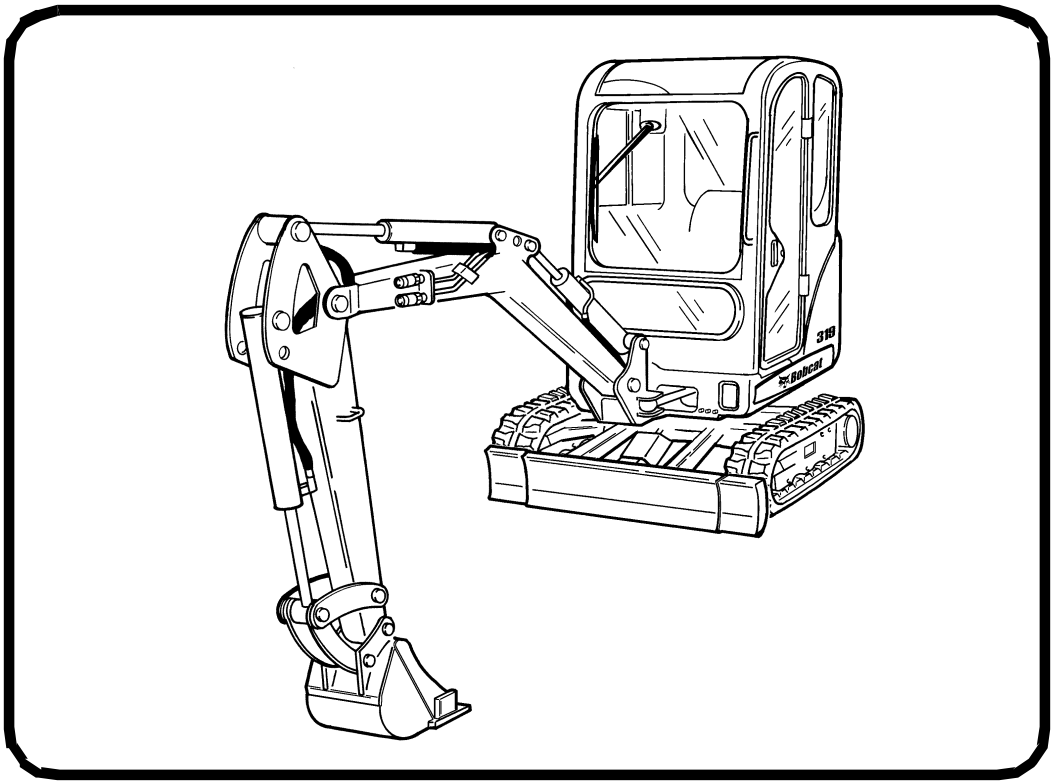
Bobcat®

Service Manual
319 Compact Excavator

S/N 563311001 & Above



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6904188 (2-06)

Printed in U.S.A.

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MAINTENANCE SAFETY

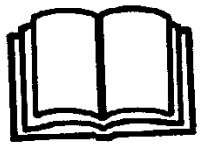
⚠ WARNING

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.

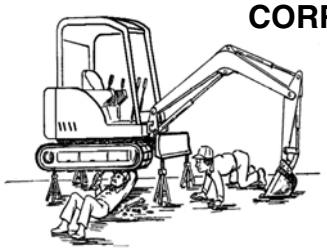
CORRECT



B-10731A

⚠ Never service the Bobcat Compact Excavator without instructions.

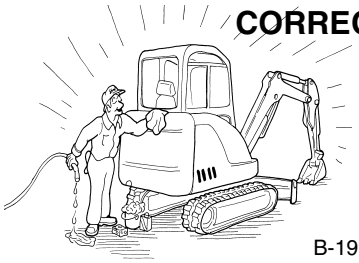
CORRECT



B-19964

⚠ Use the correct procedure to lift and support the excavator.

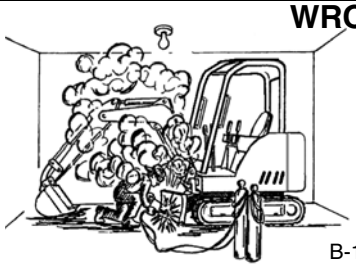
CORRECT



B-19959

⚠ Cleaning and maintenance are required daily.

WRONG

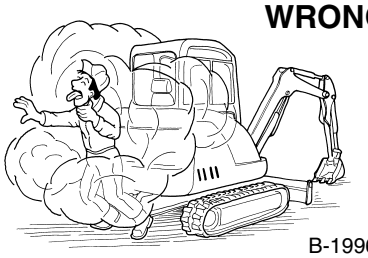


B-19965

⚠ Have good ventilation when welding or grinding painted parts.

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

WRONG

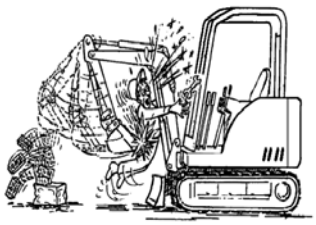


B-19960

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

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

WRONG

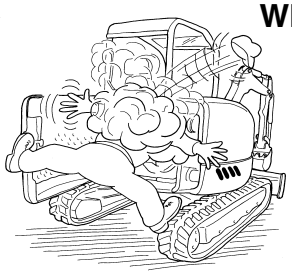


B-19966

⚠ 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

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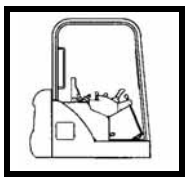
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FOREWORD

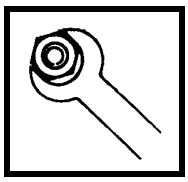
This manual is for the Bobcat Hydraulic Excavator mechanic. It provides necessary servicing and adjustment procedures for the hydraulic excavator and its component parts and systems. Refer to the Operation & Maintenance Manual for operating instructions, starting procedure, daily checks, etc.

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

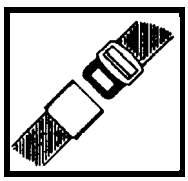
1. Check that the ROPS/TOPS/ FOGS is in good condition and is not modified.



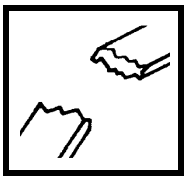
2. Check that ROPS/TOPS mounting hardware is tightened and is Bobcat approved.



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



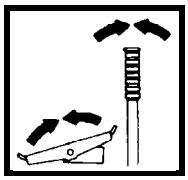
4. Inspect for loose or broken parts or connections.



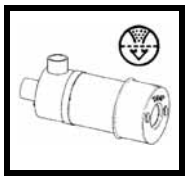
5. Machine signs must be legible and in the correct location.



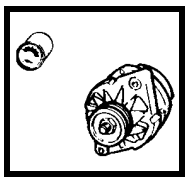
6. Steering levers, control levers and foot pedals must return to neutral. Check that foot pedals lock and control lever locks are in working order.



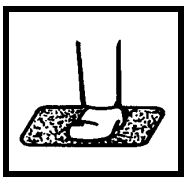
7. Inspect the air cleaner for damage or leaks. Check the condition of the element.



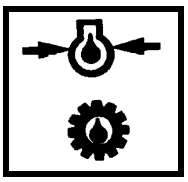
8. Check the electrical charging system.



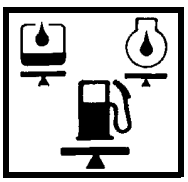
9. Safety treads must be in good condition.



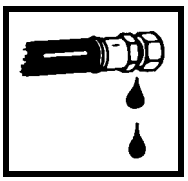
10. Check for correct function of indicator lamps (Optional on some models).



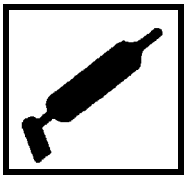
11. Check hydraulic fluid level, engine oil level and fuel supply.



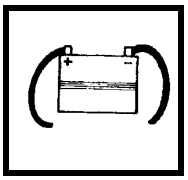
12. Inspect for fuel, oil or hydraulic fluid leaks.



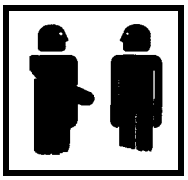
13. Lubricate the excavator.



14. Check the condition of the battery and cables.



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



CALIFORNIA
PROPOSITION 65 WARNING

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm.

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SAFETY INSTRUCTIONS

Safety Alert Symbol

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

WARNING

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

W-2003-0903

WARNING

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

W-2044-1285

IMPORTANT

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

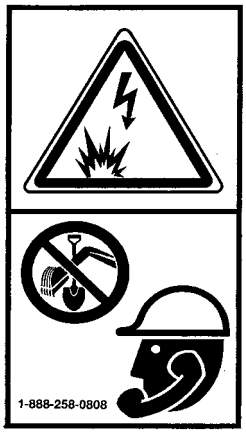
I-2019-0284

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

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

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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.



Call Before You Dig

1-888-258-0808

When you call, you will be directed to a location in your state/city for information about buried lines (telephone, cable TV, water, sewer, gas, etc.)

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SAFETY INSTRUCTIONS (CONT'D)

Fire Prevention

The machine and attachments have components that are at high temperature 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 will increase fire hazard. Clean often to avoid this accumulation. Flammable debris in the engine compartment is a potential hazard.

The spark arrestor muffler is designed to control the emission of hot particles from the engine and exhaust system, but the muffler and the exhaust gases are still hot.

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

- The operator cab, engine compartment, and engine cooling system must be inspected every day and cleaned if necessary to prevent fire hazard and overheating.

- Check all electrical wiring and connections for damage. Keep the battery terminals clean and tight. Repair or replace any damaged part.

- Check fuel and hydraulic tubes, hoses and fittings for damage and leakage. Never use open flame or bare skin to check for leaks. 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.

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

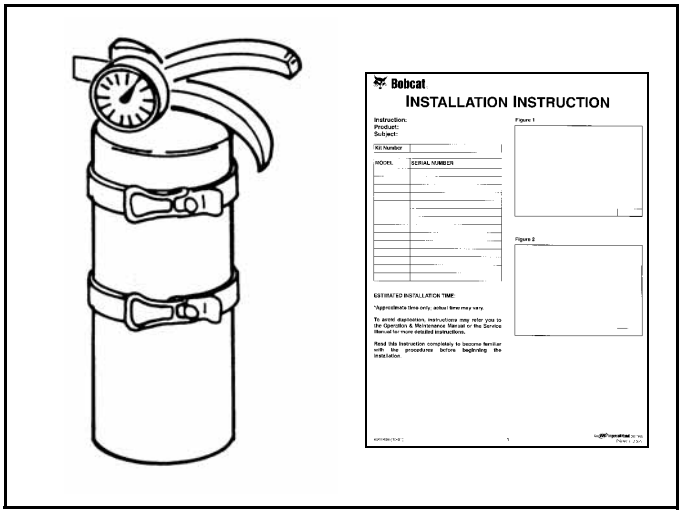
- Always clean the machine, disconnect the battery, and disconnect the wiring from the controllers before welding. Cover rubber hoses, battery and all other flammable parts. Keep a fire extinguisher near the machine when welding. Have good ventilation when grinding or welding painted parts. Wear a dust mask when grinding painted parts. Toxic dust or gas can be produced.

- Stop the engine and let it cool before adding fuel. NO SMOKING!

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

- Use the procedure in the Operation & Maintenance Manual for cleaning the spark arrestor muffler (if equipped).

Figure 1



- Know where fire extinguishers and first aid kits are located and how to use them. Fire extinguishers are available from your Bobcat dealer **[Figure 1]**.

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SI EXC-0206 SM



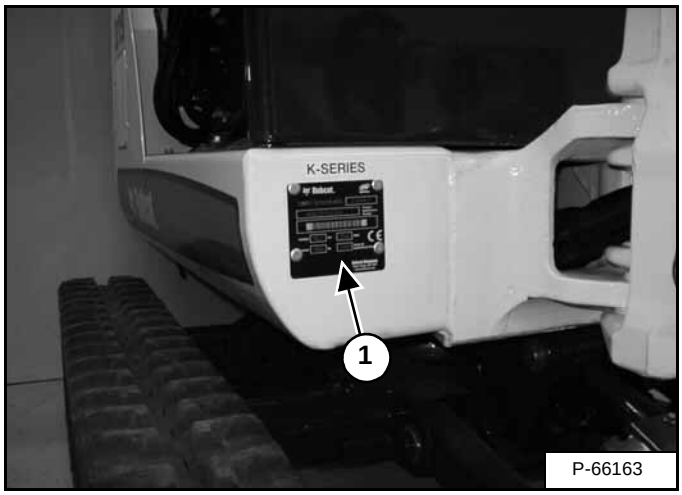
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SERIAL NUMBER LOCATIONS

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

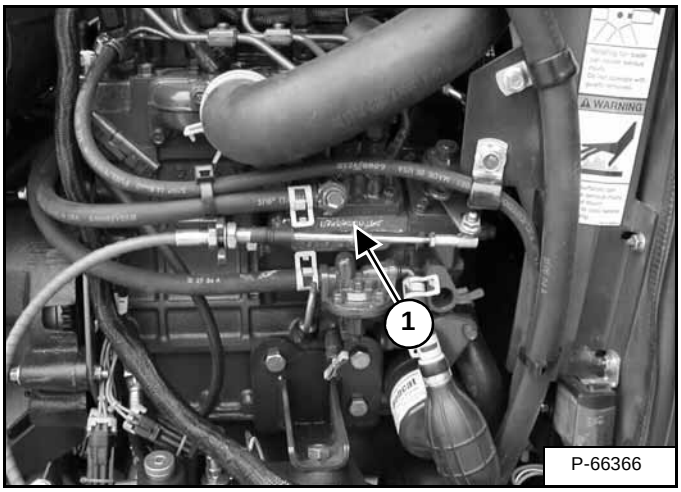
- Module 2. - Production Sequence (Series)
- Module 1. - Model / Engine Combination

1. The 4 digit Model/Engine Combination Module number identifies the model number and engine combination.

2. The 5 digit Production Sequence Number identifies the order which the excavator is produced.

Engine Serial Number

Figure 2

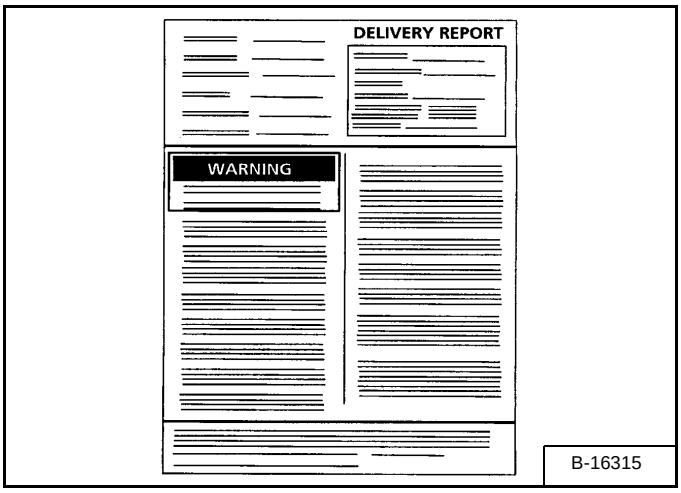


The engine serial number (Item 1) **[Figure 2]** is located on the side of the engine.

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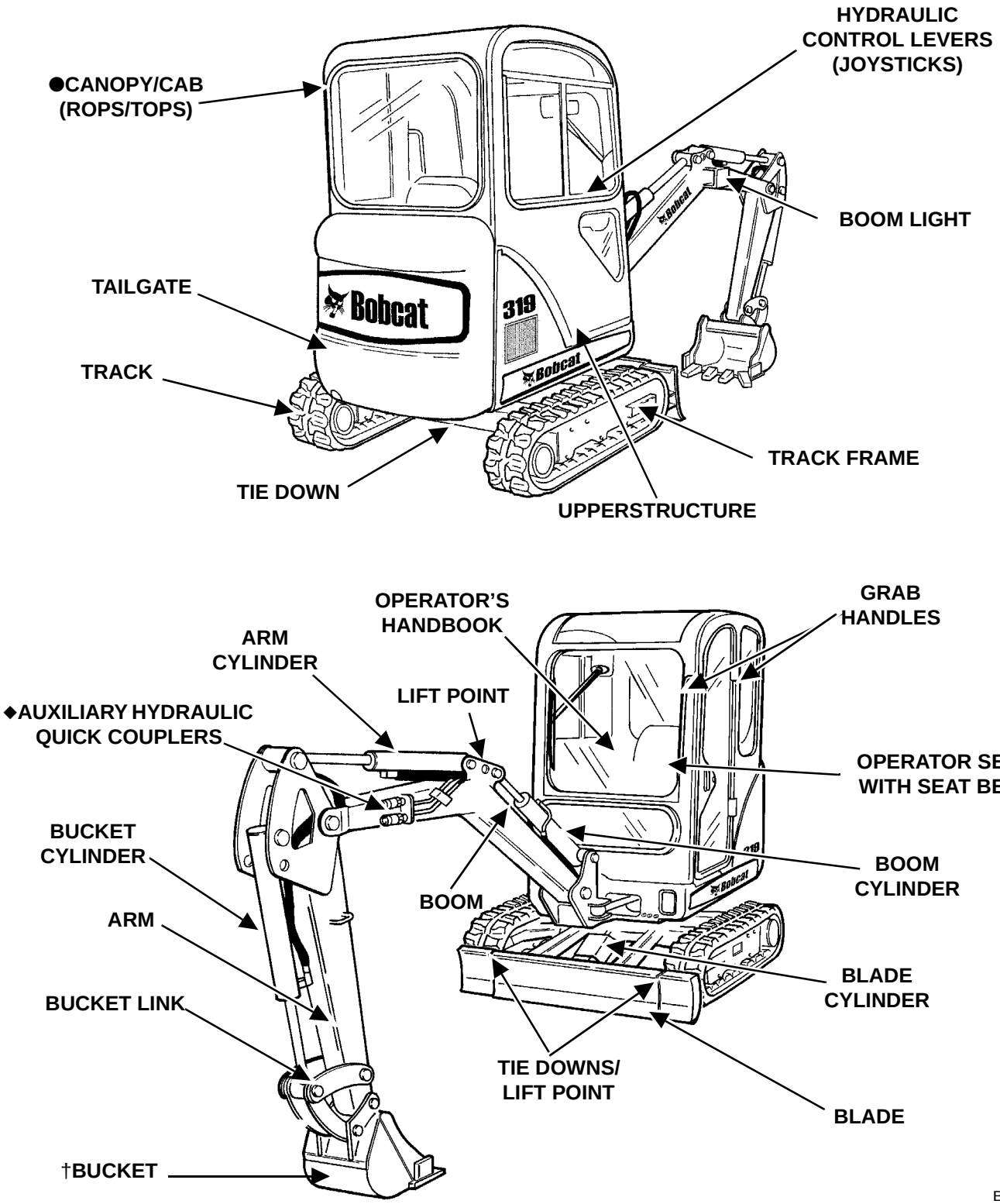
DELIVERY REPORT

Figure 3



The delivery report must be filled out by the dealer and signed by the owner or operator when the Bobcat Excavator is delivered. An explanation of the form must be given to the owner. Make sure it is filled out completely **[Figure 3]**.

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◆ OPTIONAL OR FIELD ACCESSORY (Not Standard Equipment)

† BUCKET - Several different buckets and other attachments are available from the Bobcat Loader.

● ROPS, TOPS - (Roll Over Protective Structure / Tip Over Protective Structure) as standard equipment. The ROPS/TOPS meets SAE J1040, ISO 3471 and ISO 12117.



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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 in.) 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

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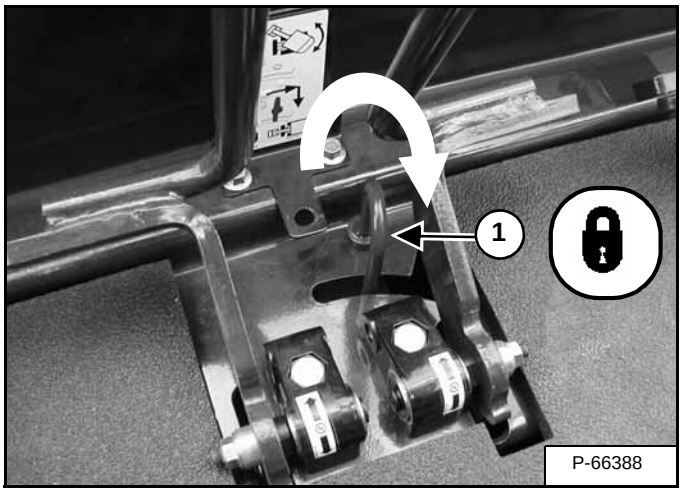


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UPPERSTRUCTURE SLEW LOCK

Operation

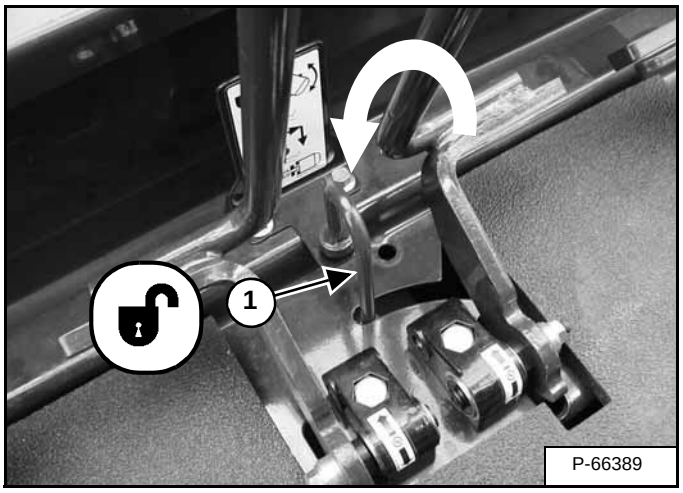
Figure 10-11-1



Move the lever (Item 1) **[Figure 10-11-1]***down* to 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. The upper structure must be parallel to the track frame to engage the Slew Lock.

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

Figure 10-11-2



Move the lever (Item 1) **[Figure 10-11-2]** *up* to disengage the upperstructure from the track frame. Secure the lever in the unlocked position.

WARNING

AVOID INJURY

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

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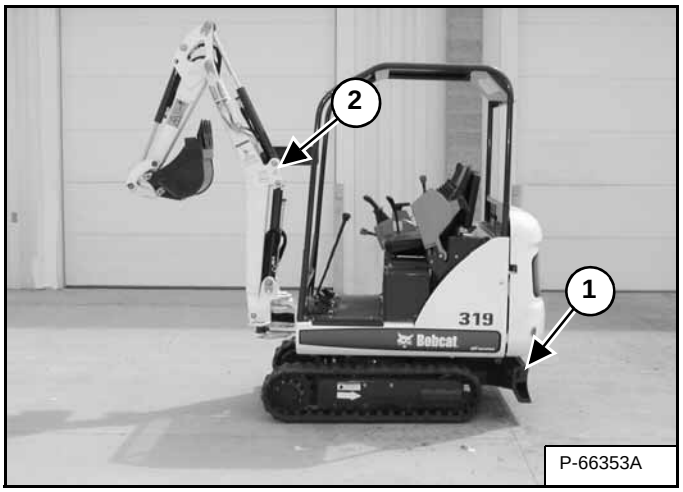


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LIFTING THE EXCAVATOR

Procedure

Figure 10-12-1



Fully extend the bucket and arm cylinders, and fully retract the boom cylinder so that the excavator is in the position shown **[Figure 10-12-1]**.

Engage the UPPERSTRUCTURE SLEW LOCK. (See Operation on Page 10-11-1.)

Raise the blade all the way.

Put all the control levers in neutral.

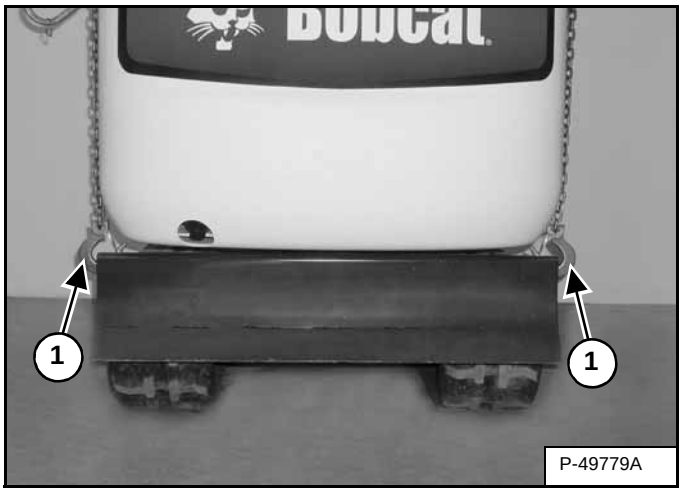
⚠ WARNING

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.**

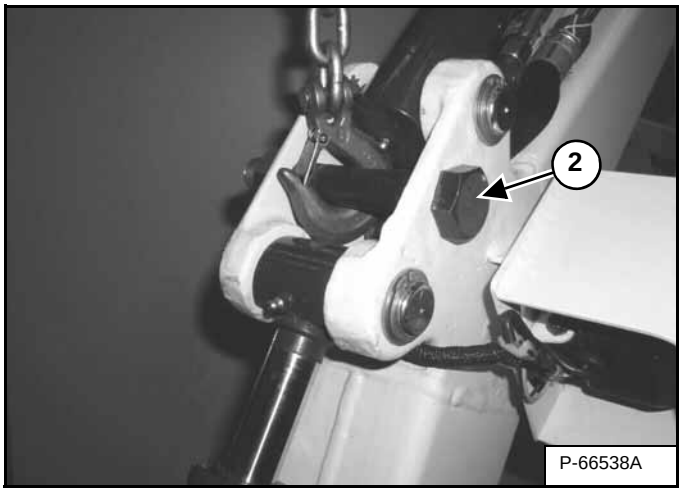
W-2202-0595

Figure 10-12-2



Fasten 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 1 in. (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]**. Fasten a chain from the bolt to the lift fixture.

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OPERATOR CAB (ROPS / TOPS)

Description

The excavator has an optional operator cab (ROPS/TOPS) (Roll Over Protective Structure/Tip Over Protective Structure). The ROPS/TOPS meets SAE J1040, ISO 3471 and ISO 12117.

An enclosed cab (ROPS/TOPS) is an Option or can be installed as a Field Accessory.

Both the cab and canopy provide operator protection if the excavator is tipped over. The seat belt must be worn for ROPS /TOPS protection.

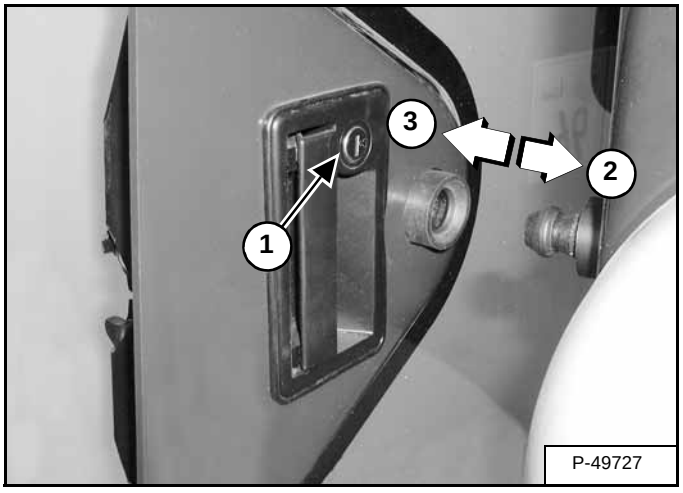
⚠ WARNING

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

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Cab Door

Figure 10-20-1



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

Push the door all the way open (Item 2) **[Figure 10-20-1]** until the latch engages to hold the door in the open position.

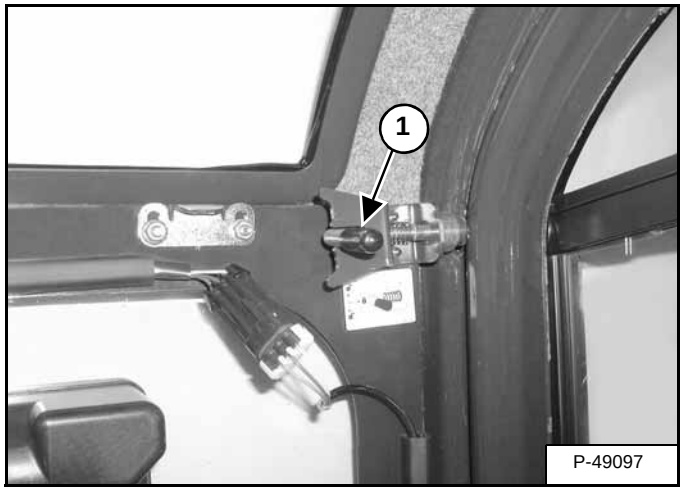
Pull the door away from the cab (Item 3) **[Figure 10-20-1]** to disengage the latch and close the door.

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Front Window

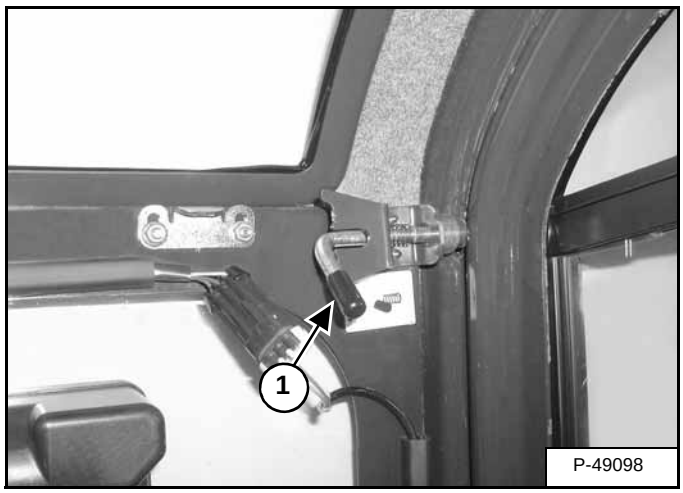
Opening The Front Window

Figure 10-20-2



Retract the 2 top window latch pins (Item 1) **[Figure 10-20-2]**.

Figure 10-20-3



Turn the 2 top latches (Item 1) **[Figure 10-20-3]** to the unlocked position.

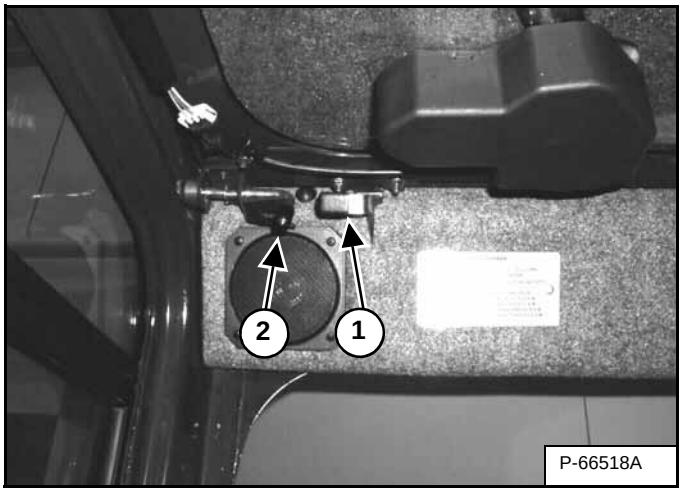
Figure 10-20-4



Use both window grab handles to pull the top of the window in **[Figure 10-20-4]**.

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

Figure 10-20-5



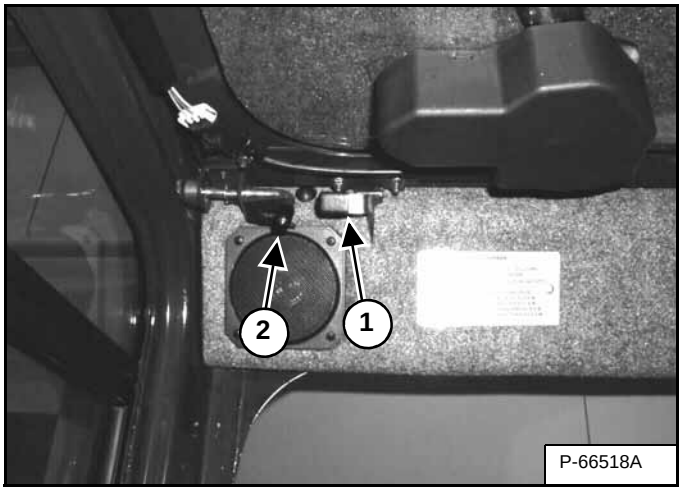
When the window is fully raised, the latch (Item 1) will close on the bracket. Turn the 2 top latches (Item 2) **[Figure 10-20-5]** to the locked position.

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Front Window (Cont'd)

Closing The Front Window

Figure 10-20-6



Support the window while releasing both window latch pins and placing the pins in the unlocked position **[Figure 10-20-6]**.

Support the window using the left grab handle and pull down on the latch (Item 1) **[Figure 10-20-6]** to release the window.

Figure 10-20-7



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

Figure 10-20-8

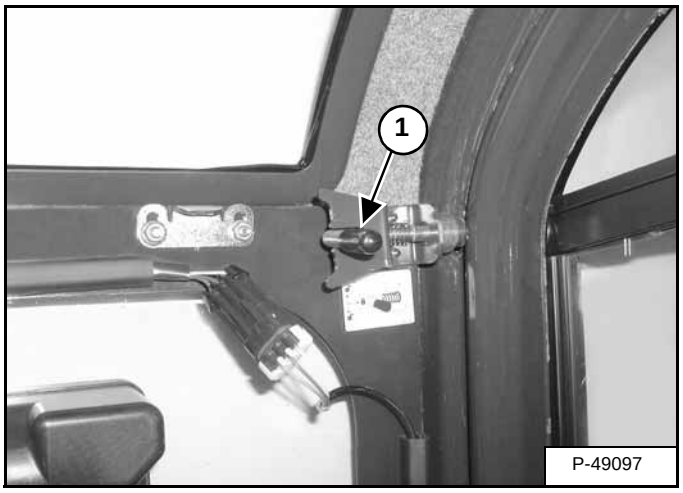
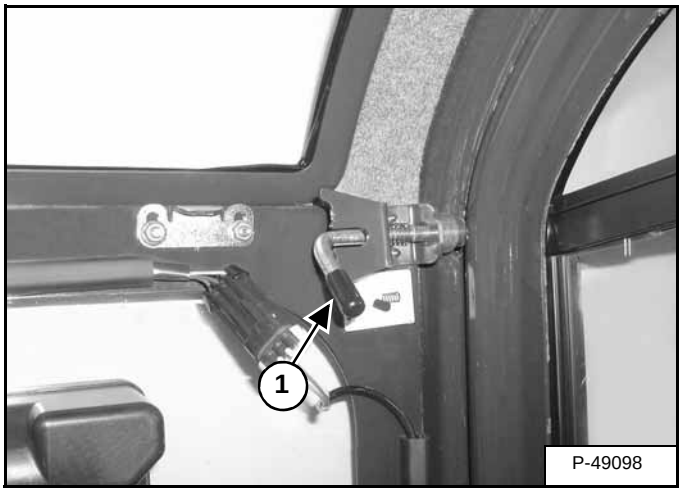


Figure 10-20-9

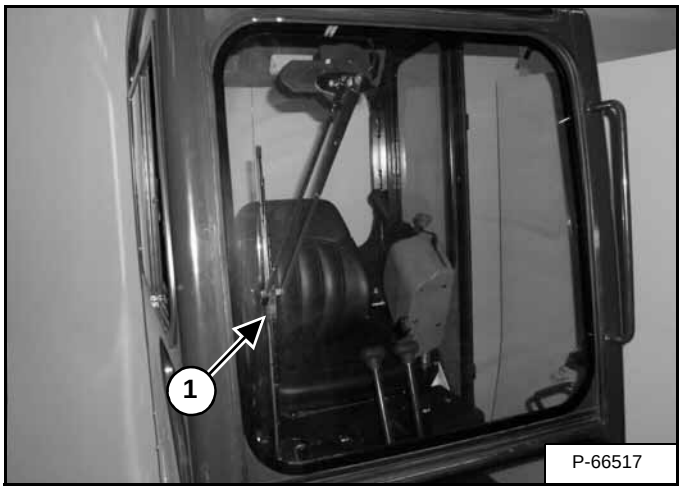


Rotate the top latches (Item 1) **[Figure 10-20-9]** to the locked position (Item 1) **[Figure 10-20-8]**.

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Front Wiper

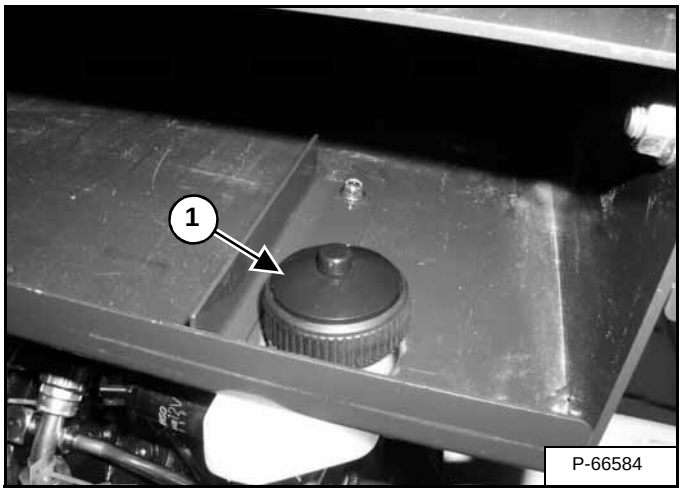
Figure 10-20-10



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

Window Washer Reservoir

Figure 10-20-11



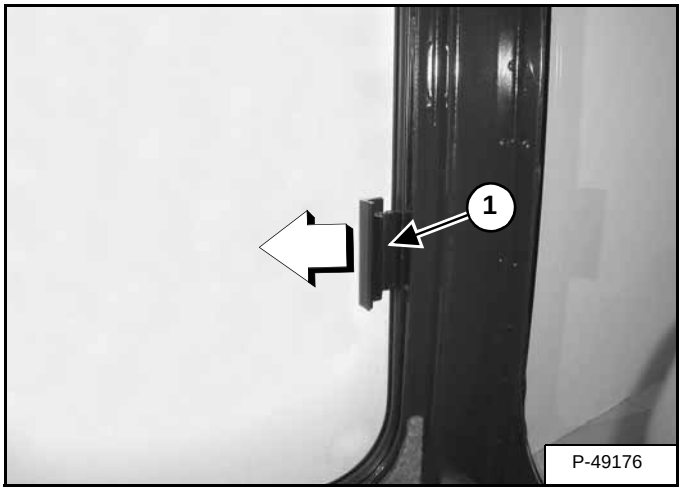
The window washer reservoir (Item 1) **[Figure 10-20-11]** is located under the operator seat.

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Right Side Window

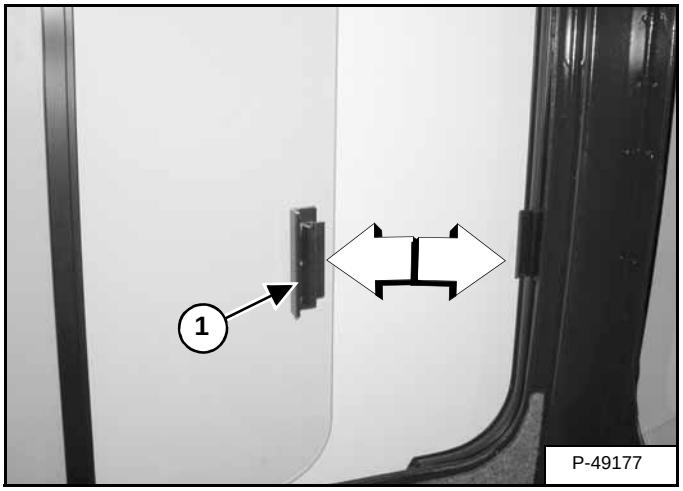
Opening the right rear window

Figure 10-20-12



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

Figure 10-20-13



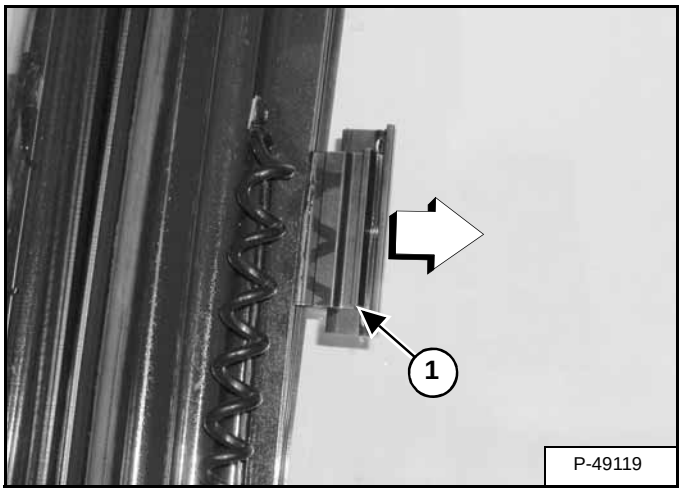
Pull the latch / handle (Item 1) **[Figure 10-20-13]** forward to open the window.

Closing the right rear window

Push the handle back to close the window.

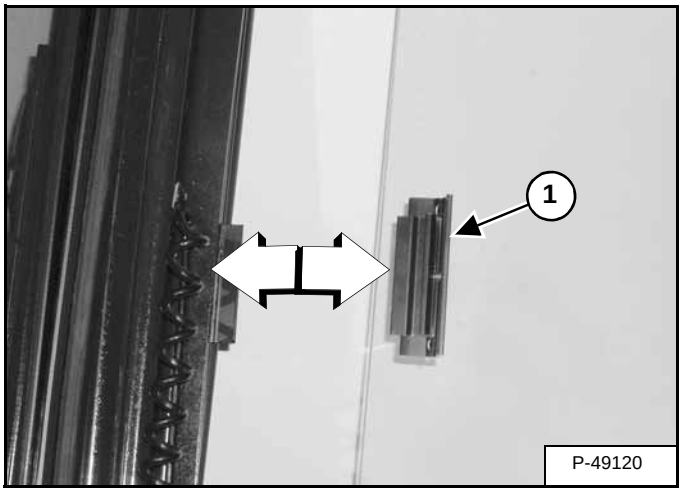
Opening the right front window

Figure 10-20-14



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

Figure 10-20-15



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

Closing the right front window

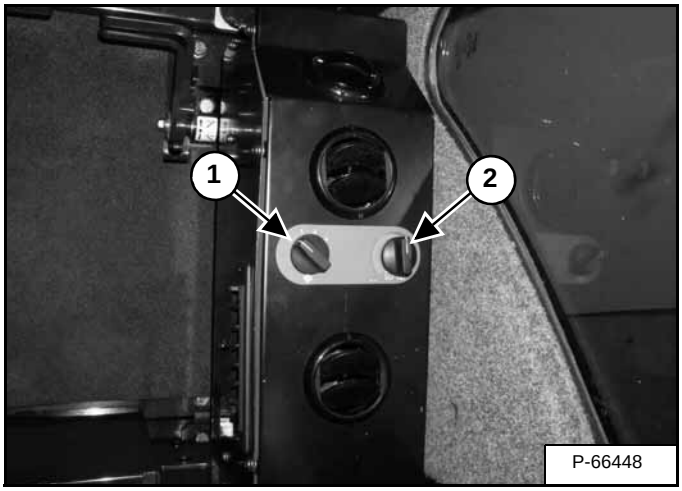
Push the handle forward to close the window.

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Heater

The optional cab is equipped with a heater.

Figure 10-20-16



Fan Switch (Item 1) **[Figure 10-20-16]** - Turn clockwise to increase fan speed; counterclockwise to decrease. There are 4 positions; OFF - LO - MED - HI.

Temperature Control (Item 2) **[Figure 10-20-16]** - Turn clockwise to increase temperature; counterclockwise to decrease.

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TRANSPORTING THE EXCAVATOR ON A TRAILER

Loading And Unloading

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

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

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

Retract the track frame if required.

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

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

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

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

Figure 10-30-1



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

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

Lower the boom, arm, bucket and blade to the transport vehicle.

Stop the engine and remove the key.

Put blocks under the front and rear of the tracks.

Fastening

Figure 10-30-2



Figure 10-30-3



Fasten chains to the front corners of the blade and to the tie down loop at the rear **[Figure 10-30-2]** & **[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.

WARNING

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

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TAILGATE

Opening And Closing

WARNING

AVOID INJURY OR DEATH

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

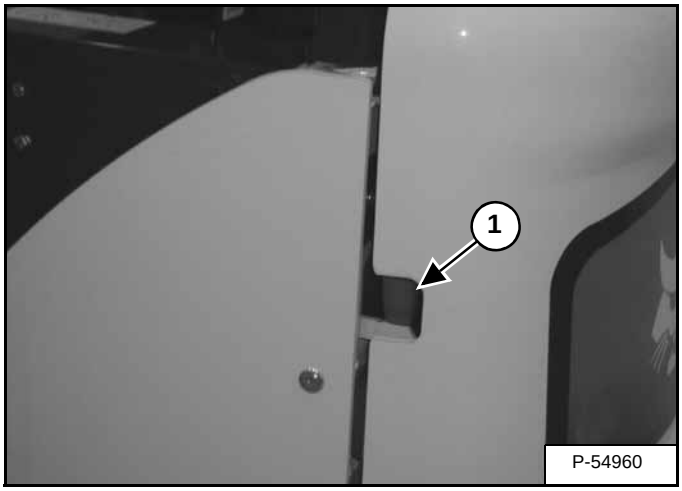
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WARNING

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



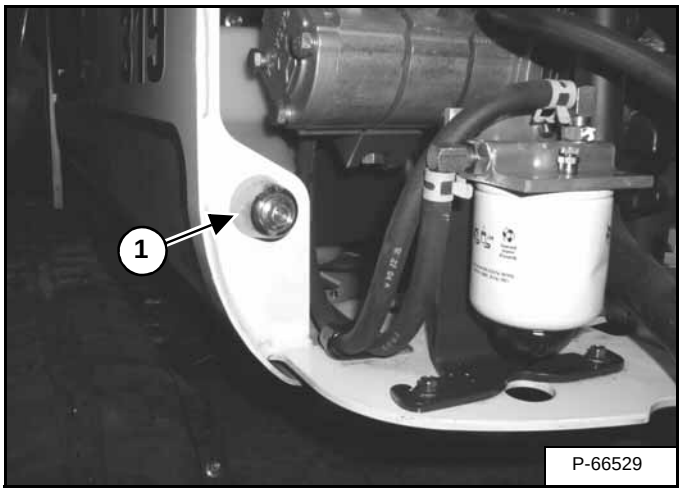
Release the latch (Item 1) **[Figure 10-40-1]** and pull the tailgate open.

Push firmly to close the tailgate.

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

Adjusting The Bumper

Figure 10-40-2

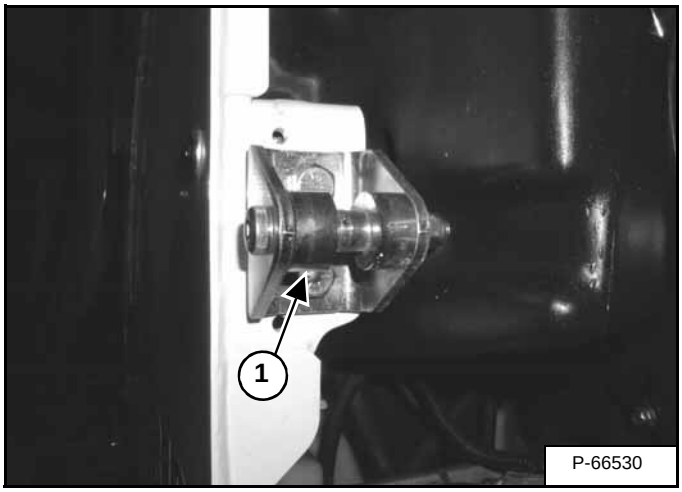


The door bumper (Item 1) **[Figure 10-40-2]** can be adjusted for alignment with the tailgate.

Close the tailgate before operating the excavator.

Adjusting The Latch

Figure 10-40-3



The door latch (Item 1) **[Figure 10-40-3]** can be adjusted by loosening the two bolts, moving the latch, and tightening the two bolts.

Close the tailgate before operating the excavator.

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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

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

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 2 fittings.		■				
Fuel Tank & 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.				■		
Travel Motor	Check lubricant level in both travel motors.			••	■		
Engine Oil and Filter	Replace oil & filter. Use CD or better grade oil and Bobcat filter.		•			■	
Radiator, & Oil Cooler	Clean debris from the radiator fins.					■	
Hydraulic Filter	Replace the filter.			••		■	
Alternator & Starter	Check the alternator and starter connections.			••		■	
Engine Valves	Check and adjust the engine valve clearance.					■	
Travel 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.**

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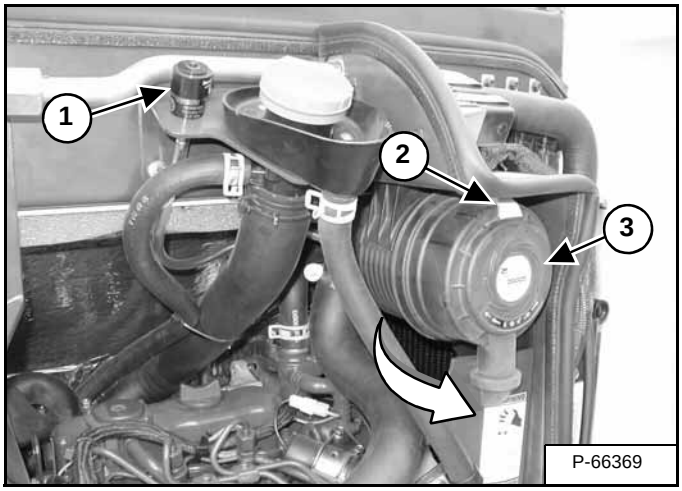
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AIR CLEANER SERVICE

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

Daily Check

Figure 10-60-1



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

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

Replacing Filter Elements

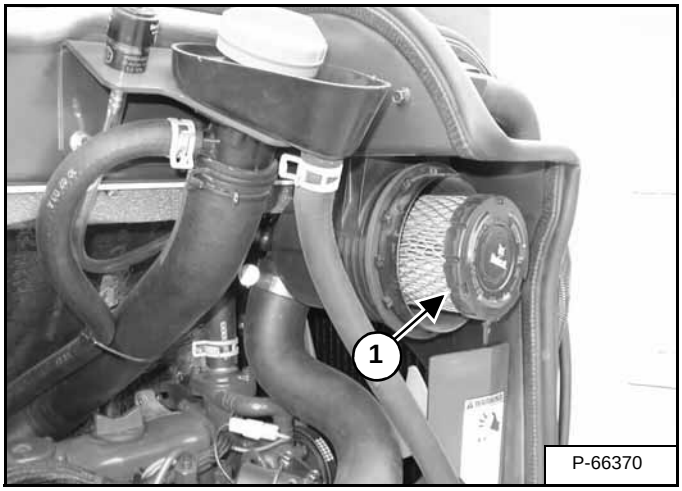
Outer Filter

Pull 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.

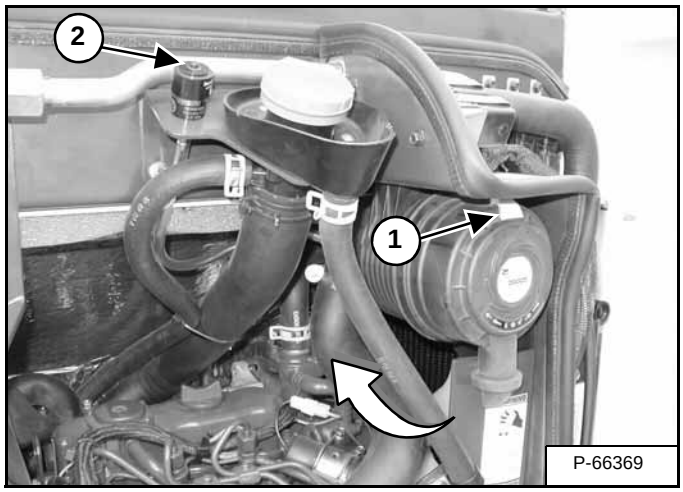
Clean the housing and the seal surface. DO NOT use compressed air.

Install a new outer filter.

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Replacing Filter Elements (Cont'd)

Figure 10-60-3



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

Push locking tab in (Item 1) **[Figure 10-60-3]**.

After the outer filter has been replaced, press the button (Item 2) **[Figure 10-60-3]** on the top of the condition indicator 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.

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

Inner Filter

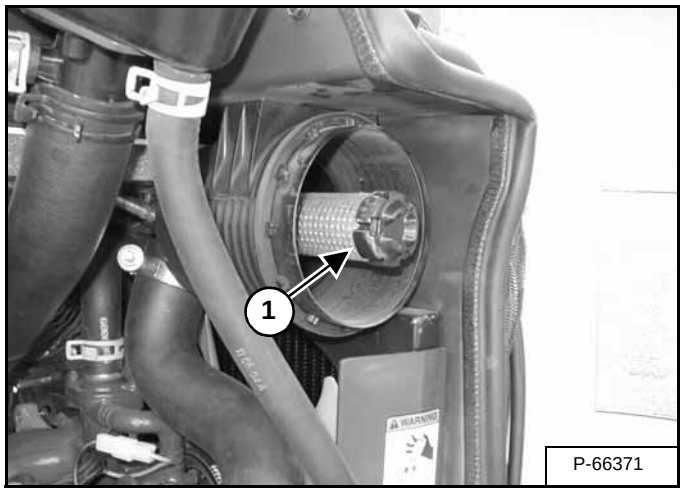
Only replace the inner filter under the following conditions:

- Replace the inner filter every *third* time the outer filter is replaced.
- After the outer filter has been replaced, press the button (Item 2) **[Figure 10-60-3]** on the top of the condition indicator 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.

Remove the dust cup, outer filter and inner filter.

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

Figure 10-60-4



Install the new inner filter (Item 1) **[Figure 10-60-4]**.

Install the outer filter and the dust cup.

Press the button on the condition indicator to reset the condition indicator by remove the red ring.

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ENGINE COOLING SYSTEM

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

Cleaning

Open the tailgate.

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

Checking Level

WARNING

AVOID BURNS

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

W-2070-1203

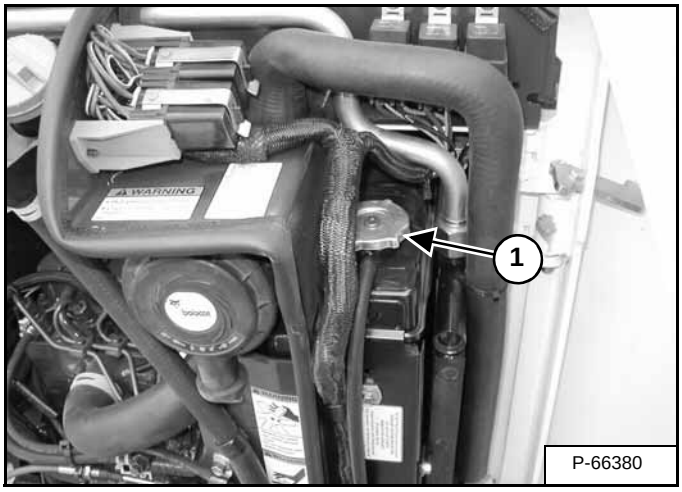
WARNING

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 0.750 to 1.0 in. (20 to 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

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Removing And Replacing Coolant

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

Turn the upperstructure so there is access to the engine and radiator from between the tracks. Stop the engine.

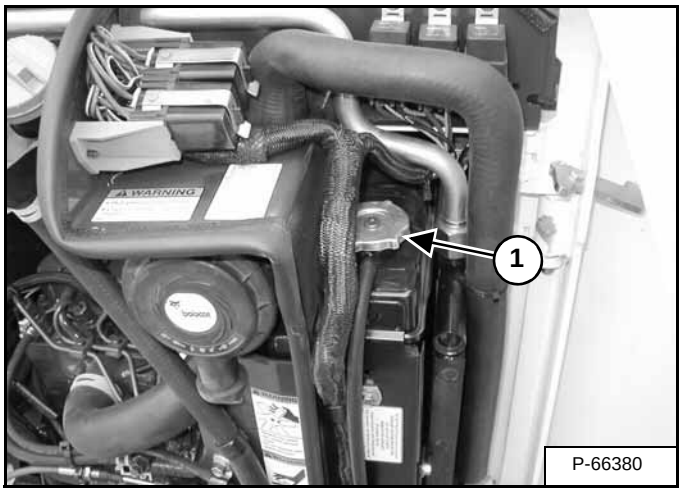
WARNING

AVOID BURNS

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

W-2070-1203

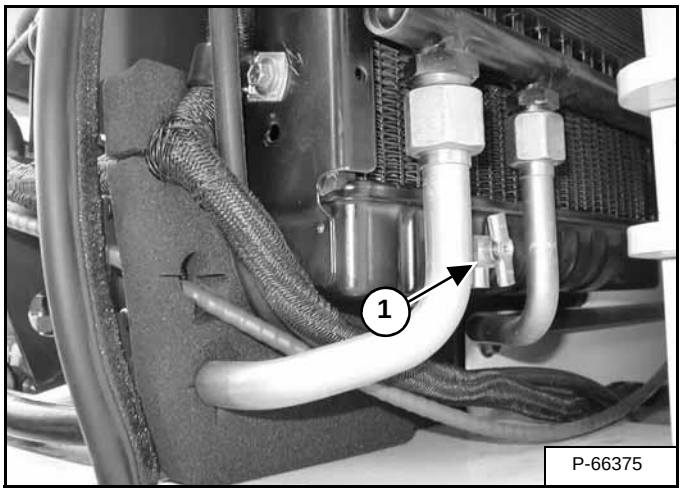
Figure 10-70-2



When the engine is cool, loosen and remove the radiator cap (Item 1) **[Figure 10-70-2]**.

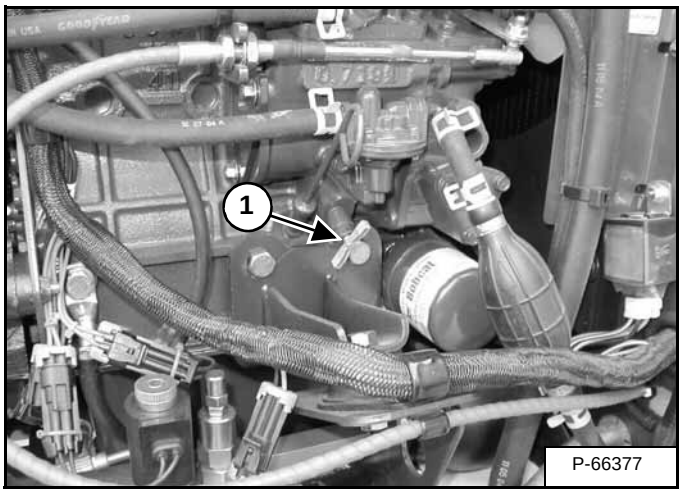
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Figure 10-70-3



Open the drain valve (Item 1) **[Figure 10-70-3]** at the bottom of the radiator and drain the coolant into a container.

Figure 10-70-4



Open the drain valve (Item 1) **[Figure 10-70-4]** on the engine block and drain the coolant into a container.

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

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

ENGINE COOLING SYSTEM (CONT'D)

Removing And Replacing Coolant (Cont'd)

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.

1 gallon and 1 pint of propylene glycol mixed with 1 gallon 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.

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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.

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

Contact your fuel supplier for local recommendations.

⚠ WARNING

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

W-2063-0887

⚠ WARNING

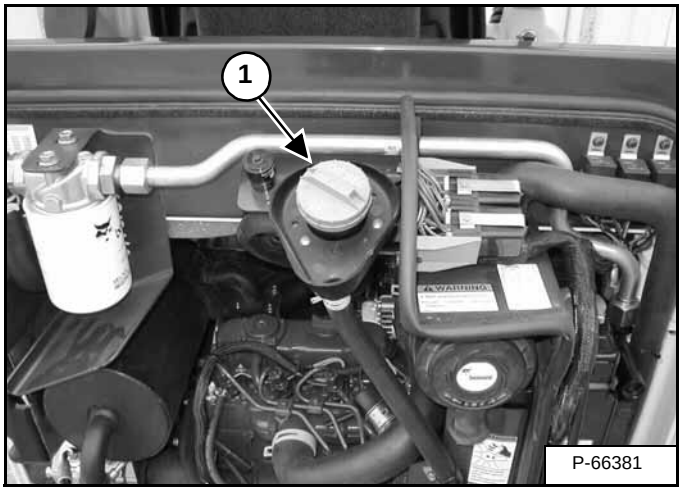
Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire which can result in injury or death.

W-2103-1285

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

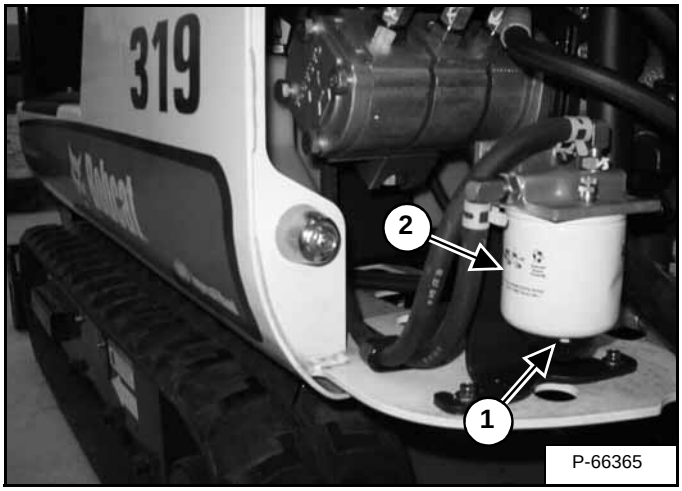
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Fuel Filters

Removing Water

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 Elements

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 hand tighten.

Remove the air from the fuel system. (See Removing Air From The Fuel System on Page 10-80-3)

Draining The Fuel Tank

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

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

Figure 10-80-3

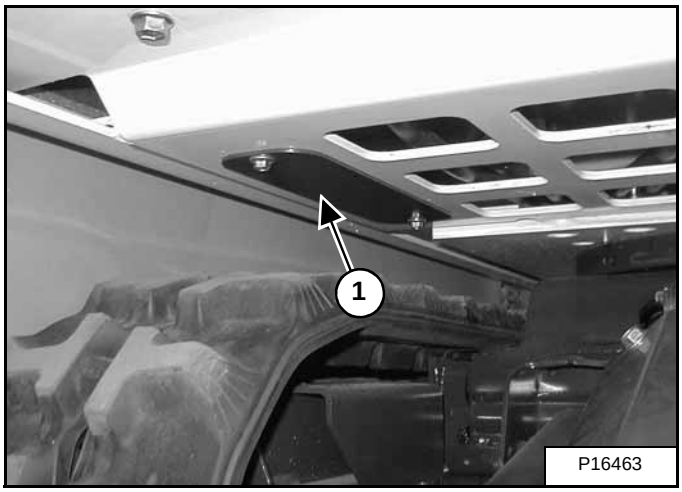
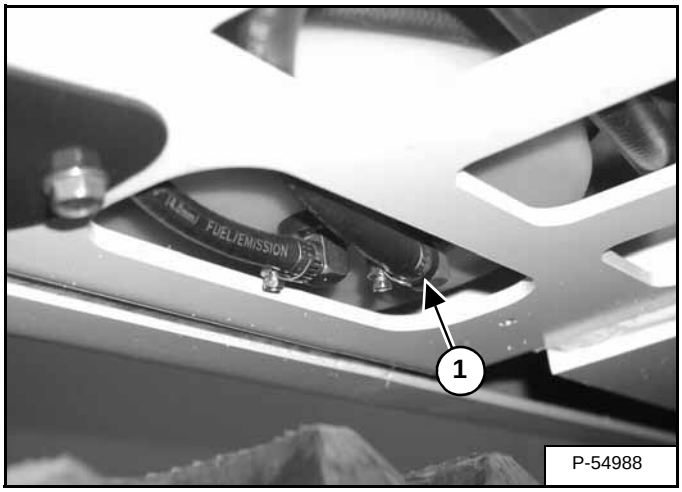


Figure 10-80-4



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.

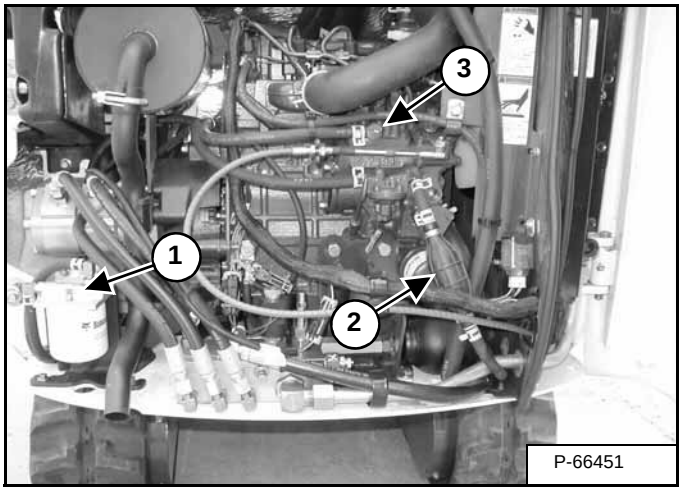
Reuse, recycle or dispose of fuel in an environmentally safe manner.

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

⚠ WARNING

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

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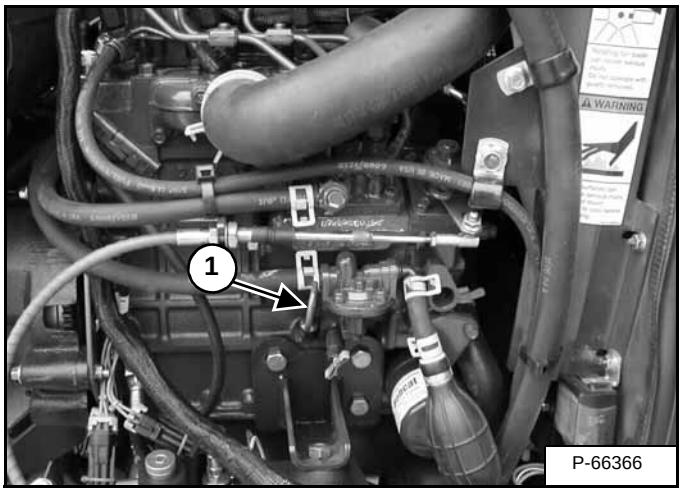
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ENGINE LUBRICATION SYSTEM

Checking And Adding Engine Oil

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

Figure 10-90-1

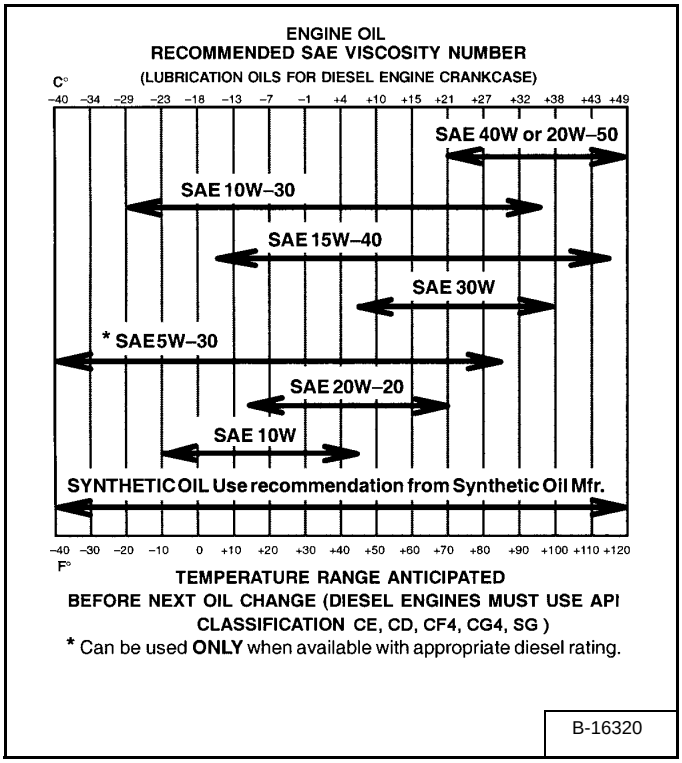


Open the tailgate and remove the dipstick (Item 1) **[Figure 10-90-1]**.

Keep the oil level between the marks on the dipstick.

Engine Oil Chart

Figure 10-90-2



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

Install the dipstick and close the tailgate.

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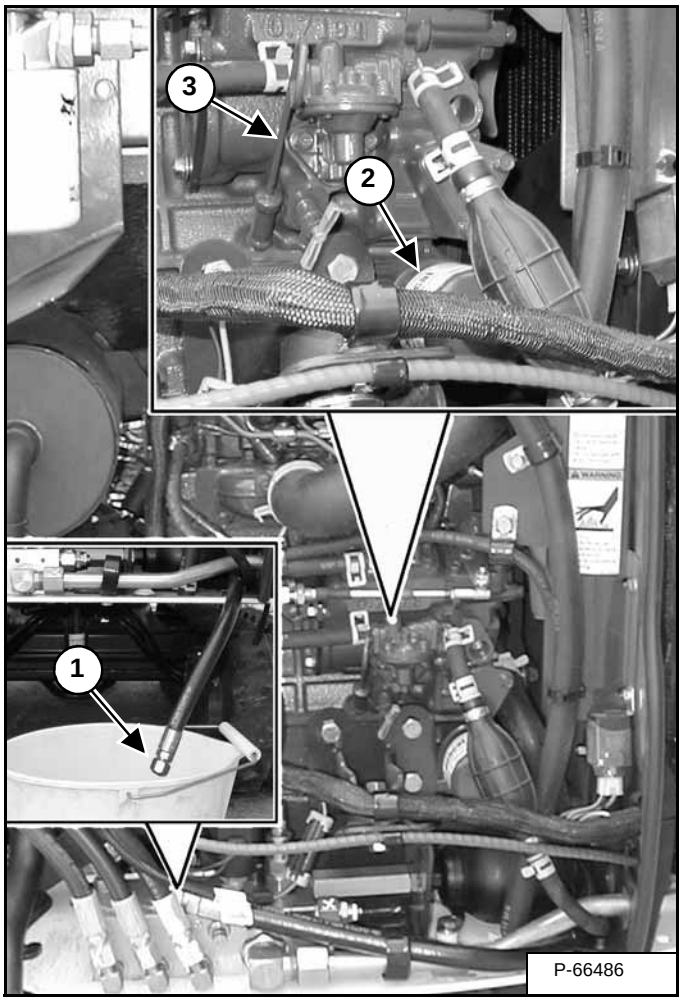
Removing And Replacing Oil And Filter

See the Service Schedule for the service interval for replacing the engine oil and filter. (See Chart on Page 10-50-1.)

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

Open the tailgate.

Figure 10-90-3



Remove the engine oil drain plug (Item 1) **[Figure 10-90-3]**. 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.

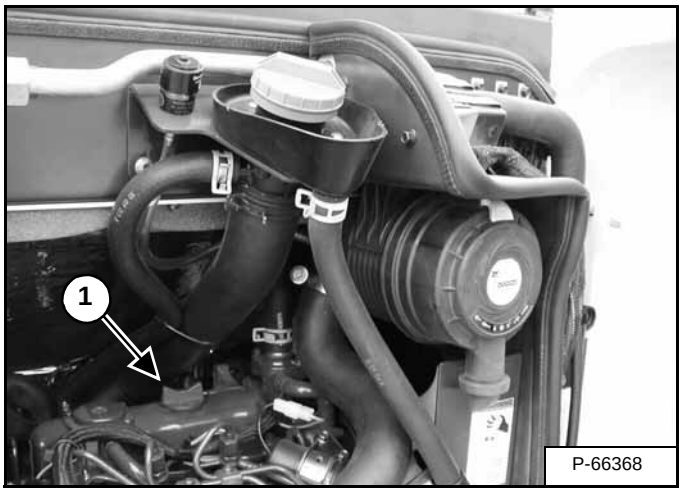
Use a genuine Bobcat filter.

Put clean oil on the filter gasket.

Install the filter and hand tighten.

Install and tighten the oil drain plug.

Figure 10-90-4



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

Put in 3.75 qt. (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 (Item 3) **[Figure 10-90-3]**.

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HYDRAULIC SYSTEM

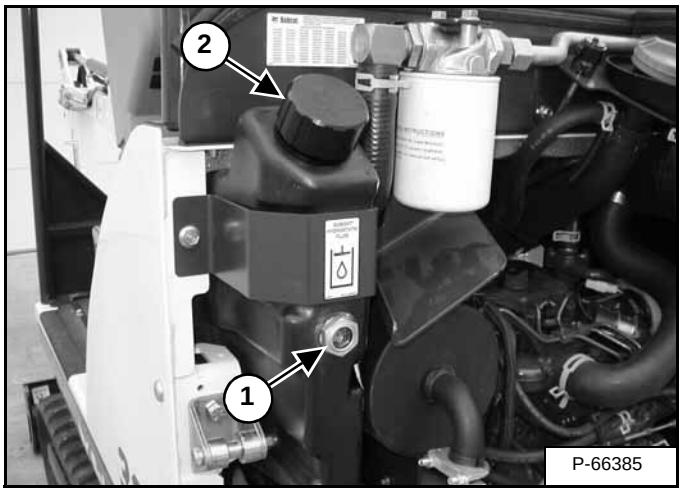
Checking And Adding Fluid

Put the machine on a level surface.

Retract the tracks fully.

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

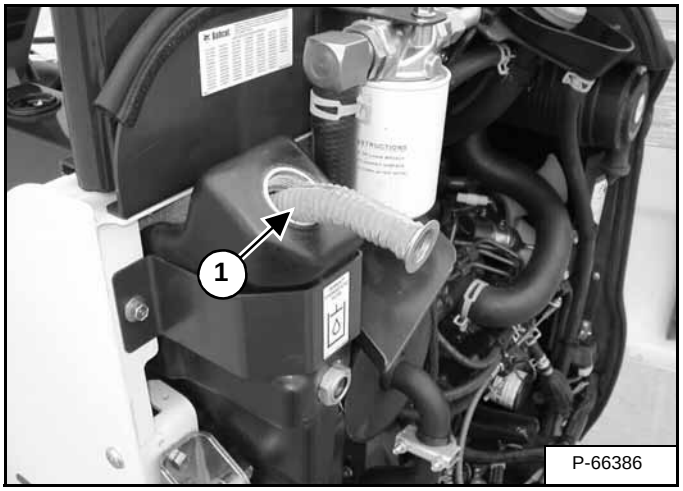
Figure 10-100-1



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

Remove 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 fill neck when adding oil.

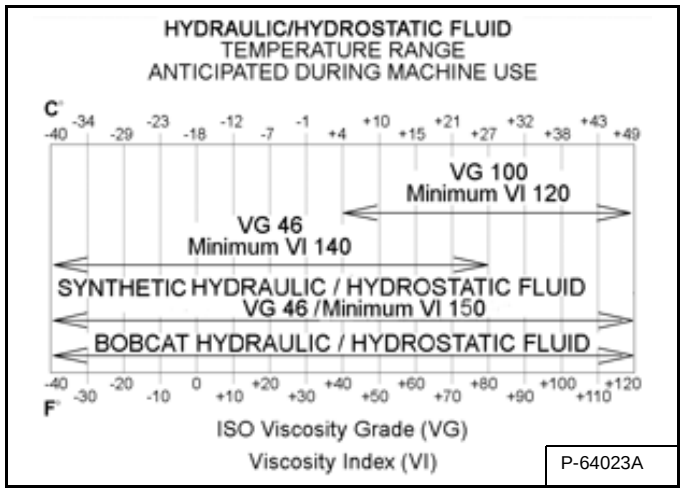
⚠ WARNING

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

W-2103-1285

Hydraulic Fluid Chart

Figure 10-100-3



Use the correct hydraulic fluid shown in chart **[Figure 10-100-3]**.

Add hydraulic fluid as needed to bring the level to the center of sight gauge (Item 1) **[Figure 10-100-1]**.

Install the oil fill cap.

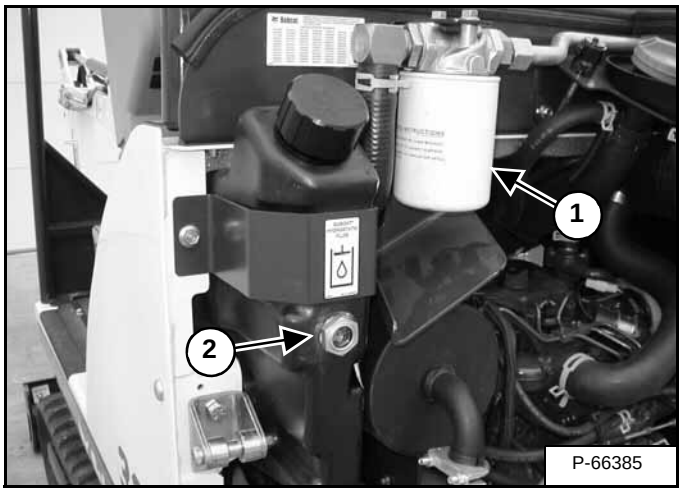
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Removing And Replacing Hydraulic Filter

See the Service Schedule for the correct service interval. (See Chart on Page 10-50-1.)

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 hand tighten 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.

Removing And Replacing Hydraulic Fluid

See the Service Schedule for the correct service interval. (See Chart on Page 10-50-1.)

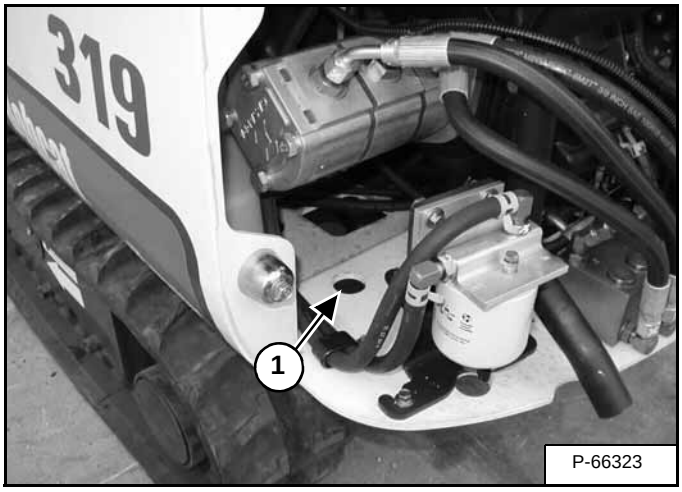
Retract the tracks fully.

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

Open the tailgate.

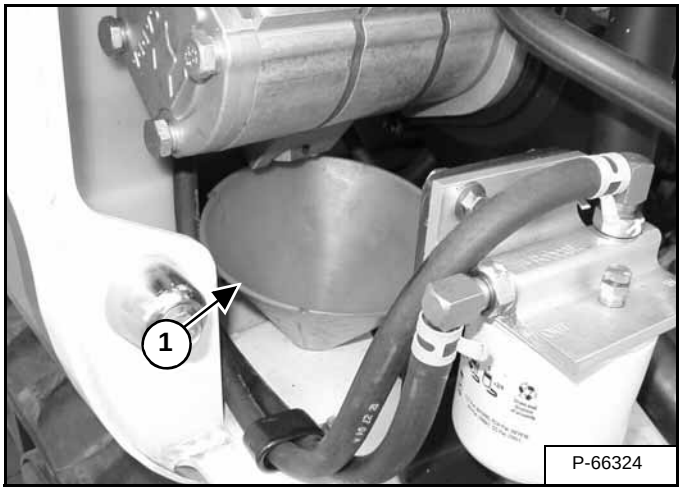
Remove and replace the hydraulic filter.

Figure 10-100-5



A hole (Item 1) **[Figure 10-100-5]** is provided in the housing for ease of draining the hydraulic fluid.

Figure 10-100-6



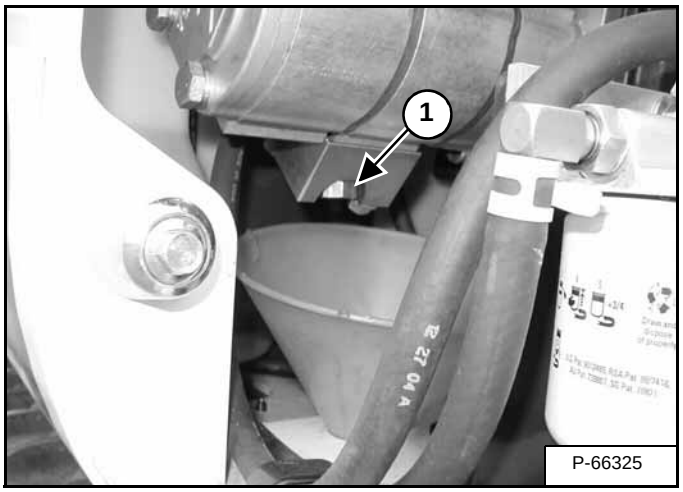
Install a funnel (Item 1) **[Figure 10-100-6]** in the hole.

Place a container under the funnel.

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Removing And Replacing Hydraulic Fluid (Cont'd)

Figure 10-100-7



Remove the drain plug (Item 1) **[Figure 10-100-7]** from the pump fitting and drain the hydraulic fluid into the container.

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.

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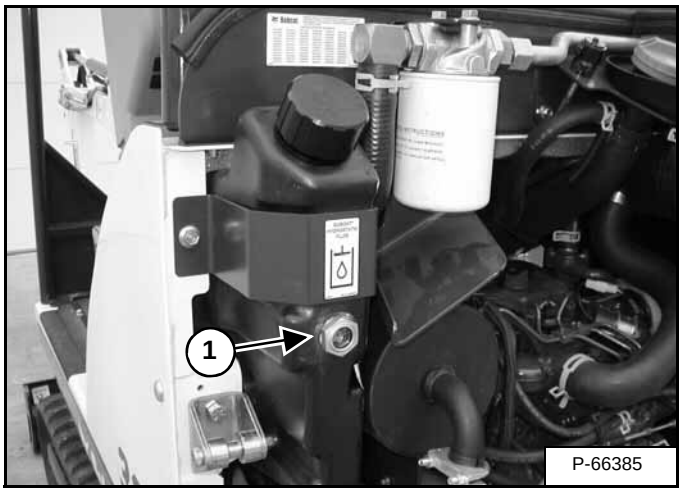
IMPORTANT

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

I-2045-0788

Install the drain plug.

Figure 10-100-8



Add fluid to the reservoir until it is at the center of the sight gauge (Item 1) **[Figure 10-100-8]**. (See Checking And Adding Fluid on Page 10-100-1.)

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

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LUBRICATING THE EXCAVATOR

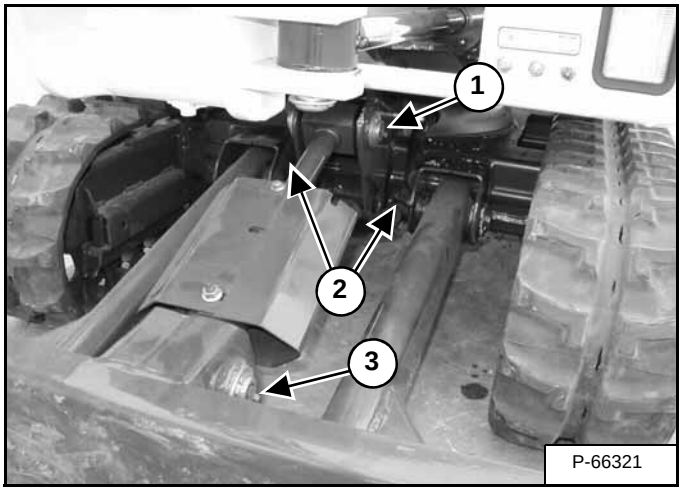
Lubrication Locations

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

Record the operating hours each time you lubricate the excavator.

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

Figure 10-110-1



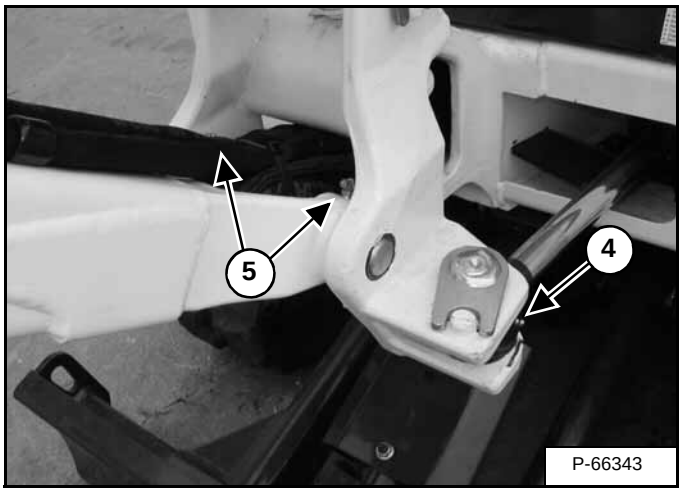
Ref Description (# of Fittings)

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

2. Blade Pivots, every 8 to 10 hours (2) **[Figure 10-110-1]**

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

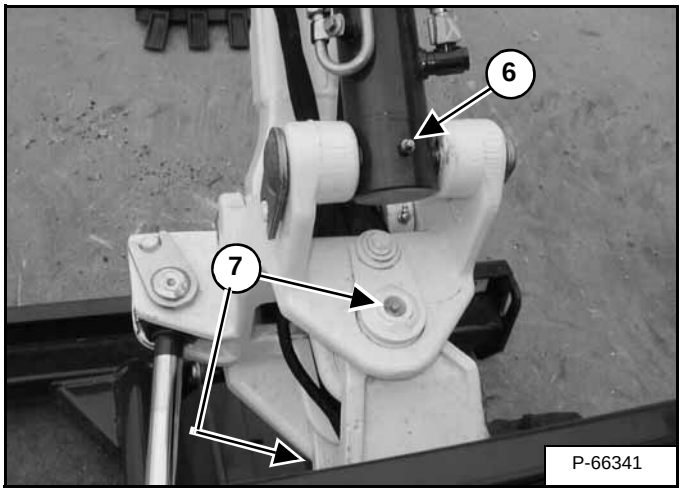
Figure 10-110-2



4. Boom Swing Cylinder-Rod End, every 8 to 10 hours (1) **[Figure 10-110-2]**

5. Boom Base End, every 8 to 10 hours (2) **[Figure 10-110-2]**

Figure 10-110-3



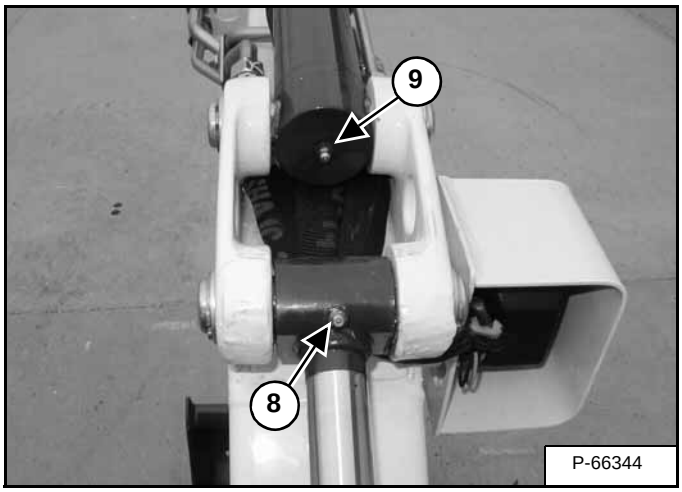
6. Boom Cylinder - Base End, every 8 to 10 hours (1) **[Figure 10-110-3]**

7. Boom Swing Pivot, every 8 to 10 hours (2 - on top and bottom swing pin) **[Figure 10-110-3]**

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Lubrication Locations (Cont'd)

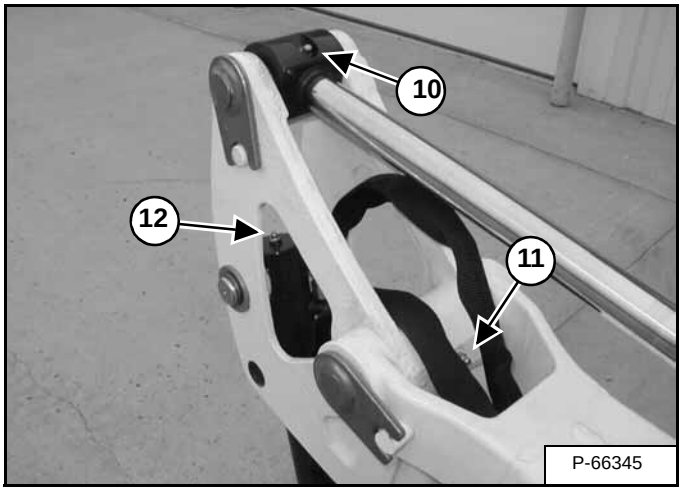
Figure 10-110-4



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

9. Arm Cylinder - Base End, every 8 to 10 hours (1) **[Figure 10-110-4]**

Figure 10-110-5

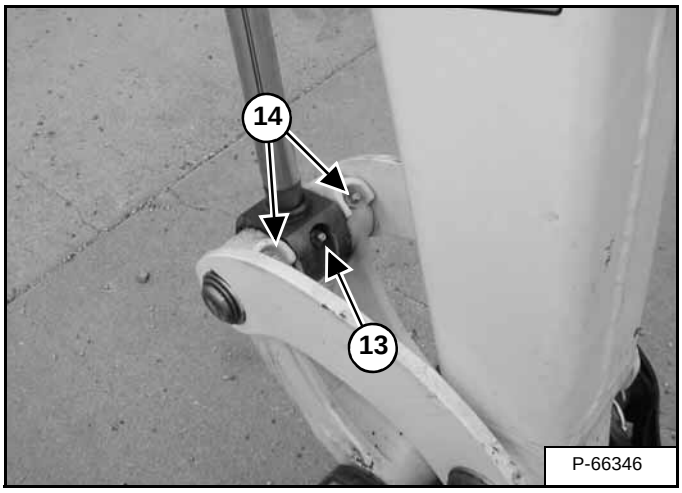


10. Arm Cylinder - Rod End, every 8 to 10 hours (1) **[Figure 10-110-5]**

11. Arm Pivot, every 8 to 10 hours (1) **[Figure 10-110-5]**

12. Bucket Cylinder - Base End, every 8 to 10 hours (1) **[Figure 10-110-5]**

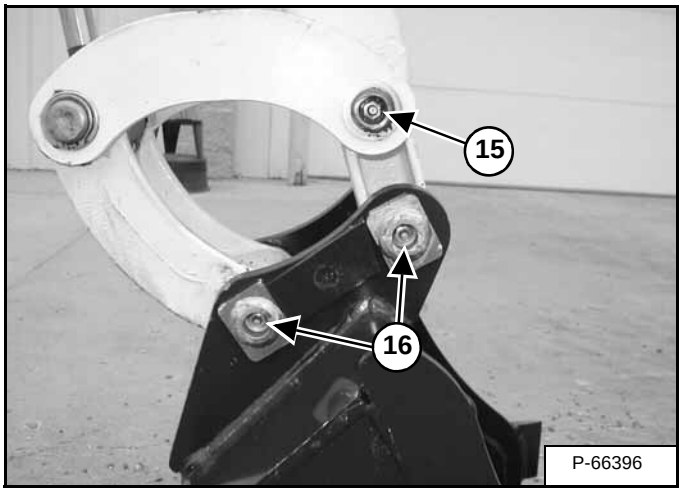
Figure 10-110-6



13. Bucket Cylinder - Rod End, every 8 to 10 hours (1) **[Figure 10-110-6]**

14. Bucket Link Pivots, every 8 to 10 hours (2) **[Figure 10-110-6]**

Figure 10-110-7



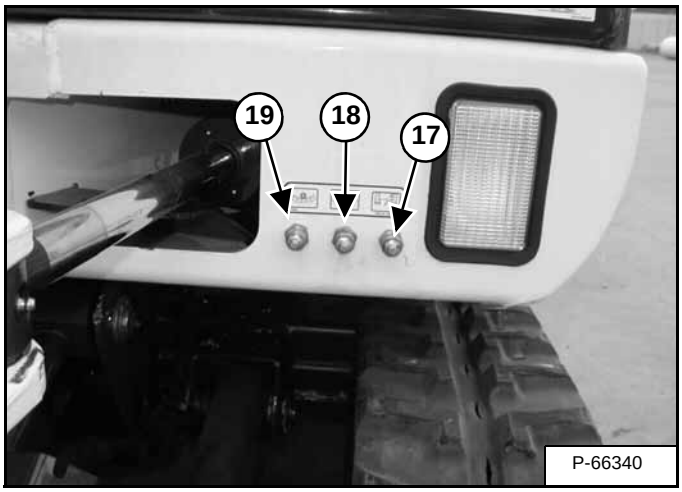
15. Bucket Link Pivot, every 8 to 10 hours (1) **[Figure 10-110-7]**

16. Bucket Pivots, every 8 to 10 hours (2) **[Figure 10-110-7]**

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Lubrication Locations (Cont'd)

Figure 10-110-8



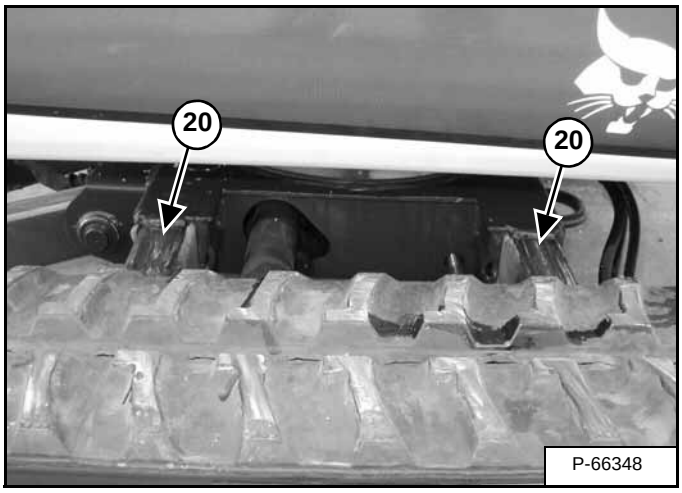
17. Boom Swing Cylinder-Base End every 8 to 10 hours **[Figure 10-110-8]**

18. Swing Circle Bearing, every 50 hours **[Figure 10-110-8]**

19. Swing Circle Pinion, every 50 hours. Pump 4 times with a grease gun. Rotate the upperstructure 180° and repeat. **[Figure 10-110-8]**

NOTE: Do not over-grease the swing circle; damage to the seal could result. Pump 4 to 5 times with a grease gun. Rotate the upperstructure 90° and repeat 3 more times.

Figure 10-110-9



20. Track Expansion Tube, as required **[Figure 10-110-9]**.

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

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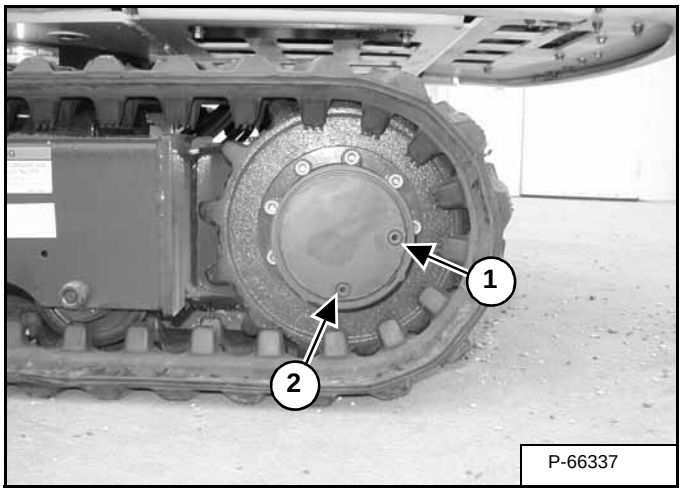


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TRAVEL MOTOR

Checking And Adding Oil

Figure 10-120-1



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

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

Add SAE-90W gear lube through the hole if the oil level is below the hole (each motor).

Install and tighten both plugs.

Repeat the procedure for the other side.

Removing And Replacing Oil

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

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

Add 0.53 qt. (0,5 L) of SAE-90W gear lube to the plug hole (Item 1) **[Figure 10-120-1]** until the gear lube level is at the bottom edge of the plug hole (each motor).

Install and tighten the plug.

Repeat the procedure for the other side.

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SPARK ARRESTOR MUFFLER

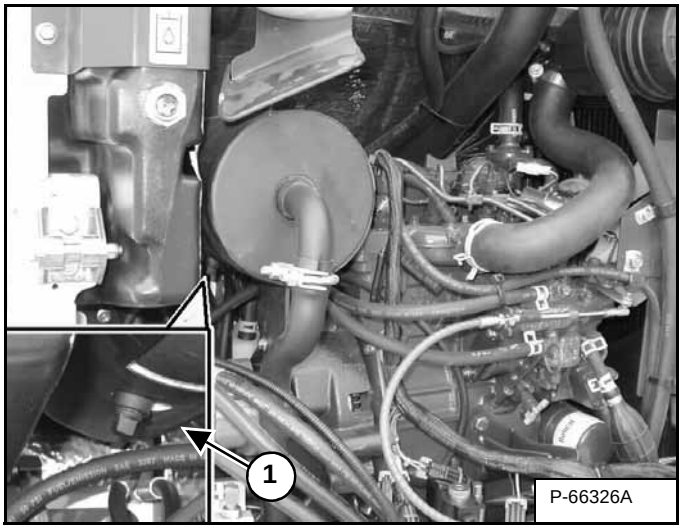
Cleaning Procedure

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

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 muffler.

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

Stop the engine. Install and tighten the plug.

Close the tailgate.

WARNING

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

W-2050-1285

WARNING

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

W-2011-1285

WARNING

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

W-2068-1285

WARNING

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

Failure to do so can cause injury or death.

W-2203-0595

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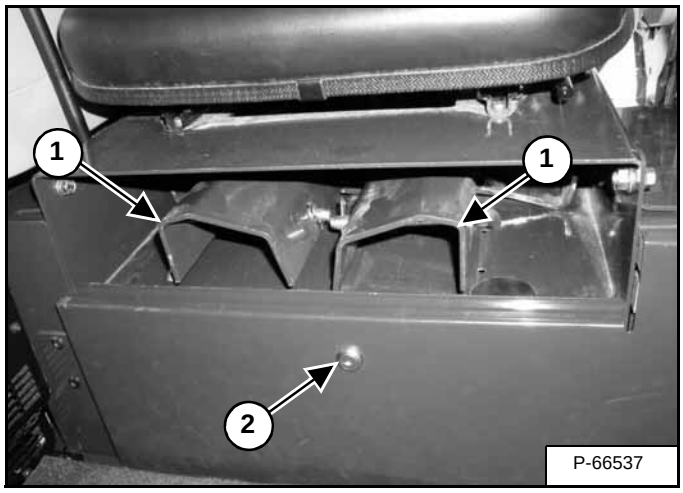
ALTERNATOR BELT

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.

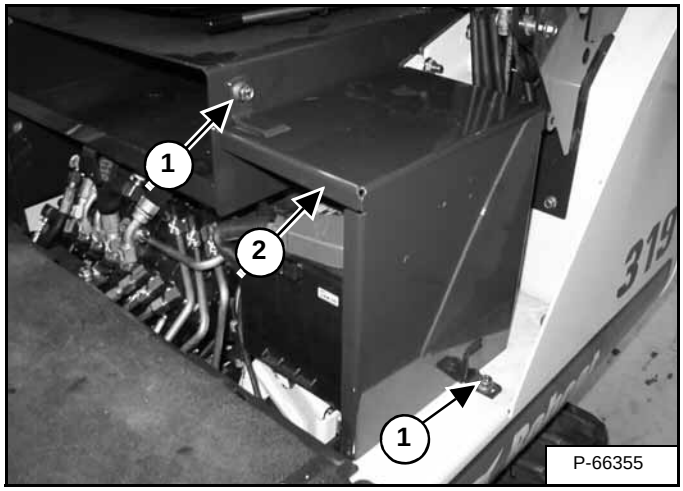
Figure 10-140-1



Remove the two blade extensions (Item 1) **[Figure 10-140-1]** from the storage compartment.

Use the start key to remove the access cover (Item 2) **[Figure 10-140-1]**.

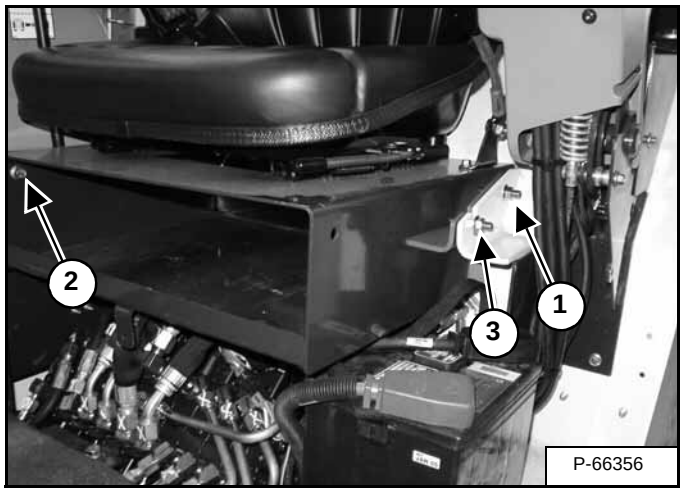
Figure 10-140-2



Remove the two bolts (Item 1) **[Figure 10-140-2]** and brackets from the battery cover.

Remove the cover (Item 2) **[Figure 10-140-2]**.

Figure 10-140-3



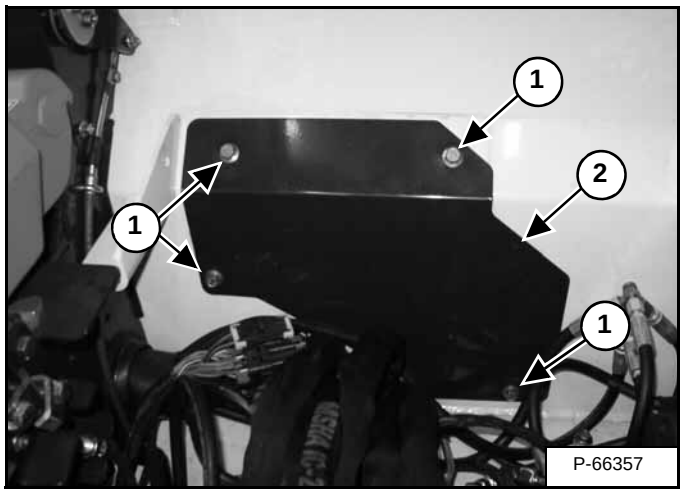
Remove the two bolts (Item 1) **[Figure 10-140-3]** and nuts from both sides of the seat mount.

Remove the bolt (Item 2) **[Figure 10-140-3]**, nut and bracket from the right side of the seat mount.

Loosen the two bolts (Item 3) **[Figure 10-140-3]** and nuts from both sides of the seat mount.

Remove the seat and seat mount.

Figure 10-140-4

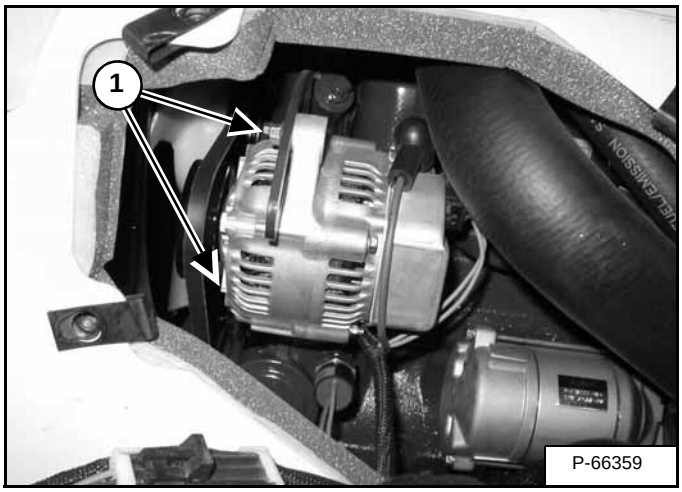


Remove the four bolts (Item 1) and remove the access panel (Item 2) **[Figure 10-140-4]**.

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Belt Adjustment (Cont'd)

Figure 10-140-5



Loosen the alternator mounting and adjustment bolts (Item 1) **[Figure 10-140-5]**.

If a belt tension tool is available, move the alternator toward the front of the machine **[Figure 10-140-5]** 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 10-140-5]** 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 2 blade extensions.

Belt Replacement

See Belt Adjustment for removal of components to access the alternator belt. (See Belt Adjustment on Page 10-140-1).

Loosen the alternator mounting and adjustment bolts (Item 1) **[Figure 10-140-5]** and loosen the belt all the way.

Remove the belt and install a new belt.

Adjust the belt as shown above.

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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.

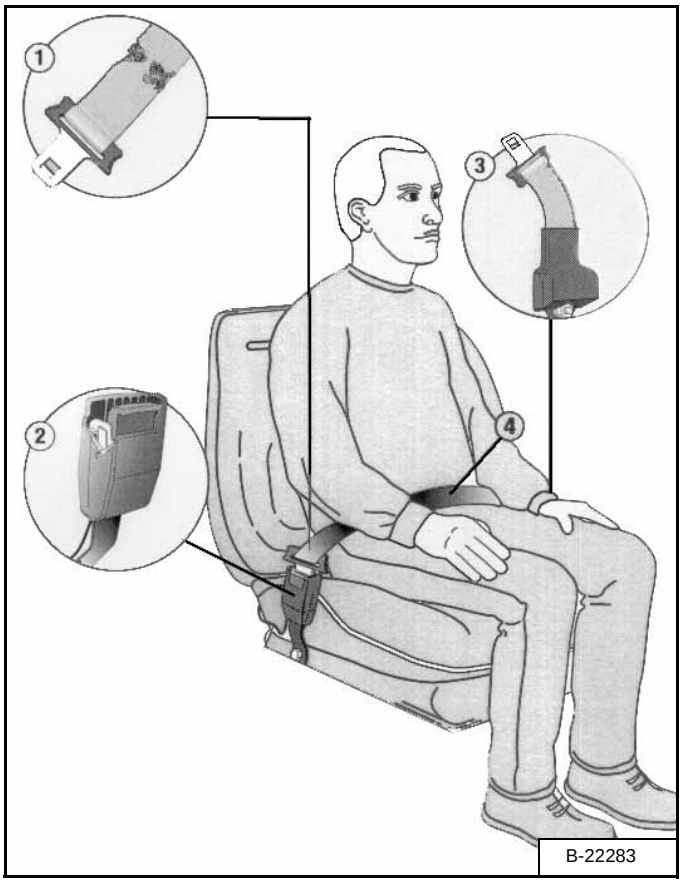
W-2466-0703

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 color 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.

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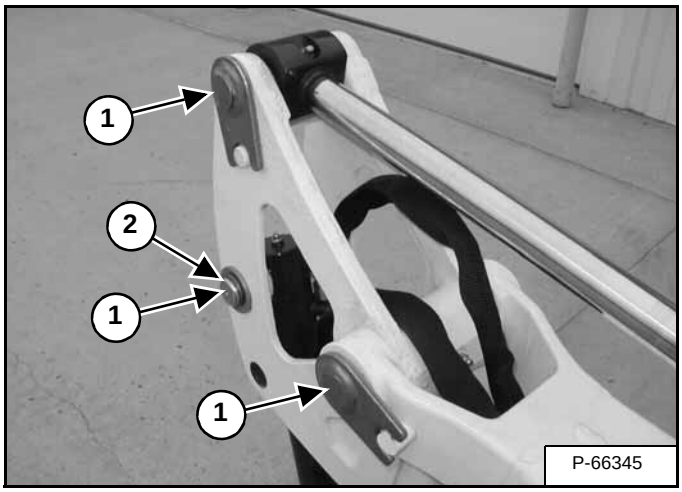


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PIVOT PINS

Inspection And Maintenance

Figure 10-160-1



The boom, arm and cylinders pivots (Item 1) have a large pin held in position with a snap ring (Item 2) **[Figure 10-160-1]**.

Check that the snap rings are securely inserted into the grooves on the pins and that the snap rings are not damage. See your Bobcat dealer for replacement parts.

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EXCAVATOR STORAGE AND RETURN TO SERVICE

Storage

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

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

Return to Service

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

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

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STOPPING THE ENGINE AND LEAVING THE EXCAVATOR

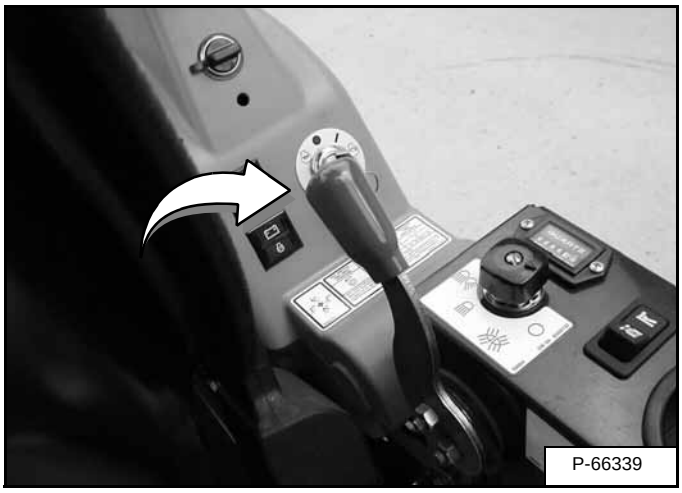
Procedure

Figure 10-180-1



Stop the machine on level ground. Lower the work equipment and the blade to the ground **[Figure 10-180-1]**.

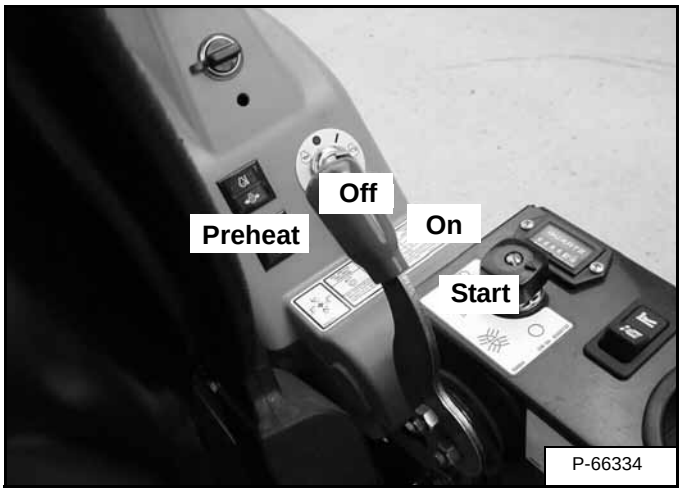
Figure 10-180-2



Move the speed control lever fully backward **[Figure 10-180-2]**.

Run the engine at idle speed for approximately 5 minutes to allow it to cool.

Figure 10-180-3



Turn the key switch OFF **[Figure 10-180-3]**.

Disconnect the seat belt.

Remove the key from the switch to prevent operation of machine by unauthorized personnel.

Exit machine.

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Emergency Exits

The right side rear window and the front window provide exits.

Right Side Rear Window

Figure 10-180-4



Slide the right side rear window to the front of the excavator and exit through the side window **[Figure 10-180-4]**.

Front Window

Figure 10-180-5



Open the front window and exit **[Figure 10-180-5]**.

NOTE: If the excavator has a Special Applications Kit installed, the front window is NOT an emergency exit.

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HYDRAULIC/HYDROSTATIC SCHEMATIC
319 (S/N 563311001 AND ABOVE)

(PRINTED NOVEMBER 2005)
V-0736legend

LEGEND

(1) HYDRAULIC RESERVOIR
(PRESSURIZED) with FILL STRAINER
Capacity . . . . . 6.8 qt. (6,5 L)

(2) PRESSURIZED BREATHER/FILL CAP
with FILTER
5 PSI (0,34 bar) - Outlet
0.435 PSI (0,03 bar) - Inlet

(3) HYDRAULIC FILTER ELEMENT
10 Micron

(4) FILTER BY-PASS 25 PSI (1,72 bar)

(5) HYDRAULIC PUMP - 3 Section Gear Pump:
3 @ 2.64 GPM (10,0 L/min.) at High Engine Idle

(6) SOLENOID VALVE - SYSTEM BY-PASS

(7) MAIN RELIEF VALVE:
3220 - 3420 PSI (222 - 236 bar)

(8) PRESSURE REDUCING VALVE:
435 PSI (30 bar)

(9) SOLENOID VALVE - CONSOLE (Joystick)
LOCK OUT

(10) TEST PORT - "F" Port - (Factory Fill)

(11) TEST PORT - "G" Port - Gauge Test Port

(12) CHECK VALVE

(13) SWING MOTOR CROSS PORT RELIEF
VALVE . . . . . 2350 - 2450 PSI (162 - 169 bar)
When Tested at "G" Port

(14) ORIFICE . . . . . 0.063" (1.60 mm)
Bore of Tee Fitting

(15) TEST PORT - Pilot Pressure

(16) PORT RELIEF VALVE
Boom Cylinder (Base End)
3045 PSI (210 bar)

(17) PORT RELIEF VALVE
Boom Cylinder (Rod End)
3625 PSI (250 bar)

(18) PORT RELIEF VALVE
Bucket Cylinder (Base End)
3625 PSI (250 bar)

(19) PORT RELIEF VALVE
Bucket Cylinder (Rod End)
3625 PSI (250 bar)

(20) PORT RELIEF VALVE
Arm Cylinder (Base End)
3625 PSI (250 bar)

(21) PORT RELIEF VALVE
Arm Cylinder (Rod End)
3625 PSI (250 bar)

(22) ANTI-CAVITATION VALVE

(23) ACCUMULATOR
Nitrogen . . . . . 165 PSI (11 bar)
non-rechargeable

(24) TRAVEL MOTOR SPOOL

(25) BUILD UP VALVE . 218 PSI (15 bar)

(26) RELIEF VALVE – Horse Power Control:
1958 PSI (135 bar)

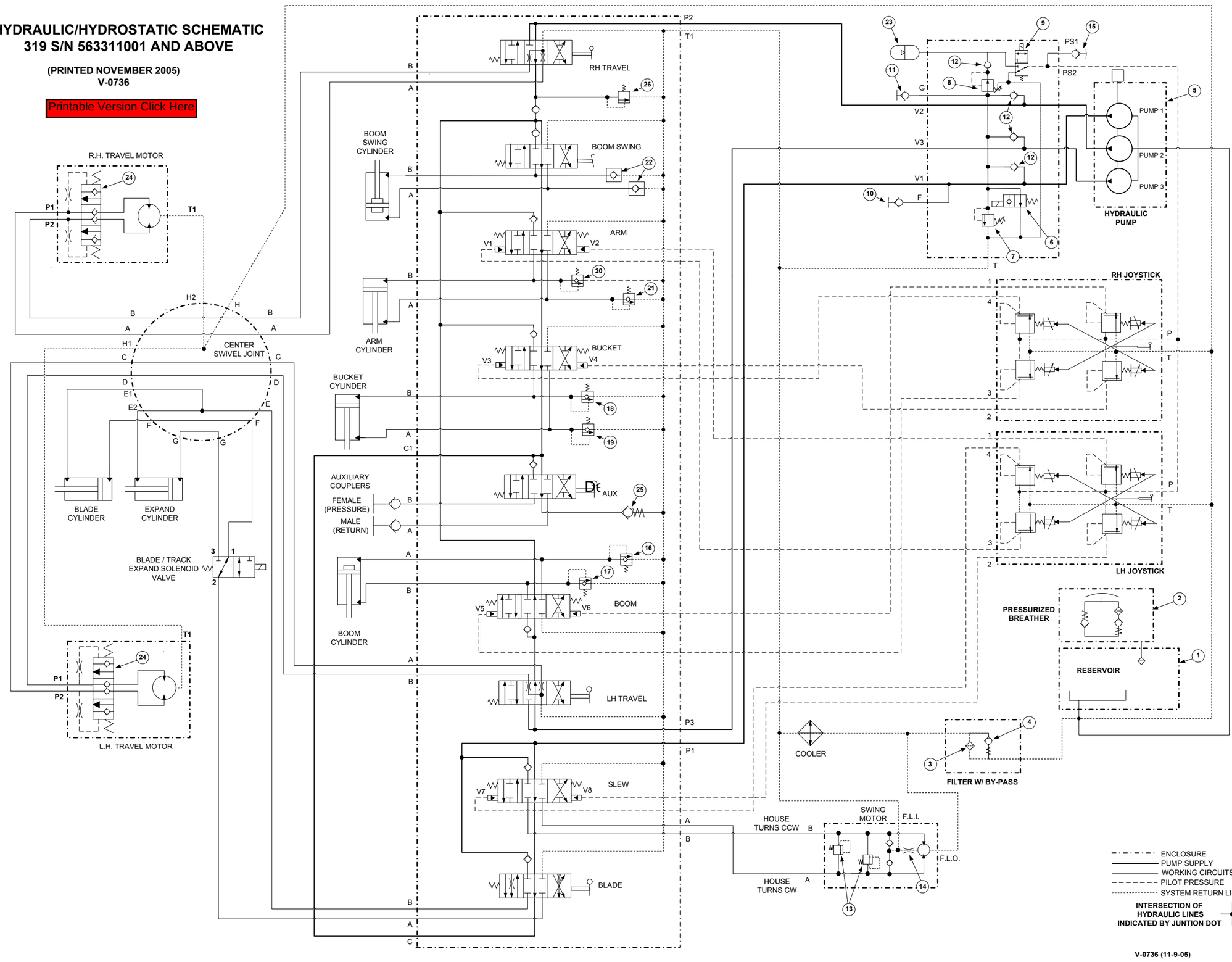
NOTE: Unless otherwise specified springs have NO significant pressure value.

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HYDRAULIC/HYDROSTATIC SCHEMATIC
319 S/N 563311001 AND ABOVE

(PRINTED NOVEMBER 2005)
V-0736

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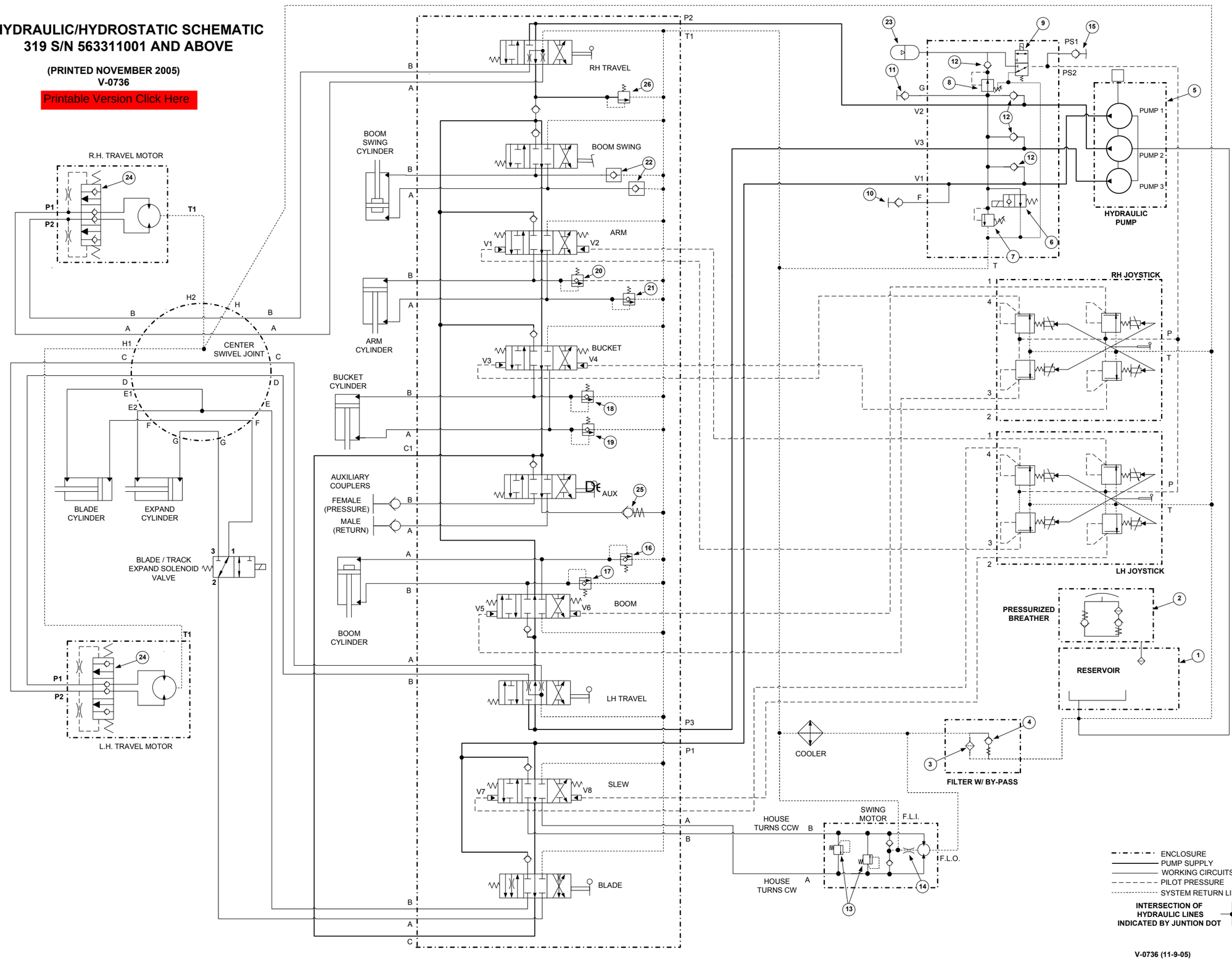


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HYDRAULIC/HYDROSTATIC SCHEMATIC
319 S/N 563311001 AND ABOVE

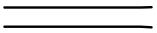
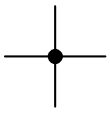
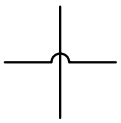
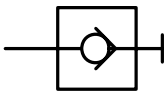
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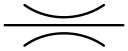
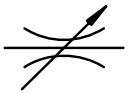
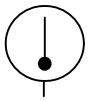
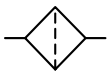
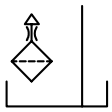
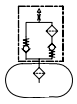
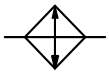
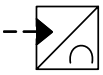
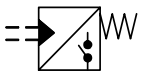
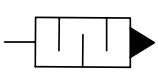
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V-0736 (11-9-05)

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).

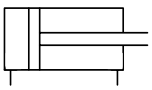
SYMBOL	DESCRIPTION
	BASIC and MISCELLANEOUS SYMBOLS
	RESTRICTION - Line with Fixed Restriction - Affected by Viscosity (property of resistance to flowing fluid).
	VARIABLE ADJUSTMENT RESTRICTION - Regulated or Variable Restriction.
	TEMPERATURE CONTROL - (Indication of temperature).
	TEMPERATURE INDICATOR - (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.

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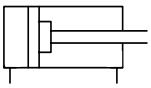
Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

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).

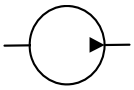


DOUBLE ACTING HYDRAULIC CYLINDER, UNEQUAL DISPLACEMENT - With single piston rod.

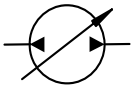


DOUBLE ACTING HYDRAULIC CYLINDER, UNEQUAL DISPLACEMENT and CUSHION ON ONE END - With single piston rod.

PUMP: To convert mechanical energy into hydraulic energy.

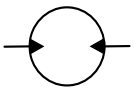


FIXED CAPACITY DISPLACEMENT HYDRAULIC PUMP - With one direction of flow.



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

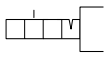
MOTOR: To convert hydraulic energy into rotary mechanical energy.



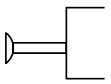
FIXED CAPACITY DISPLACEMENT BIDIRECTIONAL HYDRAULIC MOTOR - With two directions of flow (bidirectional.

SYMBOL DESCRIPTION

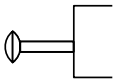
CONTROL MECHANISMS



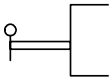
CONTROL VALVE WITH DETENT (Holds Valve in Position) - device for maintaining a given position (mechanical).



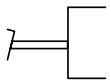
CONTROL VALVE ACTIVATED BY A PULL BUTTON (manual).



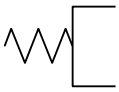
CONTROL VALVE ACTIVATED BY A PUSH-PULL BUTTON (manual).



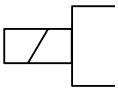
CONTROL VALVE ACTIVATED BY A LEVER (manual).



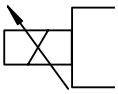
CONTROL VALVE ACTIVATED BY A PEDAL (manual).



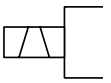
CONTROL VALVE WITH SPRING RETURN (mechanical).



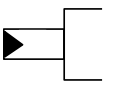
CONTROL VALVE ACTIVATED BY AN ELECTRIC SOLENOID (electrical).



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



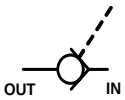
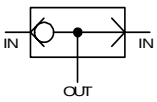
CONTROL VALVE ACTIVATED BY DUAL ELECTRICAL SOLENOID (electrical).

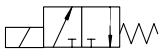
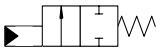
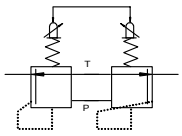
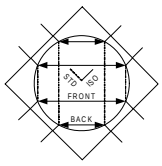
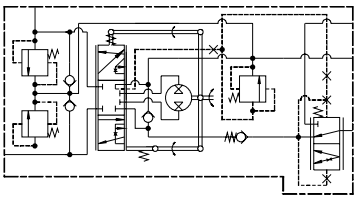
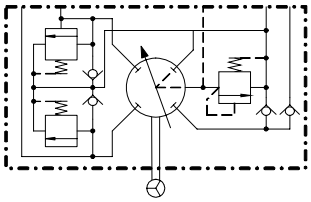
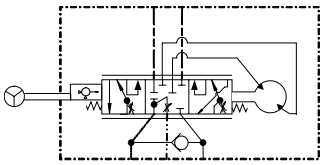


CONTROL VALVE ACTIVATED BY PILOT PRESSURE (indirect control, pilot actuated by application of pressure).

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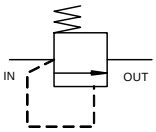
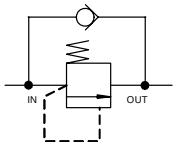
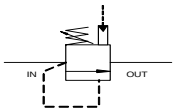
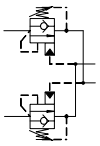
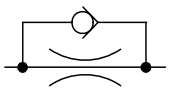
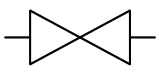
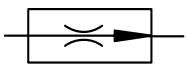
Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

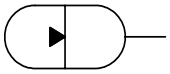
SYMBOL	DESCRIPTION
NON-RETURN VALVE, SHUTTLE VALVE: Valve which allows free flow in one direction only.	
	NON-RETURN VALVE (Check Valve) - Used as Replenishing Valve, Lock Check Valve or Anticavitation Valve - Opens if the Inlet pressure is higher than the Outlet pressure. Often contains internal spring 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.
	
	

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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.

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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.

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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.

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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.

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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.

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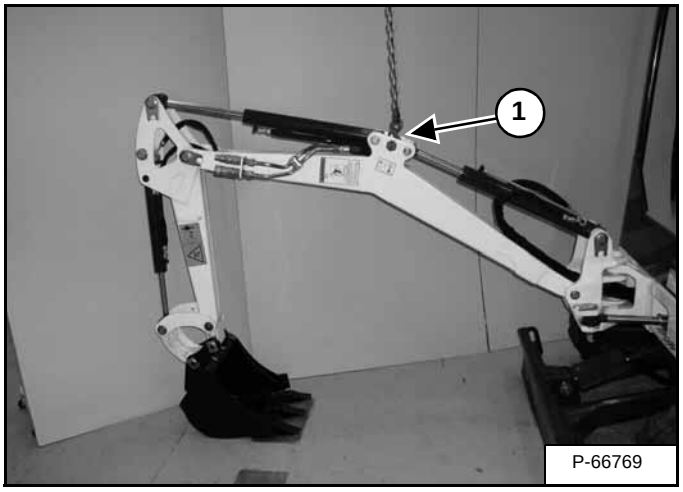
BOOM CYLINDER

Testing

Lower the boom/bucket and blade to the ground.

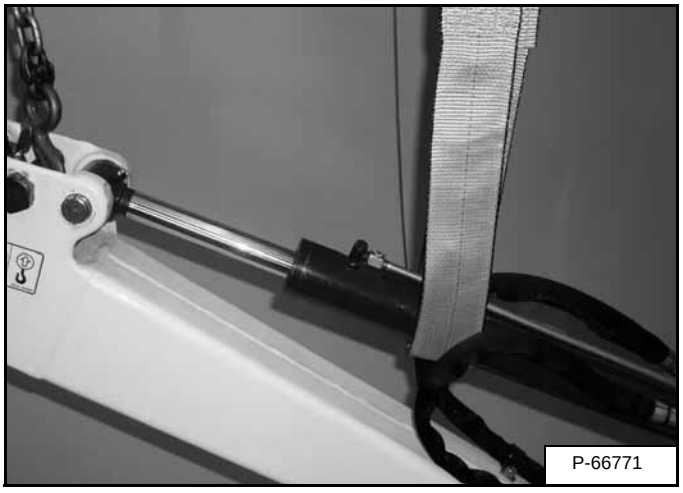
Stop the engine. Raise the control console.

Figure 20-20-1



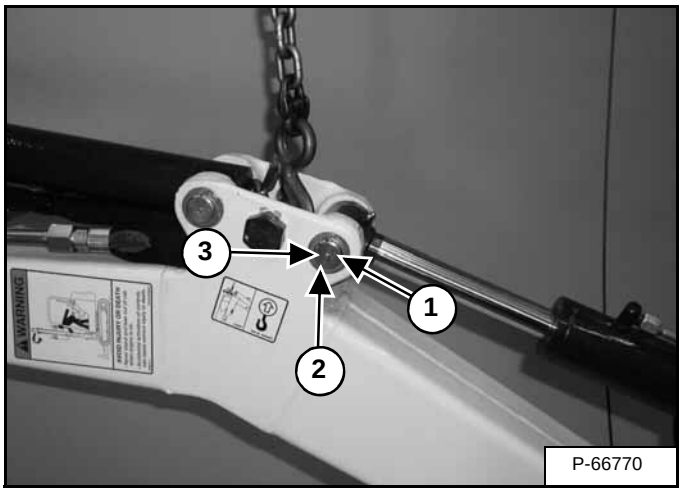
Support the boom using a chain hoist **[Figure 20-20-1]**.

Figure 20-20-2



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

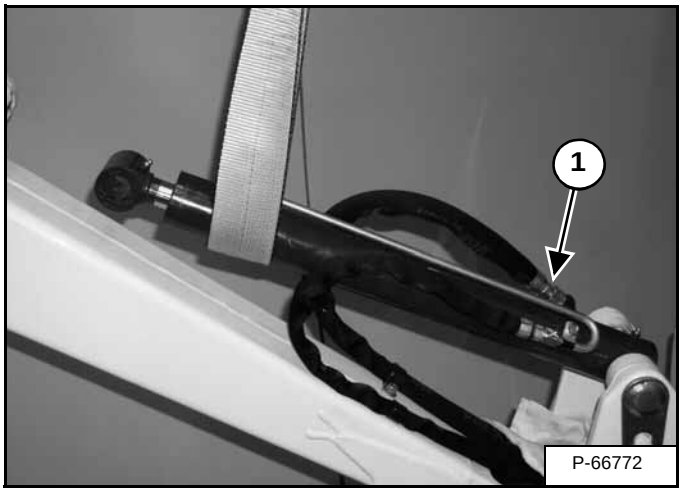
Figure 20-20-3



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.

Dealer Copy -- Not for Resale

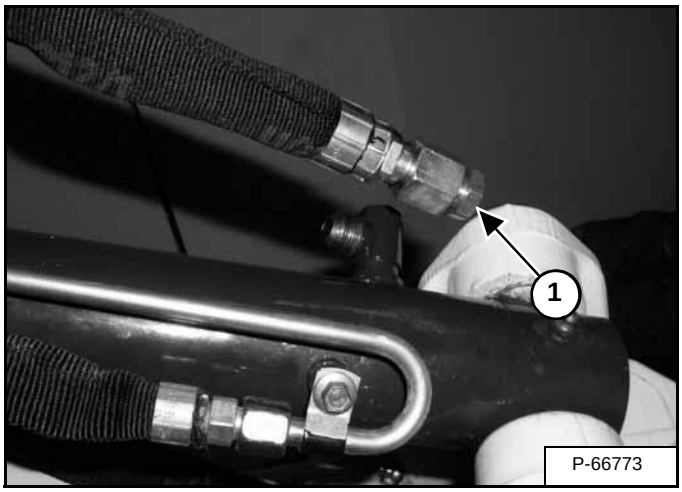
Testing (Cont'd)

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.

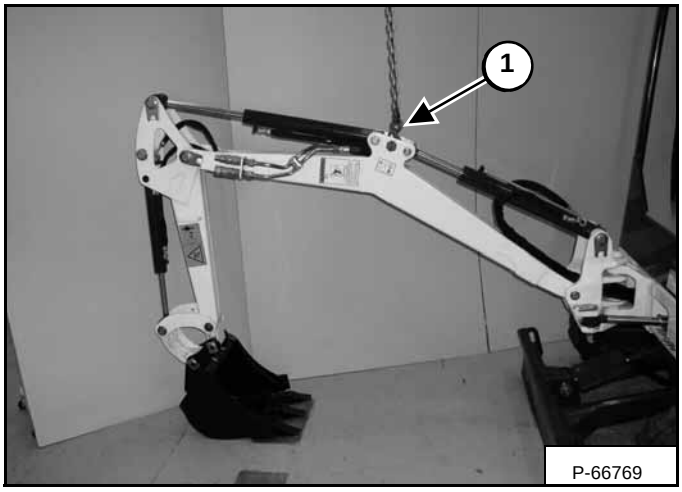
Lower control console and fasten seat belt. Start the engine and retract the boom cylinder.

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

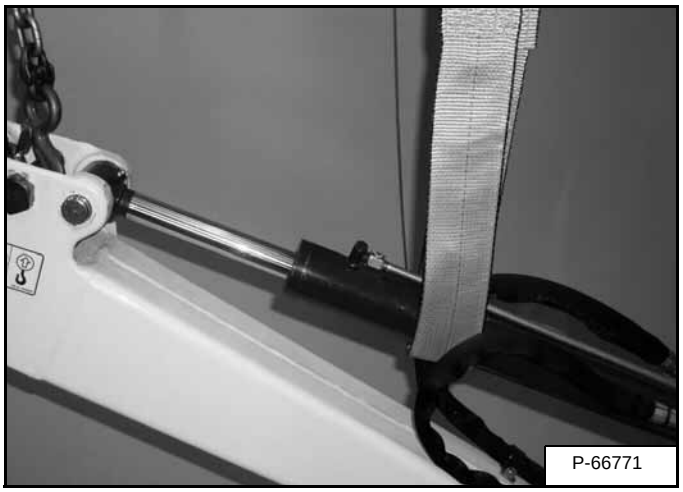
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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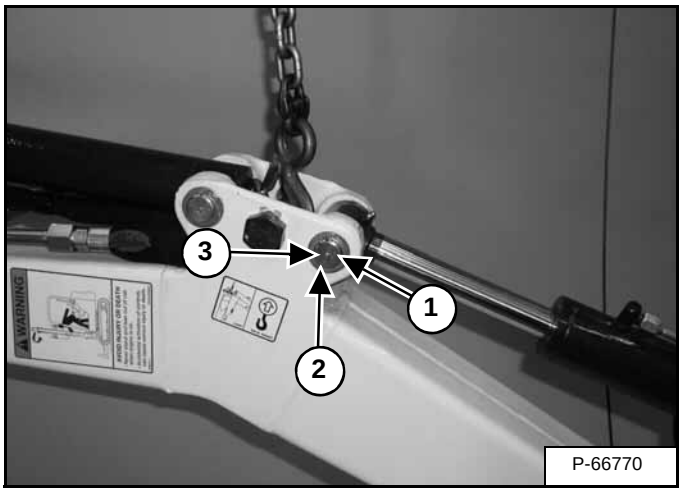
Removal and Installation (Cont'd)

Figure 20-20-7



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

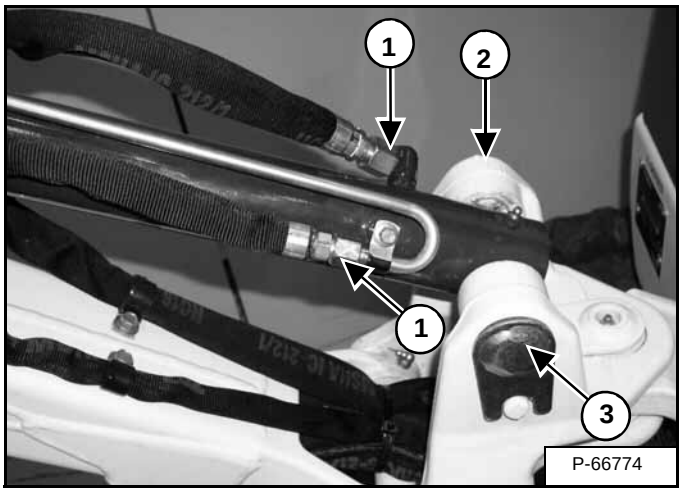
Figure 20-20-8



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

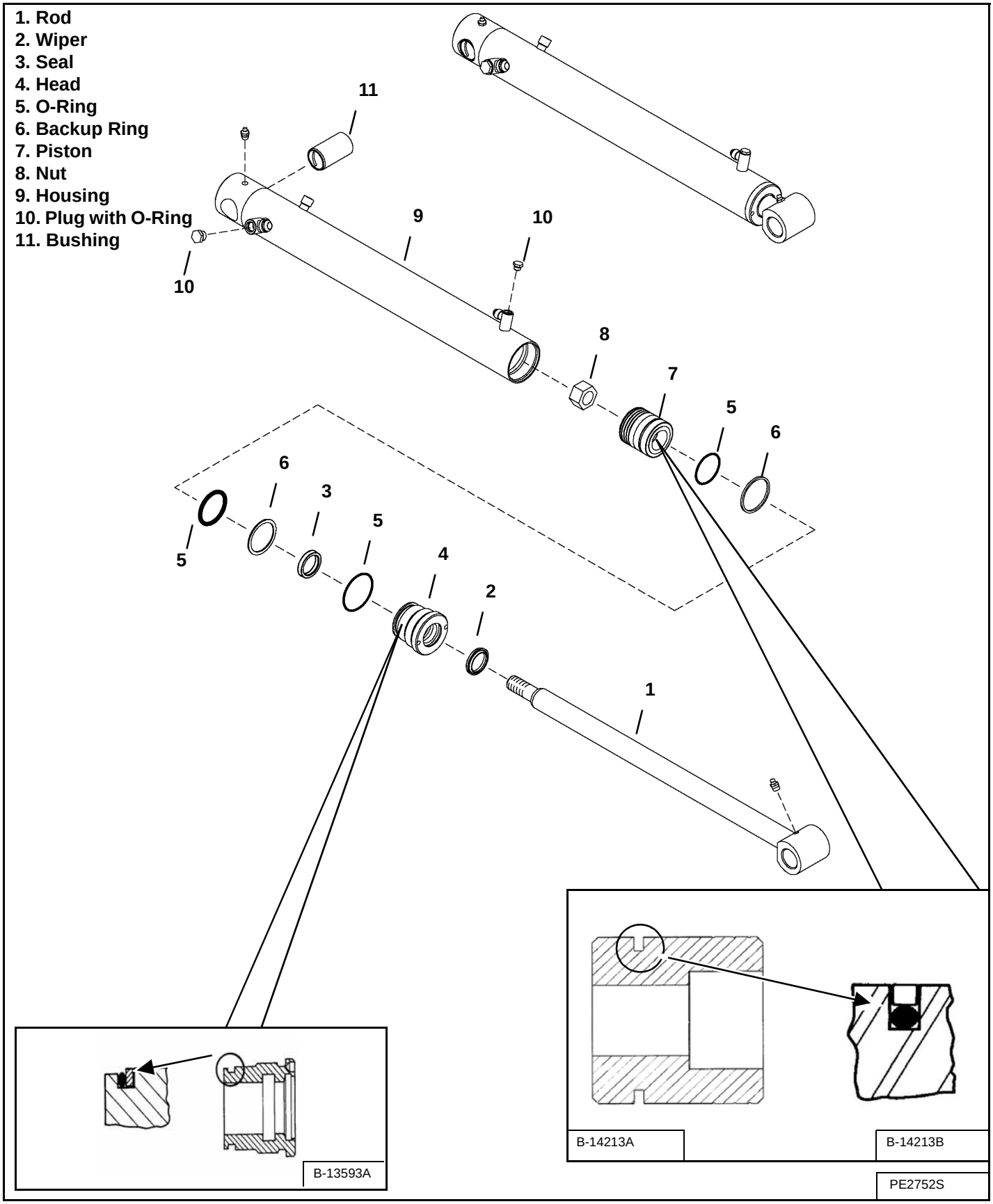
Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire which can result in injury or death.

W-2103-1285

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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
11. Bushing



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Disassembly

Clean the outside of the boom cylinder before disassembly.

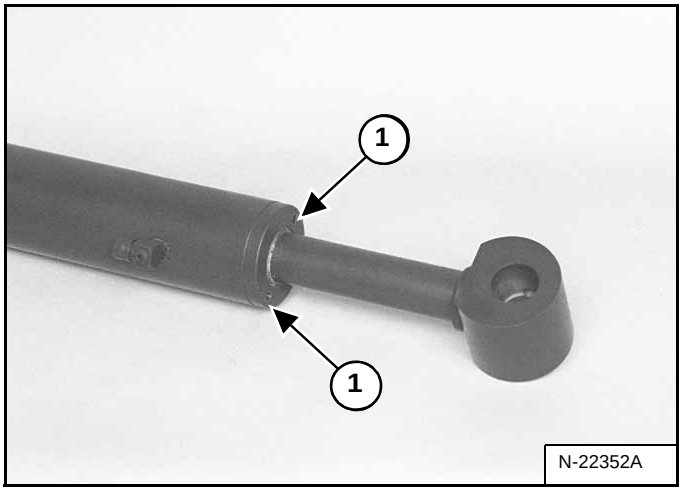
Use the following tools to disassemble the cylinder:

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.

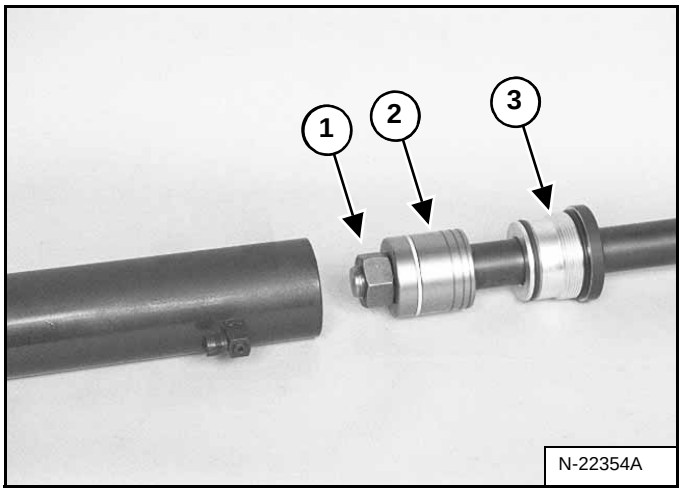
Put the base end of the cylinder in a vise.

Figure 20-20-10



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

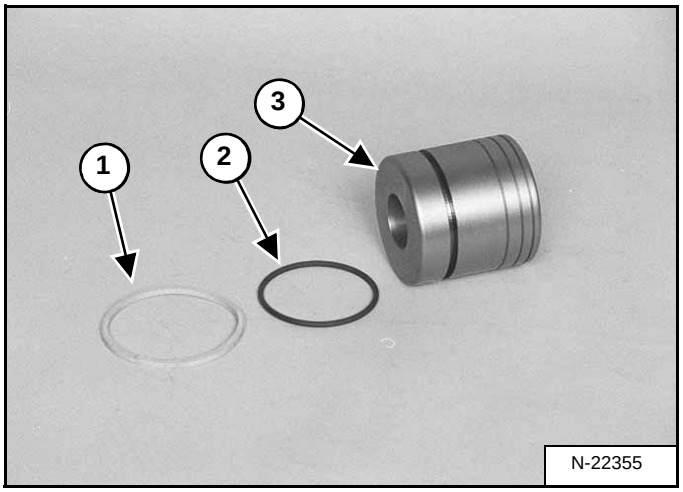
Figure 20-20-11



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

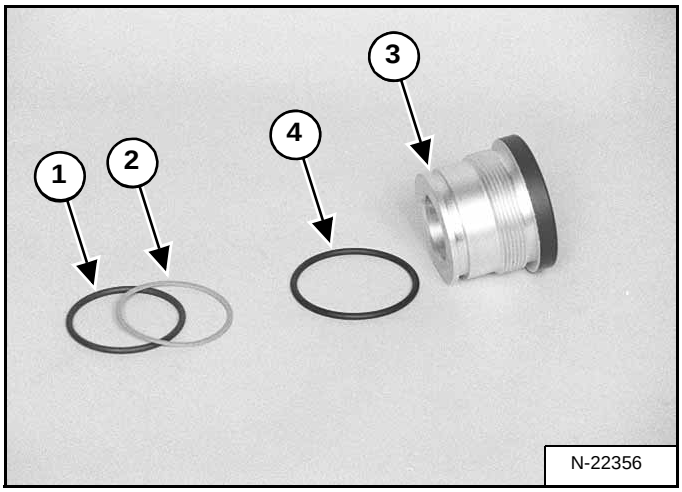


Cushion Piston: Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-20-12]**.

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Disassembly (Cont'd)

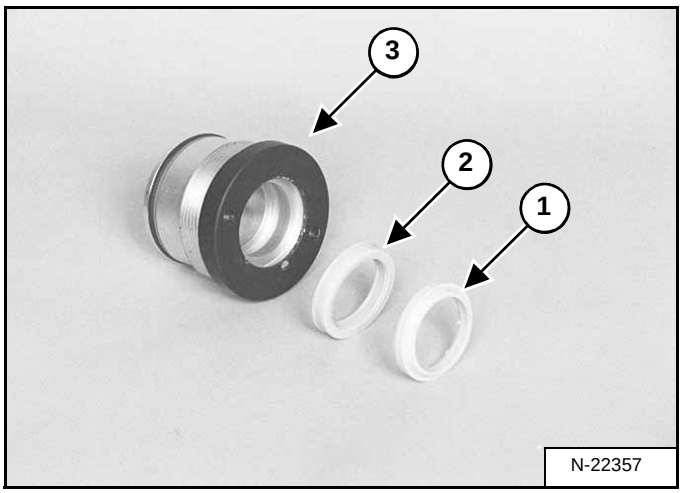
Figure 20-20-13



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]**.

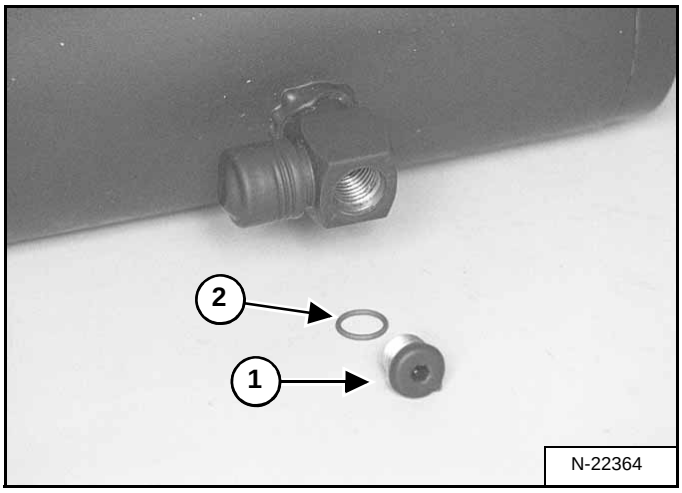
Remove the O-ring (Item 4) **[Figure 20-20-13]**.

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]**.

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Assembly

Use the following tools to assemble the cylinder:

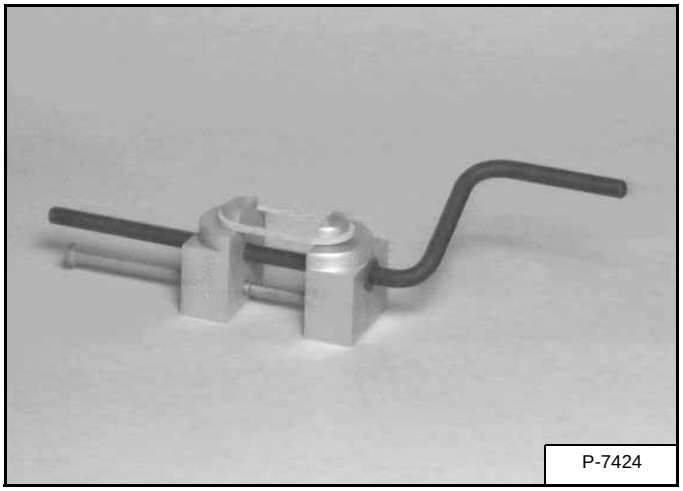
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

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.

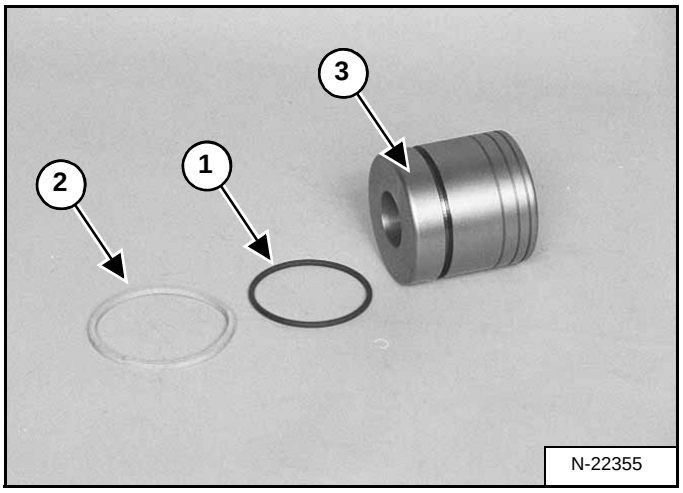
Figure 20-20-16



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

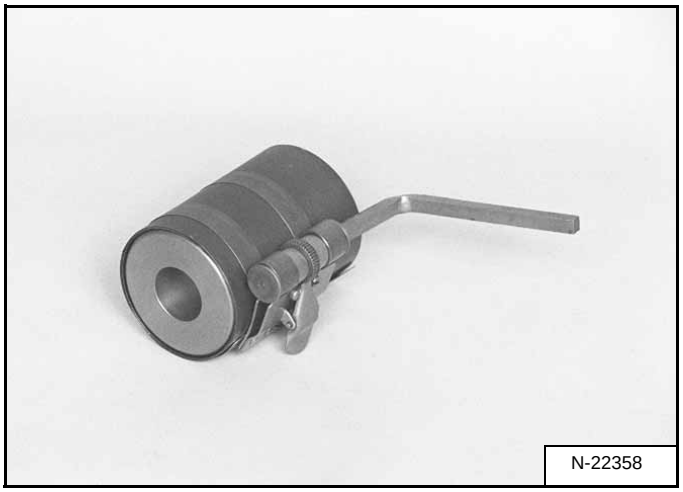
Allow the seal to stretch for 30 seconds before installing it on the piston.

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

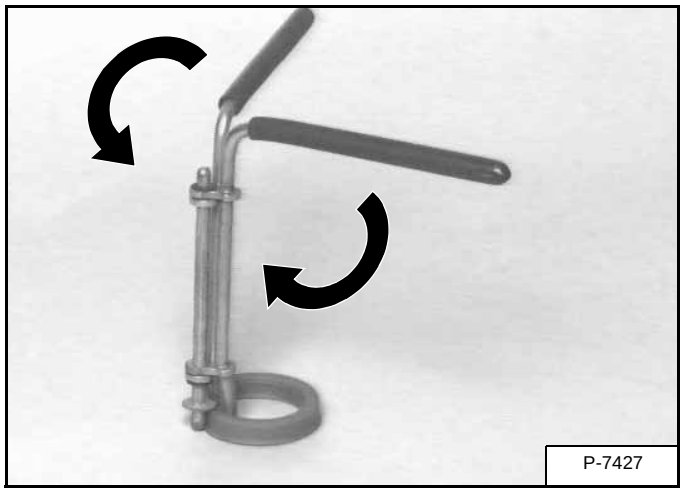


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-20-18]**.

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Assembly (Cont'd)

Figure 20-20-19

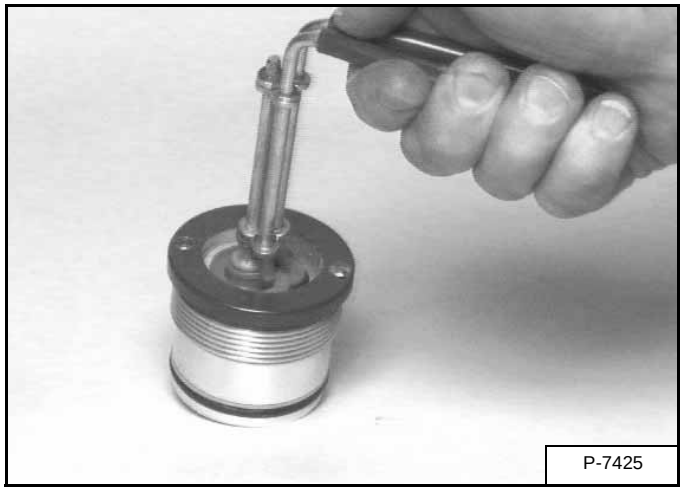


Install the rod seal on the rod seal tool **[Figure 20-20-19]**.

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

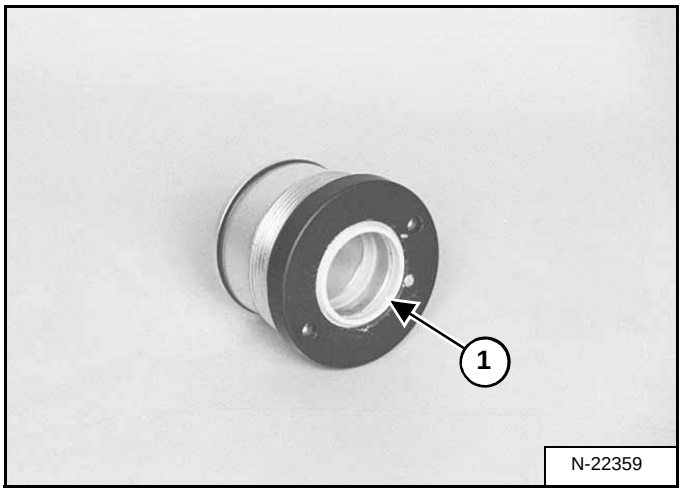
Rotate the handles to collapse the rod seal **[Figure 20-20-19]**.

Figure 20-20-20



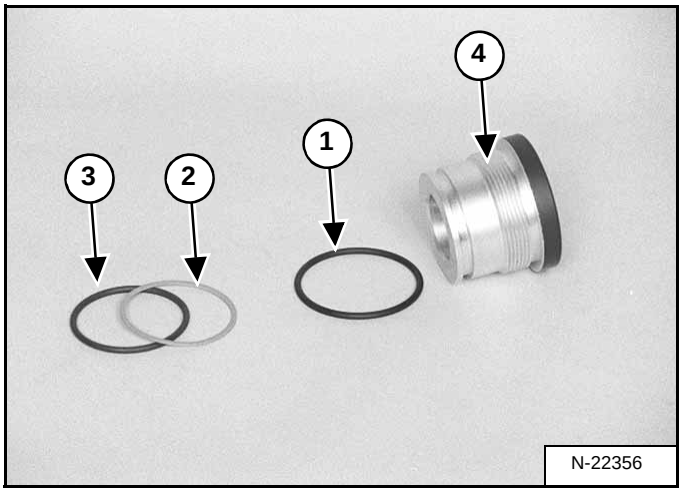
Install the rod seal in the head **[Figure 20-20-20]**.

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



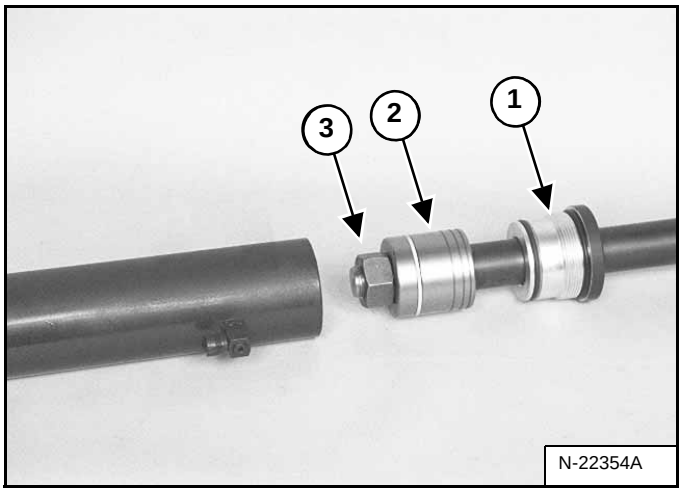
Install the O-ring (Item 1) **[Figure 20-20-22]**.

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

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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.

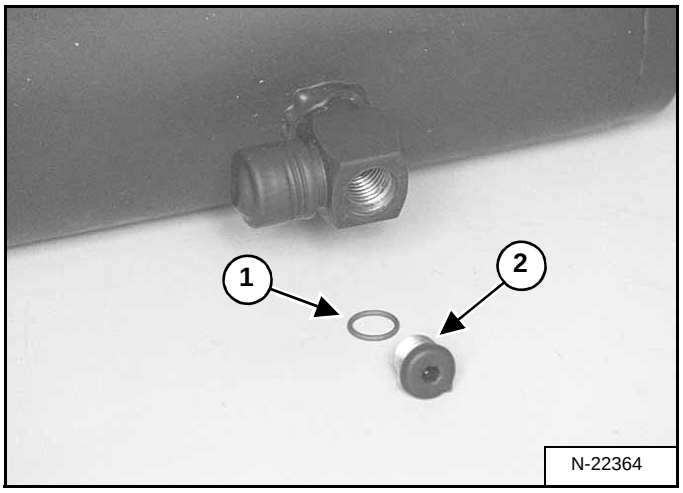
Provide an adequate support for the cylinder before tightening.

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



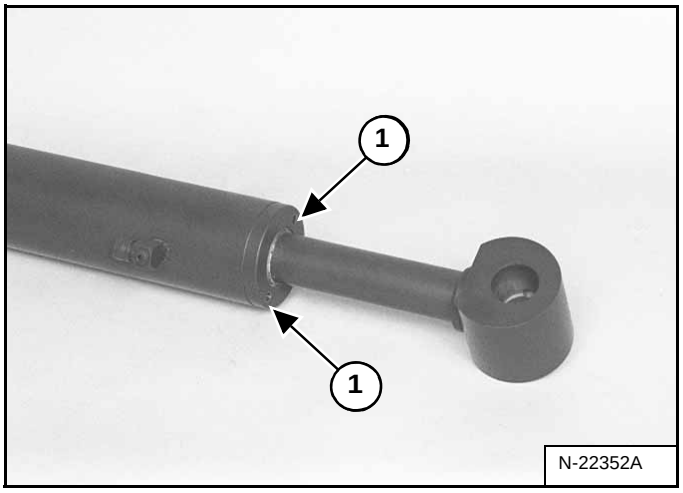
Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-20-24]**.

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.

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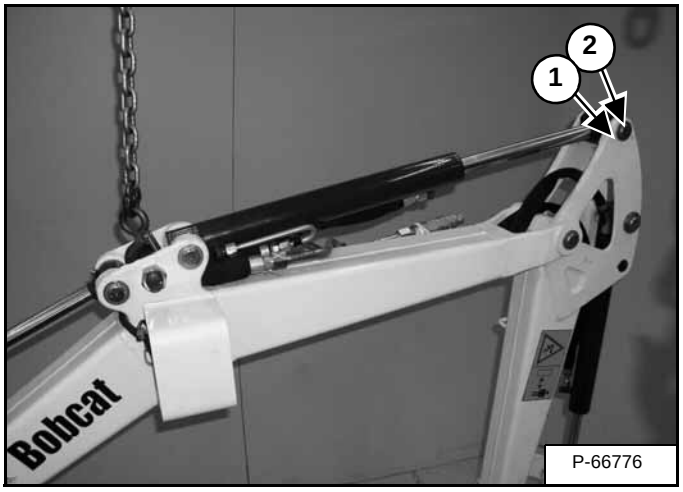
ARM CYLINDER

Testing

Lower the boom/bucket and blade to the ground.

Stop the engine. Raise the control console.

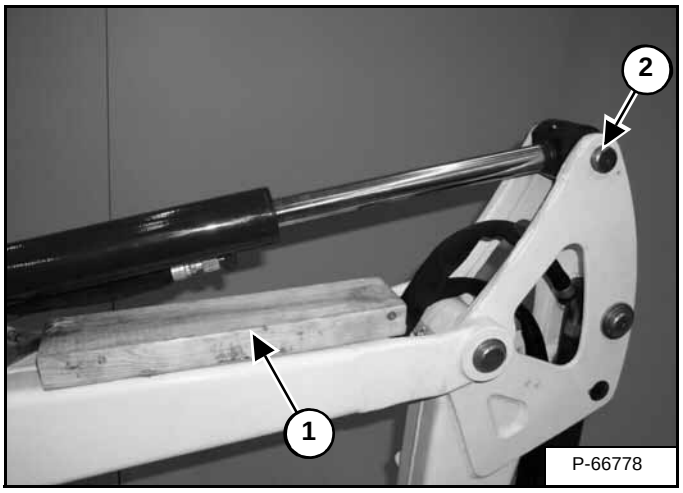
Figure 20-21-1



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 (Item 1) **[Figure 20-21-2]**.

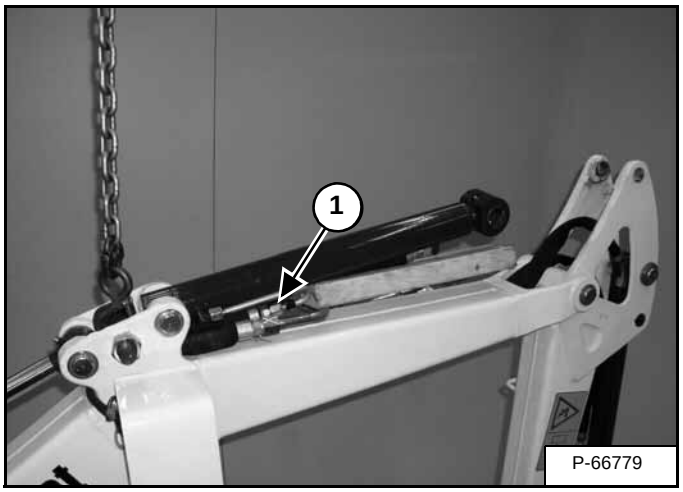
Remove the pivot pin (Item 2) **[Figure 20-21-2]**.

⚠ 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.

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Figure 20-21-3



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

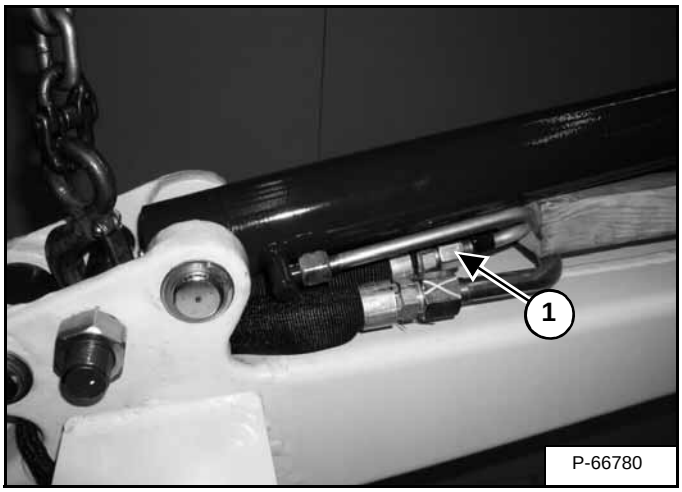
Stop the engine. With the key in the ON position, move the hydraulic controls to release the hydraulic pressure. Raise the control console.

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

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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.

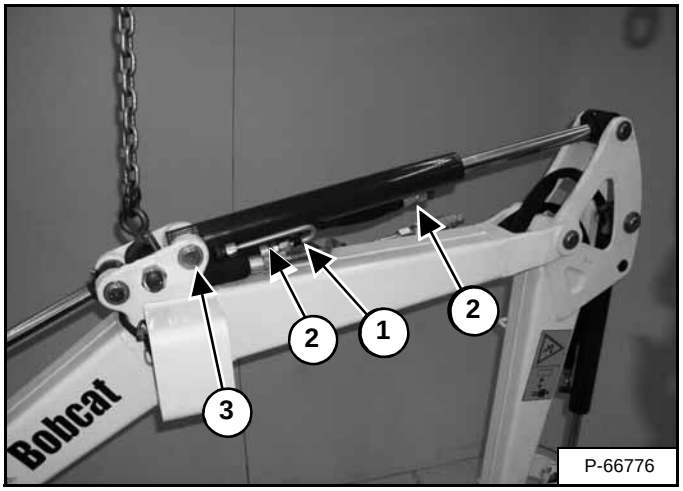
If there is any leakage from the base end hose on the arm cylinder, remove the cylinder for repair or replacement.

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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.

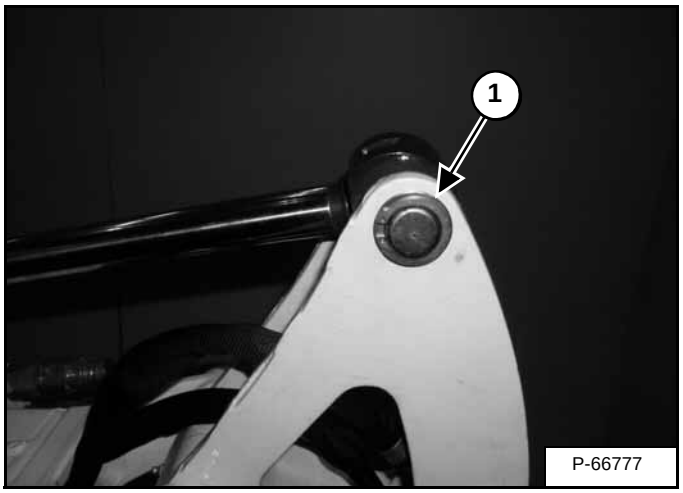
W-2145-0290

WARNING

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.

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Figure 20-21-6



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

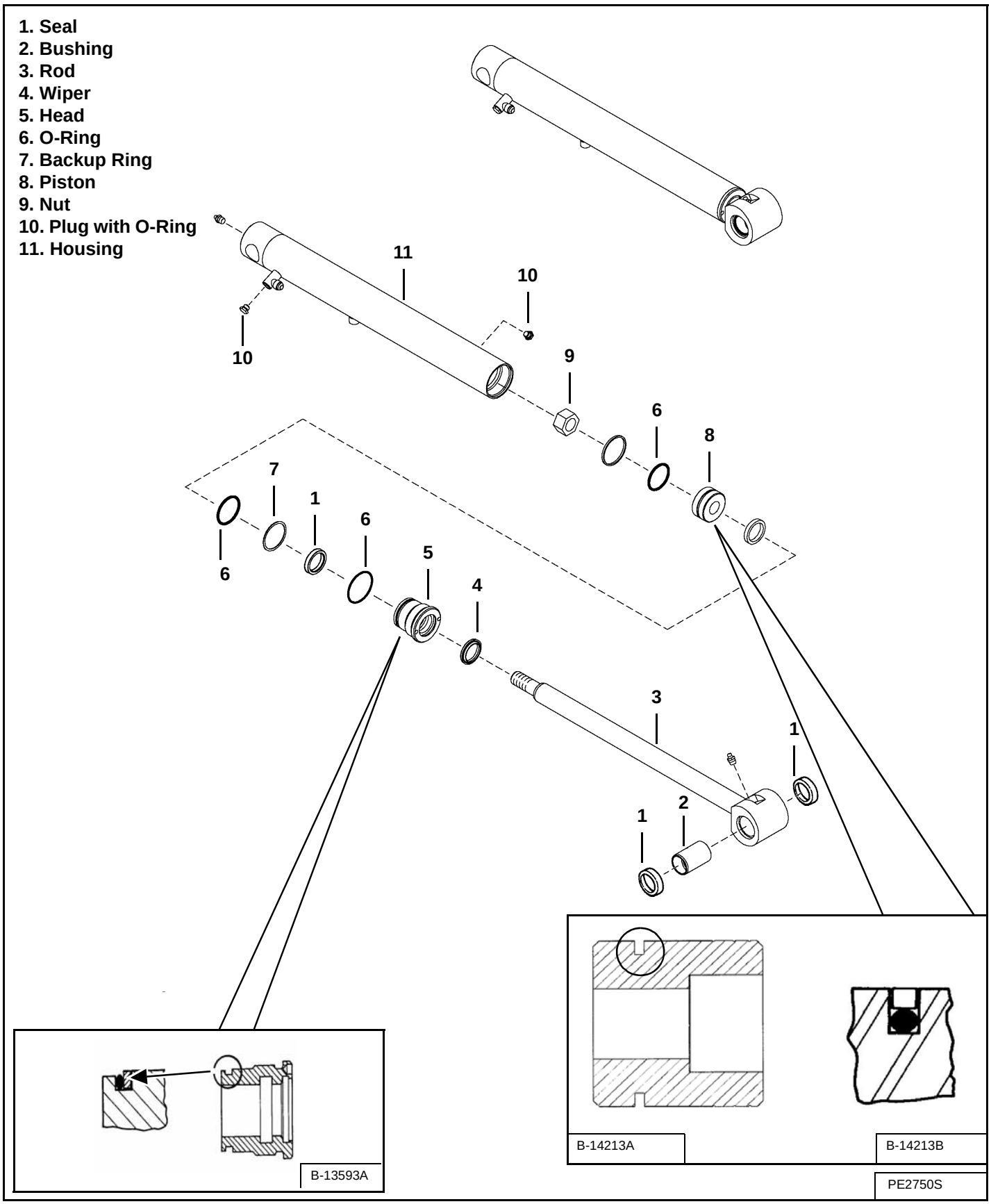
Remove the cylinder rod end pin.

Remove the cylinder from the arm.

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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



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Disassembly

Clean the outside of the arm cylinder before disassembly.

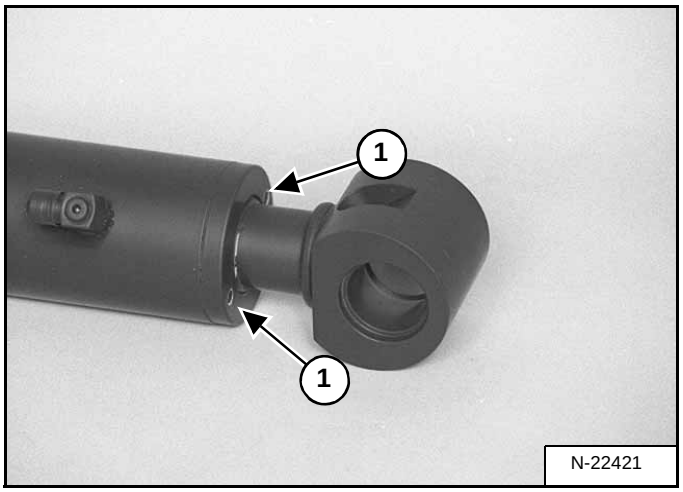
Use the following tools to disassemble the cylinder:

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.

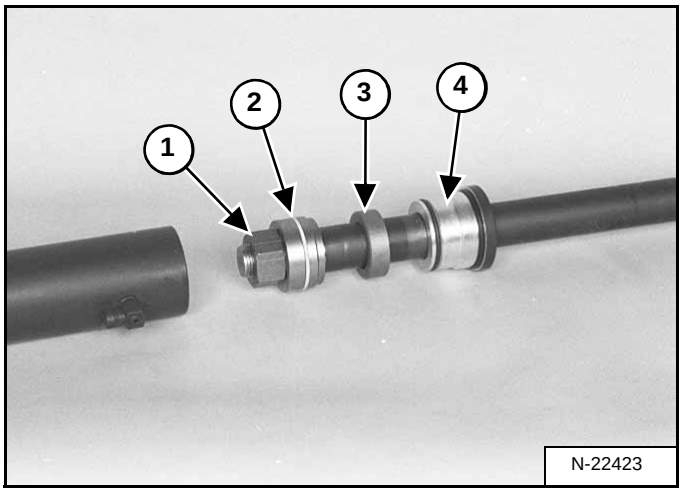
Put the base end of the cylinder in a vise.

Figure 20-21-7



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

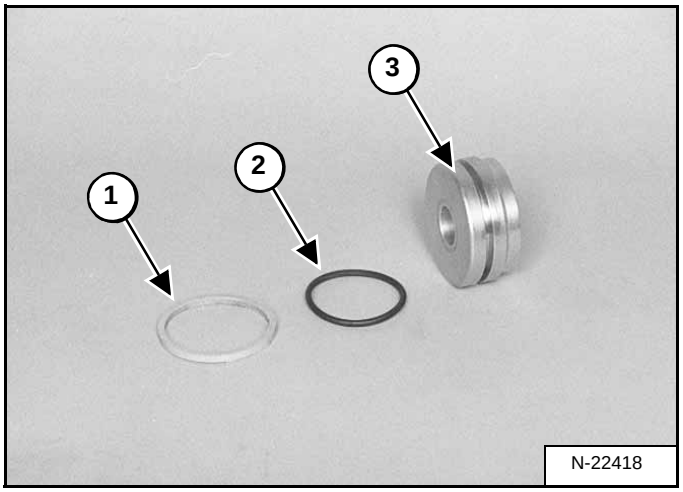
Figure 20-21-8



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) **[Figure 20-21-8]** and head (Item 4) **[Figure 20-21-8]**.

Figure 20-21-9

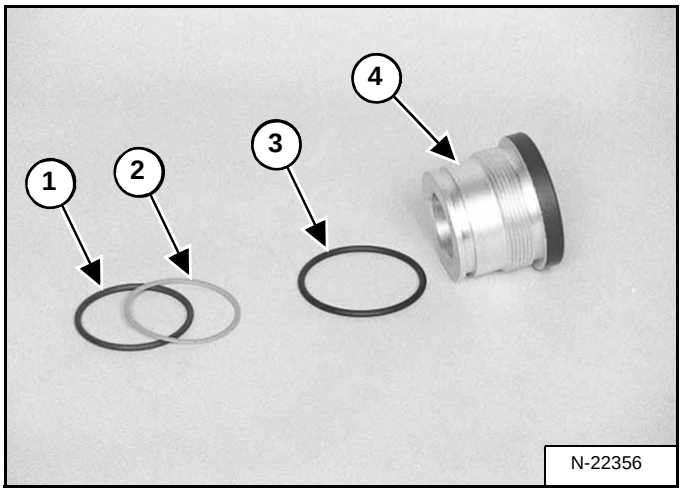


Standard Piston: Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-21-9]**.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

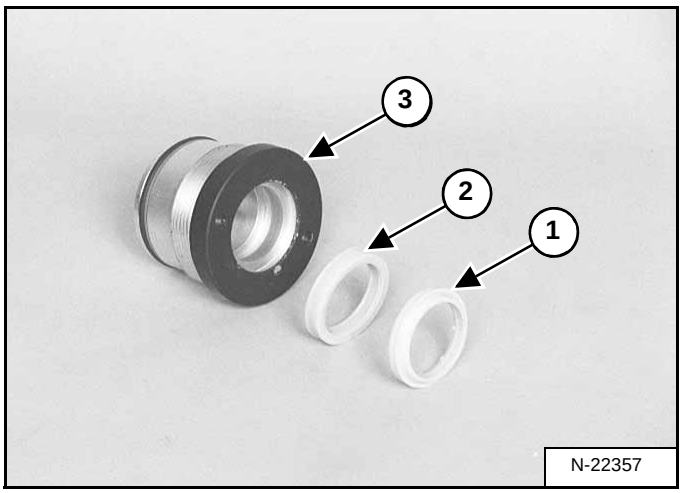
Figure 20-21-10



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]**.

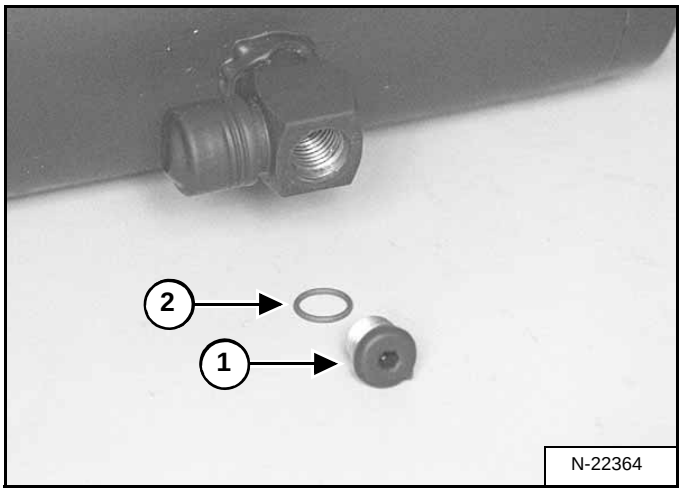
Remove the O-ring (Item 4) **[Figure 20-21-10]**.

Figure 20-21-11



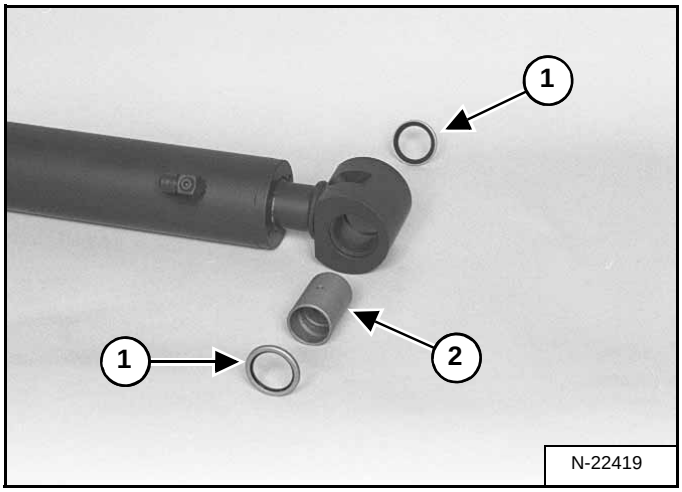
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-21-11]**.

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]**.

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Assembly

Use the following tools to assemble the cylinder:

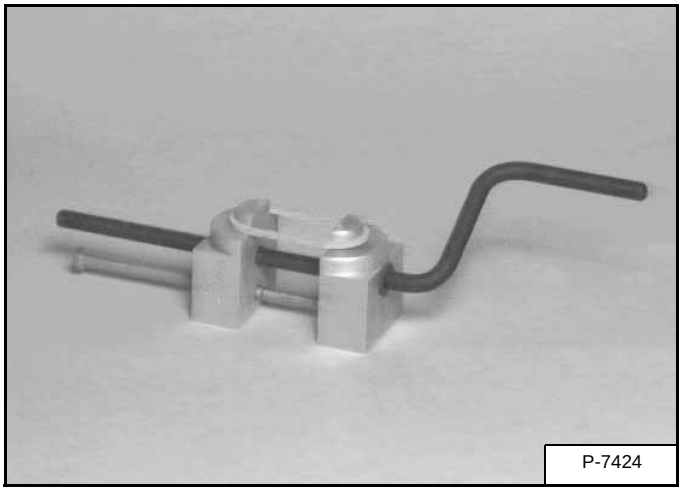
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

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.

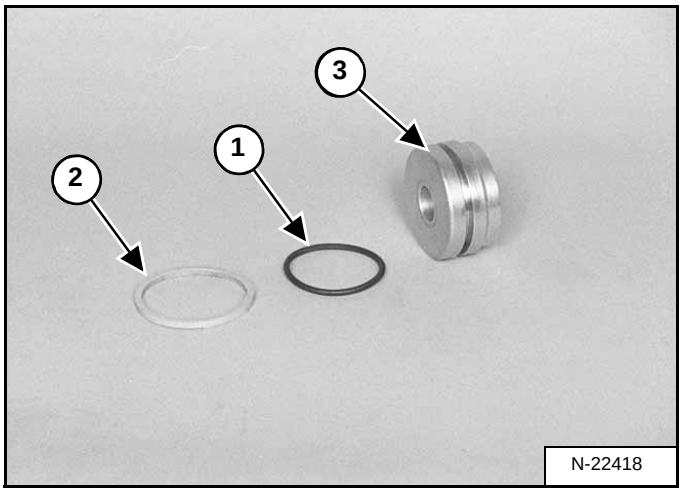
Figure 20-21-14



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

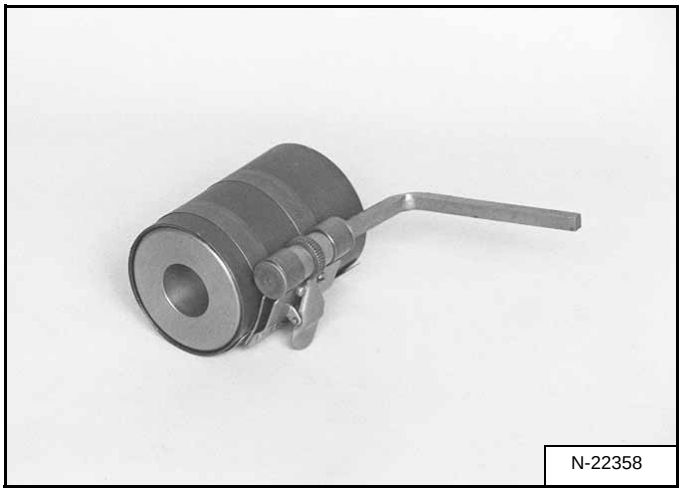
Allow the seal to stretch for 30 seconds before installing it on the piston.

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

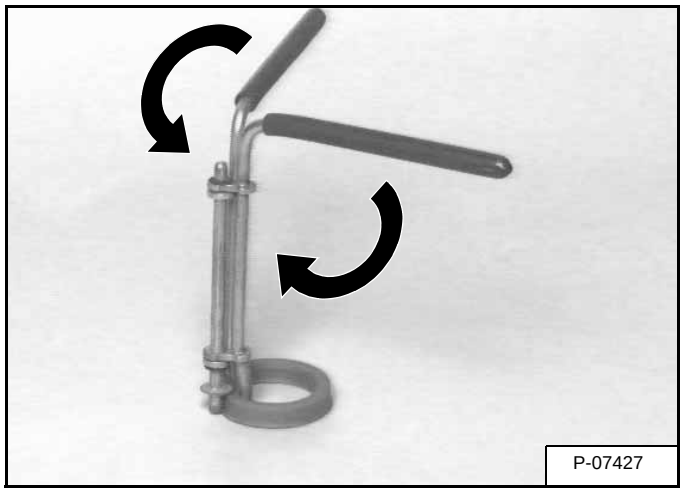


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-21-16]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-21-17

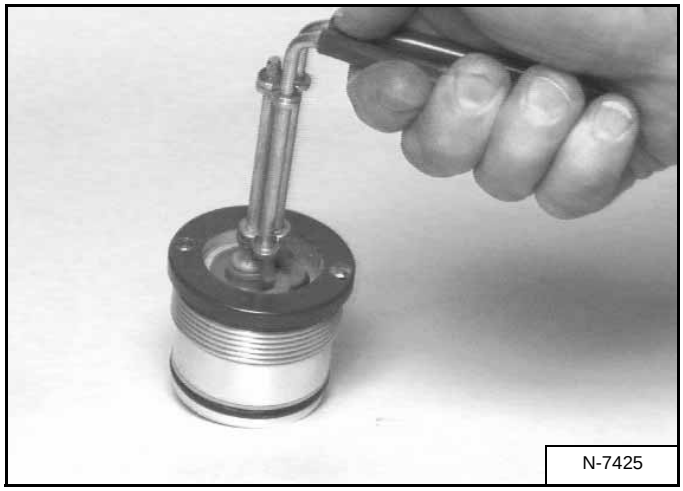


Install the rod seal on the rod seal tool **[Figure 20-21-17]**.

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

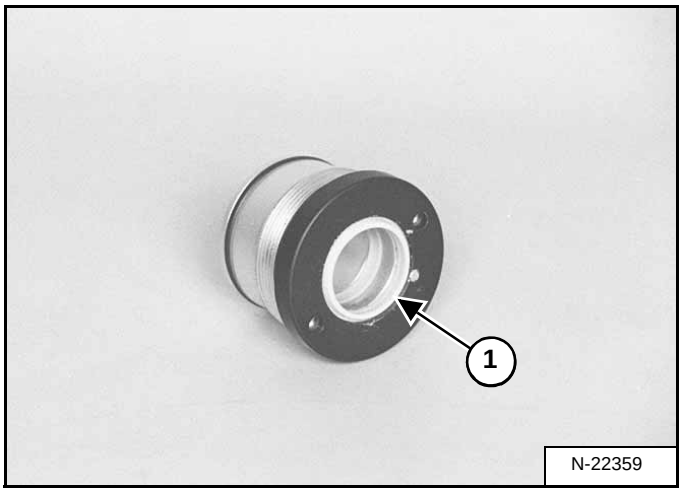
Rotate the handles to collapse the rod seal **[Figure 20-21-17]**.

Figure 20-21-18



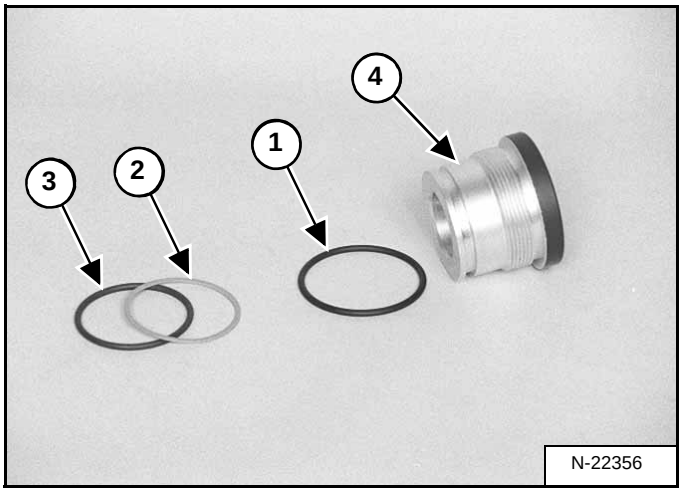
Install the rod seal in the head **[Figure 20-21-18]**.

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



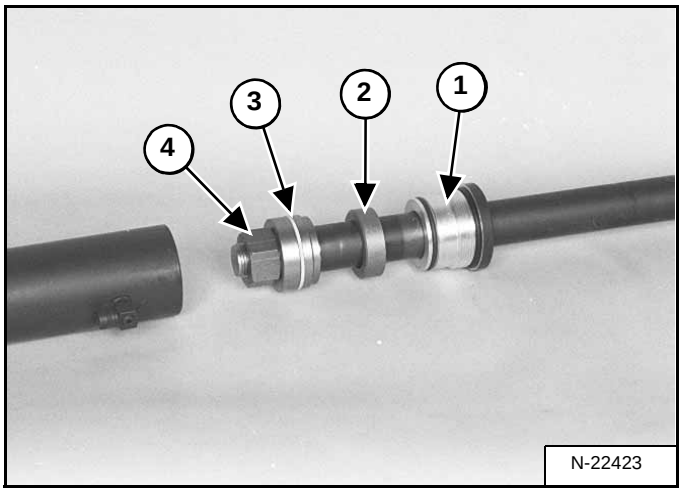
Install the O-ring (Item 1) **[Figure 20-21-20]**.

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

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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.

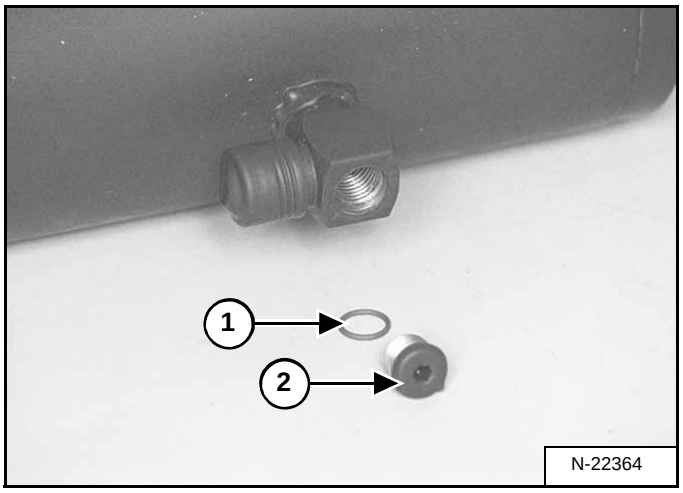
Install the nut (Item 4) **[Figure 20-21-21]**.

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

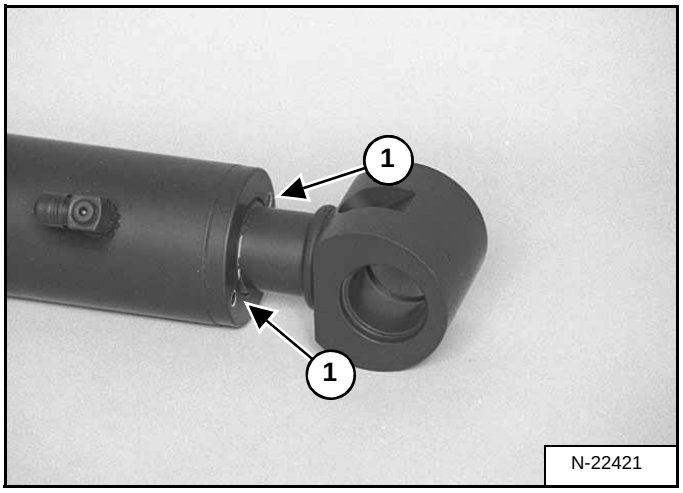


Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-21-22]**.

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

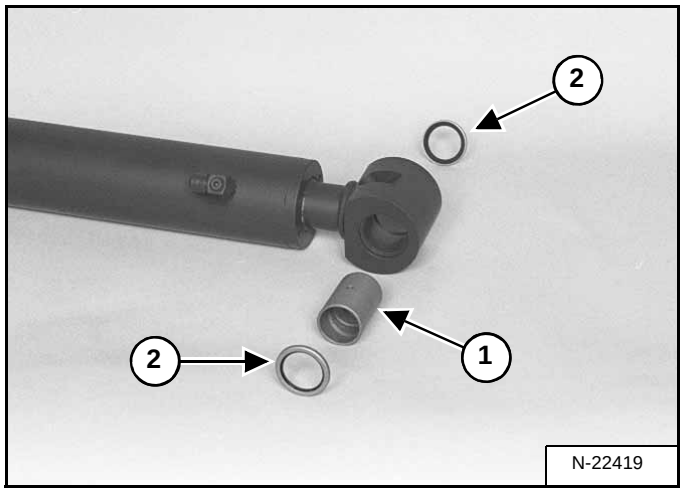


Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-21-23]** to tighten the head. Head to be torqued until flush with end of the housing.

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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.

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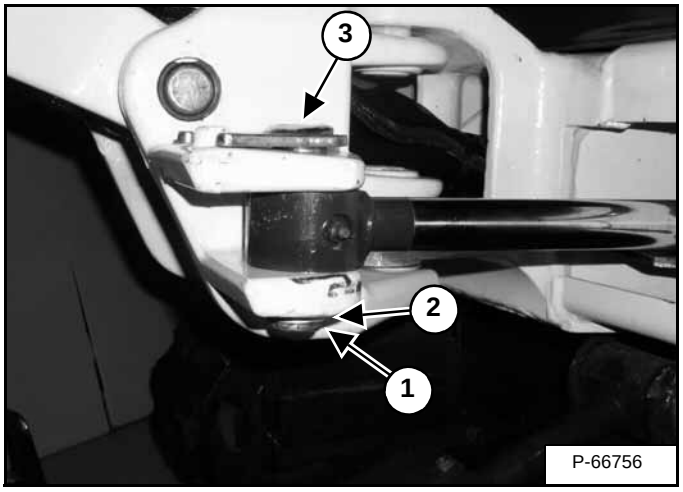
BOOM SWING CYLINDER

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.

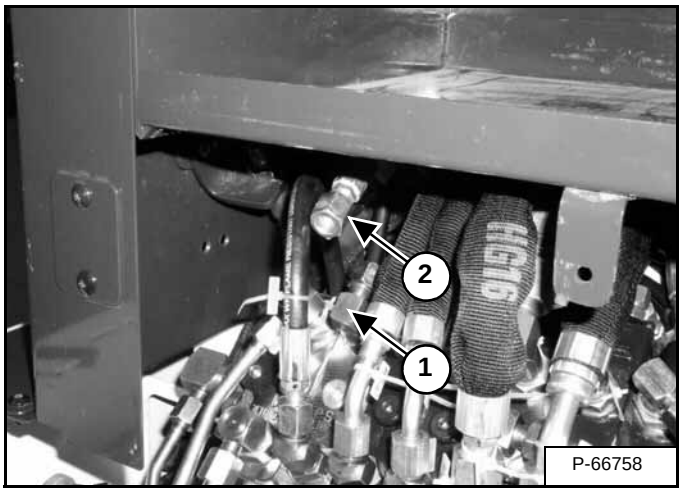
Figure 20-22-2



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 (Item 1) **[Figure 20-22-3]** 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 2) **[Figure 20-22-3]** on the cylinder, remove the cylinder for repair or replacement.

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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

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

W-2103-1285

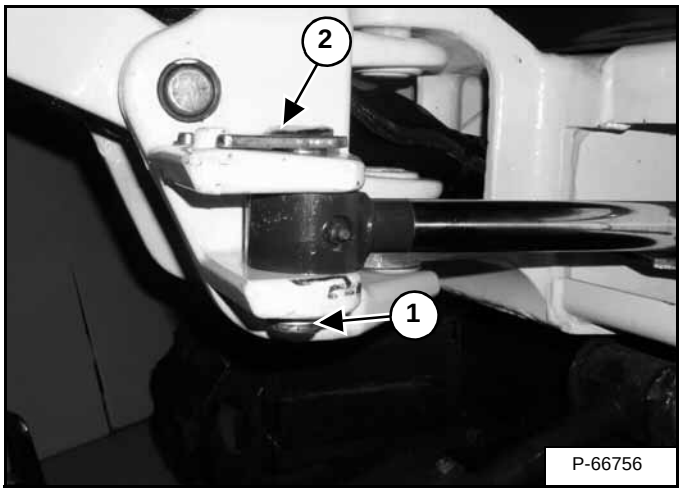
Swing the upperstructure so the pin in the base end of the cylinder is located between the tracks.

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 FLOOR MAT AND FLOOR PANELS on Page 40-100-1.)

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



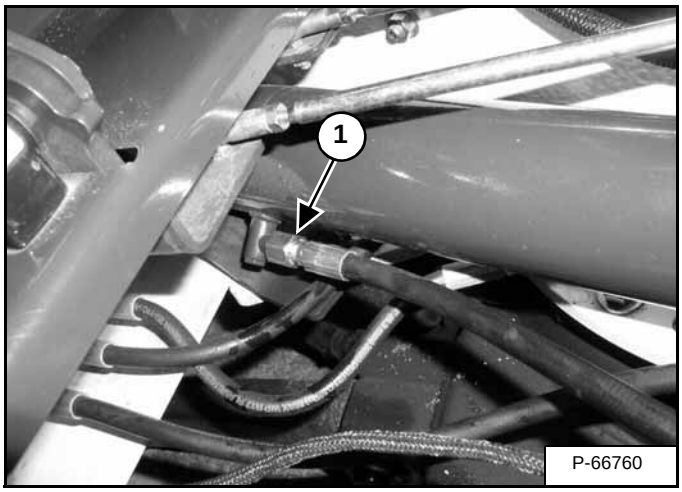
Start the excavator and fully retract the cylinder **[Figure 20-22-5]**.

Stop the engine.

Dealer Copy -- Not for Resale

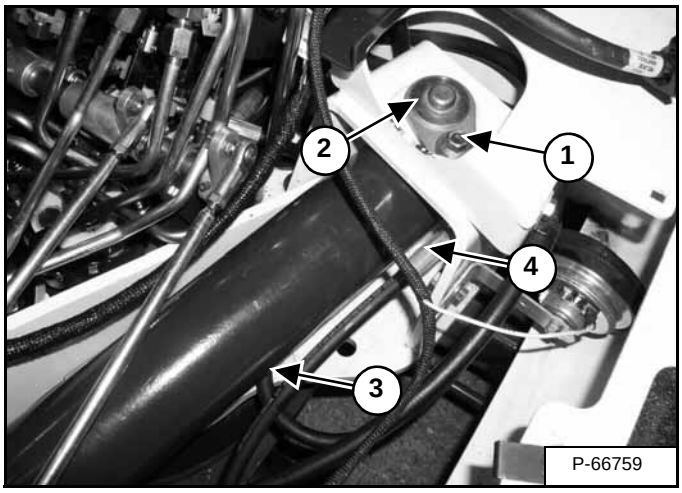
Removal and Installation (Cont'd)

Figure 20-22-6



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

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.

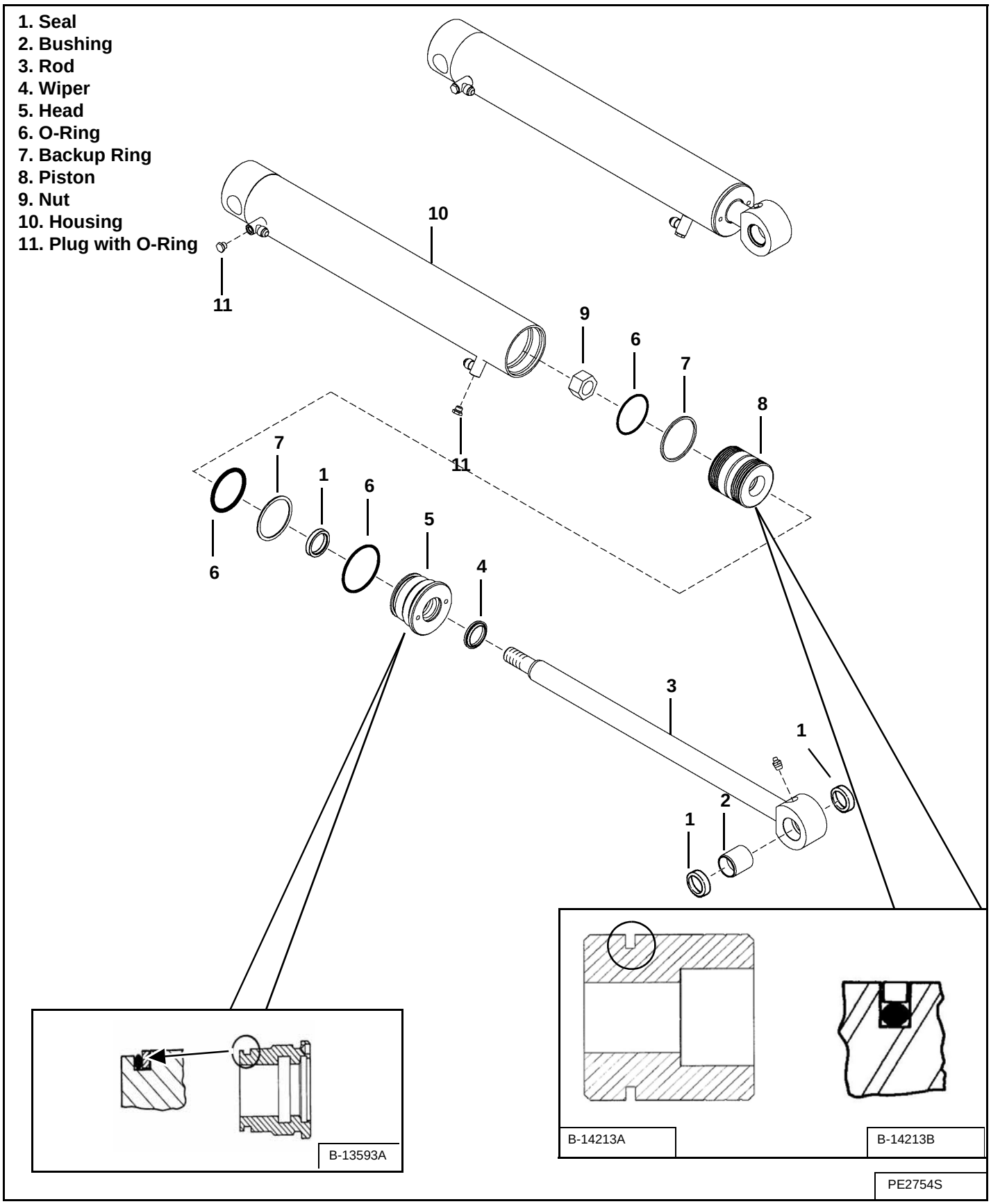
Remove the base end hydraulic hose (Item 3) **[Figure 20-22-7]**.

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

Slide the cylinder out the front of the excavator frame.

Dealer Copy -- Not for Resale

Parts Identification



Dealer Copy -- Not for Resale

Disassembly

Clean the outside of the boom swing cylinder before disassembly.

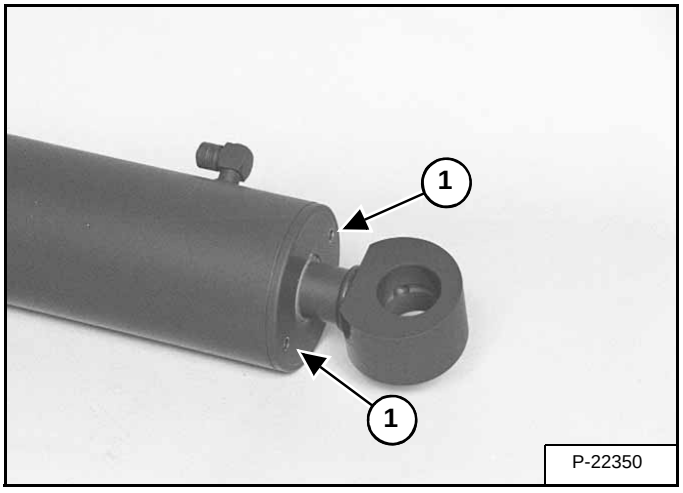
Use the following tools to disassemble the cylinder:

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.

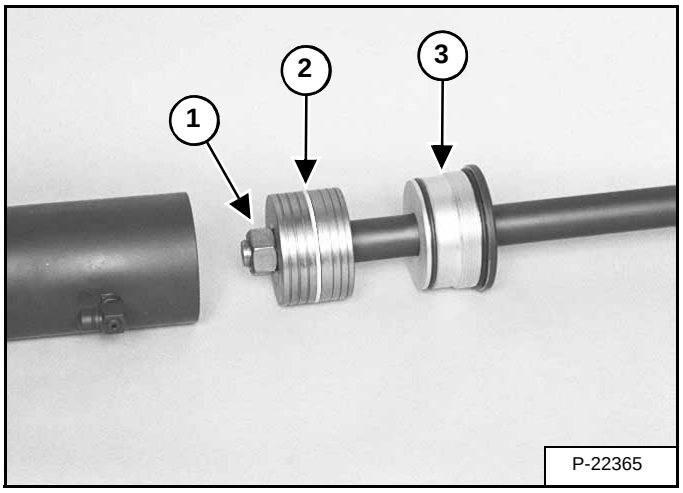
Put the base end of the cylinder in a vise.

Figure 20-22-8



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

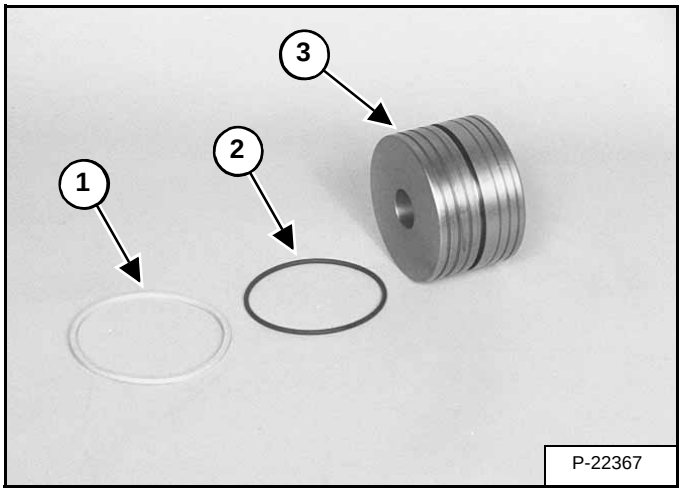
Figure 20-22-9



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

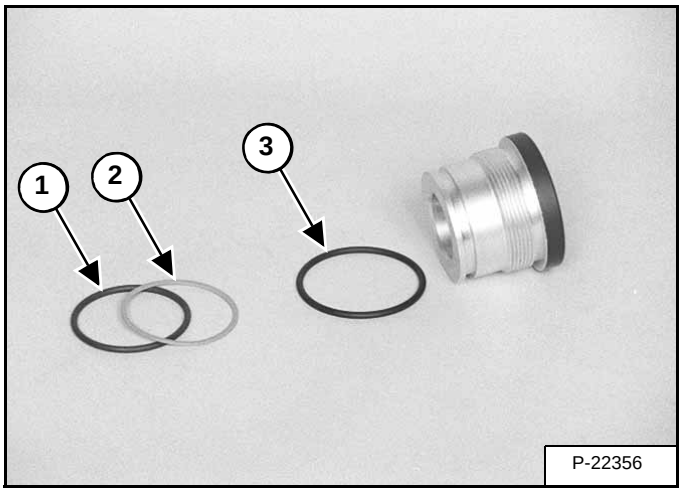


Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-22-10]**.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

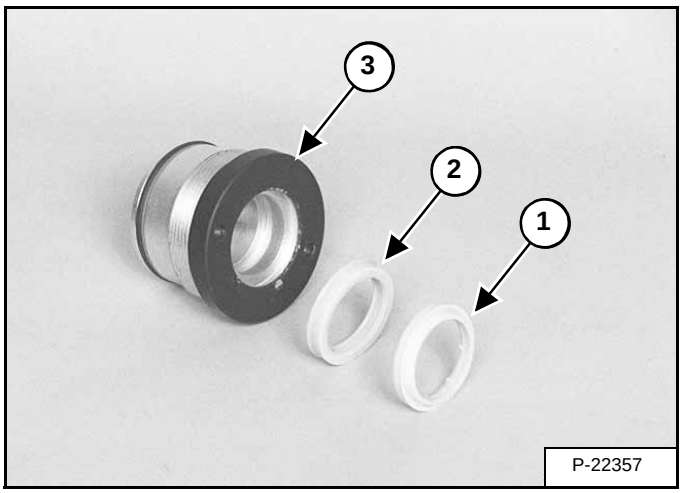
Figure 20-22-11



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

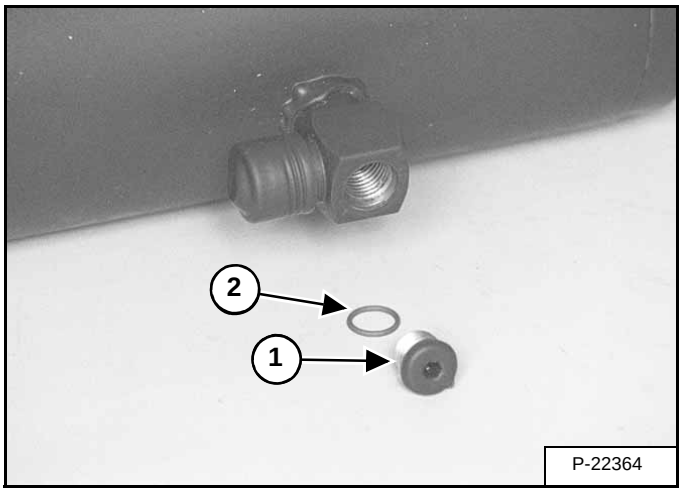
Remove the O-ring (Item 3) **[Figure 20-22-11]**.

Figure 20-22-12



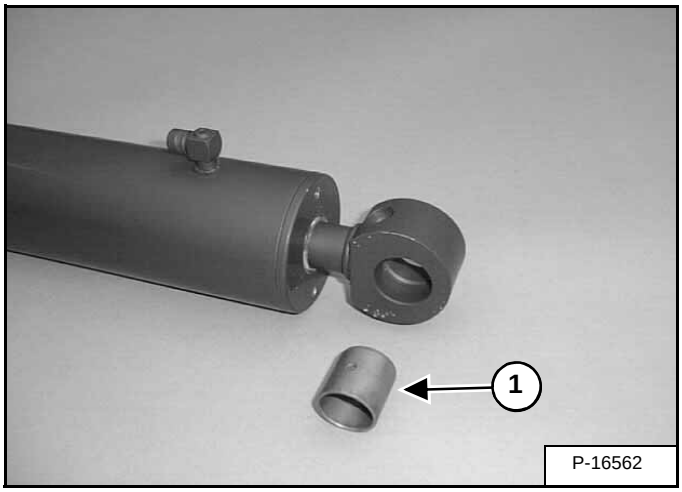
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-22-12]**.

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]**.

Dealer Copy -- Not for Resale

Assembly

Use the following tools to assemble the cylinder:

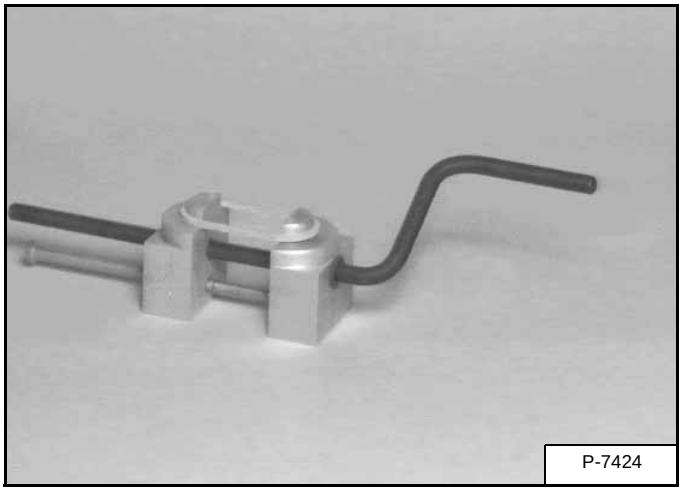
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

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.

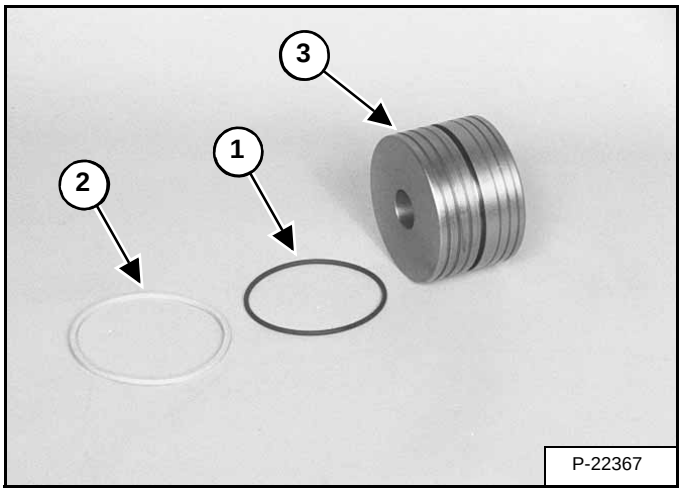
Figure 20-22-15



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

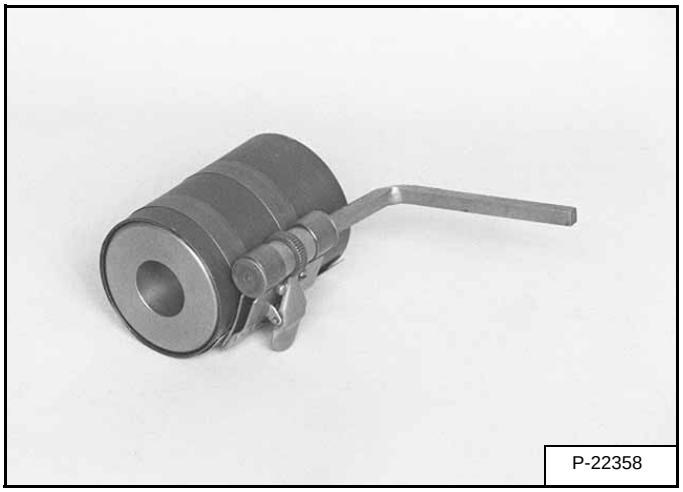
Allow the seal to stretch for 30 seconds before installing it on the piston.

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

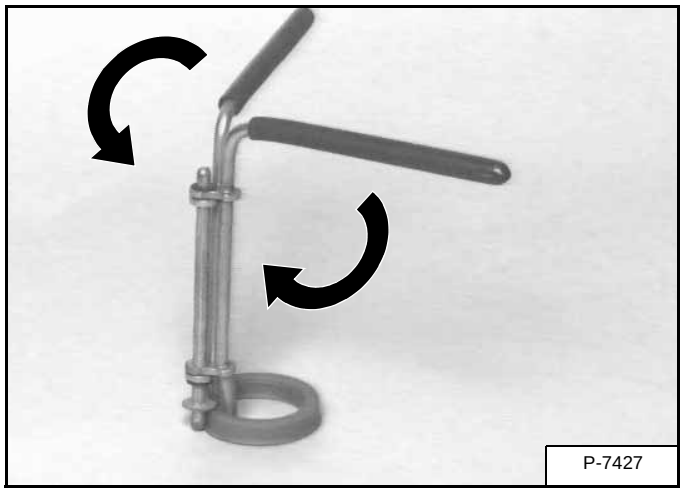


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-22-17]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-22-18

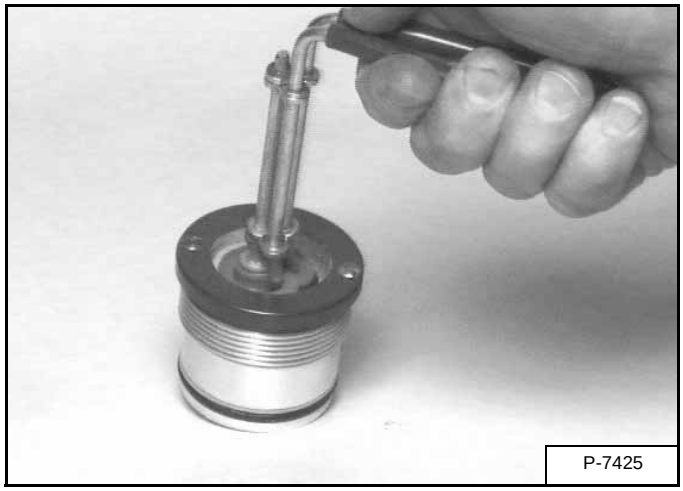


Install the rod seal on the rod seal tool **[Figure 20-22-18]**.

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

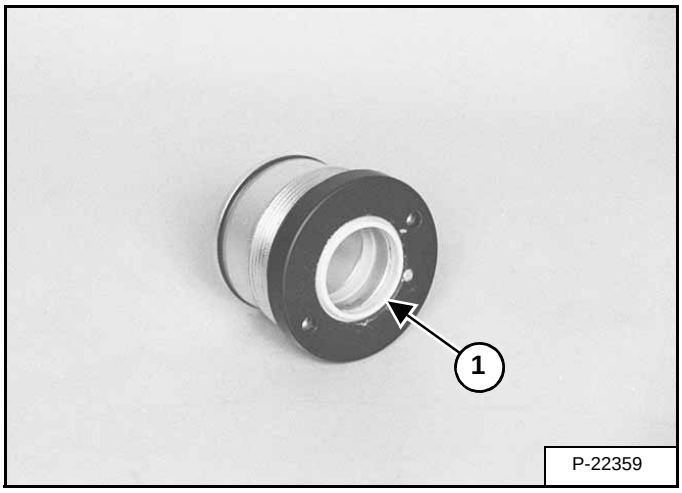
Rotate the handles to collapse the rod seal **[Figure 20-22-18]**.

Figure 20-22-19



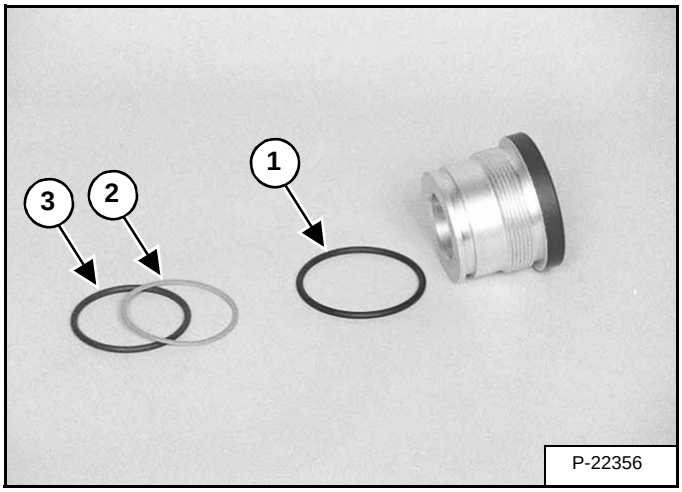
Install the rod seal in the head **[Figure 20-22-19]**.

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



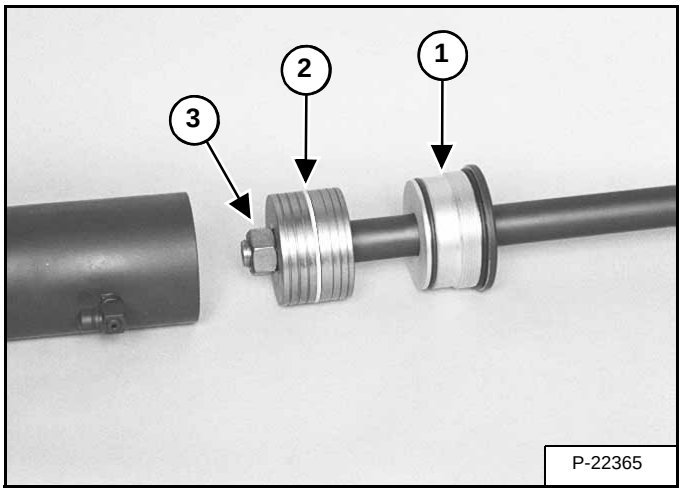
Install the O-ring (Item 1) **[Figure 20-22-21]**.

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

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-22-22



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

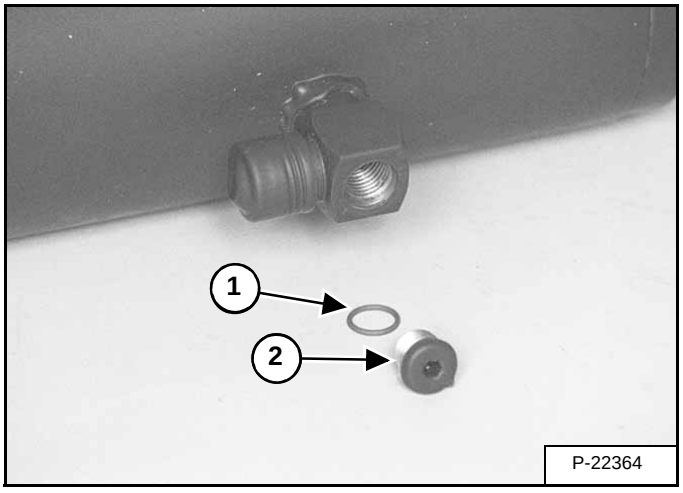
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

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

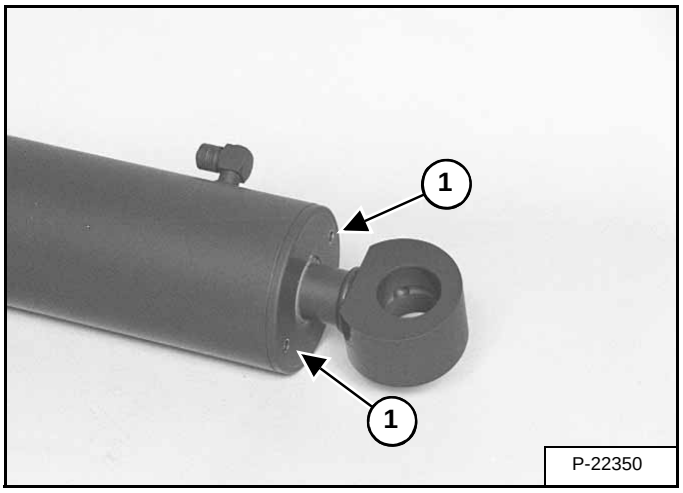


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-22-23]**.

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

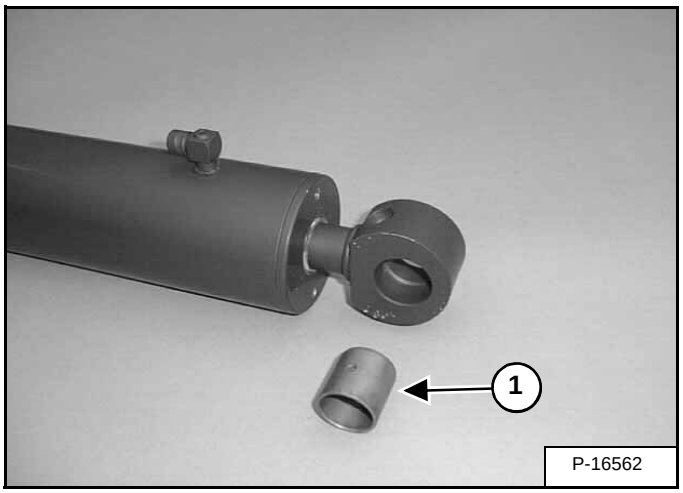
Put the base end of the hydraulic cylinder in a vise.

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.

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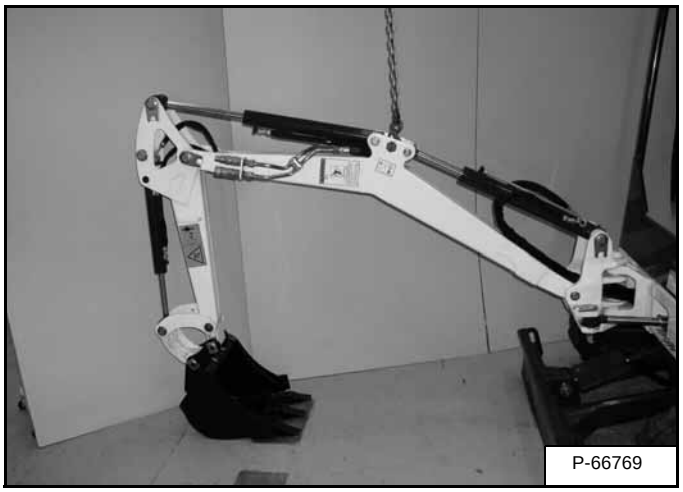


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BUCKET CYLINDER

Testing

Figure 20-23-1

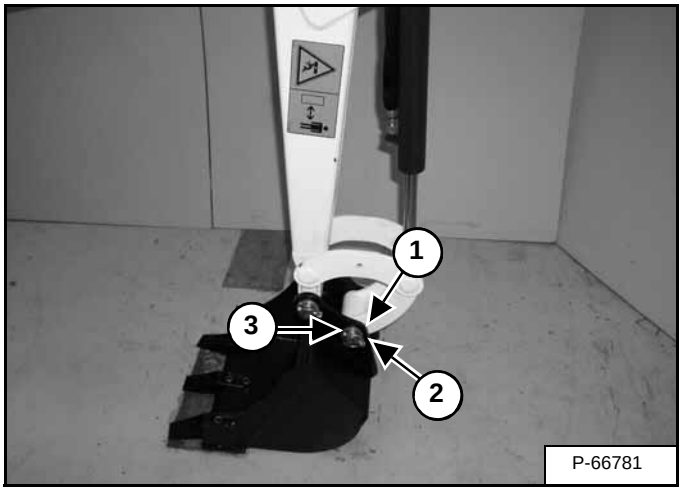


Lower the boom/bucket and blade to the ground **[Figure 20-23-1]**.

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 20-23-3]** from the outside pivot pin.

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

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

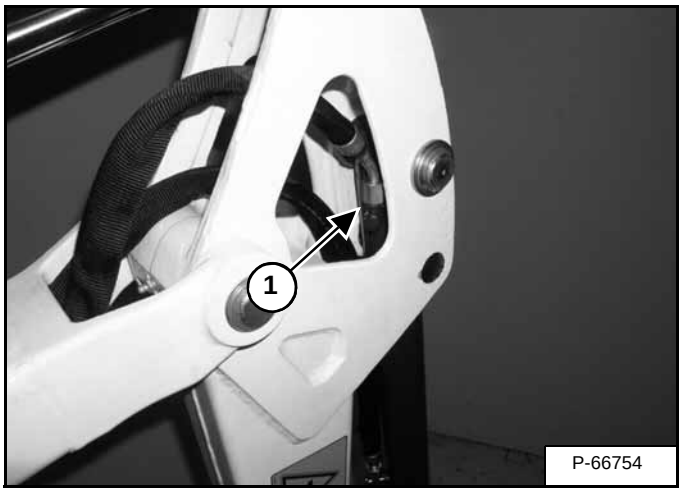
Hydraulic fluid escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. This can cause serious injury and possible death if proper medical treatment by a physician familiar with this injury is not received immediately.

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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.

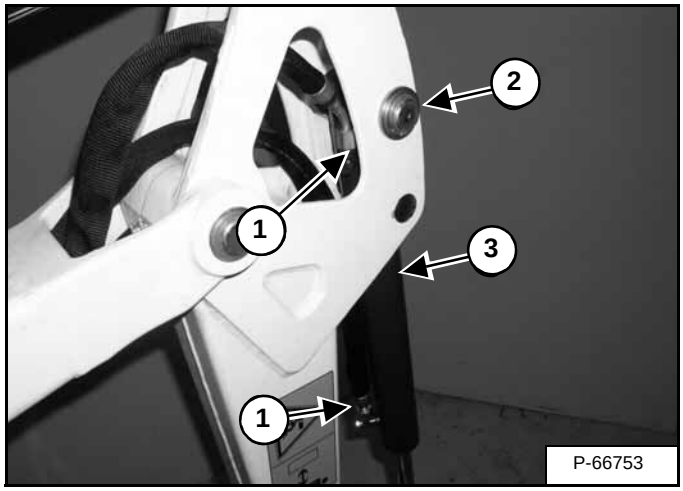
Removal and Installation

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.

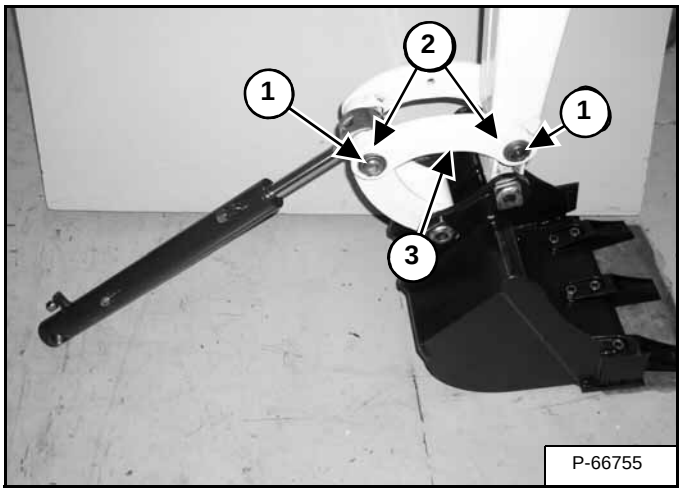
Remove the base end pin and lower the base end to the floor.

Remove the hose clamp (Item 3) **[Figure 20-23-5]** on the side of the cylinder.

