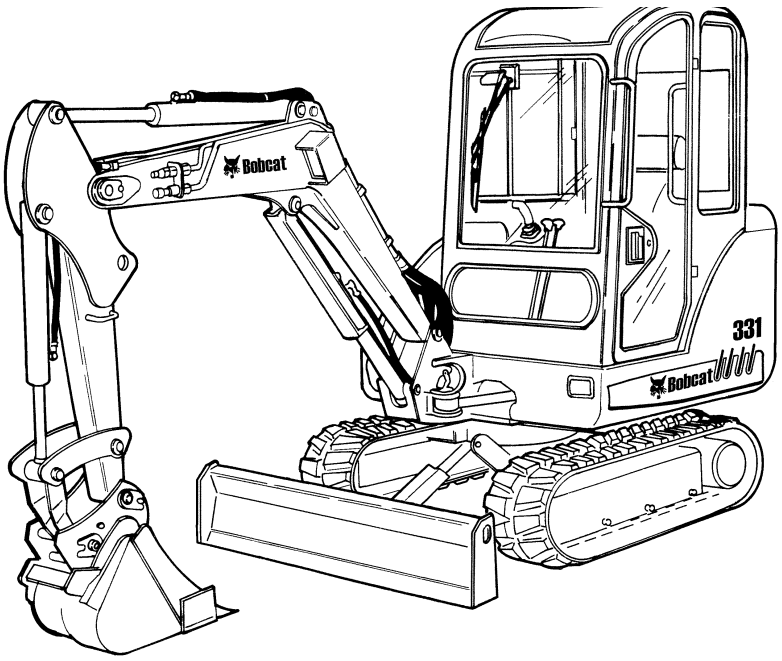
331
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Bobcat®

Service Manual

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



Ingersoll Rand
Compact Vehicle Technologies

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MAINTENANCE SAFETY

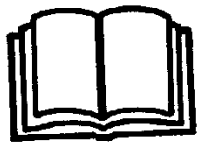
WARNING

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.

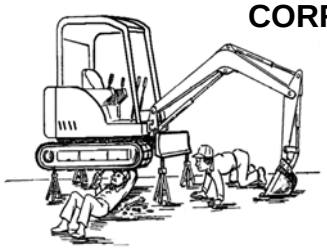
CORRECT



B-10731A

Never service the Bobcat Compact Excavator without instructions.

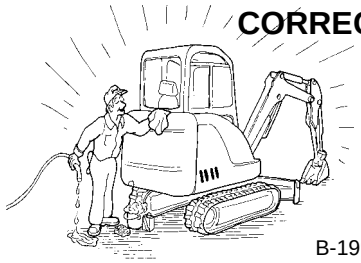
CORRECT



B-19964

Use the correct procedure to lift and support the excavator.

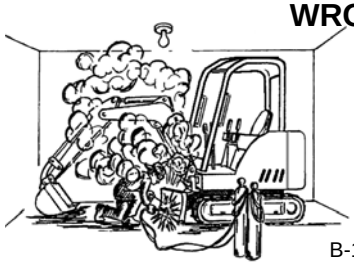
CORRECT



B-19959

Cleaning and maintenance are required daily.

WRONG

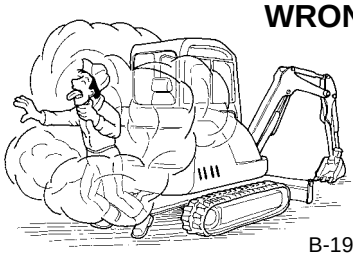


B-19965

Have good ventilation when welding or grinding painted parts.

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

WRONG

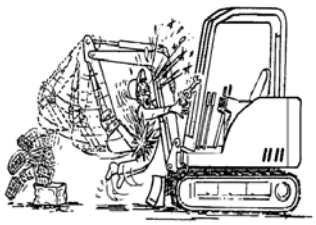


B-19960

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

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

WRONG

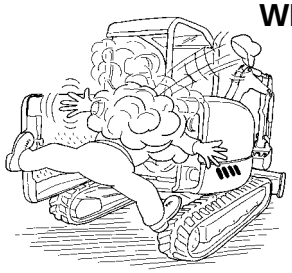


B-19966

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

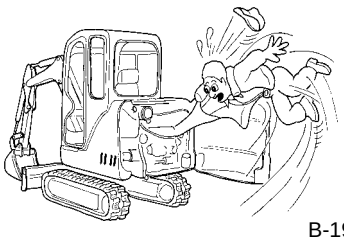
Stop, cool and clean engine of flammable materials before checking fluids.

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 rear door closed except for service. Close and latch door 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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SPECIFICATIONS SPEC-01

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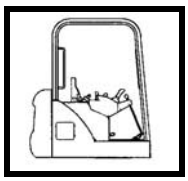
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FOREWORD

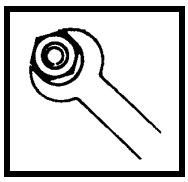
This manual is for the Bobcat Hydraulic Excavator mechanic. It provides necessary servicing and adjustment procedures for the hydraulic excavator and its component parts and systems. Refer to the Operation & Maintenance Manual for operating instructions, starting procedure, daily checks, etc.

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

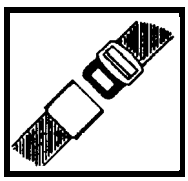
1. Check that the ROPS/TOPS/ FOPS is in good condition and is not modified.



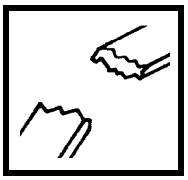
2. Check that ROPS/TOPS mounting hardware is tightened and is Bobcat approved.



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



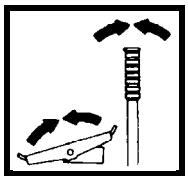
4. Inspect for loose or broken parts or connections.



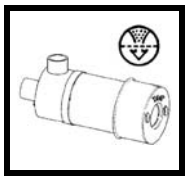
5. Machine signs must be legible and in the correct location.



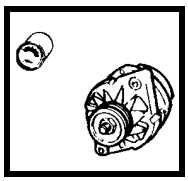
6. Steering levers, control levers and foot pedals must return to neutral. Check that foot pedals lock and control lever locks are in working order.



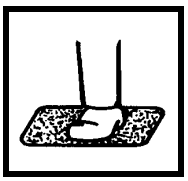
7. Inspect the air cleaner for damage or leaks. Check the condition of the element.



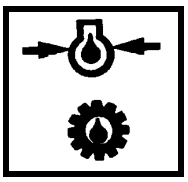
8. Check the electrical charging system.



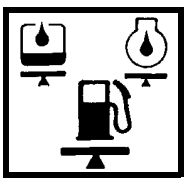
9. Safety treads must be in good condition.



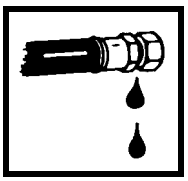
10. Check for correct function of indicator lamps (Optional on some models.



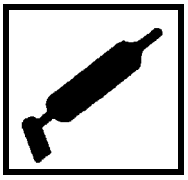
11. Check hydraulic fluid level, engine oil level and fuel supply.



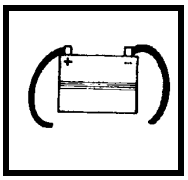
12. Inspect for fuel, oil or hydraulic fluid leaks.



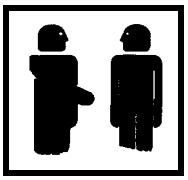
13. Lubricate the excavator.



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.



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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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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.

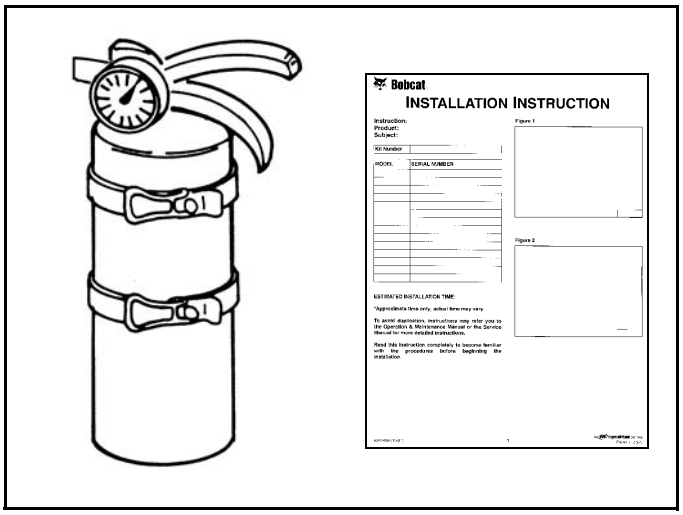
- Always clean the machine, disconnect the battery, and disconnect the wiring from the controllers before welding. Cover rubber hoses, battery and all other flammable parts. Keep a fire extinguisher near the machine when welding. Have good ventilation when grinding or welding painted parts. Wear a dust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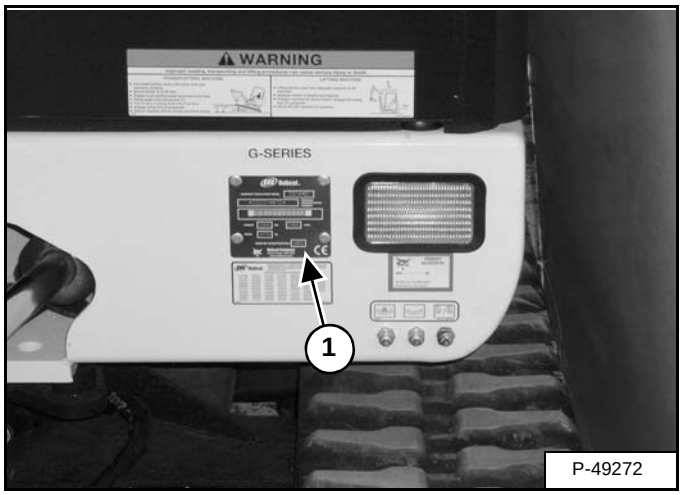
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SERIAL NUMBER LOCATIONS

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) is located on the frame of the machine in the location shown **[Figure 1]**.

Explanation of excavator Serial Number:

XXXX XXXXX

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

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

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

Engine Serial Number

Figure 2

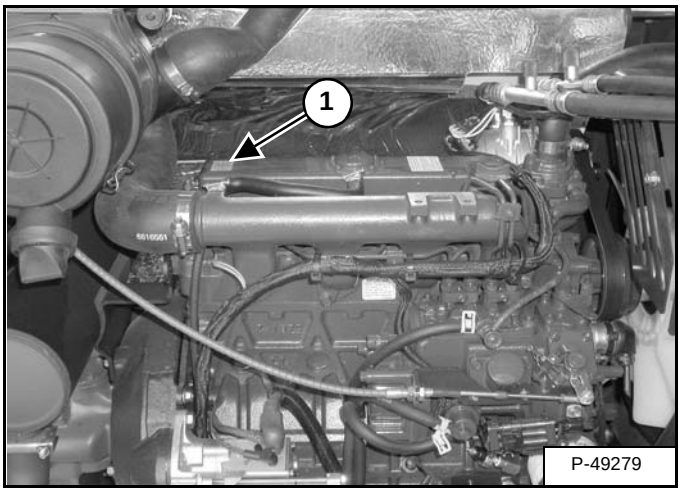
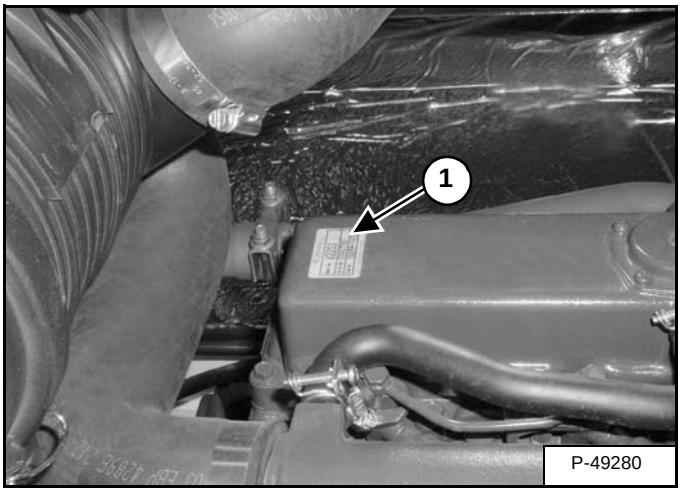


Figure 3

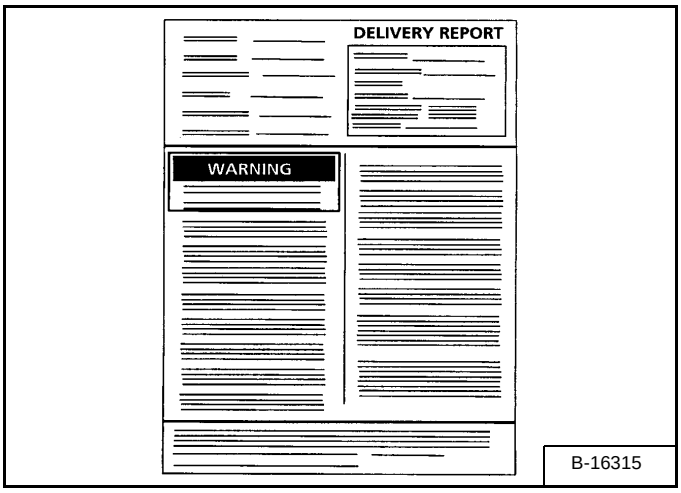


The engine serial number (Item 1) **[Figure 2]** & **[Figure 3]** is located on the engine in the locations shown.

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DELIVERY REPORT

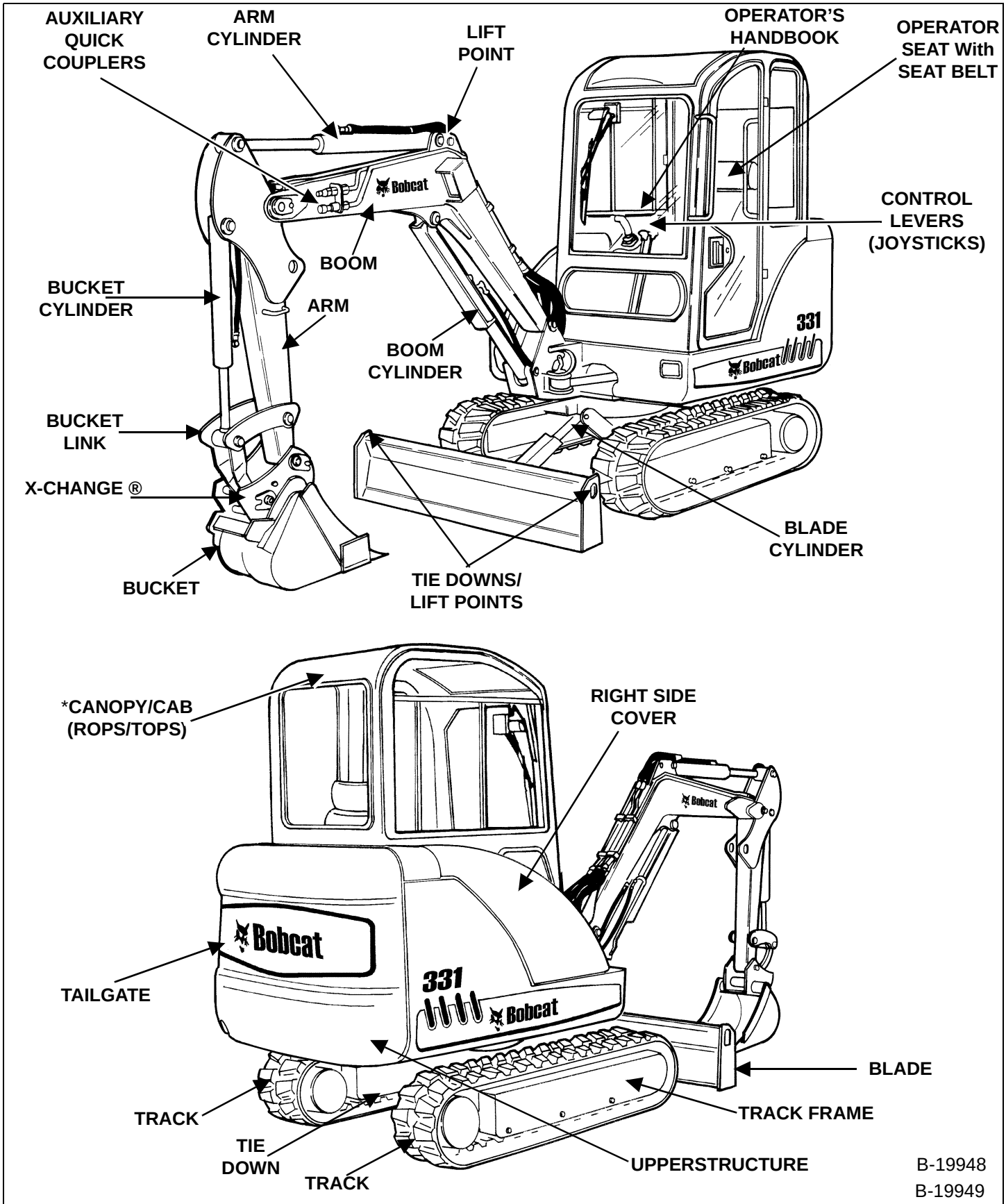
Figure 4



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 4]**.

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BOBCAT EXCAVATOR IDENTIFICATION



B-19948
B-19949

* FOGS (Falling Object Guards) is available from your Bobcat Excavator dealer.

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LIFTING AND BLOCKING THE EXCAVATOR

Procedure

Always park the machine on a level surface.

⚠ 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.

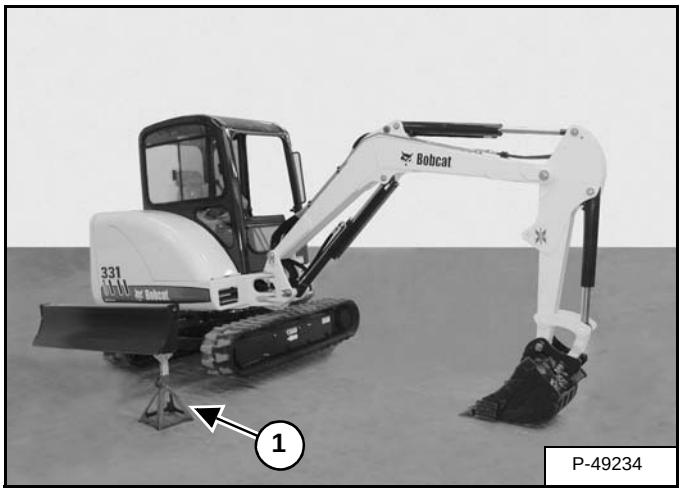
W-2003-0903

⚠ WARNING

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

W-2017-0286

Figure 10-10-1



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

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

Repeat the procedure for the other side.

Stop the engine.

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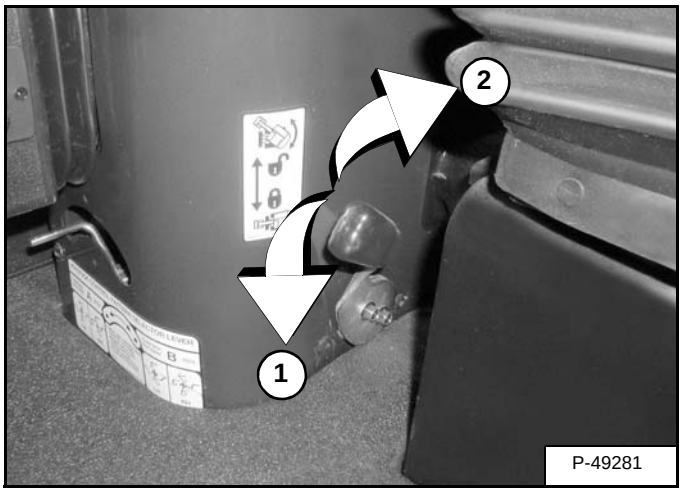


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UPPERSTRUCTURE SLEW LOCK

Operation (Early Models)

Figure 10-11-1



Push the lever down (Item 1) **[Figure 10-11-1]** to engage the upperstructure slew lock.

Pull the lever up (Item 2) **[Figure 10-11-1]** to disengage the upperstructure slew lock.

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

WARNING

AVOID INJURY

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

W-2197-0904

WARNING

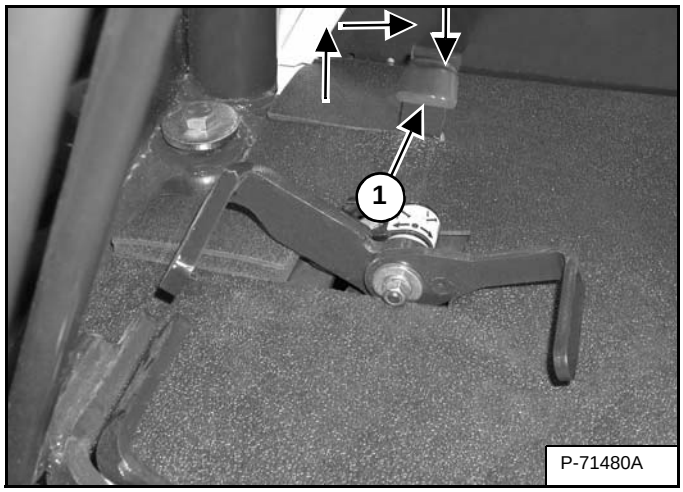
Never use attachments or buckets which are not approved by Bobcat Company. Buckets and attachments for safe loads of specified densities are approved for each model. Unapproved attachments can cause injury or death.

W-2052-0500

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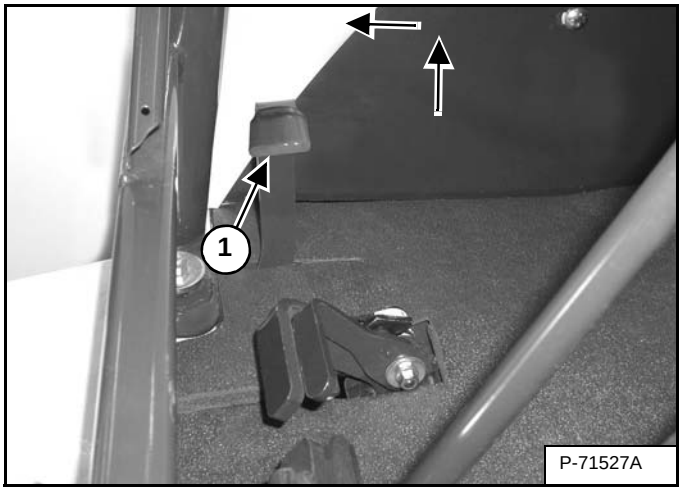
Operation (Later Models)

Figure 10-11-2



Move the lever (Item 1) **[Figure 10-11-2]** *up* slightly, then to the rear and down to engage the upperstructure slew lock.

Figure 10-11-3



Move the lever (Item 1) **[Figure 10-11-3]** *up* and then forward to disengage the upperstructure slew lock.

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

WARNING

AVOID INJURY

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

W-2197-0904

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.

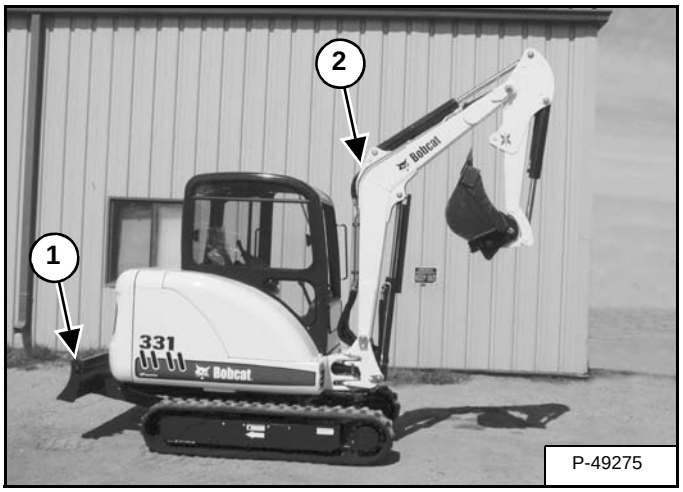
W-2052-0500

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LIFTING THE EXCAVATOR

Procedure

Figure 10-12-1



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

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

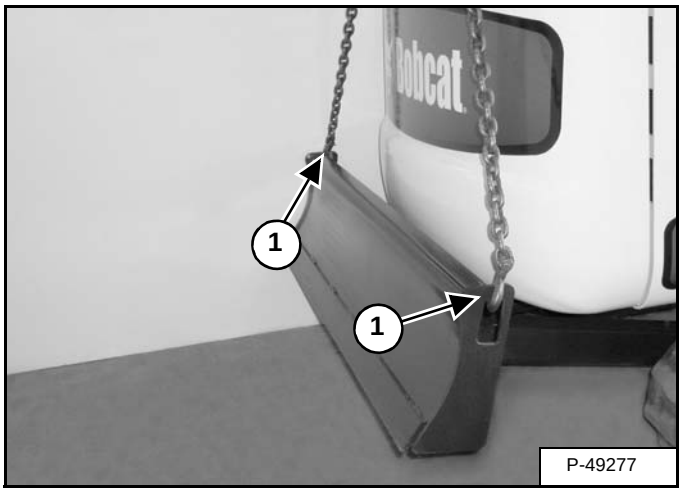


Figure 10-12-3



Fasten chains to the ends of the blade (Item 1) **[Figure 10-12-2]** and **[Figure 10-12-3]** 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.

Install a one inch (25 mm) bolt and nut (Grade 5 or 8) through the holes in 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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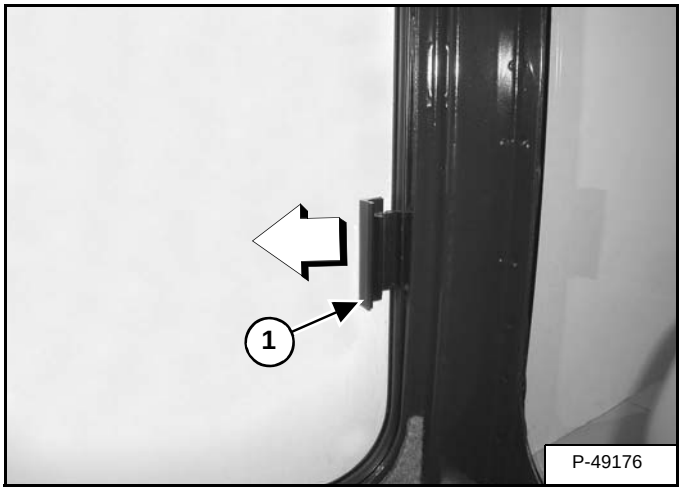
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OPERATOR CAB (ROPS/TOPS)

Emergency Exit

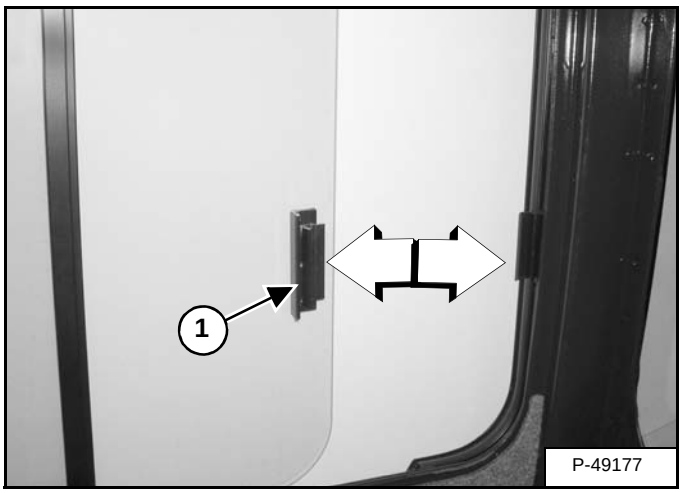
The left door, front window and right rear window provide exits.

Figure 10-20-1



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

Figure 10-20-2



Pull the latch/handle (Item 1) **[Figure 10-20-2]** forward to open the window.

Push the handle back to close the window.

Figure 10-20-3



Exit through the window **[Figure 10-20-3]**.

Figure 10-20-4

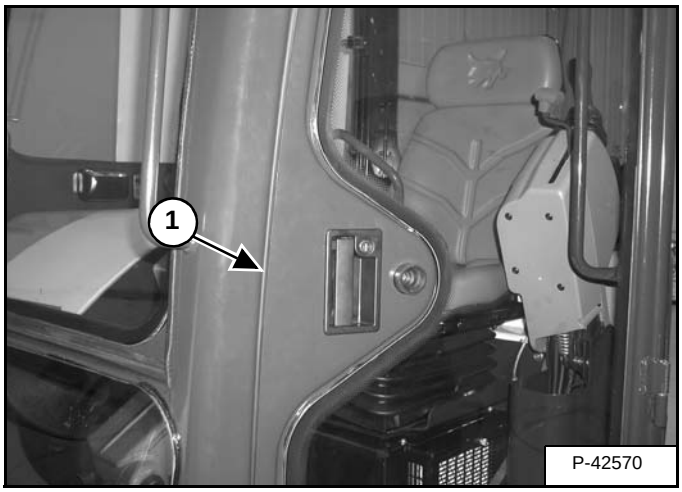


Raise the front window and exit through the window **[Figure 10-20-4]**.

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Cab Door

Figure 10-20-5



The cab door (Item 1) **[Figure 10-20-5]** can be locked with the same key as the starter switch (if equipped).

Push the door all the way open until the latch engages to hold the door in the open position.

Figure 10-20-6



Firmly pull the door away from the cab to disengage the latch and close the door **[Figure 10-20-6]**.

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Front Window

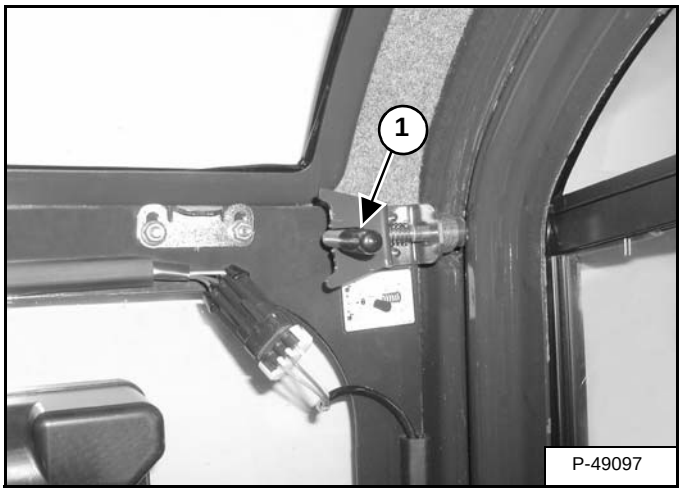
Figure 10-20-7



The front window is equipped with a wiper (Item 1) **[Figure 10-20-7]** and washer.

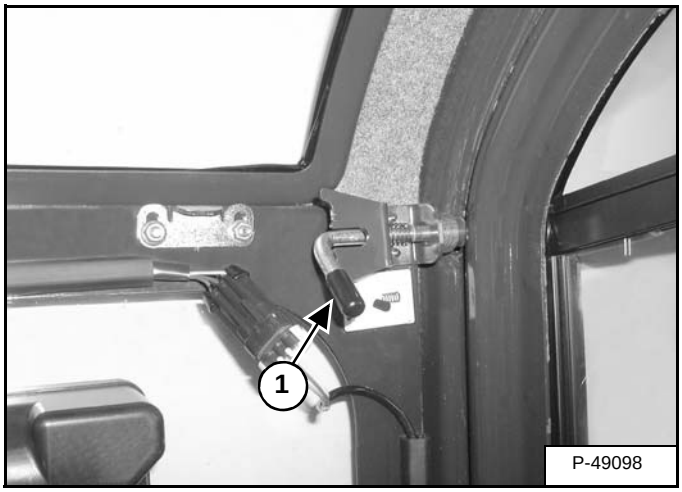
Opening The Front Window

Figure 10-20-8



Retract the two top window latch pins (Item 1) **[Figure 10-20-8]**.

Figure 10-20-9



Turn the two top latches (Item 1) **[Figure 10-20-9]** to the unlocked position.

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Front Window (Cont'd)

Opening The Front Window (Cont'd)

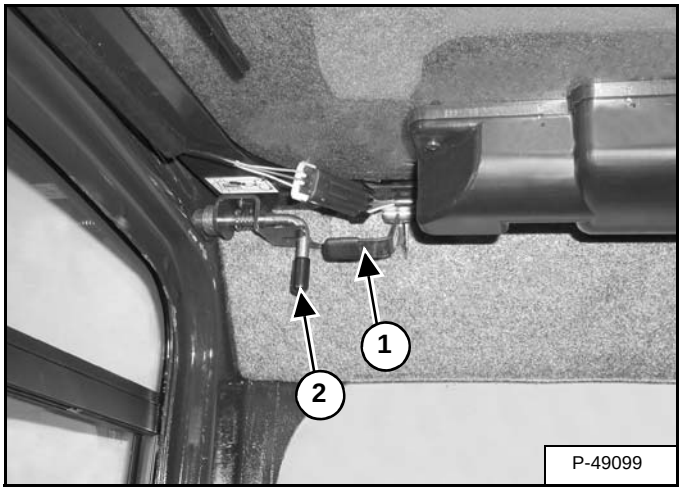
Figure 10-20-10



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

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

Figure 10-20-11



When the window is fully raised, the latch (Item 1) will close on the bracket. Turn the two top latches (Item 2) **[Figure 10-20-11]** to the locked position.

Closing The Front Window

Support the window while releasing both window latch pins and placing the pins in the unlocked position **[Figure 10-20-11]**.

Support the window using the left grab handle and pull down on the latch (Item 1) **[Figure 10-20-11]** to release the window.

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

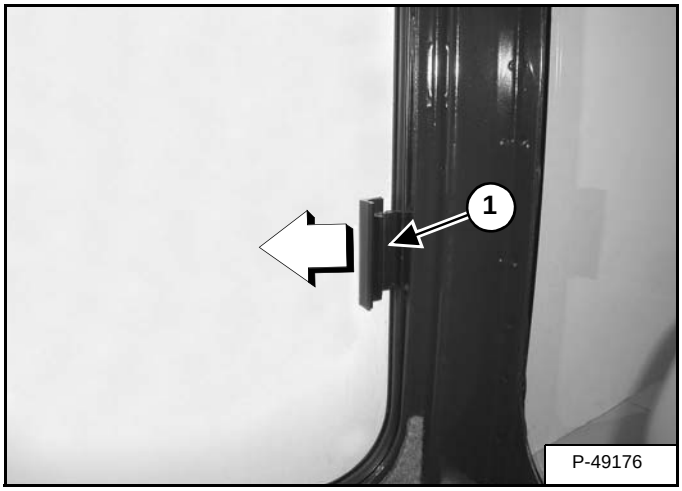
Rotate the top latches (Item 1) **[Figure 10-20-9]** to the locked position (Item 1) **[Figure 10-20-8]**.

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Right Side Windows

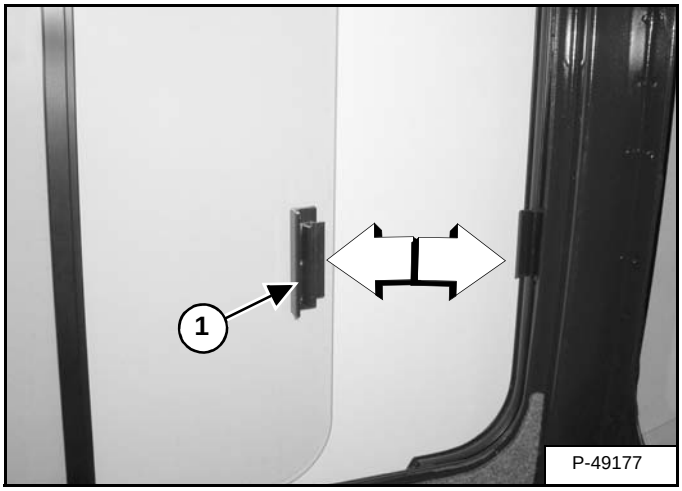
Opening the right rear window

Figure 10-20-12



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

Figure 10-20-13

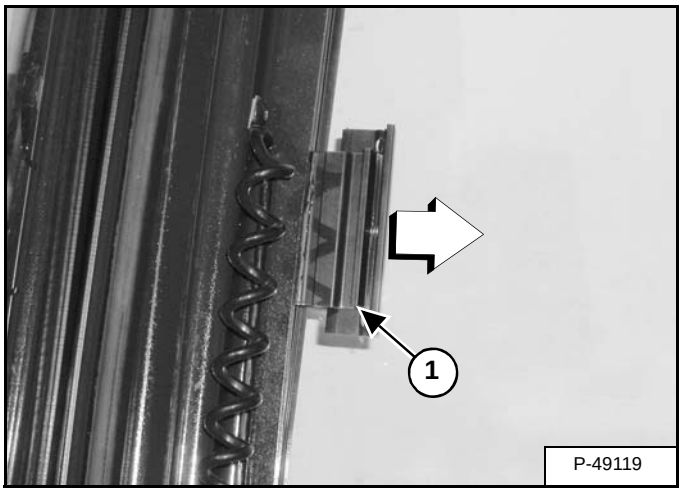


Pull the latch/handle (Item 1) **[Figure 10-20-13]** forward to open the window.

Push the handle back to close the window.

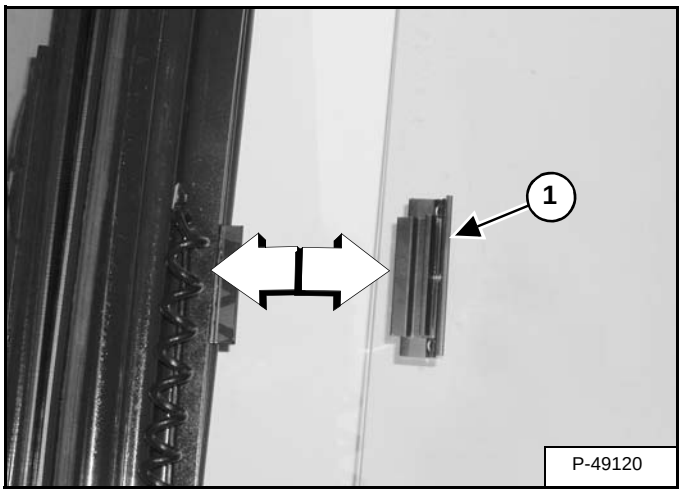
Opening the right front window

Figure 10-20-14



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

Figure 10-20-15



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

Push the handle forward to close the window.

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TRANSPORTING THE EXCAVATOR

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

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

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.

Use ramps that are the correct length and width and can support the weight of the machine.

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

Determine the direction of the track movement before moving the machine (blade forward).

Engage the slew lock.

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 (if equipped).

Put blocks at the front and rear of the tracks.

Figure 10-30-2

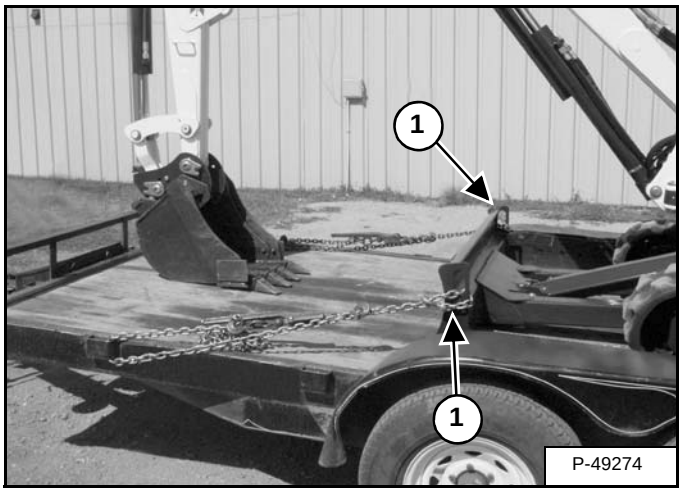
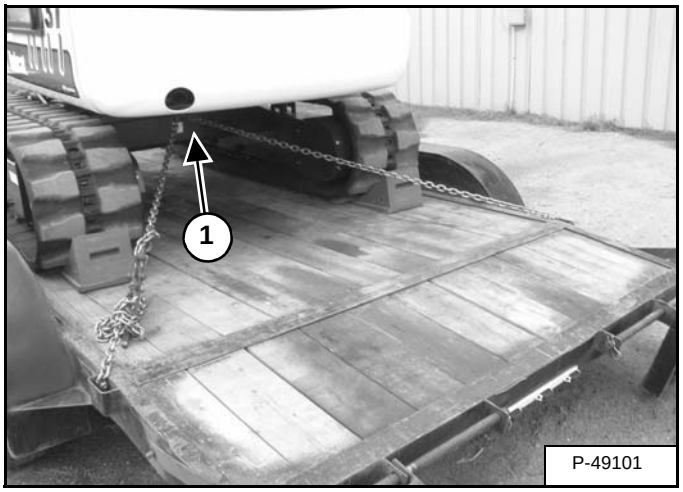


Figure 10-30-3



Fasten chains to the front corners of the blade (Item 1) **[Figure 10-30-2]** and to the tie down loop at the rear of the track frame (Item 1) **[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.

W-2058-0494

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TAILGATE

Opening And Closing The Tailgate

WARNING

AVOID INJURY OR DEATH

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

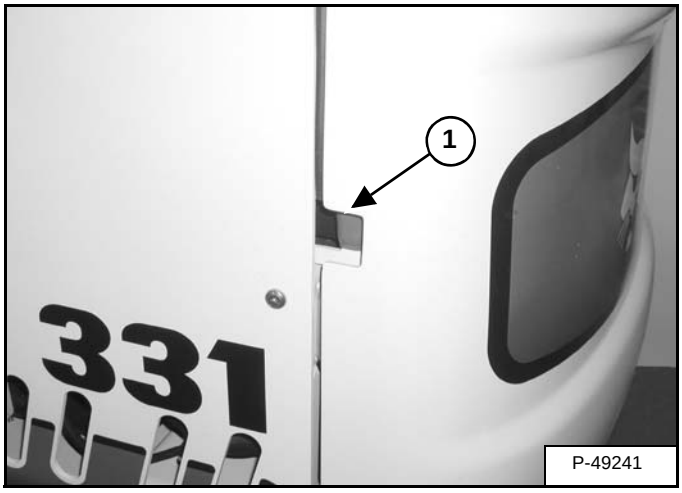
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WARNING

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



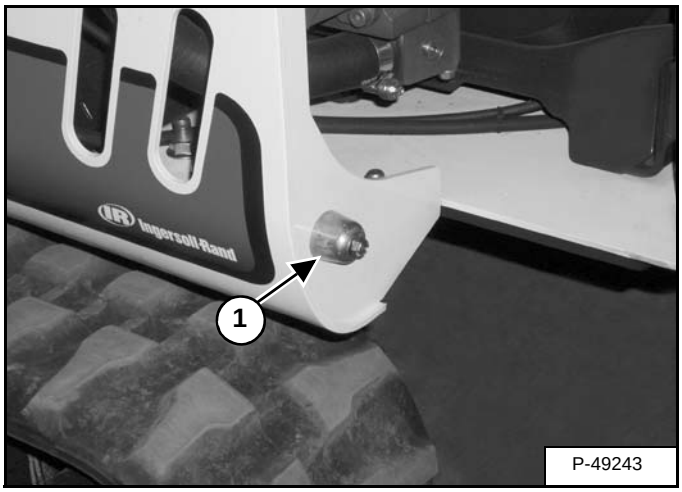
Pull the latch (Item 1) **[Figure 10-40-1]** and open the tailgate.

Push firmly to close the tailgate.

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

Adjusting The Bumper

Figure 10-40-2

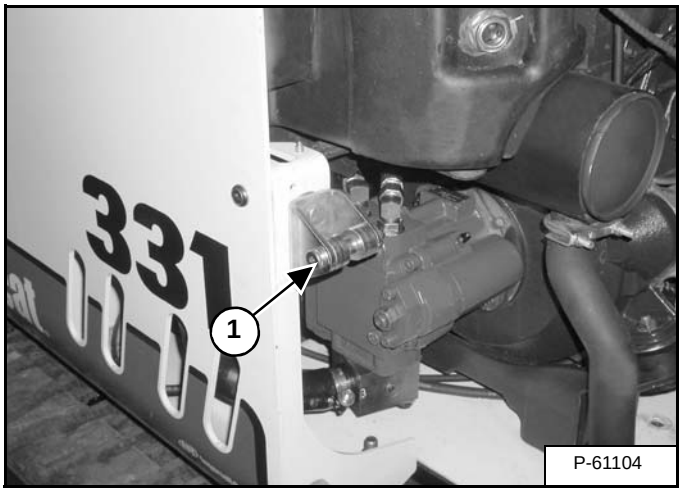


The door bumper (Item 1) **[Figure 10-40-2]** can be adjusted for alignment with the tailgate.

Close the tailgate before operating the excavator.

Adjusting The Latch

Figure 10-40-3



The door catch (Item 1) **[Figure 10-40-3]** can be adjusted for alignment.

Close the tailgate before operating the excavator.

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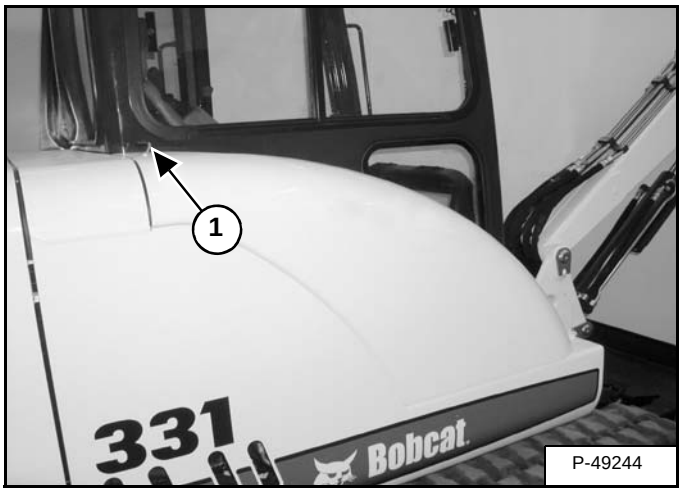


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RIGHT SIDE COVER

Opening And Closing The Right Side Cover

Figure 10-41-1



Pull the latch (Item 1) **[Figure 10-41-1]** and raise the right side cover.

NOTE: The right side cover can be locked using the start key.

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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, Reservoir Breather Cap	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.						
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	Clean the filter as needed.						
Console Lockout	Check console lockout for proper operation.						
X-Change ™	Lubricate and inspect for damage or loose parts.						
Swing Circle and Pinion	Grease two 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.						
Accessory Drive Belt	Check condition of belt and adjust as needed.		●				
Spark Arrestor Muffler	Clean the spark chamber.						
Fuel Filter	Replace fuel filter.						
Radiator, Oil Cooler, *A/C	Clean debris from the radiator fins.						
Engine Oil and Filter	Replace oil and filter use CD or better grade oil and Bobcat filter.		●				
Primary Hydraulic Filter	Replace the primary hydraulic filter.			^			
Case Drain Filter	Replace the case drain filter.			^			
Alternator & Starter	Check the alternator and starter connections.						
Engine Valves	Check and adjust the engine valve clearance.						
Engine Cooling System	Drain and flush the cooling system. Replace the coolant.						
Hydraulic System	Replace the hydraulic fluid and filters. Clean the reservoir.						
Travel Motor	Replace the lubricant in both travel motors.						

*** If Equipped**
● Also at *first* 50 Hours
^ Also at *first* 100 Hours
■ Or every 6 months.

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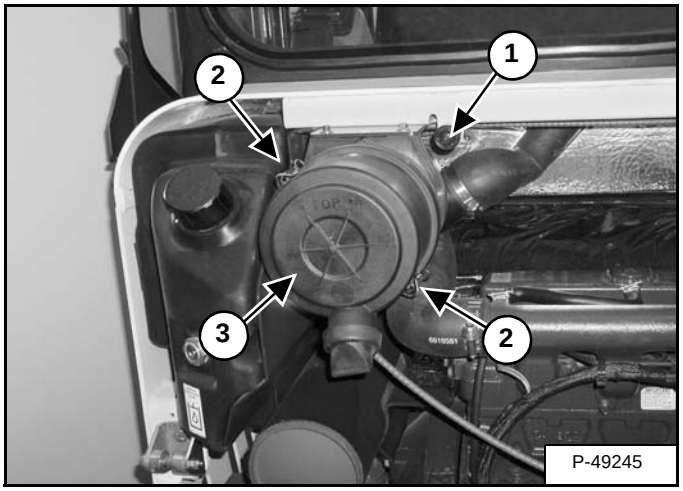
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AIR CLEANER SERVICE

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

Daily Check

Figure 10-60-1



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

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

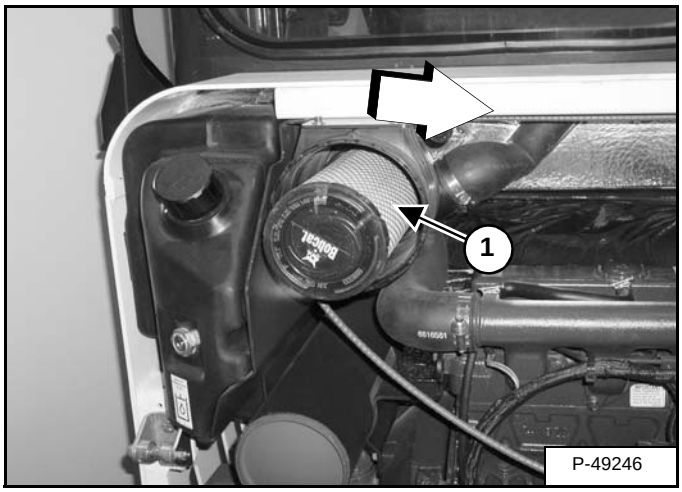
Replacing The Filters

Outer Filter

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

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

Figure 10-60-2



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

Check the housing for damage.

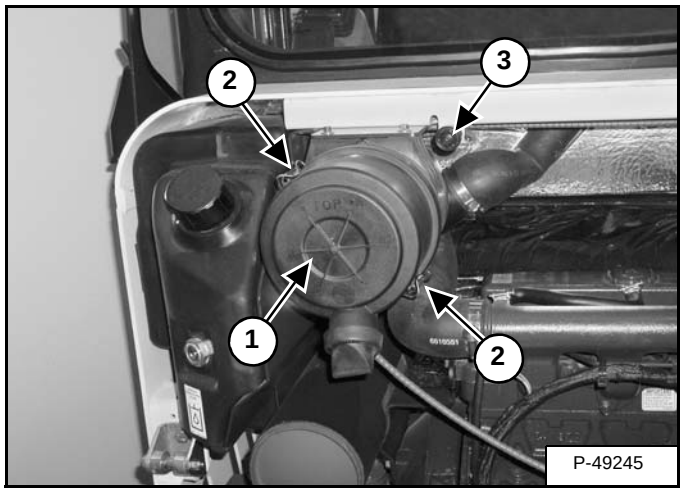
Clean the housing and the seal surface. DO NOT use compressed air.

Install a new filter.

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Replacing The Filters (Cont'd)

Figure 10-60-3



Install the dust cup (Item 1) and engage the fasteners (Item 2) **[Figure 10-60-3]**.

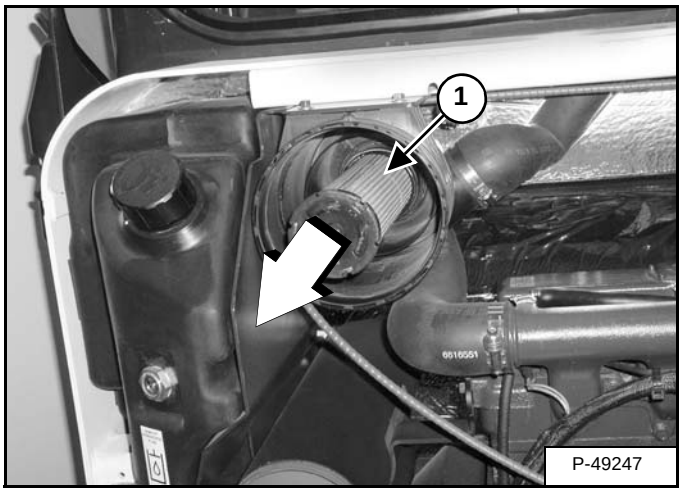
Check the air intake hose and the air cleaner housing for damage. Make sure all connections are tight.

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 3) **[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.

Figure 10-60-4



Remove the dust cup, outer filter and inner filter (Item 1) **[Figure 10-60-4]**.

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

Install the new inner filter.

Install the outer filter and the dust cup.

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

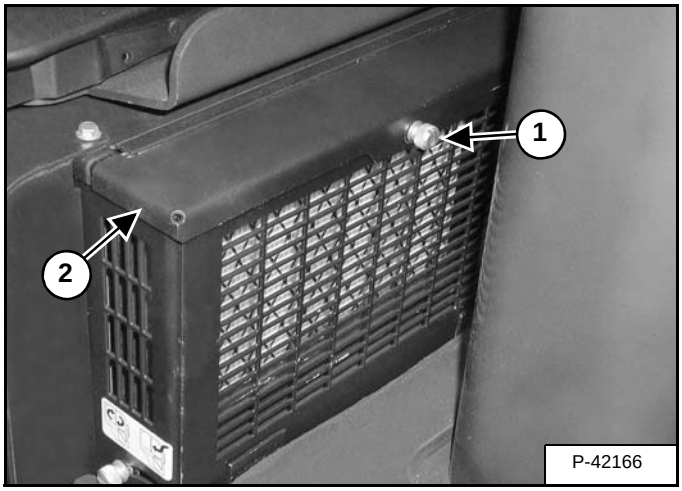
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HEATER AIR FILTER (WITH CAB OPTION ONLY)

Removal And Installation

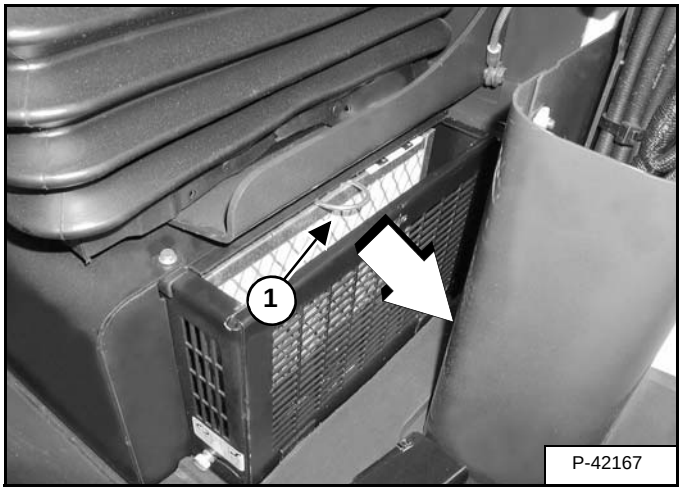
The heater filter must be cleaned regularly. The filter is located at the left of the operator seat.

Figure 10-61-1



Remove the screw (Item 1) and cover (Item 2) **[Figure 10-61-1]**.

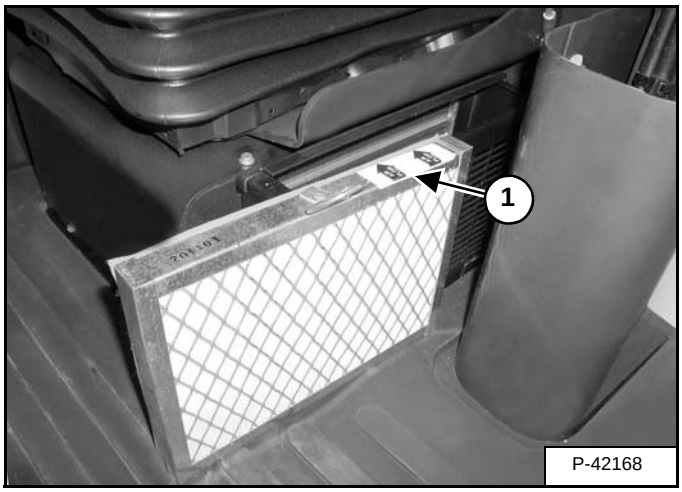
Figure 10-61-2



Pull the filter (Item 1) **[Figure 10-61-2]** away and out of the heater/AC housing.

Use low air pressure to clean the filter. Replace the filter when very dirty.

Figure 10-61-3



Installation: Install the filter with the arrows that indicate air flow direction (Item 1) **[Figure 10-61-3]** pointing towards the heater/AC housing.

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ENGINE COOLING SYSTEM

Replacing The Coolant

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

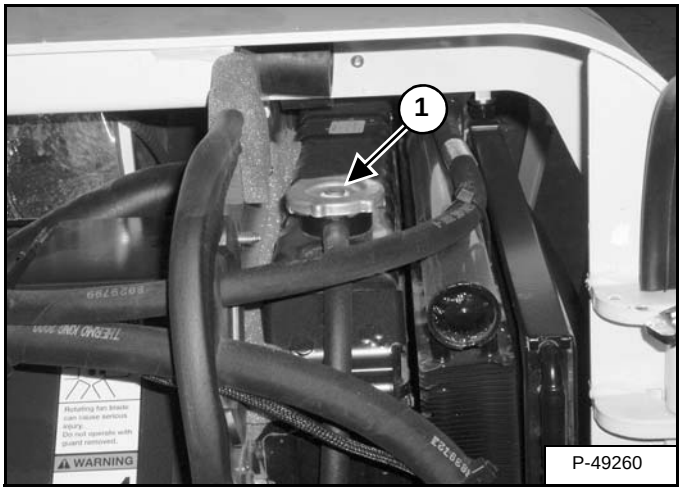
⚠ WARNING

AVOID BURNS

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

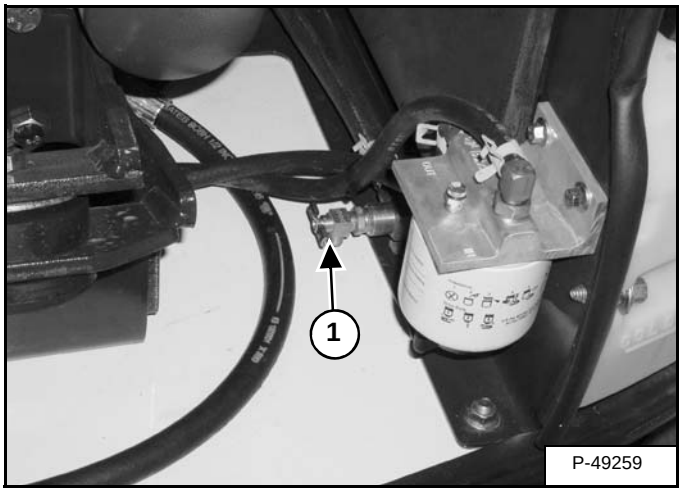
W-2070-1203

Figure 10-70-1



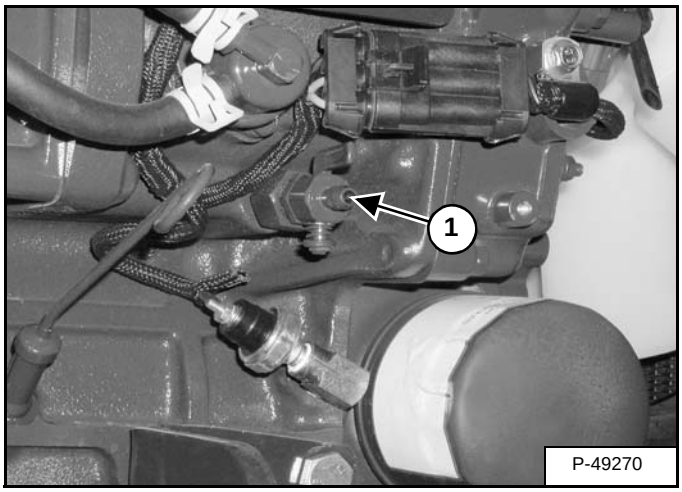
When the engine is cool, loosen and remove the radiator cap (Item 1) **[Figure 10-70-1]**.

Figure 10-70-2



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

Figure 10-70-3



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

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

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

Mix the coolant in a separate container. (See FUEL, COOLANT AND LUBRICANTS on Page SPEC-60-1.)

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.

One gallon and one pint of propylene glycol mixed with one gallon of water is the correct mixture of coolant to provide a -34°F (-37°C) freeze protection.

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

Add premixed coolant until the level is correct.

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

Add coolant to the recovery tank as needed.

Close the tailgate.

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Checking Coolant Level

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

WARNING

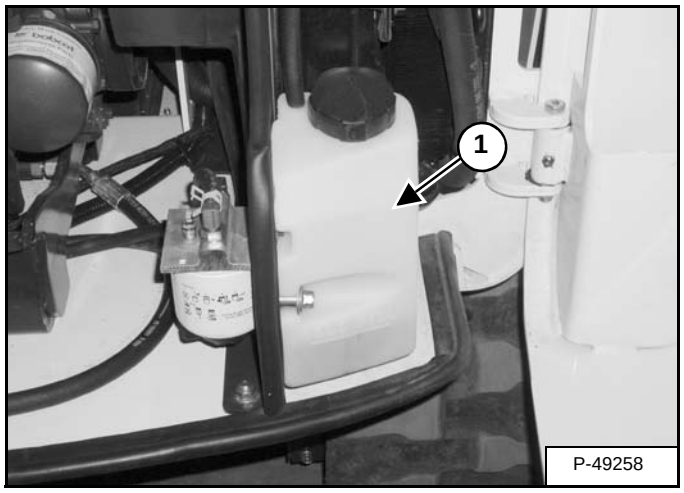
AVOID BURNS

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

W-2070-1203

Open the tailgate.

Figure 10-70-4



Check the coolant level in the coolant recovery tank (Item 1) **[Figure 10-70-4]**.

The coolant level must be between the MIN and MAX marks on the coolant recovery tank when the engine is cold.

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

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

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

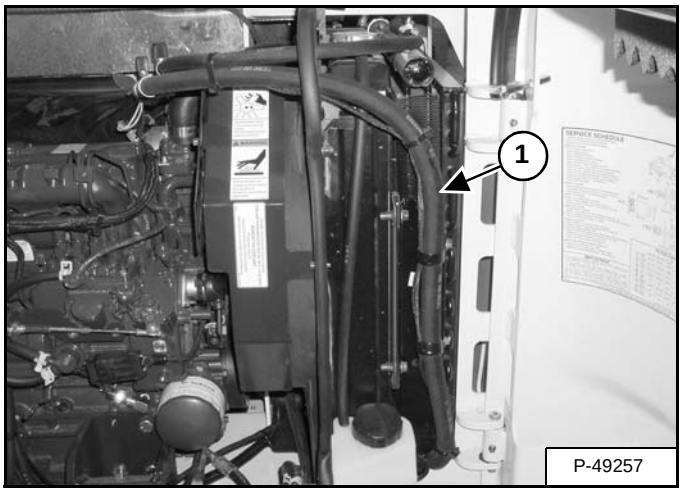
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Cleaning The Cooling System

NOTE: Allow the cooling system and engine to cool before servicing or cleaning the cooling system.

Open the tailgate.

Figure 10-70-5



Use air pressure or water pressure to clean the radiator and oil cooler (Item 1) **[Figure 10-70-5]**. Do not damage the cooling fins when cleaning.

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FUEL SYSTEM

Fuel Specifications

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

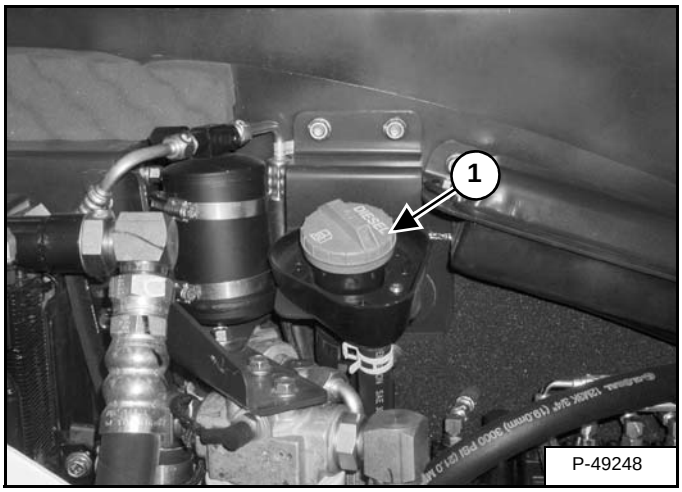
The following is a suggested blending guideline which should prevent fuel gelling problems during freezing temperature

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

See your fuel supplier for local recommendations.

Filling The Fuel Tank

Figure 10-80-1



Open the right side cover and 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.

Clean up any spilled fuel.

⚠ 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.

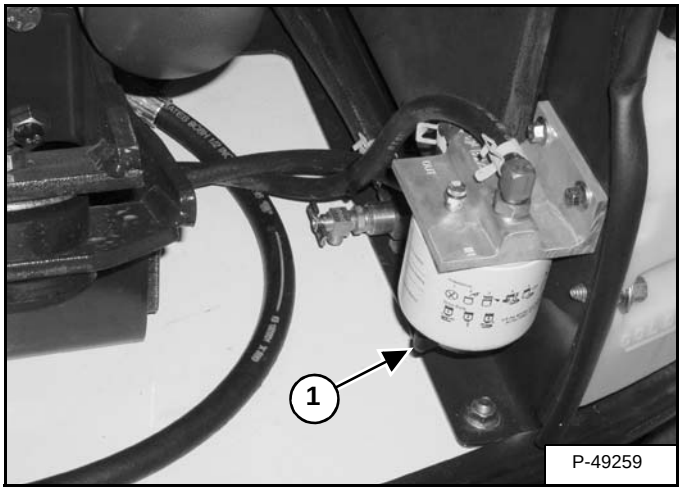
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Removing Water From The Fuel Filter

Open the tailgate.

Figure 10-80-2



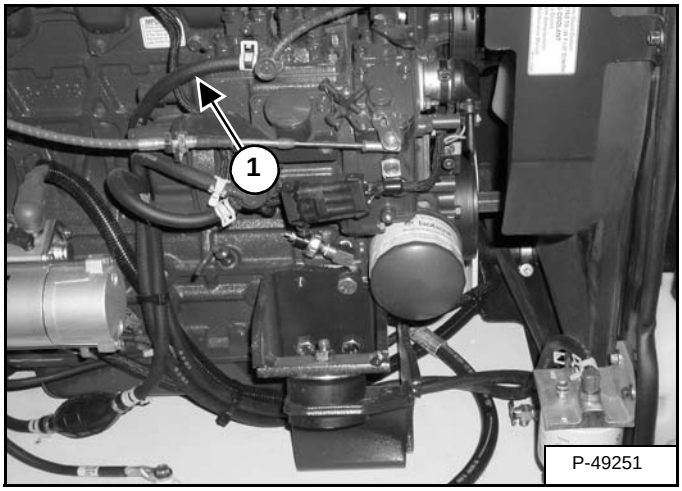
Loosen the drain (Item 1) **[Figure 10-80-2]** at the bottom of the filter to drain water from the filter.

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

Draining The Fuel Tank

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

Figure 10-80-3



Remove the hose (Item 1) **[Figure 10-80-3]** from the fuel injection pump. Route the hose to the bottom of the engine compartment and out the tailgate.

Drain the fuel into a container.

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

⚠ 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.

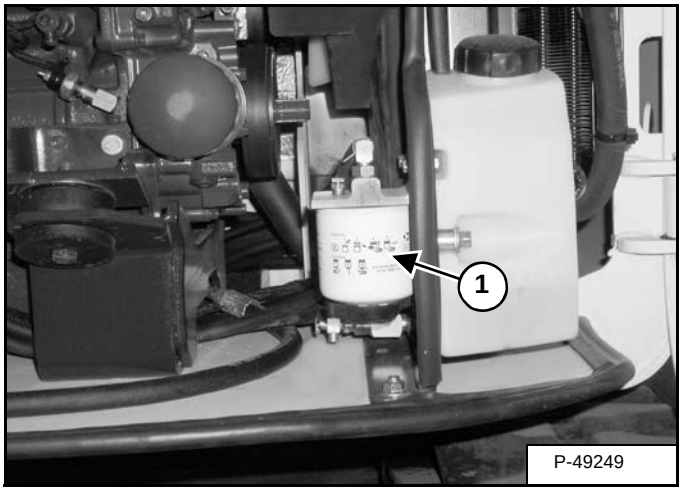
W-2072-0496

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Fuel Filter

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

Figure 10-80-4



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

Clean the area around the filter housing.

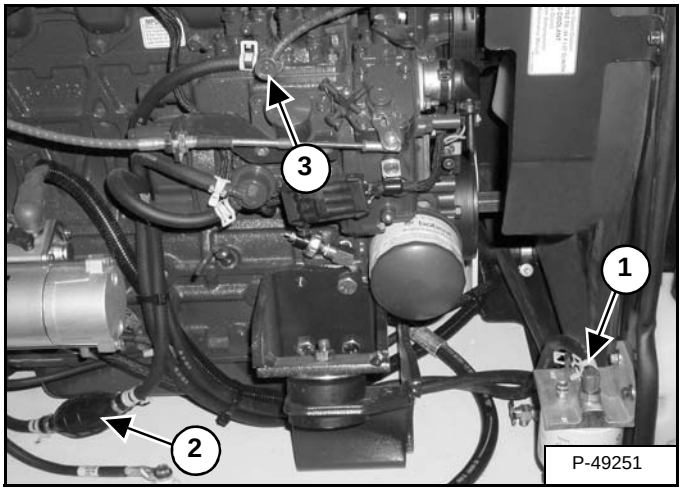
Put oil on the seal of the new filter.

Install the fuel filter, and hand tighten.

Removing Air From The Fuel System

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

Figure 10-80-5



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

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

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

⚠ WARNING

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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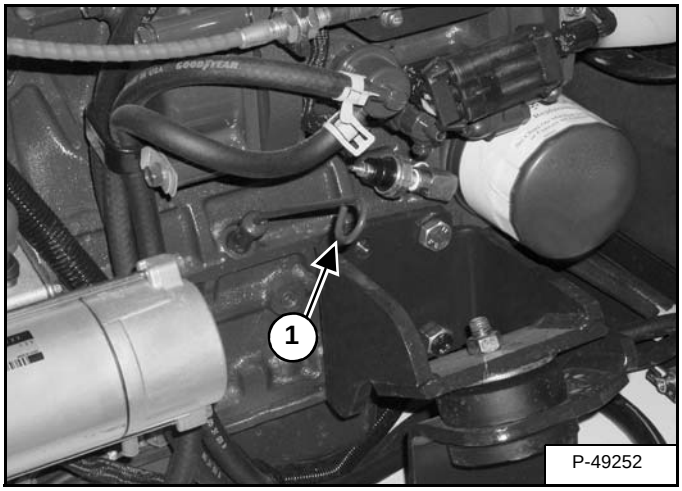
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ENGINE LUBRICATION SYSTEM

Checking Engine Oil

Check the engine oil after every 8-10 hours of operation and before starting the engine.

Figure 10-90-6



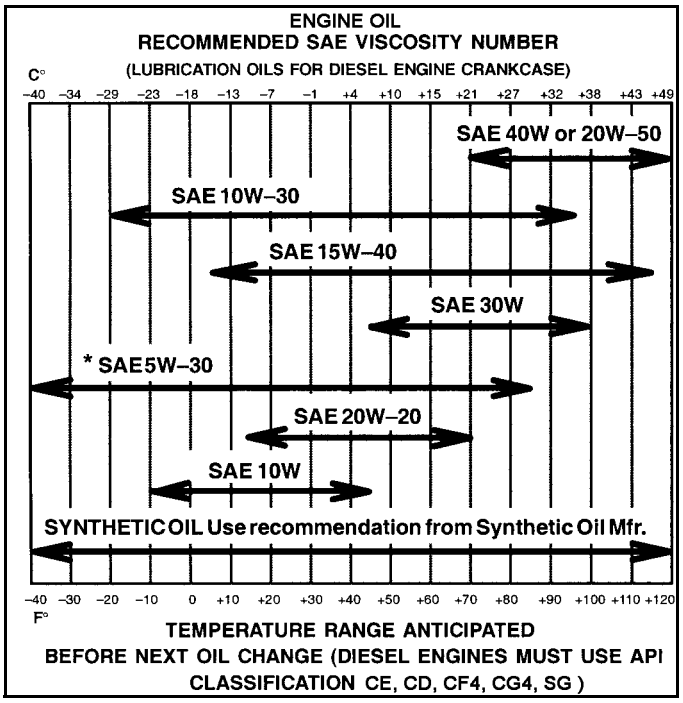
Open the tailgate and remove the dipstick (Item 1) **[Figure 10-90-6]**.

Keep the oil level between the marks on the dipstick.

Use a good quality motor oil that meets the correct API Service Classification.

Oil Chart

Figure 10-90-7



Use a good quality motor oil that meets the correct API Service Classification. See oil chart **[Figure 10-90-7]**.

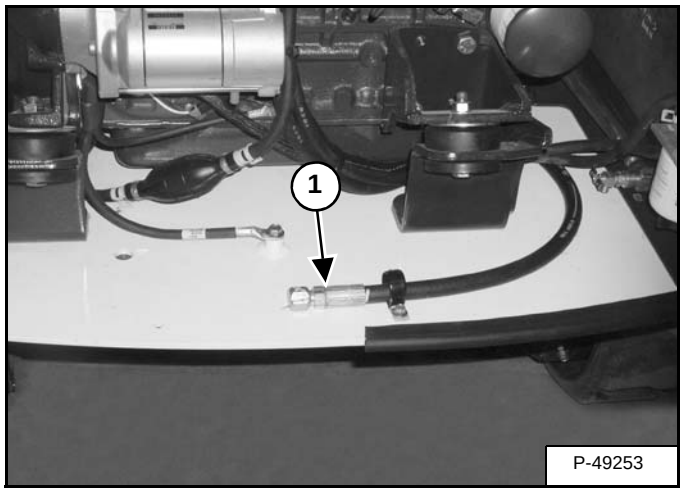
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Replacing Oil And Filter

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

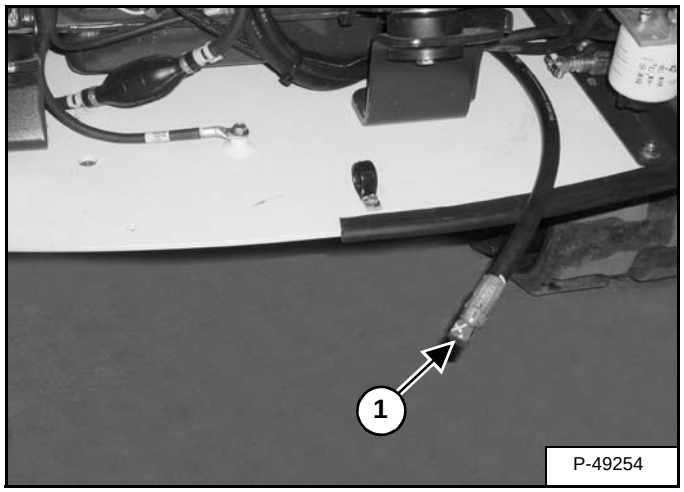
Run the engine until it is at operating temperature. Stop the engine.

Figure 10-90-8



Remove the drain hose (Item 1) **[Figure 10-90-8]** from the storage position.

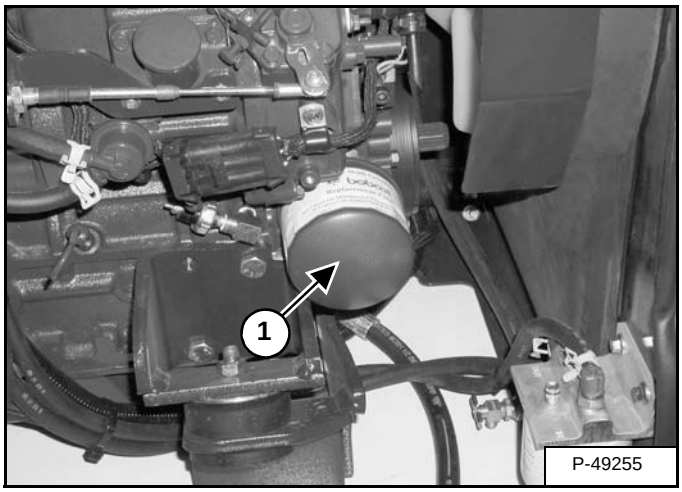
Figure 10-90-9



Remove the cap (Item 1) **[Figure 10-90-9]**. Drain the oil into a container.

Recycle or dispose of used oil in an environmentally safe manner.

Figure 10-90-10

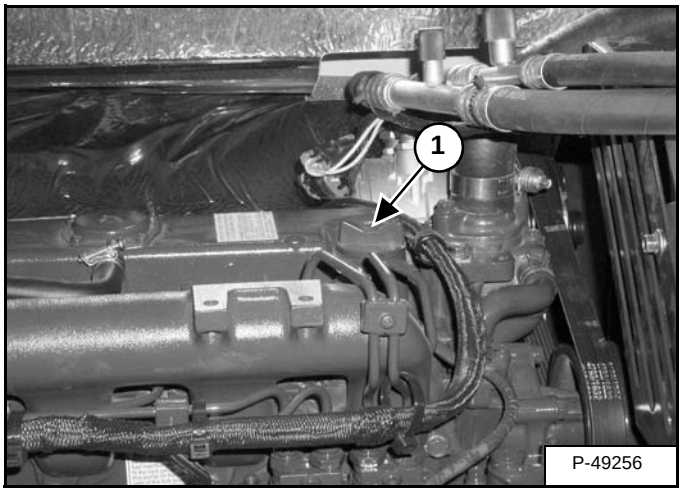


Remove the oil filter (Item 1) **[Figure 10-90-10]** and clean the filter housing surface.

Use a genuine Bobcat replacement filter. Put clean oil on the filter gasket. Install the filter and hand tighten.

Install and tighten the oil cap.

Figure 10-90-11



Remove the fill cap (Item 1) **[Figure 10-90-11]**.

Put oil in the engine. (See FUEL, COOLANT AND LUBRICANTS on Page SPEC-60-1.)

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.

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HYDRAULIC SYSTEM

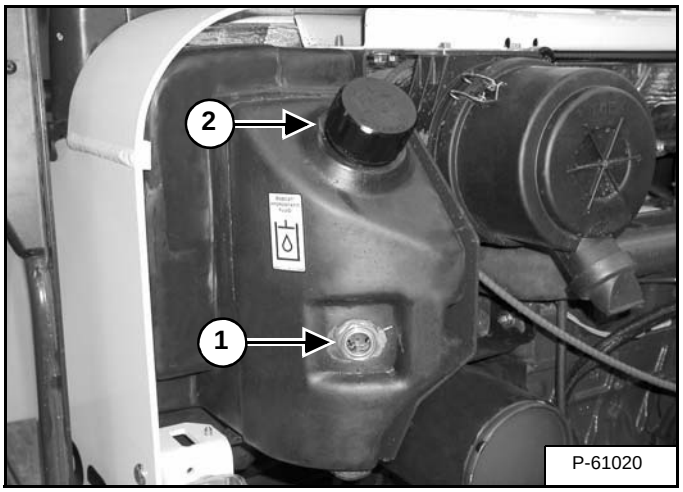
Checking And Adding Hydraulic Fluid

Put the machine on a flat level surface.

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

Open the tailgate.

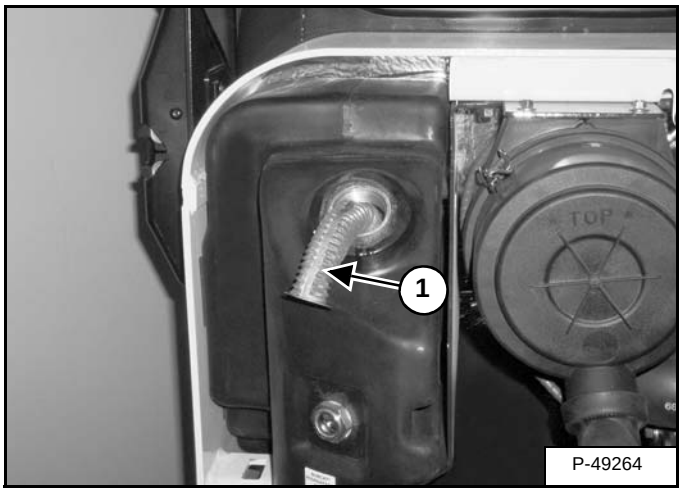
Figure 10-100-1



Check the hydraulic fluid level, it must be visible in the sight gauge (Item 1) **[Figure 10-100-1]**.

Clean the surface around the reservoir (breather) cap and remove the cap from the reservoir (Item 2) **[Figure 10-100-1]**.

Figure 10-100-2



Check the condition of the fill strainer screen (Item 1) **[Figure 10-100-2]**. Clean or replace as necessary.

Be sure the screen is installed before adding fluid.

Add the correct fluid to the reservoir until it is visible in the sight gauge. (See Specifications on Page SPEC-50-1.)

Check the cap and clean as necessary. Replace the cap if damaged.

Install the cap.

Close the tailgate.

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Replacing The Hydraulic Fluid

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

⚠ WARNING

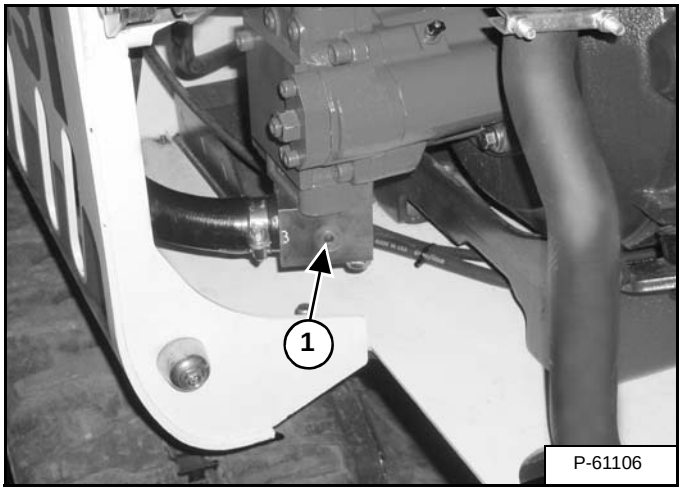
Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical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

W-2072-0496

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

Open the tailgate.

Figure 10-100-3



Remove the drain plug (Item 1) **[Figure 10-100-3]**.

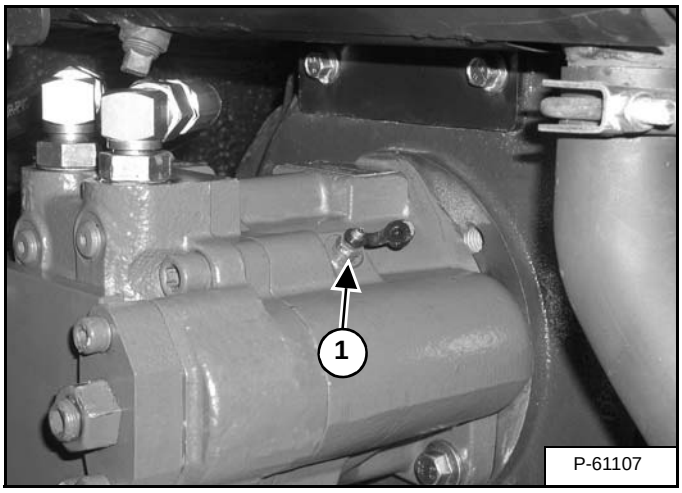
Drain the fluid into a container.

Recycle or dispose of the fluid in an environmentally safe manner.

Install the drain plug (Item 1) **[Figure 10-100-3]**.

Add fluid to the reservoir. (See Specifications on Page SPEC-50-1.)

Figure 10-100-4



Open the bleed valve (Item 1) **[Figure 10-100-4]** on the hydraulic pump. Close the valve after a steady stream of hydraulic fluid free of any air bubbles drains from the valve. Tighten the bleed valve. **DO NOT RUN THE MACHINE WITH THE BLEED VALVE OPEN.**

Start the engine and operate the machine through the hydraulic functions. Stop the engine. Check the fluid level and add as needed.

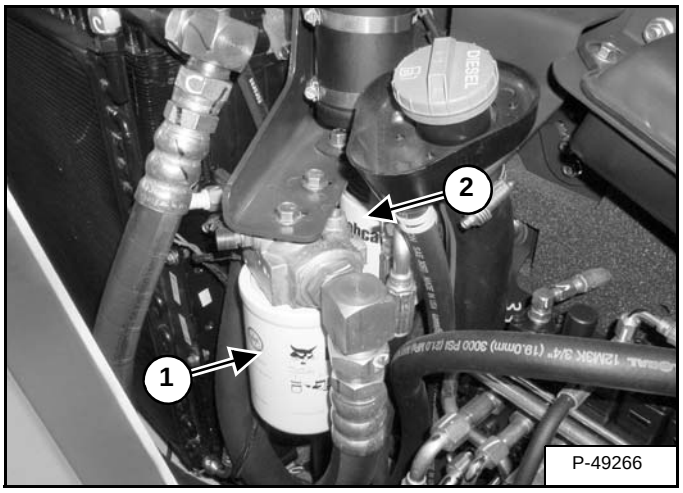
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Replacing The Hydraulic Filter

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

Open the right side cover.

Figure 10-100-5



Remove the hydraulic filter (Item 1) **[Figure 10-100-5]**.

Clean the housing where the filter gasket makes contact.

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

⚠ 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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Replacing The Case Drain Filter

Open the right side cover.

Remove the filter (Item 2) **[Figure 10-100-5]**.

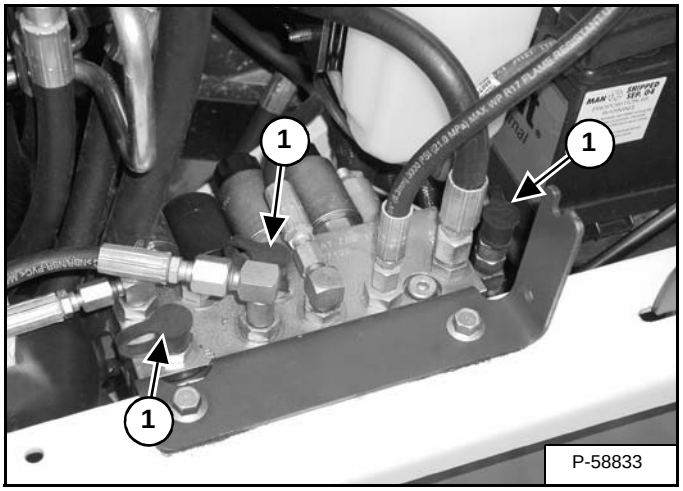
Clean the housing where the filter gasket makes contact.

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

Diagnostic Couplers

Open the right side cover.

Figure 10-100-6



Diagnostic couplers (Item 1) **[Figure 10-100-6]** are located on the hydraulic circuitry.

The couplers can be used to check circuit pressures.

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LUBRICATION OF THE HYDRAULIC EXCAVATOR

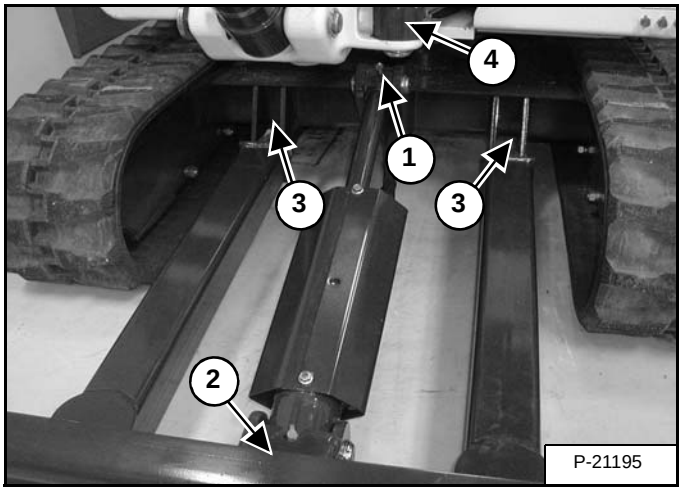
Procedure

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

Always use a good quality lithium based multipurpose grease when lubricating the machine. Apply the lubricant until extra grease shows.

Lubricate the following locations on the excavator EVERY 8-10 HOURS:

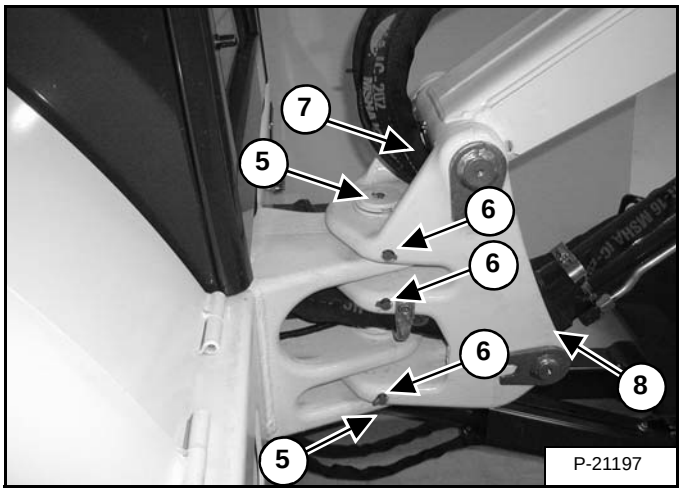
Figure 10-110-1



Ref Description (# of Fittings)

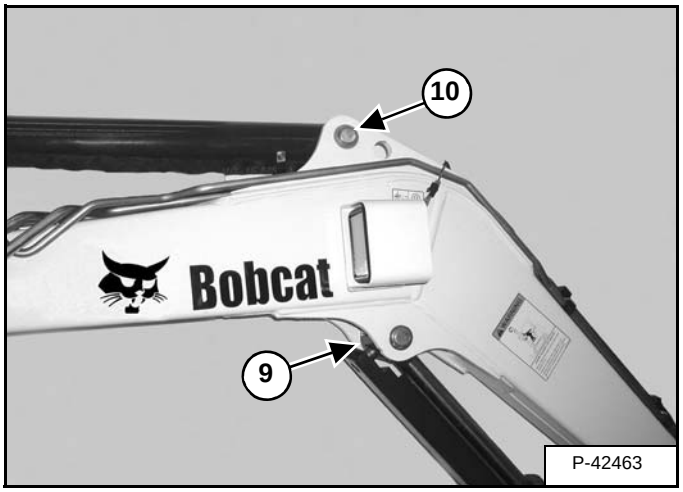
1. Blade Cylinder Rod End (1) **[Figure 10-110-1]**
2. Blade Cylinder Base End (1) **[Figure 10-110-1]**
3. Blade Pivots (2) **[Figure 10-110-1]**
4. Boom Swing Cylinder Rod End (1) **[Figure 10-110-1]**

Figure 10-110-2



5. Boom Swing Pin (2) **[Figure 10-110-2]**
6. Boom Swing Pivot (3) **[Figure 10-110-2]**
7. Boom Pivot (1) **[Figure 10-110-2]**
8. Boom Cylinder Base End (1) **[Figure 10-110-2]**

Figure 10-110-3

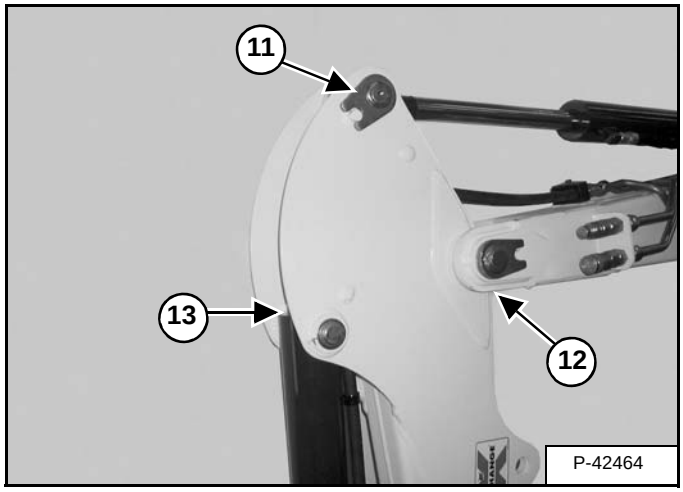


9. Boom Cylinder Rod End (1) **[Figure 10-110-3]**
10. Arm Cylinder Base End (1) **[Figure 10-110-3]**

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Procedure (Cont'd)

Figure 10-110-4

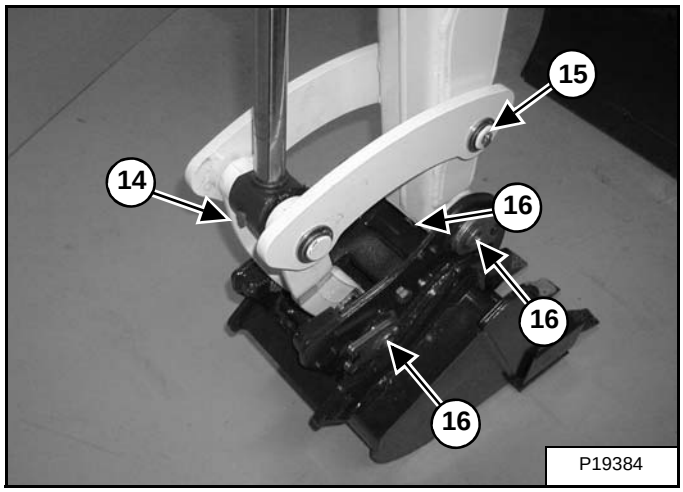


11. Arm Cylinder Rod End (1) **[Figure 10-110-4]**

12. Arm Pivot (1) **[Figure 10-110-4]**

13. Bucket Cylinder Base End (1) **[Figure 10-110-4]**

Figure 10-110-5

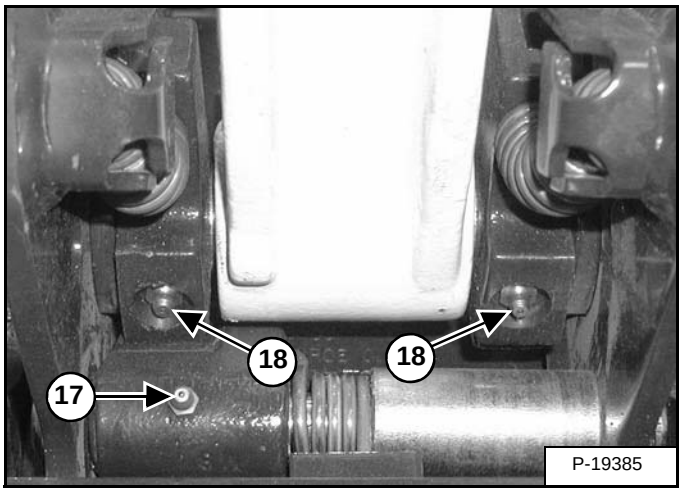


14. Bucket Cylinder Rod End (1) **[Figure 10-110-5]**

15. Bucket Link Pin (1) **[Figure 10-110-5]**

16. Bucket Pivot (3) **[Figure 10-110-5]**

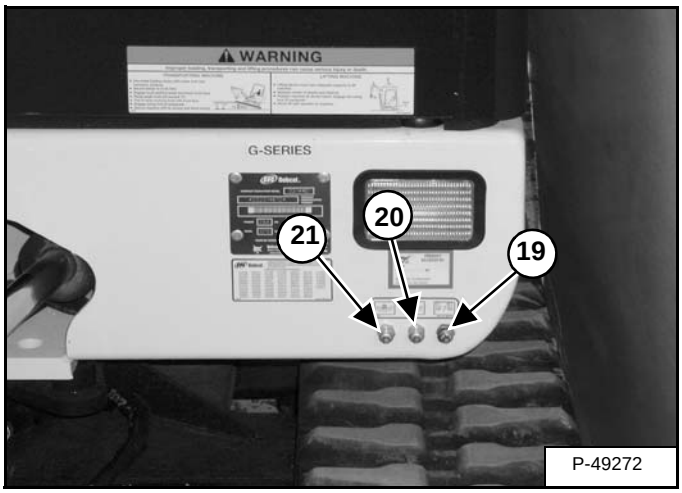
Figure 10-110-6



17. X-Change Latch (1) **[Figure 10-110-6]**

18. X-Change Pivot Pin (2) **[Figure 10-110-6]**

Figure 10-110-7



19. Boom Swing Cylinder Base End (1) **[Figure 10-110-7]**

Lubricate the following locations on the hydraulic excavator **EVERY 50 HOURS**:

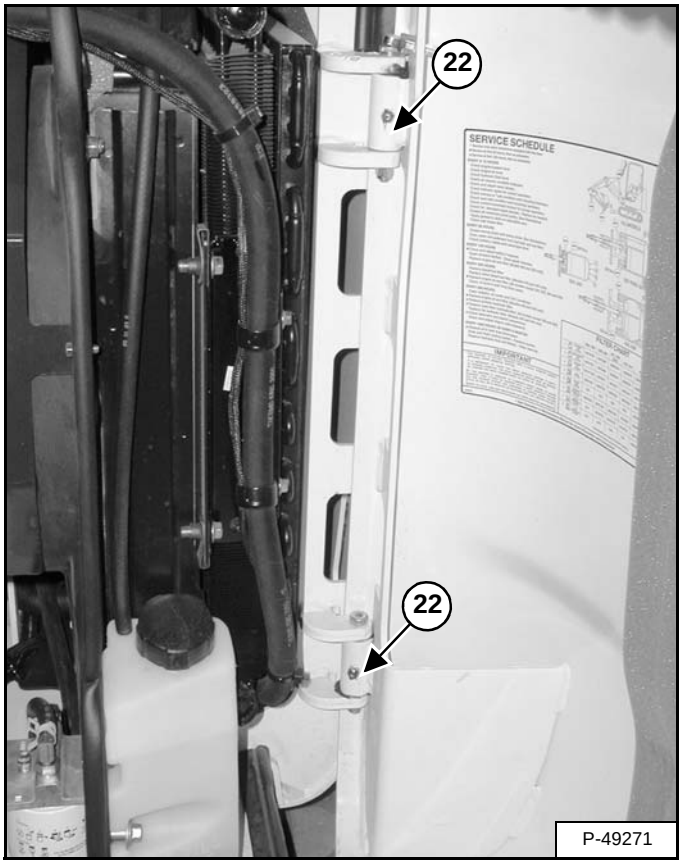
20. Slew Circle (1) **[Figure 10-110-7]**

21. Swing Pinion (1) **[Figure 10-110-7]** (Install 3 to 4 pumps of grease then rotate the upperstructure 90°. Install 3 to 4 pumps of grease and again rotate the upperstructure 90°. Repeat this until the slew pinion has been greased at four positions.)

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Procedure (Cont'd)

Figure 10-110-8



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

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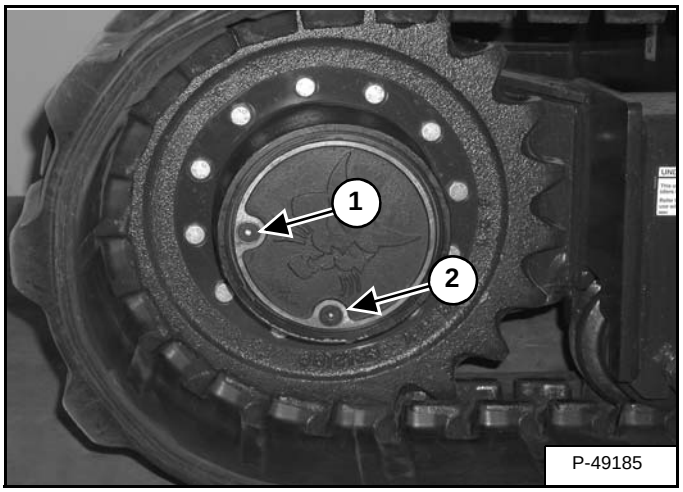


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TRAVEL MOTOR

Checking Oil Level

Figure 10-120-1



Park the excavator on a level surface with the plugs (Items 1 & 2) **[Figure 10-120-1]** in the position as shown.

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

Add lubricant through the hole if the lube level is low. (See FUEL, COOLANT AND LUBRICANTS on Page SPEC-60-1.)

Draining The Travel Motor

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

Park the excavator on a level surface with plugs (Item 1 & 2) **[Figure 10-120-1]** in the position shown. Remove both plugs and drain the lubricant into a container.

⚠ 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

Install the bottom plug (Item 2) **[Figure 10-120-1]**). Add lubricant through the top hole until the lube level is at the bottom edge of the hole. (See FUEL, COOLANT AND LUBRICANTS on Page SPEC-60-1.)

Install the plug (Item 1) **[Figure 10-120-1]**.

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SPARK ARRESTOR MUFFLER

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

Do not operate the excavator with a defective exhaust system.

IMPORTANT

This excavator is factory equipped with a U.S.D.A. Forestry Service approved spark arrestor muffler. It is necessary to do maintenance on this spark arrestor muffler to keep it in working condition. The spark arrestor muffler must be serviced by dumping the spark chamber every 100 hours of operation.

If this machine is operated on flammable forest, brush or grass covered land, it must be equipped with a spark arrestor attached to the exhaust system and maintained in working order. Failure to do so will be in violation of California State Law, Section 4442 PRC.

Make reference to local laws and regulations for spark arrestor requirements.

I-2061-0195

⚠ WARNING

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

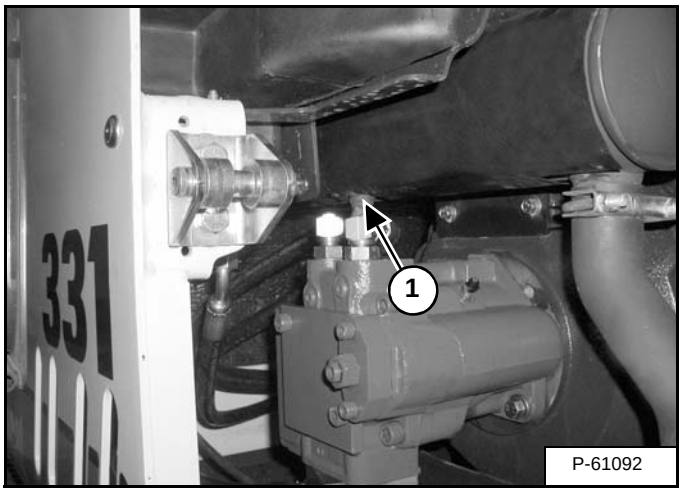
Failure to do so can cause injury or death.

W-2203-0595

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 10 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 plug hole (Item 1) **[Figure 10-130-1]**.

Stop the engine. Install and tighten the plug.

Close the tailgate.

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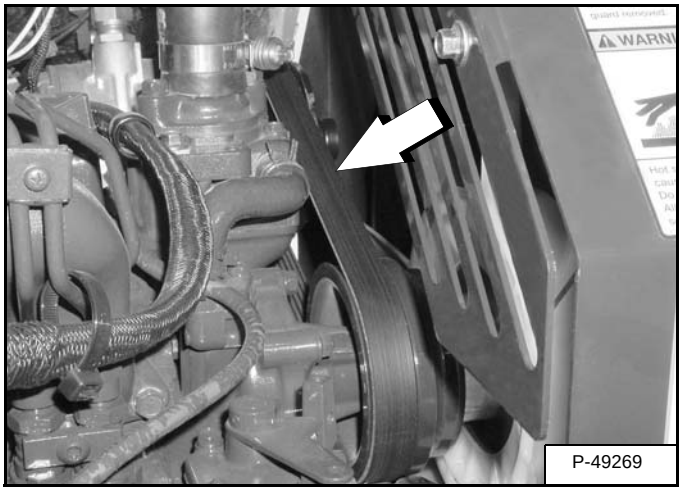
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ENGINE ACCESSORY DRIVE BELT

Belt Tension

Open the tailgate.

Figure 10-140-1



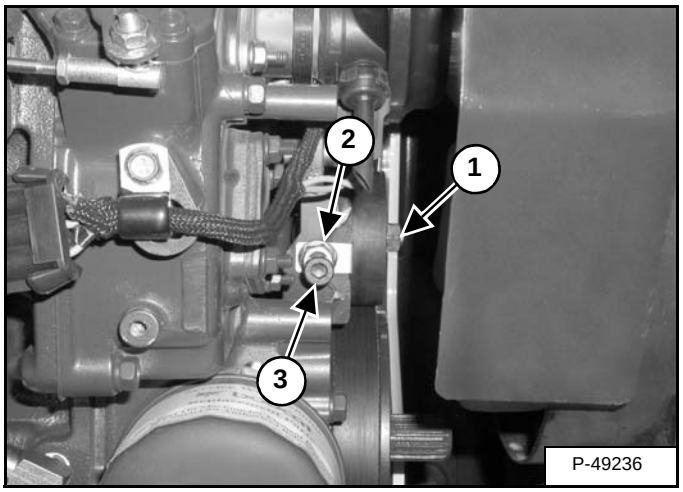
Using a belt tension gauge, measure the belt tension midway between the crankshaft pulley and alternator pulley **[Figure 10-140-1]**.

Belt tension is as follows:

New belt 107-114 ft.-lbs (145-155 Nm)
Used belt 92-99 ft.-lbs. (125-134 Nm)

Belt Adjustment

Figure 10-140-2



Loosen the nut (Item 1) on the belt idler pulley. Loosen the nut (Item 2) and tighten the bolt (Item 3) **[Figure 10-140-2]** until the belt tension is correct.

Tighten the nut (Item 1) to 29-37 ft.-lbs. (40-50 Nm) torque. Tighten the nut (Item 2) **[Figure 10-140-2]** to 15-18 ft.-lbs. (20-25 Nm) torque.

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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.

