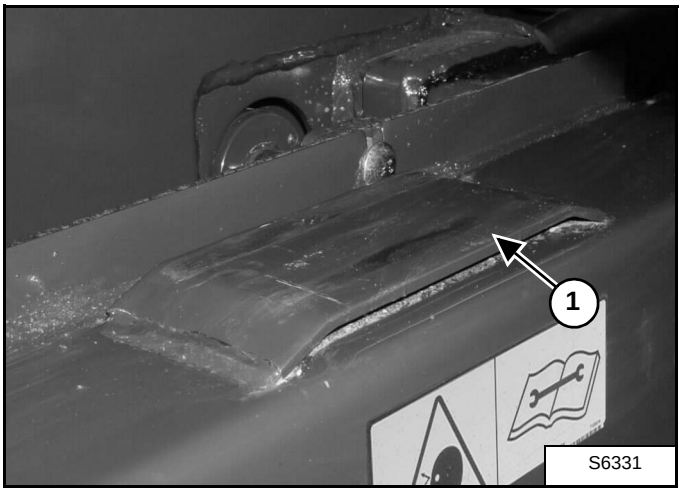
Loosen the nuts from the track roller on both sides of the track frame **[Figure 30-30-4]**.

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

Remove the track roller (Item 1) **[Figure 30-30-4]**.

Disassembly And Assembly (Cont'd)

Figure 30-30-5



Inspect the track guide (Item 1) **[Figure 30-30-5]** for wear or damage.

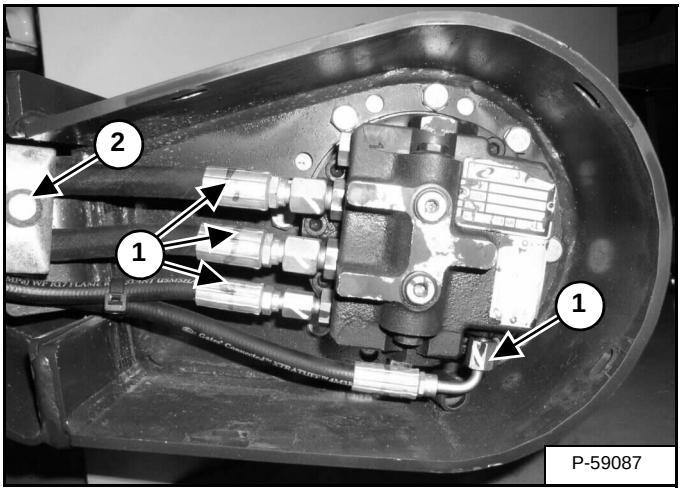
Removal And Installation Of Expandable Track Frame

Remove the track expansion cylinder (See Removal And Installation on Page 20-25-2.)

Lift and block the track frame.

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

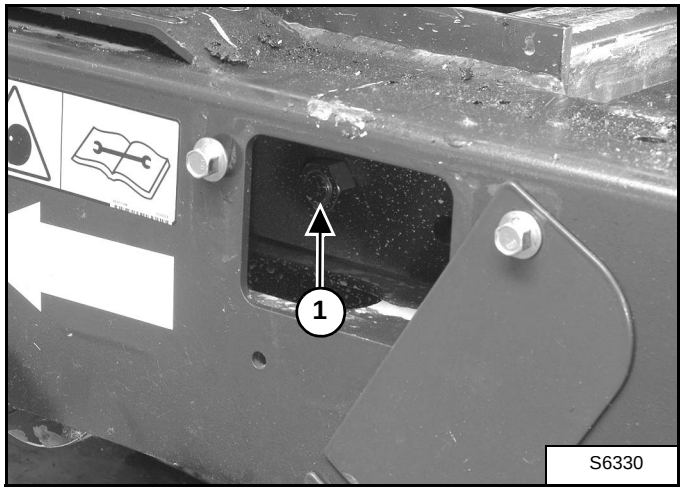
Figure 30-30-6



Remove the travel motor cover. Remove the hoses (Item 1) **[Figure 30-30-6]** from the travel motor.

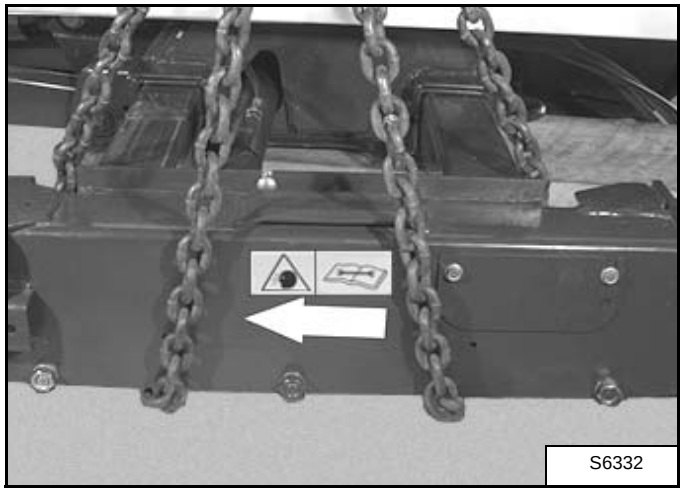
Remove the hose clamp (Item 2) **[Figure 30-30-6]** from the track frame.

Figure 30-30-7



Remove the nut (Item 1) **[Figure 30-30-7]** from the track expansion stop rod.

Figure 30-30-8



Install a chain hoist on the track frame **[Figure 30-30-8]**. Lift the frame a small amount while pulling the frame away from the excavator.

Using a 10 X 1,5 mm tap, clean the track frame bolt holes to remove the old thread locking compound.

Disassembly And Assembly (Cont'd)

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY (Item 2) [Figure 30-30-9].

⚠ WARNING



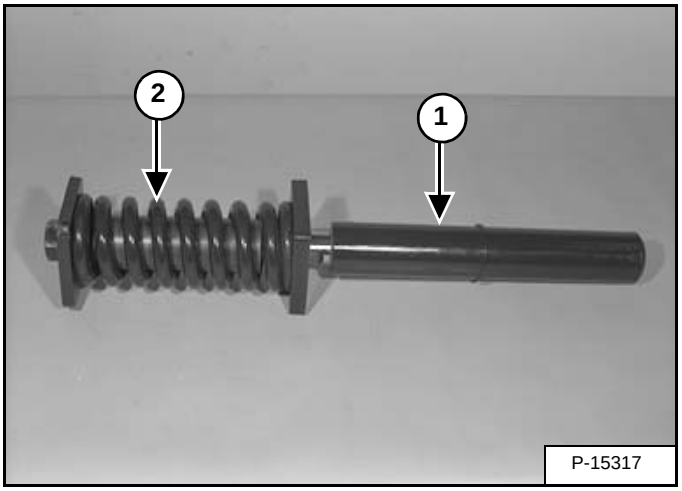
P-62574

AVOID INJURY OR DEATH

- **Spring loaded components under pressure can cause serious injury or death.**
- **Do not disassemble the coil spring assembly.**

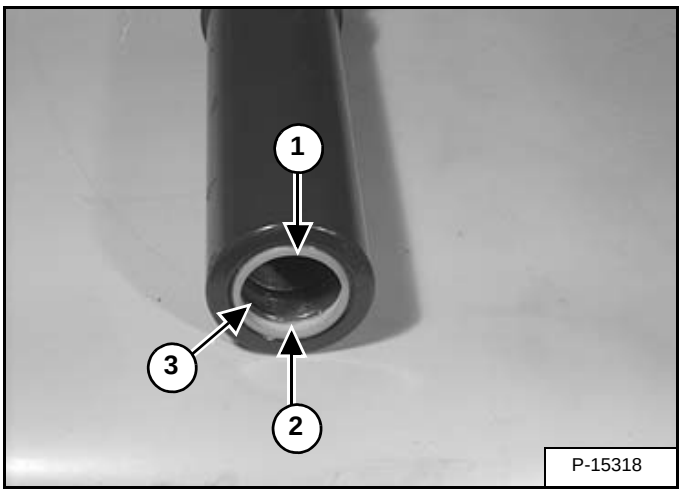
W-2617-1004

Figure 30-30-9



Remove the cylinder (Item 1) from the coil spring assembly (Item 2) **[Figure 30-30-9]**.

Figure 30-30-10



Remove the seal (Item 1), back-up ring (Item 2) and O-ring (Item 3) **[Figure 30-30-10]** from the cylinder.


Bobcat®

TRACK DAMAGE IDENTIFICATION

Cutting Of The Steel Cords

Damage:

Figure 30-40-1

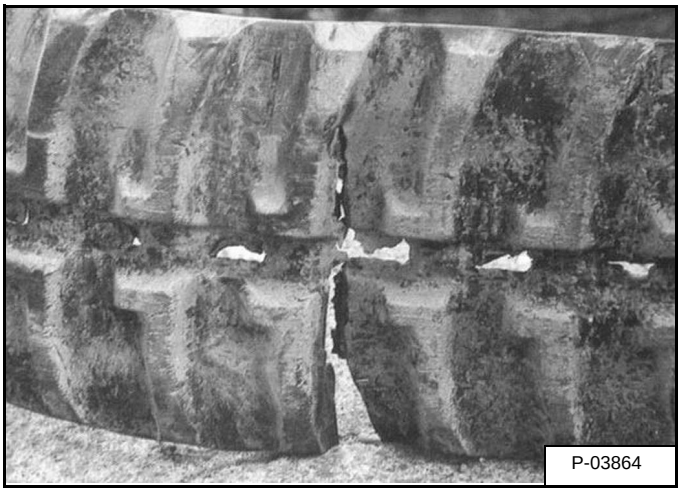
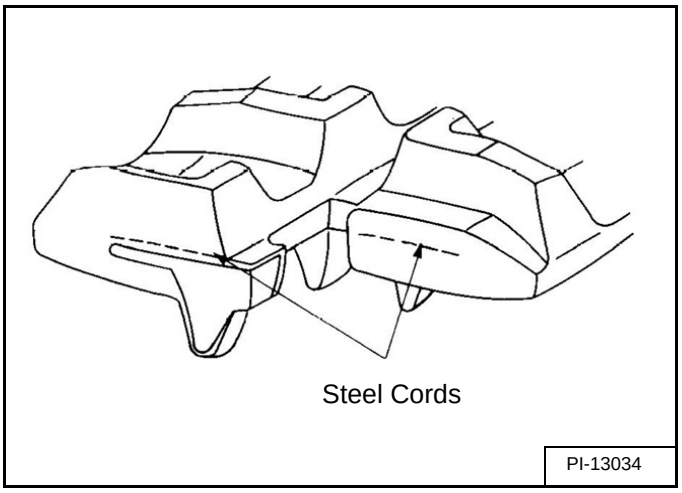


Figure 30-40-2



Embedded steel cords are cut off **[Figure 30-40-1]** and **[Figure 30-40-2]**.

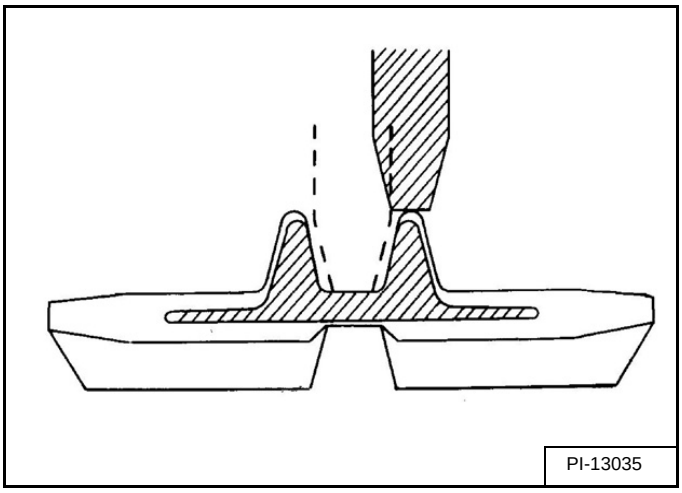
Replacement:

Replacement is required **[Figure 30-40-1]** and **[Figure 30-40-2]**.

Causes Of The Damage

When applied to rubber tracks under the following circumstances, tension in excess of the breaking strength of the embedded steel cords causes steel cords to be cut:

Figure 30-40-3



When the rubber track is detracking, the idler or sprocket rides on the projections of the embedded metal **[Figure 30-40-3]**.

When the rubber track is detracted, projections of rubber tracks get stuck between the frame of the undercarriage.

The rubber track is clogged with stones or foreign obstacles.

When moisture penetrates through a cut on the lug side rubber surface, the embedded steel cords will corrode. The deterioration of the design strength may lead to the breaking off of the steel cords.

Prevention

The following preventions should be taken to minimize the risk of this damage:

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

Avoid quick turns on bumpy and rocky fields.

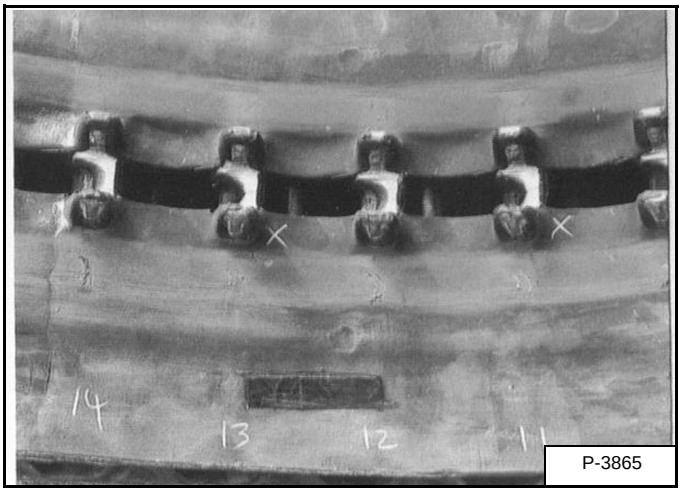
Drive carefully to avoid having stones and other articles clog the rubber tracks.

Avoid driving over sharp objects. If this is impossible, do not make turns while driving over sharp objects.

Abrasion Of Embedded Metals

Damage:

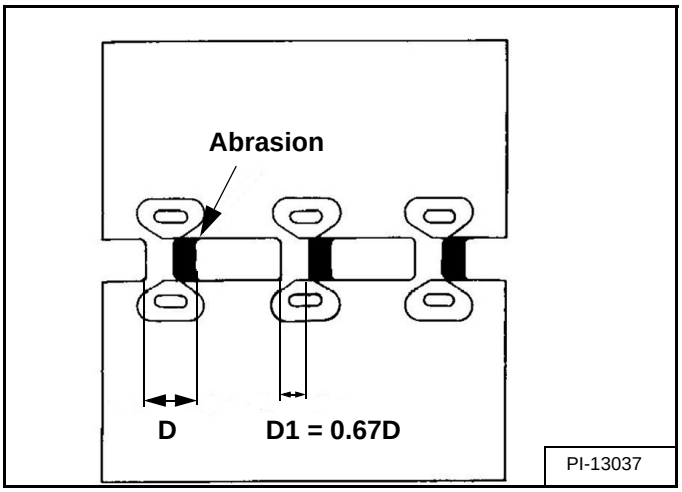
Figure 30-40-4



In proportion to the service time, embedded metals will gradually wear away by friction **[Figure 30-40-4]**.

Replacement:

Figure 30-40-5



Replacement is required when the width of the embedded metals (D1) becomes 67% of their original width (D) **[Figure 30-40-5]**.

Causes Of The Damage

When the track rollers, sprockets and idler gears roll over the embedded metals, abrasion of embedded metals is inevitable. The following cases sometimes accelerate rubber track abrasion:

Rubber tracks are driven with an extraordinary heavy load on them.

Rubber tracks are used on sandy fields.

Prevention

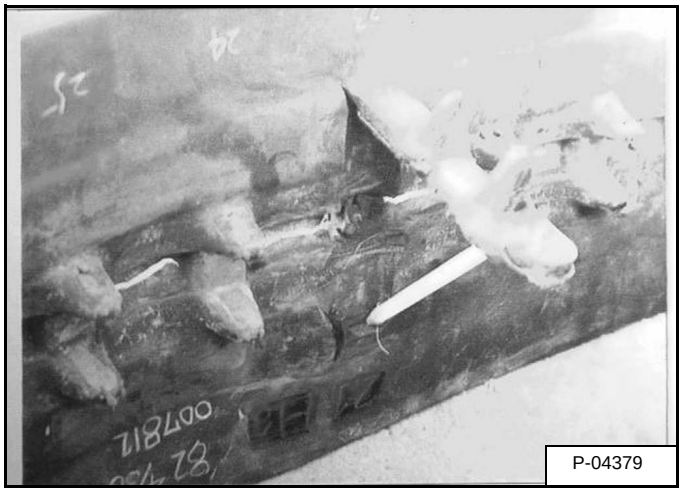
As long as rubber tracks are used under normal operating conditions, abnormal abrasion is unlikely to occur. The level of abrasion should be carefully checked when the machines are used for dozing which generate a heavy load for rubber tracks, and when they are operated under a sandy field condition for a long time.

TRACK DAMAGE IDENTIFICATION (CONT'D)

Separation Of Embedded Metals

Damage:

Figure 30-40-6



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

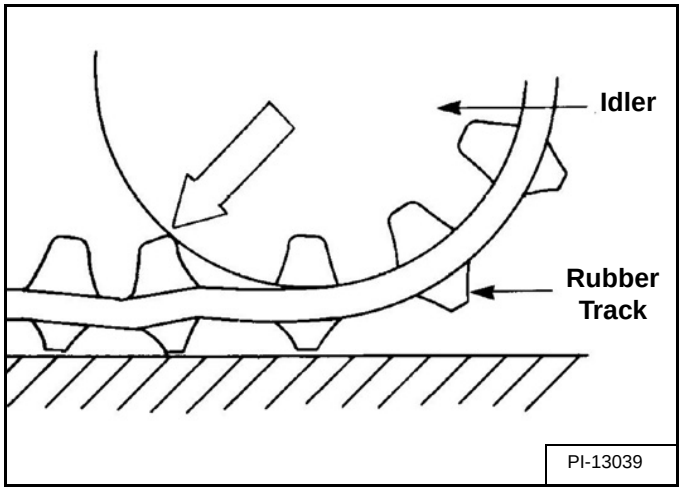
Replacement:

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

Causes Of The Damage:

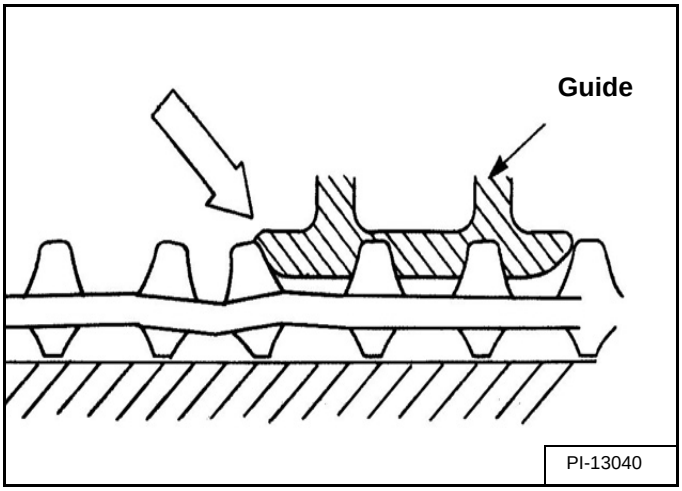
Embedded metals adhere between the steel cords and the rubber body. The following cases generate external forces greater than the adhesion strength, causing separation of the embedded metals:

Figure 30-40-7



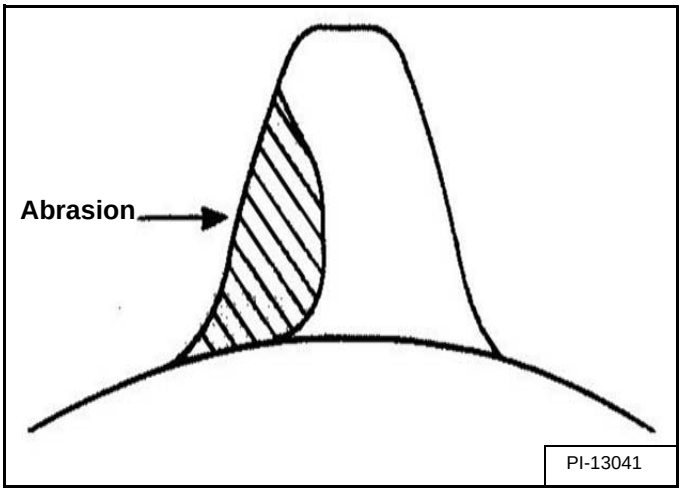
When the idler continually rides on the projections of embedded metals, the embedded metals will eventually peel off **[Figure 30-40-7]**.

Figure 30-40-8



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

Figure 30-40-9



Abnormally worn sprockets as shown will pull embedded metals out **[Figure 30-40-9]**.

Prevention:

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

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

Separation Of Embedded Metals (Cont'd)

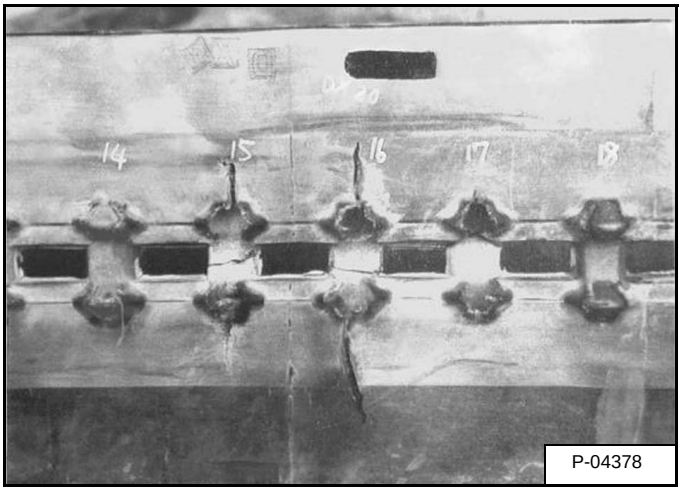
Quick turns on bumpy and rocky fields should be avoided.

If abnormal wear of sprockets is observed, they should be immediately replaced.

Separation Of Embedded Metals Due To Corrosion

Damage:

Figure 30-40-10



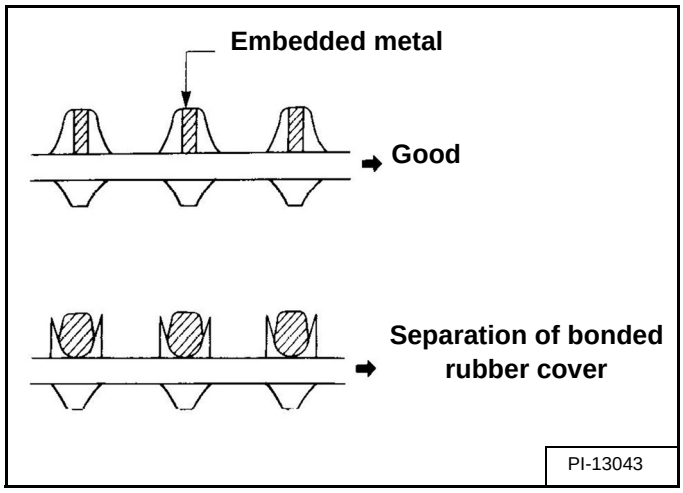
Due to corrosion of embedded metals, the adhesion to the rubber body deteriorates, resulting in complete separation **[Figure 30-40-10]**.

Replacement:

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

Causes Of The Damage

Figure 30-40-11



Embedded metals are bonded to the rubber body. The following operating conditions cause embedded metals to corrode, causing deterioration of the bonding, and finally resulting in separation of the embedded metals from the rubber body **[Figure 30-40-11]**.

Excessively salty fields, like the sea shore.

Strong acidic or alkali soil conditions

Compost spread grounds

On tracks that are out of adjustment, the track rollers, idlers and sprockets will gradually wear the rubber surface at track roller side, causing exposure of the embedded metals. Consequently the embedded metals will corrode resulting in their separation from the rubber body.

Prevention:

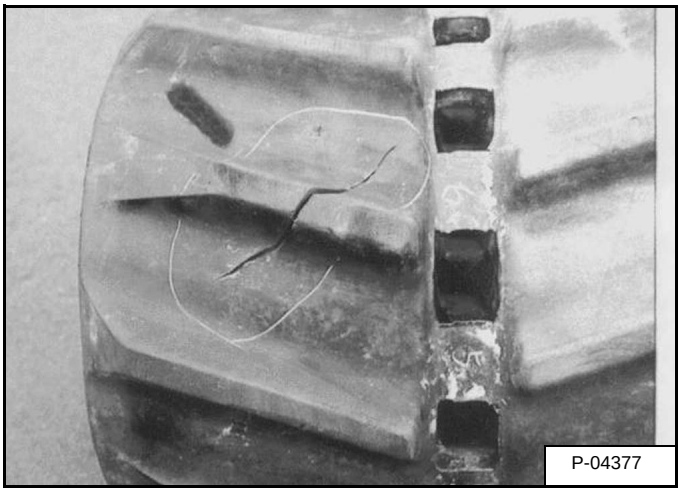
If rubber tracks are used under such field conditions as described under (Causes Of The Damage), they should be washed with plenty of water. After being completely dried, they should be stored correctly.

When the bonded rubber cover is separated from the embedded metal projections and the metals in the rubber body become loose, it is time to consider replacement of the rubber track.

Cuts On The Lug Side Rubber

Damage:

Figure 30-40-12



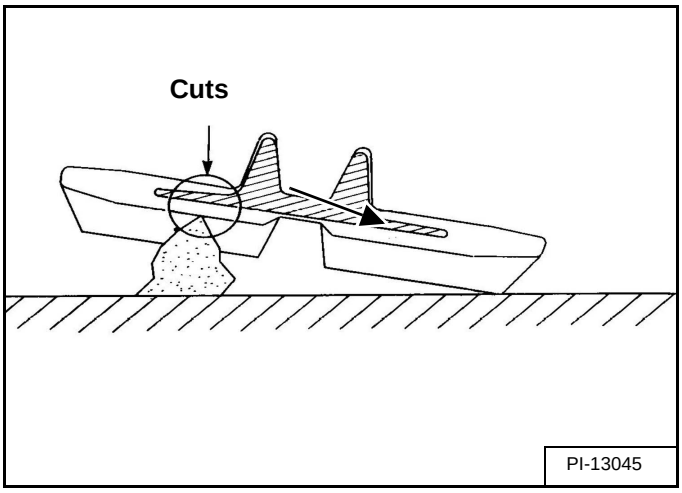
Cuts on the lug side rubber often occurs as one of the most typical failure modes **[Figure 30-40-12]**

Replacement:

When a cut on the lug side rubber reaches the embedded steel cords, it should be immediately repaired with cold vulcanization rubber.

Causes Of The Damage:

Figure 30-40-13



When rubber tracks drive over projections or sharp stones in the fields, the concentrated forces applied cause cuts on the lug side rubber surface. In case of making turns on projections, the lug side rubber surface will have an even higher chance to be cut. If the cuts run through the embedded steel cords, it might result in the breakage of steel cords due to corrosion. It is highly recommended to repair the cuts with cold vulcanization rubber as soon as they are observed **[Figure 30-40-13]**.

Prevention:

Machine operators should drive with great attention to the ground surface, especially in terrains of the following type:

Construction sites

Demolition sites

Paths covered with rocks and wood

Concrete ridges

Stumpy fields

When operating on terrains as mentioned above, quick high speed turns and overloading should be avoided.

TRACK DAMAGE IDENTIFICATION (CONT'D)

Cracks On The Lug Side Rubber Due To Fatigue

Damage:

Figure 30-40-14

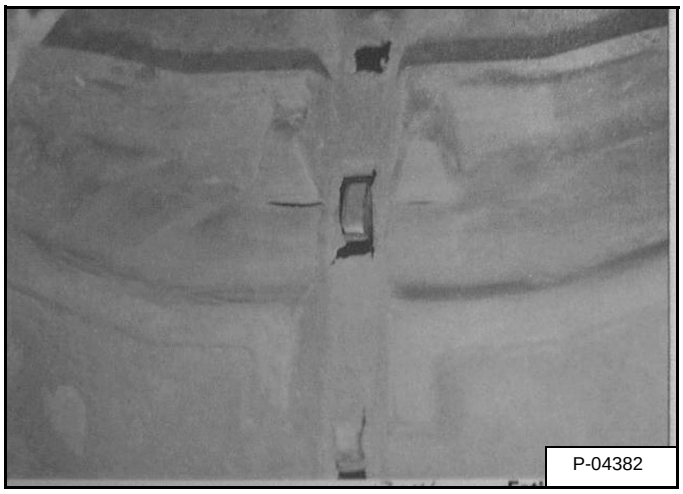
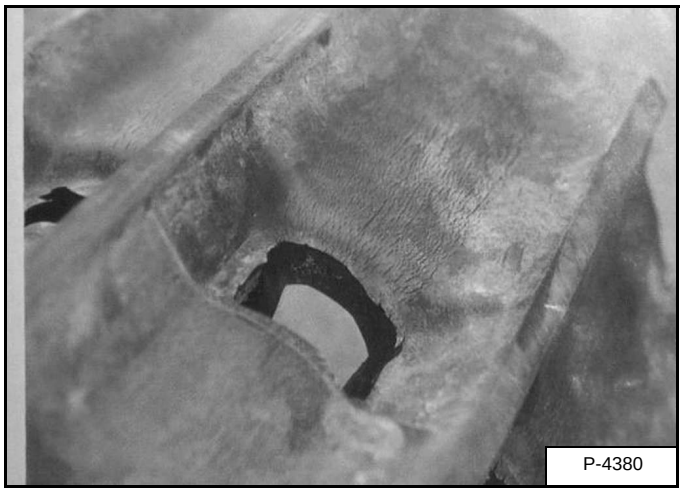


Figure 30-40-15



Small cracks around the root of the lug are a result from operation fatigue **[Figure 30-40-14]** and **[Figure 30-40-15]**

Replacement:

When the cracks become deep enough to expose the steel cords, track replacement is required.

Causes Of The Damage:

Because of wound stress applied to rubber tracks around the undercarriage parts during operation, the fatigue especially causes cracks on the lug side rubber surface. Once the cracks occur, they gradually deteriorate with even small external cracks.

Also when operating near seashores or under cold temperatures, rubber tracks are more likely to suffer from ozone cracks.

Prevention:

Rubber tracks are designed with special rubber compounds to prevent cracks due to fatigue. However, external damage on the lug side rubber, increases the possibility of cracking. Machine operators should observe soil conditions when driving, to prevent external damage to the lug side rubber. In order to minimize the occurrence of ozone cracks, follow these maintenance instructions:

Avoid exposing stored tracks to direct sun light.

Avoid exposing stored tracks to direct rain and snowfall.

Store tracks in well ventilated warehouses.

Use the tracks at least once a month.

Lug Abrasion

Damage:

Figure 30-40-16

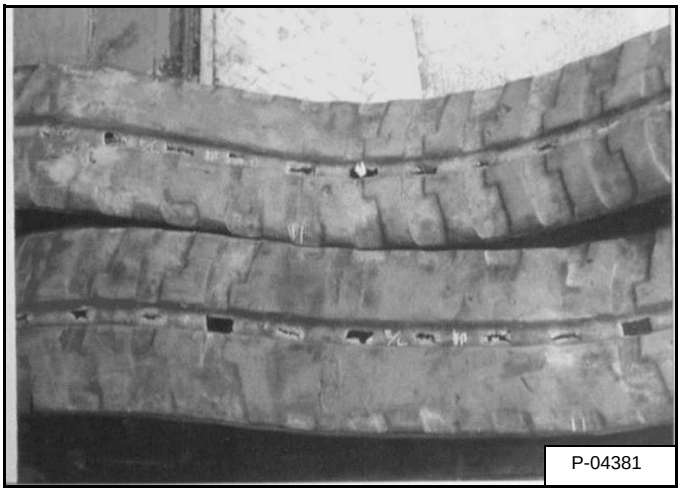
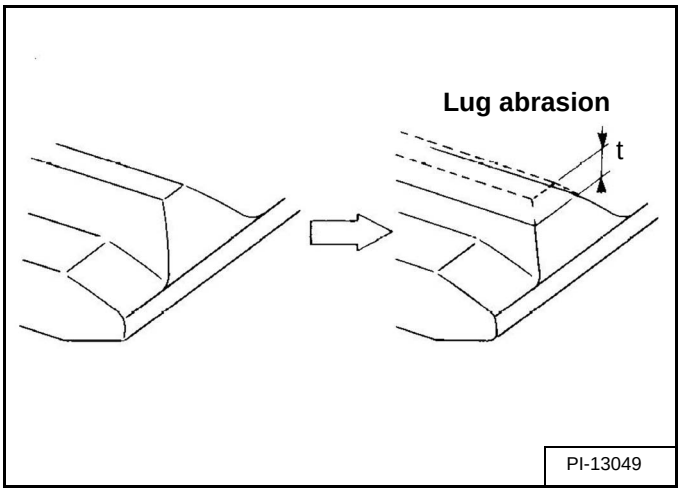


Figure 30-40-17



As operation time increases, the lug side undergoes abrasion **[Figure 30-40-16]** and **[Figure 30-40-17]**.

Replacement:

No replacement is required.

Causes Of The Damage:

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

Prevention:

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

Making quick and repeated turns on concrete and asphalt roads.

Driving up and down hilly paths with slippage.

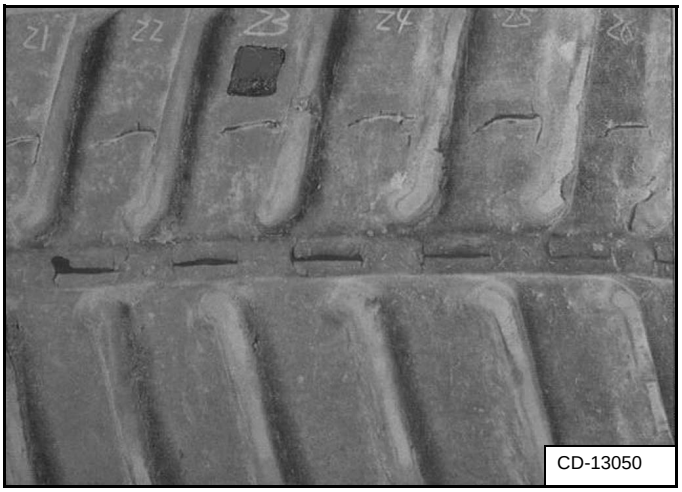
Making frequent turns on paths covered with rocks and wood.

TRACK DAMAGE IDENTIFICATION (CONT'D)

Cracks And Cuts On The Lug Side Rubber

Damage:

Figure 30-40-18



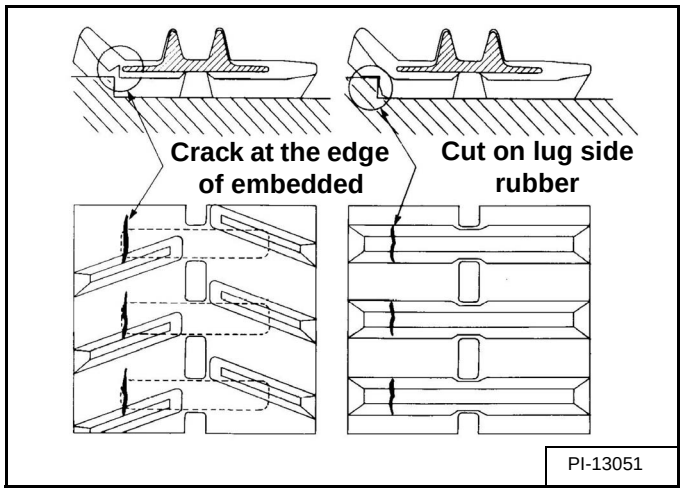
Sometimes cracks and cuts on the lug side rubber at the edges of the embedded metals can be observed **[Figure 30-40-18]**.

Replacement:

Basically, no replacement is required unless the cuts on the lug side rubber are discovered all around the edges of the embedded metals, as this will result in a complete cut off.

Causes Of The Damage:

Figure 30-40-19



When rubber tracks drive over sharp projections, intensive stress is applied to the lug side rubber surface, especially at the edges of embedded metals, causing cracks and cuts in the area around the embedded metals **[Figure 30-40-19]**.

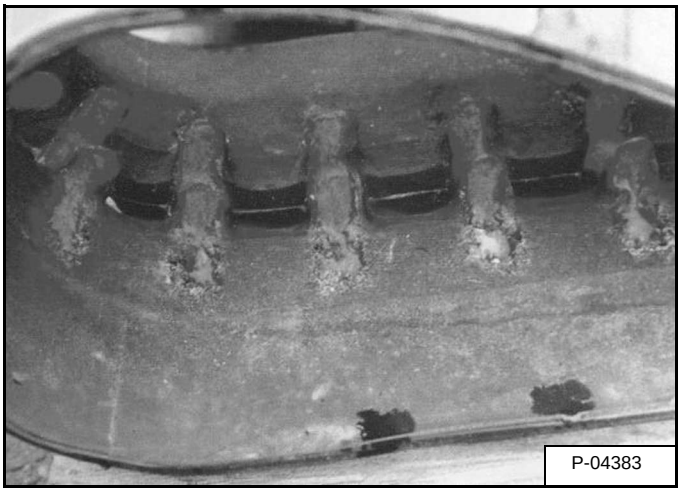
Prevention:

To avoid extensive stress applied to the lug root where metals are embedded, machine operators should avoid driving over stumps and ridges.

Abrasion Of The Track Roller Side

Damage:

Figure 30-40-20



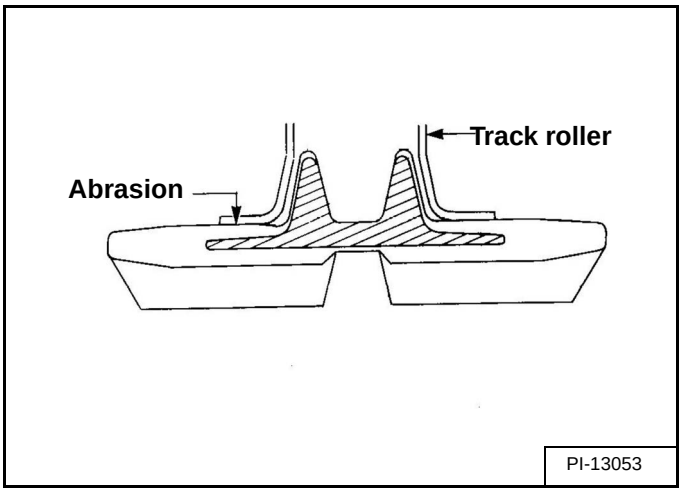
The rubber surface on which track rollers run is gradually abraded. It will result in the exposure of the embedded metals **[Figure 30-40-20]**.

Replacement:

It is recommended to replace the rubber track when more than half of the embedded metals are completely exposed.

Causes Of The Damage:

Figure 30-40-21



The abrasion of the track roller side rubber surface occurs because of sand and gravel being clogged between the rubber and the outside surface of the track rollers. The stress pushes the sand and gravel against the side of the rubber track to cause the abrasion **[Figure 30-40-21]**.

The level of abrasion is highly dependent on terrain conditions. A higher level of abrasion will occur when the rubber tracks are operated in fields covered with many stones and gravel. Small stones hardened with mud, stuck to the track rollers increase the abrasion level. After an extended period of abrasion, it will be more likely for exposed embedded metals to catch moisture through the inside steel cords, which can cause breakage of steel cords and separation of the metals from the rubber body.

Prevention:

After operation in wet fields containing many small stones, wash off the mud that is stuck to the track rollers completely. When operating on gravel paths and stony grounds, machines should be driven slowly and the turning radius should be big enough to prevent stones and gravel from getting stuck to the track roller side rubber.

TRACK DAMAGE IDENTIFICATION (CONT'D)

Cuts On The Edges Of The Track Roller Side

Damage:

Figure 30-40-22

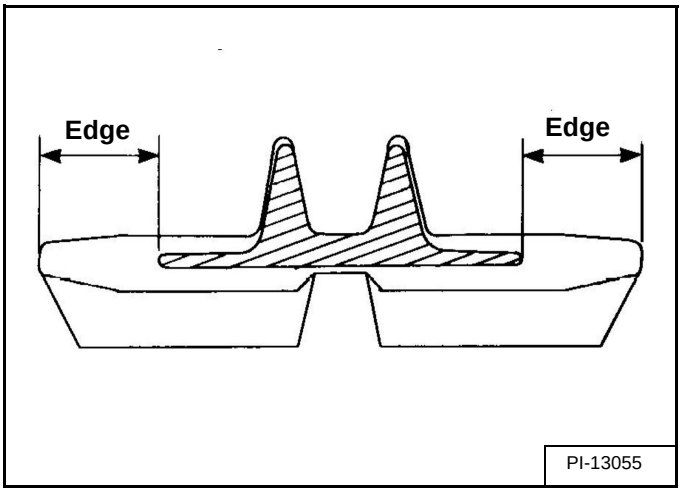


Figure 30-40-23

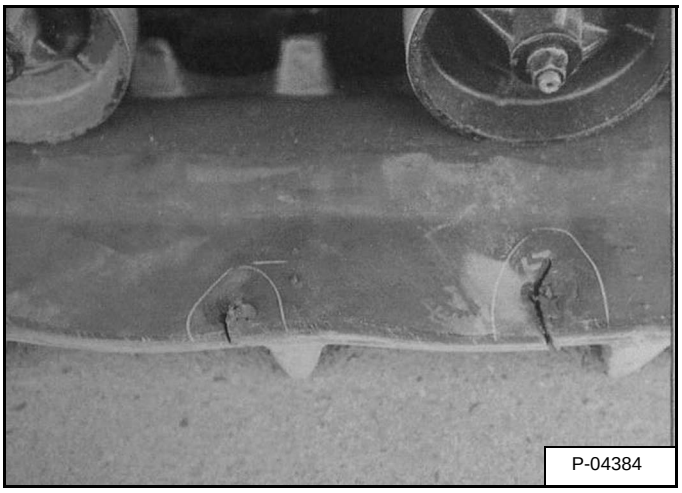
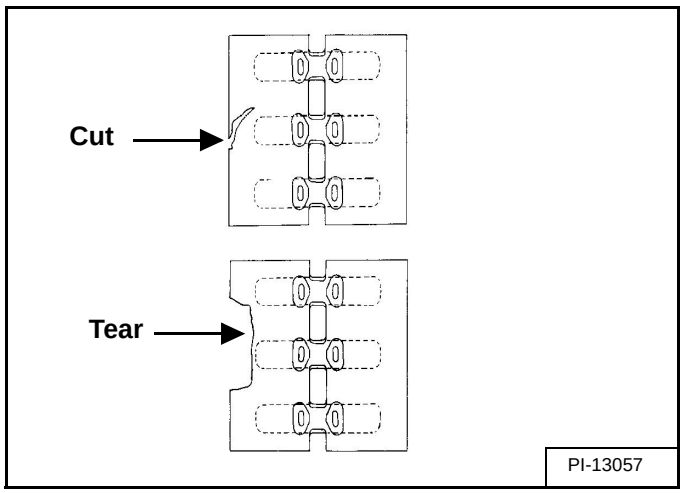


Figure 30-40-24



Both edges of a rubber track **[Figure 30-40-22]** have no special reinforcement. During operation the edges may become cut or torn off **[Figure 30-40-23]** and **[Figure 30-40-24]**.

Replacement:

In such case, the rubber track does not have to be replaced.

Causes Of The Damage:

This damage is caused by objects on the ground or by interference with the machine frame.

In case of damage by objects on the operating ground:

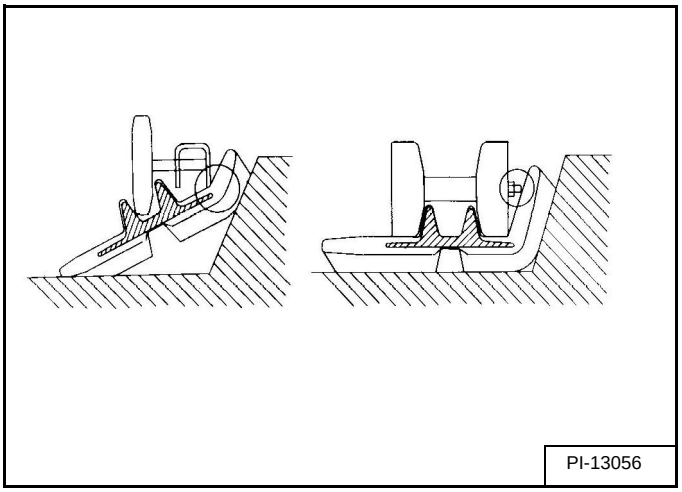
The edges of rubber track are often deformed largely due to a bumpy ground surface, stones and other objects. This causes extensive stress on the edges resulting in the damage.

When driving a machine over concrete ridges, this type of damage easily occurs.

In case of damage by interference with the machine frame.

Cuts On The Edges Of The Track Roller Side (Cont'd)

Figure 30-40-25



If a machine continues operating with rubber tracks being detracked, the rubber tracks may get caught up in the machine frame or undercarriage parts resulting in damage. Furthermore, when a machine travels along side slopes, the rubber tracks are deformed so much that they come into contact with the machine frame and undercarriage parts, which causes cutting, gouging and rubbing of rubber tracks in the end **[Figure 30-40-25]**.

Prevention:

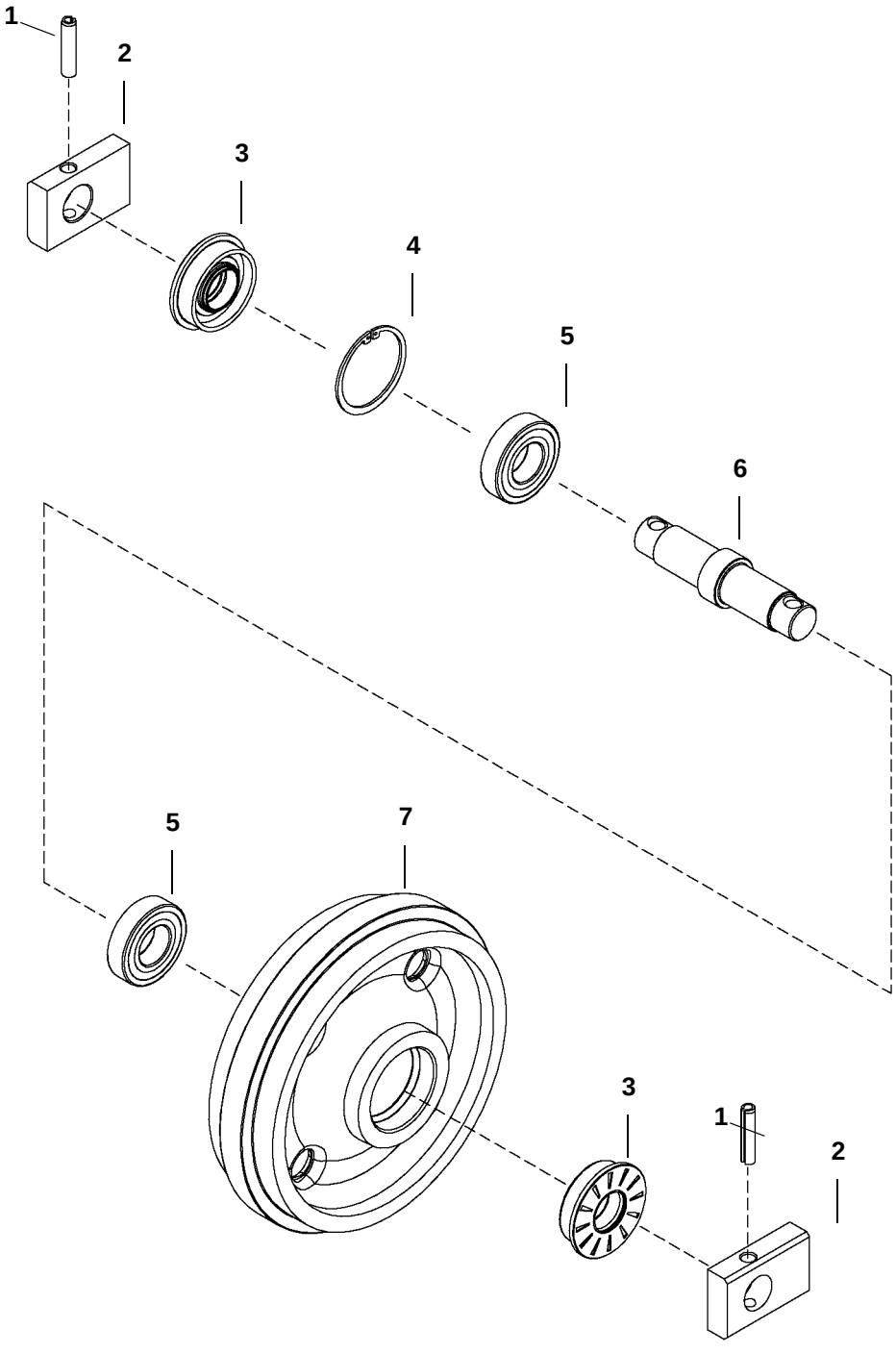
When traveling, a machine operator should be careful not to drive over any projections on the ground. He should also prevent rubber tracks from coming into contact with concrete walls, ditches and ridges. If rubber tracks are detracked, the machine should be stopped immediately for retracking.


Bobcat®

TRACK IDLER

Parts Identification

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

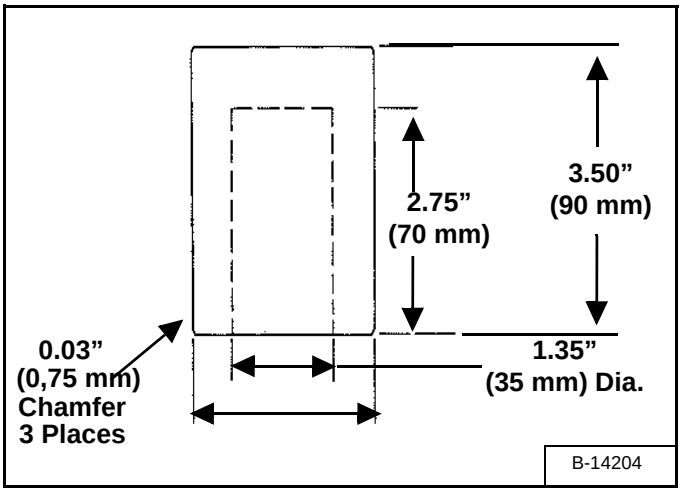


PE2202S

Disassembly

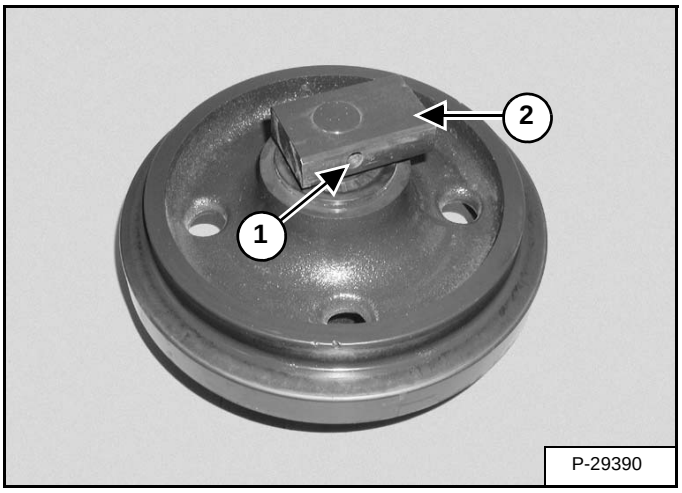
The following tools must be fabricated for this procedure:

Figure 30-50-1



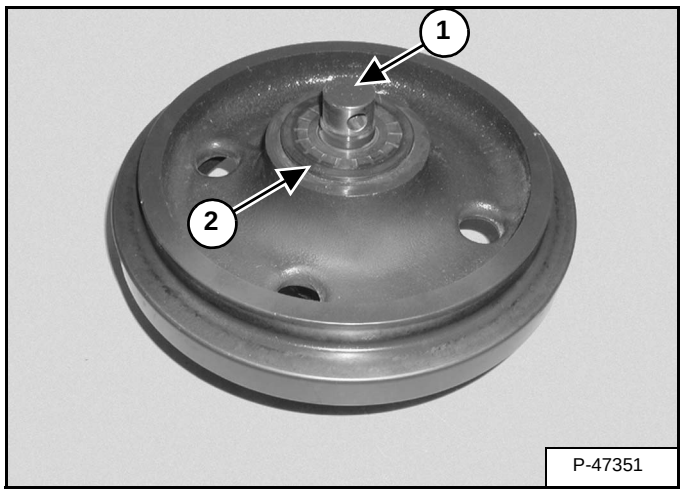
1. Driver Tool - see figure **[Figure 30-50-1]**.
2. Support Fixture - Tube, 3.0 inches ID x 0.250 inch wall x 6.0 inches long.

Figure 30-50-2



Remove the roll pin (Item 1) and block (Item 2) **[Figure 30-50-2]** from each end of the shaft.

Figure 30-50-3

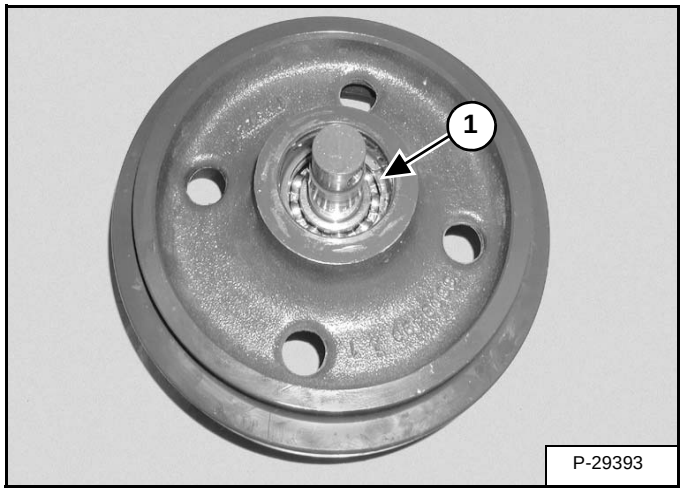


Remove any corrosion or paint from both ends of the exposed shaft (Item 1) **[Figure 30-50-3]** that could affect seal removal or damage the new seal during installation.

Apply penetrating oil to both ends of the exposed shaft to ease removal of the seal.

Remove the seal (Item 2) **[Figure 30-50-3]** from both sides of the idler.

Figure 30-50-4

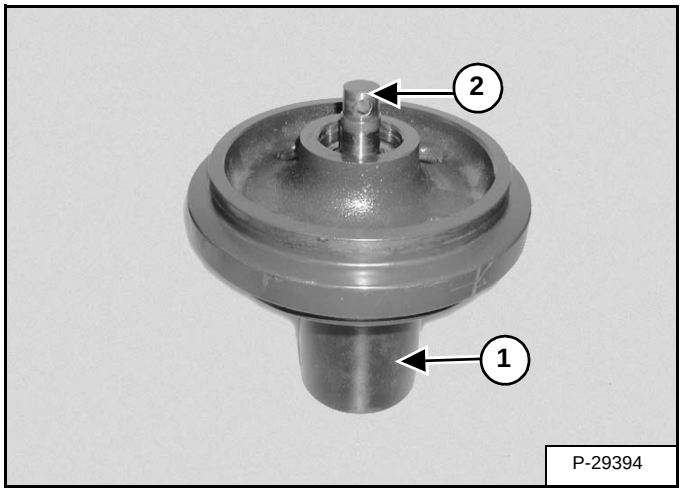


Remove the snap ring (Item 1) **[Figure 30-50-4]**.

NOTE: The snap ring is installed on one side of the idler. The other side is stepped to retain the bearing.

Disassembly (Cont'd)

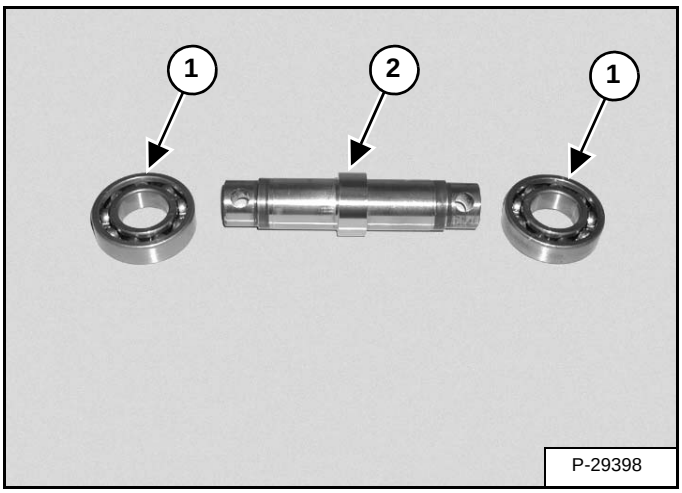
Figure 30-50-5



Place the idler on the support fixture (Item 1) **[Figure 30-50-5]**.

Using a soft faced hammer, tap the shaft (Item 2) **[Figure 30-50-5]** and bearing out the bottom of the idler.

Figure 30-50-6

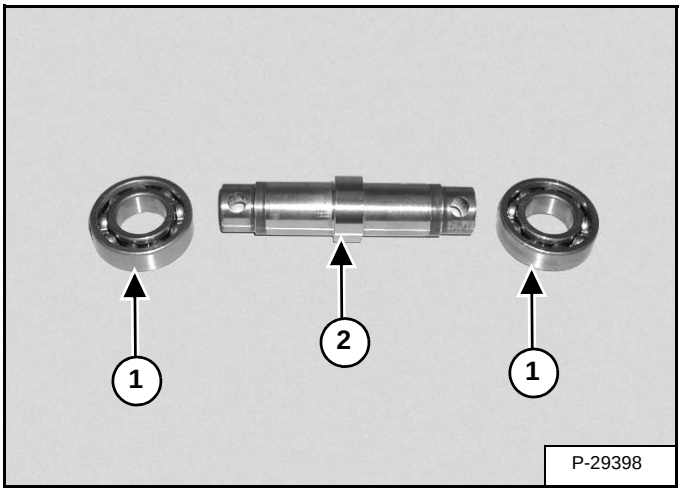


Slide the bearings (Item 1) off of the shaft (Item 2) **[Figure 30-50-6]**.

Assembly

Clean all parts in solvent and dry with compressed air.

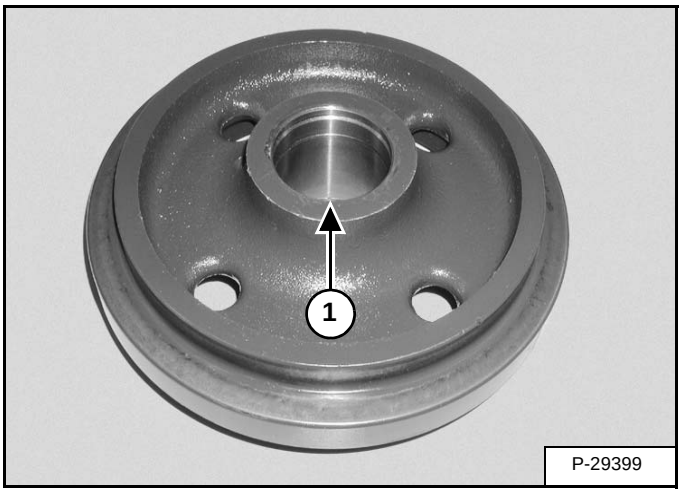
Figure 30-50-7



Inspect the bearings (Item 1) and shaft (Item 2) **[Figure 30-50-7]** for wear or damage. Replace any worn or damaged parts.

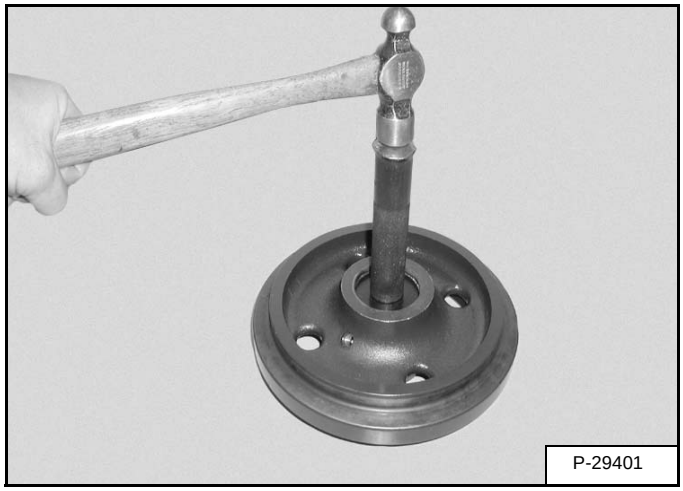
The bearings are sealed. If the bearings do not roll smoothly, or if the seals are damaged, replace the bearings.

Figure 30-50-8



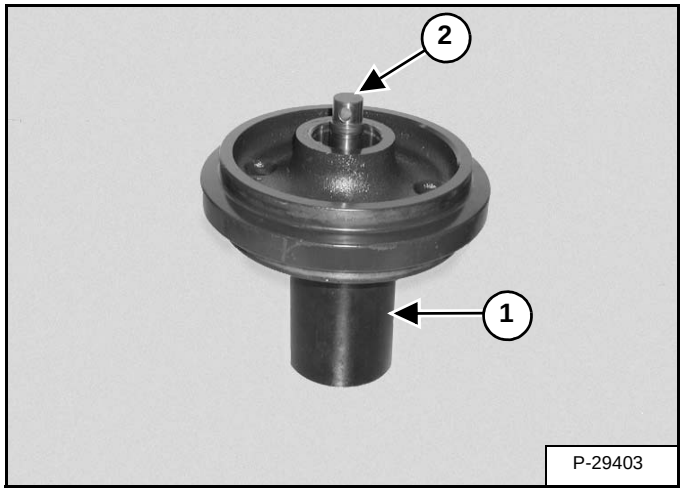
Remove all paint and corrosion from the seal surface (Item 1) **[Figure 30-50-8]** on both sides of the idler.

Figure 30-50-9



Using a bearing driver, install the bearing in the idler **[Figure 30-50-9]**.

Figure 30-50-10

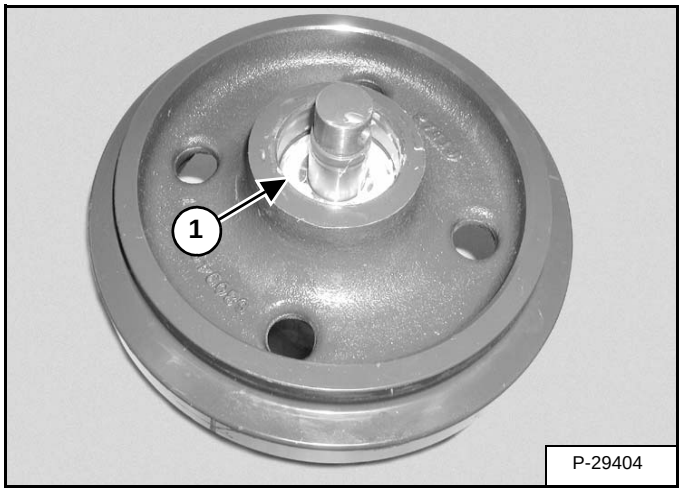


Place the idler on the support fixture (Item 1) **[Figure 30-50-10]**.

Install the shaft (Item 2) **[Figure 30-50-10]**.

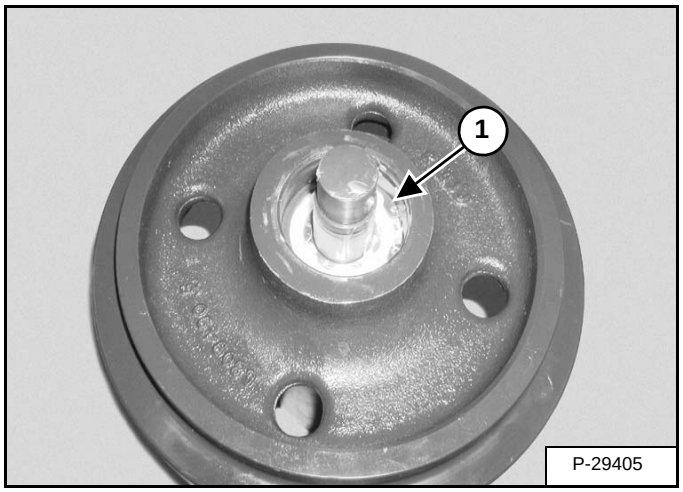
Assembly (Cont'd)

Figure 30-50-11



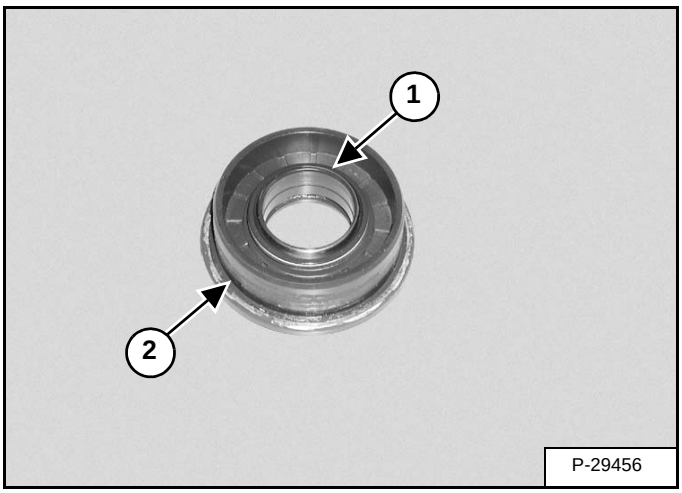
Install the bearing (Item 1) **[Figure 30-50-11]**. Use a brass drift to seat the bearing.

Figure 30-50-12



Install the snap ring (Item 1) **[Figure 30-50-12]**.

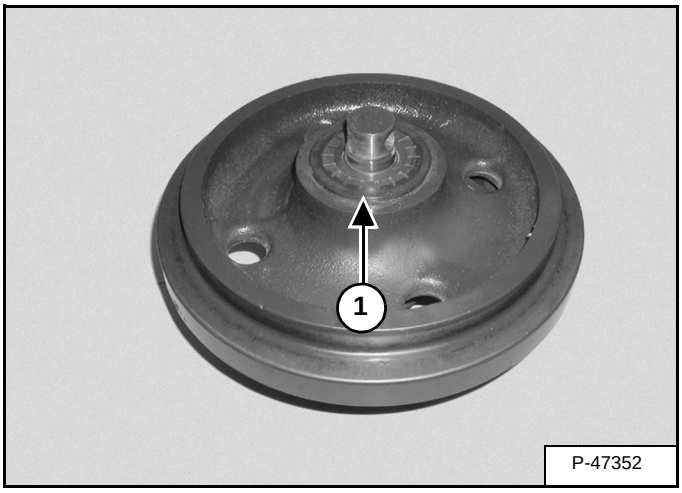
Figure 30-50-13



Apply assembly lube to the inside diameter (Item 1) **[Figure 30-50-13]** of the seal.

Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-50-13]** of the seal.

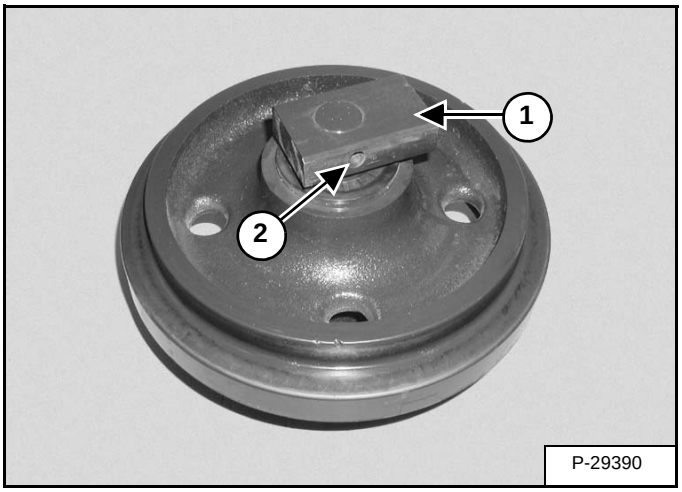
Figure 30-50-14



Using the driving tool, install the seal (Item 1) **[Figure 30-50-14]** on both sides of the idler.

Assembly (Cont'd)

Figure 30-50-15

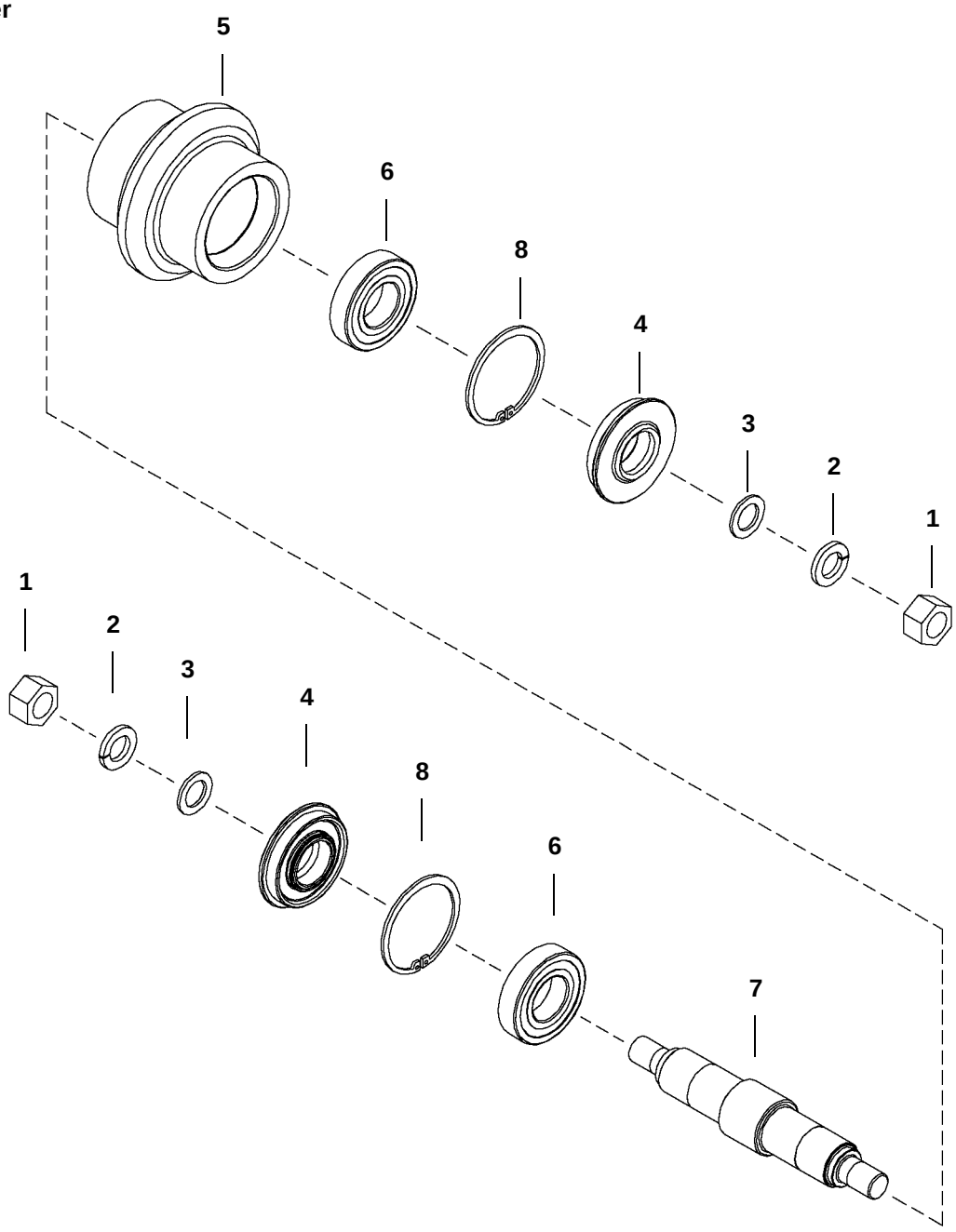


Install the block (Item 1) and roll pin (Item 2) **[Figure 30-50-15]** on both sides of the shaft.

TRACK ROLLER

Parts Identification

1. Nut
2. Lock Washer
3. Washer
4. Seal
5. Roller
6. Bearing
7. Shaft
8. Snap Ring

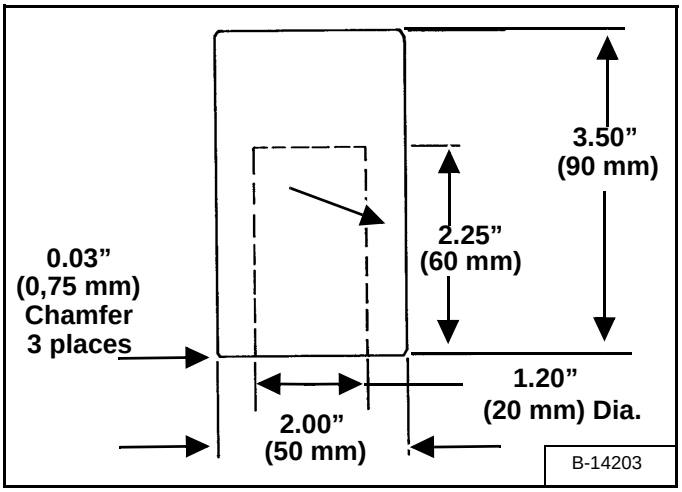


PE1914S

Disassembly

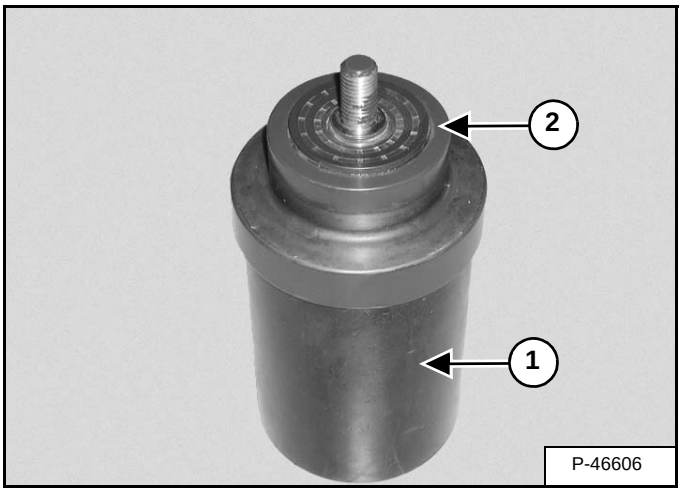
The following tools must be fabricated for this procedure:

Figure 30-60-1



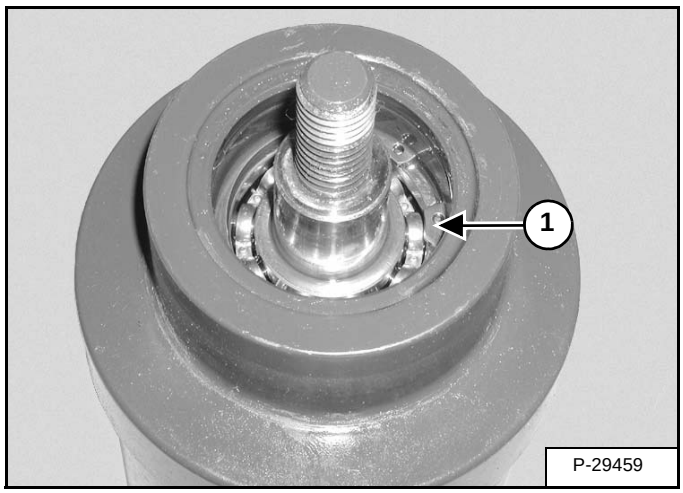
1. Driver Tool - see **[Figure 30-60-1]**.
2. Support Fixture - Tube, 3" ID x 1/4" wall x 6 inches long.

Figure 30-60-2



Support the roller in the support fixture (Item 1). Remove the seal (Item 2) **[Figure 30-60-2]** from both sides of the roller.

Figure 30-60-3

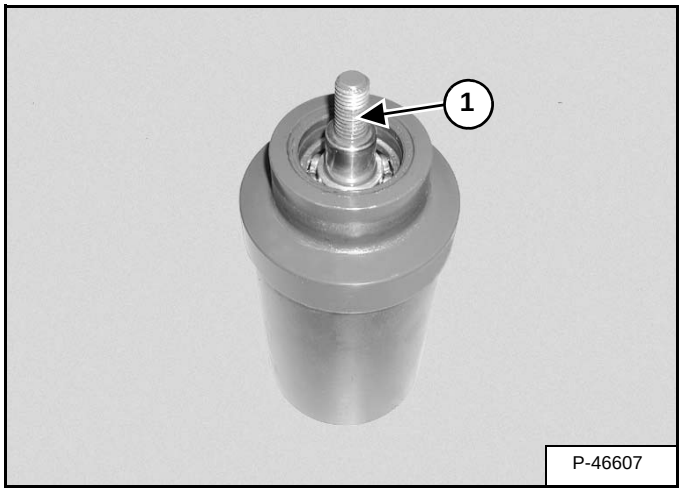


Remove the snap ring (Item 1) **[Figure 30-60-3]**.

NOTE: The snap ring is installed on one side of the roller. The other side is stepped to retain the bearing.

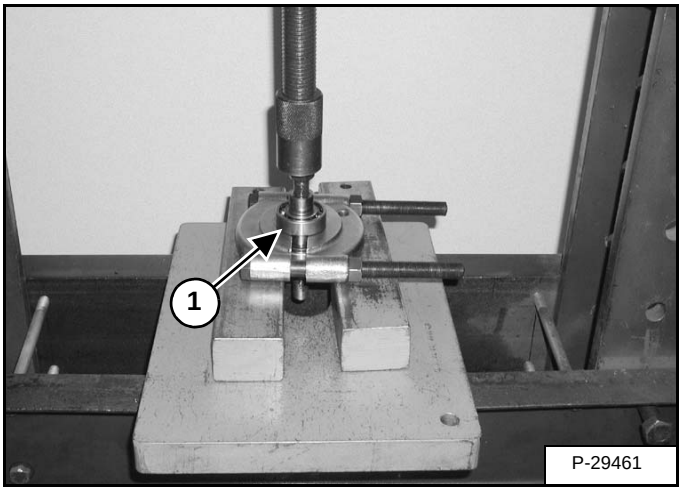
Disassembly (Cont'd)

Figure 30-60-4



Turn the roller over and tap the shaft (Item 1) **[Figure 30-60-4]** and bearings out the bottom of the roller.

Figure 30-60-5

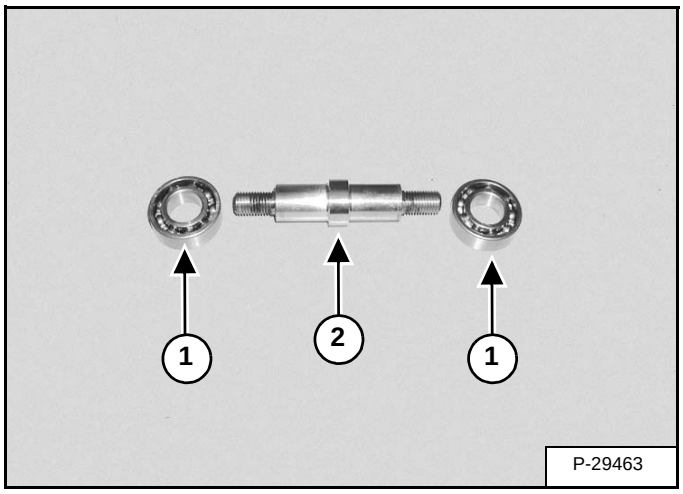


Press the bearings (Item 1) **[Figure 30-60-5]** off the shaft.

Assembly

Clean all parts in solvent and dry with compressed air.

Figure 30-60-6

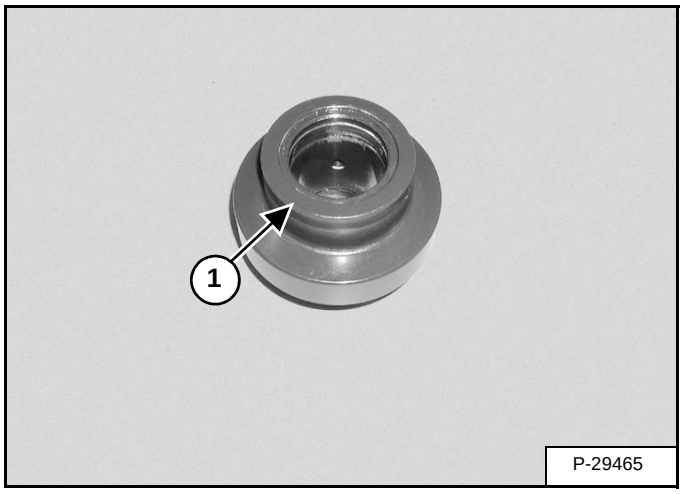


Inspect the bearings (Item 1) and shaft (Item 2) **[Figure 30-60-6]** for wear or damage.

The bearings are sealed. If the bearings do not roll smoothly or if the seals are damaged, replace the bearings.

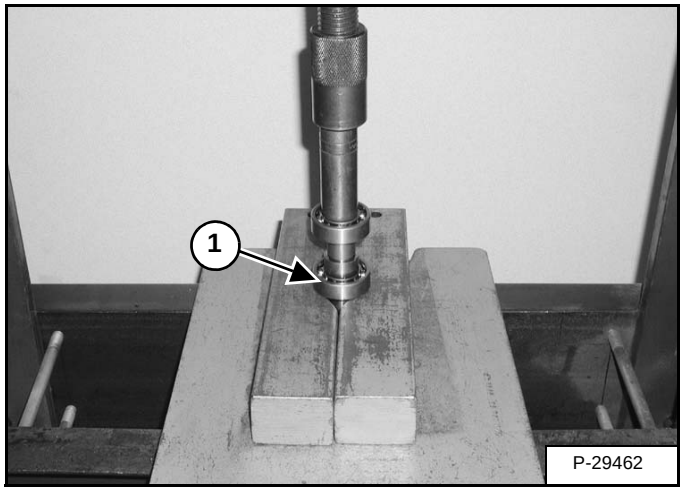
Replace any worn or damaged parts.

Figure 30-60-7



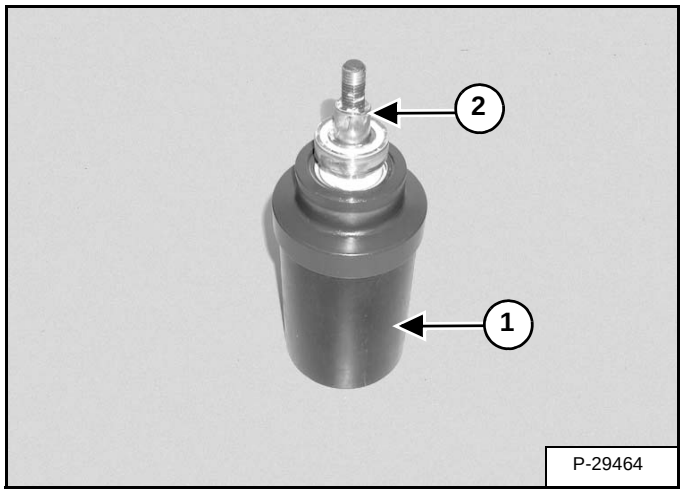
Remove all paint and corrosion from the seal surface (Item 1) **[Figure 30-60-7]** on both sides of the roller.

Figure 30-60-8



Press the bearings (Item 1) **[Figure 30-60-8]** on the shaft.

Figure 30-60-9

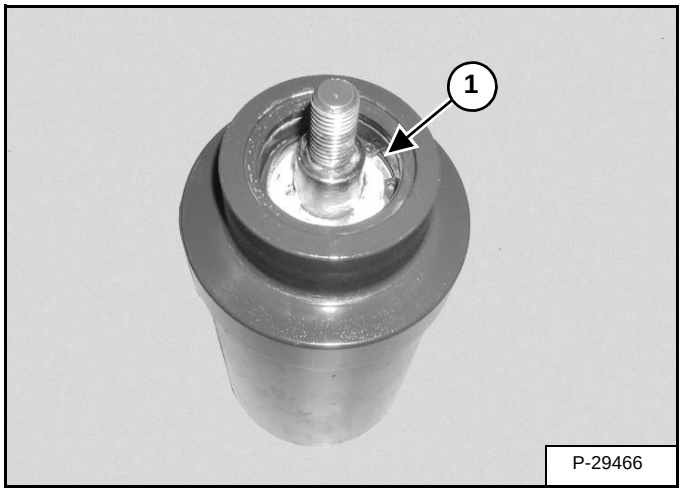


Place the roller on the support fixture (Item 1) **[Figure 30-60-9]**.

Tap the shaft and bearing assembly (Item 2) **[Figure 30-60-9]** into the roller.

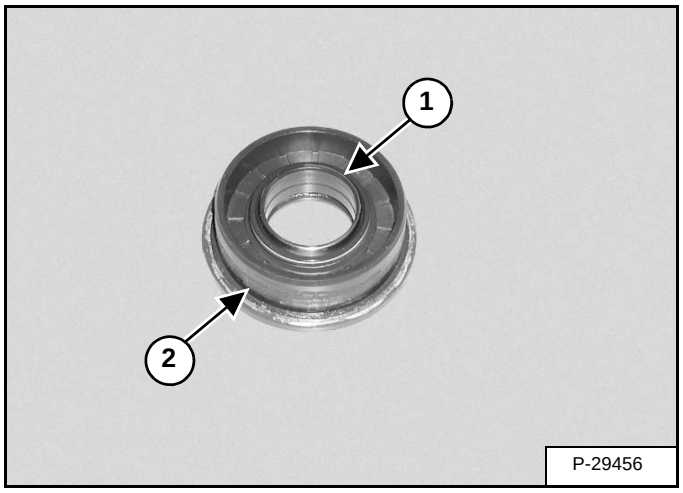
Assembly (Cont'd)

Figure 30-60-10



Install the snap ring (Item 1) **[Figure 30-60-10]**.

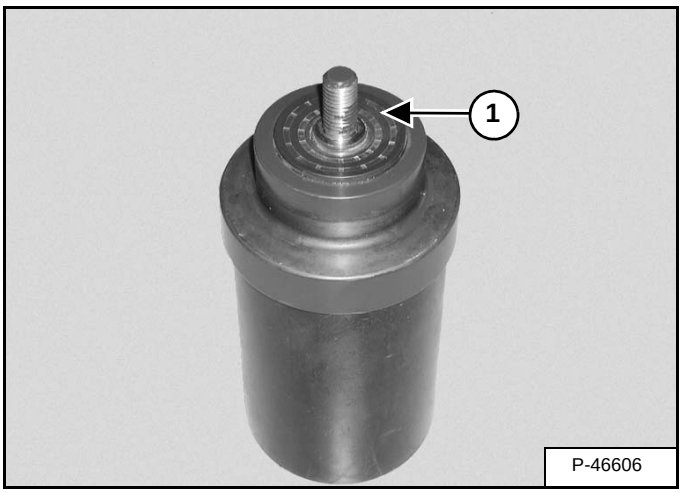
Figure 30-60-11



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

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

Figure 30-60-12



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


Bobcat®

SWING CIRCLE GEAR

Removal and Installation

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

Figure 30-70-1

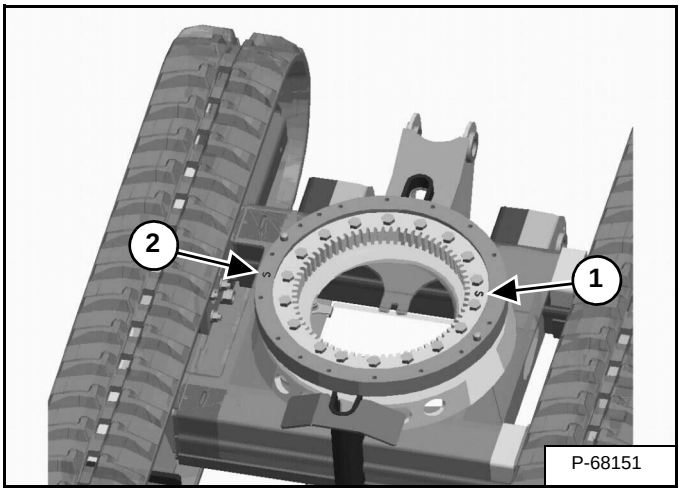
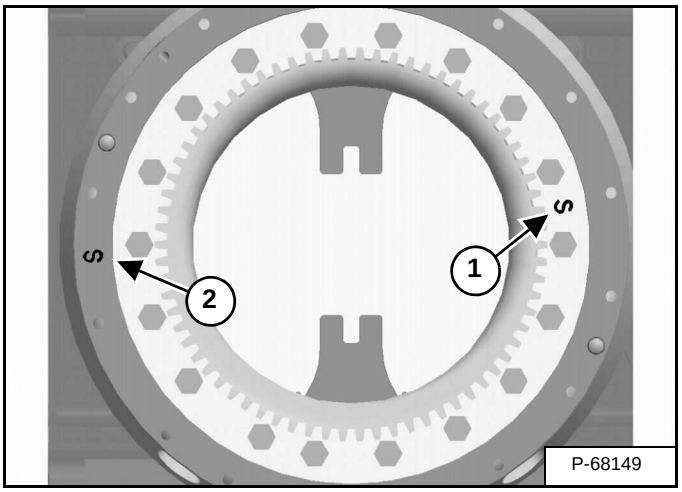


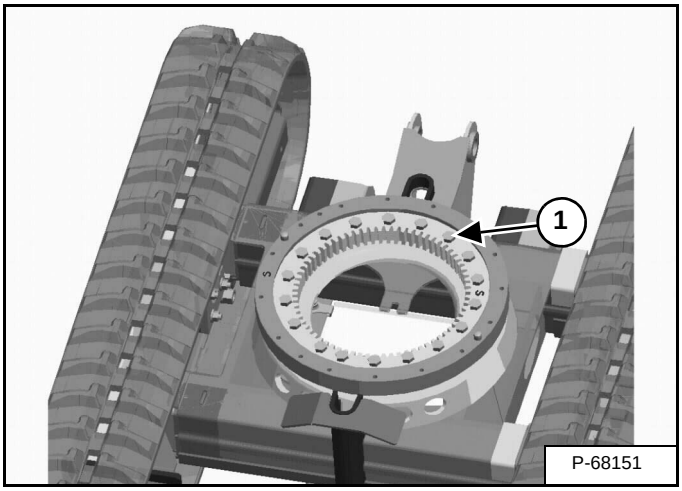
Figure 30-70-2



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 30-70-1]** and **[Figure 30-70-2]** stamped in the outer ring.

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

Figure 30-70-3



Remove the bolts and nuts from the swing circle gear **[Figure 30-70-3]**.

Installation: Tighten the bolts and nuts to 78 to 85 ft.-lb. (105 to 115 N•m) torque.


Bobcat®

UPPERSTRUCTURE AND SWING SECTION

ARM 40-200-1
Arm To Boom Bushing Removal And Installation 40-200-2
Arm To Bucket And Bucket Link Bushing Removal And Installation 40-200-3
Description 40-200-1
Removal And Installation. 40-200-1

BLADE CONTROL 40-80-1
Cable Removal and Installation. 40-80-4
Disassembly And Assembly 40-80-2
Removal and Installation 40-80-1

BOOM. 40-190-1
Boom Bushing Removal And Installation 40-190-2
Description 40-190-1
Removal And Installation. 40-190-1

BUCKET 40-210-1
Removal And Installation. 40-210-1

CAB 40-30-1
Door Removal And Installation 40-30-5
Front Window Removal And Installation 40-30-6
Glass Installation. 40-30-12
Glass Removal 40-30-10
Removal And Installation. 40-30-1
Right Side Front And Rear Sliding Window Weather Strip Removal And Installation 40-30-11
Right Side Front And Rear Sliding Window Wiper Strip Removal And Installation 40-30-11
Right Side Front Sliding Window Removal And Installation 40-30-10
Right Side Rear Sliding Window Removal And Installation. 40-30-9

CONTROL LINKAGE ASSEMBLY 40-130-1
Bracket of Control Linkage Disassembly And Assembly. 40-130-8
Description 40-130-1
Left Half of Control Linkage Disassembly And Assembly 40-130-5
Removal And Installation. 40-130-1
Right Half of Control Linkage Disassembly And Assembly 40-130-3

ENGINE SPEED CONTROL 40-70-1
Cable Removal and Installation. 40-70-2
Removal and Installation 40-70-1

FLOOR MAT AND FLOOR PANELS 40-140-1
Description 40-140-1
Removal and Installation 40-140-1

Continued On Next Page

FUEL TANK. 40-160-1
Removal and Installation 40-160-1

HORN 40-170-1
Removal And Installation. 40-170-1

LEFT CONSOLE. 40-60-1
Compression Spring Disassembly And Assembly. 40-60-4
Compression Spring Removal And Installation 40-60-3
Description. 40-60-1
Joystick Console Cover (Bottom) Removal And Installation 40-60-1
Joystick Console Cover (Top) Removal And Installation 40-60-2
Joystick Console Frame Disassembly And Assembly 40-60-8
Joystick Console Frame Removal And Installation 40-60-7
Left Rear Console Cover Removal And Installation. 40-60-8
Left Rear Console Frame Removal And Installation 40-60-9
Lever Removal And Installation 40-60-6

LEFT PEDAL. 40-120-1
Disassembly And Assembly 40-120-1
Removal And Installation. 40-120-1

RIGHT CONSOLE 40-50-1
Compression Spring Disassembly And Assembly (Canopy Only). . . 40-50-5
Compression Spring Removal And Installation (Canopy Only) 40-50-4
Description. 40-50-1
Joystick Console Cover (Bottom) Removal And Installation 40-50-1
Joystick Console Cover (Top) Disassembly And Assembly. 40-50-3
Joystick Console Cover (Top) Removal And Installation 40-50-2
Joystick Console Frame Disassembly And Assembly 40-50-9
Joystick Console Frame Removal And Installation 40-50-8
Lever Removal And Installation (Canopy Only) 40-50-6
Right Rear Console Cover Disassembly and Assembly 40-50-11
Right Rear Console Cover Removal And Installation 40-50-10
Right Rear Console Frame Removal And Installation 40-50-12

RIGHT PEDAL 40-100-1
Disassembly And Assembly 40-100-1
Removal And Installation. 40-100-1

ROPS CANOPY 40-20-1
Removal And Installation. 40-20-1

Continued On Next Page

UPPERSTRUCTURE AND SWING SECTION (CONT'D)

SEAT AND SEAT MOUNT 40-40-1
Removal And Installation 40-40-1

SWING FRAME 40-180-1
Boom Pivot Bushing Installation 40-180-5
Boom Pivot Bushing Removal 40-180-4
Bushing Removal and Installation 40-180-2
Description 40-180-1
Removal And Installation 40-180-1
Swing Frame Bushing Installation 40-180-4
Swing Frame Bushing Removal 40-180-3

TAILGATE 40-220-1
Latch Removal And Installation 40-220-2
Removal And Installation 40-220-1

TRAVEL CONTROLS 40-110-1
Disassembly And Assembly 40-110-1
Removal And Installation 40-110-1

UPPERSTRUCTURE 40-10-1
Description 40-10-1
Installation 40-10-3
Removal 40-10-1

UPPERSTRUCTURE SLEW LOCK 40-90-1
Disassembly And Assembly 40-90-1
Removal and Installation 40-90-1


Bobcat®

UPPERSTRUCTURE

Description

The upperstructure includes all the components in or attached to the frame and connects to the slew bearing. The slew bearing divides the upperstructure from the undercarriage, which includes the track frame components.

Removal

Fully extend the cylinders of the bucket and arm. Fully retract the cylinder of the boom.

Lower the blade to the ground.

Remove the battery (See Removal and Installation on Page 50-20-2).

Remove the cab or canopy (See Removal And Installation on Page 40-30-1).

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

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

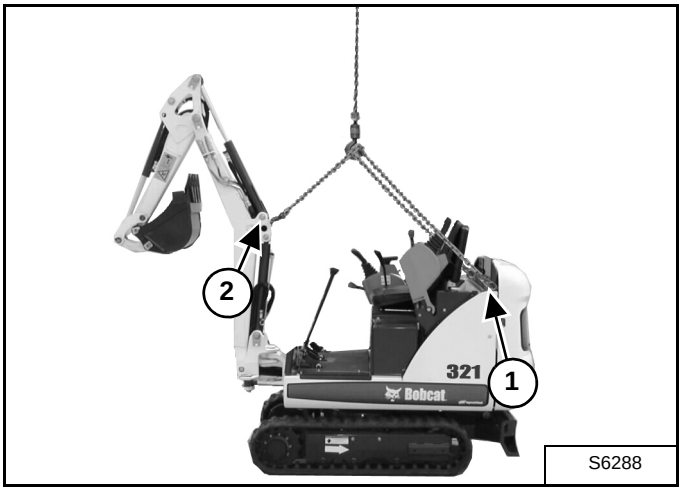
Remove the floor mat and floor panels (See Removal and Installation on Page 40-140-1).

Remove the control linkage assembly (See Removal and Installation on Page 40-90-1).

Remove the hydraulic control valve (See Removal And Installation on Page 20-40-1).

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

Figure 40-10-1



Install eye bolts (Item 1) **[Figure 40-10-1]** in the rear cab / canopy mounts.

Fasten chains to the eyebolts and up to the chain hoist.

Install a 1 in. (0,25 mm) bolt (Grade 5) (Item 2) **[Figure 40-10-1]** through the hole at the top of the boom. Fasten a chain from the bolt to the chain hoist.

⚠ WARNING

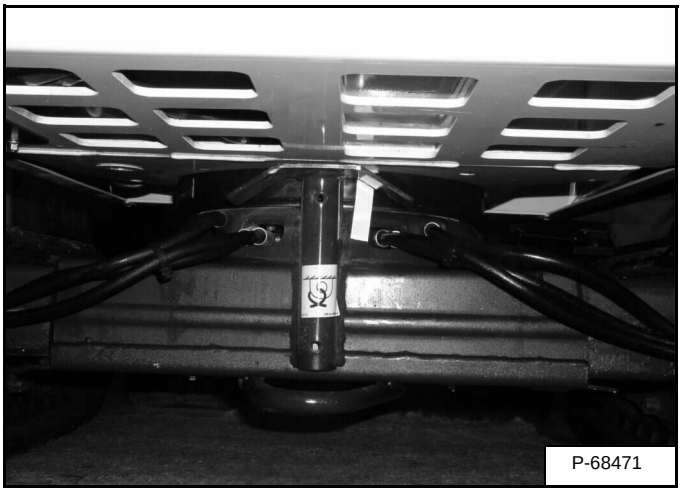
AVOID INJURY OR DEATH

- **Use a lifting fixture with sufficient capacity for the weight of the excavator plus any added attachments.**
- **Maintain center of gravity and balance when lifting.**
- **Do not swing boom or upperstructure. Engage the swing locking lever.**
- **Never lift with operator on machine.**

W-2202-0595

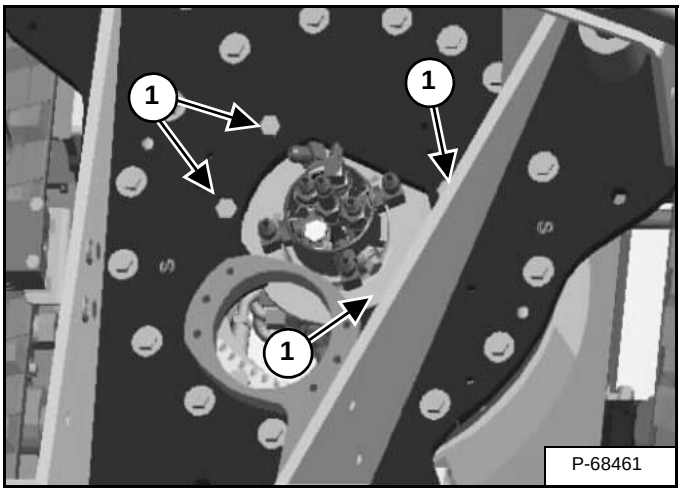
Removal (Cont'd)

Figure 40-10-2



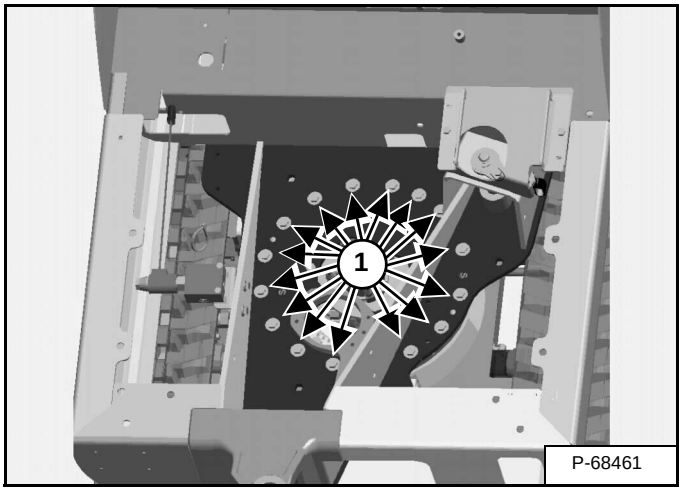
Mark the upperstructure to the swing bearing and to the track frame for ease of assembly **[Figure 40-10-2]**.

Figure 40-10-3



Remove the swivel joint nuts (Item 1) **[Figure 40-10-3]**.

Figure 40-10-4



Remove the 16 bolts (Item 1) **[Figure 40-10-4]** from the upperstructure.

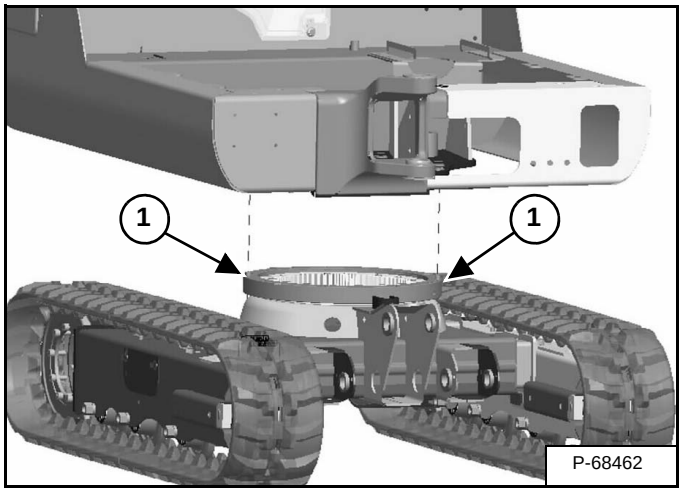
Lift the upperstructure off the swing bearing. Position the upperstructure onto supporting stands or blocks.

NOTE: Keep tension on the chain hoist to support the boom and arm when the upperstructure is supported on stands or blocks.

Installation

NOTE: Clean out the old excess Loctite® from all the 16 threaded holes in the slew bearing prior to installing the upperstructure.

Figure 40-10-5



Lower the upperstructure frame onto the swing bearing aligning the two pins (Item 1) **[Figure 40-10-5]**. Maintain a slight amount of weight on the hoist.

Install the 16 bolts and washers through the upperstructure frame and into the swing bearing.

Tighten the bolts to 42 to 46.5 ft.-lb. (57 to 63 N•m) torque.

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

Install the hydraulic control valve (See Removal And Installation on Page 20-40-1).

Install the control linkage assembly (See Removal and Installation on Page 40-90-1).

Install the floor mat and floor panels (See Removal and Installation on Page 40-100-1).

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

Fill the hydraulic reservoir (See Checking And Adding Hydraulic Oil on Page 10-100-1).

Install the battery (See Removal and Installation on Page 50-20-2).

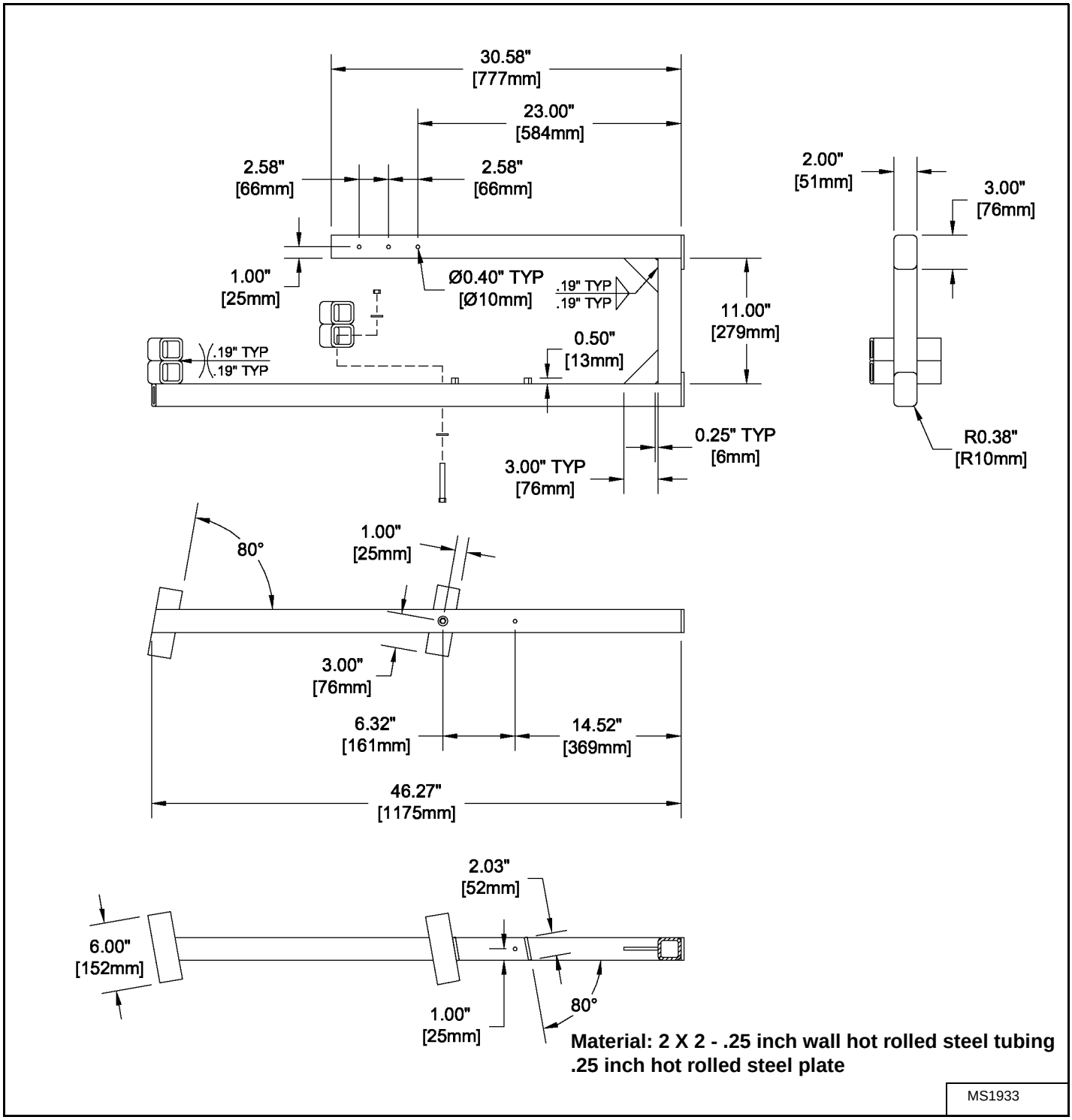
Install the cab or canopy (See Removal And Installation on Page 40-30-1).


Bobcat®

ROPS CANOPY

Removal And Installation

Figure 40-20-1

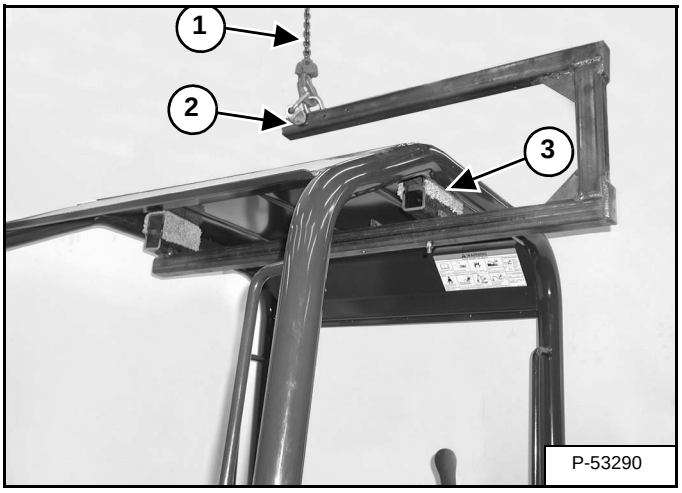


Build the service lifting bracket used to remove and install the ROPS canopy. Use the dimensions shown in **[Figure 40-20-1]** to build the service lifting bracket.

Removal And Installation (Cont'd)

Remove the upperstructure light (See UpperStructure Light Removal And Installation on Page 50-50-1.)

Figure 40-20-2



Install the chain hoist (Item 1) in the end hole of the lifting bracket (Item 2) **[Figure 40-20-2]**.

Install the cab / canopy service lifting bracket on the cab **[Figure 40-20-2]**.

NOTE: Use a lifting device of sufficient capacity.

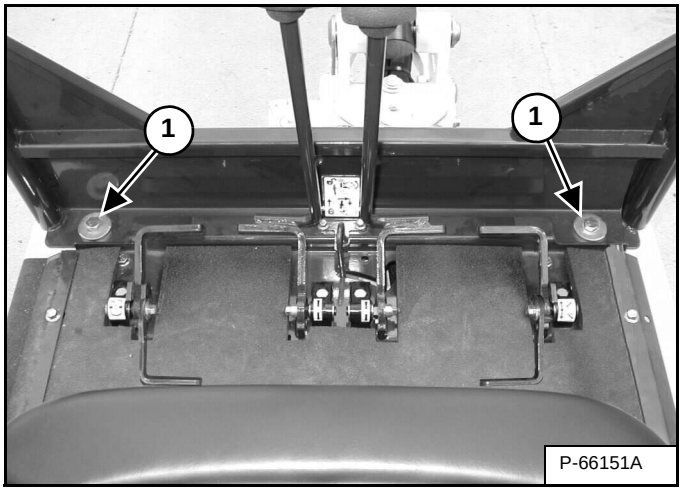
Adjust the lifting bracket to the proper width by moving the bracket (Item 3) **[Figure 40-20-2]**.

⚠ WARNING

Never use the cab/canopy service lifting bracket to lift the excavator. The bracket is not strong enough and can fail causing serious injury or death.