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Removal and Installation (Cont'd)

Figure 20-23-6



Remove the two snap rings (Item 1) and two washers (Item 2) **[Figure 20-23-6]**.

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

Remove the bucket link pins (Item 1) **[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.

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⚠ WARNING

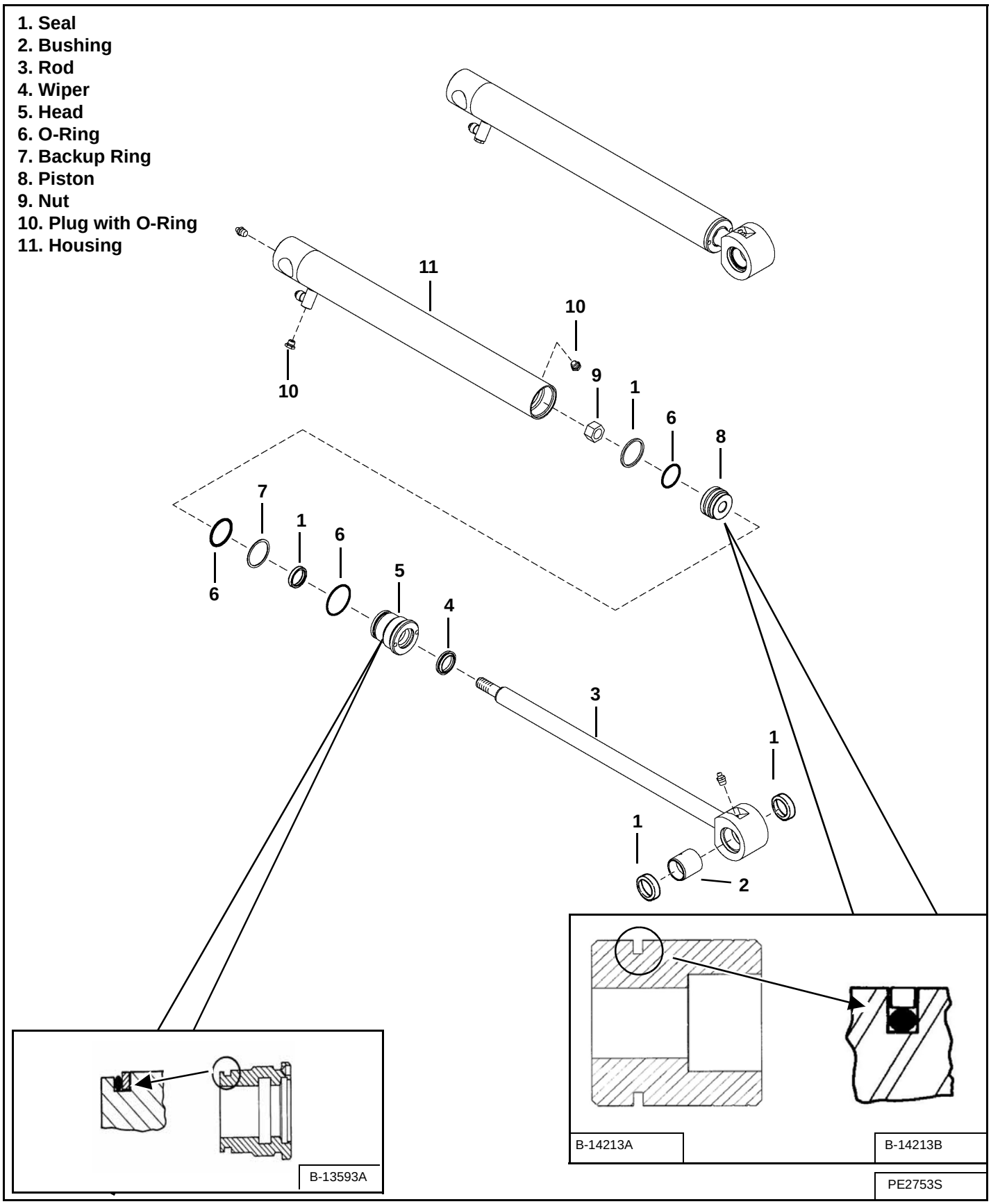
Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire which can result in injury or death.

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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



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Disassembly

Clean the outside of the bucket cylinder before disassembly.

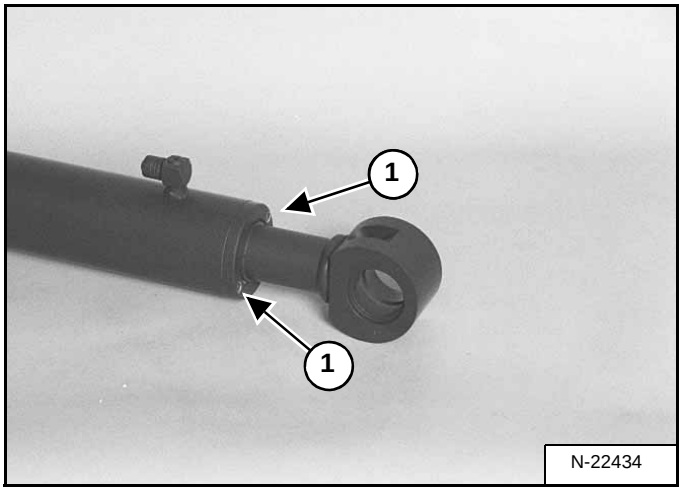
Use the following tools to disassemble the cylinder:

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.

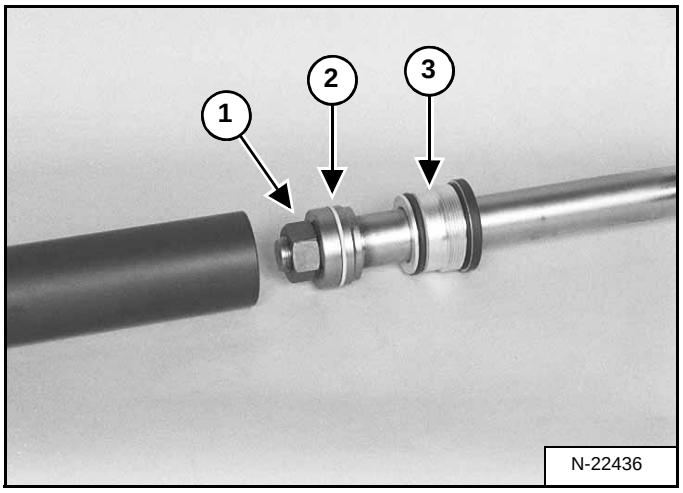
Put the base end of the cylinder in a vise.

Figure 20-23-7



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

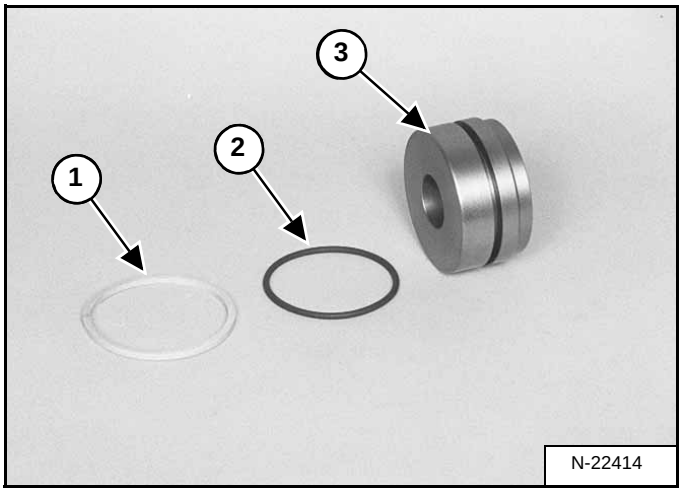
Figure 20-23-8



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

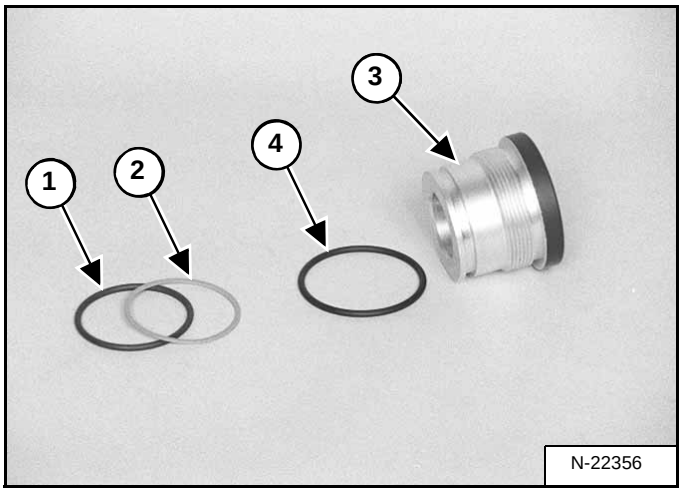


Standard Piston: Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-23-9]**.

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Disassembly (Cont'd)

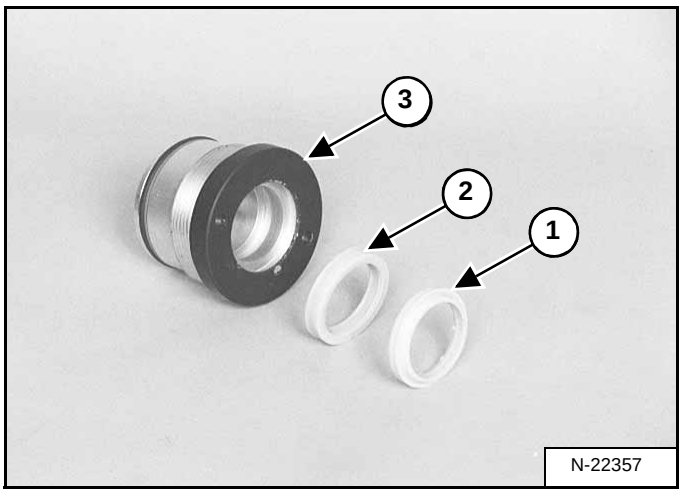
Figure 20-23-10



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]**.

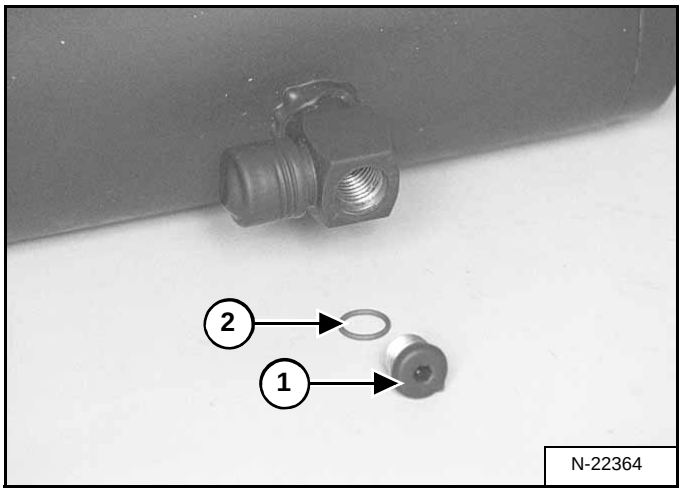
Remove the O-ring (Item 4) **[Figure 20-23-10]**.

Figure 20-23-11



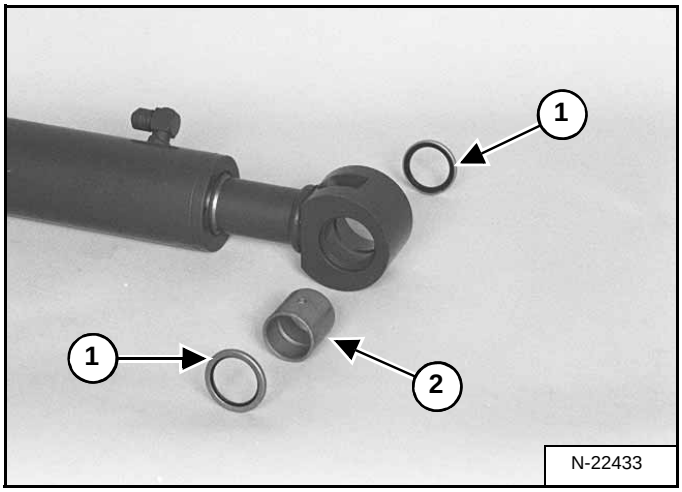
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-23-11]**.

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]**.

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Assembly

Use the following tools to assemble the cylinder:

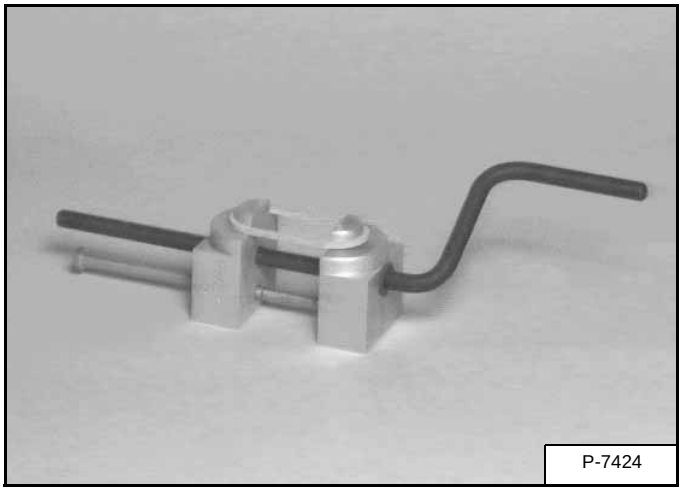
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

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.

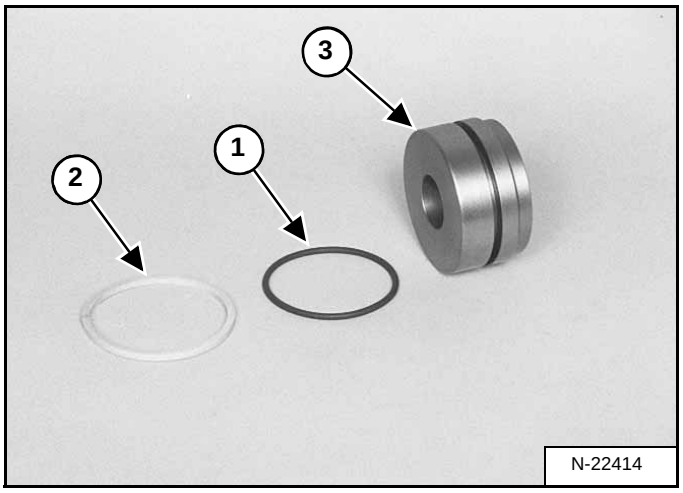
Figure 20-23-14



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

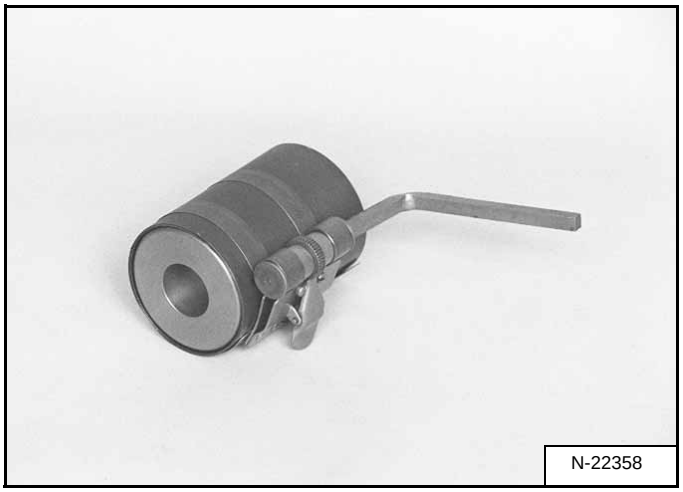
Allow the seal to stretch for 30 seconds before installing it on the piston.

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

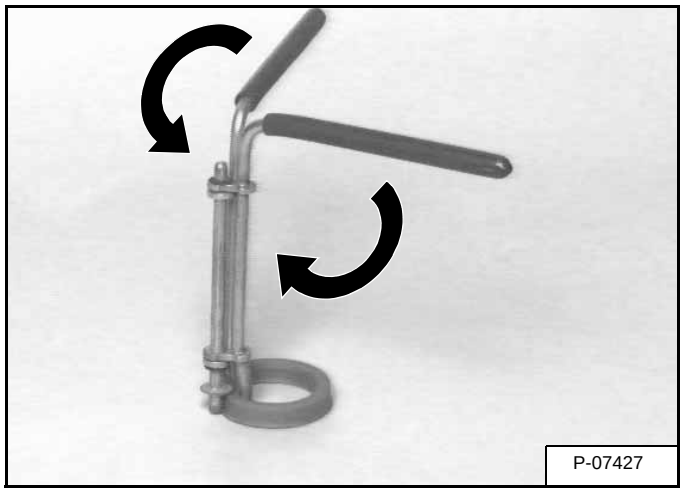


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-23-16]**.

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Assembly (Cont'd)

Figure 20-23-17

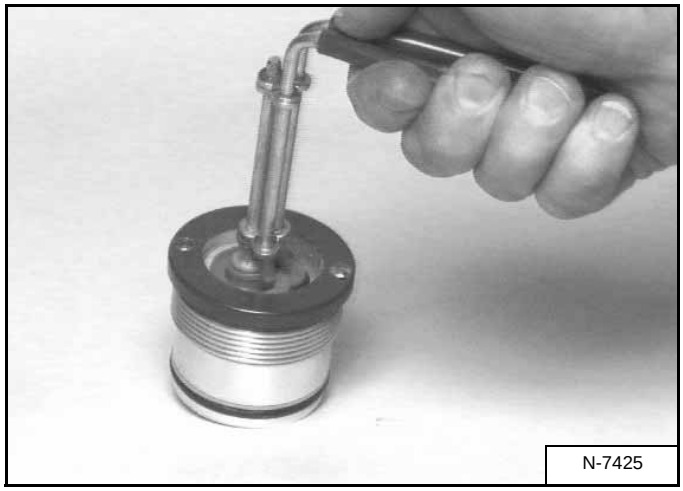


Install the rod seal on the rod seal tool **[Figure 20-23-17]**.

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

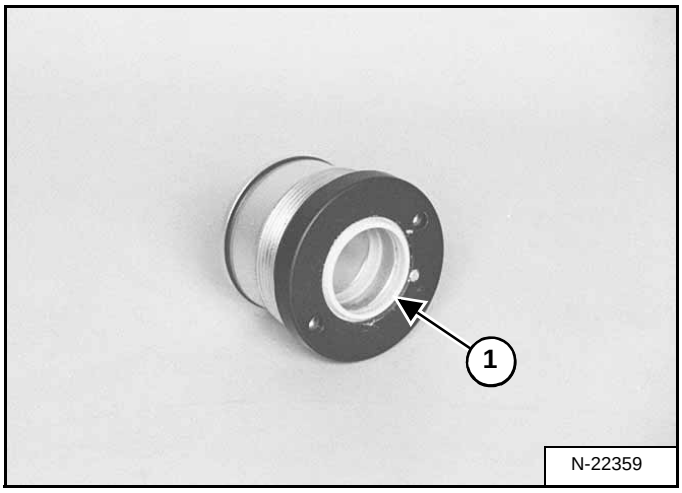
Rotate the handles to collapse the rod seal **[Figure 20-23-17]**.

Figure 20-23-18



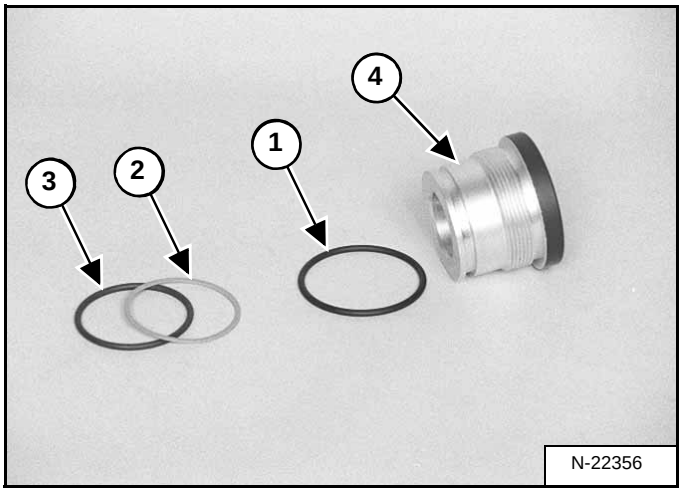
Install the rod seal in the head **[Figure 20-23-18]**.

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



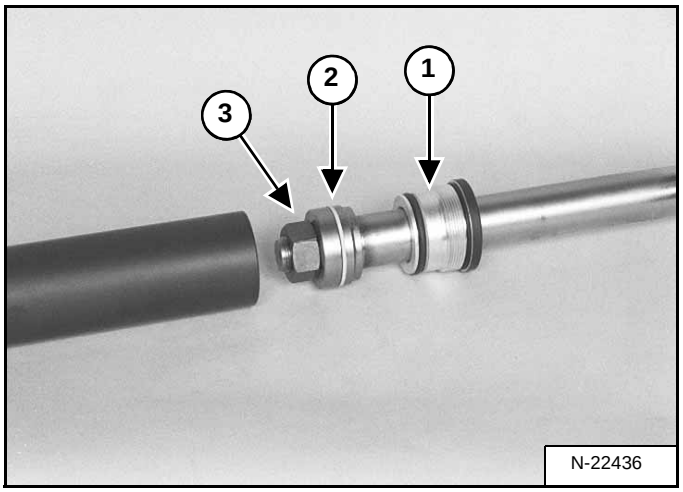
Install the O-ring (Item 1) **[Figure 20-23-20]**.

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

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Assembly (Cont'd)

Figure 20-23-21



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

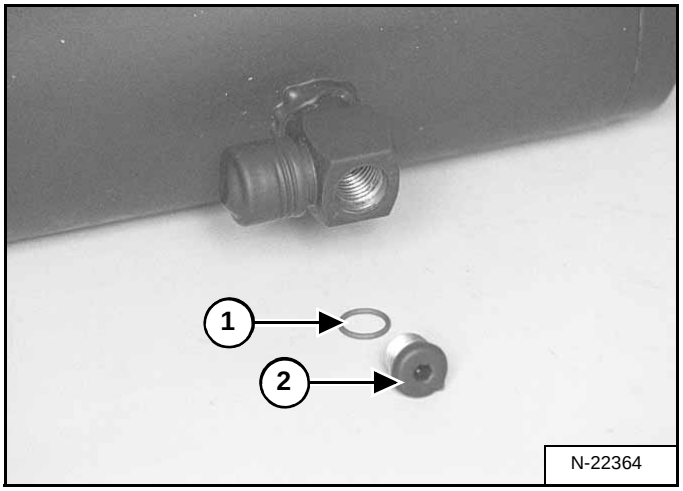
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

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



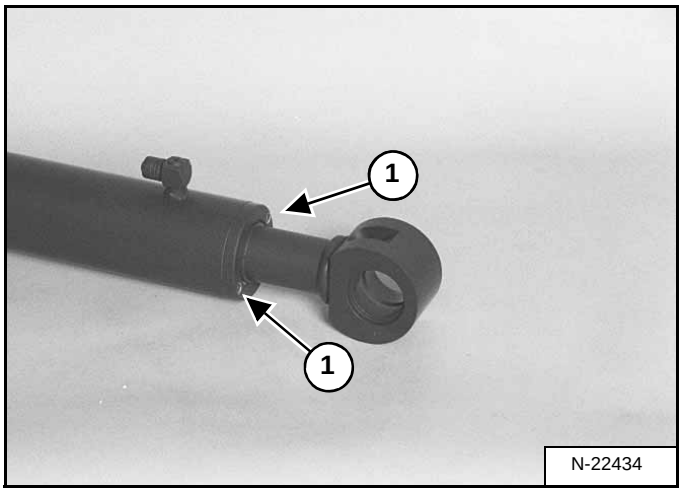
Install O-ring (Item 1) and plug (Item 2) **[Figure 20-23-22]**.

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

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

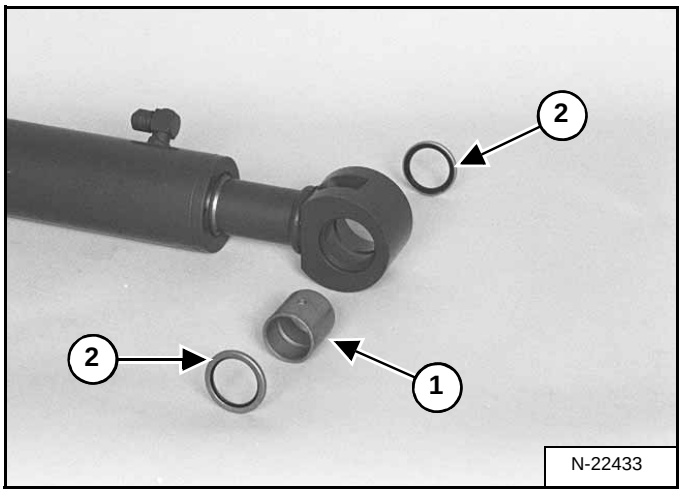
Be careful no to damage the cylinder tube.

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.

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BLADE CYLINDER

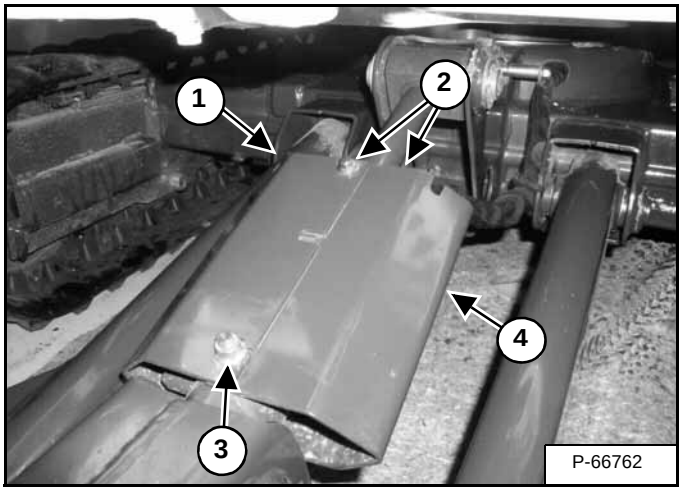
Testing

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.

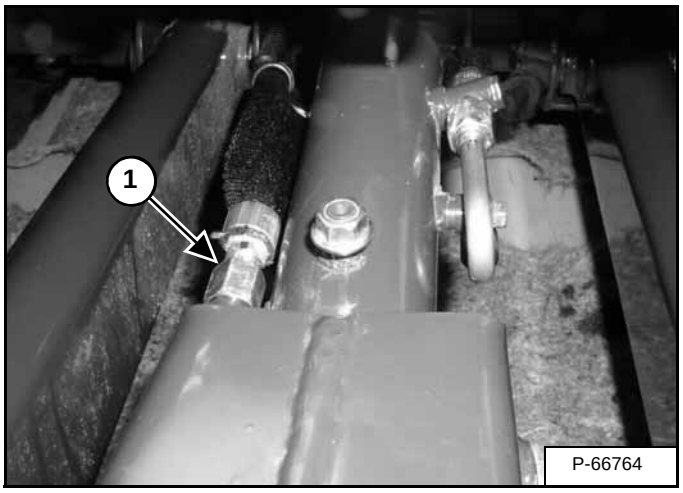
Remove the blade cylinder shields from the blade cylinder.

⚠ 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.

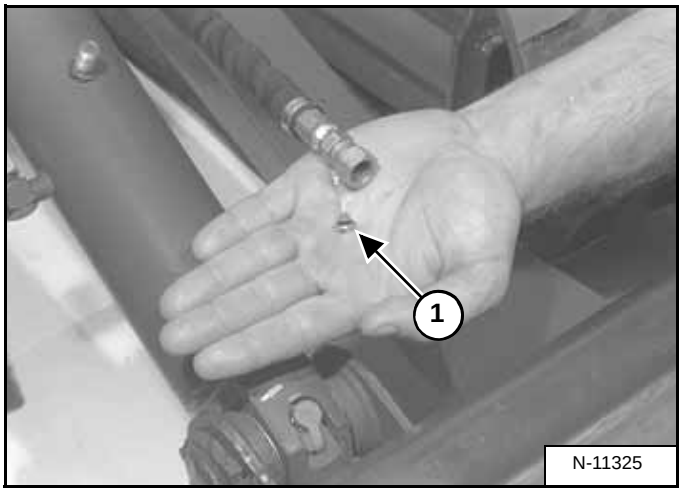
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Figure 20-24-2



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

Figure 20-24-3

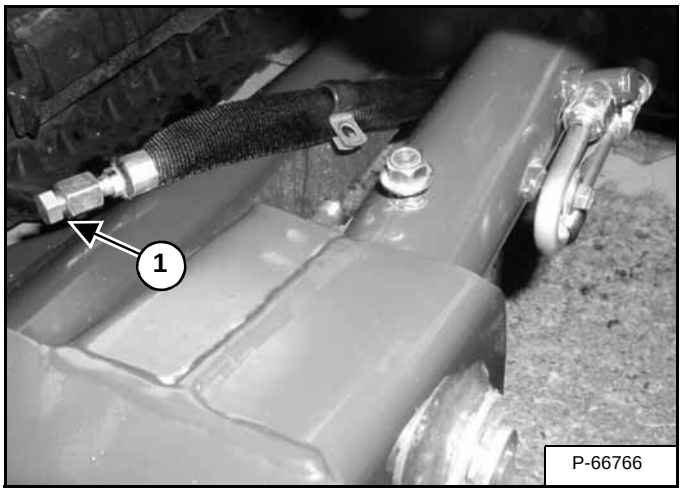


NOTE: Use care not to lose the orifice (Item 1) [Figure 20-24-3] located in the blade cylinder rod end hose.

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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.

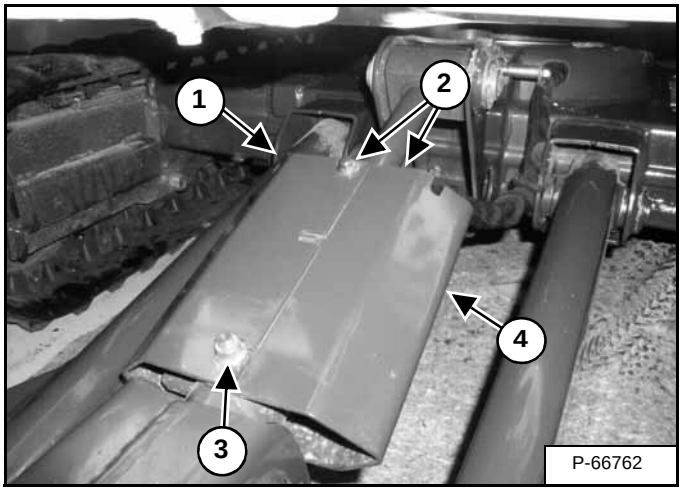
Removal and Installation

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 20-24-1



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.

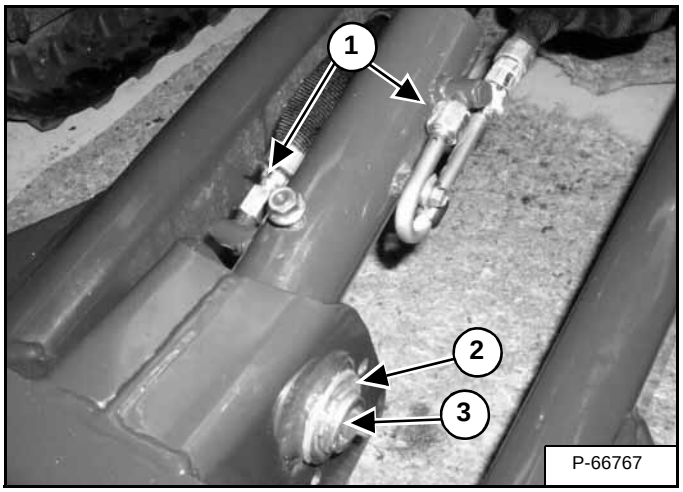
Loosen the top nut (Item 3) and the bottom nut (Item 4) **[Figure 20-24-1]** fastening the shield to the blade cylinder.

Remove the blade cylinder shields from the blade cylinder.

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Removal and Installation (Cont'd)

Figure 20-24-2



Remove and plug the blade cylinder hoses (Item 1) **[Figure 20-24-2]**.

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

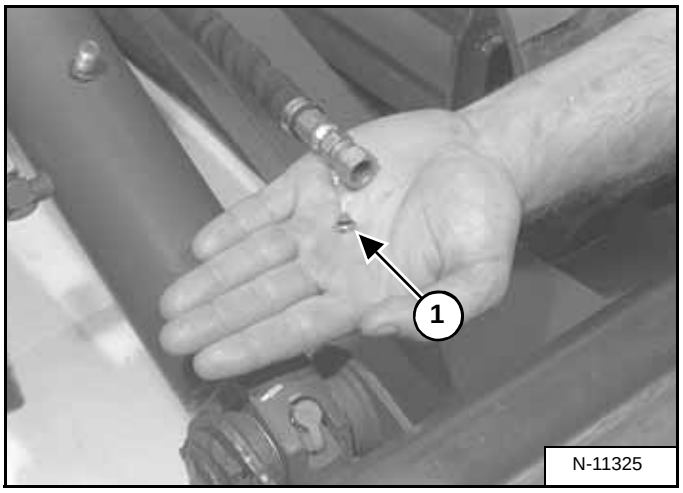
Remove the cylinder base end retaining pin (Item 3) **[Figure 20-24-2]**.

IMPORTANT

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

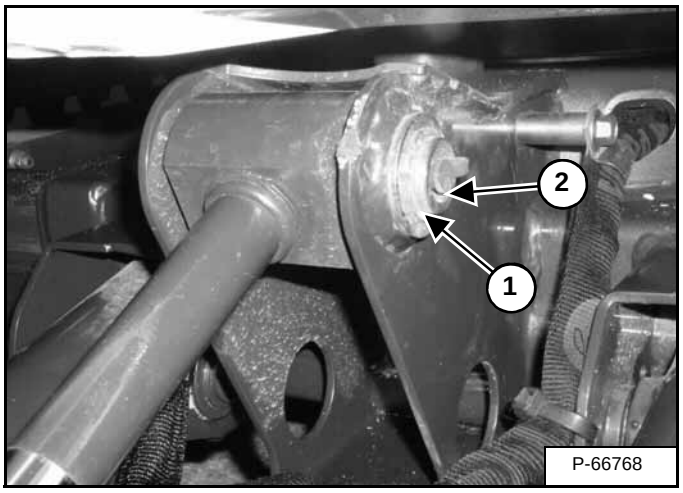
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Figure 20-24-3



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

Figure 20-24-4



Remove the snap ring and washer (Item 1) **[Figure 20-24-4]** from the cylinder rod end.

Remove the cylinder rod end retaining pin (Item 2) **[Figure 20-24-4]**.

Remove the blade cylinder.

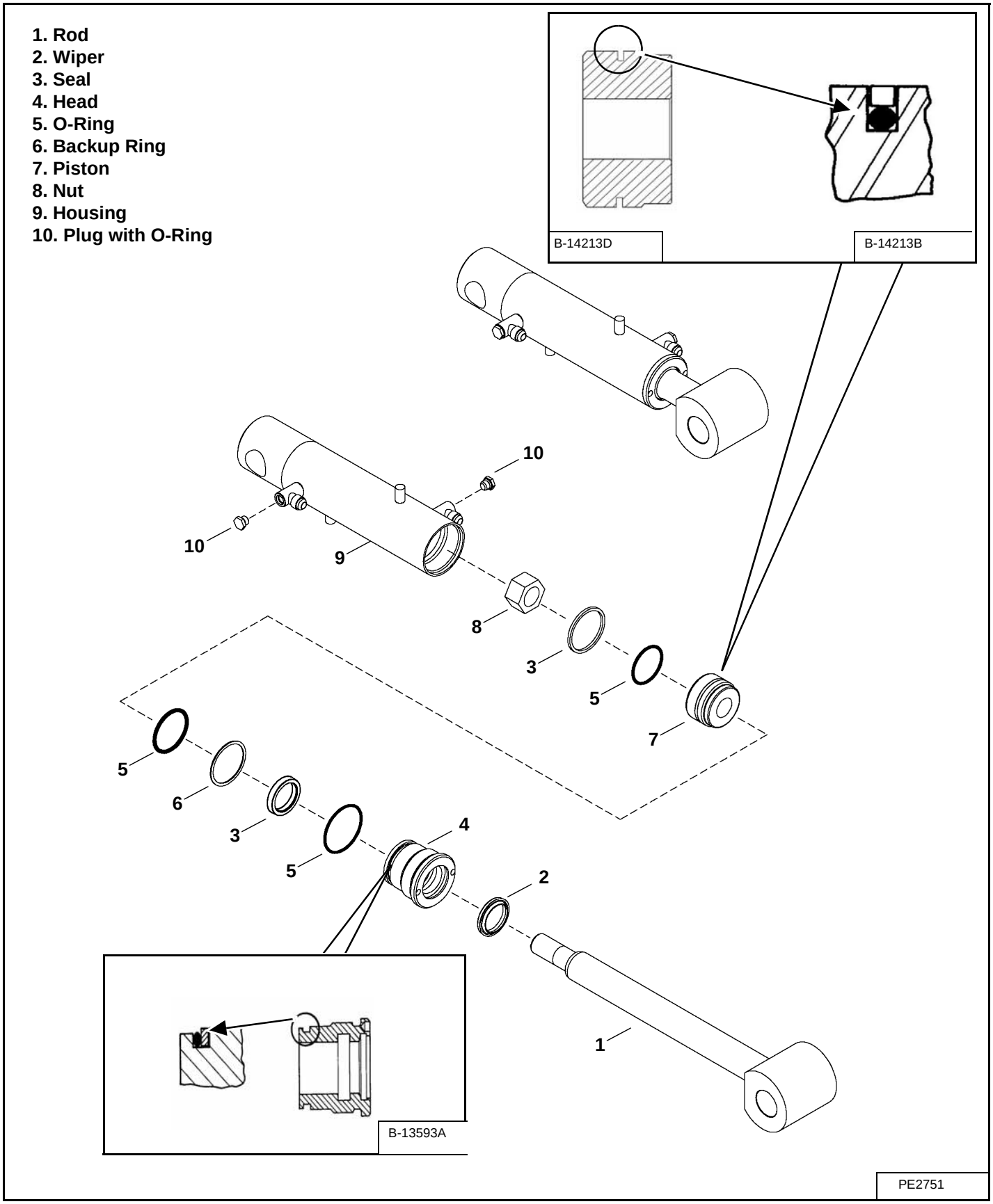
⚠ WARNING

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

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Parts Identification



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Disassembly

Clean the outside of the blade cylinder before disassembly.

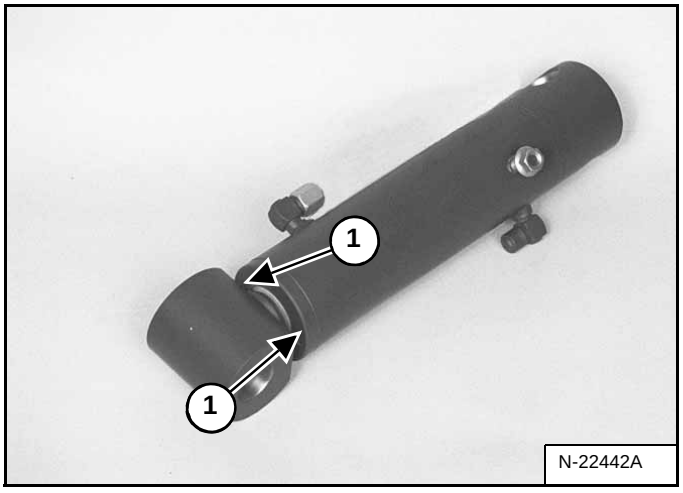
Use the following tools to disassemble the cylinder:

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.

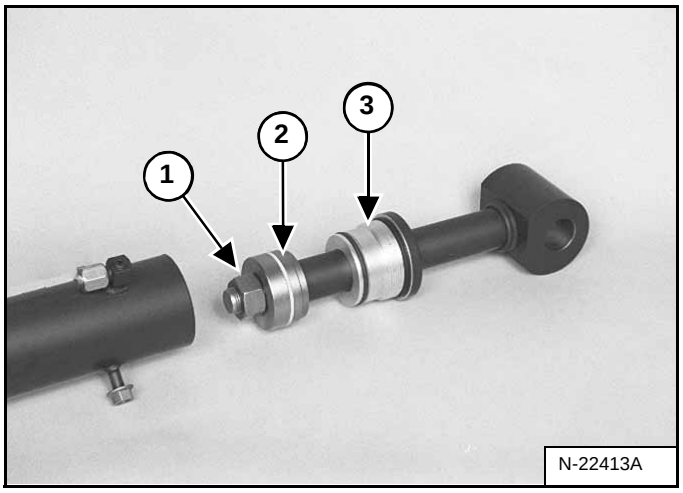
Put the base end of the cylinder in a vise.

Figure 20-24-5



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-24-5]** to loosen the head.

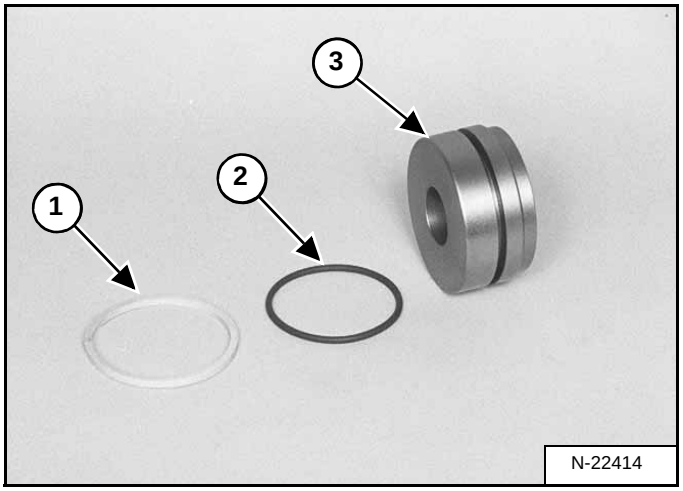
Figure 20-24-6



Remove the head and the rod assembly from the cylinder **[Figure 20-24-6]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-24-6]**.

Figure 20-24-7

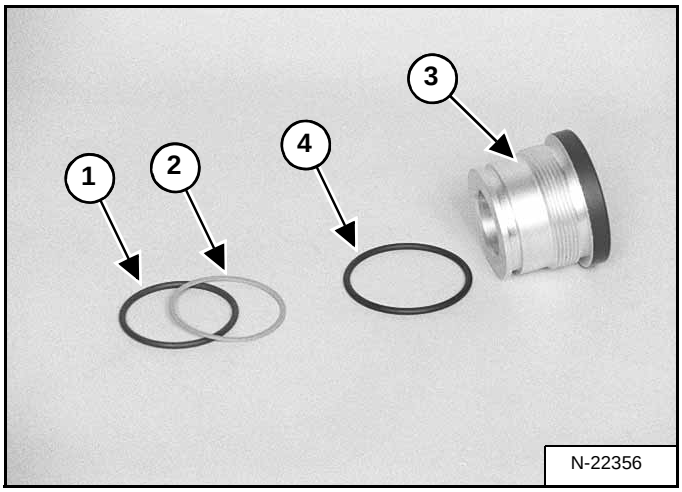


Standard Piston: Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-24-7]**.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

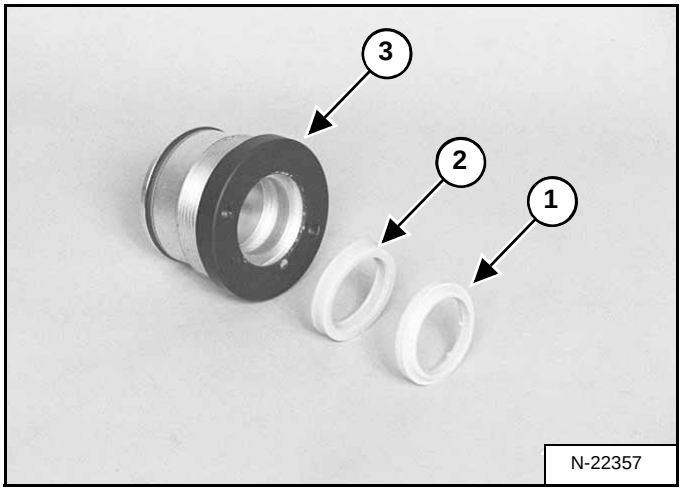
Figure 20-24-8



Remove the O-ring (Item 1) and the back-up ring (Item 2) from the groove in the head (Item 3) **[Figure 20-24-8]**.

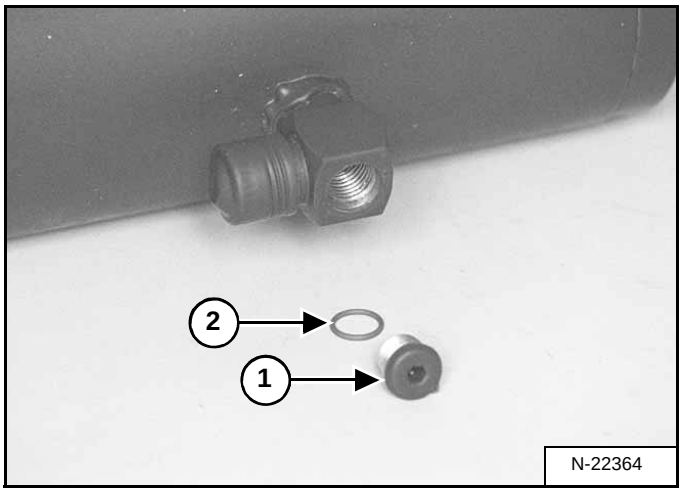
Remove the O-ring (Item 4) **[Figure 20-24-8]**.

Figure 20-24-9



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-24-9]**.

Figure 20-24-10



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-24-10]**.

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Assembly

Use the following tools to assemble the cylinder:

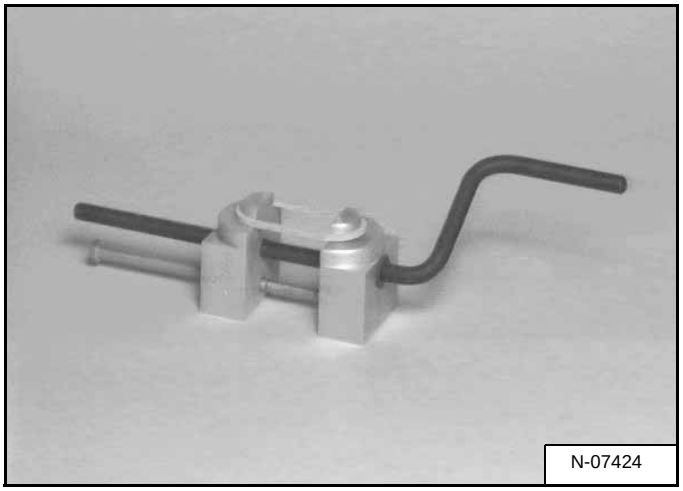
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

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.

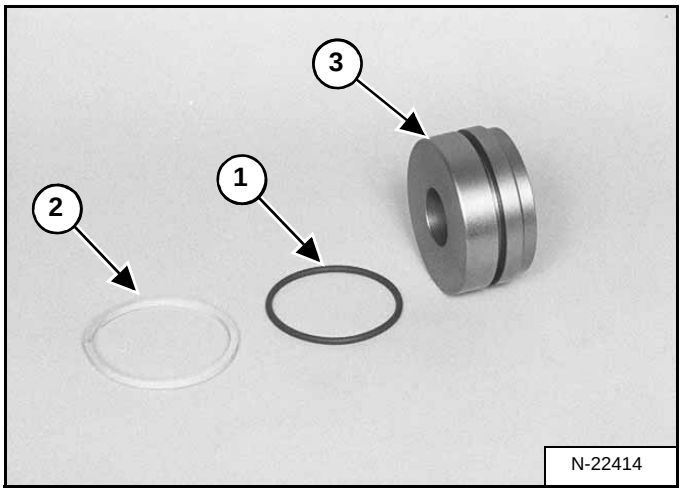
Figure 20-24-11



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-24-11]**.

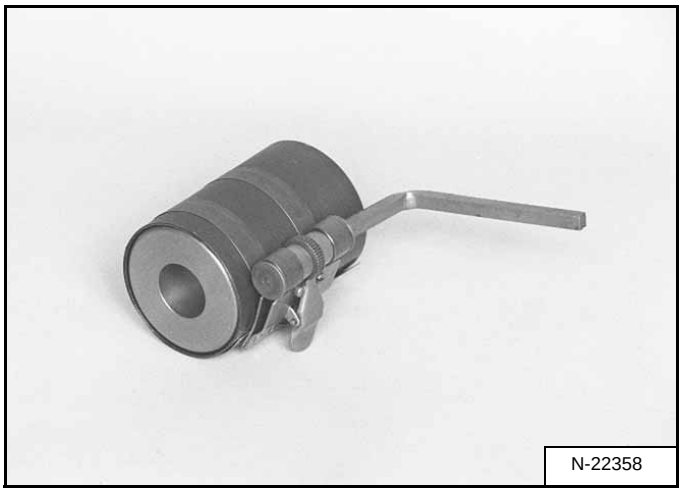
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-24-12



Standard Piston: Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-24-12]**.

Figure 20-24-13

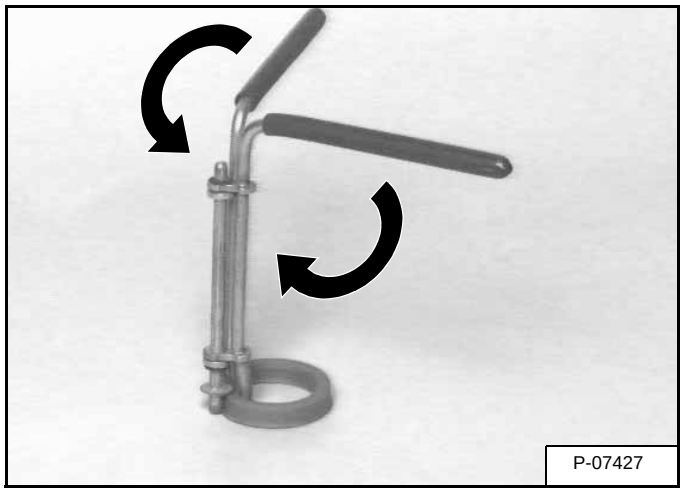


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-24-13]**.

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Assembly (Cont'd)

Figure 20-24-14

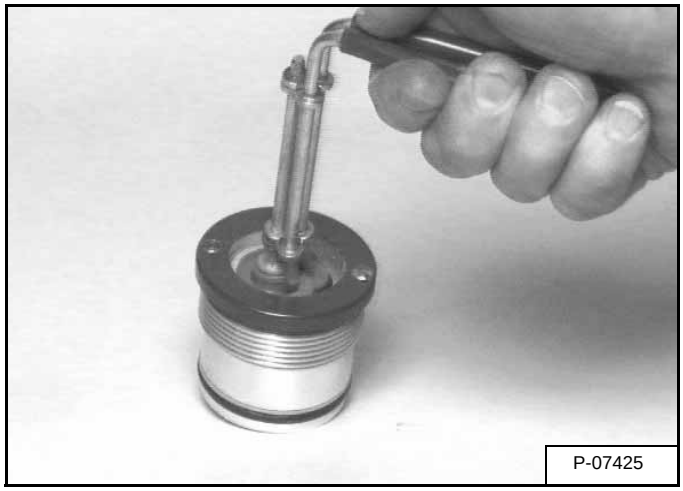


Install the rod seal on the rod seal tool **[Figure 20-24-14]**.

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

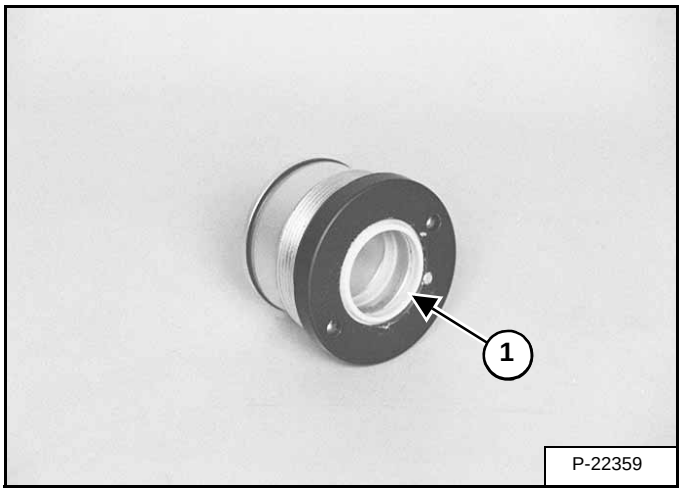
Rotate the handles to collapse the rod seal **[Figure 20-24-14]**.

Figure 20-24-15



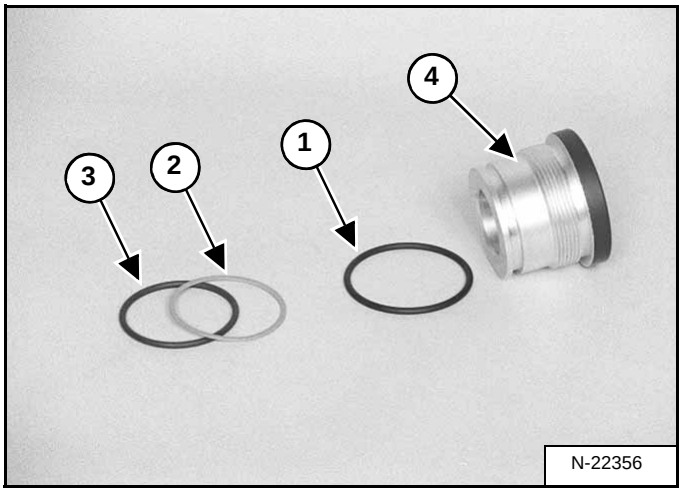
Install the rod seal in the head **[Figure 20-24-15]**.

Figure 20-24-16



Install the wiper seal with the wiper (Item 1) **[Figure 20-24-16]** toward the outside of the head.

Figure 20-24-17



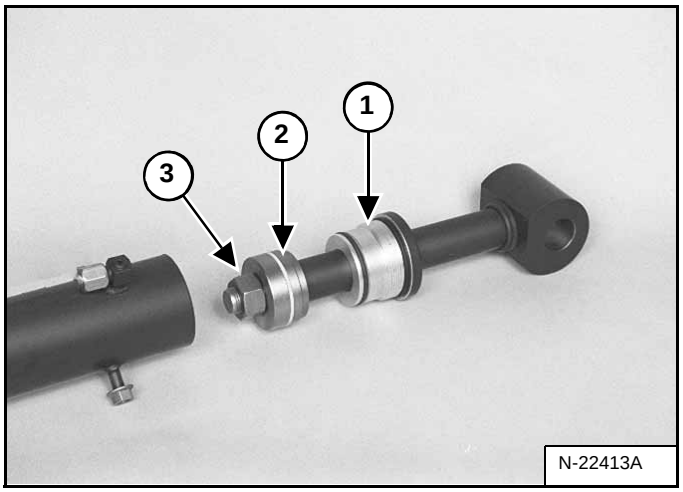
Install the O-ring (Item 1) **[Figure 20-24-17]**.

Install the back-up ring (Item 2) and O-ring (Item 3) into the groove on the head (Item 4) **[Figure 20-24-17]**.

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Assembly (Cont'd)

Figure 20-24-18



Install the head (Item 1) and piston (Item 2) **[Figure 20-24-18]** on the rod.

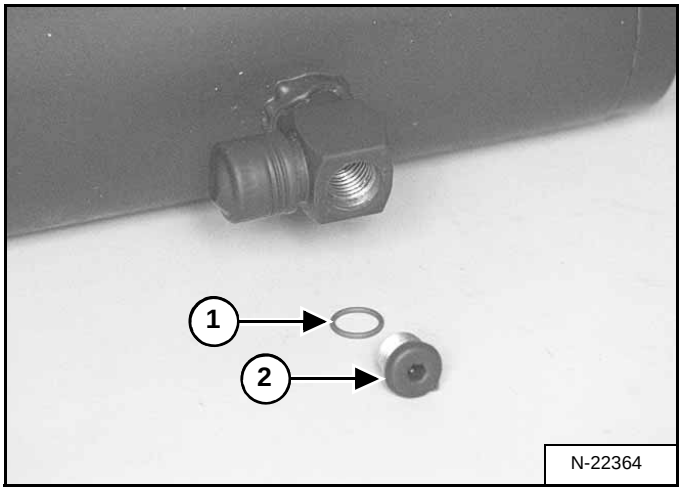
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-24-18]**.

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

Figure 20-24-19

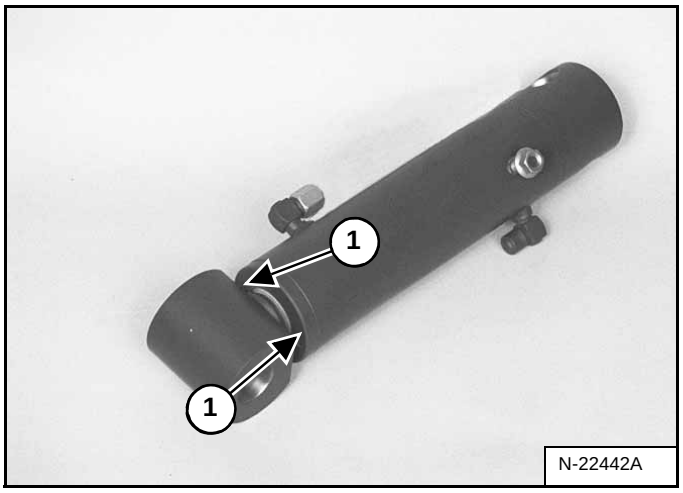


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-24-19]**.

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

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

Figure 20-24-20



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

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Dealer Copy -- Not for Resale

TRACK FRAME EXPANSION CYLINDER

Testing

Retract the track frame fully.

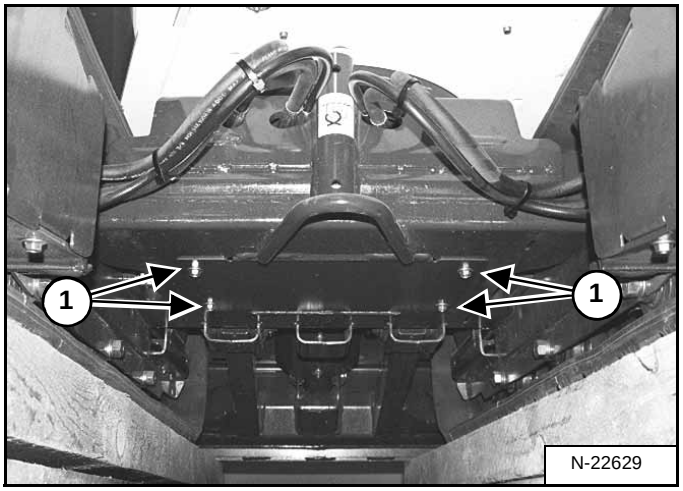
Figure 20-25-1



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

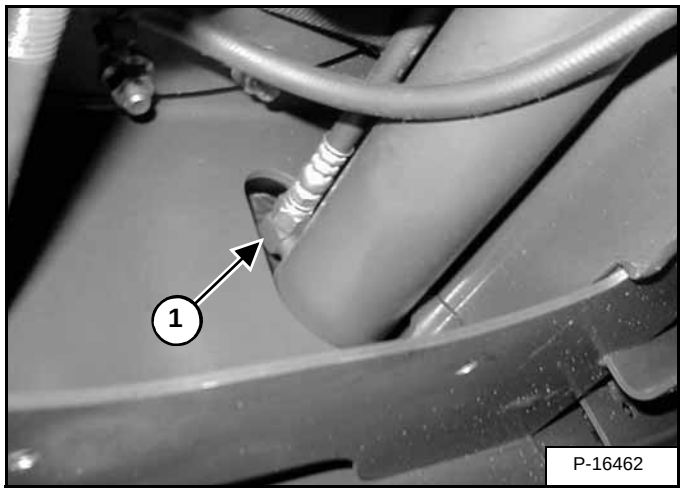
Stop the engine. Raise the control console.

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



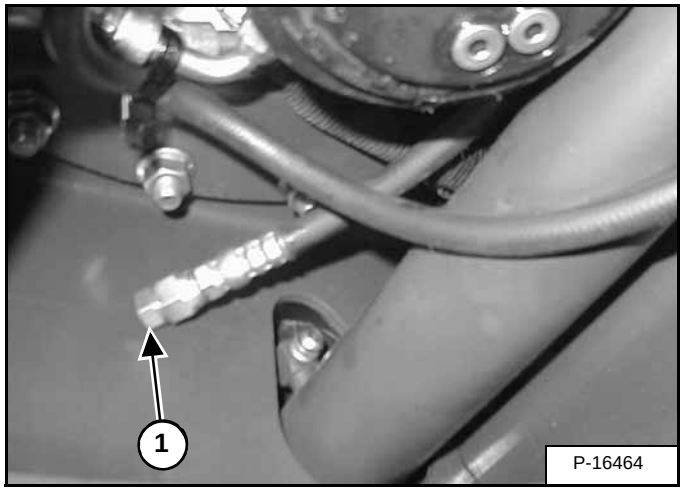
Remove the expansion cylinder base end hose (Item 1) **[Figure 20-25-3]**.

⚠ 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.

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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

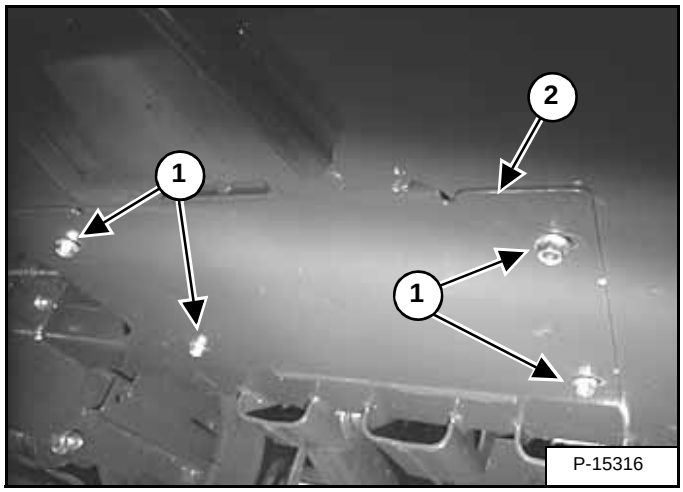
Expand the track frame fully.

Figure 20-25-5



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

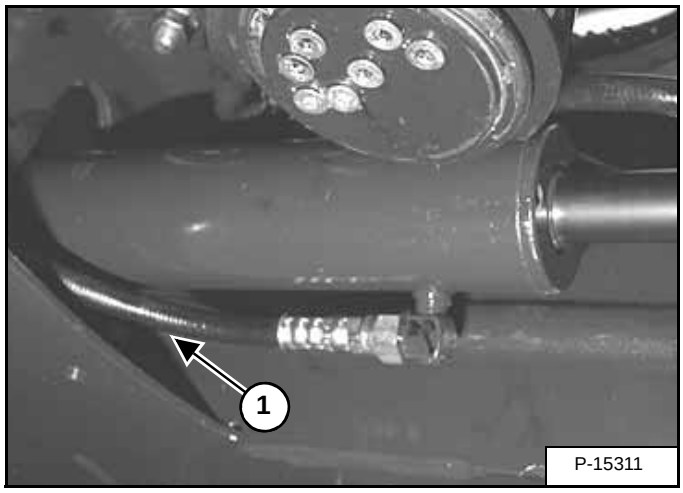
Figure 20-25-6



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

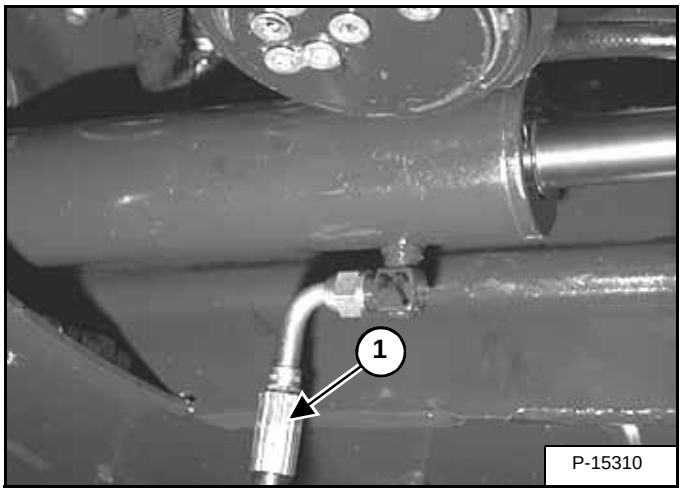
Hydraulic fluid escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. This can cause serious injury and possible death if proper medical treatment by a physician familiar with this injury is not received immediately.

W-2145-0290

Dealer Copy -- Not for Resale

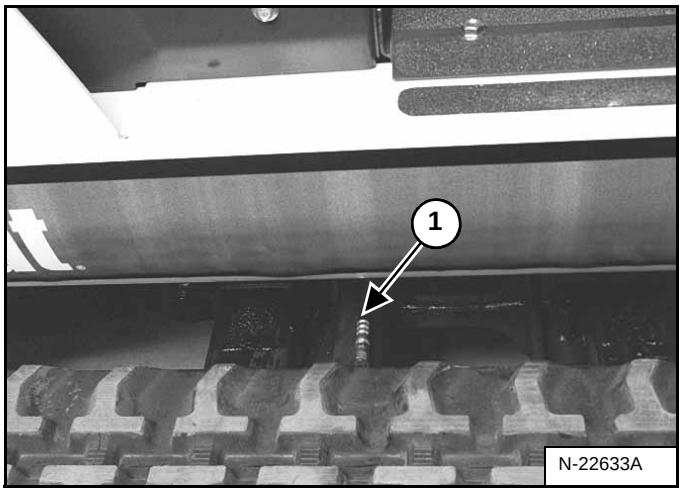
Removal And Installation (Cont'd)

Figure 20-25-8



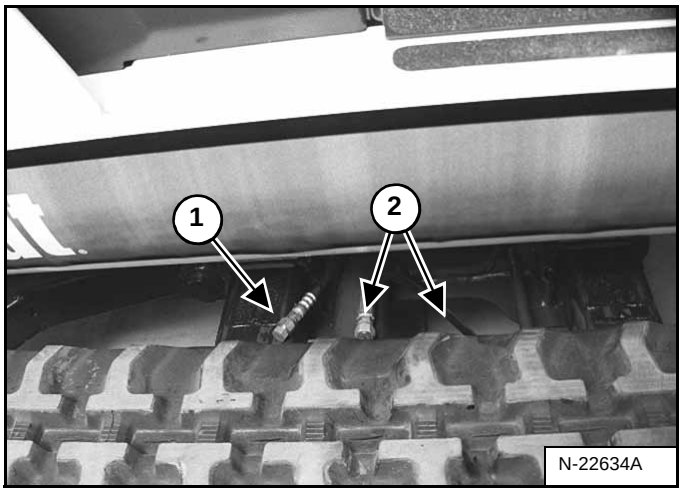
Install a hose (Item 1) **[Figure 20-25-8]** on the cylinder rod end. Place the other end of the hose in a drain pan.

Figure 20-25-9



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

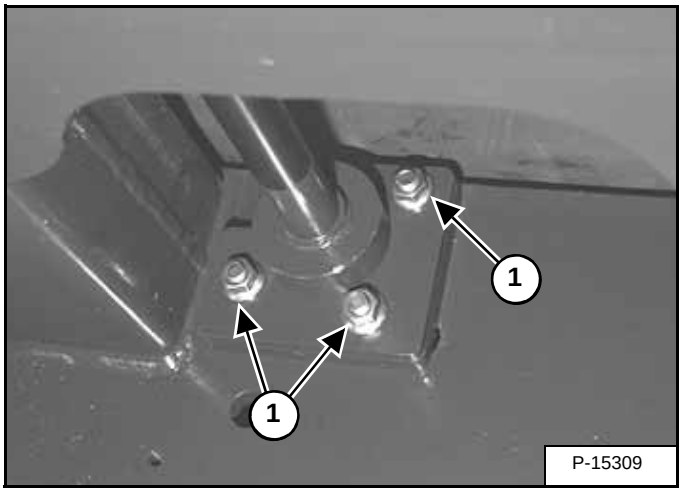
Figure 20-25-10



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



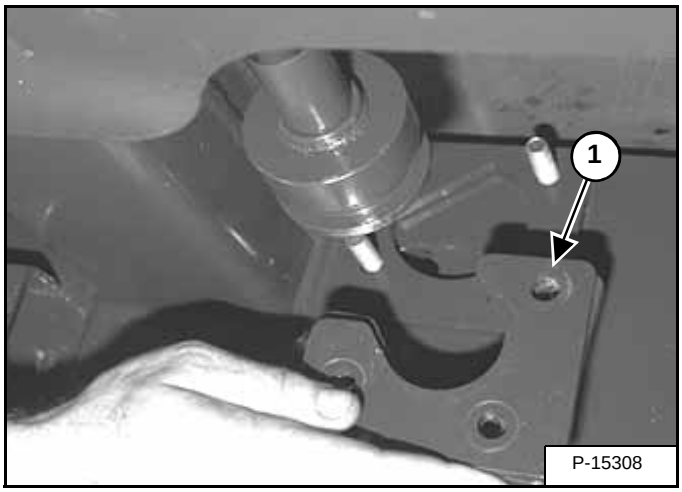
Remove the three nuts (Item 1) **[Figure 20-25-11]** from the rod end of the cylinder.

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

Dealer Copy -- Not for Resale

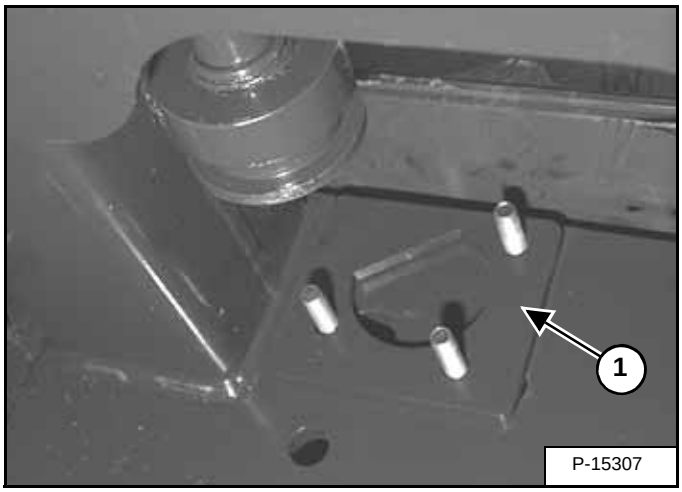
Removal And Installation (Cont'd)

Figure 20-25-12



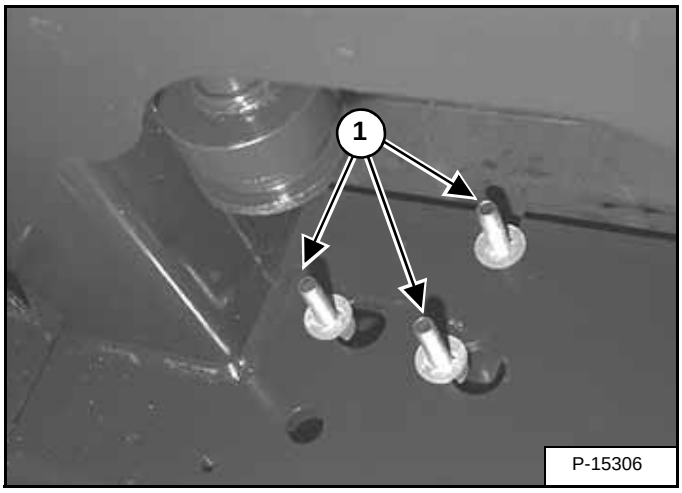
Slightly compress the cylinder. Remove the two plates (Item 1) **[Figure 20-25-12]** from the rod end of the cylinder.

Figure 20-25-13



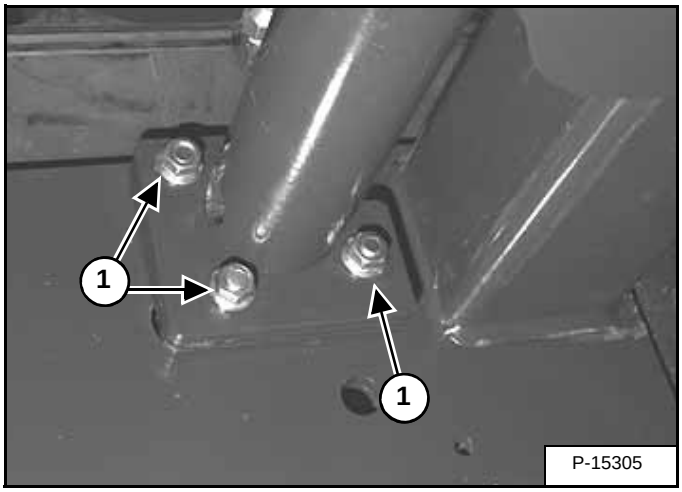
Remove the mount plate (Item 1) **[Figure 20-25-13]** from the track frame.

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



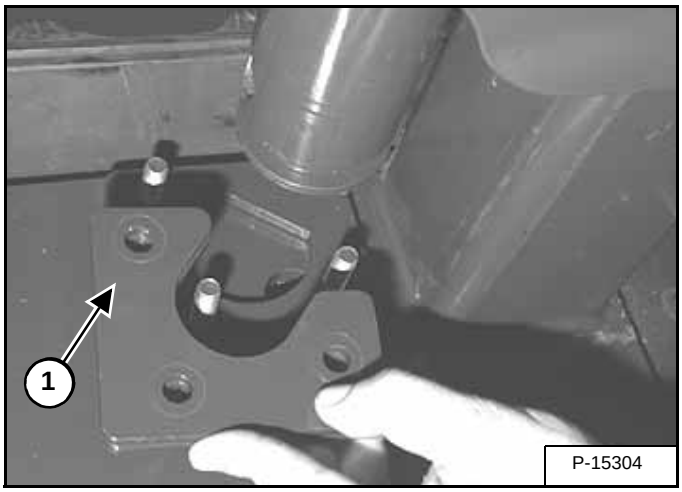
Remove the three nuts (Item 1) **[Figure 20-25-15]** from the base end of the cylinder.

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

Dealer Copy -- Not for Resale

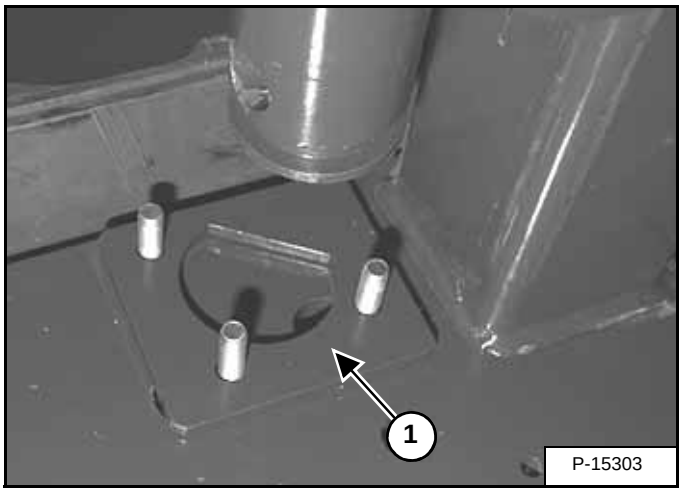
Removal And Installation (Cont'd)

Figure 20-25-16



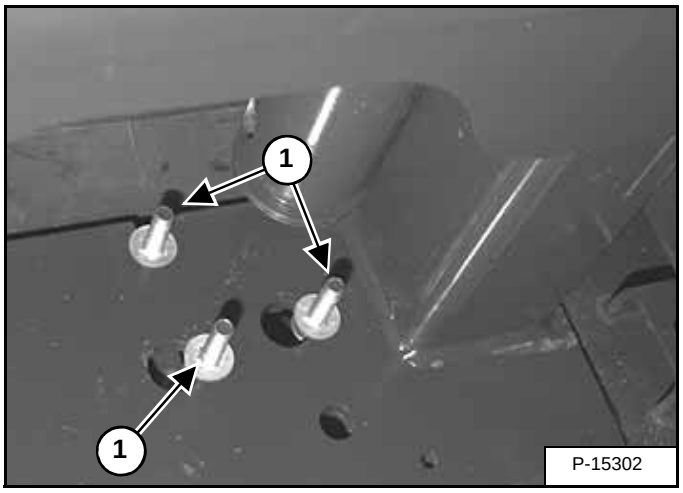
Pull the cylinder out of the mount. Remove the two plates (Item 1) **[Figure 20-25-16]** from the base end of the cylinder.

Figure 20-25-17



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

Figure 20-25-18

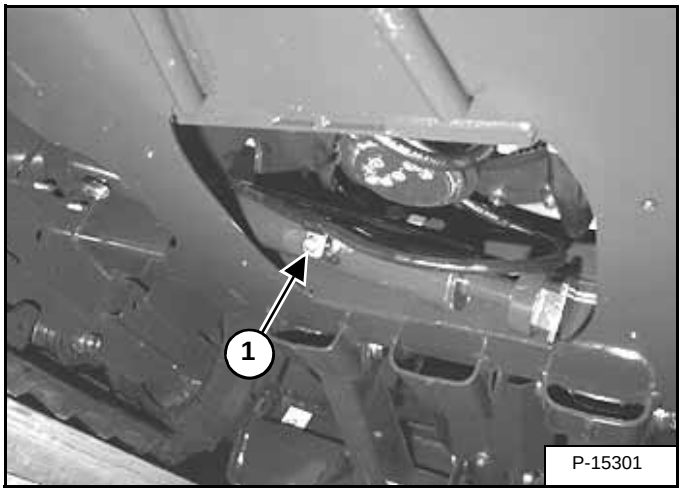


Remove the three bolts (Item 1) **[Figure 20-25-18]** and retaining clips from the track frame.

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

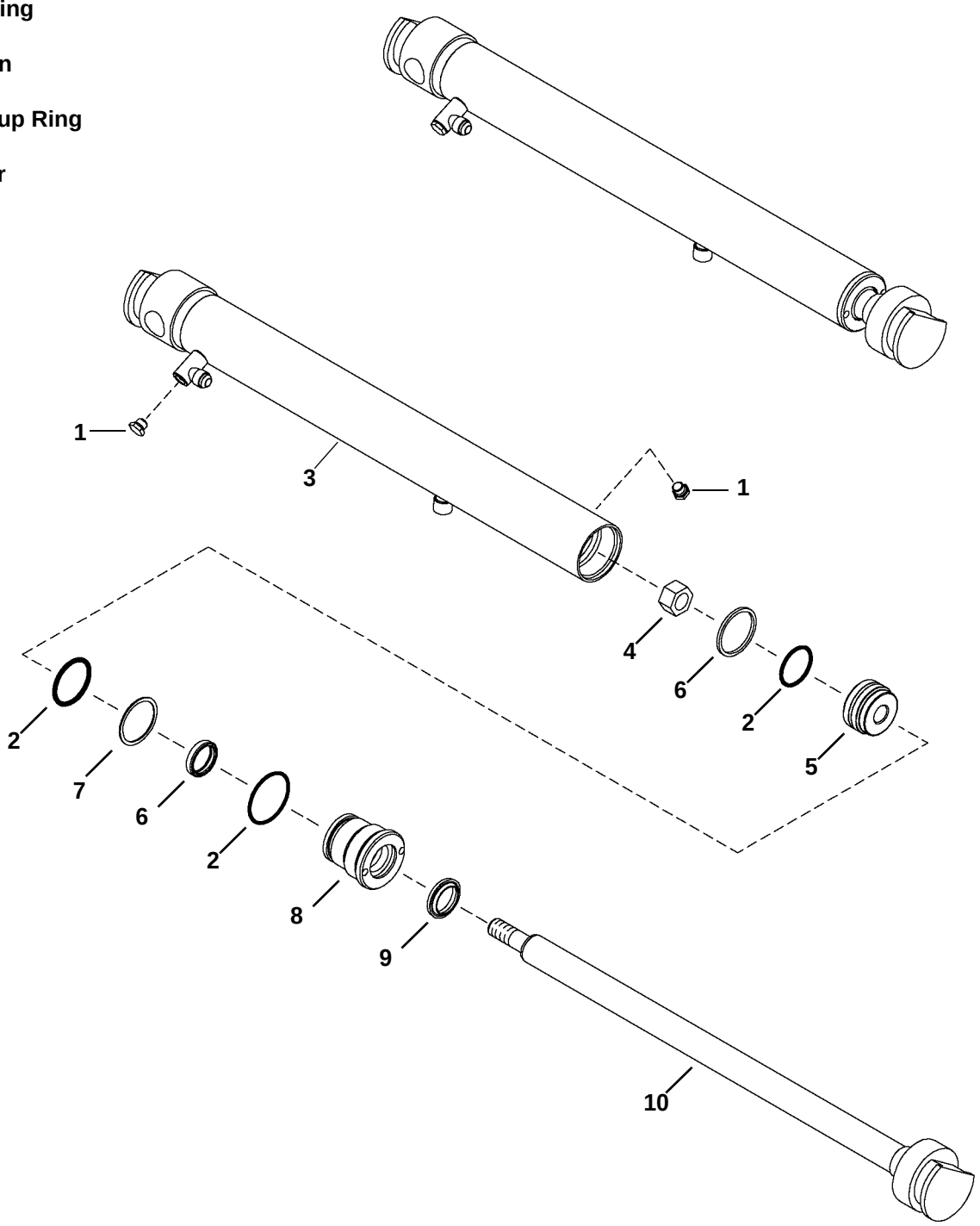
Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire which can result in injury or death.

W-2103-1285

Dealer Copy -- Not for Resale

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

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Disassembly

Clean the outside of the expansion cylinder before disassembly.

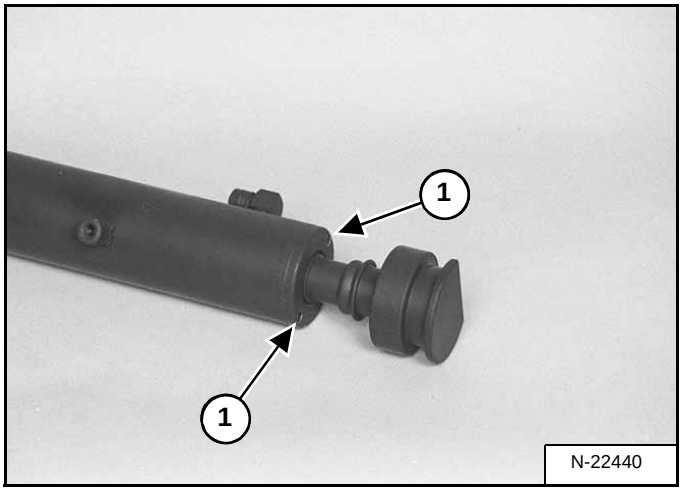
Use the following tools to disassemble the cylinder:

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.

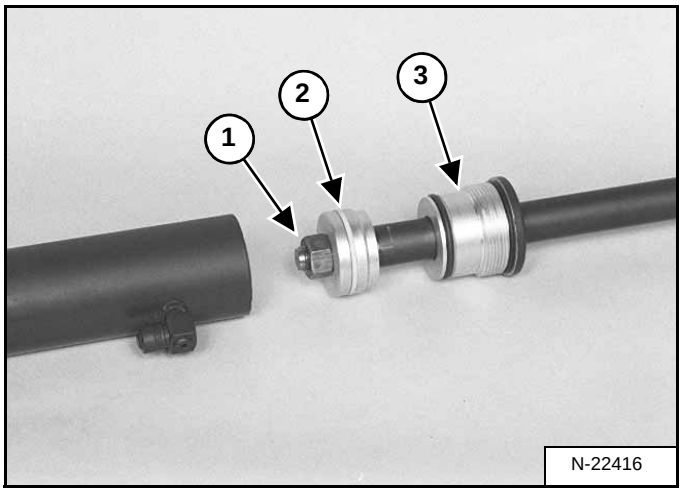
Put the base end of the cylinder in a vise.

Figure 20-25-20



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

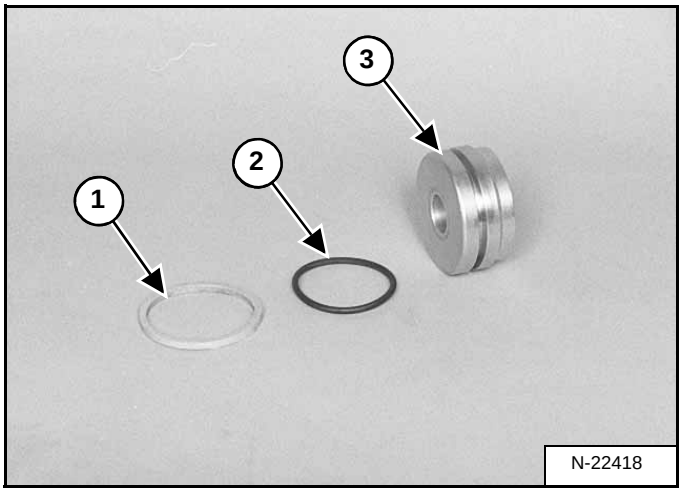
Figure 20-25-21



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

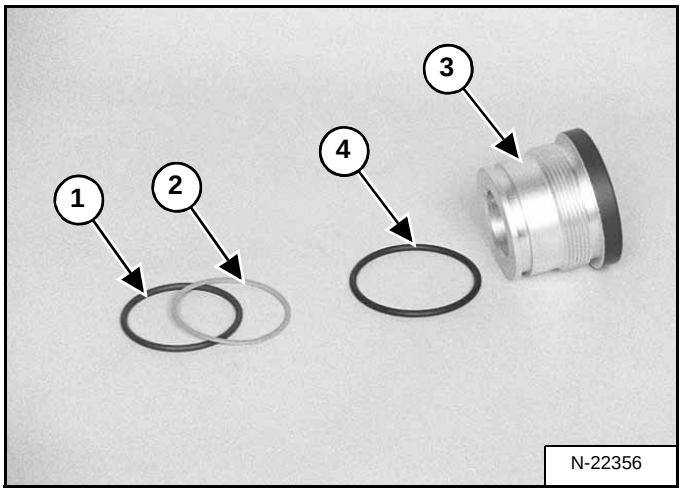


Standard Piston: Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-25-22]**.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

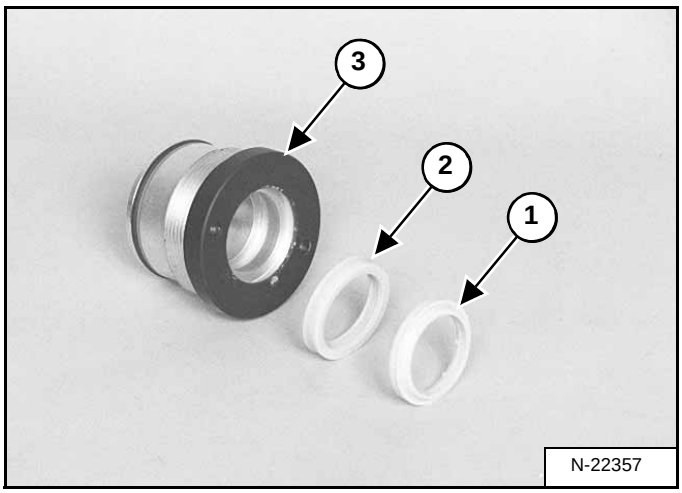
Figure 20-25-23



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]**.

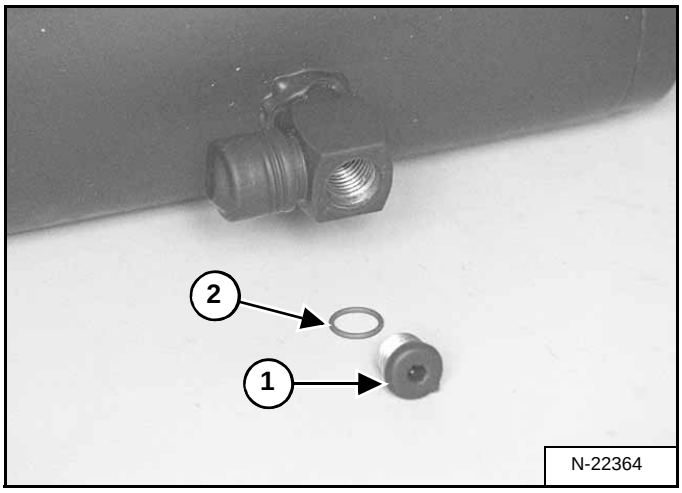
Remove the thin O-ring (Item 4) **[Figure 20-25-23]**.

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]**.

Dealer Copy -- Not for Resale

Assembly

Use the following tools to assemble the cylinder:

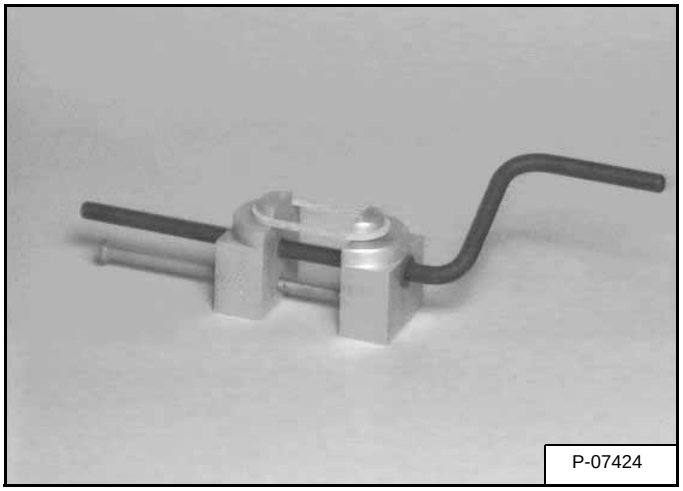
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

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.

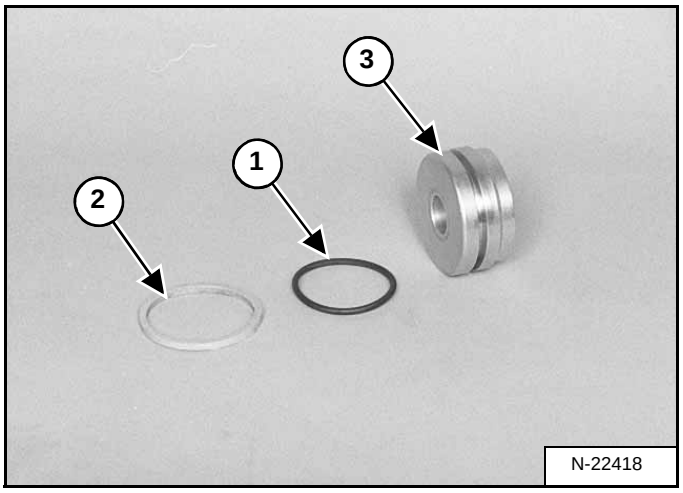
Figure 20-25-26



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

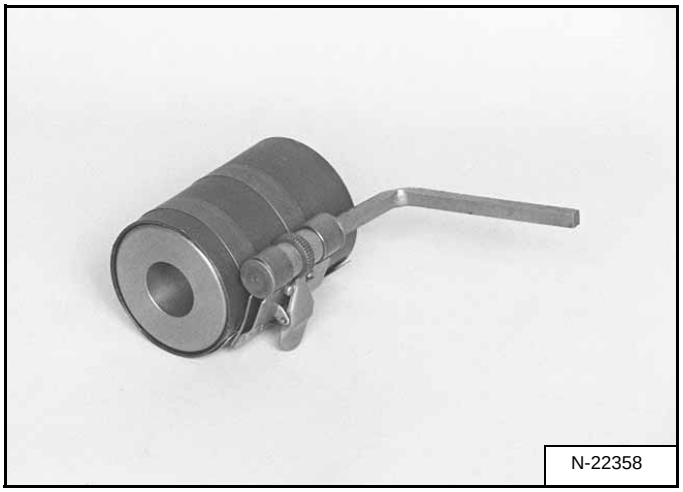
Allow the seal to stretch for 30 seconds before installing it on the piston.

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

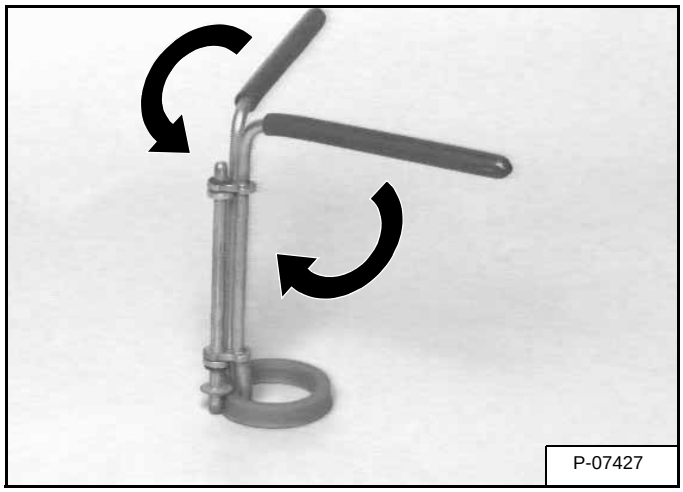


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-25-28]**.

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Assembly (Cont'd)

Figure 20-25-29

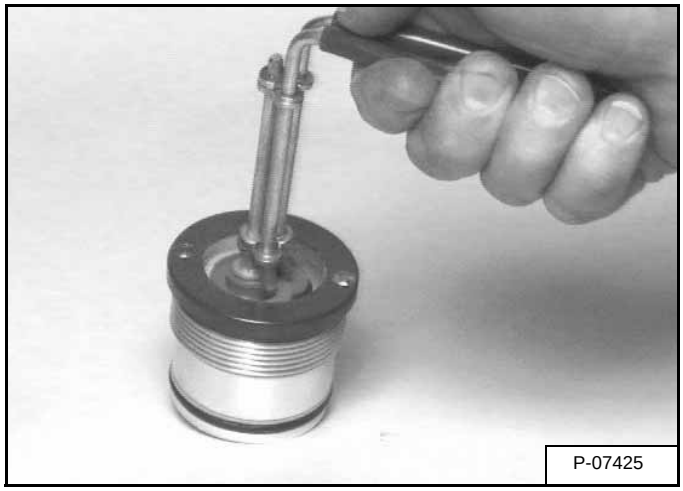


Install the rod seal on the rod seal tool **[Figure 20-25-29]**.

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

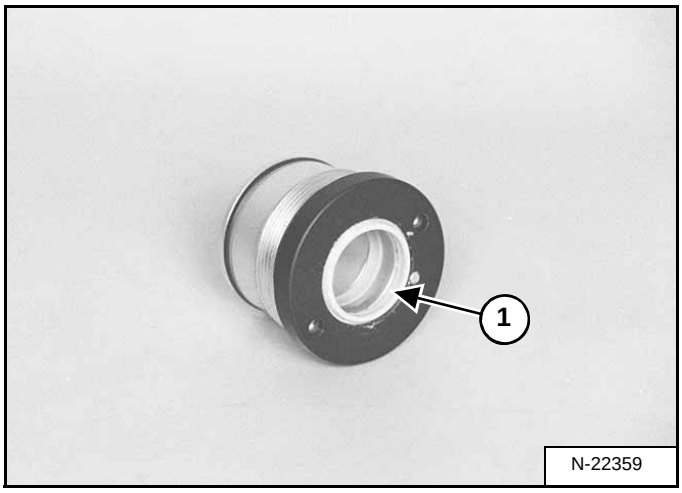
Rotate the handles to collapse the rod seal **[Figure 20-25-29]**.

Figure 20-25-30



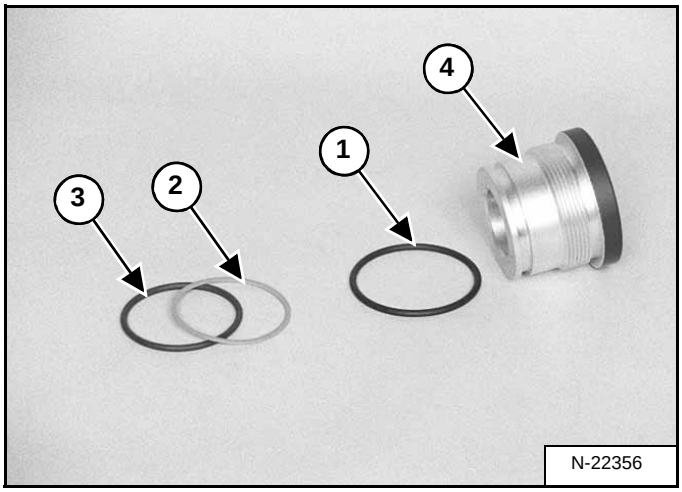
Install the rod seal in the head **[Figure 20-25-30]**.

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



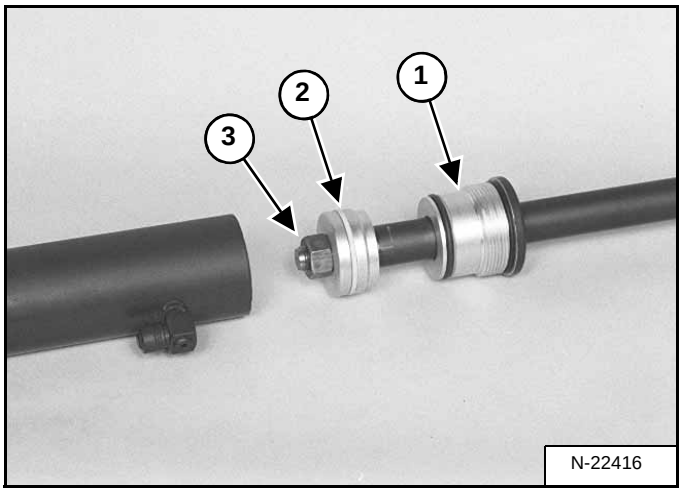
Install the O-ring (Item 1) **[Figure 20-25-32]**.

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]**.

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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.

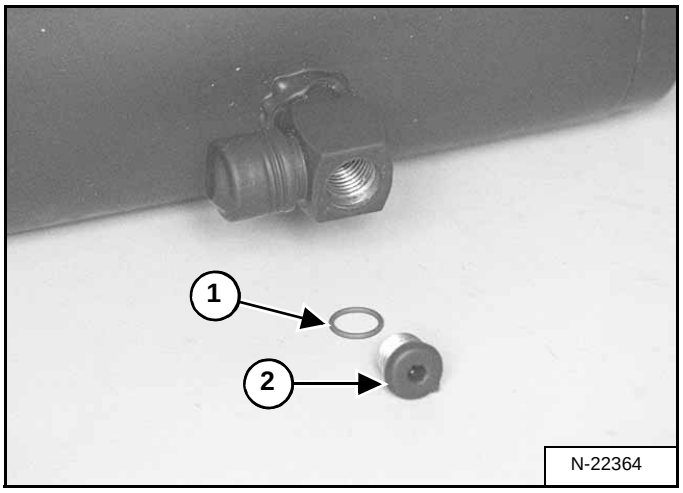
Provide an adequate support for the cylinder before tightening.

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

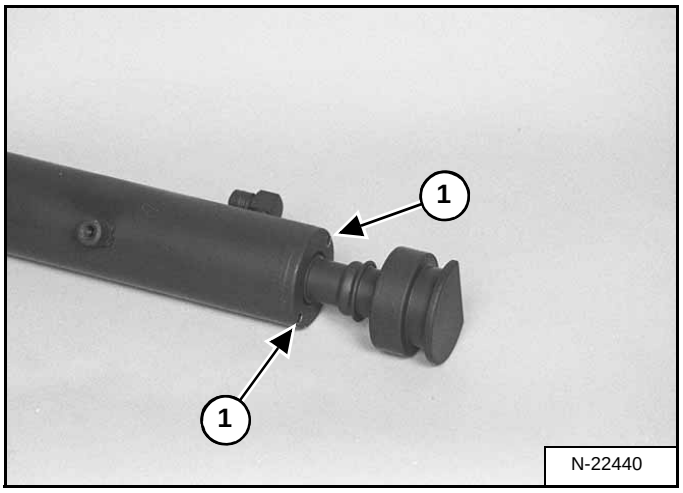


Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-25-34]**.

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.

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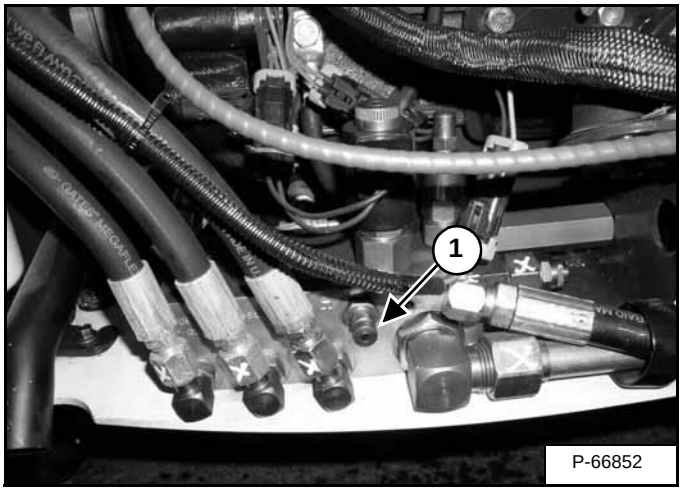
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MAIN RELIEF VALVE

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 to 10 seconds.
   Record pressure.

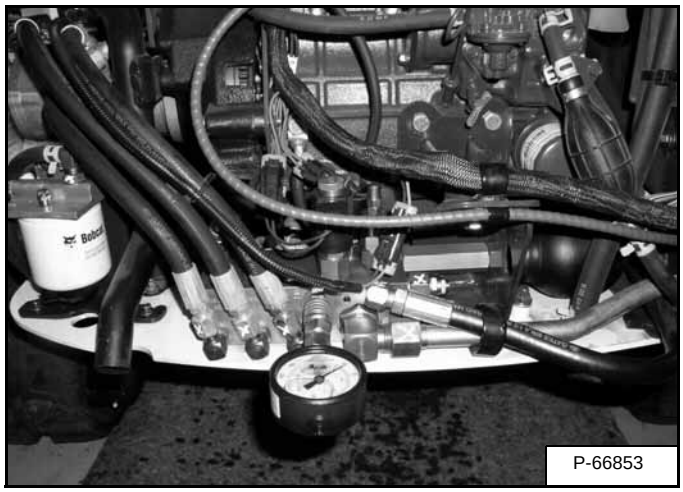
SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET (PSI)	ACCEPTABLE RANGE (PSI)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	*	435	406 to 450
PRESSURE BUILD - UP VALVE	NONE - CONSOLE DOWN	P1 & P2	G	415	345 to 485
SYSTEM BY - PASS	NONE - CONSOLE UP	DUMP TO TANK	G	115	MAX ALLOWABLE 155
MAIN RELIEF ON MANIFOLD BLOCK	BOOM	P2	G	3320	3220 to 3420
MAIN RELIEF ON MANIFOLD BLOCK	ARM	P1 & P2	G	3320	3220 to 3420
SWING MOTOR - CROSS PORT RELIEF	SLEW RIGHT	P3	G	2400	2350 to 2450
SWING MOTOR - CROSS PORT RELIEF	SLEW LEFT	P3	G	2400	2350 to 2450

** Under seat at Bulkhead*

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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:

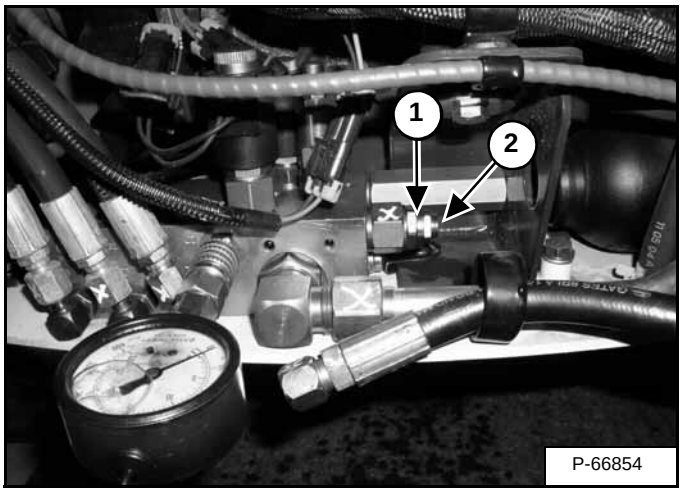
Boom up:
3220 to 3420 PSI (222 to 236 bar)

Arm in:
3220 to 3420 PSI (222 to 236 bar)

Auxiliary:
2650 to 2850 PSI (183 to 197 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]**.

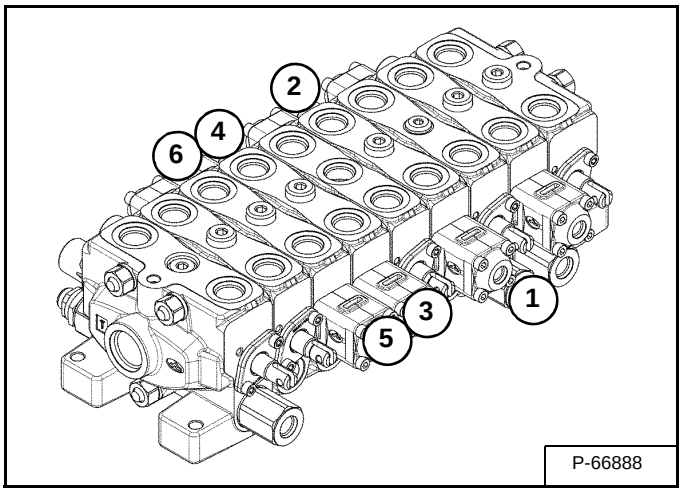
Retest the main relief valve after adjustment.

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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]**	3046 PSI (210 bar)
Base End (Item 2) **[Figure 20-31-1]**	3625 PSI (250 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]**	3625 PSI (250 bar)

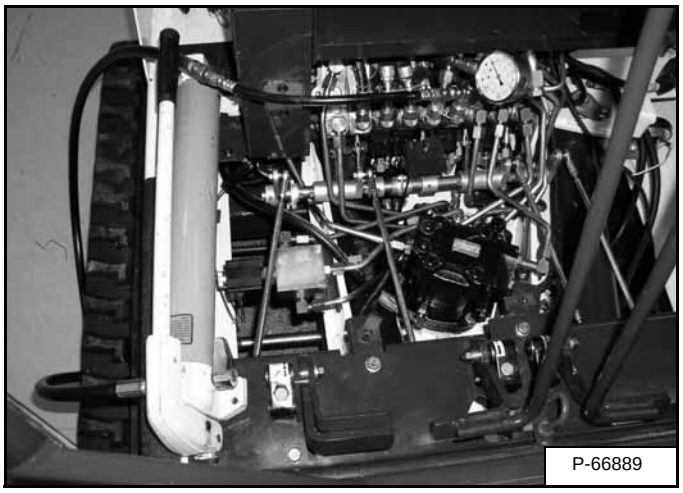
Arm Port Relief set at:

Rod End (Item 5) **[Figure 20-31-1]**	3625 PSI (250 bar)
Base End (Item 6) **[Figure 20-31-1]**	3625 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.**

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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 to 10 seconds.
   Record pressure.

Open the tailgate.

Figure 20-32-1

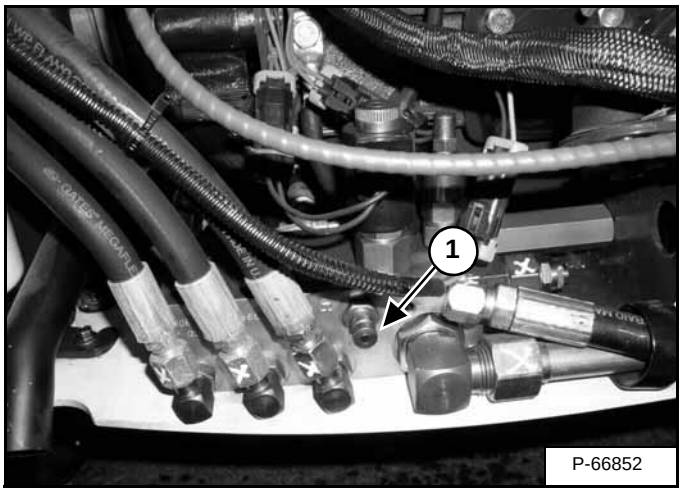
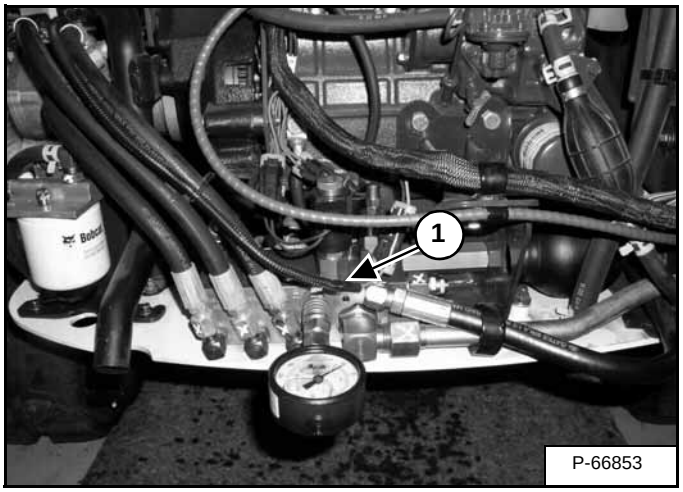


Figure 20-32-2



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

Lower the control console and fasten the seat belt.

SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET (PSI)	ACCEPTABLE RANGE (PSI)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	*	435	406 to 450
PRESSURE BUILD - UP VALVE	NONE - CONSOLE DOWN	P1 & P2	G	415	345 to 485
SYSTEM BY - PASS	NONE - CONSOLE UP	DUMP TO TANK	G	115	MAX ALLOWABLE 155
MAIN RELIEF ON MANIFOLD BLOCK	BOOM	P2	G	3320	3220 to 3420
MAIN RELIEF ON MANIFOLD BLOCK	AUXILIARY	P1 & P3	G	2750	2650 to 2850
MAIN RELIEF ON MANIFOLD BLOCK	ARM	P1 & P2	G	3320	3220 to 3420
SWING MOTOR - CROSS PORT RELIEF	SLEW RIGHT	P3	G	2400	2350 to 2450
SWING MOTOR - CROSS PORT RELIEF	SLEW LEFT	P3	G	2400	2350 to 2450

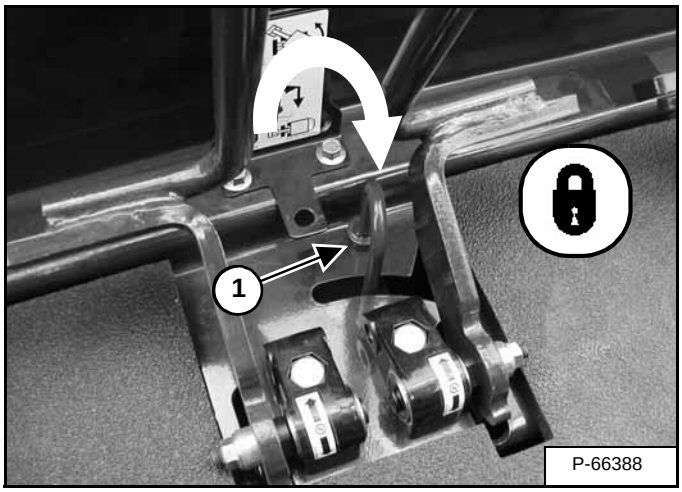
* Under seat at Bulkhead

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

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

Figure 20-32-3



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

With the hydraulic fluid at operating temperature, run 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.

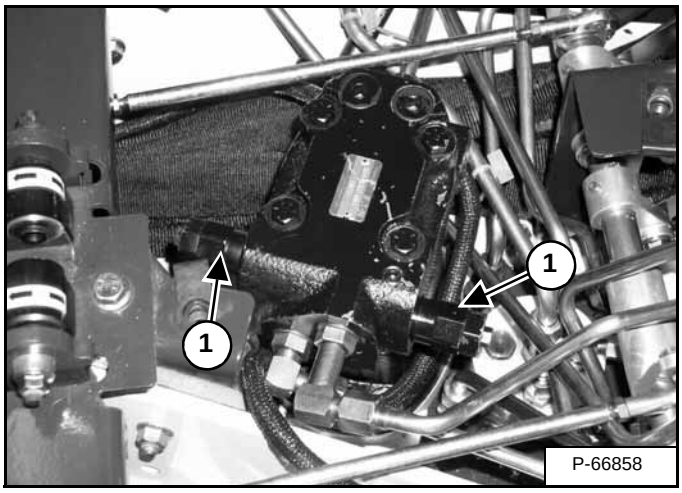
The swing (Slew) crossport relief valve pressure at "G" diagnostic port **[Figure 20-32-2]** should be as follows:

2350 to 2450 PSI (162 to 169 bar).

Swing (Slew) crossport relief valve is factory set at 2000 PSI (138 bar) at 2.64 GPM.

If the pressure is incorrect, remove the floor mat and floor panels. (See FLOOR MAT AND FLOOR PANELS on Page 40-100-1.)

Figure 20-32-4



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.

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PRESSURE REDUCING VALVE

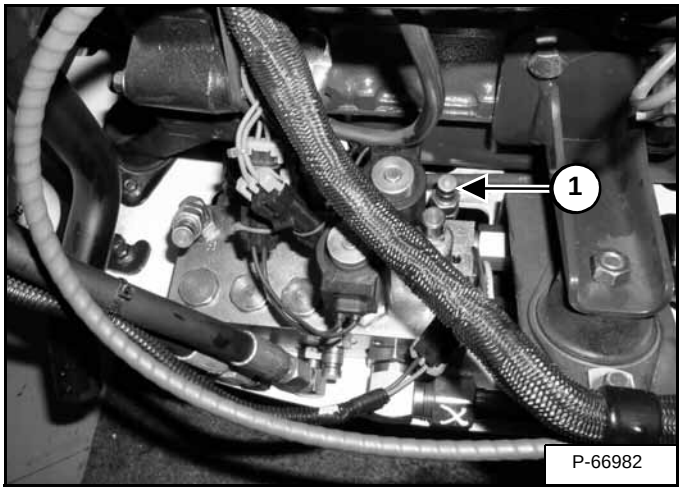
Testing And Adjusting The Pressure Reducing Valve

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

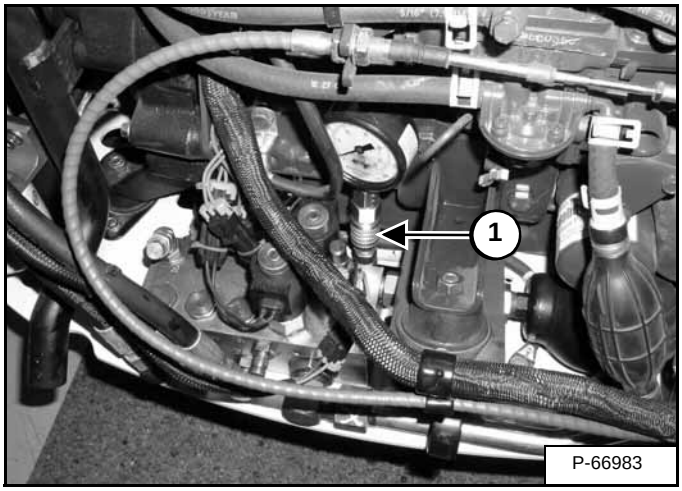
Open the tailgate.

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.

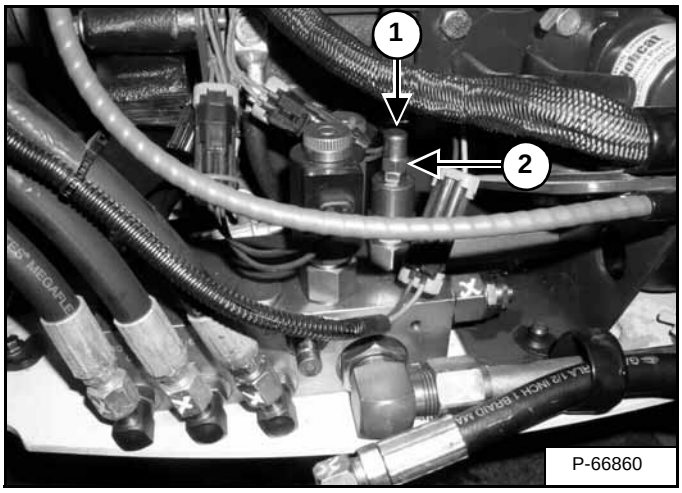
Operate the circuit over relief and record the pressure.

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.

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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

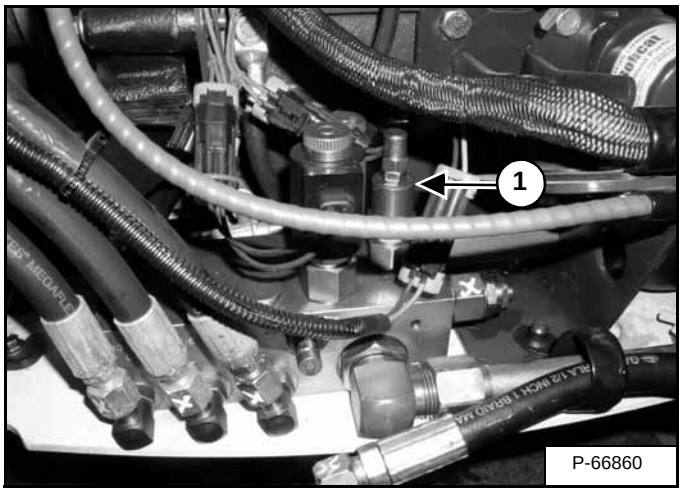
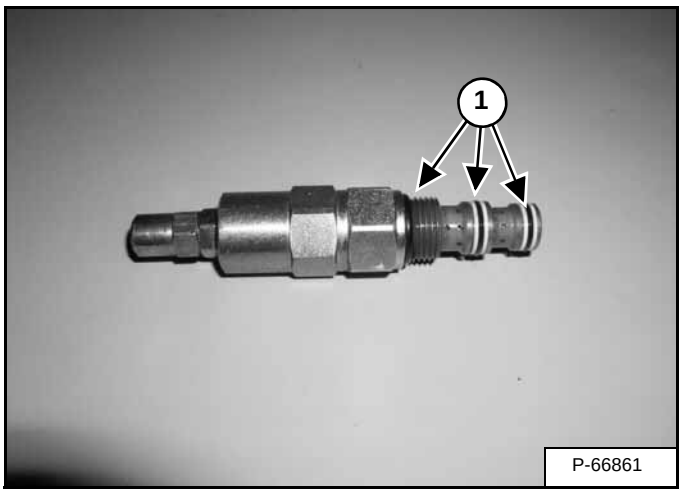


Figure 20-33-5



Inspect the O-rings and back-up rings on the pressure reducing valve (Item 1) **[Figure 20-33-4]** & **[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.

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HYDRAULIC CONTROL VALVE

Description

The hydraulic control valve is located under the seat and seat mount. The hydraulic control valve uses spools to direct the flow of hydraulic fluid to the right travel, left travel, boom swing, arm, bucket, auxiliary, boom, slew and blade/track expansion.

The right travel, left travel, boom swing and auxiliary are operated using mechanical linkages to connect the travel levers or foot pedals to the control valve spools. The blade is operated using mechanical linkage to connect the blade/track expansion lever to the control valve spools.

The arm, bucket, auxiliary, boom and slew are operated by pilot pressure from the manifold block located behind the tailgate.

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 3046 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.

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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

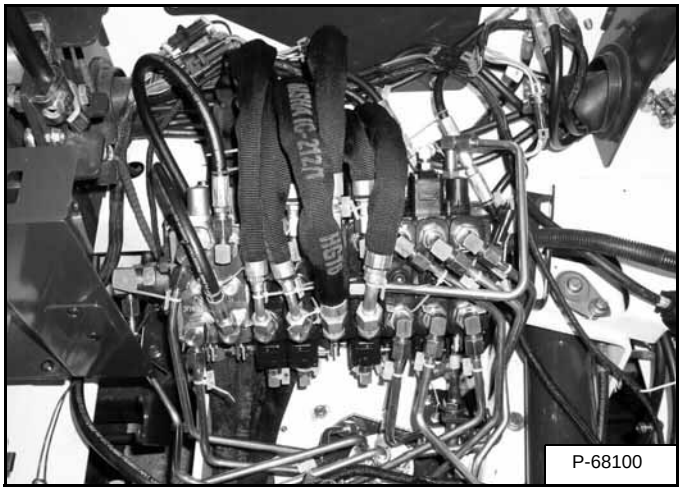
Remove the battery. (See Removal and Installation on Page 50-10-1.)

Remove the floor mat and floor panels. (See FLOOR MAT AND FLOOR PANELS on Page 40-100-1.)

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

Remove the control linkage assembly. (See Removal And Installation on Page 40-90-1.)

Figure 20-40-1



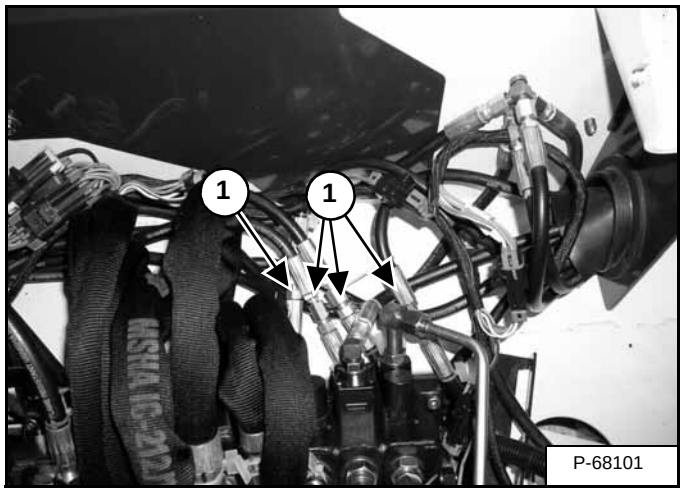
Mark all tubes and hoses for ease of assembly **[Figure 20-40-1]**.

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HYDRAULIC CONTROL VALVE (CONT'D)

Removal and Installation (Cont'd)

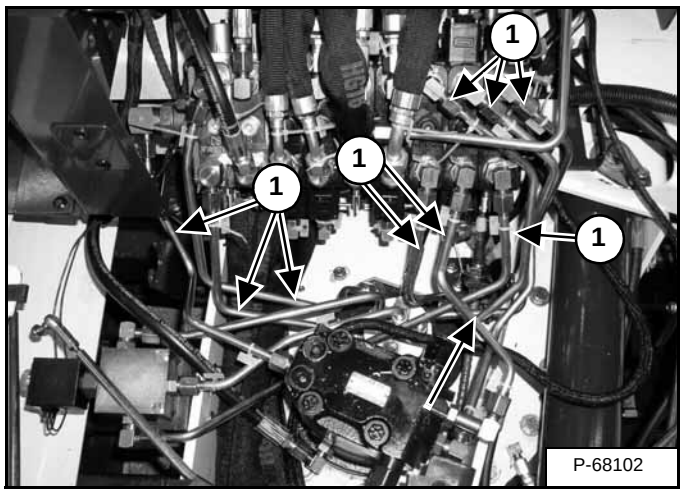
Figure 20-40-2



Disconnect and cap the four pilot hoses (Item 1) **[Figure 20-40-2]**.

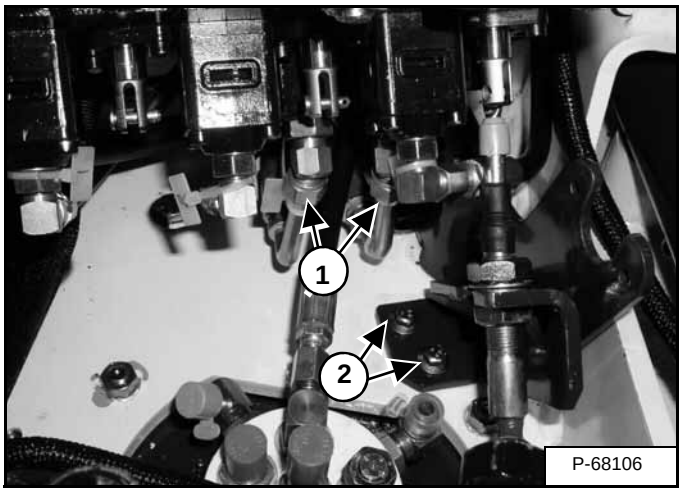
NOTE: The hoses will be removed with the valve.

Figure 20-40-3



Remove and cap the nine tubelines (Item 1) **[Figure 20-40-3]** from the control valve.

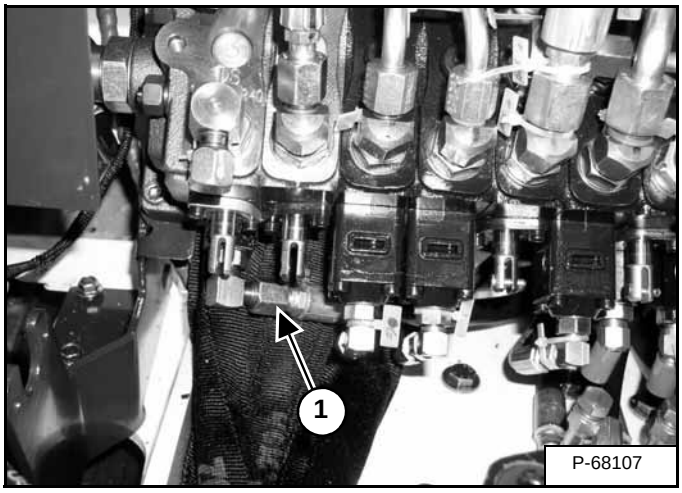
Figure 20-40-4



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

Remove the bolts (Item 2) **[Figure 20-40-4]** from the blade cable bracket. Move the blade cable bracket assembly out of the way.

Figure 20-40-5

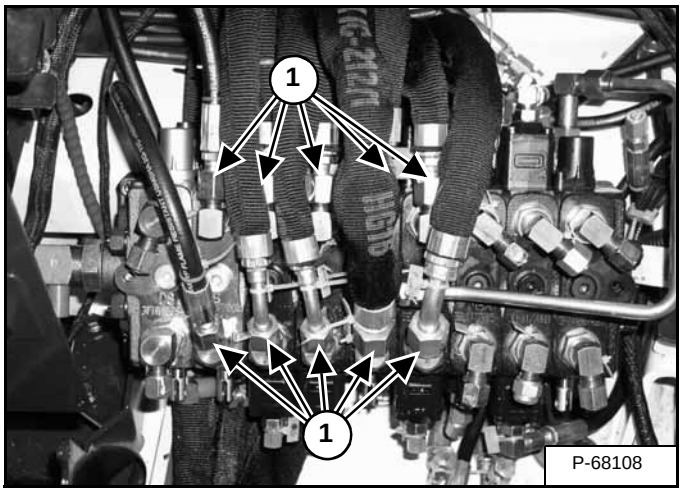


Remove and cap the hose (Item 1) **[Figure 20-40-5]**.

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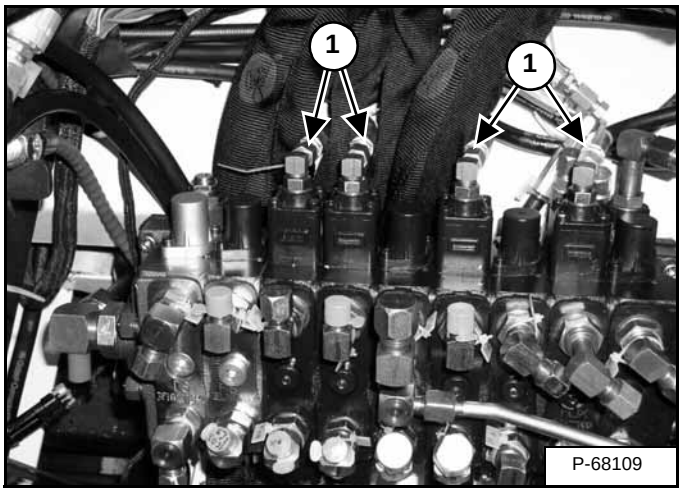
Removal and Installation (Cont'd)

Figure 20-40-6



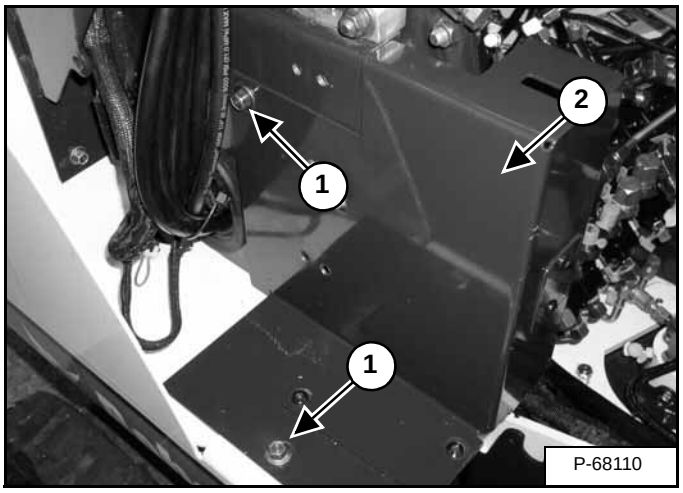
Remove and cap the ten hoses (Item 1) **[Figure 20-40-6]** from the control valve.

Figure 20-40-7



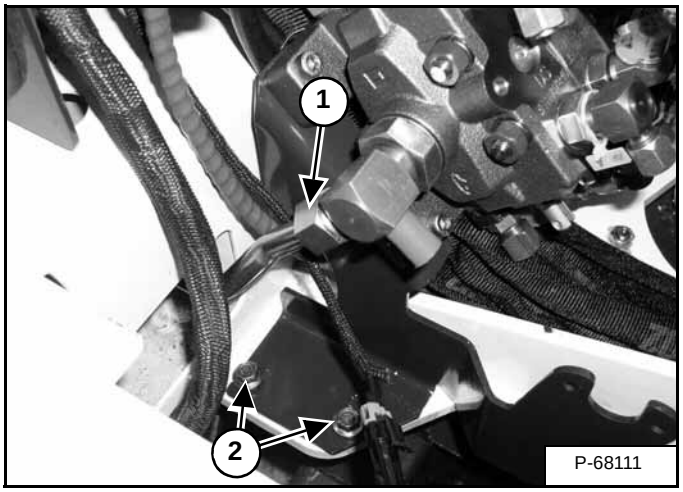
Remove and cap the four hoses (Item 1) **[Figure 20-40-6]** from the control valve.

Figure 20-40-8



Remove the two bolts (Item 1) and remove the side cover (Item 2) **[Figure 20-40-8]**.

Figure 20-40-9



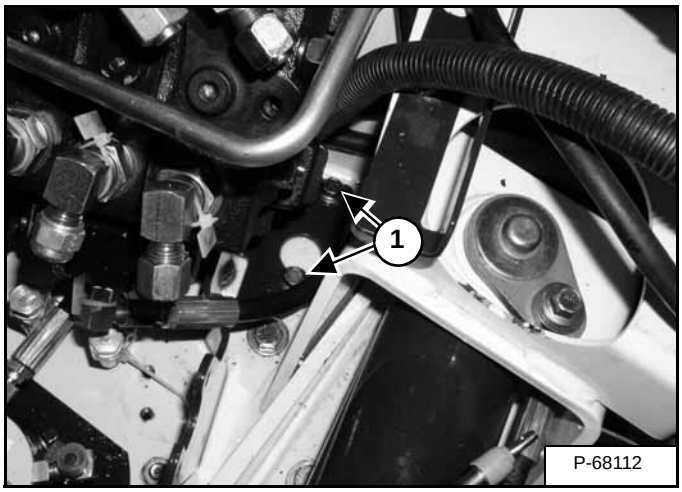
Remove and cap the tubeline (Item 1) **[Figure 20-40-9]**.

Remove the bolts (Item 1) **[Figure 20-40-9]**.

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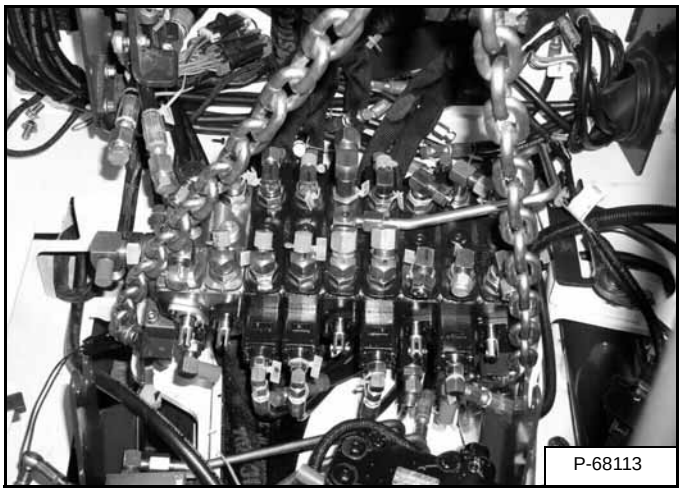
Removal and Installation (Cont'd)

Figure 20-40-10



Remove the bolts (Item 1) **[Figure 20-40-10]**.

Figure 20-40-11



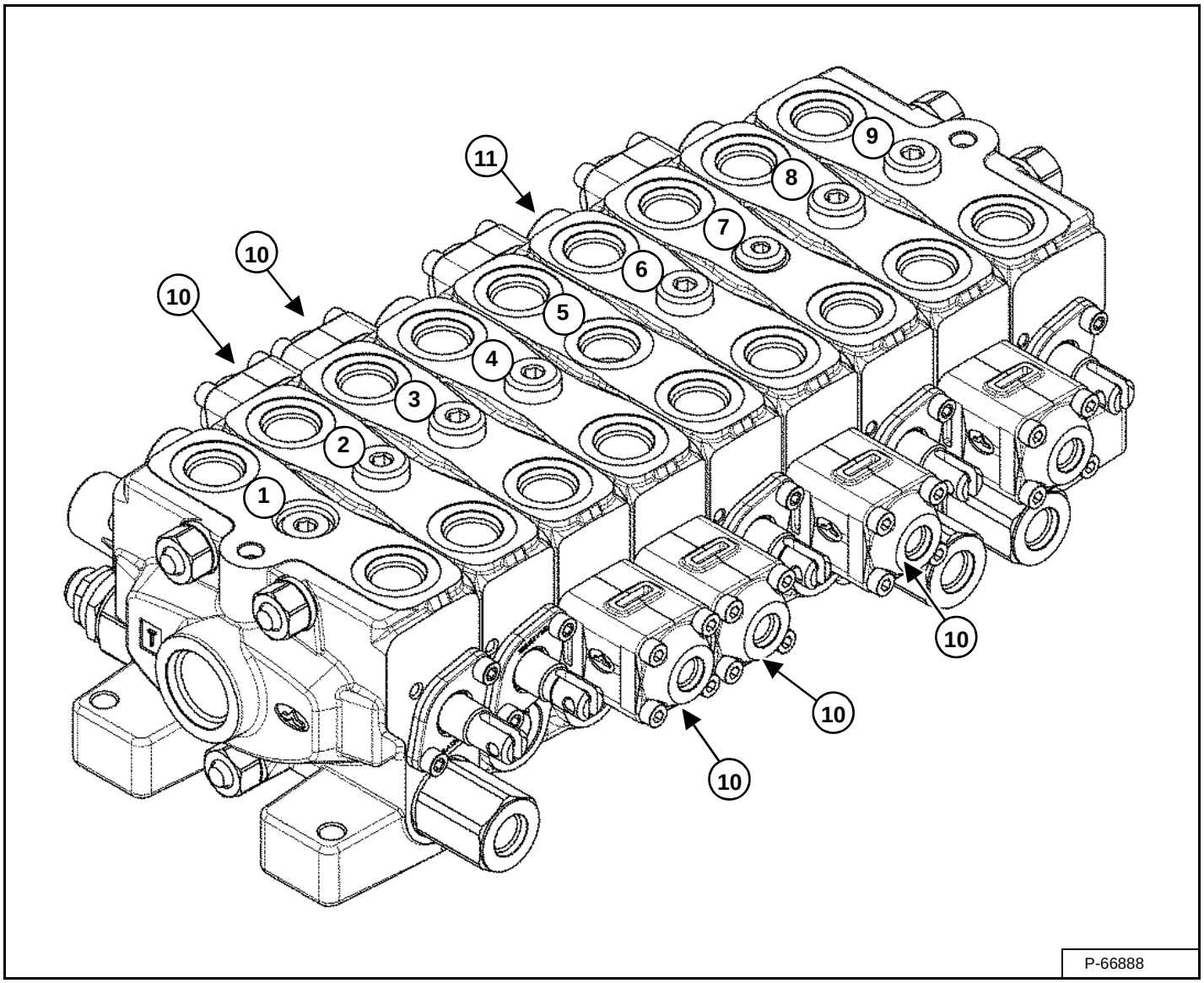
Remove the hydraulic control valve and mounting brackets (Item 1) **[Figure 20-40-11]** from the excavator.

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HYDRAULIC CONTROL VALVE (CONT'D)

Identification Chart

Item	Description
1.	RIGHT TRAVEL SECTION
2.	BOOM SWING (OFFSET) SECTION
3.	ARM SECTION
4.	BUCKET SECTION
5.	AUXILIARY SECTION
6.	BOOM SECTION
7.	LEFT TRAVEL SECTION
8.	SLEW SECTION
9.	BLADE SECTION
10.	PORT RELIEF - 3625 PSI (250 bar) (Below Spool Cover)
11.	PORT RELIEF - 3046 PSI (210 bar) (Below Spool Cover)



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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.

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Figure 20-40-12

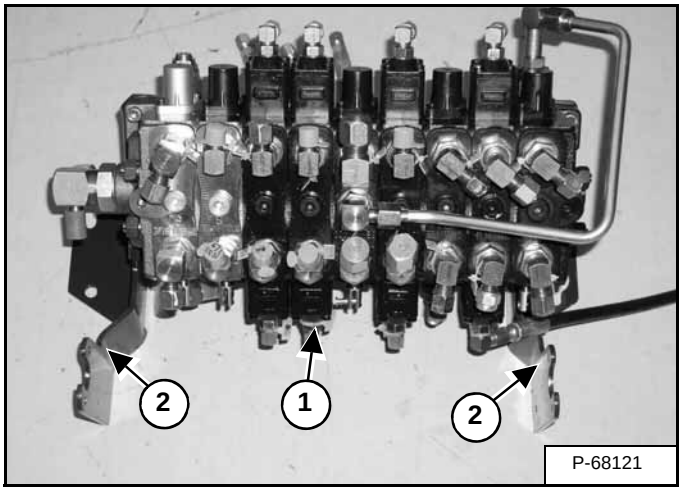
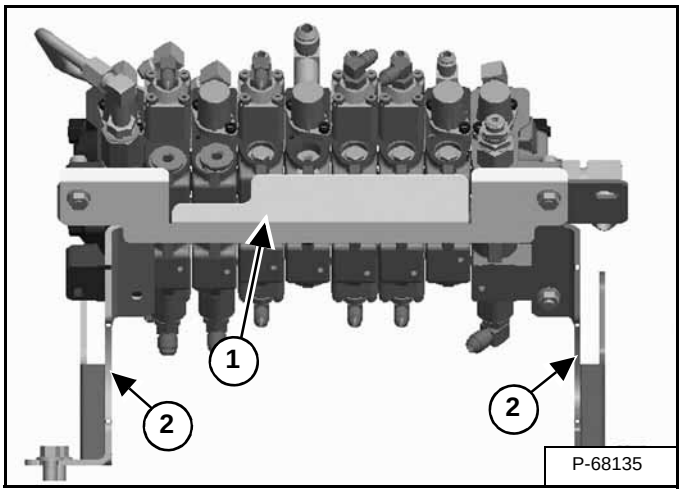
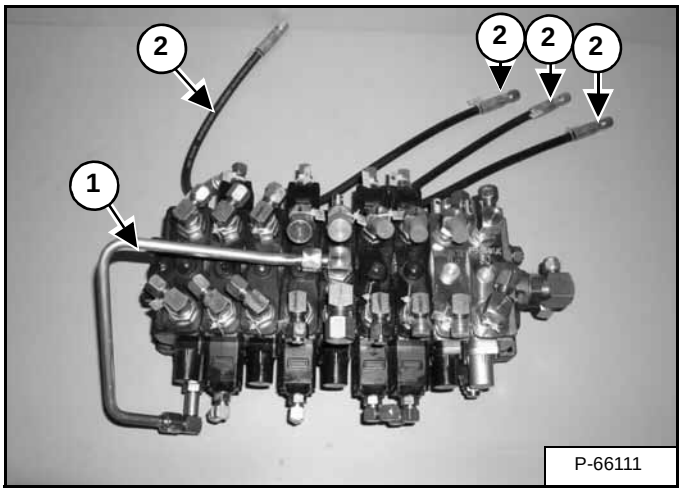


Figure 20-40-13



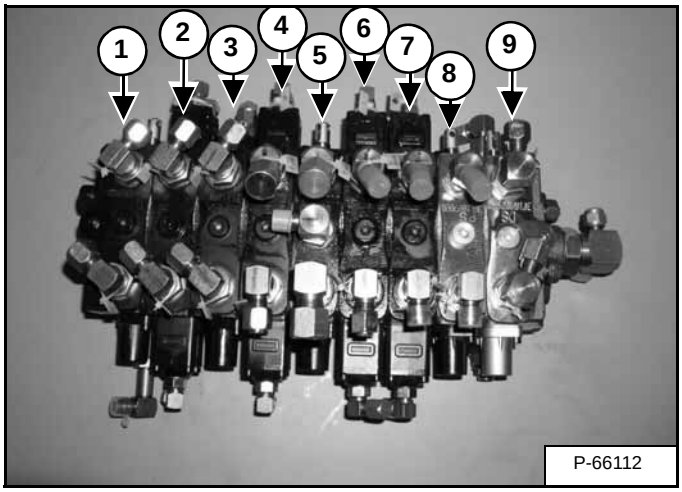
Remove the valve (Item 1) **[Figure 20-40-12]** and hose shield (Item 2) **[Figure 20-40-13]** from the mounting brackets (Item 2) **[Figure 20-40-12]** & **[Figure 20-40-13]**.

Figure 20-40-14



Remove the tubeline (Item 1) and the four hoses (Item 2) **[Figure 20-40-14]**.

Figure 20-40-15



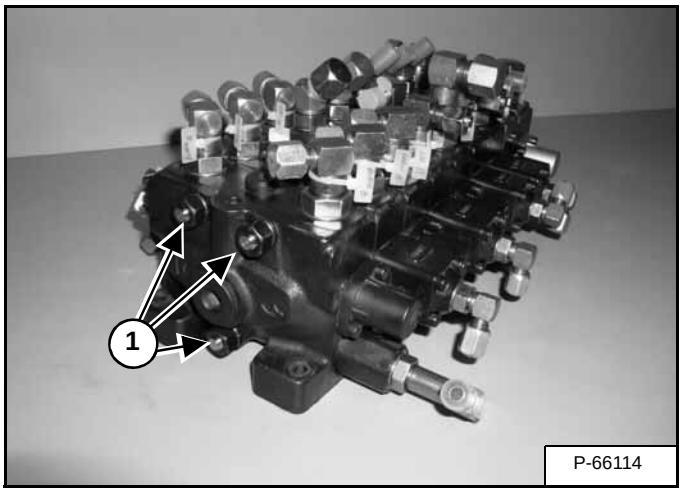
Mark the valve sections for ease of assembly **[Figure 20-40-15]**.

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

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Disassembly (Cont'd)

Figure 20-40-16



Remove the tie rod nuts and lock washers (Item 1) **[Figure 20-40-16]**.

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.

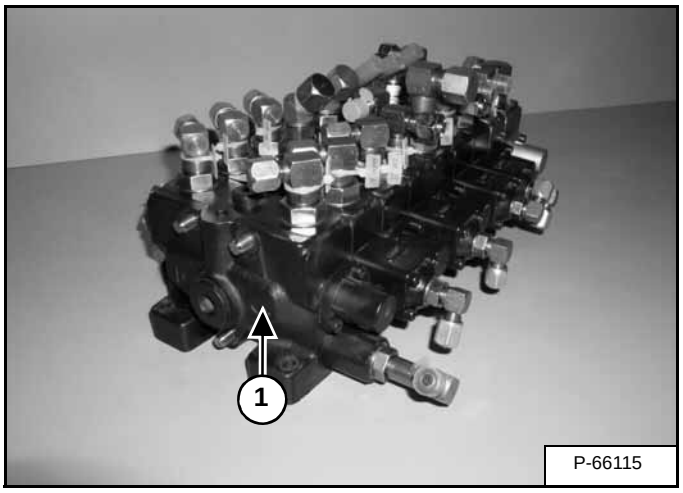
I-2003-0888

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 20-40-17

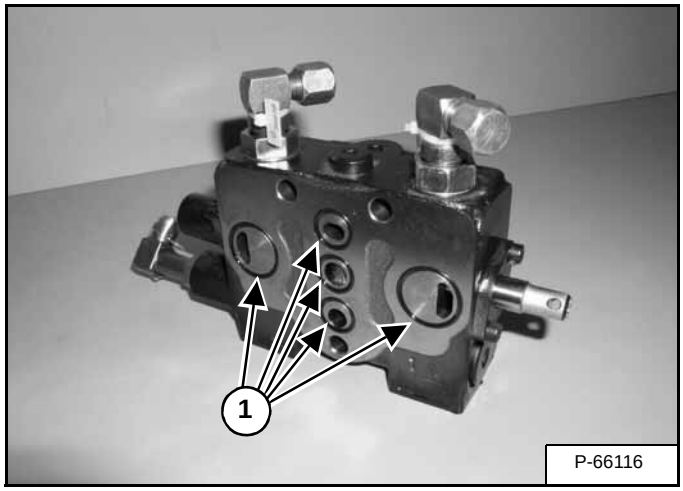


Remove the blade valve section (Item 1) **[Figure 20-40-17]** from the tie rods.

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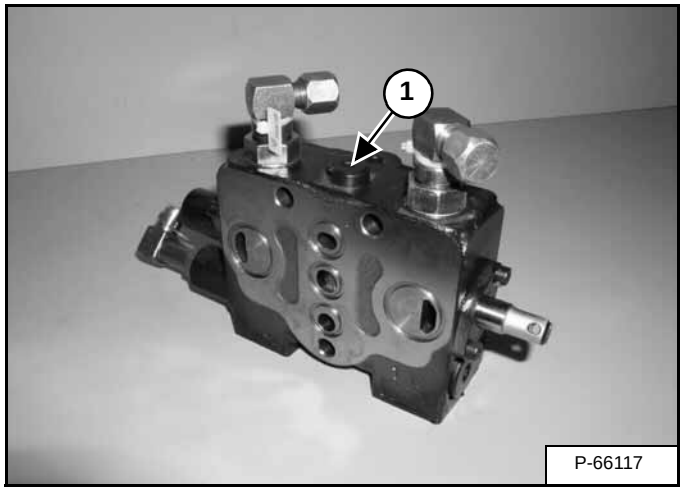
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-18



Remove the O-rings (Item 1) **[Figure 20-40-18]** from the blade valve section.

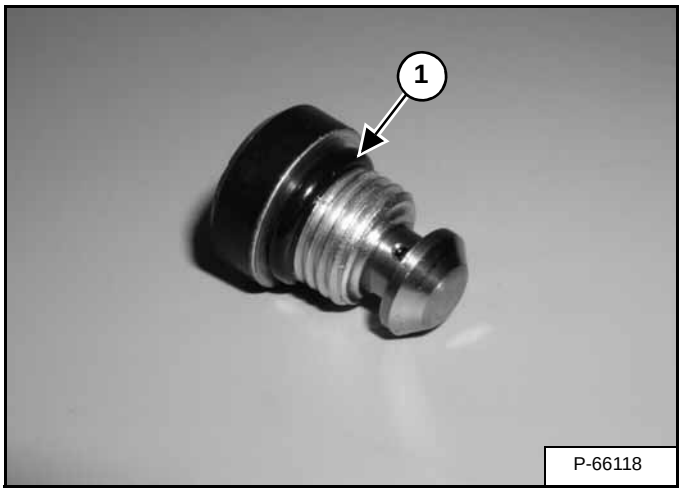
Figure 20-40-19



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

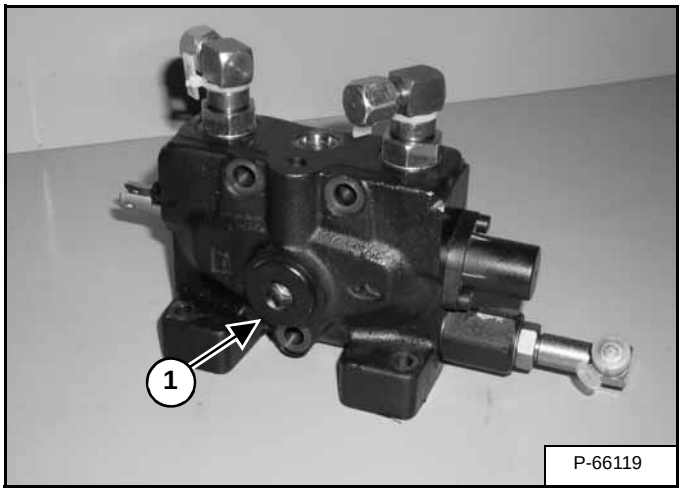
Installation: Tighten the load check valve to 18 ft.-lb. (24 N•m) torque.

Figure 20-40-20



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

Figure 20-40-21



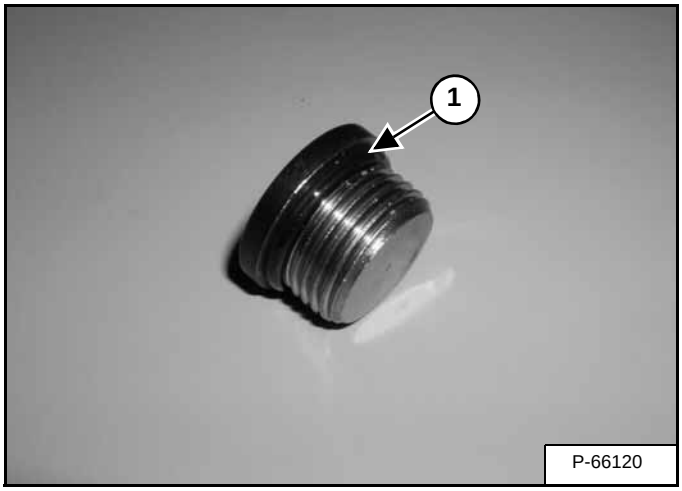
Remove the plug (Item 1) **[Figure 20-40-21]**.

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

Dealer Copy -- Not for Resale

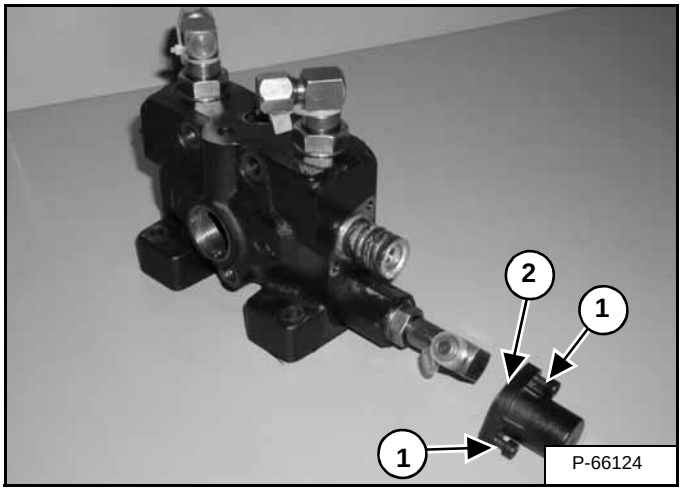
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-22



Remove the O-ring (Item 1) **[Figure 20-40-22]** from the plug.

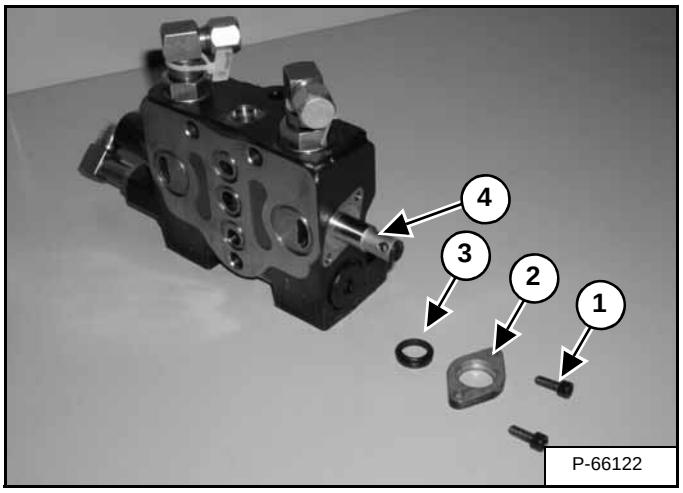
Figure 20-40-23



Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-23]**.

Installation: Tighten the bolts to 7 ft.-lb. (9,8 N•m) torque.

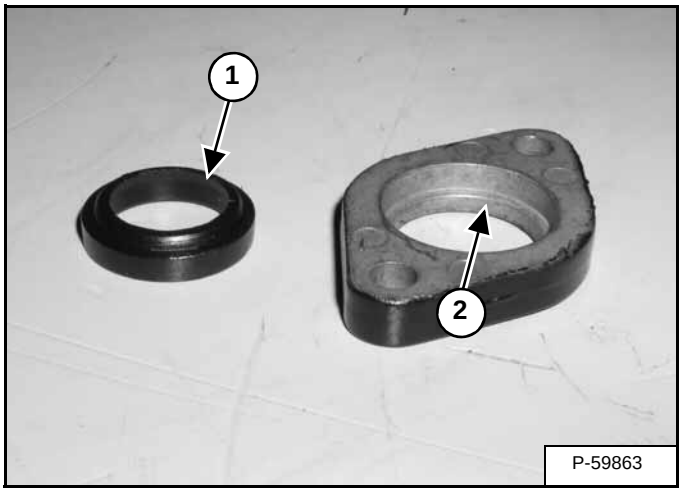
Figure 20-40-24



Remove the bolts (Item 1), spool retainer (Item 2) and seal (Item 3) from the actuating end of the spool (Item 4) **[Figure 20-40-24]**.

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

Figure 20-40-25

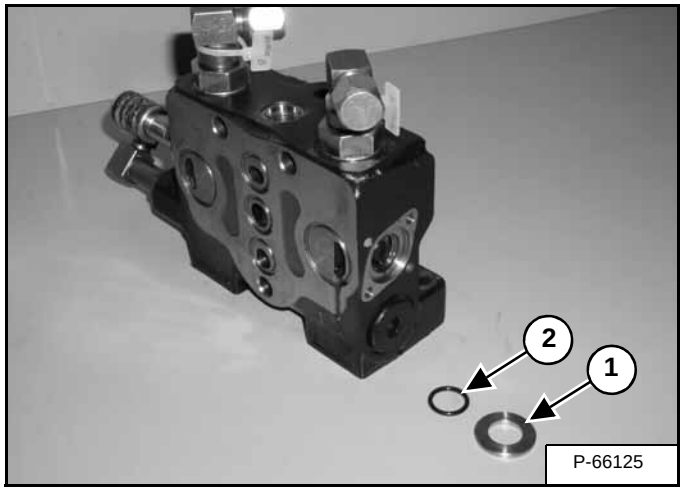


Installation: Make sure the lip (Item 1) of the seal fits inside the retaining plate (Item 2) **[Figure 20-40-25]**.

Dealer Copy -- Not for Resale

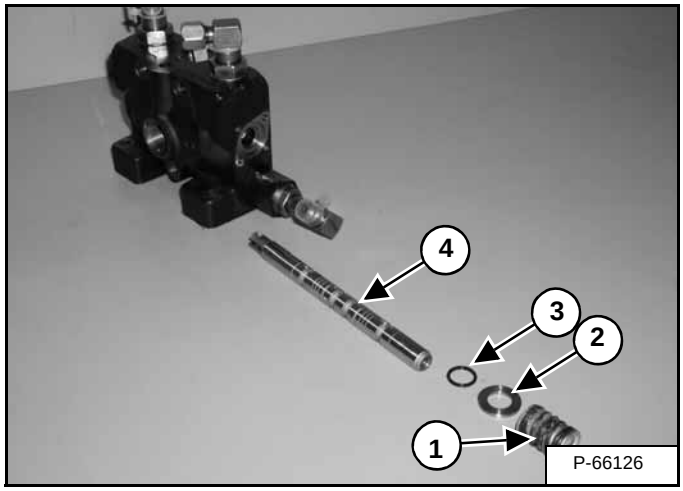
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-26



Remove the washer (Item 1) and O-ring (Item 2) **[Figure 20-40-26]**.

Figure 20-40-27



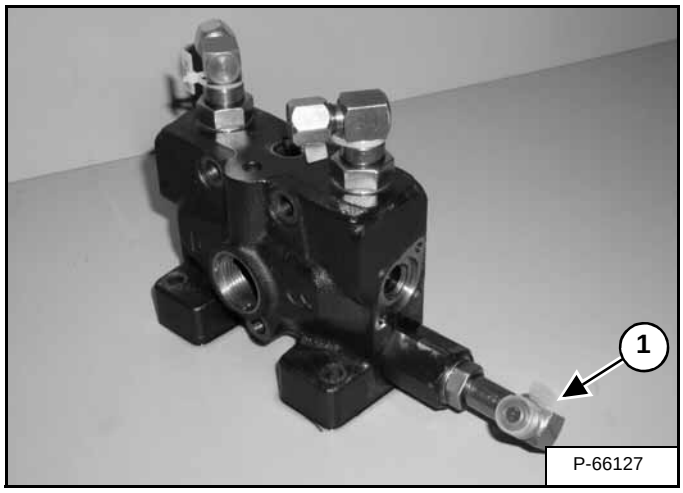
Remove the spring assembly (Item 1), washer (Item 2), O-ring (Item 3) and spool (Item 4) **[Figure 20-40-27]**.

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.

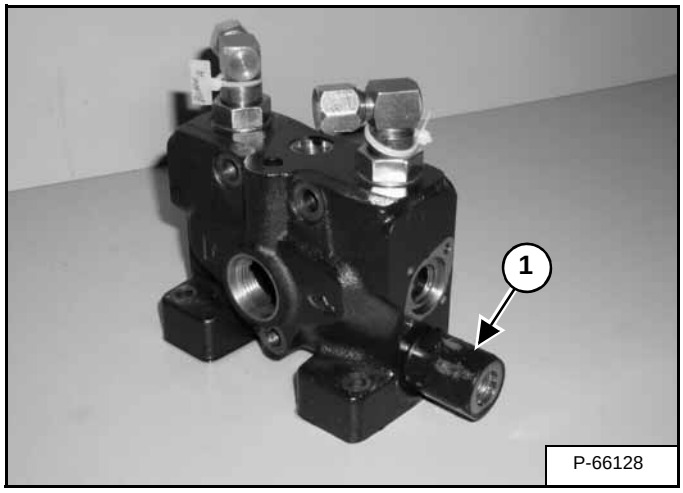
Installation: Tighten the spring retaining bolt to 7 ft.-lb. (9,8 N•m) torque.

Figure 20-40-28



Remove the hydraulic fitting (Item 1) [**[Figure 20-40-28]**.

Figure 20-40-29



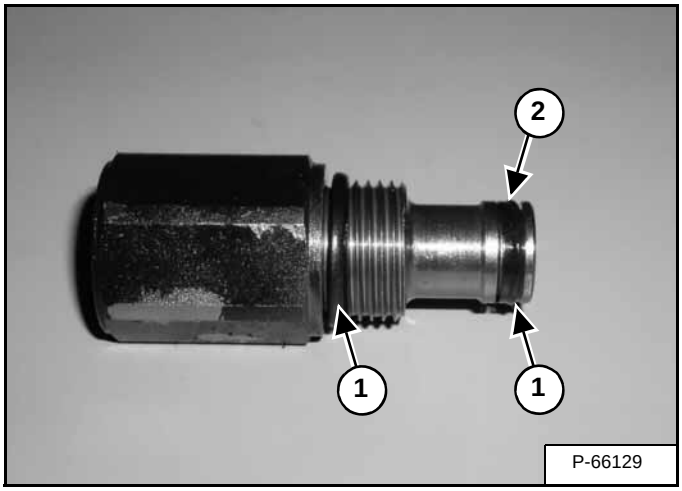
Remove the fitting (Item 1) [**[Figure 20-40-29]**.

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

Dealer Copy -- Not for Resale

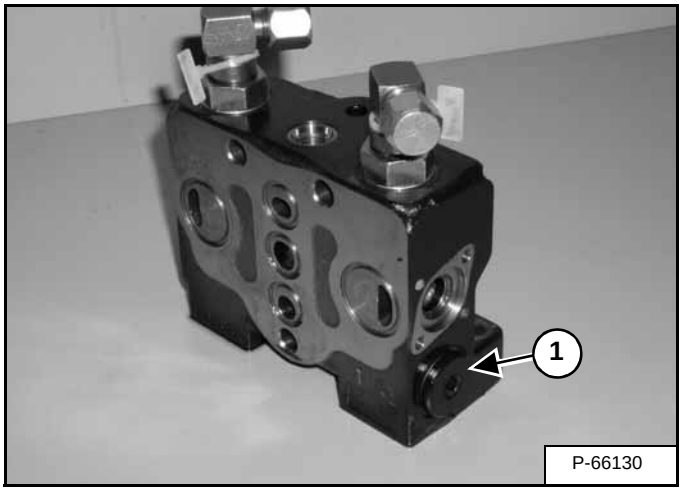
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-30



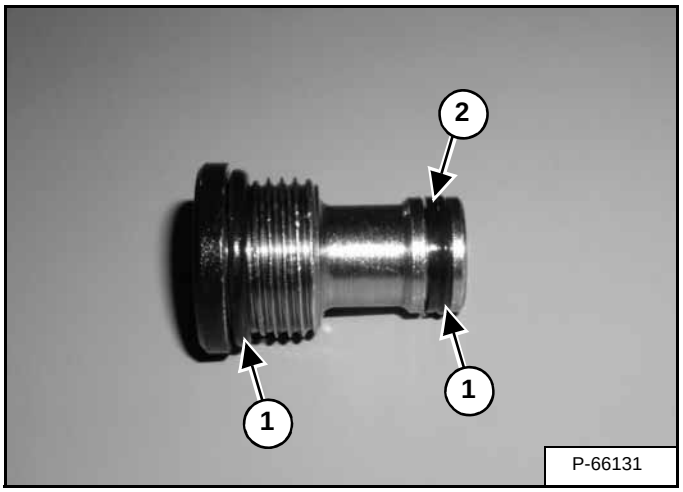
Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-30]** from the fitting.

Figure 20-40-31



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

Figure 20-40-32



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-32]** from the plug.

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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.

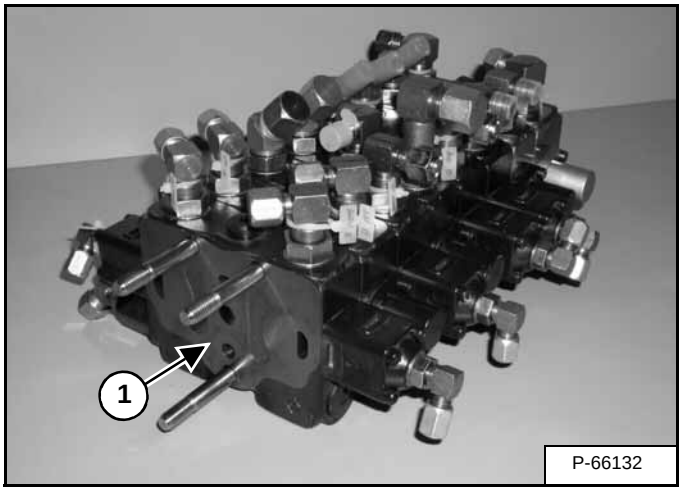
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

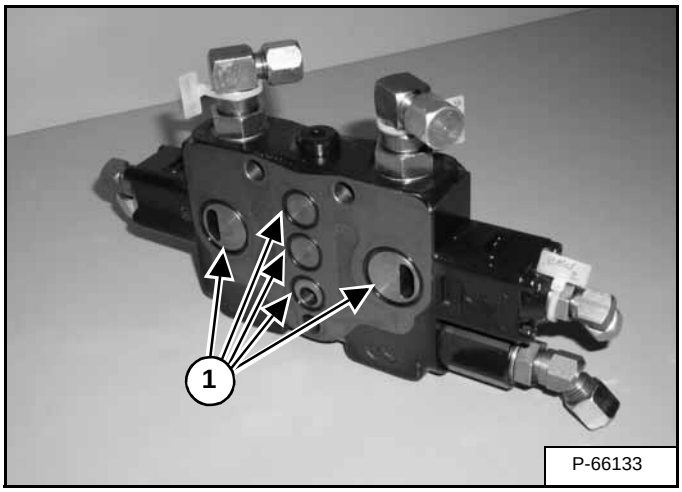
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-33



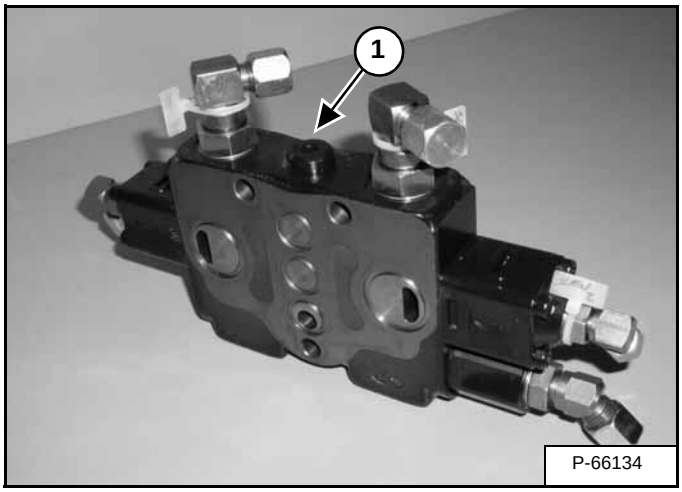
Remove the slew valve section (Item 1) **[Figure 20-40-33]** from the valve assembly.

Figure 20-40-34



Remove the O-rings (Item 1) **[Figure 20-40-34]** from the slew valve section.

Figure 20-40-35



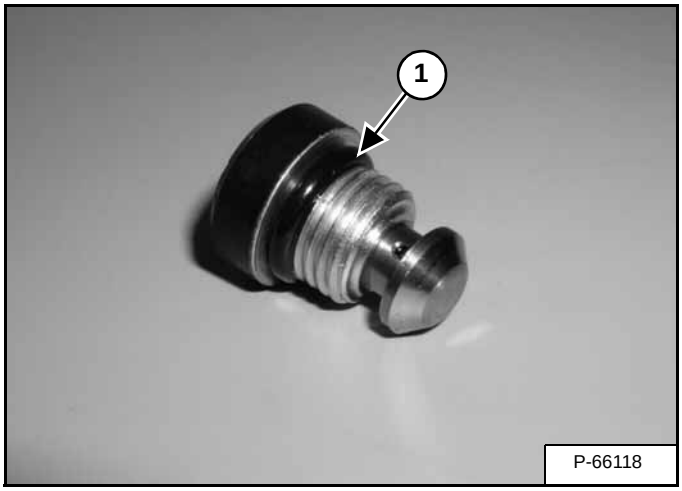
Remove the load check valve (Item 1) **[Figure 20-40-35]**.

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

Dealer Copy -- Not for Resale

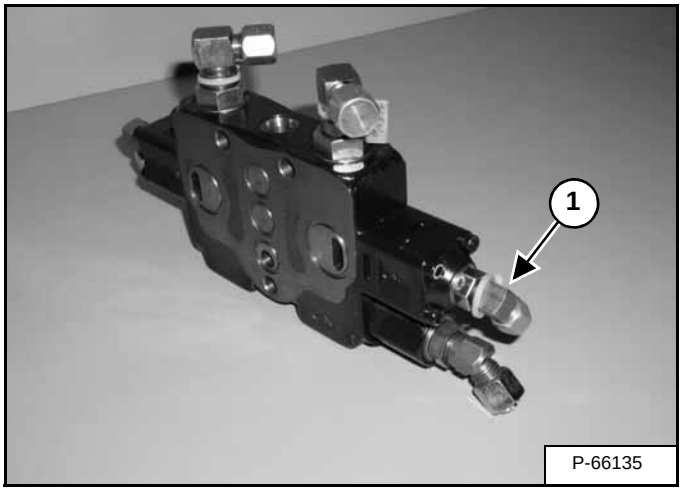
Slew Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-36



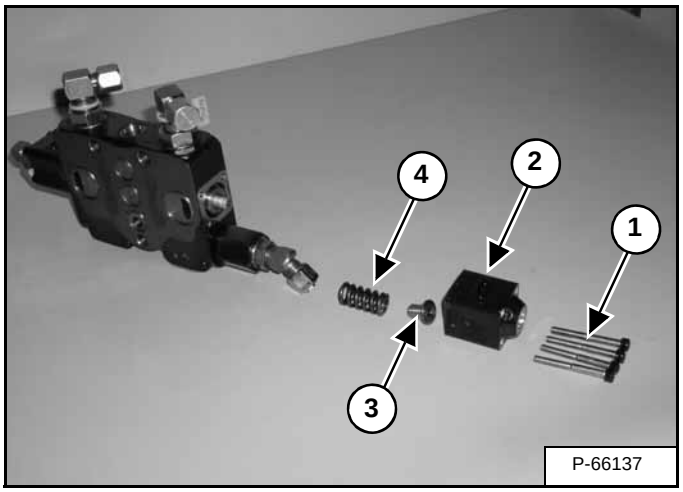
Remove the O-ring (Item 1) **[Figure 20-40-36]** from the load check valve.

Figure 20-40-37



Remove the hydraulic fitting (Item 1) **[Figure 20-40-37]**.

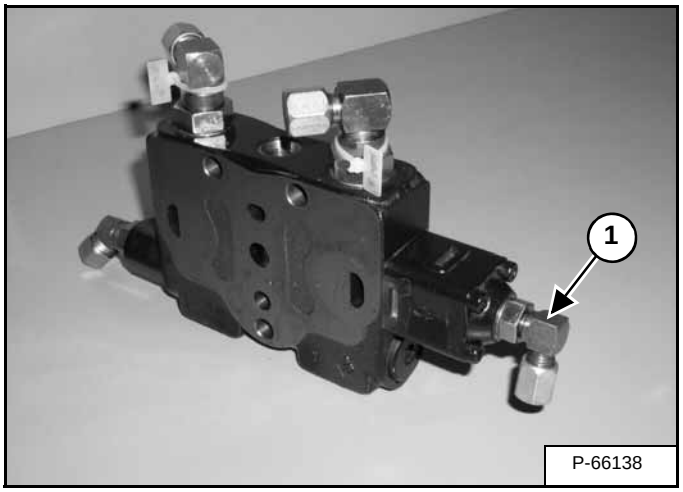
Figure 20-40-38



Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3) and spring (Item 4) **[Figure 20-40-38]**.

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

Figure 20-40-39

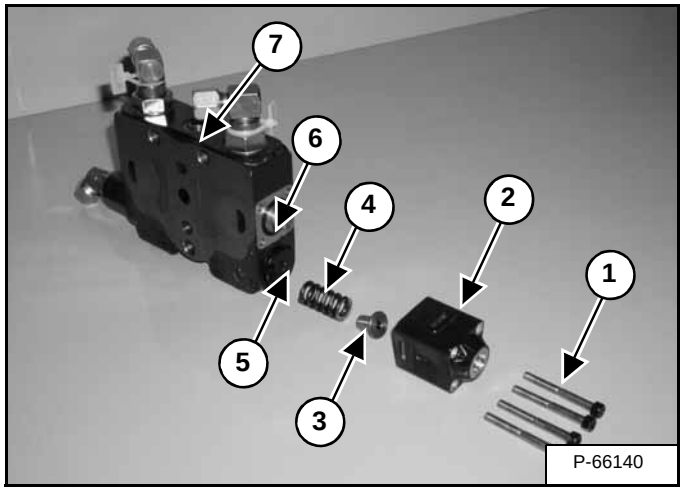


Remove the hydraulic fitting (Item 1) **[Figure 20-40-39]**.

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Slew Valve Section Disassembly And Assembly (Cont'd)

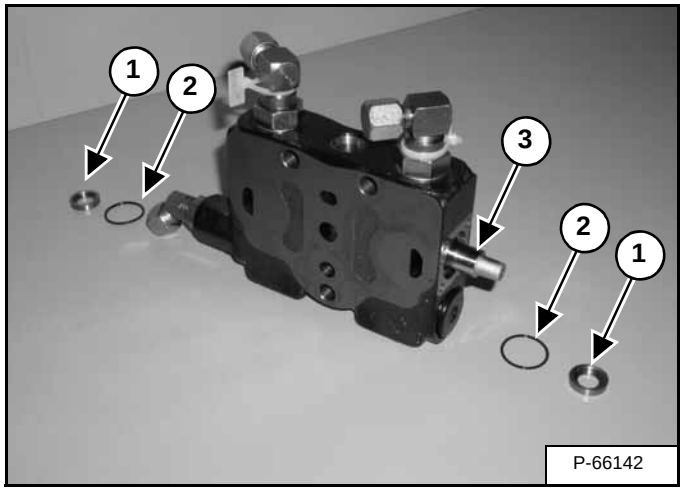
Figure 20-40-40



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

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

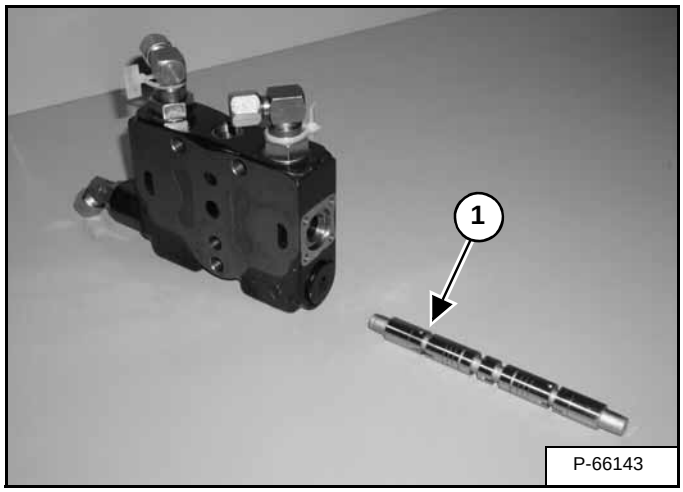
Figure 20-40-41



Remove the spring retainers (Item 1) and O-rings (Item 2) **[Figure 20-40-41]**.

Installation: Install the lip of the spring retainer (Item 1) over the spool (Item 3) **[Figure 20-40-41]**.

Figure 20-40-42

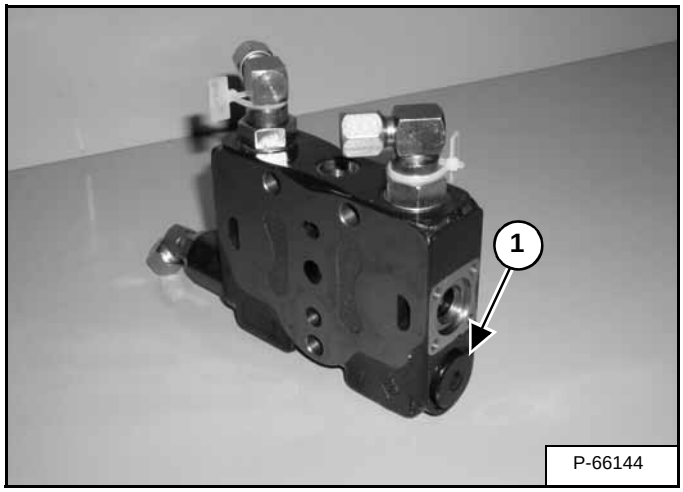


Remove the spool (Item 1) **[Figure 20-40-42]**.

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.

Figure 20-40-43



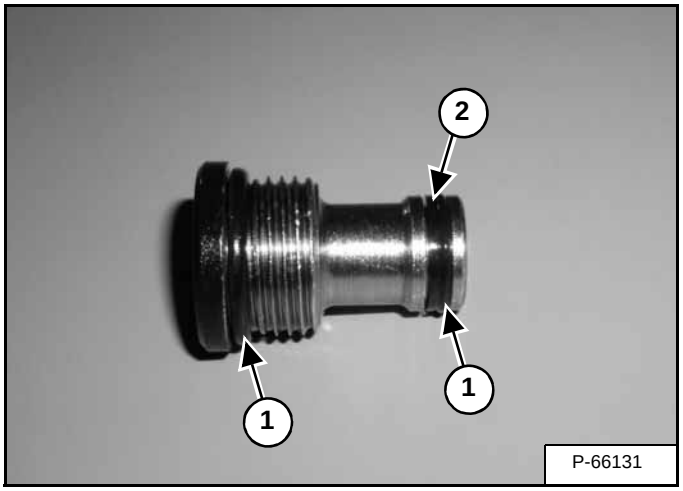
Remove the plug (Item 1) **[Figure 20-40-43]**.

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

Dealer Copy -- Not for Resale

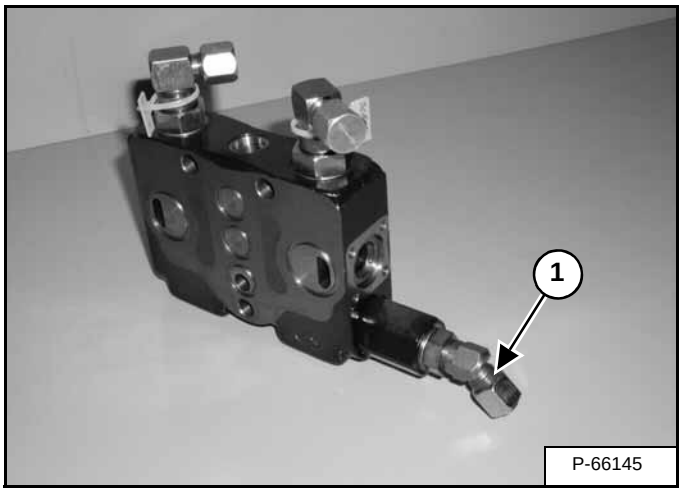
Slew Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-44



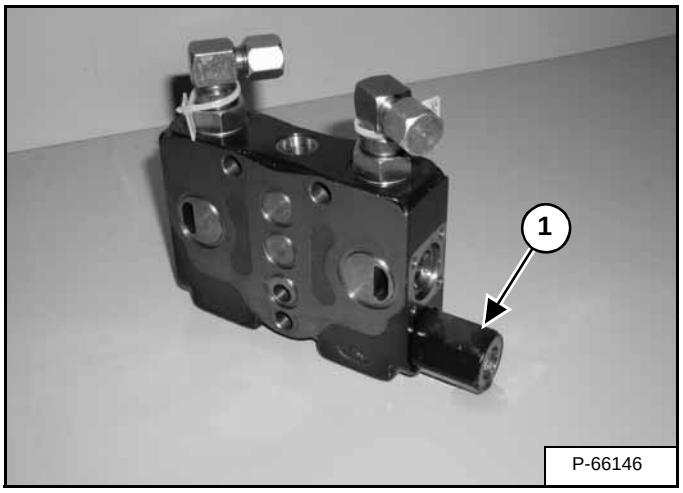
Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-44]** from the plug.

Figure 20-40-45



Remove the hydraulic fitting (Item 1) **[Figure 20-40-45]**.

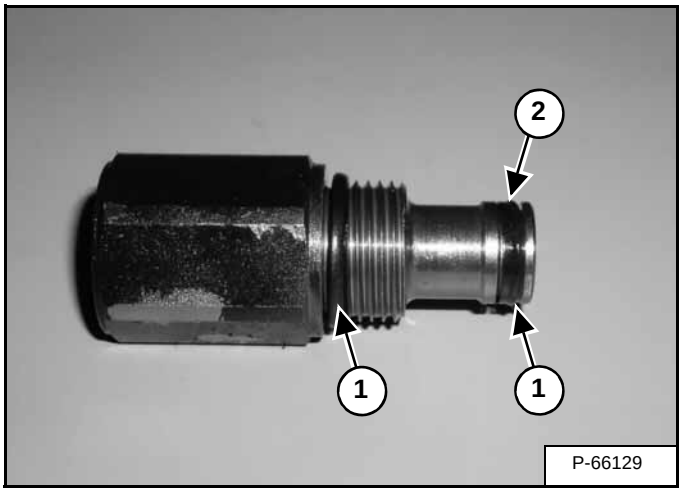
Figure 20-40-46



Remove the fitting (Item 1)[**[Figure 20-40-46]**.

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

Figure 20-40-47



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-47]** from the fitting.

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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.

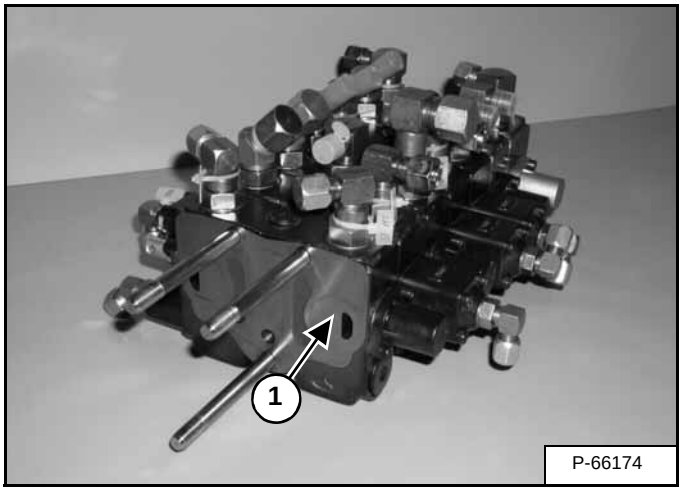
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

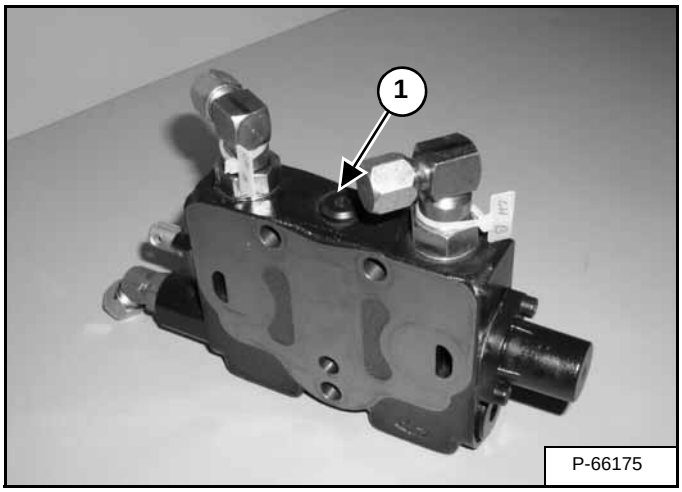
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-48



Remove the left travel valve section (Item 1) **[Figure 20-40-48]** from the valve assembly.

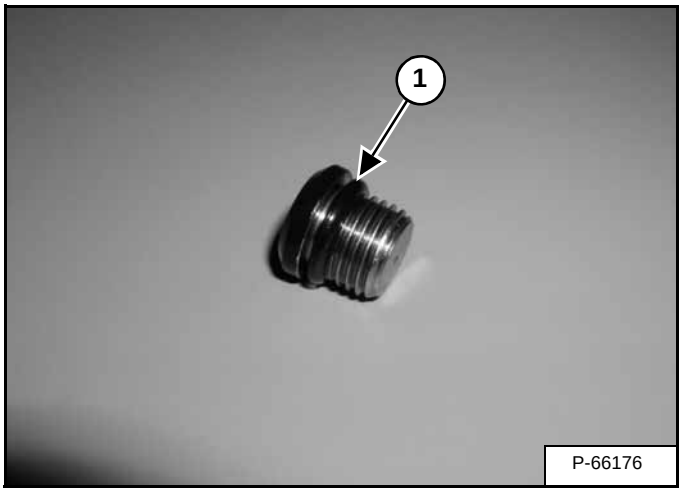
Figure 20-40-49



Remove the plug (Item 1) **[Figure 20-40-49]** from the left travel valve section.

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

Figure 20-40-50

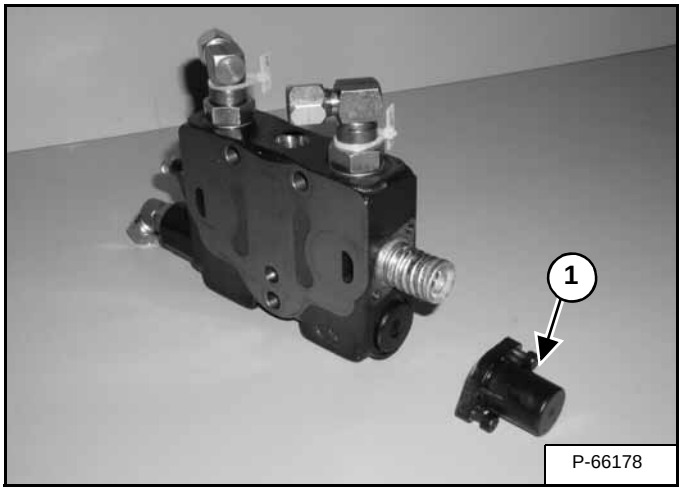


Remove the O-ring (Item 1) **[Figure 20-40-50]** from the plug.

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Left Travel Valve Section Disassembly and Assembly (Cont'd)

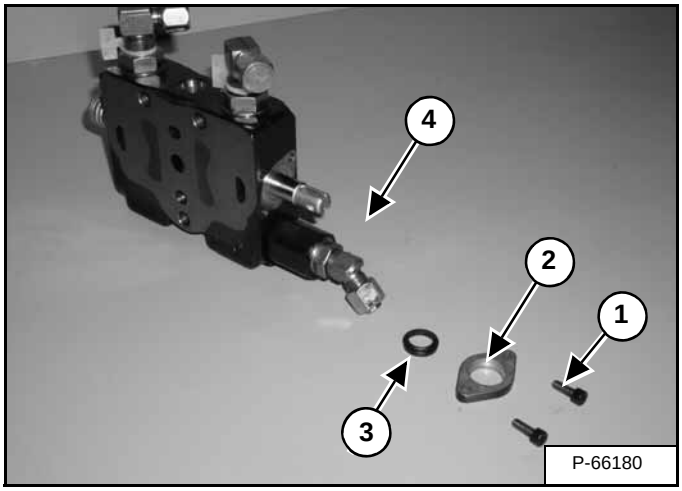
Figure 20-40-51



Remove the cap and bolts (Item 1) **[Figure 20-40-51]**.

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

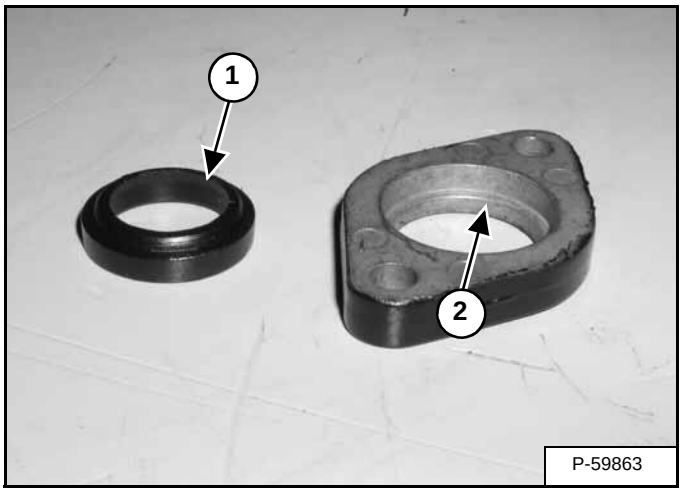
Figure 20-40-52



Remove the bolts (Item 1), retainer (Item 2) and seal (Item 3) from the spool (Item 4) **[Figure 20-40-52]**.

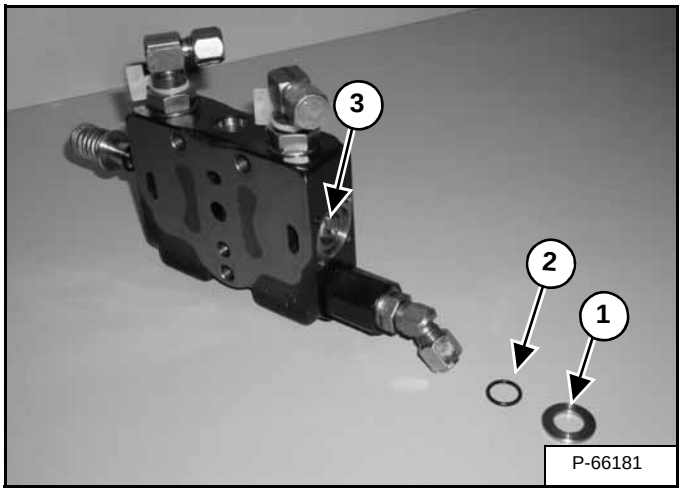
Installation: Tighten the bolts to 5 ft.-lb. (6,6 N•m) torque.

Figure 20-40-53



Installation: Make sure the lip (Item 1) of the seal fits inside the retaining plate (Item 2) **[Figure 20-40-53]**.

Figure 20-40-54

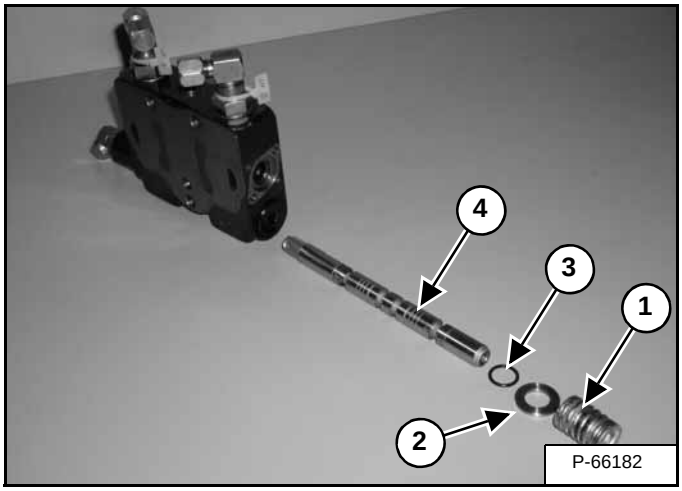


Remove the washer (Item 1) and O-ring (Item 2) from the actuating end of the spool (Item 3) **[Figure 20-40-54]**.

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Left Travel Valve Section Disassembly and Assembly (Cont'd)

Figure 20-40-55



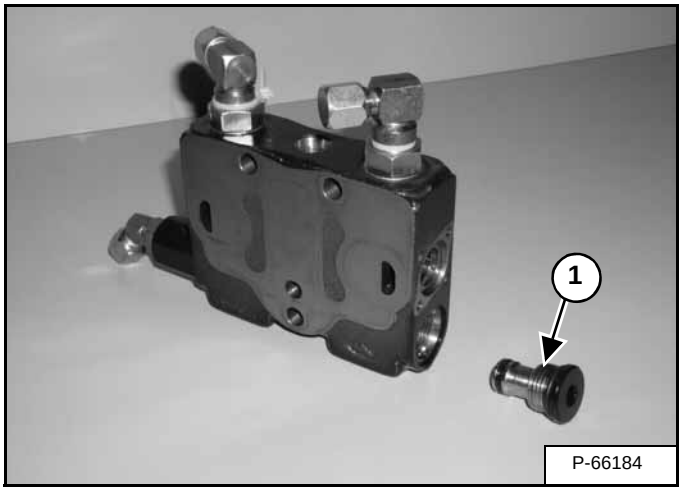
Remove the spring assembly (Item 1), washer (Item 2), O-ring (Item 3) and spool (Item 4) **[Figure 20-40-55]**.

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 20-40-55]** to 7 ft.-lb. (9.8 N•m) torque.

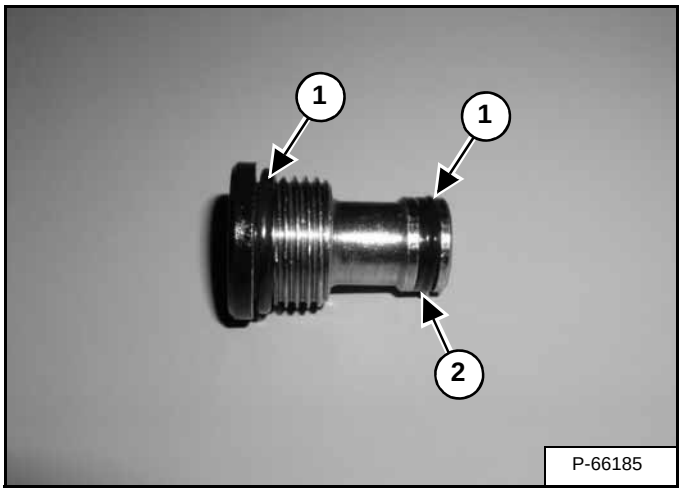
Figure 20-40-56



Remove the plug (Item 1) **[Figure 20-40-56]**.

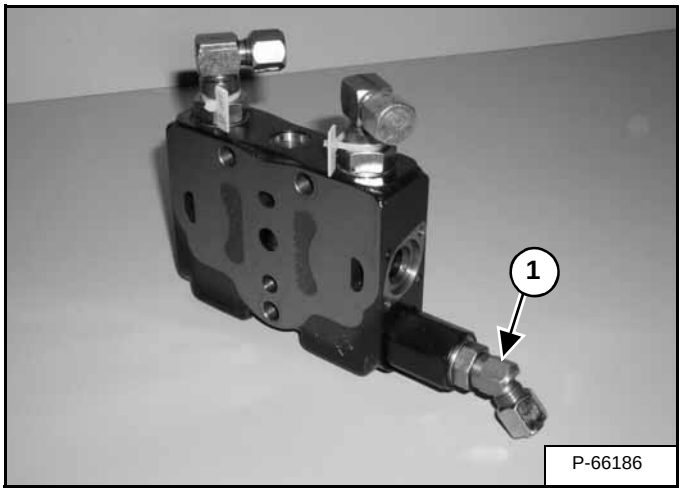
Installation: Tighten the plug to 31 ft.-lb. (42 N•m) torque.

Figure 20-40-57



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-57]** from the plug.

Figure 20-40-58

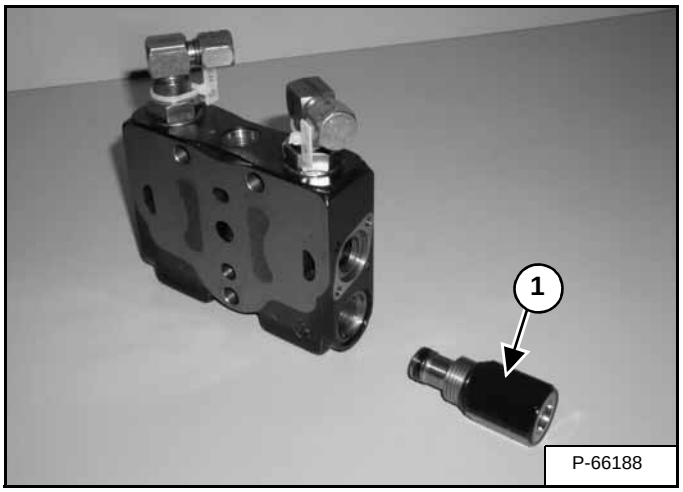


Remove the fitting (Item 1) **[Figure 20-40-58]**.

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Left Travel Valve Section Disassembly and Assembly (Cont'd)

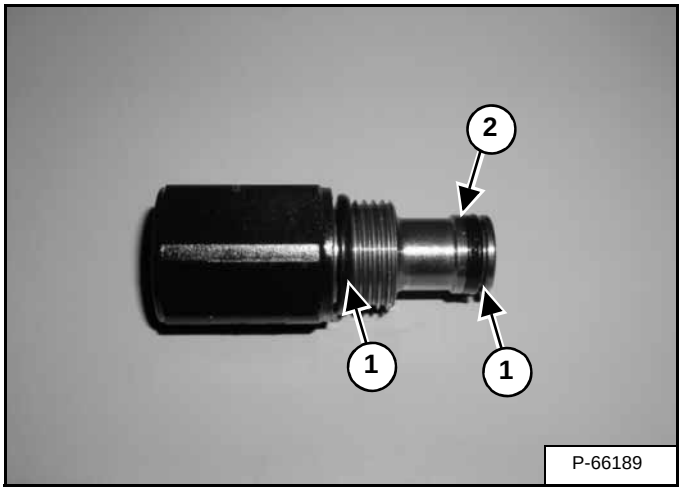
Figure 20-40-59



Remove the fitting (Item 1) **[Figure 20-40-59]**.

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

Figure 20-40-60



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-60]** from the fitting.

Dealer Copy -- Not for Resale

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.

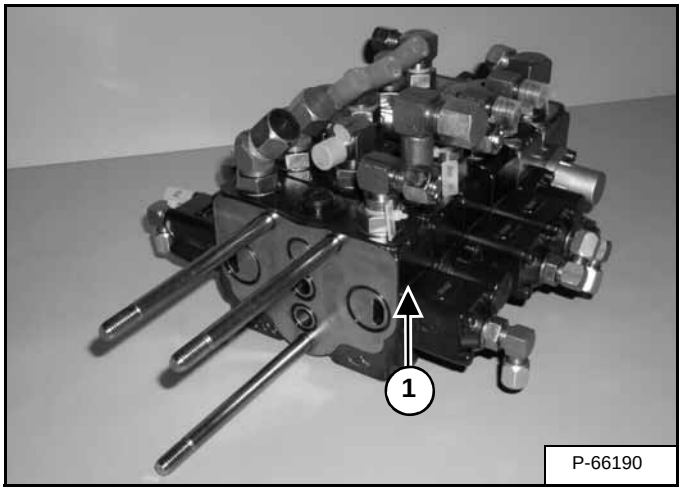
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

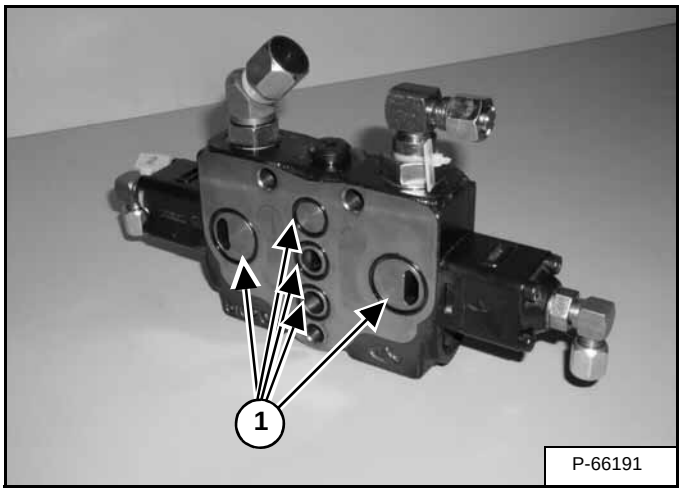
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-61



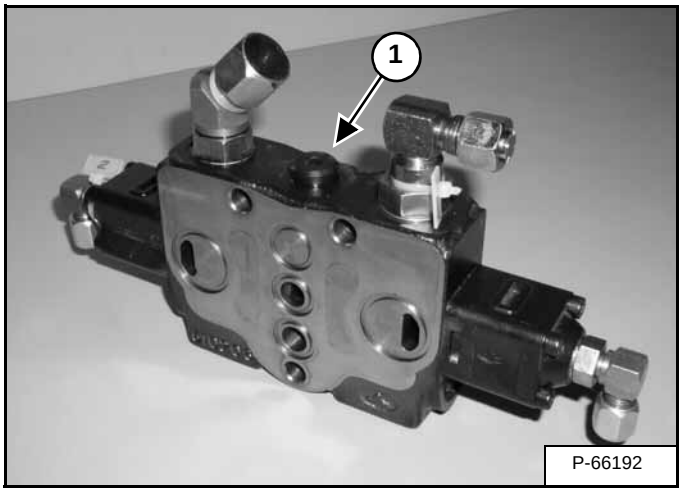
Remove the boom valve section (Item 1) **[Figure 20-40-61]** from the valve assembly.

Figure 20-40-62



Remove the O-rings (Item 1) **[Figure 20-40-62]** from the boom valve section.

Figure 20-40-63



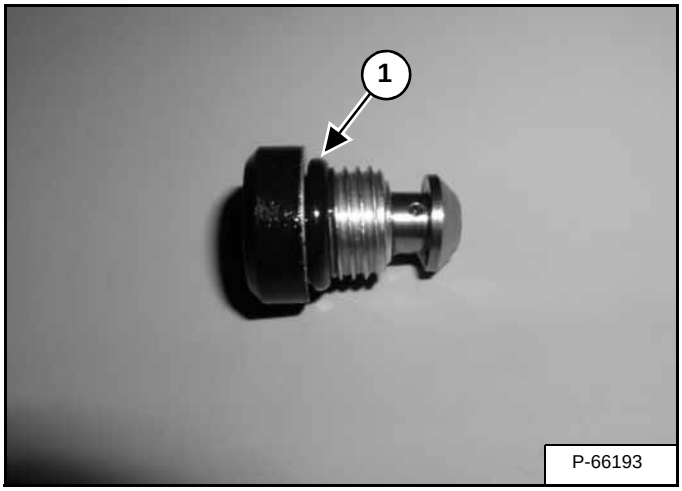
Remove the load check valve (Item 1) **[Figure 20-40-63]**.

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

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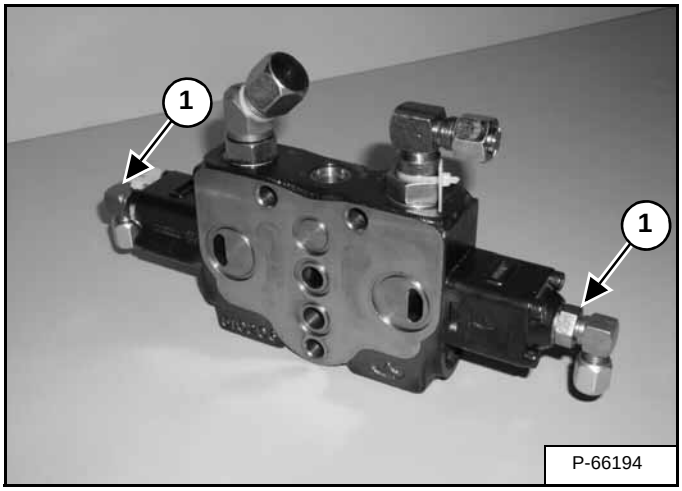
Boom Valve Section Disassembly and Assembly (Cont'd)

Figure 20-40-64



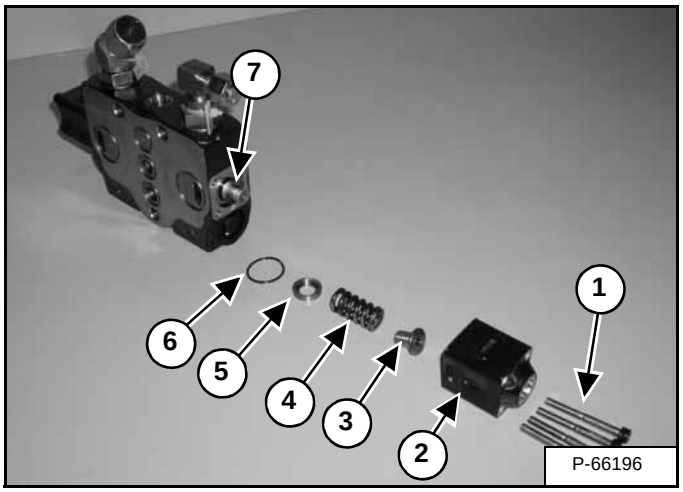
Remove the O-ring (Item 1) **[Figure 20-40-64]** from the load check valve.

Figure 20-40-65



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

Figure 20-40-66

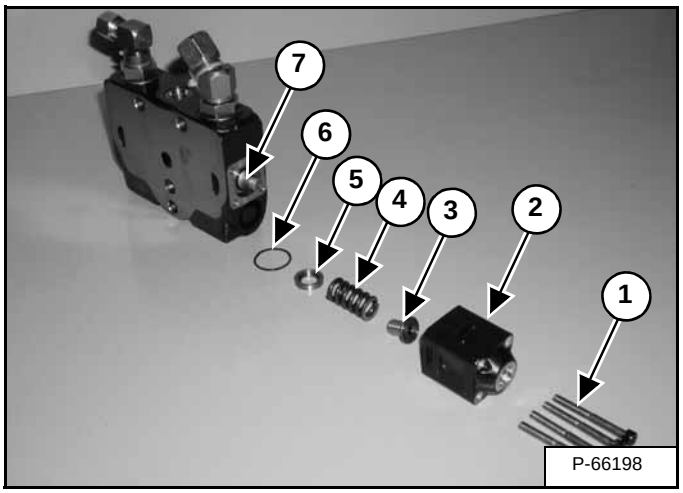


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-66]**.

Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 7) **[Figure 20-40-66]**.

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

Figure 20-40-67



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 20-40-67]**.

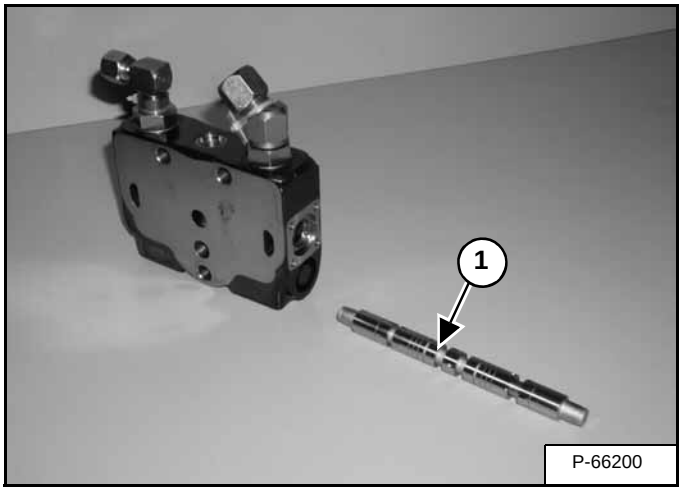
Installation: Make sure the lip on the spring retainer (Item 5) fits over the spool (Item 7) **[Figure 20-40-67]**.

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

Dealer Copy -- Not for Resale

Boom Valve Section Disassembly and Assembly (Cont'd)

Figure 20-40-68

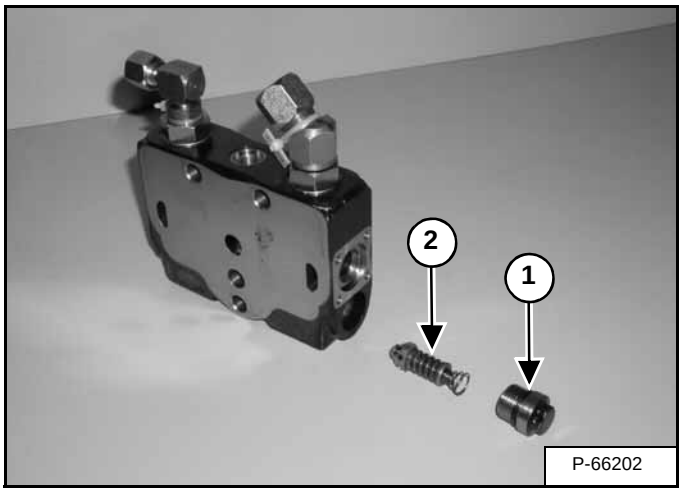


Remove the spool (Item 1) **[Figure 20-40-68]**.

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.

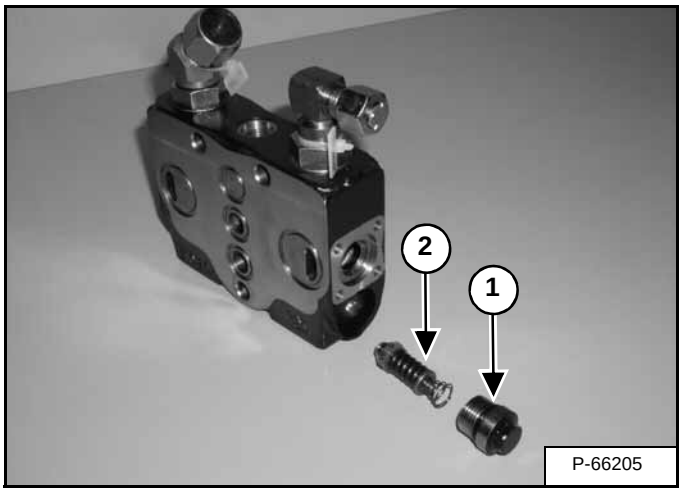
Figure 20-40-69



Remove the plug (Item 1) and valve assembly (Item 2) **[Figure 20-40-69]** from both relief valves.

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

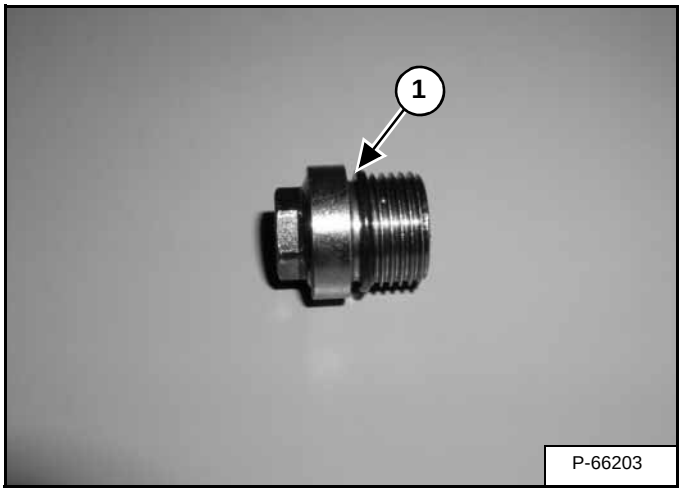
Figure 20-40-70



Remove the plug (Item 1) and valve assembly (Item 2) **[Figure 20-40-70]** from both relief valves.

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

Figure 20-40-71



Remove the O-ring (Item 1) **[Figure 20-40-71]** from both plugs.

Dealer Copy -- Not for Resale

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.

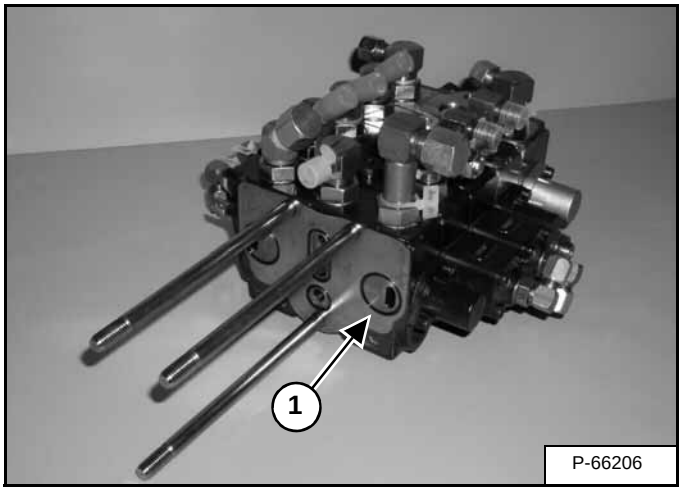
I-2003-0888

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.

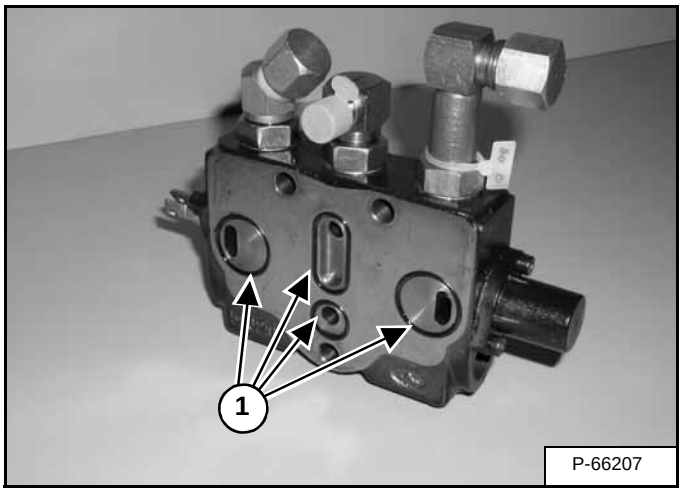
Figure 20-40-72



Remove the auxiliary valve section (Item 1) **[Figure 20-40-72]** from the valve assembly.

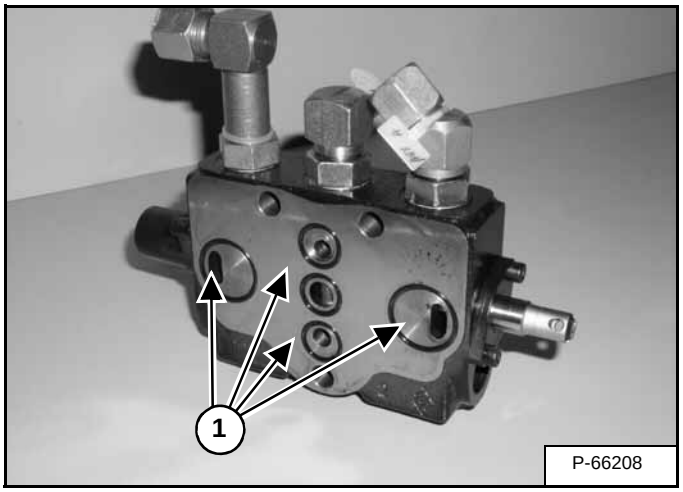
NOTE: Use care while removing the auxiliary valve section. The buildup valve (Item 1) [Figure 20-40-75 on Page 24] is spring loaded.

Figure 20-40-73



Remove the O-rings (Item 1) **[Figure 20-40-73]** from the auxiliary valve section.

Figure 20-40-74

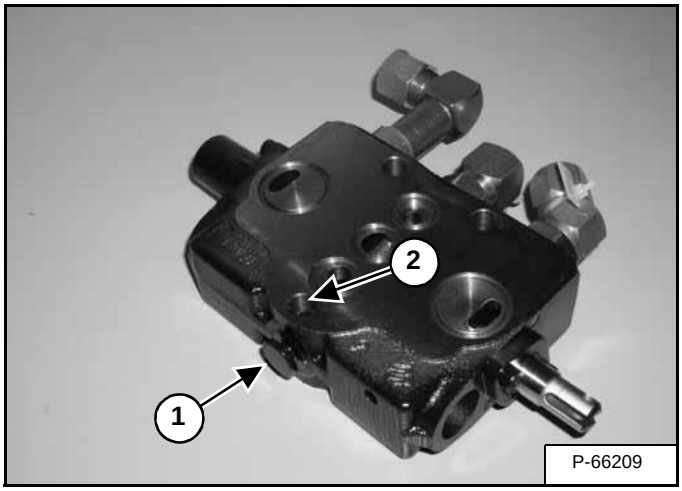


Remove the O-rings (Item 1) **[Figure 20-40-74]** from the auxiliary valve section.

Dealer Copy -- Not for Resale

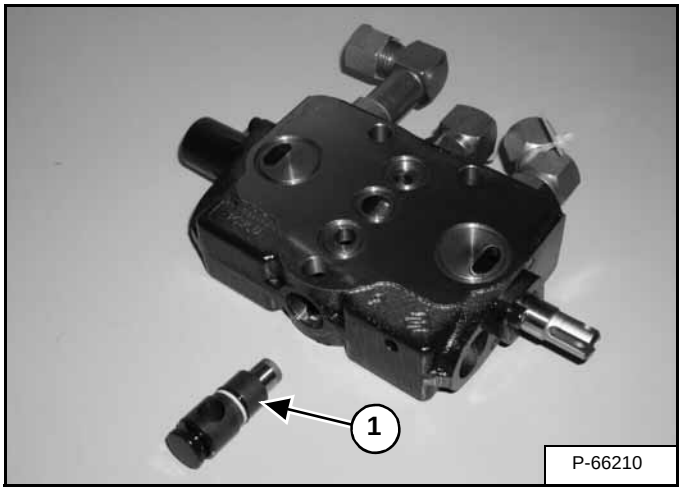
Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-75



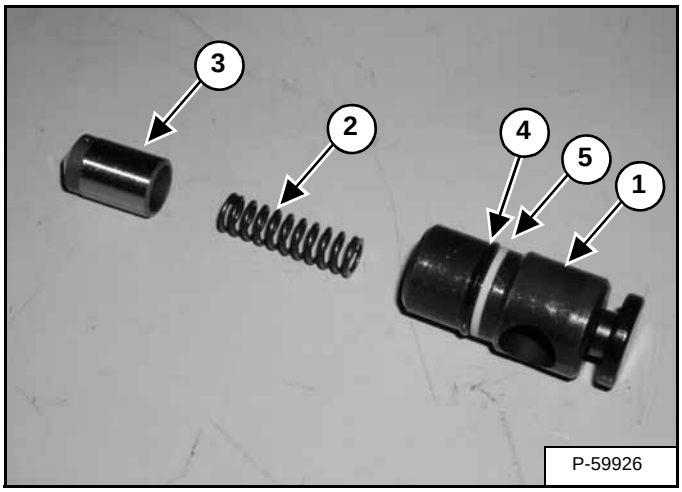
Installation: Align the hole in the buildup valve (Item 1) with the hole (Item 2) **[Figure 20-40-75]** in the auxiliary valve section. Fully depress the buildup valve and slide the auxiliary valve section on the tie rods.

Figure 20-40-76



Remove the buildup valve assembly (Item 1) **[Figure 20-40-75]** and **[Figure 20-40-76]**.

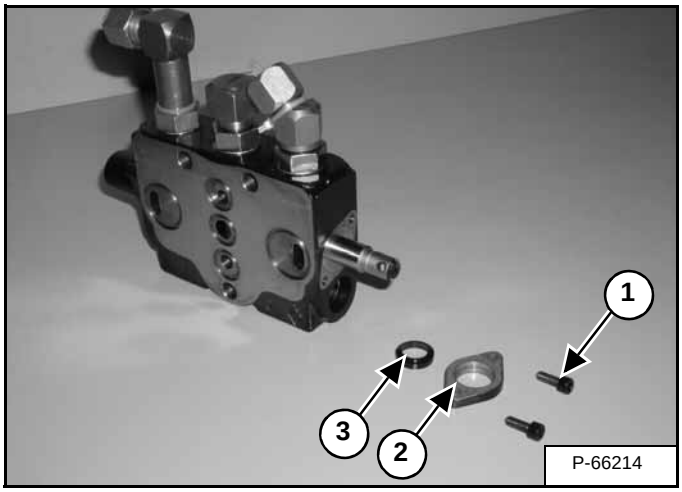
Figure 20-40-77



Remove the buildup valve (Item 1), spring (Item 2) and piston (Item 3) **[Figure 20-40-77]**.

Remove the O-ring (Item 4) and backup seal (Item 5) **[Figure 20-40-77]**.

Figure 20-40-78



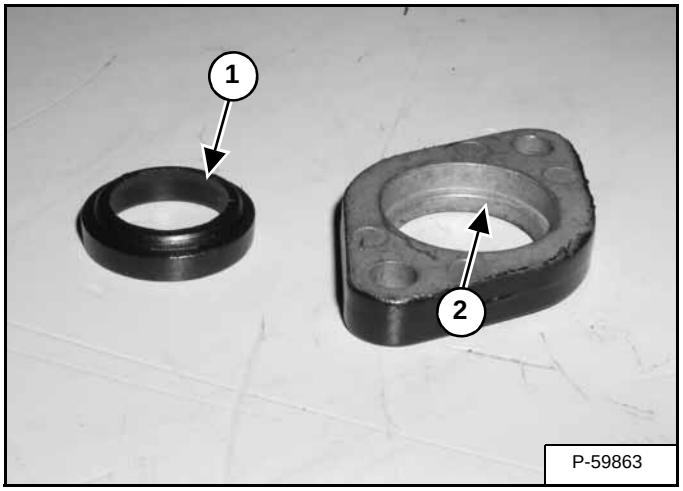
Remove the bolts (Item 1), retainer (Item 2) and seal (Item 3) **[Figure 20-40-78]**.

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

Dealer Copy -- Not for Resale

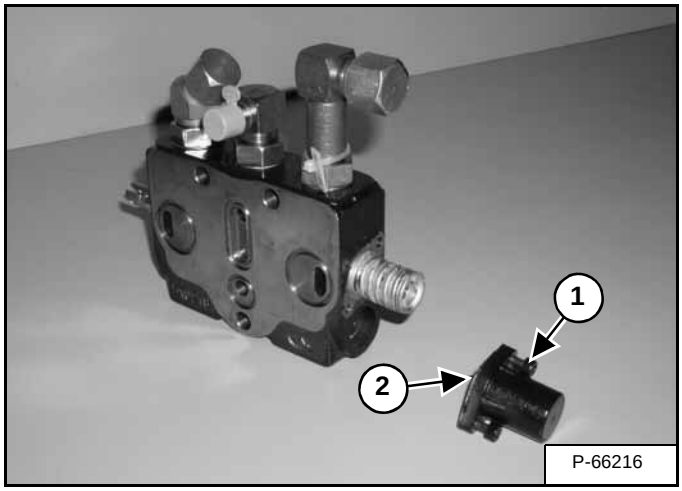
Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-79



Installation: Make sure the lip (Item 1) of the seal fits inside the retaining plate (Item 2) **[Figure 20-40-79]**.

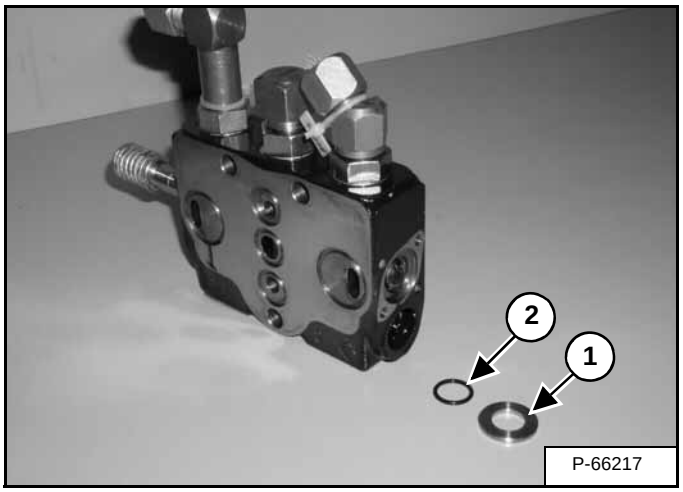
Figure 20-40-80



Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-80]**.

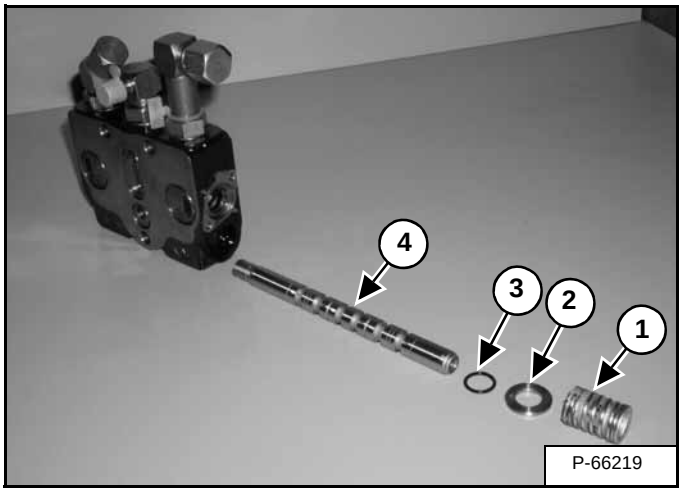
Installation: Tighten the bolts to 5 ft.-lb. (6,6 N•m) torque.

Figure 20-40-81



Remove the washer (Item 1) and O-ring (Item 2) **[Figure 20-40-81]** from the valve section.

Figure 20-40-82



Remove the spring assembly (Item 1), washer (Item 2), O-ring (Item 3) and spool (Item 4) **[Figure 20-40-82]**.

The spool and valve section are not serviced separately.

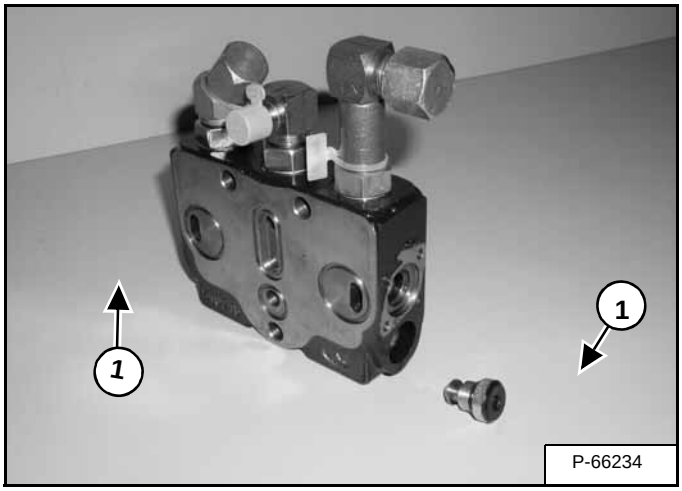
NOTE: When the spool is removed, use care not to scratch the spool surface. Do not interchange spools and valve sections.

Installation: Tighten the spring retaining screw to 7 ft.-lb. (9,8 N•m) torque.

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Auxiliary Valve Section Disassembly And Assembly (Cont'd)

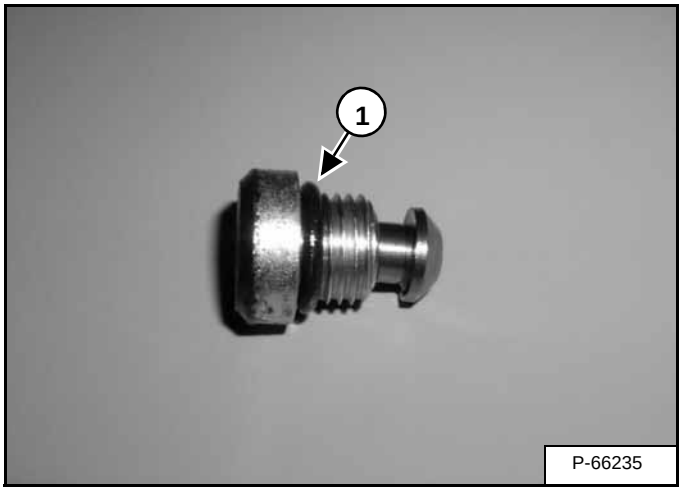
Figure 20-40-83



Remove the load check (Item 1) **[Figure 20-40-83]** from valve section.

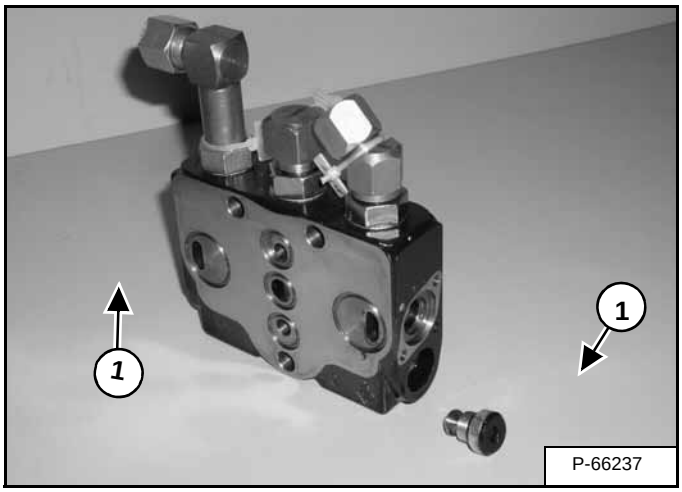
Installation: Tighten the load check to 18 ft.-lb. (24 N•m) torque.