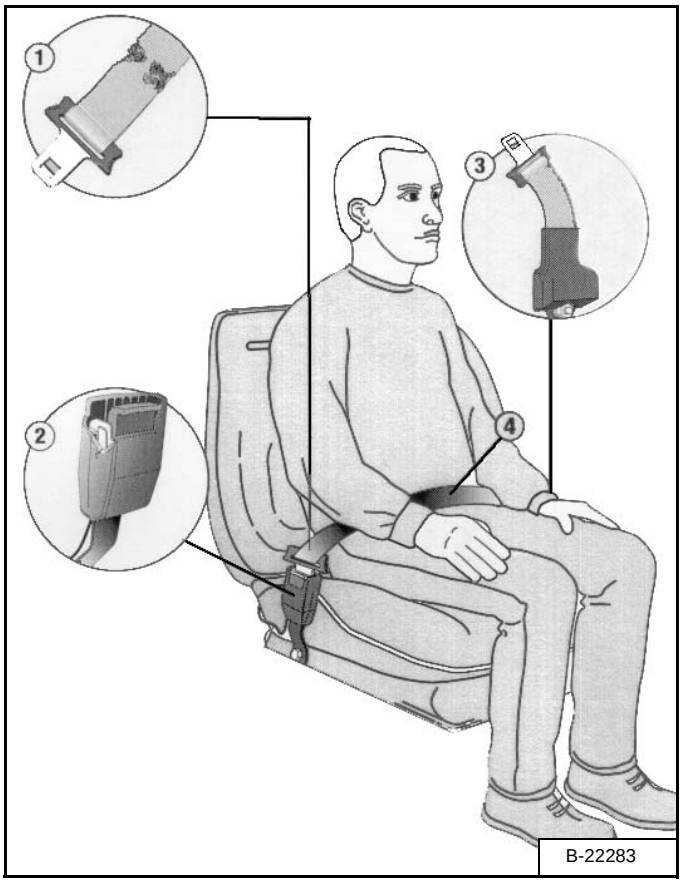
W-2466-0703

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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Parts Identification 20-70-2
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HYDRAULIC/HYDROSTATIC SCHEMATIC
331 S/N 234313000 - 234316876
331E S/N 234412000 - 234413318
334 S/N 234513000 - 234515532

(PRINTED MARCH 2007)
V-0633legend

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LEGEND

1. HYDRAULIC RESERVOIR: Pressurized with Fill Strainer
   Reservoir Capacity . .31.2 qt. (29.5 L)
2. PRESSURIZED BREATHER/FILL CAP with FILTER:
   5 PSI (3.4 bar) - Outlet
   0.435 PSI (0.3 bar) - Inlet
3. HYDRAULIC FILTER - with By-Pass
   Element - 15 Micron
   By-Pass - 50 PSI (3.44 bar)
4. CASE DRAIN FILTER - with By-Pass
   Element - 40 Micron
   By-Pass - 25 PSI (1.72 bar)
5. TRAVEL MOTOR SPOOL
6. VALVE - 2-Speed
7. PRESSURE REDUCING VALVE:
   435 PSI (30 bar)
8. TEST PORT - "P1" PORT - System Pressure
9. TEST PORT - "B" PORT - Joystick Pilot Pressure
10. TEST PORT - "G" PORT - Pressure Reducing Valve
11. ACCUMULATOR - 165 PSI (11,4 bar)
12. HYDRAULIC PUMP . . . . . Two Section - Variable Displacement Piston Pump
    Section A1 & A2:
    10.1 GPM (38,4 L/min.) at 2600 Engine RPM
13. RELIEF VALVE - Cross Port:
    3050 PSI (211 bar)
14. ORIFICE - 0.065 inch (1,65 mm)
15. SHUTTLE ORIFICE - 0.031 inch (0,79 mm)
16. MAIN RELIEF VALVE:
    3480 PSI (240 bar)
17. SHUTTLE ORIFICE - 0.022 inch (0,56 mm)
18. LOAD SENSE BLEED VALVE
19. RELIEF VALVE:
    218 PSI (15 bar)
20. RELIEF VALVE - PORT:
    2610 PSI (180 bar)
21. RELIEF VALVE - PORT:
    2610 PSI (180 bar)
22. ANTI-CAVITATION VALVE
23. ANTI-CAVITATION VALVE
24. RELIEF VALVE - PORT:
    3915 PSI (270 bar)
25. RELIEF VALVE - PORT:
    3915 PSI (270 bar)
26. RELIEF VALVE - PORT:
    3625 PSI (250 bar)
27. RELIEF VALVE - PORT:
    3625 PSI (250 bar)
28. RELIEF VALVE - PORT:
    3915 PSI (270 bar)
29. RELIEF VALVE - PORT:
    3915 PSI (270 bar)
30. RELIEF VALVE - PORT:
    3915 PSI (270 bar)
31. TEST PORT - Pump Pressure
32. SHUTTLE ORIFICE - 0.096 inch (2,44 mm)
    Model 331E ONLY
33. ORIFICE - Straight Travel
34. CHECK VALVE
35. COMPENSATOR
36. LOAD CHECK
37. CROSS PORT RELIEF VALVES (Travel Motor)
38. AUXILIARY DIRECT TO TANK (Optional)
39. AUXILIARY QUICK COUPLERS
40. ORIFICE - 0.082 inch (2,10 mm)
41. ORIFICE - 0.108 inch (2,74 mm)

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

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HYDRAULIC/HYDROSTATIC SCHEMATIC

331 S/N 234313000 - 234316876
331E S/N 234412000 – 234413318
334 S/N 234513000 - 234515532

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R.H. TRAVEL MOTOR

L.H. TRAVEL MOTOR

CENTER SWIVEL JOINT

BLADE CYLINDER

BUCKET CYLINDER

ARM CYLINDER

BOOM CYLINDER

EXTENDIBLE ARM CYLINDER (IF EQUIPPED)

BOOM SWING CYLINDER

LOCKING VALVE

TRVL RH

TRVL LH

BLADE

SLEW

AUX 2

BUCKET

ARM

BOOM

BOOM SWING

AUX 1

US OPTION
ISO/STD CONVERTER
(ISO SHOWN)

RH JOYSTICK

LH JOYSTICK

TRAVEL JOYSTICK

HYDRAULIC PUMP

OIL COOLER

PRESSURIZED BREATHER

RESERVOIR

MAIN FILTER WITH BY-PASS

CASE DRAIN FILTER WITH BY-PASS

SLEW MOTOR

- ENCLOSURE
- PUMP SUPPLY
- WORKING CIRCUITS
- PILOT PRESSURE
- SYSTEM RETURN LINES
- DIRECT TANK RETURN
- LOAD SENSE

INTERSECTION OF HYDRAULIC LINES INDICATED BY JUNCTION DOT

V-0633 (3-14-07)

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HYDRAULIC/HYDROSTATIC SCHEMATIC
331 S/N 234316877 AND ABOVE
331E S/N 234413319 AND ABOVE
334 S/N 234515533 AND ABOVE

(PRINTED MARCH 2007)
V-0892legend

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LEGEND

1. HYDRAULIC RESERVOIR: Pressurized with Fill Strainer
   Reservoir Capacity . .31.2 qt. (29.5 L)
2. PRESSURIZED BREATHER/FILL CAP with FILTER:
   5 PSI (3.4 bar) - Outlet
   0.435 PSI (0.3 bar) - Inlet
3. HYDRAULIC FILTER - with By-Pass
   Element - 15 Micron
   By-Pass - 50 PSI (3.44 bar)
4. CASE DRAIN FILTER - with By-Pass
   Element - 40 Micron
   By-Pass - 25 PSI (1.72 bar)
5. TRAVEL MOTOR SPOOL
6. VALVE - 2-Speed
7. PRESSURE REDUCING VALVE:
   435 PSI (30 bar)
8. TEST PORT - "P1" PORT - System Pressure
9. TEST PORT - "B" PORT - Joystick Pilot Pressure
10. TEST PORT - "G" PORT - Pressure Reducing Valve
11. ACCUMULATOR - 165 PSI (11,4 bar)
12. HYDRAULIC PUMP . . . . . Two Section - Variable Displacement Piston Pump
    Section A1 & A2:
    10.1 GPM (38,4 L/min.) at 2600 Engine RPM
13. RELIEF VALVE - Cross Port:
    3050 PSI (211 bar)
14. ORIFICE - 0.065 inch (1,65 mm)
15. SHUTTLE ORIFICE - 0.031 inch (0,79 mm)
16. MAIN RELIEF VALVE:
    3480 PSI (240 bar)
17. SHUTTLE ORIFICE - 0.022 inch (0,56 mm)
18. LOAD SENSE BLEED VALVE
19. RELIEF VALVE:
    218 PSI (15 bar)
20. RELIEF VALVE - PORT:
    2610 PSI (180 bar)
21. RELIEF VALVE - PORT:
    2610 PSI (180 bar)
22. ANTI-CAVITATION VALVE
23. ANTI-CAVITATION VALVE
24. RELIEF VALVE - PORT:
    3915 PSI (270 bar)
25. RELIEF VALVE - PORT:
    3915 PSI (270 bar)
26. RELIEF VALVE - PORT:
    3625 PSI (250 bar)
27. RELIEF VALVE - PORT:
    3625 PSI (250 bar)
28. RELIEF VALVE - PORT:
    3915 PSI (270 bar)
29. RELIEF VALVE - PORT:
    3915 PSI (270 bar)
30. RELIEF VALVE - PORT:
    3915 PSI (270 bar)
31. TEST PORT - Pump Pressure
32. SHUTTLE ORIFICE - 0.096 inch (2,44 mm)
    Model 331E ONLY
33. ORIFICE - Straight Travel
34. CHECK VALVE
35. COMPENSATOR
36. LOAD CHECK
37. CROSS PORT RELIEF VALVES (Travel Motor)
38. AUXILIARY DIRECT TO TANK (Optional)
39. AUXILIARY QUICK COUPLERS
40. ORIFICE - 0.082 inch (2,10 mm)
41. ORIFICE - 0.108 inch (2,74 mm)
42. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (TWO COIL)
43. CHECK VALVE 80 PSI (5,5 bar)
44. CHECK VALVE – Load Sense
45. ORIFICE - 0.025 inch (0,64 mm)
46. FILTER – Hydraulic X-Change Valve

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

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HYDRAULIC/HYDROSTATIC SCHEMATIC

331 S/N 234316877 AND ABOVE
331E S/N 234413319 AND ABOVE
334 S/N 234515533 AND ABOVE

(PRINTED MARCH 2007)
V-0892

Printable Version Click Here

R.H. TRAVEL MOTOR

L.H. TRAVEL MOTOR

CENTER SWIVEL JOINT

BLADE CYLINDER

ARM CYLINDER

BOOM CYLINDER

BUCKET CYLINDER

EXTENDIBLE ARM CYLINDER (IF EQUIPPED)

DIRECT TO TANK VALVE (IF EQUIPPED)

MALE (RETURN)

FEMALE (PRESSURE)

TRVL RH

TRVL LH

BLADE

SLEW

AUX 2

BUCKET

ARM

BOOM

BOOM SWING

BOOM SWING CYLINDER

LOCKING VALVE

US OPTION
ISO/STD CONVERTER
(ISO SHOWN)

RH JOYSTICK

LH JOYSTICK

TRAVEL JOYSTICK

RIGHT

FRONT

REAR

LEFT

PWM-1

PWM-2

2-SPD

J-STK

SLEW MOTOR

HYDRAULIC PUMP

OIL COOLER

PRESSURIZED BREATHER

RESERVOIR

MAIN FILTER WITH BY-PASS

CASE DRAIN FILTER WITH BY-PASS

HYDRAULIC X-CHANGE (OPTIONAL)

ENCLOSURE
PUMP SUPPLY
WORKING CIRCUITS
PILOT PRESSURE
SYSTEM RETURN LINES
DIRECT TANK RETURN
LOAD SENSE

INTERSECTION OF HYDRAULIC LINES INDICATED BY JUNCTION DOT

V-0892 (3-14-07)

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Glossary Of Hydraulic/Hydrostatic Symbols For Excavators

GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

SYMBOL DESCRIPTION

FLOW LINES and CONNECTIONS

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

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

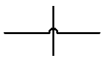
DRAIN CIRCUITS – Dotted Line – Drain Line (drain or bleed line – line conducting fluid from a component housing to the reservoir)

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

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



CONNECTED JUNCTION OF OIL LINES (Flow Line Connection)



OIL LINES CROSSING (NOT Connected)



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

SYMBOL DESCRIPTION

BASIC and MISCELLANEOUS SYMBOLS



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



VARIABLE ADJUSTMENT RESTRICTION – Regulated or Variable Restriction

TEMPERATURE CONTROL – (indication of temperature)



TEMPERATURE INDICATOR – (temperature measurement – thermometer)



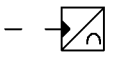
FILTER (strainer or screen) – For fluid conditioning



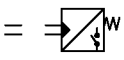
VENTED AND FILTERED RESERVOIR (reservoir open to atmosphere)



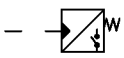
OIL COOLER (heat exchanger) – The arrows in the diamond indicate the extraction of heat (heat dissipation)



PRESSURE SENSOR – Varies electric signal with pressure



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



PRESSURE SWITCH – Switch activates when pressure reaches specified level



MUFFLER (silencer) – Reduces noise

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Glossary Of Hydraulic/Hydrostatic Symbols For Excavators (Cont'd)

GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

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 PILOT PRESSURE (indirect control, pilot actuated by application of pressure)

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Glossary Of Hydraulic/Hydrostatic Symbols For Excavators (Cont'd)

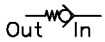
GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

SYMBOL DESCRIPTION

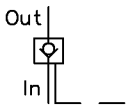
NON–RETURN VALVE, SHUTTLE VALVE: Valve which allows free flow in one direction only



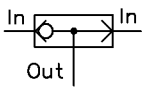
NON–RETURN VALVE (Check Valve) – Used as Replenishing Valve, Load Check Valve or Anticavitation Valve – Opens if the Inlet pressure is higher than the Outlet pressure. Often contains internal spring which has NO significant pressure value



SPRING LOADED VALVE (Bypass Valve) – Opens if the Inlet pressure is greater than the Outlet pressure plus the spring pressure



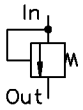
PILOT CONTROLLED NON–RETURN VALVE – It is possible to open the valve by pilot pressure



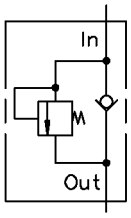
SHUTTLE VALVE – The Inlet port connected to the higher pressure is automatically connected to the Outlet port while the other Inlet port is closed

SYMBOL DESCRIPTION

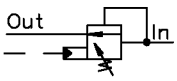
PRESSURE CONTROL VALVE: Valve ensuring the control of pressure



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.

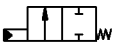
DIRECTIONAL CONTROL VALVE: Valve providing for the opening (fully or restricted) or the closing of one or more flow paths (represented by several squares)



TWO PORTS and CLOSED FLOW PATHS

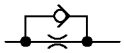


SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (Two Position) – controlled by an electric solenoid (with return spring)

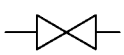


PILOT ACTIVATED DIRECTIONAL CONTROL VALVE (Two Position) – controlled by pressure (with return spring)

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

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Troubleshooting The Hydraulic Circuit

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

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Troubleshooting The Cylinder Circuit

TROUBLESHOOTING THE CYLINDER CIRCUIT		
PROBLEM	**CAUSE**	**CORRECTION**
Cylinder inoperable	Control console raised	Lower control console.
	Loose fittings or broken hoses	Repair or replace
	Low PSI at joystick	Check, repair or replace pressure reducing valve
	Lever linkage incorrectly adjusted	Readjust
	Control console lockout switch	Readjust or replace
	Cylinder internal leakage excessive	Repair or replace
	Joystick manifold pressure reducing valve defective	Repair or replace
	Joystick internal leakage excessive	Repair or replace
Cylinder for insufficient	Lever linkage incorrectly adjusted	Readjust
	Main relief valve pressure to low	Readjust or replace
	Lever linkage incorrectly adjusted	Readjust
Cylinder speed too slow	Cylinder internal leakage excessive	Repair or replace
	Joystick manifold solenoid valve defective	Repair or replace
	Joystick manifold pressure reducing valve defective	Repair or replace
	Control valve internal leakage excessive	Repair or replace
	Low tie rod torque on 3 spool & 6 spool control valves	Tighten tie rods to correct torque
	Joystick internal leakage excessive	Repair or replace
	Low or dirty fluid	Add or replace the hydraulic fluid
	Main relief valve malfunctioning	Readjust or replace

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Troubleshooting The Swing (Upperstructure Slew) Circuit

TROUBLESHOOTING THE SWING (UPPERSTRUCTURE SLEW) CIRCUIT		
PROBLEM	**CAUSE**	**CORRECTION**
Slew not operating	Control console raised Control console lock out switch incorrectly adjusted or defective	Lower control console. Readjust or replace
	Slew lock pin engaged	Disengage lock pin
	Joystick manifold pressure reducing valve defective	Repair or replace
	Slew motor gear defective	Repair or replace
	Joystick internal leakage excessive	Repair or replace
	Slew motor defective	Repair or replace
Slew force	Main relief valve set too low	Readjust or replace
	Slew motor relief valve pressure too low	Readjust or replace
Slew speed too low	Pump flow low	Check, repair or replace
	Blocked or restricted line to slew motor	Replace
	Joystick internal leakage excessive	Repair or replace
	Control valve internal leakage excessive	Repair or replace
	Slew motor internal leakage excessive	Repair or replace
Slew over run excessive	Control valve spool sticking	Repair or replace
	Joystick spool sticking	Repair or replace
	Slew motor relief valve set too low	Repair or replace
	Slew motor internal leakage excessive	Repair or replace
Slew motor seal leakage	Case drain line plugged	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 counter balance 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
	Swivel joint leaking	Repair or replace
	Travel motor counterbalance spool sticking	Repair or replace
	Lever linkage incorrectly adjusted	Readjust
Speed too slow	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
Travel motor seal leakage	Return line filter plugged	Inspect, clean 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 unaligned	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
High/low shift inoperative (2-speed)	Control valve defective	Replace
	Low pressure to 2-speed valve	Readjust

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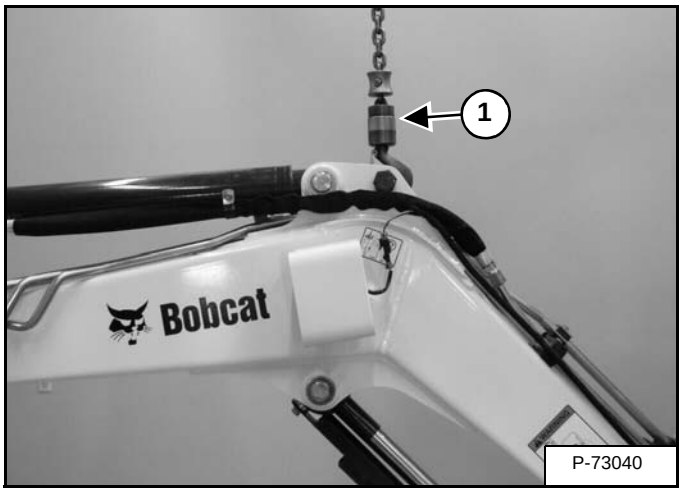
BOOM CYLINDER

Testing

Lower the boom/bucket and blade to the ground.

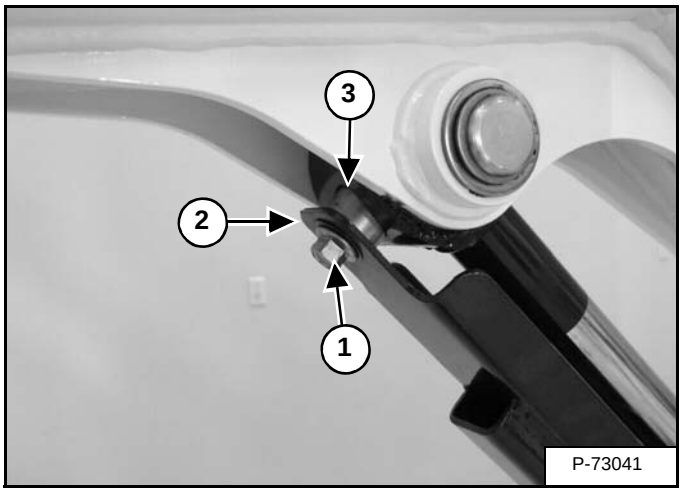
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-20-1



Support the boom with a chain hoist (Item 1) **[Figure 20-20-1]**.

Figure 20-20-2



Remove the boom shield bolt (Item 1), washer (Item 2) and spacer (Item 3) **[Figure 20-20-2]**.

Figure 20-20-3

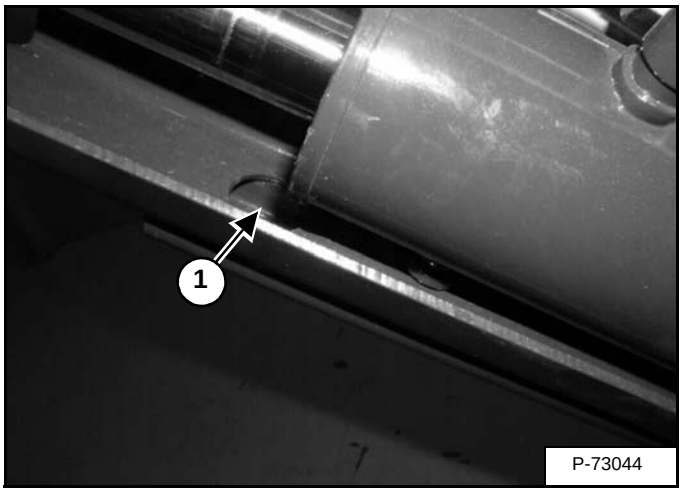
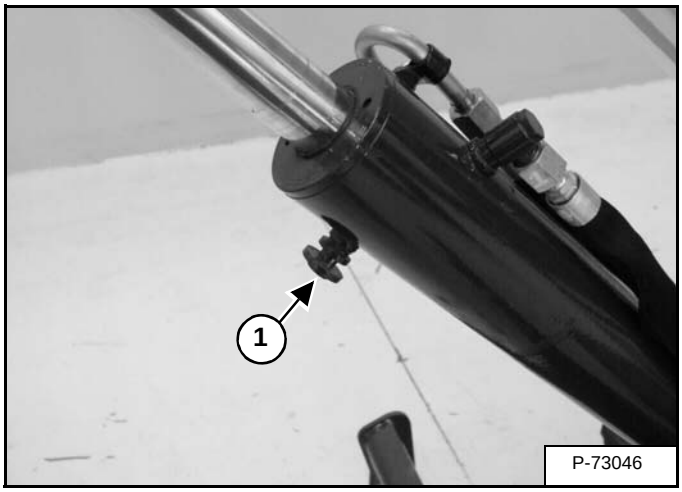


Figure 20-20-4



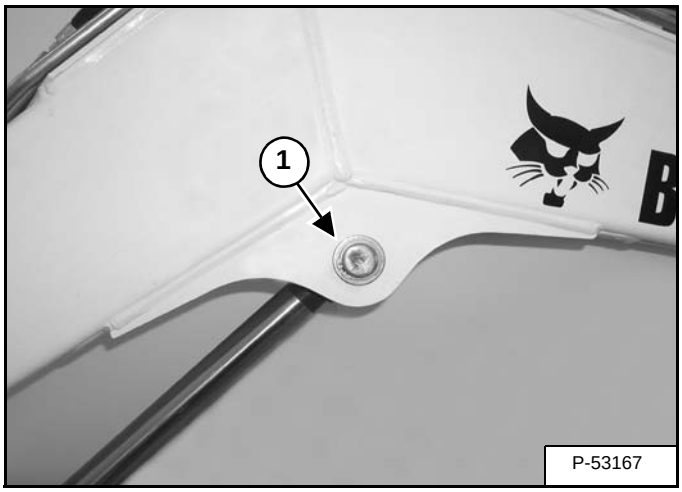
Slide the shield down until the keyhole (Item 1) **[Figure 20-20-3]** in the shield lines up with the mounting stud (Item 1) **[Figure 20-20-4]** on the cylinder.

Remove the shield.

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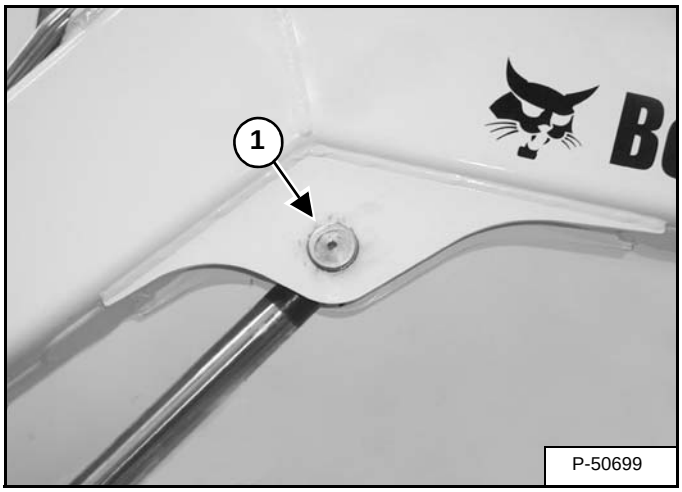
Testing (Cont'd)

Figure 20-20-5



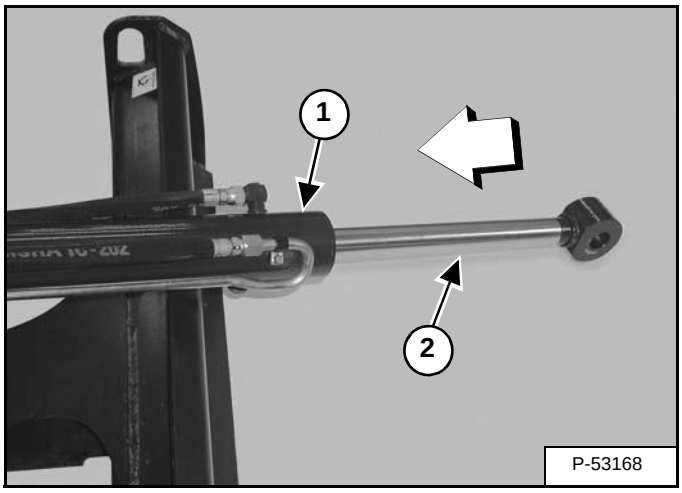
Remove the snap ring (Item 1) **[Figure 20-20-5]** and washer.

Figure 20-20-6



Remove the rod end pin (Item 1) **[Figure 20-20-6]**.

Figure 20-20-7



Lower the cylinder (Item 1) **[Figure 20-20-7]** until it rests on the blade.

Start the engine and fully retract the cylinder rod (Item 2) **[Figure 20-20-7]**.

Stop the engine. Relieve hydraulic pressure.

⚠ WARNING

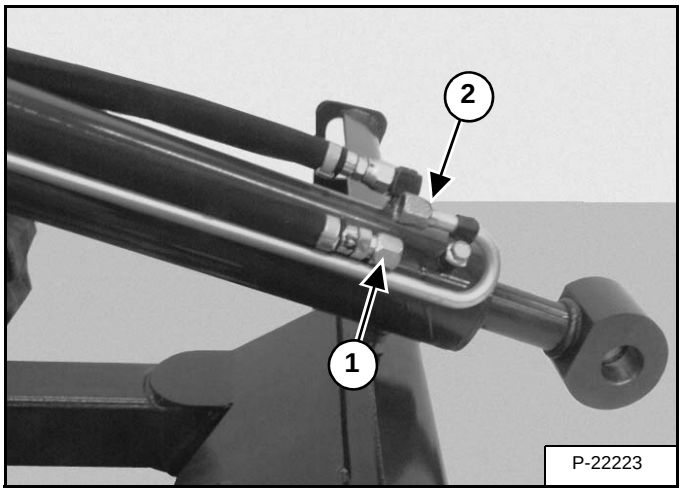
Hydraulic fluid escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. This can cause serious injury and possible death if proper medical treatment by a physician familiar with this injury is not received immediately.

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Testing (Cont'd)

Figure 20-20-8



Remove the hose from the base end of the cylinder. Cap the hose (Item 1) **[Figure 20-20-8]**.

Start the engine and retract the boom cylinder.

If there is any oil leakage from the base end fitting (Item 2) **[Figure 20-20-8]**, remove the cylinder for repair or replacement.

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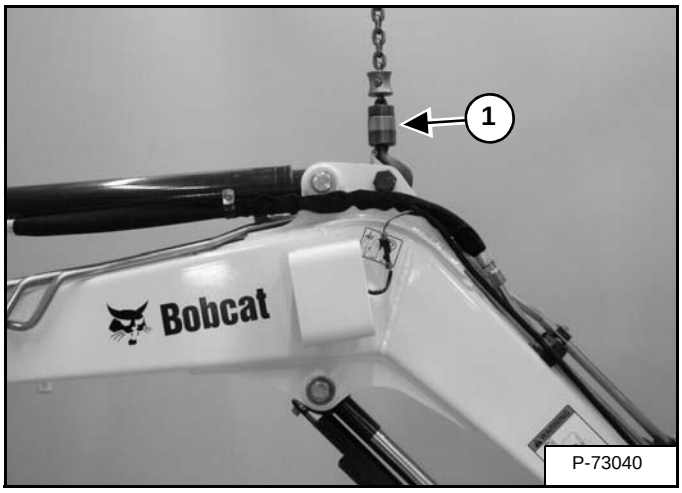
BOOM CYLINDER (CONT'D)

Removal And Installation

Lower the boom/bucket and blade to the ground.

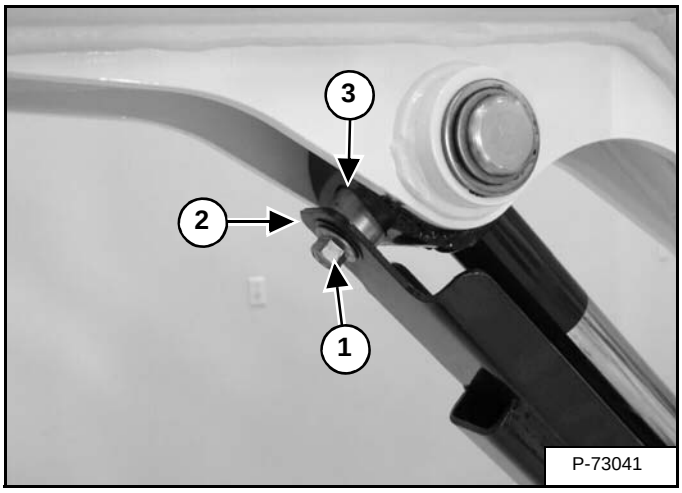
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-20-9



Support the boom with a chain hoist (Item 1) **[Figure 20-20-9]**.

Figure 20-20-10



Remove the boom shield bolt (Item 1), washer (Item 2) and spacer (Item 3) **[Figure 20-20-10]**.

Figure 20-20-11

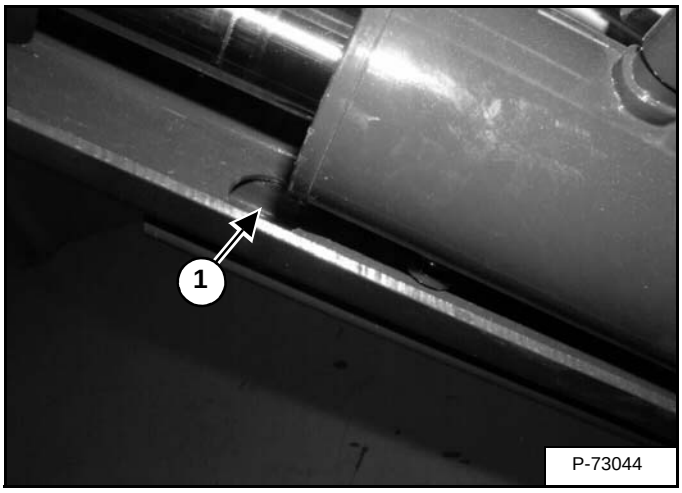
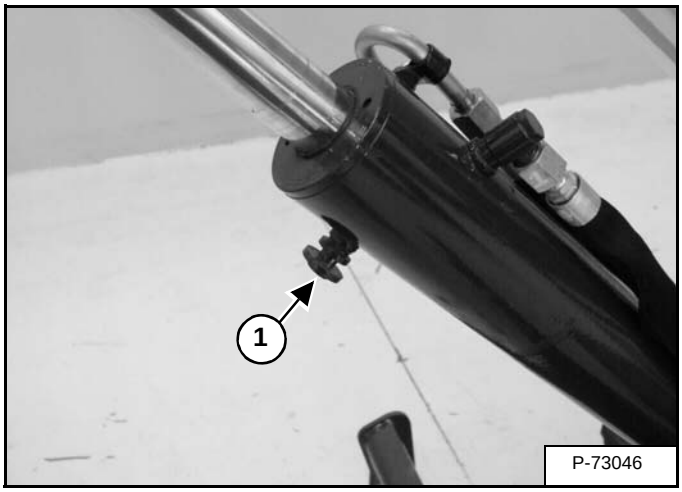


Figure 20-20-12



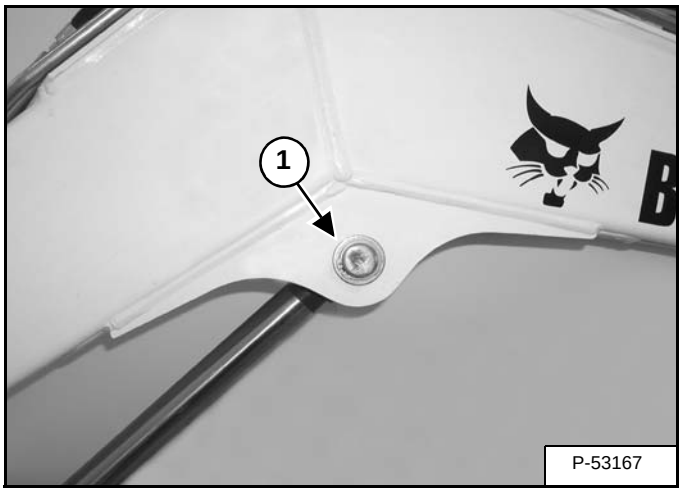
Slide the shield down until the keyhole (Item 1) **[Figure 20-20-11]** in the shield lines up with the mounting stud (Item 1) **[Figure 20-20-12]** on the cylinder.

Remove the shield.

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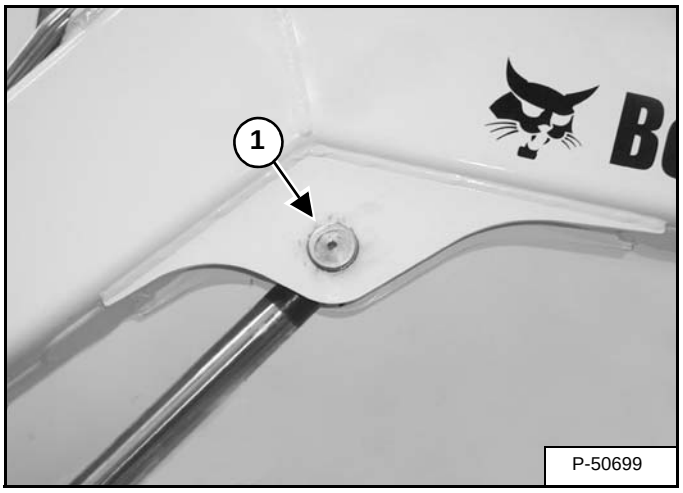
Removal And Installation (Cont'd)

Figure 20-20-13



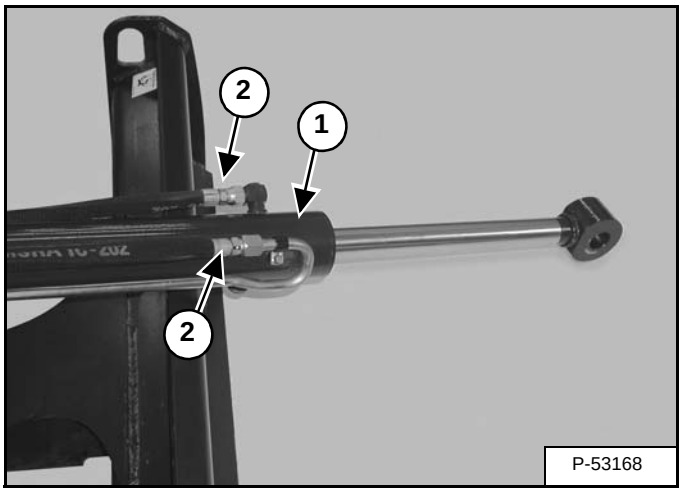
Remove the snap ring (Item 1) **[Figure 20-20-13]** and washer.

Figure 20-20-14



Remove the rod end pin (Item 1) **[Figure 20-20-14]**.

Figure 20-20-15



Lower the cylinder (Item 1) **[Figure 20-20-15]** until it rests on the blade.

Mark and remove the hoses (Item 2) **[Figure 20-20-15]**.

IMPORTANT

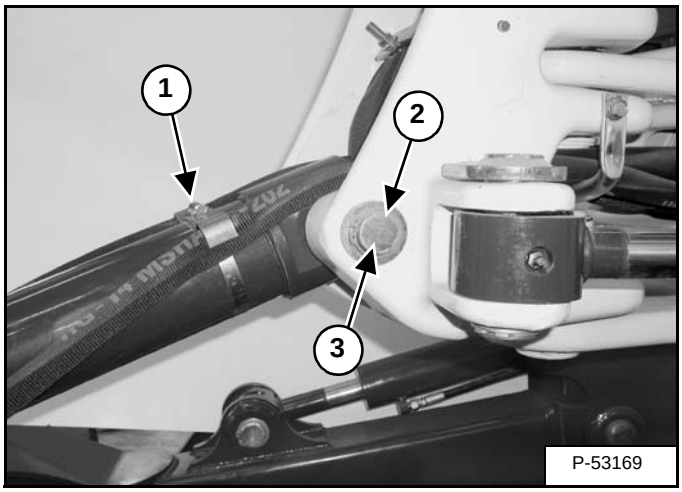
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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Removal And Installation (Cont'd)

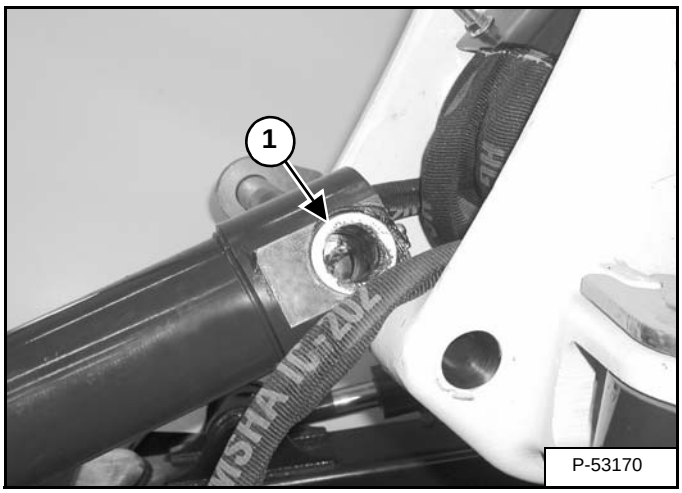
Figure 20-20-16



Loosen the cylinder hose clamp (Item 1). Remove the snap ring (Item 2) **[Figure 20-20-16]** and washer.

Remove the pin (Item 3) **[Figure 20-20-16]**.

Figure 20-20-17



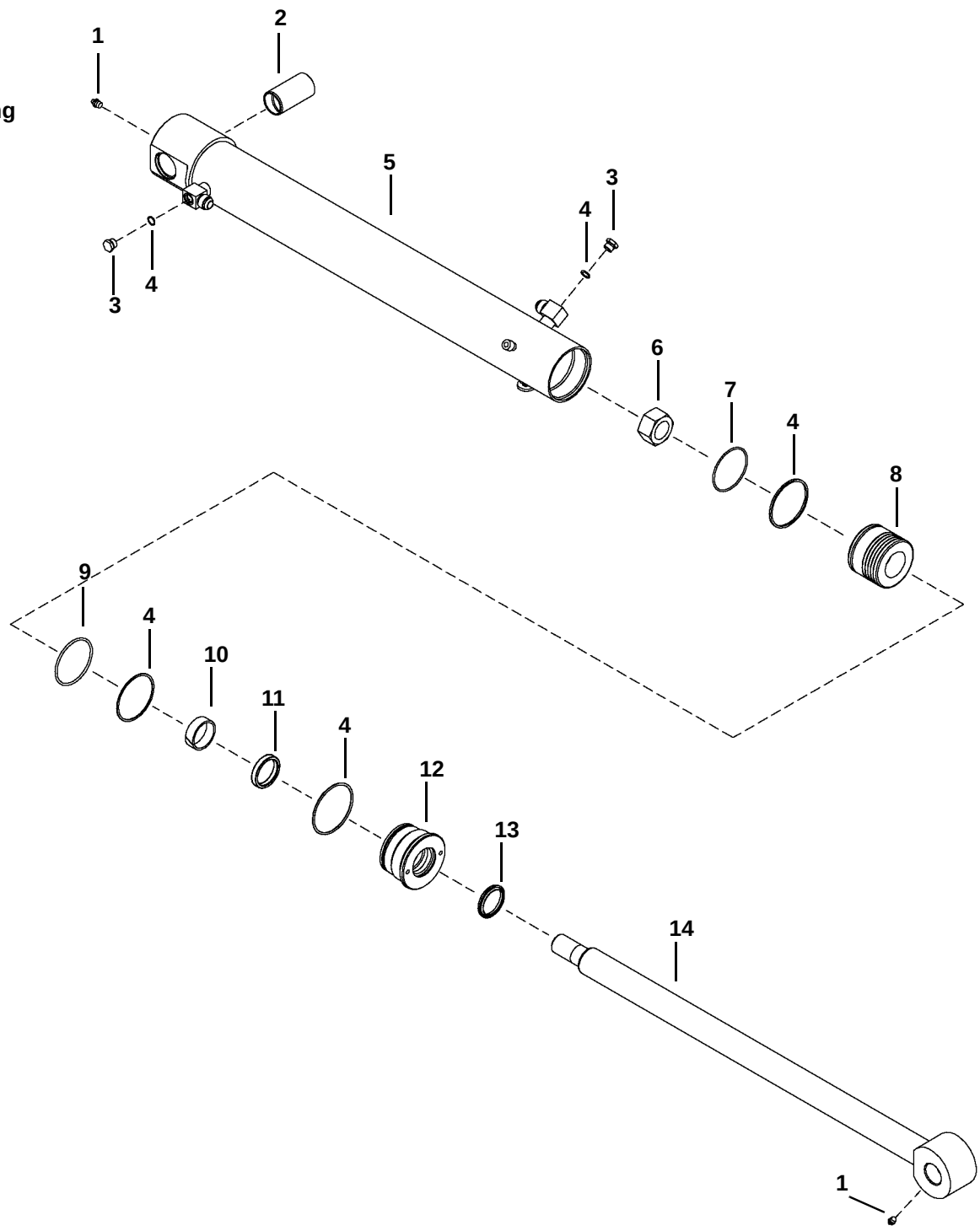
Remove the shims (Item 1) **[Figure 20-20-17]** from both sides of the cylinder.

Remove the cylinder.

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Parts Identification

1. Grease Fitting
2. Bushing
3. Plug
4. O-Ring
5. Housing
6. Nut
7. Seal
8. Piston
9. Backup Ring
10. Wear Seal
11. Rod Seal
12. Head
13. Wiper Seal
14. Rod



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Disassembly

Clean the outside of the cylinder before disassembly.

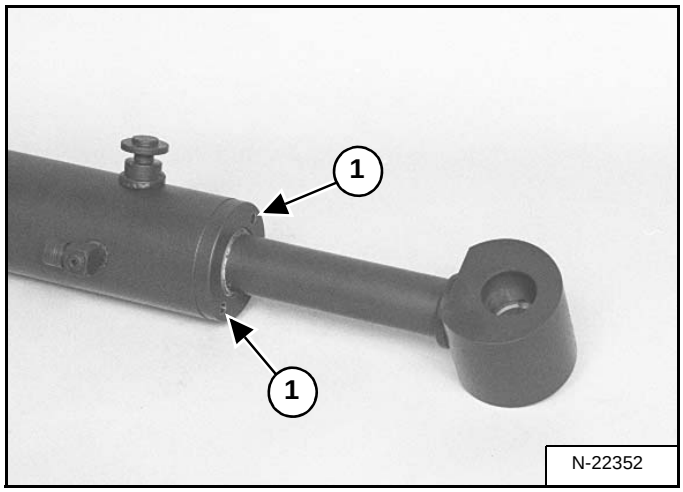
Use the following tools to disassemble the cylinder:

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.

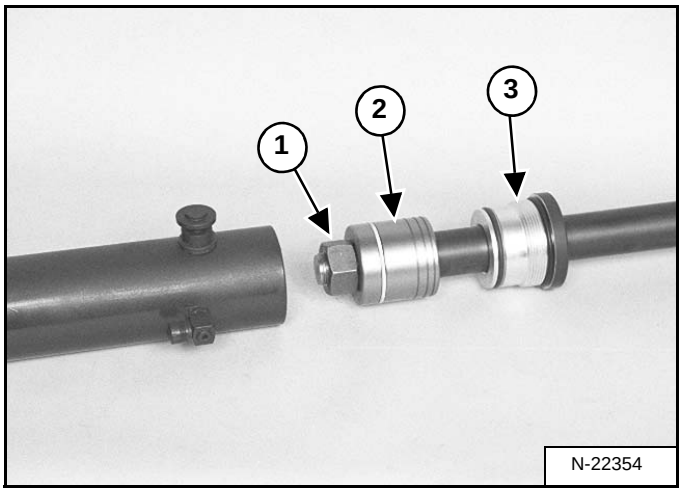
Put the base end of the cylinder in a vise.

Figure 20-20-18



Insert the adjustable gland nut wrench into the holes (Item 1) **[Figure 20-20-18]** to loosen the head.

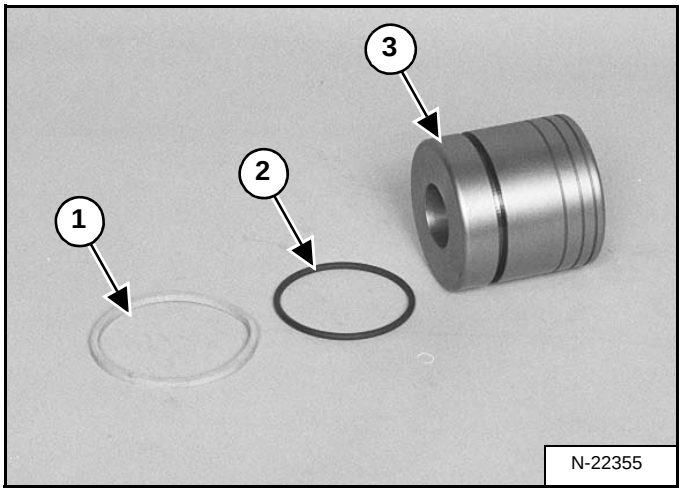
Figure 20-20-19



Remove the head and the rod assembly from the cylinder **[Figure 20-20-19]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-20-19]**.

Figure 20-20-20

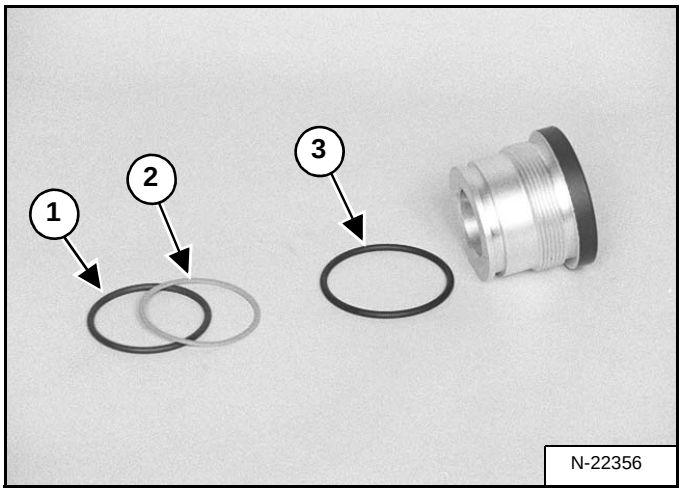


Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-20-20]**.

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Disassembly (Cont'd)

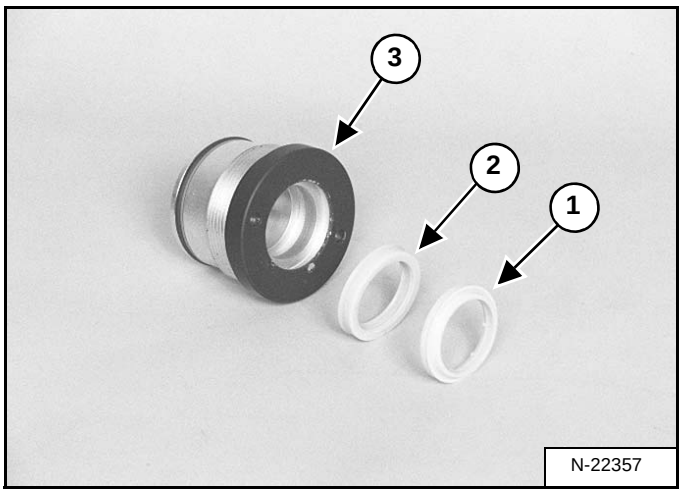
Figure 20-20-21



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

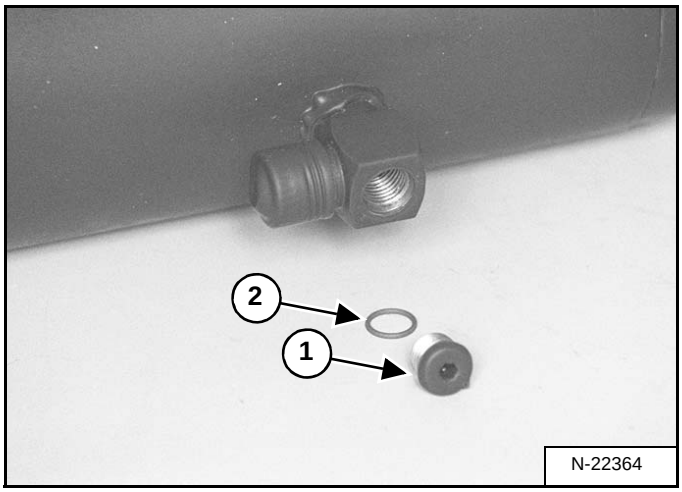
Remove the O-ring (Item 3) **[Figure 20-20-21]**.

Figure 20-20-22



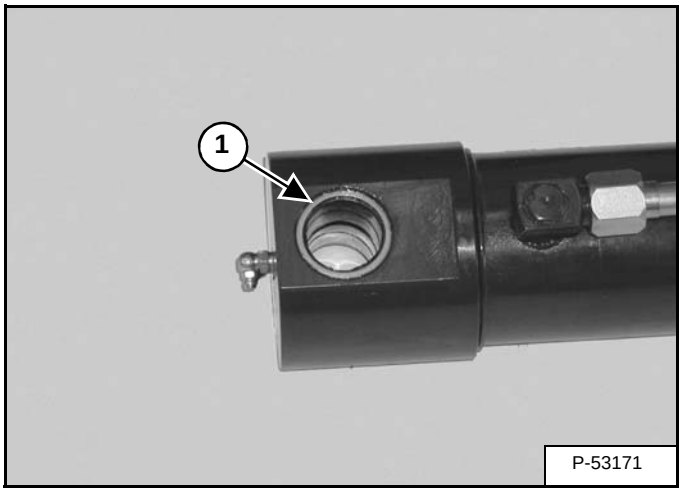
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-20-22]**.

Figure 20-20-23



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

Figure 20-20-24



Remove the seal (Item 1) **[Figure 20-20-24]** and bushing from both sides of the cylinder base end.

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Assembly

Clean all parts in solvent and dry with compressed air.

Inspect the cylinder parts for wear or damage. Replace any worn or damaged parts.

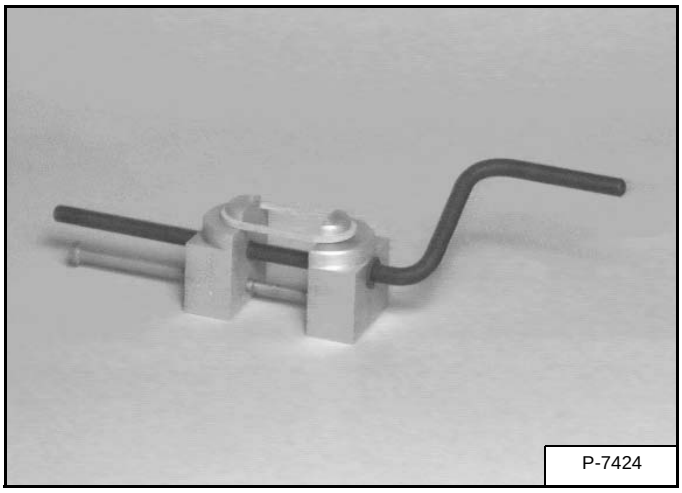
Always install new O-rings and seals.

Lubricate all O-rings and seals with hydraulic oil during installation.

Use the following tools to assemble the cylinder:

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

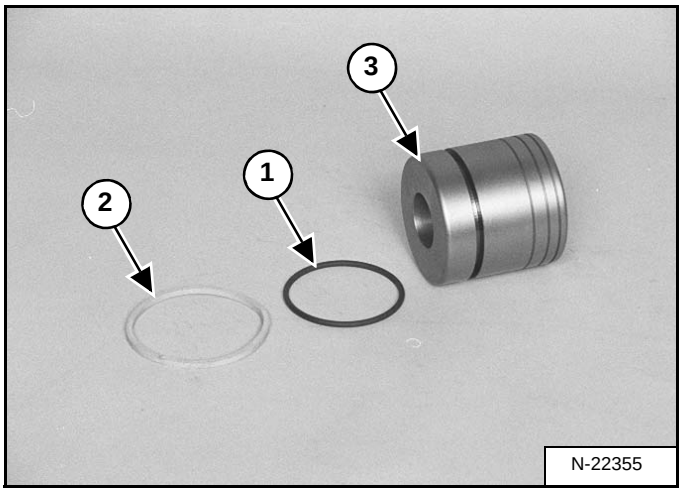
Figure 20-20-25



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

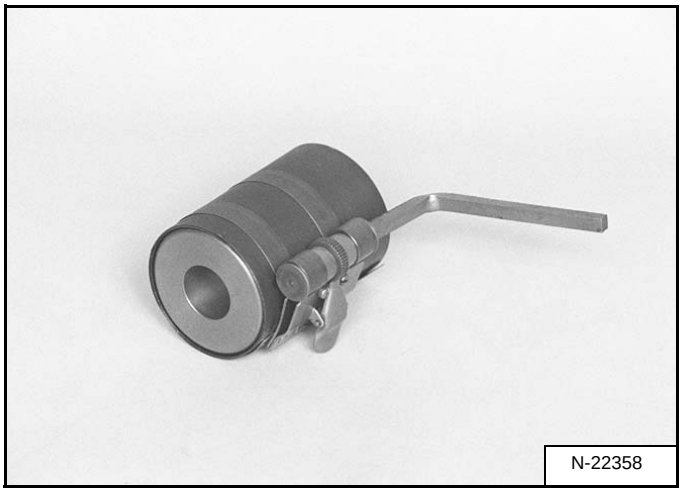
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-20-26



Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-20-26]**.

Figure 20-20-27

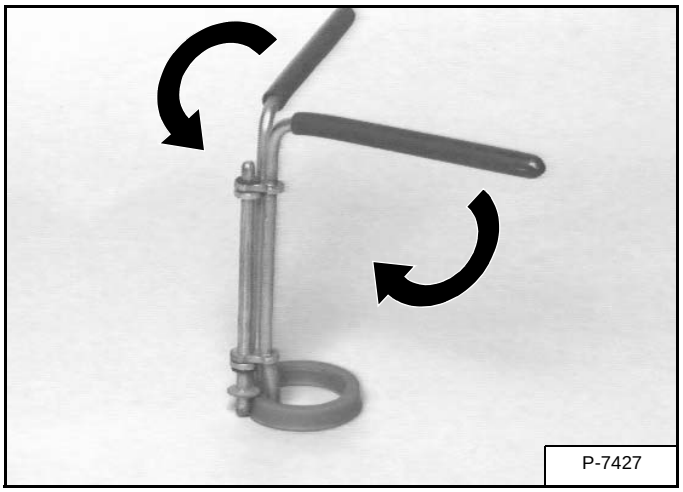


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for approximately three minutes **[Figure 20-20-27]**.

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Assembly (Cont'd)

Figure 20-20-28

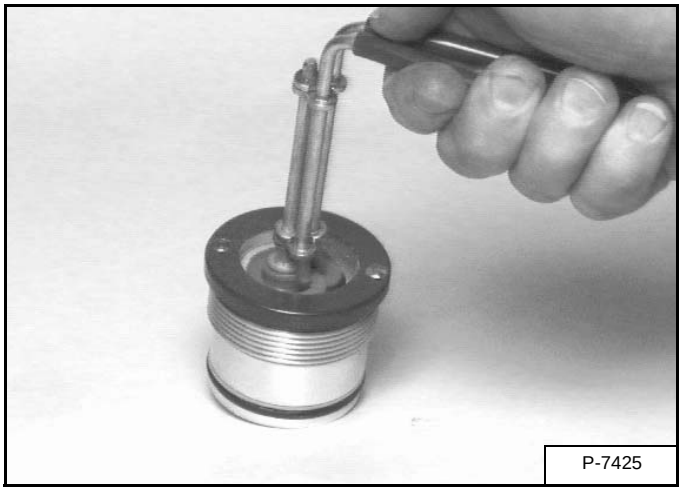


Install the rod seal on the rod seal tool **[Figure 20-20-28]**.

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

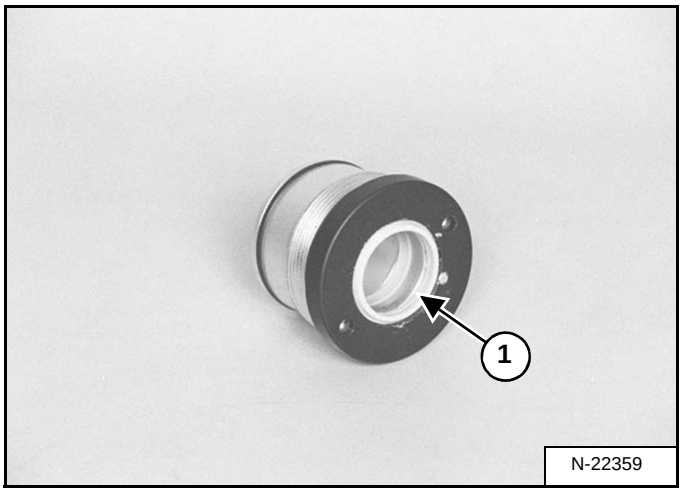
Rotate the handles to collapse the rod seal **[Figure 20-20-28]**.

Figure 20-20-29



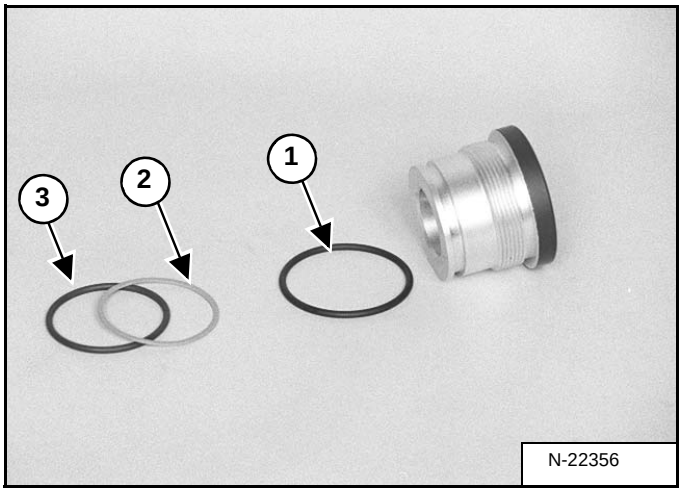
Install the rod seal in the head **[Figure 20-20-29]**.

Figure 20-20-30



Install the wiper seal with the wiper (Item 1) **[Figure 20-20-30]** toward the outside of the head.

Figure 20-20-31



Install the O-ring (Item 1) **[Figure 20-20-31]**.

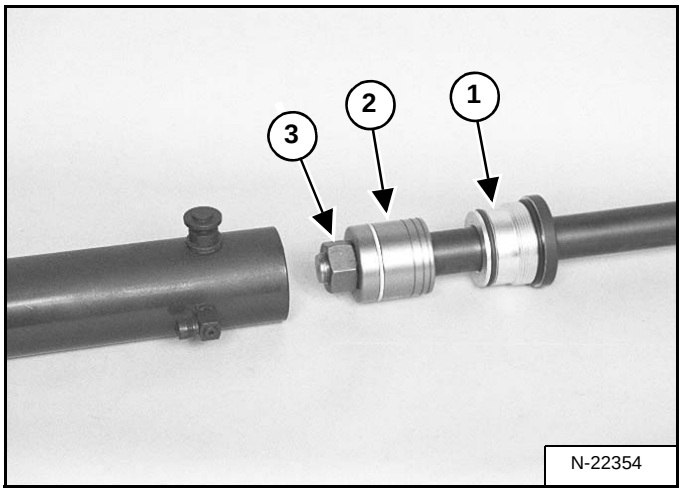
Install the back-up ring (Item 2) and O-ring (Item 3) **[Figure 20-20-31]**.

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BOOM CYLINDER (CONT'D)

Assembly (Cont'd)

Figure 20-20-32



Install the head (Item 1) and the piston (Item 2) **[Figure 20-20-32]**.

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

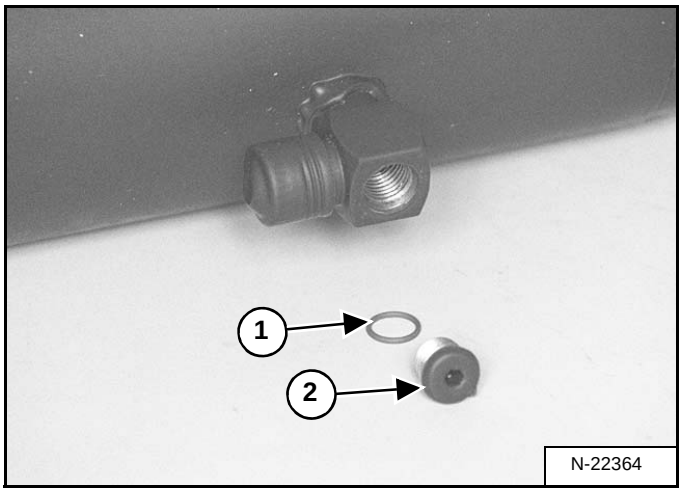
Provide an adequate support for the cylinder before tightening.

NOTE: Clean and dry the rod threads. Install a NEW NUT with pre-applied LOCTITE.

Install the nut (Item 3) **[Figure 20-20-32]**.

Tighten the nut to 850 ft.-lbs. (1153 Nm) torque.

Figure 20-20-33

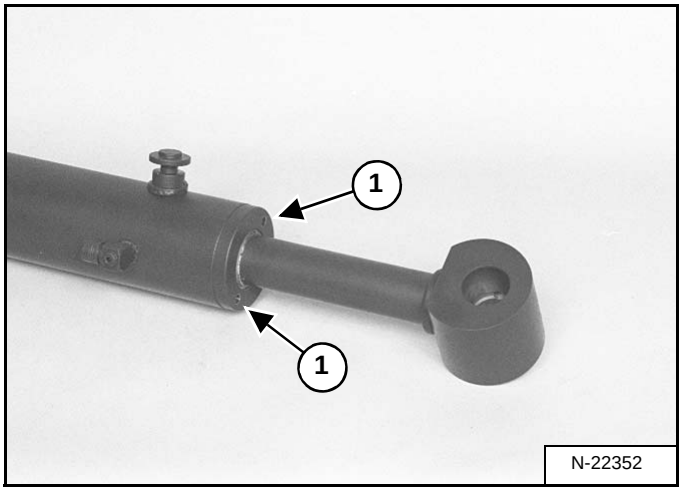


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-20-33]**.

Tighten the plug to 8 ft.-lbs. (11 Nm) torque.

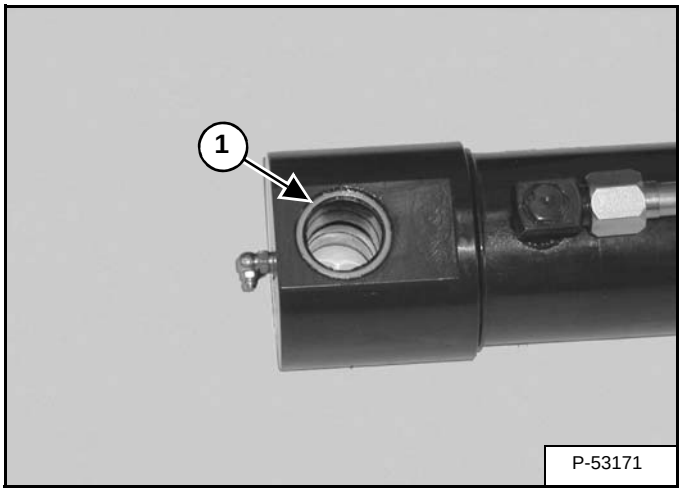
Put the base end of the cylinder in a vise.

Figure 20-20-34



Insert the adjustable gland nut wrench into the holes (Item 1) **[Figure 20-20-34]** to tighten the head. Tighten the head until it is flush with the end of the housing.

Figure 20-20-35



Install the bushing and seal (Item 1) **[Figure 20-20-35]** on both sides of the cylinder base end.

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ARM CYLINDER

Testing

Lower the boom/bucket and blade to the ground.

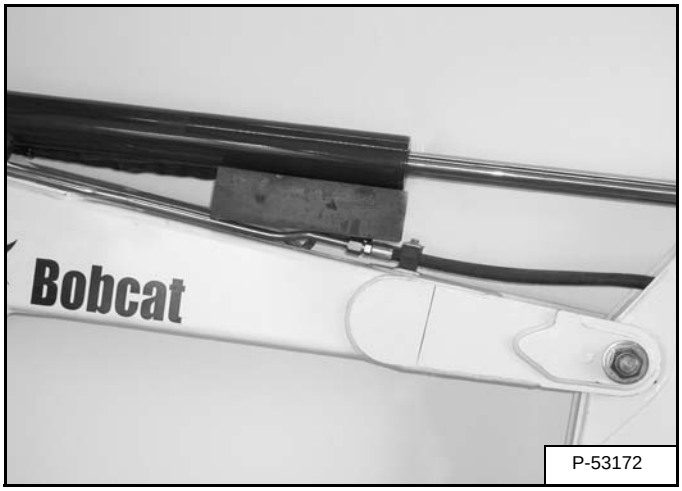
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-21-1



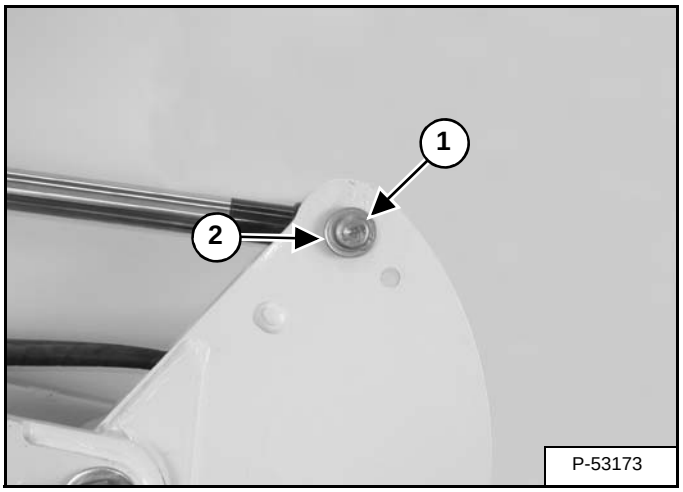
Support the boom with a chain hoist **[Figure 20-21-1]**.

Figure 20-21-2



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

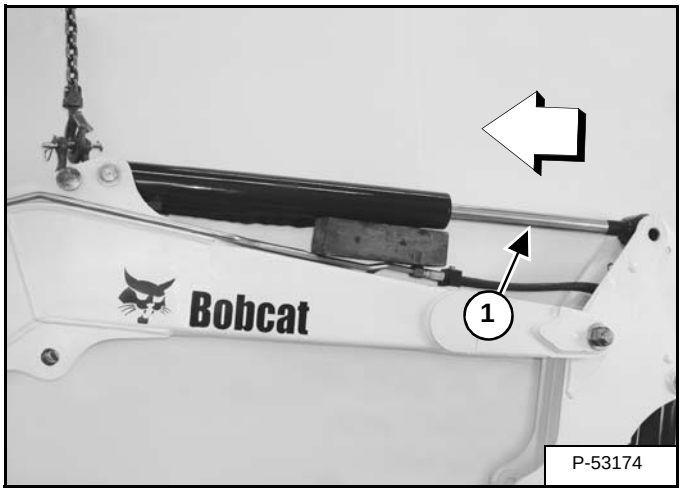
Figure 20-21-3



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

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

Figure 20-21-4



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

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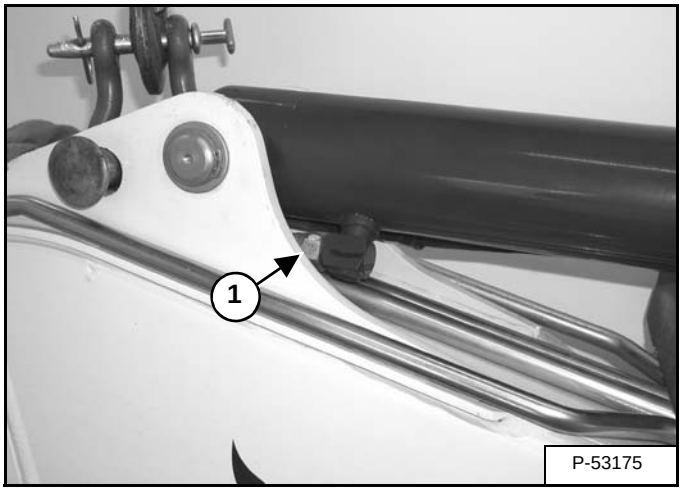
Testing (Cont'd)

⚠ 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.

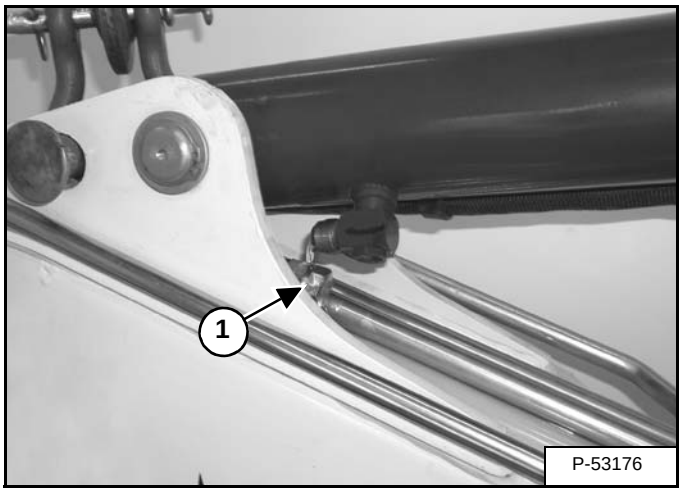
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Figure 20-21-5



Remove the hose (Item 1) **[Figure 20-21-5]** from the base end of the cylinder.

Figure 20-21-6



Install a plug (Item 1) **[Figure 20-21-6]** on the hose.

Start the engine and retract the cylinder.

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

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ARM CYLINDER (CONT'D)

Removal And Installation

Lower the boom/bucket and blade to the ground.

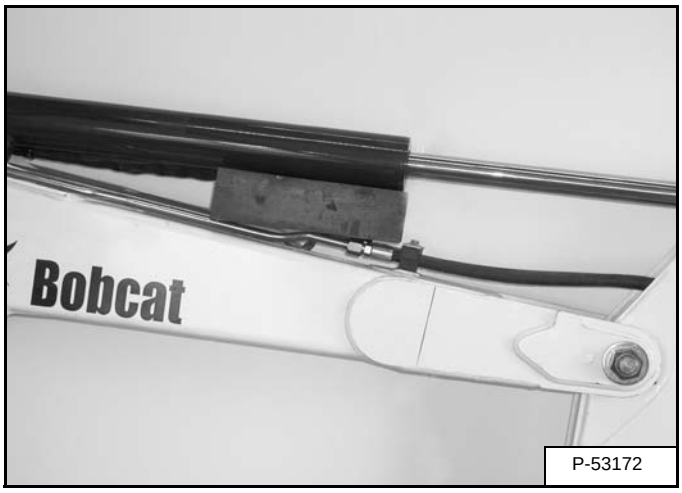
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-21-7



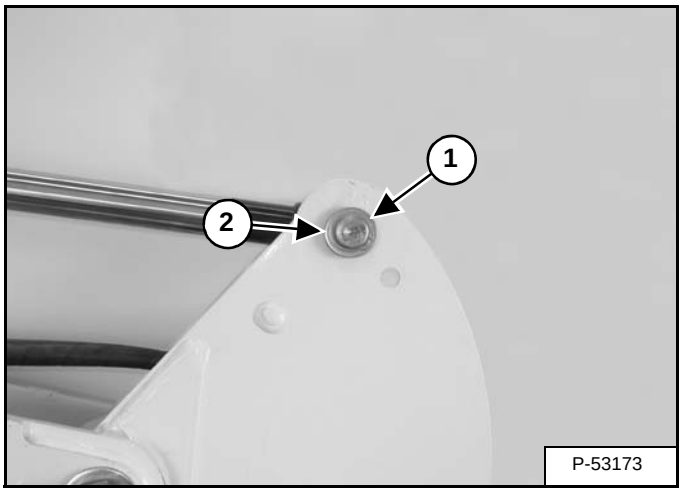
Support the boom with a chain hoist (Item 1) **[Figure 20-21-7]**.

Figure 20-21-8



Support the arm cylinder (Item 1) **[Figure 20-21-8]**.

Figure 20-21-9



Remove the snap ring (Item 1) **[Figure 20-21-9]** and washer.

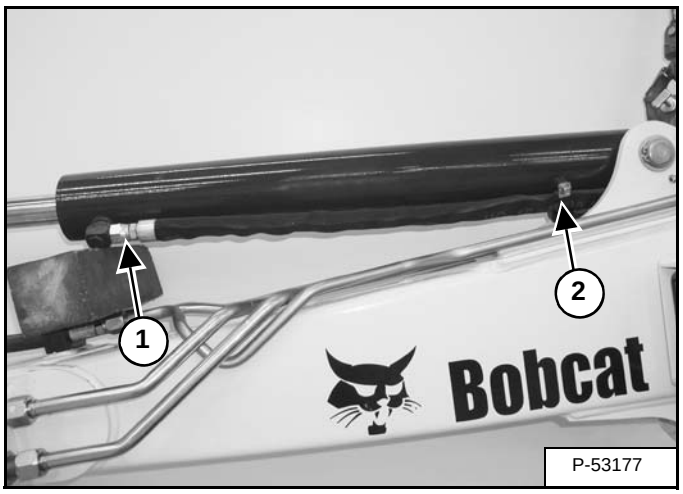
Remove the rod end pin (Item 2) **[Figure 20-21-9]**.

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 20-21-10

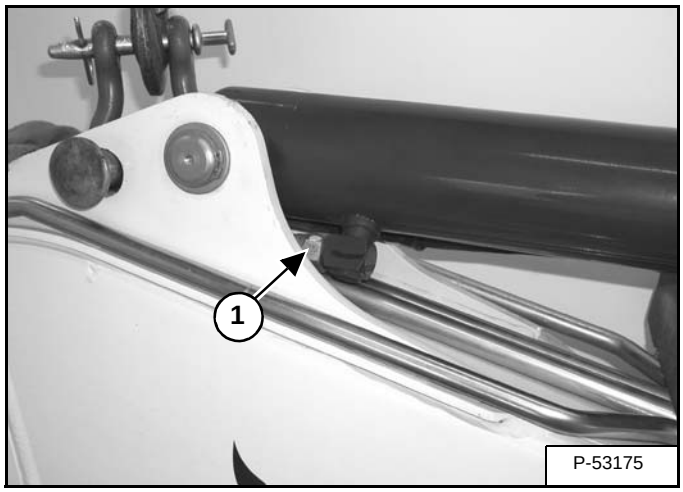


Remove the hose (Item 1) and hose clamp (Item 2) **[Figure 20-21-10]**.

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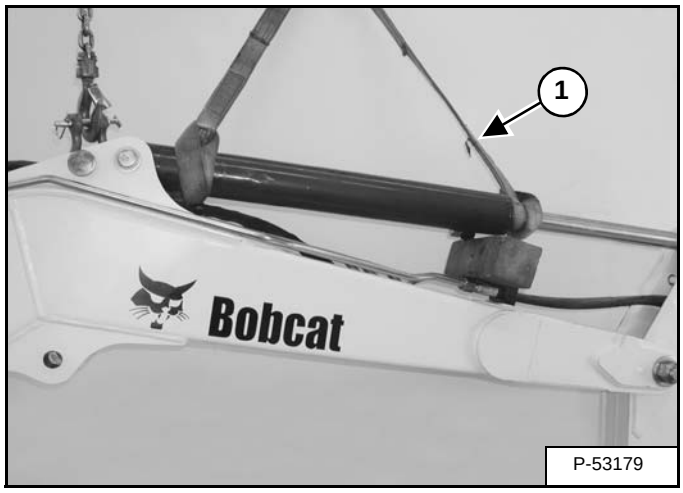
Removal And Installation (Cont'd)

Figure 20-21-11



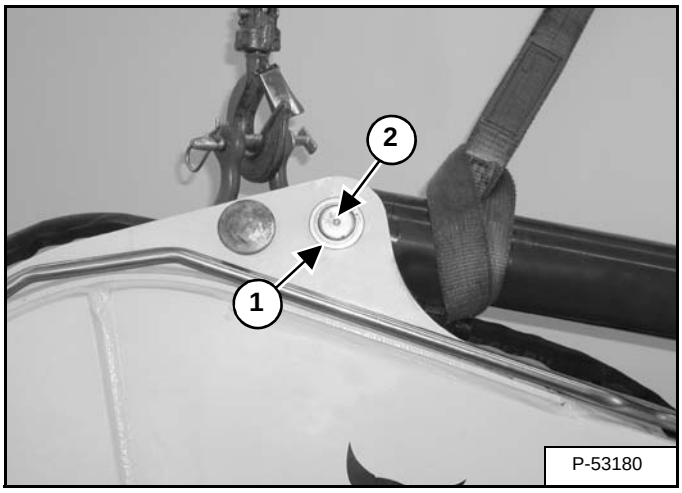
Remove the hose (Item 1) **[Figure 20-21-11]**.

Figure 20-21-12



Install a sling (Item 1) **[Figure 20-21-12]** on the cylinder.

Figure 20-21-13



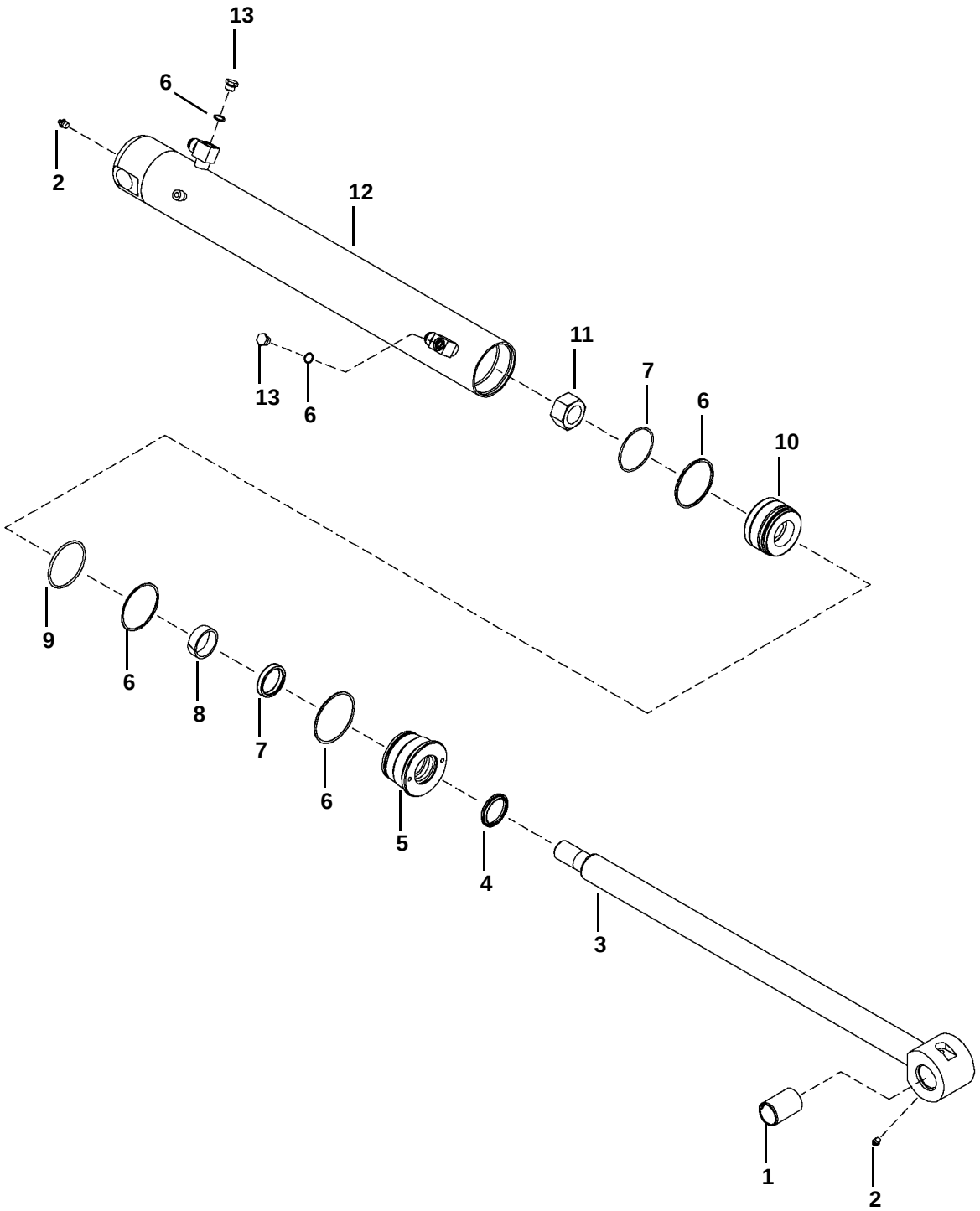
Remove the snap ring (Item 1), washer and base end pin (Item 2) **[Figure 20-21-13]**.

Remove the cylinder.

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Parts Identification

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



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Disassembly

Clean the outside of the cylinder before disassembly.

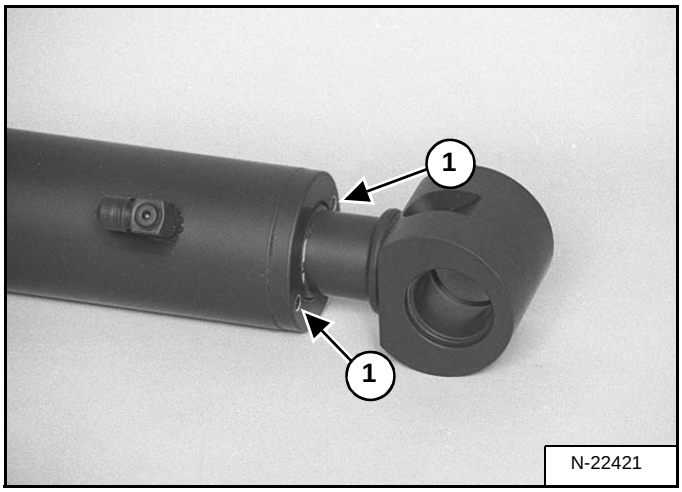
Use the following tools to disassemble the cylinder:

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.

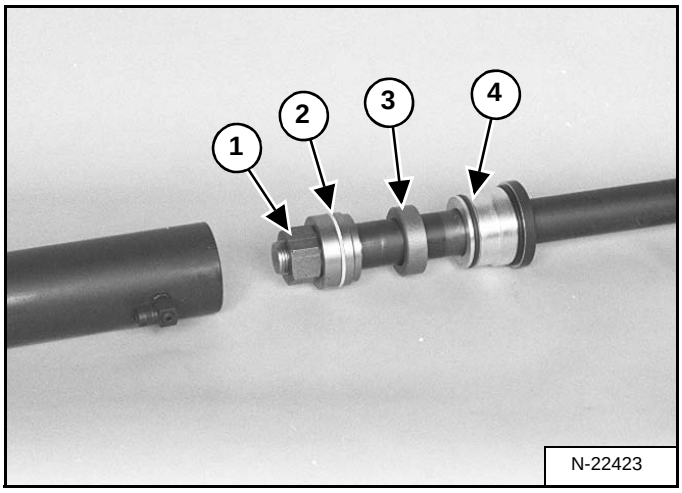
Put the base end of the cylinder in a vise.

Figure 20-21-14



Insert the adjustable gland nut wrench into the holes (Item 1) **[Figure 20-21-14]** to loosen the head.

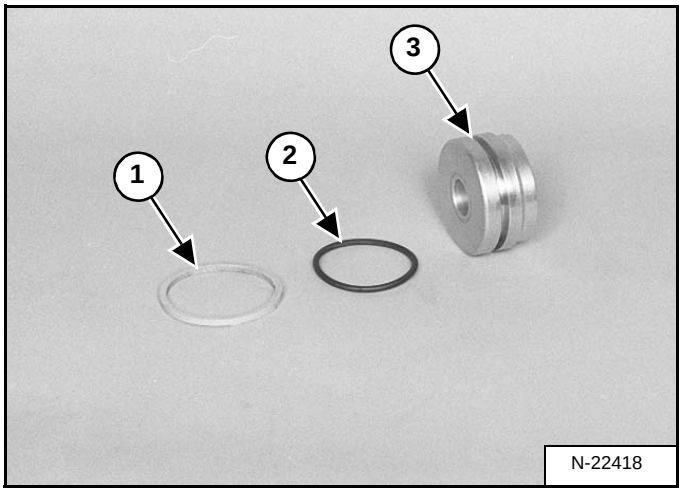
Figure 20-21-15



Remove the head and the rod assembly from the cylinder **[Figure 20-21-15]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2), spacer (Item 3) and head (Item 4) **[Figure 20-21-15]**.

Figure 20-21-16

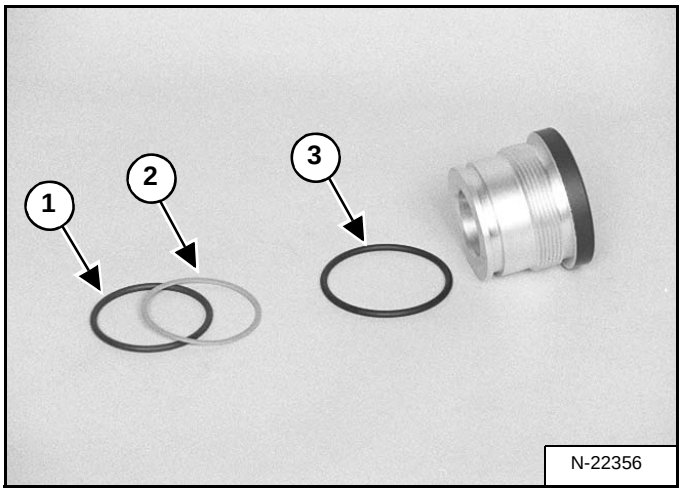


Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-21-16]**.

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Disassembly (Cont'd)

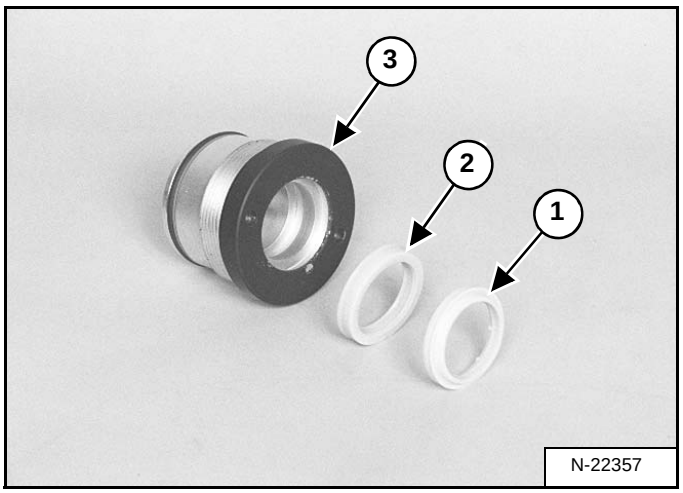
Figure 20-21-17



Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-21-17]**.

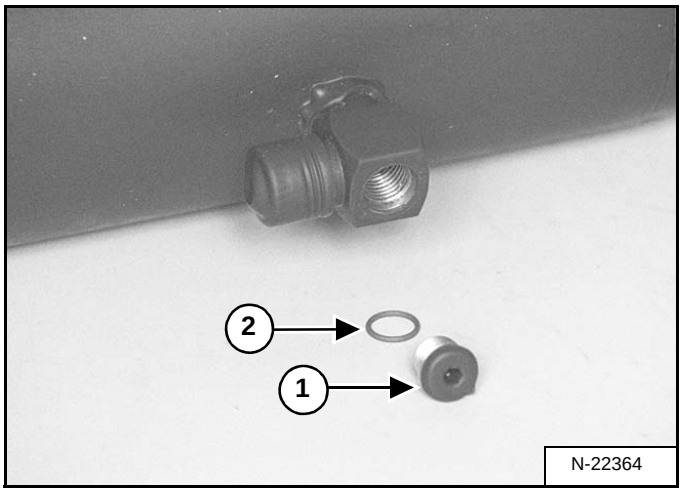
Remove the O-ring (Item 3) **[Figure 20-21-17]**.

Figure 20-21-18



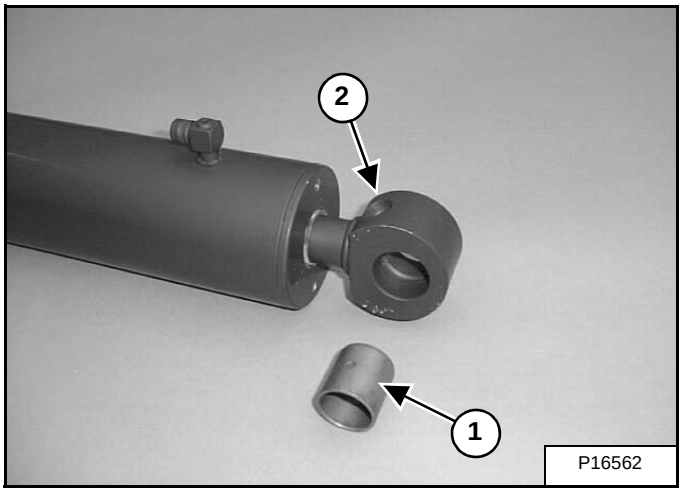
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-21-18]**.

Figure 20-21-19



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-21-19]**.

Figure 20-21-20



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

Replace the grease fitting (Item 2) **[Figure 20-21-20]** if damaged or missing.

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Assembly

Clean all parts in solvent and dry with compressed air.

Inspect the cylinder parts for wear or damage. Replace any damaged parts.

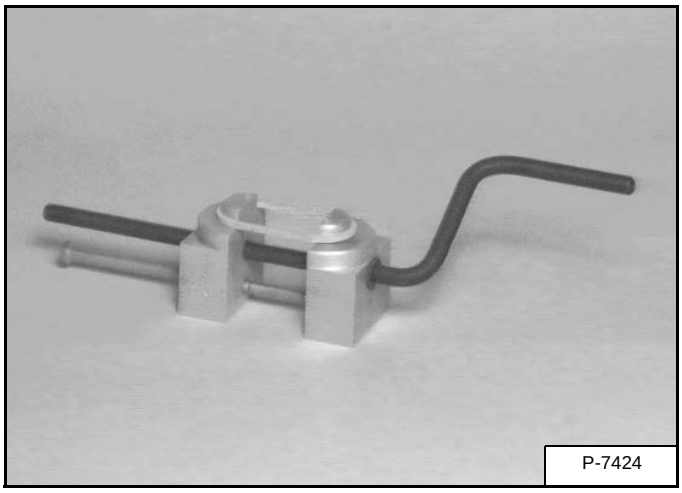
Always install new O-rings and seals during assembly.

Lubricate all O-rings and seals with hydraulic oil during installation.

Use the following tools to assemble the cylinder:

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

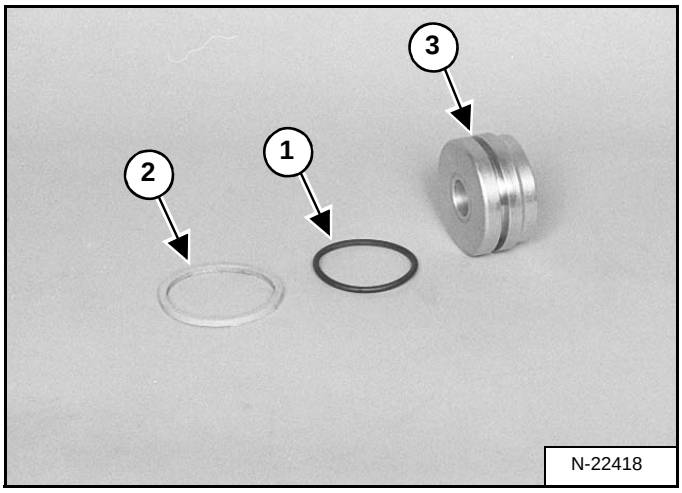
Figure 20-21-21



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

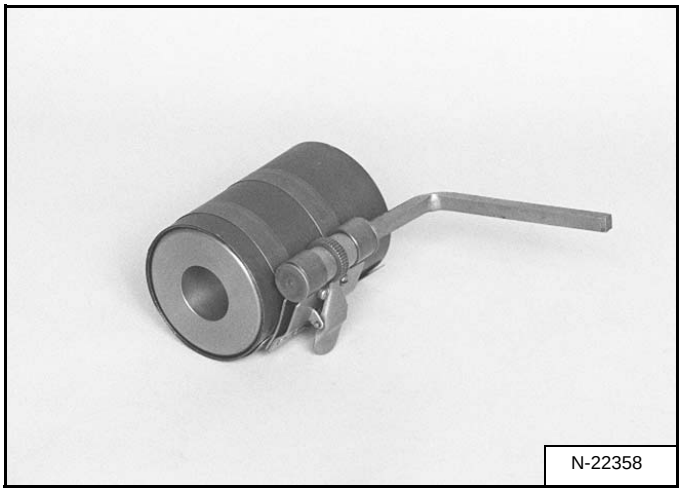
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-21-22



Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-21-22]**.

Figure 20-21-23

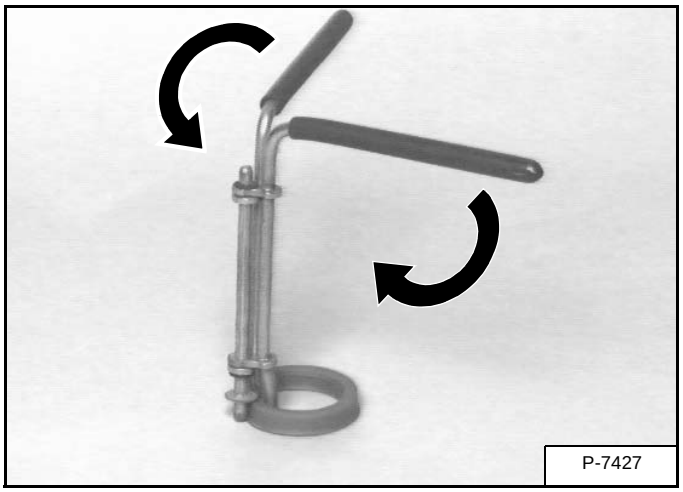


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for approximately three minutes **[Figure 20-21-23]**.

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Assembly (Cont'd)

Figure 20-21-24

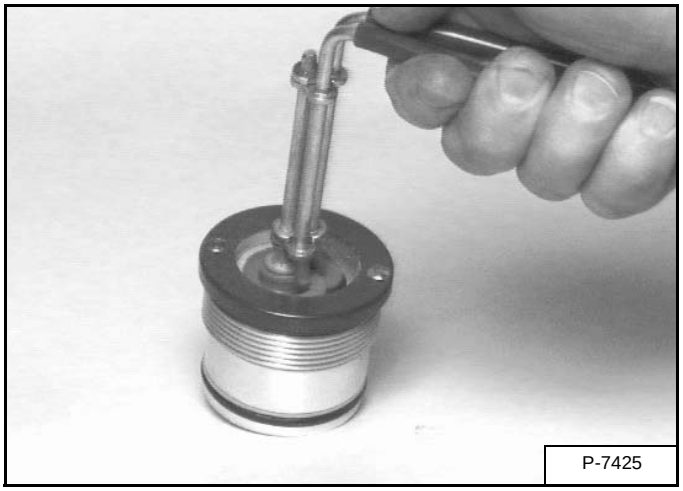


Install the rod seal on the rod seal tool **[Figure 20-21-24]**.

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

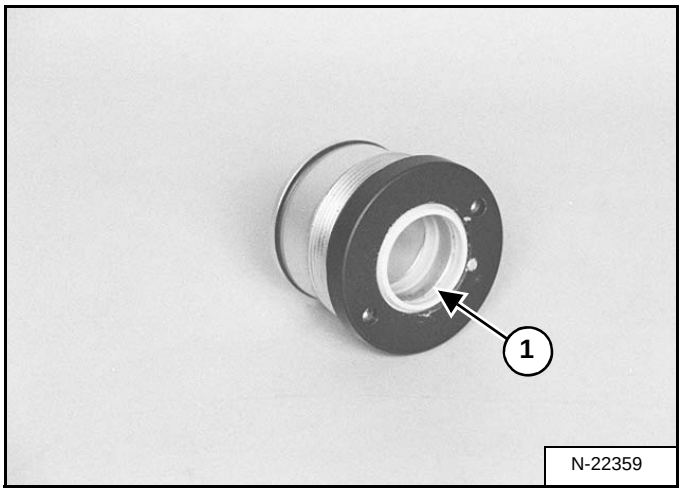
Rotate the handles to collapse the rod seal **[Figure 20-21-24]**.

Figure 20-21-25



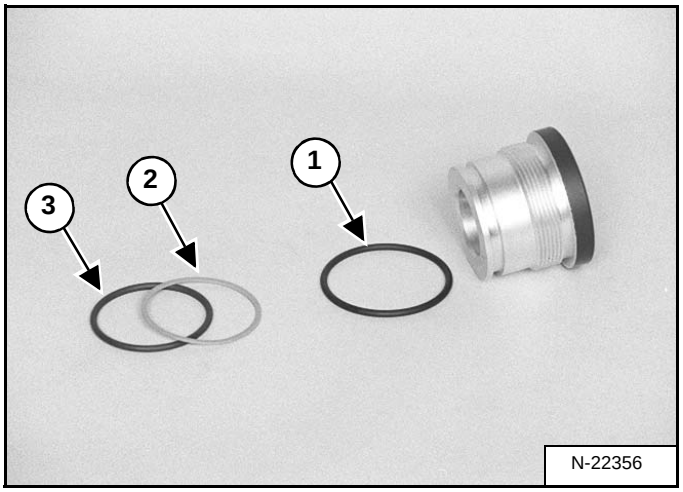
Install the rod seal in the head **[Figure 20-21-25]**.

Figure 20-21-26



Install the wiper seal with the wiper (Item 1) **[Figure 20-21-26]** toward the outside of the head.

Figure 20-21-27



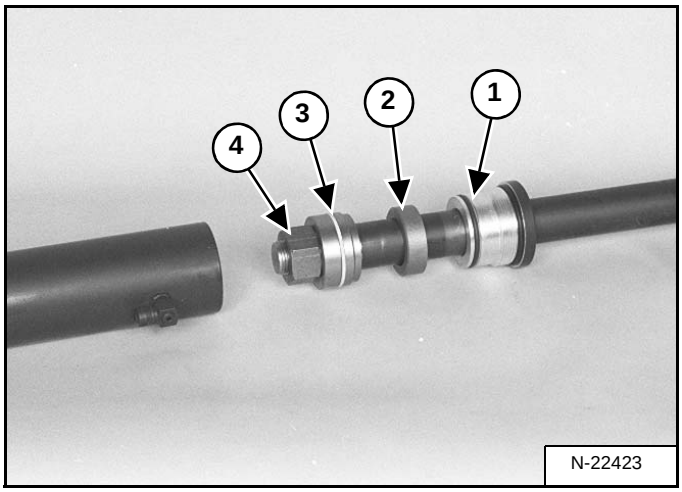
Install the O-ring (Item 1) **[Figure 20-21-27]**.

Install the back-up ring (Item 2) and O-ring (Item 3) **[Figure 20-21-27]**.

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Assembly (Cont'd)

Figure 20-21-28



Install the head (Item 1), spacer (Item 2) and the piston (Item 3) **[Figure 20-21-28]** on the rod.

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

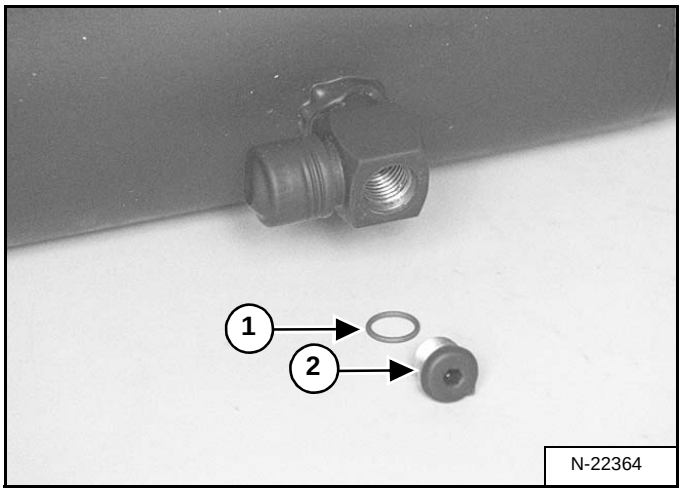
Provide an adequate support for the cylinder before tightening.

NOTE: Clean and dry the rod threads. Install a NEW NUT with pre-applied LOCTITE.

Install the nut (Item 4) **[Figure 20-21-28]**.

Tighten the nut to 850 ft.-lbs. (1152 Nm) torque.

Figure 20-21-29

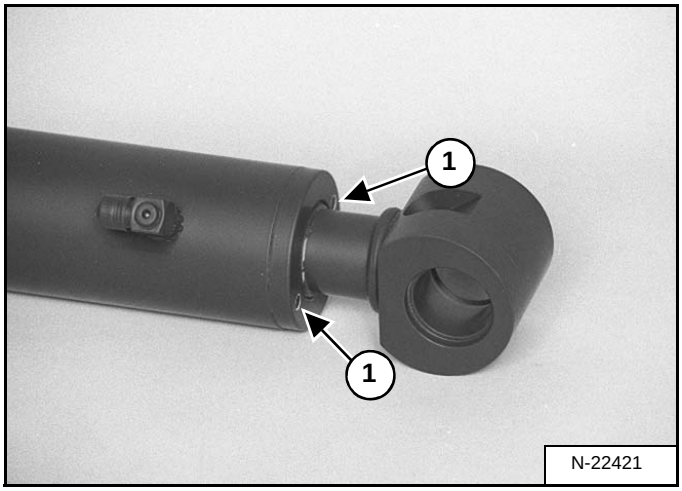


Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-21-29]**.

Tighten the plug to 8 ft.-lbs. (11 Nm) torque.

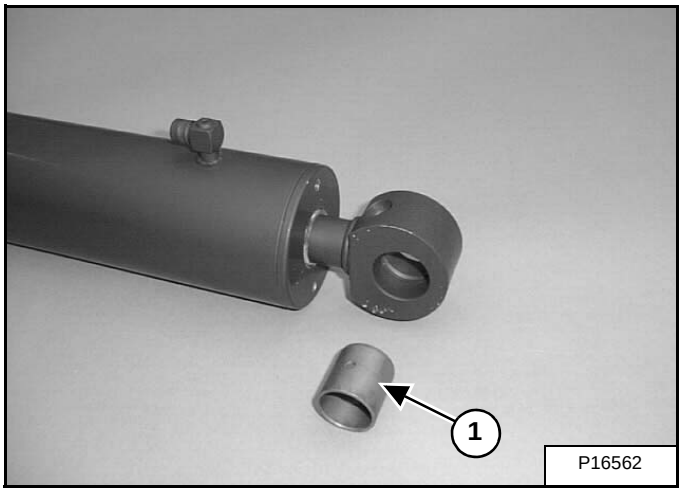
Put the base end of the cylinder in a vise.

Figure 20-21-30



Insert the adjustable gland nut wrench into the holes (Item 1) **[Figure 20-21-30]** to tighten the head. Tighten the head until it is flush with the end of the housing.

Figure 20-21-31



Install the bushing (Item 1) **[Figure 20-21-31]**. Make sure the bushing is aligned with the grease channel in the cylinder.

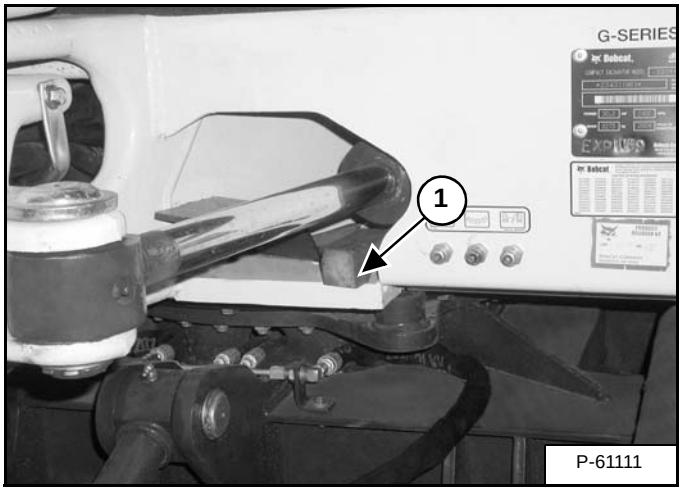
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BOOM SWING CYLINDER

Testing

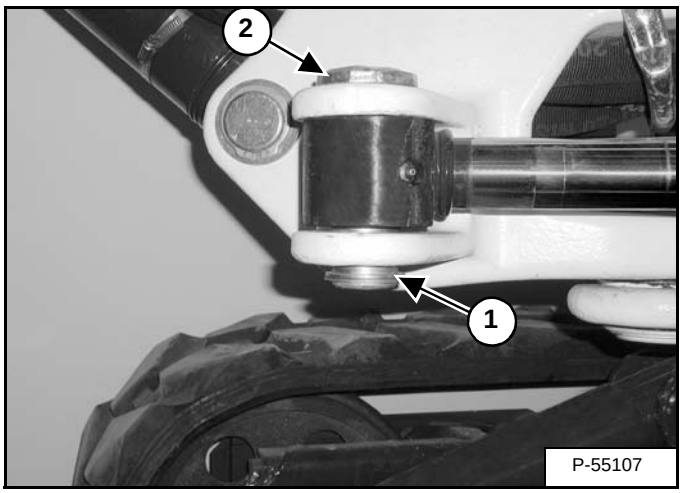
Lower the boom/bucket and blade to the ground.

Figure 20-22-1



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

Figure 20-22-2



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

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

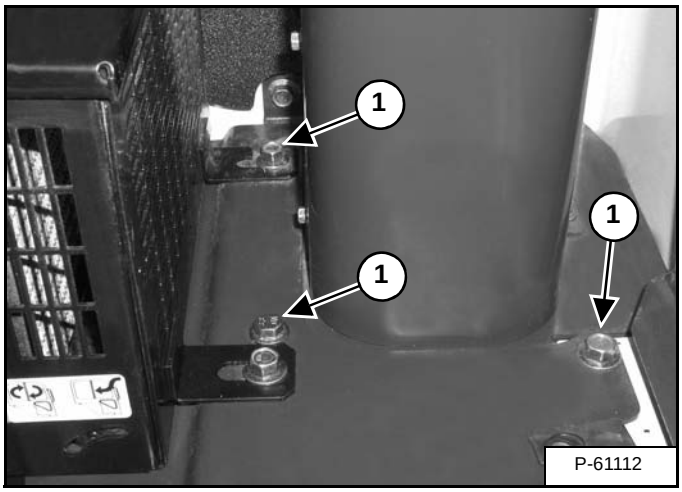
Start the engine and fully retract the cylinder rod.

Stop the engine.

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

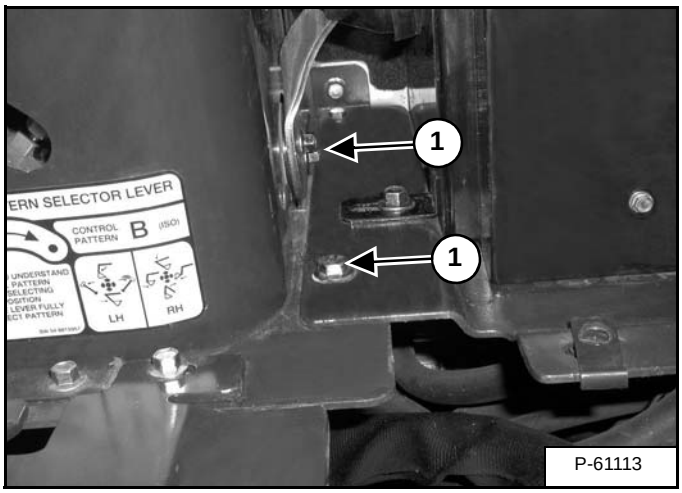
Remove the seat and seat mount. (See Removal And Installation on Page 40-40-1.)