W-2384-1000

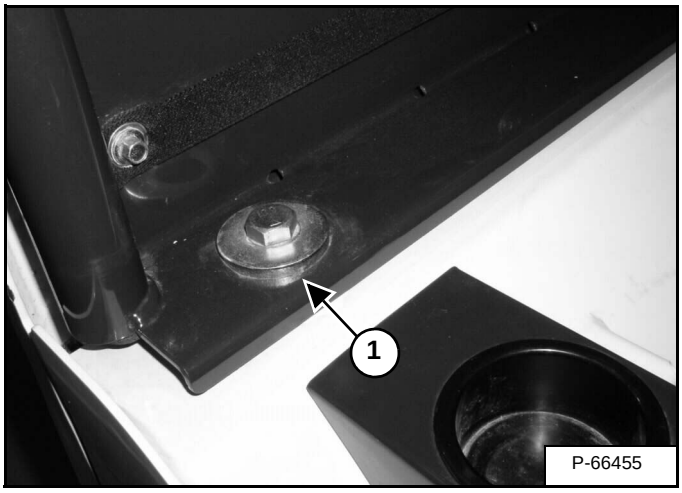
Figure 40-20-3



Remove the bolts, nuts and washers (Item 1) **[Figure 40-20-3]** from the front of the canopy.

Installation: Tighten the bolts to 118-133 ft.-lb. (160-180 N•m) torque.

Figure 40-20-4

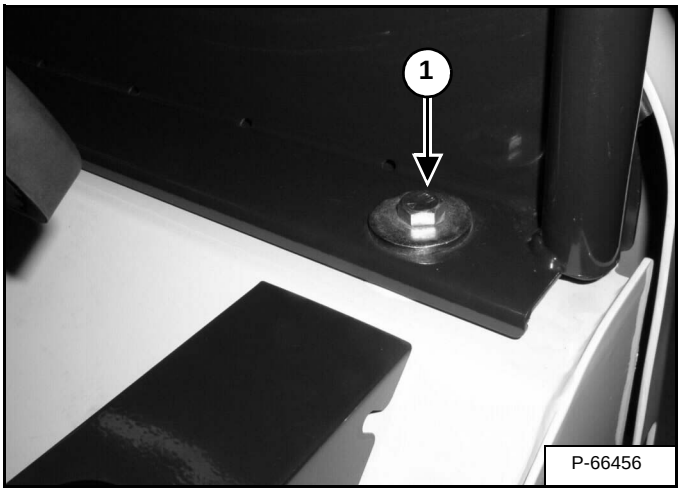


Remove the bolt and washer (Item 1) **[Figure 40-20-4]** from the right rear of the canopy.

Installation: Tighten the bolt to 118-133 ft.-lb. (160-180 N•m) torque.

Removal And Installation (Cont'd)

Figure 40-20-5



Remove the bolt and washer (Item 1) **[Figure 40-20-5]** from the left rear of the canopy.

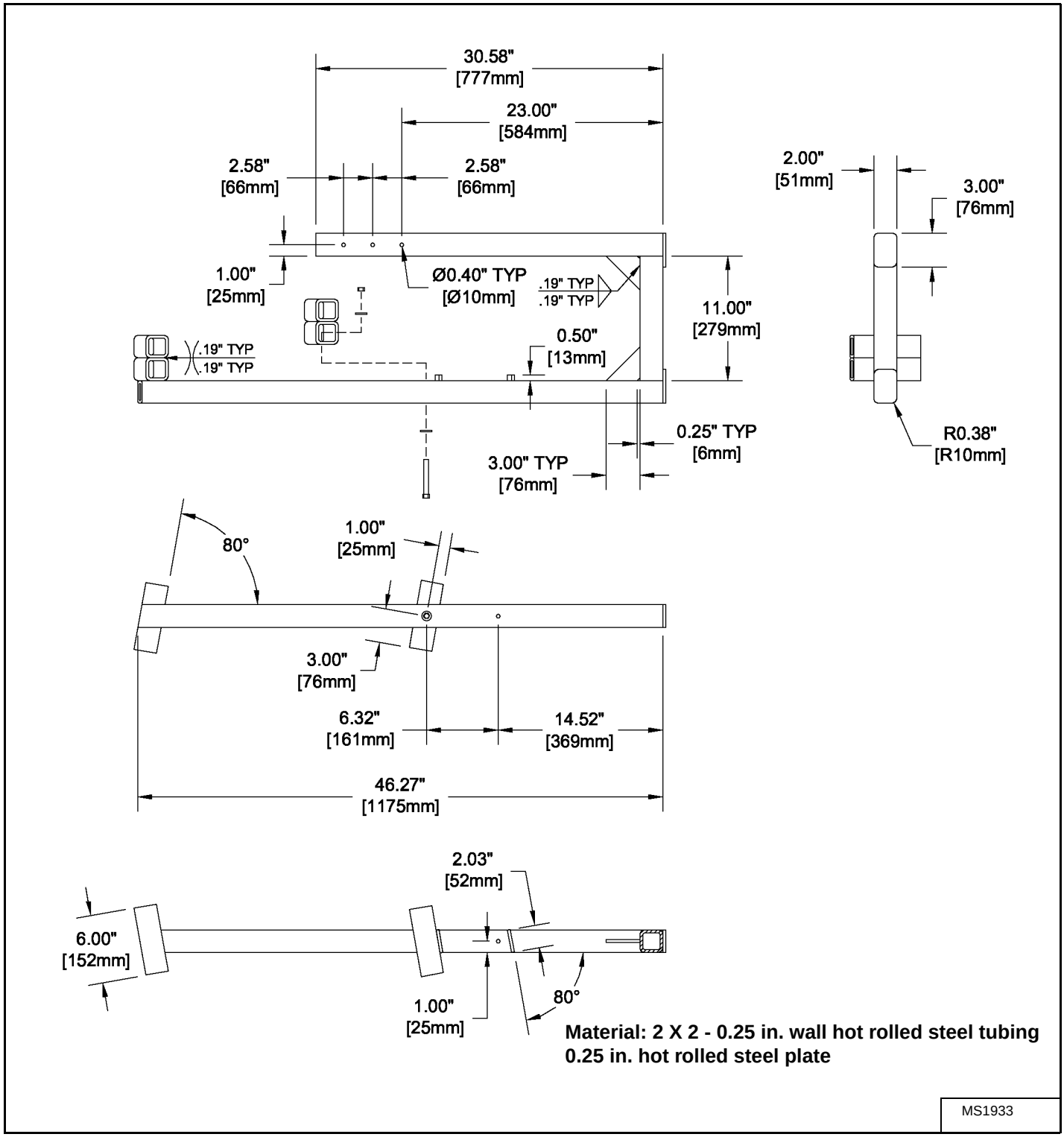
Installation: Tighten the bolt to 118-133 ft.-lb. (160-180 N•m) torque.

Remove the canopy from the upperstructure.


Bobcat®

Removal And Installation

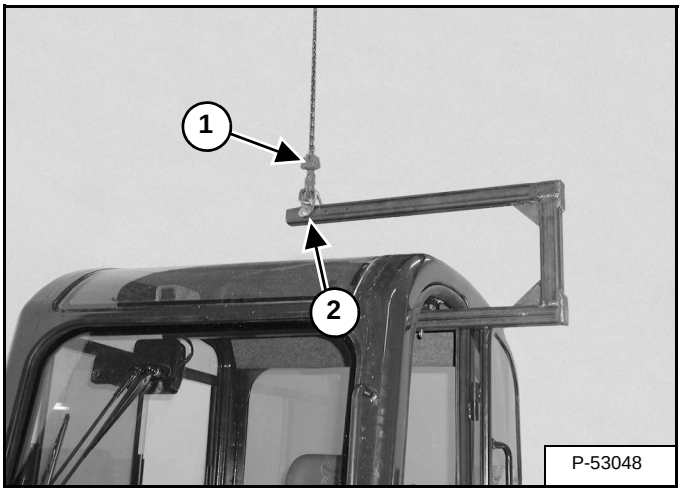
Figure 40-30-1



Build the service lifting bracket used to remove and install the cab. Use the dimensions shown in **[Figure 40-30-1]** to build the service lifting bracket.

Removal And Installation (Cont'd)

Figure 40-30-2



Install the chain hoist (Item 1) in the end hole of the lifting bracket (Item 2) **[Figure 40-30-2]**.

Install the cab / canopy service lifting bracket on the cab **[Figure 40-30-2]**.

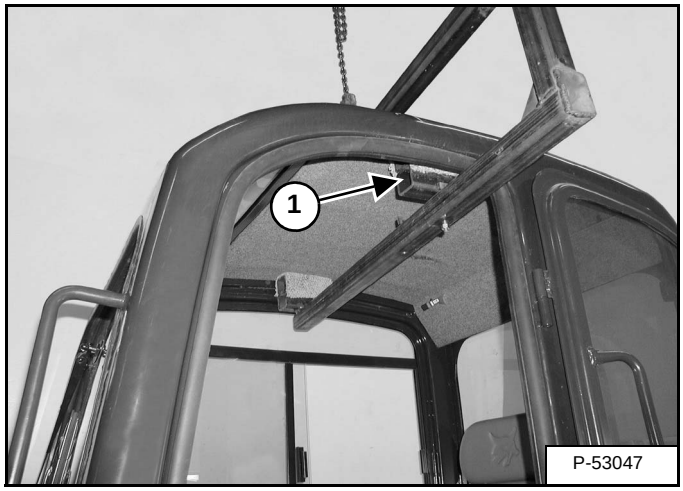
NOTE: Use a chain hoist of sufficient capacity.

⚠ WARNING

Never use the cab/canopy service lifting bracket to lift the excavator. The bracket is not strong enough and can fail causing serious injury or death.

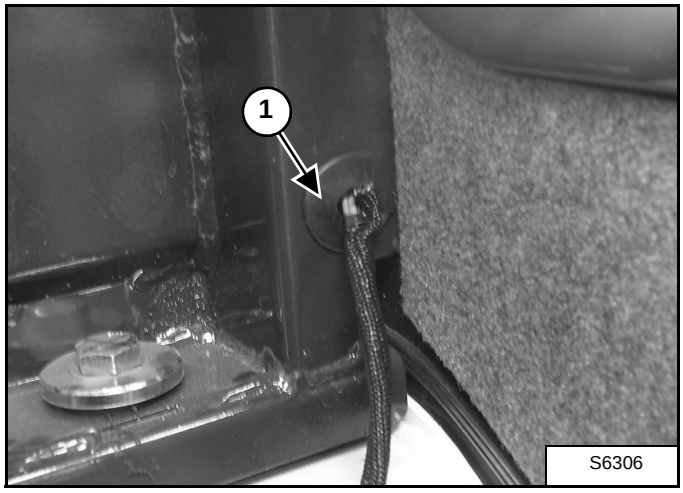
W-2384-1000

Figure 40-30-3



Adjust the lifting bracket to the proper width by moving the bracket (Item 1) **[Figure 40-30-3]**.

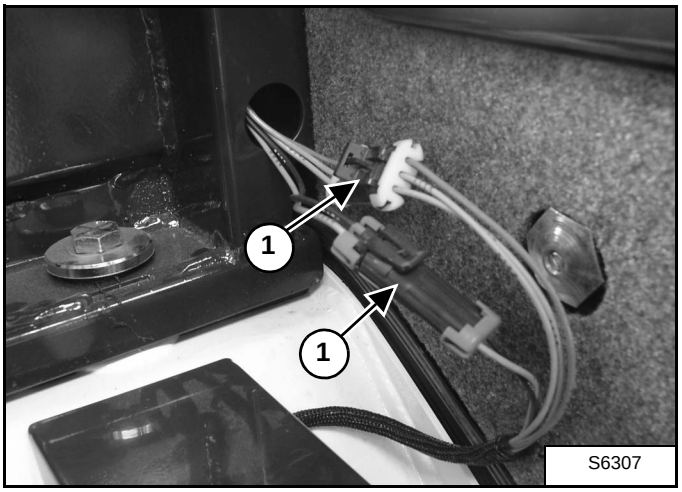
Figure 40-30-4



Remove the grommet (Item 1) **[Figure 40-30-4]** located in the left rear corner of the cab.

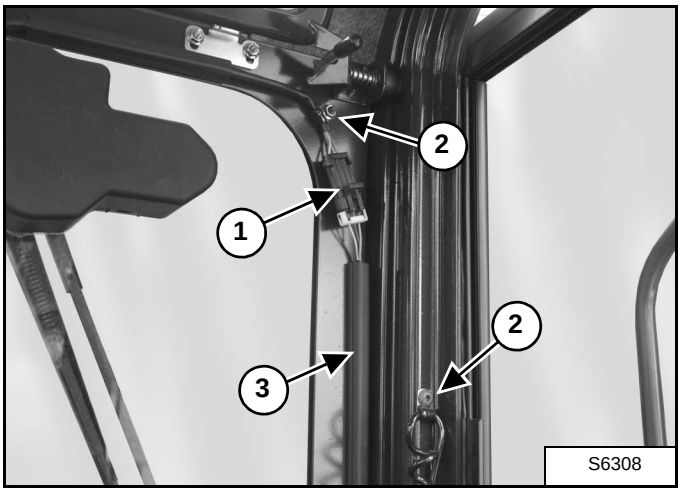
Removal And Installation (Cont'd)

Figure 40-30-5



Remove the wire harness from the cab frame and disconnect the wire connectors (Item 1) **[Figure 40-30-5]**.

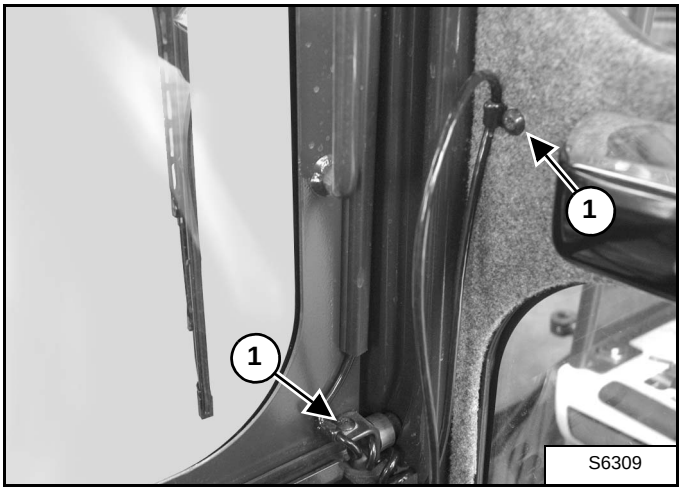
Figure 40-30-6



Disconnect the wire harness (Item 1) and remove the screws (Item 2) **[Figure 40-30-6]**.

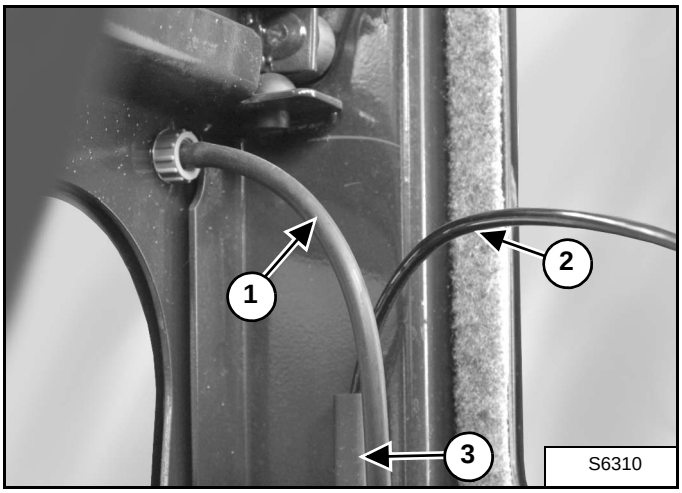
Remove the wire harness from the channel (Item 3) **[Figure 40-30-6]**.

Figure 40-30-7



Remove the screws (Item 1) **[Figure 40-30-7]**.

Figure 40-30-8

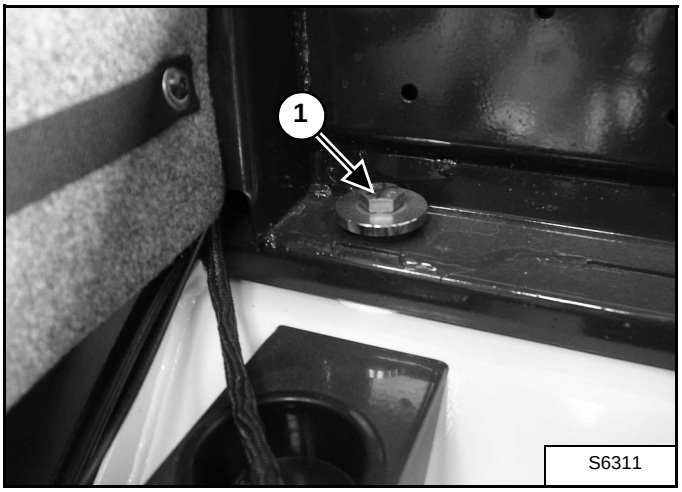


Remove the windshield washer hose (Item 1) **[Figure 40-30-8]** from the nozzle.

Remove the wire harness (Item 2) and washer hose from the channel (Item 3) **[Figure 40-30-8]**.

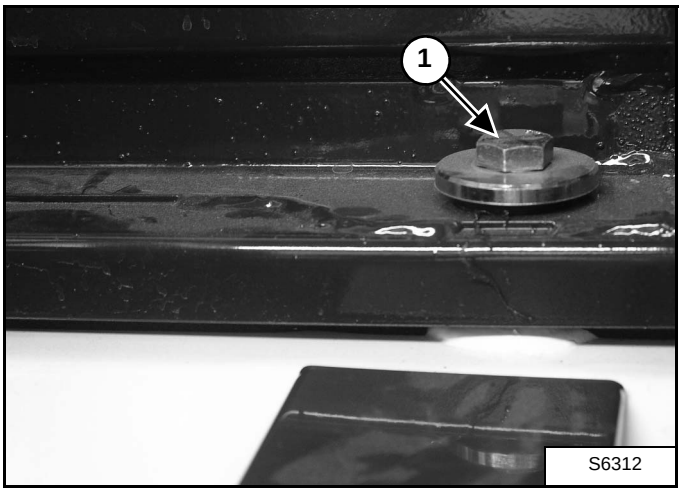
Removal And Installation (Cont'd)

Figure 40-30-9



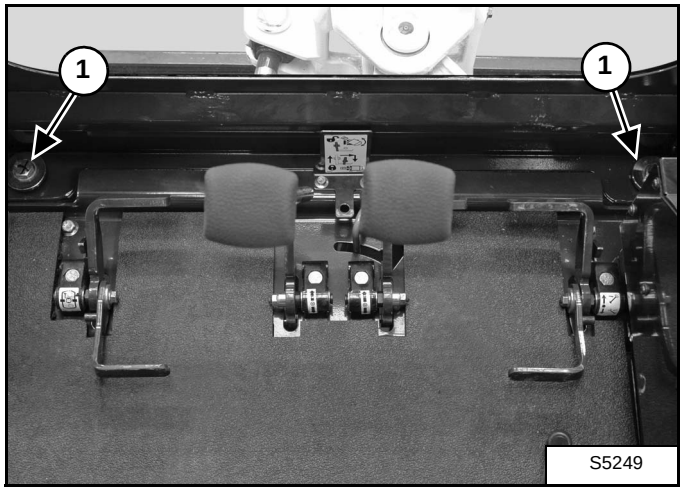
Remove the bolt and washer (Item 1) **[Figure 40-30-9]** from the right rear of the cab.

Figure 40-30-10



Remove the bolt and washer (Item 1) **[Figure 40-30-10]** from the left rear of the cab.

Figure 40-30-11

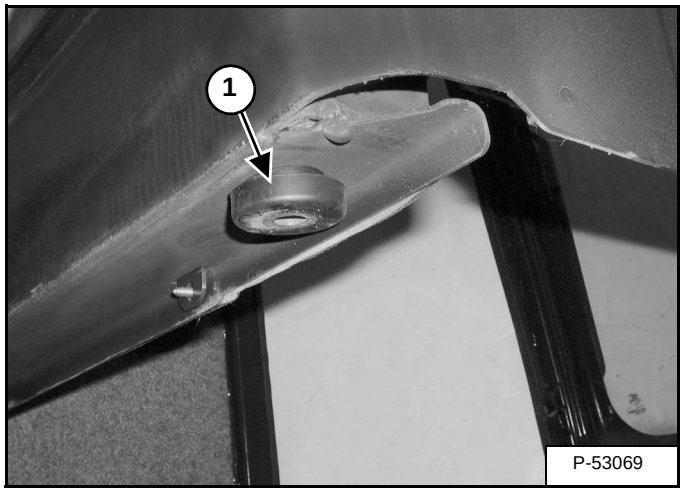


Remove the bolts, nuts and washers (Item 1) **[Figure 40-30-11]** from the front of the cab.

Installation: Tighten the bolts to 118 to 133 ft.-lb. (160 to 180 N•m) torque.

Raise the hoist and remove the cab.

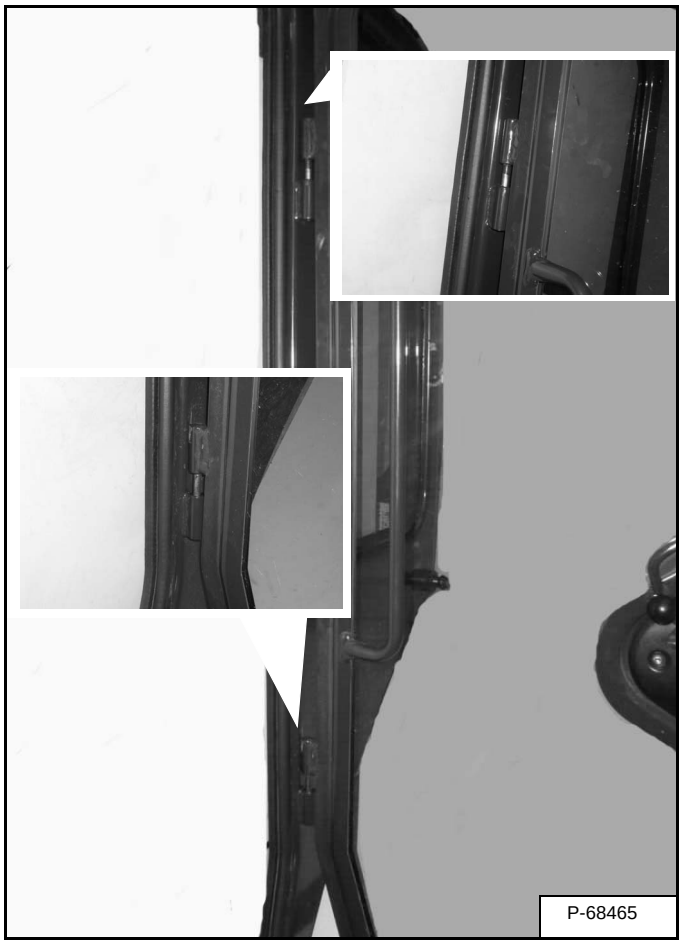
Figure 40-30-12



Installation: Install the cab mounts (Item 1) **[Figure 40-30-12]** on the four corners of the cab.

Door Removal And Installation

Figure 40-30-13



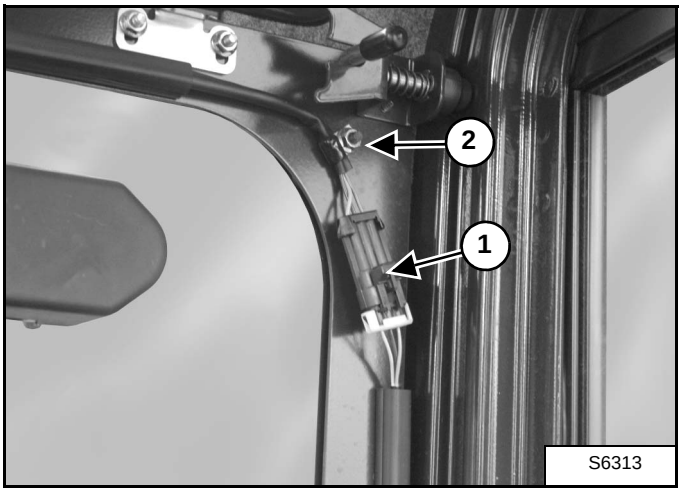
The door can be removed from the cab by slowly swinging the door back and forth while lifting up on the door **[Figure 40-30-13]**.

Installation: Align the hinges and swing the door back and forth until the door weight settles the hinges to full engagement.

NOTE: Early style door with one piece glass is shown. Later model doors have two pieces of glass. The procedure is the same for both styles of doors.

Front Window Removal And Installation

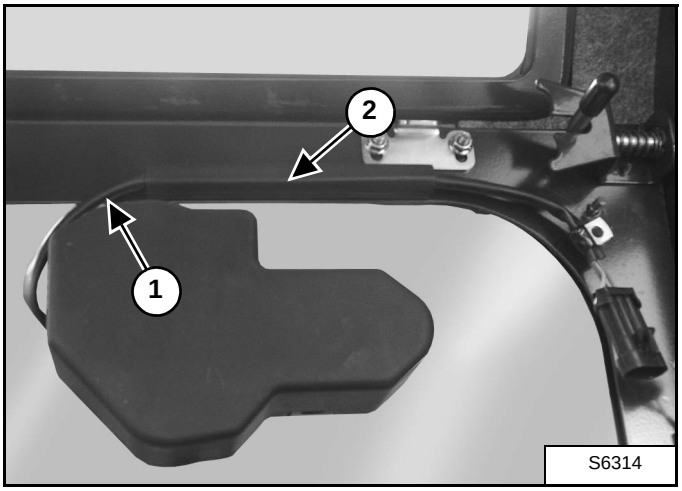
Figure 40-30-14



Disconnect the wire harness (Item 1) **[Figure 40-30-14]**.

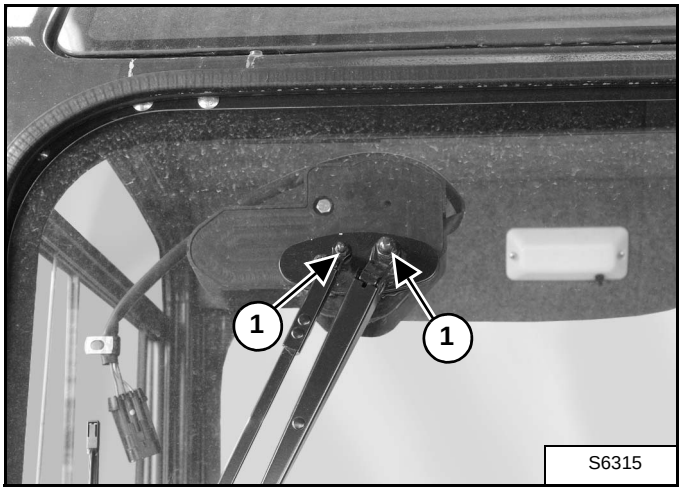
Remove the nut (Item 2) **[Figure 40-30-14]**.

Figure 40-30-15



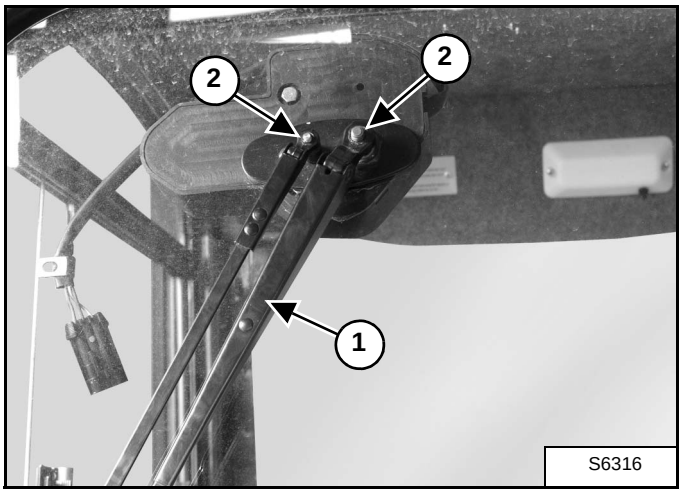
Remove the wire harness (Item 1) from the channel (Item 2) **[Figure 40-30-15]**.

Figure 40-30-16



Remove the nuts (Item 1) **[Figure 40-30-16]**.

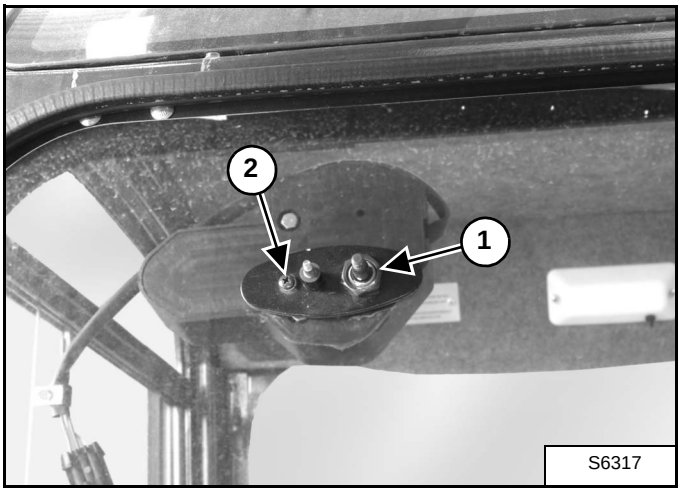
Figure 40-30-17



Remove the wiper assembly (Item 1) from the pivot mounts (Item 2) **[Figure 40-30-17]**.

Front Window Removal And Installation (Cont'd)

Figure 40-30-18

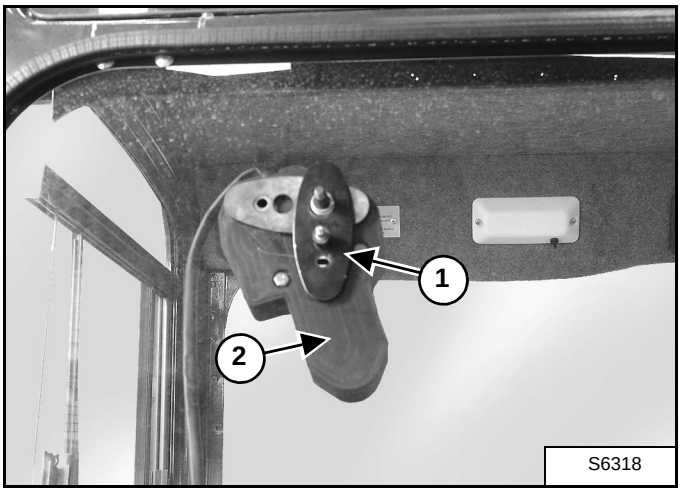


Remove the nut and washer (Item 1) **[Figure 40-30-18]**.

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

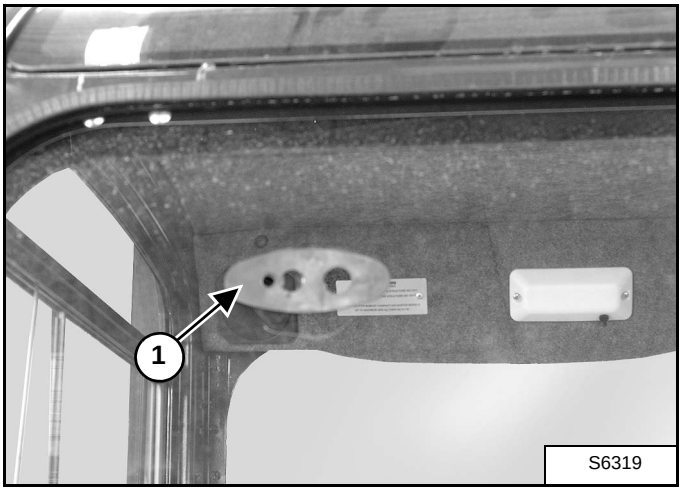
NOTE: Support the wiper motor before removing the bolts.

Figure 40-30-19



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

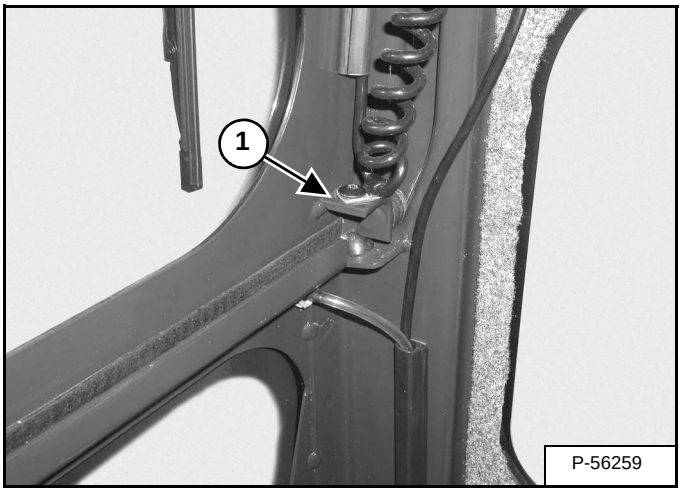
Figure 40-30-20



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

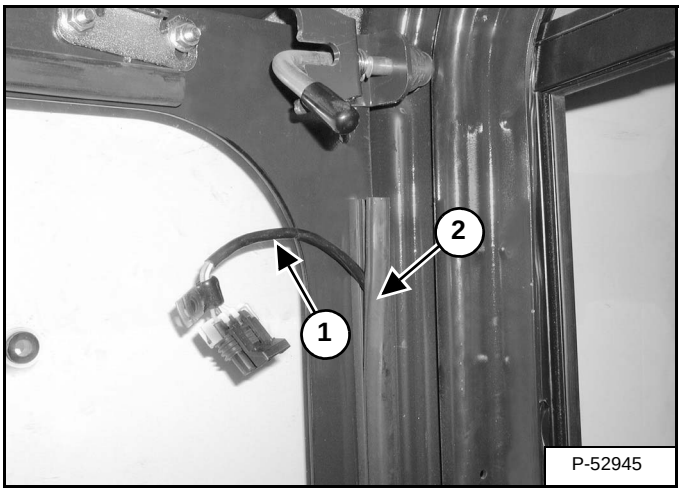
Front Window Removal And Installation (Cont'd)

Figure 40-30-21



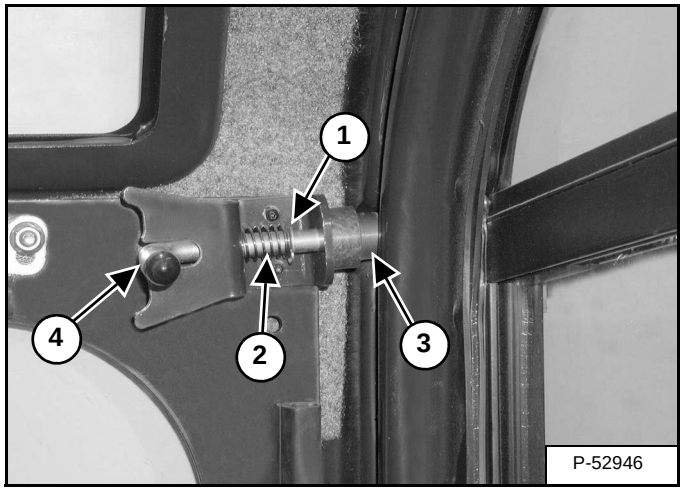
Remove the screw (Item 1) **[Figure 40-30-21]** holding the wire harness clamp to the bottom of the front window.

Figure 40-30-22



Remove the wire harness (Item 1) from the channel (Item 2) **[Figure 40-30-22]**.

Figure 40-30-23



With the help of a second person holding the front window, remove the retainer (Item 1), spring (Item 2), roller (Item 3), and handle (Item 4) **[Figure 40-30-23]** from both sides of the front window.

Figure 40-30-24

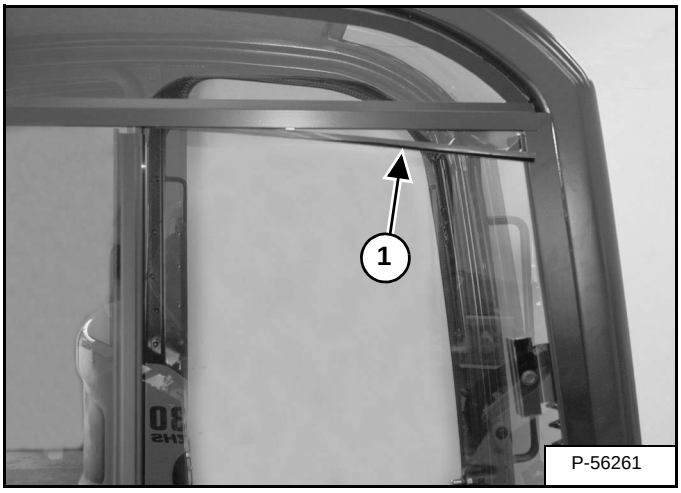


Tilt the front window (Item 1) **[Figure 40-30-24]**. Remove the front window from the cab.

Right Side Rear Sliding Window Removal And Installation

Close and latch the front and rear sliding windows.

Figure 40-30-25



Use a pick to pull the felt (Item 1) **[Figure 40-30-25]** from the top window channel.

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

Figure 40-30-26



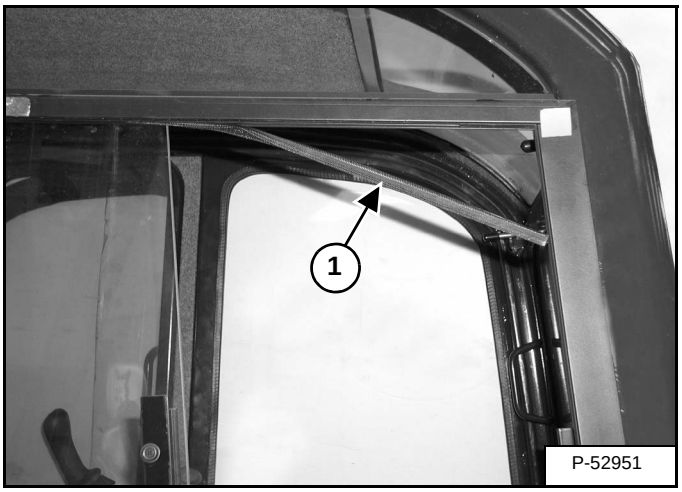
Lift the window up into the top channel and tilt the bottom edge out **[Figure 40-30-26]**. Remove the window from the cab.

Right Side Front Sliding Window Removal And Installation

NOTE: The rear sliding window must be removed before the front sliding window can be removed.

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

Figure 40-30-27



Use a pick to pull the felt (Item 1) **[Figure 40-30-27]** from the inside top window channel.

Figure 40-30-28

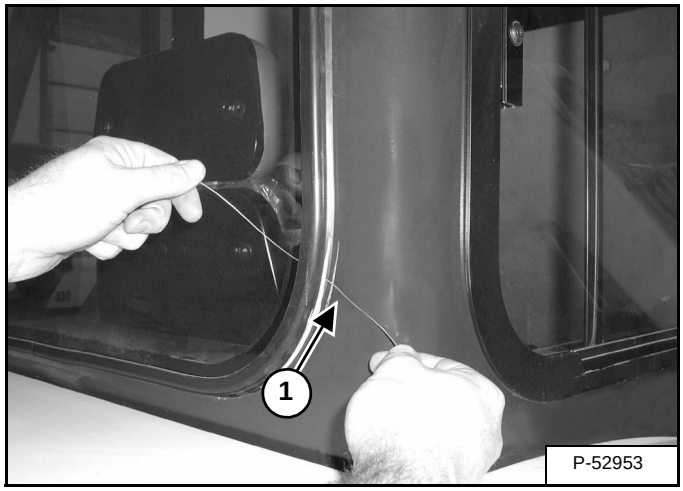


Lift the window up into the channel and tilt the bottom edge out **[Figure 40-30-28]**. Remove the window from the cab.

Glass Removal

Use the following procedure to remove the glass from the rear of the cab and right side window assembly.

Figure 40-30-29



Push a small diameter wire (Item 1) **[Figure 40-30-29]** through the adhesive. Pull the wire around the perimeter of the glass to cut the adhesive.

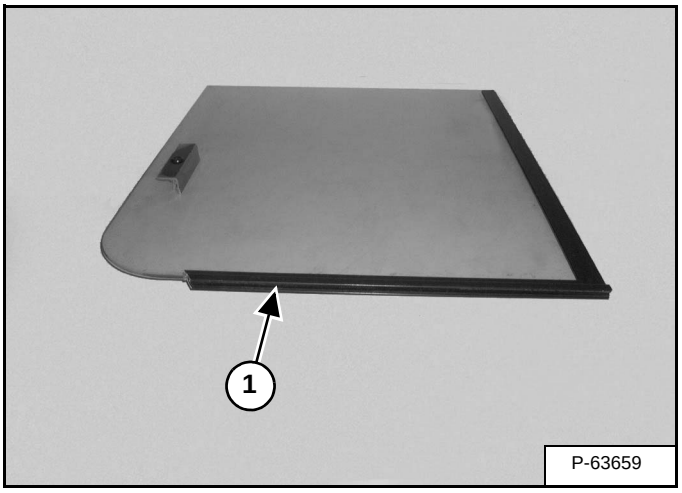
Remove the glass.

NOTE: The right side window frame is aluminum and will be destroyed when removed.

Right Side Front And Rear Sliding Window Weather Strip Removal And Installation

Remove the window.

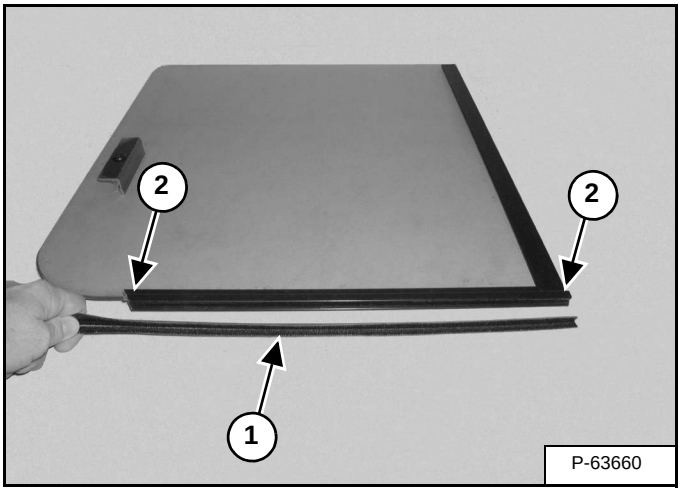
Figure 40-30-30



Remove the weather strip (Item 1) **[Figure 40-30-30]** from the bottom channel of the window.

Installation: Clean the bottom channel. Apply a bead of adhesive in the channel.

Figure 40-30-31

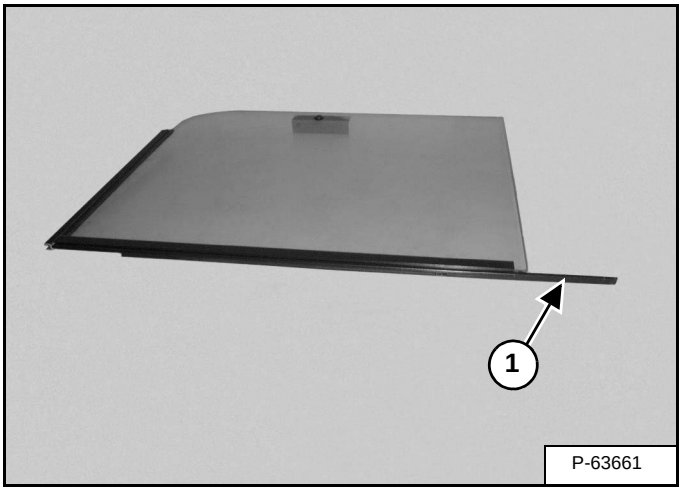


Install the new weather strip (Item 1). Cut the weather strip flush with the ends of the window channel (Item 2) **[Figure 40-30-31]**.

Right Side Front And Rear Sliding Window Wiper Strip Removal And Installation

Remove the window.

Figure 40-30-32



Remove the wiper strip (Item 1) **[Figure 40-30-32]** from the window channel.

Glass Installation

Rear and front lower glass

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

NOTE: Leave a thin film of the old urethane on the cab frame, fresh urethane will bond to the remaining film.

Prime and paint any bare metal or scratches.

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

Figure 40-30-33

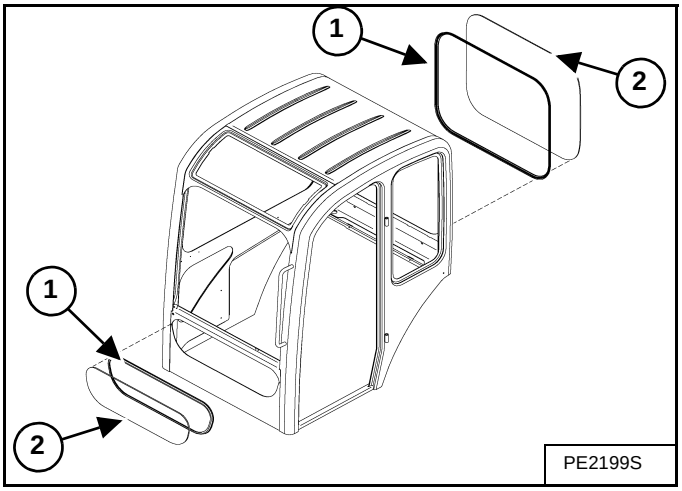
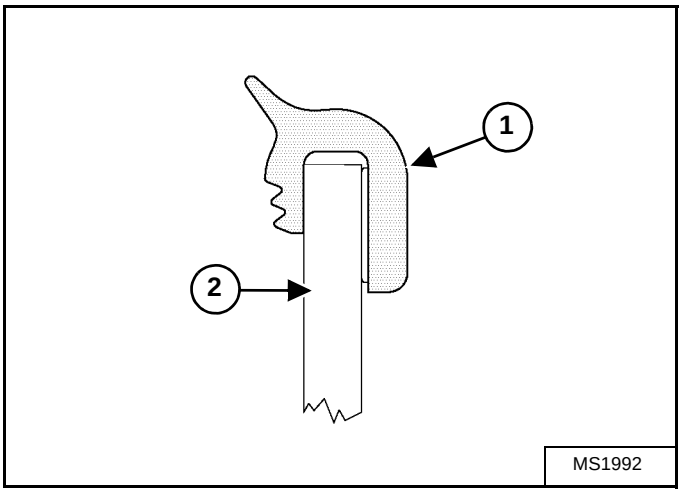


Figure 40-30-34



Install the seal (Item 1) on the glass (Item 2) **[Figure 40-30-33]** and **[Figure 40-30-34]**.

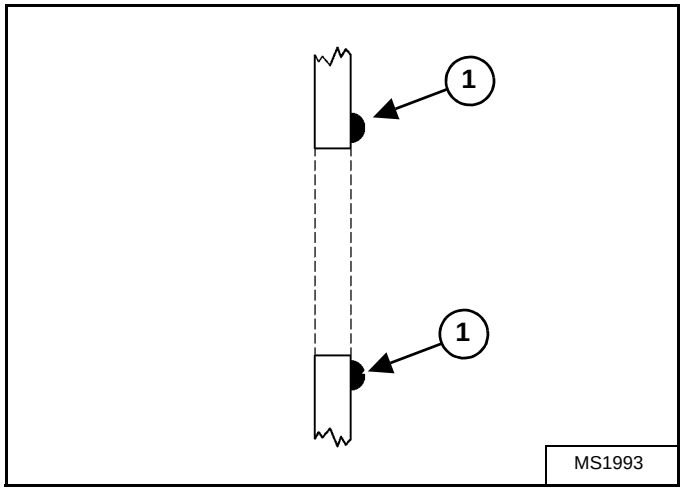
Shake the combo primer for 1 minute.

Apply the combo primer to the perimeter of the cab and glass (Item 2) **[Figure 40-30-34]**. Apply the primer in one direction only, using a dauber. Do not dip the dauber in the primer more than once. Use multiple daubers if needed.

Allow the combo primer to dry for 5 minutes. Dry time doubles if the primer is applied in two coats.

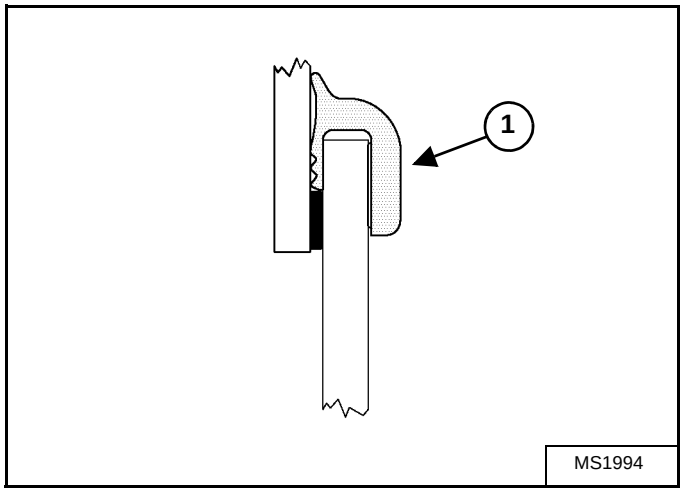
Cut the tip of the adhesive tube to the desired shape and size to provide a bead height sufficient to give good contact with the glass around the entire perimeter.

Figure 40-30-35



Apply a 0.3 x 0.25 in. bead of urethane adhesive (Item 1) **[Figure 40-30-35]** to the perimeter of the cab.

Figure 40-30-36



Install the glass and seal assembly (Item 1) **[Figure 40-30-36]**. Press the glass into the cab to make complete contact with the adhesive. Tape the glass in place.

Glass Installation (Cont'd)

Allow 2 hours for curing at normal conditions (65°F, 75% relative humidity).

Remove the tape after the adhesive is cured.

Top, right side and left side glass

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

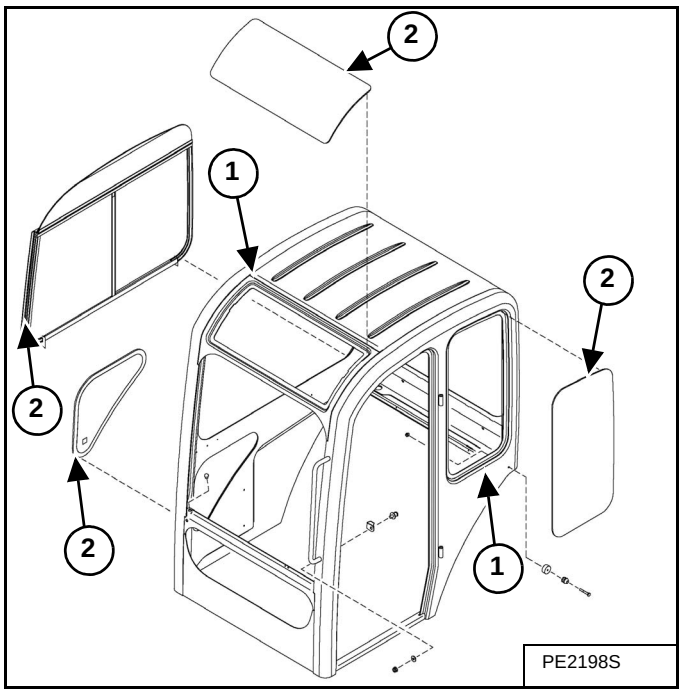
NOTE: Leave a thin film of the old urethane on the cab frame, fresh urethane will bond to the remaining film.

Prime and paint any bare metal or scratches.

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

Shake the combo primer for 1 minute.

Figure 40-30-37

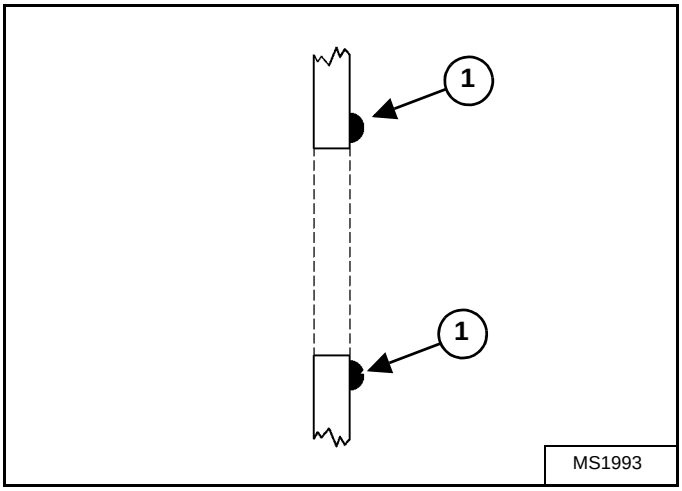


Apply combo primer to the perimeter of the cab (Item 1) and glass (Item 2) **[Figure 40-30-37]**. Apply the primer in one direction only, using a dauber. Do not dip the dauber in the primer more than once. Use multiple daubers if needed.

Allow the combo primer to dry for 5 minutes. Dry time doubles if the primer is applied in two coats.

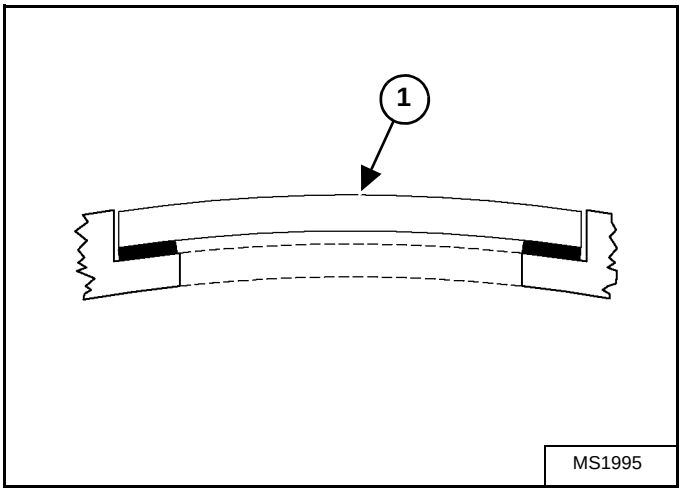
Cut the tip of the adhesive tube to the desired shape and size to provide a bead height sufficient to give good contact with the glass around the entire perimeter.

Figure 40-30-38



Apply a 0.3 x 0.25 in. bead of urethane adhesive (Item 1) **[Figure 40-30-38]** to the perimeter of the cab.

Figure 40-30-39



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

Allow 2 hours for curing at normal conditions (65°F, 75% relative humidity).

Remove the tape after the adhesive is cured.

Door and front window glass

The door and front window glass are not available separately.

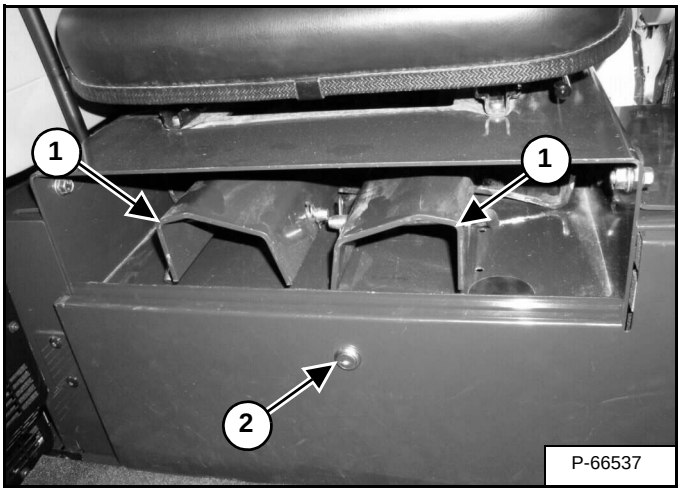
Order and install the door or front window frame and glass assembly.


Bobcat®

SEAT AND SEAT MOUNT

Removal And Installation

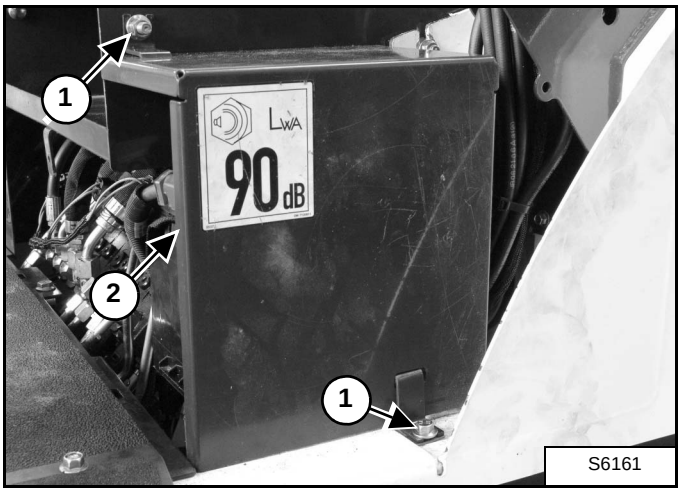
Figure 40-40-1



Remove the two blade extensions (Item 1) **[Figure 40-40-1]** from the storage compartment.

Use the start key to remove the access cover (Item 2) **[Figure 40-40-1]**.

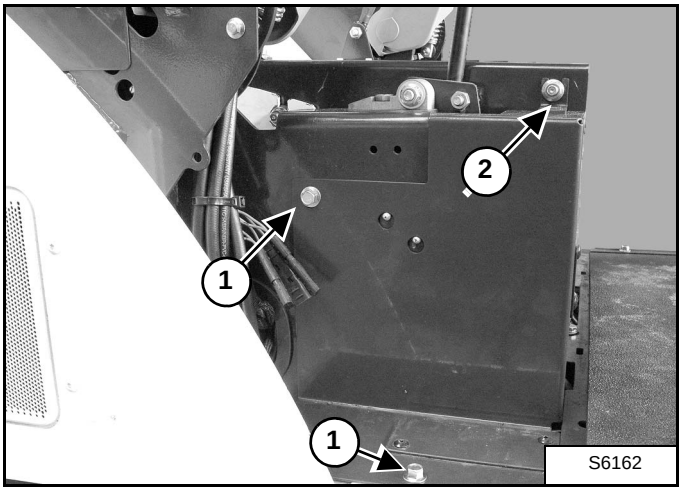
Figure 40-40-2



Remove the two bolts (Item 1) **[Figure 40-40-2]** and brackets from the battery cover.

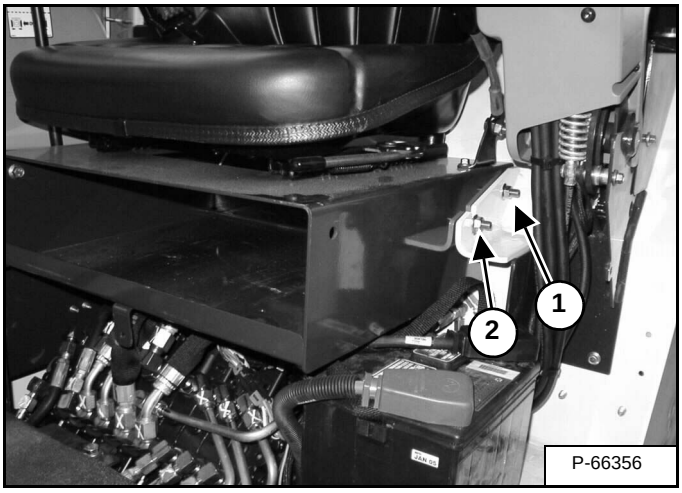
Remove the battery cover (Item 2) **[Figure 40-40-2]**.

Figure 40-40-3



Remove the screws (Item 1) and the bracket (Item 2) **[Figure 40-40-3]** to remove the right side cover.

Figure 40-40-4



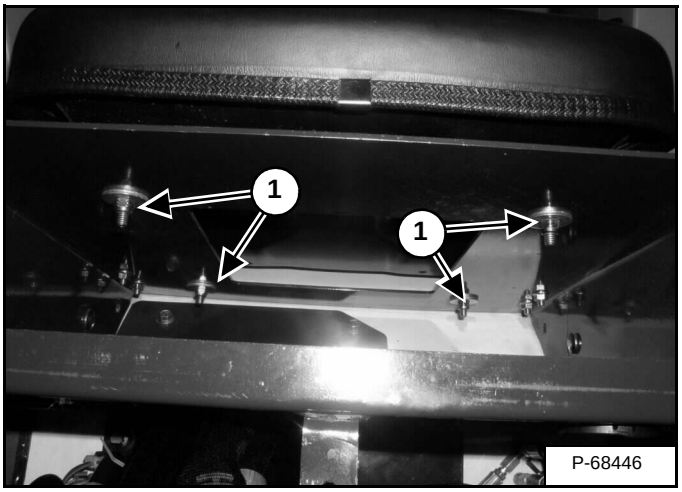
Remove the bolt (Item 1) **[Figure 40-40-4]** and nut from both sides of the seat mount.

Loosen the bolt (Item 2) **[Figure 40-40-4]** and nut from both sides of the seat mount.

Remove the seat and seat mount.

Removal And Installation (Cont'd)

Figure 40-40-5



Remove the four nuts and washers (Item 1) **[Figure 40-40-5]** 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.

RIGHT CONSOLE

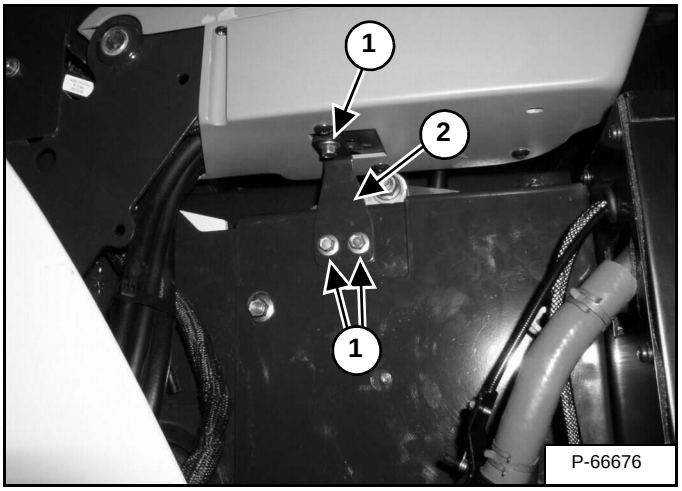
Description

An excavator equipped with a canopy, the right console contains a moveable joystick console and a rear console containing the throttle lever, hourmeter, light switch, track expansion / blade switch and cup holder.

An excavator equipped with a cab, the right joystick console is bolted in the down position and a rear console containing the throttle lever, hourmeter, light switch, track expansion / blade switch and cup holder.

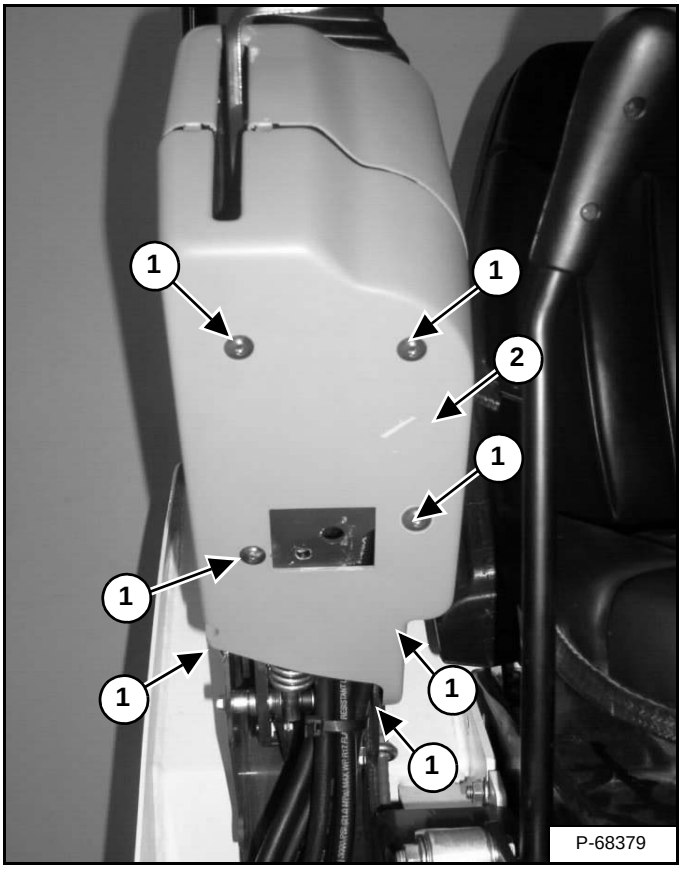
Joystick Console Cover (Bottom) Removal And Installation

Figure 40-50-1



Cab Option Only: Remove the three bolts (Item 1) and bracket (Item 2) **[Figure 40-50-1]**.

Figure 40-50-2



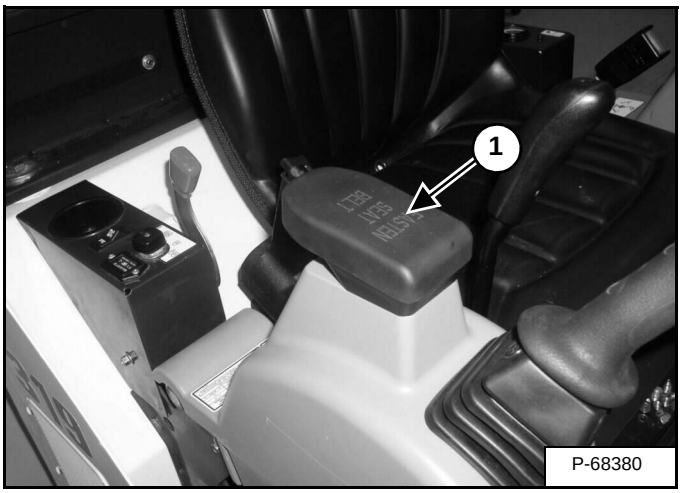
Remove the seven screws (Item 1) **[Figure 40-50-2]** from the lower half of the joystick console cover.

Remove the lower half of the joystick console cover (Item 2) **[Figure 40-50-2]**.

Lower the right console.

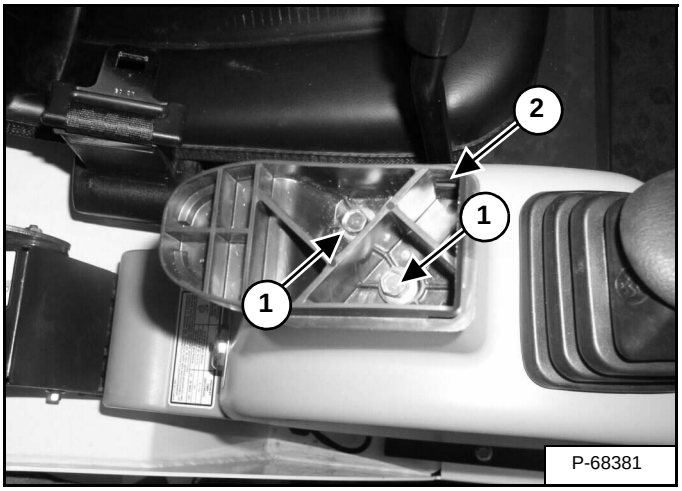
Joystick Console Cover (Top) Removal And Installation

Figure 40-50-3



Remove the cover (Item 1) **[Figure 40-50-3]** from the arm rest.

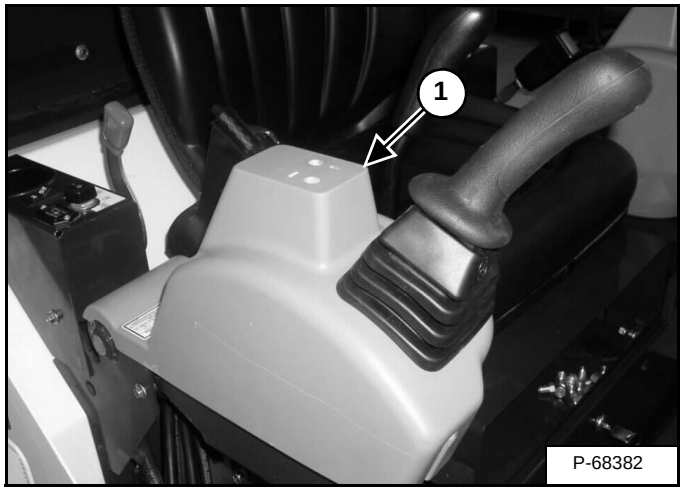
Figure 40-50-4



Remove the bolts (Item 1) **[Figure 40-50-4]** from the arm rest.

Remove the arm rest (Item 2) **[Figure 40-50-4]**.

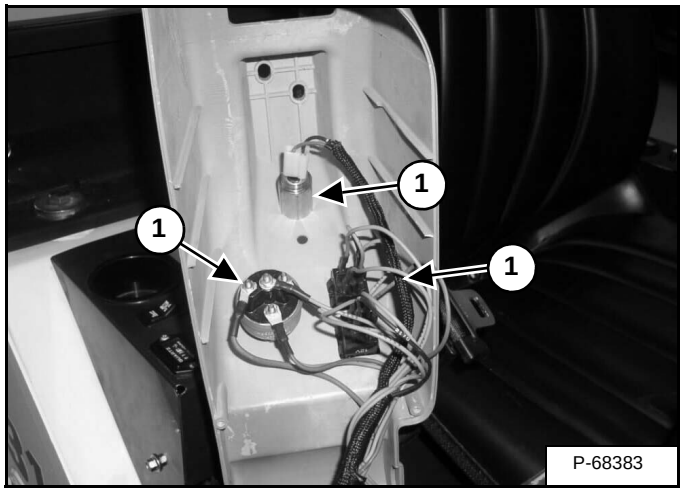
Figure 40-50-5



Remove the upper half of the joystick console cover (Item 1) **[Figure 40-50-5]** over the joystick.

Mark the wires for ease of assembly.

Figure 40-50-6

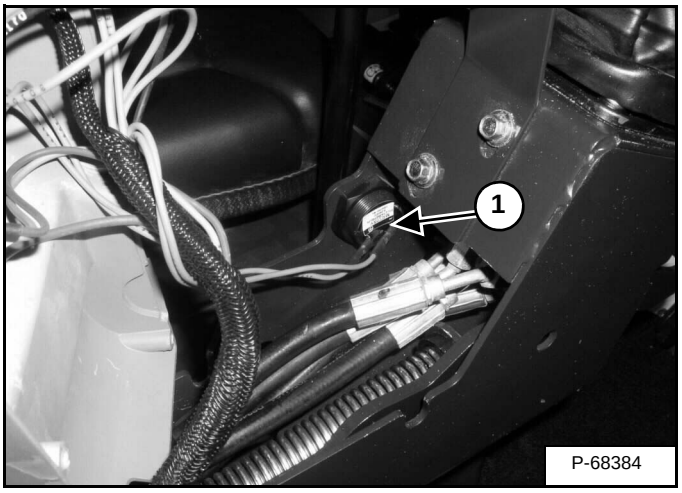


Disconnect the electrical connector and wires (Item 1) **[Figure 40-50-6]** from the key switch, indicator lights and accessory plug.

Joystick Console Cover (Top) Removal And Installation (Cont'd)

Mark the wires for ease of assembly.

Figure 40-50-7



Disconnect the electrical wires (Item 1) **[Figure 40-50-7]** from the buzzer.

Remove the joystick console cover.

Joystick Console Cover (Top) Disassembly And Assembly

Mark the wires for ease of assembly.

Figure 40-50-8

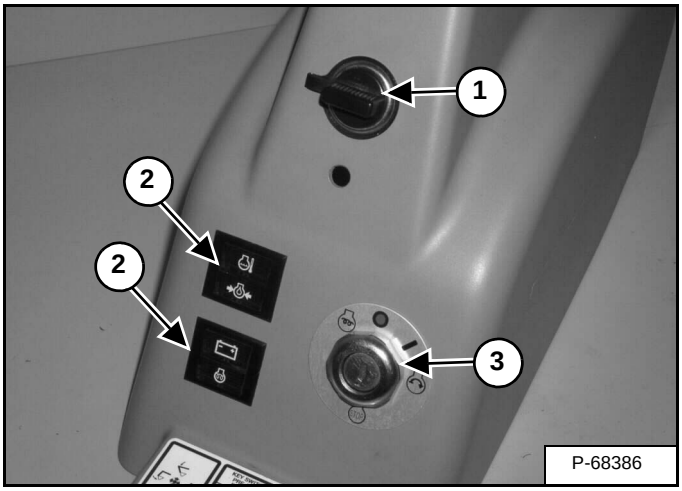
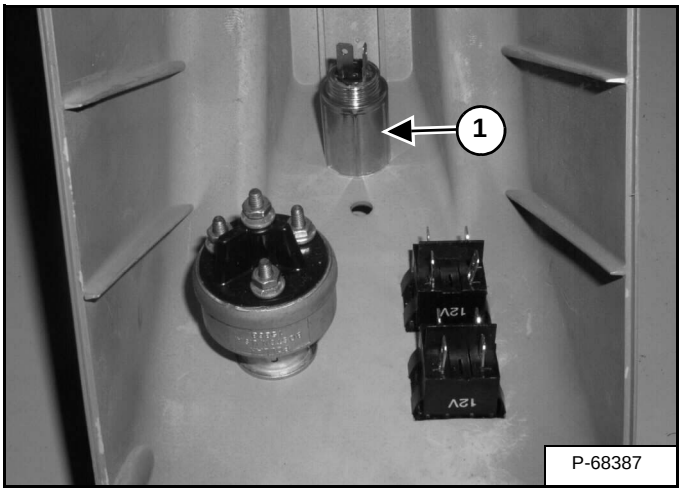


Figure 40-50-9



Remove the back (Item 1) **[Figure 40-50-9]** and **[Figure 40-50-8]** from the accessory plug and remove from the front of the cover.

Remove the indicator lights (Item 2) **[Figure 40-50-8]** in the top of the compression spring rod.

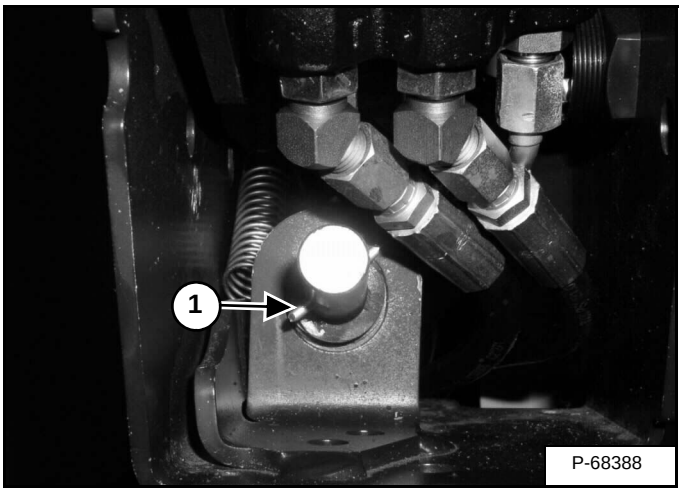
Remove the nut (Item 3) **[Figure 40-50-8]** from the front of the key switch and remove from the back of the cover.

Compression Spring Removal And Installation (Canopy Only)

Remove the lower console cover (See Joystick Console Cover (Bottom) Removal And Installation on Page 40-50-1)

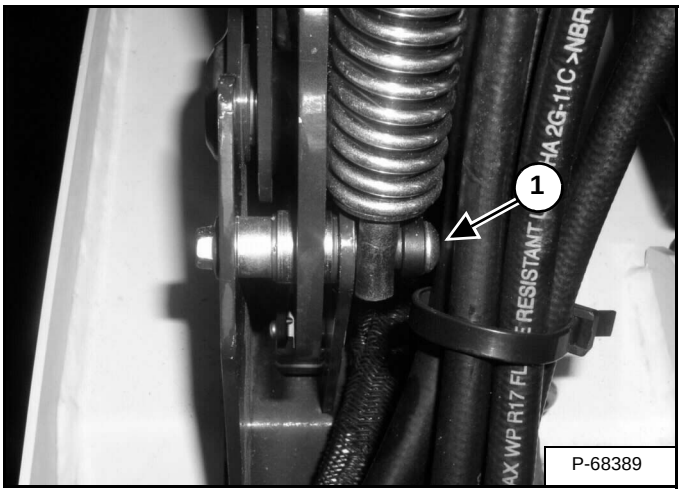
Lower the console.

Figure 40-50-10



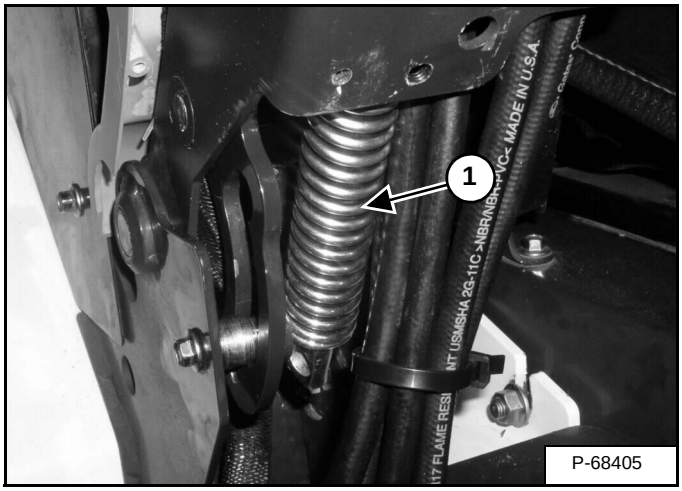
Install a pin (Item 1) **[Figure 40-50-10]** in the top of the compression spring rod.

Figure 40-50-11



Support the console in the raised position. Remove the bolt (Item 1) **[Figure 40-50-11]**.

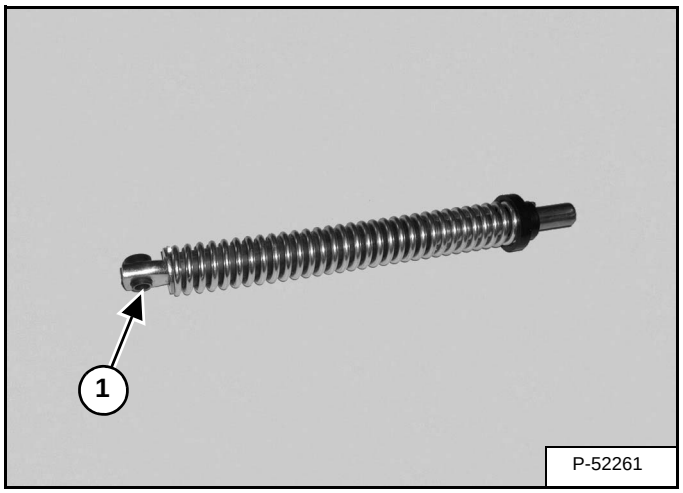
Figure 40-50-12



Remove the spring assembly (Item 1) **[Figure 40-50-12]** from the bottom of the console.

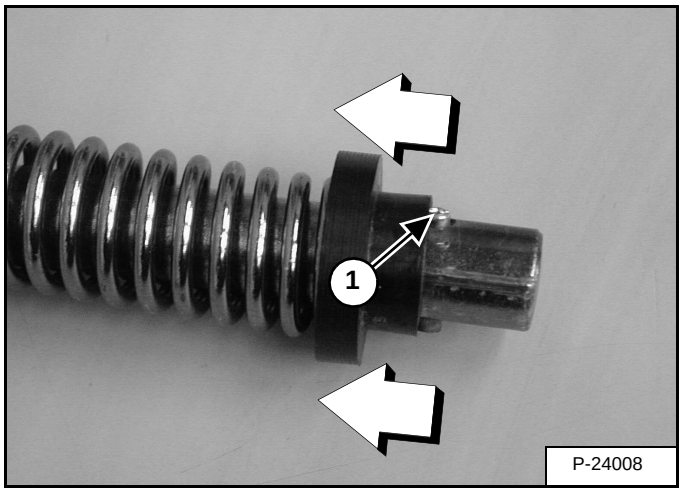
Compression Spring Disassembly And Assembly (Canopy Only)

Figure 40-50-13



Remove the bushing (Item 1) **[Figure 40-50-13]**.

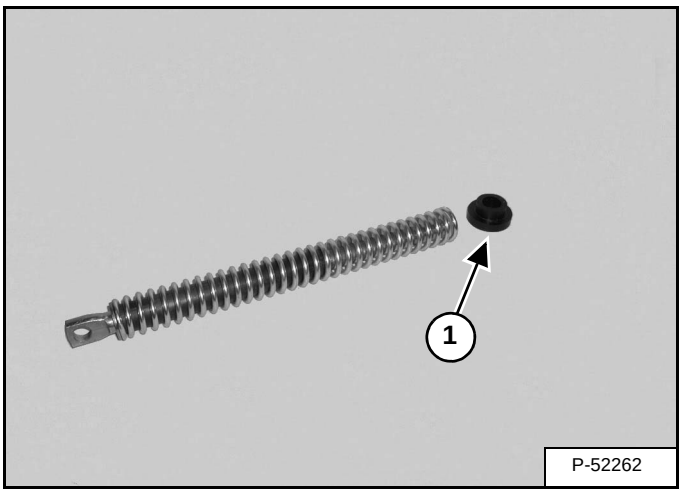
Figure 40-50-14



Apply pressure against the spring, and remove the pin (Item 1) **[Figure 40-50-14]** from the shaft.

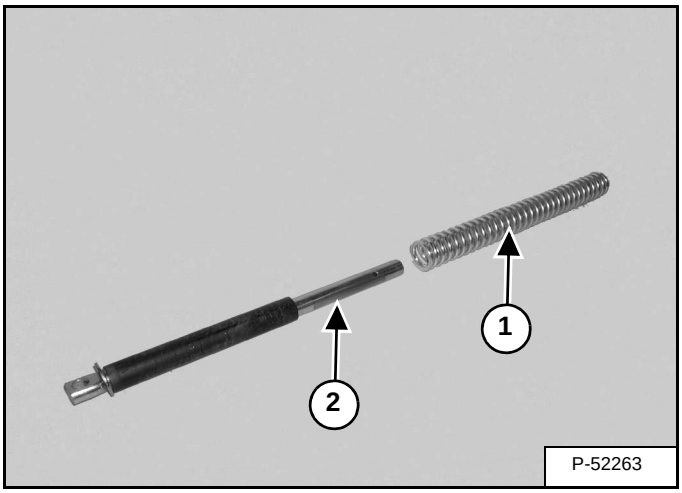
Release the pressure from the spring.

Figure 40-50-15



Remove the bushing (Item 1) **[Figure 40-50-15]**.

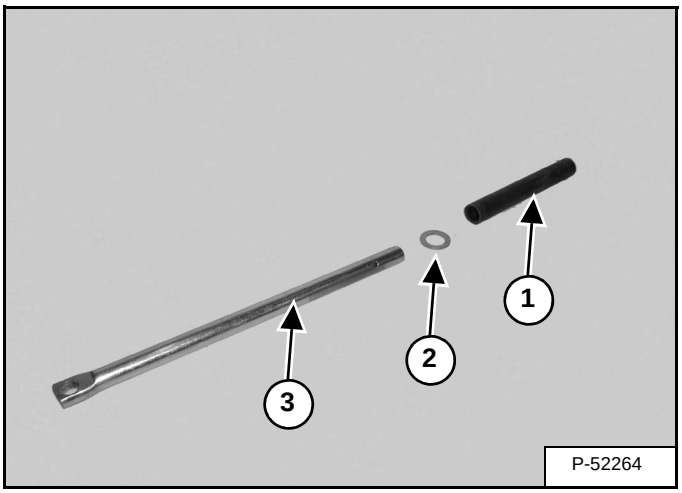
Figure 40-50-16



Remove the spring (Item 1) from the shaft (Item 2) **[Figure 40-50-16]**.

Compression Spring Disassembly And Assembly (Canopy Only) (Cont'd)

Figure 40-50-17



Remove the sleeve (Item 1) and washer (Item 2) from the shaft (Item 3) **[Figure 40-50-17]**.

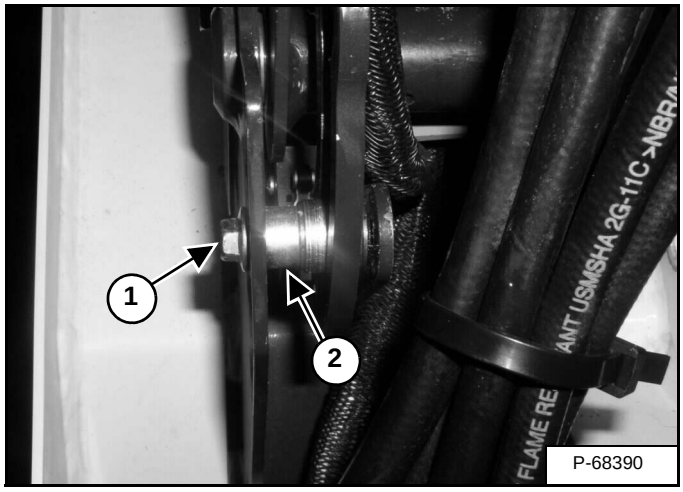
Lever Removal And Installation (Canopy Only)

Remove the joystick console cover (bottom) cover. (See Joystick Console Cover (Bottom) Removal And Installation on Page 40-50-1)

Remove the joystick console cover (top) cover. (See Joystick Console Cover (Top) Removal And Installation on Page 40-50-2)

Remove the compression spring. (See Compression Spring Removal And Installation (Canopy Only) on Page 40-50-4)

Figure 40-50-18



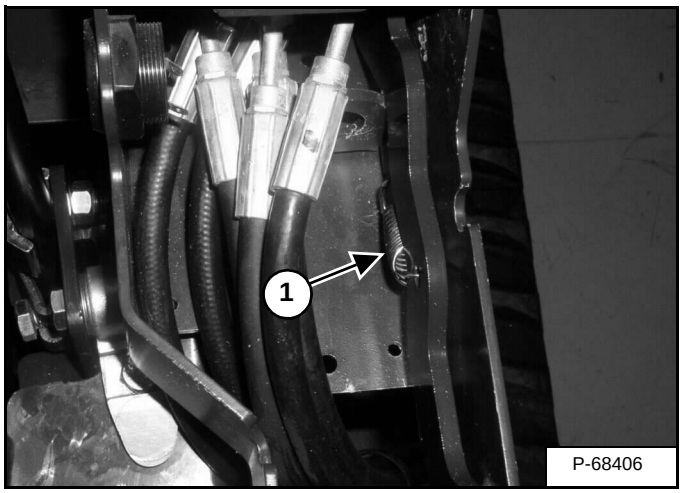
Remove the bolt (Item 1) from the lever bearing (Item 2) **[Figure 40-50-18]**.

Remove the lever bearing (Item 2) **[Figure 40-50-18]**.

Lower the console.

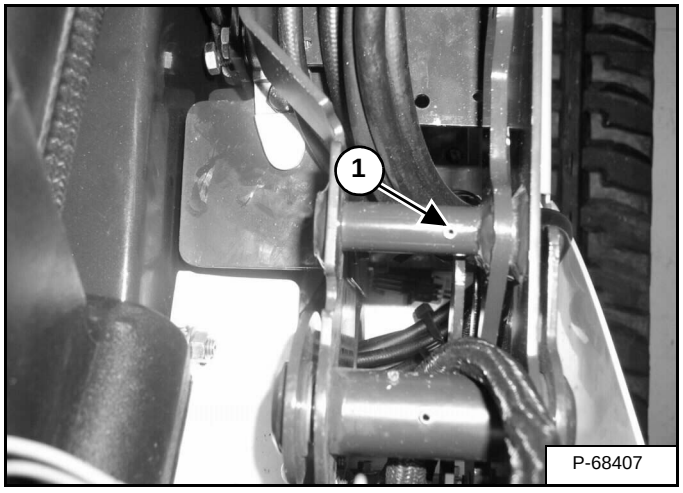
Lever Removal And Installation (Canopy Only) (Cont'd)

Figure 40-50-19



Remove the spring (Item 1) **[Figure 40-50-19]** from the console and lever.

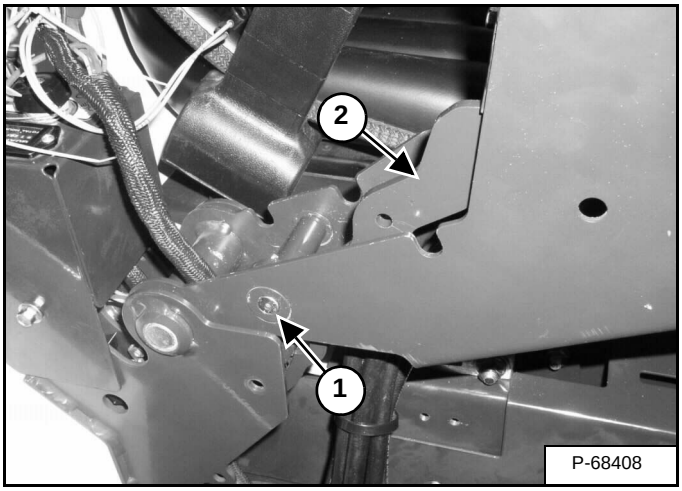
Figure 40-50-20



Remove the roll pin (Item 1) **[Figure 40-50-20]** from the lever pivot pin.

Raise and support the console.

Figure 40-50-21



Remove the pivot pin (Item 1) **[Figure 40-50-21]** from the lever.

Remove the lever (Item 2) **[Figure 40-50-21]** from the console.

Joystick Console Frame Removal And Installation

Remove the joystick console cover (bottom) cover. (See Joystick Console Cover (Bottom) Removal And Installation on Page 40-50-1)

Remove the joystick console cover (top) cover. (See Joystick Console Cover (Top) Removal And Installation on Page 40-50-2)

Remove the compression spring. (See Compression Spring Removal And Installation (Canopy Only) on Page 40-50-4)

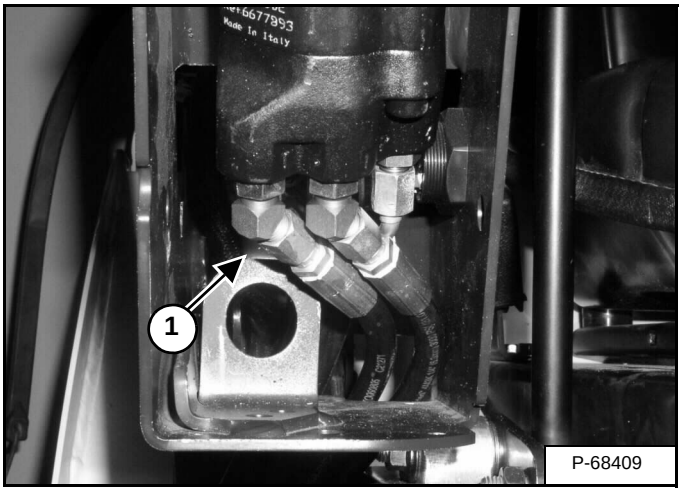
Remove the lever. (See Lever Removal And Installation (Canopy Only) on Page 40-50-6)

IMPORTANT

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

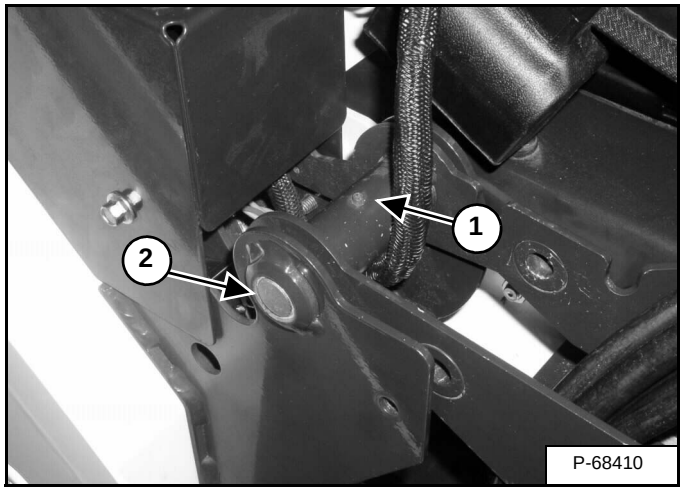
I-2003-0888

Figure 40-50-22



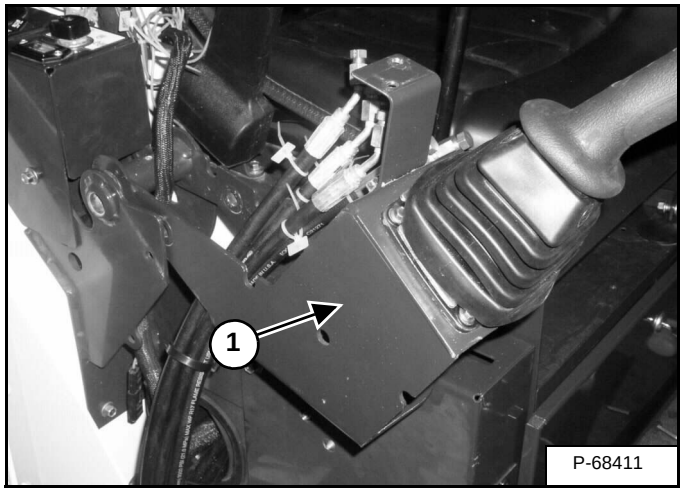
Mark the hoses for ease of assembly. Remove and cap the six hoses (Item 1) **[Figure 40-50-22]** from the joystick.

Figure 40-50-23



Remove the roll pin (Item 1) and the pivot pin (Item 2) **[Figure 40-50-23]**.

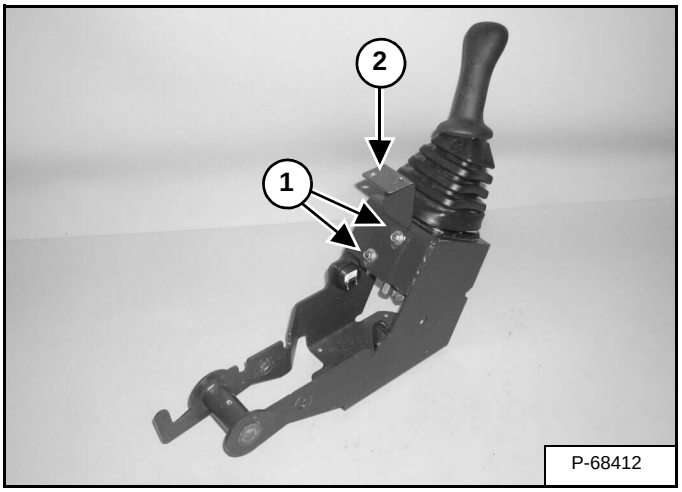
Figure 40-50-24



Remove the joystick console frame (Item 1) **[Figure 40-50-24]** from the excavator.

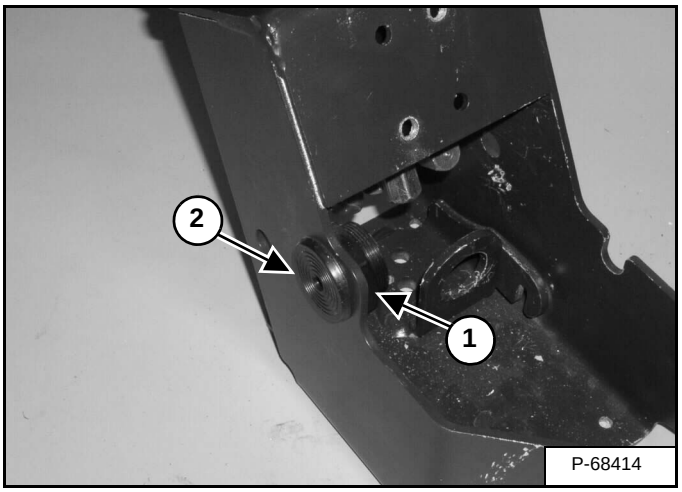
Joystick Console Frame Disassembly And Assembly

Figure 40-50-25



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

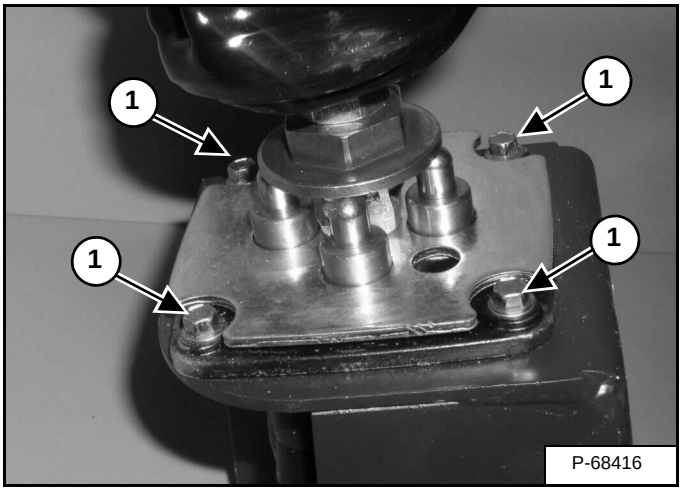
Figure 40-50-26



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

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

Figure 40-50-27



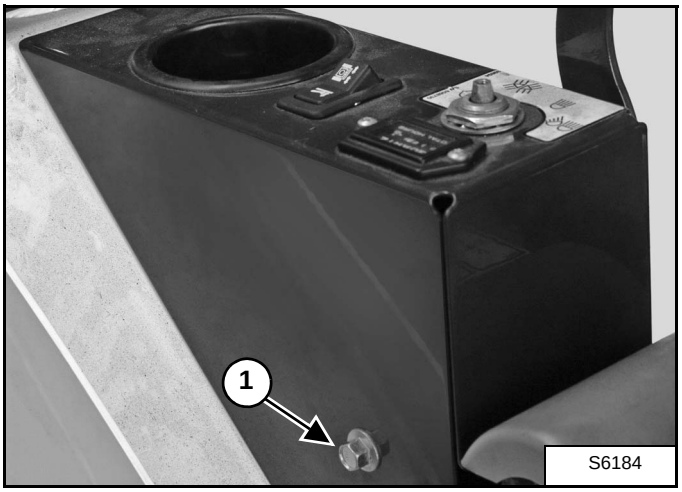
Lift the joystick boot.

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

Remove the joystick from the console frame.

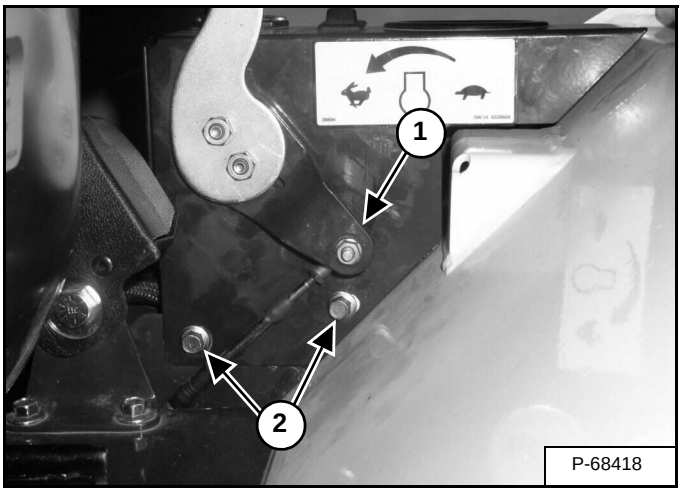
Right Rear Console Cover Removal And Installation

Figure 40-50-28



Remove the console cover screw (Item 1) **[Figure 40-50-28]**.

Figure 40-50-29

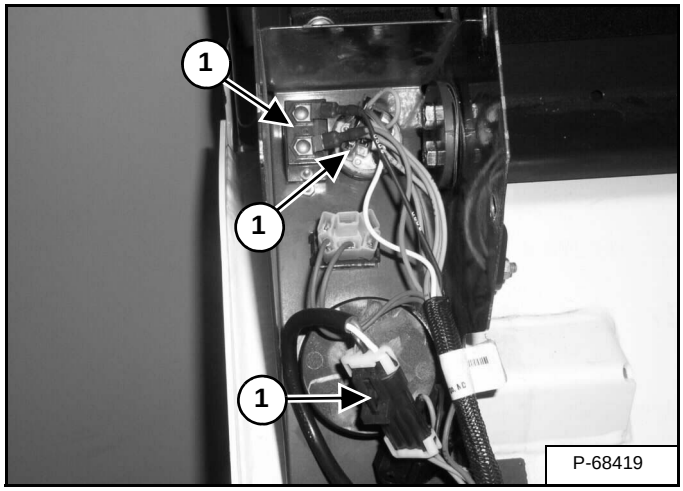


Remove the throttle linkage from the ball on the back side of the lever (Item 1) **[Figure 40-50-29]**.

Remove the console cover screws (Item 2) **[Figure 40-50-29]**.

Lift the console cover.

Figure 40-50-30



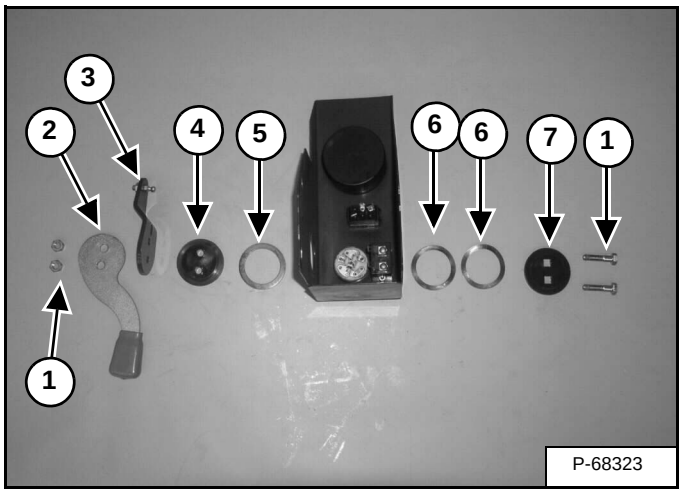
Lift the right rear console cover and mark the wires for ease of assembly.

Disconnect the wires and connectors (Item 1) **[Figure 40-50-30]** from the hourmeter, light switch, track expansion / blade switch, and microswitch.

Remove the right rear console cover from the excavator.

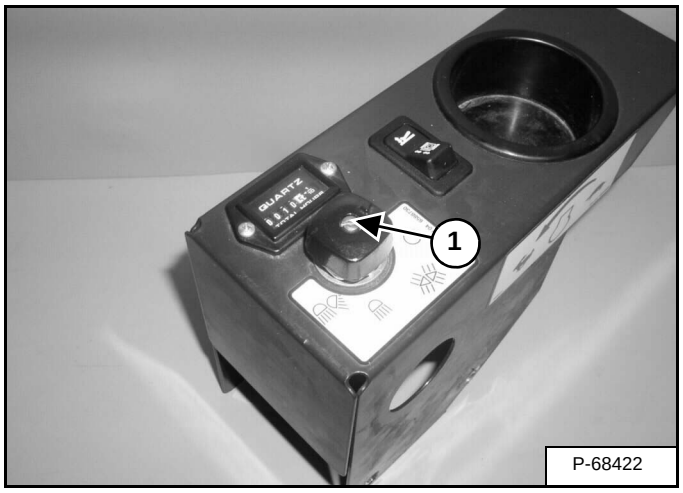
Right Rear Console Cover Disassembly and Assembly

Figure 40-50-31



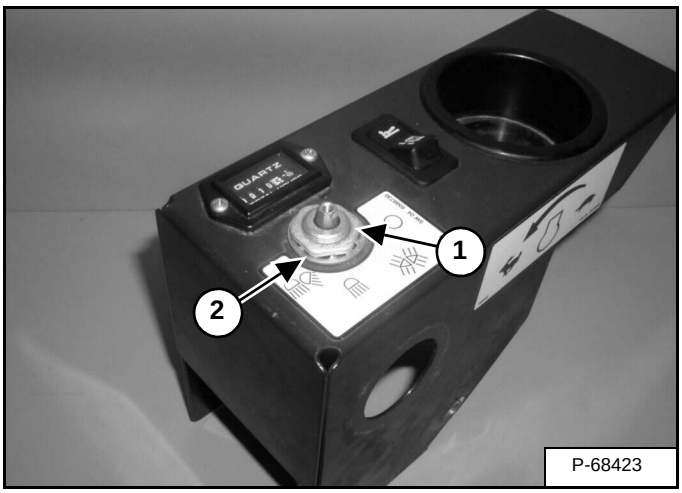
Remove the bolts and nuts (Item 1), lever (Item 2), the bracket (Item 3), the nylon spacer (Item 4), friction washer (Item 5), the two wave washers (Item 6), and the spacer (Item 7) **[Figure 40-50-31]**.

Figure 40-50-32



Remove the screw and lock washer (Item 1) and knob (Item 2) **[Figure 40-50-32]** from the light switch.

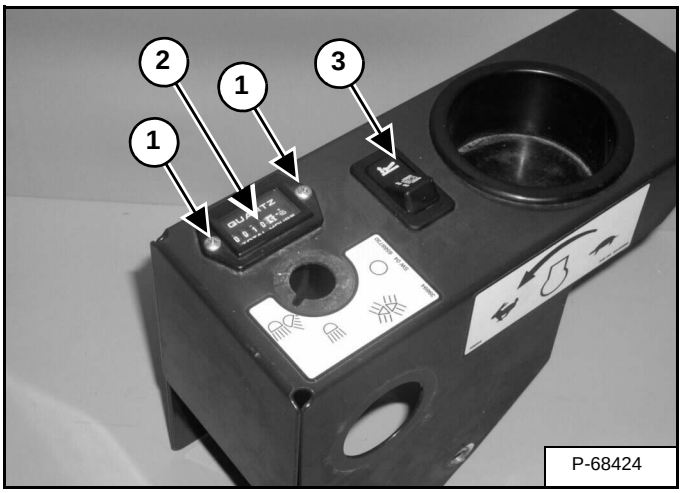
Figure 40-50-33



Remove the nut (Item 1) and lock washer (Item 2) **[Figure 40-50-33]** from the light switch.

Remove the light switch.

Figure 40-50-34

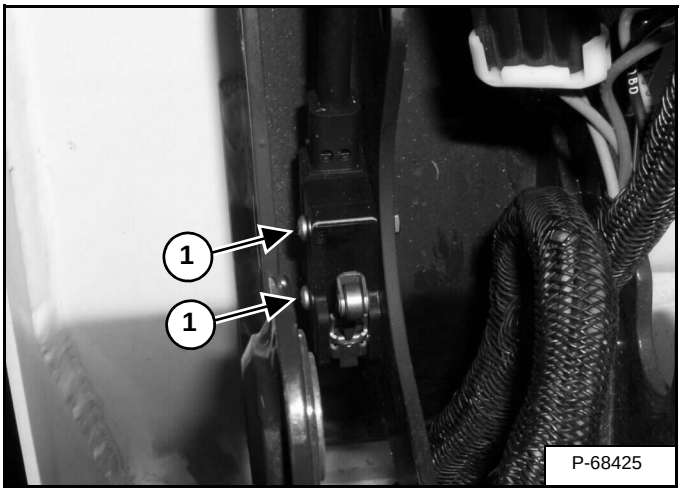


Remove the two screws and nuts (Item 1) from the hourmeter. Remove the hourmeter (Item 2) **[Figure 40-50-34]**.

Remove the track expansion / blade switch (Item 3) **[Figure 40-50-34]** from the right rear console cover.

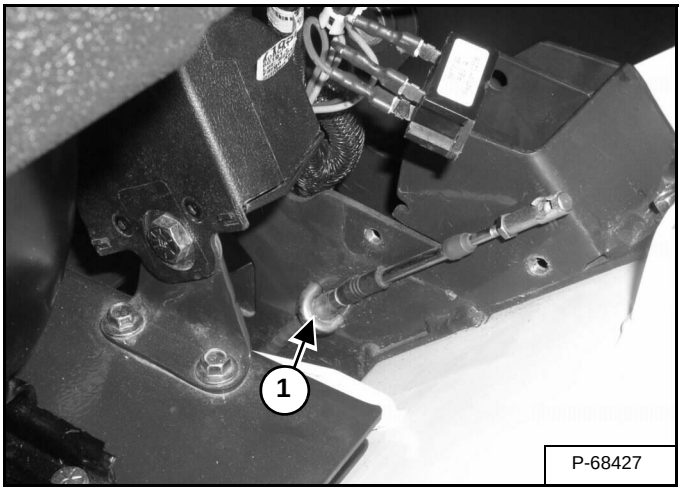
Right Rear Console Frame Removal And Installation

Figure 40-50-35



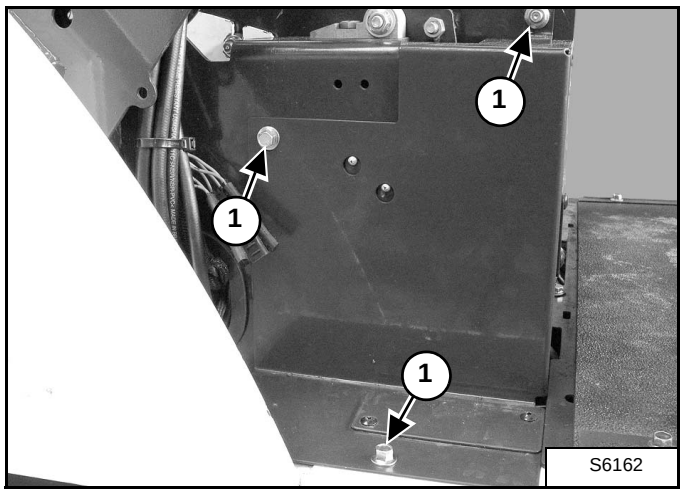
Remove the two screws and nuts (Item 1) **[Figure 40-50-35]** from the right rear console microswitch. Remove the microswitch.

Figure 40-50-36



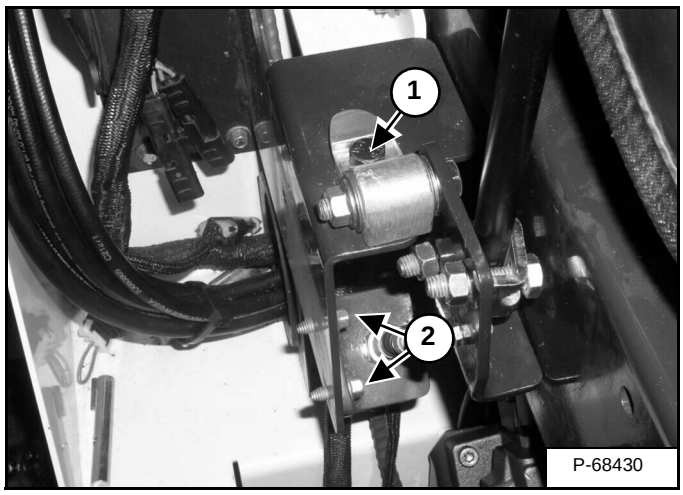
Remove the throttle cable clamp (Item 1) **[Figure 40-50-36]**.

Figure 40-50-37



Remove the three screws (Item 1) **[Figure 40-50-37]** from the right side cover. Remove the right side cover.