Figure 20-40-84



Remove the O-ring (Item 1) **[Figure 20-40-84]** from the load checks.

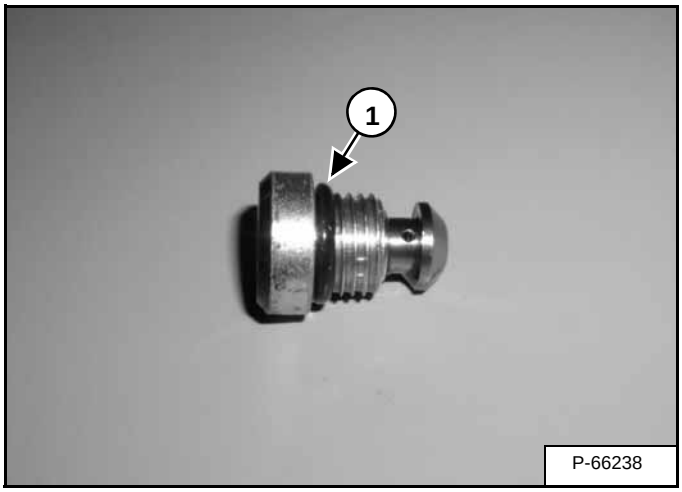
Figure 20-40-85



Remove the load check (Item 1) **[Figure 20-40-85]** from valve section.

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

Figure 20-40-86



Remove the O-ring (Item 1) **[Figure 20-40-86]** from the load checks.

Dealer Copy -- Not for Resale

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.

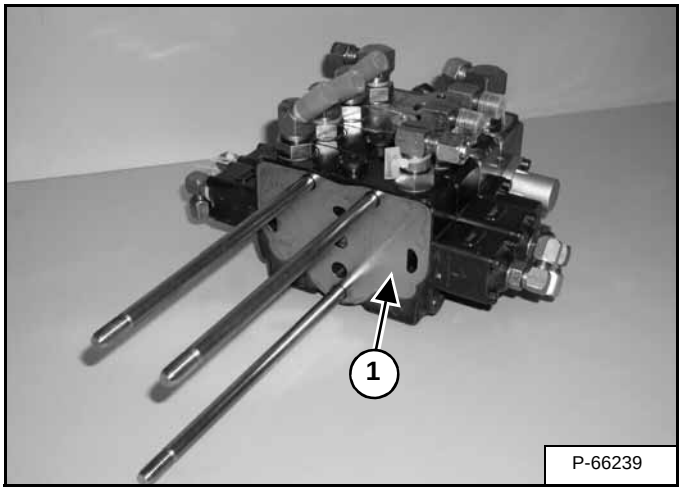
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

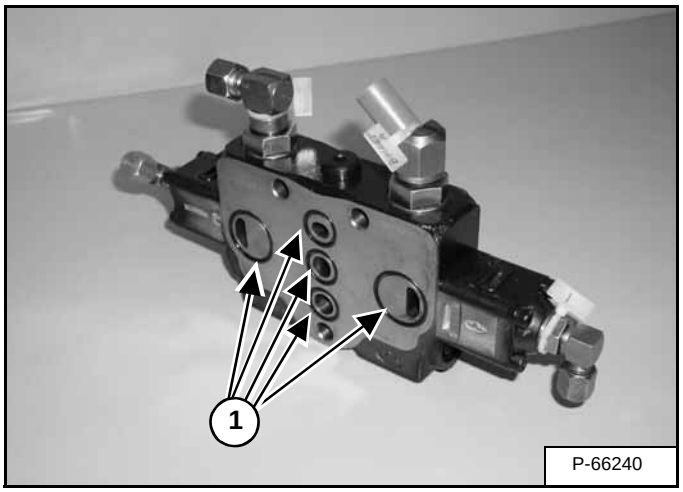
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-87



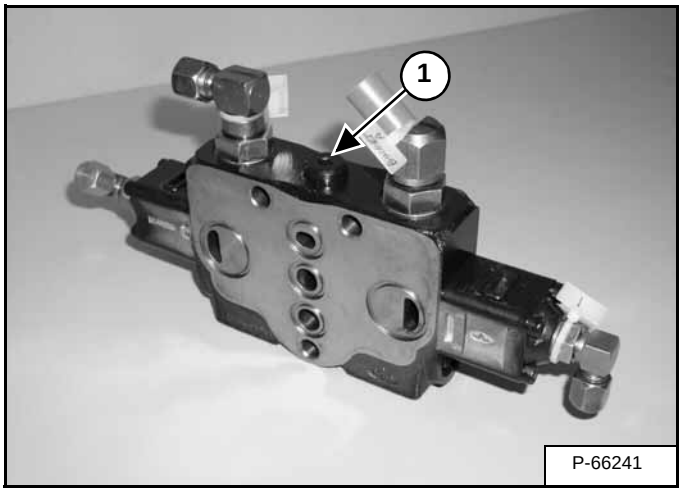
Remove the bucket valve section (Item 1) **[Figure 20-40-87]** from the valve assembly.

Figure 20-40-88



Remove the O-rings (Item 1) **[Figure 20-40-88]** from the side of the bucket valve section.

Figure 20-40-89



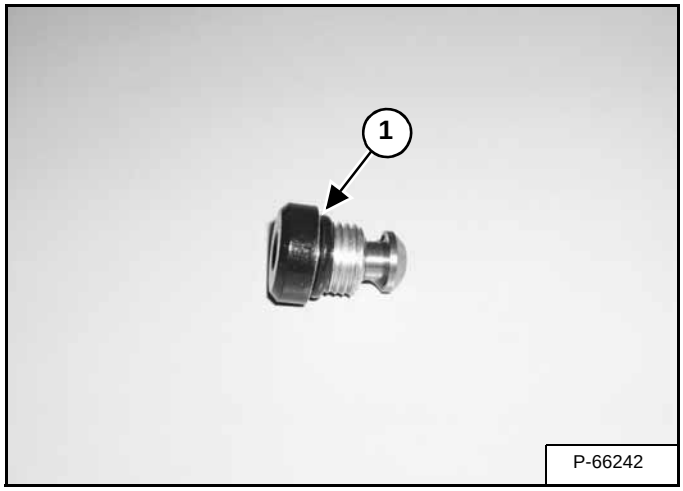
Remove the load check valve (Item 1) **[Figure 20-40-89]**.

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

Dealer Copy -- Not for Resale

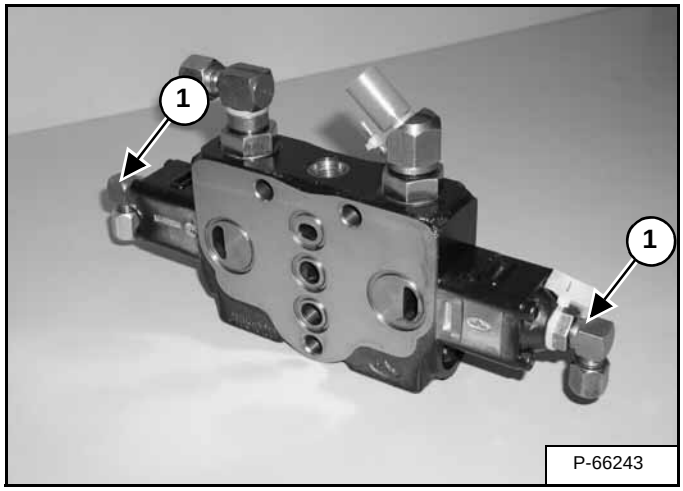
Bucket Valve Section Disassembly and Assembly (Cont'd)

Figure 20-40-90



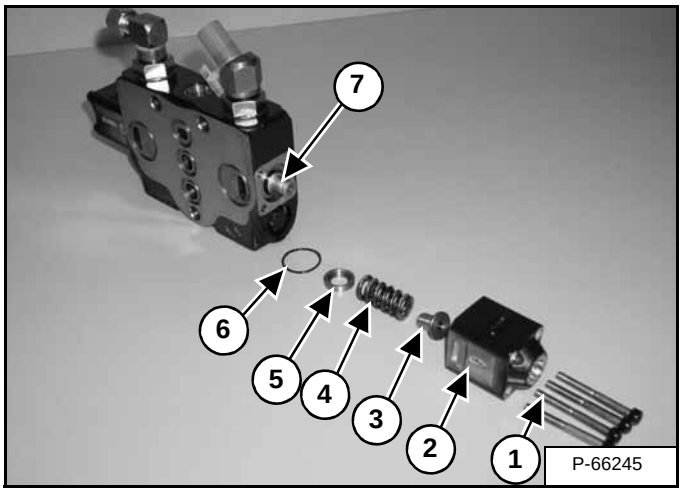
Remove the O-ring (Item 1) **[Figure 20-40-90]** from the load check valve.

Figure 20-40-91



Remove the hydraulic fittings (Item 1) **[Figure 20-40-91]**.

Figure 20-40-92

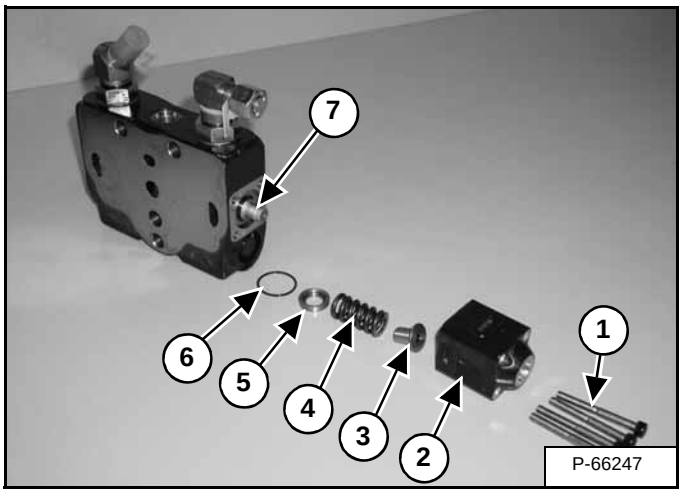


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-92]**.

Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 7) **[Figure 20-40-92]**.

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

Figure 20-40-93



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 20-40-93]**.

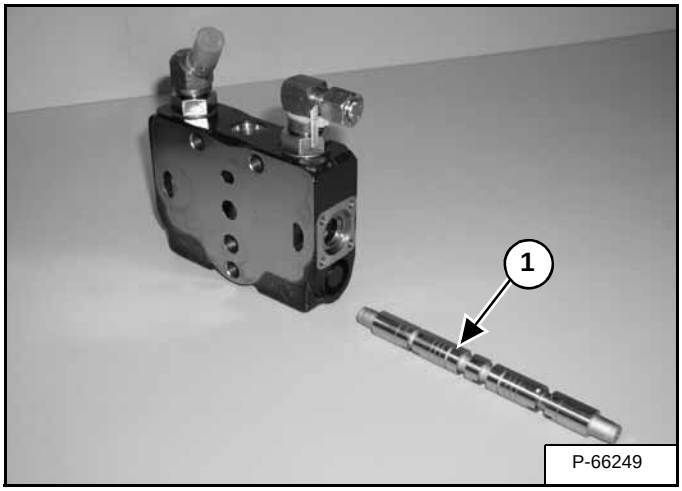
Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 7) **[Figure 20-40-93]**.

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

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Bucket Valve Section Disassembly and Assembly (Cont'd)

Figure 20-40-94

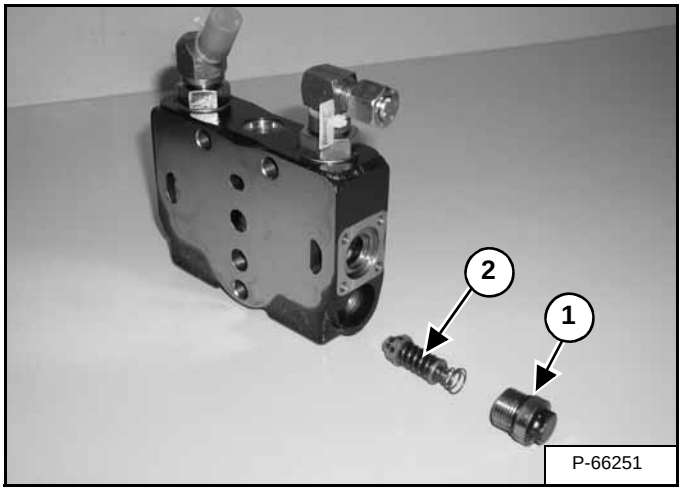


Remove the spool (Item 1) **[Figure 20-40-94]**.

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.

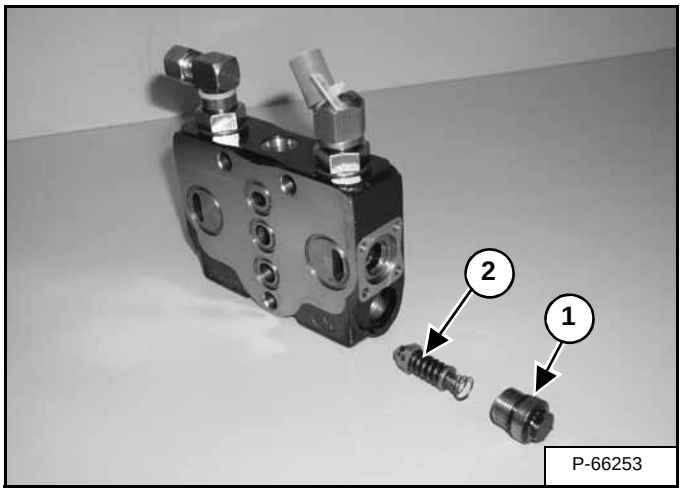
Figure 20-40-95



Remove the plug (Item 1) and valve assembly (Item 2) **[Figure 20-40-95]**.

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

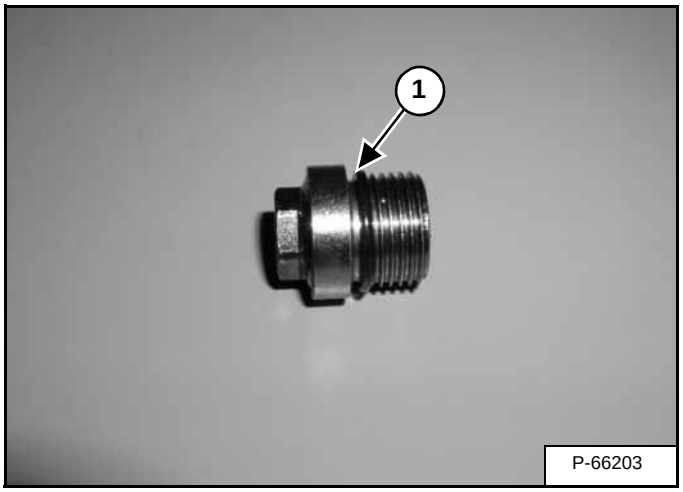
Figure 20-40-96



Remove the plug (Item 1) and valve assembly (Item 2) **[Figure 20-40-96]**.

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

Figure 20-40-97



Remove the O-ring (Item 1) **[Figure 20-40-97]** from both plugs.

Dealer Copy -- Not for Resale

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.

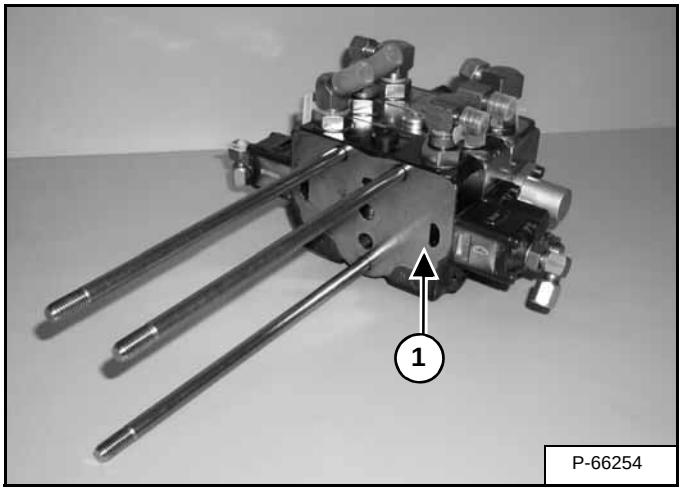
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

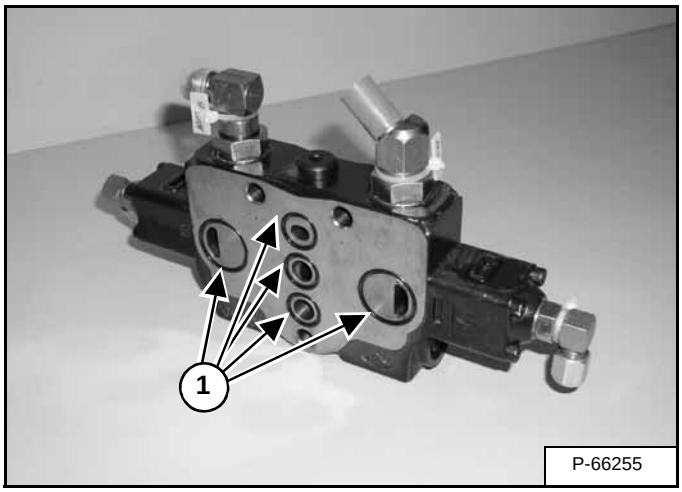
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-98



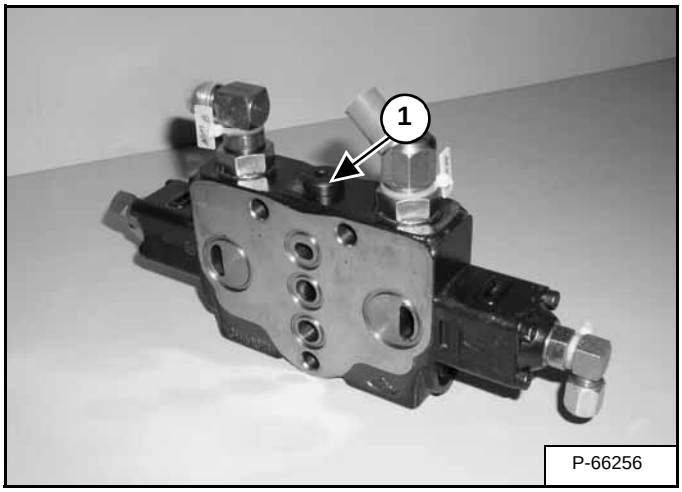
Remove the arm valve section (Item 1) **[Figure 20-40-98]** from the valve assembly.

Figure 20-40-99



Remove the O-rings (Item 1) **[Figure 20-40-99]** from the arm valve section.

Figure 20-40-100



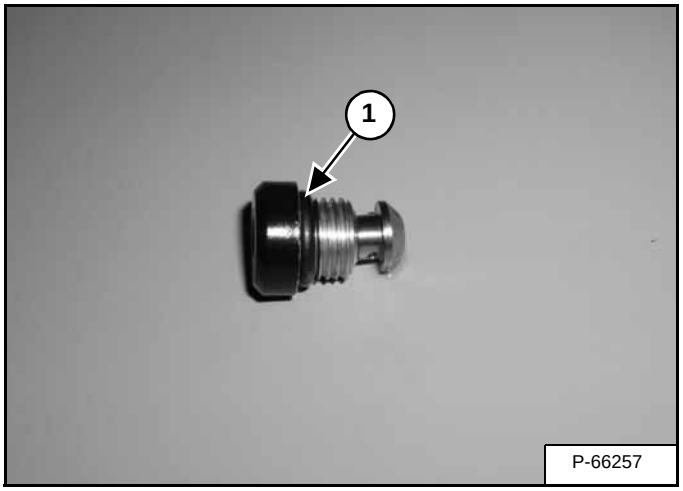
Remove the load check valve (Item 1) **[Figure 20-40-100]**.

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

Dealer Copy -- Not for Resale

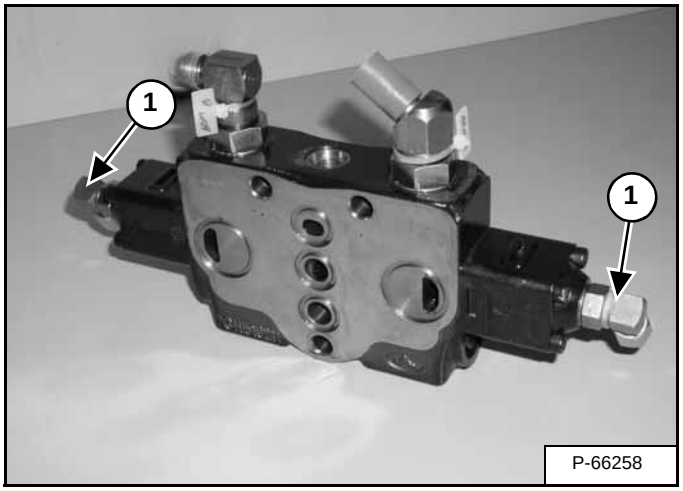
Arm Valve Section Disassembly and Assembly (Cont'd)

Figure 20-40-101



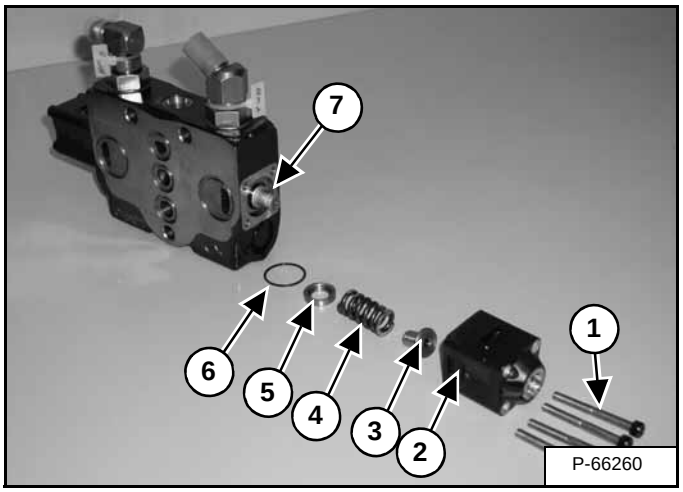
Remove the O-ring (Item 1) **[Figure 20-40-102]** from the load check valve.

Figure 20-40-102



Remove the hydraulic fitting (Item 1) **[Figure 20-40-102]**.

Figure 20-40-103

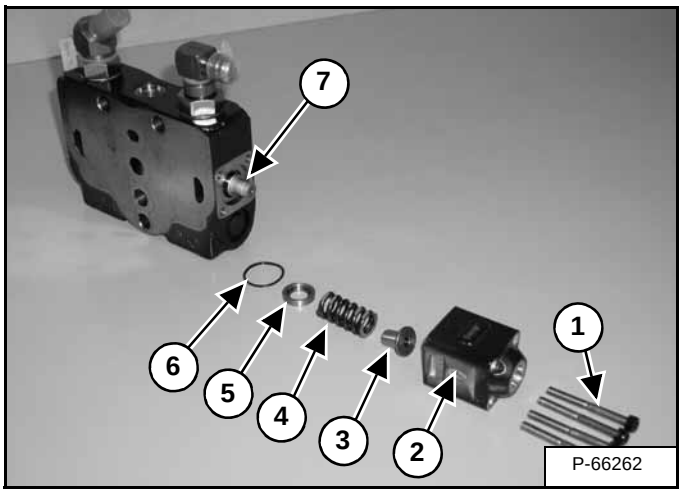


Remove the bolts (Item 1) spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-103]**.

Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 7) **[Figure 20-40-103]**.

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

Figure 20-40-104



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 20-40-104]**.

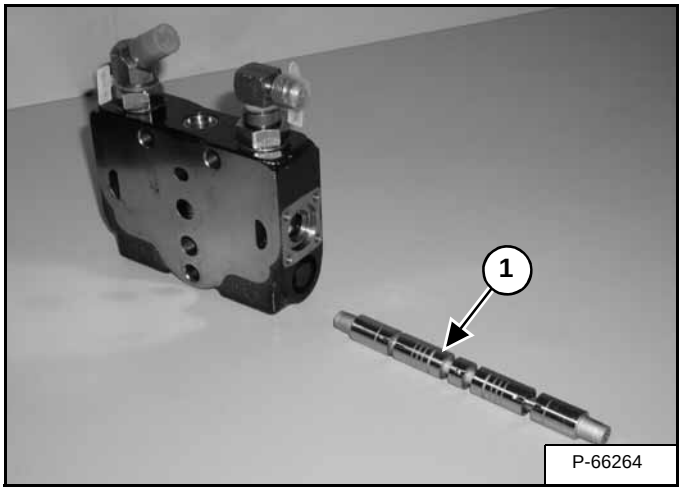
Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 7) **[Figure 20-40-104]**.

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

Dealer Copy -- Not for Resale

Arm Valve Section Disassembly and Assembly (Cont'd)

Figure 20-40-105

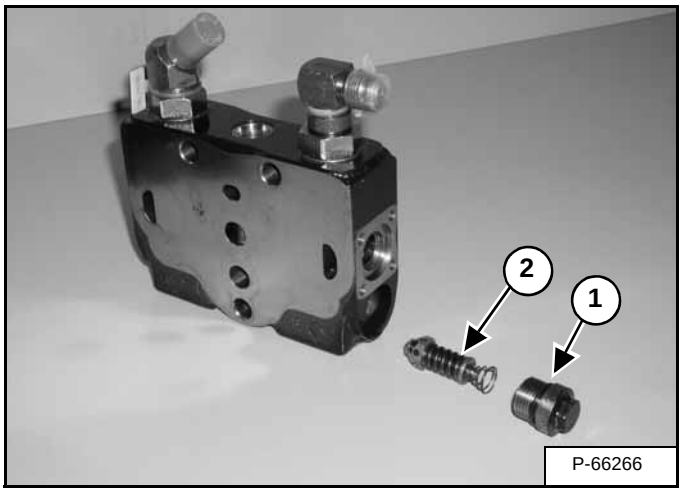


Remove the spool (item 1) **[Figure 20-40-105]**.

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.

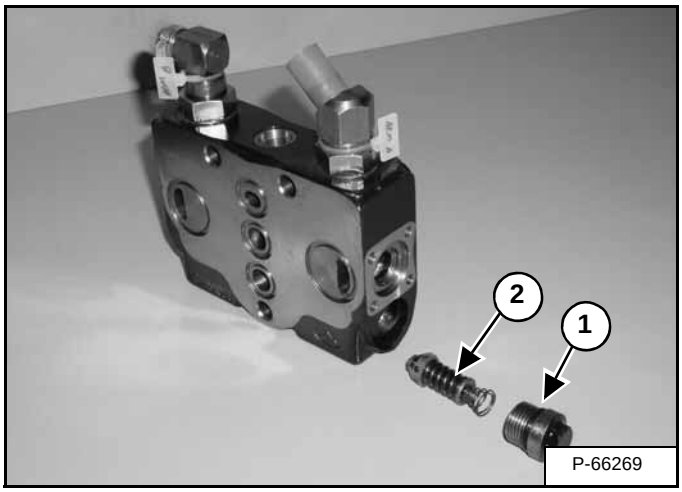
Figure 20-40-106



Remove the plug (Item 1) and relief valve assembly (Item 2) **[Figure 20-40-106]**.

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

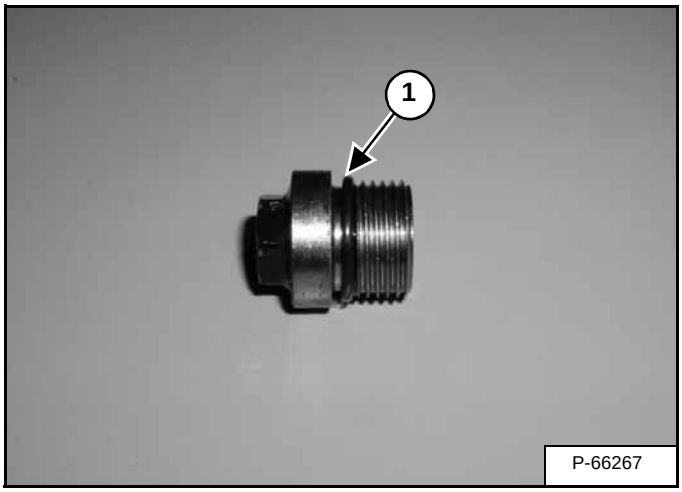
Figure 20-40-107



Remove the plug (Item 1) and relief valve assembly (Item 2) **[Figure 20-40-107]**.

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

Figure 20-40-108



Remove the O-ring (Item 1) **[Figure 20-40-108]** from both plugs.

Dealer Copy -- Not for Resale

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.

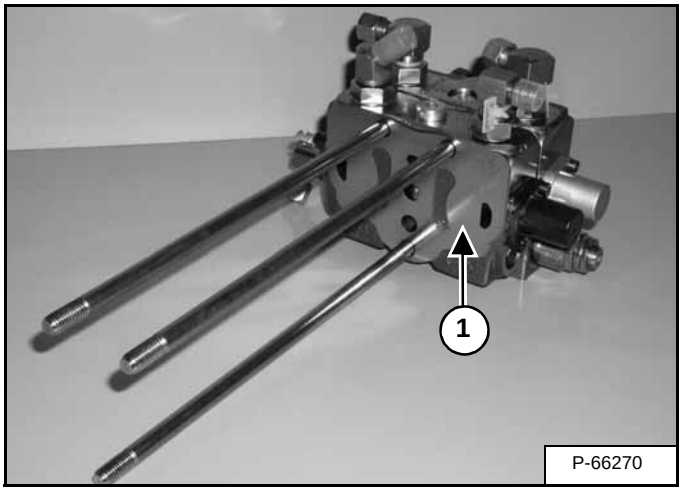
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

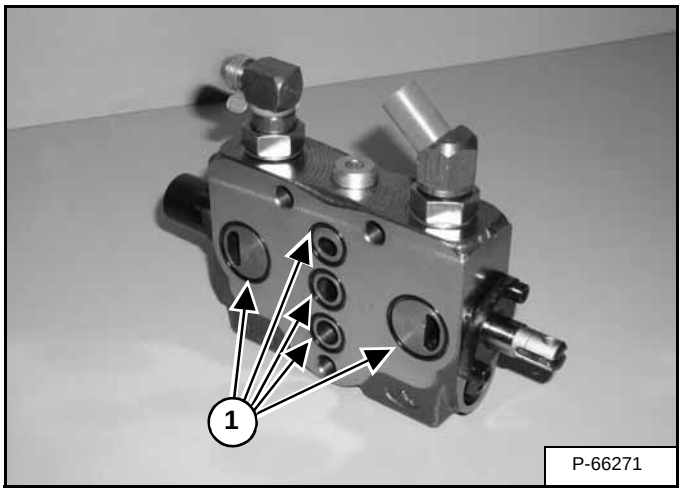
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-109



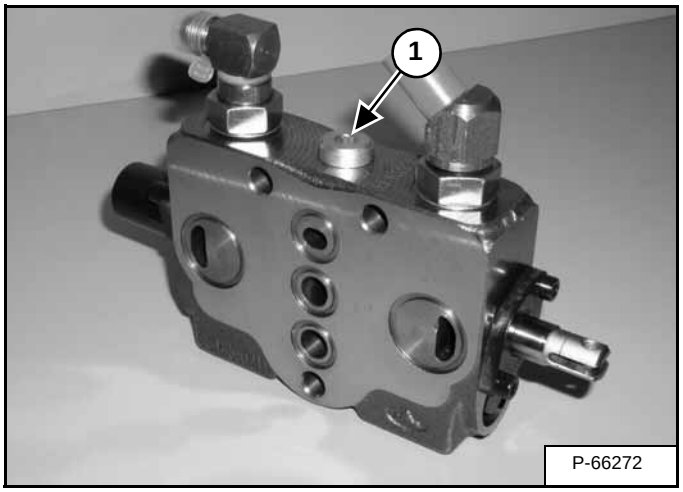
Remove the boom swing valve section (Item 1) **[Figure 20-40-109]** from the valve assembly.

Figure 20-40-110



Remove the O-rings (Item 1) **[Figure 20-40-110]** from the boom swing valve section.

Figure 20-40-111



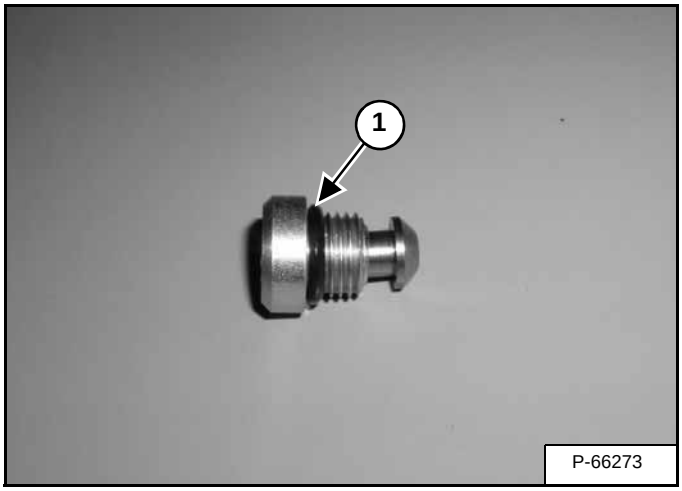
Remove the load check valve (Item 1) **[Figure 20-40-111]**.

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

Dealer Copy -- Not for Resale

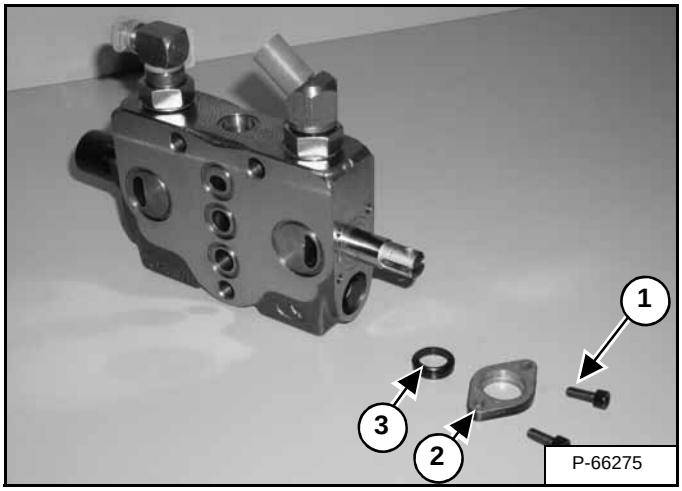
Boom Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-112



Remove the O-ring (Item 1) **[Figure 20-40-112]** from the load check valve.

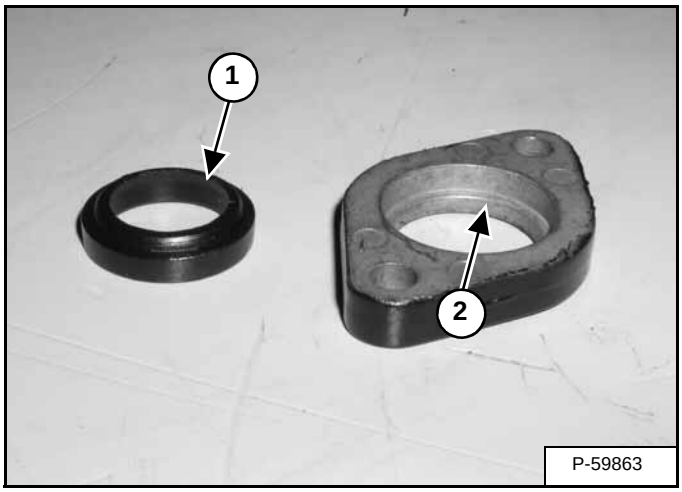
Figure 20-40-113



Remove the bolts (Item 1), retainer (Item 2) and seal (Item 3) **[Figure 20-40-113]**.

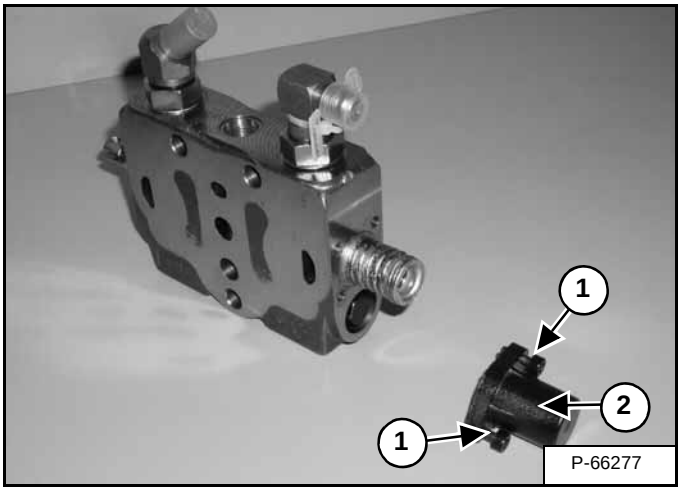
Installation: Tighten the bolts to 5 ft.-lb. (6,6 N•m) torque.

Figure 20-40-114



Installation: Make sure the lip (Item 1) of the seal fits inside the retaining plate (Item 2) **[Figure 20-40-114]**.

Figure 20-40-115



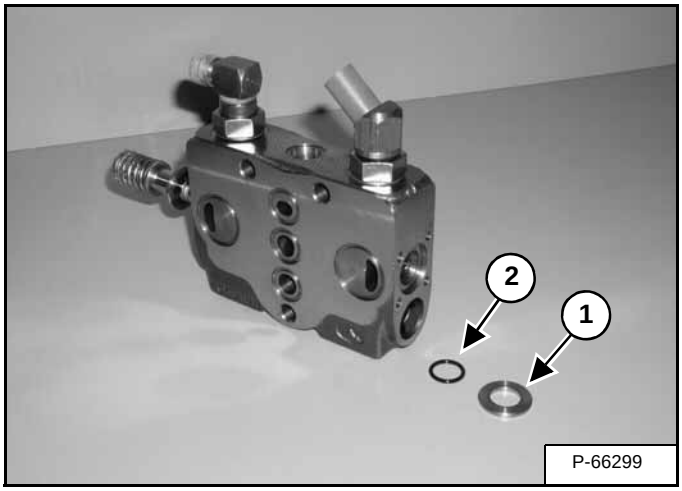
Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-115]**.

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

Dealer Copy -- Not for Resale

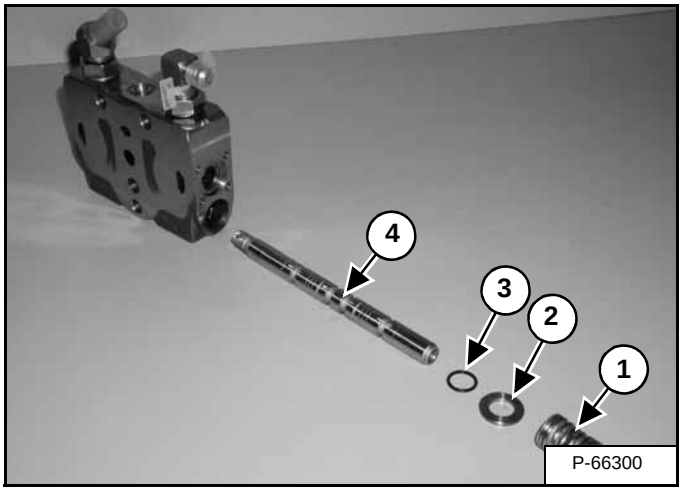
Boom Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-116



Remove the washer (Item 1) and O-ring (Item 2) **[Figure 20-40-116]** from the valve section.

Figure 20-40-117



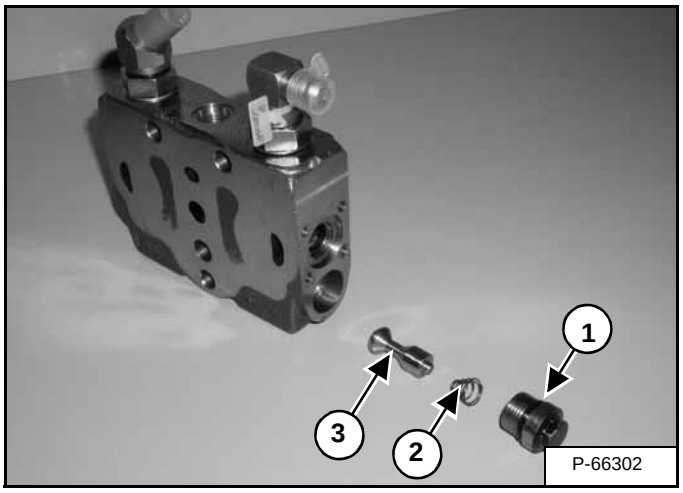
Remove the spring assembly (Item 1), washer (Item 2), O-ring (Item 3) and spool (Item 4) **[Figure 20-40-117]**.

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.

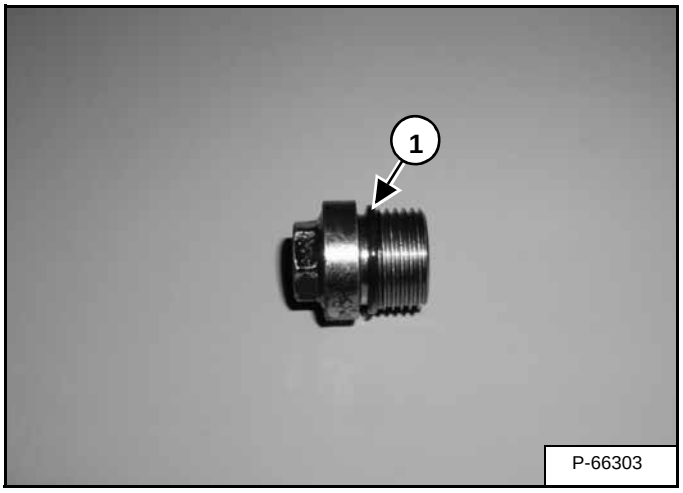
Figure 20-40-118



Remove the plug (Item 1), spring (Item 2) and valve assembly (Item 3) **[Figure 20-40-118]**.

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

Figure 20-40-119

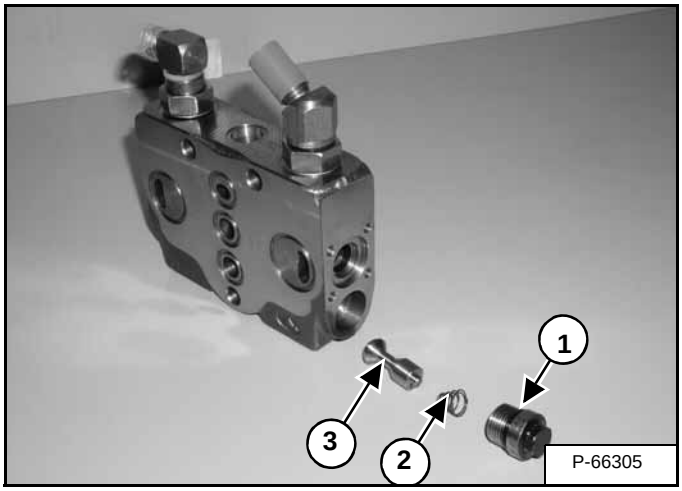


Remove the O-ring (Item 1) **[Figure 20-40-119]** from the plug.

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

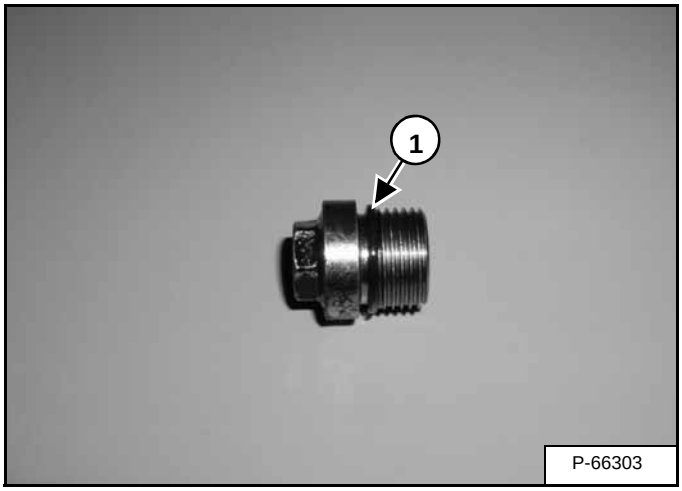
Figure 20-40-120



Remove the plug (Item 1), spring (Item 2) and valve assembly (Item 3) **[Figure 20-40-120]**.

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

Figure 20-40-121



Remove the O-ring (Item 1) **[Figure 20-40-121]** from the plug.

Dealer Copy -- Not for Resale

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.

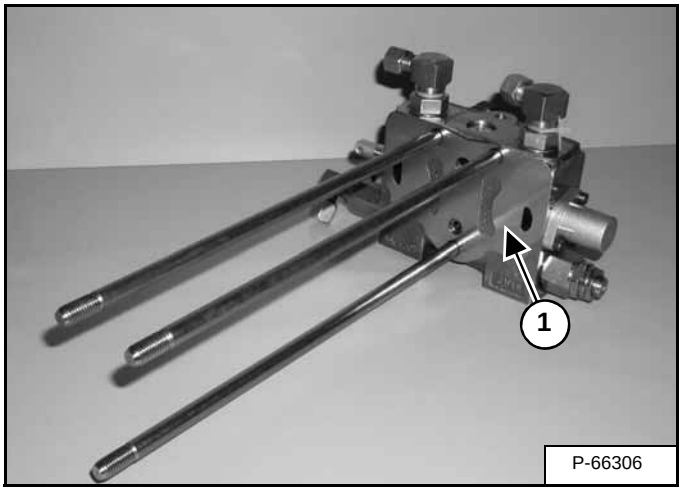
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

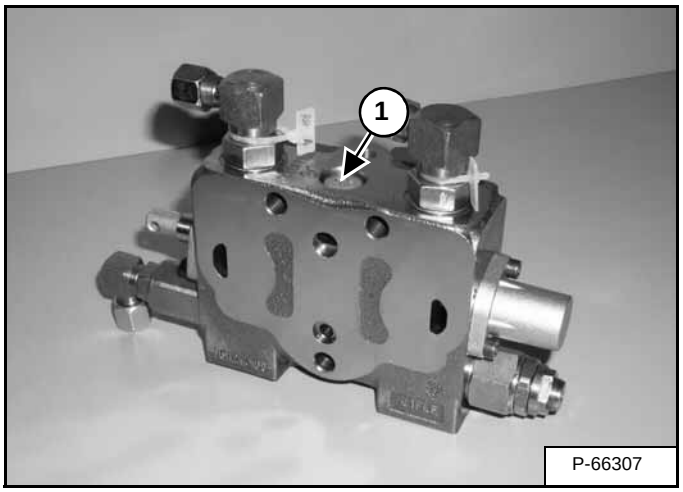
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-122



Remove the right travel valve (Item 1) **[Figure 20-40-122]** from the rods.

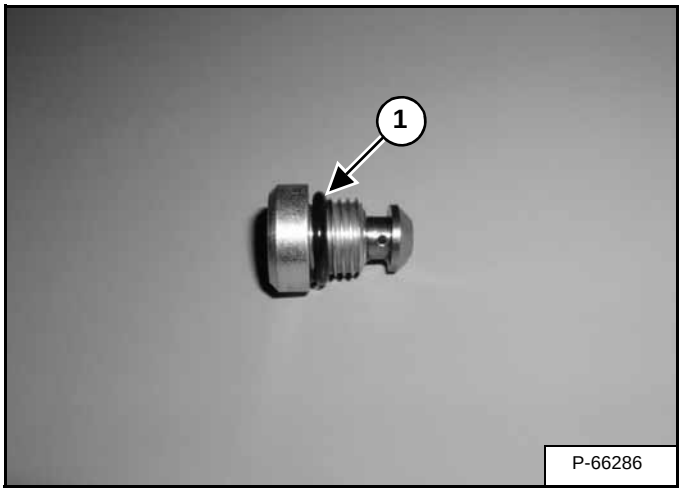
Figure 20-40-123



Remove the plug (Item 1) **[Figure 20-40-123]** from the right travel valve section.

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

Figure 20-40-124

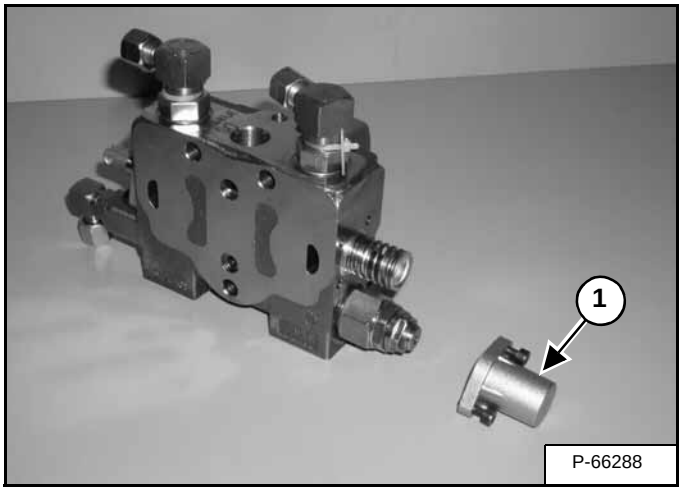


Remove the O-ring (Item 1) **[Figure 20-40-124]** from the plug.

Dealer Copy -- Not for Resale

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

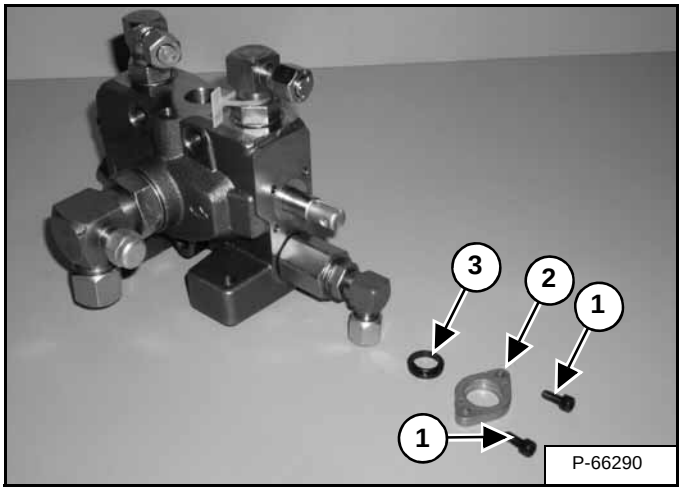
Figure 20-40-125



Remove the bolts and cap (Item 1) **[Figure 20-40-125]**.

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

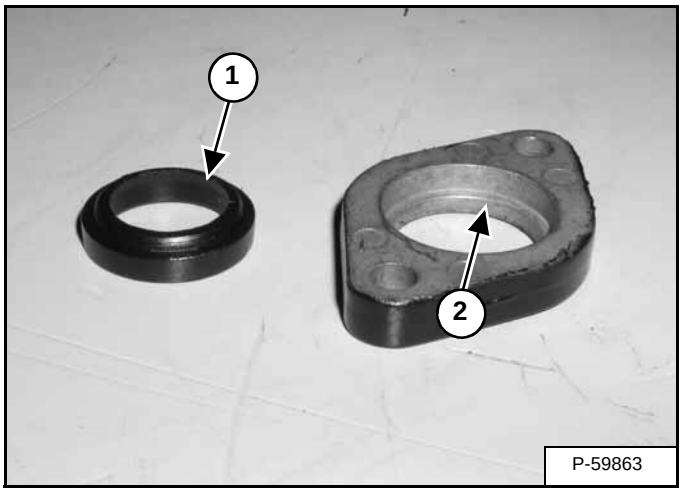
Figure 20-40-126



Remove the bolts (Item 1), retaining plate (Item 2) and seal (Item 3) **[Figure 20-40-126]**.

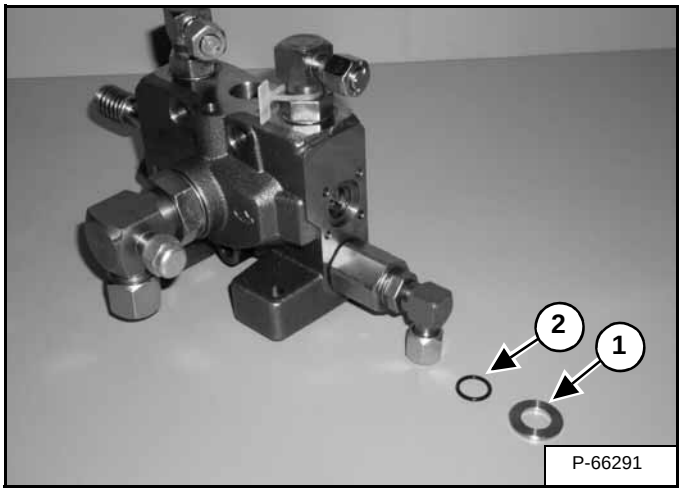
Installation: Tighten the bolts to 5 ft.-lb. (6,6 N•m) torque.

Figure 20-40-127



Installation: Make sure the lip (Item 1) of the seal fits inside the retaining plate (Item 2) **[Figure 20-40-127]**.

Figure 20-40-128

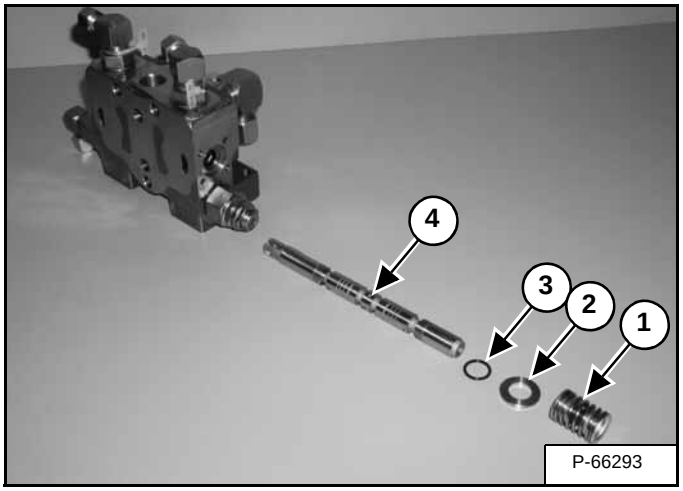


Remove the washer (Item 1) and O-ring (Item 2) **[Figure 20-40-128]** from the valve.

Dealer Copy -- Not for Resale

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

Figure 20-40-129



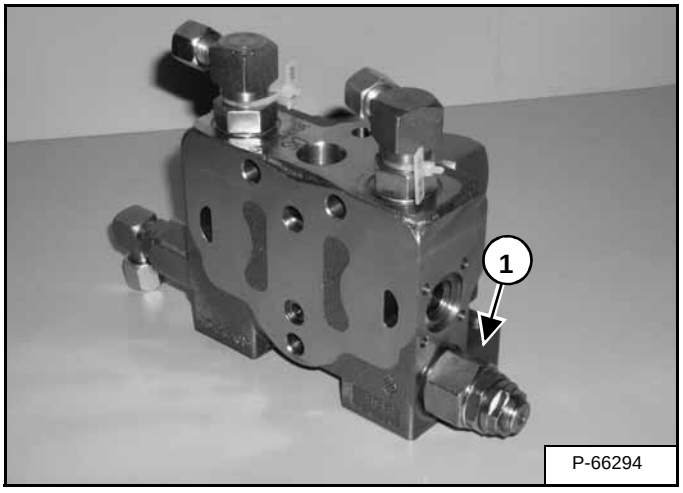
Remove the spring assembly (Item 1), washer (Item 2), O-ring (Item 3) and spool (Item 4) **[Figure 20-40-129]**.

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.

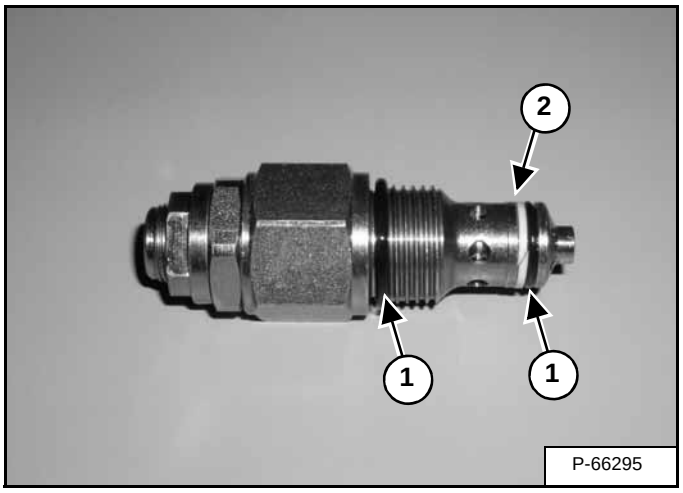
Figure 20-40-130



Remove the main relief valve (Item 1) **[Figure 20-40-130]**.

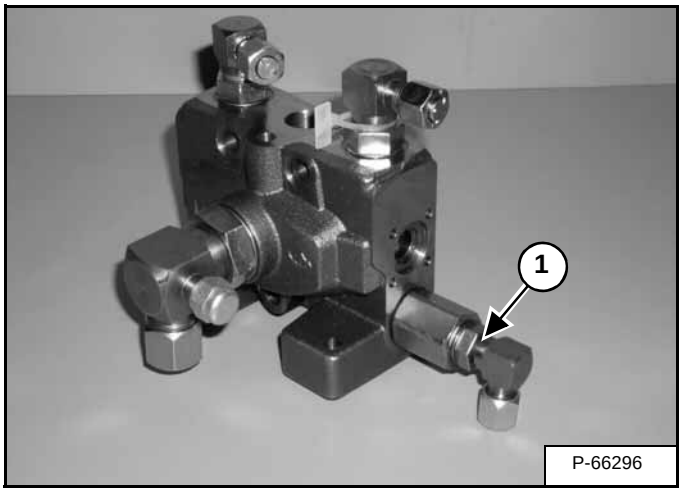
Installation: Tighten the plug to 31 ft.-lb. (42 N•m) torque.

Figure 20-40-131



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-131]** from the main relief valve.

Figure 20-40-132

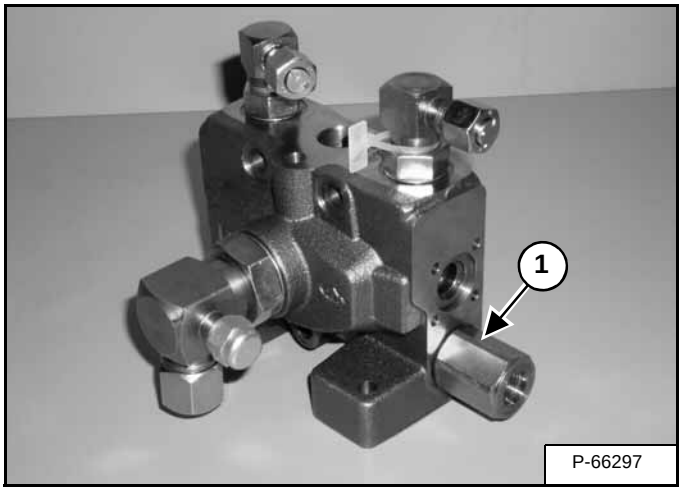


Remove the hydraulic fitting (Item 1) **[Figure 20-40-132]**.

Dealer Copy -- Not for Resale

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

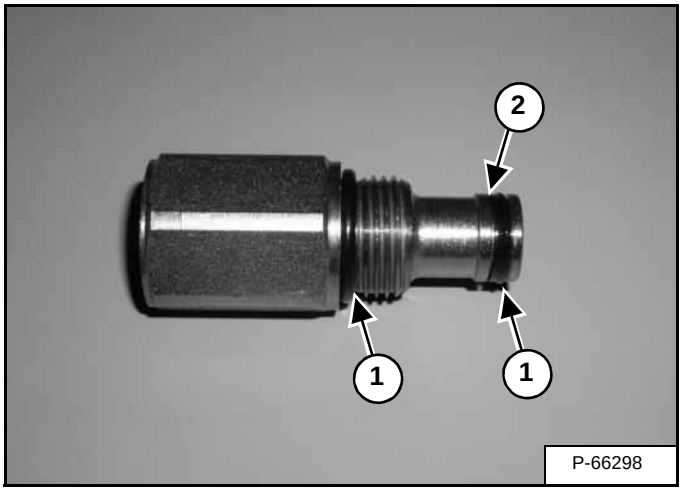
Figure 20-40-133



Remove the fitting (Item 1) **[Figure 20-40-133]**.

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

Figure 20-40-134



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-134]** from the fitting.

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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.

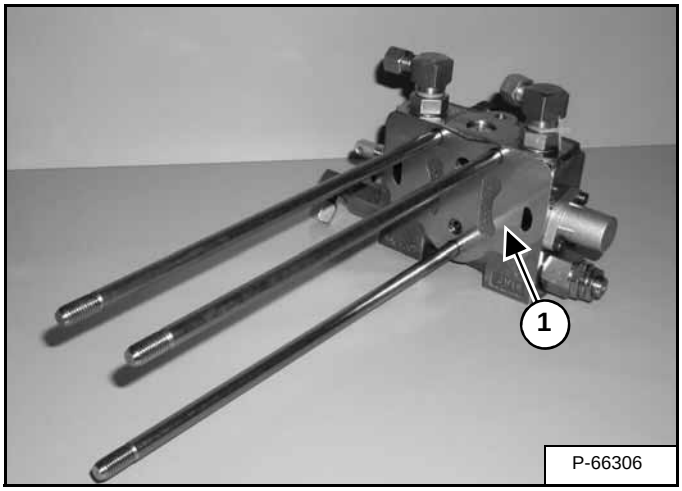
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

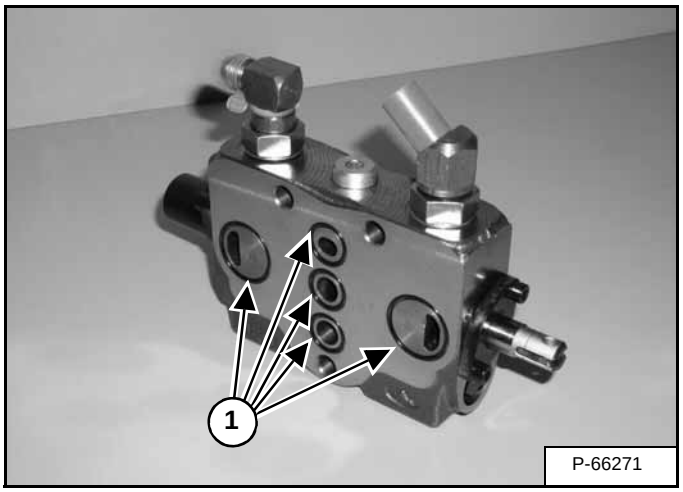
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-135



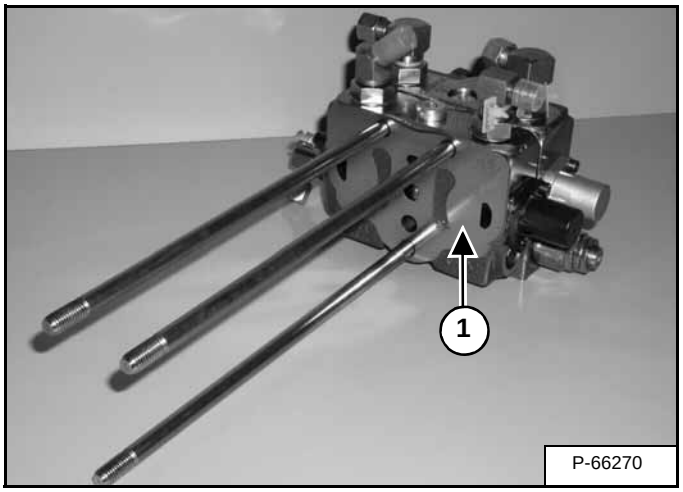
Install the tie rods (Item 1) on the right travel valve section (Item 2) **[Figure 20-40-135]**.

Figure 20-40-136



Install the O-rings (Item 1) **[Figure 20-40-136]** on the boom swing valve section.

Figure 20-40-137

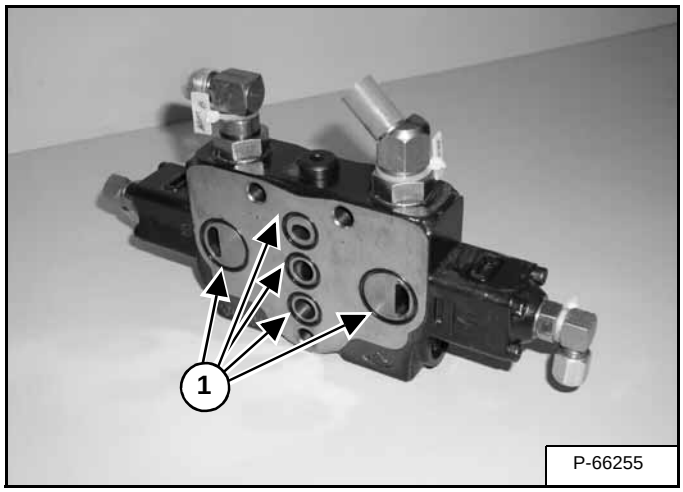


Install the boom swing valve section (Item 1) **[Figure 20-40-137]** on the tie rods.

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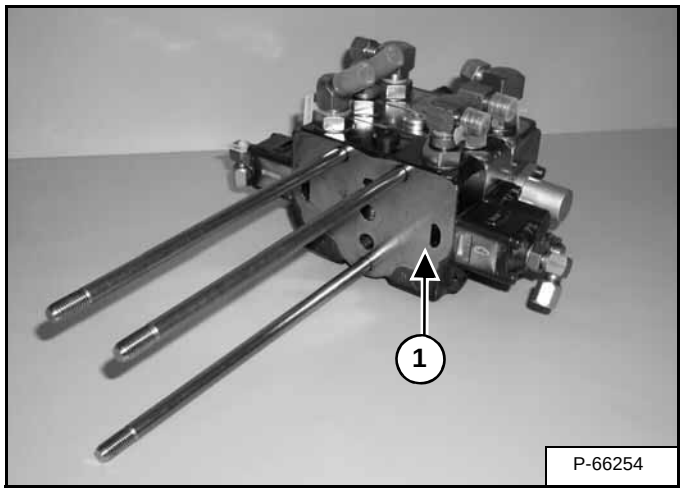
Assembly (Cont'd)

Figure 20-40-138



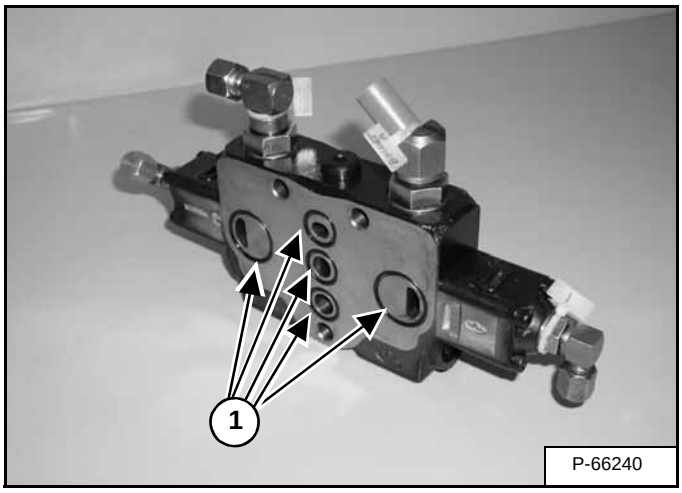
Install the O-rings (Item 1) **[Figure 20-40-138]** on the arm valve section.

Figure 20-40-139



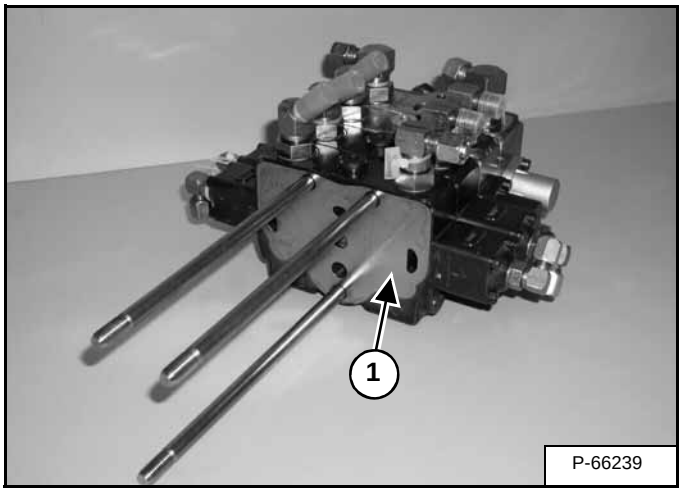
Install the arm valve section (Item 1) **[Figure 20-40-139]** on the tie rods.

Figure 20-40-140



Install the O-rings (Item 1) **[Figure 20-40-140]** on the bucket valve section.

Figure 20-40-141

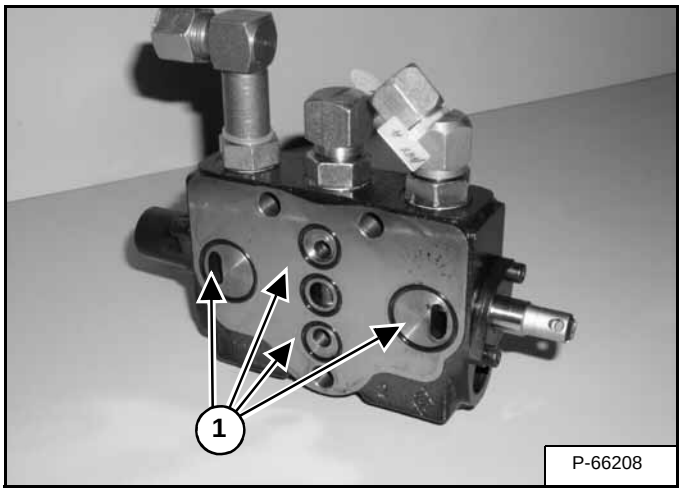


Install the bucket valve section (Item 1) **[Figure 20-40-141]** on the tie rods.

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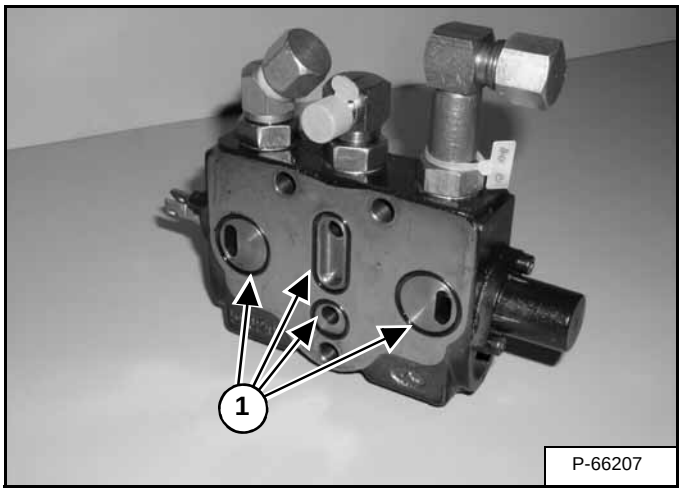
Assembly (Cont'd)

Figure 20-40-142



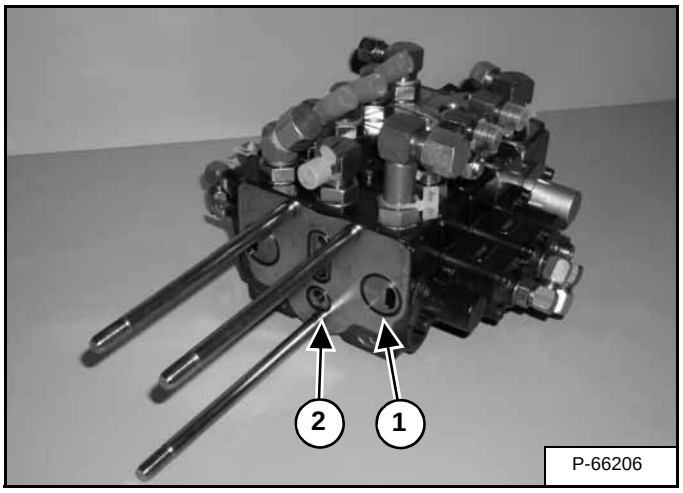
Install the O-rings (Item 1) **[Figure 20-40-142]** on the auxiliary valve section.

Figure 20-40-143



Install the O-rings (Item 1) **[Figure 20-40-143]** on the auxiliary valve section.

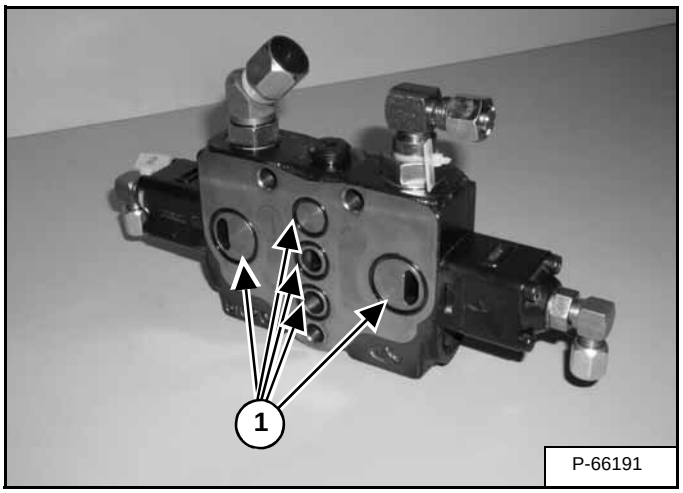
Figure 20-40-144



Install the auxiliary valve section (Item 1) **[Figure 20-40-144]** 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 20-40-144] before installing the bottom tie rod.

Figure 20-40-145

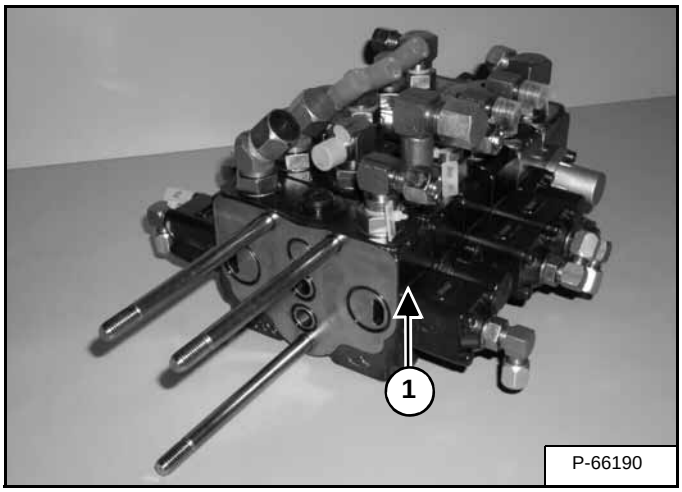


Install the O-rings (Item 1) **[Figure 20-40-145]** on the side of the boom valve section.

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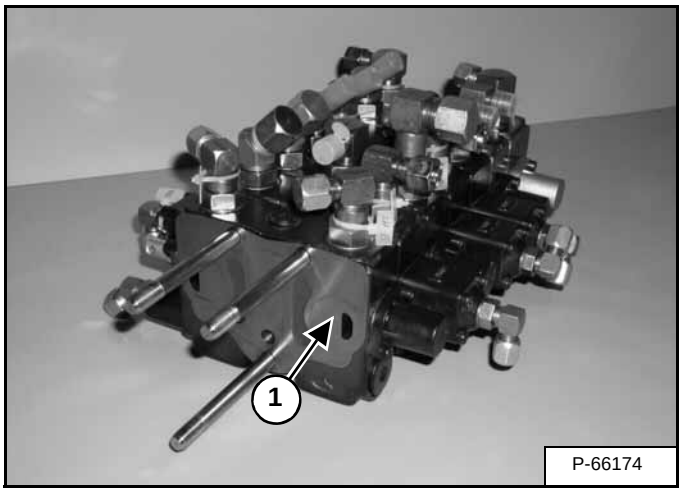
Assembly (Cont'd)

Figure 20-40-146



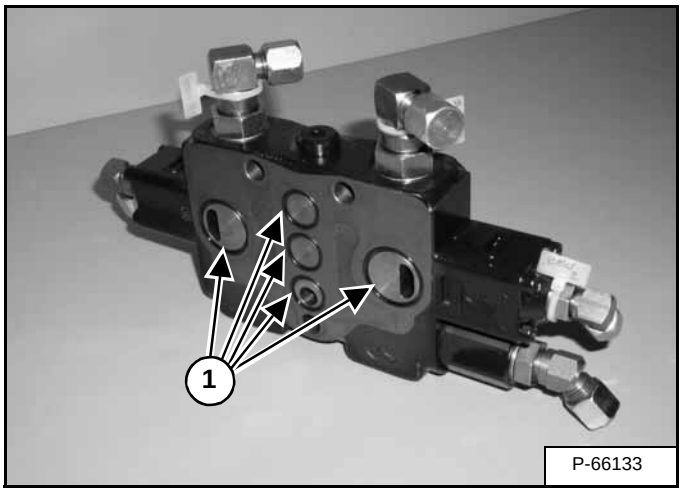
Install the boom valve section (Item 1) **[Figure 20-40-146]** on the tie rods.

Figure 20-40-147



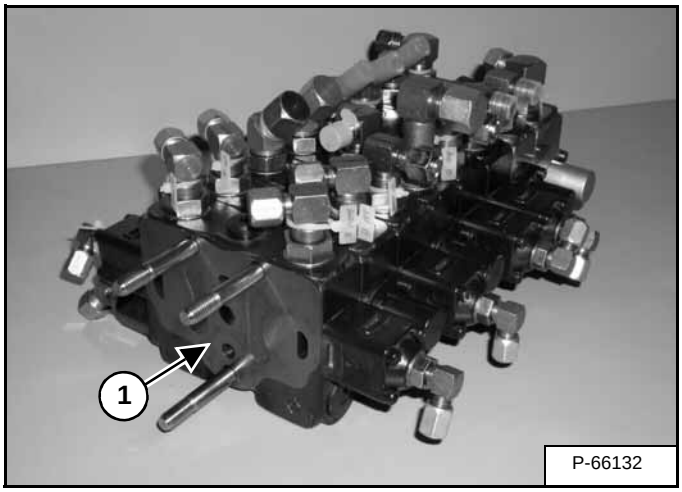
Install the left travel valve section (Item 1) **[Figure 20-40-147]** on the tie rods.

Figure 20-40-148



Install the O-rings (Item 1) **[Figure 20-40-148]** on the slew valve section.

Figure 20-40-149

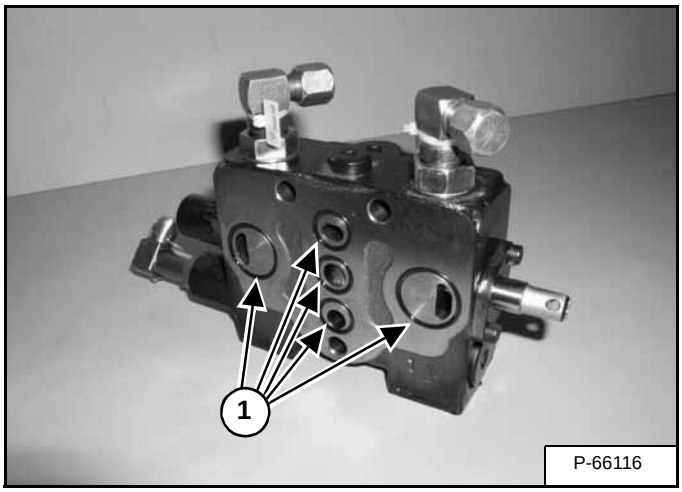


Install the slew valve section (Item 1) **[Figure 20-40-149]** on the tie rods.

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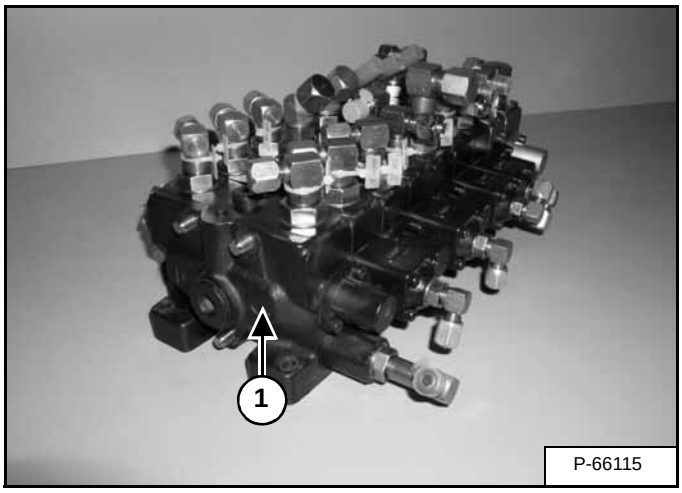
Assembly (Cont'd)

Figure 20-40-150



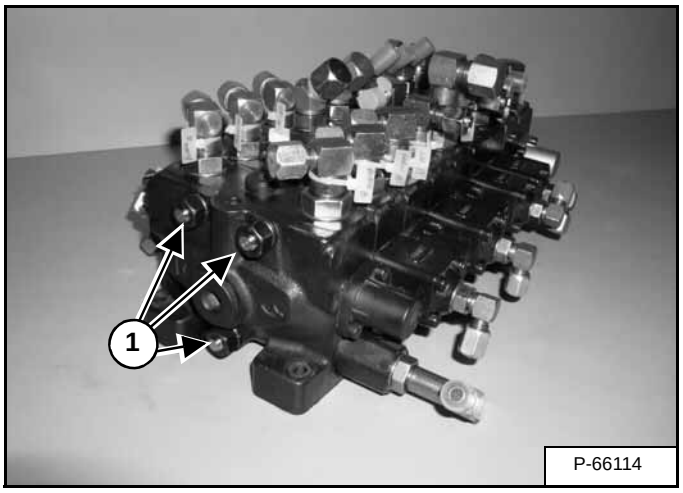
Install the O-rings (Item 1) **[Figure 20-40-150]** on the blade valve section.

Figure 20-40-151



Install the blade valve (Item 1) **[Figure 20-40-151]** on the tie rods.

Figure 20-40-152



Install the washers and nuts (Item 1) **[Figure 20-40-152]** 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 20-40-152]** to 10 ft.-lb. (13 N•m) torque in a crisscross manner.

Final tighten the tie rod nuts (Item 1) **[Figure 20-40-152]** 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.

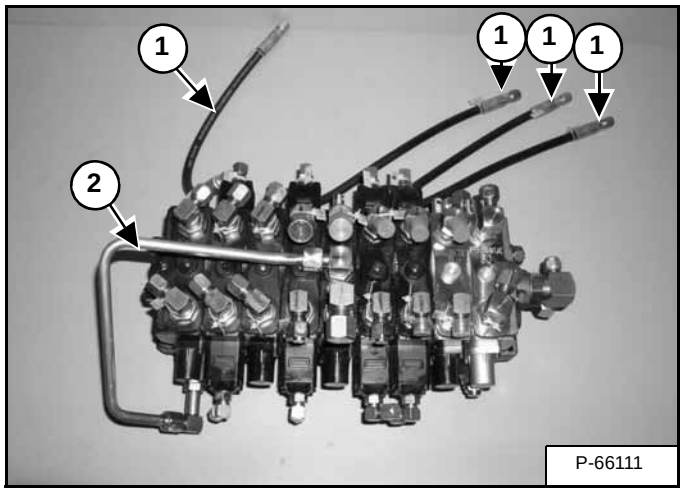
The spools must not stick, if the spools do stick, loosen the tie rod nuts and tighten per above information.

Recheck the control valve assembly for level settings.

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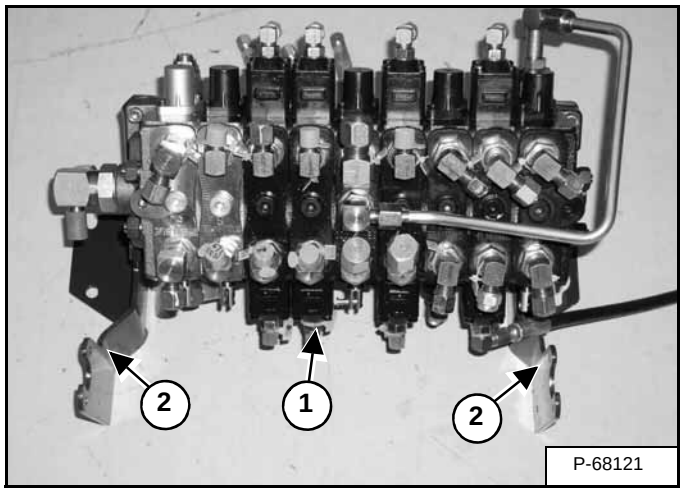
Assembly (Cont'd)

Figure 20-40-153



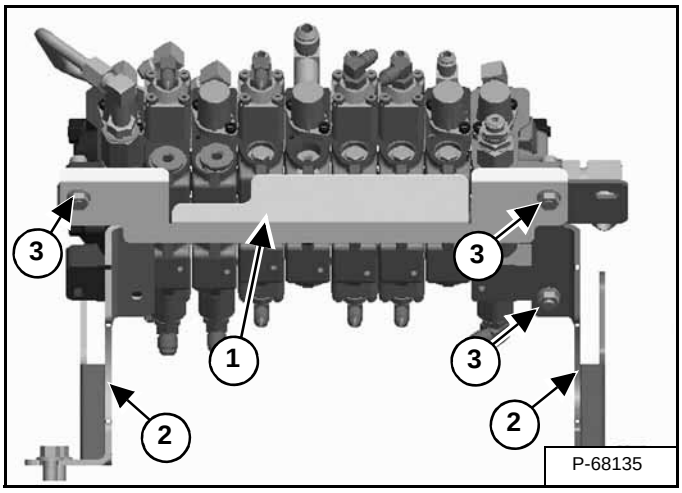
Install the hoses (Item 1) and tubeline (Item 2) **[Figure 20-40-153]**.

Figure 20-40-154



Install the valve (Item 1) on the mounting brackets (Item 2) **[Figure 20-40-154]**.

Figure 20-40-155



Install the hose shield (Item 1) **[Figure 20-40-155]** on the bottom of the mounting brackets (Item 2) **[Figure 20-40-154]** & **[Figure 20-40-155]** and attach using the three bolts and nuts (Item 3) **[Figure 20-40-155]**.

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HYDRAULIC PUMP

Description

The hydraulic gear pump is attached to the end of the engine flywheel behind the tailgate.

The hydraulic gear pump is a triple gear pump that provides hydraulic flow to the hydraulic systems. The first gear pump section, located nearest the engine, provides flow to the slew and blade/track expansion functions. The second and third gear pump sections provide flow the right travel, left travel, boom swing, arm, bucket, auxiliary and boom functions.

Testing The Hydraulic Pump

The hydraulic pump flow is 2.64 GPM (110 L/min.) for pump sections one, two and three at 2500 RPM.

NOTE: Pump Section 1 is closest to the engine.

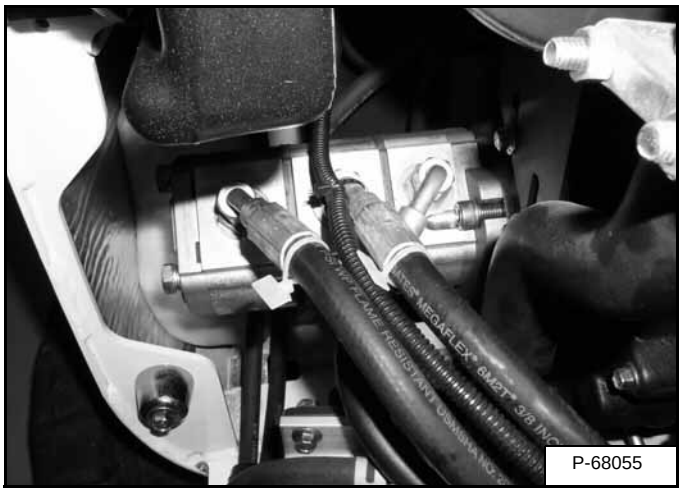
The following tool will be needed for the hydraulic pump test:

MEL10003 - Hydraulic Tester

Stop the engine.

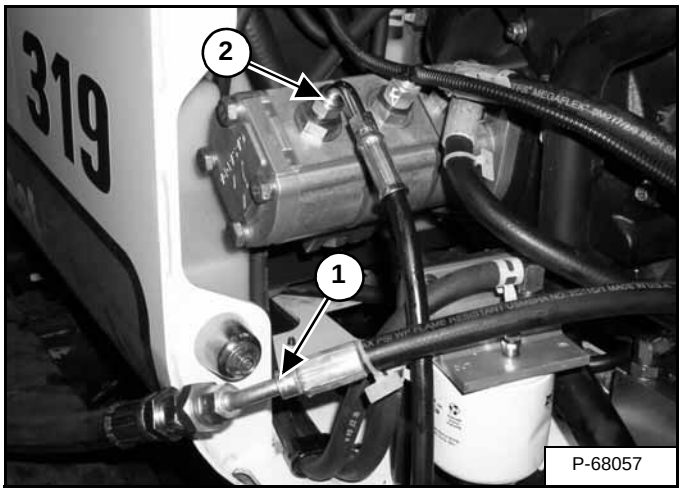
Open the tailgate.

Figure 20-50-1



Remove the outlet hose, of the section to be tested, from the hydraulic pump section for testing **[Figure 20-50-1]**.

Figure 20-50-2



Connect the hose removed from the pump (Item 1) **[Figure 20-50-2]** to the outlet of the tester.

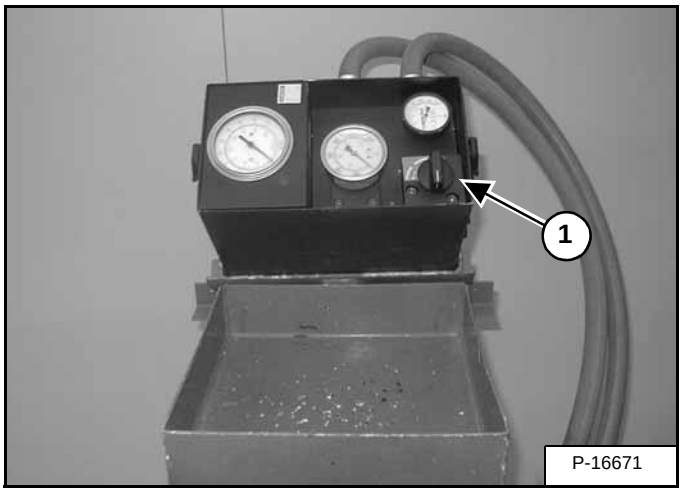
Connect the inlet hose of the tester to the fitting on the pump (Item 2) **[Figure 20-50-2]**.

NOTE: The tester connections will be the same for each pump section.

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Testing The Hydraulic Pump (Cont'd)

Figure 20-50-3



NOTE: Open the flow control knob on the hydraulic tester (Item 1) [Figure 20-50-3] fully to prevent pump damage.

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

Record the pump free flow GPM (L/min.).

Close the flow control knob (Item 1) **[Figure 20-50-3]** slowly to approximately 100 PSI below the relief valve setting which is 3220 to 3420 PSI (222 to 236 bar).

Record the pump high pressure flow GPM (L/min.).

NOTE: The high pressure flow must be at least 80% of free flow.

$$\%= \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \times 100$$

If the high pressure flow is less than 80% of free flow, remove the hydraulic pump for repair or replacement.

Repeat the testing procedure for each pump section.

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Removal And Installation

Lower the boom/bucket and blade to the ground.

Relieve hydraulic pressure.

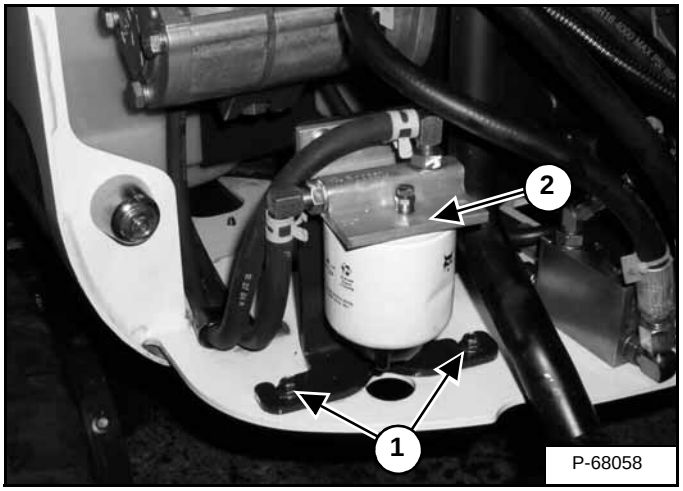
Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-100-2.)

IMPORTANT

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

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Figure 20-50-4



Loosen the bolts and nuts (Item 1) **[Figure 20-50-4]** from the fuel filter bracket.

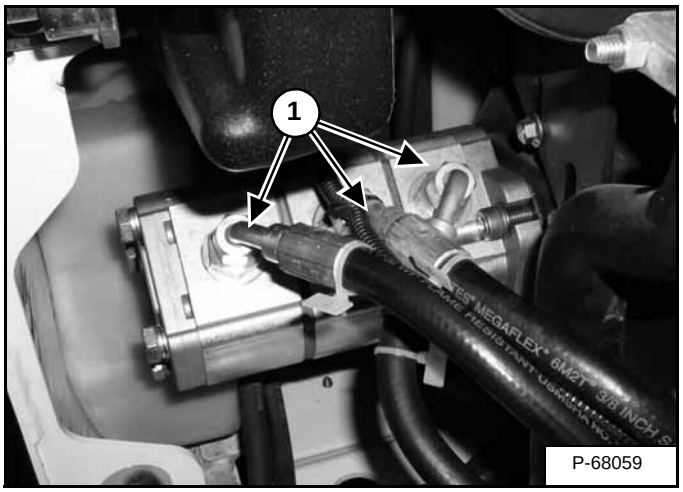
Move the fuel filter and bracket assembly (Item 2) **[Figure 20-50-4]** away from the front of the hydraulic pump.

⚠ WARNING

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

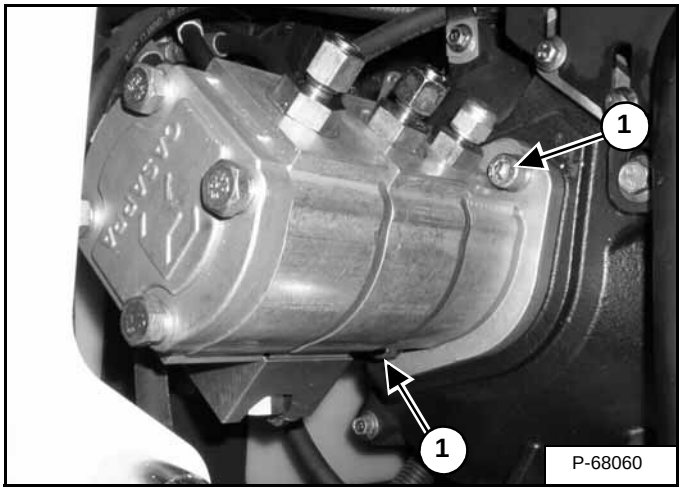
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Figure 20-50-5



Remove the three pressure hoses (Item 1) **[Figure 20-50-5]**. Cap and plug the hoses and fittings.

Figure 20-50-6



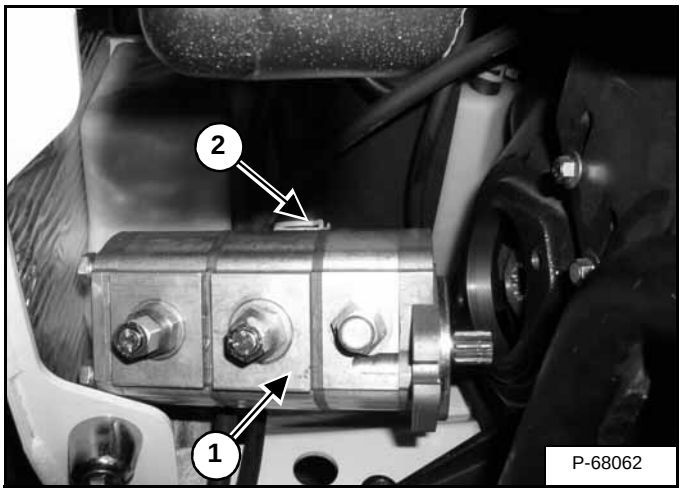
Remove the bolts (Item 1) **[Figure 20-50-6]** from the pump flange.

Installation: Tighten the bolts to 52.5 to 58.5 ft.-lb. (71 to 79 N•m) torque.

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Removal And Installation (Cont'd)

Figure 20-50-7

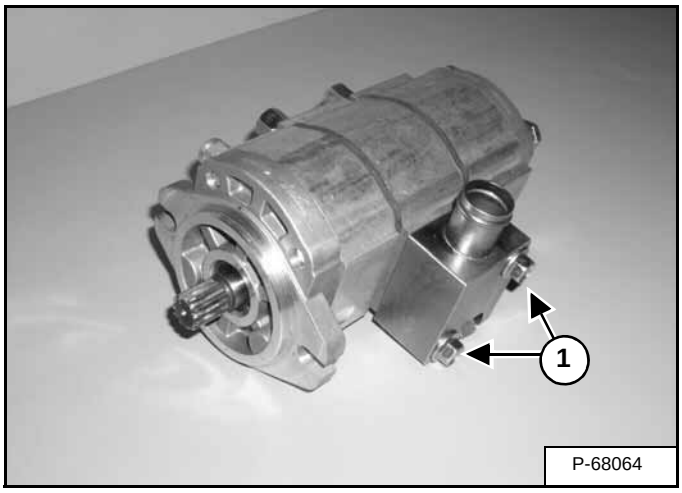


Remove the hydraulic pump (Item 1) **[Figure 20-50-7]** from the flywheel housing by sliding the pump straight out.

Release the hose clamp (Item 2) **[Figure 20-50-7]** on the inlet hose and pull the inlet hose off of the pump.

Remove the hydraulic pump from the excavator.

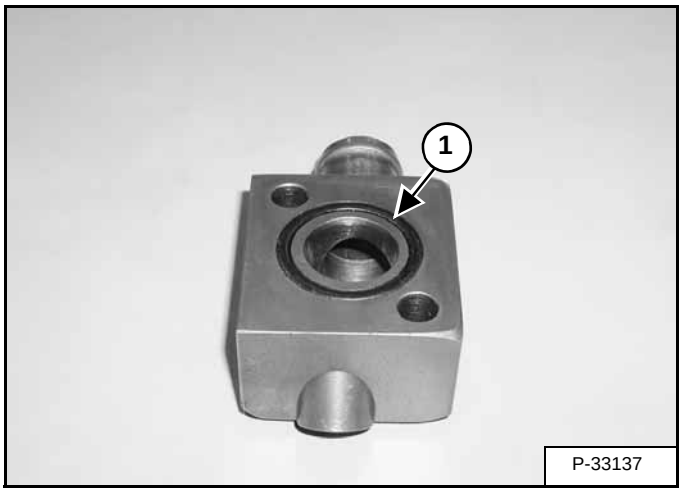
Figure 20-50-8



Remove the two bolts (Item 1) from the inlet block (Item 2) **[Figure 20-50-8]**.

Remove the inlet block.

Figure 20-50-9

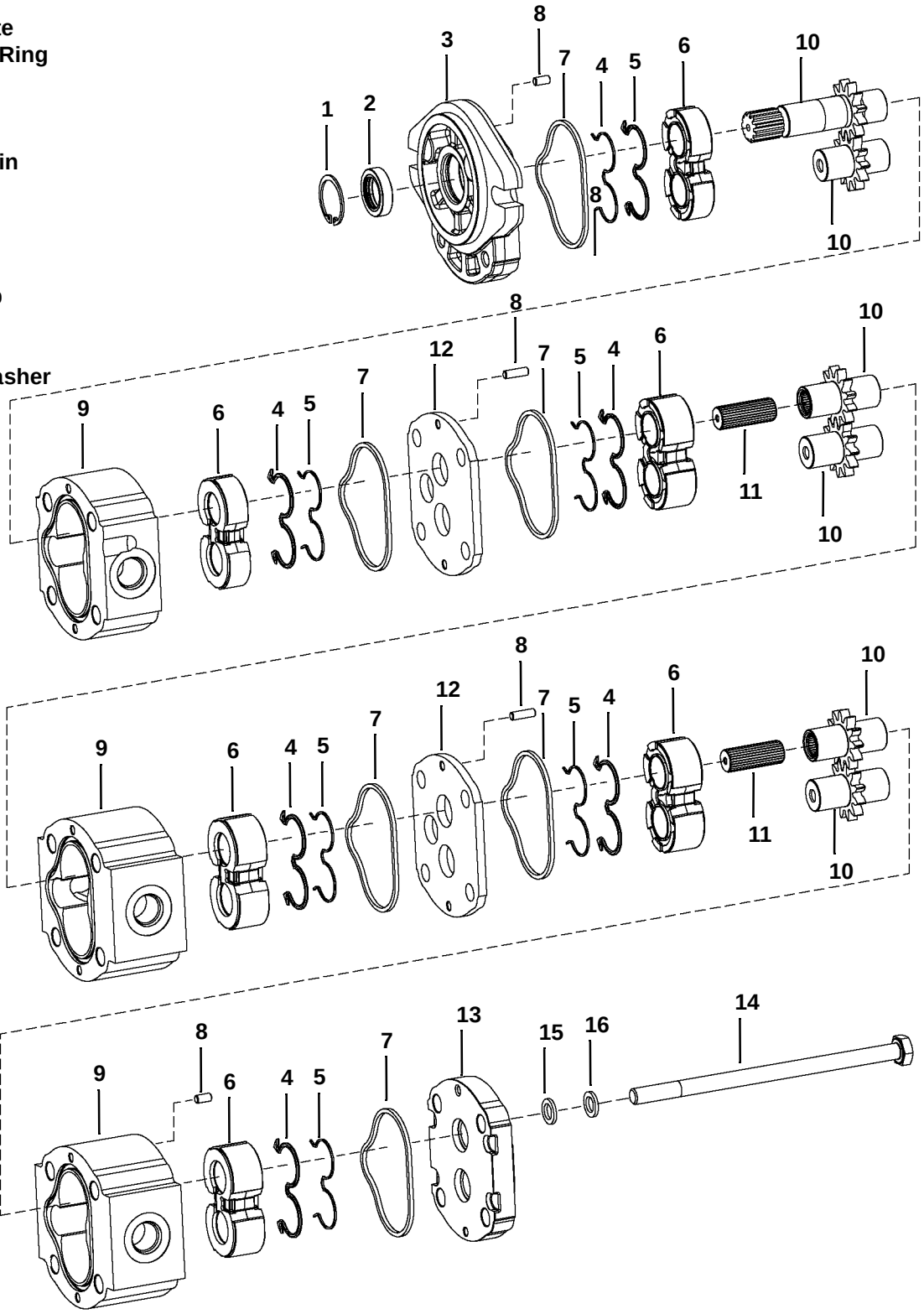


Remove the O-ring (Item 1) **[Figure 20-50-9]** from the inlet block.

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Parts Identification

1. Snap Ring
2. Seal
3. End Plate
4. Backup Ring
5. E-Seal
6. Bearing
7. Seal
8. Dowel Pin
9. Housing
10. Gear
11. Coupler
12. Plate
13. End Cap
14. Bolt
15. Washer
16. Lock Washer



MS2043S

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Disassembly

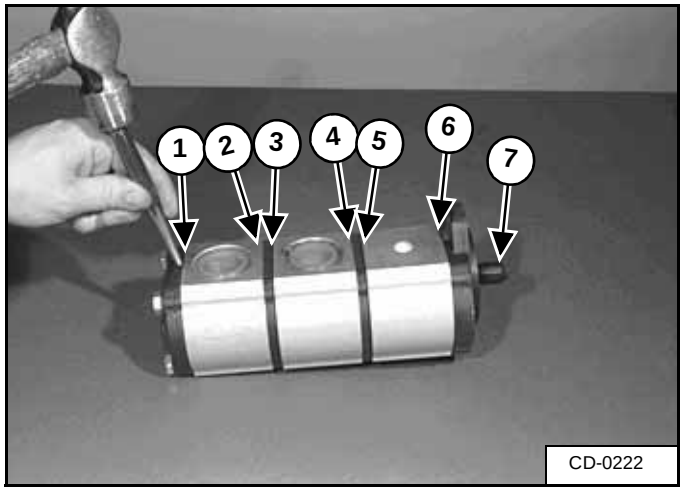
Clean the outside of the gear pump before disassembly.

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.

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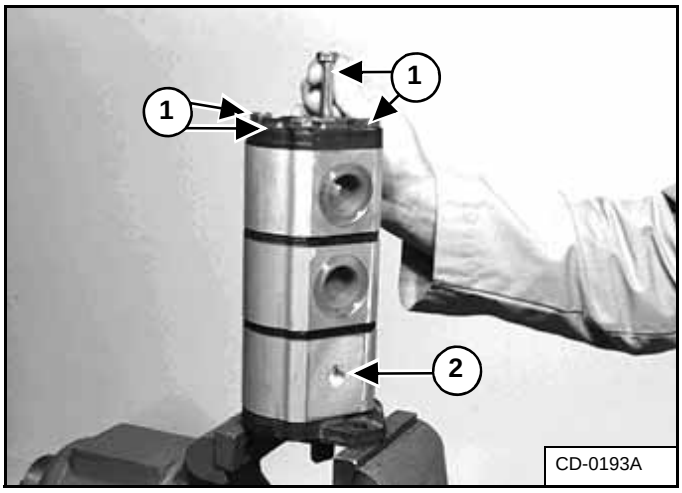
Figure 20-50-10



Mark both sides of each separation point (Items 1-6) **[Figure 20-50-10]** on the inlet side of the pump, as shown, with the corresponding separation point number.

Tape the shaft splines (Item 7) **[Figure 20-50-10]** to make sure that the splines will not damage the oil seal when the shaft is removed.

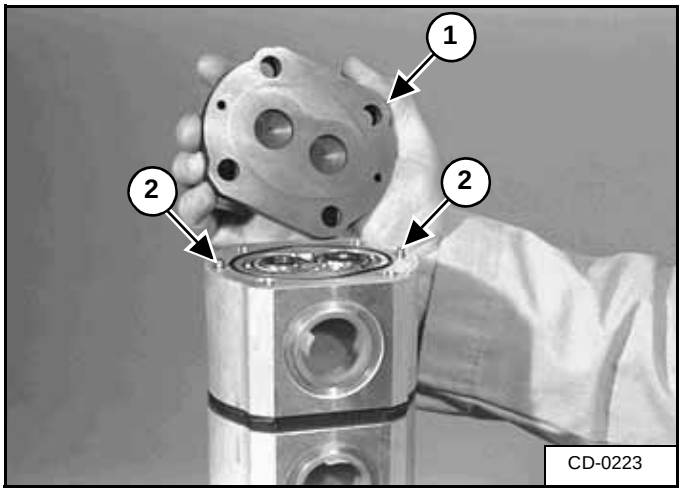
Figure 20-50-11



Put the pump, mounting flange down, in a protected jaw vise. Remove the four assembly bolts (Item 1) **[Figure 20-50-11]**.

NOTE: The pump has only two inlet ports. The pump section without the inlet port is located in section one (closest to the input shaft) (Item 2) [Figure 20-50-11].

Figure 20-50-12

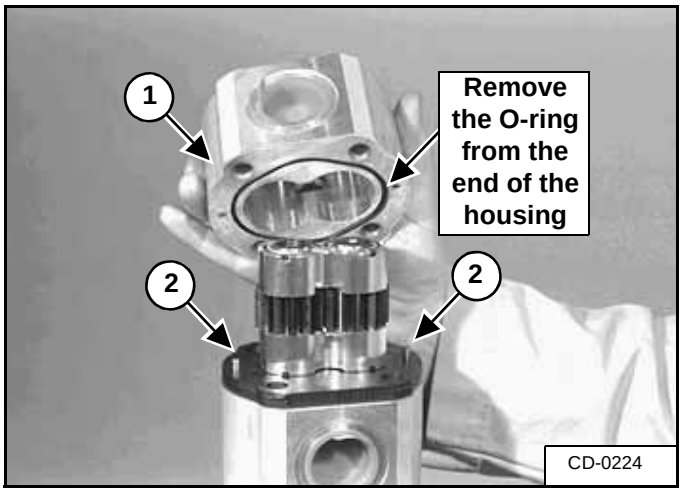


Remove the end cap (or separating plate) (Item 1) and two dowel pins (Item 2) **[Figure 20-50-12]**.

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Disassembly (Cont'd)

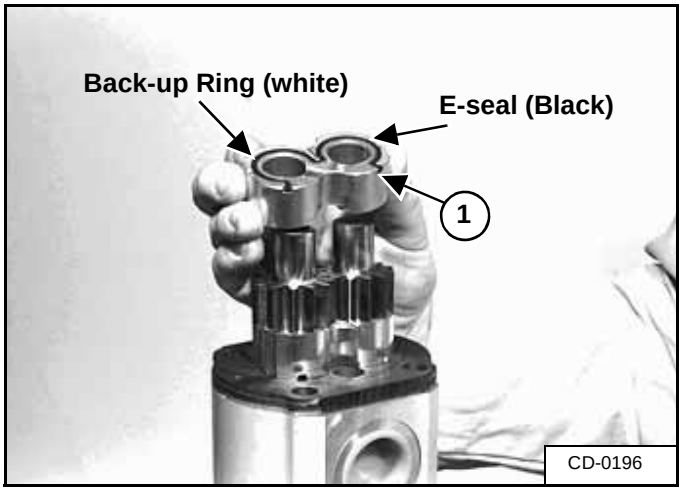
Figure 20-50-13



Remove the gear housing (Item 1) and two dowel pins (Item 2) **[Figure 20-50-13]**.

Remove the O-ring from each end of the gear housing **[Figure 20-50-13]**.

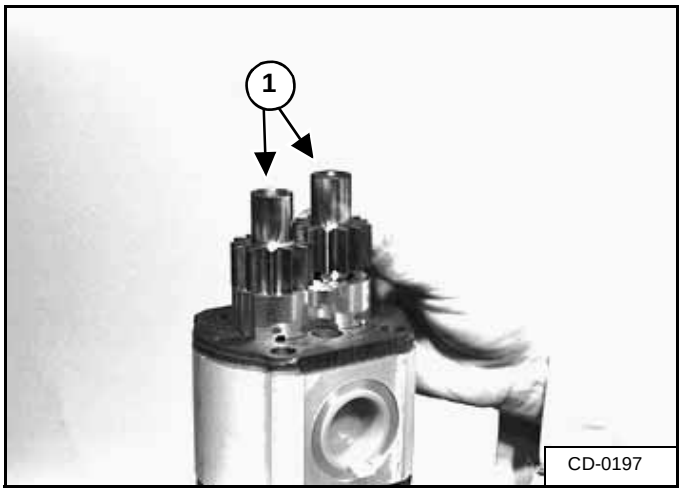
Figure 20-50-14



Remove the upper bearing (Item 1) **[Figure 20-50-14]**.

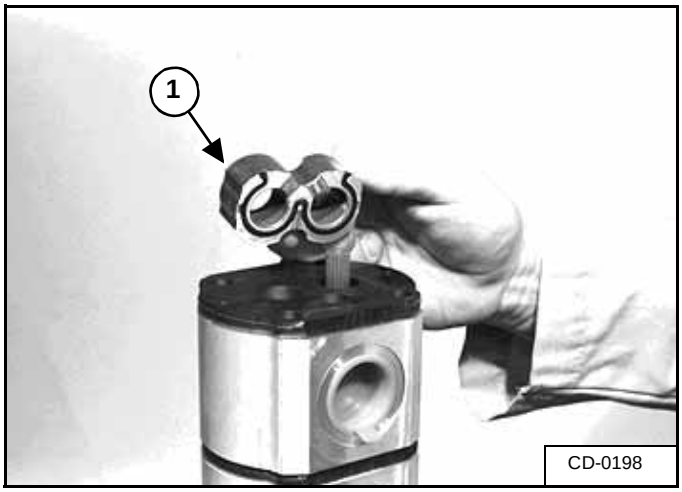
Remove the back-up ring and E-seal from the bearing.

Figure 20-50-15



Remove the drive and idler gears (Item 1) **[Figure 20-50-15]**.

Figure 20-50-16



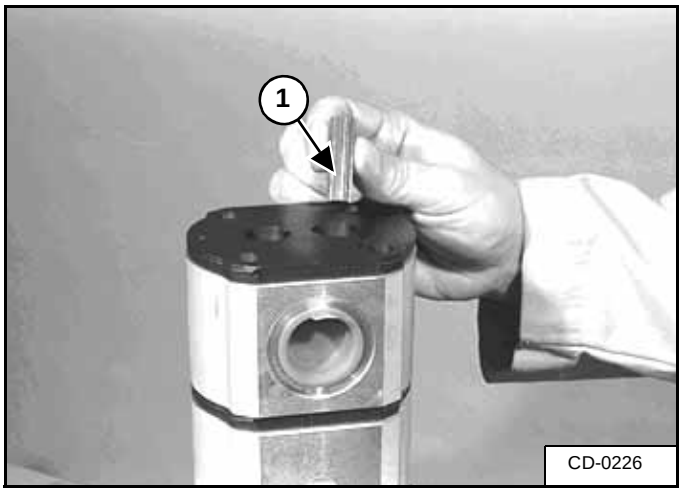
Remove the lower bearing (Item 1) **[Figure 20-50-16]**.

Remove the back-up ring and E-seal from the bearing.

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Disassembly (Cont'd)

Figure 20-50-17

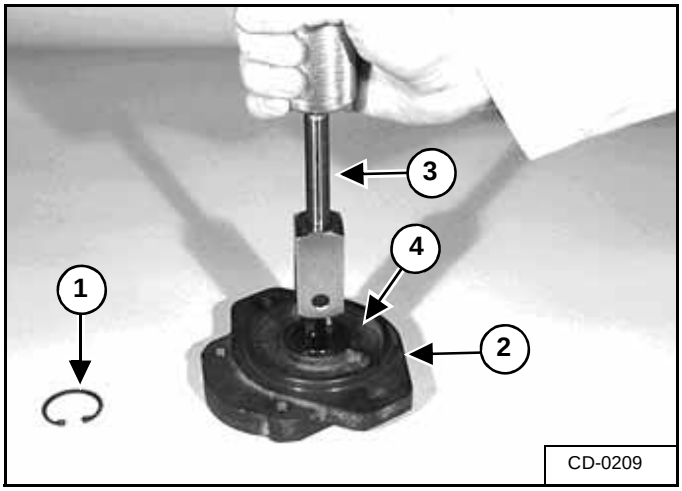


Remove the coupling (Item 1) **[Figure 20-50-17]**.

Repeat step **[Figure 20-50-12 on Page 20-50-6]** through step **[Figure 20-50-17]** to disassemble each of the remaining pump sections. Keep the parts from each section separate from the other sections.

NOTE: The gear housing, two bearings, drive gear and idler gear in each pump section are not serviced separately. These parts are matched sets which are run in at the factory. If any part is damaged, the entire section must be replaced.

Figure 20-50-18



Remove the retaining ring (Item 1) from the mounting flange, (Item 2). Using a seal puller (Item 3), remove the oil seal (Item 4) **[Figure 20-50-18]**.

Assembly

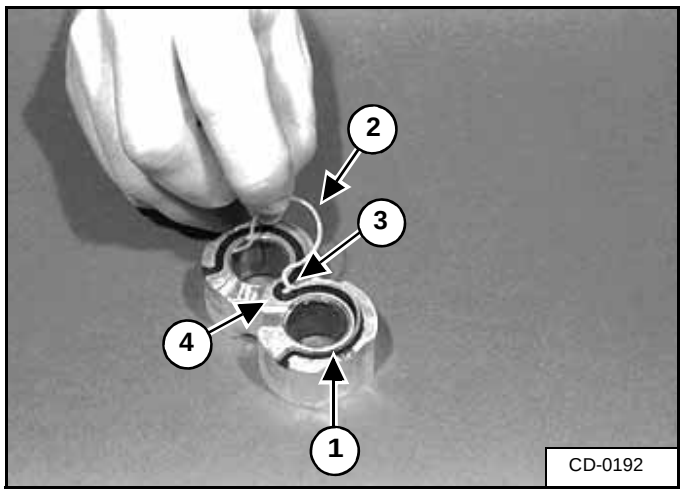
Clean all parts in solvent and dry with compressed air.

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 and all E-seals with assembly lube before installation.

Use the correct size driver and install the oil seal (seal lips to the inside of the pump) (Item 4) into the mounting flange (Item 2). Install the retaining ring (Item 1) **[Figure 20-50-18]**.

Figure 20-50-19



Install an E-seal (Item 1) **[Figure 20-50-19]** stepped side up, into each E-seal groove. Push each E-seal down into the groove.

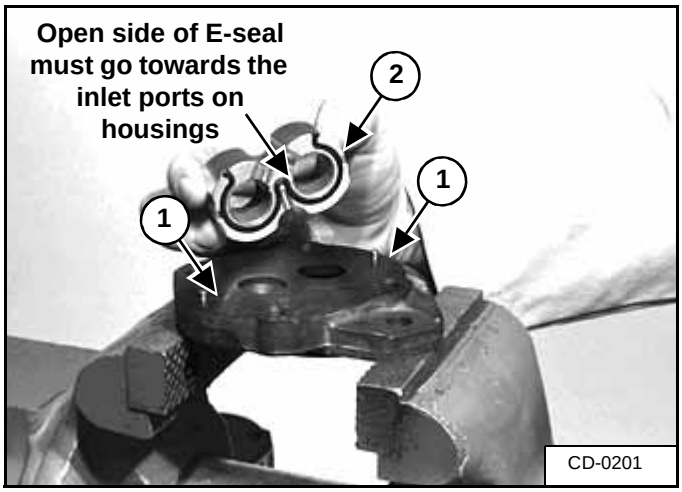
Install the back-up ring (Item 2) **[Figure 20-50-19]** into the groove made by the E-seal and bearing. Push the back-up ring down flush with the E-seal.

NOTE: There is a notch (Items 3 & 4) [Figure 20-50-19] in the center of the back-up ring and E-seal. When installing the back-up ring, make sure that these notches are aligned. If the back-up ring or E-seal are not installed correctly the back-up ring will not sit flush with the E-seal.

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Assembly (Cont'd)

Figure 20-50-20

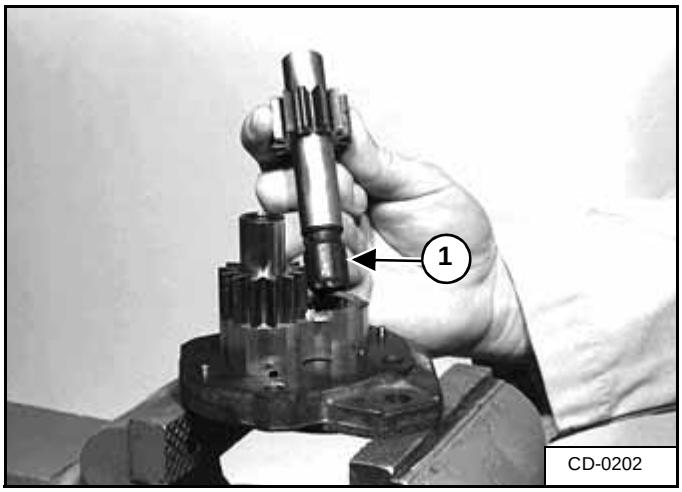


Put the mounting flange, oil seal side down, in a protected jaw vise **[Figure 20-50-20]**.

Install the two dowel pins (Item 1) **[Figure 20-50-20]** into the mounting flange (or separating plate).

Install the lower bearing (Item 2), seal side down, on the mounting flange (or separating plate). The open side of the E-seal must point toward the inlet port side (marked side) of the pump **[Figure 20-50-20]**.

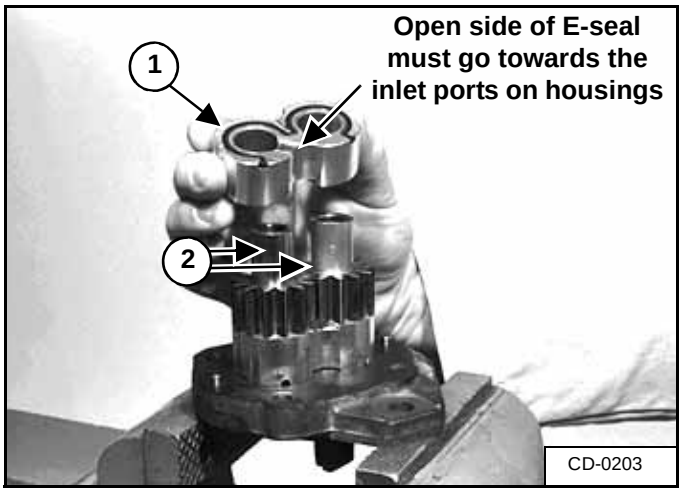
Figure 20-50-21



Tape the splined end (Item 1) **[Figure 20-50-21]** of the drive gear to make sure that the splines will not damage the oil seal during installation.

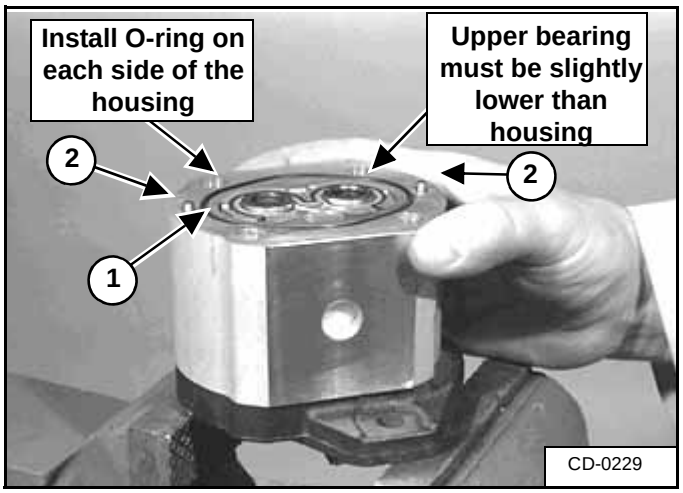
Apply oil to the drive gear and idler gear and to the side faces of the gears. Install the gears into the lower bearing **[Figure 20-50-21]**.

Figure 20-50-22



Install the upper bearing (Item 1), seal side up, on the drive and idler gears (Item 2). The open side of the E-seal must point toward the inlet port side (marked side) of the pump **[Figure 20-50-22]**.

Figure 20-50-23



Install O-rings (Item 1) **[Figure 20-50-23]** on each end of the gear housing.

Align the marks made during disassembly on the gear housing and mounting flange (or separating plate). Carefully install the gear housing over the bearings and gears **[Figure 20-50-23]**.

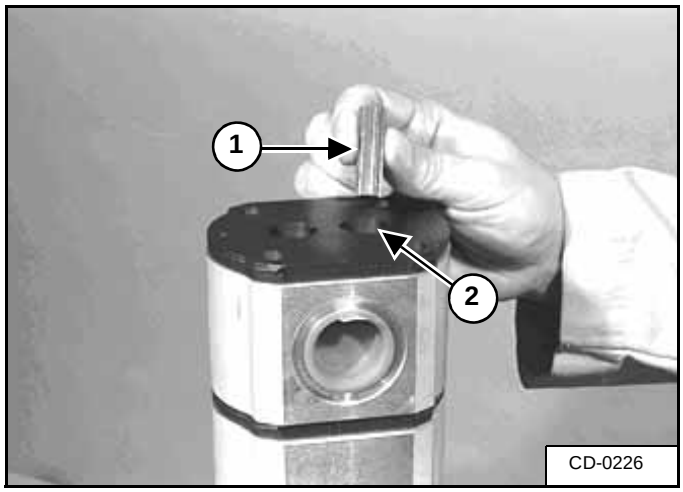
NOTE: The upper bearing must be slightly lower than the gear housing. If the bearing is higher than the housing, disassemble the pump section to verify that the E-seal, back-up ring, or O-ring have not moved out of position.

Install the two dowel pins (Item 2) **[Figure 20-50-23]** into the gear housing.

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Assembly (Cont'd)

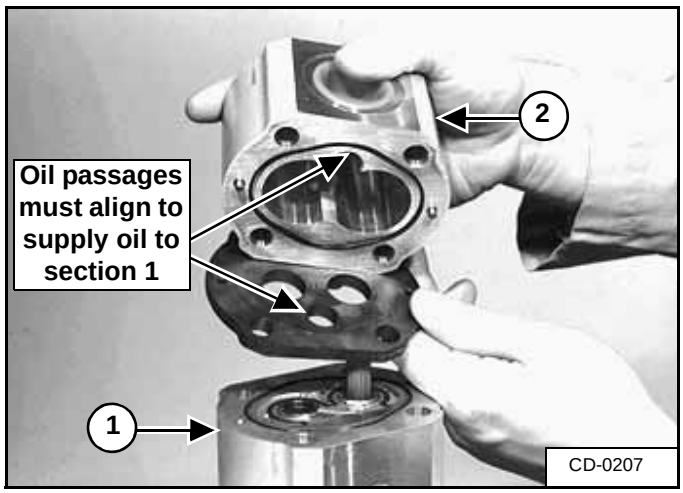
Figure 20-50-24



Apply oil to the coupling (Item 1) **[Figure 20-50-24]**.

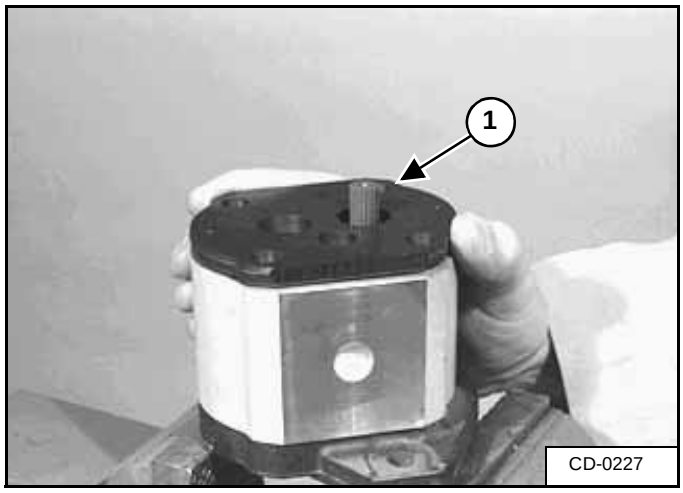
Install the coupling into the drive gear (Item 2) **[Figure 20-50-24]**.

Figure 20-50-25



NOTE: When installing the first section gear housing (Item 1) (with no inlet port), make sure that the oil passage in the housing and the separation plate align. Section one gear housing must receive oil flow through this passage from section two (center) gear housing (Item 2) [Figure 20-50-25].

Figure 20-50-26

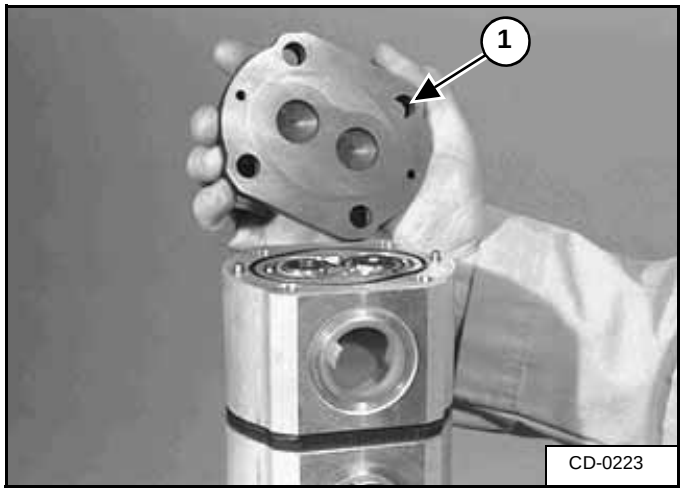


Align the marks made during disassembly on the separating plate and gear housing. Install the separating plate (Item 1) **[Figure 20-50-26]**.

Repeat step **[Figure 20-50-19 on Page 20-50-8]** through Page 20-50-11 step **[Figure 20-50-23 on Page 20-50-9]** to assemble pump section 2.

Repeat step **[Figure 20-50-19 on Page 20-50-8]** through step **[Figure 20-50-23 on Page 20-50-9]** to assemble pump section 3.

Figure 20-50-27

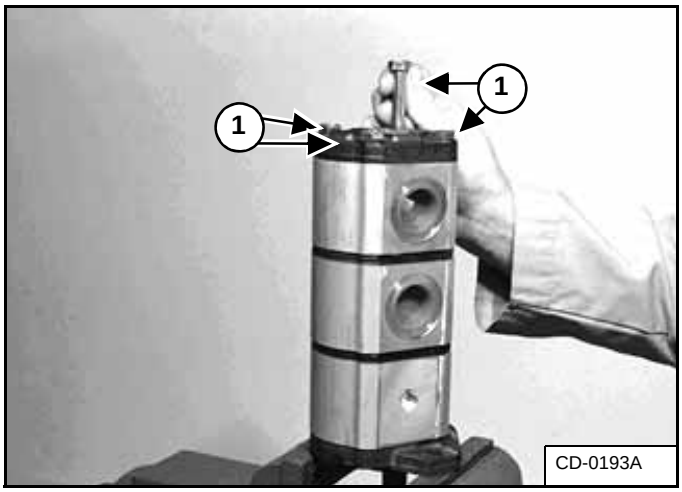


Align the marks made during disassembly on the end cap and gear housing. Install the end cap (Item 1) **[Figure 20-50-27]**.

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Assembly (Cont'd)

Figure 20-50-28



Install the four assembly bolts (Item 1) **[Figure 20-50-28]**.

Evenly tighten the bolts to a final torque of 38 to 43 ft.-lb. (52 to 58 N•m).

Rotate the input shaft periodically while tightening the bolts to make sure the pump is assembled correctly.

Using a locking plier, rotate the pump shaft to be sure there is no binding.

NOTE: Use care not to damage the pump shaft.

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MANIFOLD ASSEMBLY/ACCUMULATOR

Description

The manifold body contains a system bypass solenoid 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.

Open the tailgate.

⚠ 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.

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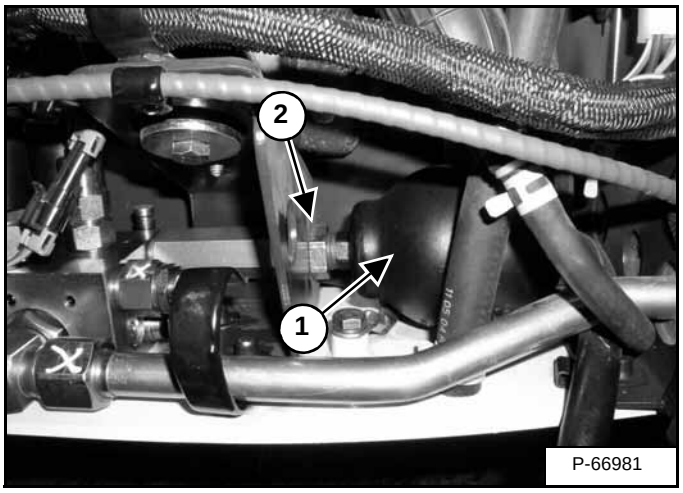
IMPORTANT

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 to 24 ft.-lb. (29 to 33 N•m) torque.

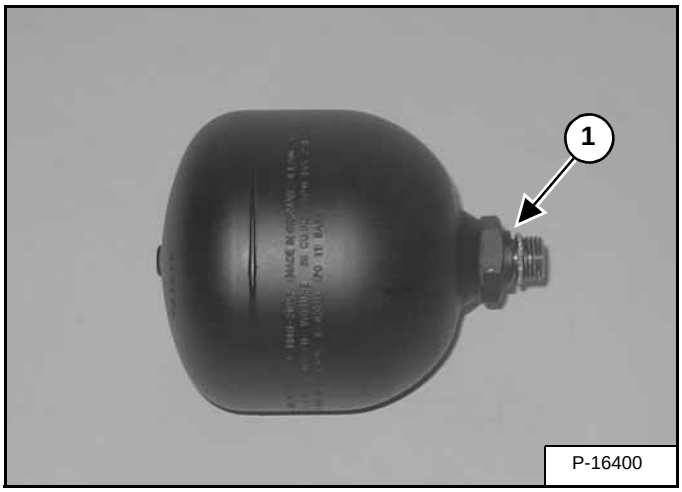
Remove the nut (Item 2) **[Figure 20-60-1]**.

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MANIFOLD ASSEMBLY/ACCUMULATOR (CONT'D)

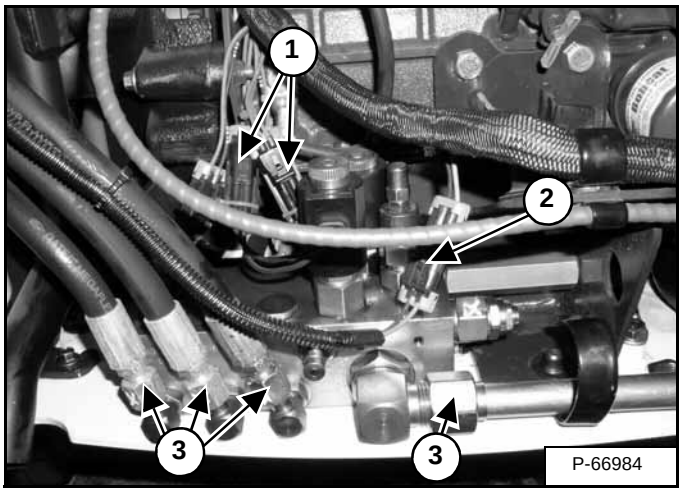
Removal and Installation (Cont'd)

Figure 20-60-2



Remove the O-ring (Item 1) **[Figure 20-60-2]** from the accumulator.

Figure 20-60-3

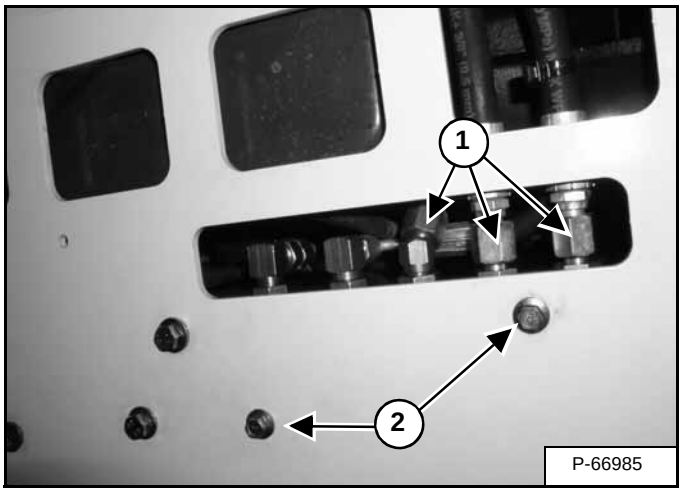


Disconnect the wire harnesses (Item 1) **[Figure 20-60-3]** from the coils.

Disconnect the fuel sender wire harnesses (Item 2) **[Figure 20-60-3]** from the coils.

Mark and remove the hoses and tubelines (Item 3) **[Figure 20-60-4]** from the manifold.

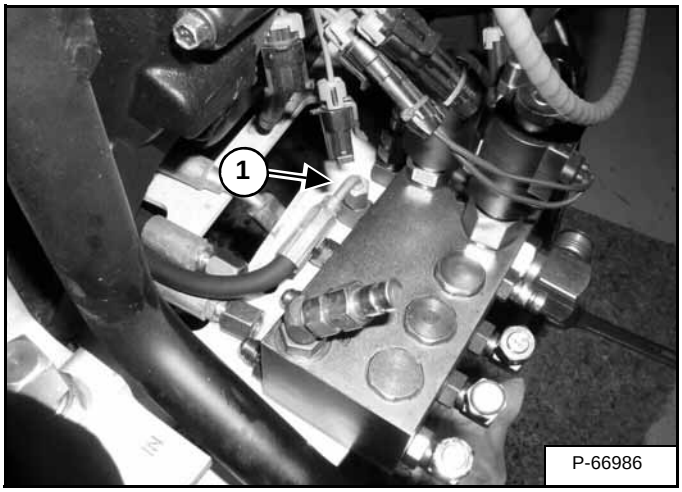
Figure 20-60-4



Mark and remove the hoses (Item 1) **[Figure 20-60-4]** from under the upperstructure.

Remove the bolts (Item 2) **[Figure 20-60-4]** from under the upperstructure.

Figure 20-60-5



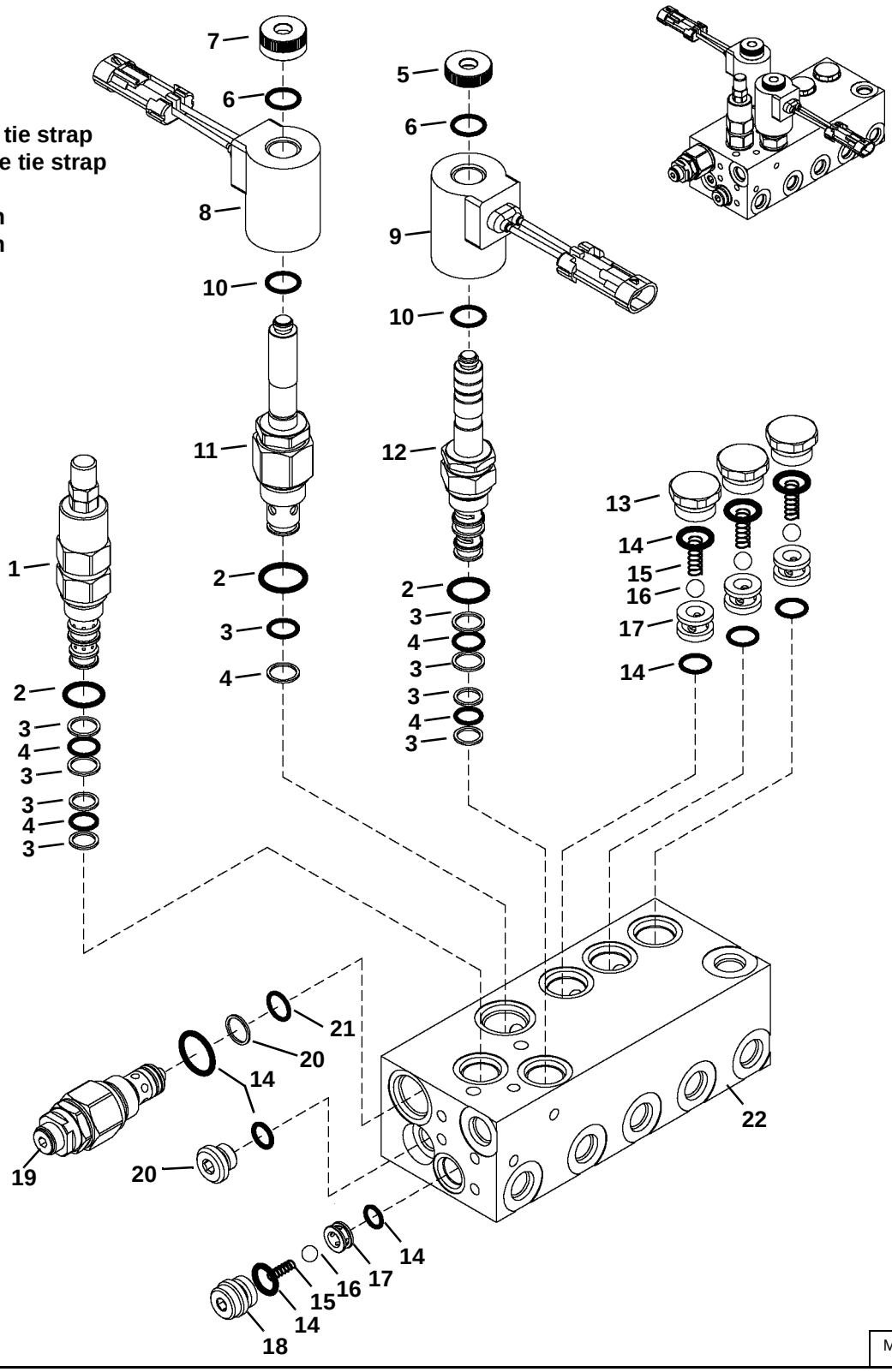
Slide the manifold assembly towards the tailgate to expose the hose. Mark and remove the hose (Item 1) **[Figure 20-60-5]** from the manifold.

Remove the manifold.

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Parts Identification

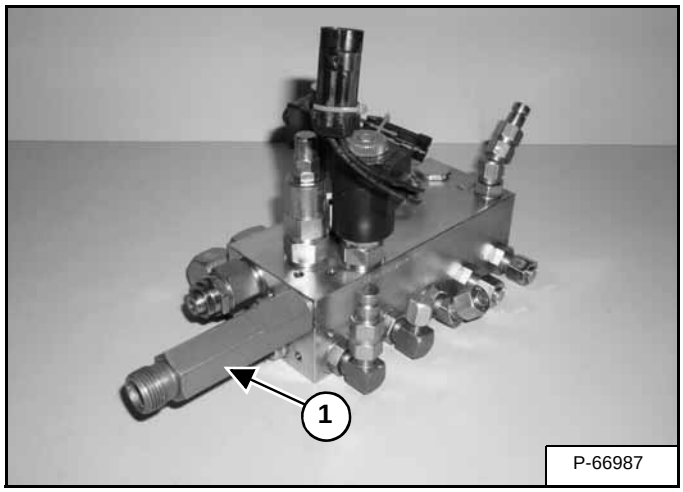
1. Pressure Reducing Valve
2. O-Ring
3. Backup Ring
4. O-Ring
5. Nut
6. O-Ring
7. Nut
8. Coil with green tie strap
9. Coil with orange tie strap
10. O-Ring
11. Solenoid Stem
12. Solenoid Stem
13. Plug
14. O-Ring
15. Spring
16. Check Ball
17. Seat
18. Plug
19. Relief Valve
20. Backup Ring
21. O-Ring
22. Valve Body



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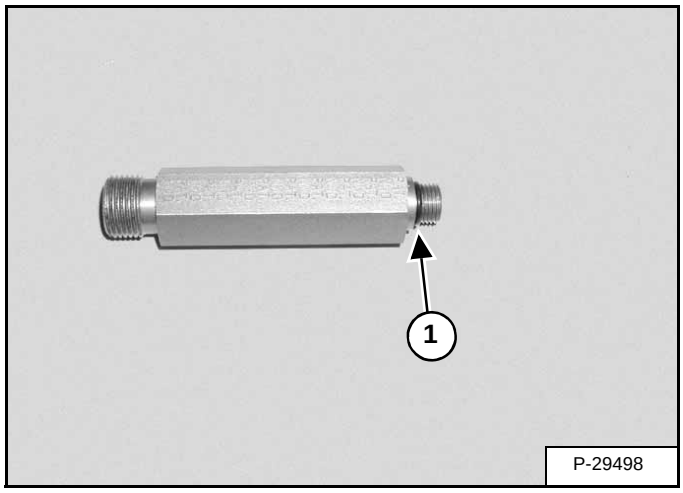
Disassembly

Figure 20-60-6



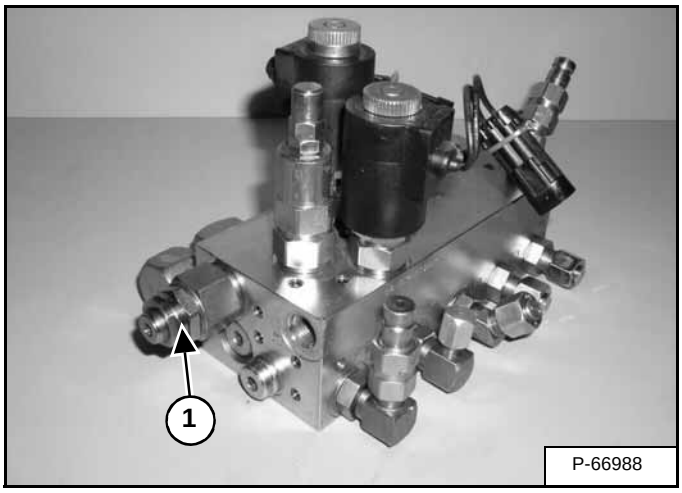
Remove the accumulator extension (Item 1) **[Figure 20-60-6]** from the manifold.

Figure 20-60-7



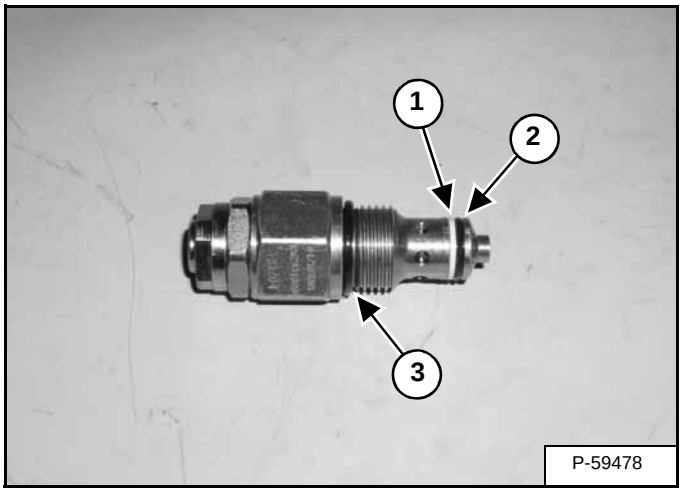
Remove the O-ring (Item 1) **[Figure 20-60-7]** from the accumulator extension.

Figure 20-60-8



Remove the relief valve (Item 1) **[Figure 20-60-8]** from the manifold.

Figure 20-60-9



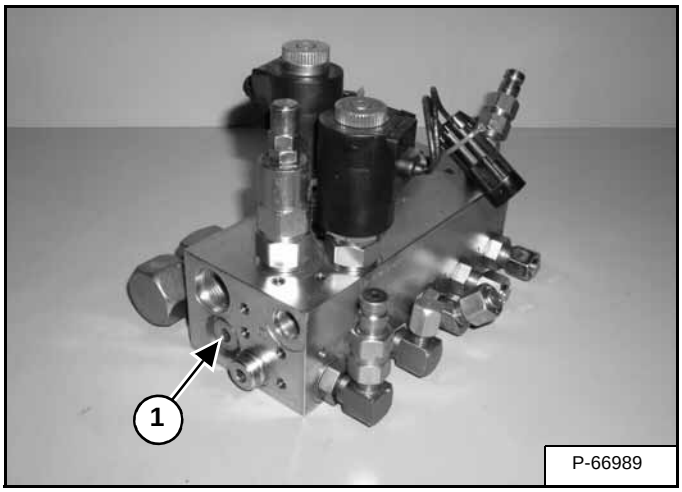
Remove the backup ring (Item 1) and O-ring (Item 2) **[Figure 20-60-9]** from the relief valve.

Remove the O-ring (Item 3) **[Figure 20-60-9]** from the relief valve.

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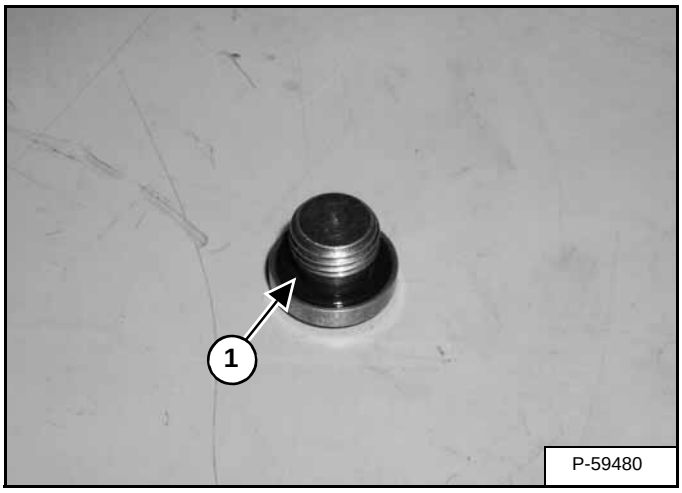
Disassembly (Cont'd)

Figure 20-60-10



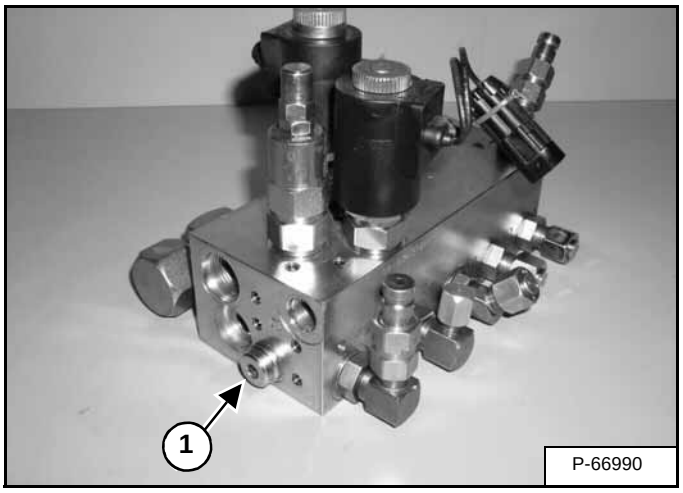
Remove the plug (Item 1) **[Figure 20-60-10]** from the manifold.

Figure 20-60-11



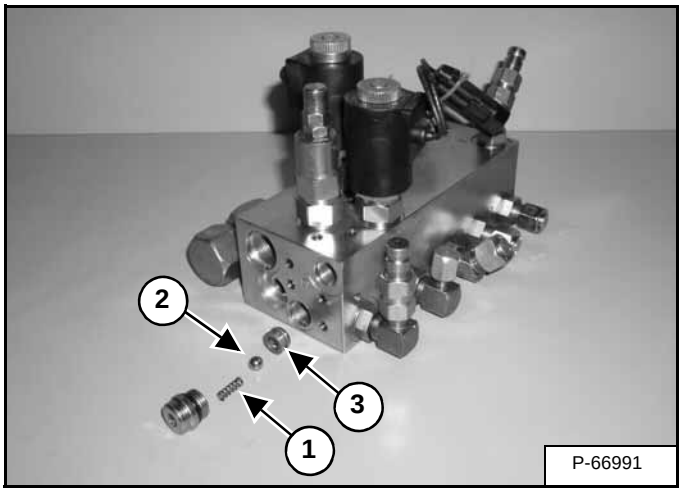
Remove the O-ring (Item 1) **[Figure 20-60-11]** from the plug.

Figure 20-60-12



Remove the plug (Item 1) **[Figure 20-60-12]** from the manifold.

Figure 20-60-13

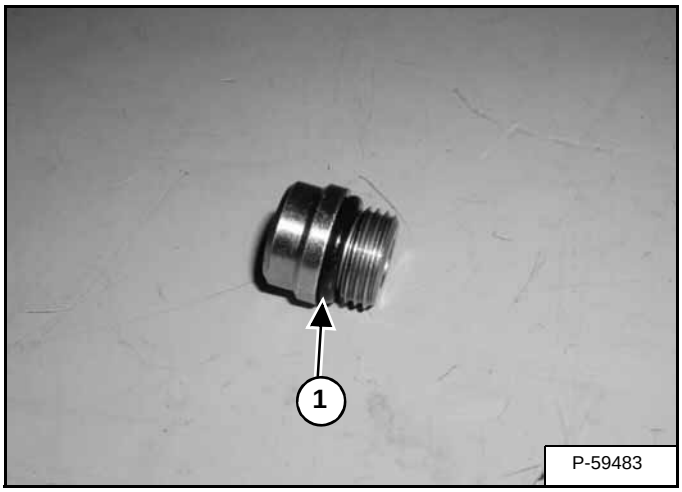


Remove the spring (Item 1), check ball (Item 2) and seat (Item 3) **[Figure 20-60-13]**.

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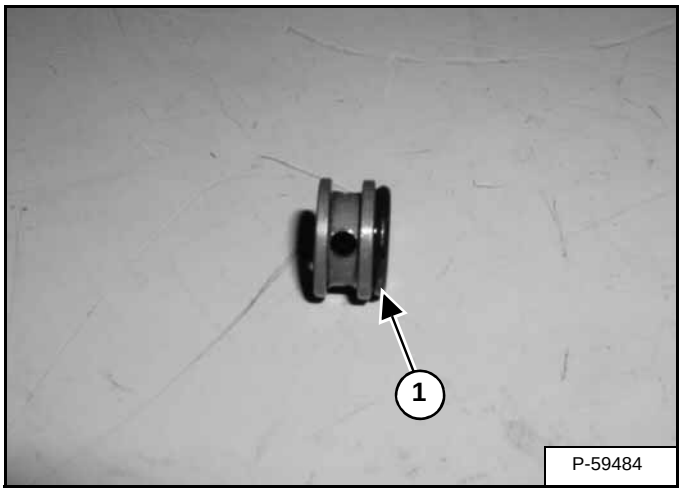
Disassembly (Cont'd)

Figure 20-60-14



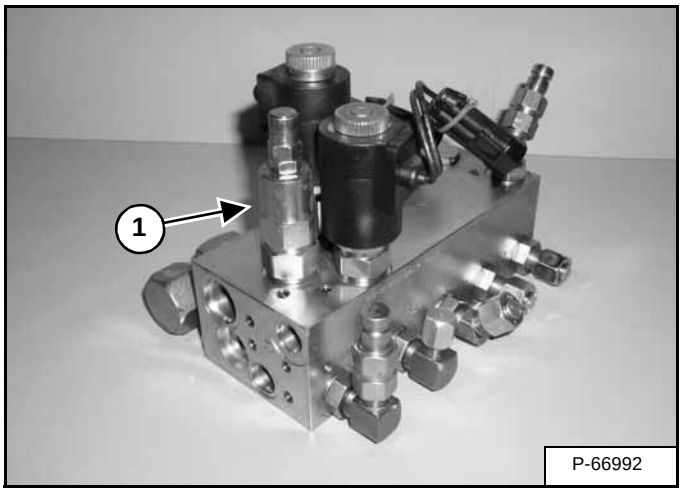
Remove the O-ring (Item 1) **[Figure 20-60-14]** from the plug.

Figure 20-60-15



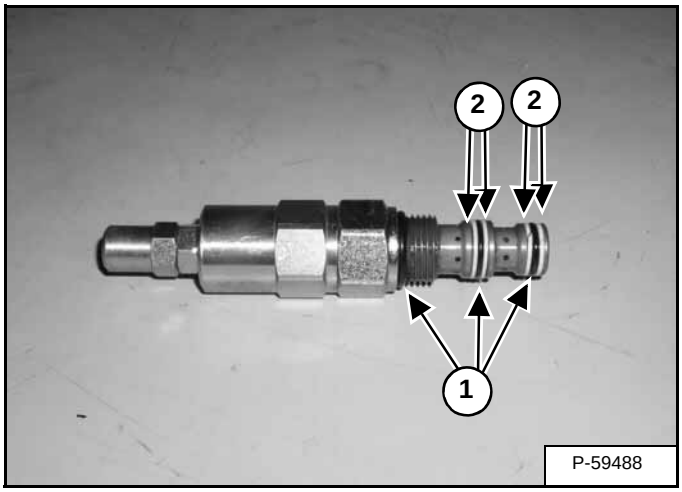
Remove the O-ring (Item 1) **[Figure 20-60-15]** from the seat.

Figure 20-60-16



Remove the pressure reducing valve (Item 1) **[Figure 20-60-16]** from the manifold.

Figure 20-60-17

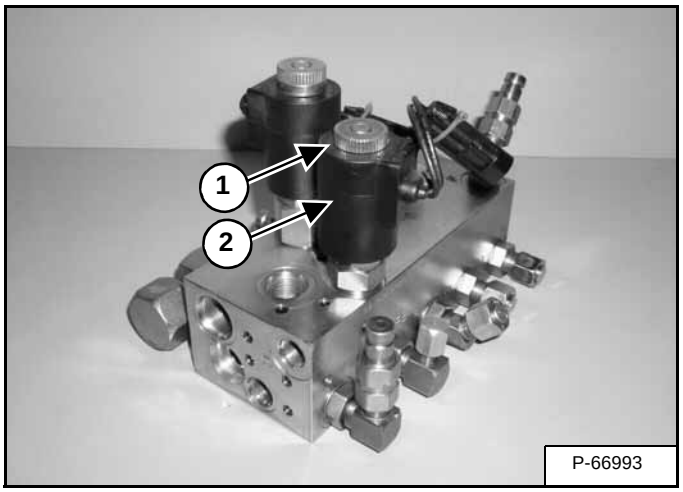


Remove the O-rings (Item 1) and backup rings (Item 2) **[Figure 20-60-17]**.

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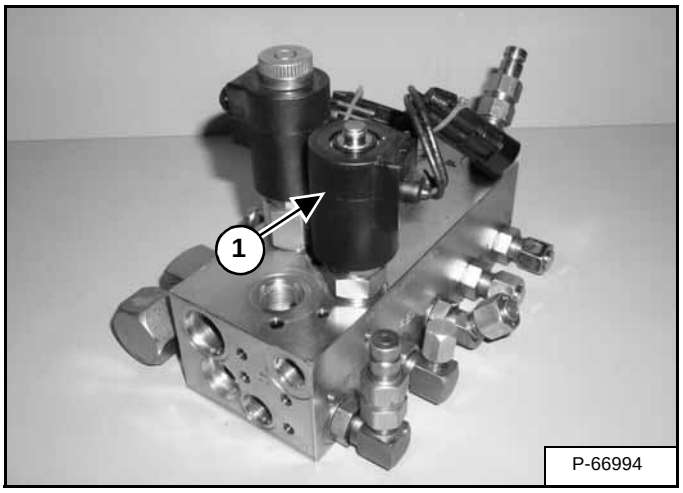
Disassembly (Cont'd)

Figure 20-60-18



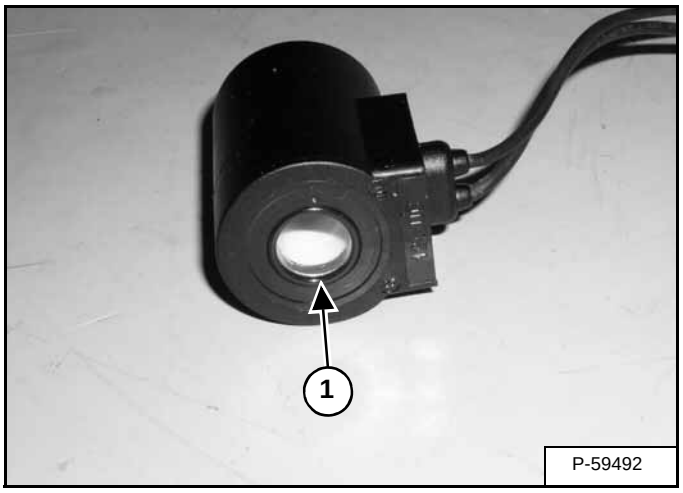
Remove the nut (Item 1) from the console (joystick) lockout solenoid (Item 2) **[Figure 20-60-18]**.

Figure 20-60-19



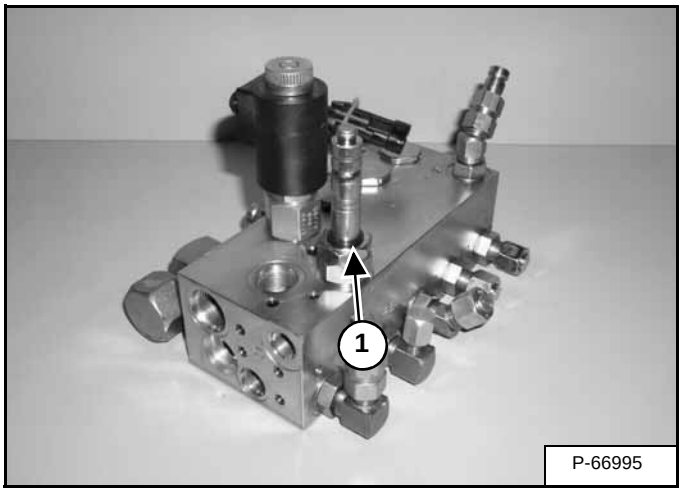
Remove the coil with the green tie strap (Item 1) **[Figure 20-60-19]** from the solenoid stem.

Figure 20-60-20



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

Figure 20-60-21

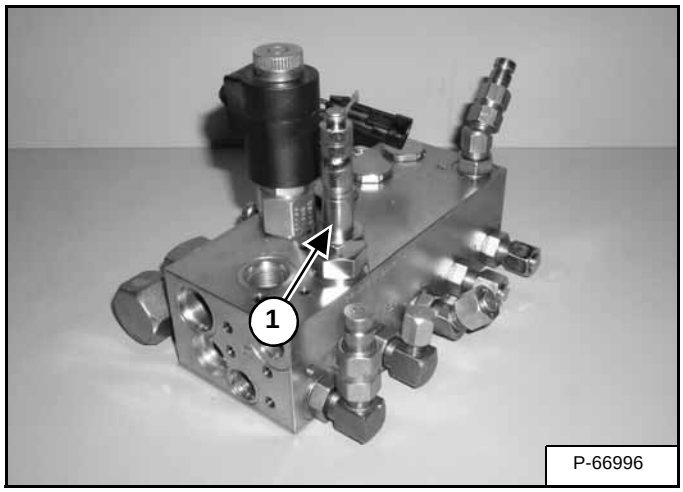


Remove the O-ring (Item 1) **[Figure 20-60-21]** from the solenoid stem.

Dealer Copy -- Not for Resale

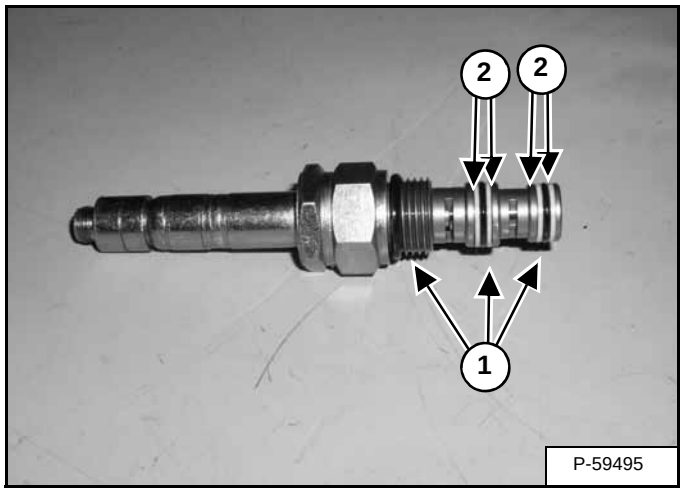
Disassembly (Cont'd)

Figure 20-60-22



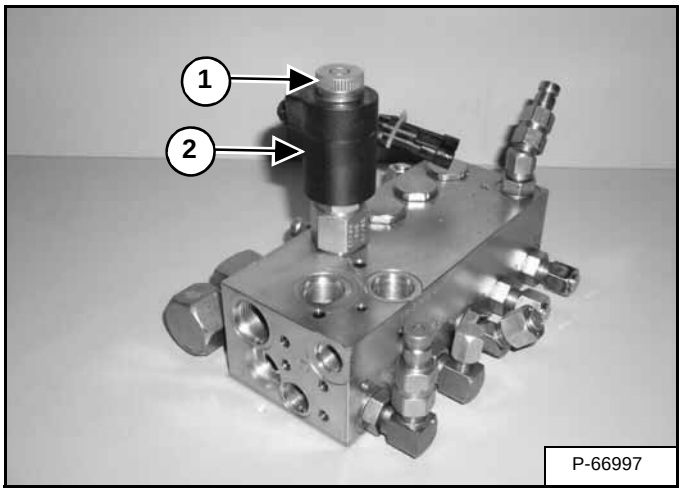
Remove the solenoid stem (Item 1) **[Figure 20-60-22]**.

Figure 20-60-23



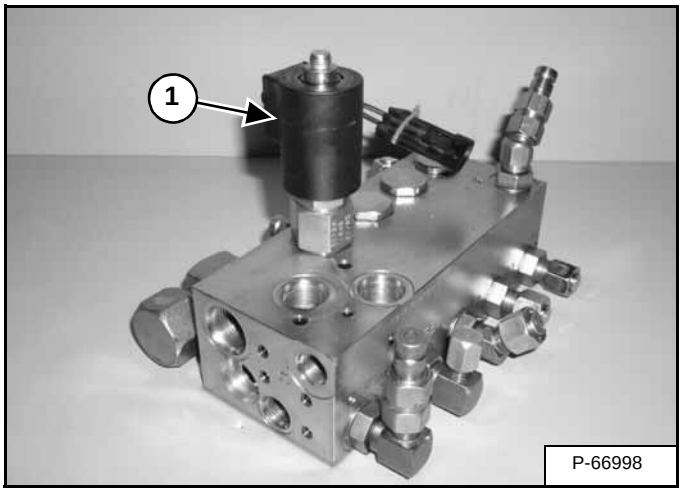
Remove the O-rings (Item 1) and backup rings (Item 2) **[Figure 20-60-23]**.

Figure 20-60-24



Remove the nut (Item 1) from the system by-pass solenoid (Item 2) **[Figure 20-60-24]**.

Figure 20-60-25

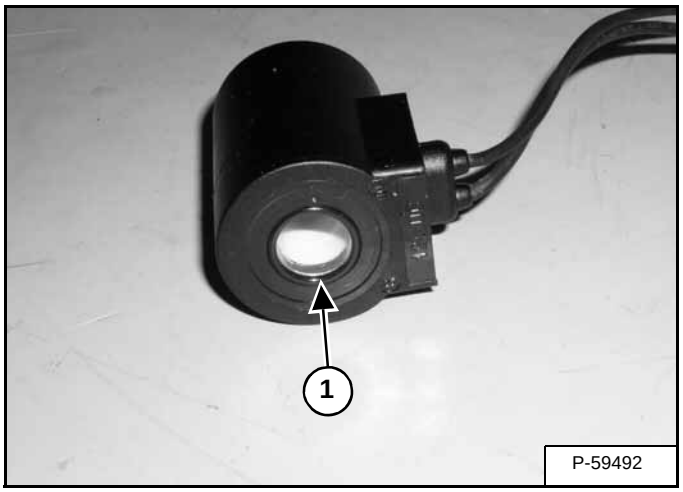


Remove the coil with orange strap (Item 1) **[Figure 20-60-25]** from the solenoid stem.

Dealer Copy -- Not for Resale

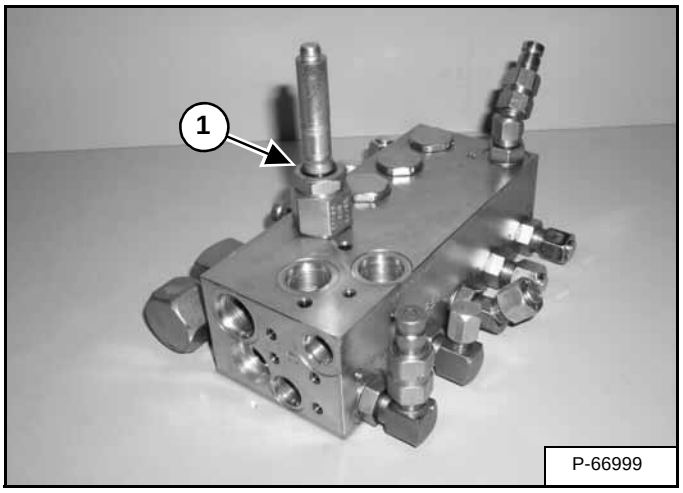
Disassembly (Cont'd)

Figure 20-60-26



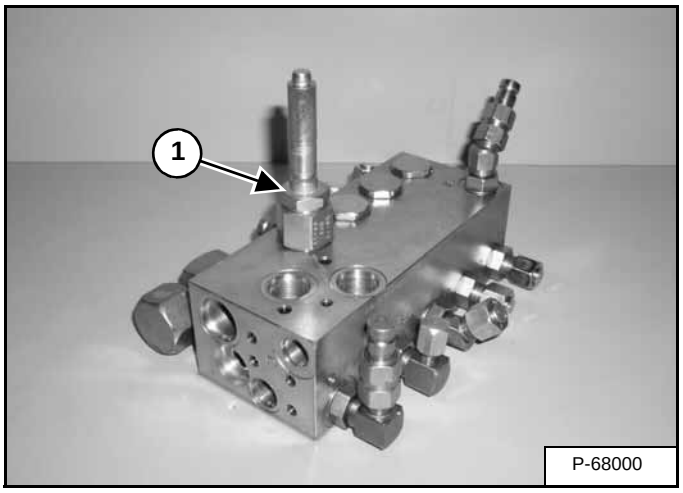
Remove the O-ring (Item 1) **[Figure 20-60-26]** from the coil.

Figure 20-60-27



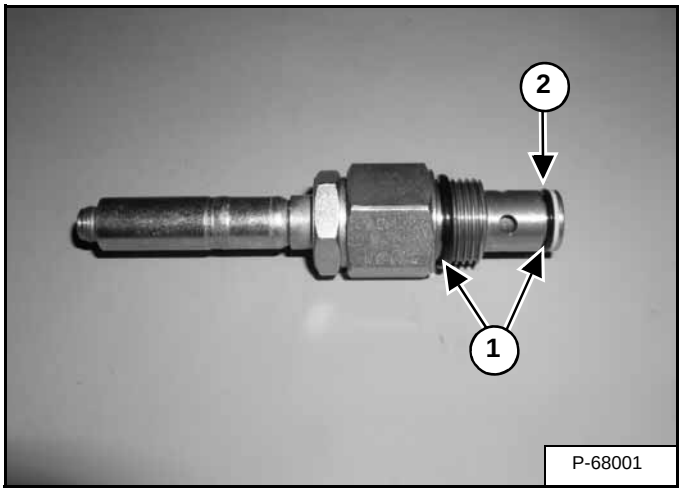
Remove the O-ring (Item 1) **[Figure 20-60-27]** from the solenoid stem.

Figure 20-60-28



Remove the solenoid stem (Item 1) **[Figure 20-60-28]**.

Figure 20-60-29

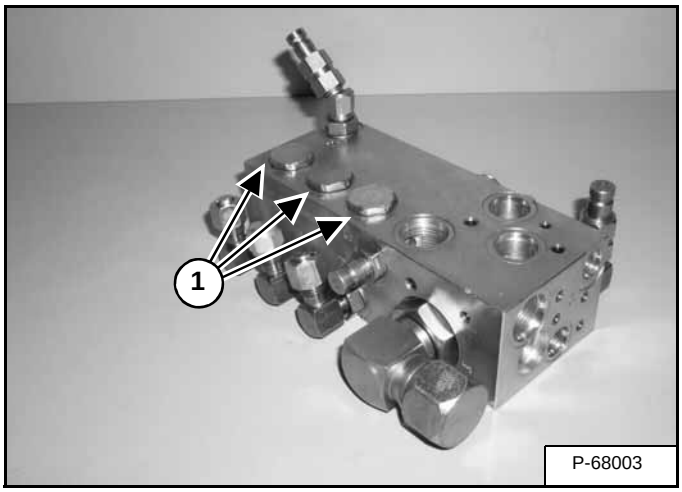


Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-60-29]**.

Dealer Copy -- Not for Resale

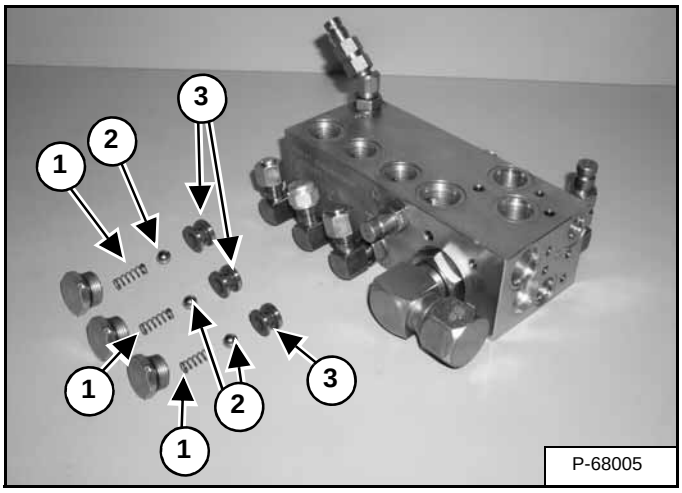
Disassembly (Cont'd)

Figure 20-60-30



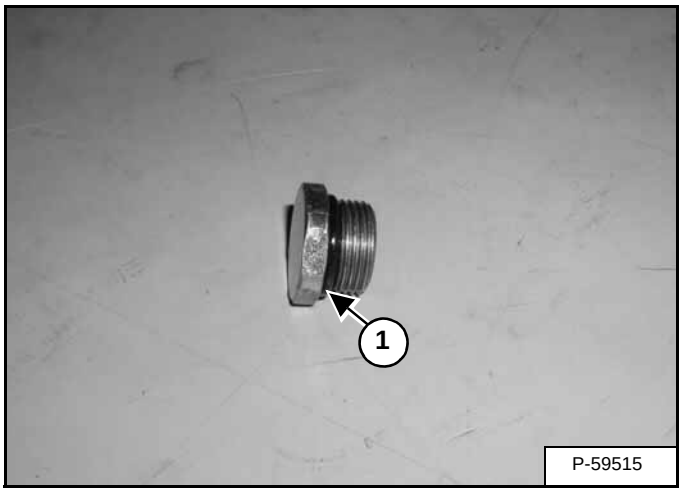
Remove the plugs (Item 1) **[Figure 20-60-30]** from the top of the manifold.

Figure 20-60-31



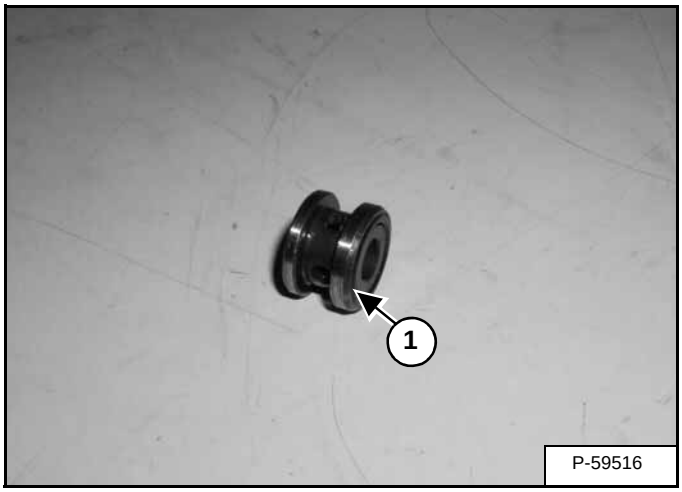
Remove the springs (Item 1), check balls (Item 2) and seats (Item 3) **[Figure 20-60-31]**.

Figure 20-60-32



Remove the O-ring (Item 1) **[Figure 20-60-32]** from the plugs.

Figure 20-60-33



Remove the O-ring (Item 1) **[Figure 20-60-33]** from the seats.

Dealer Copy -- Not for Resale

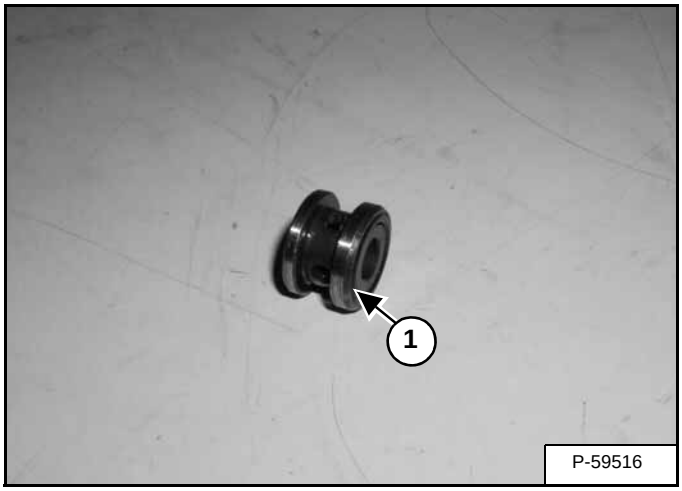
Assembly

Clean all parts in solvent and dry with compressed air.

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

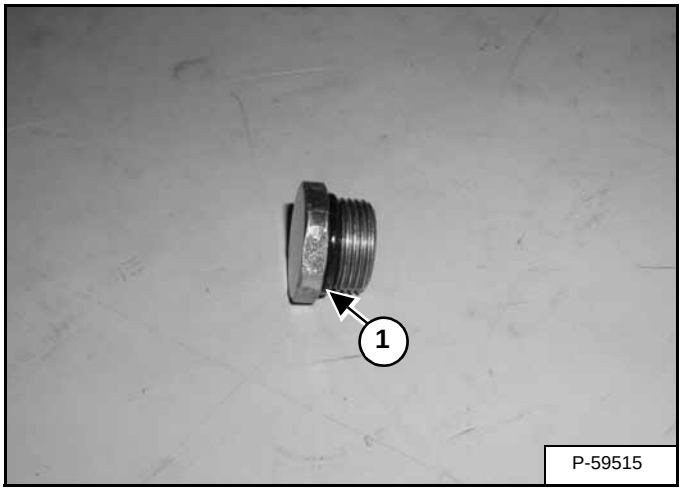
Always install new backup rings and O-rings. Lubricate all backup rings and O-rings with clean hydraulic fluid before installation.

Figure 20-60-34



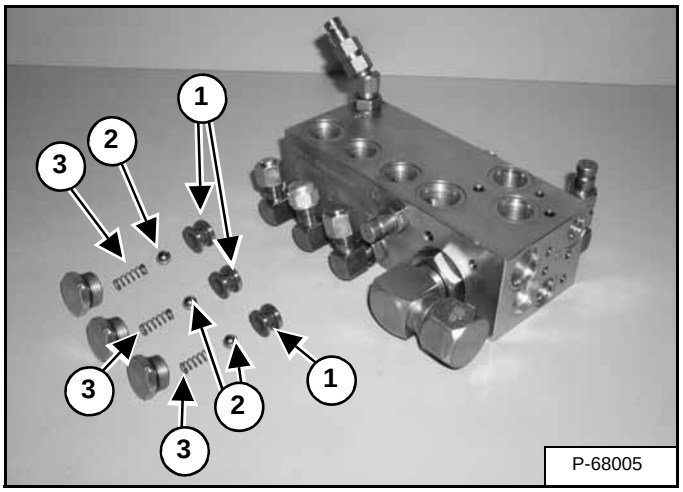
Install the O-rings (Item 1) **[Figure 20-60-34]** on the seats.

Figure 20-60-35



Install the O-rings (Item 1) **[Figure 20-60-35]** on the plugs.

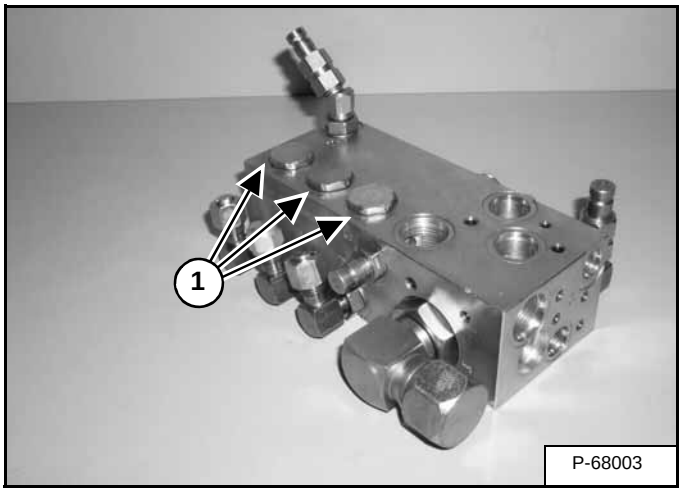
Figure 20-60-36



Install the seats (Item 1), check balls (Item 2) and springs (Item 3) **[Figure 20-60-36]** in the top of the manifold.

NOTE: Install O-ring face on seat towards the center of the manifold.

Figure 20-60-37



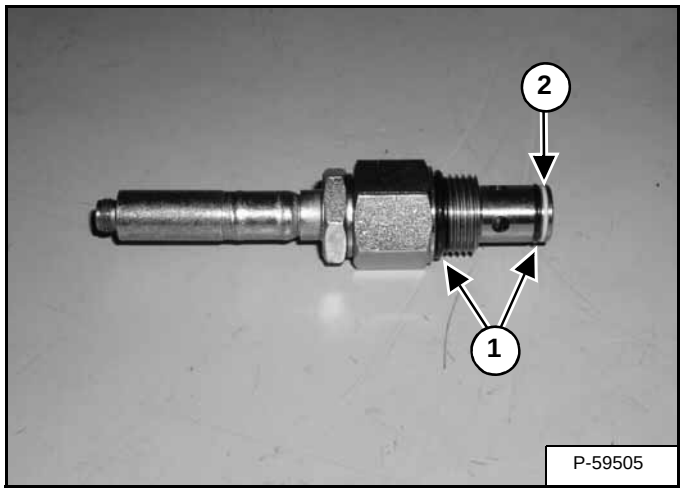
Install the plugs (Item 1) **[Figure 20-60-37]**.

Tighten the plugs to 44 ft.-lb. (60 N•m) torque.

Dealer Copy -- Not for Resale

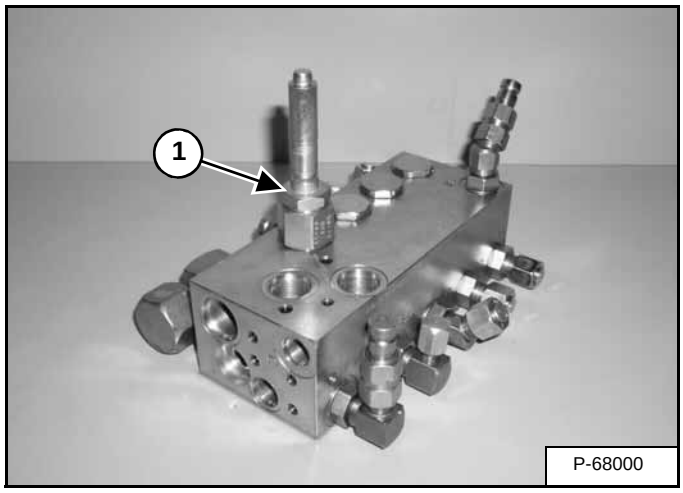
Assembly (Cont'd)

Figure 20-60-38



Install the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-60-38]**.

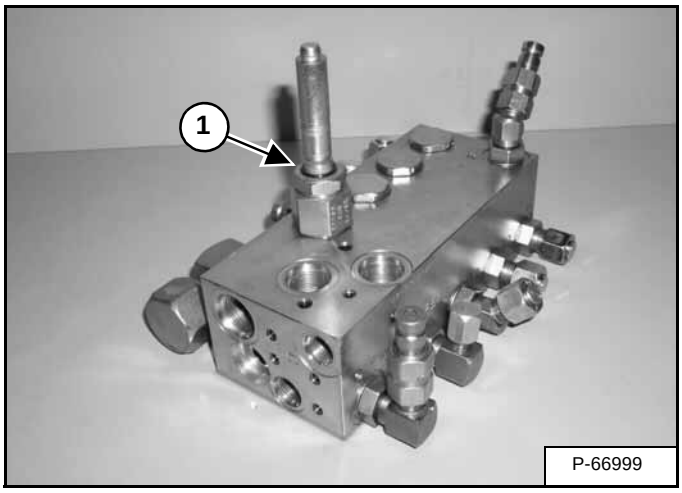
Figure 20-60-39



Install the solenoid stem (Item 1) **[Figure 20-60-39]**.

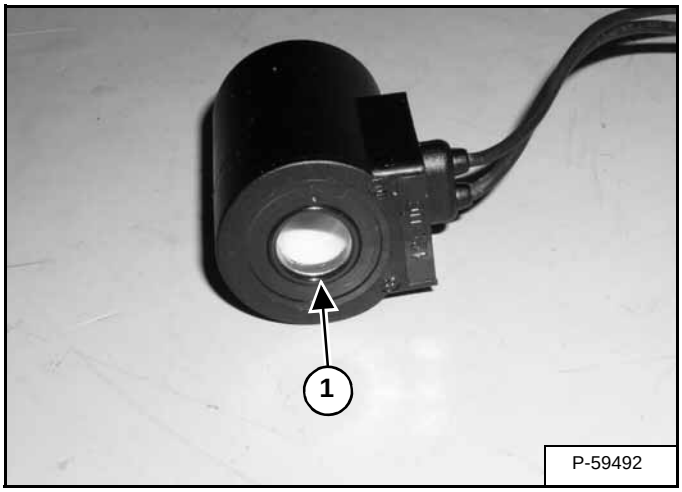
Tighten the solenoid stem to 37 ft.-lb. (50 N•m) torque.

Figure 20-60-40



Install the O-ring (Item 1) **[Figure 20-60-40]** on the solenoid stem.

Figure 20-60-41

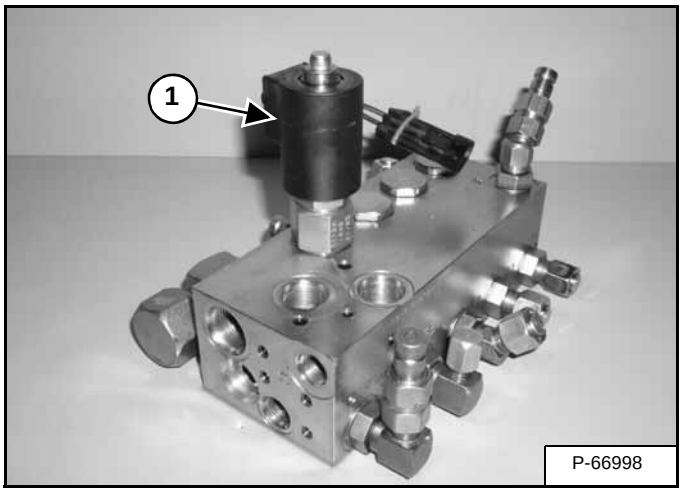


Install the O-ring (Item 1) **[Figure 20-60-41]** on the coil.

Dealer Copy -- Not for Resale

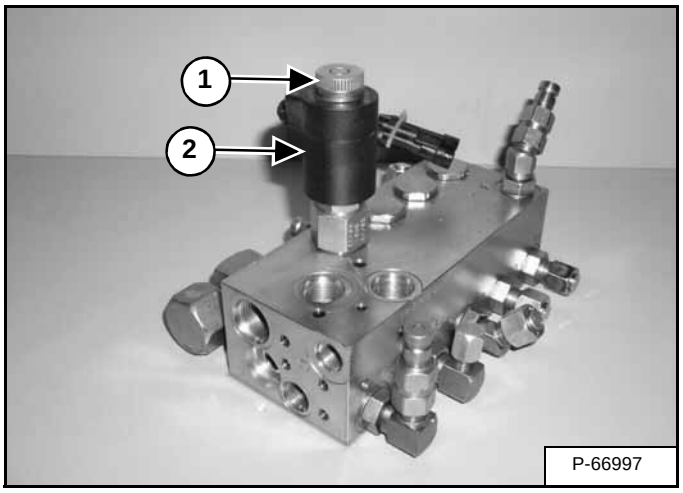
Assembly (Cont'd)

Figure 20-60-42



Install the coil with the orange tie strap (Item 1) **[Figure 20-60-42]** on the system by-pass solenoid stem.

Figure 20-60-43

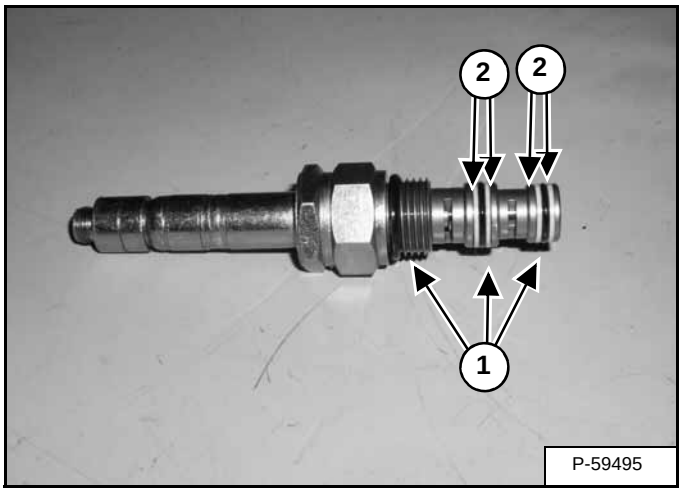


Install the nut (Item 1) on the system by-pass solenoid (Item 2) **[Figure 20-60-43]**.

Tighten the nuts to 4.4 ft.-lb. (6 N•m) torque.

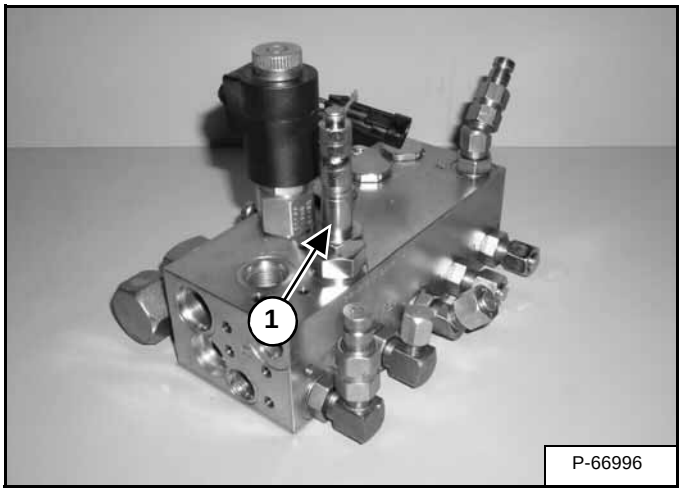
NOTE: Overtightening the nut (Item 1) [Figure 20-60-43] may cause solenoid or coil failure.

Figure 20-60-44



Install the O-rings (Item 1) and backup rings (Item 2) **[Figure 20-60-44]**.

Figure 20-60-45



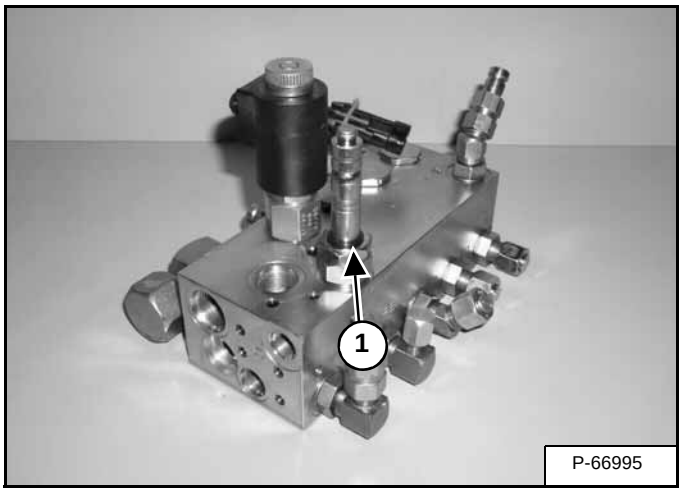
Install the solenoid stem (Item 1) **[Figure 20-60-45]**.

Tighten the solenoid stem to 22 ft.-lb. (30 N•m) torque.

Dealer Copy -- Not for Resale

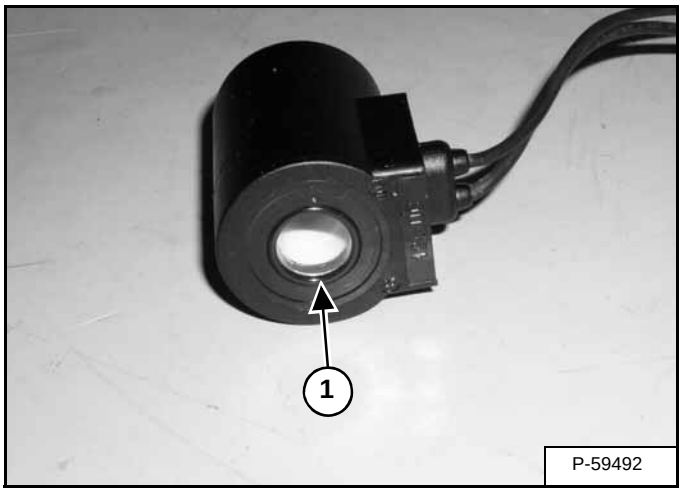
Assembly (Cont'd)

Figure 20-60-46



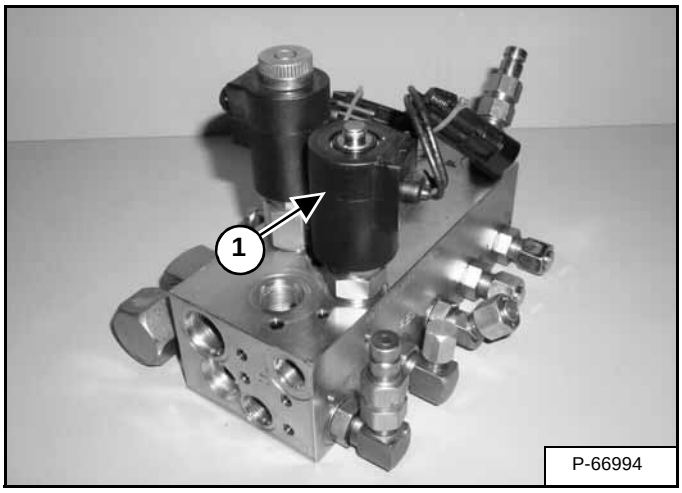
Install the O-ring (Item 1) **[Figure 20-60-46]** on the solenoid stem.

Figure 20-60-47



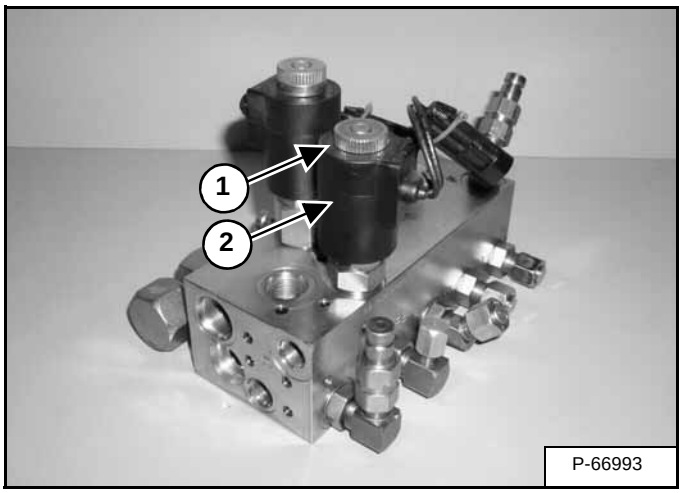
Install the O-ring (Item 1) **[Figure 20-60-47]** on the coil.

Figure 20-60-48



Install the coil with the green tie strap (Item 1) **[Figure 20-60-48]** on the console (joystick) lockout solenoid stem.

Figure 20-60-49



Install the nut (Item 1) on the console (joystick) lockout solenoid (Item 2) **[Figure 20-60-49]**.

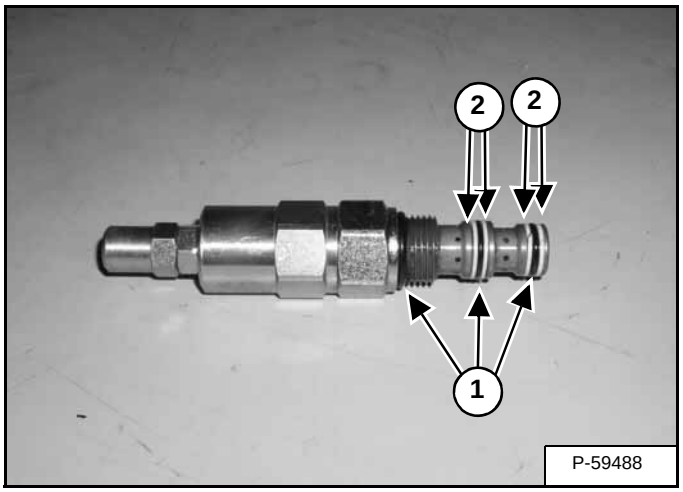
Tighten the nuts to 4.4 ft.-lb. (6 N•m) torque.

NOTE: Overtightening the nut (Item 1) [Figure 20-60-49] may cause solenoid or coil failure.

Dealer Copy -- Not for Resale

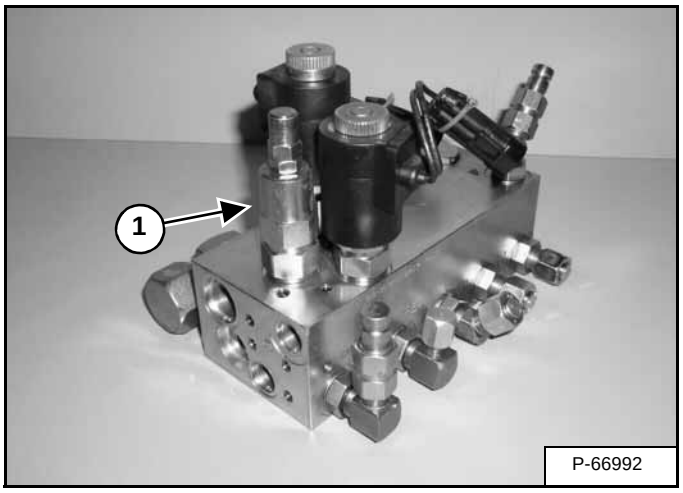
Assembly (Cont'd)

Figure 20-60-50



Remove the O-rings (Item 1) and backup rings (Item 2) **[Figure 20-60-50]**.

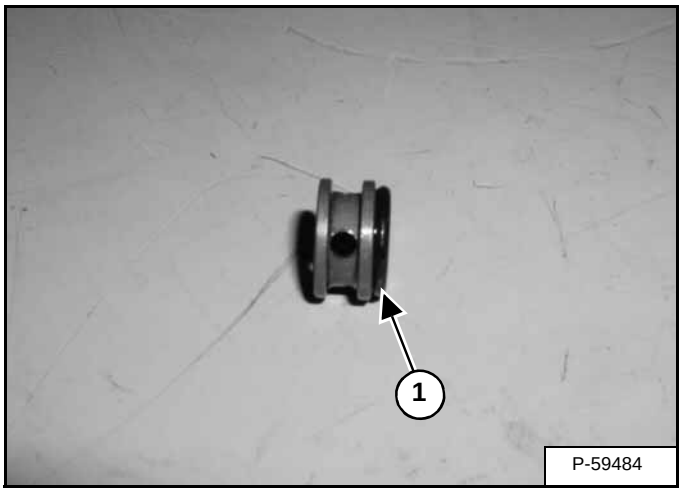
Figure 20-60-51



Install the pressure reducing valve (Item 1) **[Figure 20-60-51]** from the manifold.

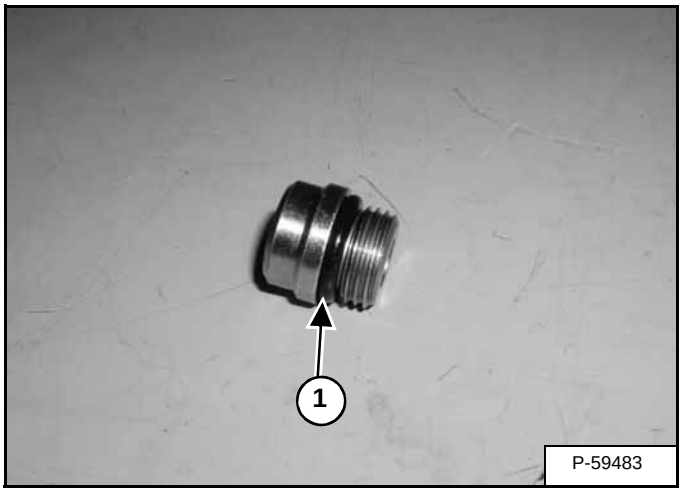
Tighten the valve to 22 ft.-lb. (30 N•m) torque.

Figure 20-60-52



Install the O-ring (Item 1) **[Figure 20-60-52]** on the seat.

Figure 20-60-53

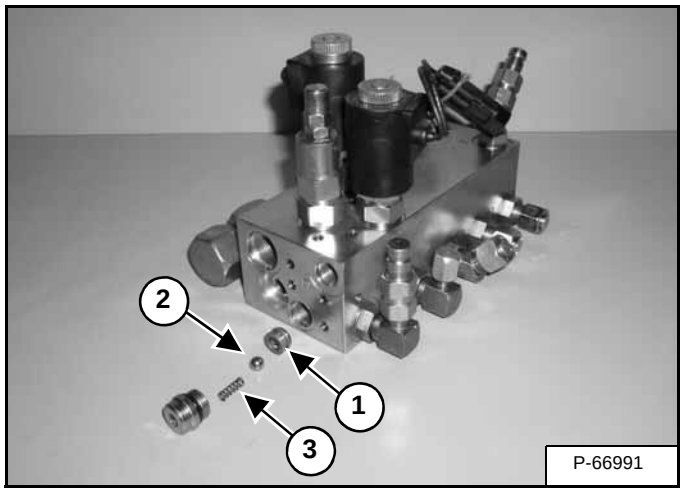


Install the O-ring (Item 1) **[Figure 20-60-53]** on the plug.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

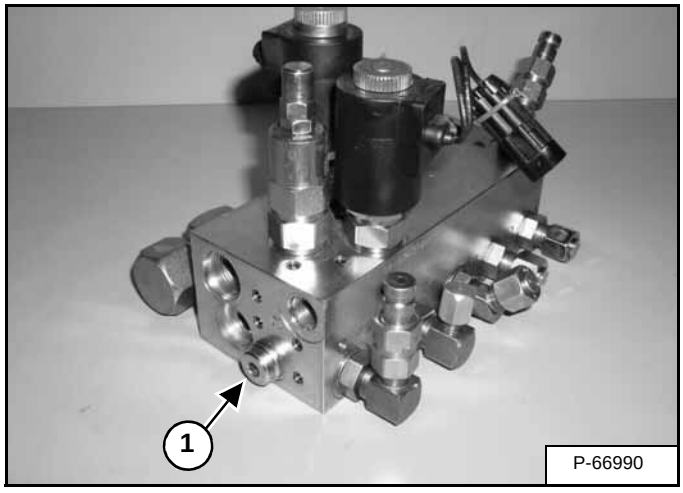
Figure 20-60-54



Install the seat (Item 1), check ball (Item 2) and spring (Item 3) **[Figure 20-60-54]**.

NOTE: Install O-ring face on seat towards the center of the manifold.

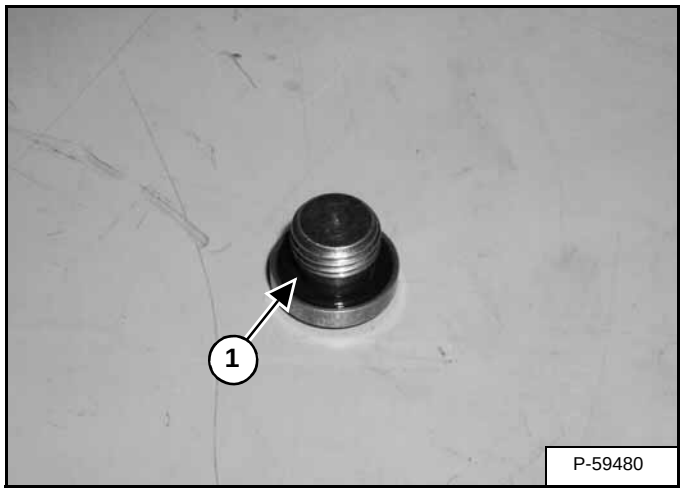
Figure 20-60-55



Install the plug (Item 1) **[Figure 20-60-55]** in the manifold.

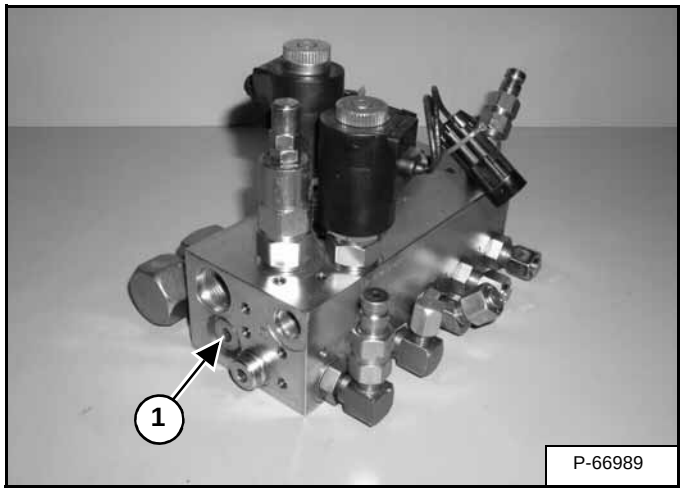
Tighten the plug to 30 ft.-lb. (40 N•m) torque.

Figure 20-60-56



Install the O-ring (Item 1) **[Figure 20-60-56]** on the plug.

Figure 20-60-57



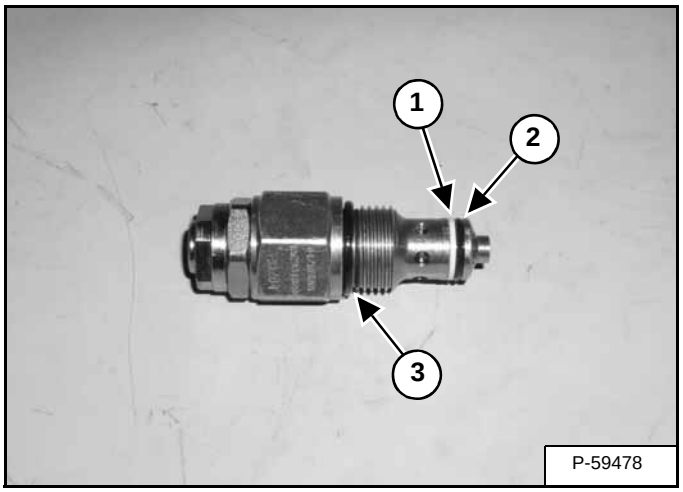
Install the plug (Item 1) **[Figure 20-60-57]** in the manifold.

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

Dealer Copy -- Not for Resale

Assembly (Cont'd)

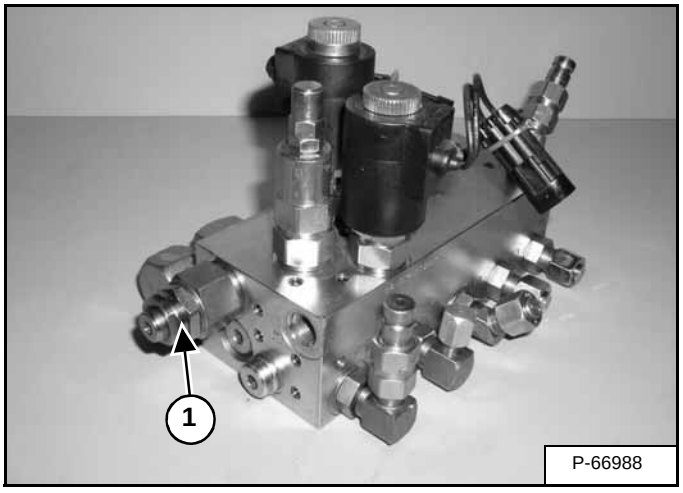
Figure 20-60-58



Install the backup ring (Item 1) O-ring (Item 2) **[Figure 20-60-58]** on the relief valve.

Install the O-ring (Item 3) **[Figure 20-60-58]** on the relief valve.

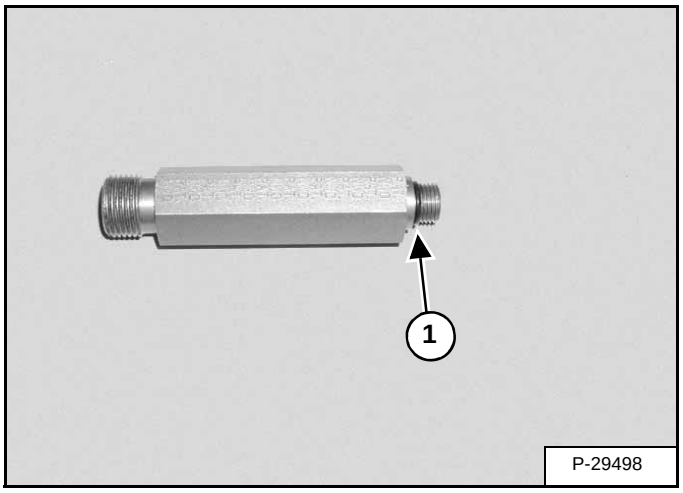
Figure 20-60-59



Install the relief valve (Item 1) **[Figure 20-60-59]** in the manifold.

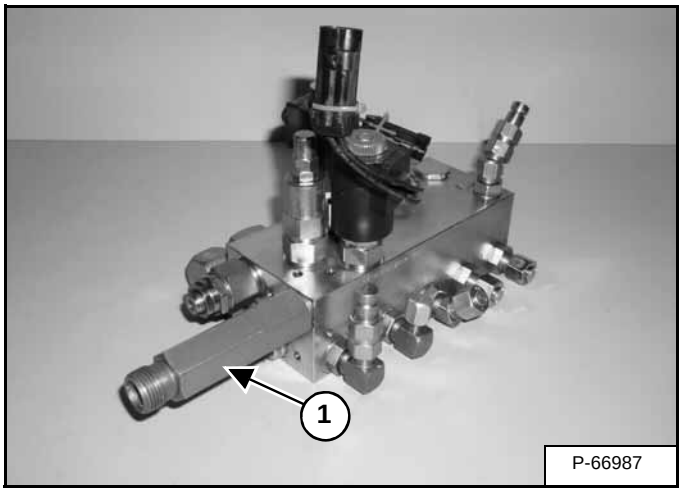
Tighten the valve to 31 ft.-lb. (42 N•m) torque.

Figure 20-60-60



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

Figure 20-60-61



Install the accumulator extension (Item 1) **[Figure 20-60-61]** on the manifold.

Tighten the extension to 21 to 24 ft.-lb. (29 to 33 N•m) torque.

Dealer Copy -- Not for Resale



Dealer Copy -- Not for Resale

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 2 speed.

Removal and Installation

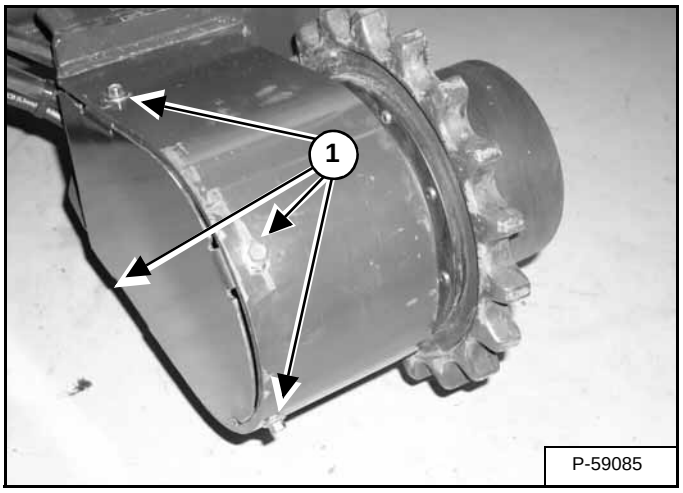
Remove the track. (See Track Removal And Installation on Page 30-20-4)

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



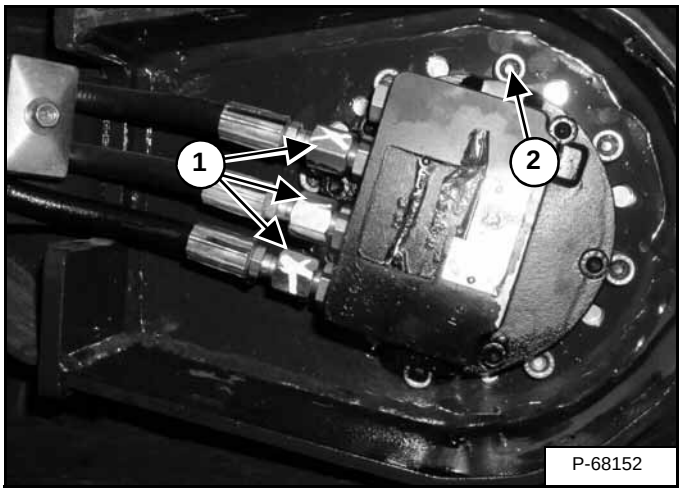
Remove the bolts (Item 1) **[Figure 20-70-1]** from the track frame cover.

Installation: Tighten the bolts to 15 to 18 ft.-lb. (20 to 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]**.

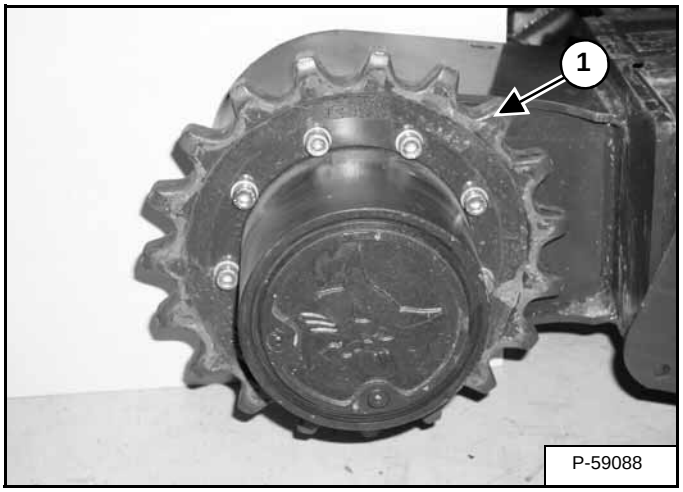
Installation: Tighten the bolts to 29 to 37 ft.-lb. (40 to 50 N•m) torque.

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



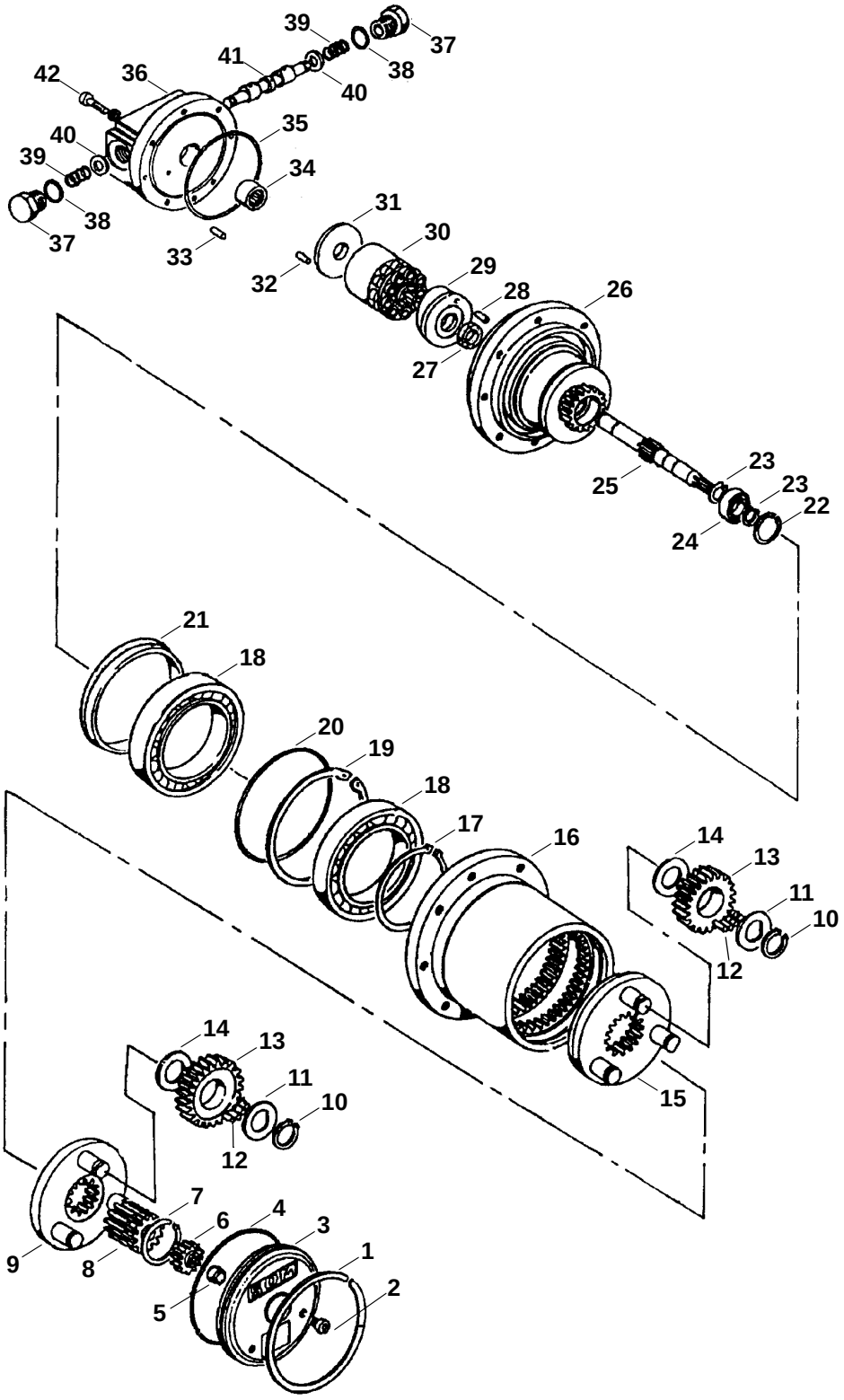
Remove the sprocket bolts. Remove the sprocket (Item 1) **[Figure 20-70-3]**.

Installation: Tighten the bolts to 48 to 55 ft.-lb. (65 to 75 N•m) torque.

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Parts Identification

1. Snap Ring
2. Plug
3. Cover
4. O-ring
5. Bushing
6. Sun Gear
7. Snap Ring
8. Sun Gear
9. Planetary Carrier
10. Snap Ring
11. Anti-rotation Washers
12. Bearings
13. Planetary Gear
14. Thrust Washer
15. Planetary Carrier
16. Ring Gear
17. Snap Ring
18. Bearing
19. Snap Ring
20. O-Ring
21. Seal Ring
22. Snap Ring
23. Snap Ring
24. Bearing
25. Drive Shaft
26. Hub
27. Seal
28. Alignment Pin
29. Swash Plate
30. Rotating Block
31. Motor Plate
32. Alignment Pin
33. Alignment Pin
34. Bearing
35. O-Ring
36. Motor Cover
37. Plug
38. O-Ring
39. Spring
40. Washer
41. Spool
42. Bolt



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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.

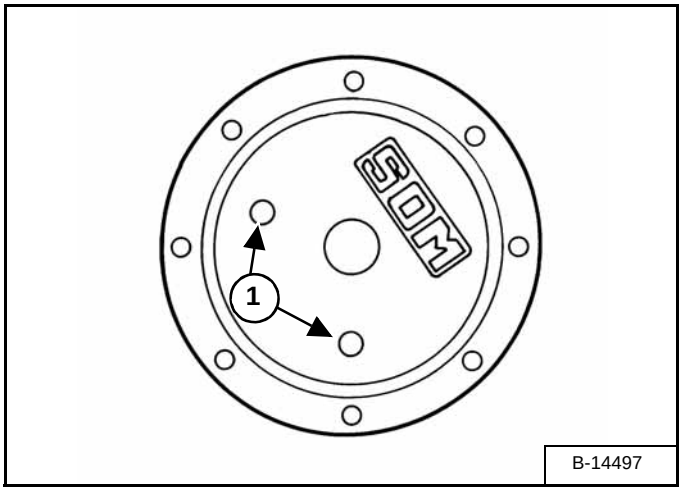
I-2003-0888

Clean the outside of the travel motor before disassembly.

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

MEL1468 for torque ring and seal ring assembly.

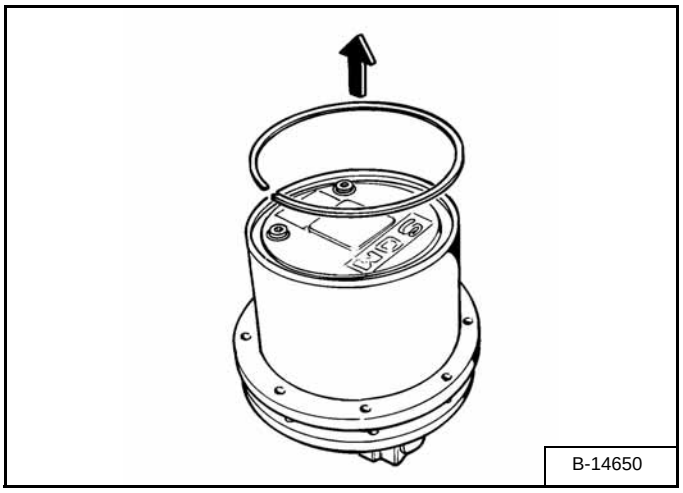
Figure 20-70-4



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

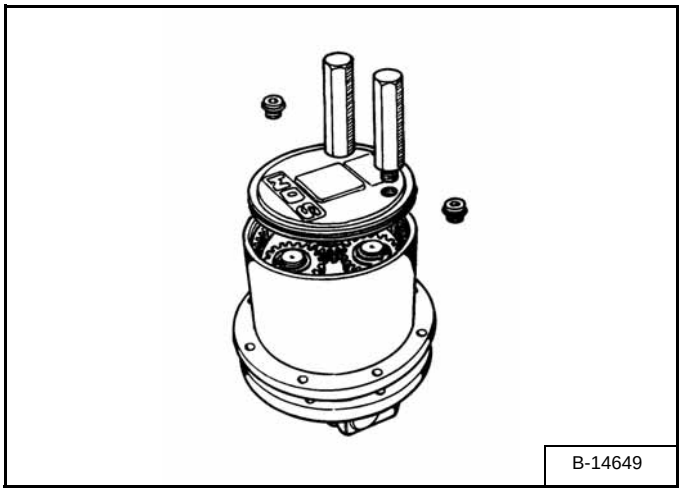
Drain the oil into a container.

Figure 20-70-5



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

Figure 20-70-6

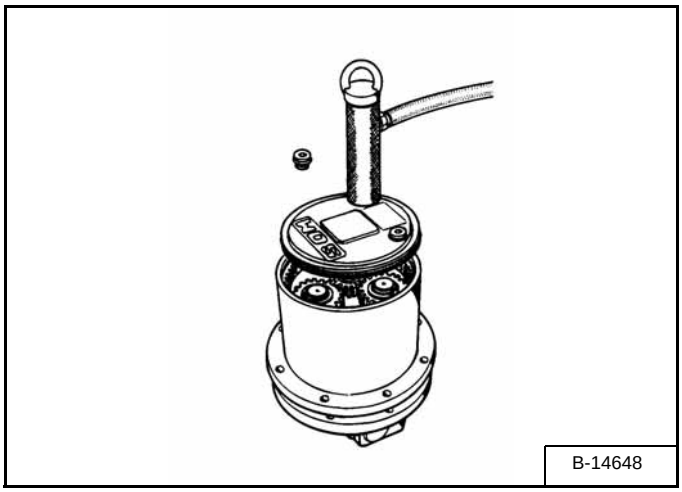


To remove the cover, install two threaded pins in the drain holes and lift the cover off **[Figure 20-70-6]**.

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Disassembly (Cont'd)

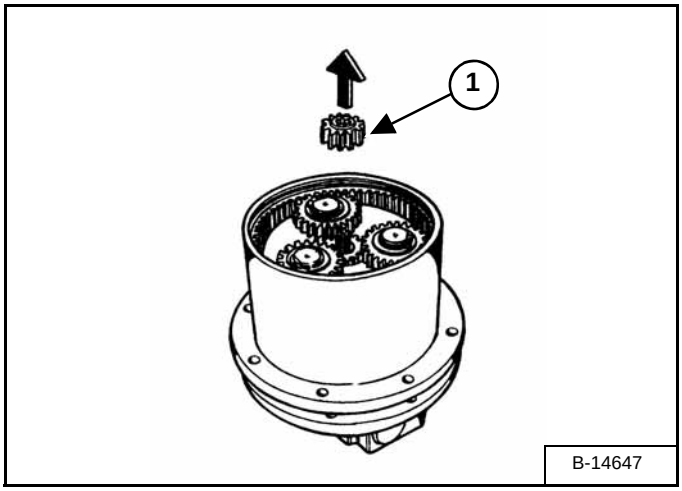
Figure 20-70-7



Air pressure may also be used to remove the cover, screw the adapter in a drain hole and apply 8 to 11 PSI **[Figure 20-70-7]**.

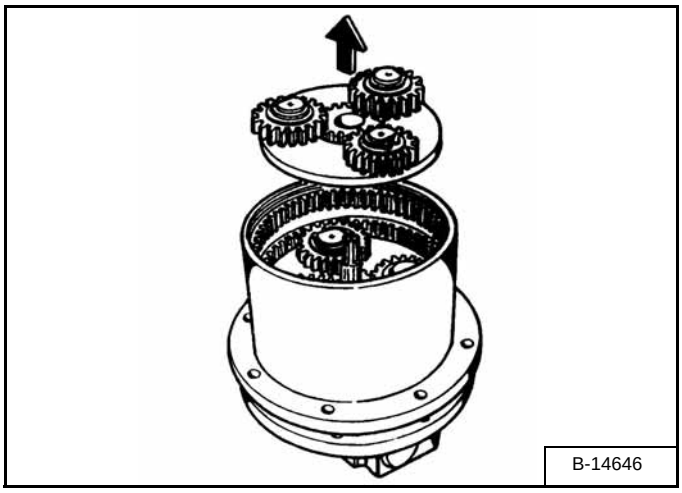
NOTE: Do not use excess pressure or seal damage may result.

Figure 20-70-8



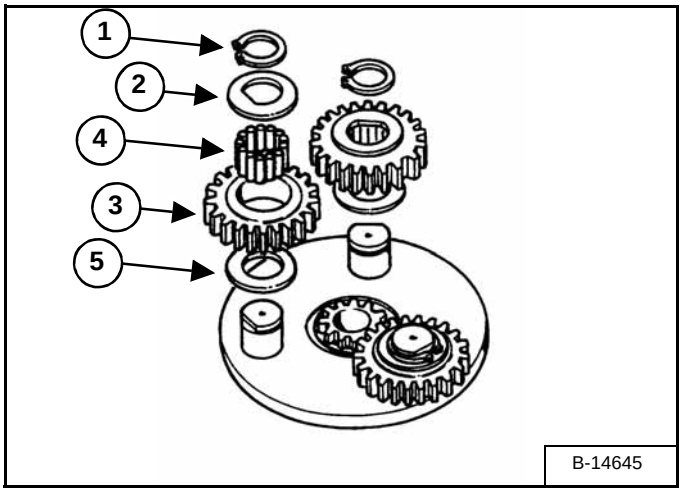
Remove the outer sun gear (Item 1) **[Figure 20-70-8]** by using two levers and prying on the bottom of the gear.

Figure 20-70-9



Remove the planetary carrier **[Figure 20-70-9]**.

Figure 20-70-10

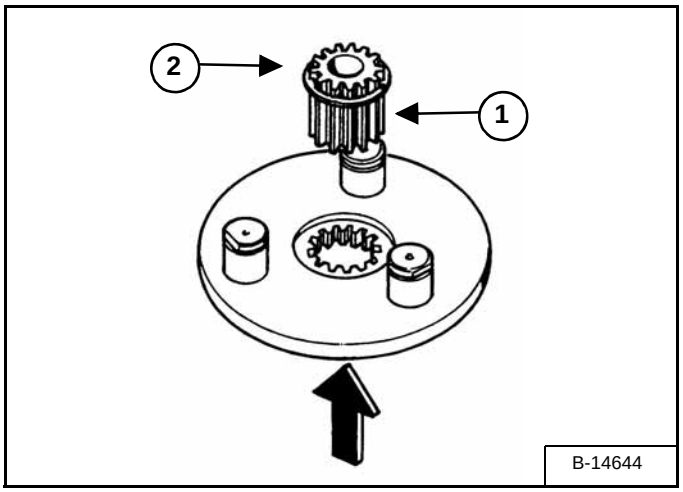


Remove the snap rings (Item 1) anti-rotation washers (Item 2), gears (Item 3), bearings (Item 4) and the bottom thrust washers (Item 5) **[Figure 20-70-10]** from the planetary carrier assembly.