Figure 20-22-3



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

Figure 20-22-4

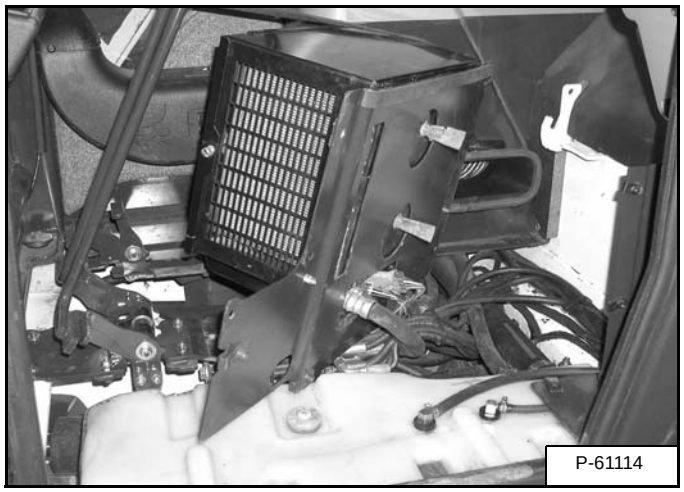


Remove the bolts (Item 1) **[Figure 20-22-4]** from the right side of the rear floor panel.

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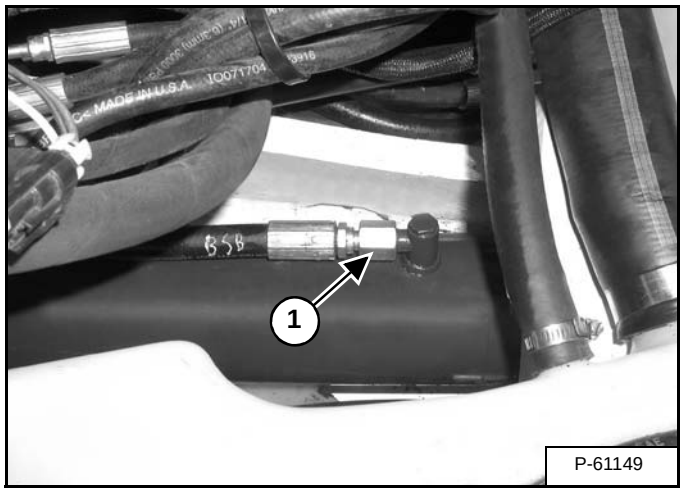
Testing (Cont'd)

Figure 20-22-5



Reposition the evaporator/heater unit as shown (Item 1) **[Figure 20-22-5]**.

Figure 20-22-6



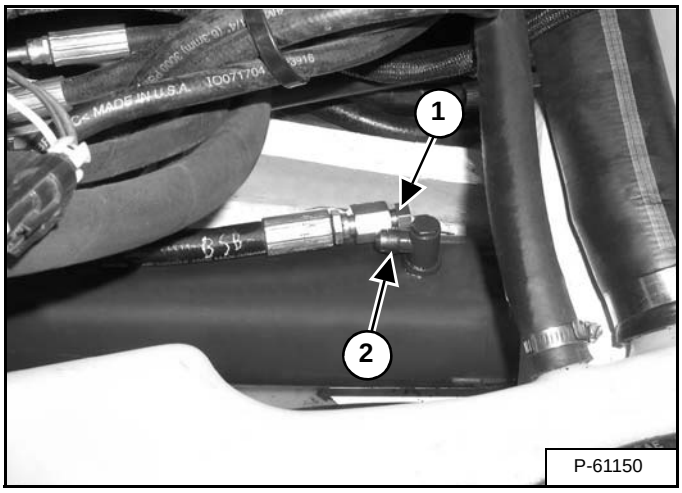
Remove the hose (Item 1) **[Figure 20-22-6]** from the base end of the cylinder.

⚠ WARNING

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

W-2145-0290

Figure 20-22-7



Install a plug (Item 1) **[Figure 20-22-7]** in the hose and tighten.

Start the engine and retract the cylinder.

If there is any oil leakage from the base end fitting (Item 2) **[Figure 20-22-7]** on the boom swing cylinder, remove the cylinder for repair or replacement.

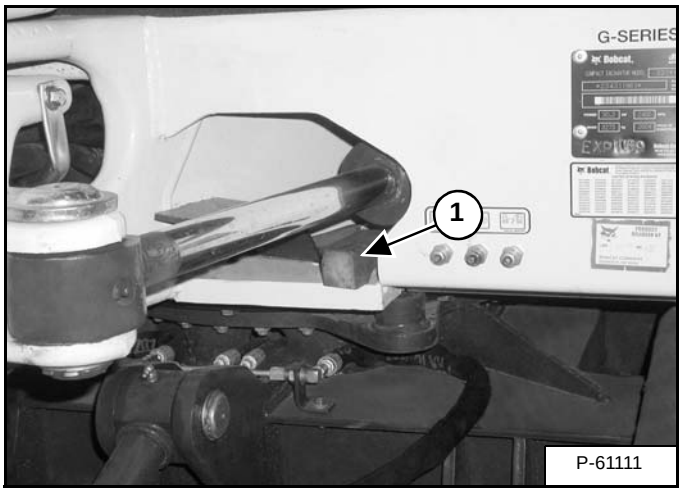
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Removal And Installation

Lower the boom/bucket and blade to the ground.

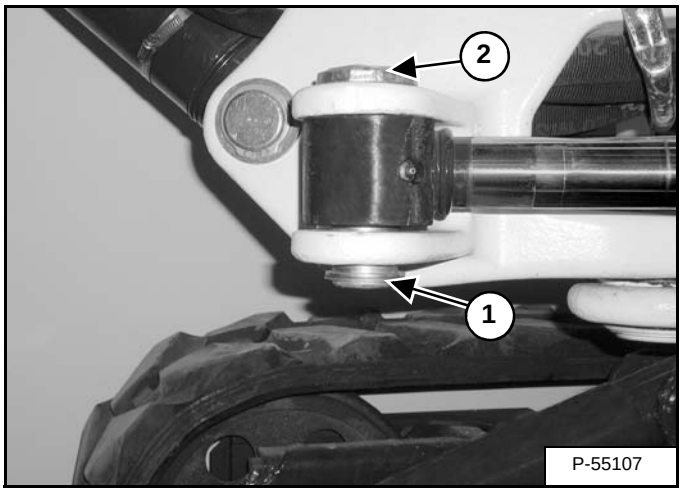
Remove the floormat and floor plate. (See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

Figure 20-22-8



Place a block (Item 1) **[Figure 20-22-8]** under the rod end of the boom swing cylinder.

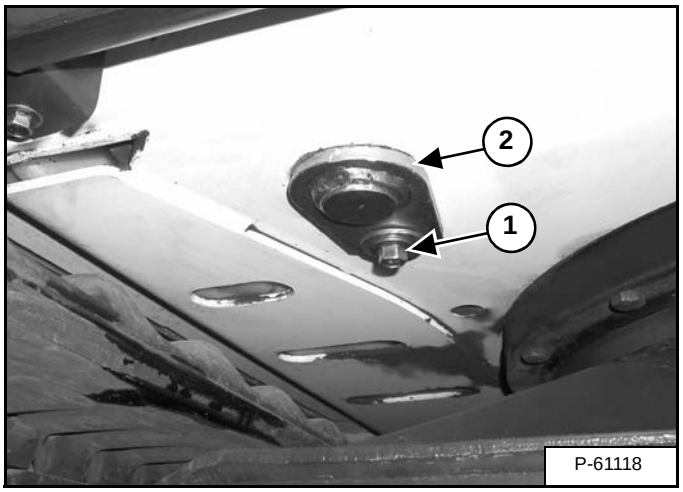
Figure 20-22-9



Remove the snap ring and washer (Item 1) **[Figure 20-22-9]** from the rod end pin of the cylinder.

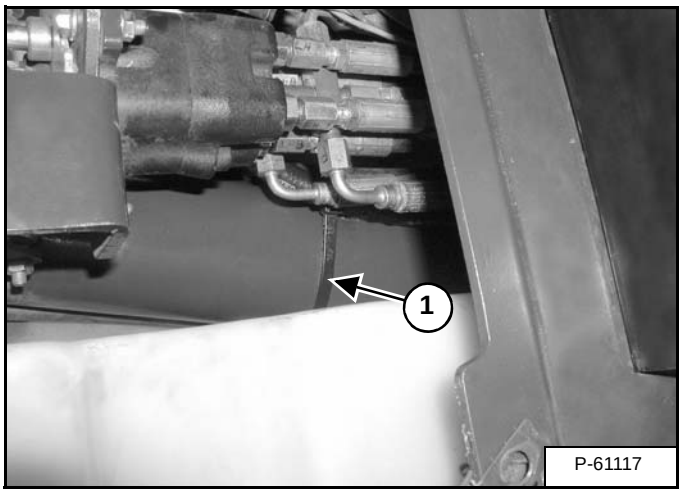
Remove the pin (Item 2) **[Figure 20-22-9]**.

Figure 20-22-10



Remove the bolt (Item 1) washer and spacer (Item 2) **[Figure 20-22-10]** from the cylinder base end pin located under the right side of the upperstructure.

Figure 20-22-11



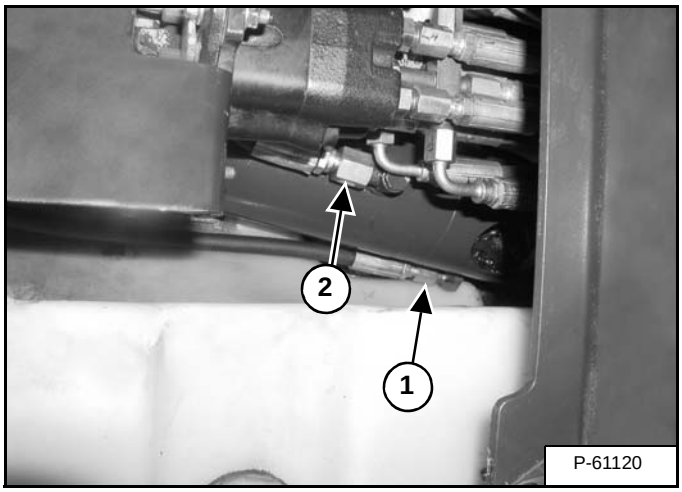
Remove the tie strap (Item 1) **[Figure 20-22-11]**.

Slide the cylinder forward to provide access to the base end of the cylinder.

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Removal And Installation (Cont'd)

Figure 20-22-12



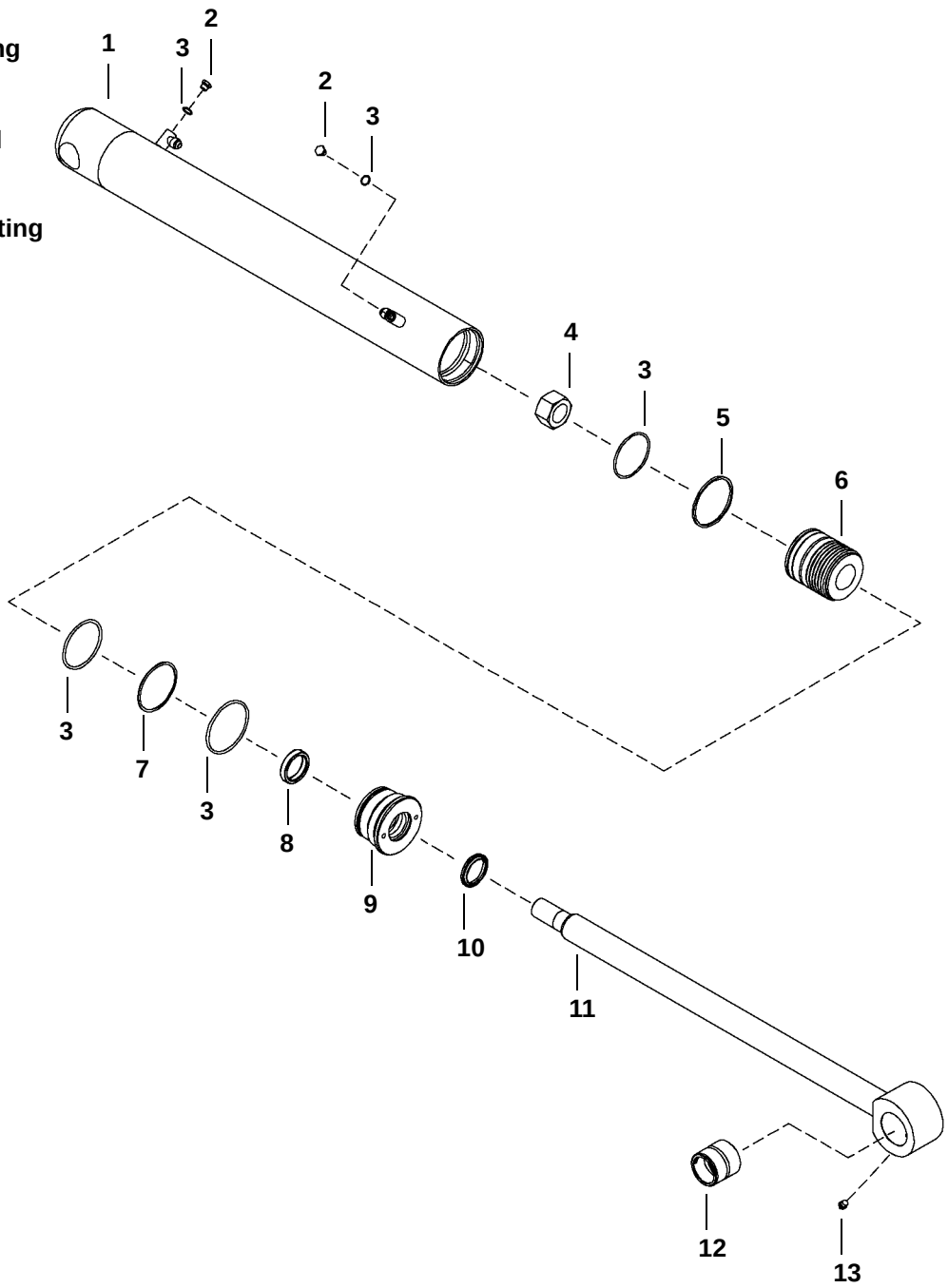
Remove the grease fitting hose (Item 1) and cylinder base end hose (Item 2) **[Figure 20-22-12]**.

Slide the cylinder forward and remove.

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Parts Identification

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



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Disassembly

Clean the outside of the cylinder before disassembly.

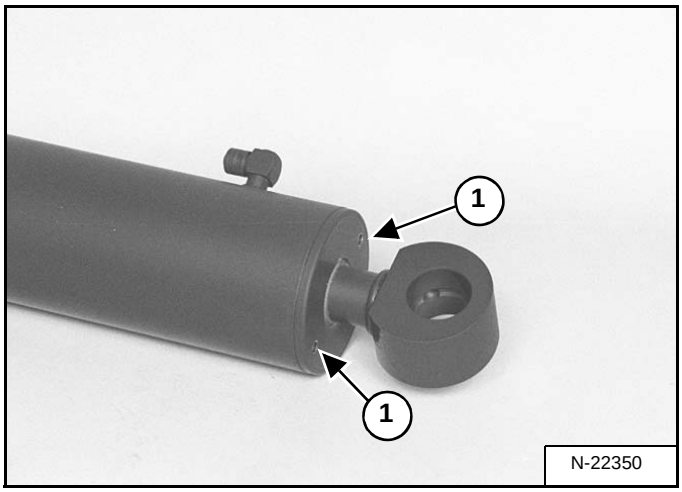
Use the following tools to disassemble the cylinder:

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.

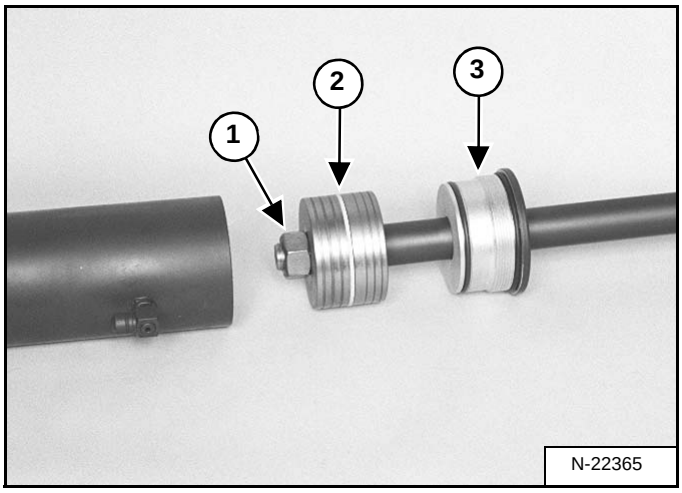
Put the base end of the cylinder in a vise.

Figure 20-22-13



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-22-13]** to loosen the head.

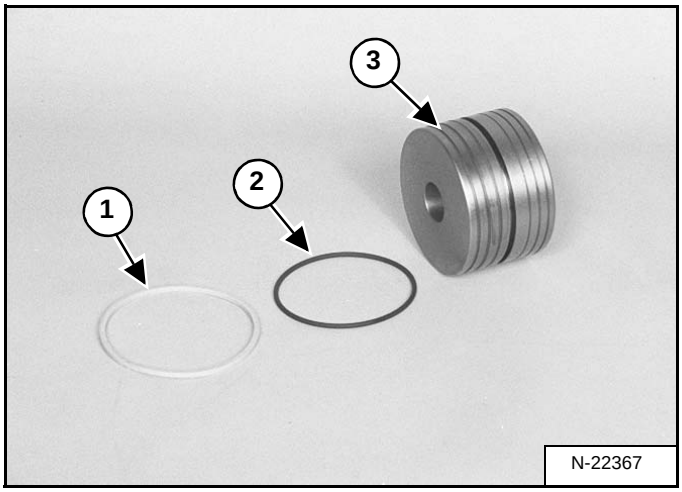
Figure 20-22-14



Remove the head and the rod assembly from the cylinder **[Figure 20-22-14]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-22-14]**.

Figure 20-22-15

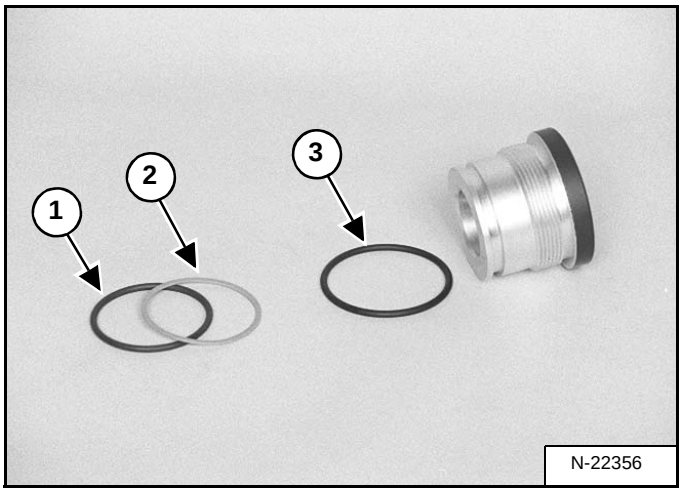


Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-22-15]**.

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Disassembly (Cont'd)

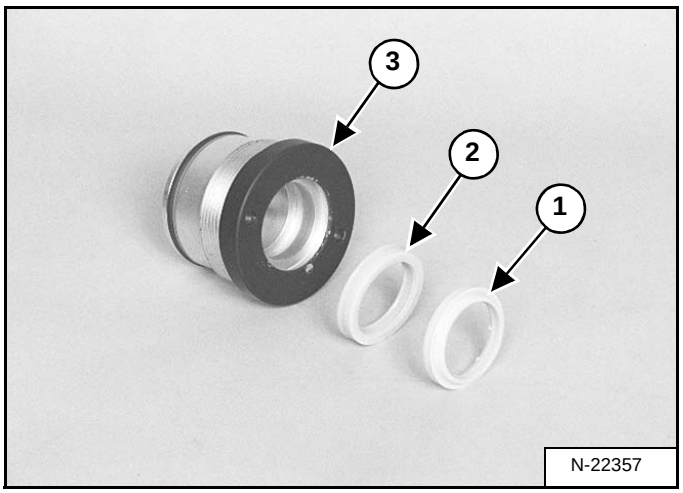
Figure 20-22-16



Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-22-16]** from the groove in the head.

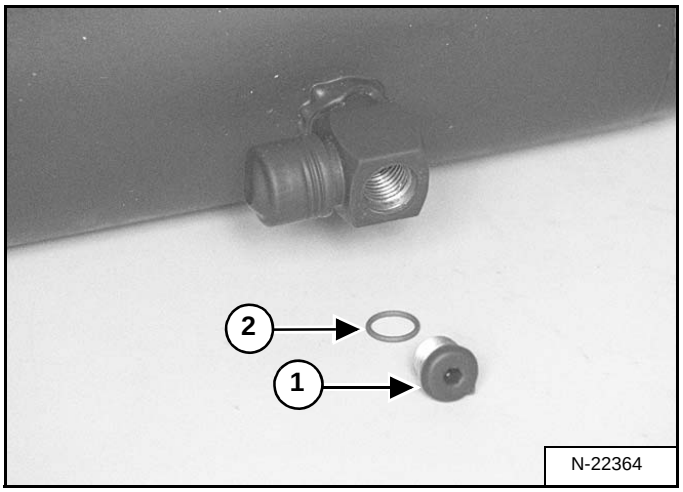
Remove the O-ring (Item 3) **[Figure 20-22-16]**.

Figure 20-22-17



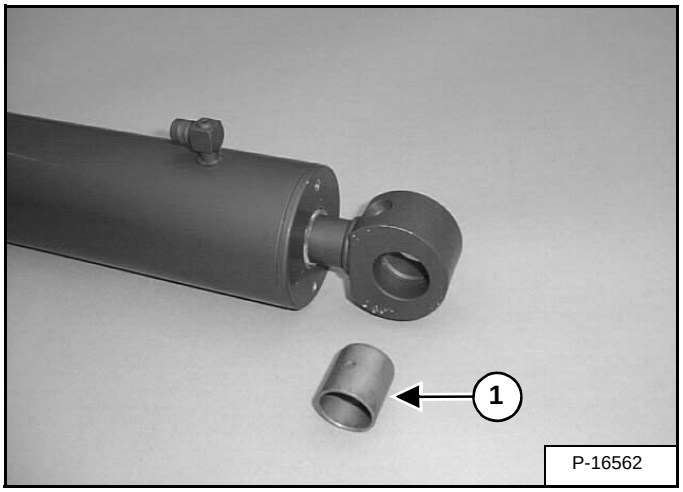
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-22-17]**.

Figure 20-22-18



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-22-18]**.

Figure 20-22-19



Remove the bushing (Item 1) **[Figure 20-22-19]**.

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Assembly

Clean all parts in solvent and dry with compressed air.

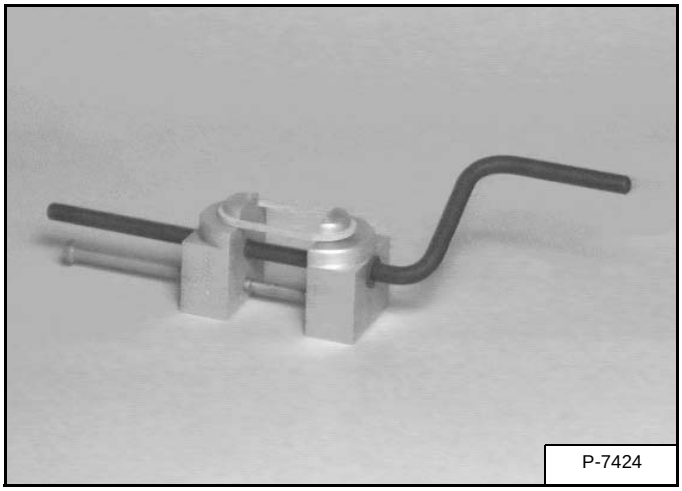
Inspect all parts for wear or damage. Replace any worn or damaged parts.

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

Use the following tools to assemble the cylinder:

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

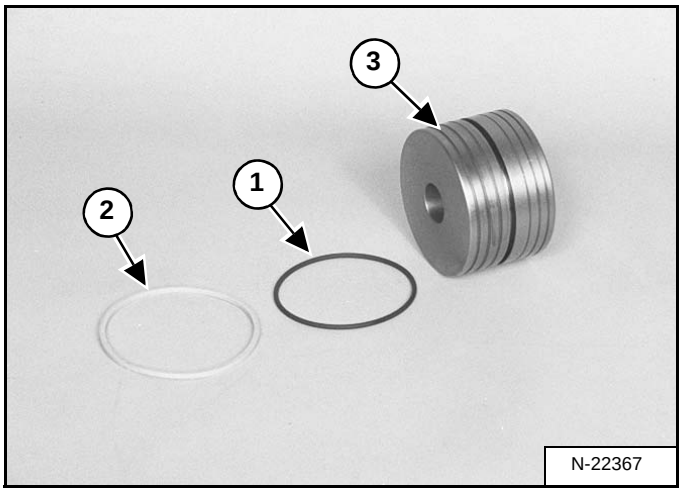
Figure 20-22-20



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

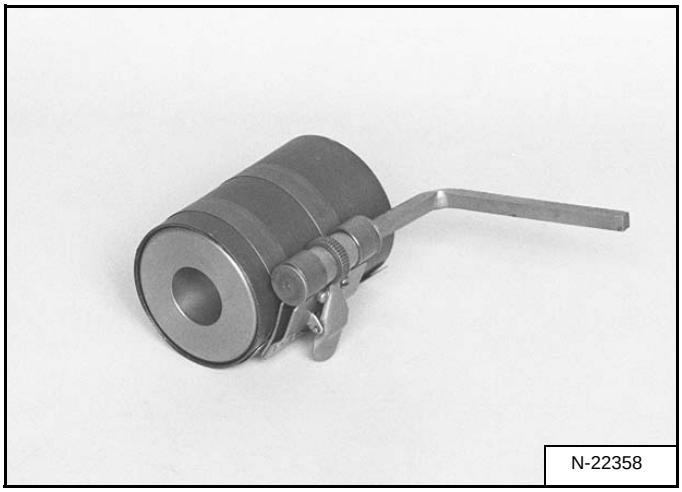
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-22-21



Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-22-21]**.

Figure 20-22-22

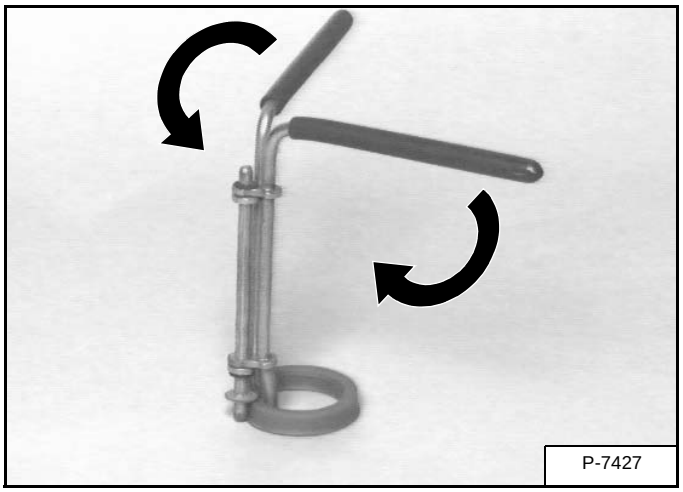


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-22-22]**.

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Assembly (Cont'd)

Figure 20-22-23

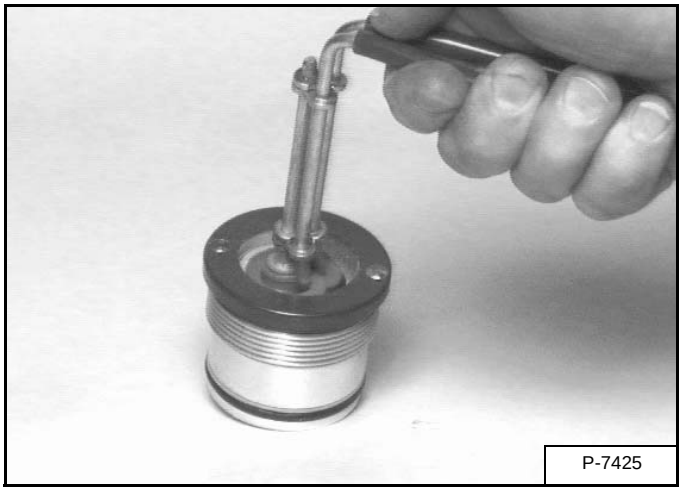


Install the rod seal on the rod seal tool **[Figure 20-22-23]**.

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

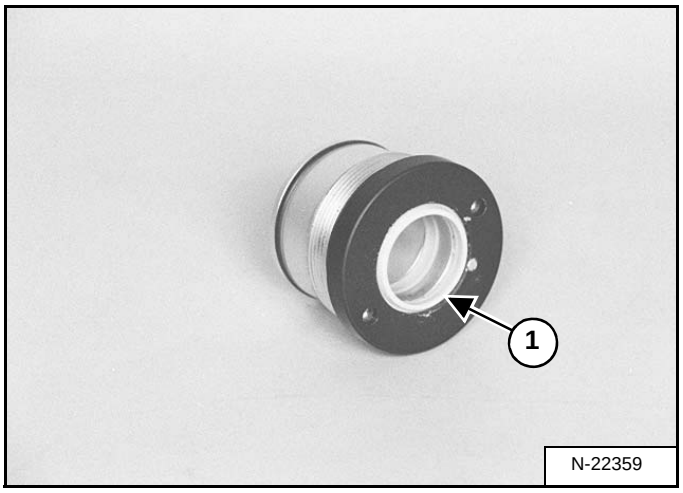
Rotate the handles to collapse the rod seal **[Figure 20-22-23]**.

Figure 20-22-24



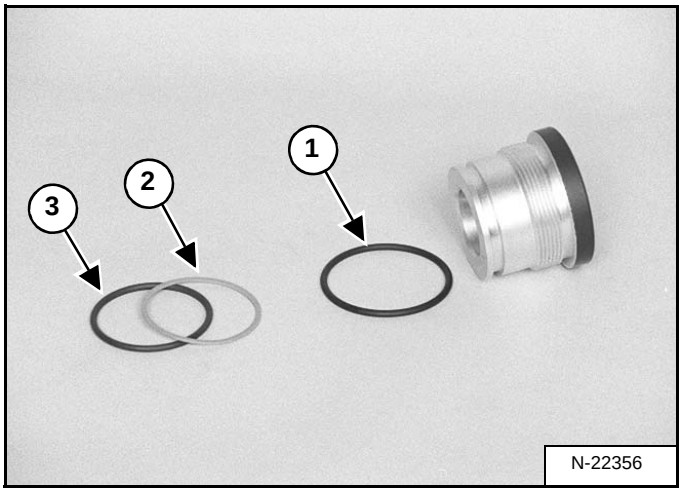
Install the rod seal in the head **[Figure 20-22-24]**.

Figure 20-22-25



Install the wiper seal with the wiper (Item 1) **[Figure 20-22-25]** toward the outside of the head.

Figure 20-22-26



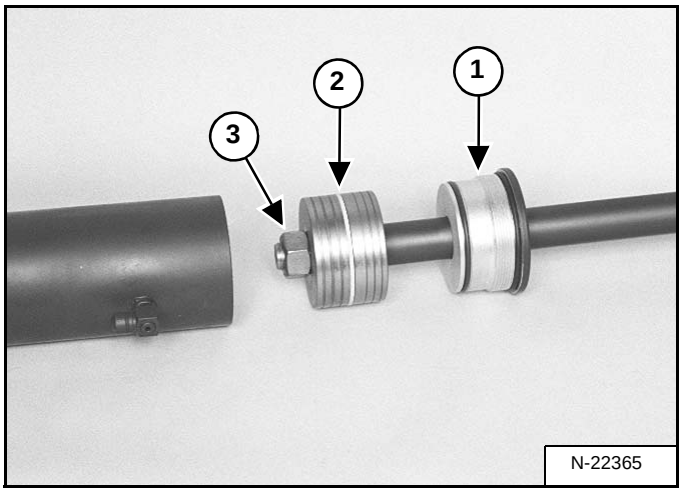
Install the O-ring (Item 1) **[Figure 20-22-26]**.

Install the back-up ring (Item 2) and O-ring (Item 3) **[Figure 20-22-26]** into the groove on the head.

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Assembly (Cont'd)

Figure 20-22-27



Install the head (Item 1) and the piston (Item 2) **[Figure 20-22-27]** on the rod as shown.

NOTE: Clean and dry the rod threads. Install a NEW NUT with pre-applied LOCTITE.

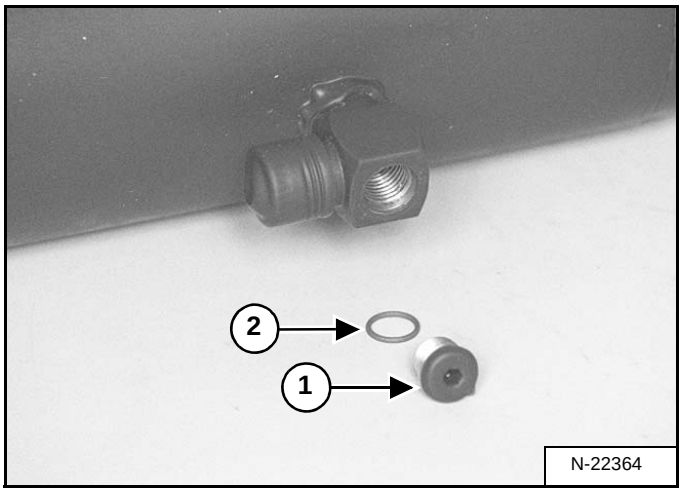
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-22-27]**.

Tighten the nut to 850 ft.-lbs. (1153 Nm) torque.

Figure 20-22-28

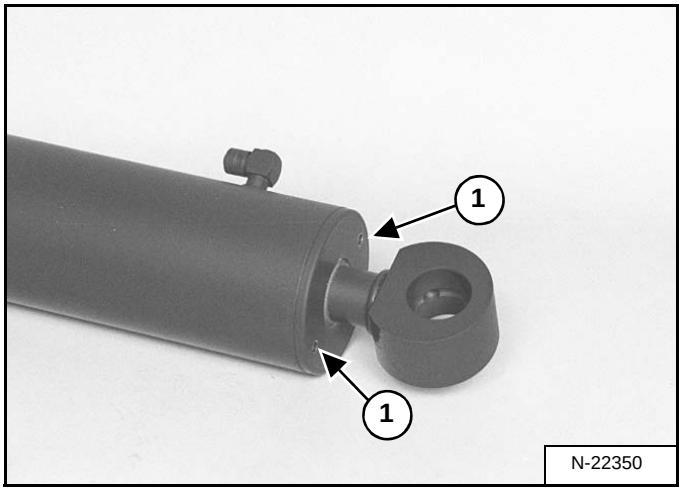


Install plug (Item 1) and O-ring (Item 2) **[Figure 20-22-28]**.

Tighten the plug to 8 ft.-lbs. (11 Nm) torque.

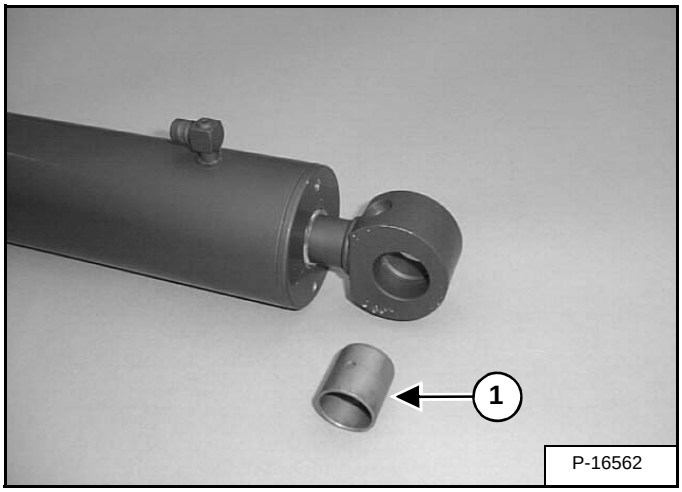
Put the base end of the hydraulic cylinder in a vise.

Figure 20-22-29



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-22-29]** to tighten the head. Head to be torqued until flush with end of housing.

Figure 20-22-30



Install the bushing (Item 1) **[Figure 20-22-30]**. The bushing must be aligned with the grease channel in the rod end of the cylinder.

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BUCKET CYLINDER

Testing

Lower the boom/bucket and blade to the ground.

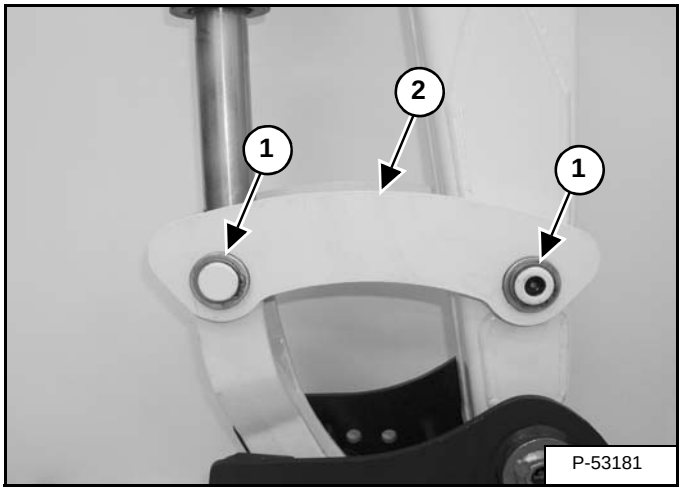
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-23-1



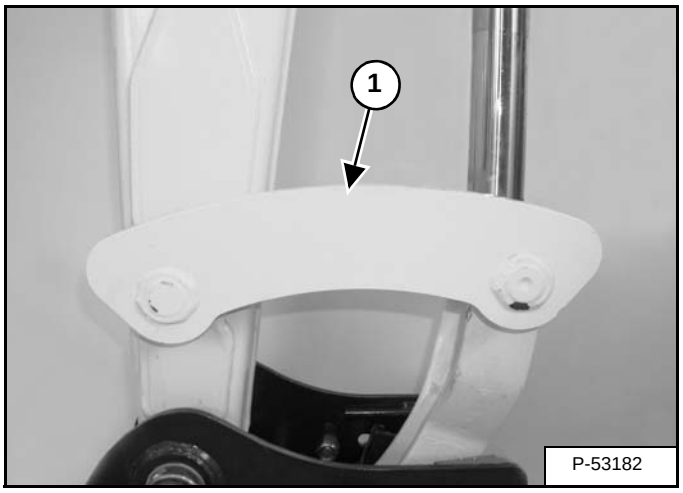
Support the boom using a chain hoist **[Figure 20-23-1]**.

Figure 20-23-2



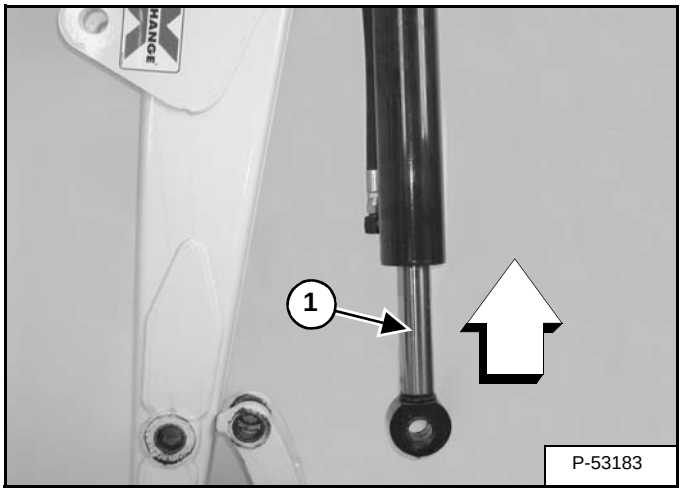
Remove the snap rings (Item 1), washers and plate (Item 2) **[Figure 20-23-2]**.

Figure 20-23-3



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

Figure 20-23-4



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

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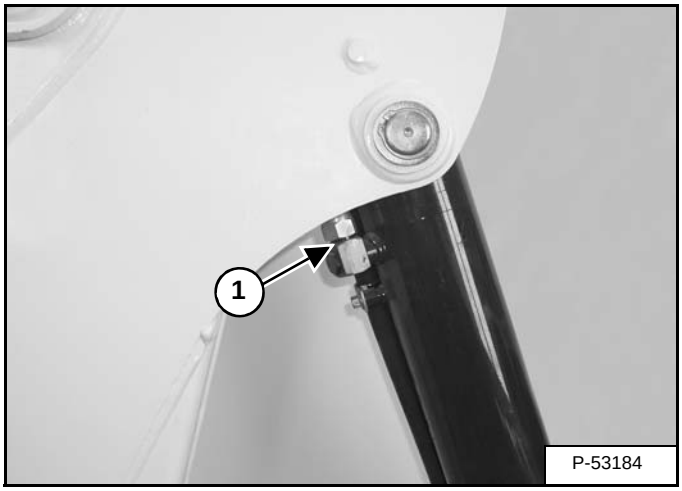
Testing (Cont'd)

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.

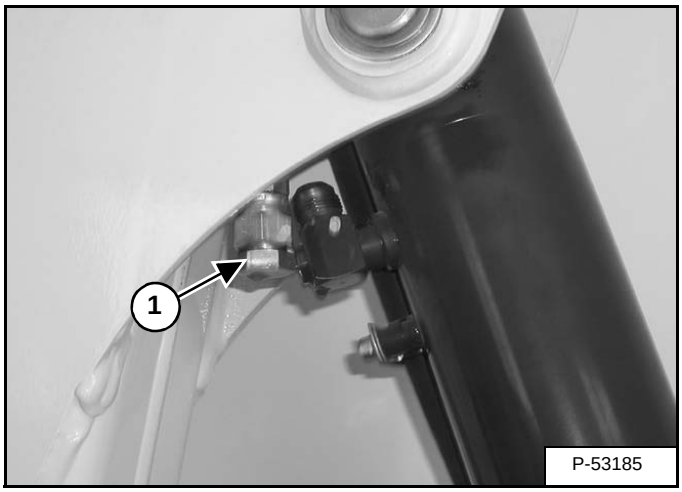
W-2145-0290

Figure 20-23-5



Remove the hose (Item 1) **[Figure 20-23-5]** from the base end of the cylinder.

Figure 20-23-6



Install a plug (Item 1) **[Figure 20-23-6]** on the hose.

Start the engine and retract the cylinder.

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

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Removal And Installation (Standard And Long Arm)

Lower the boom/bucket and blade to the ground.

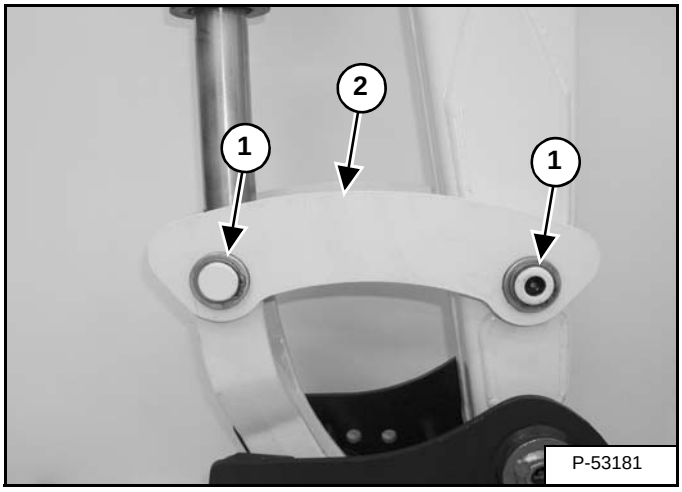
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-23-7



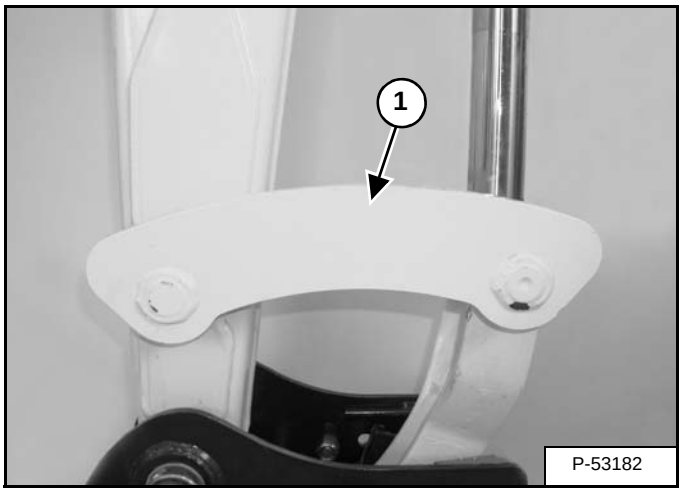
Support the boom using a chain hoist **[Figure 20-23-7]**.

Figure 20-23-8



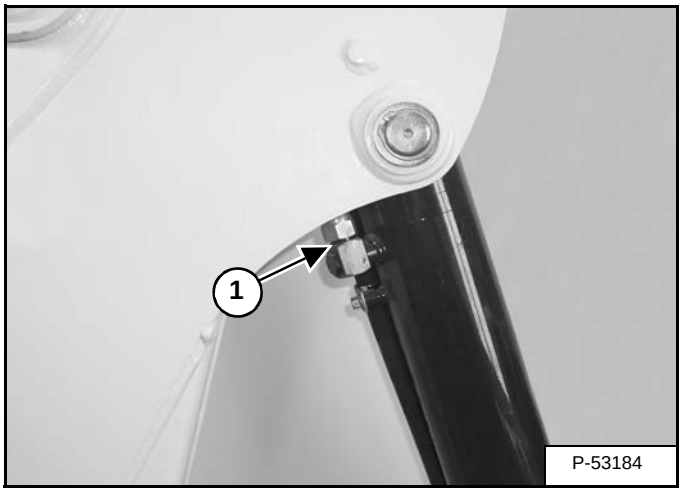
Remove the snap rings (Item 1), washers and plate (Item 2) **[Figure 20-23-8]**.

Figure 20-23-9



Remove the link (Item 1) **[Figure 20-23-9]**.

Figure 20-23-10



Remove the hose (Item 1) **[Figure 20-23-10]**.

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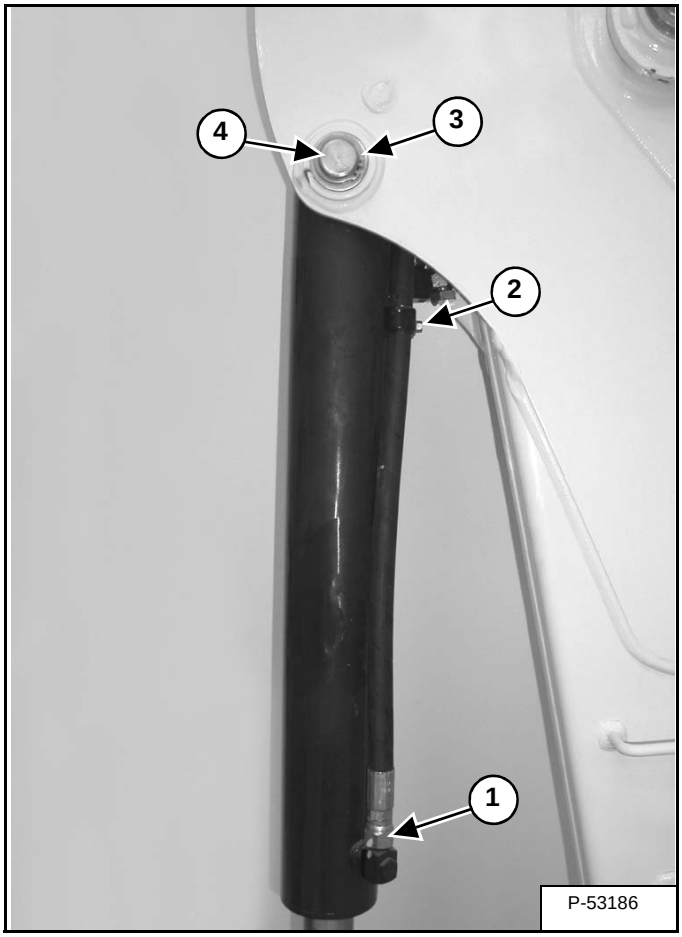
Removal And Installation (Standard And Long Arm) (Cont'd)

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 20-23-11



Remove the hose (Item 1) and hose clamp (Item 2) **[Figure 20-23-11]**.

Remove the snap ring (Item 3), washer and base end pin (Item 4) **[Figure 20-23-11]**.

Remove the cylinder.

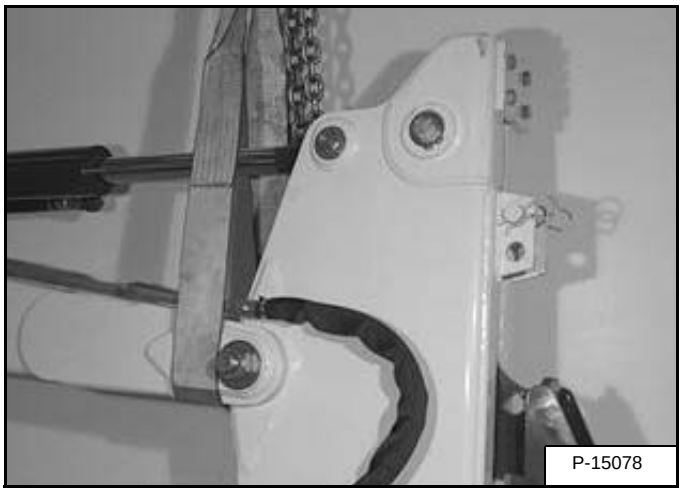
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Removal And Installation (Extendible Arm)

Lower the boom/bucket and blade to the ground.

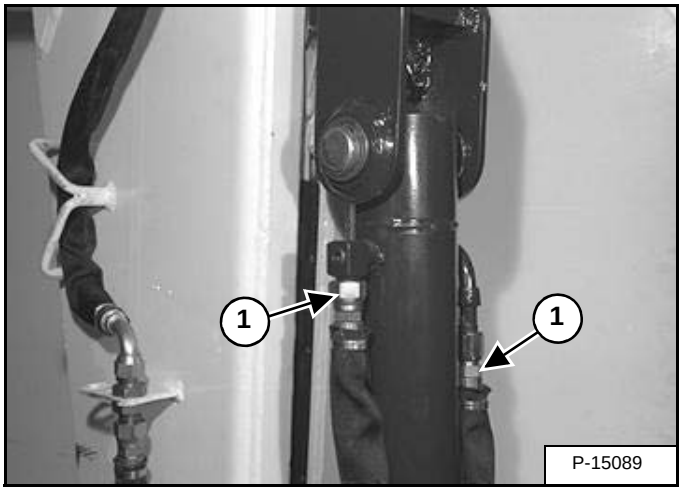
With the engine off, turn the key to the ON position and move both control levers to relieve hydraulic pressure.

Figure 20-23-12



Support the boom with a hoist **[Figure 20-23-12]**.

Figure 20-23-13



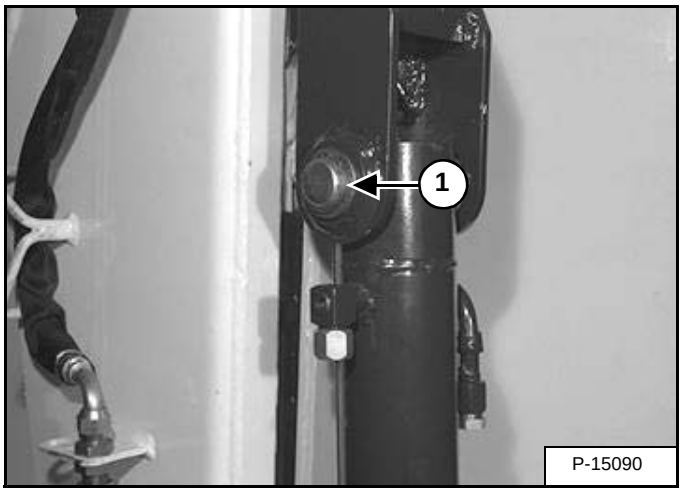
Remove the hoses (Item 1) **[Figure 20-23-13]**.

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.

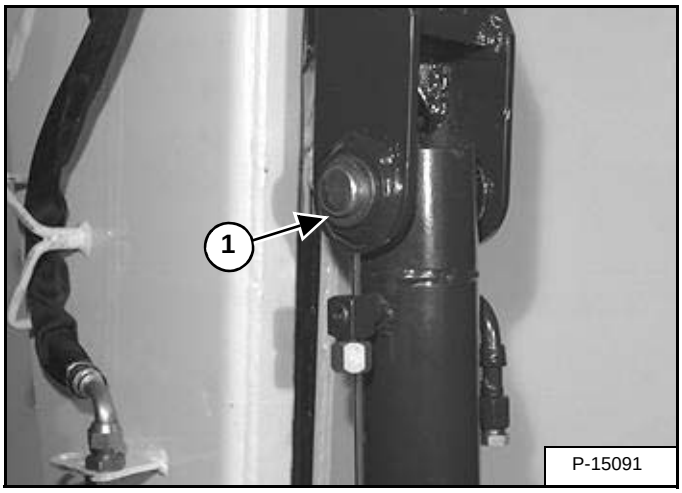
I-2003-0888

Figure 20-23-14



Remove the snap ring (Item 1) **[Figure 20-23-14]**.

Figure 20-23-15

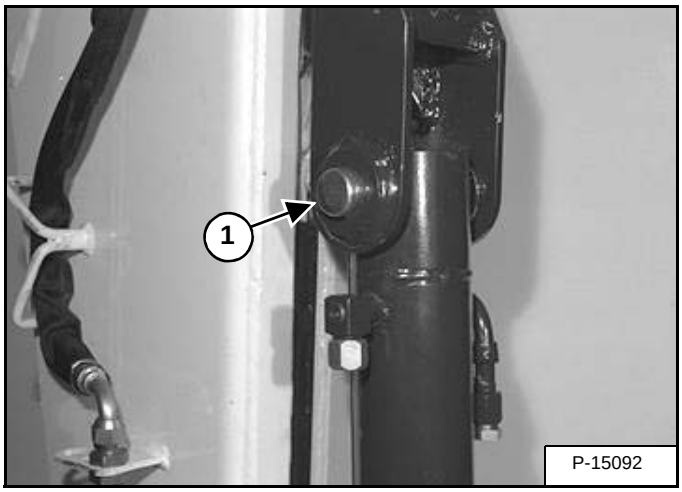


Remove the washer (Item 1) **[Figure 20-23-15]**.

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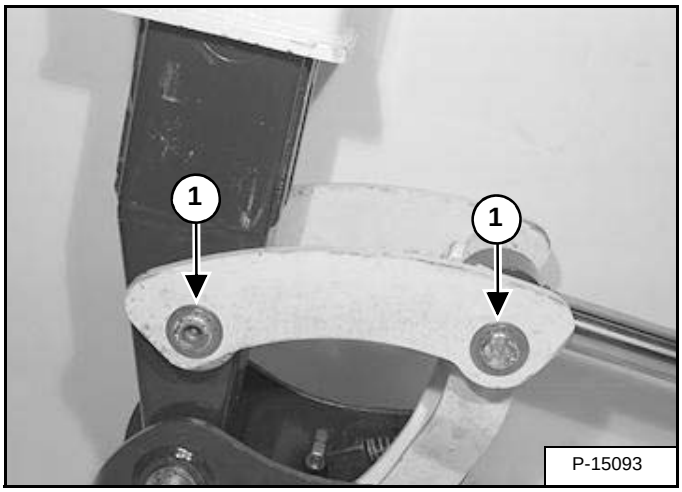
Removal And Installation (Extendible Arm) (Cont'd)

Figure 20-23-16



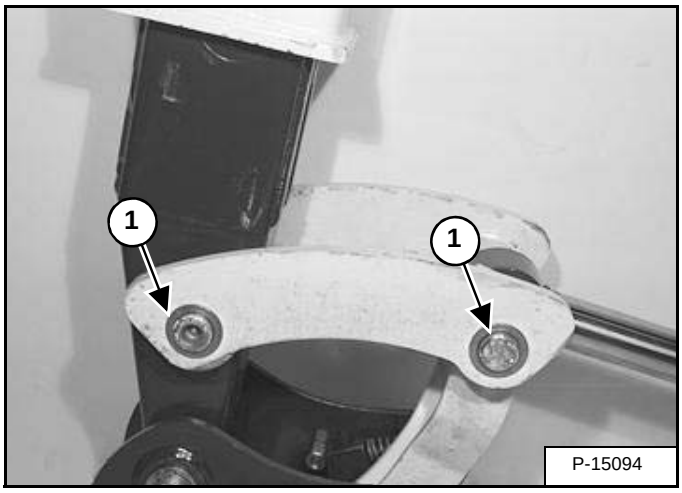
Remove the pin (Item 1) **[Figure 20-23-16]** and lay the base end of the cylinder on the ground.

Figure 20-23-17



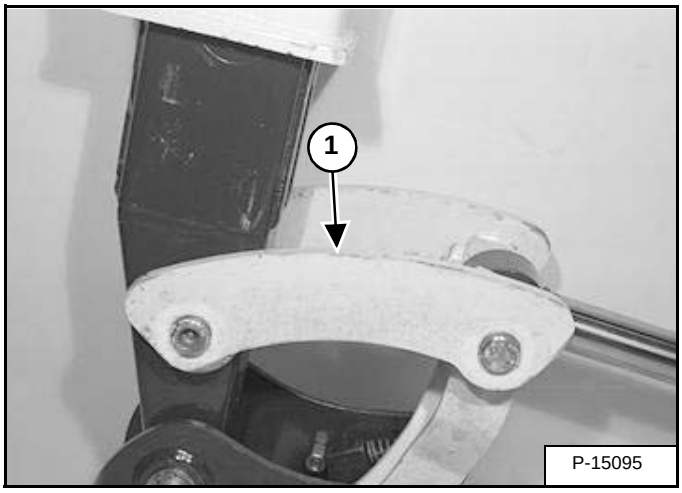
Remove the snap rings (Item 1) **[Figure 20-23-17]**.

Figure 20-23-18



Remove the washers (Item 1) **[Figure 20-23-18]**.

Figure 20-23-19

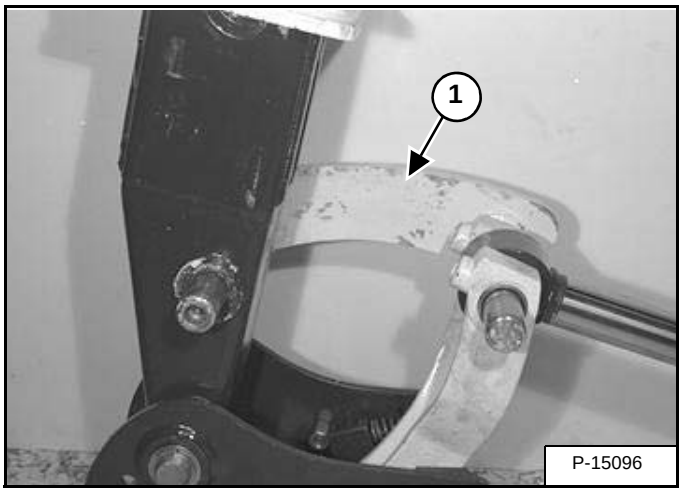


Remove the plate (Item 1) **[Figure 20-23-19]**.

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Removal And Installation (Extendible Arm) (Cont'd)

Figure 20-23-20

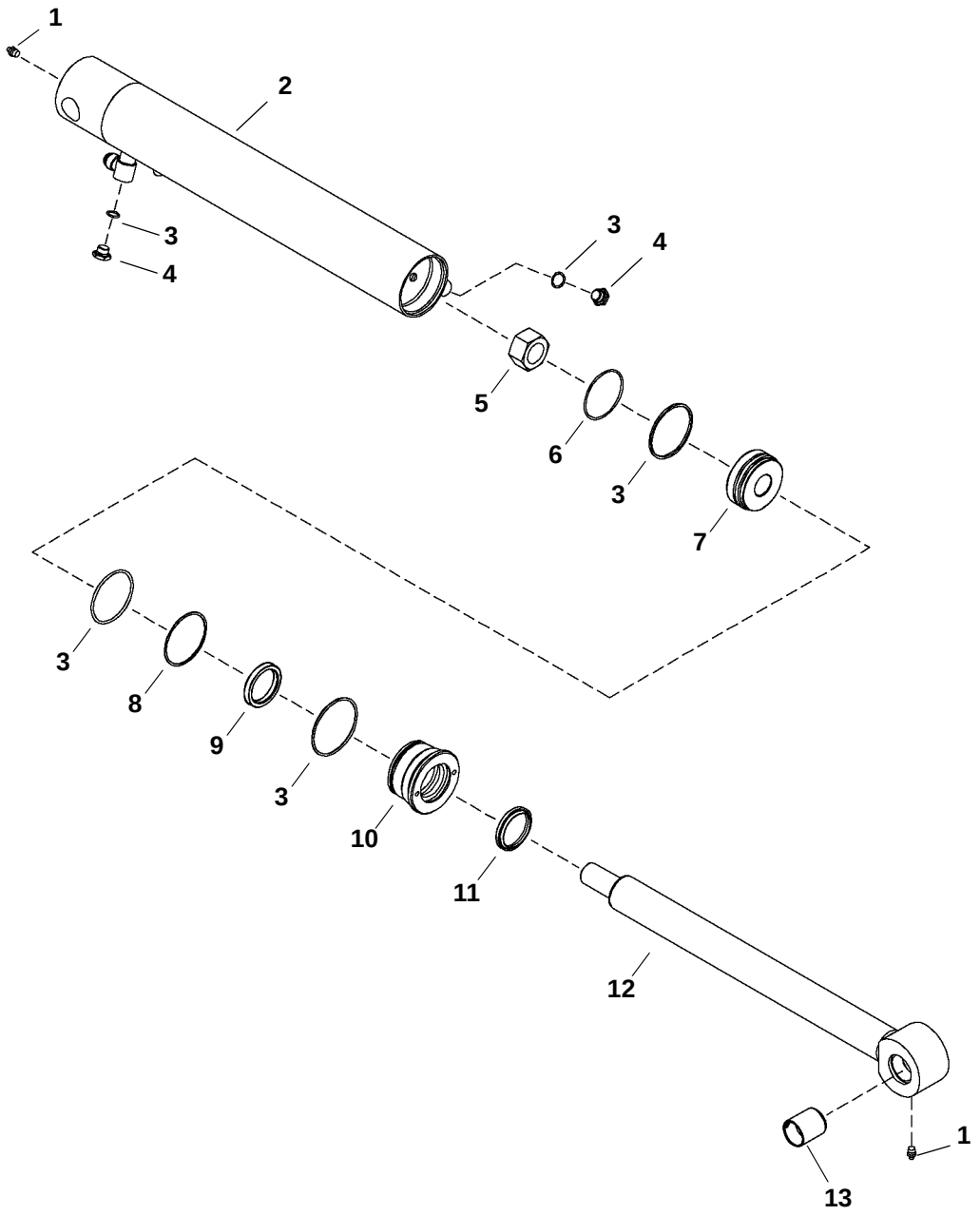


Remove the link (Item 1) **[Figure 20-23-20]** and remove the cylinder.

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Parts Identification

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



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Disassembly

Clean the outside of the cylinder before disassembly.

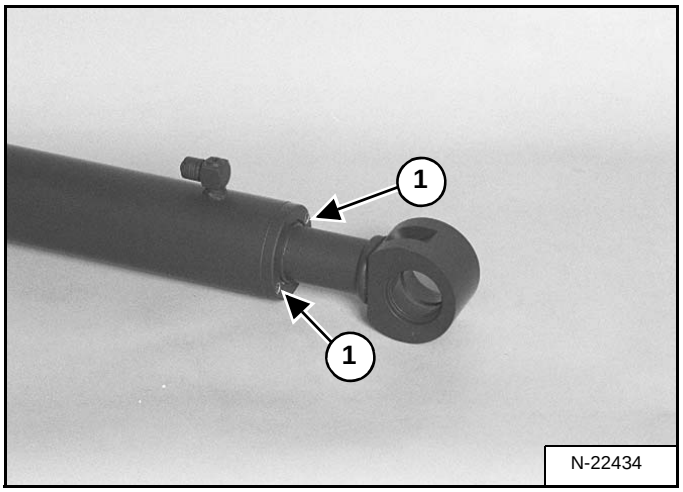
Use the following tools to disassemble the cylinder:

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.

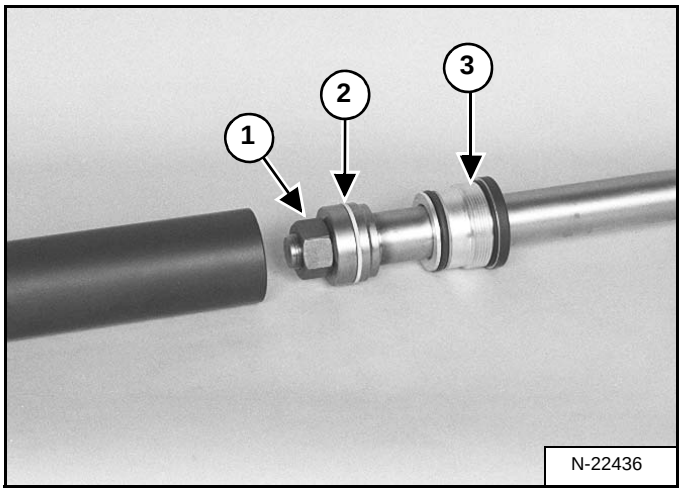
Put the base end of the cylinder in a vise.

Figure 20-23-21



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-23-21]** to loosen the head.

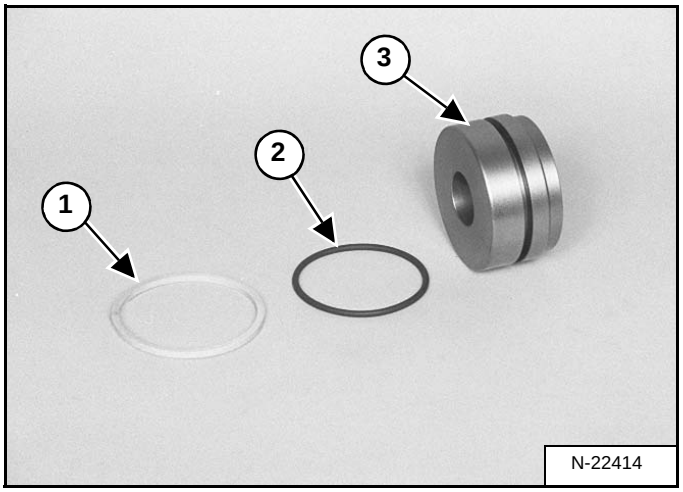
Figure 20-23-22



Remove the head and the rod assembly from the cylinder **[Figure 20-23-22]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-23-22]**.

Figure 20-23-23

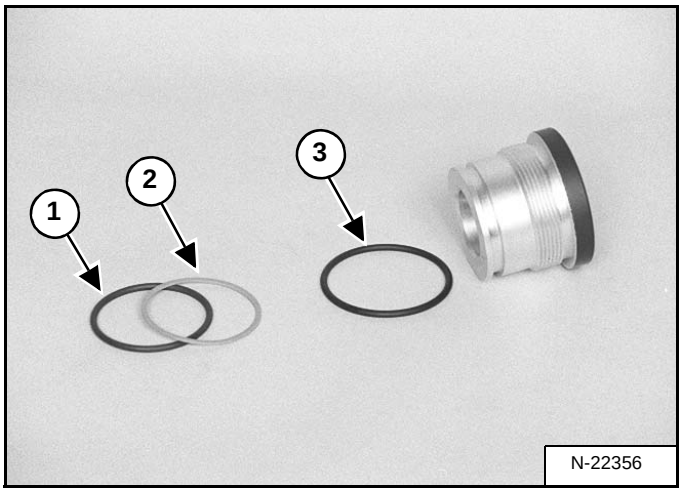


Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-23-23]**.

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Disassembly (Cont'd)

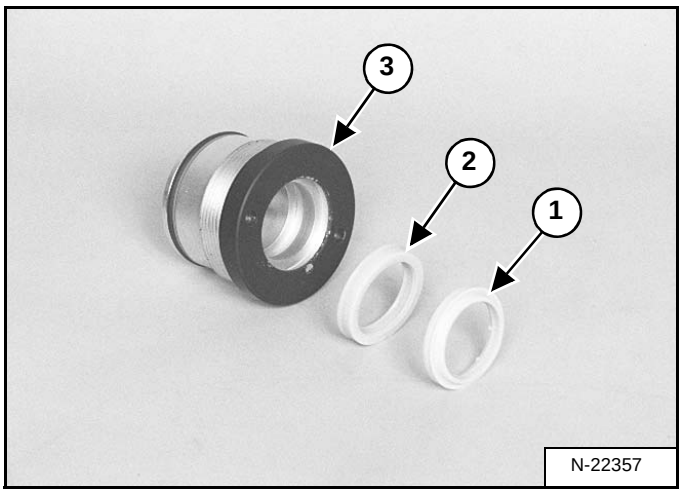
Figure 20-23-24



Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-23-24]** from the head.

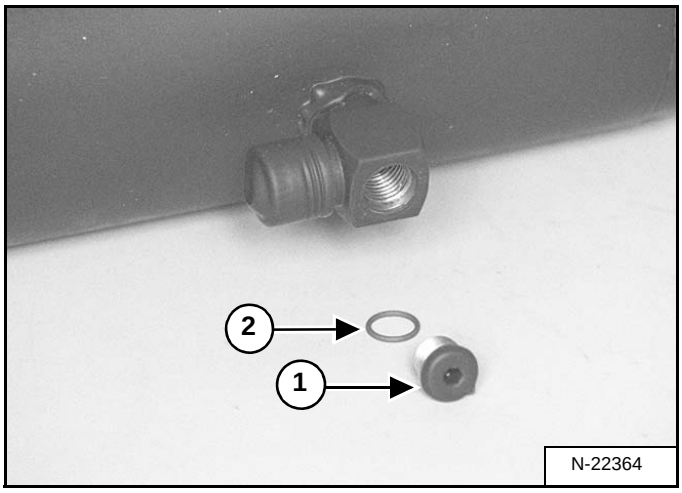
Remove the O-ring (Item 4) **[Figure 20-23-24]**.

Figure 20-23-25



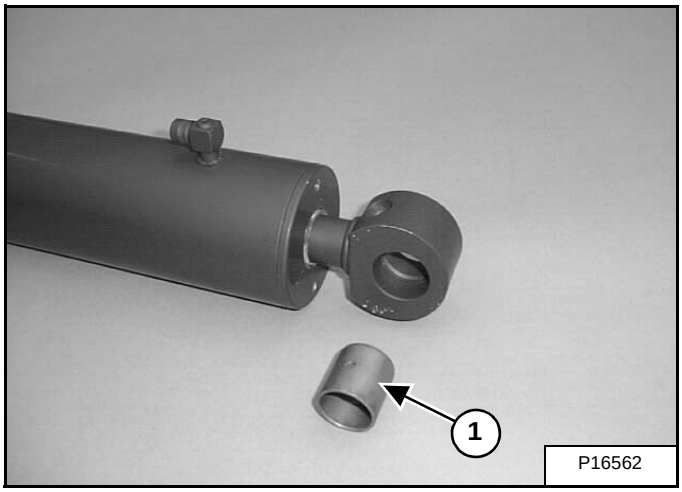
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-23-25]**.

Figure 20-23-26



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-23-26]**.

Figure 20-23-27



Remove the bushing (Item 1) **[Figure 20-23-27]**.

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Assembly

Clean all parts in solvent and dry with compressed air.

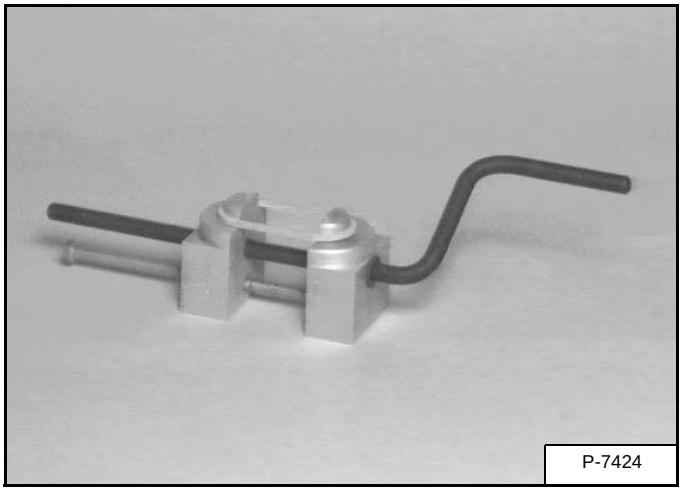
Inspect all parts for wear or damage. Replace any worn or damaged parts.

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

Use the following tools to assemble the cylinder:

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

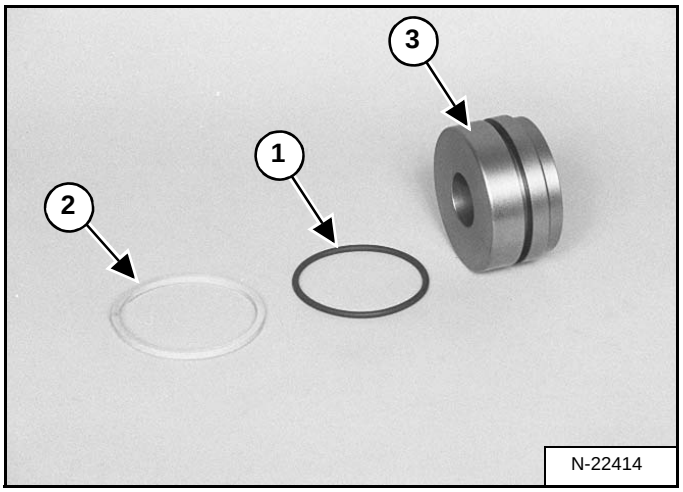
Figure 20-23-28



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

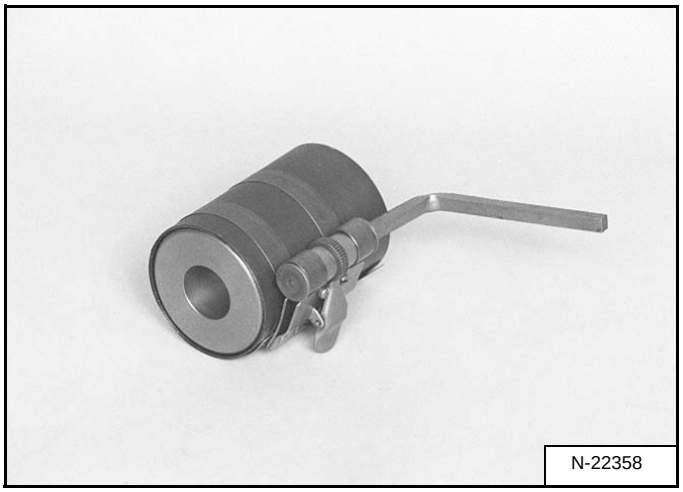
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-23-29



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

Figure 20-23-30



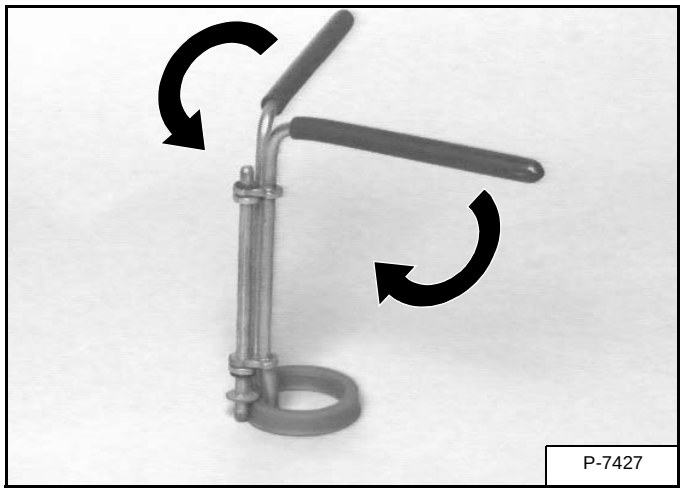
Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-23-30]**.

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BUCKET CYLINDER (CONT'D)

Assembly (Cont'd)

Figure 20-23-31

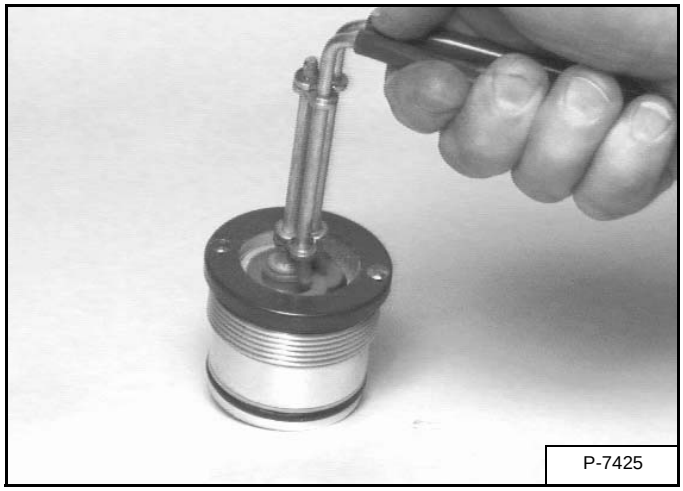


Install the rod seal on the rod seal tool **[Figure 20-23-31]**.

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

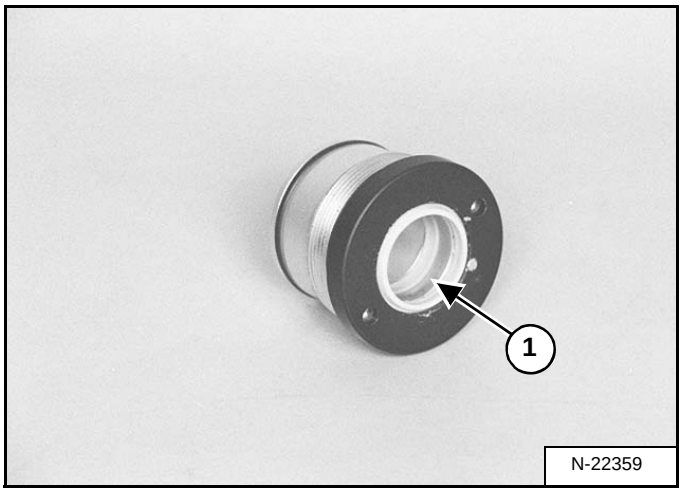
Rotate the handles to collapse the rod seal **[Figure 20-23-31]**.

Figure 20-23-32



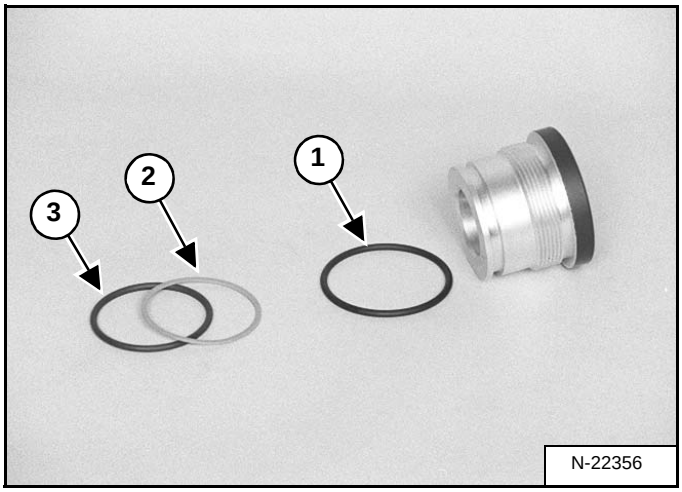
Install the rod seal in the head **[Figure 20-23-32]**.

Figure 20-23-33



Install the wiper seal with the wiper (Item 1) **[Figure 20-23-33]** toward the outside of the head.

Figure 20-23-34



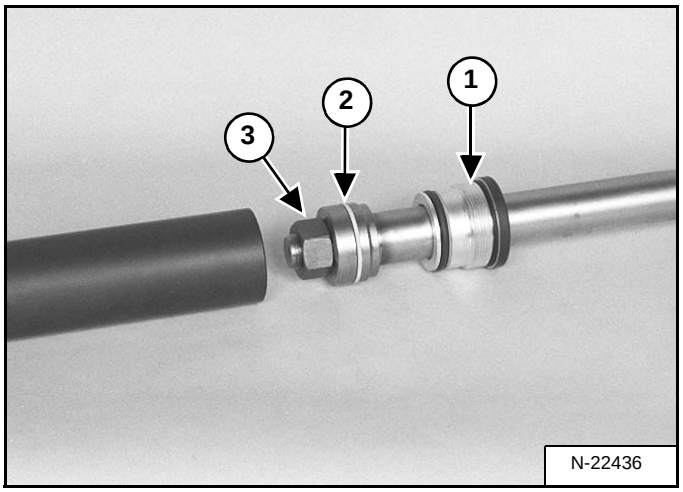
Install the O-ring (Item 1) **[Figure 20-23-34]**.

Install the back-up ring (Item 2) and O-ring (Item 3) **[Figure 20-23-34]**.

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Assembly (Cont'd)

Figure 20-23-35



Install the head (Item 1) and the piston (Item 2) **[Figure 20-23-35]** on the rod as shown.

NOTE: Clean and dry the rod threads. Install a NEW NUT with pre-applied LOCTITE.

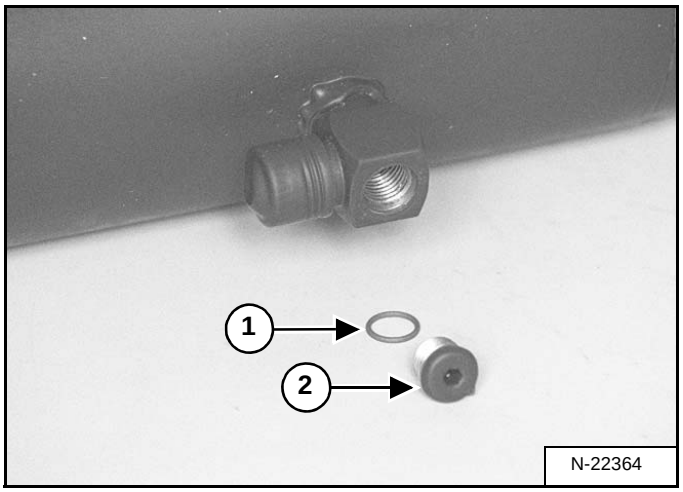
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-23-35]**.

Tighten the nut to 850 ft.-lbs. (1153 Nm) torque.

Figure 20-23-36

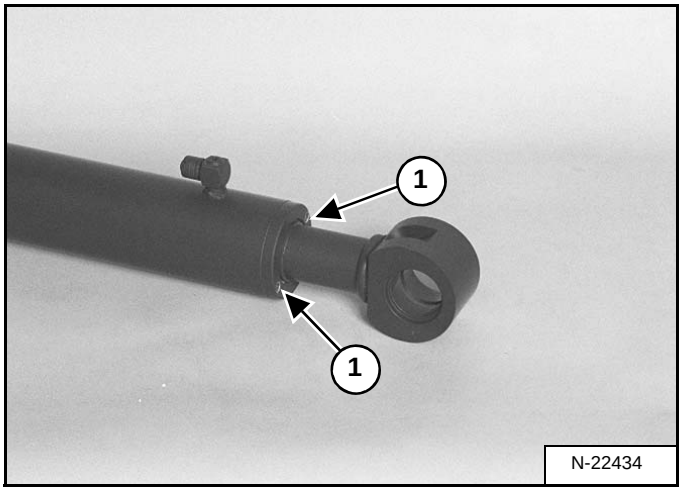


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-23-36]**.

Tighten the plug to 8 ft.-lbs. (11 Nm) torque.

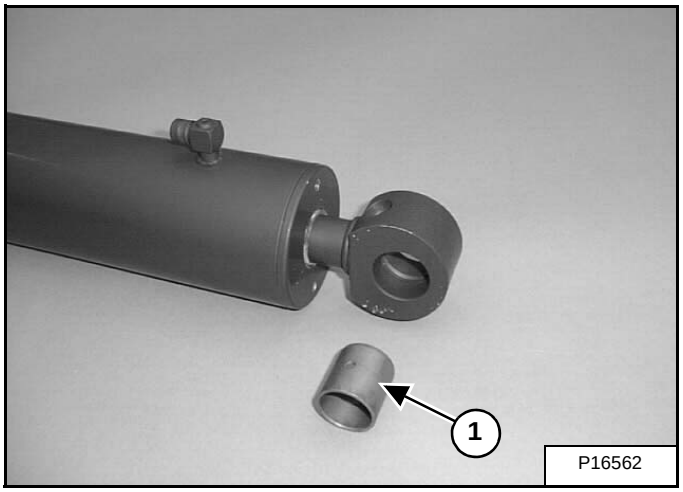
Put the base end of the cylinder in a vise.

Figure 20-23-37



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-23-37]** to tighten the head. Head to be torqued until flush with the end of the housing.

Figure 20-23-38



Install the bushing (Item 1) **[Figure 20-23-38]**. The bushing must be aligned with the grease channel in the rod end of the cylinder.

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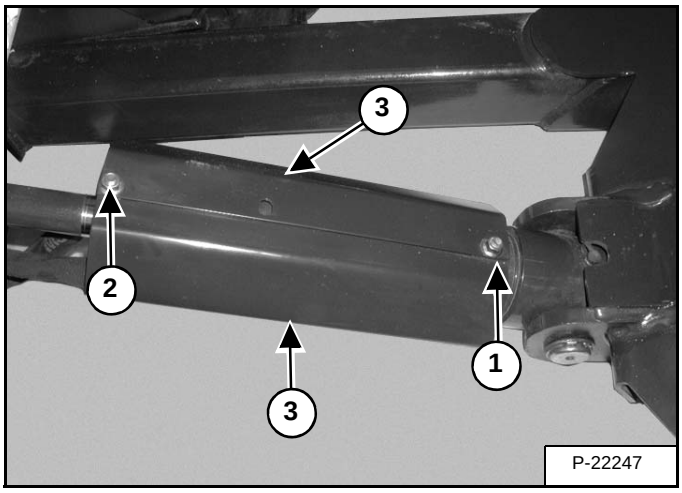
BLADE CYLINDER

Testing

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. Raise the control console.

Figure 20-24-1

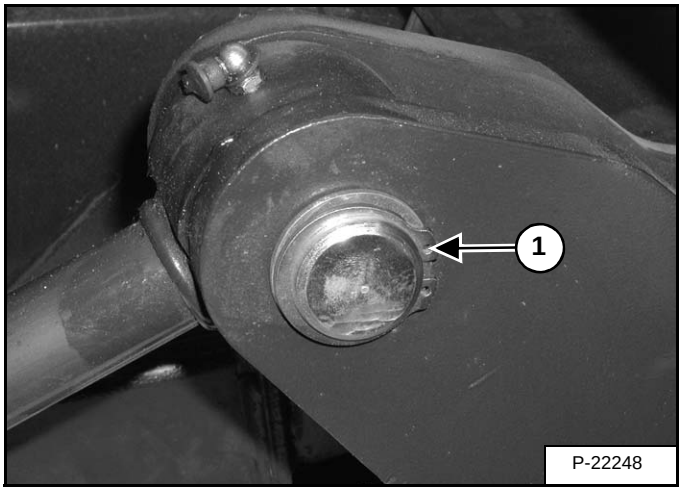


Remove the two nuts (Item 1) **[Figure 20-24-1]** from the studs.

Remove the two bolts and nuts (Item 2) **[Figure 20-24-1]** from the cylinder shields.

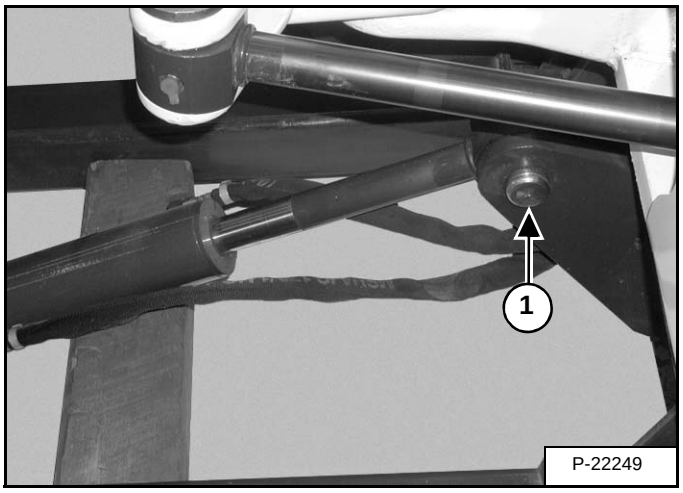
Remove the shields (Item 3) **[Figure 20-24-1]**.

Figure 20-24-2



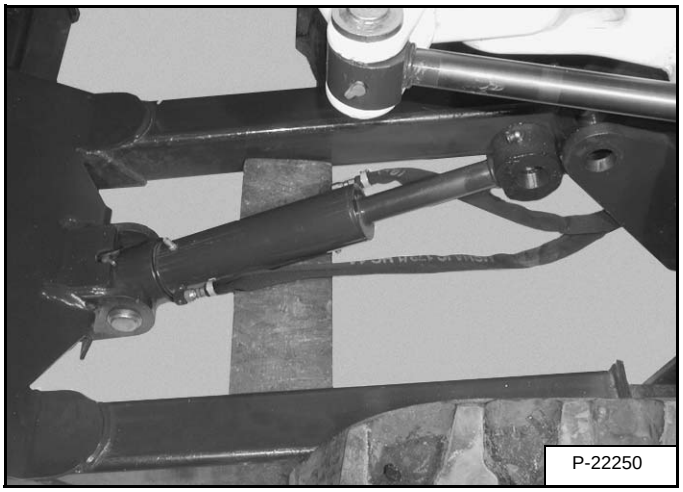
Remove the snap ring (Item 1) **[Figure 20-24-2]** and washer from the cylinder rod end.

Figure 20-24-3



Support the cylinder and remove the pin (Item 1) **[Figure 20-24-3]**.

Figure 20-24-4



Start the engine and retract the blade cylinder **[Figure 20-24-4]**.

Stop the engine. Move the blade lever in both directions to release hydraulic pressure.

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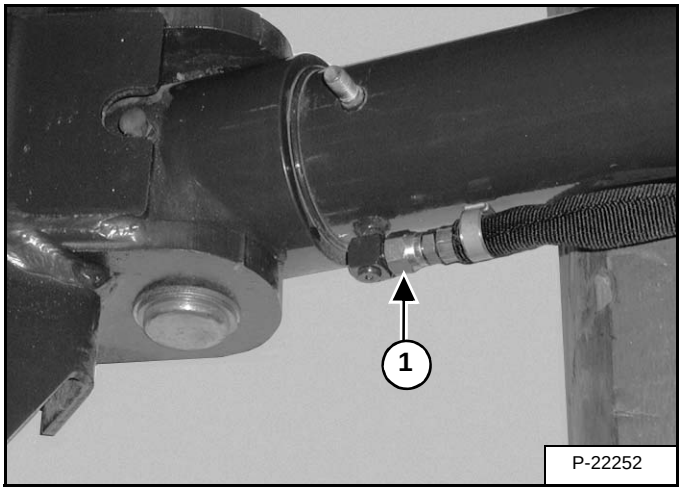
Testing (Cont'd)

⚠ 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.

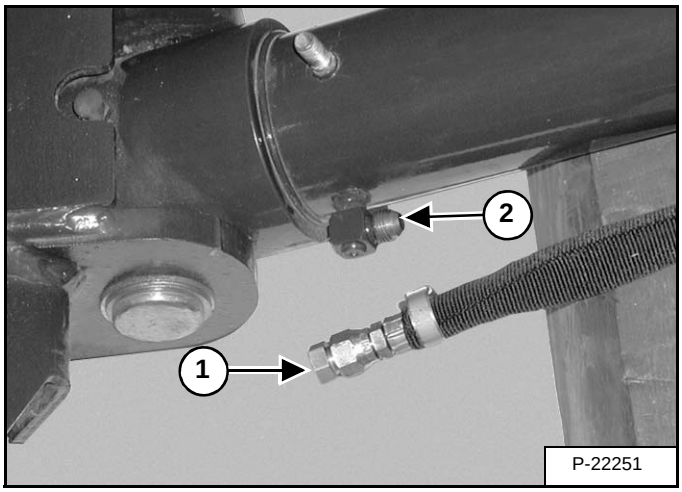
W-2145-0290

Figure 20-24-5



Remove the blade cylinder base and end hose (Item 1) **[Figure 20-24-5]**.

Figure 20-24-6



Install a plug (Item 1) **[Figure 20-24-6]** on the hose fitting and tighten.

Start the engine and retract the blade cylinder.

If there is any leakage from the base end fitting (Item 2) **[Figure 20-24-6]** on the blade cylinder, remove the cylinder for repair or replacement.

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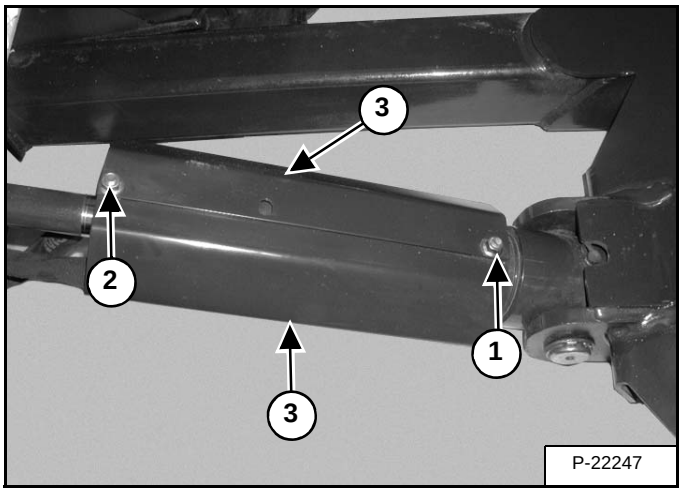
BLADE CYLINDER (CONT'D)

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. Raise the control console.

Figure 20-24-7

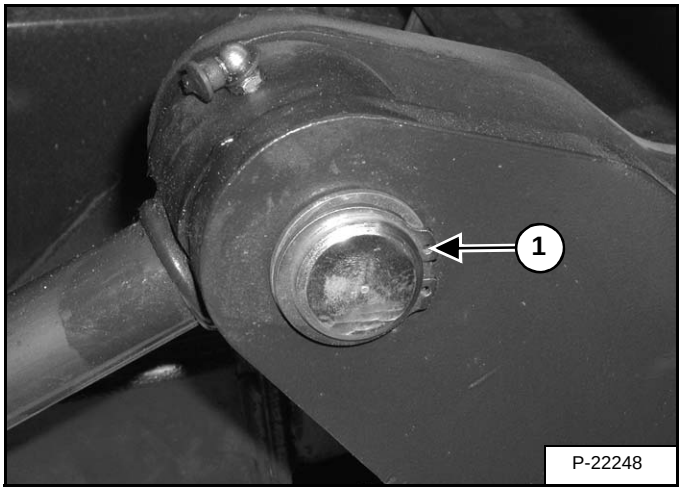


Remove the two nuts (Item 1) **[Figure 20-24-7]** from the studs.

Remove the two bolts and nuts (Item 2) **[Figure 20-24-7]** from the cylinder shields.

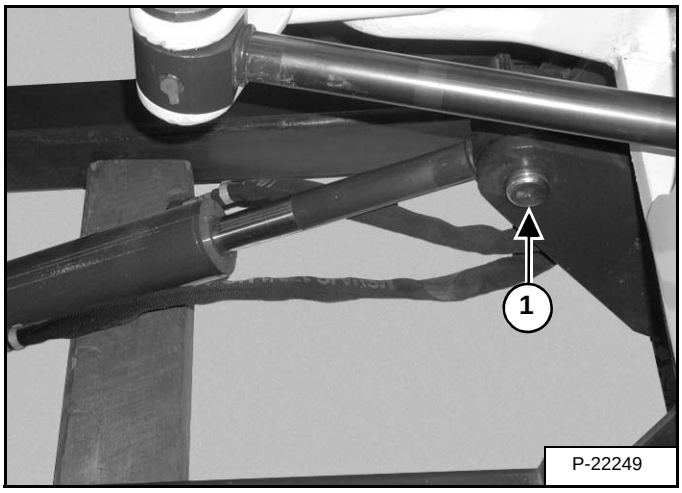
Remove the shields (Item 3) **[Figure 20-24-7]**.

Figure 20-24-8



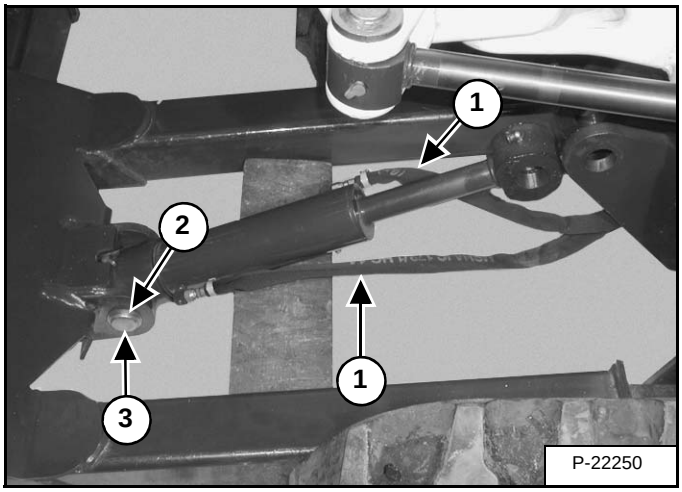
Remove the snap ring (Item 1) **[Figure 20-24-8]** and washer from the cylinder rod end.

Figure 20-24-9



Support the cylinder and remove the pin (Item 1) **[Figure 20-24-9]**.

Figure 20-24-10



Remove the hoses (Item 1) **[Figure 20-24-10]**.

Remove the base end snap ring and washer (Item 2) **[Figure 20-24-10]**.

Remove the base end pin (Item 3) **[Figure 20-24-10]** and remove the blade cylinder.

IMPORTANT

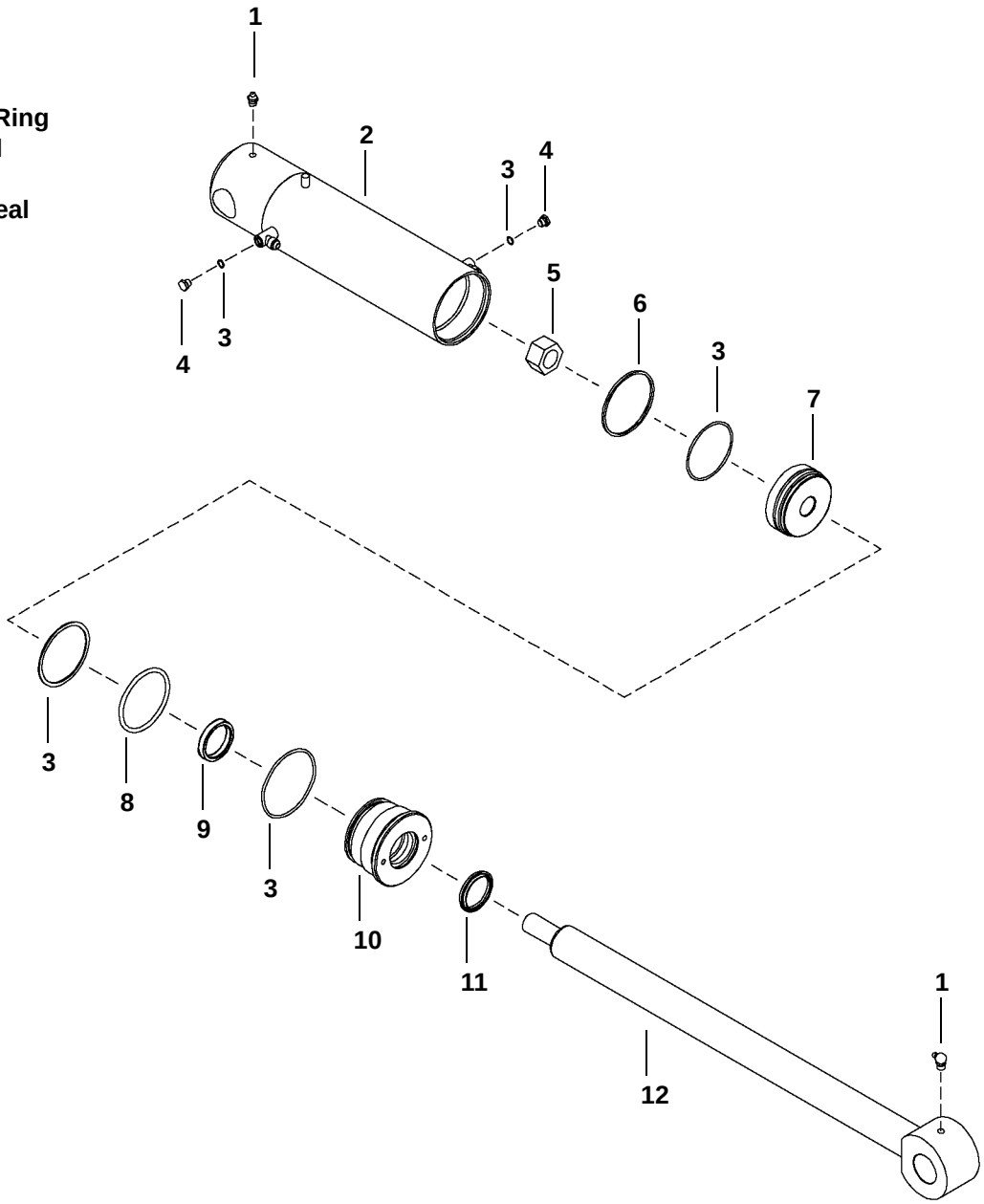
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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Parts Identification

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



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Disassembly

Clean the outside of the cylinder before disassembly.

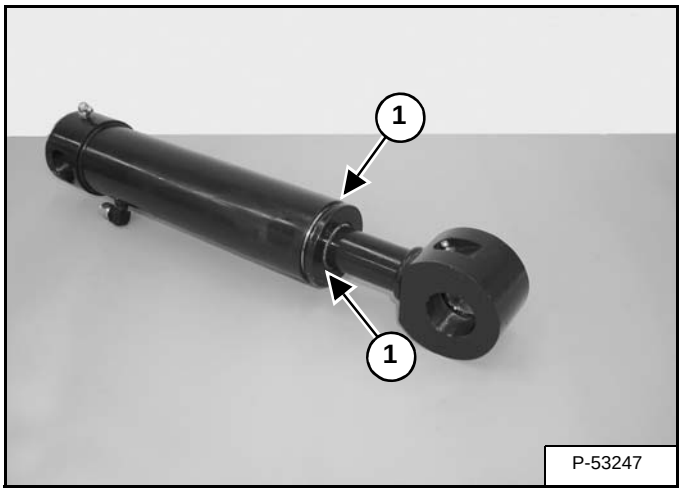
Use the following tools to disassemble the cylinder:

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.

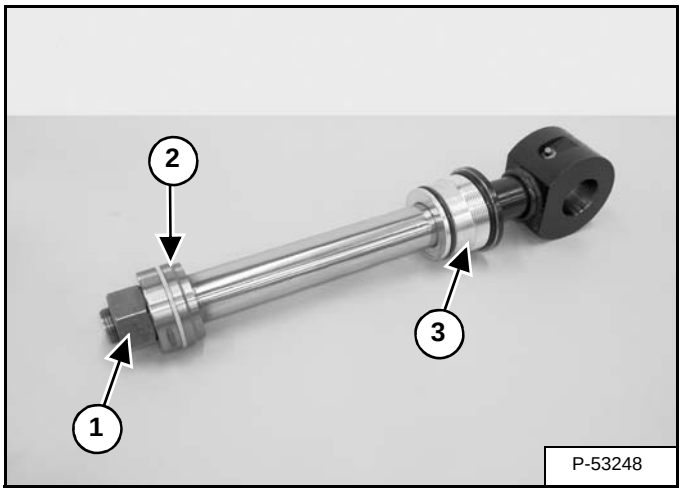
Put the base end of the cylinder in a vise.

Figure 20-24-11



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-24-11]** to loosen the head.

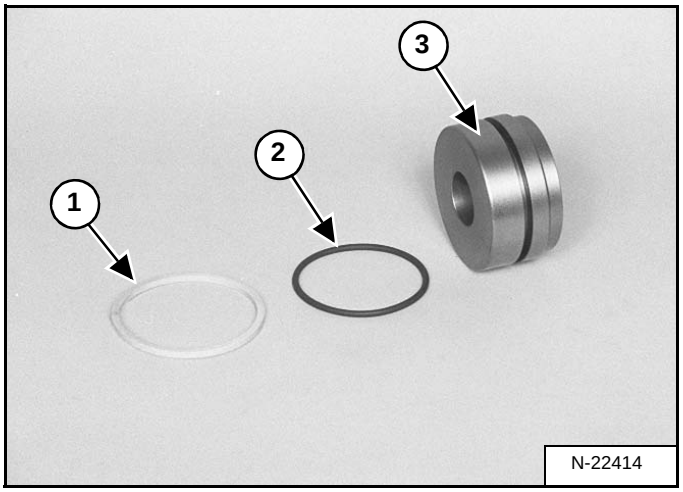
Figure 20-24-12



Remove the head and the rod assembly from the cylinder **[Figure 20-24-12]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-24-12]**.

Figure 20-24-13

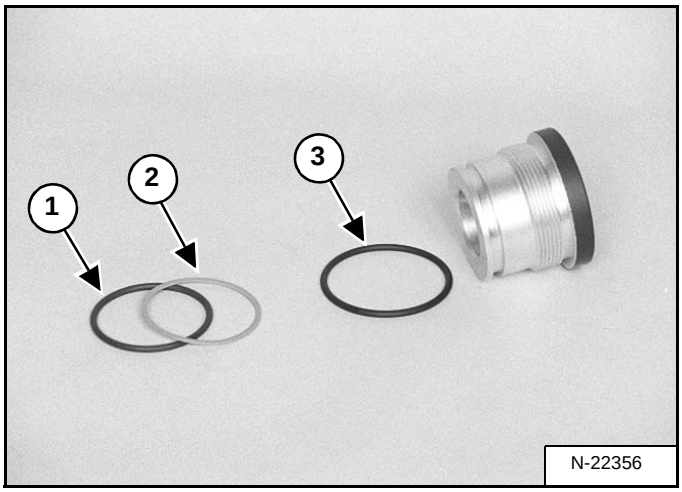


Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-24-13]**.

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Disassembly (Cont'd)

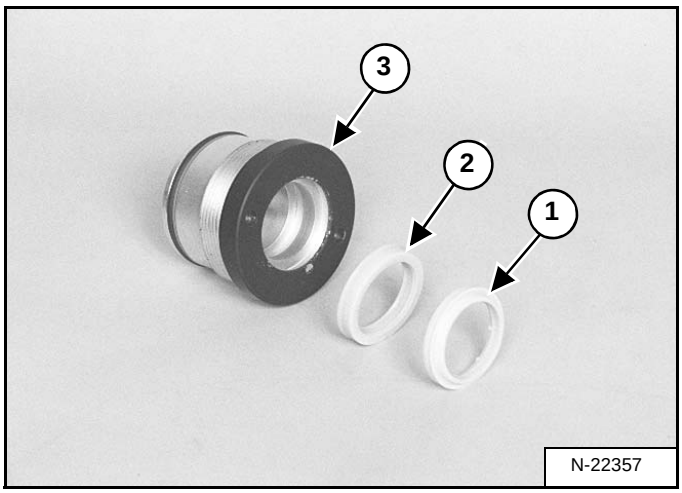
Figure 20-24-14



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

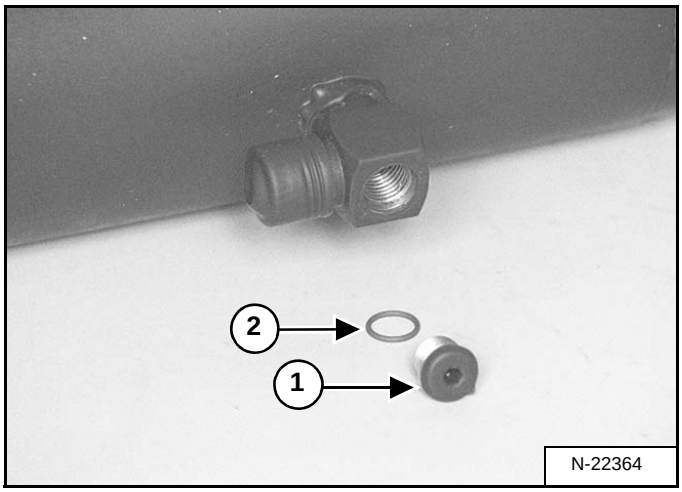
Remove the O-ring (Item 3) **[Figure 20-24-14]**.