Figure 40-50-38

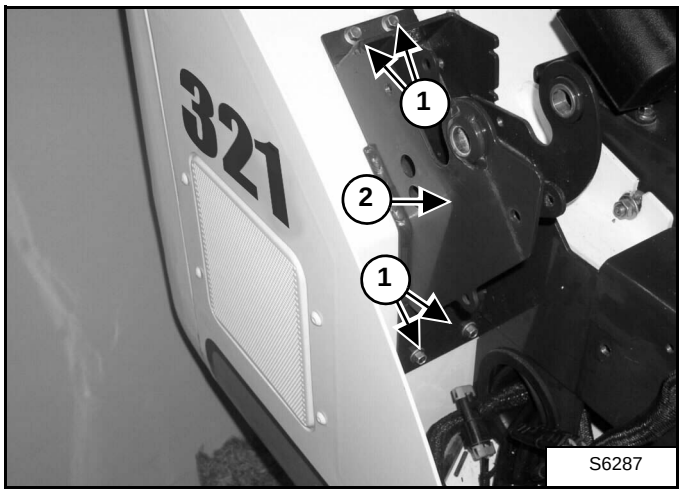


Remove the bolt and nut (Item 1) **[Figure 40-50-38]** from the blade lever bearing block.

Remove the two screws (Item 2) **[Figure 40-50-38]** from the blade lever cable bracket.

Right Rear Console Frame Removal And Installation (Cont'd)

Figure 40-50-39



Remove the four bolts (Item 1) **[Figure 40-50-39]**.

Remove the right rear console frame (Item 2) **[Figure 40-50-39]**. The joystick pilot hoses will slide through the rubber as the console frame is removed.


Bobcat®

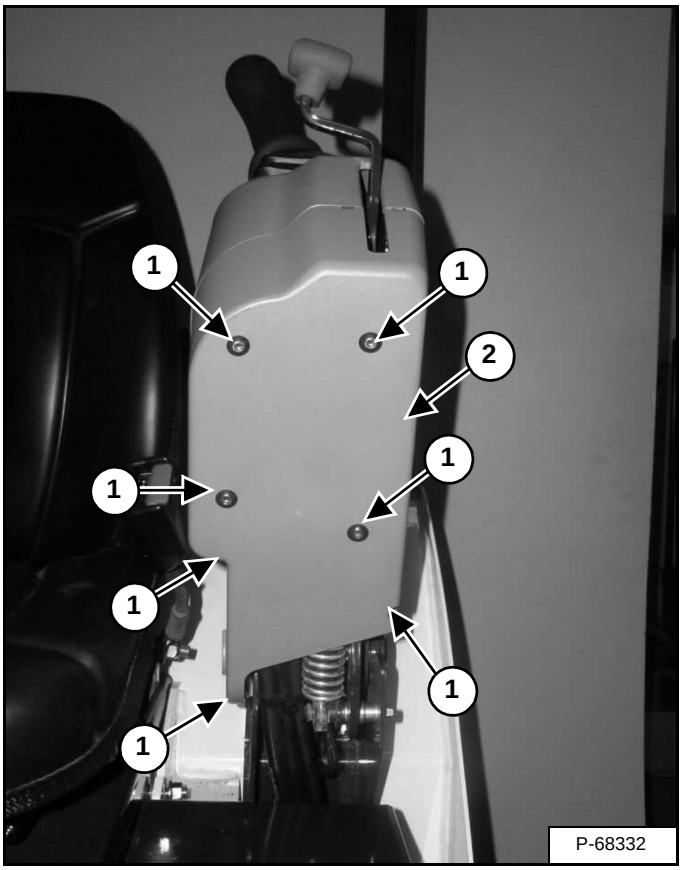
LEFT CONSOLE

Description

An excavator equipped with a canopy or cab, the left console contains a moveable joystick console and a rear console containing the fuel gauge and hydraulic lockout LED.

Joystick Console Cover (Bottom) Removal And Installation

Figure 40-60-1



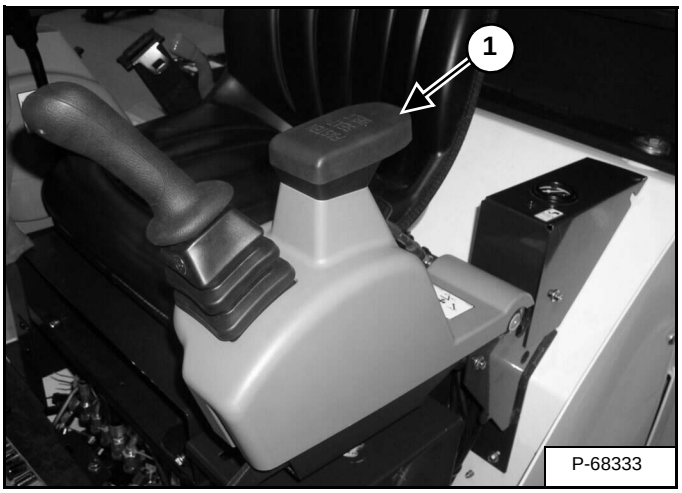
Remove the seven screws (Item 1) **[Figure 40-60-1]** from the lower half of the joystick console cover.

Remove the lower half of the joystick console cover (Item 2) **[Figure 40-60-1]**.

Lower the left console.

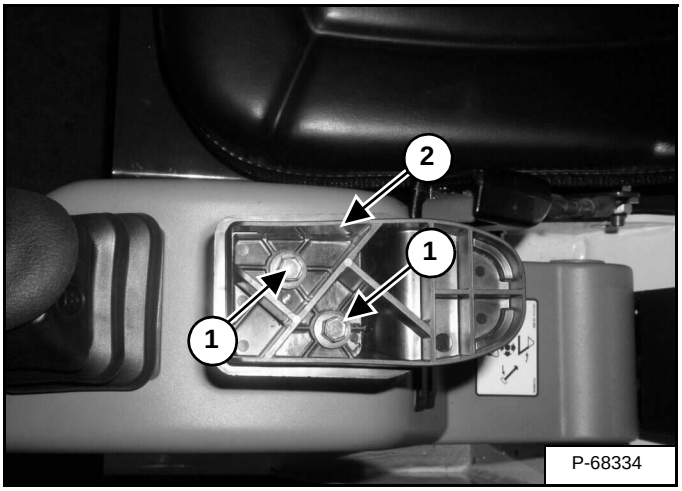
Joystick Console Cover (Top) Removal And Installation

Figure 40-60-2



Remove the cover (Item 1) **[Figure 40-60-2]** from the arm rest.

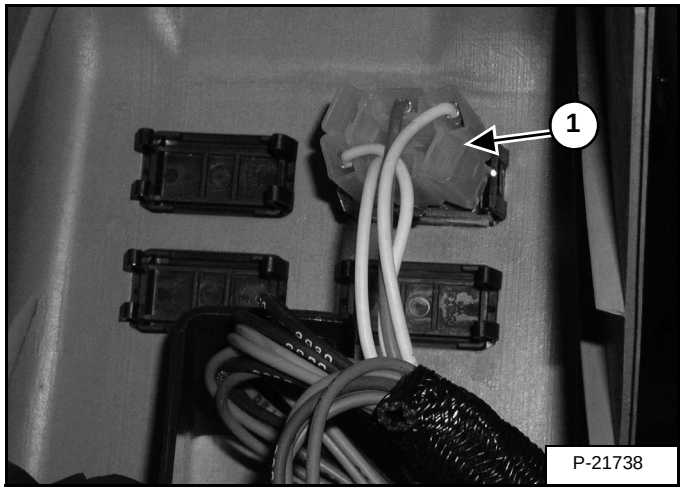
Figure 40-60-3



Remove the bolts (Item 1) **[Figure 40-60-3]** from the arm rest.

Remove the arm rest (Item 2) **[Figure 40-60-3]**.

Figure 40-60-4

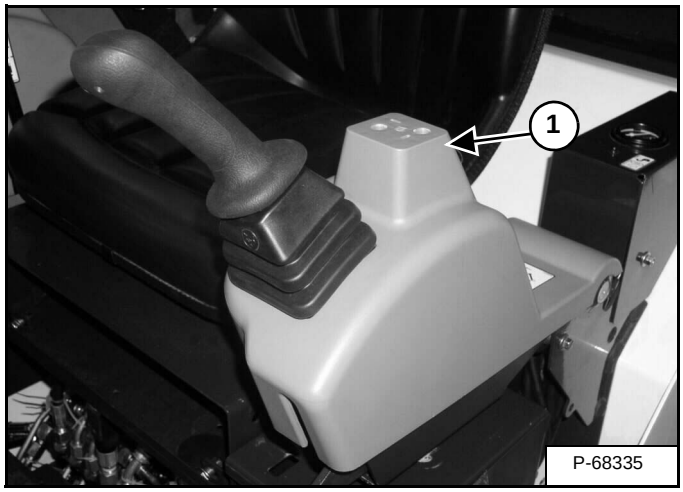


Raise the upper half of the joystick console cover to expose the electrical connectors if accessories are installed.

Disconnect the electrical connector(s) (Item 1) **[Figure 40-60-4]** if installed.

NOTE: These connectors are keyed so they can be plugged in only one way.

Figure 40-60-5



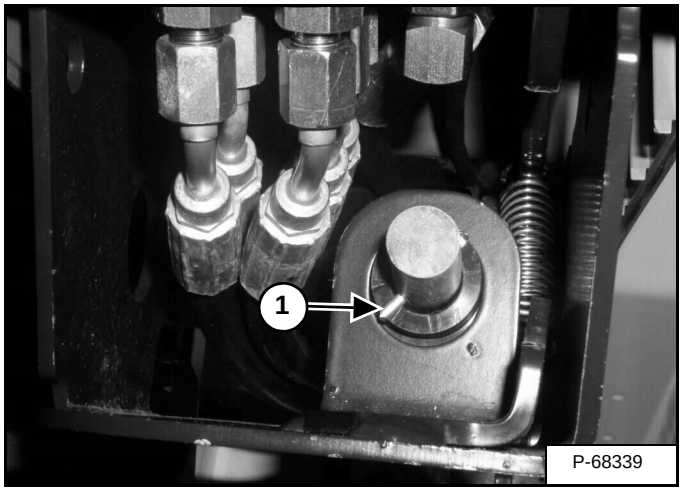
Remove the upper half of the joystick console cover (Item 1) **[Figure 40-60-5]** over the joystick.

Compression Spring Removal And Installation

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

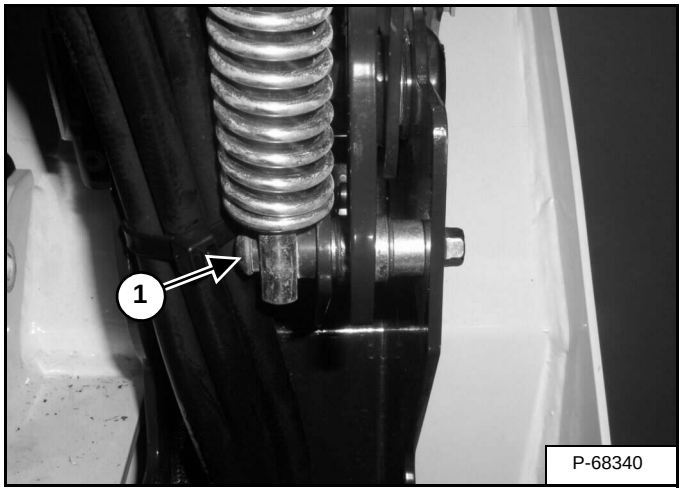
Lower the console.

Figure 40-60-6



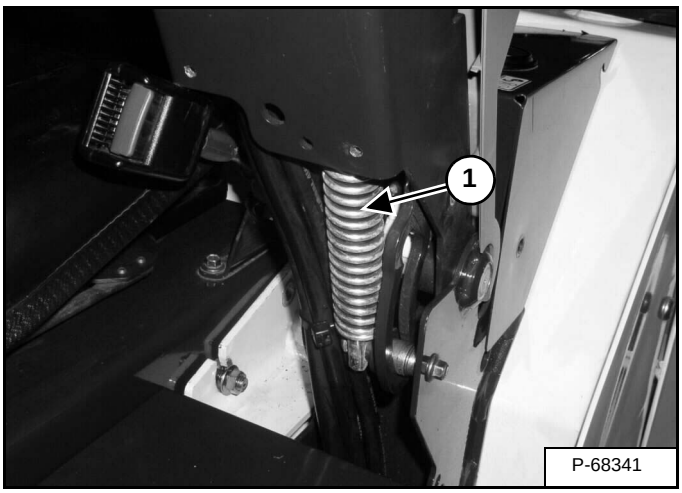
Install a pin (Item 1) **[Figure 40-60-6]** in the top of the compression spring rod.

Figure 40-60-7



Support the console in the raised position. Remove the bolt (Item 1) **[Figure 40-60-7]**.

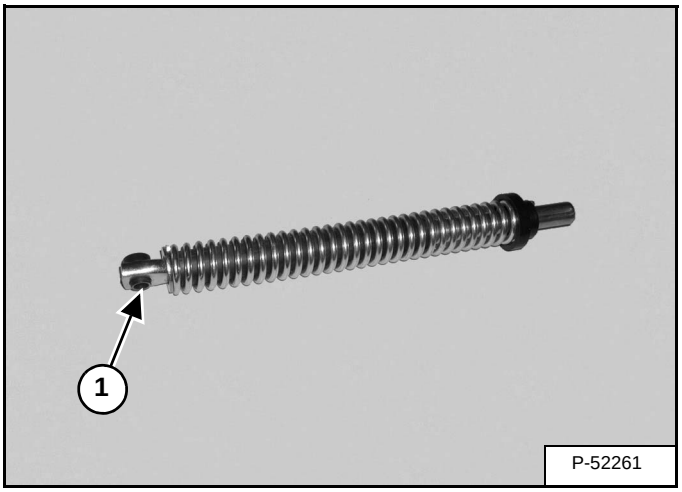
Figure 40-60-8



Remove the spring assembly (Item 1) **[Figure 40-60-8]** from the bottom of the console.

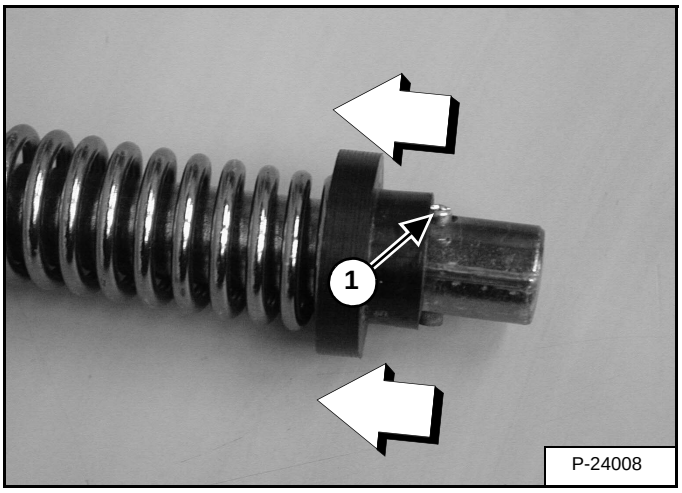
Compression Spring Disassembly And Assembly

Figure 40-60-9



Remove the bushing (Item 1) **[Figure 40-60-9]**.

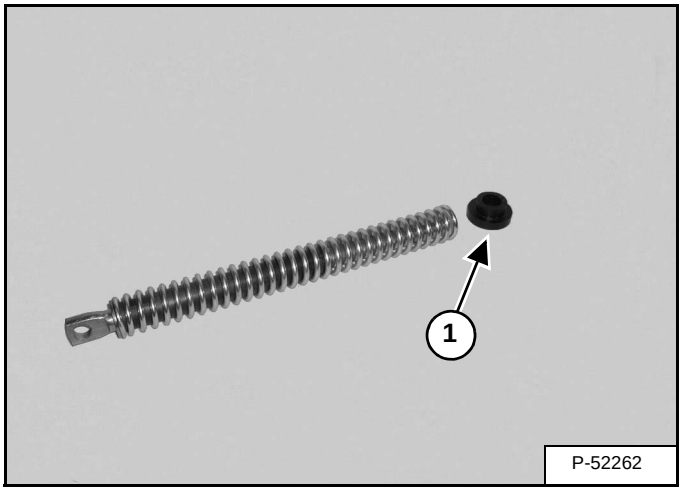
Figure 40-60-10



Apply pressure against the spring, and remove the pin (Item 1) **[Figure 40-60-10]** from the shaft.

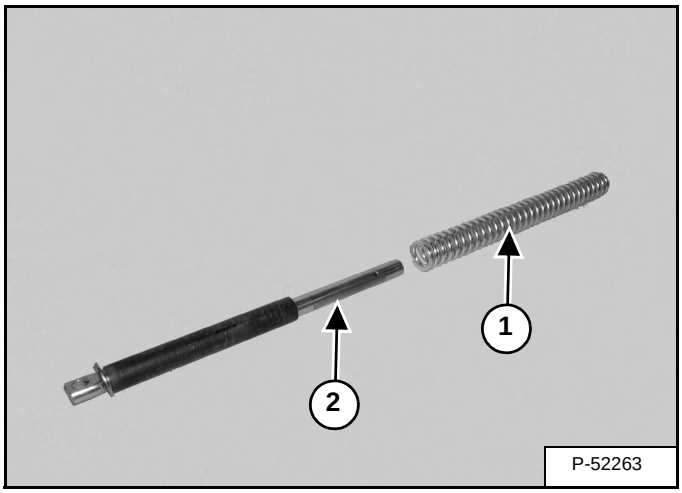
Release the pressure from the spring.

Figure 40-60-11



Remove the bushing (Item 1) **[Figure 40-60-11]**.

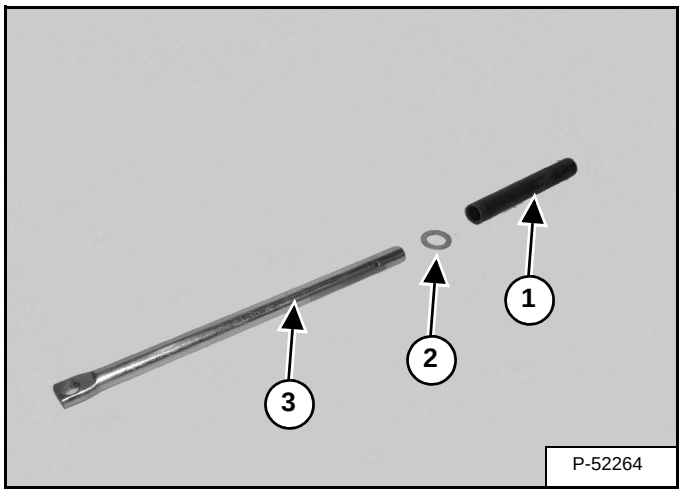
Figure 40-60-12



Remove the spring (Item 1) from the shaft (Item 2) **[Figure 40-60-12]**.

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]**.

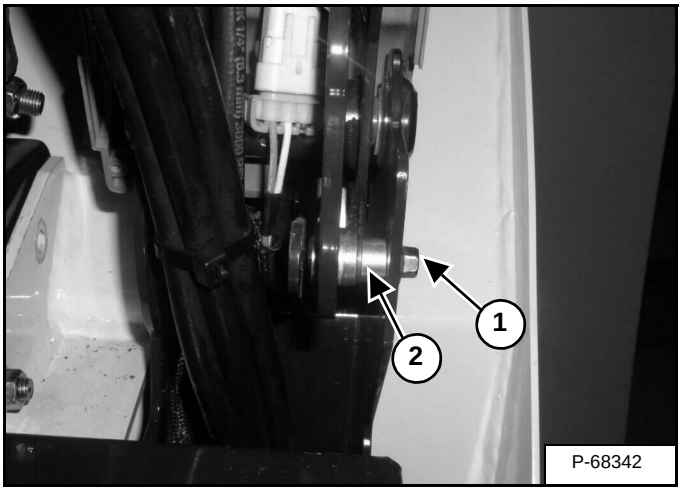
Lever Removal And Installation

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

Remove the joystick console cover (top) cover. (See Joystick Console Cover (Top) Removal And Installation on Page 40-60-2)

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

Figure 40-60-14

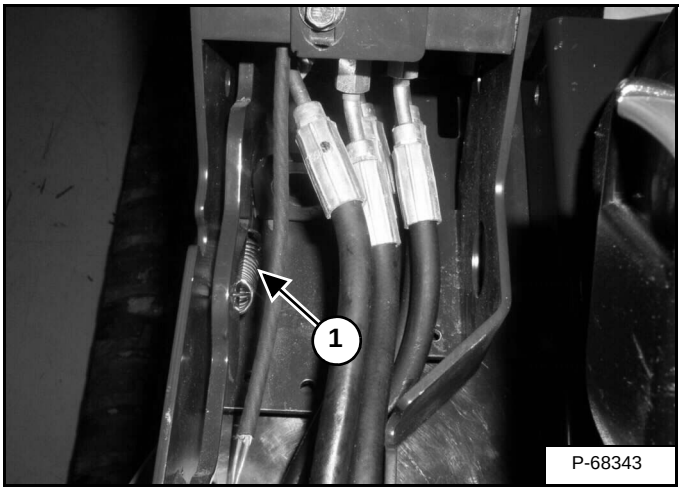


Remove the bolt (Item 1) from the lever bearing (Item 2) **[Figure 40-60-14]**.

Remove the lever bearing (Item 2) **[Figure 40-60-14]**.

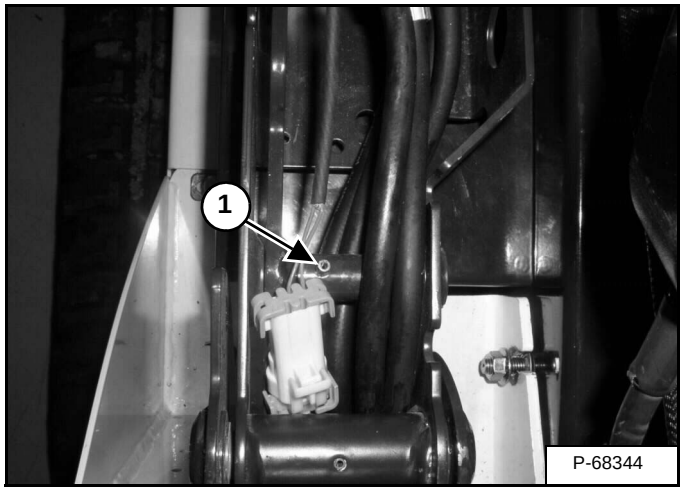
Lower the console.

Figure 40-60-15



Remove the spring (Item 1) **[Figure 40-60-15]** from the console and lever.

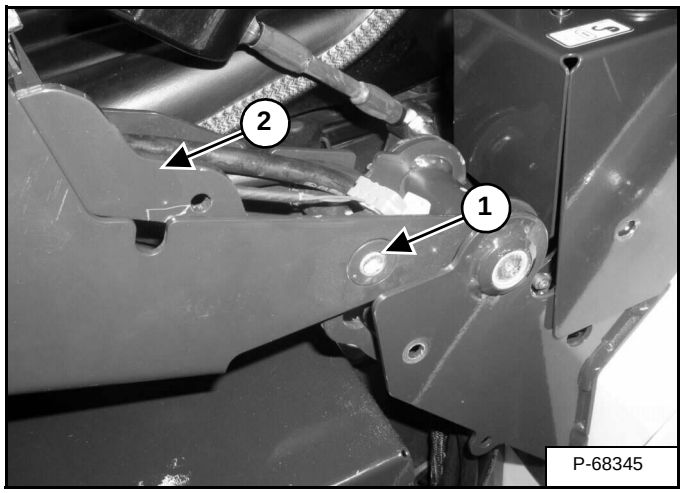
Figure 40-60-16



Remove the roll pin (Item 1) **[Figure 40-60-16]** from the lever pivot pin.

Raise and support the console.

Figure 40-60-17



Remove the pivot pin (Item 1) **[Figure 40-60-17]** from the lever.

Remove the lever (Item 2) **[Figure 40-60-17]** from the console.

Joystick Console Frame Removal And Installation

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

Remove the joystick console cover (top) cover. (See Joystick Console Cover (Top) Removal And Installation on Page 40-60-2)

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

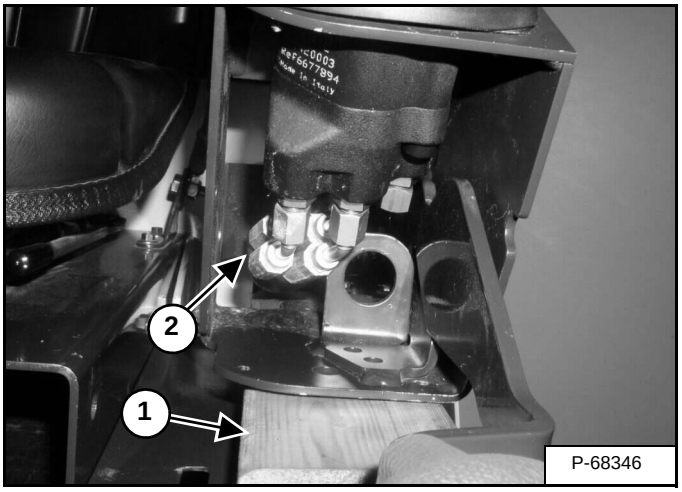
Remove the lever. (See Lever Removal And Installation on Page 40-60-6)

IMPORTANT

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

I-2003-0888

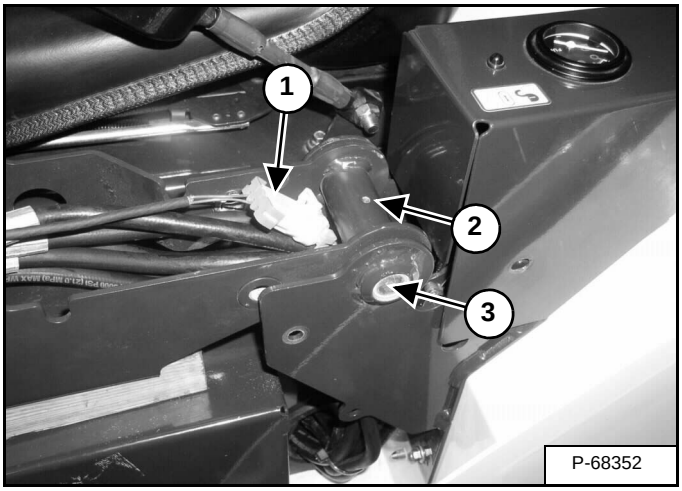
Figure 40-60-18



Lower the console on a support (Item 1) **[Figure 40-60-18]** to avoid damage to the microswitch if the console drops below the locked position.

Mark the hoses for ease of assembly. Remove and cap the six hoses (Item 2) **[Figure 40-60-18]** from the joystick.

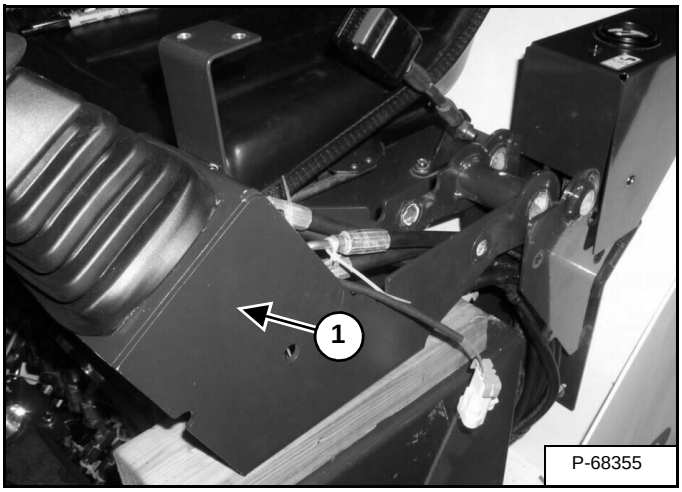
Figure 40-60-19



Lower the console on a support to avoid damage to the microswitch if the console drops below the locked position. Disconnect the joystick wire harness (Item 1) **[Figure 40-60-19]**.

Remove the roll pin (Item 2) and the pivot pin (Item 3) **[Figure 40-60-19]**.

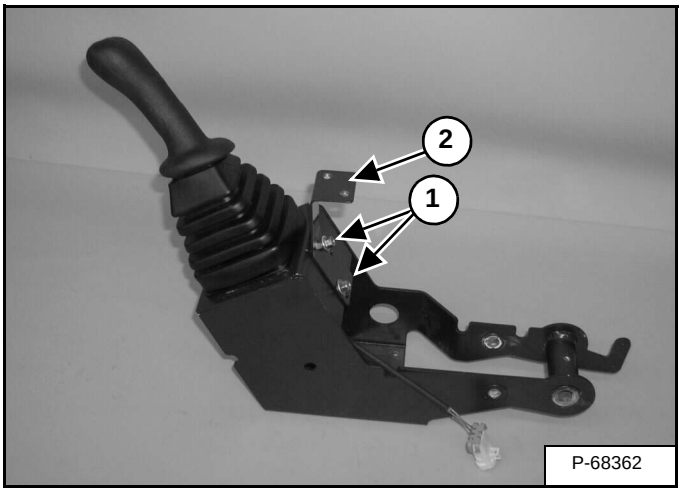
Figure 40-60-20



Remove the joystick console frame (Item 1) **[Figure 40-60-20]** from the excavator.

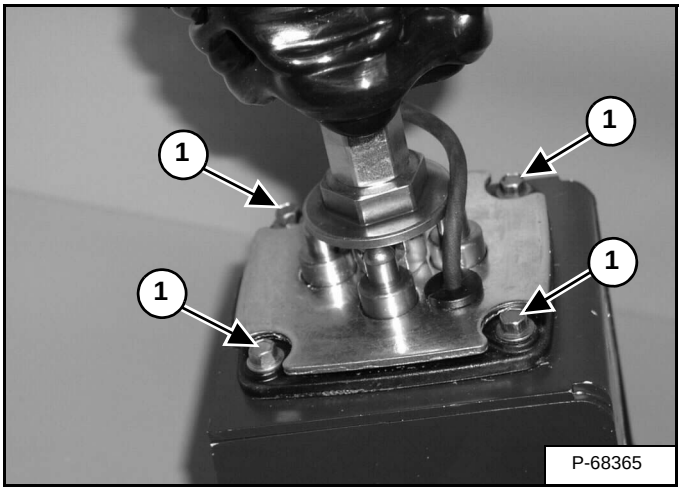
Joystick Console Frame Disassembly And Assembly

Figure 40-60-21



Remove the screws (Item 1) and bracket (Item 2) **[Figure 40-60-21]**.

Figure 40-60-22



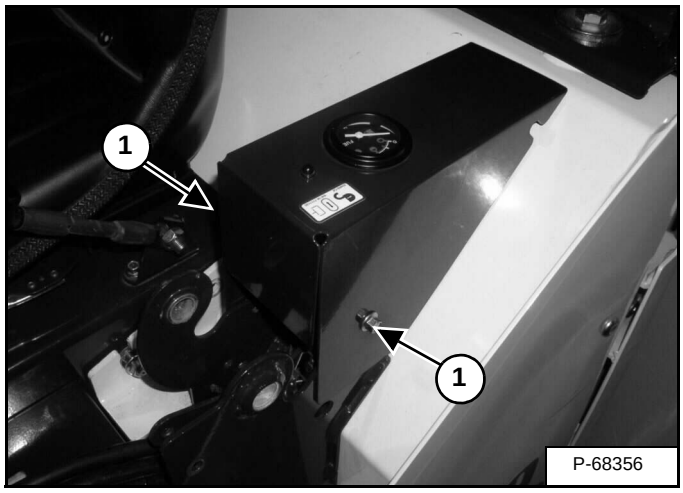
Lift the joystick boot.

Remove the screws (Item 1) **[Figure 40-60-22]** from the joystick bracket.

Remove the joystick from the console frame.

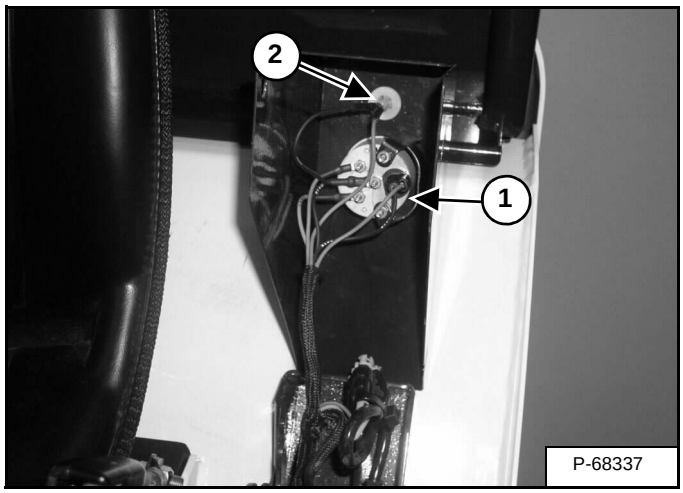
Left Rear Console Cover Removal And Installation

Figure 40-60-23



Remove the two console cover screws (Item 1) **[Figure 40-60-23]**.

Figure 40-60-24



Lift the left rear console cover and mark the wires for ease of assembly.

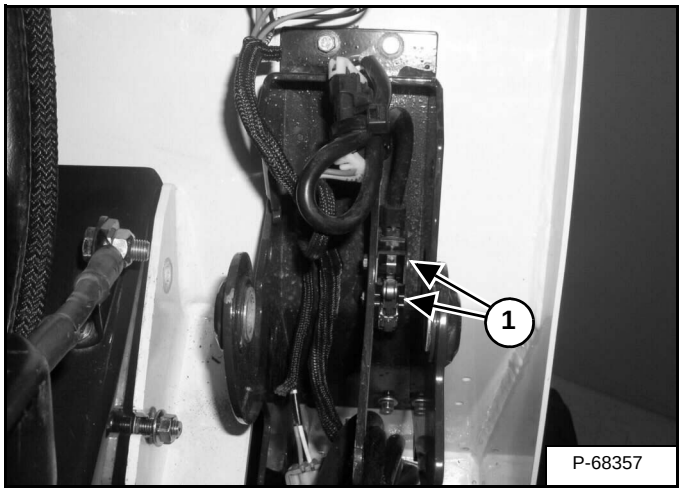
Disconnect the wires and bulb from the fuel gauge (Item 1) **[Figure 40-60-24]**.

Disconnect the wires from the LED indicator (Item 2) **[Figure 40-60-24]**.

Remove the left rear console cover from the excavator.

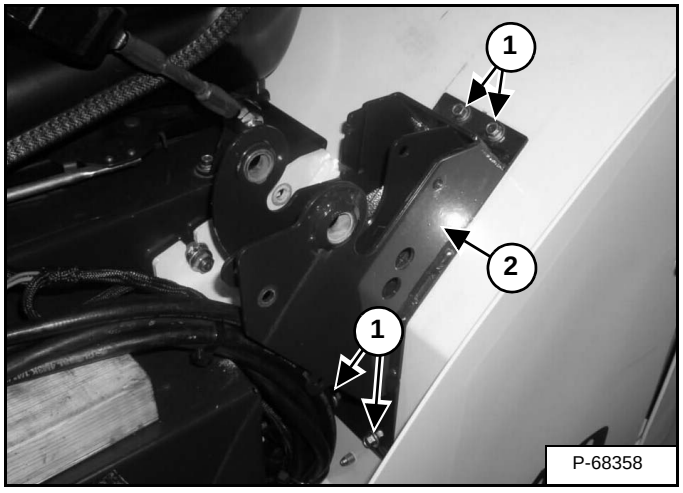
Left Rear Console Frame Removal And Installation

Figure 40-60-25



Remove the two screws (Item 1) **[Figure 40-60-25]** from the left rear console microswitch. Remove the microswitch.

Figure 40-60-26



Remove the four bolts (Item 1) **[Figure 40-60-26]**.

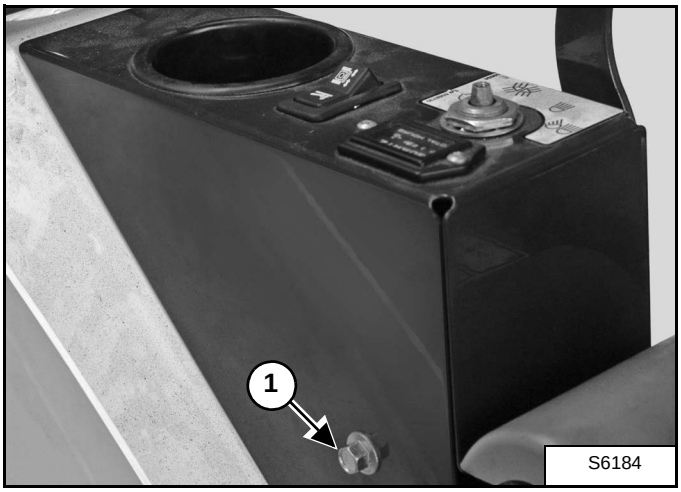
Remove the left rear console frame (Item 2) **[Figure 40-60-26]**. The joystick pilot hoses will slide through the rubber as the console frame is removed.


Bobcat®

ENGINE SPEED CONTROL

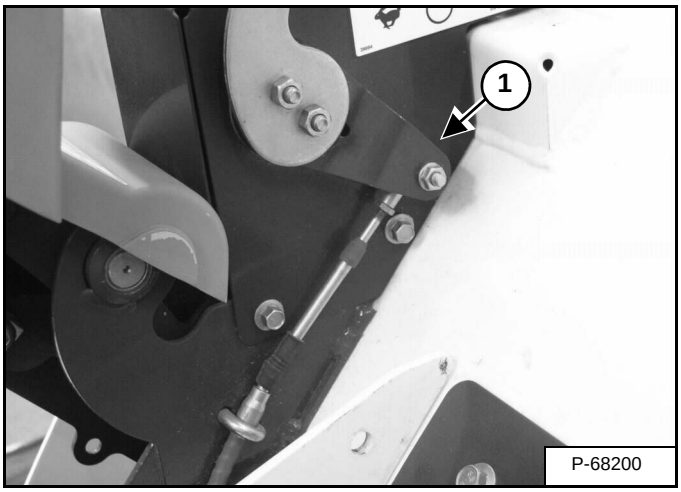
Removal and Installation

Figure 40-70-1



Remove the bolt (Item 1) **[Figure 40-70-1]** from the right side of the instrument console.

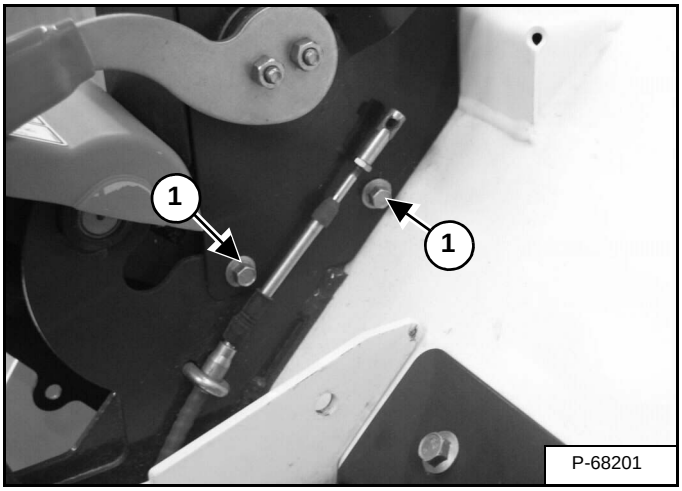
Figure 40-70-2



Remove the throttle linkage from the ball joint on the back side of the lever (Item 1) **[Figure 40-70-2]**.

NOTE: The seat is removed [Figure 40-70-2] from the excavator to show a clear view of the throttle linkage and bolts to be removed.

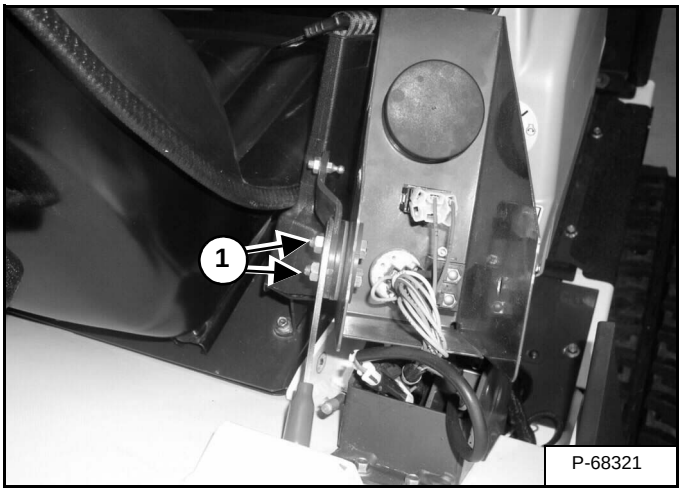
Figure 40-70-3



Remove the two bolts (Item 1) **[Figure 40-70-3]** from the left side of the instrument console.

Lift the instrument console from the console mounting bracket and turn over to view the inside of the instrument console.

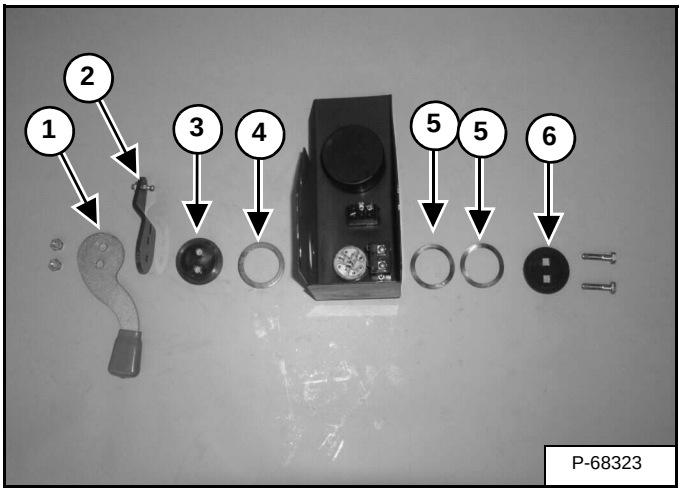
Figure 40-70-4



Remove the bolts and nuts (Item 1) **[Figure 40-70-4]** from the throttle lever.

Removal and Installation

Figure 40-70-5

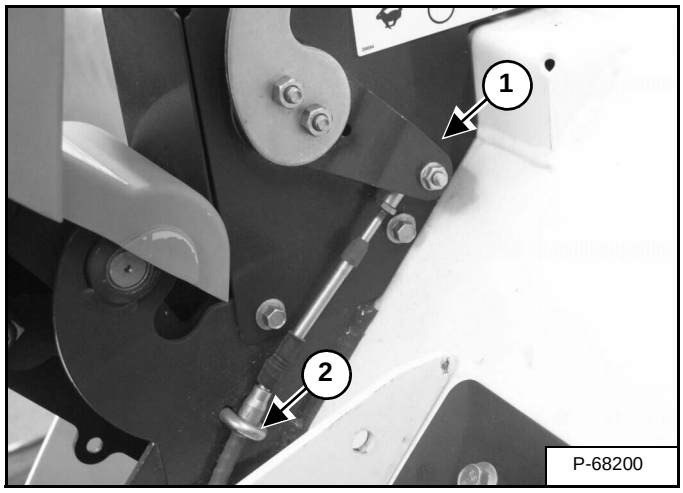


NOTE: Photograph is shown on the bench for component clarity. The instrument console does not need to be removed from the excavator [Figure 40-70-5].

Remove the lever (Item 1), the bracket (Item 2), the nylon spacer (Item 3), friction washer (Item 4), the 2 wave washers (Item 5), and the spacer (Item 6) **[Figure 40-70-5]**.

Cable Removal and Installation

Figure 40-70-6

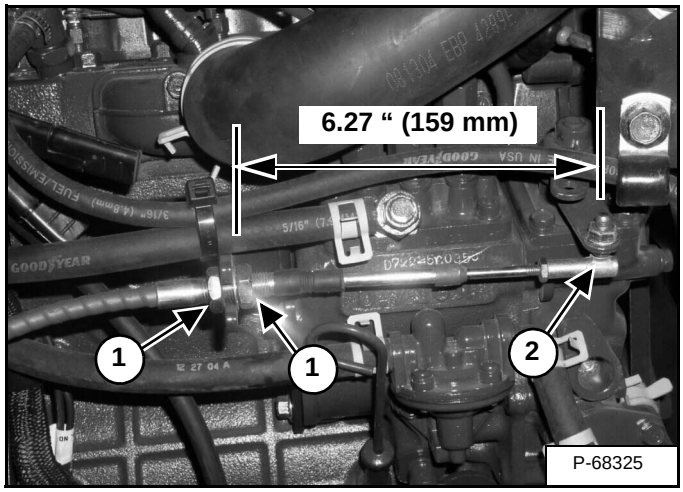


Remove the throttle linkage from the ball joint on the back side of the lever (Item 1) **[Figure 40-70-6]**.

Remove the u-clamp (Item 2) **[Figure 40-70-6]** fastening the cable to the side of the instrument console.

NOTE: The seat is removed [Figure 40-70-6] from the excavator to show a clear view of the throttle linkage and bolts to be removed.

Figure 40-70-7



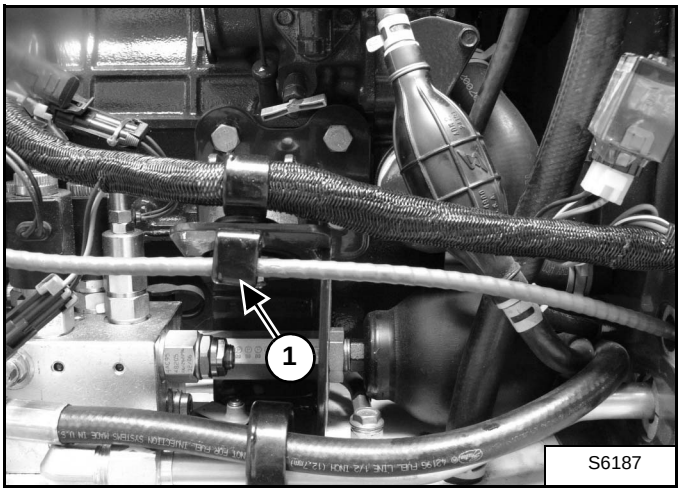
Loosen the nuts (Item 1) **[Figure 40-70-7]** fastening the cable to the bracket.

Disconnect the linkage (Item 2) **[Figure 40-70-7]** from the bracket.

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

Cable Removal and Installation (Cont'd)

Figure 40-70-8



Remove the nut and clamp (Item 1) **[Figure 40-70-8]**.

Move the cable away from the engine.

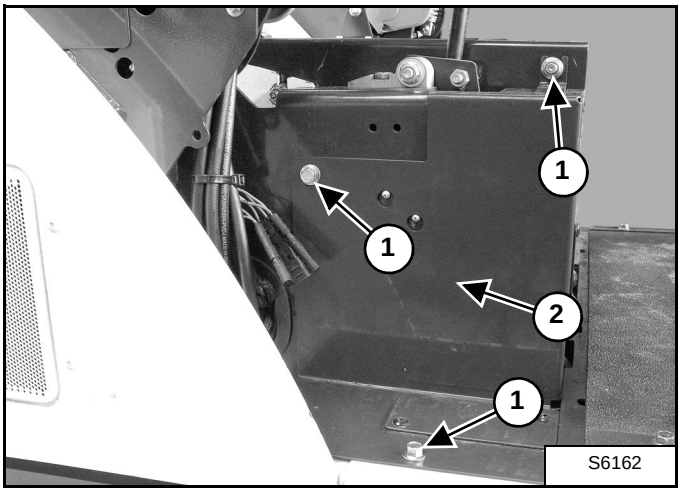
Pull the cable down from the right console and out the back of the excavator.


Bobcat®

BLADE CONTROL

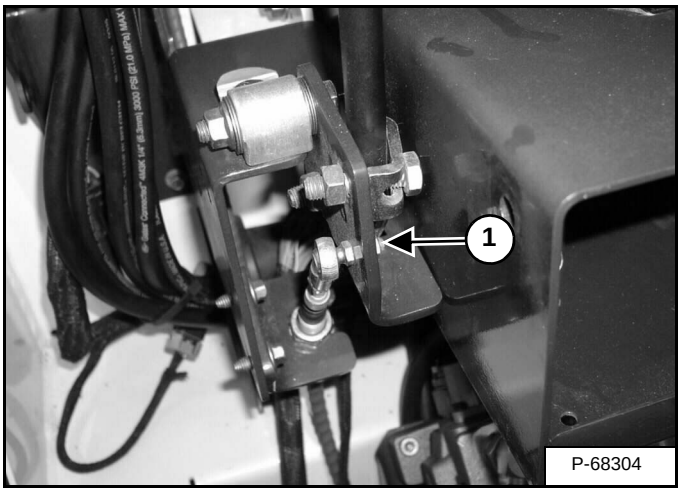
Removal and Installation

Figure 40-80-1



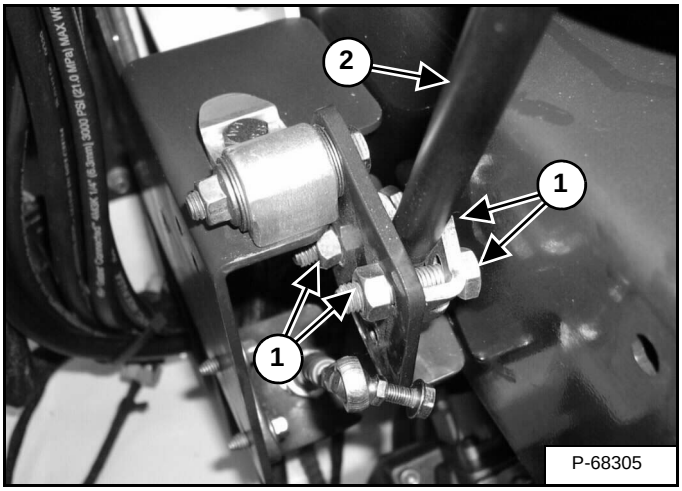
Remove the three bolts (Item 1) and remove the right side cover (Item 2) **[Figure 40-80-1]**.

Figure 40-80-2



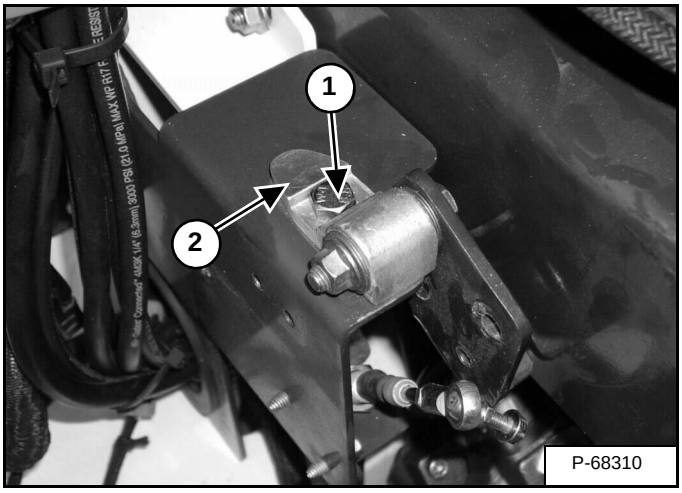
Remove the nut holding the ball joint of the blade / track expansion cable (Item 1) **[Figure 40-80-2]**.

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

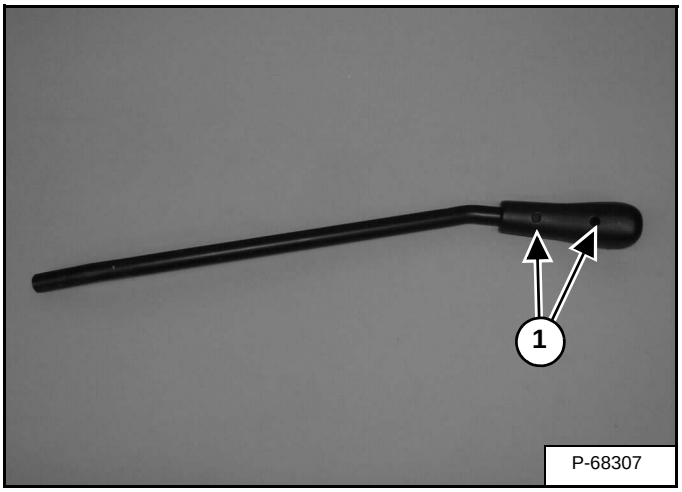


Remove the nut and bolt (Item 1) **[Figure 40-80-4]**.

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

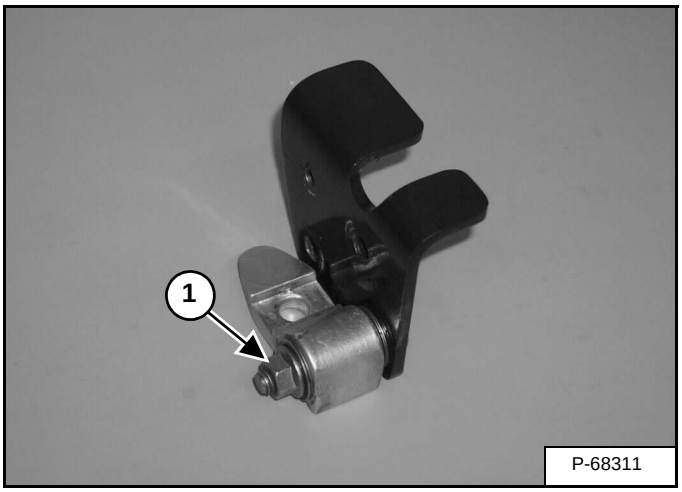
Disassembly And Assembly

Figure 40-80-5



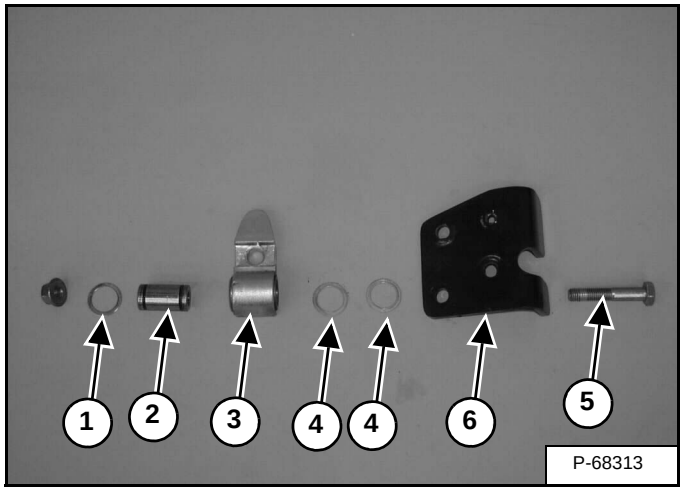
Remove the screws (Item 1) **[Figure 40-80-5]** and plastic handle halves.

Figure 40-80-6



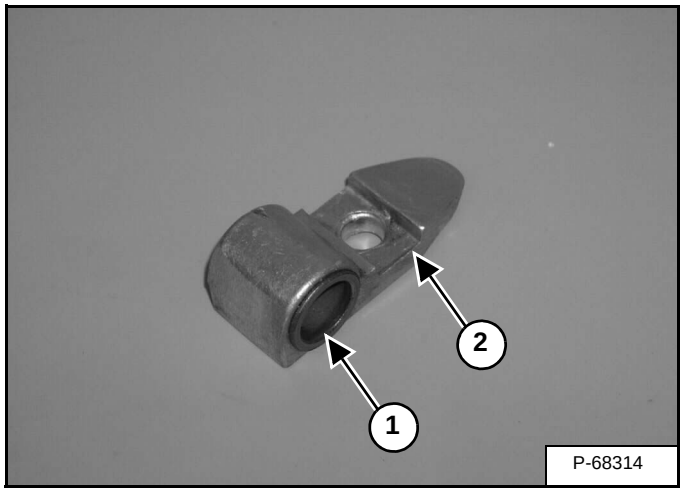
Remove the nut (Item 1) **[Figure 40-80-6]**.

Figure 40-80-7



Remove the washer (Item 1), sleeve (Item 2), bellcrank (Item 3), washers (Item 4) and bolt (Item 5) from the pivot mount (Item 6) **[Figure 40-80-7]**.

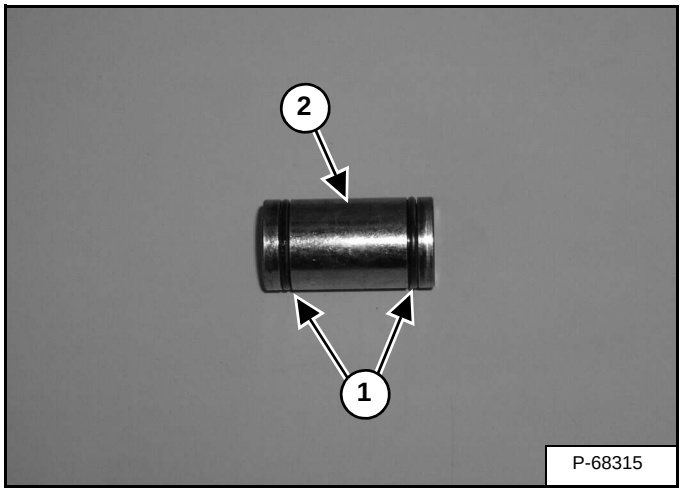
Figure 40-80-8



Remove the bushing (Item 1) from the bellcrank (Item 2) **[Figure 40-80-8]**. (Both Sides)

Disassembly And Assembly (Cont'd)

Figure 40-80-9



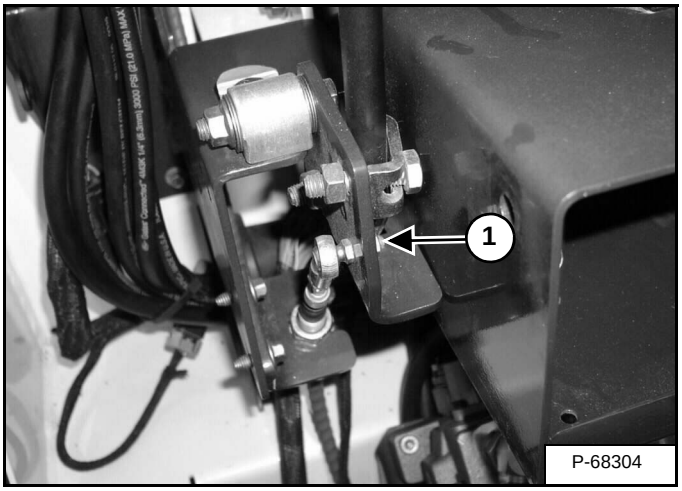
Remove the O-rings (Item 1) from the sleeve (Item 2) **[Figure 40-80-9]**.

Cable Removal and Installation

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

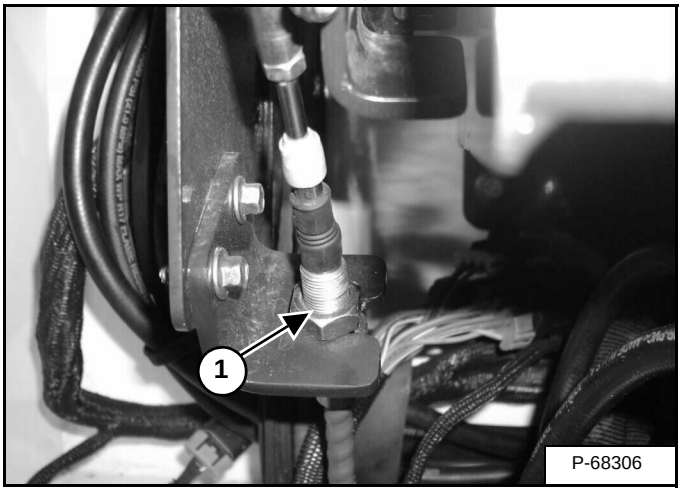
Remove the control linkage assembly (See Removal and Installation on Page 40-90-1)

Figure 40-80-10



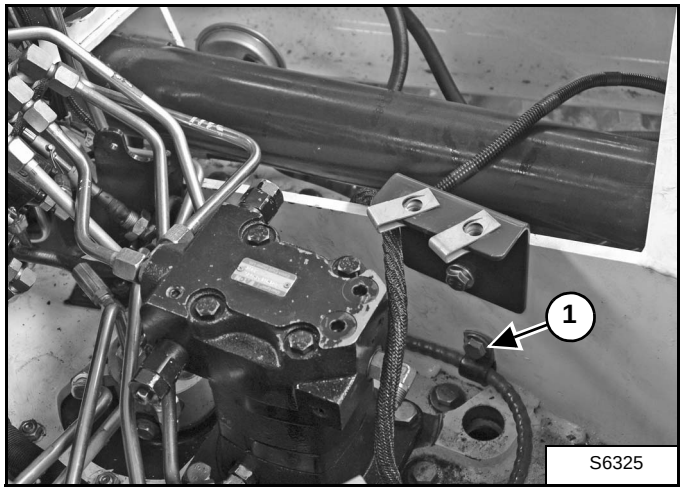
Remove the nut holding the ball joint of the blade / track expansion cable (Item 1) **[Figure 40-80-10]**.

Figure 40-80-11



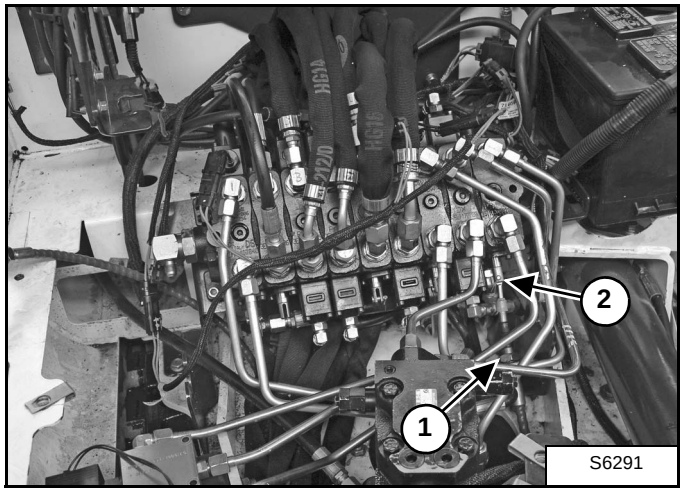
Loosen the nut (Item 1) **[Figure 40-80-11]** and slide the cable assembly out of the bracket.

Figure 40-80-12



remove the cable clamp from the frame by removing the bolt (Item 1) **[Figure 40-80-12]**.

Figure 40-80-13



Loosen the nut (Item 1) and remove the clevis pin and cotter pin (Item 2) **[Figure 40-80-13]**.

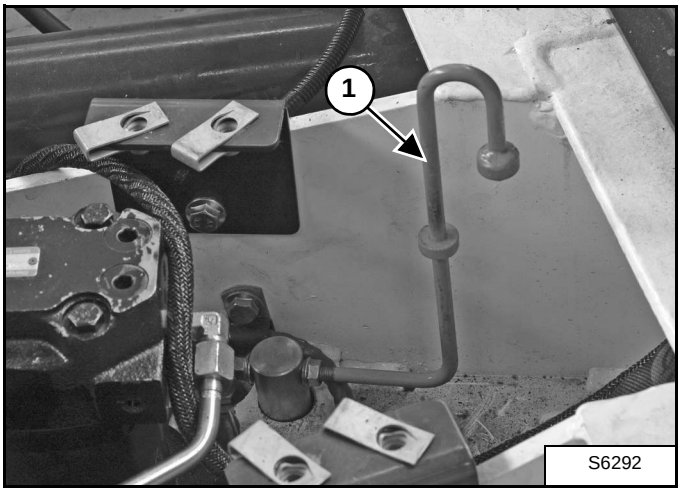
Remove the cable.

UPPERSTRUCTURE SLEW LOCK

Removal and Installation

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

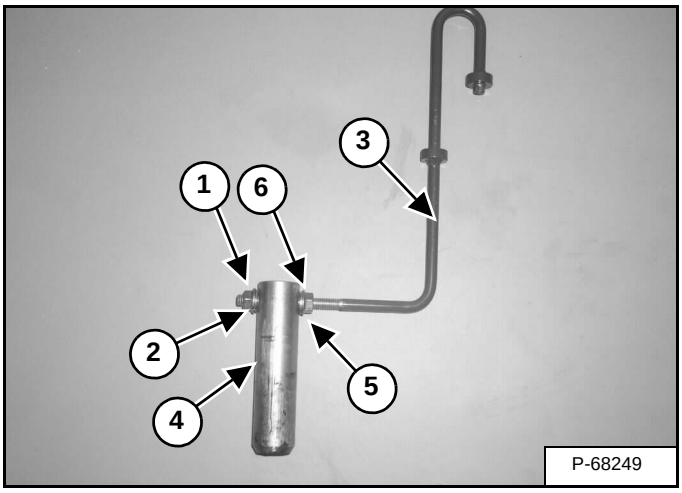
Figure 40-90-1



Remove the upperstructure slew lock lever (Item 1) **[Figure 40-90-1]** from the upperstructure.

Disassembly And Assembly

Figure 40-90-2



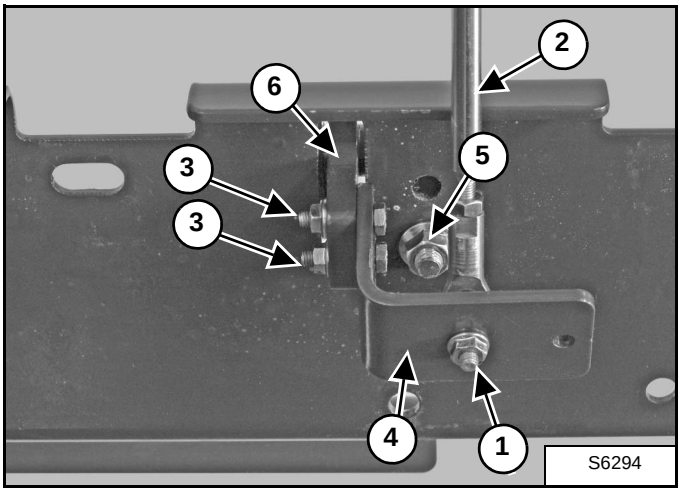
Remove the nut (Item 1) and washer (Item 2) from the swing lock lever (Item 3). Remove the pin (Item 4), washer (Item 5) and the nut (Item 6) **[Figure 40-90-2]**.


Bobcat®

RIGHT PEDAL

Removal And Installation

Figure 40-100-1



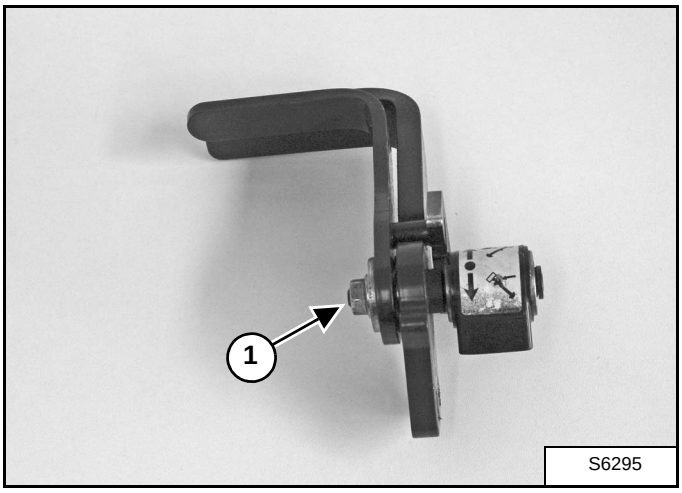
Remove the nut (Item 1) and linkage rod (Item 2) **[Figure 40-100-1]**.

Remove the two bolts and nuts (Item 3) and remove the bracket (Item 4) **[Figure 40-100-1]**.

Remove the nut and bolt (Item 5) and remove the boom swing pedal assembly (Item 6) **[Figure 40-100-1]**.

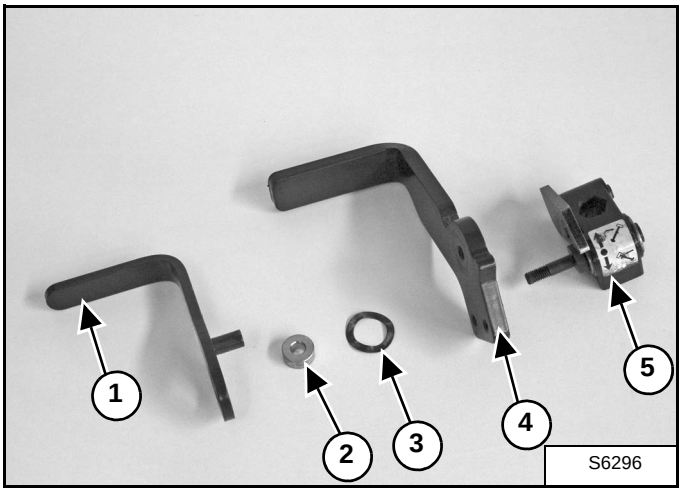
Disassembly And Assembly

Figure 40-100-2



Remove the nut and washer (Item 1) **[Figure 40-100-2]**.

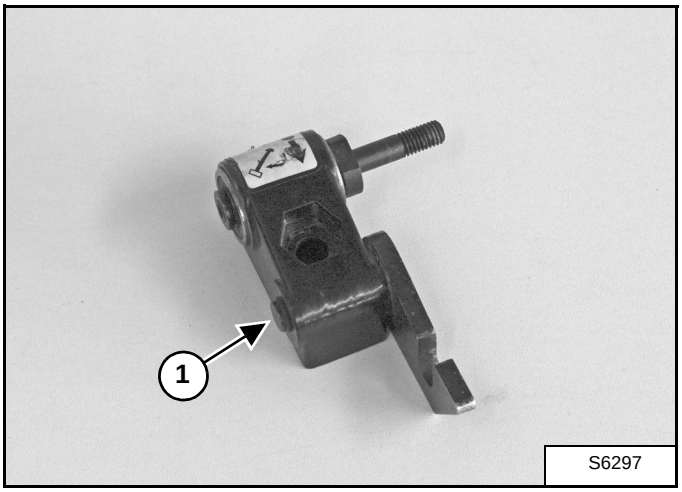
Figure 40-100-3



Remove the rear pedal (Item 1), bushing (Item 2), wave washer (Item 3) and front pedal (Item 4) from the mount (Item 5) **[Figure 40-100-3]**.

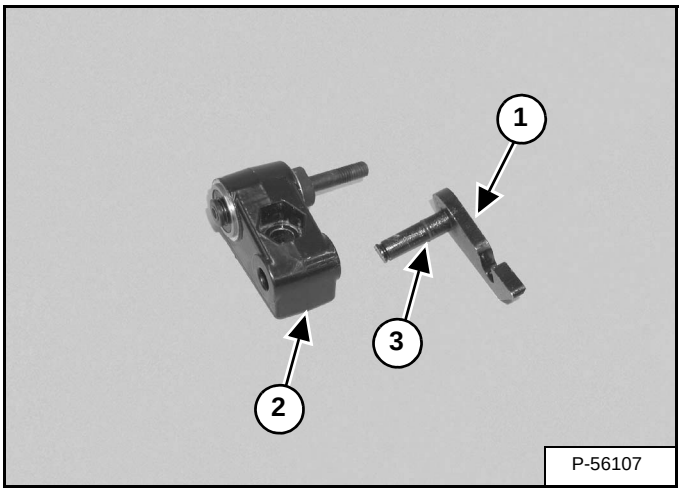
Disassembly And Assembly (Cont'd)

Figure 40-100-4



Remove the O-ring (Item 1) **[Figure 40-100-4]** from the shaft.

Figure 40-100-5



Remove the lock (Item 1) from the mount (Item 2) **[Figure 40-100-5]**.

Remove the O-ring (Item 3) **[Figure 40-100-5]** from the shaft.

NOTE: Do not lubricate the O-ring (Item 3) with grease during installation. The O-ring works as a friction lock to prevent the lock (Item 1) [Figure 40-100-5] from pivoting freely.

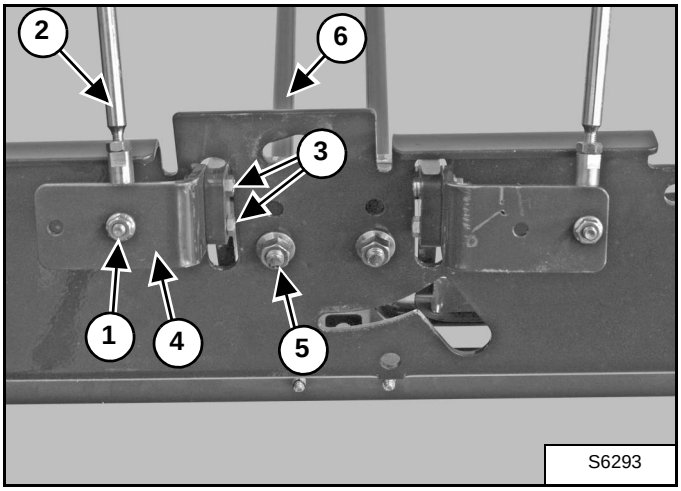
TRAVEL CONTROLS

Removal And Installation

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

NOTE: The procedure is the same for both travel controls. The left travel control is shown.

Figure 40-110-1



Remove the nut (Item 1) and linkage rod (Item 2) **[Figure 40-110-1]**.

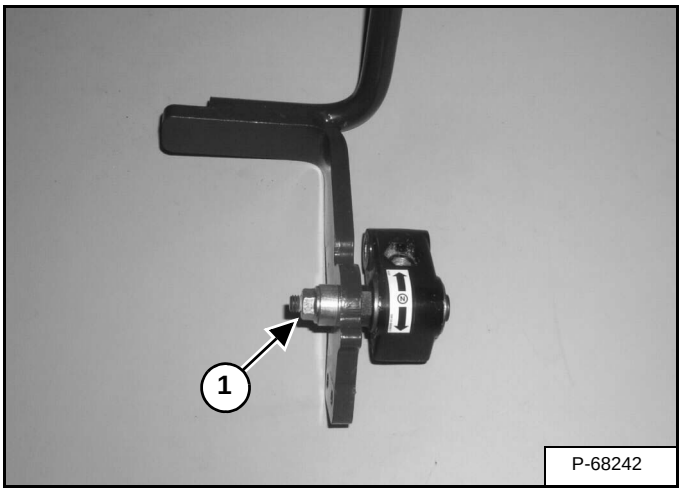
Remove the two bolts and nuts (Item 3) and remove the bracket (Item 4) **[Figure 40-110-1]**.

Remove the nut and bolt (Item 5) and remove the left travel lever (Item 6) **[Figure 40-110-1]**.

Disassembly And Assembly

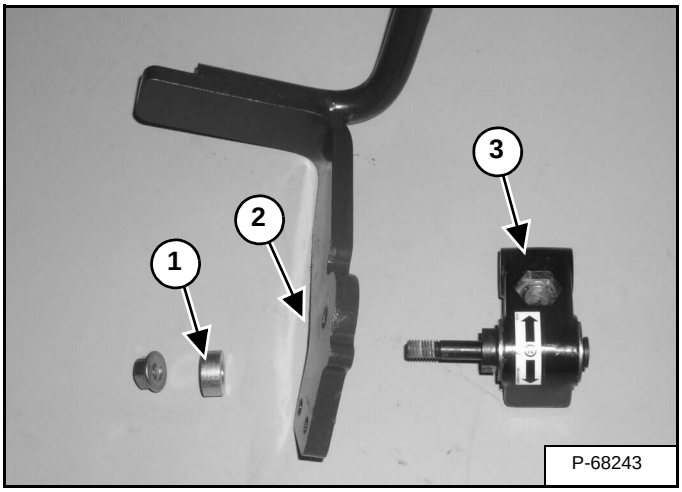
NOTE: The procedure is the same for both left and right travel controls. The left travel control is shown.

Figure 40-110-2



Remove the nut (Item 1) **[Figure 40-110-2]**.

Figure 40-110-3



Remove the bushing (Item 1) and rear pedal (Item 2) from the mount (Item 3) **[Figure 40-110-3]**.

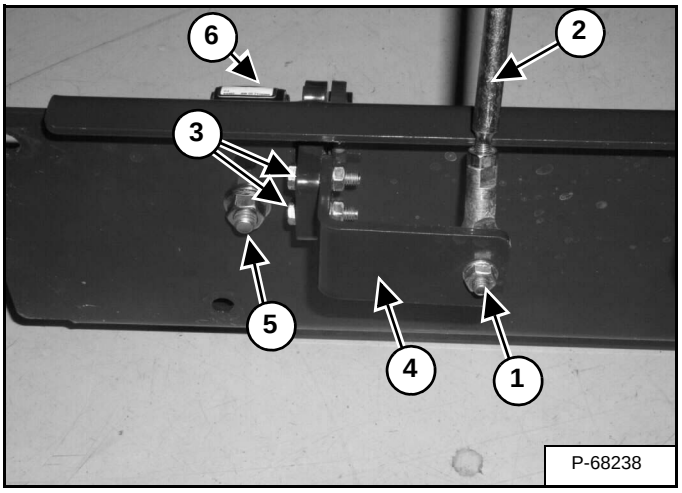

Bobcat®

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



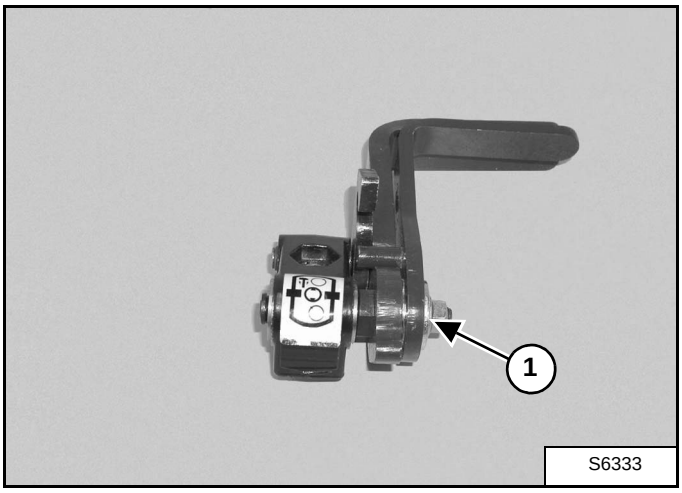
Remove the nut (Item 1) and linkage rod (Item 2) **[Figure 40-120-1]**.

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]**.

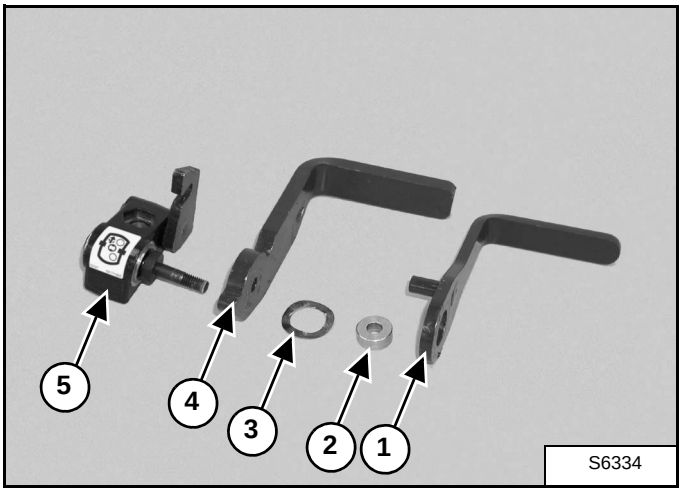
Disassembly And Assembly

Figure 40-120-2



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

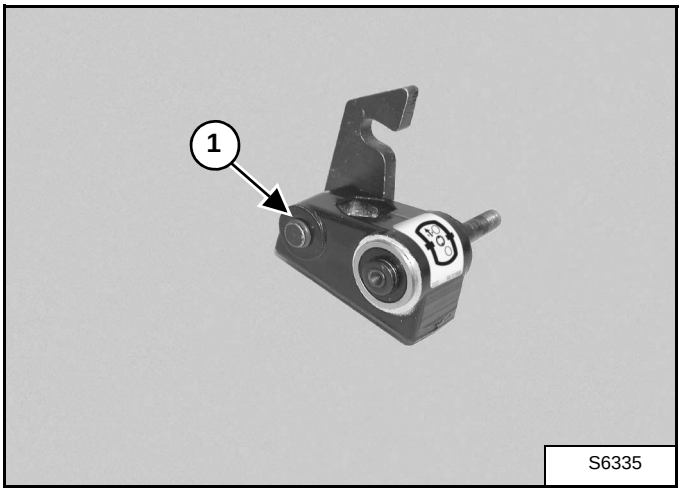
Figure 40-120-3



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]**.

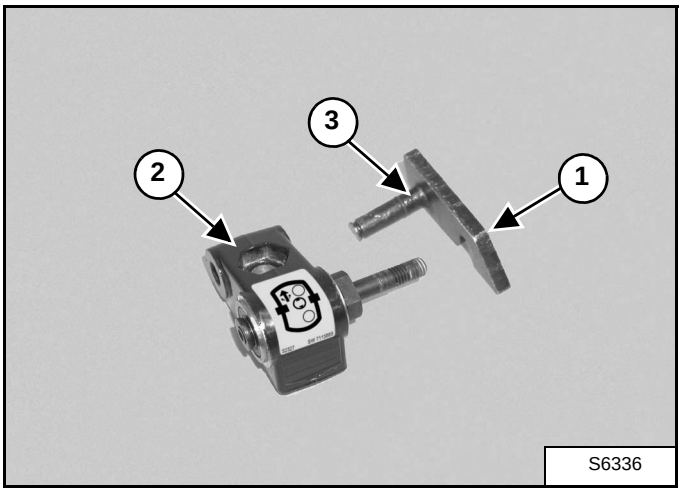
Disassembly And Assembly (Cont'd)

Figure 40-120-4



Remove the O-ring (Item 1) **[Figure 40-120-4]** from the shaft.

Figure 40-120-5



Remove the lock (Item 1) from the mount (Item 2) **[Figure 40-120-5]**.

Remove the O-ring (Item 3) **[Figure 40-120-5]** from the shaft.

NOTE: Do not lubricate the O-ring (Item 3) with grease during installation. The O-ring works as a friction lock to prevent the lock (Item 1) [Figure 40-120-5] from pivoting freely.

CONTROL LINKAGE ASSEMBLY

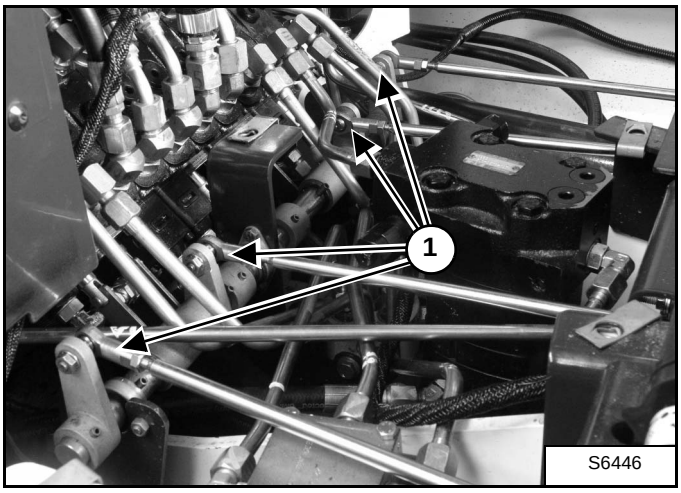
Description

The control linkage assembly is the linkage that connects the pedals and travel levers to the control valve section for the left and right travel, boom swing (offset) and the auxiliary functions. The control linkage is a two piece shaft supported on each end with a bearing.

Removal And Installation

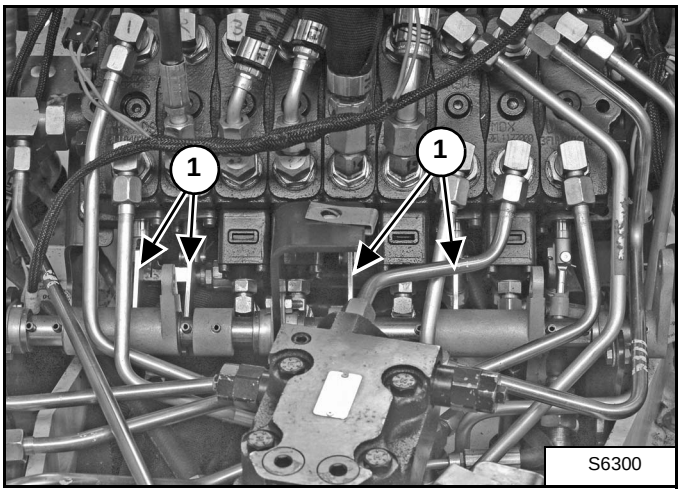
Remove the floor mat and floor panels (See Removal and Installation on Page 40-140-1)

Figure 40-130-1



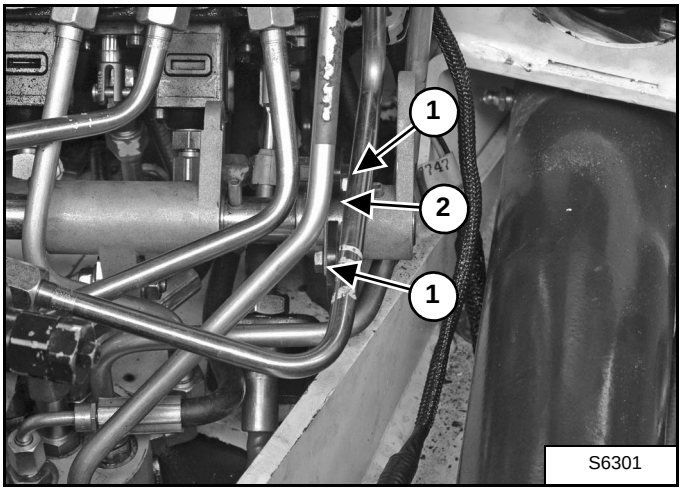
Remove the linkage rods (Item 1) **[Figure 40-130-1]** from the control linkage assembly.

Figure 40-130-2



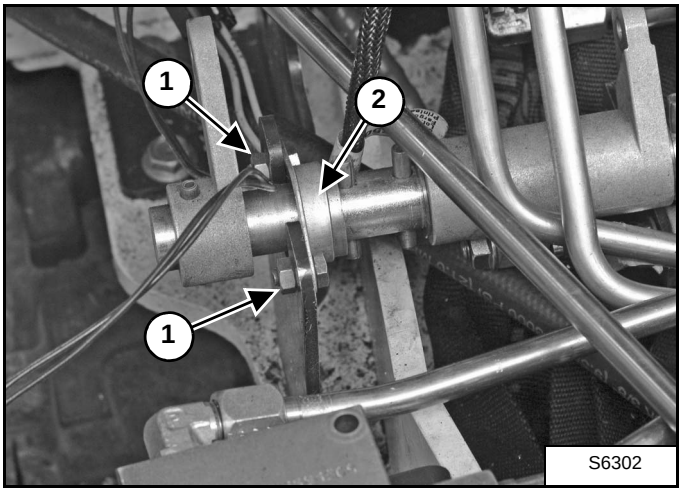
Remove the cotter pins and clevis pins (Item 1) **[Figure 40-130-2]** from the control valve.

Figure 40-130-3



Remove the bolts and nuts (Item 1) from the bearing block (Item 2) **[Figure 40-130-3]**.

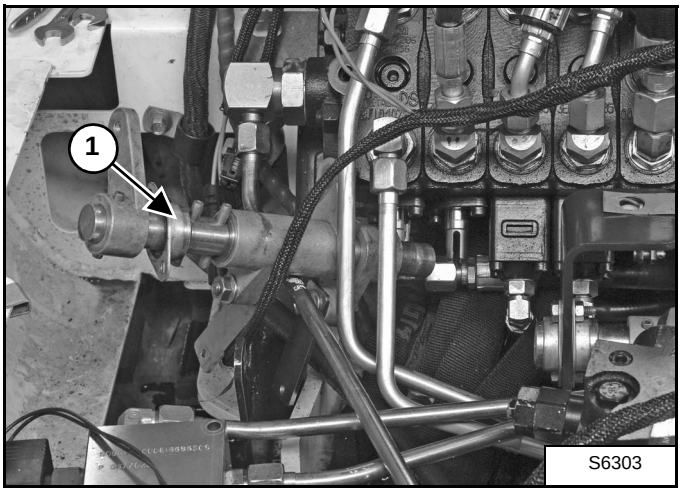
Figure 40-130-4



Remove the bolts and nuts (Item 1) from the bearing block (Item 2) **[Figure 40-130-4]**.

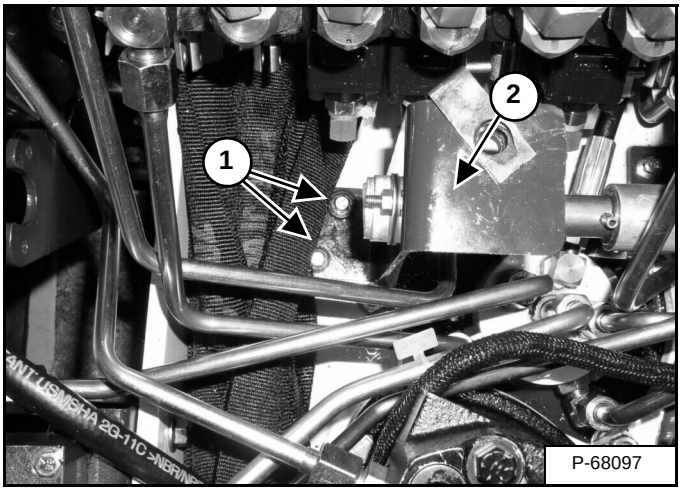
Removal And Installation (Cont'd)

Figure 40-130-5



Remove the right half of the control linkage assembly (Item 1) **[Figure 40-130-5]** from the excavator.

Figure 40-130-6



Remove the two bolts (Item 1) and remove the middle support bracket (Item 2) **[Figure 40-130-6]** with bearings attached.

Figure 40-130-7

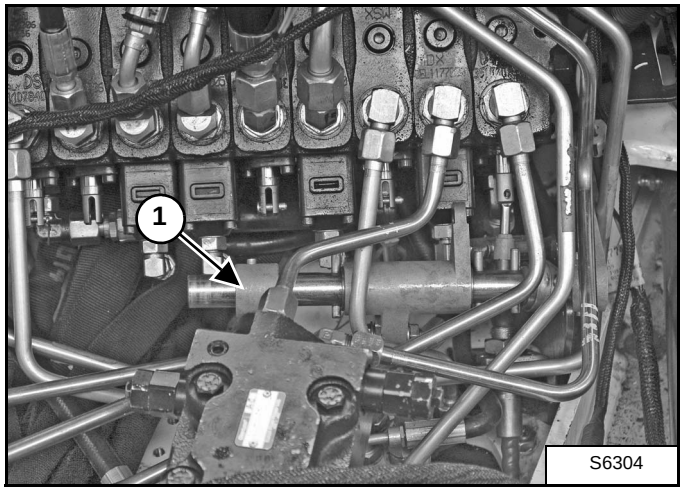
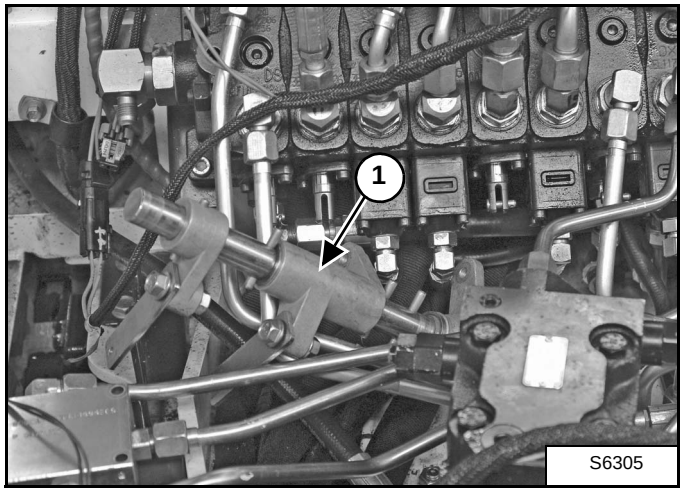


Figure 40-130-8

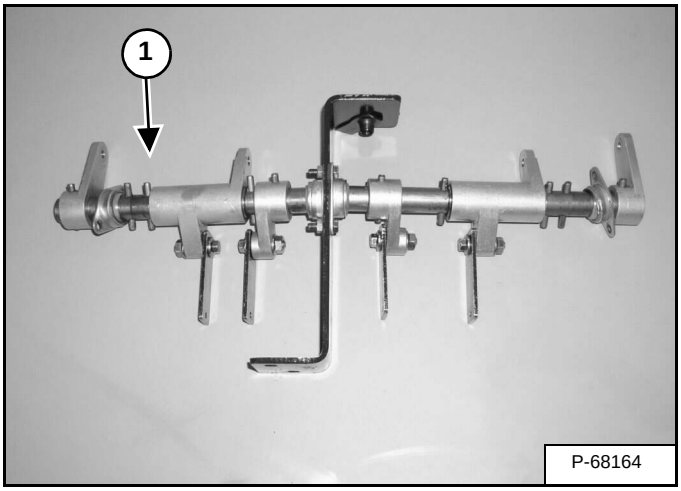


Remove the left half of the control linkage assembly (Item 1) **[Figure 40-130-7]** and **[Figure 40-130-8]** from the excavator.

Right Half of Control Linkage Disassembly And Assembly

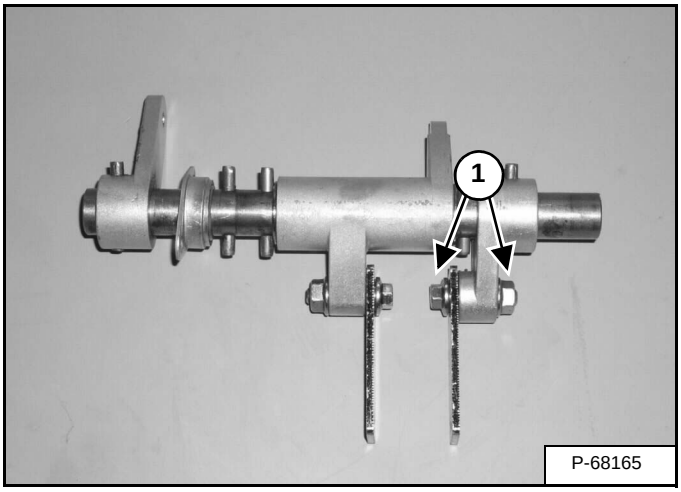
Mark the linkage rods and their orientation on the bellcranks. Mark bellcrank assemblies location and orientation on the shaft for ease of assembly.

Figure 40-130-9



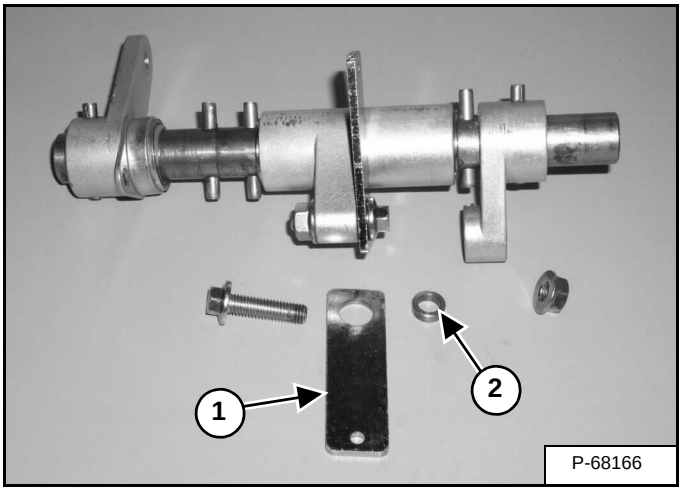
Remove the right half of the control linkage (Item 1) **[Figure 40-130-9]** from the control linkage assembly.

Figure 40-130-10



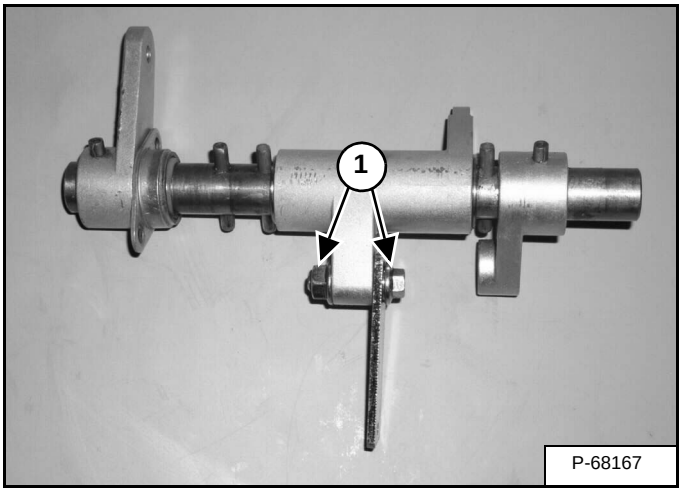
Remove the bolt and nut (Item 1) **[Figure 40-130-10]** from the bellcrank.

Figure 40-130-11



Remove the linkage plate (Item 1) and spacer (Item 2) **[Figure 40-130-11]** from the bellcrank.

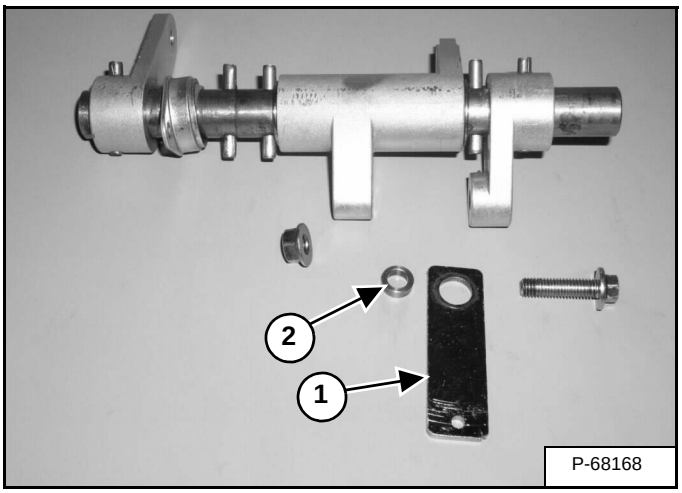
Figure 40-130-12



Remove the bolt and nut (Item 1) **[Figure 40-130-12]** from the bellcrank.

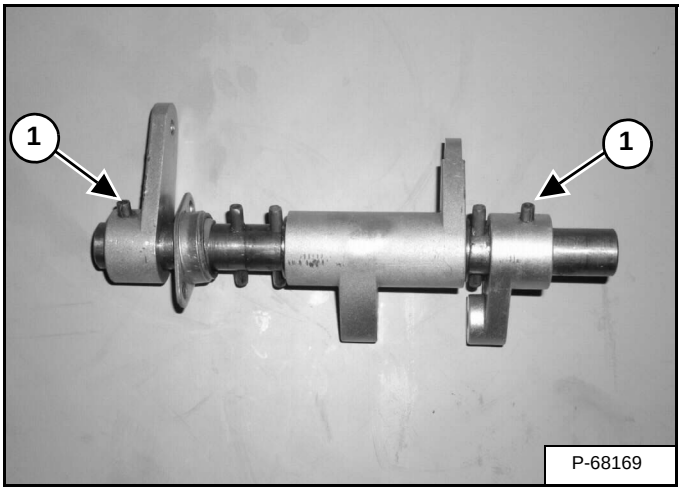
Right Half of Control Linkage Disassembly And Assembly (Cont'd)

Figure 40-130-13



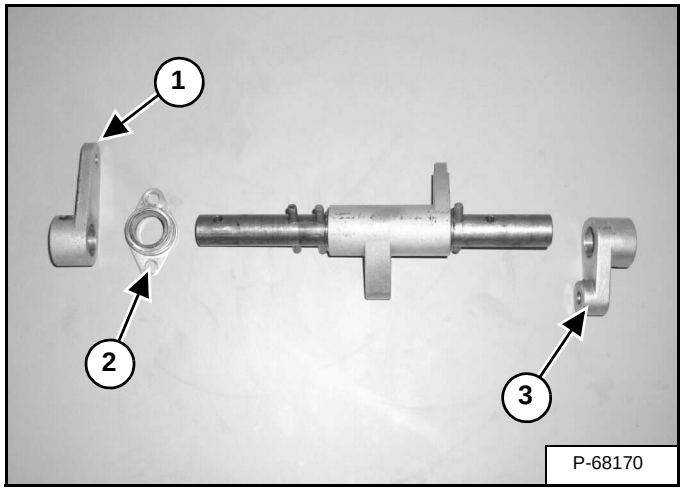
Remove the linkage plate (Item 1) and spacer (Item 2) **[Figure 40-130-13]** from the bellcrank.

Figure 40-130-14



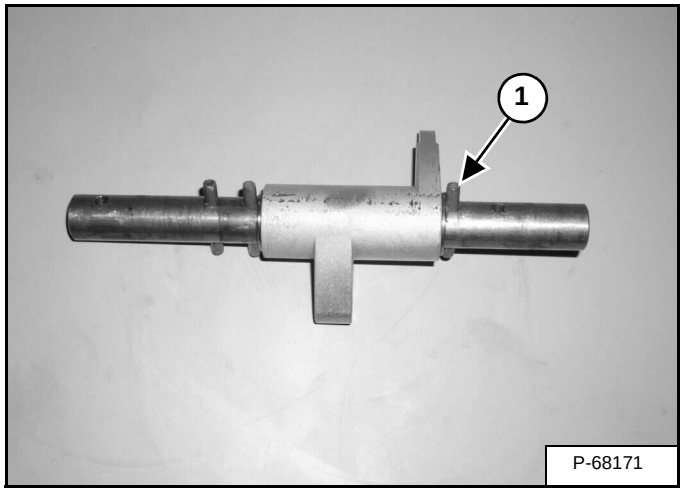
Remove the roll pins (Item 1) **[Figure 40-130-14]** from the bellcranks.

Figure 40-130-15



Remove the bellcrank (Item 1), bearing (Item 2) and bellcrank (Item 3) **[Figure 40-130-15]** from the shaft.

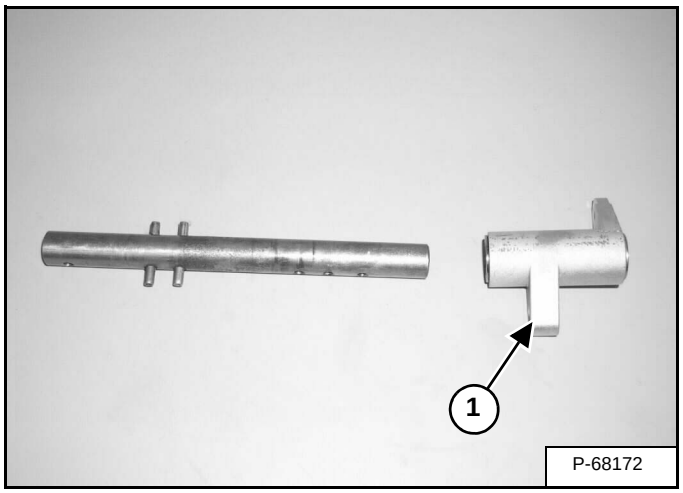
Figure 40-130-16



Remove the roll pin (Item 1) **[Figure 40-130-16]** from the shaft.

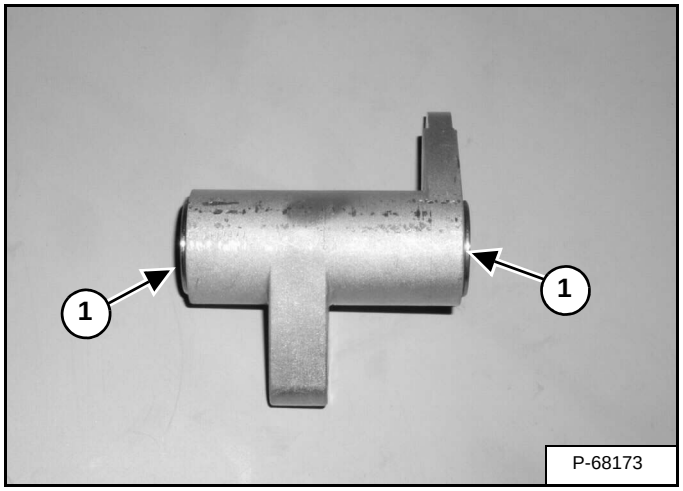
Right Half of Control Linkage Disassembly And Assembly (Cont'd)

Figure 40-130-17



Remove the bellcrank (Item 1) **[Figure 40-130-17]** from the shaft.

Figure 40-130-18

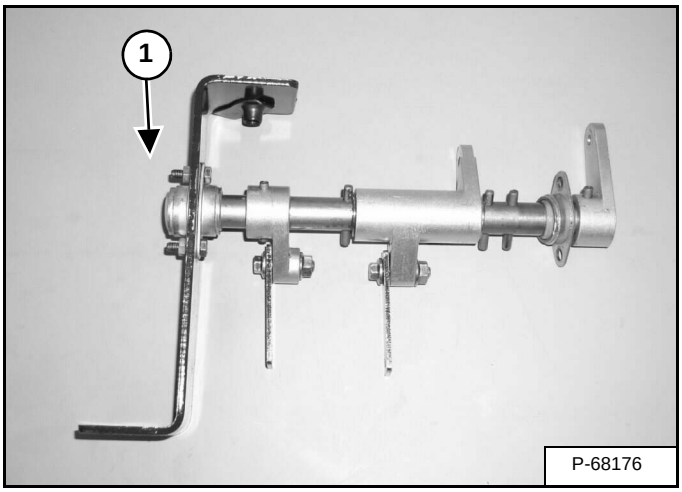


Remove the bushings (Item 1) **[Figure 40-130-18]** from the bellcrank.

Left Half of Control Linkage Disassembly And Assembly

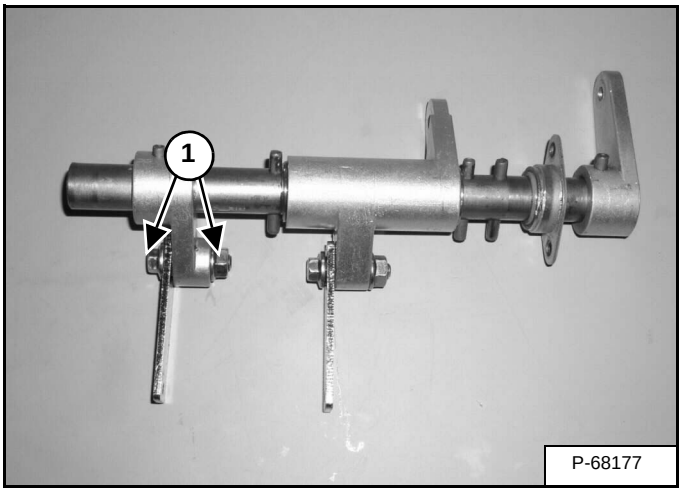
Mark the linkage rods and their orientation on the bellcranks. Mark bellcrank assemblies location and orientation on the shaft for ease of assembly.

Figure 40-130-19



Remove the left half of the control linkage (Item 1) **[Figure 40-130-19]** from the mount bracket bearing.

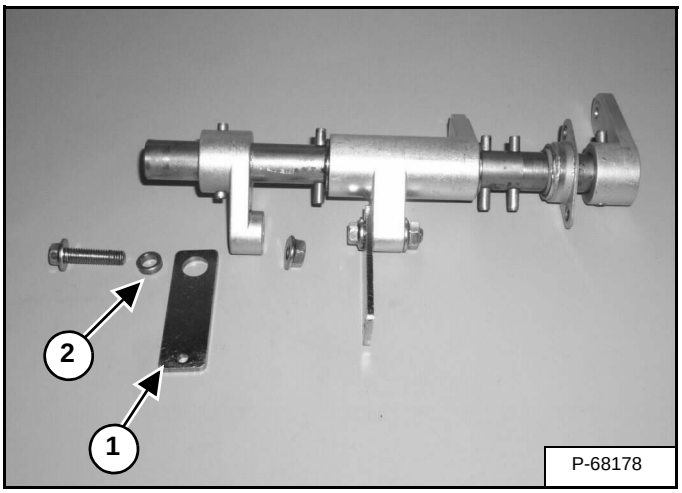
Figure 40-130-20



Remove the bolt and nut (Item 1) **[Figure 40-130-20]** from the bellcrank.

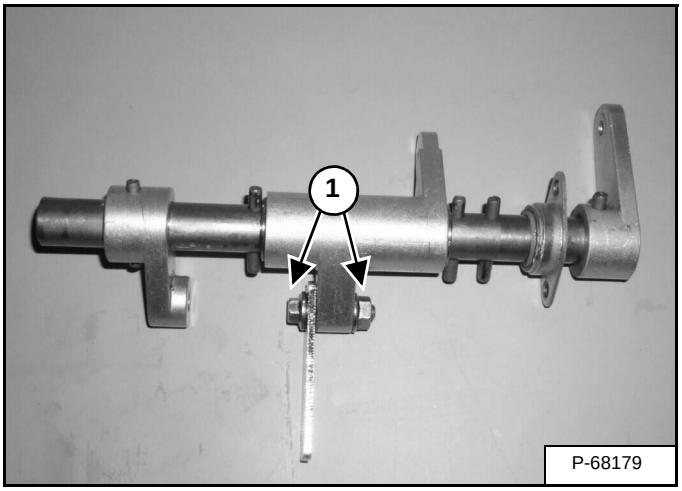
Left Half of Control Linkage Disassembly And Assembly (Cont'd)

Figure 40-130-21



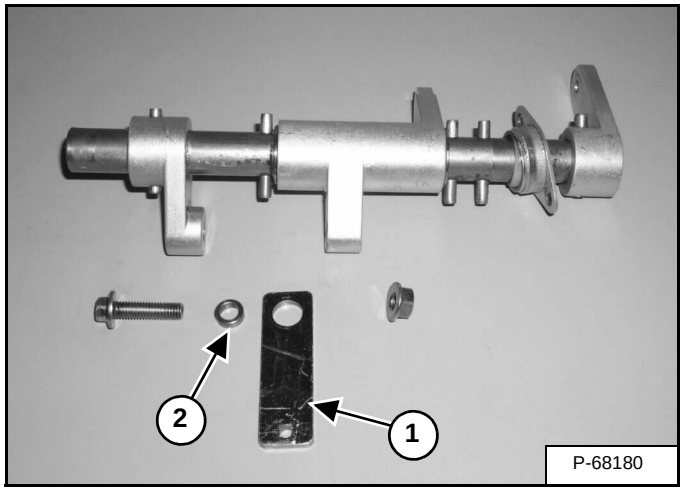
Remove the linkage plate (Item 1) and spacer (Item 2) **[Figure 40-130-21]** from the bellcrank.