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Disassembly (Cont'd)

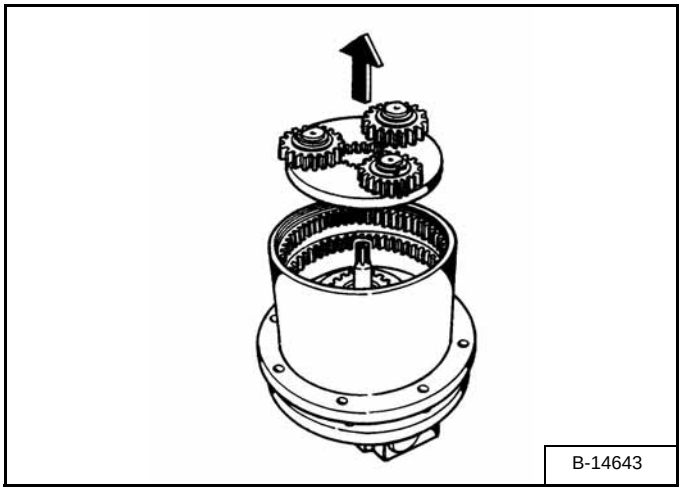
Figure 20-70-11



Remove the inner sun gear (Item 1) **[Figure 20-70-11]**, from the first stage planetary carrier.

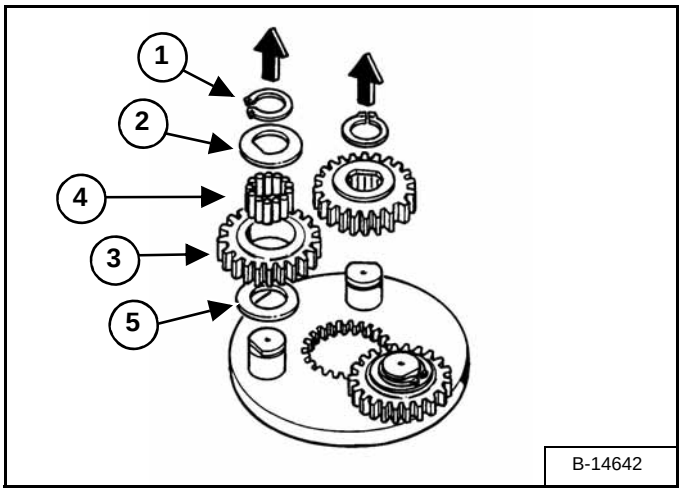
Removal of the sun gear snap ring (Item 2) **[Figure 20-70-11]** is not necessary.

Figure 20-70-12



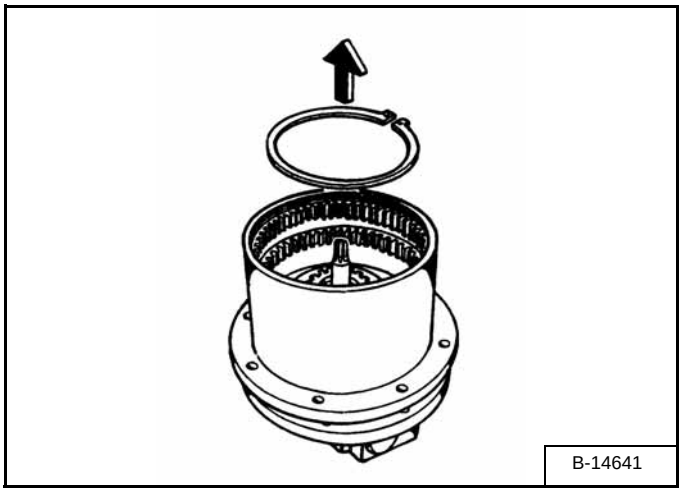
Remove the planetary carrier **[Figure 20-70-12]**.

Figure 20-70-13



Remove the snap rings (Item 1), anti-rotation washers (Item 2), gears (Item 3), bearings (Item 4) and bottom thrust washers (Item 5) **[Figure 20-70-13]** from the planetary carrier assembly.

Figure 20-70-14



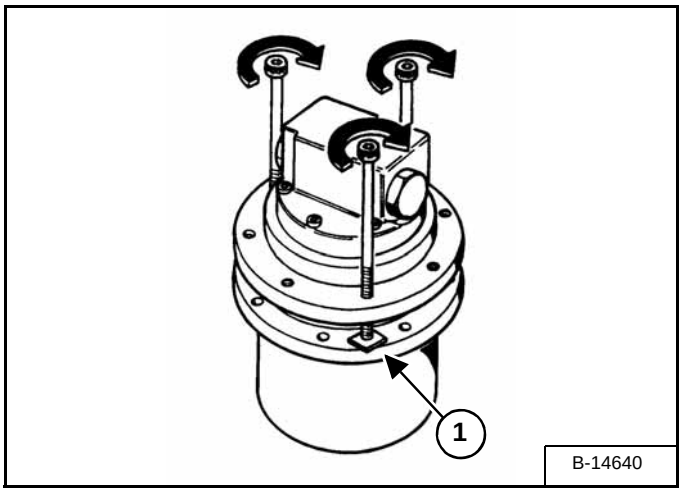
Remove the external snap ring from the hub to free the 2 bearings, ring gear and motor **[Figure 20-70-14]**.

Install three 10 mm bolts through the hub mounts, and tighten to separate the hub and ring gear assembly.

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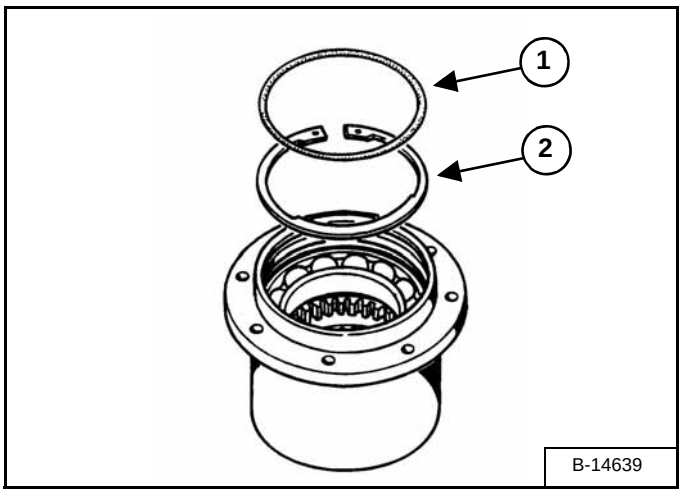
Disassembly (Cont'd)

Figure 20-70-15



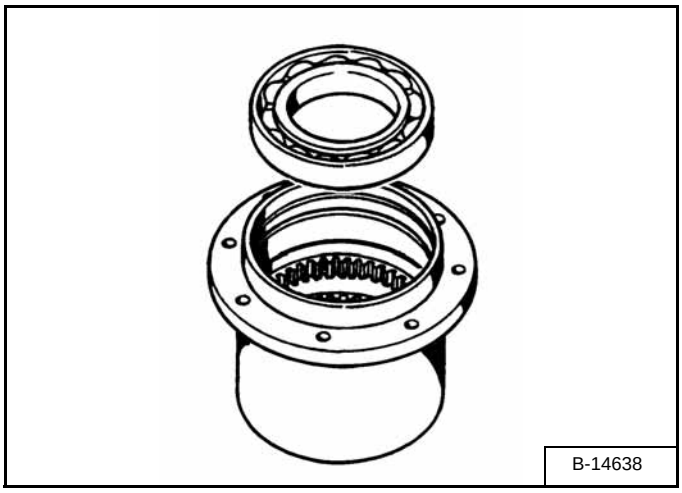
NOTE: Place a piece of scrap metal (Item 1) [Figure 20-70-15] in between the bolt and ring gear flange to prevent damage to the flange when tightening the bolts.

Figure 20-70-16



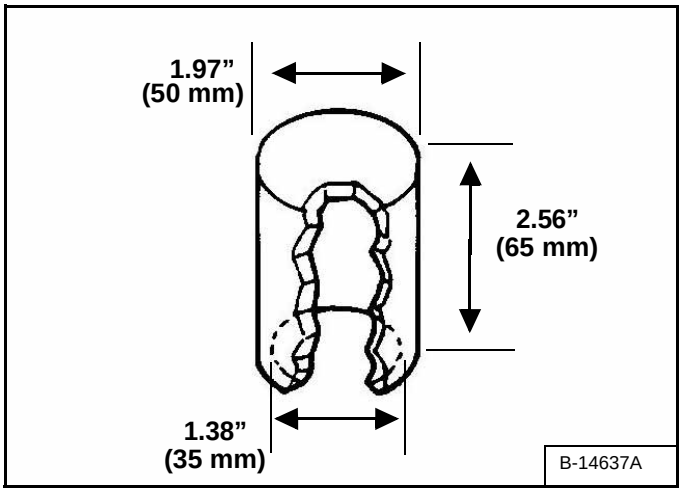
Remove the O-ring (Item 1) and internal snap ring (Item 2) **[Figure 20-70-16]** from the ring gear.

Figure 20-70-17



Remove the bearing from the carrier by pressing it out the flanged side of the carrier **[Figure 20-70-17]**.

Figure 20-70-18



Install a support cap **[Figure 20-70-18]**, over the drive shaft and gear, to protect the splines from damage.

Obtain the support cap locally.

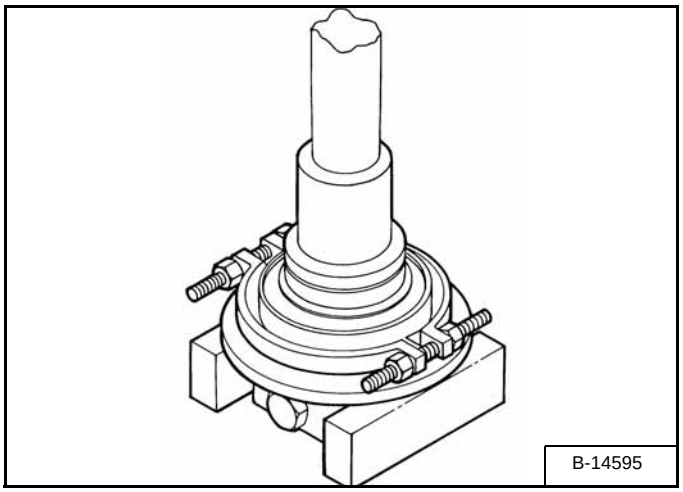
The dimensions of the support cap are as follows:

Height	2.56 in. (65 mm)
I.D.	1.38 in. (35 mm)
O.D.	1.97 in. (50 mm)

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Disassembly (Cont'd)

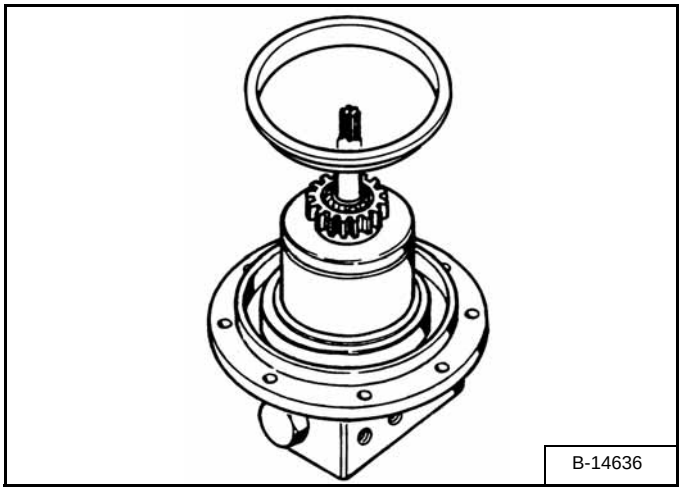
Figure 20-70-19



Press the bearing off the motor hub **[Figure 20-70-19]**.

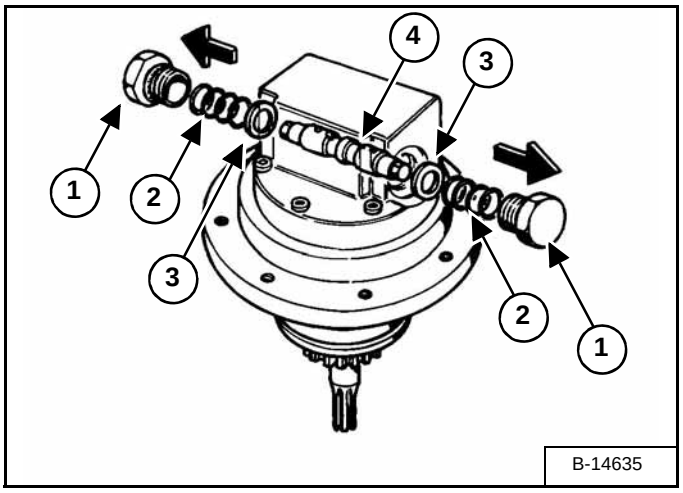
NOTE: Do not damage the bottom surface of the bearing as it is lapped (polished) to mate with the front seal ring.

Figure 20-70-20



Remove the front seal ring from the motor hub **[Figure 20-70-20]**.

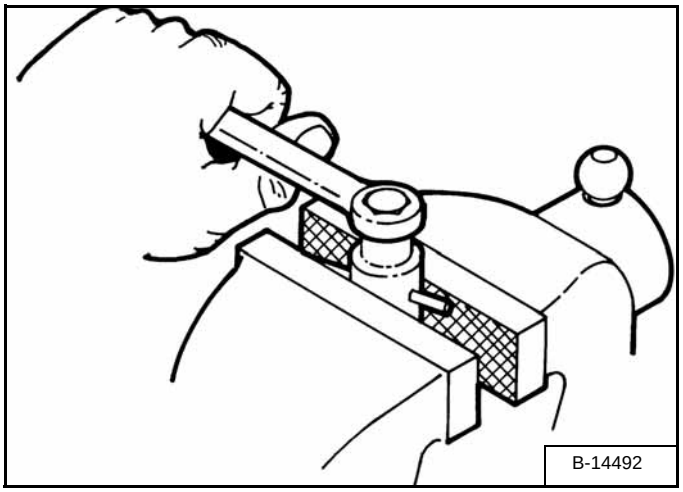
Figure 20-70-21



Remove the two plugs (Item 1), springs (Item 2), and washers (Item 3) **[Figure 20-70-21]** from each end of the housing.

Remove the spool (Item 4) **[Figure 20-70-21]**.

Figure 20-70-22



To disassemble the spool, insert a hardened pin through the hole in the spool and use a vise with protective jaws to hold the spool **[Figure 20-70-22]**.

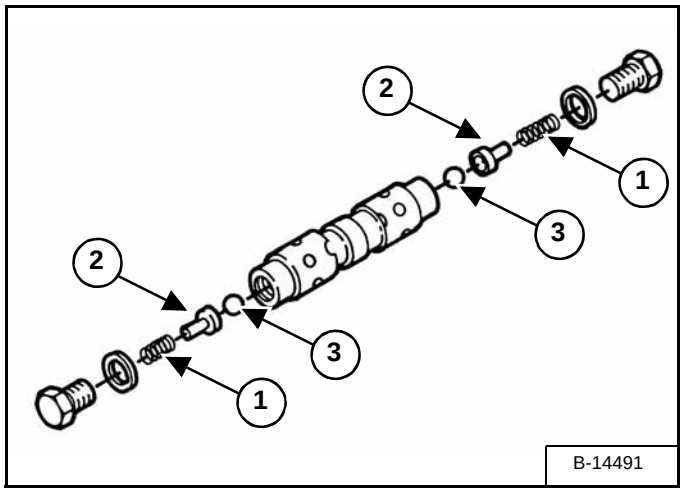
NOTE: Do not use any type of tool to grip the spool or damage to the spool will result.

Remove the two end plugs from the end of the spool **[Figure 20-70-22]**.

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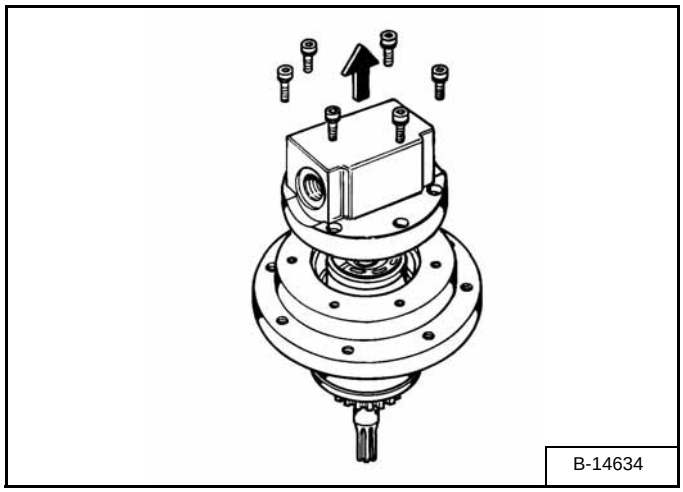
Disassembly (Cont'd)

Figure 20-70-23



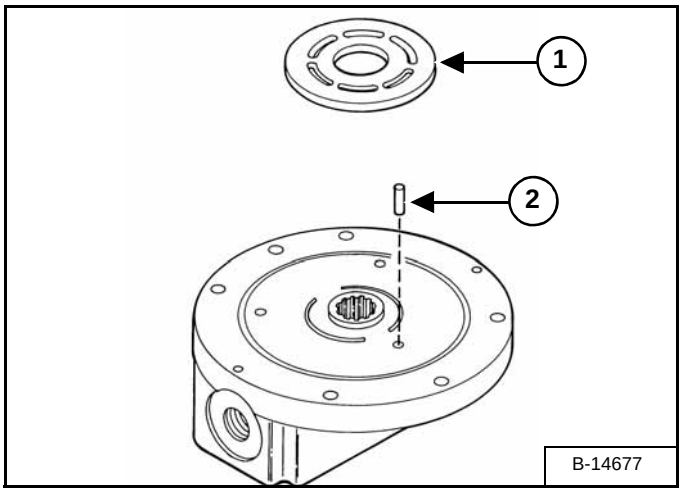
Remove the spring (Item 1) poppet (Item 2) and check ball (Item 3) **[Figure 20-70-23]** from the ends of the spool.

Figure 20-70-24



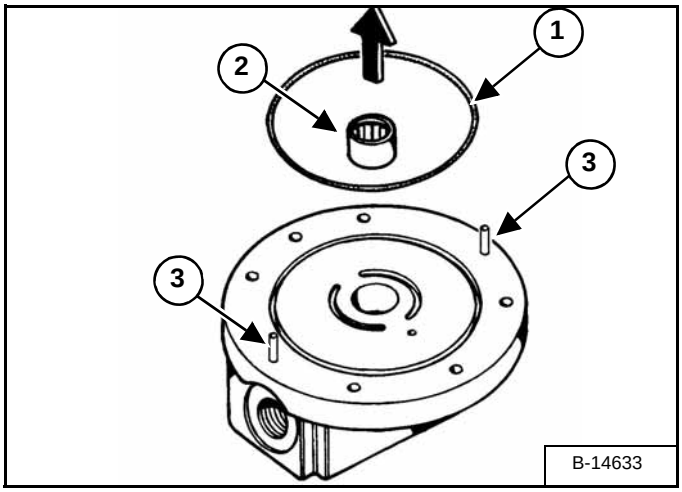
Remove the six bolts and remove the motor cover **[Figure 20-70-24]**.

Figure 20-70-25



Remove the bronze motor plate (Item 1) and dowel pin (Item 2) **[Figure 20-70-25]**.

Figure 20-70-26



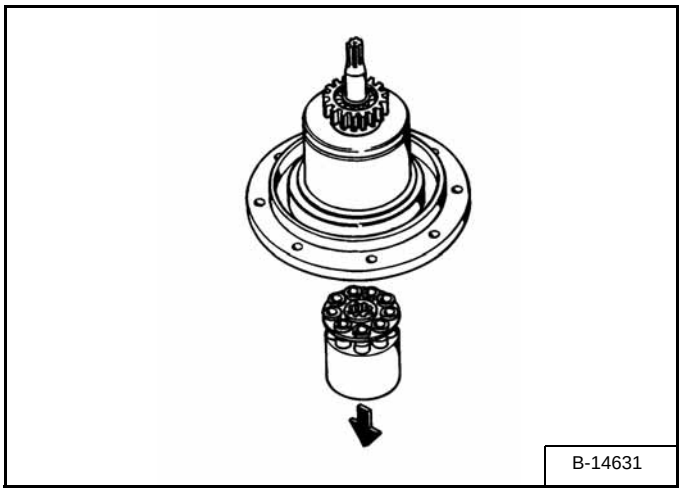
Remove the O-ring (Item 1) bearing (Item 2) and the two alignment pins (Item 3) remove the bearing (Item 2) **[Figure 20-70-26]** with a bearing puller.

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TRAVEL MOTOR (CONT'D)

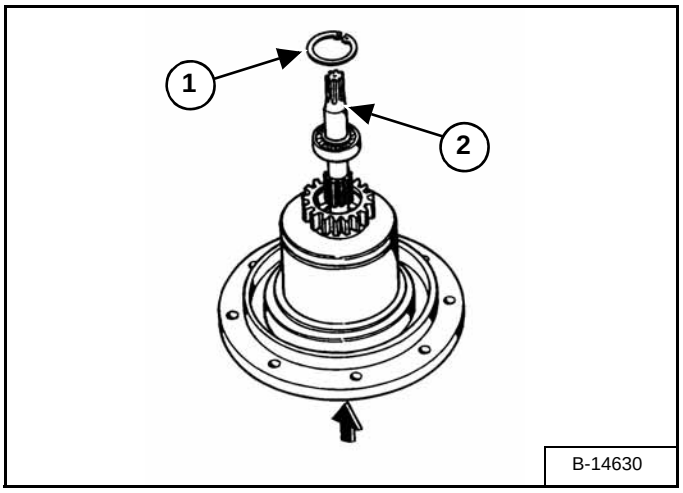
Disassembly (Cont'd)

Figure 20-70-27



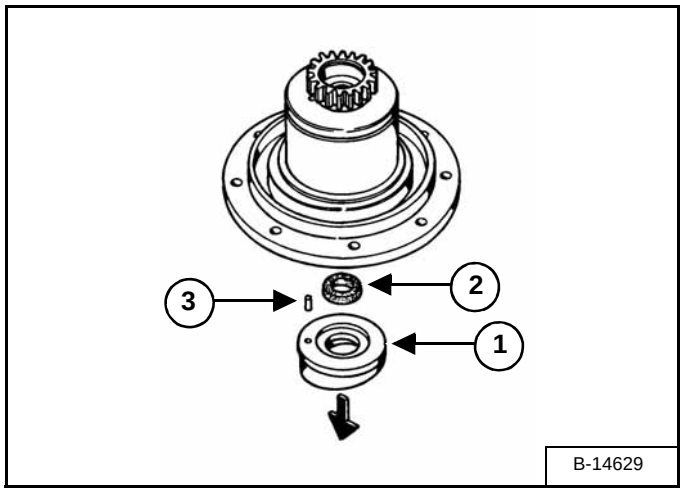
Invert the hub and the rotating block will slide out **[Figure 20-70-27]**.

Figure 20-70-28



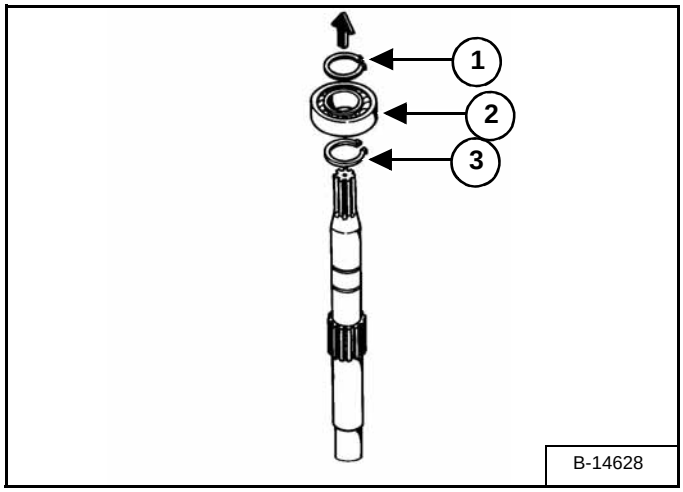
Remove the internal snap ring (Item 1) retaining the bearing/drive shaft to the hub and press the drive shaft (Item 2) **[Figure 20-70-28]** out of the hub.

Figure 20-70-29



Remove the swash plate (Item 1), seal (Item 2) and alignment pin (Item 3) **[Figure 20-70-29]**.

Figure 20-70-30



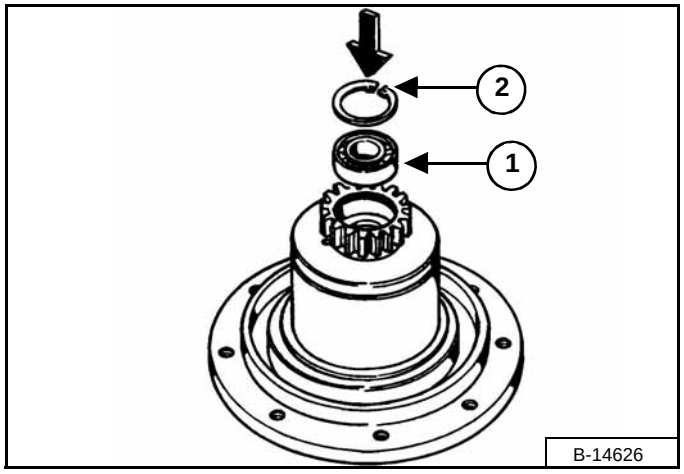
Remove the snap ring (Item 1), bearing (Item 2) and second snap ring (Item 3) **[Figure 20-70-30]** from the drive shaft.

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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 are damaged, replace all the planetary gears and sun gear from the stage (first or second) that the damaged gear is from. One damaged gear can cause microscopic fatigue crack in mating teeth and cause premature failure after servicing. Apply oil to all O-rings (do not oil the rubber torque ring) and light grease to the ball and roller bearings before installation.

Figure 20-70-31

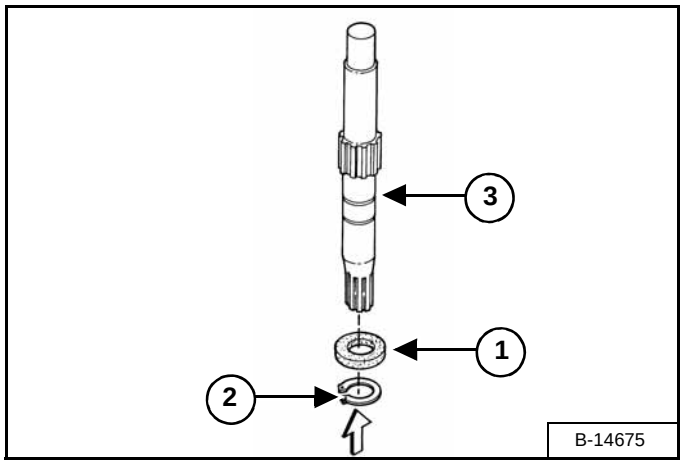


Press the bearing (Item 1) **[Figure 20-70-31]** in the motor hub.

Install the internal snap ring (Item 2) **[Figure 20-70-31]** in the motor hub.

Wrap glossy paper around the snap ring grooves to prevent damage to the seal.

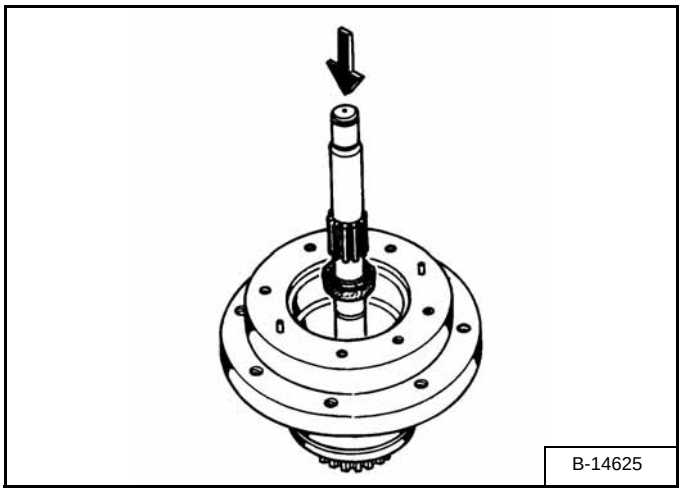
Figure 20-70-32



Lubricate with oil, and install the seal (Item 1) **[Figure 20-70-32]** on the drive shaft.

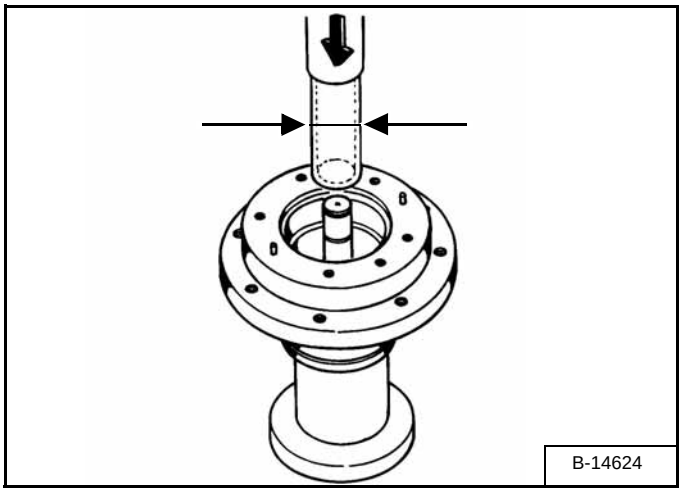
Install the snap ring (Item 2) on the drive shaft in the second groove (Item 3) **[Figure 20-70-32]**.

Figure 20-70-33



Invert the hub and press the drive shaft into the hub and bearing assembly **[Figure 20-70-33]**.

Figure 20-70-34



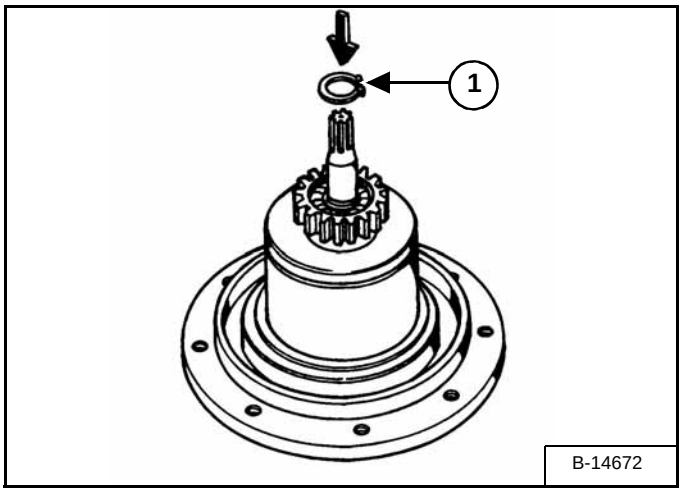
Install the new seal into the seal seat in the motor hub using the seal seating tool **[Figure 20-70-34]**. Obtain the seal seating tool locally. The dimensions of the seal seating tool are as follows:

Height	2.75 in. (70 mm)
I.D.	.677 in. (17, 2 mm)
O.D.	.708 in. (18 mm)

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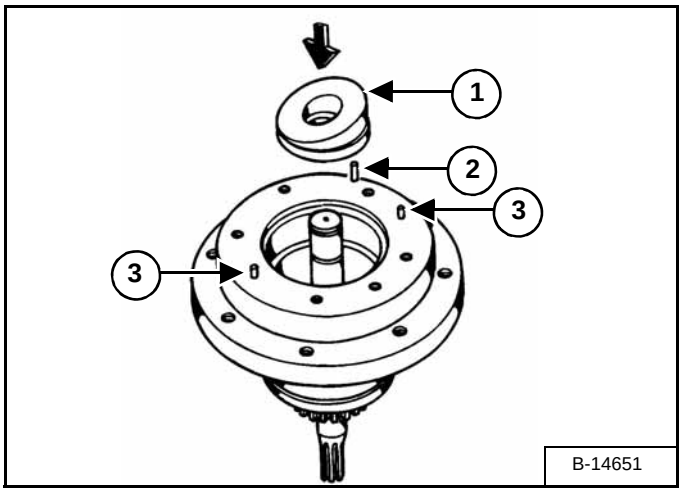
Assembly (Cont'd)

Figure 20-70-35



Invert the motor hub and install the external snap ring (Item 1) **[Figure 20-70-35]**.

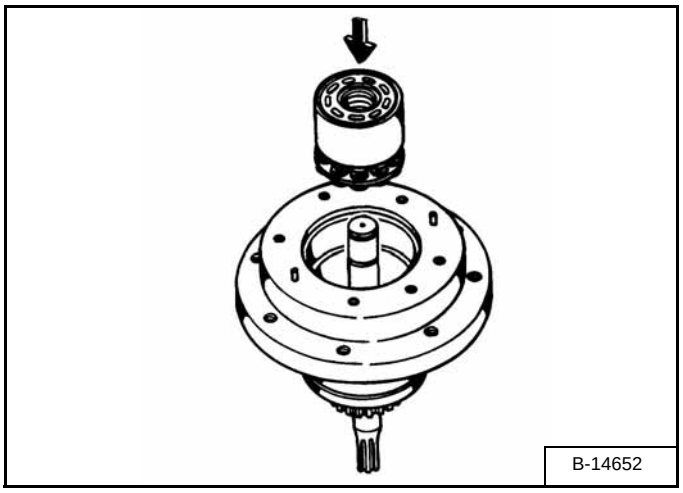
Figure 20-70-36



Install the swash plate (Item 1) and alignment pin (Item 2) **[Figure 20-70-36]** in the motor hub.

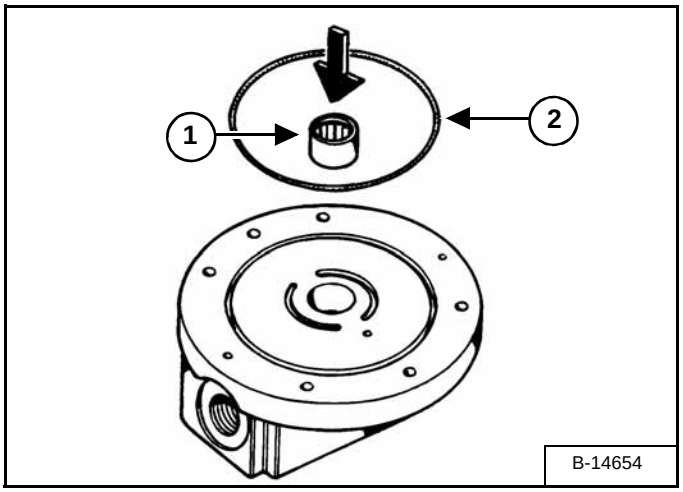
Install the two alignment pins (Item 3) **[Figure 20-70-36]** in the motor hub.

Figure 20-70-37



Lubricate with oil, and install the rotating block in the motor hub **[Figure 20-70-37]**.

Figure 20-70-38



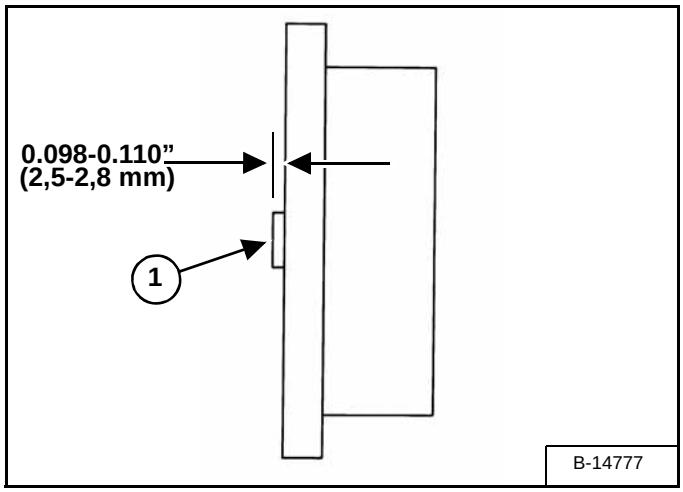
Press the bearing (Item 1) **[Figure 20-70-38]** into the motor cover.

Apply oil and install the O-ring (Item 2) **[Figure 20-70-38]**.

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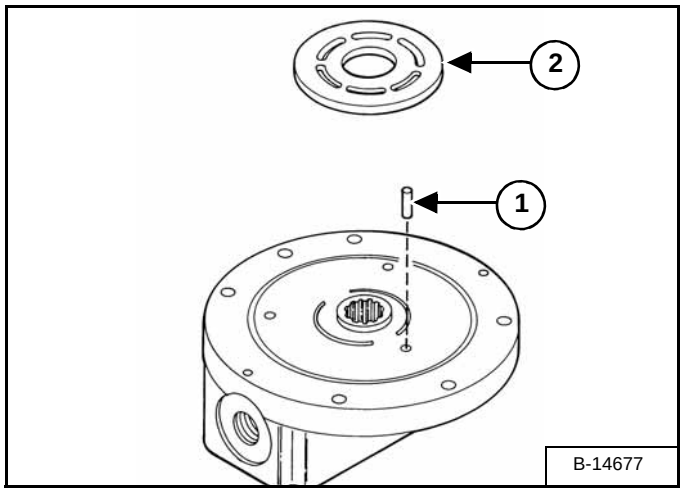
Assembly (Cont'd)

Figure 20-70-39



The bearing (Item 1) **[Figure 20-70-39]** must extend from the face of the cover 0.098 to 0.110 in. (2,5 to 2,8 mm).

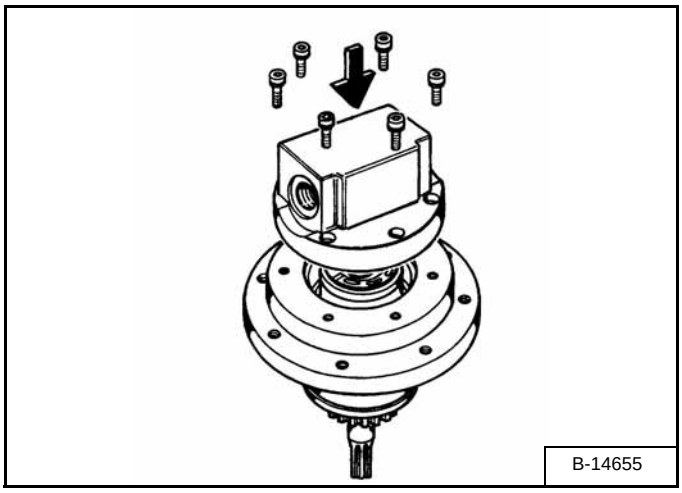
Figure 20-70-40



Install the alignment pin (Item 1) **[Figure 20-70-40]** on the motor cover.

Install the valve plate (Item 2) on the motor cover, with the alignment notch, in the valve plate (Item 2) sliding over the alignment pin (Item 1) **[Figure 20-70-40]**.

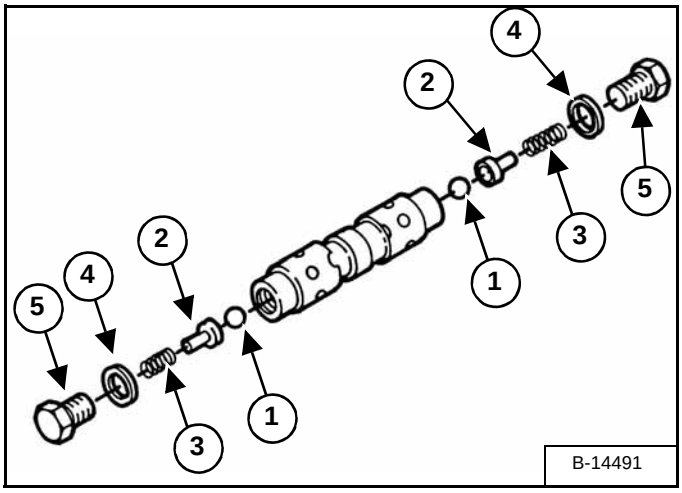
Figure 20-70-41



Lubricate the bearing with oil and install the motor cover onto the hub with six bolts **[Figure 20-70-41]**.

Tighten the bolts in a crisscross manner to 18 to 22 ft.-lb. (25 to 30 N•m) torque.

Figure 20-70-42



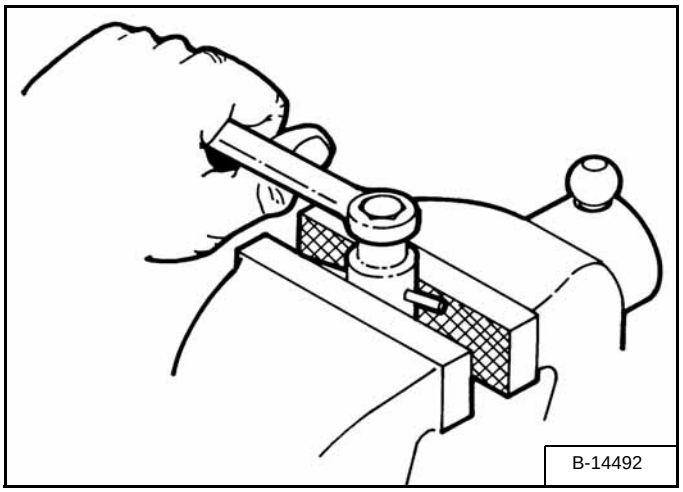
Install the check ball (Item 1), poppet (Item 2) and spring (Item 3) **[Figure 20-70-42]** into both ends of the spool.

Apply oil and install the new O-rings (Item 4) on the plugs (Item 5) **[Figure 20-70-42]**.

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Assembly (Cont'd)

Figure 20-70-43



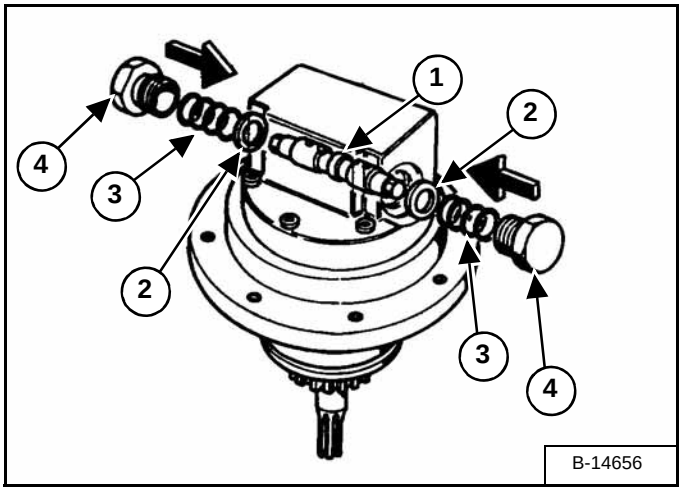
To assemble the spool, insert a hardened pin through the hole in the spool and use a vise with protective jaws to hold the spool **[Figure 20-70-43]**.

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

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

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

Figure 20-70-44



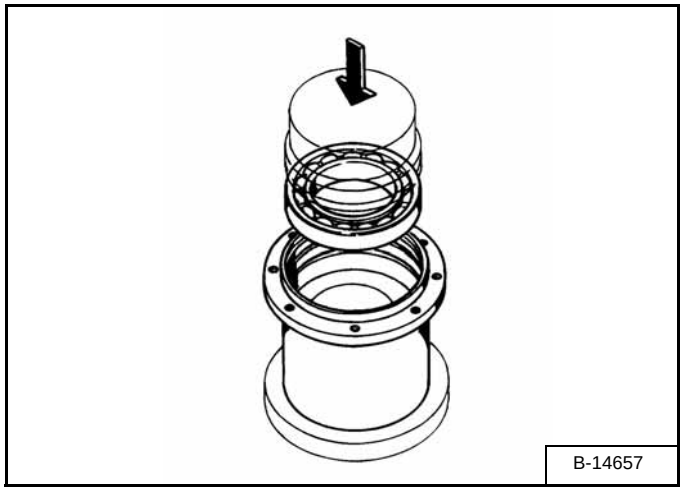
Apply oil to the spool and install the spool (Item 1) **[Figure 20-70-44]** in the motor cover.

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

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

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

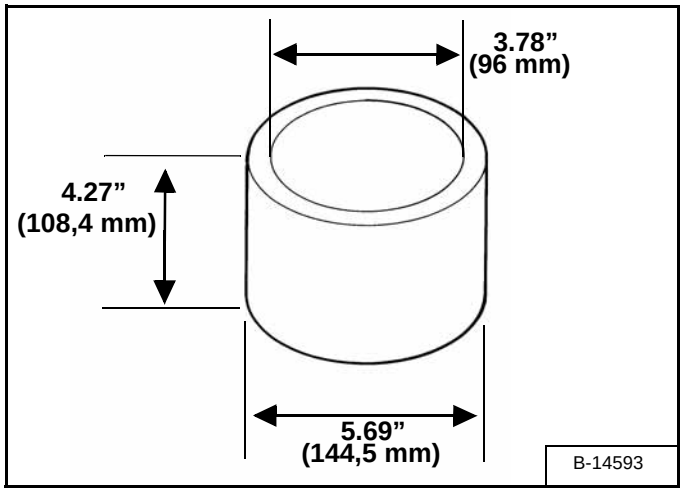
Figure 20-70-45



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

Obtain the bearing installation tool locally.

Figure 20-70-46



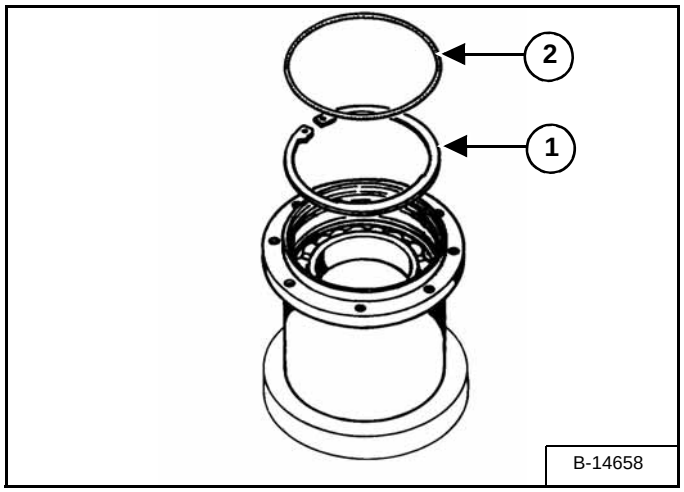
The dimensions of the bearing installation tool **[Figure 20-70-46]** are as follows:

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

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Assembly (Cont'd)

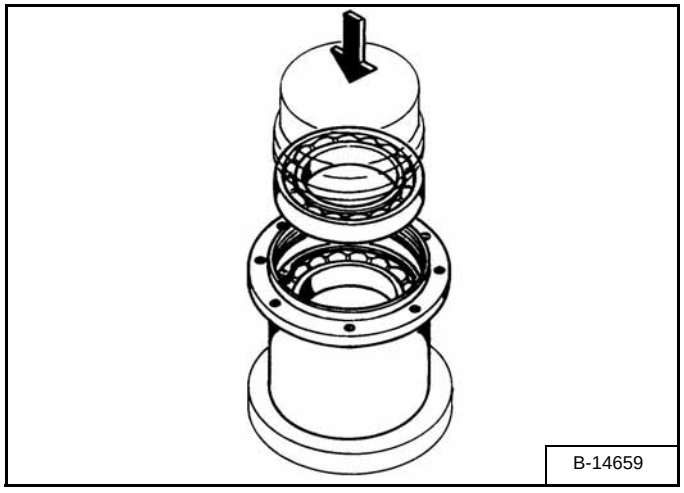
Figure 20-70-47



Install the internal snap ring (item 1) **[Figure 20-70-47]** in the housing.

Apply oil on the O-ring and install the O-ring (Item 2) **[Figure 20-70-47]** in the housing.

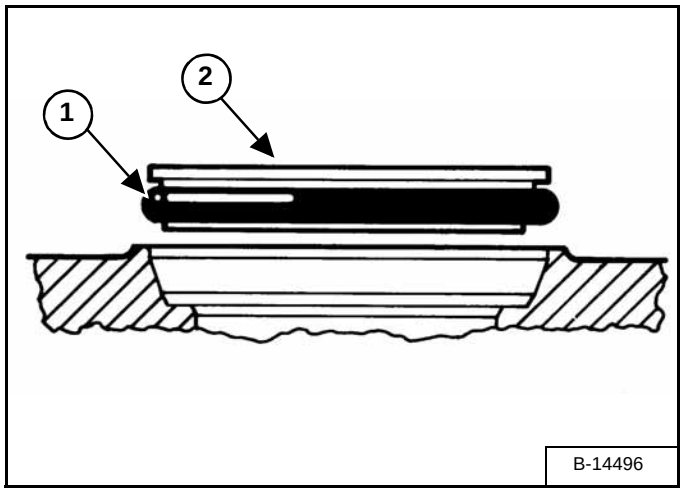
Figure 20-70-48



Apply oil to the outer edge of the second bearing and press the bearing in the housing **[Figure 20-70-48]**.

NOTE: Make sure the O-ring is correctly installed in the housing so it is not damaged when the second bearing is installed.

Figure 20-70-49

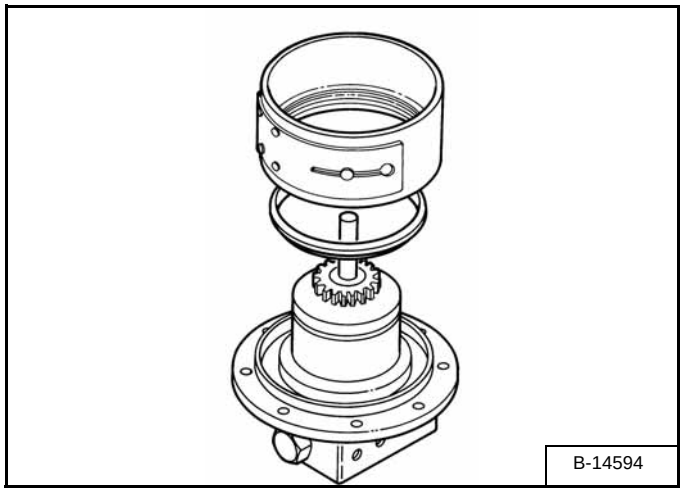


Install the O-ring (Item 1) on the seal ring (Item 2) **[Figure 20-70-49]**.

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 20-70-50

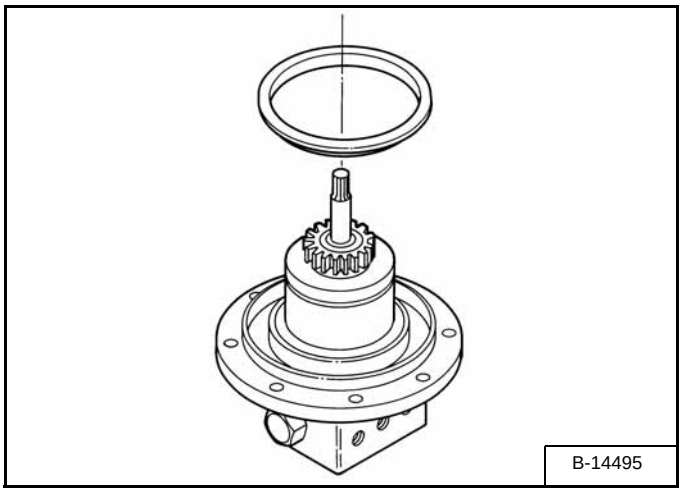


Install the seal seating tool (MEL1468) on the seal ring **[Figure 20-70-50]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-70-51



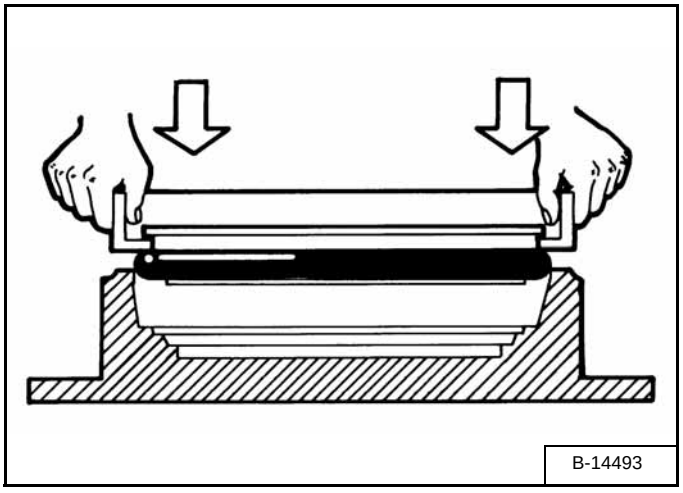
The seal ring assembly must be lubricated with alcohol, so the O-ring will slip past the housing retaining ring and seal uniform in the motor housing radius **[Figure 20-70-51]**.

The O-ring 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 **[Figure 20-70-51]**.

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

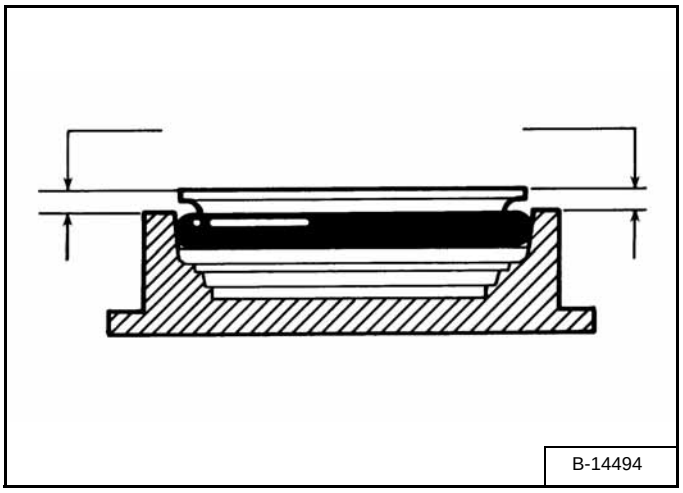
Figure 20-70-52



Shake off the excess alcohol and install the seal ring assembly on the motor **[Figure 20-70-52]**.

Use firm even pressure on the installation tool (MEL1468) to pop the O-ring into the motor housing.

Figure 20-70-53



After the seal ring is installed, check the stand out height **[Figure 20-70-53]** in four places, 90° apart.

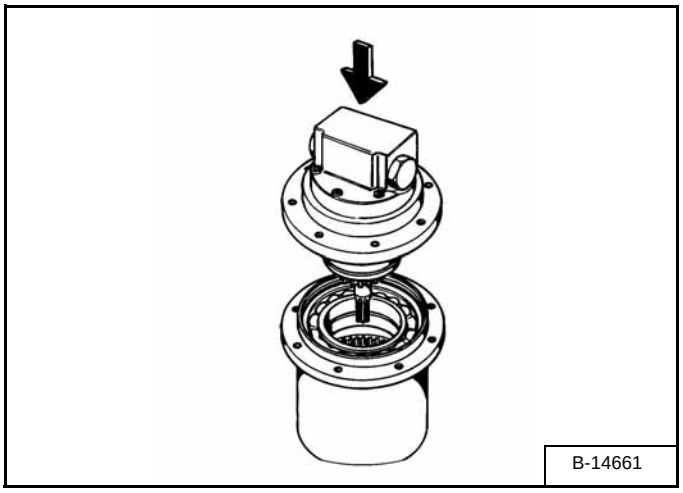
The stand out height is 0.30 ± 0.02 in. (7,7 ± 0,5 mm).

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 20-70-54

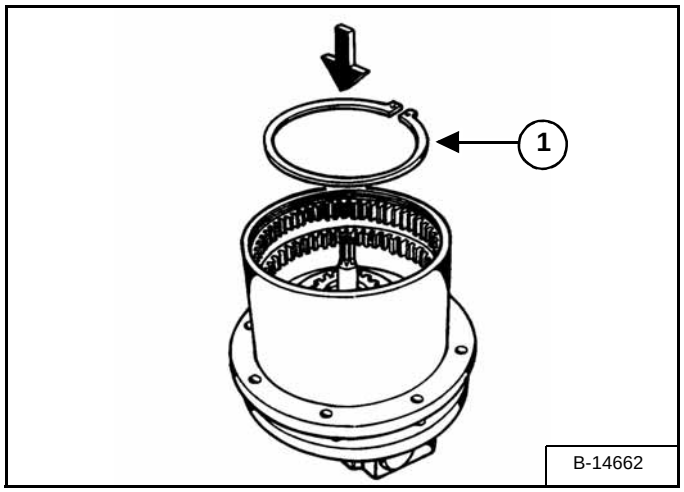


Press the reduction unit and motor assembly into the seat of the bearings **[Figure 20-70-54]**. The inner bearing may move deeper into the housing as the motor assembly is pressed into the housing. If this happens, press the inner bearing down to its original position.

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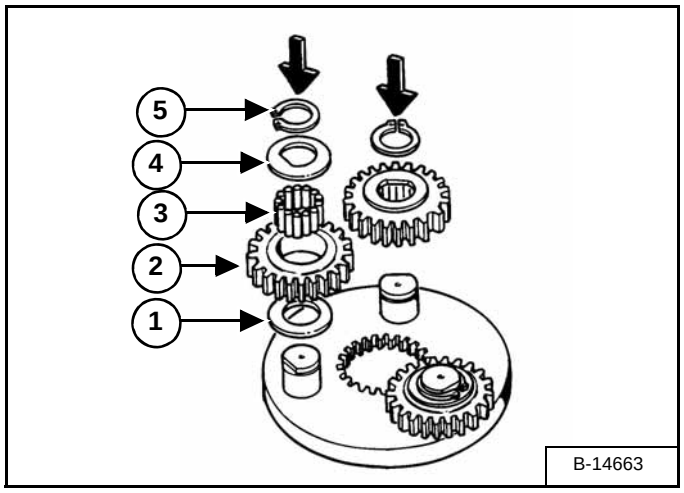
Assembly (Cont'd)

Figure 20-70-55



Install the external snap ring (Item 1) **[Figure 20-70-55]** in the motor reduction unit.

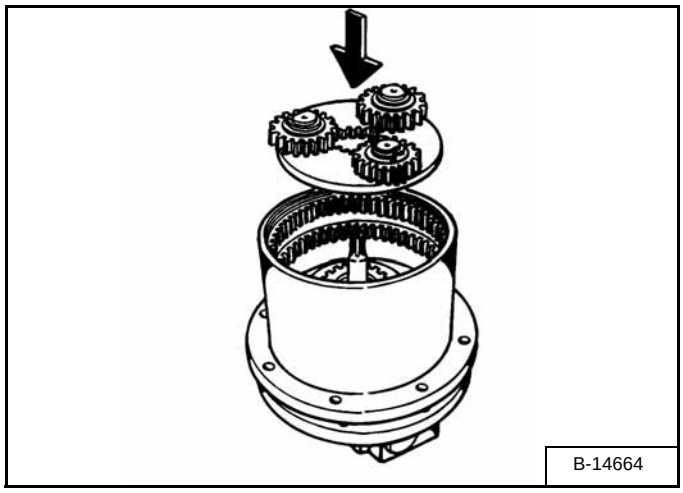
Figure 20-70-56



Install the thrust washers (Item 1), planetary gears (Item 2), bearing (Item 3) anti-rotation washers (Item 4) and external snap rings (Item 5) **[Figure 20-70-56]**.

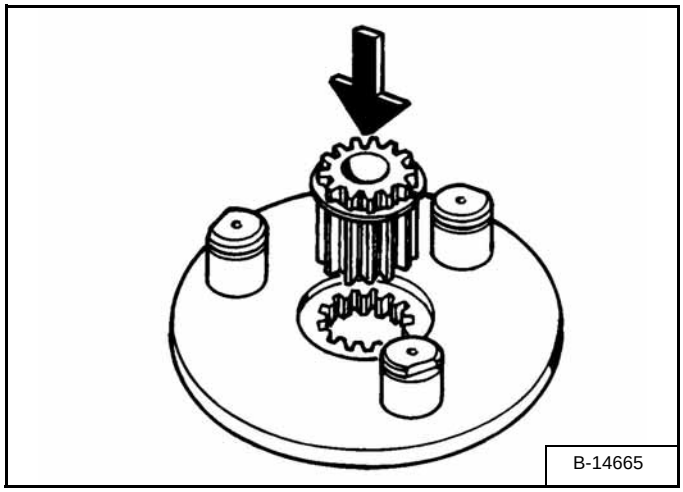
Install the snap rings so the opening of the snap ring is towards the outside.

Figure 20-70-57



Install the planetary assembly in the hub **[Figure 20-70-57]**.

Figure 20-70-58

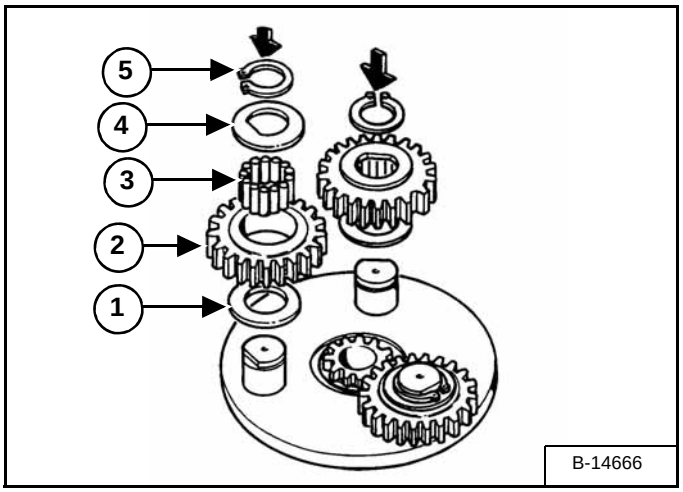


Install the sun gear into the outer planetary carrier **[Figure 20-70-58]**.

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Assembly (Cont'd)

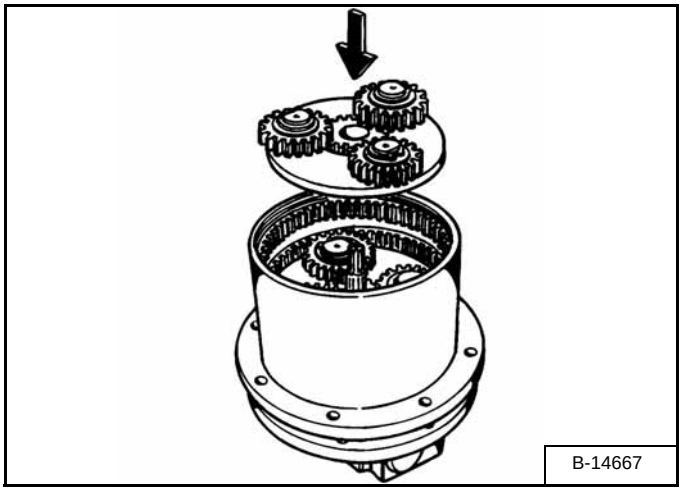
Figure 20-70-59



Install the thrust washers (Item 1) planetary gears (Item 2) bearings (Item 3) anti-rotation washers (Item 4) and external snap rings (Item 5) **[Figure 20-70-59]**.

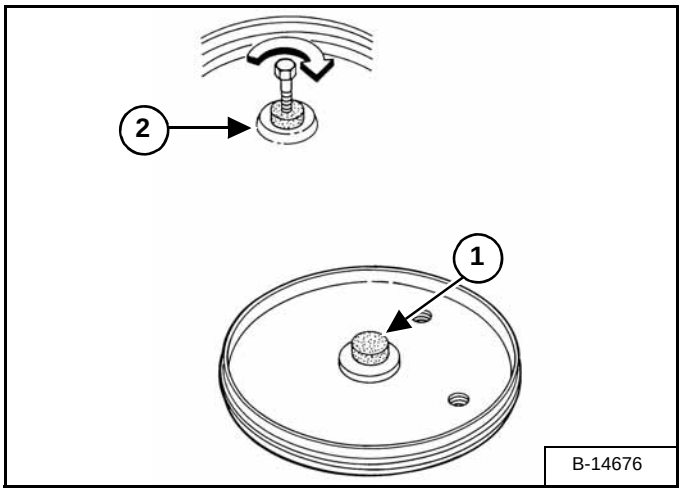
Install the snap rings so the opening of the snap ring is towards the outside.

Figure 20-70-60



Install the outer planetary assembly in the hub **[Figure 20-70-60]**.

Figure 20-70-61



Inspect the cover bushing (Item 1) **[Figure 20-70-61]** for wear.

If the bushing (Item 1) **[Figure 20-70-61]** needs to be replaced, drill a hole in the center of the bushing using a number three drill bit.

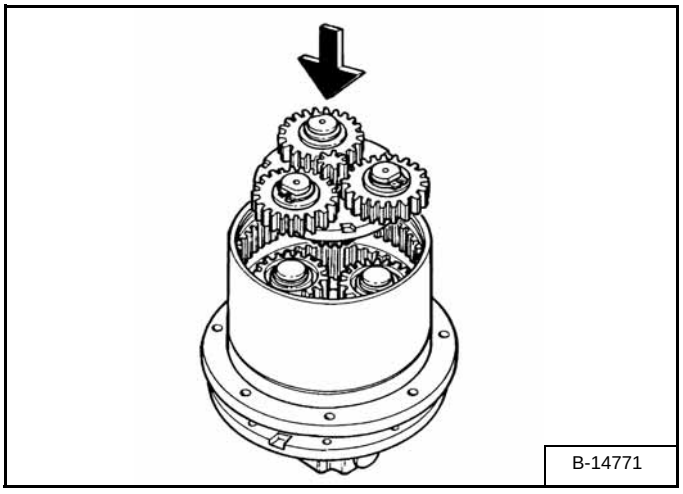
Thread the hole with a 1/4 X 28 in. NF tap.

Install a 1/4 X 28 in. bolt (Item 2) **[Figure 20-70-61]** in the bushing and pull the bushing out of the cover.

Install the new bushing in the cover with the bevel down.

The clearance between the cover bushing and the sun gear must be 0.008 to 0.031 in. (0,2 to 0,8 mm).

Figure 20-70-62



Place a 1/2 in. (13 mm) long piece of 1/16 in. (1,5 mm) solder on the sun gear **[Figure 20-70-62]**.

Seat the cover in the hub.

Remove the cover and measure the solder.

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Assembly (Cont'd)

If the clearance between the sun gear and cover bushing does not meet specifications, order the bushing shim kit from Bobcat Parts.

Shim Thickness	Part Number
0.020 in. (0,5 mm)	6669597
0.030 in. (0,76 mm)	6669598
0.050 in. (1,27 mm)	6669599

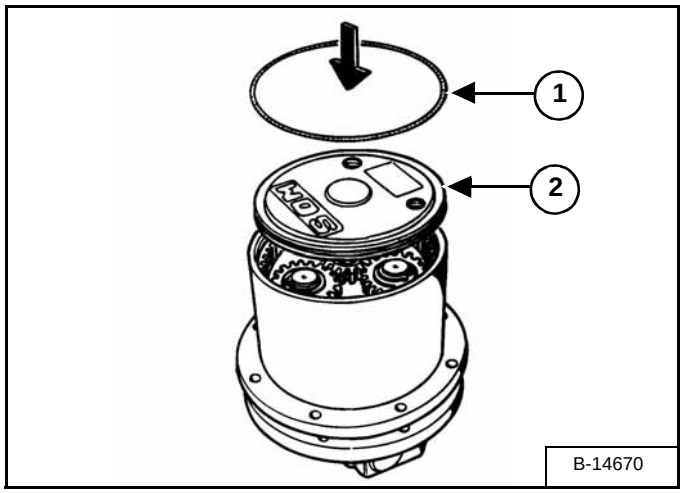
Remove the bushing.

Install the correct shim under the bushing and install the bushing.

NOTE: Make sure there are no burrs on the bushing face from bushing removal.

Repeat the procedure for checking clearance between the sun gear and cover bushing.

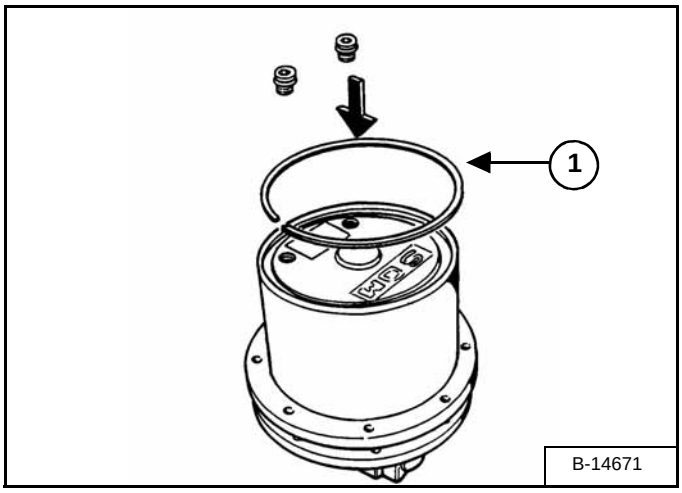
Figure 20-70-63



Lubricate and install the O-ring (Item 1) **[Figure 20-70-63]** on the cover.

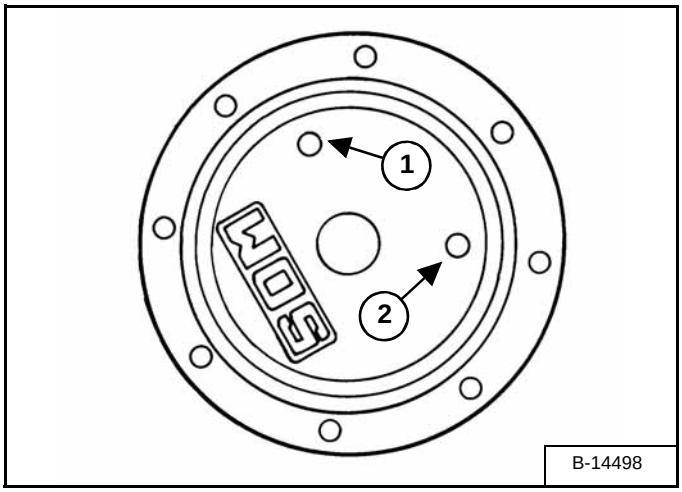
Install the cover (Item 2) **[Figure 20-70-63]** on the hub.

Figure 20-70-64



Install the internal snap ring (Item 1) **[Figure 20-70-64]** securing the cover to the travel motor.

Figure 20-70-65



Add 1.06 qt. (1,0 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 20-70-65]**.

Install and tighten the plugs plugs.

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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 battery. (See Removal and Installation on Page 50-20-1)

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

Remove the floor mat and floor panels. (See FLOOR MAT AND FLOOR PANELS on Page 40-100-1)

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid 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

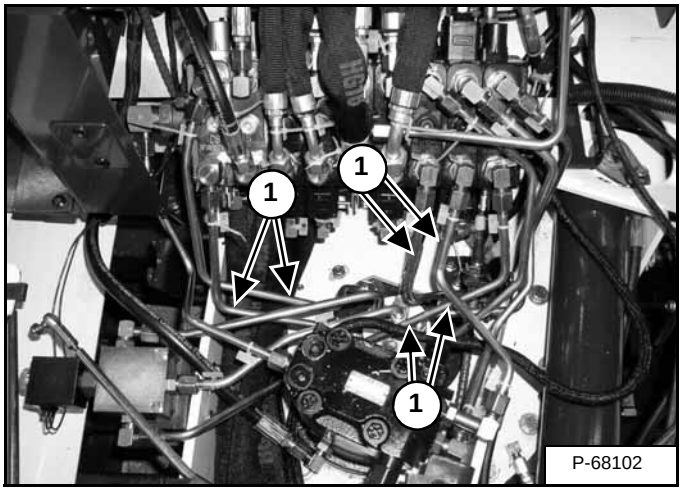
IMPORTANT

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

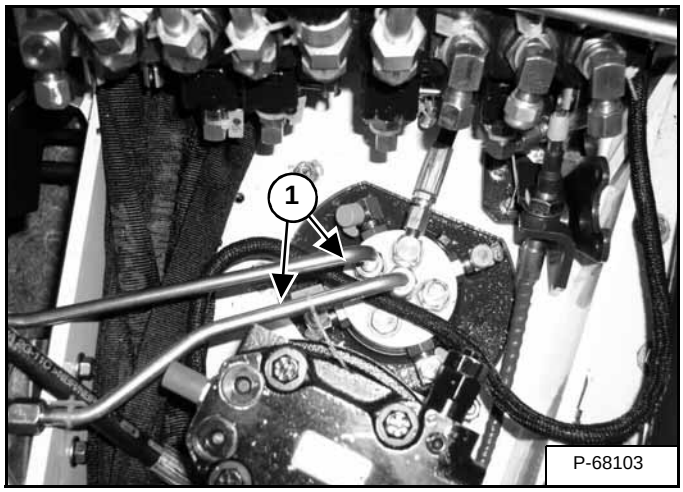


Remove the tubelines (Item 1) **[Figure 20-80-2]** from the swivel joint.

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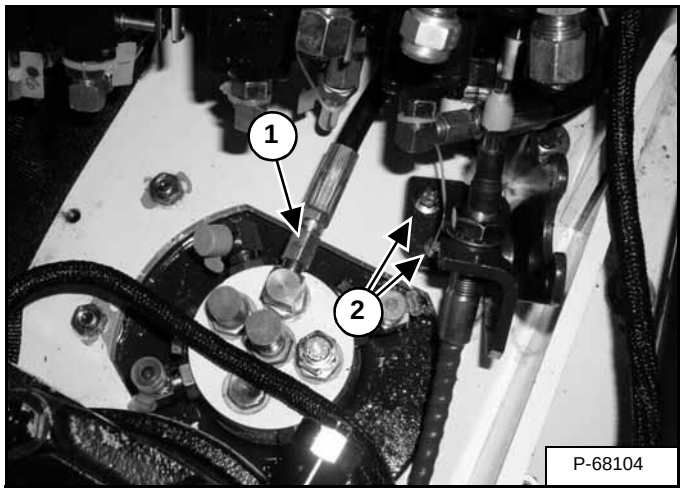
Removal And Installation (Cont'd)

Figure 20-80-3



Remove the tubelines (Item 1) **[Figure 20-80-3]** from the swivel joint.

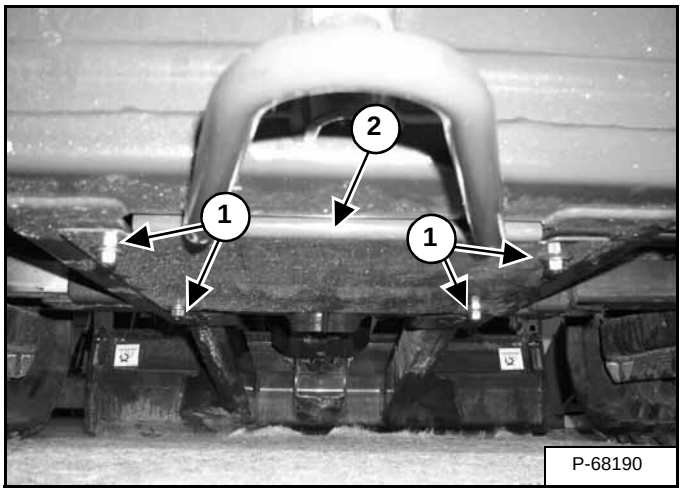
Figure 20-80-4



Remove the hose (Item 1) **[Figure 20-80-4]** from the swivel joint.

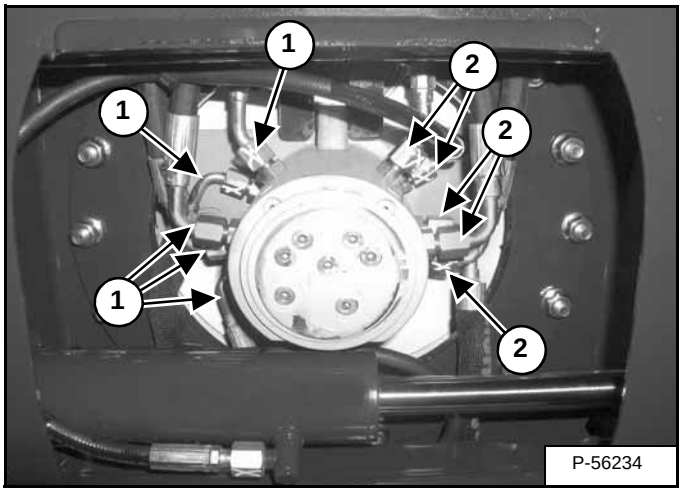
Remove the bolts (Item 2) **[Figure 20-80-4]** from the blade cable bracket. Move the blade cable bracket assembly out of the way.

Figure 20-80-5



Remove the bolts (Item 1) and plate (Item 2) **[Figure 20-80-5]** from the underside of the excavator.

Figure 20-80-6



Remove the five hoses (Item 1) **[Figure 20-80-6]** from the left side of the swivel joint.

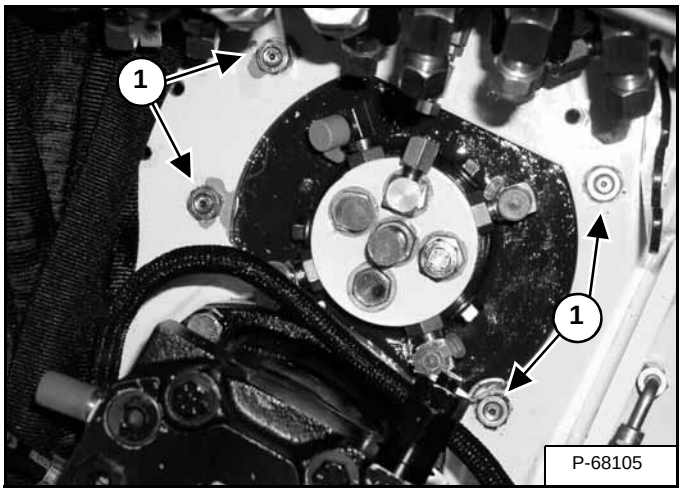
Remove the five hoses (Item 2) **[Figure 20-80-6]** from the right side of the swivel joint.

NOTE: Support the swivel joint on the underside of the excavator to prevent the swivel joint from falling when the four nuts are removed.

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Removal And Installation (Cont'd)

Figure 20-80-7

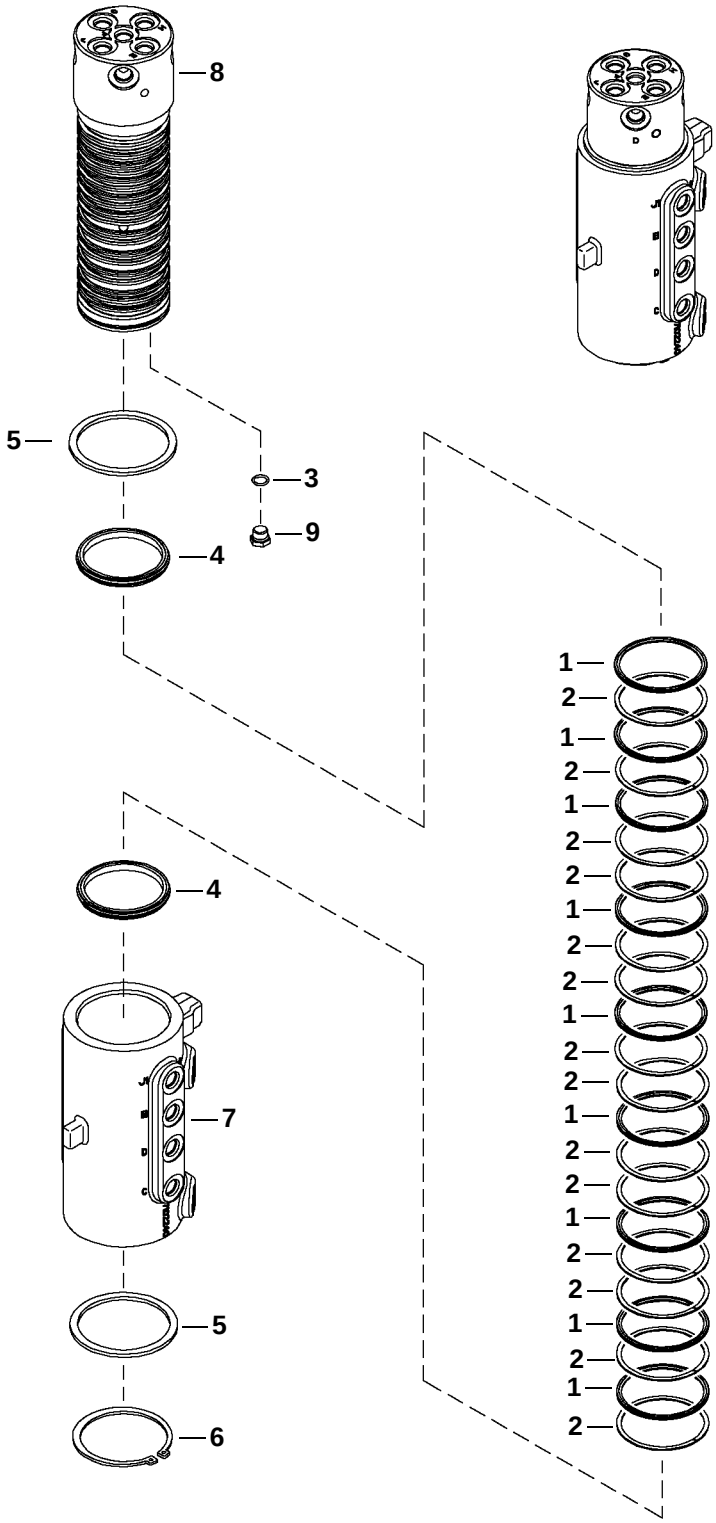


Remove the four nuts (Item 1) **[Figure 20-80-7]** and slide the swivel joint out from the underside of the excavator.

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Parts Identification

1. Seal & O-Ring
2. Backup Seal
3. O-Ring
4. Inner/Outer Seals
5. Washer
6. Snap Ring
7. Housing
8. Rotor
9. Plug



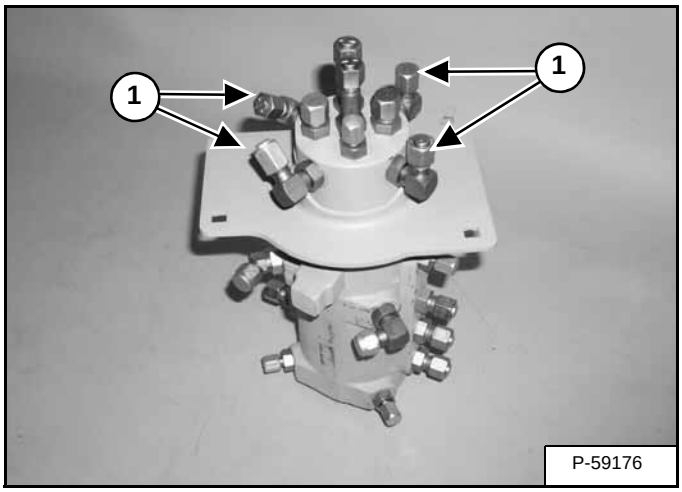
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SWIVEL JOINT (CONT'D)

Disassembly

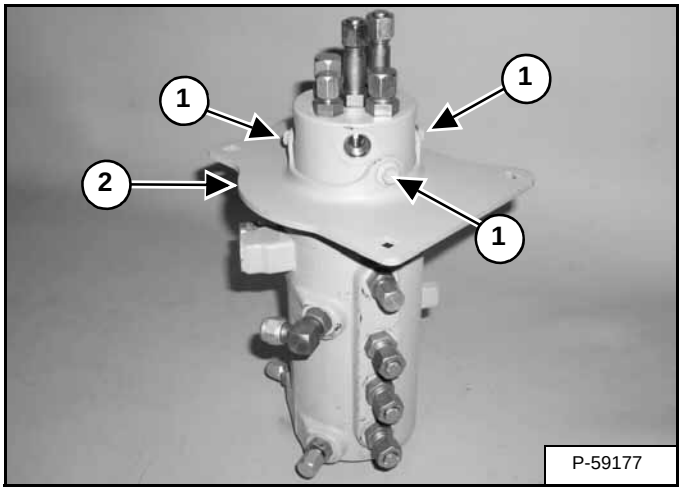
Figure 20-80-8



Mark fitting orientation. Remove the fittings (Item 1) **[Figure 20-80-8]**.

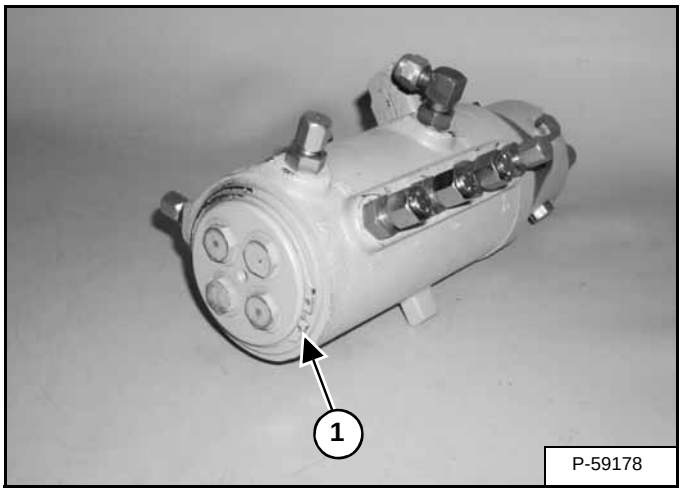
NOTE: The fittings may be different but the procedure is the same.

Figure 20-80-9



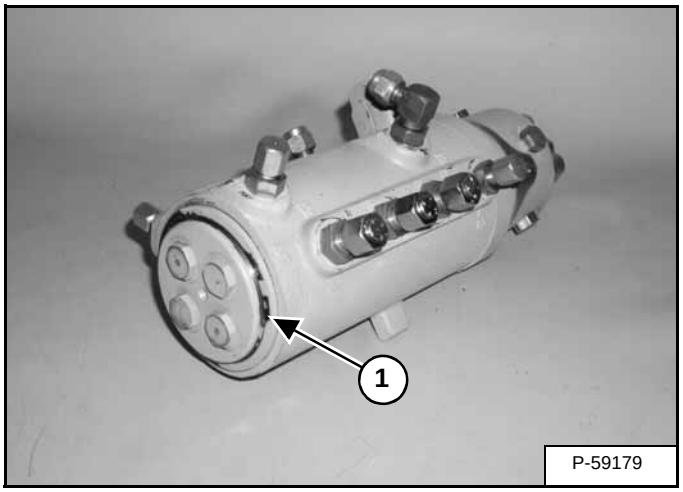
Remove the three bolts (Item 1). Remove the mount (Item 2) **[Figure 20-80-9]**.

Figure 20-80-10



Remove the snap ring (Item 1) **[Figure 20-80-10]** from the bottom of the swivel joint.

Figure 20-80-11

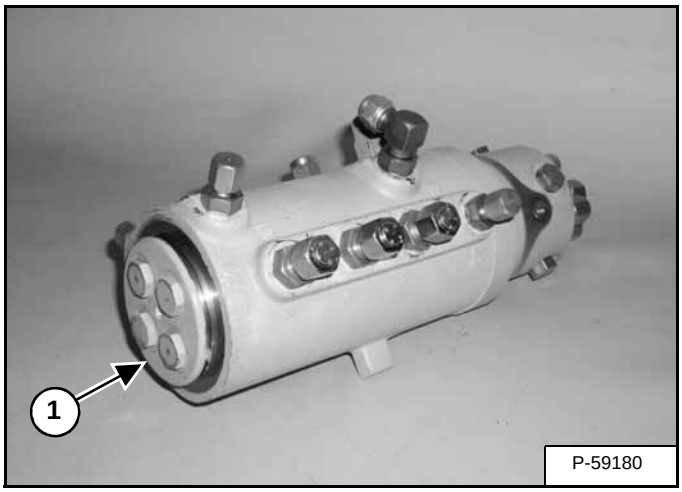


Remove the nylon washer (Item 1) **[Figure 20-80-11]**.

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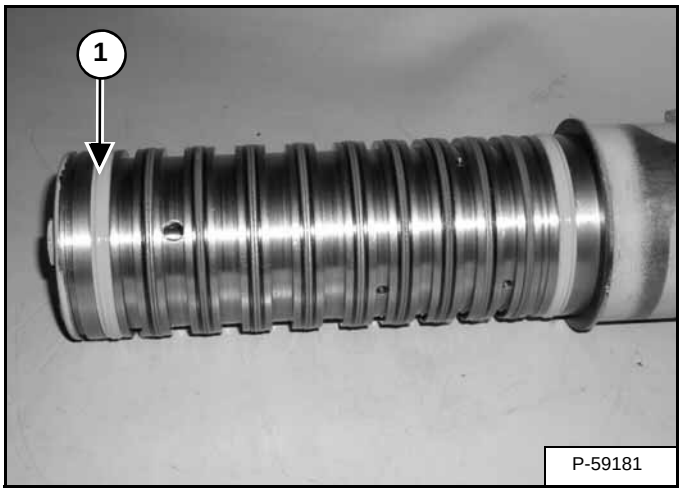
Disassembly (Cont'd)

Figure 20-80-12



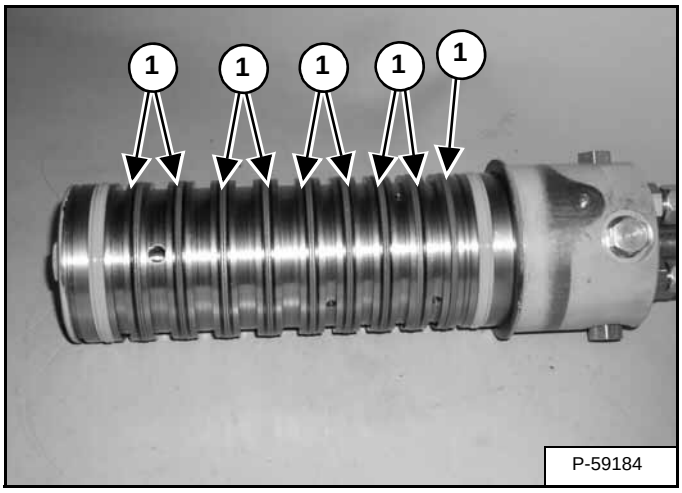
Tap the end of the rotor (Item 1) **[Figure 20-80-12]** with a rubber mallet to drive the rotor out of the housing.

Figure 20-80-13



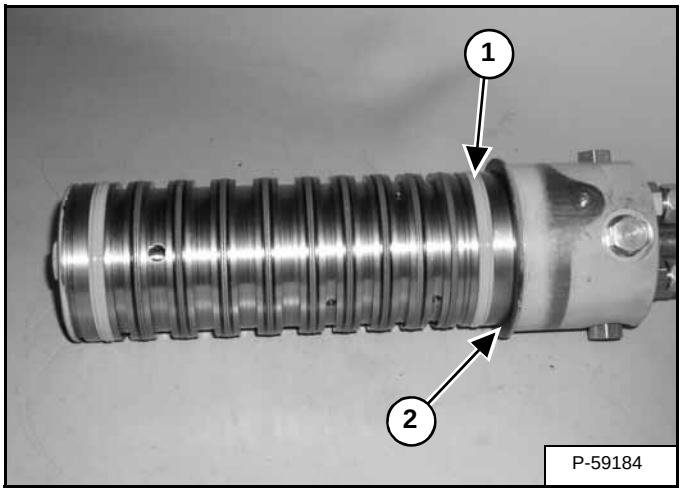
Remove the outer and inner seals (Item 1) **[Figure 20-80-13]**.

Figure 20-80-14



Remove the seals, backup seals and O-rings (Item 1) **[Figure 20-80-14]**.

Figure 20-80-15



Remove the outer and inner seals (Item 1). Remove the nylon washer (Item 2) **[Figure 20-80-15]**.

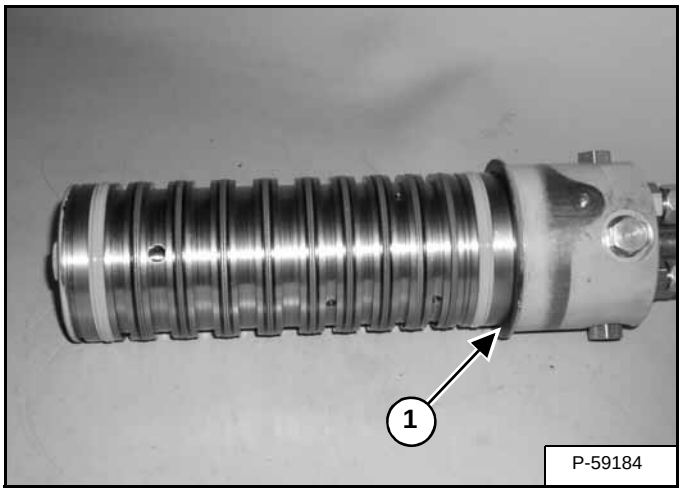
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Assembly

Clean all parts in solvent and dry with compressed air.

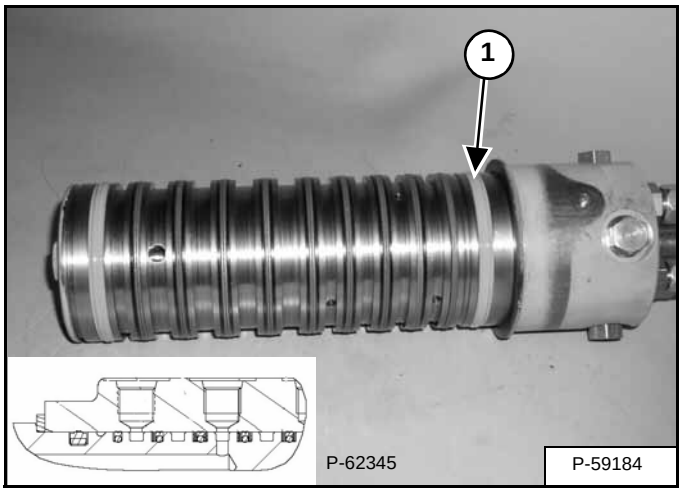
Inspect the rotor and housing for scratches or wear that could cause internal leakage. Always install new seals and backup seals. Lubricate all seals and backup seals with clean hydraulic fluid before installation.

Figure 20-80-16



Install the nylon washer (Item 1) **[Figure 20-80-16]**.

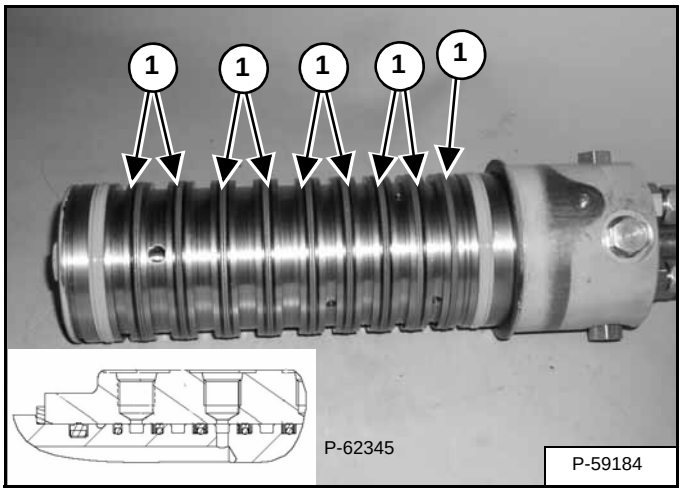
Figure 20-80-17



Heat the seals in hydraulic fluid for 3 minutes at 130°F (54°C). Install the inner and outer seals (Item 1) **[Figure 20-80-17]**.

NOTE: The inner and outer seal are serviceable as 1 part number.

Figure 20-80-18



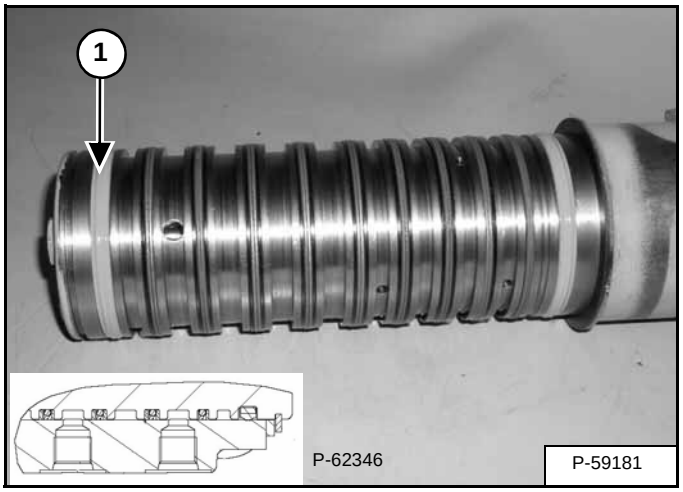
Install the O-rings under the seals (Item 1) **[Figure 20-80-18]**.

Heat the seals in hydraulic fluid for 3 minutes at 130°F (54°C).

Install the seals and backup seals (Item 1) **[Figure 20-80-18]**.

NOTE: The seal and O-ring are serviceable as 1 part number.

Figure 20-80-19



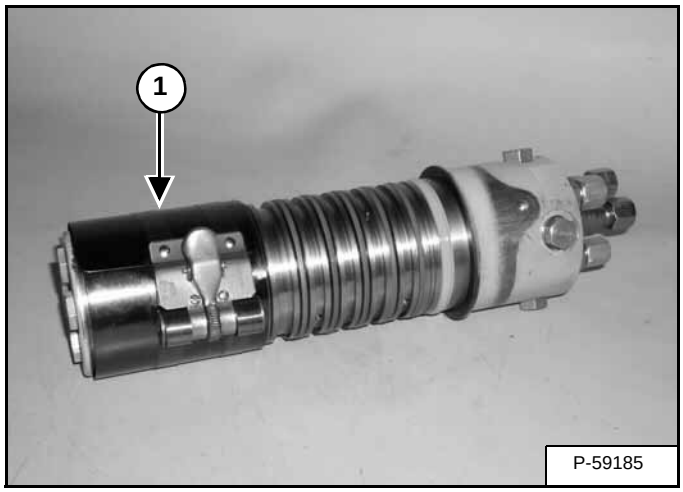
Heat the seals in hydraulic fluid for 3 minutes at 130°F (54°C). Install the inner and outer seals (Item 1) **[Figure 20-80-19]**.

NOTE: The inner and outer seal are serviceable as one part number.

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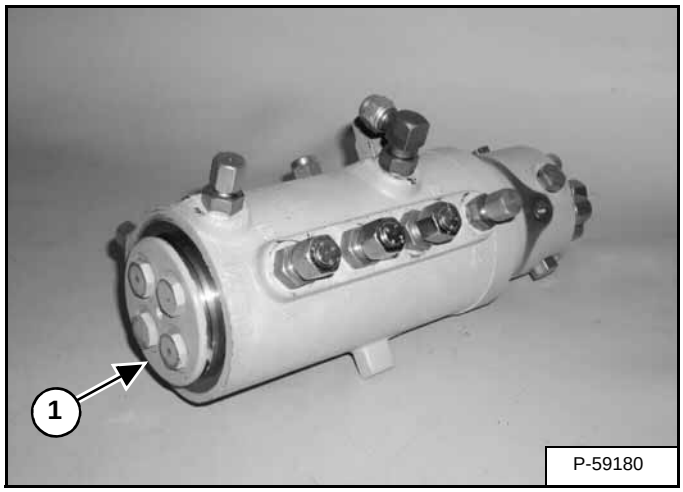
Assembly (Cont'd)

Figure 20-80-20



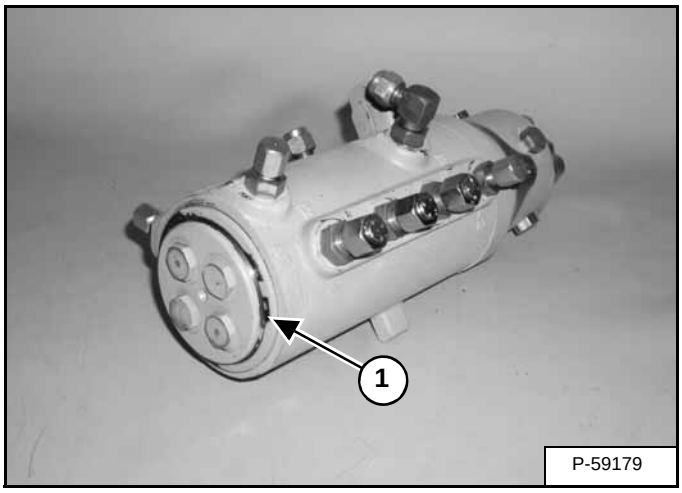
NOTE: A ring compressor (Item 1) may be used to fit the seals into the seal grove [Figure 20-80-20]. Compress the seals for 3 minutes.

Figure 20-80-21



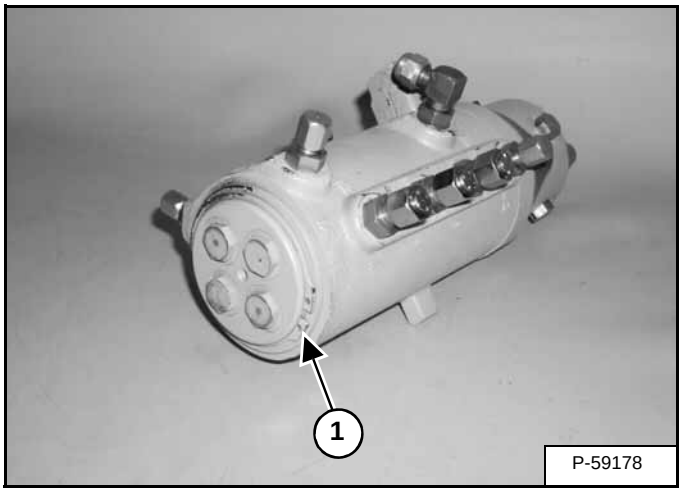
Apply hydraulic fluid to the rotor. Install the rotor (Item 1) **[Figure 20-80-21]** in the housing.

Figure 20-80-22



Install the nylon washer (Item 1) **[Figure 20-80-22]**.

Figure 20-80-23

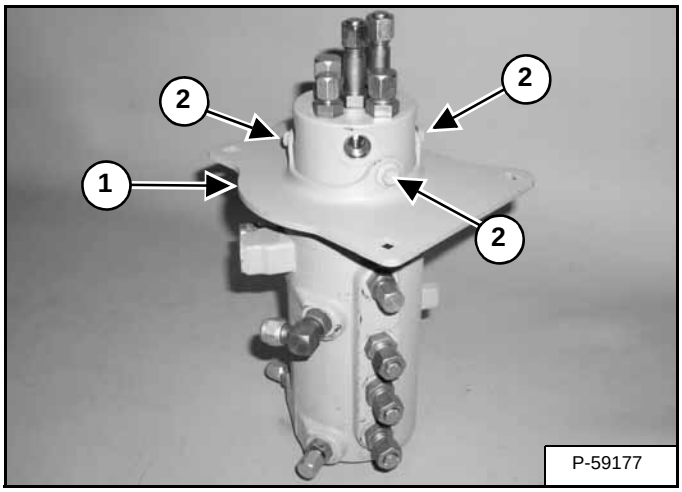


Remove the snap ring (Item 1) **[Figure 20-80-23]** from the bottom of the swivel joint.

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Assembly (Cont'd)

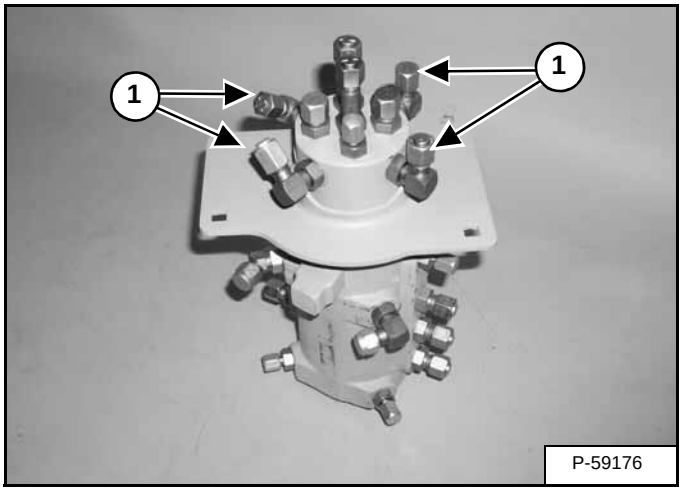
Figure 20-80-24



Install the mount (Item 1) **[Figure 20-80-24]** on the swivel joint.

Install the bolts (Item 2) **[Figure 20-80-24]**. Tighten the bolts to 32 to 35 ft.-lb. (43 to 47 N•m) torque.

Figure 20-80-25



Install the fittings (Item 1) **[Figure 20-80-25]** and orientate accordingly.

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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

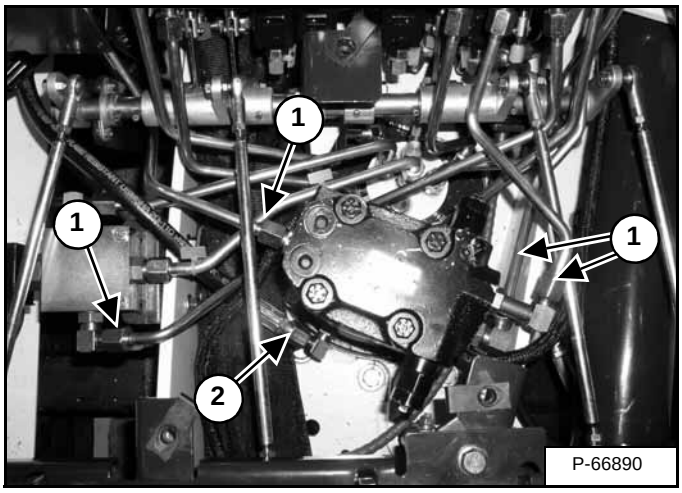
IMPORTANT

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 floor mat and floor panels. (See FLOOR MAT AND FLOOR PANELS on Page 40-140-1)

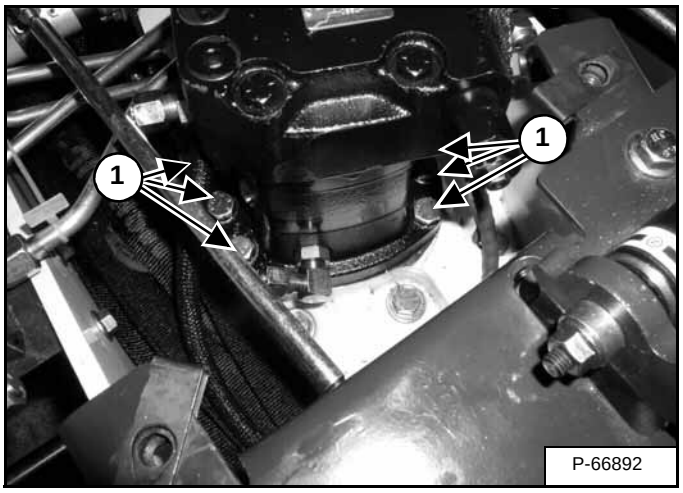
Figure 20-90-1



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

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

Figure 20-90-2



Remove the six bolts (Item 1) **[Figure 20-90-2]** from the swing motor.

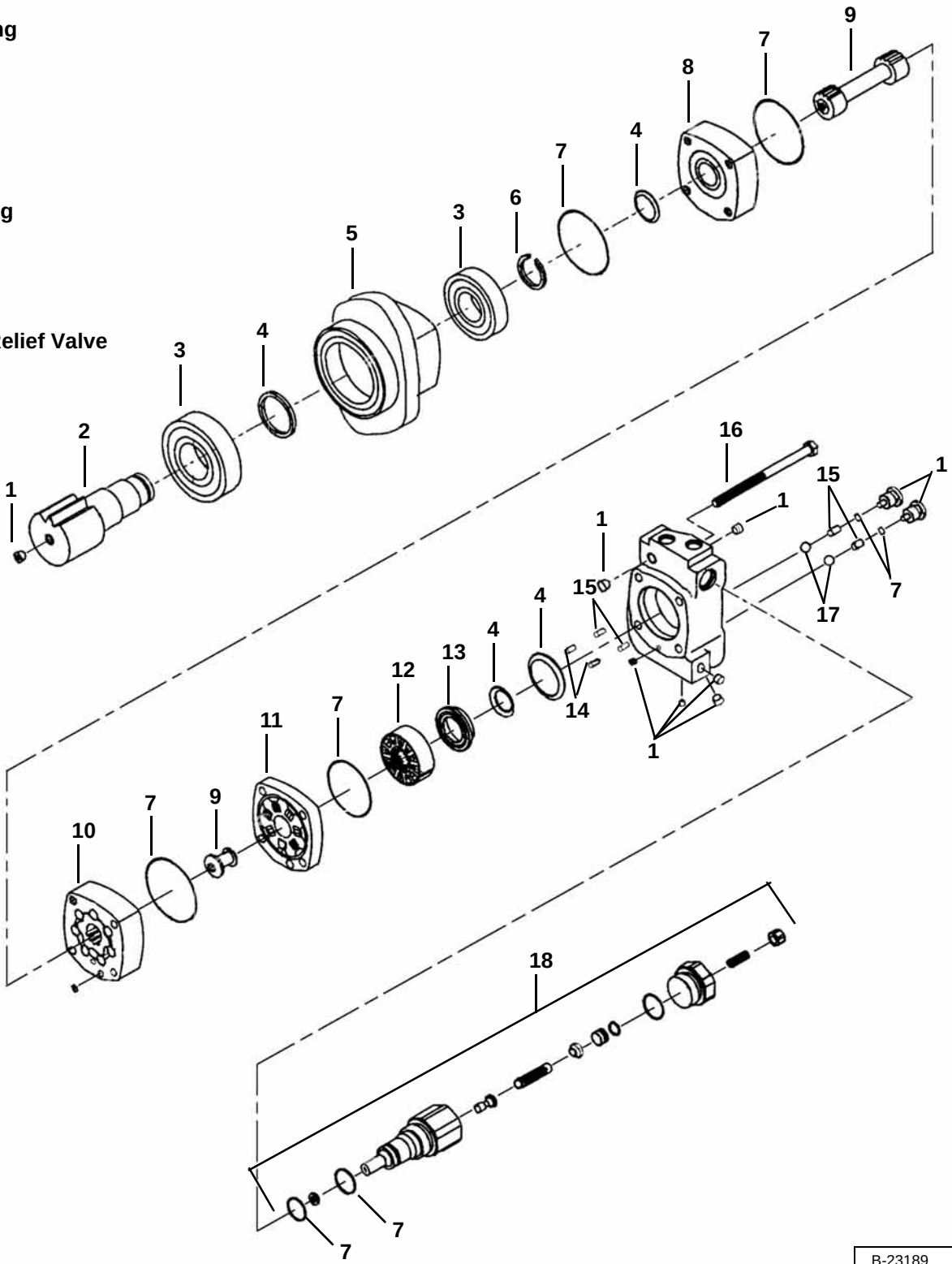
Installation: Tighten the bolts to 32 to 35 ft.-lb. (43 to 47 N•m) torque.

Remove the swing motor from the excavator.

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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



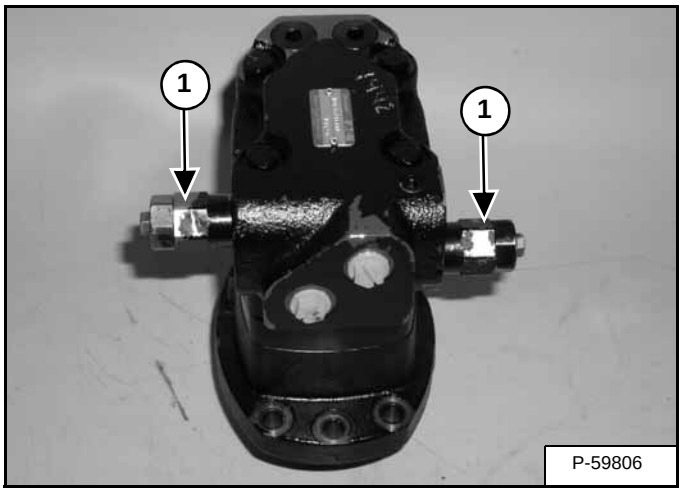
Dealer Copy -- Not for Resale

Disassembly

Clean the outside of the swing motor before disassembly.

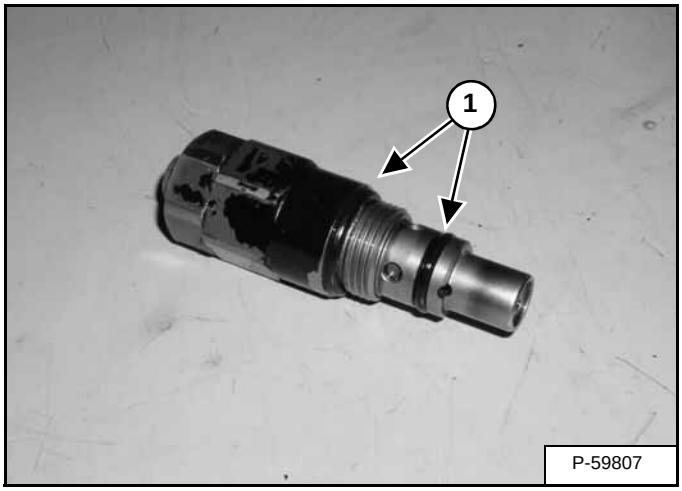
Mark the outside of the swing motor for ease of assembly.

Figure 20-90-3



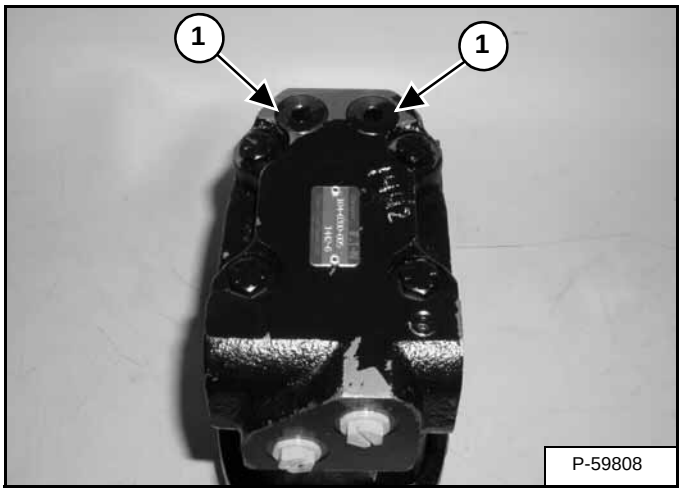
Remove the crossport relief valve (Item 1) **[Figure 20-90-3]**.

Figure 20-90-4



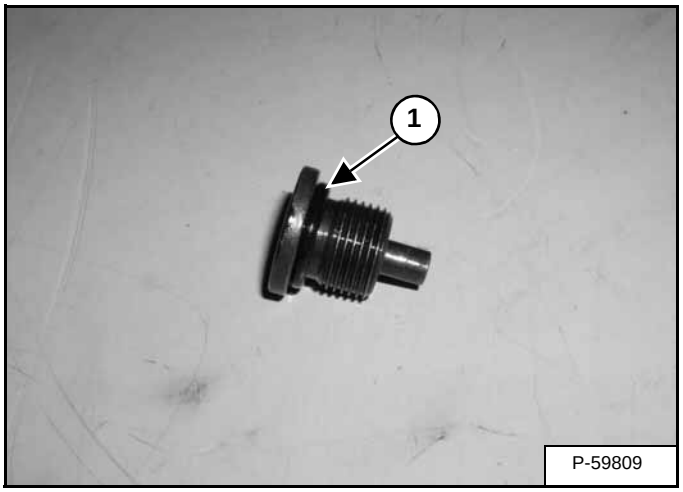
Remove the O-rings (Item 1) **[Figure 20-90-4]** from the crossport relief valves.

Figure 20-90-5



Remove the plugs (Item 1) **[Figure 20-90-5]** from the crossport relief valves.

Figure 20-90-6

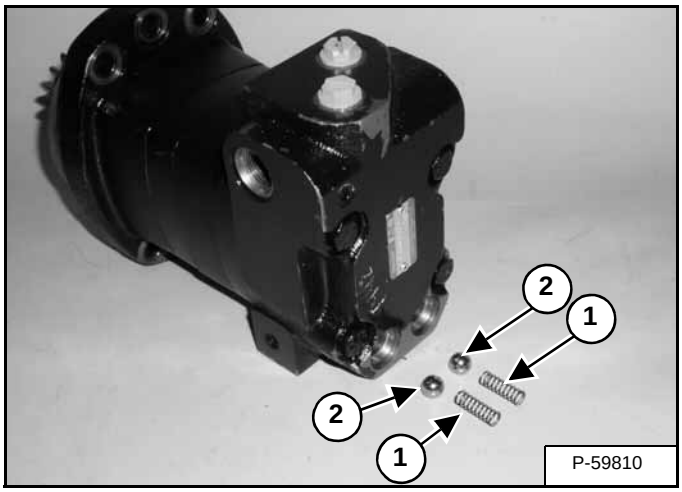


Remove the O-ring (Item 1) **[Figure 20-90-6]** from the plugs.

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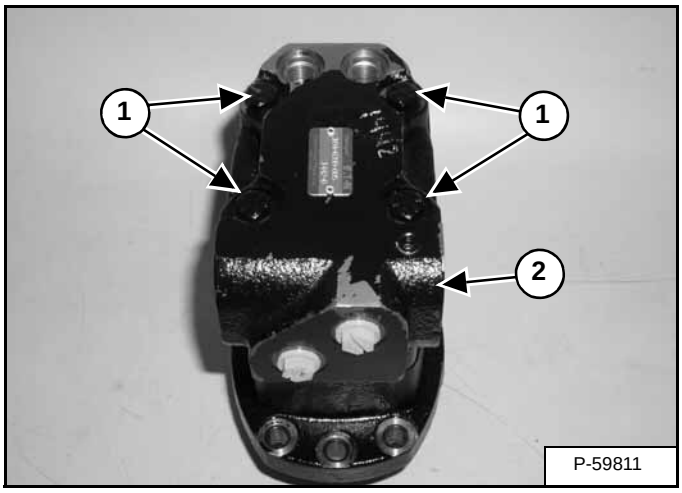
Disassembly (Cont'd)

Figure 20-90-7



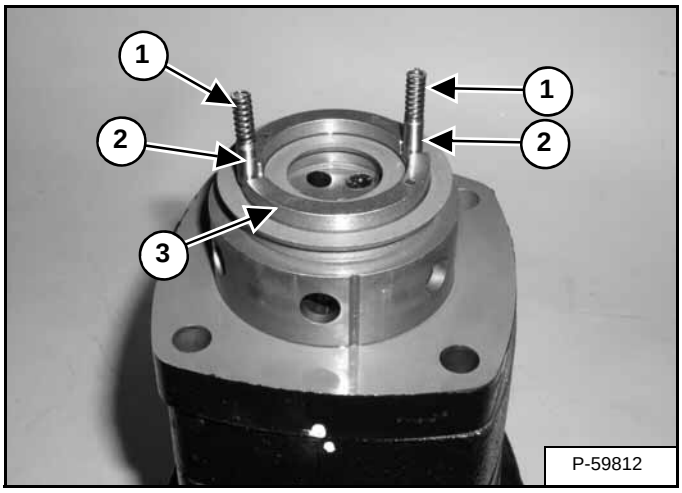
Remove the springs (Item 1) and balls (Item 2) **[Figure 20-90-7]**.

Figure 20-90-8



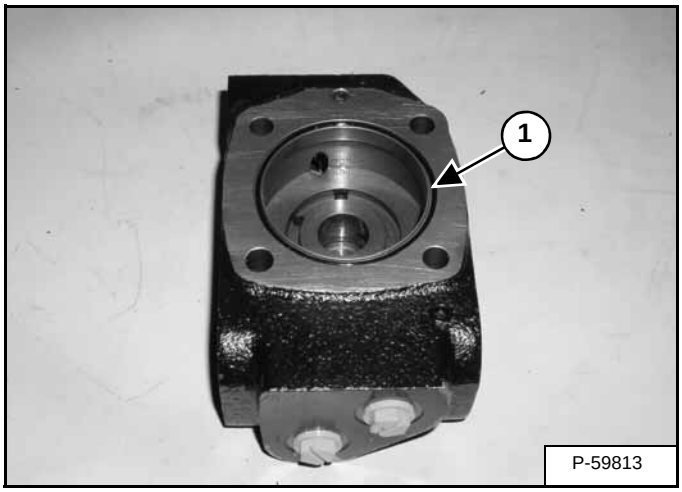
Remove the bolts (Item 1) **[Figure 20-90-8]**.

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 balance ring assembly (Item 3) **[Figure 20-90-9]** will remain on the valve for easy removal.

Figure 20-90-10

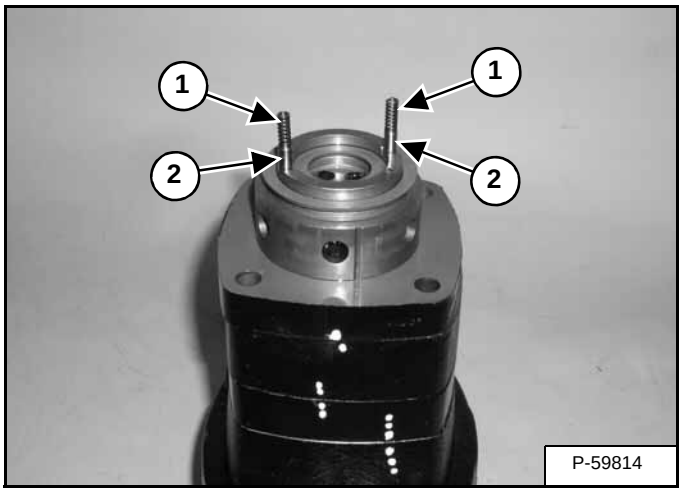


Remove the O-ring (Item 1) **[Figure 20-90-10]**.

Dealer Copy -- Not for Resale

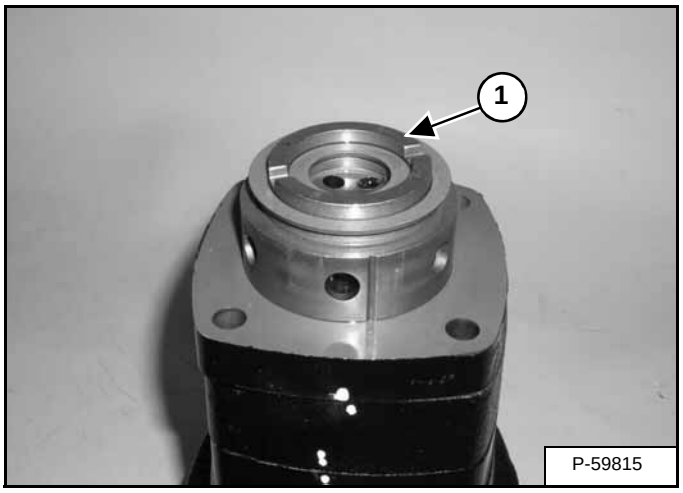
Disassembly (Cont'd)

Figure 20-90-11



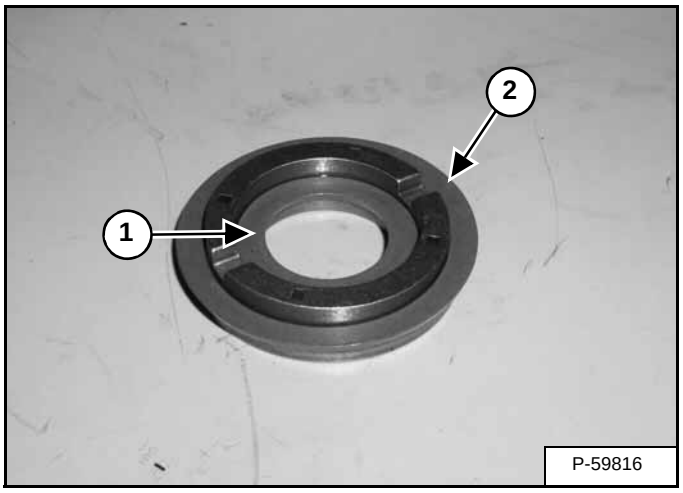
Remove the springs (Item 1) and pins (Item 2) **[Figure 20-90-11]**.

Figure 20-90-12



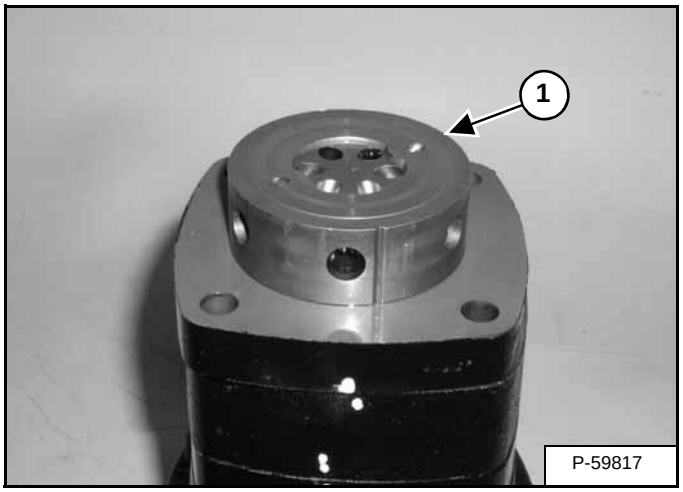
Remove the balance ring (Item 1) **[Figure 20-90-12]**.

Figure 20-90-13



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

Figure 20-90-14

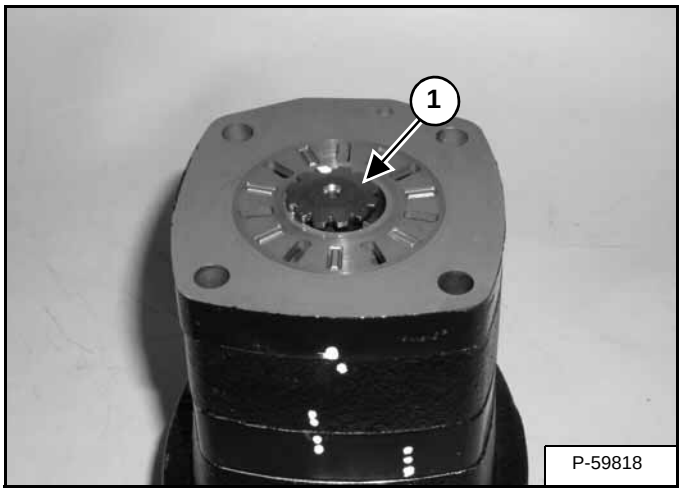


Remove the valve (Item 1) **[Figure 20-90-14]**.

Dealer Copy -- Not for Resale

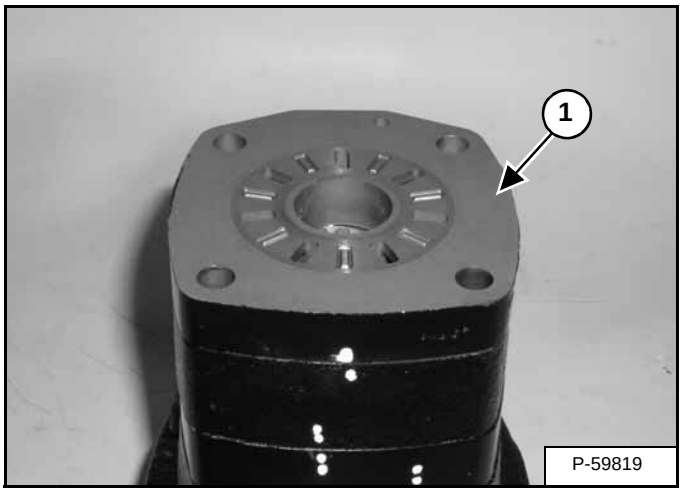
Disassembly (Cont'd)

Figure 20-90-15



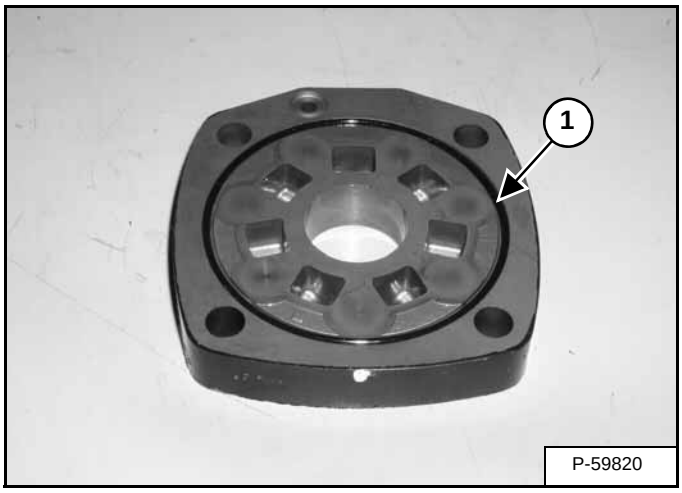
Remove the drive (Item 1) **[Figure 20-90-15]**.

Figure 20-90-16



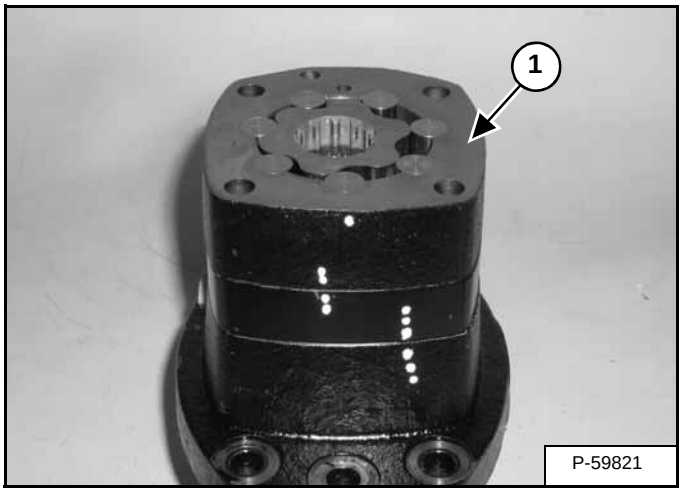
Remove the valve plate (Item 1) **[Figure 20-90-16]**.

Figure 20-90-17



Remove the O-ring (Item 1) **[Figure 20-90-17]**.

Figure 20-90-18



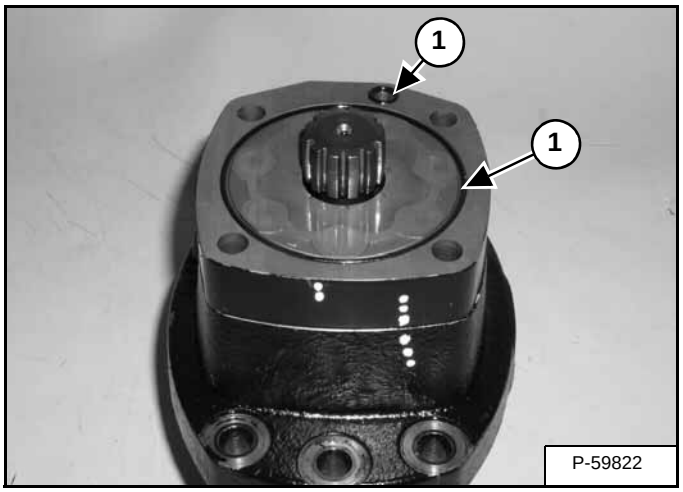
Remove the geroler (Item 1) **[Figure 20-90-18]**.

NOTE: Do not disassemble the geroler.

Dealer Copy -- Not for Resale

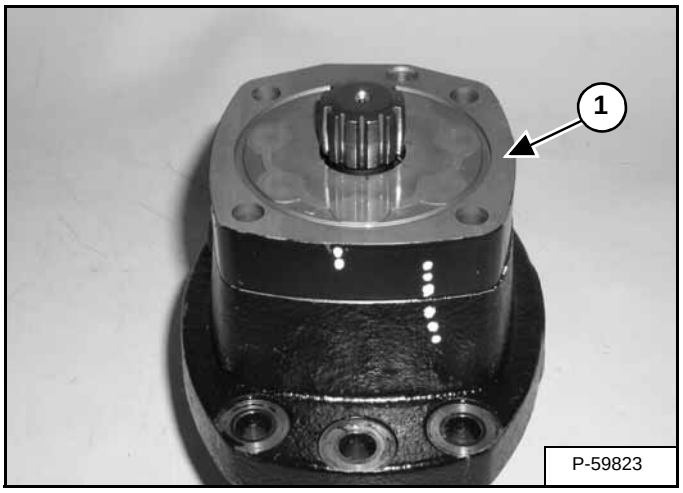
Disassembly (Cont'd)

Figure 20-90-19



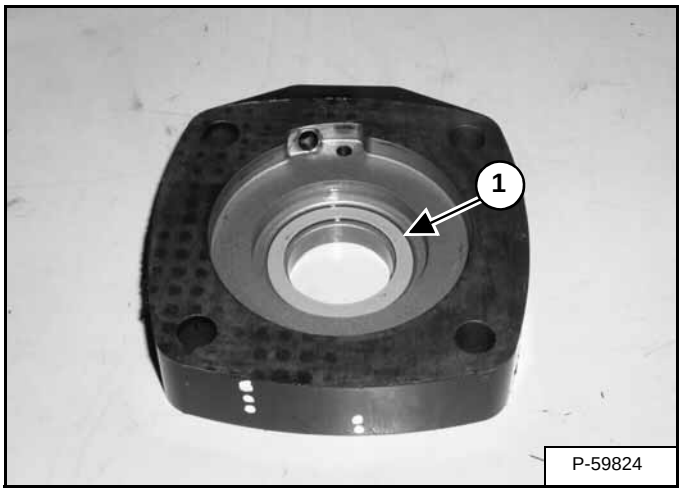
Remove the O-rings (Item 1) **[Figure 20-90-19]**.

Figure 20-90-20



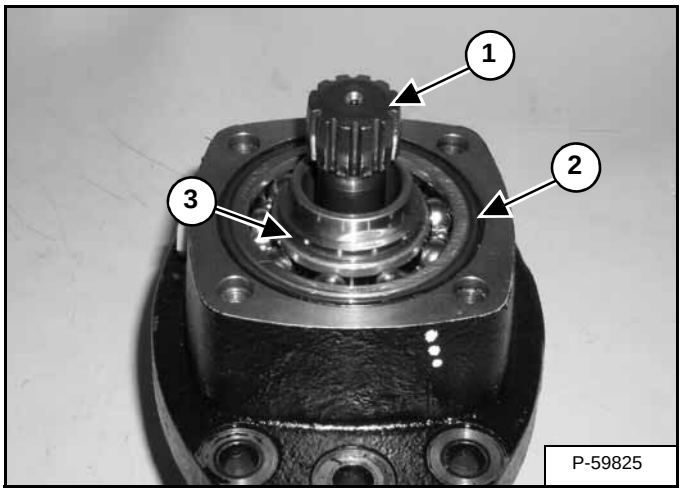
Remove the valve plate (Item 1) **[Figure 20-90-20]**.

Figure 20-90-21



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

Figure 20-90-22



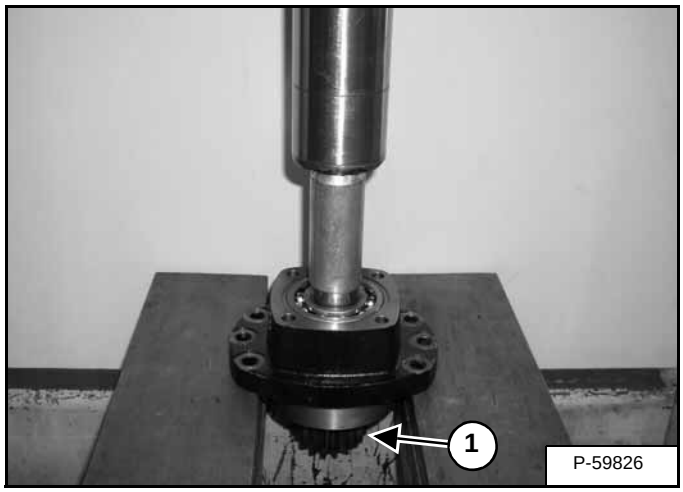
Remove the drive (Item 1). Remove the O-ring (Item 2) **[Figure 20-90-22]**.

Remove the retaining ring (Item 3) **[Figure 20-90-22]**.

Dealer Copy -- Not for Resale

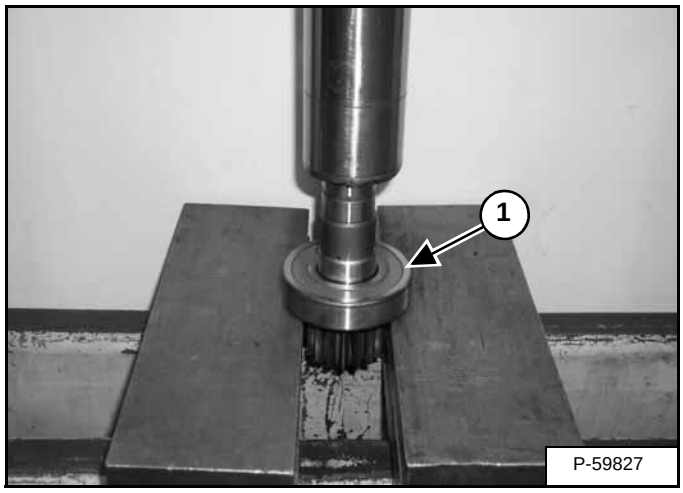
Disassembly (Cont'd)

Figure 20-90-23



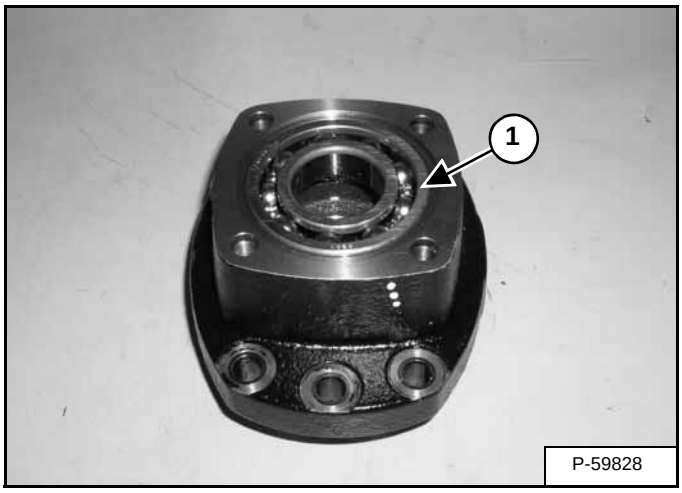
Press the shaft (Item 1) **[Figure 20-90-23]** out of the housing.

Figure 20-90-24



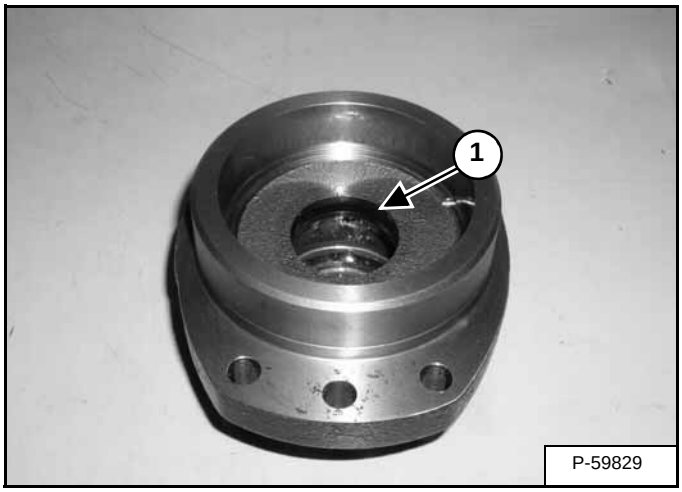
Press the bearing (Item 1) **[Figure 20-90-24]** off of the shaft.

Figure 20-90-25



Remove the bearing (Item 1) **[Figure 20-90-25]** from the housing.

Figure 20-90-26



Remove the seal (Item 1) **[Figure 20-90-26]**.

Dealer Copy -- Not for Resale

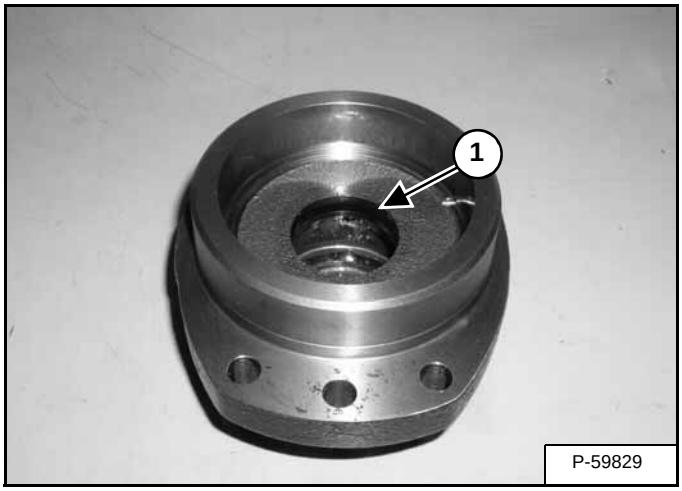
Assembly

Clean all parts in solvent and dry with compressed air.

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

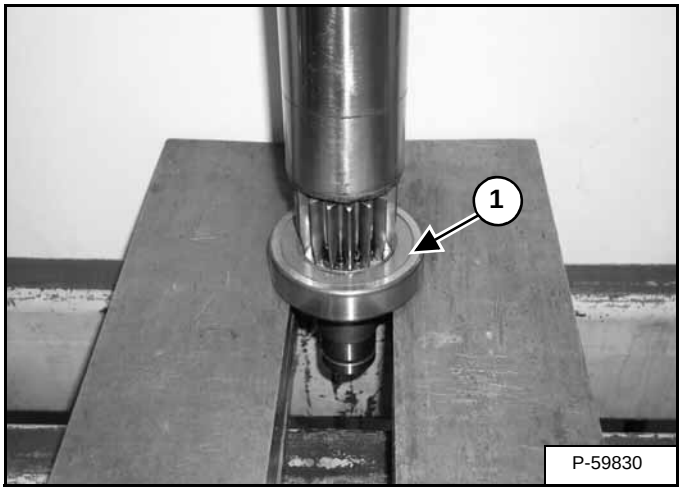
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-90-27



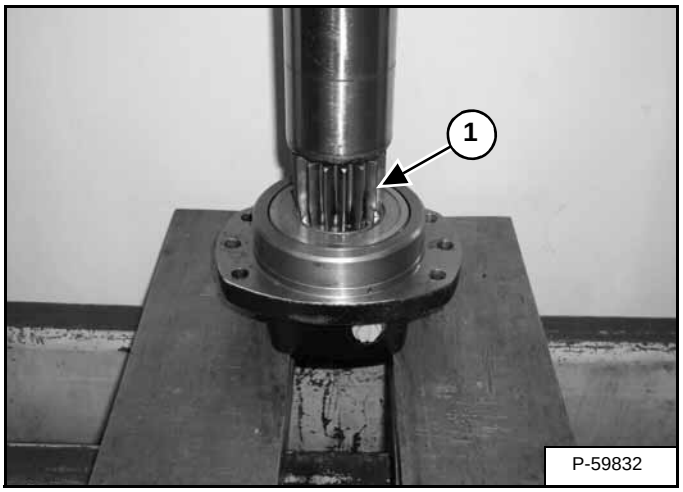
Install the seal (Item 1) **[Figure 20-90-27]** in the housing.

Figure 20-90-28



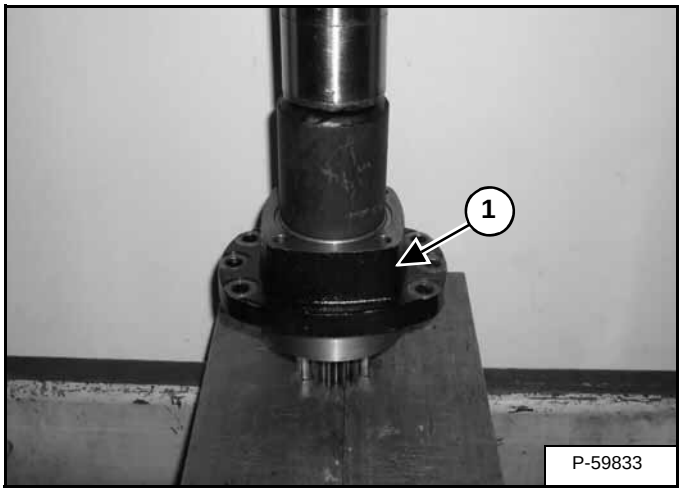
Press the bearing (Item 1) **[Figure 20-90-28]** on the shaft.

Figure 20-90-29



Press the shaft (Item 1) **[Figure 20-90-29]** in the housing.

Figure 20-90-30

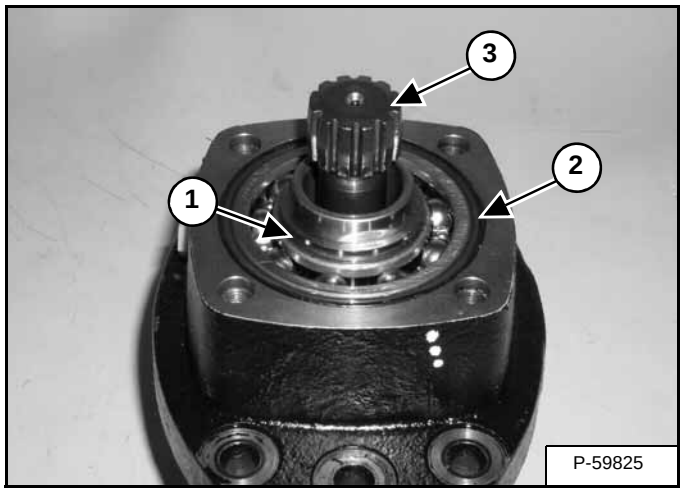


Apply assembly lube to the bearing and press the bearing (Item 1) **[Figure 20-90-30]** in the housing.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

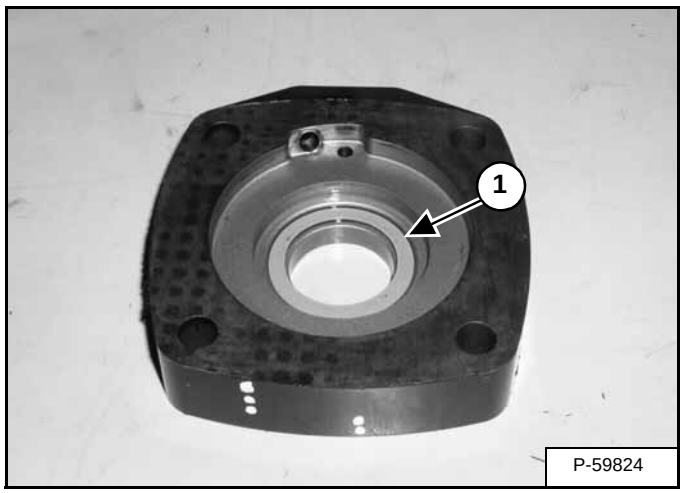
Figure 20-90-31



Install the retaining ring (Item 1) and O-ring (Item 2) **[Figure 20-90-31]**.

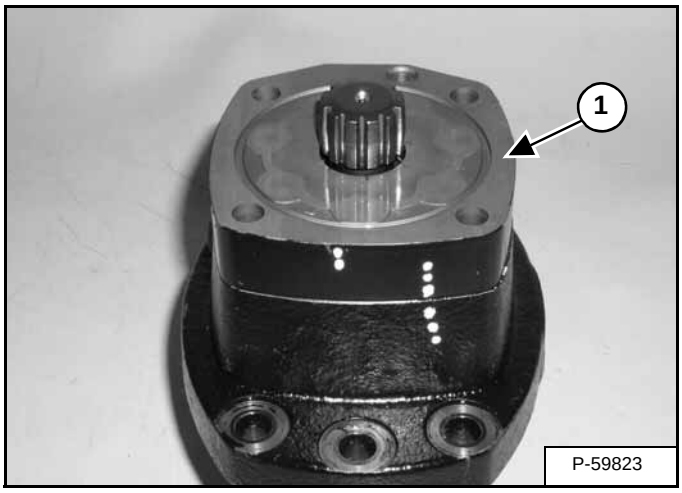
Install the drive (Item 3) **[Figure 20-90-31]**.

Figure 20-90-32



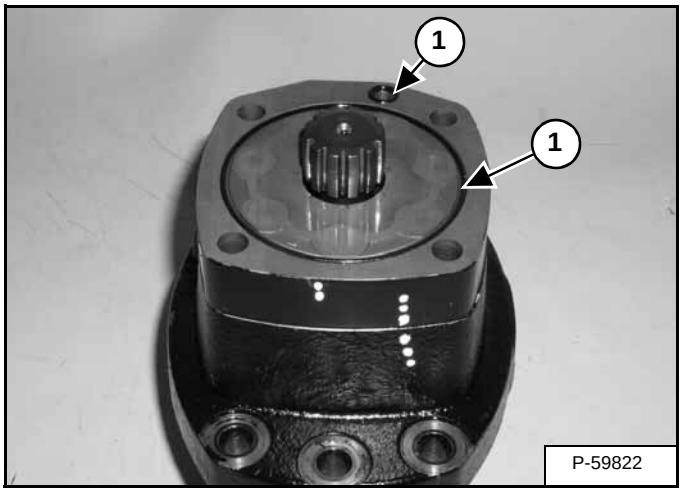
Install the seal (Item 1) **[Figure 20-90-32]** in the plate.

Figure 20-90-33



Install the valve plate (Item 1) **[Figure 20-90-33]**.

Figure 20-90-34

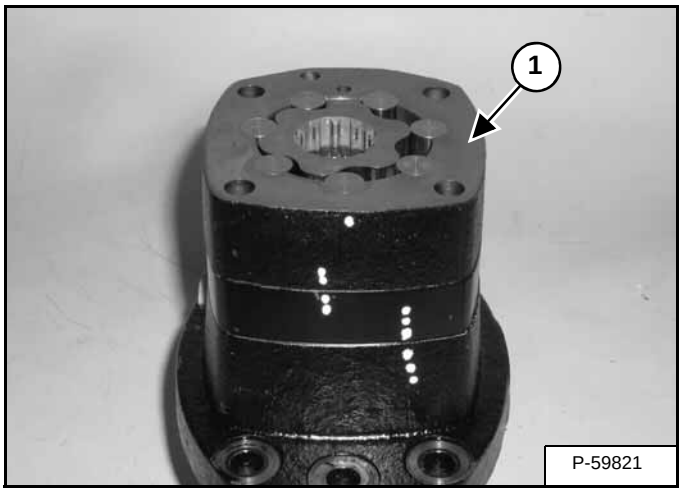


Install the O-rings (Item 1) **[Figure 20-90-34]**.

Dealer Copy -- Not for Resale

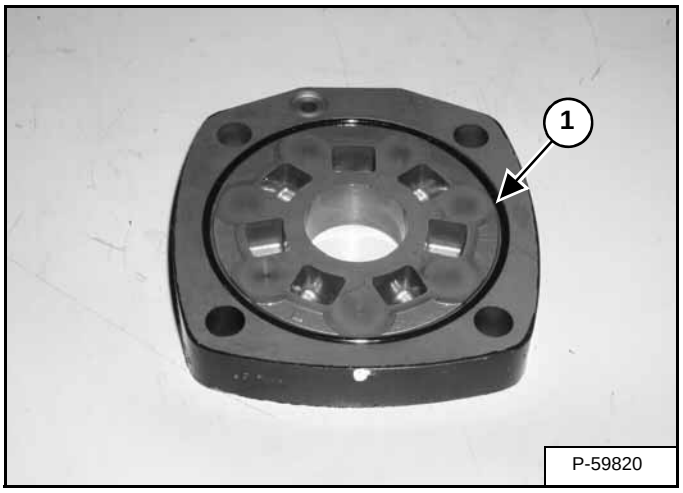
Assembly (Cont'd)

Figure 20-90-35



Install the geroler (Item 1) **[Figure 20-90-35]**.

Figure 20-90-36

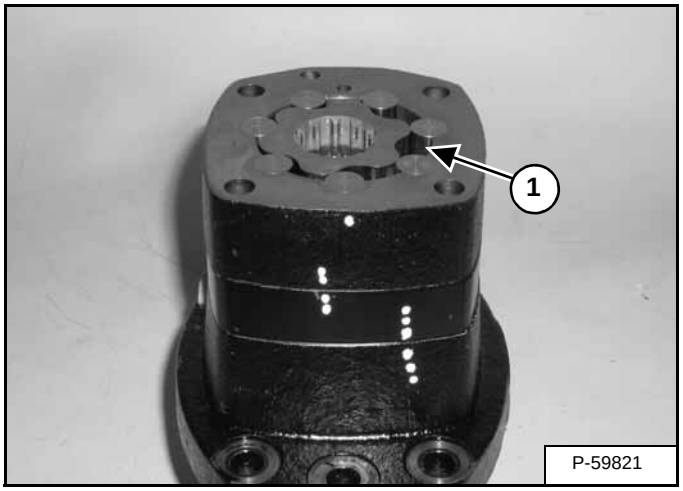


Install the O-ring (Item 1) **[Figure 20-90-36]** on the valve plate.

Motor Timing

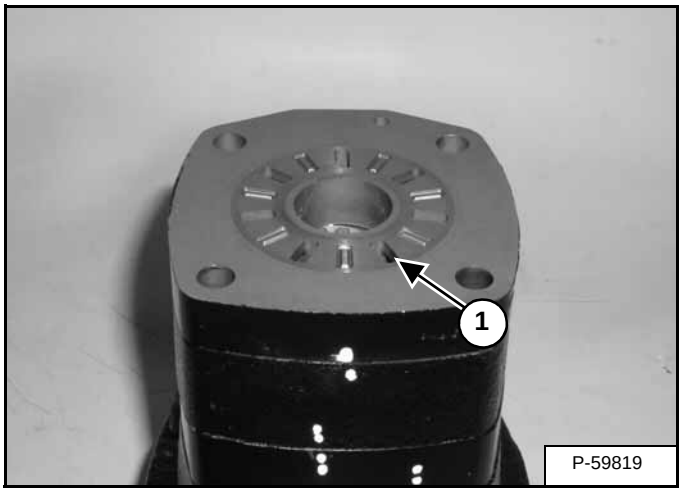
The direction that the output shaft rotates is determined by timing. Time the motor as follows:

Figure 20-90-37



Locate the largest open pocket in the geroler (Item 1) **[Figure 20-90-37]**.

Figure 20-90-38

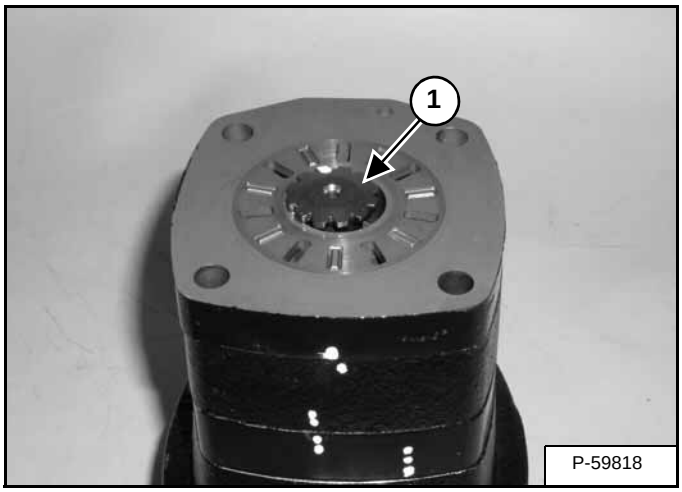


Install the valve plate and locate the open slot (Item 1) **[Figure 20-90-38]** that is over the largest open Geroler pocket.

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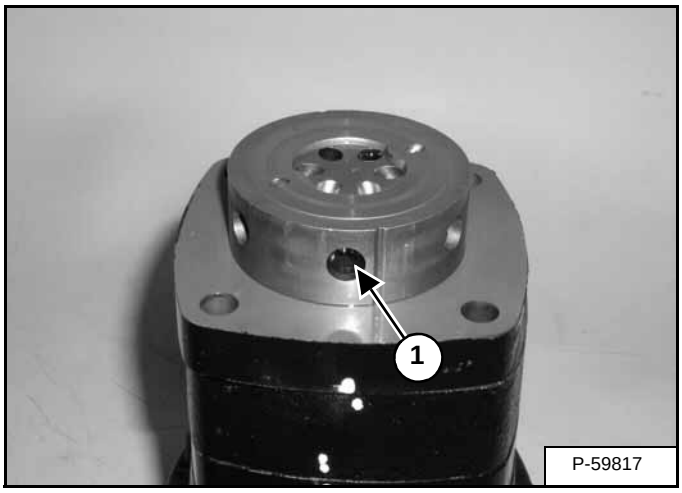
Assembly (Cont'd)

Figure 20-90-39



Install the drive (Item 1) **[Figure 20-90-39]**.

Figure 20-90-40

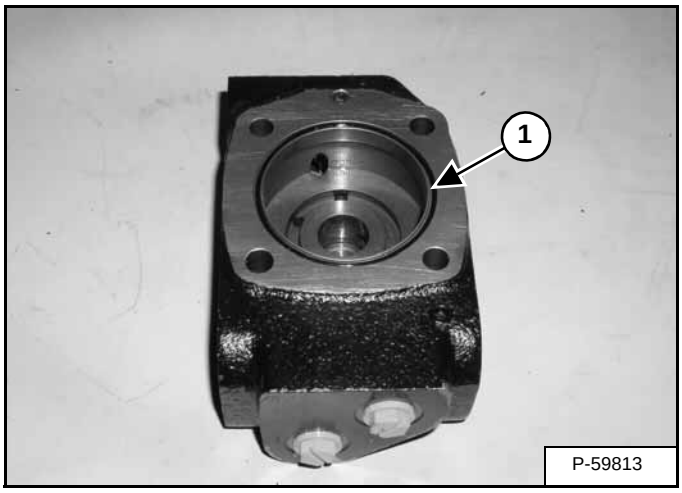


Align one of the side openings (Item 1) **[Figure 20-90-40]** in the valve with the valve plate slot that is over the largest open Geroler pocket.

Engage the valve with the valve drive by rotating it 15° clockwise until the spline teeth mesh.

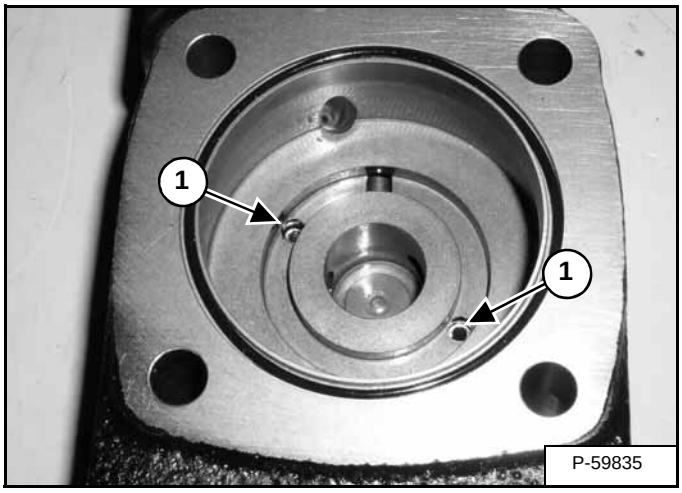
NOTE: If the valve is turned clockwise the motor will rotate in the opposite direction.

Figure 20-90-41



Install the O-ring (Item 1) **[Figure 20-90-41]**.

Figure 20-90-42

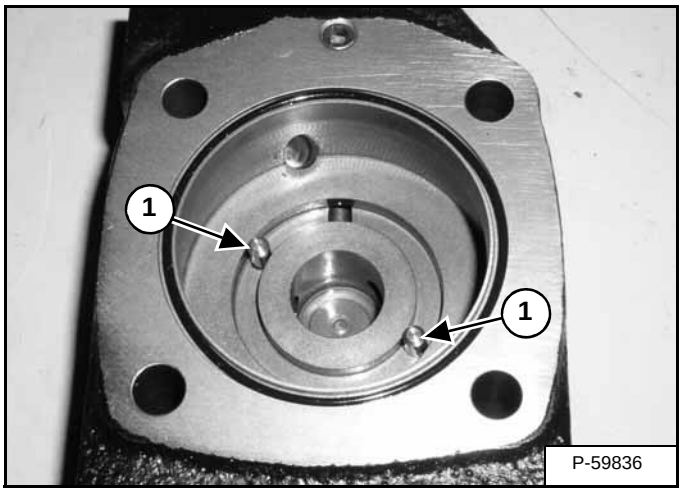


Apply assembly lube to the springs, and install the springs (Item 1) **[Figure 20-90-42]**.

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Assembly (Cont'd)

Figure 20-90-43



Install the pins (Item 1) **[Figure 20-90-43]**.

Figure 20-90-44

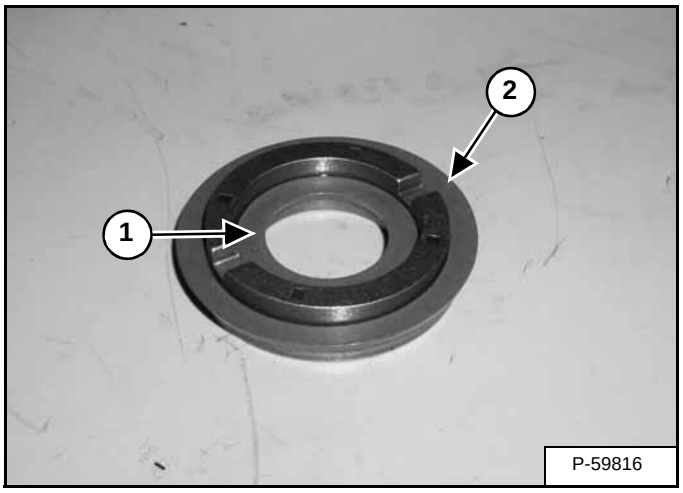
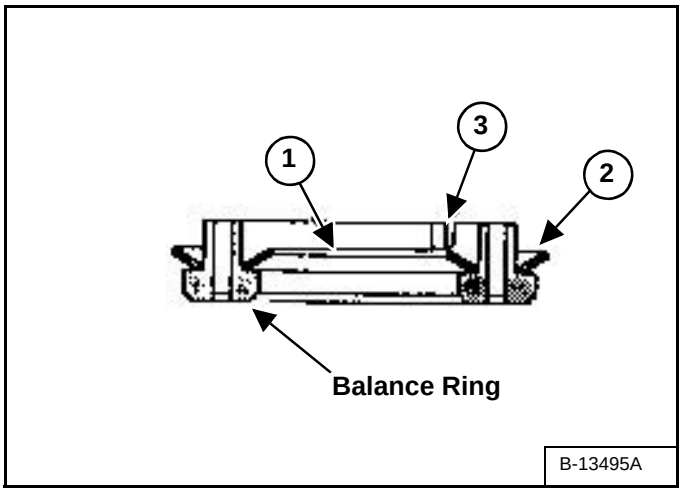
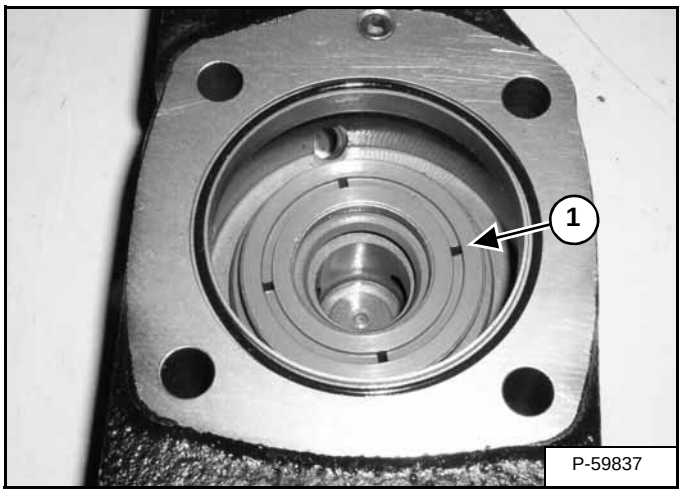


Figure 20-90-45



Install the inner (Item 1) and outer (Item 2) **[Figure 20-90-44]** & **[Figure 20-90-45]** face seals on the balance ring as shown.

Figure 20-90-46

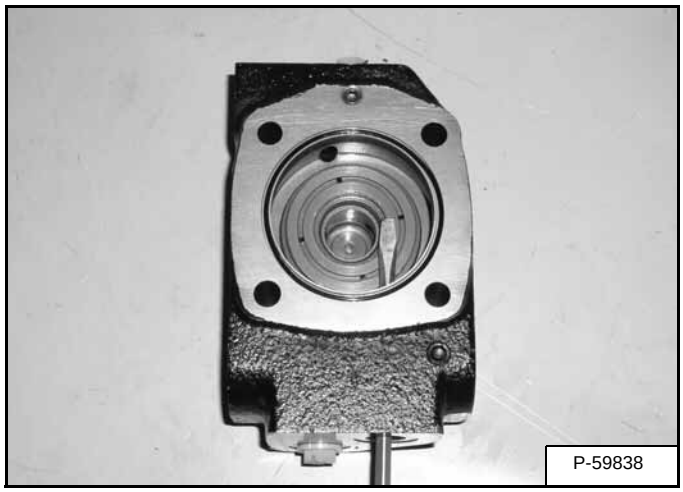


Install the balance ring (Item 1) **[Figure 20-90-46]**. Make sure the pins engage the pin notches (Item 3) **[Figure 20-90-45]** in the balance ring.

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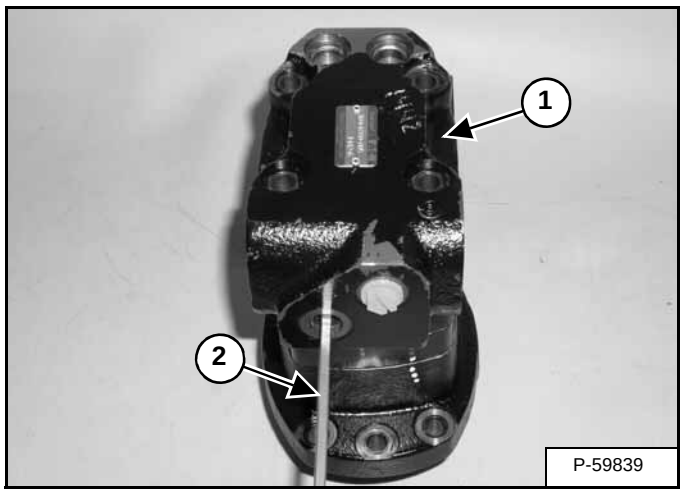
Assembly (Cont'd)

Figure 20-90-47



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 20-90-47]**.

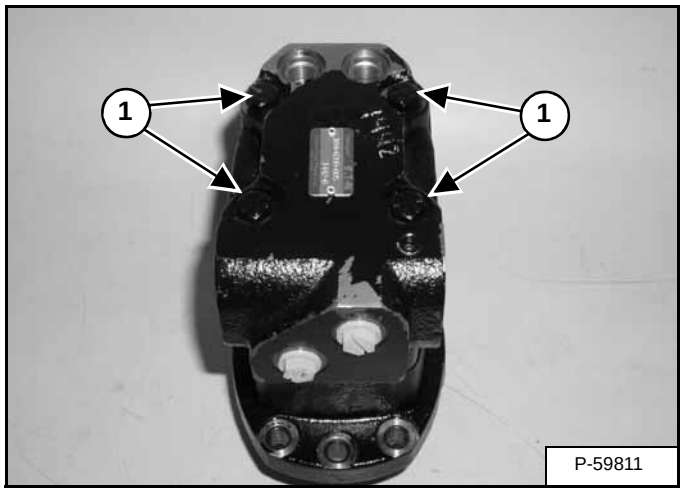
Figure 20-90-48



Install the housing (Item 1) **[Figure 20-90-48]** on the motor.

Remove the screwdriver (Item 2) **[Figure 20-90-48]**.

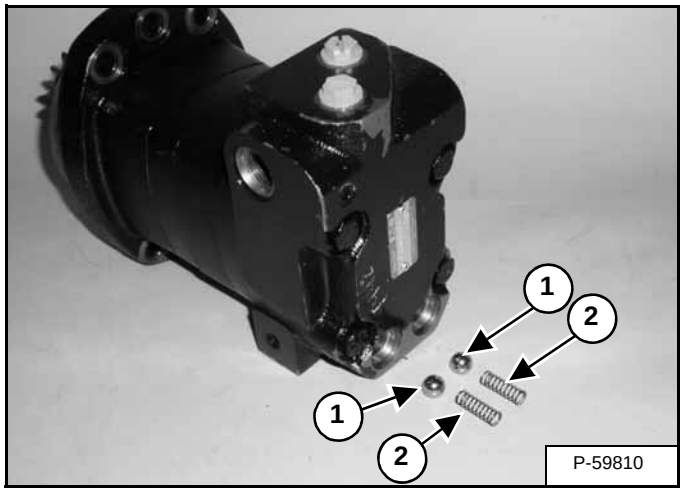
Figure 20-90-49



Install the bolts (Item 1) **[Figure 20-90-49]**. 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.

Figure 20-90-50

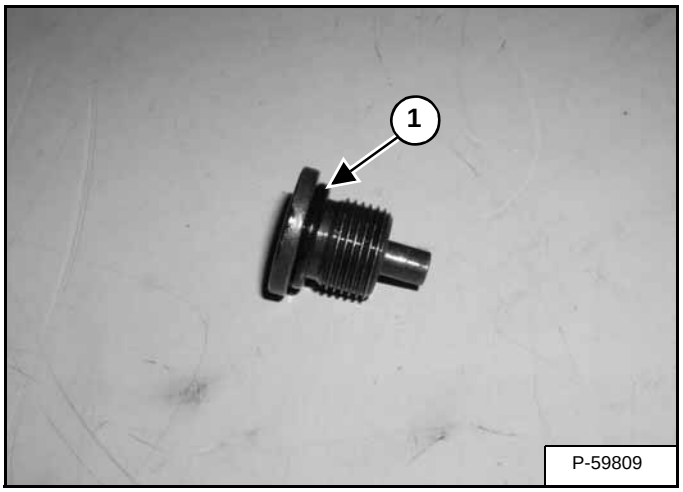


Install the balls (Item 1) and springs (Item 2) **[Figure 20-90-50]**.

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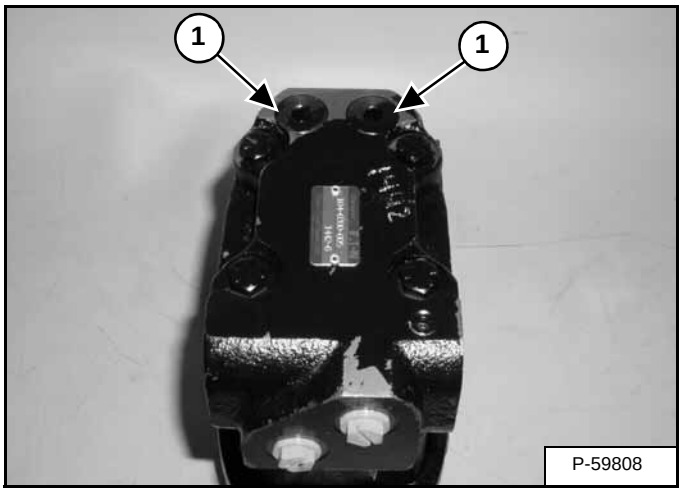
Assembly (Cont'd)

Figure 20-90-51



Install the O-ring (Item 1) **[Figure 20-90-51]** on the plugs.

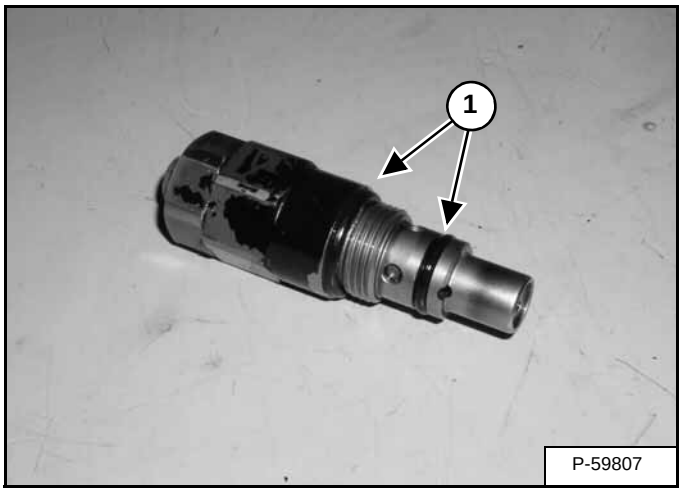
Figure 20-90-52



Install the plugs (Item 1) **[Figure 20-90-52]**.

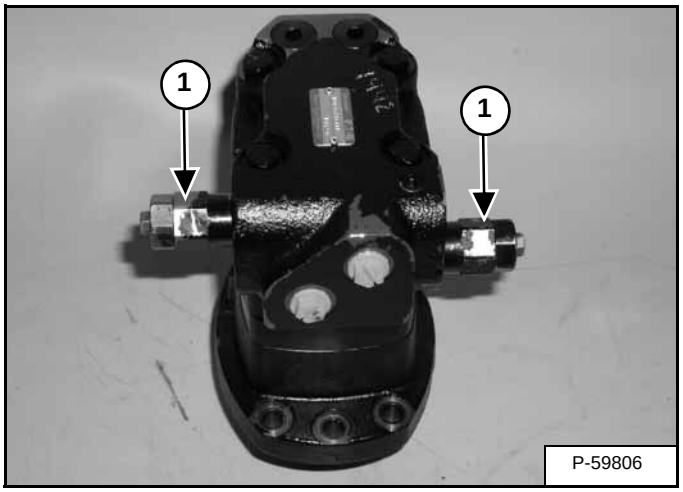
Installation: Tighten bolts to 43.5 ft.-lb. (59 N•m) torque.

Figure 20-90-53



Install the O-rings (Item 1) **[Figure 20-90-53]** on the crossport relief valves.

Figure 20-90-54



Install the crossport relief valves (Item 1) **[Figure 20-90-54]**.

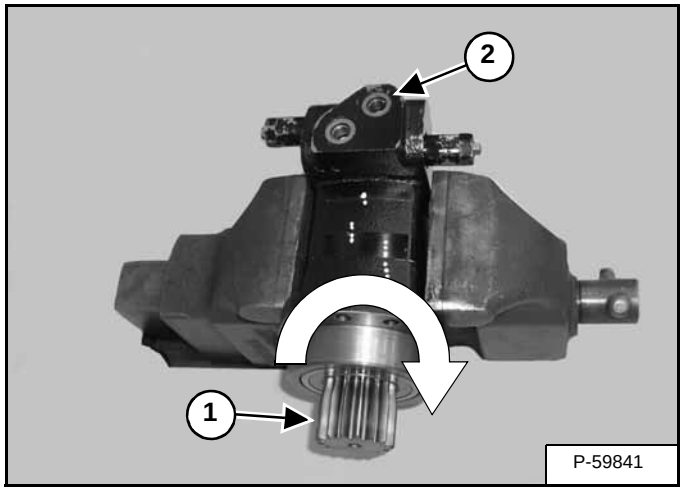
Installation: Tighten bolts to 72 ft.-lb. (98 N•m) torque.

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Assembly (Cont'd)

Clamp the motor in a vise.

Figure 20-90-55



Turn the shaft (Item 1) **[Figure 20-90-55]** in a clockwise direction.

If the motor is correctly timed, there will be suction at the top port (Item 2) **[Figure 20-90-55]**.

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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 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.

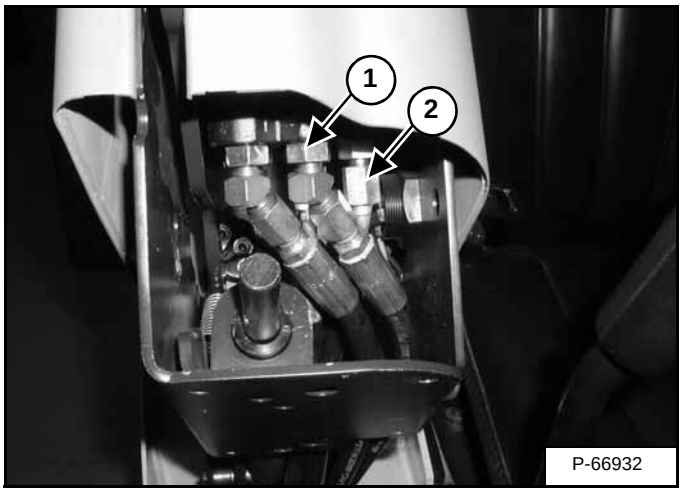
I-2003-0888

⚠ 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.

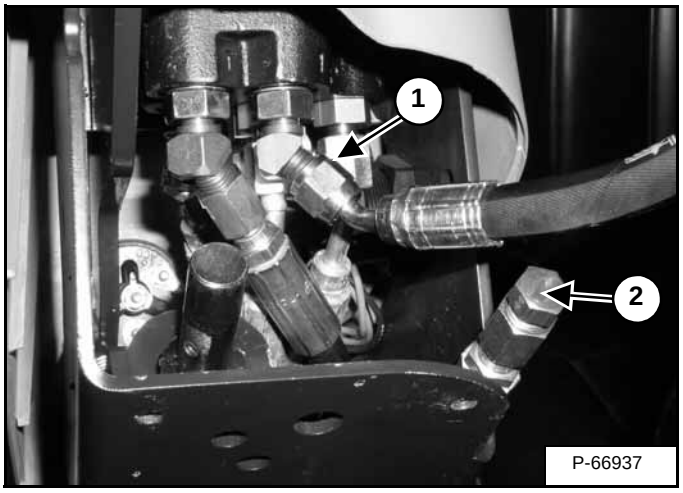
W-2145-0290

Figure 20-100-1



At the bottom of the right control lever (joystick), find the pilot hose connected to Port 1 (Item 1) & 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 20-100-2



Remove the pilot hose **[Figure 20-100-2]** 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 20-100-2]** to the control lever (joystick) fitting.

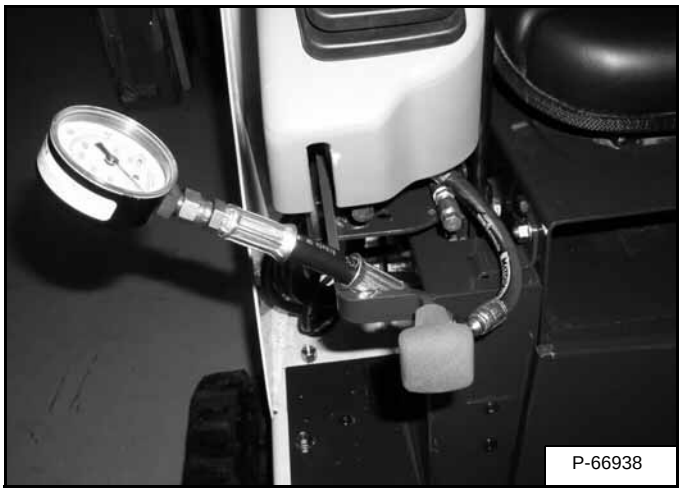
Cap the pilot hose (Item 2) **[Figure 20-100-2]**.

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RIGHT CONTROL LEVER (JOYSTICK) (CONT'D)

Testing (Cont'd)

Figure 20-100-3



Install a 1000 PSI (69 bar) gauge on the hose **[Figure 20-100-3]**.

Lower the right console to the locked position **[Figure 20-100-3]**. 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.

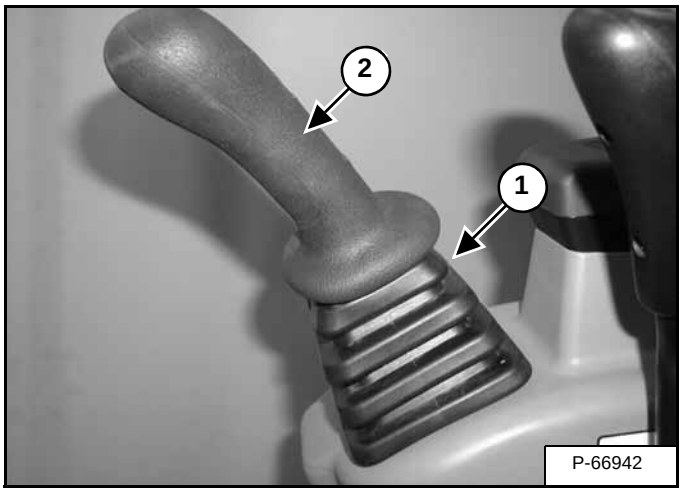
If the operating pressure is incorrect, remove the pressure reducing valve, clean, install and retest. (See Testing And Adjusting The Pressure Reducing Valve on Page 20-33-1.)

If the pressure is still incorrect replace the pressure reducing valve. (See Testing And Adjusting The Pressure Reducing Valve on Page 20-33-1.)

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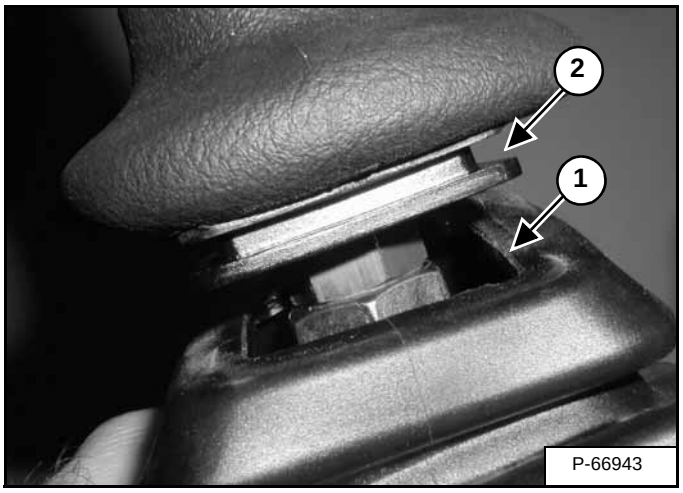
Handle Removal And Installation

Figure 20-100-4



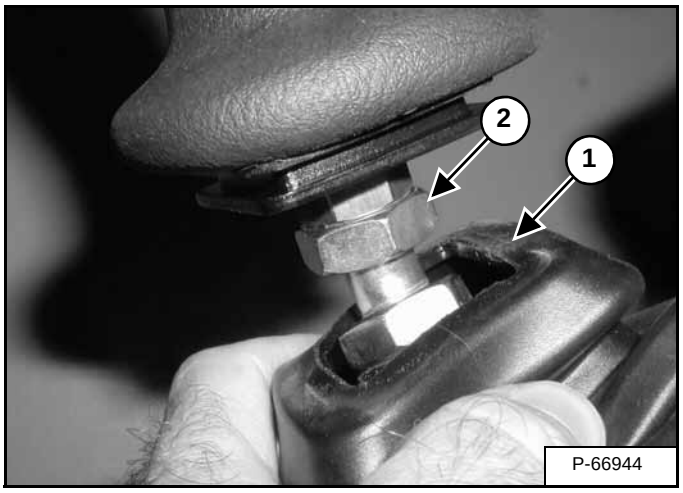
Remove the dust boot (Item 1) from the handle (Item 2) **[Figure 20-100-4]**.

Figure 20-100-5



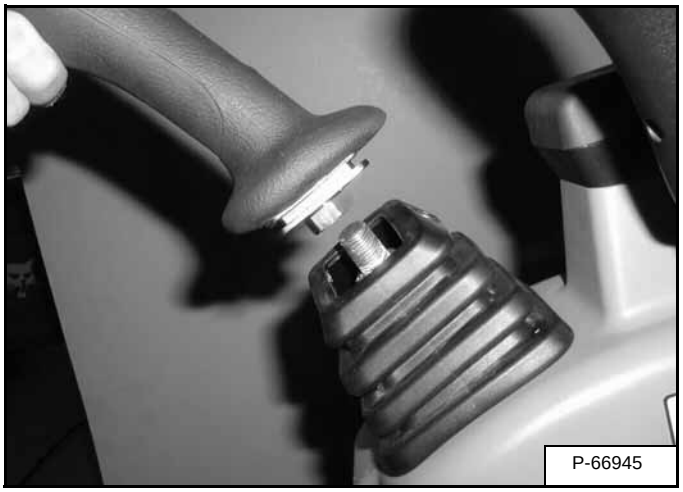
Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-100-5]** in the control handle.

Figure 20-100-6



Hold the dust boot (Item 1) down and loosen the jam nut (Item 2) **[Figure 20-100-6]**.

Figure 20-100-7



Remove the handle **[Figure 20-100-7]**.

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RIGHT 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 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.

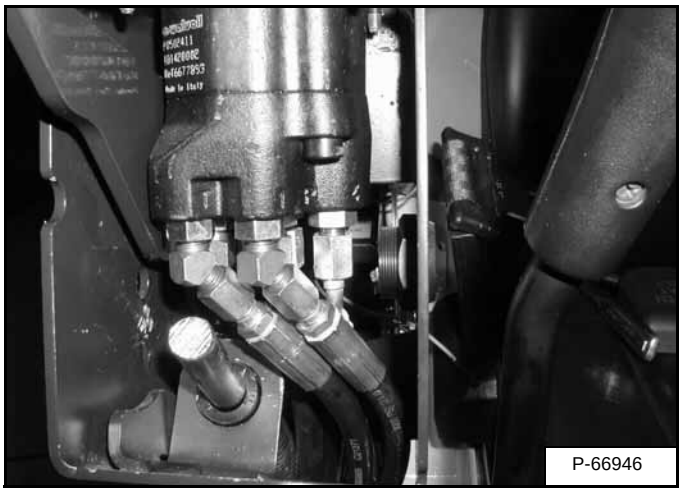
I-2003-0888

⚠ 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.

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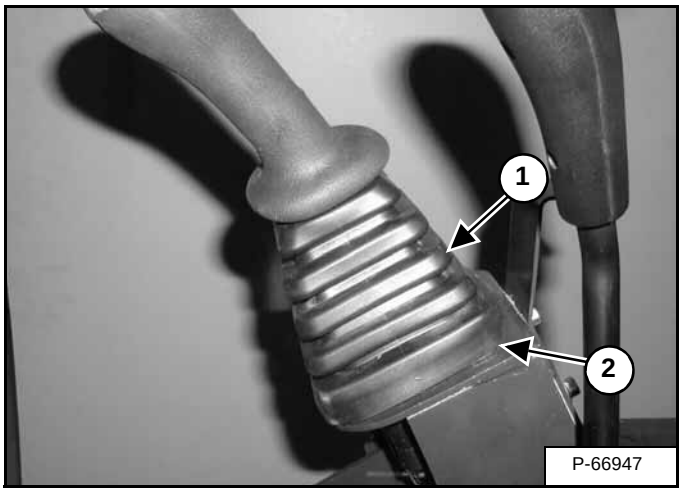
Figure 20-100-8



Mark the hoses for ease of assembly **[Figure 20-100-8]**.

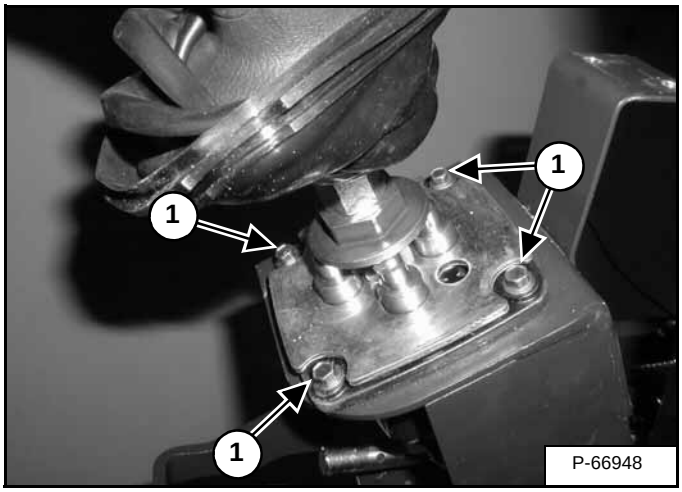
Remove the hoses while the control lever (joystick) is bolted to the console **[Figure 20-100-8]**.

Figure 20-100-9



Raise the dust boot (Item 1) up from the mounting plate (Item 2) **[Figure 20-100-9]**.

Figure 20-100-10



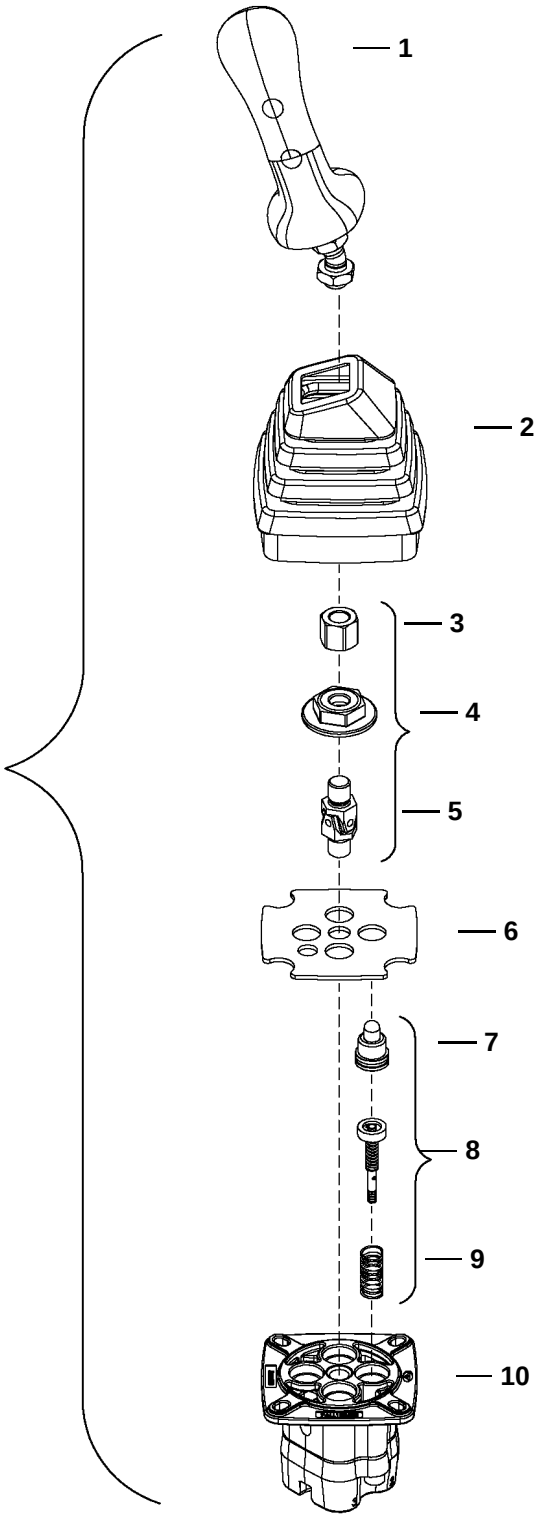
Remove the bolts (Item 1) **[Figure 20-100-10]** from the control lever (joystick) mounting plate.

Remove the control lever (joystick) from the console frame.

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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

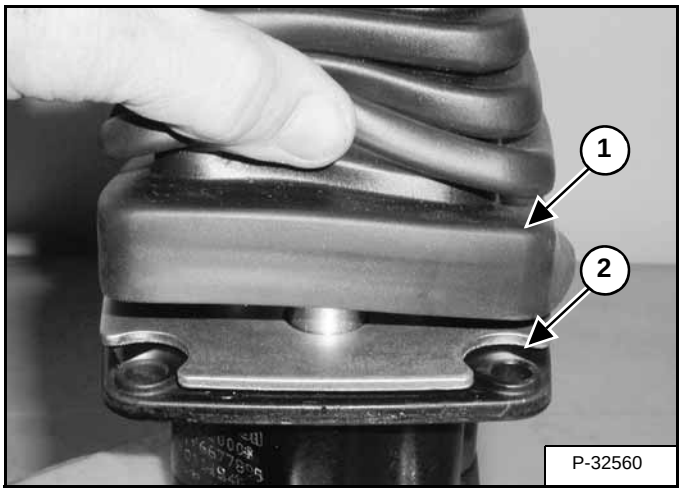
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Disassembly

Remove the right handle. (See Handle Removal And Installation on Page 20-100-3.)

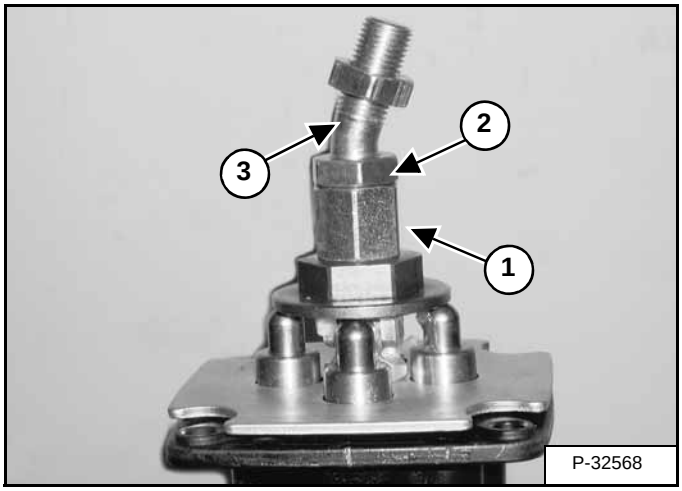
Clean the outside of the control lever before disassembly.

Figure 20-100-11



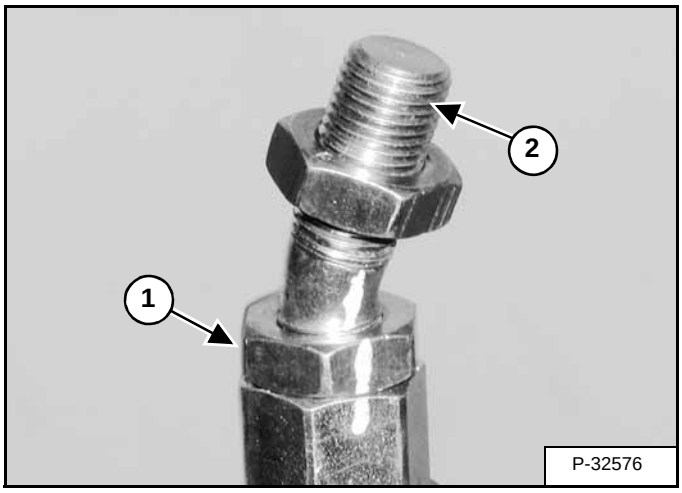
Remove the boot (Item 1) from the control lever (joystick) (Item 2) **[Figure 20-100-11]**.

Figure 20-100-12



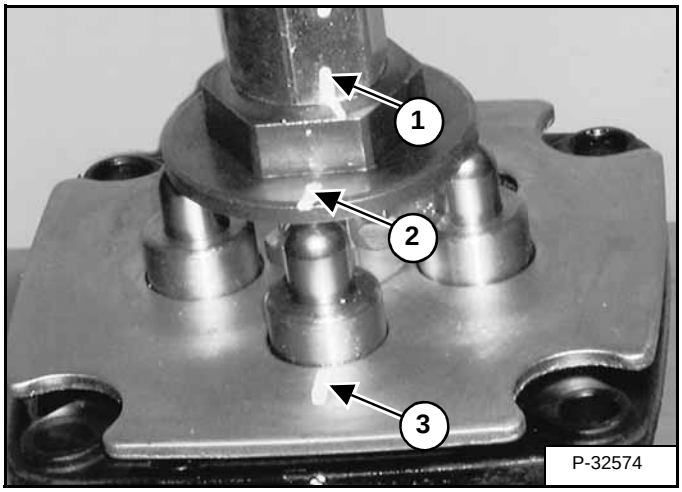
Mark the coupler (Item 1) nut (Item 2), and connector (Item 3) **[Figure 20-100-12]** for correct assembly.

Figure 20-100-13



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-100-13]**.

Figure 20-100-14

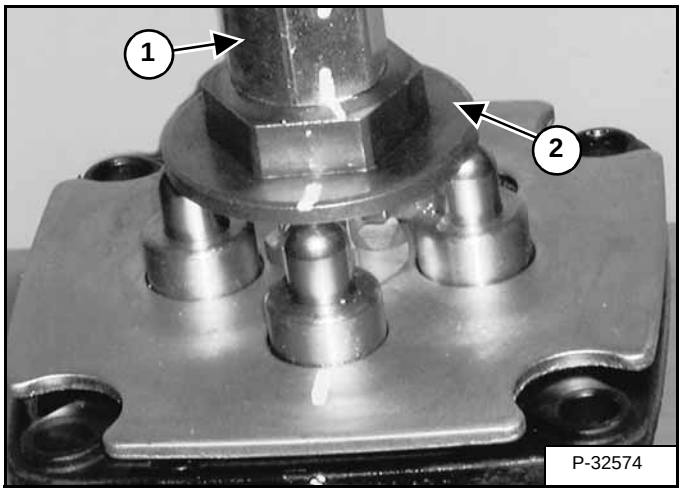


Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-100-14]** for correct installation.

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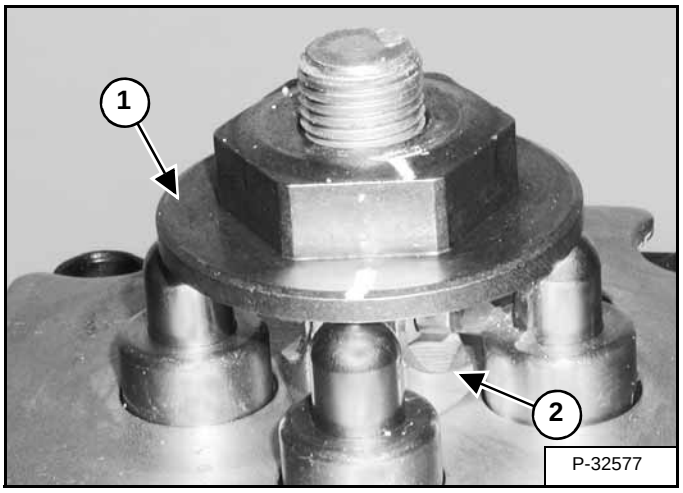
Disassembly (Cont'd)

Figure 20-100-15



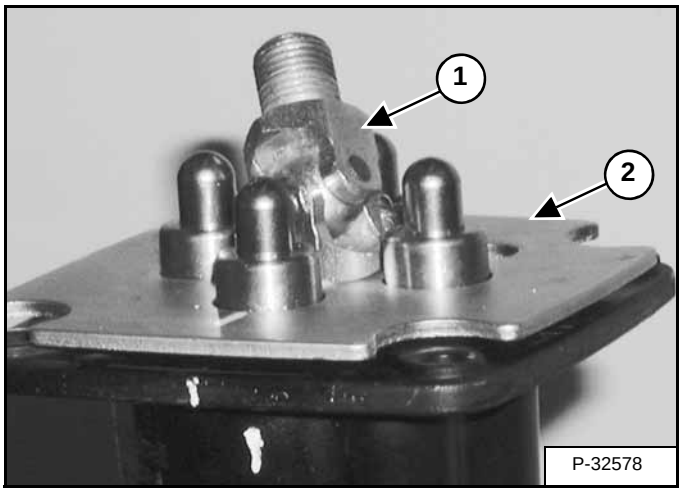
Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-100-15]**.

Figure 20-100-16



Remove the control plate (Item 1) from the U-Joint (Item 2) **[Figure 20-100-16]**.

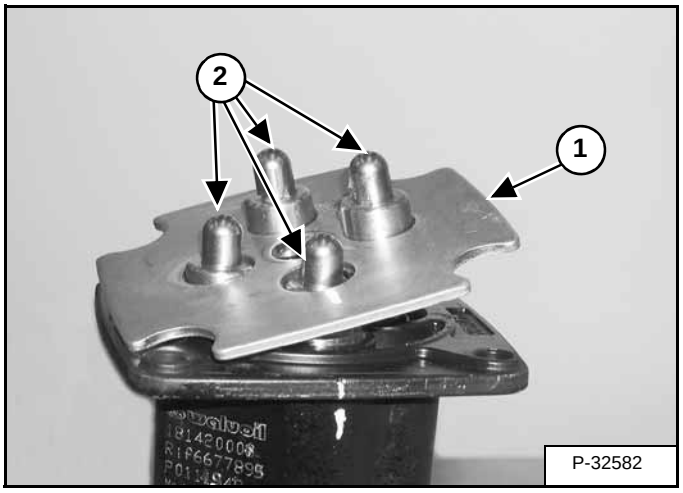
Figure 20-100-17



Mark the plate and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-100-17]**.

NOTE: The plate (Item 2) [Figure 20-100-17] is spring loaded and will come up as the U-joint is removed.

Figure 20-100-18



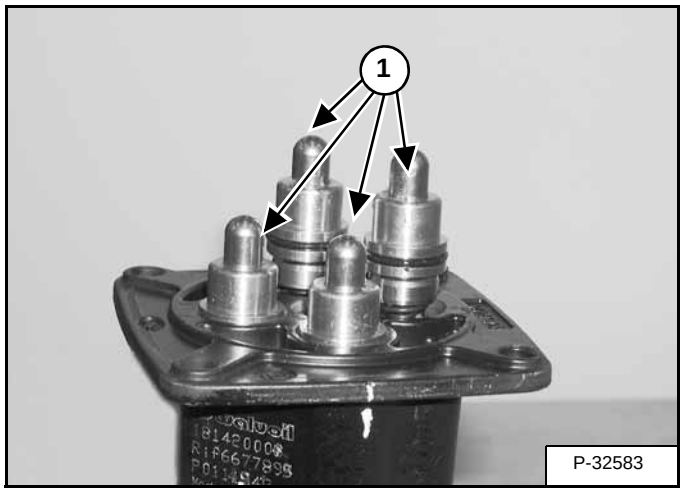
Remove the plate (Item 1) **[Figure 20-100-18]**.

NOTE: Use care while removing the plate. The plungers (Item 2) [Figure 20-100-18] are spring loaded.

Dealer Copy -- Not for Resale

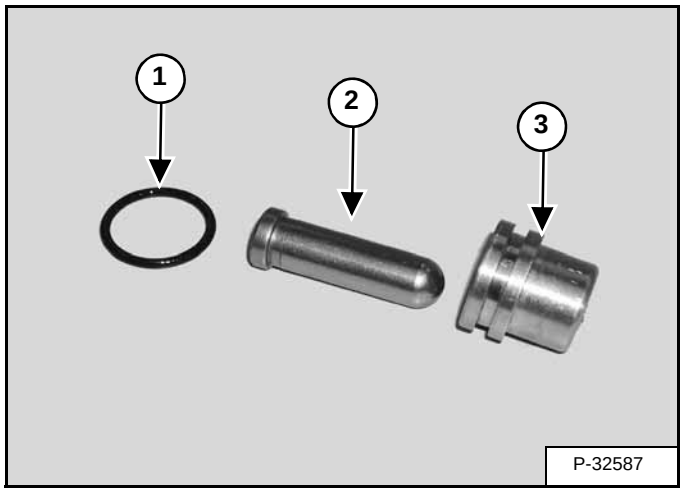
Disassembly (Cont'd)

Figure 20-100-19



Remove the plunger assemblies (Item 1) **[Figure 20-100-19]**.

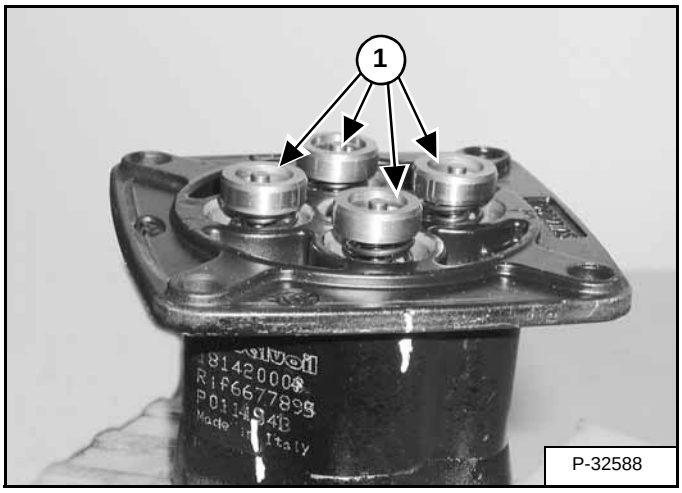
Figure 20-100-20



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

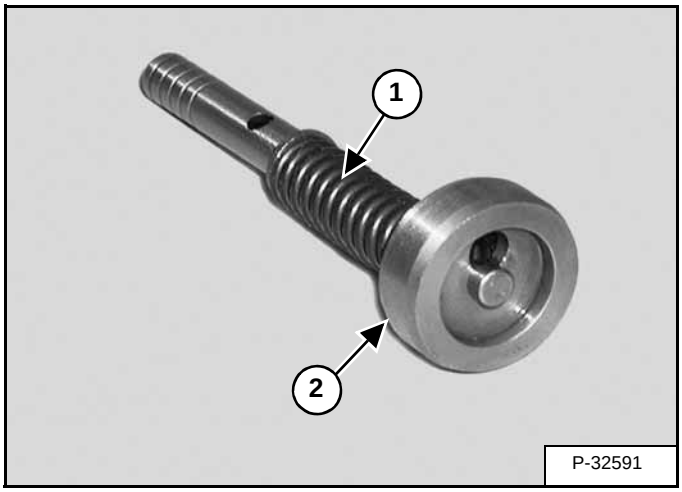
NOTE: Mark the spool assemblies for installation in their original location.

Figure 20-100-21



Remove the spool assemblies (Item 1) **[Figure 20-100-21]**.

Figure 20-100-22

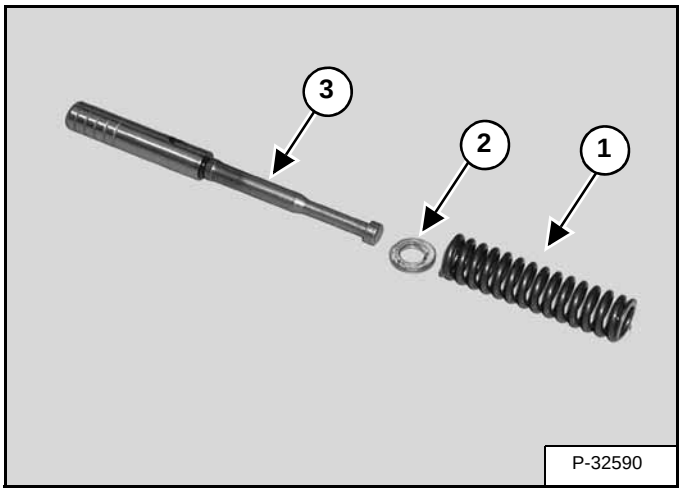


Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-100-22]**.

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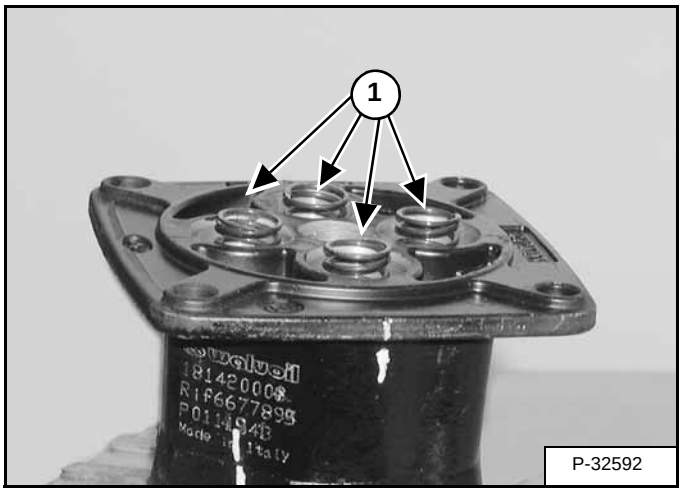
Disassembly (Cont'd)

Figure 20-100-23



Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-100-23]**.

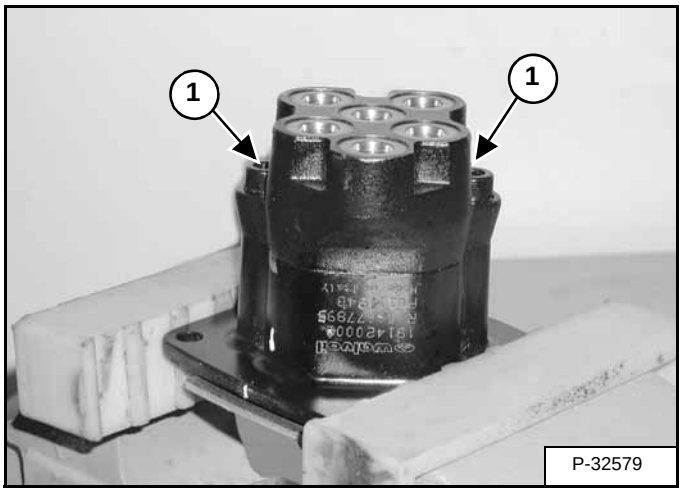
Figure 20-100-24



Remove the springs (Item 1) **[Figure 20-100-24]** from the housing.

Clamp the housing in a vise that is equipped with padded jaws.

Figure 20-100-25

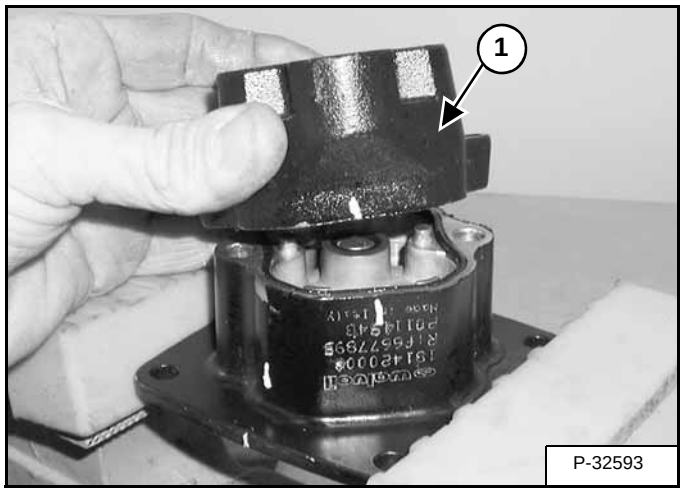


Remove the bolts (Item 1) **[Figure 20-100-25]**.

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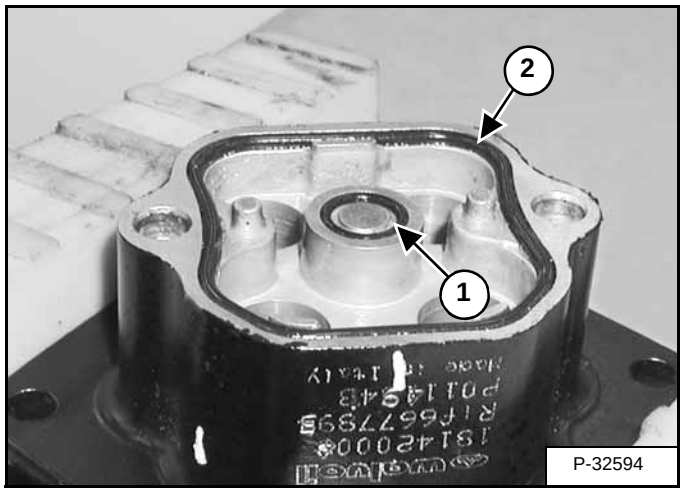
Disassembly (Cont'd)

Figure 20-100-26



Remove the end cap (Item 1) **[Figure 20-100-26]**.

Figure 20-100-27



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-100-27]**.

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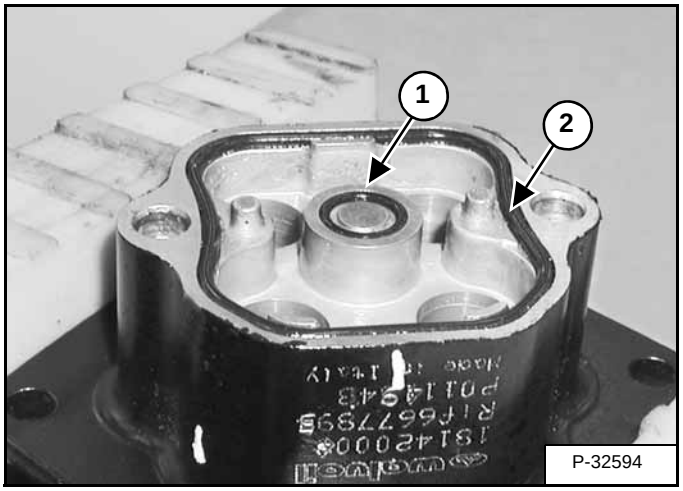
Assembly

Clean all parts in solvent and dry with compressed air.

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

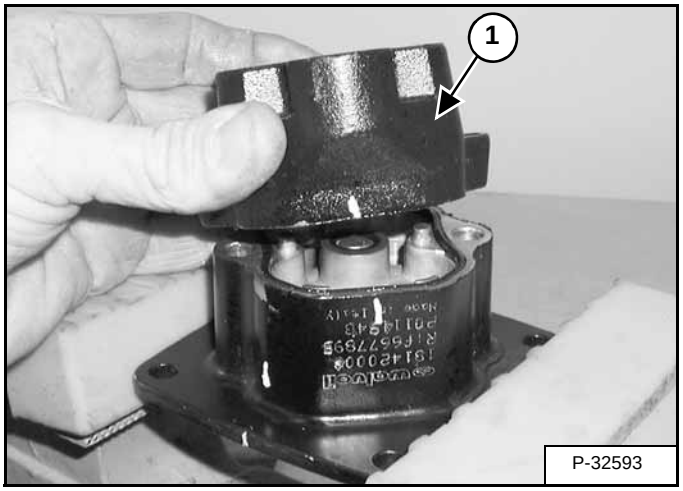
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-100-28



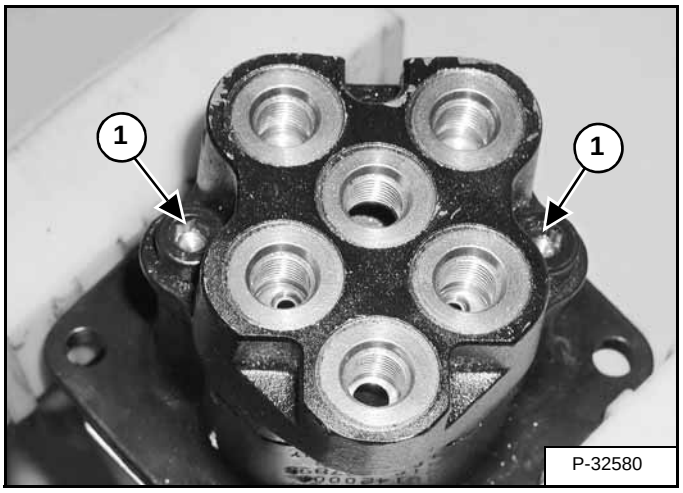
Clamp the housing in a vise equipped with padded jaws. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-100-28]**.

Figure 20-100-29



Install the end cap (Item 1) **[Figure 20-100-29]**.

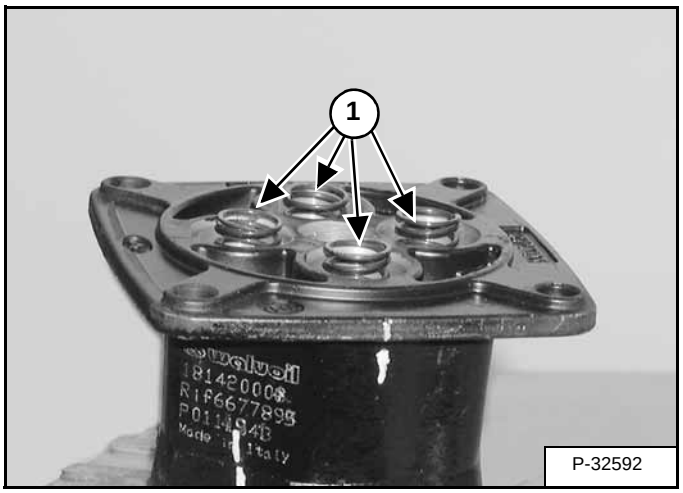
Figure 20-100-30



Install the bolts (Item 1) **[Figure 20-100-30]**.

Turn the housing over.

Figure 20-100-31

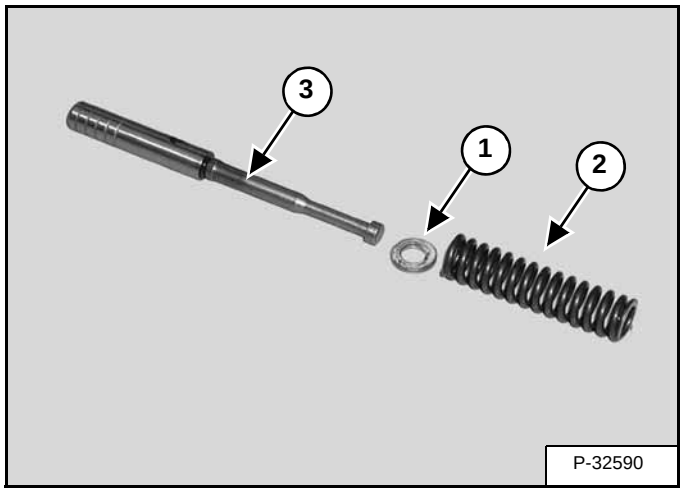


Install the springs (Item 1) **[Figure 20-100-31]**.

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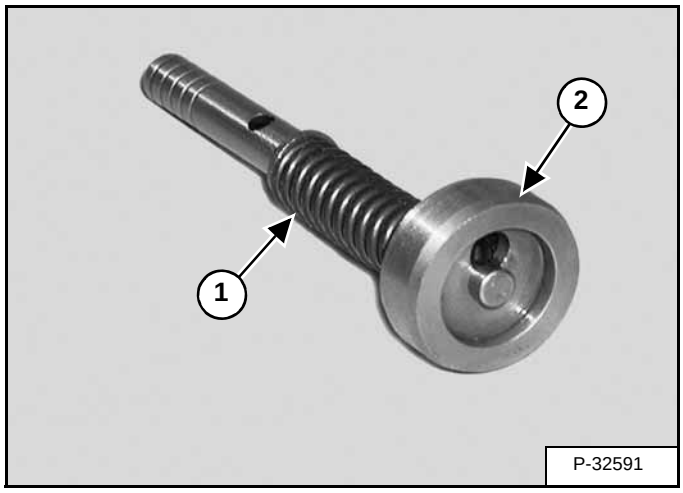
Assembly (Cont'd)

Figure 20-100-32



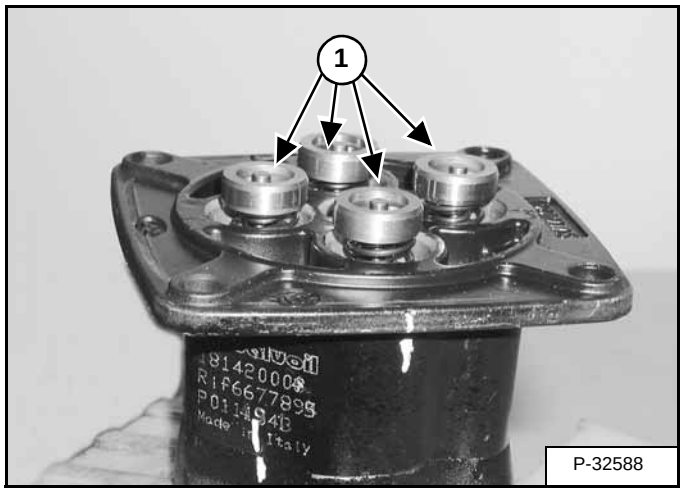
Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-100-32]**.

Figure 20-100-33



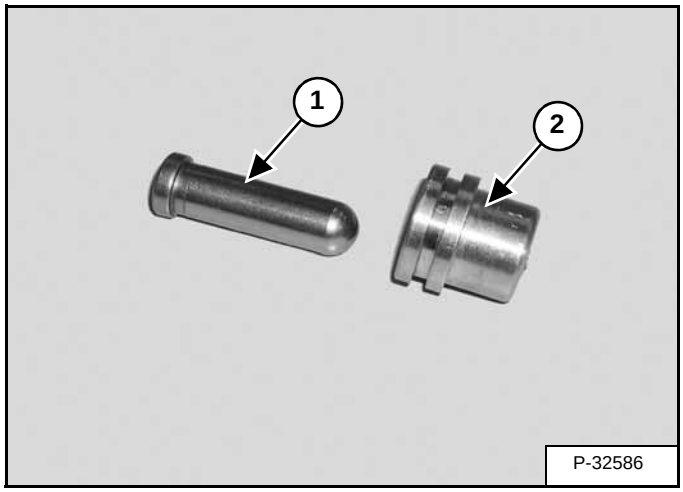
Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-100-33]**.

Figure 20-100-34



Install the spool assemblies (Item 1) **[Figure 20-100-34]** into the housing.

Figure 20-100-35

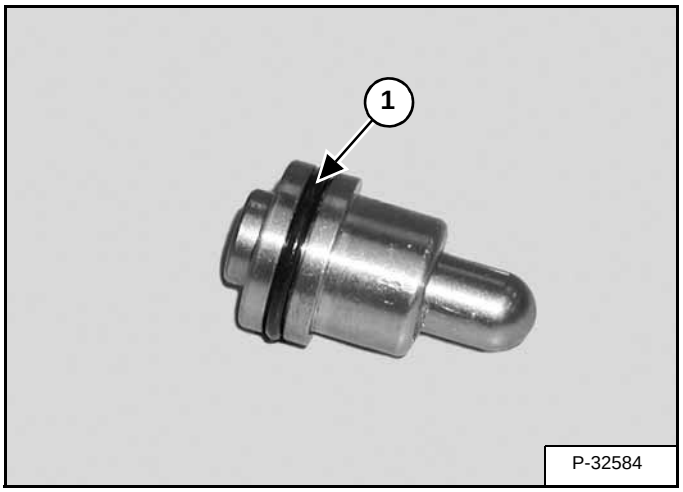


Install the plunger (Item 1) into the bushing (Item 2) **[Figure 20-100-35]**.

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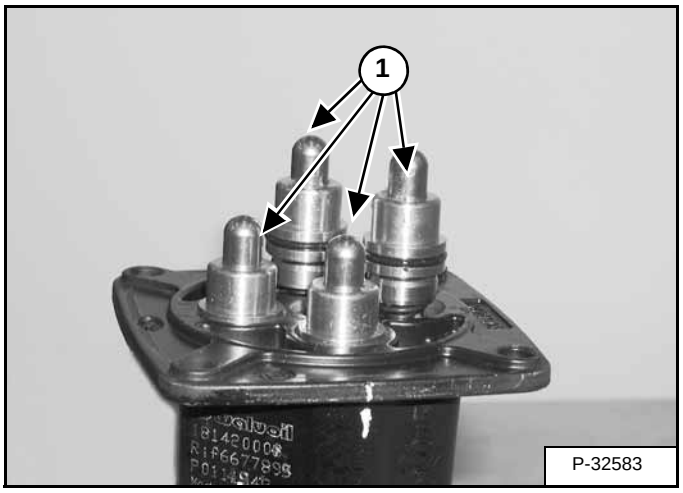
Assembly (Cont'd)

Figure 20-100-36



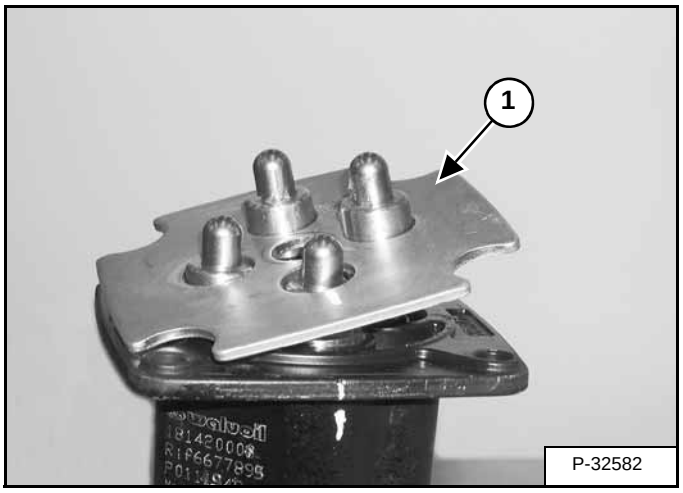
Install the O-ring (Item 1) **[Figure 20-100-36]** on the bushing.

Figure 20-100-37



Install the plunger assemblies (Item 1) **[Figure 20-100-37]** into the housing.

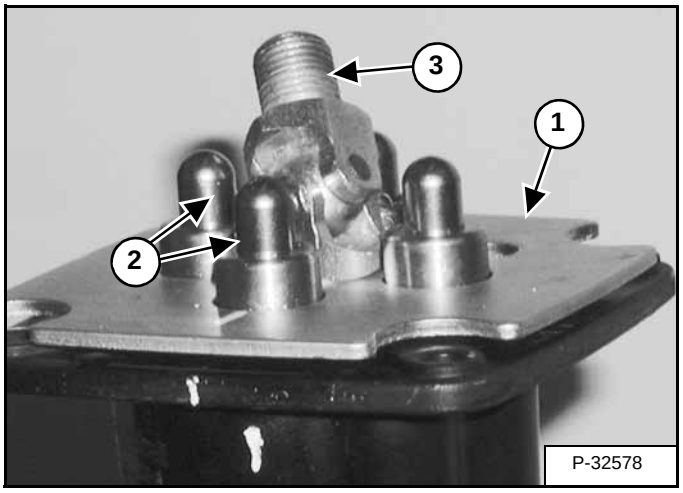
Figure 20-100-38



Install the plate (Item 1) **[Figure 20-100-38]**.

NOTE: Spring pressure can dislodge the plunger assemblies until the plate (Item 1) [Figure 20-100-38] is secured in place.

Figure 20-100-39

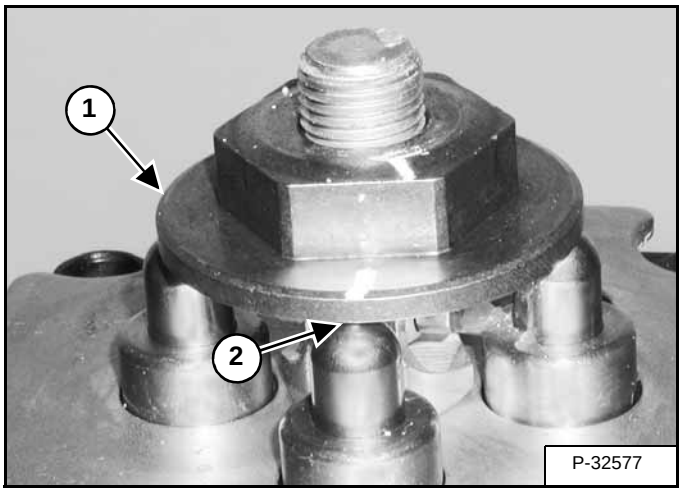


Press down on the plate (Item 1) to seat the plunger assemblies (Item 2). Install the U-joint (Item 3) **[Figure 20-100-39]**.