Figure 20-24-15



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

Figure 20-24-16



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

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Assembly

Clean all parts in solvent and dry with compressed air.

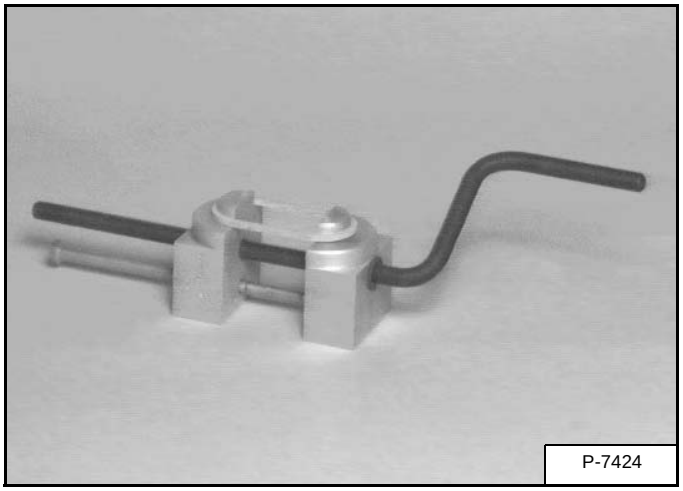
Inspect all parts for wear or damage. Replace any worn or damaged parts.

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

Use the following tools to assemble the cylinder:

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

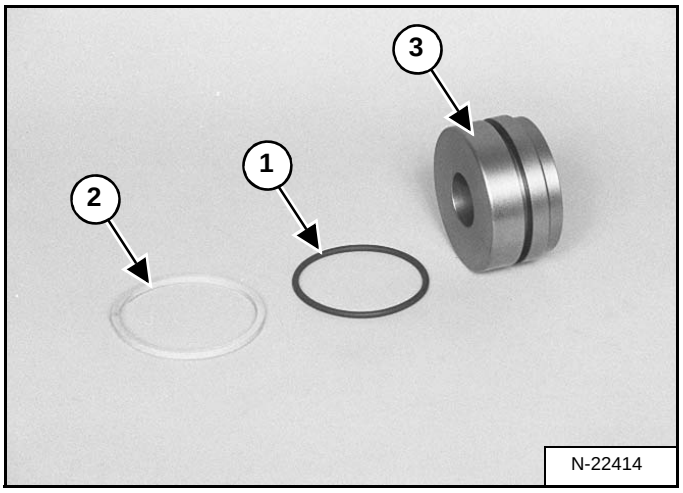
Figure 20-24-17



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

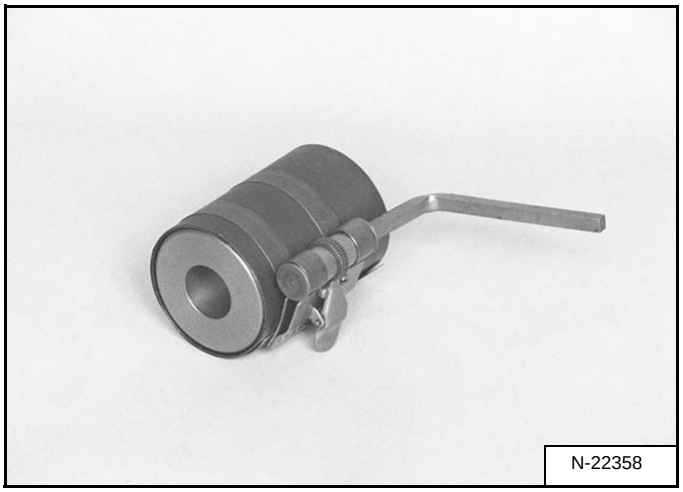
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-24-18



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

Figure 20-24-19

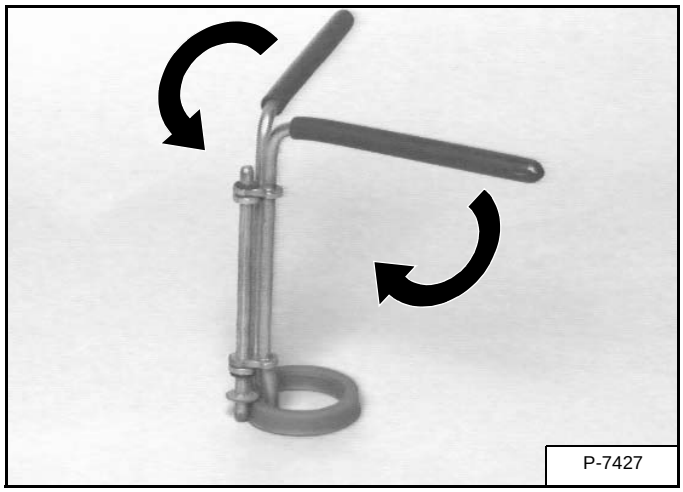


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-24-19]**.

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Assembly (Cont'd)

Figure 20-24-20

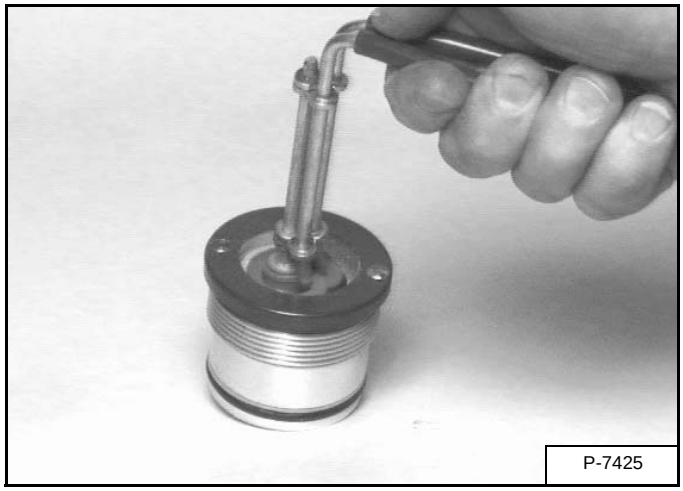


Install the rod seal on the rod seal tool **[Figure 20-24-20]**.

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

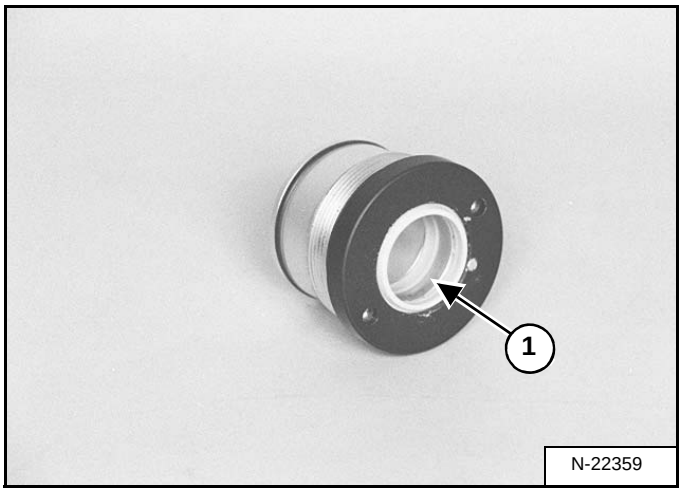
Rotate the handles to collapse the rod seal **[Figure 20-24-20]**.

Figure 20-24-21



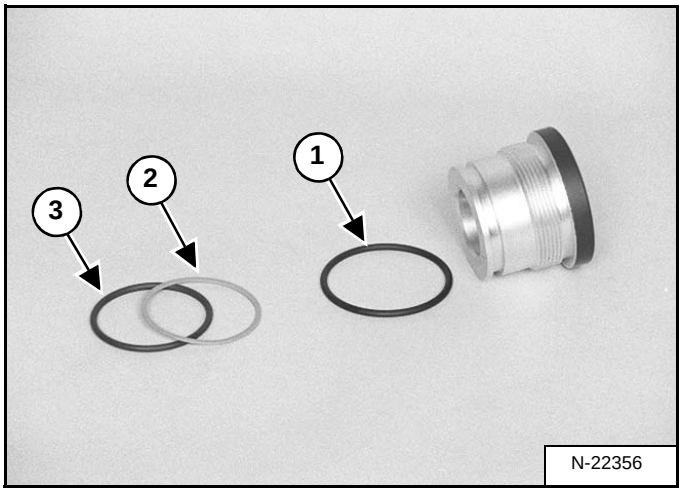
Install the rod seal in the head **[Figure 20-24-21]**.

Figure 20-24-22



Install the wiper seal with the wiper (Item 1) **[Figure 20-24-22]** toward the outside of the head.

Figure 20-24-23



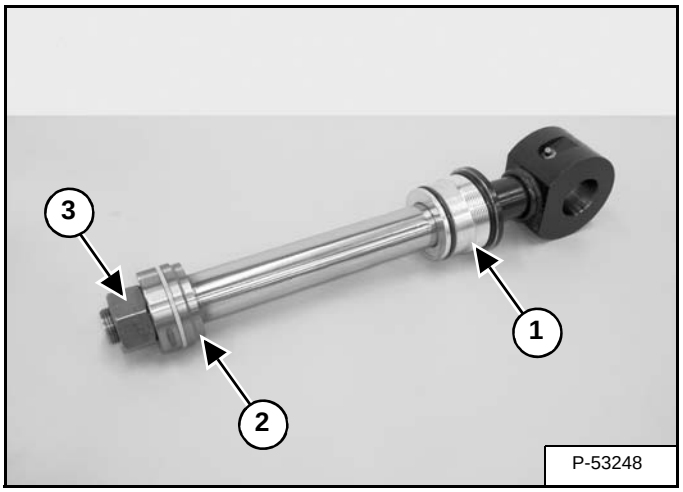
Install the O-ring (Item 1) **[Figure 20-24-23]**.

Install the back-up washer (Item 2) and O-ring (Item 3) **[Figure 20-24-23]**.

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Assembly (Cont'd)

Figure 20-24-24



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

NOTE: Clean and dry the rod threads. Install a NEW NUT with pre-applied LOCTITE.

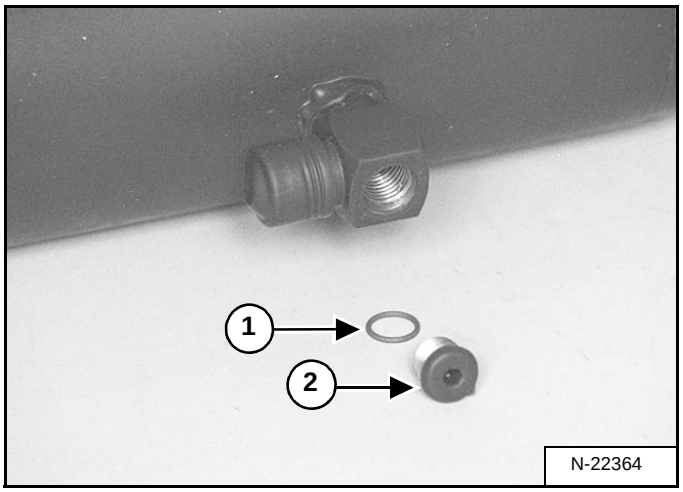
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

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

Tighten the nut to 600 ft.-lbs. (814 Nm) torque.

Figure 20-24-25

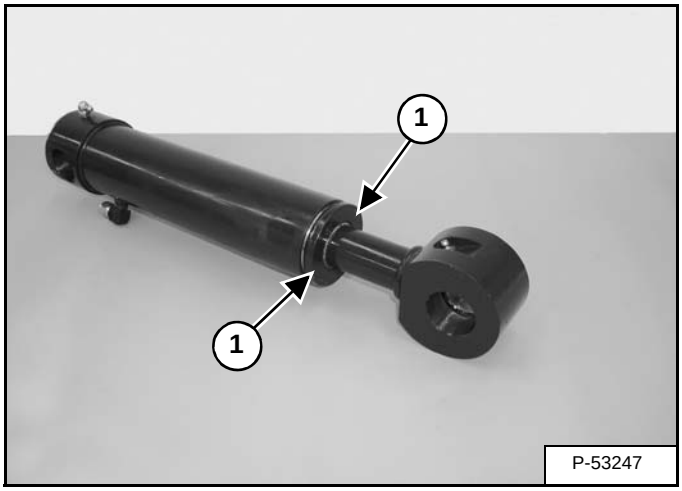


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-24-25]**.

Tighten the plug to 8 ft.-lbs. (11 Nm) torque.

Put the base end of the cylinder in a vise.

Figure 20-24-26



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-24-26]** to tighten the head. Head to be torqued until flush with the end of the housing.

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EXTENDIBLE ARM CYLINDER

Removal And Installation

Extend the arm cylinder, until the cylinder rod end pin is accessible.

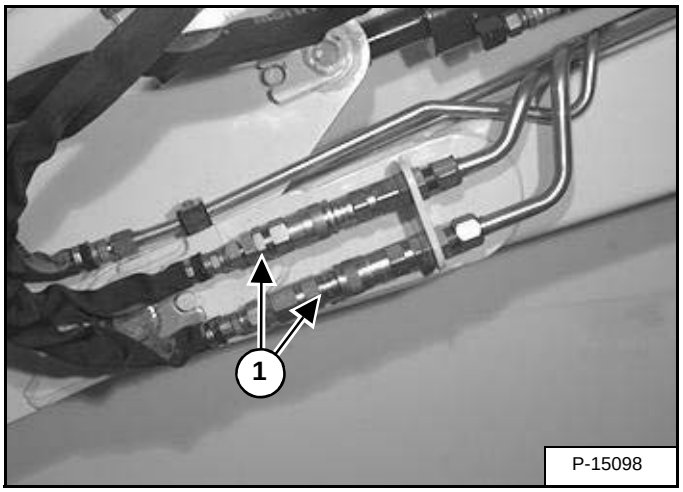
Extend the extendible arm cylinder, retract the bucket cylinder and lower the boom until the bucket is on the ground. Relieve hydraulic pressure.

Figure 20-25-1



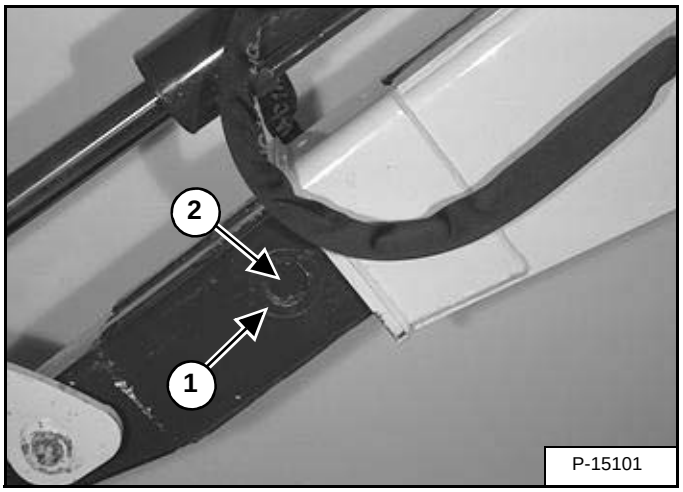
Support the boom with a hoist **[Figure 20-25-1]**.

Figure 20-25-2



Disconnect the quick couplers (Item 1) **[Figure 20-25-2]**.

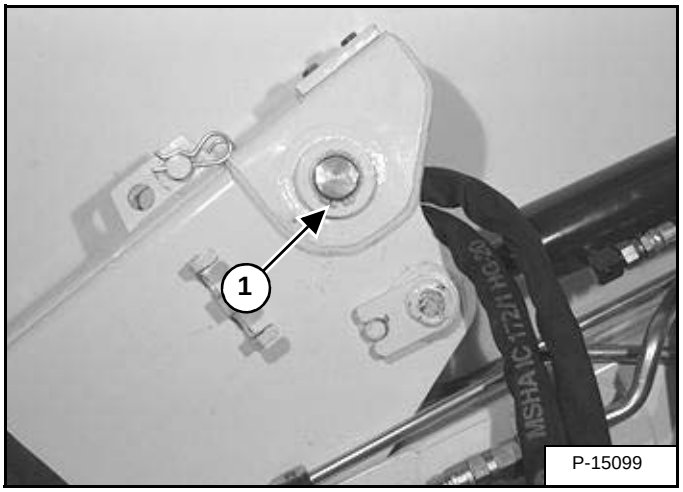
Figure 20-25-3



Remove the snap ring (Item 1) **[Figure 20-25-3]** from the rod end of the cylinder.

Remove the pin (Item 2) **[Figure 20-25-3]**.

Figure 20-25-4

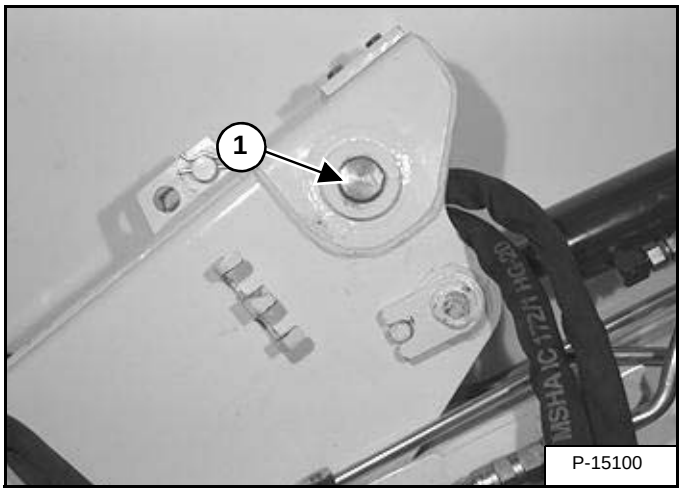


Remove the snap ring (Item 1) **[Figure 20-25-4]** from the base end of the cylinder.

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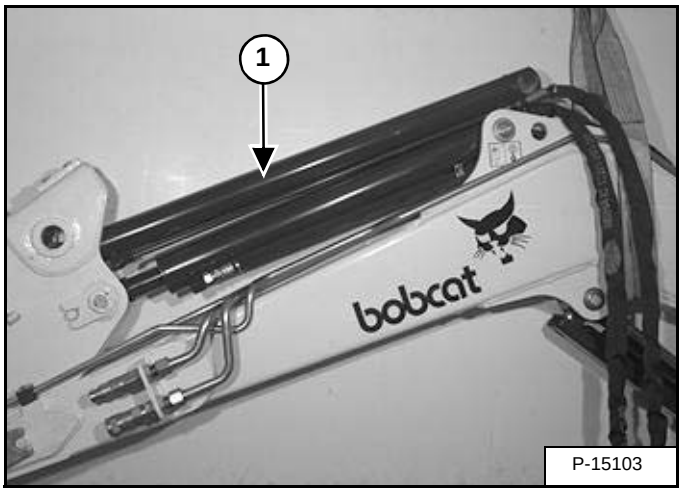
Removal And Installation (Cont'd)

Figure 20-25-5



Remove the pin (Item 1) **[Figure 20-25-5]**.

Figure 20-25-6

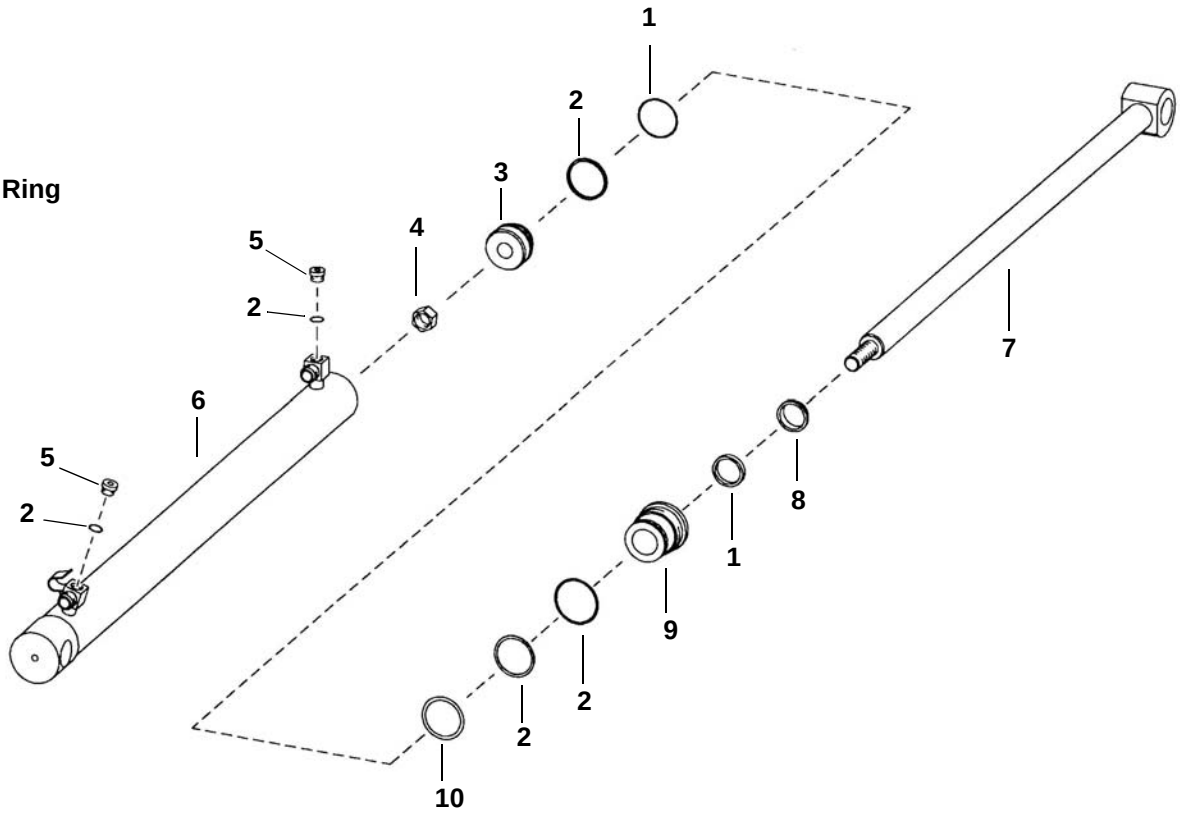


Remove the cylinder (Item 1) **[Figure 20-25-6]** from the arm.

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Parts Identification

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



TS-1912

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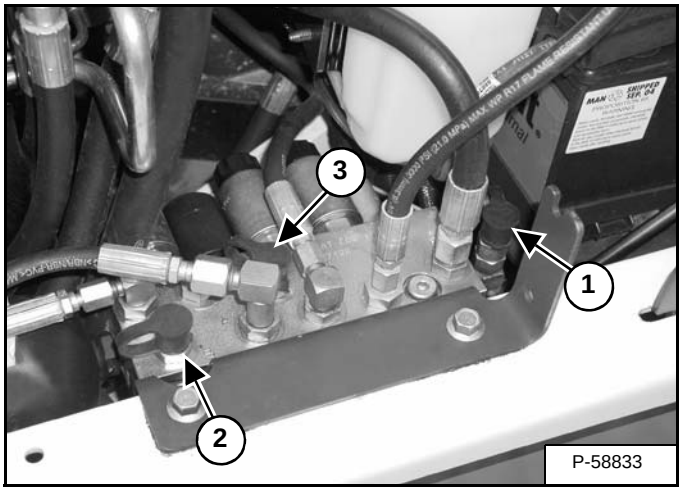
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MAIN RELIEF VALVE

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 2550-2620 RPM.

Figure 20-30-1



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

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

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

System Pressures At Gauge Port Specifications

TEST CONDITIONS

1. Engine High Idle Speed

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

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

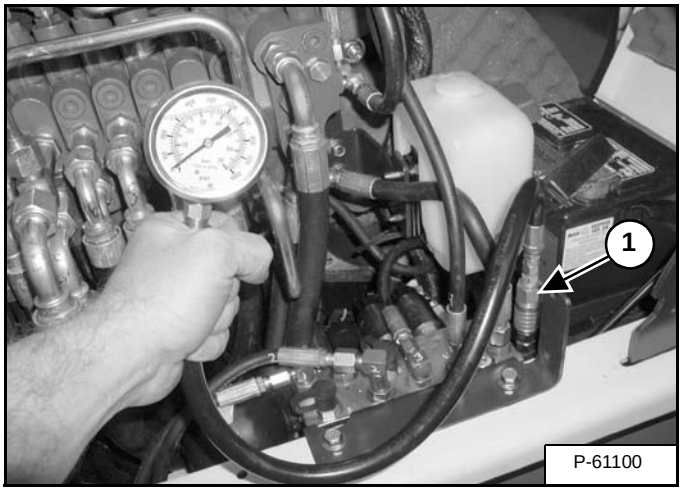
SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET (PSI)	ACCEPTABLE RANGE (PSI)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	G	428	406 - 450
SYSTEM BACK PRESSURE	NONE - CONSOLE DOWN	THROUGH NEUTRAL	P1		280-420
MAIN RELIEF	ANY EXCEPT SLEW	P1	P1	3480	3380-3580
SWING MOTOR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

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

Open the right side cover.

Figure 20-30-2



Connect the test gauge coupler and 1000 psi (69 Bar) gauge from the test kit to the P1 diagnostic coupler (Item 1) **[Figure 20-30-2]**.

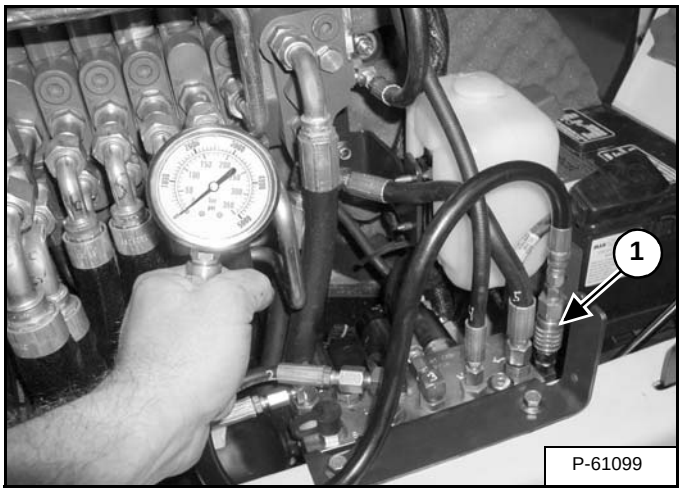
Lower the control console and fasten the seat belt.

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

With the console lowered, and the engine at full RPM there is system back pressure of 280-420 PSI (19-29 bar).

Remove the gauge.

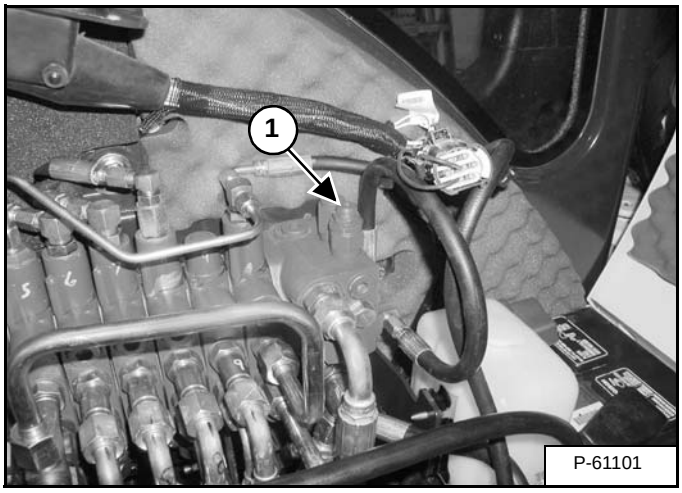
Figure 20-30-3



Connect the test gauge coupler and 5000 PSI (345 bar) gauge to the diagnostic coupler (Item 1) **[Figure 20-30-3]**.

Engage the blade raise circuit over relief and record the pressure.

Figure 20-30-4



The main relief valve (Item 1) **[Figure 20-30-4]** pressure should be as follows:

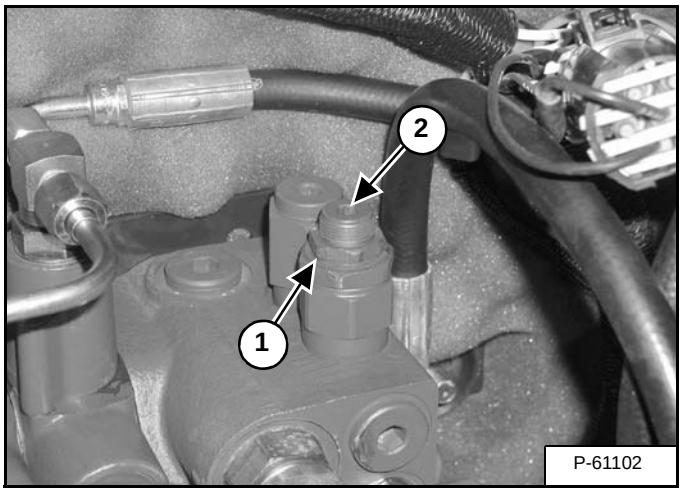
A target pressure of 3480 PSI (240 bar) with an acceptable range of 3380-3530 PSI (233-243 bar).

Stop the engine.

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

Figure 20-30-5



If adjustment is needed, loosen the nut (Item 1) **[Figure 20-30-5]**.

Turn the adjustment screw (Item 2) **[Figure 20-30-5]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

NOTE: 1/2 turn is approximately 400 PSI (28 bar).

Tighten the nut (Item 1) **[Figure 20-30-5]**.

Retest the main relief valve after adjustment.

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PORT RELIEF VALVES

Testing And Adjusting Port Relief Valve Pressure

Figure 20-31-1

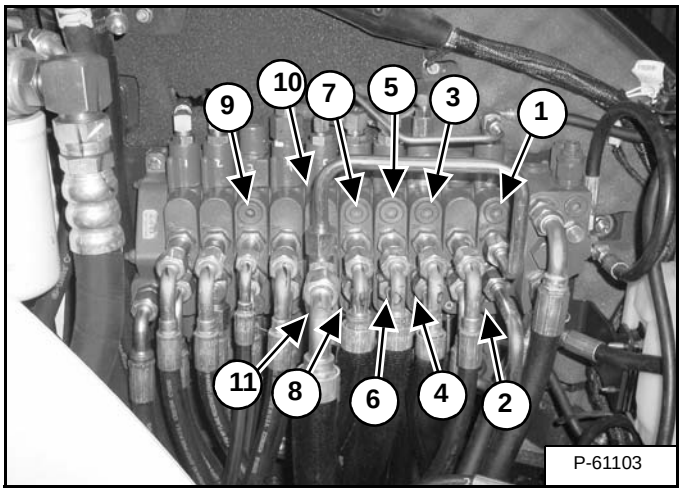
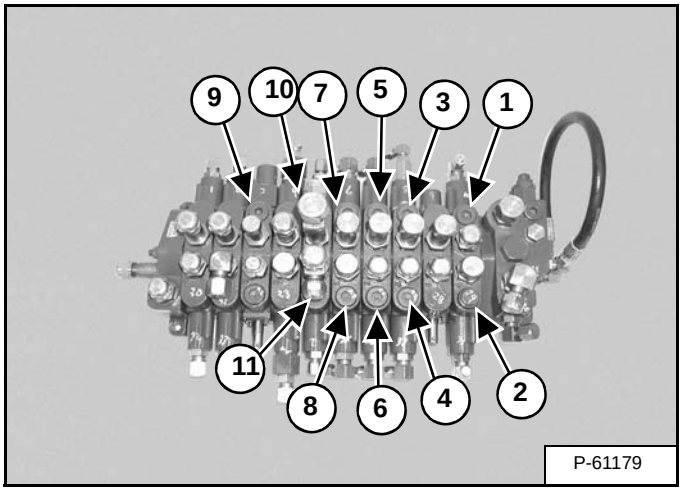


Figure 20-31-2



Auxiliary Port Relief set at (Early Models Only):

Male Quick Coupler (Item 1) **[Figure 20-31-1]** & **[Figure 20-31-2]** 2610 PSI (180 bar)

Female Quick Coupler (Item 2) **[Figure 20-31-1]** & **[Figure 20-31-2]** 2610 PSI (180 bar)

Boom Port Relief set at:

Rod End (Item 3) **[Figure 20-31-1]** & **[Figure 20-31-2]** 3915 PSI (270 bar)

Base End (Item 2) **[Figure 20-31-1]** & **[Figure 20-31-2]** 3915 PSI (270 bar)

Arm Port Relief set at:

Rod End (Item 5) **[Figure 20-31-1]** & **[Figure 20-31-2]** 3625 PSI (250 bar)

Base End (Item 6) **[Figure 20-31-1]** & **[Figure 20-31-2]** 3625 PSI (250 bar)

Bucket Port Relief set at:

Rod End (Item 7) **[Figure 20-31-1]** & **[Figure 20-31-2]** 3915 PSI (270 bar)

Base End (Item 8) **[Figure 20-31-1]** & **[Figure 20-31-2]** 3915 PSI (270 bar)

Blade Port Relief set at:

Base End (Item 9) **[Figure 20-31-1]** & **[Figure 20-31-2]** 3915 PSI (270 bar)

Auxiliary Port Relief set at (Later Models Only):

Male Quick Coupler (Item 10) **[Figure 20-31-1]** & **[Figure 20-31-2]** 2610 PSI (180 bar)

Female Quick Coupler (Item 11) **[Figure 20-31-1]** & **[Figure 20-31-2]** 2610 PSI (180 bar)

When testing the port relief valves with a hydraulic hand pump, slowly pressurize the valve. If the hand pump is pumped fast, the pressure will be altered by as much as 50 PSI (3.5 bar).

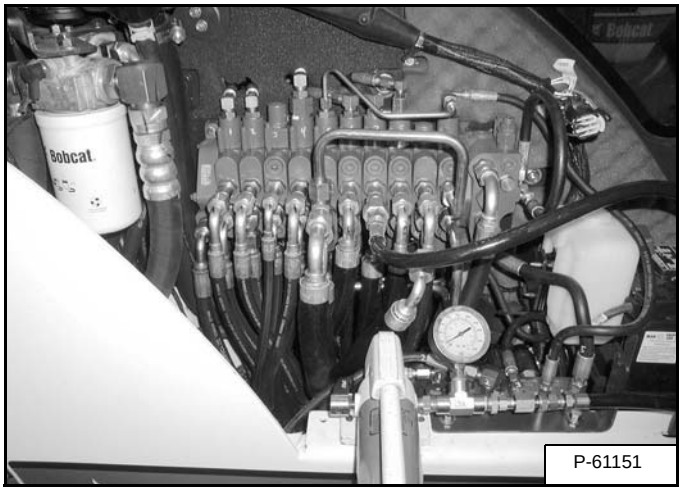
When testing port relief valves with a hydraulic hand pump, valve crack pressure should be observed.

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

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Testing And Adjusting Port Relief Valve Pressure (Cont'd)

Figure 20-31-3



Install the hand pump hose and a pressure gauge (minimum of 5000 PSI (345 bar) into the valve section work port in which the port relief valve is located. Slowly pressurize this section with the hand pump until the port relief valve opens and make a note of the pressure reading **[Figure 20-31-3]**.

Relief valves are non-adjustable. When testing the relief valves and pressure is not correct, remove and replace the relief valve.

⚠ WARNING

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

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

W-2019-1285

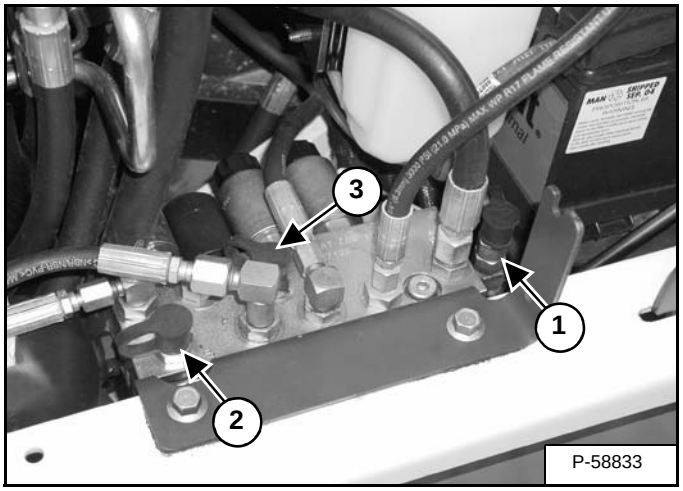
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CROSSPORT RELIEF VALVES

Testing And Adjusting The Crossport Relief Valves

All testing is done with the hydraulic oil at operating temperature and the engine high speed setting of 2550-2620 RPM.

Figure 20-32-1



There is one diagnostic coupler (Item 1) that is used to check the crossport relief valves. The second coupler (Item 2) is used in assembly of the excavator. The third coupler (Item 3) **[Figure 20-32-1]** is used to check the pressure reducing valve.

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

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

System Pressures At Gauge Port Specifications

TEST CONDITIONS

1. Engine High Idle Speed

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

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

SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET (PSI)	ACCEPTABLE RANGE (PSI)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	G	428	406 - 450
SYSTEM BACK PRESSURE	NONE	THROUGH NEUTRAL	P1		280-420
SYSTEM RELIEF	ANY EXCEPT SLEW	P1	P1	3480	3380-3530
SWING MOTOR - CROSS PORT RELIEF	SLEW RIGHT	P1	P1	3050	2900-3200
SWING MOTOR - CROSS PORT RELIEF	SLEW LEFT	P1	P1	3050	2900-3200

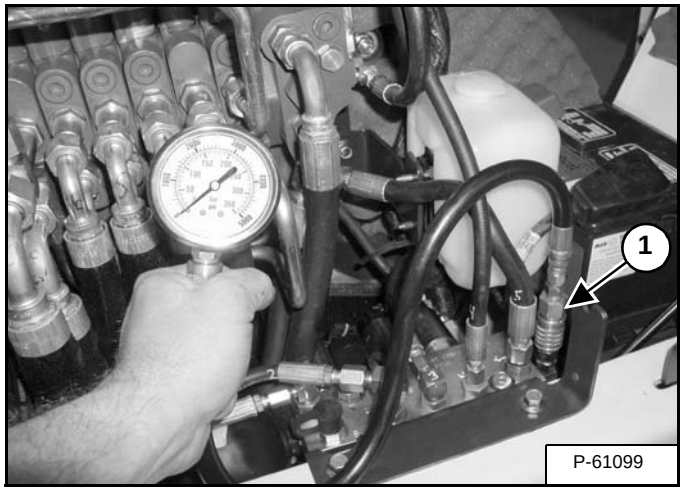
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CROSSPORT RELIEF VALVES (CONT'D)

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

Open the right side cover.

Figure 20-32-2



Connect the test gauge coupler and 5000 PSI (345 bar) gauge from the test kit to the diagnostic coupler (Item 1) **[Figure 20-32-2]**.

Lower control console and fasten the seat belt.

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

With the console lowered, and the engine at full RPM there is system back pressure of 280-420 PSI (19-29 bar).

The crossport relief valves are preset to 1700 PSI (117 bar). Adding the system back pressure raises the gauge readings.

Engage the slew lock lever (See Operation (Early Models) on Page 10-11-1) to prevent the upperstructure from turning.

Engage the slew circuit to the right, over the relief and record the pressure.

Repeat the procedure to the left and record the pressure.

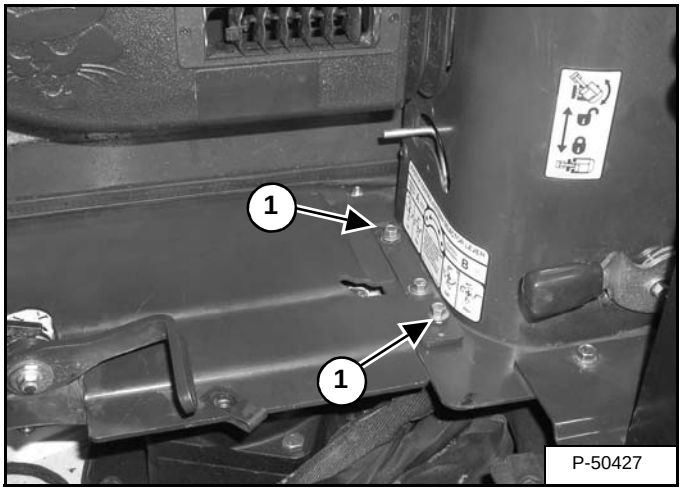
The crossport relief valve pressure should be as follows:

A target pressure of 3050 PSI (210 bar) with an acceptable range of 2900-3200 PSI (200-221 bar).

Stop the engine.

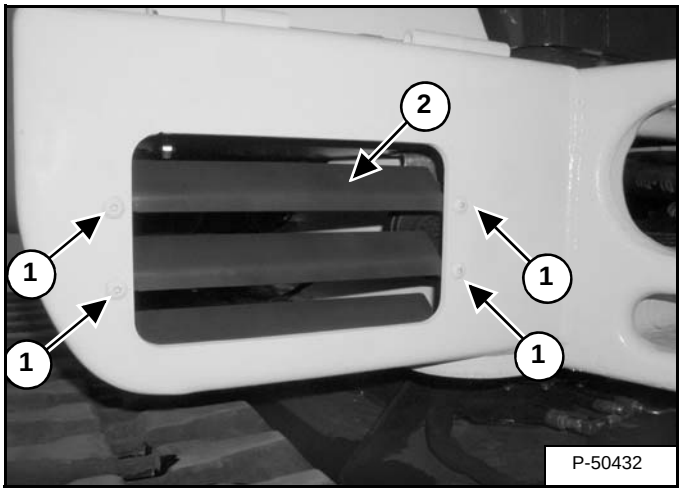
If the relief valves need adjustment, remove the floor mat and floor panel. (See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

Figure 20-32-3



Remove the two bolts (Item 1) **[Figure 20-32-3]**.

Figure 20-32-4

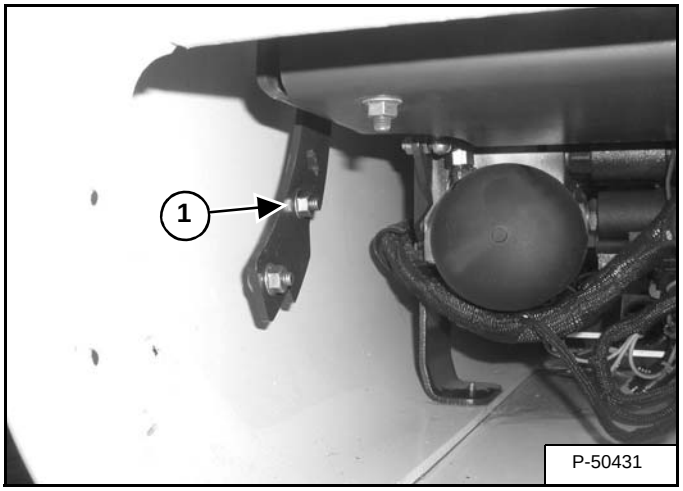


Remove the bolts (Item 1) and vent assembly (Item 2) **[Figure 20-32-4]**.

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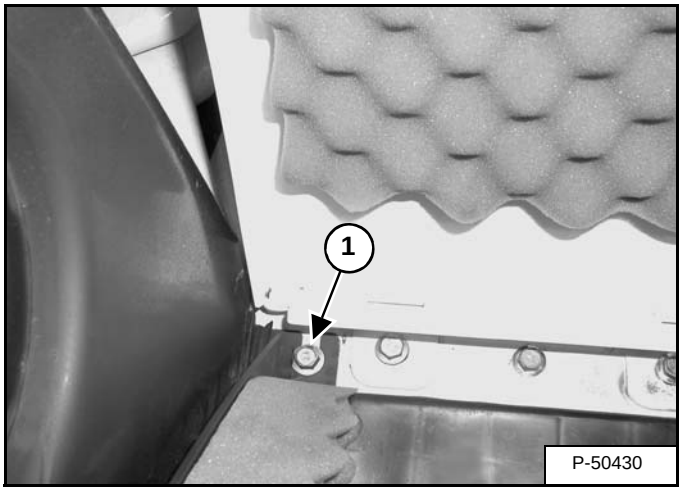
Testing And Adjusting The Crossport Relief Valves (Cont'd)

Figure 20-32-5



Remove the right side cover stop bolt and nut (Item 1) **[Figure 20-32-5]**.

Figure 20-32-6



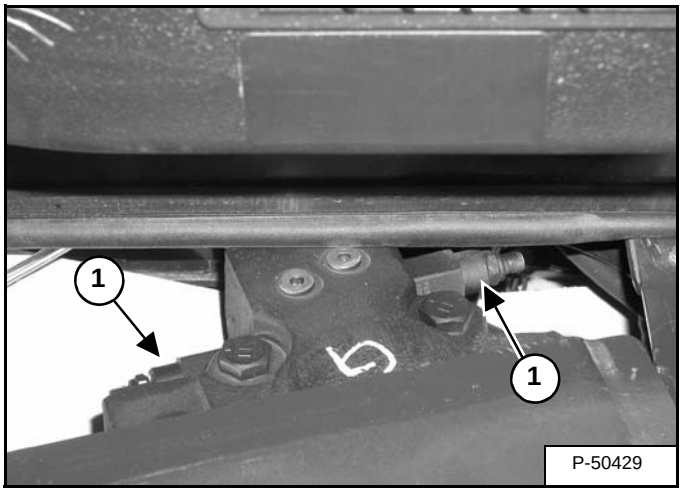
Open the right side cover and remove the bolt (Item 1) **[Figure 20-32-6]**.

NOTE: Canopy equipped excavators have two bolts installed.

Figure 20-32-7



Figure 20-32-8

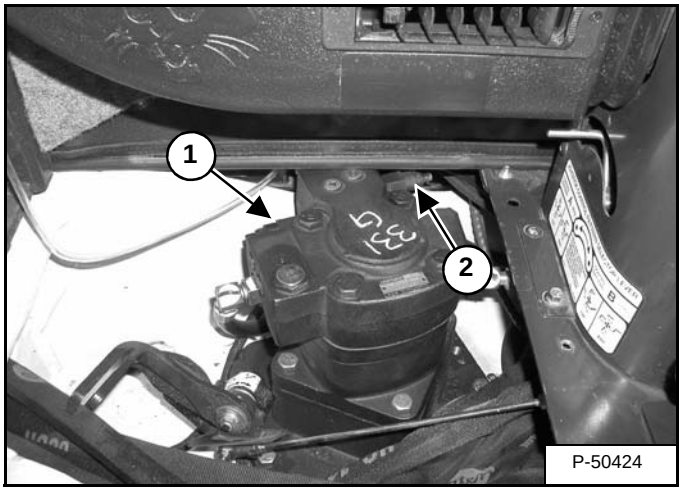


Slide the plate/right foot pedal assembly towards the center of the cab **[Figure 20-32-7]** to access the relief valves (Item 1) **[Figure 20-32-8]**.

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

Figure 20-32-9



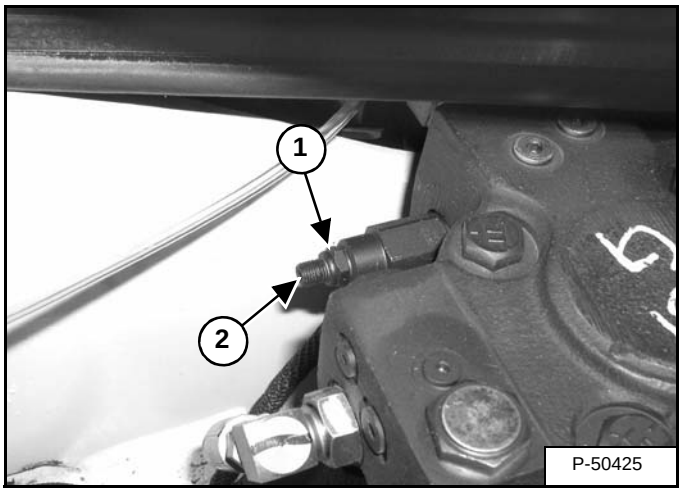
The front relief valve (Item 1) **[Figure 20-32-9]** is slew left.

The rear relief valve (Item 2) **[Figure 20-32-9]** is slew right.

NOTE: Left and right as viewed from the operator's seat.

NOTE: The right floor panel is removed for photo clarity.

Figure 20-32-10



Loosen the nut (Item 1) **[Figure 20-32-10]**.

Turn the adjustment screw (Item 2) **[Figure 20-32-10]** clockwise to increase the pressure or counter clockwise to decrease pressure.

NOTE: 1/4 turn is 100 PSI (6.9 bar)

Tighten the nut (Item 1) **[Figure 20-32-10]**, reinstall the right floor panel and retest the crossport relief valves.

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PRESSURE REDUCING VALVE

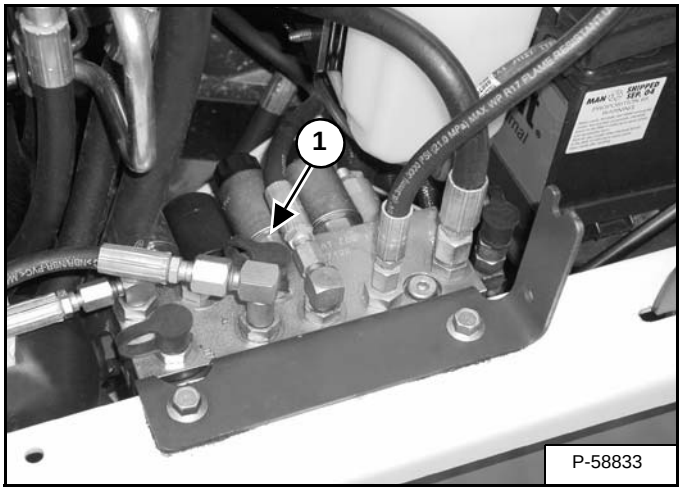
Testing And Adjusting The Pressure Reducing Valve

The pressure reducing valve supplies lower hydraulic pressure to joysticks.

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

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

Figure 20-33-1

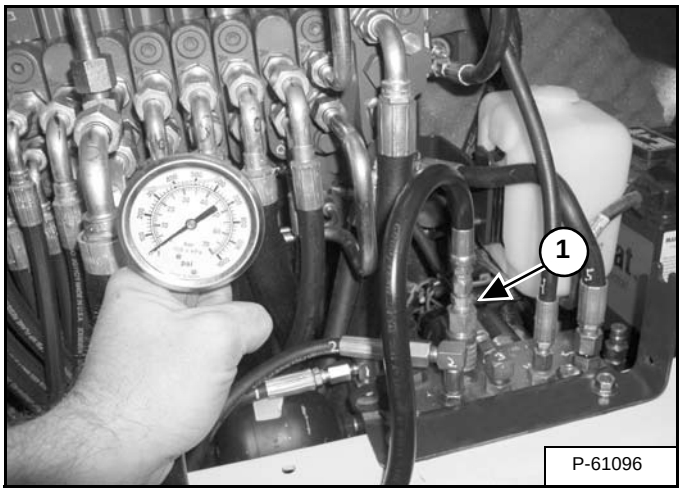


The diagnostic port (Item 1) **[Figure 20-33-1]** will be used to check the pressure reducing valve.

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

Open the right side cover.

Figure 20-33-2



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

Lower the control console and fasten the seat belt.

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

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

Engage the bucket curl circuit and fully curl the bucket.

The pressure reducing valve pressure should be as follows:

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

Move the engine speed control to low idle speed.

Stop the engine.

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

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PRESSURE REDUCING VALVE (CONT'D)

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

Figure 20-33-3

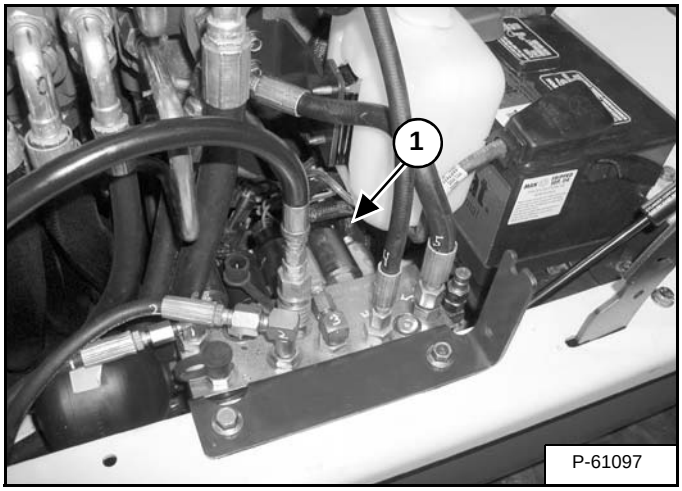
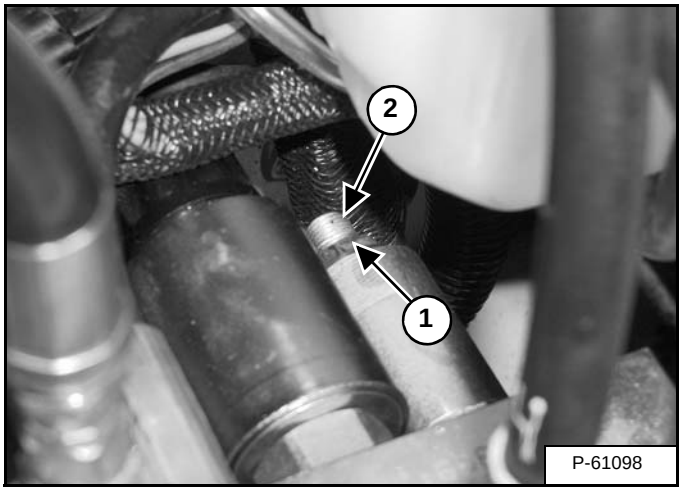


Figure 20-33-4



Loosen the nut (Item 1) **[Figure 20-33-3]**.

Turn the adjustment screw (Item 2) **[Figure 20-33-4]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

NOTE: 1/2 turn is approximately 40 PSI (2.8 bar).

Tighten the nut (Item 1) **[Figure 20-33-4]**.

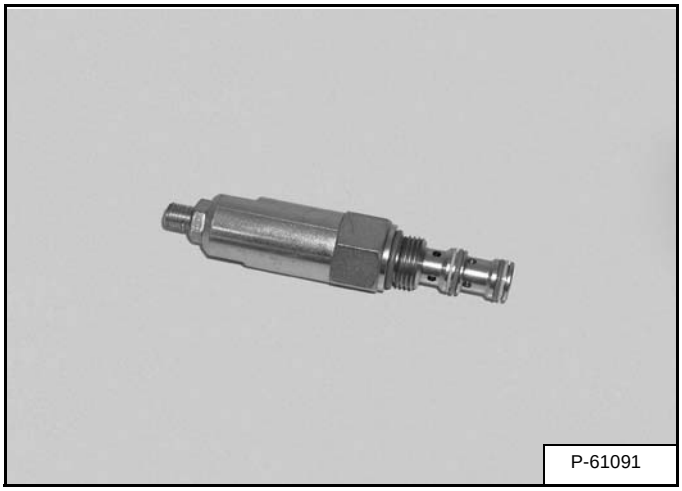
Retest the pressure reducing valve after adjustment.

If the pressure is still incorrect, relieve hydraulic pressure and remove the pressure reducing valve from the manifold assembly for inspection or repair.

If the amount of oil pressure is at or over the service limits, it is an indication of worn O-rings and back-up rings on the pressure reducing valve or a stuck pressure reducing valve.

Inspect the port of the pressure reducing valve (Item 1) **[Figure 20-33-4]** on the manifold assembly to verify no damage. If damaged replace the manifold assembly.

Figure 20-33-5



Inspect the O-rings and back-up rings on the pressure reducing valve **[Figure 20-33-5]**. If O-rings and back-up rings are worn or damaged, replace O-rings and back-up rings. (See Disassembly And Assembly on Page 20-60-5.)

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

Repeat the pressure reducing valve test.

If the O-rings and back-rings were not worn or damaged and the correct pressure could not be achieved, replace the pressure reducing valve.

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HYDRAULIC CONTROL VALVE (S/N 234313000 - 234316876, S/N 234412000 - 234413318, S/N 234513000 - 234515532)

Description

The hydraulic control valve is a 10 section closed center system and has one main relief valve. The main relief valve operates at 3260PSI (225 bar). The boom, bucket, and blade section have 3915 PSI (270 bar) work port reliefs.

The arm section has 3625 PSI (250 bar) work port reliefs. The first auxiliary section has 2610 PSI (180 bar) work port reliefs.

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Removal And Installation

Lower the boom/bucket and blade to the ground.

Stop the engine.

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

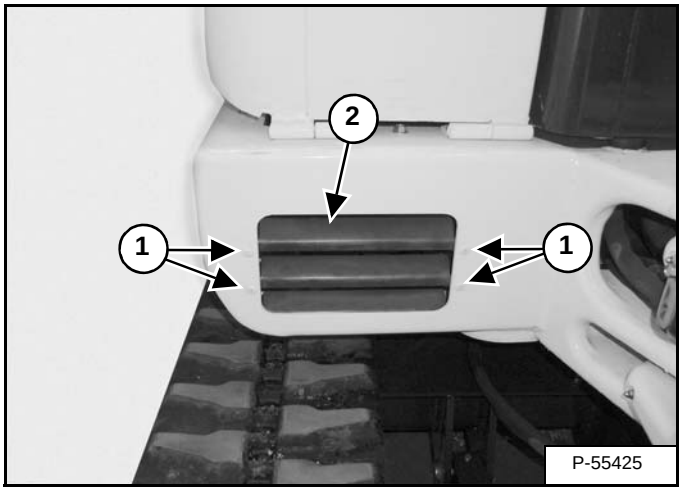
IMPORTANT

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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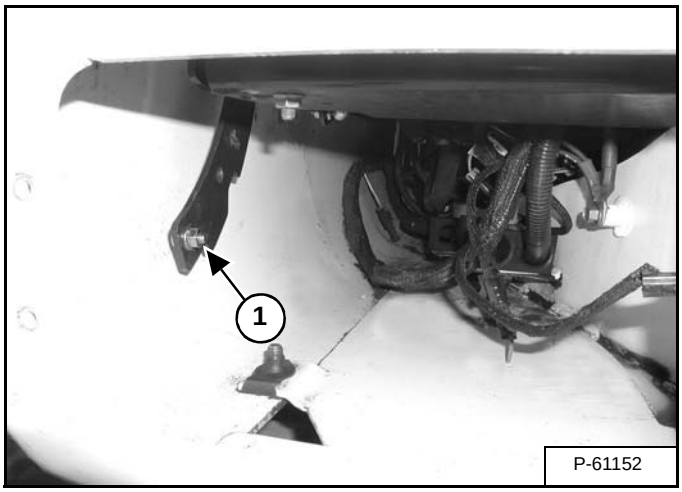
Drain the hydraulic reservoir.(See Checking And Adding Hydraulic Fluid on Page 10-100-1.)

Figure 20-40-6



Remove the bolts (Item 1) and louver (Item 2) **[Figure 20-40-6]**.

Figure 20-40-7

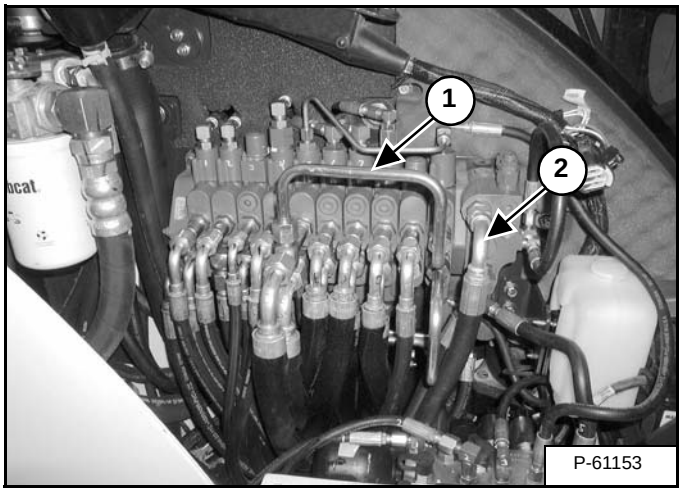


Remove the bolt (Item 1) **[Figure 20-40-7]** and nut from the stop.

Open the right side cover.

Mark all tubelines and hoses for proper installation.

Figure 20-40-8

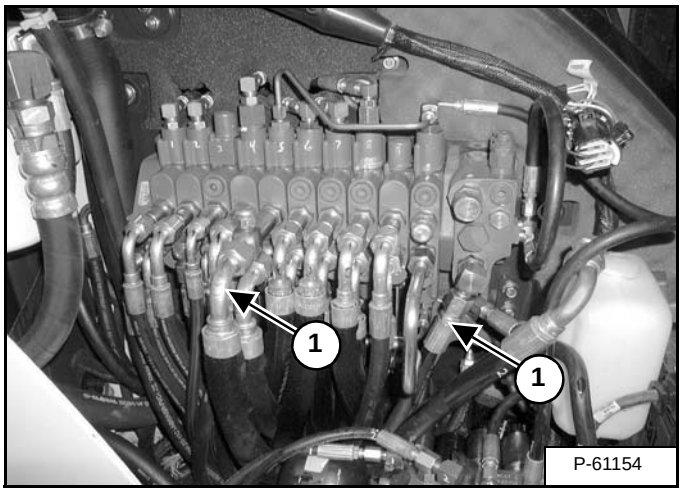


Remove the tubeline (Item 1) and hose (Item 2) **[Figure 20-40-8]**.

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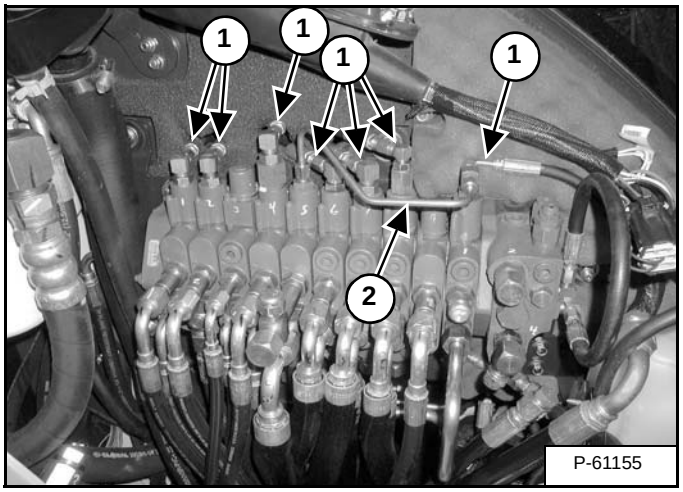
Removal And Installation (Cont'd)

Figure 20-40-9



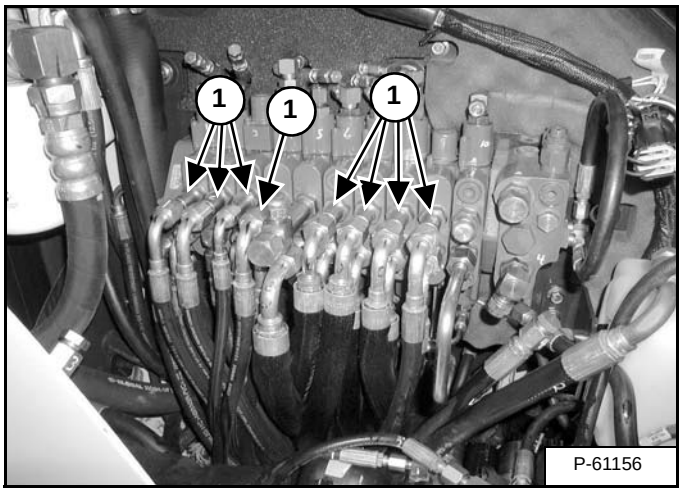
Remove the hoses (Item 1) **[Figure 20-40-9]**.

Figure 20-40-10



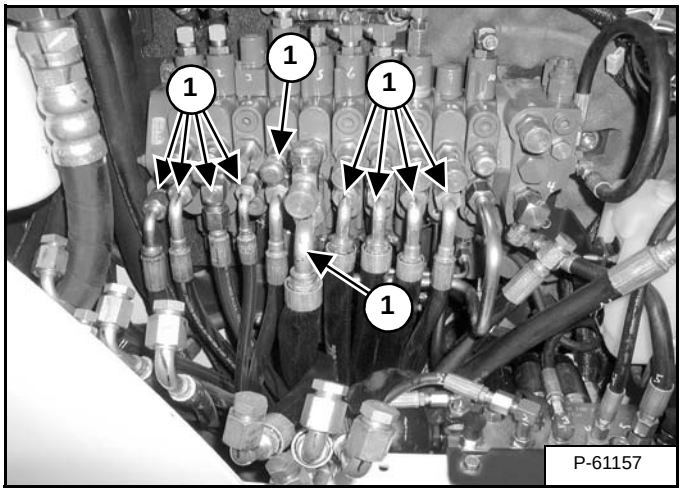
Remove the hoses (Item 1) and tubeline (Item 2) **[Figure 20-40-10]**.

Figure 20-40-11



Remove the hoses (Item 1) **[Figure 20-40-11]**.

Figure 20-40-12

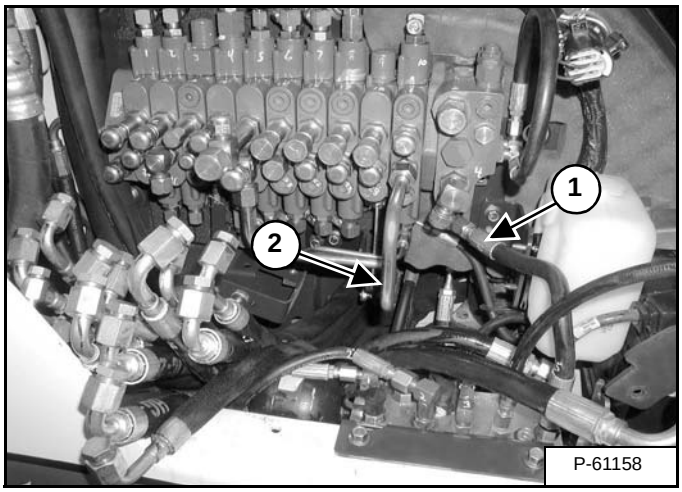


Remove the hoses (Item 1) **[Figure 20-40-12]**.

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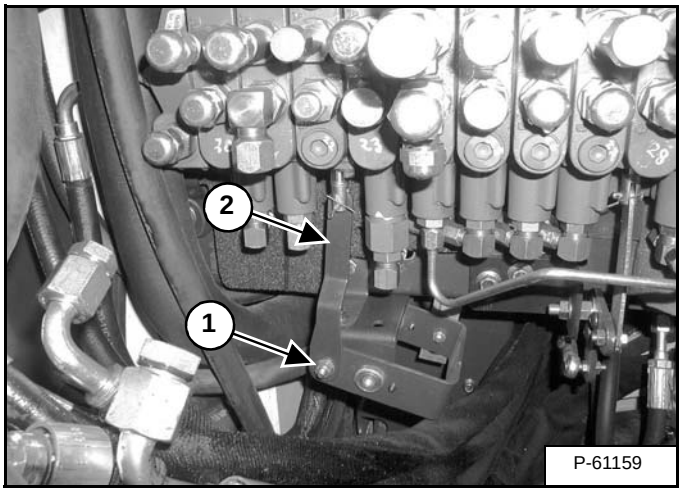
Removal And Installation (Cont'd)

Figure 20-40-13



Remove the hose (Item 1) and tubeline (Item 2) **[Figure 20-40-13]**.

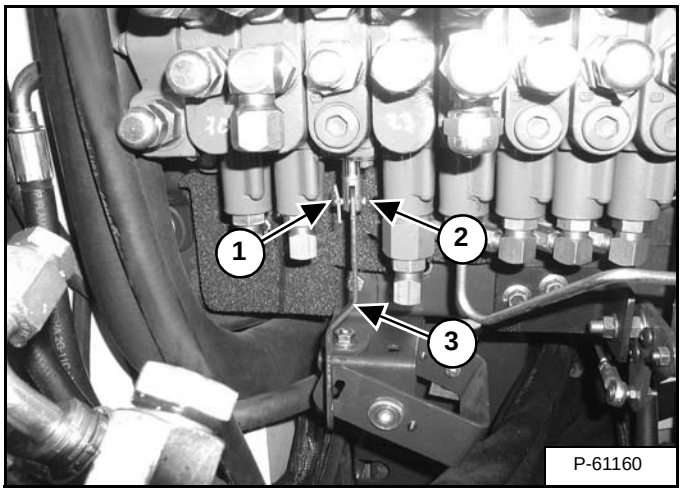
Figure 20-40-14



Remove the nut (Item 1) and bolt from the blade control linkage (Item 2) **[Figure 20-40-14]**.

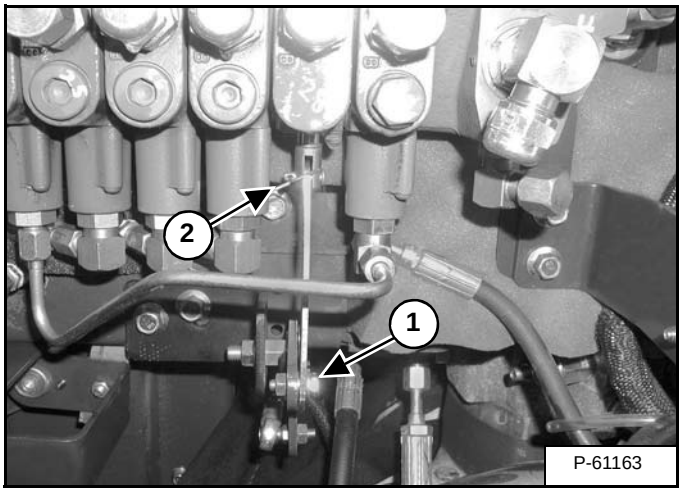
Turn the blade control linkage 90°.

Figure 20-40-15



Remove the cotter pin (Item 1), clevis pin (Item 2) and linkage (Item 3) **[Figure 20-40-15]**.

Figure 20-40-16



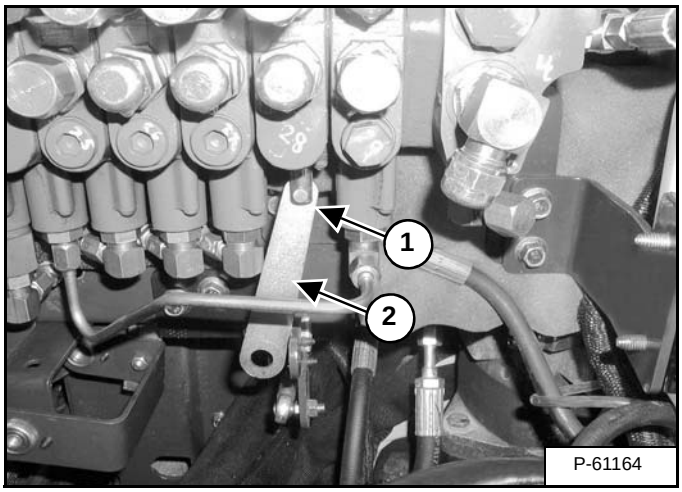
Remove the bolt (Item 1) **[Figure 20-40-16]**, nut, washer and spacer.

Remove the cotter pin (Item 2) **[Figure 20-40-16]**.

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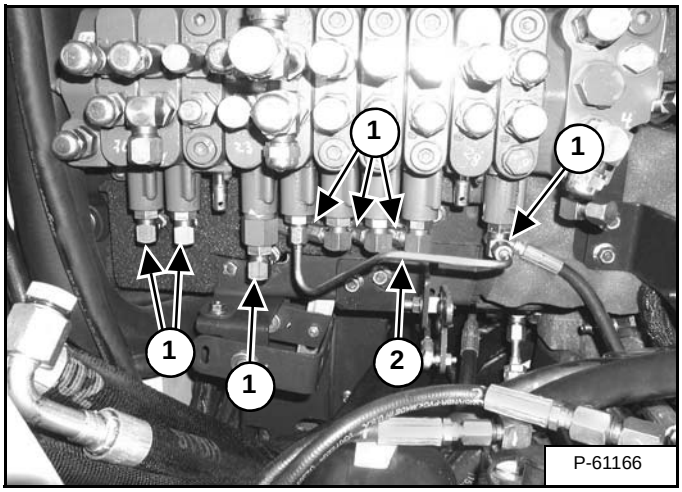
Removal And Installation (Cont'd)

Figure 20-40-17



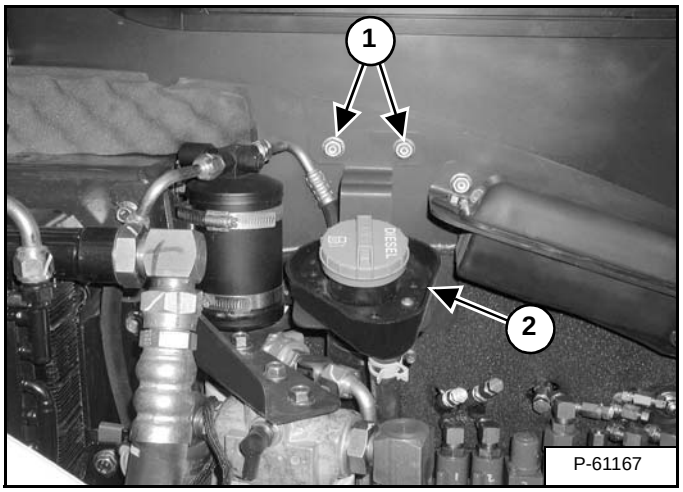
Turn the linkage 90°. Remove the clevis pin (Item 1) and linkage (Item 2) **[Figure 20-40-17]**.

Figure 20-40-18



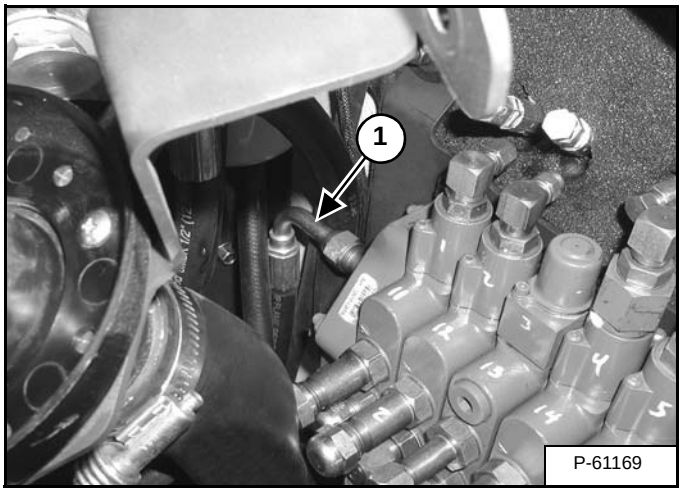
Remove the hoses (Item 1) and tubeline (Item 2) **[Figure 20-40-18]**.

Figure 20-40-19



Remove the nuts (Item 1) and relocate the fuel fill (Item 2) **[Figure 20-40-19]**.

Figure 20-40-20

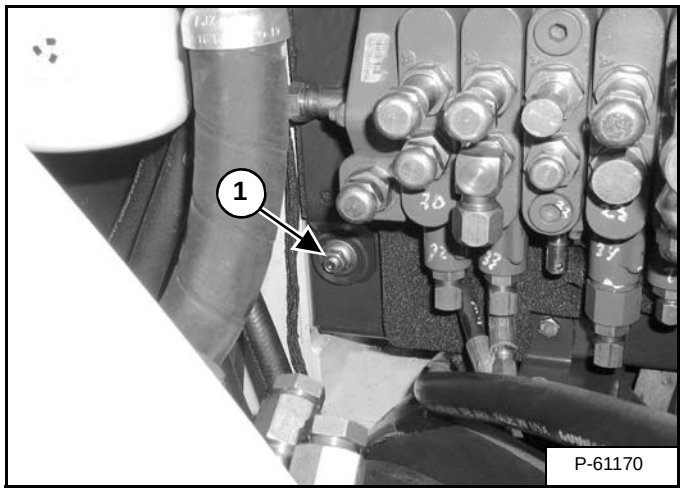


Remove the hose (Item 1) **[Figure 20-40-20]**.

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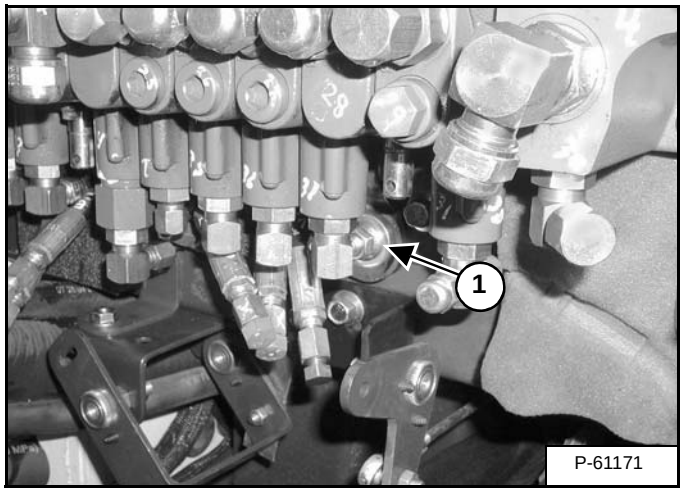
Removal And Installation (Cont'd)

Figure 20-40-21



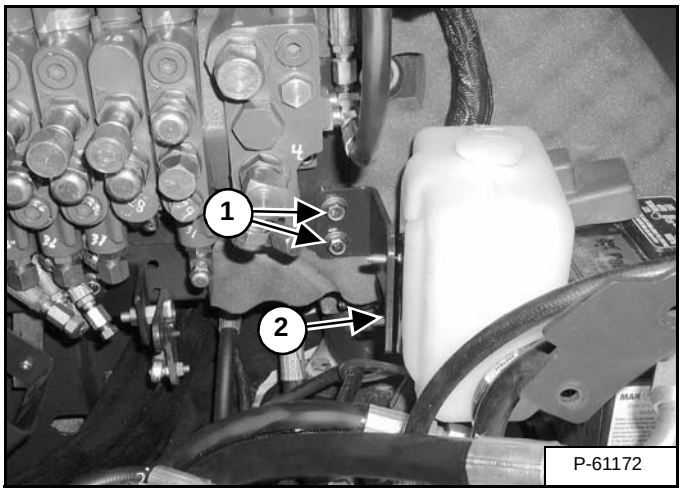
Remove the nut (Item 1) **[Figure 20-40-21]**, flat washer and rubber washer from the control valve.

Figure 20-40-22



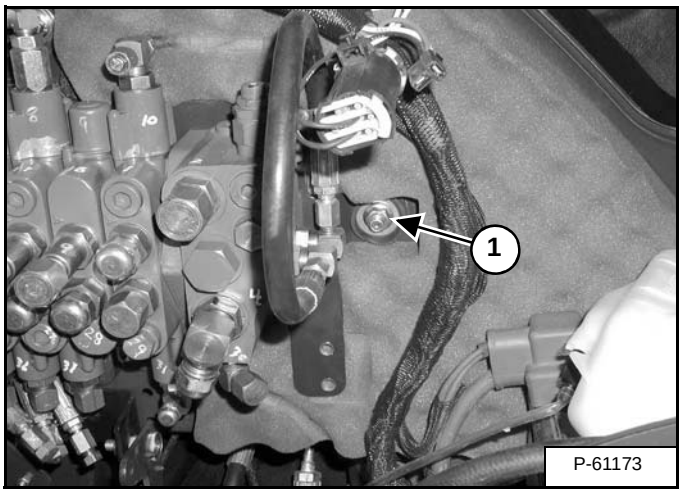
Remove the nut (Item 1) **[Figure 20-40-22]**, flat washer and rubber washer.

Figure 20-40-23



Remove the nuts (Item 1) from the windshield washer fluid reservoir mount bracket (Item 2) **[Figure 20-40-23]** (if equipped). Relocate the reservoir and mount bracket.

Figure 20-40-24

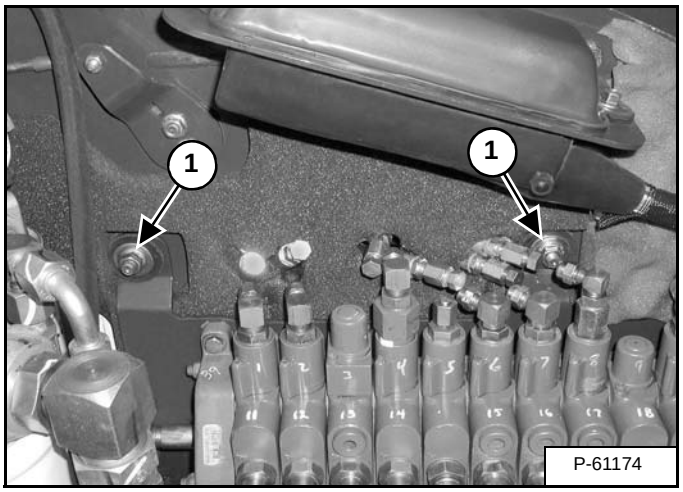


Remove the nut (Item 1) **[Figure 20-40-24]**, flat washer and rubber washer.

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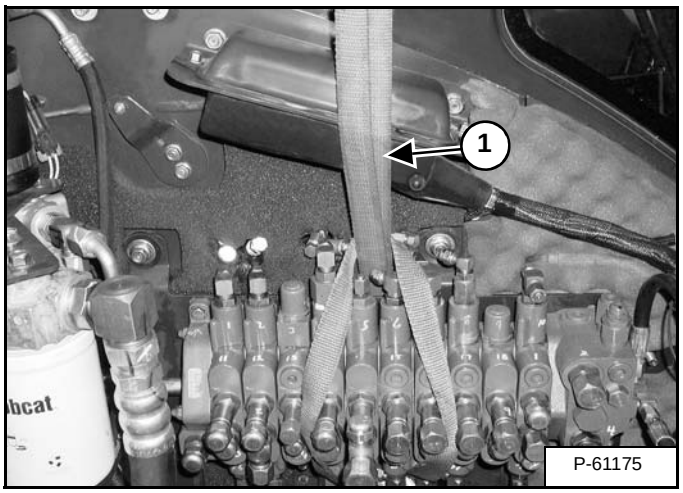
Removal And Installation (Cont'd)

Figure 20-40-25



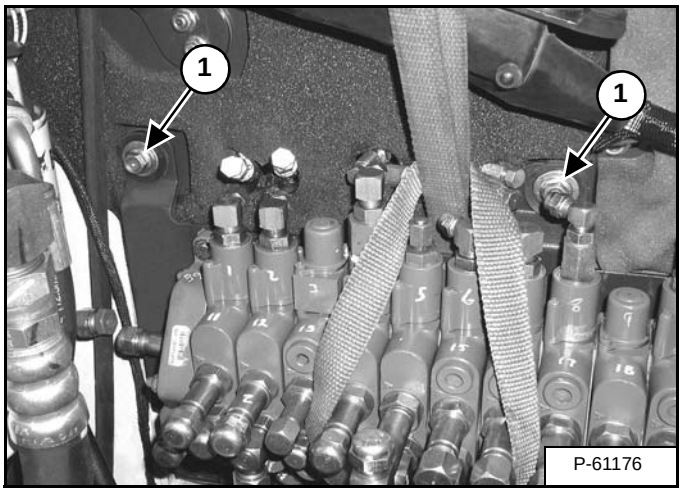
Loosen the nuts (Item 1) **[Figure 20-40-25]**.

Figure 20-40-26



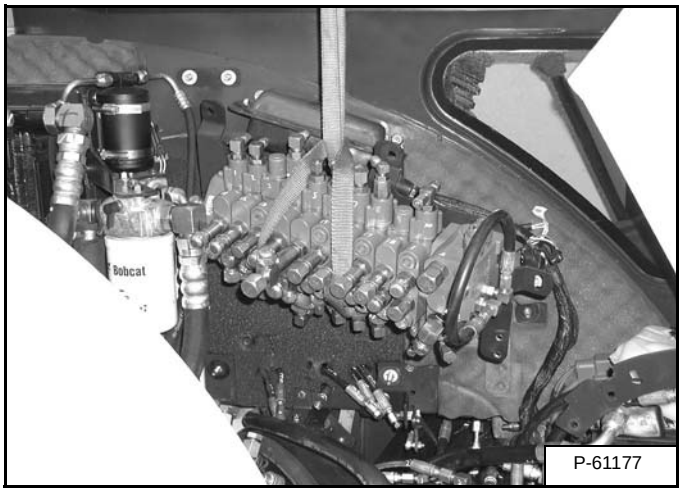
Install a sling (Item 1) **[Figure 20-40-26]** around the control valve and connect to a chain hoist.

Figure 20-40-27



Remove the nuts (Item 1) **[Figure 20-40-27]**, flat washers, and rubber washers.

Figure 20-40-28

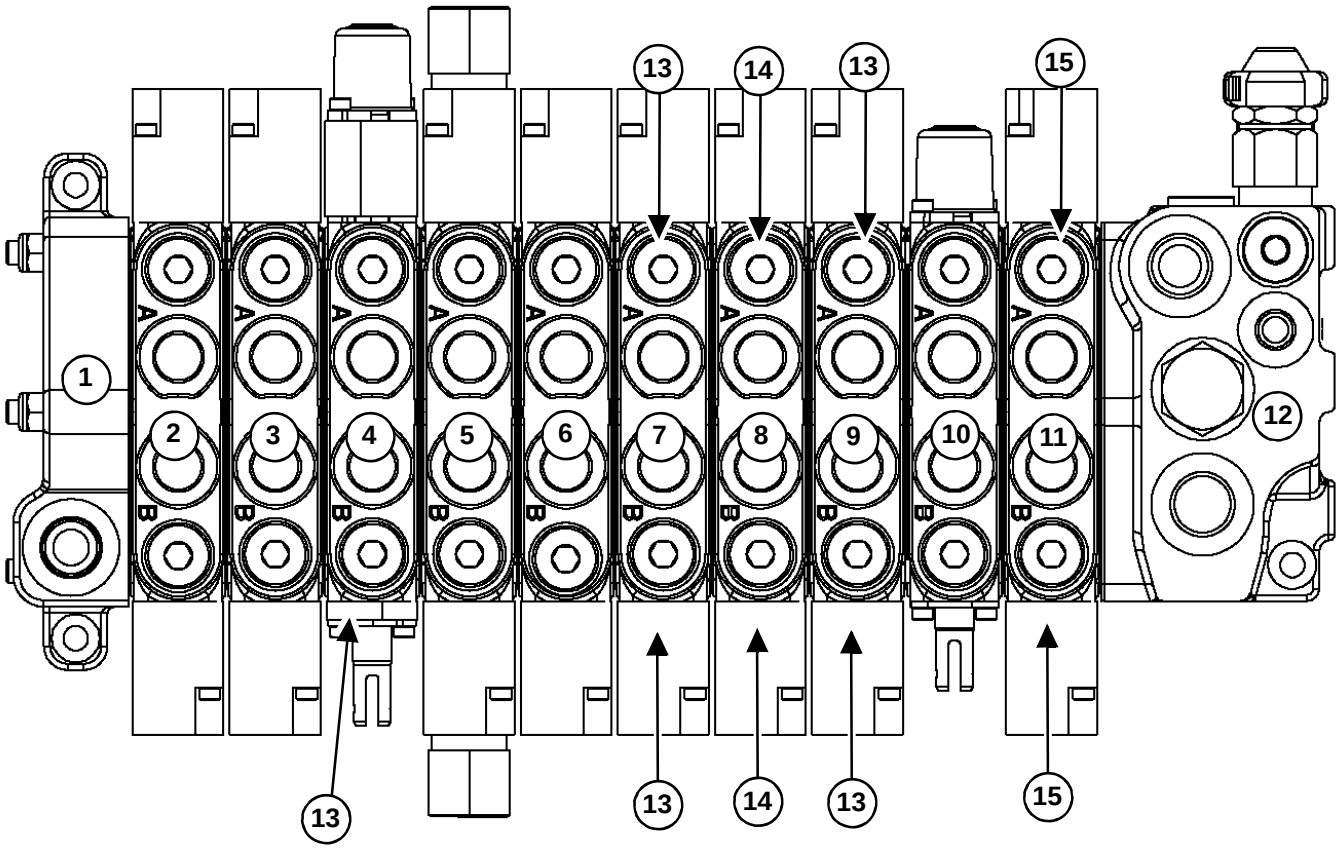


Raise the hoist and remove the control valve from the excavator **[Figure 20-40-28]**.

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Parts Identification

1. **Outlet Section**
2. **Right Travel Section**
3. **Left Travel Section**
4. **Blade Section**
5. **Slew Section**
6. **Second Auxiliary Section**
7. **Bucket Section**
8. **Arm Section**
9. **Boom Section**
10. **Boom Swing Section**
11. **Auxiliary Section**
12. **Inlet Section**
13. **Port Relief 3915 PSI (270 Bar)**
14. **Port Relief 3625 PSI (250 Bar)**
15. **Port Relief 2610 (180 Bar)**



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Disassembly

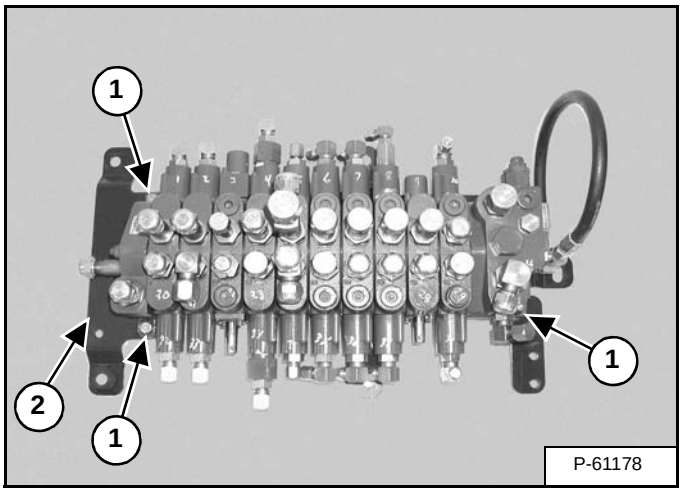
Clean the outside of the control valve before disassembly.

IMPORTANT

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

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Figure 20-40-29

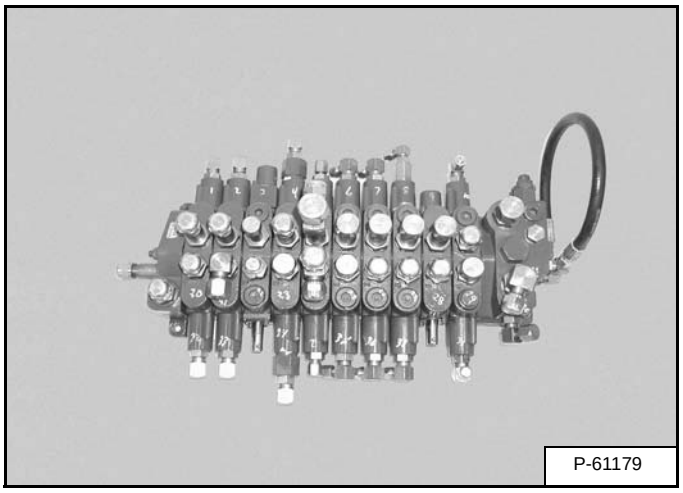


Remove the three bolts (Item 1) from the mount plate (Item 2) **[Figure 20-40-29]**.

Remove the mount plate from the control valve.

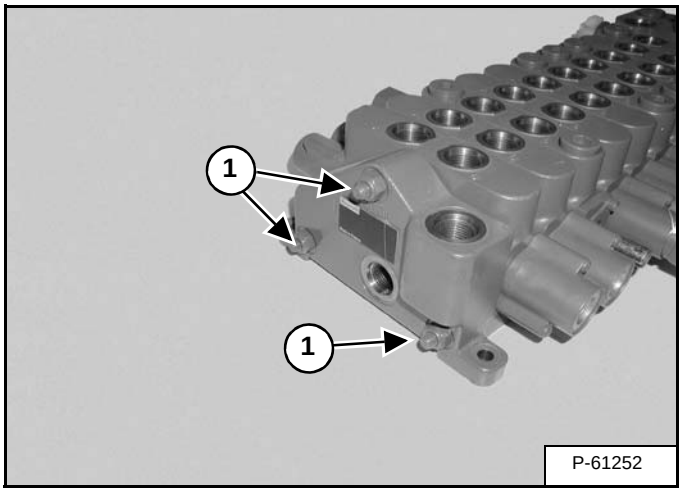
Mark all of the sections of the control valve for proper installation.

Figure 20-40-30



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

Figure 20-40-31

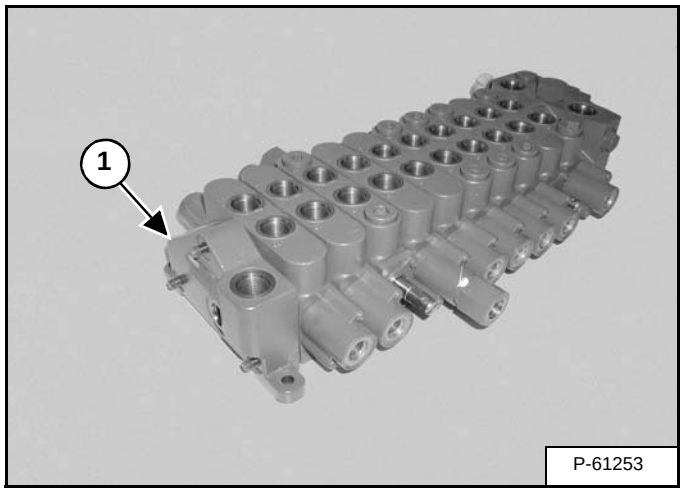


Remove the nuts (Item 1) **[Figure 20-40-31]**.

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Disassembly (Cont'd)

Figure 20-40-32

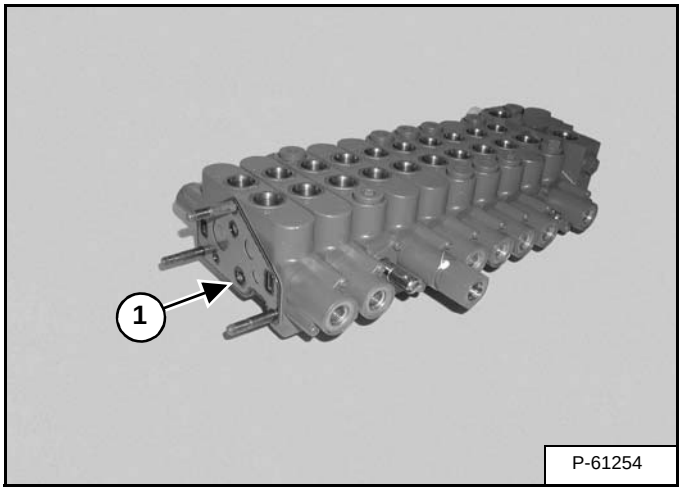


Remove the end cap (Item 1) **[Figure 20-40-32]** from the control valve.

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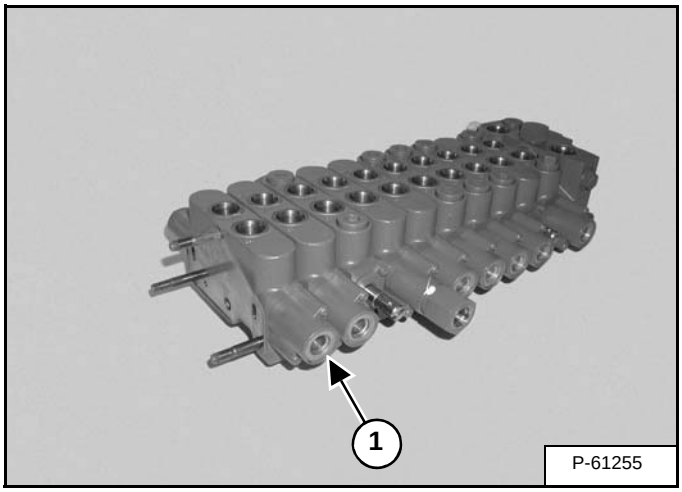
Right Travel Valve Section Disassembly And Assembly

Figure 20-40-33



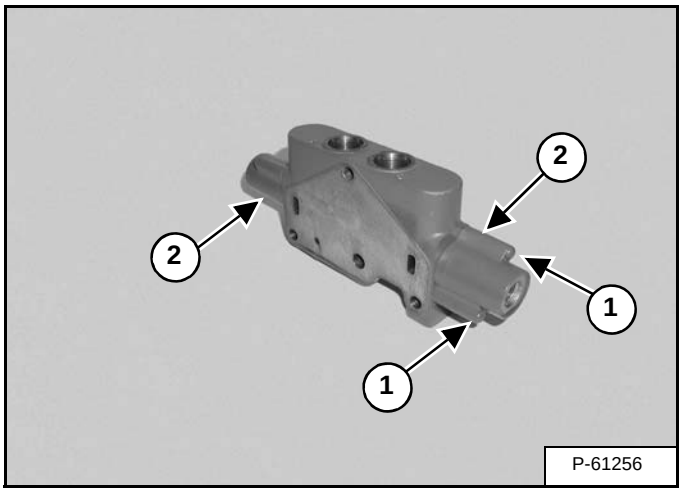
Remove the gasket (Item 1) **[Figure 20-40-33]** from the valve section.

Figure 20-40-34



Remove the right travel valve section (Item 1) **[Figure 20-40-34]** from the control valve.

Figure 20-40-35

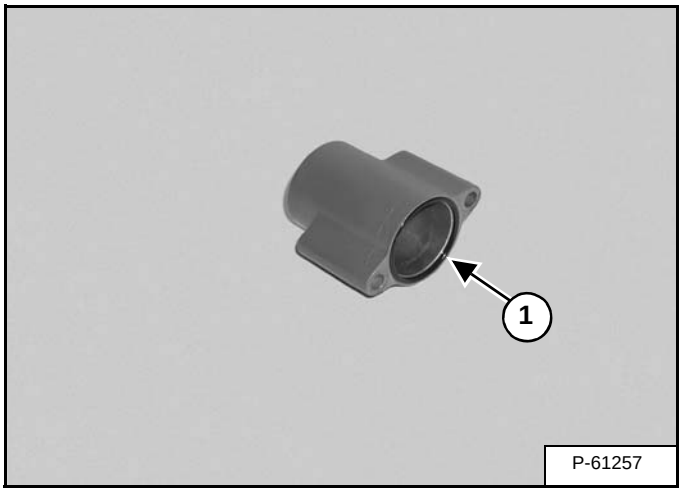


Remove the screws (Item 1) from both end caps (Item 2) **[Figure 20-40-35]**.

Installation: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

Remove the end caps from the valve section.

Figure 20-40-36

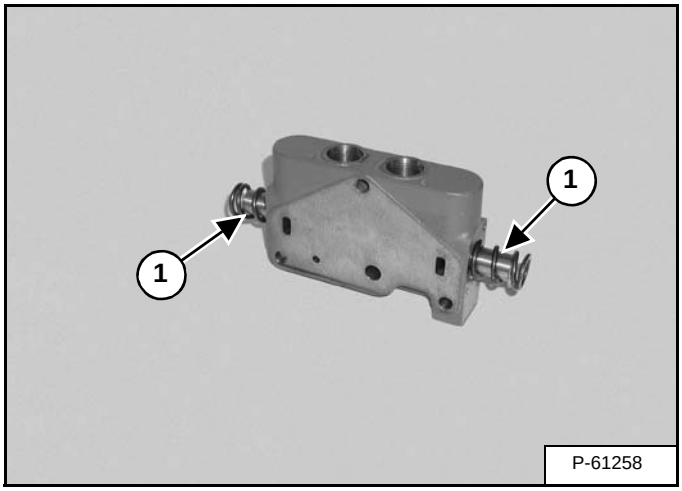


Remove the O-ring (Item 1) **[Figure 20-40-36]** from the end caps.

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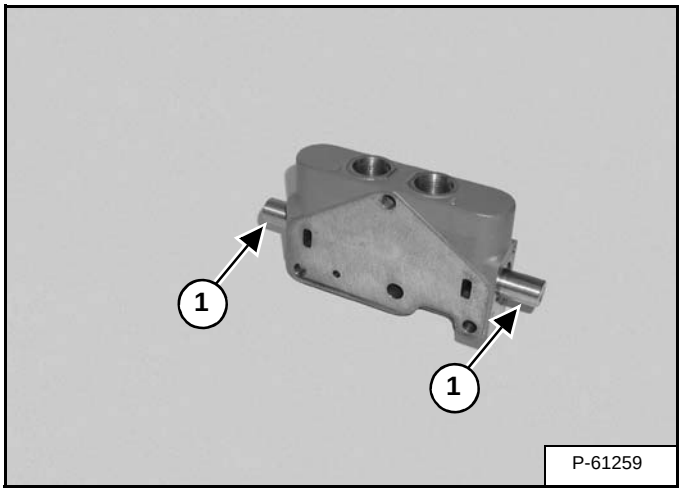
Right Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-37



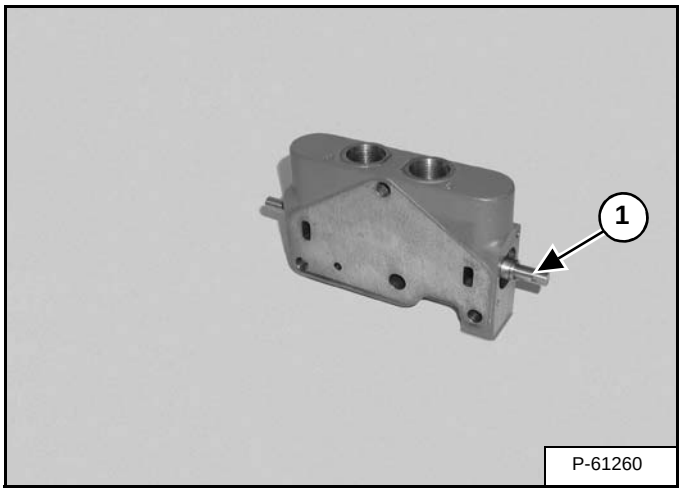
Remove the centering springs (Item 1) **[Figure 20-40-37]** from the spring guides.

Figure 20-40-38



Remove the spring guides (Item 1) **[Figure 20-40-38]** from both ends of the valve spool.

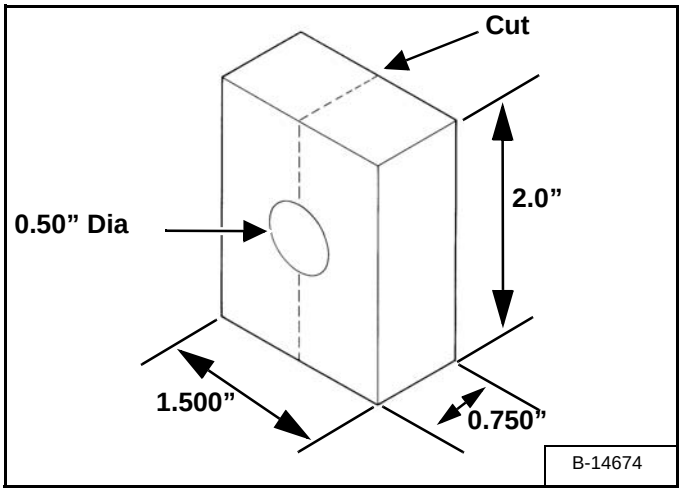
Figure 20-40-39



Record the orientation of the spool (Item 1) **[Figure 20-40-39]**. Remove the spool from the valve section.

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

Figure 20-40-40



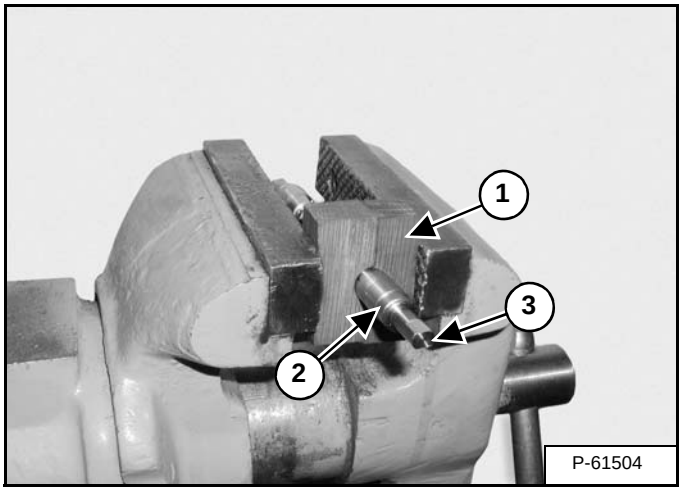
To remove the plugs from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.500 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-40]**.

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

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

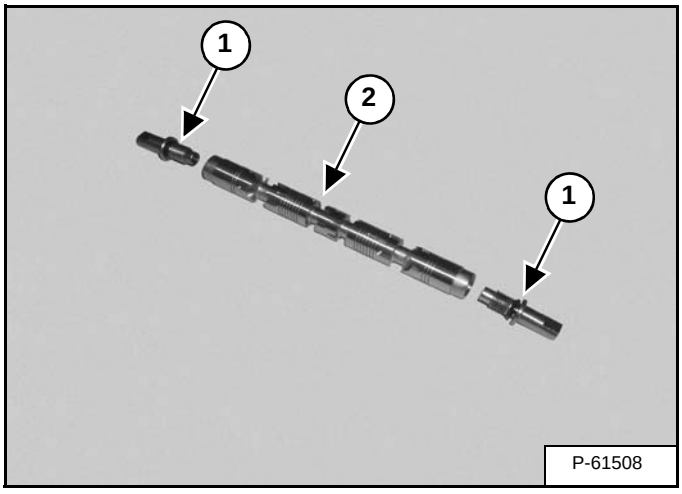
Figure 20-40-41



Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the plugs (Item 3) **[Figure 20-40-41]**.

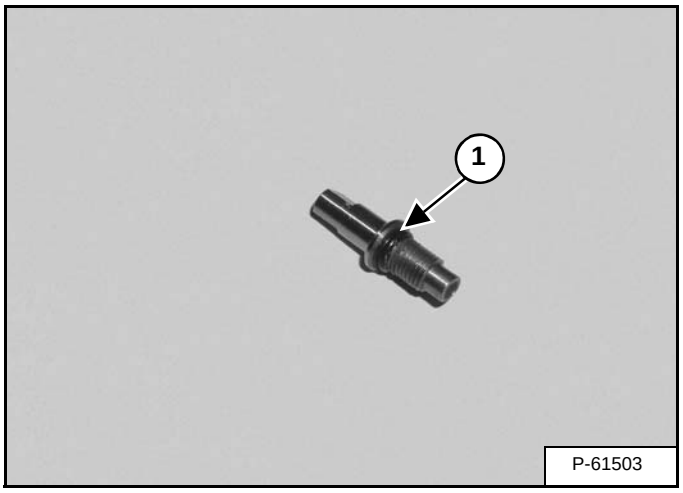
Installation: Apply thread lock adhesive (Loctite 262) or equivalent to the threads. Tighten the plugs to 44 in.-lbs. (5 Nm) torque.