Figure 40-130-22



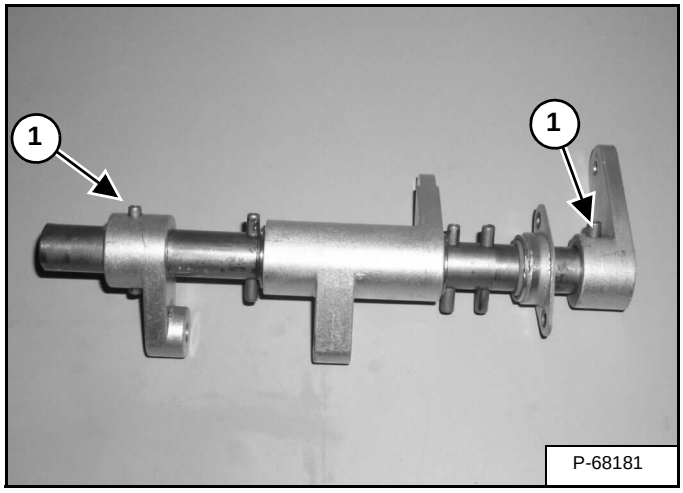
Remove the bolt and nut (Item 1) **[Figure 40-130-22]** from the bellcrank.

Figure 40-130-23



Remove the linkage plate (Item 1) and spacer (Item 2) **[Figure 40-130-23]** from the bellcrank.

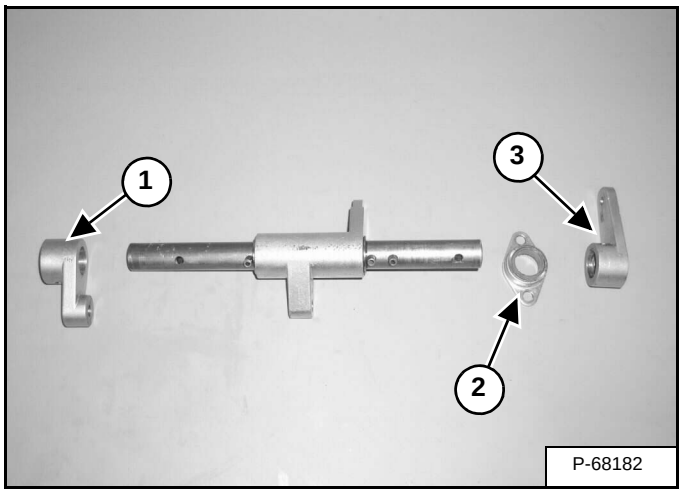
Figure 40-130-24



Remove the roll pins (Item 1) **[Figure 40-130-24]** from the bellcranks.

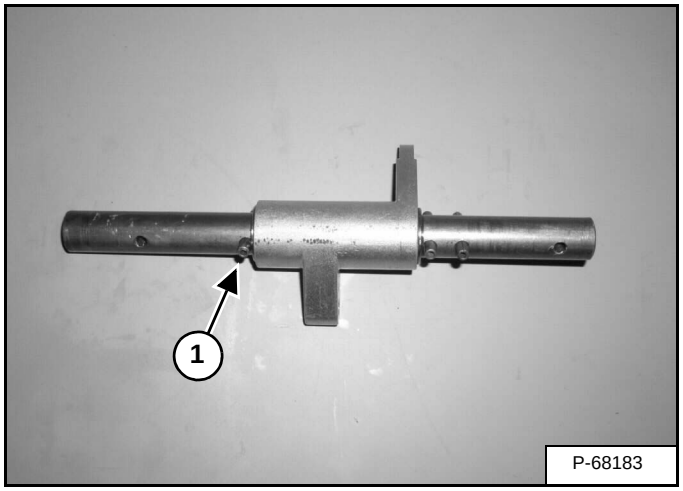
Left Half of Control Linkage Disassembly And Assembly (Cont'd)

Figure 40-130-25



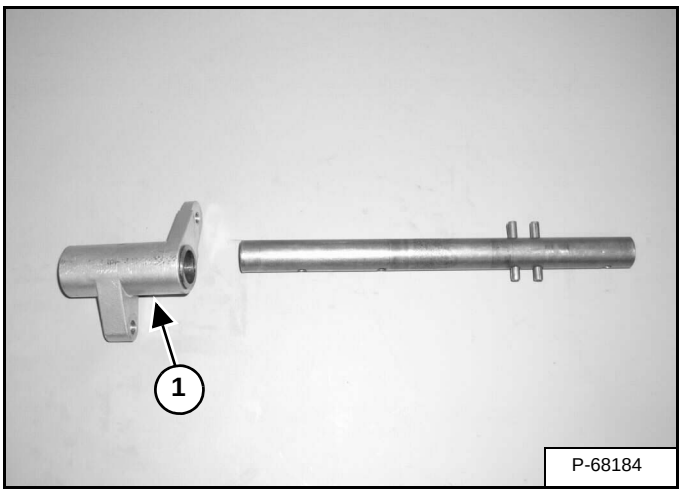
Remove the bellcrank (Item 1), bearing (Item 2) and bellcrank (Item 3) **[Figure 40-130-25]** from the shaft.

Figure 40-130-26



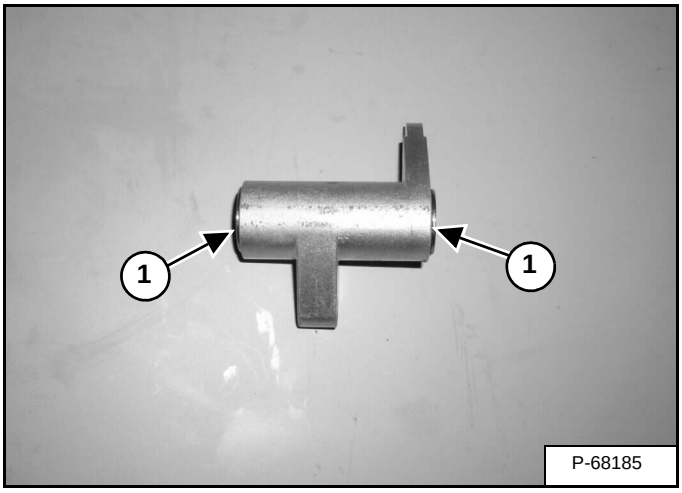
Remove the roll pin (Item 1) **[Figure 40-130-26]** from the shaft.

Figure 40-130-27



Remove the bellcrank (Item 1) **[Figure 40-130-27]** from the shaft.

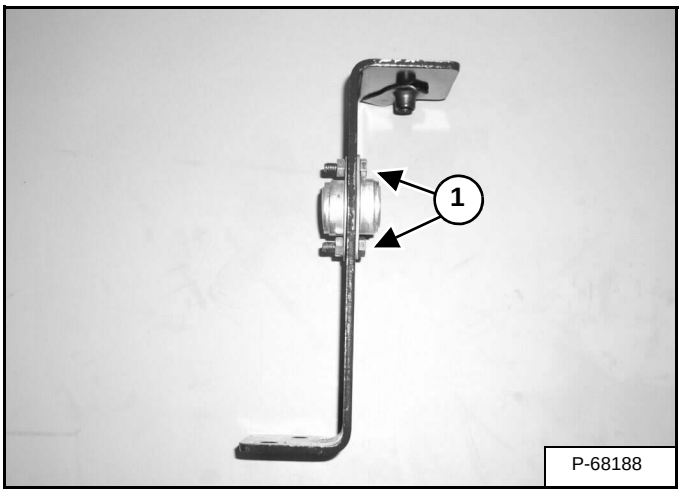
Figure 40-130-28



Remove the bushings (Item 1) **[Figure 40-130-28]** from the bellcrank.

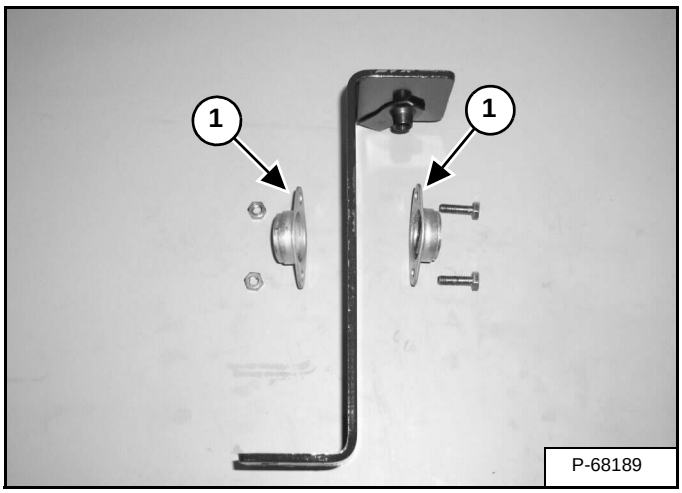
Bracket of Control Linkage Disassembly And Assembly

Figure 40-130-29



Remove the bolts and nuts (Item 1) **[Figure 40-130-29]** from the bearings.

Figure 40-130-30



Remove the bearings (Item 1) **[Figure 40-130-30]** from the bracket.

FLOOR MAT AND FLOOR PANELS

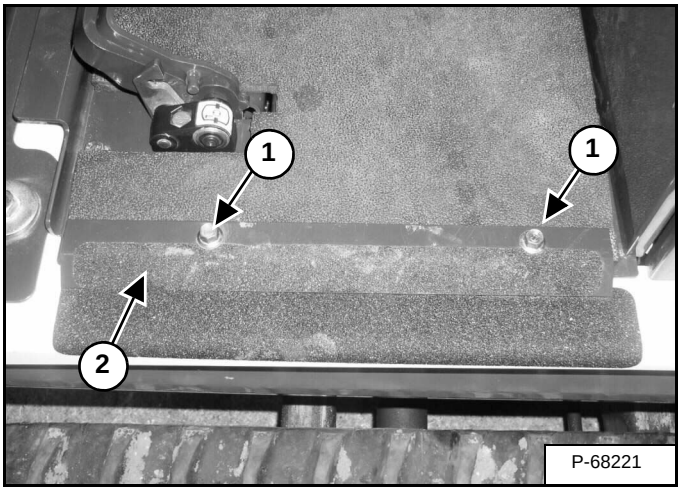
Description

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 an 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

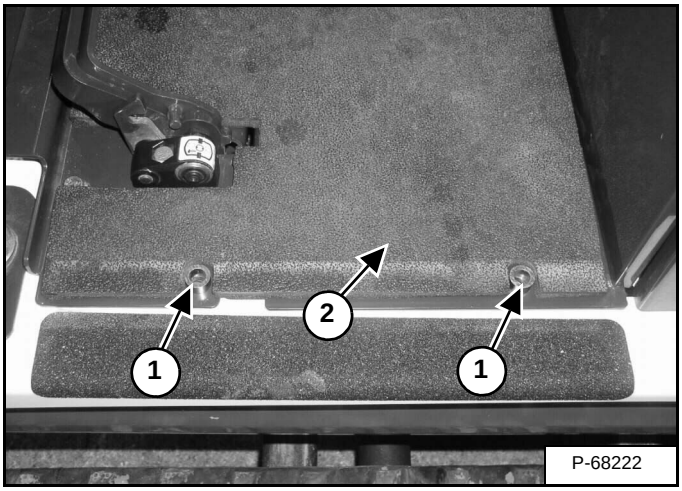


Remove the bolts (Item 1) **[Figure 40-140-1]** in both floor mat retaining plates.

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

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

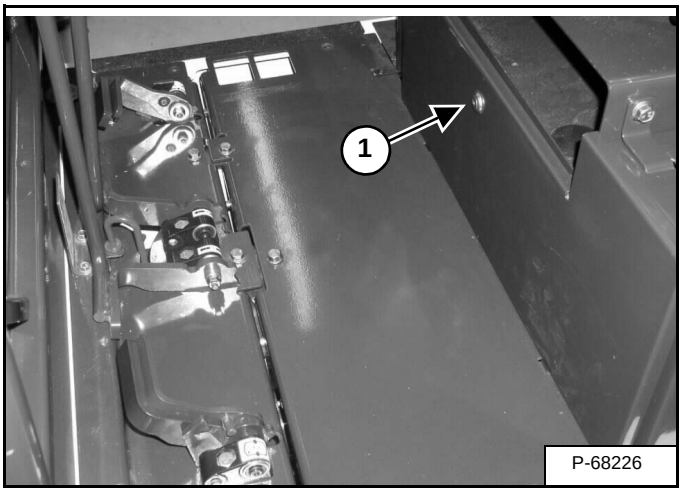
Figure 40-140-2



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

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

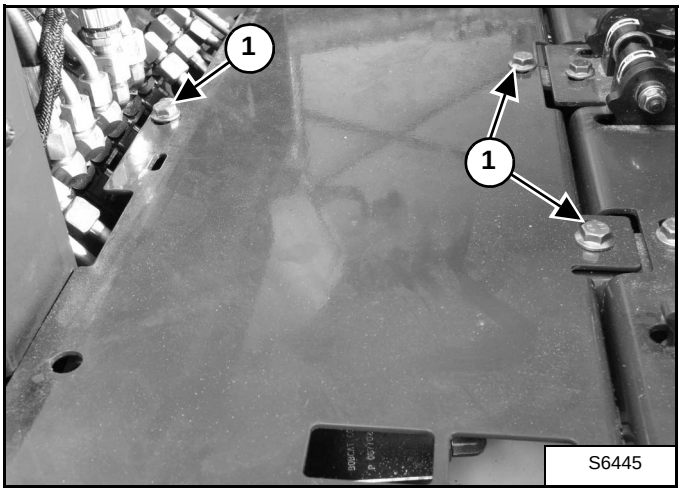
Figure 40-140-3



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

Removal and Installation (Cont'd)

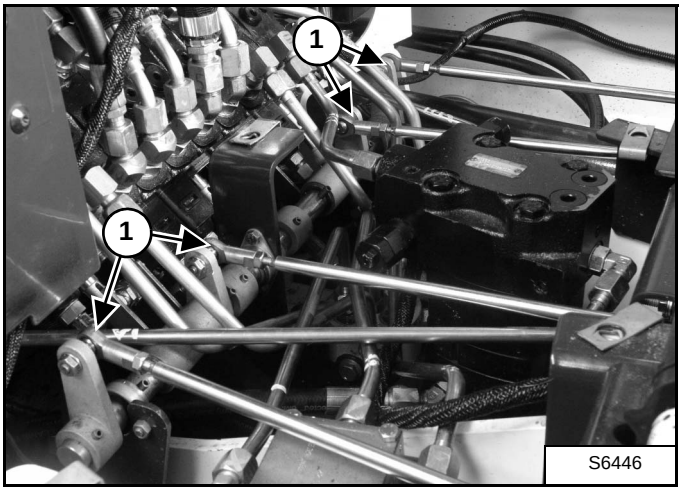
Figure 40-140-4



Remove the bolts (Item 1) **[Figure 40-140-4]** from the rear floor panel.

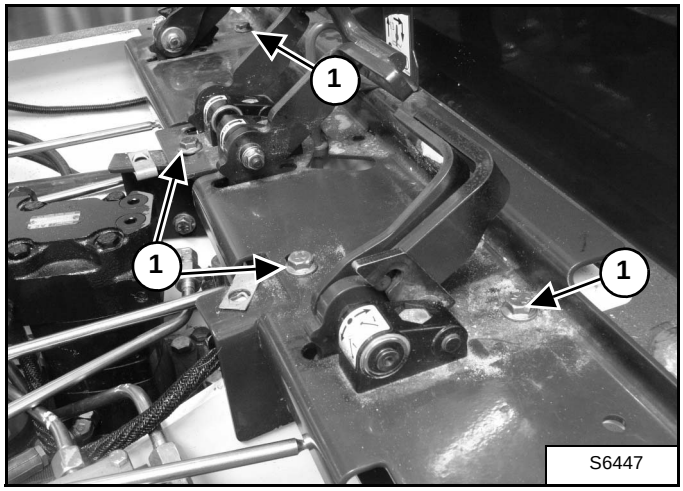
Remove the rear floor panel.

Figure 40-140-5



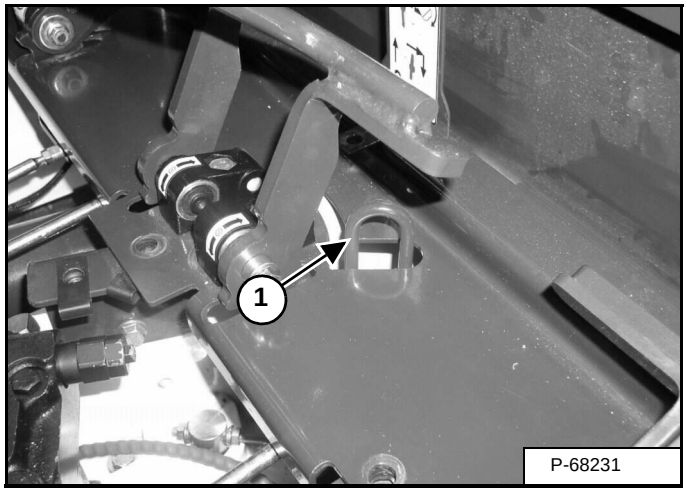
Remove the nuts (Item 1) **[Figure 40-140-5]** from the control valve linkages and remove the linkages from the bellcranks.

Figure 40-140-6



Remove the four bolts (Item 1) **[Figure 40-140-6]** from the front floor panel.

Figure 40-140-7



Lift the upperstructure slew lock (Item 1) **[Figure 40-140-7]** from the stored (locked) position into the slot in the front floor panel. The front floor panel can now be removed while leaving the upperstructure slew lock in place.

Remove the front floor panel.

FUEL TANK

Removal and Installation

Open the tailgate.

Remove the muffler (See Removal And Installation on Page 60-30-1)

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

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

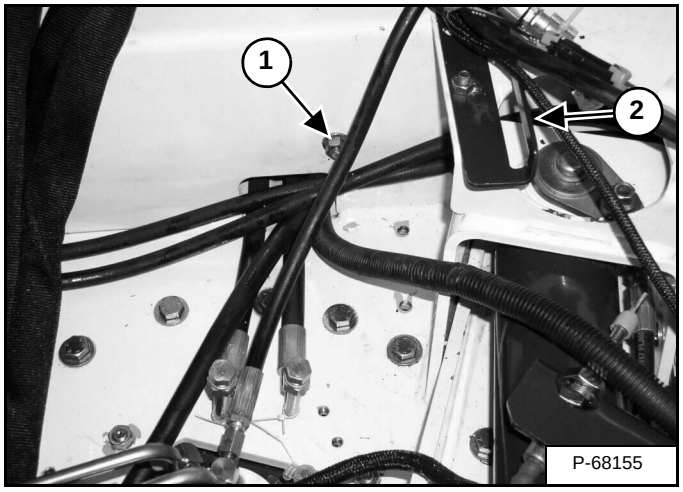
Remove the engine (See Engine Removal and Installation on Page 60-60-7)

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

Remove the battery (See Removal and Installation on Page 50-20-2)

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

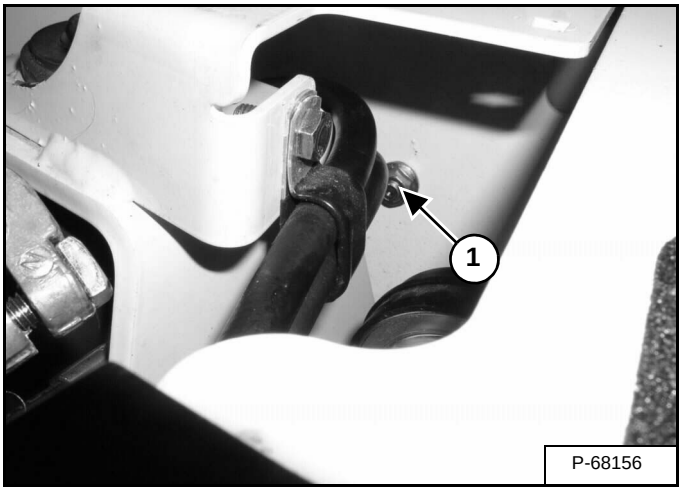
Figure 40-160-1



Remove the nut (Item 1) **[Figure 40-160-1]** from the fuel tank mounting bolt behind the control valve.

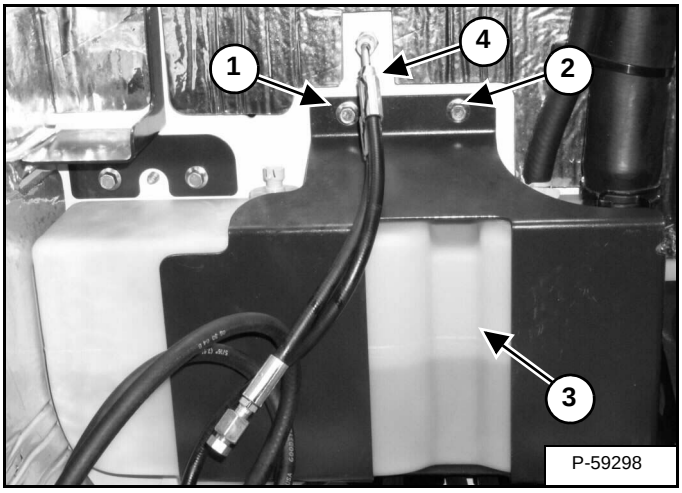
NOTE: The control valve assembly has been removed for picture clarity. The nut can be accessed through the clearance hole for the base end boom swing cylinder mounting (Item 2) [Figure 40-160-1].

Figure 40-160-2



Remove the nut (Item 1) **[Figure 40-160-2]** from the fuel tank mounting bolt under the battery.

Figure 40-160-3



Remove the short bolt (Item 1) and the long bolt (Item 2) **[Figure 40-160-3]** from the fuel tank mounting bracket.

Remove the fuel tank (Item 3) **[Figure 40-160-3]** from the back of the excavator.

NOTE: The bulk head hoses (Item 4) [Figure 40-160-3] may need to be loosened and rotated away from the fuel tank bracket.

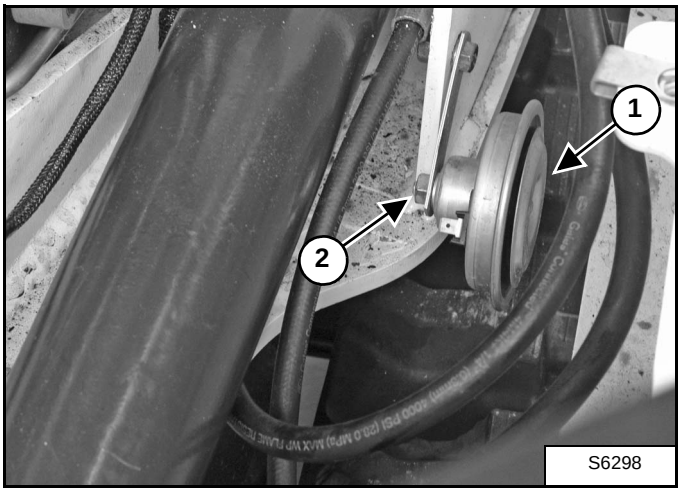

Bobcat®

HORN

Removal And Installation

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

Figure 40-170-1



Remove the wire (Item 1) **[Figure 40-170-1]** from the horn.

Remove the nut (Item 2) **[Figure 40-170-1]**.

Remove the horn.


Bobcat®

SWING FRAME

Description

The swing frame is the casting connected to the boom swing cylinder and the boom with top mounted boom cylinder. The swing casting provides the pivot point for the boom in the offset function and the up down motion of the boom. The swing frame is connected to the upperstructure by a top and bottom pivot pin.

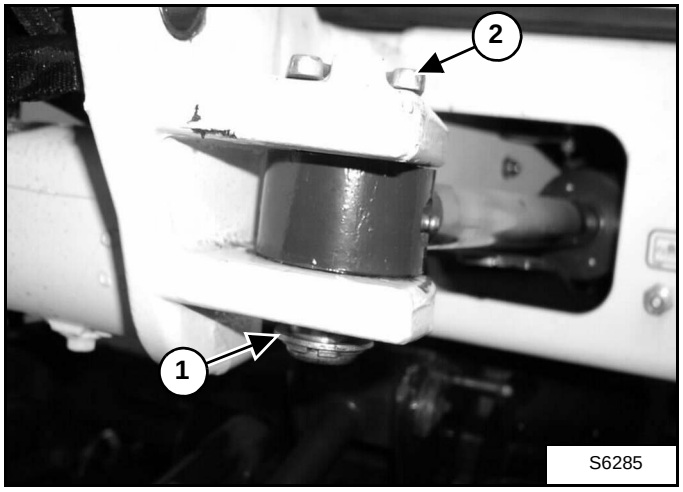
Removal And Installation

Remove the bucket (See Removal And Installation on Page 40-210-1).

Remove the arm (See Removal And Installation on Page 40-200-1).

Remove the boom (See Removal And Installation on Page 40-190-1).

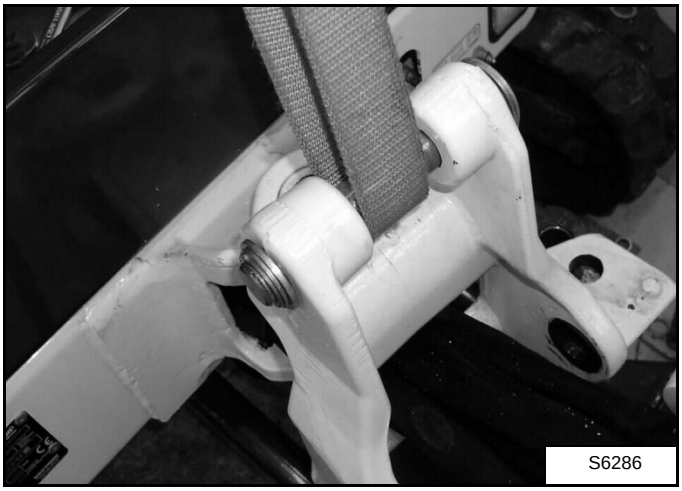
Figure 40-180-1



Remove the snap ring and washer (Item 1) **[Figure 40-180-1]** from the cylinder pivot pin.

Remove the pivot pin (Item 2) **[Figure 40-180-1]**.

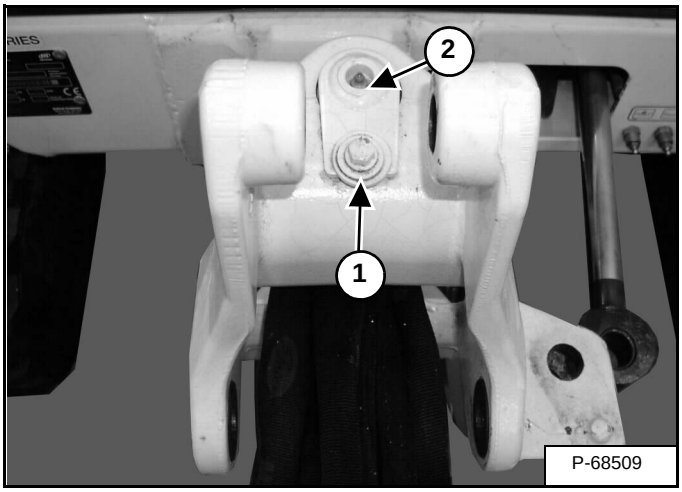
Figure 40-180-2



Install the pivot pin, washers and retaining clip **[Figure 40-180-2]**.

Install a chain hoist on the swing frame **[Figure 40-180-2]**.

Figure 40-180-3



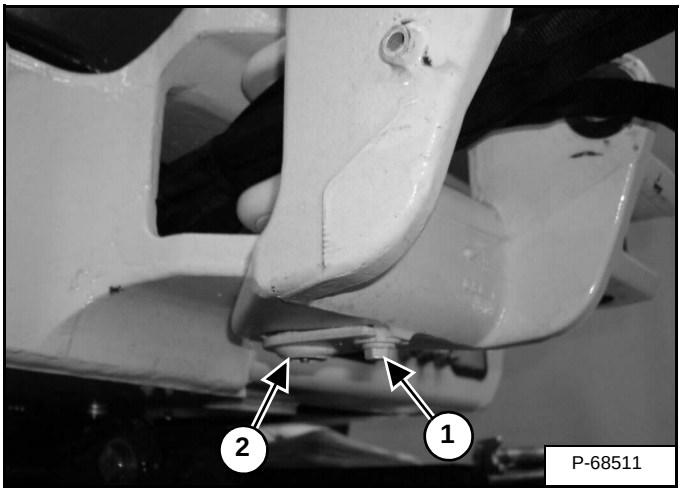
NOTE: Chain hoist and pivot pin have been removed for photo clarity.

Remove the bolt, washers and spacer (Item 1) **[Figure 40-180-3]** from the top pivot pin.

Remove the top pivot pin (Item 2) **[Figure 40-180-3]** from the swing frame.

Removal And Installation (Cont'd)

Figure 40-180-4



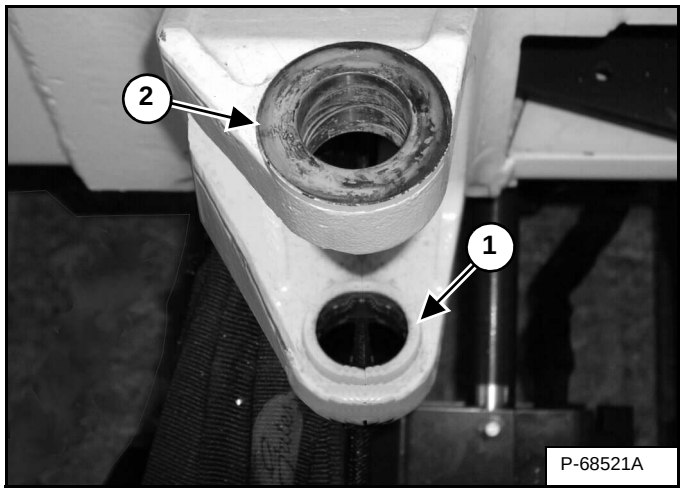
Remove the bolt and washers (Item 1) **[Figure 40-180-4]** from the bottom pivot pin.

Remove the bottom pivot pin (Item 2) **[Figure 40-180-4]** from the swing frame.

Remove the swing frame from the excavator.

Bushing Removal and Installation

Figure 40-180-5



Remove the bottom bushing (Item 1) **[Figure 40-180-5]** from the upperstructure by driving the bushing down through the casting.

Remove the top bushing (Item 2) **[Figure 40-180-5]** from the upperstructure by driving the bushing up through the casting.

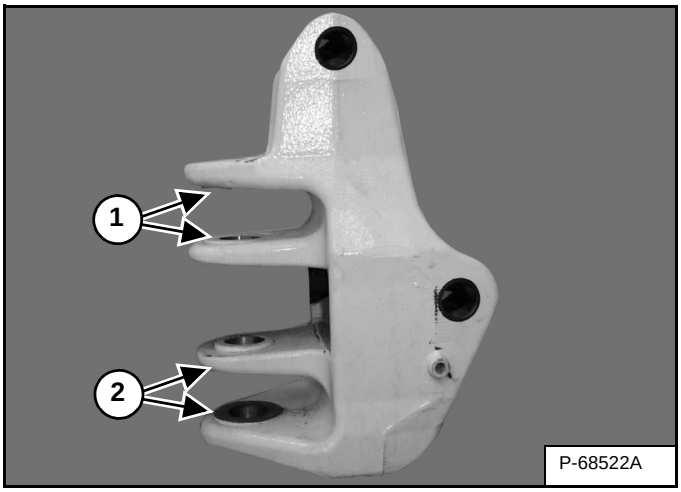
During installation, center the bushing on the casting hole.

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

Install the bushing so the flanged edge of bushing is seated in the casting. The flanged edge of the bushings must be installed from the top and bottom of the upperstructure casting.

Swing Frame Bushing Removal

Figure 40-180-6



Remove the top pivot bushings (Item 1) and the bottom pivot bushings (Item 2) **[Figure 40-180-6]**. The bushings will need to be pressed in toward each other to be removed from the swing frame casting.

The following parts will be needed for removal and installation of the swing frame bushings:

- Bolt - 0.625 x 4.5 inch long
- Nut - 0.625 inch
- Washer - 0.625 inch I.D. x 2.312 inch O.D. x 0.25 inch thick
- Washer - 0.625 inch I.D x 3.5 inch O.D. x 0.25 inch thick
- Spacer - 2.875 inch I.D x 3.375 inch O.D. x 1.5 inch thick

Figure 40-180-7

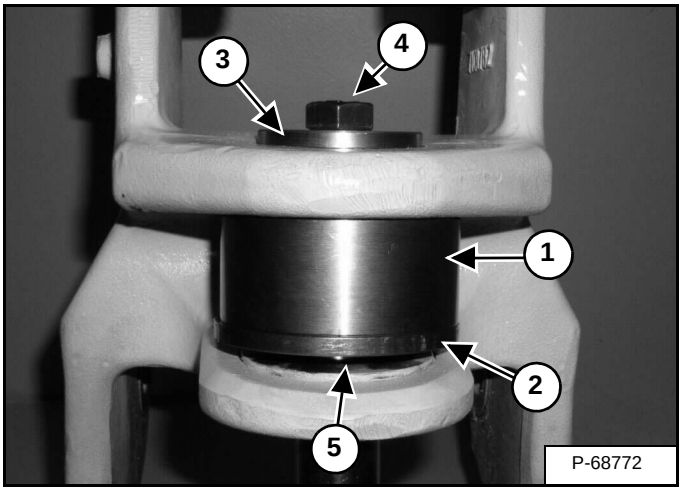
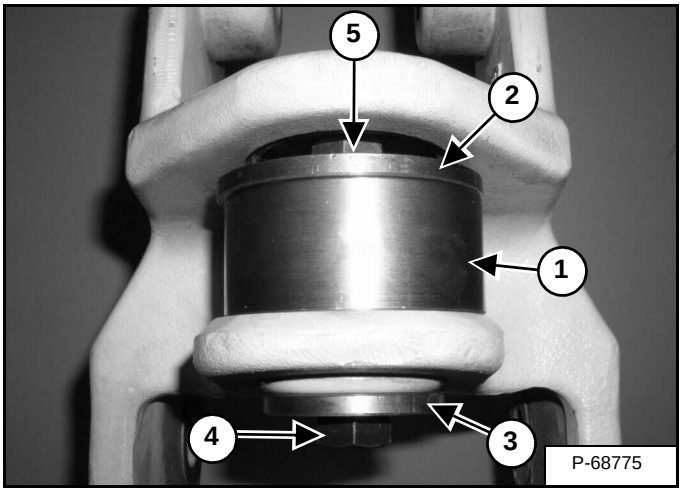


Figure 40-180-8



Install the spacer (Item 1) and washer (Item 2) **[Figure 40-180-7]** and **[Figure 40-180-8]** over the flanged end of the bushing.

The spacer (Item 1) **[Figure 40-180-7]** and **[Figure 40-180-8]** must be centered over the bushing to avoid contact between the bushing and the spacer during removal.

Install the washer (Item 3) **[Figure 40-180-7]** and **[Figure 40-180-8]** on the opposite end of the bushing. The washer must be centered on the bushing and must not contact the casting.

Install the bolt (Item 4) and the nut (Item 5) **[Figure 40-180-7]** and **[Figure 40-180-8]** through the washers and spacer.

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

Swing Frame Bushing Installation

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

Center the bushing on the casting hole.

NOTE: Make sure the bushing is centered in 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 40-180-8]** 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 40-180-8]**.

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

Boom Pivot Bushing Removal

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

Bolt - 0.625 x 4.5 inch long

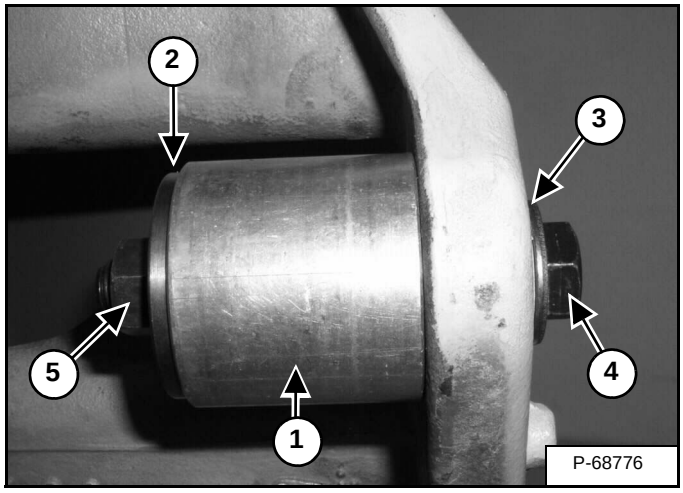
Nut - 0.625 inch

Washer - 0.625 inch I.D. x1.375 inch O.D. x 0.25 inch thick

Washer - 0.625 inch I.D. x 2.625 inch O.D. x 0.25 inch thick

Spacer - 2.250 inch I.D. x 2.625 inch O.D. x 1.5 inch thick

Figure 40-180-9



Install the spacer (Item 1) and washer (Item 2) **[Figure 40-180-9]** over the flanged end of the bushing.

The spacer (Item 1) **[Figure 40-180-9]** must be centered over the bushing to avoid contact between the bushing and the spacer during removal.

Install the washer (Item 3) **[Figure 40-180-9]** 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 40-180-9]** through the washers and spacer.

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

Boom Pivot Bushing Installation

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

Center 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 40-180-9]** 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 40-180-9]**.

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


Bobcat®

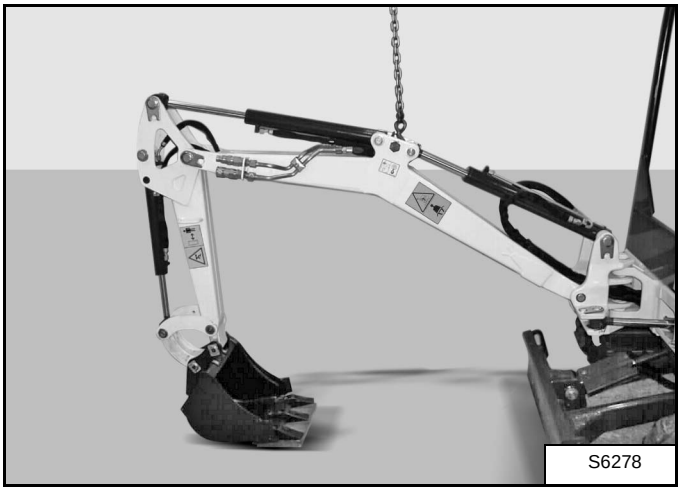
BOOM

Description

The boom is the section that is connected to the swing frame and the arm. The boom has the boom and arm cylinders mounted on the top of the boom.

Removal And Installation

Figure 40-190-1



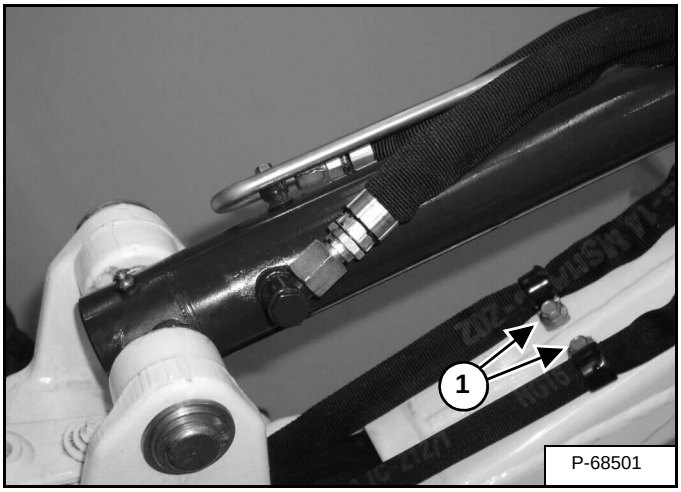
Install a chain hoist on the boom **[Figure 40-190-1]**.

Remove the bucket (See Removal and Installation on Page 40-160-1).

Remove the arm (See Removal And Installation on Page 40-200-1).

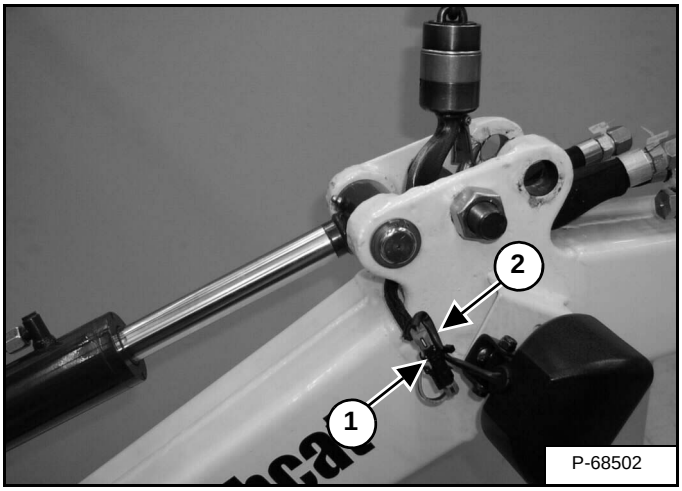
Remove the arm cylinder.

Figure 40-190-2



Remove the screws (Item 1) **[Figure 40-190-2]** from the hose clamps.

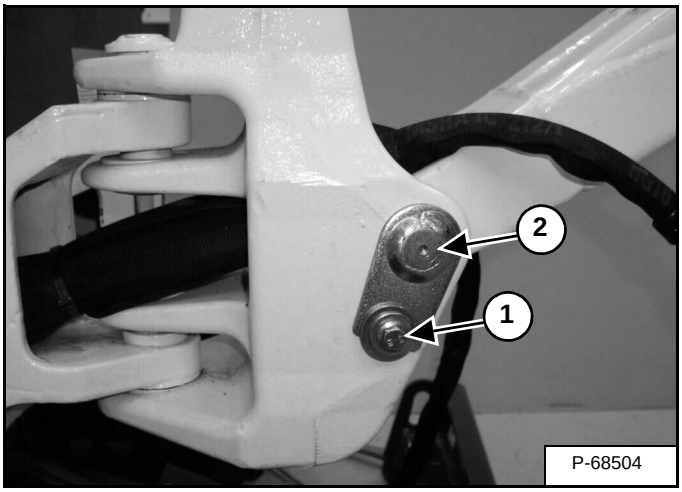
Figure 40-190-3



Remove the tie strap (Item 1) on the light wire harness. Disconnect the harness (Item 2) **[Figure 40-190-3]**.

Remove the boom cylinder (See Removal and Installation on Page 20-20-2).

Figure 40-190-4

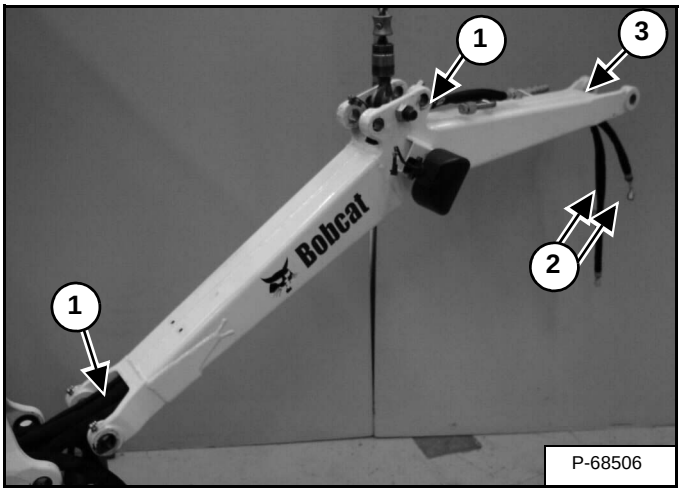


Remove the bolt and washers (Item 1) **[Figure 40-190-4]** from the pivot pin.

Remove the pivot pin (Item 2) **[Figure 40-190-4]**.

Removal And Installation (Cont'd)

Figure 40-190-5



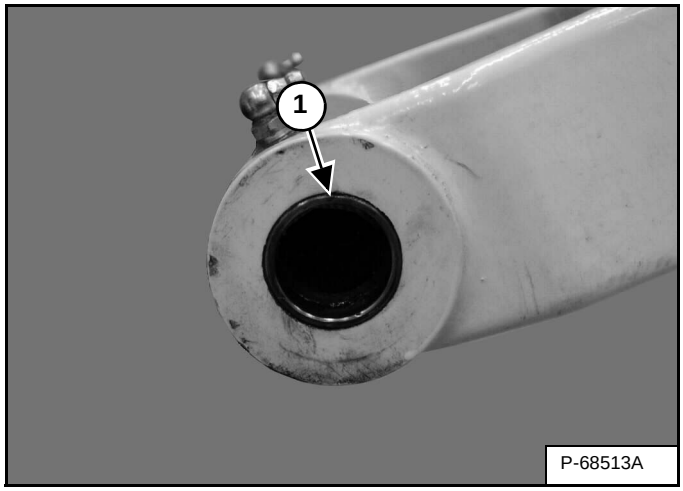
Lift the boom from the swing frame **[Figure 40-190-5]**.

Installation: Feed the two arm cylinder hoses and the two auxiliary hoses (Item 1) through the inside of the boom and comes out at the base pivot of the arm cylinder. Continue feeding the two bucket cylinder hoses (Item 2) through the end of the boom (Item 3) **[Figure 40-190-5]**.

Boom Bushing Removal And Installation

Remove the boom (See Removal And Installation on Page 40-190-1).

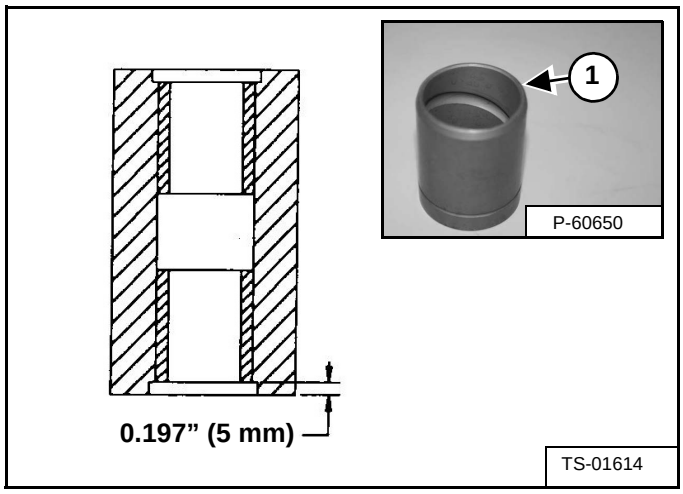
Figure 40-190-6



Remove the bushings (Item 1) **[Figure 40-190-6]** from both sides of the boom.

Install the new bushings in the boom.

Figure 40-190-7



Install the bushings until they are seated 0.197 in. (5 mm) in the pin boss **[Figure 40-190-7]**.

NOTE: Install the new bushings with the tapered end first (Item 1) [Figure 40-190-7].

ARM

Description

The arm is the section that is connected to the end of the boom section and the bucket / bucket link. The excavator comes with a standard length but has an optional long arm.

Removal And Installation

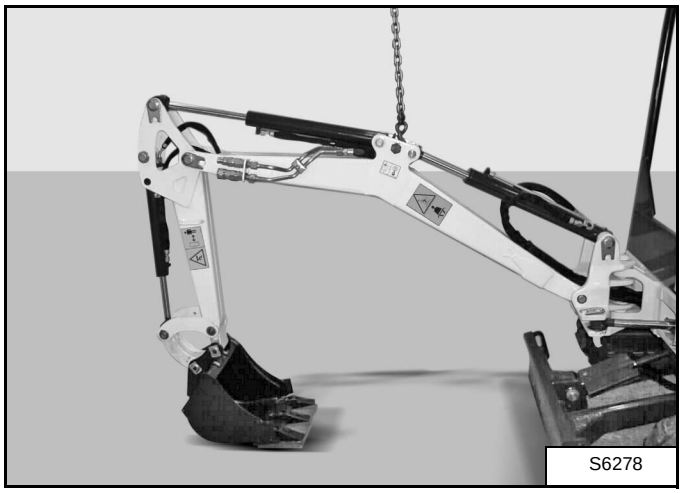
Remove the bucket (See Removal and Installation on Page 40-160-1).

IMPORTANT

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

I-2003-0888

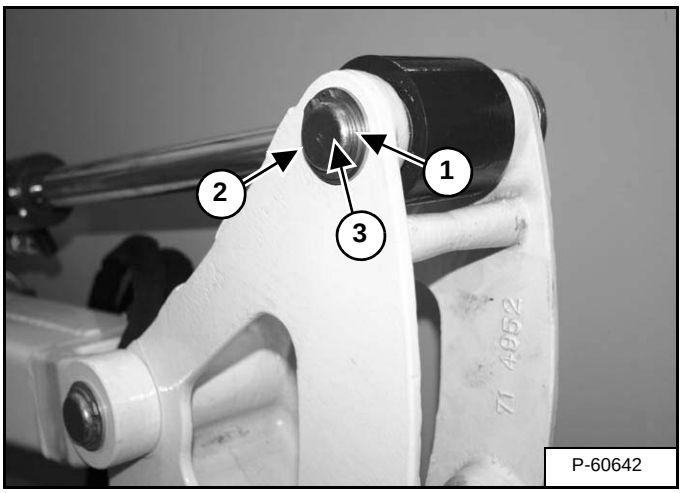
Figure 40-200-1



Support the boom with a chain hoist **[Figure 40-200-1]**.

Remove the bucket cylinder (See Removal and Installation on Page 20-23-2).

Figure 40-200-2

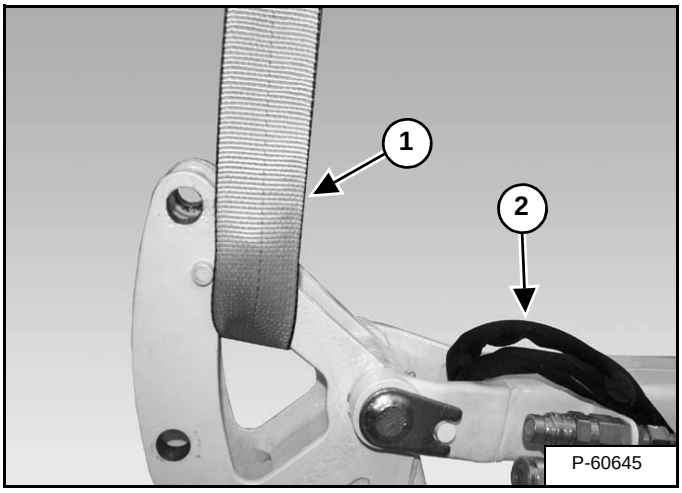


Remove the snap ring (Item 1) and washer (Item 2) **[Figure 40-200-2]** from the rod end pivot pin.

Remove the pivot pin (Item 3) **[Figure 40-200-2]**.

Remove the rod end of the cylinder from the arm.

Figure 40-200-3

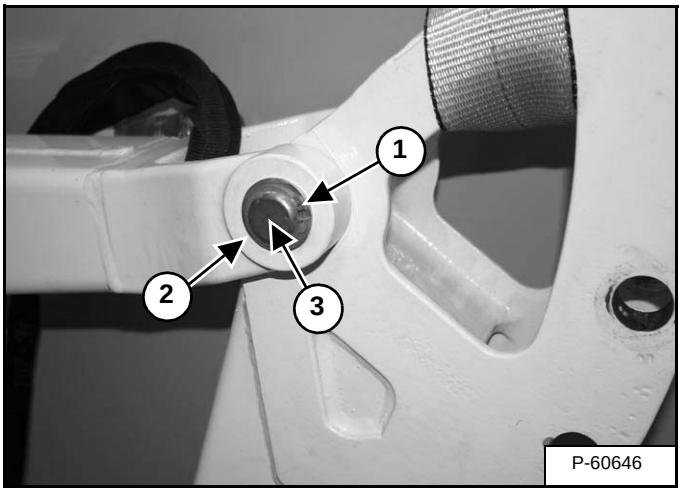


Install a strap (Item 1) **[Figure 40-200-3]** to support the arm.

Move the bucket cylinder hoses (Item 2) **[Figure 40-200-3]** away from the arm.

Removal And Installation (Cont'd)

Figure 40-200-4



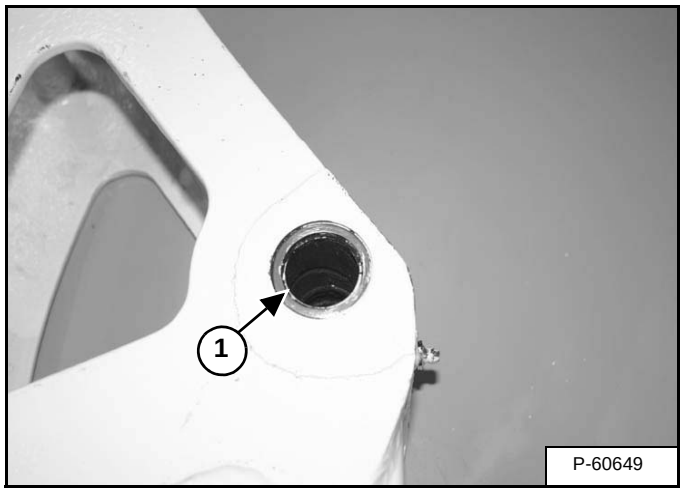
Remove the snap ring (Item 1) and washer (Item 2) **[Figure 40-200-4]** from the arm pivot pin.

Remove the pivot pin (Item 3) **[Figure 40-200-4]**.

Remove the arm.

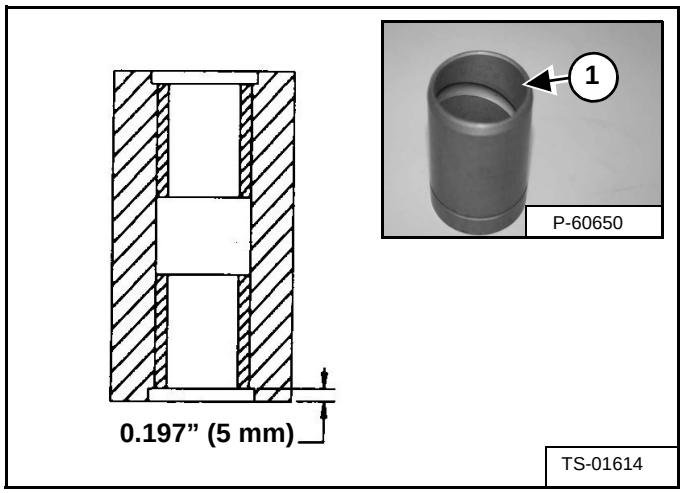
Arm To Boom Bushing Removal And Installation

Figure 40-200-5



Remove the dust seals and bushings (Item 1) **[Figure 40-200-5]** from both sides of the arm.

Figure 40-200-6



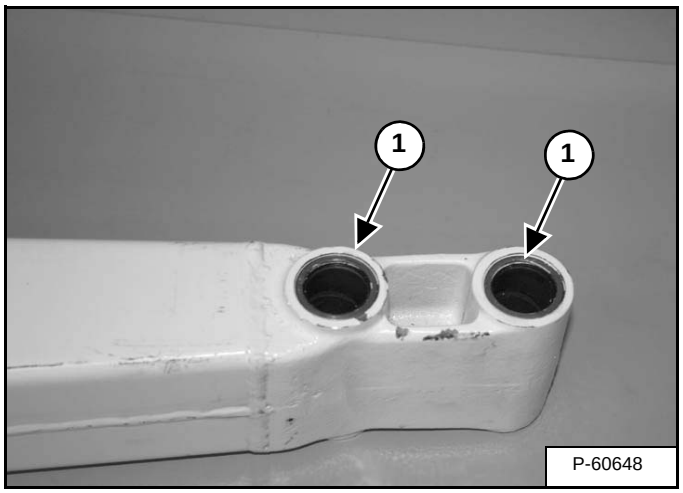
Install the new bushings until they are seated 0.197 in. (5 mm) in the pin boss **[Figure 40-200-6]**.

NOTE: Install the new bushings with the tapered end first (Item 1) [Figure 40-200-6].

Install new dust seals with the lip facing out.

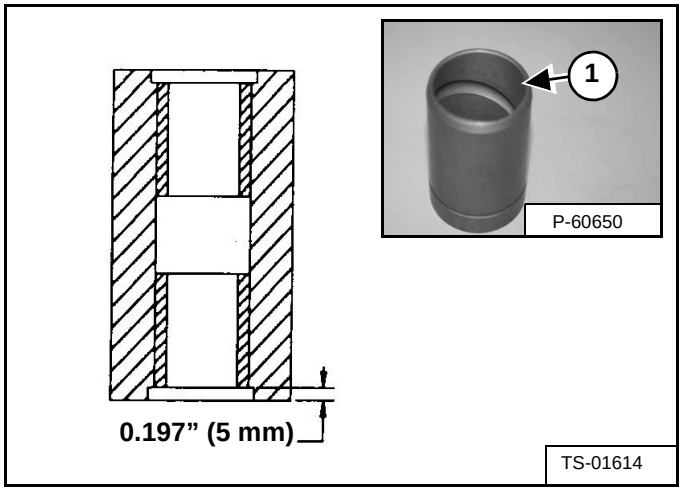
Arm To Bucket And Bucket Link Bushing Removal And Installation

Figure 40-200-7



Remove the dust seals and bushings (Item 1) **[Figure 40-200-7]** from both sides of the arm.

Figure 40-200-8



Install the bushings until they are seated 0.197 in. (5 mm) in the pin boss **[Figure 40-200-8]**.

NOTE: Install the new bushings with the tapered end first (Item 1) [Figure 40-200-8].

Install new dust seals with the lip facing out.


Bobcat®

BUCKET

Removal And Installation

WARNING

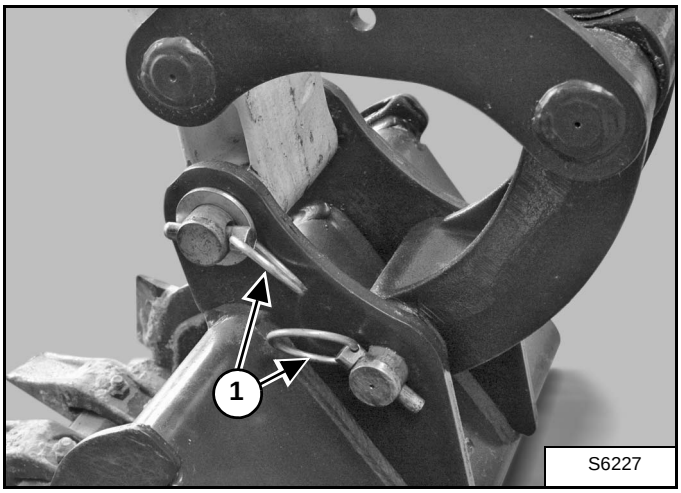
AVOID INJURY OR DEATH

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

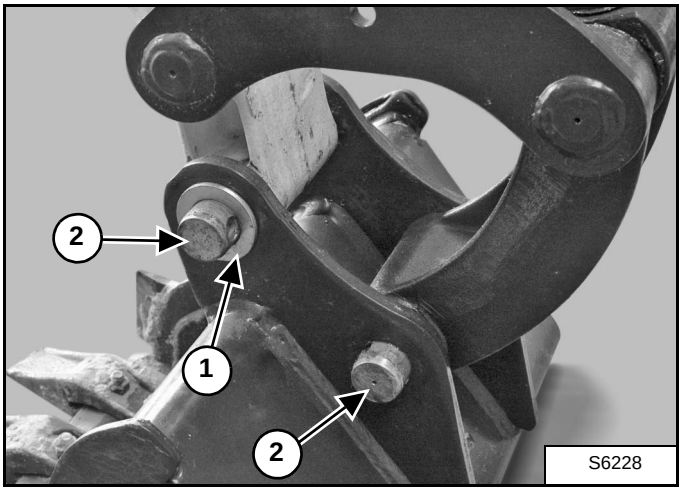
Park the excavator on a flat level surface. Put the bucket on the ground.

Figure 40-210-1



Remove the pin retainer clips (Item 1) **[Figure 40-210-1]**.

Figure 40-210-2



Remove the washer (Item 1) **[Figure 40-210-2]**.

Remove the pivot pins (Item 2) **[Figure 40-210-2]**.

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

Install the arm into the bucket and align the hole.

Install the pivot pin.

Extend the bucket cylinder until the connecting link aligns with the other bucket pin hole and install the pivot pin.

Install the washer (Item 1) **[Figure 40-210-2]**.

Install the pin retainer clips (Item 1) **[Figure 40-210-1]**.

Add grease to the pivot pins before operation.

WARNING

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-2052-0500

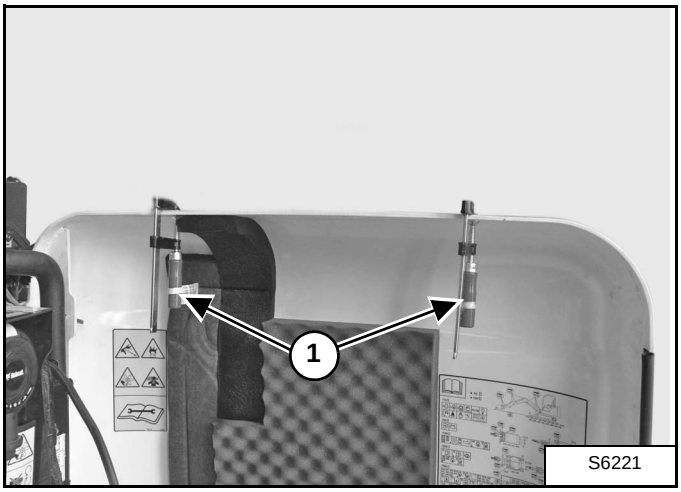

Bobcat®

TAILGATE

Removal And Installation

Open the tailgate.

Figure 40-220-1



Install and tighten two c-clamps (Item 1) **[Figure 40-220-1]** equally spaced from the sides on the top of the tailgate.

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

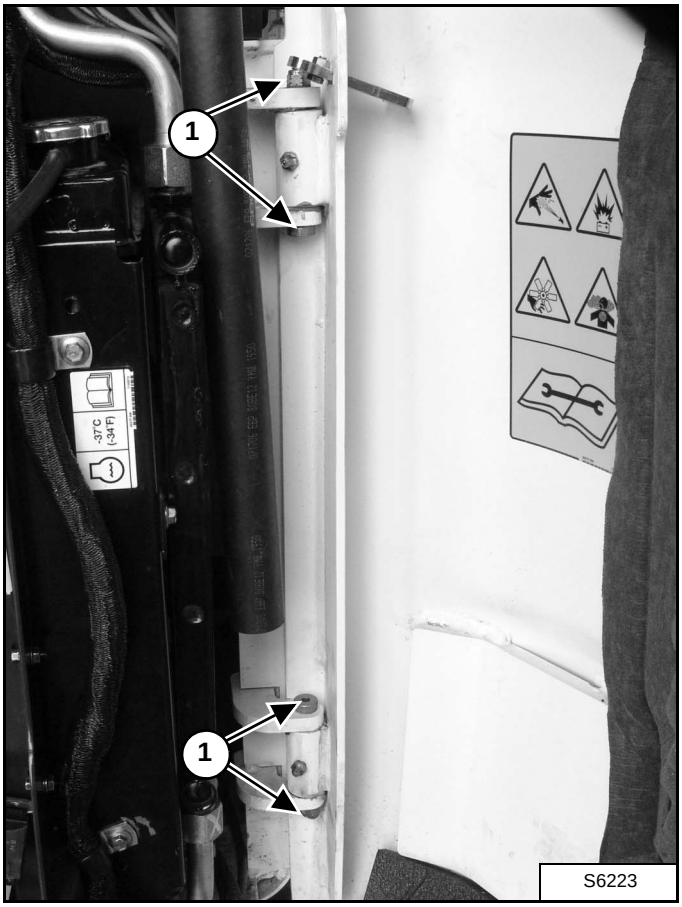
Figure 40-220-2



Install chains to the c-clamps and chain hoist **[Figure 40-220-2]**.

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

Figure 40-220-3

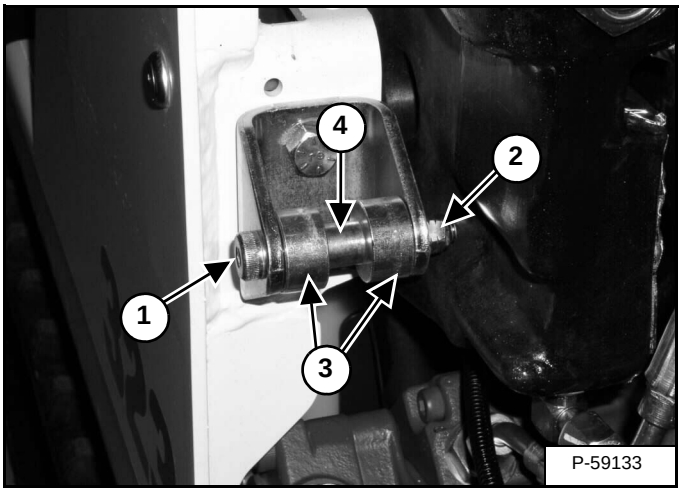


Remove the nuts and bolts (Item 1) **[Figure 40-220-3]** from the hinges.

Remove the tailgate from the excavator.

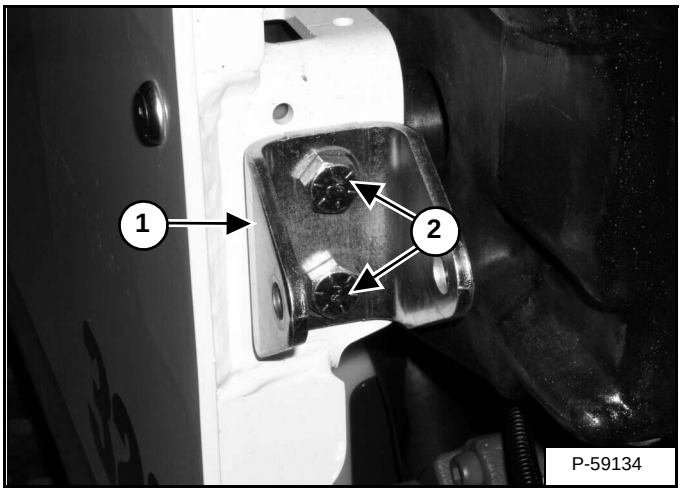
Latch Removal And Installation

Figure 40-220-4



Remove the bolt (Item 1), nut (Item 2), outer rollers (Item 3) and inner roller (Item 4) **[Figure 40-220-4]**.

Figure 40-220-5



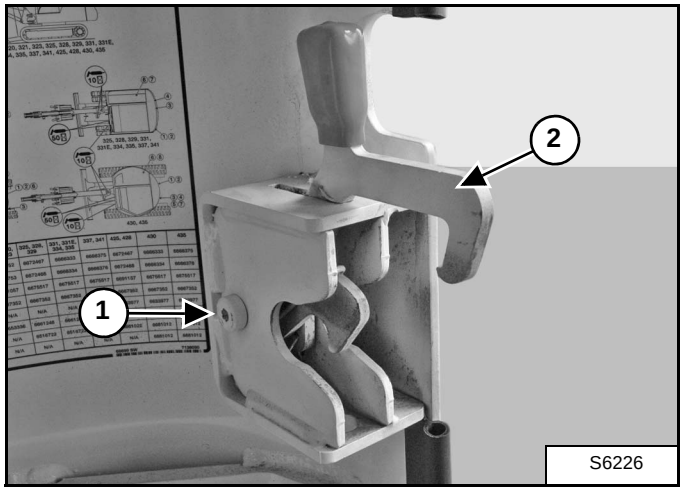
For ease of assembly, mark around the outside edge (Item 1) **[Figure 40-220-5]** of the latch bracket.

Remove the two bolts (Item 2) **[Figure 40-220-5]**, washer and nuts.

For latch adjustment (See Adjusting The Tailgate Catch on Page 10-40-1.)

Remove the bracket (Item 1) **[Figure 40-220-5]**.

Figure 40-220-6



Remove the bolt (Item 1). Remove the latch assembly (Item 2) **[Figure 40-220-6]** from the tailgate.

ELECTRICAL SYSTEM AND ANALYSIS

ALTERNATOR. 50-30-1
- Alternator Output Test 50-30-2
- Alternator Regulator Test. 50-30-3
- Alternator Regulator Test With Voltmeter 50-30-3
- Belt Adjustment 50-30-5
- Charging System Inspection 50-30-7
- Description 50-30-1
- Full Field Test 50-30-2
- Parts Identification. 50-30-8
- Removal And Installation. 50-30-4
- Tests 50-30-1

BATTERY 50-20-1
- Removal and Installation 50-20-2
- Servicing 50-20-1
- Using A Booster Battery (Jump Starting) 50-20-3

ELECTRICAL SYSTEM INFORMATION 50-10-1
- Description 50-10-5
- Fuel Timer And Diode Location / Identification 50-10-6
- Fuse And Relay Location / Identification 50-10-5
- Glossary Of Electrical Symbols. 50-10-1
- Troubleshooting 50-10-4

FUEL LEVEL SENDER 50-80-1
- Removal And Installation. 50-80-1
- Testing. 50-80-1

LIGHTS. 50-50-1
- Boom Light Disassembly And Assembly. 50-50-2
- Boom Light Removal And Installation 50-50-2
- Light Switch Removal And Installation 50-50-3
- UpperStructure Light Disassembly and Assembly 50-50-1
- UpperStructure Light Removal And Installation 50-50-1

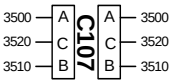
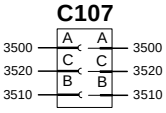
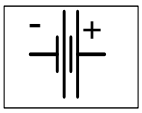
MICROSWITCH 50-60-1
- Left Console Microswitch Removal And Installation 50-60-2
- Right Console Microswitch Removal And Installation . . . 50-60-4
- Testing Left Console Microswitch 50-60-1
- Testing Right Console Microswitch 50-60-2

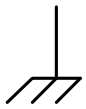
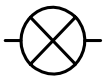
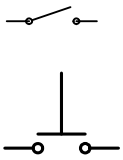
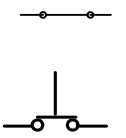
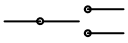
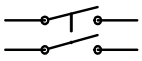
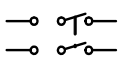
STARTER 50-40-1
- Cleaning And Inspection 50-40-3
- Parts Identification. 50-40-2
- Removal And Installation. 50-40-1

TWO-SPEED BOOST SWITCH 50-70-1
- Description 50-70-1
- Removal And Installation. 50-70-1

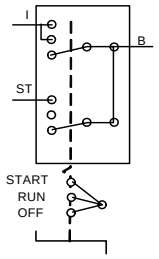
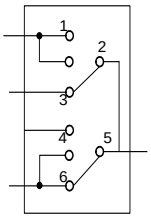
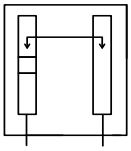
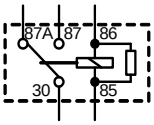
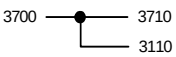
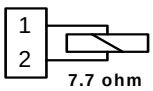
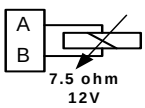

Bobcat®

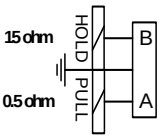
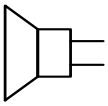
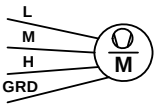
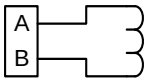
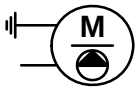
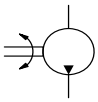
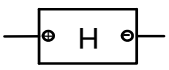
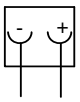
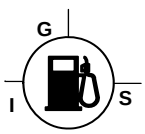
Glossary Of Electrical Symbols

SYMBOL	DESCRIPTION
	CONNECTIONS
	CONNECTOR - Harness - Used for connecting 2 harnesses together or a harness to a component. The connector can vary from a single pin to any number of pins (Example: 3 pin connectors shown). The connector pins can be numbered alphabetical (shown) or numerical (1, 2, 3 etc.). The harness wires numbers are called out next to the connector (Example: 3500).
	The connector number is called out next to the connector (Example: C107). These connector numbers are used for schematic identification only and do not appear on the harness or connector.
	COMPONENTS
	BATTERY - Used for supplying and storing electrical power for the machine.
+	POSITIVE ELECTRICAL CIRCUIT - Indicates positive battery circuit.
-	NEGATIVE ELECTRICAL CIRCUIT - Indicates battery ground circuit.
	ALTERNATOR - Used to create the electrical current to supply voltage to the battery and components.
	STARTER - Uses battery current to start the machine engine.
	GROUND - Used to represent an external ground connection.

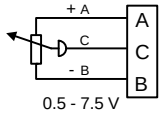
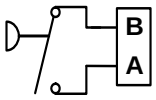
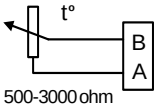
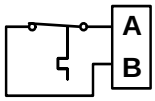
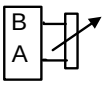
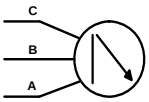
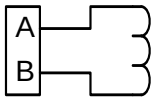
SYMBOL	DESCRIPTION
	COMPONENTS
	GROUND - Frame - Used to represent an component that is internally grounded.
	LIGHT -
	SWITCH - Single Pole - Single Throw (ON-OFF) Normally Open
	SWITCH - Single Pole - Single Throw (ON-OFF) Normally Closed.
	SWITCH - Single Pole - Double Throw (ON-OFF-ON) - This switch can be in any of three positions. (Some switches are spring activated to return them to a certain position when released.)
	SWITCH - Double Pole - Single Throw (ON-OFF) Open and Closed positions will be specified depending on switch application.)
	SWITCH - Double Pole - Double Throw (ON-OFF) Open and Closed positions will be specified depending on switch application.
	POTENTIOMETER - Variable resistance - Provides variable resistance.

Glossary Of Electrical Symbols (Cont'd)

SYMBOL	DESCRIPTION
	COMPONENTS
	SWITCH - Ignition - Multi position switch to activate various start functions at different positions.
	SWITCH - Light - Multi position switch to activate various lights at different positions.
	ROTARY CONTROL - Provides variable voltage proportional to position.
	RELAY - Uses a low amp switch to control a high amp component.
	FUSE - Used to protect the wire harness from an overloaded circuit. (The fuse rating is listed next to the fuse.)
	SPLICE (•) - Used to show when multiple wires are connected together on the schematic.
	SOLENOID - ON / OFF - Electrically activated coil that controls movement magnetically. (The ohm rating of the solenoid coil is listed next to the component [if available]).
	SOLENOID - VARIABLE - Electrically activated coil that controls movement magnetically. (The ohm rating and voltage of the solenoid coil is listed next to the component [if available]).

SYMBOL	DESCRIPTION
	SOLENOID - Fuel and Traction Lock - Dual solenoids. (The ohm rating of the solenoid coils are listed next to the component [if available]). The pull solenoid is energized for a short time.
	HORN - Audible alarm. Sound is activated manually by a switch to warn personnel.
	BUZZER - Audible alarm. Sounds at a predetermined setting to warn the operator of a component condition.
	RESISTOR - Limits current flow.
	DIODE - Allows electrical current to flow in 1 direction only.
	MOTOR - HVAC - Multi speed motor.
	MOTOR - Wiper - Single or multi speed motor.
	MOTOR - Washer - Single speed.
	PUMP - FUEL
	HOURMETER - Records the time the engine is running.
	POWER PLUG - Supplies 12 volt power for customer supplied accessories.
	GAUGE - Instrument - Indicates certain engine or other component conditions. (The different types of gauge are marked with a icon that represents what function the gauge is monitoring. Example: the gauge shown is for fuel.)

Glossary Of Electrical Symbols (Cont'd)

SYMBOL	DESCRIPTION
	SENDERS AND SENSORS
	PRESSURE SENDER - Provides a variable voltage proportional to pressure. (Sender voltage rating is listed to show volts at high and low setting.)
	PRESSURE SWITCH - Switch opens or closes at a predetermined pressure to active a function or to turn on a warning light. (Switch is shown in the open position.)
	TEMPERATURE SENDER - Provides a variable resistance (ohm) signal proportional to temperature. (Sender ohm rating is listed to show ohms at high and low setting.)
	TEMPERATURE SWITCH - The switch opens or closes at a predetermined temperature to active a function or to turn on a warning light. (Switch is shown in the closed position.)
 **30-270 ohm**	FUEL SENDER - Provides a variable resistance, based on the fuel level in the tank. (Sender ohm rating is listed to show ohms at full and empty setting.)
	HALL EFFECT SENSOR - Detects linear or rotary position and provides a proportional variable voltage.
	SPEED SENSOR - magnetic pickup - detects RPM.

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.

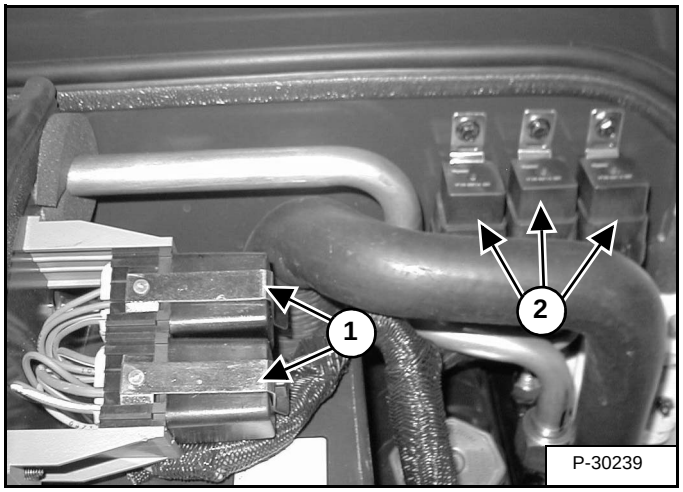
W-2003-0807

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 ground 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.

Description

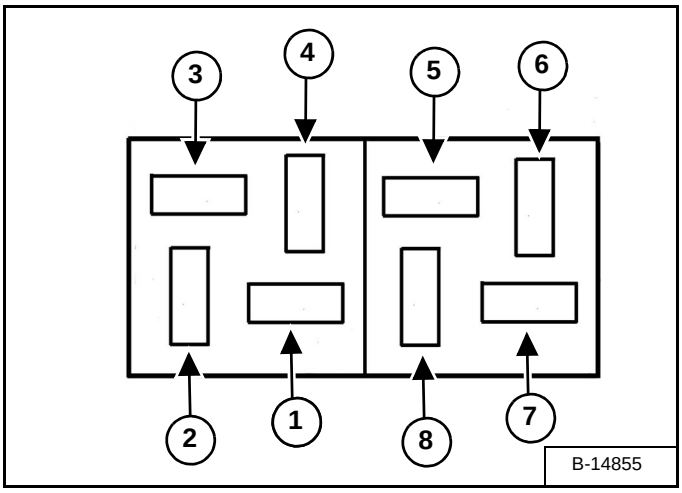
Figure 50-10-1



The excavator has a 12 volt, negative ground electrical system. The electrical system is controlled by fuses and relays located in the right side of the engine compartment (Items 1 and 2) **[Figure 50-10-1]**. The fuses will protect the electrical system when there is an electrical overload. The reason for the overload must be found before starting the engine again.

Fuse And Relay Location / Identification

Figure 50-10-2



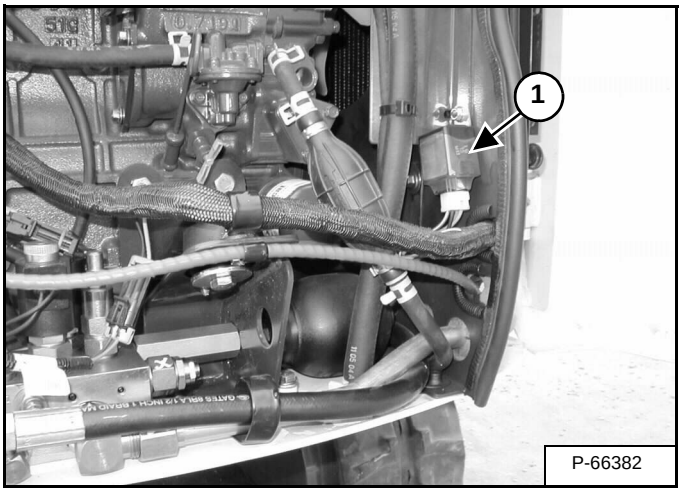
1. **Instrument** - 10A (SW) Hourmeter, Warning Buzzer and Fuel Gauge Back Light
2. **Accessory** - 20A (SW) Accessory Connector, Heater and Horn
3. **Start** - 20A (SW) Key Switch, Unswitched Accessory Connector
4. **Cab** - 15A (SW) Cab Power, Lights, Wiper and Dome Light
5. **Power** - 15A (UNSW) Appliance Socket
6. **Timer Power** - 15A (UNSW) Stop Timer Module
7. **Power -** 15A (SW) Stop Timer Module
8. **Open** - Not Used **[Figure 50-10-2]**

Always replace fuses using the same type and capacity.

The three electrical relays (Item 2) **[Figure 50-10-1]** are located in the engine compartment to the right of the fuel fill. The three relays control the starter, glow plugs and switched power circuits.

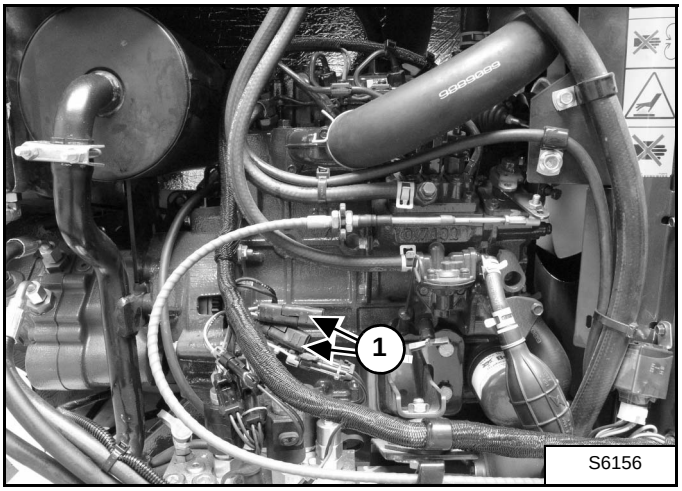
Fuel Timer And Diode Location / Identification

Figure 50-10-3



The fuel shutoff timer (Item 1) **[Figure 50-10-3]** is located on the right side of the engine compartment.

Figure 50-10-4

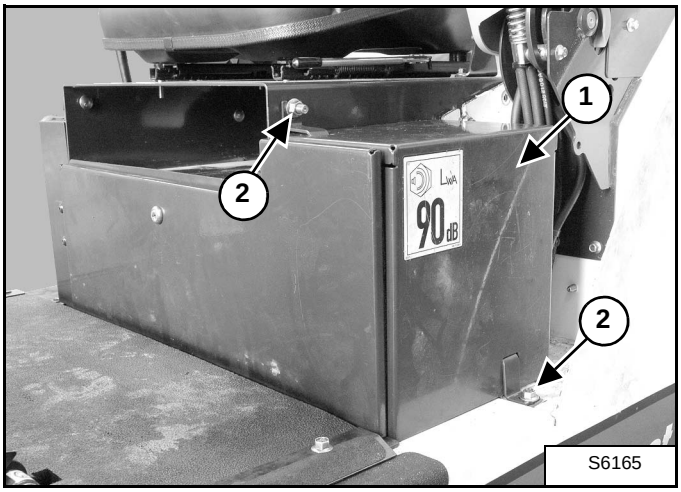


There are two diodes (Item 1) **[Figure 50-10-4]** in the harness to the left of the intake manifold. They are for alternator feedback protection and the glow plug during start function.

BATTERY

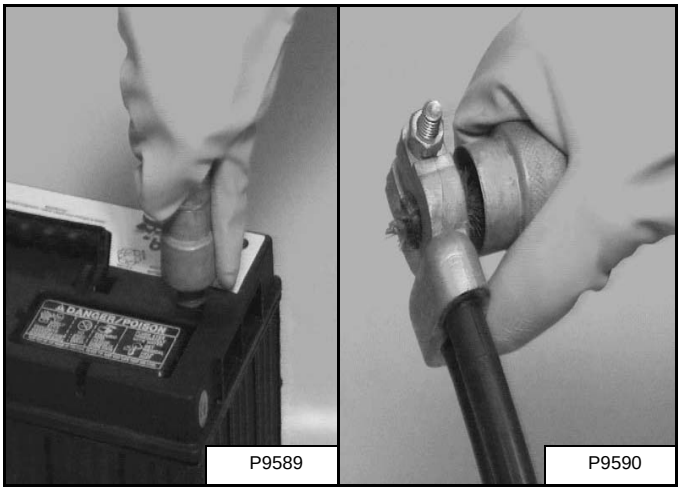
Servicing

Figure 50-20-1



The battery is located under the cover (Item 1) next to the operator's seat. Remove the two bolts (Item 2) **[Figure 50-20-1]** and brackets to open the cover.

Figure 50-20-2



The battery cables must be clean and tight **[Figure 50-20-2]**. Remove acid or corrosion from the battery and cables using a sodium bicarbonate and water solution. Cover the battery terminals and cable ends with battery saver grease to prevent corrosion.

Check for broken or loose connections.

If the battery cables are removed for any reason, disconnect the negative (-) cable first. When installing the battery cables, make the last connection the negative (-) cable to the battery.

The original equipment battery is maintenance free. If a replacement battery is installed, check the electrolyte level in the battery.

If the electrolyte level is lower than 0.50 in. (13 mm) above the plates, add distilled water only.

⚠ WARNING

AVOID INJURY OR DEATH

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

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

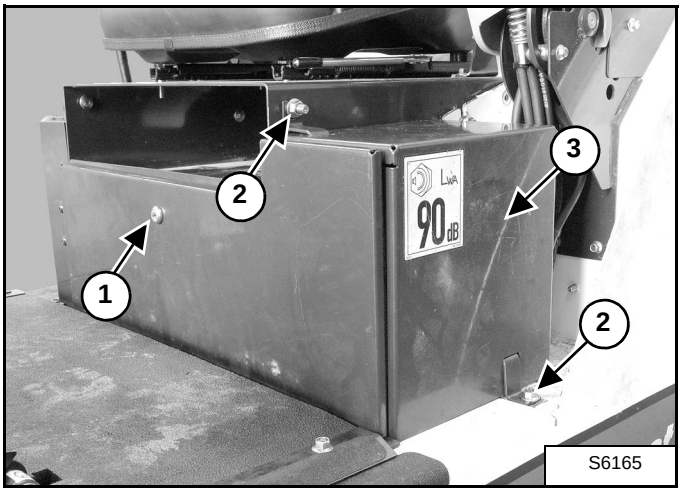
If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

BATTERY (CONT'D)

Removal and Installation

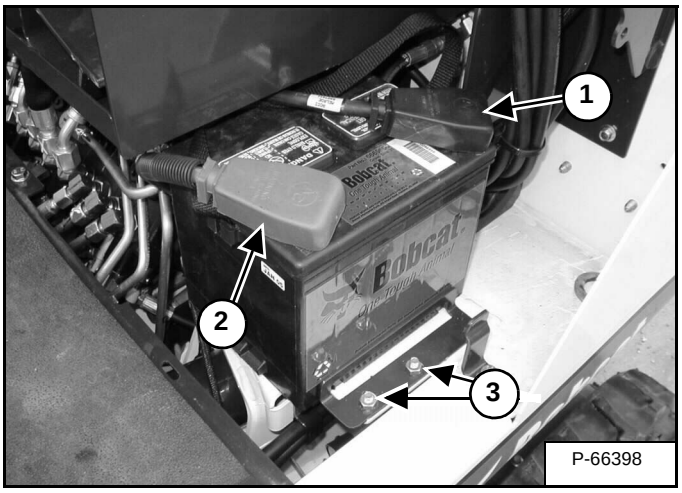
Figure 50-20-3



Remove the front access cover (Item 1) **[Figure 50-20-3]** using the start key.

Remove the two bolts (Item 2) and brackets and remove the battery cover (Item 3) **[Figure 50-20-3]**.

Figure 50-20-4



Disconnect the negative (-) cable (Item 1) **[Figure 50-20-4]** first.

Disconnect the positive (+) cable (Item 2) **[Figure 50-20-4]**.

Remove the two bolts (Item 3) **[Figure 50-20-4]** from the hold down clamp and remove the clamp.

Remove the battery.

Always clean the terminals and the cable ends, even when installing a new battery.

Install the battery. Install the hold down clamp and tighten the bolts.

Connect the battery cables. Connect the negative (-) cable (Item 1) **[Figure 50-20-4]** last to prevent sparks.

⚠ WARNING

AVOID INJURY OR DEATH

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

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

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

W-2065-0807

Using A Booster Battery (Jump Starting)

IMPORTANT

If jump starting the excavator from a second machine:

When jump starting the excavator from a battery installed in a second machine, make sure the engine is NOT running while using the glow plugs. High voltage spikes from a running machine can burn out the glow plugs.

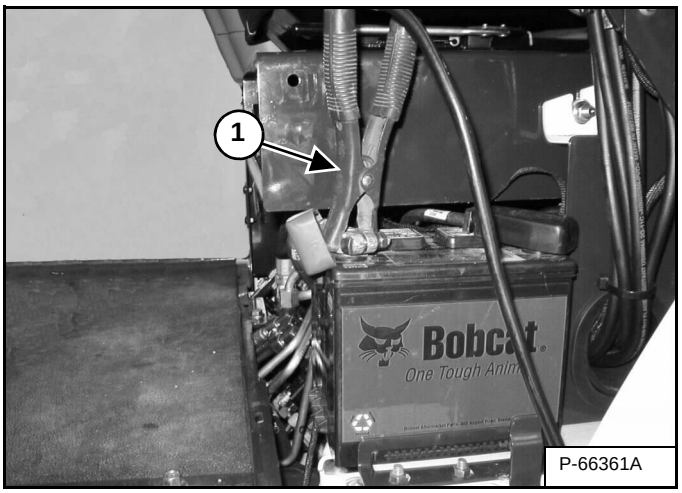
I-2060-0906

If it is necessary to use a booster battery to start the engine. BE CAREFUL! There must be one person in the operator's seat and one person to connect and disconnect the battery cables.

Engage the upperstructure slew lock. Be sure the key switch is OFF. The booster battery must be 12 volt.

Open the tailgate.

Figure 50-20-5



Connect one end of the first cable to the positive (+) terminal of the booster battery. Connect the other end of the same cable to the positive (+) terminal (Item 1) **[Figure 50-20-5]** on the excavator battery.

⚠ WARNING

AVOID INJURY OR DEATH

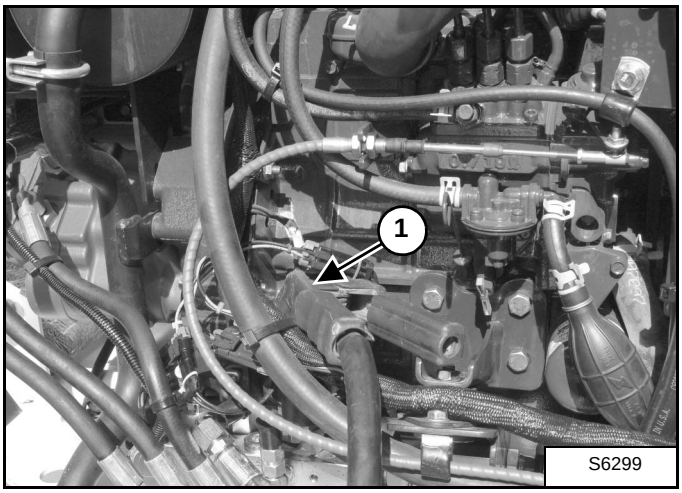
Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

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

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

W-2065-0807

Figure 50-20-6



Connect one end of the second cable to the negative (-) terminal of the booster battery. Connect the other end of the same cable to the negative cable (Item 1) **[Figure 50-20-6]** on the excavator engine.

IMPORTANT

Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the excavator. (Remove both cables from the battery.)**
- **Extra battery cables (booster cables) are connected wrong.**

I-2222-0903

Using A Booster Battery (Jump Starting) (Cont'd)

Start the engine. After the engine has started, remove the negative (-) cable first (Item 1) **[Figure 50-20-6 on Page 50-20-3]**.

Disconnect the cable from the battery (Item 1) **[Figure 50-20-5 on Page 50-20-3]**.

ALTERNATOR

Description

Figure 50-30-1

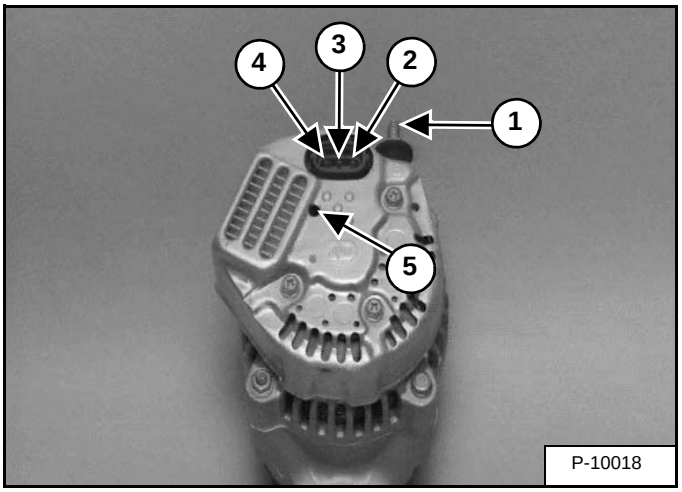
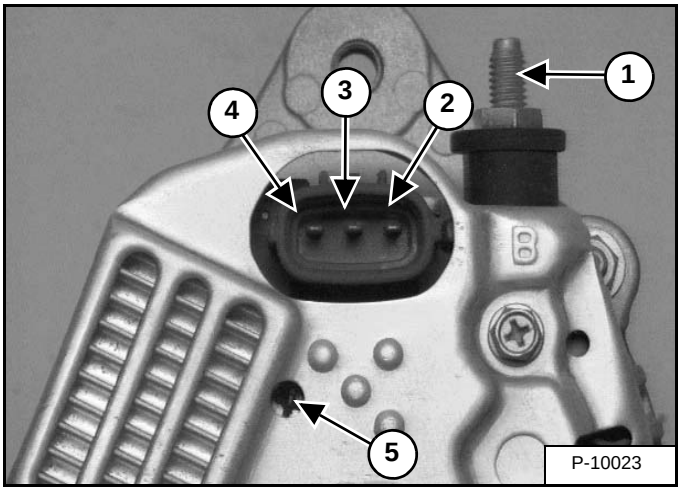


Figure 50-30-2



The output terminal (Item 1) **[Figure 50-30-1]** and **[Figure 50-30-2]**.

The battery or power sensing terminal (Item 2) **[Figure 50-30-1]** and **[Figure 50-30-2]**.

The ignition terminal (Item 3) **[Figure 50-30-1]** and **[Figure 50-30-2]**.

Open terminal not used in the excavator harness (Item 4) **[Figure 50-30-1]** and **[Figure 50-30-2]**.

Access hole for full field test (Item 5) **[Figure 50-30-1]** and **[Figure 50-30-2]**.

Tests

Perform the following alternator tests in this order:

Alternator Output Test: Tests the alternator and regulator output.

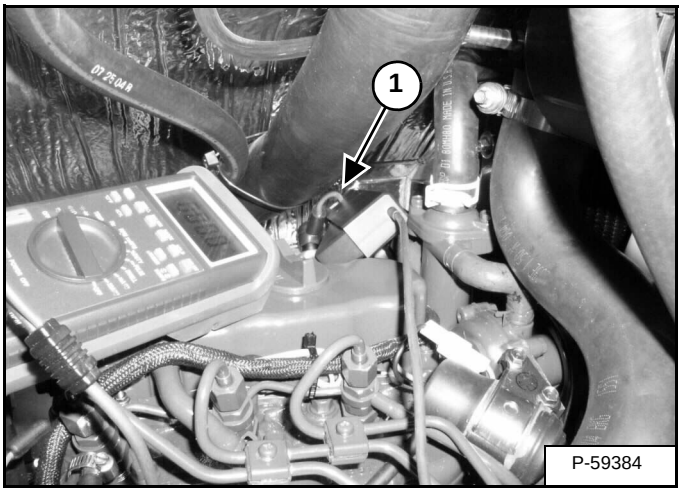
Full Field Test: Tests the maximum amperage output of the alternator.

Alternator Regulator Test: Tests the regulator voltage output.

Alternator Output Test

Check the battery and battery connections (See Removal and Installation on Page 50-20-2)

Figure 50-30-3



Use an induction meter and loop around the positive (+) wire (Item 1) **[Figure 50-30-3]** at the alternator.

Start the engine and run at full RPM.

The ammeter reading should be between 35 and 40 amps.

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

⚠ WARNING

AVOID INJURY OR DEATH

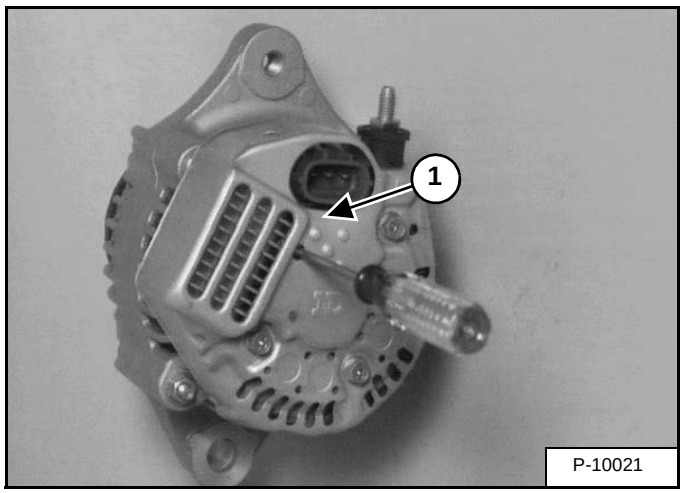
When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

W-2050-0807

Full Field Test

Start the engine and run at full RPM.

Figure 50-30-4



Place a small screw driver in the test port (Item 1) **[Figure 50-30-4]** to provide a ground to the alternator case. This will give maximum amperage output from the alternator.

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

The ammeter reading should be above 35 amps.

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

⚠ WARNING

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

Alternator Regulator Test

Disconnect the fuel stop solenoid connector.

Turn the lights on (if equipped) and crank the engine for 30 seconds to discharge the battery.

Connect the fuel stop solenoid connector.

Start the engine and run at full RPM.

The ammeter reading should be around 35 amps and slowly decrease with alternator output.

If ammeter reading is low or does not decrease with time, replace the alternator's regulator.

Disconnect the negative (-) cable from the battery.

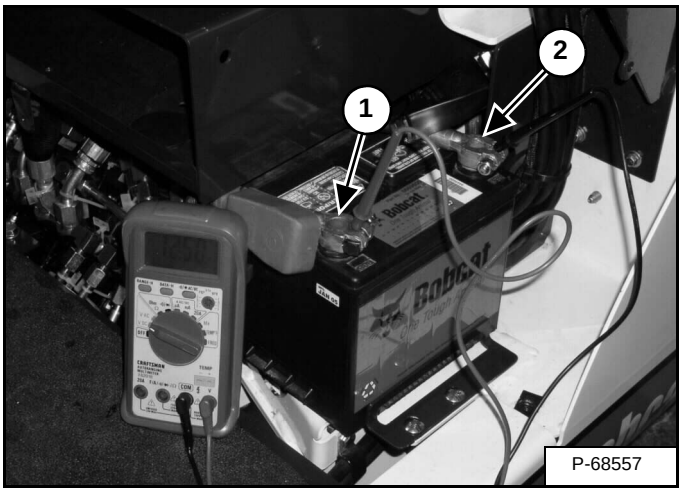
Reconnect the alternator wires.

Reconnect the negative (-) cable from the battery.

NOTE: The alternator regulator test can also be run using a voltmeter.

Alternator Regulator Test With Voltmeter

Figure 50-30-5



Connect the positive (+) voltmeter lead to the positive (+) battery terminal (Item 1) **[Figure 50-30-5]**.

Connect the negative (-) voltmeter lead to the negative (-) battery terminal (Item 2) **[Figure 50-30-5]**.

Start the engine and run at full RPM.

The voltmeter should read between 13.9 and 14.7 volts.

If the voltmeter reading is not within this range, replace the alternator's regulator.

IMPORTANT

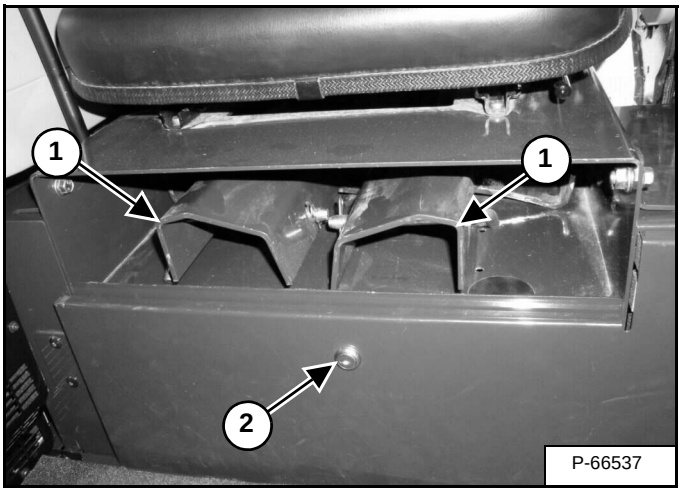
Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the loader. (Remove both cables from the battery.)**
- **Extra battery cables (booster cables) are connected wrong.**

I-2023-1285

Removal And Installation

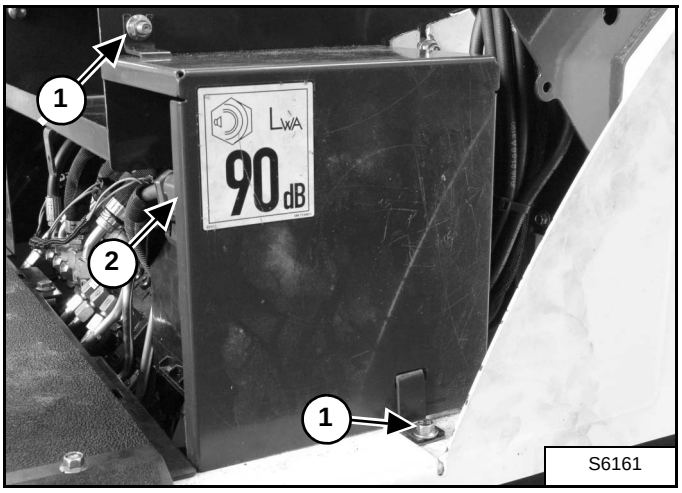
Figure 50-30-6



Remove the two blade extensions (Item 1) **[Figure 50-30-6]** from the storage compartment.

Use the start key to remove the access cover (Item 2) **[Figure 50-30-6]**.

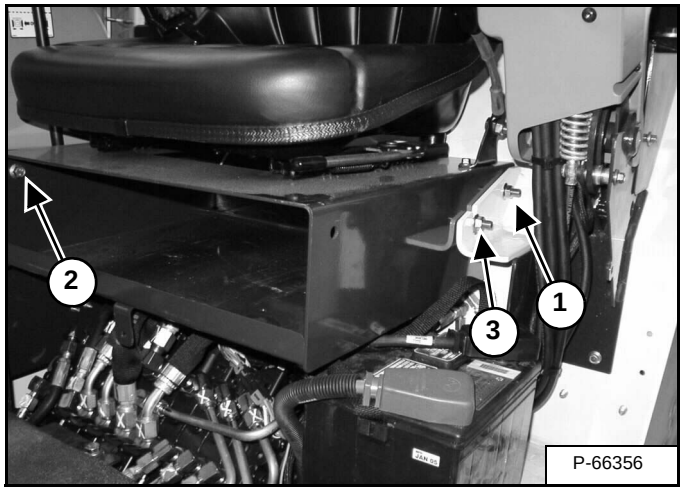
Figure 50-30-7



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

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

Figure 50-30-8



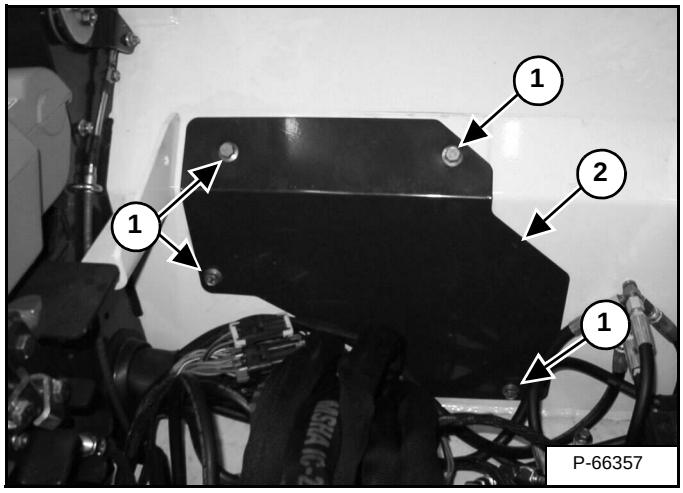
Remove the two bolts (Item 1) **[Figure 50-30-8]** and nuts from both sides of the seat mount.

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.

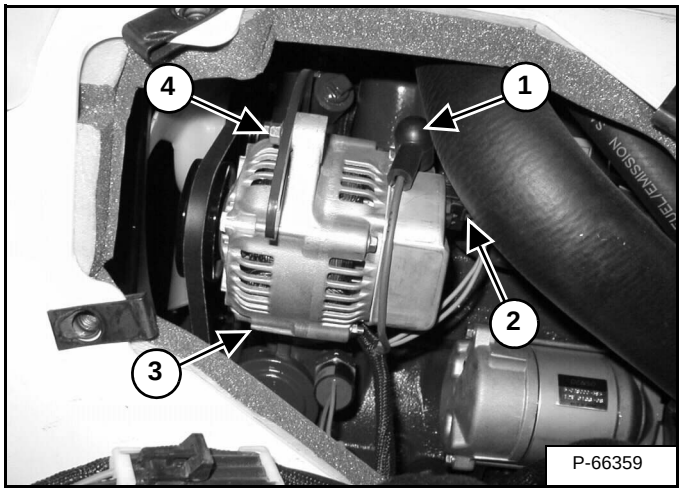
Figure 50-30-9



Remove the four bolts (Item 1) and remove the access panel (Item 2) **[Figure 50-30-9]**.

Removal And Installation (Cont'd)

Figure 50-30-10



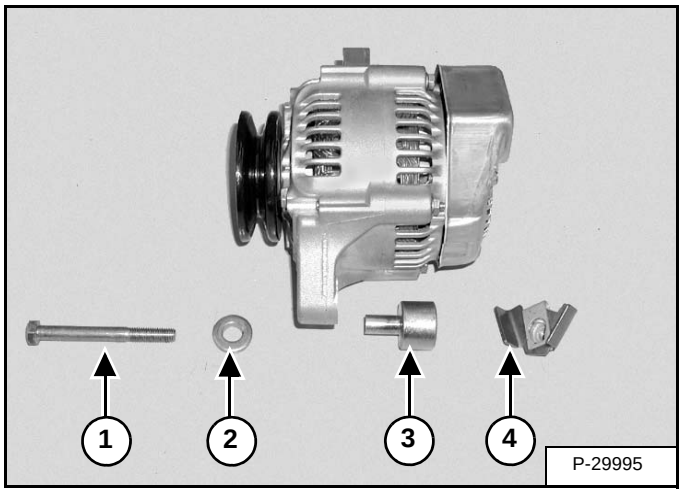
Disconnect the red wire (Item 1) **[Figure 50-30-10]**.

Disconnect the wire harness connector (Item 2) **[Figure 50-30-10]**.

Remove the bottom mount bolt (Item 3) **[Figure 50-30-10]**.

Remove alternator adjustment bolt (Item 4) **[Figure 50-30-10]**.

Figure 50-30-11



NOTE: Alternator will fall if not supported while removing adjustment bolt.

Remove belt from the alternator pulley.

Remove alternator.

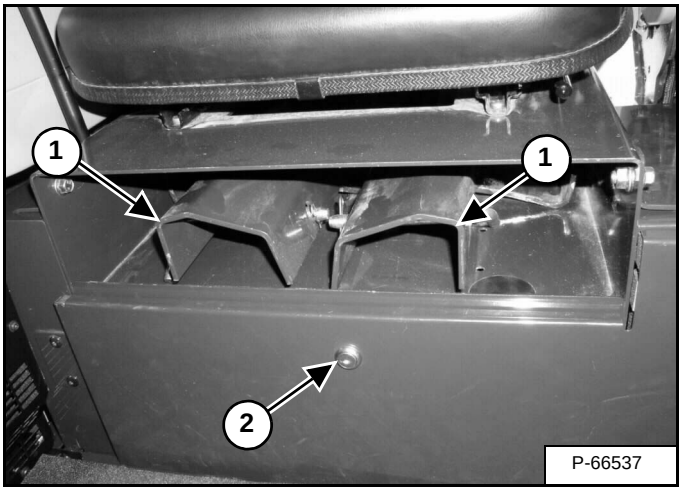
NOTE: The lower alternator mounting bolt (Item 1) is assembled with a washer (Item 2) spacer (Item 3) and retaining bracket with nut (Item 4) [Figure 50-30-11] which will fall during disassembly.

Belt Adjustment

Replace the belt if it has stretched or there are cracks in the belt. Replace the pulley if the belt contacts the bottom of the groove in the pulley.

Stop the engine.

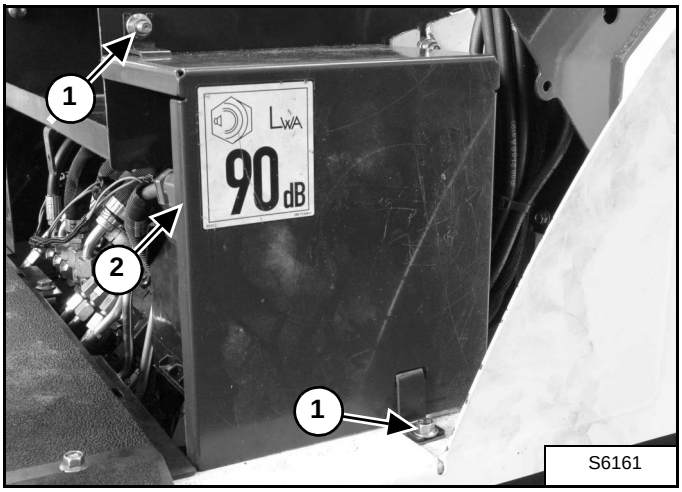
Figure 50-30-12



Remove the two blade extensions (Item 1) **[Figure 50-30-12]** from the storage compartment.

Use the start key to remove the access cover (Item 2) **[Figure 50-30-12]**.