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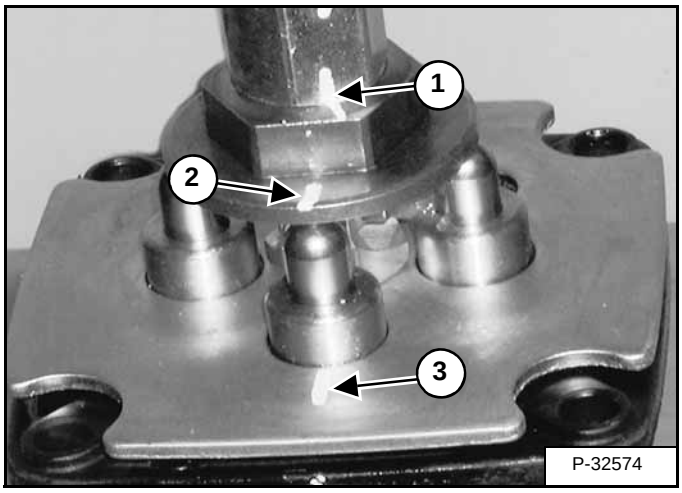
Assembly (Cont'd)

Figure 20-100-40



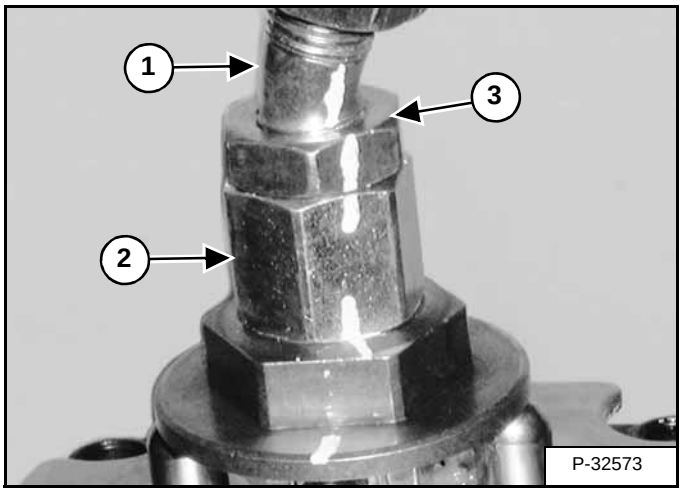
Install the control plate (Item 1) until the plate makes light contact with all 4 plungers (Item 2) **[Figure 20-100-40]**.

Figure 20-100-41



Align the coupler (Item 1) with the control plate (Item 2) and plate (Item 3) **[Figure 20-100-41]**. Tighten the coupler.

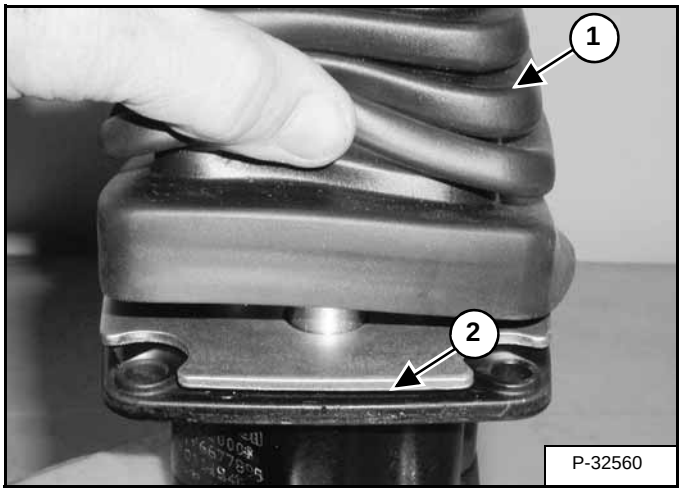
Figure 20-100-42



Install the connector (Item 1) **[Figure 20-100-42]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-100-42]**.

Figure 20-100-43



Install the tabs of the boot (Item 1) in between the joystick flange and mounting plate (Item 2) **[Figure 20-100-43]**.

Install the handle. (See Handle Removal And Installation on Page 20-100-3.)

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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 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.

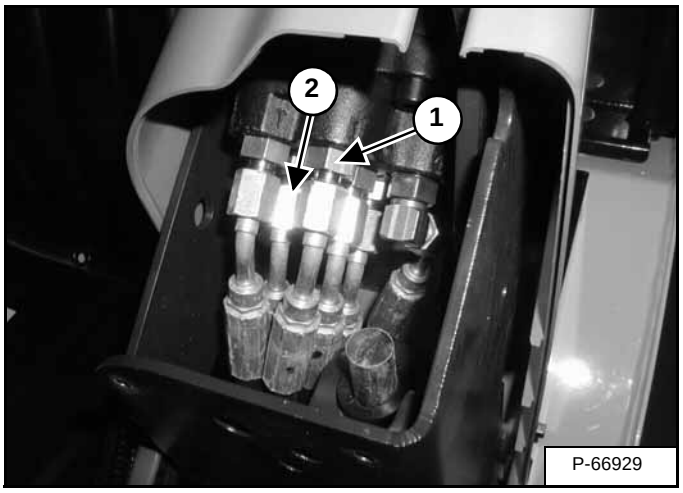
I-2003-0888

⚠ 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.

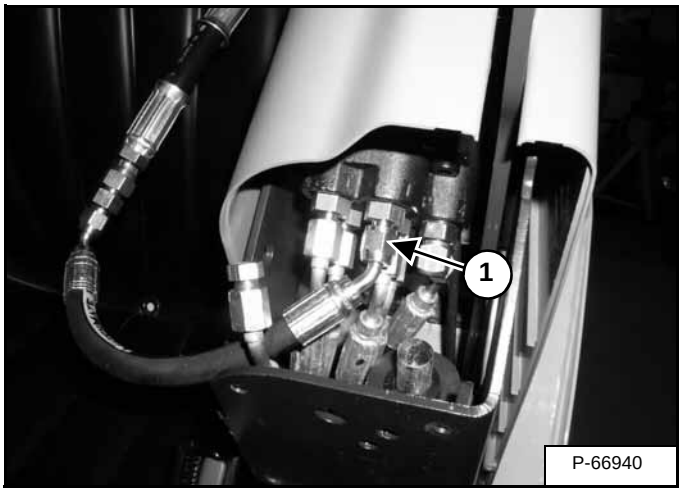
W-2145-0290

Figure 20-101-1



At the bottom of the left control lever (joystick), find the pilot hose connected to Port 1 (Item 1) & 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 20-101-2



Remove the pilot hose **[Figure 20-101-2]** from the bottom of the control lever (joystick) that is to be checked.

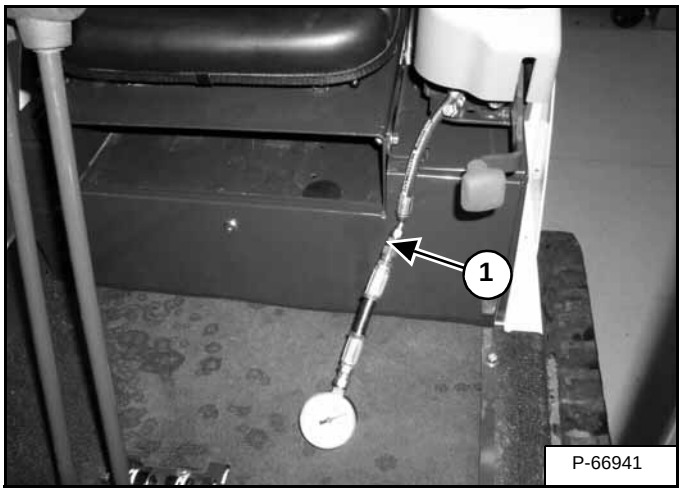
From the test kit, install a fitting and gauge hose (Item 1) **[Figure 20-101-2]** to the control lever (joystick) fitting.

Cap the pilot hose (Item 2) **[Figure 20-101-2]**.

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Testing (Cont'd)

Figure 20-101-3



Install a 1000 PSI (69 bar) gauge on the hose **[Figure 20-101-3]**.

Lower the left console to the locked position **[Figure 20-101-3]**. 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.)

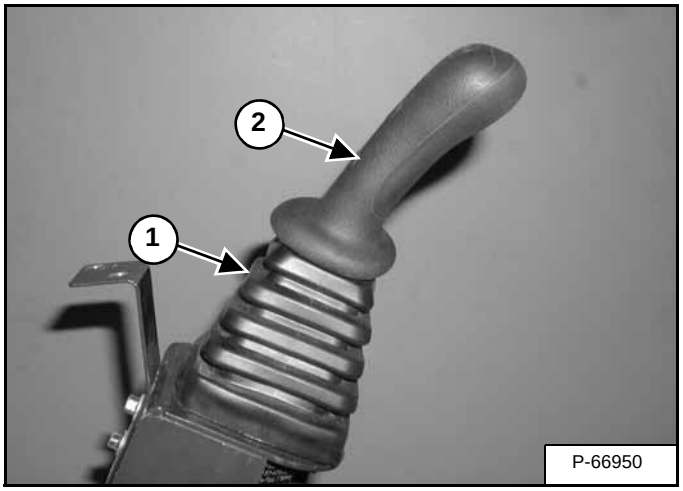
If the pressure is still incorrect replace the pressure reducing valve. (See Testing And Adjusting The Pressure Reducing Valve Page 20-33-1.)

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Handle Removal And Installation

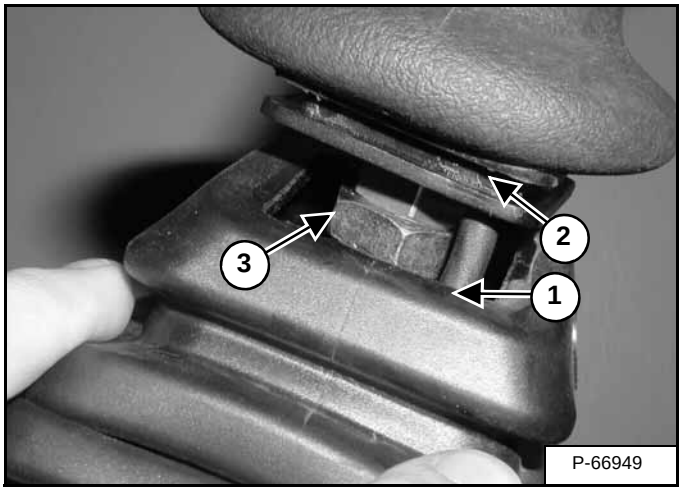
Remove the console cover. (See Left Rear Console Cover Removal And Installation Page 40-60-8.)

Figure 20-101-4



Remove the dust boot (Item 1) from the handle (Item 2) **[Figure 20-101-4]**.

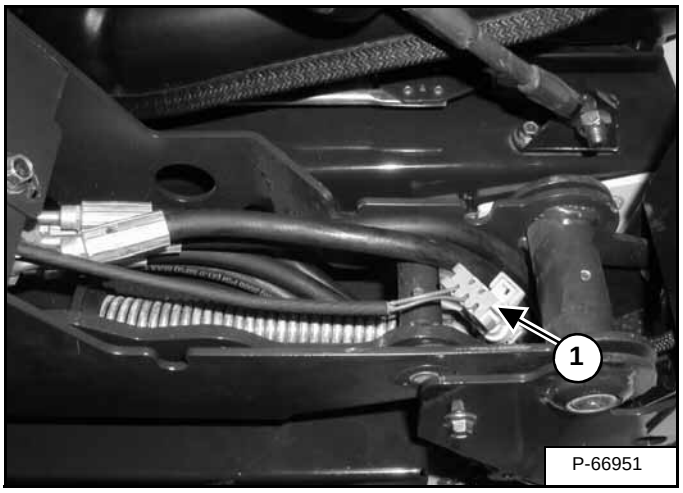
Figure 20-101-5



Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-101-5]**.

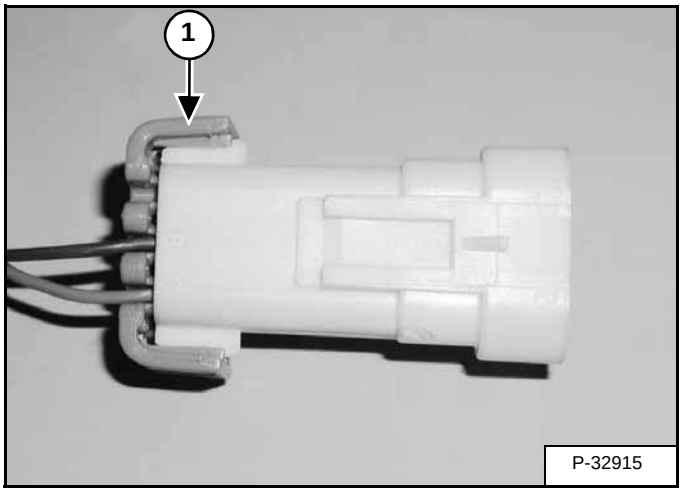
Hold the dust boot (Item 1) down and loosen the nut (Item 3) **[Figure 20-101-5]**.

Figure 20-101-6



Disconnect the wire harness (Item 1) **[Figure 20-101-6]**.

Figure 20-101-7

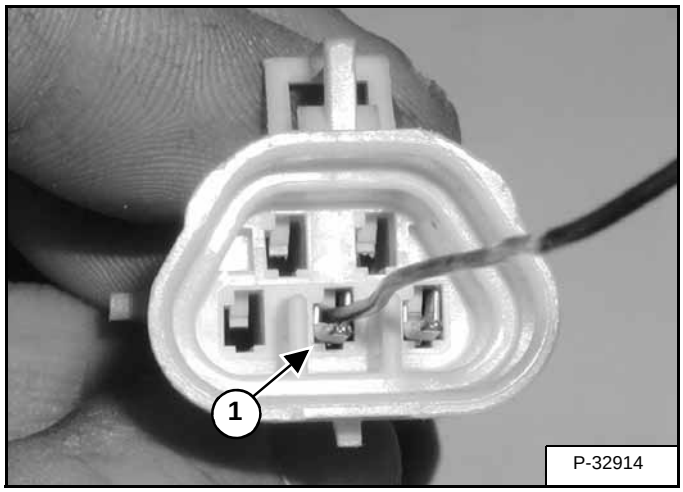


Remove the lock (Item 1) **[Figure 20-101-7]** from the electrical connector.

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Handle Removal And Installation (Cont'd)

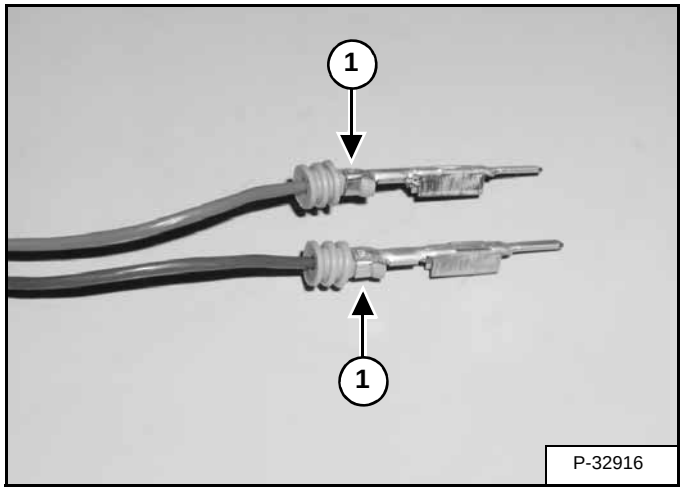
Figure 20-101-8



With a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 20-101-8]**.

Remove the individual wires from the back of the electrical connector.

Figure 20-101-9



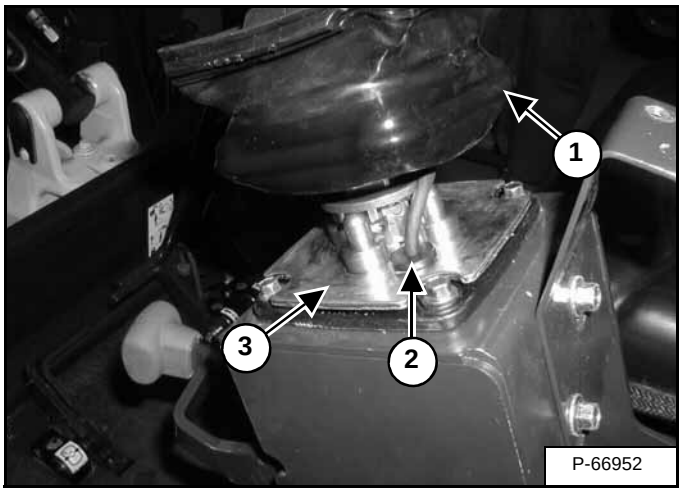
Installation: Use a small piece of wire and rebend the tab (Item 1) **[Figure 20-101-9]** on each wire before installing in the electrical connector.

Installation: The wires must be installed in the proper locations in the wire connector, listed below.

C Red
D Black

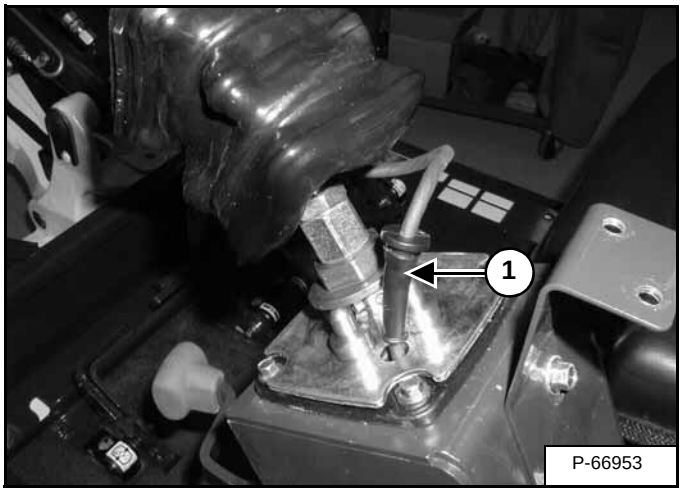
Check each wire to be certain the tab locks into position.

Figure 20-101-10



Raise the dust boot (Item 1) and pull the grommet (Item 2) up through the plate (Item 3) **[Figure 20-101-10]**.

Figure 20-101-11



Remove the grommet and wire (Item 1) **[Figure 20-101-11]** from the mount plate.

Remove the handle from the control lever.

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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.

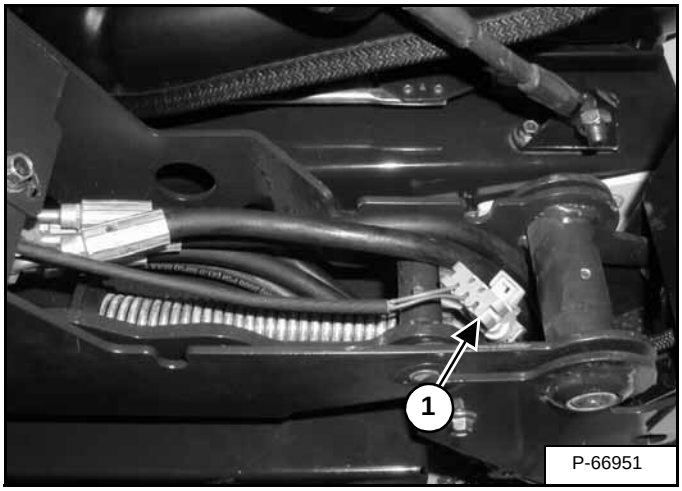
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⚠ WARNING

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.

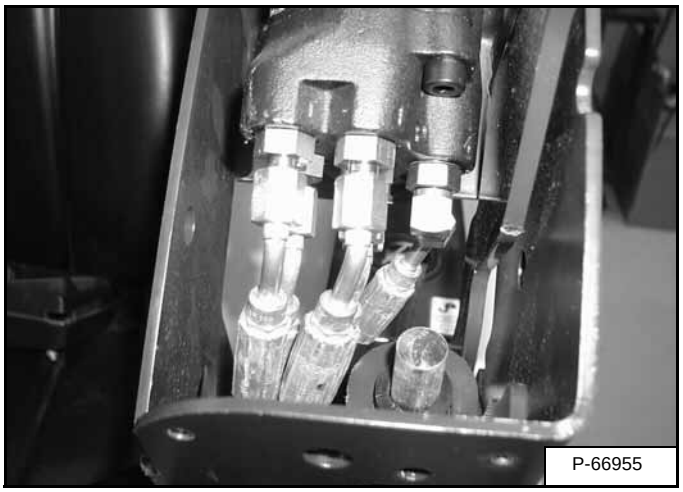
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Figure 20-101-12



Disconnect the wire connector (Item 1) **[Figure 20-101-12]**.

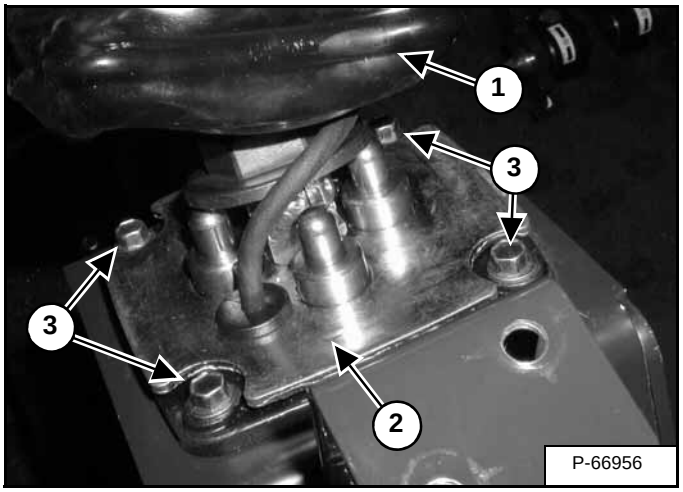
Figure 20-101-13



Mark the hoses for ease of assembly **[Figure 20-101-13]**.

Remove the hoses while the control lever (joystick) is bolted to the console **[Figure 20-101-13]**.

Figure 20-101-14



Raise the dust boot (Item 1) up from the plate (Item 2) **[Figure 20-101-14]**.

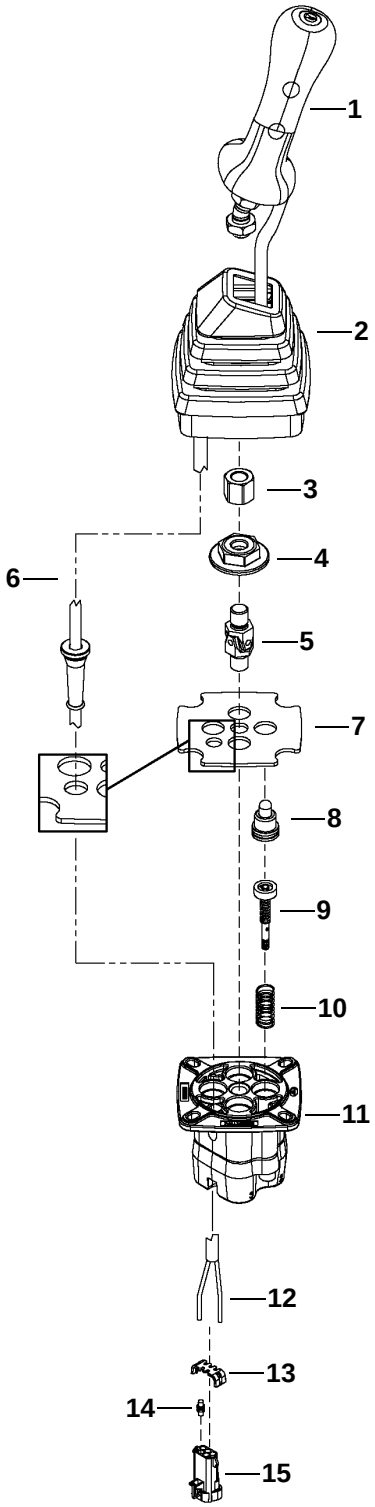
Remove the bolts (Item 3) **[Figure 20-101-14]** from the joystick plate.

Remove the joystick.

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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

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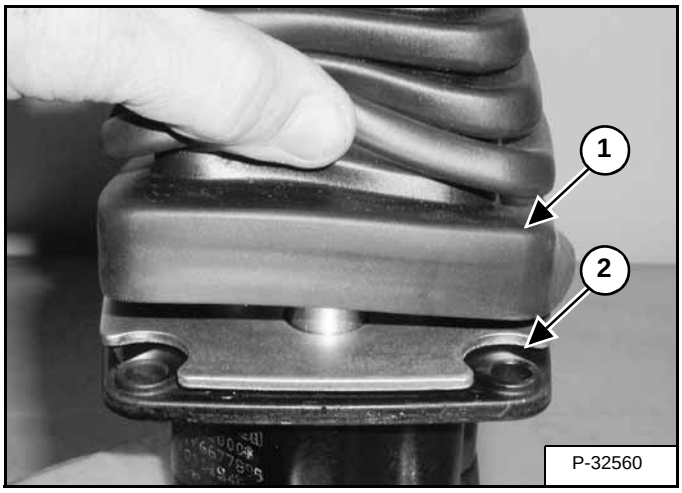
LEFT CONTROL LEVER (JOYSTICK) (CONT'D)

Disassembly

Remove the right handle. (See Handle Removal And Installation Page 20-100-3.)

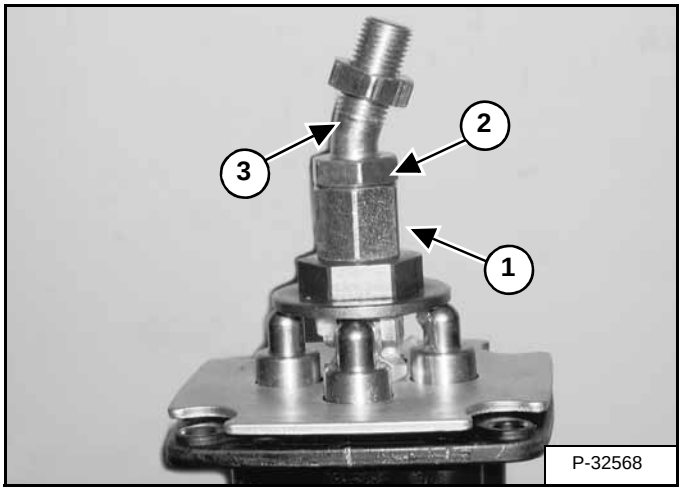
Clean the outside of the control lever before disassembly.

Figure 20-101-15



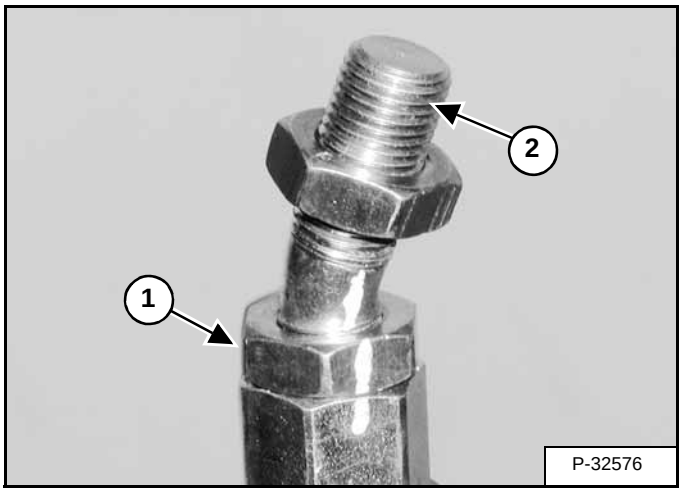
Remove the boot (Item 1) from the control lever (joystick) (Item 2) **[Figure 20-101-15]**.

Figure 20-101-16



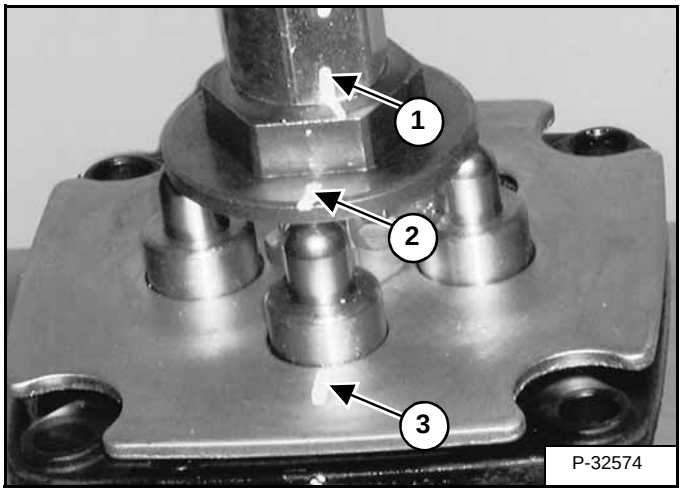
Mark the coupler (Item 1) nut (Item 2), and connector (Item 3) **[Figure 20-101-16]** for correct assembly.

Figure 20-101-17



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-101-17]**.

Figure 20-101-18

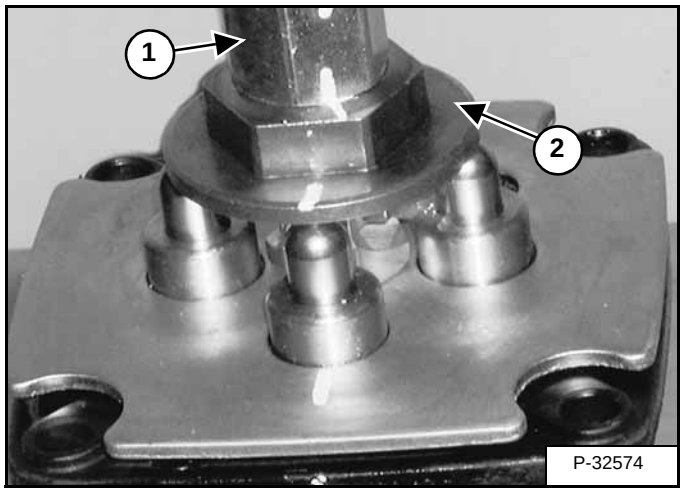


Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-101-18]** for correct installation.

Dealer Copy -- Not for Resale

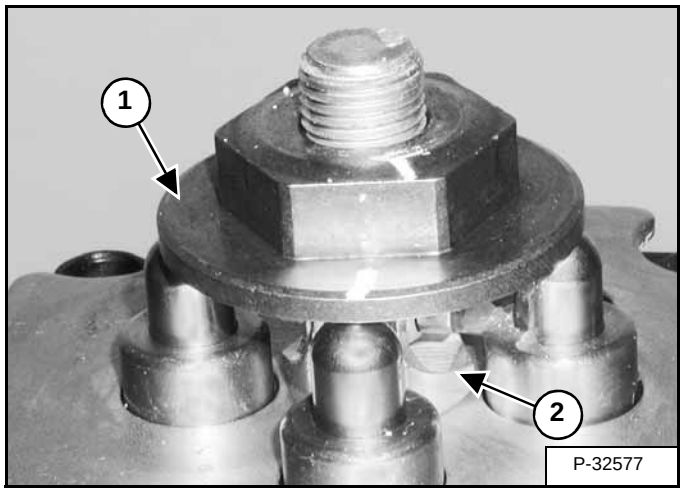
Disassembly (Cont'd)

Figure 20-101-19



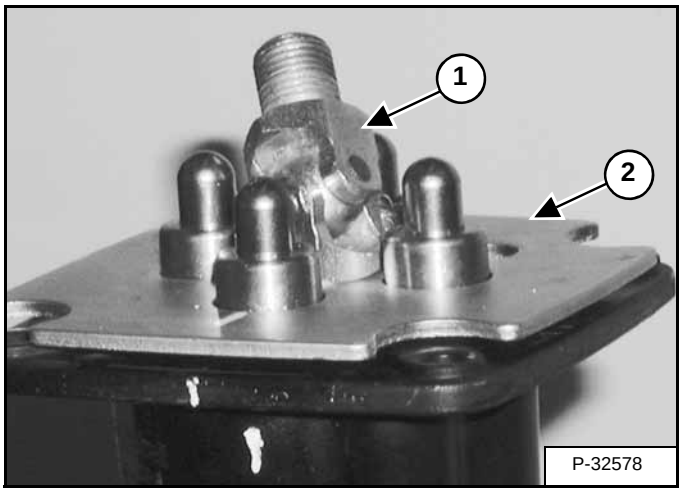
Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-101-19]**.

Figure 20-101-20



Remove the control plate (Item 1) from the U-Joint (Item 2) **[Figure 20-101-20]**.

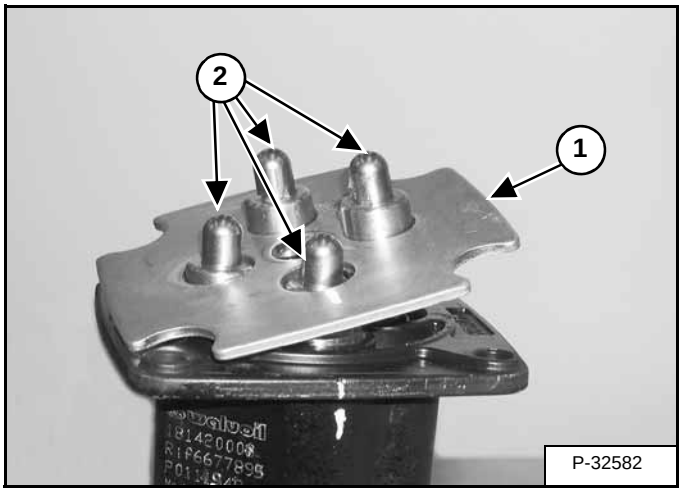
Figure 20-101-21



Mark the plate and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-101-21]**.

NOTE: The plate (Item 2) [Figure 20-101-21] is spring loaded and will come up as the U-joint is removed.

Figure 20-101-22



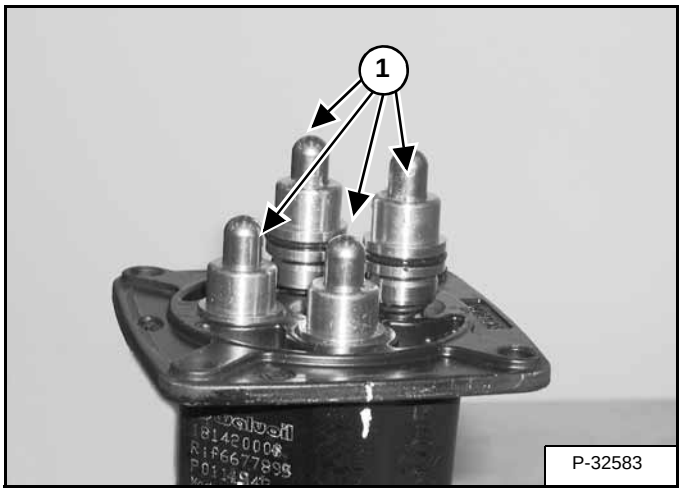
Remove the plate (Item 1) **[Figure 20-101-22]**.

NOTE: Use care while removing the plate. The plungers (Item 2) [Figure 20-101-22] are spring loaded.

Dealer Copy -- Not for Resale

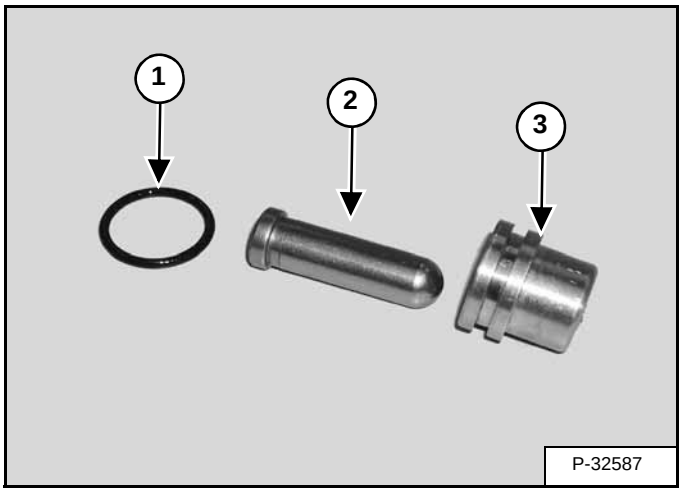
Disassembly (Cont'd)

Figure 20-101-23



Remove the plunger assemblies (Item 1) **[Figure 20-101-23]**.

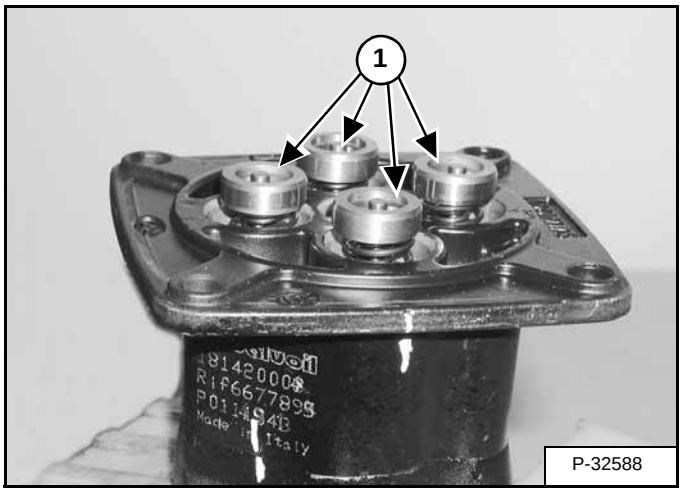
Figure 20-101-24



Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-101-24]**.

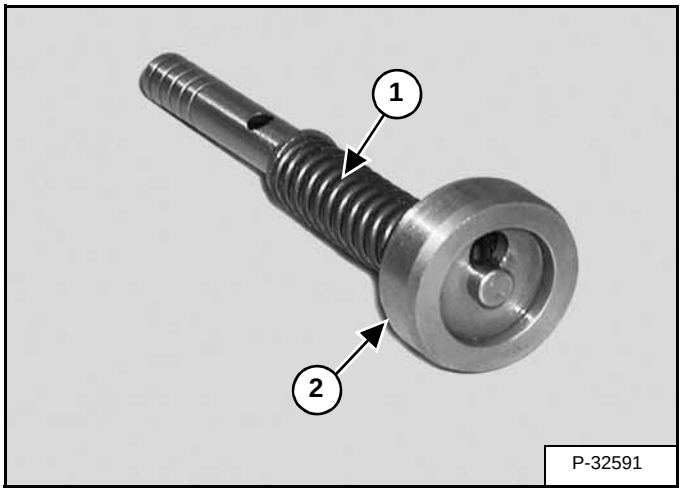
NOTE: Mark the spool assemblies for installation in their original location.

Figure 20-101-25



Remove the spool assemblies (Item 1) **[Figure 20-101-25]**.

Figure 20-101-26

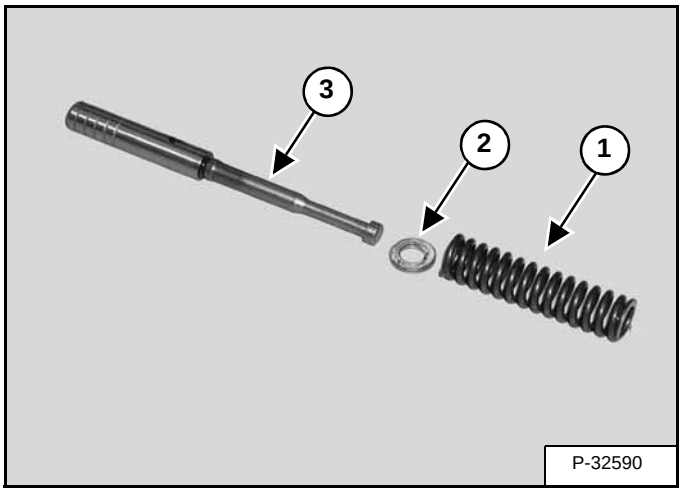


Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-101-26]**.

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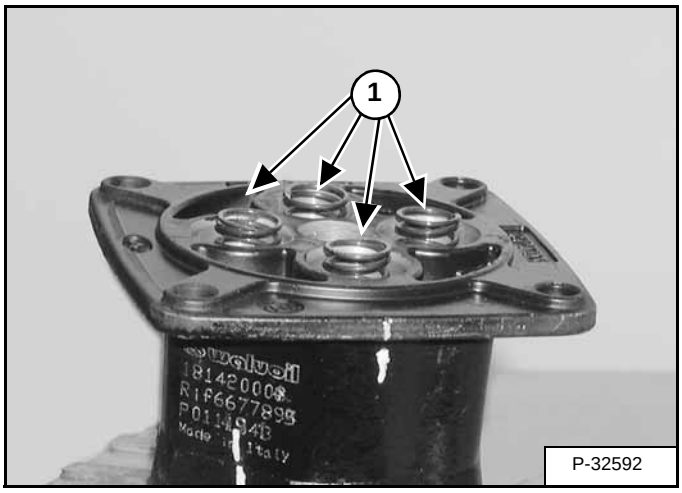
Disassembly (Cont'd)

Figure 20-101-27



Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-101-27]**.

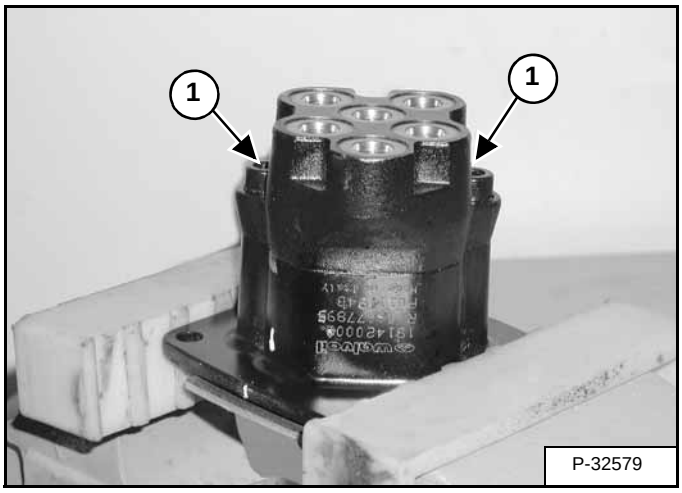
Figure 20-101-28



Remove the springs (Item 1) **[Figure 20-101-28]** from the housing.

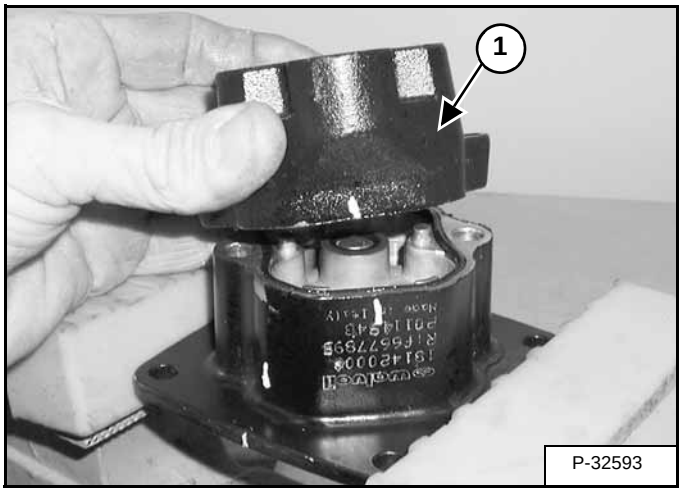
Clamp the housing in a vise that is equipped with padded jaws.

Figure 20-101-29



Remove the bolts (Item 1) **[Figure 20-101-29]**.

Figure 20-101-30

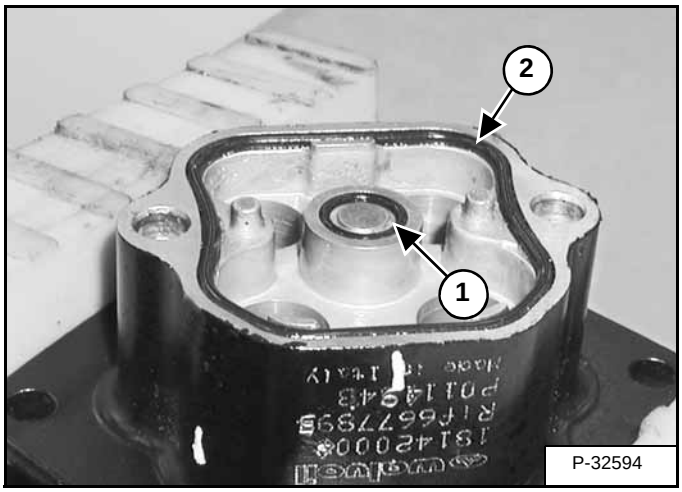


Remove the end cap (Item 1) **[Figure 20-101-30]**.

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Disassembly (Cont'd)

Figure 20-101-31



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-101-31]**.

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LEFT CONTROL LEVER (JOYSTICK) (CONT'D)

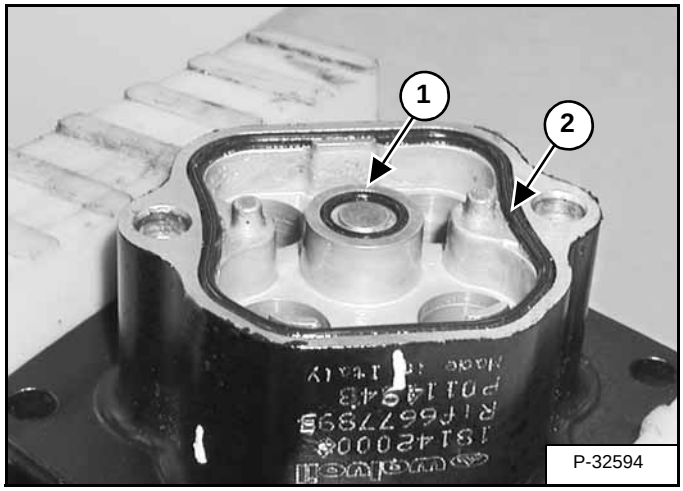
Assembly

Clean all parts in solvent and dry with compressed air.

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

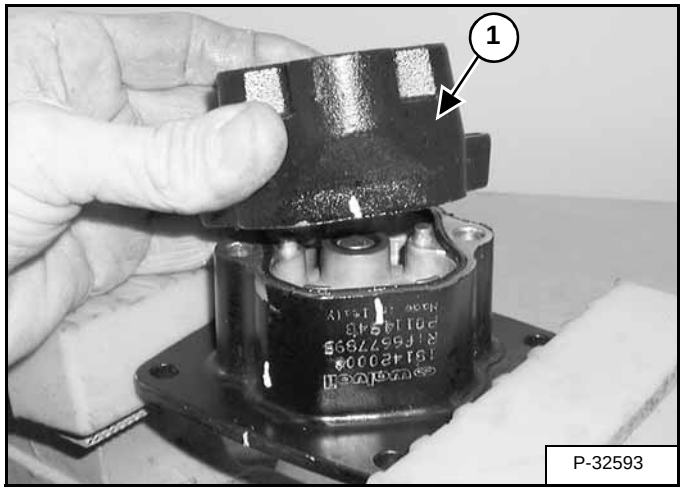
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-101-32



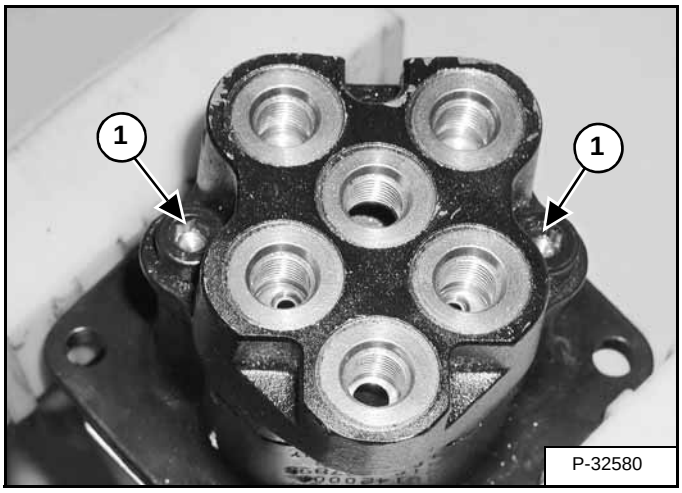
Clamp the housing in a vise equipped with padded jaws. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-101-32]**.

Figure 20-101-33



Install the end cap (Item 1) **[Figure 20-101-33]**.

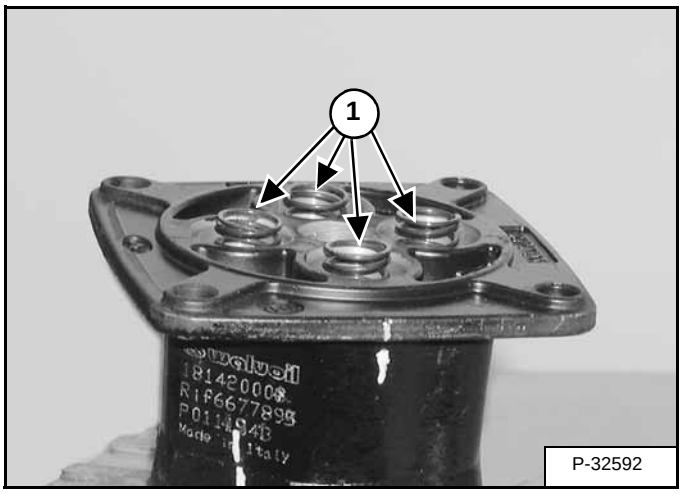
Figure 20-101-34



Install the bolts (Item 1) **[Figure 20-101-34]**.

Turn the housing over.

Figure 20-101-35

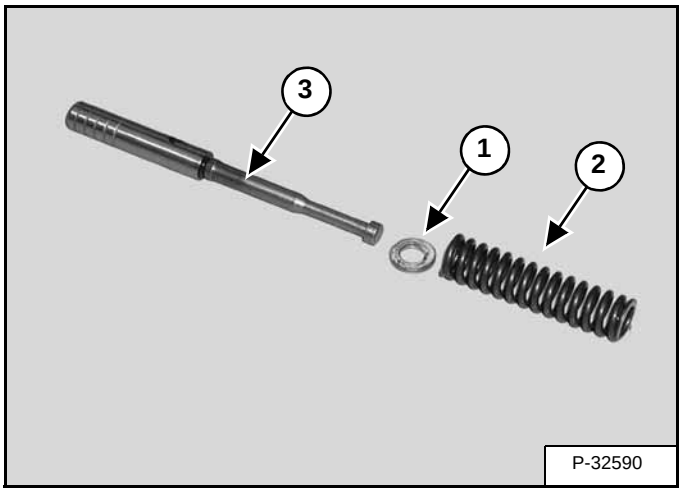


Install the springs (Item 1) **[Figure 20-101-35]**.

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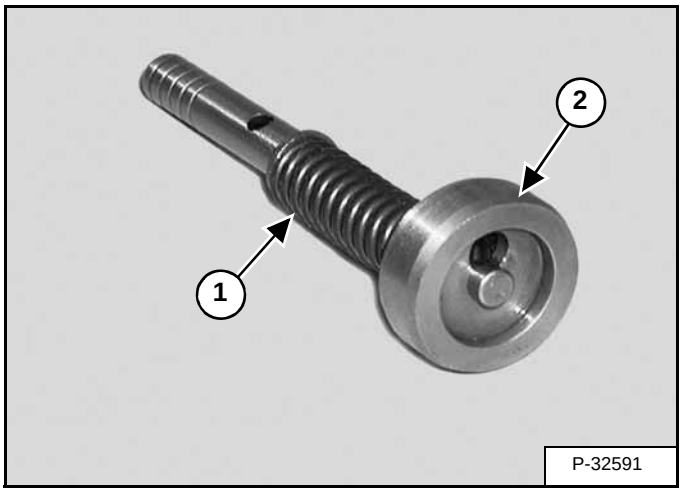
Assembly (Cont'd)

Figure 20-101-36



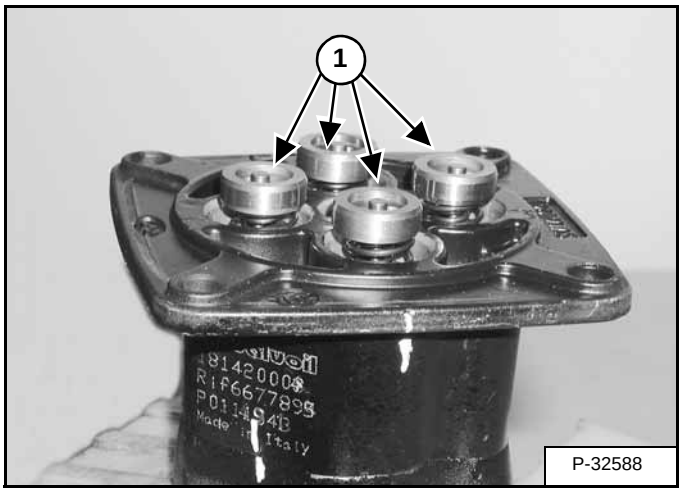
Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-101-36]**.

Figure 20-101-37



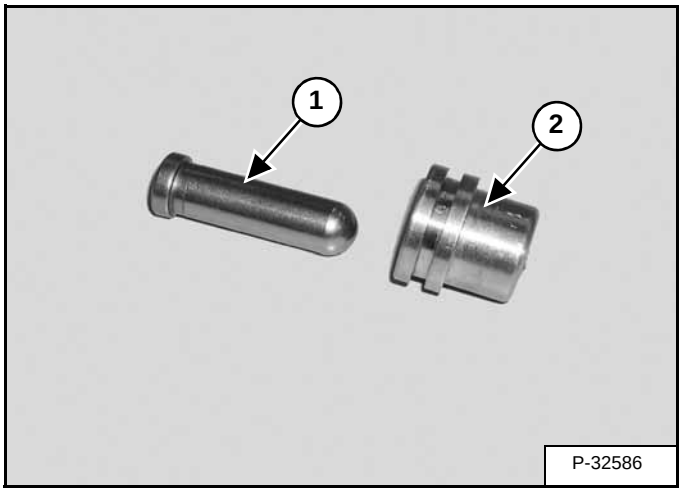
Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-101-37]**.

Figure 20-101-38



Install the spool assemblies (Item 1) **[Figure 20-101-38]** into the housing.

Figure 20-101-39

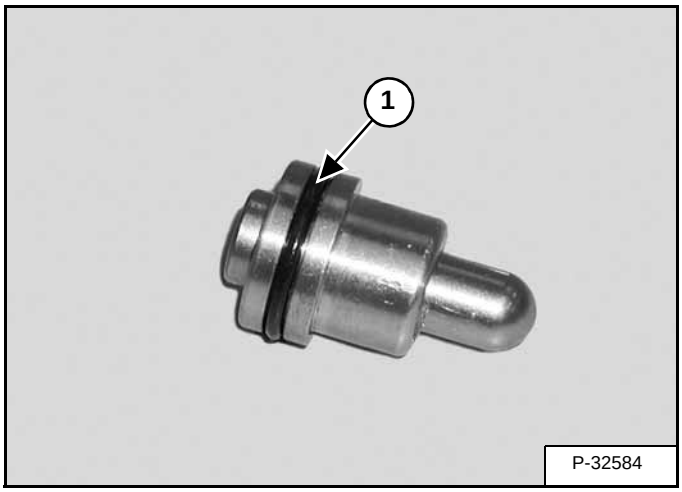


Install the plunger (Item 1) into the bushing (Item 2) **[Figure 20-101-39]**.

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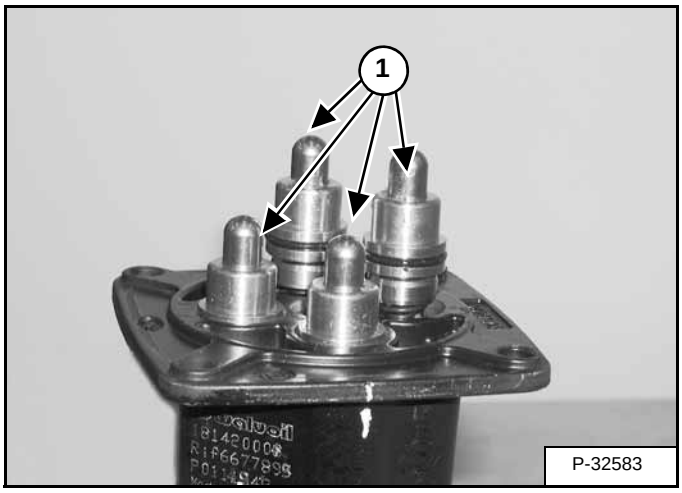
Assembly (Cont'd)

Figure 20-101-40



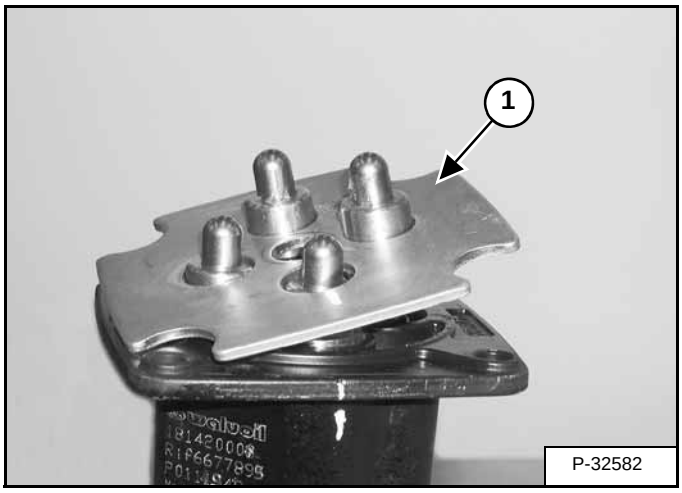
Install the O-ring (Item 1) **[Figure 20-101-40]** on the bushing.

Figure 20-101-41



Install the plunger assemblies (Item 1) **[Figure 20-101-41]** into the housing.

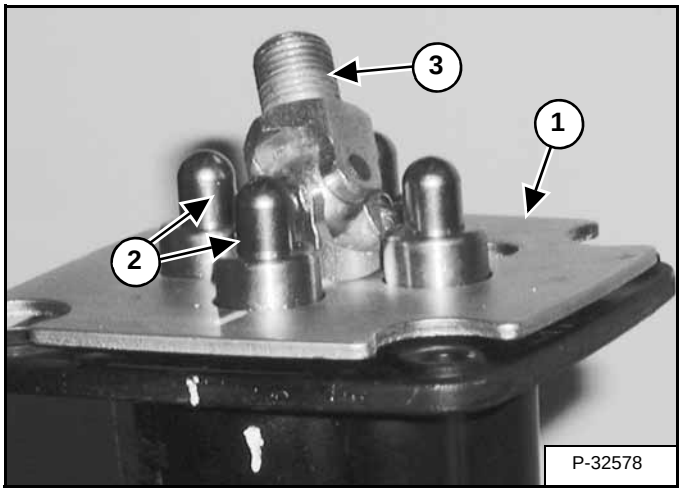
Figure 20-101-42



Install the plate (Item 1) **[Figure 20-101-42]**.

NOTE: Spring pressure can dislodge the plunger assemblies until the plate (Item 1) [Figure 20-101-42] is secured in place.

Figure 20-101-43

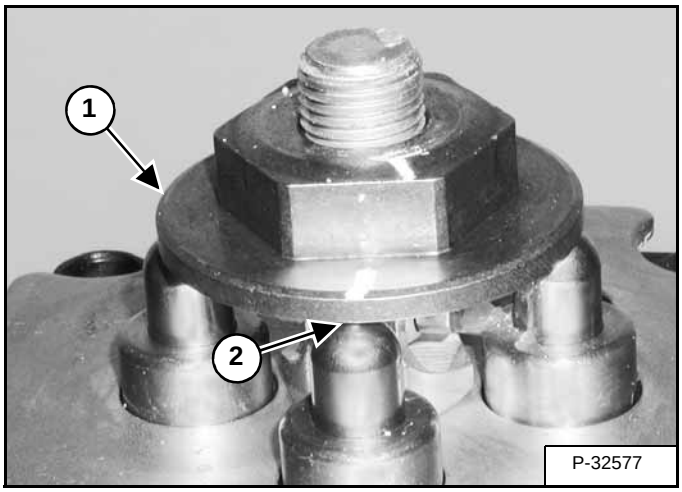


Press down on the plate (Item 1) to seat the plunger assemblies (Item 2). Install the U-joint (Item 3) **[Figure 20-101-43]**.

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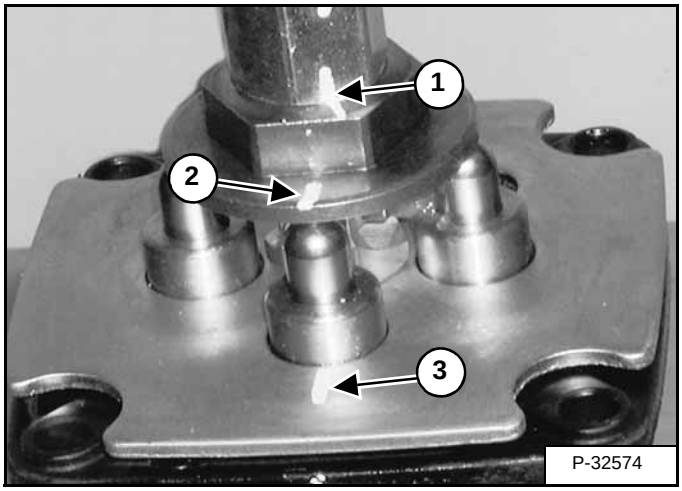
Assembly (Cont'd)

Figure 20-101-44



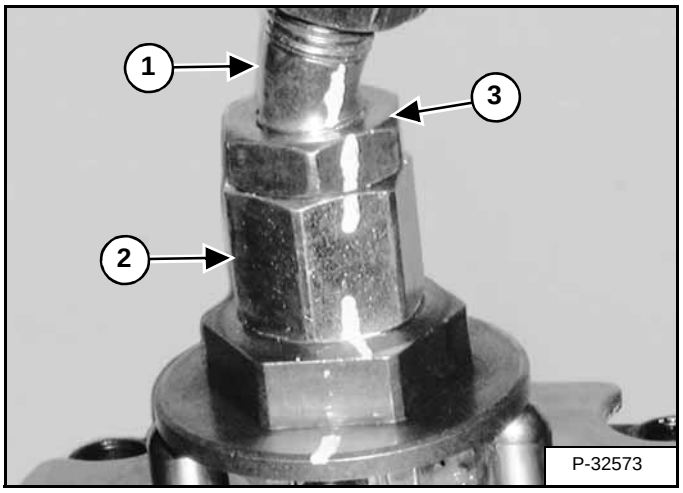
Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-101-44]**.

Figure 20-101-45



Align the coupler (Item 1) with the control plate (Item 2) and plate (Item 3) **[Figure 20-101-45]**. Tighten the coupler.

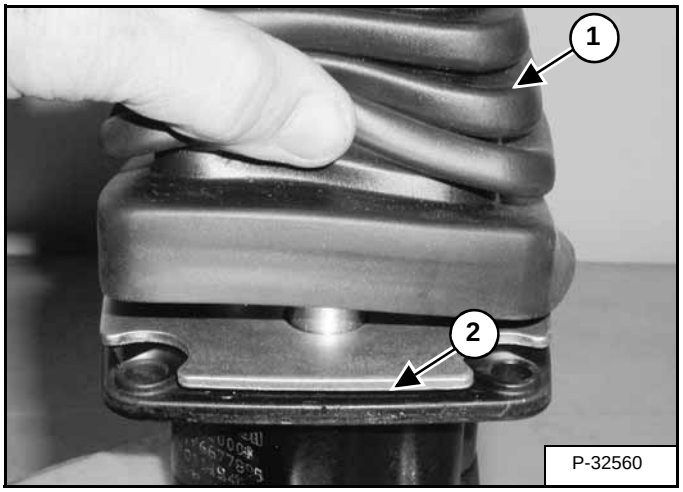
Figure 20-101-46



Install the connector (Item 1) **[Figure 20-101-46]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-101-46]**.

Figure 20-101-47



Install the tabs of the boot (Item 1) in between the joystick flange and mounting plate (Item 2) **[Figure 20-101-47]**.

Install the handle. (See Handle Removal And Installation Page 20-101-3.)

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HYDRAULIC FILTER

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.

Housing Removal and Installation

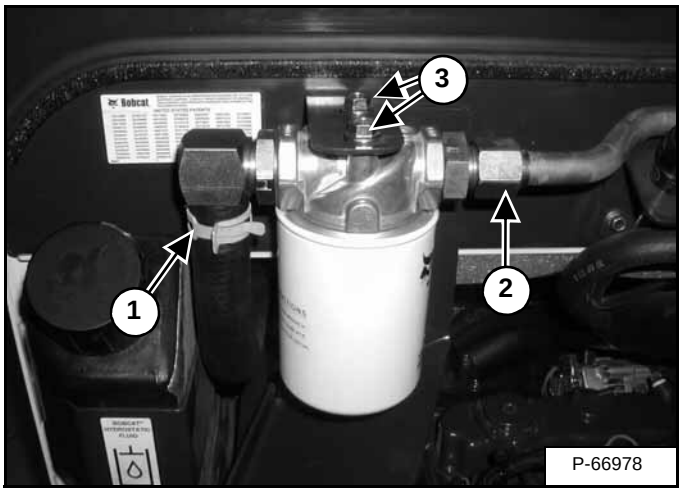
IMPORTANT

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 20-110-1



Loosen the hose clamp (Item 1) **[Figure 20-110-1]** 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.

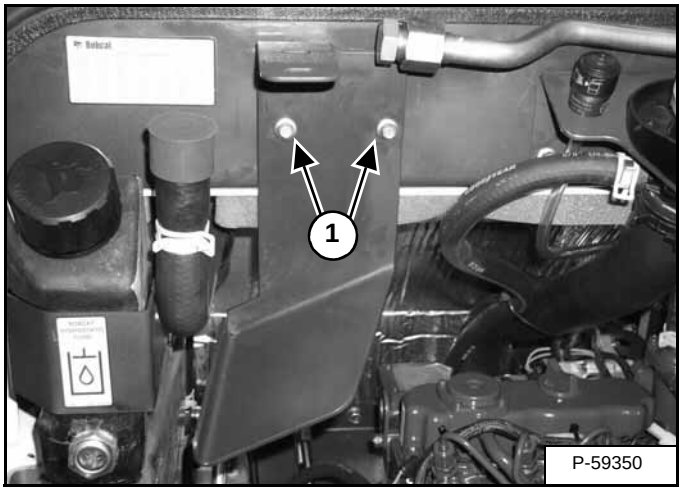
Remove the tube line (Item 2) **[Figure 20-110-1]**.

Remove the bolts (Item 3) **[Figure 20-110-1]**.

Remove the filter and filter housing.

Installation: Tighten the bolts to 28 ft.-lb. (38 N•m) torque.

Figure 20-110-2



Remove the screws (Item 1) **[Figure 20-110-2]** from the filter mount bracket.

Remove the bracket.

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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.

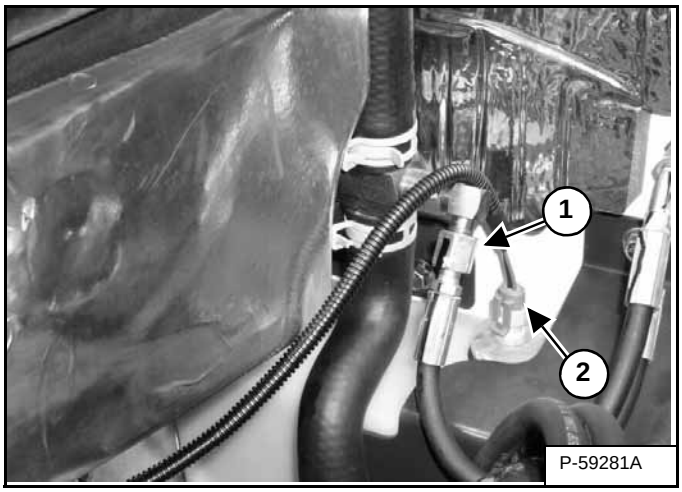
Removal and Installation

Open tailgate.

Drain hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-100-2.)

Remove the muffler and extension. (See Removal And Installation on Page 60-30-1.)

Figure 20-120-1



Remove the hose (Item 1) **[Figure 20-120-1]** from the hydraulic reservoir tee fitting.

Disconnect the fuel level sender harness (Item 2) **[Figure 20-120-1]** from the fuel level sender.

Figure 20-120-2

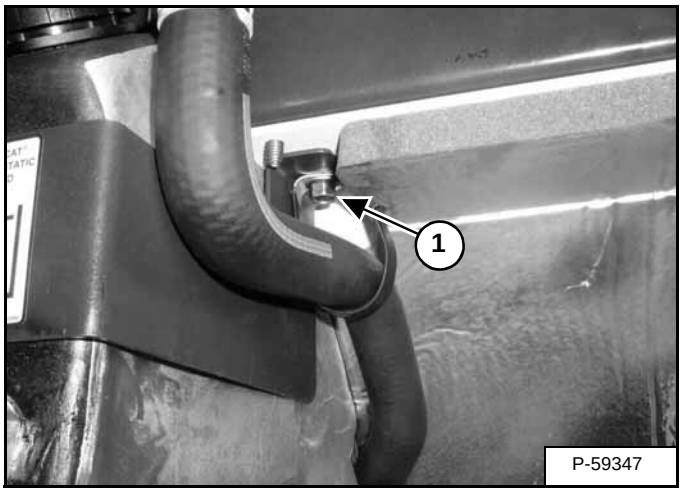
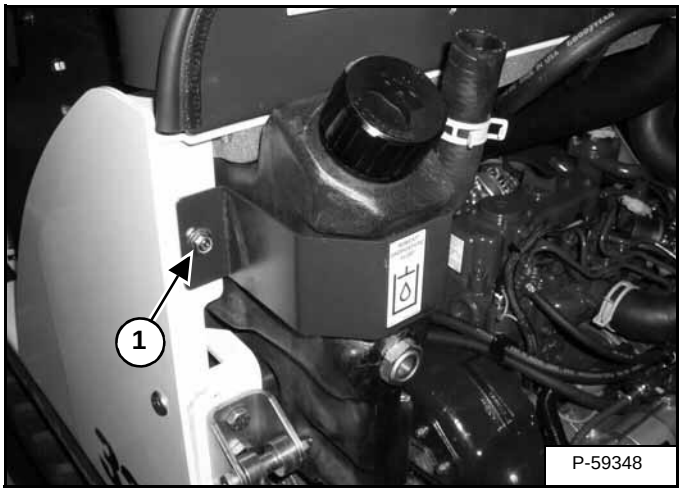


Figure 20-120-3

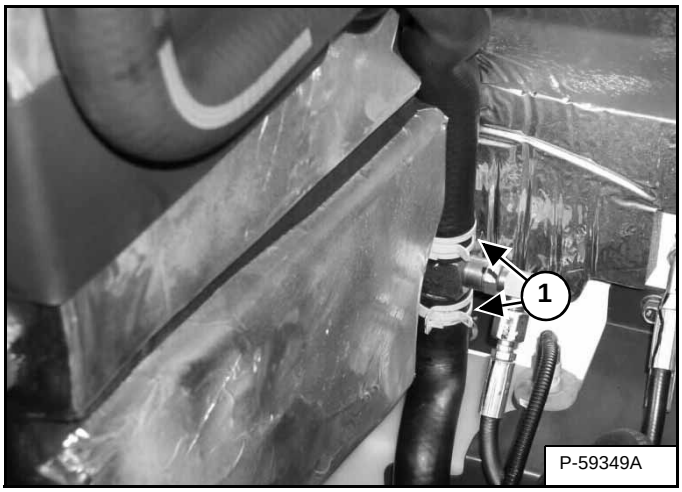


Remove the two bolts (Item 1) **[Figure 20-120-2]** & **[Figure 20-120-3]** from the hydraulic reservoir bracket.

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Removal and Installation (Cont'd)

Figure 20-120-4



Release the hose clamps (Item 1) **[Figure 20-120-4]** and remove hoses from tee fitting on reservoir.

Tilt hydraulic reservoir towards engine and slide reservoir out **[Figure 20-120-4]**.

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OIL COOLER

Description

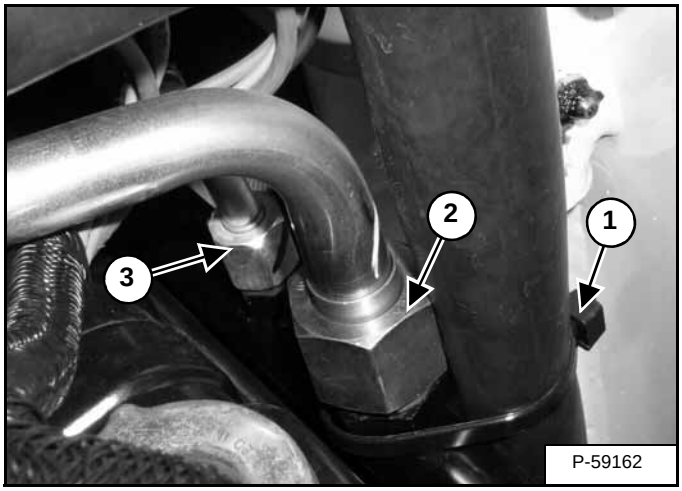
The oil cooler is used to cool the excavators hydraulic fluid. Oil passages are coiled into a heat exchanger. The air is forces around these passages cooling the oil.

Removal And Installation

Open tailgate.

Drain hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-100-2.)

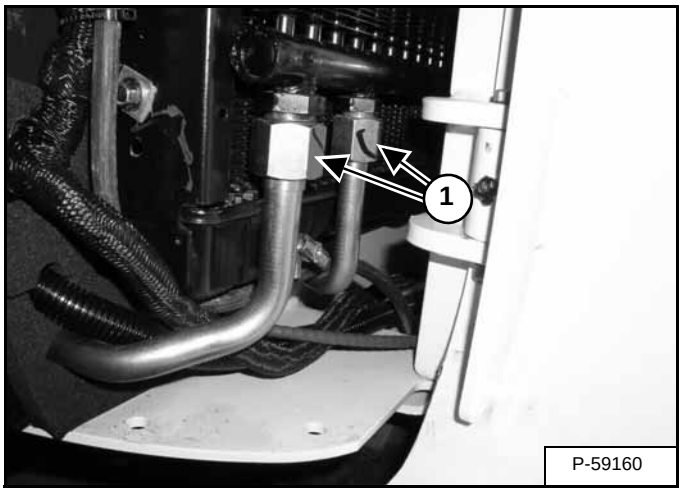
Figure 20-130-1



Remove tie strap (Item 1) **[Figure 20-130-1]**.

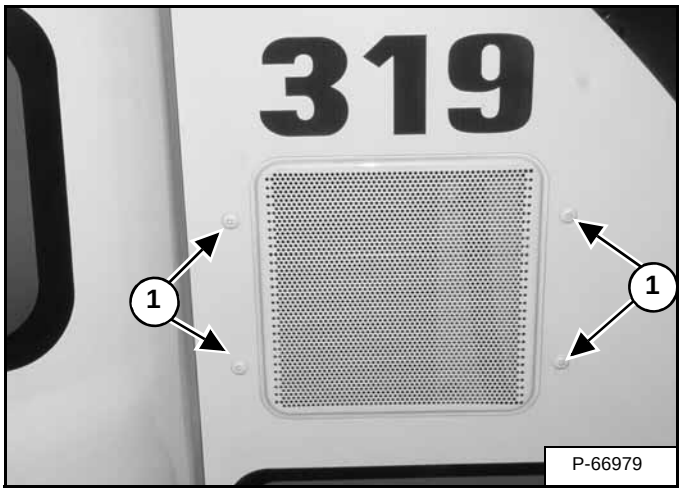
Remove the tubeline (Item 2) and hose (Item 3) **[Figure 20-130-1]** from the top of the oil cooler.

Figure 20-130-2



Remove the tubelines (Item 1) **[Figure 20-130-2]** from the bottom of the oil cooler.

Figure 20-130-3



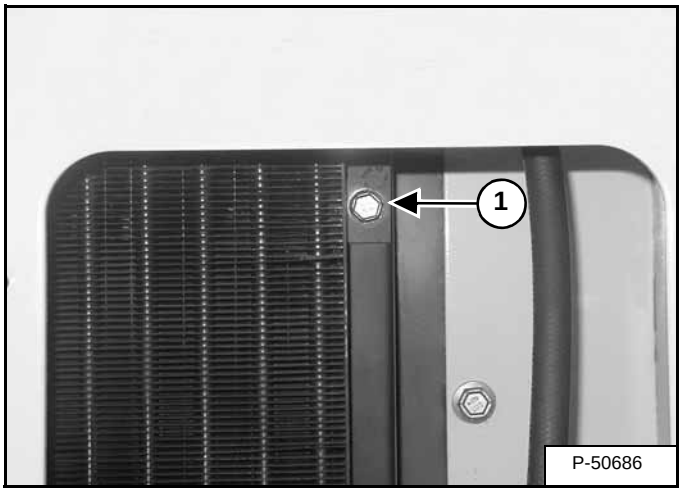
Remove the four bolts (Item 1) **[Figure 20-130-3]** holding the grill to the side frame.

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 20-130-4

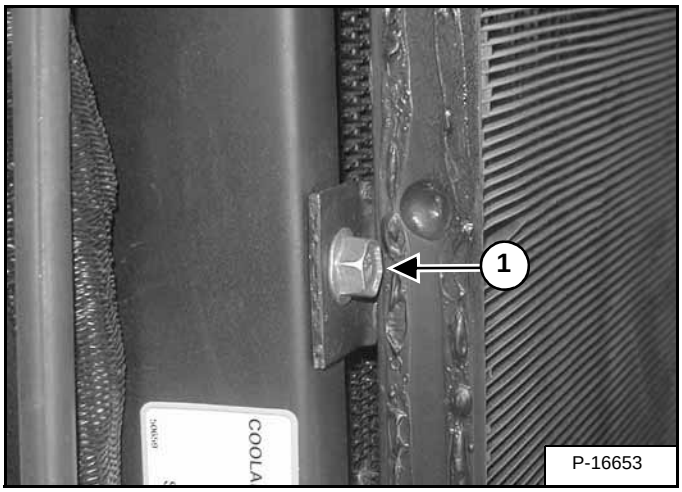


Remove the bolt (Item 1) **[Figure 20-130-4]** mounting the oil cooler to the radiator.

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Removal And Installation (Cont'd)

Figure 20-130-5



Remove the bolt (Item 1) **[Figure 20-130-5]** mounting the oil cooler to the radiator.

Remove the oil cooler from rear of excavator.

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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

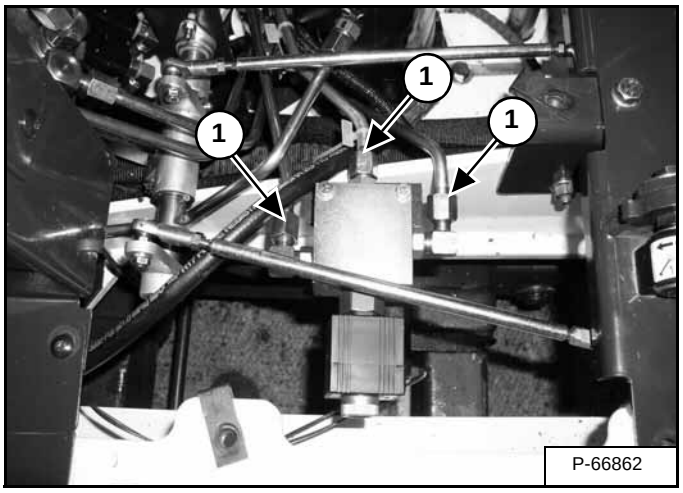
Remove the floor mat and floor panel. (See FLOOR MAT AND FLOOR PANELS on Page 40-100-1.)

⚠ 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

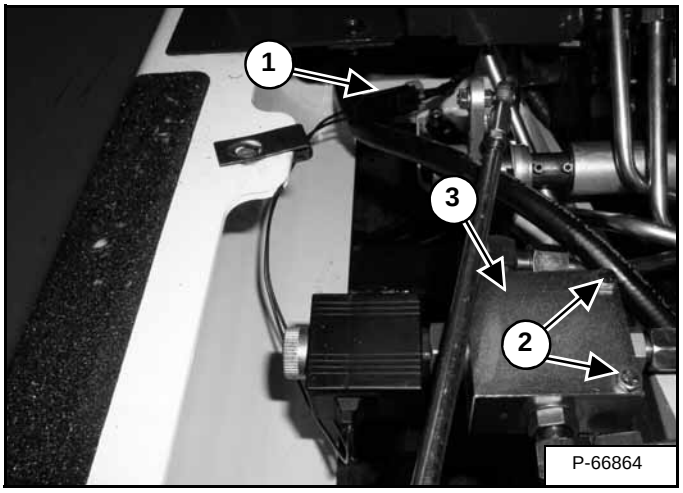
Figure 20-140-1



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

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

Figure 20-140-2



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

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

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

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BLADE/TRACK EXPANSION SOLENOID BLOCK (CONT'D)

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

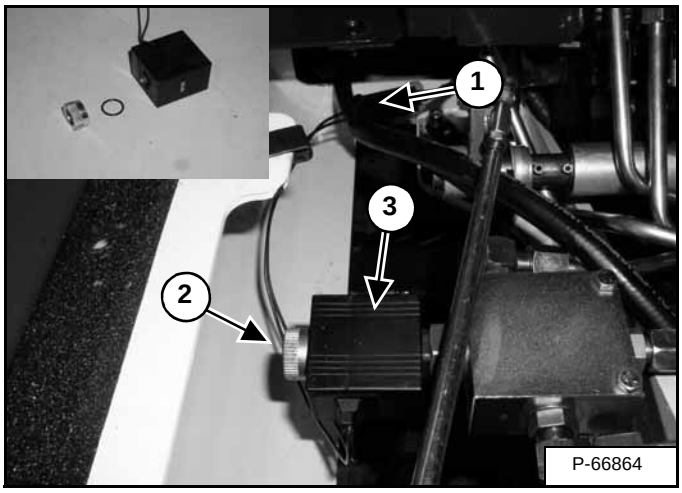
Remove the floormat and floor panel. (See FLOOR MAT AND FLOOR PANELS on Page 40-100-1.)

⚠ 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

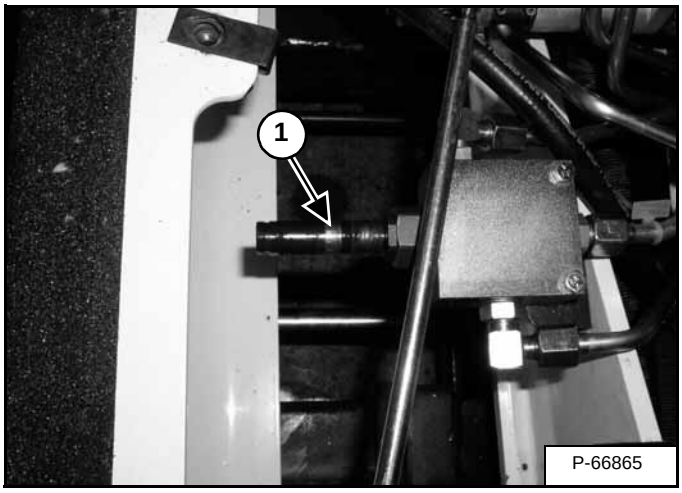


Disconnect the wire harness (Item 1) **[Figure 20-140-3]** from the excavator harness.

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 20-140-4



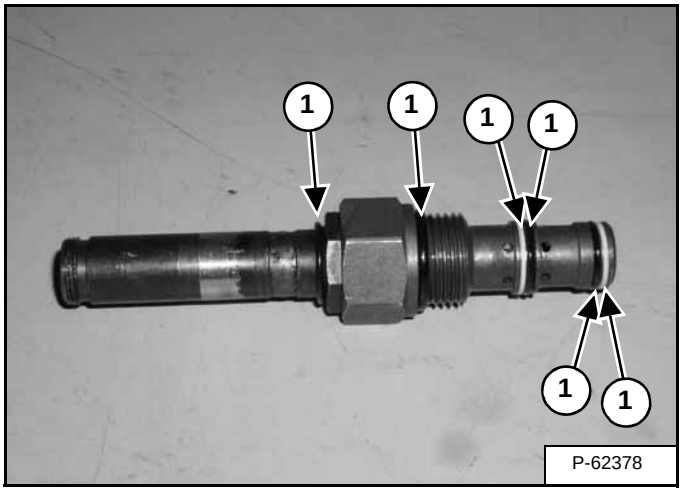
Remove the solenoid stem (Item 1) **[Figure 20-140-4]**.

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

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Solenoid Removal and Installation (Cont'd)

Figure 20-140-5



Remove the O-rings and backup rings (Item 1) **[Figure 20-140-5]** 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.

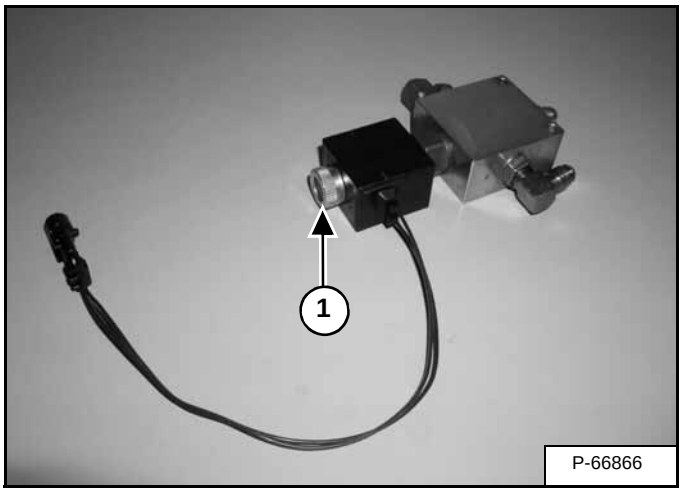
I-2003-0888

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 20-140-6

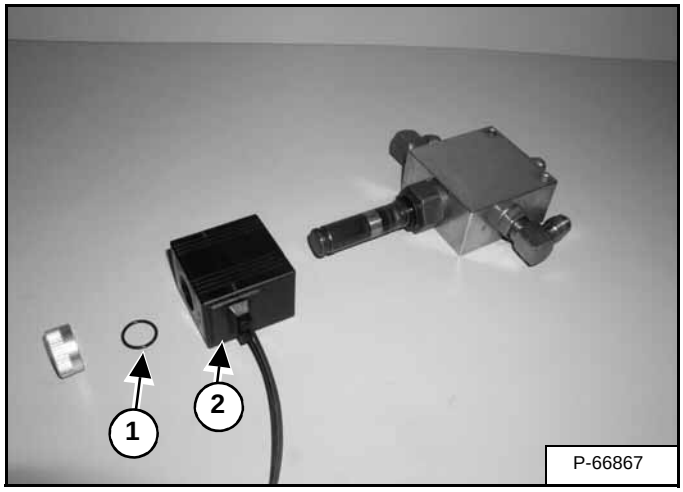


Remove the nut (Item 1) **[Figure 20-140-6]** from the solenoid.

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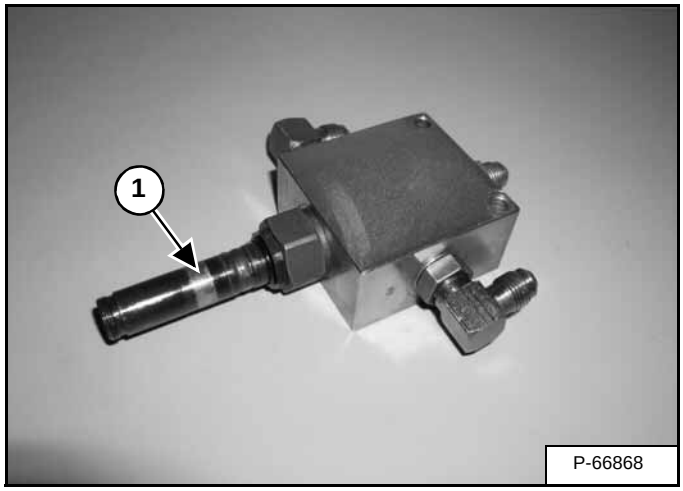
Block Disassembly And Assembly (Cont'd)

Figure 20-140-7



Remove the O-ring (Item 1) and solenoid (Item 2) **[Figure 20-140-7]**.

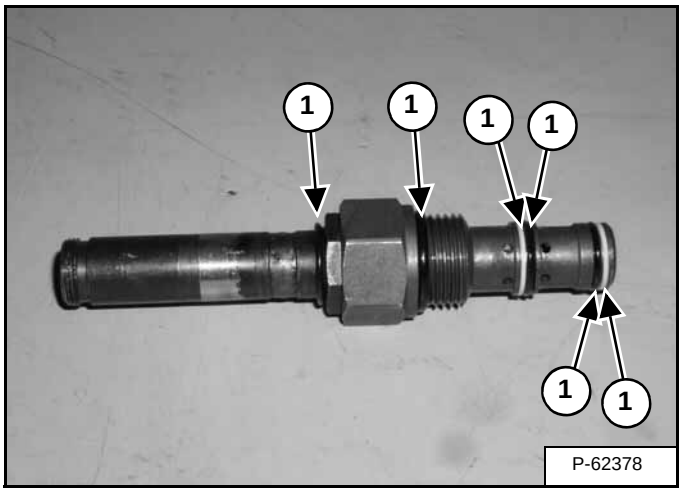
Figure 20-140-8



Remove the solenoid stem (Item 1) **[Figure 20-140-8]**.

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

Figure 20-140-9



Remove the O-rings and backup rings (Item 1) **[Figure 20-140-9]** from the solenoid stem.

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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. 30-30-1
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Roller Parts Identification 30-20-12
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Track Tension Grease Cylinder Disassembly And Assembly 30-20-11
Track Tension Grease Cylinder Parts Identification 30-20-10

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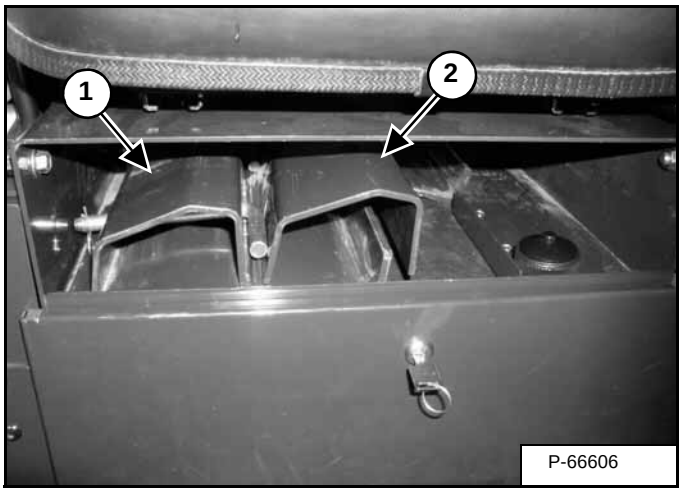
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BLADE

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 30-10-10

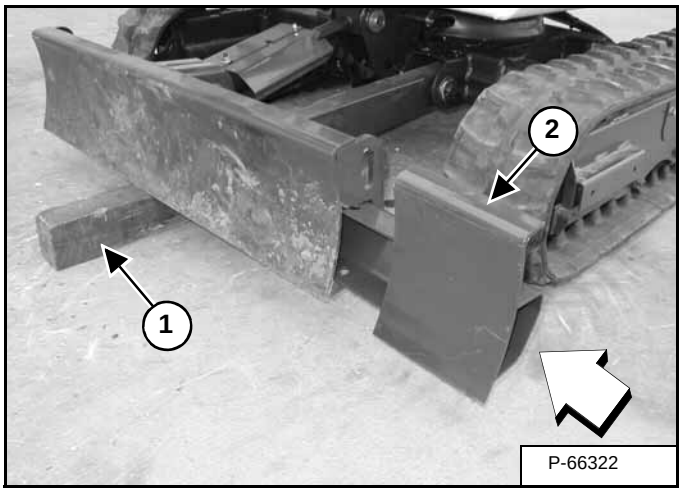


The blade extensions (Item 1 and 2) **[Figure 30-10-10]** are stored under the operator seat.

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 30-10-10]. If the blade extensions are installed differently, breakage to the water bottle and cap could result.

Extension Removal And Installation

Figure 30-10-11



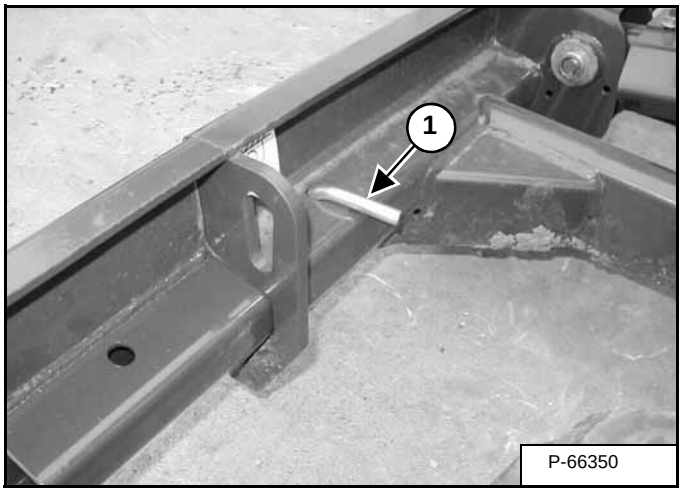
Put a block (Item 1) **[Figure 30-10-11]** under the blade.

Fully lower the blade to the block.

Stop the engine.

Slide the extension (Item 2) **[Figure 30-10-11]** into the blade frame (both sides).

Figure 30-10-12



Install the pin (Item 1) **[Figure 30-10-12]** and spring clip (both sides).

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.

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BLADE (CONT'D)

Blade Removal And Installation

Expand the tracks.

Lower the blade to the ground.

Remove the blade cylinder. (See Removal and Installation on Page 20-24-2)

Figure 30-10-13

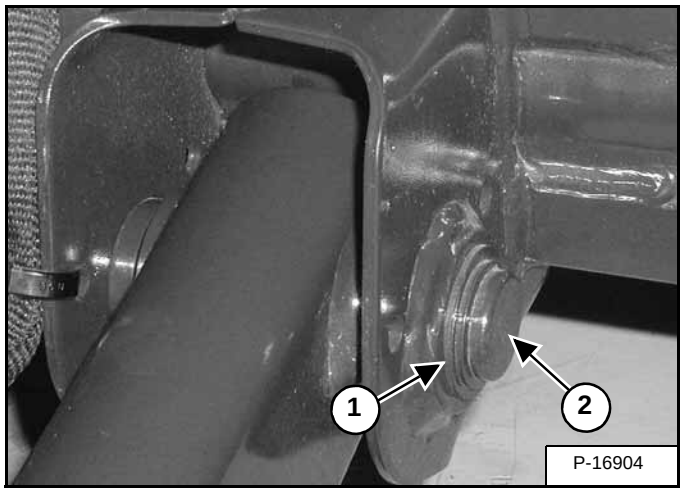
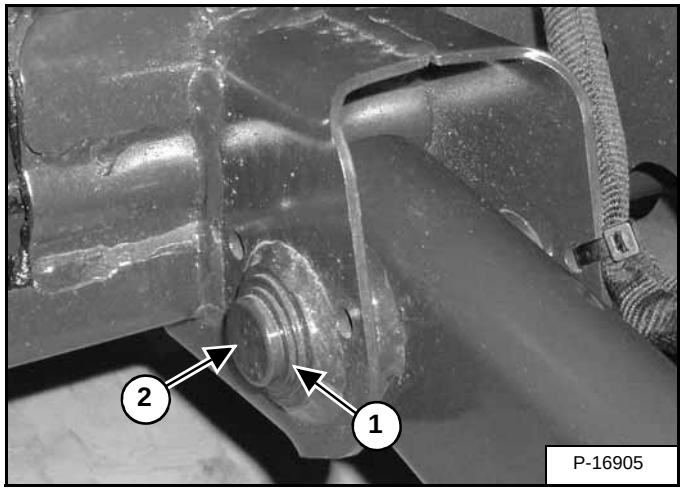


Figure 30-10-14



Remove the snap ring (Item 1) **[Figure 30-10-13]** & **[Figure 30-10-14]** and washer from the blade arm pivot pins (both sides).

Remove the blade arm pivot pins (Item 2) **[Figure 30-10-13]** & **[Figure 30-10-14]**.

Remove blade from excavator.

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TRACK FRAME COMPONENTS

Description

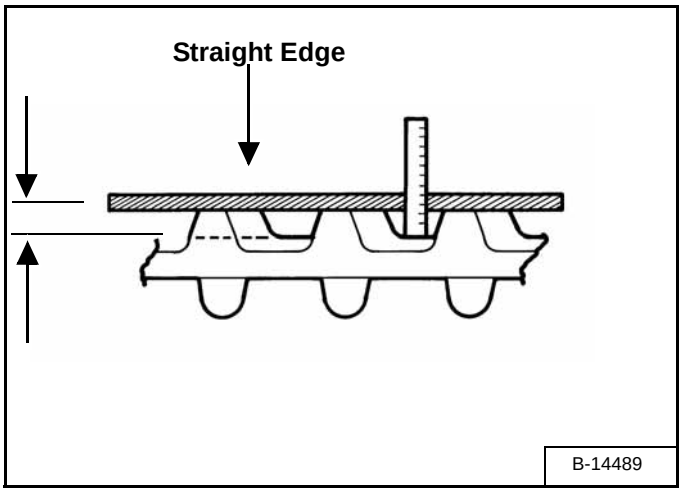
The track frame consists of front idler, track rollers, track, drive sprocket and the track frame. The track frame is an expandable undercarriage, which the left and right track frames expand and retrack.

Track Lug Height

Rubber Track

The lug height of a new rubber track is 0.709 in. (18,0 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 0.567 in. (20,0 mm)

$$\frac{0.567}{0.709} \times 100 = 80$$

80% of the track lug is remaining with 20% wear on the track lugs.

The rubber track should be replaced when lug height measures .246 in. (6,25 mm) from the base of the track to the top of the lug.

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Checking Tension

NOTE: The wear of undercarriage parts vary with working conditions and types of soil conditions. Maintain the correct track tension by inspecting regularly.

Figure 30-20-2



Raise one side of the machine (approximately 4 in.) 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.

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Figure 30-20-3

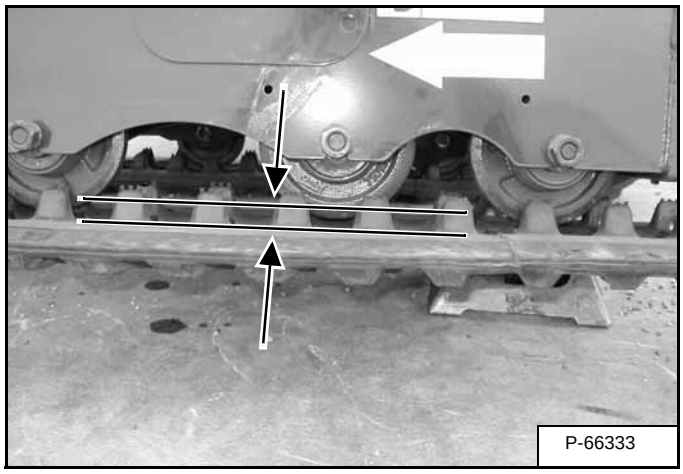
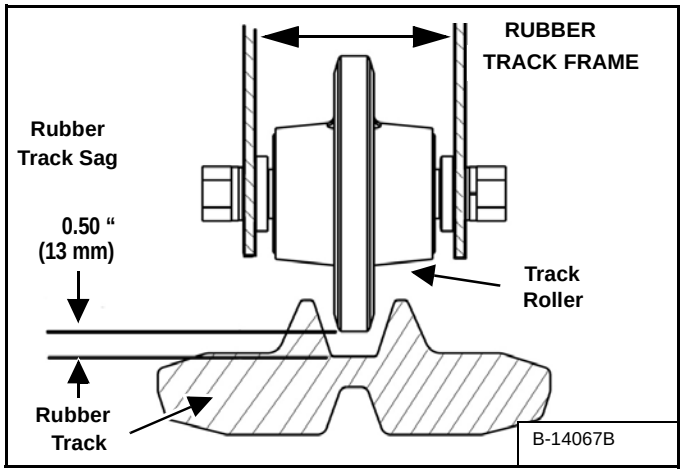


Figure 30-20-4

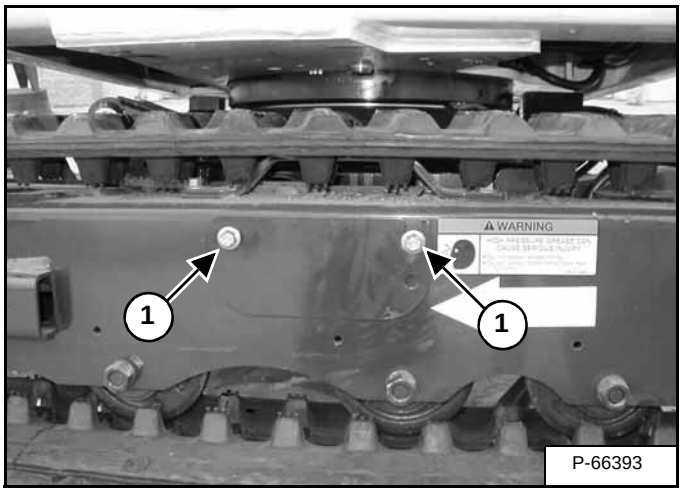


Measure the rubber track sag at the middle track roller **[Figure 30-20-3]**. Do not get your fingers into pinch points between the track and the track roller. Use material of appropriate size to check the gap between the contact edge of the roller and top edge of the track guide lug **[Figure 30-20-3]** & **[Figure 30-20-4]**.

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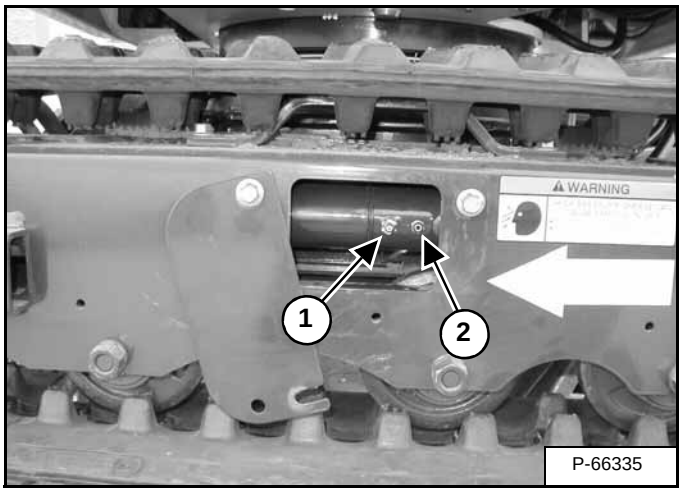
Adjusting Tension

Figure 30-20-5



Loosen the two bolts (Item 1) **[Figure 30-20-5]** from the cover. Pivot the cover downward.

Figure 30-20-6



Add grease to the fitting (Item 1) **[Figure 30-20-6]** until the track tension is correct.

If tension is too tight, loosen the bleed screw (Item 2) **[Figure 30-20-6]** (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. See your dealer for repairs.

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.

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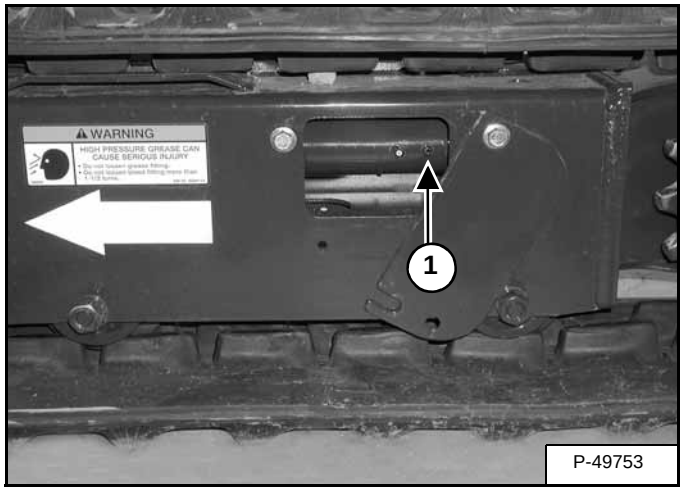
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Track Removal And Installation

Lift and block the side of the machine where the track will be removed. (See Procedure on Page 10-10-1.)

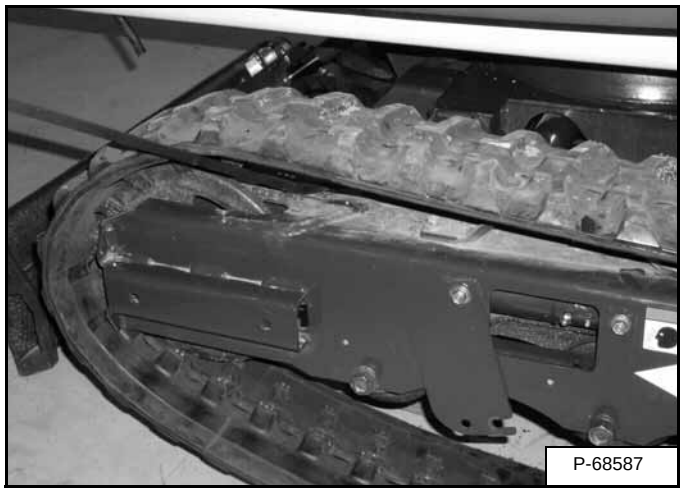
Figure 30-20-7



Slowly loosen the bleed screw fitting (Item 1) **[Figure 30-20-7]** (1 turn maximum) to remove track tension.

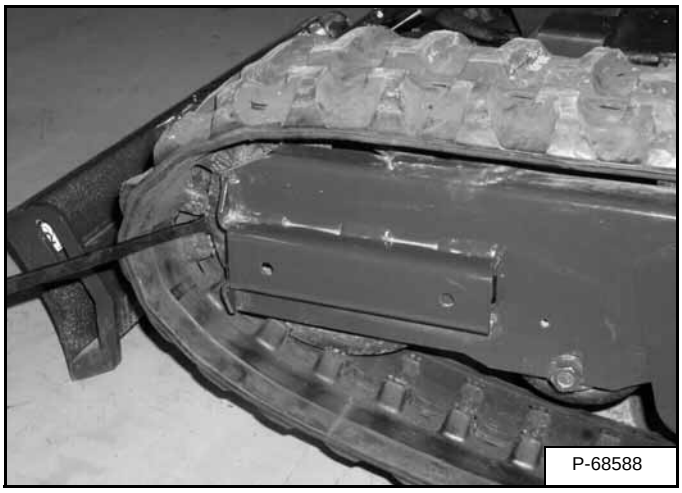
NOTE: Apply additional pressure to the track by standing on the lower track span so all the tension is released from the grease cylinder for easier removal of the track.

Figure 30-20-8



Install a bar between the drive lugs **[Figure 30-20-8]**.

Figure 30-20-9



Turn the track until the bar contacts the frame **[Figure 30-20-9]**.

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 Checking Tension for adding grease to the track tension cylinder and for checking track tension. (See Checking Tension on Page 30-20-2)

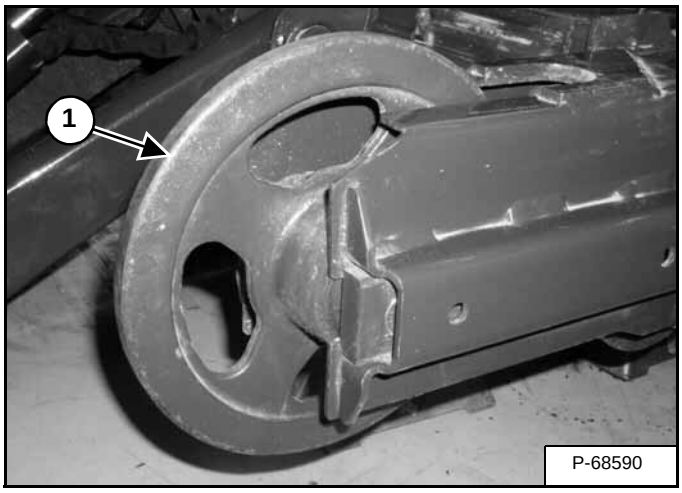
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Idler (Front) Removal And Installation

Lift and block the side of the machine where the track will be removed. (See Procedure on Page 10-10-1.)

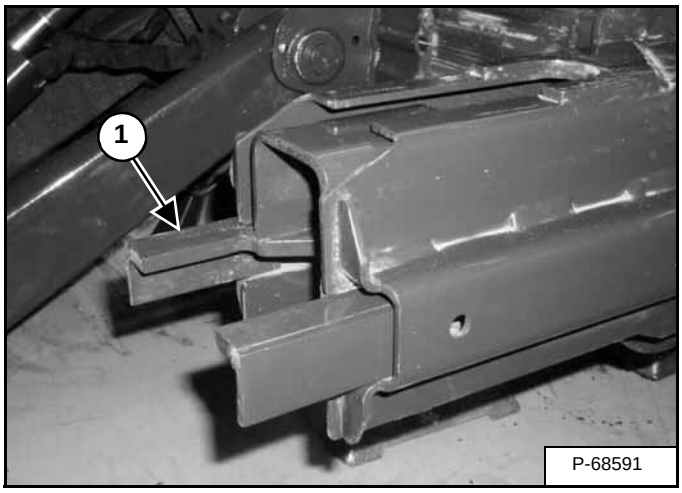
Remove the track. (See Track Removal And Installation on Page 30-20-4)

Figure 30-20-10



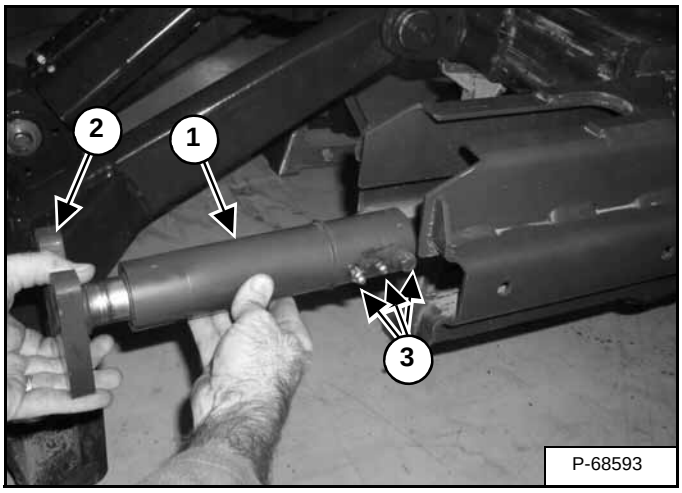
Slide the front track idler (Item 1) **[Figure 30-20-10]** out of the track frame.

Figure 30-20-11



Remove the yoke (Item 1) **[Figure 30-20-11]** from the track frame.

Figure 30-20-12



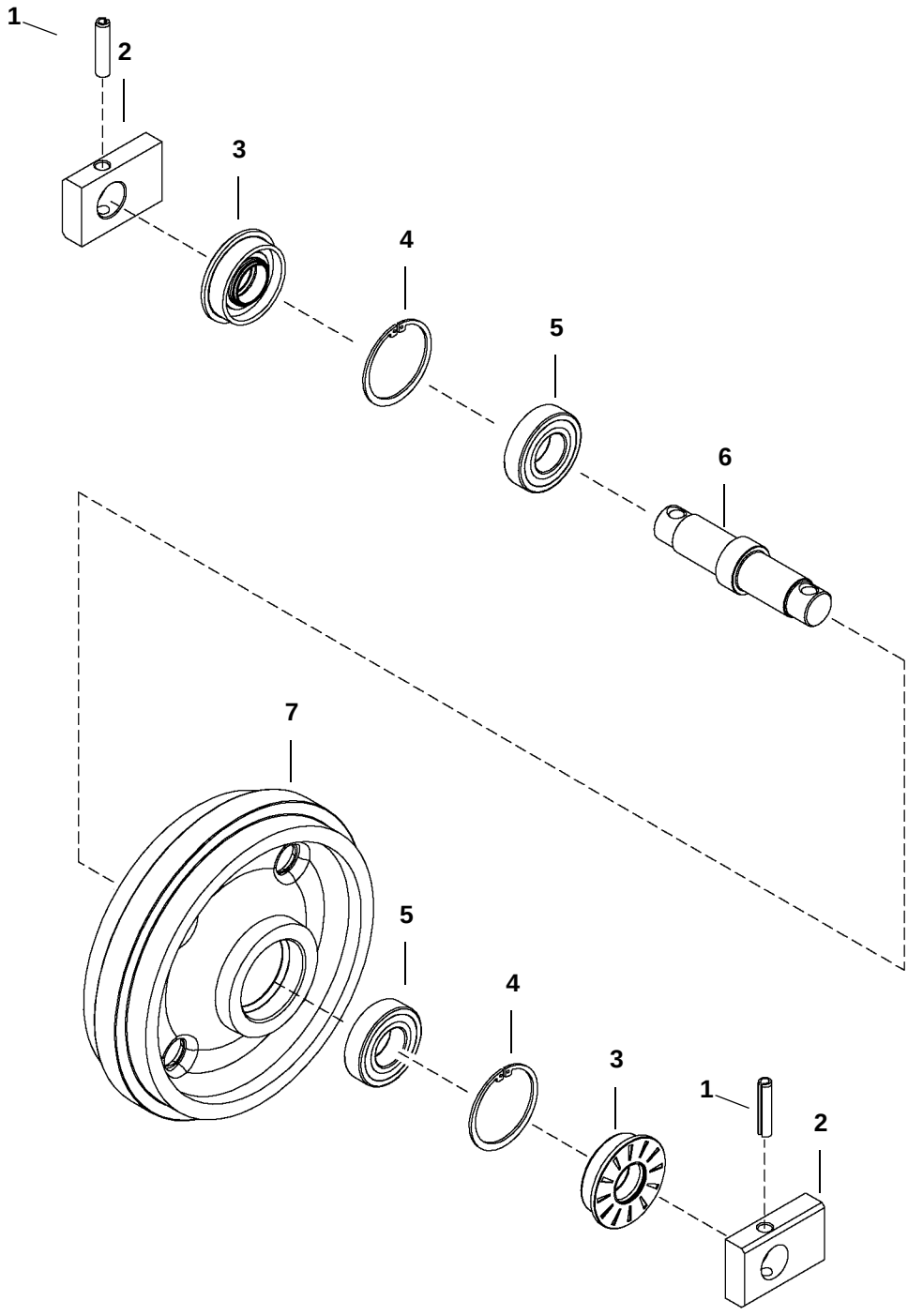
Slide the track tension grease cylinder (Item 1) **[Figure 30-20-12]** forward and remove it from the track frame.

Installation: Make sure the "H" plate (Item 2) on the end of the grease cylinder is orientated in the vertical position and the grease fittings and alignment bolt (Item 3) **[Figure 30-20-12]** are pointed to the outside of the track frame.

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Idler (Front) Parts Identification

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



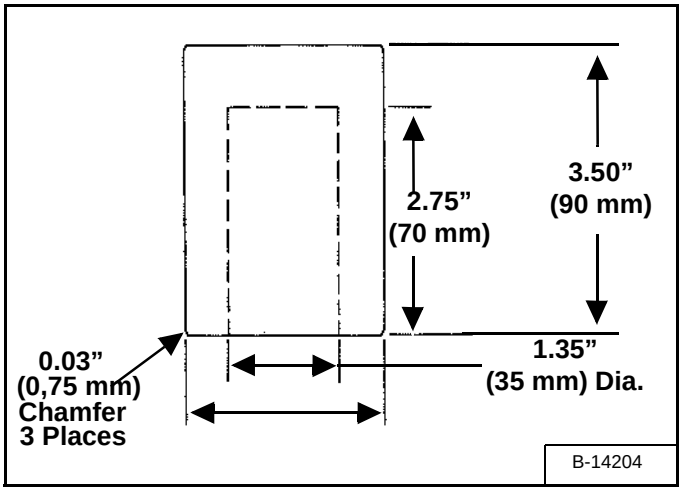
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Idler (Front) Disassembly

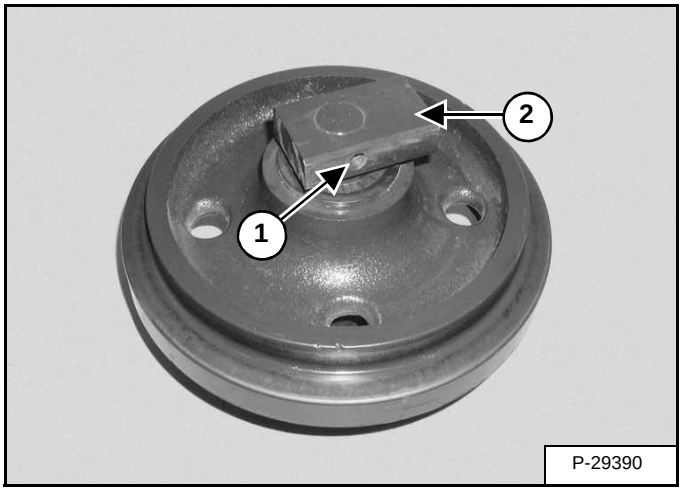
The following tools must be fabricated for this procedure:

Figure 30-20-13



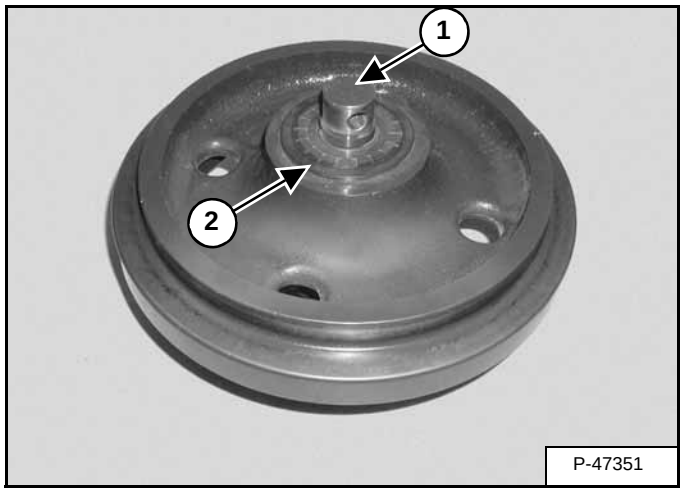
1. Driver Tool - see **[Figure 30-20-13]**.
2. Support Fixture - Tube, 3.0 in. ID x 0.250 in. wall x 6.0 in. long.

Figure 30-20-14



Remove the roll pin (Item 1) and block (Item 2) **[Figure 30-20-14]** from each end of the shaft.

Figure 30-20-15

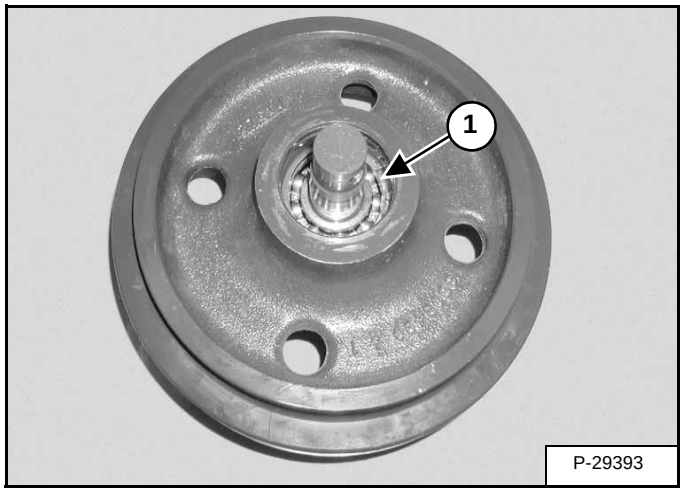


Remove any corrosion or paint from both ends of the exposed shaft (Item 1) **[Figure 30-20-15]** that could affect seal removal or damage the new seal during installation.

Apply penetrating oil to both ends of the exposed shaft to ease removal of the seal.

Remove the seal (Item 2) **[Figure 30-20-15]** from both sides of the idler.

Figure 30-20-16



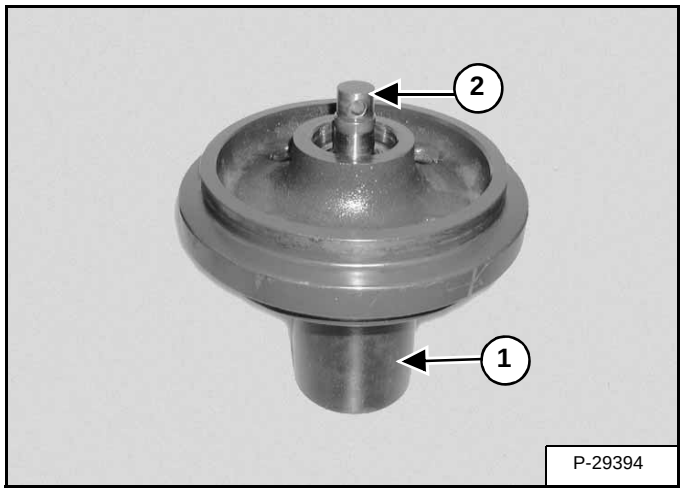
Remove the snap ring (Item 1) **[Figure 30-20-16]**.

NOTE: The snap ring is installed on one side of the idler. The other side is stepped to retain the bearing.

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Idler (Front) Disassembly (Cont'd)

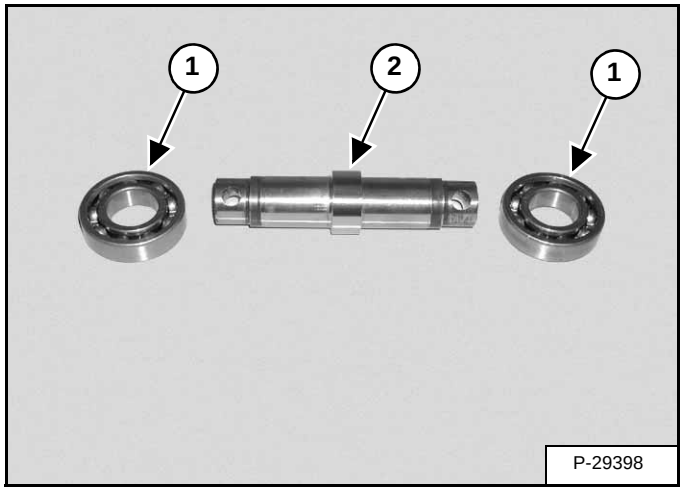
Figure 30-20-17



Place the idler on the support fixture (Item 1) **[Figure 30-20-17]**.

Using a soft faced hammer, tap the shaft (Item 2) **[Figure 30-20-17]** and bearing out the bottom of the idler.

Figure 30-20-18

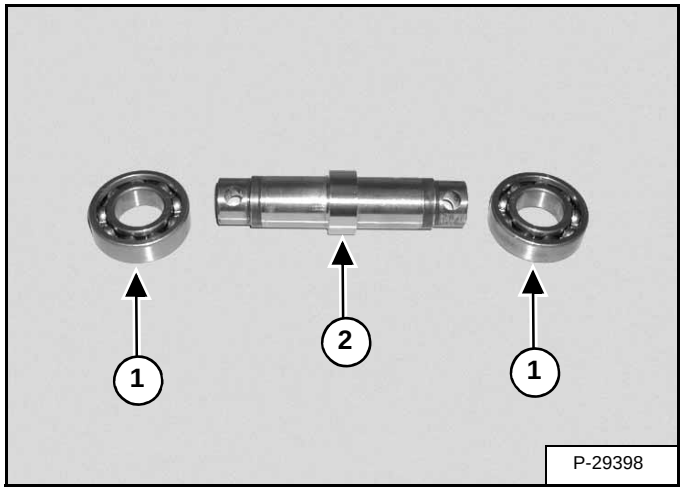


Slide the bearings (Item 1) off of the shaft (Item 2) **[Figure 30-20-18]**.

Idler (Front) Assembly

Clean all parts in solvent and dry with compressed air.

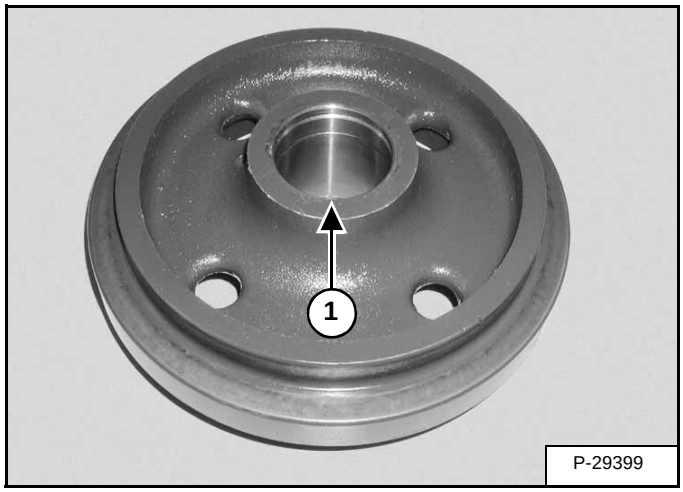
Figure 30-20-19



Inspect the bearings (Item 1) and shaft (Item 2) **[Figure 30-20-19]** 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 30-20-20

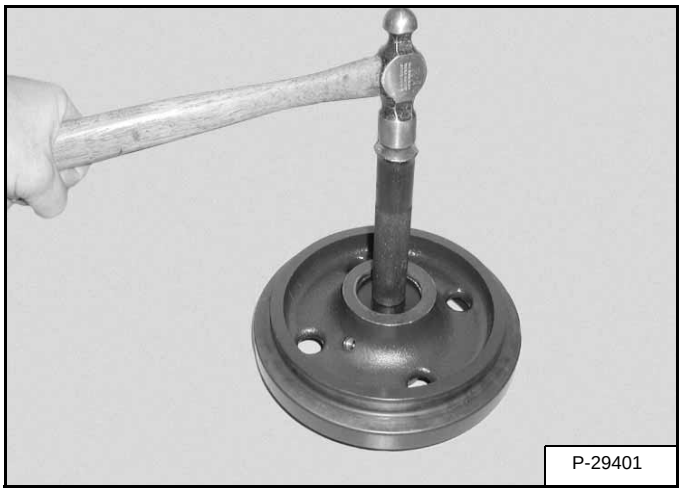


Remove all paint and corrosion from the seal surface (Item 1) **[Figure 30-20-20]** on both sides of the idler.

Dealer Copy -- Not for Resale

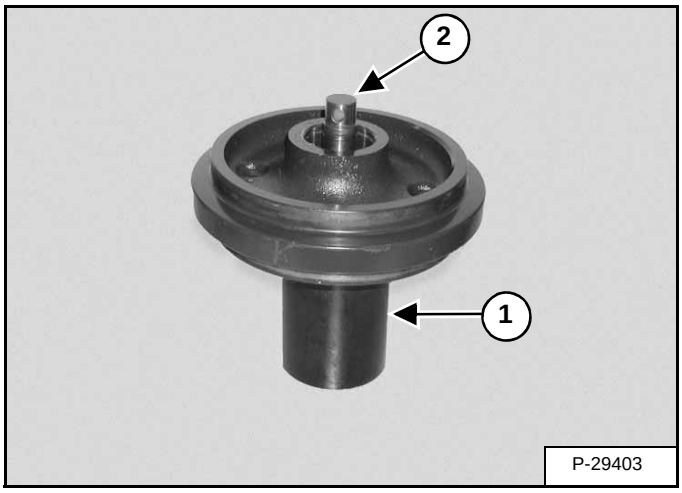
Idler (Front) Assembly (Cont'd)

Figure 30-20-21



Using a bearing driver, install the bearing in the idler **[Figure 30-20-21]**.

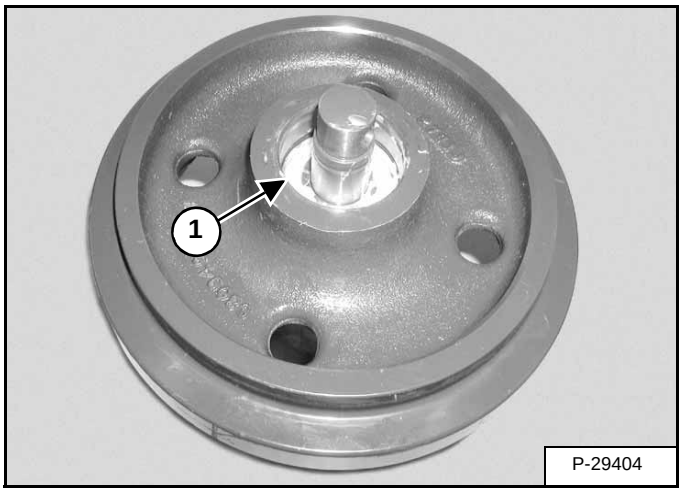
Figure 30-20-22



Place the idler on the support fixture (Item 1) **[Figure 30-20-22]**.

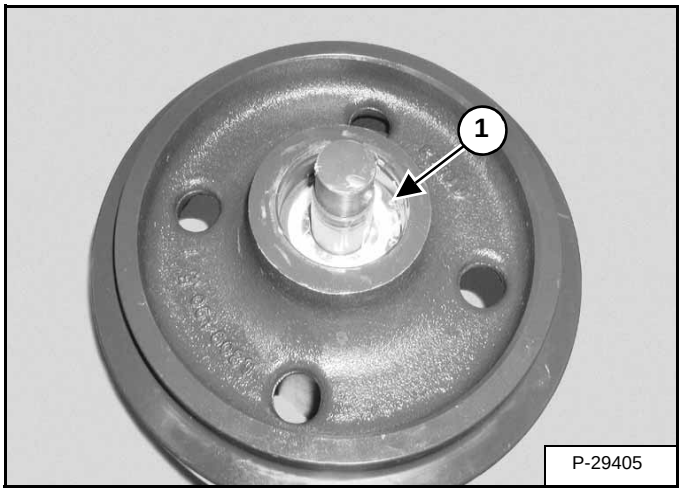
Install the shaft (Item 2) **[Figure 30-20-22]**.

Figure 30-20-23



Install the bearing (Item 1) **[Figure 30-20-23]**. Use a brass drift to seat the bearing.

Figure 30-20-24

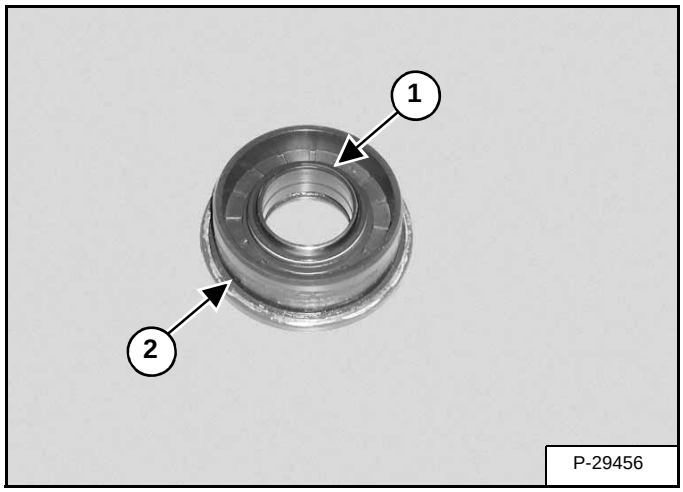


Install the snap ring (Item 1) **[Figure 30-20-24]**.

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Idler (Front) Assembly (Cont'd)

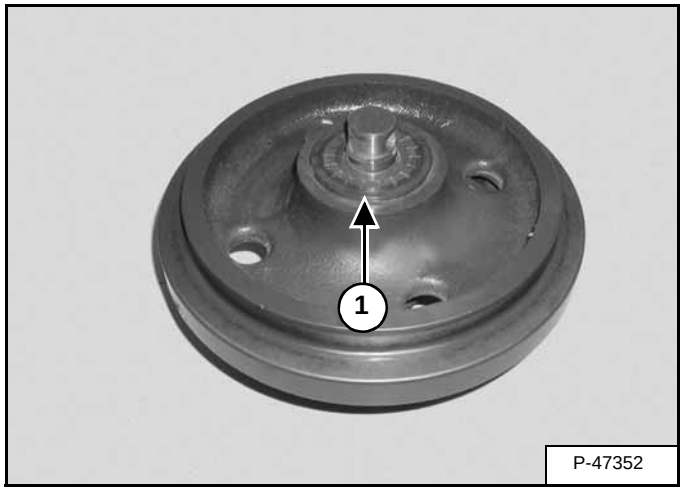
Figure 30-20-25



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

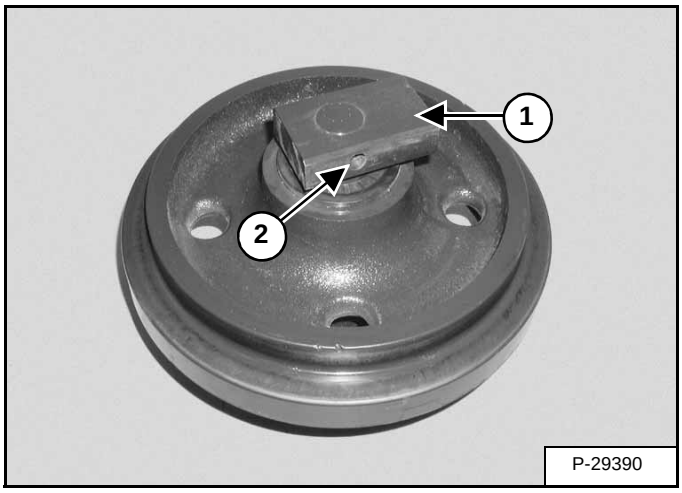
Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-20-25]** of the seal.

Figure 30-20-26



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

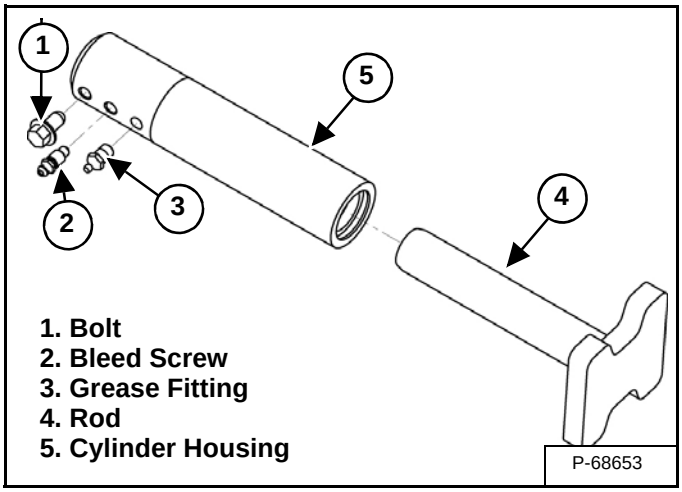
Figure 30-20-27



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

Track Tension Grease Cylinder Parts Identification

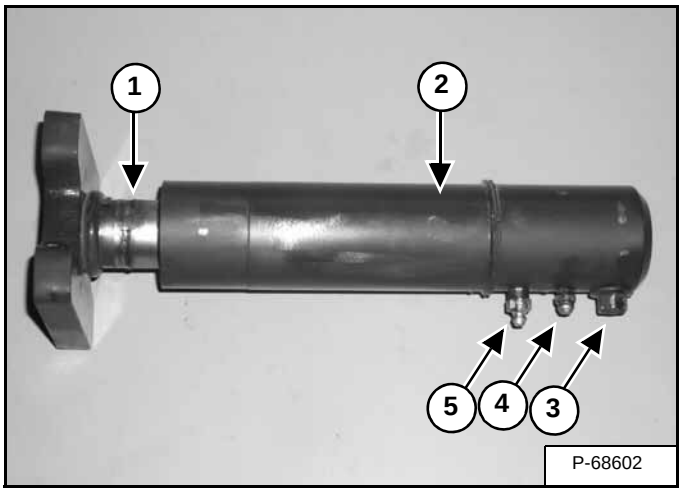
Figure 30-20-28



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Track Tension Grease Cylinder Disassembly And Assembly

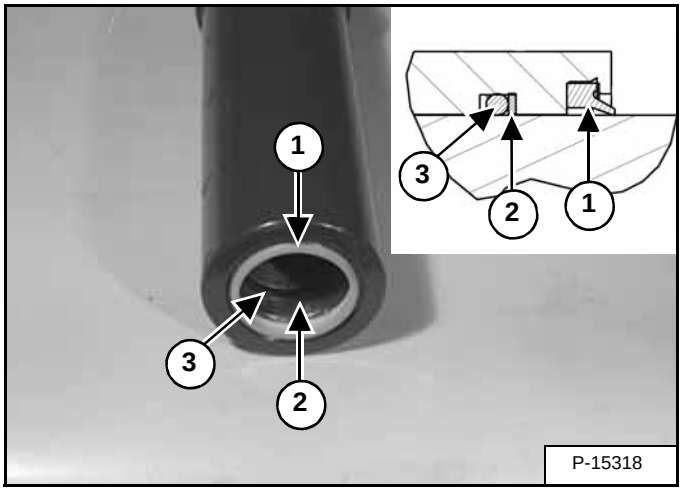
Figure 30-20-29



Remove the rod (Item 1) from the cylinder housing (Item 2) **[Figure 30-20-29]**.

Remove the bolt (Item 3), bleed screw (Item 4) and grease fitting (Item 5) from the cylinder housing (Item 2) **[Figure 30-20-29]**.

Figure 30-20-30



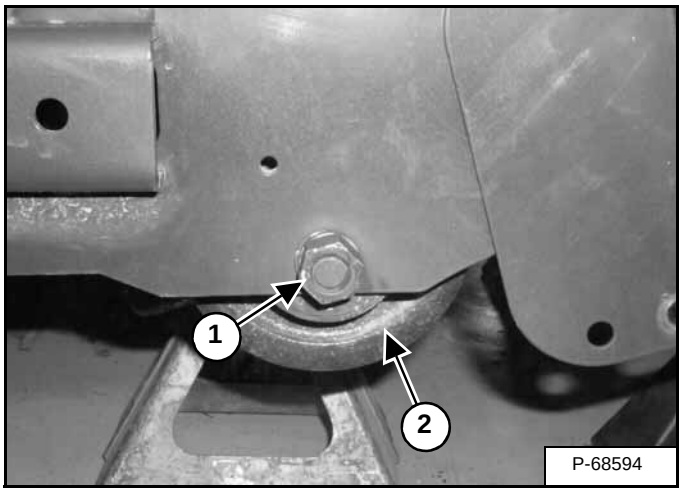
Remove the seal (Item 1), back-up ring (Item 2) and O-ring (Item 3) **[Figure 30-20-30]** from the cylinder housing.

Roller Removal And Installation

Lift and block the side of the machine where the track will be removed. (See Procedure on Page 10-10-1.)

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

Figure 30-20-31



Loosen the nuts (Item 1) **[Figure 30-20-31]** from the track roller on both sides of the track frame.

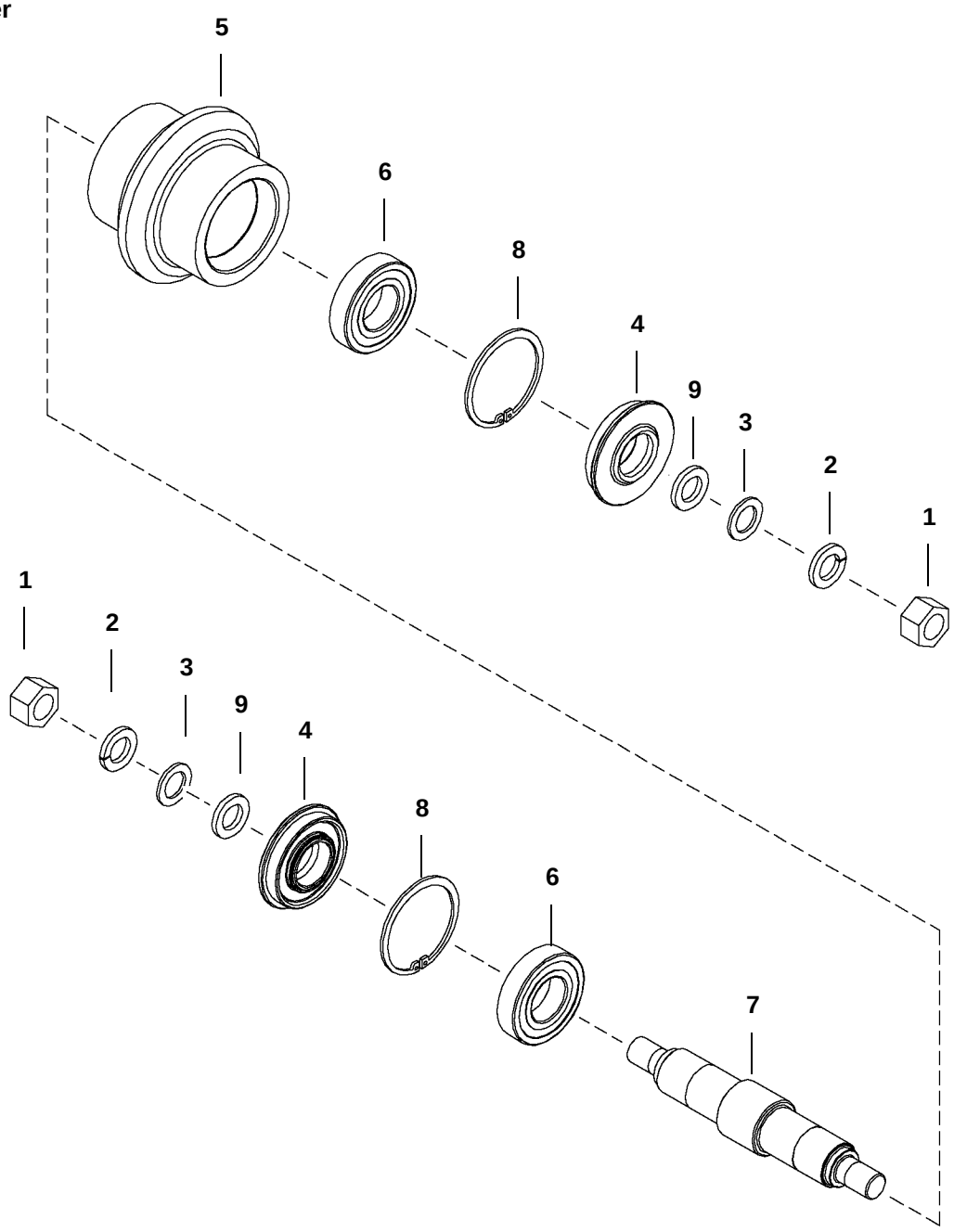
Installation: Tighten the nuts to 125 to 140 ft.-lb. (170 to 190 N•m) torque.

Remove the track roller (Item 2) **[Figure 30-20-31]**.

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Roller Parts Identification

1. Nut
2. Lock Washer
3. Washer
4. Seal
5. Roller
6. Bearing
7. Shaft
8. Snap Ring
9. Spacer



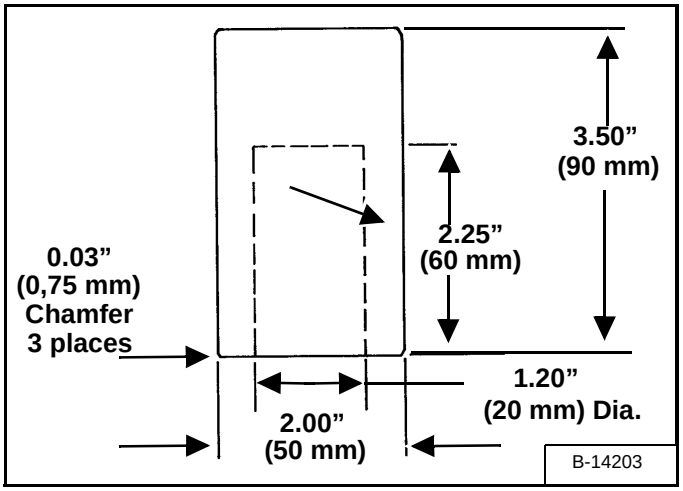
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Dealer Copy -- Not for Resale

Roller Disassembly

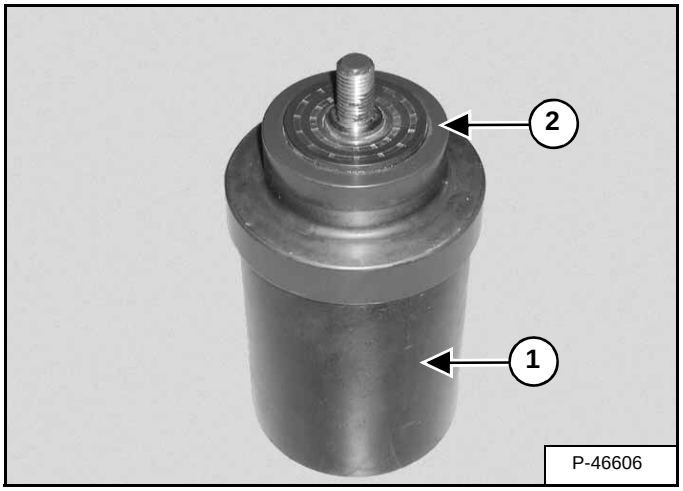
The following tools must be fabricated for this procedure:

Figure 30-20-32



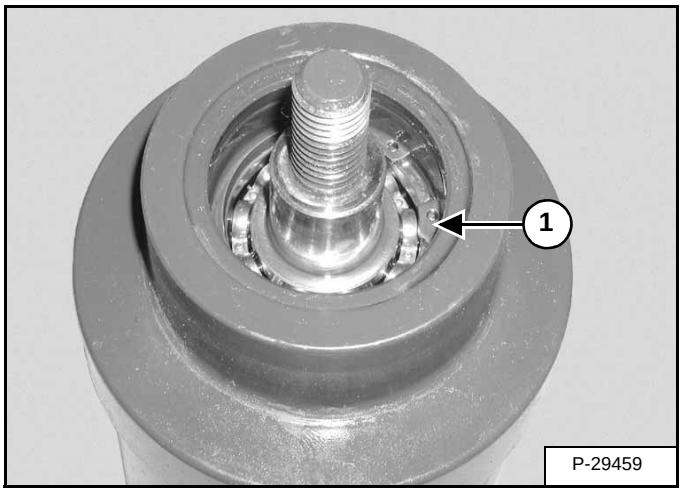
1. Driver Tool - see **[Figure 30-20-32]**.
2. Support Fixture - Tube, 3 in. ID x 1/4 in. wall x 6 in. long.

Figure 30-20-33



Support the roller in the support fixture (Item 1). Remove the seal (Item 2) **[Figure 30-20-33]** from both sides of the roller.

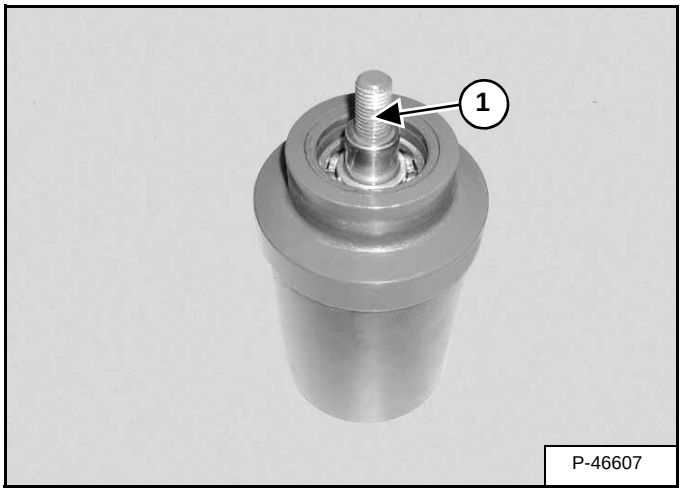
Figure 30-20-34



Remove the snap ring (Item 1) **[Figure 30-20-34]**.

NOTE: The snapring is installed on one side of the roller. The other side is stepped to retain the bearing.

Figure 30-20-35

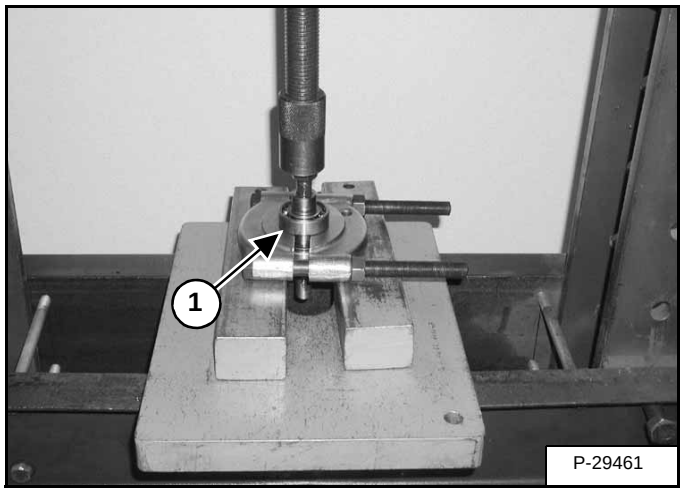


Turn the roller over and tap the shaft (Item 1) **[Figure 30-20-35]** and bearings out the bottom of the roller.

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Roller Disassembly (Cont'd)

Figure 30-20-36



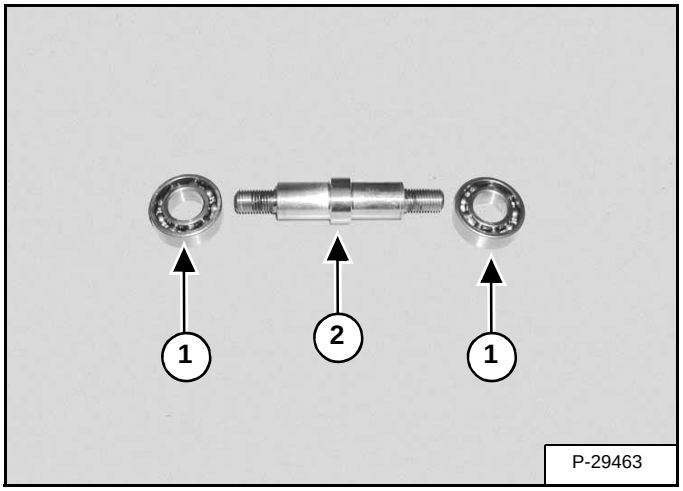
Press the bearings (Item 1) **[Figure 30-20-36]** off the shaft.

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Roller Assembly

Clean all parts in solvent and dry with compressed air.

Figure 30-20-37

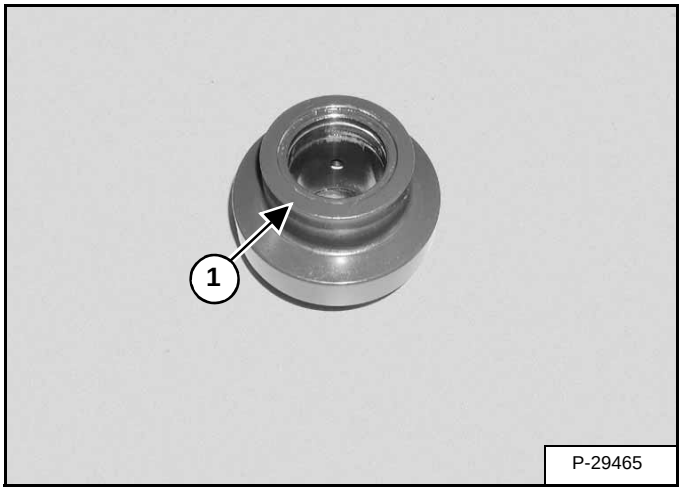


Inspect the bearings (Item 1) and shaft (Item 2) **[Figure 30-20-37]** for wear or damage.

The bearings are sealed. If the bearings do not roll smoothly or if the seals are damaged, replace the bearings.

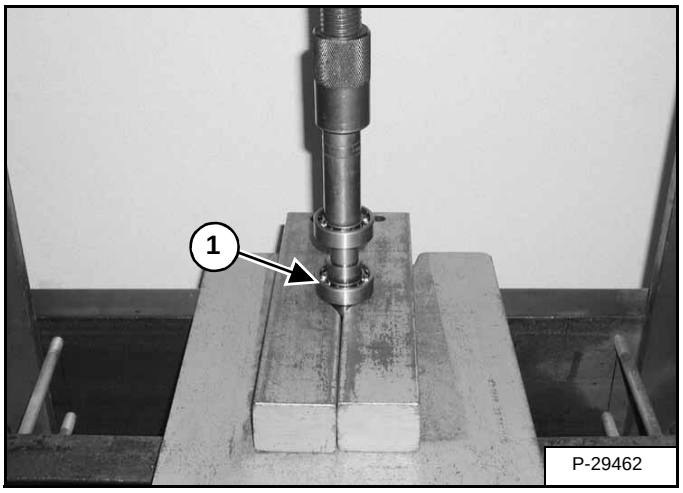
Replace any worn or damaged parts.

Figure 30-20-38



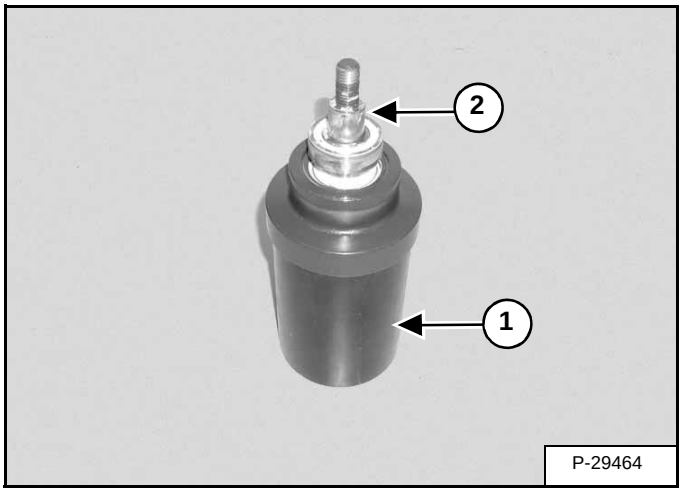
Remove all paint and corrosion from the seal surface (Item 1) **[Figure 30-20-38]** on both sides of the roller.

Figure 30-20-39



Press the bearings (Item 1) **[Figure 30-20-39]** on the shaft.

Figure 30-20-40



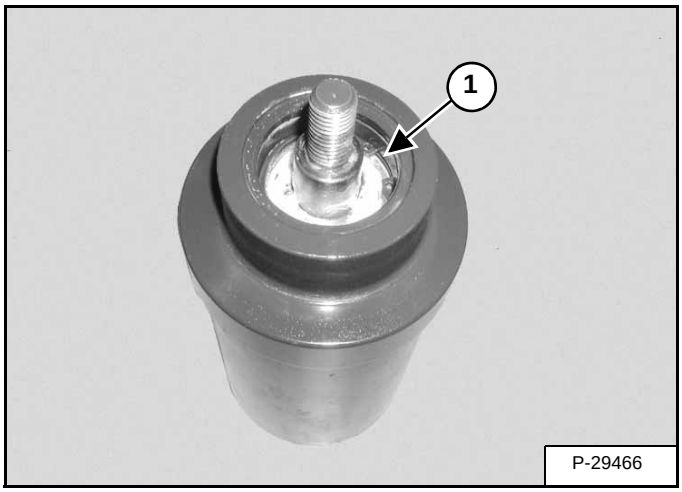
Place the roller on the support fixture (Item 1) **[Figure 30-20-40]**.

Tap the shaft and bearing assembly (Item 2) **[Figure 30-20-40]** into the roller.

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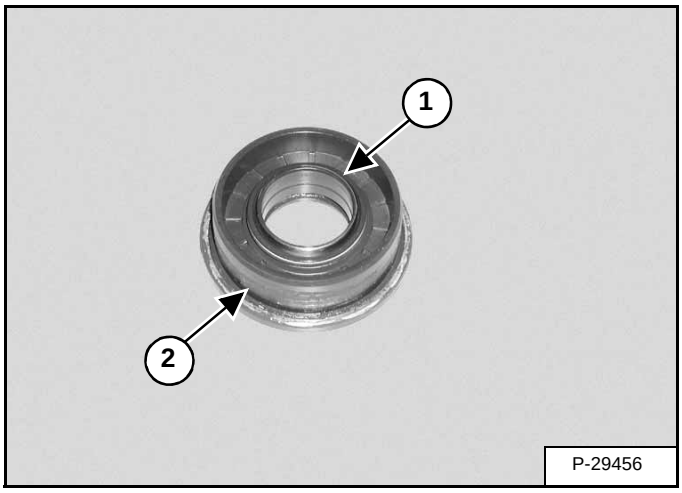
Roller Assembly (Cont'd)

Figure 30-20-41



Install the snap ring (Item 1) **[Figure 30-20-41]**.

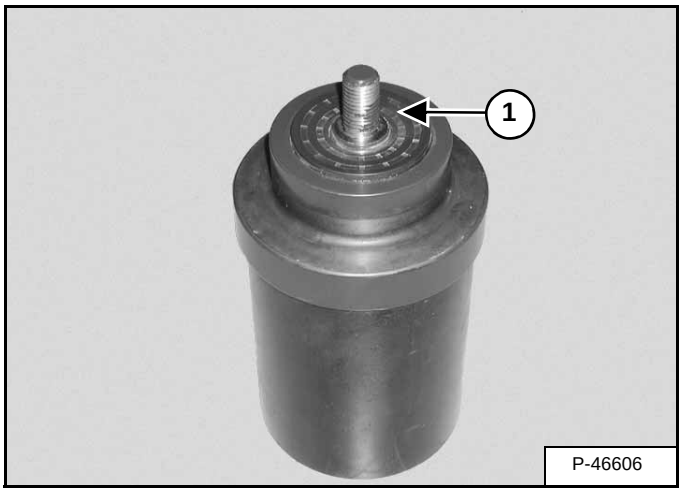
Figure 30-20-42



Apply assembly lube to the inside diameter (Item 1) **[Figure 30-20-42]** of the seal.

Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-20-42]** of the seal.

Figure 30-20-43



Using the driving tool, install the seal (Item 1) **[Figure 30-20-43]** on both sides of the roller.

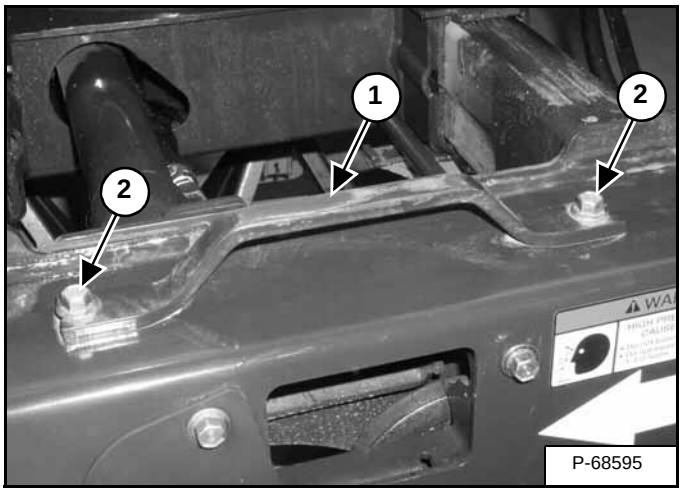
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Track Guide Removal And Installation

Lift and block the side of the machine where the track will be removed. (See Procedure on Page 10-10-1.)

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

Figure 30-20-44



Inspect the track guide (Item 1) **[Figure 30-20-44]** for wear or damage.

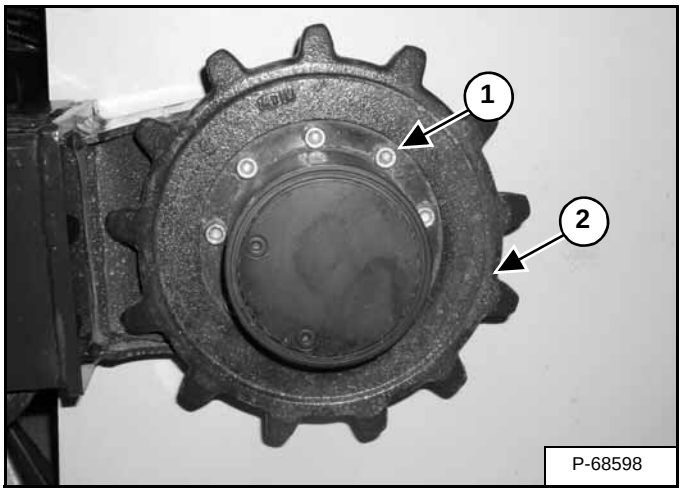
Remove the screws (Item 2) and track guide (Item 1) **[Figure 30-20-44]** if worn or damaged.

Sprocket Removal And Installation

Lift and block the side of the machine where the track will be removed. (See Procedure on Page 10-10-1.)

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

Figure 30-20-45



Remove the sprocket bolts (Item 1). Remove the sprocket (Item 2) **[Figure 30-20-45]**.

Installation: Tighten the bolts to 48 to 55 ft.-lb. (65 to 75 N•m) torque.

Dealer Copy -- Not for Resale

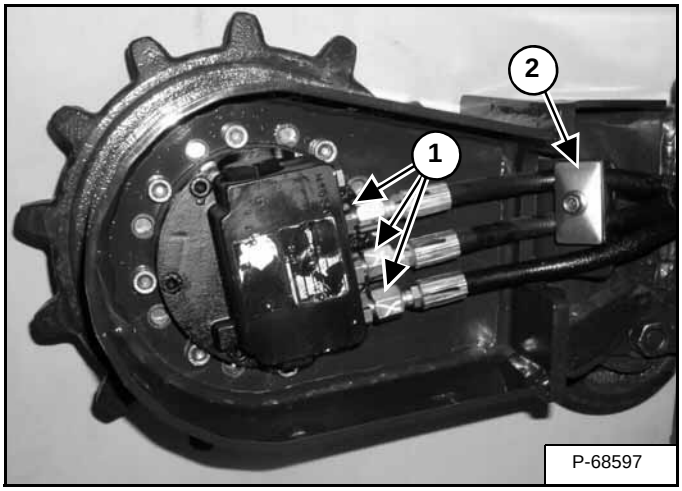
Frame Removal And Installation

Remove the track expansion cylinder. (See Removal And Installation on Page 20-25-2.)

Lift and block the side of the machine where the track will be removed. (See Procedure on Page 10-10-1.)

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

Figure 30-20-46

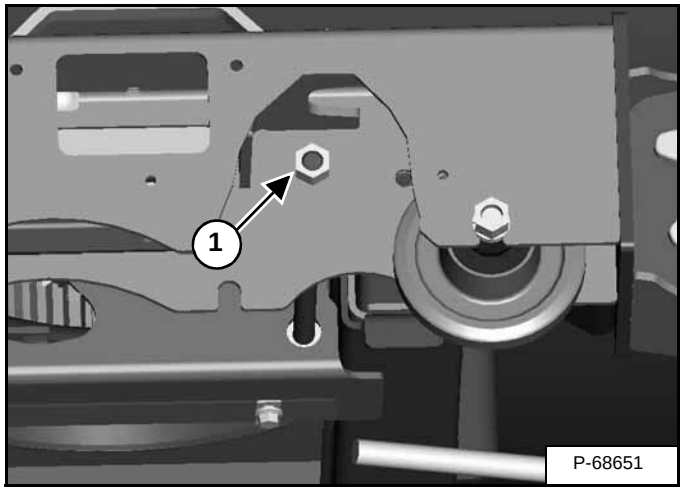


Remove the travel motor cover. Remove and cap the hoses (Item 1) **[Figure 30-20-46]** from the travel motor.

Remove the hose clamp (Item 2) **[Figure 30-20-46]** from the track frame.

NOTE: The track frame has a cutout to reveal the nut on the inside of track frame. The nut can be access with a wrench from the bottom of the track frame. Remove the middle track roller for greater access for the wrench.

Figure 30-20-47



Remove the nut (Item 1) **[Figure 30-20-47]** from the track expansion stop rod.

Figure 30-20-48



Install a chain hoist on the track frame **[Figure 30-20-48]**. Lift the frame a small amount while pulling the frame away from the excavator.

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Track Damage Identification

Figure 30-20-49

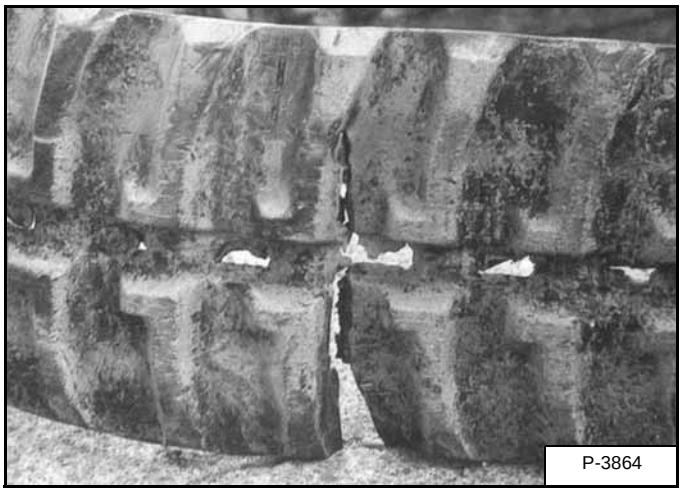
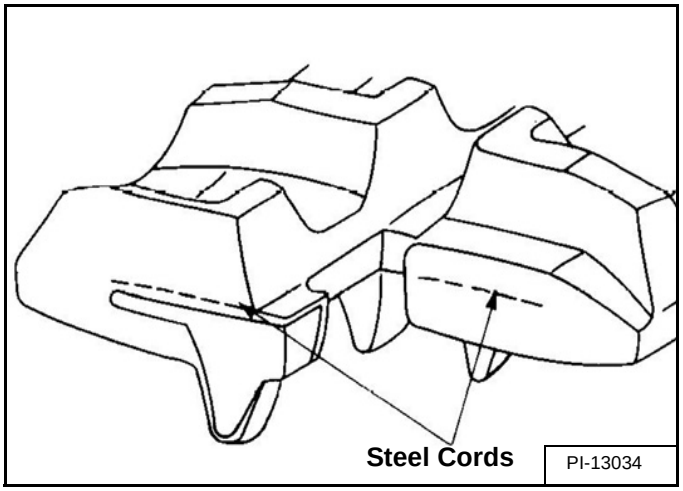


Figure 30-20-50



Cutting Of Steel Cords

The following pages show photos and illustrations of track damage and the probable cause of the damage. It is intended to be used for identifying the reason for track damage and how to avoid future track damage.

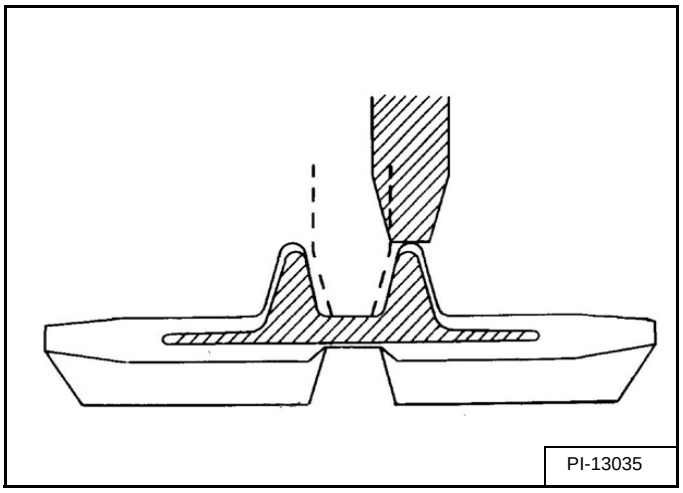
Damage:

Embedded steel cords are cut off **[Figure 30-20-49]** & **[Figure 30-20-50]**.

Replacement:

Replacement is required **[Figure 30-20-49]** & **[Figure 30-20-50]**.

Figure 30-20-51



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:

When the rubber track is detracting, the idler or sprocket rides on the projections of the embedded metal **[Figure 30-20-51]**.

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.

Furthermore, when moisture invades 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:

Periodical checking on site of the recommended track tension. (See Checking Tension on Page 30-20-2.)

Avoiding quick turns on bumpy and rocky fields.

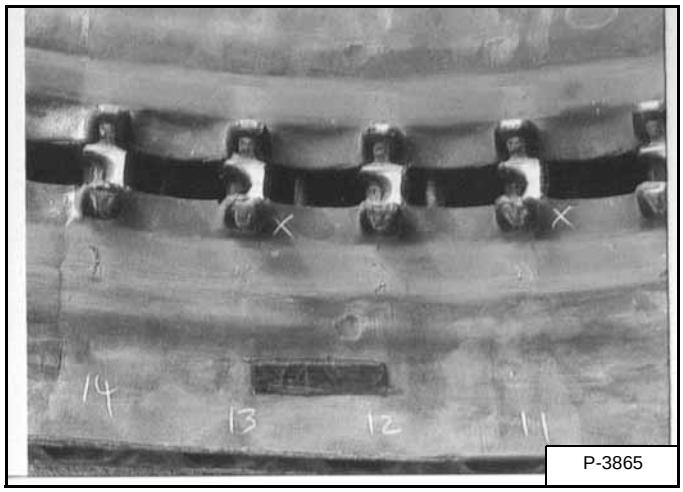
Drive carefully to avoid having stones and other articles clog the rubber tracks.

Driving over sharp objects should be avoided. If this is impossible, do not make turns while driving over sharp objects.

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Track Damage Identification (Cont'd)

Figure 30-20-52

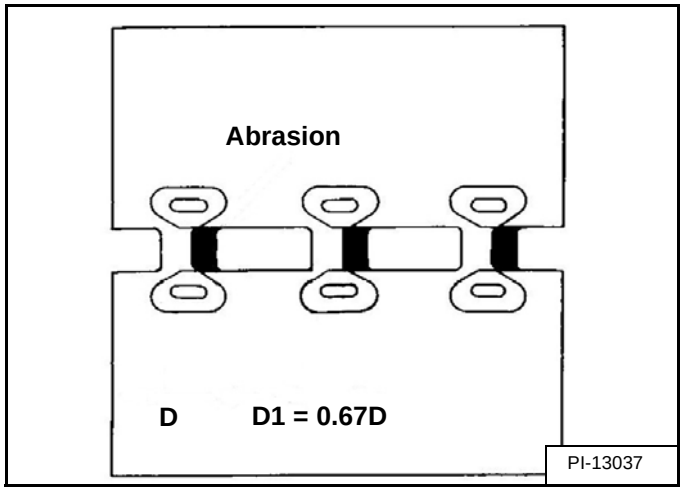


Abrasion Of Embedded Metals

Damage:

In proportion to the service time, embedded metals will gradually wear away by friction **[Figure 30-20-52]**.

Figure 30-20-53



Replacement:

Replacement is required when the width of the embedded metals (D1) becomes 67% of their original width (D) **[Figure 30-20-53]**.

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 their abrasion:

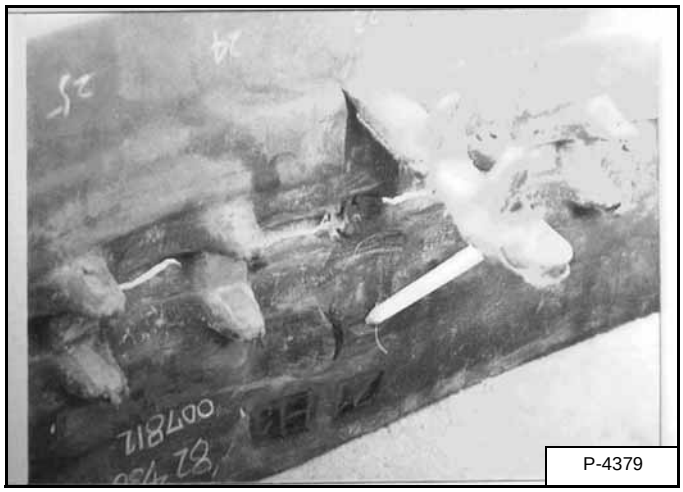
Rubber tracks are driven with an extraordinary heavy load on them.

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.

Figure 30-20-54



Separation Of Embedded Metals

Damage:

Extraordinary outer forces applied to embedded metals cause their separation from the rubber track's body **[Figure 30-20-54]**.

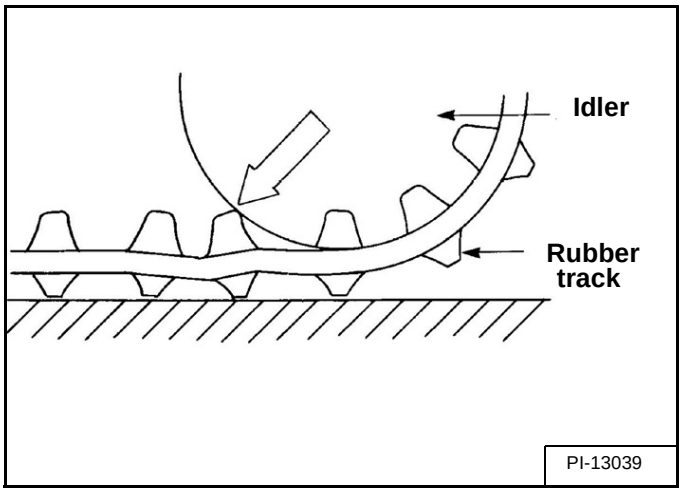
Replacement:

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

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Track Damage Identification (Cont'd)

Figure 30-20-55

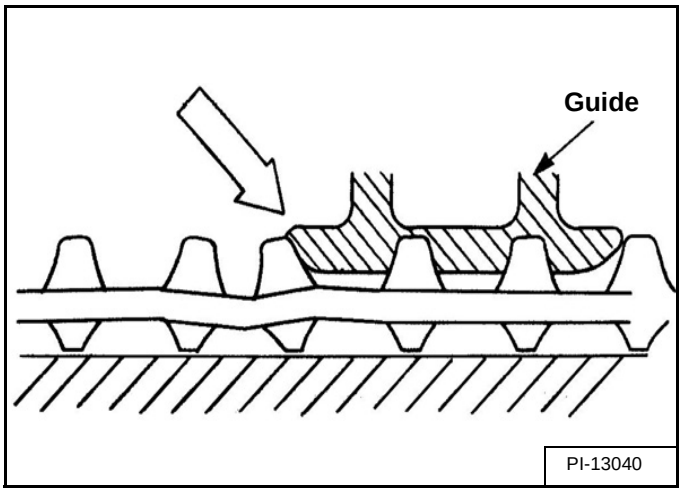


Causes of the damage:

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

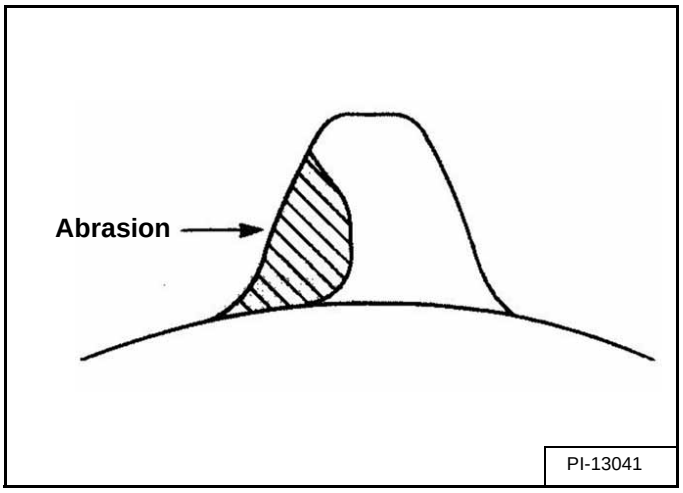
When the idler continually rides on the projections of embedded metals, the embedded metals will eventually peel off **[Figure 30-20-55]**.

Figure 30-20-56



When a rubber track is detracted, it becomes stuck between the guide or the undercarriage frame, causing the separation of embedded metals **[Figure 30-20-56]**.

Figure 30-20-57



Abnormally worn sprockets as shown will pull embedded metals out **[Figure 30-20-57]**.

Prevention:

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

Recommended track tension should be periodically checked. (See Checking Tension on Page 30-20-2.)

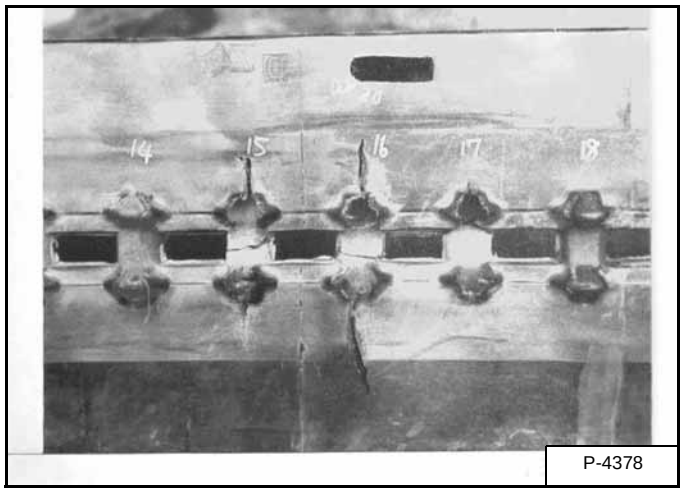
Quick turns on bumpy and rocky fields should be avoided.

If abnormal wear of sprockets is observed, they should be immediately replaced.

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Track Damage Identification (Cont'd)

Figure 30-20-58



Separation Of Embedded Metals Due To Corrosion

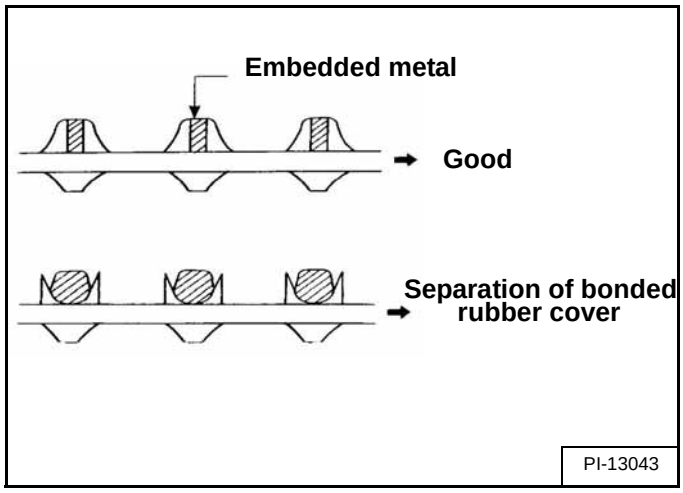
Damage:

Due to corrosion of embedded metals, the adhesion to the rubber body deteriorates, resulting in complete separation **[Figure 30-20-58]**.

Replacement:

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

Figure 40-20-59



Causes of the damage:

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 40-20-59]**.

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:

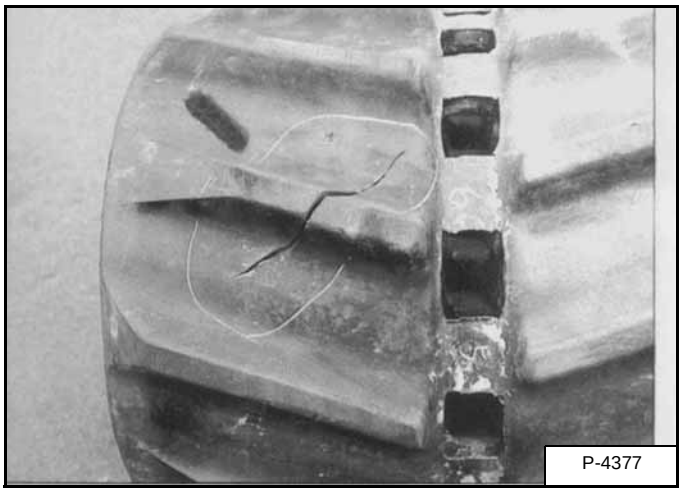
If rubber tracks are used under such field conditions as described under (Causes of the damage), they should be washed with plenty of water. After being completely dried, they should be stored correctly.

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.

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Track Damage Identification (Cont'd)

Figure 30-20-60



Cuts On The Lug Side Rubber

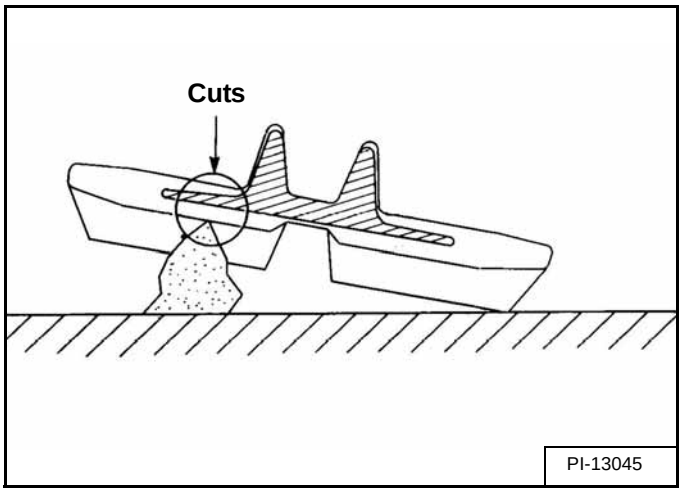
Damage:

Cuts on the lug side rubber often occurs as one of the most typical failure modes **[Figure 30-20-60]**.

Replacement:

When a cut on the lug side rubber reaches the embedded steel cords, it should be immediately repaired with cold vulcanization rubber.

Figure 40-20-61



Causes of the damage:

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 steel cords' breakage due to their corrosion. It is highly recommended to repair the cuts with cold vulcanization rubber as soon as they are observed **[Figure 40-20-61]**.

Prevention:

Machine operators are requested to drive with great attention to the ground's 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, high speed, quick turns and overloading should be avoided.

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Track Damage Identification (Cont'd)

Figure 30-20-62

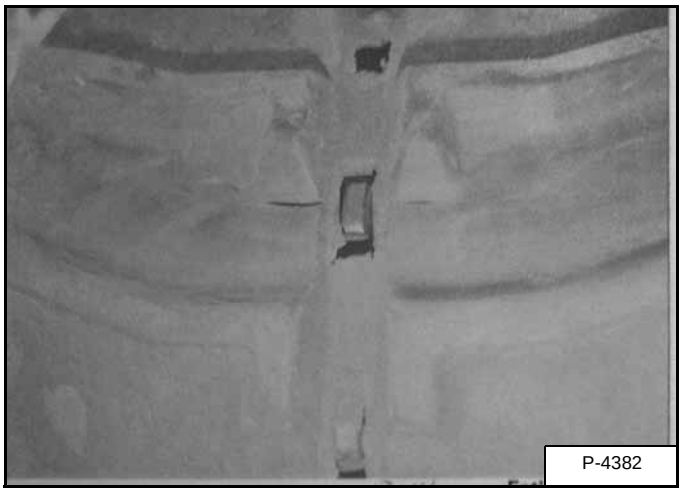
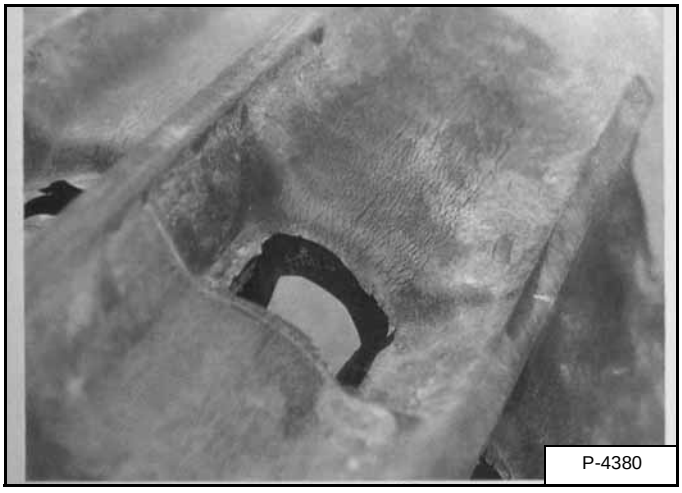


Figure 30-20-63



Cracks On The Lug Side Rubber Due To Fatigue

Damage:

Small cracks around the root of the lug as a result from operation fatigue **[Figure 30-20-62]** & **[Figure 30-20-63]**.

Replacement:

When the cracks reach so deep that they 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 injuries on the lug side rubber sometimes cause more chance of cracking. Machine operators should observe soil conditions when driving, so as not to cause external injuries to the lug side rubber. In order to minimize the occurrence of ozone cracks, attention should be paid to the following instructions for maintenance:

Avoid exposing stored tracks to direct sun light.

Avoid exposing stored tracks to direct rain and snow fall.

Store tracks in well ventilated warehouses.

Use the tracks at least once a month.

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Track Damage Identification (Cont'd)

Figure 30-20-64

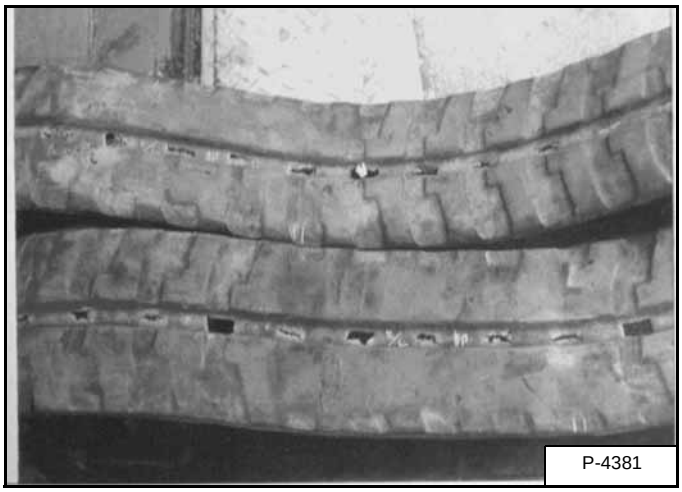
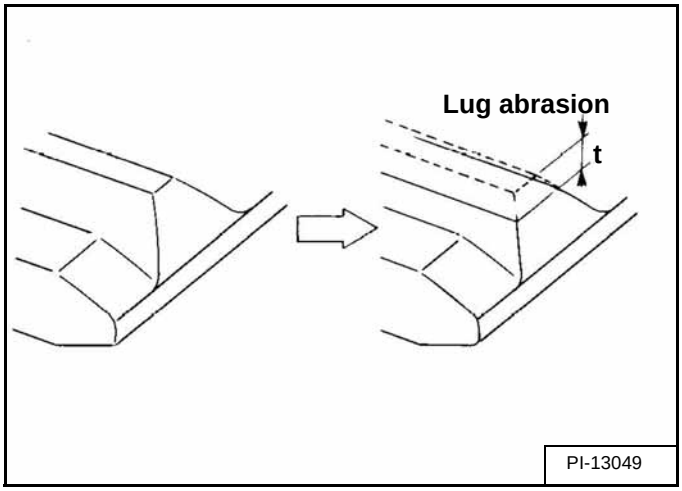


Figure 30-20-65



Lug Abrasion

Damage:

As its service time proceeds, the lug side inevitably undergoes abrasion **[Figure 30-20-64]** & **[Figure 30-20-65]**.

Replacement:

No replacement is required.

Causes of the damage:

Lug abrasion is more or less inevitable. Even if lug abrasion is proceeding, the rubber track can be used. However, as the traction performance deteriorates accordingly, 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, following operating conditions should be avoided:

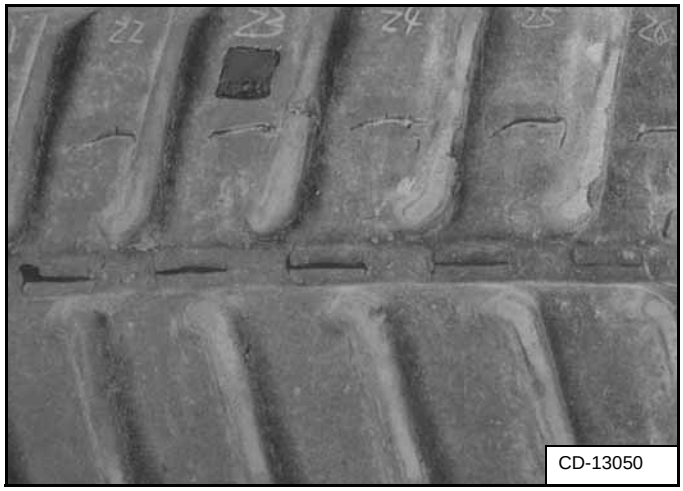
Making quick and repeated turns on concrete and asphalt roads

Driving up and down hilly paths with slippage.

Making frequent turns on paths covered with rocks and wood.

Cracks And Cuts On The Lug Side Rubber

Figure 30-20-66



Damage:

Sometimes cracks and cuts on the lug side rubber at the edges of the embedded metals can be observed **[Figure 30-20-66]**.

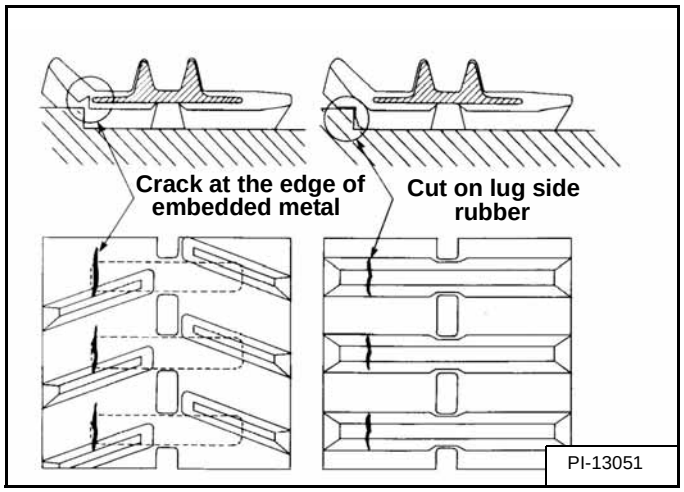
Replacement:

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.

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Track Damage Identification (Cont'd)

Figure 30-20-67



Causes of the damage:

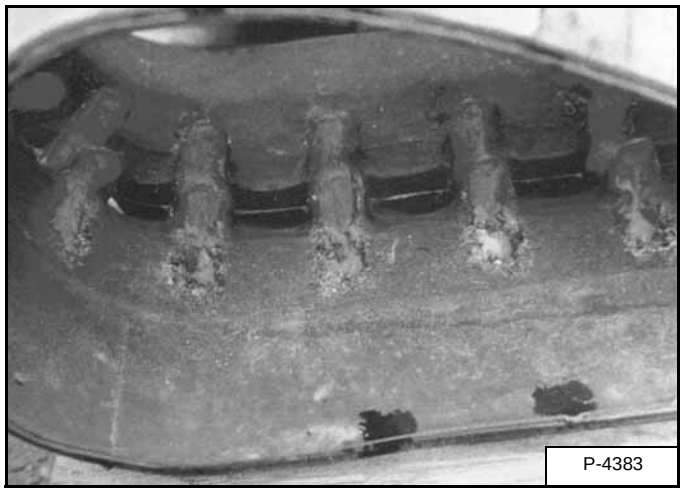
When rubber tracks drive over sharp projections, intensive stress is applied to the lug side rubber surface, especially at the edges of embedded metals, causing cracks and cuts in the area around the embedded metals **[Figure 30-20-67]**.

Prevention:

To avoid extensive stress applied to the lug root where metals are embedded, machine operators are requested to avoid driving over stumps and ridges.

Abrasion Of The Track Roller Side

Figure 30-20-68



Damage:

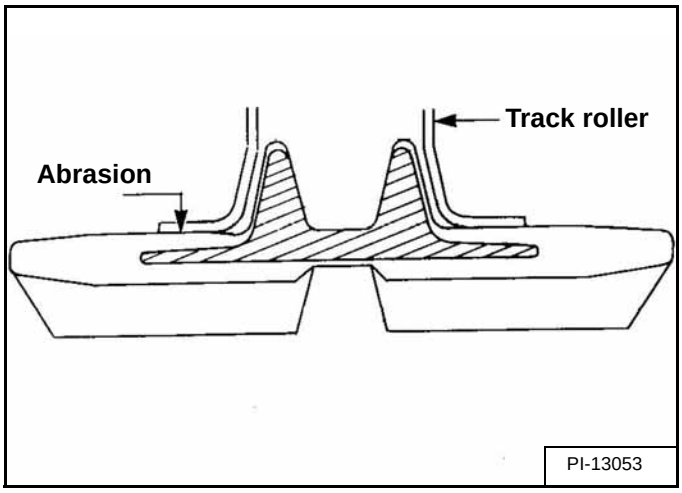
The rubber surface on which track rollers run is gradually abraded. It will end in the exposure of the embedded metals **[Figure 30-20-68]**.

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 30-20-69



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 30-20-69]**.

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.

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Track Damage Identification (Cont'd)

Cuts On The Edges Of Track Roller Side

Figure 30-20-70

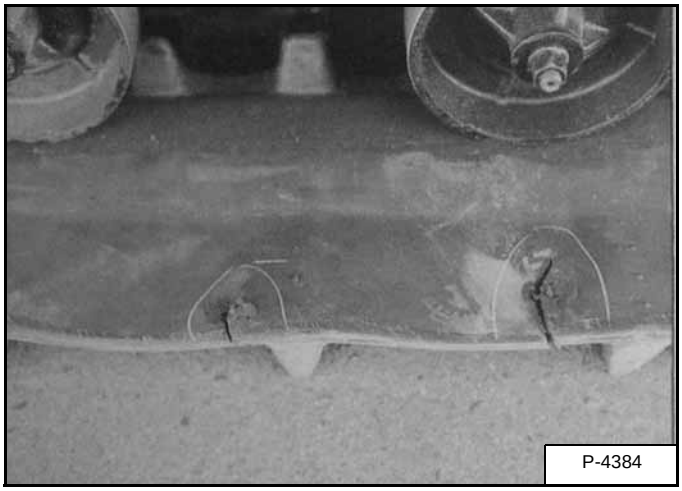
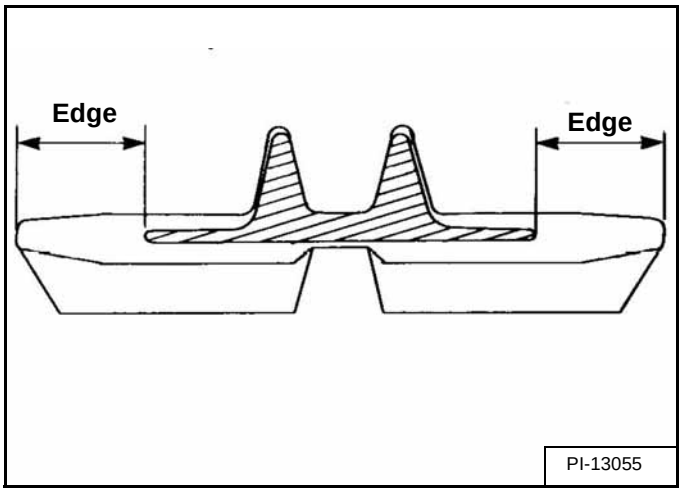


Figure 30-20-71



Damage:

Both edges of a rubber track have no special reinforcements. It sometimes occurs during operation that they are cut or torn off **[Figure 30-20-70]** & **[Figure 30-20-71]**.

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 field or by interference with the machine frame.

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Track Damage Identification (Cont'd)

Figure 30-20-72

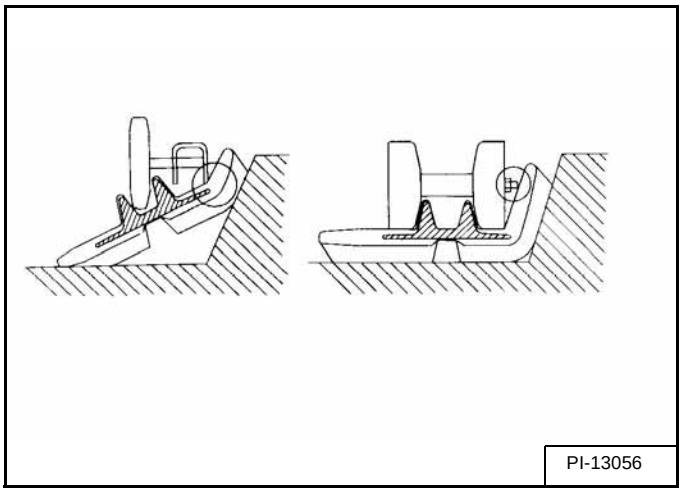
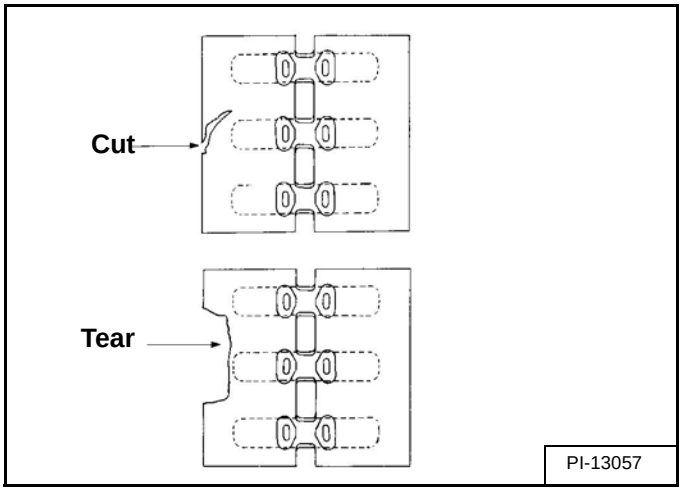


Figure 30-20-73



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, which cause extensive stress on the edges resulting in the damage. Especially, when a machine drives over concrete ridges, this type of damage easily occurs **[Figure 30-20-72]**.

In case of damage by interference with the machine frame

If a machine continues operating with rubber tracks being detracted, 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 30-20-73]**.

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 detracted, the machine should be stopped immediately for retracting.

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SWING CIRCLE GEAR

Removal and Installation

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

Figure 30-30-1

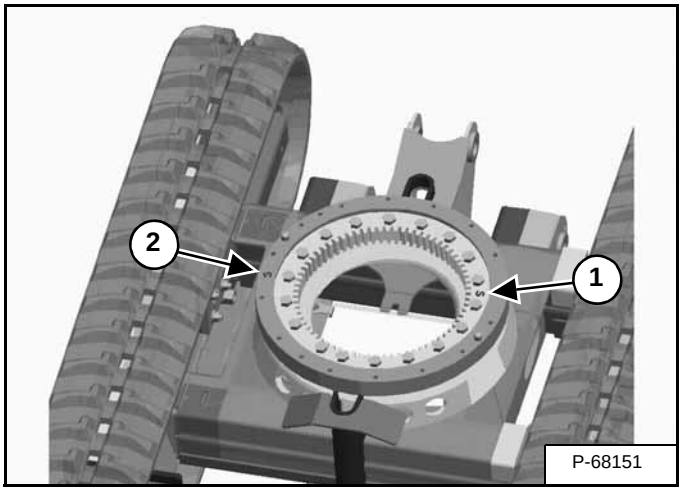
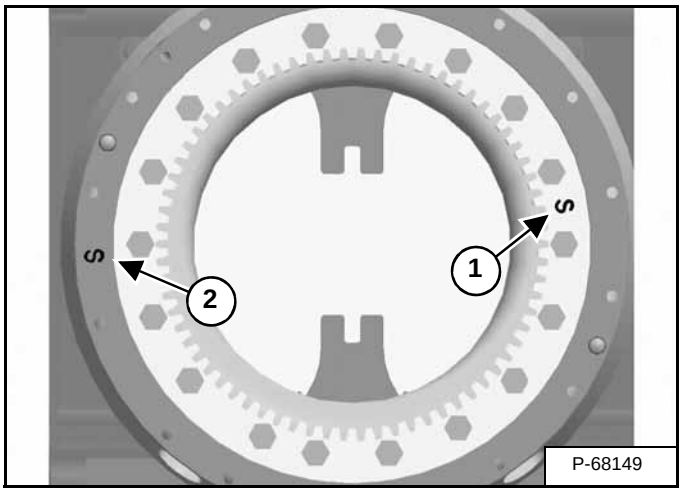


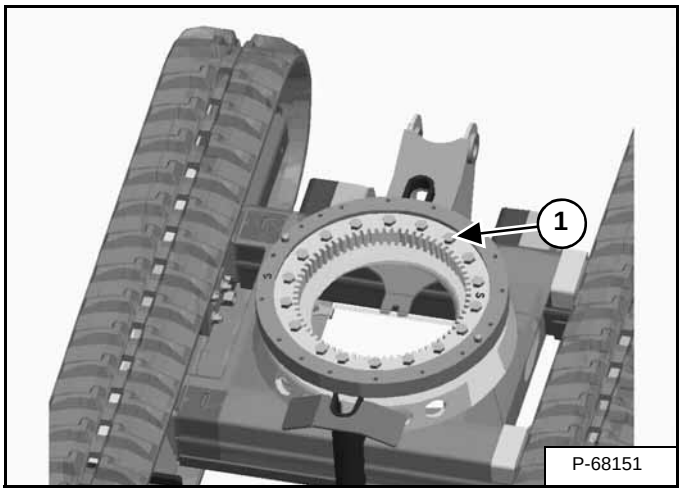
Figure 30-30-2



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 30-30-1]** & **[Figure 30-30-2]** stamped in the outer ring.

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

Figure 30-30-3



Remove the bolts and nuts from the swing circle gear **[Figure 30-30-3]**.

Installation: Tighten the bolts and nuts to 78 to 85 ft.-lb. (105 to 115 N•m) torque.

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Cable Removal and Installation 40-70-4
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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, arm. Fully retract the cylinder of the boom.

Lower the blade to the ground.

Remove the battery. (See Removal and Installation on Page 50-20-1)

Remove the cab or canopy. (See Removal And Installation on Page 40-30-1)

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

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

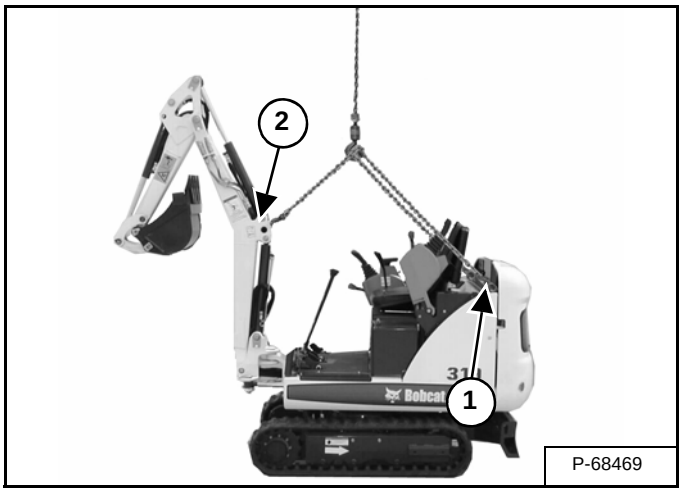
Remove the floor mat and floor panels. (See FLOOR MAT AND FLOOR PANELS on Page 40-100-1)

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. (.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

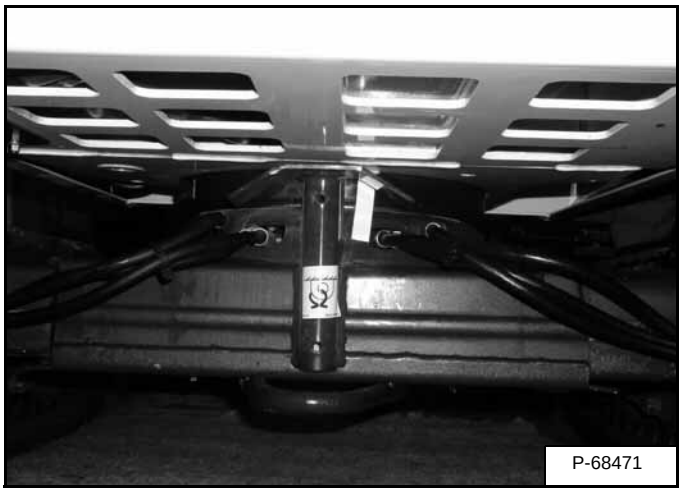
- **Use a lifting fixture with sufficient capacity for the weight of the excavator plus any added attachments.**
- **Maintain center of gravity and balance when lifting.**
- **Do not swing boom or upperstructure. Engage the swing locking lever.**
- **Never lift with operator on machine.**

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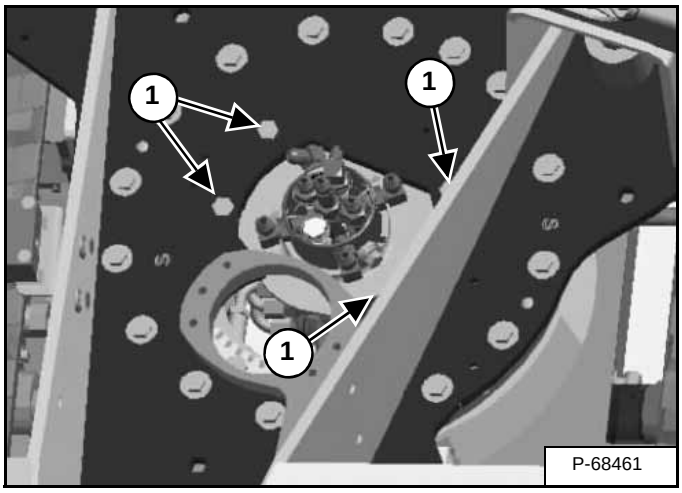
Removal (Cont'd)

Figure 40-10-2



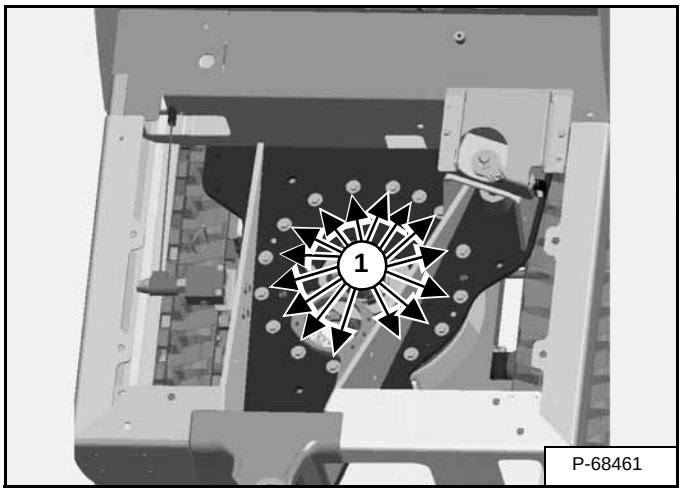
Mark the upperstructure to the swing bearing and to the track frame **[Figure 40-10-2]** for ease of assembly.

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.

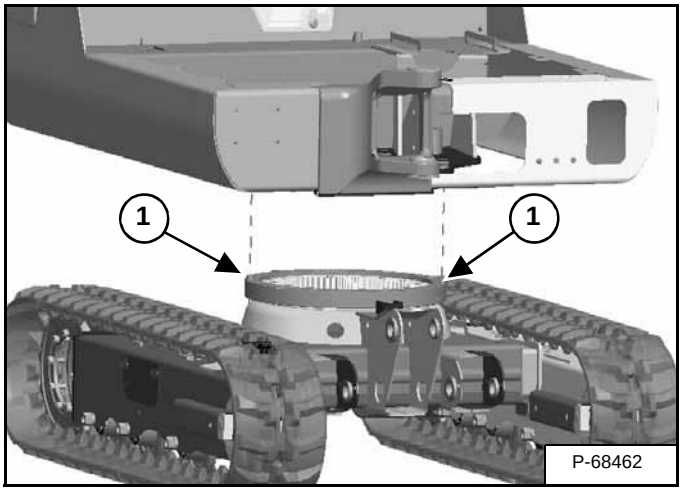
NOTE: Keep tension on the chain hoist to support the boom and arm when the upperstructure is supported on stands or blocks.

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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 (Item 2) **[Figure 40-10-5]** 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 FLOOR MAT AND FLOOR PANELS on Page 40-100-1)

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

Fill the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-100-2)

Install the battery. (See Removal and Installation on Page 50-20-1)

Install the cab or canopy. (See Removal And Installation on Page 40-30-1)

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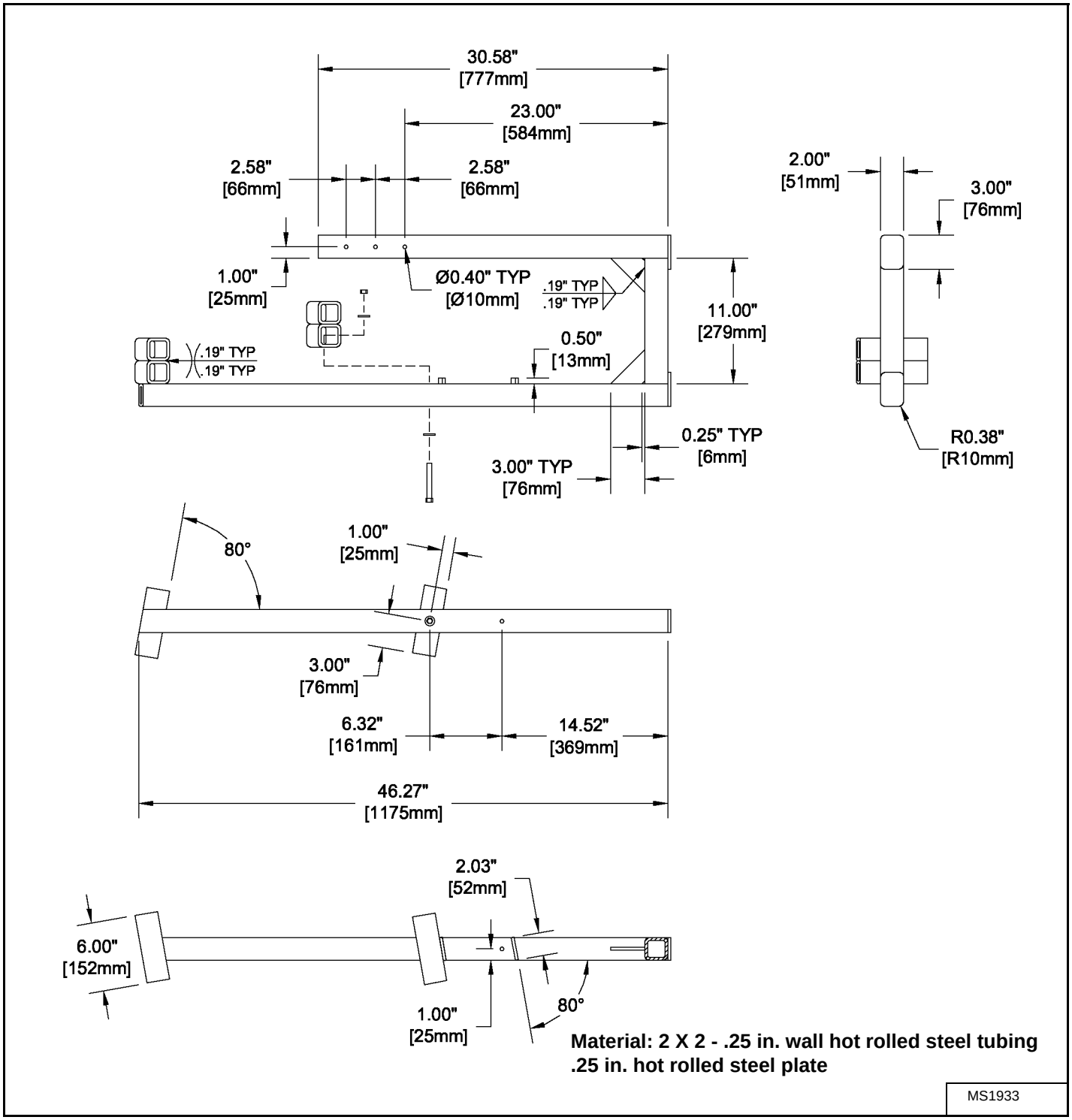


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CANOPY

Removal And Installation

Figure 40-20-1



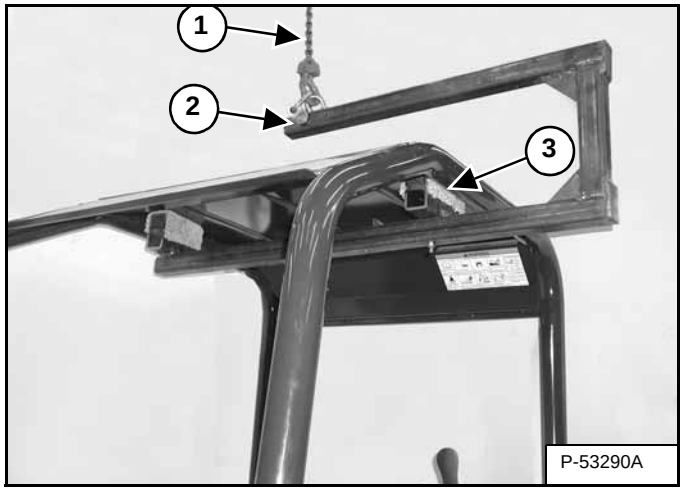
Build the service lifting bracket used to remove and install the ROPS canopy. Use the dimensions shown **[Figure 40-20-1]** to build the service lifting bracket.

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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 (Item 2) **[Figure 40-20-2]**.

NOTE: Use a lifting device of sufficient capacity.

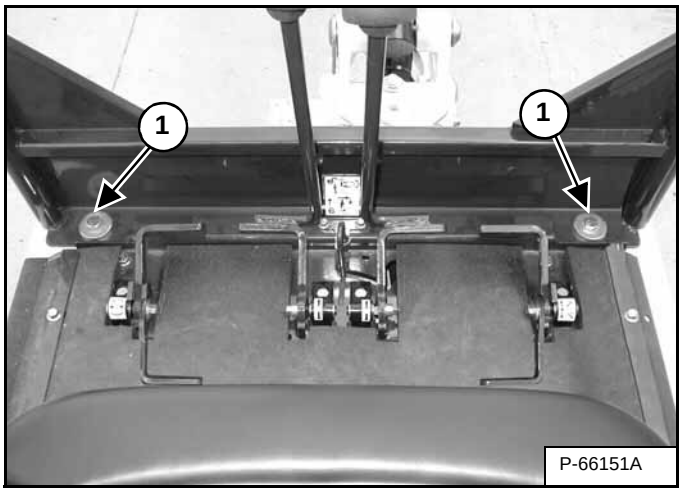
Adjust the lifting bracket to the proper width by moving the bracket (Item 3) **[Figure 40-20-2]**.

⚠ 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

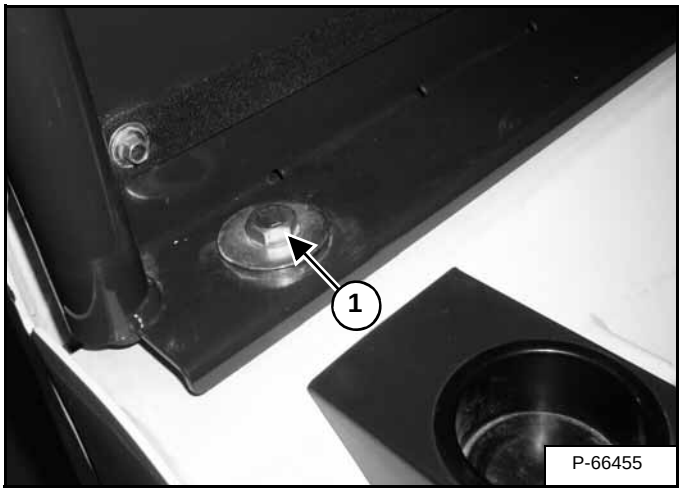
Figure 40-20-3



Remove the bolts, nuts and washers (Item 1) **[Figure 40-20-3]** from the front of the canopy.

Installation: Tighten the bolts to 118 to 133 ft.-lb. (160 to 180 N•m) torque.

Figure 40-20-4



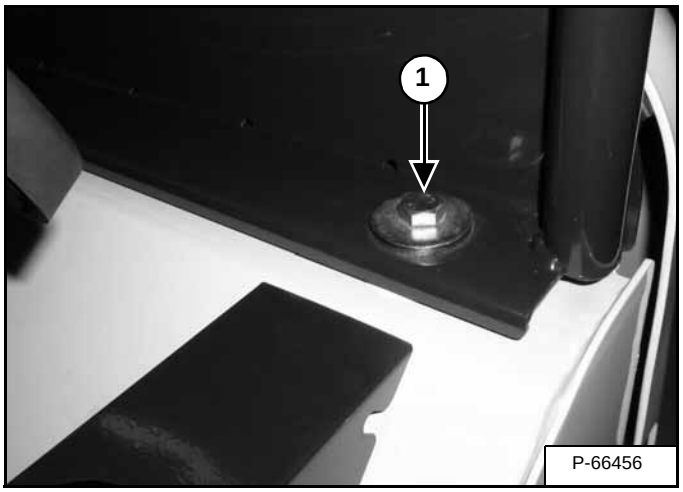
Remove the bolt and washer (Item 1) **[Figure 40-20-4]** from the right rear of the canopy.

Installation: Tighten the bolt to 118 to 133 ft.-lb. (160 to 180 N•m) torque.

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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 to 133 ft.-lb. (160 to 180 N•m) torque.

Remove the canopy from the upperstructure.

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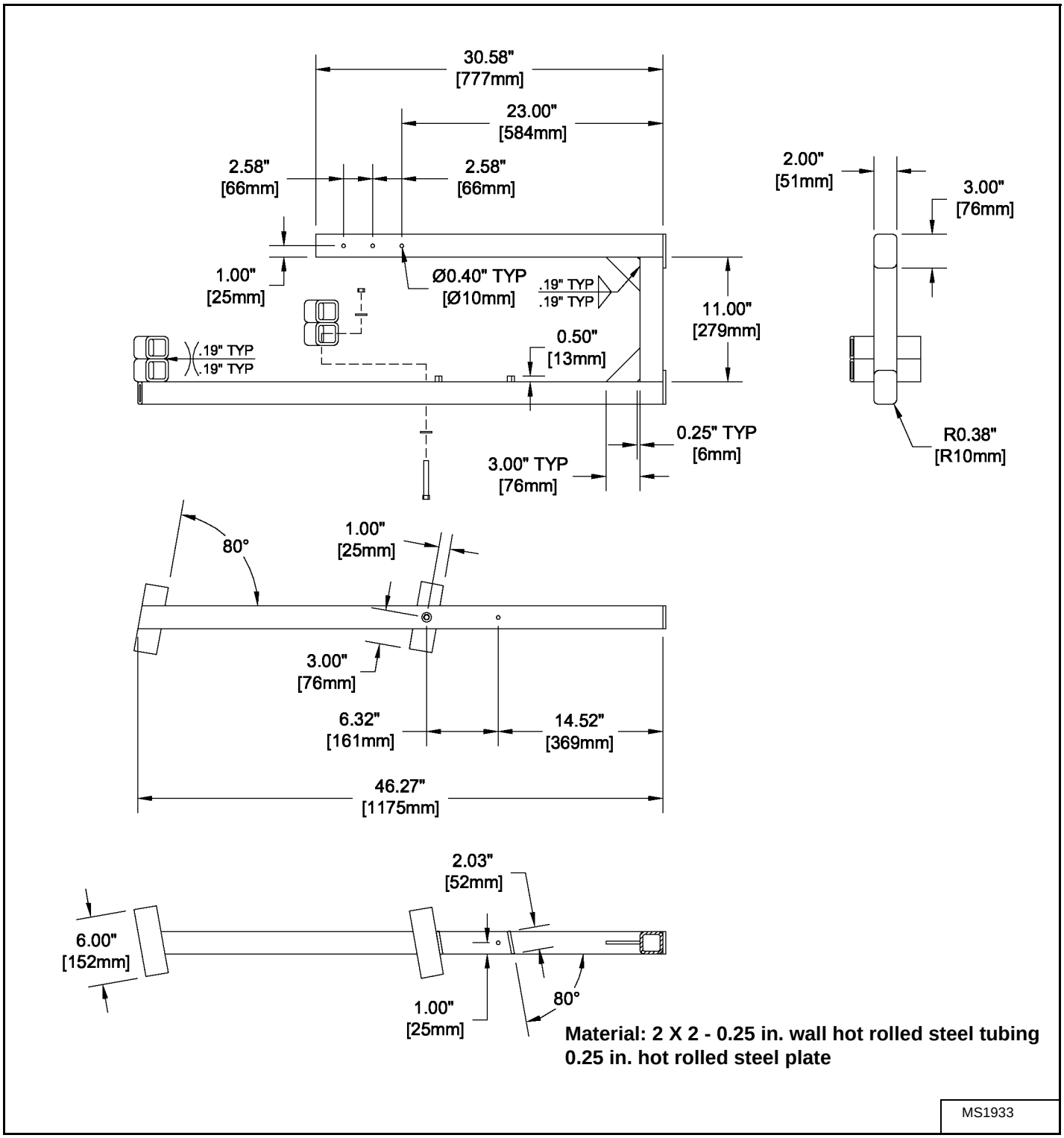


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Removal And Installation

Build the service lifting bracket used to remove and install the cab. Use the dimensions shown **[Figure 40-30-1]** to build the service lifting bracket.

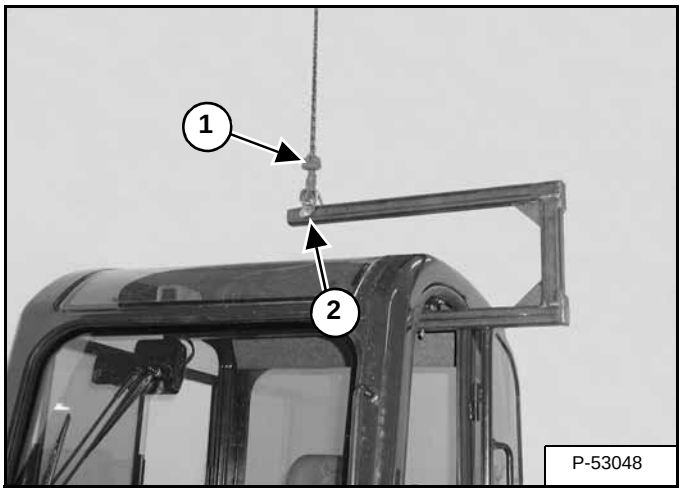
Figure 40-30-1



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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]**.

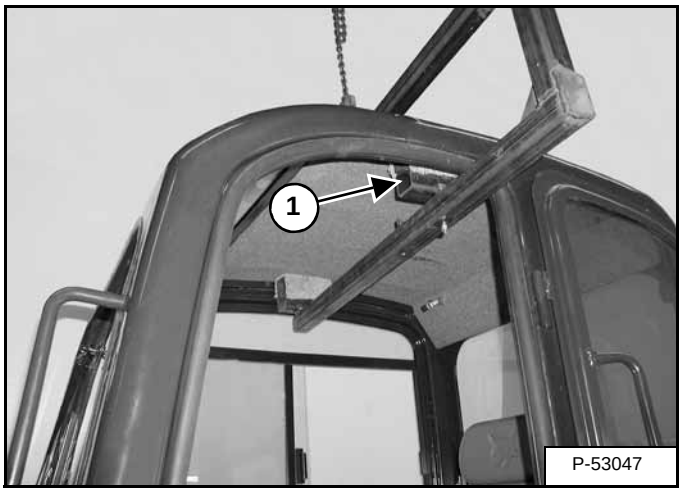
NOTE: Use a chain hoist of sufficient capacity.

⚠ 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.

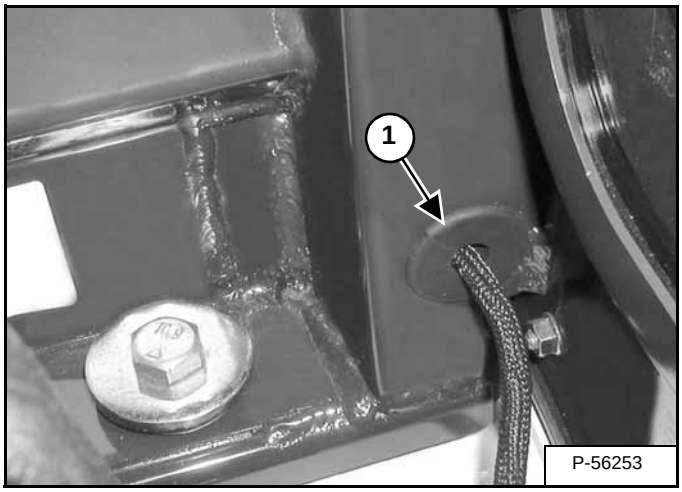
W-2384-1000

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

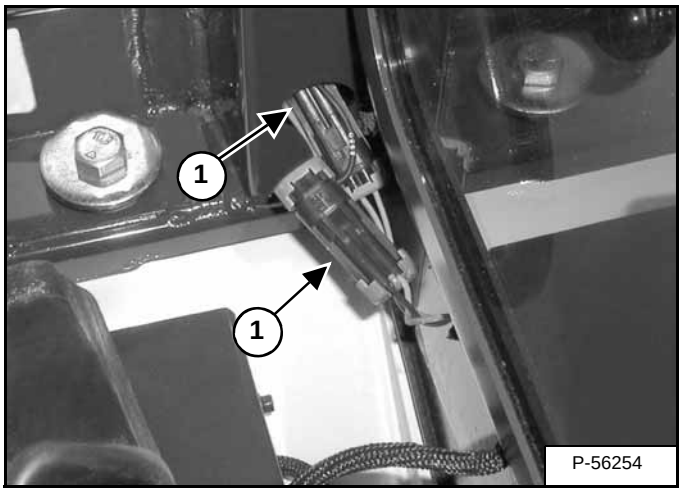


Remove the grommet (Item 1) **[Figure 40-30-4]** located in the left rear corner of the cab.

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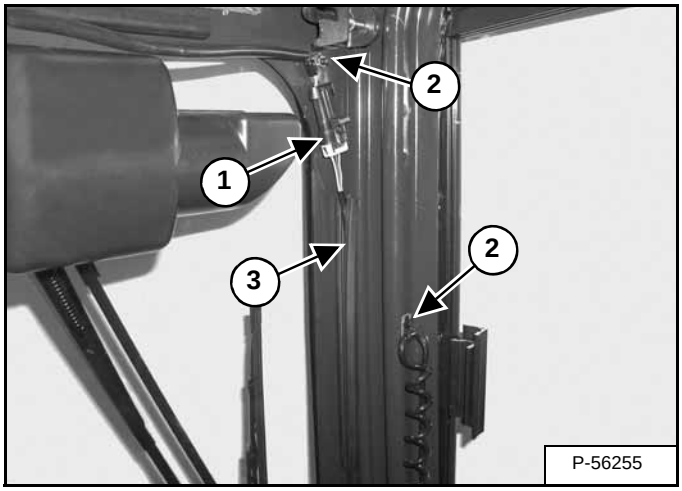
Removal And Installation (Cont'd)

Figure 40-30-5



Remove the wire harness from the cab frame and disconnect the wire connectors (Item 1) **[Figure 40-30-5]**.

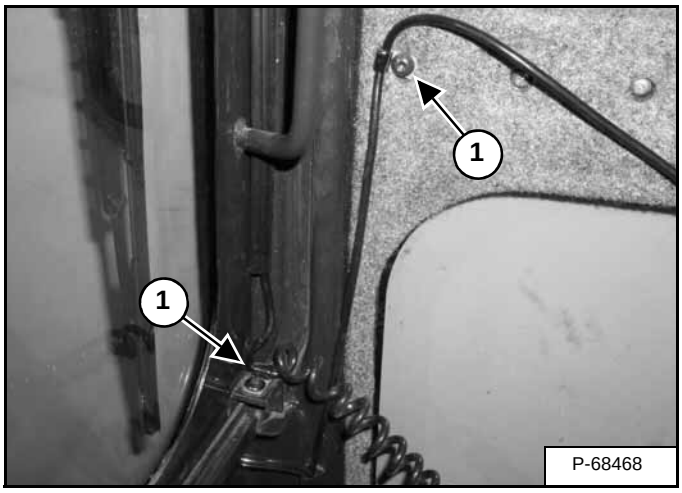
Figure 40-30-6



Disconnect the wire harness (Item 1) and remove the screws (Item 2) **[Figure 40-30-6]**.

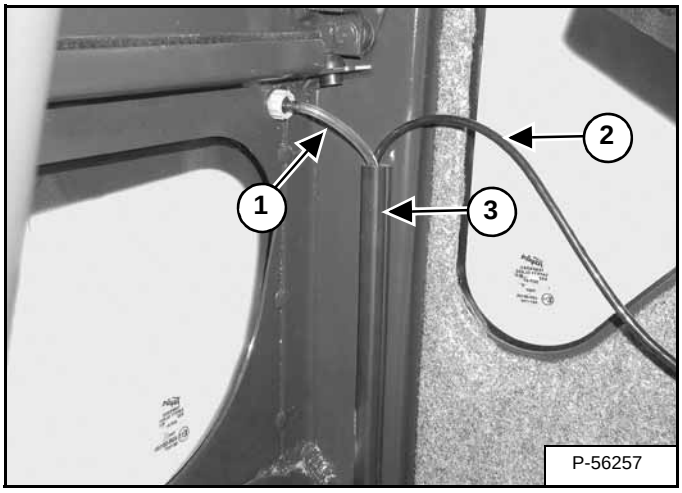
Remove the wire harness from the channel (Item 3) **[Figure 40-30-6]**.