Figure 20-40-42



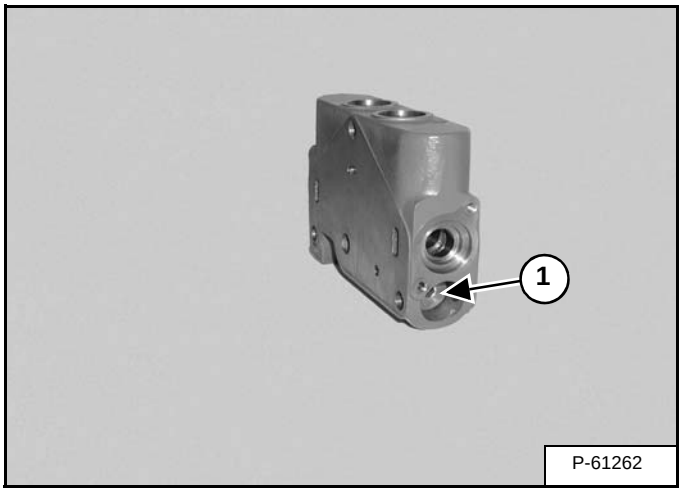
Remove the plugs (Item 1) from the spool (Item 2) **[Figure 20-40-42]**.

Figure 20-40-43



Remove the O-ring (Item 1) **[Figure 20-40-43]** from the plugs.

Figure 20-40-44



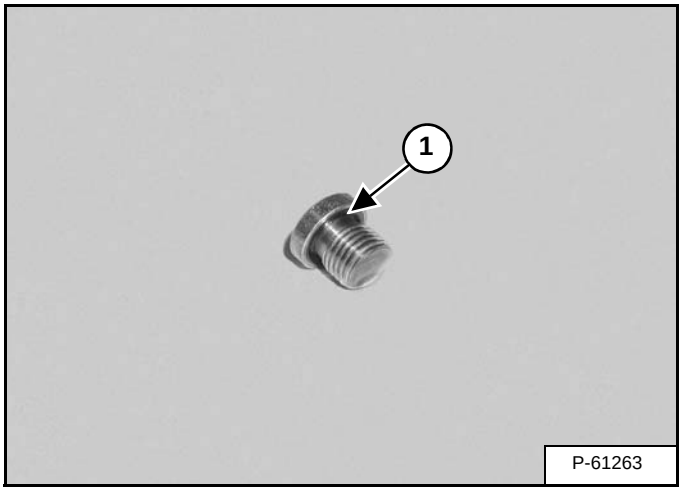
Remove the plug (Item 1) **[Figure 20-40-44]** from the valve section.

Installation: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

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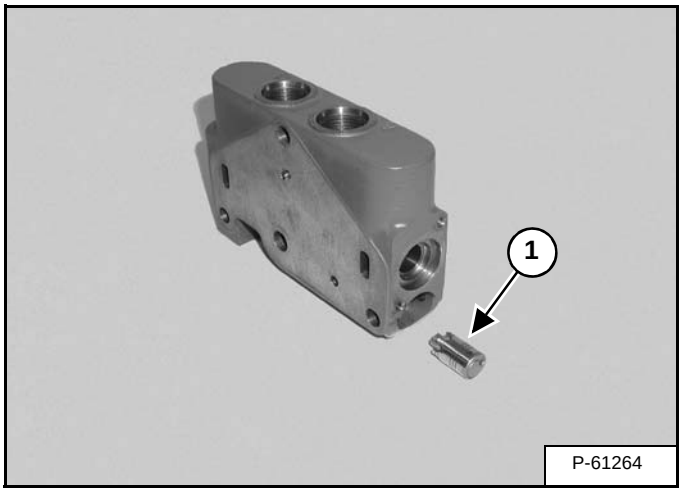
Right Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-45



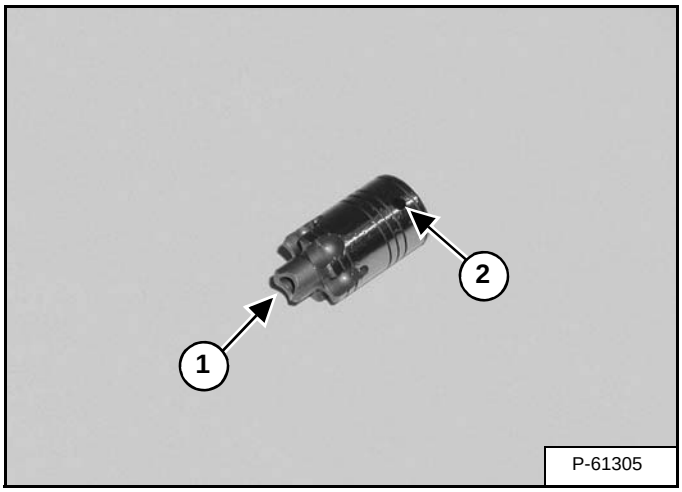
Remove the O-ring (Item 1) **[Figure 20-40-45]** from the plug.

Figure 20-40-46



Remove the compensator (Item 1) **[Figure 20-40-46]** from the valve section.

Figure 20-40-47



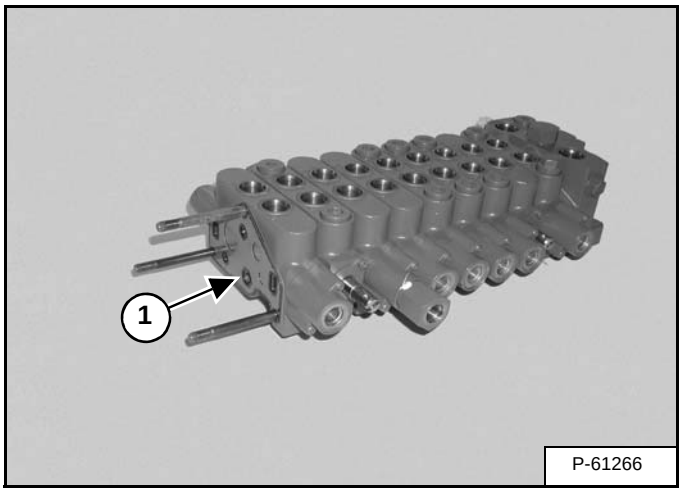
Check the orifice (Item 1) **[Figure 20-40-47]** in the compensator to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-40-47]** to be sure it is not plugged.

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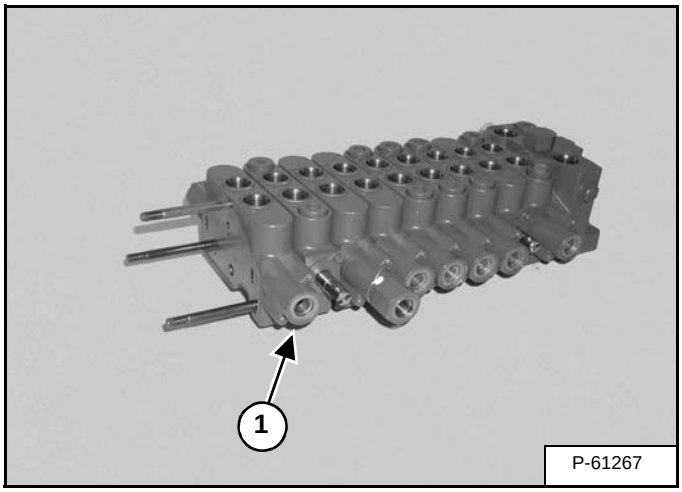
Left Travel Valve Section Disassembly And Assembly

Figure 20-40-48



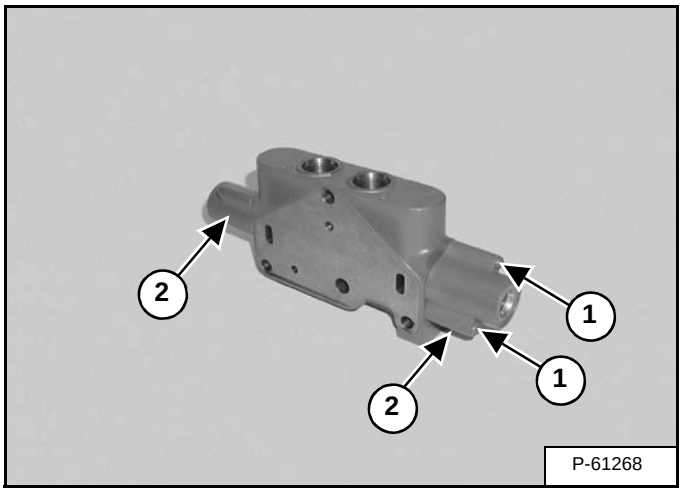
Remove the gasket (Item 1) **[Figure 20-40-48]** from the valve section.

Figure 20-40-49



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

Figure 20-40-50

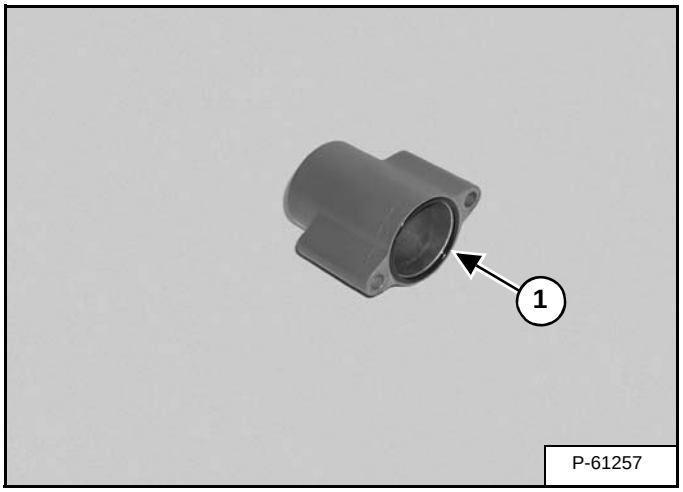


Remove the screws (Item 1) from both end caps (Item 2) **[Figure 20-40-50]**.

Installation: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

Remove the end caps from the valve section.

Figure 20-40-51

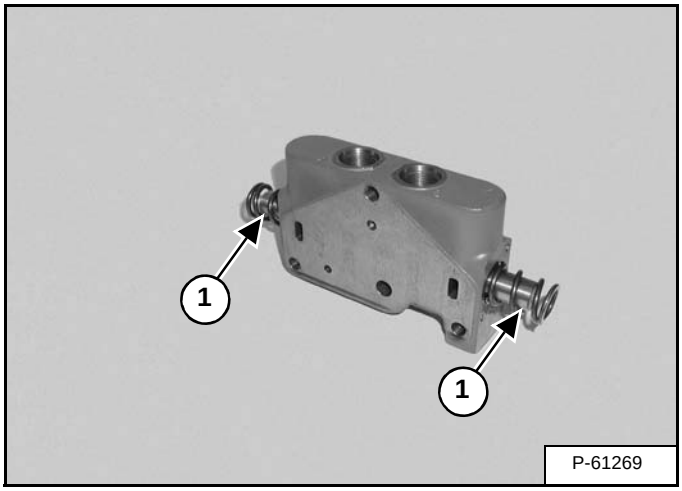


Remove the O-ring (Item 1) **[Figure 20-40-51]** from the end caps.

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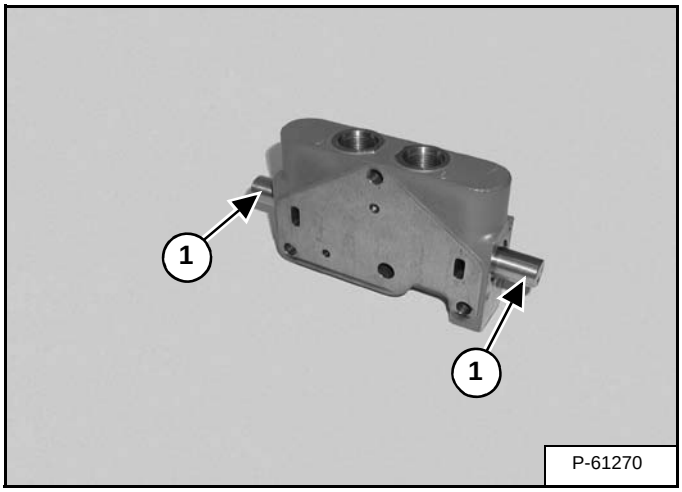
Left Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-52



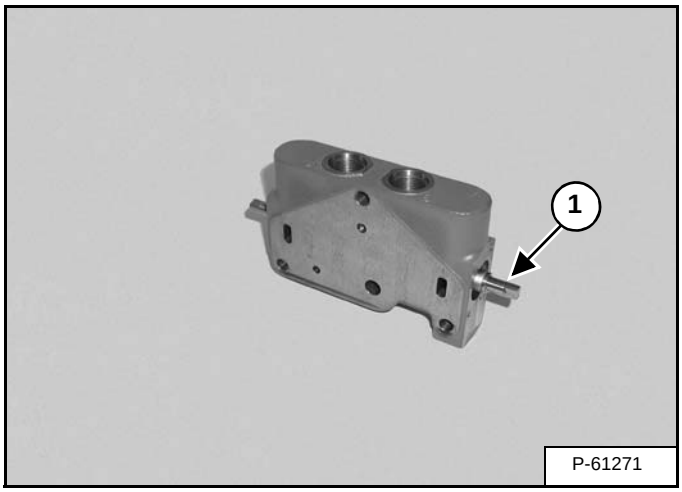
Remove the centering springs (Item 1) **[Figure 20-40-52]** from the spring guides.

Figure 20-40-53



Remove the spring guides (Item 1) **[Figure 20-40-53]** from both ends of the valve spool.

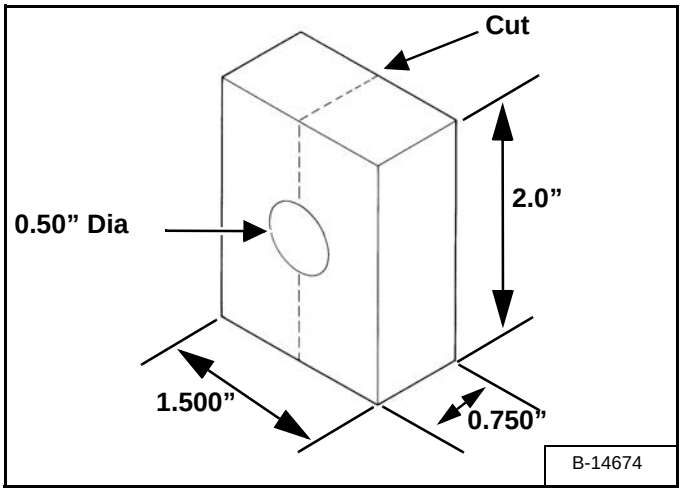
Figure 20-40-54



Record the orientation of the spool (Item 1) **[Figure 20-40-54]**. Remove the spool from the valve section.

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

Figure 20-40-55



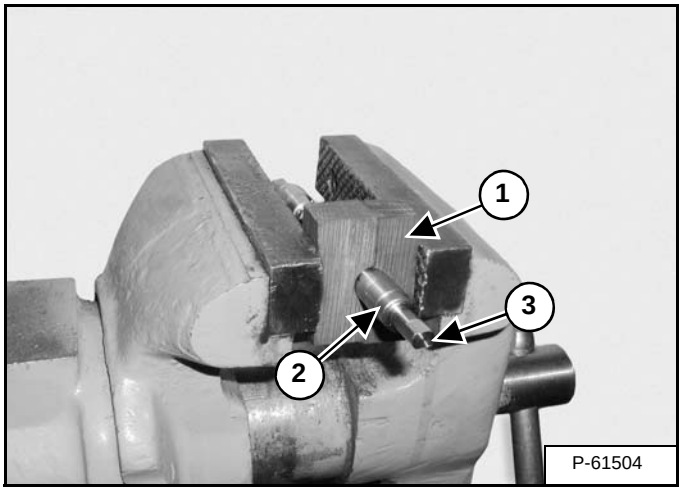
To remove the plugs from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.500 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-55]**.

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

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

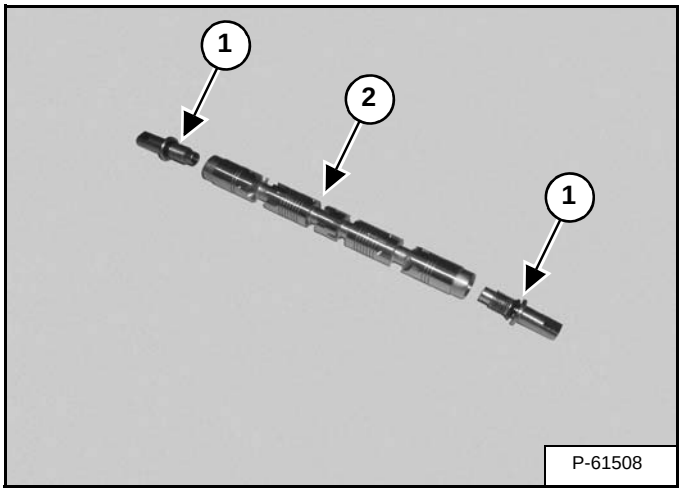
Figure 20-40-56



Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the plugs (Item 3) **[Figure 20-40-56]**.

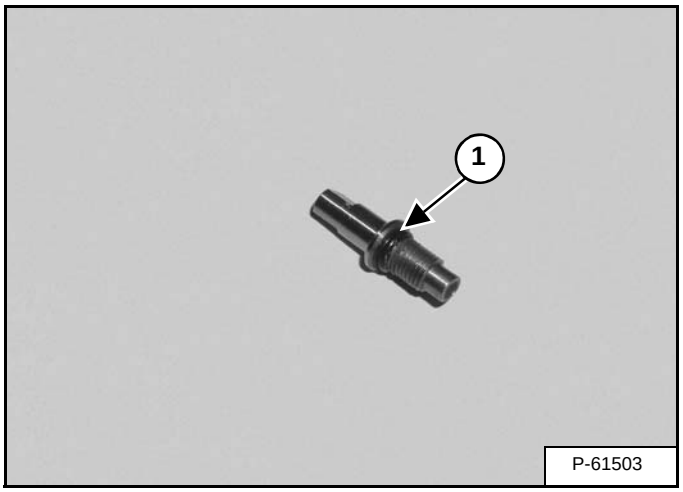
Installation: Apply thread lock adhesive (Loctite 262) or equivalent to the threads. Tighten the plugs to 44 in.-lbs. (5 Nm) torque.

Figure 20-40-57



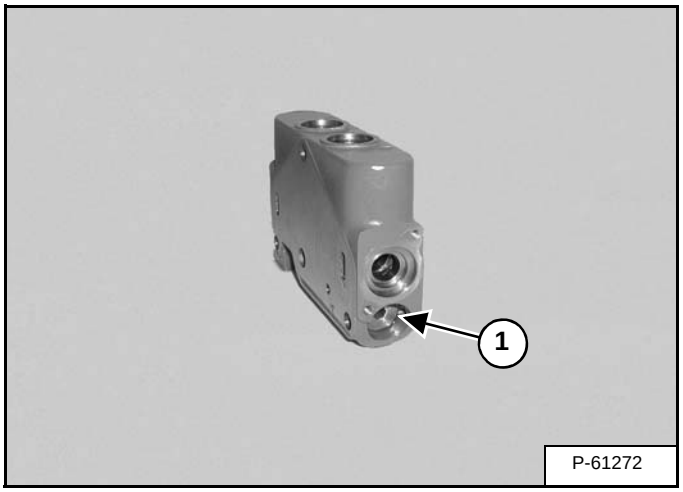
Remove the plugs (Item 1) from the spool (Item 2) **[Figure 20-40-57]**.

Figure 20-40-58



Remove the O-ring (Item 1) **[Figure 20-40-58]** from the plugs.

Figure 20-40-59



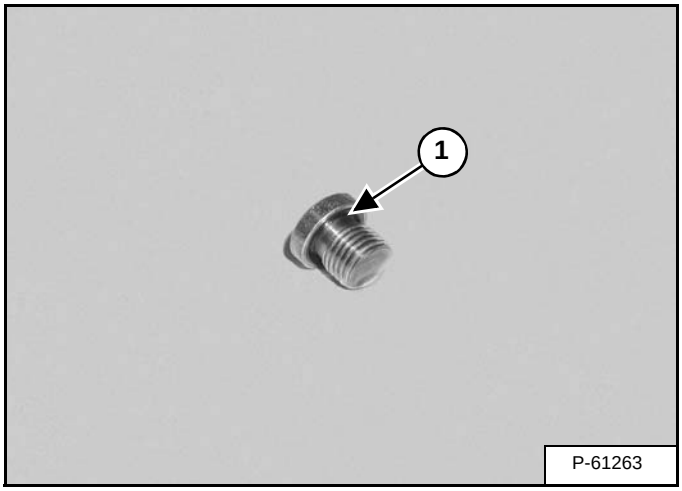
Remove the plug (Item 1) **[Figure 20-40-59]** from the valve section.

Installation: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

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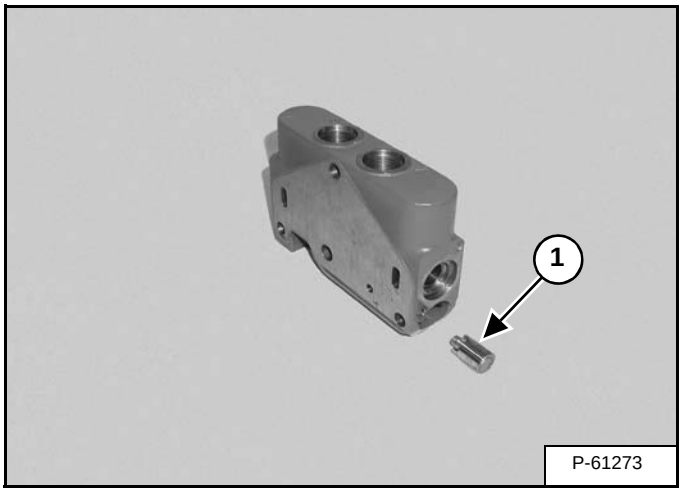
Left Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-60



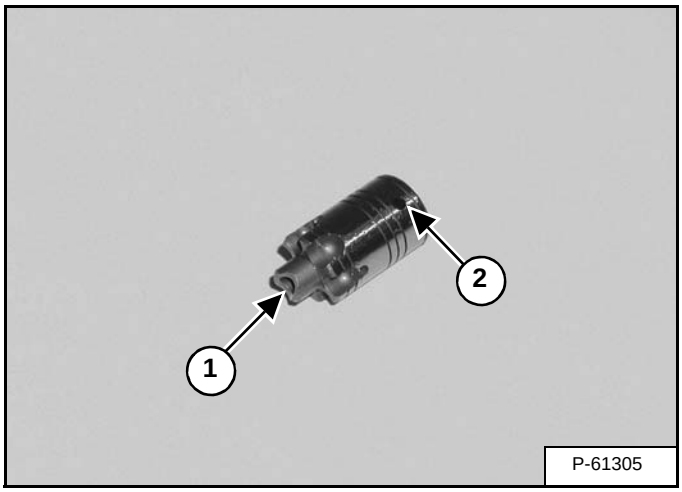
Remove the O-ring (Item 1) **[Figure 20-40-60]** from the plug.

Figure 20-40-61



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

Figure 20-40-62



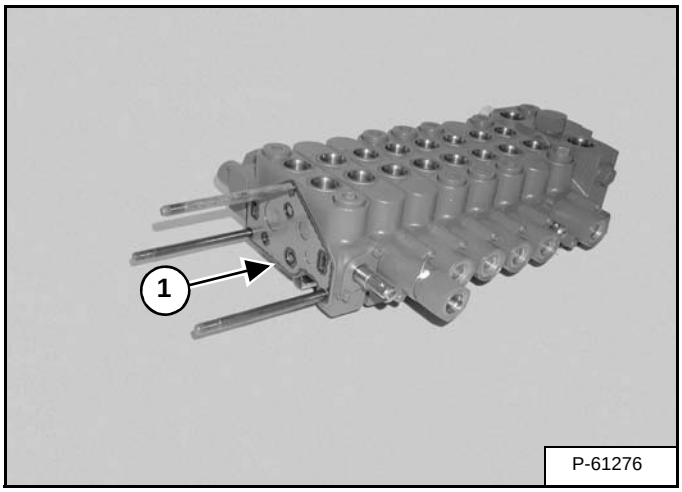
Check the orifice (Item 1) **[Figure 20-40-62]** in the compensator to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-40-62]** to be sure it is not plugged.

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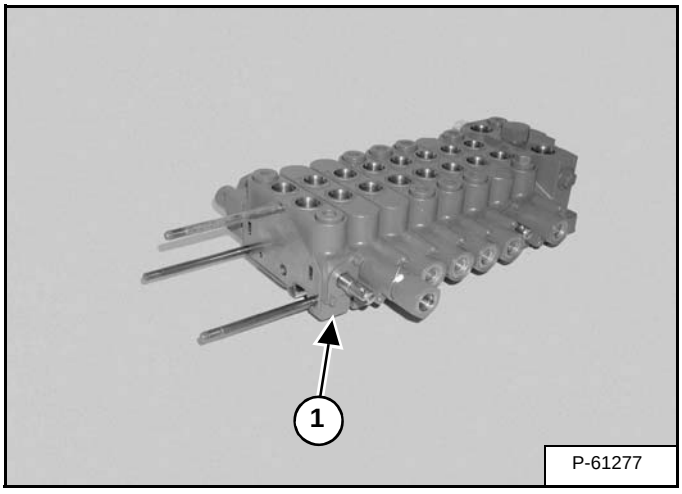
Blade Valve Section Disassembly And Assembly

Figure 20-40-63



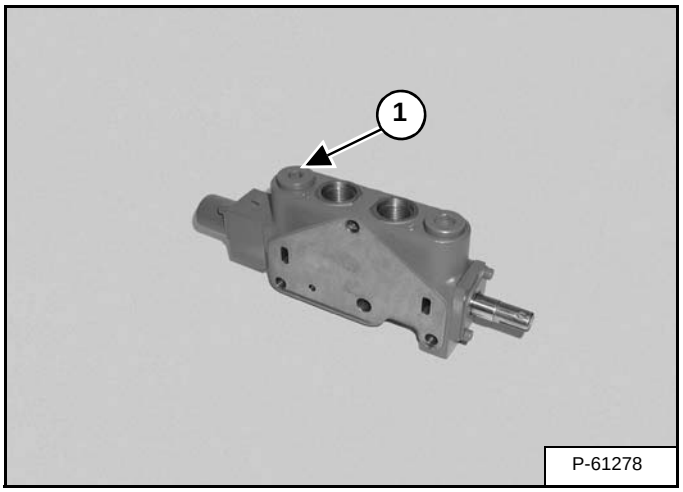
Remove the gasket (Item 1) **[Figure 20-40-63]** from the valve section.

Figure 20-40-64



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

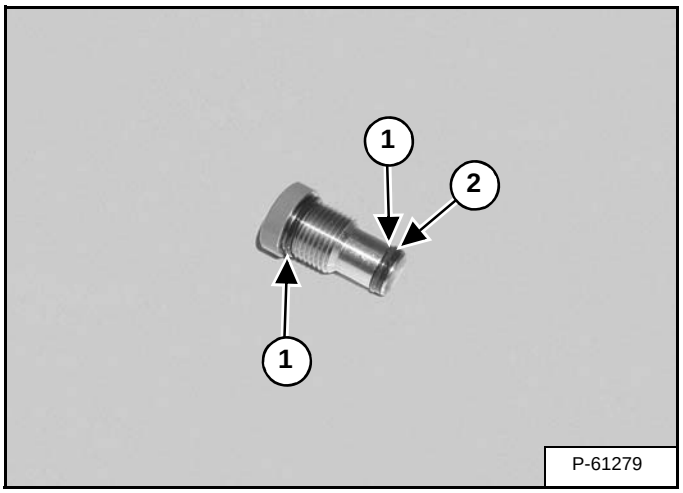
Figure 20-40-65



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

Installation: Tighten the plug to 22-26 ft.-lbs. (30-35 Nm)

Figure 20-40-66

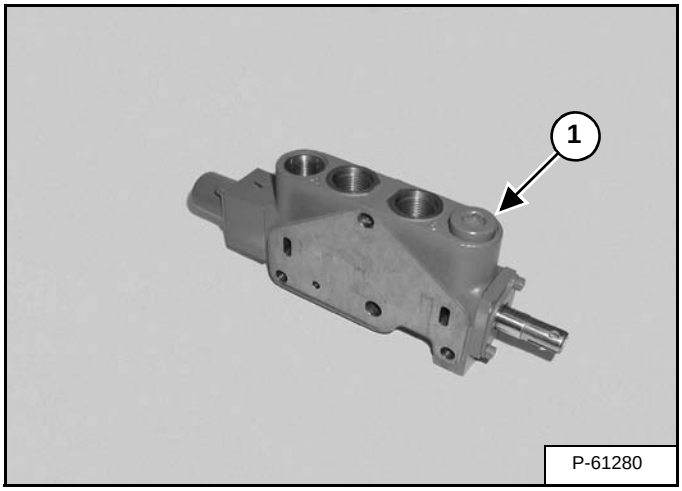


Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-66]** from the plug.

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Blade Valve Section Disassembly And Assembly (Cont'd)

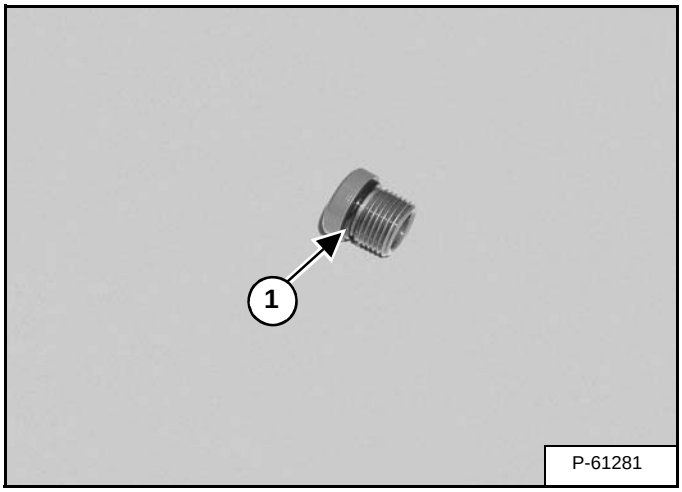
Figure 20-40-67



Remove the plug (Item 1) **[Figure 20-40-67]** from the port relief valve.

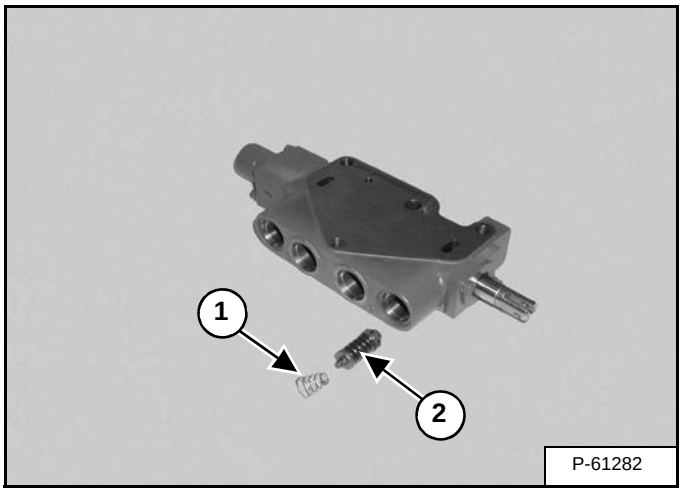
Installation: Tighten the plug to 22-26 ft.-lbs. (30-35 Nm) torque.

Figure 20-40-68



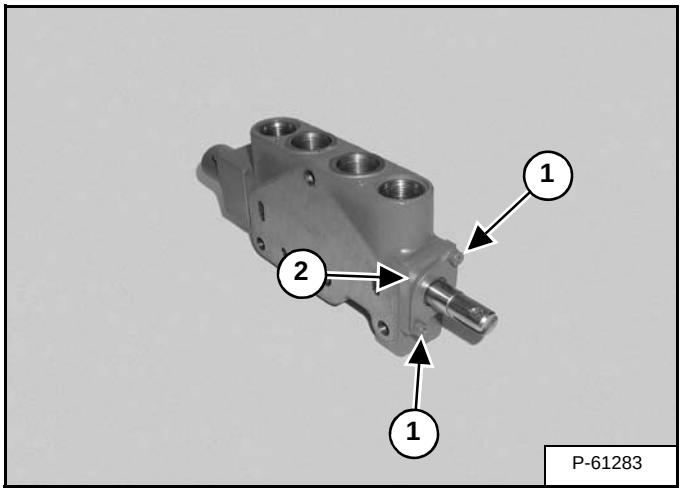
Remove the O-ring (Item 1) from the plug **[Figure 20-40-67]**.

Figure 20-40-69



Remove the spring (Item 1) and valve assembly (Item 2) **[Figure 20-40-69]**.

Figure 20-40-70



Remove the screws (Item 1) from the valve spool retainer (Item 2) **[Figure 20-40-70]**.

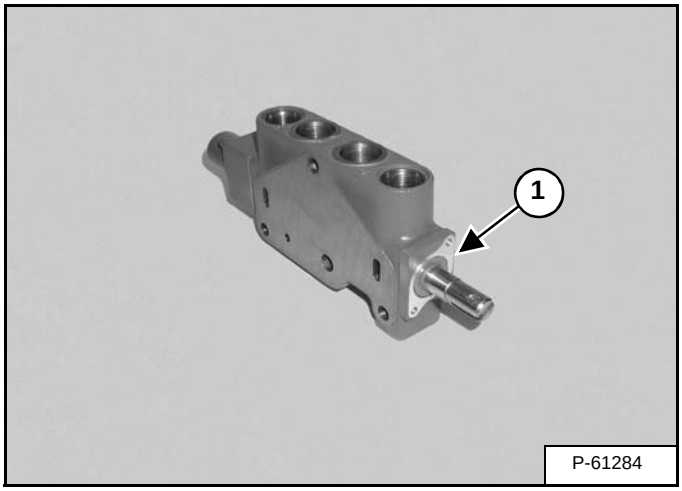
Installation: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

Remove the retainer.

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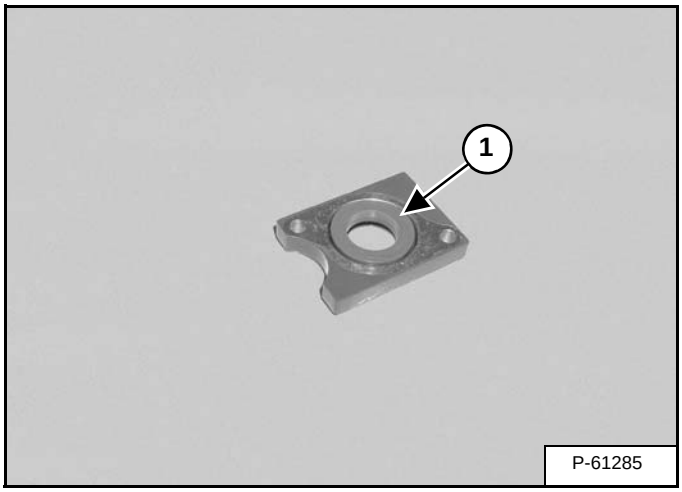
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-71



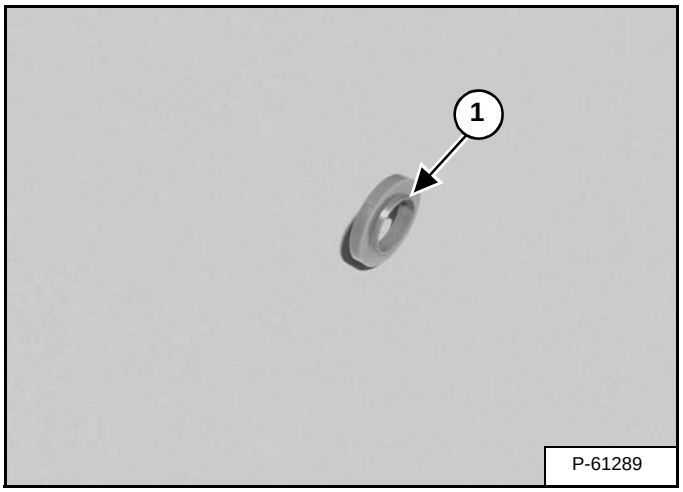
Remove the seal carrier (Item 1) **[Figure 20-40-71]**.

Figure 20-40-72



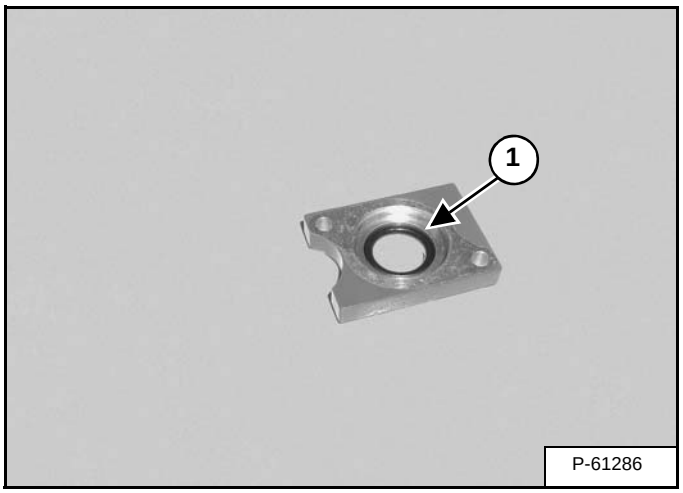
Remove the seal (Item 1) **[Figure 20-40-72]** from the seal carrier.

Figure 20-40-73



Assembly: Install the seal on the spool with the flange (Item 1) **[Figure 20-40-73]** toward the outside of the valve section.

Figure 20-40-74

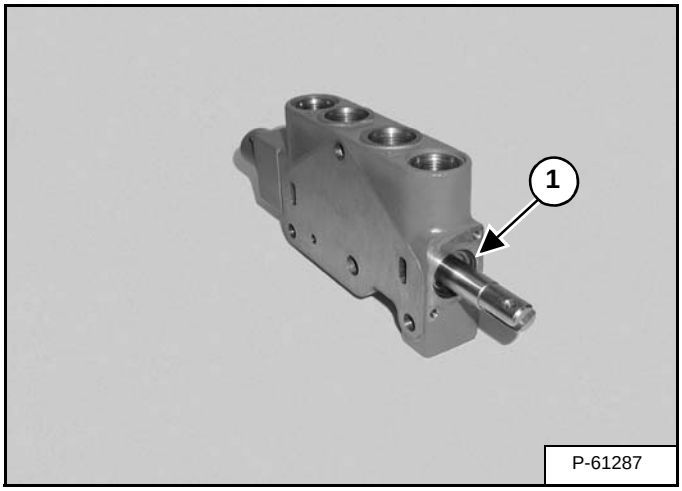


Remove the O-ring (Item 1) **[Figure 20-40-74]**.

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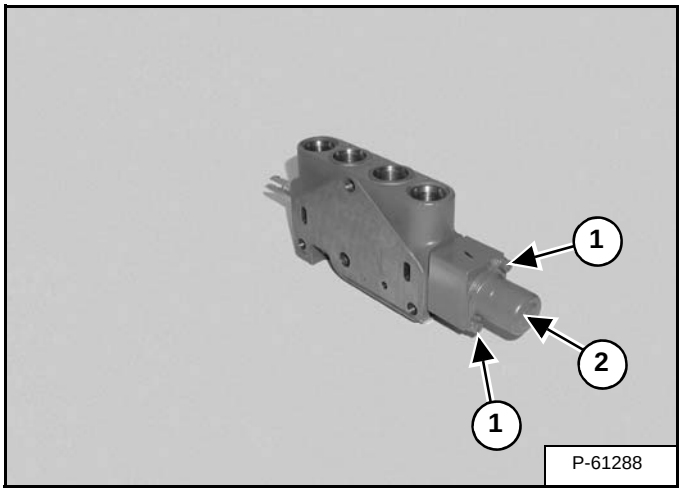
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-75



Remove the O-ring (Item 1) **[Figure 20-40-75]** from the valve section.

Figure 20-40-76



Remove the screws (Item 1) from the end cap (Item 2) **[Figure 20-40-76]**.

Installation: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

Remove the end cap.

IMPORTANT

The detent assembly has small springs and balls. Do not lose these parts during disassembly and assembly.

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Figure 20-40-77

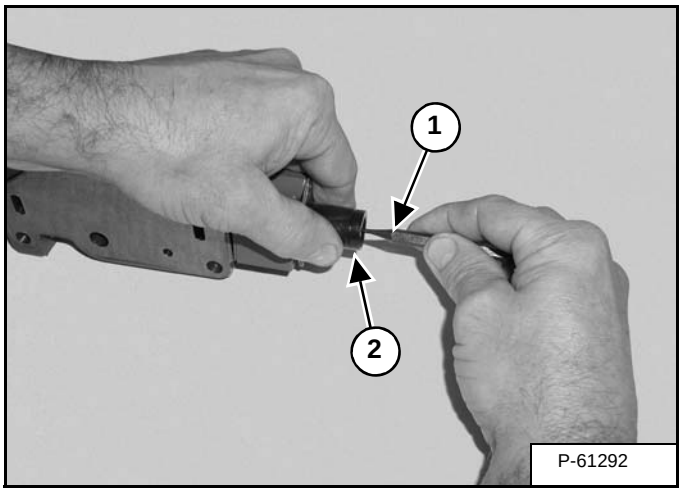
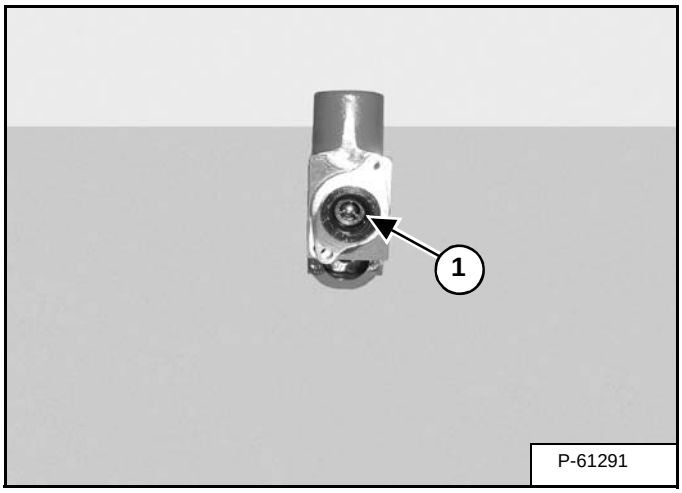


Figure 20-40-78



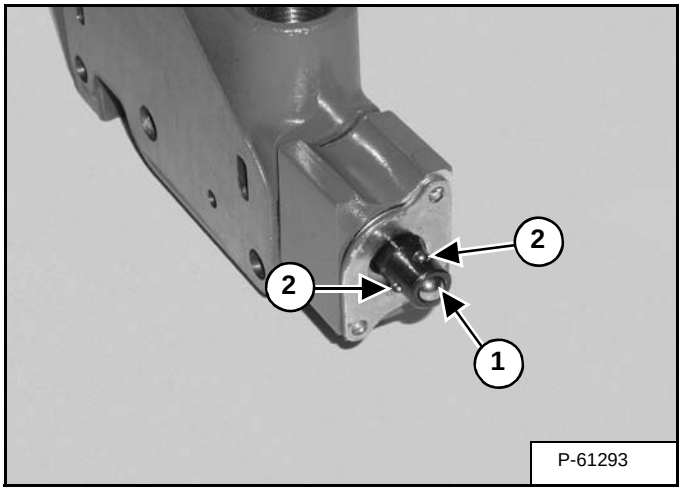
Using a brass drift (Item 1) **[Figure 20-40-77]** press in on the center ball (Item 1) **[Figure 20-40-78]**.

Continue to press in on the ball and remove the detent sleeve (Item 2) **[Figure 20-40-77]**.

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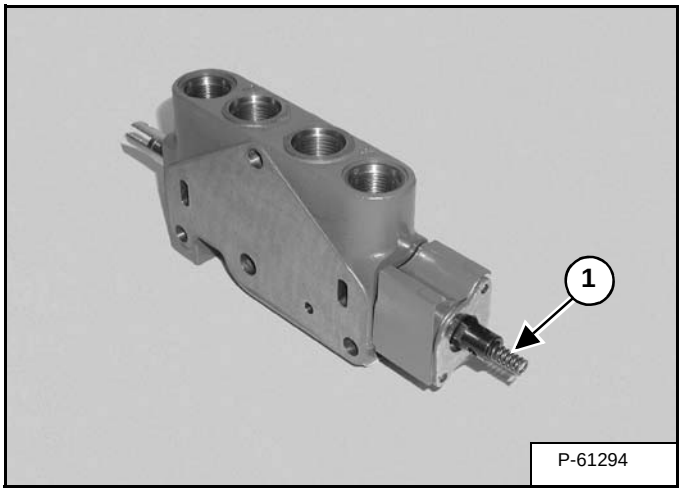
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-79



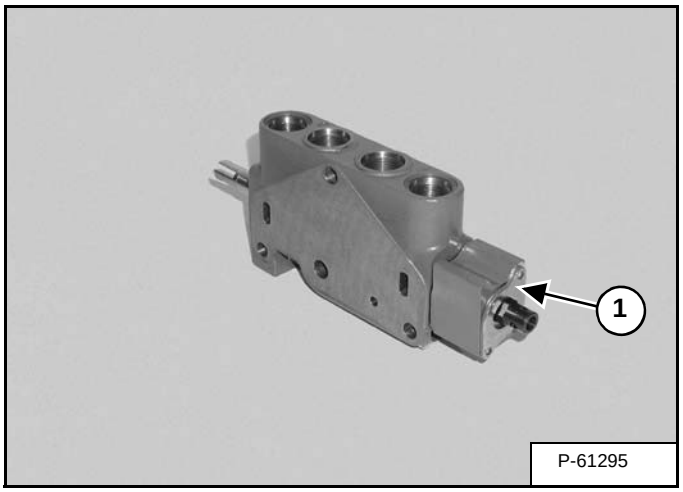
Remove the center ball (Item 1) and three detent balls (Item 2) **[Figure 20-40-79]**.

Figure 20-40-80



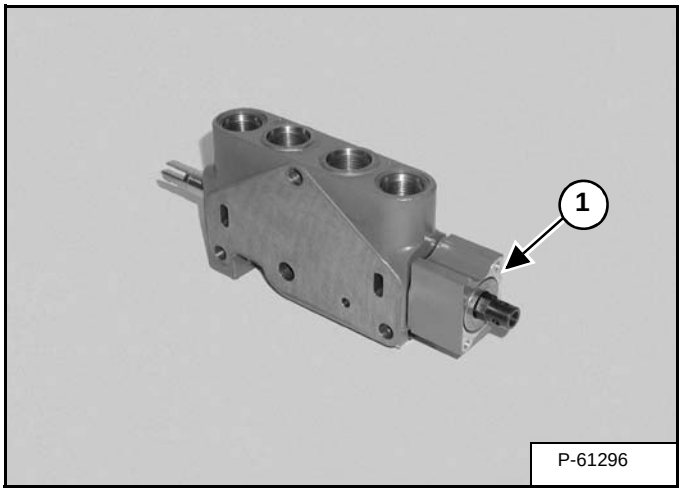
Remove the spring (Item 1) **[Figure 20-40-80]**.

Figure 20-40-81



Remove the retainer (Item 2) **[Figure 20-40-81]**.

Figure 20-40-82

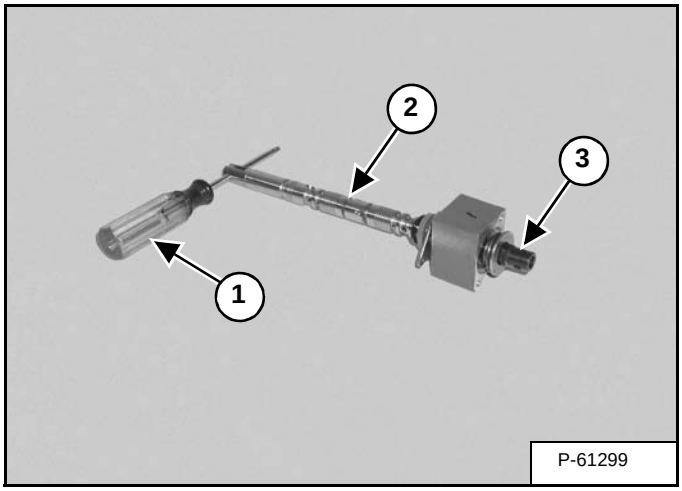


Remove the spool assembly (Item 1) **[Figure 20-40-82]**.

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Blade Valve Section Disassembly And Assembly (Cont'd)

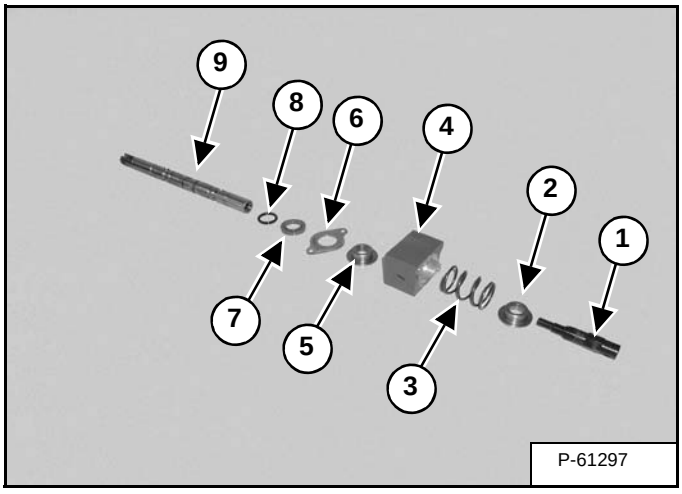
Figure 20-40-83



Using a screwdriver (Item 1) to hold the spool (Item 2) loosen the detent ball retainer (Item 3) **[Figure 20-40-83]**.

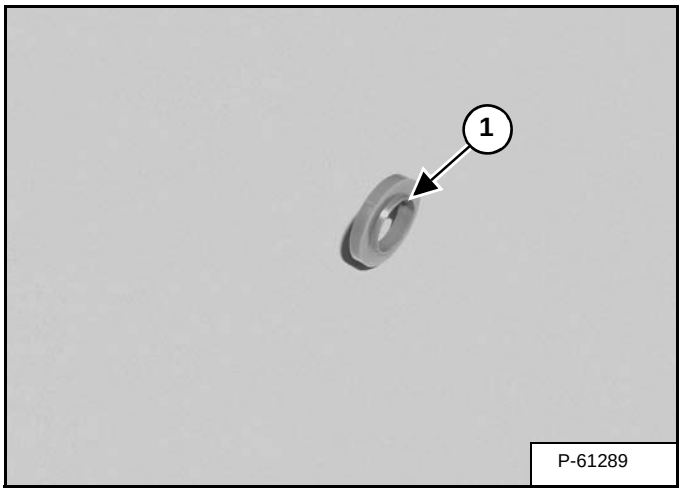
Installation: Apply thread lock adhesive (Loctite 242) or equivalent to the threads. Tighten the detent ball retainer to 44 in.-lbs. (5 Nm) torque.

Figure 20-40-84



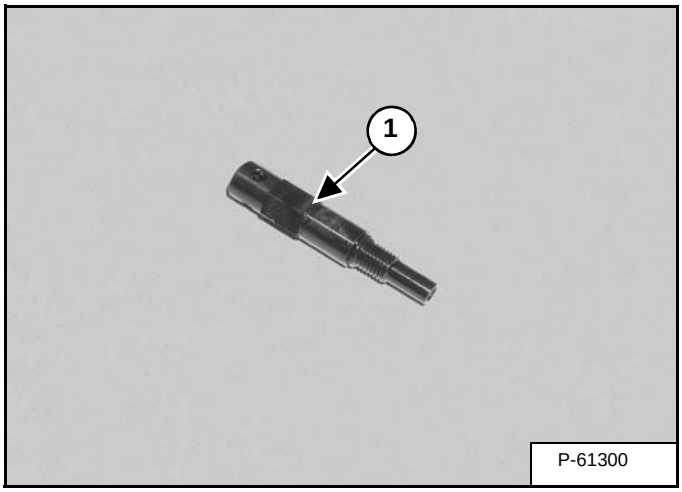
Remove the detent ball retainer (Item 1), spring retainer (Item 2), spring (Item 3), housing (Item 4), spring retainer (Item 5), retainer (Item 6), seal (Item 7) and O-ring (Item 8) from the spool (Item 9) **[Figure 20-40-84]**.

Figure 20-40-85



Assembly: Install the seal on the spool with the flange (Item 1) **[Figure 20-40-85]** toward the outside of the valve section.

Figure 20-40-86

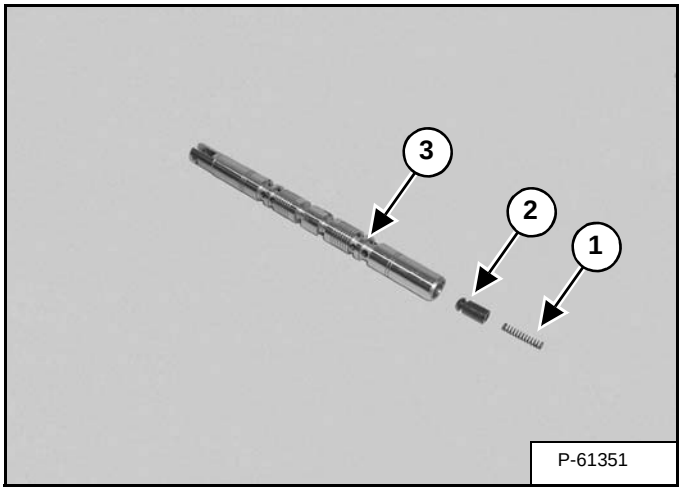


Remove the O-ring (Item 1) **[Figure 20-40-86]** from the detent ball retainer.

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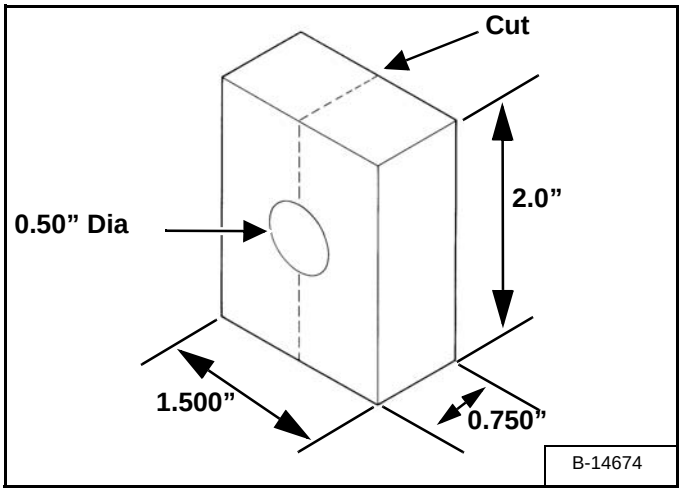
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-87



Remove the spring (Item 1) and poppet (Item 2) **[Figure 20-40-87]** from the spool.

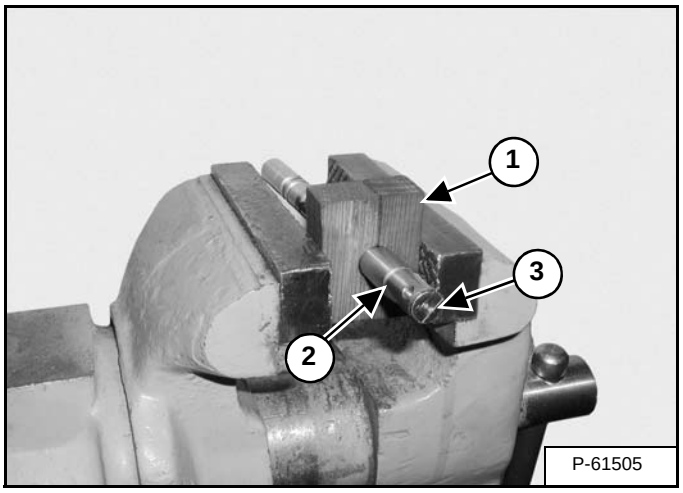
Figure 20-40-88



To remove the linkage end from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.50 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-88]**.

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

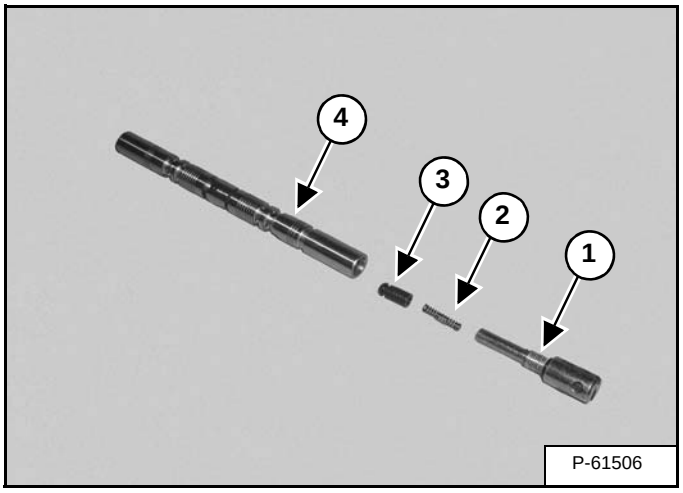
Figure 20-40-89



Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the linkage end (Item 3) **[Figure 20-40-89]**.

Installation: Apply thread lock adhesive (Loctite 242) or equivalent to the threads. Tighten the linkage end to 44 in.-lbs. (5 Nm) torque.

Figure 20-40-90

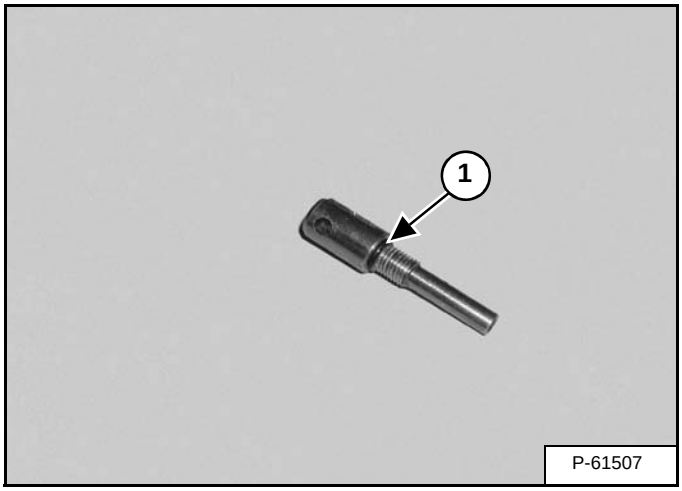


Remove the linkage end (Item 1), spring (Item 2), and poppet (Item 3) from the spool (Item 4) **[Figure 20-40-90]**.

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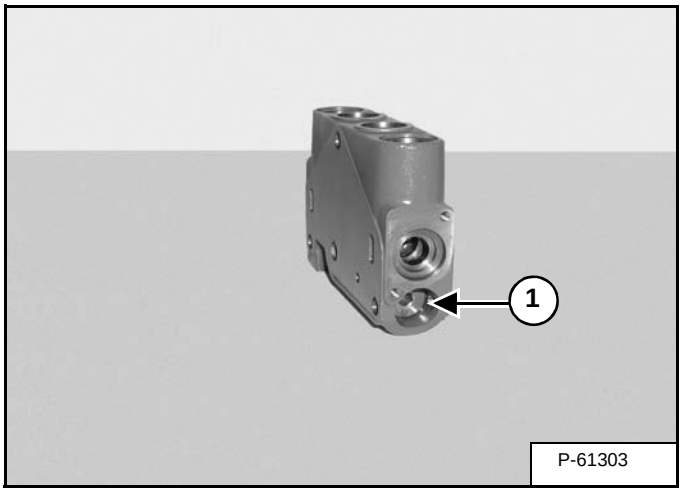
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-91



Remove the O-ring (Item 1) **[Figure 20-40-91]** from the linkage end.

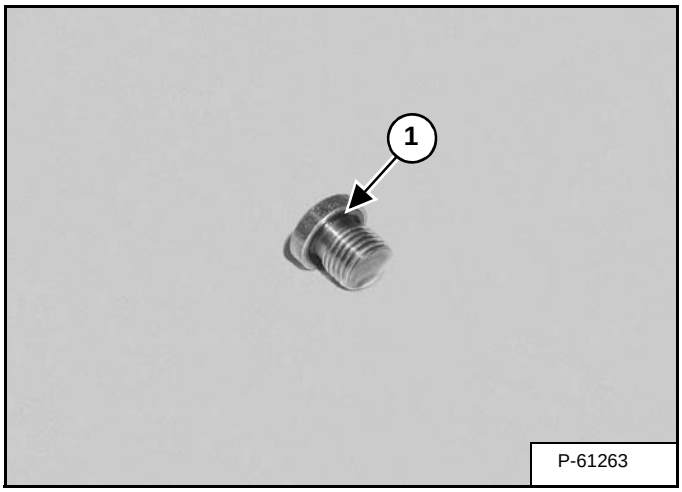
Figure 20-40-92



Remove the plug (Item 1) **[Figure 20-40-92]** from the valve section.

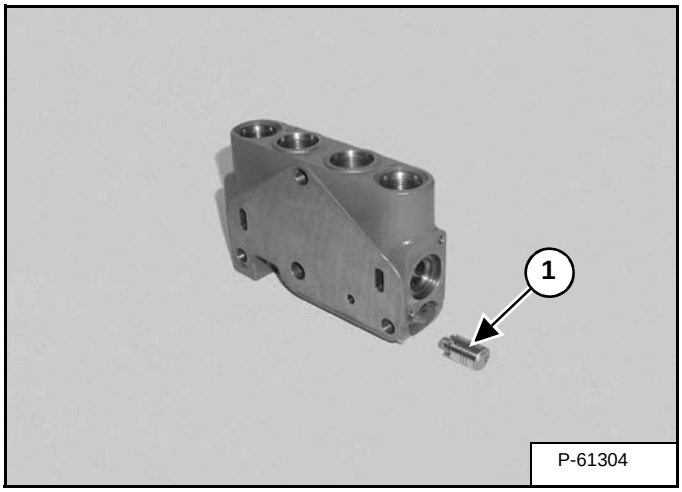
Installation: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

Figure 20-40-93



Remove the O-ring (Item 1) **[Figure 20-40-93]** from the plug.

Figure 20-40-94

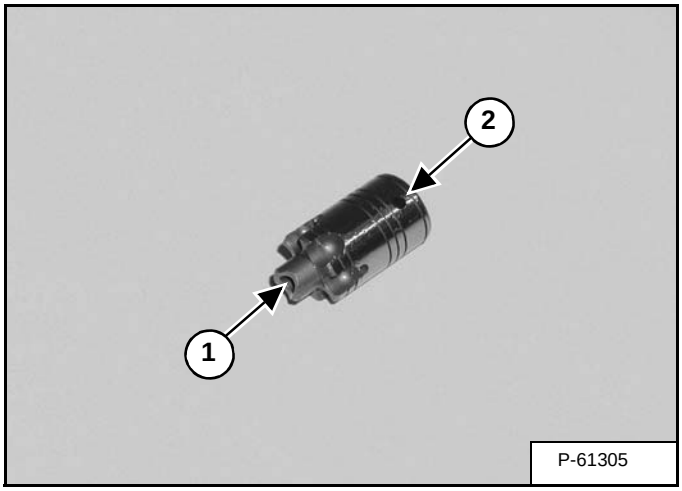


Remove the compensator (Item 1) **[Figure 20-40-94]** from the valve section.

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Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-95



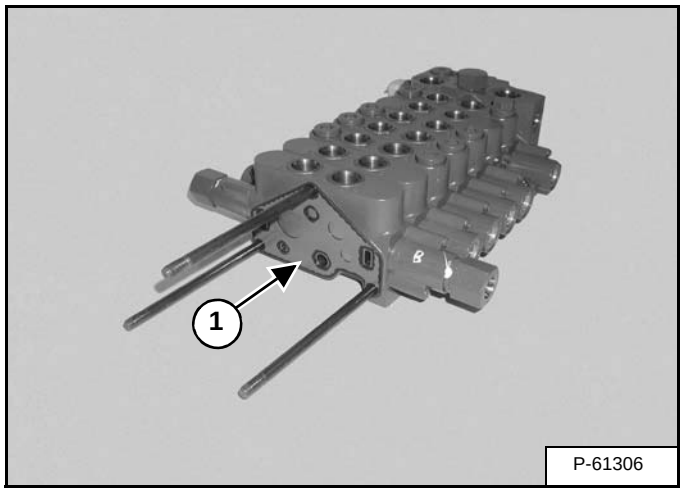
Check the orifice (Item 1) **[Figure 20-40-95]** in the compensator to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-40-95]** to be sure it is not plugged.

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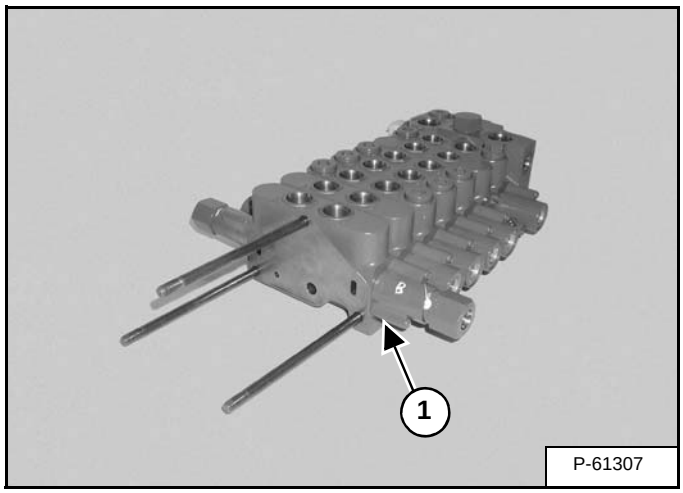
Slew Valve Section Disassembly And Assembly

Figure 20-40-96



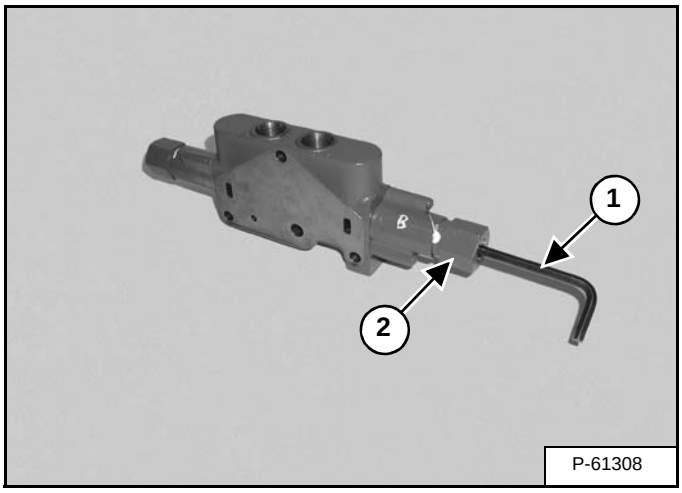
Remove the gasket (Item 1) **[Figure 20-40-96]** from the valve section.

Figure 20-40-97



Remove the slew valve section (Item 1) **[Figure 20-40-97]** from the control valve.

Figure 20-40-98



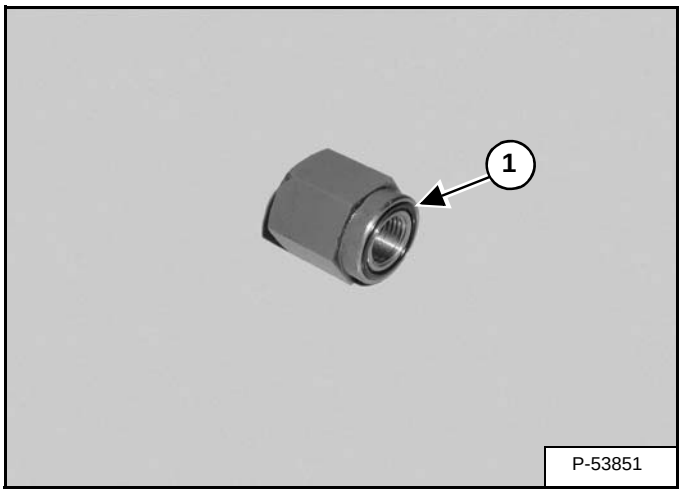
Install a hex wrench (Item 1) **[Figure 20-40-98]** to hold the spool limiter.

Remove the nut (Item 2) **[Figure 20-40-98]**.

Repeat the procedure on the opposite end of the valve section.

Installation: Tighten the nut to 22 ft.-lbs. (30 Nm) torque.

Figure 20-40-99

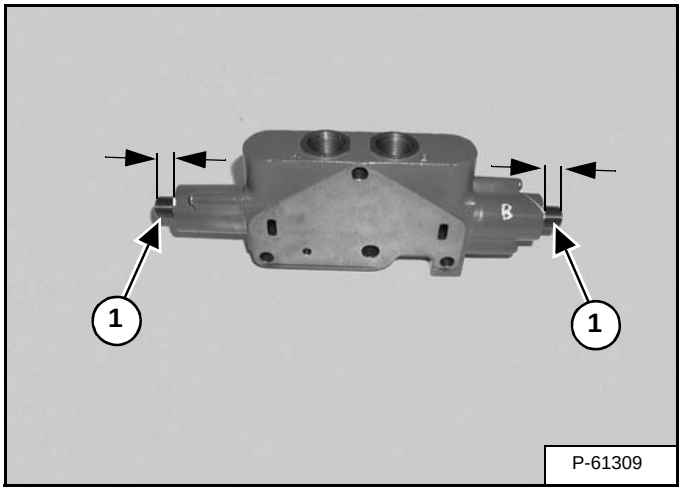


Remove the O-ring (Item 1) **[Figure 20-40-99]** from the nuts.

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Slew Valve Section Disassembly And Assembly (Cont'd)

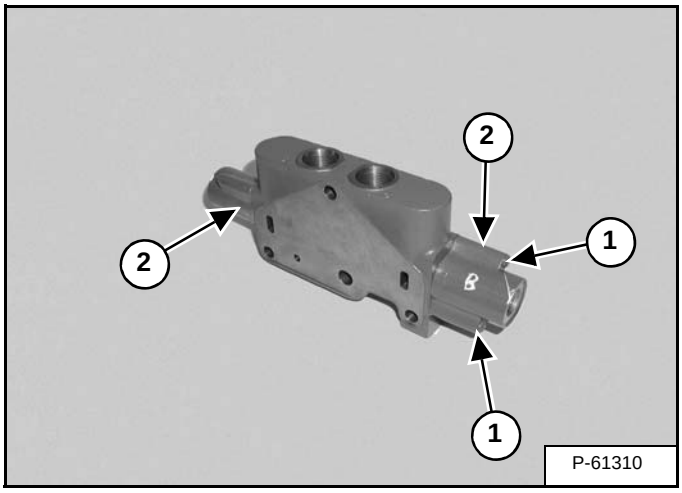
Figure 20-40-100



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

Remove the spool limiters.

Figure 20-40-101

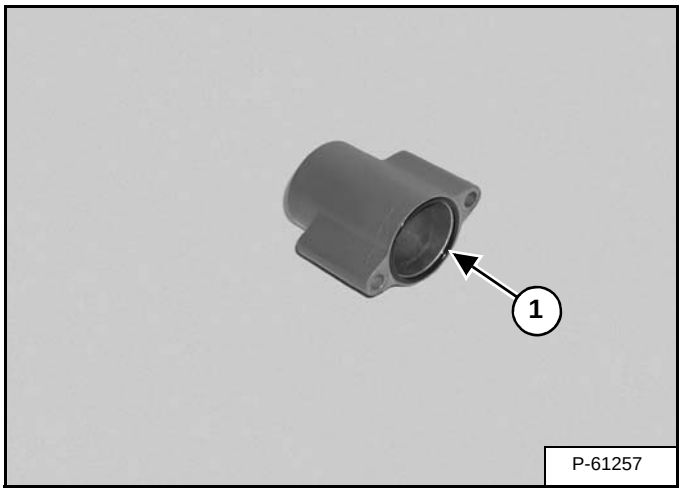


Remove the screws (Item 1) from both end caps (Item 2) **[Figure 20-40-101]**.

Assembly: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

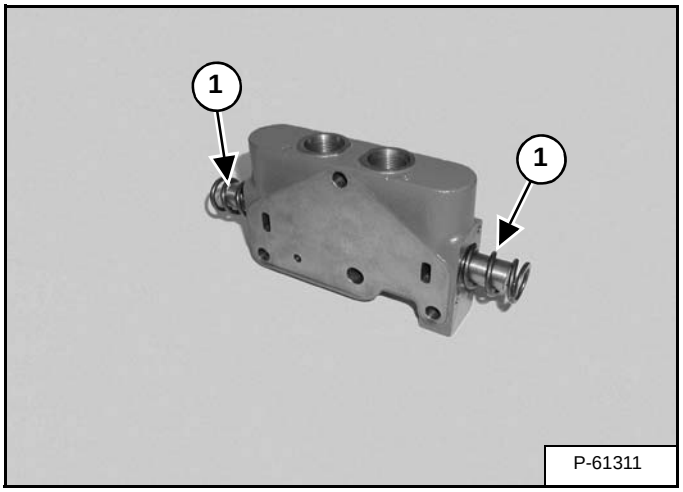
Remove the end caps from the valve section.

Figure 20-40-102



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

Figure 20-40-103

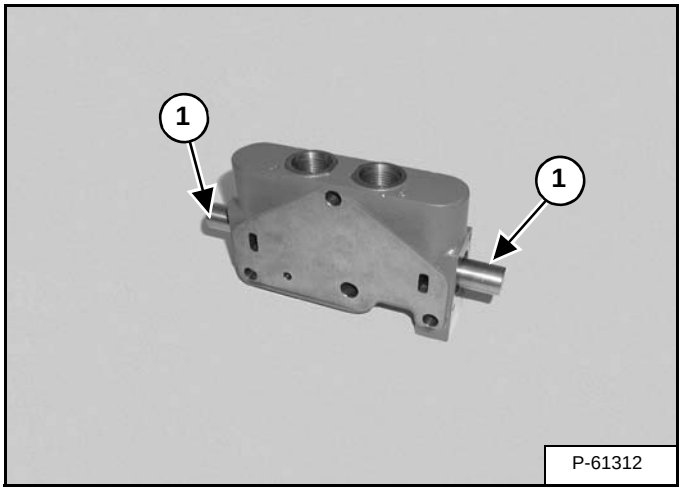


Remove the centering springs (Item 1) **[Figure 20-40-103]** from the spring guides.

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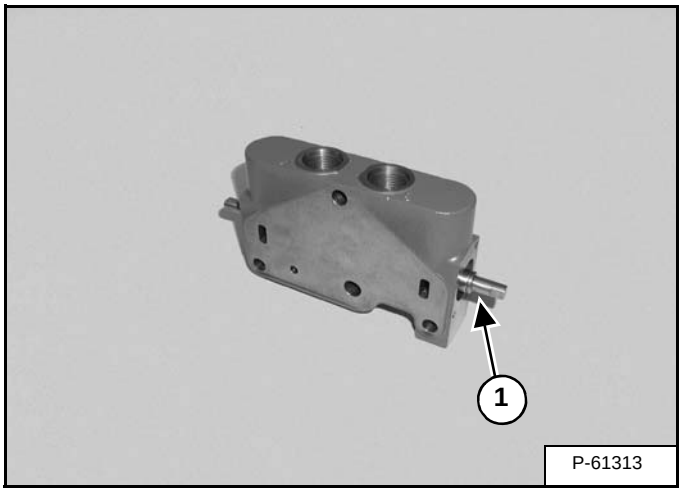
Slew Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-104



Remove the spring guides (Item 1) **[Figure 20-40-104]** from both ends of the valve spool.

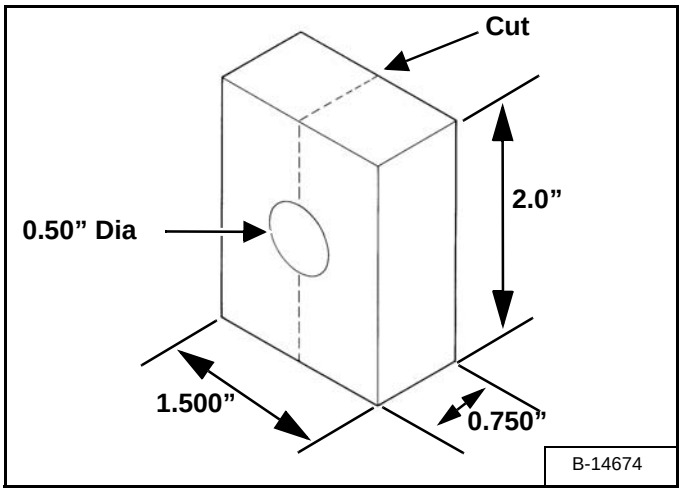
Figure 20-40-105



Record the orientation of the spool (Item 1) **[Figure 20-40-105]**. Remove the spool from the valve section.

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

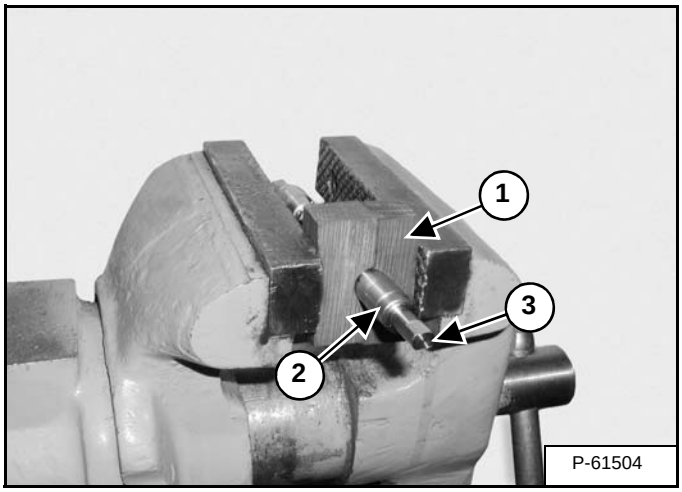
Figure 20-40-106



To remove the plugs from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.500 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-106]**.

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

Figure 20-40-107



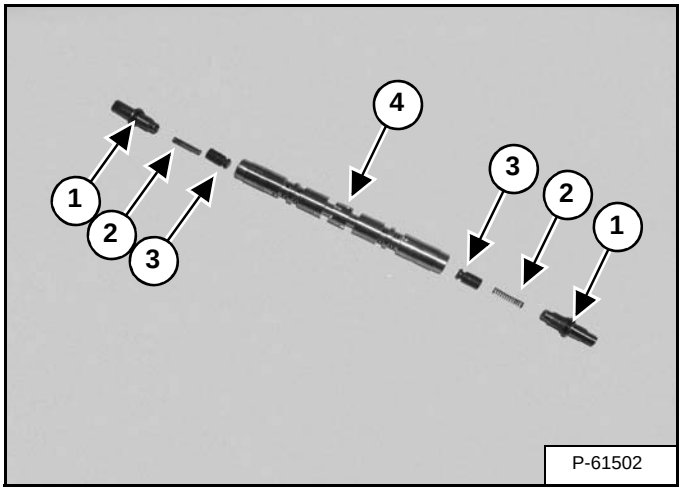
Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the plugs (Item 3) **[Figure 20-40-107]**. (Both ends)

Installation: Apply thread lock adhesive (Loctite 262) or equivalent to the threads. Tighten the plugs to 44 in.-lbs. (5 Nm) torque.

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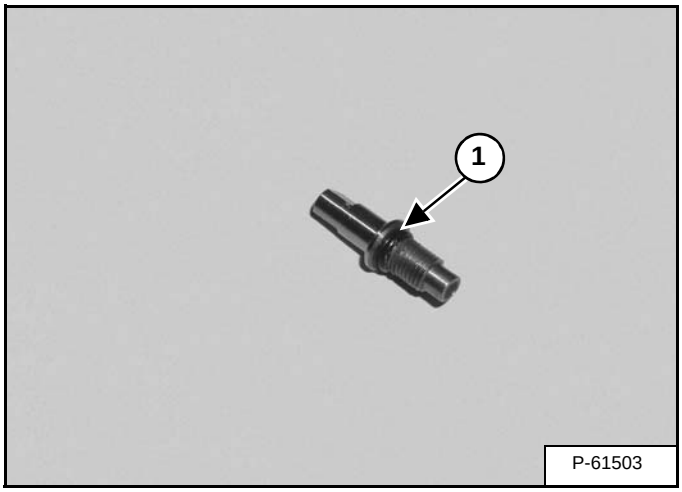
Slew Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-108



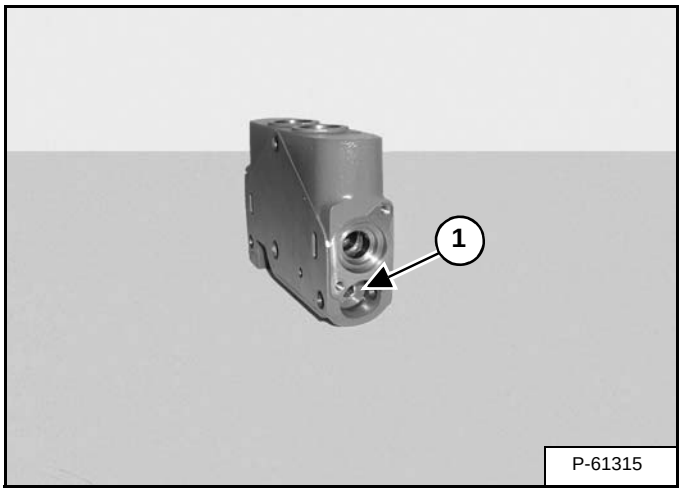
Remove the plugs (Item 1), springs (Item 2), and poppet (Item 3) from the spool (Item 4) **[Figure 20-40-108]**.

Figure 20-40-109



Remove the O-ring (Item 1) **[Figure 20-40-109]** from the plugs.

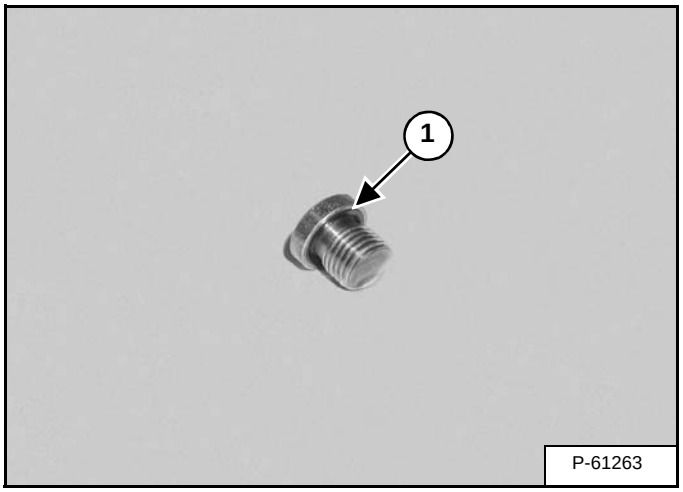
Figure 20-40-110



Remove the plug (Item 1) **[Figure 20-40-110]** from the valve section.

Installation: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

Figure 20-40-111

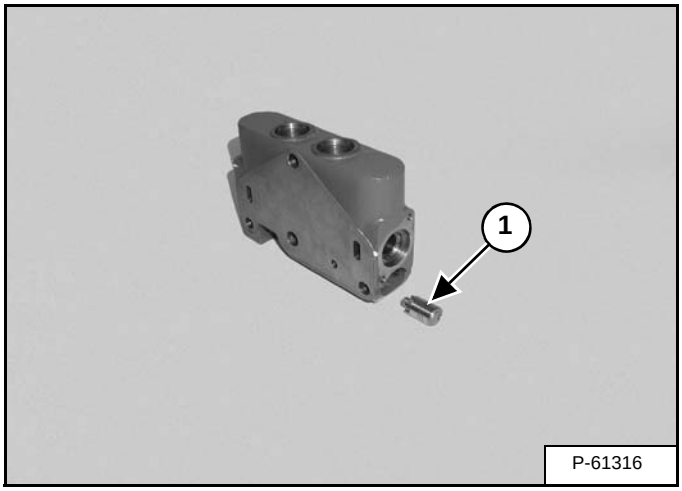


Remove the O-ring (Item 1) **[Figure 20-40-111]** from the plug.

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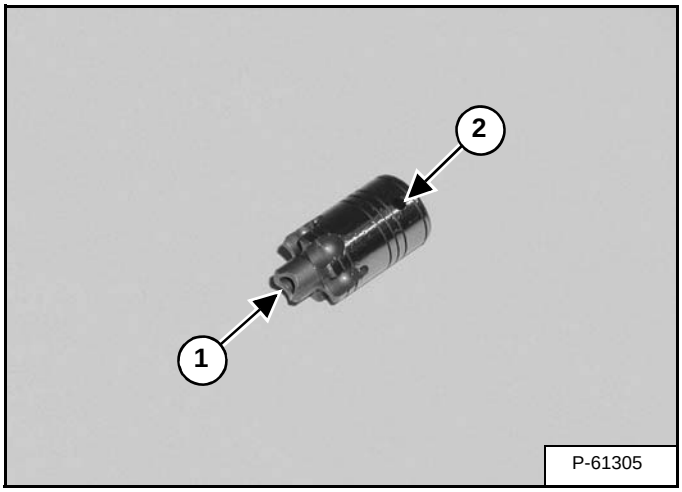
Slew Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-112



Remove the compensator (Item 1) **[Figure 20-40-112]** from the valve section.

Figure 20-40-113



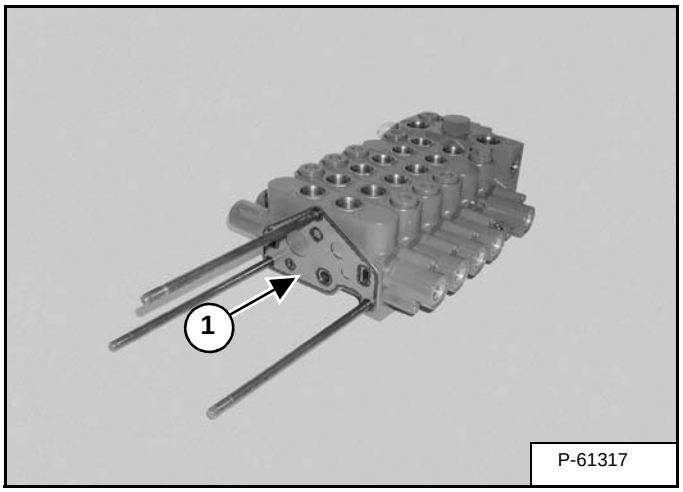
Check the orifice (Item 1) **[Figure 20-40-113]** to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-40-113]** in the compensator, to be sure it is not plugged.

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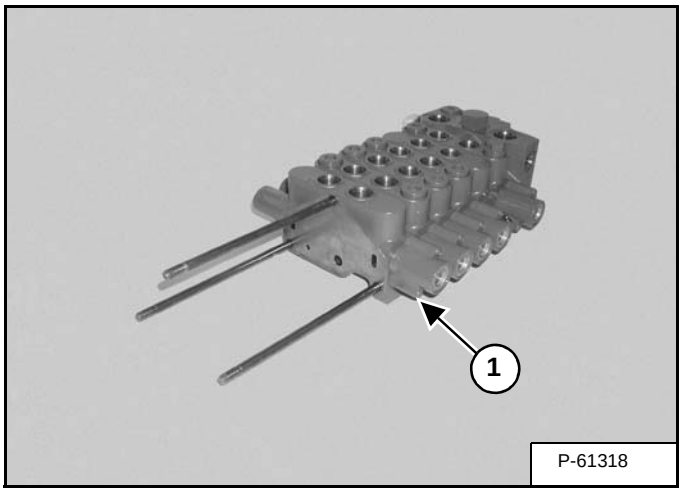
Second Auxiliary Valve Section Disassembly And Assembly

Figure 20-40-114



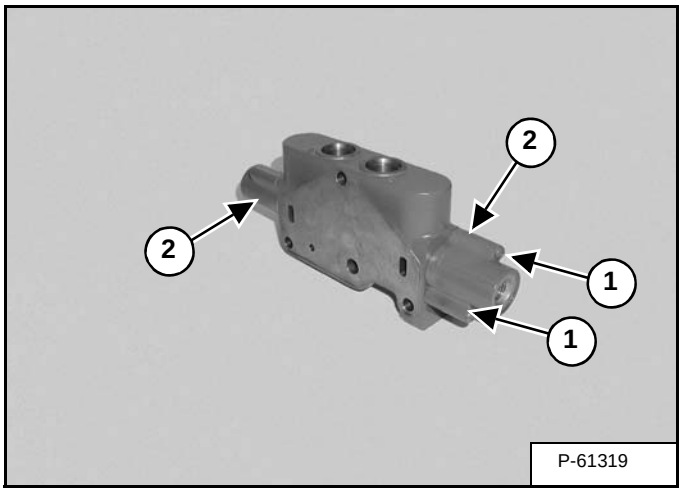
Remove the gasket (Item 1) **[Figure 20-40-114]** from the valve section.

Figure 20-40-115



Remove the second auxiliary valve section (Item 1) **[Figure 20-40-115]** from the control valve.

Figure 20-40-116

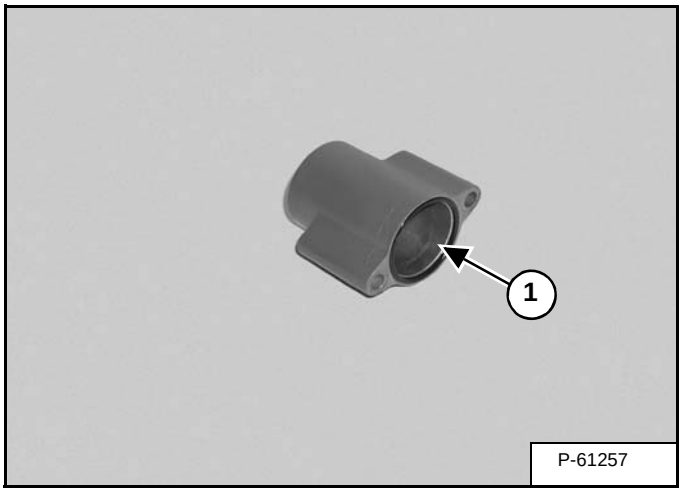


Remove the screws (Item 1) **[Figure 20-40-116]** from both end caps.

Installation: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

Remove the end cap (Item 2) **[Figure 20-40-116]** from both ends of the valve section.

Figure 20-40-117

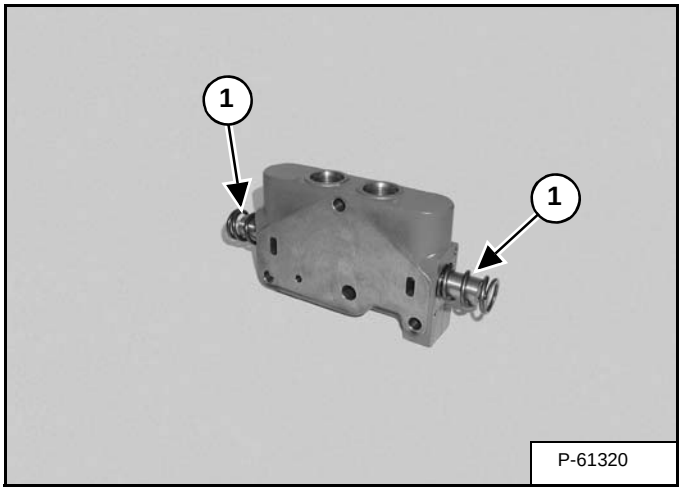


Remove the O-ring (Item 1) **[Figure 20-40-117]** from both end caps.

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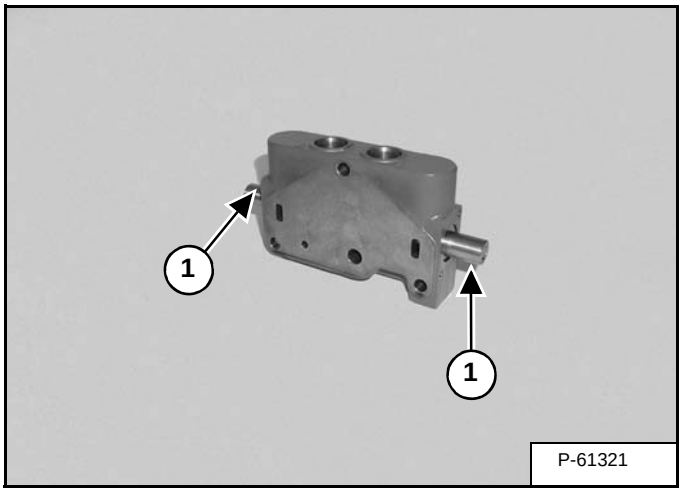
Second Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-118



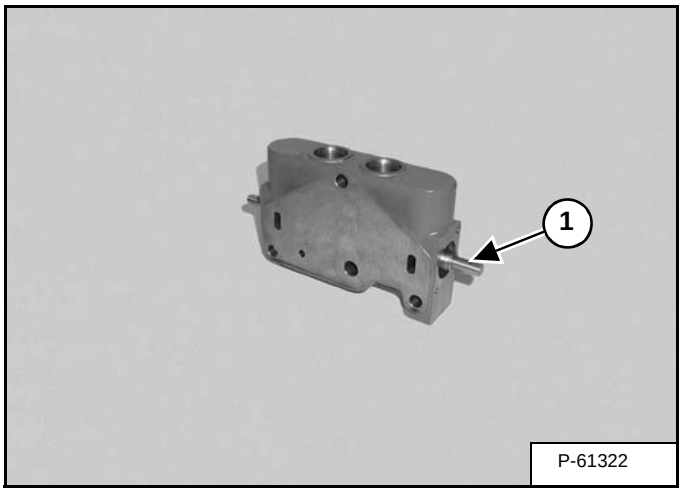
Remove the centering springs (Item 1) **[Figure 20-40-118]** from both ends of the valve spool.

Figure 20-40-119



Remove the spring guides (Item 1) **[Figure 20-40-119]** from both ends of the valve spool.

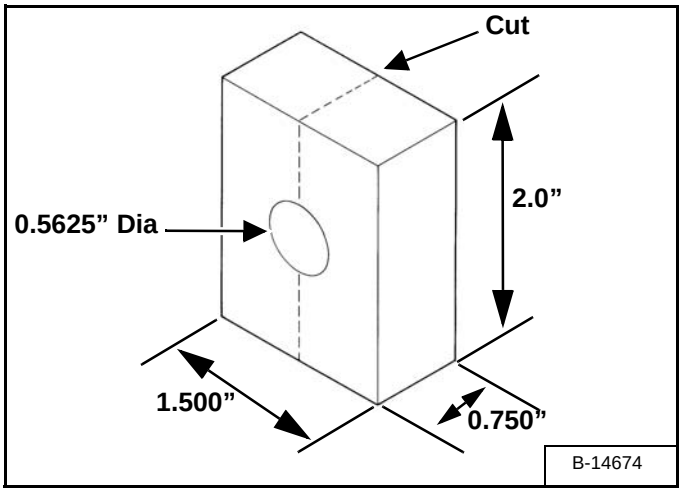
Figure 20-40-120



Record the orientation of the spool (Item 1) **[Figure 20-40-120]**. Remove the spool from the valve section.

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

Figure 20-40-121



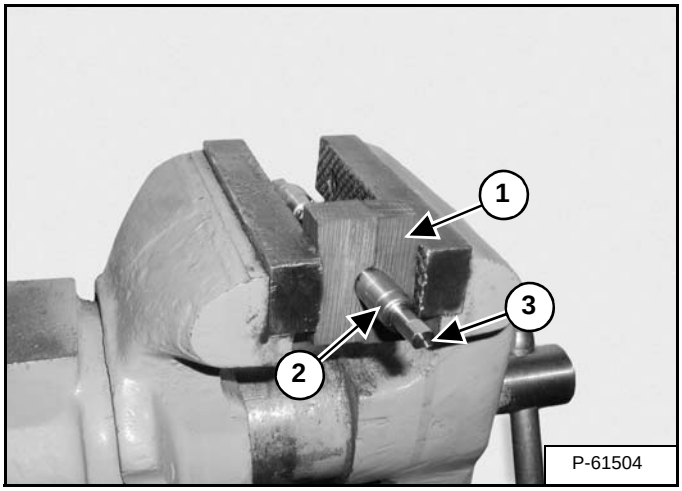
To remove the plugs from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.500 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-121]**.

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

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

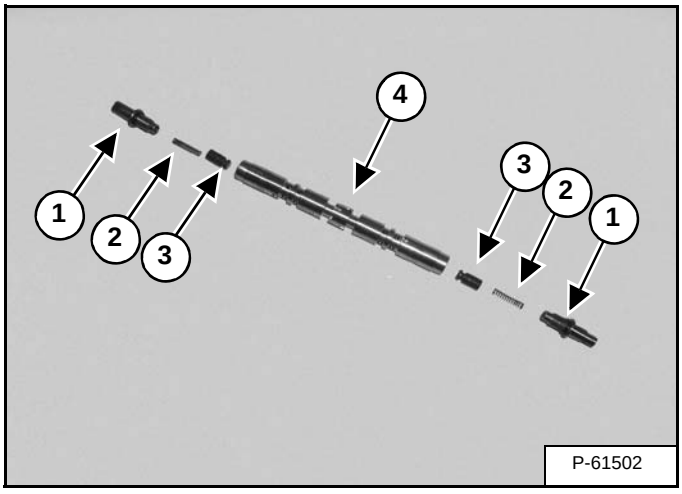
Figure 20-40-122



Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the plugs (Item 3) **[Figure 20-40-122]**. (Both ends)

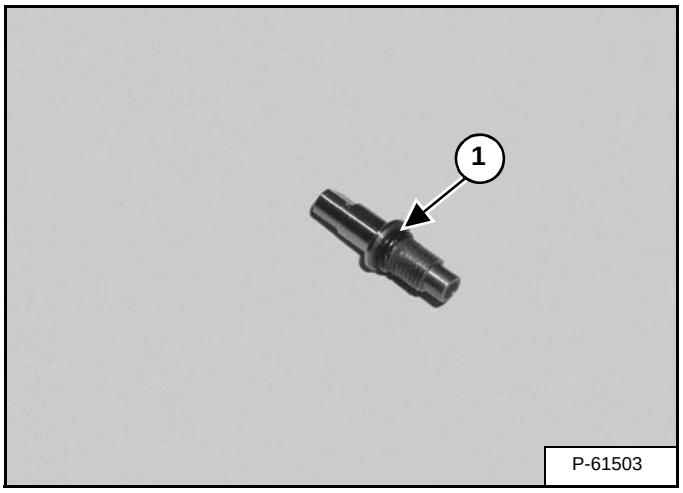
Installation: Apply thread lock adhesive (Loctite 262) or equivalent to the threads. Tighten the plugs to 44 in.-lbs. (5 Nm) torque.

Figure 20-40-123



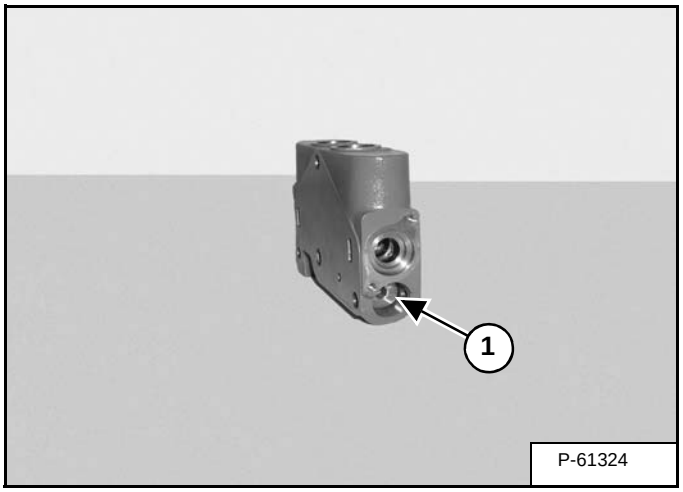
Remove the plugs (Item 1), springs (Item 2), and poppet (Item 3) from the spool (Item 4) **[Figure 20-40-123]**.

Figure 20-40-124



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

Figure 20-40-125



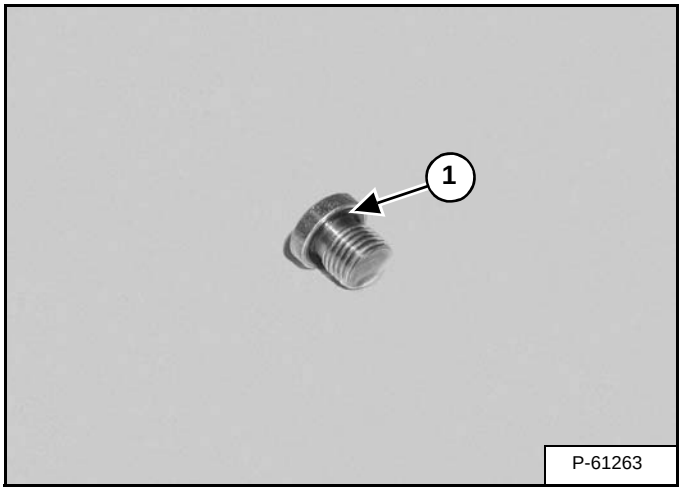
Remove the plug (Item 1) **[Figure 20-40-125]** from the valve section.

Assembly: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

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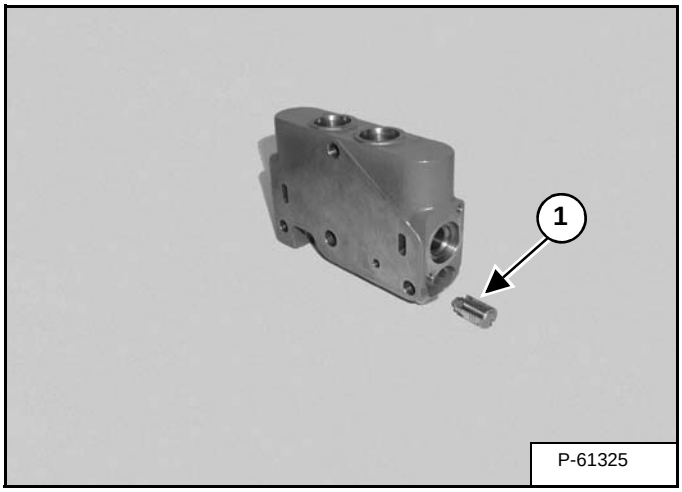
Second Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-126



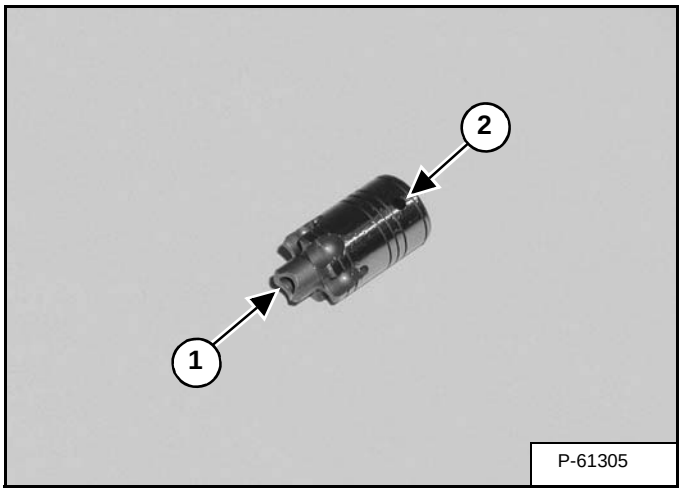
Remove the O-ring (Item 1) **[Figure 20-40-126]** from the plug.

Figure 20-40-127



Remove the compensator (Item 1) **[Figure 20-40-127]** from the valve section.

Figure 20-40-128



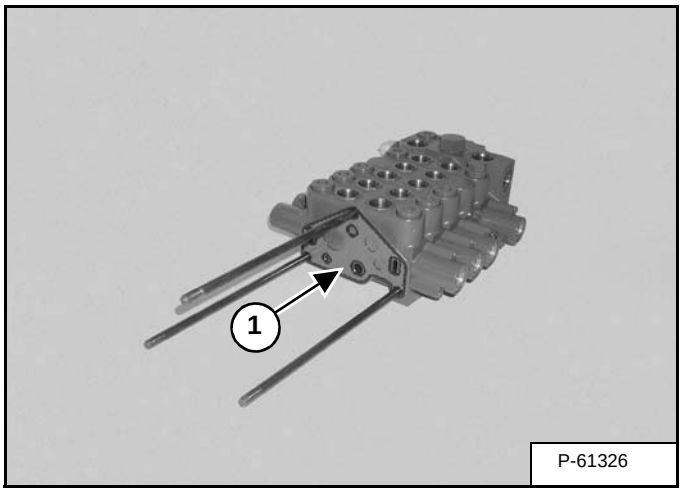
Check the orifice (Item 1) **[Figure 20-40-128]** in the compensator to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-40-128]** to be sure it is not plugged.

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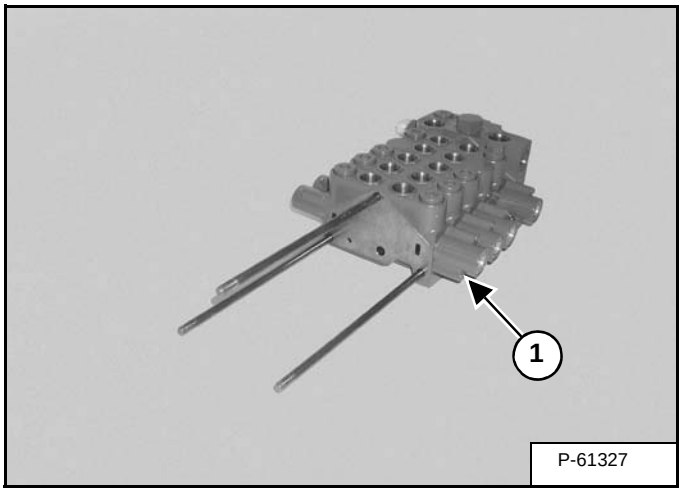
Bucket Valve Section Disassembly And Assembly

Figure 20-40-129



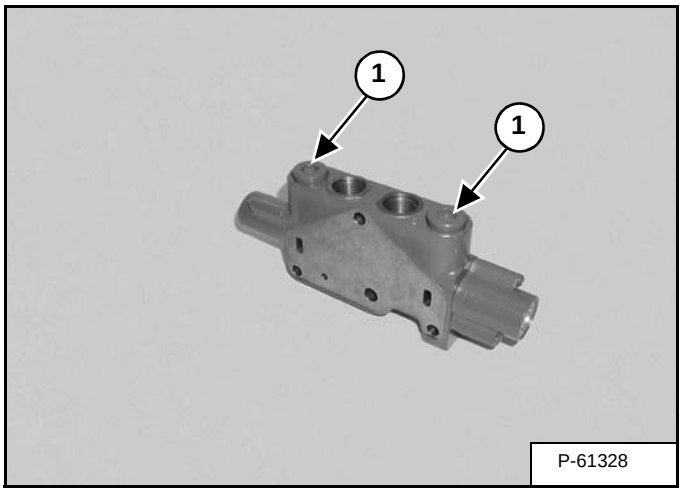
Remove the gasket (Item 1) **[Figure 20-40-129]** from the valve section.

Figure 20-40-130



Remove the bucket valve section (Item 1) **[Figure 20-40-130]** from the control valve.

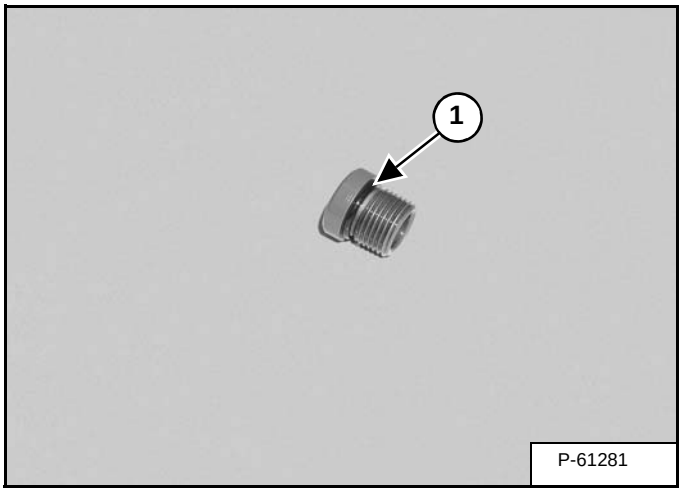
Figure 20-40-131



Remove the plugs (Item 1) **[Figure 20-40-131]** from the port relief valves.