Figure 50-30-13

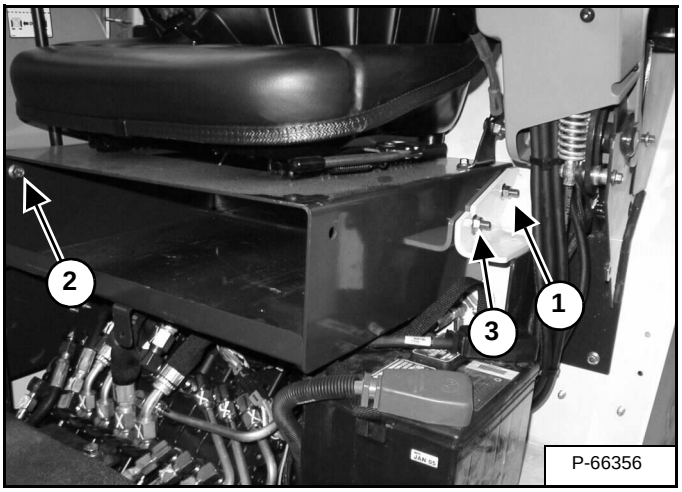


Remove the two bolts (Item 1) **[Figure 50-30-13]** and brackets from the battery cover.

Remove the cover (Item 2) **[Figure 50-30-13]**.

Belt Adjustment (Cont'd)

Figure 50-30-14



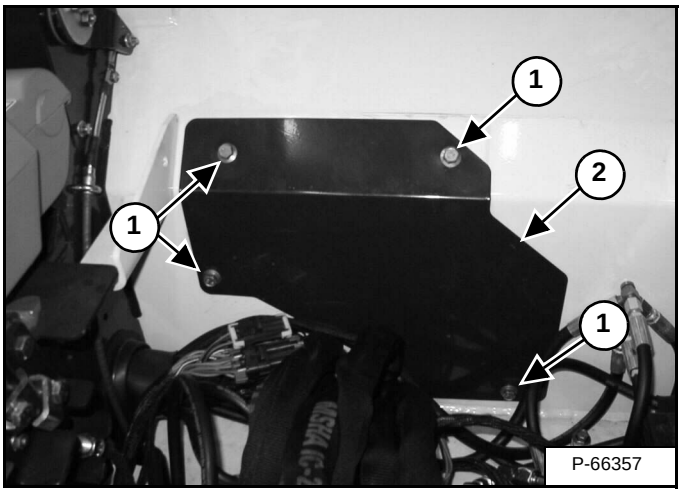
Remove the two bolts (Item 1) **[Figure 50-30-14]** and nuts from both sides of the seat mount.

Remove the bolt (Item 2) **[Figure 50-30-14]**, nut and bracket from the right side of the seat mount.

Loosen the two bolts (Item 3) **[Figure 50-30-14]** and nuts from both sides of the seat mount.

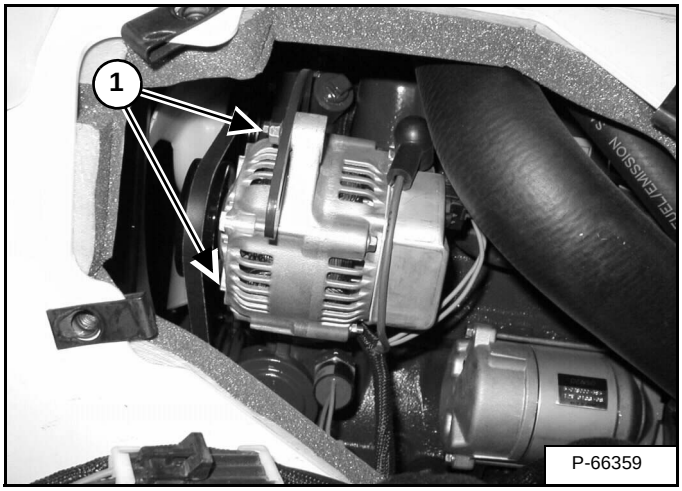
Remove the seat and seat mount.

Figure 50-30-15



Remove the four bolts (Item 1) and remove the access panel (Item 2) **[Figure 50-30-15]**.

Figure 50-30-16



Loosen the alternator mounting and adjustment bolts (Item 1) **[Figure 50-30-16]**.

If a belt tension tool is available, move the alternator toward the front of the machine **[Figure 50-30-16]** until the belt has (New belt = 56 to 60 lbf. or Used belt = 48 to 52 lbf.) tension.

If a belt tension tool is not available, move the alternator toward the front of the machine **[Figure 50-30-16]** until the belt has 0.50 in. (13 mm) movement at the middle of the belt span with 13 lb. (58 N) of force.

Tighten the mounting and adjustment bolts.

Install the access panel, the seat and seat mount, the battery cover, the access cover and the two blade extensions.

Charging System Inspection

⚠ WARNING

AVOID INJURY OR DEATH

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

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

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

W-2065-0807

⚠ WARNING

Keep arcs, sparks flames and lighted tobacco away from batteries. When *jumping* from booster battery make final connection (negative) at machine frame.

Do not jump start or charge a frozen or damaged battery. Warm battery to 60°F (16°C) before connecting to a charger. Unplug charger before connecting or disconnecting cables to battery. Never lean over battery while boosting, testing or charging.

Battery gas can explode and cause serious injury.

W-2066-0705

IMPORTANT

Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the loader. (Remove both cables from the battery.)**
- **Extra battery cables (booster cables) are connected wrong.**

I-2023-1285

If the charging system malfunctions check the following:

Check the condition and tension of the alternator belt. (See Belt Adjustment on Page 50-30-5.) If belt is worn or deteriorated replace.

Inspect the alternator wiring harness and connectors at alternator. Harness and connectors must be clean and tight.

Check the fuse for the alternator in the fuse panel. If fuse is burned, find the cause and repair / replace. If fuse is in doubt, remove it and check for continuity.

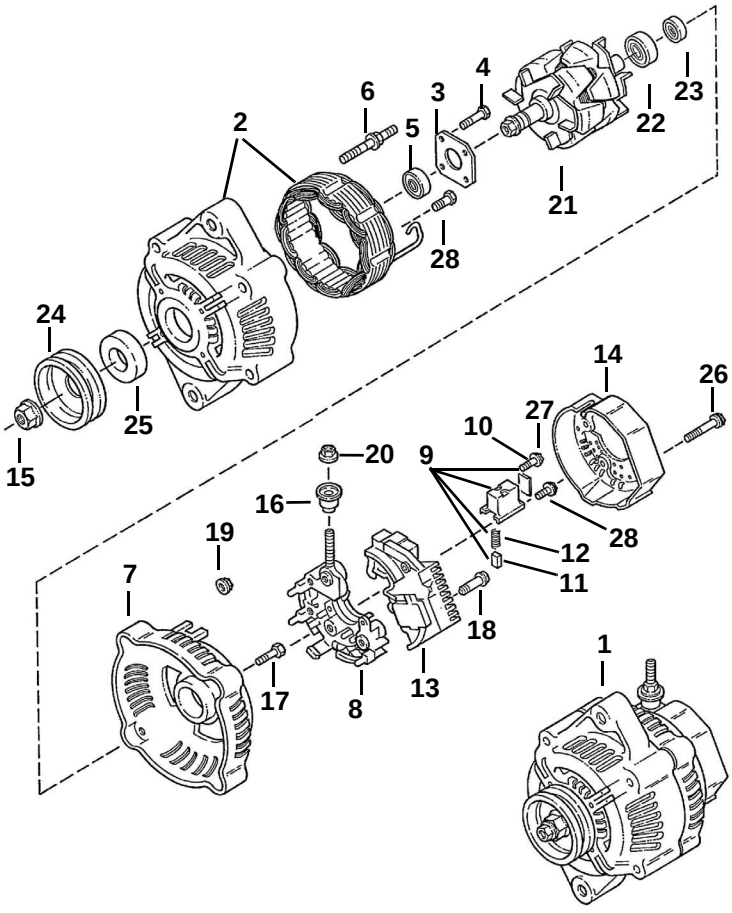
Check the electrolyte level in the battery. Add distilled water as needed. (Does not apply to maintenance free batteries.)

Verify the charge of the battery. Make sure battery is fully charged.

Disconnect the battery cables (negative first, then positive). Inspect the cable clamps and battery posts for corrosion. Remove acid or corrosion from the battery and cables with a sodium bicarbonate and water solution. Put grease on the cable ends and battery terminals to prevent corrosion. Reconnect the cable to the positive terminal.

Parts Identification

1. Alternator
2. Frame Assy.
3. Plate
4. Screw
5. Bearing
6. Stud
7. Frame End
8. Holder
9. Holder
10. Seal
11. Brush
12. Spring
13. Regulator
14. Cover
15. Nut
16. Insulator
17. Bolt
18. Screw
19. Nut
20. Nut
21. Rotor Assy.
22. Bearing
23. Cover
24. Pulley
25. Spacer
26. Bolt
27. Screw
28. Screw



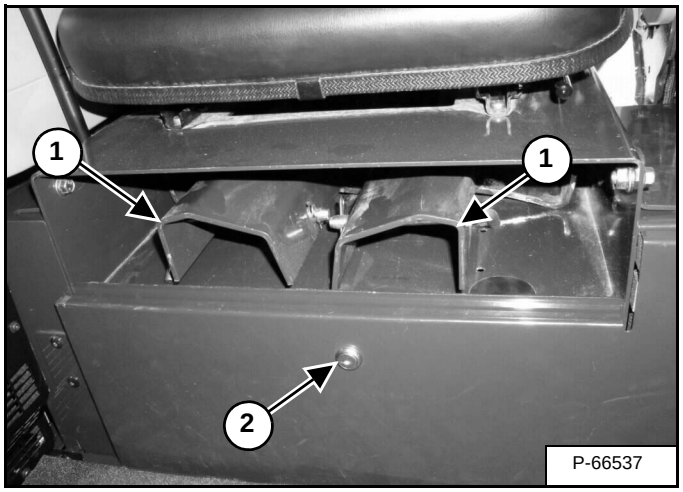
C-3456

STARTER

Removal And Installation

Stop the engine.

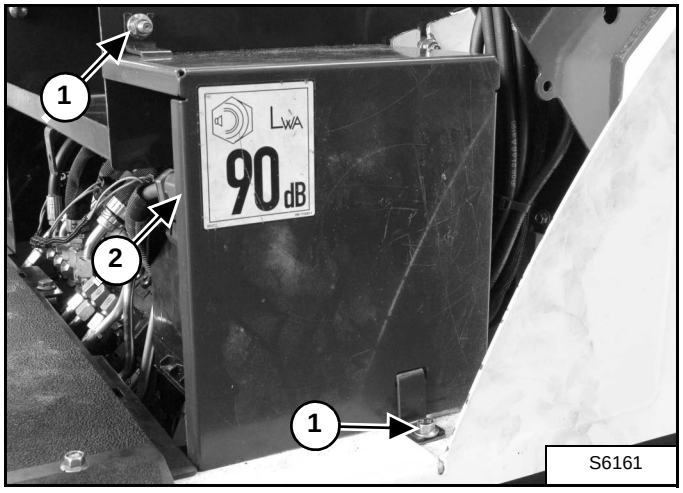
Figure 50-40-1



Remove the two blade extensions (Item 1) **[Figure 50-40-1]** from the storage compartment.

Use the start key to remove the access cover (Item 2) **[Figure 50-40-1]**.

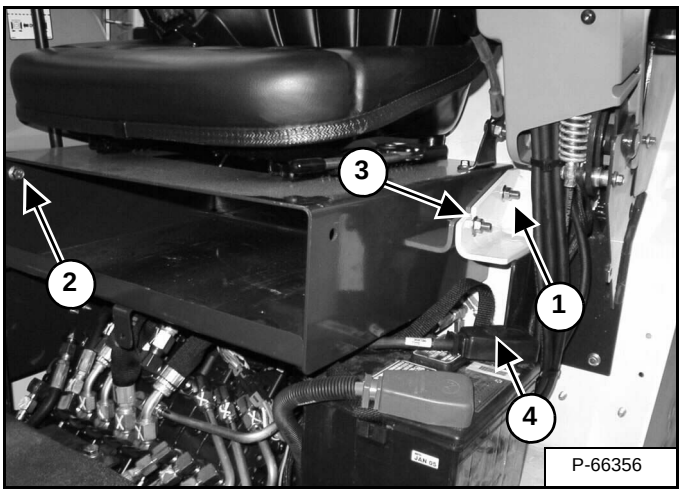
Figure 50-40-2



Remove the two bolts (Item 1) **[Figure 50-40-2]** and brackets from the battery cover.

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

Figure 50-40-3



Remove the two bolts (Item 1) **[Figure 50-40-3]** and nuts from both sides of the seat mount.

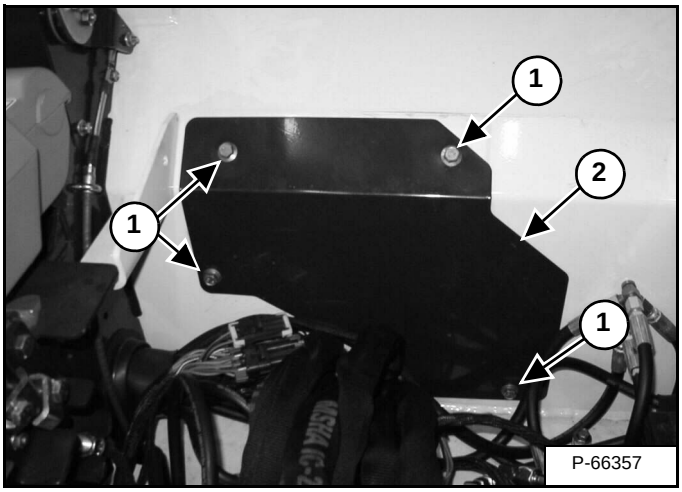
Remove the bolt (Item 2) **[Figure 50-40-3]**, nut and bracket from the right side of the seat mount.

Loosen the two bolts (Item 3) **[Figure 50-40-3]** and nuts from both sides of the seat mount.

Remove the seat and seat mount.

Disconnect the negative (-) cable (Item 4) **[Figure 50-40-3]** from the battery.

Figure 50-40-4

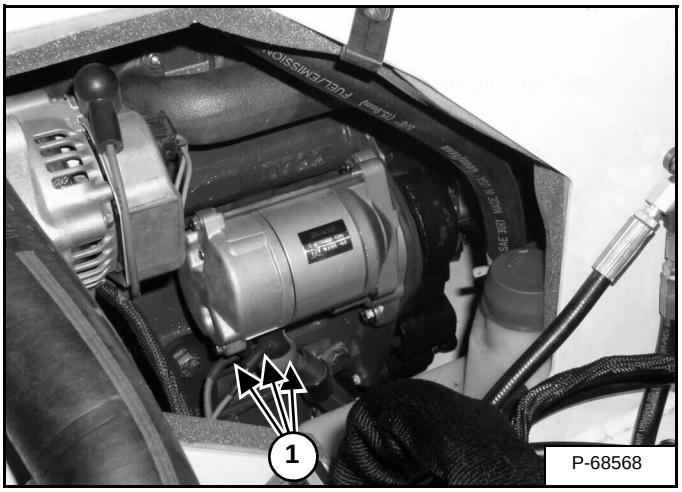


Remove the four bolts (Item 1) and remove the access panel (Item 2) **[Figure 50-40-4]**.

Removal And Installation (Cont'd)

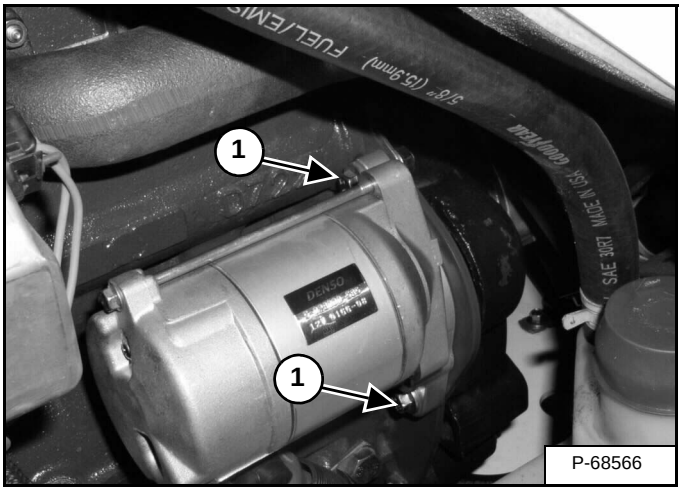
Mark the starter wires for ease of assembly.

Figure 50-40-5



Disconnect the wires (Item 1) **[Figure 50-40-5]** from the starter.

Figure 50-40-6

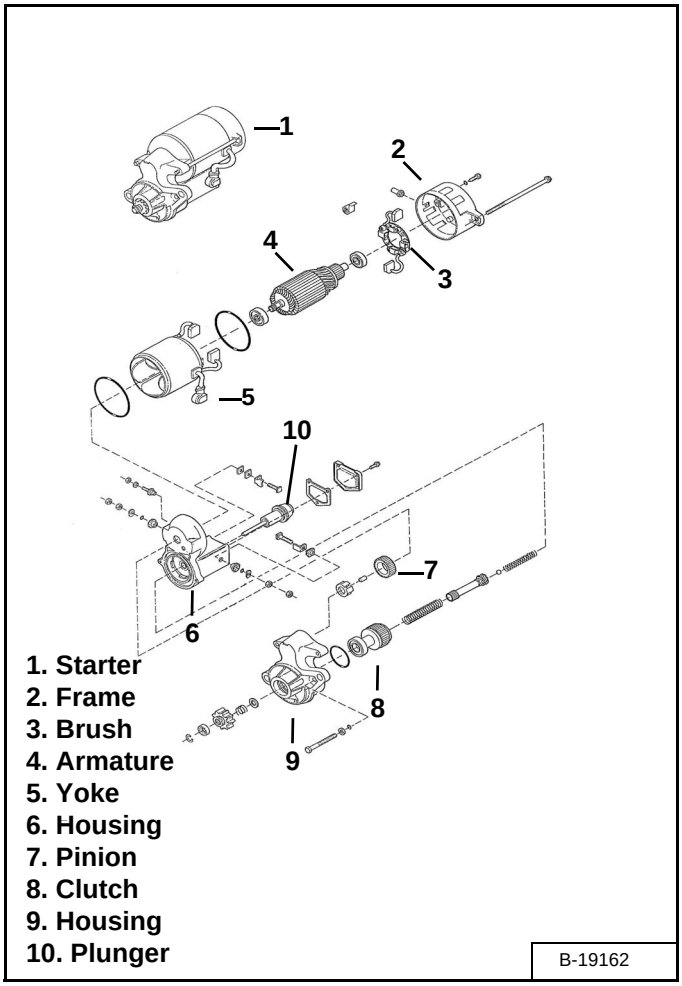


Remove the mounting bolts (Item 1) **[Figure 50-40-6]** from the starter.

Remove the starter from the bell housing.

Parts Identification

Figure 50-40-7



1. Starter
2. Frame
3. Brush
4. Armature
5. Yoke
6. Housing
7. Pinion
8. Clutch
9. Housing
10. Plunger

Cleaning And Inspection

⚠ WARNING

Wear safety glasses to prevent eye injury when any of the following conditions exist:
- **When fluids are under pressure.**
- **Flying debris or loose material is present.**
- **Engine is running.**
- **Tools are being used.**

W-2019-1285

Use a brush and air pressure to clean the drive, field coils, armature and starter housing.

NOTE: Do not use solvent to clean the drive assembly. The solvent will remove the lubricant and the drive will slip.

Check the following items:

Armature
- Broken or burned insulation.
- Loose connections at commutator.
- Open or grounded circuits.
- Worn shaft or bearings.
- Rough commutator.

Field Coils
- Broken or burned insulation.
- Electrical continuity.
- Brush connections.

Drive Gear
- Worn teeth.
- Tooth engagement (drive gear must engage ring gear by 1/2 the depth of the ring gear tooth).

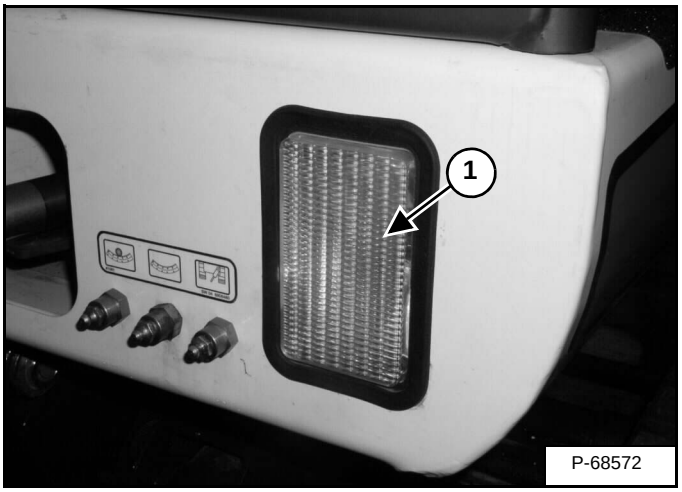
Brush Holders
- Broken springs.
- Broken insulation.
- Spring tension.


Bobcat®

LIGHTS

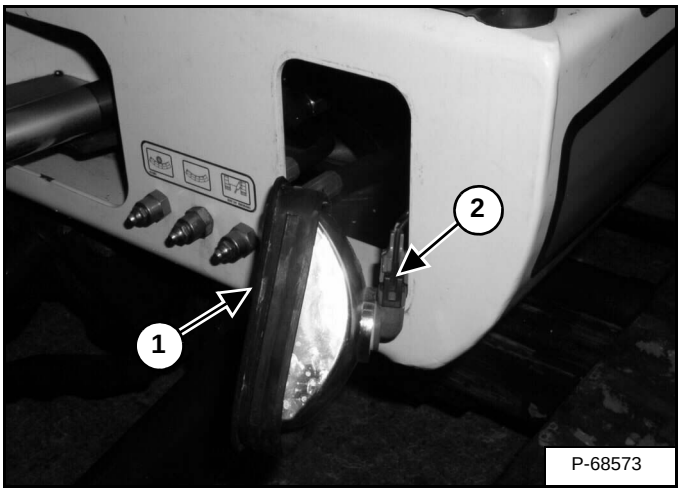
UpperStructure Light Removal And Installation

Figure 50-50-1



Push out on the light housing (Item 1) **[Figure 50-50-1]** until the light is outside the upperstructure.

Figure 50-50-2



Pull the light (Item 1) **[Figure 50-50-2]** out of the upperstructure.

Disconnect the wire harness (Item 2) **[Figure 50-50-2]**.

UpperStructure Light Disassembly and Assembly

Figure 50-50-3

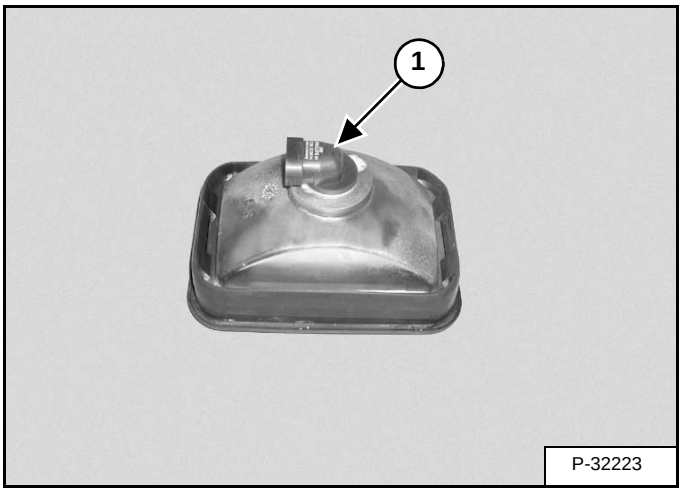
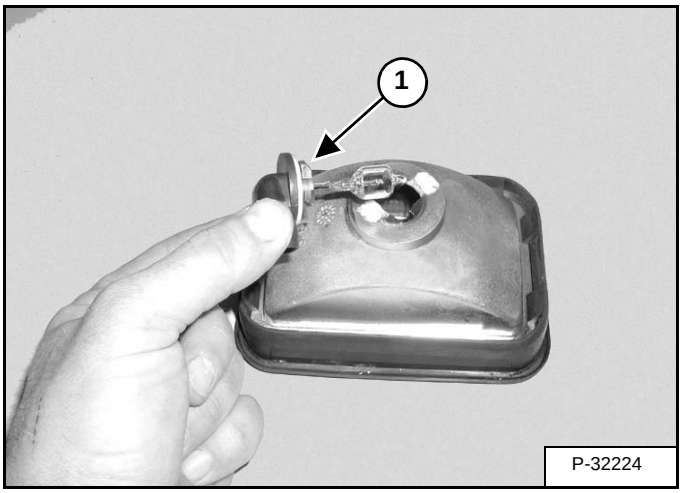


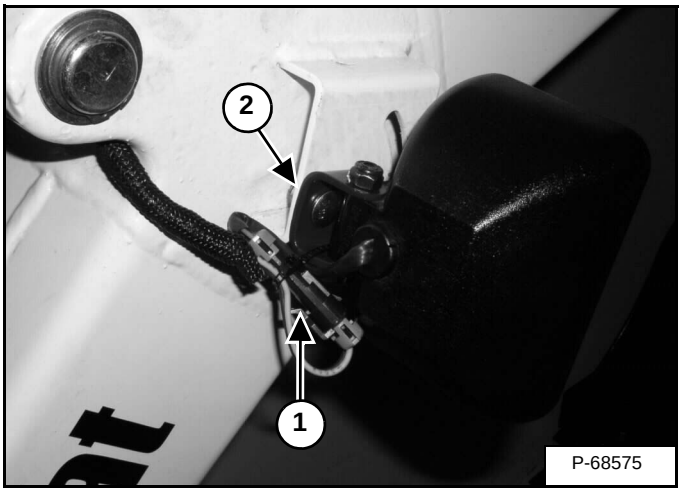
Figure 50-50-4



Remove the light bulb assembly (Item 1) **[Figure 50-50-3]** and **[Figure 50-50-4]** from the lens.

Boom Light Removal And Installation

Figure 50-50-5

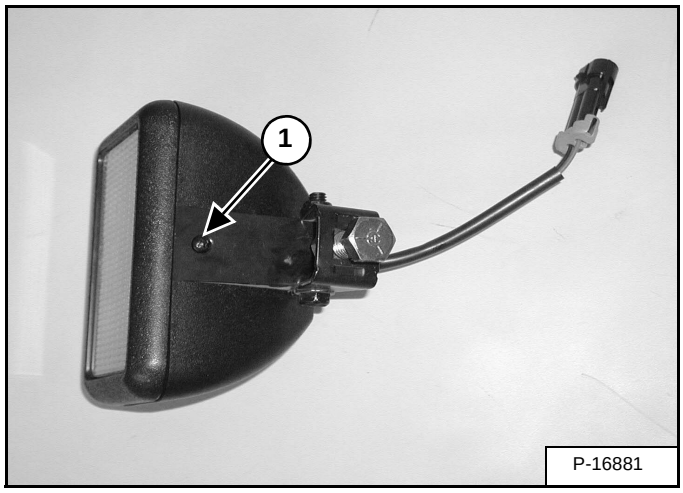


Disconnect the wire harness (Item 1) **[Figure 50-50-5]**.

Remove the nut and bolt (Item 2) **[Figure 50-50-5]**.

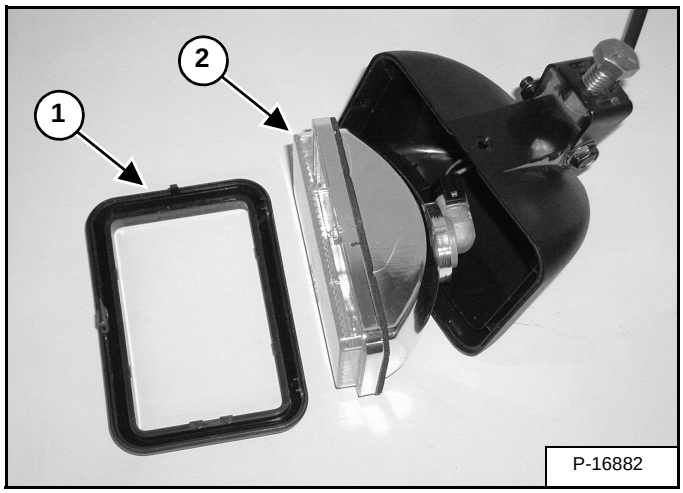
Boom Light Disassembly And Assembly

Figure 50-50-6



Remove the screw (Item 1) **[Figure 50-50-6]** from the side of the light.

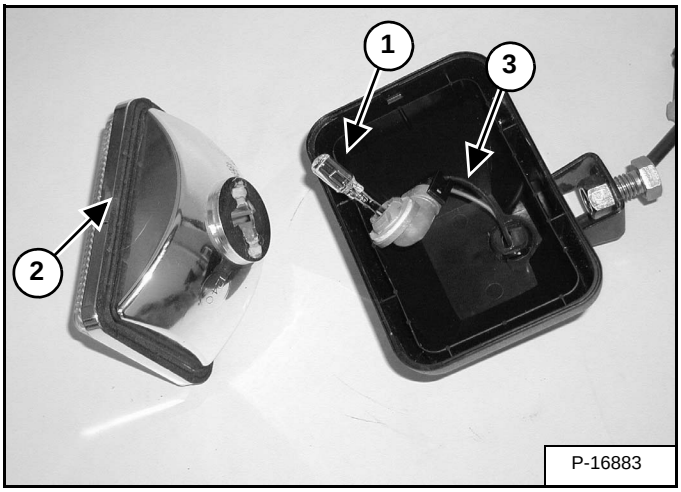
Figure 50-50-7



Remove the cover (Item 1) and lens assembly (Item 2) **[Figure 50-50-7]**.

Boom Light Disassembly And Assembly (Cont'd)

Figure 50-50-8

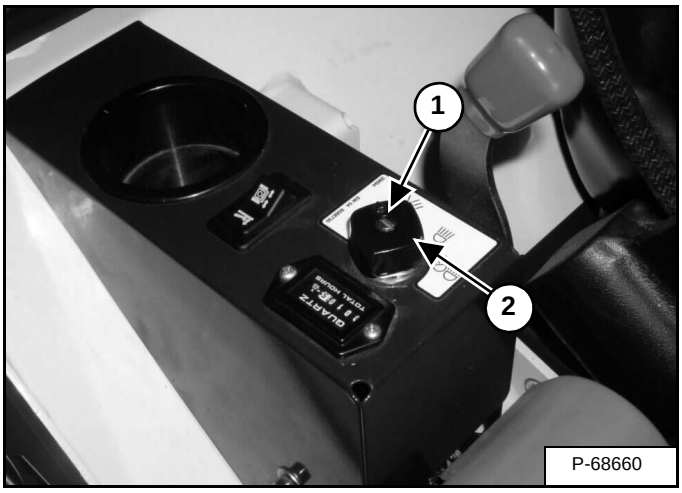


Remove the light bulb assembly (Item 1) from the lens assembly (Item 2) **[Figure 50-50-8]**.

Disconnect the wire connector (Item 3) **[Figure 50-50-8]** from the light bulb assembly.

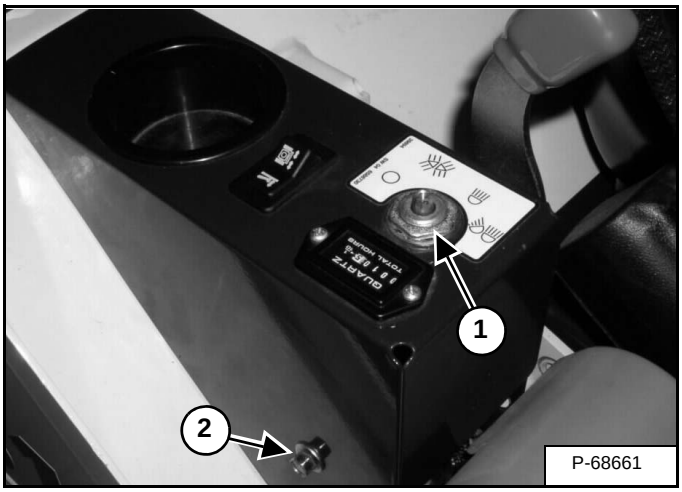
Light Switch Removal And Installation

Figure 50-50-9



Remove the screw (Item 1) and knob (Item 2) **[Figure 50-50-9]** from the switch.

Figure 50-50-10

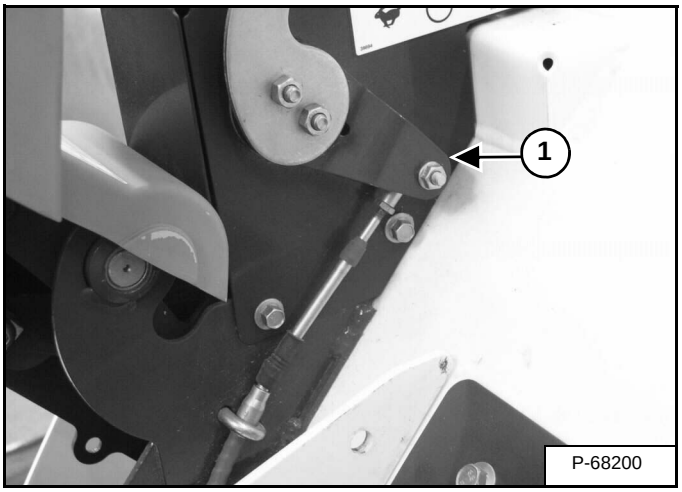


Remove the nut and lock washer (Item 1) **[Figure 50-50-10]** from the switch.

Remove the screw (Item 2) **[Figure 50-50-10]** from the instrument console.

Light Switch Removal And Installation (Cont'd)

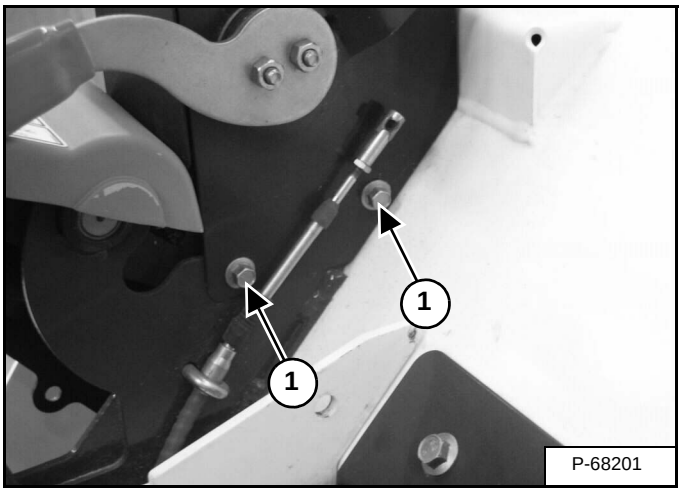
Figure 50-50-11



Remove the throttle linkage from the ball on the back side of the lever (Item 1) **[Figure 50-50-11]**.

NOTE: The seat is removed [Figure 50-50-11] from the excavator to show a clear view of the throttle linkage and bolts to be removed.

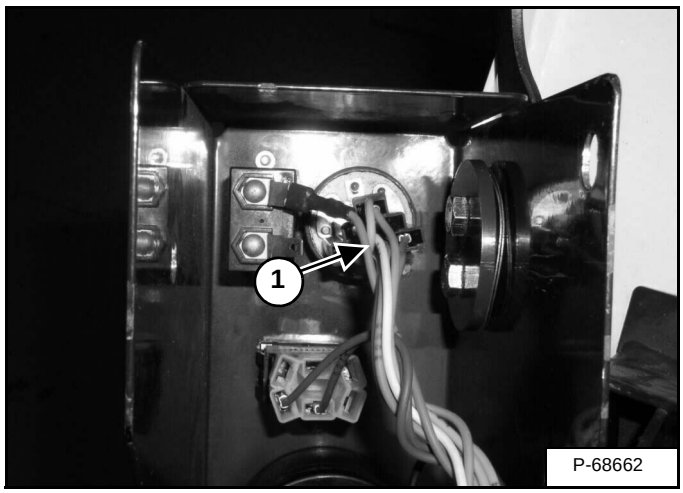
Figure 50-50-12



Remove the two bolts (Item 1) **[Figure 50-50-12]** from the left side of the instrument console.

Lift the instrument console from the console mounting bracket.

Figure 50-50-13



Disconnect the wire harness (Item 1) **[Figure 50-50-13]** from the switch.

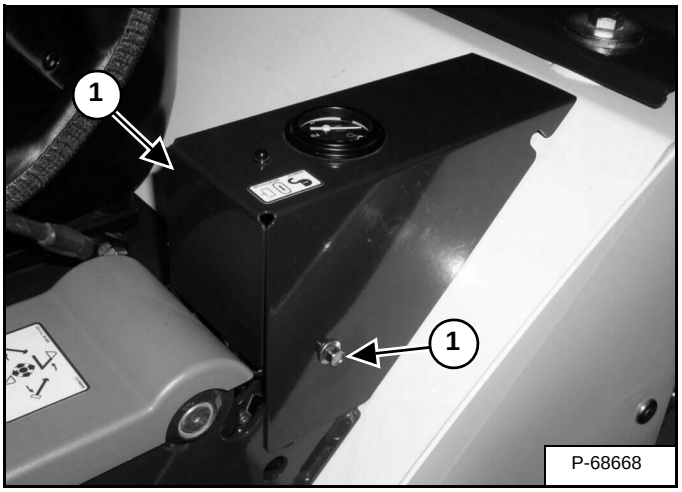
Remove the switch from the bottom of the panel.

MICROSWITCH

Testing Left Console Microswitch

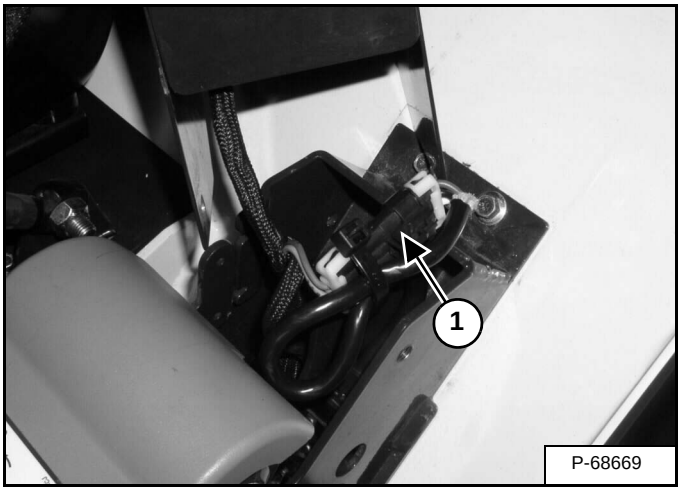
Lower the control console.

Figure 50-60-1



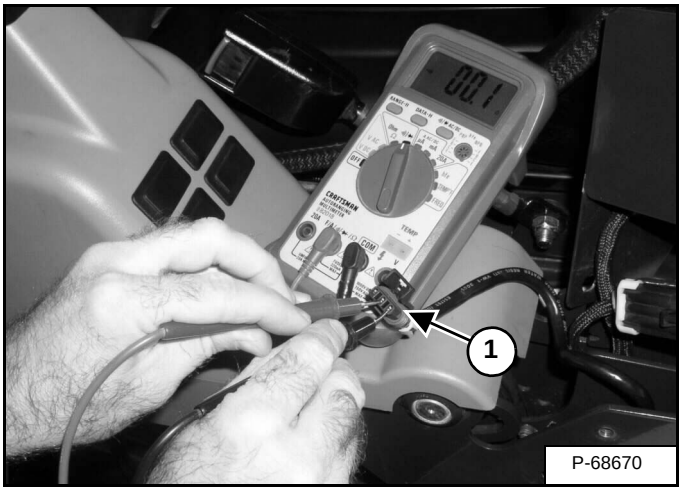
Remove the two bolts (Item 1) **[Figure 50-60-1]**, on both sides, and lift the left instrument console off to the side.

Figure 50-60-2



Remove the tie strap and disconnect the microswitch harness (Item 1) **[Figure 50-60-2]** from the control harness.

Figure 50-60-3



Use a continuity tester to check the microswitch prior to removal. Test the continuity between the black and white wire pins (Item 1) **[Figure 50-60-3]**.

The microswitch is normally open.

With the console raised the gauge reading should show no current.

By pushing the actuator on the microswitch, the gauge reading should show a completed circuit. If not, the microswitch is faulty and must be replaced.

Left Console Microswitch Removal And Installation

Figure 50-60-4

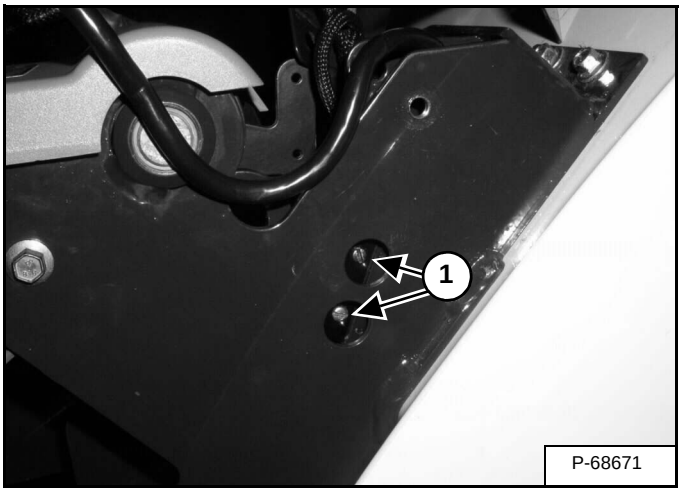
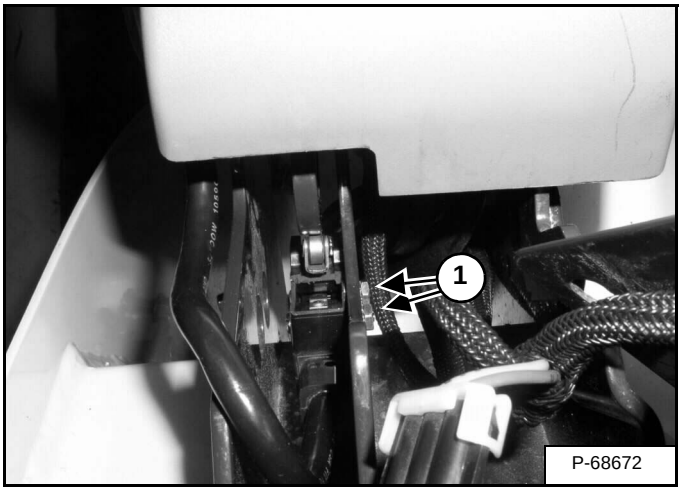


Figure 50-60-5



Remove the nuts, lock washers and bolts (Item 1) **[Figure 50-60-4]** and **[Figure 50-60-5]** fastening the microswitch.

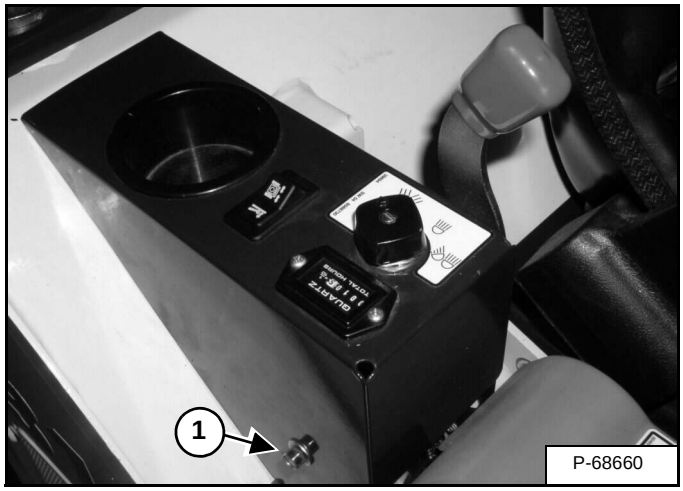
Remove the microswitch.

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

Testing Right Console Microswitch

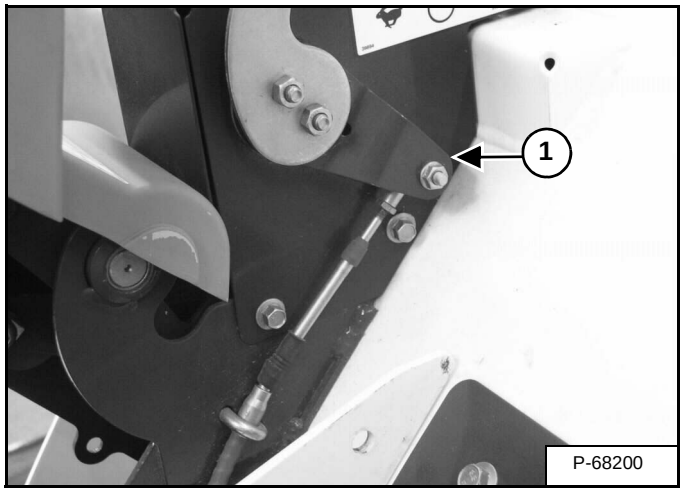
Lower the control console.

Figure 50-60-6



Remove the screw (Item 1) **[Figure 50-60-6]** from the instrument console.

Figure 50-60-7

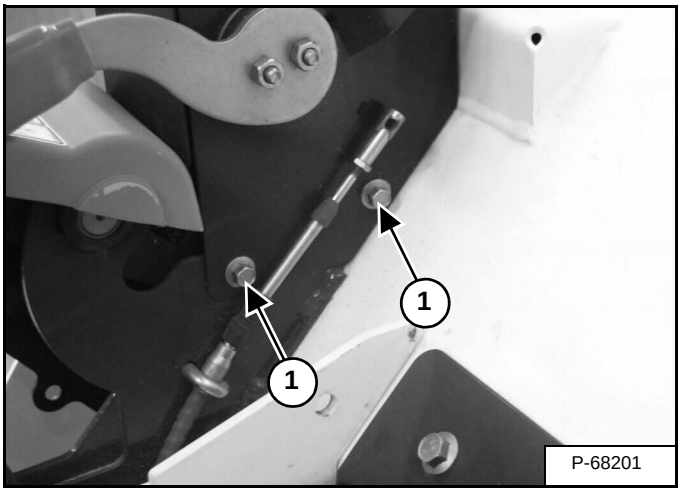


Remove the throttle linkage from the ball on the back side of the lever (Item 1) **[Figure 50-60-7]**.

NOTE: The seat is removed [Figure 50-60-7] from the excavator to show a clear view of the throttle linkage and bolts to be removed.

Testing Right Console Microswitch (Cont'd)

Figure 50-60-8



Remove the two bolts (Item 1) **[Figure 50-60-8]** from the left side of the instrument console.

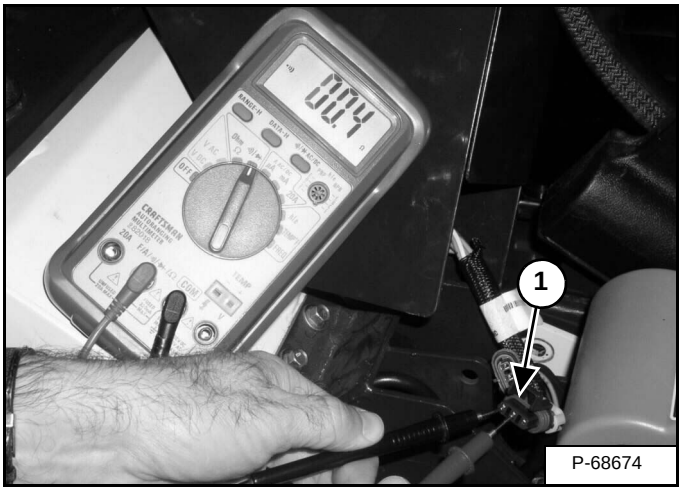
Lift the instrument console from the console mounting bracket.

Figure 50-60-9



Disconnect the microswitch harness (Item 1) **[Figure 50-60-9]** from the control harness.

Figure 50-60-10



Use a continuity tester to check the microswitch prior to removal. Test the continuity between the black and white wire pins (Item 1) **[Figure 50-60-10]**.

The microswitch is normally open.

With the console raised the gauge reading should show no current.

By pushing the actuator on the microswitch, the gauge reading should show a completed circuit. If not, the microswitch is faulty and must be replaced.

Right Console Microswitch Removal And Installation

Figure 50-60-11

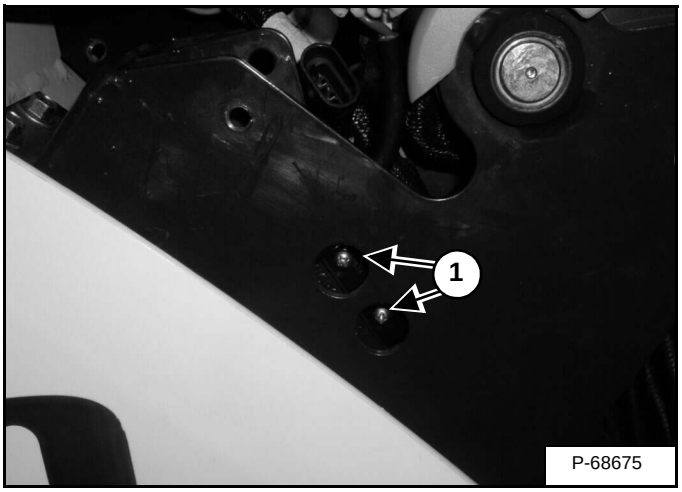
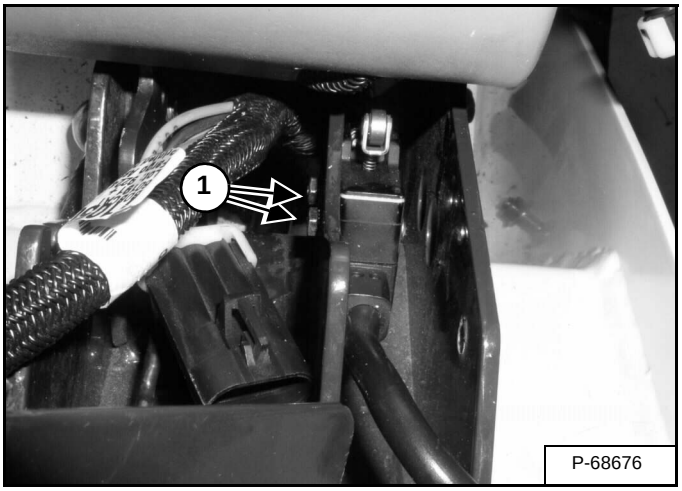


Figure 50-60-12



Remove the nuts, lock washers 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.

TWO-SPEED BOOST SWITCH

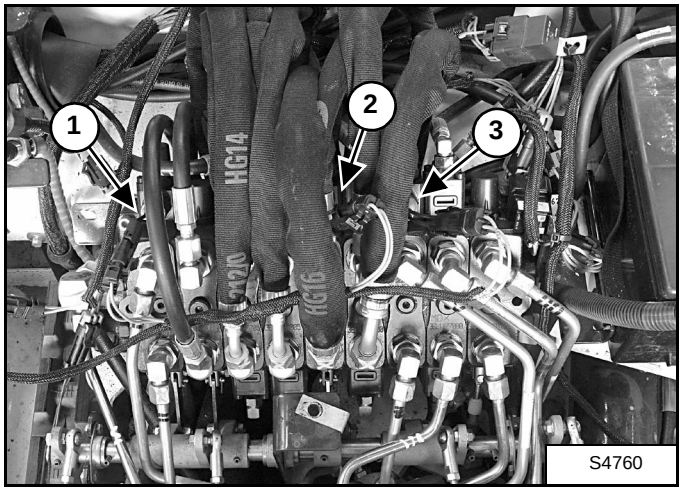
Description

The two speed boost switch allows the hydraulic fluid, in either low or high travel speed, from the gear pump to be routed back into the flow from the piston pump for the travel sections when the slew and blade functions are not in use. However the slew and blade functions have priority so when the slew or blade functions are required during low or high travel speed, the hydraulic fluid will be dedicated only to the slew or blade function.

Removal And Installation

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

Figure 50-70-1

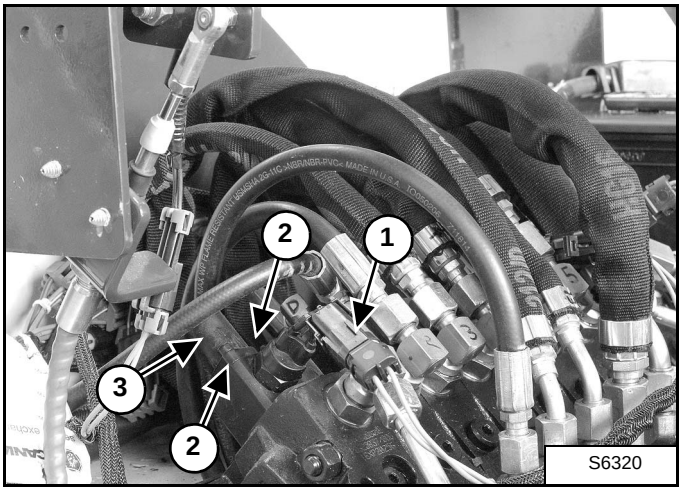


Locate the two-speed boost switches on the control valve assembly **[Figure 50-70-1]**:

1. Right hand travel two-speed boost switch.
2. Auxiliary boost switch.
3. Left hand travel two-speed boost switch.

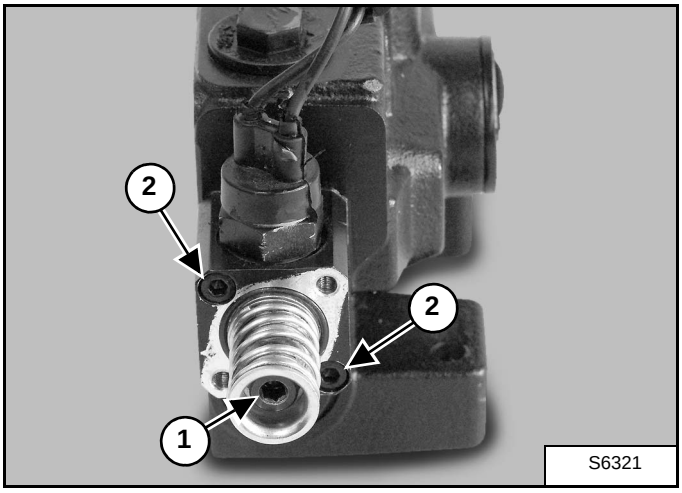
NOTE: This procedure is shown for the two-speed boost switch of the right hand travel section. The procedure is the same for the other two-speed boost switches.

Figure 50-70-2



Disconnect the wire harness (Item 1). Remove the two bolts (Item 2) and cap (Item 3) **[Figure 50-70-2]**.

Figure 50-70-3



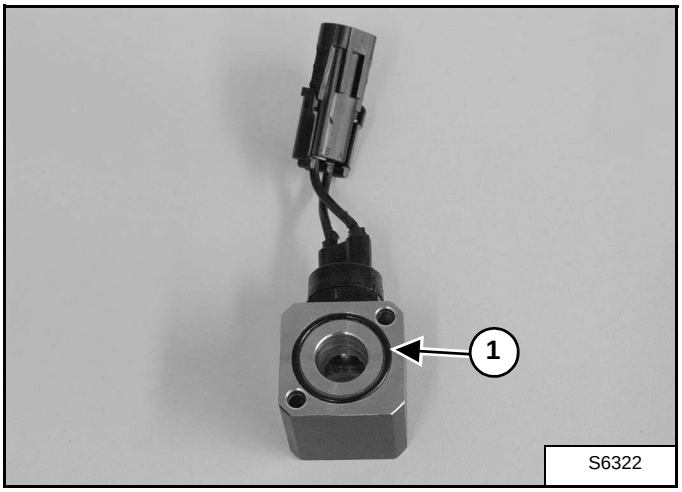
Remove the spring assembly by removing the screw (Item 1) **[Figure 50-70-3]**.

Remove the bolts (Item 2) **[Figure 50-70-3]** and remove the switch from the spool.

NOTE: The valve section is shown removed for photo clarity.

Removal And Installation (Cont'd)

Figure 50-70-4



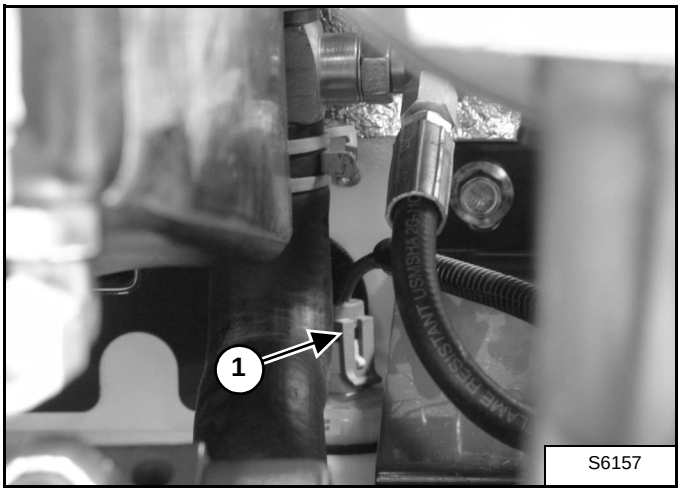
Remove the O-ring (Item 1) **[Figure 50-70-4]** from the switch.

FUEL LEVEL SENDER

Removal And Installation

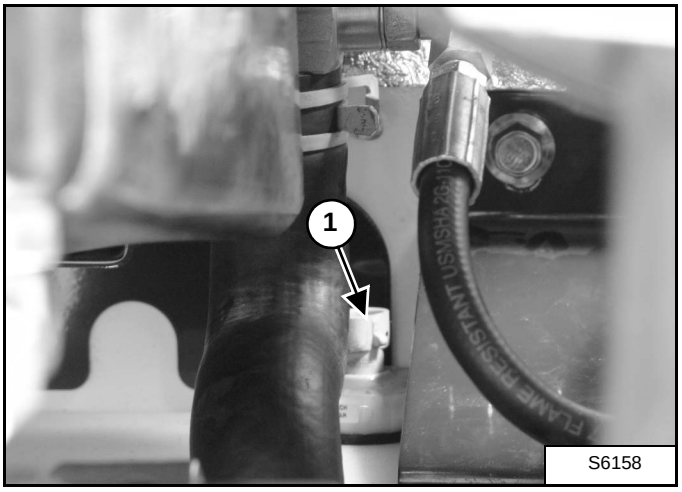
Open the tailgate.

Figure 50-80-1



Disconnect the wire harness (Item 1) **[Figure 50-80-1]** from the fuel level sender.

Figure 50-80-2

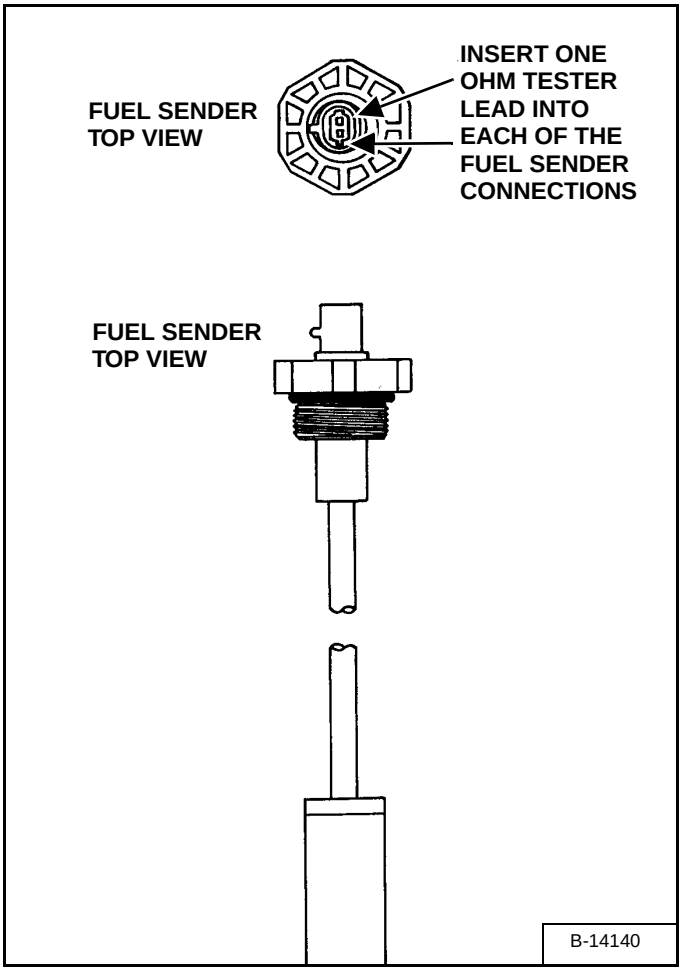


Remove the sender (Item 1) **[Figure 50-80-2]** from the fuel tank.

Testing

Use an ohmmeter to check the resistance of the fuel level sender.

Figure 50-80-3



Insert one of the ohm tester leads into each of the fuel sender electrical connectors in the end of the fuel sender **[Figure 50-80-3]**.

With the fuel sender in the position shown **[Figure 50-80-3]**, read the ohms in the empty position. Slide the float upwards and the ohm reading will decrease. See resistance chart below.

The approximate resistance should read as follows:

FULL: 15-35 Ohms.
HALF: 120-145 Ohms.
EMPTY: 230-250 Ohms.


Bobcat®

ENGINE SERVICE

AIR CLEANER 60-30-1
Removal And Installation 60-30-1

ENGINE 60-60-1
Camshaft 60-60-3
Connecting Rods 60-60-4
Crankshaft 60-60-4
Cylinder Head 60-60-2
Cylinders 60-60-3
Description 60-60-1
Engine 60-60-2
Engine Mount Replacement 60-60-14
Engine Removal and Installation 60-60-7
Fuel Injection Pump 60-60-2
Fuel Injector Nozzles 60-60-2
Oil Pump 60-60-4
Piston Rings 60-60-3
Pistons 60-60-4
Rocker Arms 60-60-3
Specifications 60-60-2
Thermostat 60-60-5
Torque Values 60-60-6
Valve Springs 60-60-2
Valves 60-60-2

ENGINE COMPONENTS AND TESTING 60-50-1
Engine Compression Checking 60-50-2
Fuel Injection Pump Check 60-50-3
Fuel Injection Pump Removal And Installation 60-50-4
Fuel Injection Pump Timing 60-50-6
Fuel Injector Checking 60-50-8
Fuel Injector Removal And Installation 60-50-7
Fuel Shutoff Solenoid - Checking 60-50-2
Fuel Shutoff Solenoid Removal And Installation 60-50-3
Fuel Shutoff Timer Removal And Installation 60-50-3
Glow Plug Removal And Installation 60-50-10
Valve Clearance Adjustment 60-50-1

FLYWHEEL AND HOUSING 60-70-1
Flywheel Housing Removal And Installation 60-70-1
Flywheel Installation 60-70-3
Hydraulic Pump Coupler Removal And Installation 60-70-2
Flywheel Removal 60-70-2
Rear End Plate Removal And Installation 60-70-3

RADIATOR 60-40-1
Removal And Installation 60-40-1

Continued On Next Page

ENGINE SERVICE (CONT'D)

RECONDITIONING THE ENGINE 60-80-1
Connecting Rod Alignment 60-80-25
Crankshaft And Bearings Removal And Installation 60-80-25
Crankshaft And Bearings, Servicing 60-80-27
Crankshaft Gear Removal And Installation 60-80-17
Cylinder Bore, Checking 60-80-29
Cylinder Head Disassembly And Assembly. 60-80-2
Cylinder Head Removal And Installation 60-80-1
Cylinder Head, Servicing 60-80-3
Cylinder Head Top Clearance 60-80-4
Engine Oil Pressure, Checking 60-80-20
Fuel Camshaft Governor 60-80-17
Fuel Camshaft Removal And Installation. 60-80-16
Idler Gear And Camshaft Removal And Installation 60-80-12
Idler Gear and Shaft, Servicing 60-80-15
Oil Pan Removal And Installation 60-80-18
Oil Pump Removal And Installation 60-80-19
Oil Pump, Service 60-80-19
Piston And Connecting Rod Removal And Installation 60-80-21
Piston And Connecting Rod, Servicing 60-80-23
Relief Valve 60-80-21
Rocker Arm And Shaft, Checking 60-80-10
Testing The Thermostat. 60-80-31
Thermostat Removal And Installation 60-80-31
Timing Gearcase Cover Removal And Installation 60-80-10
Timing Gears Checking Backlash 60-80-16
Valve And Valve Seat Reconditioning 60-80-6
Valve Guide, Checking 60-80-4
Valve Seat Tightness 60-80-7
Valve Spring 60-80-8
Valve Tappets 60-80-9
Valve Timing, Checking 60-80-6
Water Pump Disassembly And Assembly 60-80-30
Water Pump Removal And Installation 60-80-30

SPARK ARRESTOR MUFFLER 60-20-1
Removal And Installation 60-20-1

TROUBLESHOOTING 60-10-1
Chart 60-10-1

TROUBLESHOOTING

Chart

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.

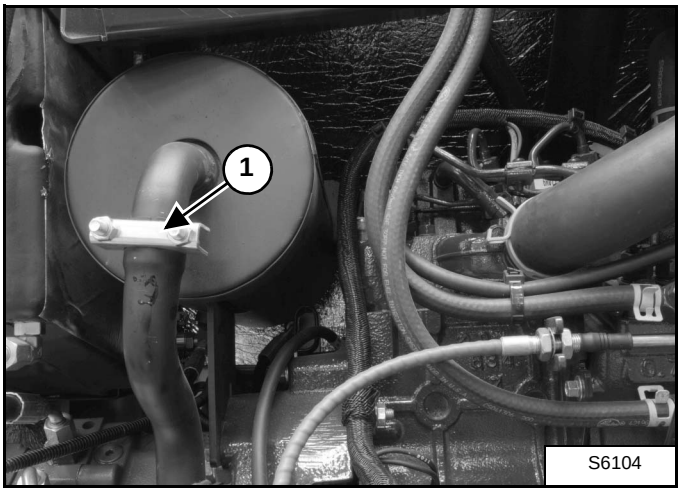
PROBLEM	CAUSE
Slow cranking speed	1, 2, 3, 4
Engine will not start	2, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 19, 27, 28, 29
Difficult to start	5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 25, 27, 28, 29
No power from engine	8, 9, 10, 11, 12, 13, 15, 16, 17, 21, 22, 24, 25, 26, 28, 29
Engine is mis-firing	8, 9, 11, 12, 13, 15, 16, 17, 21, 22, 24, 25, 26, 28
Too much fuel consumption	10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29
Black exhaust	10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29
Blue / white exhaust	4, 10, 15, 16, 17, 21, 23, 27, 29, 30, 50
Low oil pressure	4, 31, 32, 33, 34, 35, 37, 38, 39, 52
Engine knocking	13, 15, 16, 19, 22, 24, 25, 27, 29, 31, 40, 41, 53
Engine running rough	7, 8, 9, 10, 11, 12, 13, 17, 18, 22, 24, 25, 26, 29, 40, 53
Vibration	12, 13, 17, 21, 22, 25, 26, 29, 40, 42, 43
High oil pressure	4, 33, 36
Overheating	10, 12, 13, 15, 16, 20, 21, 40, 44, 45, 46, 47, 48, 51
Too much crankcase pressure	22, 27, 29, 30, 40, 49
Poor compression	10, 16, 21, 24, 25, 27, 28, 29, 30, 41, 53
Start and stop	9, 10, 11

KEY TO CORRECT THE CAUSE	
1. Battery capacity low	28. Worn valves and seat
2. Bad electrical connections	29. Broken or worn piston rings
3. Faulty starter motor	30. Worn valve stems or guides
4. Incorrect grade of oil	31. Worn or damaged bearings
5. Low cranking speed	32. Not enough oil in the oil pan
6. Fuel tank empty	33. Switch is defective
7. Faulty stop control operation	34. Oil pump worn
8. Plugged fuel line	35. Relief valve is stuck open
9. Plugged fuel filter	36. Relief valve is stuck closed
10. Restriction in the air cleaner	37. Broken relief valve spring
11. Air in the fuel system	38. Faulty suction pipe
12. Faulty fuel injection pump	39. Plugged oil filter
13. Faulty fuel injectors	40. Piston seizure
14. Broken injection pump drive	41. Incorrect piston height
15. Incorrect injection pump timing	42. Faulty engine mounting
16. Incorrect valve timing	43. Incorrect alignment of flywheel
17. Poor compression	44. Faulty thermostat
18. Plugged fuel tank vent	45. Restriction in water jacket
19. Incorrect grade of fuel	46. Loose alternator belt
20. Exhaust pipe restriction	47. Plugged radiator
21. Cylinder head gasket leaking	48. Plugged breather pipe
22. Over heating	49. Plugged breather pipe
23. Cold running	50. Damaged valve stem oil deflectors
24. Incorrect tappet adjustment	51. Coolant level too low
25. Sticking valves	52. Plugged oil pump pipe strainer
26. Incorrect high pressure fuel lines	53. Broken valve spring
27. Worn cylinder bores	


Bobcat®

Removal And Installation

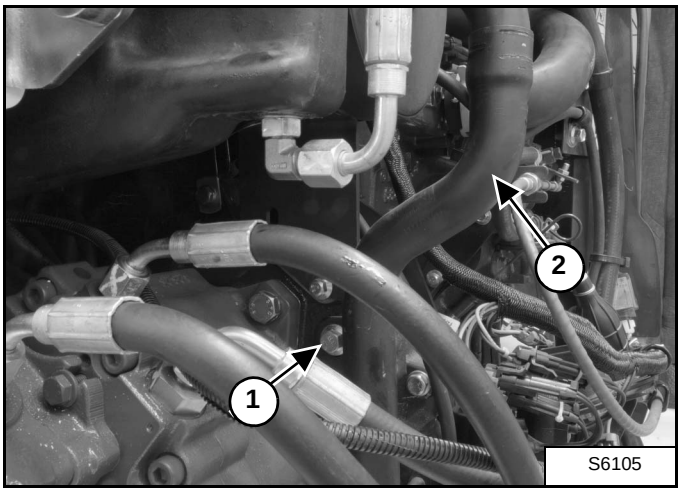
Figure 60-20-1



Loosen the exhaust extension clamp (Item 1) **[Figure 60-20-1]**.

Installation: Tighten clamp to 5.90-7.37 ft.-lb. (8-10 N•m) torque.

Figure 60-20-2



Remove the bolt (Item 1) **[Figure 60-20-2]** from the exhaust extension mounting bracket.

Slide exhaust extension (Item 2) **[Figure 60-20-2]** off muffler and remove from excavator.

⚠ 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.

⚠ WARNING

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

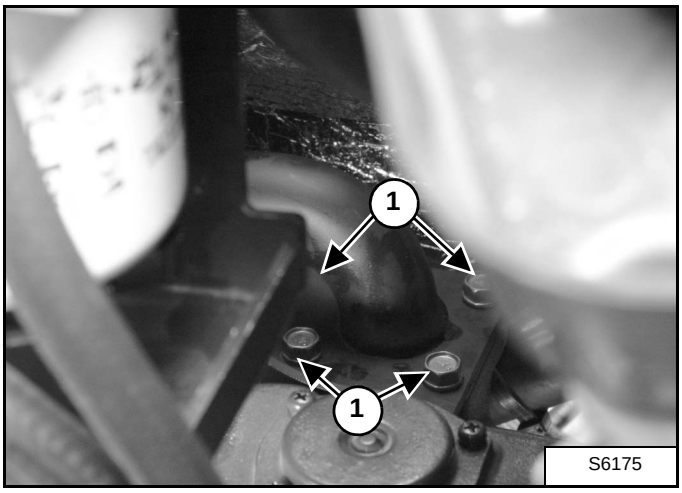
W-2011-1285

⚠ WARNING

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

W-2068-1285

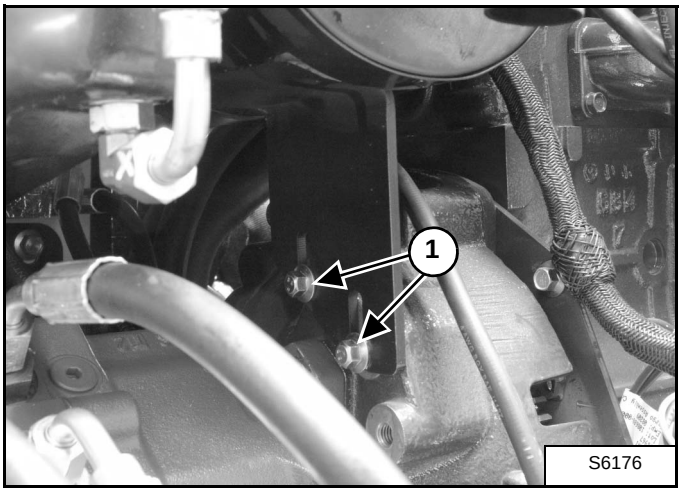
Figure 60-20-3



Remove the four bolts (Item 1) **[Figure 60-20-3]** from the muffler mount flange.

Removal And Installation (Cont'd)

Figure 60-20-4



Loosen the two bolts (Item 1) **[Figure 60-20-4]**.

Remove the muffler.

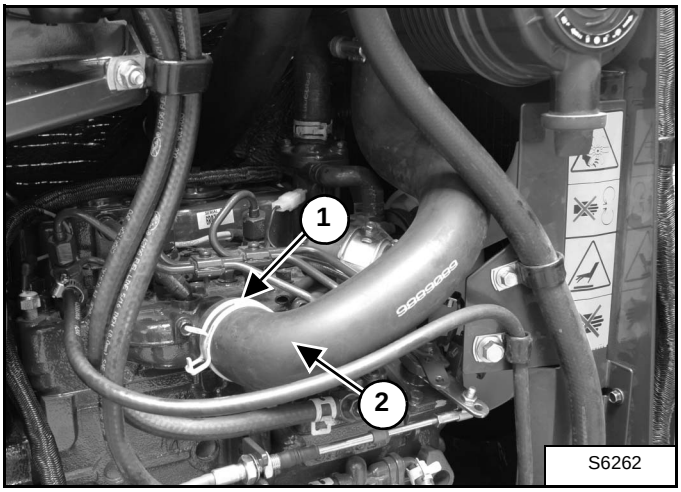
NOTE: Plug the exhaust manifold hole after muffler removal so no contamination can get into the engine.

AIR CLEANER

Removal And Installation

Open the tailgate.

Figure 60-30-1

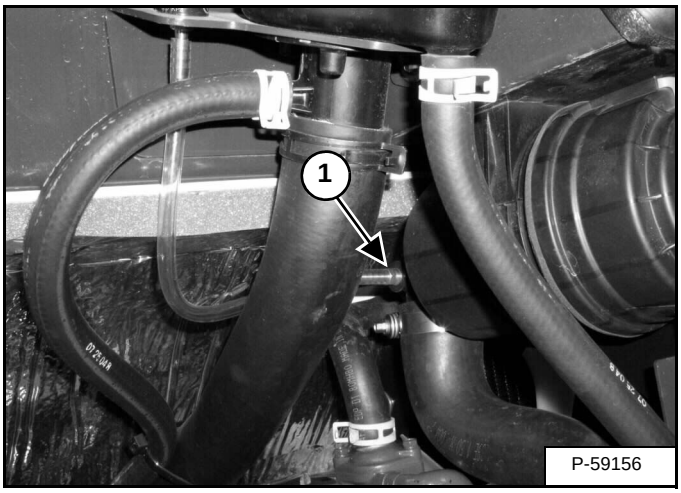


Loosen the hose clamp (Item 1) **[Figure 60-30-1]** on the air intake hose.

Remove the hose (Item 2) **[Figure 60-30-1]**.

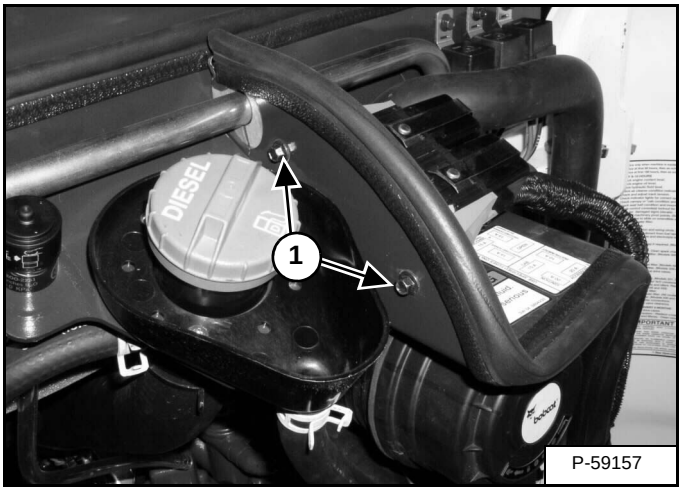
NOTE: Plug the intake manifold hole to prevent any contamination from getting into the engine.

Figure 60-30-2



Remove the hose (Item 1) **[Figure 60-30-2]** from the back of the air cleaner.

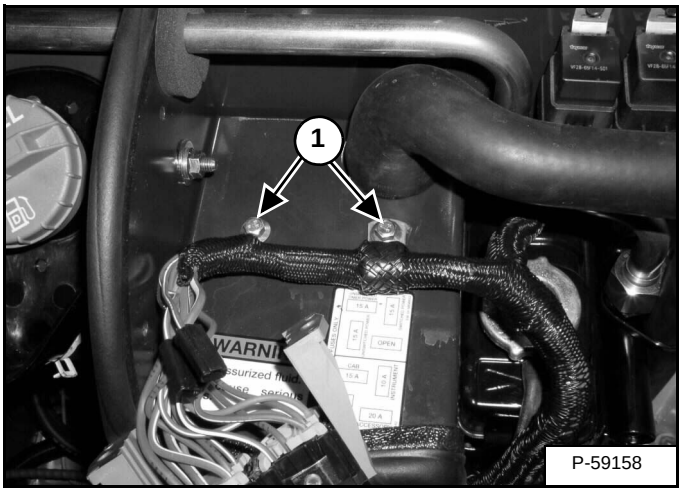
Figure 60-30-3



Remove the two bolts (Item 1) **[Figure 60-30-3]** fastening the fuse bracket to the excavator.

Move the fuse assembly aside to expose the two air cleaner mounting bolts.

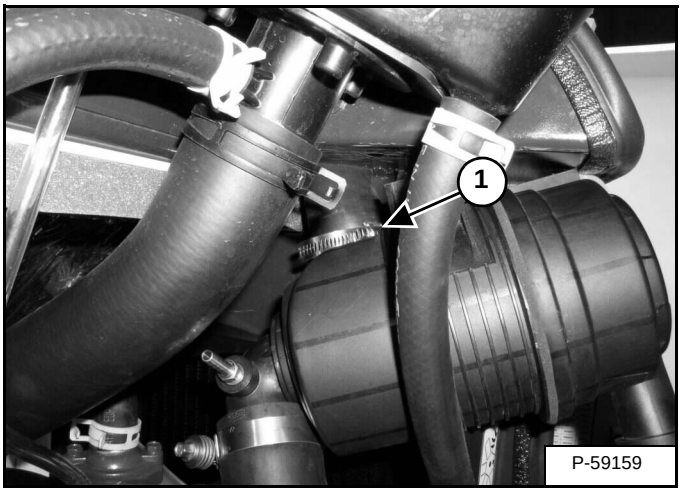
Figure 60-30-4



Remove the two bolts (Item 1) **[Figure 60-30-4]**.

Removal And Installation (Cont'd)

Figure 60-30-5



Loosen the hose clamp (Item 1) **[Figure 60-30-5]** and remove hose from the top of the air cleaner.

Remove the air cleaner and intake hose assembly from the excavator.

RADIATOR

Removal And Installation

Open the tailgate.

WARNING

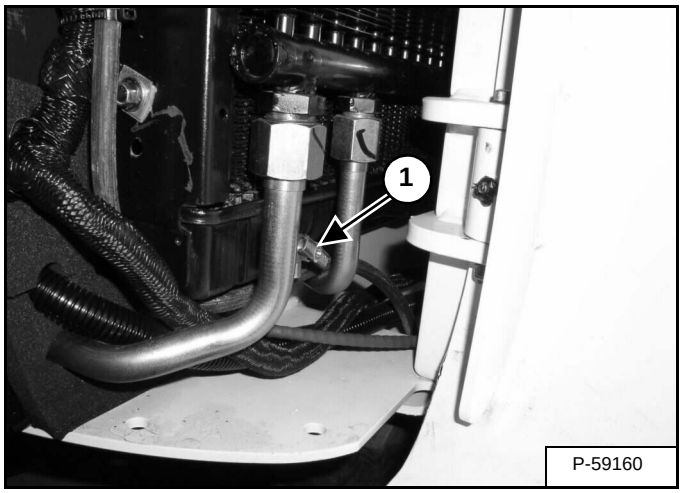
AVOID BURNS

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

W-2070-1203

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

Figure 60-40-1

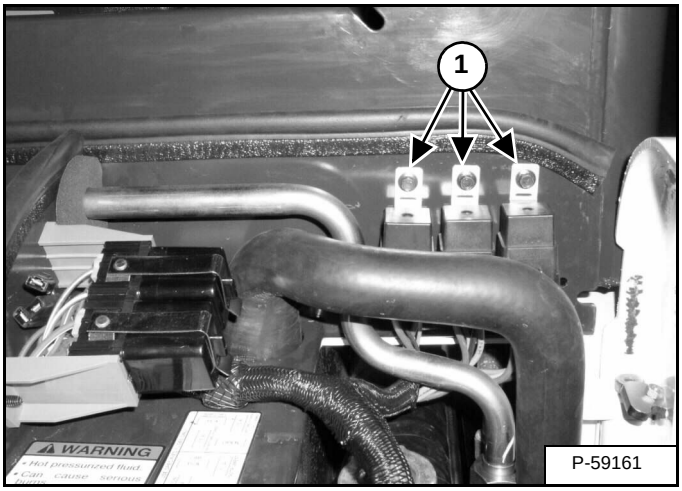


Open the radiator drain valve (Item 1) **[Figure 60-40-1]** and drain the coolant into a container.

Loosen the radiator cap from the radiator fill neck.

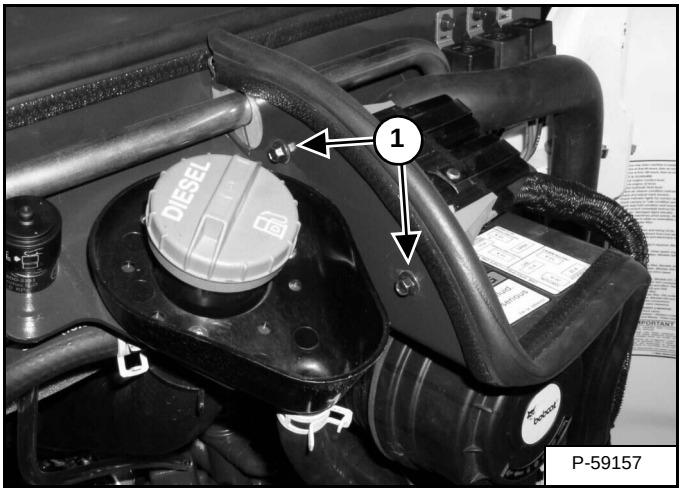
Mark the three electrical relays for ease of assembly.

Figure 60-40-2



Remove the bolts (Item 1) **[Figure 60-40-2]** fastening the relays to the frame.

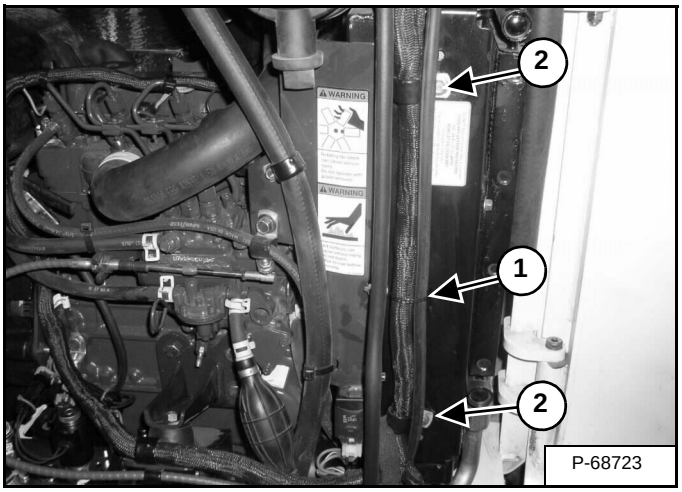
Figure 60-40-3



Remove the bolts (Item 1) **[Figure 60-40-3]** fastening the fuse bracket assembly to the frame.

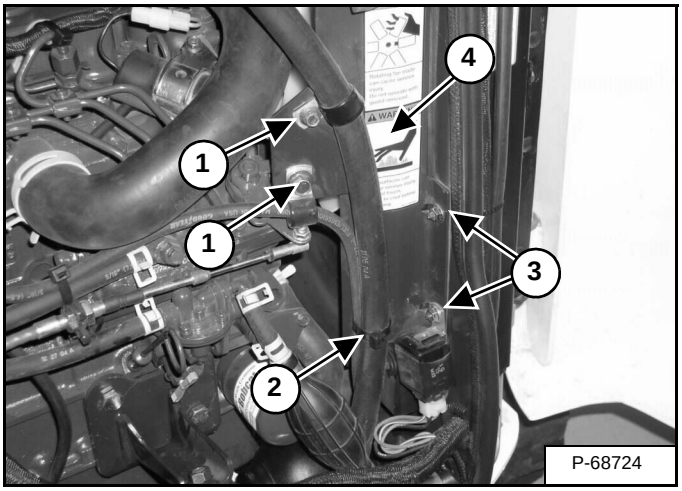
Removal And Installation (Cont'd)

Figure 60-40-4



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

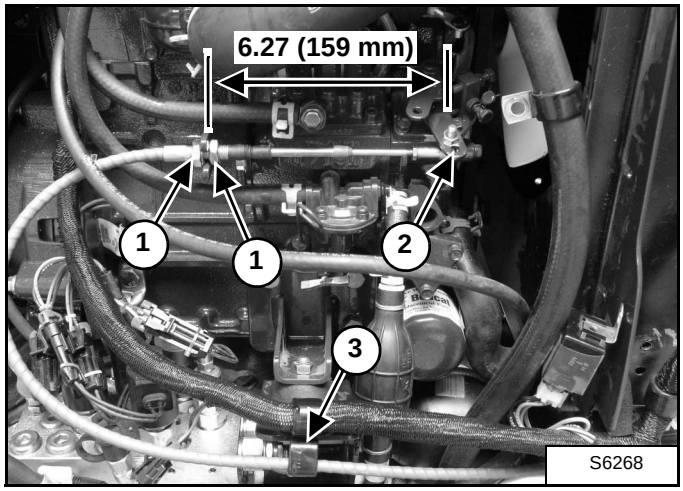
Figure 60-40-5



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

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

Figure 60-40-6



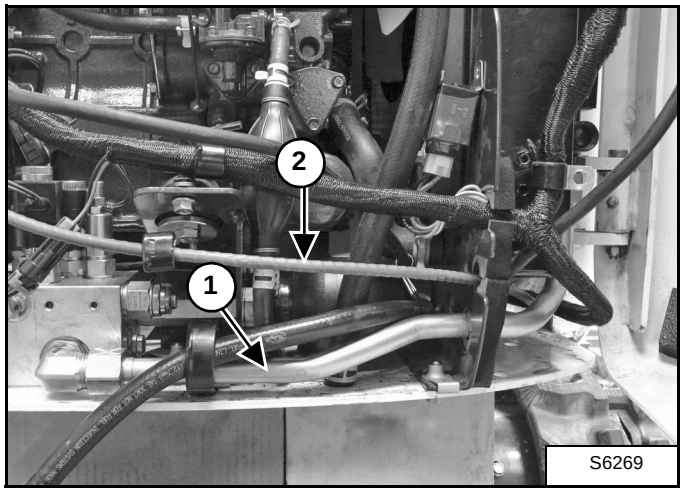
Loosen the nuts (Item 1) **[Figure 60-40-6]** fastening the cable to the bracket.

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

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

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

Figure 60-40-7

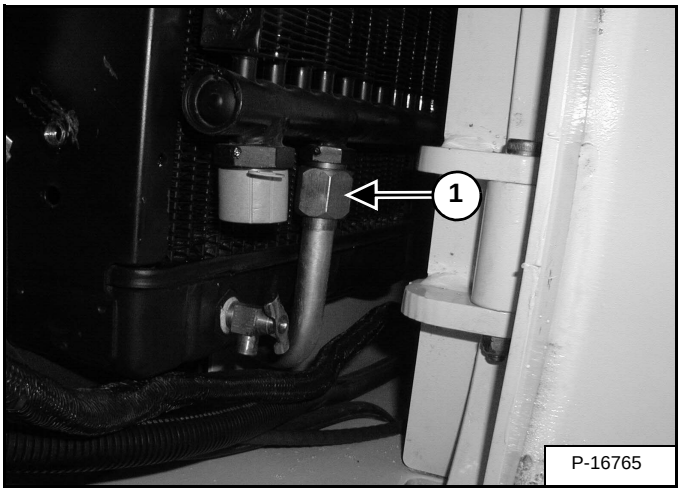


Remove the tubeline (Item 1) **[Figure 60-40-7]** from the manifold assembly to the oil cooler. Remove the tubeline by pulling the tubeline through the radiator bracket from the engine side of the radiator.

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

Removal And Installation (Cont'd)

Figure 60-40-8



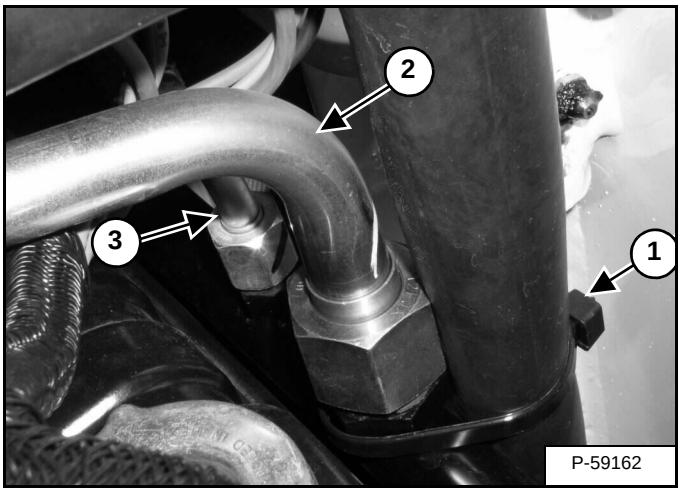
Remove the tubeline (Item 1) **[Figure 60-40-8]** from the oil cooler to the control valve assembly.

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

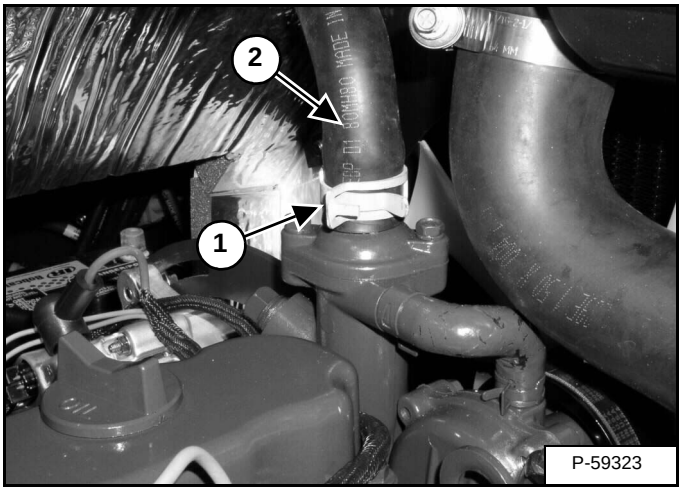
Figure 60-40-9



Remove the tie strap (Item 1) **[Figure 60-40-9]**.

Remove the tubeline (Item 2) and hose (Item 3) **[Figure 60-40-9]** from the top of the oil cooler.

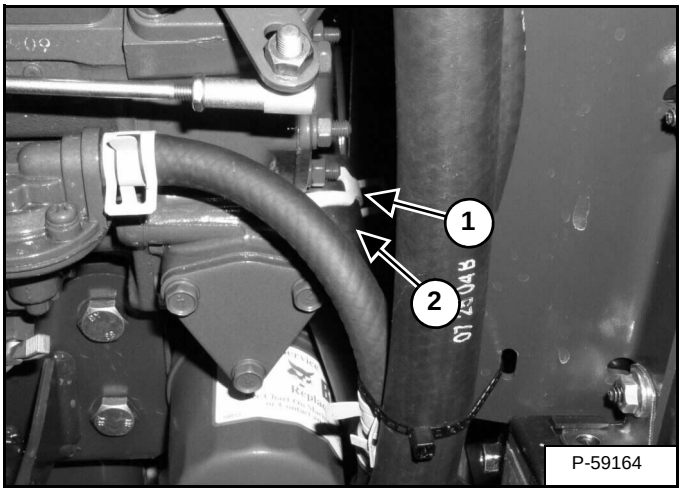
Figure 60-40-10



Slide the hose clamp (Item 1) **[Figure 60-40-10]** away from the end of the upper radiator hose.

Remove the upper radiator hose (Item 2) **[Figure 60-40-10]**.

Figure 60-40-11

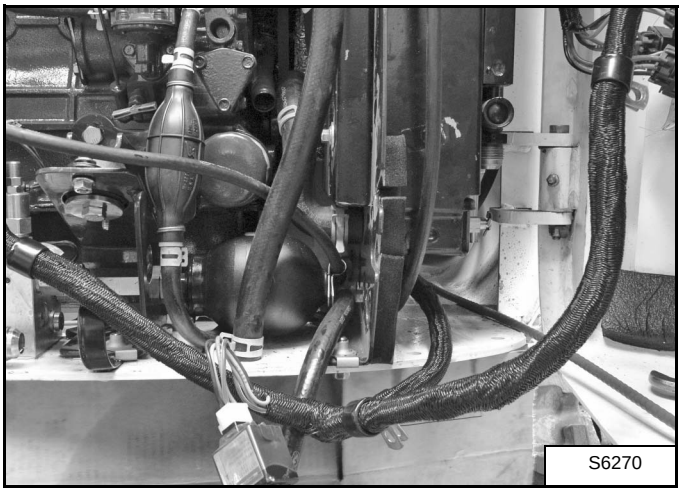


Slide the hose clamp (Item 1) **[Figure 60-40-11]** away from the end of the lower radiator hose.

Remove the lower radiator hose (Item 2) **[Figure 60-40-11]**.

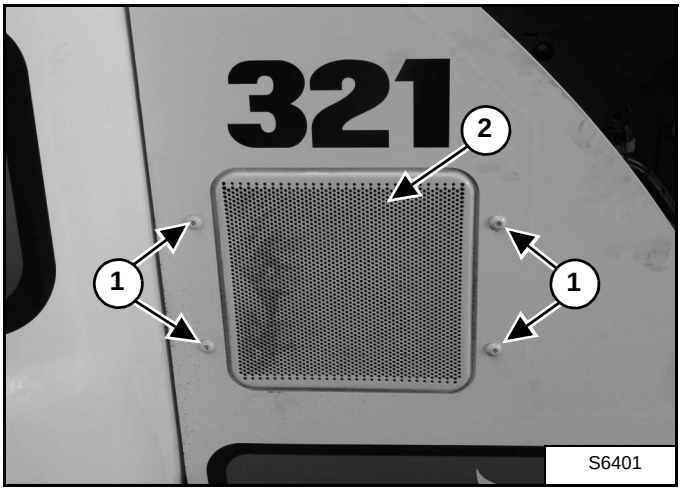
Removal And Installation (Cont'd)

Figure 60-40-12



Move the wire harness and battery cable down below the radiator bracket. This allows the radiator and oil cooler assembly to pass over the harness and cable during removal **[Figure 60-40-12]**.

Figure 60-40-13

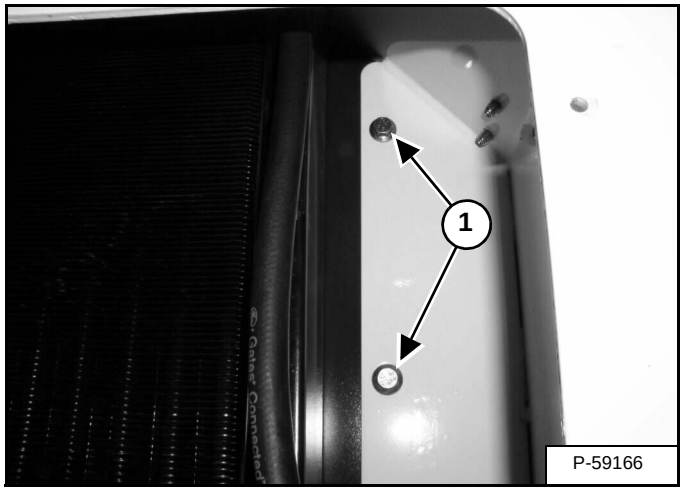


Remove the screws (Item 1) and grill (Item 2) **[Figure 60-40-13]**.

Remove the grill.

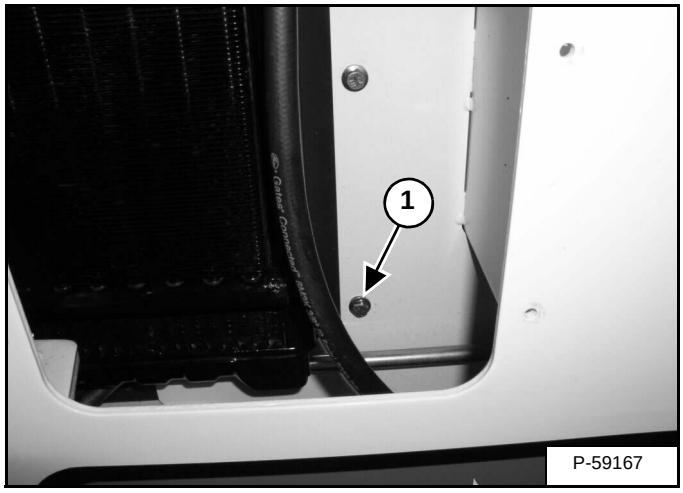
NOTE: Use a magnet or pick to prevent the grill from dropping and being scratched or damaged.

Figure 60-40-14



Remove the top bolts (Item 1) **[Figure 60-40-14]** mounting the radiator to the frame.

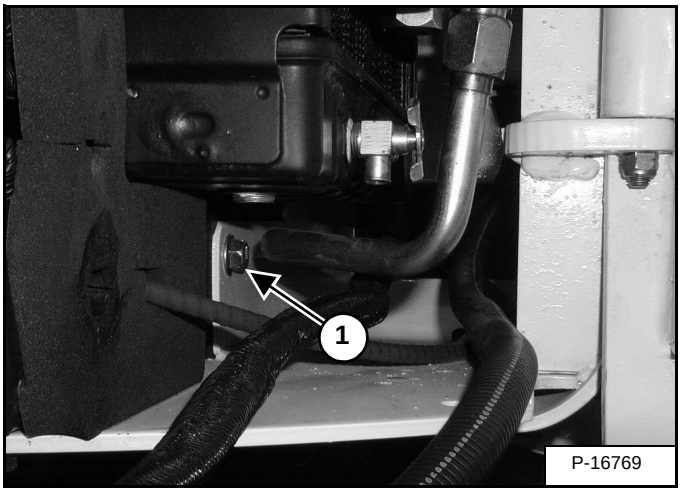
Figure 60-40-15



Remove the bottom bolt (Item 1) **[Figure 60-40-15]** mounting the radiator to the frame.

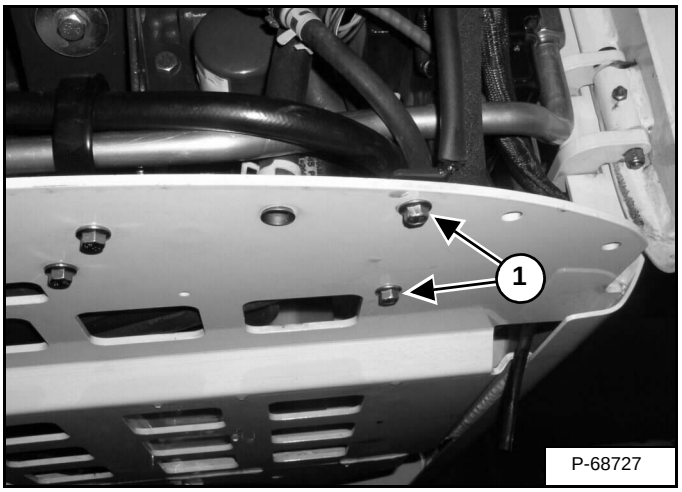
Removal And Installation (Cont'd)

Figure 60-40-16



Remove the bottom bolt (Item 1) **[Figure 60-40-16]** mounting the radiator to the frame.

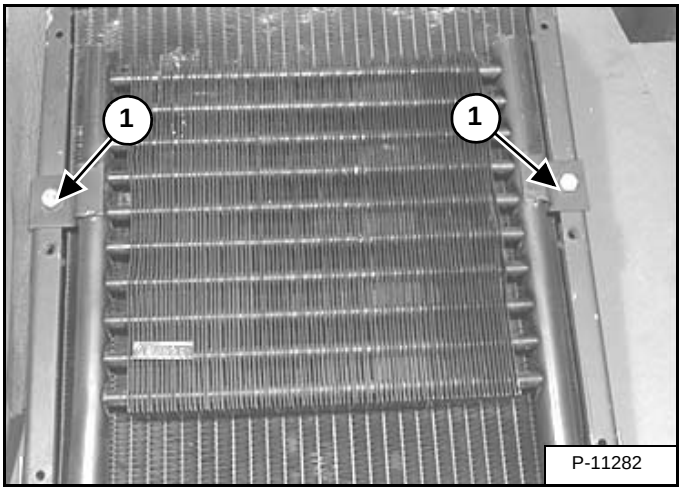
Figure 60-40-17



Remove the bolts (Item 1) **[Figure 60-40-17]** on the underside of the upperstructure.

Slide the radiator and oil cooler assembly out the back of the excavator.

Figure 60-40-18



Remove the bolts (Item 1) **[Figure 60-40-18]** from the oil cooler.

Remove the oil cooler from the radiator.


Bobcat®

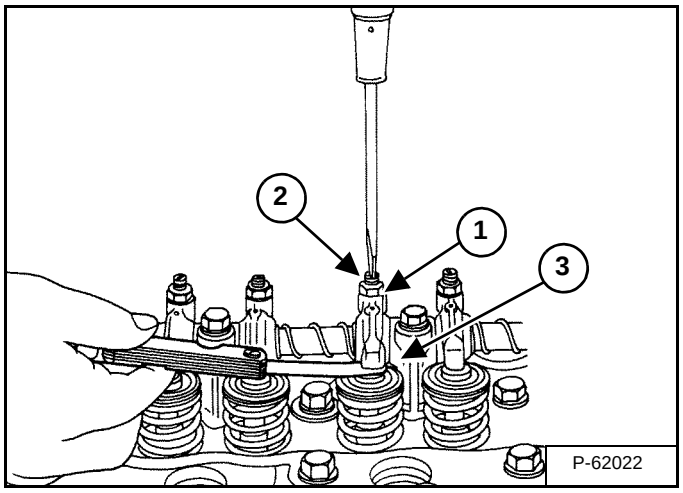
Valve Clearance Adjustment

NOTE: The valve clearance must be checked and adjusted when the engine is cold.

Remove the cylinder head cover and the glow plugs.

Adjust the valve clearance as follows:

Figure 60-50-1



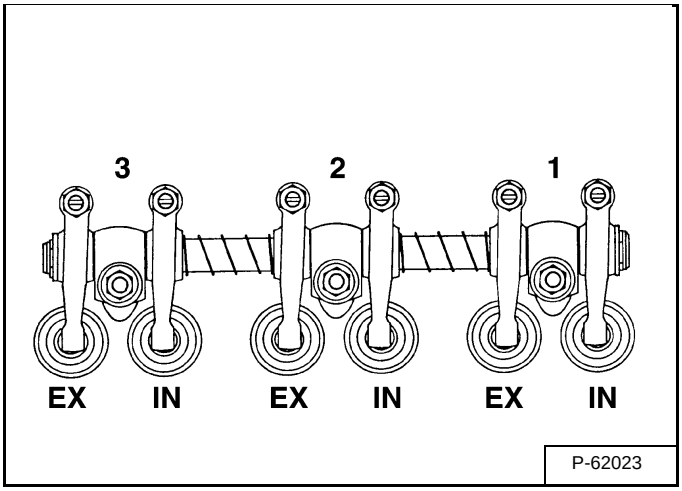
Loosen the lock nut (Item 1) **[Figure 60-50-1]**.

Turn the adjustment screw (Item 2) **[Figure 60-50-1]** until the correct clearance is obtained.

NOTE: The clearance is measured between the rocker arm and valve stem tip (Item 3) [Figure 60-50-1].

If adjustments are necessary, tighten lock nut before moving on to the next rocker arm.

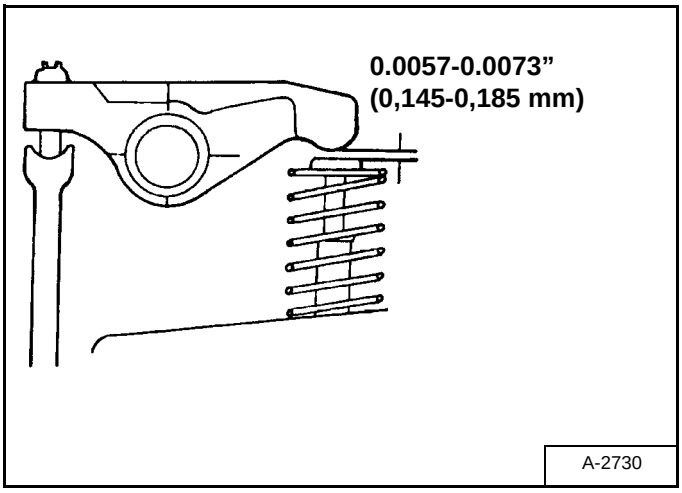
Figure 60-50-2



With No. 1 piston at TDC (compression) both the intake and exhaust valves are up. Set both No. 1 valves, No. 2 exhaust valve and No. 3 intake valve. **[Figure 60-50-2]**.

Rotate the flywheel 360°, No. 1 (overlap position). Set No. 2 intake valve and No. 3 exhaust valve. **[Figure 60-50-2]**.

Figure 60-50-3



Make sure the piston is at TDC when adjusting the clearance at the valves. The correct clearance is 0.0057-0.0073 inch (0,145-0,185 mm) cold clearance **[Figure 60-50-3]**.

Engine Compression Checking

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

MEL10630 - Engine Compression Test Kit

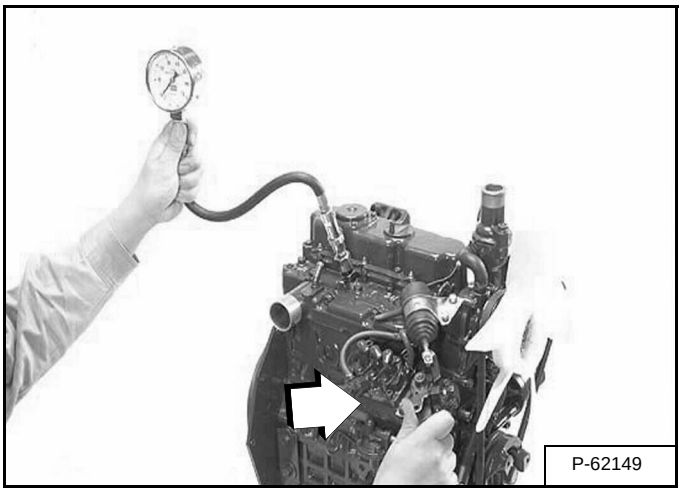
Warm the engine.

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 60-50-4



Connect the compression gauge to the adapter **[Figure 60-50-4]**.

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

Hold fuel shut off lever to no fuel. (shutoff) See arrow, **[Figure 60-50-4]**. 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 412-469 PSI (28-32 bar) with no more than 10% difference between the cylinders.

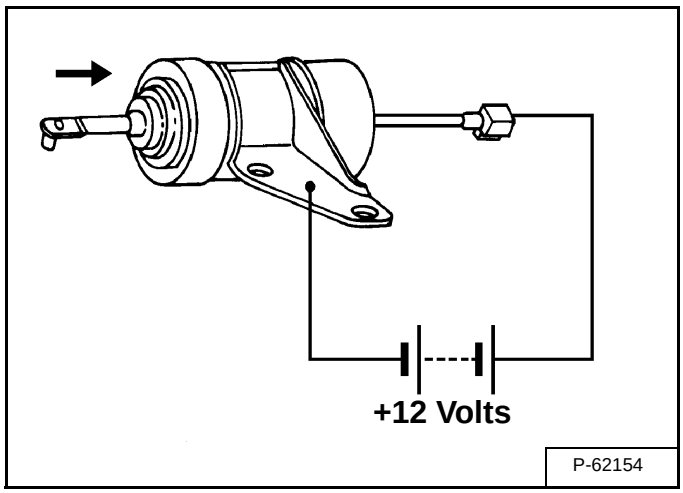
If the pressures are not within 10% of each other, apply a small amount of oil in the cylinders and retest.

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.

Fuel Shutoff Solenoid - Checking

Figure 60-50-5



The energize to stop solenoid does not have 12 volts applied to it while the engine is running **[Figure 60-50-5]**.

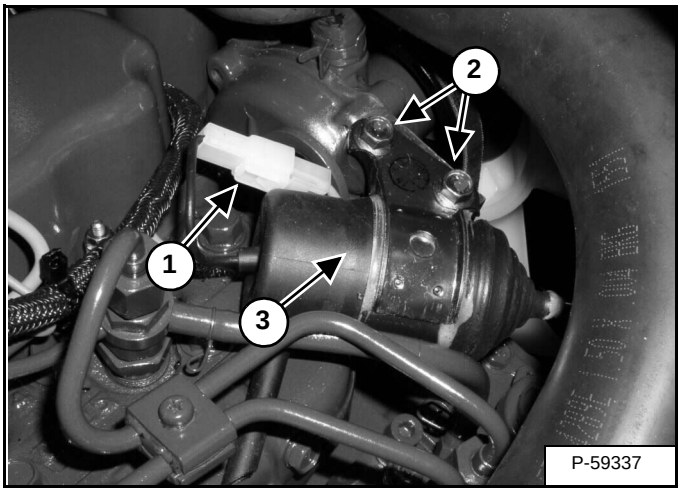
The solenoid is energized for a brief period with 12 volts when the ignition key is turned off.

The length of time 12 volts is applied is controlled by a timer in the electrical harness.

To test the solenoid, directly apply 12 volts to the electrical lead of the solenoid. The solenoid arm should pull back into the solenoid housing until the 12 volt power supply is removed.

Fuel Shutoff Solenoid Removal And Installation

Figure 60-50-6



Disconnect the wire from the solenoid (Item 1) **[Figure 60-50-6]**.