Figure 40-30-7



Remove the screws (Item 1) **[Figure 40-30-7]**.

Figure 40-30-8



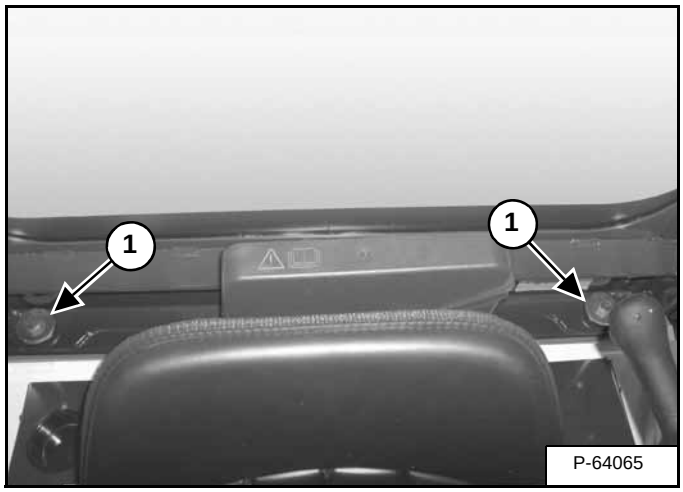
Remove the windshield washer hose (Item 1) **[Figure 40-30-8]** from the nozzle.

Remove the wire harness (Item 2) and washer hose from the channel (Item 3) **[Figure 40-30-8]**.

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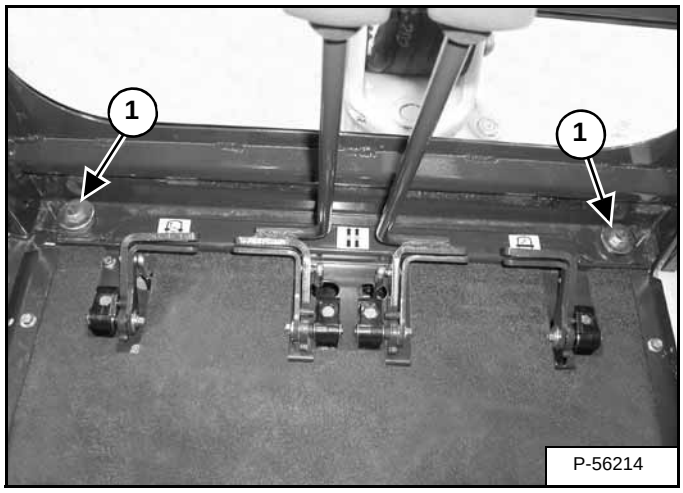
Removal And Installation (Cont'd)

Figure 40-30-9



Remove the bolts and washers (Item 1) **[Figure 40-30-9]** from the rear of the cab.

Figure 40-30-10

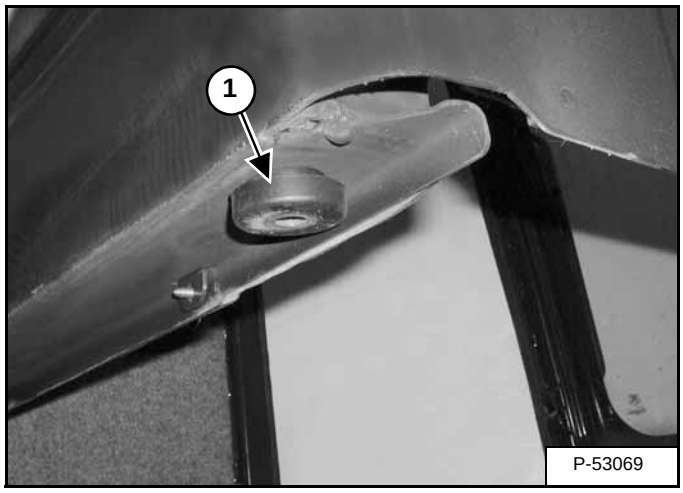


Remove the bolts, washers (Item 1) **[Figure 40-30-10]** and nuts from the front of the cab.

Installation: Tighten the bolts to 118 to 133 ft.-lb. (160 to 180 N•m) torque.

Raise the hoist and remove the cab.

Figure 40-30-11

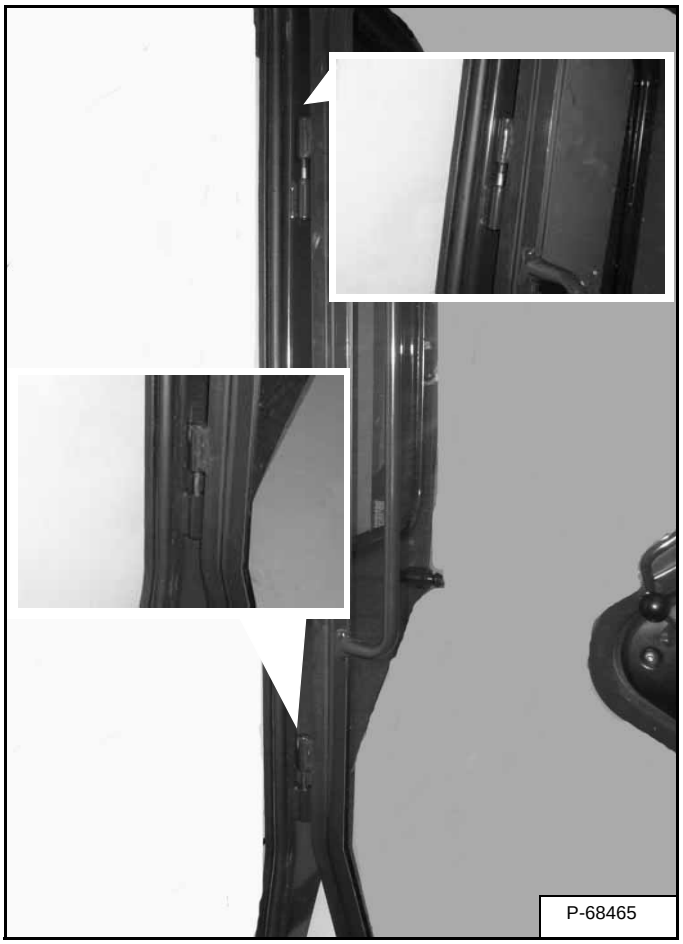


Installation: Install the cab mounts (Item 1) **[Figure 40-30-11]** on the four corners of the cab.

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Door Removal And Installation

Figure 40-30-12



The door can be removed from the cab by slowly swinging the door back and forth while lifting up on the door **[Figure 40-30-12]**.

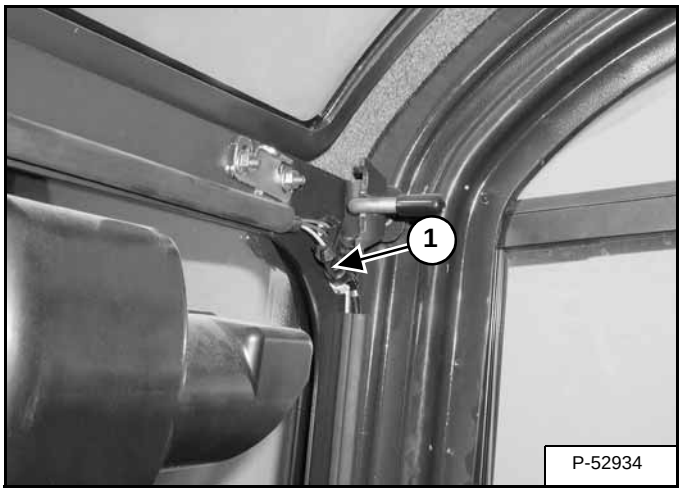
Installation: Align the hinges and swing the door back and forth until the door weight settles the hinges to full engagement.

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.

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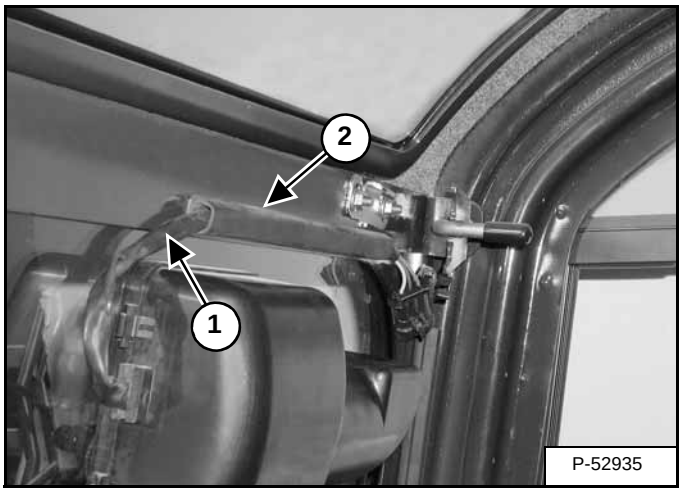
Front Window Removal And Installation

Figure 40-30-13



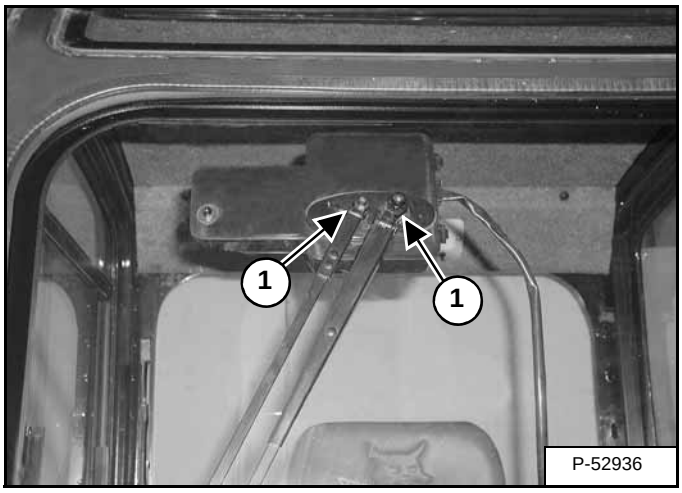
Disconnect the wire harness (Item 1) **[Figure 40-30-13]**.

Figure 40-30-14



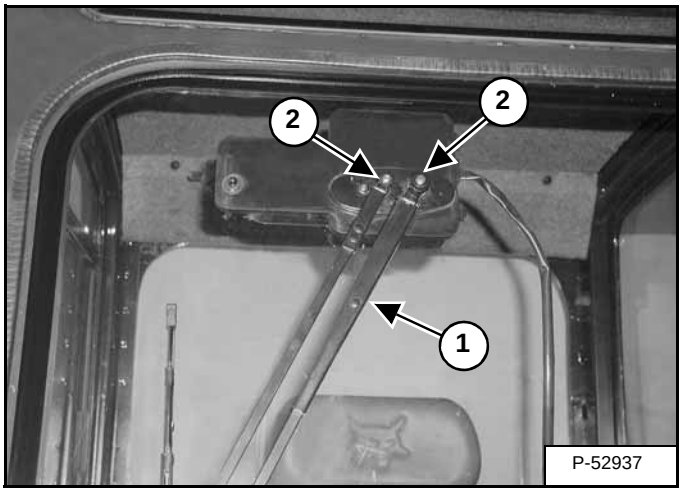
Remove the wire harness (Item 1) from the channel (Item 2) **[Figure 40-30-14]**.

Figure 40-30-15



Remove the nuts (Item 1) **[Figure 40-30-15]**.

Figure 40-30-16

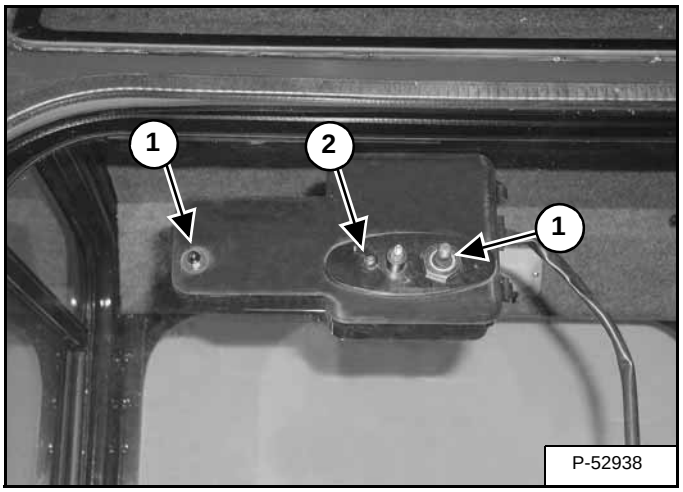


Remove the wiper assembly (Item 1) from the pivot mounts (Item 2) **[Figure 40-30-16]**.

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Front Window Removal And Installation (Cont'd)

Figure 40-30-17

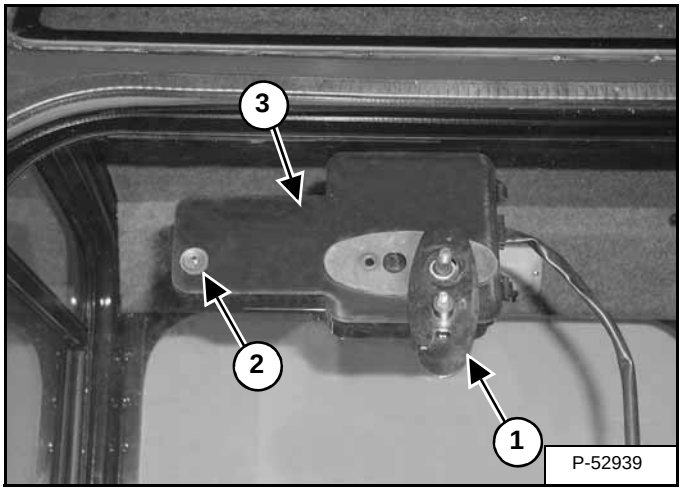


Remove the nuts and washers (Item 1) **[Figure 40-30-17]**.

Remove the bolt (Item 2) **[Figure 40-30-17]**.

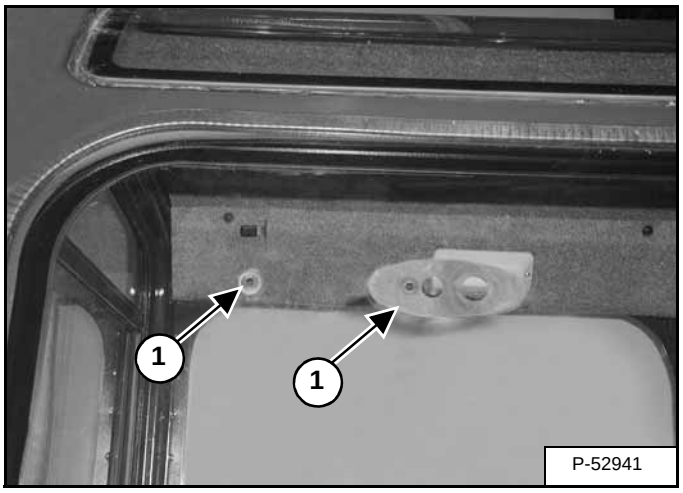
NOTE: Support the wiper motor before removing the bolts.

Figure 40-30-18



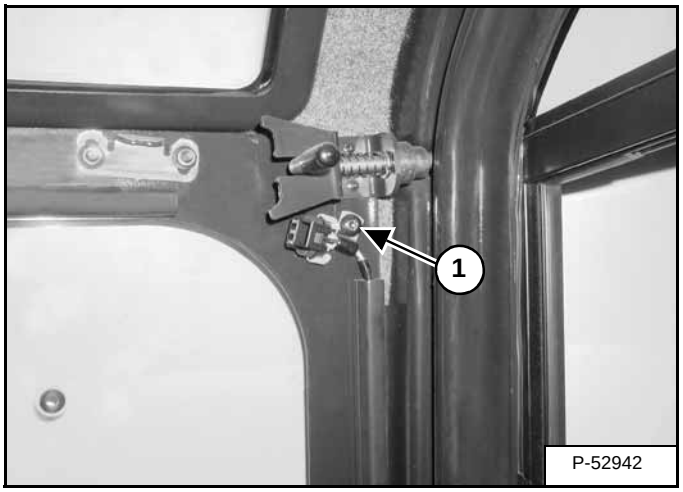
Remove the plate (Item 1), washer (Item 2), and wiper motor (Item 3) **[Figure 40-30-18]**.

Figure 40-30-19



Remove the seals (Item 1) and bushings **[Figure 40-30-19]**.

Figure 40-30-20

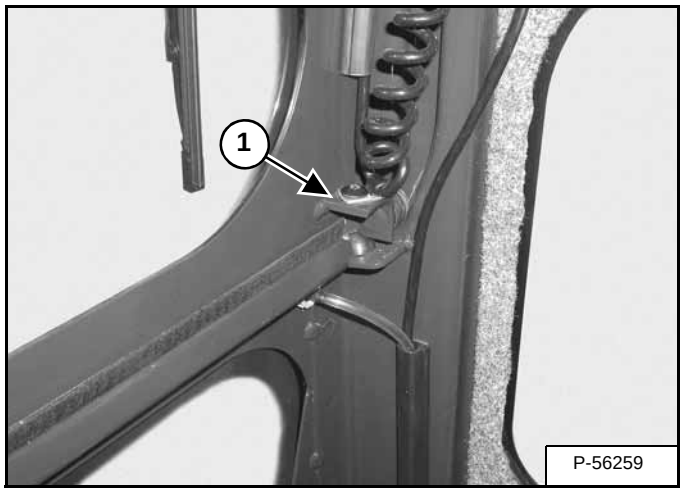


Remove the screw (Item 1) **[Figure 40-30-20]** holding the wire harness clamp to the top of the front window.

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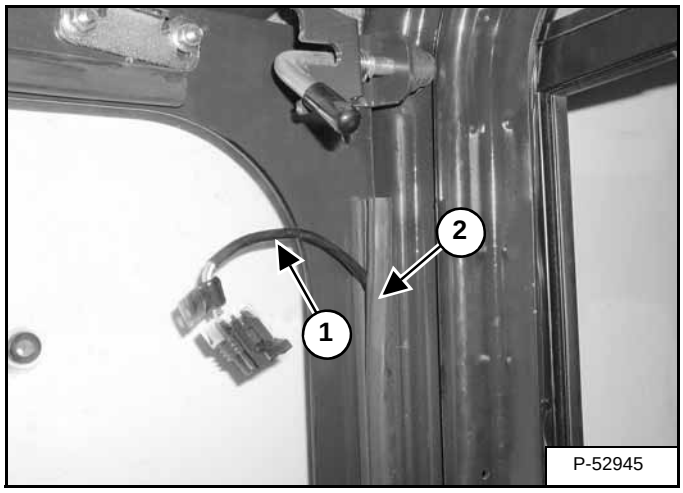
Front Window Removal And Installation (Cont'd)

Figure 40-30-21



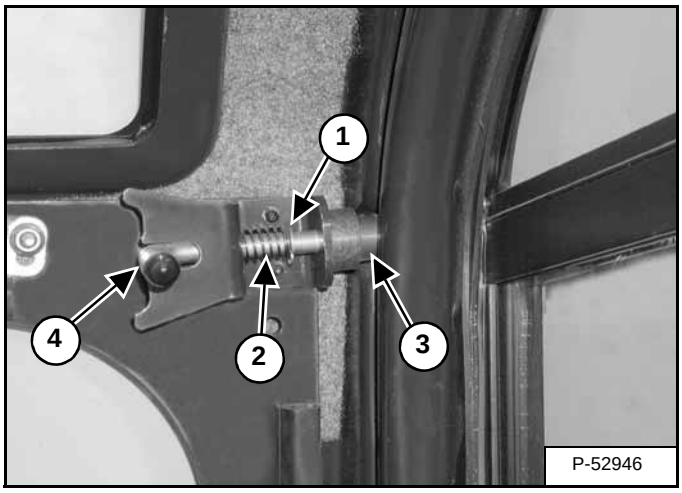
Remove the screw (Item 1) **[Figure 40-30-21]** holding the wire harness clamp to the bottom of the front window.

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



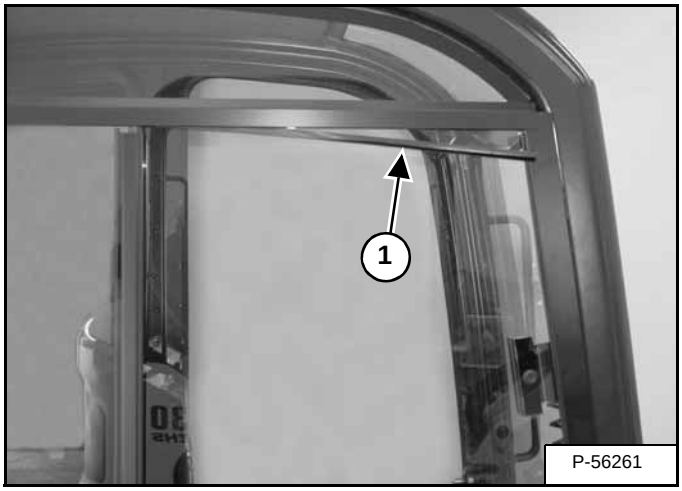
Tilt the front window (Item 1) **[Figure 40-30-24]**. Remove the front window from the cab.

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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.

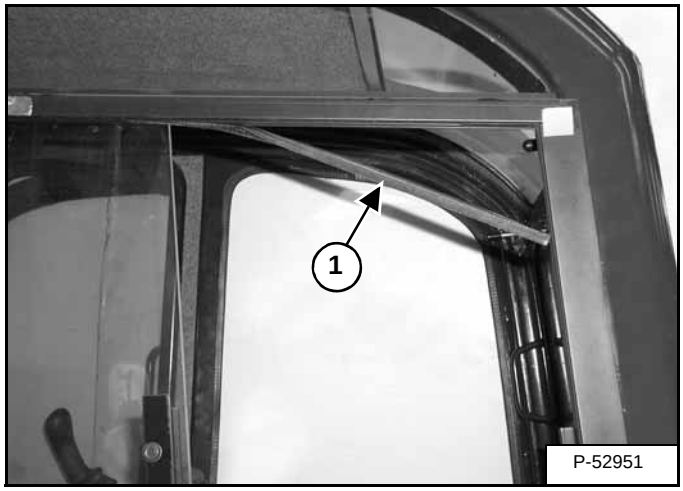
Dealer Copy -- Not for Resale

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

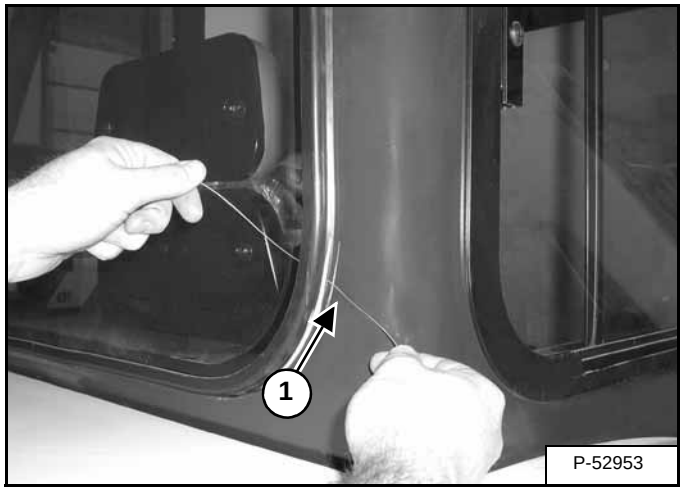


Lift the window up into the channel and tilt the bottom edge out **[Figure 40-30-28]**. Remove the window from the cab.

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.

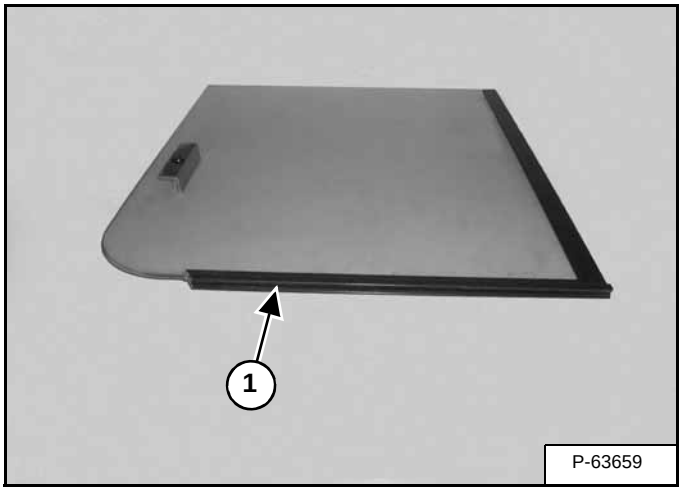
NOTE: The right side window frame is aluminum and will be destroyed when removed.

Dealer Copy -- Not for Resale

Right Side Front And Rear Sliding Window Weather Strip Removal And Installation

Remove the window.

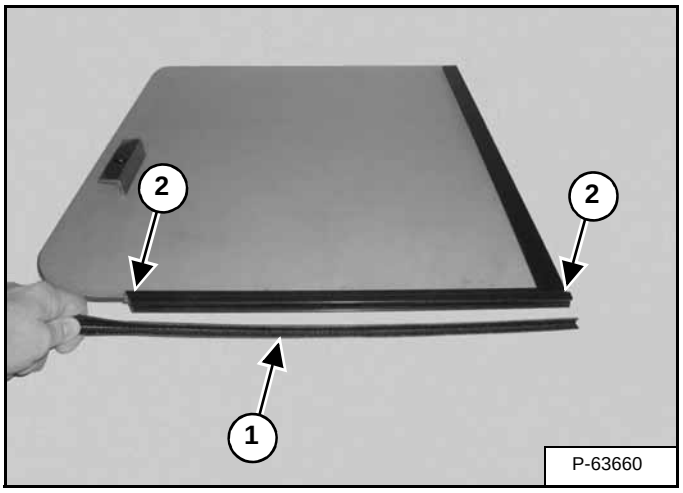
Figure 40-30-30



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

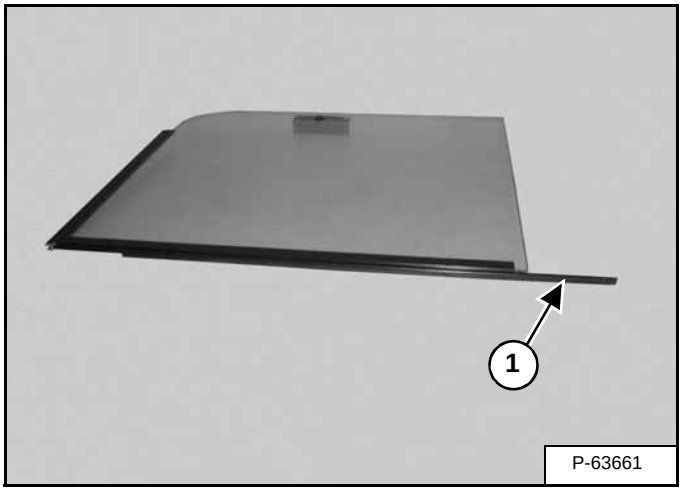


Install the new weather strip (Item 1). Cut the weather strip flush with the ends of the window channel (Item 2) **[Figure 40-30-31]**.

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.

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CAB (CONT'D)

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

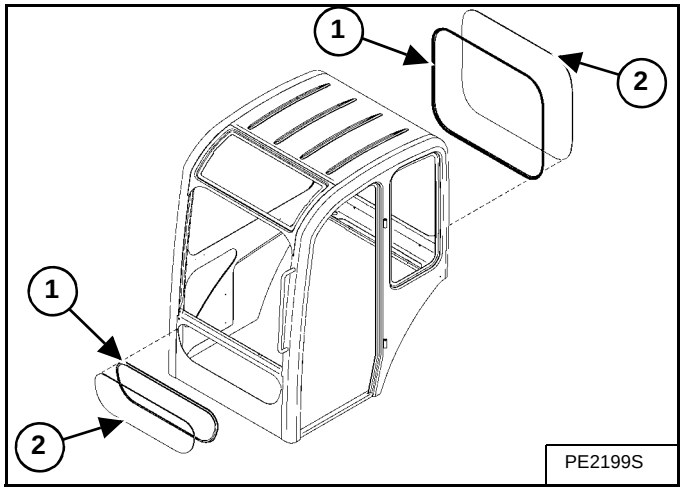
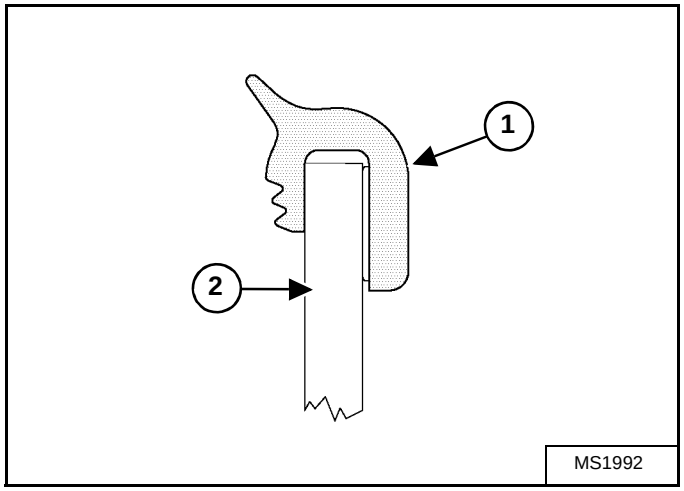


Figure 40-30-34



Install the seal (Item 1) on the glass (Item 2) **[Figure 40-30-33]** & **[Figure 40-30-34]**.

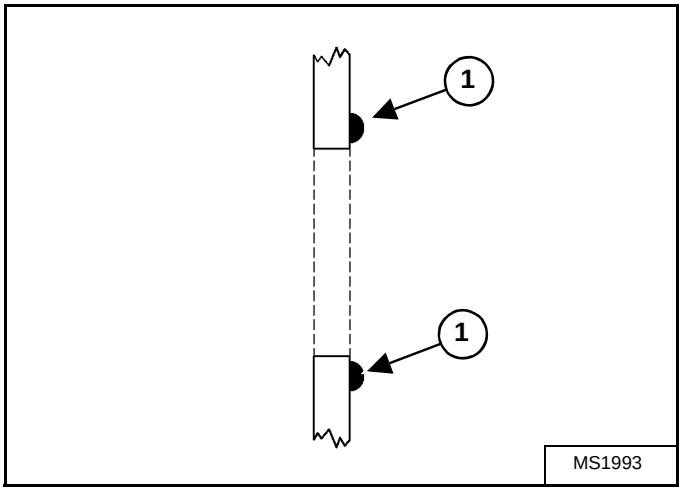
Shake the combo primer for 1 minute.

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.

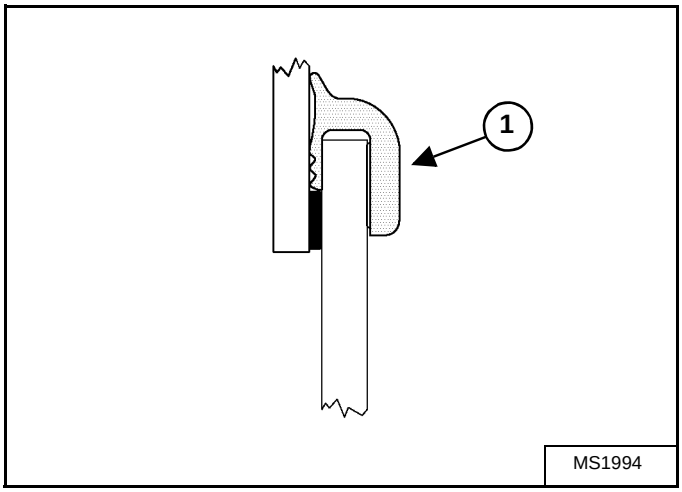
Cut the tip of the adhesive tube to the desired shape and size to provide a bead height sufficient to give good contact with the glass around the entire perimeter.

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.

Dealer Copy -- Not for Resale

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.

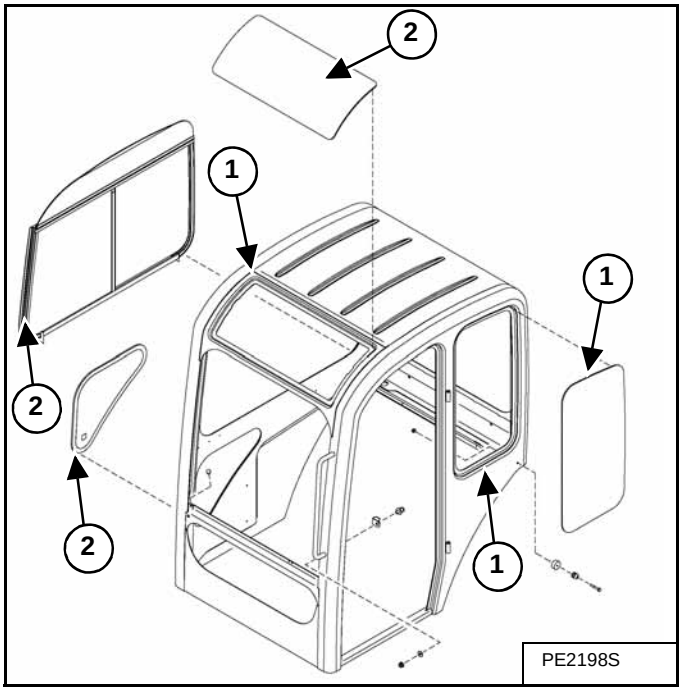
NOTE: Leave a thin film of the old urethane on the cab frame, fresh urethane will bond to the remaining film.

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

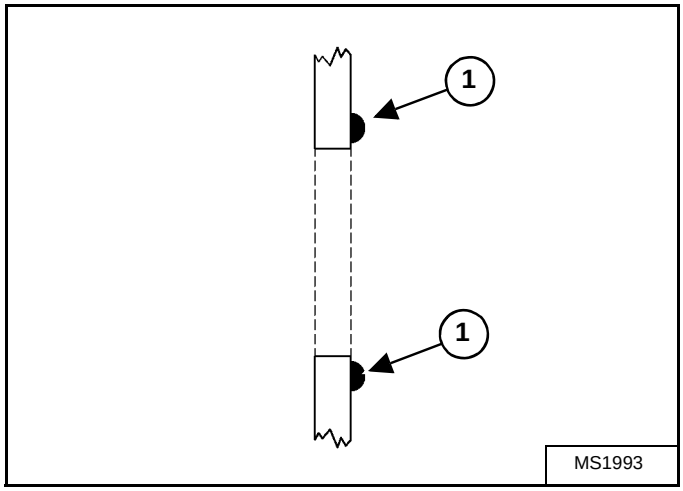


Apply combo primer to the perimeter of the cab (Item 1) and glass (Item 2) **[Figure 40-30-37]**. Apply the primer in one direction only, using a dauber. Do not dip the dauber in the primer more than once. Use multiple daubers if needed.

Allow the combo primer to dry for 5 minutes. Dry time doubles if the primer is applied in two coats.

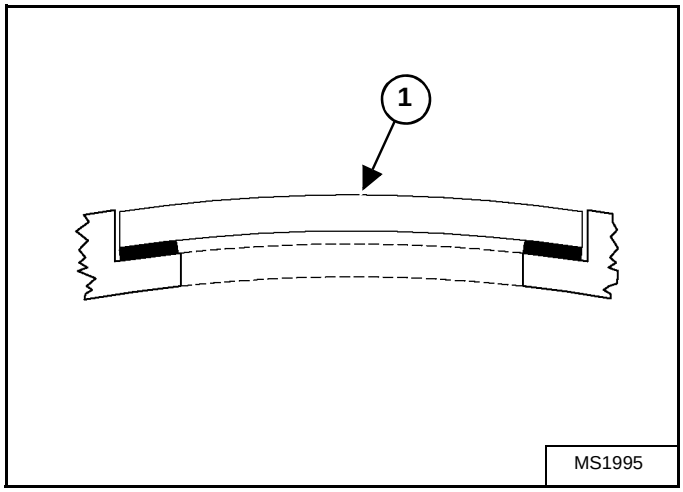
Cut the tip of the adhesive tube to the desired shape and size to provide a bead height sufficient to give good contact with the glass around the entire perimeter.

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.

Dealer Copy -- Not for Resale

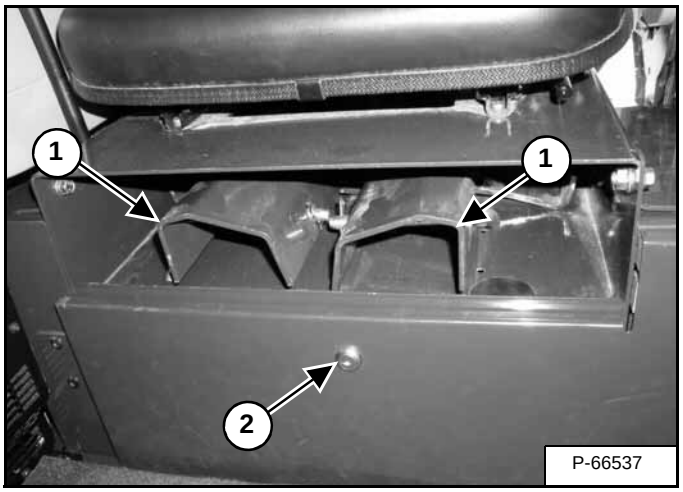


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SEAT AND SEAT MOUNT

Seat Mount Removal And Installation

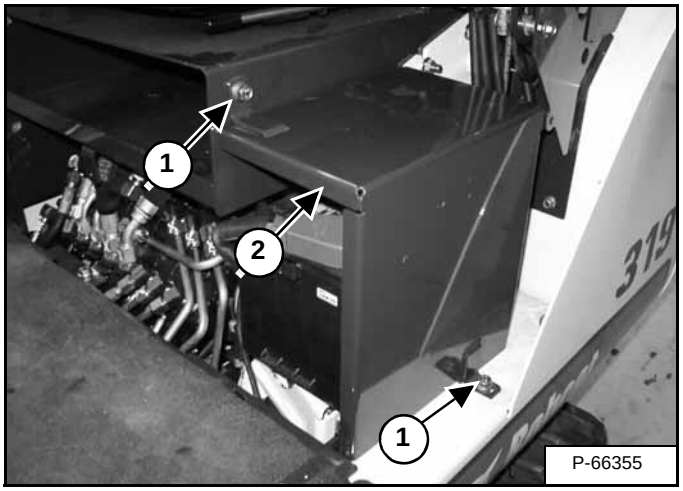
Figure 40-40-1



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]**.

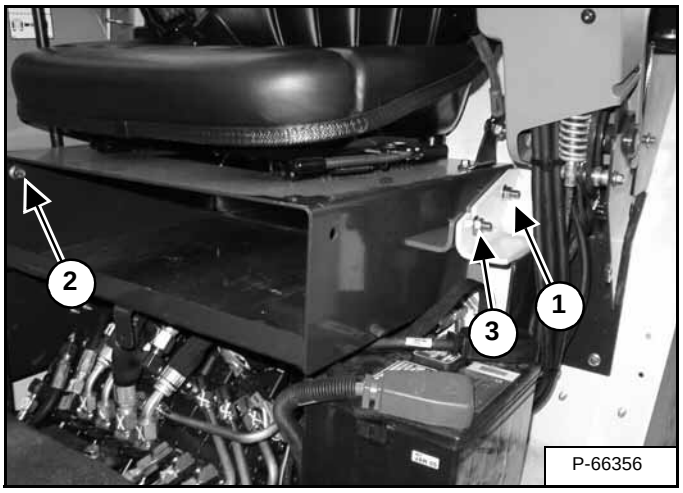
Figure 40-40-2



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



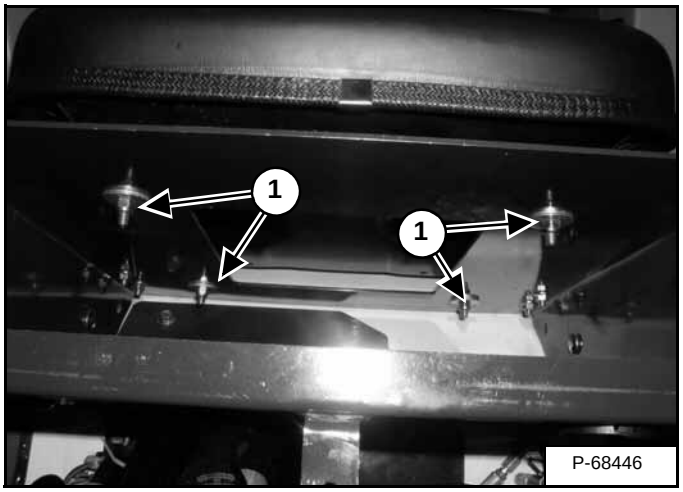
Remove the two bolts (Item 1) **[Figure 40-40-3]** and nuts from both sides of the seat mount.

Remove the bolt (Item 2) **[Figure 40-40-3]**, nut and bracket from the right side of the seat mount.

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

Remove the seat and seat mount.

Figure 40-40-4



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

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

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Dealer Copy -- Not for Resale

RIGHT CONSOLE

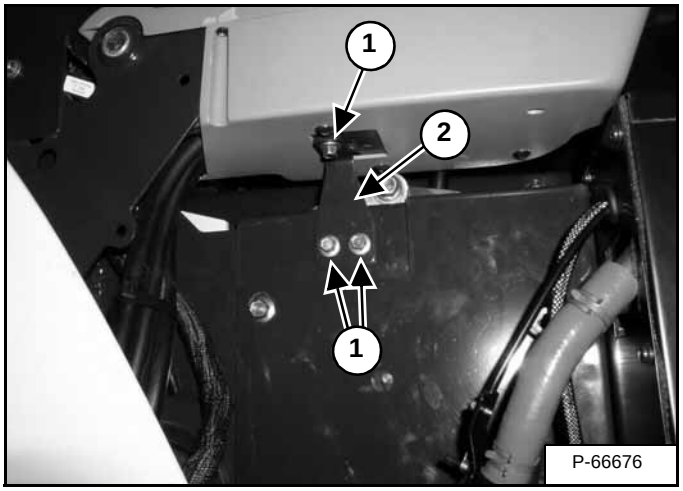
Description

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.

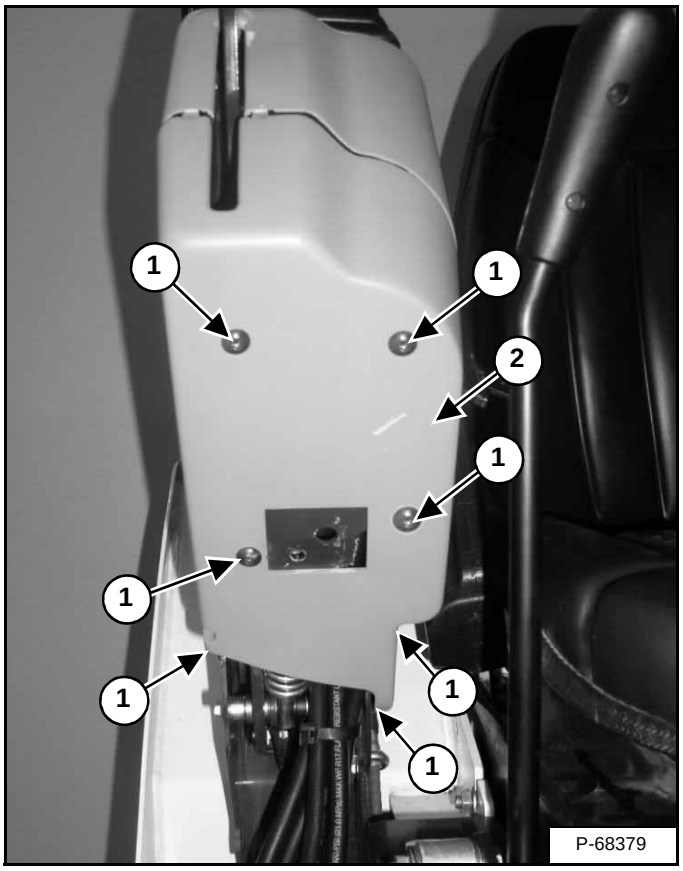
Joystick Console Cover (Bottom) Removal And Installation

Figure 40-50-5



Cab Option Only: Remove the three bolts (Item 1) and bracket (Item 2) **[Figure 40-50-5]**.

Figure 40-50-6



Remove the seven screws (Item 1) **[Figure 40-50-6]** from the lower half of the joystick console cover.

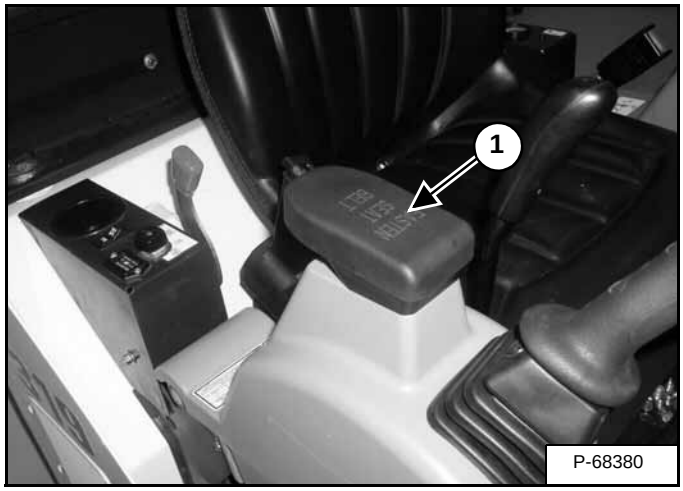
Remove the lower half of the joystick console cover (Item 2) **[Figure 40-50-6]**.

Lower the right console.

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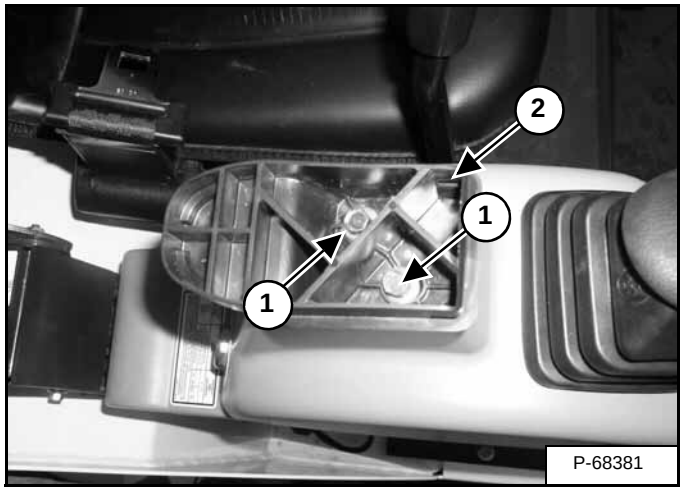
Joystick Console Cover (Top) Removal And Installation

Figure 40-50-7



Remove the cover (Item 1) **[Figure 40-50-7]** from the arm rest.

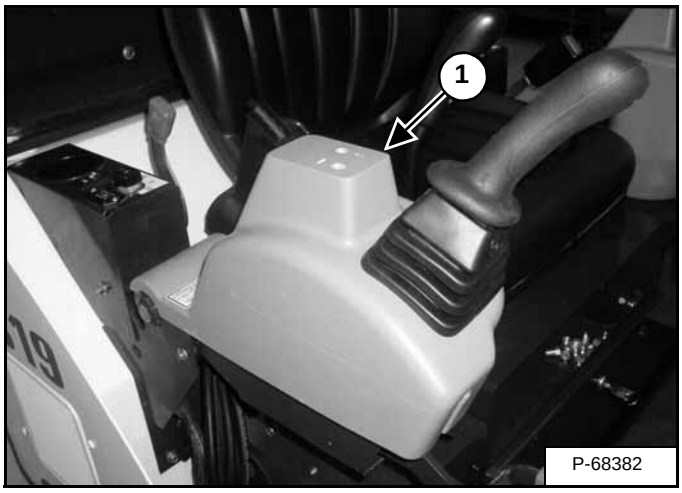
Figure 40-50-8



Remove the bolts (Item 1) **[Figure 40-50-8]** from the arm rest.

Remove the arm rest (Item 2) **[Figure 40-50-8]**.

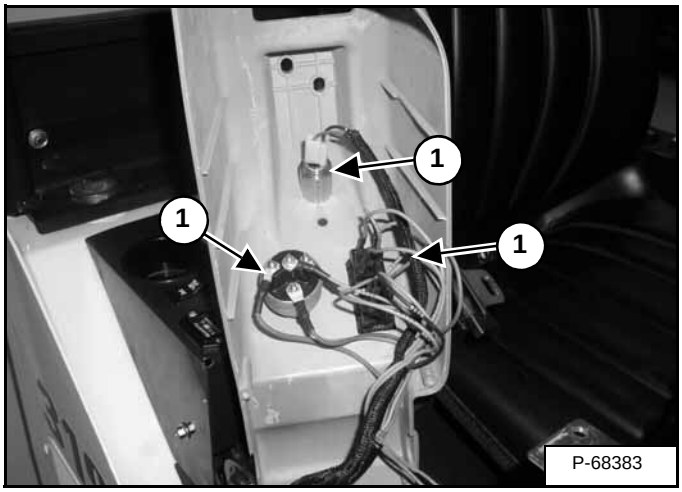
Figure 40-50-9



Remove the upper half of the joystick console cover (Item 1) **[Figure 40-50-9]** over the joystick.

Mark the wires for ease of assembly.

Figure 40-50-10



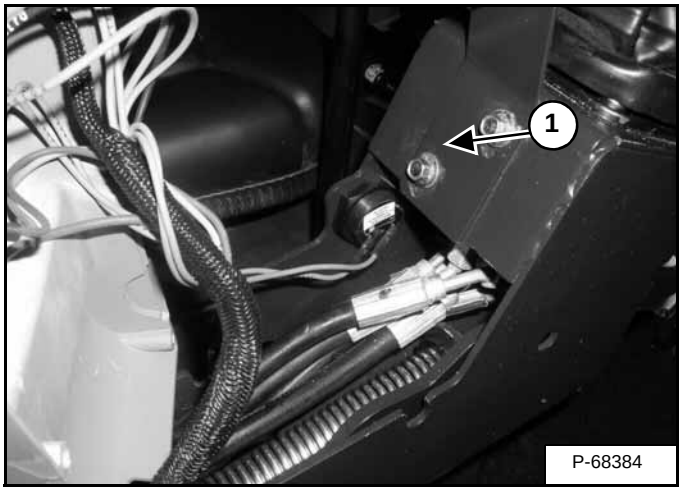
Disconnect the electrical connector and wires (Item 1) **[Figure 40-50-10]** from the key switch, indicator lights and accessory plug.

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Joystick Console Cover (Top) Removal And Installation (Cont'd)

Mark the wires for ease of assembly.

Figure 40-50-11



Disconnect the electrical wires (Item 1) **[Figure 40-50-11]** from the buzzer.

Remove the joystick console cover.

Joystick Console Cover (Top) Disassembly And Assembly

Mark the wires for ease of assembly.

Figure 40-50-12

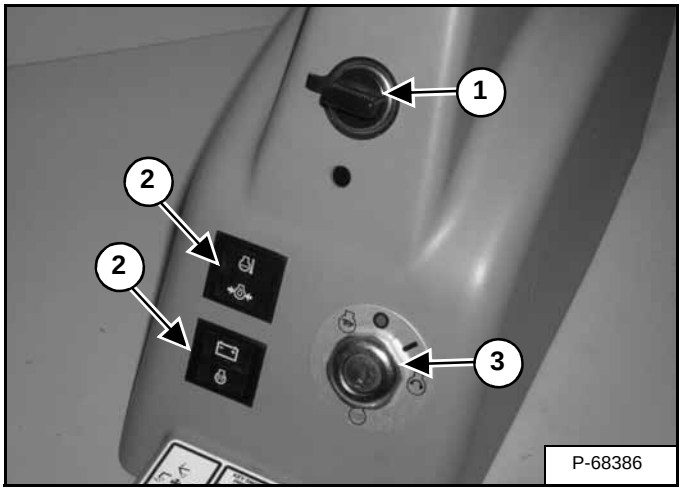
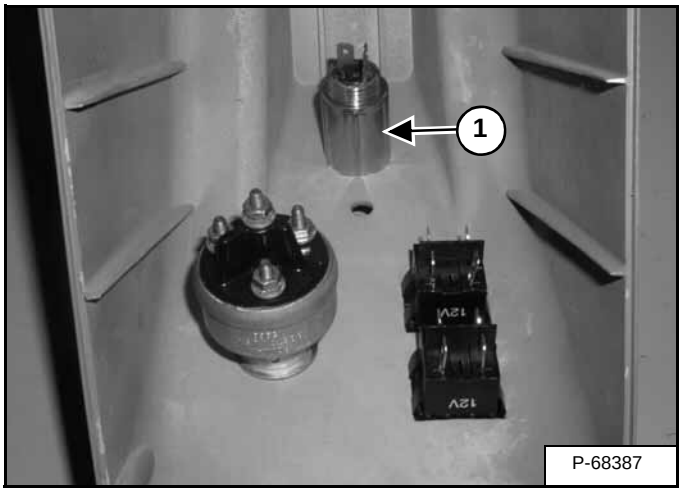


Figure 40-50-13



Remove the back (Item 1) **[Figure 40-50-13]** from the accessory plug and remove from the front of the cover **[Figure 40-50-12]**.

Remove the indicator lights (Item 2) **[Figure 40-50-12]** in the top of the compression spring rod.

Remove the nut (Item 3) **[Figure 40-50-12]** from the front of the key switch and remove from the back of the cover.

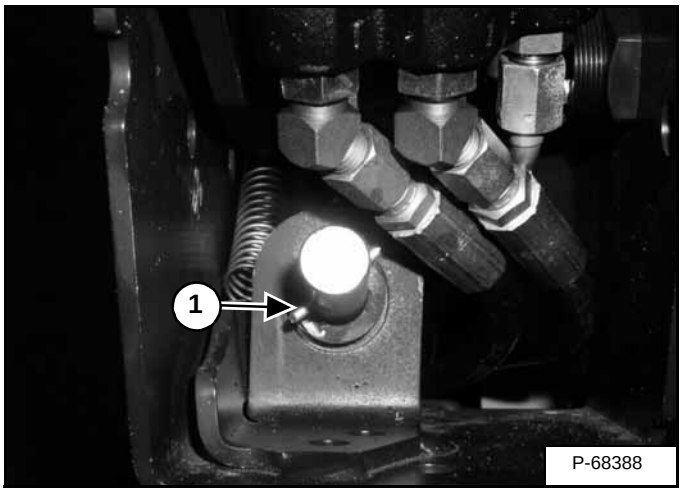
Dealer Copy -- Not for Resale

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)

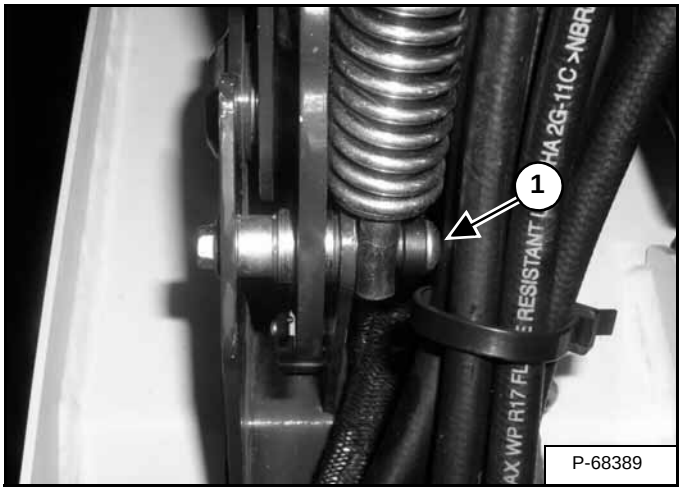
Lower the console.

Figure 40-50-14



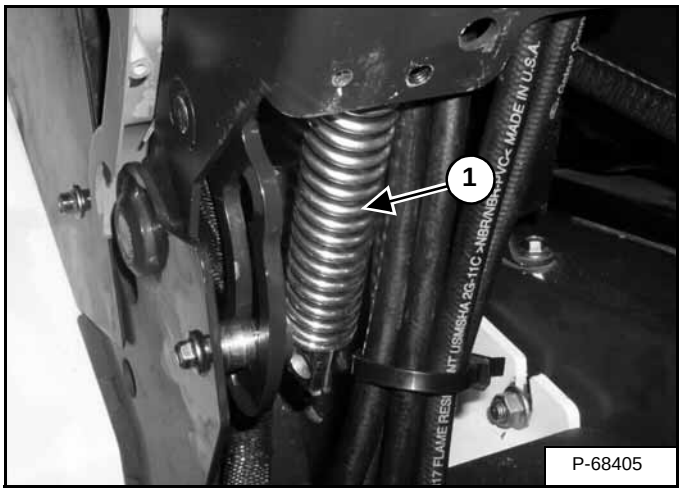
Install a pin (Item 1) **[Figure 40-50-14]** in the top of the compression spring rod.

Figure 40-50-15



Support the console in the raised position. Remove the bolt (Item 1) **[Figure 40-50-15]**.

Figure 40-50-16

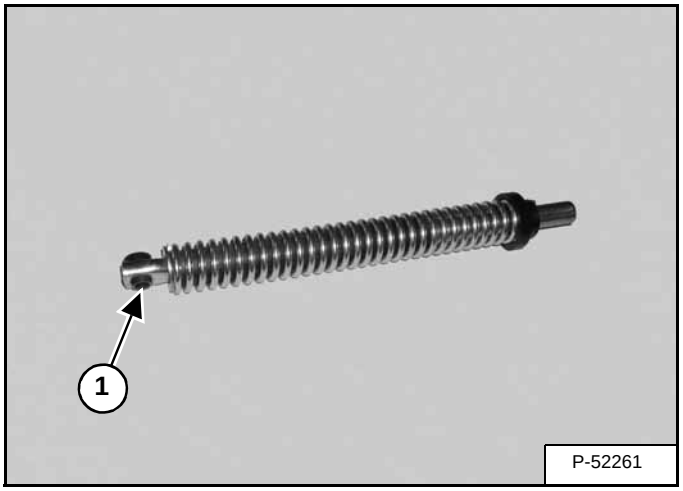


Remove the spring assembly (Item 1) **[Figure 40-50-16]** from the bottom of the console.

Dealer Copy -- Not for Resale

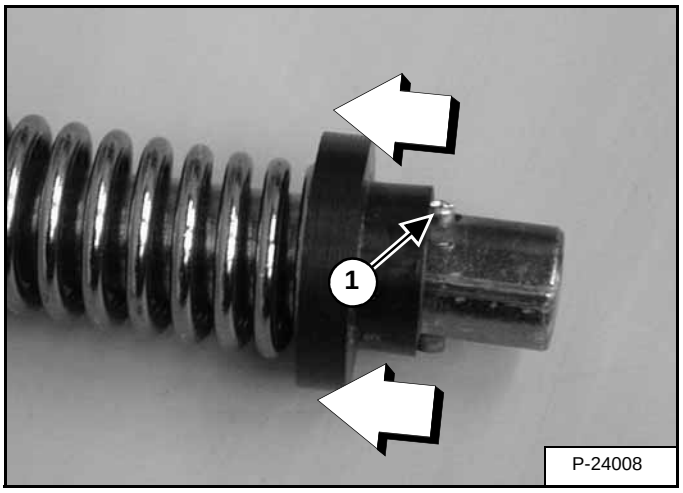
Compression Spring Disassembly And Assembly (Canopy Only)

Figure 40-50-17



Remove the bushing (Item 1) **[Figure 40-50-17]**.

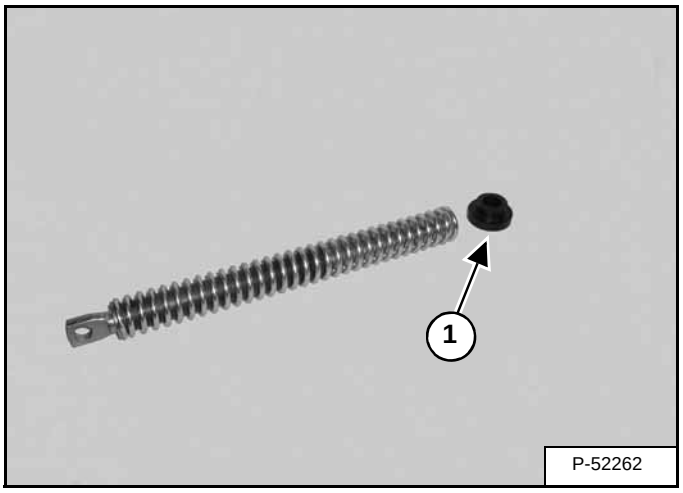
Figure 40-50-18



Apply pressure against the spring, and remove the pin (Item 1) **[Figure 40-50-18]** from the shaft.

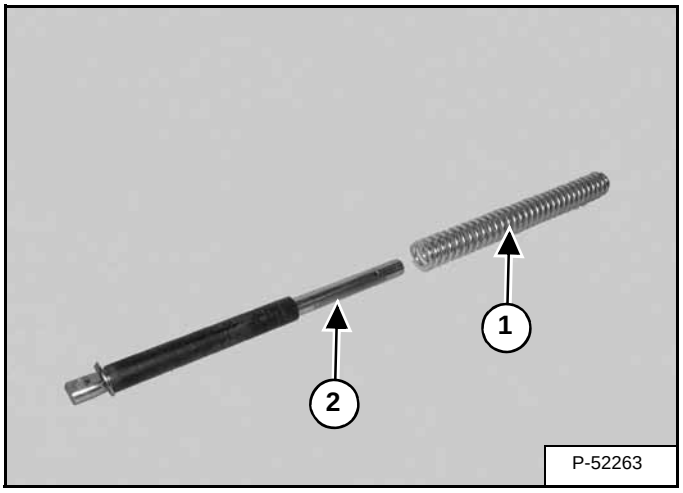
Release the pressure from the spring.

Figure 40-50-19



Remove the bushing (Item 1) **[Figure 40-50-19]**.

Figure 40-50-20

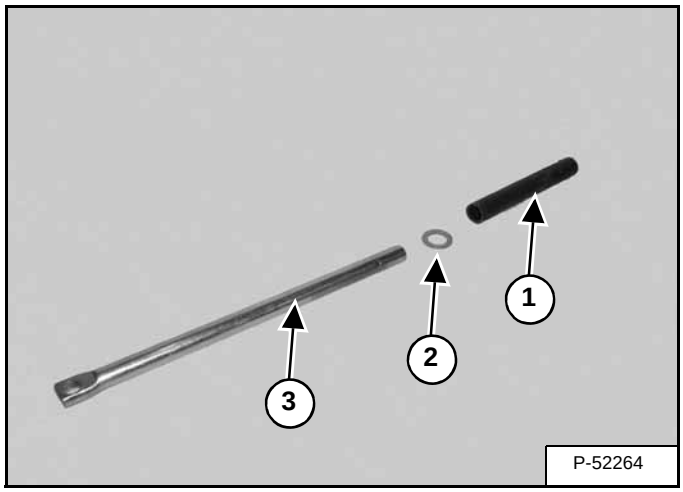


Remove the spring (Item 1) from the shaft (Item 2) **[Figure 40-50-20]**.

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Compression Spring Disassembly And Assembly (Canopy Only) (Cont'd)

Figure 40-50-21



Remove the sleeve (Item 1) and washer (Item 2) from the shaft (Item 3) **[Figure 40-50-21]**.

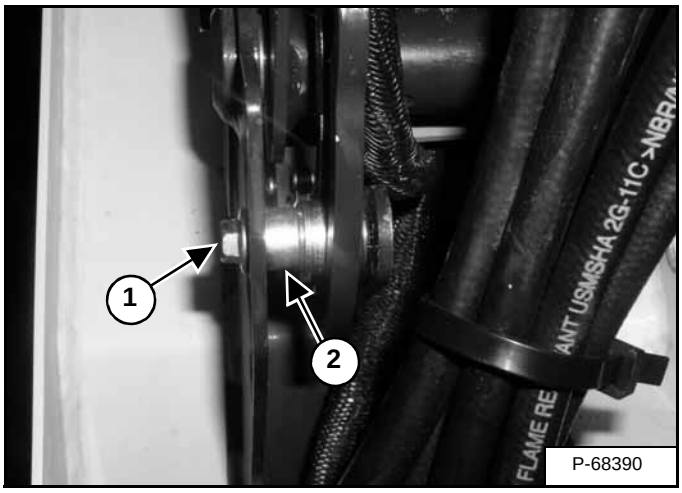
Lever Removal And Installation (Canopy Only)

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 40-50-22



Remove the bolt (Item 1) from the lever bearing (Item 2) **[Figure 40-50-22]**.

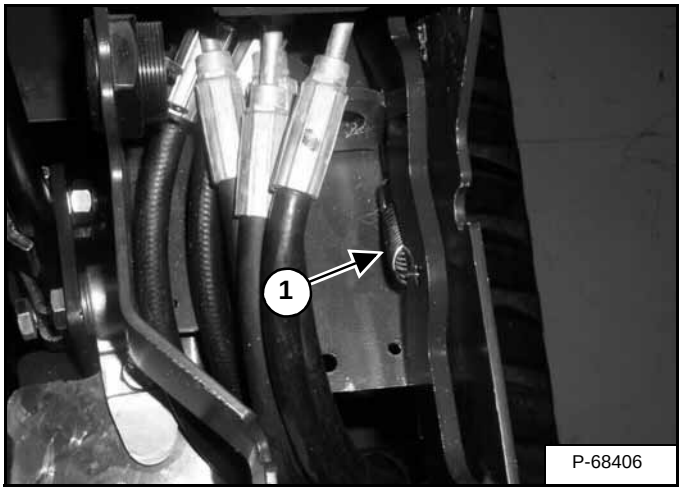
Remove the lever bearing (Item 2) **[Figure 40-50-22]**.

Lower the console.

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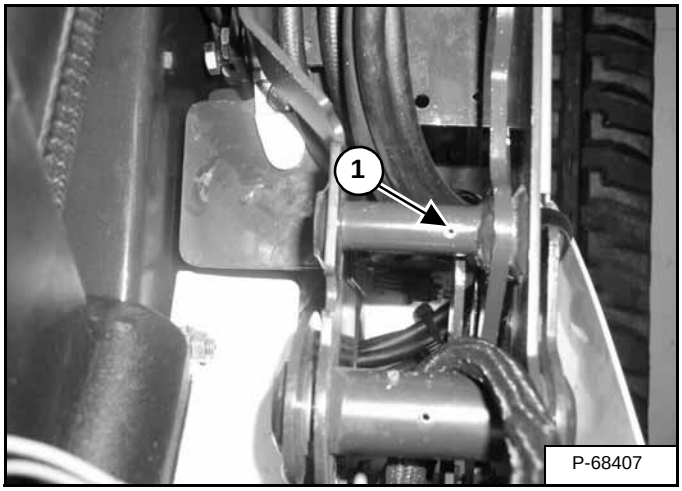
Lever Removal And Installation (Canopy Only) (Cont'd)

Figure 40-50-23



Remove the spring (Item 1) **[Figure 40-50-23]** from the console and lever.

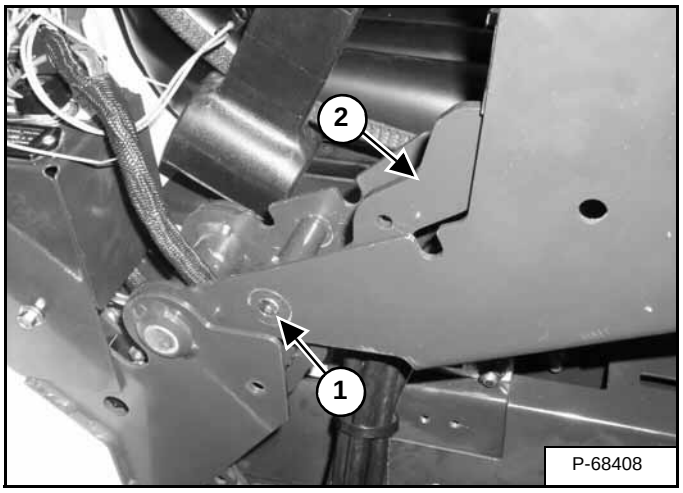
Figure 40-50-24



Remove the roll pin (Item 1) **[Figure 40-50-24]** from the lever pivot pin.

Raise and support the console.

Figure 40-50-25



Remove the pivot pin (Item 1) **[Figure 40-50-25]** from the lever.

Remove the lever (Item 2) **[Figure 40-50-25]** from the console.

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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)

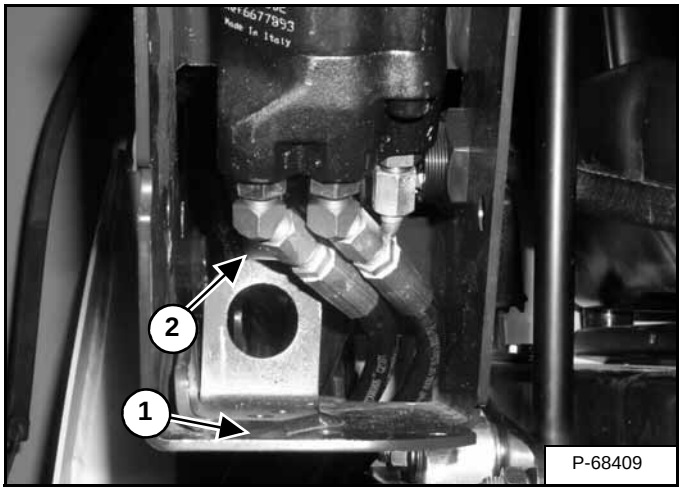
Remove the lever. (See Lever Removal And Installation (Canopy Only) on Page 40-50-6)

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.

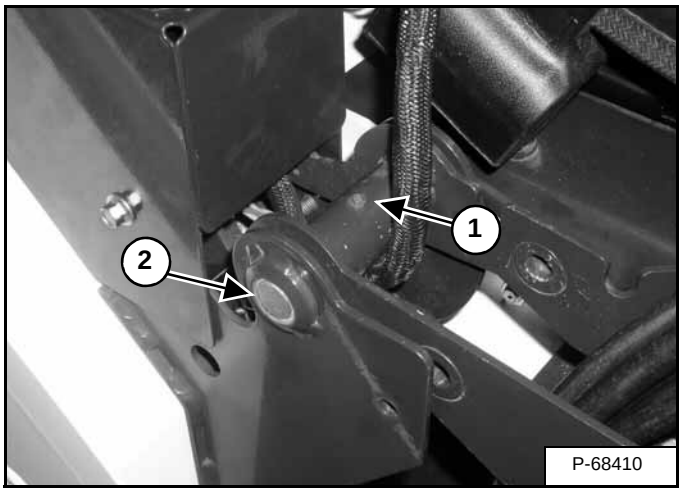
I-2003-0888

Figure 40-50-26



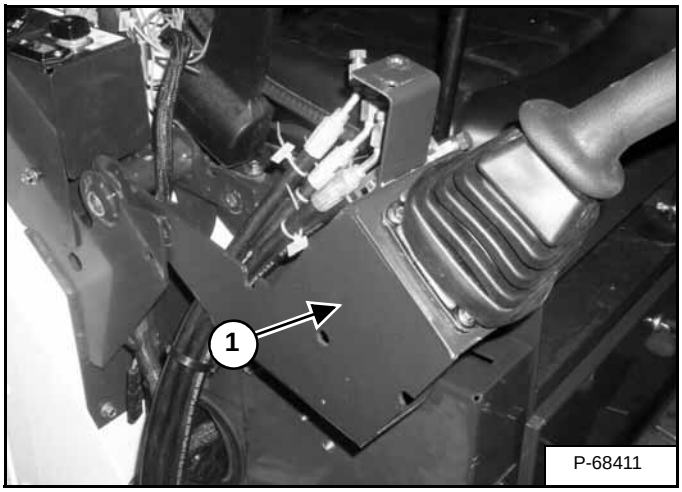
Mark the hoses for ease of assembly. Remove and cap the six hoses (Item 2) **[Figure 40-50-26]** from the joystick.

Figure 40-50-27



Remove the roll pin (Item 1) and the pivot pin (Item 2) **[Figure 40-50-27]**.

Figure 40-50-28

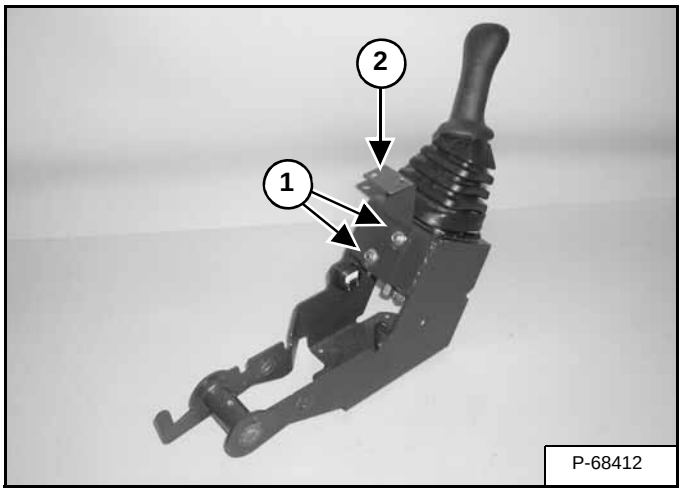


Remove the joystick console frame (Item 1) **[Figure 40-50-28]** from the excavator.

Dealer Copy -- Not for Resale

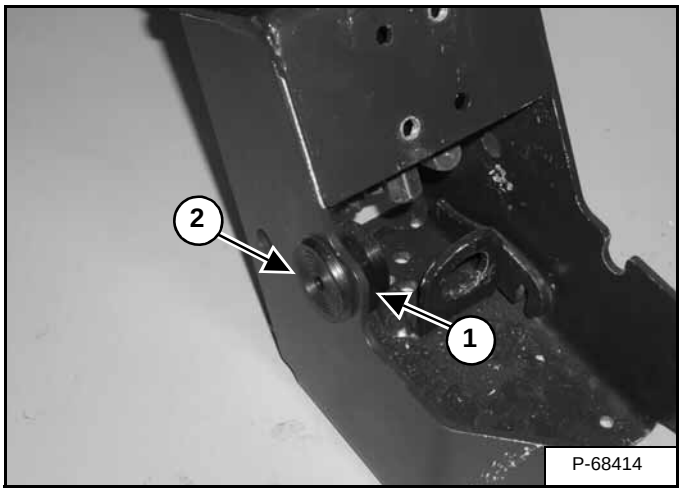
Joystick Console Frame Disassembly And Assembly

Figure 40-50-29



Remove the screws (Item 1) and bracket (Item 2) **[Figure 40-50-29]**.

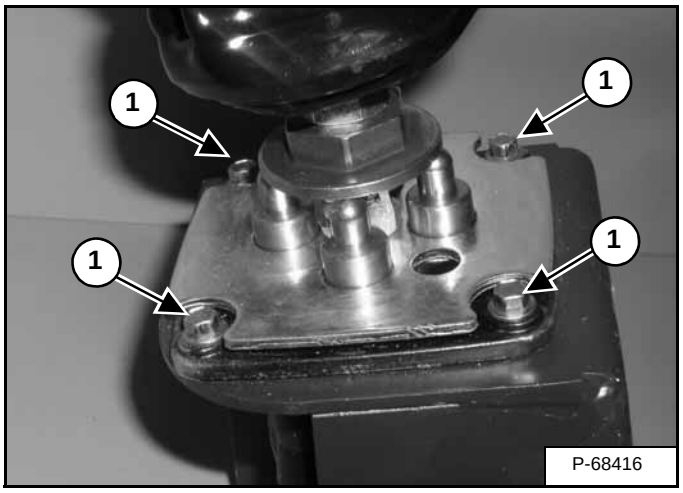
Figure 40-50-30



Remove the nut (Item 1) **[Figure 40-50-30]** from the buzzer.

Remove the buzzer (Item 2) **[Figure 40-50-30]**.

Figure 40-50-31



Lift the joystick boot.

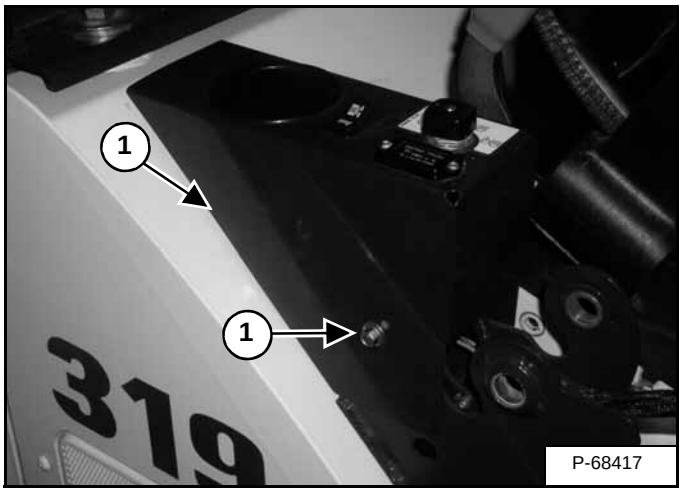
Remove the screws (Item 1) **[Figure 40-50-31]** from the joystick bracket.

Remove the joystick from the console frame.

Dealer Copy -- Not for Resale

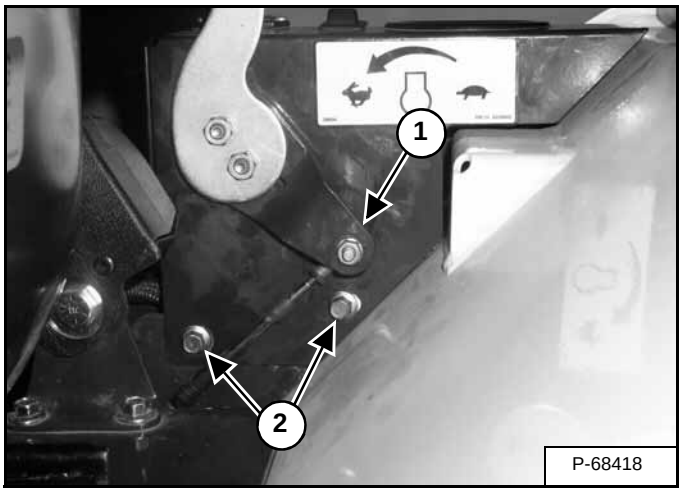
Right Rear Console Cover Removal And Installation

Figure 40-50-32



Remove the console cover screw (Item 1) **[Figure 40-50-32]**.

Figure 40-50-33

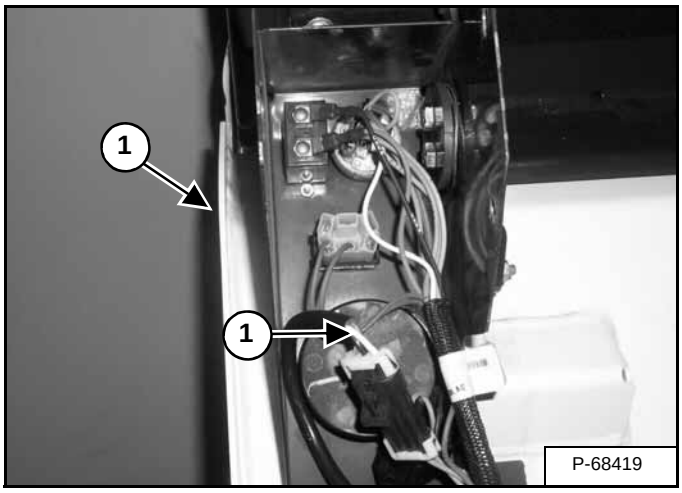


Remove the throttle linkage from the ball on the back side of the lever (Item 1) **[Figure 40-50-33]**.

Remove the console cover screws (Item 2) **[Figure 40-50-33]**.

Lift the console cover.

Figure 40-50-34



Lift the right rear console cover and mark the wires for ease of assembly.

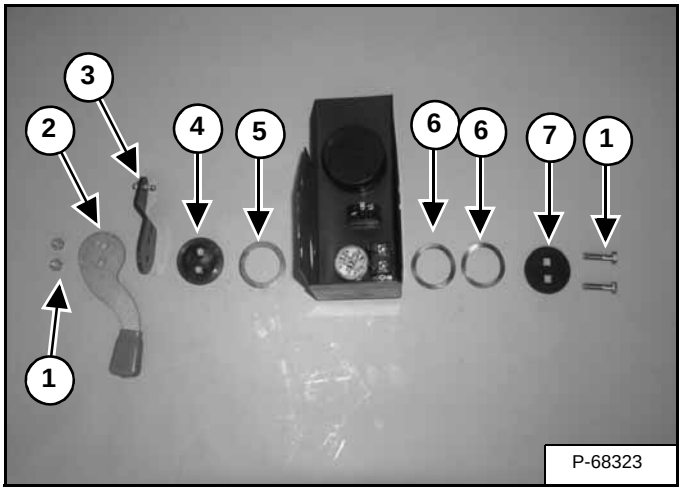
Disconnect the wires and connectors (Item 1) **[Figure 40-50-34]** from the hourmeter, light switch, track expansion/blade switch, and microswitch.

Remove the right rear console cover from the excavator.

Dealer Copy -- Not for Resale

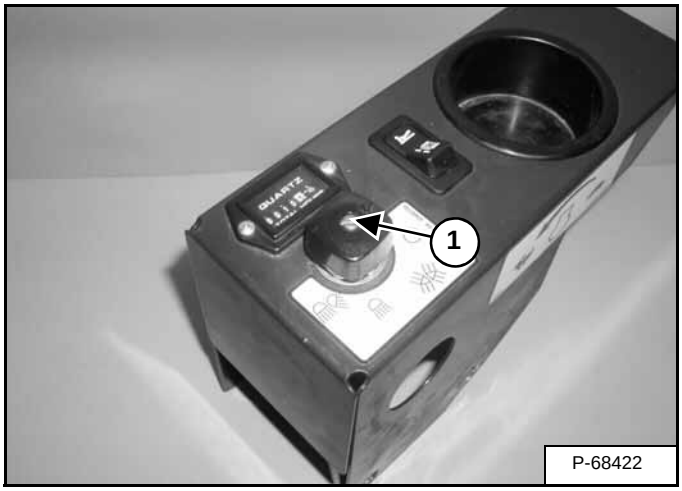
Right Rear Console Cover Disassembly and Assembly

Figure 40-50-35



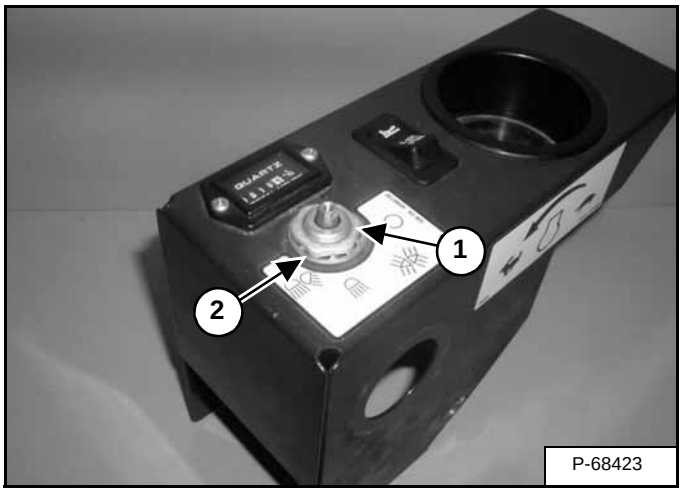
Remove the bolts and nuts (Item 1), lever (Item 2), the bracket (Item 3), the nylon spacer (Item 4), friction washer (Item 5), the two wave washers (Item 6), and the spacer (Item 7) **[Figure 40-50-35]**.

Figure 40-50-36



Remove the screw and lock washer (Item 1) and knob (Item 2) **[Figure 40-50-36]** from the light switch.

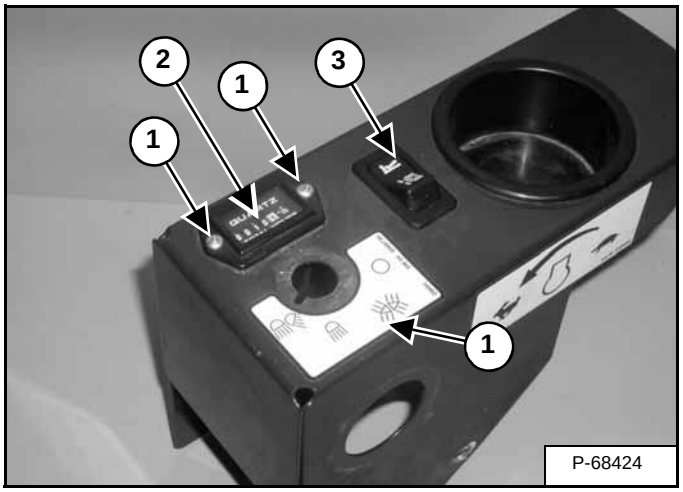
Figure 40-50-37



Remove the nut (Item 1) and lock washer (Item 2) **[Figure 40-50-37]** from the light switch.

Remove the light switch (Item 1) **[Figure 40-50-37]**.

Figure 40-50-38



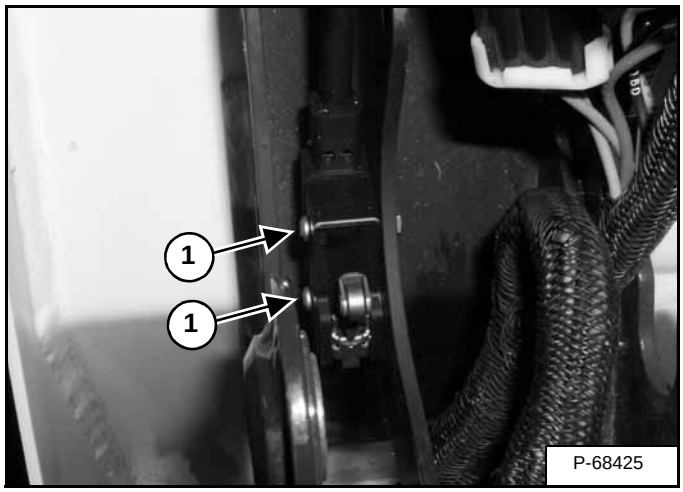
Remove the two screws and nuts (Item 1) from the hourmeter. Remove the hourmeter (Item 2) **[Figure 40-50-38]**.

Remove the track expansion/blade switch (Item 3) **[Figure 40-50-38]** from the right rear console cover.

Dealer Copy -- Not for Resale

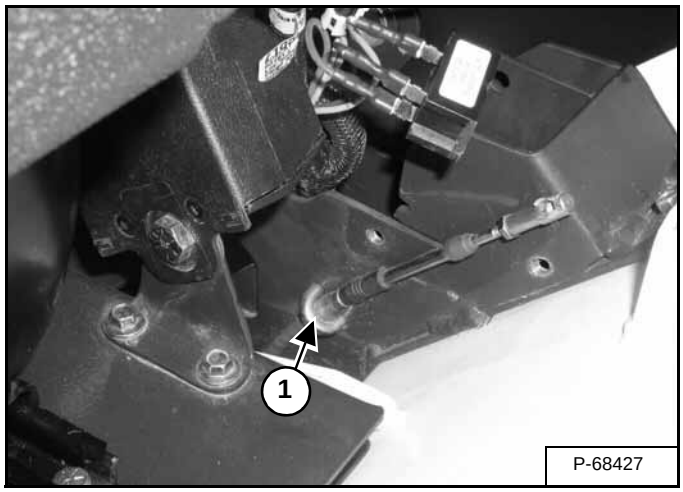
Right Rear Console Frame Removal And Installation

Figure 40-50-39



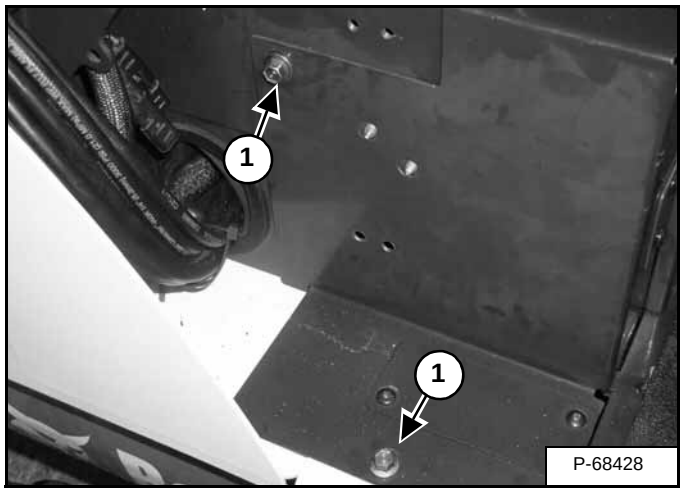
Remove the two screws and nuts (Item 1) **[Figure 40-50-39]** from the right rear console microswitch. Remove the microswitch.

Figure 40-50-40



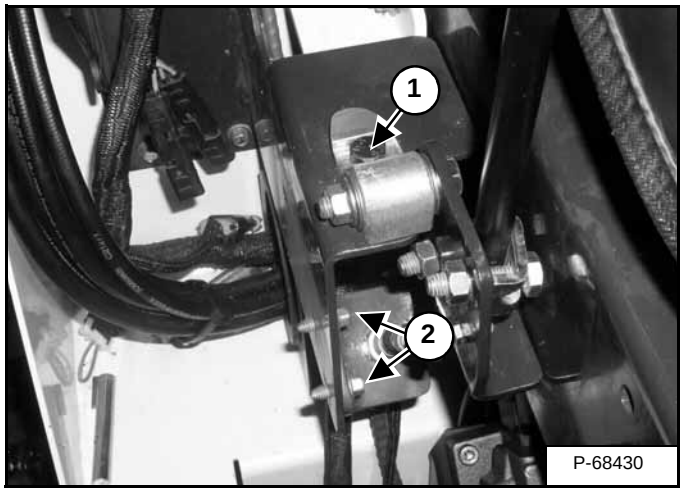
Remove the throttle canle clamp (Item 1) **[Figure 40-50-40]**.

Figure 40-50-41



Remove the two screws (Item 1) **[Figure 40-50-41]** from the right side cover. Remove the right side cover.

Figure 40-50-42



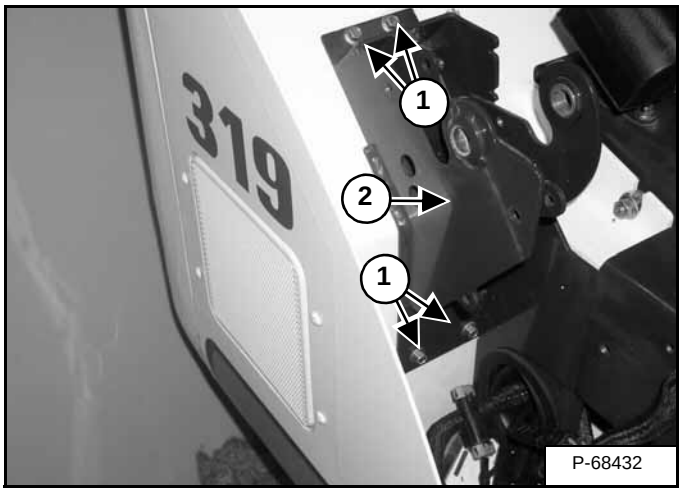
Remove the bolt and nut (Item 1) **[Figure 40-50-42]** from the blade lever bearing block.

Remove the two screws (Item 2) **[Figure 40-50-42]** from the blade lever cable bracket.

Dealer Copy -- Not for Resale

Right Rear Console Frame Removal And Installation (Cont'd)

Figure 40-50-43



Remove the four bolts (Item 1) **[Figure 40-50-43]**.

Remove the right rear console frame (Item 2) **[Figure 40-50-43]**. The joystick pilot hoses will slide through the rubber as the console frame is removed.

Dealer Copy -- Not for Resale



Dealer Copy -- Not for Resale

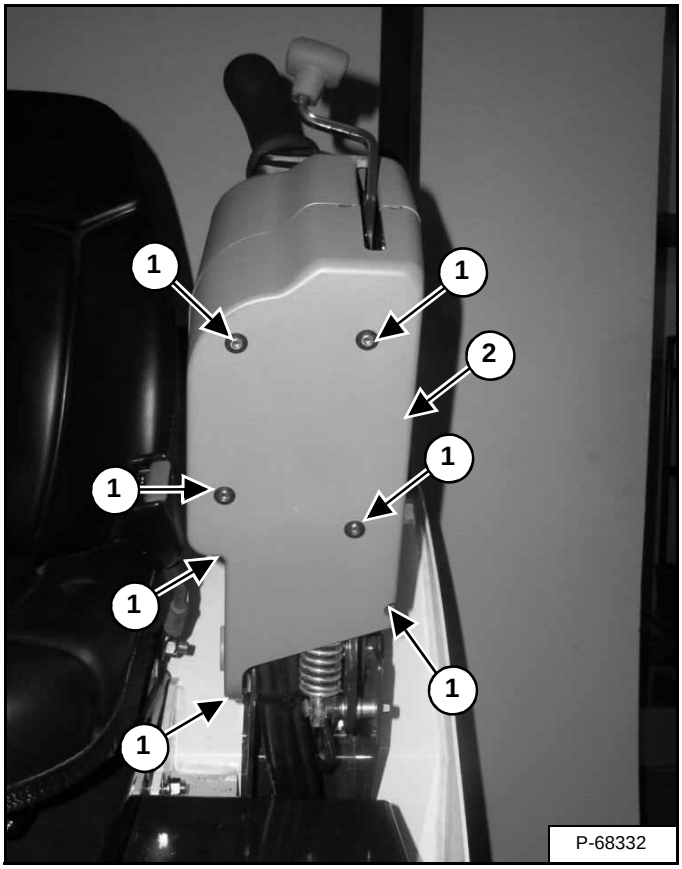
LEFT CONSOLE

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 40-60-44



Remove the seven screws (Item 1) **[Figure 40-60-44]** from the lower half of the joystick console cover.

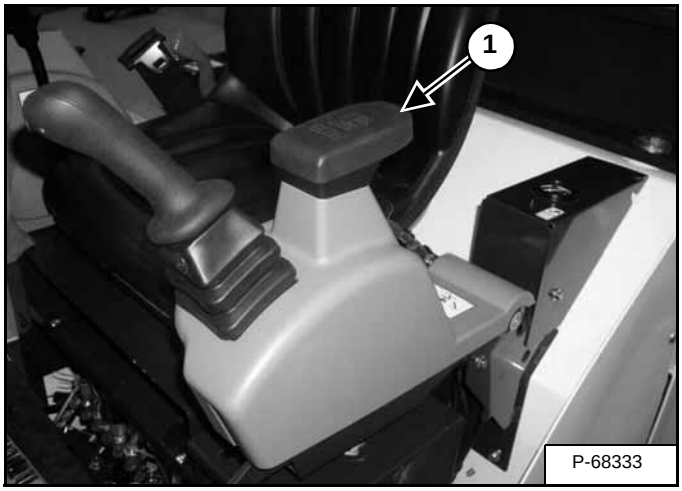
Remove the lower half of the joystick console cover (Item 2) **[Figure 40-60-44]**.

Lower the left console.

Dealer Copy -- Not for Resale

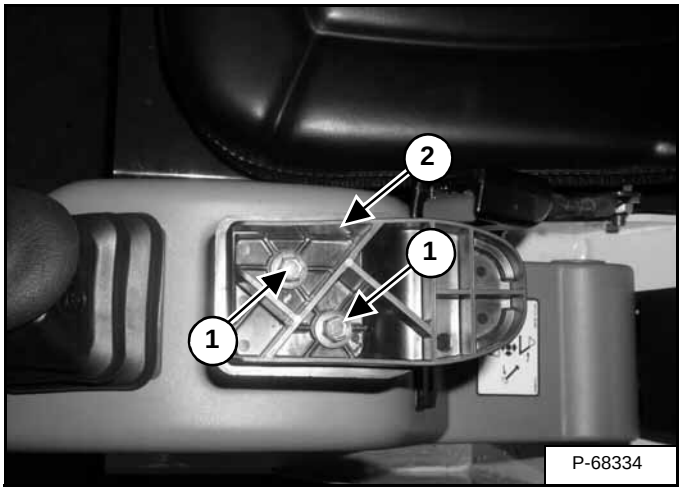
Joystick Console Cover (Top) Removal And Installation

Figure 40-60-45



Remove the cover (Item 1) **[Figure 40-60-45]** from the arm rest.

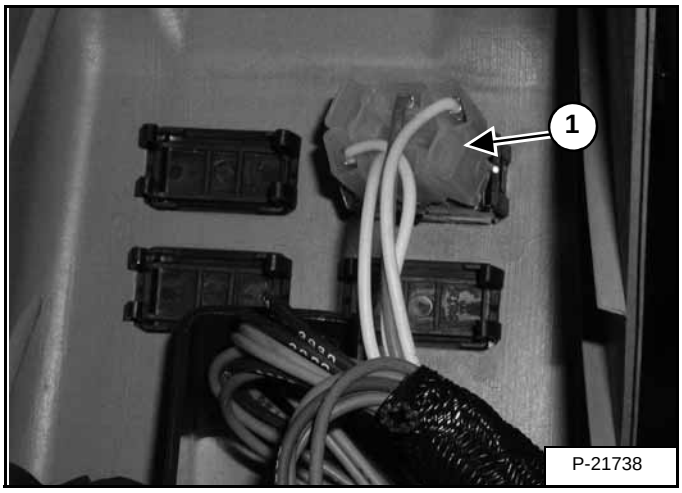
Figure 40-60-46



Remove the bolts (Item 1) **[Figure 40-60-46]** from the arm rest.

Remove the arm rest (Item 2) **[Figure 40-60-46]**.

Figure 40-60-47

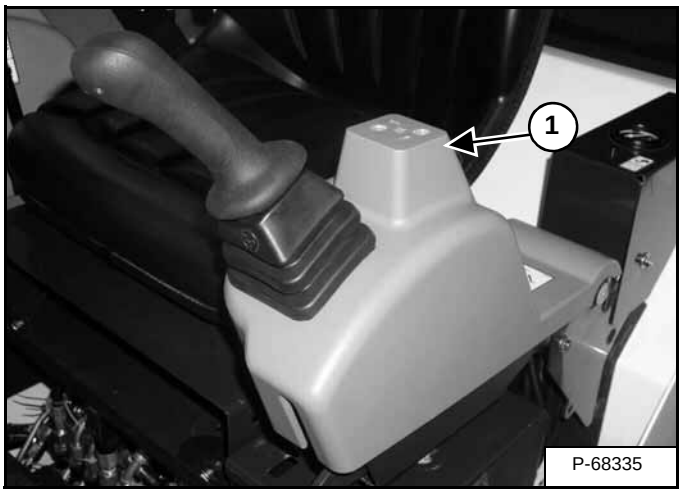


Raise the upper half of the joystick console cover to expose the electrical connectors if accessories are installed.

Disconnect the electrical connector(s) (Item 1) **[Figure 40-60-47]** if installed.

NOTE: These connectors are keyed so they can be plugged in only one way.

Figure 40-60-48



Remove the upper half of the joystick console cover (Item 1) **[Figure 40-60-48]** over the joystick.

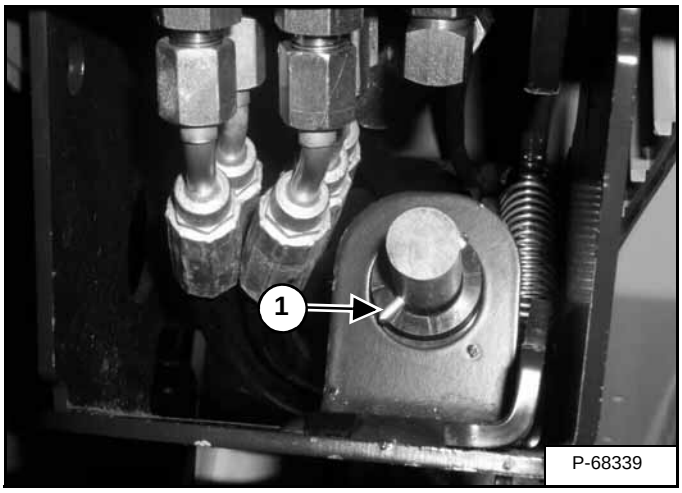
Dealer Copy -- Not for Resale

Compression Spring Removal And Installation

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

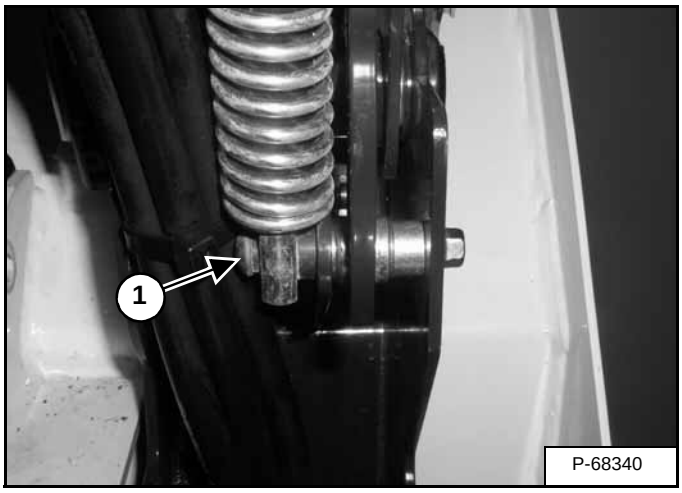
Lower the console.

Figure 40-60-49



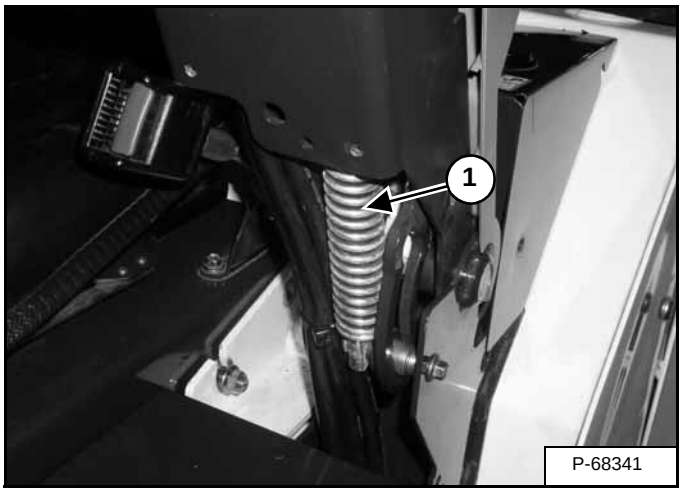
Install a pin (Item 1) **[Figure 40-60-49]** in the top of the compression spring rod.

Figure 40-60-50



Support the console in the raised position. Remove the bolt (Item 1) **[Figure 40-60-50]**.

Figure 40-60-51

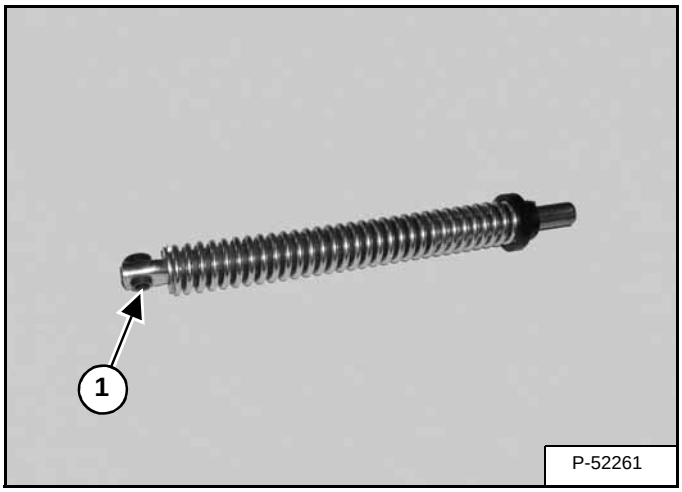


Remove the spring assembly (Item 1) **[Figure 40-60-51]** from the bottom of the console.

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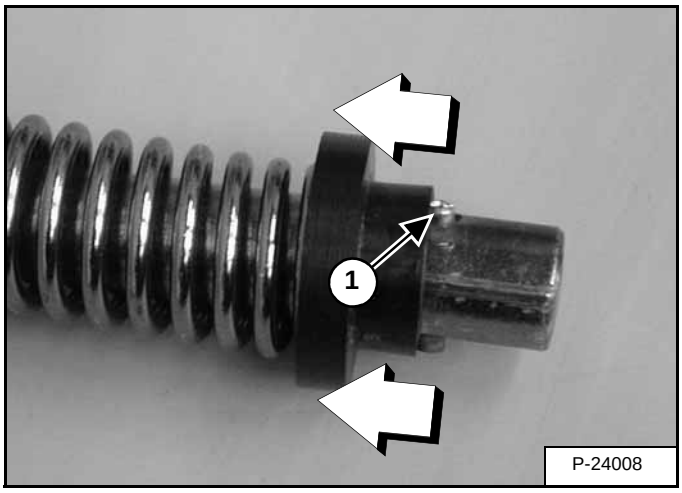
Compression Spring Disassembly And Assembly

Figure 40-60-52



Remove the bushing (Item 1) **[Figure 40-60-52]**.

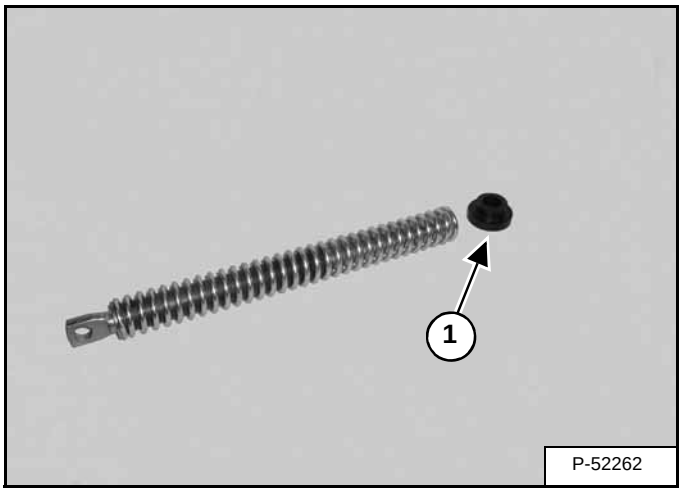
Figure 40-60-53



Apply pressure against the spring, and remove the pin (Item 1) **[Figure 40-60-53]** from the shaft.

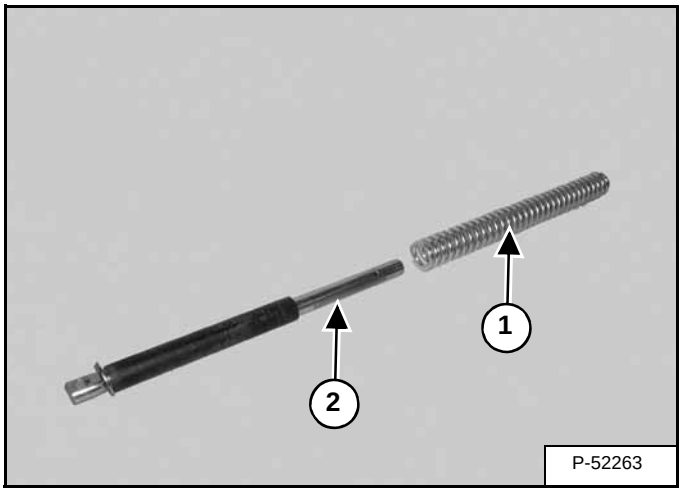
Release the pressure from the spring.

Figure 40-60-54



Remove the bushing (Item 1) **[Figure 40-60-54]**.

Figure 40-60-55

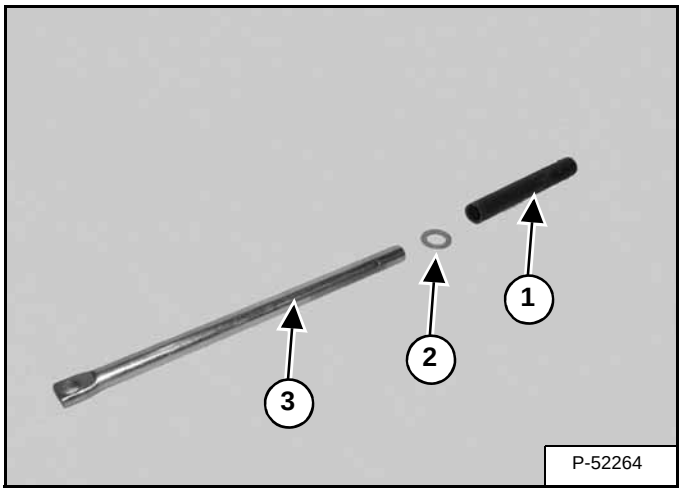


Remove the spring (Item 1) from the shaft (Item 2) **[Figure 40-60-55]**.

Dealer Copy -- Not for Resale

Compression Spring Disassembly And Assembly (Cont'd)

Figure 40-60-56



Remove the sleeve (Item 1) and washer (Item 2) from the shaft (Item 3) **[Figure 40-60-56]**.

Dealer Copy -- Not for Resale

LEFT CONSOLE (CONT'D)

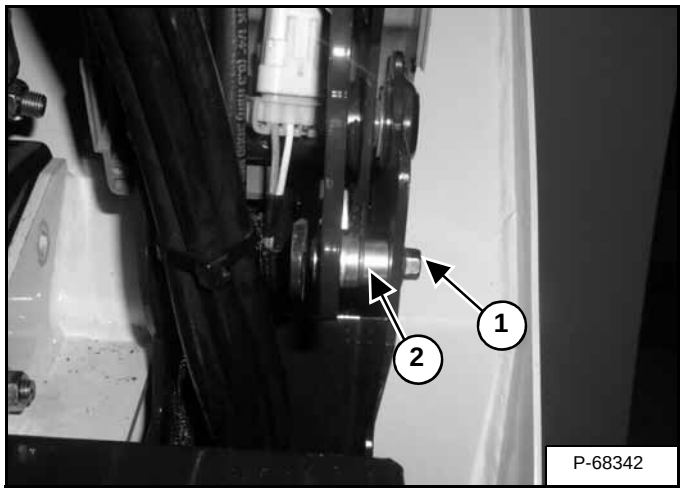
Lever Removal And Installation

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 40-60-57

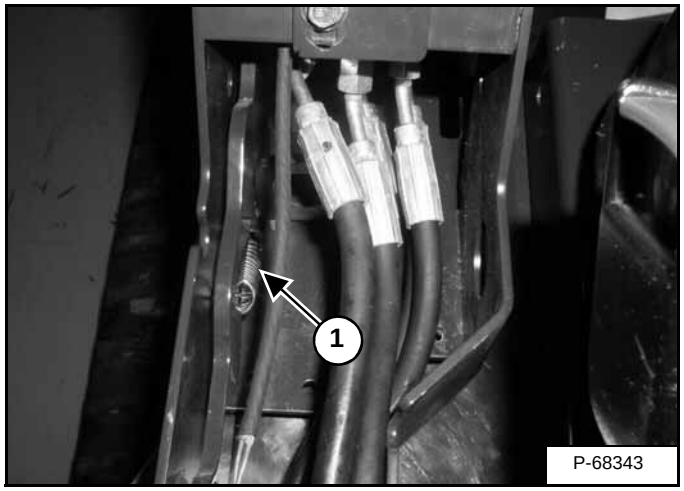


Remove the bolt (Item 1) from the lever bearing (Item 2) **[Figure 40-60-57]**.

Remove the lever bearing (Item 2) **[Figure 40-60-57]**.

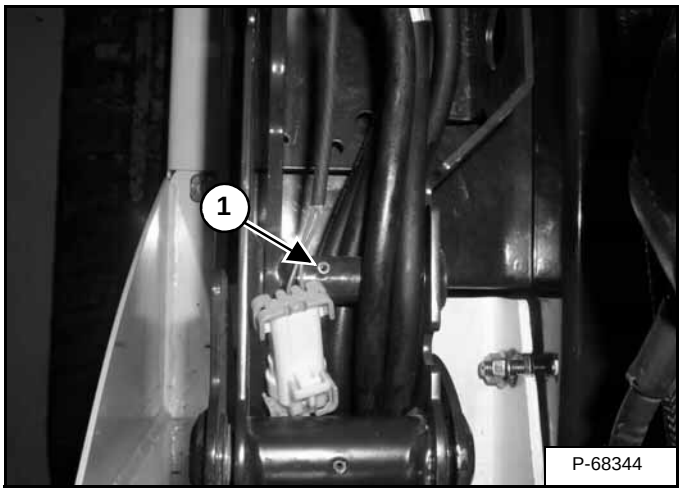
Lower the console.

Figure 40-60-58



Remove the spring (Item 1) **[Figure 40-60-58]** from the console and lever.

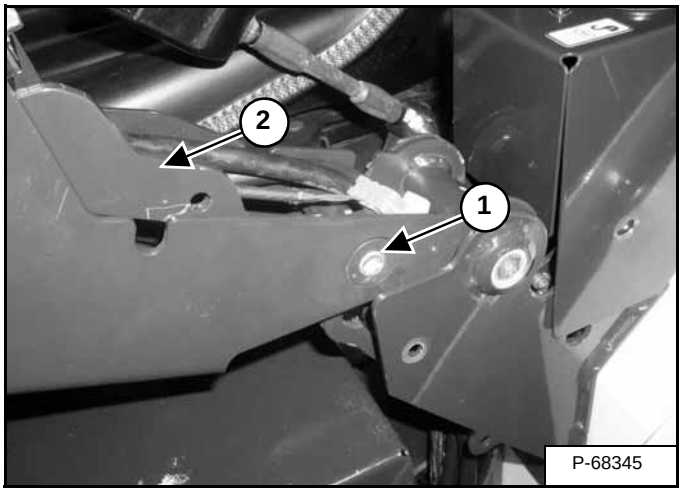
Figure 40-60-59



Remove the roll pin (Item 1) **[Figure 40-60-59]** from the lever pivot pin.

Raise and support the console.

Figure 40-60-60



Remove the pivot pin (Item 1) **[Figure 40-60-60]** from the lever.

Remove the lever (Item 2) **[Figure 40-60-60]** from the console.

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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)

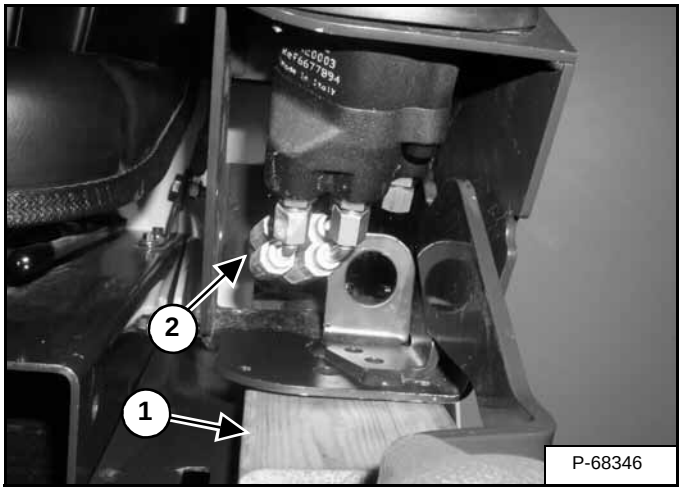
Remove the lever. (See Lever Removal And Installation on Page 40-60-6)

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

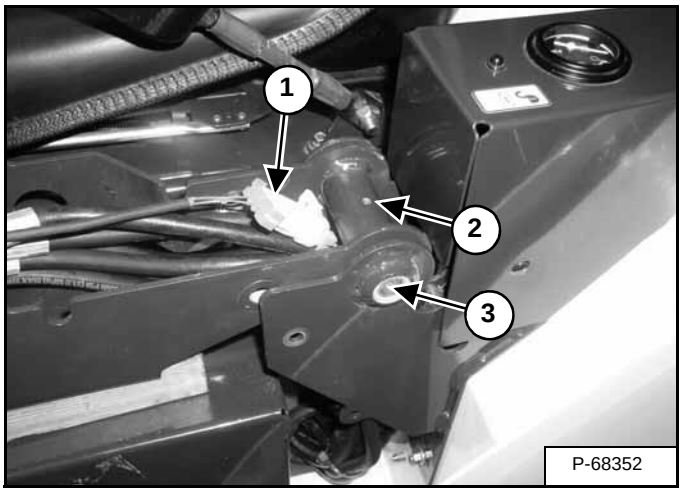
Figure 40-60-61



Lower the console on a support (Item 1) **[Figure 40-60-61]** 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 40-60-61]** from the joystick.

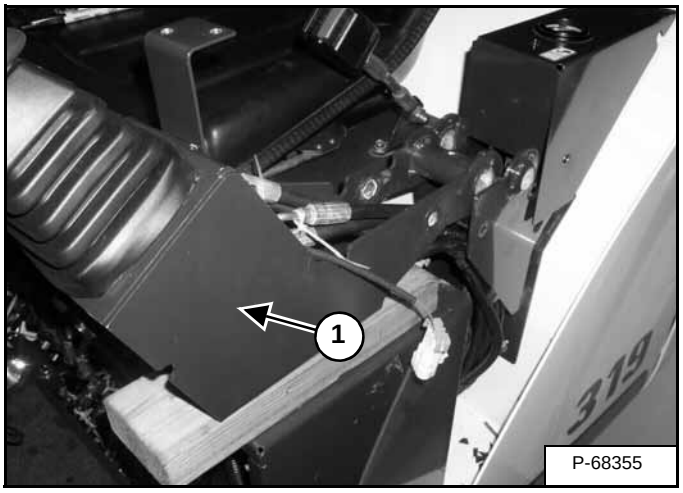
Figure 40-60-62



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 40-60-62]**.

Remove the roll pin (Item 2) and the pivot pin (Item 3) **[Figure 40-60-62]**.

Figure 40-60-63

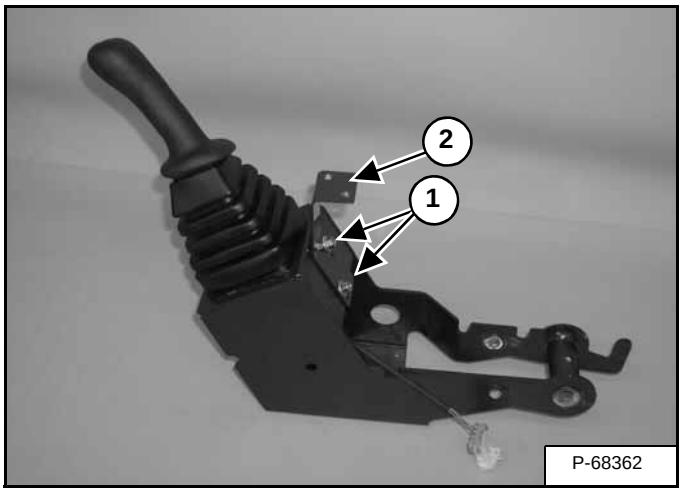


Remove the joystick console frame (Item 1) **[Figure 40-60-63]** from the excavator.

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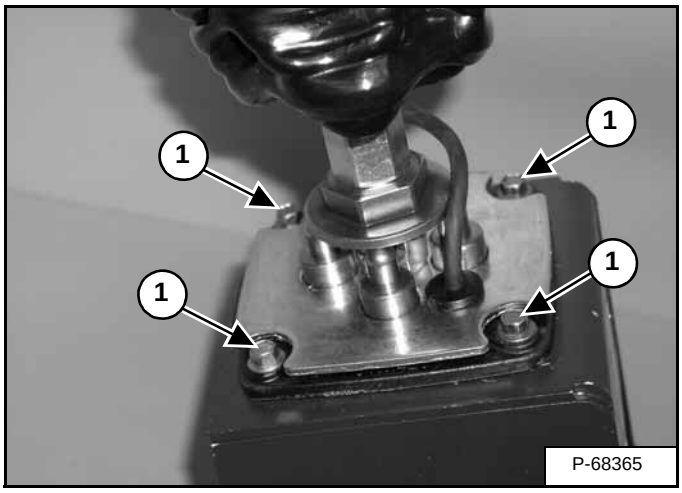
Joystick Console Frame Disassembly And Assembly

Figure 40-60-64



Remove the screws (Item 1) and bracket (Item 2) **[Figure 40-60-64]**.

Figure 40-60-65



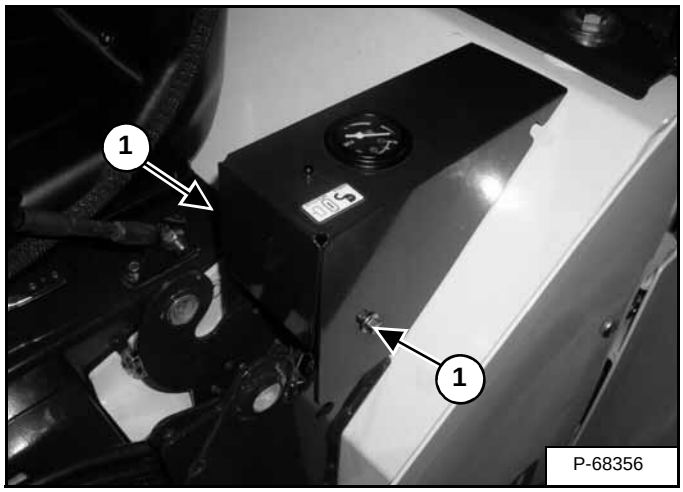
Lift the joystick boot.

Remove the screws (Item 1) **[Figure 40-60-65]** from the joystick bracket.

Remove the joystick from the console frame.

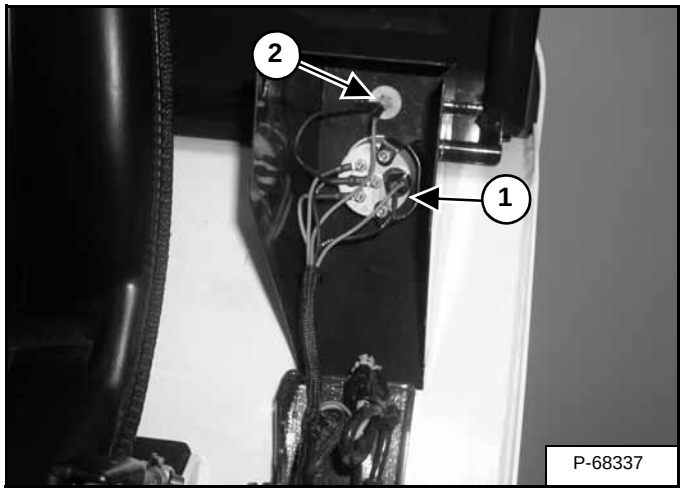
Left Rear Console Cover Removal And Installation

Figure 40-60-66



Remove the two console cover screws (Item 1) **[Figure 40-60-66]**.

Figure 40-60-67



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 40-60-67]**.

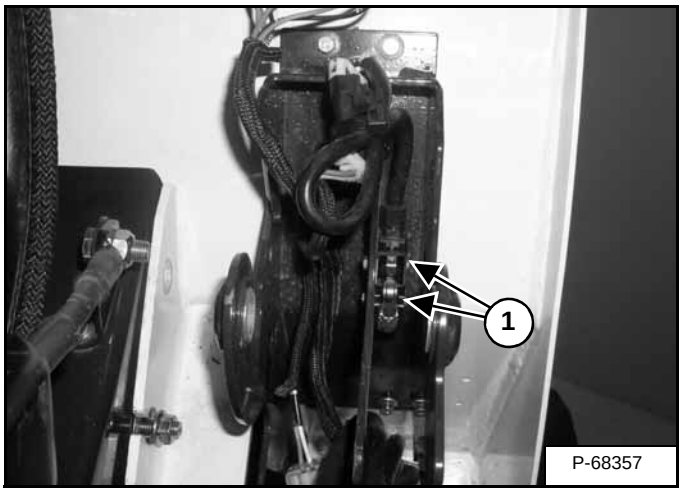
Disconnect the wires from the LED indicator (Item 2) **[Figure 40-60-67]**.

Remove the left rear console cover from the excavator.

Dealer Copy -- Not for Resale

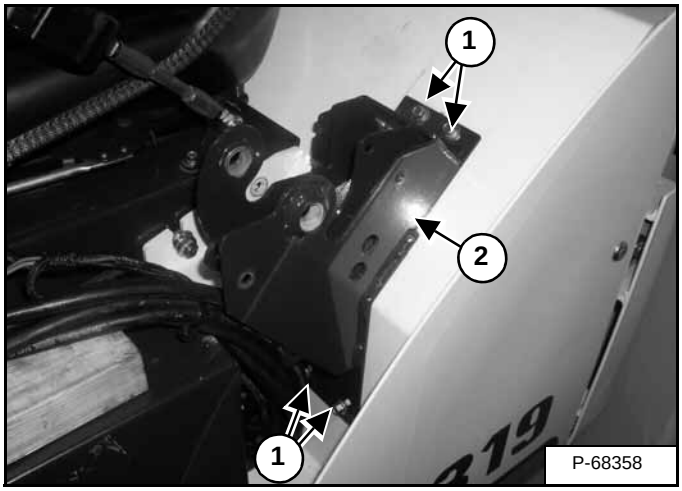
Left Rear Console Frame Removal And Installation

Figure 40-60-68



Remove the two screws (Item 1) **[Figure 40-60-68]** from the left rear console microswitch. Remove the microswitch.

Figure 40-60-69



Remove the four bolts (Item 1) **[Figure 40-60-69]**.

Remove the left rear console frame (Item 2) **[Figure 40-60-69]**. The joystick pilot hoses will slide through the rubber as the console frame is removed.

Dealer Copy -- Not for Resale

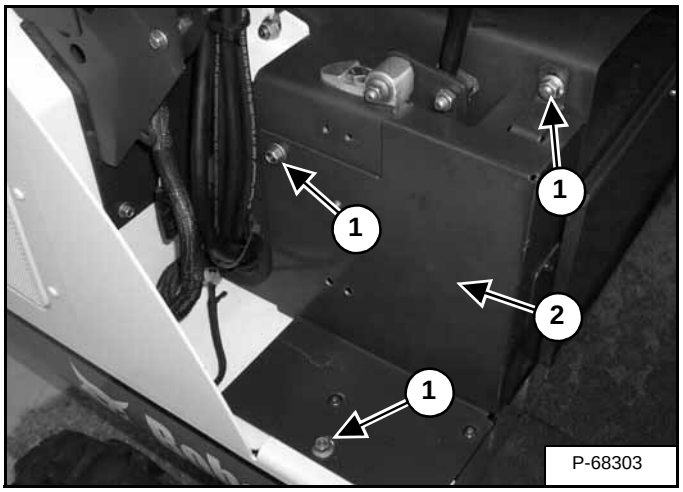


Dealer Copy -- Not for Resale

BLADE CONTROL

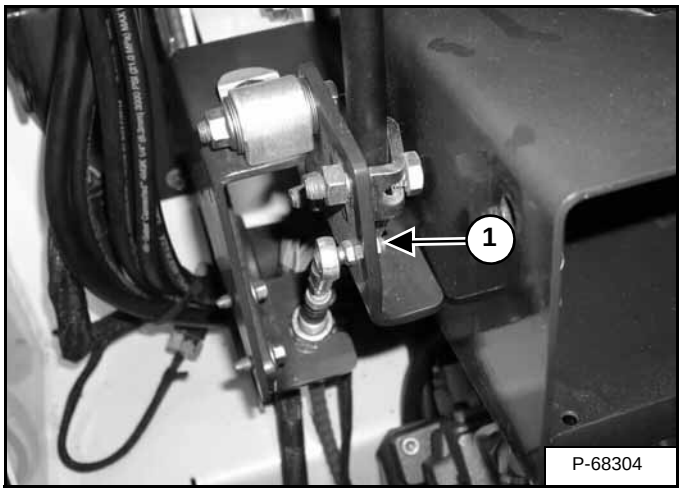
Removal and Installation

Figure 40-70-1



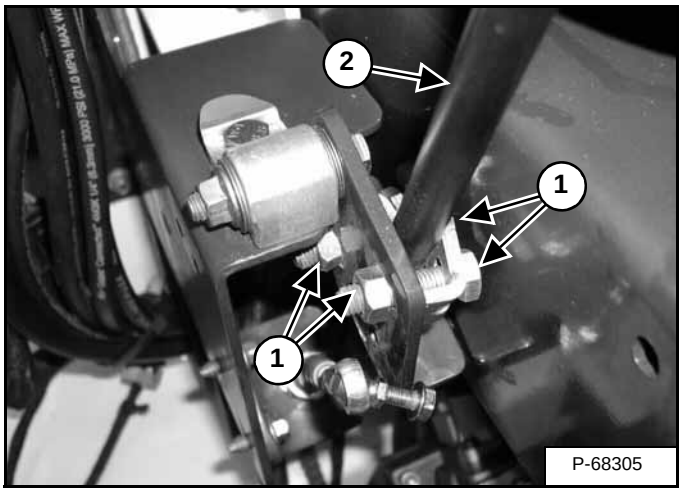
Remove the three bolts (Item 1) and remove the side panel (Item 2) **[Figure 40-70-1]**.

Figure 40-70-2



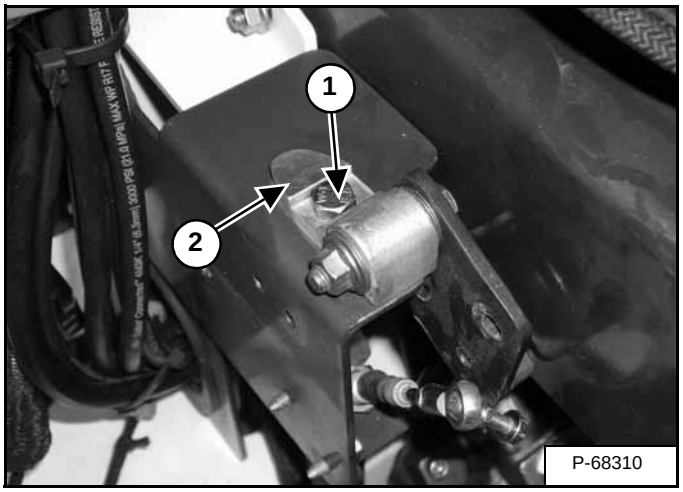
Remove the nut holding the ball joint of the blade/track expansion cable (Item 1) **[Figure 40-70-2]**.

Figure 40-70-3



Remove the bolts and clamps (Item 1). Remove the blade/track expansion lever (Item 2) **[Figure 40-70-3]**.

Figure 40-70-4



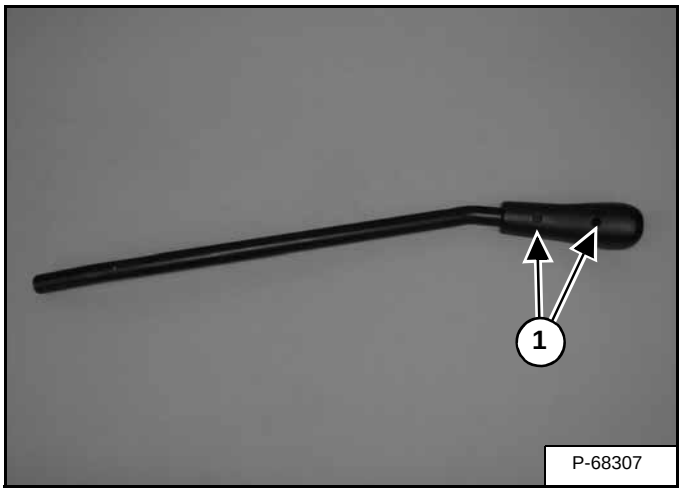
Remove the nut and bolt (Item 1) **[Figure 40-70-4]**.

Remove the bellcrank and pivot mount (Item 2) **[Figure 40-70-4]**.

Dealer Copy -- Not for Resale

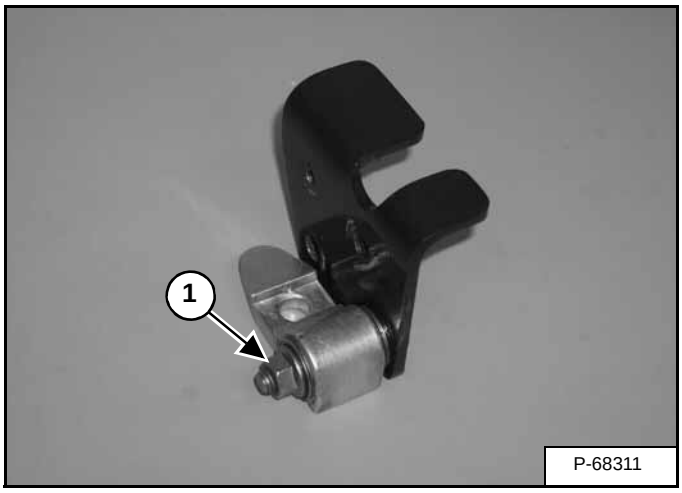
Disassembly And Assembly

Figure 40-70-5



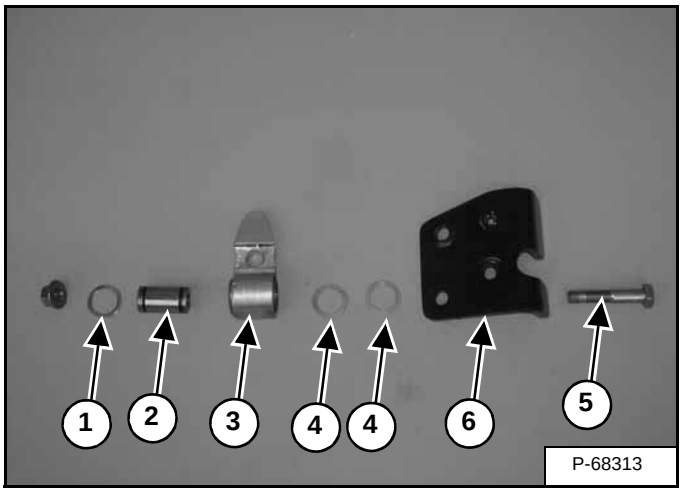
Remove the screws (Item 1) **[Figure 40-70-5]** and plastic handle halves.

Figure 40-70-6



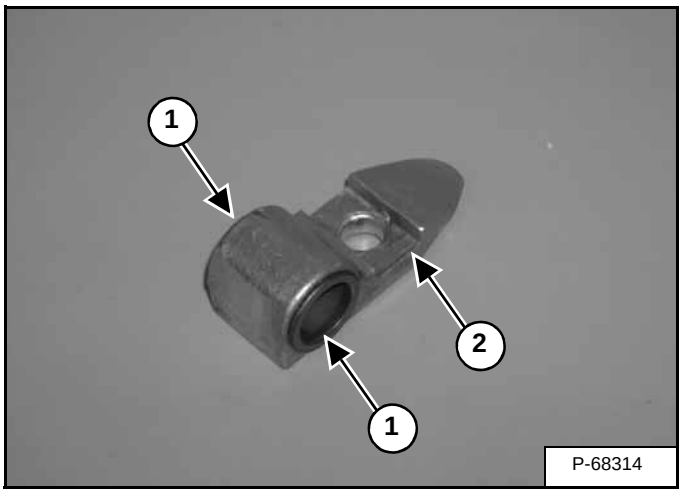
Remove the nut (Item 1) **[Figure 40-70-6]**.

Figure 40-70-7



Remove the washer (Item 1), sleeve (Item 2), bellcrank (Item 2), washers (Item 4) and bolt (Item 5) from the pivot mount (Item 6) **[Figure 40-70-7]**.

Figure 40-70-8

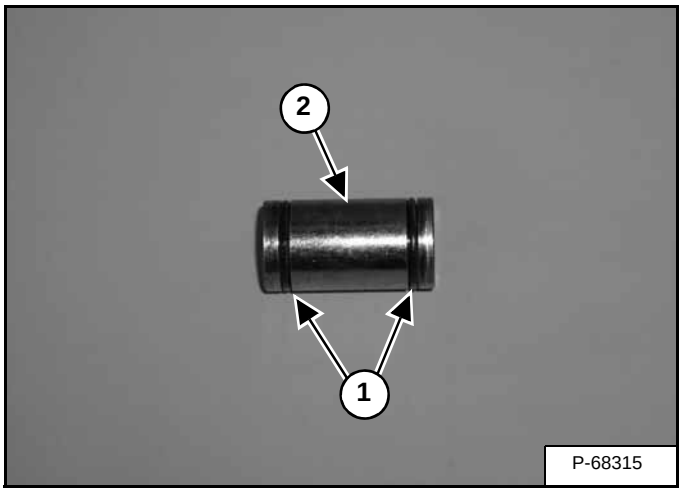


Remove the bushing (Item 1) from the bellcrank (Item 2) **[Figure 40-70-8]**. (Both Sides)

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Disassembly And Assembly (Cont'd)

Figure 40-70-9



Remove the O-rings (Item 1) from the sleeve (Item 2) **[Figure 40-70-9]**.

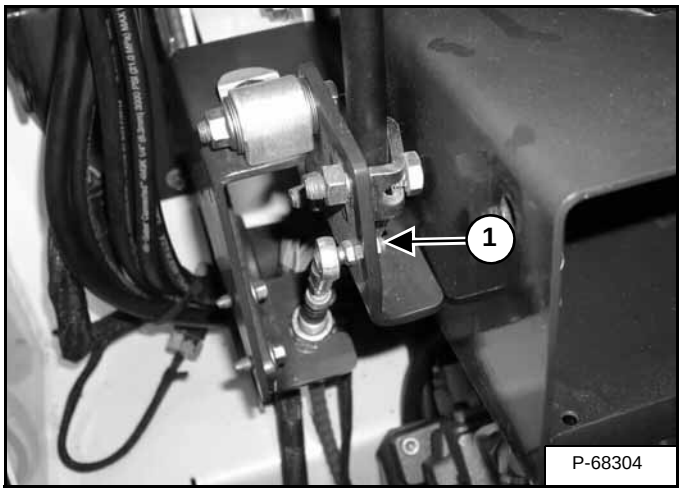
Dealer Copy -- Not for Resale

Cable Removal and Installation

Remove the floor mat and floor panels. (See FLOOR MAT AND FLOOR PANELS on Page 40-100-1)

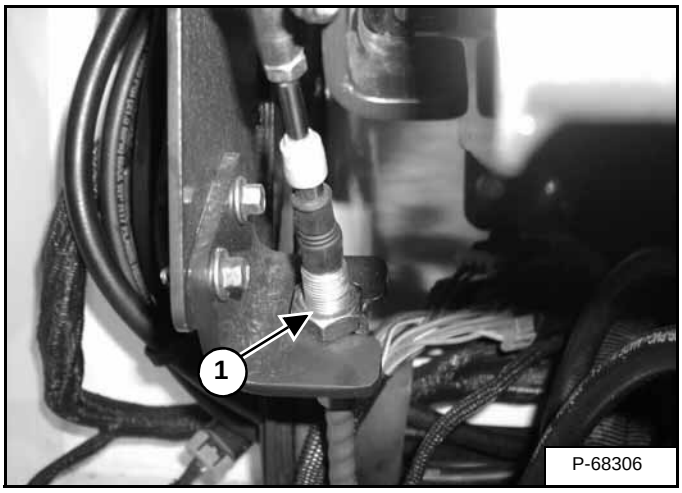
Remove the control linkage assembly. (See Removal And Installation on Page 40-90-1)

Figure 40-70-10



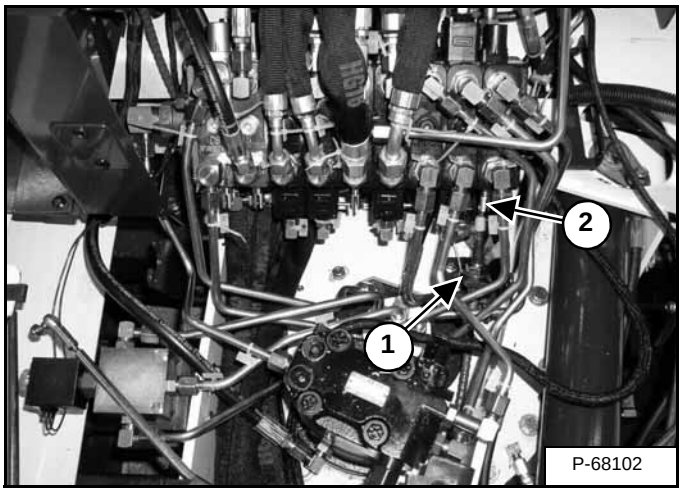
Remove the nut holding the ball joint of the blade/track expansion cable (Item 1) **[Figure 40-70-10]**.

Figure 40-70-11



Loosen the nut (Item 1) **[Figure 40-70-11]** and slide the cable assembly out of the bracket.

Figure 40-70-12



Loosen the nut (Item 1) and remove the clevis pin and cotter pin (Item 2) **[Figure 40-70-12]**.

Remove the cable (Item 3) **[Figure 40-70-12]**.

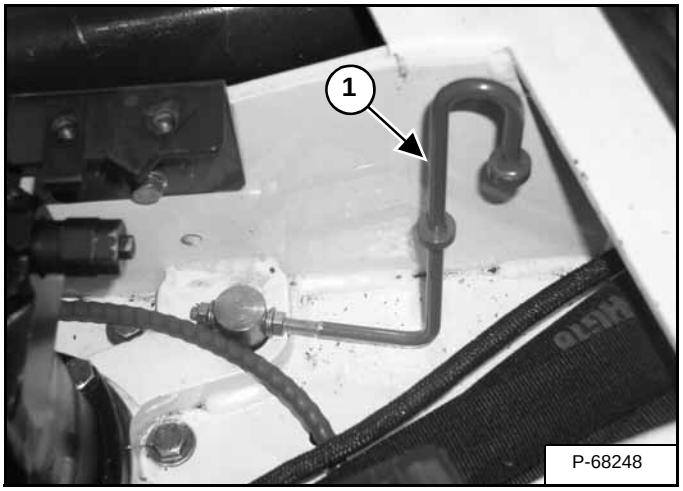
Dealer Copy -- Not for Resale

UPPERSTRUCTURE SLEW LOCK

Removal and Installation

Remove the floor mat and floor panels. (See FLOOR MAT AND FLOOR PANELS on Page 40-100-1)

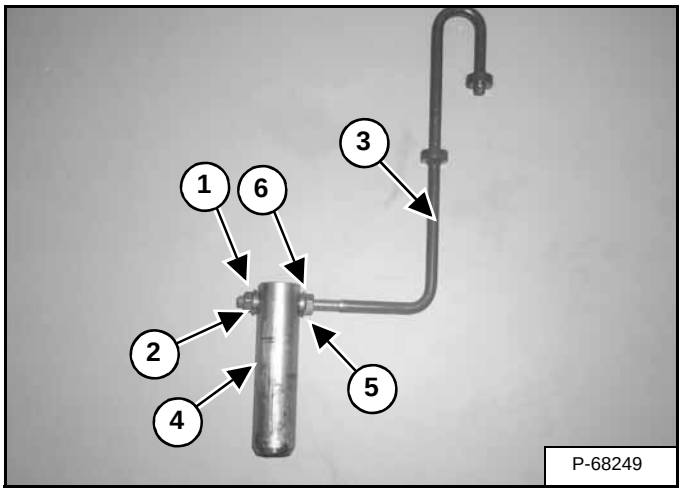
Figure 40-80-1



Remove the upperstructure slew lock lever (Item 1) **[Figure 40-80-1]** from the upperstructure.

Disassembly And Assembly

Figure 40-80-2



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 40-80-2]**.

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CONTROL LINKAGE ASSEMBLY

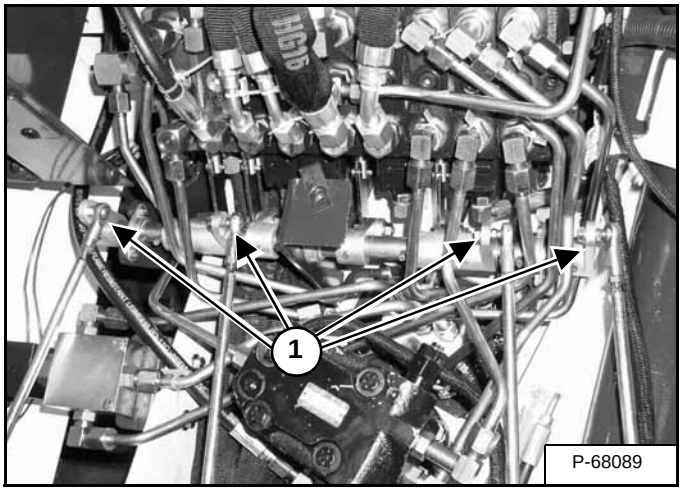
Description

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

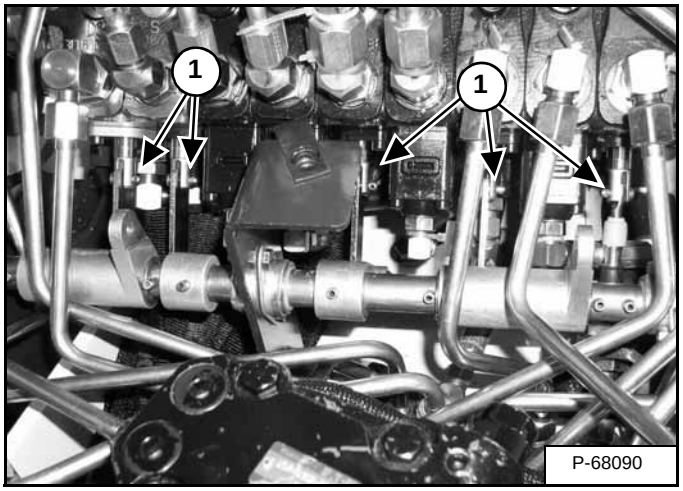
Remove the floor mat and floor panels. (See FLOOR MAT AND FLOOR PANELS on Page 40-100-1)

Figure 40-90-1



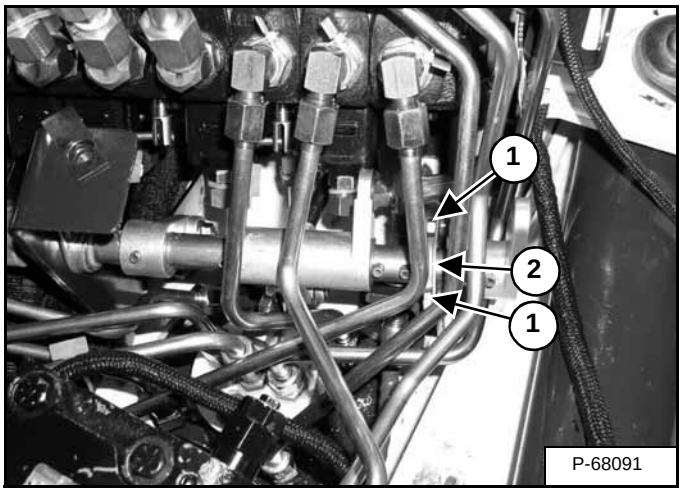
Remove the linkage rods (Item 1) **[Figure 40-90-1]** from the control linkage assembly.

Figure 40-90-2



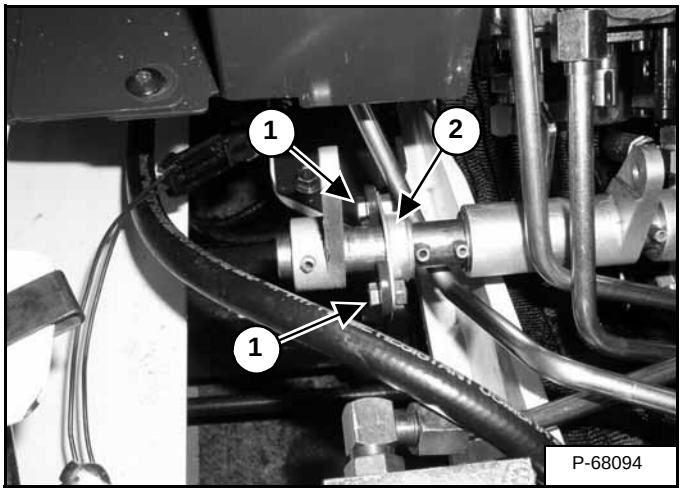
Remove the cotter pins and clevis pins (Item 1) **[Figure 40-90-2]** from the clevis at the control valve.

Figure 40-90-3



Remove the bolts and nuts (Item 1) from the bearing block (Item 2) **[Figure 40-90-3]**.

Figure 40-90-4

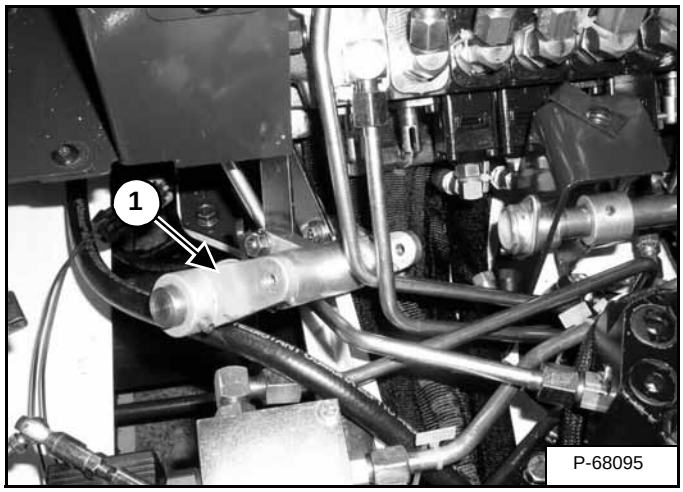


Remove the bolts and nuts (Item 1) from the bearing block (Item 2) **[Figure 40-90-4]**.

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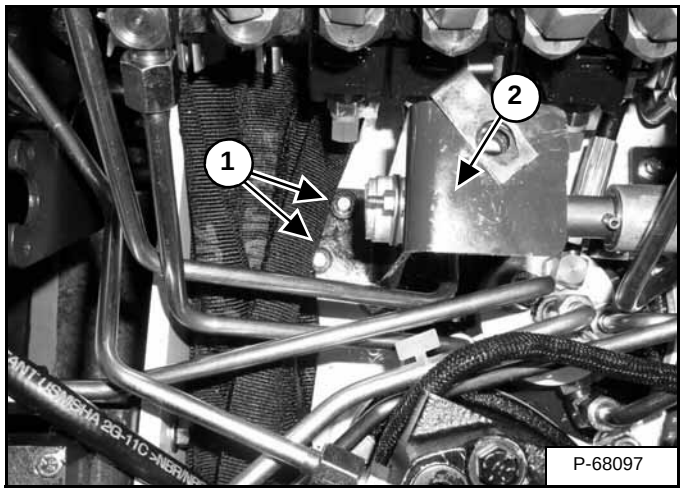
Removal And Installation (Cont'd)

Figure 40-90-5



Remove the right half of the control linkage assembly (Item 1) **[Figure 40-90-5]** from the excavator.

Figure 40-90-6



Remove the two bolts (Item 1) and remove the middle support bracket (Item 2) **[Figure 40-90-6]** with bearings attached.

Figure 40-90-7

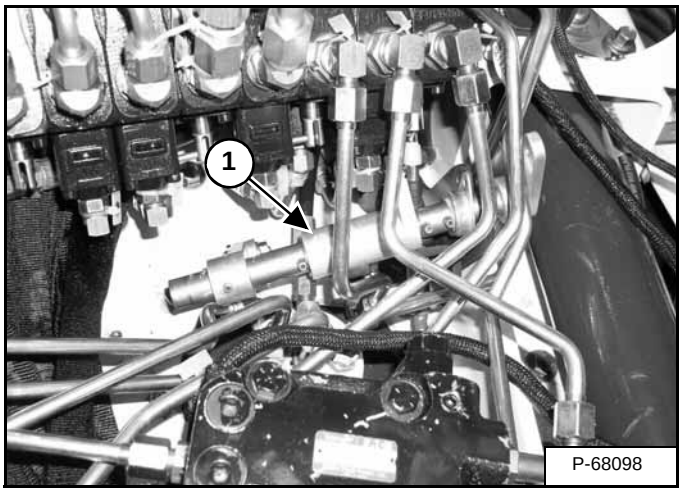
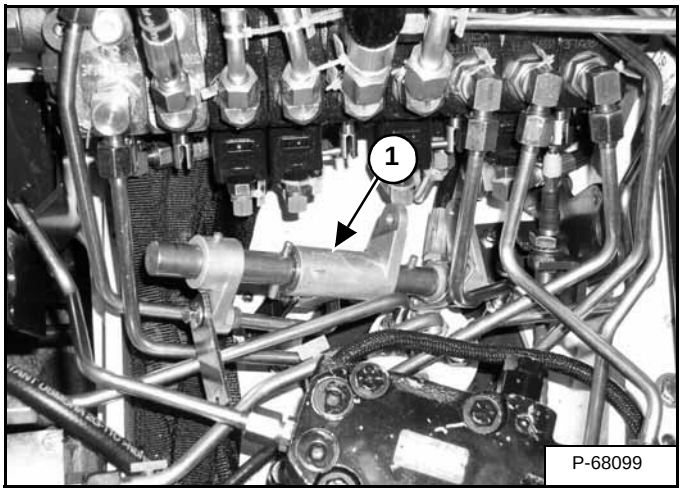


Figure 40-90-8



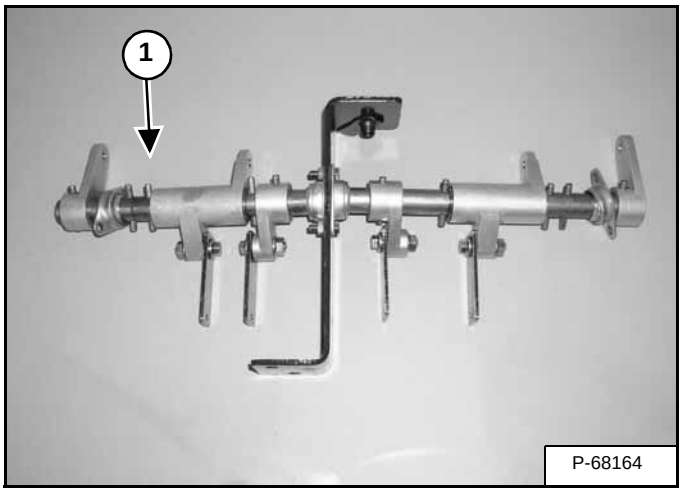
Remove the left half of the control linkage assembly (Item 1) **[Figure 40-90-7]** and **[Figure 40-90-8]** from the excavator.

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Right Half of Control Linkage Disassembly And Assembly

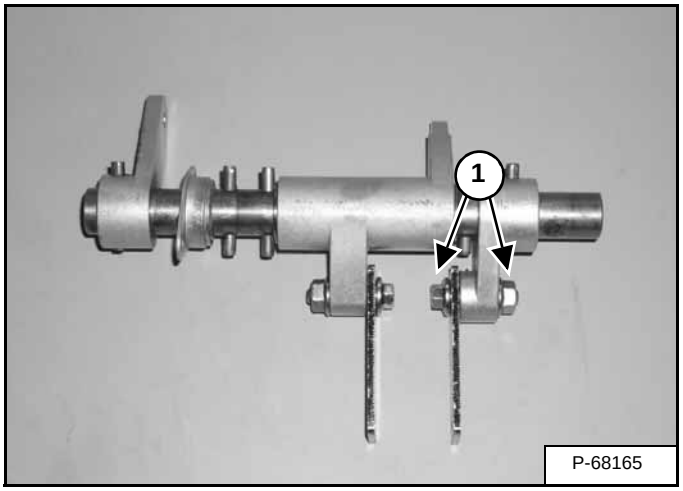
Mark the linkage rods and their orientation on the bellcranks. Mark bellcrank assemblies location and orientation on the shaft for ease of assembly.

Figure 40-90-9



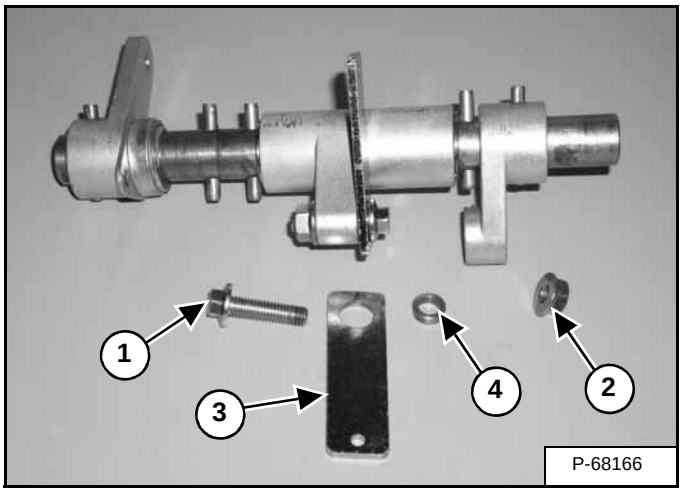
Remove the right half of the control linkage (Item 1) **[Figure 40-90-9]** from the control linkage assembly.

Figure 40-90-10



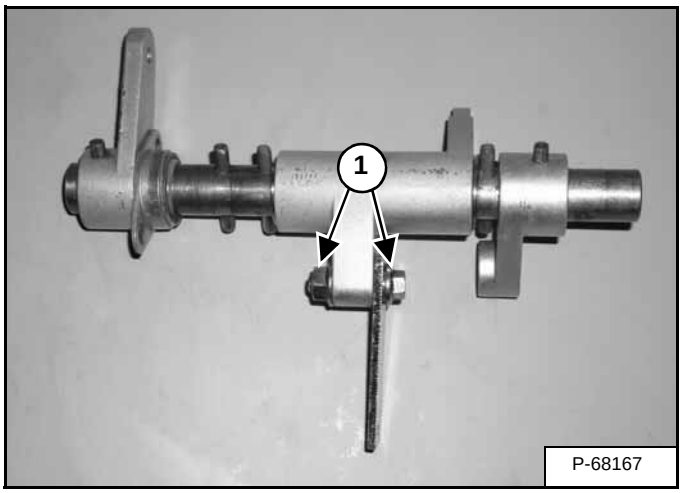
Remove the bolt and nut (Item 1) **[Figure 40-90-10]** from the bellcrank.

Figure 40-90-11



Remove the bolt (Item 1), nut (Item 2), linkage plate (Item 3) and spacer (Item 4) **[Figure 40-90-11]** from the bellcrank.

Figure 40-90-12

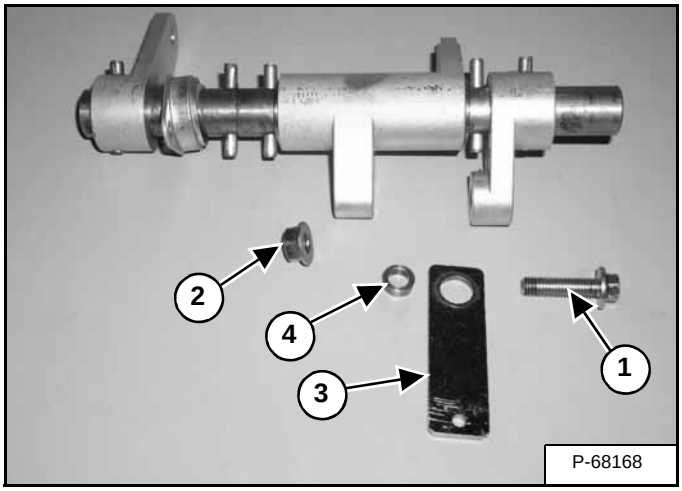


Remove the bolt and nut (Item 1) **[Figure 40-90-12]** from the bellcrank.

Dealer Copy -- Not for Resale

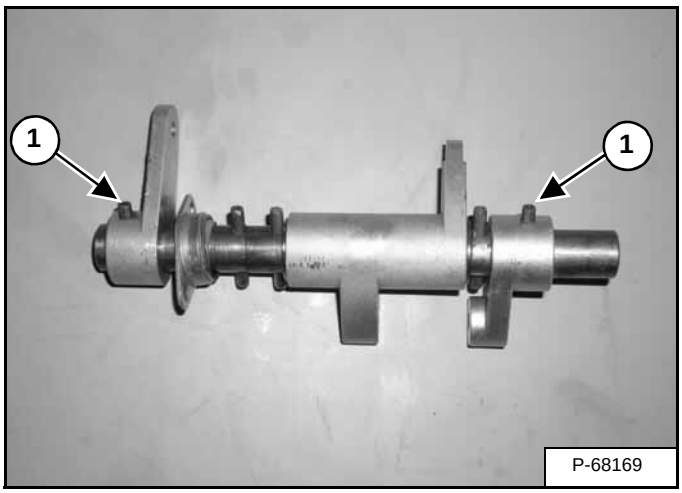
Right Half of Control Linkage Disassembly And Assembly (Cont'd)

Figure 40-90-13



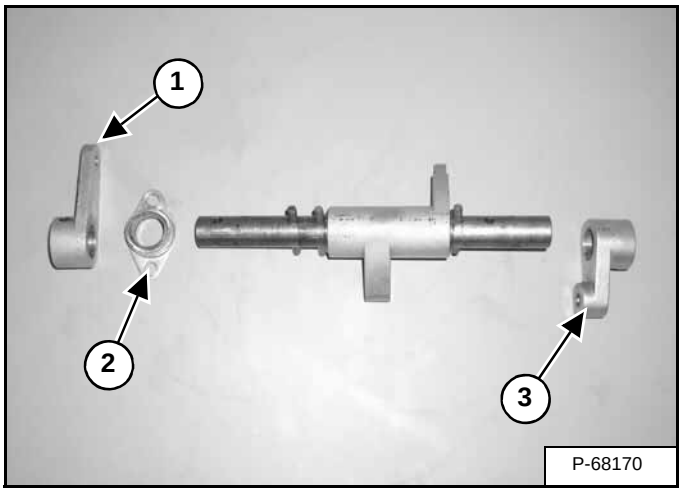
Remove the bolt (Item 1), nut (Item 2), linkage plate (Item 3) and spacer (Item 4) **[Figure 40-90-13]** from the bellcrank.

Figure 40-90-14



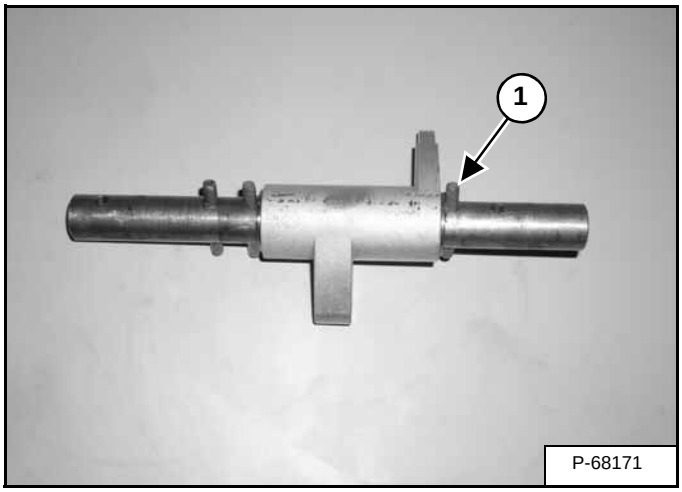
Remove the roll pins (Item 1) **[Figure 40-90-14]** from the bellcranks.

Figure 40-90-15



Remove the bellcrank (Item 1), bearing (Item 2) and bellcrank (Item 3) **[Figure 40-90-15]** from the shaft.

Figure 40-90-16

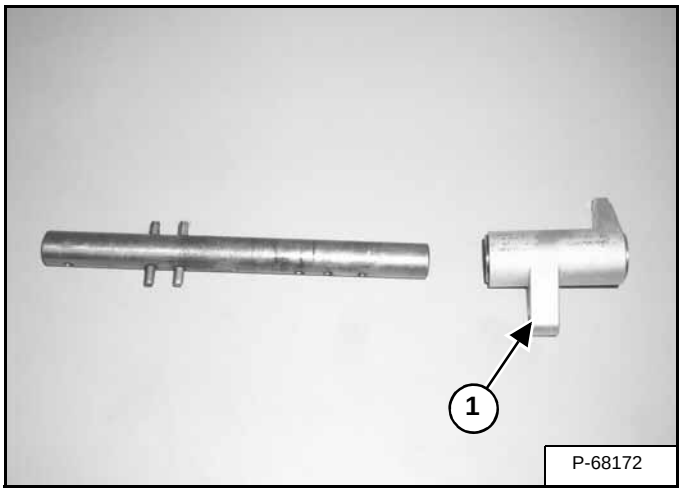


Remove the roll pin (Item 1) **[Figure 40-90-16]** from the shaft.

Dealer Copy -- Not for Resale

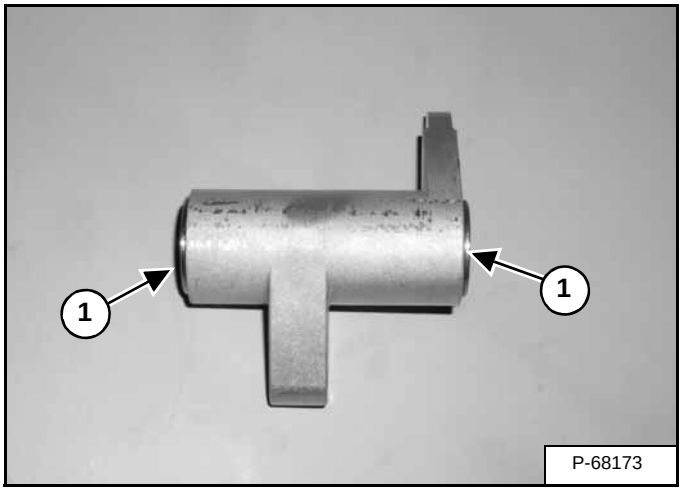
Right Half of Control Linkage Disassembly And Assembly (Cont'd)

Figure 40-90-17



Remove the bellcrank (Item 1) **[Figure 40-90-17]** from the shaft.

Figure 40-90-18

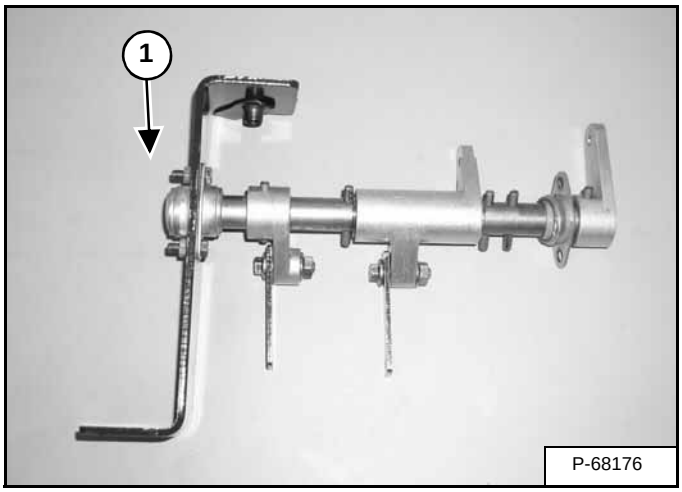


Remove the bushings (Item 1) **[Figure 40-90-18]** from the bellcrank.

Left Half of Control Linkage Disassembly And Assembly

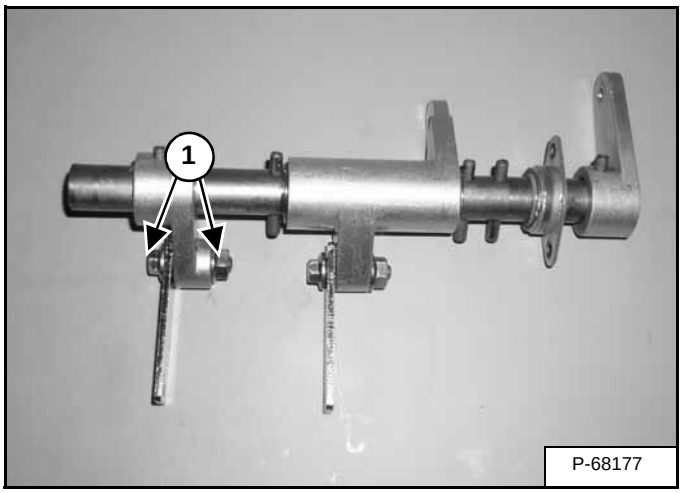
Mark the linkage rods and their orientation on the bellcranks. Mark bellcrank assemblies location and orientation on the shaft for ease of assembly.

Figure 40-90-19



Remove the left half of the control linkage (Item 1) **[Figure 40-90-19]** from the mount bracket bearing.

Figure 40-90-20

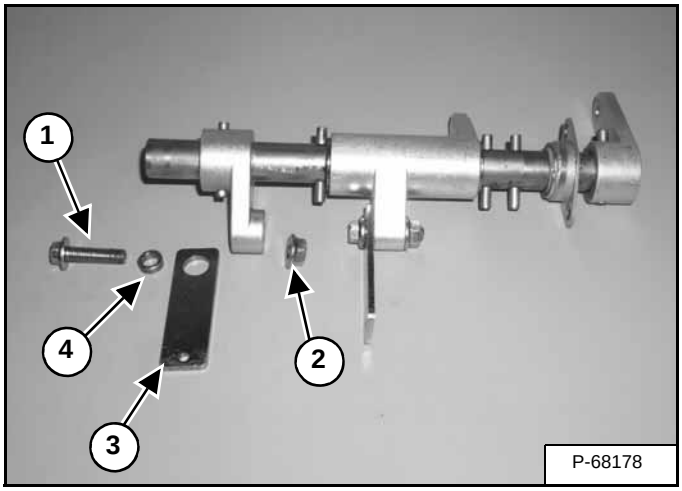


Remove the bolt and nut (Item 1) **[Figure 40-90-20]** from the bellcrank.

Dealer Copy -- Not for Resale

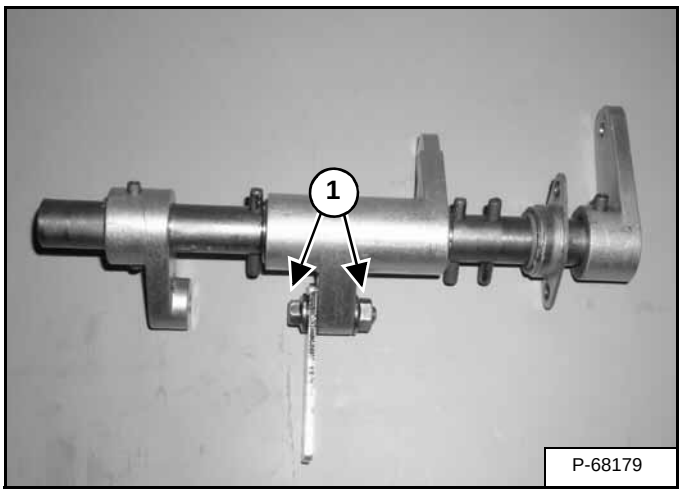
Left Half of Control Linkage Disassembly And Assembly (Cont'd)

Figure 40-90-21



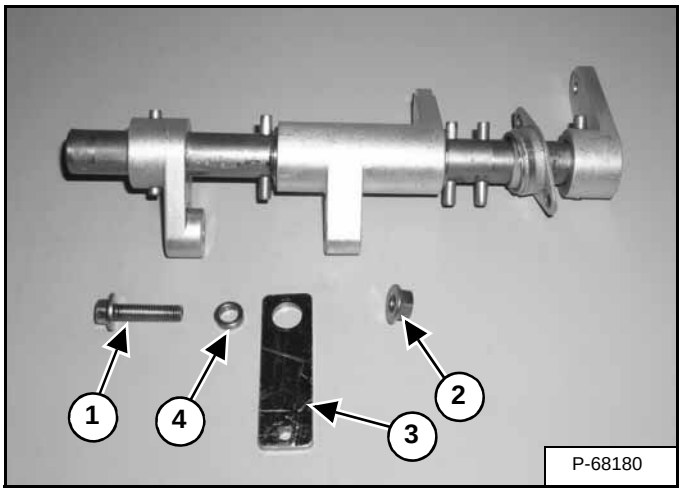
Remove the bolt (Item 1), nut (Item 2), linkage plate (Item 3) and spacer (Item 4) **[Figure 40-90-21]** from the bellcrank.

Figure 40-90-22



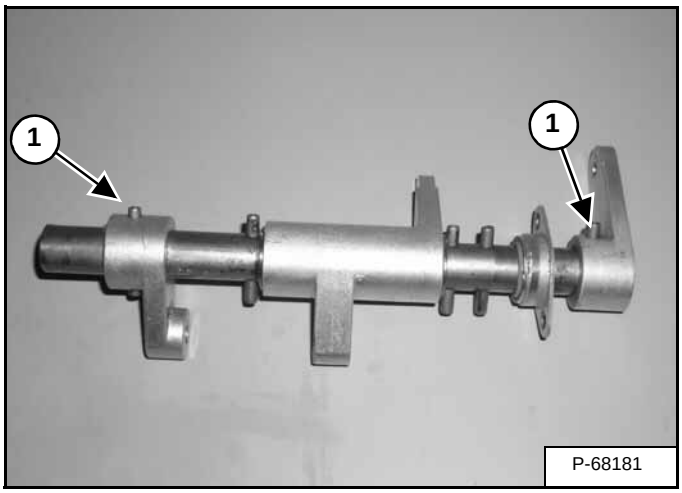
Remove the bolt and nut (Item 1) **[Figure 40-90-22]** from the bellcrank.

Figure 40-90-23



Remove the bolt (Item 1), nut (Item 2), linkage plate (Item 3) and spacer (Item 4) **[Figure 40-90-23]** from the bellcrank.

Figure 40-90-24

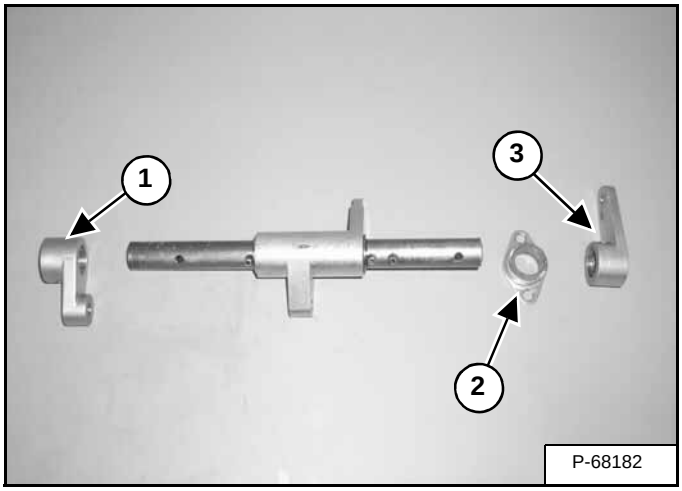


Remove the roll pins (Item 1) **[Figure 40-90-24]** from the bellcranks.

Dealer Copy -- Not for Resale

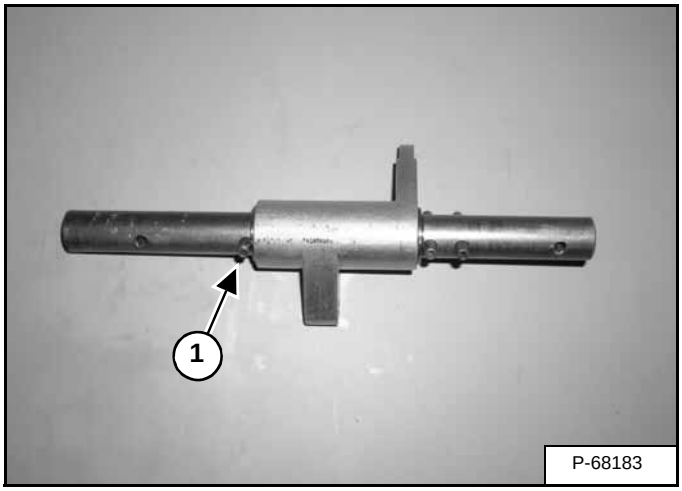
Left Half of Control Linkage Disassembly And Assembly (Cont'd)

Figure 40-90-25



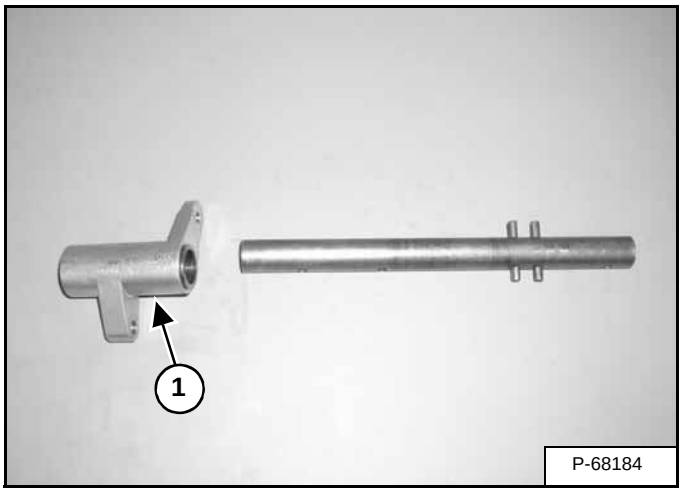
Remove the bellcrank (Item 1), bearing (Item 2) and bellcrank (Item 3) **[Figure 40-90-25]** from the shaft.

Figure 40-90-26



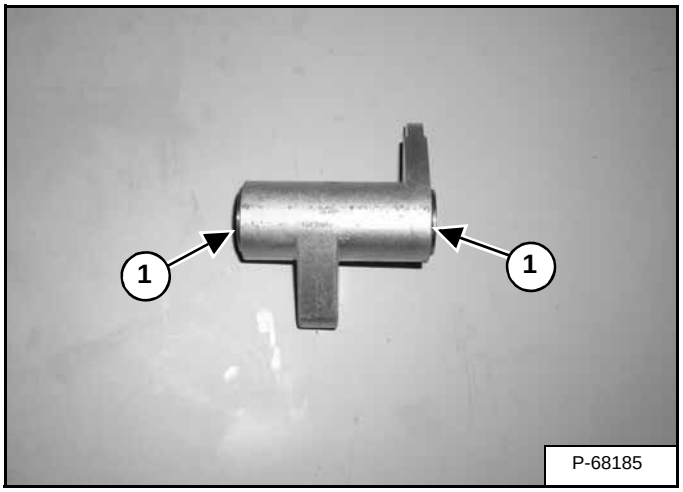
Remove the roll pin (Item 1) **[Figure 40-90-26]** from the shaft.

Figure 40-90-27



Remove the bellcrank (Item 1) **[Figure 40-90-27]** from the shaft.

Figure 40-90-28

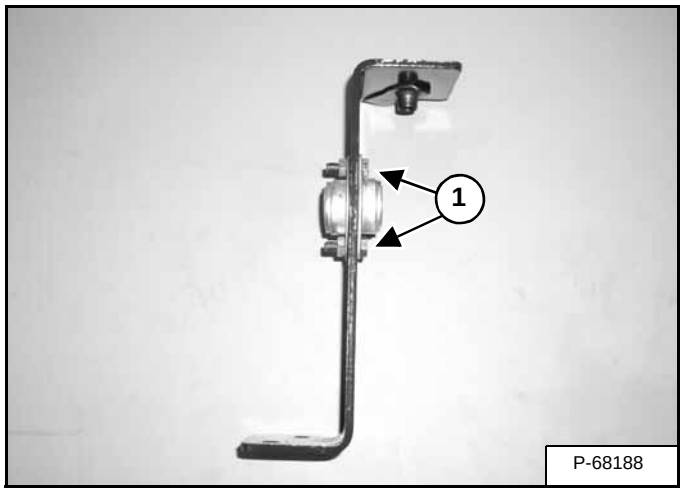


Remove the bushings (Item 1) **[Figure 40-90-28]** from the bellcrank.

Dealer Copy -- Not for Resale

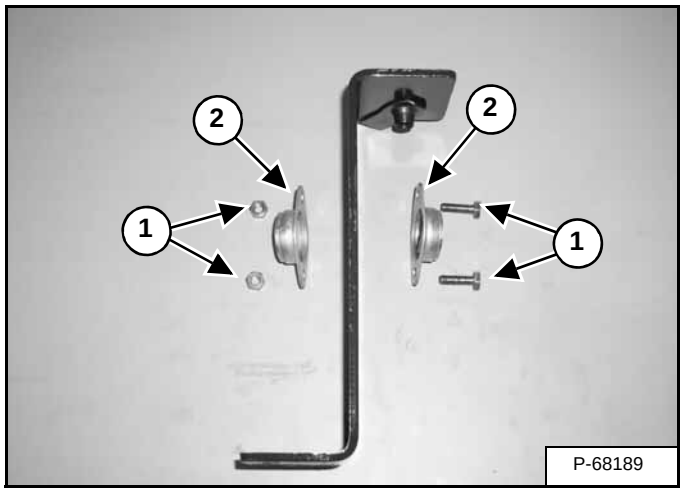
Bracket of Control Linkage Disassembly And Assembly

Figure 40-90-29



Remove the bolts and nuts (Item 1) **[Figure 40-90-29]** from the bearings.

Figure 40-90-30



Remove the bolts/nuts (Item 1) and bearings (Item 2) **[Figure 40-90-30]** from the bracket.

Dealer Copy -- Not for Resale

FLOOR MAT AND FLOOR PANELS

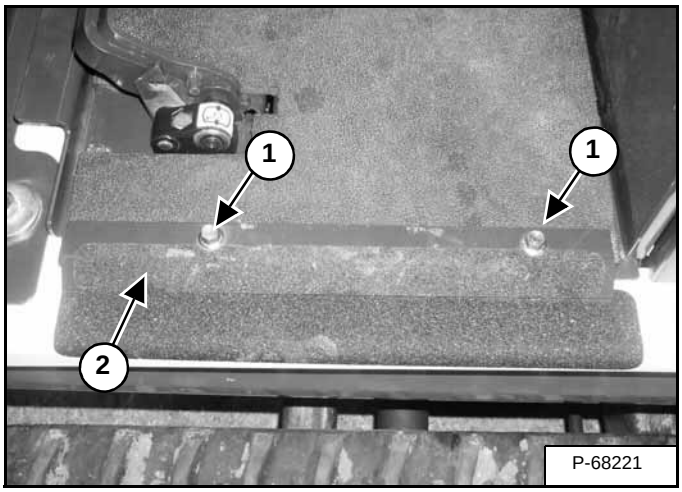
Description

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.

Rear Floor Panel Removal and Installation

Figure 40-100-1

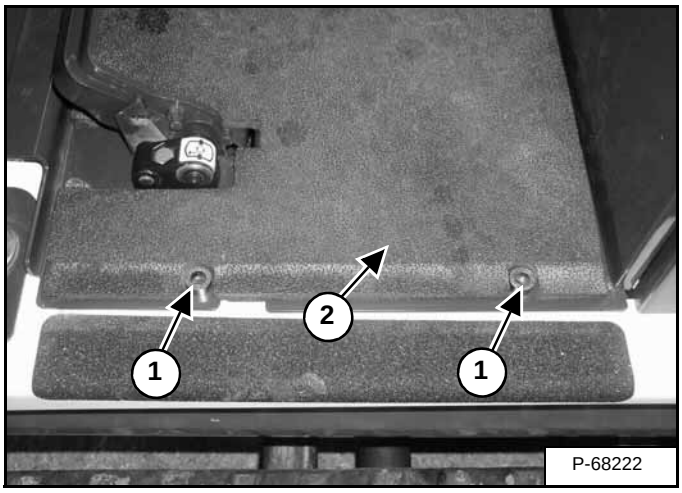


Remove the bolts (Item 1) **[Figure 40-100-1]** in both floor mat retaining plates.

Remove the floor mat retaining plate (Item 2) **[Figure 40-100-1]** from both sides.

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

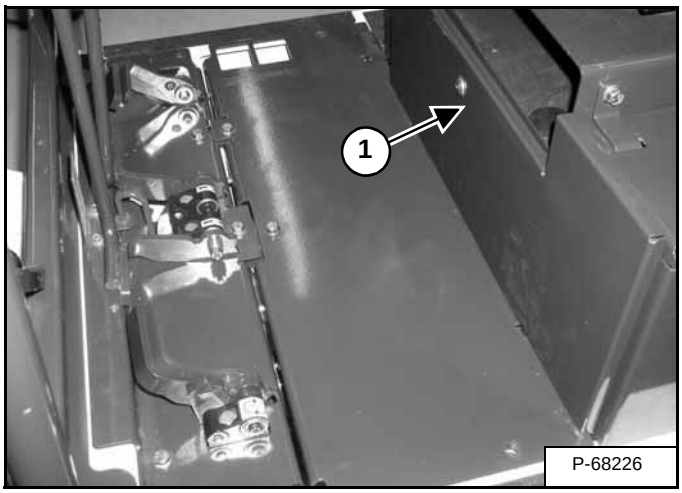
Figure 40-100-2



Remove the spacers (Item 1) **[Figure 40-100-2]** from both sides of the floor mat.

Remove the floor mat (Item 2) **[Figure 40-100-2]**.

Figure 40-100-3

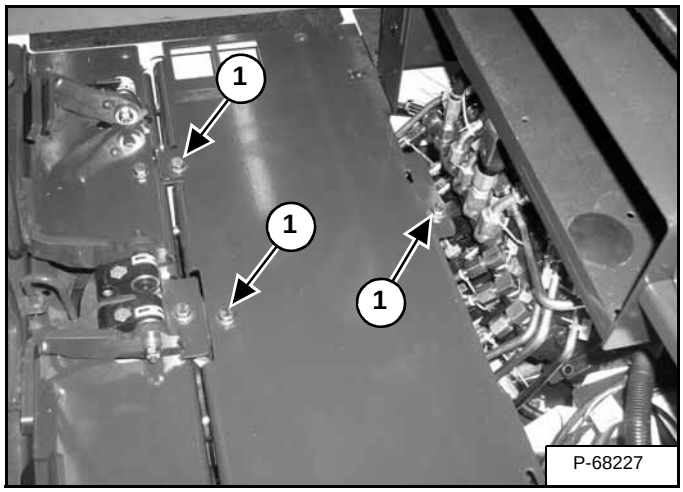


Remove the access panel (Item 1) **[Figure 40-100-3]**.

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Front Floor Panel Removal and Installation

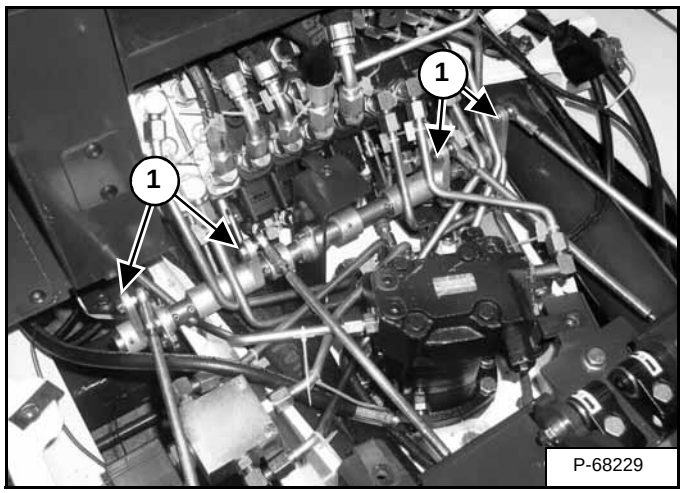
Figure 40-100-4



Remove the bolts (Item 1) **[Figure 40-100-4]** from the rear floor panel.

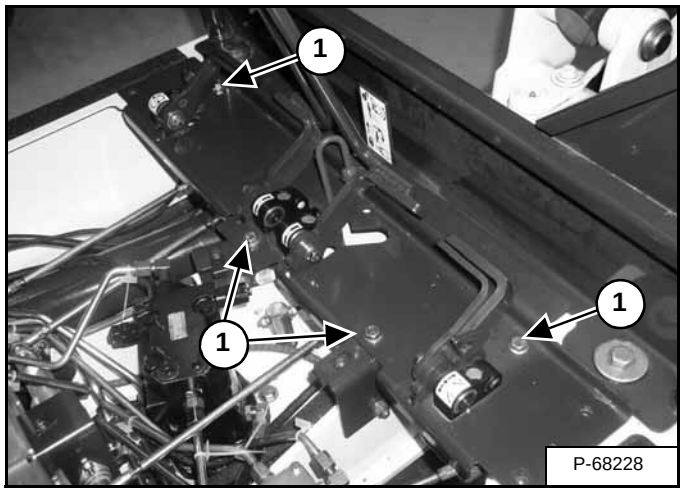
Remove the rear floor panel.

Figure 40-100-5



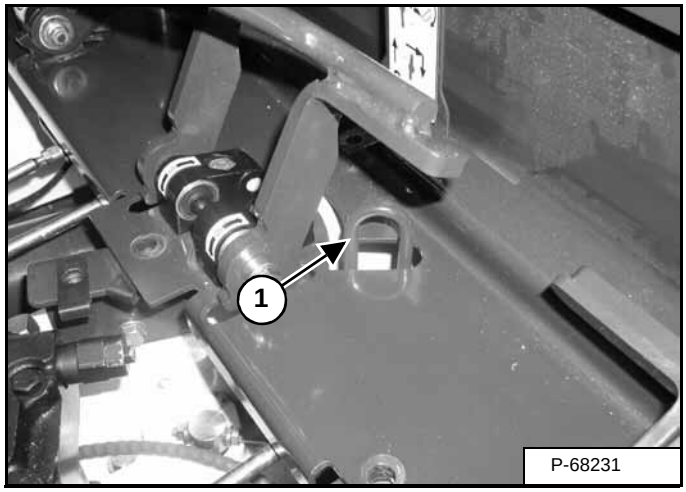
Remove the nuts (Item 1) **[Figure 40-100-5]** from the control valve linkages and remove linkage from bellcrank.

Figure 40-100-6



Remove the four bolts (Item 1) **[Figure 40-100-6]** from the front floor panel.

Figure 40-100-7



Lift the upperstructure slew lock (Item 1) **[Figure 40-100-7]** 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.

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Linkage Rod Removal And Installation

Remove the floor mat and floor panels. (See FLOOR MAT AND FLOOR PANELS on Page 40-100-1)

NOTE: The four linkage rods can be removed without removing the front floor panel if the linkage rods are being repaired [Figure 40-100-8]. If the front floor panel is removed for repair then the four linkage rods are removed with the front floor panel [Figure 40-100-9].

NOTE: Before disassembling the linkages, measure the distance between the center lines of the linkage end and the orientation for ease of assembly.

Figure 40-100-8

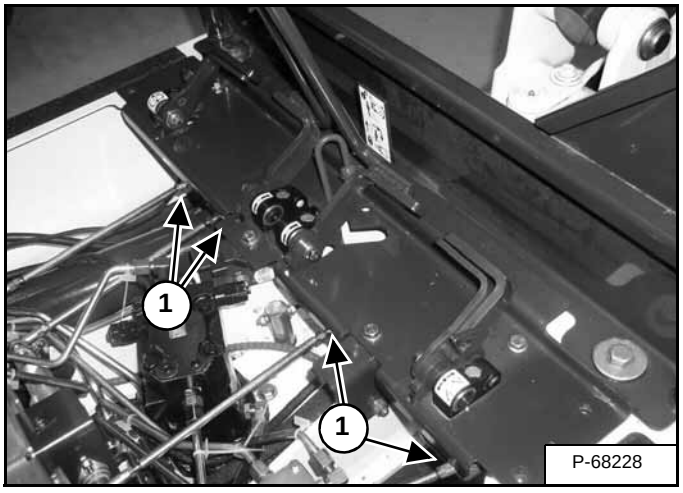
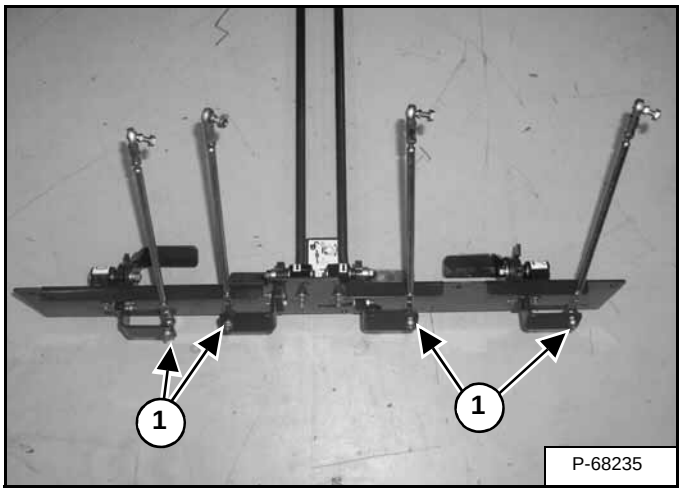


Figure 40-100-9

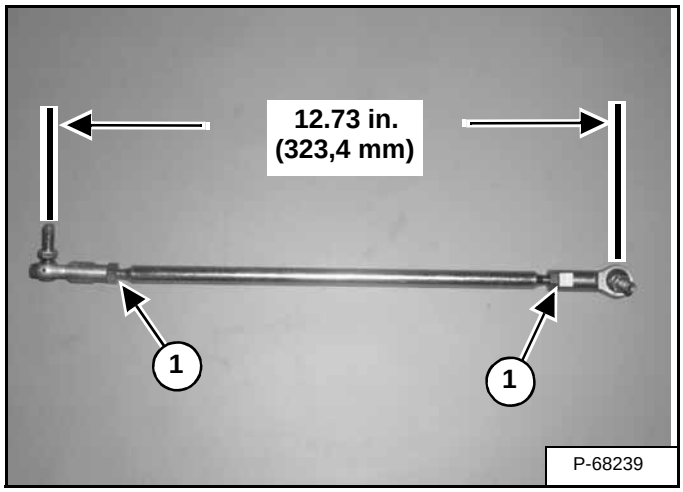


Remove the nuts (Item 1) **[Figure 40-100-8]** & **[Figure 40-100-9]** from the end of the ball joints.

Remove the linkages.

Linkage Rod Adjustment

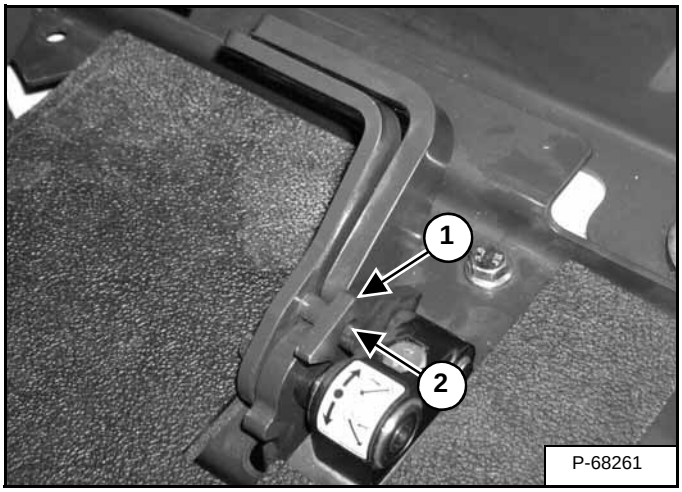
Figure 40-100-10



Loosen the nut (Item 1) **[Figure 40-100-10]** on the end of the ball joint on the boom swing linkage rod.

Adjust the boom swing linkage rod as dimensioned **[Figure 40-100-10]**.

Figure 40-100-11

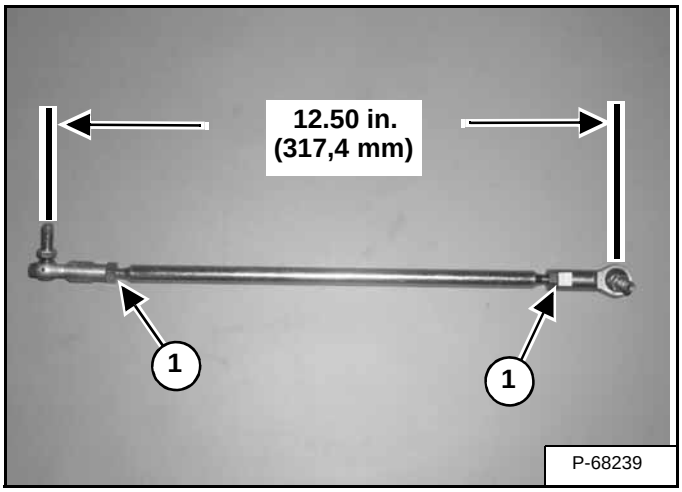


NOTE: Linkage rod ball joint dimensions may need final adjustment, with pedal (valve) in neutral, to ensure the lock (Item 1) engages the pedal lock pin (Item 2) [Figure 40-100-11] when the floor panel is installed.

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Linkage Rod Adjustment (Cont'd)

Figure 40-100-12



Loosen the nut (Item 1) **[Figure 40-100-12]** on the end of the ball joint on the right hand travel linkage rod.

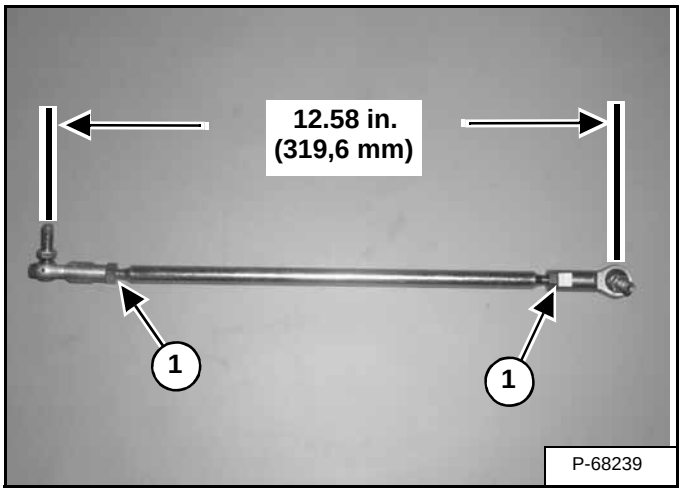
Adjust the right hand travel linkage rod as dimensioned **[Figure 40-100-12]**.

Figure 40-100-13



NOTE: Linkage rod ball joint dimensions [Figure 40-100-13] may need final adjustment, with levers (valve) in neutral, to ensure travel levers are even (in-line) with each other when the floor panel is installed.

Figure 40-100-14



Loosen the nut (Item 1) **[Figure 40-100-14]** on the end of the ball joint on the left hand travel linkage rod.

Adjust the left hand travel linkage rod as dimensioned **[Figure 40-100-14]**.

Figure 40-100-15

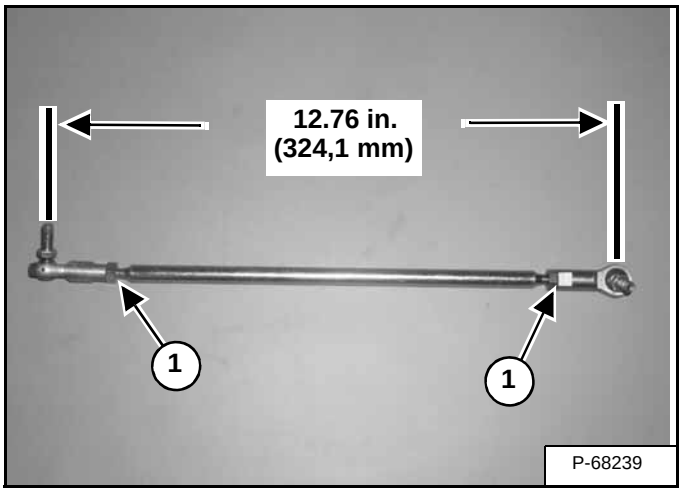


NOTE: Linkage rod ball joint dimensions [Figure 40-100-15] may need final adjustment, with levers (valve) in neutral, to ensure travel levers are even (in-line) with each other when the floor panel is installed.

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Linkage Rod Adjustment (Cont'd)

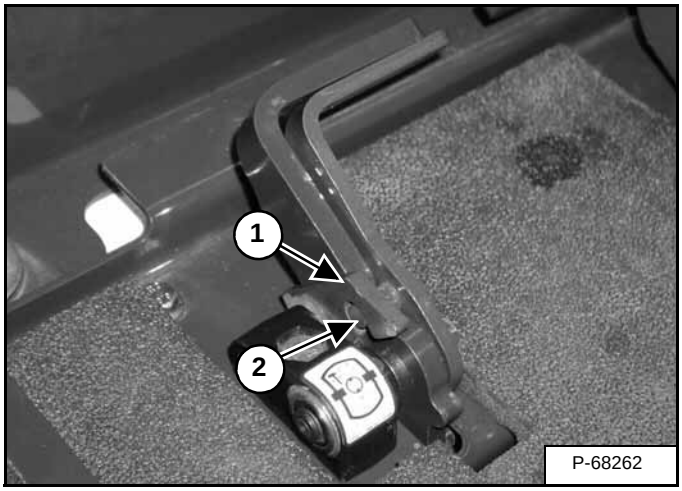
Figure 40-100-16



Loosen the nut (Item 1) **[Figure 40-100-16]** on the end of the ball joint on the auxiliary linkage rod.

Adjust the auxiliary linkage rod as dimensioned **[Figure 40-100-16]**.

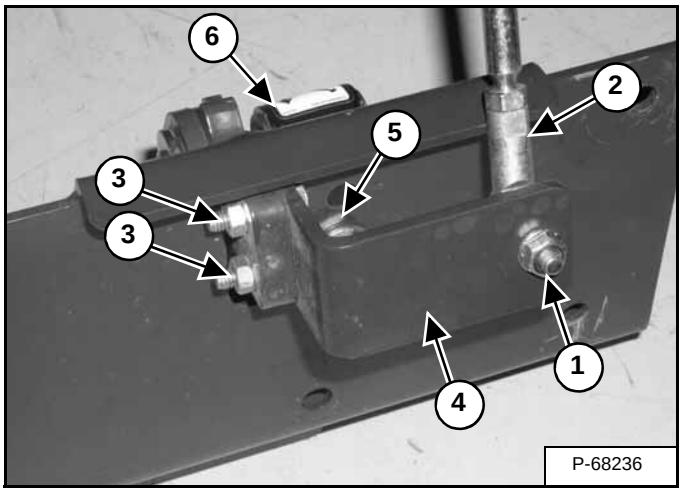
Figure 40-100-17



NOTE: Linkage rod ball joint dimensions may need final adjustment, with pedal (valve) in neutral, to ensure the lock (Item 1) engages the pedal lock pin (Item 2) [Figure 40-100-17] when the floor panel is installed.

Boom Swing Pedal Removal And Installation

Figure 40-100-18



Remove the nut (Item 1) and linkage rod (Item 2) **[Figure 40-100-18]**.

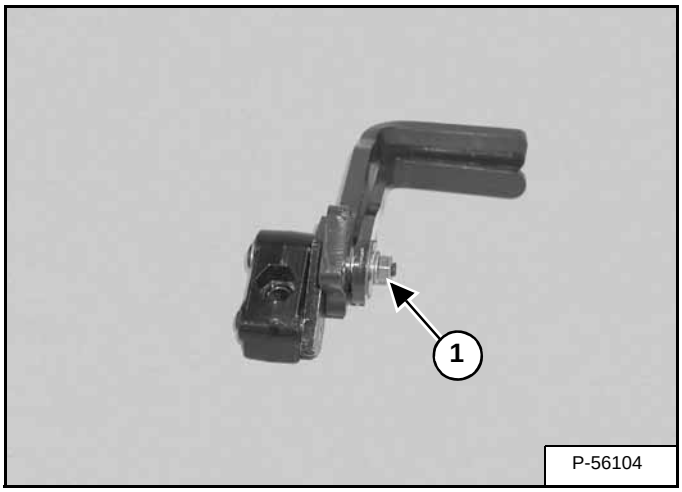
Remove the two bolts and nuts (Item 3) and remove the bracket (Item 4) **[Figure 40-100-18]**.

Remove the nut and bolt (Item 5) and remove the boom swing pedal assembly (Item 6) **[Figure 40-100-18]**.

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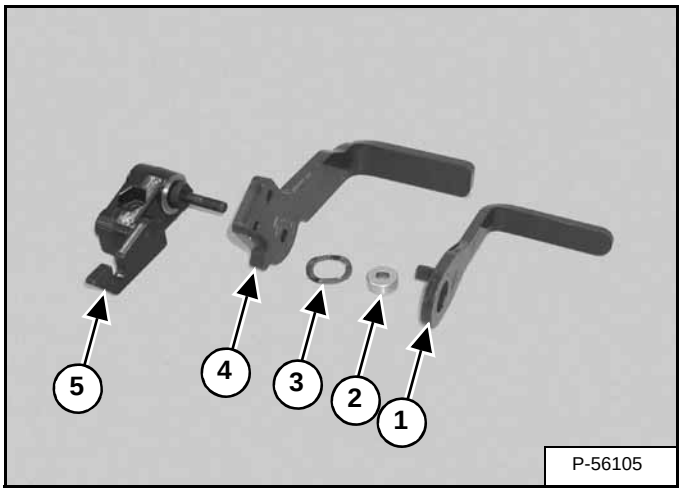
Boom Swing Pedal Disassembly And Assembly

Figure 40-100-19



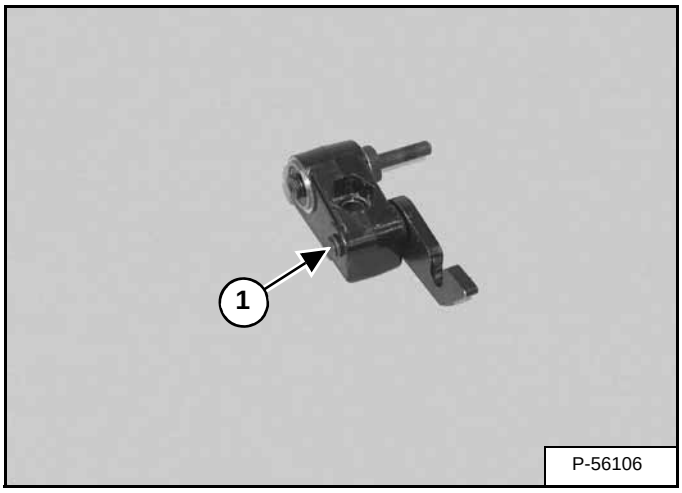
Remove the nut and washer (Item 1) **[Figure 40-100-19]**.

Figure 40-100-20



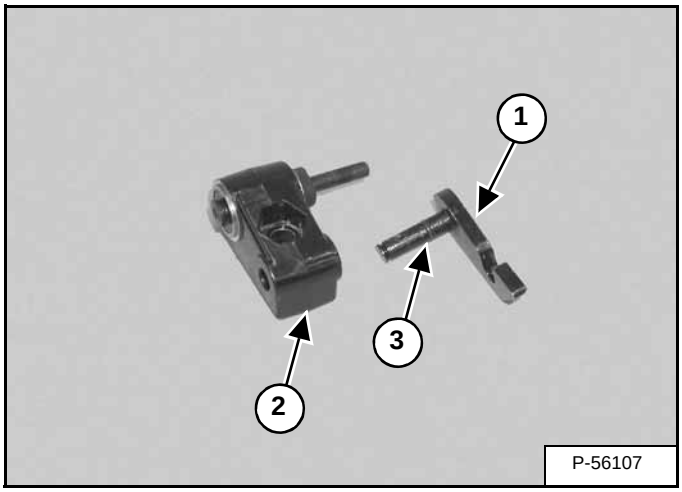
Remove the rear pedal (Item 1), bushing (Item 2), wave washer (Item 3) and front pedal (Item 4) from the mount (Item 5) **[Figure 40-100-20]**.

Figure 40-100-21



Remove the O-ring (Item 1) **[Figure 40-100-21]** from the shaft.

Figure 40-100-22



Remove the lock (Item 1) from the mount (Item 2) **[Figure 40-100-22]**.

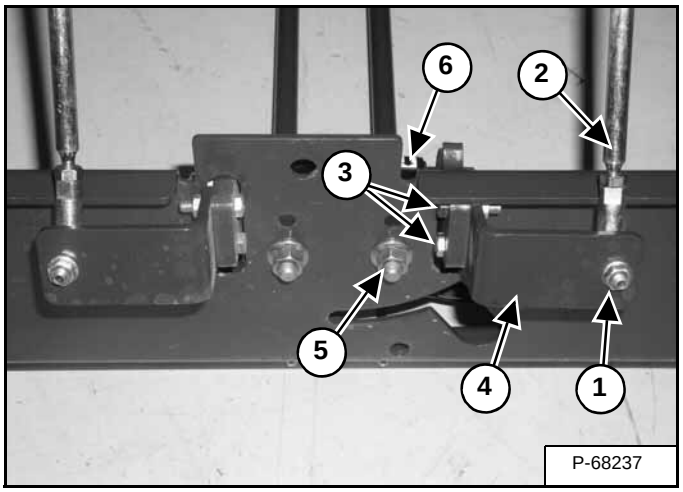
Remove the O-ring (Item 3) **[Figure 40-100-22]** from the shaft.

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 40-100-22] from pivoting freely.

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Right Travel Lever Removal And Installation

Figure 40-100-23



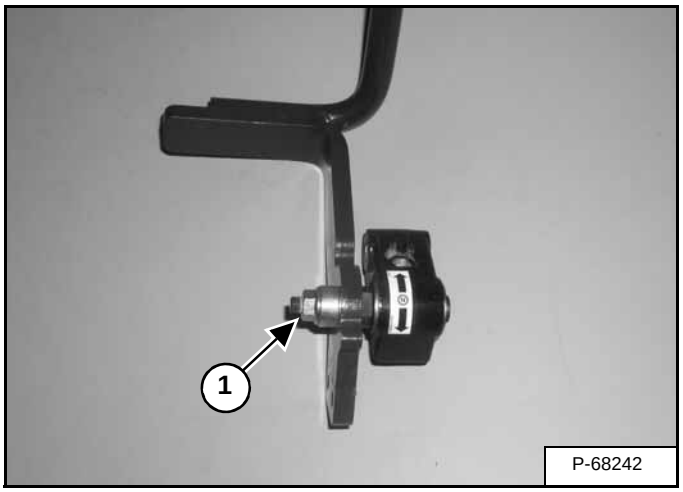
Remove the nut (Item 1) and linkage rod (Item 2) **[Figure 40-100-23]**.

Remove the two bolts and nuts (Item 3) and remove the bracket (Item 4) **[Figure 40-100-23]**.

Remove the nut and bolt (Item 5) and remove the right travel lever (Item 6) **[Figure 40-100-23]**.

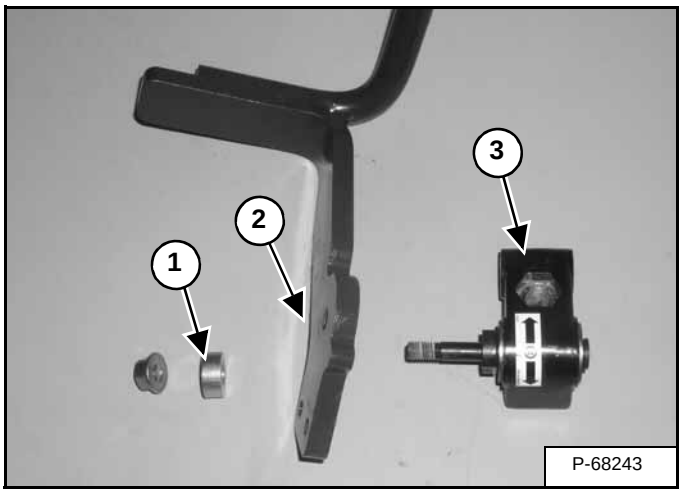
Right Travel Lever Disassembly And Assembly

Figure 40-100-24



Remove the nut (Item 1) **[Figure 40-100-24]**.

Figure 40-100-25

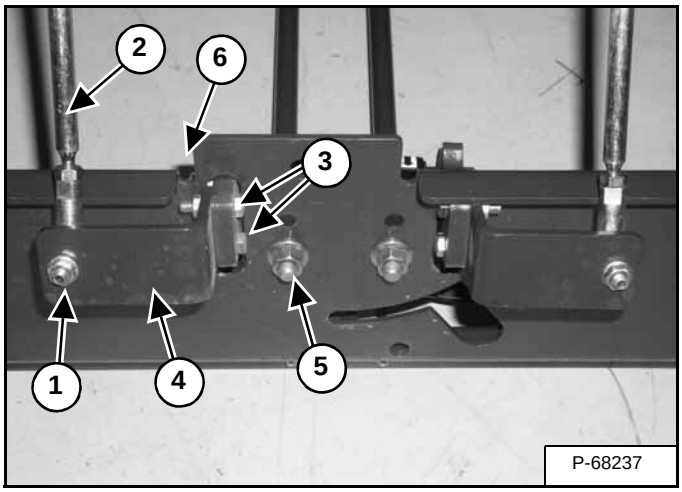


Remove the bushing (Item 1) and rear pedal (Item 2) from the mount (Item 3) **[Figure 40-100-25]**.

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Left Travel Lever Removal And Installation

Figure 40-100-26



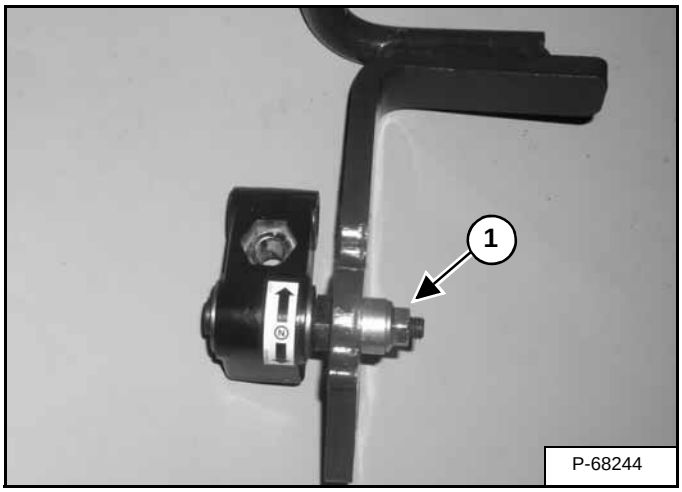
Remove the nut (Item 1) and linkage rod (Item 2) **[Figure 40-100-26]**.

Remove the two bolts and nuts (Item 3) and remove the bracket (Item 4) **[Figure 40-100-26]**.

Remove the nut and bolt (Item 5) and remove the right travel lever (Item 6) **[Figure 40-100-26]**.

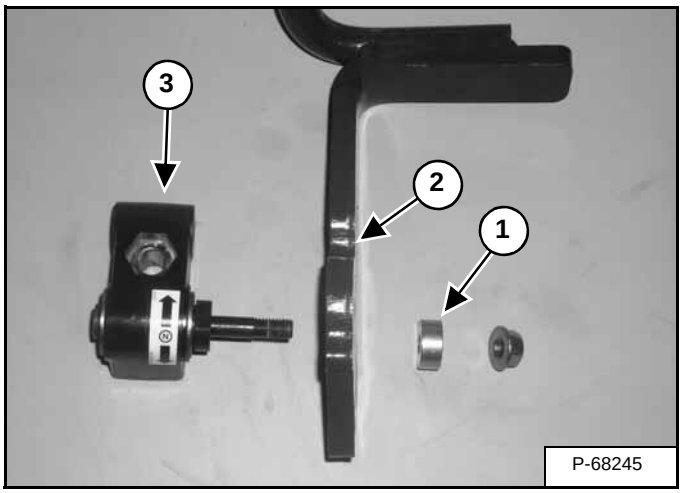
Left Travel Lever Disassembly And Assembly

Figure 40-100-27



Remove the nut (Item 1) **[Figure 40-100-27]**.

Figure 40-100-28

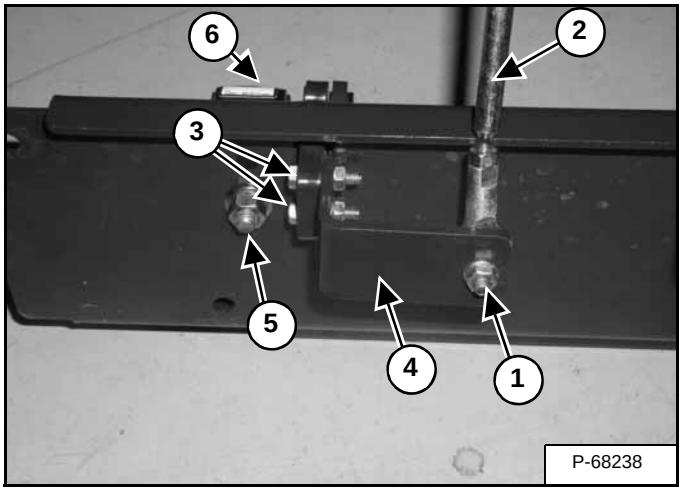


Remove the bushing (Item 1) and rear pedal (Item 2) from the mount (Item 3) **[Figure 40-100-28]**.

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Auxiliary Pedal Removal And Installation (If Equipped)

Figure 40-100-29



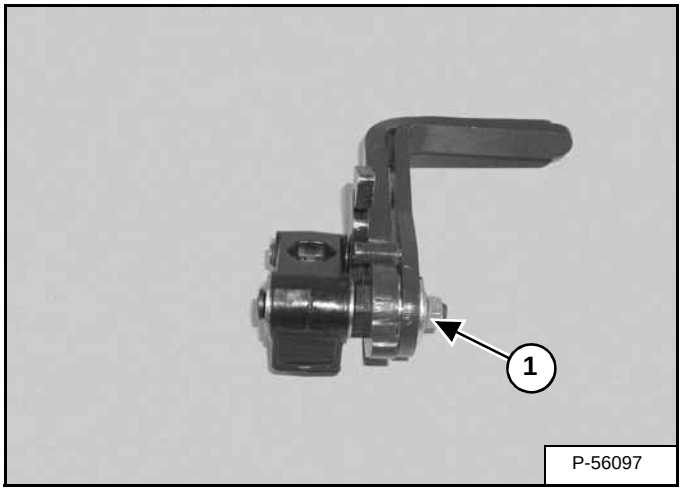
Remove the nut (Item 1) and linkage rod (Item 2) **[Figure 40-100-29]**.

Remove the two bolts and nuts (Item 3) and remove the bracket (Item 4) **[Figure 40-100-29]**.

Remove the nut and bolt (Item 5) and remove the boom swing pedal assembly (Item 6) **[Figure 40-100-29]**.

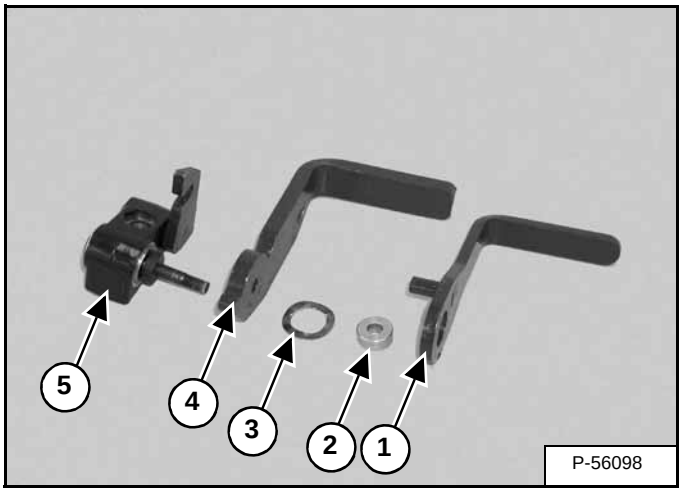
Auxiliary Pedal Disassembly And Assembly (If Equipped)

Figure 40-100-30



Remove the nut and washer (Item 1) **[Figure 40-100-30]**.

Figure 40-100-31

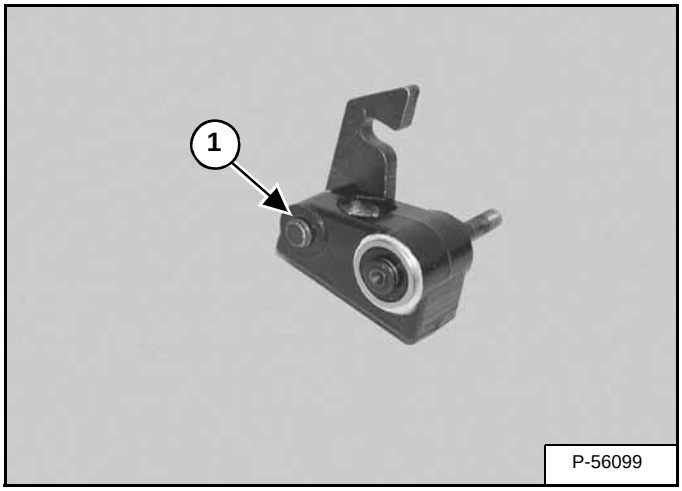


Remove the rear pedal (Item 1), bushing (Item 2), wave washer (Item 3), and front pedal (Item 4) from the mount (Item 5) **[Figure 40-100-31]**.

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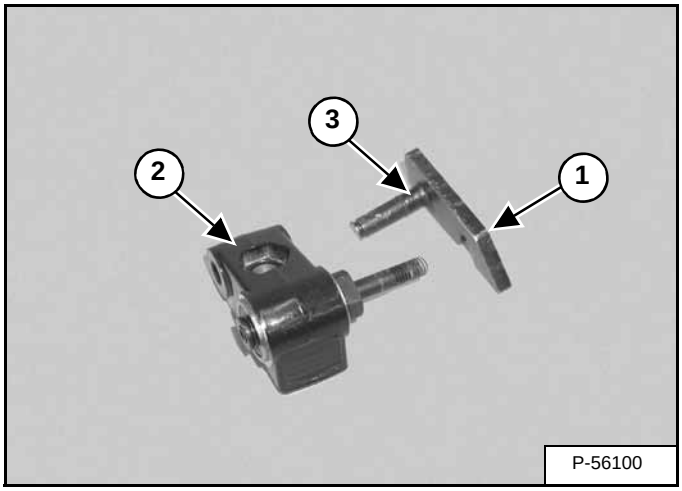
Auxiliary Pedal Disassembly And Assembly (If Equipped)

Figure 40-100-32



Remove the O-ring (Item 1) **[Figure 40-100-32]** from the shaft.

Figure 40-100-33



Remove the lock (Item 1) from the mount (Item 2) **[Figure 40-100-33]**.

Remove the O-ring (Item 3) **[Figure 40-100-33]** 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 40-100-33] from pivoting freely.

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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 20-120-1)

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

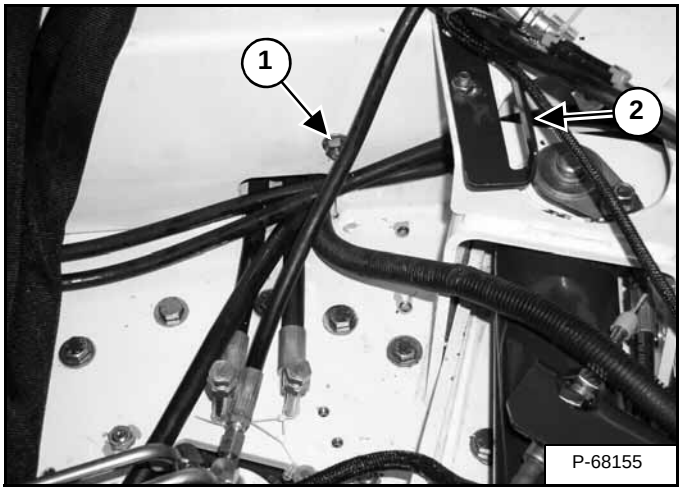
Remove the engine. (See Engine Removal and Installation on Page 60-10-8)

Remove the floor mat and floor panels. (See FLOOR MAT AND FLOOR PANELS on Page 40-100-1)

Remove the battery. (See Removal and Installation on Page 50-20-1)

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

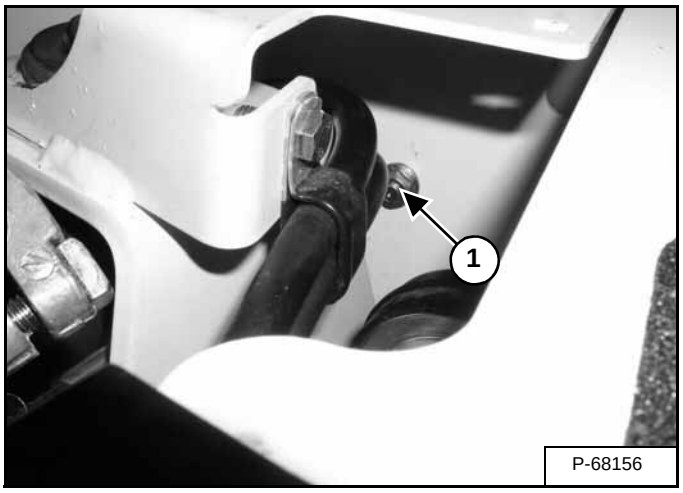
Figure 40-110-1



Remove the nut (Item 1) **[Figure 40-110-1]** from the fuel tank mounting bolt behind the control valve.

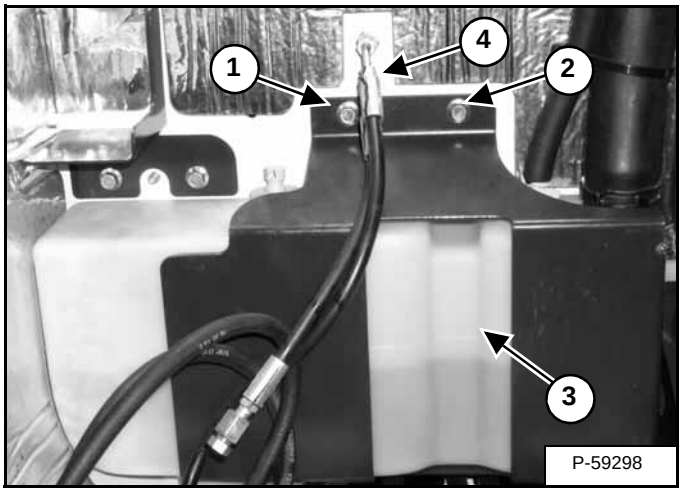
NOTE: The control valve assembly has been removed for picture clarity. The nut can be accessed through the clearance hole for the base end boom swing cylinder mounting (Item 2) [Figure 40-110-1].

Figure 40-110-2



Remove the nut (Item 1) **[Figure 40-110-2]** from the fuel tank mounting bolt under the battery.

Figure 40-110-3



Remove the short bolt (Item 1) and the long bolt (Item 2) **[Figure 40-110-3]** from the fuel tank mounting bracket.

Remove the fuel tank (Item 3) **[Figure 40-110-3]** from the back of the excavator.

NOTE: The bulk head hoses (Item 4) [Figure 40-110-3] may need to be loosened and rotated away from the fuel tank bracket.

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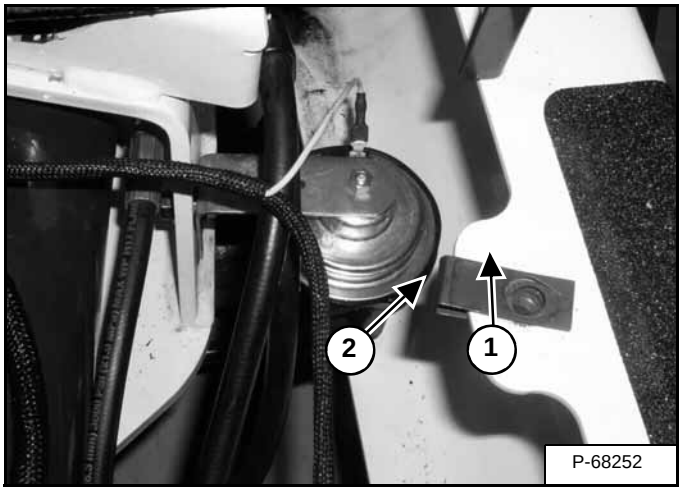
Dealer Copy -- Not for Resale

HORN

Removal and Installation

Remove the battery. (See Removal and Installation on Page 50-20-1)

Figure 40-170-1



NOTE: The floor mat and rear floor panel has been removed for photo clarity.

Remove the wire (Item 1) **[Figure 40-170-1]** from the horn.

Remove the nut (Item 2) **[Figure 40-170-1]**.

Remove the horn.

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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.