Installation: Tighten the plugs to 22-26 ft.-lbs. (30-35 Nm) torque.

Figure 20-40-132

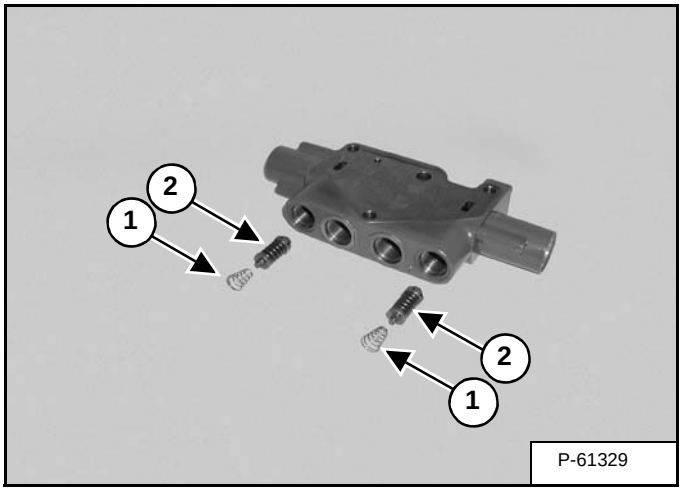


Remove the O-ring (Item 1) **[Figure 20-40-132]** from the plugs.

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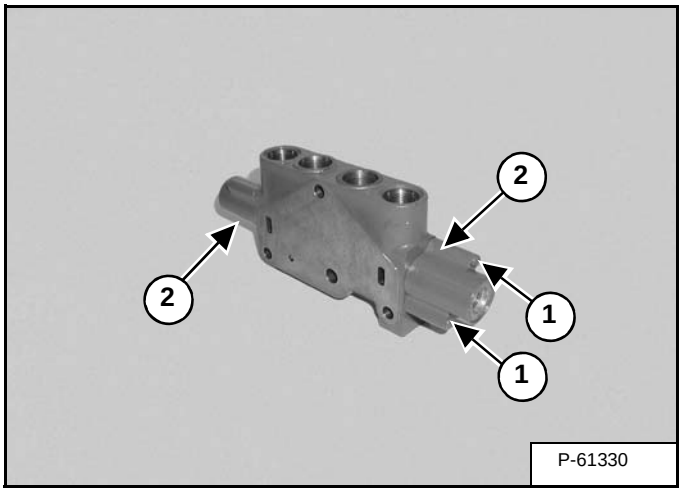
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-133



Remove the springs (Item 1) and valves (Item 2) **[Figure 20-40-133]**.

Figure 20-40-134

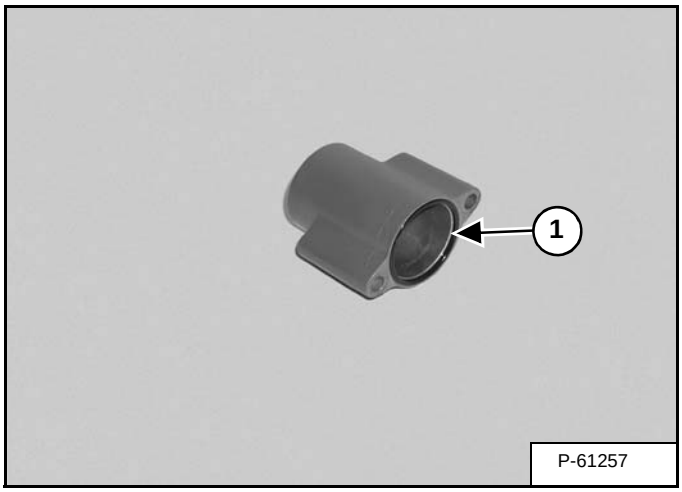


Remove the screws (Item 1) from both end caps (Item 2) **[Figure 20-40-134]**.

Remove the end caps.

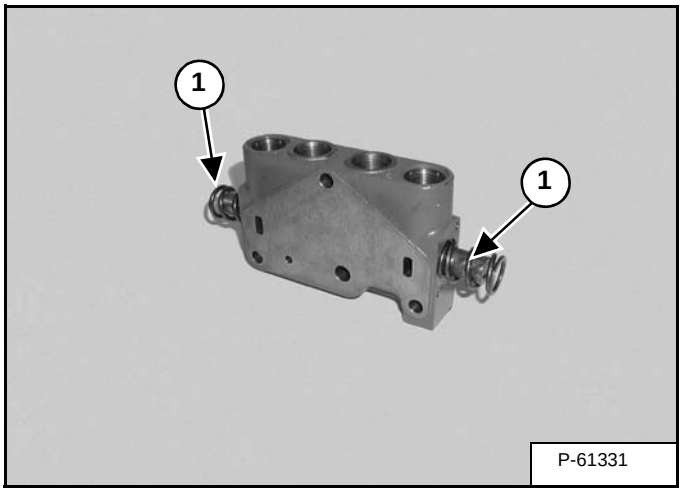
Installation: Tighten the screws to 27 in-.lbs. (3 Nm) torque.

Figure 20-40-135



Remove the O-ring (Item 1) **[Figure 20-40-135]** from the end cap.

Figure 20-40-136

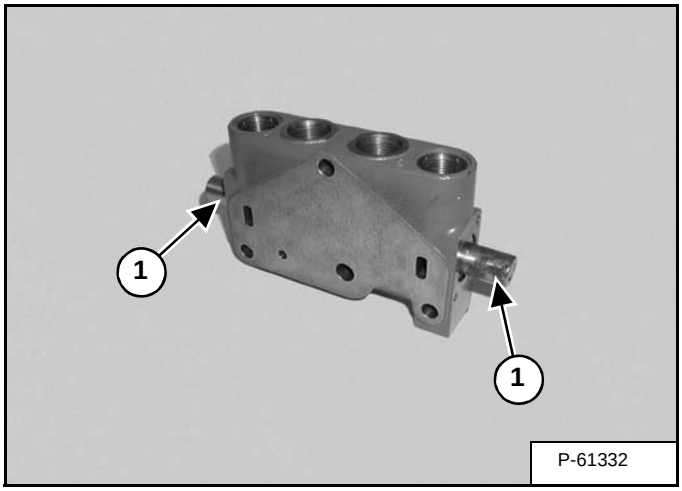


Remove the centering springs (Item 1) **[Figure 20-40-136]** from both ends of the valve spool.

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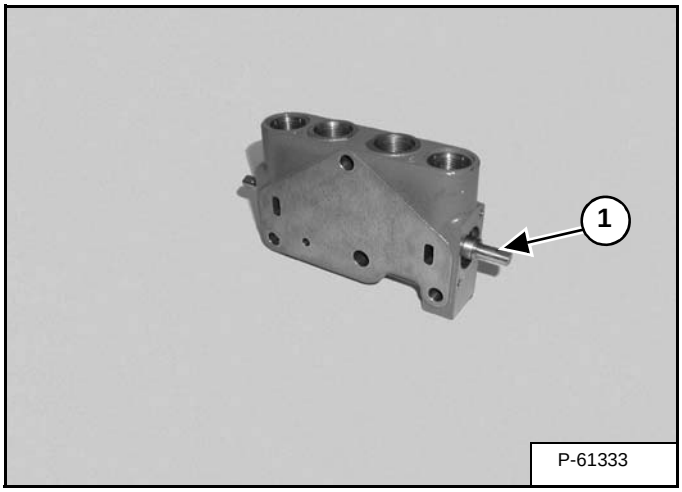
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-137



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

Figure 20-40-138



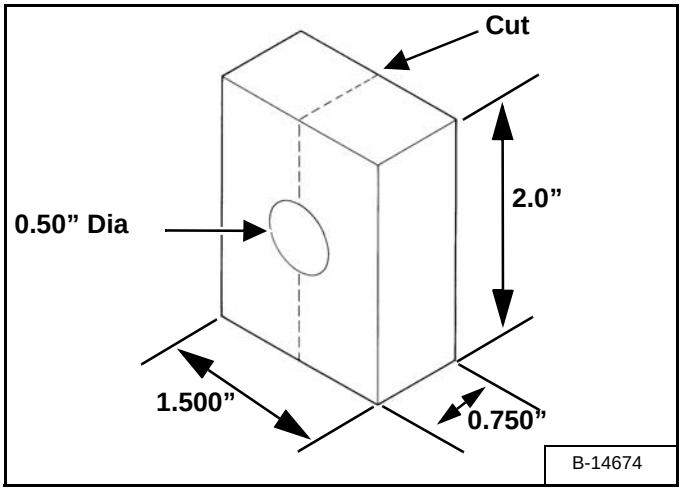
Record the orientation of the spool (Item 1) **[Figure 20-40-138]**. Remove the spool from the valve section.

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

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Bucket Valve Section Disassembly And Assembly (Cont'd)

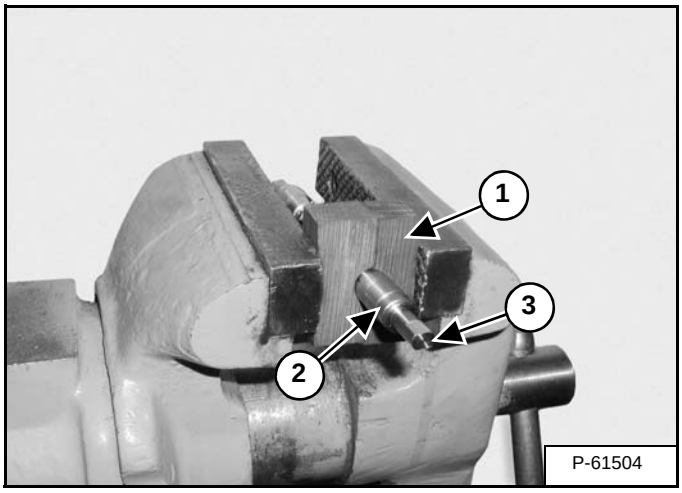
Figure 20-40-139



To remove the plugs from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.500 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-139]**.

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

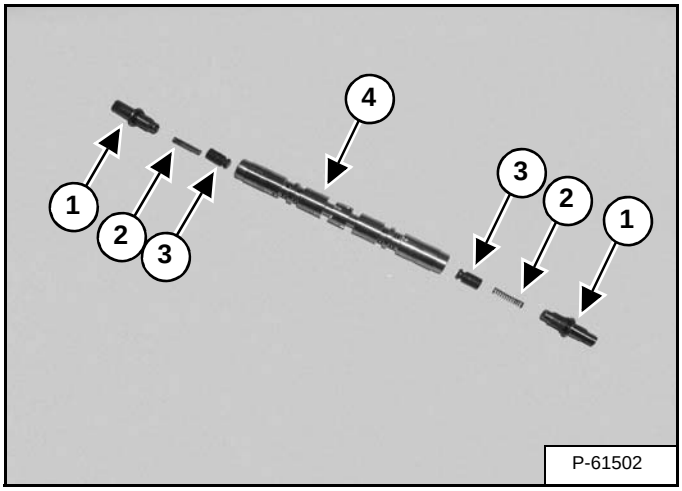
Figure 20-40-140



Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the plugs (Item 3) **[Figure 20-40-140]**. (Both ends)

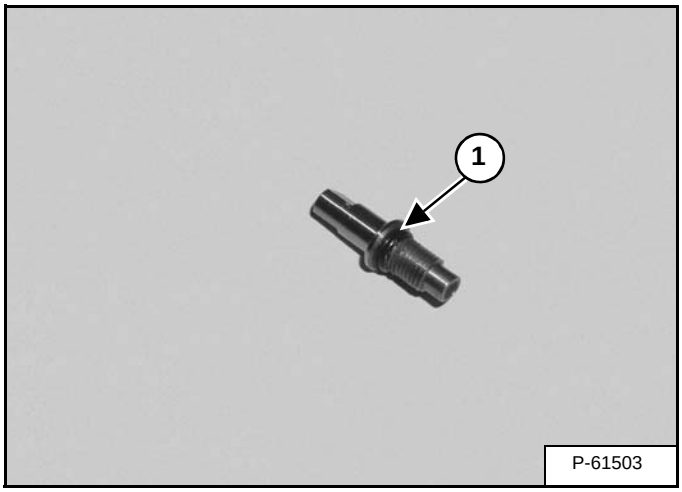
Installation: Apply thread lock adhesive (Loctite 262) or equivalent to the threads. Tighten the plugs to 44 in.-lbs. (5 Nm) torque.

Figure 20-40-141



Remove the plugs (Item 1), springs (Item 2) and poppets (Item 3) from the spool (Item 4) **[Figure 20-40-141]**.

Figure 20-40-142

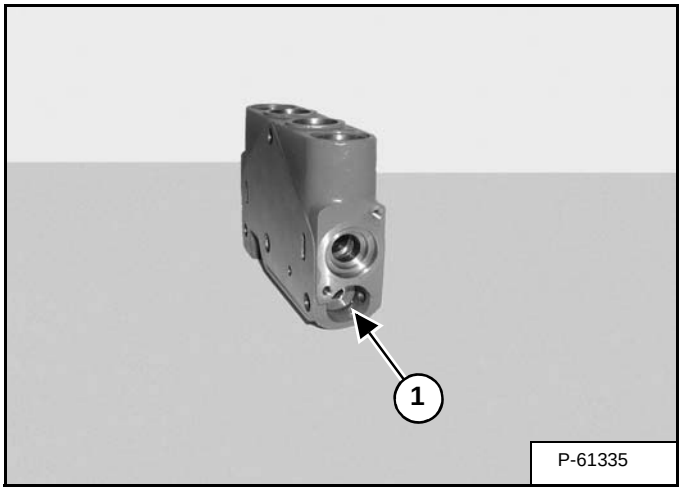


Remove the O-ring (Item 1) **[Figure 20-40-142]** from the plugs.

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Bucket Valve Section Disassembly And Assembly (Cont'd)

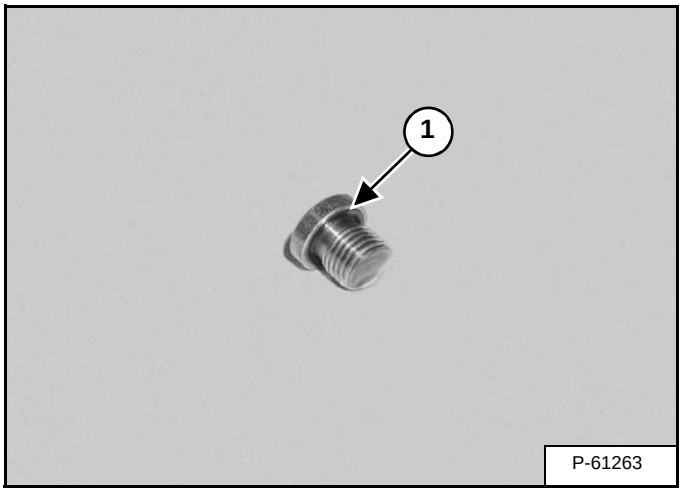
Figure 20-40-143



Remove the plug (Item 1) **[Figure 20-40-143]** from the top of the valve section.

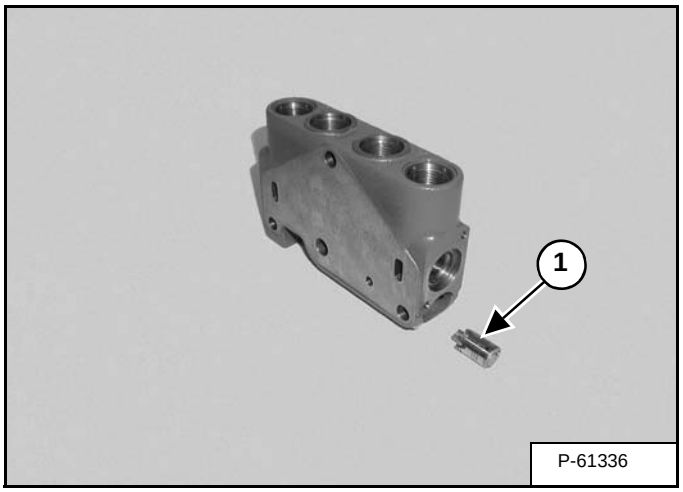
Installation: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

Figure 20-40-144



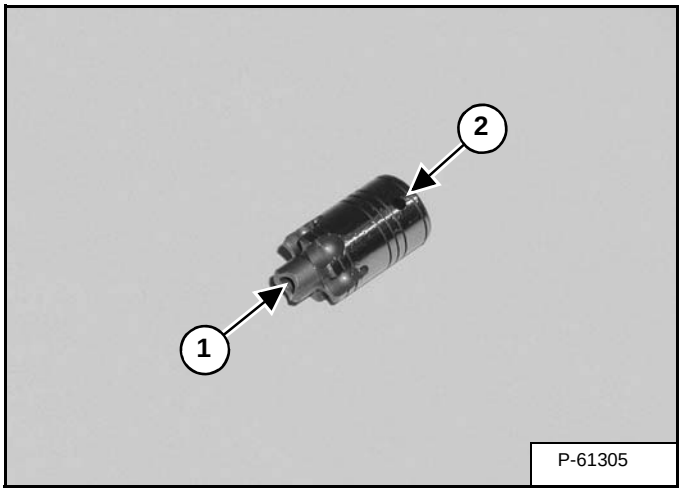
Remove the O-ring (Item 1) **[Figure 20-40-144]** from the plug.

Figure 20-40-145



Remove the compensator (Item 1) **[Figure 20-40-145]** from the valve section.

Figure 20-40-146



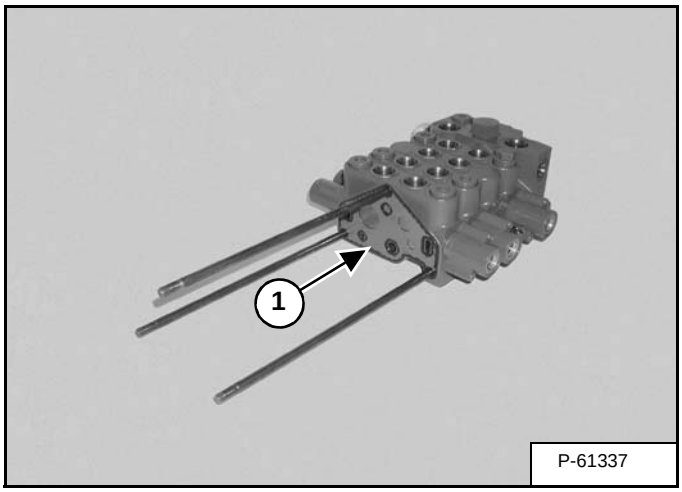
Check the orifice (Item 1) **[Figure 20-40-146]** in the compensator to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-40-146]** to be sure it is not plugged.

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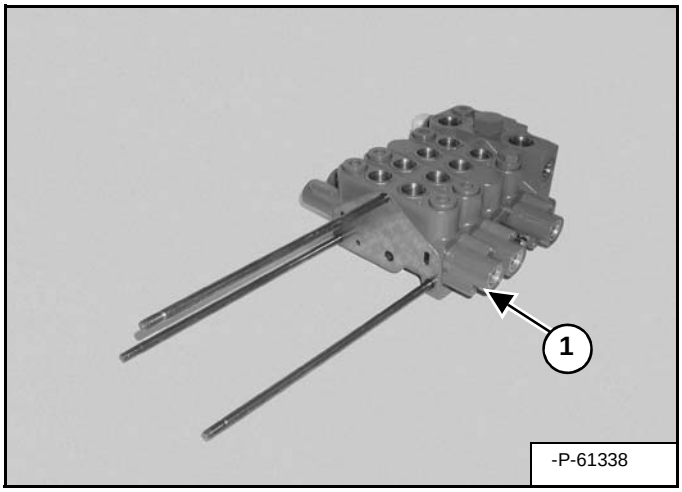
Arm Valve Section Disassembly And Assembly

Figure 20-40-147



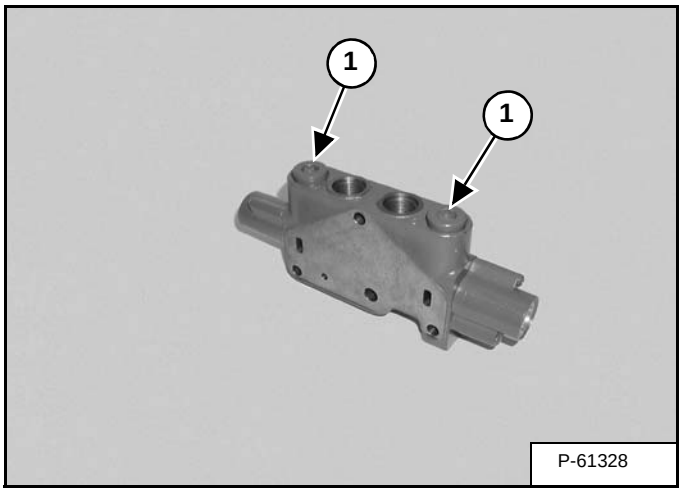
Remove the gasket (Item 1) **[Figure 20-40-147]** from the valve section.

Figure 20-40-148



Remove the arm valve section (Item 1) **[Figure 20-40-148]** from the control valve.

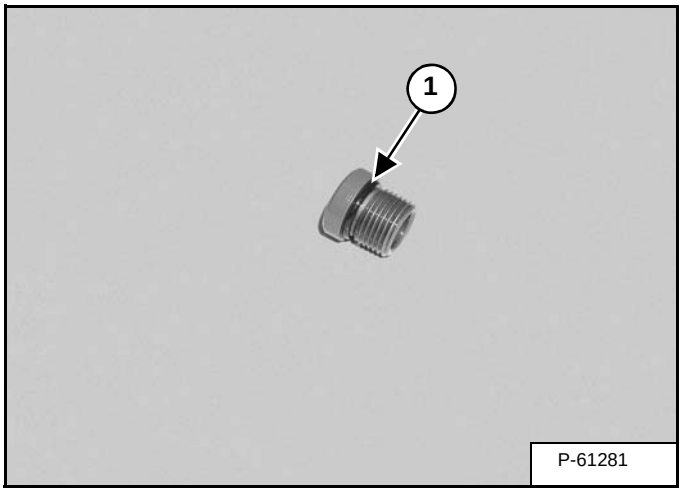
Figure 20-40-149



Remove the plugs (Item 1) **[Figure 20-40-149]** from the port relief valves.

Installation: Tighten the plugs to 22-26 ft.-lbs. (30-35 Nm) torque.

Figure 20-40-150

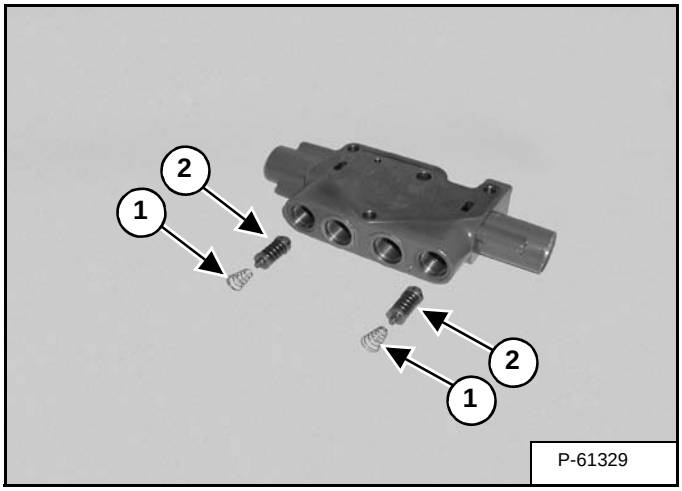


Remove the O-ring (Item 1) **[Figure 20-40-150]** from the plugs.

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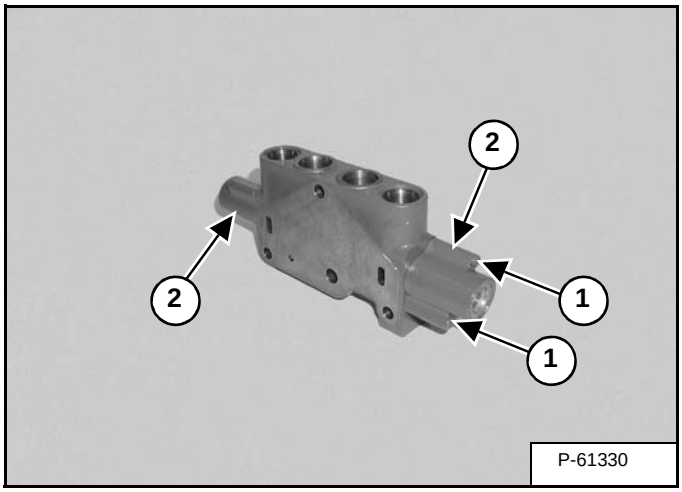
Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-151



Remove the springs (Item 1) and valves (Item 2) **[Figure 20-40-151]**.

Figure 20-40-152

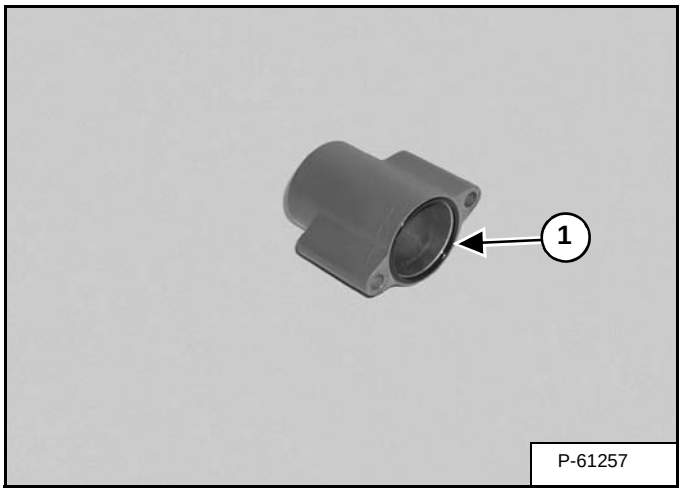


Remove the screws (Item 1) from both valve section end caps (Item 2) **[Figure 20-40-152]**.

Installation: Tighten the screws to 27 in.-lbs (3 Nm) torque.

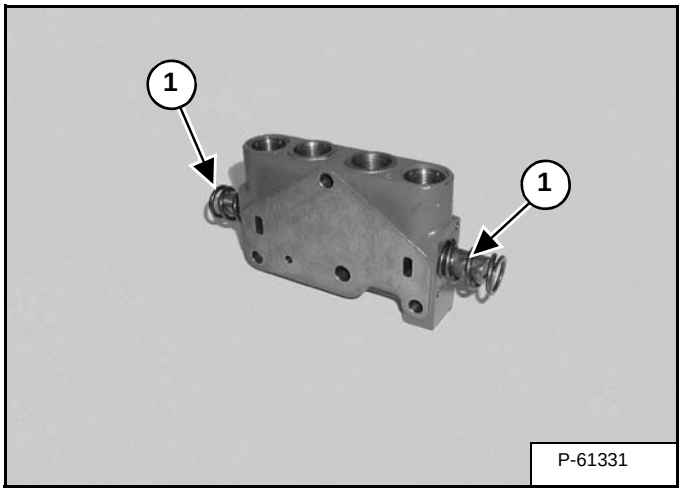
Remove the end caps.

Figure 20-40-153



Remove the O-ring (Item 1) **[Figure 20-40-153]** from the end caps.

Figure 20-40-154

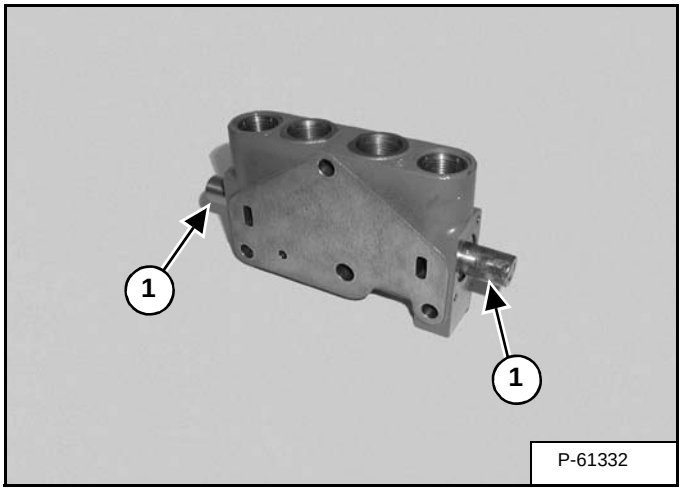


Remove the centering spring (Item 1) **[Figure 20-40-154]** from both ends of the valve spool.

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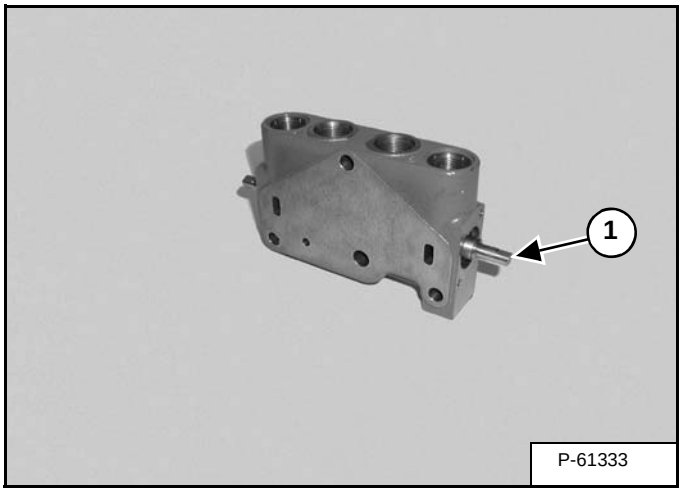
Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-155



Remove the spring guides (Item 1) **[Figure 20-40-155]** from both ends of the valve spool.

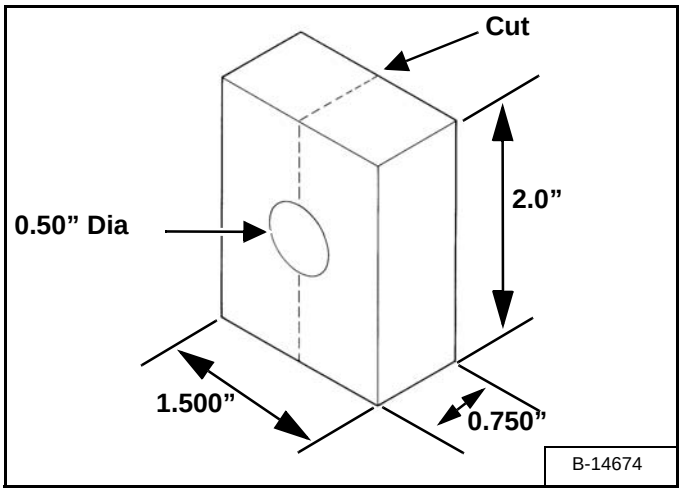
Figure 20-40-156



Record the orientation of the spool (Item 1) **[Figure 20-40-156]**. Remove the spool from the valve section.

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

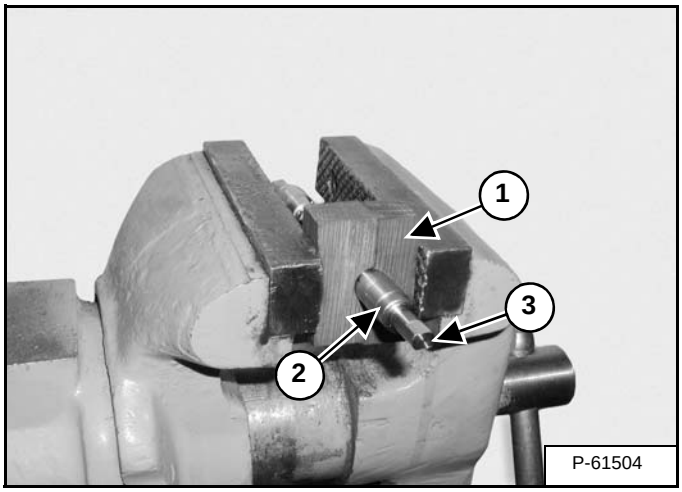
Figure 20-40-157



To remove the plugs from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.500 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-157]**.

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

Figure 20-40-158



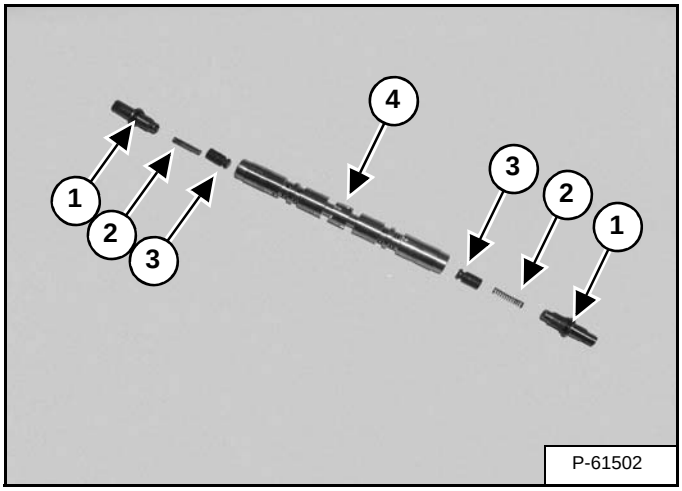
Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the plug (Item 3) **[Figure 20-40-158]**. (Both ends)

Installation: Apply thread lock adhesive (Loctite 262) or equivalent to the threads. Tighten the plugs to 44 in.-lbs. (5 Nm) torque.

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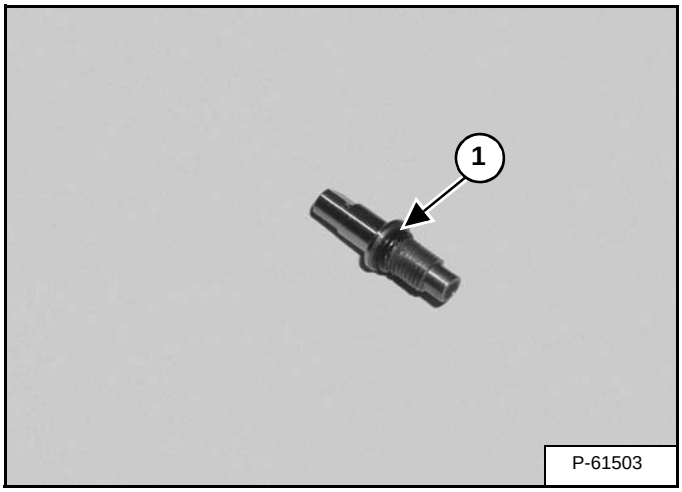
Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-159



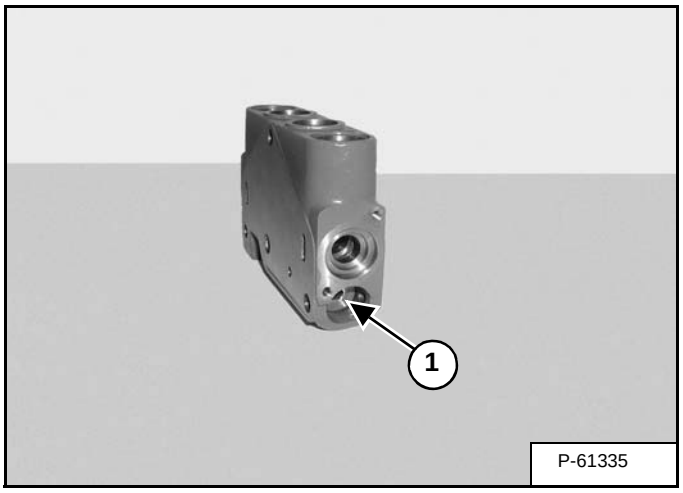
Remove the plugs (Item 1), springs (Item 2), and poppet (Item 3) from the spool (Item 4) **[Figure 20-40-159]**.

Figure 20-40-160



Remove the O-ring (Item 1) **[Figure 20-40-160]** from the plugs.

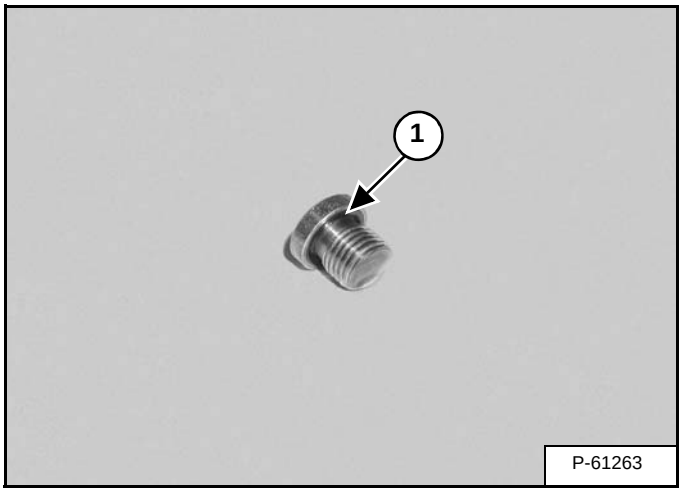
Figure 20-40-161



Remove the plug (Item 1) **[Figure 20-40-161]** from the top of the valve section.

Installation: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

Figure 20-40-162

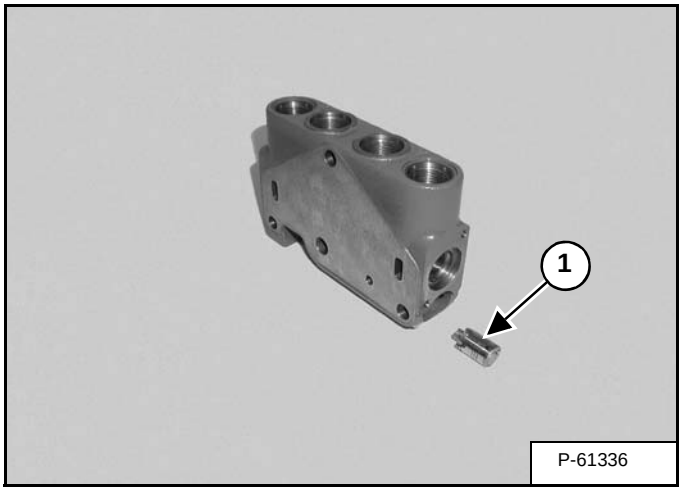


Remove the O-ring (Item 1) **[Figure 20-40-162]** from the plug.

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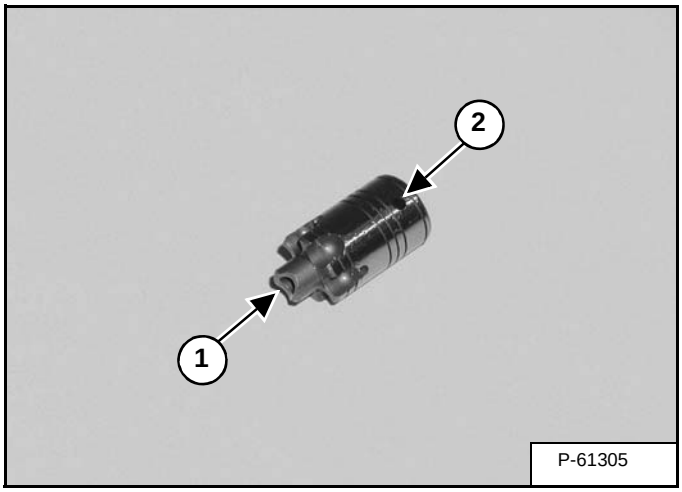
Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-163



Remove the compensator (Item 1) **[Figure 20-40-163]** from the valve section.

Figure 20-40-164



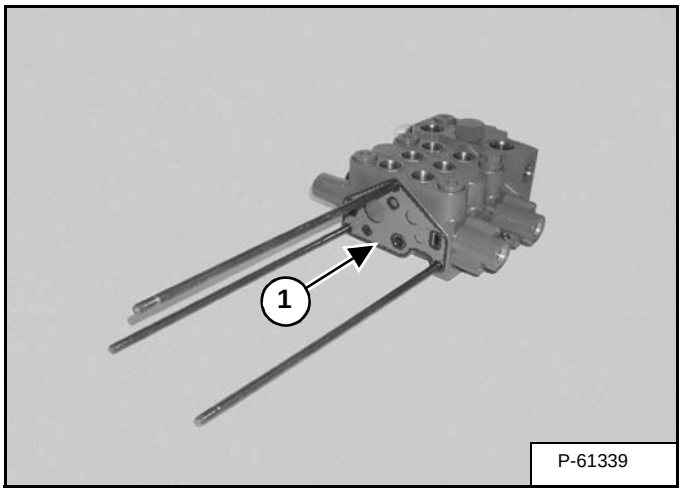
Check the orifice (Item 1) **[Figure 20-40-164]** in the compensator to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-40-164]** to be sure it is not plugged.

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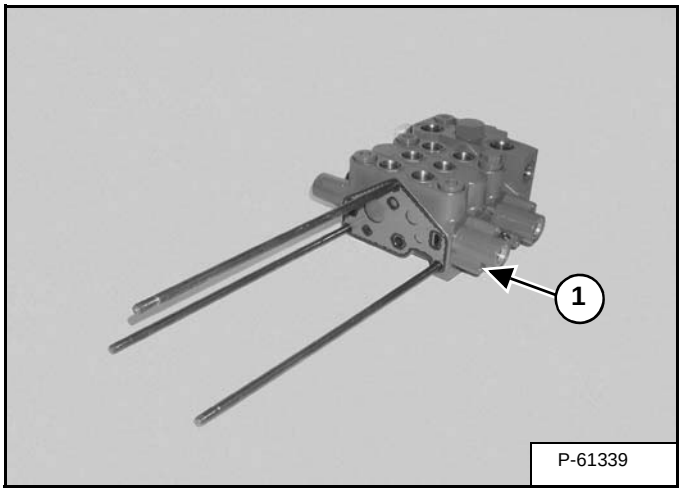
Boom Valve Section Disassembly And Assembly

Figure 20-40-165



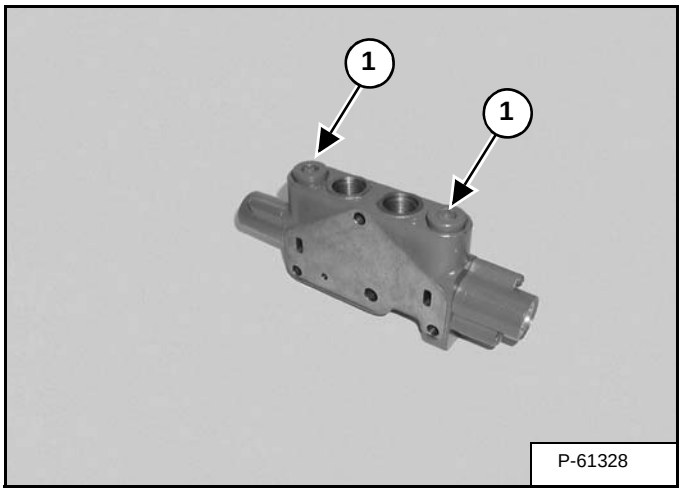
Remove the gasket (Item 1) **[Figure 20-40-165]** from the valve section.

Figure 20-40-166



Remove the boom valve section (Item 1) **[Figure 20-40-166]** from the control valve.

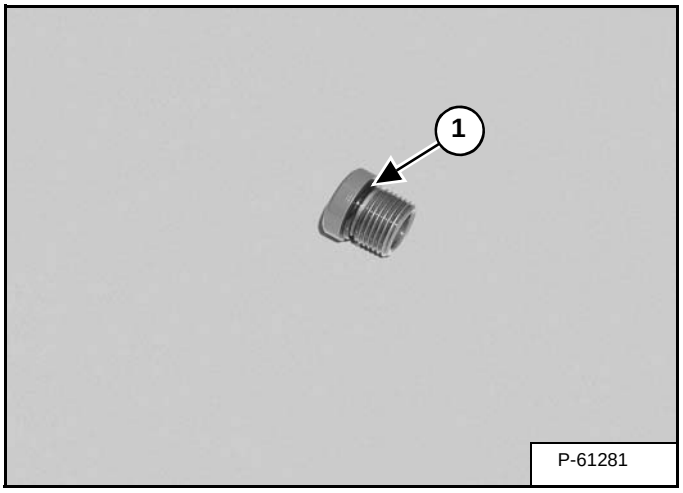
Figure 20-40-167



Remove the plugs (Item 1) **[Figure 20-40-167]** from the port relief valves.

Installation: Tighten the plugs to 22-26 ft.-lbs. (30-35 Nm) torque.

Figure 20-40-168

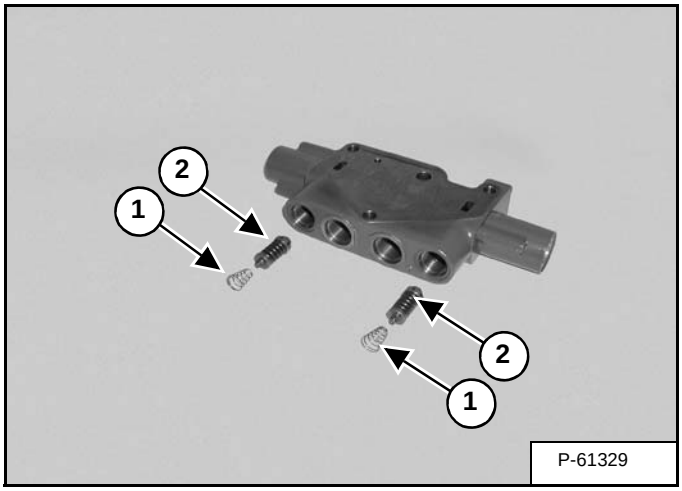


Remove the O-ring **[Figure 20-40-168]** from the plugs.

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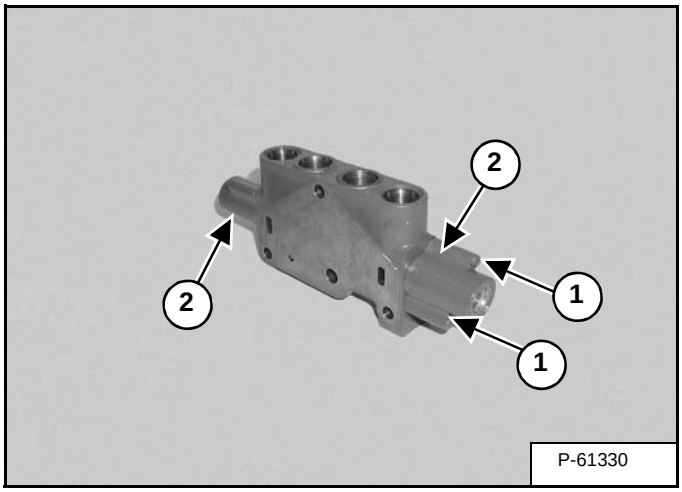
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-169



Remove the springs (Item 1) and valves (Item 2) **[Figure 20-40-169]**.

Figure 20-40-170

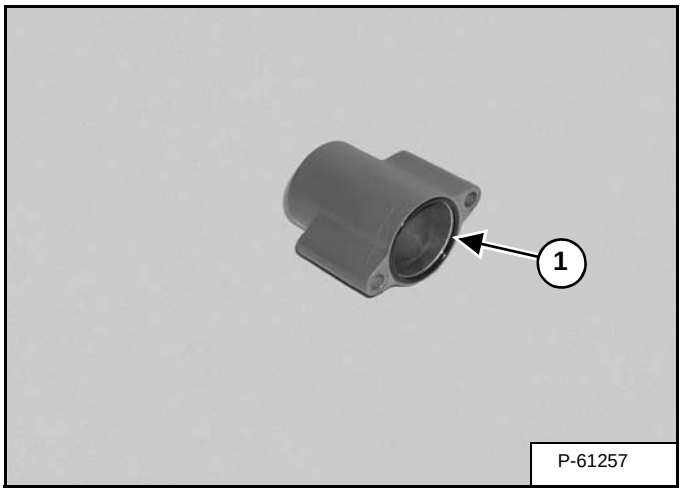


Remove the screws (Item 1) from both end caps (Item 2) **[Figure 20-40-170]**.

Installation: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

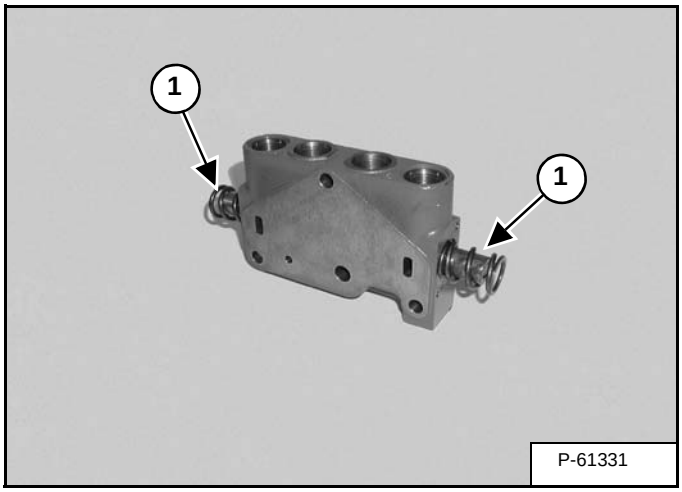
Remove the end caps.

Figure 20-40-171



Remove the O-ring (Item 1) **[Figure 20-40-171]** from the end caps.

Figure 20-40-172

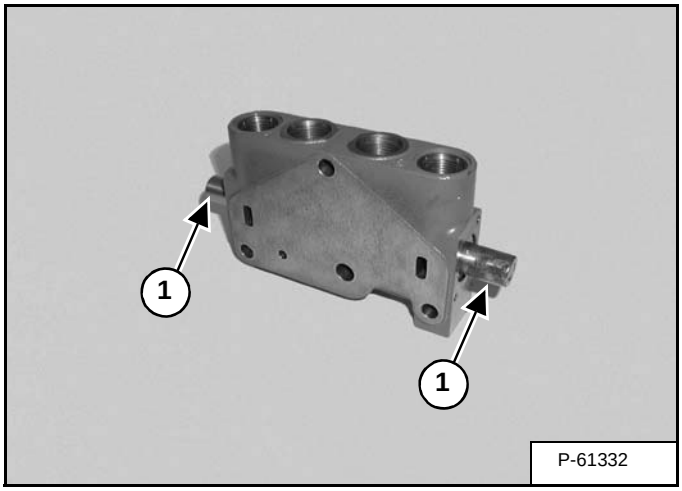


Remove the centering spring (Item 1) **[Figure 20-40-172]** from both ends of the valve spool.

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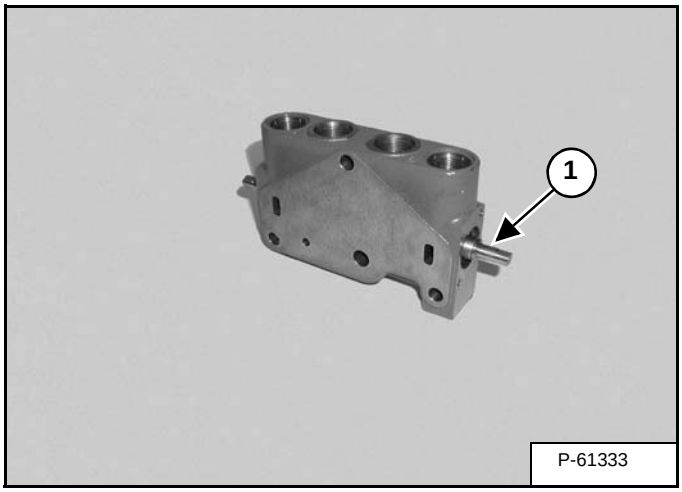
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-173



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

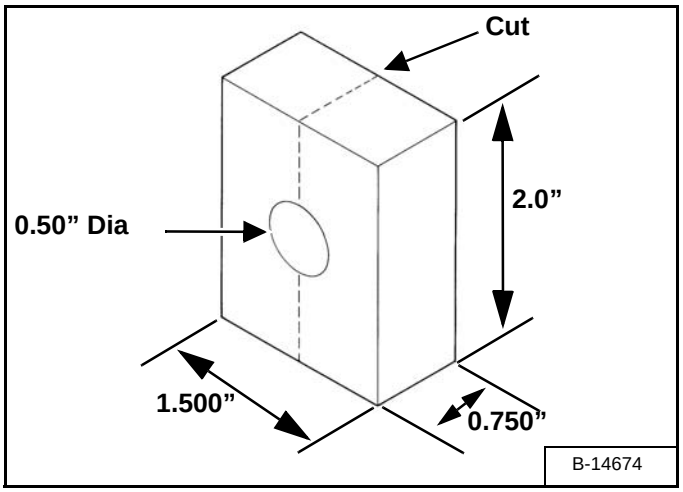
Figure 20-40-174



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

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

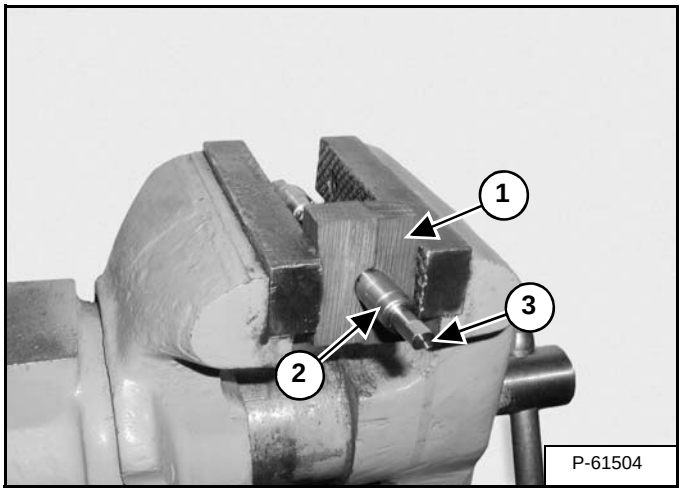
Figure 20-40-175



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

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

Figure 20-40-176



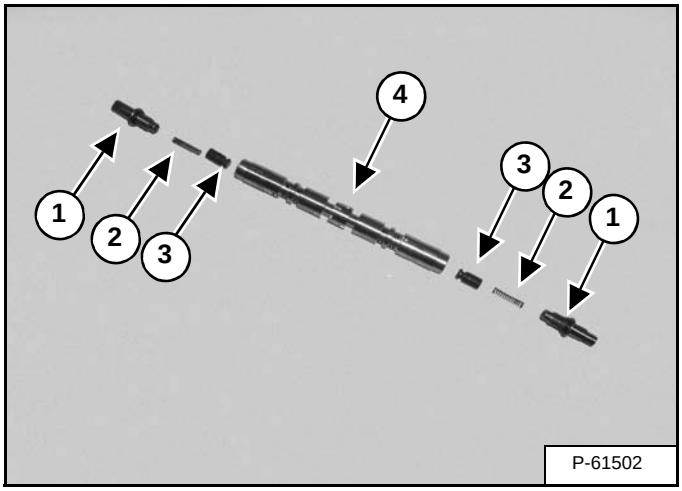
Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the plugs (Item 3) **[Figure 20-40-176]**. (Both ends)

Installation: Apply thread lock adhesive (Loctite 262) or equivalent to the threads. Tighten the plugs to 44 in.-lbs. (5 Nm) torque.

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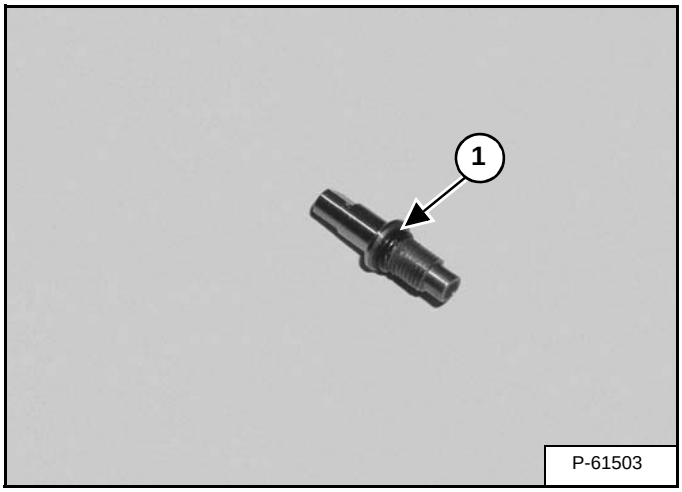
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-177



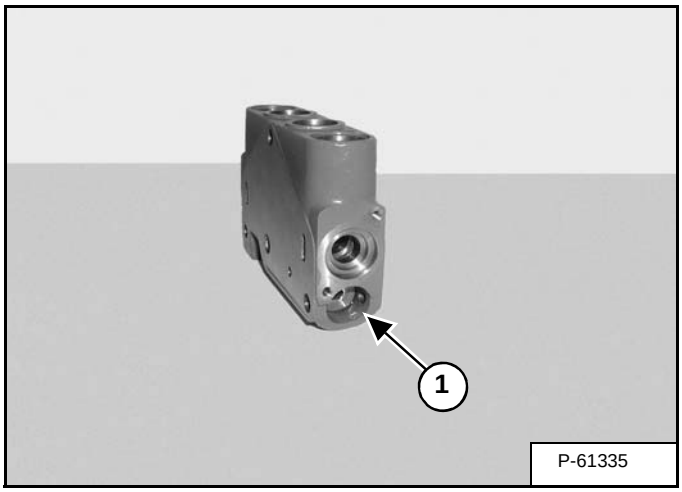
Remove the plugs (Item 1), springs (Item 2), and poppet (Item 3) from the spool (Item 4) **[Figure 20-40-177]**.

Figure 20-40-178



Remove the O-ring (Item 1) **[Figure 20-40-178]** from the plugs.

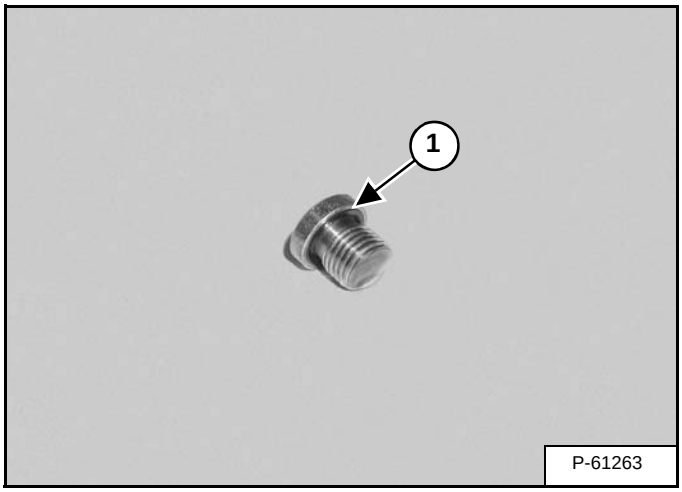
Figure 20-40-179



Remove the plug (Item 1) **[Figure 20-40-179]** from the top of the valve section.

Installation: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

Figure 20-40-180

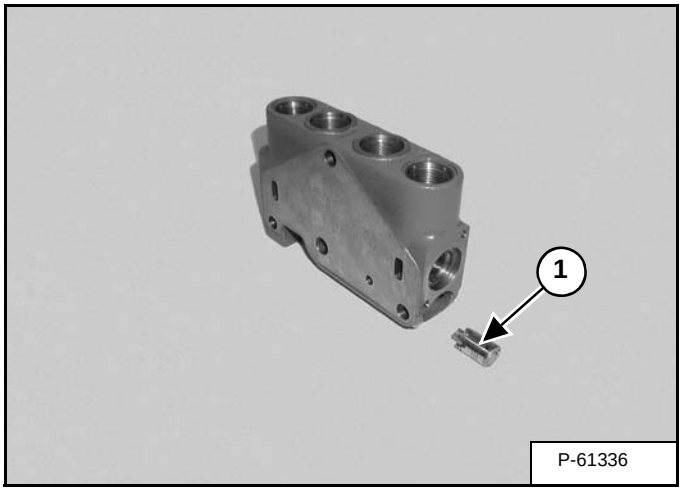


Remove the O-ring (Item 1) **[Figure 20-40-180]** from the plug.

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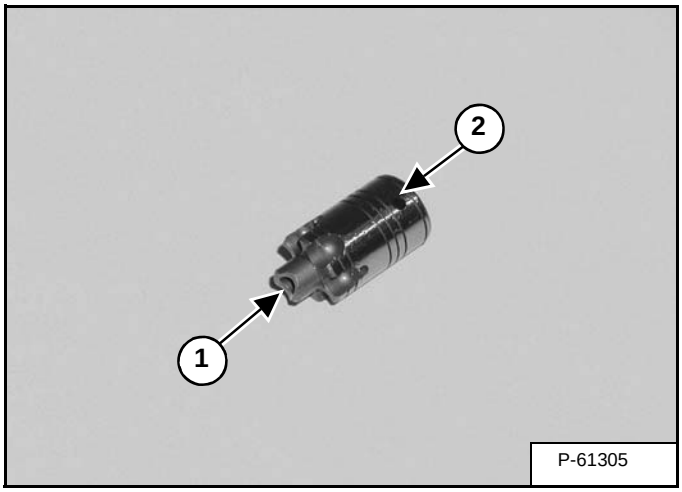
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-181



Remove the compensator (Item 1) **[Figure 20-40-181]** from the valve section.

Figure 20-40-182



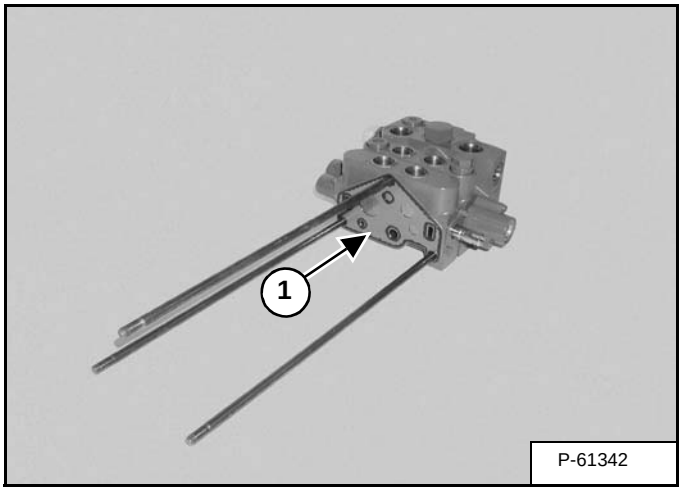
Check the orifice (Item 1) **[Figure 20-40-182]** in the compensator to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-40-182]** to be sure it is not plugged.

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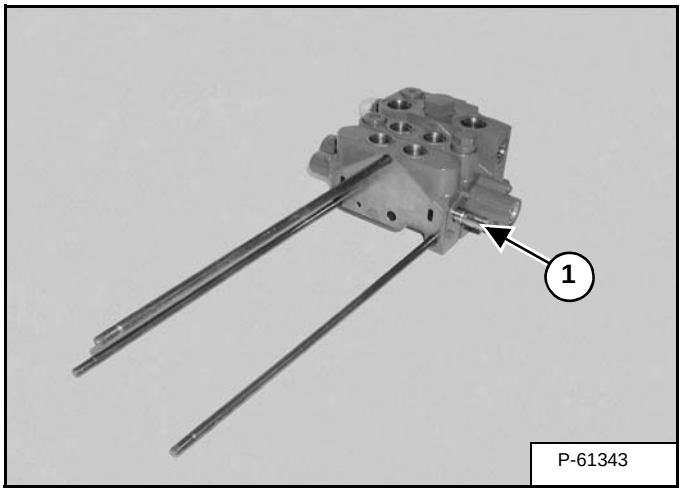
Boom Swing Valve Section Disassembly And Assembly

Figure 20-40-183



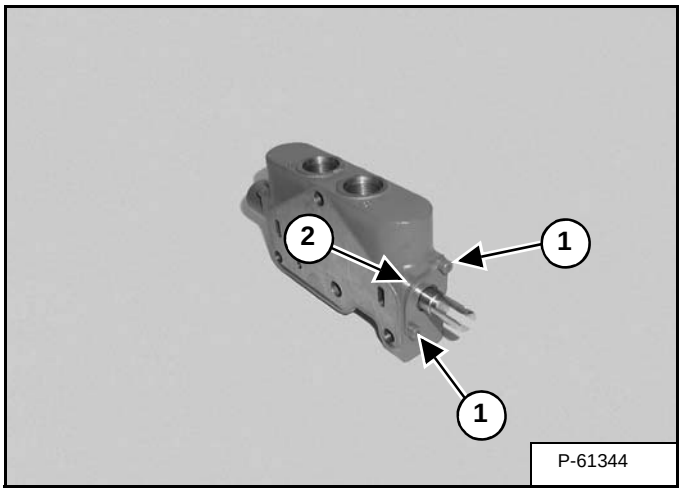
Remove the gasket (Item 1) **[Figure 20-40-183]** from the valve section.

Figure 20-40-184



Remove the boom swing valve section (Item 1) **[Figure 20-40-184]** from the control valve.

Figure 20-40-185

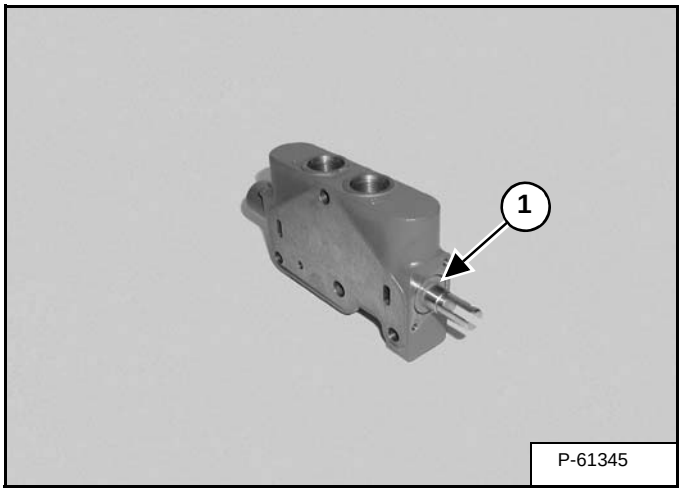


Remove the screws (Item 1) from the valve spool retainer (Item 2) **[Figure 20-40-185]**.

Installation: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

Remove the retainer.

Figure 20-40-186

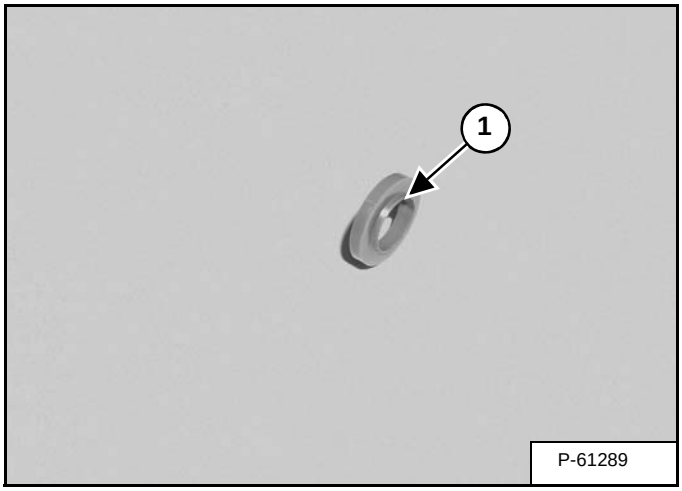


Remove the seal (Item 1) **[Figure 20-40-186]** from the spool.

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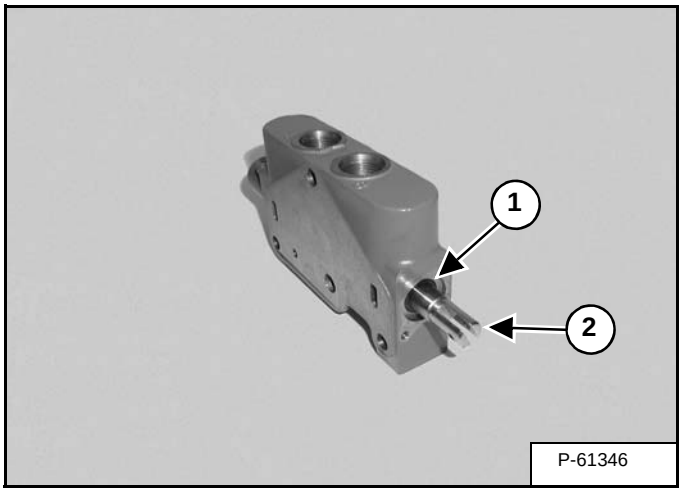
Boom Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-187



Assembly: Install the seal on the spool with the flange (Item 1) **[Figure 20-40-187]** toward the outside of the valve section.

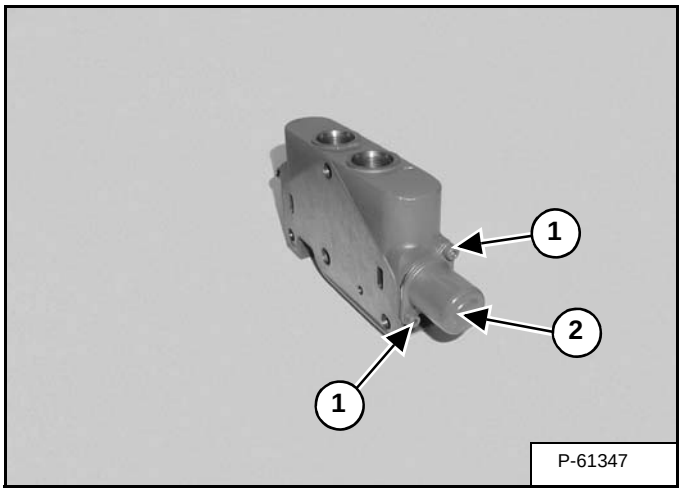
Figure 20-40-188



Remove the O-ring (Item 1) **[Figure 20-40-188]** from the valve spool.

NOTE: The valve spool (Item 2) [Figure 20-40-188] can only be removed from the valve section from the spring end of the valve section.

Figure 20-40-189

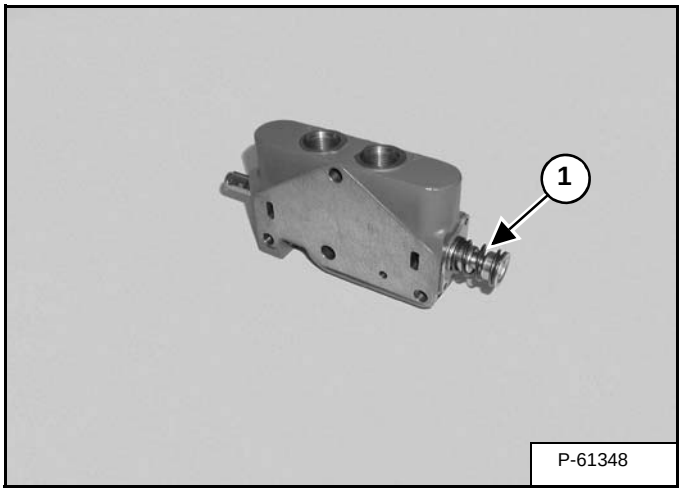


Remove the screws (Item 1) from the end cap (Item 2) **[Figure 20-40-189]**.

Installation: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

Remove the end cap.

Figure 20-40-190

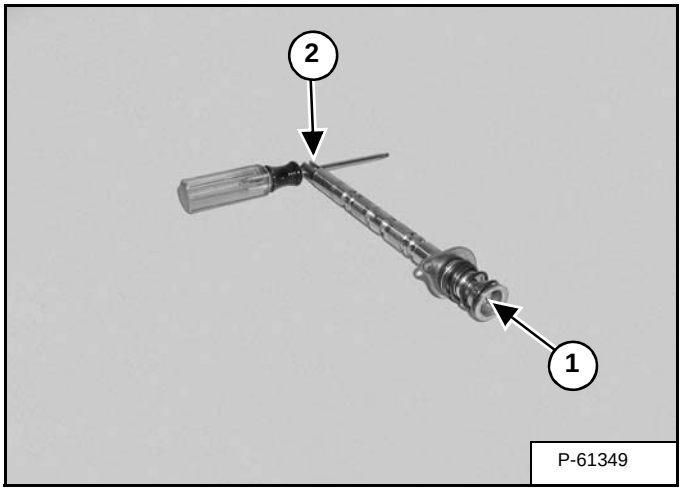


Remove the spool assembly (Item 1) **[Figure 20-40-190]**.

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

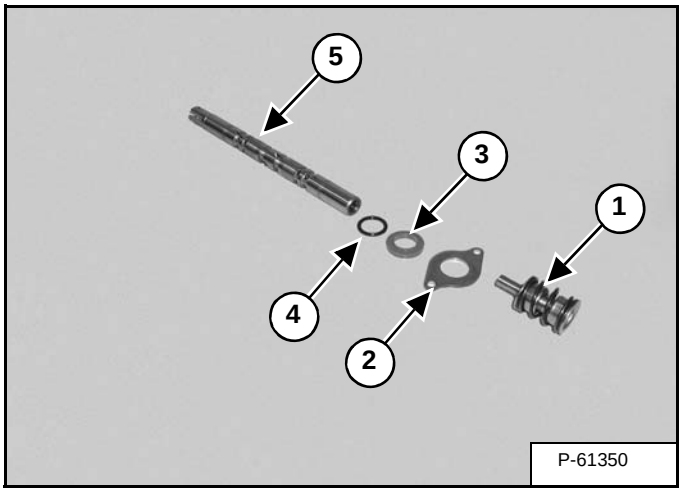
Figure 20-40-191



Loosen the bolt (Item 1) **[Figure 20-40-191]**.

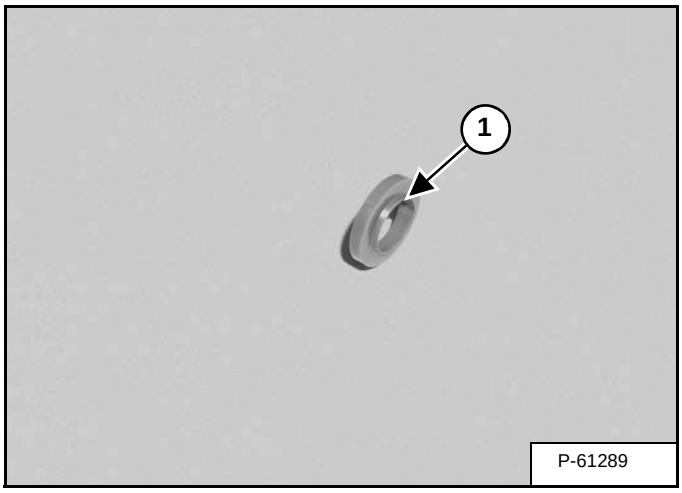
NOTE: To remove the bolt, the spool must be held on the linkage end (Item 2) [Figure 20-40-191], to keep the spool from rotating.

Figure 20-40-192



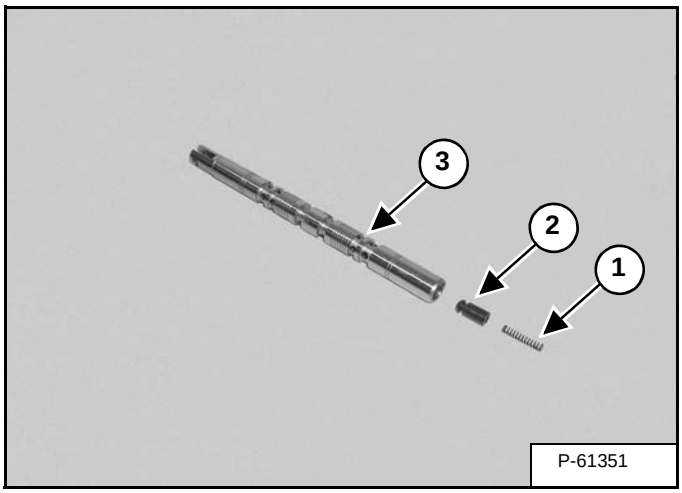
Remove the spring assembly (Item 1), retainer (Item 2), seal (Item 3) and O-ring (Item 4) from the spool (Item 5) **[Figure 20-40-192]**.

Figure 20-40-193



Assembly: Install the seal on the spool with the flange (Item 1) **[Figure 20-40-193]** toward the outside of the valve section.

Figure 20-40-194

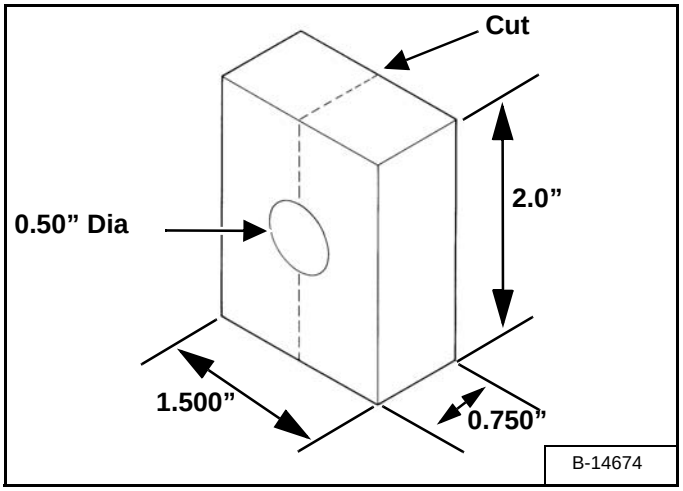


Remove the spring (Item 1) and poppet (Item 2) from the spool (Item 3) **[Figure 20-40-194]**.

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

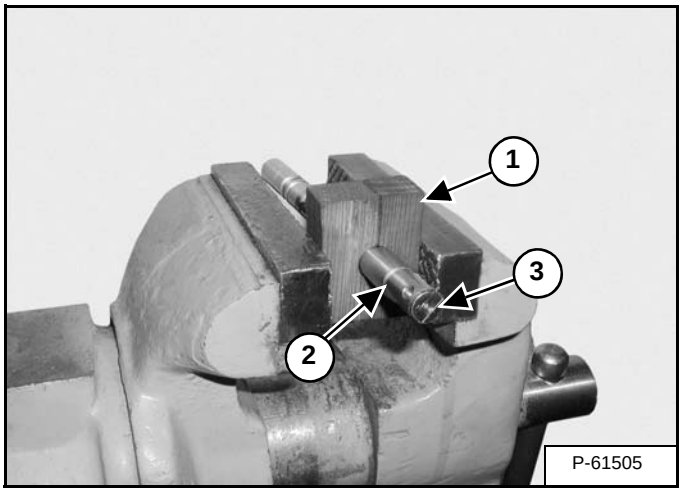
Figure 20-40-195



To remove the linkage end from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.50 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-195]**.

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

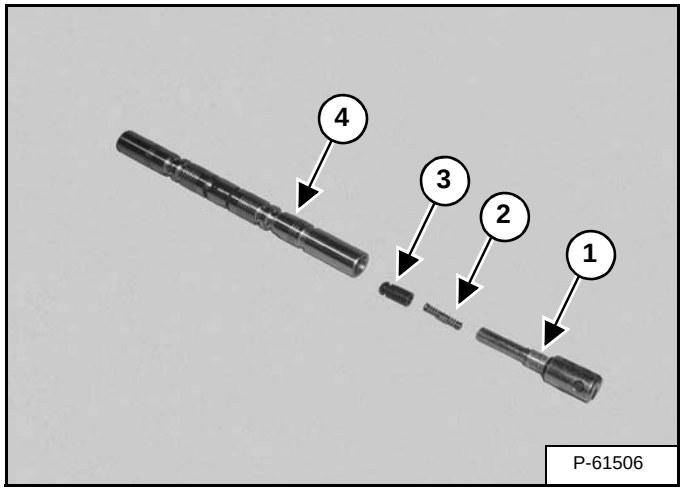
Figure 20-40-196



Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the linkage end (Item 3) **[Figure 20-40-196]**.

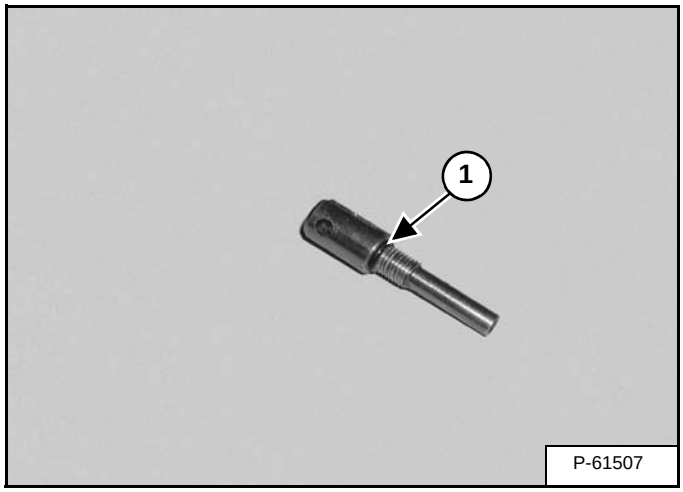
Installation: Apply thread lock adhesive (Loctite 262) or equivalent to the threads. Tighten the linkage end to 44 in.-lbs. (5 Nm) torque.

Figure 20-40-197



Remove the linkage end (Item 1), spring (Item 2), and poppet (Item 3) from the spool (Item 4) **[Figure 20-40-197]**.

Figure 20-40-198

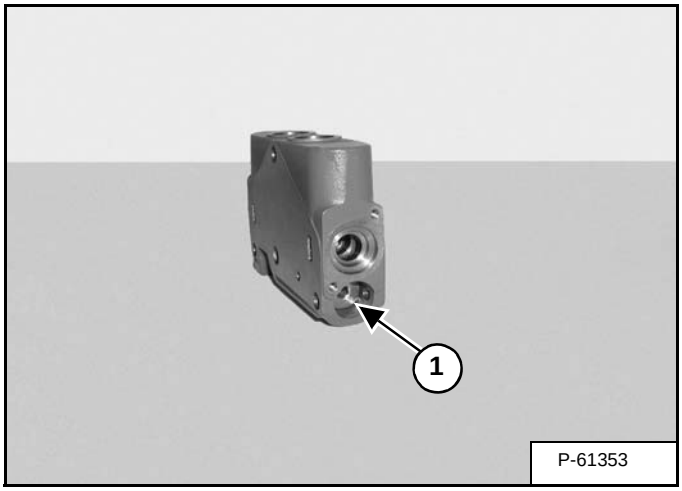


Remove the O-ring (Item 1) **[Figure 20-40-198]** from the linkage end.

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

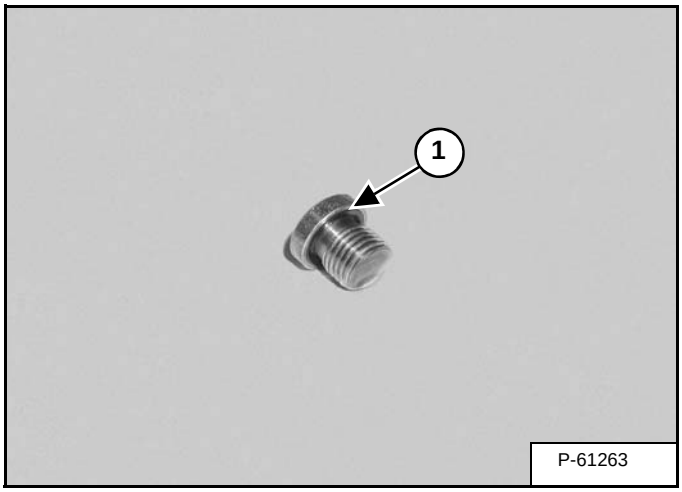
Figure 20-40-199



Remove the plug (Item 1) **[Figure 20-40-199]** from the valve section.

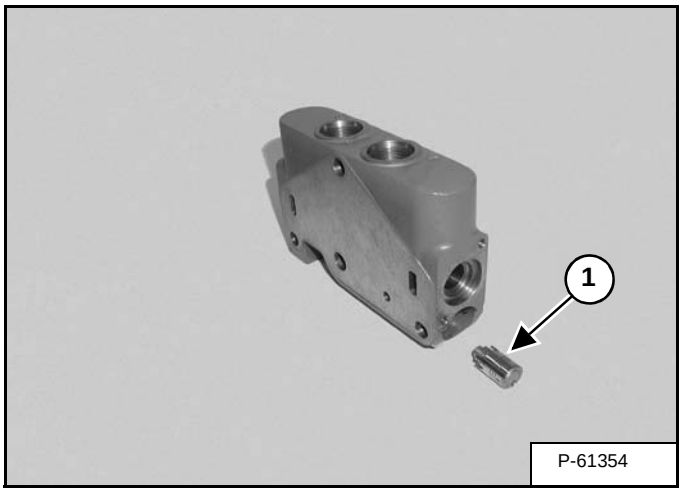
Installation: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

Figure 20-40-200



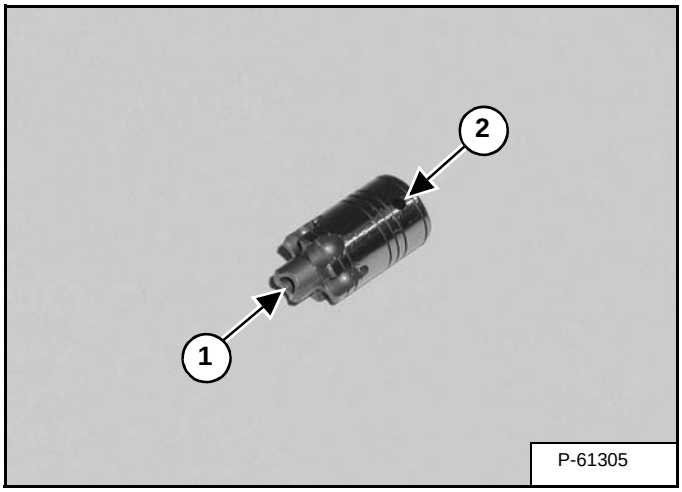
Remove the O-ring (Item 1) **[Figure 20-40-200]** from the plug.

Figure 20-40-201



Remove the compensator (Item 1) **[Figure 20-40-201]** from the valve section.

Figure 20-40-202



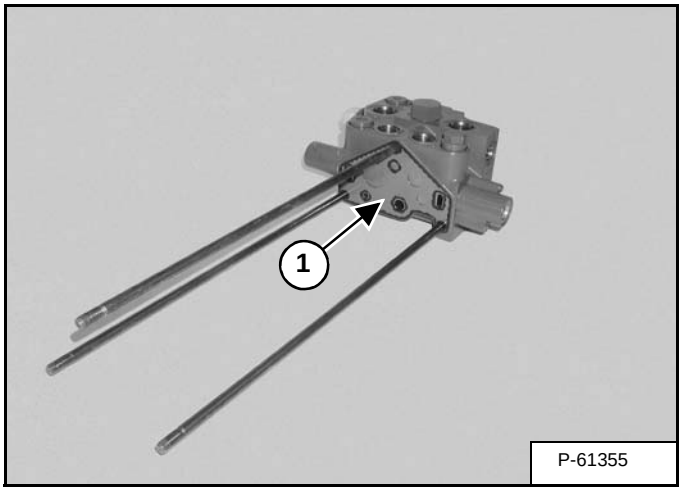
Check the orifice (Item 1) **[Figure 20-40-202]** in the compensator to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-40-202]** to be sure it is not plugged.

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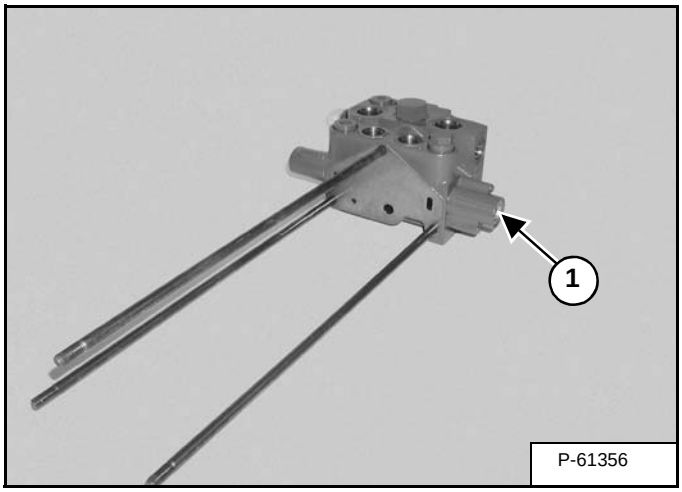
First Auxiliary Valve Section Disassembly And Assembly

Figure 20-40-203



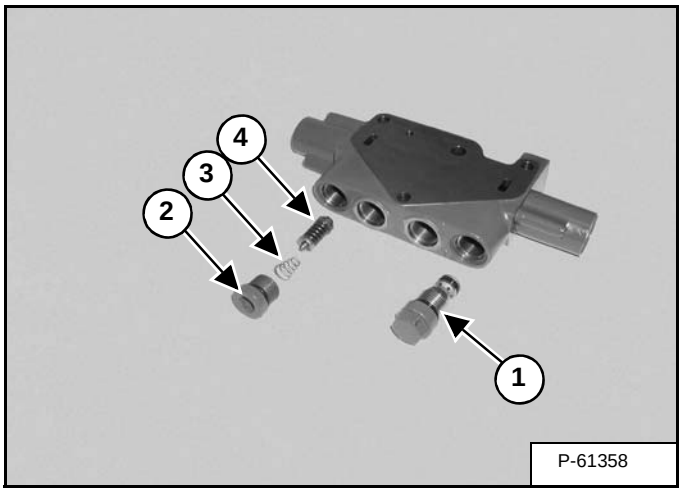
Remove the gasket (Item 1) **[Figure 20-40-203]** from the valve section.

Figure 20-40-204



Remove the first auxiliary valve section (Item 1) **[Figure 20-40-204]** from the control valve.

Figure 20-40-205

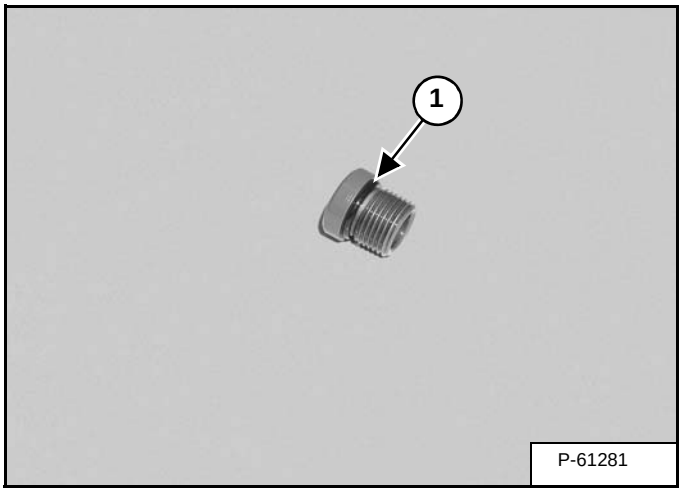


Remove the port relief valve (Item 1) **[Figure 20-40-205]** from the valve section.

Remove the plug (Item 2), spring (Item 3) and port relief valve (Item 4) **[Figure 20-40-205]** from the valve section.

Installation: Tighten the plug to 22-26 ft.-lbs. (30-35 Nm) torque.

Figure 20-40-206

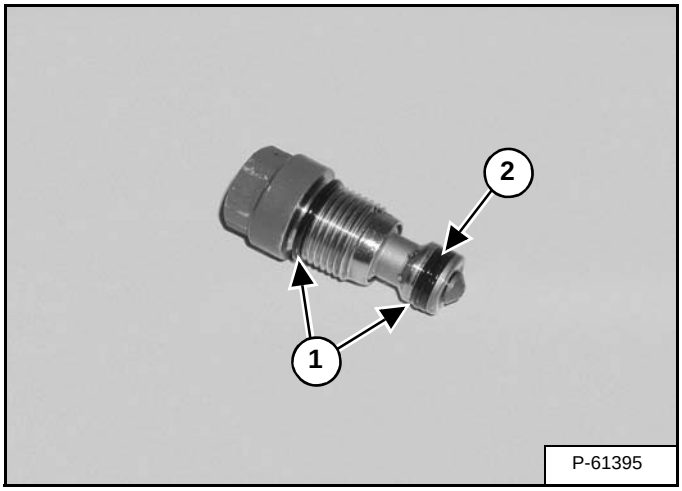


Remove the O-ring (Item 1) **[Figure 20-40-206]** from the plug.

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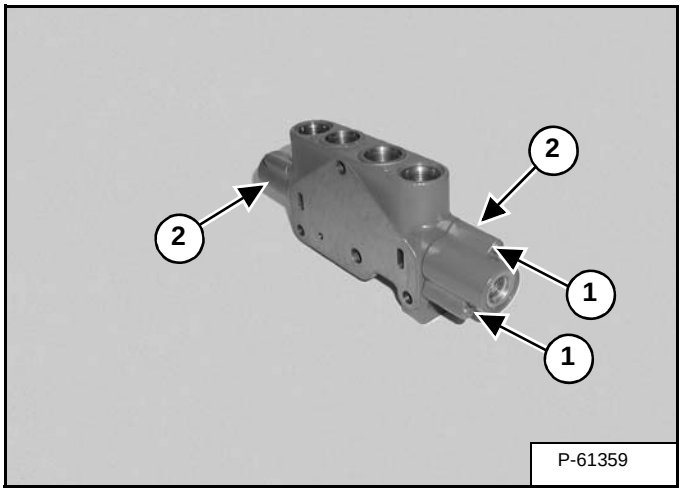
First Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-207



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-207]** from the load check valve body.

Figure 20-40-208

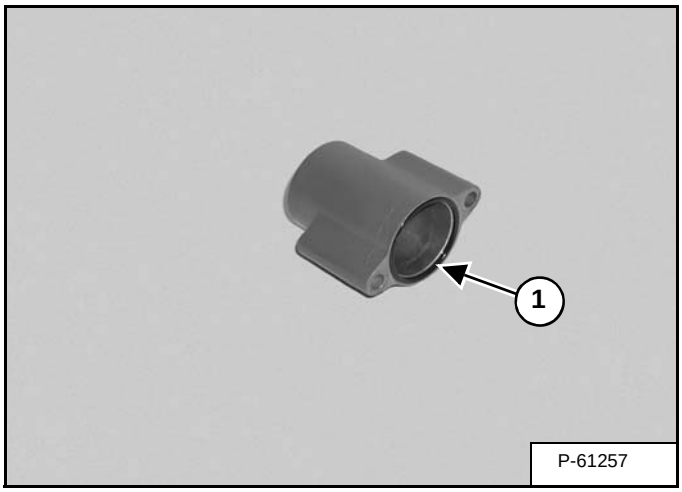


Remove the screws (Item 1) **[Figure 20-40-208]** from both end caps.

Installation: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

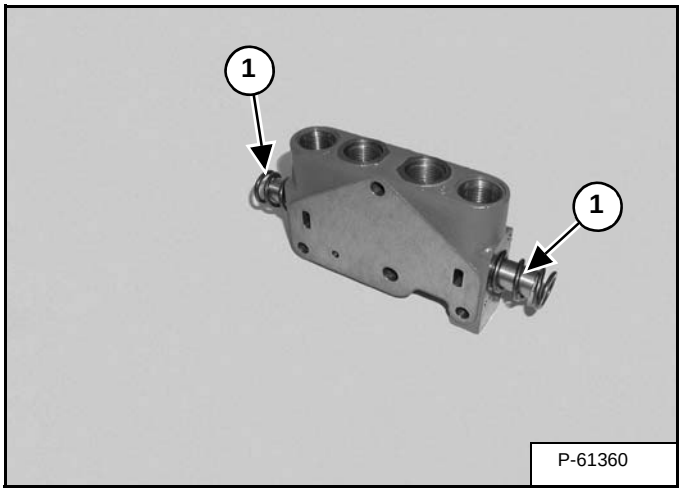
Remove the end cap (Item 2) **[Figure 20-40-208]** from both ends of the valve section.

Figure 20-40-209



Remove the O-ring (Item 1) **[Figure 20-40-209]** from both end caps.

Figure 20-40-210

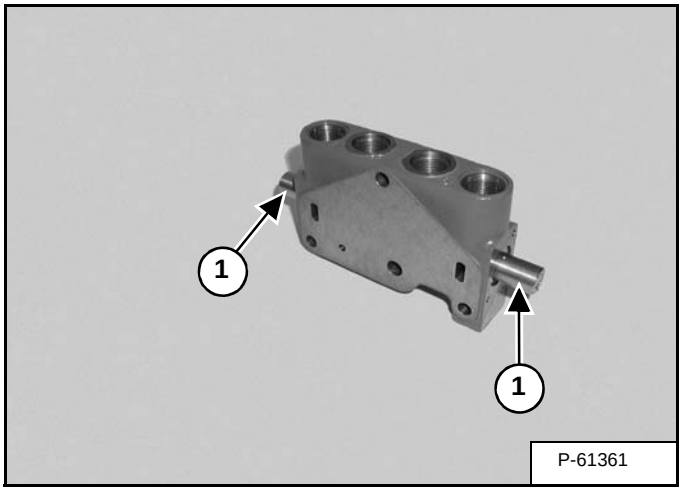


Remove the centering springs (Item 1) **[Figure 20-40-210]** from both ends of the valve spool.

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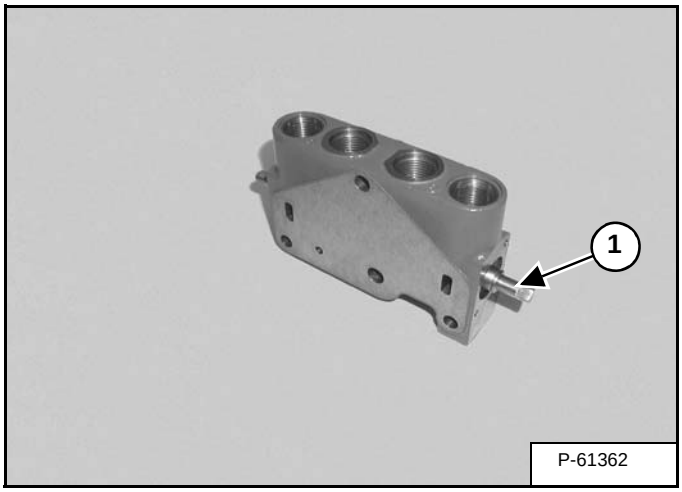
First Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-211



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

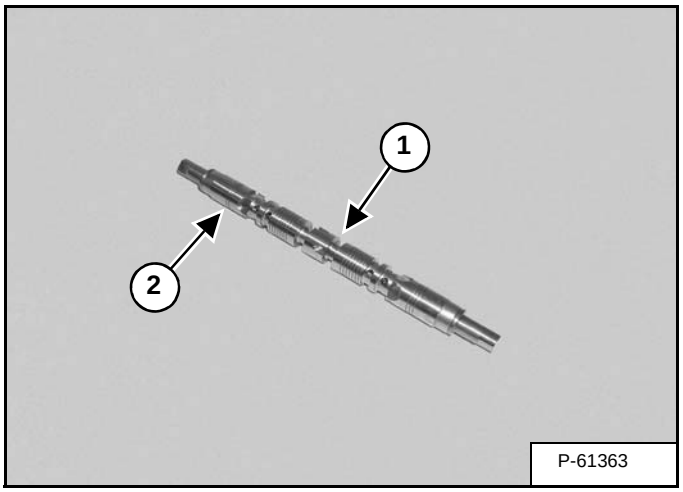
Figure 20-40-212



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

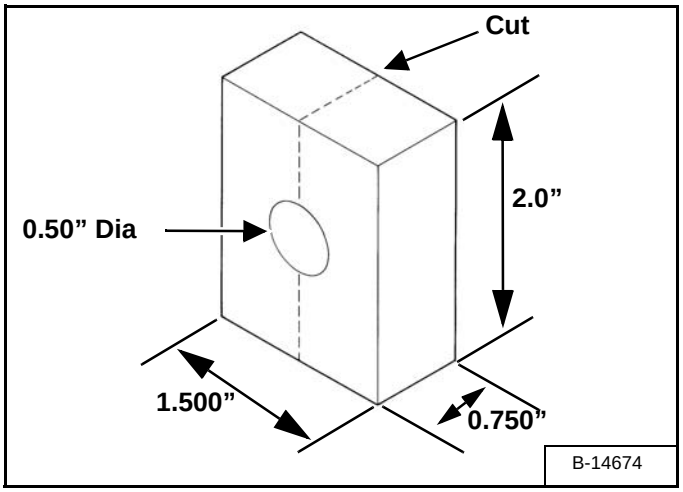
NOTE: The spool is not symmetrical. Incorrect spool installation will cause poor hydraulic valve performance.

Figure 20-40-213



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

Figure 20-40-214



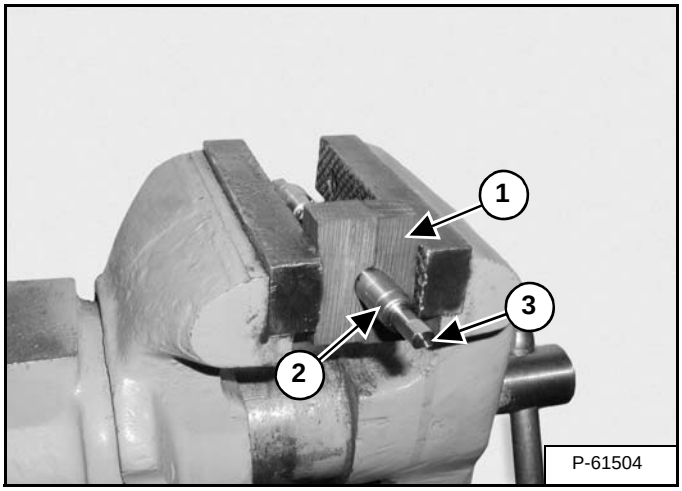
To remove the plugs from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.500 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-214]**.

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

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

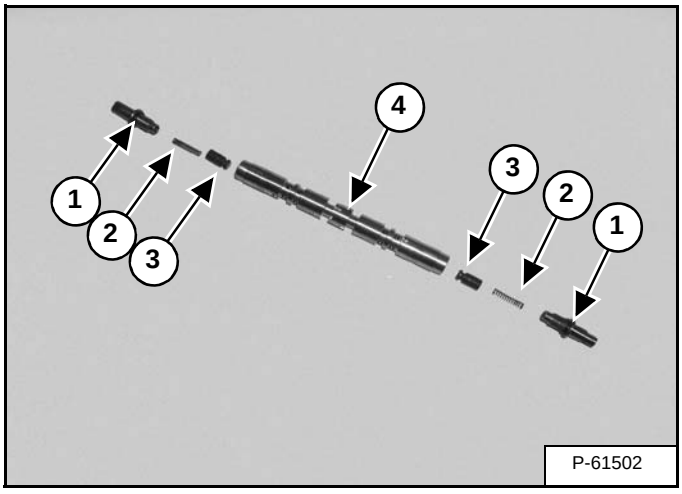
Figure 20-40-215



Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the plugs (Item 3) **[Figure 20-40-215]**. (Both ends)

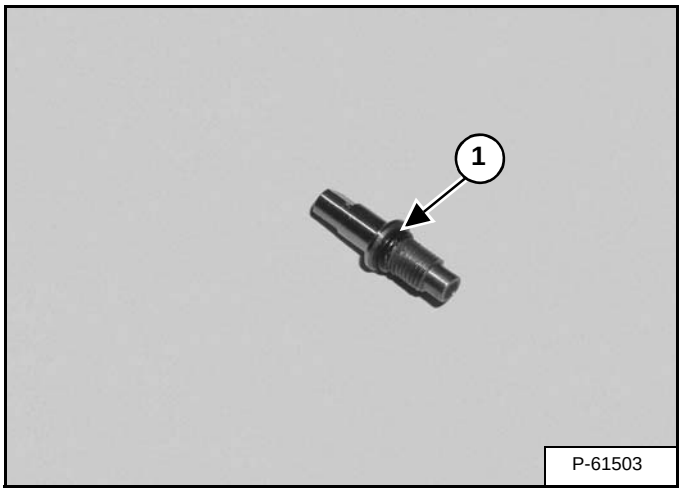
Installation: Apply thread lock adhesive (Loctite 262) or equivalent to the threads. Tighten the plugs to 44 in.-lbs. (5 Nm) torque.

Figure 20-40-216



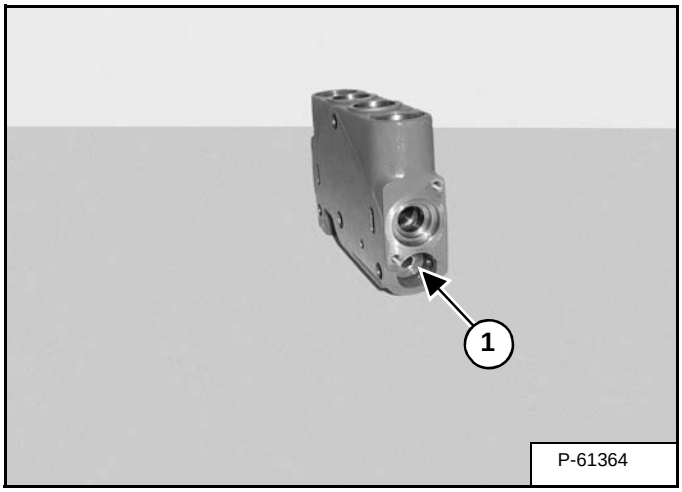
Remove the plugs (Item 1), springs (Item 2), and poppet (Item 3) from the spool (Item 4) **[Figure 20-40-216]**.

Figure 20-40-217



Remove the O-ring (Item 1) **[Figure 20-40-217]** from the plugs.

Figure 20-40-218



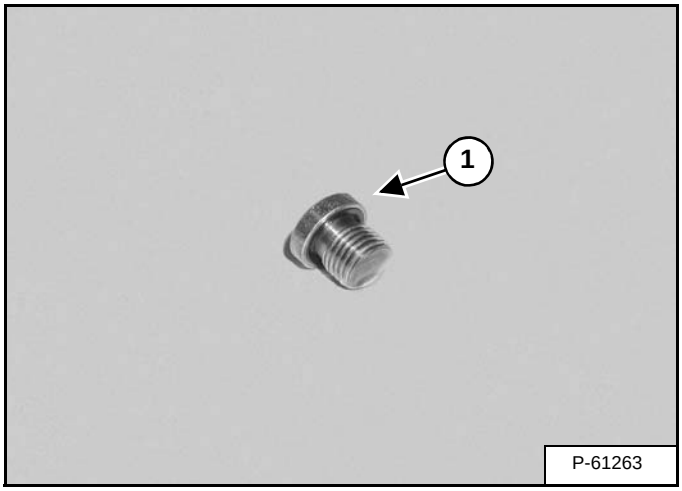
Remove the plug (Item 1) **[Figure 20-40-218]** from the valve section.

Installation: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

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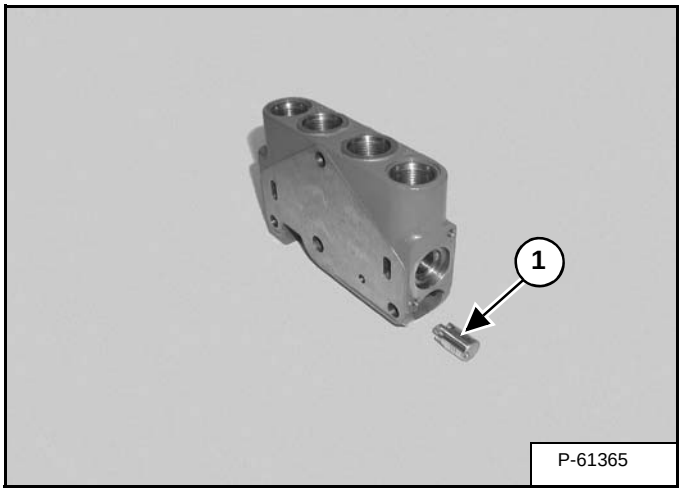
First Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-219



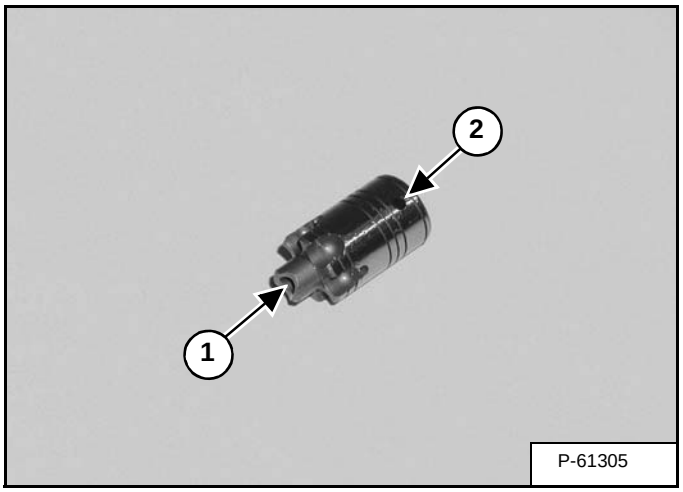
Remove the O-ring (Item 1) **[Figure 20-40-219]** from the plug.