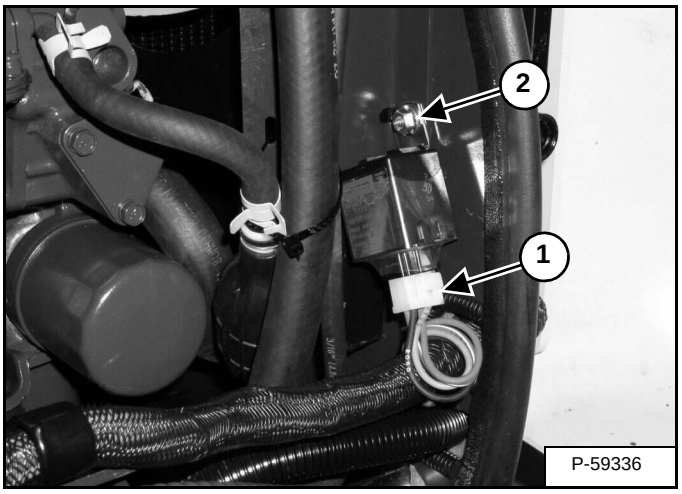
Remove the solenoid mounting bolts (Item 2) **[Figure 60-50-6]**.

Remove the solenoid (Item 3) **[Figure 60-50-6]**.

Fuel Shutoff Timer Removal And Installation

The fuel shutoff timers function is to provide pull in current to the fuel solenoid for only a short duration. This provides longer fuel solenoid service life and also allows for more starter cranking power.

Figure 60-50-7



Disconnect the wire harness (Item 1) **[Figure 60-50-7]** from the timer module.

Remove the nut (Item 2) **[Figure 60-50-7]**.

Remove the fuel shutoff timer.

Fuel Injection Pump Check

NOTE: Never try to disassemble the injection pump assembly. For repairs, you should contact a Kubota-authorized pump service shop.

Remove the air cleaner (See Removal And Installation on Page 60-30-1.)

Remove the engine stop solenoid.

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

MEL1237 - Adapter Fuel Line
MEL1173-1 - Pressure Gauge

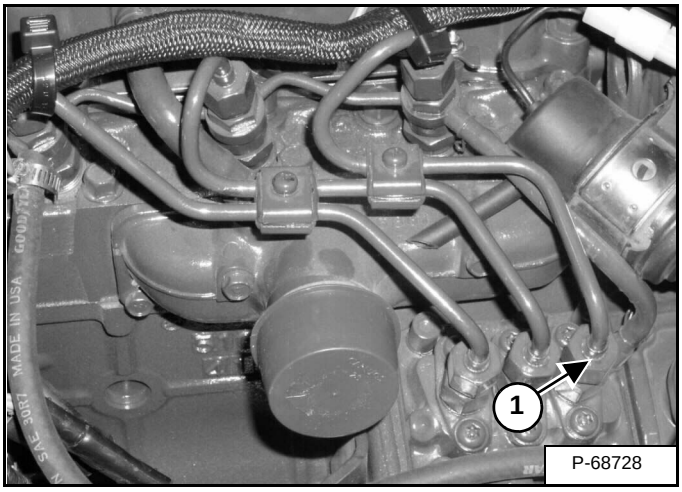
WARNING

AVOID INJURY OR DEATH

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

W-2072-0807

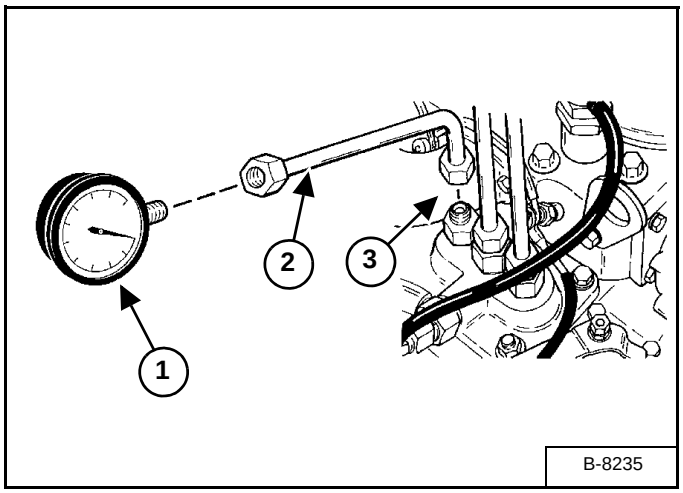
Figure 60-50-8



To check the initial discharge pressure, remove a high pressure tubeline (Item 1) **[Figure 60-50-8]** from the fuel injection pump.

Loosen the other end of the tubeline at the injector, so that the tubeline can be turned away from the fitting.

Figure 60-50-9



Connect a pressure gauge (Item 1) to the long leg of the test tubeline (Item 2) **[Figure 60-50-9]** and tighten.

Connect the short leg of the tubeline to the fitting at the fuel injection pump (Item 3) **[Figure 60-50-9]**.

Set the speed control lever to the maximum engine speed position to allow full fuel delivery.

Fuel Tightness of Pump Element

With the starter, rotate the engine to increase the pressure to 1991 PSI (137 bar).

If the pressure cannot be reached, replace the pump with a new one or send to a Kubota-authorized pump service shop.

Fuel Tightness of Delivery Valve

Manually turn the flywheel to raise the pressure to approx. 1991 PSI (137 bar). Now turn the flywheel back about 1/2 turn (to keep the plunger free), and clock the time taken for the pressure to drop from 1991-1849 PSI (137-127 bar).

The pressure should hold at 1991 PSI (137 bar), for at least 5 seconds or more.

If the time is less than the allowable limit, replace the pump with a new one, or send to a Kubota-authorized pump service shop.

Fuel Injection Pump Removal And Installation

IMPORTANT

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

I-2028-0289

Clean the injection pump and area around it with a cleaning solvent or steam cleaning.

IMPORTANT

Never steam clean or put cold water on an injection pump while the engine is running or while it is hot. If you do it will cause serious damage to the injection pump.

I-2135-0997

IMPORTANT

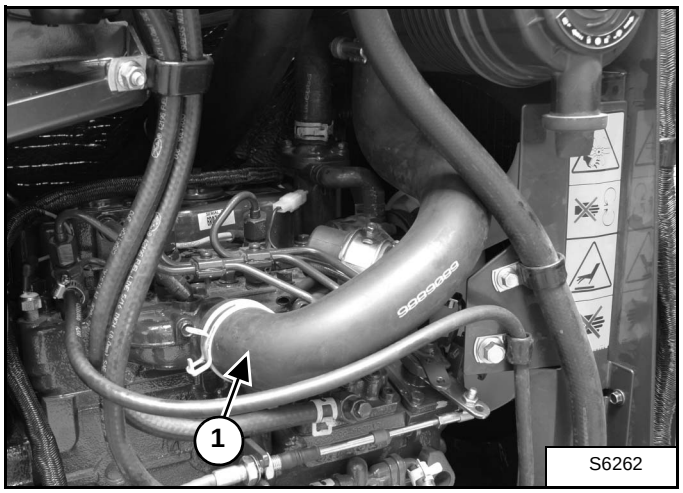
Do not bend the high pressure fuel injection tubes when removing or installing them.

I-2029-0289

Clean around the injection pump.

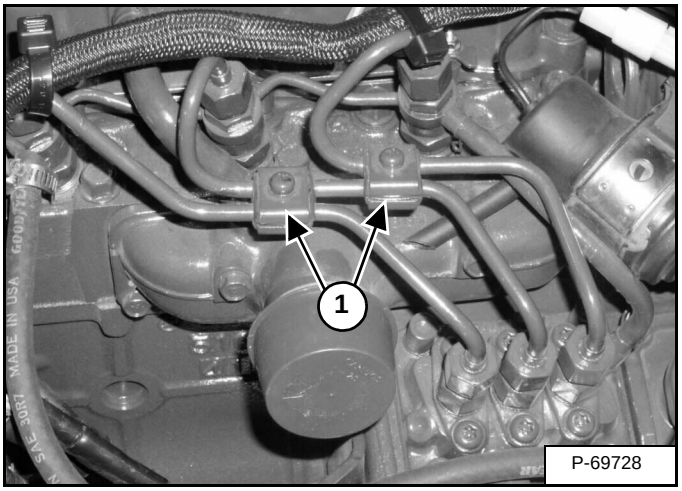
Fuel Injection Pump Removal And Installation (Cont'd)

Figure 60-50-10



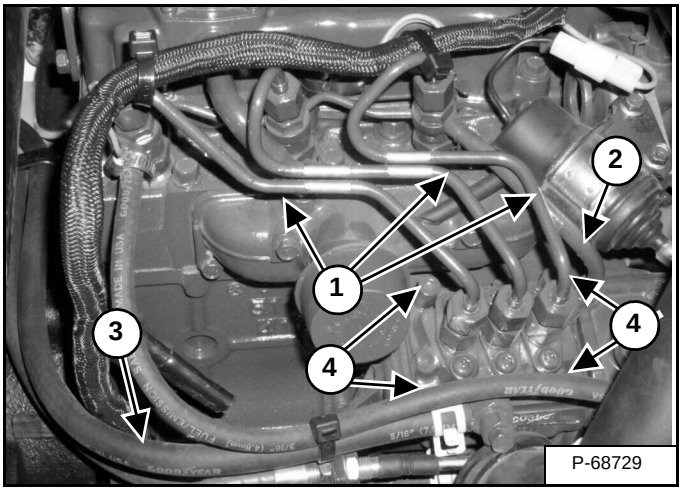
Remove the air intake hose (Item 1) **[Figure 60-50-10]** and cap.

Figure 60-50-11



Remove the fuel line clamps (Item 1) **[Figure 60-50-11]**.

Figure 60-50-12



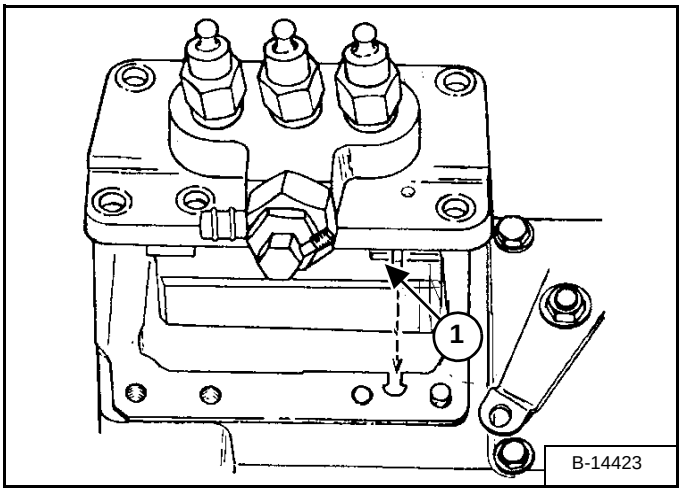
Disconnect the high pressure lines (Item 1) **[Figure 60-50-12]** from the fuel injector and fuel injection pump.

Disconnect the fuel return hose (Item 2) and the fuel feed hose (Item 3) **[Figure 60-50-12]**.

Remove the four injection pump mounting bolts (Item 4) **[Figure 60-50-12]**.

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

Figure 60-50-13



Align the pin (Item 1) **[Figure 60-50-13]** in the control rack with the slot in the engine block.

Remove the injection pump.

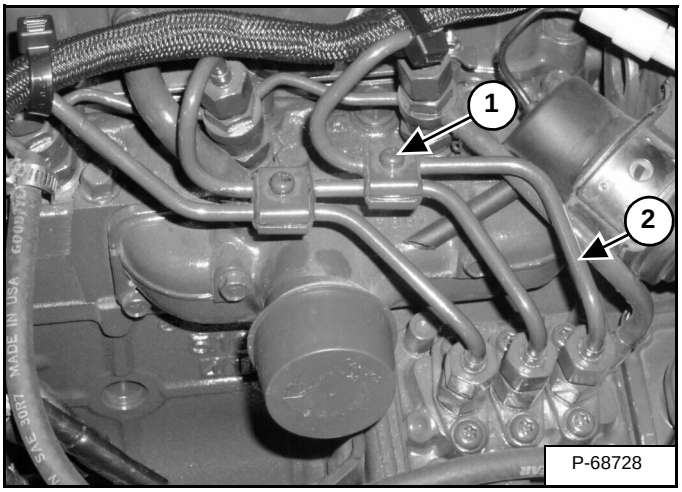
Installation: When the injection pump is installed, make sure the pin (Item 1) **[Figure 60-50-13]** on the control rack is correctly installed on the fork lever. If the slot is not installed correctly, the engine will run over maximum speed and serious damage can result.

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

Fuel Injection Pump Timing

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

Figure 60-50-14



Remove the fuel line clamp (Item 1) **[Figure 60-50-14]**.

Remove the number one cylinder high pressure line (Item 2) **[Figure 60-50-14]** from the injection pump.

IMPORTANT

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

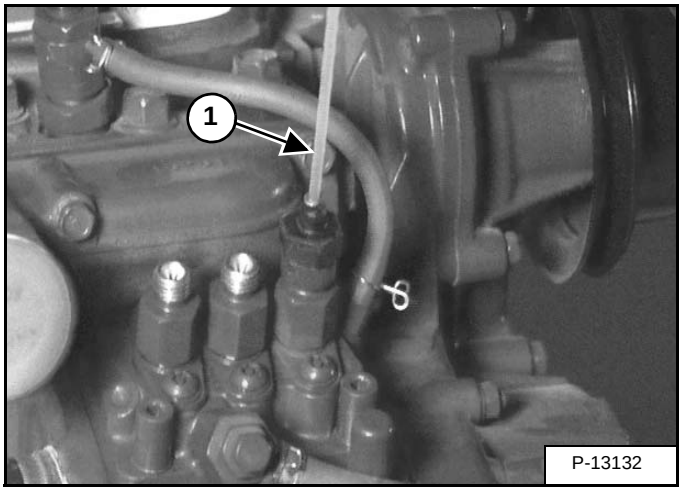
I-2029-0289

IMPORTANT

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

I-2028-0289

Figure 60-50-15



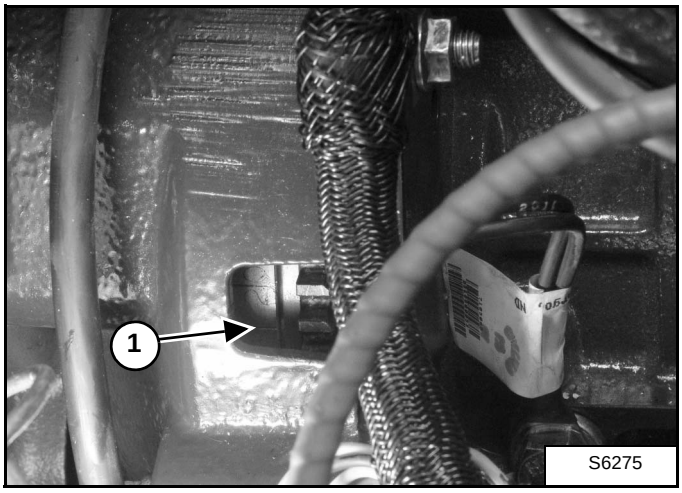
Install a short plastic tube (Item 1) **[Figure 60-50-15]** in the number one cylinder port of the injection pump. The tube should fit tight in the port and point upward.

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

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

Turn the flywheel counter-clockwise (facing the flywheel) slowly until the start of fuel rise in the plastic tube (Item 1) **[Figure 60-50-15]**.

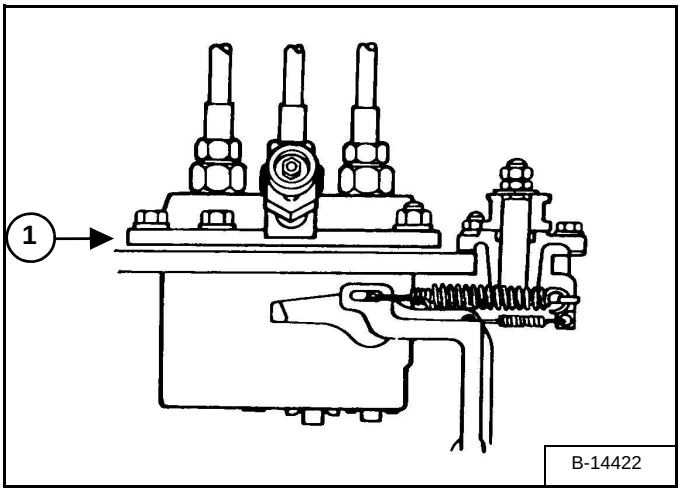
Figure 60-50-16



At this point look at the timing mark (located on the flywheel) for proper alignment (Item 1) **[Figure 60-50-16]**. When the timing mark is aligned as shown the timing is correct for the injection pump, which is 19-21° B.T.D.C.

Fuel Injection Pump Timing (Cont'd)

Figure 60-50-17



The correct engine timing for all Kubota D722-E2B engines is 19-21° B.T.D.C. Add or subtract shims (Item 1) **[Figure 60-50-17]** to time the engine to 19-21° B.T.D.C. The engine is correctly timed when the 19-21° B.T.D.C. mark on the flywheel is aligned with the notch in the timing hole.

NOTE: Adding or reducing the shim thickness by 0,05 mm retards or advances the injection timing by approximately 0.5°.

Some problems caused by faulty injector nozzles:

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

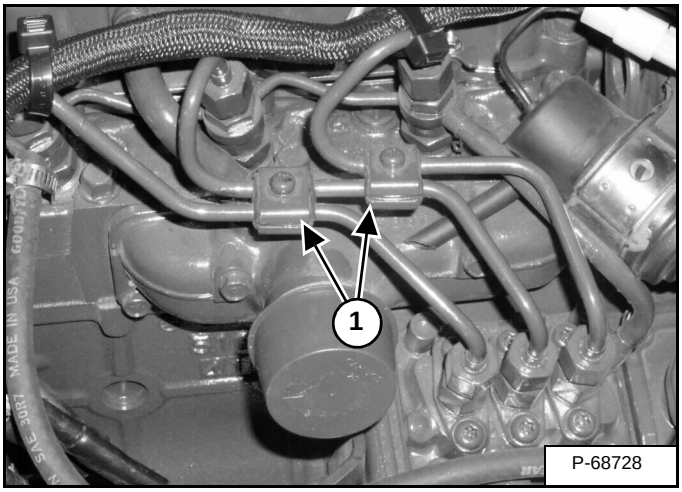
Fuel Injector Removal And Installation

IMPORTANT

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

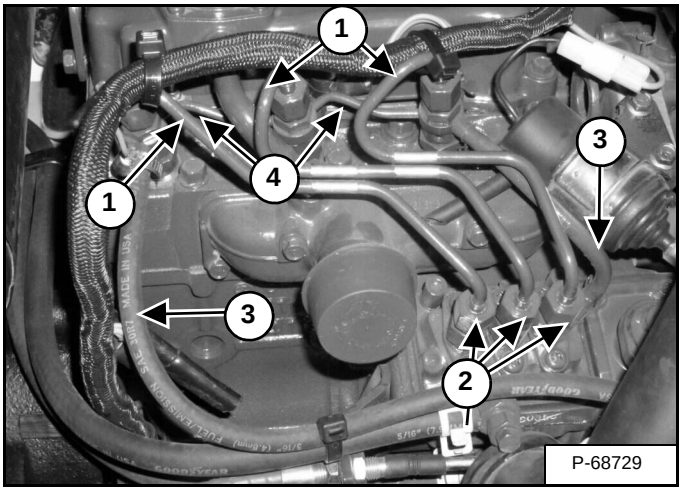
I-2029-0289

Figure 60-50-18



Remove the high pressure fuel line clamps (Item 1) **[Figure 60-50-18]**.

Figure 60-50-19



Disconnect the high pressure fuel lines from the fuel injectors (Item 1) **[Figure 60-50-19]**.

Disconnect the fuel lines (Item 2) **[Figure 60-50-19]** from the injection pump.

Fuel Injector Removal And Installation (Cont'd)

Remove the high pressure fuel lines.

Disconnect the return fuel hoses (Item 3) **[Figure 60-50-19]**.

Remove the retainer nut from the top of the fuel injectors.

Remove the fuel return pipe (Item 4) **[Figure 60-50-19]**.

Loosen the injector nozzle.

Installation: Tighten the injector nozzle to 36-51 ft.-lb. (49-69 N•m) torque.

Remove the injector nozzle from the cylinder head.

NOTE: Be sure to replace the copper washer and nozzle cap anytime new or reconditioned fuel injectors are installed.

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2072-0807

ENGINE COMPONENTS AND TESTING (CONT'D)

Fuel Injector Checking

IMPORTANT

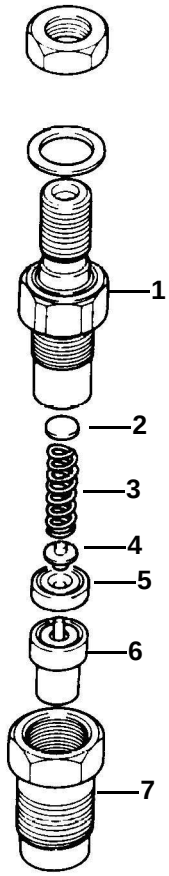
Do not disassemble or test the fuel injector nozzles unless you have the correct service and testing tools.

I-2027-0284

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

MEL10018 - Injector Nozzle Tester

Figure 60-50-20



(1) Nozzle Holder
(2) Adjusting Washer
(3) Nozzle Spring
(4) Push Rod
(5) Distance Piece
(6) Nozzle Piece
(7) Nozzle Retaining Nut

PI-9981

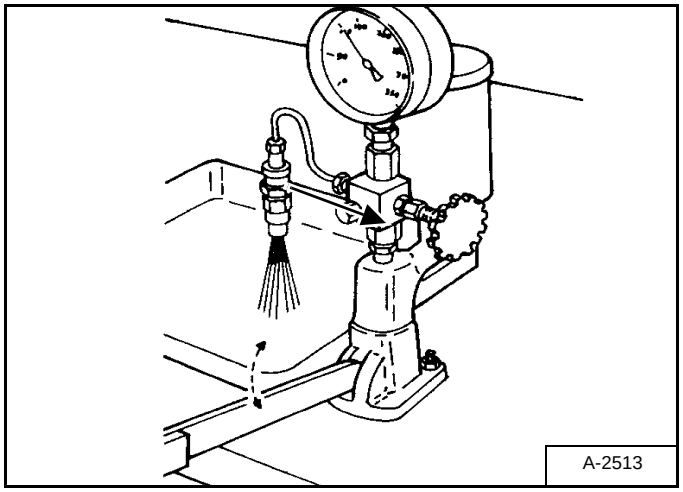
The nozzle release pressure can be adjusted by adding or removing washer(s) (Item 2) from the top of the nozzle spring (Item 3) **[Figure 60-50-20]**.

Fuel Injector Checking (Cont'd)

Each spacer will change the release pressure by about 34 PSI (2,3 bar).

Fuel Injection Pressure.	1991-2134 PSI (137-147 bar)

Figure 60-50-21



Assemble the injector nozzle. Connect the nozzle to the tester with the nozzle down **[Figure 60-50-21]**.

Operate the hand lever at a slow rate and record the opening pressure. If the pressure is not correct, disassemble the nozzle and add or remove the spacer (Item 2) **[Figure 60-50-20]** as needed.

NOTE: When assembling the injector nozzle, tighten the retainer nut (Item 1) [Figure 60-50-20] to 23.5-28.9 ft.-lb. (25,3-28,9 N•m) torque. Any higher torque will cause slow action of the valve.

When the injector nozzle is assembled, tighten the nozzle body to 36-51 ft.-lb. (49-69 N•m) torque.

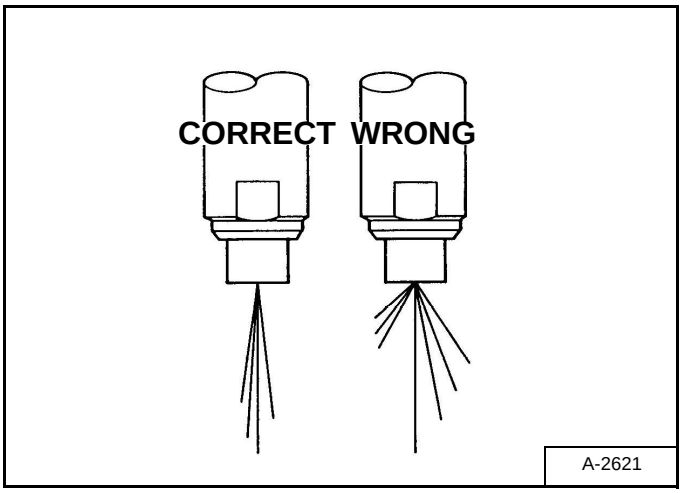
Check for inside leakage. Operate the hand lever until the pressure 1849 PSI (127 bar). Keep the nozzle under this pressure for 10 seconds, check to see if fuel leaks from the nozzle. If fuel leaks, replace the nozzle.

⚠ WARNING

AVOID INJURY OR DEATH

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

Figure 60-50-22



Check that the spray pattern is correct **[Figure 60-50-22]**:

1. Fuel does not come out the side of the nozzle.
2. Drops of fuel are not present at the nozzle.
3. The injector has an even flow coming from the nozzle.

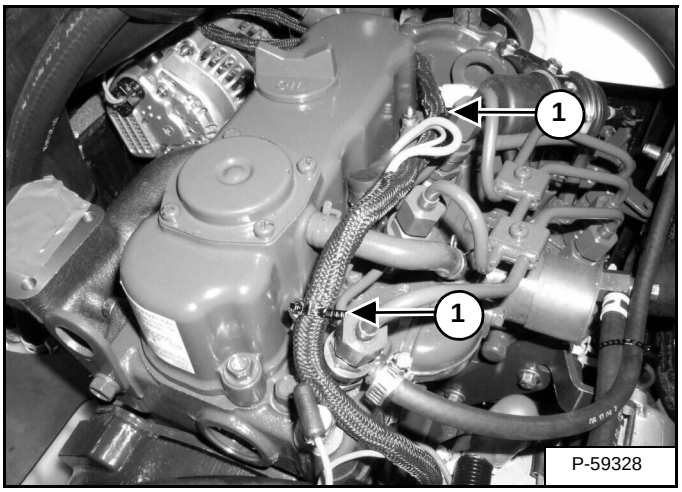
Glow Plug Removal And Installation

IMPORTANT

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

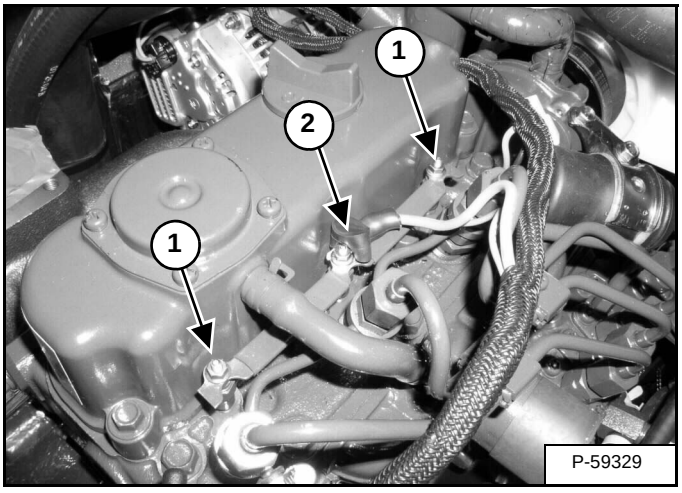
I-2029-0289

Figure 60-50-23



Remove the tie straps (Item 1) **[Figure 60-50-23]**.

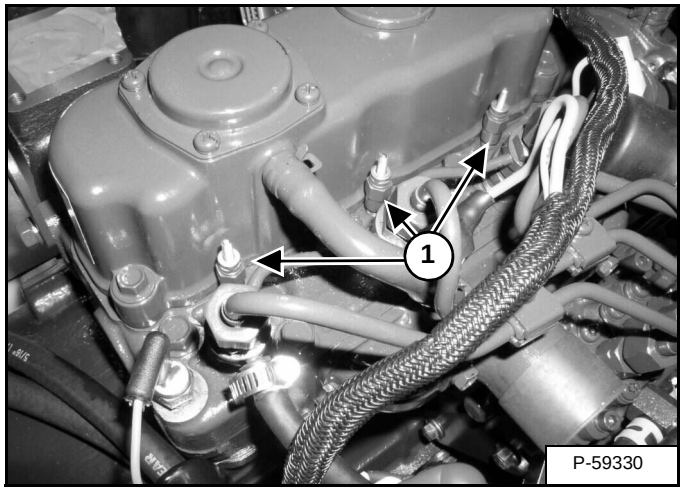
Figure 60-50-24



Remove the nuts (Item 1) **[Figure 60-50-24]**.

Remove the glow plug lead (Item 2) **[Figure 60-50-24]** and nut.

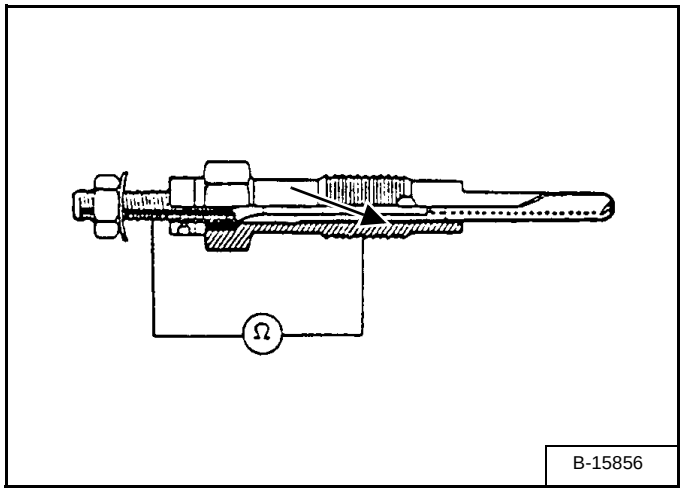
Figure 60-50-25



Remove the glow plugs (Item 1) **[Figure 60-50-25]** from the cylinder head.

Installation: Tighten the glow plugs to 6-11 ft.-lb. (8-15 N•m) torque.

Figure 60-50-26



Connect an ohmmeter to the terminal end of the glow plug, touch the other lead from the ohmmeter to the heating end of the glow plug **[Figure 60-50-26]**.

The reading will be approximately 0.9 ohm. If the resistance is zero ohm, the glow plug has a short circuit. If the resistance is infinite, the coil of the glow plug is broken.

ENGINE

Description

The 321-323 Bobcat Excavator has a Kubota direct injected D722-E2B diesel engine with a displacement of 43.88 cu.in. (0,719 L).The engine is rated at 13.3 HP (9,9 Kwh) and has an open crankcase ventilation system.

The engine has three cylinders and the rotation is counter-clockwise (viewed from the flywheel side). Engine block heaters are also available from Bobcat Parts.

The engine serial number is stamped on the engine and is located near the injection pump. The model number is located on the valve cover. Use these numbers to obtain the correct service parts.

The engine is liquid cooled with a propylene glycol / water mixture. The cooling fan is belt driven. The speed of the fan is determined by the engine speed.

Specifications

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

Engine

Compression (At Operating Temperature)	412 to 469 PSI (28 to 32 bar)
Limit Permitted	327 PSI (23 bar)

Fuel Injector Nozzles

Opening Pressure	1991 to 2134 PSI (137 to 147 bar)
Fuel Tightness Nozzle Seat	1849 PSI (127 bar)

Fuel Injection Pump

Fuel Tightness of Pump Element	1991 PSI (137 bar)
Fuel Tightness of Delivery Valve (factory spec)	10 Sec. Initial Pressure Drop From 1991 to 1849 PSI (137 to 127 bar)
Fuel Tightness of Delivery Valve Limit Permitted	5 Sec. Initial Pressure Drop From 2134 to 1991 PSI (137 to 127 bar)
Injection Timing @ 3600 rpm	19-21 degrees B.T.D.C.

Cylinder Head

Cylinder Head Distortion Limit	0.002 (0,05)
Thickness of Gasket Free	0.0415 to 0.0512 (1,15 to 1,30)
Thickness of Gasket Tightened	0.0413 to 0.0453 (1,05 to 1,15)
Top Clearance	0.0197 to 0.0276 (0,50 to 0,70)

Valves

Valve Seat Angle	45 degrees
Valve Seat Width	0.084 (2,12)
O.D. of Valve Stem	0.2350 to 0.2354 (5,968 to 5,980)
I.D. of Valve Guide	0.2366 to 0.2372 (6,01 to 6,025)
Clearance between Valve Stem and Guide	0.0012 to 0.0022 (0,03 to 0,057)
Limit Permitted	0.004 (0,1)
Depth of Valve	-0.004 to 0.004 (-0,10 to 0,10)
Limit Permitted	0.0118 (0,30)
Valve Clearance (Cold) (Intake and Exhaust)	0.006 to 0.007 (0,145 to 0,185)

Valve Springs

Free Length	1.232 to 1.252 (31,3 to 31,8)
Limit Permitted	1.118 (28,4)
Fitted Length	1.063 (27)
Load to Compress to Fitted Length	14.6 lb. (6,6 kg)
Limited Permitted	12.3 lb. (5,6 kg)
Limited Permitted for Spring Tilt	0.047 (1,2)

Specifications (Cont'd)

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

Rocker Arms

O.D. of Rocker Arm Shaft	0.4123 to 0.4128 (10,47 to 10,48)
I.D. of Rocker Arm Bushing	0.4134 to 0.4141 (10,5 to 10,52)
Clearance between Rocker Arm Shaft and Bushing	0.0006 to 0.0018 (0,016 to 0,045)
Limit Permitted	0.006 (0,15)

Camshaft

O.D. of Camshaft Bearing Journal	1.2966 to 1.2972 (32,93 to 32,95)
I.D. of Camshaft Bearing	1.2992 to 1.3002 (33,00 to 33,025)
Clearance between Camshaft Bearing and Journal	0.002 to 0.004 (0,05 to 0,91)
Limit Permitted	0.006 (0,15)
Alignment of the Camshaft Limit Permitted	0.0004 (0,01)
Cam Lobe Height	1.0583 (26,88)
Limit Permitted	1.0563 (26,83)
Idle Gear to Cam Gear Backlash	0.002 to 0.005 (0,041 to 0,123)
Limit Permitted	0.006 (0,15)

Cylinders

I.D. of Cylinder Liner	2.6378 to 2.6385 (67,000 to 67,019)
Limit Permitted	2.6445 (67,169)
Rebore Size for Oversize Piston	2.6476 to 2.6484 (67,250 to 67,269)

Piston Rings

Ring Gap, Top and Oil	0.0059 to 0.0118 (0,15 to 0,30)
Ring Gap, 2nd	0.0118 to 0.0177 (0,30 to 0,45)
Limit Permitted	0.0472 (1,20)
Side Clearance of Ring in Groove;	
Top Ring	Because of top ring design, measurement does not apply
2nd Ring	0.0033 to 0.0045 (0,085 to 0,12)
Oil Ring	0.0016 to 0.0031 (0,02 to 0,06)
Limit Permitted	0.006 (0,15)

Specifications (Cont'd)

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

Pistons

I.D. of Piston Pin Bore	0.7874 to 0.7879 (20,00 to 20,013)
Limit Permitted	0.7894 (20,05)
O.D. of Piston Pin	0.7875 to 0.7878 (20,002 to 20,011)

Connecting Rods

I.D. of Connecting Rod Bushing (Small End, Fitted)	0.7884 to 0.7890 (20,03 to 20,04)
Clearance between Piston Pin and Bushing	0.0006 to 0.0015 (0,014 to 0,038)
Clearance between Piston Pin and Bushing Limit Permitted	0.004 (0,10)
Connecting Rod Alignment Limit Permitted	0.002 (0,05)

Crankshaft

Crankshaft Alignment Limit Permitted	0.0008 (0,02)
O.D. of Crankshaft Journal No. 1 (Water Pump Side)	1.5722 to 1.5728 (39,93 to 39,95)
I.D. of Crankshaft Bearing No. 1	1.5715 to 1.5764 (39,98 to 40,04)
Clearance between No. 1 Crankshaft Journal and Bearing	0.0013 to 0.0042 (0,03 to 0,11)
Limit Permitted	0.008 (0,20)
O.D. of Crankshaft Journal No. 2 (Flywheel Side)	1.7297 to 1.7303 (43,93 to 43,95)
I.D. of Crankshaft Bearing No. 2	1.7317 to 1.7333 (43,98 to 44,03)
Clearance between No. 2 Crankshaft Journal and Bearing	0.0011 to 0.0020 (0,03 to 0,05)
Limit Permitted	0.008 (0,20)
O.D. of Crankshaft Journal No. 3 (Intermediate)	1.5722 to 1.5728 (39,93 to 39,95)
I.D. of Crankshaft Bearing No. 3	1.5742 to 1.5758 (39,98 to 40,03)
Clearance between No. 3 Crankshaft Journal and Bearing	0.0011 to 0.0020 (0,03 to 0,05)
Limit Permitted	0.008 (0,20)
O.D. of Connecting Rod Journals	1.3370 to 1.3376 (33,96 to 33,98)
I.D. of Connecting Rod Bearings`	1.3389 to 1.3390 (33,99 to 34,01)
Clearance between Connecting Rod Journal and Bearing	0.0008 to 0.0020 (0,02 to 0,051)
Limit Permitted	0.006 (0,15)
Crankshaft End Play	0.006 to 0.012 (0,15 to 0,31)
Limit Permitted	0.020 (0,50)

Oil Pump

Oil Pressure @ Rated RPM	28 to 64 PSI (2 to 4 bar)
Limit Permitted	21 PSI (1 bar)
Oil Pressure @ Idle Speed	7 PSI (,5 bar)
Clearance between Outer Rotor and Pump Body	0.003 to 0.006 (0,07 to 0,15)
End Clearance between Inner Rotor and Cover	0.003 to 0.005 (0,08 to 0,14)
Clearance between Inner Rotor and Outer Rotor	0.0012 to 0.006 (0,03 to 0,14)

Specifications (Cont'd)

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

Thermostat

Opening Temperature	
Starting	157 to 163°F (70 to 73°C)
Full Open	185°F (85°C)

Torque Values

Kubota Metric Engine Bolts

Thread Size (Dia. x Pitch)	Material		
	Head Mark 4	**Head Mark 7**	**Head Mark 10**
M5 x 0.8		3 to 4 ft.-lb. (4 to 5 N•m)	
M6 x 1.0		6 to 7 ft.-lb. (8 to 9 N•m)	6 to 9 ft.-lb. (8 to 12 N•m)
M8 x 1.25	6 to 9 ft.-lb. (8 to 12 N•m)	11 to 16 ft.-lb. (15 to 22 N•m)	18 to 25 ft.-lb. (24 to 34 N•m)
M10 x 1.25	13 to 18 ft.-lb. (18 to 24 N•m)	22 to 30 ft.-lb. (30 to 41 N•m)	36 to 50 ft.-lb. (49 to 68 N•m)
M12 x 1.25	22 to 30 ft.-lb. (30 to 41 N•m)	40 to 54 ft.-lb. (54 to 73 N•m)	69 to 87 ft.-lb. (94 to 118 N•m)
M14 x 1.5	36 to 50 ft.-lb. (49 to 68 N•m)	58 to 80 ft.-lb. (79 to 108 N•m)	116 to 137 ft.-lb. (157 to 186 N•m)

Tightening Torques For General Use Screws, Bolts And Nuts

Grade / Nominal Diameter / Unit	Standard Screw and Bolt (4)			Special Screw and Bolt (7)		
	N•m	**kgf•m**	**ft.-lb.**	**N•m**	**kgf•m**	**ft.-lb.**
M6	7.9 to 9.3	0.80 to 0.95	5.8 to 6.9	9.8 to 11.3	1.00 to 1.15	7.23 to 8.32
M8	17.7 to 20.6	1.8 to 2.1	13.0 to 15.2	23.5 to 27.5	2.4 to 2.8	17.4 to 20.3
M10	39.2 to 45.1	4.0 to 4.6	28.9 to 33.3	49.0 to 55.9	5.0 to 5.7	36.2 to 41.2
M12	62.8 to 72.6	6.4 to 7.4	46.3 to 53.5	77.5 to 90.2	7.9 to 9.2	57.1 to 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)

Engine Removal and Installation

Open the tailgate (See Opening And Closing The Tailgate on Page 10-40-1).

Remove the muffler (See Removal And Installation on Page 60-30-1)

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

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

Remove the hydraulic pump (See Removal And Installation on Page 20-50-6).

Remove the accumulators assembly (See Removal And Installation on Page 20-61-1).

Drain the cooling system (See Replacing The Coolant on Page 10-70-1).

IMPORTANT

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

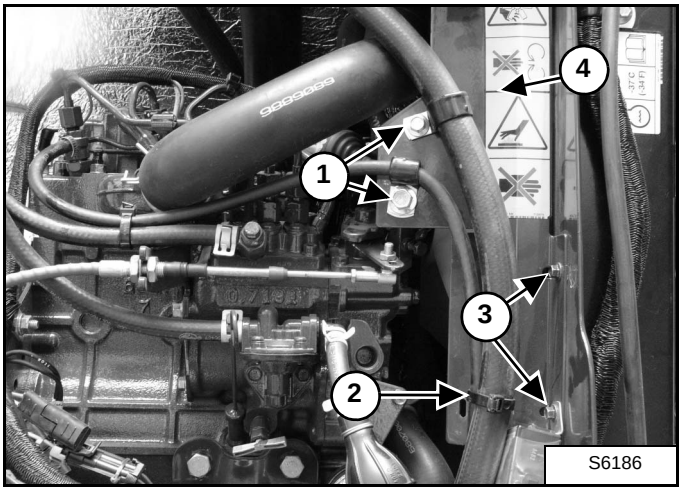
I-2003-0888

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, state and federal regulations for the correct disposal.

I-2067-0499

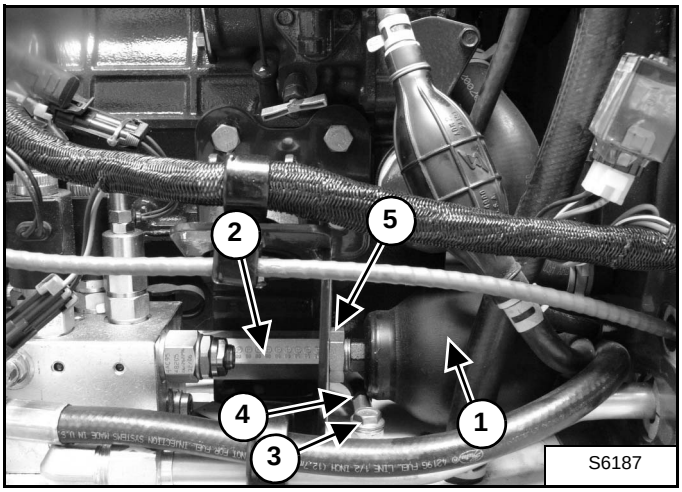
Figure 60-60-1



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

Remove the nuts (Item 3) and remove the fan guard (Item 4) **[Figure 60-60-1]**.

Figure 60-60-2



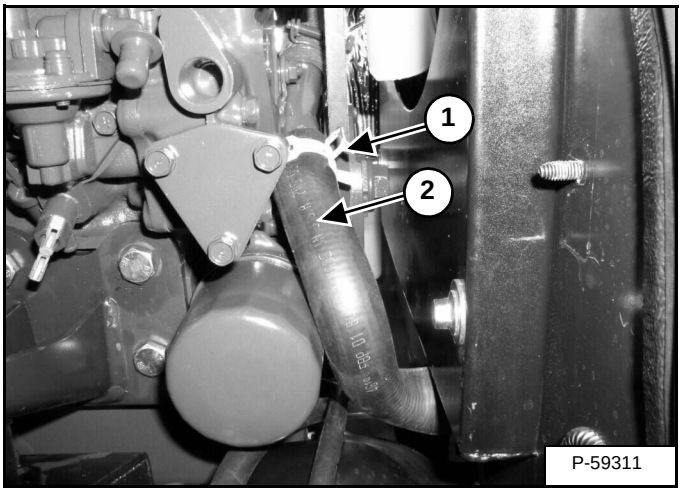
Remove the accumulator (Item 1). Do not remove the accumulator extension tube (Item 2) **[Figure 60-60-2]** from the motor mount and manifold assembly.

Remove the bolt (Item 3) from the engine ground wire (Item 4) **[Figure 60-60-2]**.

Remove the nut (Item 5) from the accumulator extension tube (Item 2) **[Figure 60-60-2]**.

Removal and Installation (Cont'd)

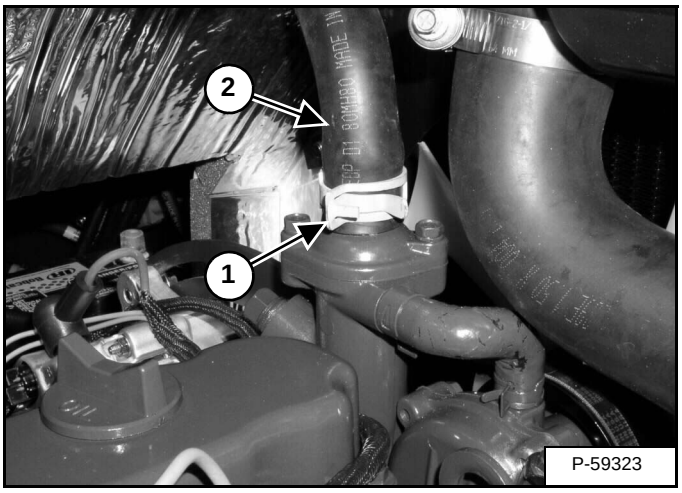
Figure 60-60-3



Slide the hose clamp (Item 1) **[Figure 60-60-3]** away from the end of the lower radiator hose.

Remove the lower radiator hose (Item 2) **[Figure 60-60-3]** and cap.

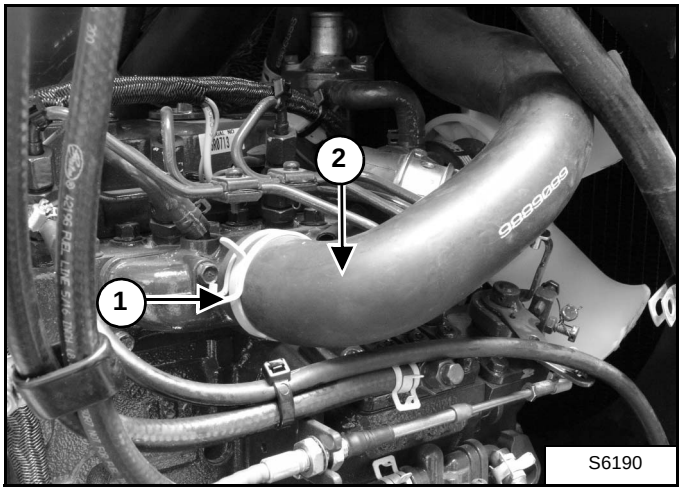
Figure 60-60-4



Slide the hose clamp (Item 1) **[Figure 60-60-4]** away from the end of the upper radiator hose.

Remove the upper radiator hose (Item 2) **[Figure 60-60-4]** and cap.

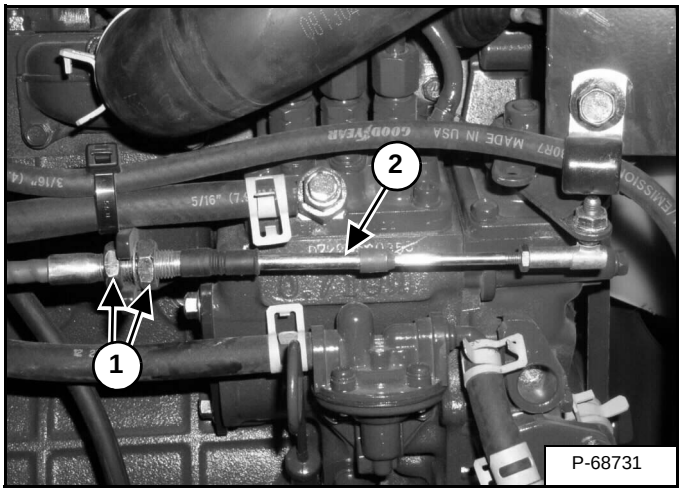
Figure 60-60-5



Slide the hose clamp (Item 1) **[Figure 60-60-5]** away from the end of the air in-take hose.

Remove the air in-take hose (Item 2) **[Figure 60-60-5]** and cap.

Figure 60-60-6

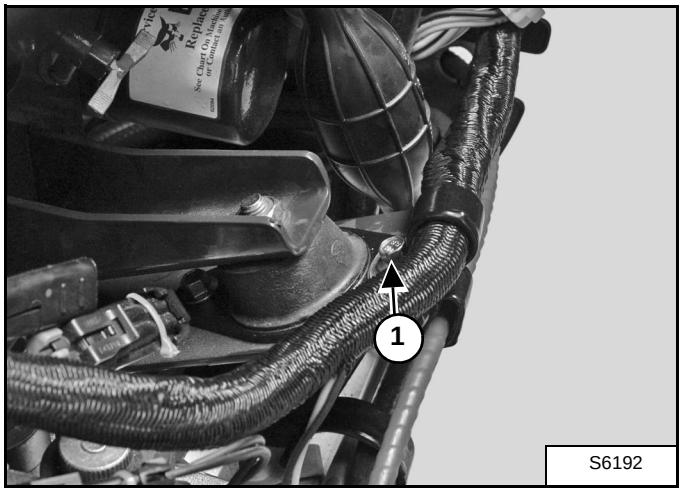


Loosen the nuts (Item 1) **[Figure 60-60-6]** fastening the throttle cable to the bracket.

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

Removal and Installation (Cont'd)

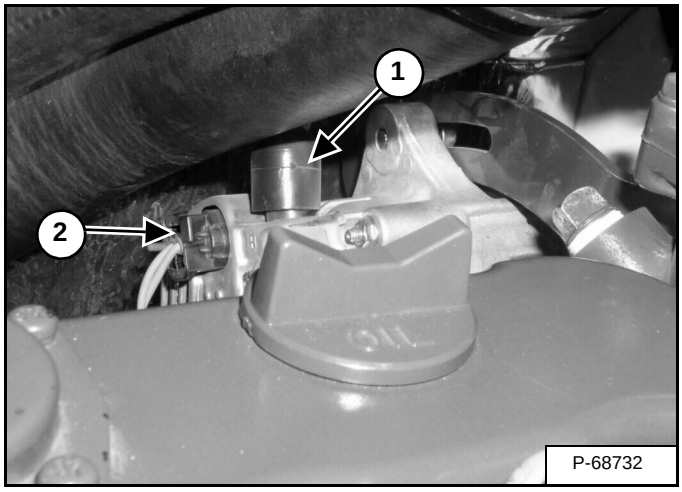
Figure 60-60-7



Remove nut and cable clamp (Item 1) **[Figure 60-60-7]** from engine mount bracket.

Move the throttle cable out of the way of the engine.

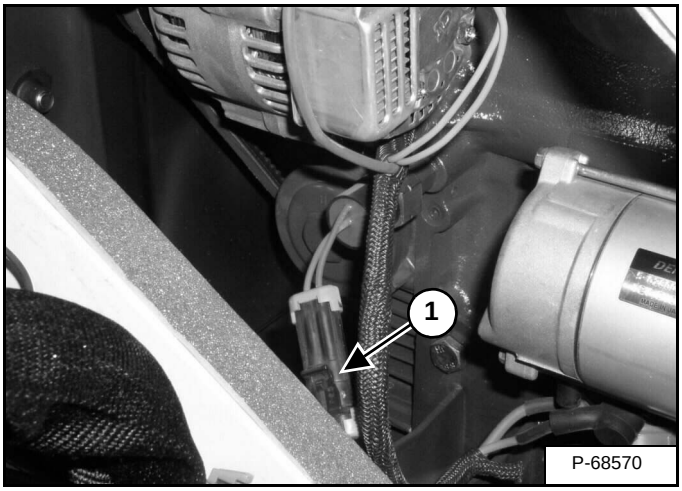
Figure 60-60-8



Disconnect the red wire (Item 1) **[Figure 60-60-8]** from the alternator.

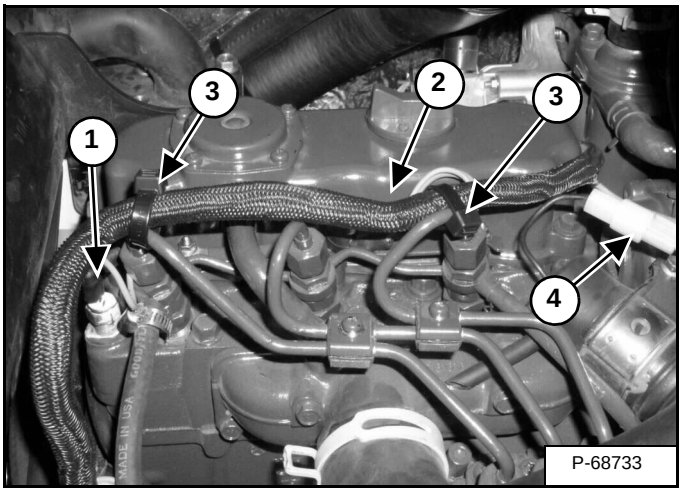
Disconnect the wire harness connector (Item 2) **[Figure 60-60-8]** from the alternator.

Figure 60-60-9



Disconnect the wire connector (Item 1) **[Figure 60-60-9]** from the oil pressure sending unit on the back side of the engine.

Figure 60-60-10



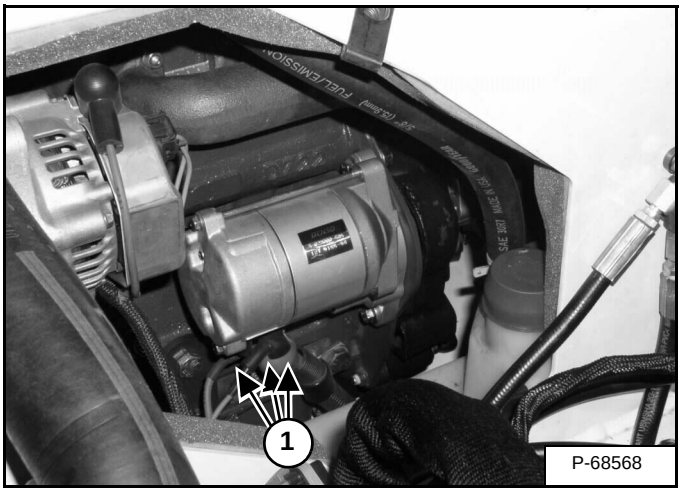
Remove the wire harness from the water temperature sending unit (Item 1) and the glow plugs (Item 2) **[Figure 60-60-10]**.

Remove the tie straps (Item 3) **[Figure 60-60-10]**.

Disconnect the wire connector (Item 4) **[Figure 60-60-10]** from the fuel shutoff.

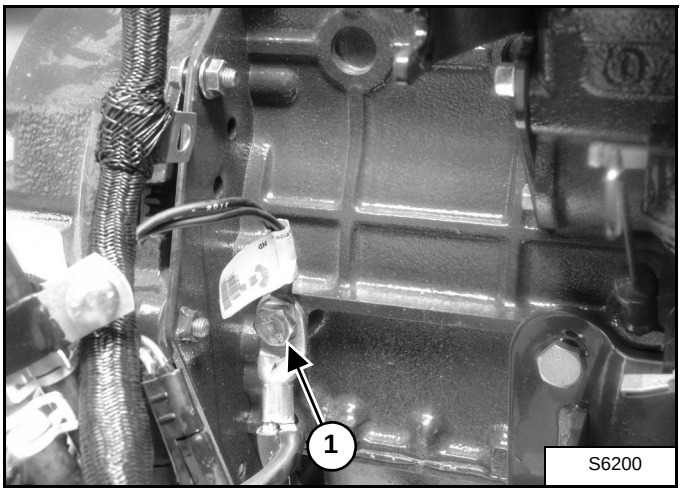
Removal and Installation (Cont'd)

Figure 60-60-11



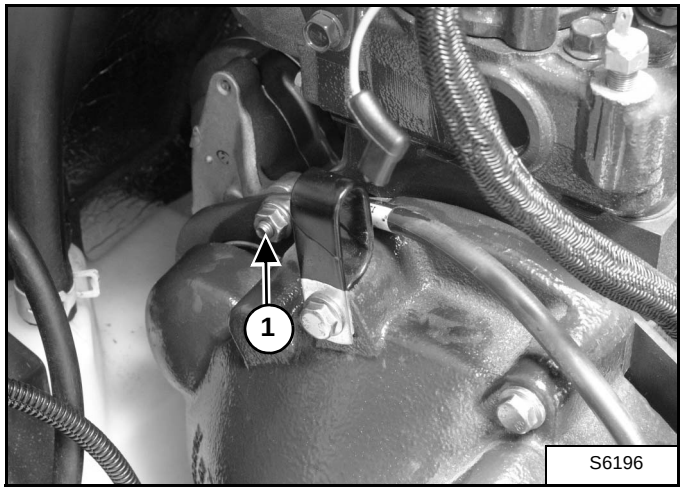
Disconnect the positive wires from the starter (Item 1) **[Figure 60-60-11]**.

Figure 60-60-12



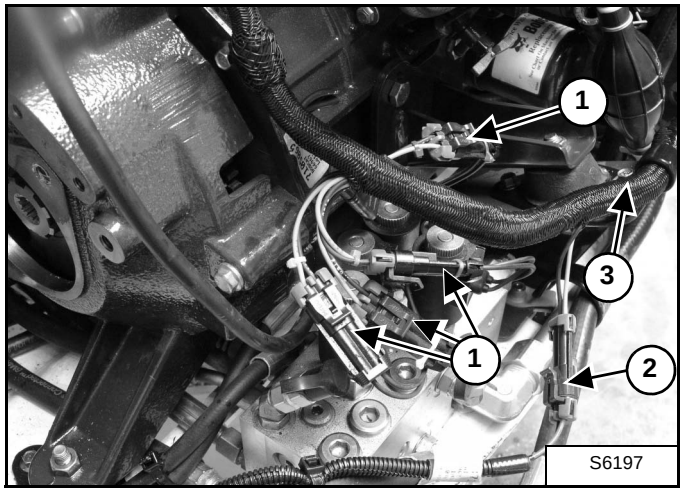
Disconnect the grounding wire (Item 1) **[Figure 60-60-12]** from the engine ground bolt.

Figure 60-60-13



Disconnect the grounding wire (Item 1) **[Figure 60-60-13]** from the starter mounting bolt.

Figure 60-60-14



Disconnect the wire connectors (Item 1) **[Figure 60-60-14]** from the two solenoids.

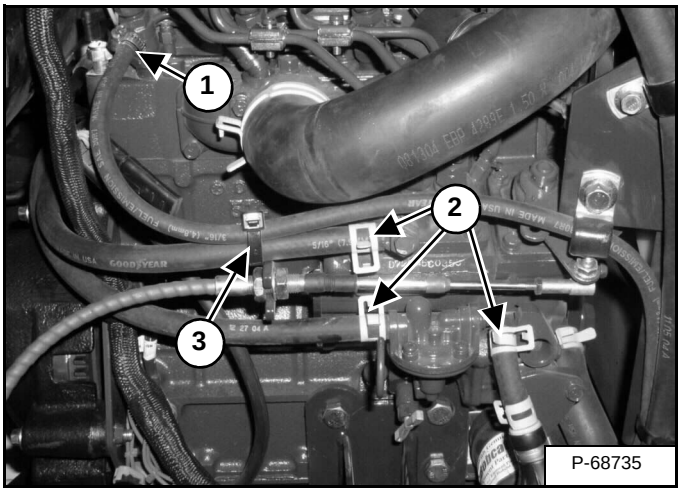
Disconnect the wire connector (Item 2) **[Figure 60-60-14]** from the fuel level sender wire harness.

Remove the bolt (Item 3) **[Figure 60-60-14]** fastening the wire harness clamp to the engine mount.

Move the wire harness out of the way of the engine.

Removal and Installation (Cont'd)

Figure 60-60-15

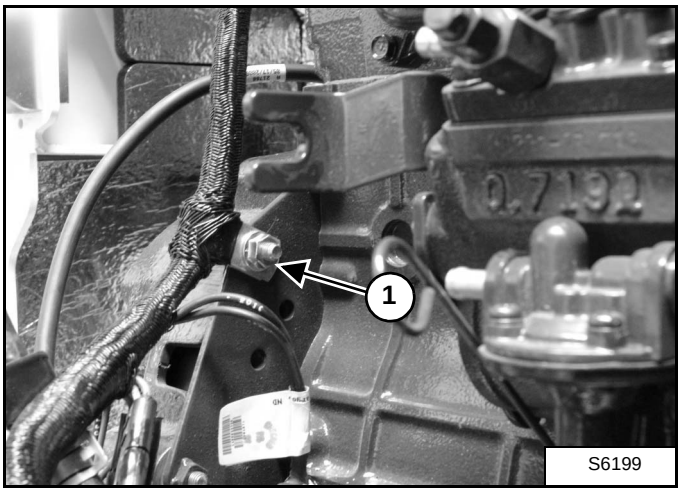


Remove and cap the return fuel line (Item 1) **[Figure 60-60-15]**.

Remove and cap the fuel lines (Item 2) **[Figure 60-60-15]**.

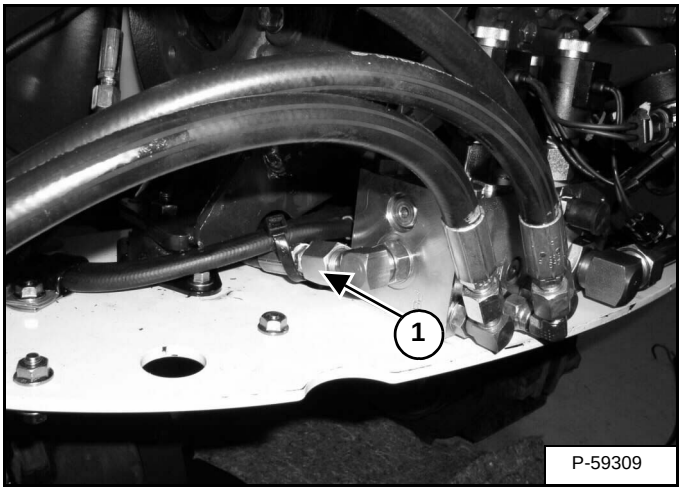
Remove tie strap (Item 3) **[Figure 60-60-15]**.

Figure 60-60-16



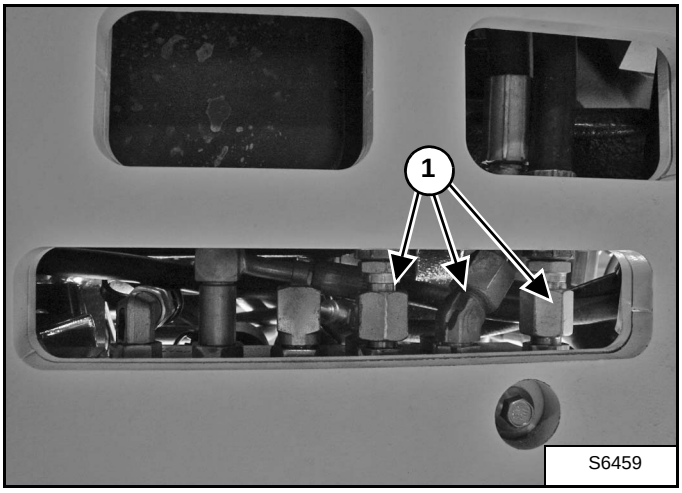
Remove the bolt (Item 1) **[Figure 60-60-16]** from the fuel line clamp.

Figure 60-60-17



Disconnect and cap the hose (Item 1) **[Figure 60-60-17]** on the side of the manifold assembly.

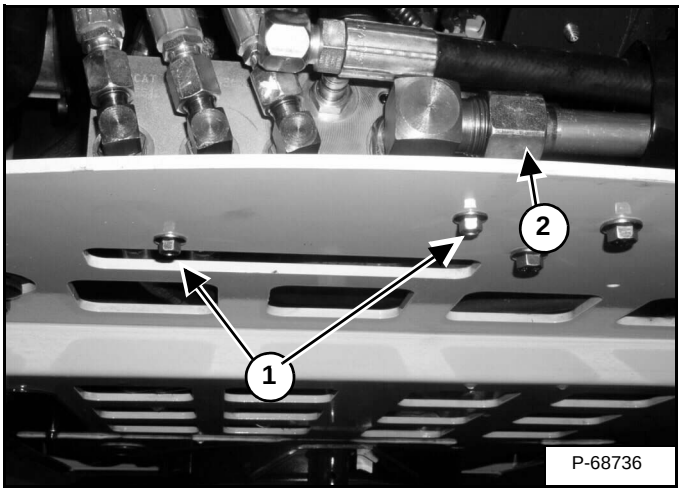
Figure 60-60-18



Mark and disconnect the three hoses (Item 1) **[Figure 60-60-18]** on the backside of the manifold assembly. Disconnect and cap the three hoses from the underside of upperstructure.

Removal and Installation (Cont'd)

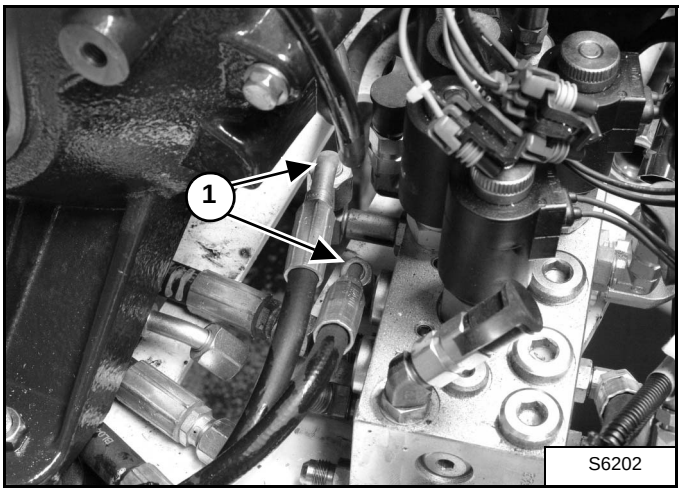
Figure 60-60-19



Remove the two bolts (Item 1) **[Figure 60-60-19]** fastening the manifold assembly to the upperstructure.

Disconnect and cap the tubeline (Item 2) **[Figure 60-60-19]** from the manifold assembly.

Figure 60-60-20



Slide the manifold assembly towards the rear of the excavator. Disconnect and cap the two hoses (Item 1) **[Figure 60-60-20]** on the backside of the manifold assembly.

Remove the manifold assembly from the excavator.

Figure 60-60-21

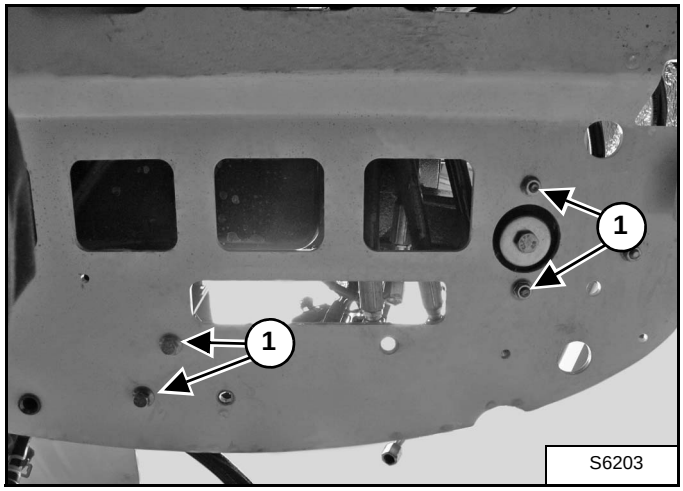
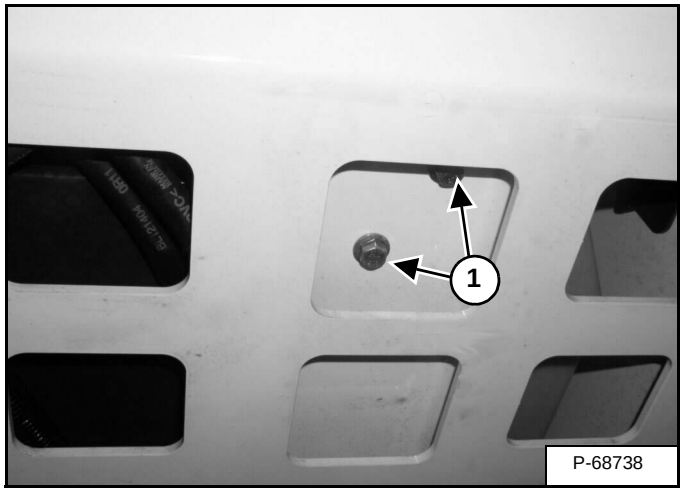


Figure 60-60-22

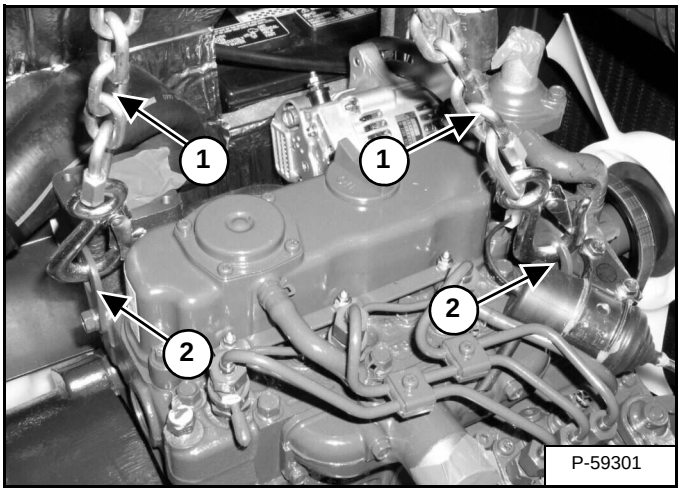


Remove the six engine mount bolts (Item 1) **[Figure 60-60-21]** and **[Figure 60-60-22]**.

NOTE: The engine mounts are left assembled to the engine and will be removed with the engine.

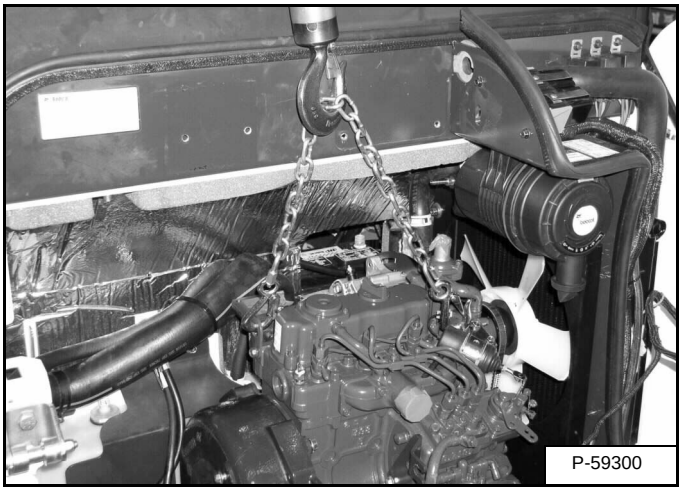
Removal and Installation (Cont'd)

Figure 60-60-23



Connect a chain (Item 1) to the two engine lifting brackets (Item 2) **[Figure 60-60-23]**.

Figure 60-60-24

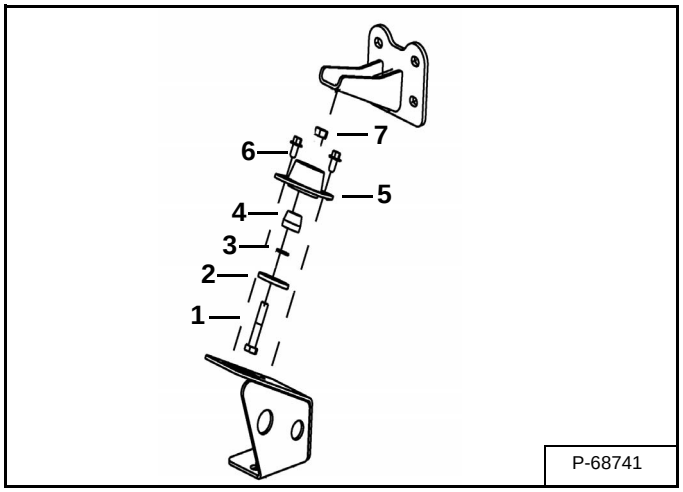


Lift and slide the engine out while turning the engine to provide clearance during engine removal **[Figure 60-60-24]**.

NOTE: Protect the back of the excavator canopy / cab from lifting chain damage during engine removal.

Engine Mount Replacement

Figure 60-60-25



Use the following procedure to install new front and rear engine mounts:

Remove the existing mount from the engine. Refer to engine removal and installation for engine mount locations.

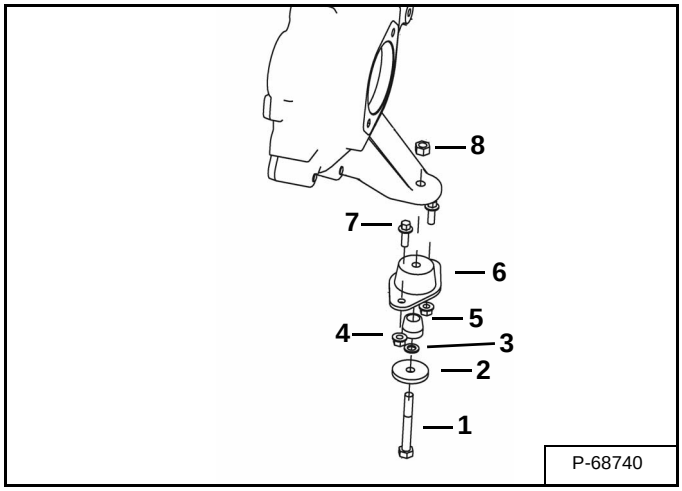
Replace the two front and rear engine mounts.

Use the parts shown to install the new engine mounts for the front and rear engine mounts **[Figure 60-60-25]**.

Item 1 - Mounting Bolt
Item 2 - Mount Washer
Item 3 - Flat Washer
Item 4 - Spacer
Item 5 - Mount
Item 6 - Screw
Item 7 - Nut

Tighten the mounting bolts to 32 to 35 ft.-lb. (43 to 47 N•m) torque.

Figure 60-60-26



Use the following procedure to install new side engine mounts:

Remove the existing side mount from the engine. Refer to engine removal and installation for engine mount locations.

Use the parts shown to install the new engine mount for the side engine mount **[Figure 60-60-26]**.

Item 1 - Mounting Bolt
Item 2 - Mount Washer
Item 3 - Flat Washer
Item 4 - Nut
Item 5 - Spacer
Item 6 - Mount
Item 7 - Screw
Item 8 - Nut

Tighten the mounting bolt to 32 to 35 ft.-lb. (43 to 47 N•m) torque.

FLYWHEEL AND HOUSING

Flywheel Housing Removal And Installation

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

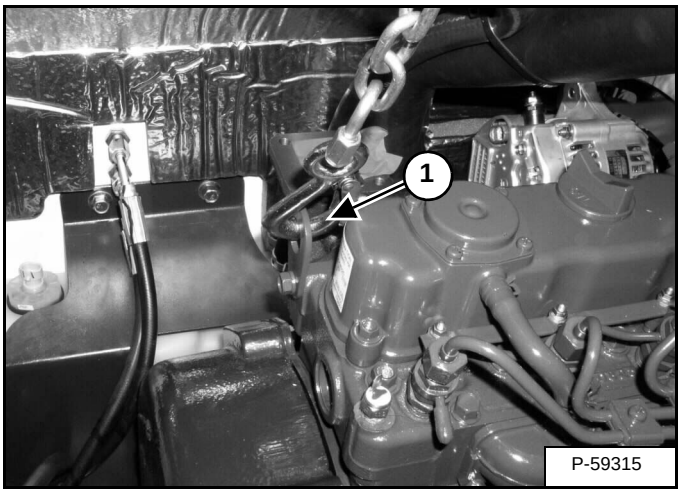
Remove the hydraulic pump (See Removal And Installation on Page 20-50-6).

Remove the accumulators assembly (See Removal And Installation on Page 20-61-1).

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

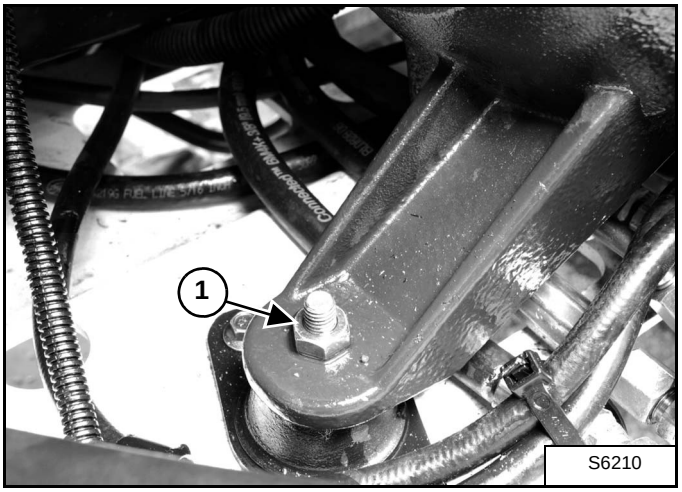
Remove the spark arrestor muffler (See Removal And Installation on Page 60-30-1).

Figure 60-70-1



Install a chain hoist to the engine lifting eye to support the engine (Item 1) **[Figure 60-70-1]**.

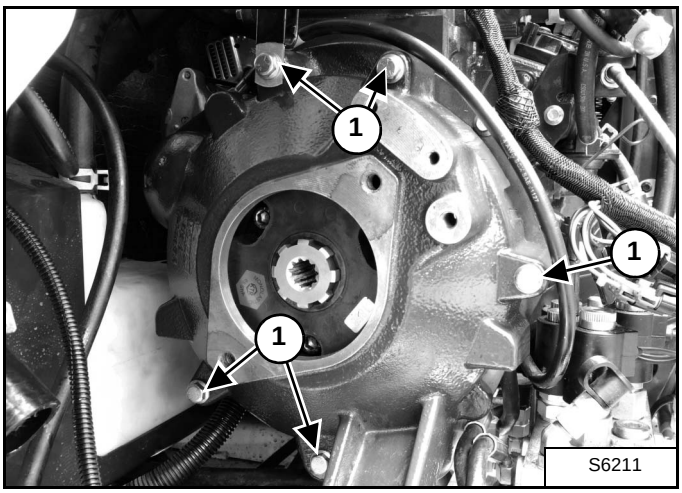
Figure 60-70-2



Remove the mount bolt and nut (Item 1) **[Figure 60-70-2]** from the engine mount.

Installation: Tighten the bolt and nut to 32 to 35 ft.-lb. (43 to 47 N•m) torque.

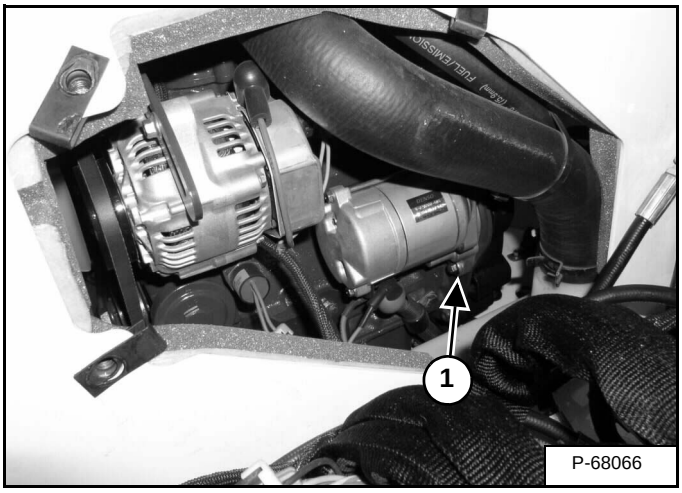
Figure 60-70-3



Remove the five flywheel housing bolts (Item 1) **[Figure 60-70-3]**.

Installation: Tighten the bolts to 18 to 19 ft.-lb. (24 to 26 N•m) torque.

Figure 60-70-4



Remove the access panel.

Remove the one bolt (Item 1) **[Figure 60-70-4]** from the bottom starter mounting bolt.

Installation: Tighten the bolts to 18 to 19 ft.-lb. (24 to 26 N•m) torque.

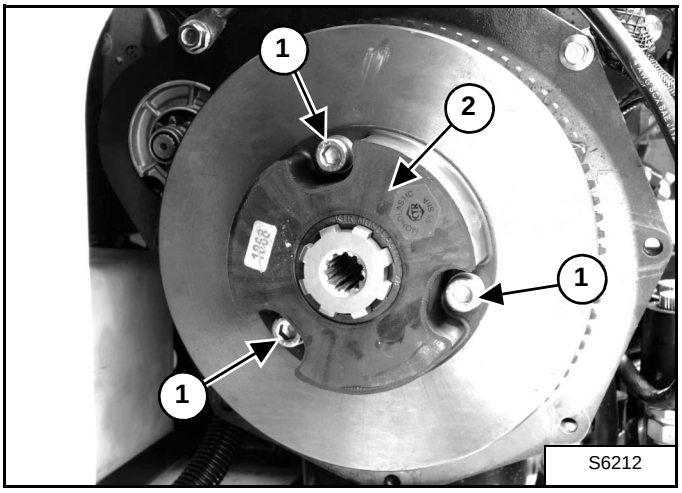
Remove the flywheel housing.

NOTE: Check that the alignment dowel pins are installed in the flywheel housing for assembly.

Hydraulic Pump Coupler Removal And Installation

Remove the flywheel housing (See Flywheel Housing Removal And Installation on Page 60-70-1).

Figure 60-70-5



Remove the three bolts (Item 1) **[Figure 60-70-5]** from the hydraulic pump coupler.

Installation: Apply Loctite® 242 (Blue) to bolts and tighten the bolts to 52.5 to 58.5 ft.-lb. (71 to 79 N•m) torque. Also lubricate the bolt heads prior to installation.

NOTE: Apply anti-seize compound on spline teeth prior to pump installation.

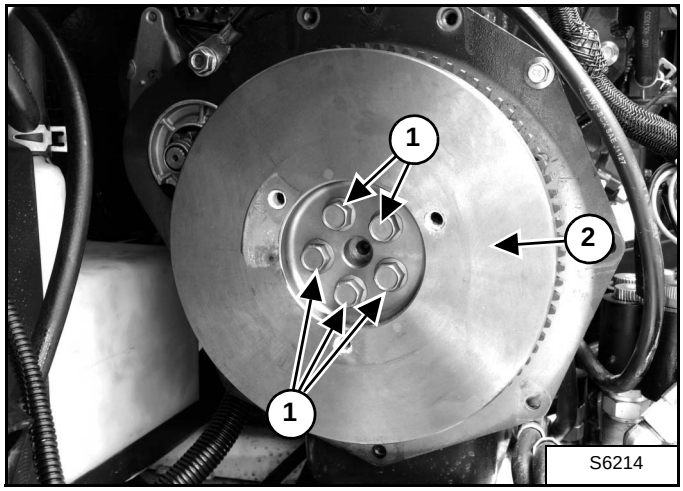
Remove the hydraulic pump coupler (Item 2) **[Figure 60-70-5]**.

Flywheel Removal

Remove the flywheel housing (See Flywheel Housing Removal And Installation on Page 60-70-1).

Remove the hydraulic pump coupler (See Hydraulic Pump Coupler Removal And Installation on Page 60-70-2).

Figure 60-70-6

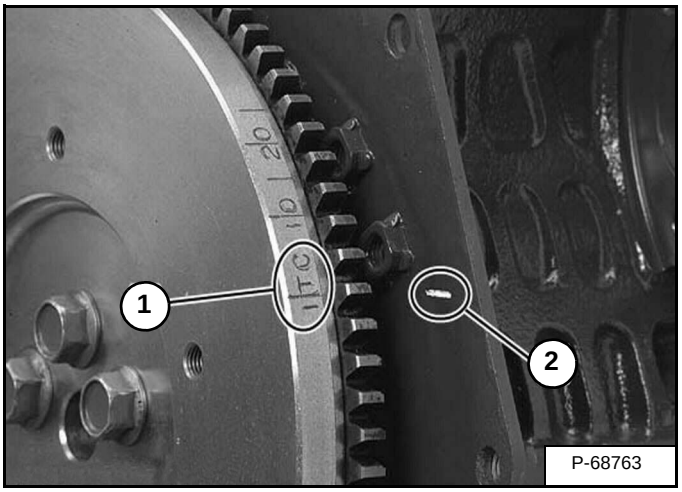


Remove the five bolts (Item 1) **[Figure 60-70-6]** from the flywheel.

Remove the flywheel (Item 2) **[Figure 60-70-6]**.

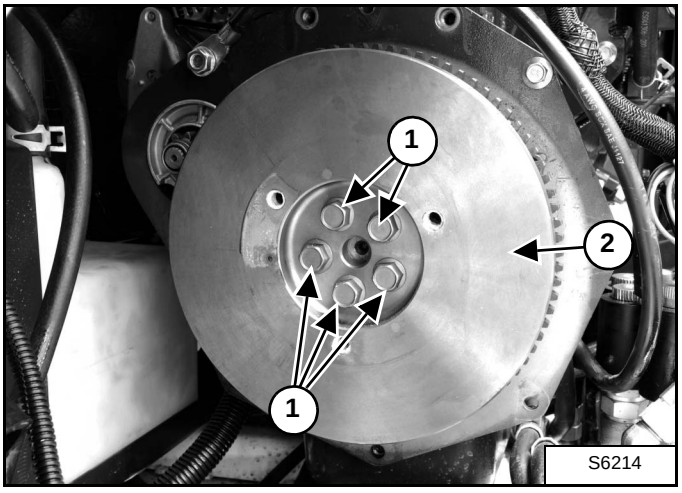
Flywheel Installation

Figure 60-70-7



Align the "1TC" (Item 1) on the outer surface of the flywheel with the alignment mark (Item 2) **[Figure 60-70-7]** on the rear end plate.

Figure 60-70-8



Apply engine oil to the five bolt threads and underside of bolt heads before installation.

Install the five bolts (Item 1) **[Figure 60-70-8]** on the flywheel.

Tighten the bolts to 39.8 to 43.4 ft.-lb. (53,9 to 58,8 N•m) torque.

Rear End Plate Removal And Installation

Remove the flywheel housing (See Flywheel Housing Removal And Installation on Page 60-70-1).

Remove the hydraulic pump coupler (See Hydraulic Pump Coupler Removal And Installation on Page 60-70-2).

Remove the flywheel (See Flywheel Removal on Page 60-70-2).

Figure 60-70-9

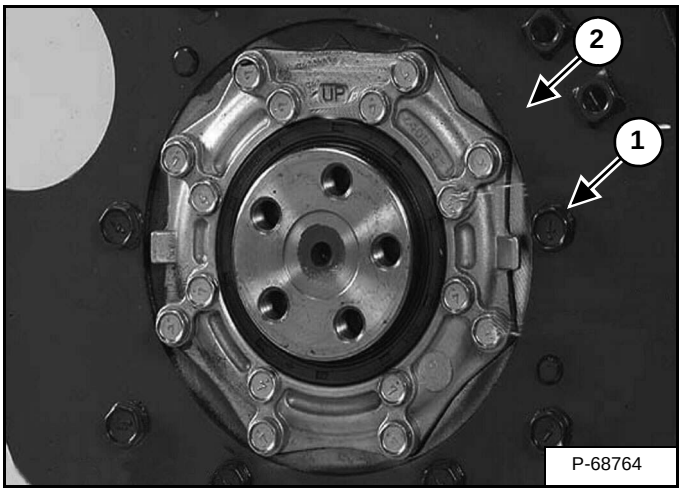
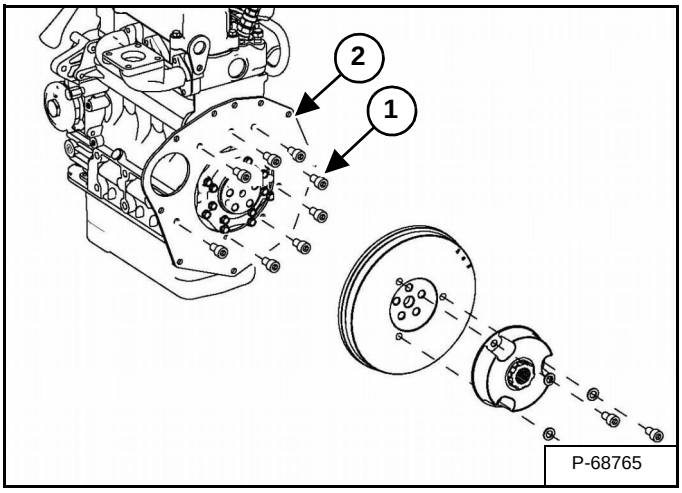


Figure 60-70-10



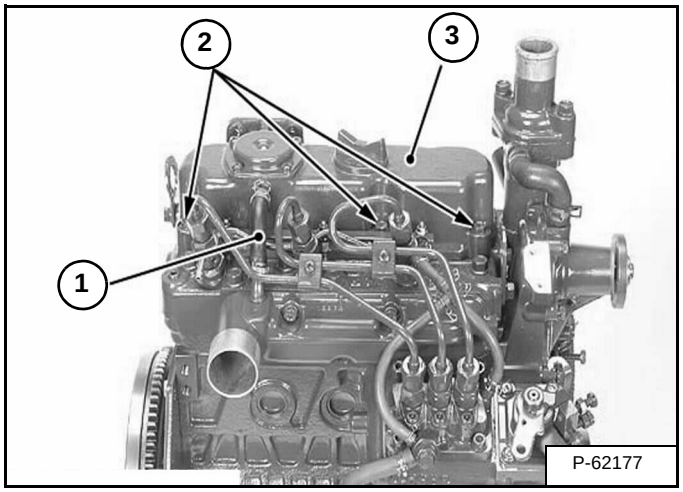
Remove the bolts (Item 1) from the rear end plate (Item 2) **[Figure 60-70-9]** and **[Figure 60-70-10]**. Remove end plate from the side of the engine.


Bobcat®

RECONDITIONING THE ENGINE

Cylinder Head Removal And Installation

Figure 60-80-1



Remove the breather hose (Item 1) **[Figure 60-80-1]**.

Remove the bolts (Item 2) from the valve cover and remove the valve cover and gasket (Item 3) **[Figure 60-80-1]**.

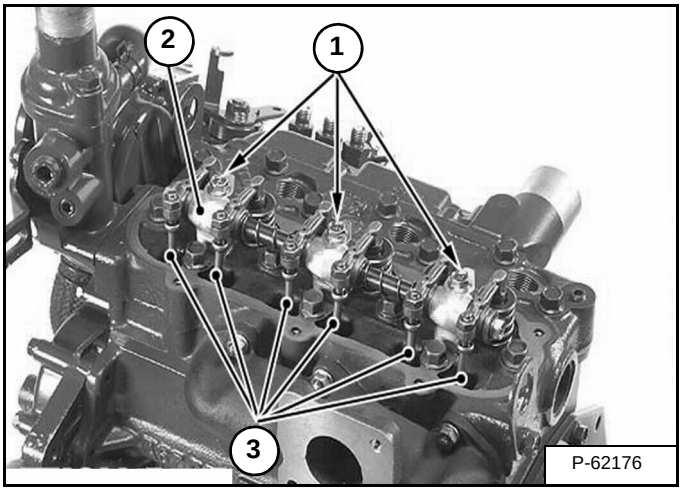
Installation: Tighten the bolts to 5-8 ft.-lb. (7-11 N•m) torque. Gradually tighten center bolts before the end bolts to avoid cracking valve cover.

Remove the fuel injector nozzles (See Fuel Injector Removal And Installation on Page 60-50-7.)

Remove the glow plugs (See Glow Plug Removal And Installation on Page 60-50-10.)

Remove the alternator (See Removal And Installation on Page 50-30-4.)

Figure 60-80-2



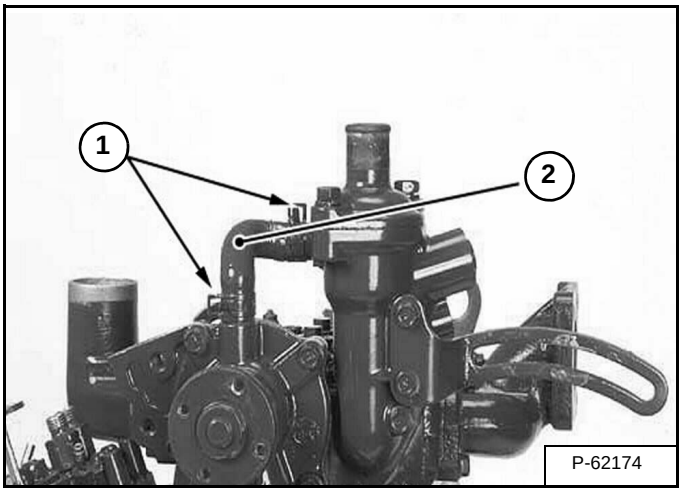
Remove the rocker arm bracket screws (Item 1) and shaft assembly (Item 2) **[Figure 60-80-2]**.

Installation: Tighten the nuts to 7-8 in.-lb. (9,8-11,3 Nm) torque.

Remove the pushrods (Item 3) **[Figure 60-80-2]**.

Remove the intake and exhaust manifolds.

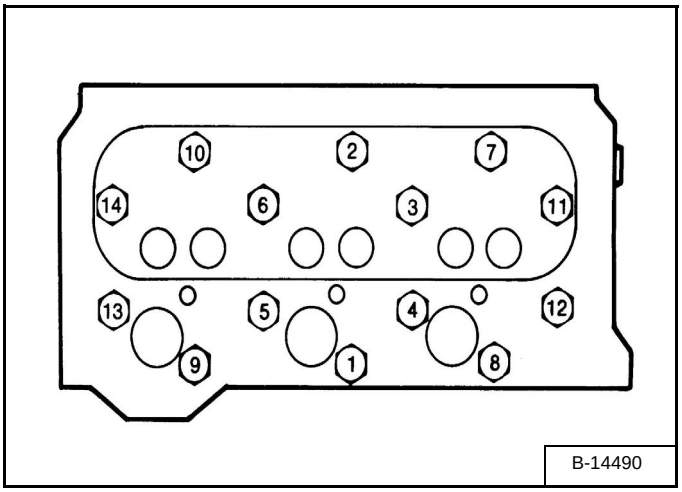
Figure 60-80-3



Remove the water return hose **[Figure 60-80-3]**.

Cylinder Head Removal And Installation (Cont'd)

Figure 60-80-4



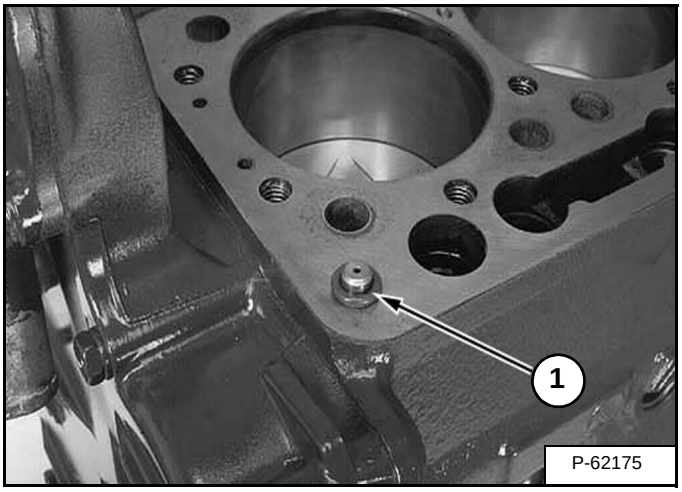
Remove the cylinder head bolts in order of #14 to #1 **[Figure 60-80-4]**.

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

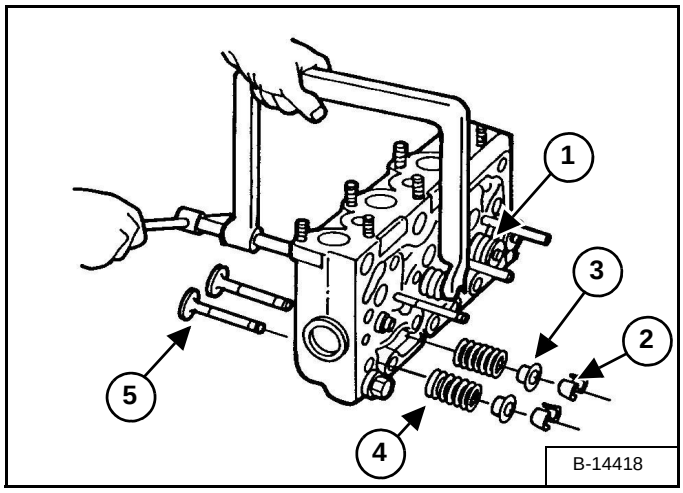
Figure 60-80-5



Installation: Always use a new head gasket and new O-ring. Make sure the O-ring (Item 1) **[Figure 60-80-5]** is seated over the dowel.

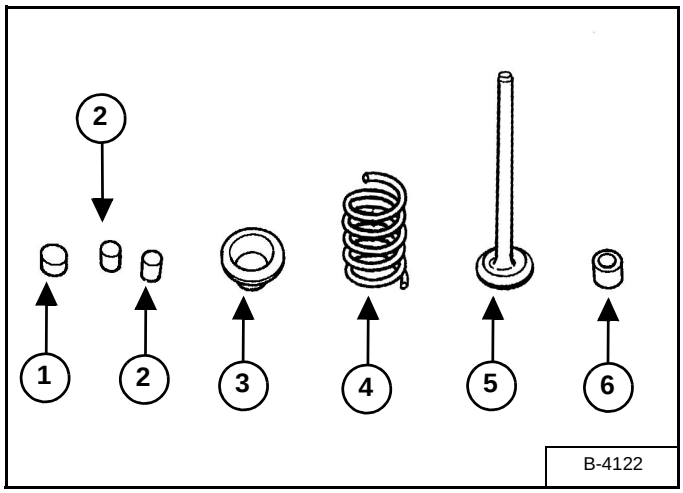
Cylinder Head Disassembly And Assembly

Figure 60-80-6



Use a valve spring compressor to compress the valve spring **[Figure 60-80-6]**.

Figure 60-80-7



Remove the valve cap (Item 1) **[Figure 60-80-7]** and valve spring collet (Item 2) **[Figure 60-80-6]** and **[Figure 60-80-7]**.

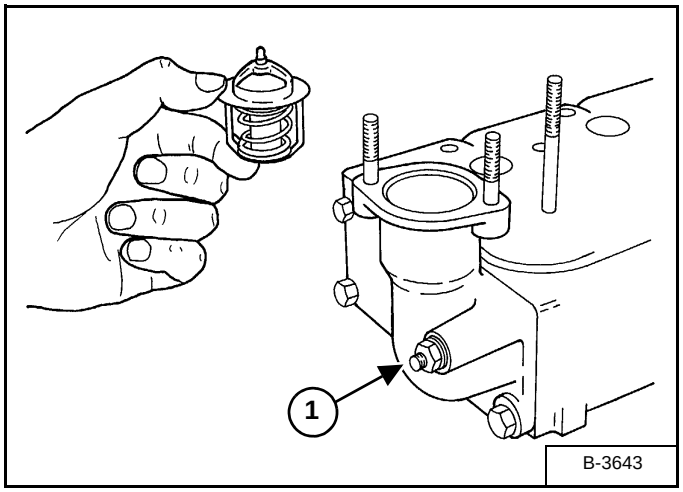
Remove the valve spring retainer (Item 3) **[Figure 60-80-6]** and **[Figure 60-80-7]** and the spring (Item 4) **[Figure 60-80-6]** and **[Figure 60-80-7]**.

Remove the valve (Item 5) **[Figure 60-80-6]** and **[Figure 60-80-7]**.

Remove the seal (Item 6) **[Figure 60-80-7]**.

Cylinder Head Disassembly And Assembly (Cont'd)

Figure 60-80-8

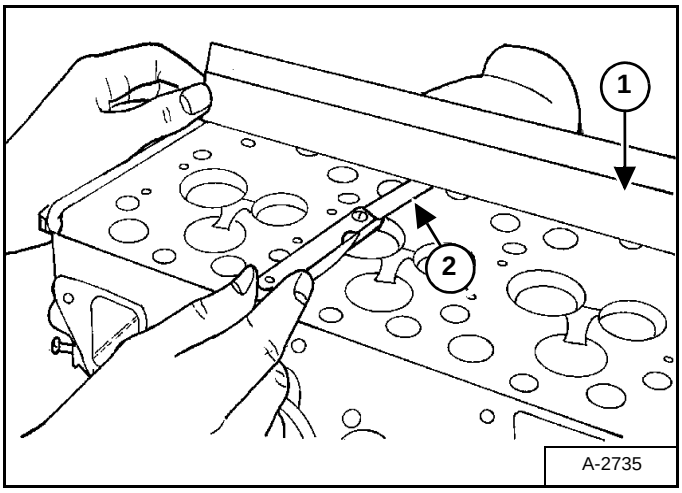


Remove the thermostat cover and thermostat from the cylinder head. Remove the thermostat housing (Item 1) **[Figure 60-80-8]**.

Installation: Apply Liquid-Type Gasket (Three Bond 1215 or equivalent) to both sides of the new thermostat cover gasket and new thermostat housing gasket.

Cylinder Head, Servicing

Figure 60-80-9



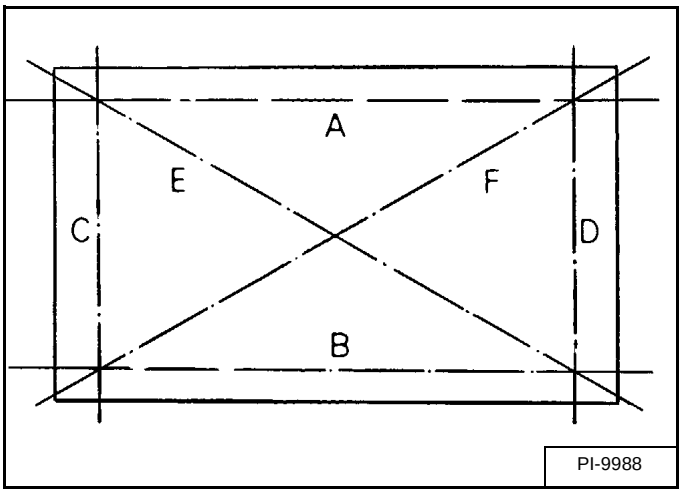
Clean the surface of the cylinder head.

Put a straight edge (Item 1) **[Figure 60-80-9]** on the cylinder head.

NOTE: Do not put the straight edge across combustion chambers.

Put a feeler gauge (Item 2) **[Figure 60-80-9]** between the straight edge and the surface of the cylinder head.

Figure 60-80-10

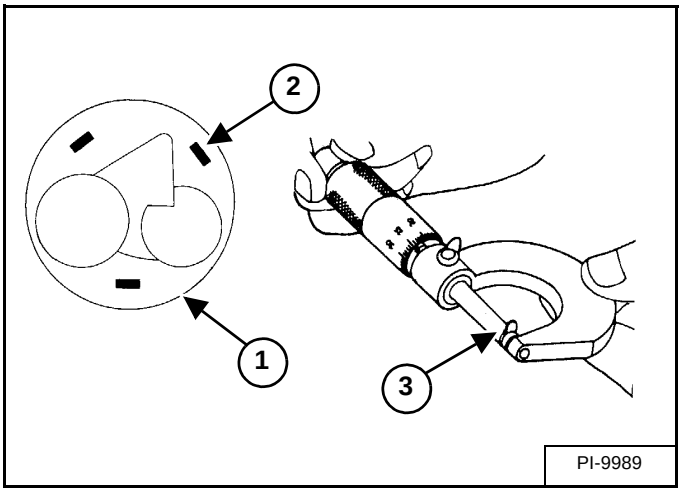


Put the straight edge on the cylinder head's four sides and two diagonal as shown in figure **[Figure 60-80-10]**.

The maximum distortion of the head surface ± 0.002 in. (± 0,05 mm). If the measurement is more than the specification, remove the combustion chambers, then grind the cylinder head. Grind the same amount of material from the bottom of the combustion chambers as was removed from the head.

Cylinder Head Top Clearance

Figure 60-80-11



Install the cylinder head gasket. Put the piston (Item 1) **[Figure 60-80-11]** being checked at T.D.C.

Put 3 pieces of 0.06 in. (1,5 mm) diameter solder (Item 2) **[Figure 60-80-11]** on the top piston. Use grease to hold them in position.

NOTE: Put the solder in position so they do not touch the valves.

Turn the piston to bottom dead center.

Install the cylinder head and tighten to the correct torque in the correct sequence (See Cylinder Head Removal And Installation on Page 60-80-1.)

Turn the crankshaft until the piston exceeds T.D.C. Remove the cylinder head.

Remove the solder wire (Item 3) **[Figure 60-80-11]** and measure it.

If the measurement exceeds the specifications, check the oil clearance of the crank pin journal or the piston pin.

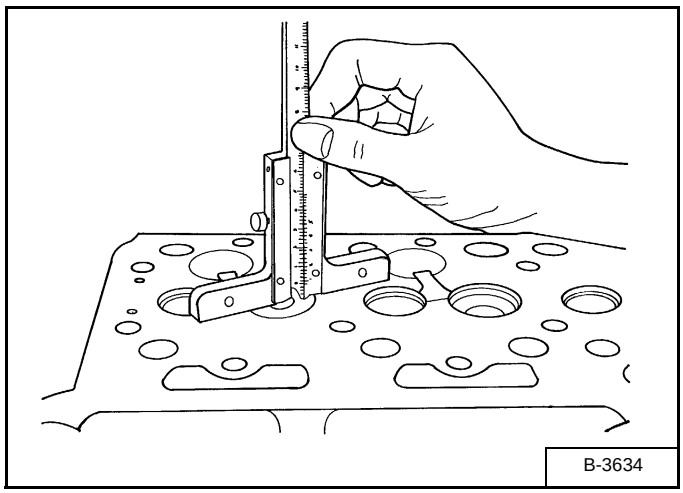
Top clearance 0.0197-0.0276 in. (0,50-0,70 mm)

Valve Guide, Checking

Remove the valve and spring from the cylinder head (See Cylinder Head Removal And Installation on Page 60-80-1.)

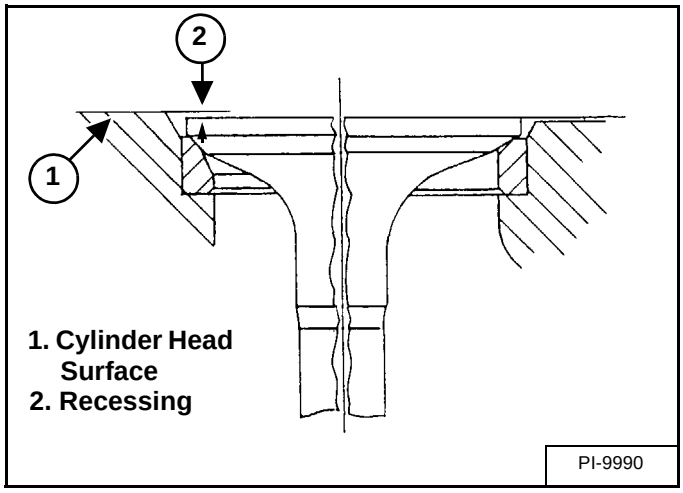
Clean the valve seat and combustion chamber.

Figure 60-80-12



Install the valve into the guide. Measure the valve recessing with a depth gauge **[Figure 60-80-12]**.

Figure 60-80-13



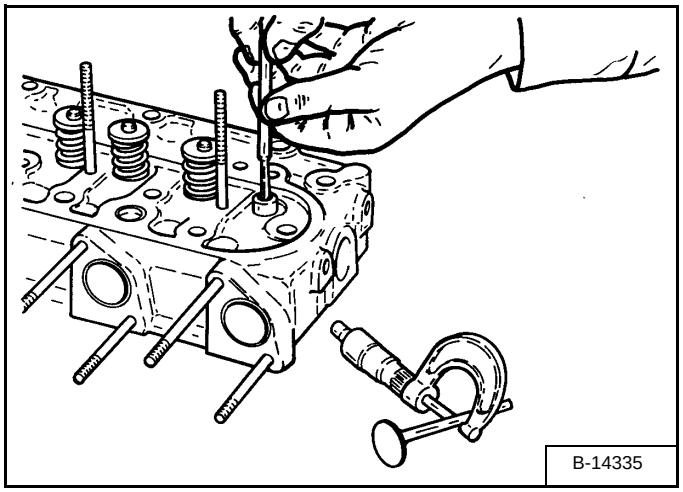
If the measurement exceeds the allowable limit, replace the valve or cylinder head **[Figure 60-80-13]**.

Recessing	0.004 in. (0,10 mm)
Allowable Limit (Recessing)	0.012 in. (0,30 mm)

Remove the carbon from the valve guide.

Valve Guide, Checking (Cont'd)

Figure 60-80-14



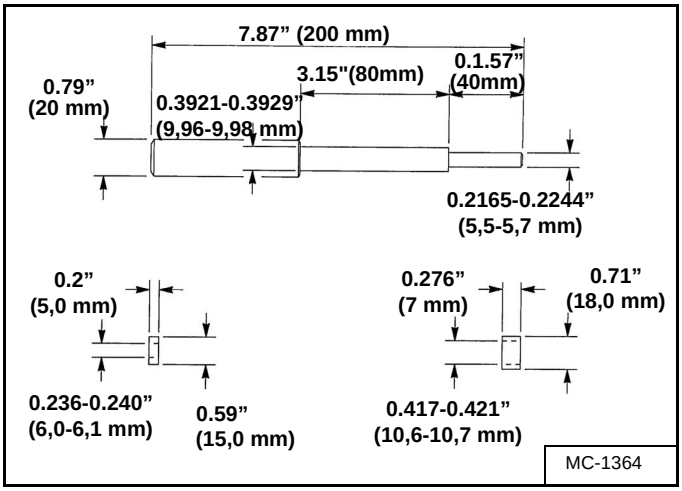
Measure the valve stem O.D. **[Figure 60-80-14]**.

Measure the valve guide I.D. **[Figure 60-80-14]**.

Calculate the clearance. If the clearance exceeds the allowable limit, replace the valve and / or valve guide.