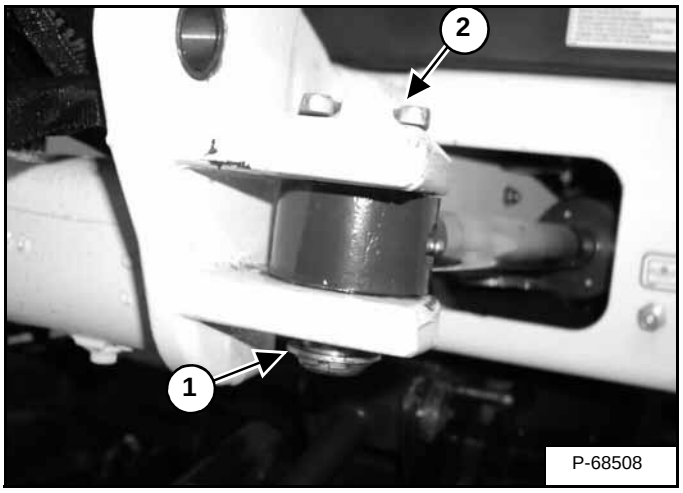
Removal And Installation

Remove the bucket. (See Removal And Installation on Page 40-160-1)

Remove the arm. (See Removal And Installation on Page 40-150-1)

Remove the boom. (See Removal And Installation on Page 40-140-1)

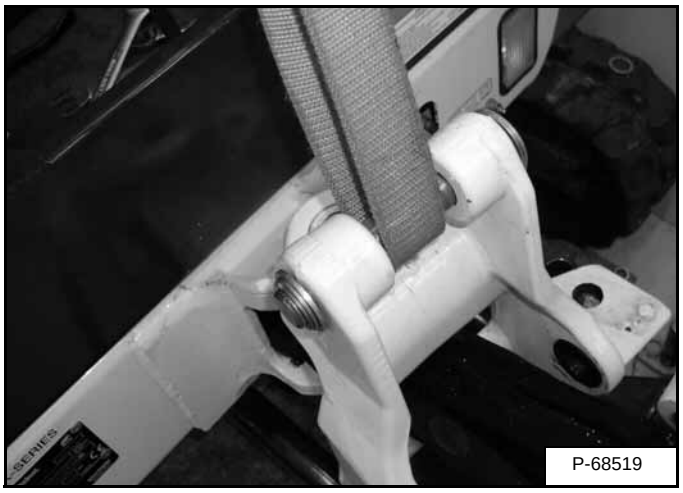
Figure 40-130-1



Remove the snap ring and washer (Item 1) **[Figure 40-130-1]** from the cylinder pivot pin.

Remove the pivot pin (Item 2) **[Figure 40-130-1]**.

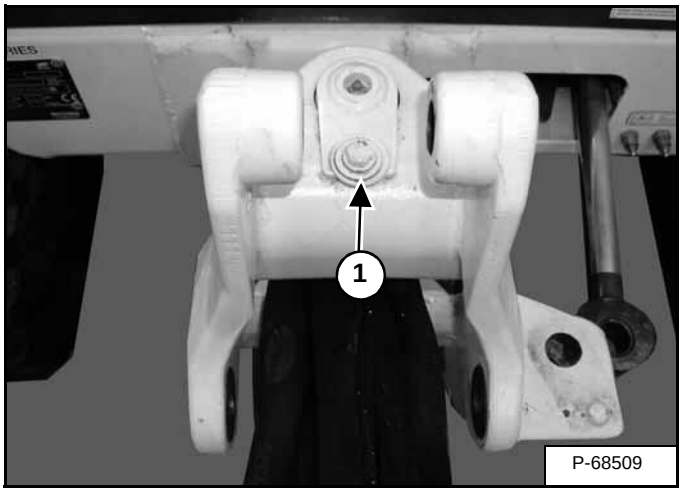
Figure 40-130-2



Install the pivot pin, washers and retaining clip **[Figure 40-130-2]**.

Install a chain hoist on the swing frame **[Figure 40-130-2]**.

Figure 40-130-3



NOTE: Chain hoist and pivot pin have been removed for photo clarity.

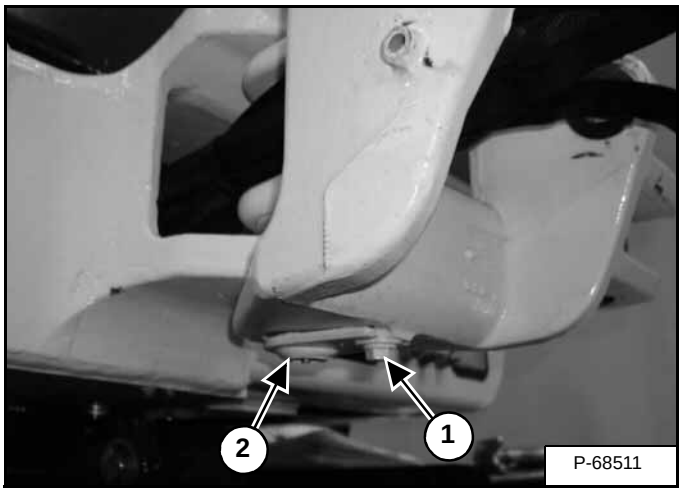
Remove the bolt, washers and spacer (Item 1) **[Figure 40-130-3]** from the top pivot pin.

Remove the top pivot pin (Item 2) **[Figure 40-130-3]** from the swing frame.

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Removal And Installation (Cont'd)

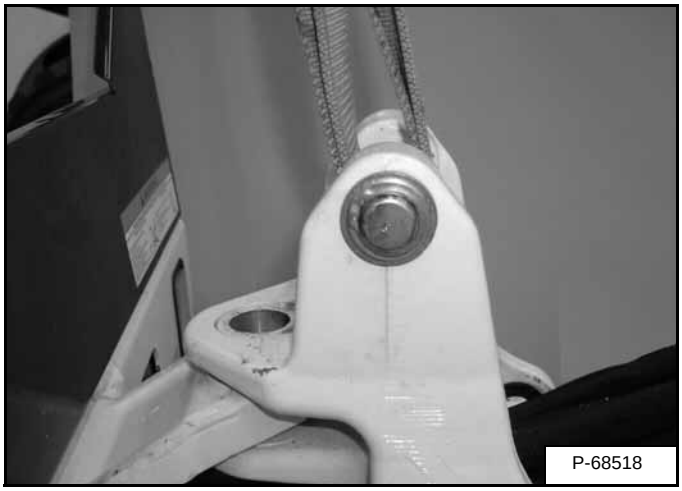
Figure 40-130-4



Remove the bolt and washers (Item 1) **[Figure 40-130-4]** from the bottom pivot pin.

Remove the bottom pivot pin (Item 2) **[Figure 40-130-4]** from the swing frame.

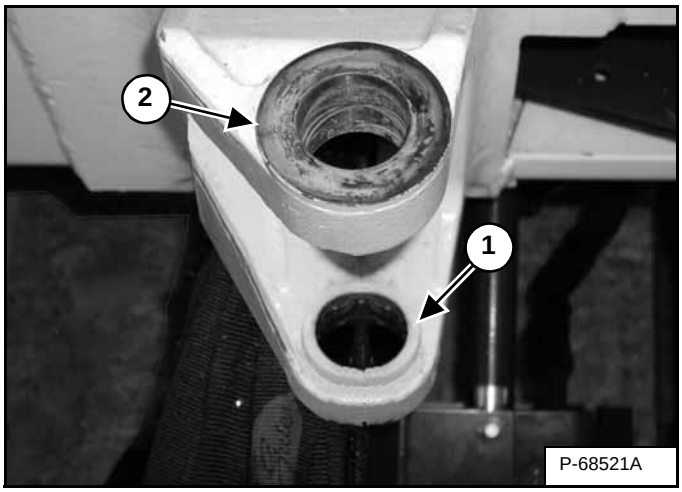
Figure 40-130-5



Remove the swing frame from the excavator **[Figure 40-130-5]**.

Bushing Removal and Installation

Figure 40-130-6



Remove the bottom bushing (Item 1) **[Figure 40-130-6]** from the upperstructure by driving the bushing down through the casting.

Remove the top bushing (Item 2) **[Figure 40-130-6]** from the upperstructure by driving the bushing up through the casting.

During installation, center the bushing on the casting hole.

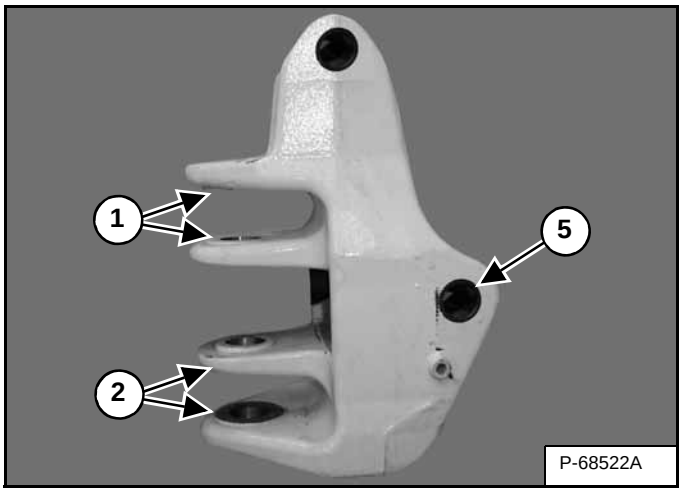
NOTE: Make sure the bushing is centered in the casting hole and is started in the hole evenly and square.

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.

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Swing Frame Bushing Removal

Figure 40-130-7



Remove the top pivot bushings (Item 1) and the bottom pivot bushings (Item 2) **[Figure 40-130-7]**. 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 40-130-8

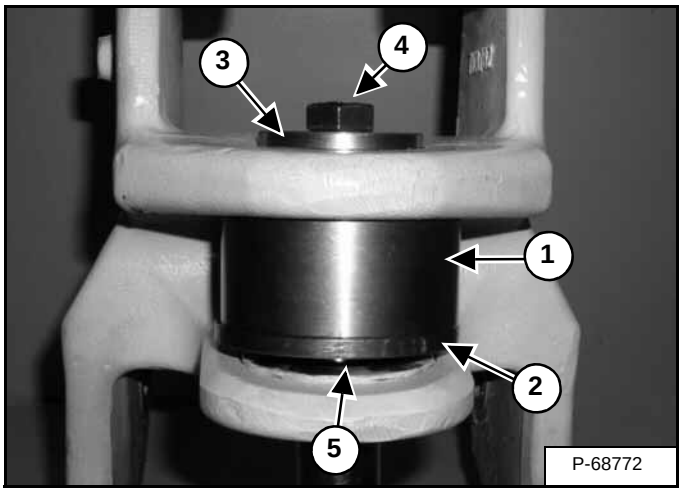
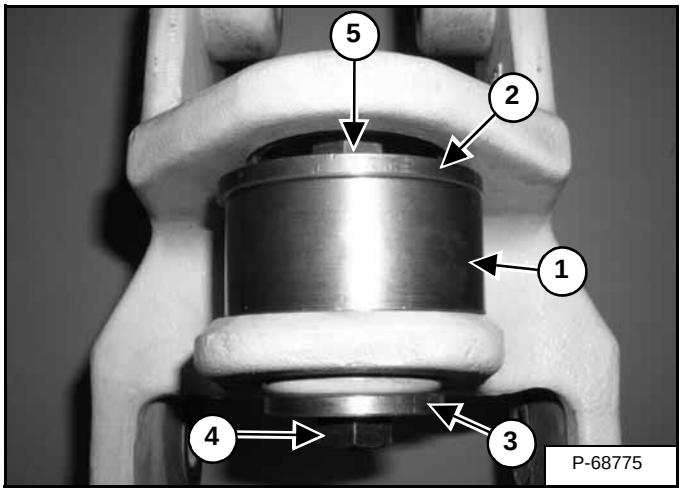


Figure 40-130-9



Install the spacer (Item 1) and washer (Item 2) **[Figure 40-130-8]** & **[Figure 40-130-9]** over the flanged end of the bushing.

The spacer (Item 1) **[Figure 40-130-8]** & **[Figure 40-130-9]** must be centered over the bushing to avoid contact between the bushing and the spacer during removal.

Install the washer (Item 3) **[Figure 40-130-8]** & **[Figure 40-130-9]** 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 40-130-8]** & **[Figure 40-130-9]** through the washers and spacer.

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

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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 40-130-9]** 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 40-130-9]**.

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

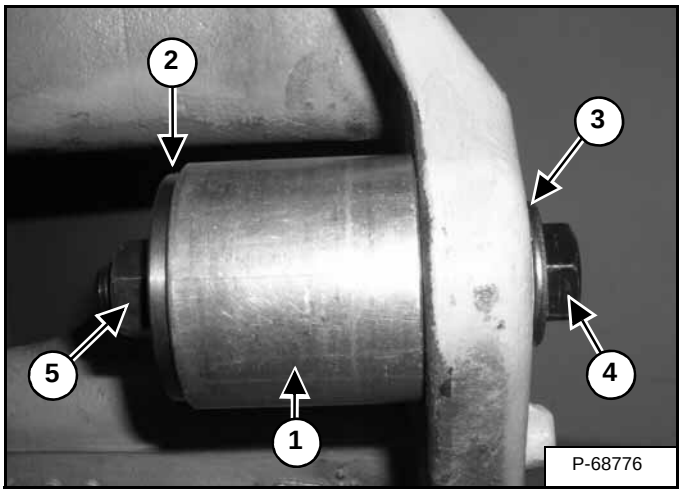
Nut - 0.625 inch

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 40-130-10



Install the spacer (Item 1) and washer (Item 2) **[Figure 40-130-10]** over the flanged end of the bushing.

The spacer (Item 1) **[Figure 40-130-10]** must be centered over the bushing to avoid contact between the bushing and the spacer during removal.

Install the washer (Item 3) **[Figure 40-130-10]** 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 40-130-10]** through the washers and spacer.

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

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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 40-130-10]** 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 40-130-10]**.

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

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Dealer Copy -- Not for Resale

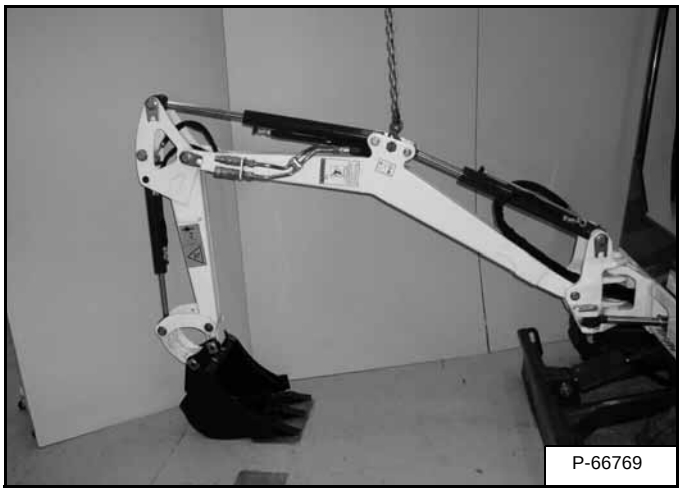
BOOM

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 40-140-1

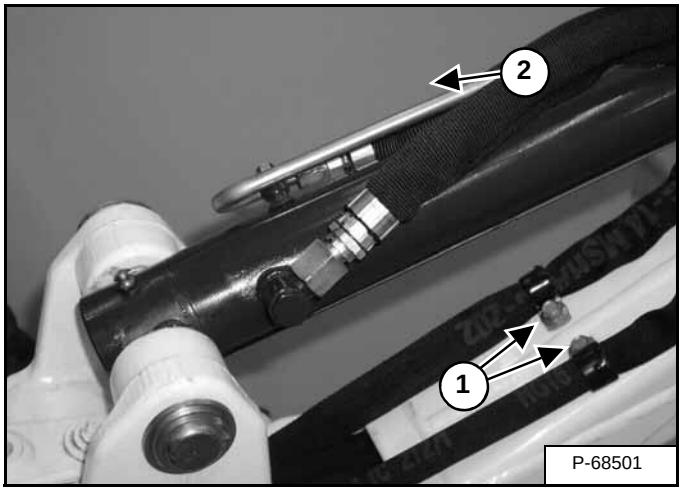


Install a chain hoist on the boom **[Figure 40-140-1]**.

Remove the bucket. (See Removal And Installation on Page 40-160-1)

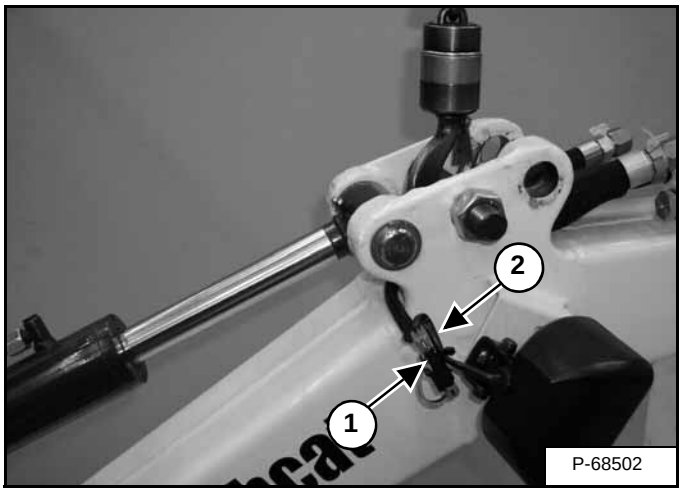
Remove the arm. (See Removal And Installation on Page 40-150-1)

Figure 40-140-2



Remove the screws (Item 1) **[Figure 40-140-2]** from the hose clamps.

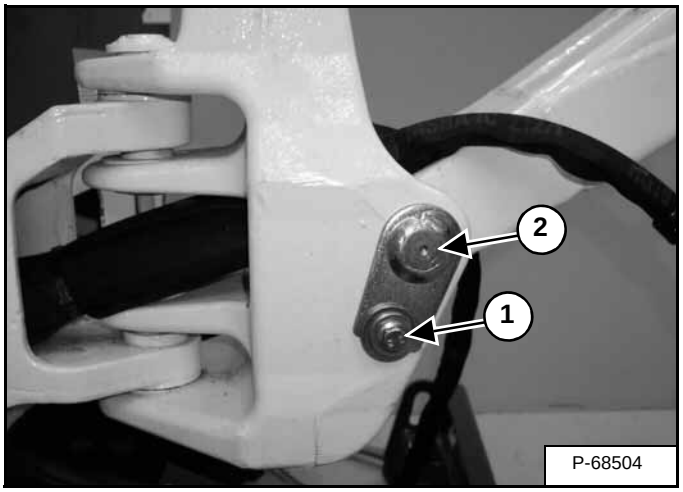
Figure 40-140-3



Remove the tie strap (Item 1) on the light wire harness. Disconnect the harness (Item 2) **[Figure 40-140-3]**.

Remove the boom cylinder. (See Removal and Installation on Page 20-20-2)

Figure 40-140-4



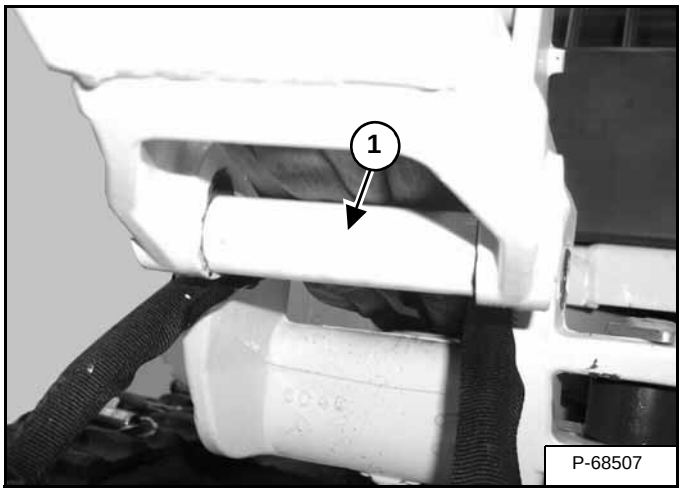
Remove the bolt and washers (Item 1) **[Figure 40-140-4]** from the pivot pin.

Remove the pivot pin (Item 2) **[Figure 40-140-4]**.

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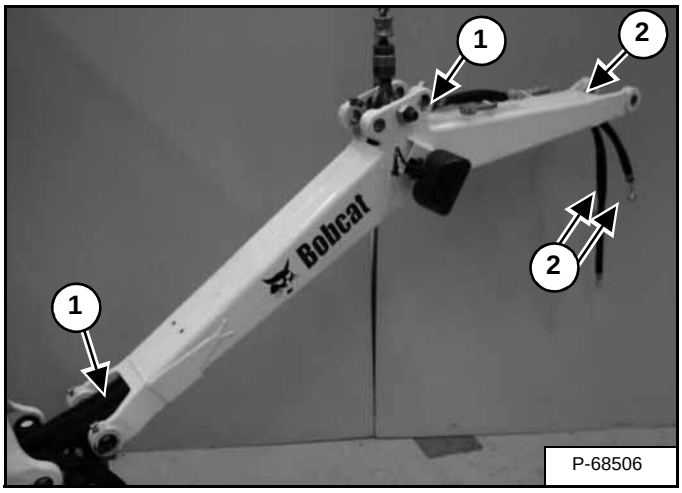
Removal And Installation (Cont'd)

Figure 40-140-5



Remove the pivot pin sleeve (Item 1) **[Figure 40-140-5]** after the pivot pin is removed.

Figure 40-140-6



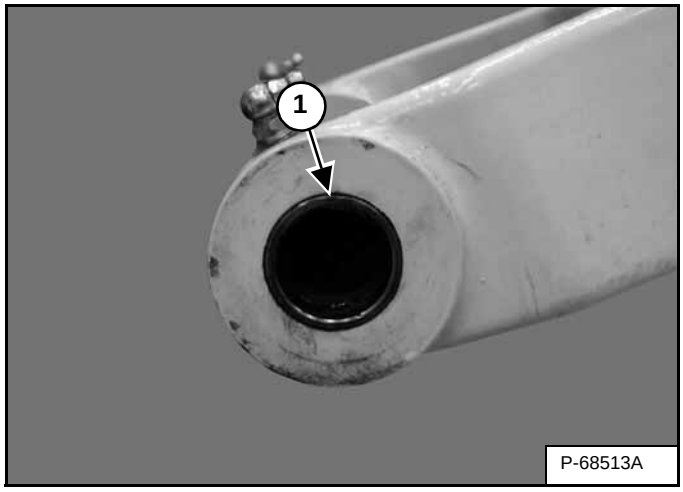
Lift the boom from the swing frame **[Figure 40-140-6]**.

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 40-140-6]**.

Boom Bushing Removal And Installation

Remove the boom. (See Removal And Installation on Page 40-140-1)

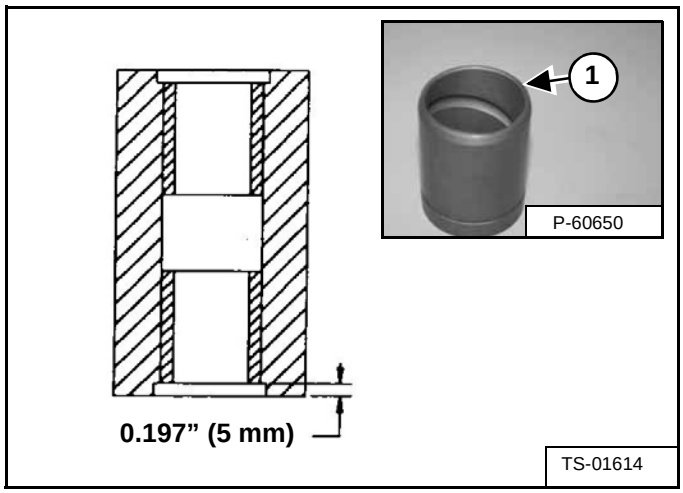
Figure 40-140-7



Remove the bushings (Item 1) **[Figure 40-140-7]** from both sides of the boom.

Install the new bushings in the boom.

Figure 40-140-8



Install the bushings until they are seated 0.197 in. (5 mm) in the pin boss **[Figure 40-140-8]**.

NOTE: Install the new bushings with the tapered end first (Item 1) [Figure 40-140-8].

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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)

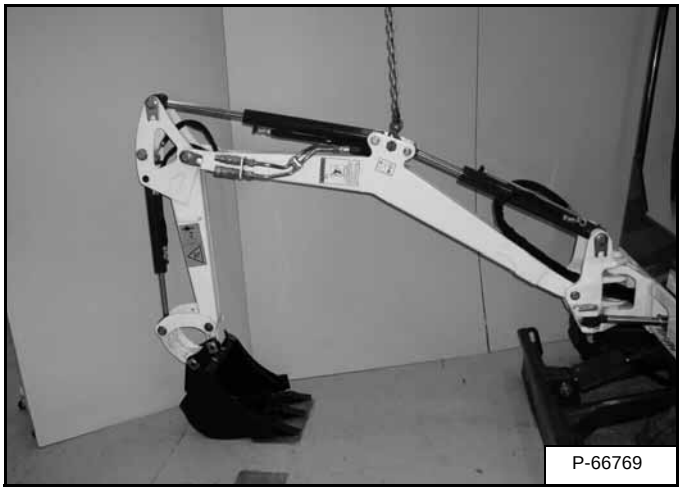
Remove the bucket cylinder. (See Removal and Installation on Page 20-23-2)

IMPORTANT

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

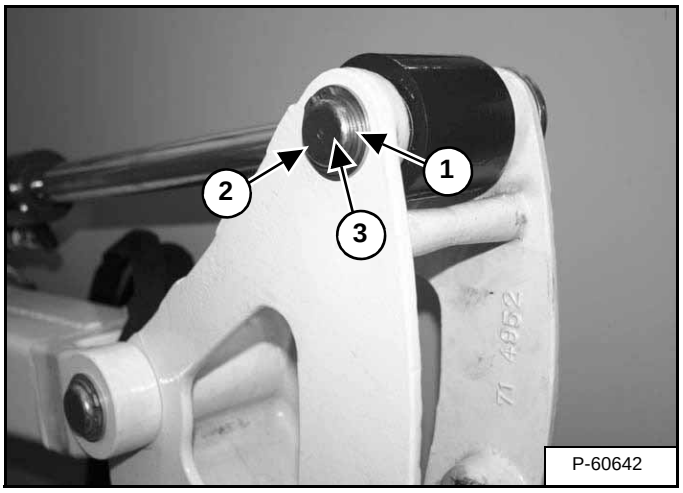
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Figure 40-150-1



Support the boom with a chain hoist **[Figure 40-150-1]**.

Figure 40-150-2

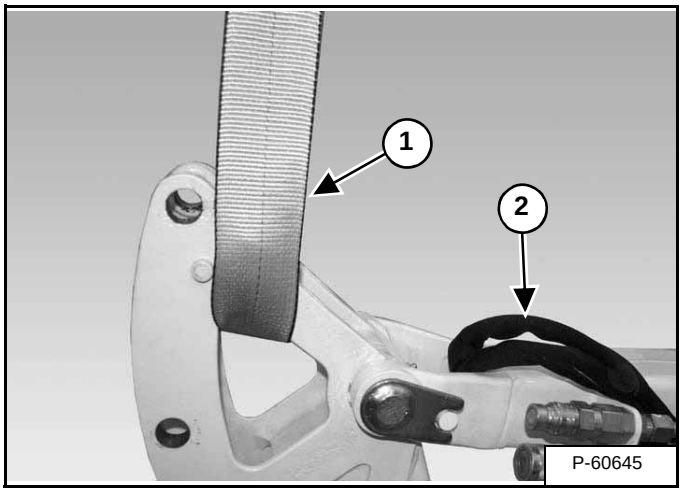


Remove the snap ring (Item 1) and washer (Item 2) **[Figure 40-150-2]** from the rod end pivot pin.

Remove the pivot pin (Item 3) **[Figure 40-150-2]**.

Remove the rod end of the cylinder from the arm.

Figure 40-150-3



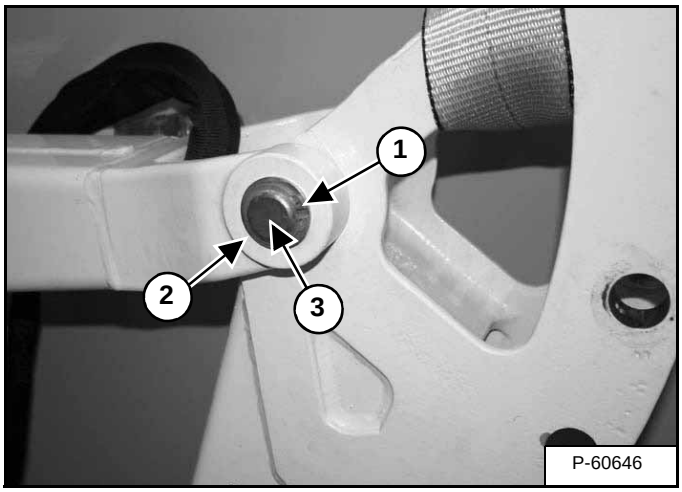
Install a strap (Item 1) **[Figure 40-150-3]** to support the arm.

Move the bucket cylinder hoses (Item 2) **[Figure 40-150-3]** away from the arm.

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Removal And Installation (Cont'd)

Figure 40-150-4



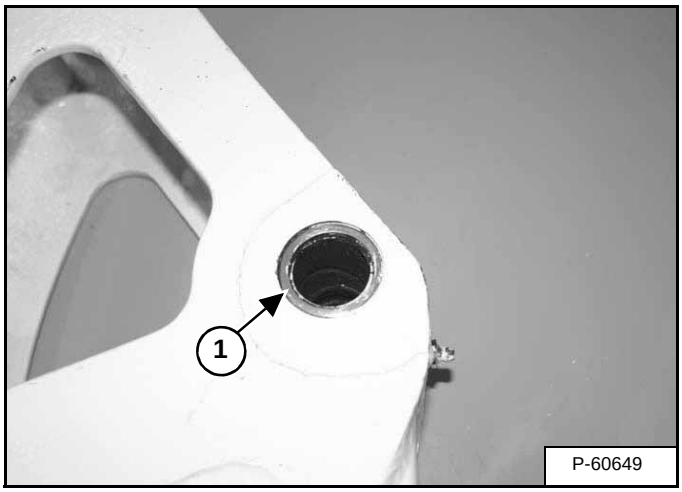
Remove the snap ring (Item 1) and washer (Item 2) **[Figure 40-150-4]** from the arm pivot pin.

Remove the pivot pin (Item 3) **[Figure 40-150-4]**.

Remove the arm.

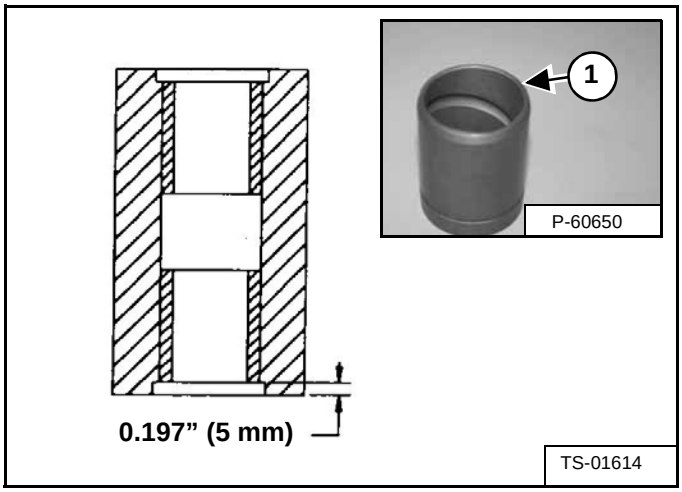
Arm To Boom Bushing Removal And Installation

Figure 40-150-5



Remove the dust seals and bushings (Item 1) **[Figure 40-150-5]** from both sides of the arm.

Figure 40-150-6



Install the new bushings until they are seated 0.197 in. (5 mm) in the pin boss **[Figure 40-150-6]**.

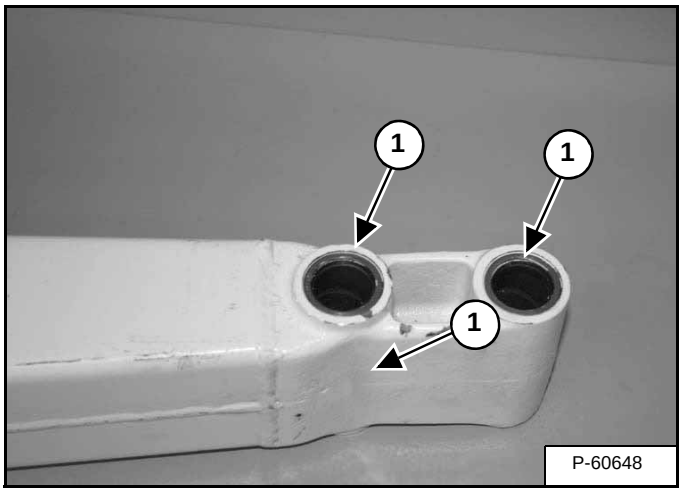
NOTE: Install the new bushings with the tapered end first (Item 1) [Figure 40-150-6].

Install new dust seals with the lip facing out.

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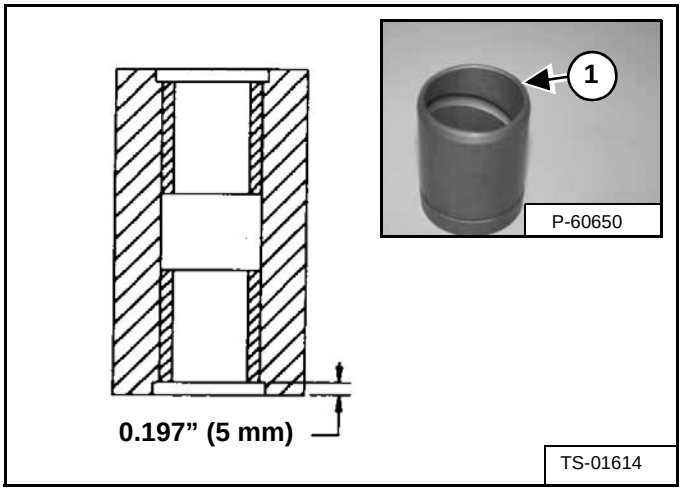
Arm To Bucket And Bucket Link Bushing Removal And Installation

Figure 40-150-7



Remove the dust seals and bushings (Item 1) **[Figure 40-150-7]** from both sides of the arm.

Figure 40-150-8



Install the bushings until they are seated 0.197 in. (5 mm) in the pin boss **[Figure 40-150-8]**.

NOTE: Install the new bushings with the tapered end first (Item 1) [Figure 40-150-8].

Install new dust seals with the lip facing out.

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BUCKET

Removal And Installation

WARNING

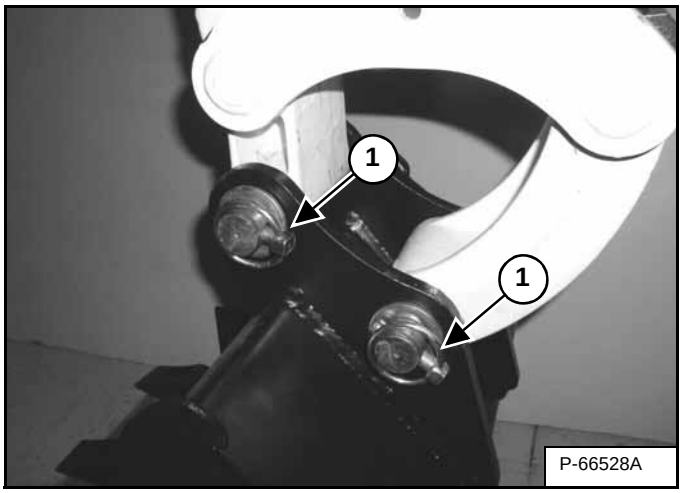
AVOID INJURY OR DEATH

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

W-2140-0189

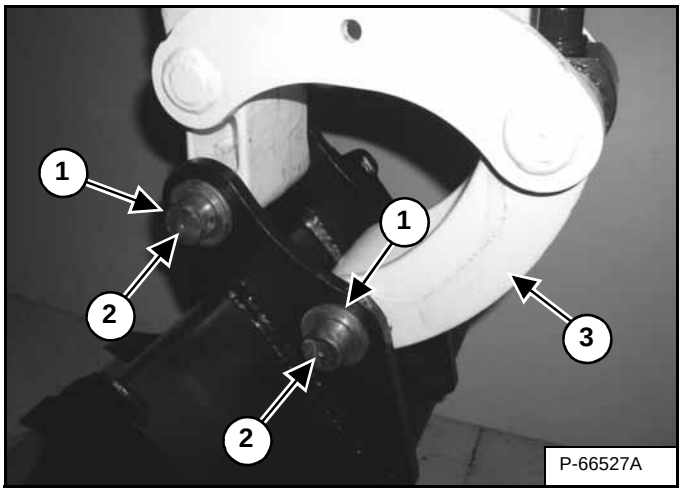
Park the excavator on a flat surface and put the bucket on the ground.

Figure 40-160-1



Remove the fasteners (Item 1) **[Figure 40-160-1]**.

Figure 40-160-2



Remove the washers (Item 1) and the pivot pins (Item 2) **[Figure 40-160-2]**.

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

Install the arm into the bucket, align the hole, install the pivot pin (Item 2) and washer (Item 1) **[Figure 40-160-2]**.

Install the link (Item 3) into the bucket, align the hole, install the pivot pin and washer (Item 2) **[Figure 40-160-2]**.

Install the fasteners (Item 1) **[Figure 40-160-1]**. Add grease to the pivot.

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

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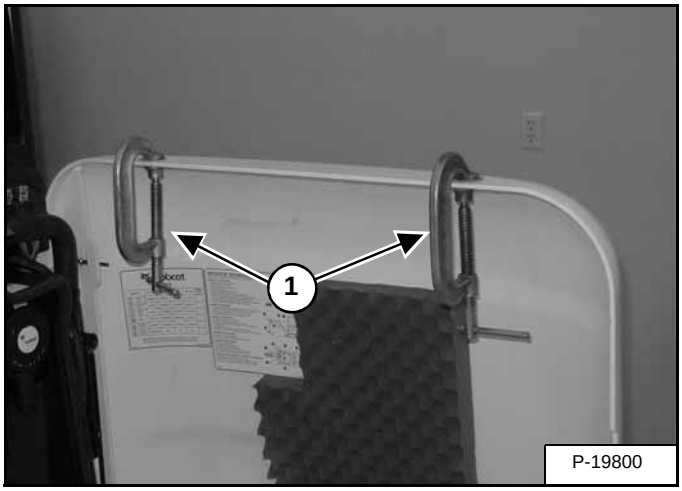
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TAILGATE

Removal And Installation

Open the tailgate.

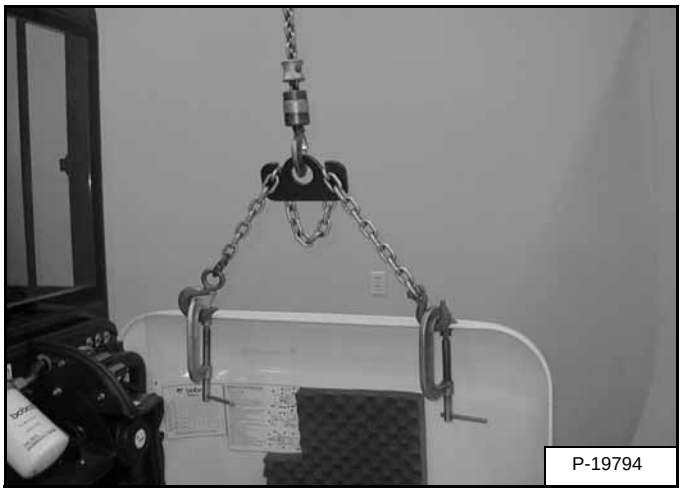
Figure 40-170-1



Install and tighten two C-clamps (Item 1) **[Figure 40-170-1]** equally spaced from the sides on the top of the tailgate.

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

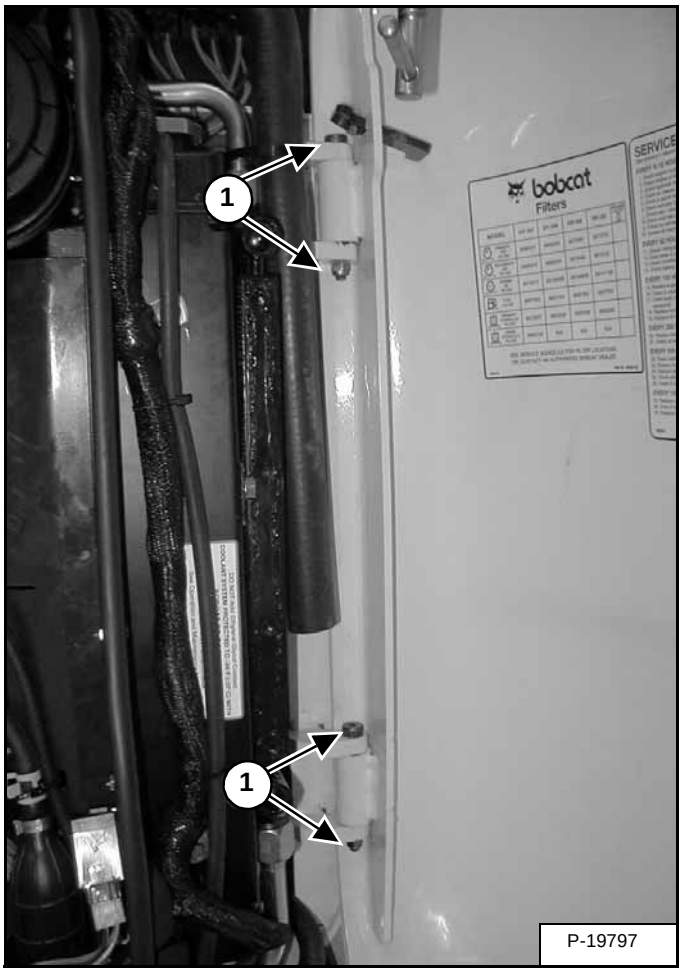
Figure 40-170-2



Install chains to the C-clamps and chain hoist **[Figure 40-170-2]**.

NOTE: Use a lifting device of sufficient capacity. Approximate weight of the tailgate is 120 lb. (55 kg).

Figure 40-170-3



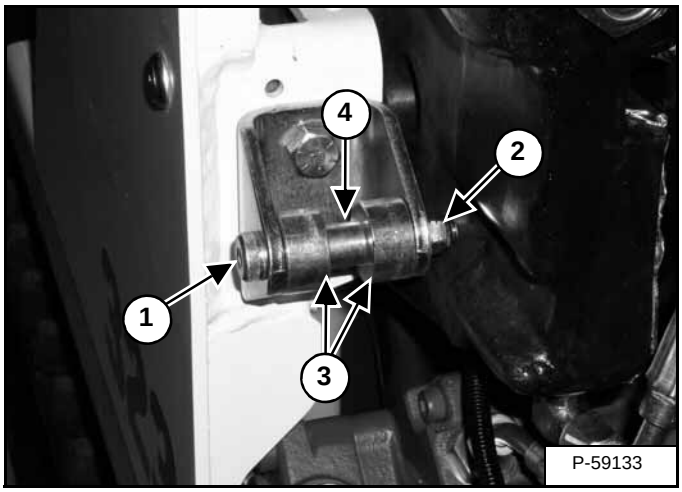
Remove the nuts and bolts (Item 1) **[Figure 40-170-3]** from the hinges.

Remove the tailgate from the excavator.

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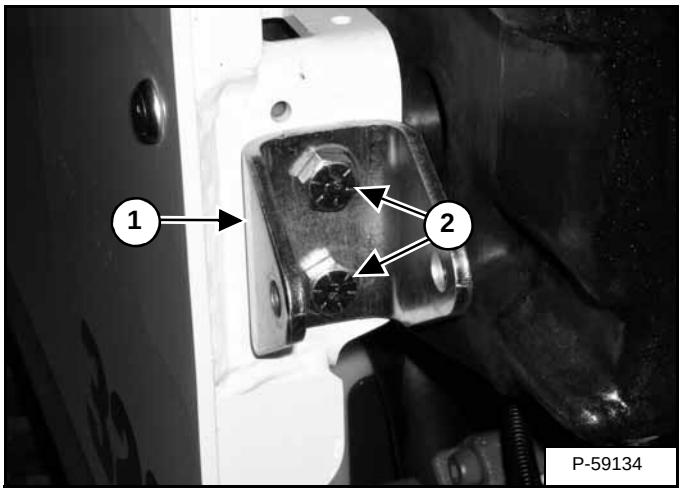
Latch Removal And Installation

Figure 40-170-4



Remove the bolt (Item 1), nut (Item 2), outer rollers (Item 3) and inner roller (Item 4) **[Figure 40-170-4]**.

Figure 40-170-5



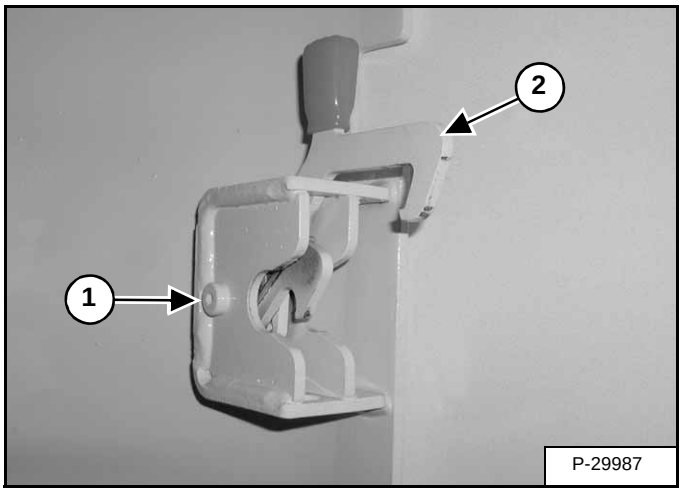
For ease of assembly, mark around the outside edge (Item 1) **[Figure 40-170-5]** of the latch bracket.

Remove the two bolts (Item 2) **[Figure 40-170-5]**, washer and nuts.

See latch adjustment. (See Adjusting The Latch on Page 10-40-1)

Remove the bracket (Item 1) **[Figure 40-170-5]**.

Figure 40-170-6



Remove the bolt (Item 1). Remove the latch assembly (Item 2) **[Figure 40-170-6]** from the tailgate.

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ELECTRICAL SYSTEM AND ANALYSIS

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Continued On Next Page

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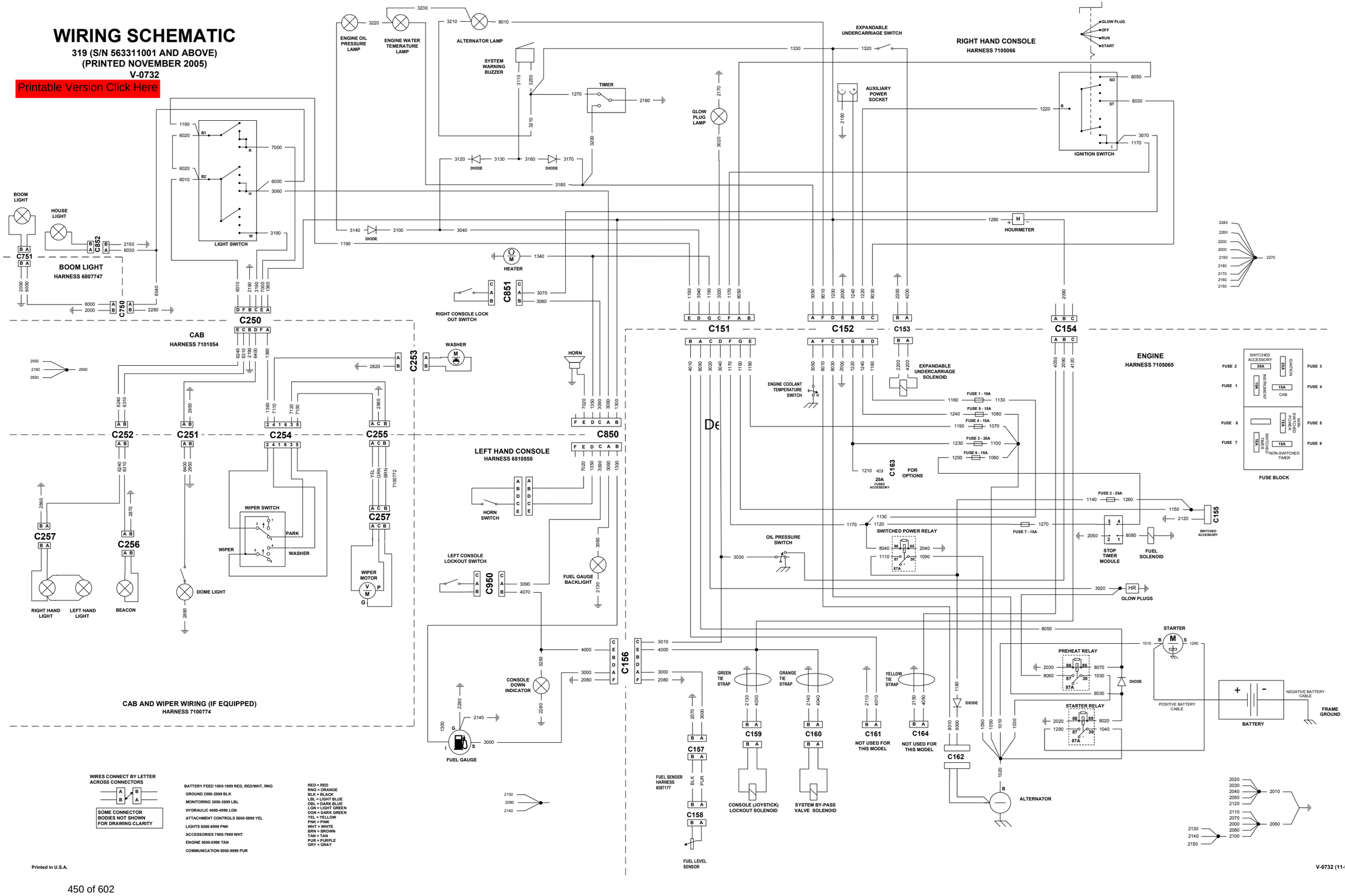
STARTER 50-40-1
Parts Identification 50-40-2
Removal And Installation 50-40-1

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WIRING SCHEMATIC

319 (S/N 563311001 AND ABOVE)
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V-0732

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CAB AND WIPER WIRING (IF EQUIPPED)

HARNESS 7100774

WIRES CONNECT BY LETTER ACROSS CONNECTORS

SOME CONNECTOR BODIES NOT SHOWN FOR DRAWING CLARITY

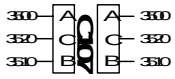
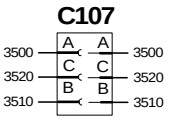
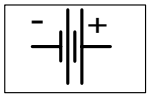
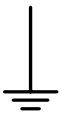
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GROUND 2000-2999 BLK
MONITORING 3000-3999 LBL
HYDRAULIC 4000-4999 LGN
ATTACHMENT CONTROLS 5000-5999 YEL
LIGHTS 6000-6999 PNK
ACCESSORIES 7000-7999 WHT
ENGINE 8000-8999 TAN
COMMUNICATION 9000-9999 PUR

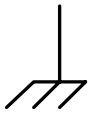
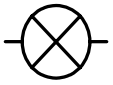
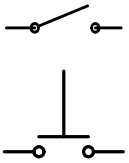
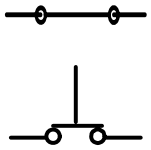
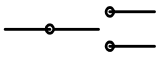
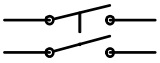
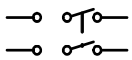
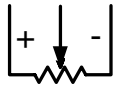
RED = RED
RNG = ORANGE
BLK = BLACK
LBL = LIGHT BLUE
DBL = DARK BLUE
LGN = LIGHT GREEN
DGN = DARK GREEN
YEL = YELLOW
PNK = PINK
WHT = WHITE
BRN = BROWN
TAN = TAN
PUR = PURPLE
GRY = GRAY

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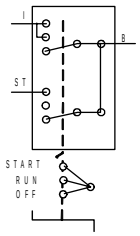
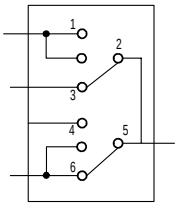
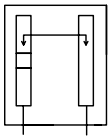
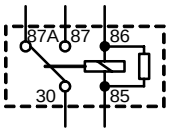
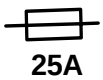
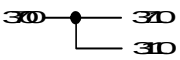
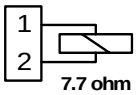
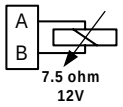
Glossary Of Electrical Symbols

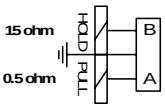
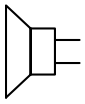
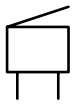
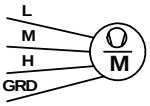
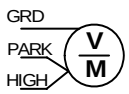
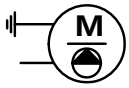
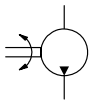
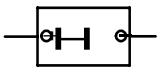
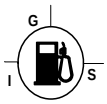
SYMBOL	DESCRIPTION
	CONNECTIONS
	CONNECTOR - Harness - Used for connecting 2 harnesses together or a harness to a component. The connector can vary from a single pin to any number of pins (Example: 3 pin connectors shown). The connector pins can be numbered alphabetical (shown) or numerical (1, 2, 3 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.

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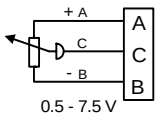
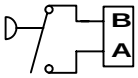
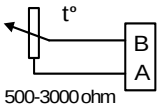
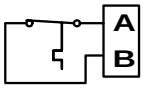
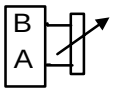
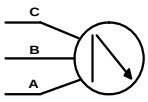
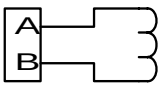
Glossary Of Electrical Symbols (Cont'd)

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.
 **25A**	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.)

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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.)
	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.

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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

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.

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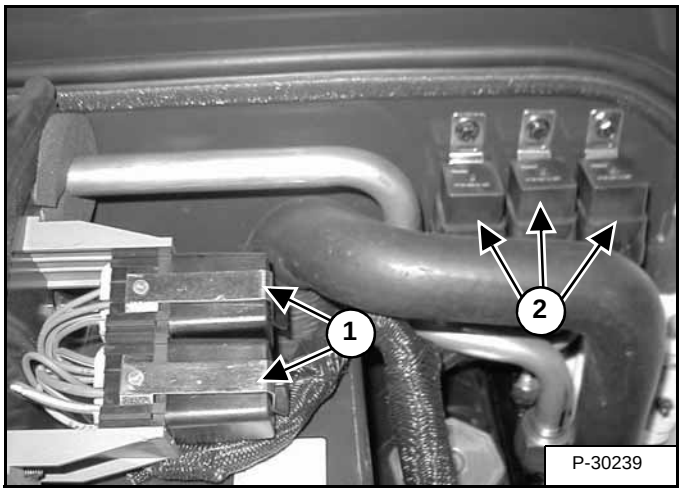
PROBLEM	CAUSE
Battery will not take charge.	1, 2, 3, 4, 5
Alternator will not charge.	1, 2, 5
Starter will not turn engine.	2, 3, 4, 6, 7, 8, 9

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.

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Description

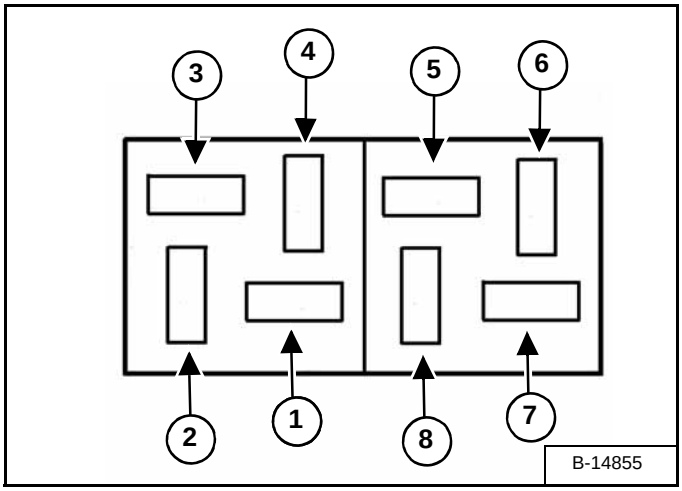
Figure 50-10-7



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 & 2) **[Figure 50-10-7]**. 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 50-10-8



1. **Instrument** - 10A (SW) Hourmeter, Warning Buzzer & Fuel Gauge Back Light
2. **Accessory** - 20A (SW) Accessory Connector, Heater & Horn
3. **Start** - 20A (SW) Key Switch, Unswitched Accessory Connector
4. **Cab** - 15A (SW) Cab Power, Lights, Wiper & 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 50-10-8]**

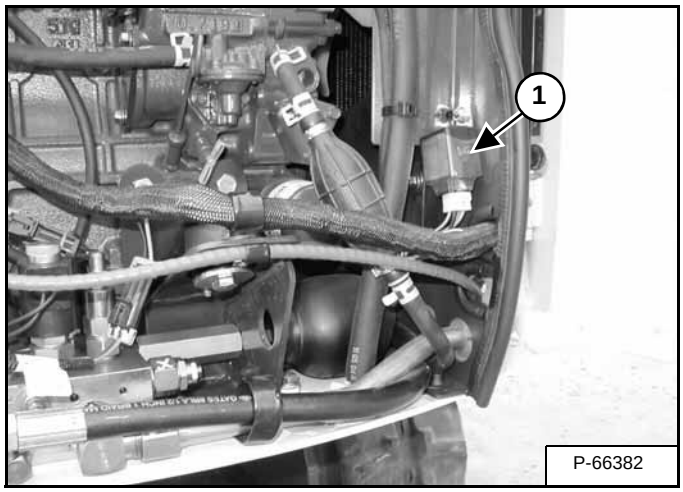
Always replace fuses using the same type and capacity.

The three electrical relays (Item 2) **[Figure 50-10-7]** 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.

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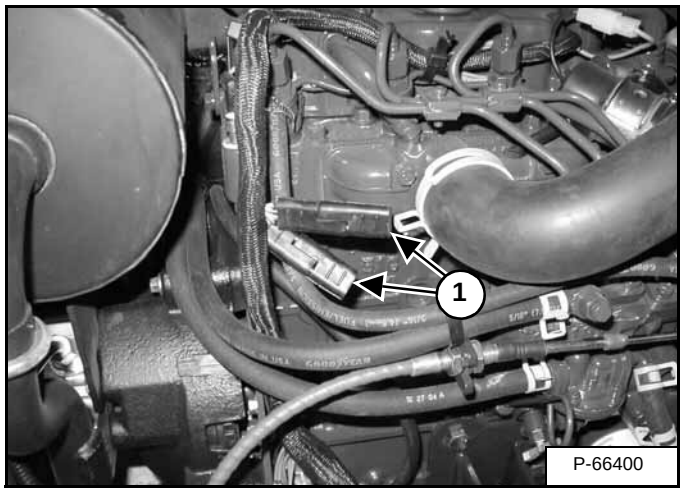
Fuel Timer And Diode Location / Identification

Figure 50-10-9



The fuel shutoff timer (Item 1) **[Figure 50-10-9]** is located on the right side of the engine compartment.

Figure 50-10-10



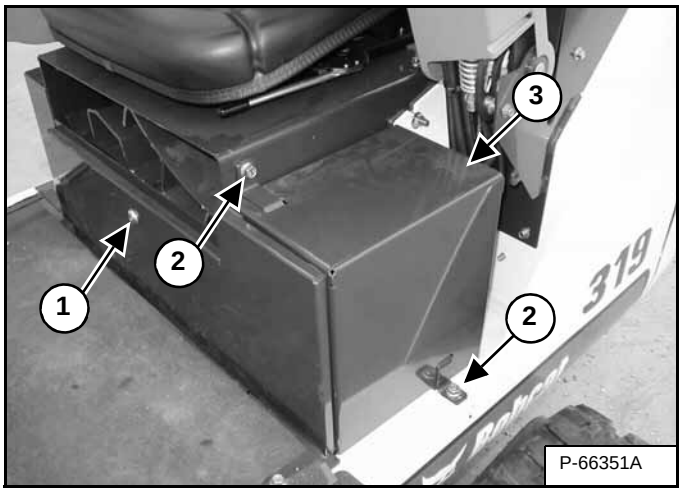
There are two diodes (Item 1) **[Figure 50-10-10]** in the harness to the left of the intake manifold. They are for alternator feedback protection and the glow plug during start function.

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BATTERY

Removal and Installation

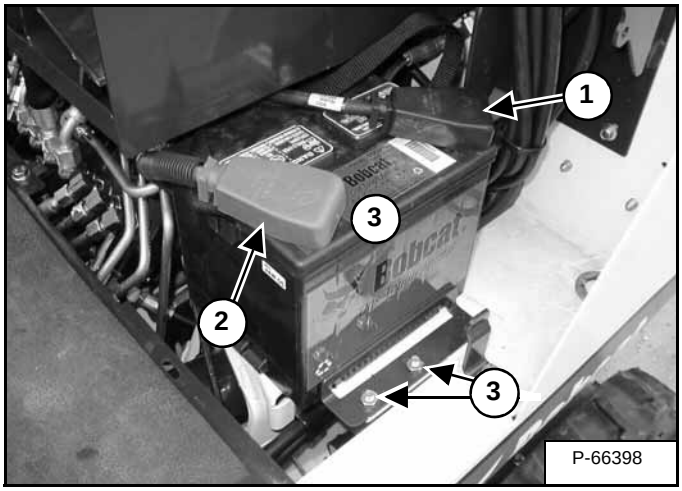
Figure 50-20-1



Remove the front access cover (Item 1) **[Figure 50-20-1]** using the start key.

Remove the two bolts (Item 2) and brackets and remove the battery cover (Item 3) **[Figure 50-20-1]**.

Figure 50-20-2



Disconnect the negative (-) cable (Item 1) **[Figure 50-20-2]** first.

Disconnect the positive (+) cable (Item 2) **[Figure 50-20-2]**.

Remove the two bolts (Item 3) **[Figure 50-20-2]** 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 50-20-2]** last to prevent sparks.

⚠ WARNING

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.

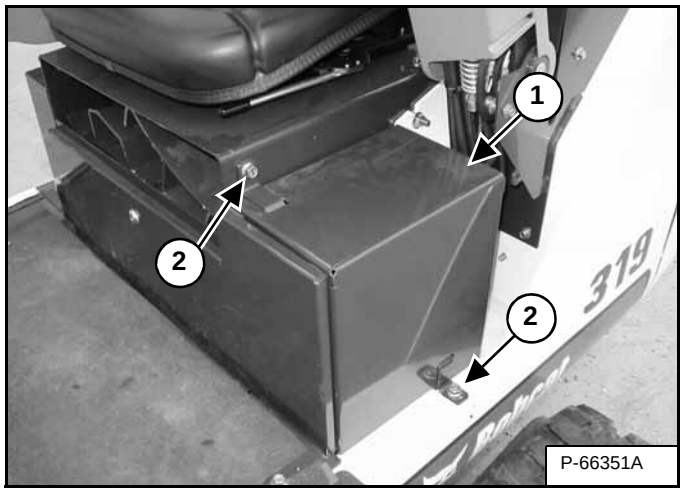
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BATTERY (CONT'D)

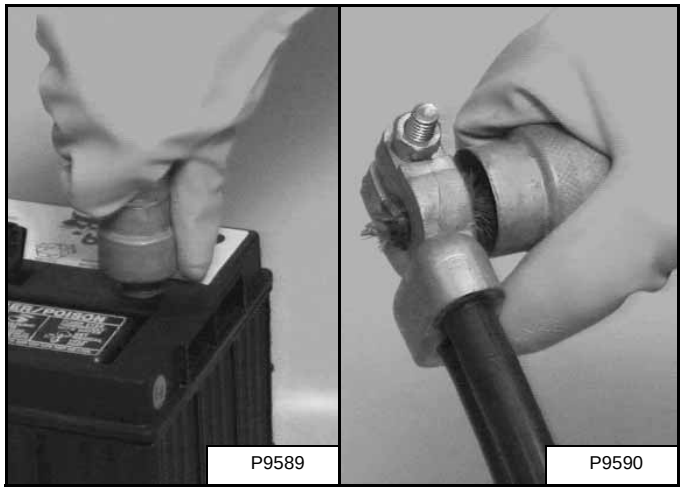
Servicing

Figure 50-20-3



The battery is located under the cover (Item 1) next to the operator's seat. Remove the two bolts (Item 2) **[Figure 50-20-3]** and brackets to open the cover.

Figure 50-20-4



The battery cables must be clean and tight **[Figure 50-20-4]**. 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

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.

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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 is NOT running while using the glow plugs. High voltage spikes from a running machine can burn out the glow plugs.

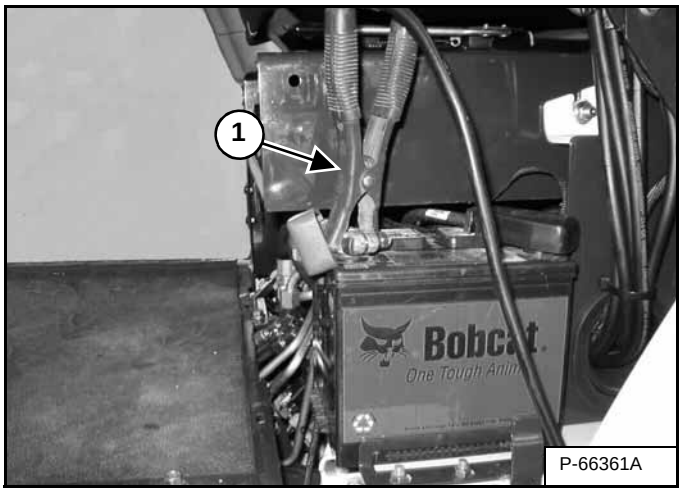
I-2060-0195

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

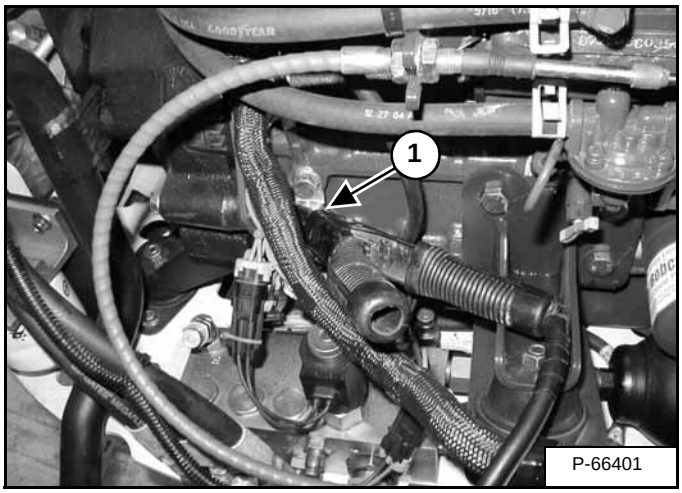
Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

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-2065-1296

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 2) **[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.**

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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]**.

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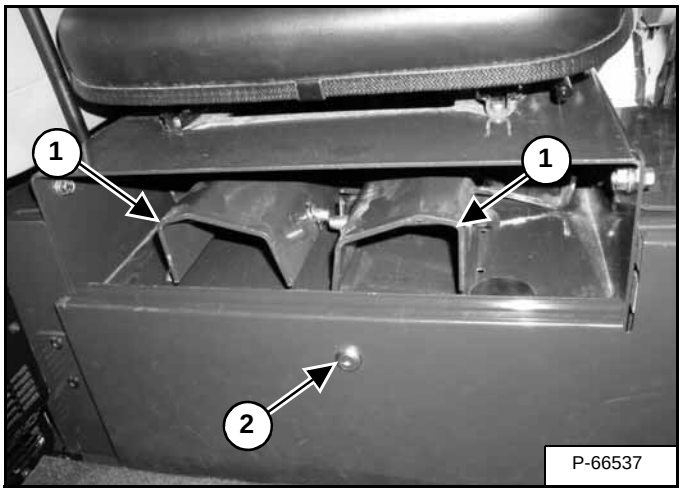
ALTERNATOR

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.

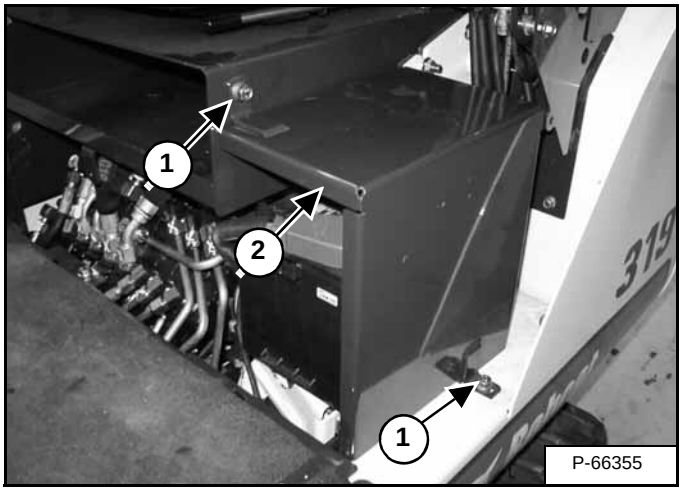
Figure 50-30-1



Remove the two blade extensions (Item 1) **[Figure 50-30-1]** from the storage compartment.

Use the start key to remove the access cover (Item 2) **[Figure 50-30-1]**.

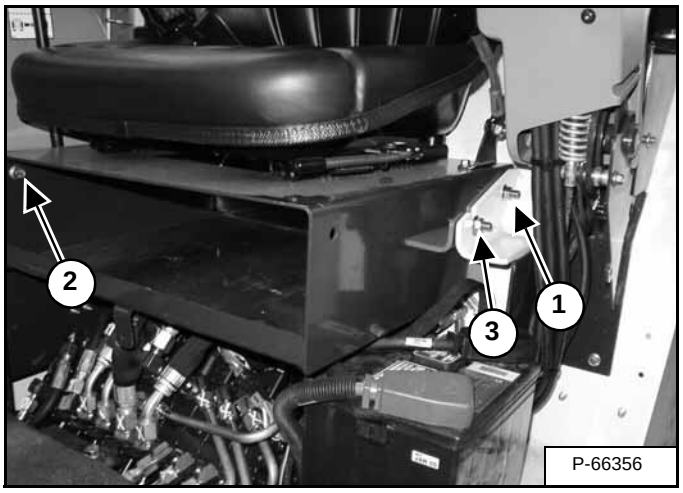
Figure 50-30-2



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

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

Figure 50-30-3



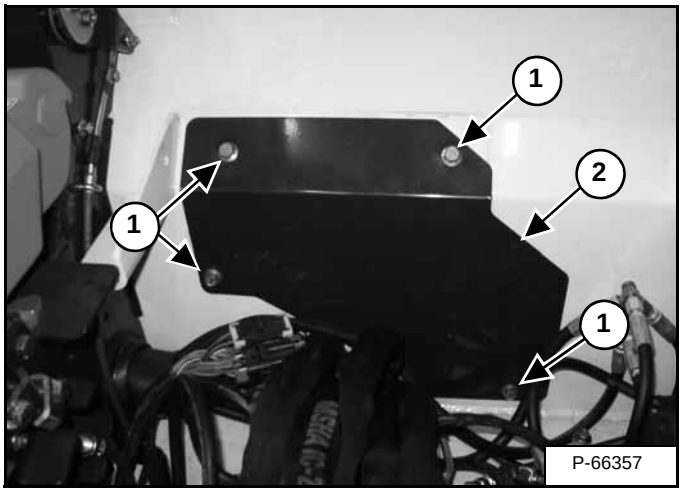
Remove the two bolts (Item 1) **[Figure 50-30-3]** and nuts from both sides of the seat mount.

Remove the bolt (Item 2) **[Figure 50-30-3]**, nut and bracket from the right side of the seat mount.

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

Remove the seat and seat mount.

Figure 50-30-4

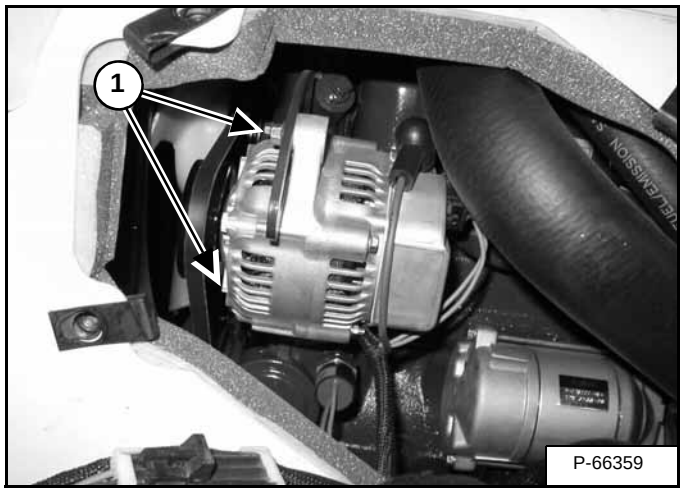


Remove the four bolts (Item 1) and remove the access panel (Item 2) **[Figure 50-30-4]**.

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Belt Adjustment (Cont'd)

Figure 50-30-5



Loosen the alternator mounting and adjustment bolts (Item 1) **[Figure 50-30-5]**.

If a belt tension tool is available, move the alternator toward the front of the machine **[Figure 50-30-5]** 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 50-30-5]** 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

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-2065-1296

⚠ 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.**

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Charging System Inspection (Cont'd)

If the charging system malfunctions check the following:

Check the condition and tension of the alternator belt. (See Belt Adjustment on Page 50-30-1.) 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.

Description

Figure 50-30-6

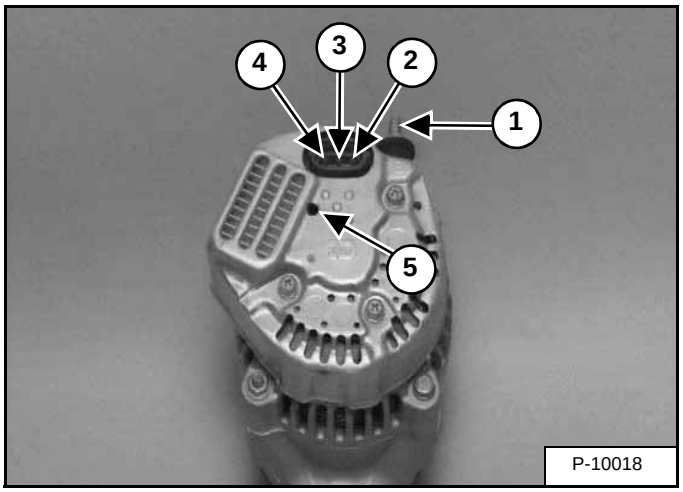
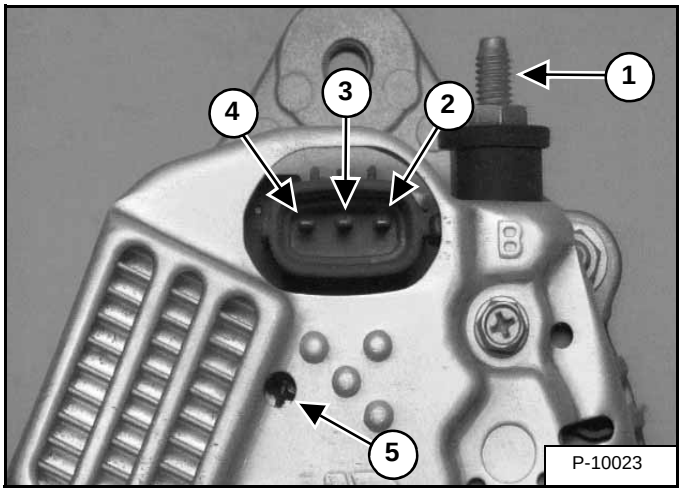


Figure 50-30-7



The output terminal (Item 1) **[Figure 50-30-6]** & **[Figure 50-30-7]**.

The battery or power sensing terminal (Item 2) **[Figure 50-30-6]** & **[Figure 50-30-7]**.

The ignition terminal (Item 3) **[Figure 50-30-6]** & **[Figure 50-30-7]**.

Open terminal not used in the excavator harness (Item 4) **[Figure 50-30-6]** & **[Figure 50-30-7]**.

Access hole for full field test (Item 5) **[Figure 50-30-6]** & **[Figure 50-30-7]**.

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Tests

Perform the following alternator tests in this order:

Alternator Output Test: Tests the alternator and regulator output.

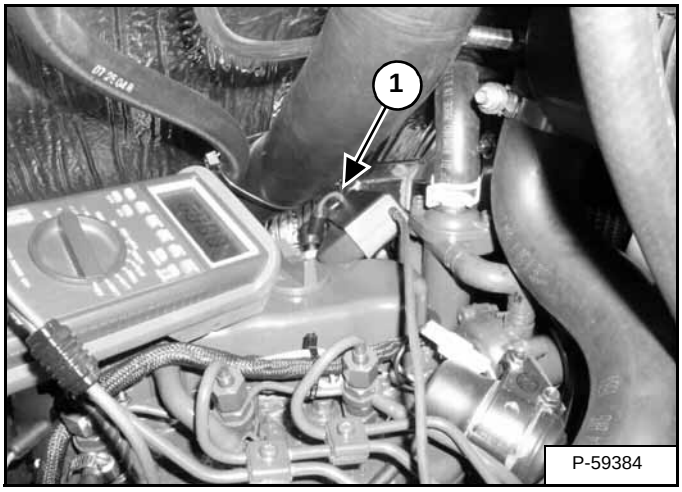
Full Field Test: Tests the maximum amperage output of the alternator.

Alternator Regulator Test: Tests the regulator voltage output.

Alternator Output Test

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

Figure 50-30-8



Use an induction meter and loop around the positive (+) wire (Item 1) **[Figure 50-30-8]** at the alternator.

Start the engine and run at full RPM.

The ammeter reading should be between 35 and 40 amps.

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

⚠ WARNING

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

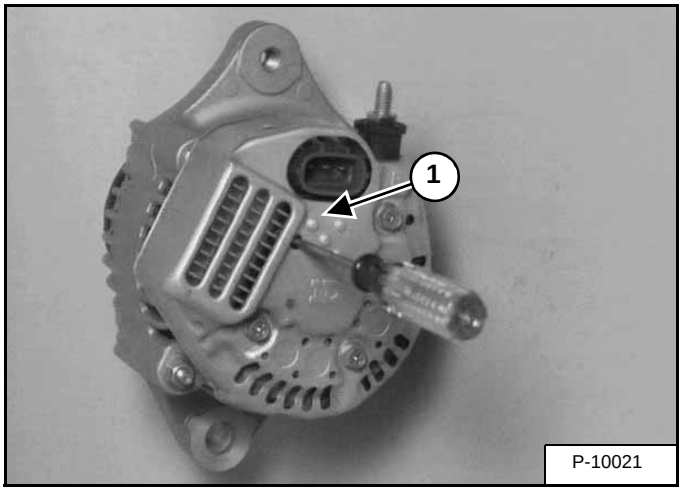
W-2050-1285

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Full Field Test

Start the engine and run at full RPM.

Figure 50-30-9



Place a small screw driver in the test port (Item 1) **[Figure 50-30-9]** to provide a ground to the alternator case. This will give maximum amperage output from the alternator.

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

The ammeter reading should be above 35 amps.

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

⚠ WARNING

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

W-2050-1285

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.

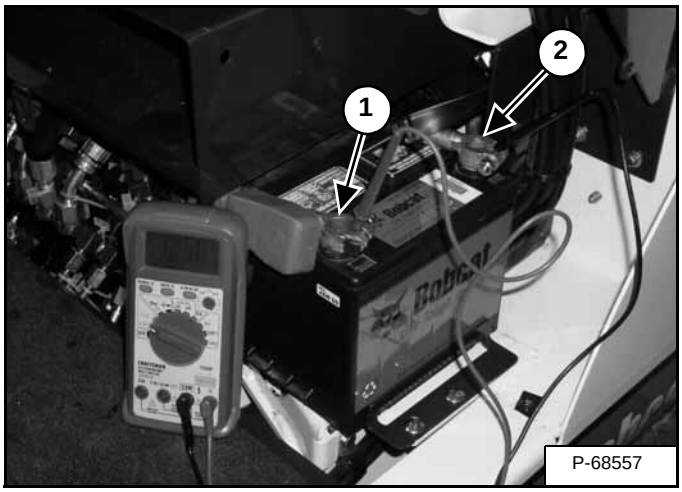
Reconnect the negative (-) cable from the battery.

NOTE: The alternator regulator test can also be run using a voltmeter.

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Alternator Regulator Test With Voltmeter

Figure 50-30-10



Connect the positive (+) voltmeter lead to the positive (+) battery terminal (Item 1) **[Figure 50-30-10]**.

Connect the negative (-) voltmeter lead to the negative (-) battery terminal (Item 2) **[Figure 50-30-10]**.

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

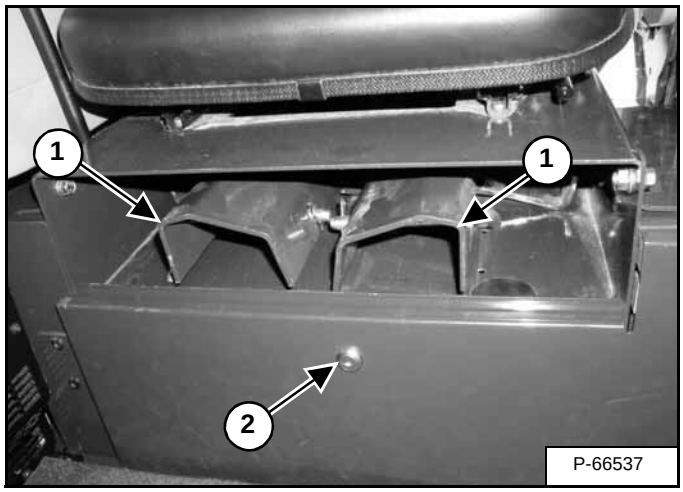
Damage to the alternator can occur if:

- **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

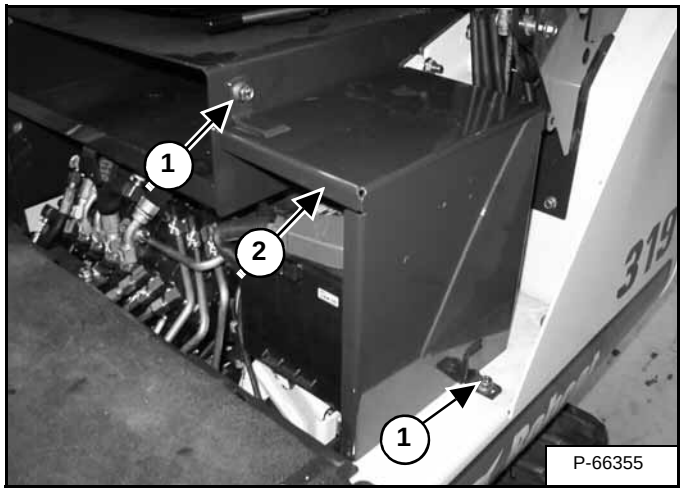
Figure 50-30-11



Remove the two blade extensions (Item 1) **[Figure 50-30-11]** from the storage compartment.

Use the start key to remove the access cover (Item 2) **[Figure 50-30-11]**.

Figure 50-30-12



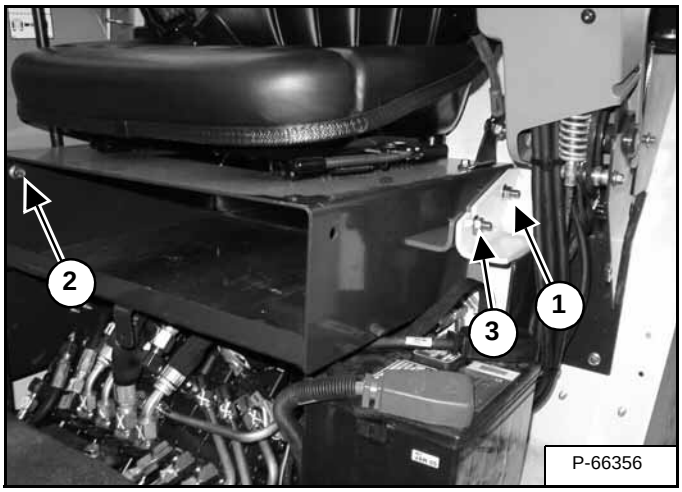
Remove the two bolts (Item 1) **[Figure 50-30-12]** and brackets from the battery cover.

Remove the cover (Item 2) **[Figure 50-30-12]**.

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Removal And Installation (Cont'd)

Figure 50-30-13



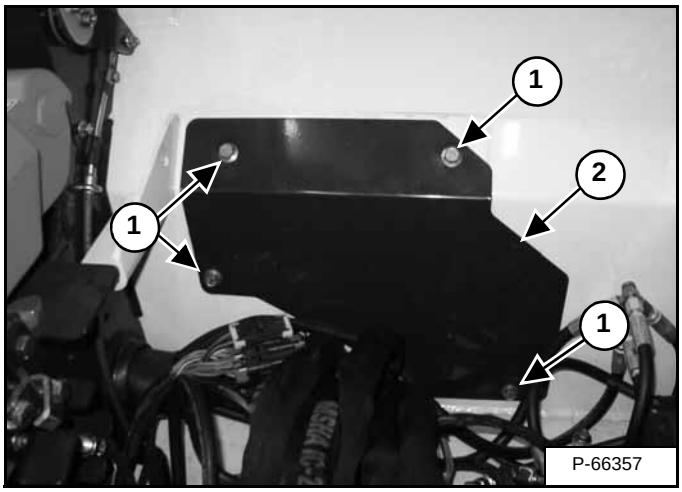
Remove the two bolts (Item 1) **[Figure 50-30-13]** and nuts from both sides of the seat mount.

Remove the bolt (Item 2) **[Figure 50-30-13]**, nut and bracket from the right side of the seat mount.

Loosen the two bolts (Item 3) **[Figure 50-30-13]** and nuts from both sides of the seat mount.

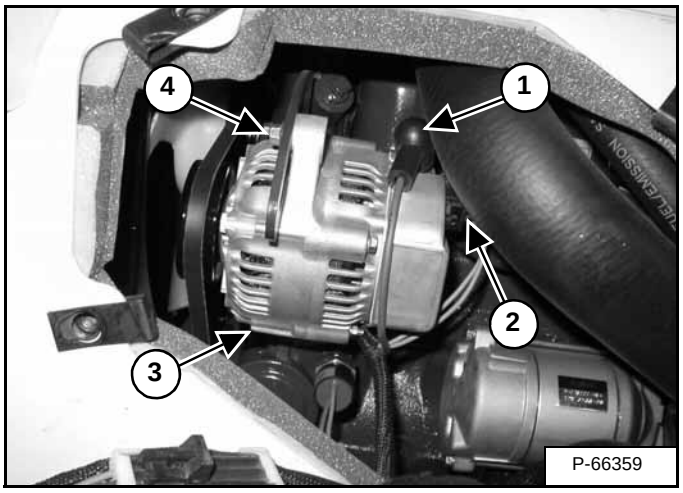
Remove the seat and seat mount.

Figure 50-30-14



Remove the four bolts (Item 1) and remove the access panel (Item 2) **[Figure 50-30-14]**.

Figure 50-30-15



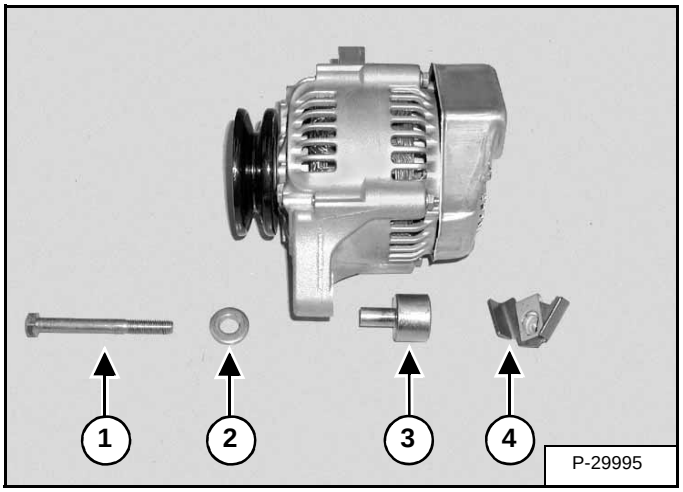
Disconnect the red wire (Item 1) **[Figure 50-30-15]**.

Disconnect the wire harness connector (Item 2) **[Figure 50-30-15]**.

Remove the bottom mount bolt (Item 3) **[Figure 50-30-15]**.

Remove alternator adjustment bolt (Item 4) **[Figure 50-30-15]**.

Figure 50-30-16



NOTE: Alternator will fall if not supported while removing adjustment bolt.

Remove belt from the alternator pulley.

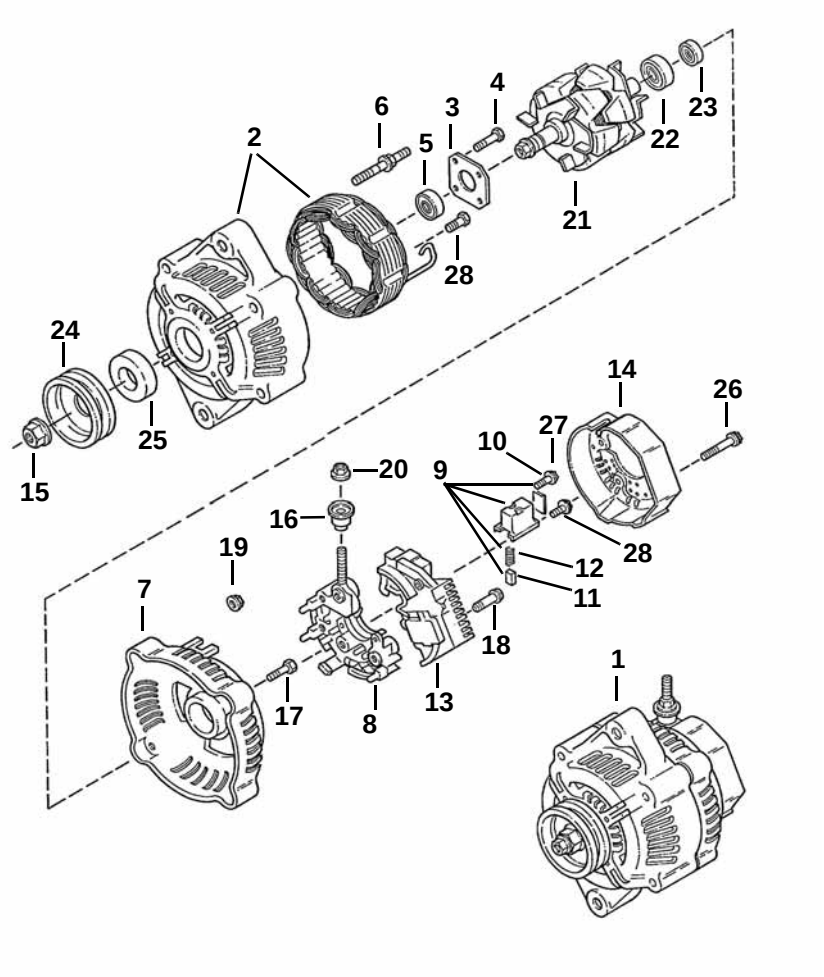
Remove alternator.

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 50-30-16] which will fall during disassembly.

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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

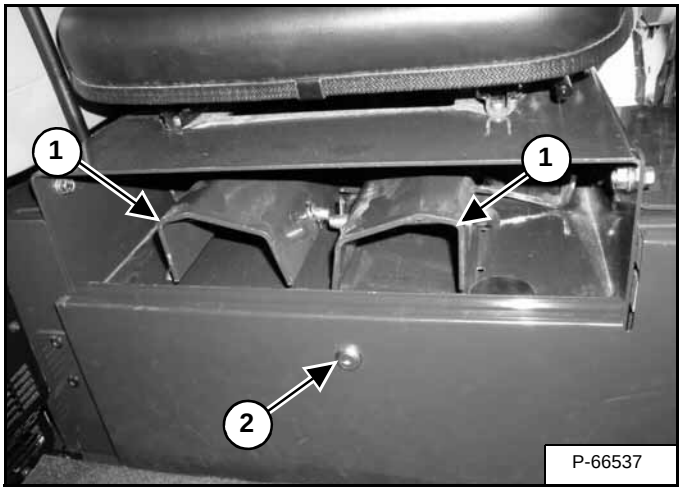
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STARTER

Removal And Installation

Stop the engine.

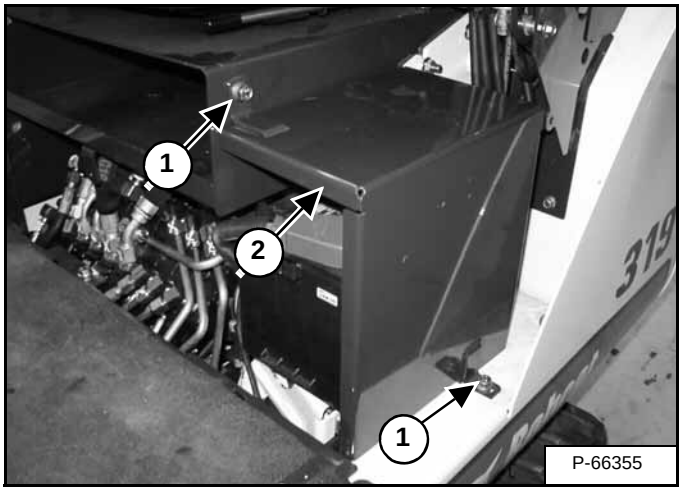
Figure 50-40-1



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]**.

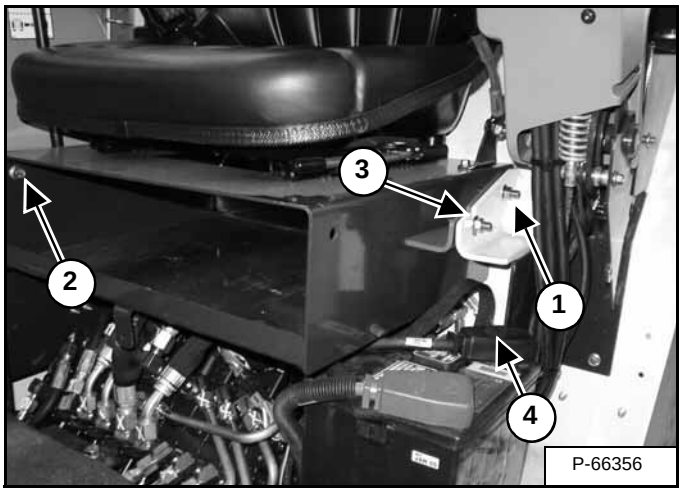
Figure 50-40-2



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.

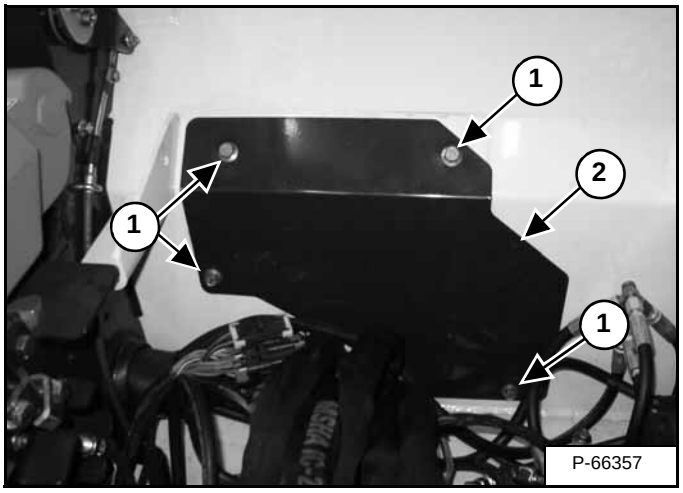
Remove the bolt (Item 2) **[Figure 50-40-3]**, nut and bracket from the right side of the seat mount.

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



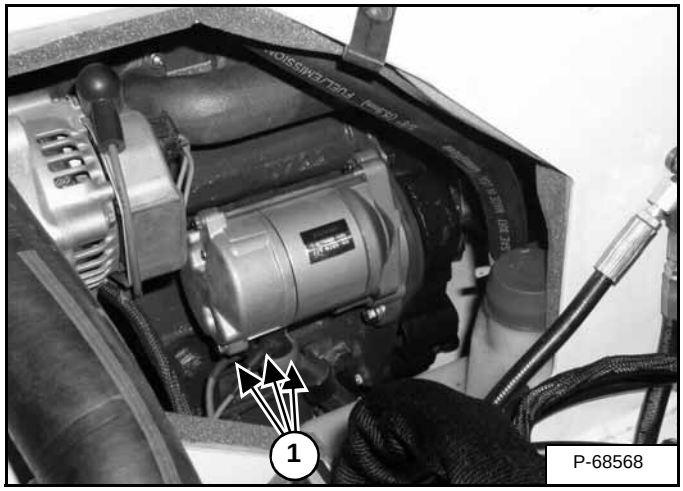
Remove the four bolts (Item 1) and remove the access panel (Item 2) **[Figure 50-40-4]**.

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Removal And Installation (Cont'd)

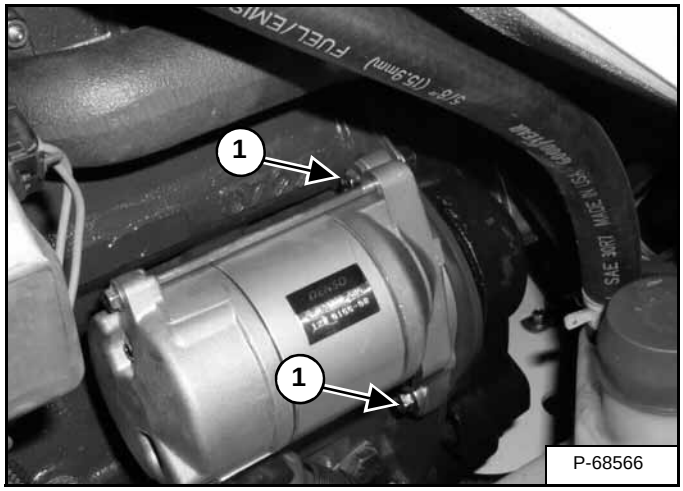
Mark the starter wires for ease of assembly.

Figure 50-40-1



Disconnect the wires (Item 1) **[Figure 50-40-1]** from the starter.

Figure 50-40-2

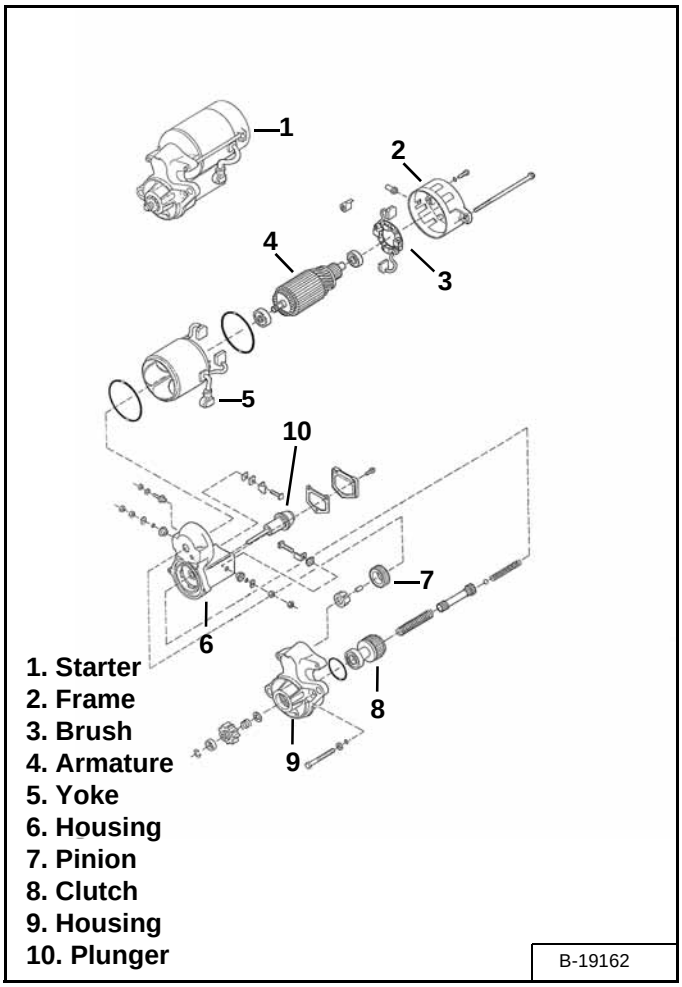


Remove the mounting bolts (Item 1) **[Figure 50-40-2]** from the starter.

Remove the starter from the bell housing.

Parts Identification

Figure 50-40-3

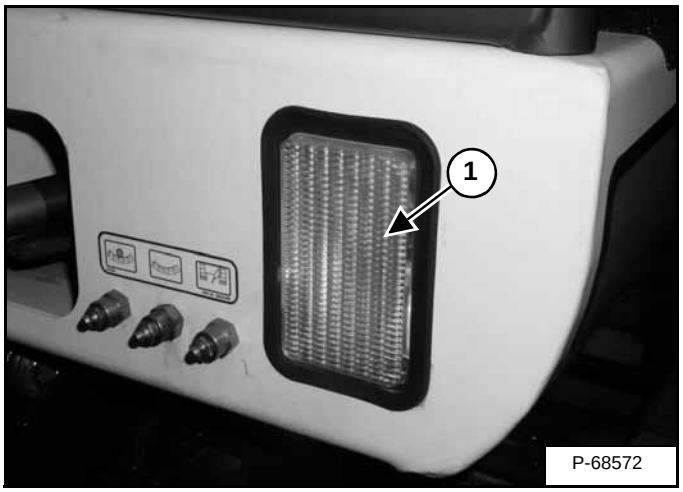


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LIGHTS

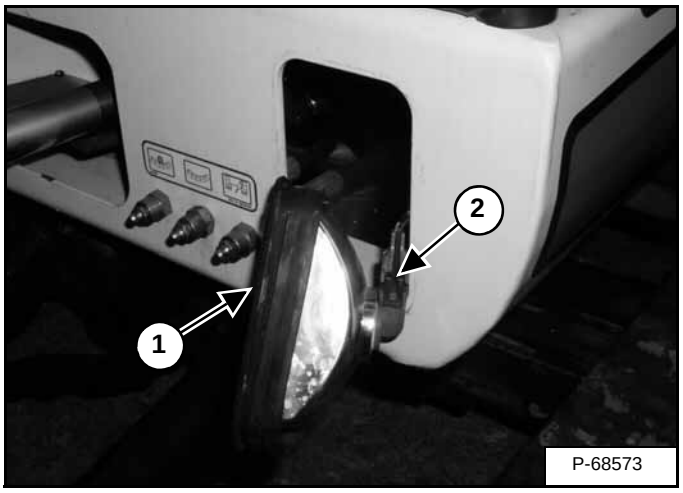
UpperStructure Light Removal And Installation

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

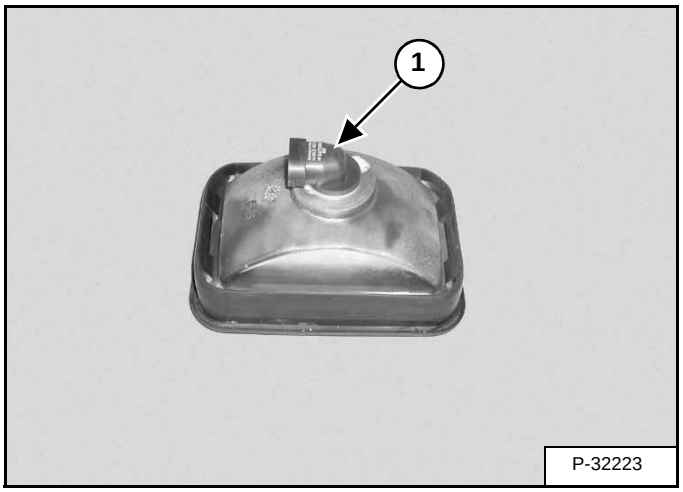
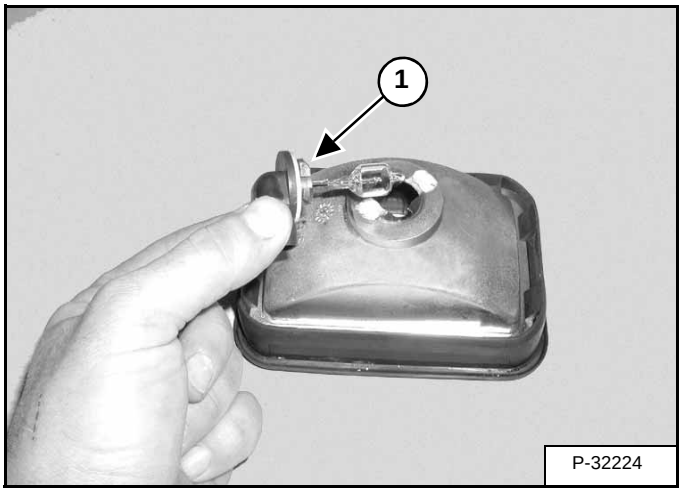


Figure 50-50-4

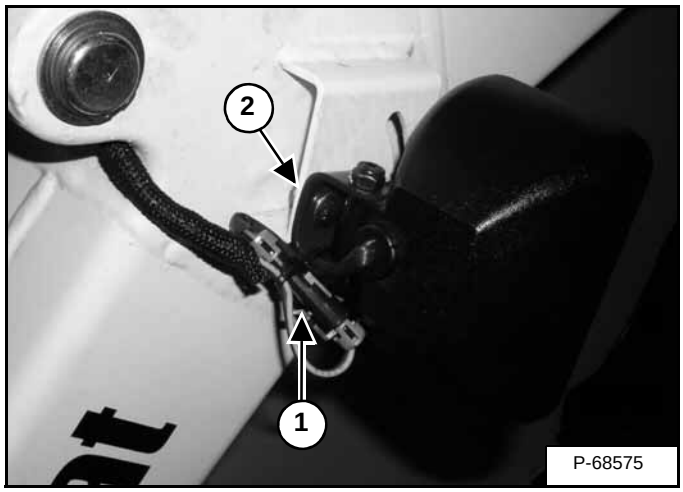


Remove the light bulb assembly (Item 1) **[Figure 50-50-3]** & **[Figure 50-50-4]** from the lens.

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Boom Light Removal And Installation

Figure 50-50-5

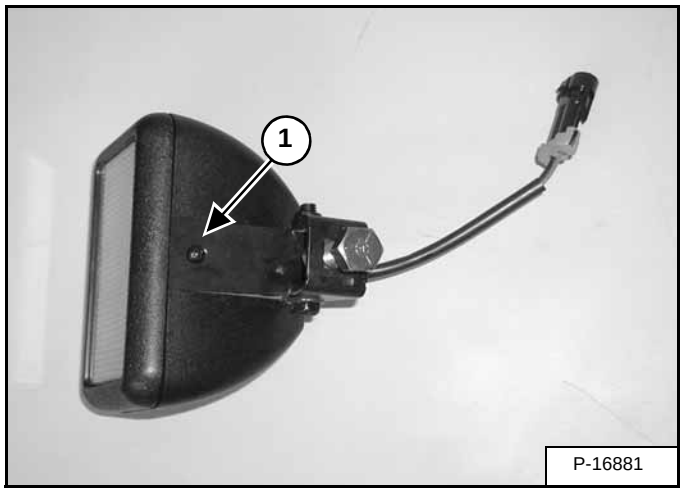


Disconnect the wire harness (Item 1) **[Figure 50-50-5]**.

Remove the nut and bolt (Item 2) **[Figure 50-50-5]**.

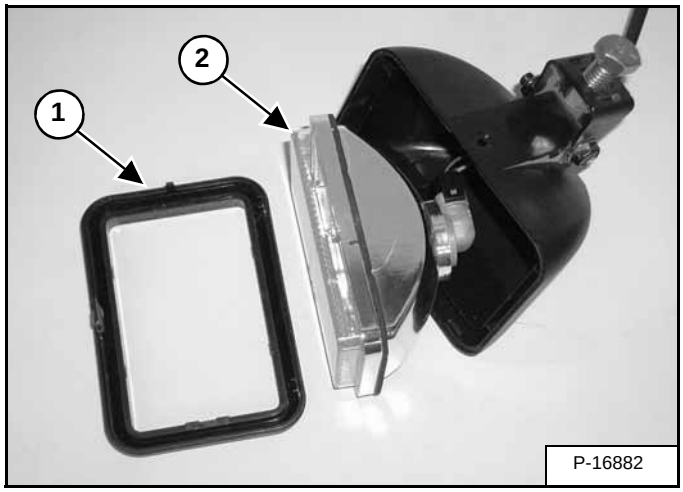
Boom Light Disassembly And Assembly

Figure 50-50-6



Remove the screw (Item 1) **[Figure 50-50-6]** from the side of the light.

Figure 50-50-7

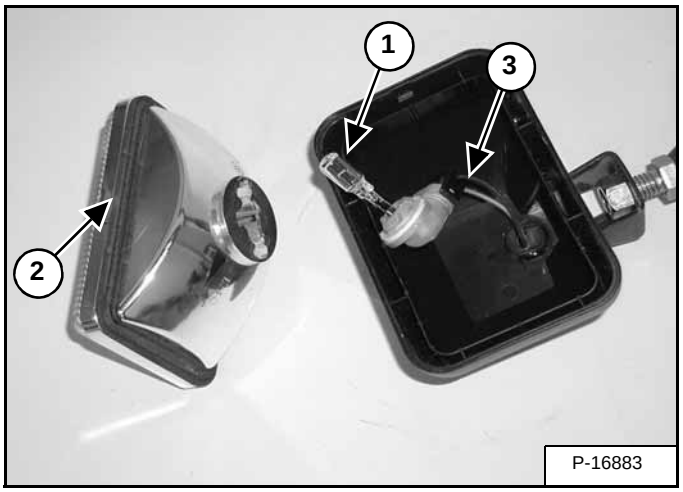


Remove the cover (Item 1) and lens assembly (Item 2) **[Figure 50-50-7]**.

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Boom Light Disassembly And Assembly (Cont'd)

Figure 50-50-8

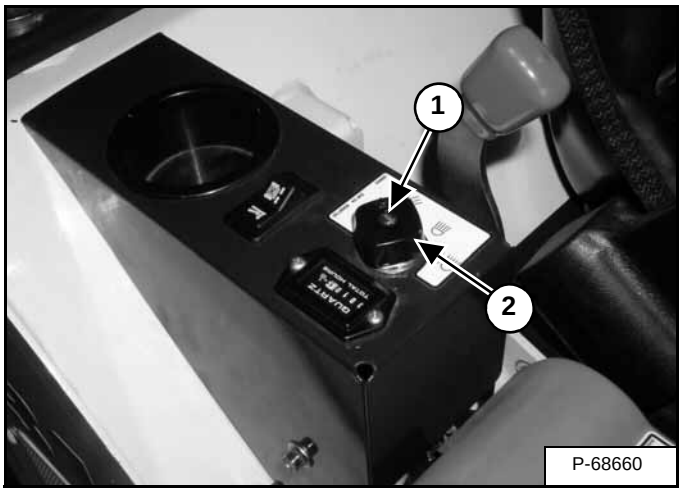


Remove the light bulb assembly (Item 1) from the lens assembly (Item 2) **[Figure 50-50-8]**.

Disconnect the wire connector (Item 3) **[Figure 50-50-8]** from the light bulb assembly.

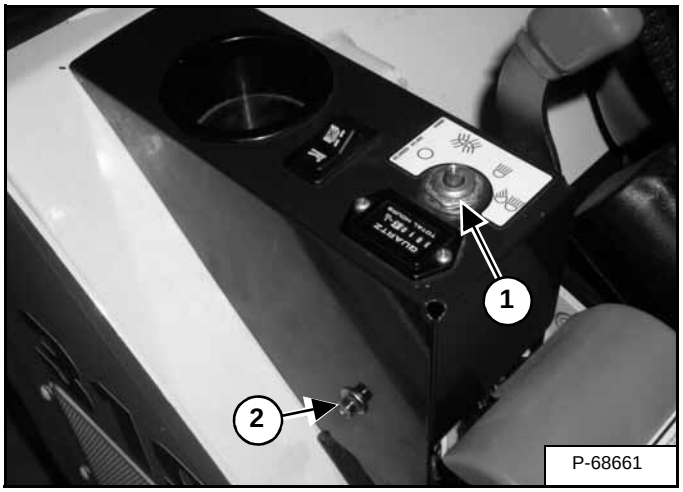
Light Switch Removal And Installation

Figure 50-50-9



Remove the screw (Item 1) and knob (Item 2) **[Figure 50-50-9]** from the switch.

Figure 50-50-10



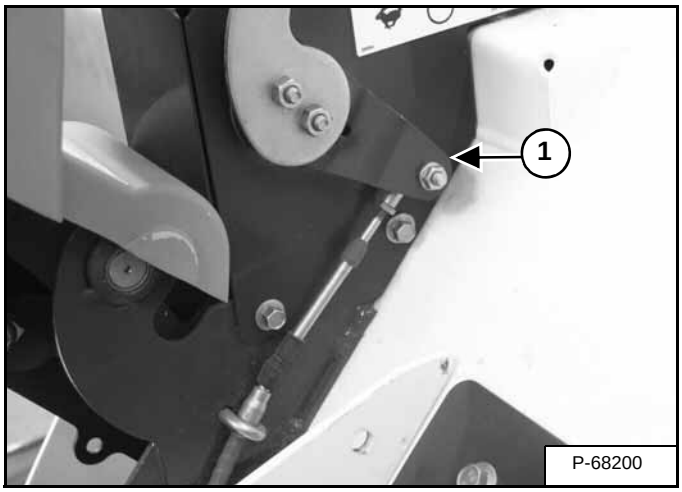
Remove the nut and lock washer (Item 1) **[Figure 50-50-10]** from the switch.

Remove the screw (Item 2) **[Figure 50-50-10]** from the instrument console.

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Light Switch Removal And Installation (Cont'd)

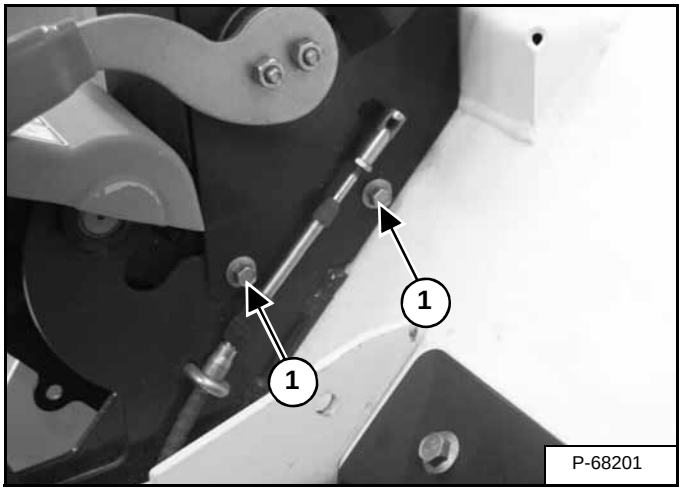
Figure 50-50-11



Remove the throttle linkage frrom 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.

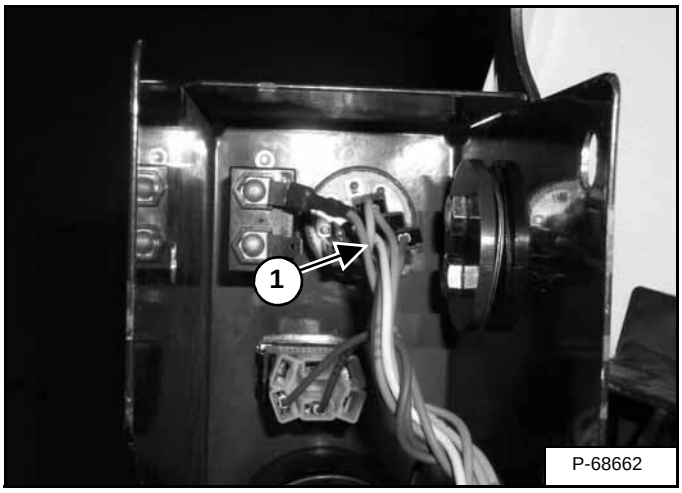
Figure 50-50-12



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.

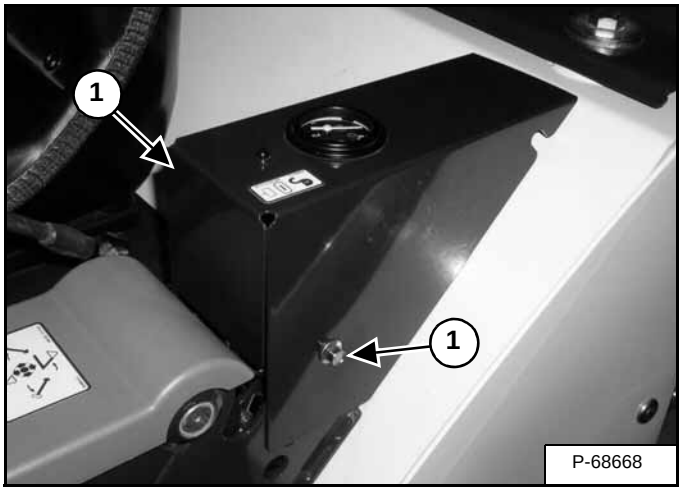
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MICROSWITCH

Testing Left Console Microswitch

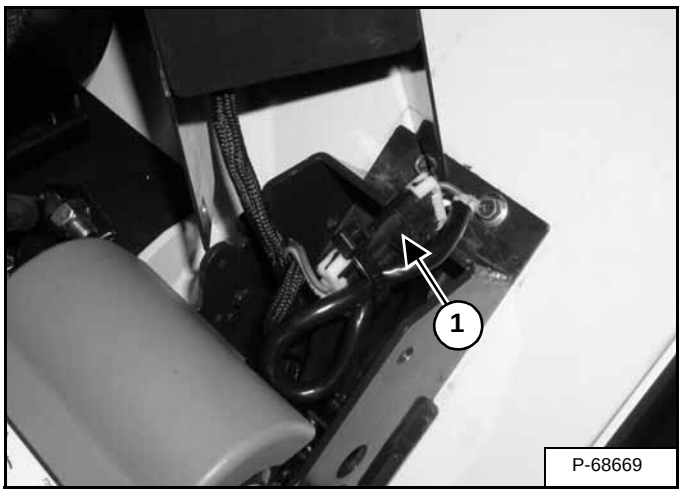
Lower the control console.

Figure 50-60-1



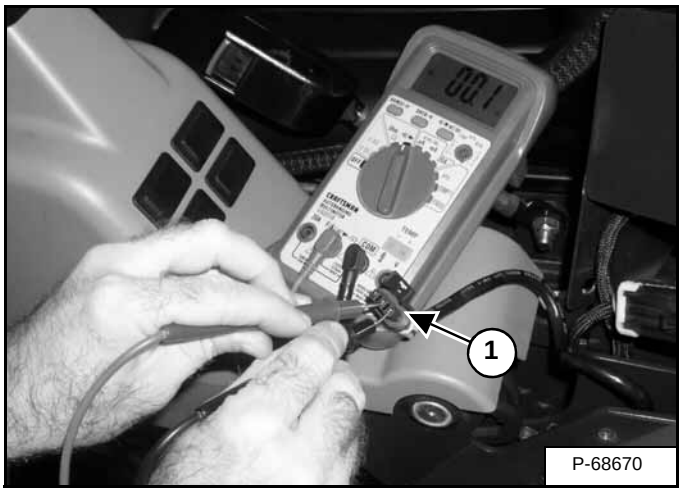
Remove the two bolts (Item 1) **[Figure 50-60-1]**, on both sides, and lift the left instrument console off to the side.

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.

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MICROSWITCH (CONT'D)

Left Console Microswitch Removal And Installation

Figure 50-60-4

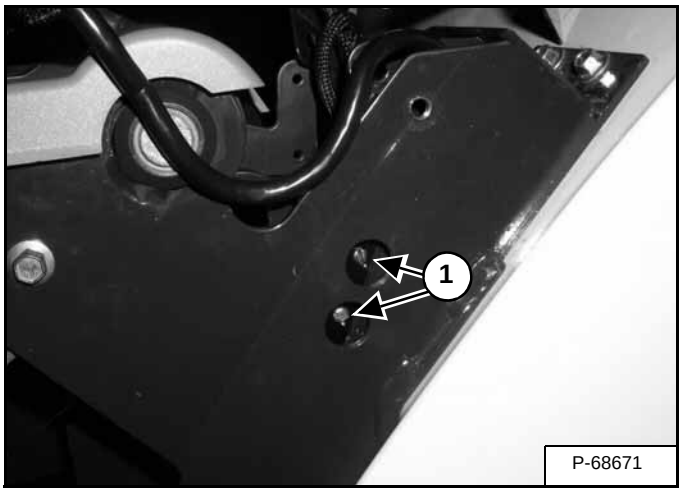
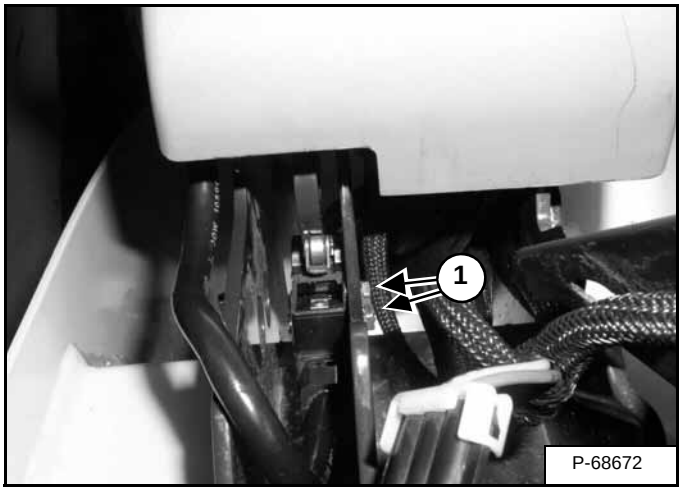


Figure 50-60-5



Remove the nuts, lock washers and bolts (Item 1) **[Figure 50-60-4]** & **[Figure 50-60-5]** fastening the microswitch.

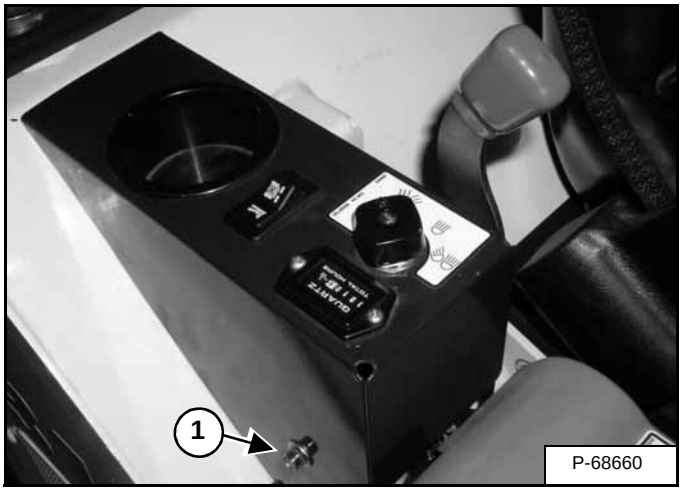
Remove the microswitch.

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

Testing Right Console Microswitch

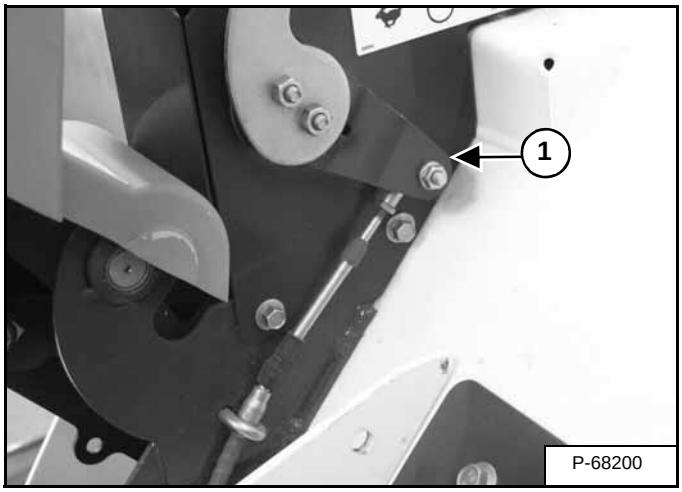
Lower the control console.

Figure 50-60-6



Remove the screw (Item 1) **[Figure 50-60-6]** from the instrument console.

Figure 50-60-7



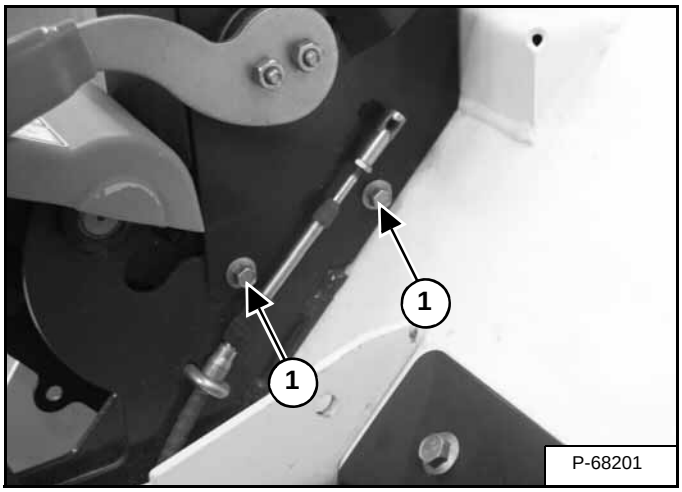
Remove the throttle linkage from the ball on the back side of the lever (Item 1) **[Figure 50-60-7]**.

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.

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Testing Right Console Microswitch (Cont'd)

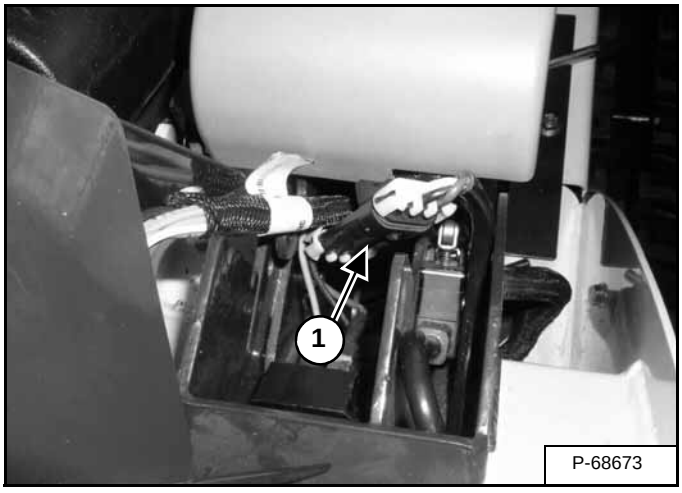
Figure 50-60-8



Remove the two bolts (Item 1) **[Figure 50-60-8]** from the left side of the instrument console.

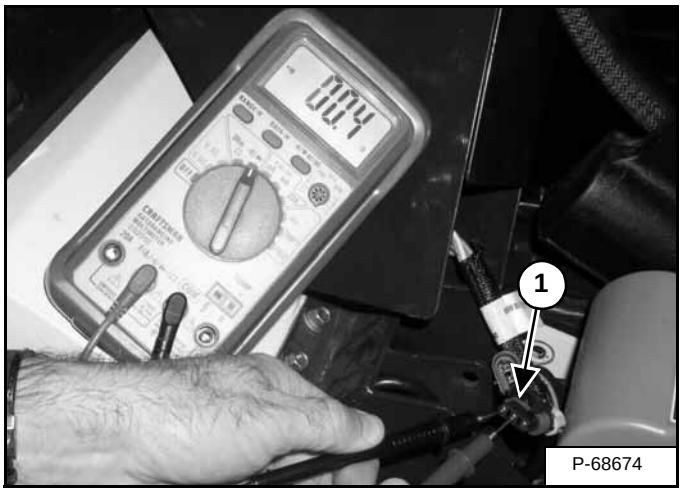
Lift the instrument console from the console mounting bracket.

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.

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MICROSWITCH (CONT'D)

Right Console Microswitch Removal And Installation

Figure 50-60-11

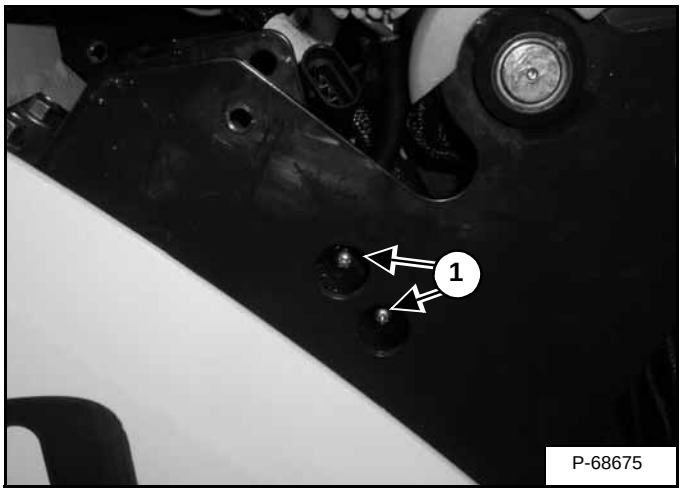
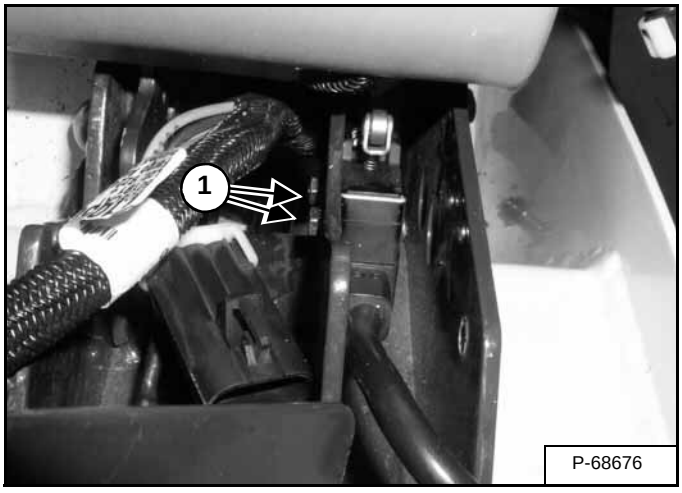


Figure 50-60-12



Remove the nuts, lock washers and bolts (Item 1) **[Figure 50-60-11]** & **[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.

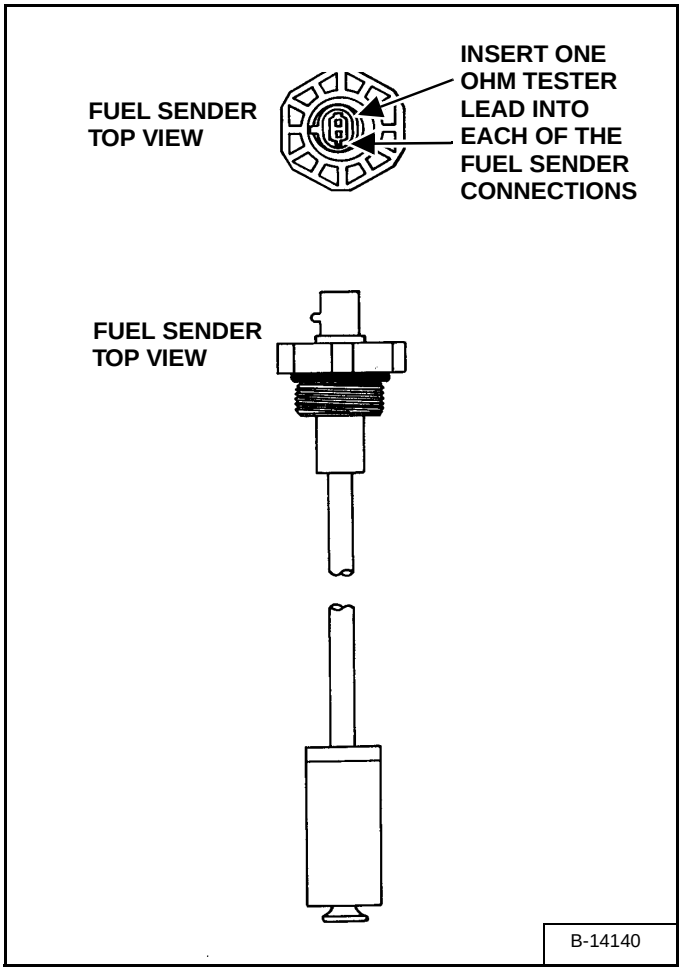
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FUEL LEVEL SENDER

Testing

Use an ohmmeter to check the resistance of the fuel level sender.

Figure 50-70-1



Insert one of the ohm tester leads into each of the fuel sender electrical connectors in the end of the fuel sender **[Figure 50-70-1]**.

With the fuel sender in the position shown **[Figure 50-70-1]**, read the ohms in the empty position. Slide the float upwards and the ohm reading will decrease. See resistance chart below.

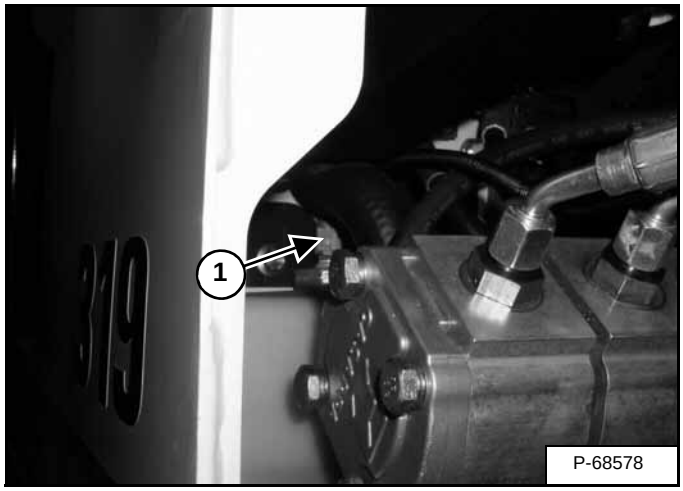
The approximate resistance should read as follows:

FULL: 15-35 Ohms.
HALF: 120-145 Ohms.
EMPTY: 230-250 Ohms.

Removal and Installation

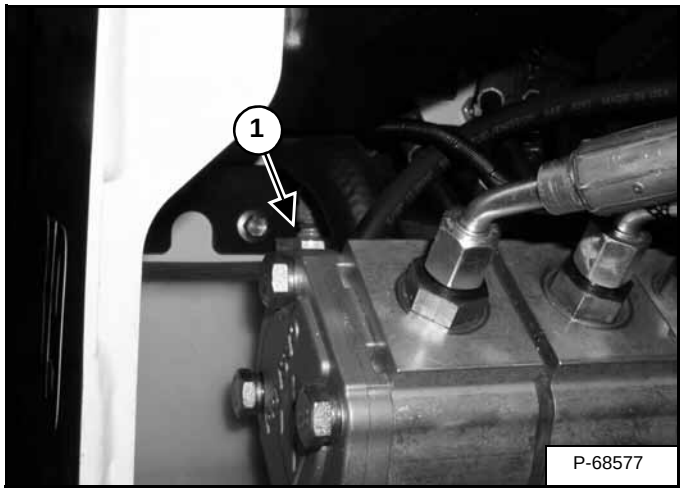
Open the tailgate.

Figure 50-70-2



Disconnect the wire harness (Item 1) **[Figure 50-70-2]** from the fuel level sender.

Figure 50-70-3



Remove the sender (Item 1) **[Figure 50-70-3]** from the fuel tank.

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ENGINE INFORMATION

Description

The 319 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.

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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 & 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 & 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)

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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 & 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 & 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 & 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)

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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 & Bushing	0.0006 to 0.0015 (0,014 to 0,038)
Clearance between Piston Pin & 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 & Pump Body	0.003 to 0.006 (0,07 to 0,15)
End Clearance between Inner Rotor & 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)

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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)

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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)

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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.

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	

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Engine Removal and Installation

Open the tailgate. (See Opening And Closing 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 20-120-1)

Remove the hydraulic filter housing assembly. (See Housing Removal and Installation on Page 20-110-1)

Remove the hydraulic pump. (See Removal And Installation on Page 20-50-3)

Drain the cooling system. (See Removing And Replacing Coolant on Page 10-70-2)

IMPORTANT

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

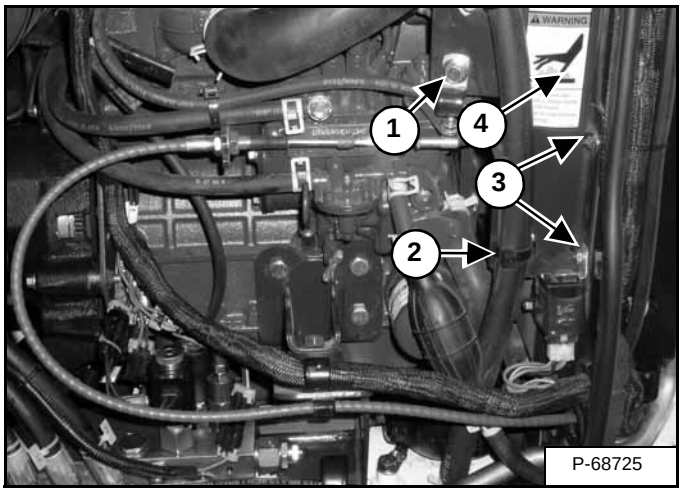
I-2003-0888

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

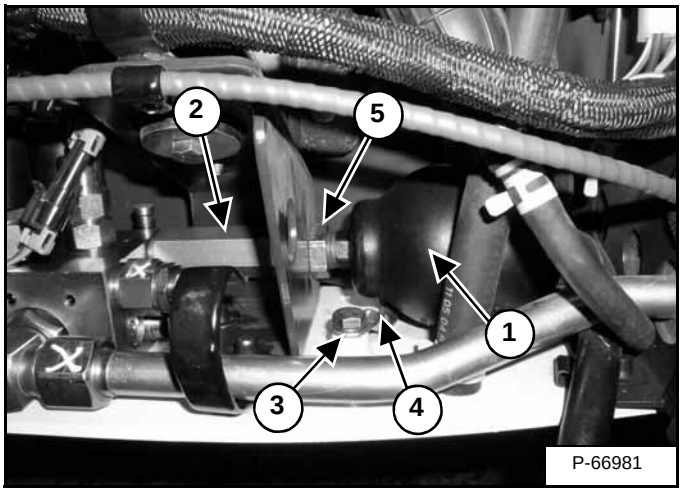
Figure 60-10-1



Remove the bolt (Item 1) and tie strap (Item 2) **[Figure 60-10-1]** from the fan guard.

Remove the nuts (Item 3) and remove the fan guard (Item 4) **[Figure 60-10-1]**.

Figure 60-10-2



Remove the accumulator (Item 1). Do not remove the accumulator extension tube (Item 2) **[Figure 60-10-2]** from the motor mount and manifold assembly.

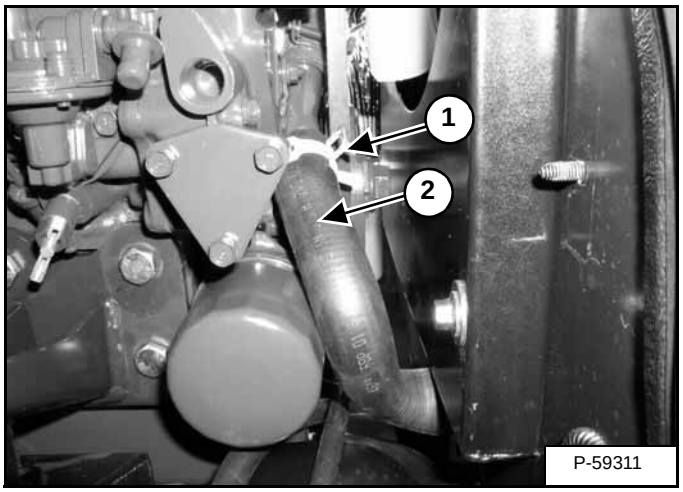
Remove the bolt (Item 3) from the engine ground wire (Item 4) **[Figure 60-10-2]**.

Remove the nut (Item 5) from the accumulator extension tube (Item 2) **[Figure 60-10-2]**.

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Removal and Installation (Cont'd)

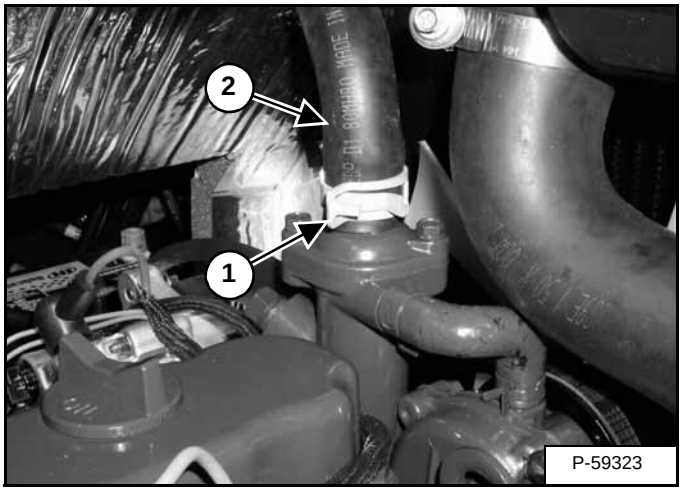
Figure 60-10-3



Slide the hose clamp (Item 1) **[Figure 60-10-3]** away from the end of the lower radiator hose.

Remove the lower radiator hose (Item 2) **[Figure 60-10-3]** and cap.

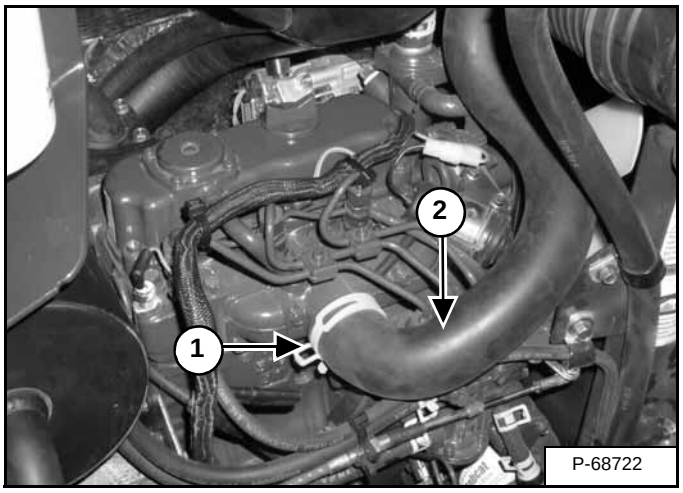
Figure 60-10-4



Slide the hose clamp (Item 1) **[Figure 60-10-4]** away from the end of the upper radiator hose.

Remove the upper radiator hose (Item 2) **[Figure 60-10-4]** and cap.

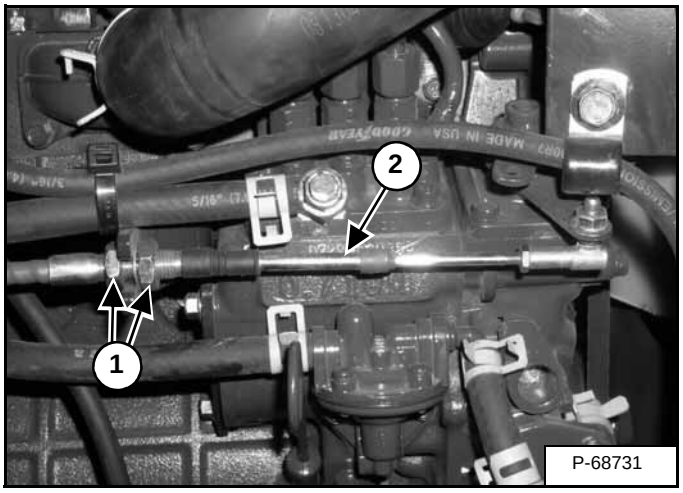
Figure 60-10-5



Slide the hose clamp (Item 1) **[Figure 60-10-5]** away from the end of the air in-take hose.

Remove the air in-take hose (Item 2) **[Figure 60-10-5]** and cap.

Figure 60-10-6



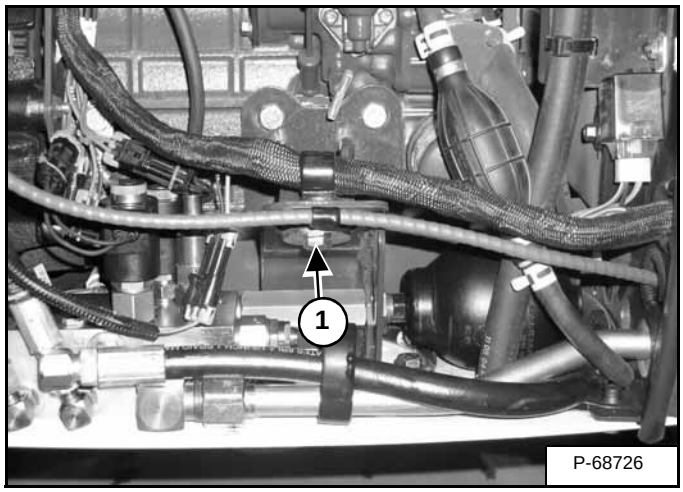
Loosen the nuts (Item 1) **[Figure 60-10-6]** fastening the throttle cable to the bracket.

Disconnect the throttle linkage (Item 2) **[Figure 60-10-6]** from the throttle bracket.

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Removal and Installation (Cont'd)

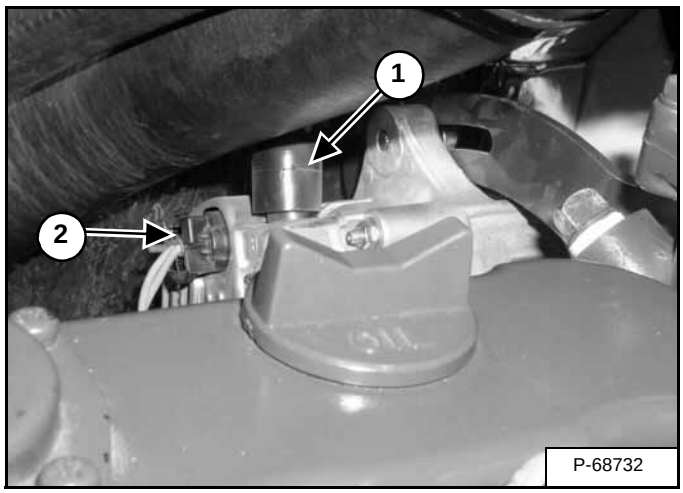
Figure 60-10-7



Remove nut and cable clamp (Item 1) **[Figure 60-10-7]** from engine mount bracket.

Move the throttle cable out of the way of the engine.

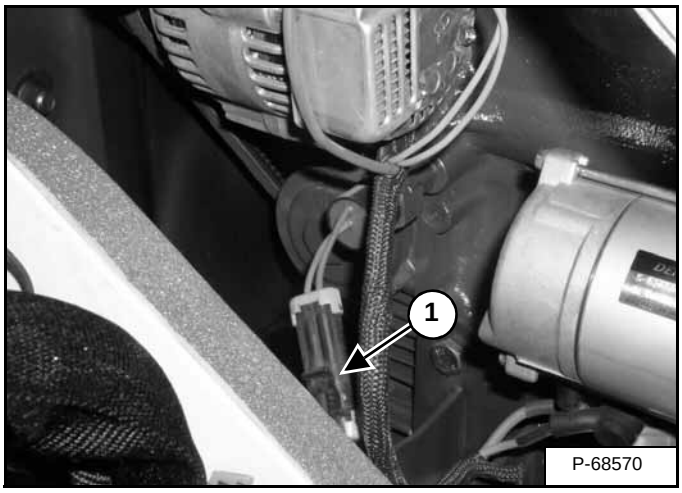
Figure 60-10-8



Disconnect the red wire (Item 1) **[Figure 60-10-8]** from the alternator.

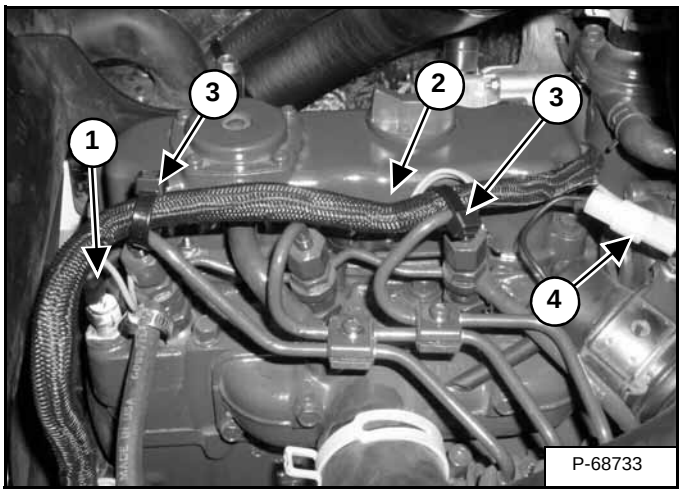
Disconnect the wire harness connector (Item 2) **[Figure 60-10-8]** from the alternator.

Figure 60-10-9



Disconnect the wire connector (Item 1) **[Figure 60-10-9]** from the oil pressure sending unit on the back side of the engine.

Figure 60-10-10



Remove the wire harness from the water temperature sending unit (Item 1) and the glow plugs (Item 2) **[Figure 60-10-10]**.

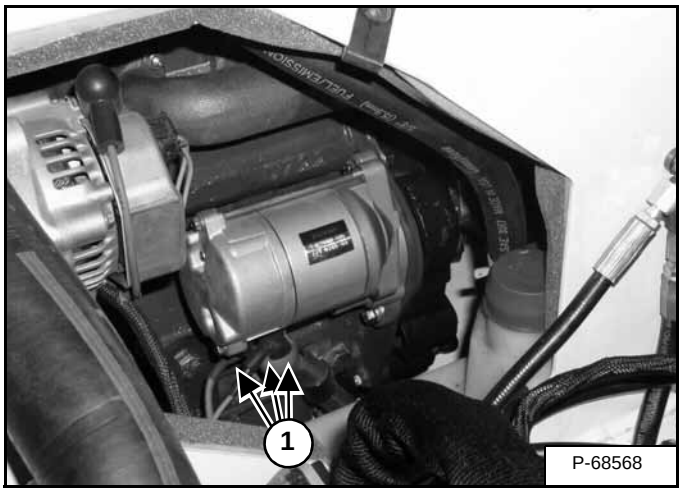
Remove the tie straps (Item 3) **[Figure 60-10-10]**.

Disconnect the wire connector (Item 4) **[Figure 60-10-10]** from the fuel shutoff.

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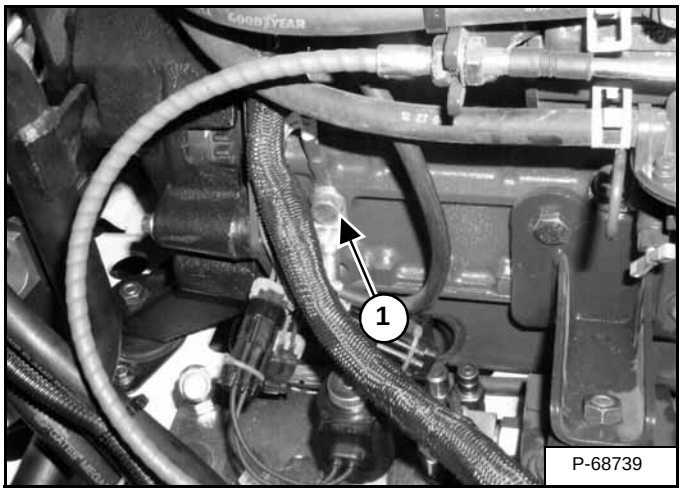
Removal and Installation (Cont'd)

Figure 60-10-11



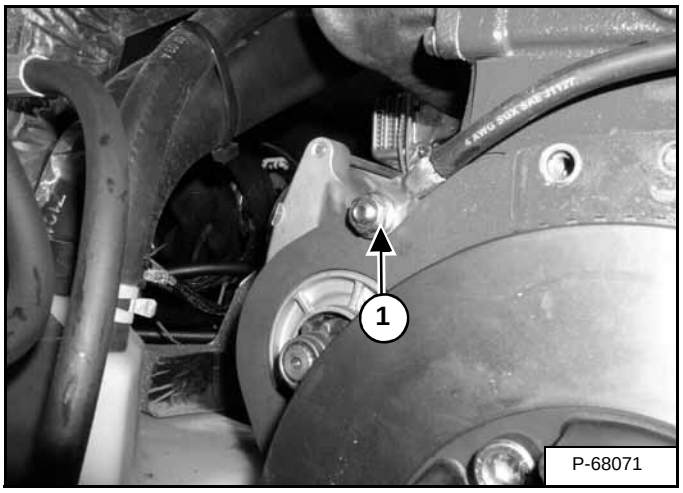
Disconnect the positive wires from the starter (Item 1) **[Figure 60-10-11]**.

Figure 60-10-12



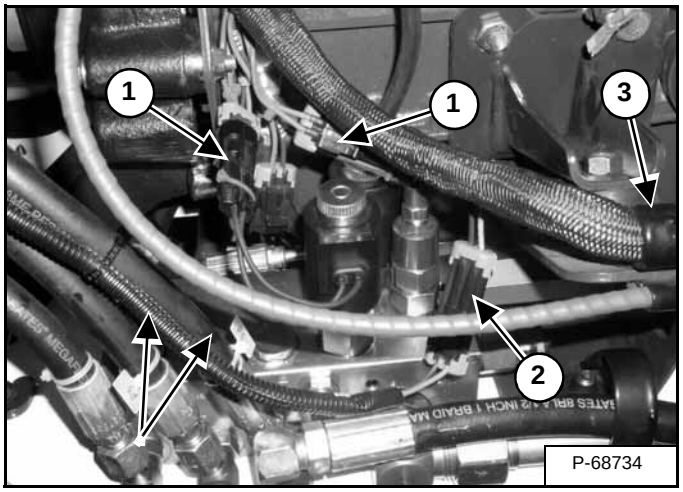
Disconnect the grounding wire (Item 1) **[Figure 60-10-12]** from the engine ground bolt.

Figure 60-10-13



Disconnect the grounding wire (Item 1) **[Figure 60-10-13]** from the starter mounting bolt.

Figure 60-10-14



Disconnect the wire connectors (Item 1) **[Figure 60-10-14]** from the two solenoids.

Disconnect the wire connector (Item 2) **[Figure 60-10-14]** from the fuel level sender wire harness.

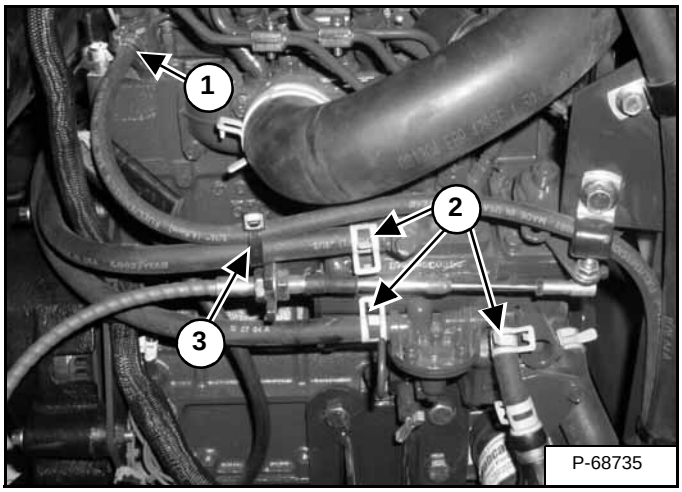
Remove the bolt (Item 3) **[Figure 60-10-14]** fastening the wire harness clamp to the engine mount.

Move the wire harness out of the way of the engine.

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Removal and Installation (Cont'd)

Figure 60-10-15

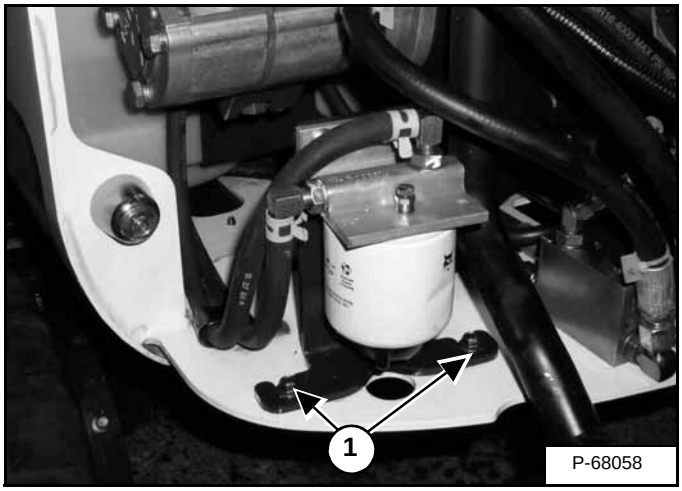


Remove and cap the return fuel line (Item 1) **[Figure 60-10-15]**.

Remove and cap the fuel lines (Item 2) **[Figure 60-10-15]**.

Remove tie strap (Item 3) **[Figure 60-10-15]**.

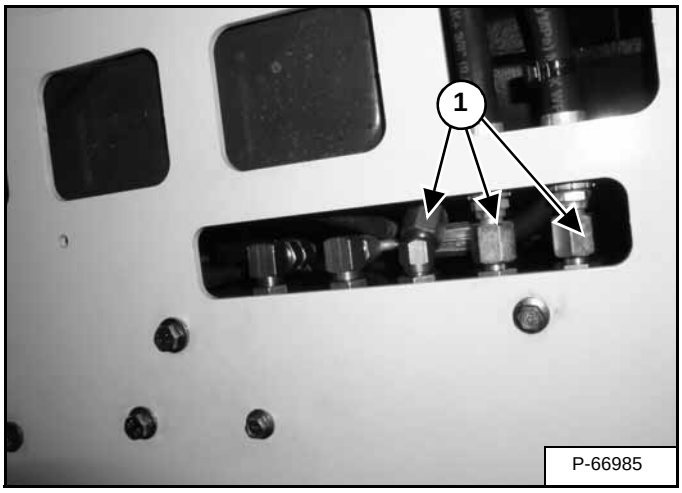
Figure 60-10-16



Loosen the two bolts (Item 1) **[Figure 60-10-16]** from the fuel filter bracket.

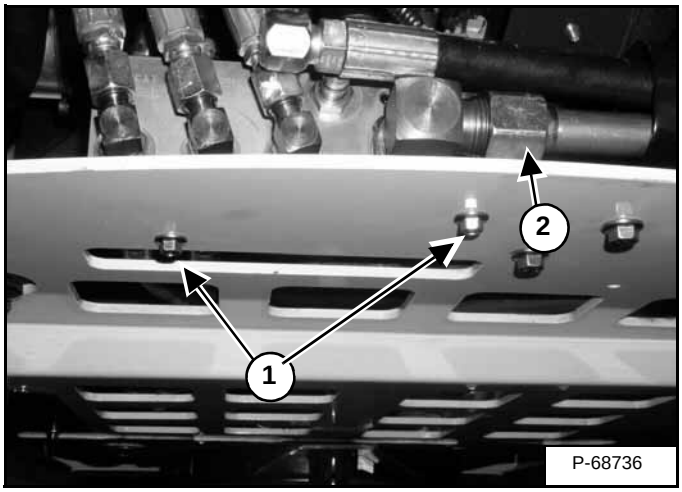
Remove the fuel filter assembly with fuel lines from the engine compartment.

Figure 60-10-17



Mark and disconnect the three hoses (Item 1) **[Figure 60-10-17]** on the backside of the manifold assembly. Disconnect and cap the three hoses from the underside of upperstructure.

Figure 60-10-18



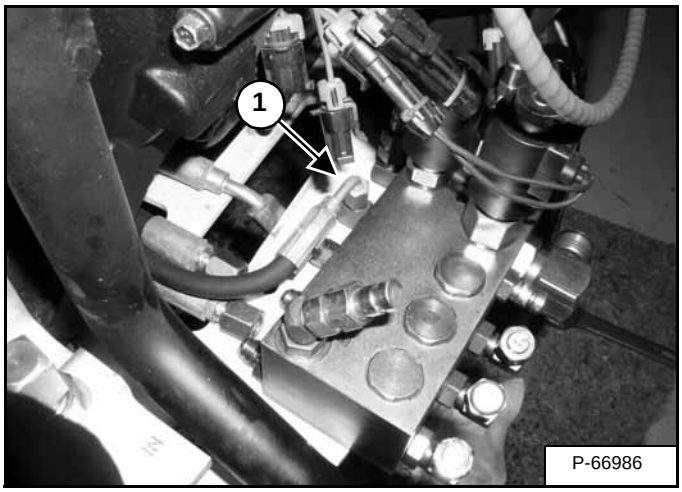
Remove the two bolts (Item 1) **[Figure 60-10-18]** fastening the manifold assembly to the upperstructure.

Disconnect and cap the tubeline (Item 2) **[Figure 60-10-18]** from the manifold assembly.

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Removal and Installation (Cont'd)

Figure 60-10-19



Slide the manifold assembly towards the rear of the excavator. Disconnect and cap the hose (Item 1) **[Figure 60-10-19]** on the backside of the manifold assembly.

Remove the manifold assembly from the excavator.

Figure 60-10-20

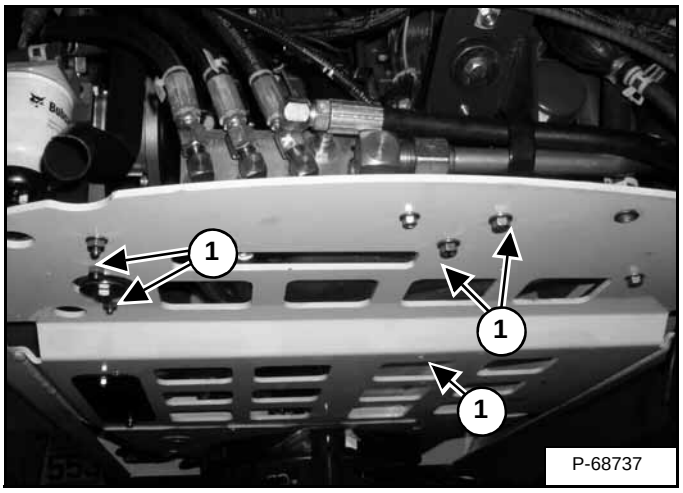
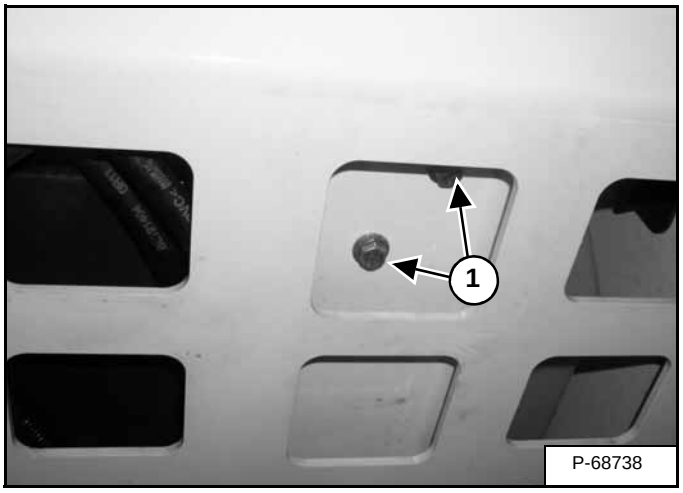


Figure 60-10-21



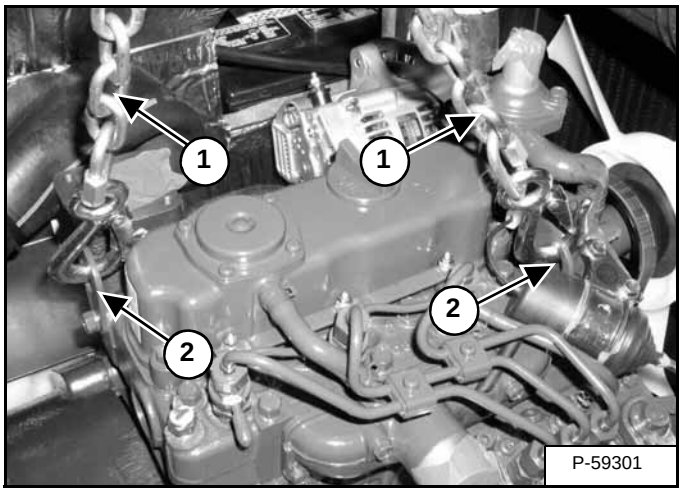
Remove the six engine mount bolts (Item 1) **[Figure 60-10-20]** & **[Figure 60-10-21]**.

NOTE: The engine mounts are left assembled to the engine and will be removed with the engine.

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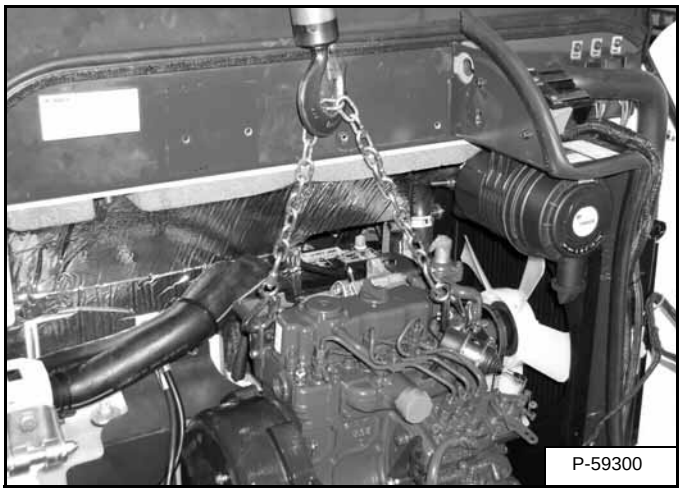
Removal and Installation (Cont'd)

Figure 60-10-22



Connect a chain (Item 1) to the two engine lifting brackets (Item 2) **[Figure 60-10-22]**.

Figure 60-10-23



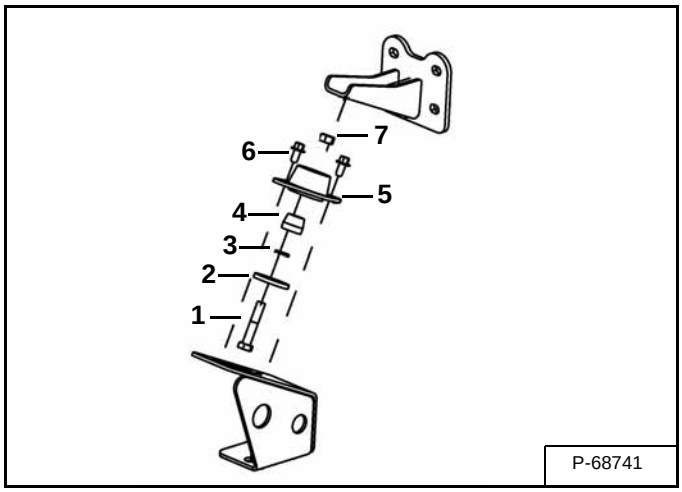
Lift and slide the engine out while turning the engine to provide clearance during engine removal **[Figure 60-10-23]**.

NOTE: Protect the back of the excavator canopy/cab from lifting chain damage during engine removal.

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Engine Mount Replacement

Figure 60-10-24



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.

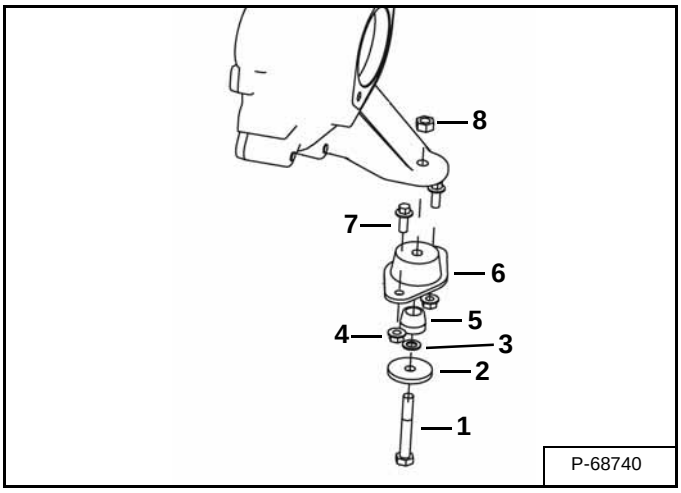
Replace the two front and rear engine mounts.

Use the parts shown to install the new engine mounts for the front and rear engine mounts **[Figure 60-10-24]**.

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 60-10-25



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 60-10-25]**.

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.

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Compression - Checking

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

MEL10630 - Engine Compression Test Kit

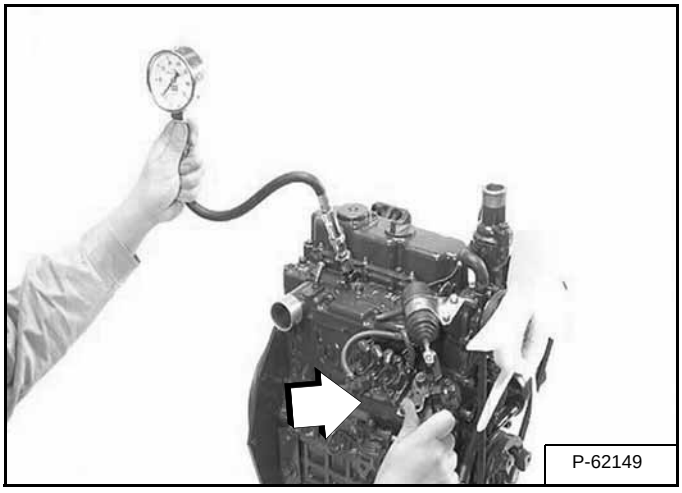
Warm the engine.

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

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

Install the compression adapter in the cylinder head.

Figure 60-10-26



Connect the compression gauge to the adapter **[Figure 60-10-26]**.

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

Hold fuel shut off lever to no fuel. (shutoff) See arrow, **[Figure 60-10-26]**. 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 to 469 PSI (28 to 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.

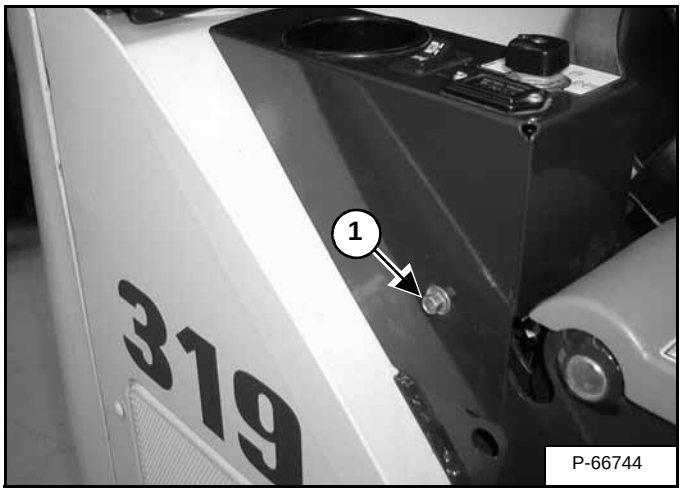
If the pressures do not increase after applying oil, check top clearance, valve clearance and cylinder head.

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ENGINE SPEED CONTROL

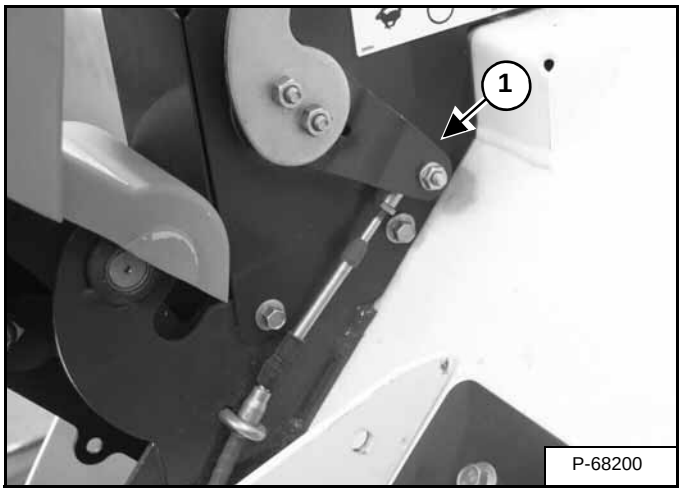
Removal and Installation

Figure 60-20-1



Remove the bolt (Item 1) **[Figure 60-20-1]** from the right side of the instrument console.

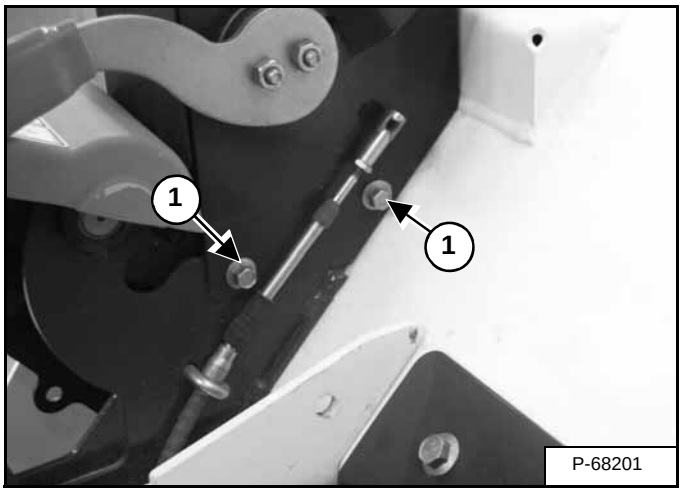
Figure 60-20-2



Remove the throttle linkage from the ball joint on the back side of the lever (Item 1) **[Figure 60-20-2]**.

NOTE: The seat is removed [Figure 60-20-2] from the excavator to show a clear view of the throttle linkage and bolts to be removed.

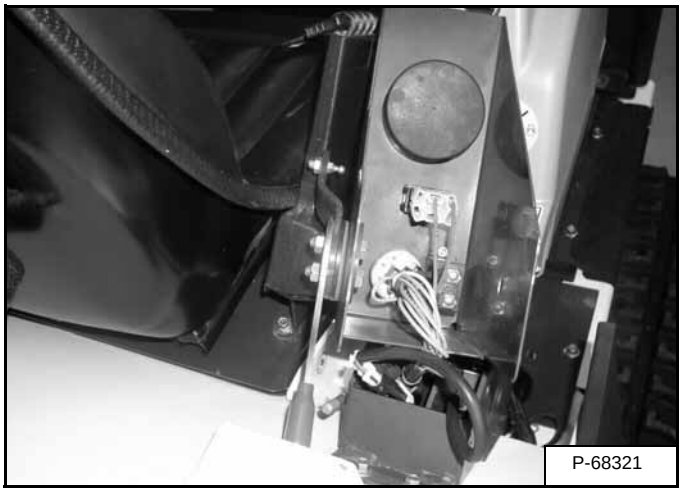
Figure 60-20-3



Remove the two bolts (Item 1) **[Figure 60-20-3]** 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 60-20-4

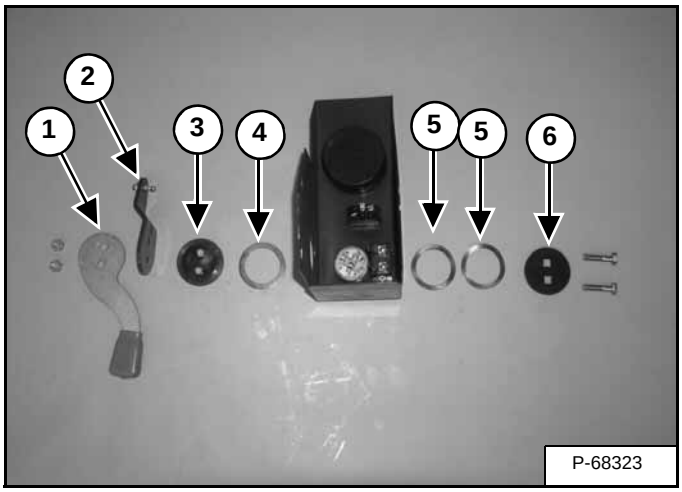


Remove the bolts and nuts (Item 1) **[Figure 60-20-4]** from the throttle lever.

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Removal and Installation

Figure 60-20-5

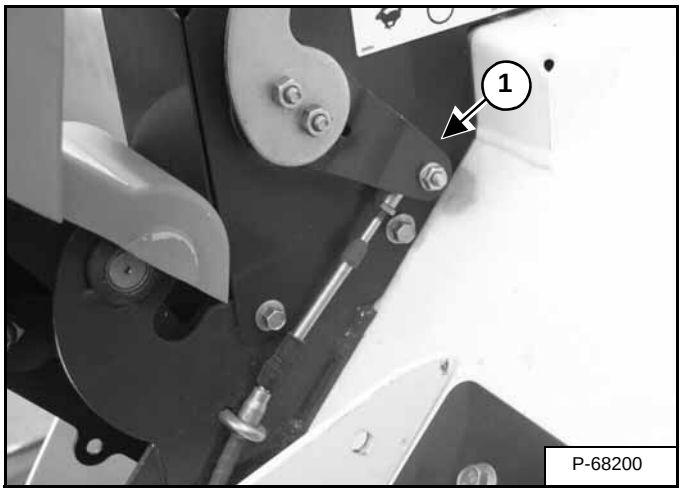


NOTE: Photograph is shown on the bench for component clarity. The instrument console does not need to be remove from the excavator [Figure 60-20-5].

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 60-20-5]**.

Cable Removal and Installation

Figure 60-20-6

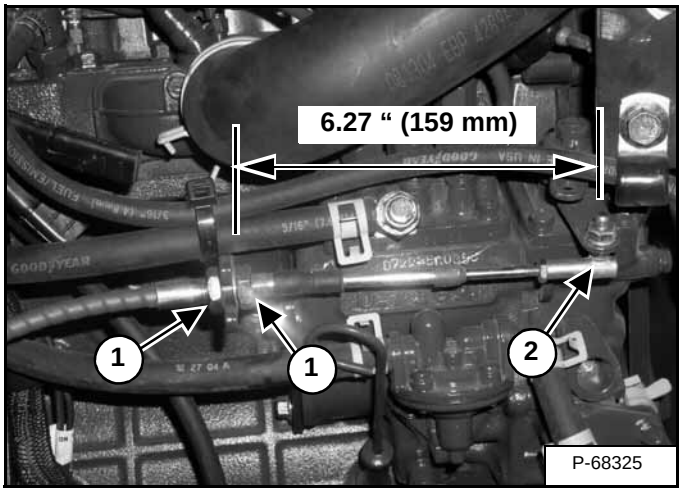


Remove the throttle linkage from the ball joint on the back side of the lever (Item 1) **[Figure 60-20-6]**.

Remove the u-clamp (Item 2) **[Figure 60-20-6]** fastening the cable to the side of the instrument console.

NOTE: The seat is removed [Figure 60-20-6] from the excavator to show a clear view of the throttle linkage and bolts to be removed.

Figure 60-20-7



Loosen the nuts (Item 1) **[Figure 60-20-7]** fastening the cable to the bracket.

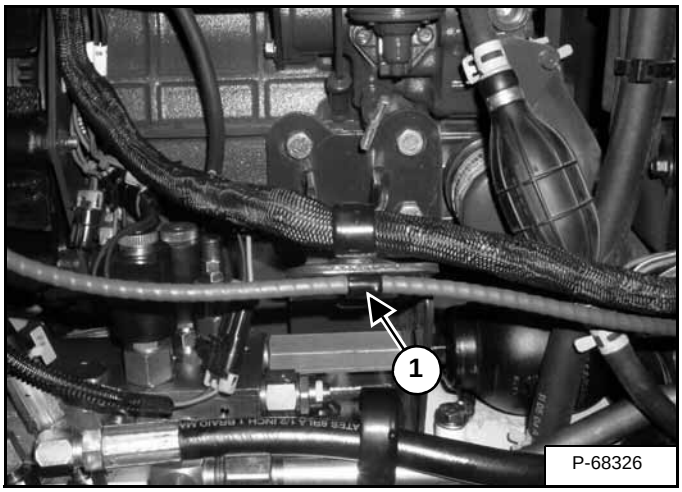
Disconnect the linkage (Item 2) **[Figure 60-20-7]** from the bracket.

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

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Cable Removal and Installation (Cont'd)

Figure 60-20-8



Remove the nut and clamp (Item 1) **[Figure 60-20-8]**.

Move the cable away from the engine.

Pull the cable down from the right console and out the back of the excavator.

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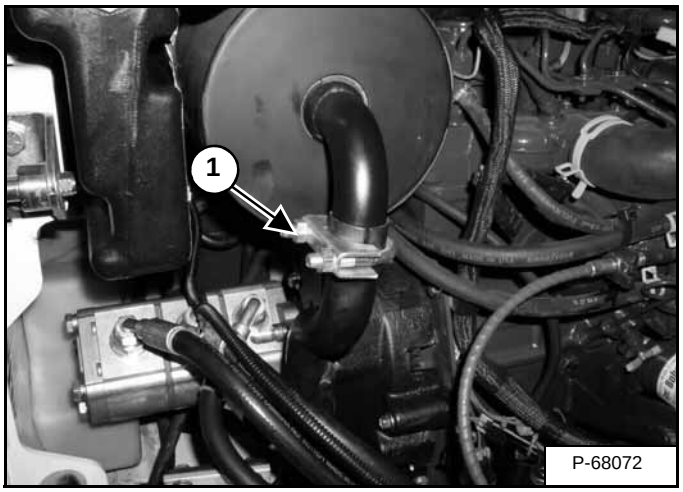


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SPARK ARRESTOR MUFFLER

Removal And Installation

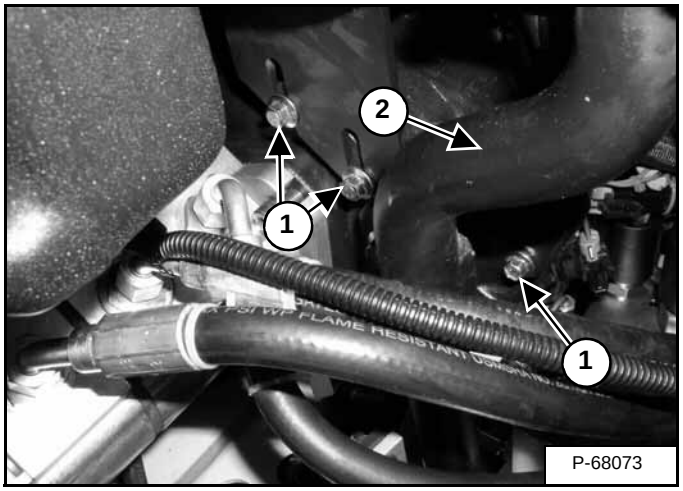
Figure 60-30-1



Loosen the exhaust extension clamp (Item 1) **[Figure 60-30-1]**.

Installation: Tighten clamp to 5.90 to 7.37 ft.-lb. (8 to 10 N•m) torque.

Figure 60-30-2



Remove the bolt (Item 1) **[Figure 60-30-2]** from the exhaust extension mounting bracket.

Slide exhaust extension (Item 2) **[Figure 60-30-2]** off muffler and remove from excavator.

Loosen the two bolts (Item 3) **[Figure 60-30-2]**.

WARNING

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

W-2050-1285

WARNING

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

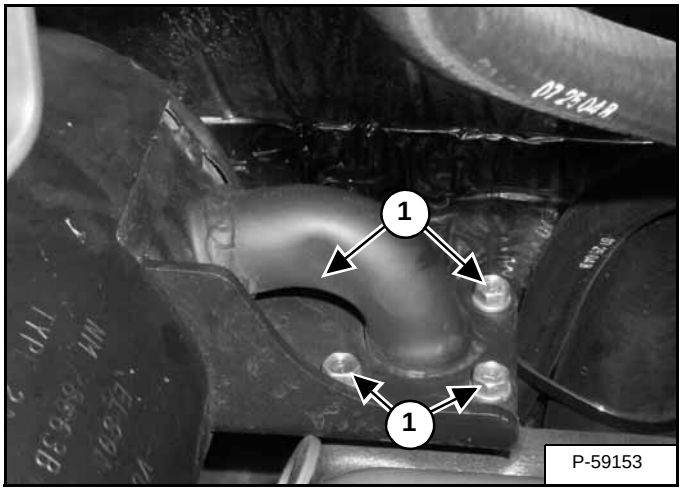
W-2011-1285

WARNING

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

W-2068-1285

Figure 60-30-3



Remove the four bolts (Item 1) **[Figure 60-30-3]** from the muffler mount flange. Remove the muffler.

NOTE: Plug the exhaust manifold hole after muffler removal so no contamination can get into the engine.

Dealer Copy -- Not for Resale



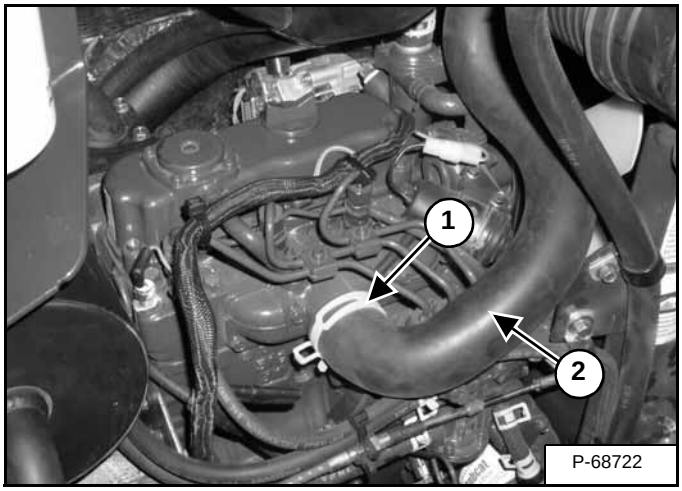
Dealer Copy -- Not for Resale

AIR CLEANER

Housing Removal And Installation

Open the tailgate.

Figure 60-40-1

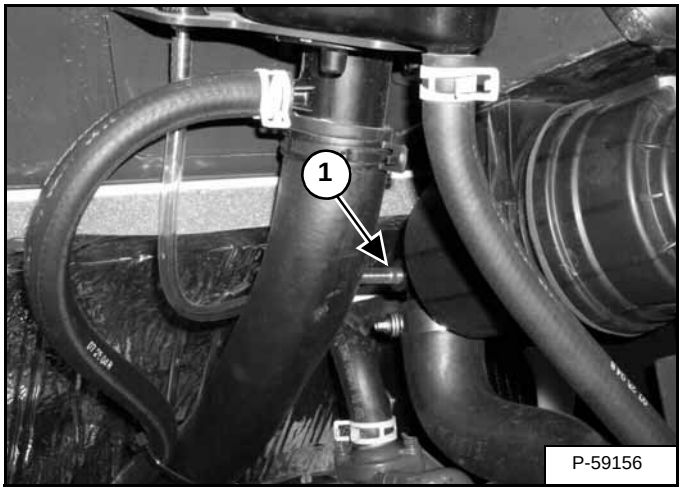


Loosen the hose clamp (Item 1) **[Figure 60-40-1]** on the air intake hose.

Remove the hose (Item 2) **[Figure 60-40-1]**.

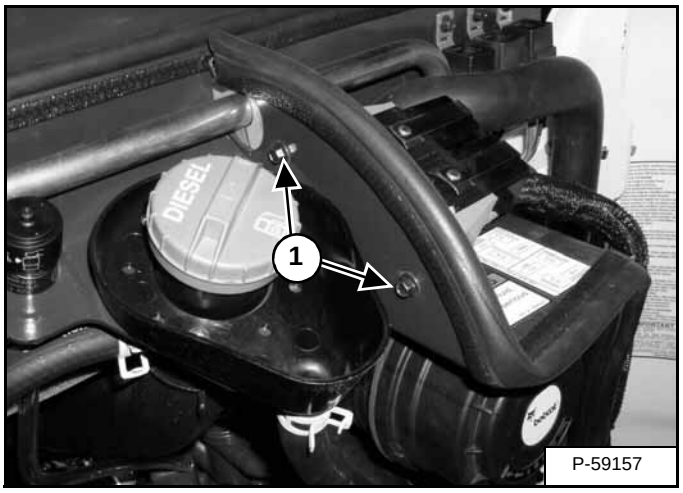
NOTE: Plug the intake manifold hole to prevent any contamination from getting into the engine.

Figure 60-40-2



Remove the hose (Item 1) **[Figure 60-40-2]** from the back of the air cleaner.

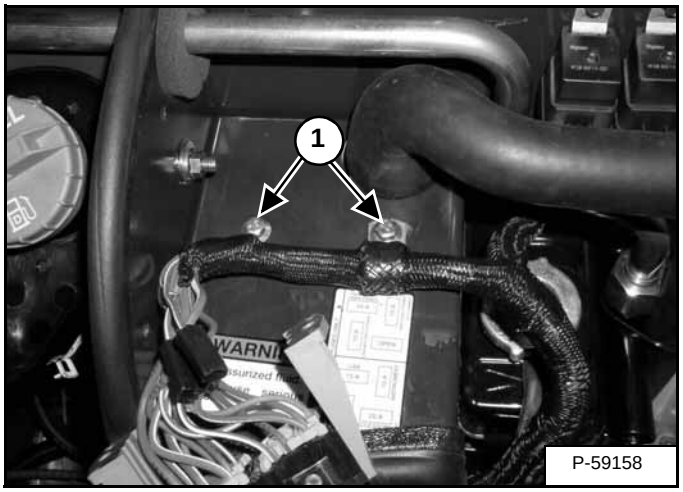
Figure 60-40-3



Remove the two bolts (Item 1) **[Figure 60-40-3]** fastening the fuse bracket to the excavator.

Move the fuse assembly aside to expose the two air cleaner mounting bolts.

Figure 60-40-4

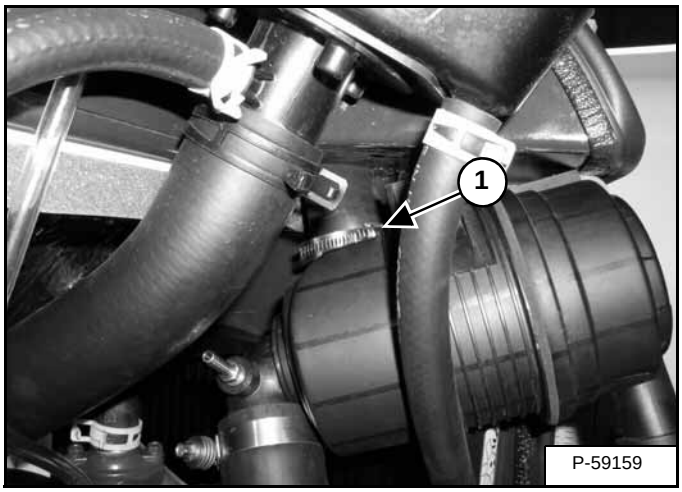


Remove the two bolts (Item 1) **[Figure 60-40-4]**.

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Housing Removal And Installation (Cont'd)

Figure 60-40-5



Loosen the hose clamp (Item 1) **[Figure 60-40-5]** and remove hose from the top of the air cleaner.

Remove the air cleaner and intake hose assembly from the excavator.

Dealer Copy -- Not for Resale

Radiator Removal And Installation

Open the tailgate.

WARNING

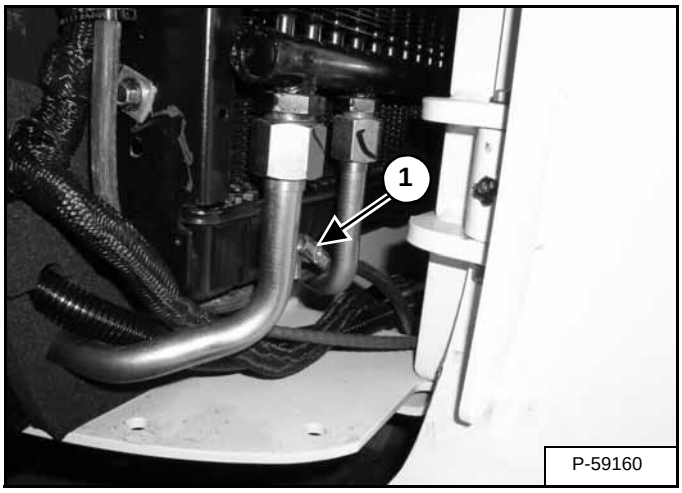
AVOID BURNS

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

W-2070-1203

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

Figure 60-50-1

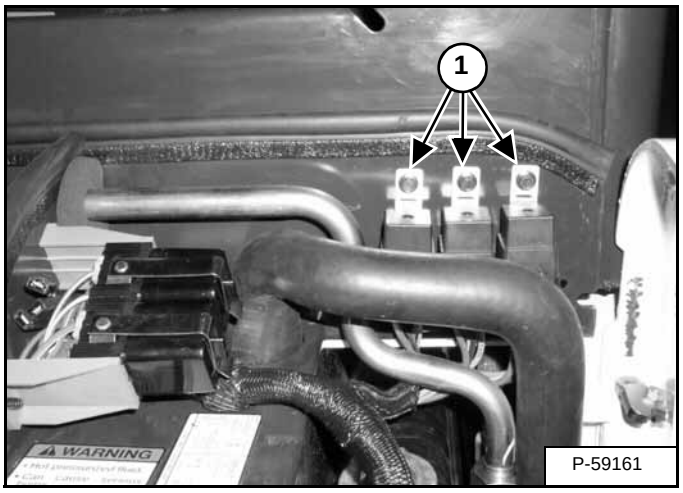


Open the radiator drain valve (Item 1) **[Figure 60-50-1]** and drain the coolant into a container.

Loosen the radiator cap from the radiator fill neck.

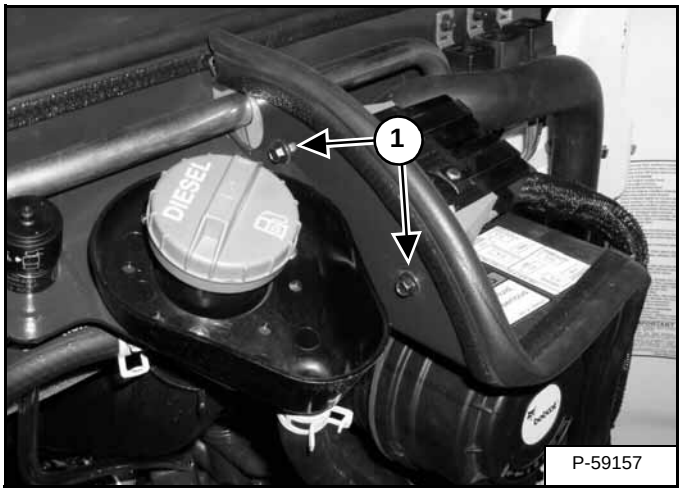
Mark the three electrical relays for ease of assembly.

Figure 60-50-2



Remove the bolts (Item 1) **[Figure 60-50-2]** fastening the relays to the frame.

Figure 60-50-3

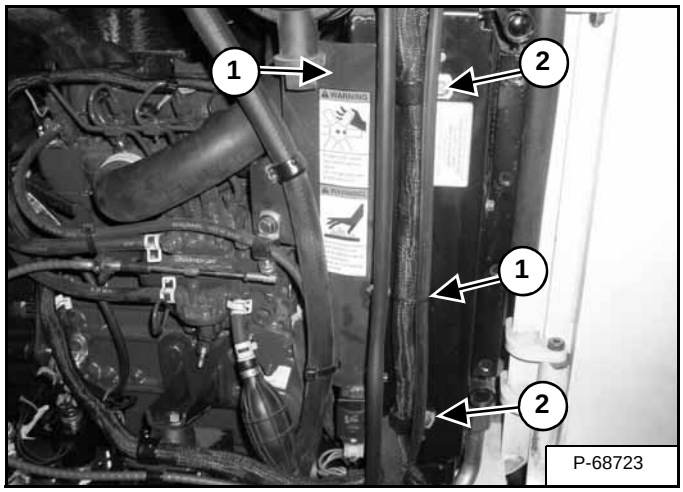


Remove the bolts (Item 1) **[Figure 60-50-3]** fastening the fuse bracket assembly to the frame.

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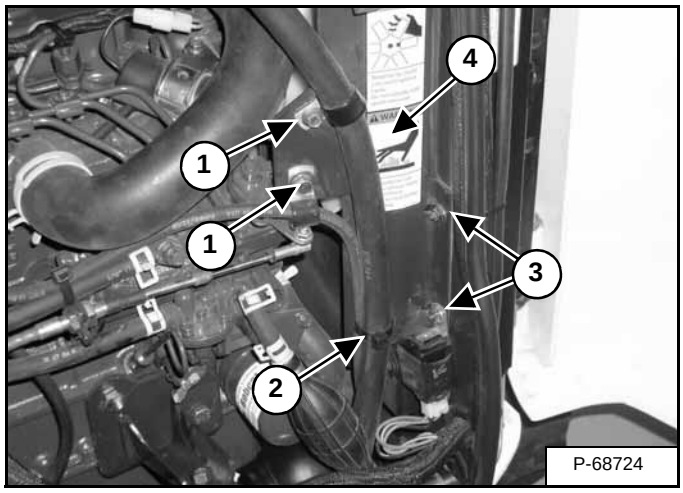
Radiator Removal And Installation (Cont'd)

Figure 60-50-4



Remove the tie straps (Item 1) and bolts (Item 2) **[Figure 60-50-4]** fastening the wire harness to the radiator.

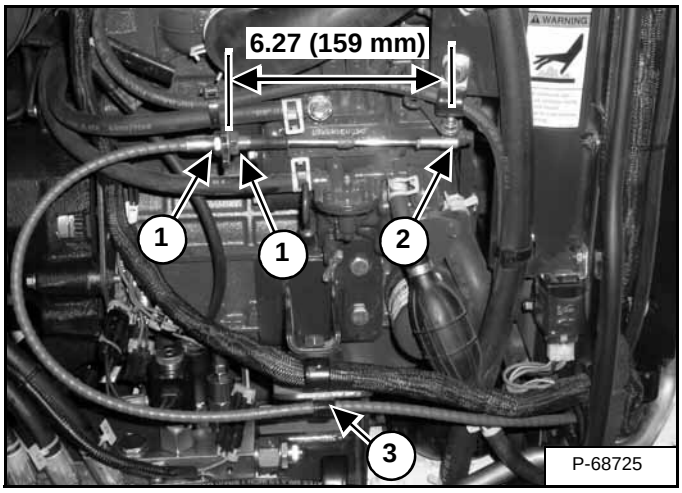
Figure 60-50-5



Remove the bolts (Item 1) and tie strap (Item 2) **[Figure 60-50-5]** on the fan guard.

Remove the nuts (Item 3) and remove the fan guard (Item 4) **[Figure 60-50-5]**.

Figure 60-50-6



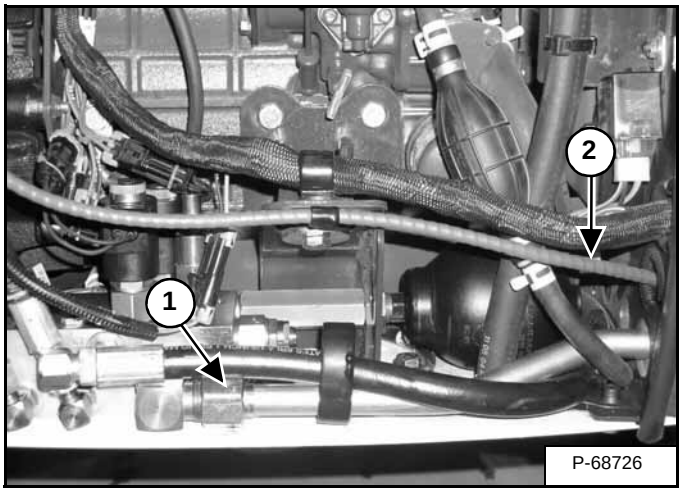
Loosen the nuts (Item 1) **[Figure 60-50-6]** fastening the cable to the bracket.

Disconnect the linkage (Item 2) **[Figure 60-50-6]** from the bracket.

Remove the nut and cable clamp (Item 3) **[Figure 60-50-6]** from the engine mount.

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

Figure 60-50-7



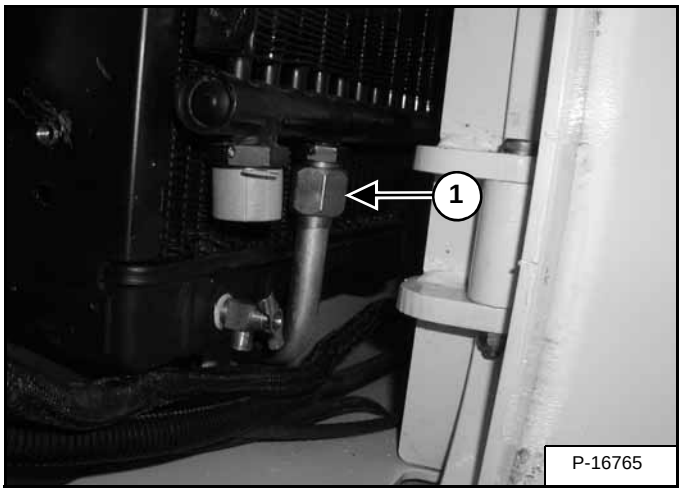
Remove the tubeline (Item 1) **[Figure 60-50-7]** from the manifold assembly to the oil cooler. Remove the tubeline by pulling the tubeline through the radiator bracket from the engine side of the radiator.

Push the engine speed control cable (Item 2) **[Figure 60-50-7]** through the radiator bracket towards the tailgate. Move the cable to the side.

Dealer Copy -- Not for Resale

Radiator Removal And Installation (Cont'd)

Figure 60-50-8



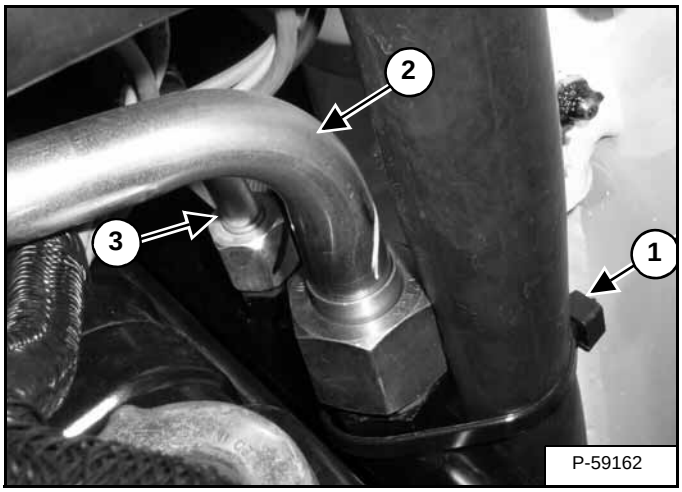
Remove the tubeline (Item 1) **[Figure 60-50-8]** from the oil cooler to the control valve assembly.

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

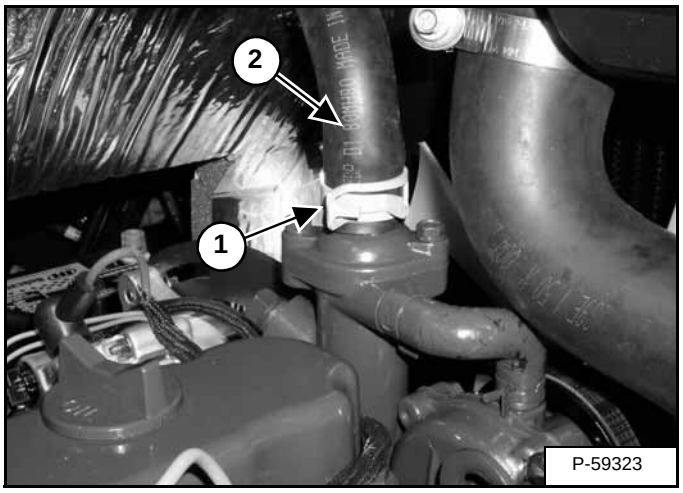
Figure 60-50-9



Remove the tie strap (Item 1) **[Figure 60-50-9]**.

Remove the tubeline (Item 2) and hose (Item 3) **[Figure 60-50-9]** from the top of the oil cooler.

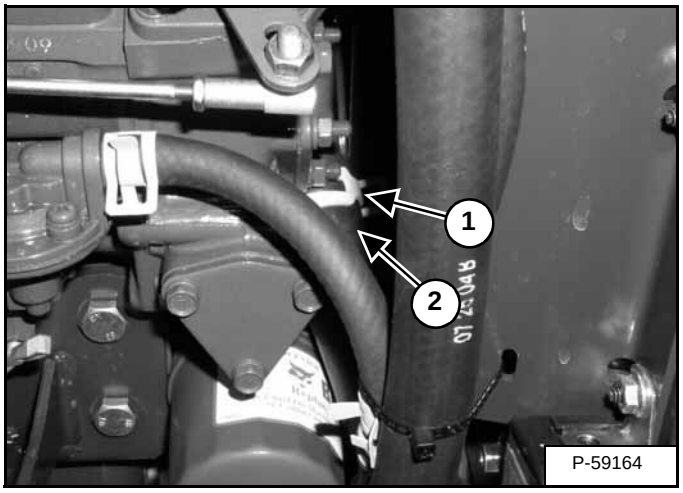
Figure 60-50-10



Slide the hose clamp (Item 1) **[Figure 60-50-10]** away from the end of the upper radiator hose.

Remove the upper radiator hose (Item 2) **[Figure 60-50-10]**.

Figure 60-50-11



Slide the hose clamp (Item 1) **[Figure 60-50-11]** away from the end of the lower radiator hose.

Remove the lower radiator hose (Item 2) **[Figure 60-50-11]**.

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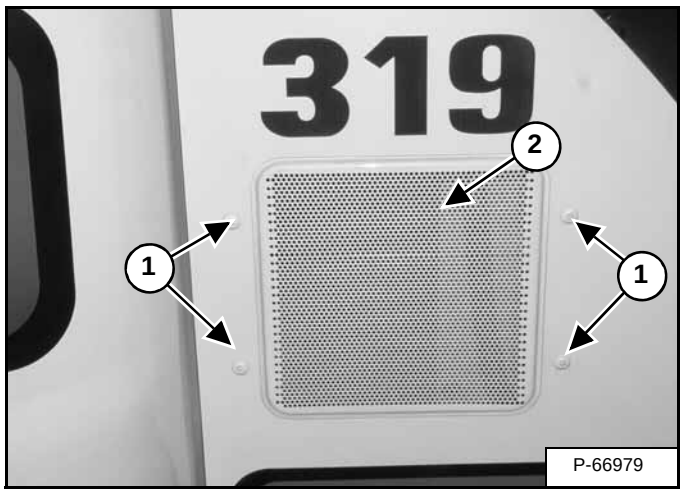
Radiator Removal And Installation (Cont'd)

Figure 60-50-12



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 60-50-12]**.

Figure 60-50-13

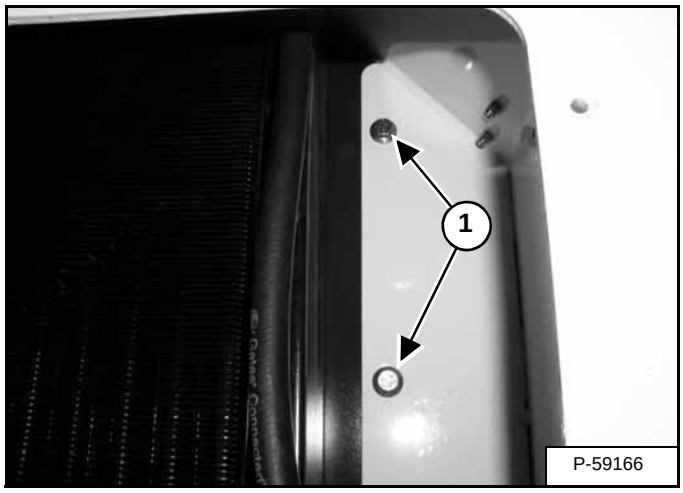


Remove the screws (Item 1) and grill (Item 2) **[Figure 60-50-13]**.

Remove the grill.

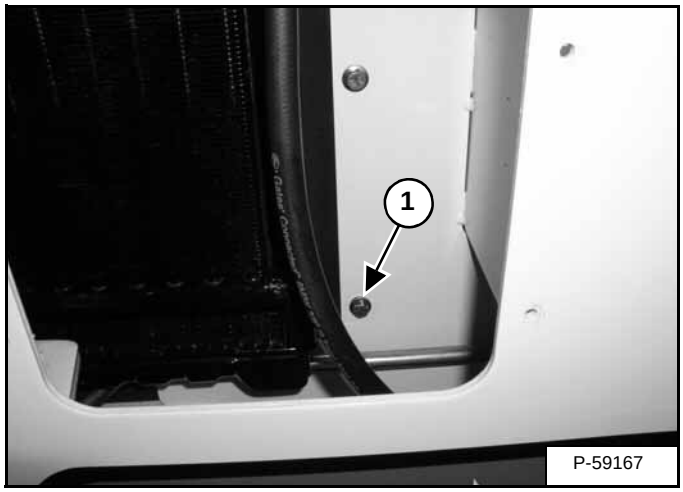
NOTE: Use a magnet or pick to prevent the grill from dropping and being scratched or damaged.

Figure 60-50-14



Remove the top bolts (Item 1) **[Figure 60-50-14]** mounting the radiator to the frame.

Figure 60-50-15

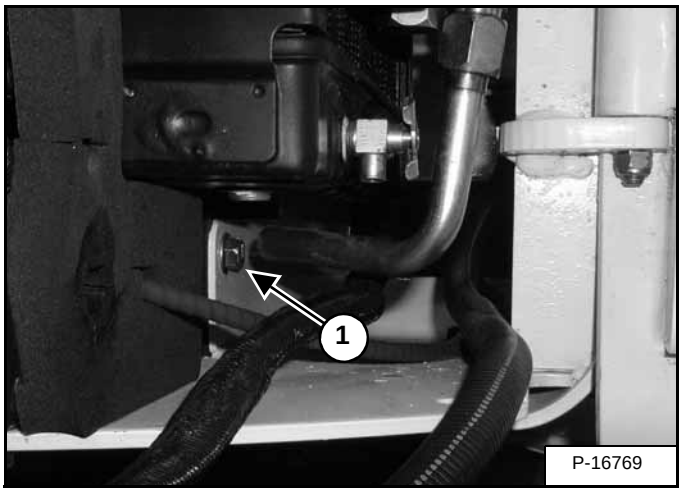


Remove the bottom bolt (Item 1) **[Figure 60-50-15]** mounting the radiator to the frame.

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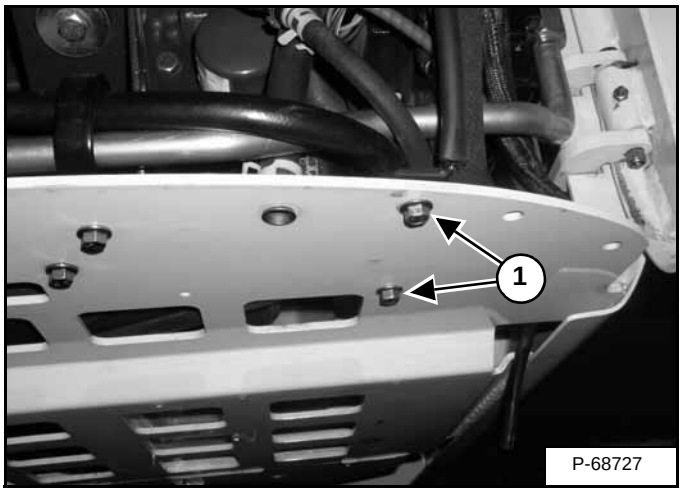
Radiator Removal And Installation (Cont'd)

Figure 60-50-16



Remove the bottom bolt (Item 1) **[Figure 60-50-16]** mounting the radiator to the frame.

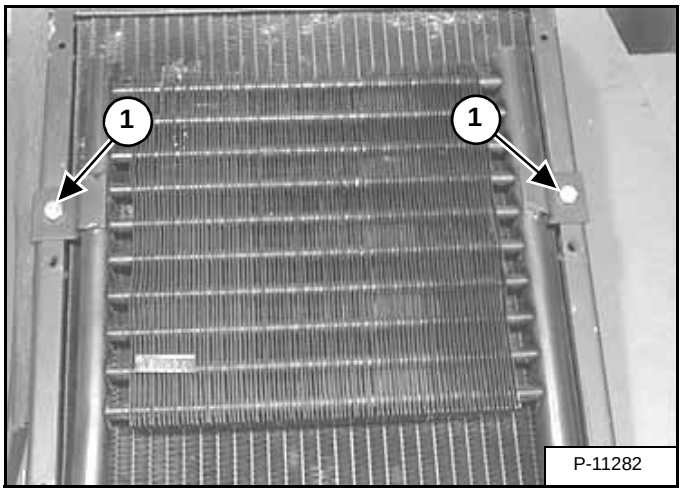
Figure 60-50-17



Remove the bolts (Item 1) **[Figure 60-50-17]** on the underside of the upperstructure.

Slide the radiator and oil cooler assembly out the back of the excavator.

Figure 60-50-18



Remove the bolts (Item 1) **[Figure 60-50-18]** from the oil cooler.

Remove the oil cooler from the radiator.

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Water Pump Removal And Installation

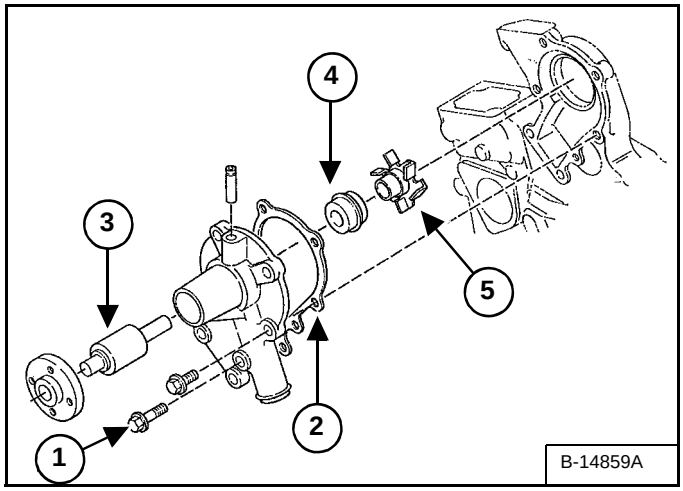
Drain the cooling system.

Remove the radiator. (See Radiator Removal And Installation on Page 60-50-1.)

Remove the alternator belt.

Remove the fan.

Figure 60-50-19



Remove the water pump bolts (Item 1) **[Figure 60-50-19]**.

Remove the water pump.

Installation: Always use a new gasket (Item 2) **[Figure 60-50-19]** when installing the water pump and apply Liquid-Type Gasket (Three Bond 1215 or equivalent) to both sides of new gasket.

Water Pump Disassembly And Assembly

Put the water pump in a vise.

Remove the pulley.

Press the shaft (Item 3) **[Figure 60-50-19]** out of the pulley side of the water pump. Press out the shaft with the impeller on it.

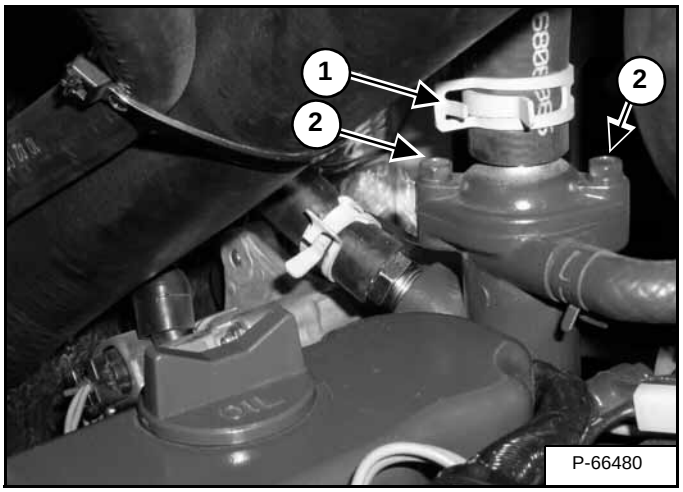
Remove the seal (Item 4) and impeller (Item 5) **[Figure 60-50-19]**.

Install a new seal when assembling the water pump.

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Thermostat Removal And Installation

Figure 60-50-20



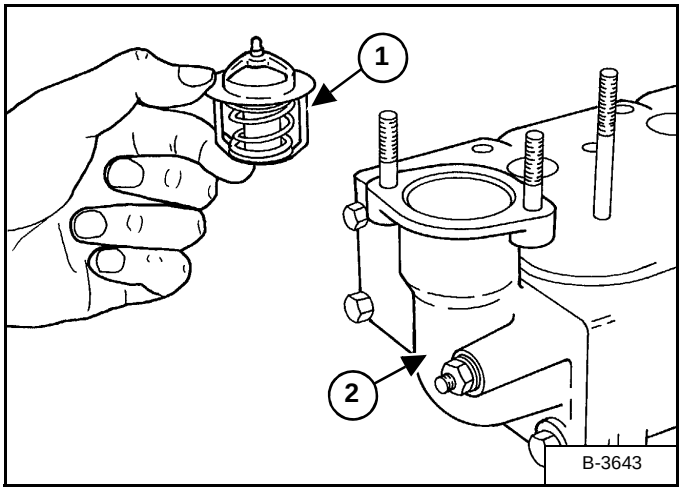
Drain the engine coolant until it is below the thermostat level.

Remove the hose (Item 1) **[Figure 60-50-20]**.

Remove the bolts (Item 2) **[Figure 60-50-20]** 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 60-50-21



Remove the housing and thermostat (Item 1) **[Figure 60-50-21]**.

Remove the four mounting bolts at the coolant housing (Item 2) **[Figure 60-50-21]**.

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 60-10-5)

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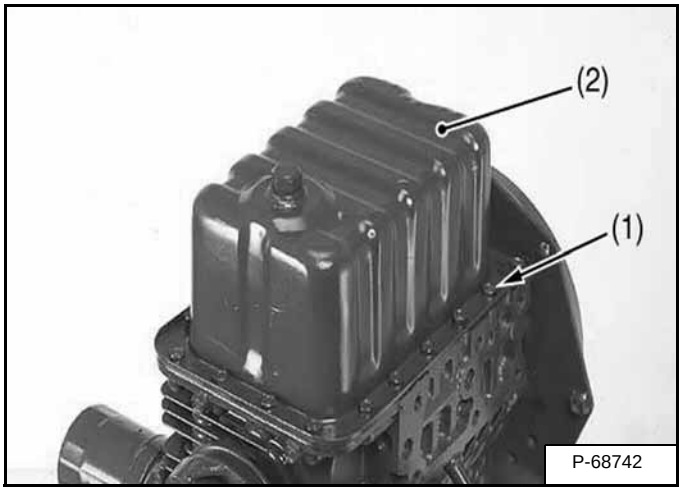
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LUBRICATION SYSTEM

Oil Pan Removal And Installation

Remove the engine from the excavator. (See Engine Removal and Installation on Page 60-10-8.)

Figure 60-60-1



Unscrew the oil pan mounting screws (Item 1) and remove the oil pan (Item 2) **[Figure 60-60-1]**.

Figure 60-60-2

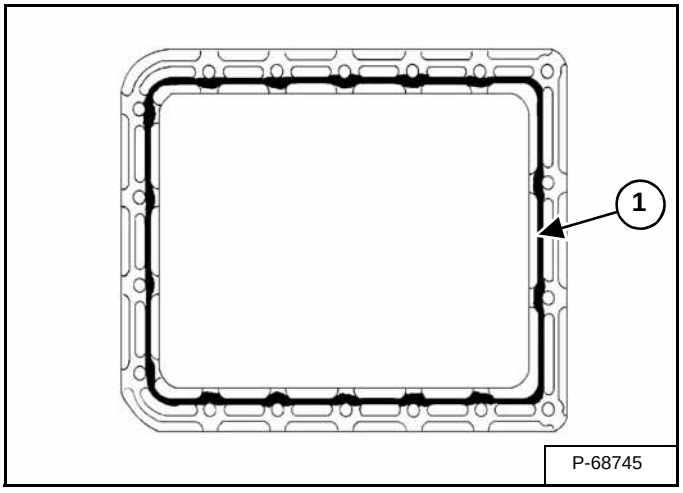
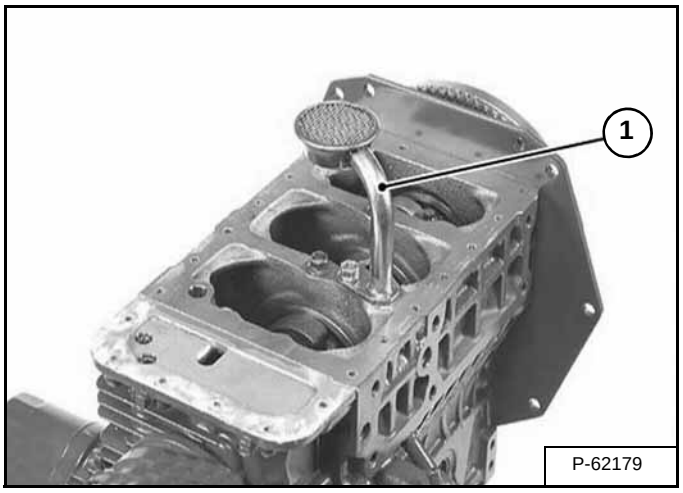
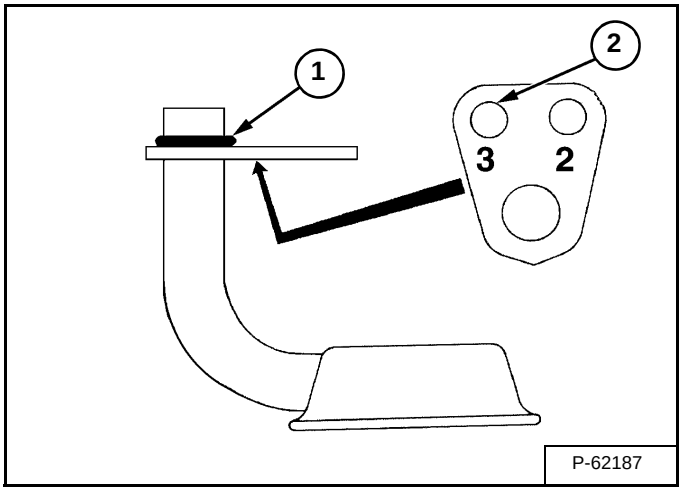


Figure 60-60-3



Remove the oil pump strainer (Item 1) **[Figure 60-60-3]**.

Figure 60-60-4



Installation: Check O-ring (Item 1) on strainer and use hole 3 (Item 2) **[Figure 60-60-4]** 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 60-60-2]**.

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.

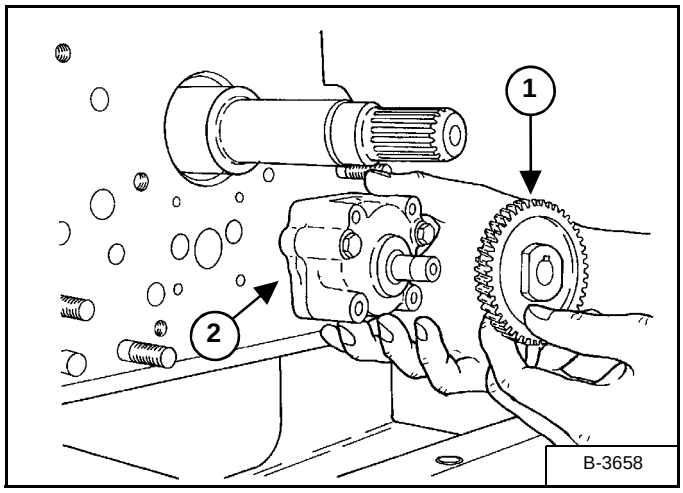
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Oil Pump Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-100-1)

Remove the crankshaft gear.

Figure 60-60-5



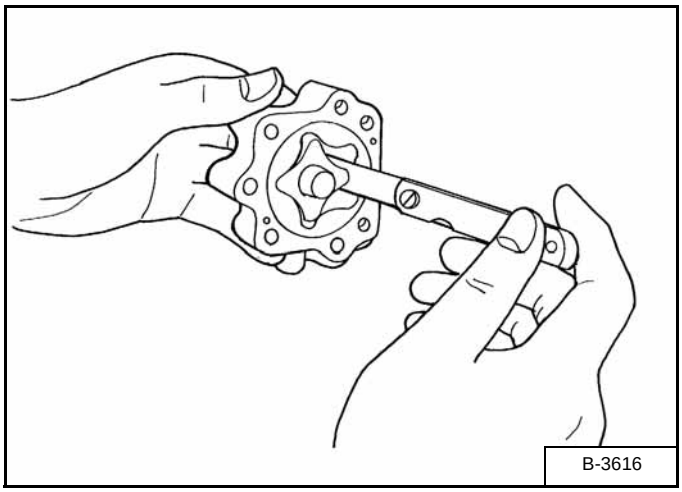
Remove the nut from the oil pump shaft. Use a puller to remove the oil pump gear (Item 1) **[Figure 60-60-5]**.

Remove the oil pump mounting bolts. Remove the oil pump (Item 2) **[Figure 60-60-5]**.

Installation: Tighten the oil pump mounting bolts to 60-72 in.-lb. (6,9-8,1 N•m) torque.

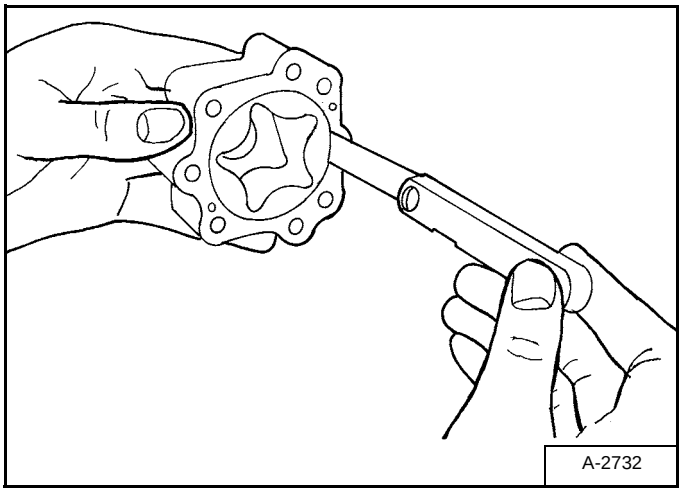
Oil Pump Inspection

Figure 60-60-6



Measure the clearance between the lobes of the inner rotor and outer rotor with a feeler gauge **[Figure 60-60-6]**.

Figure 60-60-7



Measure the clearance between the outer rotor and pump body with a feeler gauge **[Figure 60-60-7]**.

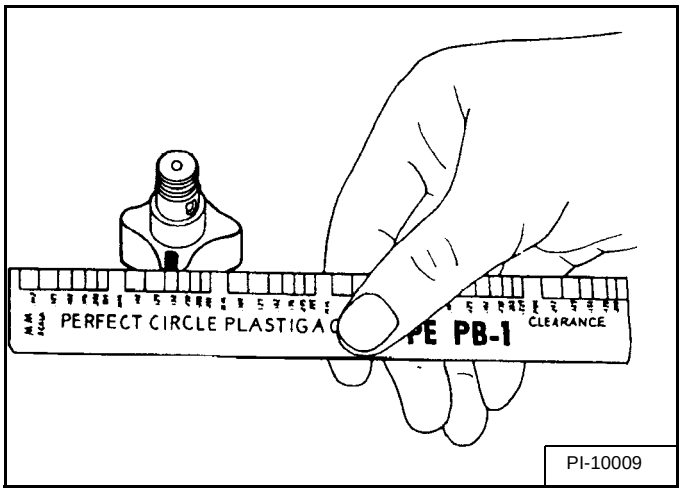
If the clearance exceeds the factory limit, replace the oil pump rotor assembly.