Figure 20-40-220



Remove the compensator (Item 1) **[Figure 20-40-220]** from the valve section.

Figure 20-40-221



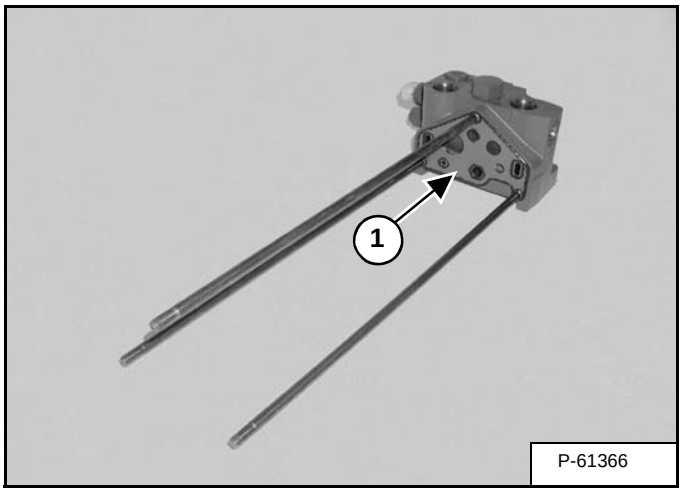
Check the orifice (Item 1) **[Figure 20-40-221]** in the compensator to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-40-221]** to be sure it is not plugged.

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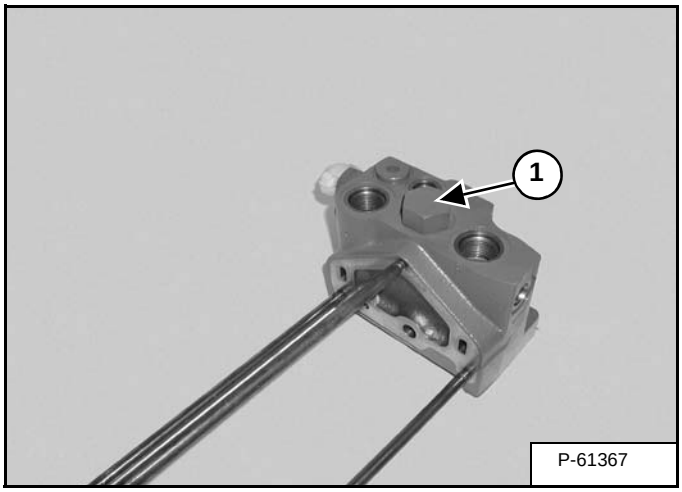
Inlet Section Disassembly And Assembly

Figure 20-40-222



Remove the gasket (Item 1) **[Figure 20-40-222]**.

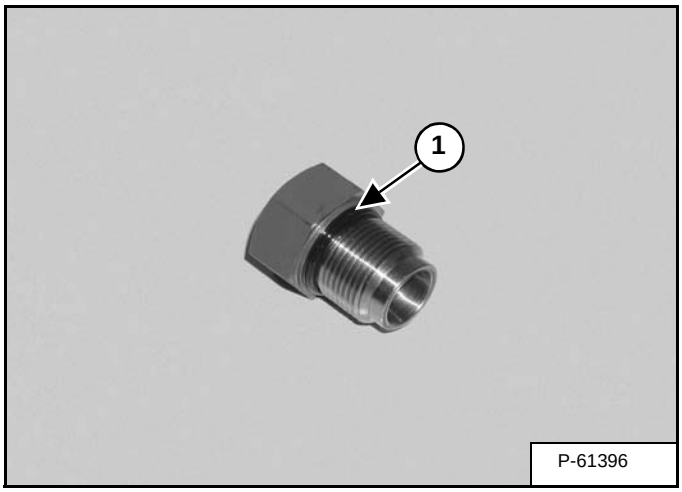
Figure 20-40-223



Remove the plug (Item 1) **[Figure 20-40-223]** from the open center valve.

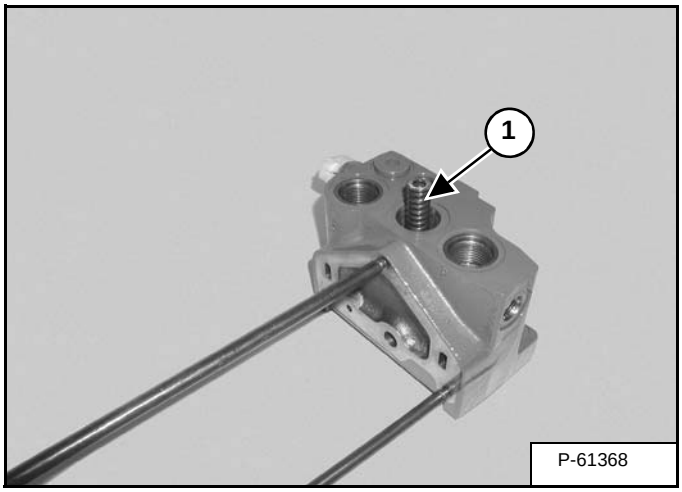
Installation: Tighten the plug to 52 ft.-lbs. (70 Nm) torque.

Figure 20-40-224



Remove the O-ring (Item 1) **[Figure 20-40-224]** from the plug.

Figure 20-40-225

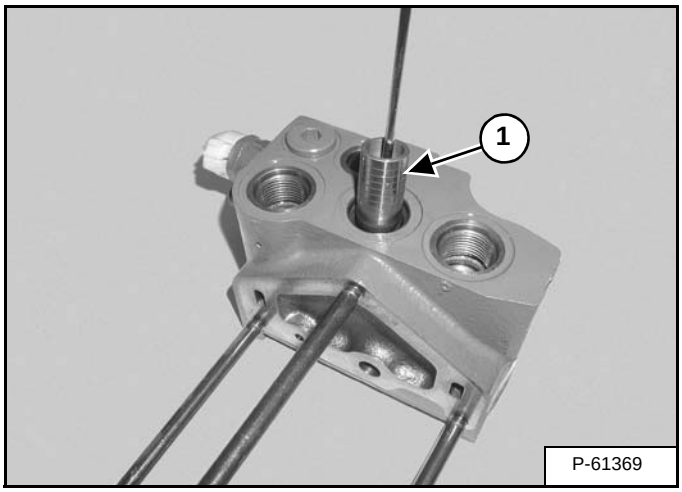


Remove the spring (Item 1) **[Figure 20-40-225]**.

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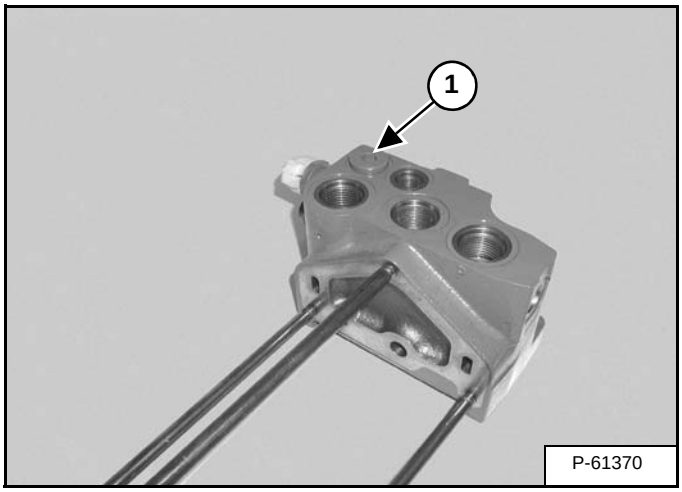
Inlet Section Disassembly And Assembly (Cont'd)

Figure 20-40-226



Remove the spool (Item 1) **[Figure 20-40-226]**.

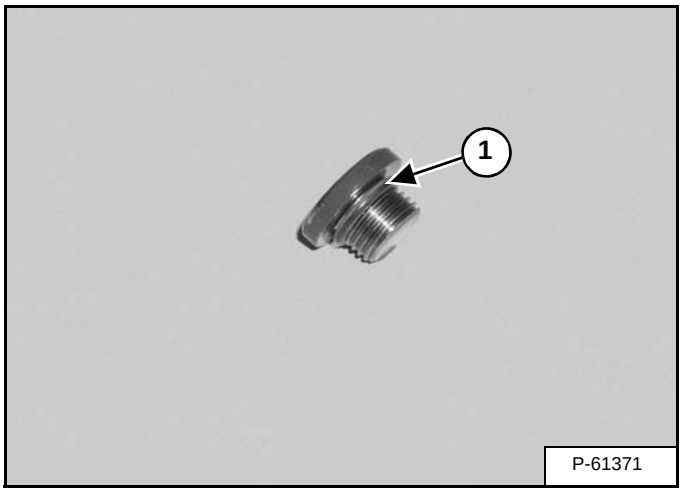
Figure 20-40-227



Remove the plug (Item 1) **[Figure 20-40-227]**.

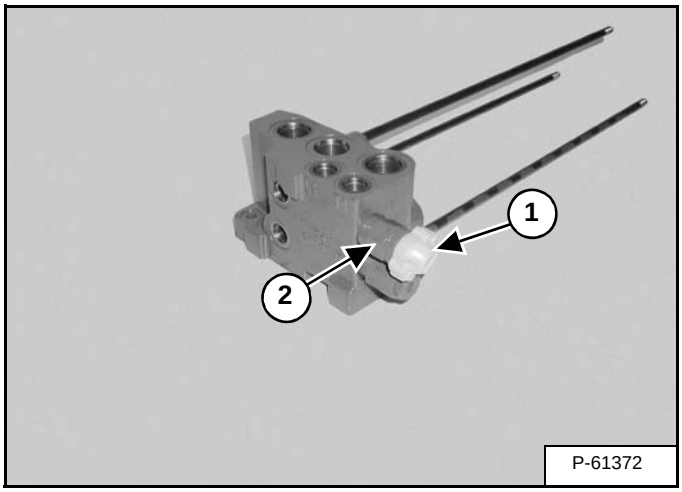
Installation: Tighten the plug to 15 ft.-lbs. (20 Nm) torque.

Figure 20-40-228



Remove the O-ring (Item 1) **[Figure 20-40-228]** from the plug.

Figure 20-40-229



Remove the protective cover (Item 1) from the main relief valve (Item 2) **[Figure 20-40-229]**.

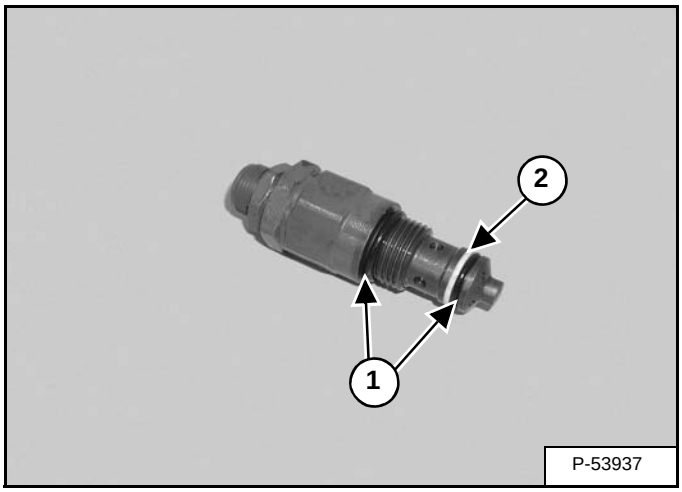
Remove the main relief valve from the inlet section.

Installation: Tighten the main relief valve to 33 ft.-lbs. (45 Nm) torque.

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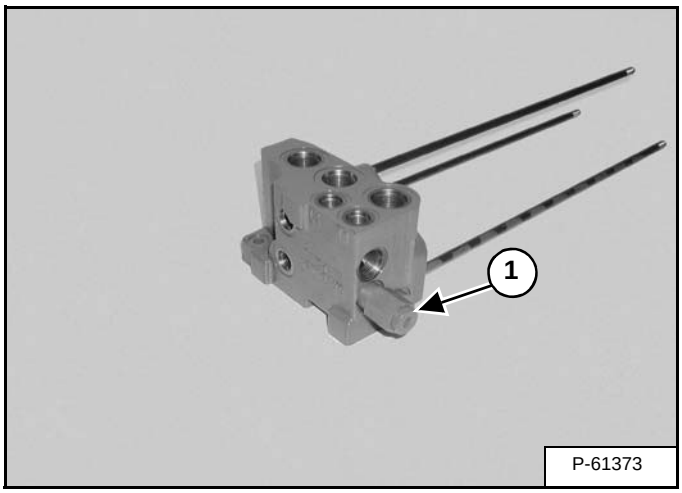
Inlet Section Disassembly And Assembly (Cont'd)

Figure 20-40-230



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-230]** from the relief valve.

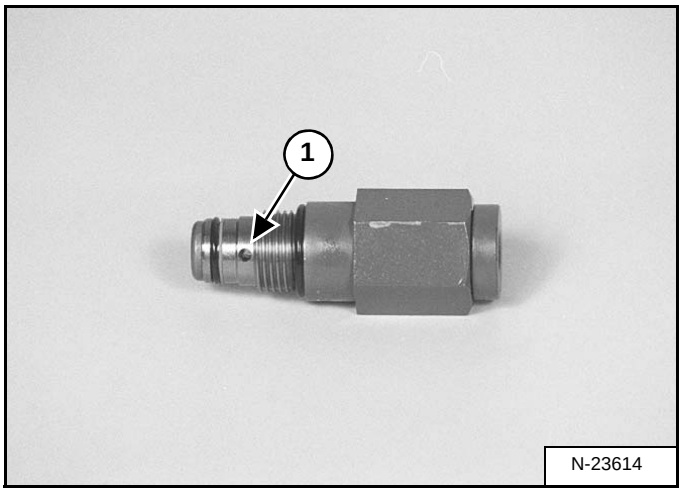
Figure 20-40-231



Remove the load sense bleed valve (Item 1) **[Figure 20-40-231]** from the inlet section.

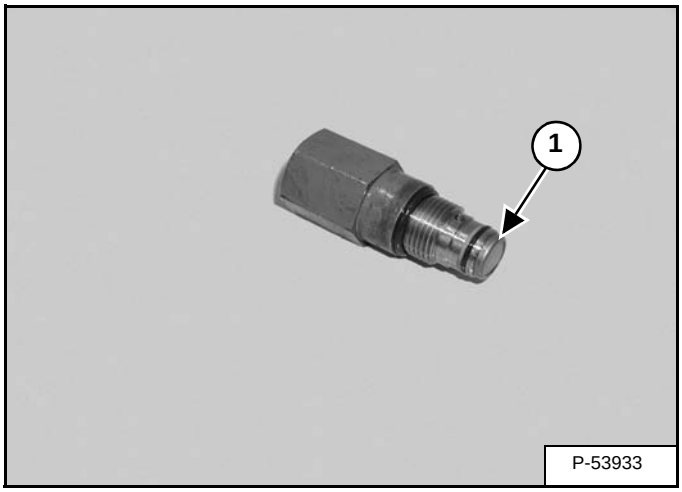
Installation: Tighten the load sense bleed valve to 15 ft.-lbs. (20 Nm) torque.

Figure 20-40-232



Check the port (Item 1) **[Figure 20-40-232]** in the load sense bleed valve to be sure it is not plugged.

Figure 20-40-233

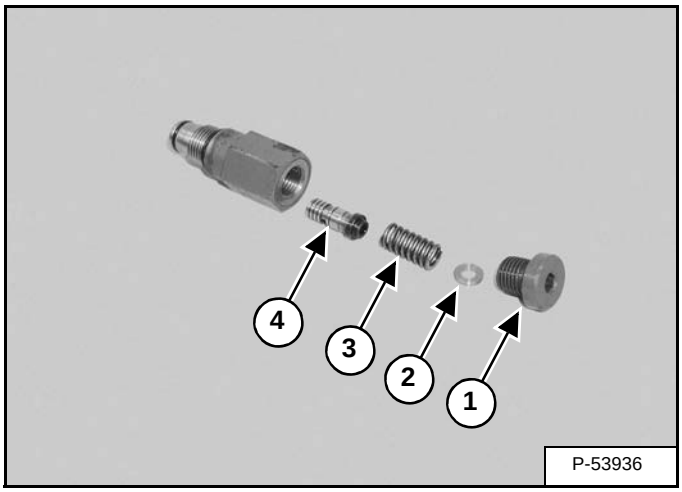


Remove the filter (Item 1) **[Figure 20-40-233]** from the end of the load sense bleed valve.

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Inlet Section Disassembly And Assembly (Cont'd)

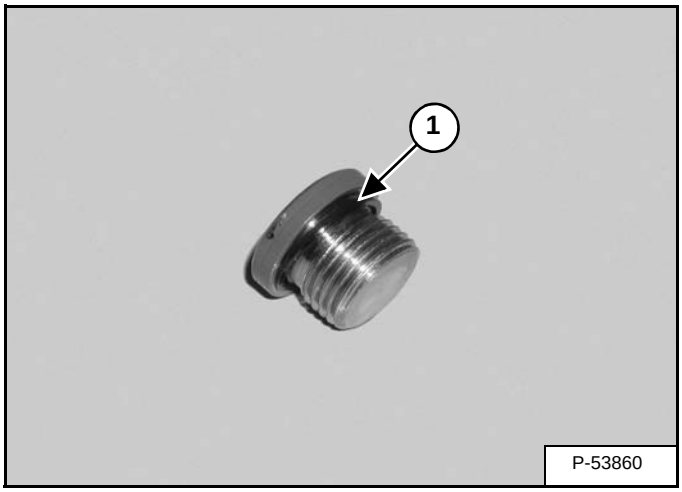
Figure 20-40-234



Remove the plug (Item 1), shims (Item 2), spring (Item 3) and spool (Item 4) **[Figure 20-40-234]** from the load sense bleed valve.

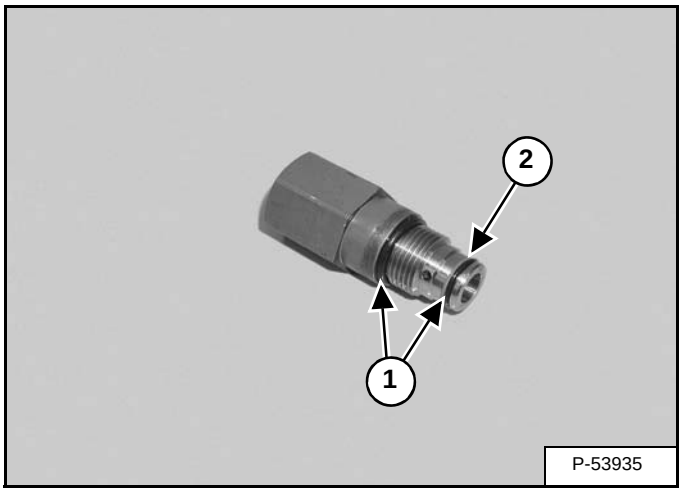
Installation: Tighten the plug to 15 ft.-lbs. (20 Nm) torque.

Figure 20-40-235



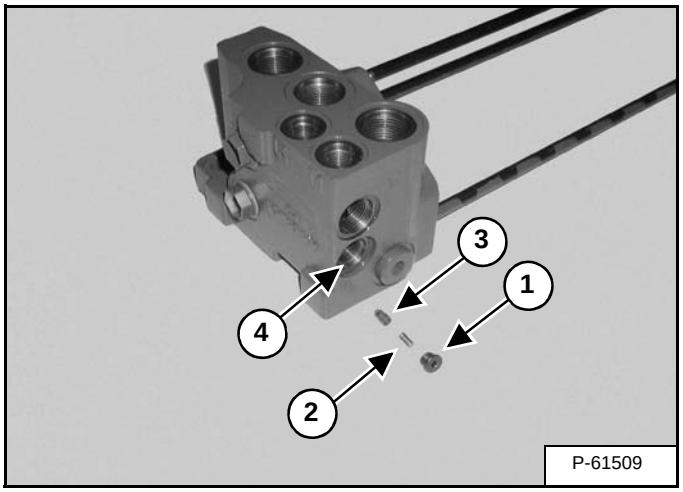
Remove the O-ring (Item 1) **[Figure 20-40-235]** from the plug.

Figure 20-40-236



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-236]**.

Figure 20-40-237

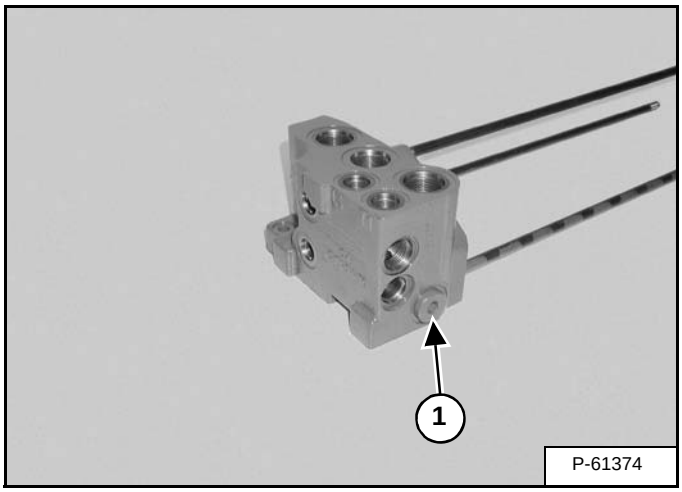


Remove the plug (Item 1), spring (Item 2) and poppet (Item 3) from the port (Item 4) **[Figure 20-40-237]**.

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Inlet Section Disassembly And Assembly (Cont'd)

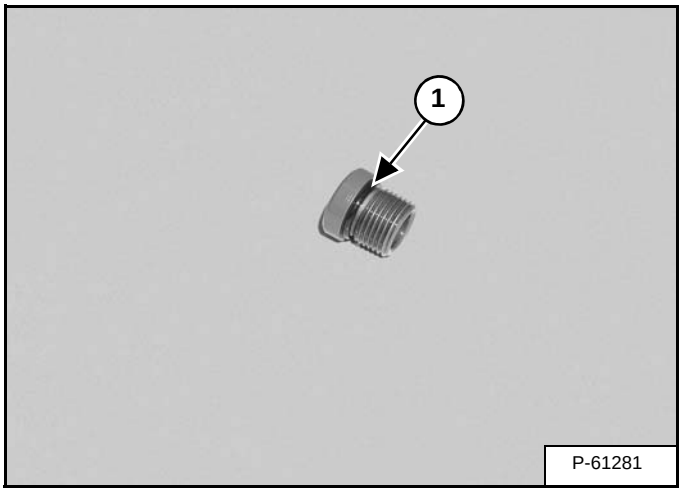
Figure 20-40-238



Remove the plug (Item 1) **[Figure 20-40-238]**.

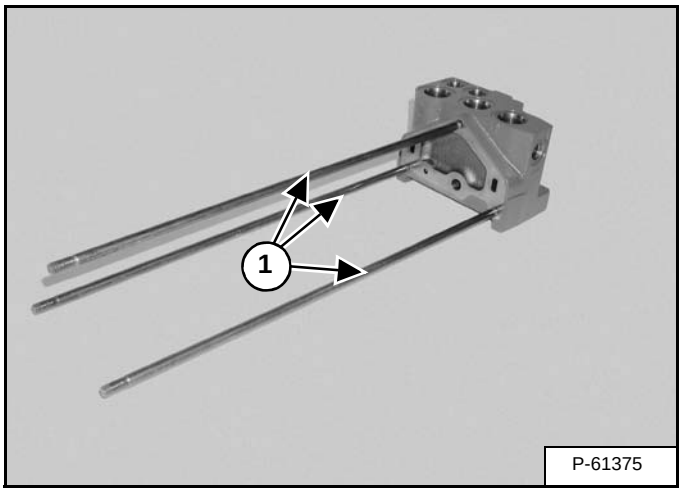
Installation: Tighten the plug to 15 ft.-lbs. (20 Nm) torque.

Figure 20-40-239



Remove the O-ring (Item 1) **[Figure 20-40-239]** from the plug.

Figure 20-40-240



Remove the tie rods (Item 1) **[Figure 20-40-240]** from the inlet section.

Installation: Tighten the tie rods to 11 ft.-lbs. (15 Nm) torque.

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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.

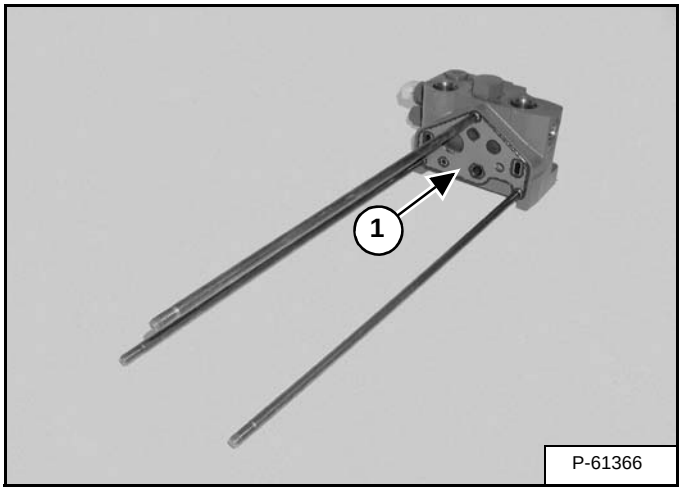
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

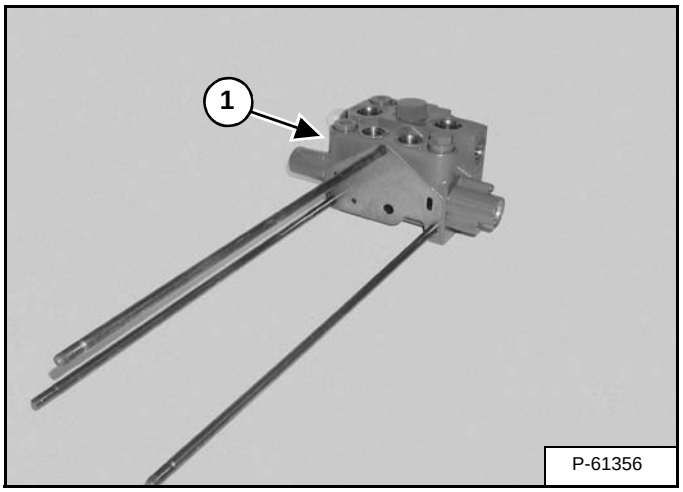
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-241



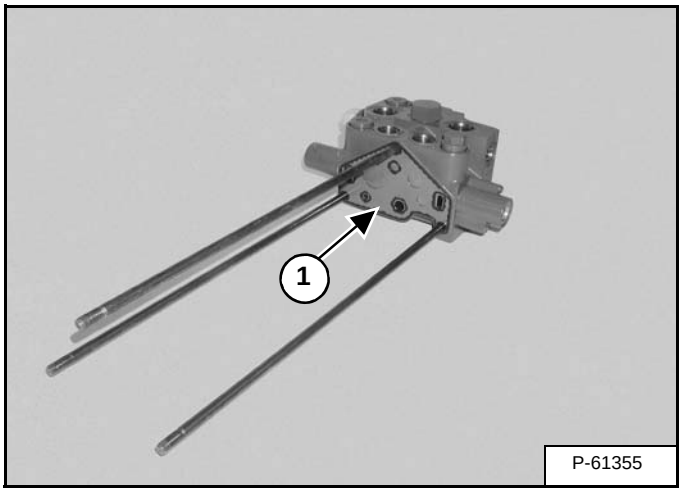
Install the gasket (Item 1) **[Figure 20-40-241]** on the inlet section.

Figure 20-40-242



Install the first auxiliary valve section (Item 1) **[Figure 20-40-242]** on the tie rods.

Figure 20-40-243

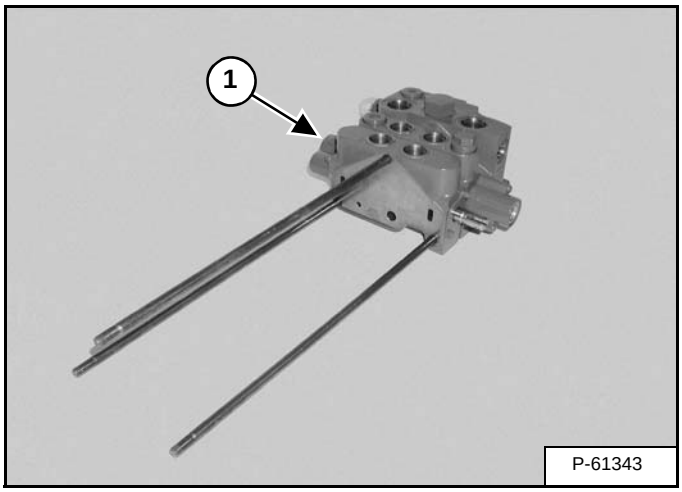


Install the gasket (Item 1) **[Figure 20-40-243]** on the first auxiliary valve section.

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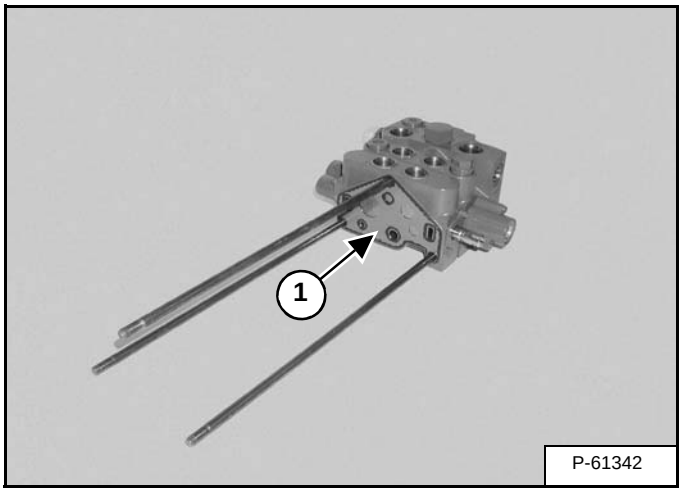
Assembly (Cont'd)

Figure 20-40-244



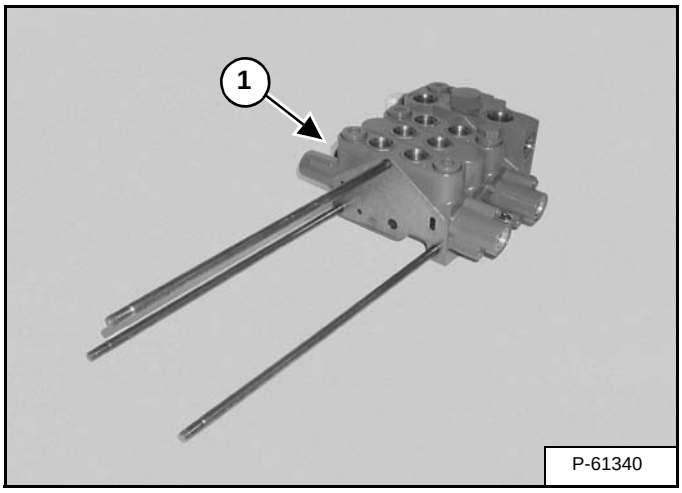
Install the boom swing valve section (Item 1) **[Figure 20-40-244]** on the tie rods.

Figure 20-40-245



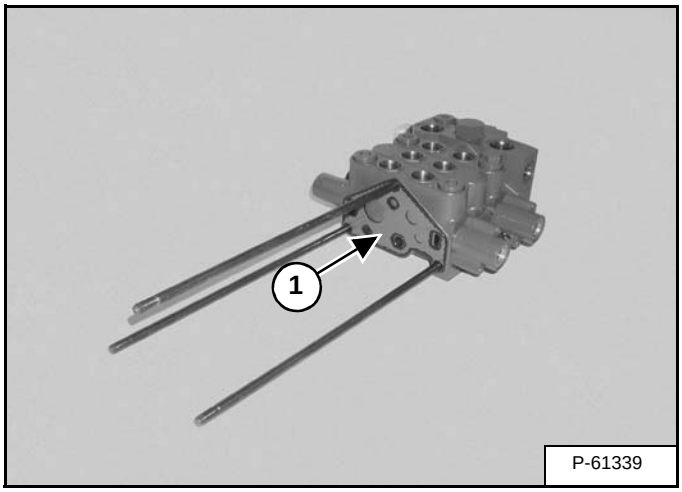
Install the gasket (Item 1) **[Figure 20-40-245]** on the boom swing valve section.

Figure 20-40-246



Install the boom valve section (Item 1) **[Figure 20-40-246]** on the tie rods.

Figure 20-40-247

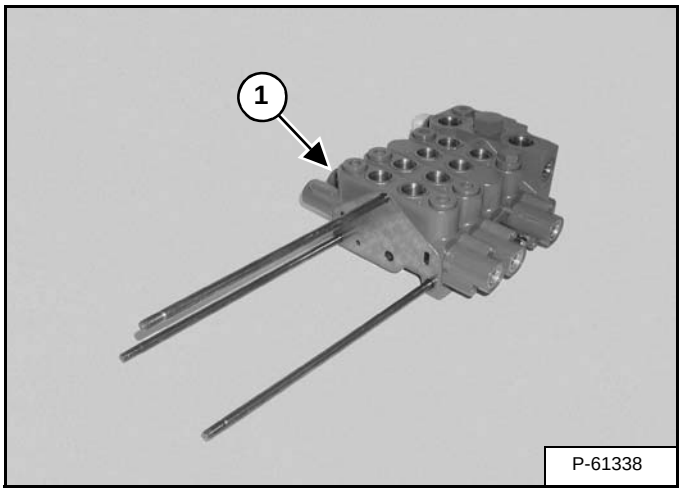


Install the gasket (Item 1) **[Figure 20-40-247]** on the boom valve.

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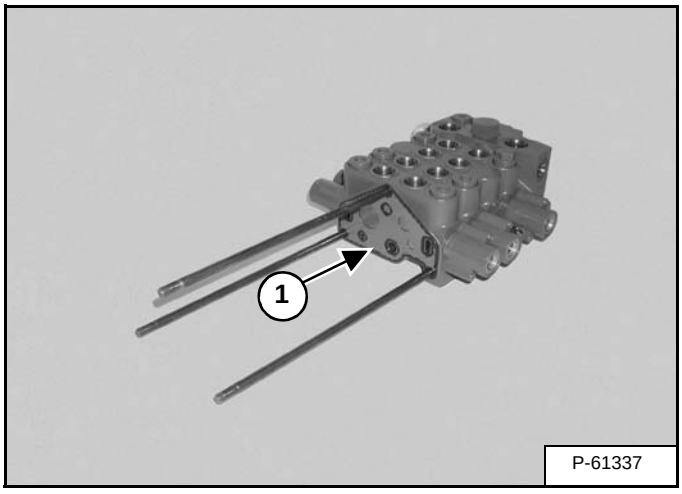
Assembly (Cont'd)

Figure 20-40-248



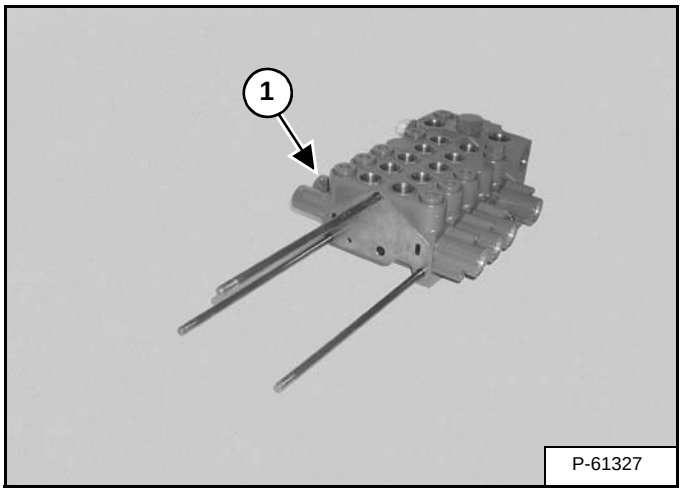
Install the arm valve section (Item 1) **[Figure 20-40-248]** on the tie rods.

Figure 20-40-249



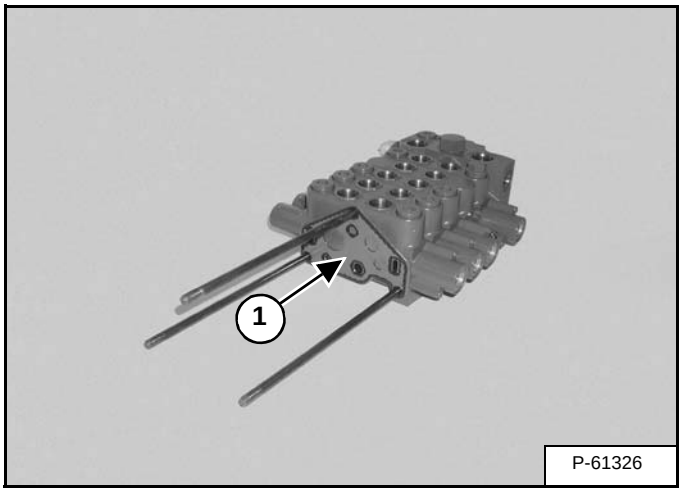
Install the gasket (Item 1) **[Figure 20-40-249]** on the arm valve section.

Figure 20-40-250



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

Figure 20-40-251

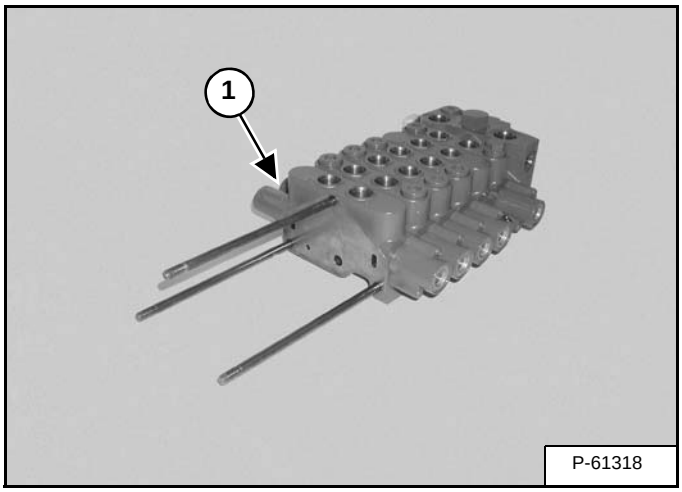


Install the gasket (Item 1) **[Figure 20-40-251]** on the bucket valve section.

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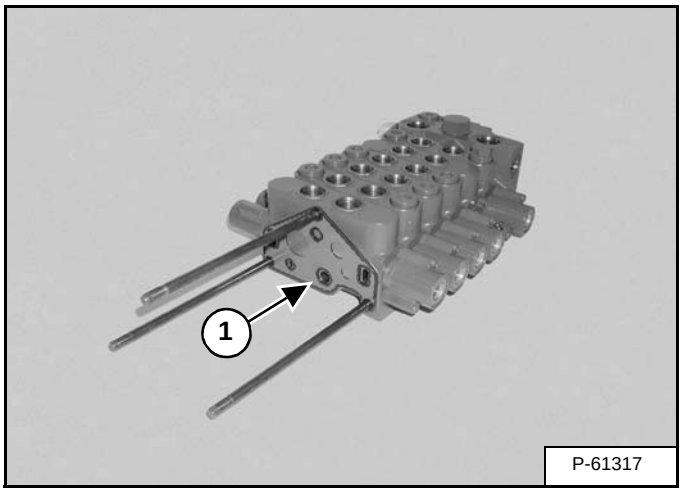
Assembly (Cont'd)

Figure 20-40-252



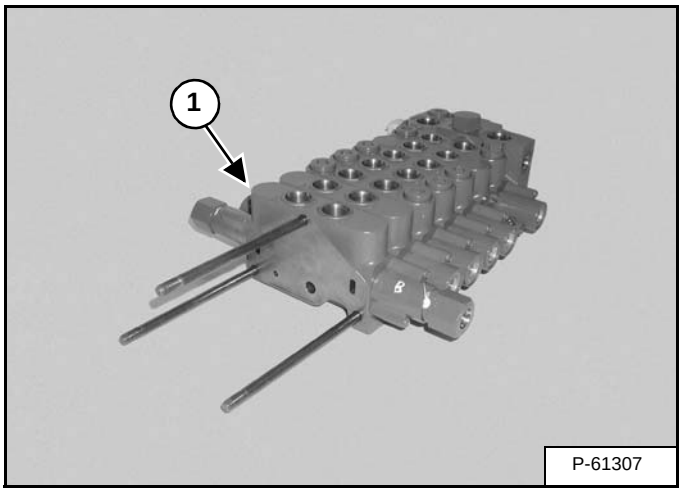
Install the second auxiliary valve section (Item 1) **[Figure 20-40-252]** on the tie rods.

Figure 20-40-253



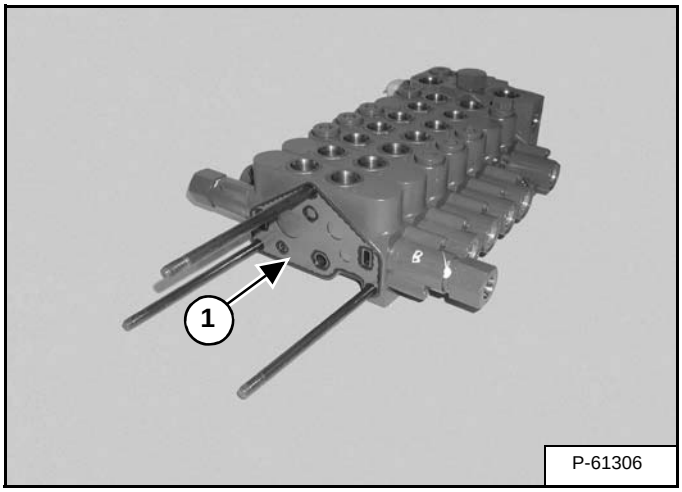
Install the gasket (Item 1) **[Figure 20-40-253]** on the second auxiliary valve section.

Figure 20-40-254



Install the slew valve section (Item 1) **[Figure 20-40-254]** on the tie rods.

Figure 20-40-255

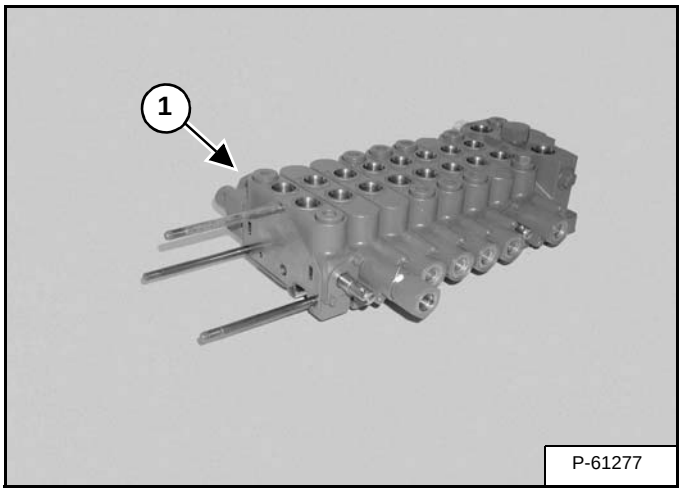


Install the gasket (Item 1) **[Figure 20-40-255]** on the slew valve section.

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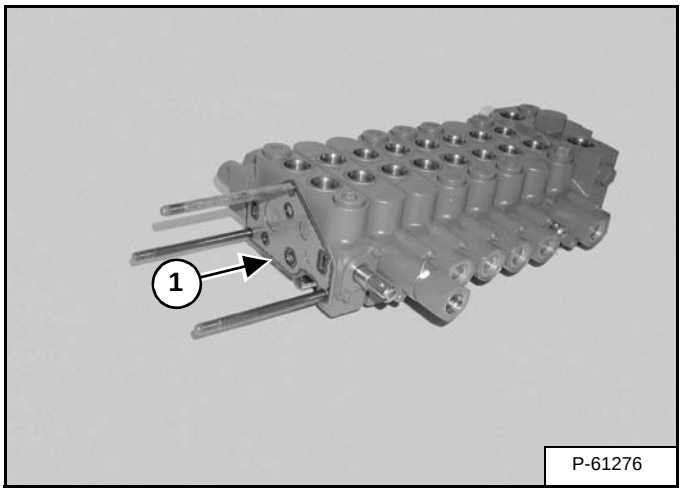
Assembly (Cont'd)

Figure 20-40-256



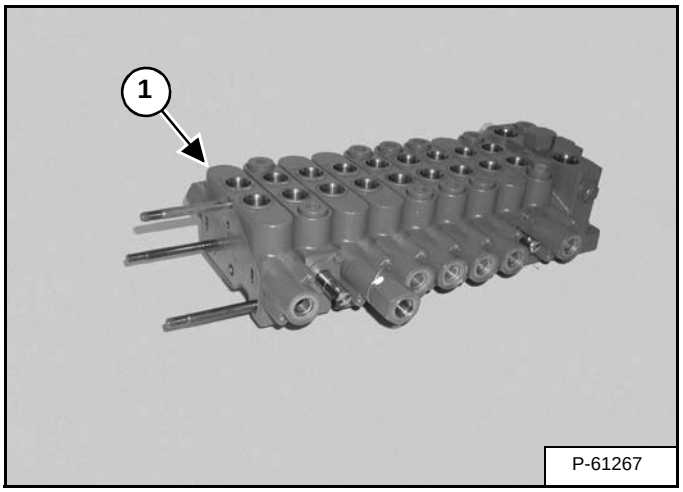
Install the blade valve section (Item 1) **[Figure 20-40-256]** on the tie rods.

Figure 20-40-257



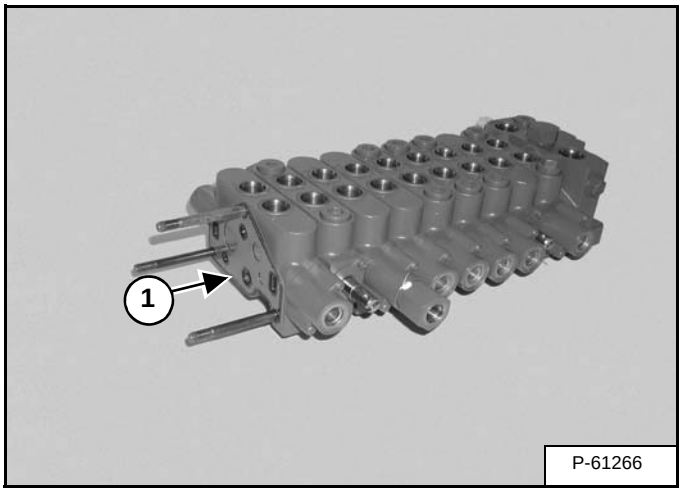
Install the gasket (Item 1) **[Figure 20-40-257]** on the blade valve section.

Figure 20-40-258



Install the left travel valve section (Item 1) **[Figure 20-40-258]** on the tie rods.

Figure 20-40-259

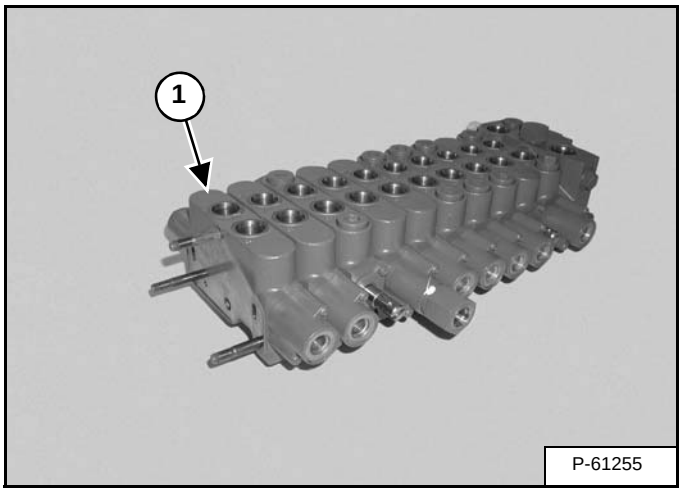


Install the gasket (Item 1) **[Figure 20-40-259]** on the left travel valve section.

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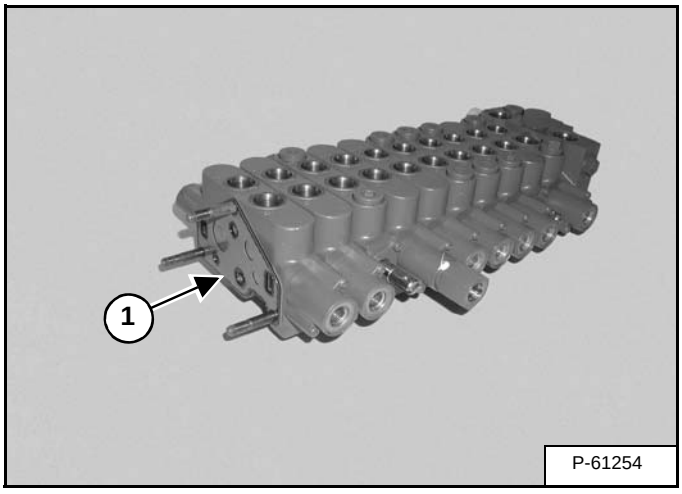
Assembly (Cont'd)

Figure 20-40-260



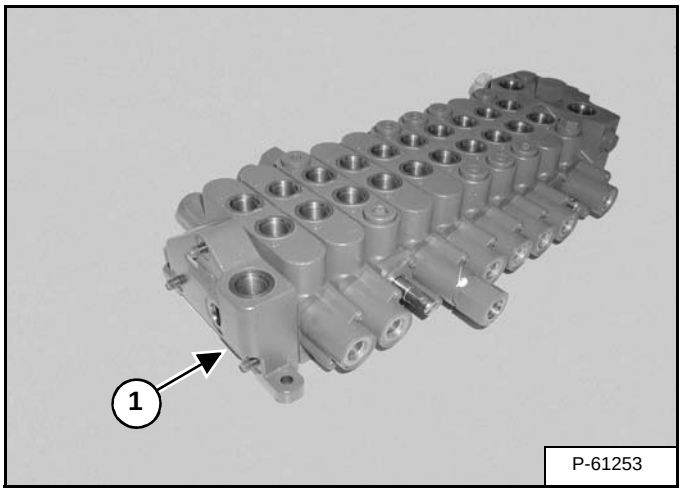
Install the right travel valve section (Item 1) **[Figure 20-40-260]** on the tie rods.

Figure 20-40-261



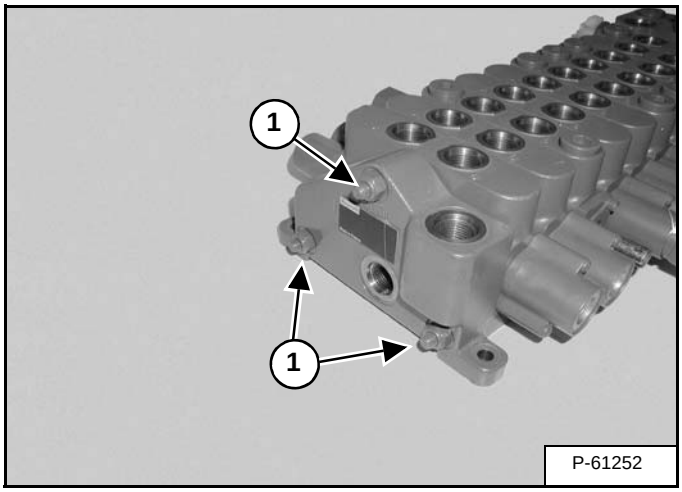
Install the gasket (Item 1) **[Figure 20-40-261]** on the right travel valve.

Figure 20-40-262



Install the end cap (Item 1) **[Figure 20-40-262]** on the tie rods.

Figure 20-40-263



Install the nuts (Item 1) **[Figure 20-40-263]** 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) to 5 ft.-lbs. (7 Nm) torque in a crisscross manner. Final tighten the tie rod nuts (Item 1) **[Figure 20-40-263]** to 11 ft.-lbs. (15 Nm) torque.

The valve assembly must not have any spacing between the valve sections and the spools must be free when pushed in and released.

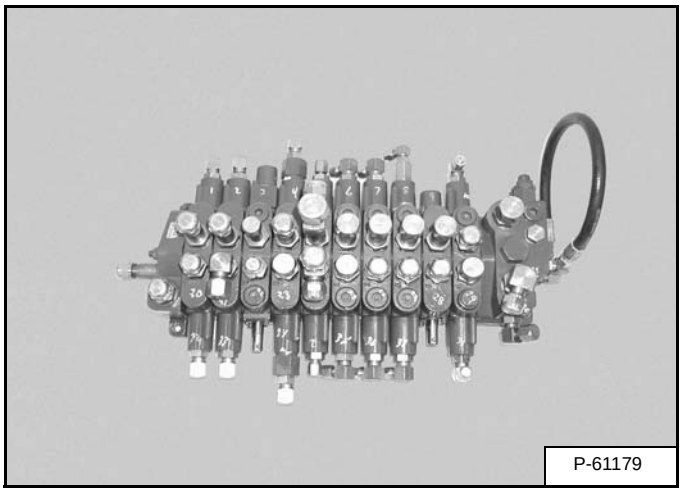
The spools must not stick, if the spools stick, loosen the tie rod nuts and tighten per above information.

Recheck the control valve assembly for level settings.

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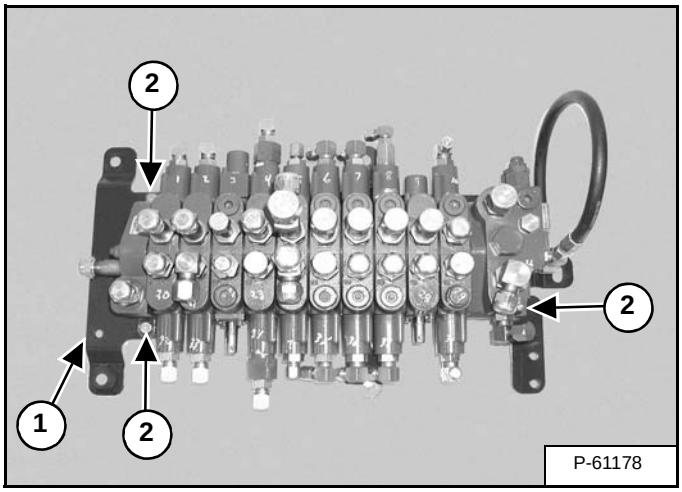
Assembly (Cont'd)

Figure 20-40-264



Install the fittings and hose **[Figure 20-40-264]**.

Figure 20-40-265



Install the mount plate (Item 1) with three bolts and nuts (Item 2) **[Figure 20-40-265]**.

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

Description

They hydraulic control valve is a 9 section closed center system and has one main relief valve. The main relief valve operates at 3480 PSI (240 bar). The boom, bucket, and blade section have 3915 PSI (270 bar) work port reliefs.

The arm section has 3625 PSI (250 bar) work port reliefs. The first auxiliary section has 2610 PSI (180 bar) work port reliefs.

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

Removal And Installation

Lower the boom/bucket and blade to the ground.

Stop the engine.

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

IMPORTANT

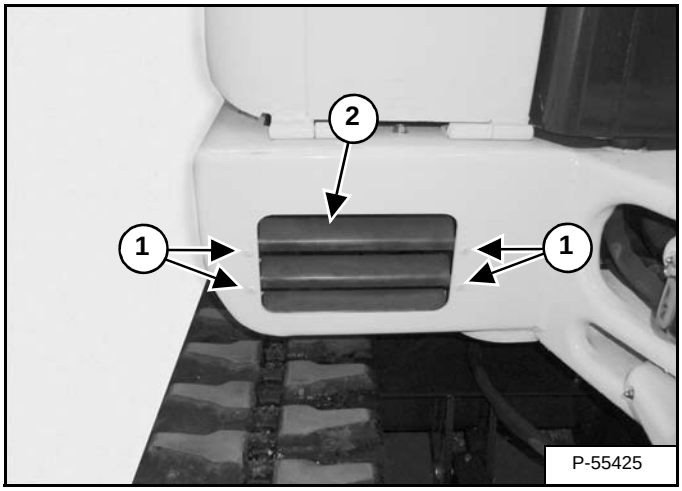
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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Drain the hydraulic reservoir. (See Replacing The Hydraulic Fluid on Page 10-50-2.)

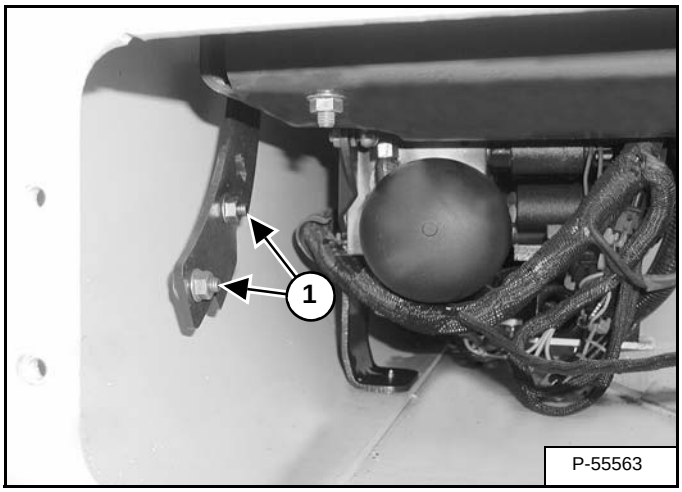
Remove the right console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 20-41-1



Remove the bolts (Item 1) and louver (Item 2) **[Figure 20-41-1]**.

Figure 20-41-2

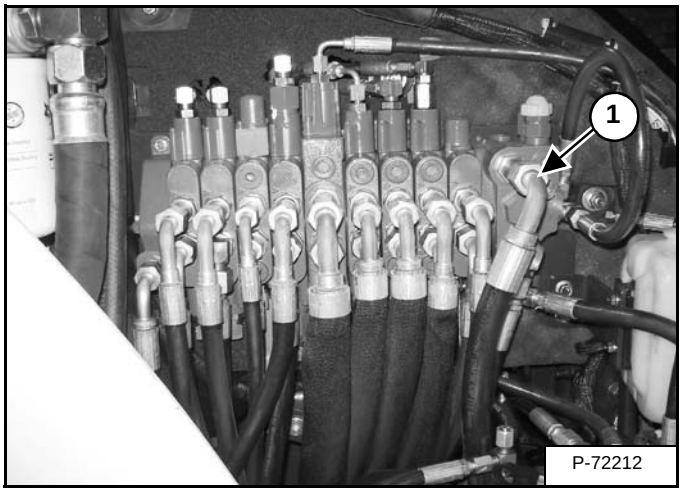


Remove the bolts (Item 1) **[Figure 20-41-2]** and nuts from the stop.

Open the right side cover.

Mark all tubelines and hoses for proper installation.

Figure 20-41-3



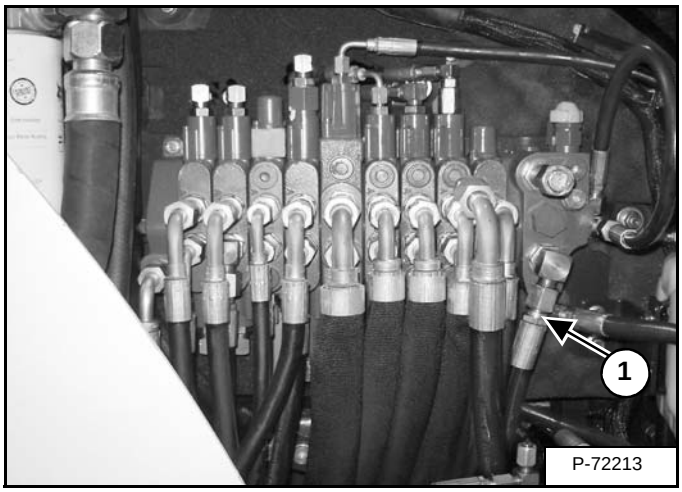
Remove the hose (Item 1) **[Figure 20-41-3]**.

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234316877 & ABOVE, S/N 234413319 & ABOVE, S/N 234515533 & ABOVE (562912779 & ABOVE) (CONT'D)

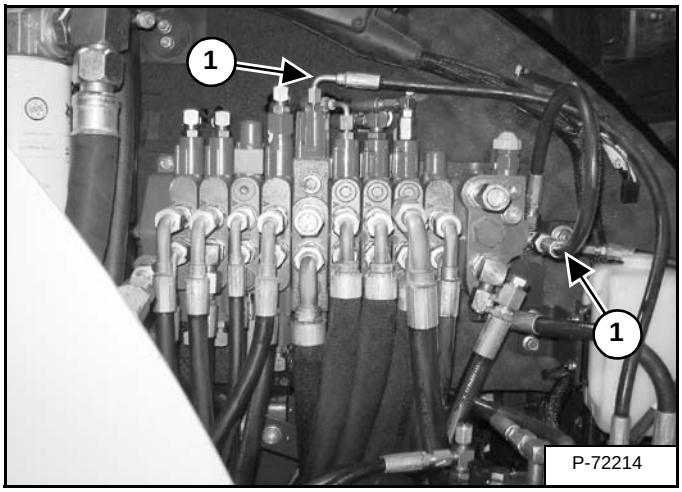
Removal And Installation (Cont'd)

Figure 20-41-4



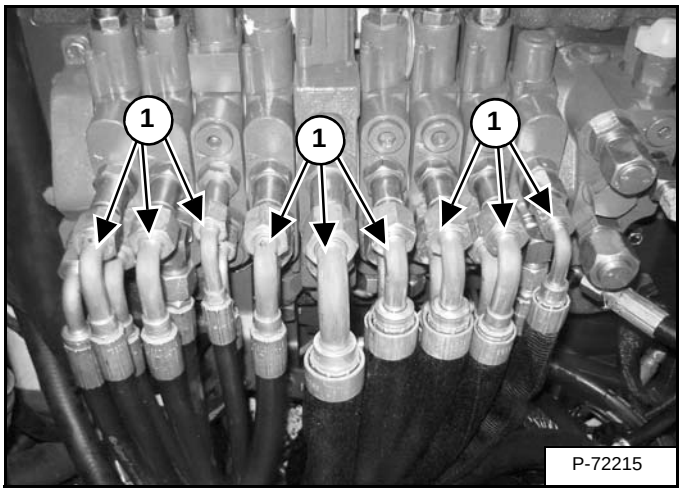
Remove the hose (Item 1) **[Figure 20-41-4]**.

Figure 20-41-5



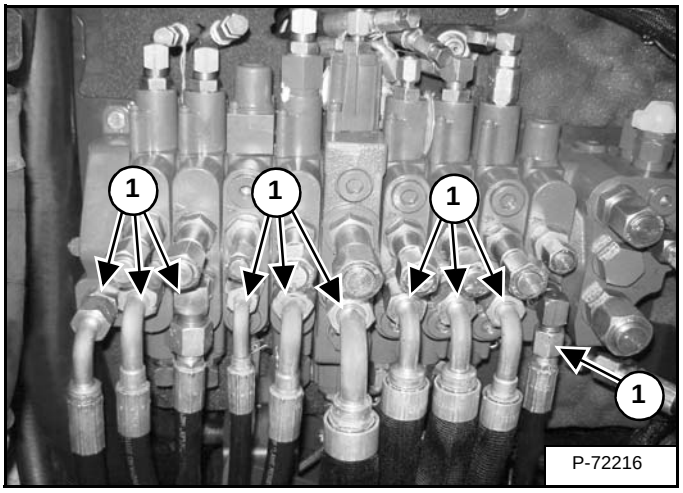
Remove the hoses (Item 1) **[Figure 20-41-5]**.

Figure 20-41-6



Remove the hoses (Item 1) **[Figure 20-41-6]**.

Figure 20-41-7

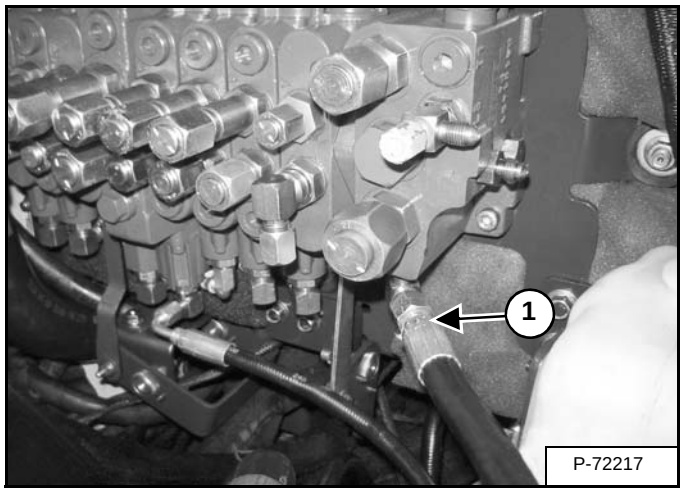


Remove the hoses (Item 1) **[Figure 20-41-7]**.

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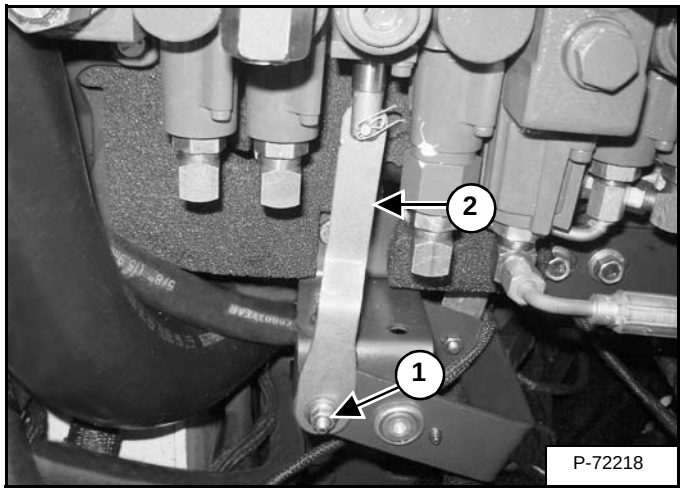
Removal And Installation (Cont'd)

Figure 20-41-8



Remove the hose (Item 1) **[Figure 20-41-8]**.

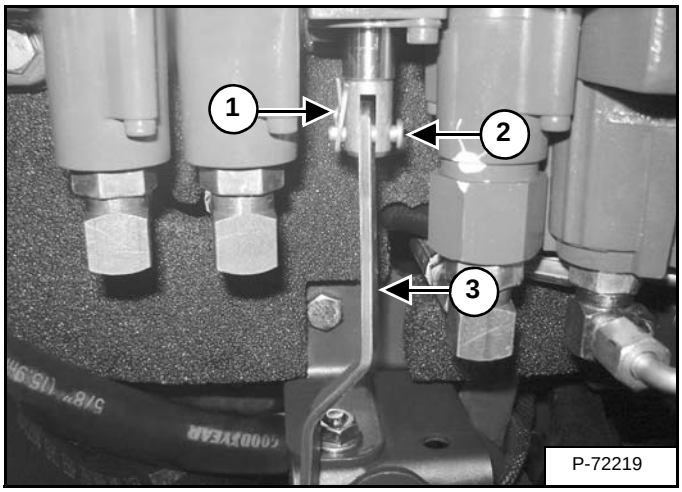
Figure 20-41-9



Remove the nut (Item 1) and bolt from the blade control linkage (Item 2) **[Figure 20-41-9]**.

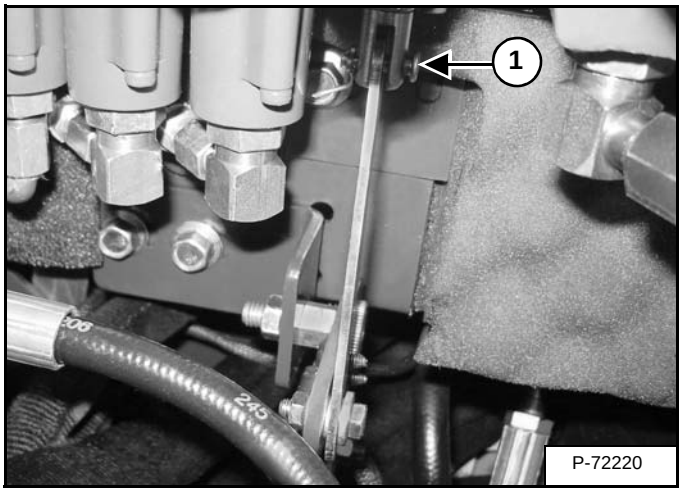
Turn the blade control linkage 90°.

Figure 20-41-10



Remove the cotter pin (Item 1), clevis pin (Item 2) and linkage (Item 3) **[Figure 20-41-10]**.

Figure 20-41-11

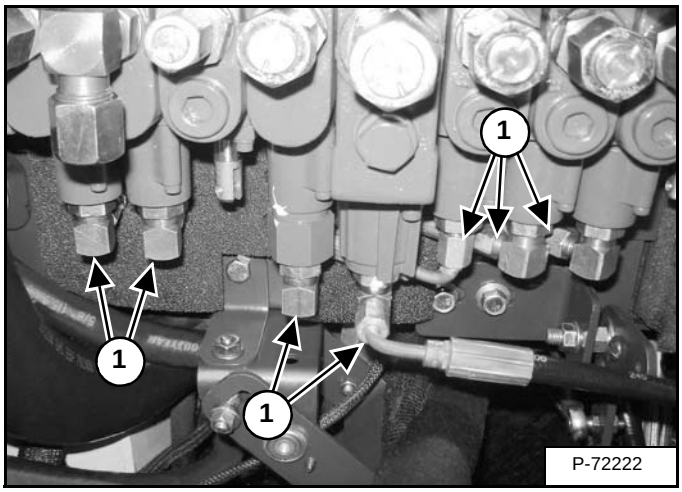


Remove the cotter pin and clevis pin (Item 1) **[Figure 20-41-11]**.

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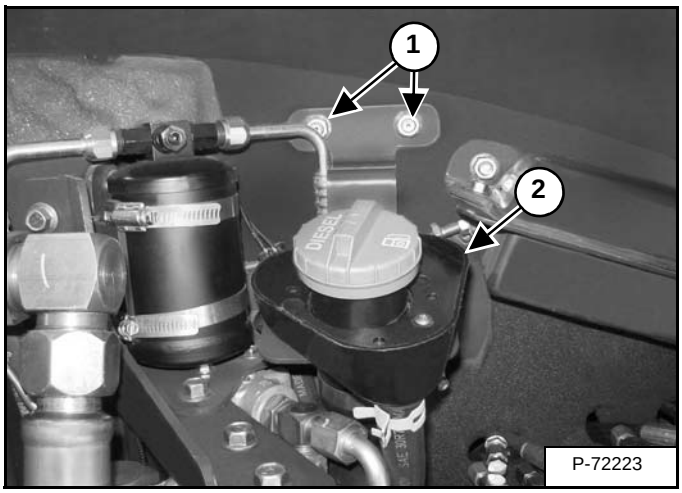
Removal And Installation (Cont'd)

Figure 20-41-12



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

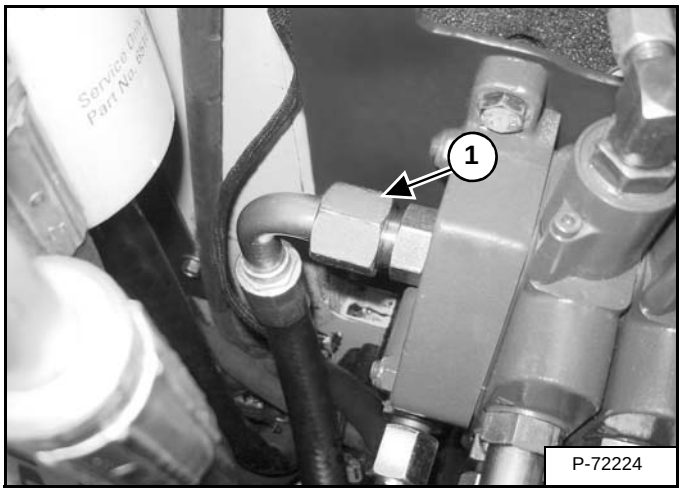
Figure 20-41-13



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

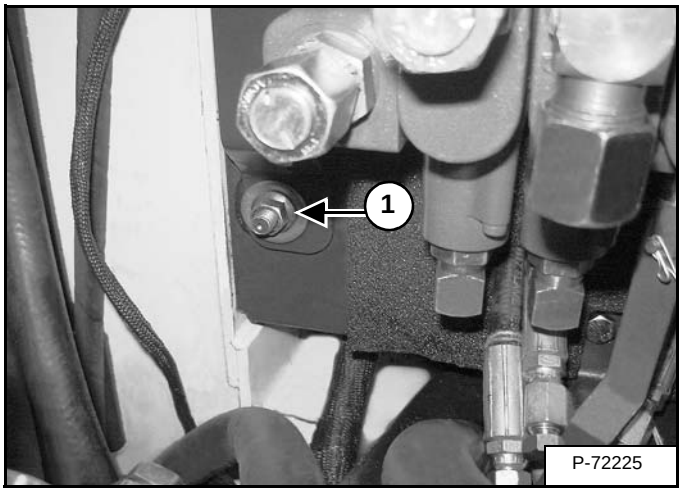
Relocate the fuel fill.

Figure 20-41-14



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

Figure 20-41-15

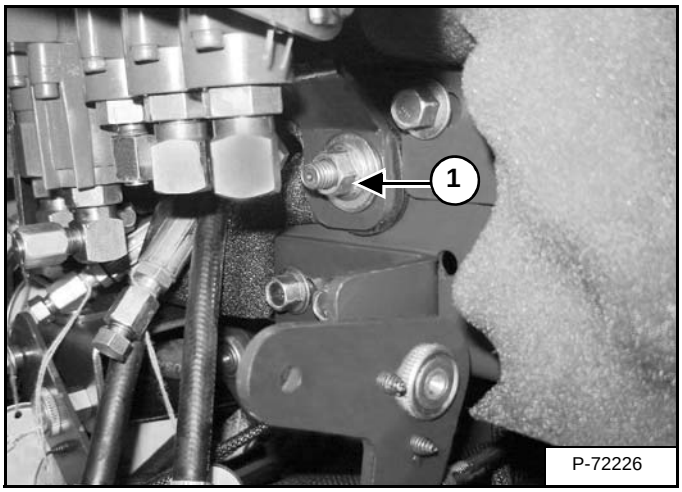


Remove the nut (Item 1) **[Figure 20-41-15]**, flat washer and rubber washer from the control valve.

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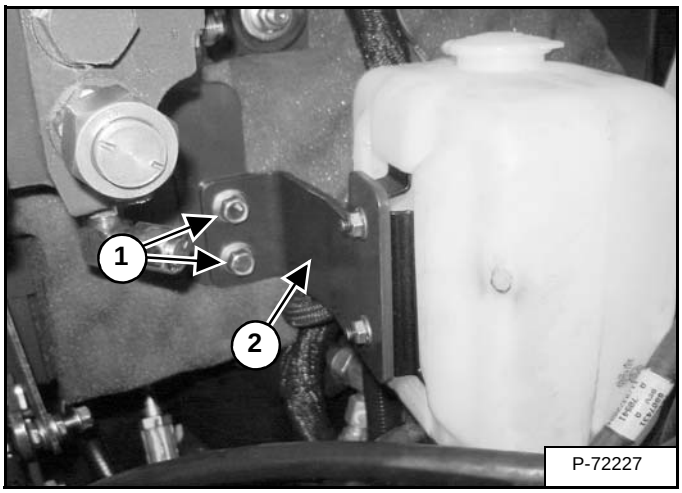
Removal And Installation (Cont'd)

Figure 20-41-16



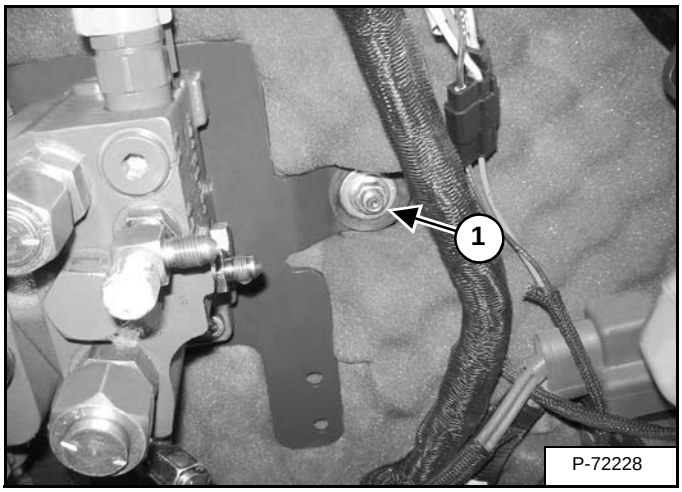
Remove the nut (Item 1) **[Figure 20-41-16]**, flat washer and rubber washer.

Figure 20-41-17



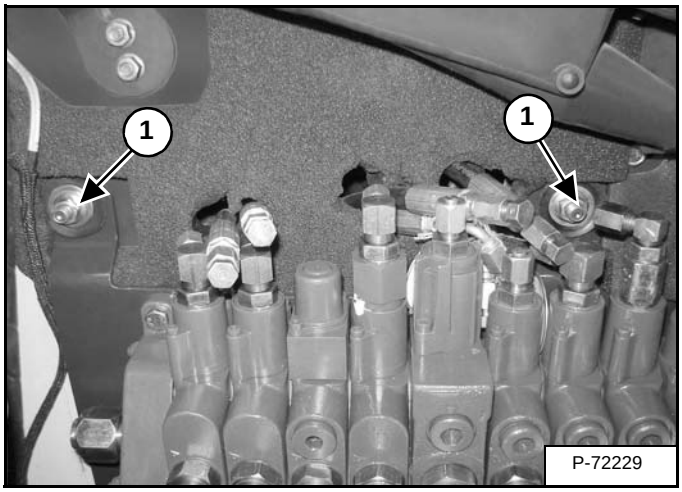
Remove the bolts (Item 1) from the windshield washer fluid reservoir mount bracket (Item 2) **[Figure 20-41-17]** (if equipped). Relocate the reservoir and mount bracket.

Figure 20-41-18



Remove the nut (Item 1) **[Figure 20-41-18]**, flat washer and rubber washer.

Figure 20-41-19

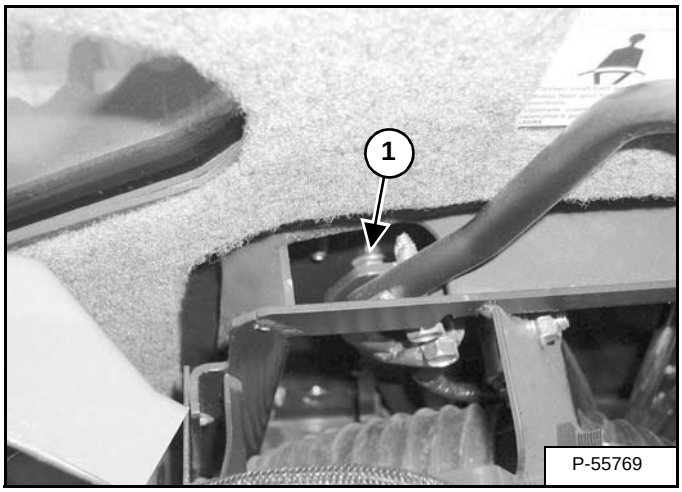


Loosen the two nuts (Item 1) **[Figure 20-41-19]**.

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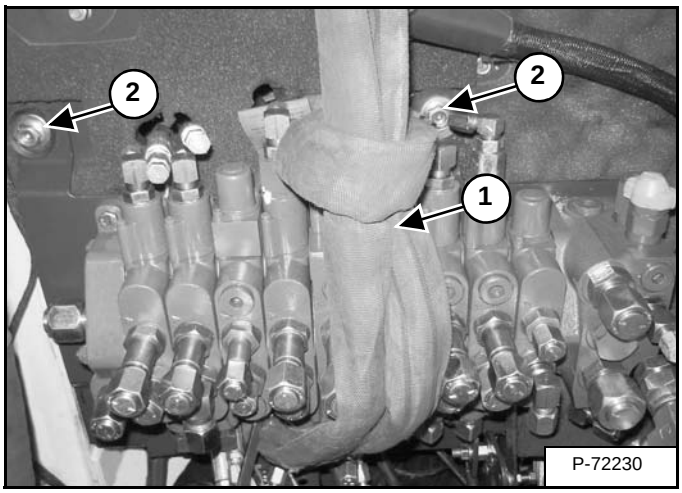
Removal And Installation (Cont'd)

Figure 20-41-20



NOTE: Access the head of the bolt (Item 1) [Figure 20-41-20] through the right console in the cab to loosen the nut (Item 2) [Figure 20-41-19].

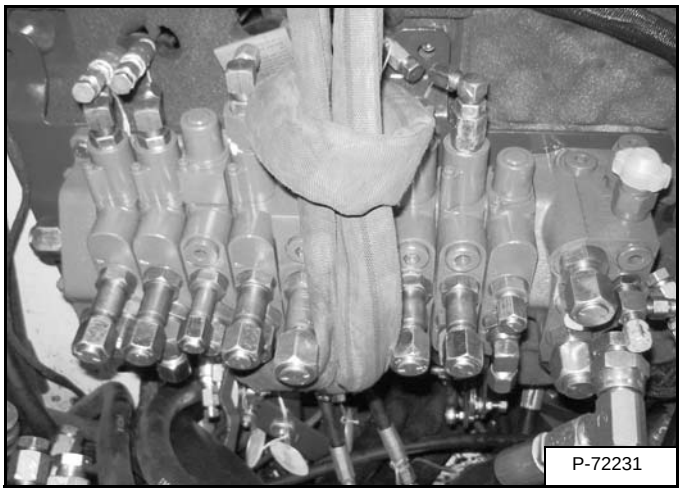
Figure 20-41-21



Install a sling (Item 1) **[Figure 20-41-21]** around the control valve and connect to a chain hoist.

Remove the nuts (Item 2) **[Figure 20-41-21]**, flat washers, and rubber washers.

Figure 20-41-22

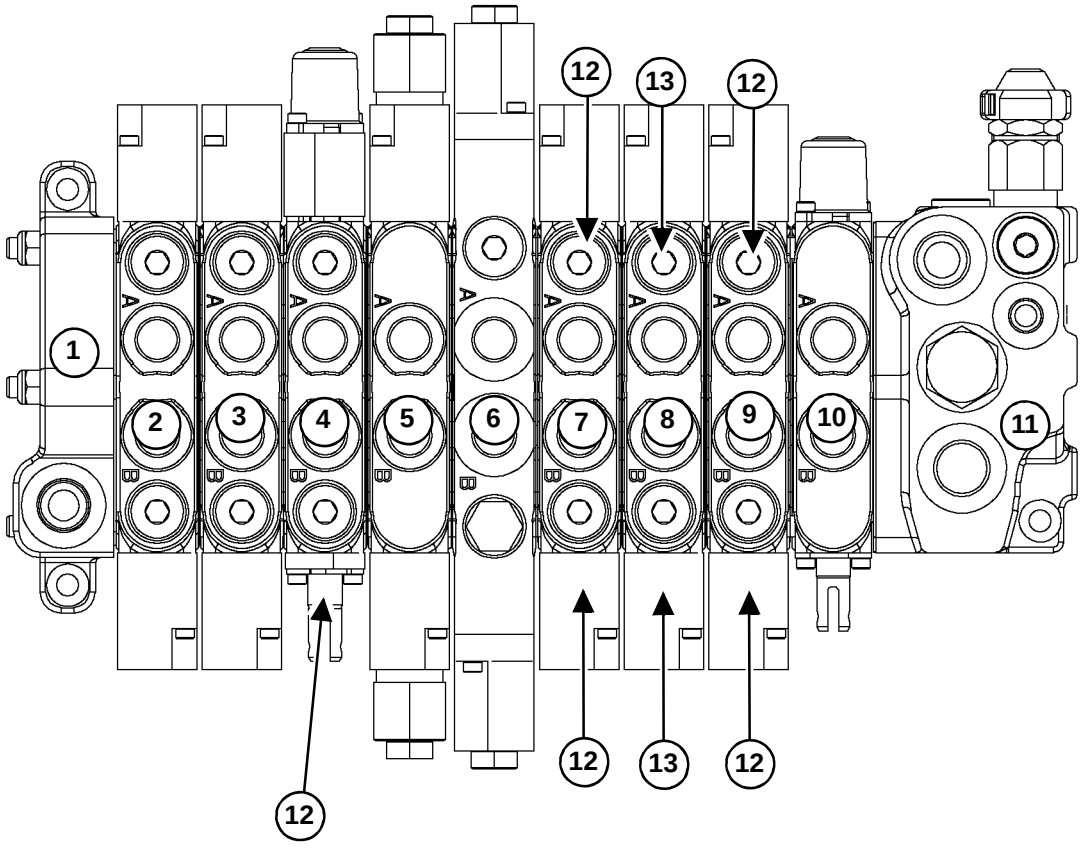


Raise the hoist and remove the control valve from the Excavator **[Figure 20-41-22]**.

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Parts Identification

1. **Outlet Section**
2. **Right Travel Section**
3. **Left Travel Section**
4. **Blade Section**
5. **Slew Section**
6. **Auxiliary Section**
7. **Bucket Section**
8. **Arm Section**
9. **Boom Section**
10. **Boom Swing Section**
11. **Inlet Section**
12. **Port Relief 3915 PSI (270 Bar)**
13. **Port Relief 3625 PSI (250 Bar)**



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Disassembly

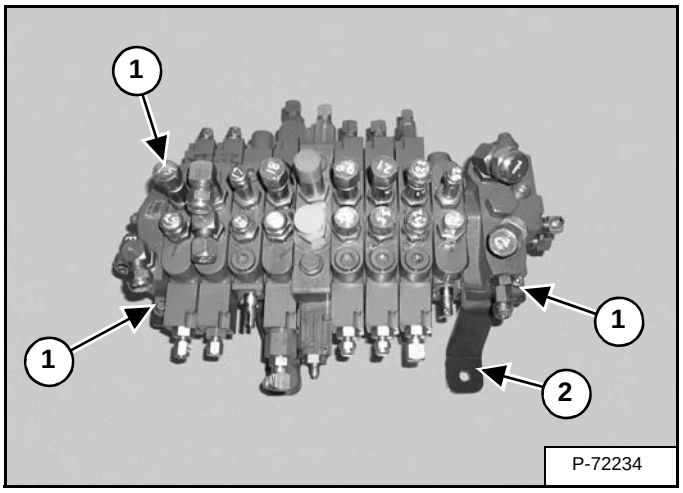
Clean the outside of the control valve before disassembly.

IMPORTANT

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

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Figure 20-41-23

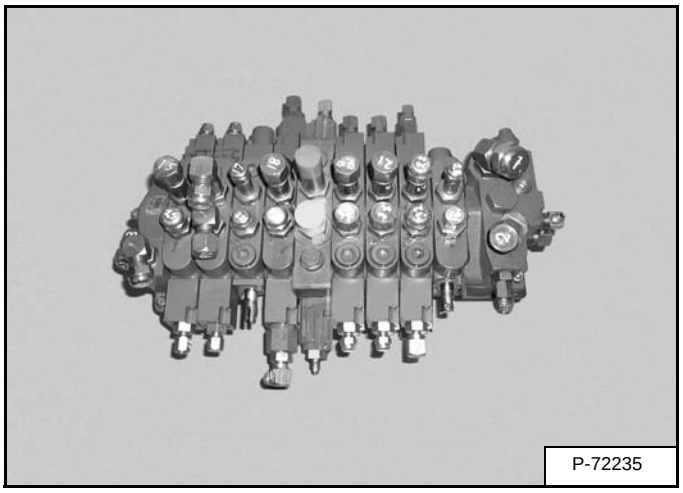


Remove the bolts (Item 1) from the mount plate (Item 2) **[Figure 20-41-23]**.

Remove the mount plate from the control valve.

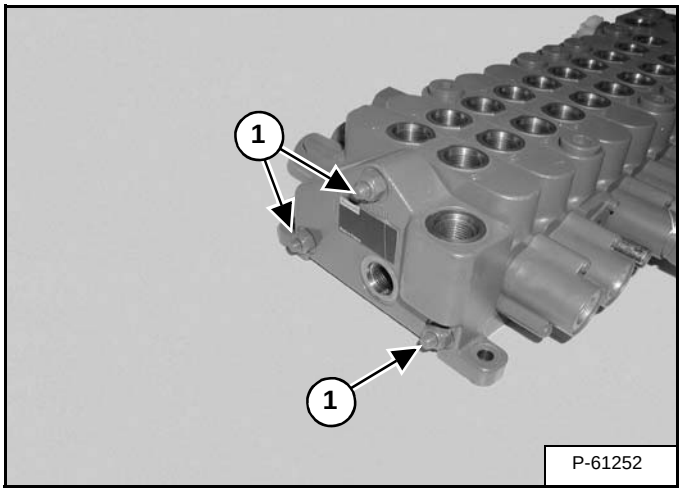
Mark all of the sections of the control valve for proper installation.

Figure 20-41-24



Remove the fittings **[Figure 20-41-24]**.

Figure 20-41-25

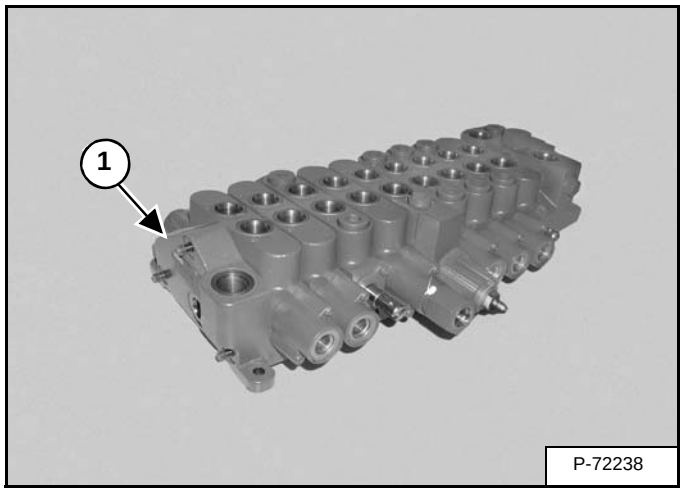


Remove the nuts (Item 1) **[Figure 20-41-25]** and washers.

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Disassembly (Cont'd)

Figure 20-41-26

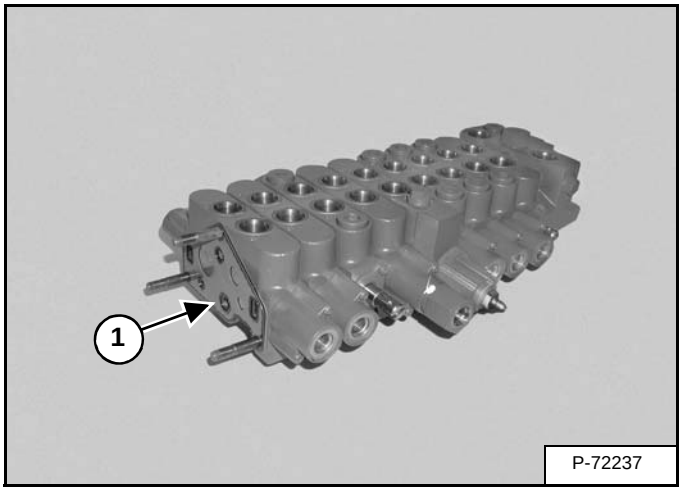


Remove the end cap (Item 1) **[Figure 20-41-26]** from the control valve.

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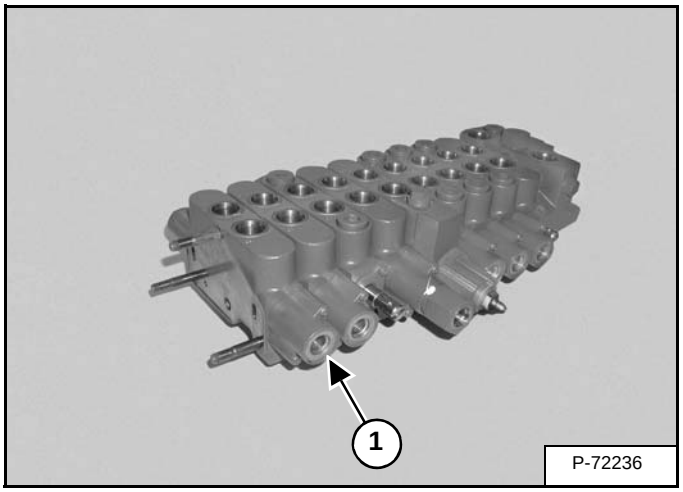
Right Travel Valve Section Disassembly And Assembly

Figure 20-41-27



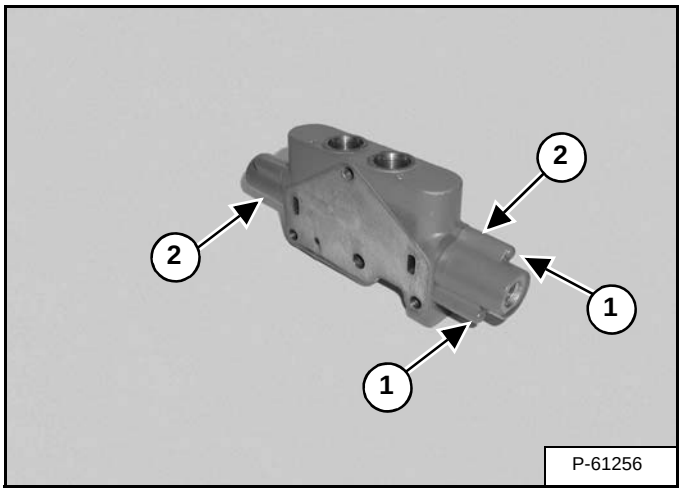
Remove the gasket (Item 1) **[Figure 20-41-27]** from the valve section.

Figure 20-41-28



Remove the right travel valve section (Item 1) **[Figure 20-41-28]** from the control valve.

Figure 20-41-29

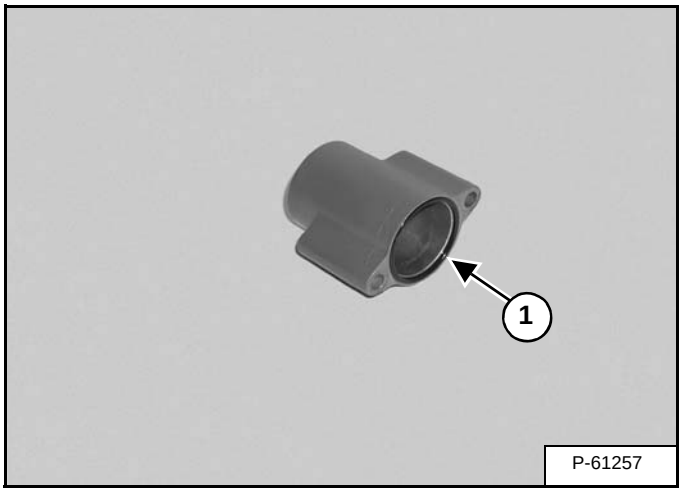


Remove the screws (Item 1) from both end caps (Item 2) **[Figure 20-41-29]**.

Installation: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

Remove the end caps from the valve section.

Figure 20-41-30

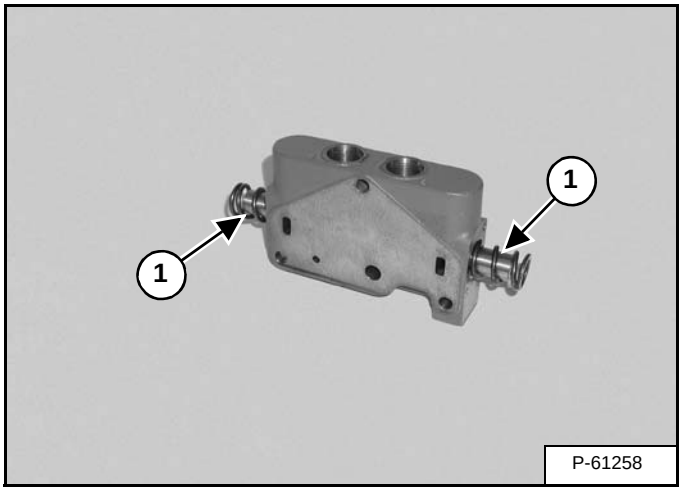


Remove the O-ring (Item 1) **[Figure 20-41-30]** from the end caps.

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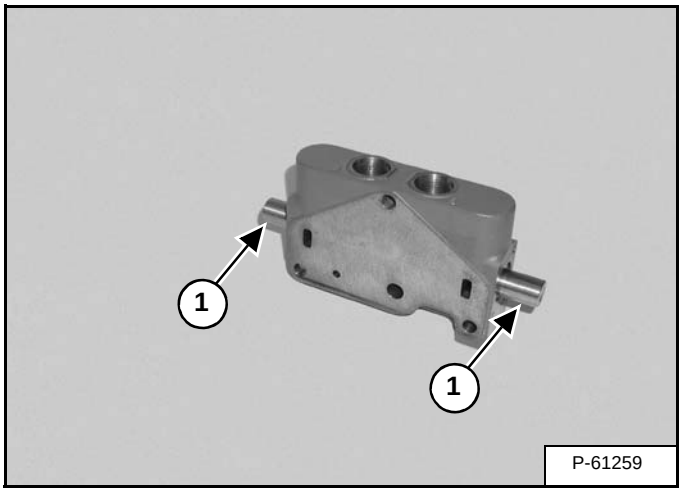
Right Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-31



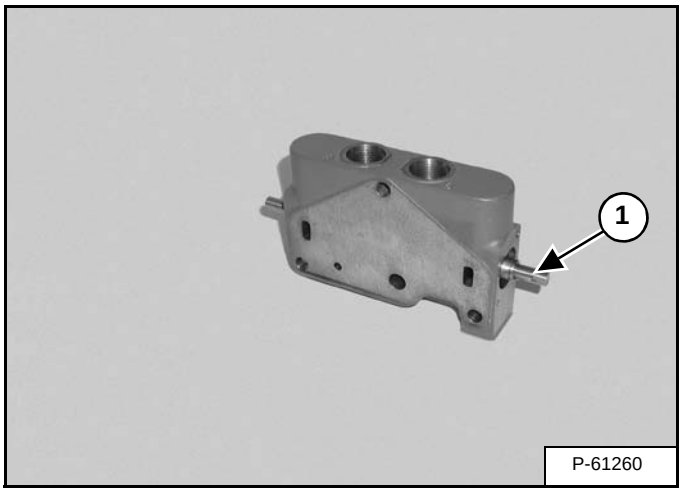
Remove the centering springs (Item 1) **[Figure 20-41-31]** from the spring guides.

Figure 20-41-32



Remove the spring guides (Item 1) **[Figure 20-41-32]** from both ends of the valve spool.

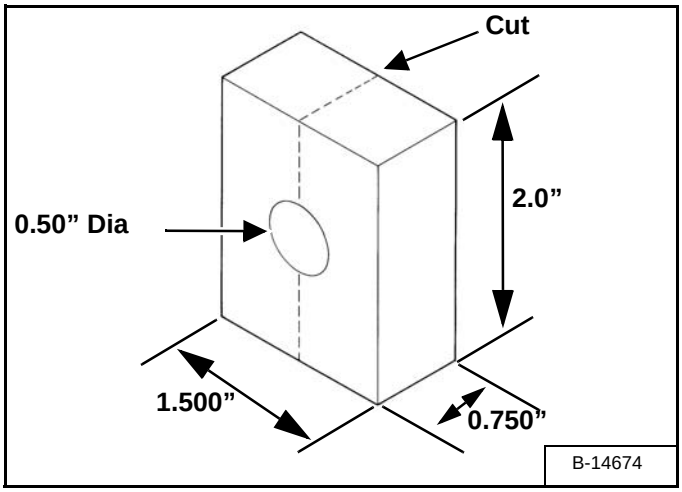
Figure 20-41-33



Record the orientation of the spool (Item 1) **[Figure 20-41-33]**. Remove the spool (Item 1) from the valve section.

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

Figure 20-41-34



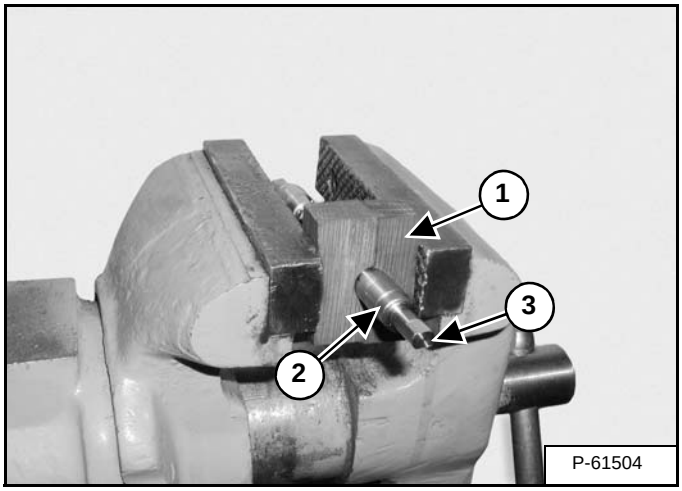
To remove the plugs from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.500 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-41-34]**.

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

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

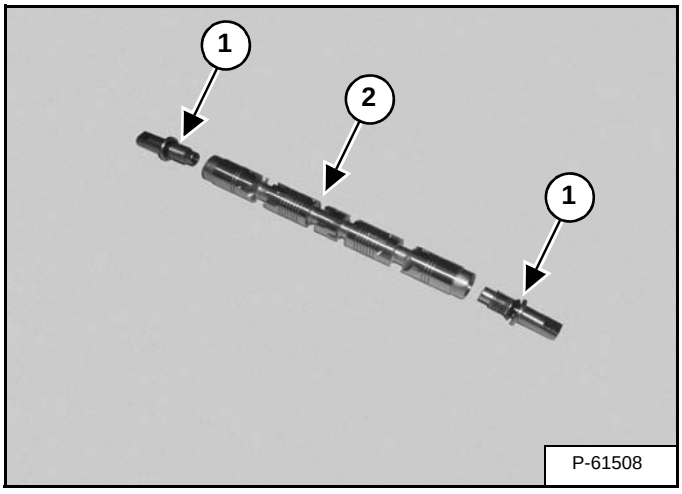
Figure 20-41-35



Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the plugs (Item 3) **[Figure 20-41-35]**.

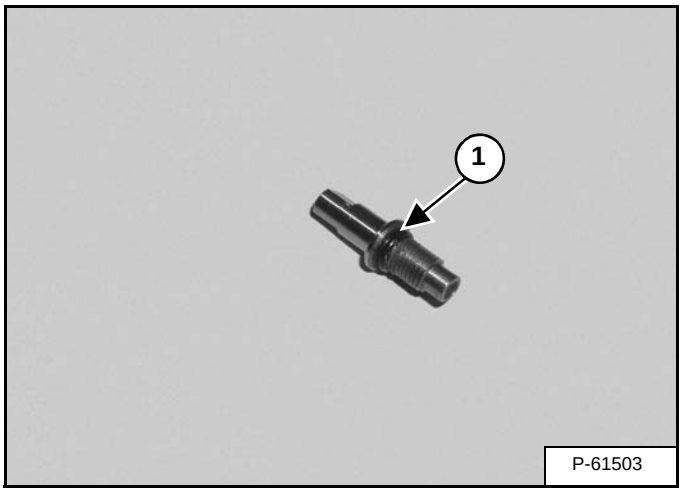
Installation: Apply thread lock adhesive (Loctite 262) or equivalent to the threads. Tighten the plugs to 44 in.-lbs. (5 Nm) torque.

Figure 20-41-36



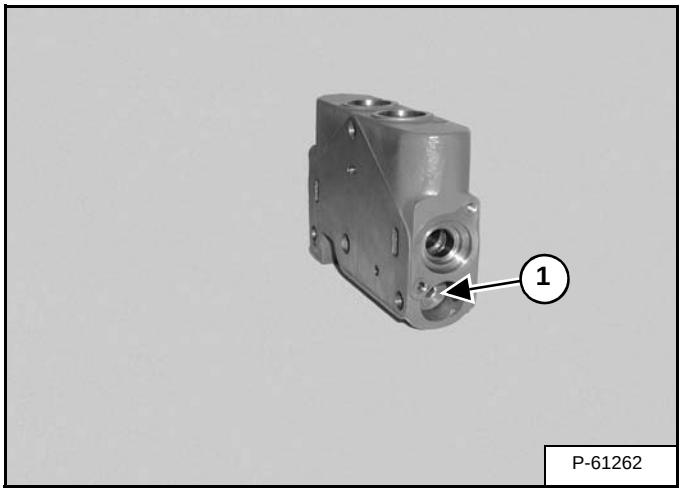
Remove the plugs (Item 1) from the spool (Item 2) **[Figure 20-41-36]**.

Figure 20-41-37



Remove the O-ring (Item 1) **[Figure 20-41-37]** from the plugs.

Figure 20-41-38



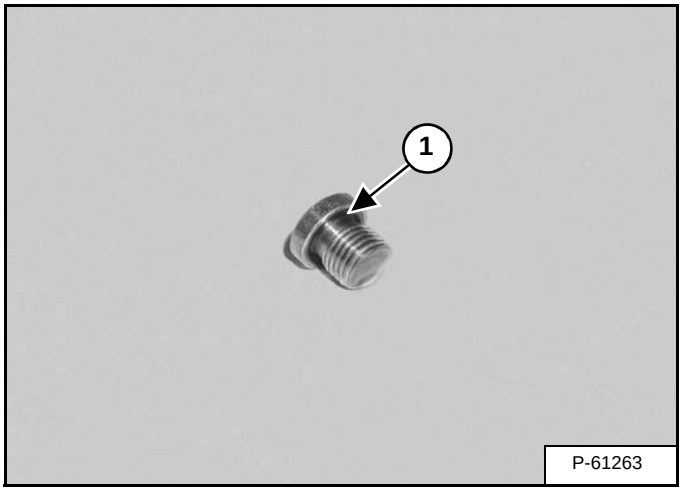
Remove the plug (Item 1) **[Figure 20-41-38]** from the valve section.