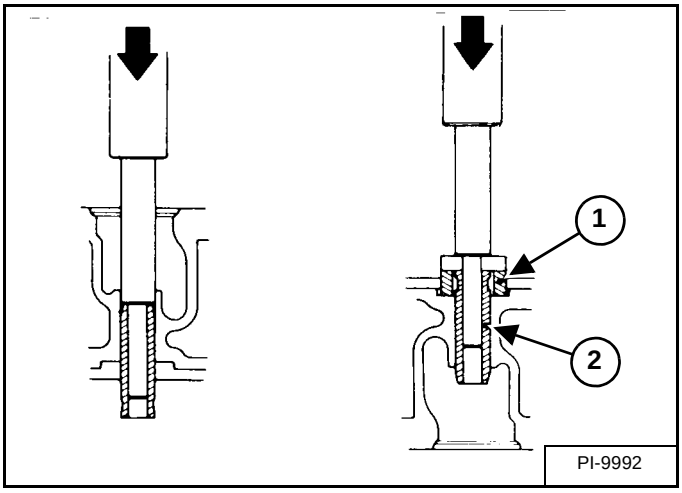
Valve Guide I.D	0.2366-0.2372 in. (6,01-6,025 mm)
Valve Stem O.D	0.2350-0.2354 in. (5,968-5,980 mm)
Clearance Between Valve Stem and Guide	0.0012-0.0022 in. (0,03-0,057 mm)
Allowable Limit	0.0039 in. (0,10 mm)

Figure 60-80-15



To remove and replace the valve guide, make the driver tools as shown in figure **[Figure 60-80-15]**.

Figure 60-80-16



Press the used valve guide out of the cylinder head using the special driver tool **[Figure 60-80-16]**. (See previous page for tool dimensions.)

Put oil on the outside diameter of the new valve guide. Press the new valve guide into the cylinder head from the top side. Use the special driver tools (Items 1 and 2) **[Figure 60-80-16]**, press the new guide until the tools contact the cylinder head.

Ream the valve guide to the correct specifications.

NOTE: Valve guide I.D. (Intake and Exhaust) factory spec. is .2366-.2372 in. (6,01-6,025 mm)

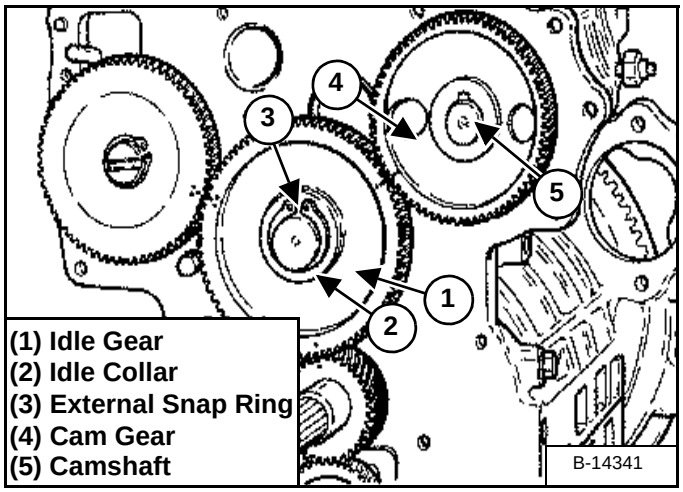
Valve Timing, Checking

Stop the engine and open the rear door.

Remove the engine (See Engine Removal and Installation on Page 60-60-7.)

Remove the timing gearcase cover (See Timing Gearcase Cover Removal And Installation on Page 60-80-10.)

Figure 60-80-17

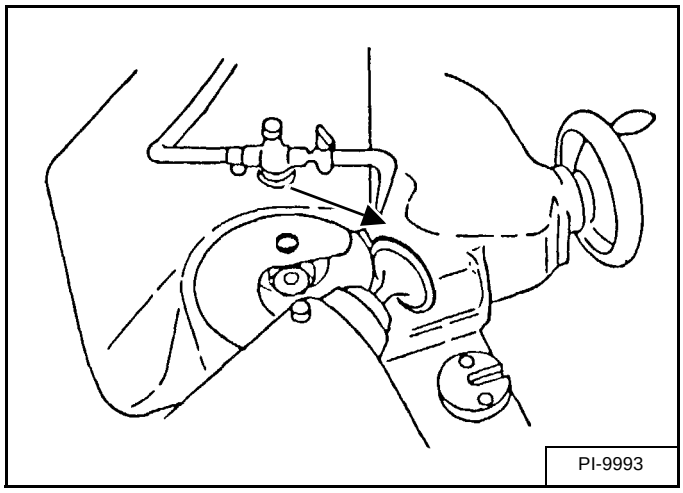


(1) Idle Gear
(2) Idle Collar
(3) External Snap Ring
(4) Cam Gear
(5) Camshaft

Make sure the timing marks are in correct alignment **[Figure 60-80-17]**.

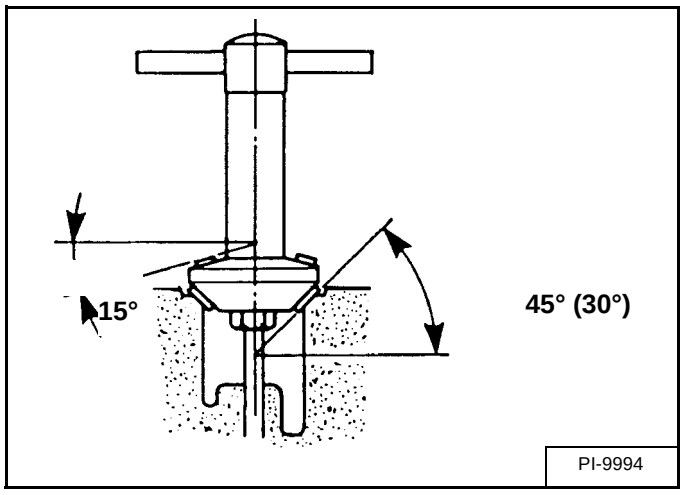
Valve And Valve Seat Reconditioning

Figure 60-80-18



Grind the valve face to the correct angle using a valve refacer **[Figure 60-80-18]** and **[Figure 60-80-20]**.

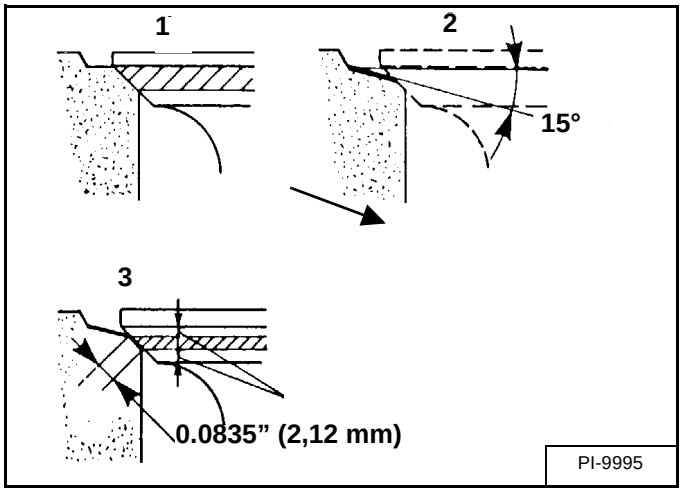
Figure 60-80-19



Grind the valve surface in the cylinder head to the correct angle **[Figure 60-80-19]**.

Valve And Valve Seat Reconditioning (Cont'd)

Figure 60-80-20



Check the seat surface and valve face (Item 1) **[Figure 60-80-20]**.

If the seat surface is too wide, use a 15 degree cutter (Item 2) to get the correct width (Item 3) **[Figure 60-80-20]**.

Valve Seat Width

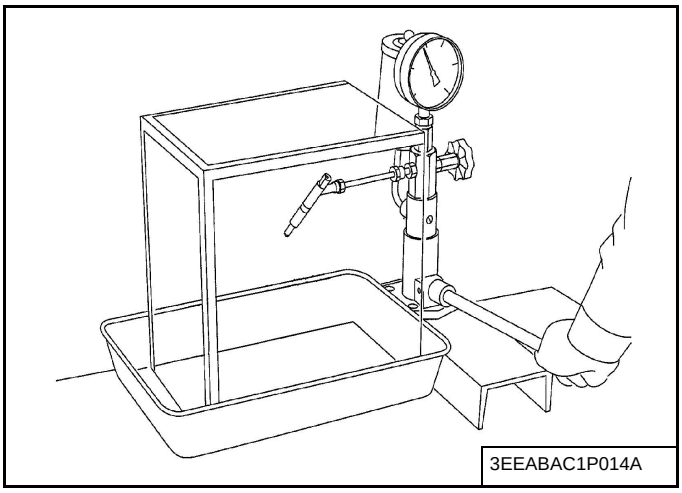
Intake	0.0835 in. (2,12 mm)
Exhaust	0.0835 in. (2,12 mm)

Valve Seat and Face Angle

Intake	45°
Exhaust	45°

Valve Seat Tightness

Figure 60-80-21



Set the injection nozzle to a nozzle tester (Code No. 07909-31361) **[Figure 60-80-21]**.

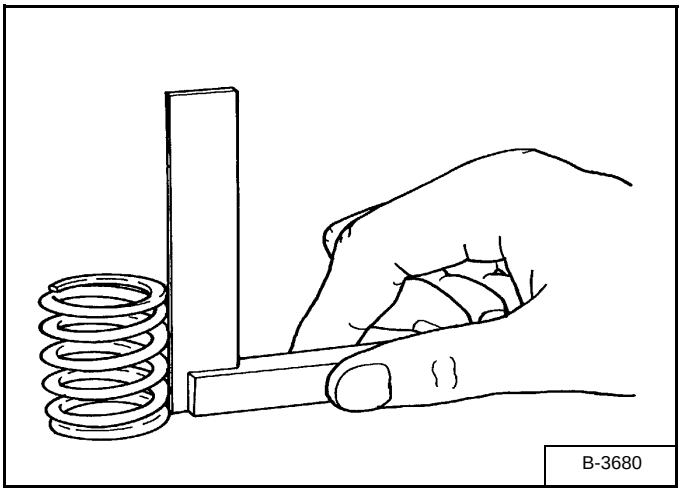
Raise the fuel pressure, and keep at 12.75 MPa (130 kgf/cm², 1849 PSI) for 10 seconds.

If any fuel leak is found, replace the injection nozzle assembly or repair at Denso service Shop.

Valve seat tightness	Factory spec.	No fuel leak at 12.75 MPa 130 kgf/cm² 1849 PSI

Valve Spring

Figure 60-80-22



Measure the length of the valve spring. If the measurement is less than the allowable limit, replace the spring **[Figure 60-80-22]**.

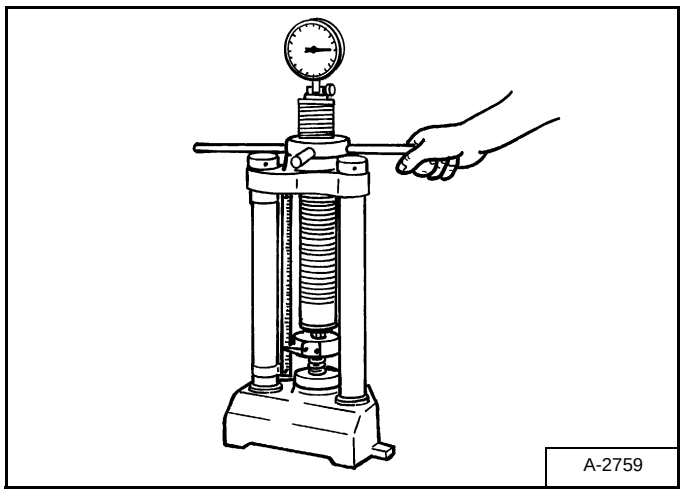
Free Length	1.232 - 1.252 in. (31,3 - 31,8 mm)
Allowable Limit	1.118 in. (28,4 mm)

Put the spring on a flat surface, place a square on the side of the spring **[Figure 60-80-22]**.

Rotate the spring and measure the maximum tilt. If the measurement is in excess of the allowable limit, replace the spring.

Tilt	0.047 in. (1,2 mm)

Figure 60-80-23



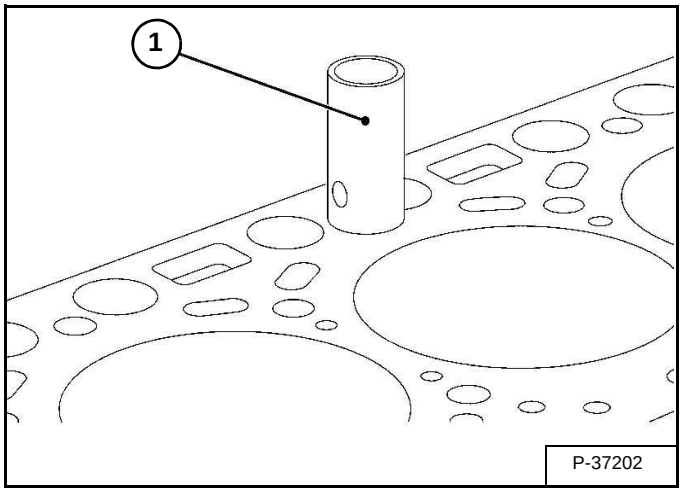
Put the spring on a tester and compress to specified length **[Figure 60-80-23]**.

Read the compressed load on the gauge. If the measurement exceeds allowable limit, replace the spring.

Setting Length	1.063 in. (27 mm)
Setting Load	14.6 lb. (64.7 N)
Allowable Limit (setting load)	12.3 lb. (54.9 N)

Valve Tappets

Figure 60-80-24



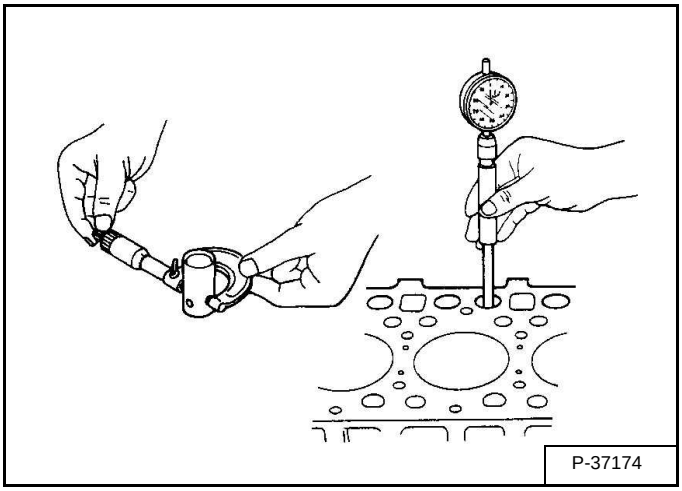
Remove the tappets (Item 1) **[Figure 60-80-24]** from the crankcase.

When reassembling replace the head gasket with a new one.

Before installing the tappets (Item 1) **[Figure 60-80-24]**, apply engine oil thinly around them.

NOTE: Mark the cylinder number to the tappets to prevent interchanging.

Figure 60-80-25



Measure the tappet O.D. with an outside micrometer **[Figure 60-80-25]**.

Measure the I.D. of the tappet guide bore with a cylinder gauge, and calculate the oil clearance **[Figure 60-80-25]**.

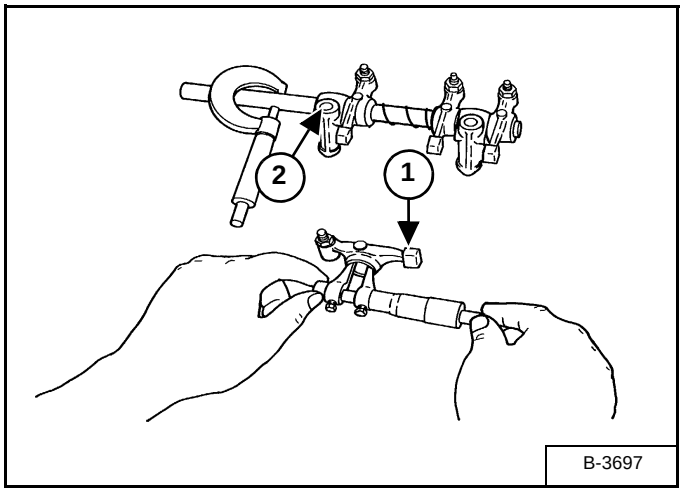
If the oil clearance exceeds the allowable limit or the tappet is damaged, replace the tappet.

Oil clearance between tappet and guide	Factory spec.	0.016 to 0.052 mm 0.00063 to 0.00205 in.
	Allowable limit	0.10 mm 0.0039 in.

Tappet O.D.	Factory spec.	17.966 to 17.984 mm 0.70732 to 0.70803 in.
Tappet guide I.D.	Factory spec.	18.000 to 18.018 mm 0.70866 to 0.70937 in.

Rocker Arm And Shaft, Checking

Figure 60-80-26



Measure the rocker arm I.D. (Item 1) **[Figure 60-80-26]** with an inside micrometer.

Measure the rocker shaft O.D. (Item 2) **[Figure 60-80-26]** with an outside micrometer.

If the clearance exceeds the allowable limit, replace the rocker arm and measure the clearance again.

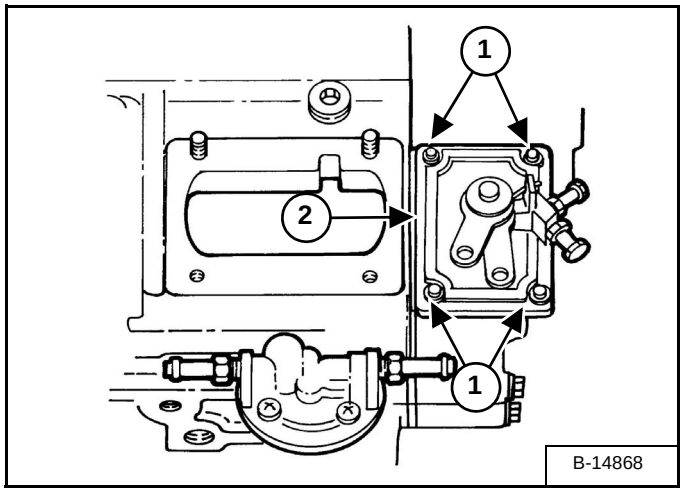
If the clearance still exceeds the allowable limit after the rocker arm is replaced, replace the rocker arm shaft.

Oil Clearance Between Rocker Arm and Shaft	
	0.0006-0.0018 in. (0,016-0,045 mm)
Allowable Limit	0.0059 in. (0,15 mm)
Rocker Arm Shaft	0.4123-0.4128 in. (10,47-10,48 mm)
Rocker Arm I.D.	0.4134-0.4141 in. (10,5-10,52 mm)

Timing Gearcase Cover Removal And Installation

Remove the fuel injection pump (See Fuel Injection Pump Removal And Installation on Page 60-50-4.)

Figure 60-80-27

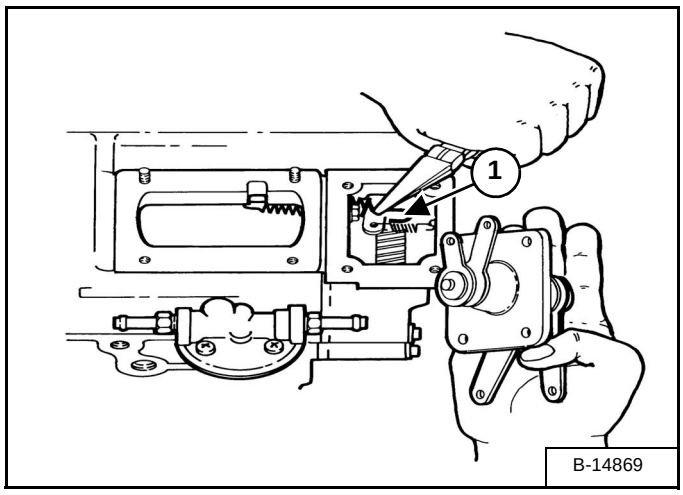


Remove the cylinder head, rocker arms and push rods. (See Cylinder Head Removal And Installation on Page 60-80-1.)

Remove the screws (Item 1) from the speed control plate (Item 2) **[Figure 60-80-27]**.

NOTE: Take care not to damage the spring.

Figure 60-80-28

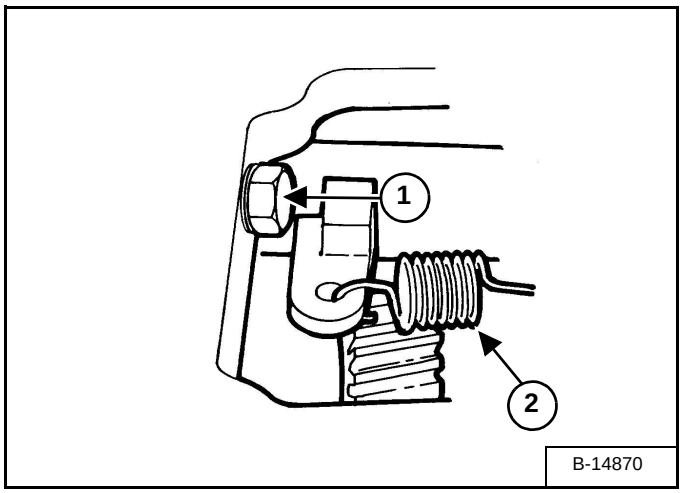


Separate the speed control plate from the engine and remove the spring (Item 1) **[Figure 60-80-28]**.

Remove the speed control plate.

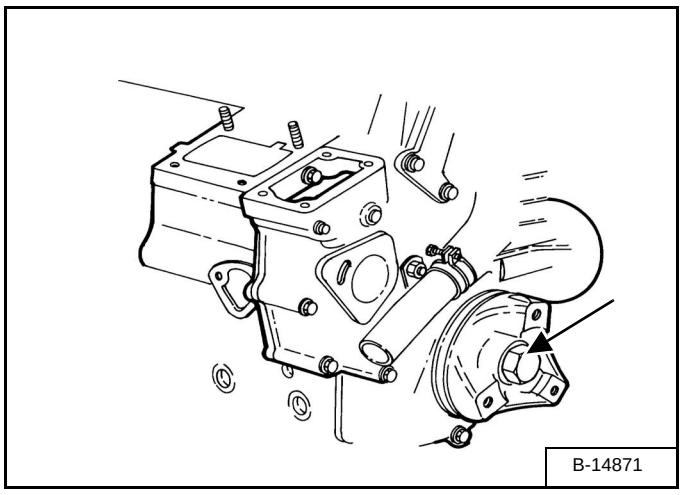
Timing Gearcase Cover Removal And Installation (Cont'd)

Figure 60-80-29



Remove the bolt (Item 1) and disconnect the shaft spring (Item 2) **[Figure 60-80-29]**.

Figure 60-80-30

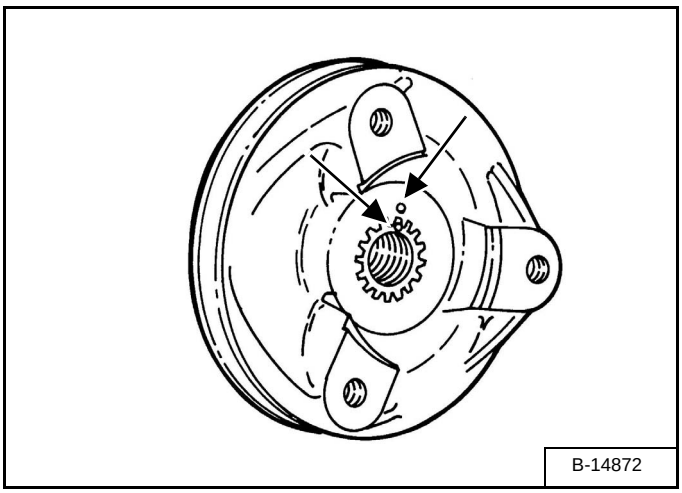


Remove the crankshaft pulley bolt.

Installation: Tighten the bolt 72-80 ft.-lb. (98-108 N•m) torque.

Use a puller and remove the crankshaft pulley **[Figure 60-80-30]**.

Figure 60-80-31

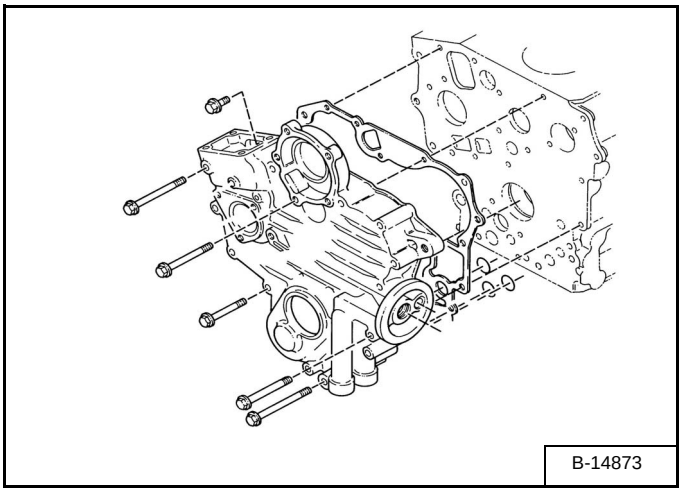


When installing the crank shaft pulley, make sure the alignment marks are aligned **[Figure 60-80-31]**.

Remove the timing gear case cover bolts.

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

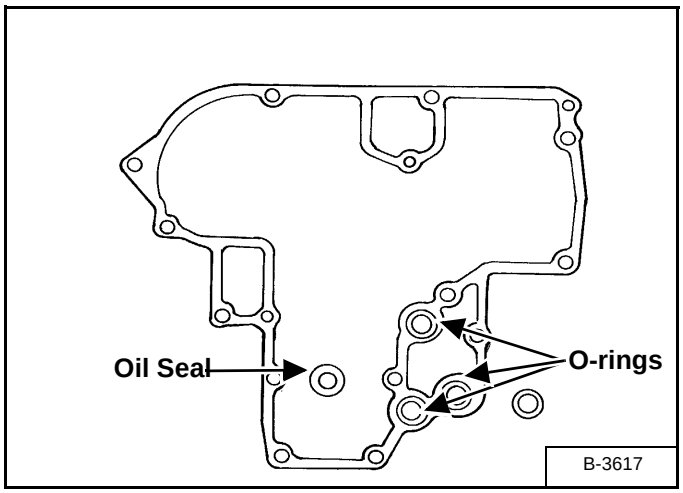
Figure 60-80-32



Remove the timing gear case **[Figure 60-80-32]**.

Timing Gearcase Cover Removal And Installation (Cont'd)

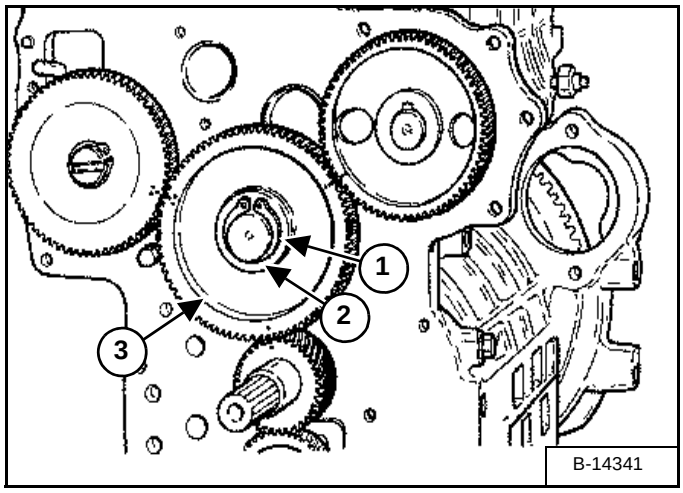
Figure 60-80-33



Installation: Install three new O-rings and the oil seal into the timing gear case cover **[Figure 60-80-33]**.

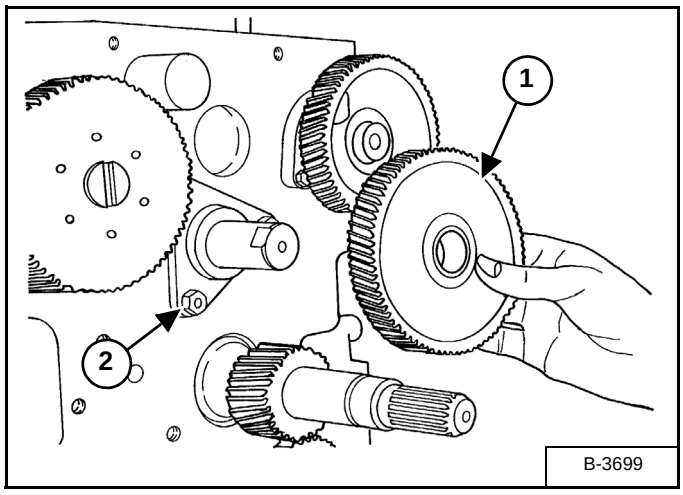
Idler Gear And Camshaft Removal And Installation

Figure 60-80-34



Remove the snap ring (Item 1) and collar (Item 2) from the idler gear shaft (Item 3) **[Figure 60-80-34]**.

Figure 60-80-35



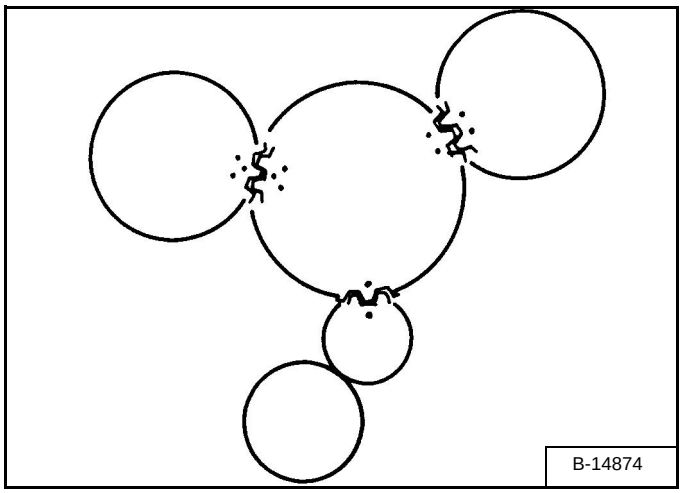
Remove the idler gear (Item 1) **[Figure 60-80-35]**.

Remove idler gear mounting screws (Item 2) **[Figure 60-80-35]**.

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

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

Figure 60-80-36

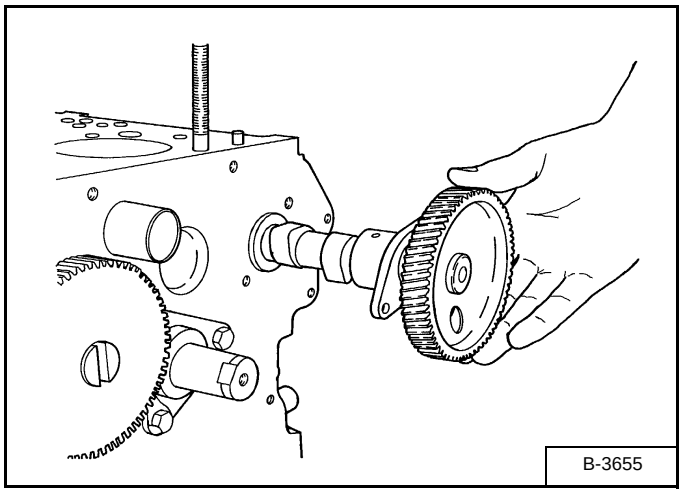


Installation: Make sure the timing marks are in correct alignment when installing the timing gears **[Figure 60-80-36]**.

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

Remove the bolts.

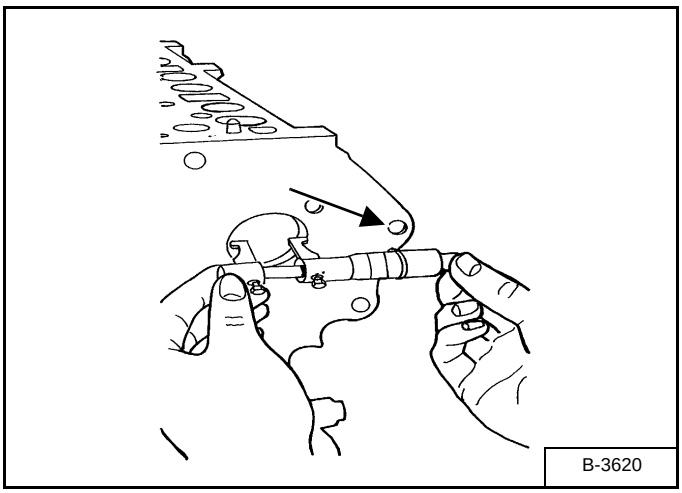
Figure 60-80-37



Remove the camshaft from the engine block **[Figure 60-80-37]**.

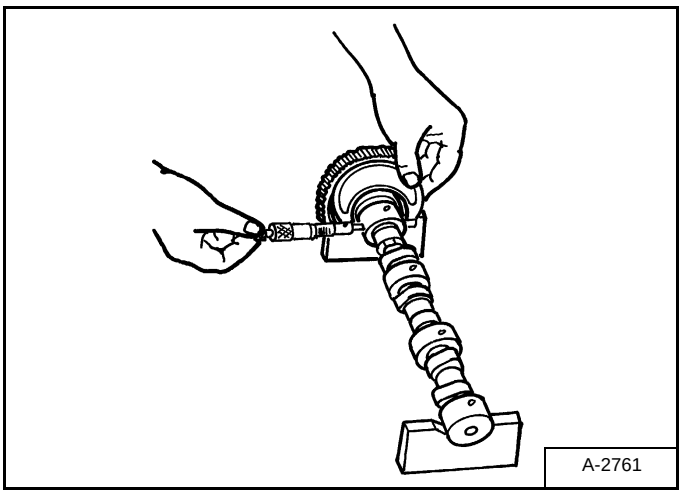
Installation: Tighten the camshaft retainer bolts to 14-15 ft.-lb. (18-21 N•m) torque.

Figure 60-80-38



Measure the camshaft bearing in the engine block **[Figure 60-80-38]**.

Figure 60-80-39



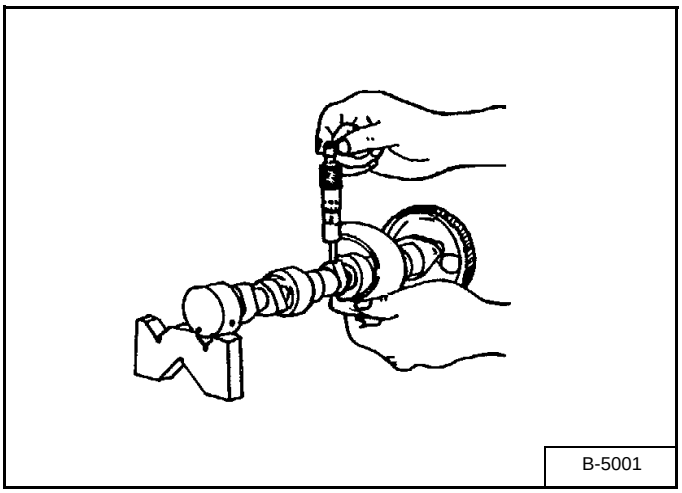
Measure the camshaft journal **[Figure 60-80-39]**.

Calculate the oil clearance. If the clearance exceeds the allowable limit, replace the camshaft.

Bearing I.D.	1.299-1.300 in. (33,00-33,03 mm)
Journal O.D.	1.2966-1.2972 in. (32,93-32,95 mm)
Clearance of Camshaft Journal	
	0.002-0.004 in. (0,05-0,09 mm)
Allowable Limit	0.006 in. (0,15 mm)

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

Figure 60-80-40

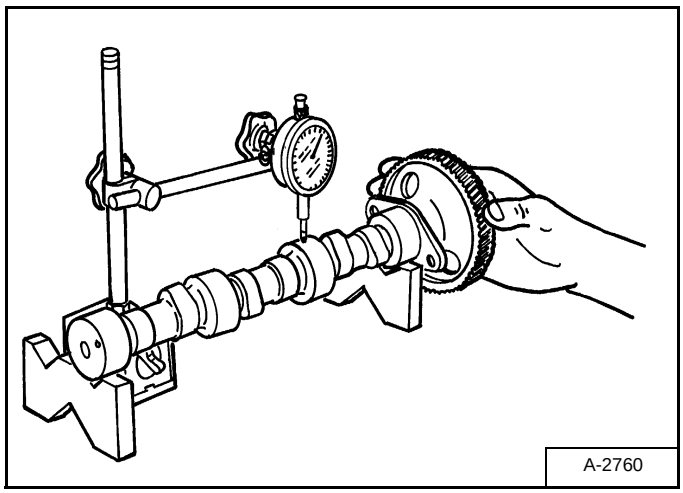


Measure the cam lobes at their highest point **[Figure 60-80-40]**.

If the measurement is less than the allowable limit, replace the camshaft.

Cam Lob Height	1.058 in. (26,88 mm)
Allowable Limit	1.056 in. (26,83 mm)

Figure 60-80-41



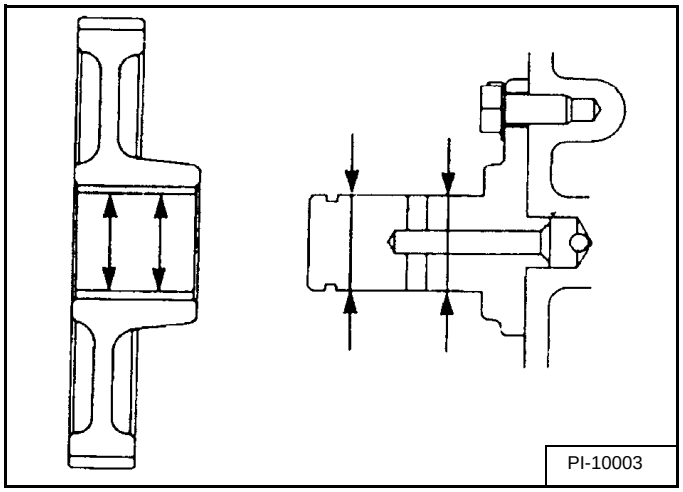
Put the camshaft in V-blocks. Install a dial indicator **[Figure 60-80-41]**.

Turn the camshaft at a slow rate. If the misalignment exceeds the allowable limit, replace the camshaft.

Camshaft Alignment Allowable Limit	
	0.0004 in. (0,01 mm)

Idler Gear and Shaft, Servicing

Figure 60-80-42



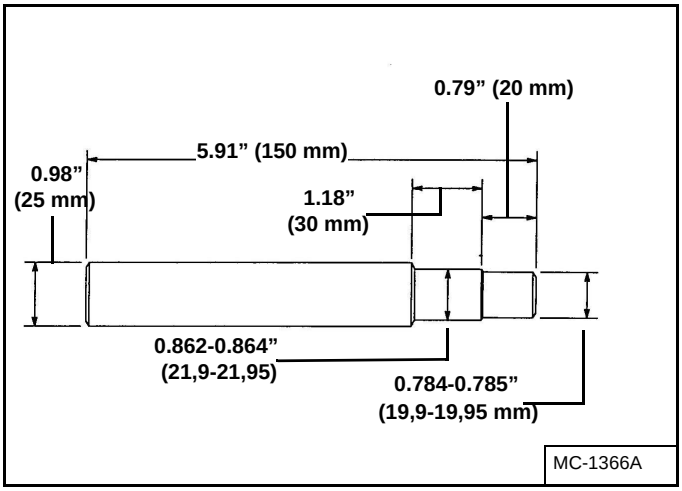
Measure the O.D. of the idler gear shaft **[Figure 60-80-42]**.

Measure the I.D. of the idler gear bushing **[Figure 60-80-42]**.

If the clearance exceeds the allowable limit, replace the bushing.

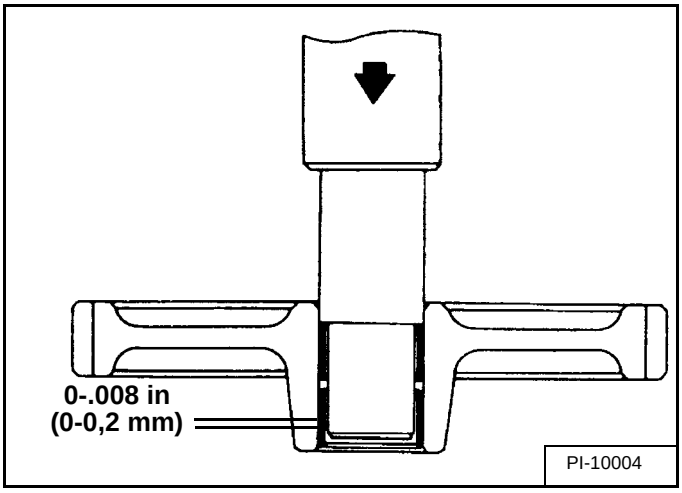
Idler Gear Shaft O.D.	0.786-0.787 in. (19,97-19,98 mm)
Idler Gear Shaft I.D.	0.787-0.789 in. (20,00-20,05 mm)
Oil Clearance between Idler Shaft and Gear Bushing	0.0008-0.0033 in. (0,020-0,084 mm)
Allowable Limit	0.004 in. (0,10 mm)

Figure 60-80-43



To replace the idler gear bushing, make a driver tool as shown in figure **[Figure 60-80-43]**.

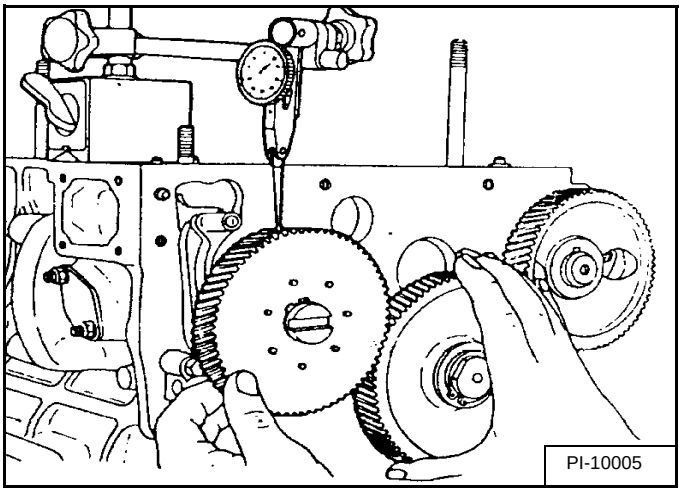
Figure 60-80-44



Use a press and special driver tool, to remove the old bushing and install the new bushing **[Figure 60-80-44]**.

Timing Gears Checking Backlash

Figure 60-80-45



When the gears are installed, check the backlash of the gears.

Install a dial indicator with its tip on a gear tooth **[Figure 60-80-45]**.

Hold one gear while turning the other gear **[Figure 60-80-45]**.

If the backlash exceeds the allowable limit, check the oil clearance of the shaft and gear. If the oil clearance is correct, replace the gears.

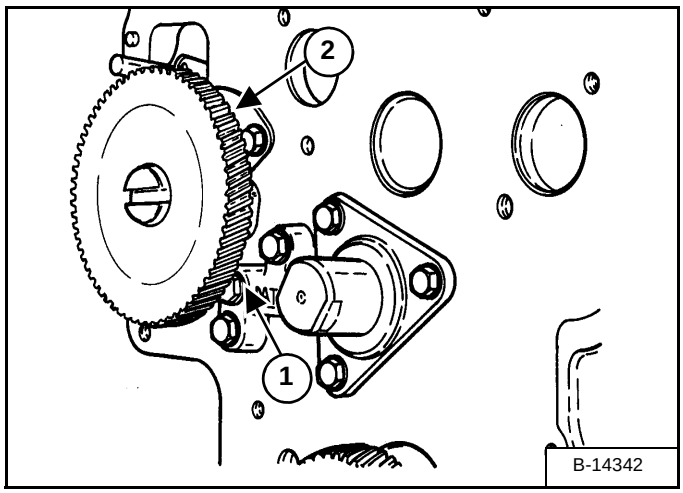
Crank Gear and Idler Gear.	
	0.002-0.005 in. (0,043-0,124 mm)
Allowable Limit	0.006 in. (0,15 mm)
Cam Gear and Idler Gear	
	0.002-0.005 in. (0,047-0,12 mm)
Allowable Limit	0.006 in. (0,15 mm)
Injection Pump Gear and Idler Gear	
	0.002-0.005 in. (0,046-0,124 mm)
Allowable Limit	0.006 in. (0,15 mm)
Oil Pump Gear and Crankshaft Cover	
	0.002-0.005 in. (0,041-0,123 mm)
Allowable Limit	0.006 in. (0,15 mm)

Fuel Camshaft Removal And Installation

Remove the timing gearcase cover (See Timing Gearcase Cover Removal And Installation on Page 60-80-10.)

Remove the idler gear (See Cylinder Head Removal And Installation on Page 60-80-1.)

Figure 60-80-46



Remove the bolt (Item 1) from the retainer plate (Item 2) **[Figure 60-80-46]**.

Installation: Tighten the bolt to 60-72 in.-lb. (6,8-8,1 N•m) torque.

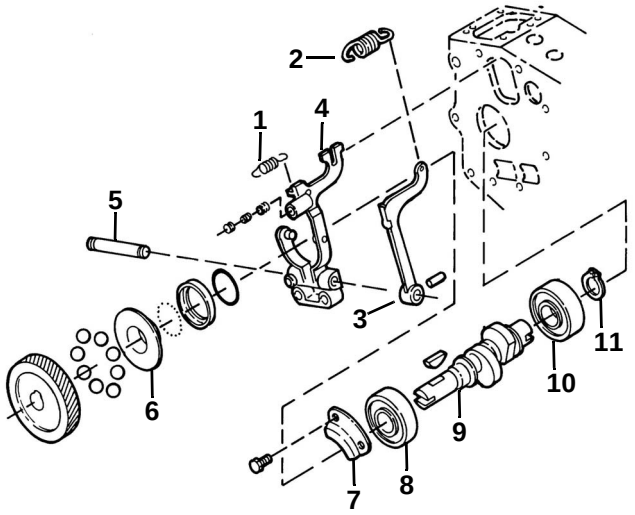
Remove the fuel camshaft retainer plate (Item 2) **[Figure 60-80-46]**.

Remove the fuel camshaft and fork lever assembly at the same time.

Fuel Camshaft Governor

The governor serves to keep the engine speed constant by automatically adjusting the amount of fuel supplied to the engine according to changes in the load.

Figure 60-80-47



1. Start Spring
2. Governor Spring
3. Fork Lever
4. Fork Lever
5. Fork Lever Shaft
6. Governor Sleeve
7. Retaining Plate
8. Bearing
9. Fuel Camshaft
10. Bearing
11. Snap Ring

B-14875

Disassemble and assemble the governor and fuel camshaft as shown **[Figure 60-80-47]**.

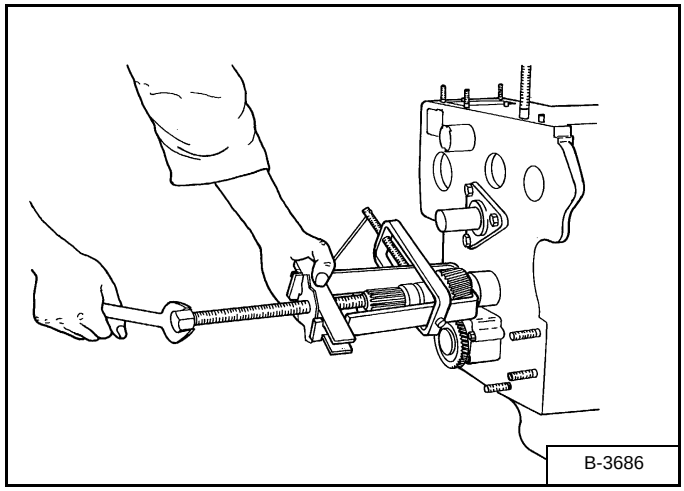
Check all the parts for wear or damage and replace as needed.

Crankshaft Gear Removal And Installation

Remove the timing gearcase cover (See Timing Gearcase Cover Removal And Installation on Page 60-80-10.)

Remove the idler gear (See Idler Gear And Camshaft Removal And Installation on Page 60-80-12.)

Figure 60-80-48



B-3686

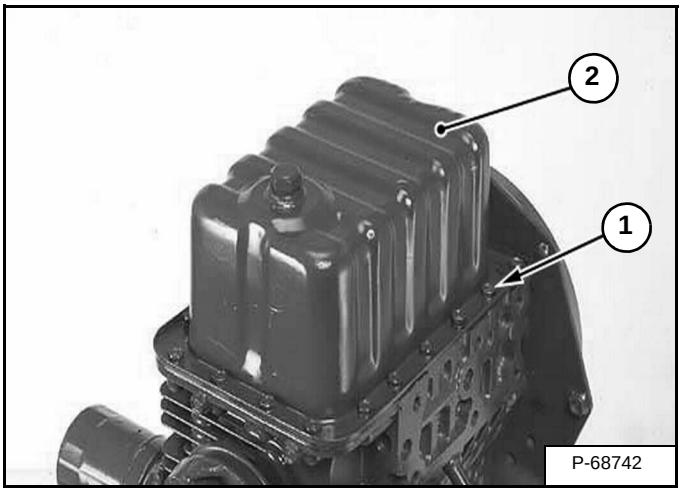
Remove the crankshaft gear with a puller **[Figure 60-80-48]**.

Remove the crankshaft key.

Oil Pan Removal And Installation

Remove the engine from the excavator (See Engine Removal and Installation on Page 60-60-7.)

Figure 60-80-49



Unscrew the oil pan mounting screws (Item 1) and remove the oil pan (Item 2) **[Figure 60-80-49]**.

Figure 60-80-50

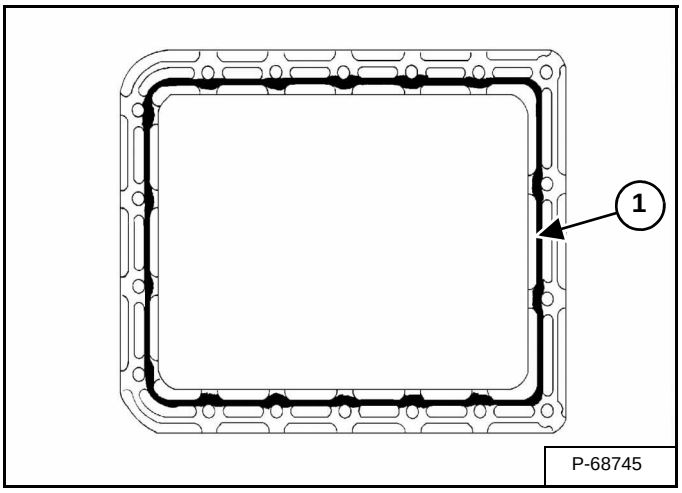
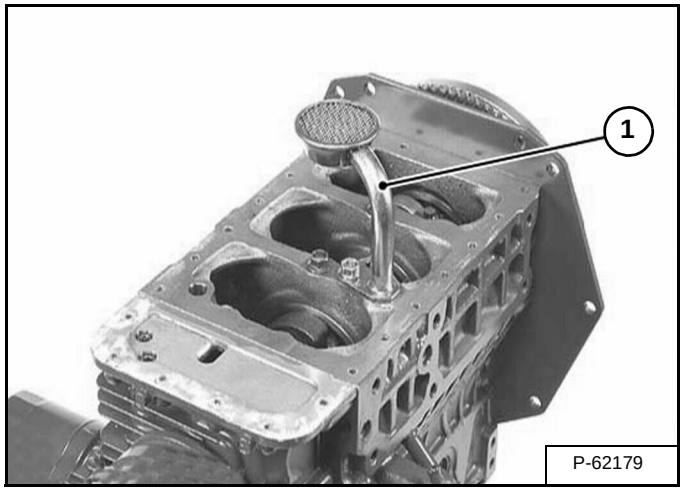
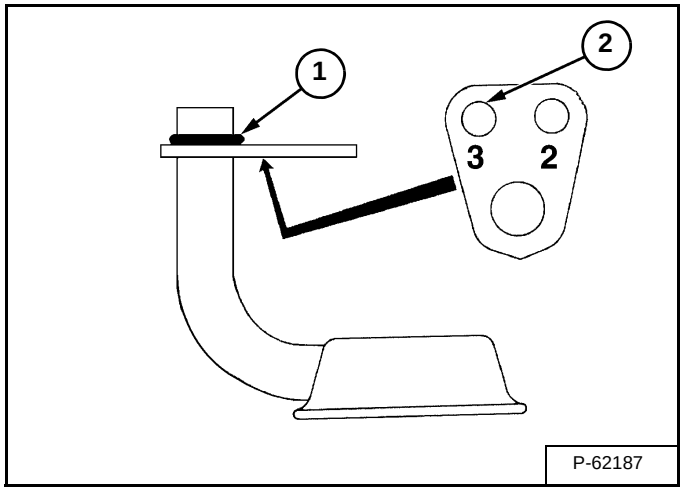


Figure 60-80-51



Remove the oil pump strainer (Item 1) **[Figure 60-80-51]**.

Figure 60-80-52



Installation: Check O-ring (Item 1) on strainer and use hole 3 (Item 2) **[Figure 60-80-52]** when installing strainer. Install the oil strainer, using care not to damage the O-ring.

Apply liquid gasket to the oil pan (Item 1) **[Figure 60-80-50]**.

Confirm that the liquid gasket coating surface is free of water, dust and oil in order to maintain sealing effect.

Carefully apply the adhesive evenly.

NOTE: When mounting the adhesive-applied parts, take care to fit them to the mating parts.

Assemble the adhesive-applied parts within ten minutes.

To avoid uneven tightening, tighten mounting screws in diagonal order from the center.

After cleaning the oil strainer, install it.

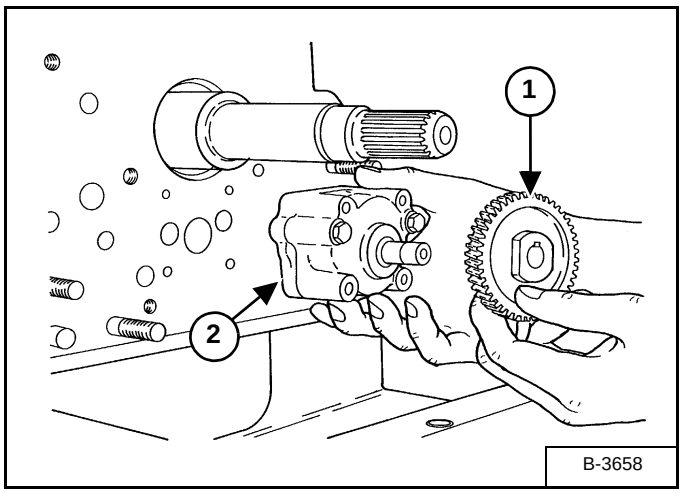
Attach the oil pan with its central drain plug facing toward the air suction side.

Oil Pump Removal And Installation

Remove the timing gearcase cover (See Timing Gearcase Cover Removal And Installation on Page 60-80-10.)

Remove the crankshaft gear.

Figure 60-80-53



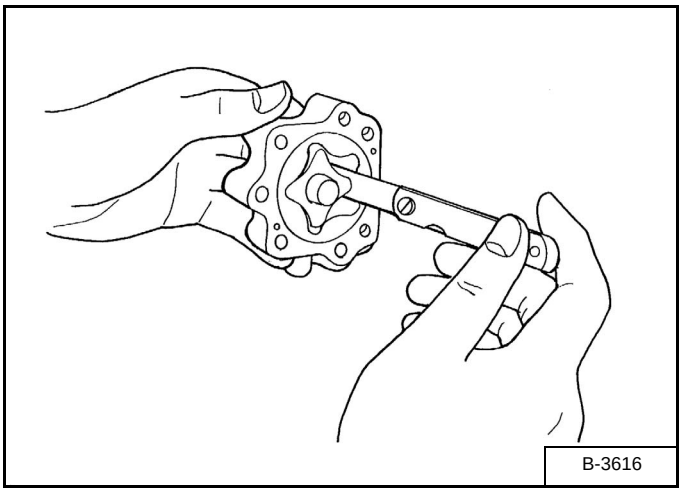
Remove the nut from the oil pump shaft. Use a puller to remove the oil pump gear (Item 1) **[Figure 60-80-53]**.

Remove the oil pump mounting bolts. Remove the oil pump (Item 2) **[Figure 60-80-53]**.

Installation: Tighten the oil pump mounting bolts to 60-72 in.-lb. (6,9-8,1 N•m) torque.

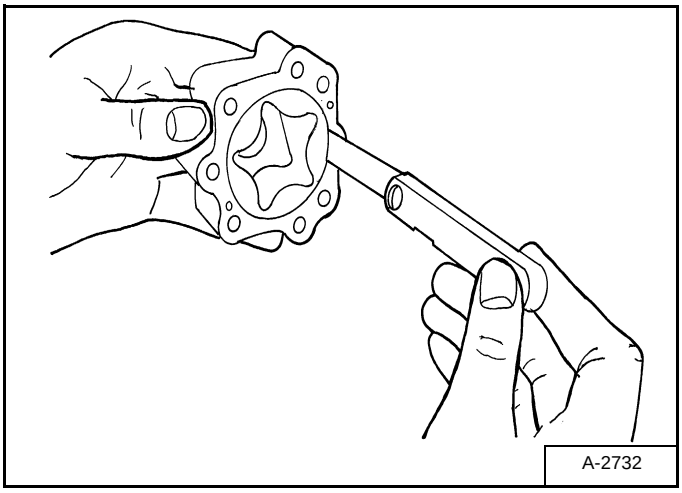
Oil Pump, Service

Figure 60-80-54



Measure the clearance between the lobes of the inner rotor and outer rotor with a feeler gauge **[Figure 60-80-54]**.

Figure 60-80-55



Measure the clearance between the outer rotor and pump body with a feeler gauge **[Figure 60-80-55]**.

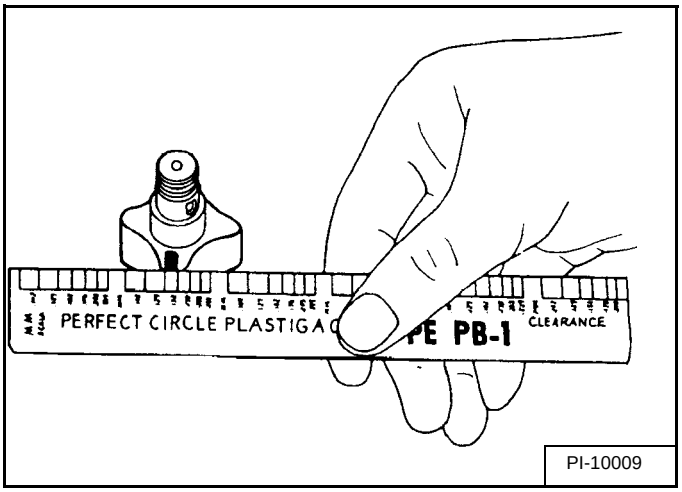
If the clearance exceeds the factory limit, replace the oil pump rotor assembly.

Clearance Between Inner and Outer Rotor
0.001-0.006 in. (0,03-0,14 mm)

Clearance Between Outer Rotor and Body
0.003-0.006 in. (0,07-0,15 mm)

Oil Pump, Service, (Cont'd)

Figure 60-80-56



Put a piece of press gauge on the rotor face **[Figure 60-80-56]**.

Install the cover and tighten the bolts.

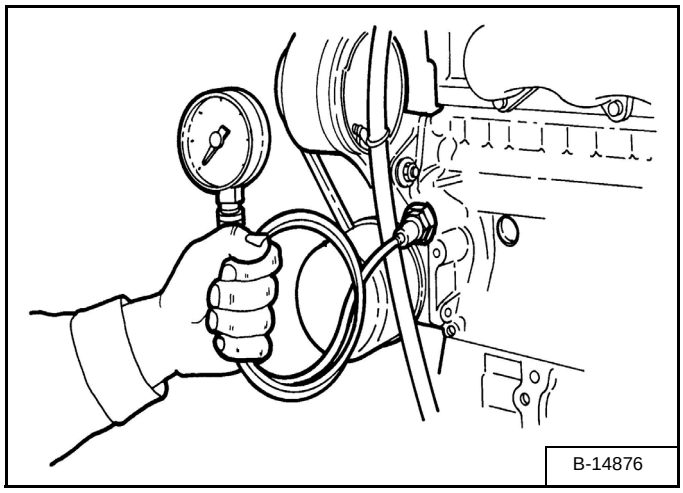
Remove the cover carefully. Measure the width of the press gauge **[Figure 60-80-56]**.

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

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

Engine Oil Pressure, Checking

Figure 60-80-57



Remove the oil pressure sensor.

Install a pressure gauge **[Figure 60-80-57]**.

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

Measure oil pressure at both idling and rated speeds.

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

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

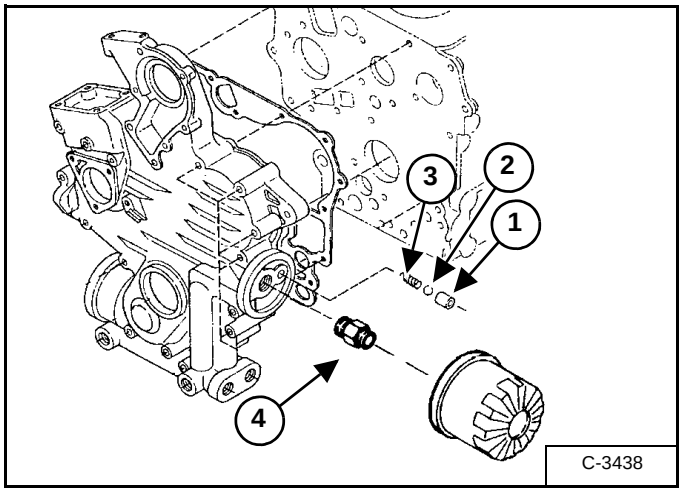
At Idle Speed Allowable Limit	7 PSI (0,48 bar)
At Rated Speed	28-64 PSI (2-4 bar)
Allowable Limit	21 PSI (1 bar)

Installation: After checking engine oil pressure, tighten oil pressure sensor to 11-15 ft.-lb. (15-20 N•m).

Relief Valve

The relief valve prevents damage of the lubricating system due to high pressure. This relief valve is a ball type.

Figure 60-80-58



Remove the valve seat (Item 1) **[Figure 60-80-58]**, ball (Item 2) **[Figure 60-80-58]** and spring (Item 3) **[Figure 60-80-58]**.

Check the parts for wear or damage and replace as needed.

Spring Free Length	
Factory Spec	1.26 in. (32 mm)
Allowable Limit	1.10 in. (28 mm)

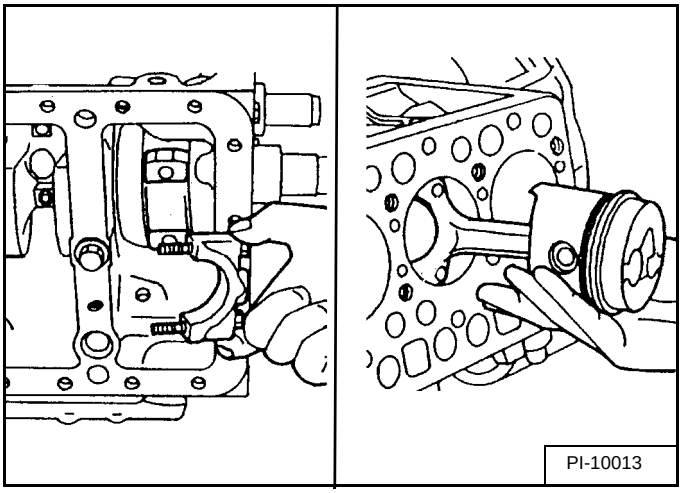
Installation: Tighten the oil fitter adapter (Item 4) **[Figure 60-80-58]** to 29-36 ft.-lb. (39-49 N•m) torque.

Piston And Connecting Rod Removal And Installation

Remove the cylinder head (See Cylinder Head Removal And Installation on Page 60-80-1.)

Remove the top edge from the cylinder bore with a ridge reamer.

Figure 60-80-59

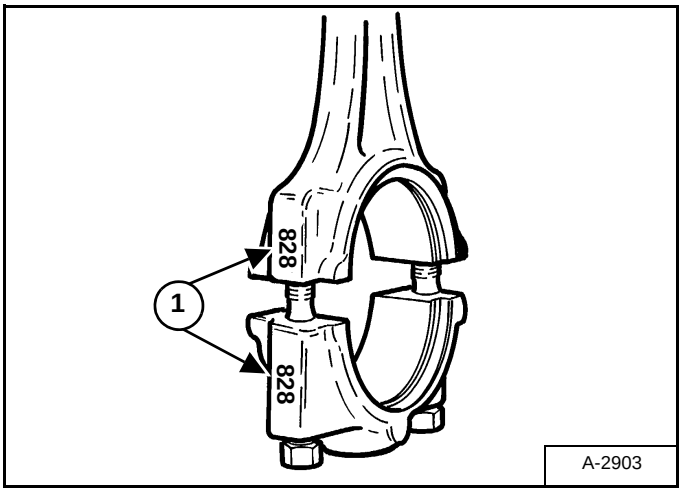


Remove the rod cap and bearing **[Figure 60-80-59]**.

Use a hammer handle and push the piston connecting rod assembly out of the cylinder bore **[Figure 60-80-59]**.

NOTE: Make sure the pistons are marked so they will be returned to the same cylinder bore.

Figure 60-80-60

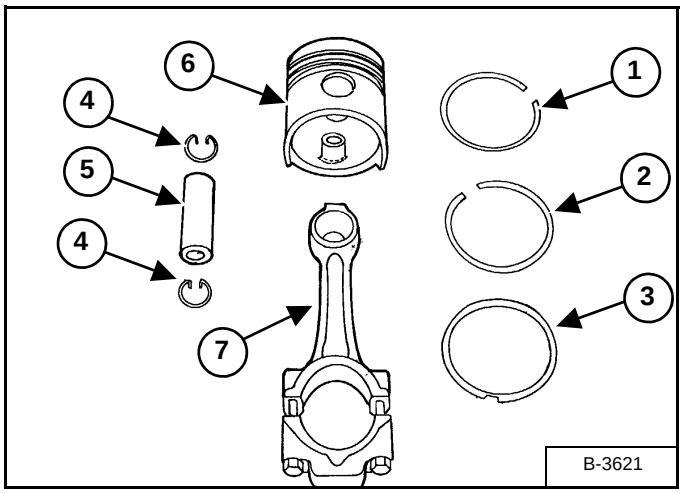


Installation: Make sure the marks (Item 1) on the connecting rod and bearing are aligned when installing the bearing cap **[Figure 60-80-60]**.

Repeat the procedure to remove the other piston / connecting rod assemblies from the engine block.

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

Figure 60-80-61



Remove the first compression ring (Item 1) **[Figure 60-80-61]**.

Remove the second compression ring (Item 2) **[Figure 60-80-61]**.

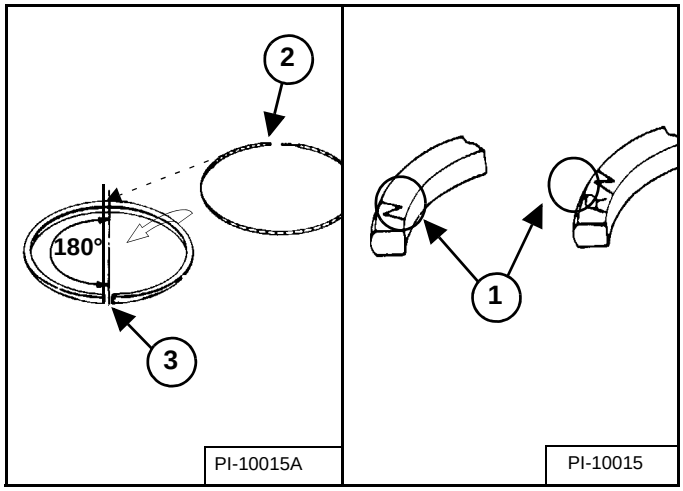
Remove the oil ring (Item 3) **[Figure 60-80-61]**.

Remove the snap ring (Item 4) and piston pin (Item 5) **[Figure 60-80-61]**.

Separate the piston (Item 6) from the connecting rod (Item 7) **[Figure 60-80-61]**.

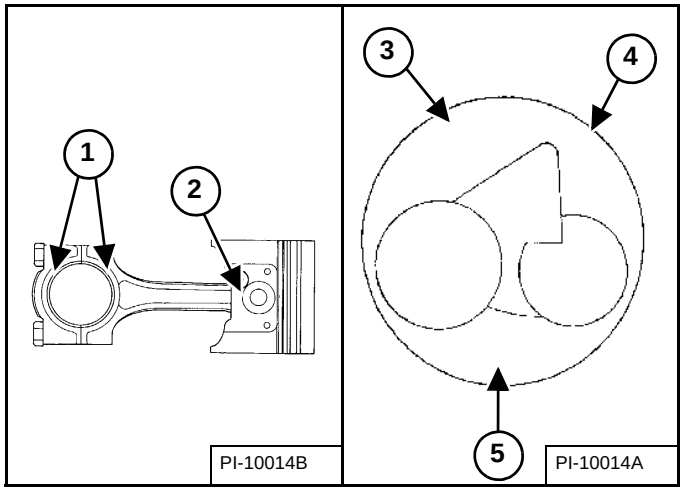
NOTE: Make sure the piston and rod assembly is marked so as not to change the piston rod assembly with another piston or connecting rod.

Figure 60-80-62



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 60-80-62]**.

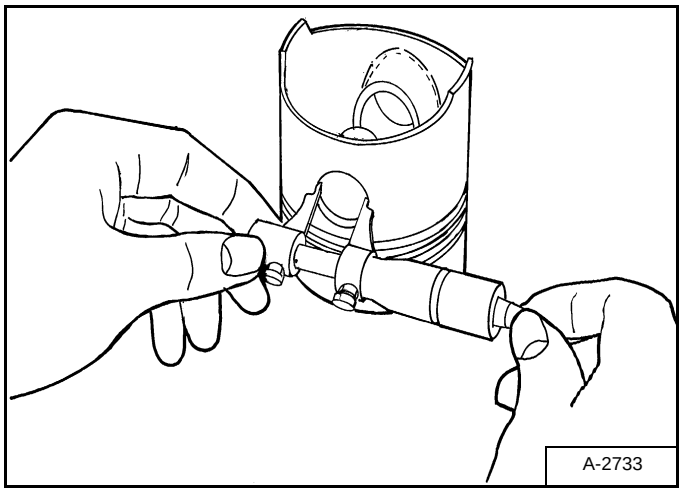
Figure 60-80-63



Installation: When reassembling, align the marks (Item 1) on the connecting rod and piston (Item 2). Heat the piston in oil to 176° F (80° C) 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 60-80-63]** with no gap facing the piston pin in the cylinder.

Piston And Connecting Rod, Servicing

Figure 60-80-64

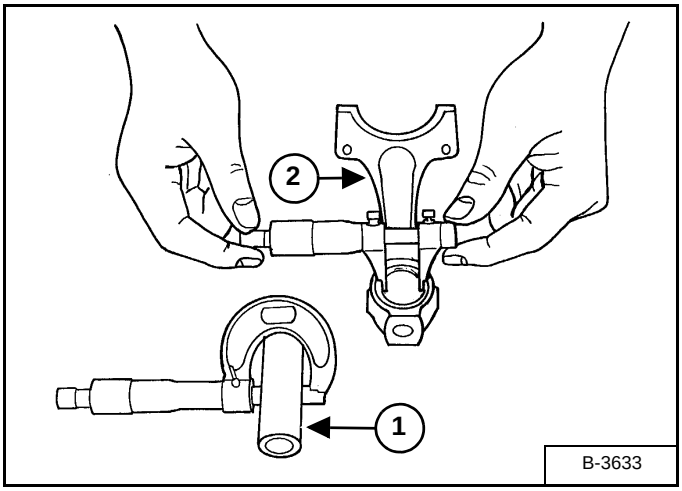


Measure the I.D. of the piston pin bore in both horizontal and vertical direction **[Figure 60-80-64]**.

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

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

Figure 60-80-65



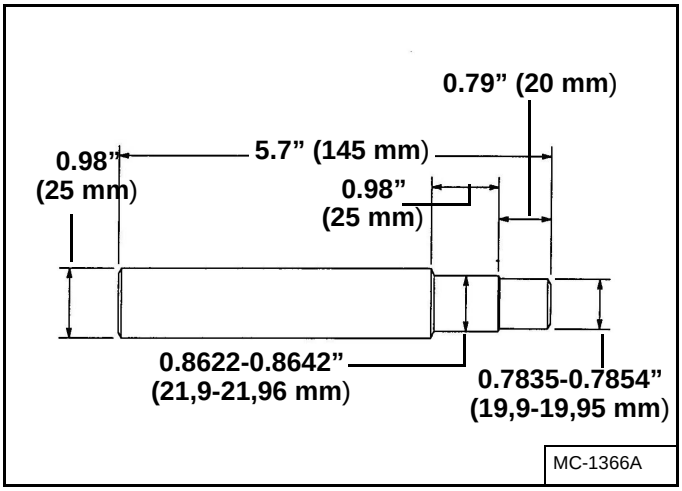
Measure the O.D. of the piston pin (Item 1) **[Figure 60-80-65]**.

Measure the I.D. of the connecting rod small end (Item 2) **[Figure 60-80-65]**.

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

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

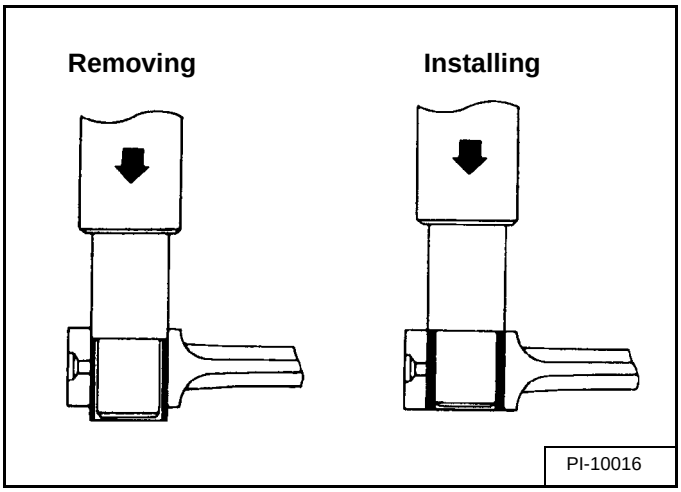
Figure 60-80-66



To replace the connecting rod small end bushing, make a driver tool as shown in figure **[Figure 60-80-66]**.

Piston And Connecting Rod, Servicing (Cont'd)

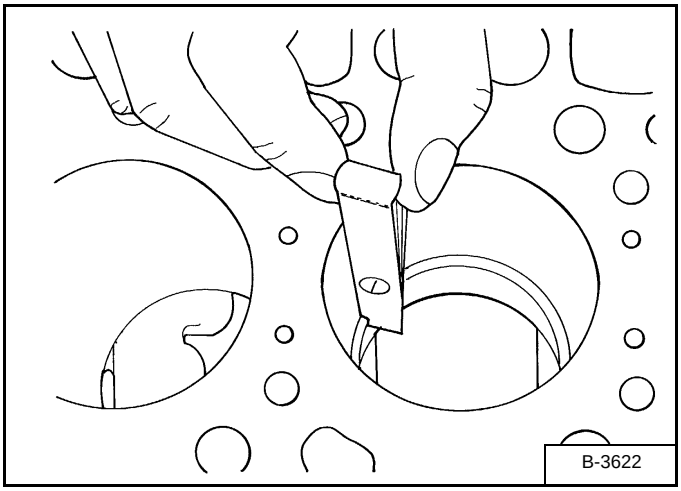
Figure 60-80-67



Use a press and special driver tool to remove the small end bushing **[Figure 60-80-67]**.

Installation: Clean the small end bushing and bore. Put oil on the bushing and press into the connecting rod until it is flush **[Figure 60-80-67]**.

Figure 60-80-68

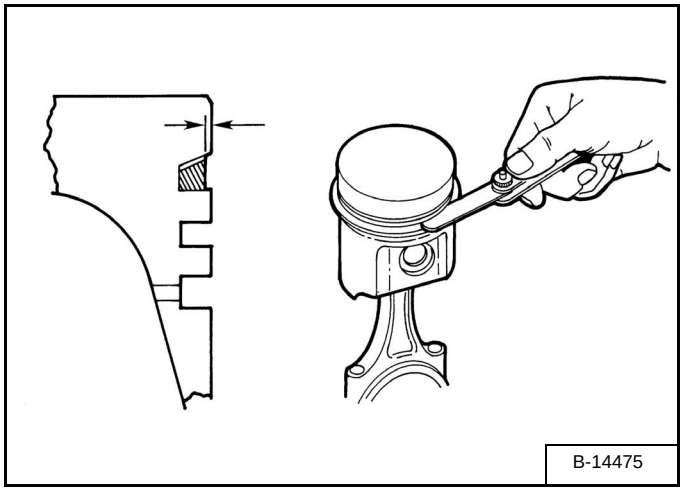


Install a new piston ring into the lower part of the cylinder bore. Measure the ring gap with a feeler gauge **[Figure 60-80-68]**.

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

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

Figure 60-80-69



Remove the carbon from the ring grooves. Measure the clearance between the ring and groove with a feeler gauge **[Figure 60-80-69]**.

Second ring	0.0033-0.0045 in. (0,09-0,12 mm)
Oil ring	0.0016-0.0031 in. (0,04-0,08 mm)
Allowable limit second ring	
	0.0059 in. (0,15 mm)
Allowable limit oil ring	
	0.0059 in. (0,15 mm)

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

Connecting Rod Alignment

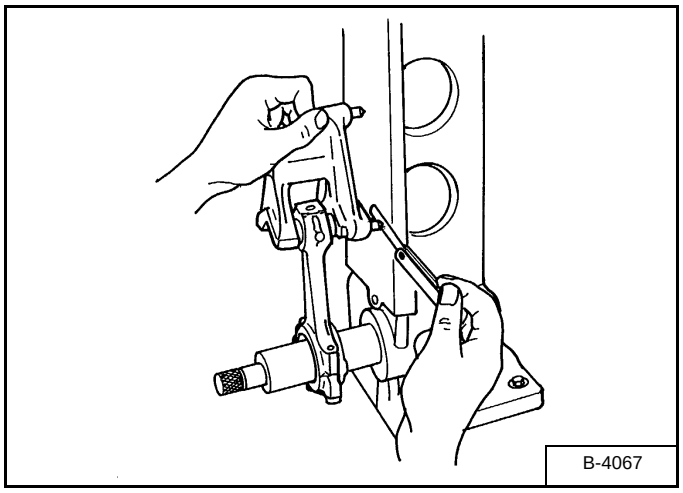
NOTE: The small end bushing is the basis of this check, check the bushing for wear before doing this check.

Install the piston pin into the connecting rod.

Install the connecting rod on an alignment tool.

Put the gauge over the piston pin and move it against the face plate.

Figure 60-80-70



If the gauge does not fit squarely against the face place, measure the space between the gauge and face plate **[Figure 60-80-70]**.

If the measurement exceeds the allowable limit, replace the connecting rod.

Rod Alignment Allowable Limit

0.002 in.(0,05 mm)

Crankshaft And Bearings Removal And Installation

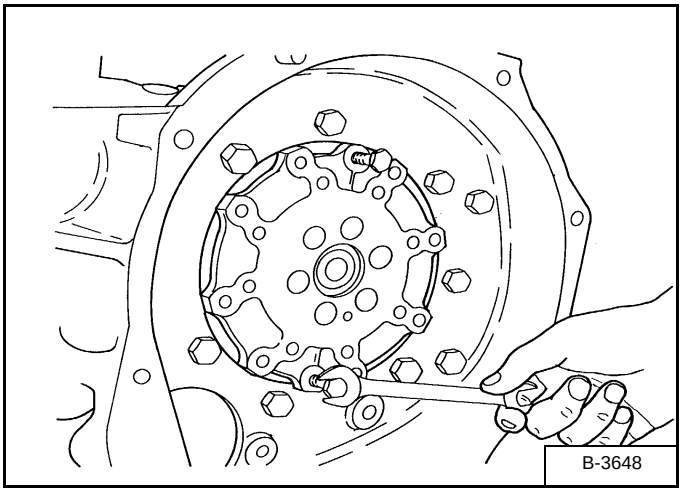
Remove the piston and connecting rod assemblies (See Piston And Connecting Rod Removal And Installation on Page 60-80-21.)

Remove the engine flywheel (See Cylinder Head Removal And Installation on Page 60-80-1.)

Remove the bolts which fasten the bearing case cover to the block.

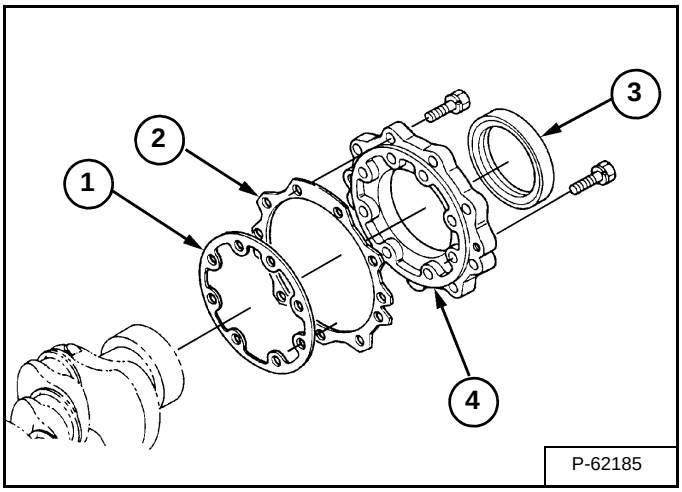
Installation: Tighten the bearing case cover bolts to 7-8 ft.-lb. (10-11 N•m) torque. Tighten bolts with even force on the diagonal line.

Figure 60-80-71



Install two bolts into the bearing case cover and pull the cover out **[Figure 60-80-71]**.

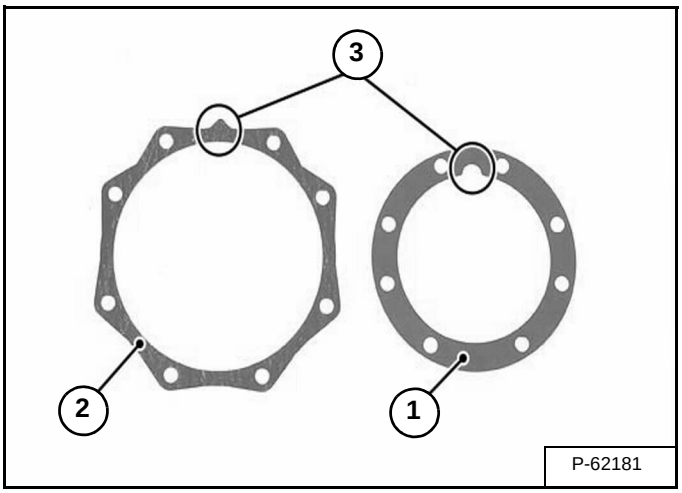
Figure 60-80-72



Installation: When installing the cover (Item 4), make sure the casting mark (Item 3) is in the up position. Lightly oil inside lip of oil seal (Item 3) **[Figure 60-80-72]**.

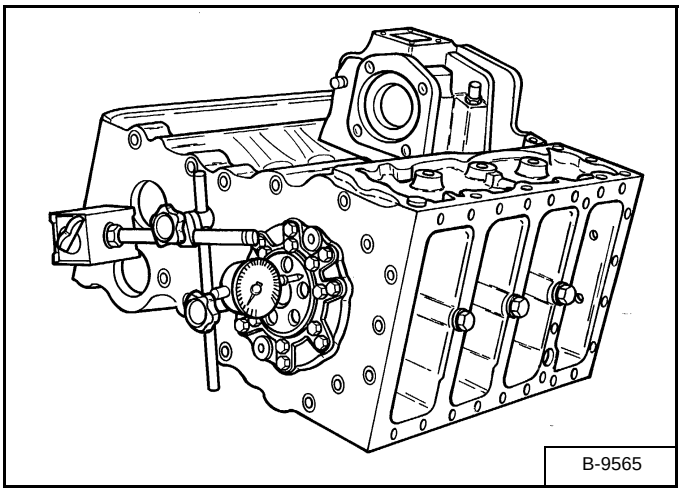
Crankshaft And Bearings Removal And Installation (Cont'd)

Figure 60-80-73



Installation: When installing the bearing case gasket (Item 1) **[Figure 60-80-72]** and **[Figure 60-80-73]**, and the bearing case cover gasket (Item 2) **[Figure 60-80-72]** and **[Figure 60-80-73]** make sure the mark (Item 3) **[Figure 60-80-73]** is in the up position.

Figure 60-80-74

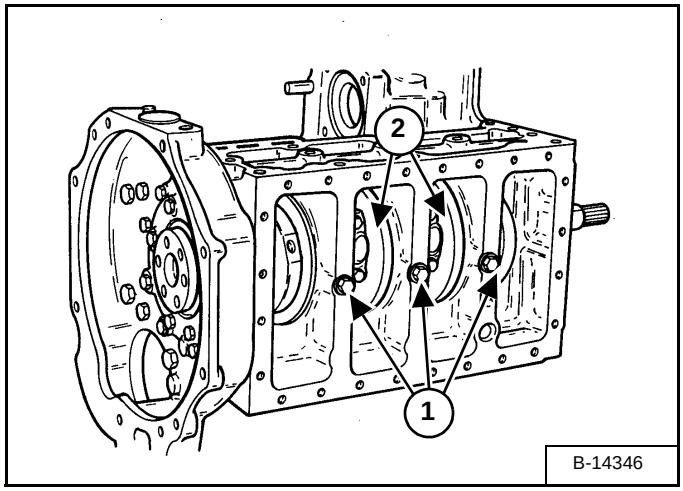


Before removing the crankshaft / main bearings, check the end play. Install a dial indicator. Measure the end play by moving the crankshaft back and forth **[Figure 60-80-74]**.

If the measurement exceeds the allowable limit, replace the thrust washers.

End Play	0.006-0.012 in. (0,15-0,31 mm)
Allowable Limit	0.020 in. (0,5 mm)

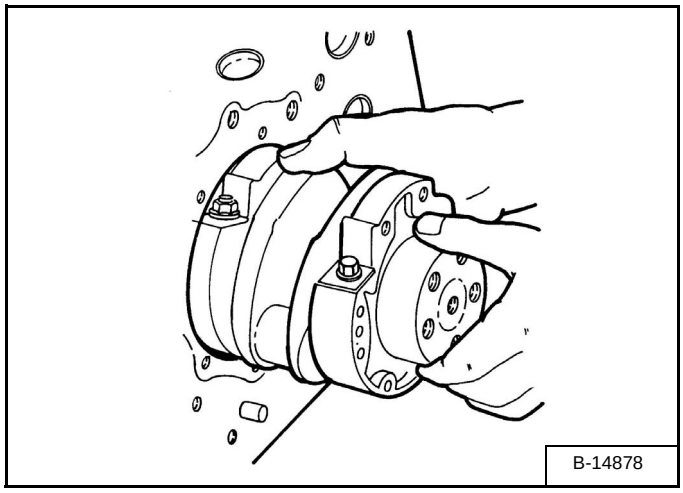
Figure 60-80-75



Remove the main bearing case bolt (Item 1) **[Figure 60-80-75]**.

Installation: Align the bearing case hole (Item 2) **[Figure 60-80-75]** with the hole in the block. Put oil on the bolt threads and tighten to 20-22 ft.-lb. (27-30 N•m) torque.

Figure 60-80-76

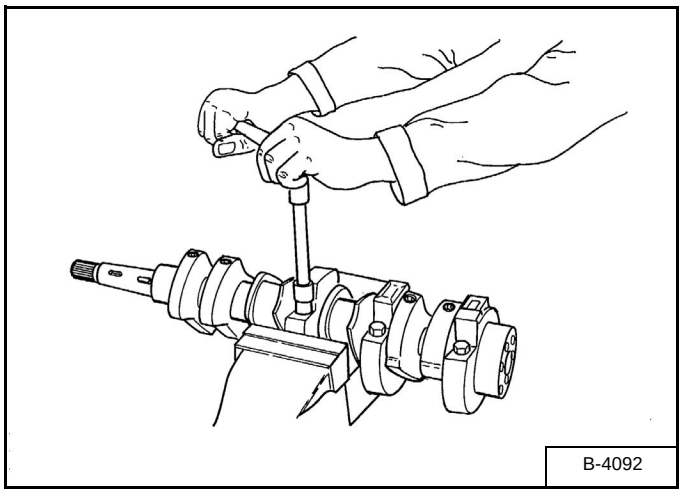


Remove the crankshaft / main bearing assembly from the engine block **[Figure 60-80-76]**.

Mark the bearing case halves for correct installation.

Crankshaft And Bearings Removal And Installation (Cont'd)

Figure 60-80-77

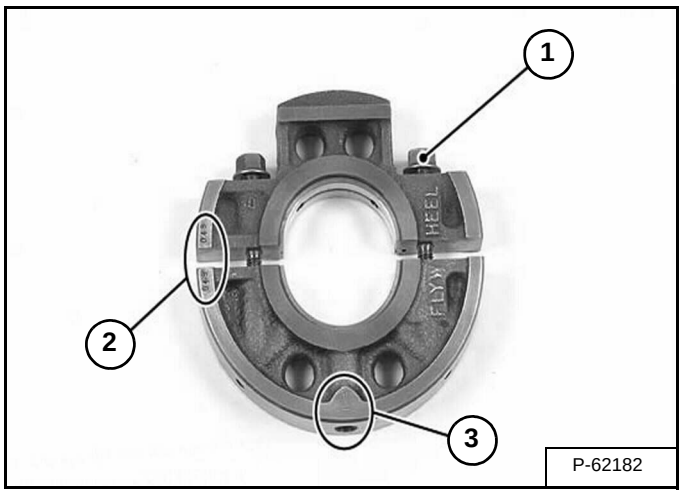


Remove the two bearing case bolts **[Figure 60-80-77]**.

Remove the bearing case and bearing.

Installation: Tighten the bearing case bolts (Item 1) **[Figure 60-80-78]** to 9-12 ft.-lb. (13-16 N•m) torque.

Figure 60-80-78

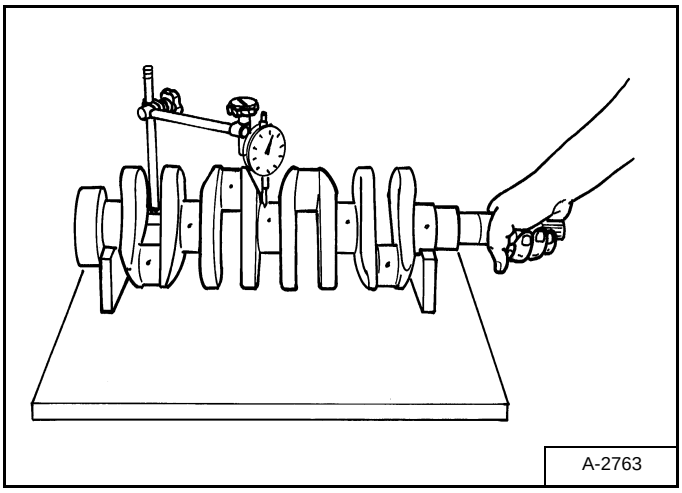


Installation: When installing the main bearing case assemblies, face the mark FLYWHEEL to the flywheel side of the engine block **[Figure 60-80-78]**. Be sure the thrust washer with its oil grooves face outward.

Identification marks on the main bearing case assemblies are the alignment number (Item 2) and the marking "1" or "2" (Item 3) **[Figure 60-80-78]** can be found on the main bearing case assemblies to ensure proper assembly.

Crankshaft And Bearings, Servicing

Figure 60-80-79



Put the crankshaft on V-blocks. Install a dial indicator on the center journal **[Figure 60-80-79]**.

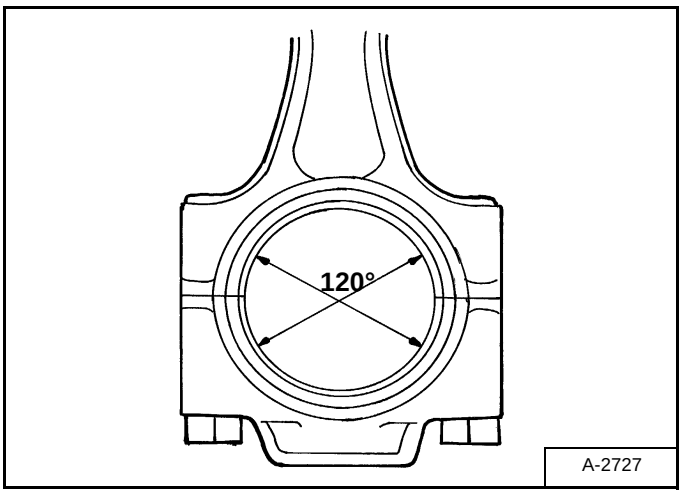
Turn the crankshaft at a slow rate.

If the misalignment exceeds the allowable limit, replace the crankshaft.

Alignment	0.0008 in. (0,02 mm)

Tighten the connecting rod cap bolts 20-22 ft.-lb. (27-30 N•m) torque.

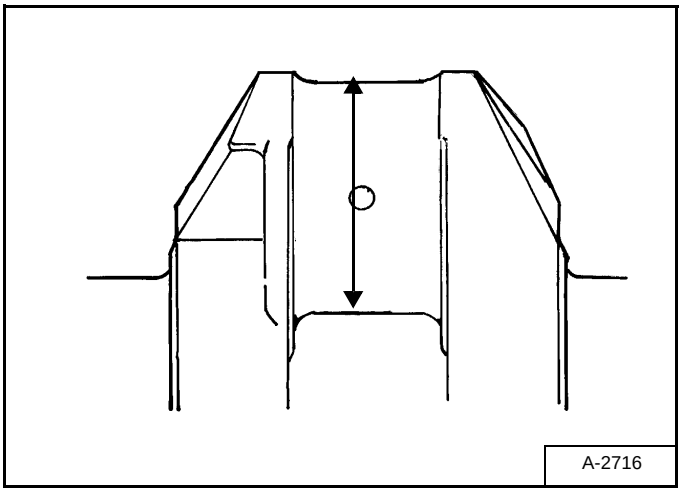
Figure 60-80-80



Measure the crankpin bearing I.D. **[Figure 60-80-80]**.

Crankshaft And Bearings, Servicing (Cont'd)

Figure 60-80-81



Measure the crankpin O.D. **[Figure 60-80-81]**.

Calculate the oil clearance.

Crankpin Bearing I.D.	
	1.3389-1.3390 in. (33,99 -34,01 mm)
Crankpin O.D.	1.3370-1.3376 in. (33,96-33,98 mm)
Oil Clearance	0.0008-0.0020 in.(0,020-0,051 mm)
Allowable limit	0.0059 in. (0,15 mm)

Figure 60-80-82

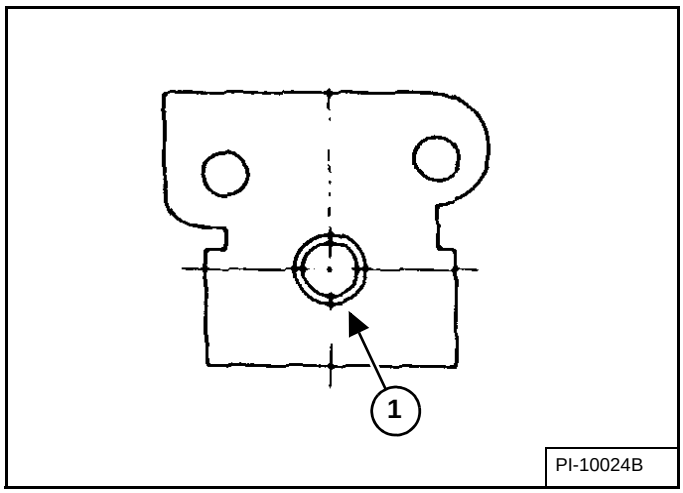
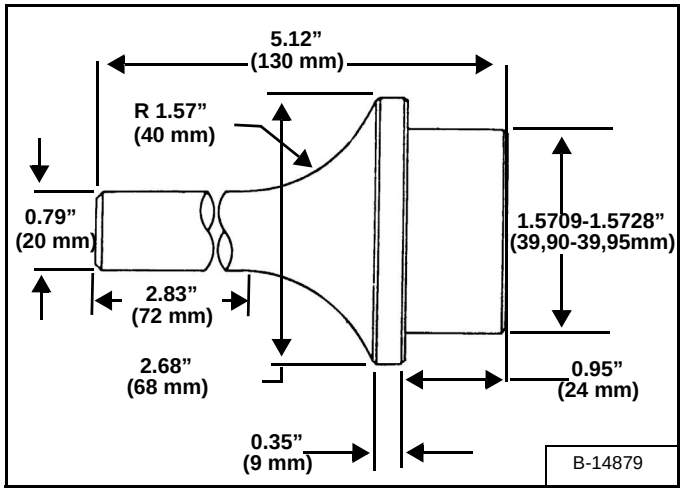


Figure 60-80-83



Remove the bearing (Item 1) **[Figure 60-80-82]** from the front of the engine block with the removal tool shown in **[Figure 60-80-83]**.

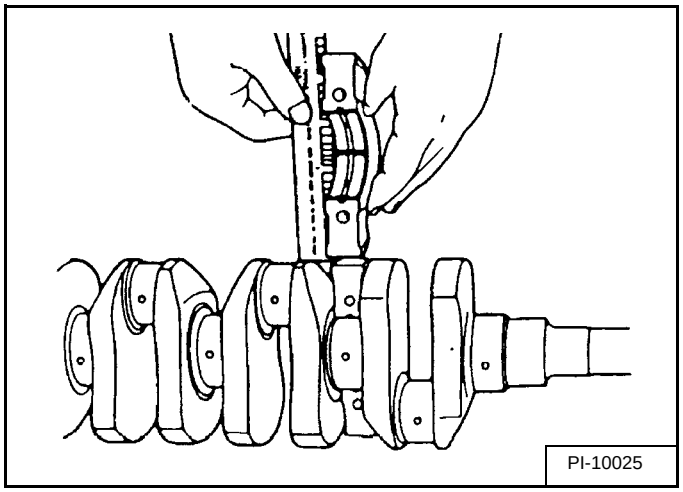
Installation: Clean the new bearing and bore and apply oil to them. Install the new bearing with the installation driver tool **[Figure 60-80-82]**.

Clean the crankshaft journal and bearing. Put a strip of press gauge on the center journal.

Install the main bearing case halves and tighten the bolts to 9-12 ft.-lb. (12,7-15,7 N•m) torque. Remove the bearing case halves.

Crankshaft And Bearings, Servicing (Cont'd)

Figure 60-80-84



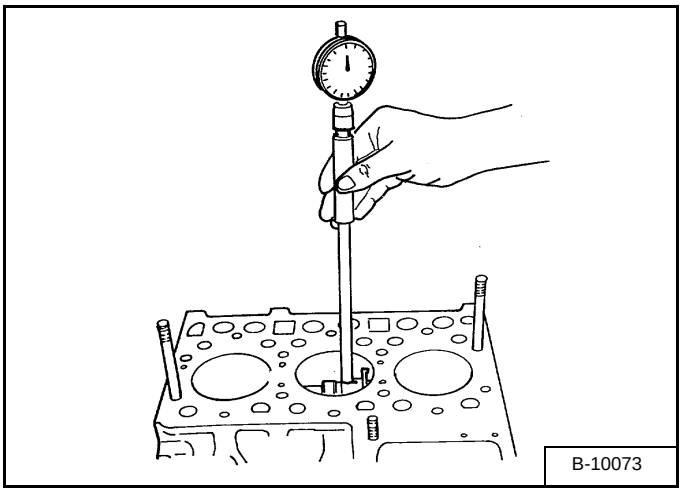
Measure the flattened press gauge **[Figure 60-80-84]**.

If the clearance exceeds the allowable limit, replace the crankshaft bearing.

Crankshaft Journal O.D. (Flywheel side)	
	1.7297-1.7303 in. (43,93-43,95 mm)
Bearing I.D.	1.7317-1.7333 in. (43,98-44,03 mm)
Crankshaft Journal O.D. (Middle)	
	1.5722-1.5728 in. (39,93-39,95 mm)
Bearing I.D.	1.5742-1.5758 in. (39,98-40,03 mm)
Crankshaft journal O.D. (Front)	
	1.5722-1.5728 in. (39,93-39,95 mm)
Bearing I.D.	1.5714-1.5764 in. (39,98-40,04 mm)
Oil Clearance	0.0013-0.0042 in. (0,034-0,106 mm)
Allowable Limit	0.008 in. (0,2 mm)

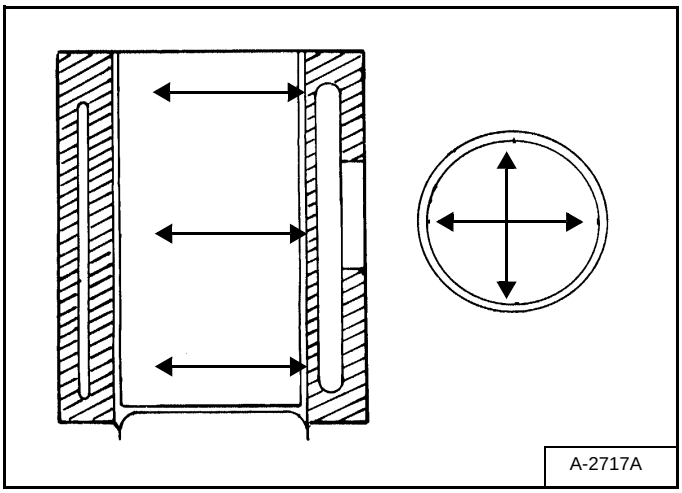
Cylinder Bore, Checking

Figure 60-80-85



Check the inside diameter of the cylinder line **[Figure 60-80-85]**.

Figure 60-80-86



To find the maximum wear check the inside diameter in six different locations **[Figure 60-80-86]**.

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

Cylinder Bore I.D.	2.638-2.639 in. (67,0-67,02 mm)
Allowable Limit	2.644 in. (67,17 mm)

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

Water Pump Removal And Installation

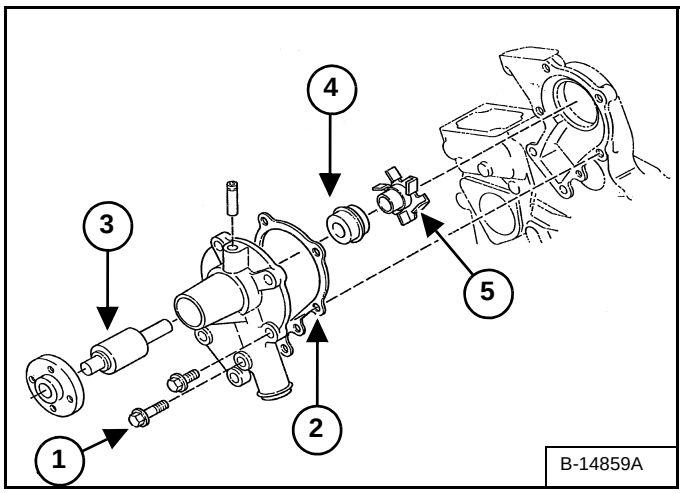
Drain the cooling system.

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

Remove the alternator belt.

Remove the fan.

Figure 60-80-87



Remove the water pump bolts (Item 1) **[Figure 60-80-87]**.

Remove the water pump.

Installation: Always use a new gasket (Item 2) **[Figure 60-80-87]** when installing the water pump and apply Liquid-Type Gasket (Three Bond 1215 or equivalent) to both sides of new gasket.

Water Pump Disassembly And Assembly

Put the water pump in a vise.

Remove the pulley.

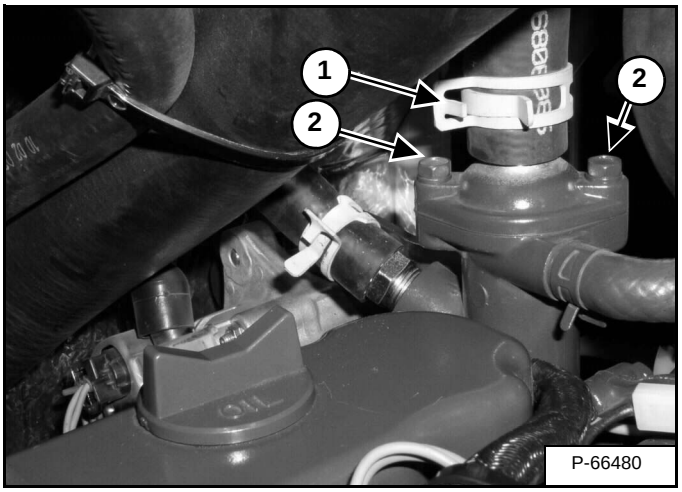
Press the shaft (Item 3) **[Figure 60-80-87]** out of the pulley side of the water pump. Press out the shaft with the impeller on it.

Remove the seal (Item 4) and impeller (Item 5) **[Figure 60-80-87]**.

Install a new seal when assembling the water pump.

Thermostat Removal And Installation

Figure 60-80-88



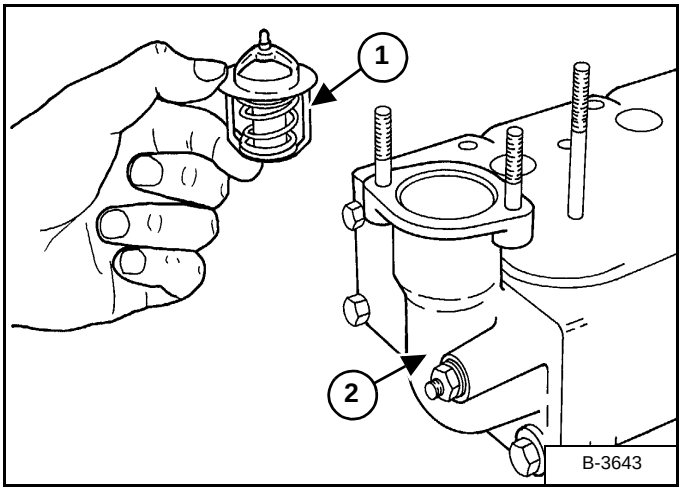
Drain the engine coolant until it is below the thermostat level.

Remove the hose (Item 1) **[Figure 60-80-88]**.

Remove the bolts (Item 2) **[Figure 60-80-88]** and thermostat housing.

Installation: Make sure all gasket surfaces are clean. Replace the gasket before installing the thermostat housing. Install liquid gasket to thermostat housing.

Figure 60-80-89



Remove the housing and thermostat (Item 1) **[Figure 60-80-89]**.

Remove the four mounting bolts at the coolant housing (Item 2) **[Figure 60-80-89]**.

Remove coolant housing from the engine block.

Testing The Thermostat

Hang the thermostats in a suitable container filled with coolant.

Heat the coolant gradually. Use a thermometer to check the temperature when it starts to open and when it's fully open.

If the thermostats do not operate correctly they must be replaced.

NOTE: See specifications on the thermostat (See Thermostat on Page 60-60-5.)


Bobcat®

HEATER

HEATER COIL 70-40-1
Removal And Installation. 70-40-1

HEATER FAN 70-50-1
Removal And Installation. 70-50-1

HEATER SYSTEM 70-10-1
Components 70-10-1
Description 70-10-1

HEATER UNIT 70-30-1
Louver Removal and Installation 70-30-2
Removal And Installation. 70-30-1
Threaded Insert Removal And Installation 70-30-2

HEATER VALVE 70-60-1
Removal And Installation. 70-60-1

REGULATOR MAINTENANCE. 70-20-1
Filter Element Removal And Installation 70-20-1
Heater Coil 70-20-1


Bobcat®

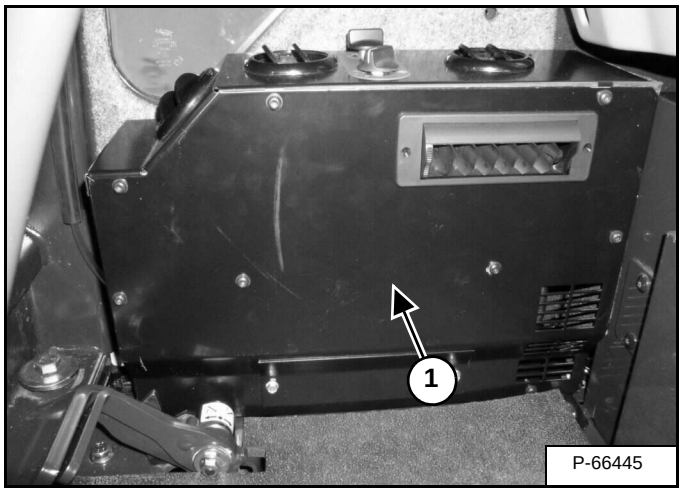
HEATER SYSTEM

Description

The heater system includes the heater unit which is located on the floor on the right side of excavator cab. The heater unit includes the heater coil, fan motor, blower cages, a temperature switch, fan switch, filter and louvers.

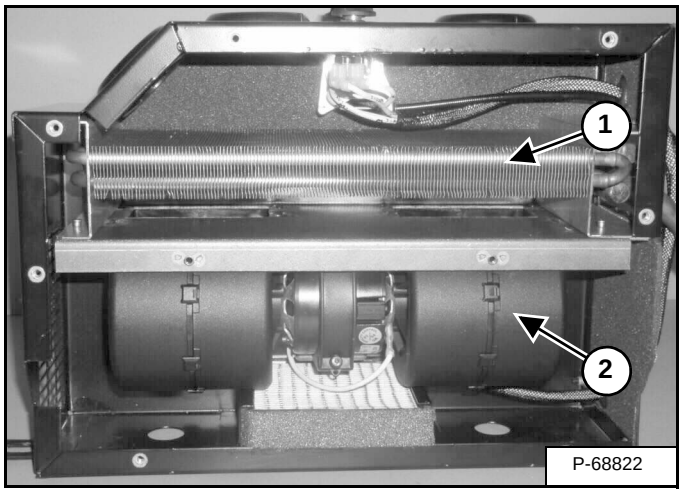
Components

Figure 70-10-1



Heater Unit: The heater unit (Item 1) **[Figure 70-10-1]** is located on the floor on the ride side of the excavator cab. The unit delivers the warm air for heat into the cab.

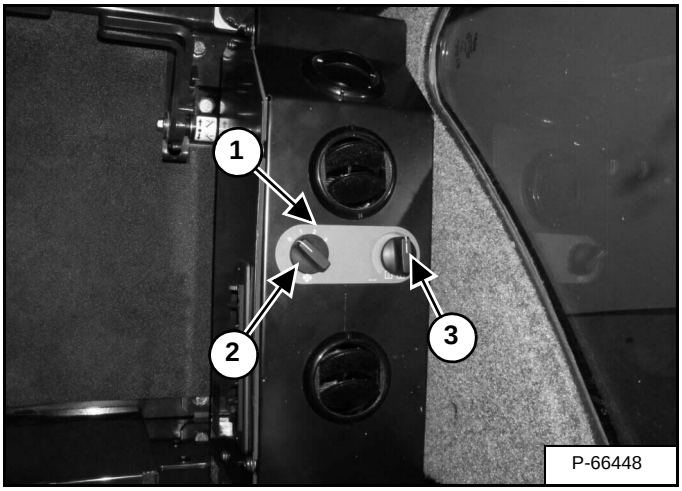
Figure 70-10-2



Heater Coil: The heater coil (Item 1) **[Figure 70-10-2]** supplies the warm air into the cab by passing air through the coil.