Clearance Between Inner & Outer Rotor
0.001-0.006 in. (0,03-0,14 mm)
Clearance Between Outer Rotor & Body
0.003-0.006 in. (0,07-0,15 mm)

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Oil Pump Inspection (Cont'd)

Figure 60-60-8



Put a piece of press gauge on the rotor face **[Figure 60-60-8]**.

Install the cover and tighten the bolts.

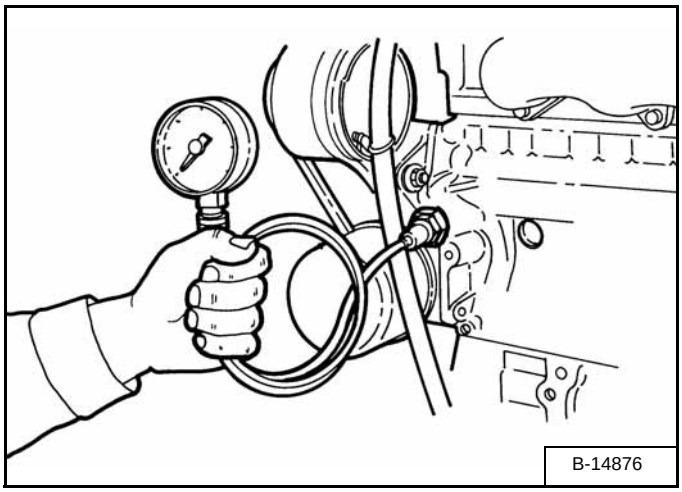
Remove the cover carefully. Measure the width of the press gauge **[Figure 60-60-8]**.

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 - Testing

Figure 60-60-9



Remove the oil pressure sensor.

Install a pressure gauge **[Figure 60-60-9]**.

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)

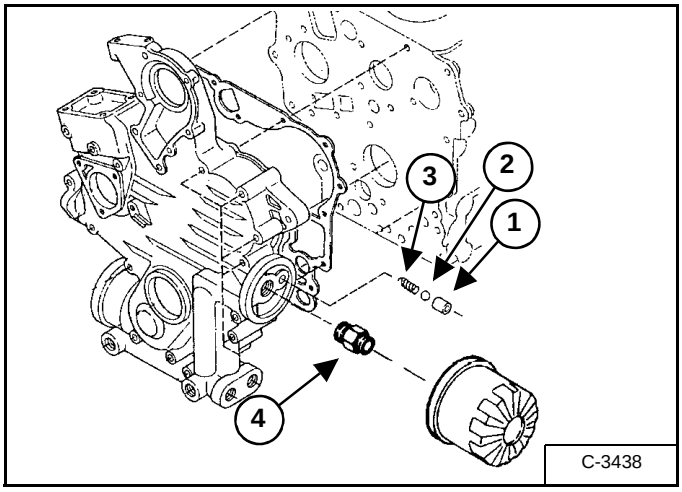
Installation: After checking engine oil pressure, tighten oil pressure sensor to 11-15 ft.-lb. (15-20 N•m).

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Relief Valve

The relief valve prevents damage of the lubricating system due to high pressure. This relief valve is a ball type.

Figure 60-60-10



Remove the valve seat (Item 1) **[Figure 60-60-10]**, ball (Item 2) **[Figure 60-60-10]** and spring (Item 3) **[Figure 60-60-10]**.

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 fiter adapter (Item 4) **[Figure 60-60-10]** to 29-36 ft.-lb. (39-49 N•m) torque.

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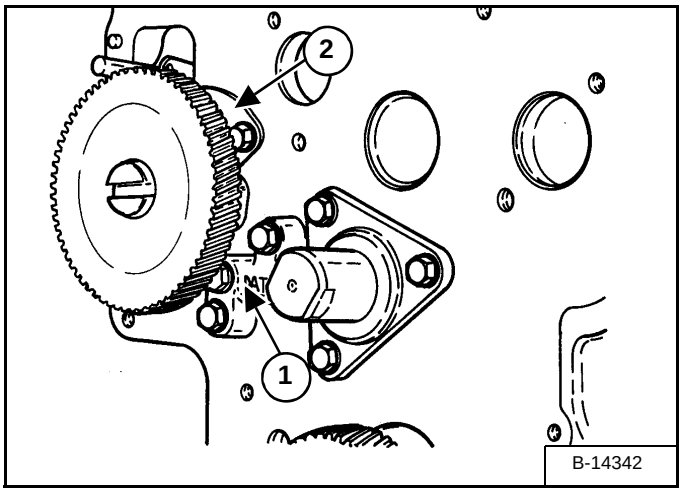
FUEL SYSTEM

Fuel Camshaft Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-100-1.)

Remove the idler gear. (See Idler Gear And Shaft Removal And Installation on Page 60-100-3)

Figure 60-70-11



Remove the bolt (Item 1) from the retainer plate (Item 2) **[Figure 60-70-11]**.

Installation: Tighten the bolt to 60 to 72 in.-lb. (6,8 to 8,1 N•m) torque.

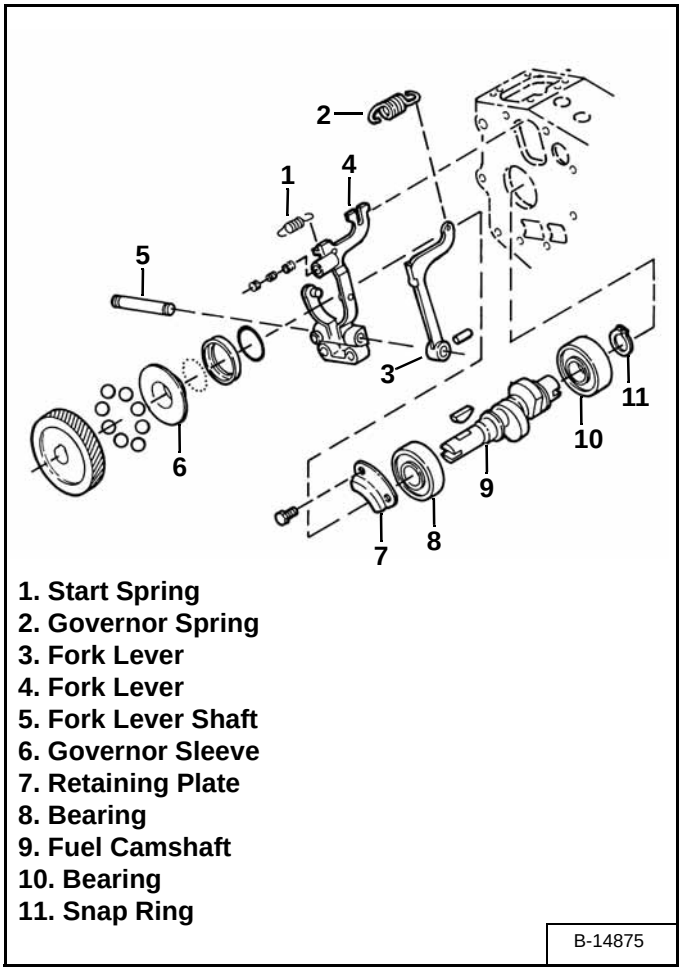
Remove the fuel camshaft retainer plate (Item 2) **[Figure 60-70-11]**.

Remove the fuel camshaft and fork lever assembly at the same time.

Fuel Camshaft Governor Disassembly And Assembly

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 60-70-12



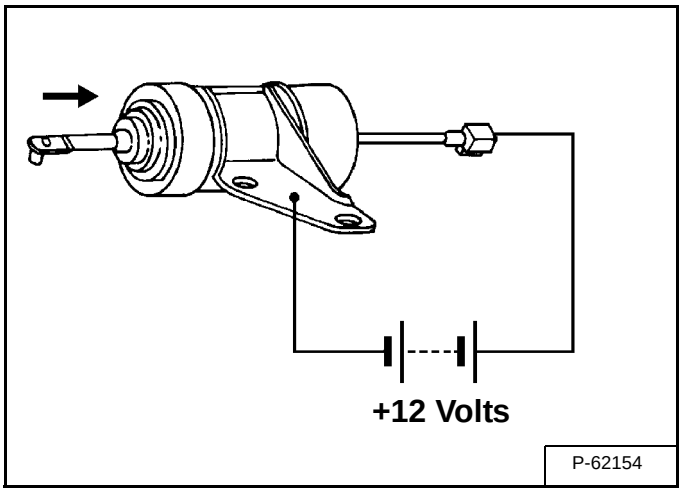
Disassemble and assemble the governor and fuel camshaft as shown **[Figure 60-70-12]**.

Check all the parts for wear or damage and replace as needed.

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Fuel Shutoff Solenoid - Checking

Figure 60-70-13



The energize to stop solenoid does not have 12 volts applied to it while the engine is running **[Figure 60-70-13]**.

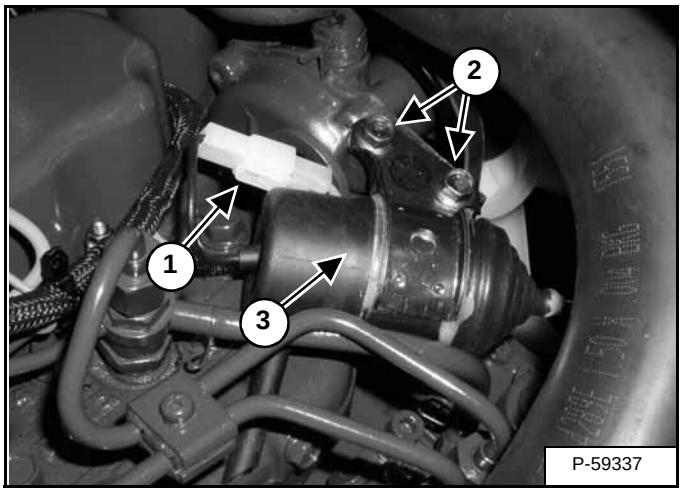
The solenoid is energized for a brief period with 12 volts when the ignition key is turned off.

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 60-70-14



Disconnect the wire from the solenoid (Item 1) **[Figure 60-70-14]**.

Remove the solenoid mounting bolts (Item 2) **[Figure 60-70-14]**.

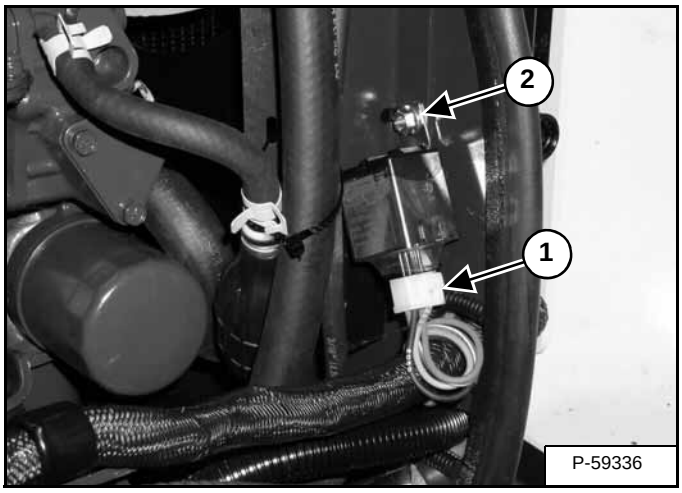
Remove the solenoid (Item 3) **[Figure 60-70-14]**.

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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 60-70-15



Disconnect the wire harness (Item 1) **[Figure 60-70-15]** from the timer module **[Figure 60-70-15]**.

Remove the nut (Item 2) **[Figure 60-70-15]**.

Remove the fuel shutoff timer.

Fuel Injection Pump - Checking

NOTE: Never try to disassemble the injection pump assembly. For repairs, you should contact a Kubota-authorized pump service shop.

Remove the air cleaner housing. (See Housing Removal And Installation on Page 60-40-1)

Remove the engine stop solenoid.

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

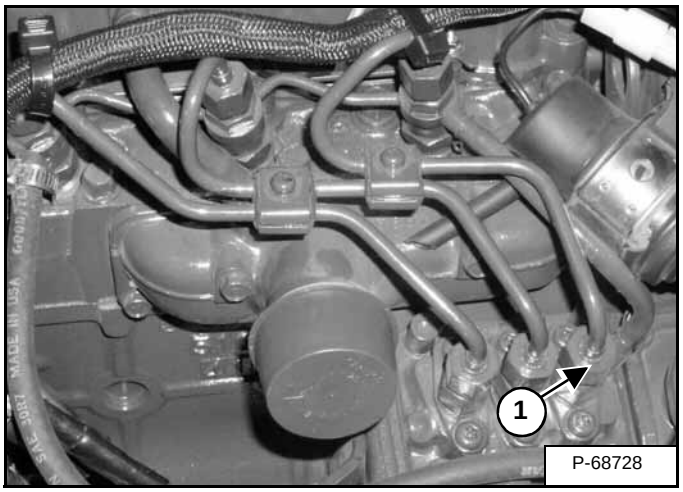
MEL1237 - Adapter Fuel Line
MEL1173-1 - Pressure Gauge

⚠ WARNING

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.

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Figure 60-70-16



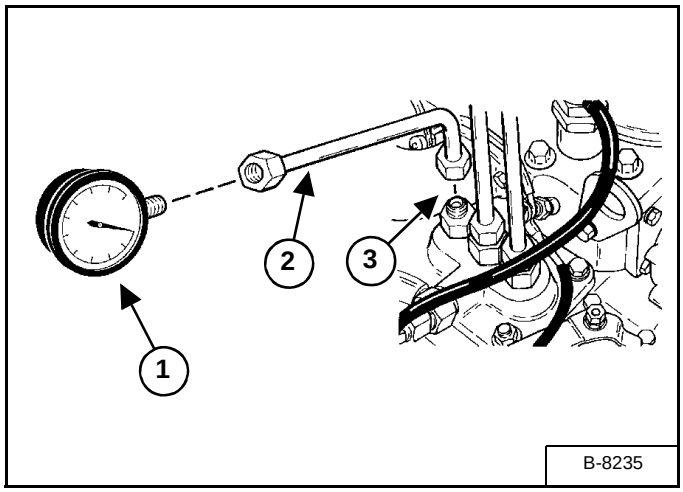
To check the initial discharge pressure, remove a high pressure tubeline (Item 1) **[Figure 60-70-16]** from the fuel injection pump.

Loosen the other end of the tubeline at the injector, so that the tubeline can be turned away from the fitting.

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Fuel Injection Pump - Checking (Cont'd)

Figure 60-70-17



Connect a pressure gauge (Item 1) to the long leg of the test tubeline (Item 2) **[Figure 60-70-17]** and tighten.

Connect the short leg of the tubeline to the fitting at the fuel injection pump (Item 3) **[Figure 60-70-17]**.

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 to 1849 PSI (137 to 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.

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IMPORTANT

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

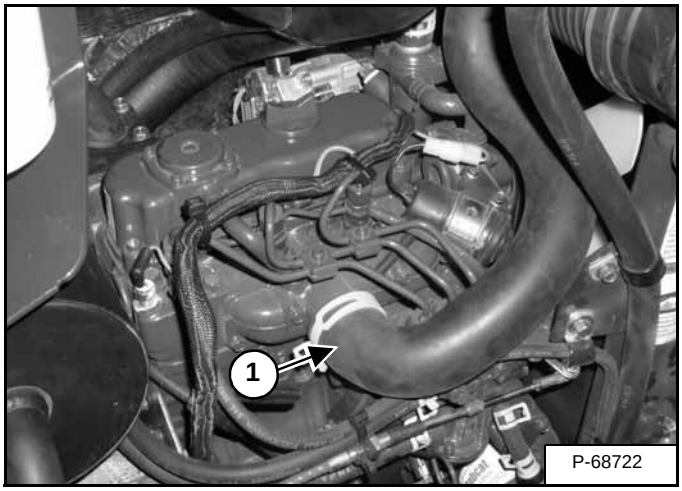
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Clean around the injection pump.

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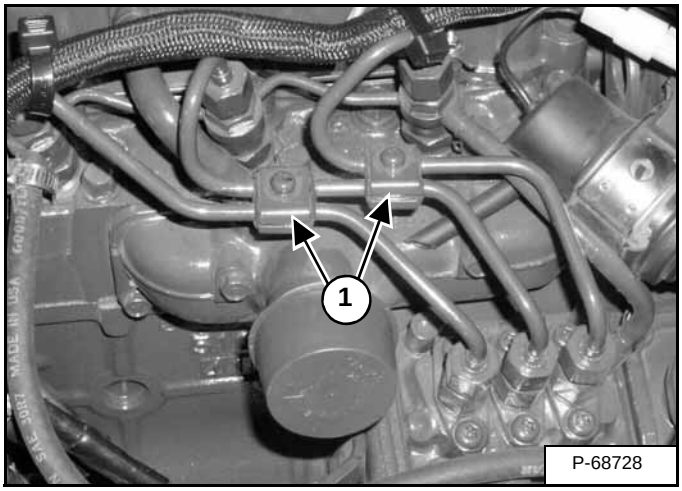
Fuel Injection Pump Removal And Installation (Cont'd)

Figure 60-70-18



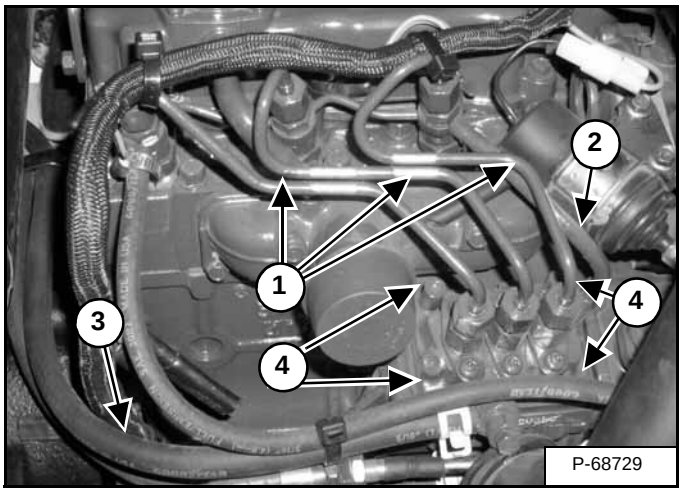
Remove the air intake hose (Item 1) **[Figure 60-70-18]** and cap.

Figure 60-70-19



Remove the fuel line clamps (Item 1) **[Figure 60-70-19]**.

Figure 60-70-20



Disconnect the high pressure lines (Item 1) **[Figure 60-70-20]** from the fuel injector and fuel injection pump.

Disconnect the fuel return hose (Item 2) and the fuel feed hose (Item 3) **[Figure 60-70-20]**.

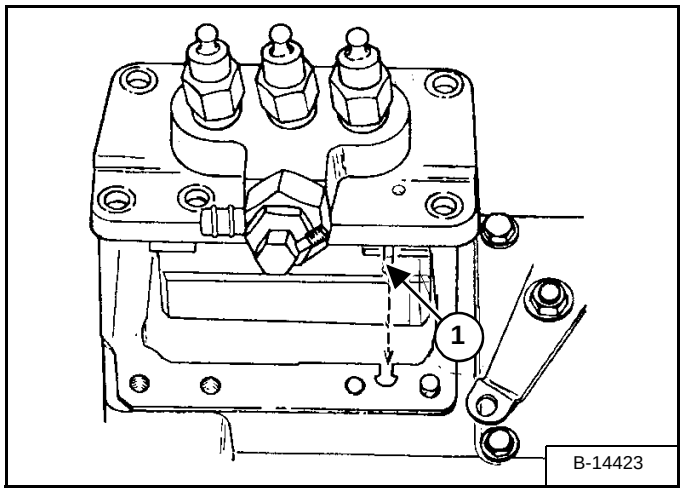
Remove the four injection pump mounting bolts (Item 4) **[Figure 60-70-20]**.

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

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Fuel Injection Pump Removal And Installation (Cont'd)

Figure 60-70-21



Align the pin (Item 1) **[Figure 60-70-21]** in the control rack with the slot in the engine block.

Remove the injection pump.

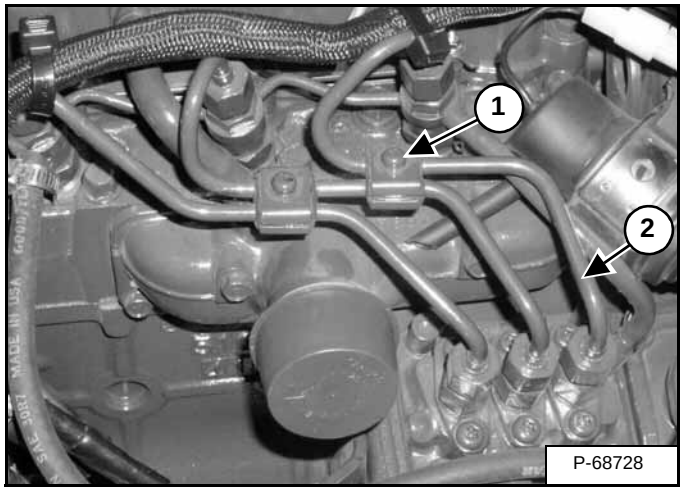
Installation: When the injection pump is installed, make sure the pin (Item 1) **[Figure 60-70-21]** on the control rack is correctly installed on the fork lever. If the slot is not installed correctly, the engine will run over maximum speed and serious damage can result.

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

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 60-70-22



Remove the fuel line clamp (Item 1) **[Figure 60-70-22]**.

Remove the number one cylinder high pressure line (Item 2) **[Figure 60-70-22]** from the injection pump.

Remove the exhaust extension tube. (See Removal And Installation on Page 60-30-1)

IMPORTANT

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

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IMPORTANT

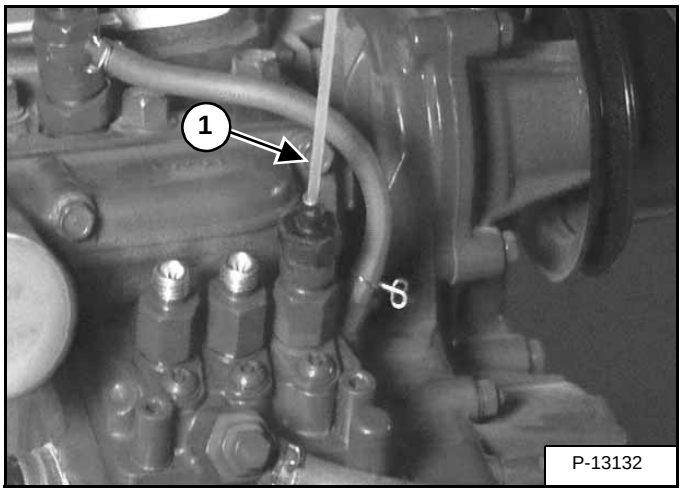
Do not attempt to maintain or adjust unless you are trained and have the correct equipment.

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Injection Pump - Timing (Cont'd)

Figure 60-70-23



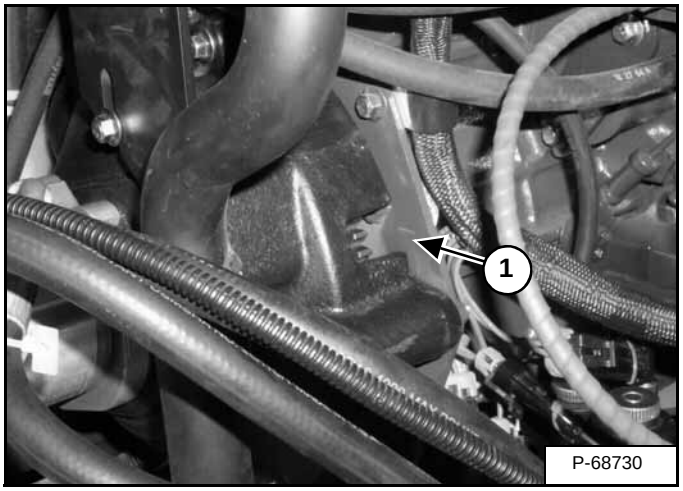
Install a short plastic tube (Item 1) **[Figure 60-70-23]** in the number one cylinder port of the injection pump. The tube should fit tight in the port and point upward.

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).

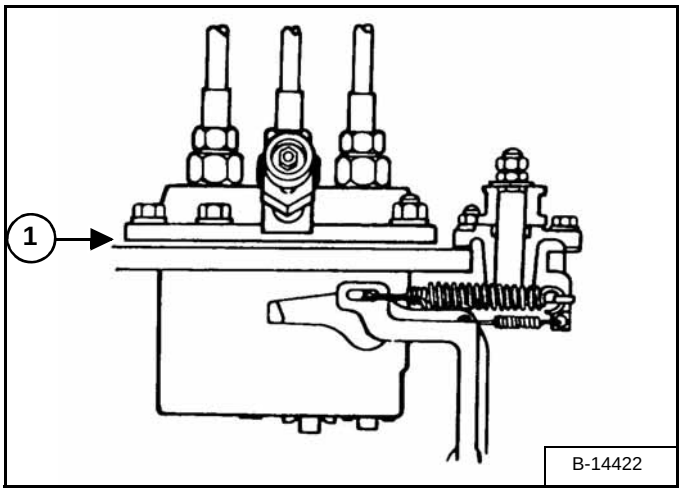
Turn the flywheel counter-clockwise (facing the flywheel) slowly until the start of fuel rise in the plastic tube (Item 1) **[Figure 60-70-23]**.

Figure 60-70-24



At this point look at the timing mark (located on the flywheel) for proper alignment (Item 1) **[Figure 60-70-24]**. When the timing mark is aligned as shown the timing is correct for the injection pump, which is 19 to 21° B.T.D.C.

Figure 60-70-25



The correct engine timing for all Kubota D722-E2B engines is 19 tot 21° B.T.D.C. Add or subtract shims (Item 1) **[Figure 60-70-25]** to time the engine to 19 to 21° B.T.D.C. The engine is correctly timed when the 19 to 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.

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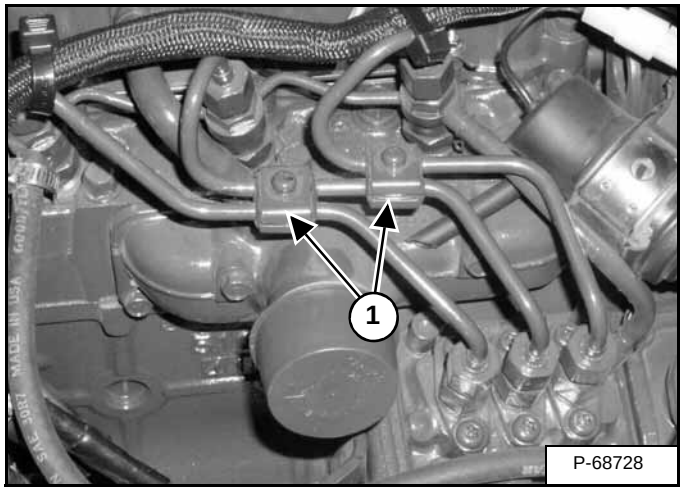
Fuel Injector Removal And Installation

IMPORTANT

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

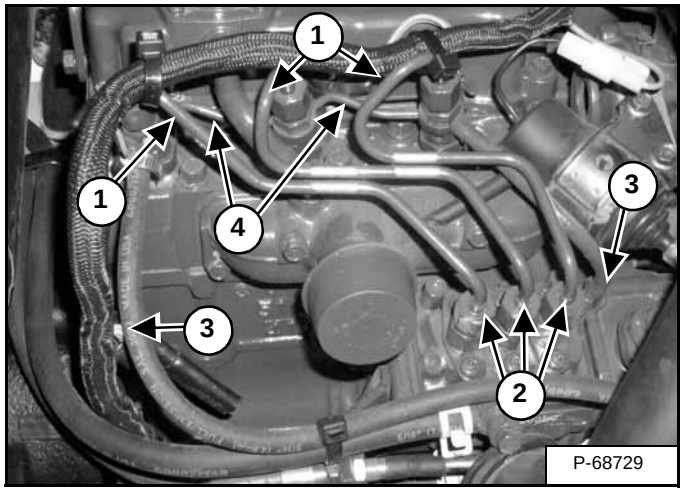
I-2029-0289

Figure 60-70-26



Remove the high pressure fuel line clamps (Item 1) **[Figure 60-70-26]**.

Figure 60-70-27



Disconnect the high pressure fuel lines from the fuel injectors (Item 1) **[Figure 60-70-27]**.

Disconnect the fuel lines (Item 2) **[Figure 60-70-27]** from the injection pump.

Remove the high pressure fuel lines.

Disconnect the return fuel hoses (Item 3) **[Figure 60-70-27]**.

Remove the retainer nut from the top of the fuel injectors.

Remove the fuel return pipe (Item 4) **[Figure 60-70-27]**.

Loosen the injector nozzle.

Installation: Tighten the injector nozzle to 36 to 51 ft.-lb. (49 to 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

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.

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Fuel Injector Nozzle Pressure - Checking

IMPORTANT

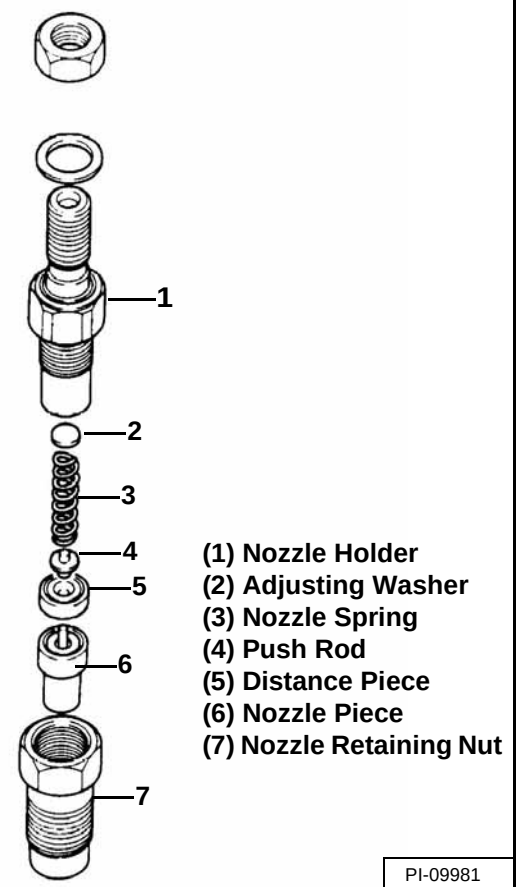
Do not disassemble or test the fuel injector nozzles unless you have the correct service and testing tools.

I-2027-0284

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

MEL10018 - Injector Nozzle Tester

Figure 60-70-28

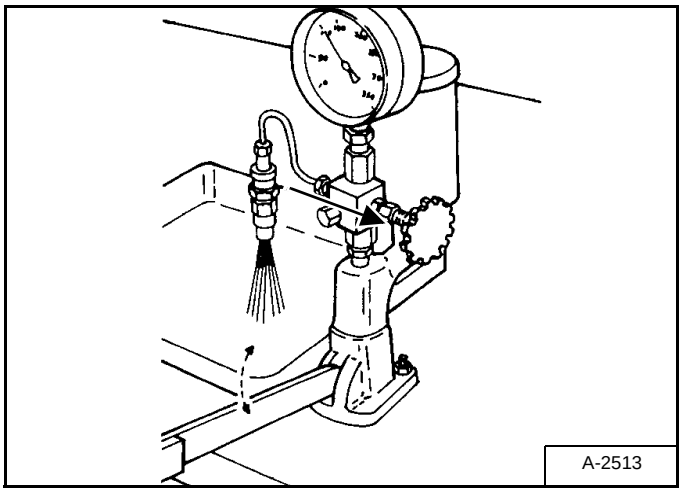


The nozzle release pressure can be adjusted by adding or removing washer(s) (Item 2) from the top of the nozzle spring (Item 3) **[Figure 60-70-28]**.

Each spacer will change the release pressure by about 34 PSI (2,3 bar).

Fuel Injection Pressure.	1991 to 2134 PSI (137 to 147 bar)

Figure 60-70-29



Assemble the injector nozzle. Connect the nozzle to the tester with the nozzle down **[Figure 60-70-29]**.

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 60-70-28]** as needed.

NOTE: When assembling the injector nozzle, tighten the retainer nut (Item 1) [Figure 60-70-28] to 23.5 to 28.9 ft.-lb. (25,3 to 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 to 51 ft.-lb. (49 to 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.

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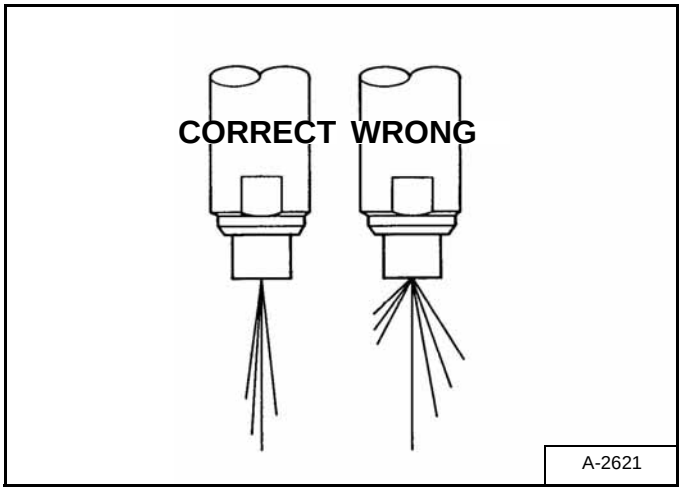
Nozzle Spray Condition

⚠ 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.

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Figure 60-70-30

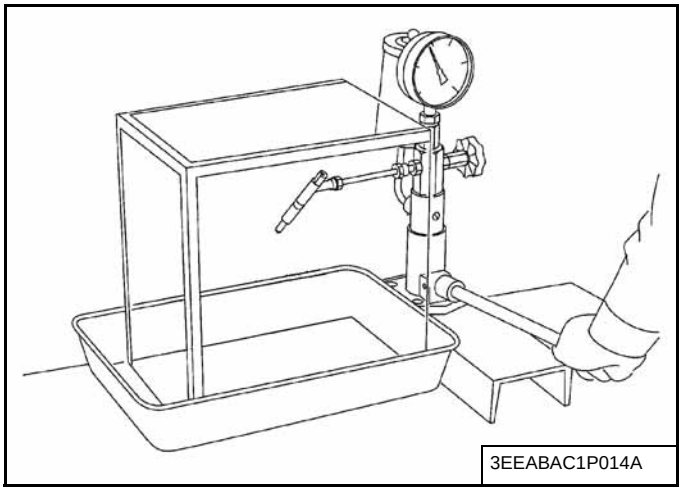


Check that the spray pattern is correct **[Figure 60-70-30]**:

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.

Valve Seat Tightness

Figure 60-70-31



Set the injection nozzle to a nozzle tester (Code No. 07909-31361) **[Figure 60-70-31]**.

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

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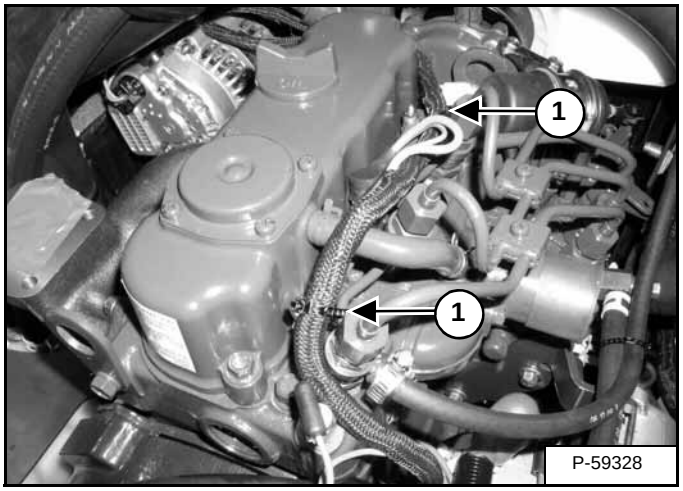
Glow Plug Removal And Installation

IMPORTANT

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

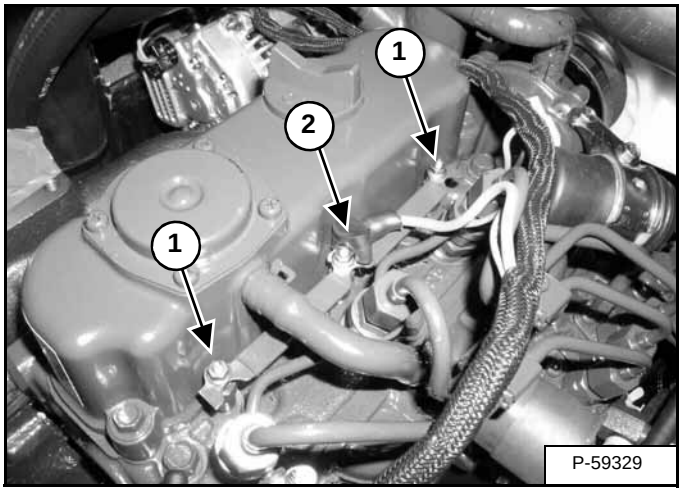
I-2029-0289

Figure 60-80-1



Remove the tie straps (Item 1) **[Figure 60-80-1]**.

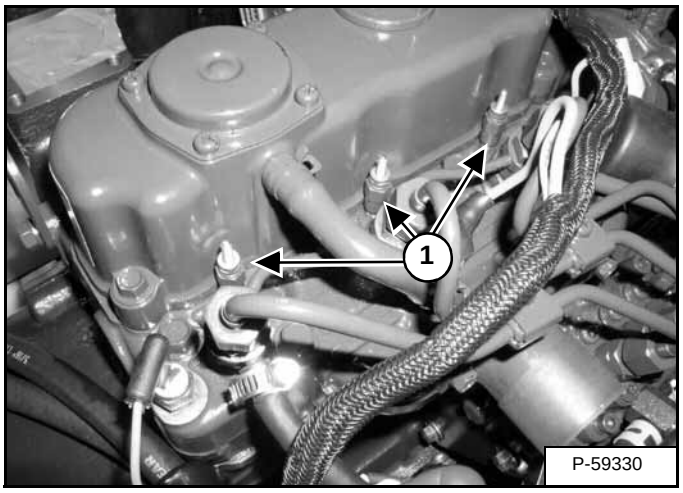
Figure 60-80-2



Remove the nuts (Item 1) **[Figure 60-80-2]**.

Remove the glow plug lead (Item 2) **[Figure 60-80-2]** and nut.

Figure 60-80-3



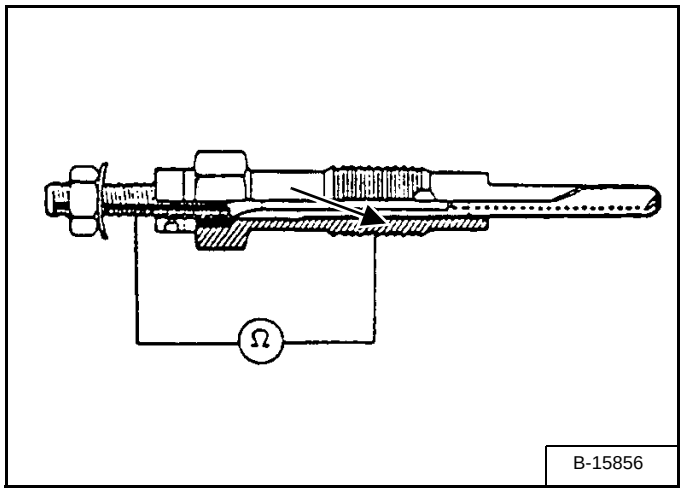
Remove the glow plugs (Item 1) **[Figure 60-80-3]** from the cylinder head.

Installation: Tighten the glow plugs to 6 to 11 ft.-lb. (8 to 15 N•m) torque.

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Glow Plugs - Testing

Figure 60-80-4



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 60-80-4]**.

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.

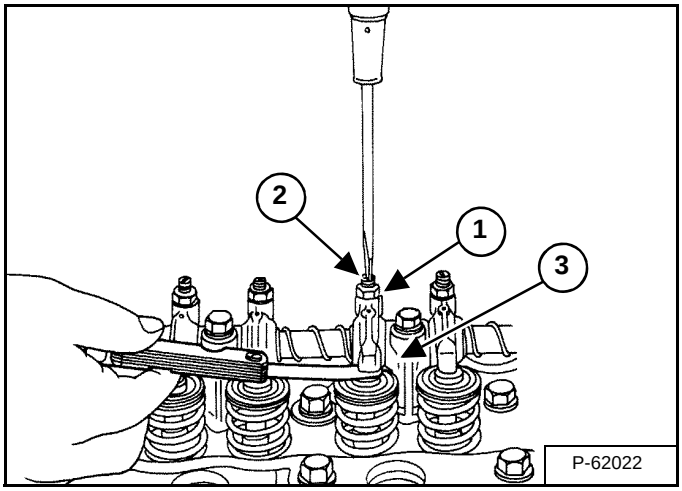
Valve Clearance Adjustment

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 60-80-5



Loosen the lock nut (Item 1) **[Figure 60-80-5]**.

Turn the adjustment screw (Item 2) **[Figure 60-80-5]** until the correct clearance is obtained.

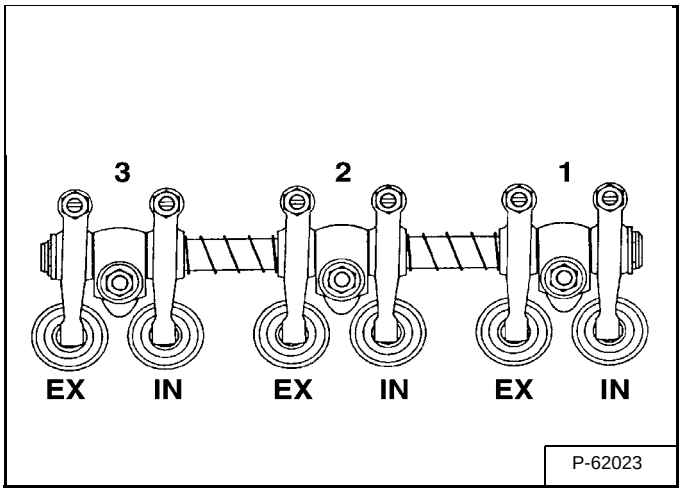
NOTE: The clearance is measured between the rocker arm and valve stem tip (Item 3) [Figure 60-80-5].

If adjustments are necessary, tighten lock nut before moving on to the next rocker arm.

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Valve Clearance Adjustment (Cont'd)

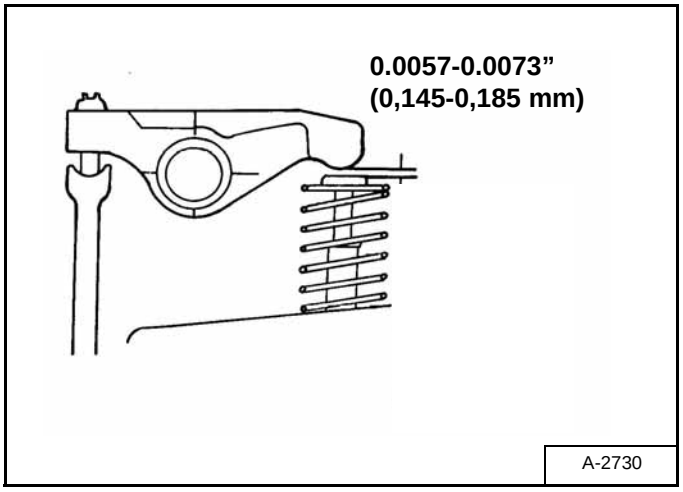
Figure 60-80-6



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 60-80-6]**.

Rotate the flywheel 360°, No. 1 (overlap position). Set No. 2 intake valve and No. 3 exhaust valve. **[Figure 60-80-6]**.

Figure 60-80-7



Make sure the piston is at TDC when adjusting the clearance at the valves. The correct clearance is 0.0057 to 0.0073 in. (0,145 to 0,185 mm) cold clearance **[Figure 60-80-7]**.

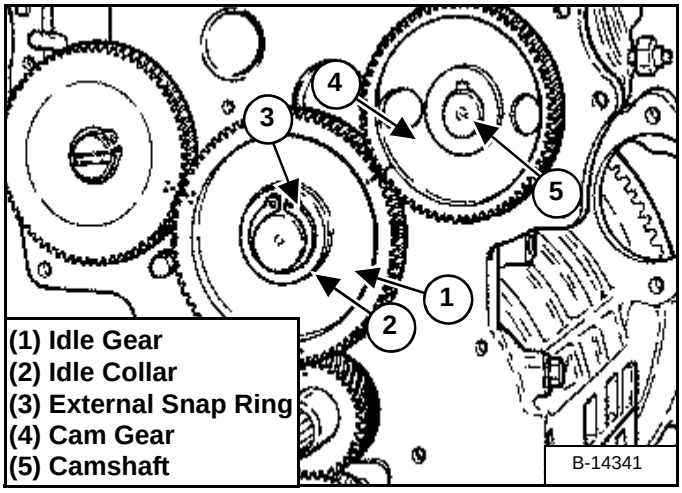
Valve Timing, Checking

Stop the engine and open the rear door.

Remove the engine. (See Engine Removal and Installation on Page 60-10-8.)

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-100-1.)

Figure 60-80-8

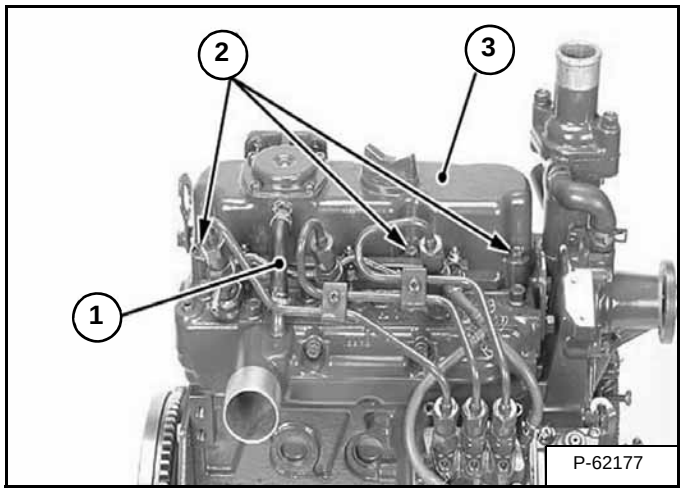


Make sure the timing marks are in correct alignment **[Figure 60-80-8]**.

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Cylinder Head Removal And Installation

Figure 60-80-9



Remove the breather hose (Item 1) **[Figure 60-80-9]**.

Remove the bolts (Item 2) from the valve cover and remove the valve cover and gasket (Item 3) **[Figure 60-80-9]**.

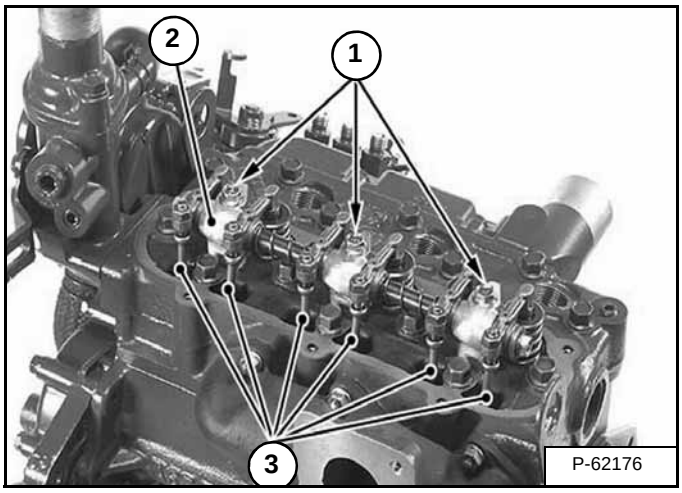
Installation: Tighten the bolts to 5 to 8 ft.-lb. (7 to 11 N•m) torque. Gradually tighten center bolts before the end bolts to avoid cracking valve cover.

Remove the fuel injector nozzles. (See Fuel Injector Removal And Installation on Page 60-70-8.)

Remove the glow plugs. (See Glow Plug Removal And Installation on Page 60-80-1.)

Remove the alternator. (See Removal And Installation on Page 50-30-6.)

Figure 60-80-10



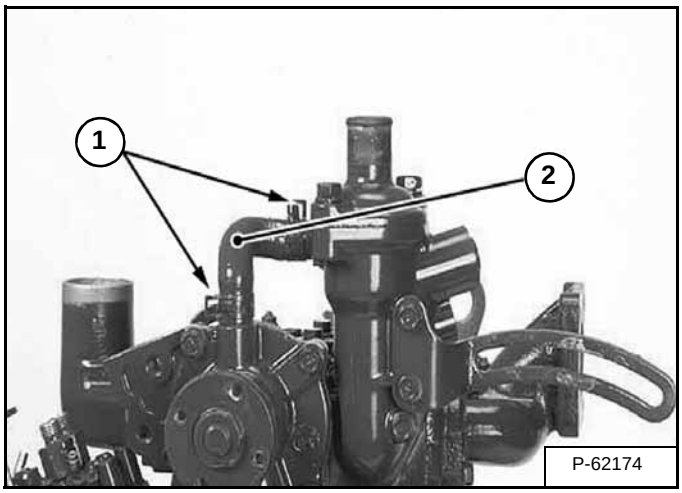
Remove the rocker arm bracket screws (Item 1) and shaft assembly (Item 2) **[Figure 60-80-10]**.

Installation: Tighten the nuts to 7 to 8 in.-lb. (9,8 to 11,3 N•m) torque.

Remove the pushrods (Item 3) **[Figure 60-80-10]**.

Remove the intake and exhaust manifolds.

Figure 60-80-11

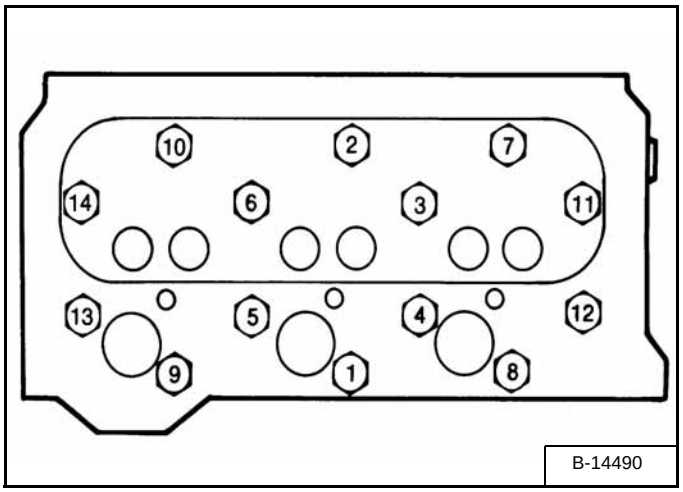


Remove the water return hose **[Figure 60-80-11]**.

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Cylinder Head Removal And Installation (Cont'd)

Figure 60-80-12



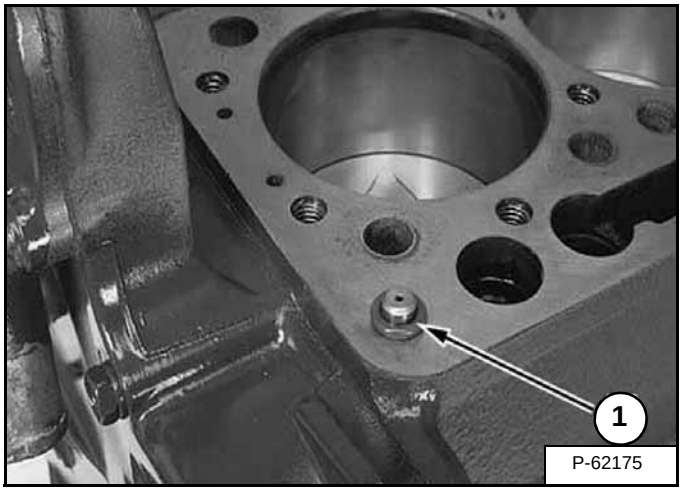
Remove the cylinder head bolts in order of #14 to #1 **[Figure 60-80-12]**.

Installation: Put oil on the bolt threads. Tighten the bolts in the correct sequence of #1 to #14 to 28 to 31 ft.-lb. (38 to 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 60-80-13

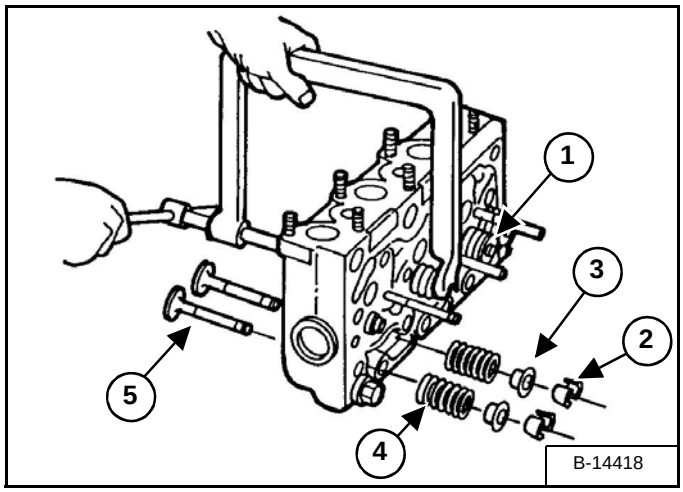


Installation: Always use a new head gasket and new O-ring. Make sure the O-ring (Item 1) **[Figure 60-80-13]** is seated over the dowel.

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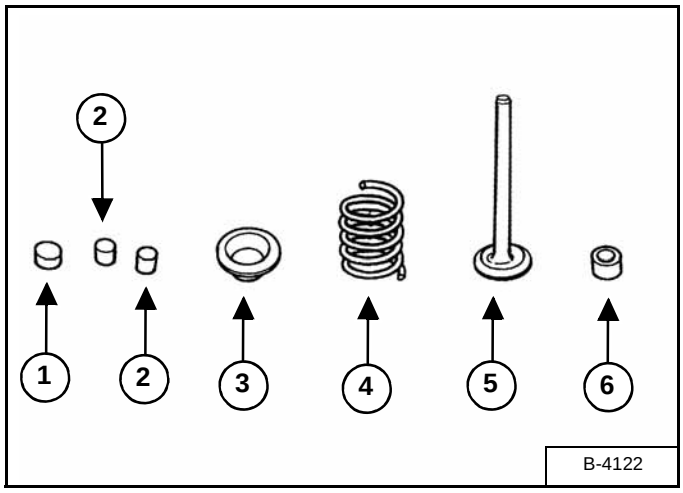
Cylinder Head Disassembly And Assembly

Figure 60-80-14



Use a valve spring compressor to compress the valve spring **[Figure 60-80-14]**.

Figure 60-80-15



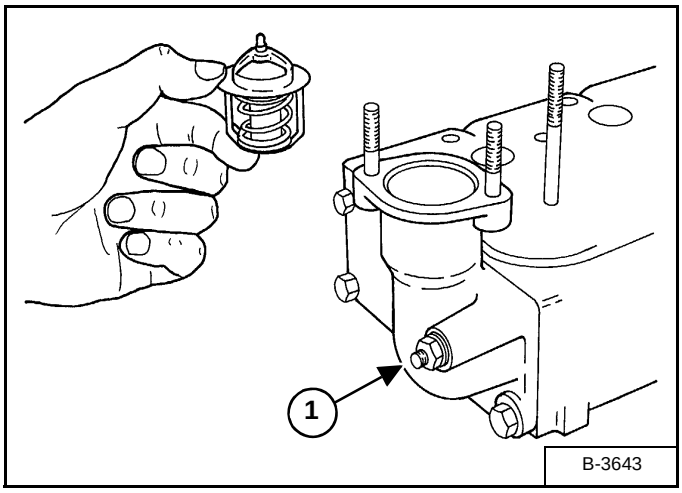
Remove the valve cap (Item 1) **[Figure 60-80-15]** and valve spring collet (Item 2) **[Figure 60-80-14]** & **[Figure 60-80-15]**.

Remove the valve spring retainer (Item 3) **[Figure 60-80-14]** & **[Figure 60-80-15]** and the spring (Item 4) **[Figure 60-80-14]** & **[Figure 60-80-15]**.

Remove the valve (Item 5) **[Figure 60-80-14]** & **[Figure 60-80-15]**.

Remove the seal (Item 6) **[Figure 60-80-15]**.

Figure 60-80-16



Remove the thermostat cover and thermostat from the cylinder head. Remove the thermostat housing (Item 1) **[Figure 60-80-16]**.

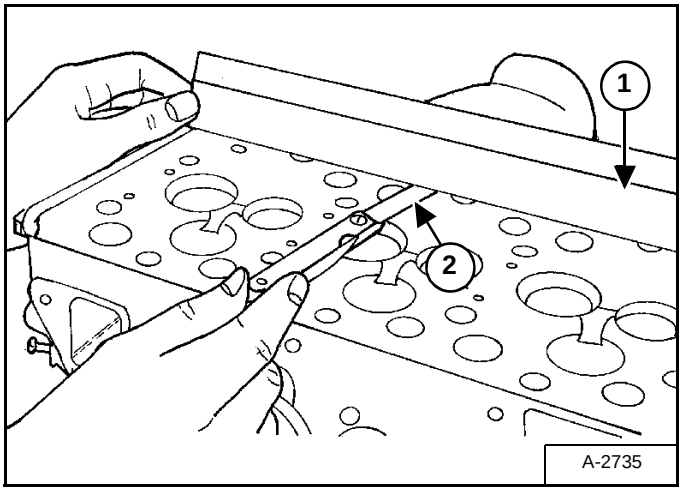
Installation: Apply Liquid-Type Gasket (Three Bond 1215 or equivalent) to both sides of the new thermostat cover gasket and new thermostat housing gasket.

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Cylinder Head - Servicing

Clean the surface of the cylinder head.

Figure 60-80-17

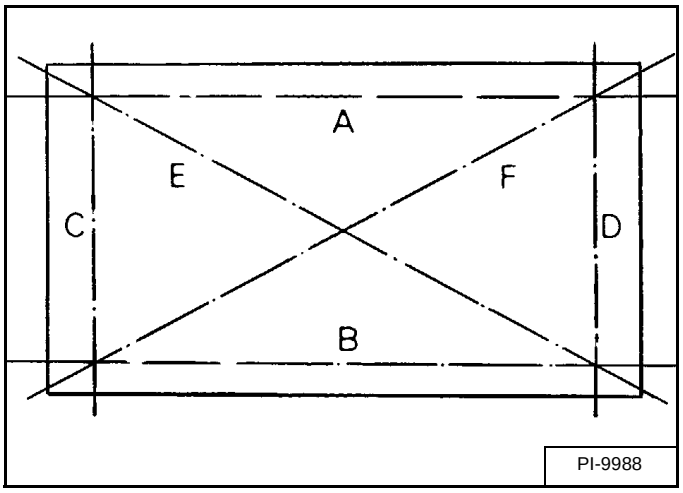


Put a straight edge (Item 1) **[Figure 60-80-17]** on the cylinder head.

NOTE: Do not put the straight edge across combustion chambers.

Put a feeler gauge (Item 2) **[Figure 60-80-17]** between the straight edge and the surface of the cylinder head.

Figure 60-80-18



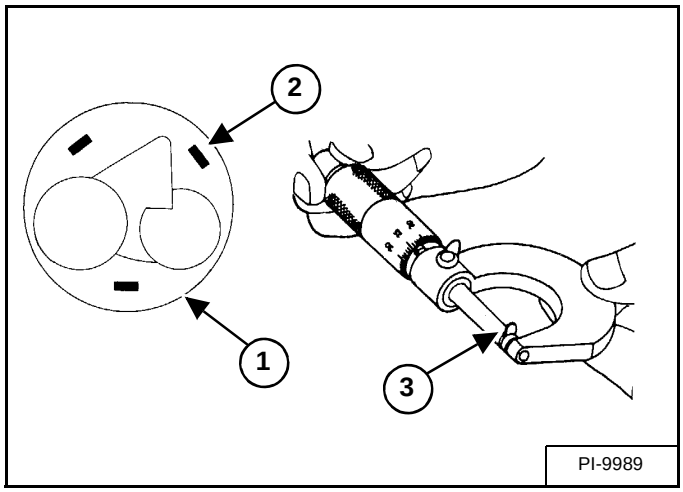
Put the straight edge on the cylinder head's 4 sides and 2 diagonal as shown in figure **[Figure 60-80-18]**.

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.

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Cylinder Head Top Clearance

Figure 60-80-19



Install the cylinder head gasket. Put the piston (Item 1) **[Figure 60-80-19]** being checked at T.D.C.

Put 3 pieces of 0.06 in. (1,5 mm) diameter solder (Item 2) **[Figure 60-80-19]** 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 60-80-4.).

Turn the crankshaft until the piston exceeds T.D.C. Remove the cylinder head.

Remove the solder wire (Item 3) **[Figure 60-80-19]** and measure it.

If the measurement exceeds the specifications, check the oil clearance of the crank pin journal or the piston pin.

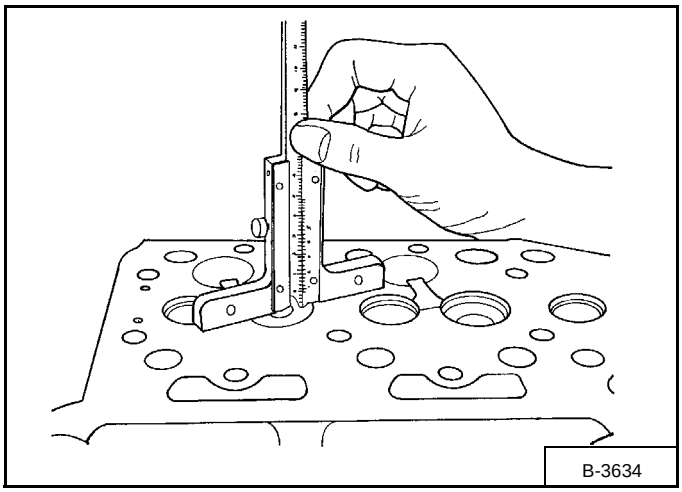
Top Clearance	0.0197 to 0.0276 in. (0,50 to 0,70 mm)

Valve Guide - Checking

Remove the valve and spring from the cylinder head. (See Cylinder Head Removal And Installation on Page 60-80-4.)

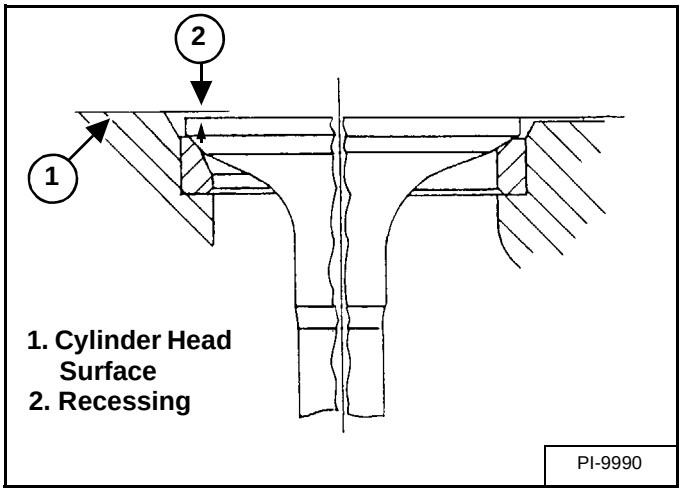
Clean the valve seat and combustion chamber.

Figure 60-80-20



Install the valve into the guide. Measure the valve recessing with a depth gauge **[Figure 60-80-20]**.

Figure 60-80-21



If the measurement exceeds the allowable limit, replace the valve or cylinder head **[Figure 60-80-21]**.

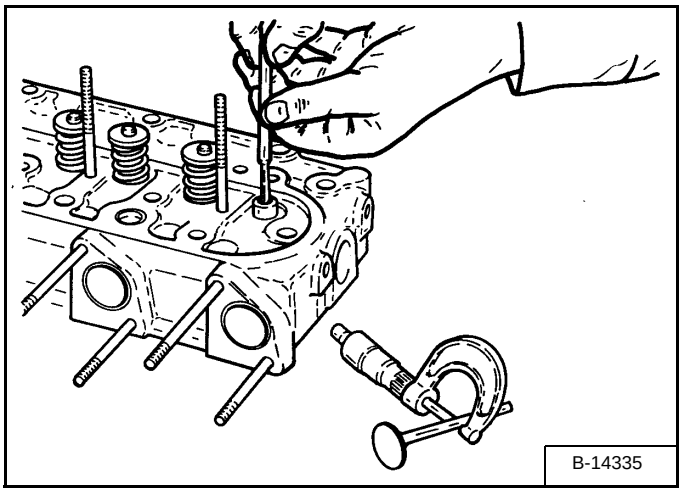
Recessing	0.004 in. (0,10 mm)
Allowable Limit (Recessing)	0.012 in. (0,30 mm)

Remove the carbon from the valve guide.

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Valve Guide, Checking (Cont'd)

Figure 60-80-22



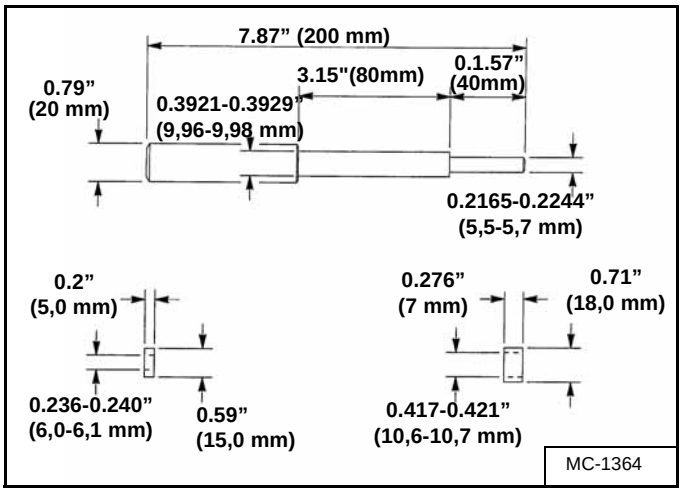
Measure the valve stem O.D. **[Figure 60-80-22]**.

Measure the valve guide I.D. **[Figure 60-80-22]**.

Calculate the clearance. If the clearance exceeds the allowable limit, replace the valve and/or valve guide.

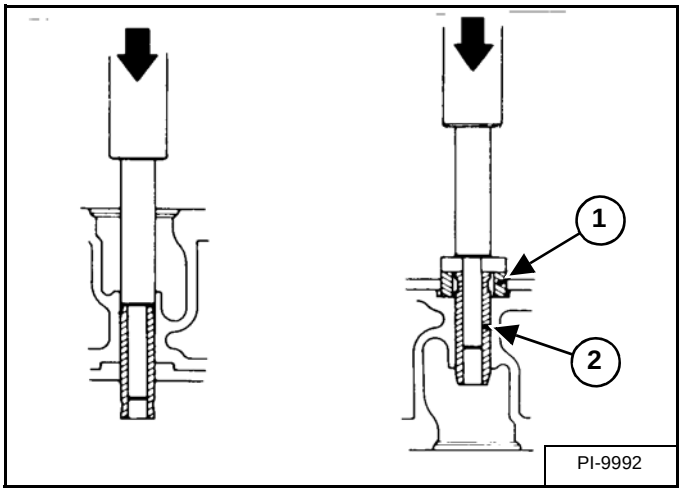
Valve Guide I.D	0.2366 to 0.2372 in. (6,01 to 6,025 mm)
Valve Stem O.D	0.2350 to 0.2354 in. (5,968 to 5,980 mm)
Clearance Between Valve Stem and Guide	0.0012 to 0.0022 in. (0,03 to 0,057 mm)
Allowable Limit	0.0039 in. (0,10 mm)

Figure 60-80-23



To remove and replace the valve guide, make the driver tools as shown in **[Figure 60-80-23]**.

Figure 60-80-24



Press the used valve guide out of the cylinder head using the special driver tool **[Figure 60-80-24]**. (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 (Item 1 & 2) **[Figure 60-80-24]**, press the new guide until the tools contact the cylinder head.

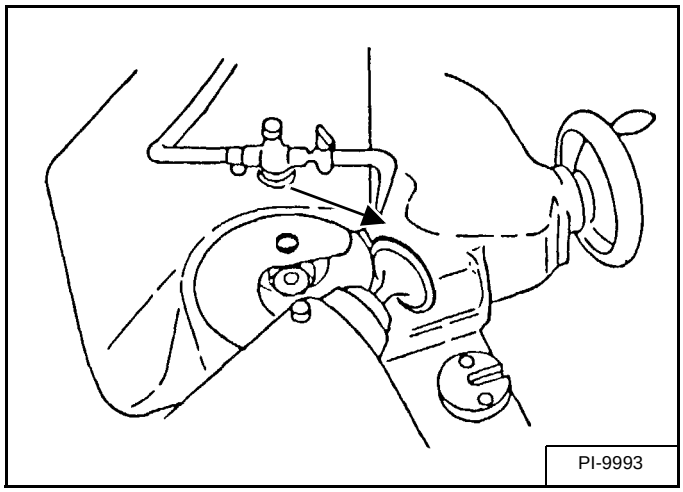
Ream the valve guide to the correct specifications.

NOTE: Valve guide I.D. (Intake and Exhaust) factory spec. is .2366 to .2372 in. (6,01 to 6,025 mm)

Dealer Copy -- Not for Resale

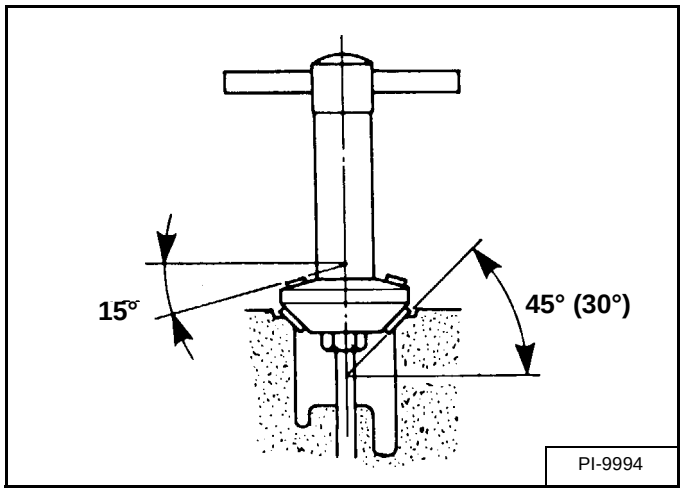
Reconditioning The Valve And Valve Seat

Figure 60-80-25



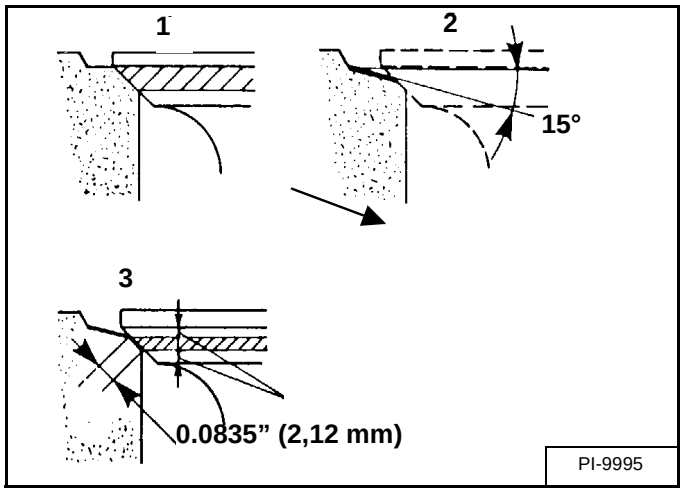
Grind the valve face to the correct angle using a valve refacer **[Figure 60-80-25]** & **[Figure 60-80-27]**.

Figure 60-80-26



Grind the valve surface in the cylinder head to the correct angle **[Figure 60-80-26]**.

Figure 60-80-27



Check the seat surface and valve face (Item 1) **[Figure 60-80-27]**.

If the seat surface is too wide, use a 15 degree cutter (Item 2) to get the correct width (Item 3) **[Figure 60-80-27]**.

Valve Seat Width

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

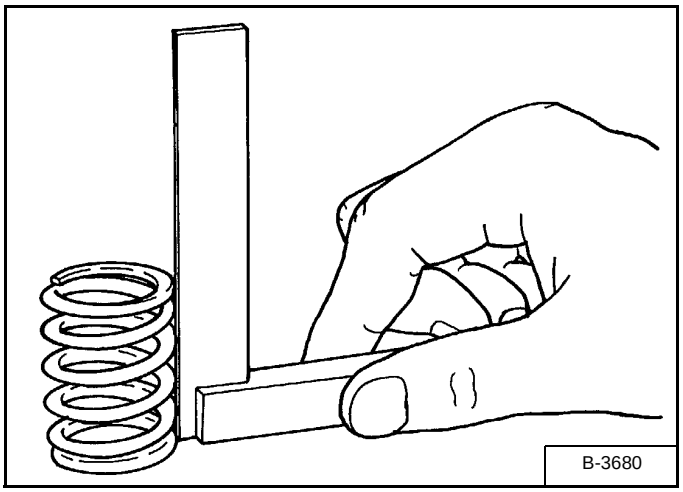
Valve Seat & Face Angle

Intake	45°
Exhaust	45°

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Valve Spring

Figure 60-80-28



Measure the length of the valve spring. If the measurement is less than the allowable limit, replace the spring **[Figure 60-80-28]**.

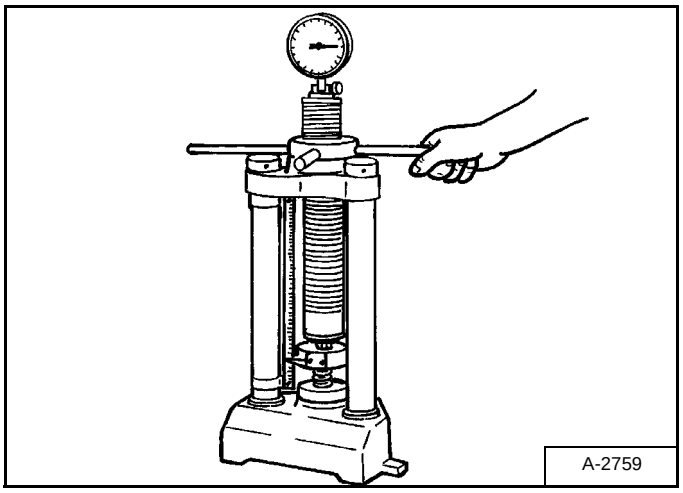
Free Length	1.232 to 1.252 in. (31,3 to 31,8 mm)
Allowable Limit	1.118 in. (28,4 mm)

Put the spring on a flat surface, place a square on the side of the spring **[Figure 60-80-28]**.

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 60-80-29



Put the spring on a tester and compress to specified length **[Figure 60-80-29]**.

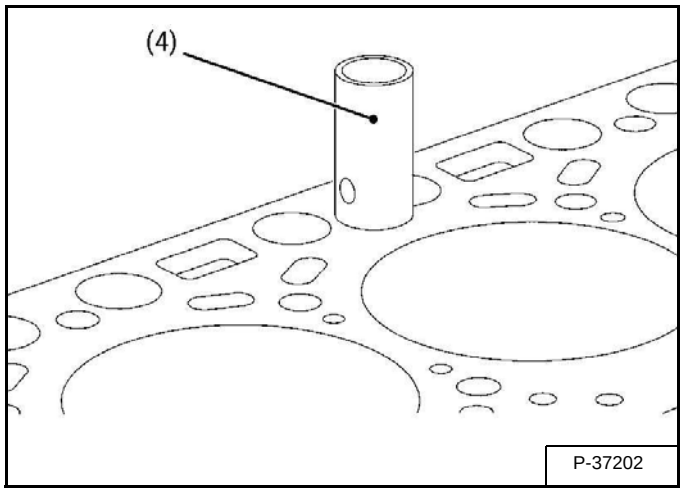
Read the compressed load on the gauge. If the measurement exceeds allowable limit, replace the spring.

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)

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Valve Tappets

Figure 60-80-30



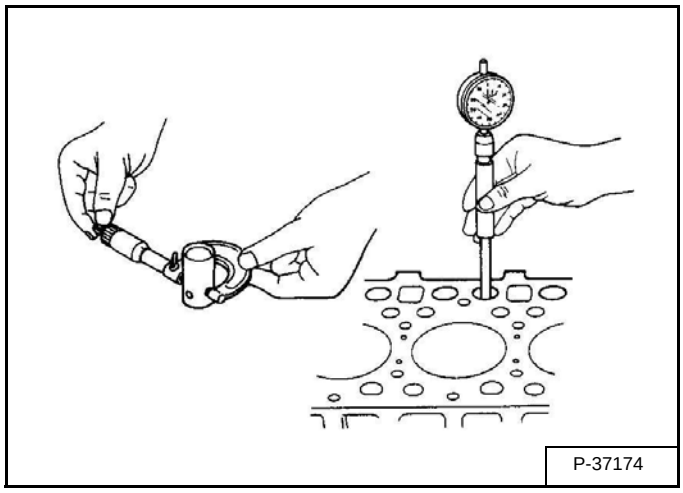
Remove the tappets (Item 4) **[Figure 60-80-30]** from the crankcase.

When reassembling replace the head gasket with a new one.

Before installing the tappets (Item 4) **[Figure 60-80-30]**, apply engine oil thinly around them.

NOTE: Mark the cylinder number to the tappets to prevent interchanging.

Figure 60-80-31



Measure the tappet O.D. with an outside micrometer **[Figure 60-80-31]**.

Measure the I.D. of the tappet guide bore with a cylinder gauge, and calculate the oil clearance **[Figure 60-80-31]**.

If the oil clearance exceeds the allowable limit or the tappet is damaged, replace the tappet.

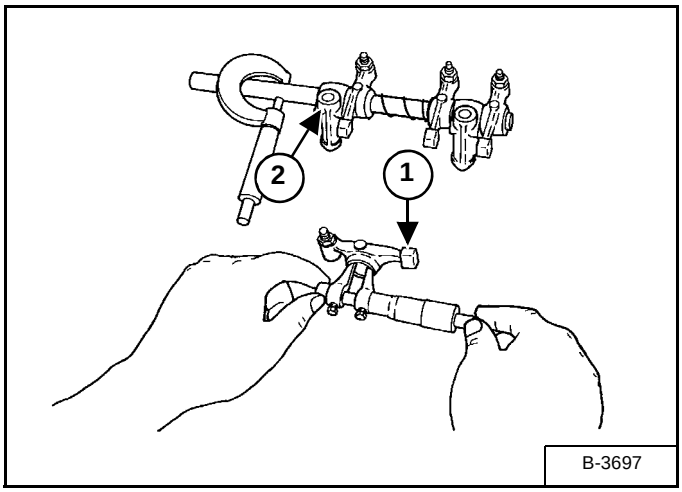
Oil clearance between tappet and guide	Factory spec.	0.016 to 0.052 mm 0.00063 to 0.00205 in.
	Allowable limit	0.10 mm 0.0039 in.

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.

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Rocker Arm And Shaft - Checking

Figure 60-80-32



Measure the rocker arm I.D. (Item 1) **[Figure 60-80-32]** with an inside micrometer.

Measure the rocker shaft O.D. (Item 2) **[Figure 60-80-32]** 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 & Shaft	
	0.0006 to 0.0018 in. (0,016 to 0,045 mm)
Allowable Limit	0.0059 in. (0,15 mm)
Rocker Arm Shaft	0.4123 to 0.4128 in. (10,47 to 10,48 mm)
Rocker Arm I.D.	0.4134 to 0.4141 in. (10,5 to 10,52 mm)

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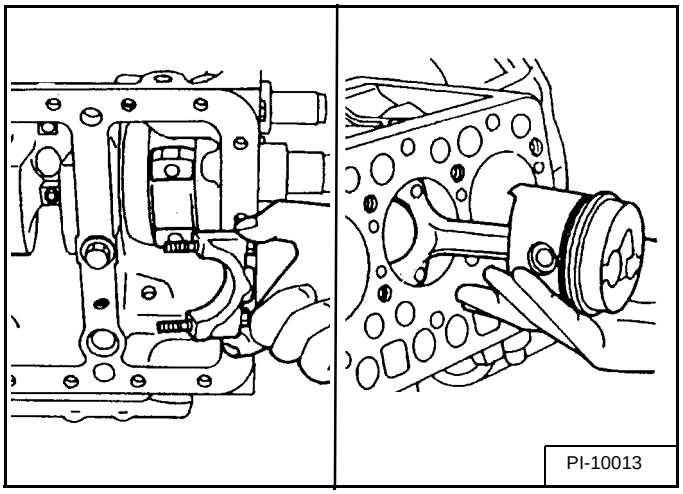
CRANKSHAFT AND PISTONS

Piston And Connecting Rod Removal And Installation

Remove the cylinder head. (See Cylinder Head Removal And Installation on Page 60-80-4.)

Remove the top edge from the cylinder bore with a ridge reamer.

Figure 60-90-1

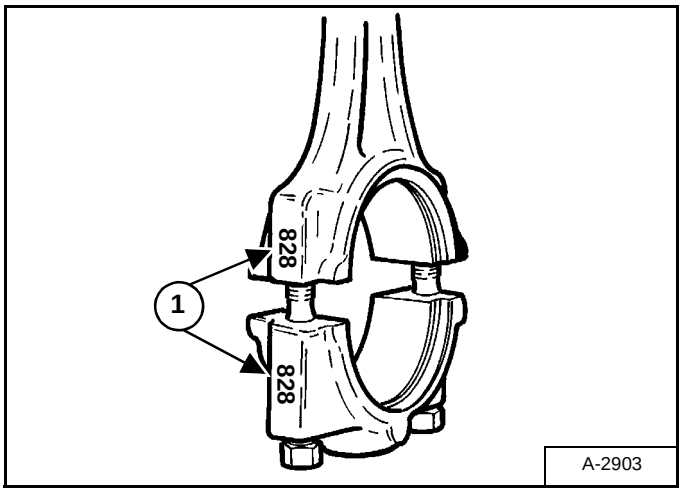


Remove the rod cap and bearing **[Figure 60-90-1]**.

Use a hammer handle and push the piston connecting rod assembly out of the cylinder bore **[Figure 60-90-1]**.

NOTE: Make sure the pistons are marked so they will be returned to the same cylinder bore.

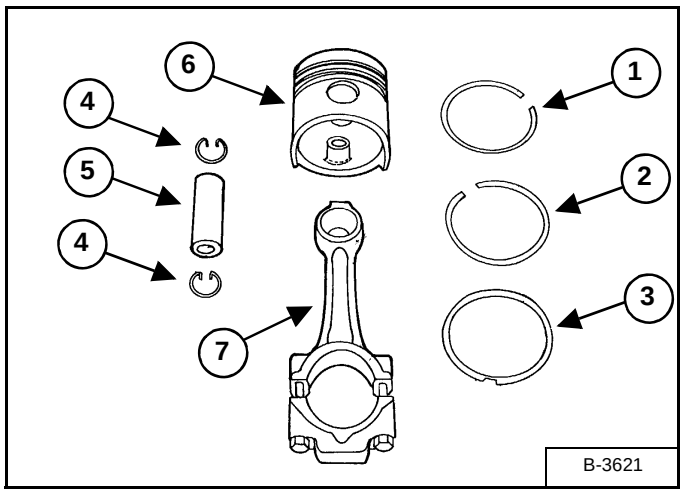
Figure 60-90-2



Installation: Make sure the marks (Item 1) on the connecting rod and bearing are aligned when installing the bearing cap **[Figure 60-90-2]**.

Repeat the procedure to remove the other piston/ connecting rod assemblies from the engine block.

Figure 60-90-3



Remove the first compression ring (Item 1) **[Figure 60-90-3]**.

Remove the second compression ring (Item 2) **[Figure 60-90-3]**.

Remove the oil ring (Item 3) **[Figure 60-90-3]**.

Remove the snap ring (Item 4) and piston pin (Item 5) **[Figure 60-90-3]**.

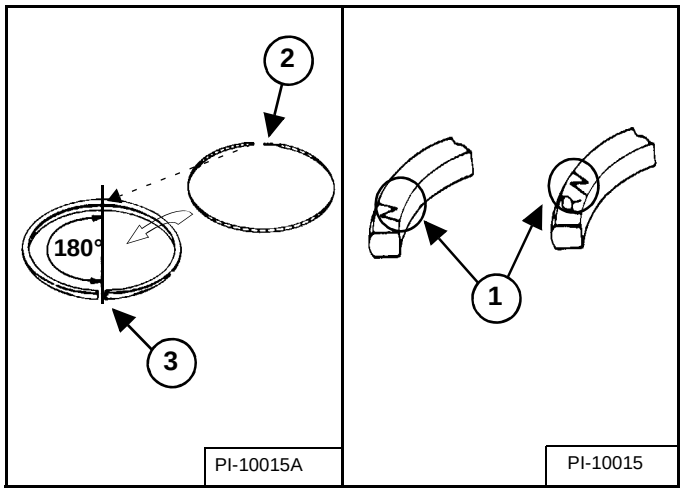
Separate the piston (Item 6) from the connecting rod (Item 7) **[Figure 60-90-3]**.

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.

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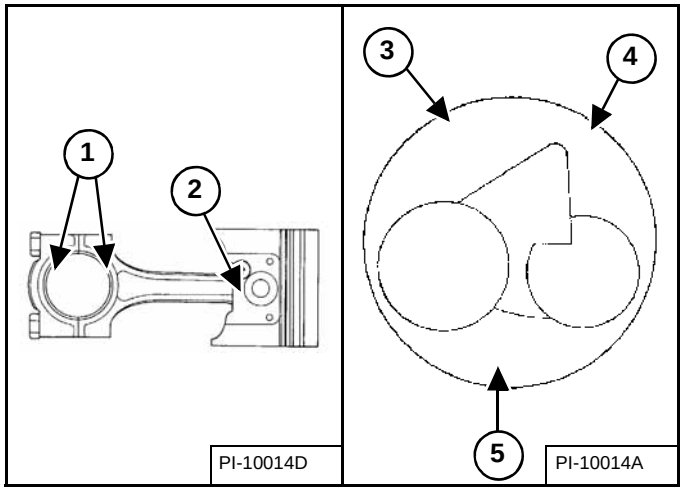
Piston And Connecting Rod Removal And Installation (Cont'd)

Figure 60-90-4



Installation: When installing new rings, assemble the ring so the mark (Item 1) near the gap faces the top of the piston. When installing the oil ring, place the expander joint (Item 2) on the opposite side of the oil ring gap (Item 3) **[Figure 60-90-4]**.

Figure 60-90-5

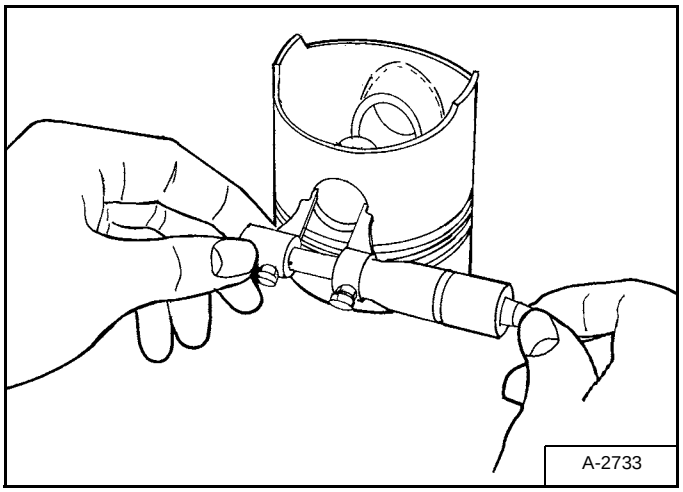


Installation: When reassembling, align the marks (Item 1) on the connecting rod and piston (Item 2). Heat the piston in oil to 176° F (80° C) for 10 to 15 minutes and tap the piston pin into position. Place the piston rings so that there are gaps every 120° (Item 3, 4 & 5) **[Figure 60-90-5]** with no gap facing the piston pin in the cylinder.

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Piston And Connecting Rod - Servicing

Figure 60-90-6

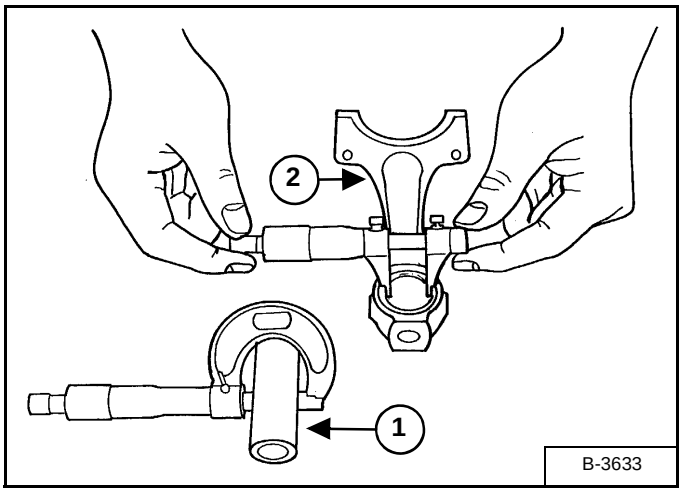


Measure the I.D. of the piston pin bore in both horizontal and vertical direction **[Figure 60-90-6]**.

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

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

Figure 60-90-7



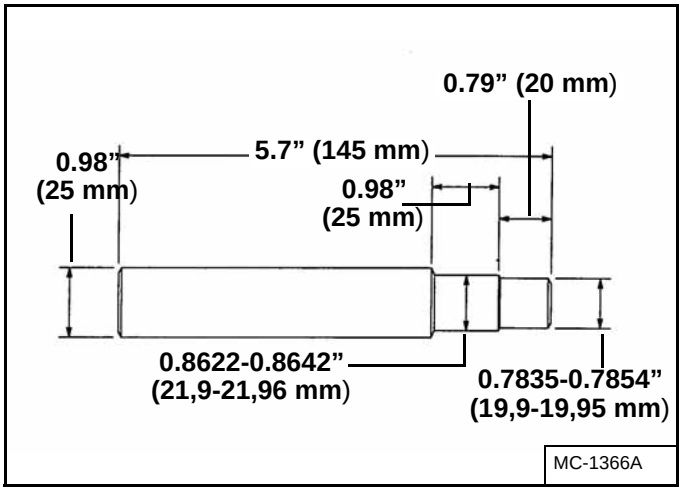
Measure the O.D. of the piston pin (Item 1) **[Figure 60-90-7]**.

Measure the I.D. of the connecting rod small end (Item 2) **[Figure 60-90-7]**.

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

Figure 60-90-8

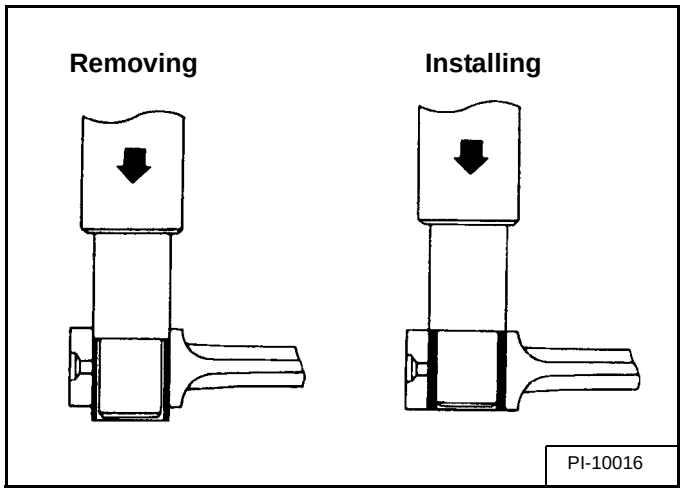


To replace the connecting rod small end bushing, make a driver tool as shown in figure **[Figure 60-90-8]**.

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Piston And Connecting Rod - Servicing (Cont'd)

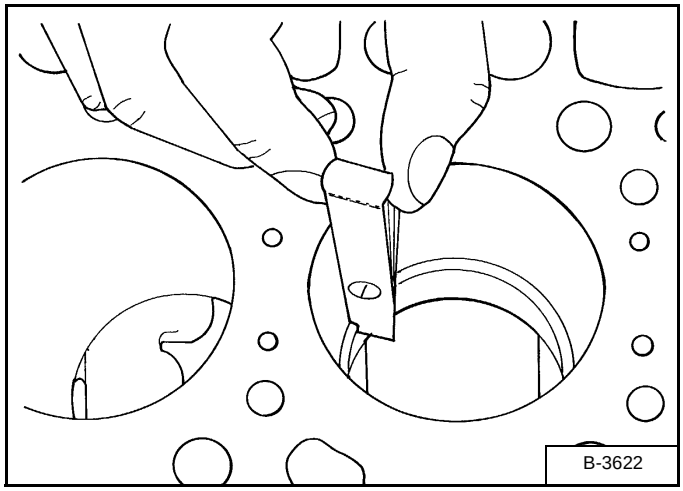
Figure 60-90-9



Use a press and special driver tool to remove the small end bushing **[Figure 60-90-9]**.

Installation: Clean the small end bushing and bore. Put oil on the bushing and press into the connecting rod until it is flush **[Figure 60-90-9]**.

Figure 60-90-10

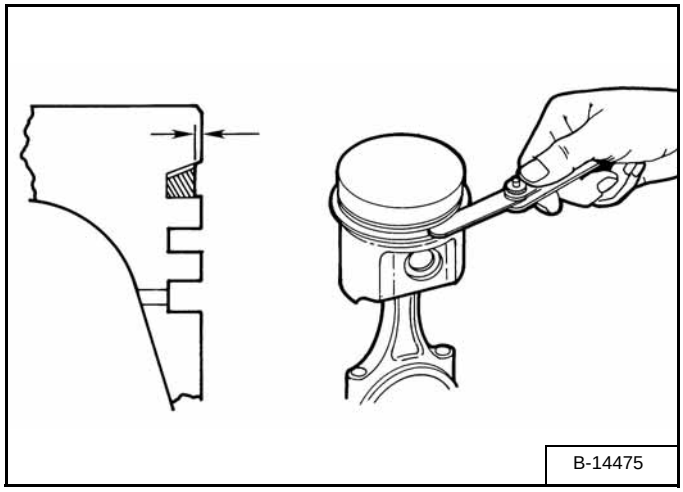


Install a new piston ring into the lower part of the cylinder bore. Measure the ring gap with a feeler gauge **[Figure 60-90-10]**.

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

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

Figure 60-90-11



Remove the carbon from the ring grooves. Measure the clearance between the ring and groove with a feeler gauge **[Figure 60-90-11]**.

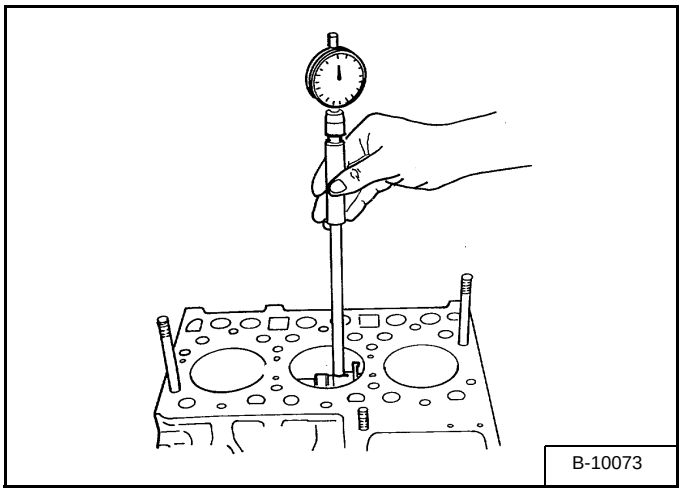
Second Ring	0.0033 to 0.0045 in. (0,09 to 0,12 mm)
Oil Ring	0.0016 to 0.0031 in. (0,04 to 0,08 mm)
Allowable Limit Second Ring	
	0.0059 in. (0,15 mm)
Allowable Limit Oil Ring	
	0.0059 in. (0,15 mm)

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

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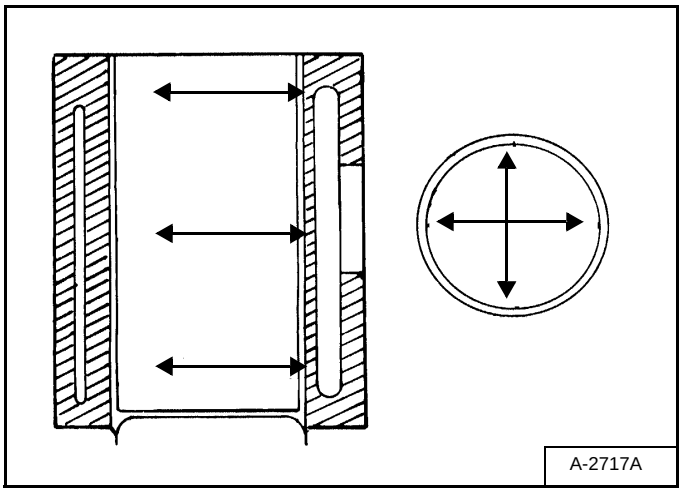
Cylinder Bore Checking

Figure 60-90-12



Check the inside diameter of the cylinder line **[Figure 60-90-12]**.

Figure 60-90-13



To find the maximum wear check the inside diameter in 6 different locations **[Figure 60-90-13]**.

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

Cylinder Bore I.D.	2.638 to 2.639 in. (67,0 to 67,02 mm)
Allowable Limit	2.644 in. (67,17 mm)

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

Connecting Rod Alignment

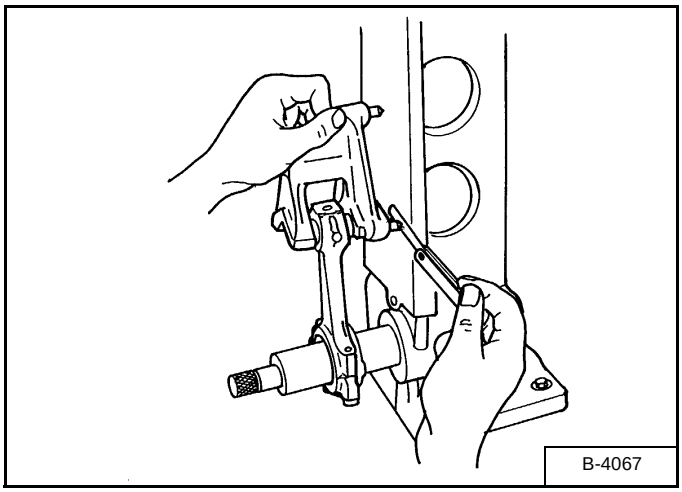
NOTE: The small end bushing is the basis of this check, check the bushing for wear before doing this check.

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 60-90-14



If the gauge does not fit squarely against the face place, measure the space between the gauge and face plate **[Figure 60-90-14]**.

If the measurement exceeds the allowable limit, replace the connecting rod.

Rod Alignment Allowable Limit

0.002 in. (0,05 mm)

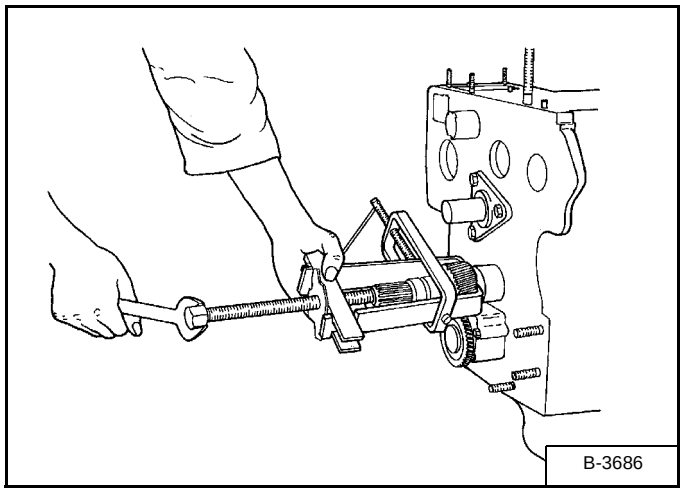
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Crankshaft Gear Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-100-1.)

Remove the idler gear. (See Idler Gear And Shaft Removal And Installation on Page 60-100-3.)

Figure 60-90-15



Remove the crankshaft gear with a puller **[Figure 60-90-15]**.

Remove the crankshaft key.

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Crankshaft And Bearings Removal And Installation

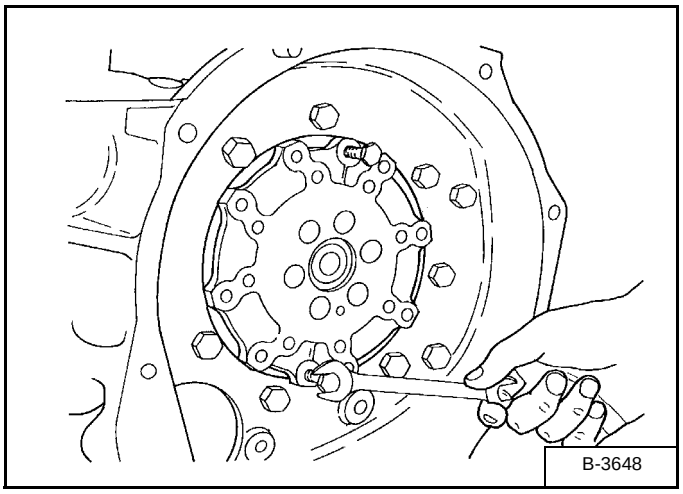
Remove the piston and connecting rod assemblies. (See Piston And Connecting Rod Removal And Installation on Page 60-80-1.)

Remove the engine flywheel. (See Cylinder Head Removal And Installation on Page 60-80-4.)

Remove the bolts which fasten the bearing case cover to the block.

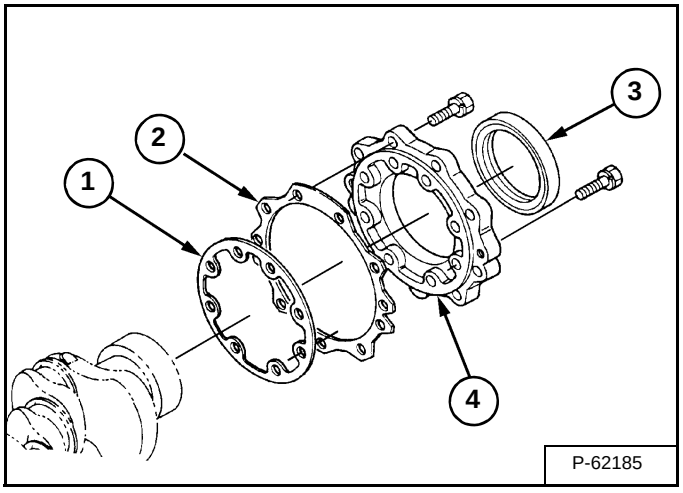
Installation: Tighten the bearing case cover bolts to 7 to 8 ft.-lb. (10 to 11 N•m) torque. Tighten bolts with even force on the diagonal line.

Figure 60-90-16



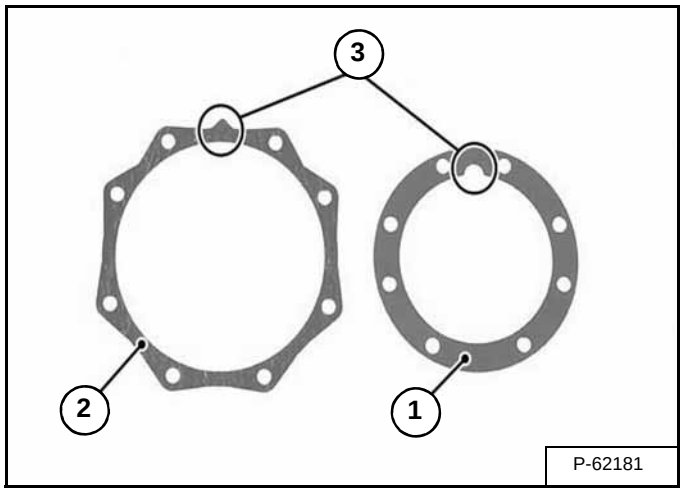
Install 2 bolts into the bearing case cover and pull the cover out **[Figure 60-90-16]**.

Figure 60-90-17



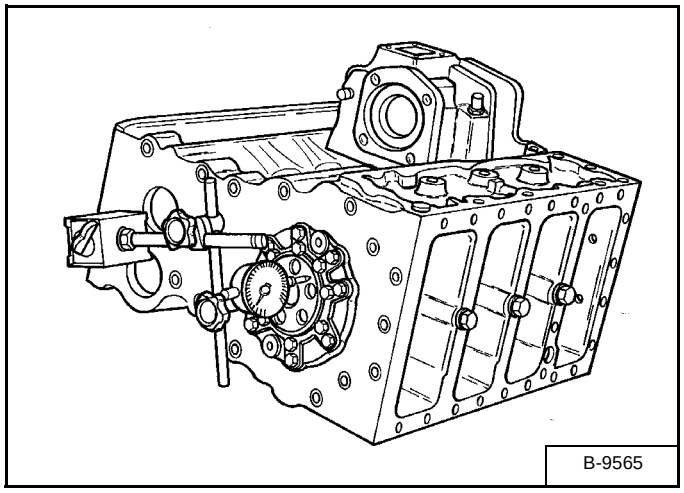
Installation: When installing the cover (Item 4), make sure the casting mark (Item 3) is in the up position. Lightly oil inside lip of oil seal (Item 3) **[Figure 60-90-17]**.

Figure 60-90-18



Installation: When installing the bearing case gasket (Item 1) **[Figure 60-90-17]** & **[Figure 60-90-18]**, and the bearing case cover gasket (Item 2) **[Figure 60-90-17]** & **[Figure 60-90-18]** make sure the mark (Item 3) **[Figure 60-90-18]** is in the up position.

Figure 60-90-19



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 60-90-19]**.

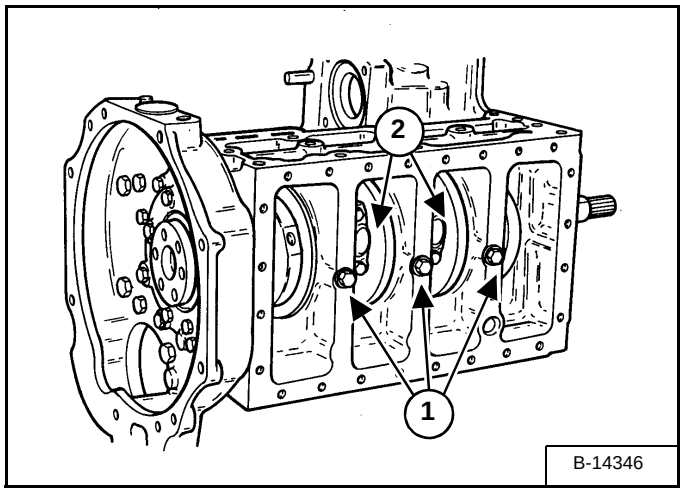
If the measurement exceeds the allowable limit, replace the thrust washers.

End Play	0.006 to 0.012 in. (0,15 to 0,31 mm)
Allowable Limit	0.020 in. (0,5 mm)

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Crankshaft And Bearings Removal And Installation (Cont'd)

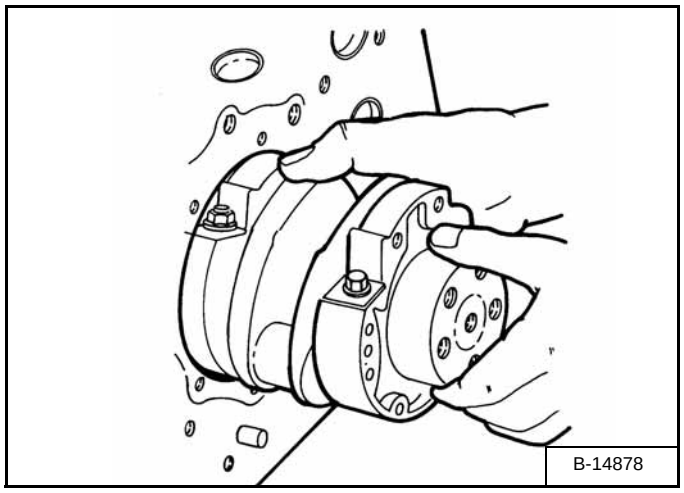
Figure 60-90-20



Remove the main bearing case bolt (Item 1) **[Figure 60-90-20]**.

Installation: Align the bearing case hole (Item 2) **[Figure 60-90-20]** with the hole in the block. Put oil on the bolt threads and tighten to 20 to 22 ft.-lb. (27 to 30 N•m) torque.

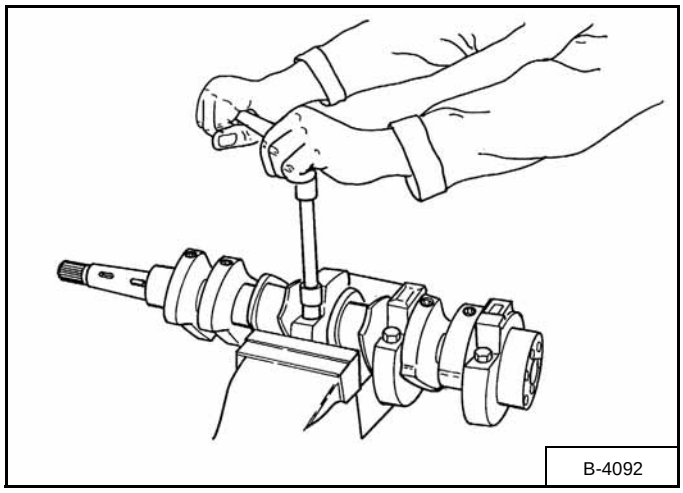
Figure 60-90-21



Remove the crankshaft/main bearing assembly from the engine block **[Figure 60-90-21]**.

Mark the bearing case halves for correct installation.

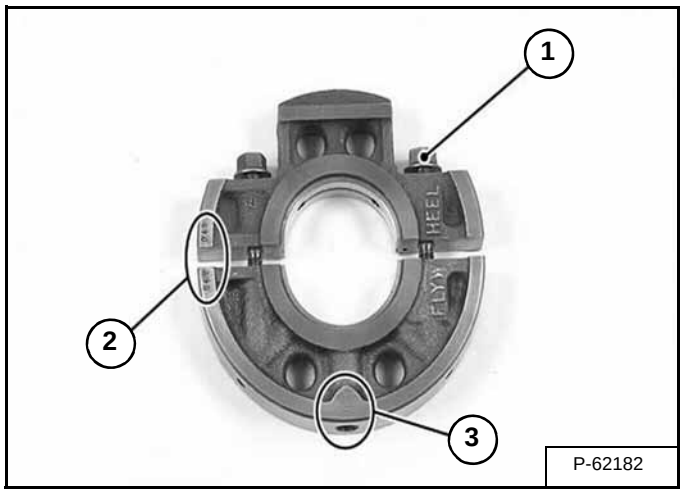
Figure 60-90-22



Remove the 2 bearing case bolts **[Figure 60-90-22]**.

Remove the bearing case and bearing.

Figure 60-90-23



Installation: Tighten the bearing case bolts (Item 1) **[Figure 60-90-23]** to 9 to 12 ft.-lb. (13 to 16 N•m) torque.

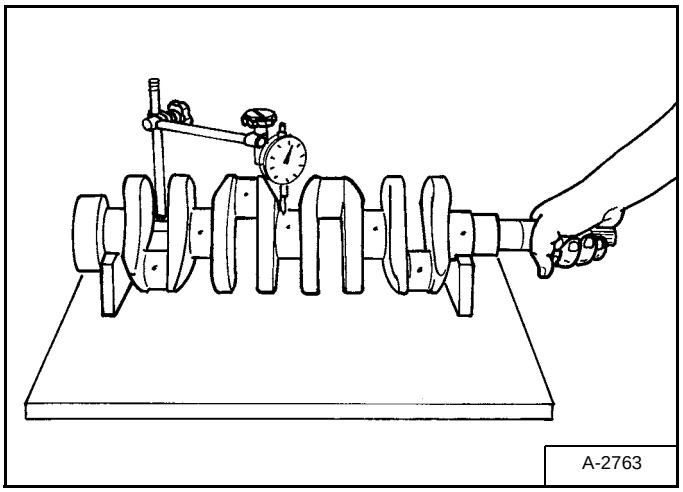
Installation: When installing the main bearing case assemblies, face the mark FLYWHEEL to the flywheel side of the engine block **[Figure 60-90-23]**. Be sure the thrust washer with its oil grooves face outward.

Identification marks on the main bearing case assemblies are the alignment number (Item 2) and the marking "1" or "2" (Item 3) **[Figure 60-90-23]** can be found on the main bearing case assemblies to ensure proper assembly.

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Crankshaft And Bearings - Servicing

Figure 60-90-24



Put the crankshaft on V-blocks. Install a dial indicator on the center journal **[Figure 60-90-24]**.

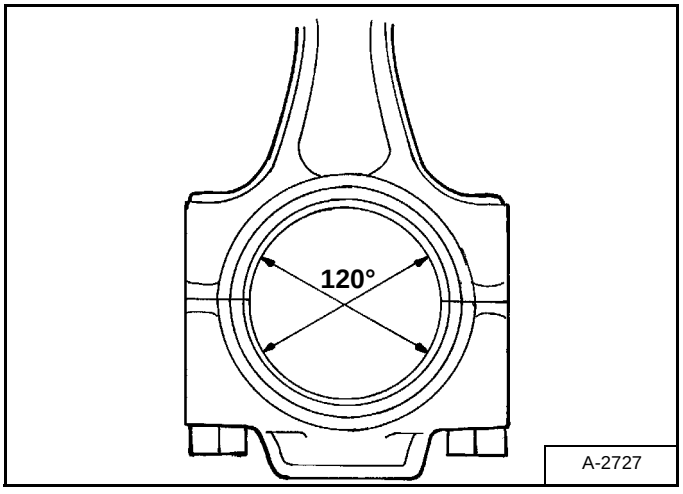
Turn the crankshaft at a slow rate.

If the misalignment exceeds the allowable limit, replace the crankshaft.

Alignment	0.0008 in. (0,02 mm)

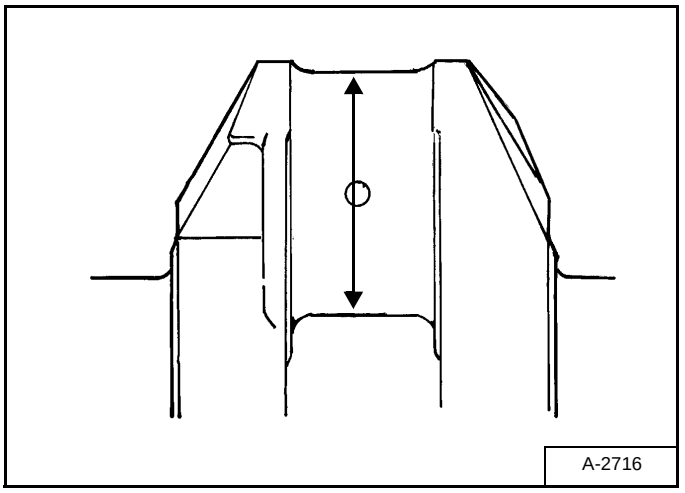
Tighten the connecting rod cap bolts 20 to 22 ft.-lb. (27 to 30 N•m) torque.

Figure 60-90-25



Measure the crankpin bearing I.D. **[Figure 60-90-25]**.

Figure 60-90-26



Measure the crankpin O.D. **[Figure 60-90-26]**.

Calculate the oil clearance.

Crankpin Bearing I.D.	1.3389 to 1.3390 in. (33,99 to 34,01 mm)
Crankpin O.D.	1.3370 to 1.3376 in. (33,96-33,98 mm)
Oil Clearance	0.0008 to 0.0020 in. (0,020 to 0,051 mm)
Allowable limit	0.0059 in. (0,15 mm)

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Crankshaft And Bearings - Servicing (Cont'd)

Figure 60-90-27

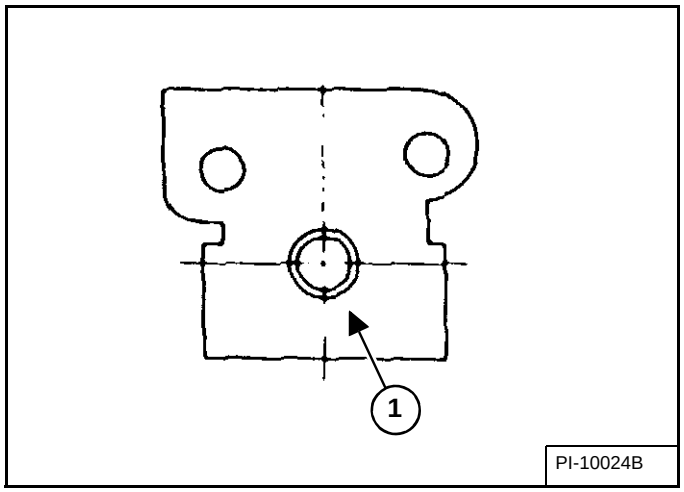
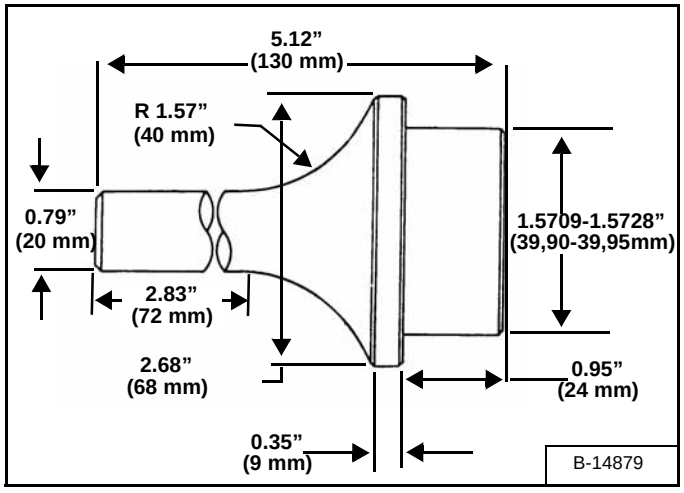


Figure 60-90-28



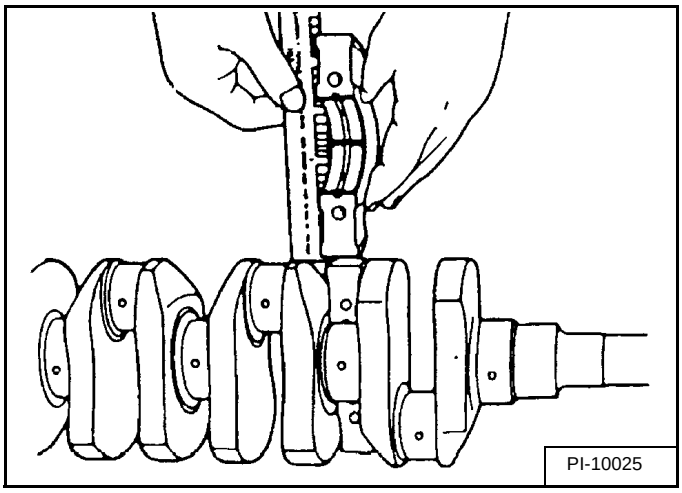
Remove the bearing (Item 1) **[Figure 60-90-27]** from the front of the engine block with the removal tool shown in **[Figure 60-90-28]**.

Installation: Clean the new bearing and bore and apply oil to them. Install the new bearing with the installation driver tool **[Figure 60-90-27]**.

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 to 12 ft.-lb. (12,7 to 15,7 N•m) torque. Remove the bearing case halves.

Figure 60-90-29



Measure the flattened press gauge **[Figure 60-90-29]**.

If the clearance exceeds the allowable limit, replace the crankshaft bearing.

Crankshaft Journal O.D. (Flywheel side)	
	1.7297 to 1.7303 in. (43,93 to 43,95 mm)
Bearing I.D.	1.7317 to 1.7333 in. (43,98 to 44,03 mm)
Crankshaft Journal O.D. (Middle)	
	1.5722 to 1.5728 in. (39,93 to 39,95 mm)
Bearing I.D.	1.5742 to 1.5758 in. (39,98 to 40,03 mm)
Crankshaft journal O.D. (Front)	
	1.5722 to 1.5728 in. (39,93 to 39,95 mm)
Bearing I.D.	1.5714 to 1.5764 in. (39,98 to 40,04 mm)
Oil Clearance	0.0013 to 0.0042 in. (0,034 to 0,106 mm)
Allowable Limit	0.008 in. (0,2 mm)

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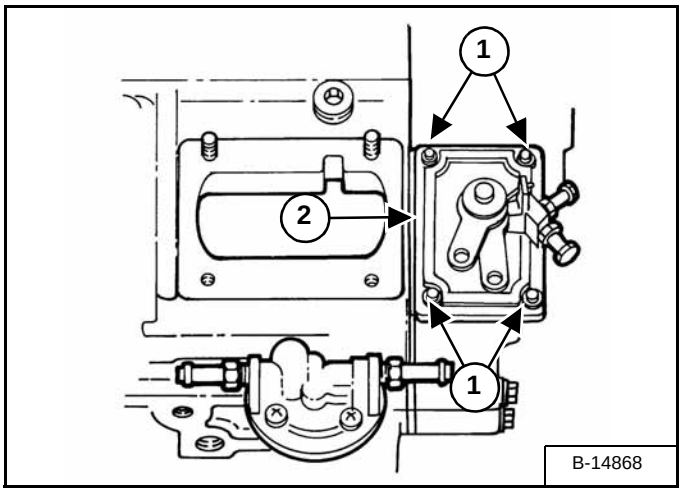
CAMSHAFT AND TIMING GEARS

Timing Gearcase Cover Removal And Installation

Remove the fuel injection pump. (See Fuel Injection Pump Removal And Installation on Page 60-70-4.)

Remove the cylinder head, rocker arms and push rods. (See Cylinder Head Removal And Installation on Page 60-80-4.)

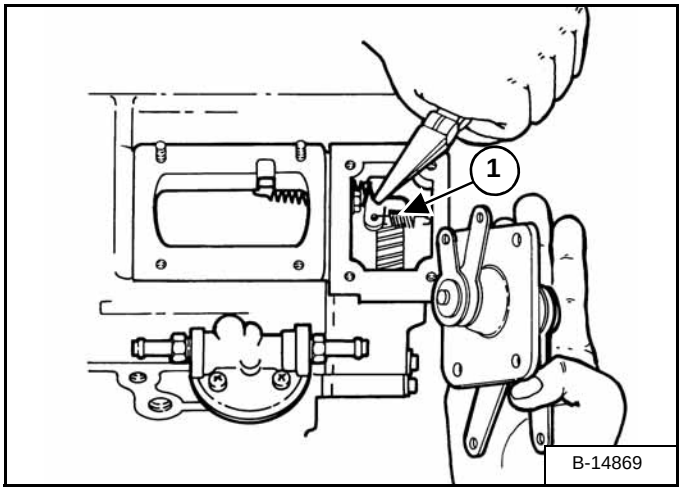
Figure 60-100-1



Remove the screws (Item 1) from the speed control plate (Item 2) **[Figure 60-100-1]**.

NOTE: Take care not to damage the spring.

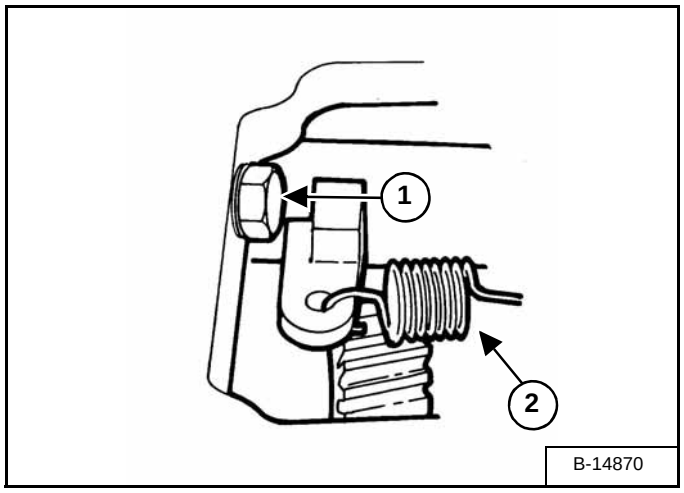
Figure 60-100-2



Separate the speed control plate from the engine and remove the spring (Item 1) **[Figure 60-100-2]**.

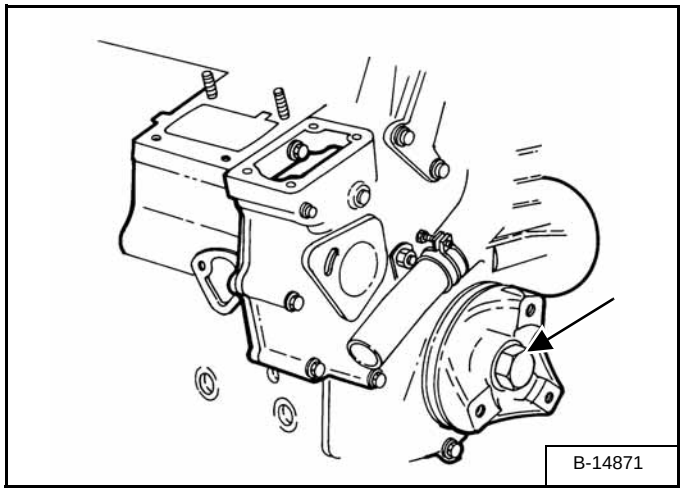
Remove the speed control plate.

Figure 60-100-3



Remove the bolt (Item 1) and disconnect the shaft spring (Item 2) **[Figure 60-100-3]**.

Figure 60-100-4



Remove the crankshaft pulley bolt.

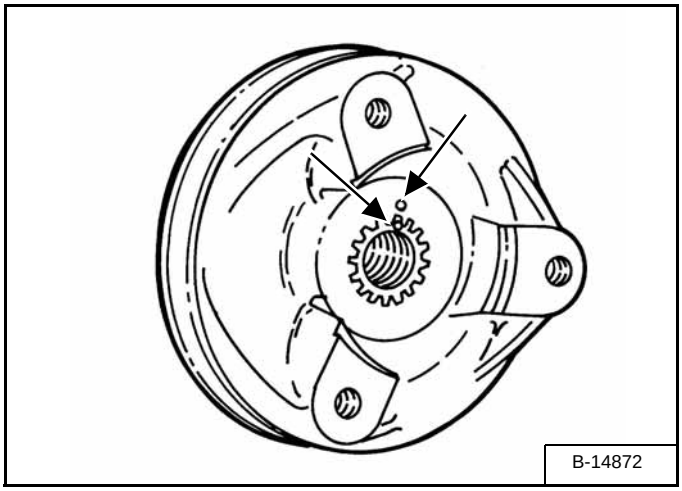
Installation: Tighten the bolt 72 to 80 ft.-lb. (98 to 108 N•m) torque.

Use a puller and remove the crankshaft pulley **[Figure 60-100-4]**.

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Timing Gearcase Cover Removal And Installation (Cont'd)

Figure 60-100-5

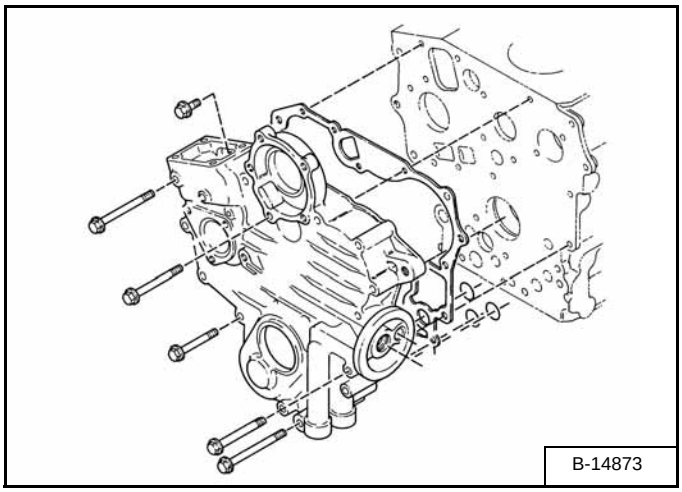


When installing the crank shaft pulley, make sure the alignment marks are aligned **[Figure 60-100-5]**.

Remove the timing gear case cover bolts.

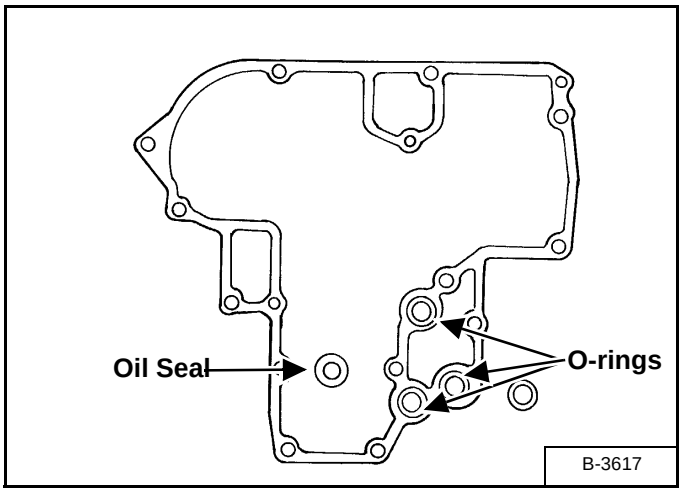
Installation: Tighten the bolts to 7 to 8 ft.-lb. (10 to 11 N•m) torque.

Figure 60-100-6



Remove the timing gear case **[Figure 60-100-6]**.

Figure 60-100-7



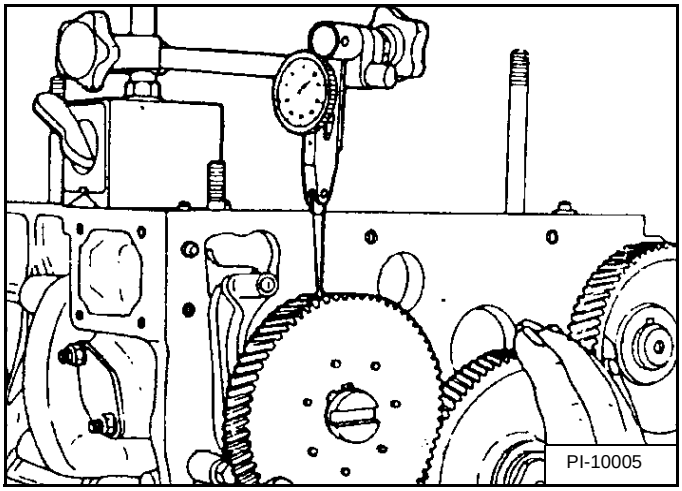
Installation: Install three new O-rings and the oil seal into the timing gear case cover **[Figure 60-100-7]**.

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Timing Gears Backlash - Checking

When the gears are installed, check the backlash of the gears.

Figure 60-100-8



Install a dial indicator with its tip on a gear tooth **[Figure 60-100-8]**.

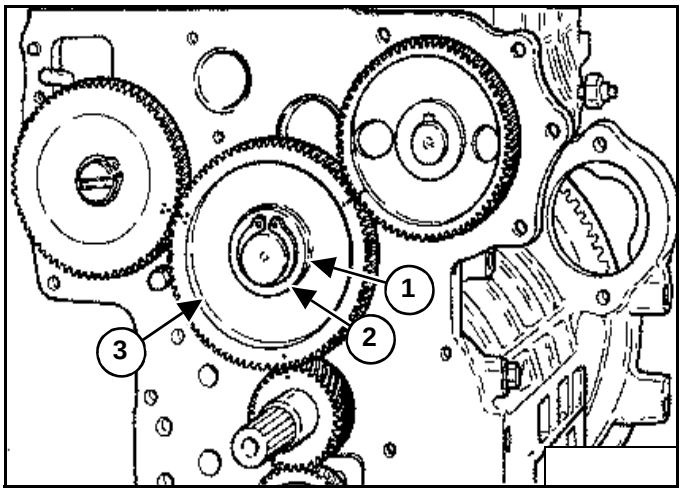
Hold one gear while turning the other gear **[Figure 60-100-8]**.

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 & Idler Gear.	
	0.002 to 0.005 in. (0,043 to 0,124 mm)
Allowable Limit	0.006 in. (0,15 mm)
Cam Gear & Idler Gear	
	0.002 to 0.005 in. (0,047 to 0,12 mm)
Allowable Limit	0.006 in. (0,15 mm)
Injection Pump Gear & Idler Gear	
	0.002 to 0.005 in. (0,046 to 0,124 mm)
Allowable Limit	0.006 in. (0,15 mm)
Oil Pump Gear & Crankshaft Cover	
	0.002 to 0.005 in. (0,041 to 0,123 mm)
Allowable Limit	0.006 in. (0,15 mm)

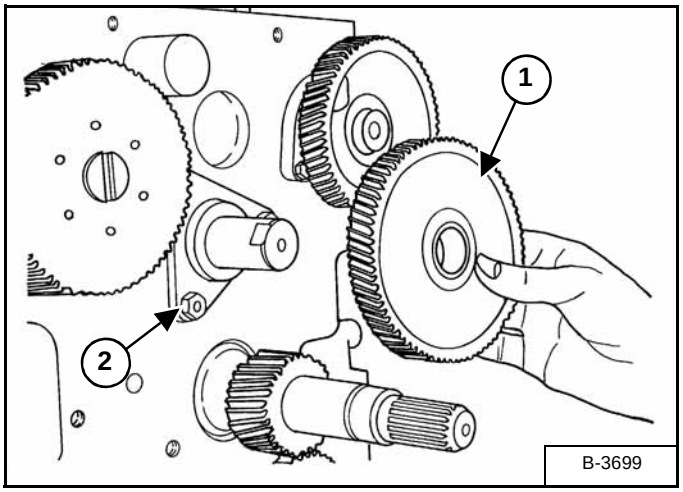
Idler Gear And Shaft Removal And Installation

Figure 60-100-9



Remove the snap ring (Item 1) and collar (Item 2) from the idler gear shaft (Item 3) **[Figure 60-100-9]**.

Figure 60-100-10



Remove the idler gear (Item 1) **[Figure 60-100-10]**.

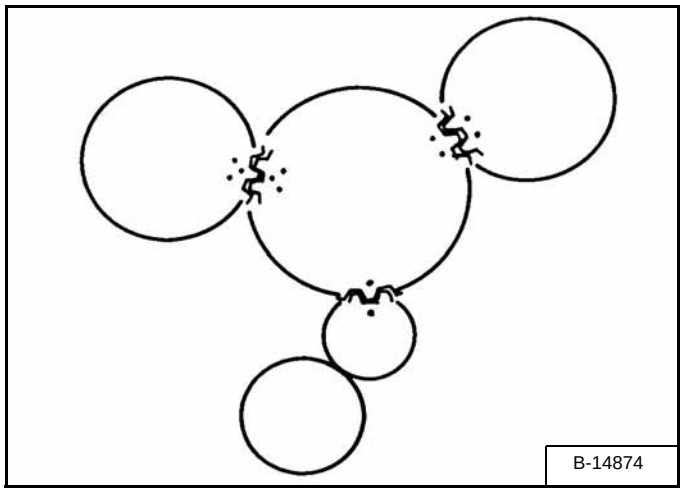
Remove idler gear mounting screws (Item 2) **[Figure 60-100-10]**.

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

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

Figure 60-100-11

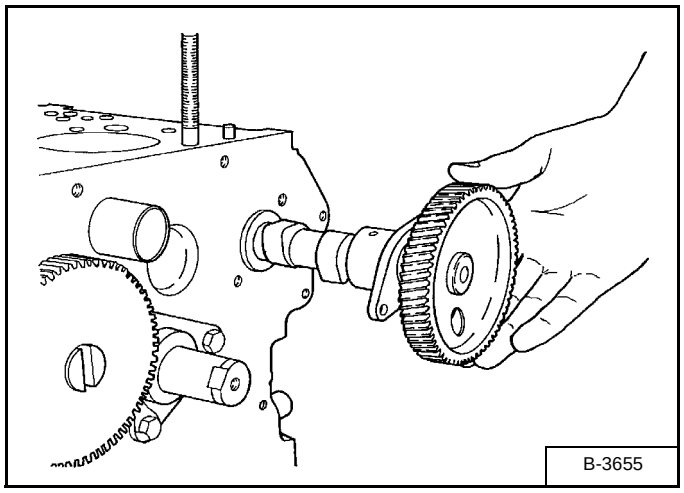


Installation: Make sure the timing marks are in correct alignment when installing the timing gears **[Figure 60-100-11]**.

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

Remove the bolts.

Figure 60-100-12

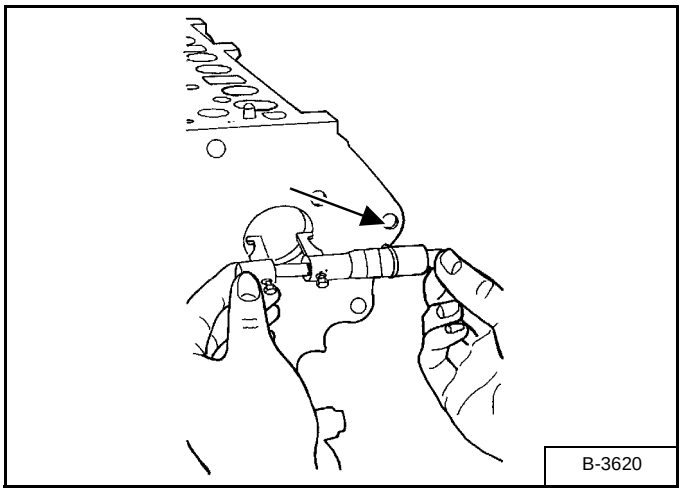


Remove the camshaft from the engine block **[Figure 60-100-12]**.

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

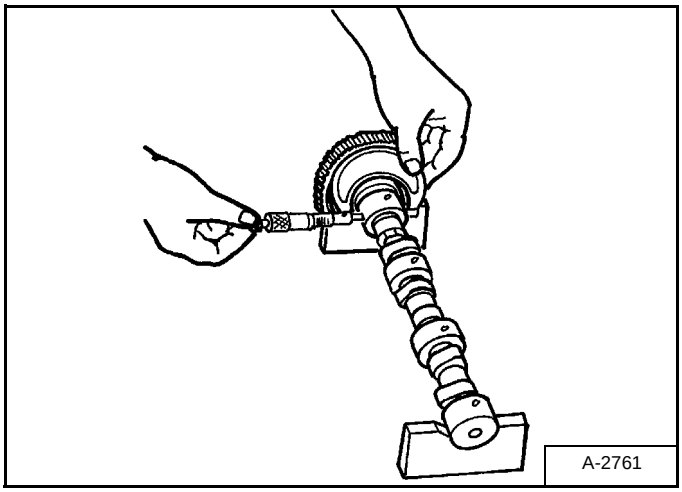
Camshaft - Servicing

Figure 60-100-13



Measure the camshaft bearing in the engine block **[Figure 60-100-13]**.

Figure 60-100-14



Measure the camshaft journal **[Figure 60-100-14]**.

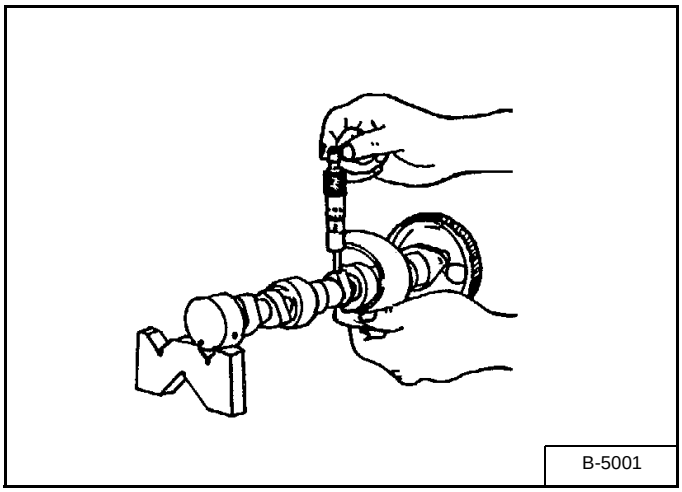
Calculate the oil clearance. If the clearance exceeds the allowable limit, replace the camshaft.

Bearing I.D.	1.299 to 1.300 in. (33,00 to 33,03 mm)
Journal O.D.	1.2966 to 1.2972 in. (32,93 to 32,95 mm)
Clearance of Camshaft Journal	
	0.002 to 0.004 in. (0,05 to 0,09 mm)
Allowable Limit	0.006 in. (0,15 mm)

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Camshaft - Servicing (Cont'd)

Figure 60-100-15

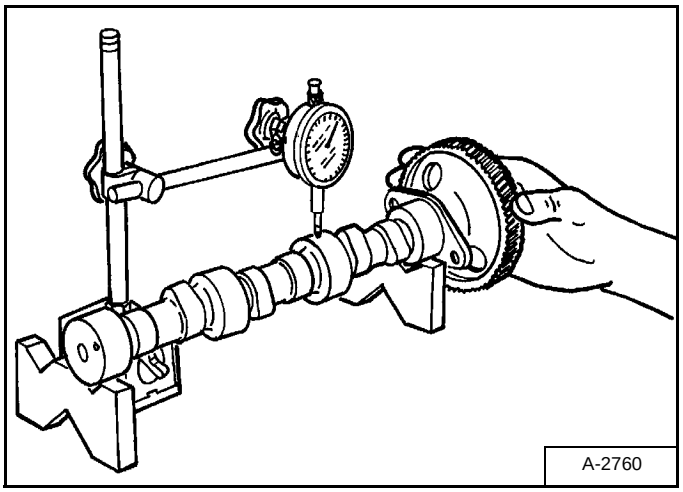


Measure the cam lobes at their highest point **[Figure 60-100-15]**.

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 60-100-16



Put the camshaft in V-blocks. Install a dial indicator **[Figure 60-100-16]**.

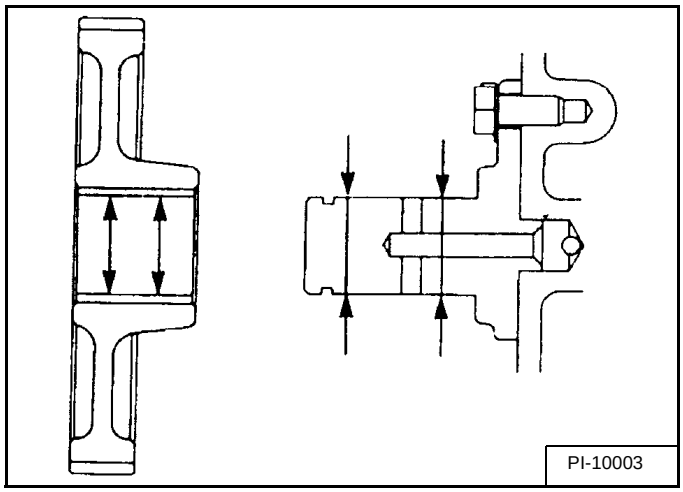
Turn the camshaft at a slow rate. If the misalignment exceeds the allowable limit, replace the camshaft.

Camshaft Alignment Allowable Limit
0.0004 in. (0,01 mm)

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Idler Gear And Shaft Servicing

Figure 60-100-17



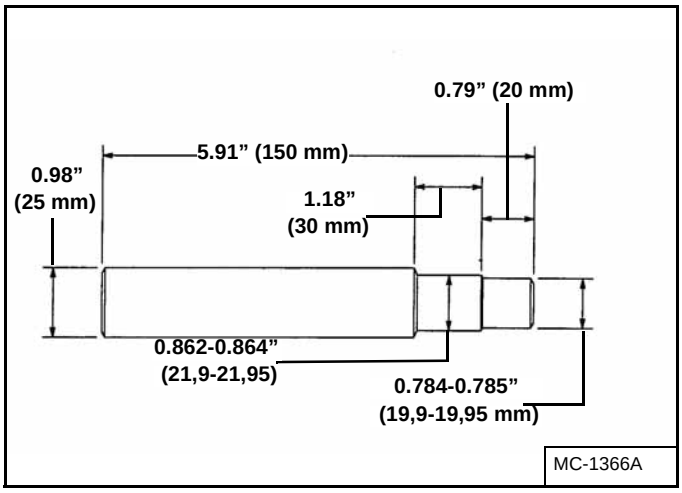
Measure the O.D. of the idler gear shaft **[Figure 60-100-17]**.

Measure the I.D. of the idler gear bushing **[Figure 60-100-17]**.

If the clearance exceeds the allowable limit, replace the bushing.

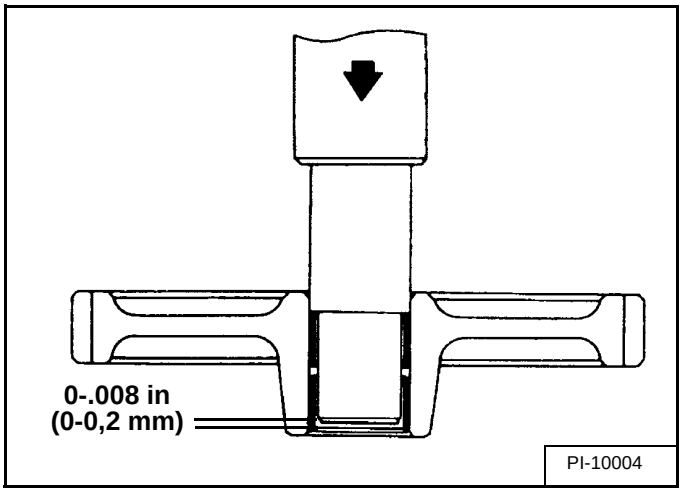
Idler Gear Shaft O.D.	0.786 to 0.787 in. (19,97 to 19,98 mm)
Idler Gear Shaft I.D.	0.787 to 0.789 in. (20,00 to 20,05 mm)
Oil Clearance between Idler Shaft & Gear Bushing	0.0008 to 0.0033 in. (0,020 to 0,084 mm)
Allowable Limit	0.004 in. (0,10 mm)

Figure 60-100-18



To replace the idler gear bushing, make a driver tool as shown in figure **[Figure 60-100-18]**.

Figure 60-100-19



Use a press and special driver tool, to remove the old bushing and install the new bushing **[Figure 60-100-19]**.

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FLYWHEEL AND HOUSING

Flywheel Housing Removal And Installation

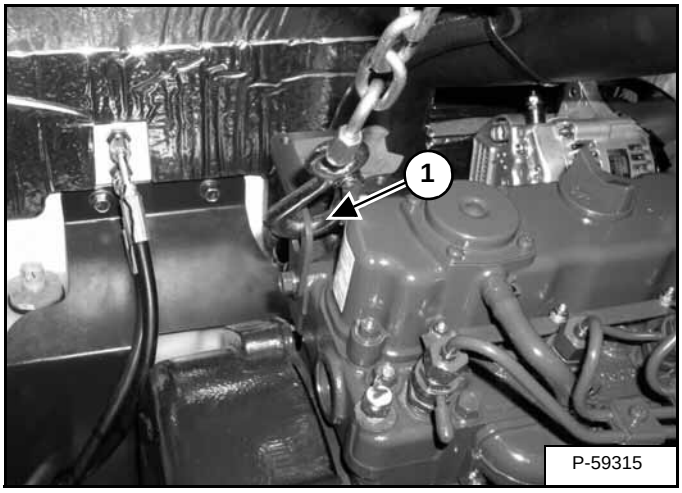
Drain the hydraulic reservoir. (See Hydraulic Pump Coupler Removal And Installation on Page 60-110-2.)

Remove the hydraulic gear pump. (See Removal And Installation on Page 60-110-3.)

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

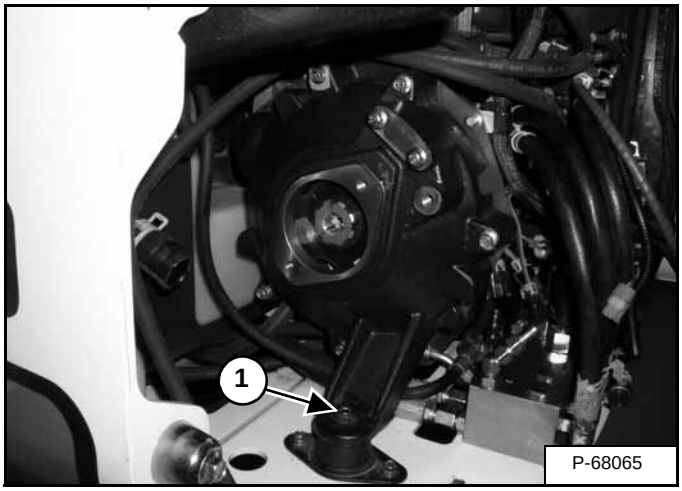
Remove the spark arrestor muffler. (See Removal And Installation on Page 60-30-1)

Figure 60-110-1



Install a chain hoist to the engine lifting eye to support the engine (Item 1) **[Figure 60-110-1]**.

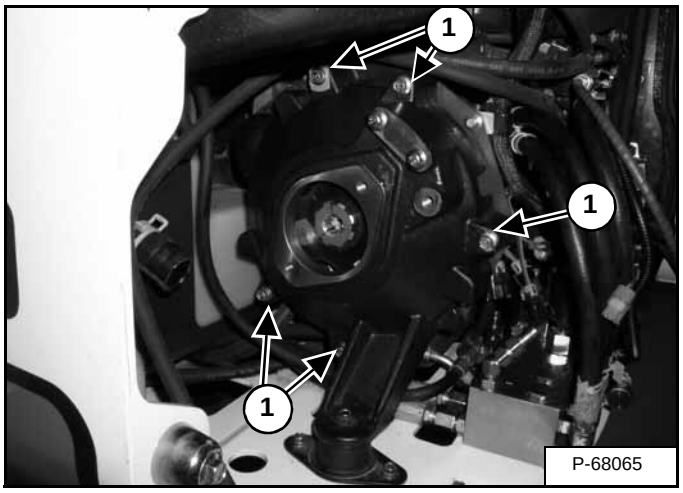
Figure 60-110-2



Remove the mount bolt and nut (Item 1) **[Figure 60-110-2]** from the engine mount.

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

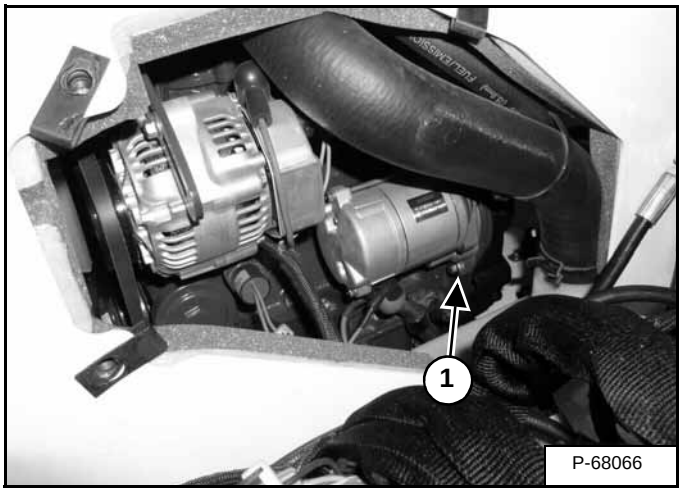
Figure 60-110-3



Remove the five flywheel housing bolts (Item 1) **[Figure 60-110-3]**.

Installation: Tighten the bolts to 18 to 19 ft.-lb. (24 to 26 N•m) torque.

Figure 60-110-4



Remove the access panel.

Remove the one bolt (Item 1) **[Figure 60-110-4]** 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.

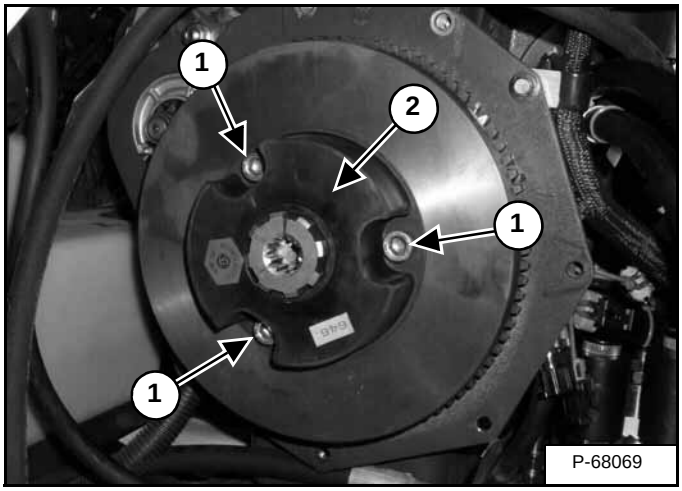
NOTE: Check that the alignment dowel pins are installed in the flywheel housing for assembly.

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Hydraulic Pump Coupler Removal And Installation

Remove the flywheel housing. (See Flywheel Housing Removal And Installation on Page 60-110-1.)

Figure 60-110-5



Remove the three bolts (Item 1) **[Figure 60-110-5]** 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.

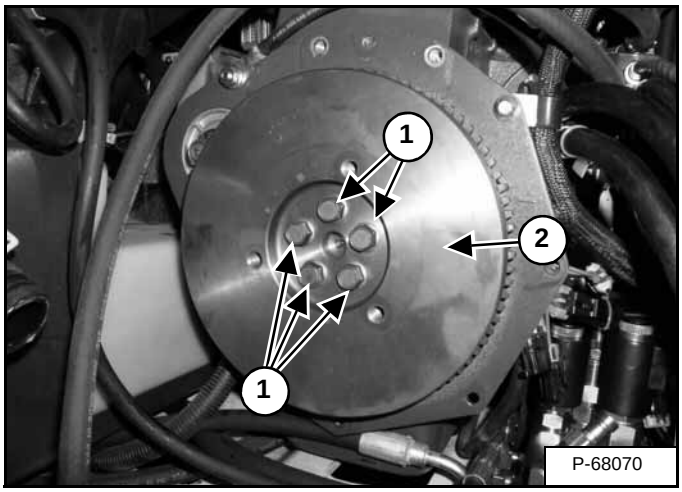
Remove the hydraulic pump coupler (Item 2) **[Figure 60-110-5]**.

Flywheel Removal

Remove the flywheel housing. (See Flywheel Housing Removal And Installation on Page 60-110-1.)

Remove the hydraulic pump coupler. (See Hydraulic Pump Coupler Removal And Installation on Page 60-110-2.)

Figure 60-110-6



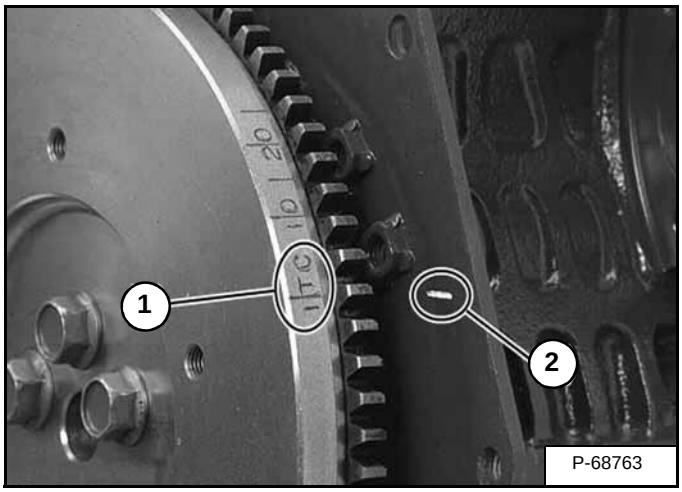
Remove the five bolts (Item 1) **[Figure 60-110-6]** from the flywheel.

Remove the flywheel (Item 2) **[Figure 60-110-6]**.

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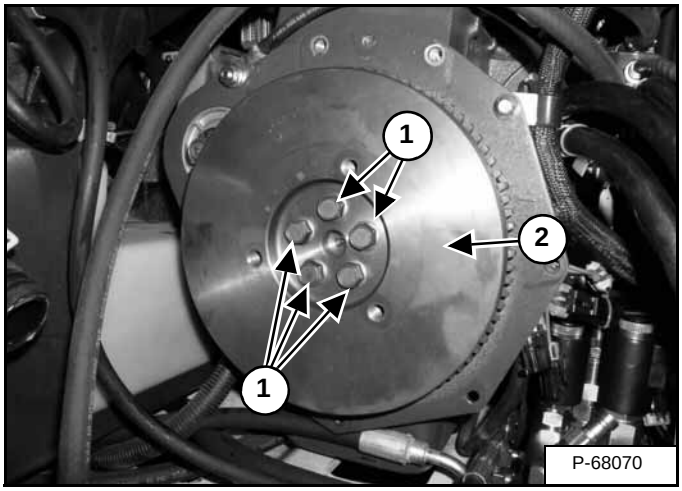
Flywheel Installation

Figure 60-110-7



Align the "1TC" (Item 1) on the outer surface of the flywheel with the alignment mark (Item 2) **[Figure 60-110-7]** on the rear end plate.

Figure 60-110-8



Apply engine oil to the five bolt threads and underside of bolt heads before installation.

Install the five bolts (Item 1) **[Figure 60-110-8]** 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 60-110-1.)

Remove the hydraulic pump coupler. (See Hydraulic Pump Coupler Removal And Installation on Page 60-110-2.)

Remove the flywheel. (See Flywheel Removal on Page 60-110-2.)

Figure 60-110-9

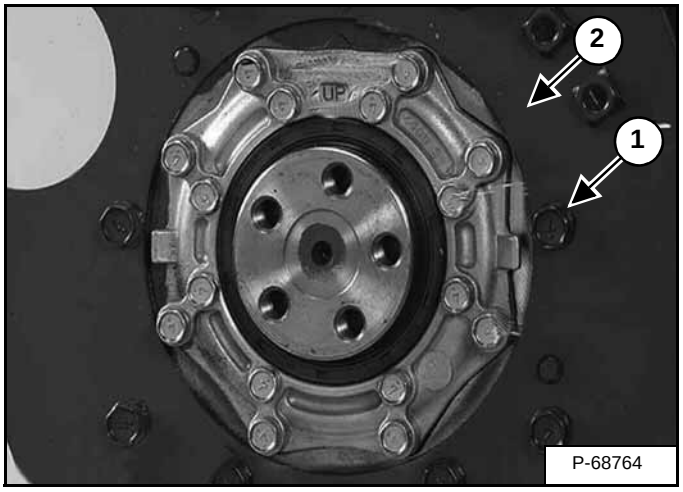
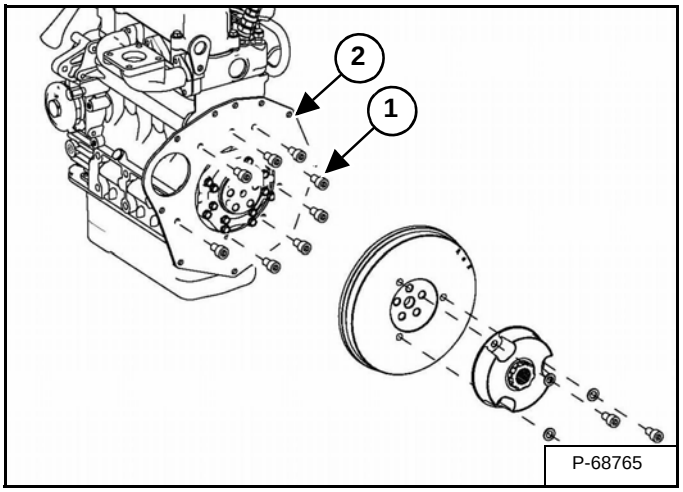


Figure 60-110-10



Remove the bolts (Item 1) from the rear end plate (Item 2) **[Figure 60-110-9]** & **[Figure 60-110-10]**. Remove end plate from the side of the engine.

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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

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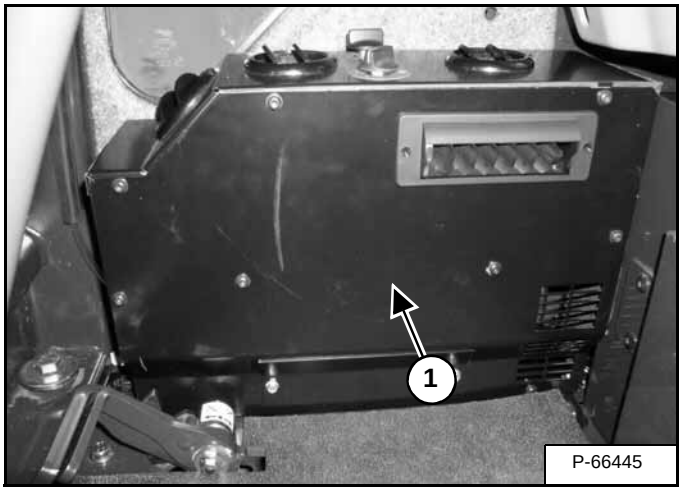
HEATER SYSTEM

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.

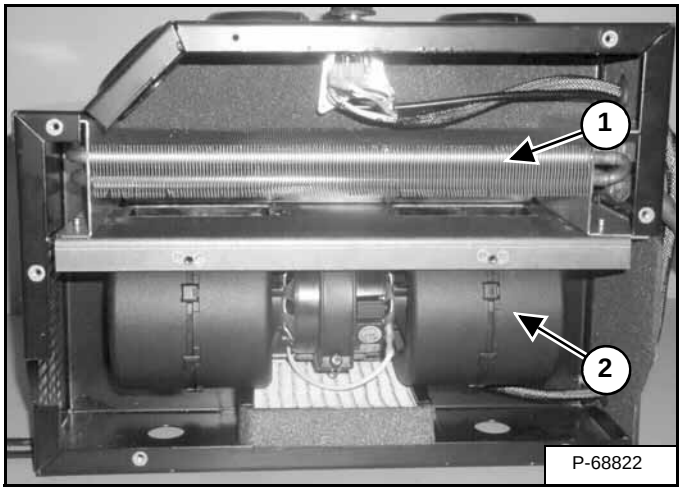
Components

Figure 70-10-11



Heater Unit: The heater unit (Item 1) **[Figure 70-10-11]** is located on the floor on the ride side of the excavator cab. The unit delivers the warm air for heat into the cab.

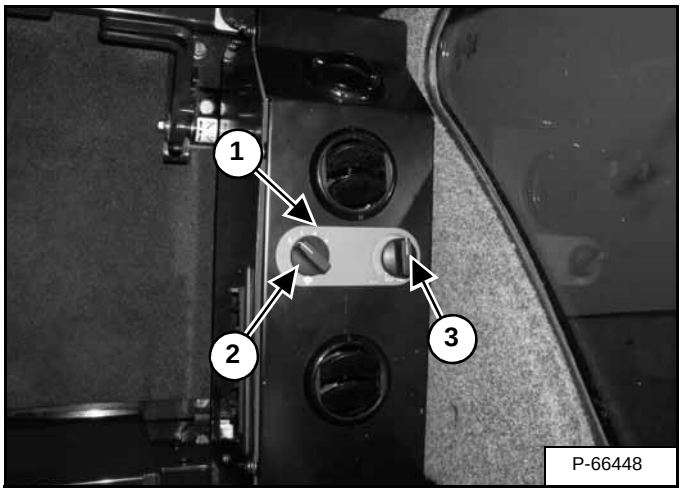
Figure 70-10-12



Heater Coil: The heater coil (Item 1) **[Figure 70-10-12]** supplies the warm air into the cab by passing air through the coil.

Heater Fan: The fan (Item 2) **[Figure 70-10-12]** is used to push air through the heater coil and into the cab.

Figure 70-10-13

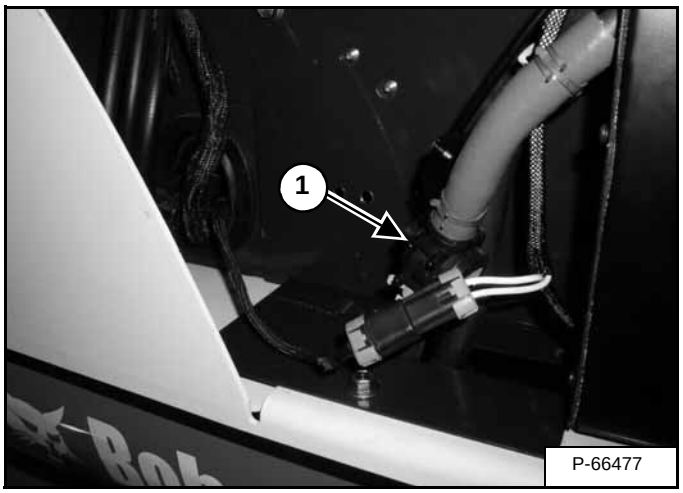


Control Panel: The panel (Item 1) **[Figure 70-10-13]** has three separate components.

Fan Switch: This is a four position rotary switch (Item 2) **[Figure 70-10-13]**.

Temperature Switch: The temperature switch (Item 3) **[Figure 70-10-13]** controls the Heat Valve from fully Off to fully On.

Figure 70-10-14



Heater Valve: The heater valve (Item 1) **[Figure 70-10-14]** is manually controls the amount of engine coolant that flows to the heater coil.

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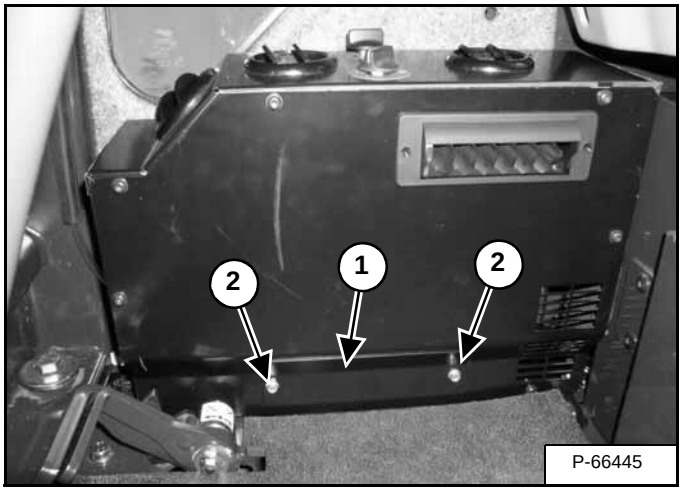
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REGULATOR MAINTENANCE

Filter Element Removal And Installation

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

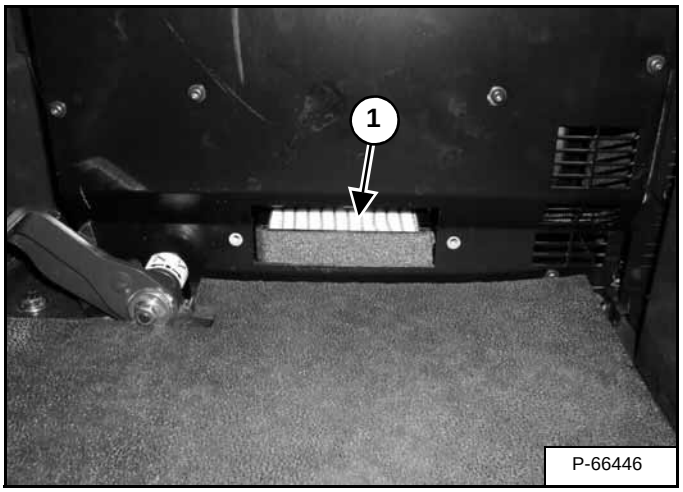
Figure 70-20-1



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

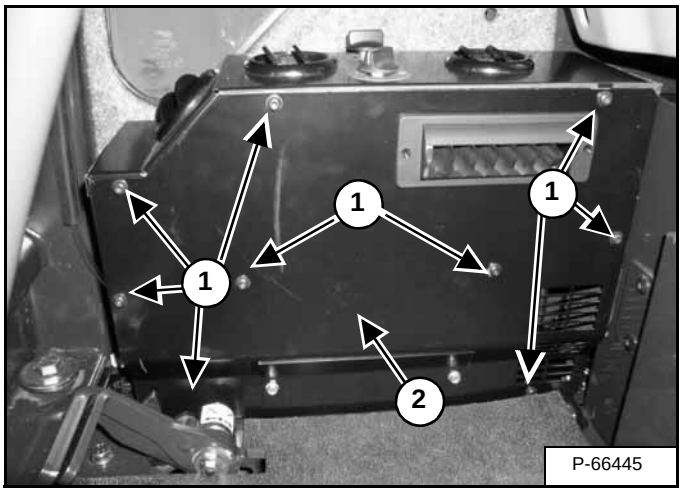


Remove the filter (Item 1) **[Figure 70-20-2]**. Shake the filter or use low air pressure to remove debris. Replace the filter after three cleanings or if the filter becomes to dirty to clean or damaged.

Reinstall the filter, cover and bolts.

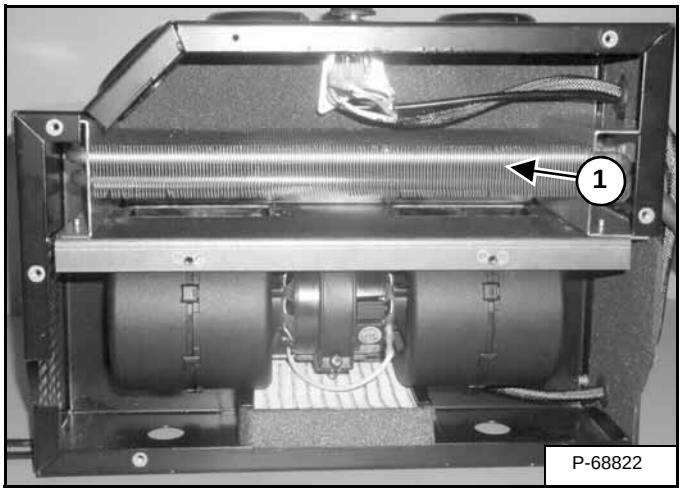
Heater Coil

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.

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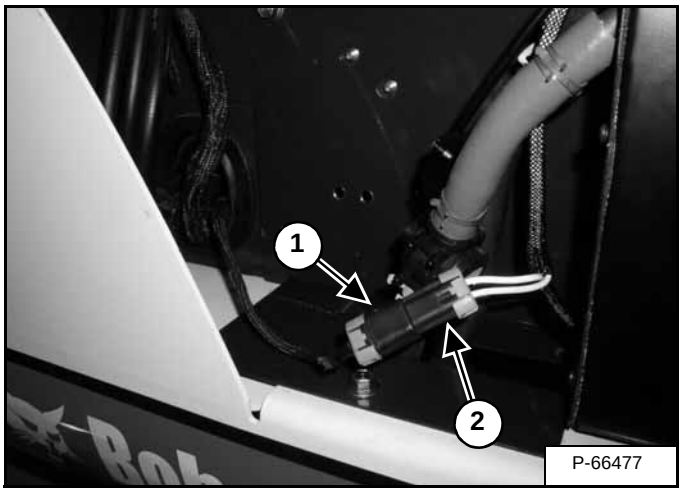
HEATER UNIT

Removal And Installation

Drain the engine coolant. (See Removing And Replacing Coolant on Page 10-70-2.)

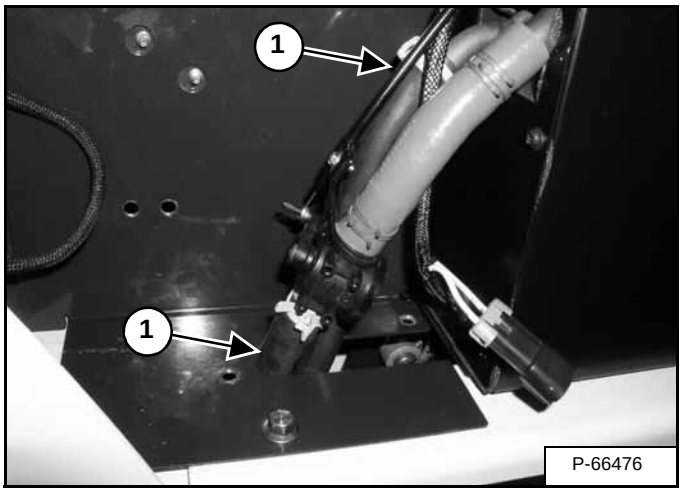
Remove the cab. (See Removal And Installation on Page 40-30-1.)

Figure 70-30-1



Disconnect the heater wire harness (Item 1) **[Figure 70-30-1]**.

Figure 70-30-2

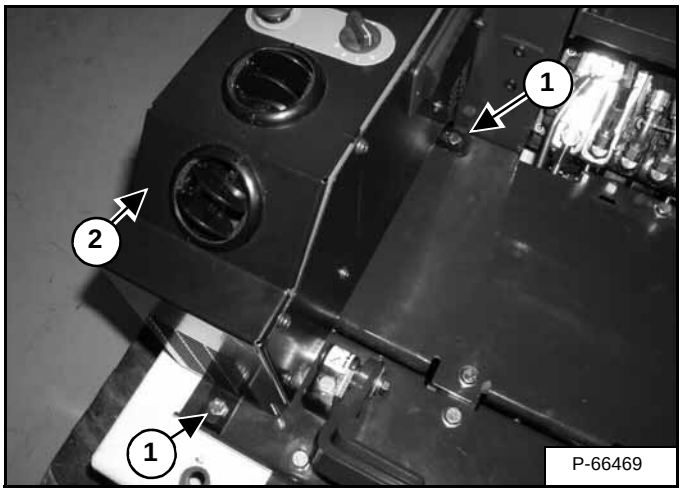


Mark the two hoses (Item 1) **[Figure 70-30-2]** for ease of assembly.

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



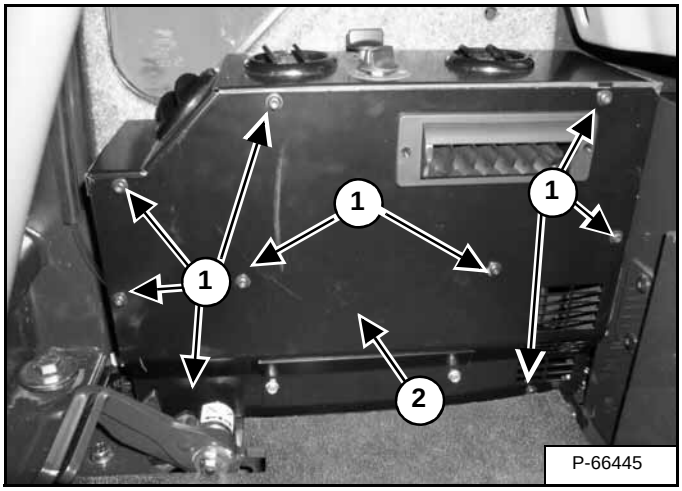
Remove the two screws (Item 1) **[Figure 70-30-3]** mounting the heater to the floor panels.

Remove heater assembly (Item 2) **[Figure 70-30-3]** from the excavator.

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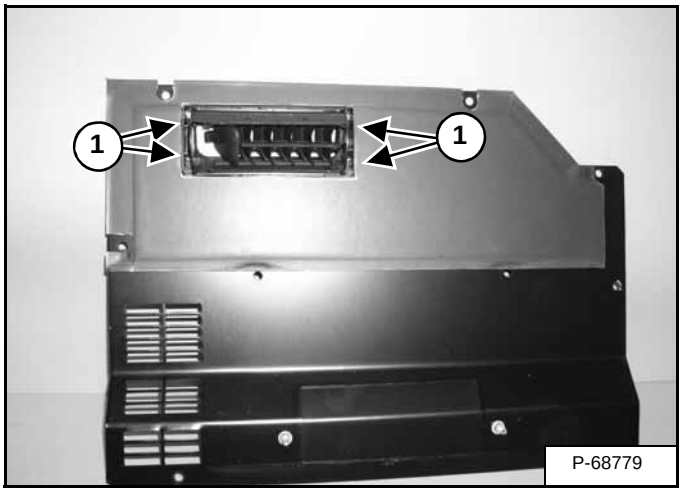
Louver Removal and Installation

Figure 70-30-4



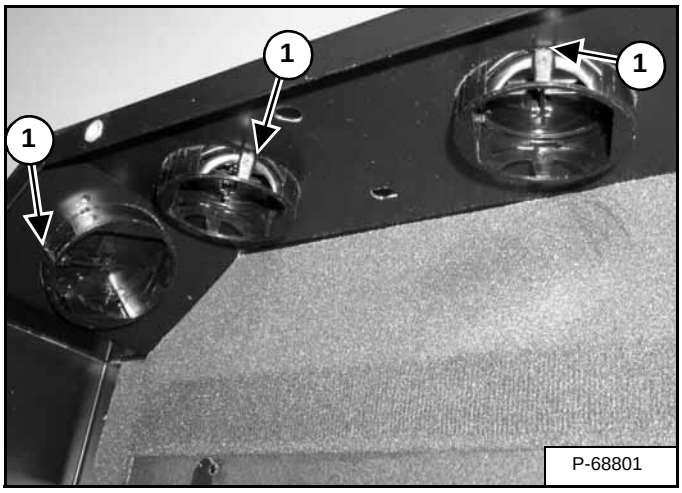
Remove the nine bolts and washers (Item 1) and remove the panel (Item 2) **[Figure 70-30-4]**.

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.

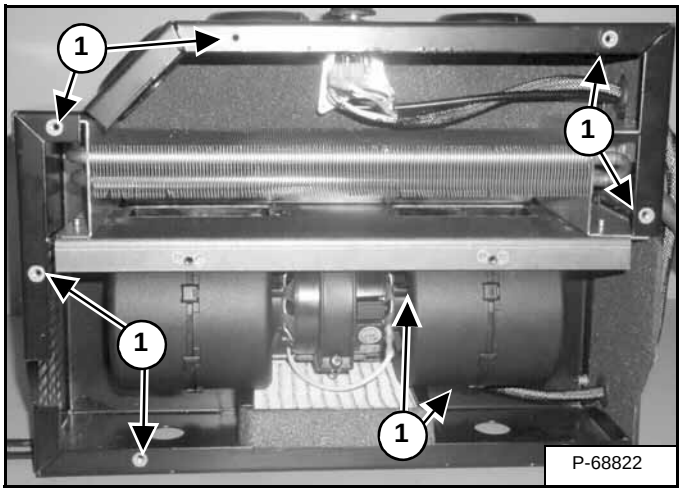
Figure 70-30-6



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.

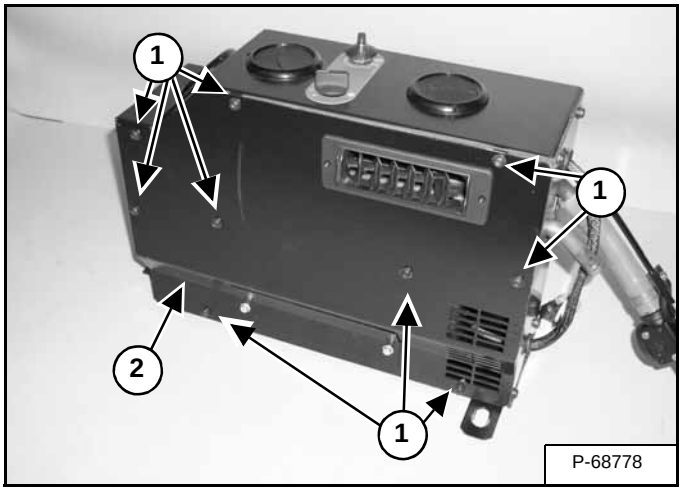
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HEATER COIL

Removal And Installation

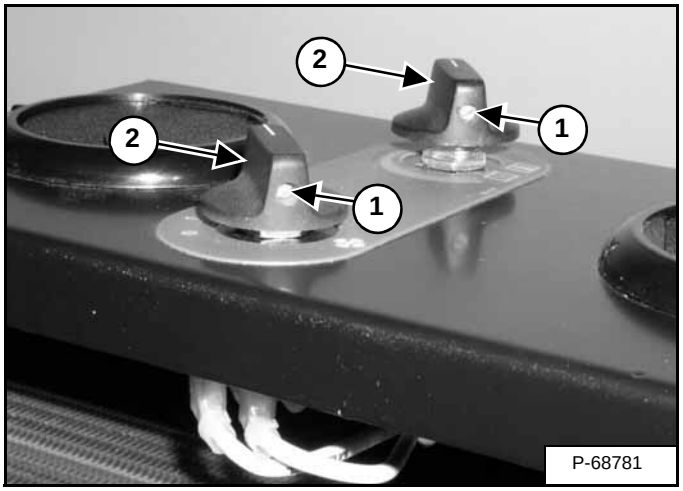
Remove the heater unit. (See Removal And Installation on page 70-30-1.)

Figure 70-40-8



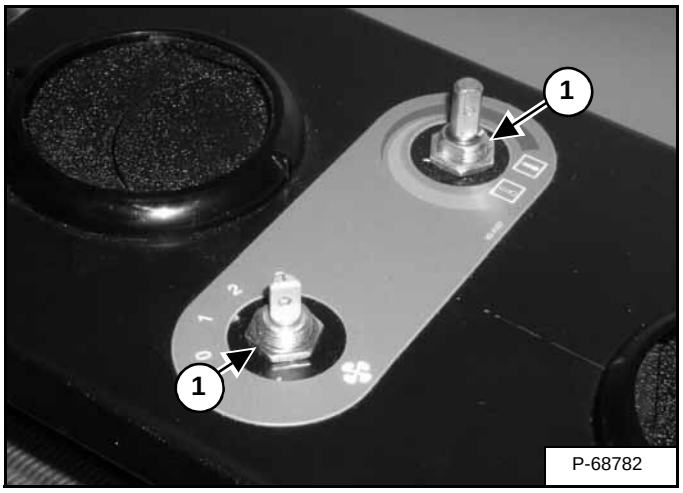
Remove the nine bolts and washers (Item 1) and remove the panel (Item 2) **[Figure 70-40-8]**.

Figure 70-40-9



Loosen the set screws (Item 1) and remove the knobs (Item 2) **[Figure 70-40-9]**.

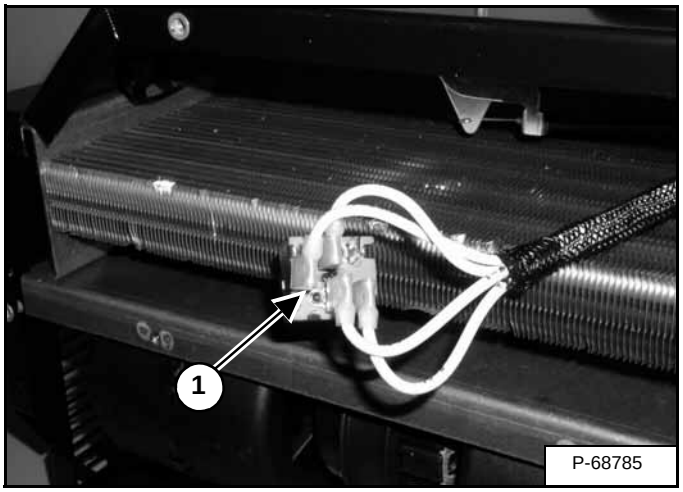
Figure 70-40-10



Remove the two nuts (Item 1) **[Figure 70-40-10]** from the switches.

Push the two switches down into the heater unit.

Figure 70-40-11

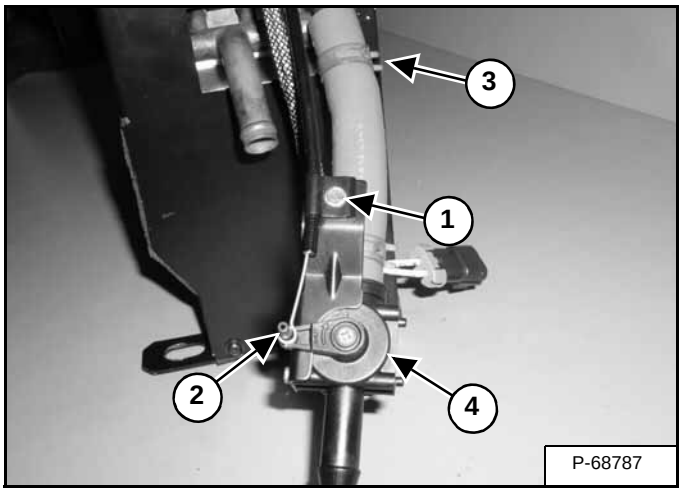


Mark and remove the wires (Item 1) **[Figure 70-40-11]** from the fan switch.

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Removal And Installation (Cont'd)

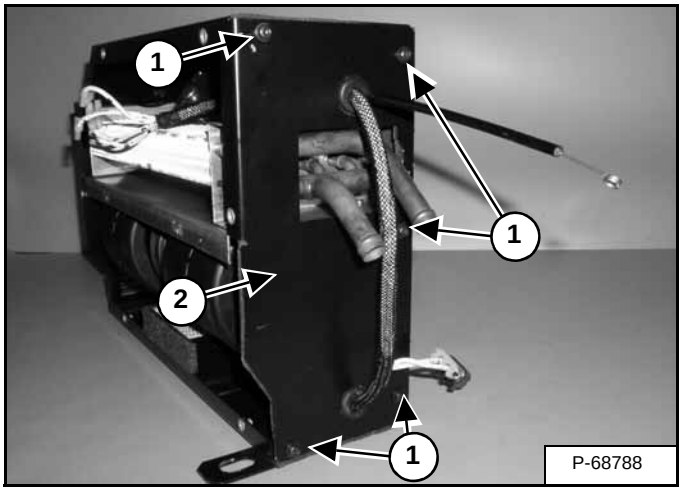
Figure 70-40-12



Loosen the screw (Item 1) on the cable clamp. Slip the cable off the heater valve pin (Item 2) **[Figure 70-40-12]**.

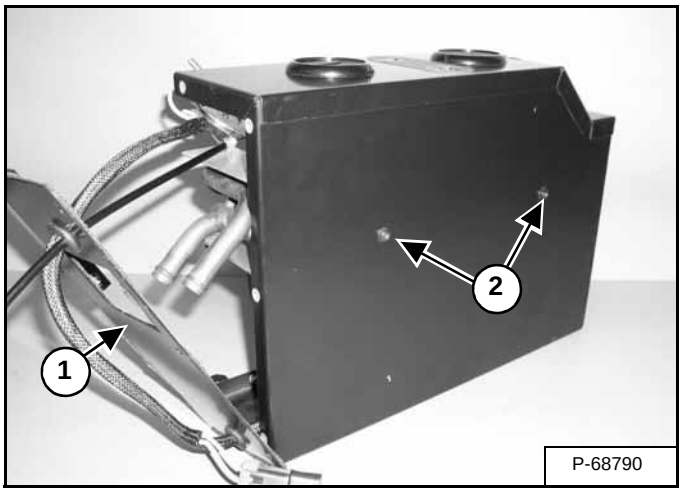
Remove the hose clamp (Item 3) and remove the heater valve assembly (Item 4) **[Figure 70-40-12]** from the heater coil.

Figure 70-40-13



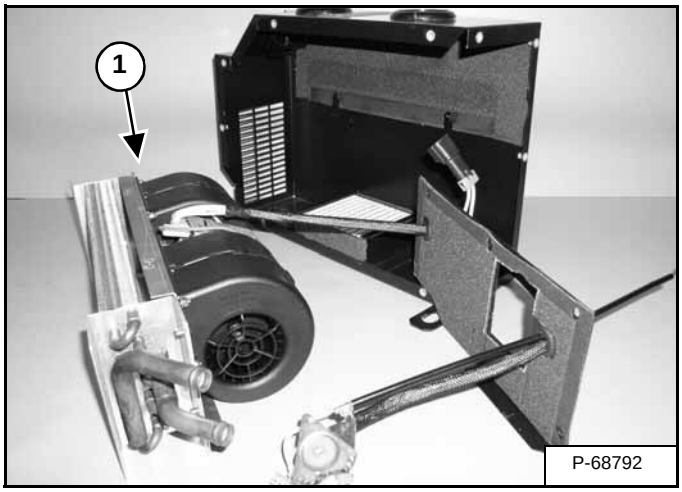
Remove the five bolts and washers (Item 1) and remove the panel (Item 2) **[Figure 70-40-13]**.

Figure 70-40-14



Tilt the panel (Item 1) back and remove the two screws (Item 2) **[Figure 70-40-14]** from the side panel.

Figure 70-40-15

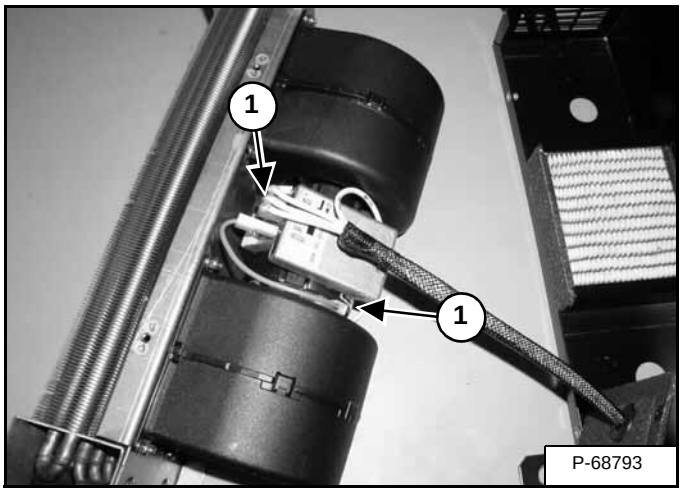


Remove the heater coil and heater fan assembly (Item 1) **[Figure 70-40-15]** from the heater unit.

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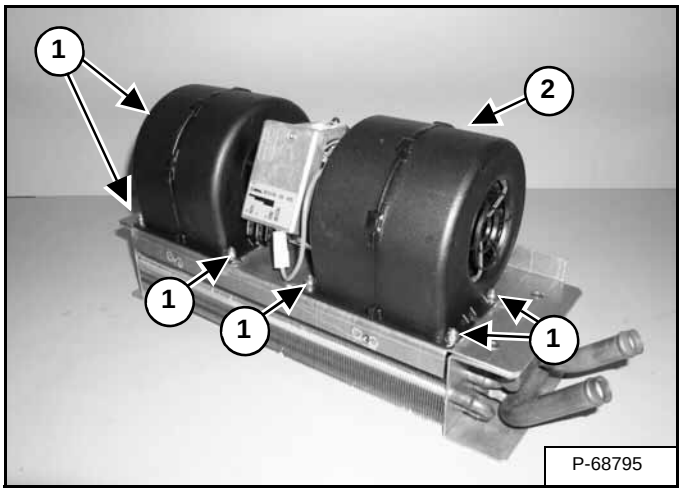
Removal And Installation (Cont'd)

Figure 70-40-16



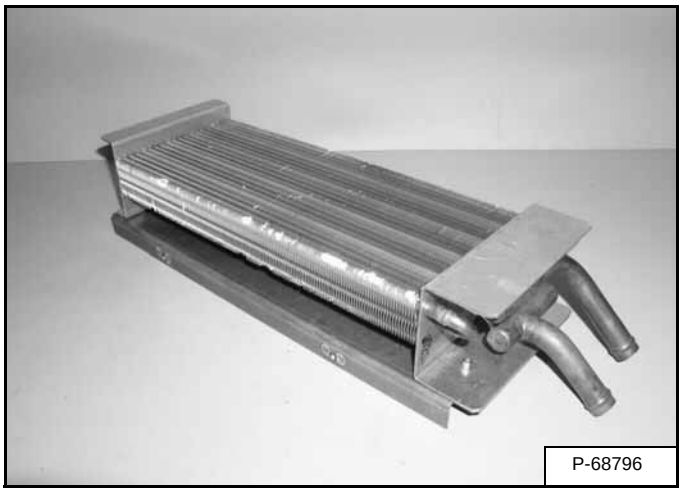
Mark and remove the four wires (Item 1) **[Figure 70-40-16]** from the heater fan motor.

Figure 70-40-17



Remove the six nuts and washers (Item 1) and remove the heater fan assembly (Item 2) **[Figure 70-40-17]**. Remove the heater fan assembly from the heater coil. Heater coil can be repaired or replaced.

Figure 70-40-18



The heater coil **[Figure 70-40-18]** can be cleaned with low air or water pressure.

If the heater coil needs replacement it must be replaced as a complete unit.

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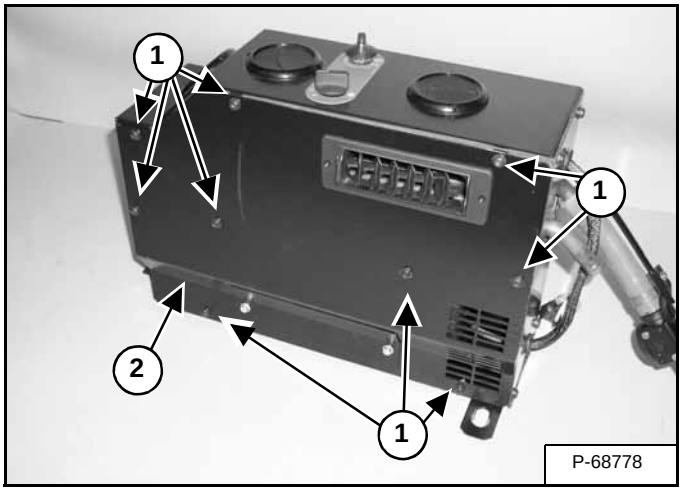
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HEATER FAN

Removal And Installation

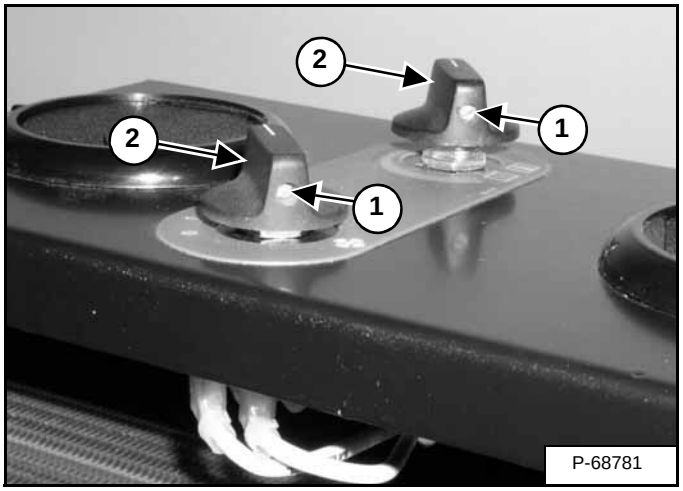
Remove the heater unit. (See Removal And Installation on page 70-30-1.)

Figure 70-50-19



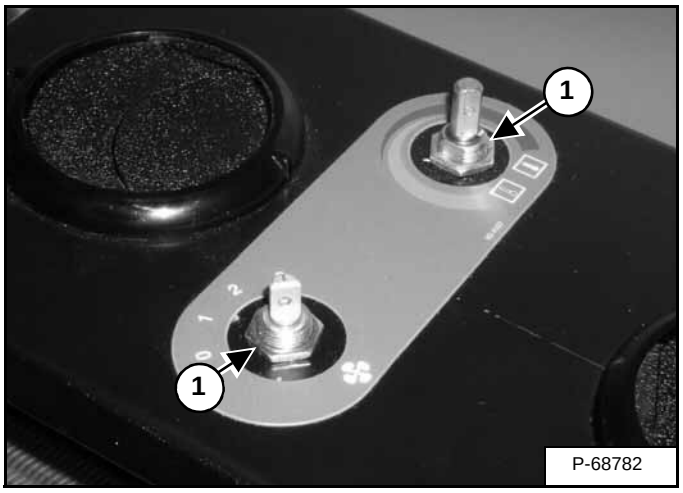
Remove the nine bolts and washers (Item 1) and remove the panel (Item 2) **[Figure 70-50-19]**.

Figure 70-50-20



Loosen the set screws (Item 1) and remove the knobs (Item 2) **[Figure 70-50-20]**.

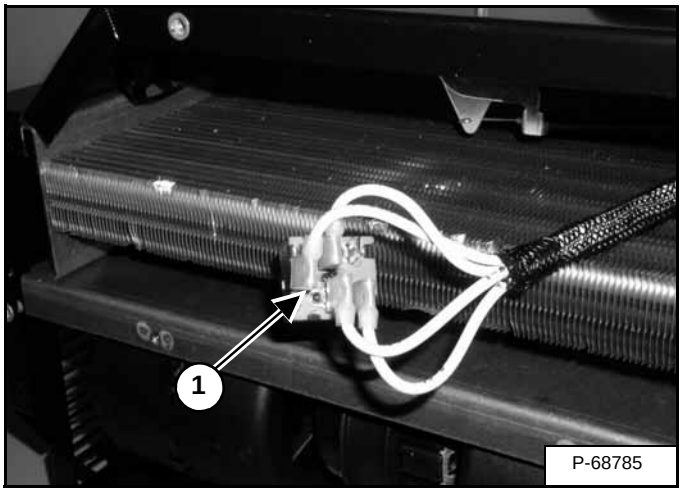
Figure 70-50-21



Remove the two nuts (Item 1) **[Figure 70-50-21]** from the switches.

Push the two switches down into the heater unit.

Figure 70-50-22

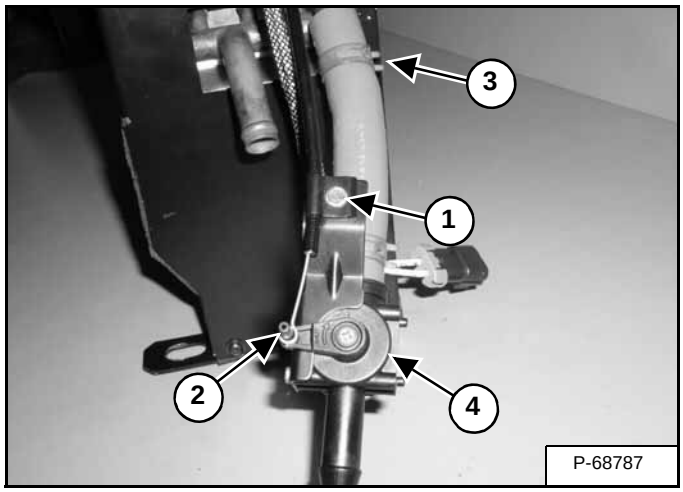


Mark and remove the wires (Item 1) **[Figure 70-50-22]** from the fan switch.

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Removal And Installation (Cont'd)

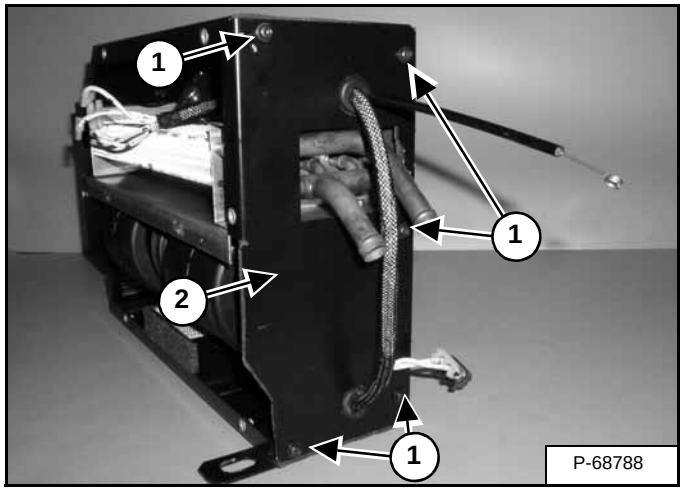
Figure 70-50-23



Loosen the screw (Item 1) on the cable clamp. Slip the cable off the heater valve pin (Item 2) **[Figure 70-50-23]**.

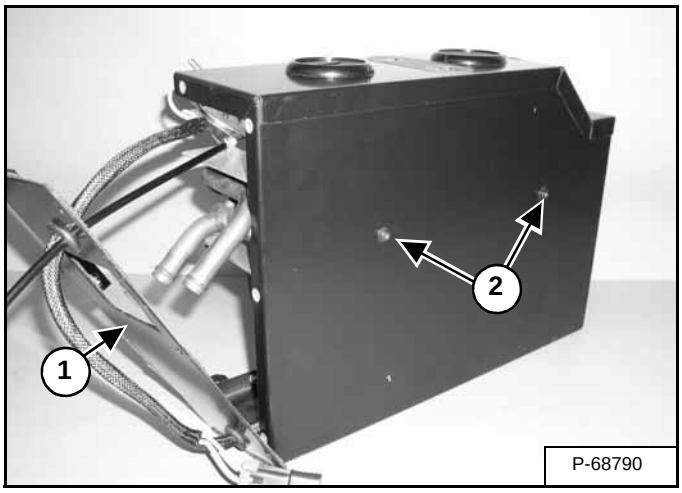
Remove the hose clamp (Item 3) and remove the heater valve assembly (Item 4) **[Figure 70-50-23]** from the heater coil.

Figure 70-50-24



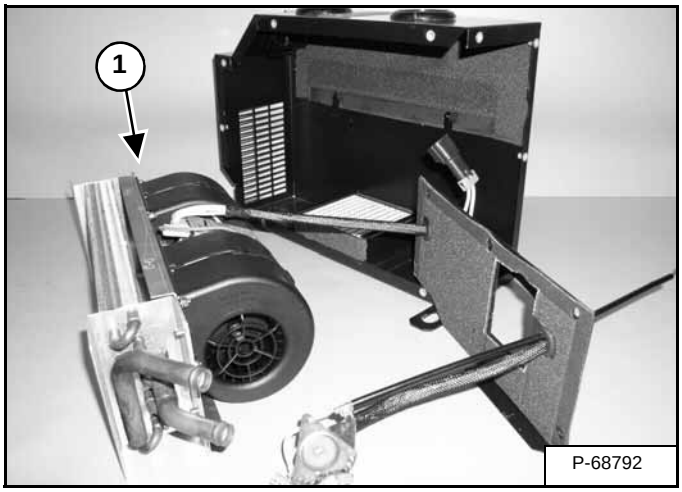
Remove the five bolts and washers (Item 1) and remove the panel (Item 2) **[Figure 70-50-24]**.

Figure 70-50-25



Tilt the panel (Item 1) back and remove the two screws (Item 2) **[Figure 70-50-25]** from the side panel.

Figure 70-50-26

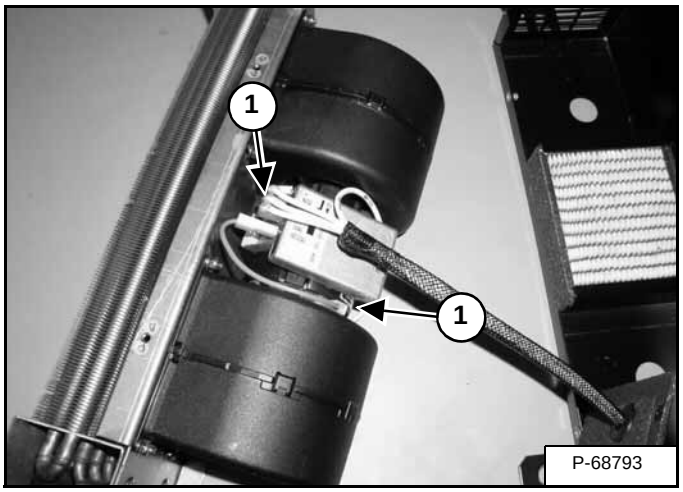


Remove the heater coil and heater fan assembly (Item 1) **[Figure 70-50-26]** from the heater unit.

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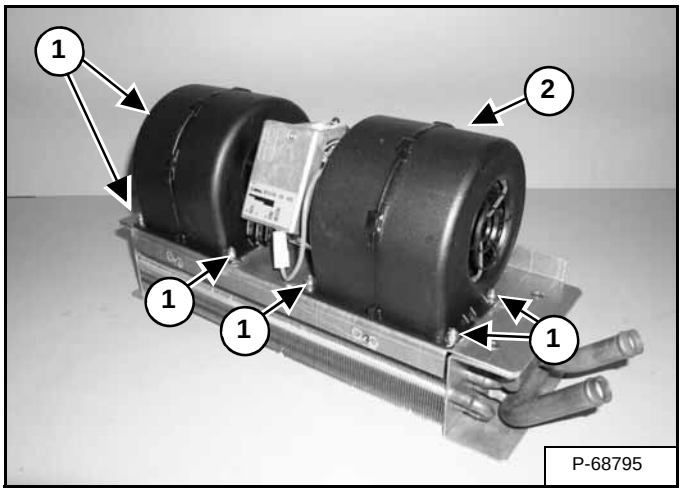
Removal And Installation (Cont'd)

Figure 70-50-27



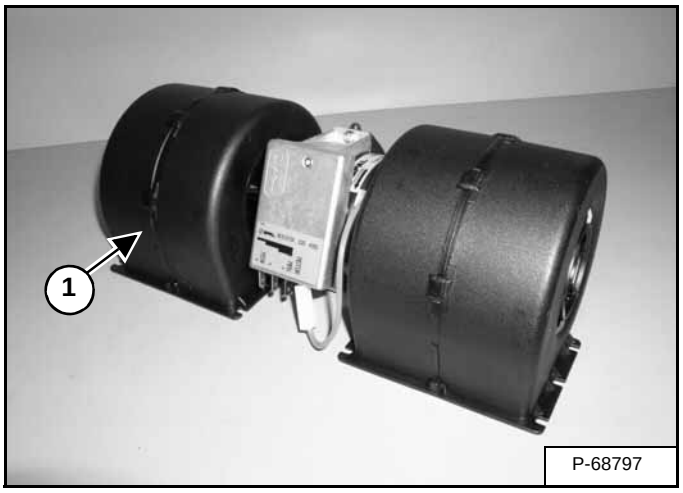
Mark and remove the four wires (Item 1) **[Figure 70-50-27]** from the heater fan motor.

Figure 70-50-28



Remove the six nuts and washers (Item 1) and remove the heater fan assembly (Item 2) **[Figure 70-50-28]**. Remove the heater fan assembly from the heater coil.

Figure 70-50-29



The heater fan assembly (Item 1) **[Figure 70-50-29]** is not reapairable. Order complete assembly from Bobcat Parts.

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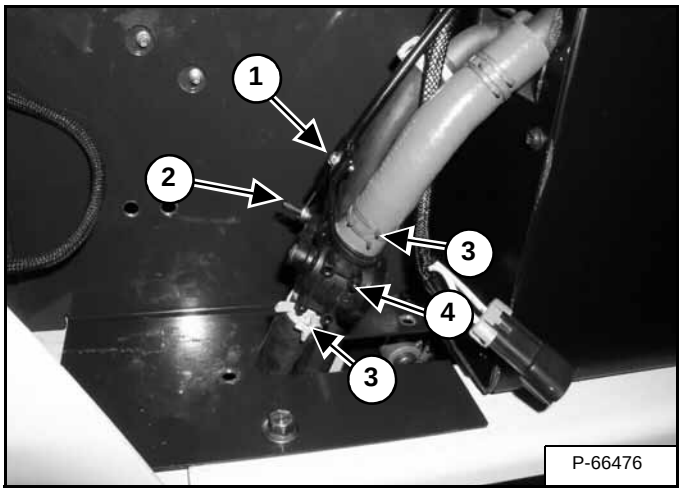
HEATER VALVE

Removal And Installation

Drain the engine coolant. (See Removing And Replacing Coolant on page 10-70-2.)

Remove the cab. (See Removal And Installation on Page 40-30-1.)

Figure 70-60-30



Loosen the screw and cable clamp (Item 1) **[Figure 70-60-30]**.

Slide the cable off the heater valve pin (Item 2) **[Figure 70-60-30]**.

Disconnect and cap the two hoses (Item 3) from the heater valve (Item 4) **[Figure 70-60-30]**.

Remove the heater valve.

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Decimal And Millimeter Equivalents. SPEC-50-1
U.S. To Metric Conversion Chart SPEC-50-1

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Torque For General SAE Bolts. SPEC-20-1

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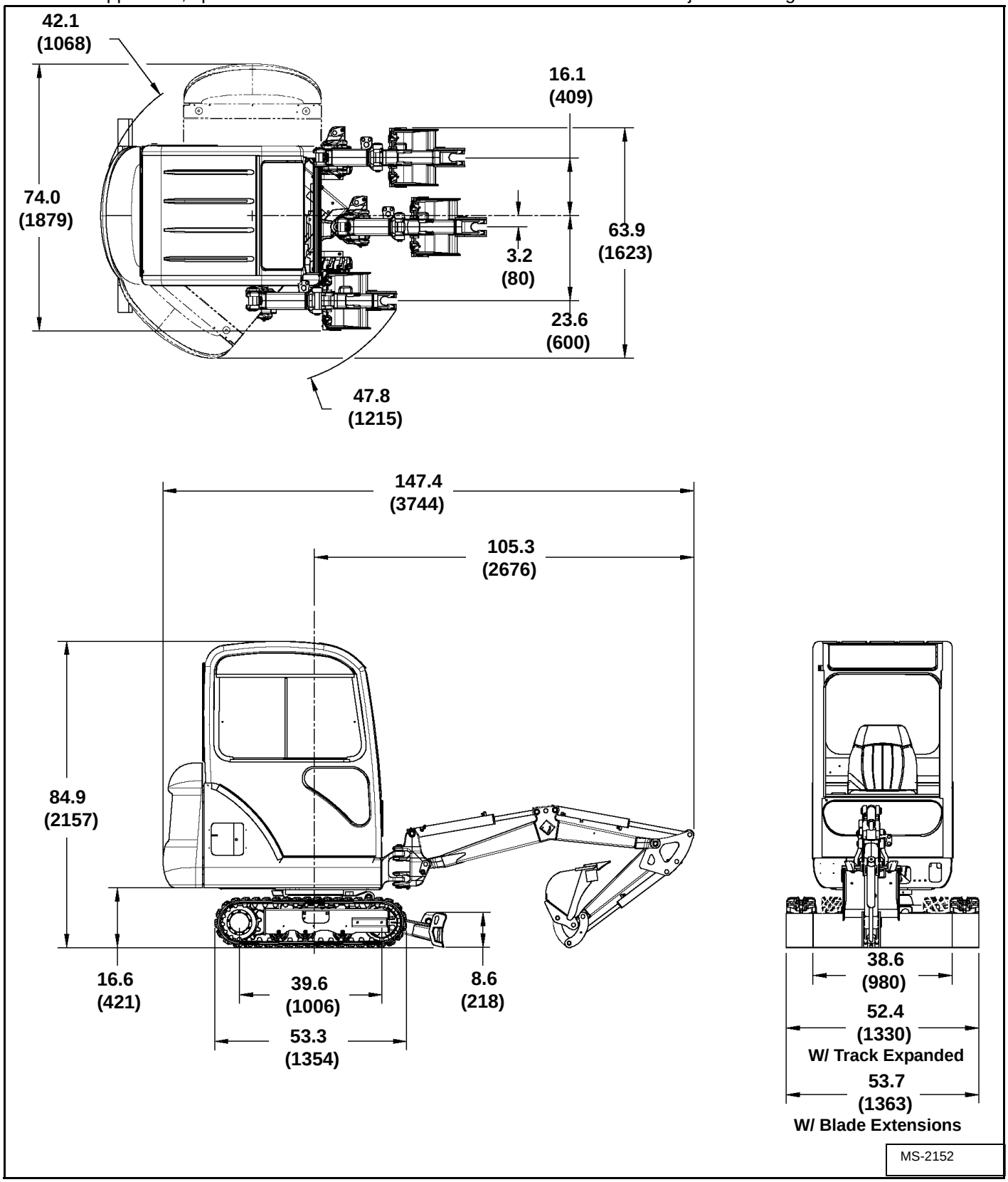


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319 EXCAVATOR SPECIFICATIONS

Dimensions

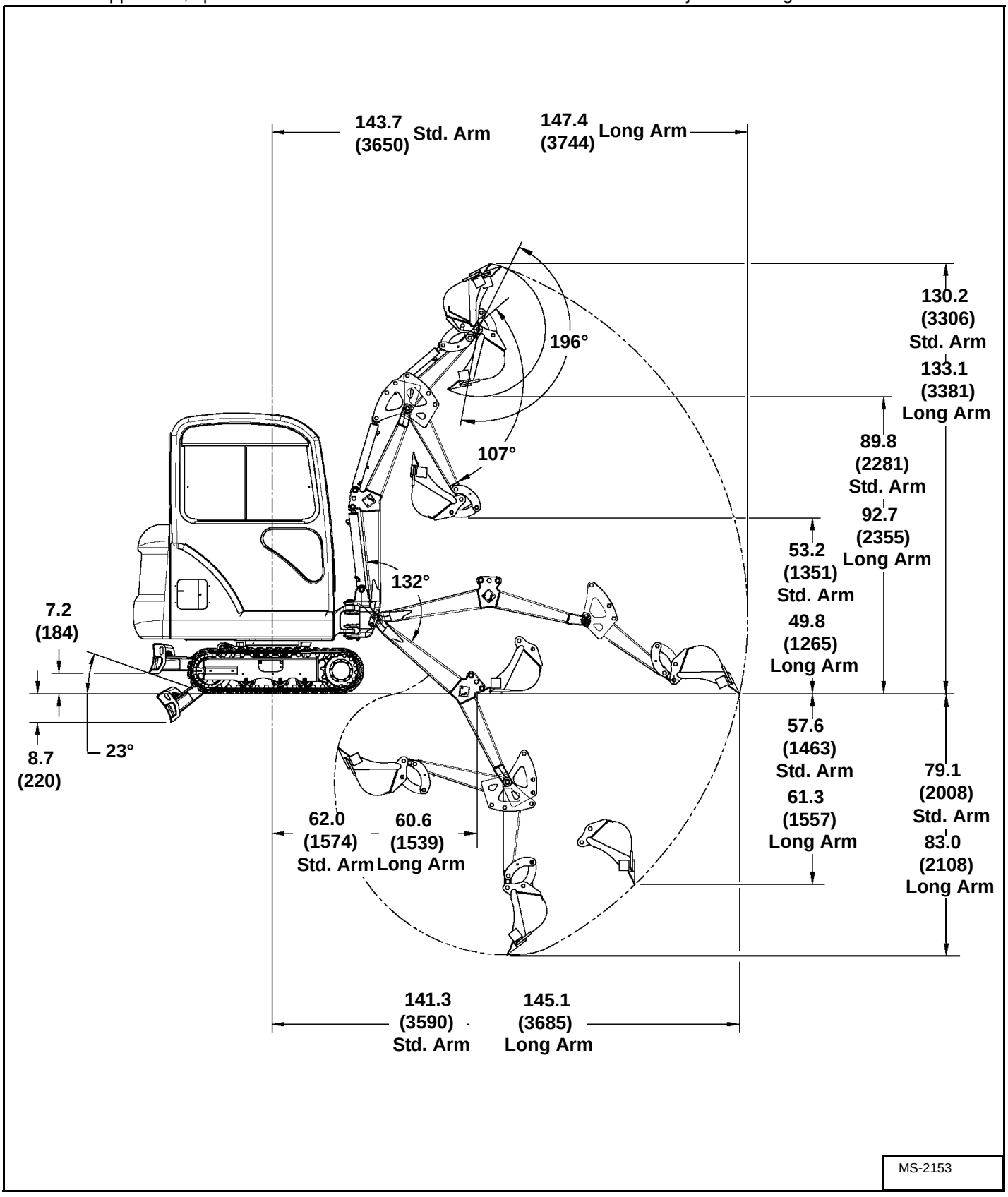
- All dimensions are shown in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



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Dimensions (Cont'd)

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



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Performance

Operating weight (Canopy w/ 16 inch Bucket & Rubber Tracks)	2803 lb. (1271 kg)
Operating weight (Cab w/ 16 inch Bucket & Rubber Tracks)	3087 lb. (1400 kg)
Travel Speed	1.04 mph (1,66 km/hr.)
Digging Force (per ISO 6015) Arm Bucket	 2070 lbf. (9208 N) 2772 lbf. (12330 N)
Boom Swing (Offset)	Left 90° Right 50°

Controls

Steering	Two hand levers
Hydraulics	Two hand operated levers (joysticks) control boom, bucket, arm and upperstructure slew
Auxiliary Hydraulics (Optional)	Controlled by foot pedal
Auxiliary Pressure Release	Controlled by foot pedal
Engine	Hand Lever engine speed, key type start switch
Starting Aid	Glow Plugs - activated by key switch
Brakes Travel Service & Parking Swing Service Holding	 Hydraulic lock in motor circuit Hydraulic lock on motor Locking Pin

Engine

Make/Model	Kubota D722-E2B
Fuel/Cooling	Diesel/Liquid (Antifreeze mixture)
Horsepower (SAE Net)	13.3 HP (9,9 kW) @ 2500 RPM
Torque @ 2000 RPM (SAE Net)	31.1 lbf.-ft. (42.2 N•m)
Number Of Cylinders	Three
Displacement	43.9 cu. in. (0,72 L)
Bore / Stroke	2.64 in. / 2.68 in. (67 / 68 mm)
Lubrication	Pressure System with Filter
Crankcase Ventilation	Closed Breather
Air Cleaner	Dual dry replaceable paper cartridges
Ignition	Diesel Compression
Low Idle	1125 - 1225 RPM
High Idle	2635 - 2665 RPM
Engine Coolant	Propylene Glycol / water mixture (53% PG / 47% water)

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Hydraulic System

Pump Type	Engine driven, gear type
Pump Capacity	Three @ 2.64 GPM (10,0 L/min.) @ 2500 RPM
Auxiliary Flow	7.9 GPM (30,0 L/min.) @ 2500 RPM
Hydraulic Filter	Full flow replaceable, 3 micron synthetic media element
Control Valve	9 Spool, Parallel Type Open Center
Fluid Type	Bobcat Fluid, Hydraulic/Hydrostatic 6903117 - (2.5 Gal.) 6903118 - (5 Gal.) 6903119 - (55 Gal.)
System Relief Pressure Travel Circuits Slew Circuit Boom, Arm, Bucket, Blade, Boom Swing, Auxiliary Hydraulics Joystick Control Pressure	 3300 PSI (228 bar) 1975-2075 PSI (136-140 bar) 3300 PSI (228 bar) 435 PSI (30,0 bar)
Arm Port Relief Base End Rod End	3625 PSI (250 bar) 3625 PSI (250 bar)
Boom Port Relief Base End Rod End	3046 PSI (210 bar) 3625 PSI (250 bar)
Bucket Port Relief Base End Rod End	3625 PSI (250 bar) 3625 PSI (250 bar)
Main Hydraulic Filter Bypass	25 PSI (1,7 bar)

Hydraulic Cylinders

	Bore	Rod	Stroke
Boom (Cushioned - Boom Up)	2.25 (57,2 mm)	1.25 (31,8 mm)	16.95 (430,5 mm)
Arm	2.00 (50,8 mm)	1.25 (31,8 mm)	15.36 (390,1 mm)
Bucket	1.75 (44,5 mm)	1.00 (25,4 mm)	15.16 (385,1 mm)
Blade	2.00 (50,8 mm)	1.25 (31,8 mm)	3.81 (96,8 mm)
Boom Swing (Cushioned - Both Directions)	2.75 (69,85 mm)	1.25 (31,8 mm)	16,19 (429,3 mm)
Undercarriage	1.75 (44,5 mm)	1.00 (25,4 mm)	13,78 (350,0 mm)

Hydraulic Cycle Times

Boom	Raise 4.4 Seconds	Lower 3.9 Seconds
Arm	Retract 2.4 Seconds	Extend 1.9 Seconds
Bucket	Curl 2.0 Seconds	Dump 1.6 Seconds
Blade	Raise 1.5 Seconds	Lower 1.5 Seconds
Boom Swing	Left 3.6 Seconds	Right 4.1 Seconds
Undercarriage	Expand 3.7 Seconds	Retract 3.1 Seconds

Electrical

Starting Aid	Glow Plugs
Alternator	12 volts, 40 amps, open, negative ground
Battery	12 volts - 530 CCA @ 0° F (-18° C)
Starter	12 volts; gear reduction 3.87 HP (1.4 kW)
Instrumentation	Fuel gauge, audible alarm, visual warning for engine functions and hourmeter

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Drive System

Final Drive	Each track is independently driven by an Axial Piston Motor
Type of Reduction	Two-stage planetary gear reduction

Slew System

Slew Motor	Orbit Motor
Slew Circle	Single row shear type ball bearing with internal gear
Slew Speed	11 RPM

Undercarriage

Crawler Track Design	Sealed track rollers with boxed section track, Roller frame, Grease type track adjuster
Width of crawler	Retracted; 38.6 in. (980 mm) Extended; 52.4 in. (1330 mm)

Capacities

Fuel Tank	6.3 Gal. (23,8 L)
Hydraulic Reservoir	6.8 qt. (6,4 L)
Cooling System	6.0 qt. (5,7 L)
Engine Oil and Filter	3.75 qt. (3,5 L)
Final Drive (each)	0.53 qt. (0,5 L)

Tracks

Type	Rubber
Width	7.87 in. (200 mm)
Number Of Shoes	Single Assembly
Number of Track Rollers (per side)	3

Ground Pressure

Rubber Tracks (per SAE J1309)	4.24 PSI (0,29 bar)

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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)

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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)

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HYDRAULIC CONNECTION SPECIFICATIONS

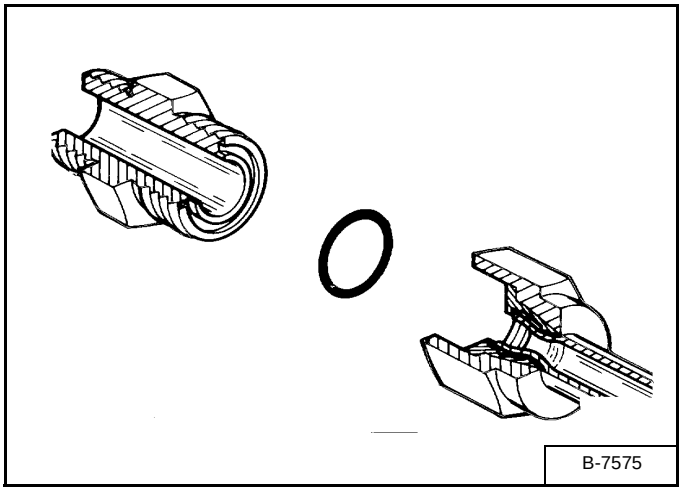
O-ring Face Seal Connection

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.

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Figure SPEC-30-1



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-30-1]**.

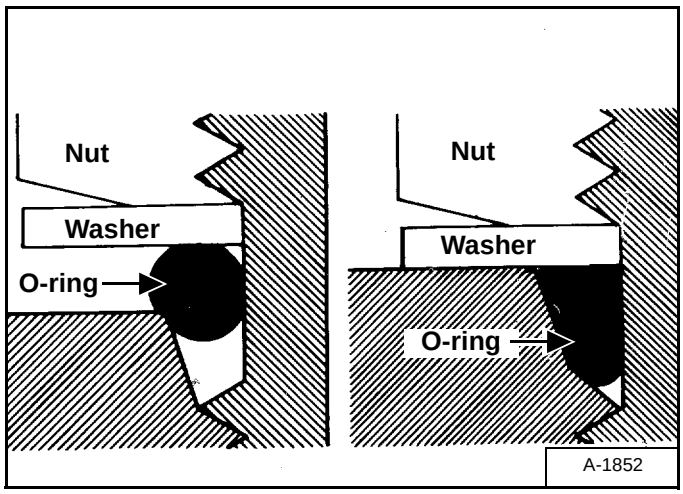
Figure SPEC-30-2

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)

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Straight Thread O-ring Fitting

Figure SPEC-30-3



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-30-3]**.

Tubelines And Hoses

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

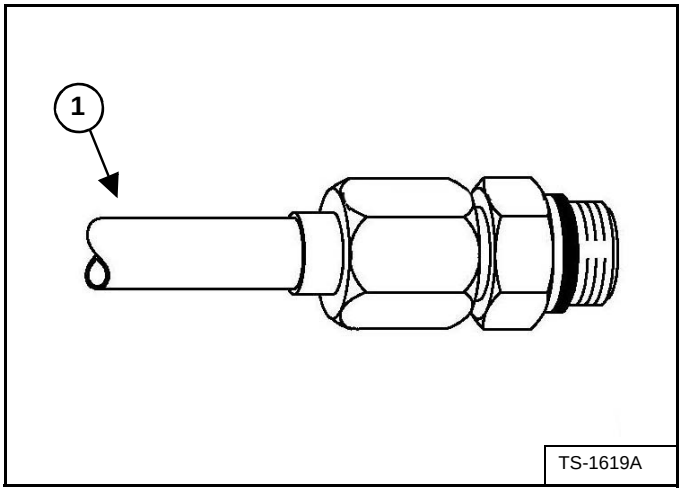
Replace hoses which show signs of wear, damage or weather cracked rubber.

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

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Flare Fitting

Figure SPEC-30-4



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-30-4]**

Use the chart **[Figure SPEC-30-5]** to find the correct tightness needed. If the fitting leaks after tightening, disconnect it and inspect the seat area for damage.

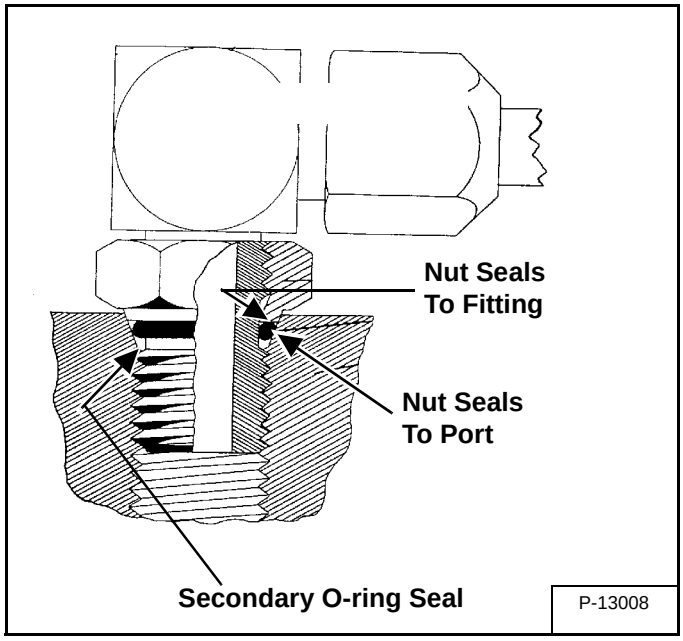
Figure SPEC-30-5

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)

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Port Seal Fitting

Figure SPEC-30-6



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-30-6]**.

The hex portion of the nut does not contact the surface of the component when the nut is tight.

Figure SPEC-30-7

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:

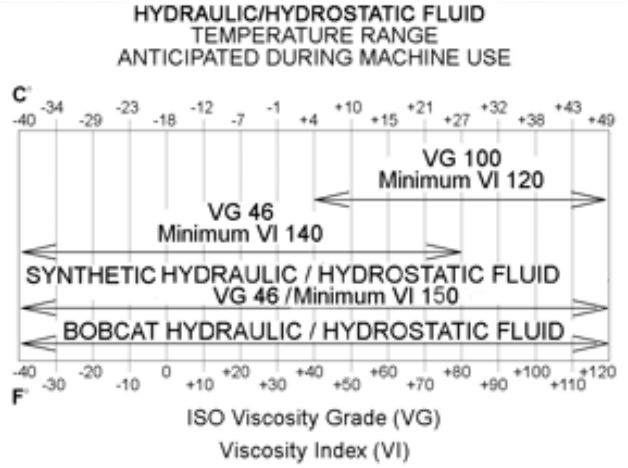
Port seal and nut, washer and O-ring (O-ring Boss) fittings use the same tightening torque valve chart.

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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.

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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.

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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

1 mm = 0.03937”

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

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

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SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	☐
SERVICE MANAGER	☒
SALES MANAGER	☐

NOTICE **Insert This Sheet With The Below Listed Manual For Future Reference.**

Revision No: 319-1
Date: 24 March 2006
Product: Bobcat Excavator
Model: 319
Manual No: 6904188 (11-05)

319 Service Manual (P/N 6904188) Dated (2-06) contains updated service information which replaces the previous 319 Service Manual (P/N 6904188) Dated (11-05)

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