Heater Fan: The fan (Item 2) **[Figure 70-10-2]** is used to push air through the heater coil and into the cab.

Figure 70-10-3

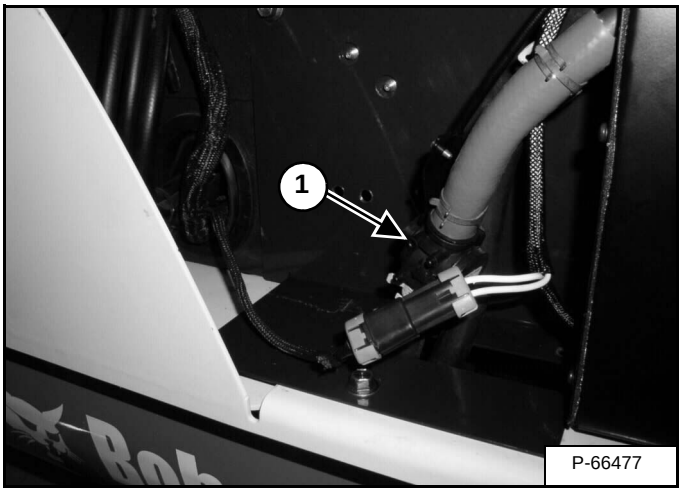


Control Panel: The panel (Item 1) **[Figure 70-10-3]** has three separate components:

Fan Switch: This is a four position rotary switch (Item 2) **[Figure 70-10-3]**.

Temperature Switch: The temperature switch (Item 3) **[Figure 70-10-3]** controls the Heat Valve from fully Off to fully On.

Figure 70-10-4



Heater Valve: The heater valve (Item 1) **[Figure 70-10-4]** is manually controls the amount of engine coolant that flows to the heater coil.

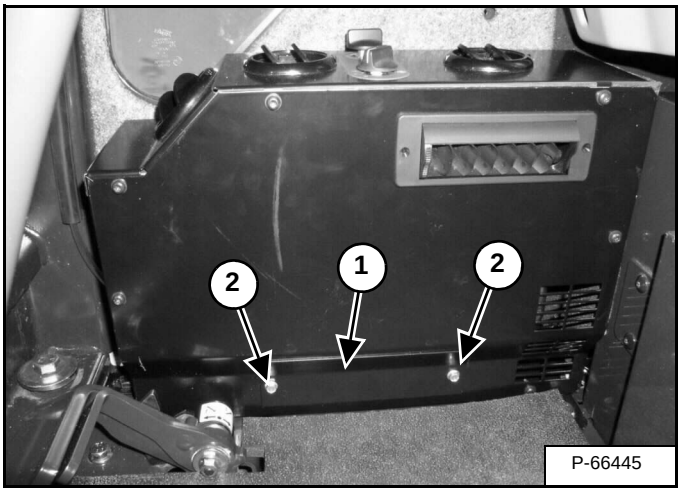

Bobcat®

REGULATOR MAINTENANCE

Filter Element Removal And Installation

The recirculation filter must be cleaned regularly. The filter is located at the right of the operator seat.

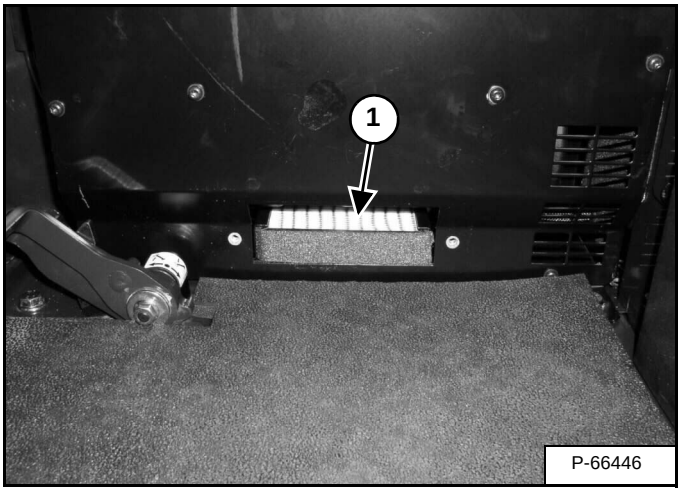
Figure 70-20-1



The cab filter is located on the lower side of the heater panel (Item 1) **[Figure 70-20-1]**.

Remove the two bolts (Item 2) **[Figure 70-20-1]** and remove the panel.

Figure 70-20-2

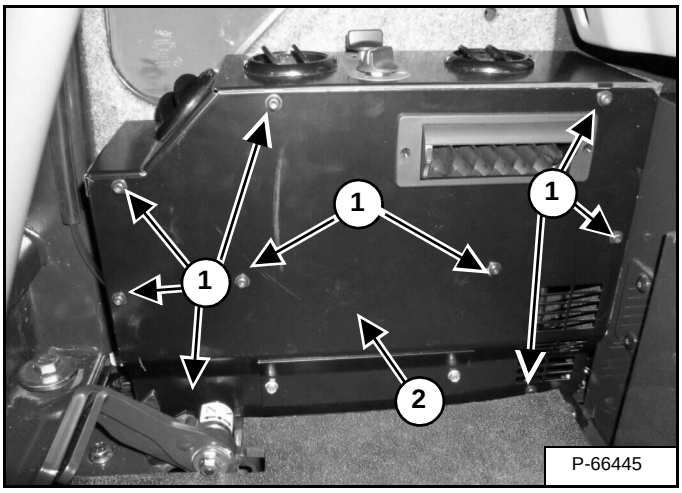


Remove the filter (Item 1) **[Figure 70-20-2]**. Shake the filter or use low air pressure to remove debris. Replace the filter after three cleanings or if the filter becomes to dirty to clean or damaged.

Reinstall the filter, cover and bolts.

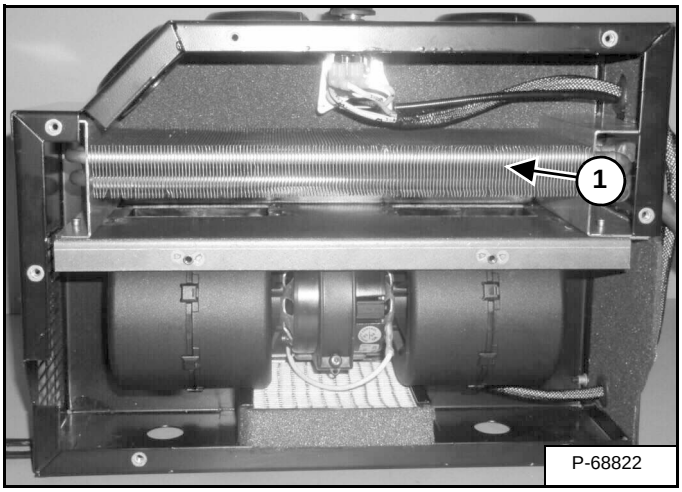
Heater Coil

Figure 70-20-3



Remove the nine bolts and washers (Item 1) and remove the panel (Item 2) **[Figure 70-20-3]**.

Figure 70-20-4



The heater coil (Item 1) **[Figure 70-20-4]** can be now be cleaned with low pressure water or air. High pressure may damage the fins of the heater coil.


Bobcat®

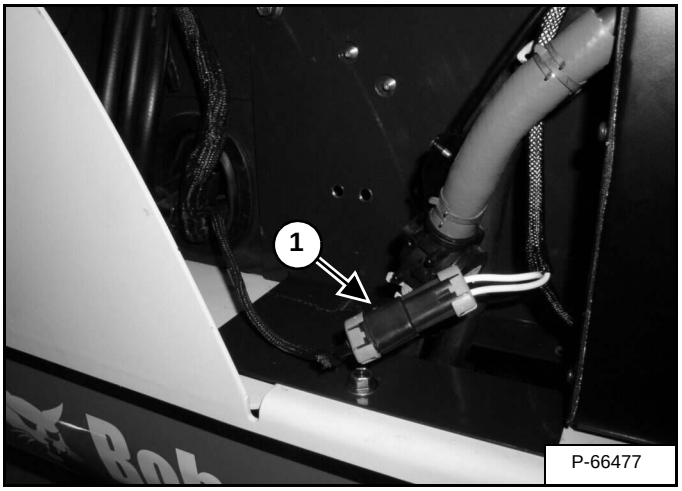
HEATER UNIT

Removal And Installation

Drain the engine coolant (See Replacing The Coolant on Page 10-70-1.)

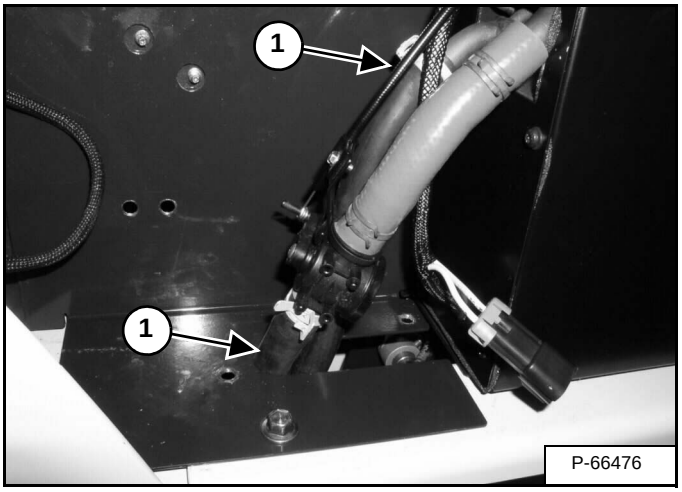
Remove the cab (See Removal And Installation on Page 40-30-1.)

Figure 70-30-1



Disconnect the heater wire harness (Item 1) **[Figure 70-30-1]**.

Figure 70-30-2

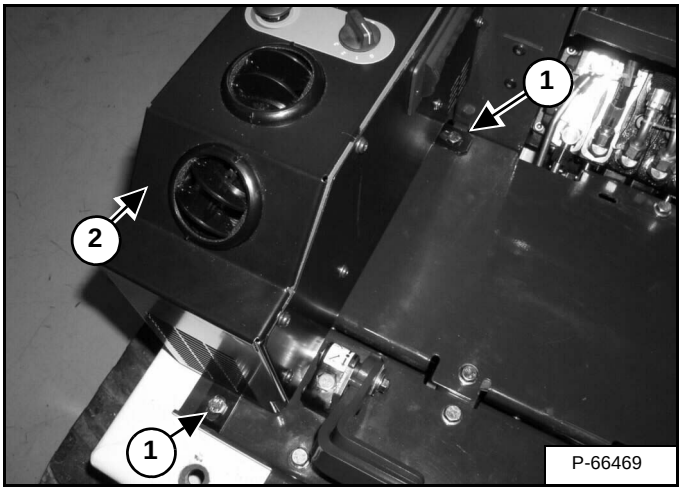


Mark the two hoses (Item 1) **[Figure 70-30-2]** for ease of assembly.

Disconnect and cap the two hoses (Item 1) **[Figure 70-30-2]**.

Cap the heater fittings once the hoses are removed.

Figure 70-30-3

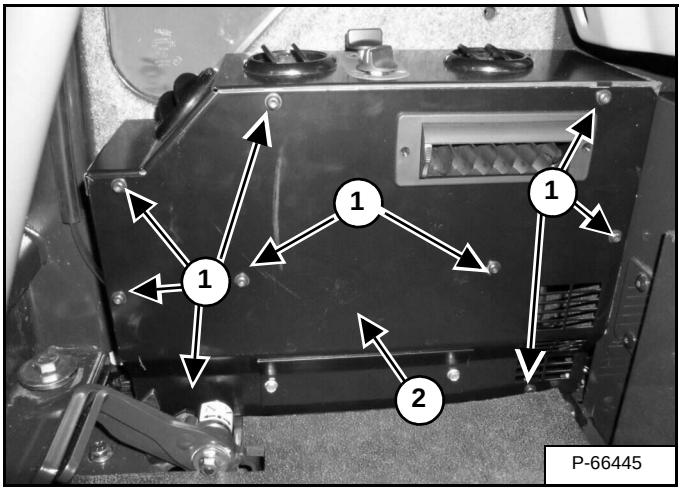


Remove the two screws (Item 1) **[Figure 70-30-3]** mounting the heater to the floor panels.

Remove heater assembly (Item 2) **[Figure 70-30-3]** from the excavator.

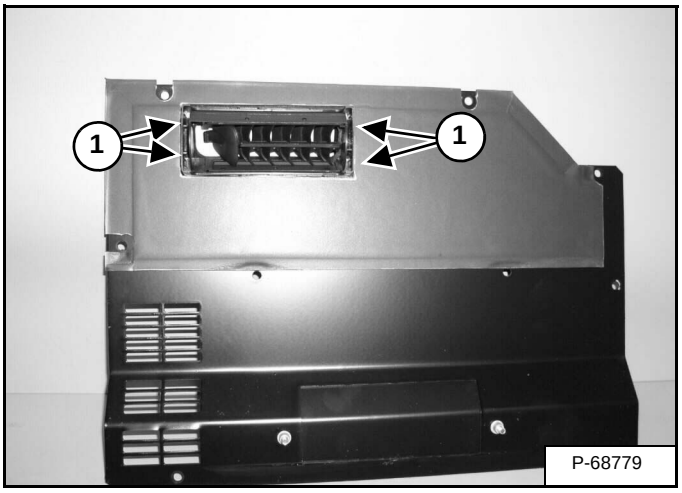
Louver Removal and Installation

Figure 70-30-4



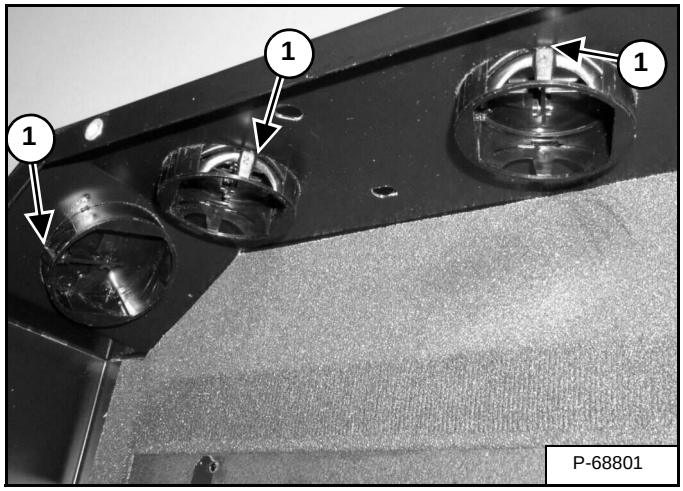
Remove the nine bolts and washers (Item 1) and remove the panel (Item 2) **[Figure 70-30-4]**.

Figure 70-30-5



Push in on the two clips (Item 1) **[Figure 70-30-5]** on each side of the louver and push the louver from the panel.

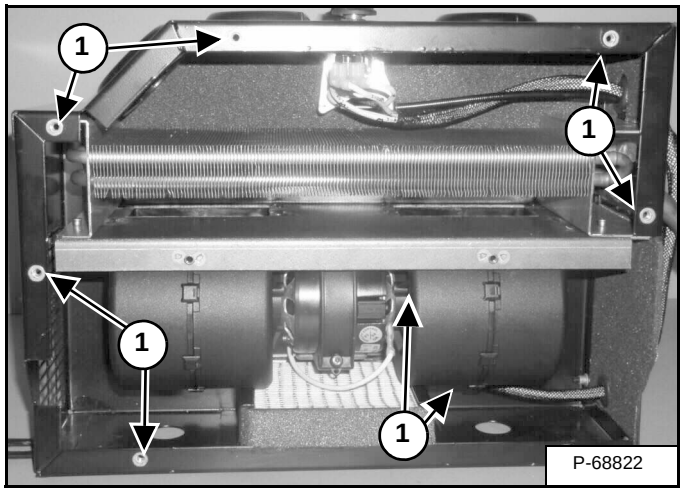
Figure 70-30-6



Push in on the two clips (Item 1) **[Figure 70-30-6]** on each side of each louver and push each louver from the heater box.

Threaded Insert Removal And Installation

Figure 70-30-7



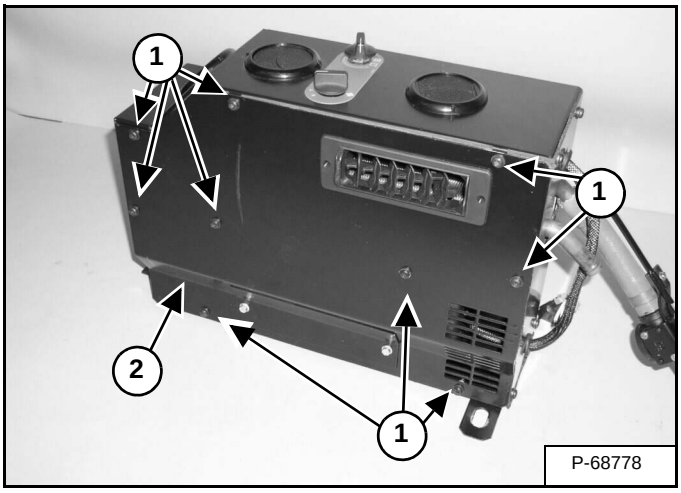
If the threaded insert is damaged, remove and replace the threaded insert (Item 1) **[Figure 70-30-7]** from the heater box.

HEATER COIL

Removal And Installation

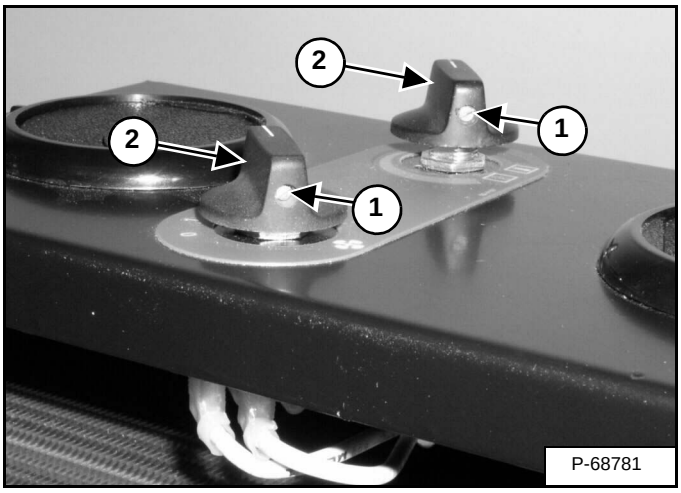
Remove the heater unit (See Removal And Installation on page 70-30-1.)

Figure 70-40-1



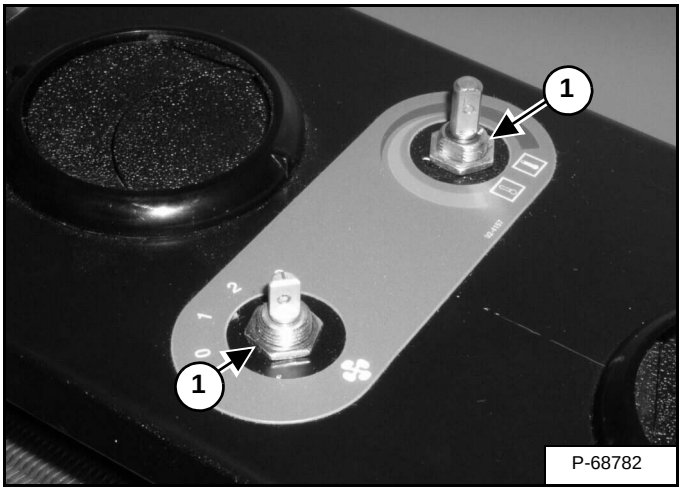
Remove the nine bolts and washers (Item 1) and remove the panel (Item 2) **[Figure 70-40-1]**.

Figure 70-40-2



Loosen the set screws (Item 1) and remove the knobs (Item 2) **[Figure 70-40-2]**.

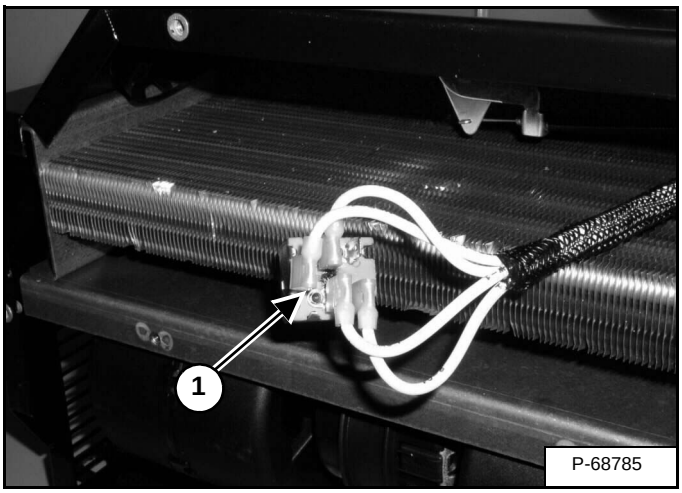
Figure 70-40-3



Remove the two nuts (Item 1) **[Figure 70-40-3]** from the switches.

Push the two switches down into the heater unit.

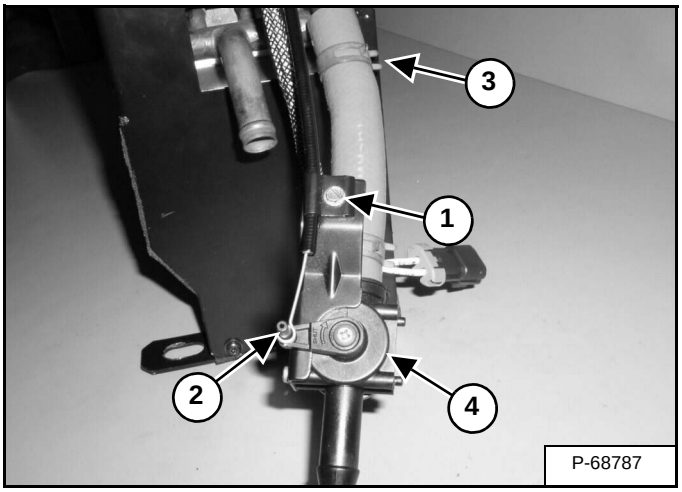
Figure 70-40-4



Mark and remove the wires (Item 1) **[Figure 70-40-4]** from the fan switch.

Removal And Installation (Cont'd)

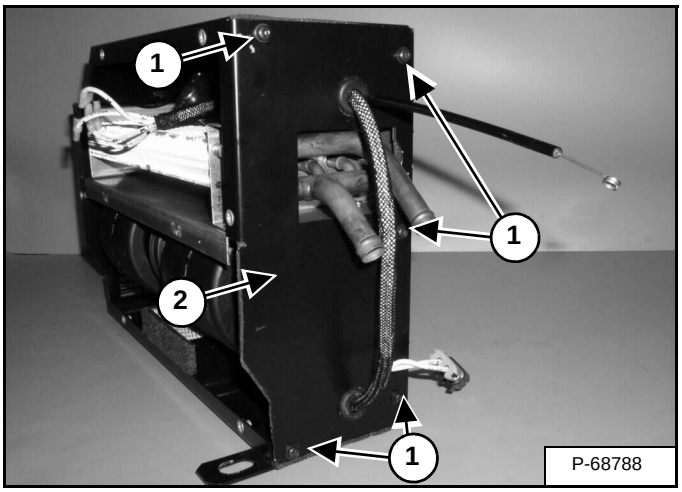
Figure 70-40-5



Loosen the screw (Item 1) on the cable clamp. Slip the cable off the heater valve pin (Item 2) **[Figure 70-40-5]**.

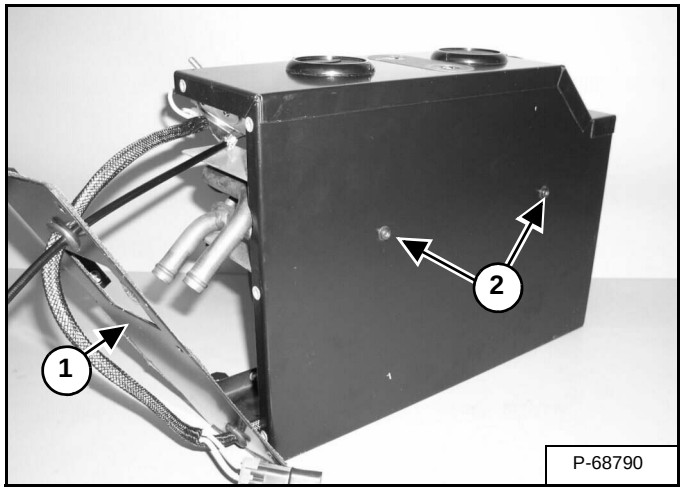
Remove the hose clamp (Item 3) and remove the heater valve assembly (Item 4) **[Figure 70-40-5]** from the heater coil.

Figure 70-40-6



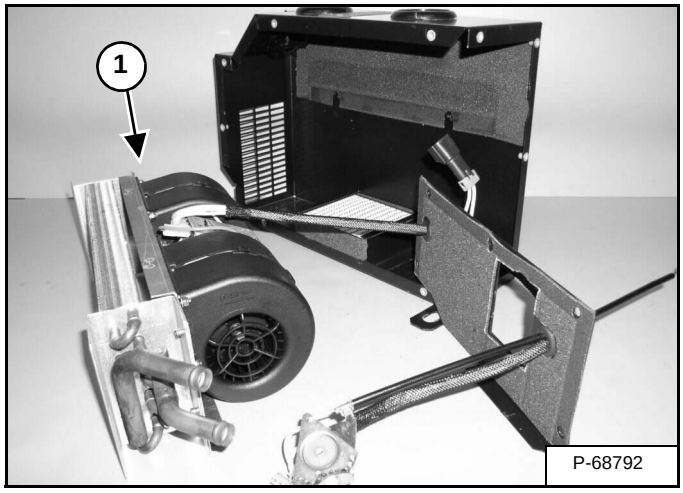
Remove the five bolts and washers (Item 1) and remove the panel (Item 2) **[Figure 70-40-6]**.

Figure 70-40-7



Tilt the panel (Item 1) back and remove the two screws (Item 2) **[Figure 70-40-7]** from the side panel.

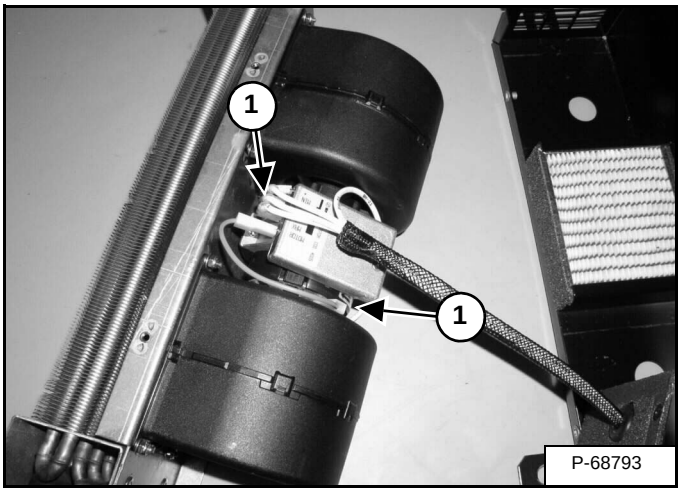
Figure 70-40-8



Remove the heater coil and heater fan assembly (Item 1) **[Figure 70-40-8]** from the heater unit.

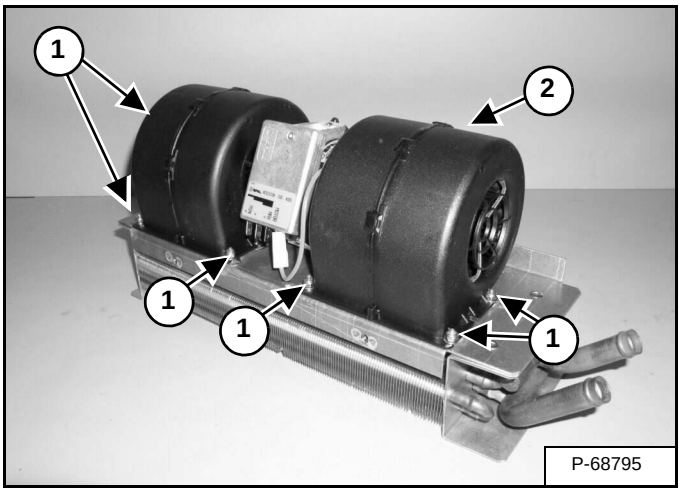
Removal And Installation (Cont'd)

Figure 70-40-9



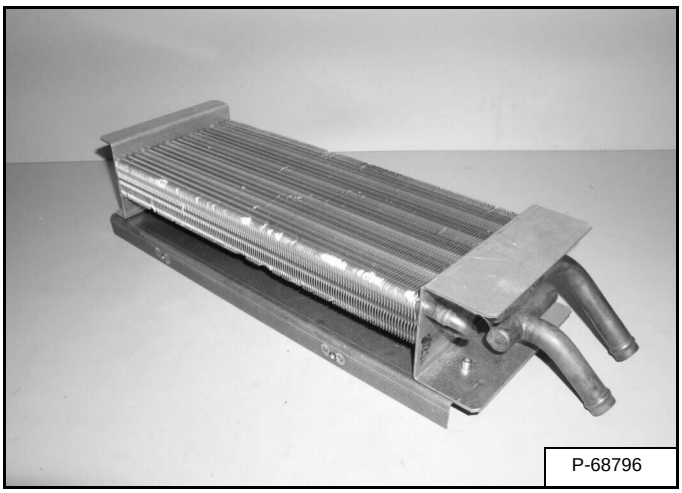
Mark and remove the four wires (Item 1) **[Figure 70-40-9]** from the heater fan motor.

Figure 70-40-10



Remove the six nuts and washers (Item 1) and remove the heater fan assembly (Item 2) **[Figure 70-40-10]**. Remove the heater fan assembly from the heater coil. Heater coil can be repaired or replaced.

Figure 70-40-11



The heater coil **[Figure 70-40-11]** can be cleaned with low air or water pressure.

If the heater coil needs replacement it must be replaced as a complete unit.

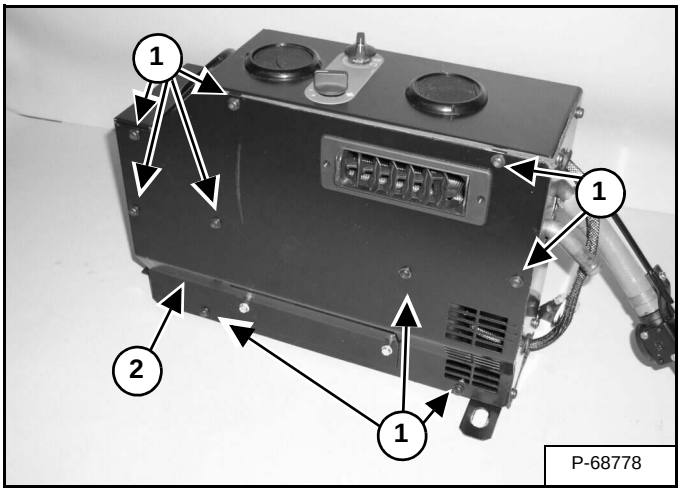

Bobcat®

HEATER FAN

Removal And Installation

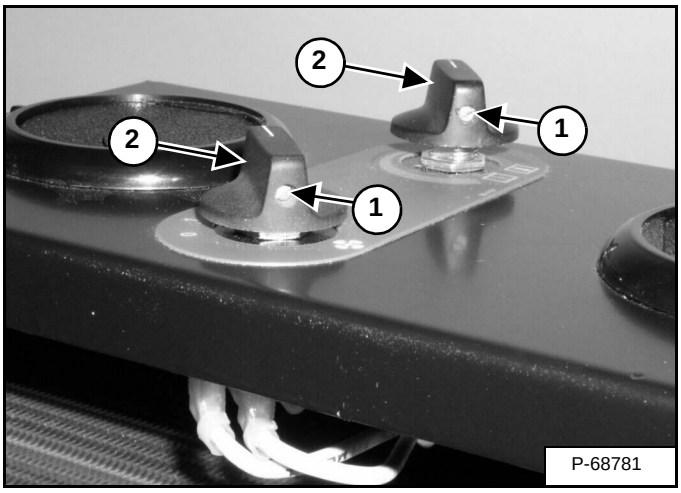
Remove the heater unit (See Removal And Installation on page 70-30-1.)

Figure 70-50-1



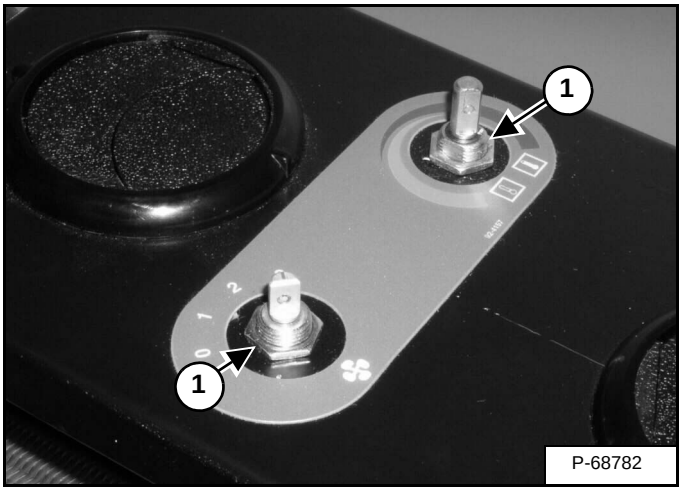
Remove the nine bolts and washers (Item 1) and remove the panel (Item 2) **[Figure 70-50-1]**.

Figure 70-50-2



Loosen the set screws (Item 1) and remove the knobs (Item 2) **[Figure 70-50-2]**.

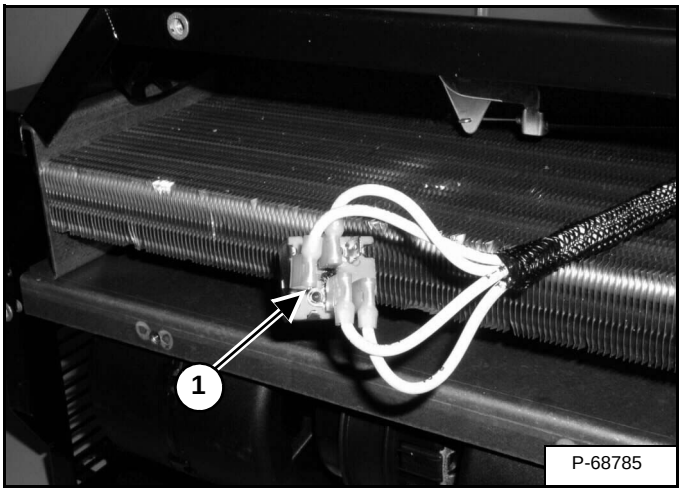
Figure 70-50-3



Remove the two nuts (Item 1) **[Figure 70-50-3]** from the switches.

Push the two switches down into the heater unit.

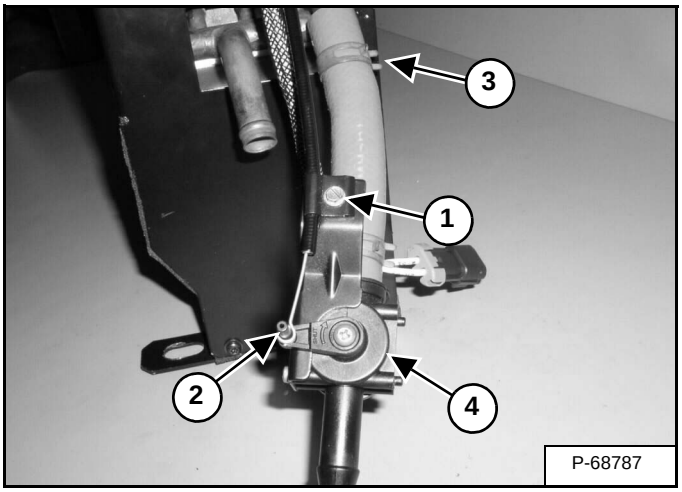
Figure 70-50-4



Mark and remove the wires (Item 1) **[Figure 70-50-4]** from the fan switch.

Removal And Installation (Cont'd)

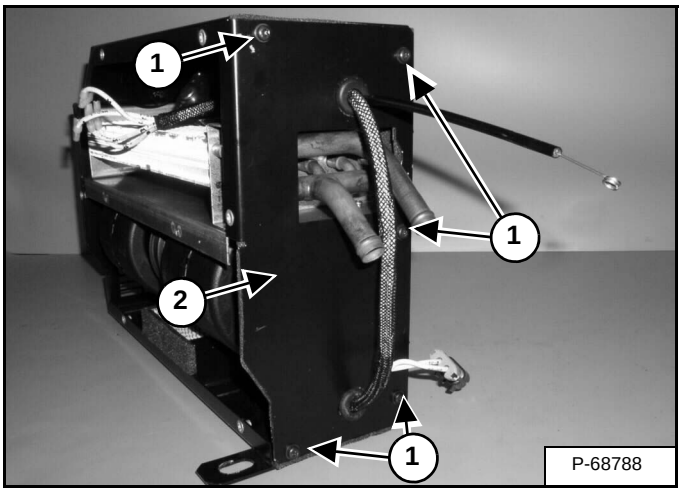
Figure 70-50-5



Loosen the screw (Item 1) on the cable clamp. Slip the cable off the heater valve pin (Item 2) **[Figure 70-50-5]**.

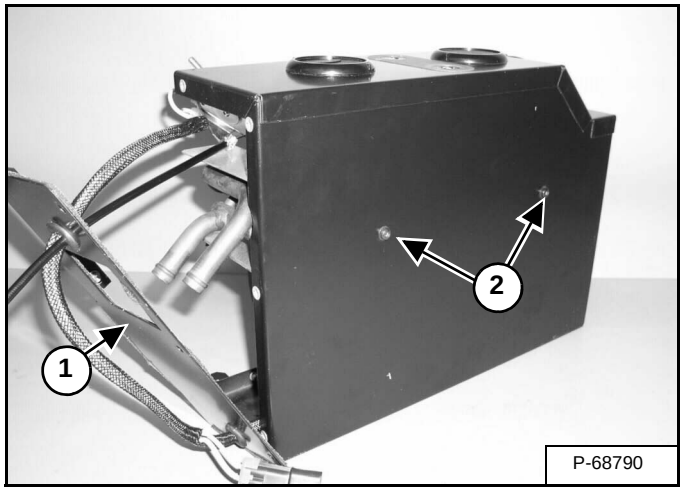
Remove the hose clamp (Item 3) and remove the heater valve assembly (Item 4) **[Figure 70-50-5]** from the heater coil.

Figure 70-50-6



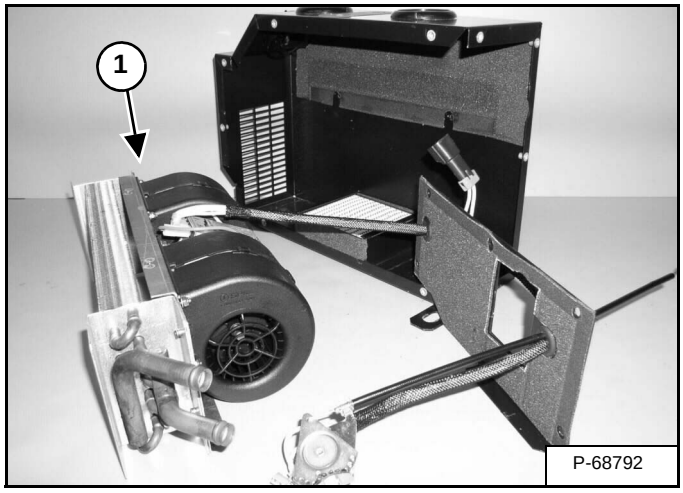
Remove the five bolts and washers (Item 1) and remove the panel (Item 2) **[Figure 70-50-6]**.

Figure 70-50-7



Tilt the panel (Item 1) back and remove the two screws (Item 2) **[Figure 70-50-7]** from the side panel.

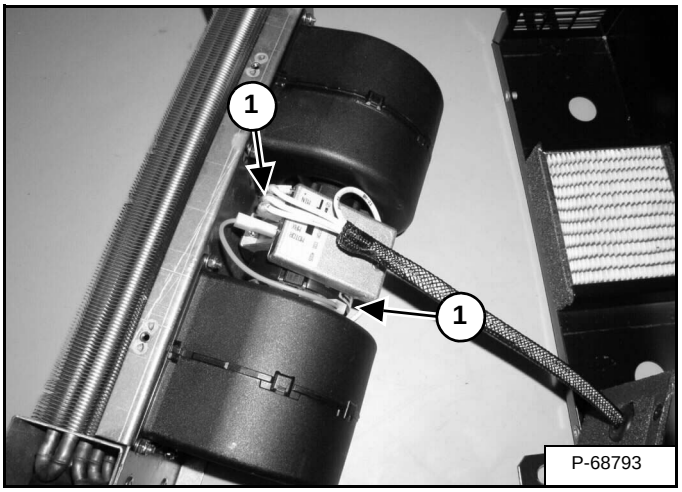
Figure 70-50-8



Remove the heater coil and heater fan assembly (Item 1) **[Figure 70-50-8]** from the heater unit.

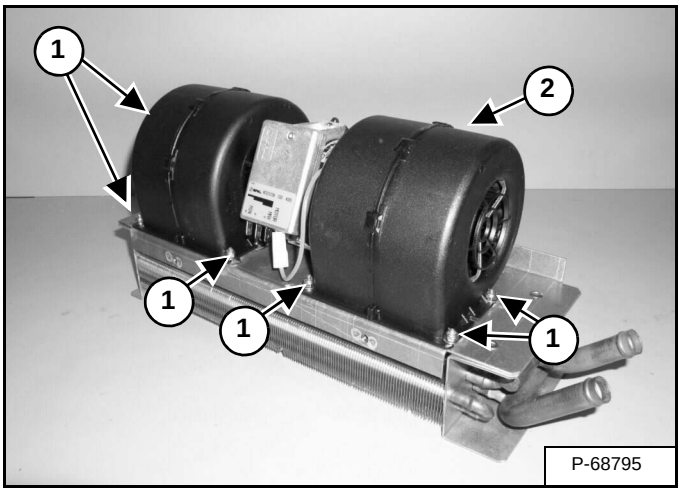
Removal And Installation (Cont'd)

Figure 70-50-9



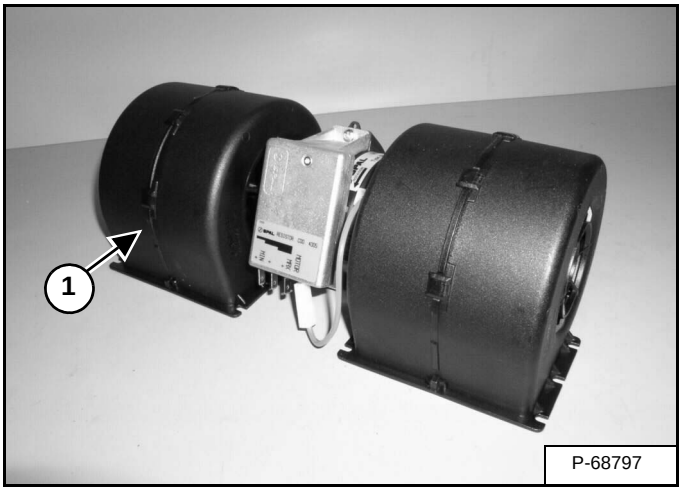
Mark and remove the four wires (Item 1) **[Figure 70-50-9]** from the heater fan motor.

Figure 70-50-10



Remove the six nuts and washers (Item 1) and remove the heater fan assembly (Item 2) **[Figure 70-50-10]**. Remove the heater fan assembly from the heater coil.

Figure 70-50-11



The heater fan assembly (Item 1) **[Figure 70-50-11]** is not repairable. Order complete assembly from Bobcat Parts.


Bobcat®

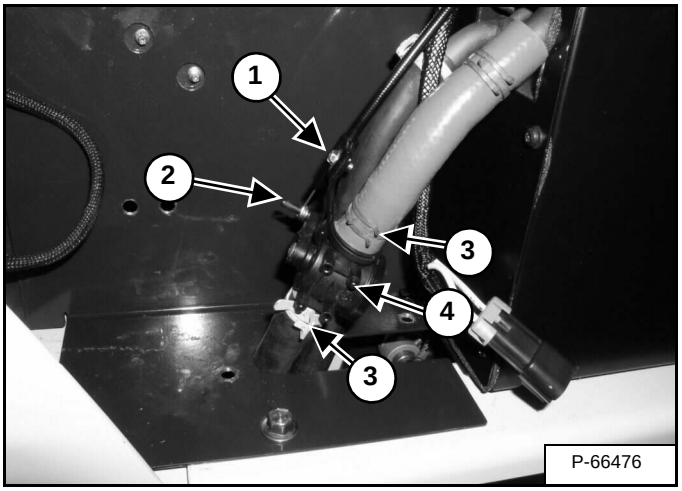
HEATER VALVE

Removal And Installation

Drain the engine coolant (See Replacing The Coolant on page 10-70-1.)

Remove the cab (See Removal And Installation on Page 40-30-1.)

Figure 70-60-1



Loosen the screw and cable clamp (Item 1) **[Figure 70-60-1]**.

Slide the cable off the heater valve pin (Item 2) **[Figure 70-60-1]**.

Disconnect and cap the two hoses (Item 3) from the heater valve (Item 4) **[Figure 70-60-1]**.

Remove the heater valve.


Bobcat®

SPECIFICATIONS

CONVERSIONS SPEC-60-1
- Decimal And Millimeter Equivalents SPEC-60-1
- U.S. To Metric Conversion Chart SPEC-60-1

HYDRAULIC CONNECTION SPECIFICATIONS SPEC-40-1
- Flare Fitting SPEC-40-3
- O-ring Face Seal Connection SPEC-40-1
- Port Seal Fitting SPEC-40-4
- Straight Thread O-ring Fitting SPEC-40-2
- Tubelines And Hoses SPEC-40-2

HYDRAULIC FLUID SPECIFICATIONS SPEC-50-1
- Specifications SPEC-50-1

SPECIFICATIONS 321 EXCAVATOR SPEC-10-1
- Attachments SPEC-10-10
- Brakes SPEC-10-7
- Bucket SPEC-10-10
- Controls SPEC-10-4
- Drive system SPEC-10-6
- Electrical SPEC-10-5
- Engine SPEC-10-5
- Environmental SPEC-10-9
- Fluid capacities SPEC-10-8
- Fluid specifications SPEC-10-8
- Function Time SPEC-10-4
- Hydraulic cylinders SPEC-10-6
- Hydraulic system SPEC-10-5
- Instrumentation SPEC-10-9
- Lift Capacity (Object handling applications excluded) SPEC-10-3
- Machine dimensions SPEC-10-1
- Options SPEC-10-10
- Performance SPEC-10-4
- Safety SPEC-10-9
- Serviceability SPEC-10-7
- Slew system SPEC-10-7
- Standard features SPEC-10-10
- Traction SPEC-10-6
- Weights SPEC-10-4
- Working range SPEC-10-2

Continued On Next Page

SPECIFICATIONS (CONT'D)

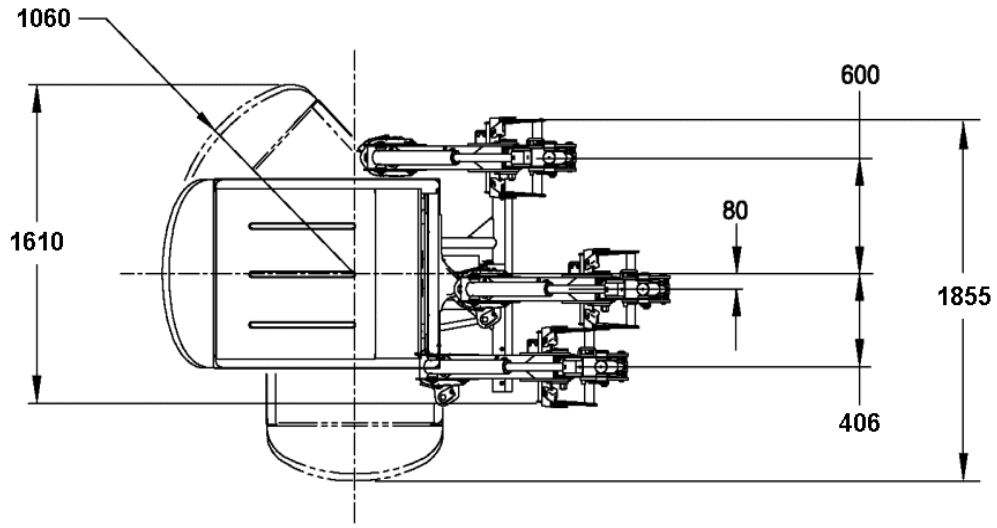
SPECIFICATIONS 323 EXCAVATOR SPEC-20-1
- Attachments. SPEC-20-10
- Brakes SPEC-20-7
- Buckets SPEC-20-10
- Controls SPEC-20-4
- Drive system SPEC-20-6
- Electrical SPEC-20-5
- Engine SPEC-20-5
- Environmental SPEC-20-9
- Fluid capacities SPEC-20-8
- Fluid specifications SPEC-20-8
- Function time SPEC-20-4
- Hydraulic cylinders SPEC-20-6
- Hydraulic system SPEC-20-5
- Instrumentation SPEC-20-9
- Lift Capacity (Object handling applications excluded) SPEC-20-3
- Machine dimensions SPEC-20-1
- Options SPEC-20-10
- Performance SPEC-20-4
- Safety. SPEC-20-9
- Serviceability SPEC-20-7
- Slew system SPEC-20-7
- Standard features SPEC-20-10
- Traction SPEC-20-6
- Weights SPEC-20-4
- Working range SPEC-20-2

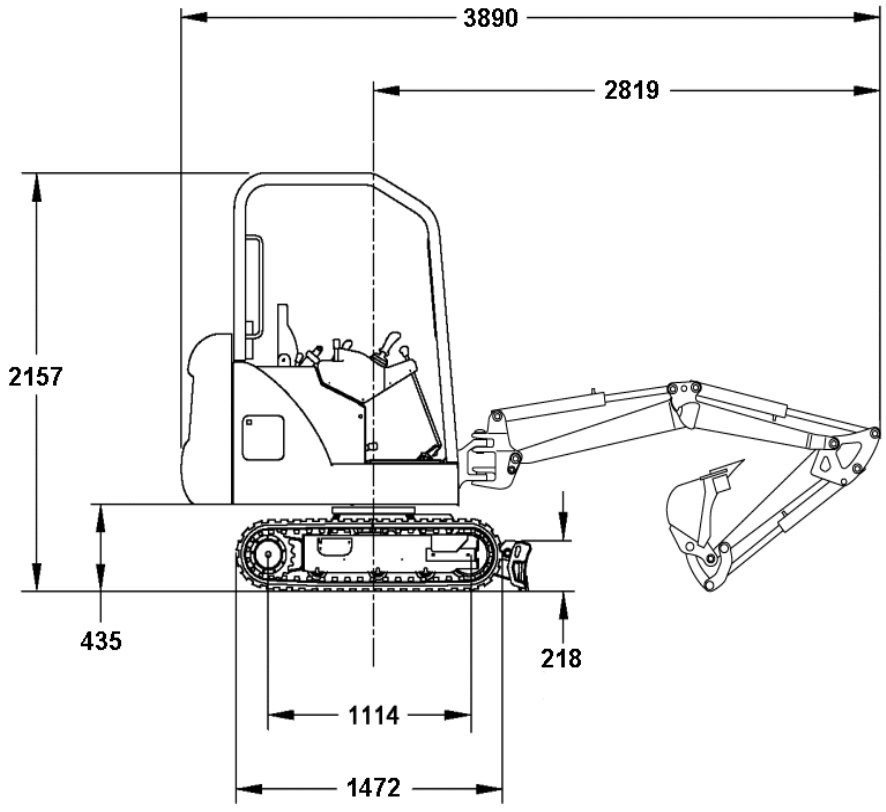
TORQUE SPECIFICATIONS FOR BOLTS SPEC-30-1
- Torque For General Metric Bolts SPEC-30-2
- Torque For General SAE Bolts SPEC-30-1

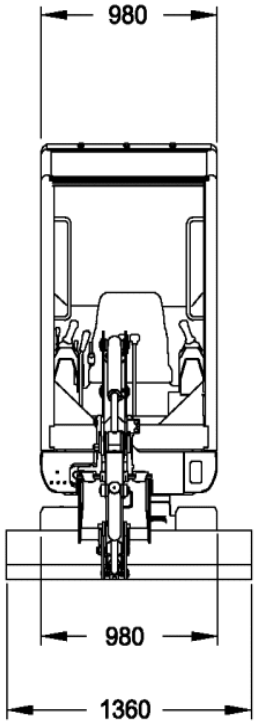
SPECIFICATIONS 321 EXCAVATOR

Machine dimensions

- All dimensions are given in mm.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



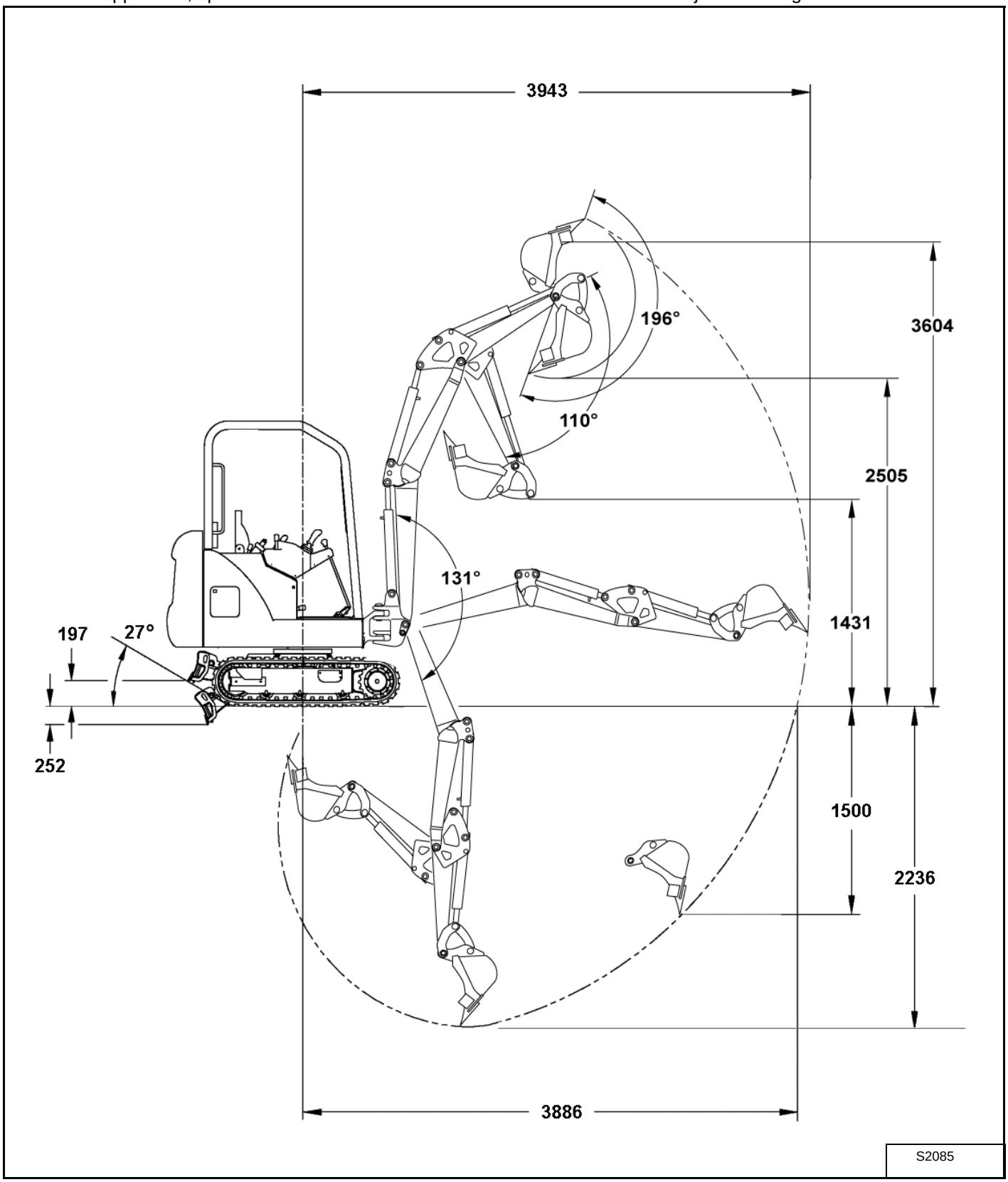




S2114

Working range

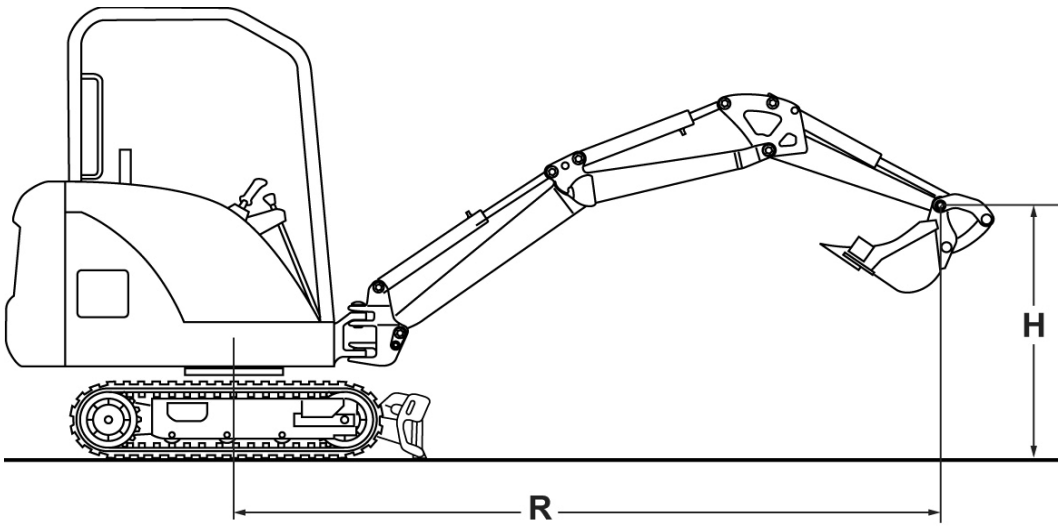
- All dimensions are given in mm.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



SPECIFICATIONS 321 EXCAVATOR (CONT'D)

Lift Capacity (Object handling applications excluded)

- All dimensions are given in mm.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



S2128

Rated lift capacity over blade, blade down				
Lift point height [H] (mm)	**Maximum radius [R] (mm)**	**Lift at max. radius (kg)**	**Lift at 2000 mm radius**	**Lift at 3000 mm radius**
2000	3120	256 *		
1000	3390	238 *	452 *	273 *
Ground	3280	221 *	514 *	277 *
-1000	2710	204 *	371 *	
Rated lift capacity over blade, blade up				
Lift point height [H] (mm)	**Maximum radius [R] (mm)**	**Lift at max. radius (kg)**	**Lift at 2000 mm radius**	**Lift at 3000 mm radius**
2000	3120	248 *		
1000	3390	173	422 *	183
Ground	3280	169	338	182
-1000	2710	203 *	304	
Rated lift capacity over side, blade up, undercarriage retracted				
Lift point height [H] (mm)	**Maximum radius [R] (mm)**	**Lift at max. radius (kg)**	**Lift at 2000 mm radius**	**Lift at 3000 mm radius**
2000	3120	167		
1000	3390	131	285	169
Ground	3280	128	255	153
-1000	2710	162	279	
Rated lift capacity over side, blade up, undercarriage expanded				
Lift point height [H] (mm)	**Maximum radius [R] (mm)**	**Lift at max. radius (kg)**	**Lift at 2000 mm radius**	**Lift at 3000 mm radius**
2000	3120	253 *		
1000	3390	235 *	480 *	274 *
Ground	3280	212 *	426	275 *
-1000	2710	200 *	384 *	

* Rated hydraulic lift capacity

Performance

Digging force, dipperstick (ISO 6015)	8500 N
Digging force, bucket (ISO 6015)	16100 N
Drawbar pull (theoretical at 90% efficiency)	15594 N
Ground pressure with rubber tracks	26,6 kPa
Ground pressure with steel tracks	27,5 kPa

Function Time

Boom raise time	5,3 s
Boom lower time	6,3 s
Bucket curl time	2,3 s
Bucket dump time	3,0 s
Dipperstick retract time	2,5 s
Dipperstick extend time	3,2 s
Boom swing left time	3,3 s
Boom swing right time	4,1 s
Blade raise time	2,6 s
Blade lower time	2,6 s
Slew rate	8,4 RPM
Undercarriage expand time	4,1 s
Undercarriage retract time	3,5 s

Weights

Operating weight with ROPS canopy, rubber tracks, 406 mm bucket	1476 kg
Additional weight for cab	129 kg
Additional weight for steel tracks	53 kg
Reduction for shipping weight	39 kg

Controls

Engine	Hand lever on right-hand side
Starting	Key-type starter switch and shutdown
Blade	Right hand lever
Boom swing	Right foot pedal
Hydraulics	Two joysticks control boom, bucket, dipperstick, and upper structure slew
Auxiliary hydraulics	Electric switch in right joystick
Upper structure slew brake	Hydraulic lock on motor
Holding brake for upper structure slew	Pin lock
Steering	Direction and speed controlled by two hand levers or foot pedals

Engine

Make / model	Kubota / D722-E2B-BC-5-SI
Fuel	Diesel
Cooling	Liquid
Maximum power at 2500 RPM (ISO 9249)	9,9 kW
Maximum governed speed	2500 RPM
High idle speed	2800 RPM
Low idle speed	1275-1375 RPM
Torque at 2000 RPM (SAE Net)	42,2 N•m
Number of cylinders	3
Displacement	0,72 l
Bore	67 mm
Stroke	68 mm
Air filter	Dry replaceable paper cartridge
Ignition	Diesel-compression
Starting aid	Intake air heater

Electrical

Alternator	12 V - 40 A - open frame with internal regulator
Battery	12 V - 530 A cold cranking at -18°C - 75 min reserve capacity
Starter	12 V - gear reduction type - 1,4 kW

Hydraulic system

Pump type	Dual piston pump with gear pump
Pump 1 capacity	11,0 l/min at 2500 RPM
Pump 2 and 3 capacity	11,0 l/min at 2500 RPM
System relief pressure for implement circuits	227 bar
System relief pressure for travel circuits	172 bar
System relief pressure for slew circuits	137-141 bar
System relief pressure for auxiliary circuits	226 bar
Dipperstick port relief base and rod end	250 bar
Boom port relief base and rod end	210-250 bar
Bucket port relief base and rod end	250 bar
Main hydraulic filter bypass	1,7 bar
Case drain bypass	1,4 bar
Control valve	Nine-spool parallel type, open centre
Hydraulic filter	Full-flow replaceable
Fluid lines	SAE standard tubelines, hoses, and fittings
Auxiliary flow	11,0 l/min

Hydraulic cylinders

Boom cylinder	Cushion up
Boom cylinder bore	60 mm
Boom cylinder rod	35 mm
Boom cylinder stroke	429 mm
Dipperstick cylinder	No cushion
Dipperstick cylinder bore	51 mm
Dipperstick cylinder rod	22 mm
Dipperstick cylinder stroke	402 mm
Bucket cylinder	No cushion
Bucket cylinder bore	51 mm
Bucket cylinder rod	32 mm
Bucket cylinder stroke	385 mm
Boom swing cylinder	Cushion left
Boom swing cylinder bore	70 mm
Boom swing cylinder rod	32 mm
Boom swing cylinder stroke	429 mm
Blade cylinder	No cushion
Blade cylinder bore	57 mm
Blade cylinder rod	35 mm
Blade cylinder stroke	118 mm
Undercarriage cylinder	No cushion
Undercarriage cylinder bore	44 mm
Undercarriage cylinder rod	25 mm
Undercarriage cylinder stroke	385 mm

Drive system

Travel motor	Each track is driven by a hydrostatic axial piston motor
Drive reduction	Two-stage planetary gear reduction 30,3:1

Traction

Track width, rubber, standard	230 mm
Track width, steel, optional	230 mm
Track adjusters	Grease type with shock absorbing recoil springs
Track type, standard	Half-pitch, rubber
Track type, optional	Steel
Travel speed, low range	2,18 km/h
Travel speed, high range	3,31 km/h
Undercarriage	Crawler-type tractor design with reinforced box-section track roller frame and sealed track rollers
Number of track rollers per side	3
Gradeability travelling down or backing up slopes	30°
Gradeability travelling on side slopes	15°
Gradeability travelling up side slopes	15°

Brakes

Parking brake	Hydraulic lock on motor
Slew brake	Hydraulic lock on motor and pin lock
Travel brake	Hydraulic lock on motor

Slew system

Boom swing, left	90°
Boom swing, right	50°
Slew circle	Single row shear-type ball bearings with internal gear
Slew drive	Orbit motor

Serviceability

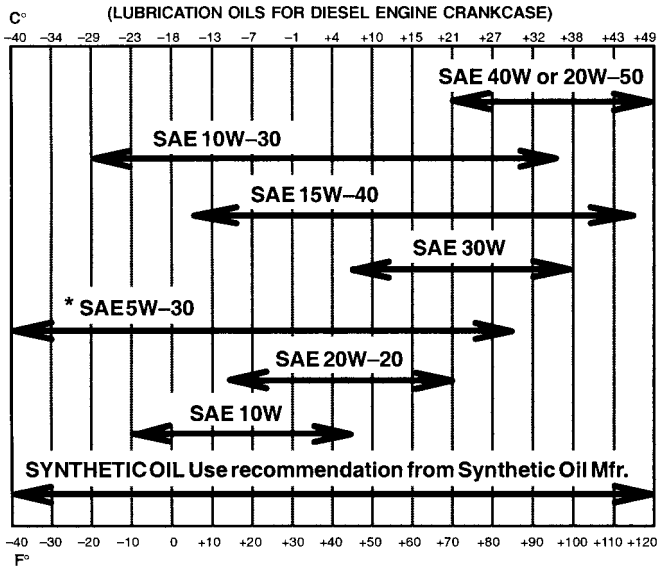
Access is available to the following through the rear tailgate, side access hood or engine cover:
- Air cleaner
- Battery
- Cooling system (engine oil and hydraulic oil coolers) for cleaning
- Engine oil and fuel filters
- Engine oil level
- Fuel filler
- Starter
- Sight gauge for hydraulic level
- Sight gauge for fuel level

Tailgate and access covers have locks for vandal-proofing.
Easy access to all grease points.
Central grease point for swing bearing, swing pinion, and offset cylinder.

Fluid capacities

Cooling system	5,7 l
Engine lubrication plus oil filter	3,5 l
Fuel reservoir	23,7 l
Hydraulic reservoir	9,8 l
Hydraulic system with bucket and dipper cylinder retracted, bucket on the ground, and blade down	18,5 l
Travel motor (each)	0,5 l

Fluid specifications

Engine coolant	Polypropylene glycol / water mix (53% - 47%) with freeze protection to -37°C
Engine oil	Oil must meet API Service Classification of CD, CE, CF4, CG4, or better. Recommended SAE viscosity number for anticipated temperature range.  * Can by used only when available with appropriate diesel rating. For synthetic oil use the recommendation from the oil manufacturer.
Hydraulic fluid	Bobcat Superior SH 5 l can - 6904842A 25 l container - 6904842B 209 l drum 6904842C 1000 l tank 6904842D Bobcat Bio Hydraulic 5 l can - 6904843A 25 l container - 6904843B 209 l drum 6904843C 1000 l tank 6904843D

Environmental

Noise level L_{pA} (EU Directive 2000/14/EC)	76 dB(A)
Noise level L_{WA} (EU Directive 2000/14/EC)	90 dB(A)
Whole body vibration (ISO 2631-1)	- ms^{-2}
Hand-arm vibration (ISO 5349-1)	- ms^{-2}

Instrumentation

- Hour meter
- Fuel gauge
- Engine temperature gauge with audible alarm
- Engine oil pressure indicator with audible alarm
- Charging system indicator with audible alarm
- Air intake heater indicator
- Console indicator
- Two-speed range indicator

Safety

Retractable seat belt, standard	Should always be worn when operating the excavator
Operator cab, standard	A four-post canopy or optional closed cab. Meets ISO 3471 for Roll Over Protection Structure (ROPS) and ISO 12117 for Tip Over Protective Structure (TOPS). An optional top Falling Object Guard Structure (FOGS) meeting ISO 10262 Level I * is available.
Grab handles, standard	Should always be used when entering / exiting excavator.
Safety tread, standard	Slip resistant tread on canopy threshold to be used when entering / exiting excavator.
Front working lights, standard	Use for indoor and low light operation.
Control lockout, standard	Operator console locks out work group and travel functions when in the upright position.
Upper carriage slew lock, standard	A lock pin is provided to lock the upper structure to the undercarriage for transport.
Pedal lock, standard	Prevents activation of the boom swing function.
Travel motion alarm, optional	For use when required.
Special applications kit, optional	Restricts objects and material from entering cab openings.
Operator's handbook, standard	Weather-resistant operator handbook attached to the inside of the cab, providing operational instructions and warnings decals with pictorials and international symbols.

- Level I - Acceptance is intended for protection from falling bricks, small concrete blocks, and hand tools encountered in operations such as highway maintenance, landscaping, and other construction site services.

Standard features

- 980 mm dozer blade with two 190 mm extensions
- 230 mm rubber track
- Auxiliary hydraulics with Quick Couplers
- Control console locks
- Horn
- Hydraulically expandible undercarriage from 980 to 1360 mm
- Hydraulic joystick controls
- Retractable seat belt
- *ROPS / TOPS canopy
- Spark arrester muffler
- Two-speed travel
- Working lights
- Warranty: 12 months, 2000 hours

- Roll Over Protective Structure (ROPS) - Meets requirements of ISO 3471
  Tip Over Protective Structure (TOPS) - Meets requirements of ISO 12117

Options

- AM / FM stereo radio
- Cab / canopy light kit
- Cab enclosure, vinyl
- Catalytic exhaust purifier kit
- FOPS kit
- Keyless ignition
- Lifting chain kit
- ROPS / TOPS cab with heater
- Special applications kit
- Steel tracks
- Travel motion alarm

Attachments

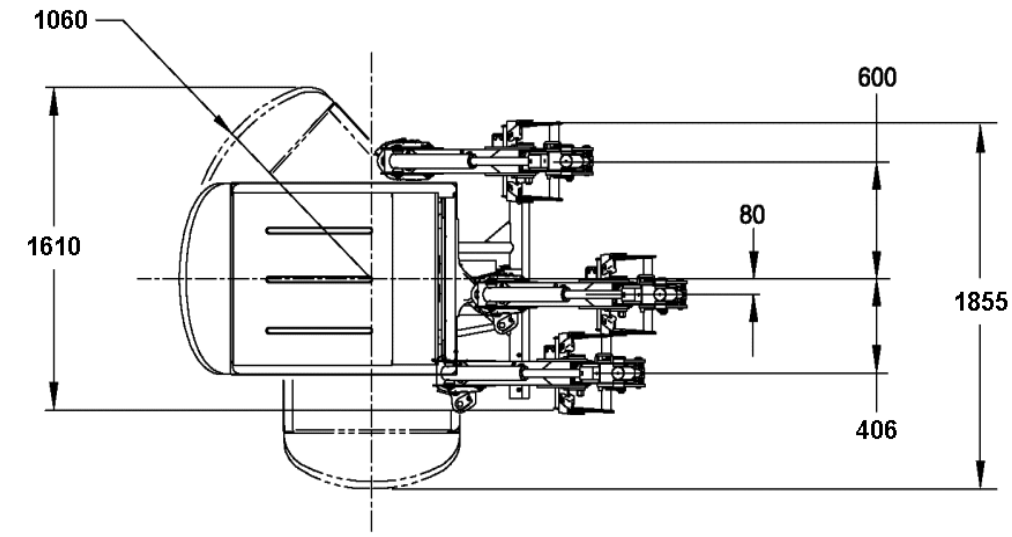
- Auger
- Grading bucket
- Hydraulic breaker
- Trenching bucket

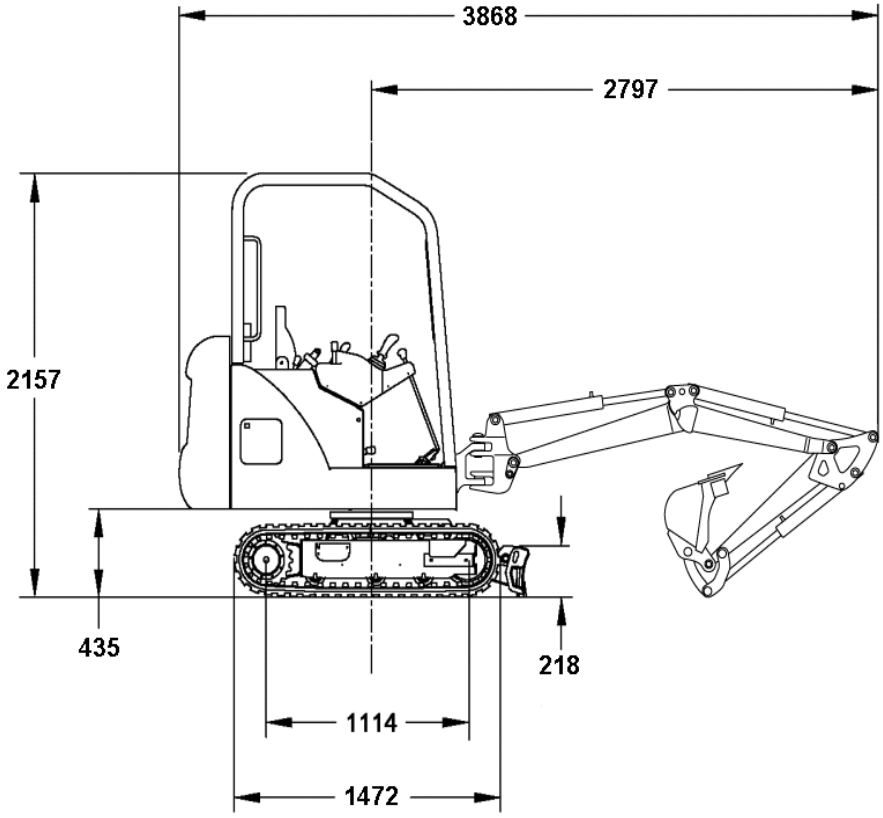
Bucket

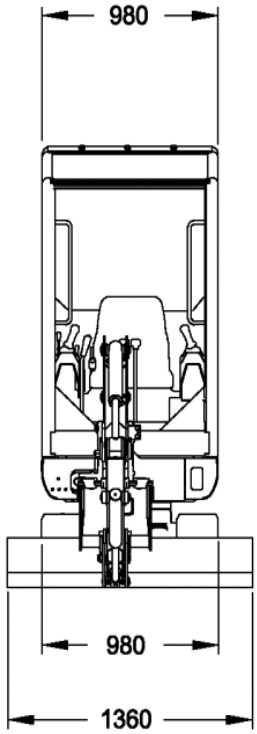
Width (mm)	Weight (kg)	Struck capacity (m^3)	Rated capacity (m^3)
203	25,1	0,011	0,013
228	28,2	0,014	0,017
305	31,3	0,018	0,024
406	37,3	0,026	0,036
610	46,4	0,041	0,058

Machine dimensions

- All dimensions are given in mm.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



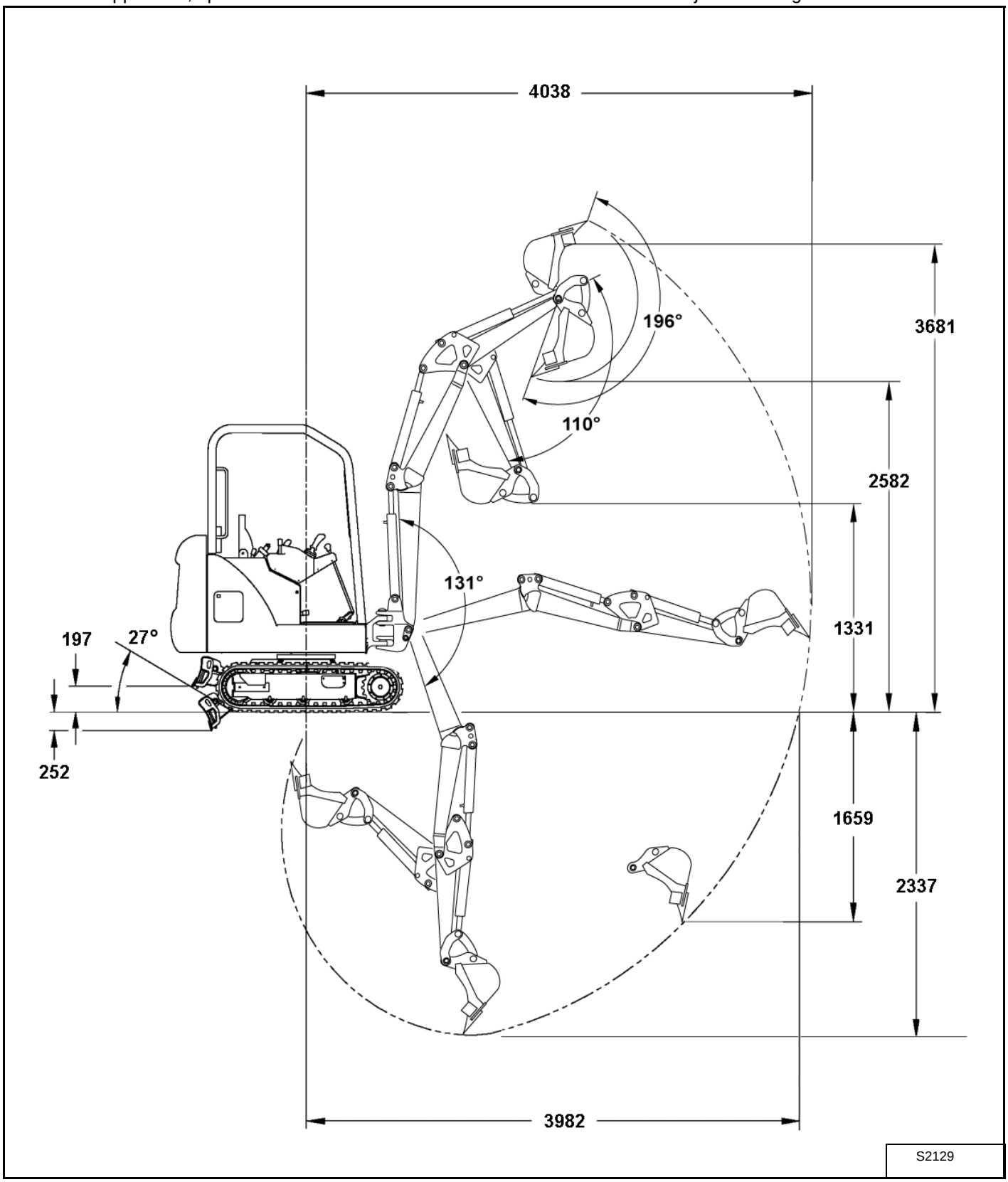




S2130

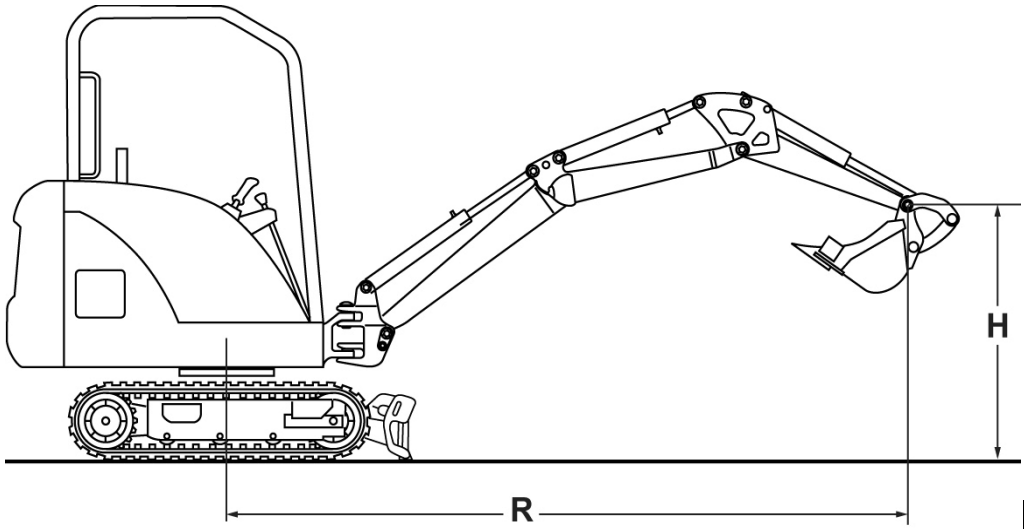
Working range

- All dimensions are given in mm.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



Lift Capacity (Object handling applications excluded)

- All dimensions are given in mm.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



Rated lift capacity over blade, blade down				
Lift point height [H] (mm)	**Maximum radius [R] (mm)**	**Lift at max. radius (kg)**	**Lift at 2000 mm radius**	**Lift at 3000 mm radius**
2000	3120	261 *		263 *
1000	3390	254 *	499 *	293 *
Ground	3280	236 *	571 *	305 *
-1000	2710	219 *	424 *	
Rated lift capacity over blade, blade up				
Lift point height [H] (mm)	**Maximum radius [R] (mm)**	**Lift at max. radius (kg)**	**Lift at 2000 mm radius**	**Lift at 3000 mm radius**
2000	3120	244 *		247 *
1000	3390	178	458 *	222
Ground	3280	173	364	155
-1000	2710	212 *	353	
Rated lift capacity over side, blade up, undercarriage retracted				
Lift point height [H] (mm)	**Maximum radius [R] (mm)**	**Lift at max. radius (kg)**	**Lift at 2000 mm radius**	**Lift at 3000 mm radius**
2000	3120	161		172
1000	3390	128	293	161
Ground	3280	135	268	153
-1000	2710	156	264	
Rated lift capacity over side, blade up, undercarriage expanded				
Lift point height [H] (mm)	**Maximum radius [R] (mm)**	**Lift at max. radius (kg)**	**Lift at 2000 mm radius**	**Lift at 3000 mm radius**
2000	3120	262 *		258 *
1000	3390	236 *	457 *	288 *
Ground	3280	231 *	425	285 *
-1000	2710	218 *	405 *	

* Rated hydraulic lift capacity

Performance

Digging force, dipperstick (ISO 6015)	7900 N
Digging force, bucket (ISO 6015)	16100 N
Drawbar pull (theoretical at 90% efficiency)	15594 N
Ground pressure with rubber tracks	27,4 kPa
Ground pressure with steel tracks	28,3 kPa

Function time

Boom raise time	5,3 s
Boom lower time	6,3 s
Bucket curl time	2,3 s
Bucket dump time	3,0 s
Dipperstick retract time	2,5 s
Dipperstick extend time	3,2 s
Boom swing left time	3,3 s
Boom swing right time	4,1 s
Blade raise time	2,6 s
Blade lower time	2,6 s
Slew rate	8,4 RPM
Undercarriage expand time	4,1 s
Undercarriage retract time	3,5 s

Weights

Operating weight with ROPS canopy, rubber tracks, 406 mm bucket	1516 kg
Additional weight for cab	129 kg
Additional weight for steel tracks	53 kg
Reduction for shipping weight	39 kg

Controls

Engine	Hand lever on right-hand side
Starting	Key-type starter switch and shutdown
Blade	Right hand lever
Boom swing	Right foot pedal
Hydraulics	Two joysticks control boom, bucket, dipperstick, and upper structure slew
Auxiliary hydraulics	Electric switch in right joystick
Upper structure slew brake	Hydraulic lock on motor
Holding brake for upper structure slew	Pin lock
Steering	Direction and speed controlled by two hand levers or foot pedals

Engine

Make / model	Kubota / D722-E2B-BC-5-SI
Fuel	Diesel
Cooling	Liquid
Maximum power at 2500 RPM (ISO 9249)	9,9 kW
Maximum governed speed	2500 RPM
High idle speed	2800 RPM
Low idle speed	1275-1375 RPM
Torque at 2000 RPM (SAE Net)	42,2 N•m
Number of cylinders	3
Displacement	0,72 l
Bore	67 mm
Stroke	68 mm
Air filter	Dry replaceable paper cartridge
Ignition	Diesel-compression
Starting aid	Intake air heater

Electrical

Alternator	12 V - 40 A - open frame with internal regulator
Battery	12 V - 530 A cold cranking at -18°C - 75 min reserve capacity
Starter	12 V - gear reduction type - 1,4 kW

Hydraulic system

Pump type	Dual piston pump with gear pump
Pump 1 capacity	11,0 l/min at 2500 RPM
Pump 2 and 3 capacity	11,0 l/min at 2500 RPM
System relief pressure for implement circuits	227 bar
System relief pressure for travel circuits	172 bar
System relief pressure for slew circuits	137-141 bar
System relief pressure for auxiliary circuits	226 bar
Dipperstick port relief base and rod end	250 bar
Boom port relief base and rod end	210-250 bar
Bucket port relief base and rod end	250 bar
Main hydraulic filter bypass	1,7 bar
Case drain bypass	1,4 bar
Control valve	Nine-spool parallel type, open centre
Hydraulic filter	Full-flow replaceable
Fluid lines	SAE standard tubelines, hoses, and fittings
Auxiliary flow	11,0 l/min

Hydraulic cylinders

Boom cylinder	Cushion up
Boom cylinder bore	60 mm
Boom cylinder rod	35 mm
Boom cylinder stroke	429 mm
Dipperstick cylinder	No cushion
Dipperstick cylinder bore	51 mm
Dipperstick cylinder rod	32 mm
Dipperstick cylinder stroke	402 mm
Bucket cylinder	No cushion
Bucket cylinder bore	51 mm
Bucket cylinder rod	32 mm
Bucket cylinder stroke	385 mm
Boom swing cylinder	Cushion left
Boom swing cylinder bore	70 mm
Boom swing cylinder rod	32 mm
Boom swing cylinder stroke	429 mm
Blade cylinder	No cushion
Blade cylinder bore	57,2 mm
Blade cylinder rod	35 mm
Blade cylinder stroke	118 mm
Undercarriage cylinder	No cushion
Undercarriage cylinder bore	44 mm
Undercarriage cylinder rod	25 mm
Undercarriage cylinder stroke	385 mm

Drive system

Travel motor	Each track is driven by a hydrostatic axial piston motor
Drive reduction	Two-stage planetary gear reduction 30,3:1

Traction

Track width, rubber, standard	230 mm
Track width, steel, optional	230 mm
Track adjusters	Grease type with shock absorbing recoil springs
Track type, standard	Half-pitch, rubber
Track type, optional	Steel
Travel speed, low range	2,18 km/h
Travel speed, high range	3,31 km/h
Undercarriage	Crawler-type tractor design with reinforced box-section track roller frame and sealed track rollers
Number of track rollers per side	3
Gradeability travelling down or backing up slopes	30°
Gradeability travelling on side slopes	15°
Gradeability travelling up side slopes	15°

Brakes

Parking brake	Hydraulic lock on motor
Slew brake	Hydraulic lock on motor and pin lock
Travel brake	Hydraulic lock on motor

Slew system

Boom swing, left	90°
Boom swing, right	50°
Slew circle	Single row shear-type ball bearings with internal gear
Slew drive	Orbit motor

Serviceability

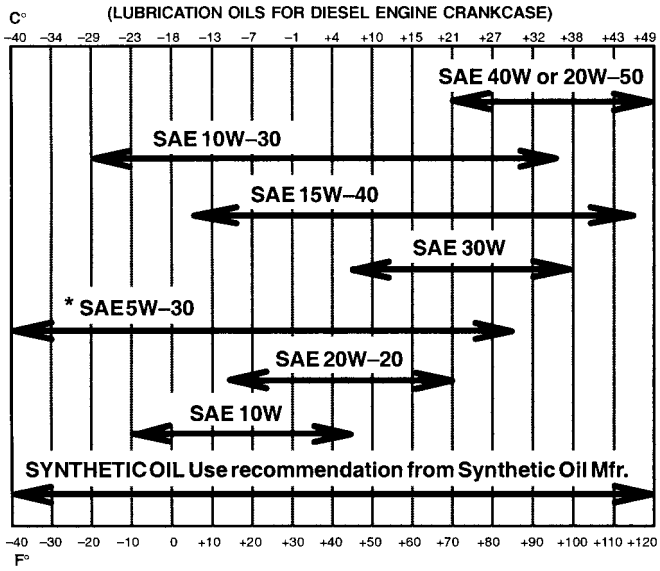
Access is available to the following through the rear tailgate, side access hood or engine cover:
- Air cleaner
- Battery
- Cooling system (engine oil and hydraulic oil coolers) for cleaning
- Engine oil and fuel filters
- Engine oil level
- Fuel filler
- Starter
- Sight gauge for hydraulic level
- Sight gauge for fuel level

Tailgate and access covers have locks for vandal-proofing.
Easy access to all grease points.
Central grease point for swing bearing, swing pinion, and offset cylinder.

Fluid capacities

Cooling system	5,7 l
Engine lubrication plus oil filter	3,5 l
Fuel reservoir	23,7 l
Hydraulic reservoir	9,8 l
Hydraulic system with bucket and dipper cylinder retracted, bucket on the ground, and blade down	18,5 l
Travel motor (each)	0,5 l

Fluid specifications

Engine coolant	Polypropylene glycol / water mix (53% - 47%) with freeze protection to -37°C
Engine oil	Oil must meet API Service Classification of CD, CE, CF4, CG4, or better. Recommended SAE viscosity number for anticipated temperature range.  * Can by used only when available with appropriate diesel rating. For synthetic oil use the recommendation from the oil manufacturer.
Hydraulic fluid	Bobcat Superior SH 5 l can - 6904842A 25 l container - 6904842B 209 l drum 6904842C 1000 l tank 6904842D Bobcat Bio Hydraulic 5 l can - 6904843A 25 l container - 6904843B 209 l drum 6904843C 1000 l tank 6904843D

Environmental

Noise level L_{pA} (EU Directive 2000/14/EC)	76 dB(A)
Noise level L_{WA} (EU Directive 2000/14/EC)	90 dB(A)
Whole body vibration (ISO 2631-1)	- ms^{-2}
Hand-arm vibration (ISO 5349-1)	- ms^{-2}

Instrumentation

- Hour meter
- Fuel gauge
- Engine temperature gauge with audible alarm
- Engine oil pressure indicator with audible alarm
- Charging system indicator with audible alarm
- Air intake heater indicator
- Console indicator
- Two-speed range indicator

Safety

Retractable seat belt, standard	Should always be worn when operating the excavator
Operator cab, standard	A four-post canopy or optional closed cab. Meets ISO 3471 for Roll Over Protection Structure (ROPS) and ISO 12117 for Tip Over Protective Structure (TOPS). An optional top Falling Object Guard Structure (FOGS) meeting ISO 10262 Level I * is available.
Grab handles, standard	Should always be used when entering / exiting excavator.
Safety tread, standard	Slip resistant tread on canopy threshold to be used when entering / exiting excavator.
Front working lights, standard	Use for indoor and low light operation.
Control lockout, standard	Operator console locks out work group and travel functions when in the upright position.
Upper carriage slew lock, standard	A lock pin is provided to lock the upper structure to the undercarriage for transport.
Pedal lock, standard	Prevents activation of the boom swing function.
Travel motion alarm, optional	For use when required.
Special applications kit, optional	Restricts objects and material from entering cab openings.
Operator's handbook, standard	Weather-resistant operator handbook attached to the inside of the cab, providing operational instructions and warnings decals with pictorials and international symbols.

* Level I - Acceptance is intended for protection from falling bricks, small concrete blocks, and hand tools encountered in operations such as highway maintenance, landscaping, and other construction site services.

Standard features

- 980 mm dozer blade with two 190 mm extensions
- 230 mm rubber track
- Auxiliary hydraulics with Quick Couplers
- Control console locks
- Horn
- Hydraulically expandible undercarriage from 980 to 1360 mm
- Hydraulic joystick controls
- Retractable seat belt
- * ROPS / TOPS canopy
- Spark arrester muffler
- Two-speed travel
- Working lights
- Warranty: 12 months, 2000 hours
- Roll Over Protective Structure (ROPS) - Meets requirements of ISO 3471
  Tip Over Protective Structure (TOPS) - Meets requirements of ISO 12117

Options

- AM / FM stereo radio
- Cab / canopy light kit
- Cab enclosure, vinyl
- Catalytic exhaust purifier kit
- FOPS kit
- Keyless ignition
- Lifting chain kit
- ROPS / TOPS cab with heater
- Special applications kit
- Steel tracks
- Travel motion alarm

Attachments

- Auger
- Grading bucket
- Hydraulic breaker
- Trenching bucket

Buckets

Width (mm)	Weight (kg)	Struck capacity (m^3)	Rated capacity (m^3)
203	25,1	0,011	0,013
228	28,2	0,014	0,017
305	31,3	0,018	0,024
406	37,3	0,026	0,036
610	46,4	0,041	0,058

TORQUE SPECIFICATIONS FOR BOLTS

Torque For General SAE Bolts

The following table shows standard torque specifications for bolts with zinc phosphate coating. Bolts purchased from Bobcat that have zinc phosphate coating are specified by the letter “H” following the part number.

	THREAD SIZE	SAE GRADE 5	SAE GRADE 8
INCH. LB. (N•m)	.250	80-90 (9-10)	110-120 (13-14)
	.3125	180-200 (21-23)	215-240 (24-27)
FOOT LB. (N•m)	.375	25-28 (34-38)	35-40 (48-54)
	.4375	40-45 (54-61)	60-65 (82-88)
	.500	65-70 (88-95)	90-100 (125-135)
	.5625	90-100 (125-135)	125-140 (170-190)
	.625	125-140 (170-190)	175-190 (240-190)
	.750	220-245 (300-330)	300-330 (410-450)
	.875	330-360 (450-490)	475-525 (645-710)
	1.000	475-525 (645-710)	725-800 (985-1085)
	1.125	650-720 (880-975)	1050-1175 (1425-1600)
	1.250	900-1000 (1200-1360)	1475-1625 (2000-2200)
	1.375	1200-1350 (1630-1830)	2000-2200 (2720-2980)
	1.500	1500-1650 (2040-2240)	2600-2850 (3530-3870)
	1.625	2000-2800 (2720-2980)	3450-3800 (4680-5150)
	1.750	2500-2750 (3390-3730)	4300-4800 (5830-6500)
	1.875	3150-3500 (4270-4750)	5500-6100 (7450-8300)
	2.000	3800-4200 (5150-5700)	6500-7200 (8800-9800)

TORQUE SPECIFICATIONS FOR BOLTS (CONT'D)

Torque For General Metric Bolts

Thread Size (Dia.)	Material		
	8.8	**10.9**	**12.9**
M4	2.0-2.5 ft.-lb. (2,5-3,5 N•m)	2.8-3.1 ft.-lb. (3,8-4,2 N•m)	3.5-3.9 ft.-lb. (4,7-5,3 N•m)
M5	4.0-5.0 ft.-lb. (5,5-6,5 N•m)	5.6-6.2 ft.-lb. (8,4-7,6 N•m)	6.2-7.0 ft.-lb. (8,5-9,5 N•m)
M6	7.0-7.5 ft.-lb. (9,5-10,5 N•m)	9.1-10.1 ft.-lb. (12,2-13,7 N•m)	10.4-11.6 ft.-lb. (14,2-15,8 N•m)
M7	11.0-12.5 ft.-lb. (15-17 N•m)	16.2-14.7 ft.-lb. (20-22 N•m)	17.5-19.5 ft.-lb. (23,7-26,3 N•m)
M8	18-19 ft.-lb. (24-26 N•m)	21.7-24.0 ft.-lb. (29,4-32,6 N•m)	25.5-28.5 ft.-lb. (35-39 N•m)
M10	32-35 ft.-lbs (43-47 N•m)	42.0-46.5 ft.-lb. (57-63 N•m)	52.5-58.5 ft.-lb. (71-79 N•m)
M12	55-60 ft.-lb. (75-85 N•m)	78-85 ft.-lb. (105-115 N•m)	91-110 ft.-lb. (91-110 N•m)
M14	100-90 ft.-lb. (125-140 N•m)	118-133 ft.-lb. (118-133 N•m)	140-155 ft.-lb. (140-155 N•m)
M16	140-155 ft.-lb. (190-210 N•m)	188-210 ft.-lb. (255-285 N•m)	225-245 ft.-lb. (300-330 N•m)
M18	190-215 ft.-lb. (260-290 N•m)	255-285 ft.-lb. (345-385 N•m)	210-340 ft.-lb. (420-460 N•m)
M20	275-300 ft.-lb. (370-410 N•m)	360-405 ft.-lb. (490-550 N•m)	440-490 ft.-lb. (590-650 N•m)
M22	370-400 ft.-lb. (500-550 N•m)	554-560 ft.-lb. (740-760 N•m)	590-650 ft.-lb. (800-880 N•m)
M24	470-520 ft.-lb. (640-700 N•m)	625-700 ft.-lb. (850-950 N•m)	730-830 ft.-lb. (1000-1120 N•m)
M27	680-760 ft.-lb. (930-1030 N•m)	900-1000 ft.-lb. (1230-1370 N•m)	1100-1200 ft.-lb. (1470-1630 N•m)
M30	930-1030 ft.-lb. (1260-1400 N•m)	1250-1400 ft.-lb. (1700-1900 N•m)	1500-1600 ft.-lb. (2000-2200 N•m)
M33	1270-1400 ft.-lb. (1720-1900 N•m)	2300-2500 ft.-lb. (2300-2500 N•m)	2000-2300 ft.-lb. (2700-3100 N•m)
M36	1620-1800 ft.-lb. (200-2450 N•m)	2200-2400 ft.-lb. (2900-3200 N•m)	2600-2900 ft.-lb. (3500-3900 N•m)

HYDRAULIC CONNECTION SPECIFICATIONS

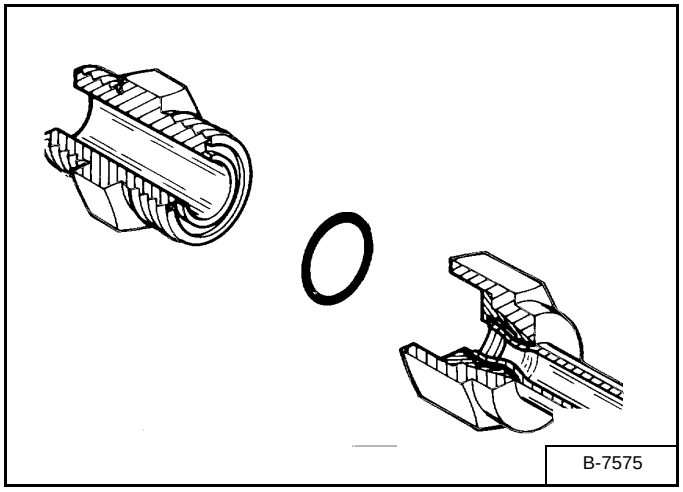
O-ring Face Seal Connection

IMPORTANT

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

I-2003-0888

Figure SPEC-40-1



When the fitting is tightened, you can feel when the fitting is tight to eliminate leakage caused by under or over torqued fittings. Use vaseline petroleum jelly to hold the O-ring in position until the fittings are assembled **[Figure SPEC-40-1]**.

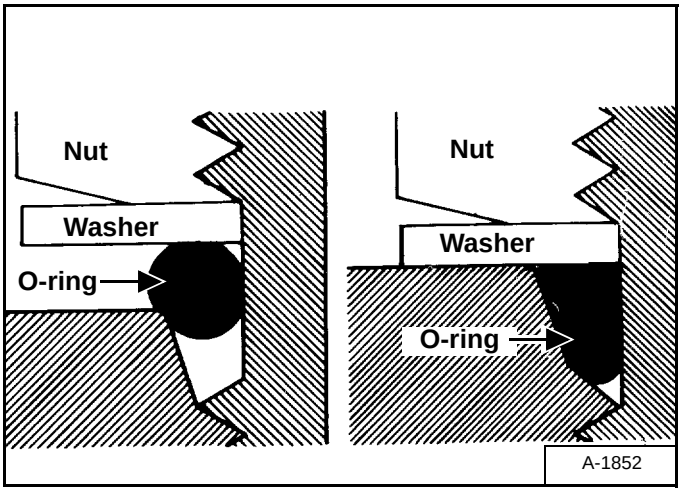
Figure SPEC-40-2

O-ring Face Seal Tightening Torque		
Tubeline Outside Diameter	**Thread Size**	**TORQUE ft.-lb. (N•m)**
1/4”	9/16” - 18	13 (18)
3/8”	11/16” - 16	22 (30)
1/2”	13/16” - 16	40 (54)
5/8”	1” - 14	60 (81)
3/4”	1-3/16” - 12	84 (114)
7/8”	1-3/16” - 12	98 (133)
1”	1-7/16” - 12	118 (160)
1-1/4”	1-11/16” - 12	154 (209)
1-1/2”	2” - 12	163 (221)

HYDRAULIC CONNECTION SPECIFICATIONS (CONT'D)

Straight Thread O-ring Fitting

Figure SPEC-40-3



Lubricate the O-ring before installing the fitting. Loosen the jam nut and install the fitting. Tighten the jam nut until the washer is tight against the surface **[Figure SPEC-40-3]**.

Tubelines And Hoses

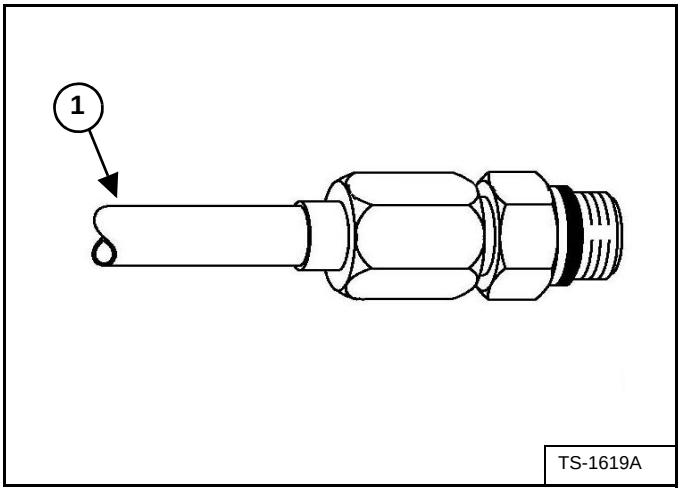
Replace any tubelines that are bent or flattened. They will restrict flow, which will slow hydraulic action and cause heat.

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

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

Flare Fitting

Figure SPEC-40-4



Use the following procedure to tighten the flare fitting:

Tighten the nut until it makes contact with the seat. Make a mark across the flats of both the male and female parts of the connection (Item 1) **[Figure SPEC-40-4]**

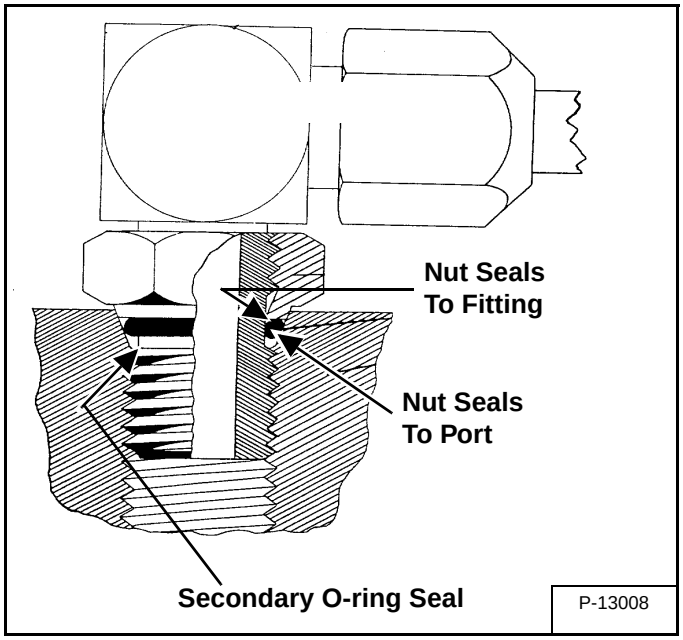
Use the chart **[Figure SPEC-40-5]** to find the correct tightness needed. If the fitting leaks after tightening, disconnect it and inspect the seat area for damage.

Figure SPEC-40-5

Flare Fitting Tightening Torque		
Tubeline Outside Diameter	**Thread Size**	**TORQUE ft.-lb. (N•m)**
1/4"	7/16" - 20	13 (18)
5/16"	1/2" - 20	17 (23)
3/8"	9/16" - 18	22 (30)
1/2"	3/4" - 16	40 (54)
5/8"	7/8" - 14	60 (81)
3/4"	1-1/16" - 12	84 (114)
7/8"	1-3/16" - 12	98 (133)
1"	1-5/16" - 12	118 (160)
1-1/4"	1-5/8" - 12	154 (209)
1-1/2"	1-7/8" - 12	163 (221)
2"	2-1/2" - 12	252 (342)

Port Seal Fitting

Figure SPEC-40-6



The nut is the primary seal, the O-ring is the secondary seal and helps absorb vibration and pressure pulses at the connection **[Figure SPEC-40-6]**.

The hex portion of the nut does not contact the surface of the component when the nut is tight.

Figure SPEC-40-7

Port Seal and O-ring Boss Tightening Torque	
Thread Size	**TORQUE ft.-lb. (N•m)**
7/16” - 20	13 18)
9/16” - 18	22 (30)
3/4” -1 6	40 (54)
7/8” - 14	60 (81)
1-1/16” - 12	84 (114)
1-3/16” - 12	98 (133)
1-5/16” - 12	118 (160)
1-7/16” - 12	154 (209)
1-5/8” - 12	163 (221)

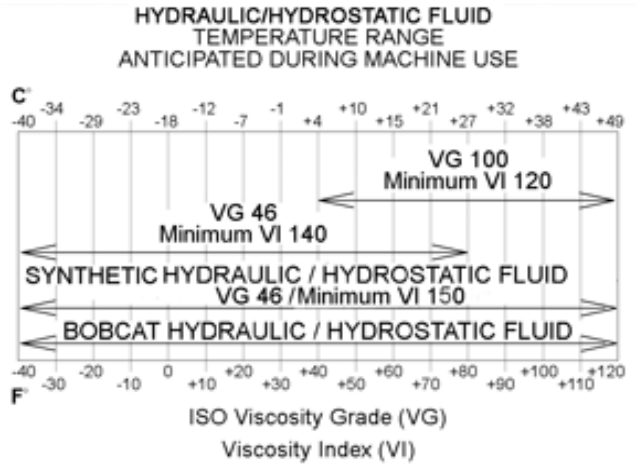
Use the following procedure to tighten the port seal fitting:

Port seal and nut, washer and O-ring (O-ring Boss) fittings use the same tightening torque valve chart.

HYDRAULIC FLUID SPECIFICATIONS

Specifications

Use Bobcat hydraulic fluid (P/N 6903117 - 2, 2 1/2 Gal.), (P/N 6903118 - 5 Gal.), (P/N 6903119 - 55 Gal.).



DO NOT use automatic transmission fluids in the excavator or permanent damage to the hydraulic system will result.

WARNING

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

W-2072-0496

When temperatures below zero degree F (-18°C) are common, the excavator must be kept in a warm building. Extra warm-up time must be used each time the excavator is started during cold temperature conditions. Cold fluid will not flow easily and it makes action of the hydraulic function slower. Loss of fluid flow to the hydraulic system can cause damage in less than 60 seconds.

WARNING

During cold weather (32°F [0°C] and below), do not operate machine until the engine has run for at least five minutes at less than half throttle. This warm-up period is necessary for foot pedal operation and safe stopping. Do not operate controls during warm-up period.

When temperatures are below -20°F (-30°C), the hydrostatic oil must be heated or kept warm. The hydrostatic system will not get enough oil at low temperatures. Park the machine in an area where the temperature will be above 0°F (-18°C) if possible.

W-2027-1285


Bobcat®

CONVERSIONS

Decimal And Millimeter Equivalents

FRACTIONS	DECIMALS	MM
1/64	0.015625	0.397
1/32	0.03125	0.794
3/64	0.046875	1.191
1/16	0.0625	1.588
5/64	0.078125	1.984
3/32	0.09375	2.381
7/64	0.109375	2.778
1/8	0.1250	3.175
9/64	0.140625	3.572
5/32	0.15625	3.969
11/64	0.171875	4.366
3/16	0.1876	4.762
13/64	0.203125	5.159
7/32	0.21875	5.556
15/64	0.234375	5.953
1/4	0.2500	6.350
17/64	0.265625	6.747
9/32	0.28125	7.144
19/64	0.296875	7.541
5/16	0.3125	7.938
21/64	0.328125	8.334
11/32	0.34375	8.731
23/64	0.359375	9.128
3/8	0.3750	9.525
25/64	0.390625	9.922
13/32	0.40625	10.319
27/64	0.421875	10.716
7/16	0.4375	11.112
29/64	0.453125	11.509
15/32	0.46875	11.906
31/64	0.484375	12.303
1/2	0.5000	12.700

FRACTIONS	DECIMALS	MM
33/64	0.515625	13.097
17/32	0.53125	13.494
35/64	0.546875	13.891
9/16	0.5625	14.288
37/64	0.578125	14.684
19/32	0.59375	15.081
39/64	0.609375	15.478
5/8	0.6250	15.875
41/64	0.640625	16.272
21/32	0.65625	16.669
43/64	0.671875	17.066
11/16	0.6875	17.462
45/64	0.703125	17.859
23/32	0.71875	18.256
47/64	0.734375	18.653
3/4	0.7500	19.050
49/64	0.765625	19.447
25/32	0.78125	19.844
51/64	0.796875	20.241
13/16	0.8125	20.638
53/64	0.828125	21.034
27/32	0.84375	21.431
55/64	0.859375	21.828
7/8	0.8750	22.225
57/64	0.890625	22.622
29/32	0.90625	23.019
59/64	0.921875	23.416
15/16	0.9375	23.812
61/64	0.953125	24.209
31/32	0.96875	24.606
63/64	0.984375	25.003
1	1.000	25.400

1 mm = 0.03937”

0.001 = 0.0254 mm

U.S. To Metric Conversion Chart

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


Bobcat®