Installation: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

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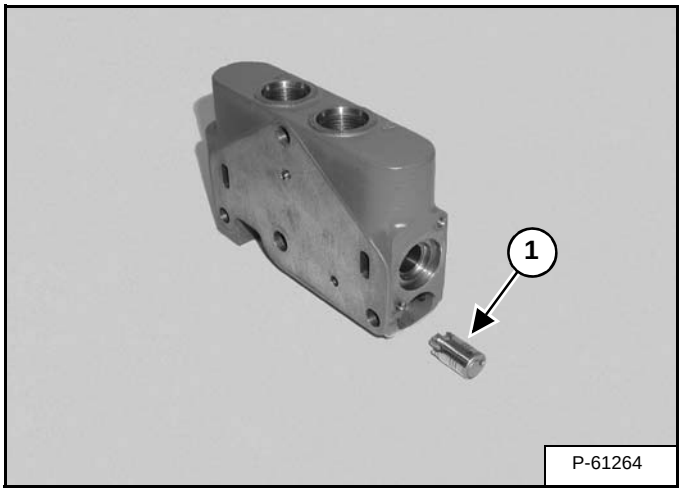
Right Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-39



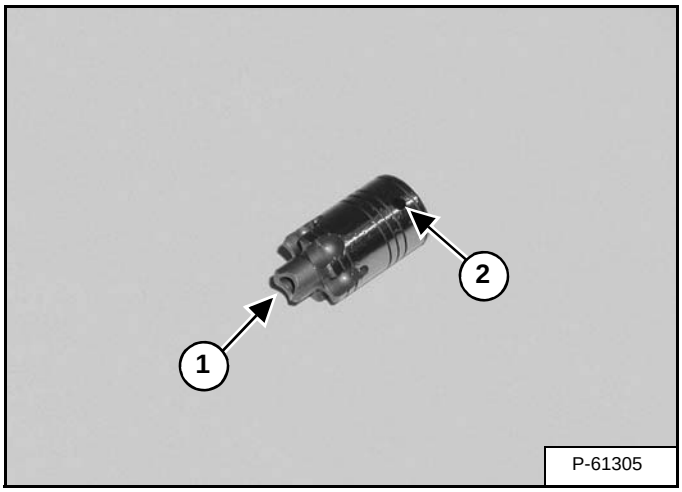
Remove the O-ring (Item 1) **[Figure 20-41-39]** from the plug.

Figure 20-41-40



Remove the compensator (Item 1) **[Figure 20-41-40]** from the valve section.

Figure 20-41-41



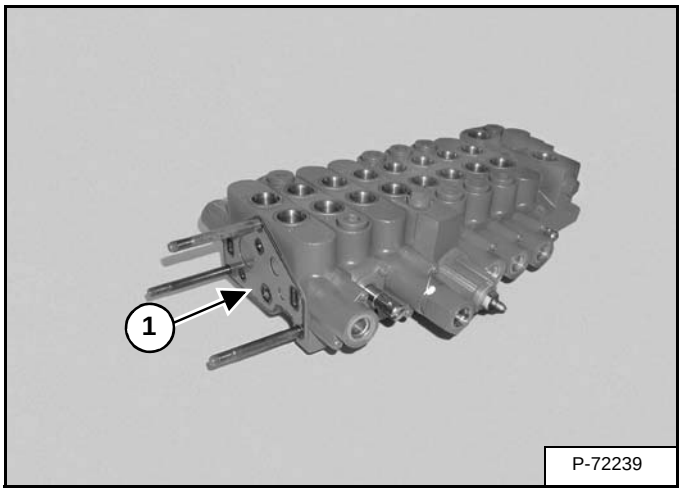
Check the orifice (Item 1) **[Figure 20-41-41]** in the compensator to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-41-41]** to be sure it is not plugged.

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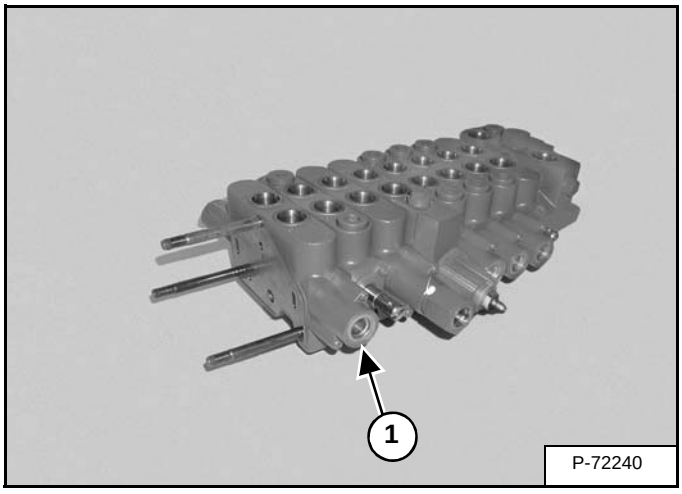
Left Travel Valve Section Disassembly And Assembly

Figure 20-41-42



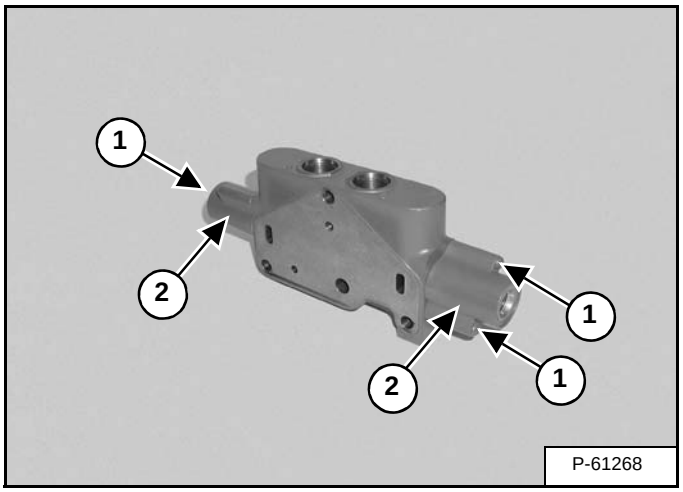
Remove the gasket (Item 1) **[Figure 20-41-42]** from the valve section.

Figure 20-41-43



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

Figure 20-41-44

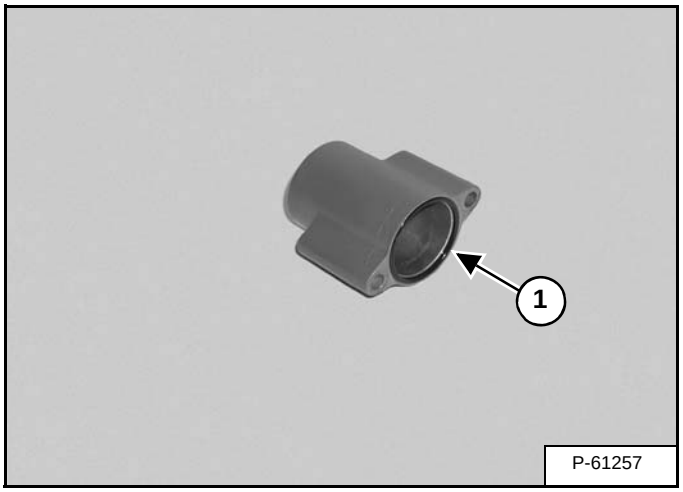


Remove the screws (Item 1) from both end caps (Item 2) **[Figure 20-41-44]**.

Installation: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

Remove the end caps from the valve section.

Figure 20-41-45

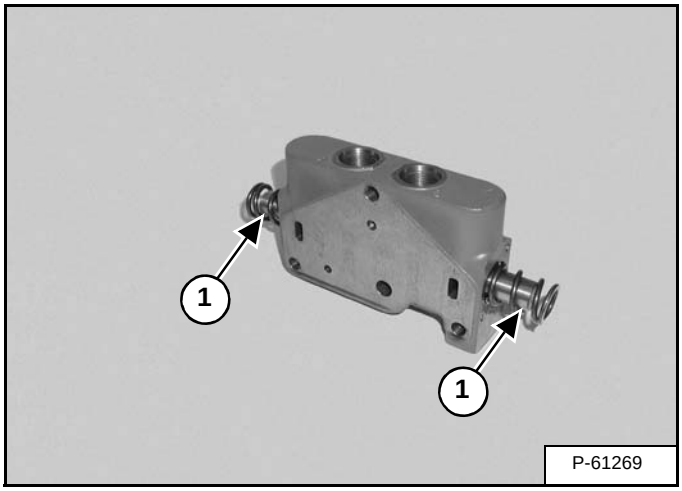


Remove the O-ring (Item 1) **[Figure 20-41-45]** from the end caps.

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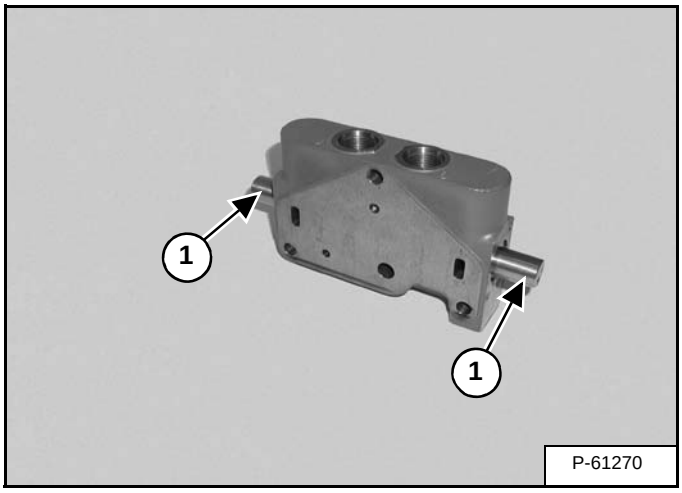
Left Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-46



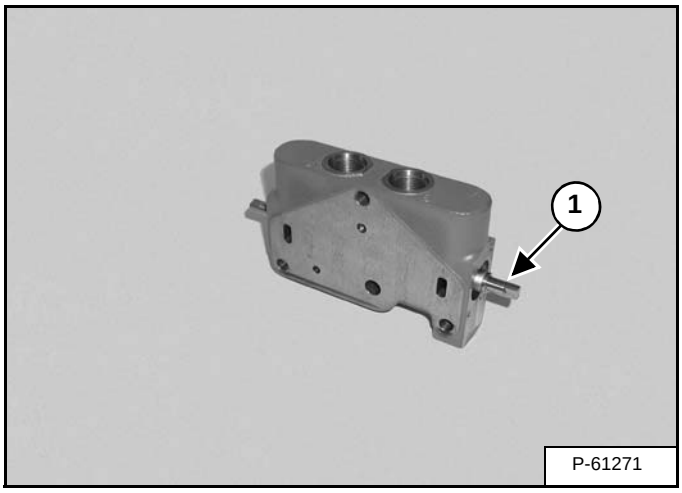
Remove the centering springs (Item 1) **[Figure 20-41-46]** from the spring guides.

Figure 20-41-47



Remove the spring guides (Item 1) **[Figure 20-41-47]** from both ends of the valve spool.

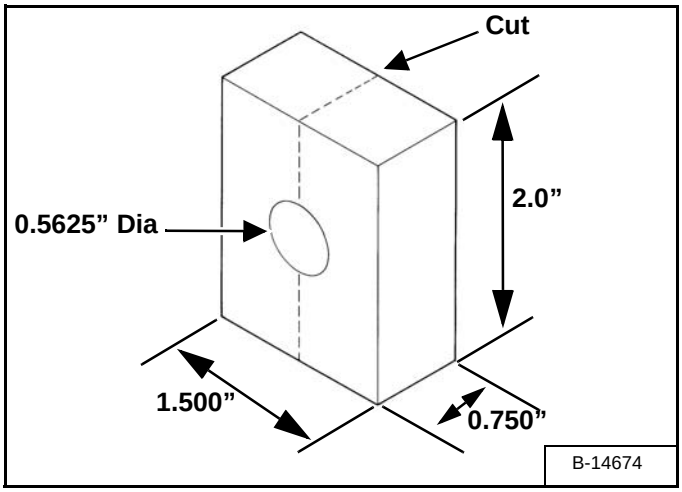
Figure 20-41-48



Record the orientation of the spool (Item 1) **[Figure 20-41-48]**. Remove the spool from the valve section.

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

Figure 20-41-49



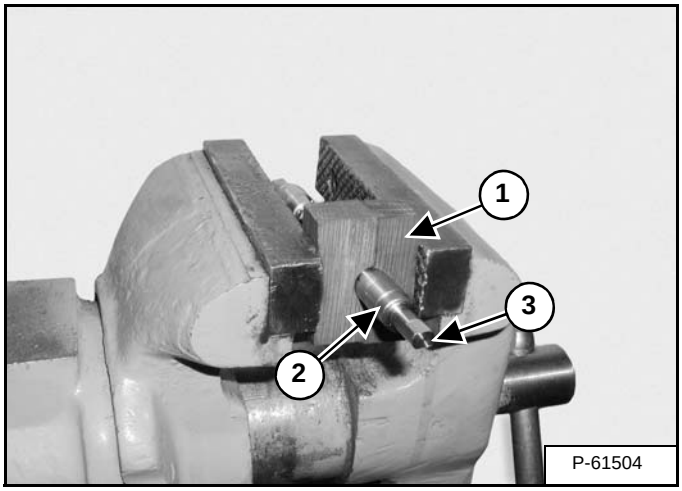
To remove the plugs from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.500 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-41-49]**.

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

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

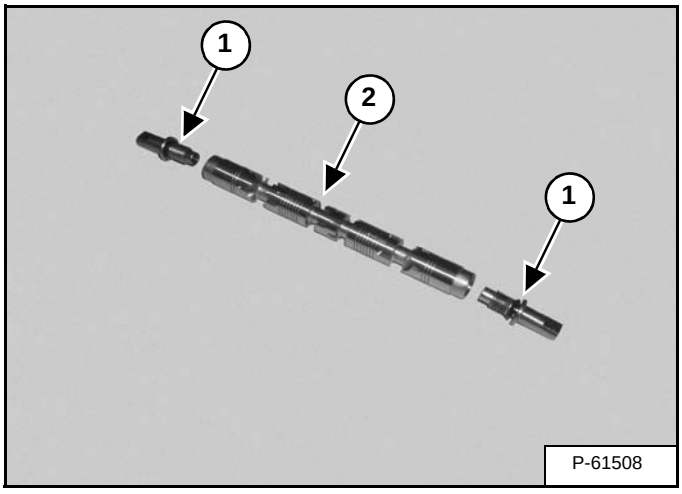
Figure 20-41-50



Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the plugs (Item 3) **[Figure 20-41-50]**.

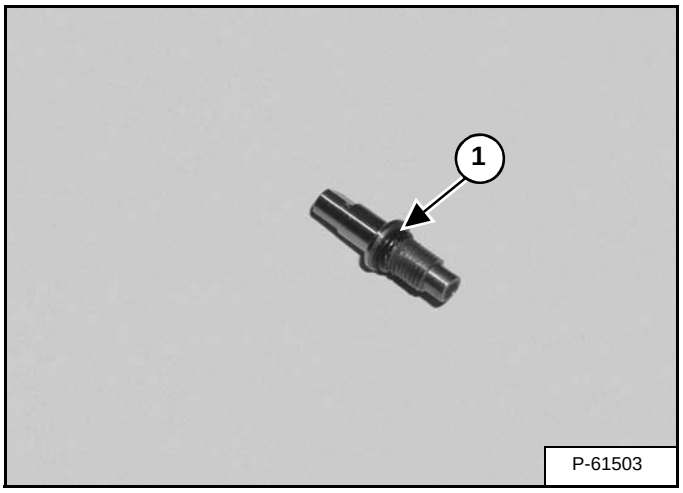
Installation: Apply thread lock adhesive (Loctite 262) or equivalent to the threads. Tighten the plugs to 44 in.-lbs. (5 Nm) torque.

Figure 20-41-51



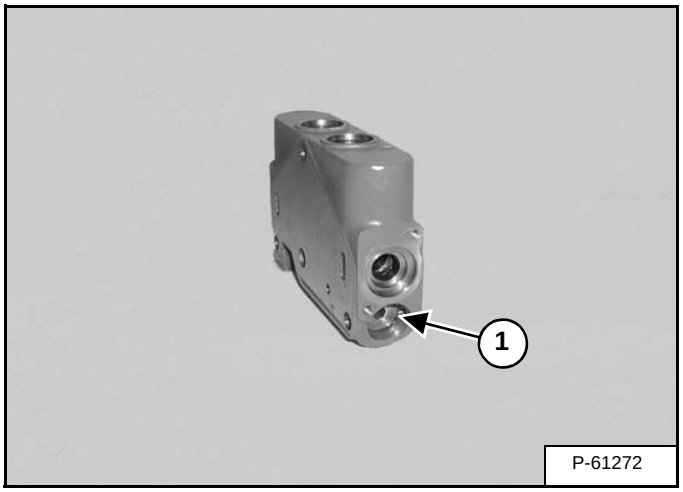
Remove the plugs (Item 1) from the spool (Item 2) **[Figure 20-41-51]**.

Figure 20-41-52



Remove the O-ring (Item 1) **[Figure 20-41-52]** from the plugs.

Figure 20-41-53



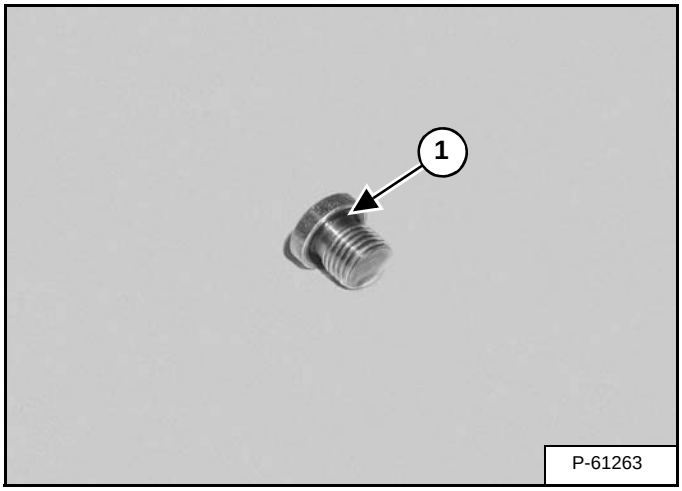
Remove the plug (Item 1) **[Figure 20-41-53]** from the valve section.

Installation: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

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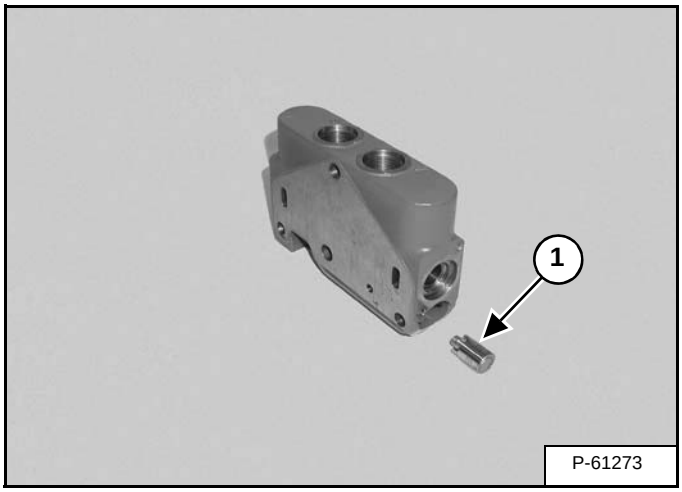
Left Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-54



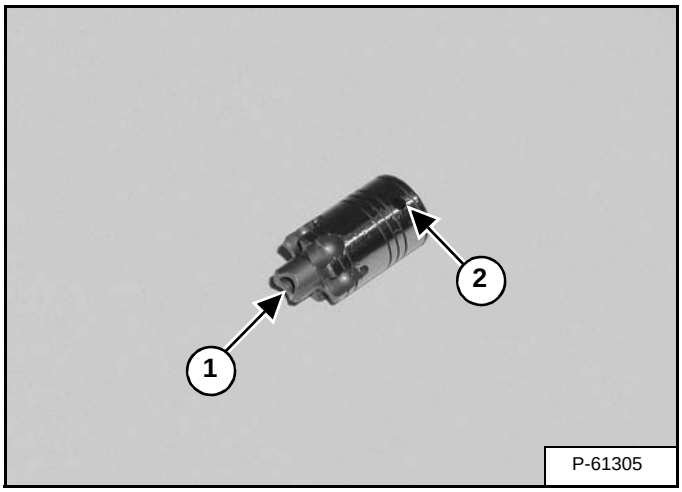
Remove the O-ring (Item 1) **[Figure 20-41-54]** from the plug.

Figure 20-41-55



Remove the compensator (Item 1) **[Figure 20-41-55]** from the valve section.

Figure 20-41-56



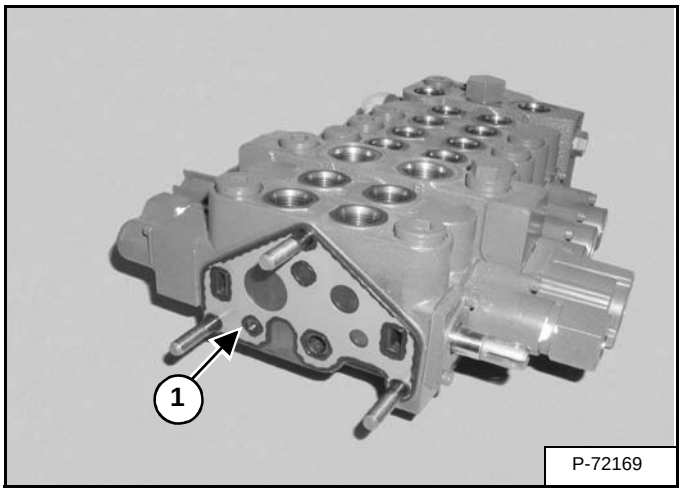
Check the orifice (Item 1) **[Figure 20-41-56]** in the compensator to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-41-56]** to be sure it is not plugged.

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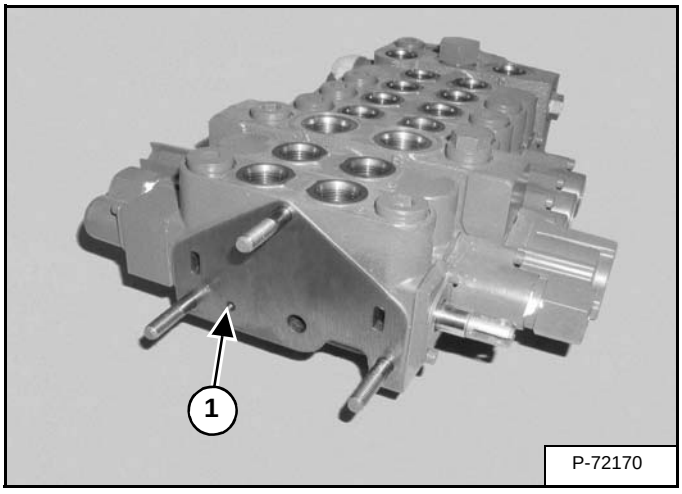
Blade Valve Section Disassembly And Assembly

Figure 20-41-57



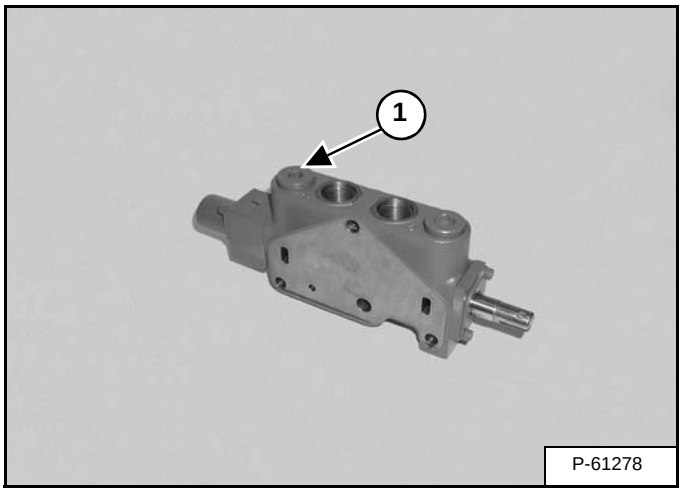
Remove the gasket (Item 1) **[Figure 20-41-57]** from the valve section.

Figure 20-41-58



Remove blade valve section (Item 1) **[Figure 20-41-58]** from the control valve.

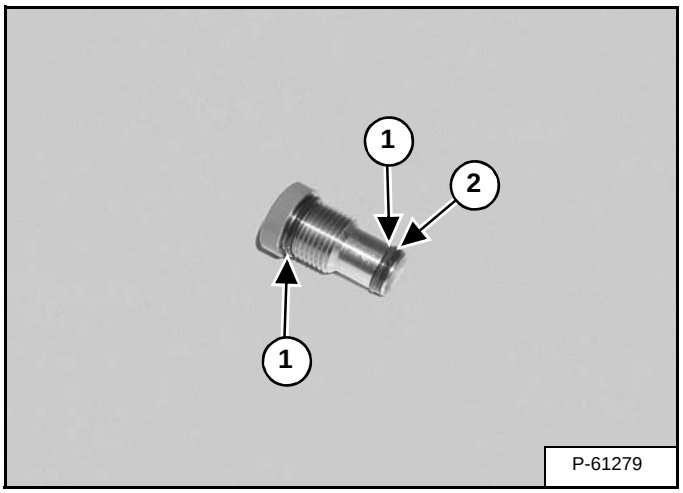
Figure 20-41-59



Remove the plug (Item 1) **[Figure 20-41-59]**.

Installation: Tighten the plug to 22-26 ft.-lbs. (30-35 Nm)

Figure 20-41-60

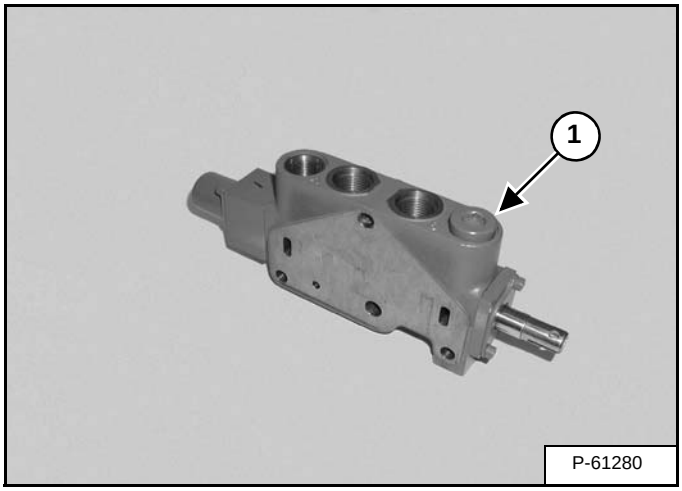


Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-41-60]** from the plug.

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Blade Valve Section Disassembly And Assembly (Cont'd)

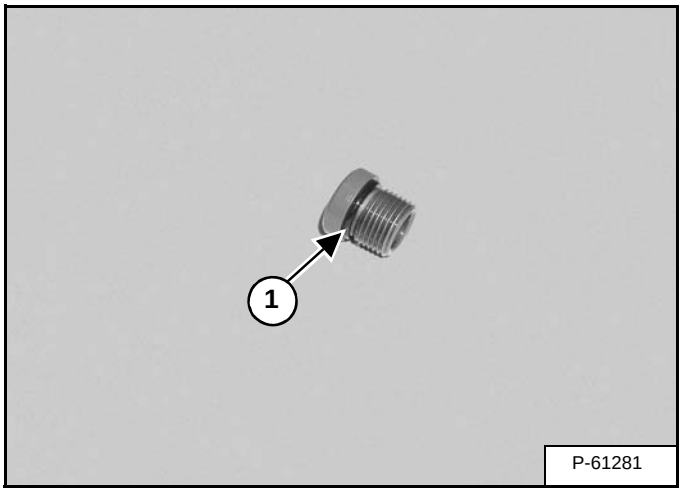
Figure 20-41-61



Remove the plug (Item 1) **[Figure 20-41-61]** from the port relief valve.

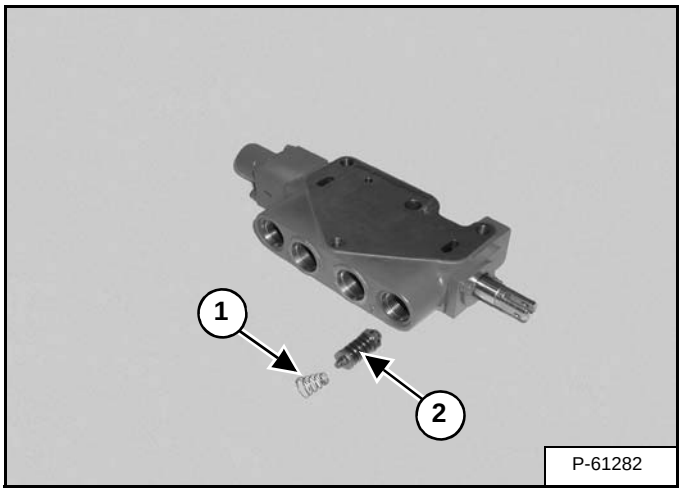
Installation: Tighten the plug to 22-26 ft.-lbs. (30-35 Nm) torque.

Figure 20-41-62



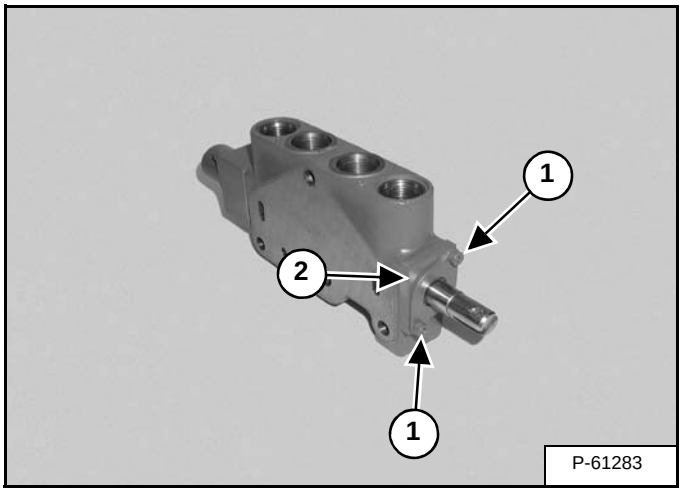
Remove the O-ring (Item 1) from the plug **[Figure 20-41-62]**.

Figure 20-41-63



Remove the spring (Item 1) and valve assembly (Item 2) **[Figure 20-41-63]**.

Figure 20-41-64



Remove the screws (Item 1) from the valve spool retainer (Item 2) **[Figure 20-41-64]**.

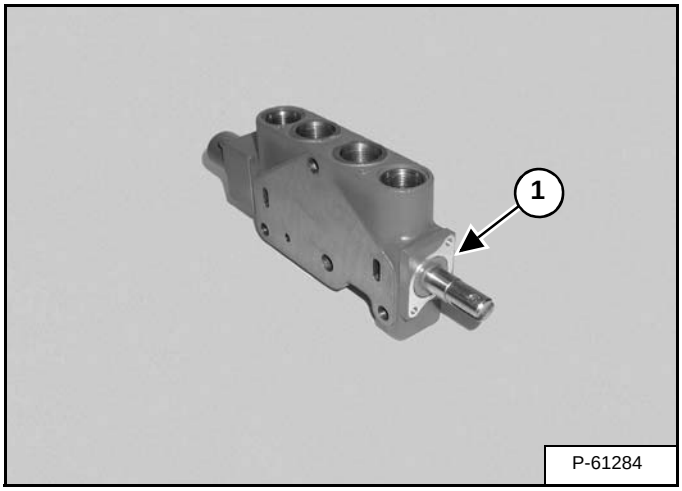
Installation: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

Remove the retainer.

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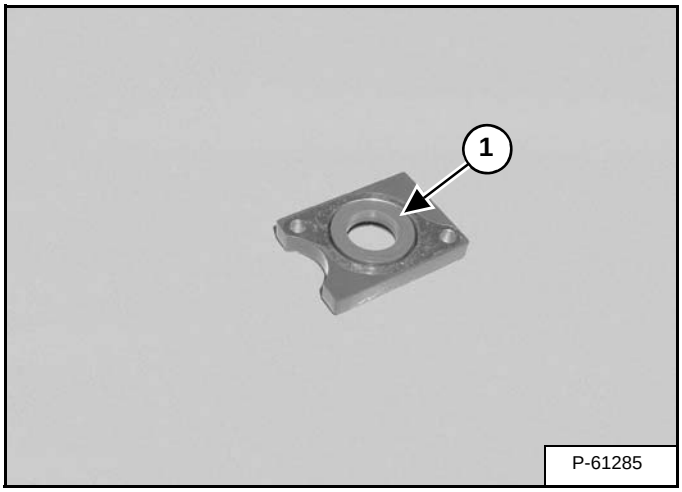
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-65



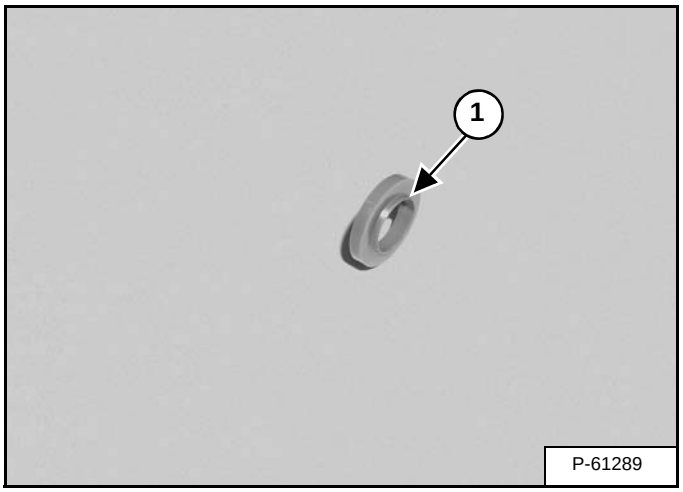
Remove the seal carrier (Item 1) **[Figure 20-41-65]**.

Figure 20-41-66



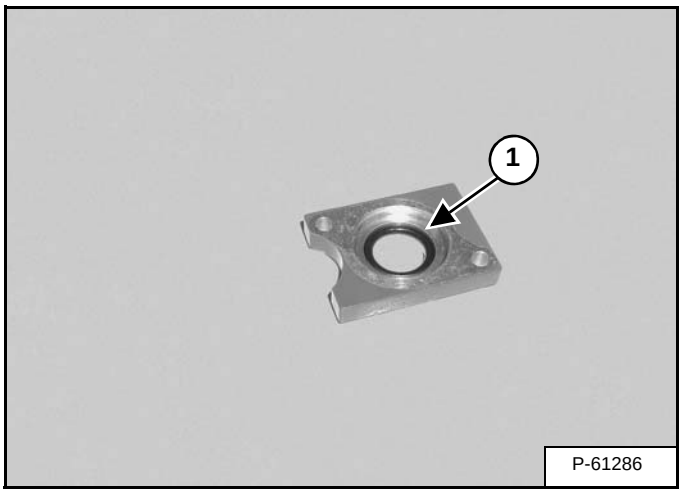
Remove the seal (Item 1) **[Figure 20-41-66]** from the seal carrier.

Figure 20-41-67



Assembly: Install the seal on the spool with the flange (Item 1) **[Figure 20-41-67]** toward the outside of the valve section.

Figure 20-41-68

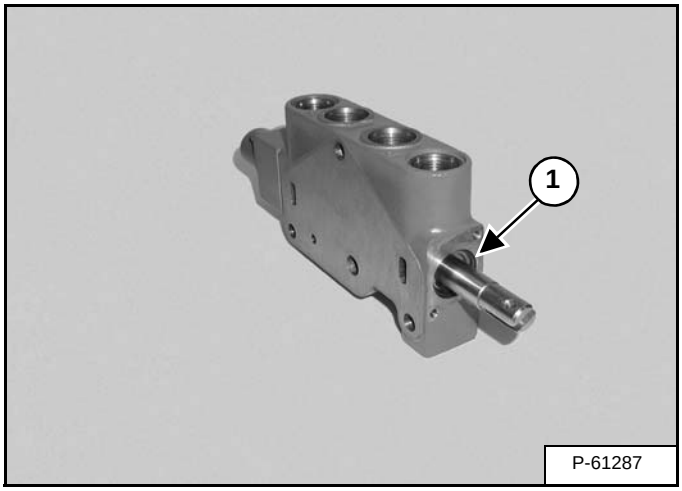


Remove the O-ring (Item 1) **[Figure 20-41-68]**.

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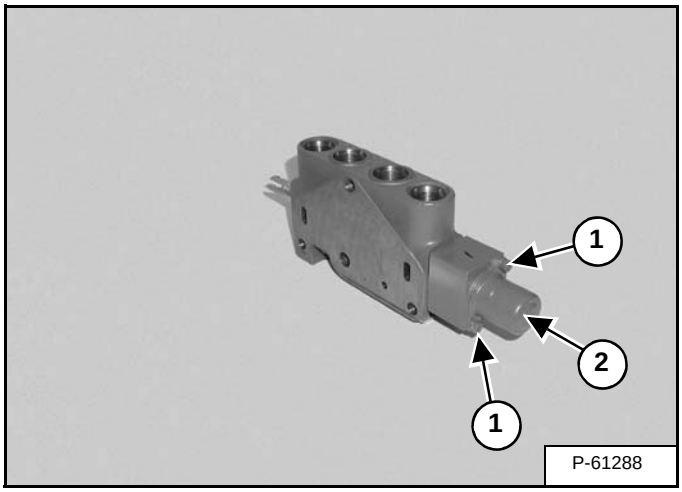
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-69



Remove the O-ring (Item 1) **[Figure 20-41-69]** from the valve section.

Figure 20-41-70



Remove the screws (Item 1) from the end cap (Item 2) **[Figure 20-41-70]**.

Installation: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

Remove the end cap.

IMPORTANT

The detent assembly has small springs and balls. Do not lose these parts during disassembly and assembly.

I-2012-0284

Figure 20-41-71

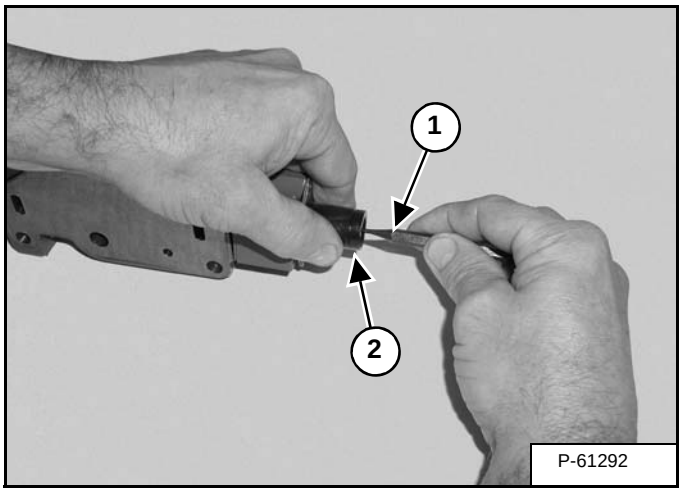
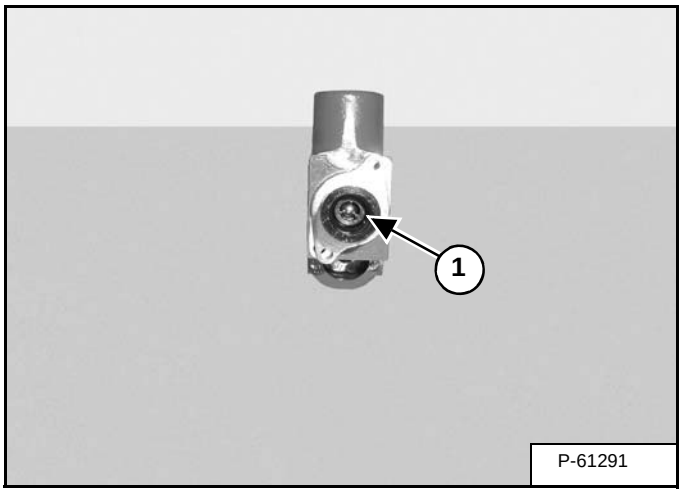


Figure 20-41-72



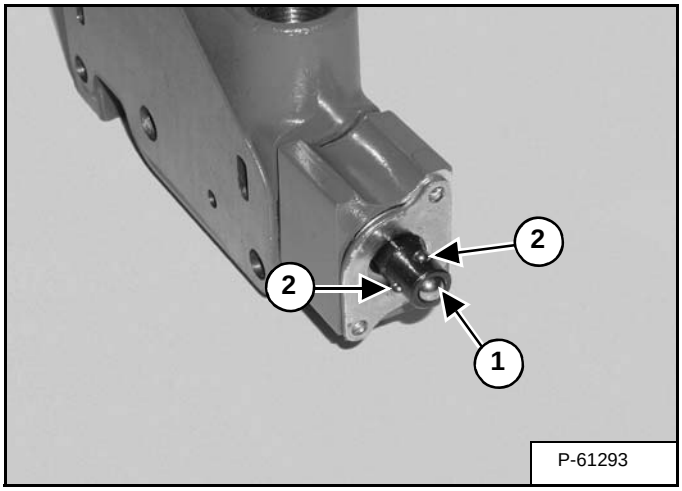
Using a brass drift (Item 1) **[Figure 20-41-71]** press in on the center ball (Item 1) **[Figure 20-41-72]**.

Continue to press in on the ball and remove the detent sleeve (Item 2) **[Figure 20-41-71]**.

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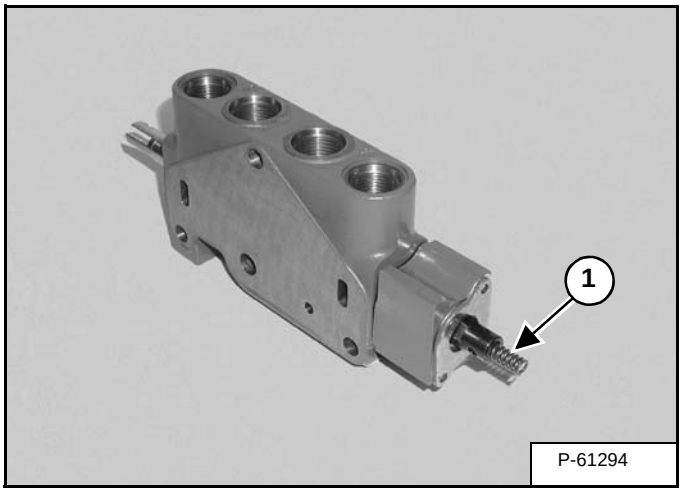
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-73



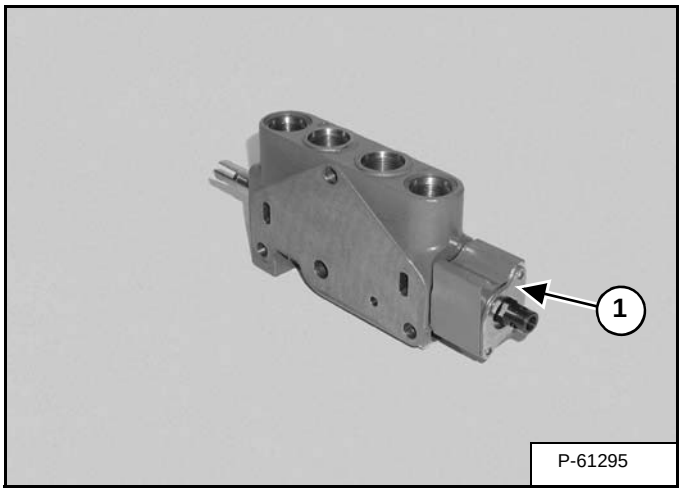
Remove the center ball (Item 1) and three detent balls (Item 2) **[Figure 20-41-73]**.

Figure 20-41-74



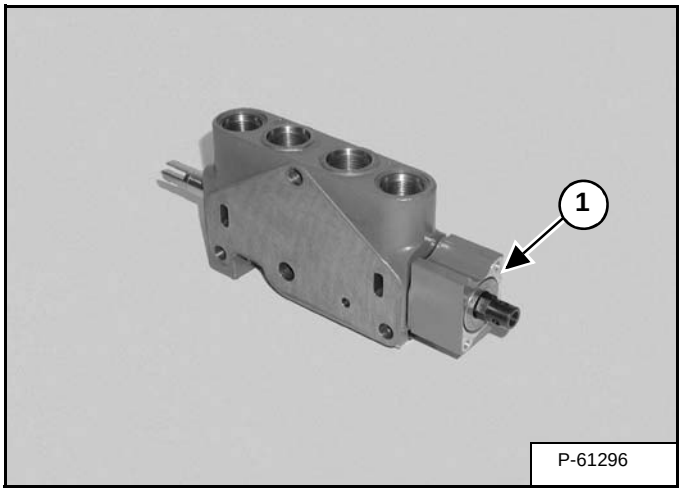
Remove the spring (Item 1) **[Figure 20-41-74]**.

Figure 20-41-75



Remove the retainer (Item 2) **[Figure 20-41-75]**.

Figure 20-41-76

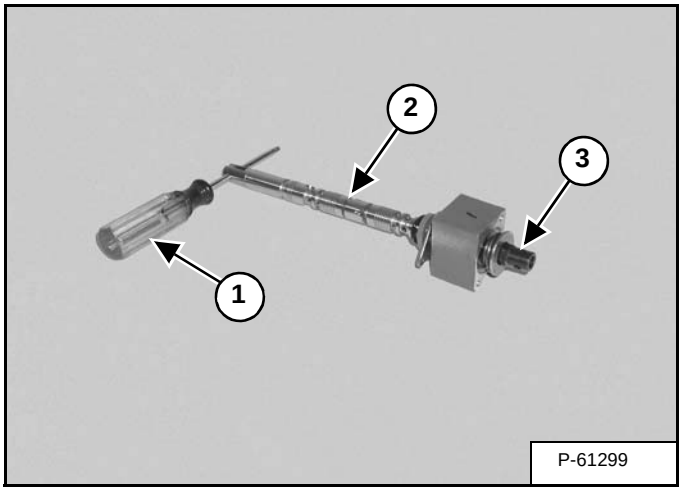


Remove the spool assembly (Item 1) **[Figure 20-41-76]**.

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Blade Valve Section Disassembly And Assembly (Cont'd)

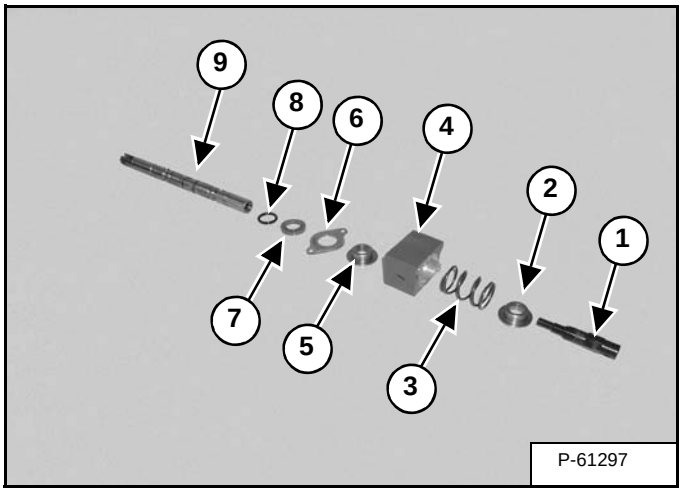
Figure 20-41-77



Using a screwdriver (Item 1) to hold the spool (Item 2) loosen the detent ball retainer (Item 3) **[Figure 20-41-77]**.

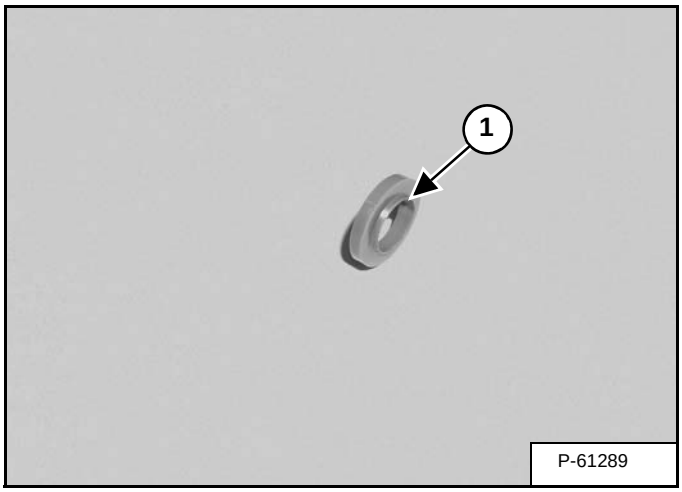
Installation: Apply thread lock adhesive (Loctite 242) or equivalent to the threads. Tighten the detent ball retainer to 44 in.-lbs. (5 Nm) torque.

Figure 20-41-78



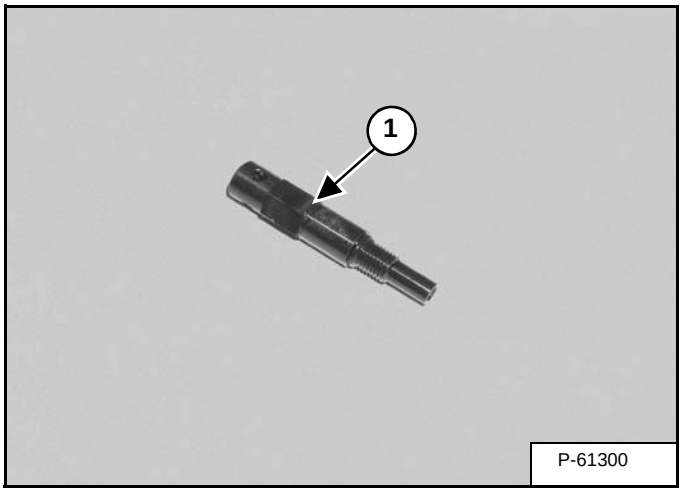
Remove the detent ball retainer (Item 1), spring retainer (Item 2), spring (Item 3), housing (Item 4), spring retainer (Item 5), retainer (Item 6), seal (Item 7) and O-ring (Item 8) from the spool (Item 9) **[Figure 20-41-78]**.

Figure 20-41-79



Assembly: Install the seal on the spool with the flange (Item 1) **[Figure 20-41-79]** toward the outside of the valve section.

Figure 20-41-80

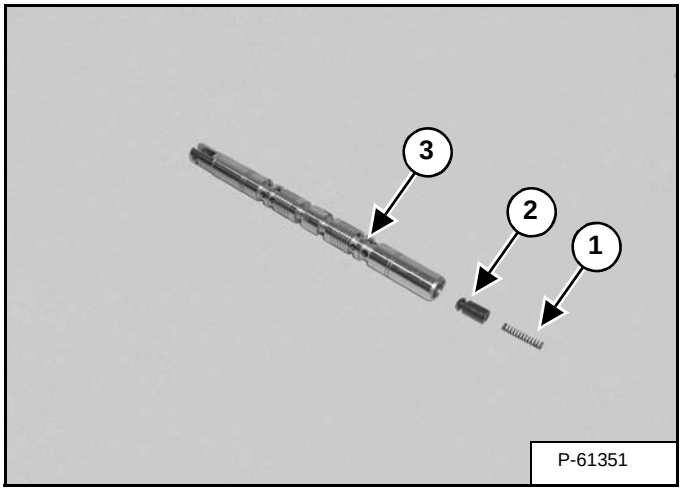


Remove the O-ring (Item 1) **[Figure 20-41-80]** from the detent ball retainer.

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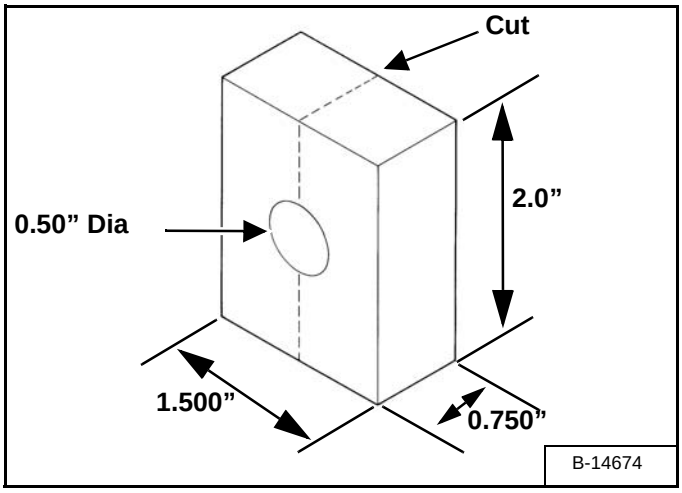
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-81



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

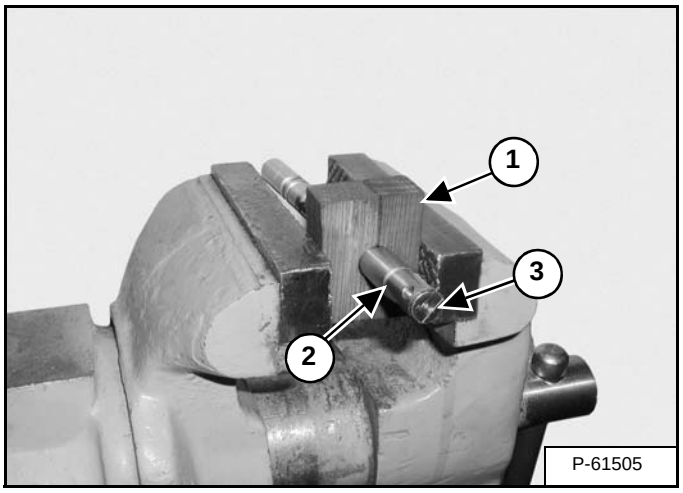
Figure 20-41-82



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

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

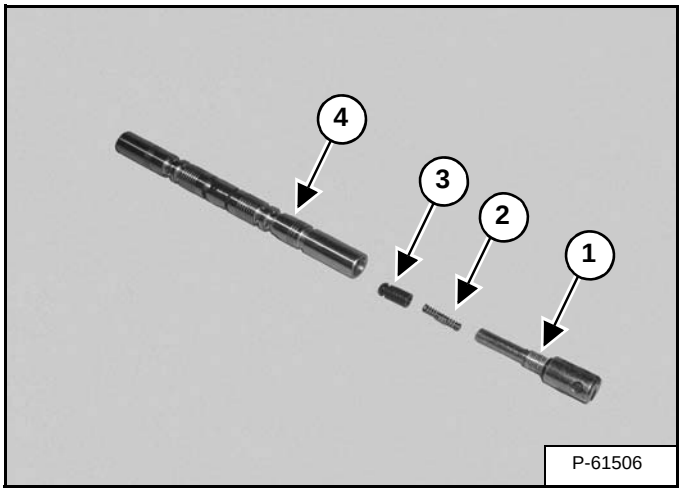
Figure 20-41-83



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

Installation: Apply thread lock adhesive (Loctite 242) or equivalent to the threads. Tighten the linkage end to 44 in.-lbs. (5 Nm) torque.

Figure 20-41-84

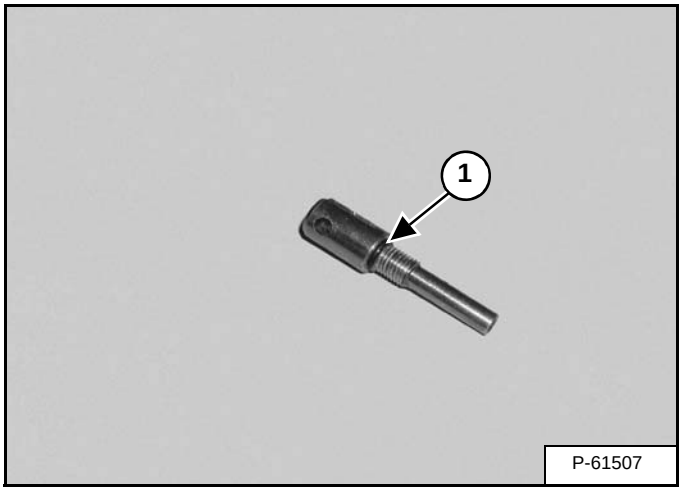


Remove the linkage end (Item 1), spring (Item 2), and poppet (Item 3) from the spool (Item 4) **[Figure 20-41-84]**.

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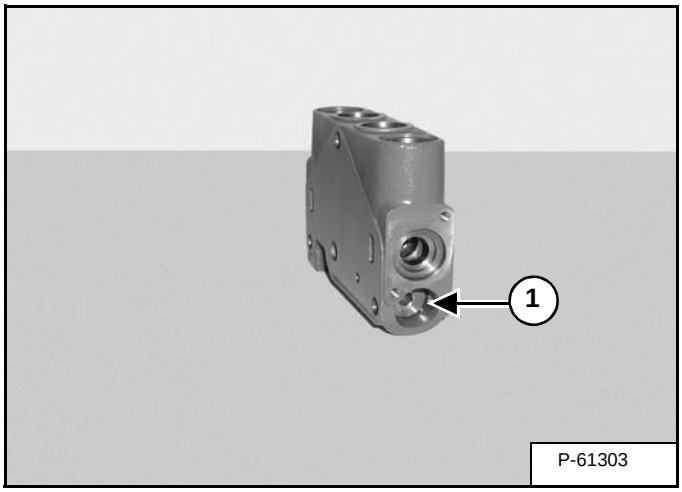
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-85



Remove the O-ring (Item 1) **[Figure 20-41-85]** from the linkage end.

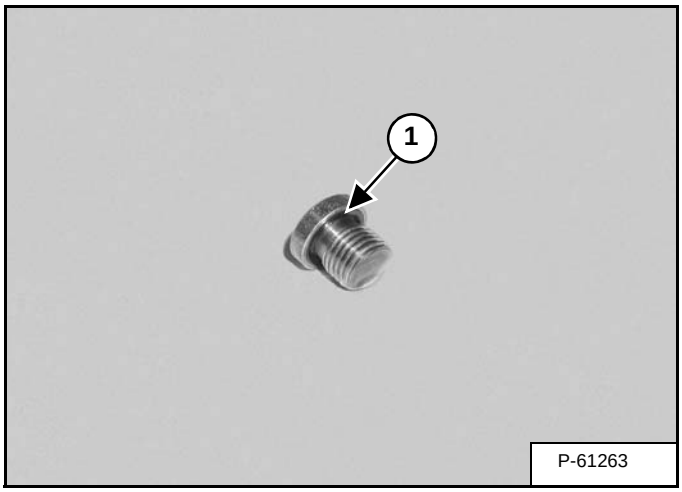
Figure 20-41-86



Remove the plug (Item 1) **[Figure 20-41-86]** from the valve section.

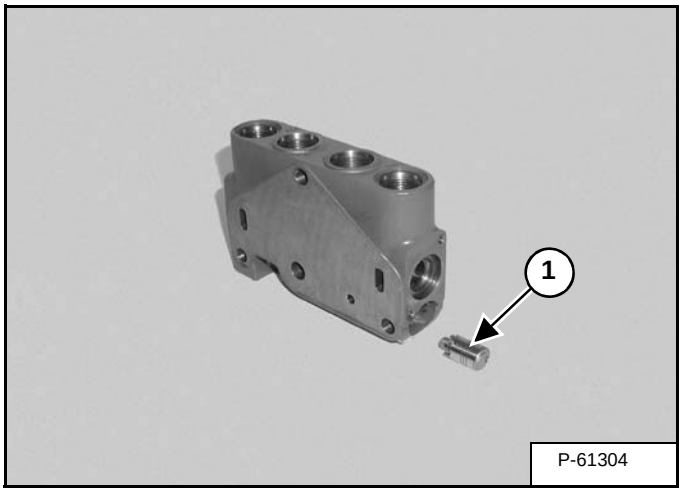
Installation: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

Figure 20-41-87



Remove the O-ring (Item 1) **[Figure 20-41-87]** from the plug.

Figure 20-41-88

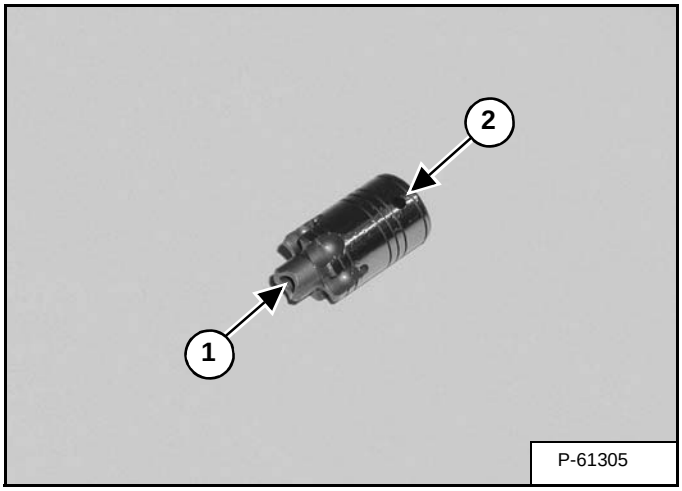


Remove the compensator (Item 1) **[Figure 20-41-88]** from the valve section.

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Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-89



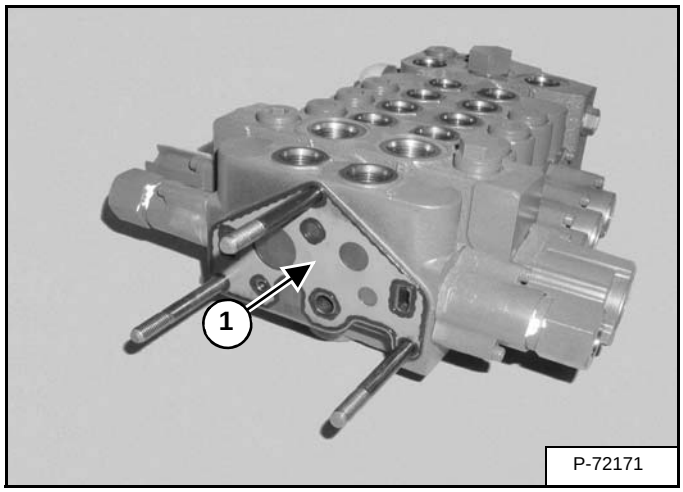
Check the orifice (Item 1) **[Figure 20-41-89]** in the compensator to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-41-89]** to be sure it is not plugged.

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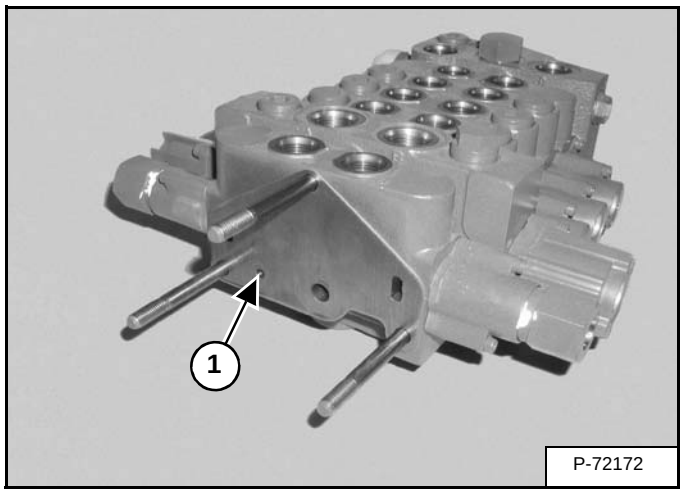
Slew Valve Section Disassembly And Assembly

Figure 20-41-90



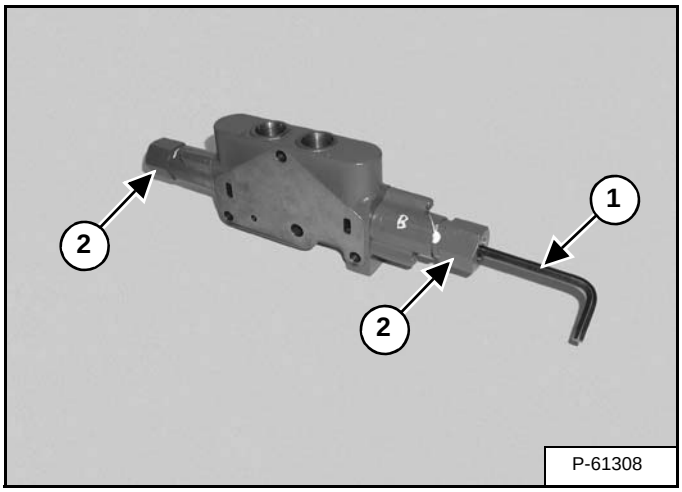
Remove the gasket (Item 1) **[Figure 20-41-90]** from the valve section.

Figure 20-41-91



Remove the slew valve section (Item 1) **[Figure 20-41-91]** from the control valve.

Figure 20-41-92



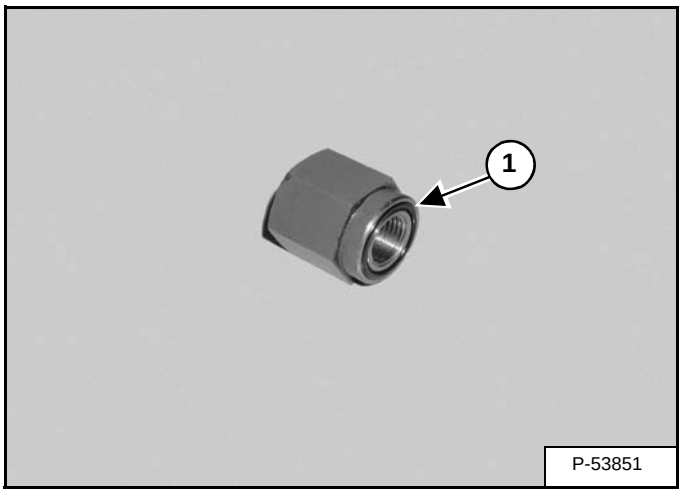
Install a hex wrench (Item 1) **[Figure 20-41-92]** to hold the spool limiter.

Remove the nut (Item 2) **[Figure 20-41-92]**.

Repeat the procedure on the opposite end of the valve section.

Installation: Tighten the nut to 22 ft.-lbs. (30 Nm) torque.

Figure 20-41-93

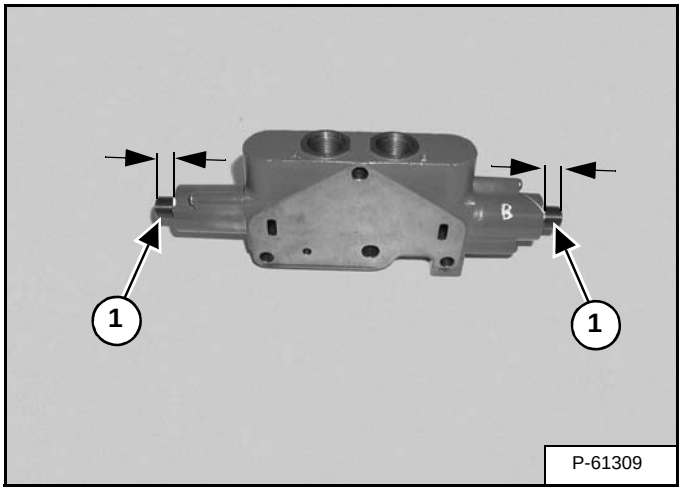


Remove the O-ring (Item 1) **[Figure 20-41-93]** from the nuts.

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Slew Valve Section Disassembly And Assembly (Cont'd)

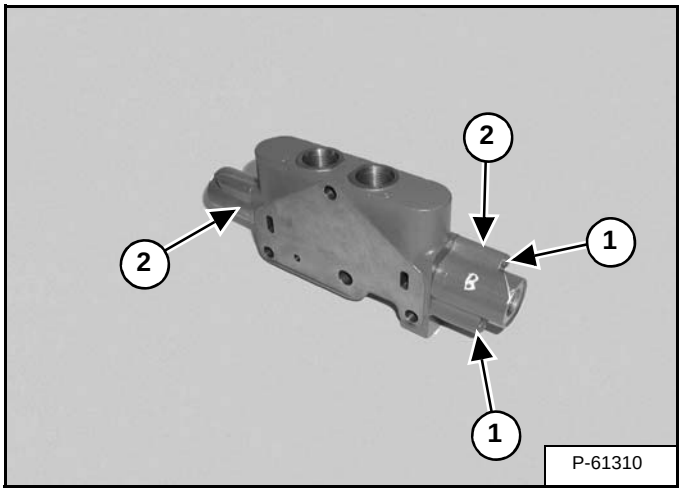
Figure 20-41-94



Measure and record the length of the spool limiter (Item 1) **[Figure 20-41-94]** on both ends of the valve section.

Remove the spool limiters.

Figure 20-41-95

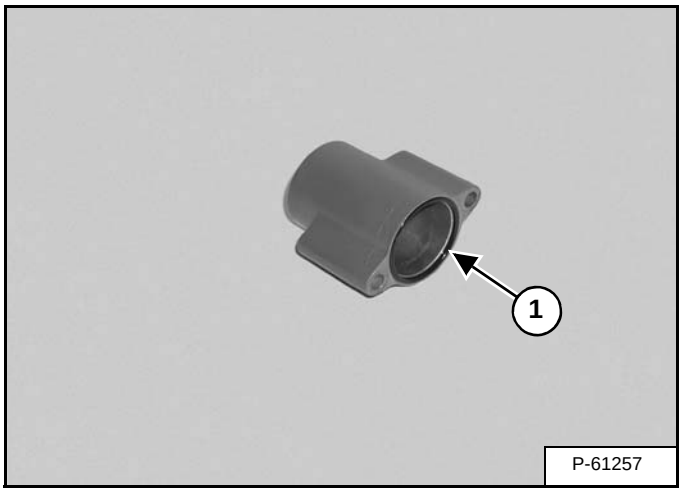


Remove the screws (Item 1) from both end caps (Item 2) **[Figure 20-41-95]**.

Assembly: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

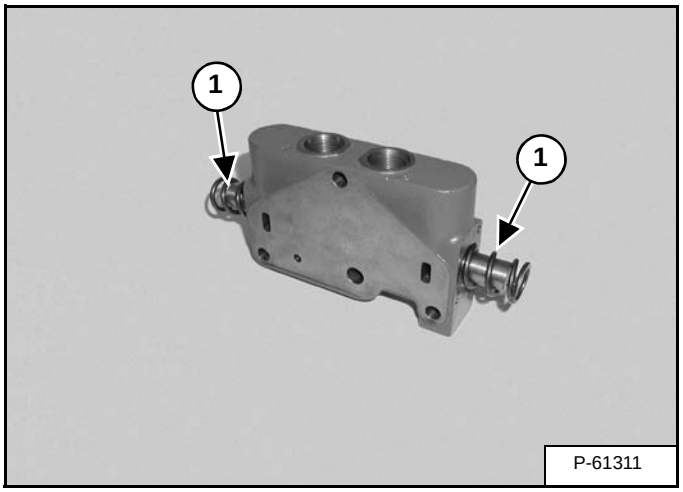
Remove the end caps from the valve section.

Figure 20-41-96



Remove the O-ring (Item 1) **[Figure 20-41-96]** from the end caps.

Figure 20-41-97

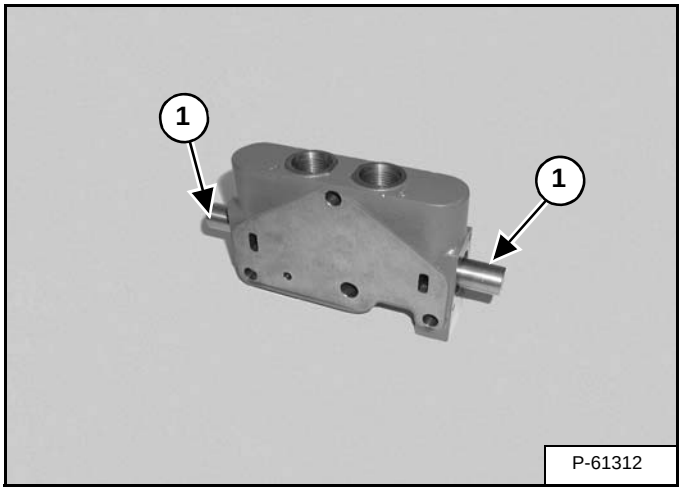


Remove the centering springs (Item 1) **[Figure 20-41-97]** from the spring guides.

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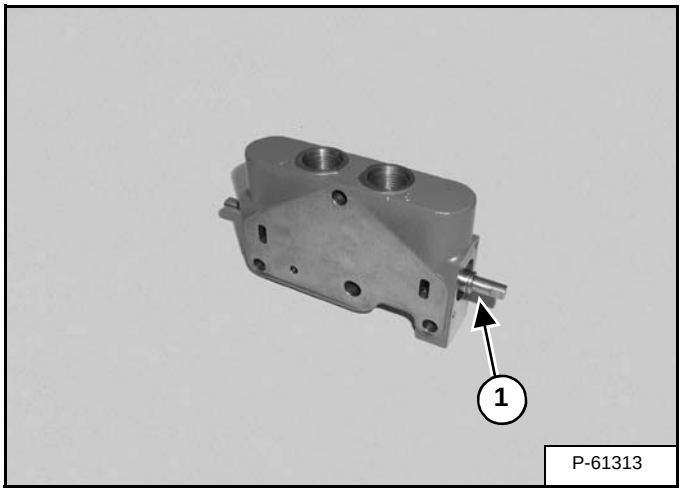
Slew Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-98



Remove the spring guides (Item 1) **[Figure 20-41-98]** from both ends of the valve spool.

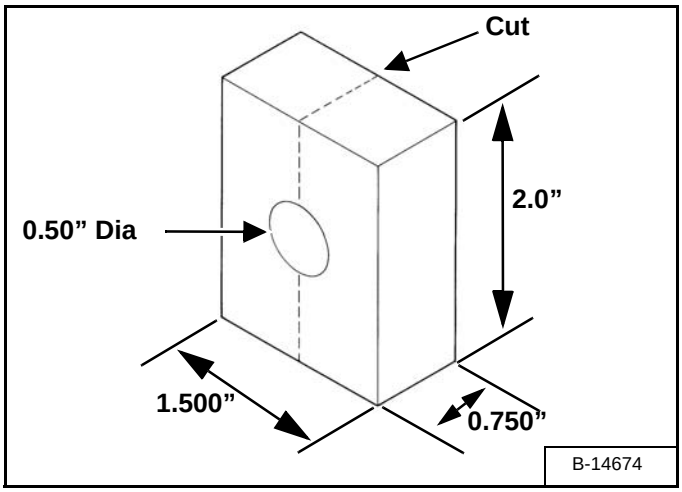
Figure 20-41-99



Record the orientation of the spool (Item 1) **[Figure 20-41-99]**. Remove the spool from the valve section.

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

Figure 20-41-100



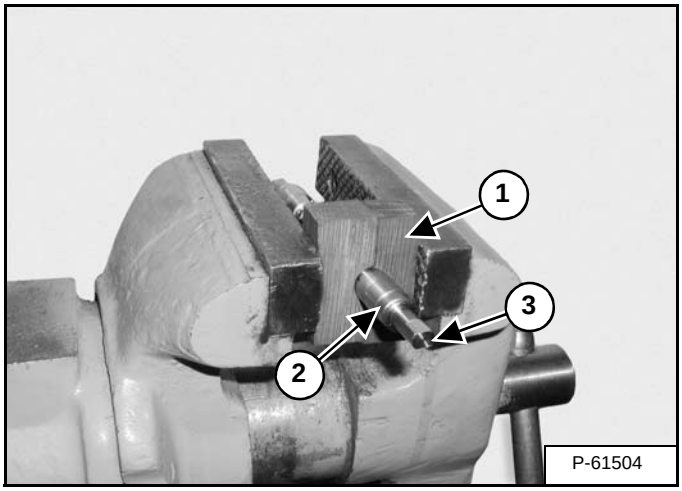
To remove the plugs from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.500 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-41-100]**.

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

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Slew Valve Section Disassembly And Assembly (Cont'd)

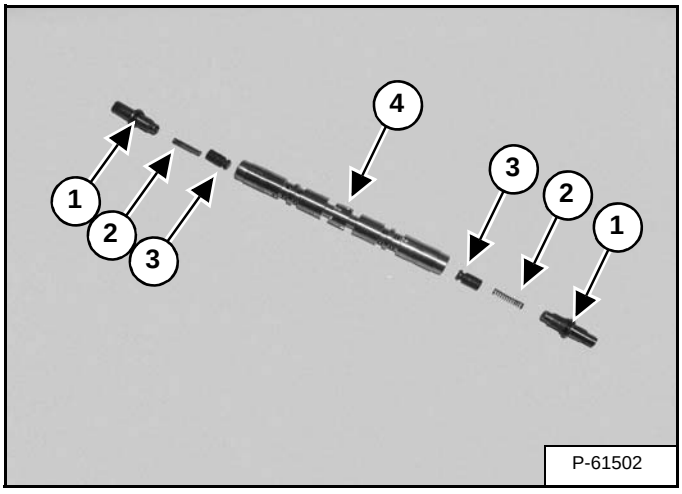
Figure 20-41-101



Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the plugs (Item 3) **[Figure 20-41-101]**. (Both ends)

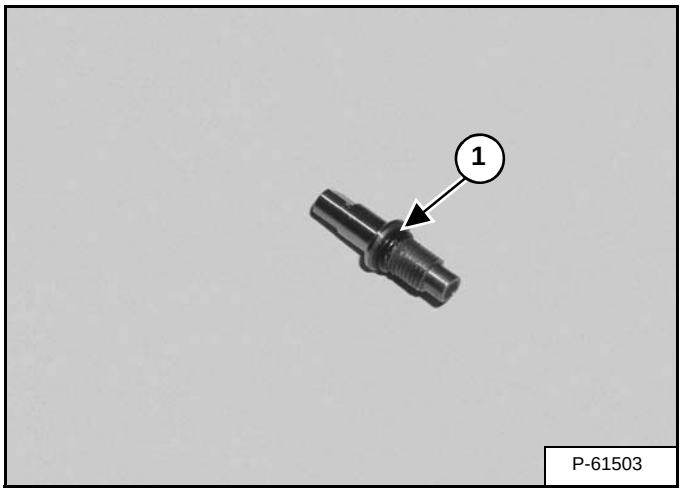
Installation: Apply thread lock adhesive (Loctite 262) or equivalent to the threads. Tighten the plugs to 44 in.-lbs. (5 Nm) torque.

Figure 20-41-102



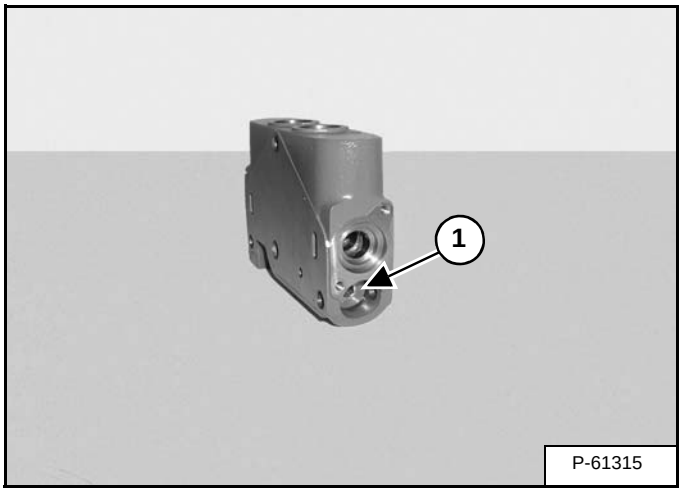
Remove the plugs (Item 1), springs (Item 2), and poppet (Item 3) from the spool (Item 4) **[Figure 20-41-102]**.

Figure 20-41-103



Remove the O-ring (Item 1) **[Figure 20-41-103]** from the plugs.

Figure 20-41-104



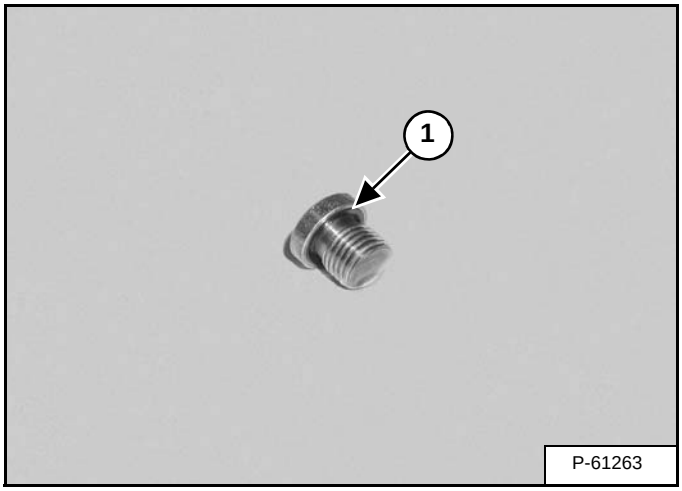
Remove the plug (Item 1) **[Figure 20-41-104]** from the valve section.

Installation: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

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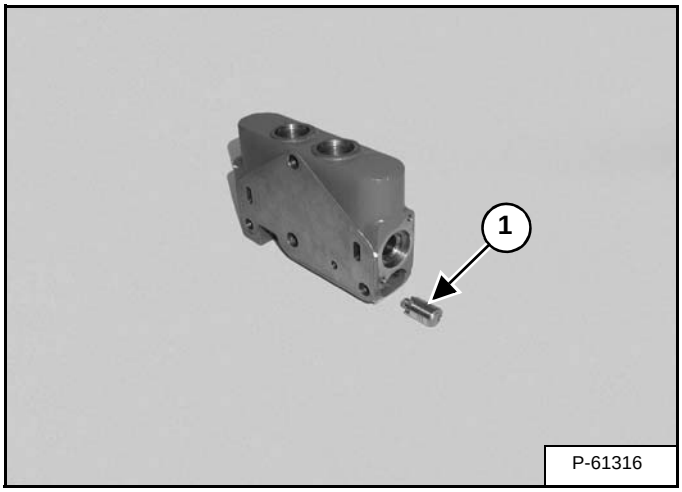
Slew Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-105



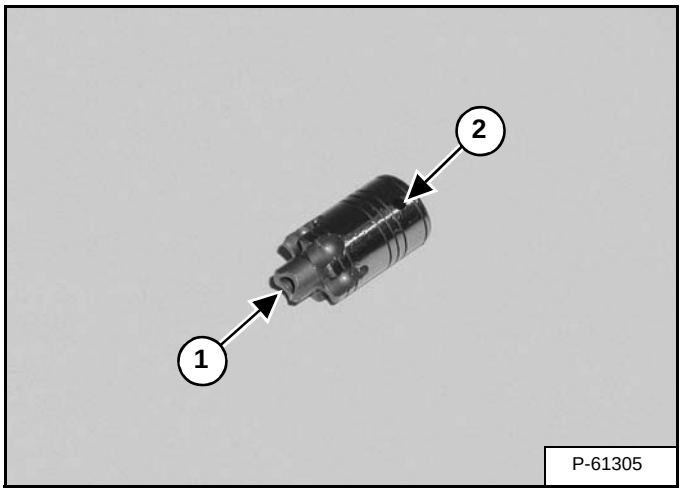
Remove the O-ring (Item 1) **[Figure 20-41-105]** from the plug.

Figure 20-41-106



Remove the compensator (Item 1) **[Figure 20-41-106]** from the valve section.

Figure 20-41-107



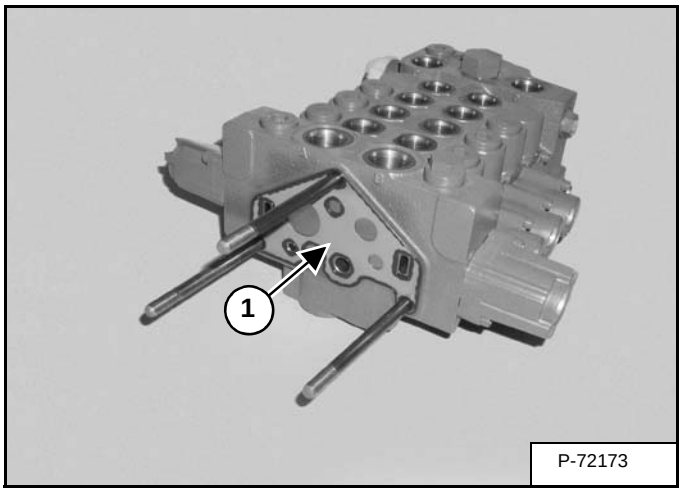
Check the orifice (Item 1) **[Figure 20-41-107]** to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-41-107]** in the compensator, to be sure it is not plugged.

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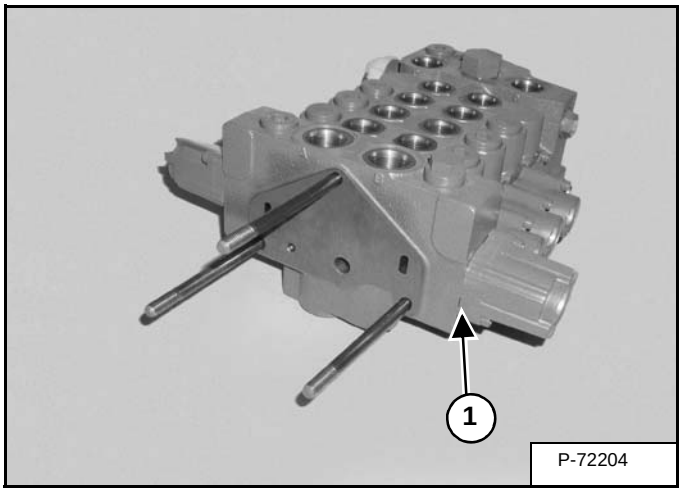
Auxiliary Valve Section Disassembly And Assembly

Figure 20-41-108



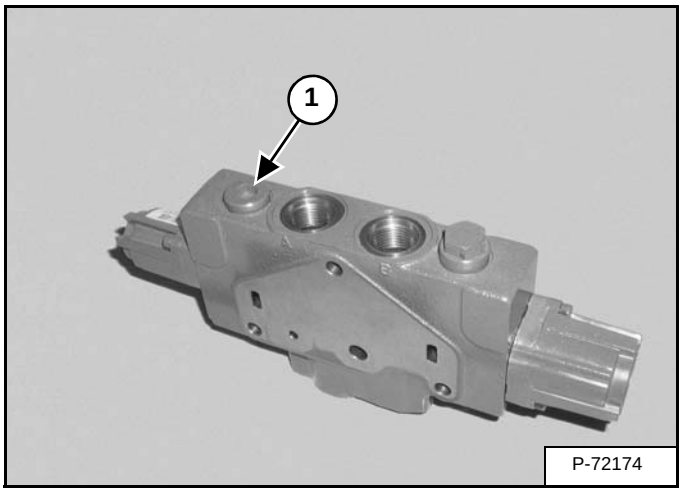
Remove the gasket (Item 1) **[Figure 20-41-108]** from the valve section.

Figure 20-41-109



Remove the second auxiliary valve section (Item 1) **[Figure 20-41-109]** from the control valve.

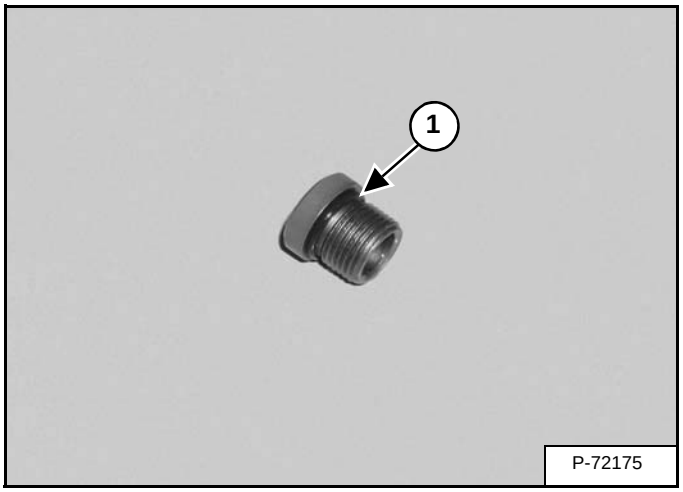
Figure 20-41-110



Remove the plug (Item 1) **[Figure 20-41-110]** from the port relief.

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

Figure 20-41-111

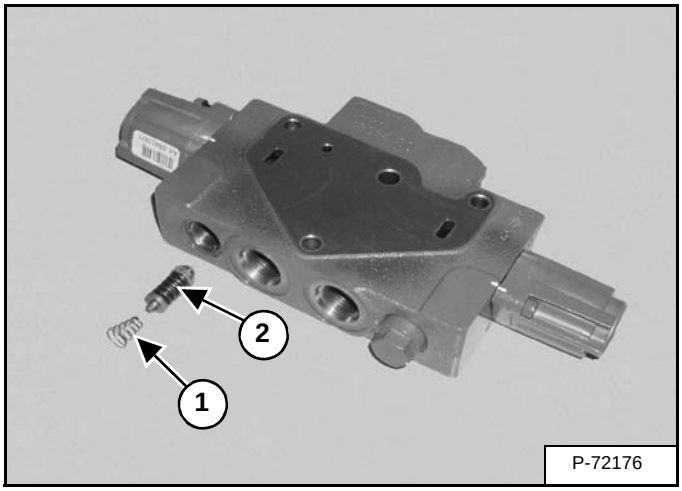


Remove the O-ring (Item 1) **[Figure 20-41-111]** from the plug.

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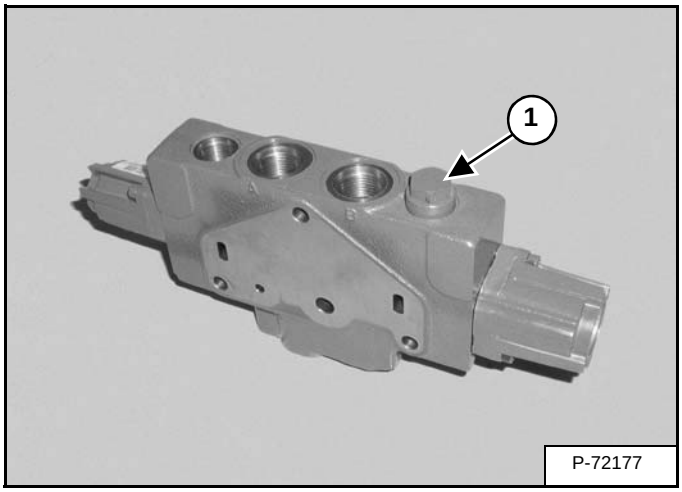
Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-112



Remove the spring (Item 1) and valve (Item 2) **[Figure 20-41-112]**.

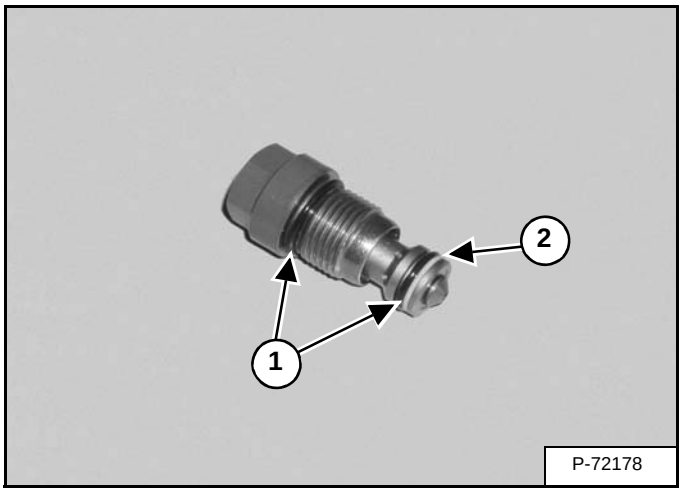
Figure 20-41-113



Remove the load check valve (Item 1) **[Figure 20-41-113]** from the valve section.

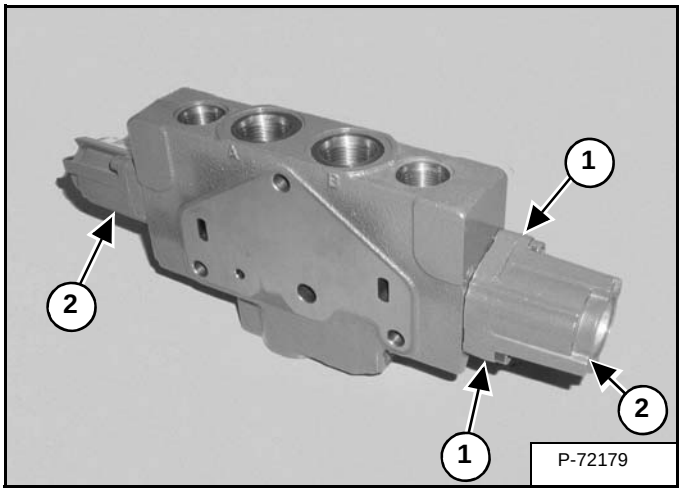
Installation: Tighten the plug to 22-26 ft.-lb. 930-35 N•m) torque.

Figure 20-41-114



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-41-114]** from the check valve.

Figure 20-41-115



Remove the screws (Item 1) **[Figure 20-41-115]** from both end caps.

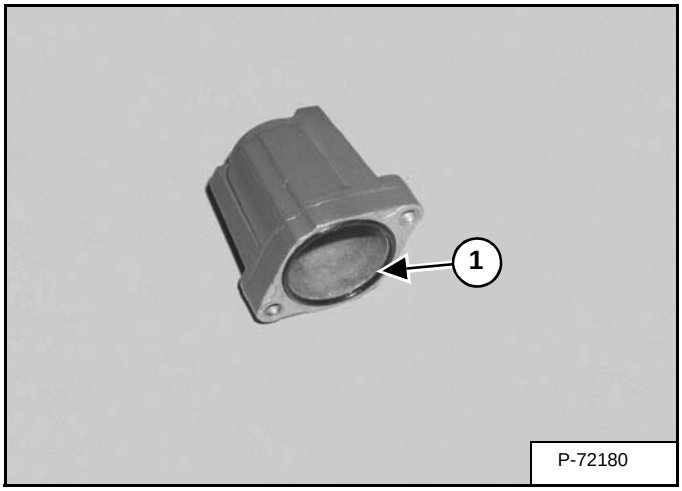
Installation: Tighten the screws to 27 in.-lb. (3 N•m) torque.

Remove the end cap (Item 2) **[Figure 20-41-115]** from both ends of the valve section.

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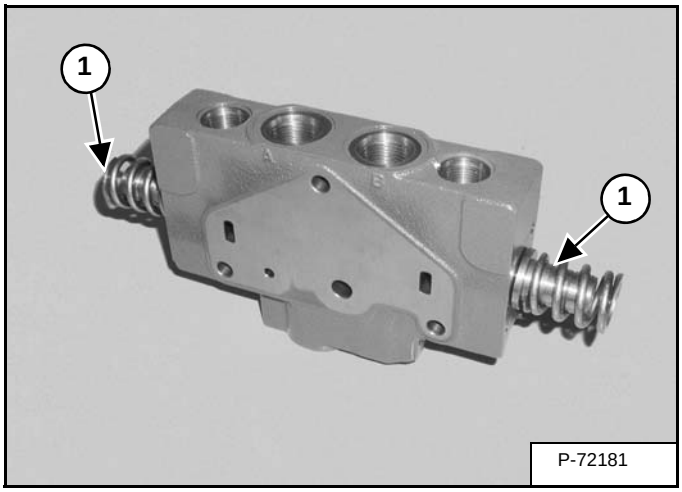
Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-116



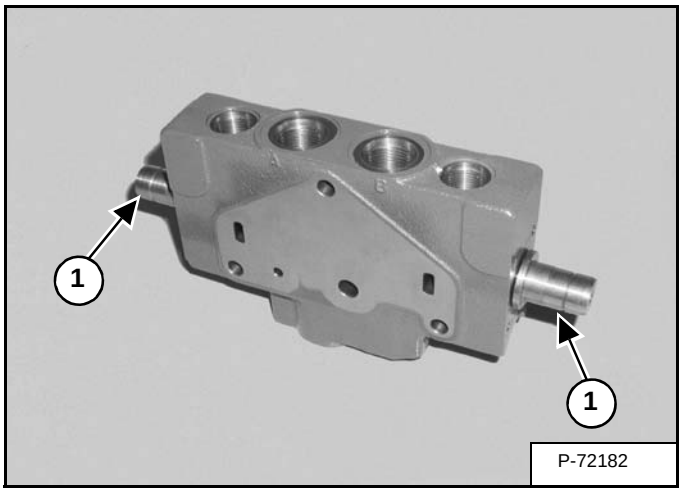
Remove the O-ring (Item 1) **[Figure 20-41-116]** from both end caps.

Figure 20-41-117



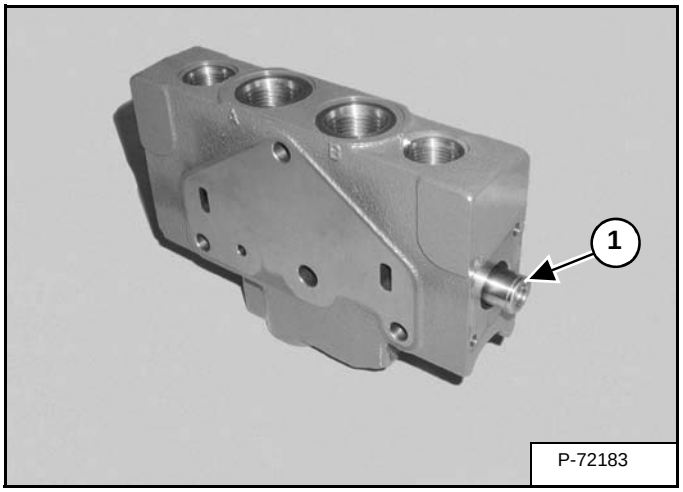
Remove the centering springs (Item 1) **[Figure 20-41-117]** from both ends of the valve spool.

Figure 20-41-118



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

Figure 20-41-119



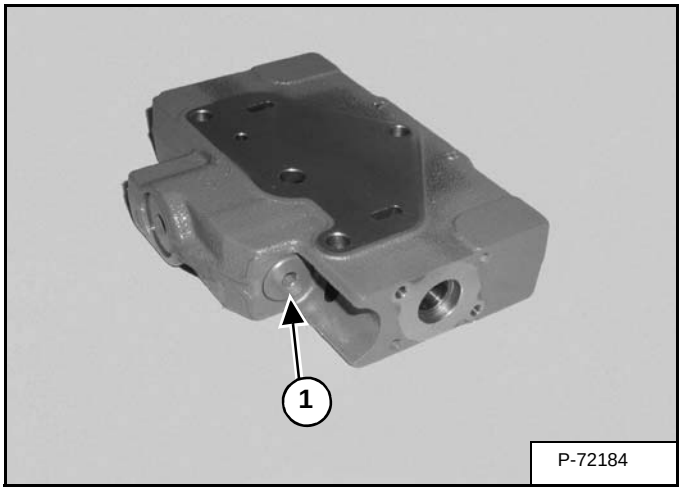
Record the orientation of the spool (Item 1) **[Figure 20-41-119]**. Remove the spool from the valve section.

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

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Auxiliary Valve Section Disassembly And Assembly (Cont'd)

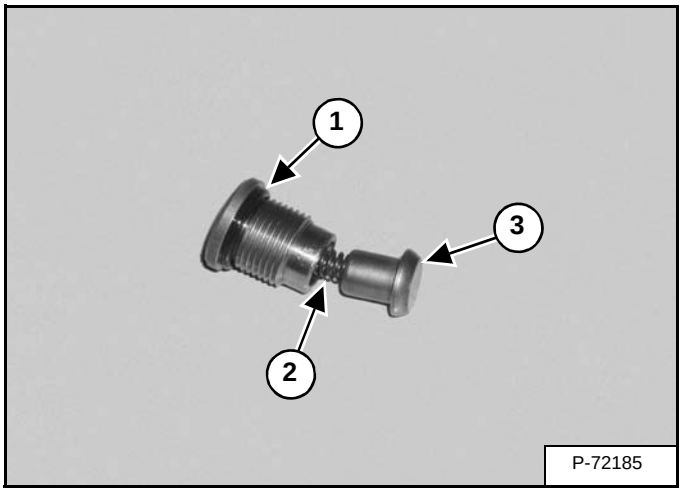
Figure 20-41-120



Remove the plug (Item 1) **[Figure 20-41-120]** from the valve section.

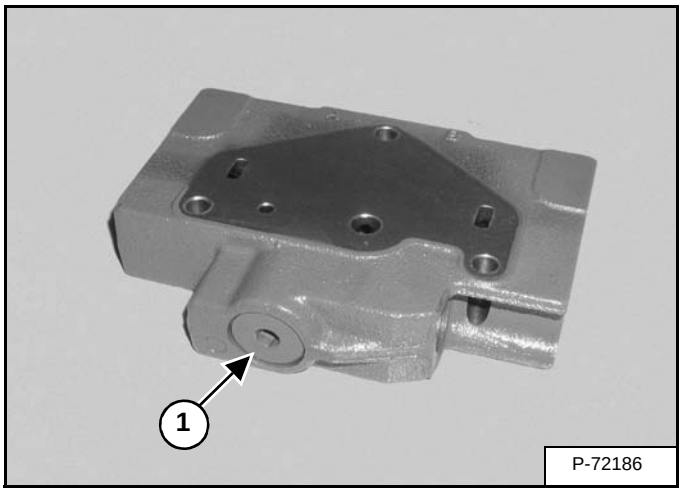
Assembly: Tighten the plug to 22 ft.-lb. (30 N•m) torque.

Figure 20-41-121



Remove the O-ring (Item 1), spring (Item 2) and plunger (Item 3) **[Figure 20-41-121]** from the plug.

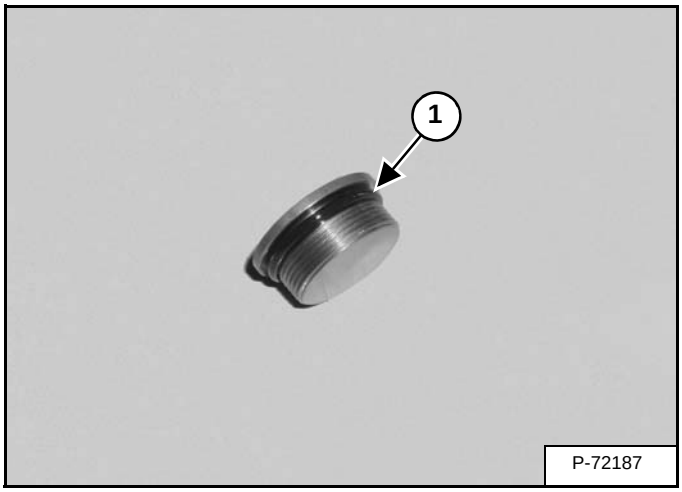
Figure 20-41-122



Remove the plug (Item 1) **[Figure 20-41-122]** from the valve section.

Assembly: Tighten the plug to 22 ft.-lb. (30 N•m) torque.

Figure 20-41-123

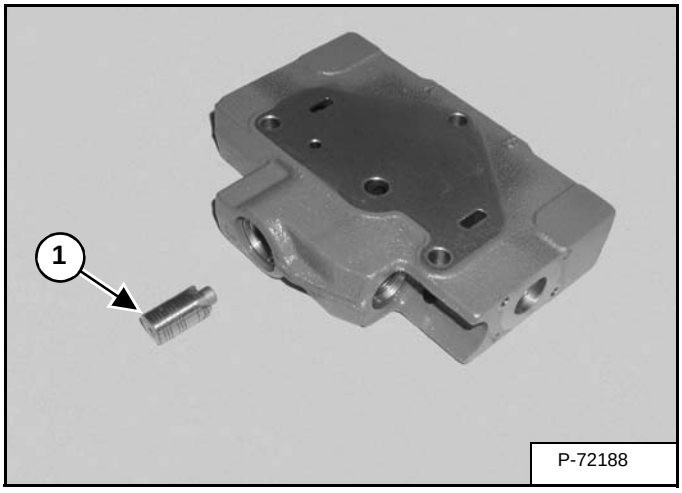


Remove the O-ring (Item 1) **[Figure 20-41-123]** from the plug.

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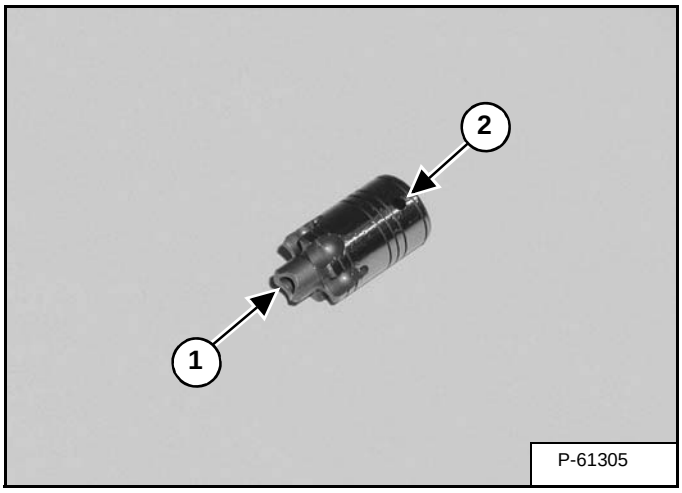
Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-124



Remove the compensator (Item 1) **[Figure 20-41-124]** from the valve section.

Figure 20-41-125



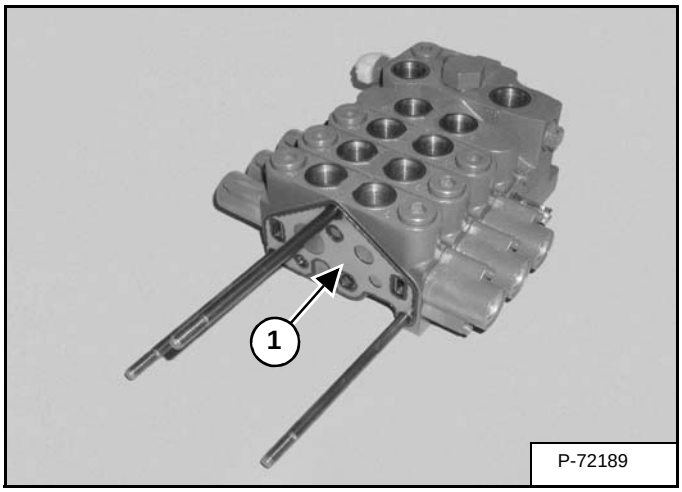
Check the orifice (Item 1) **[Figure 20-41-125]** in the compensator to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-41-125]** to be sure it is not plugged.

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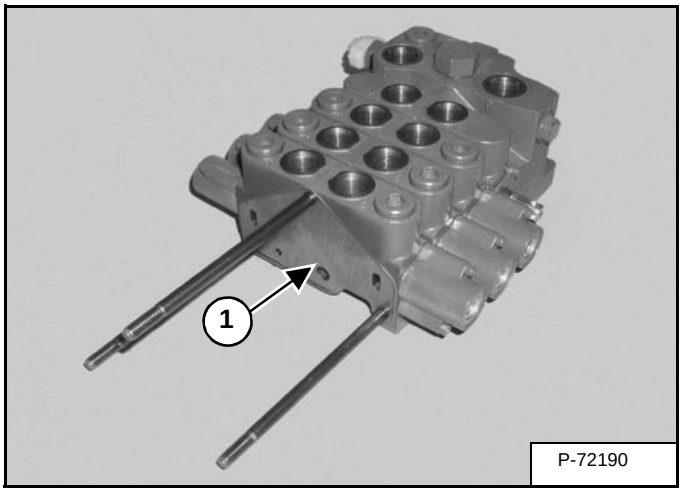
Bucket Valve Section Disassembly And Assembly

Figure 20-41-126



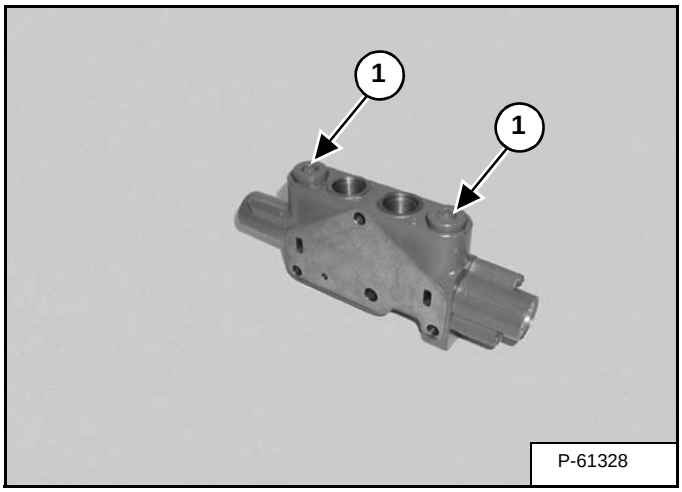
Remove the gasket (Item 1) **[Figure 20-41-126]** from the valve section.

Figure 20-41-127



Remove the bucket valve section (Item 1) **[Figure 20-41-127]** from the control valve.

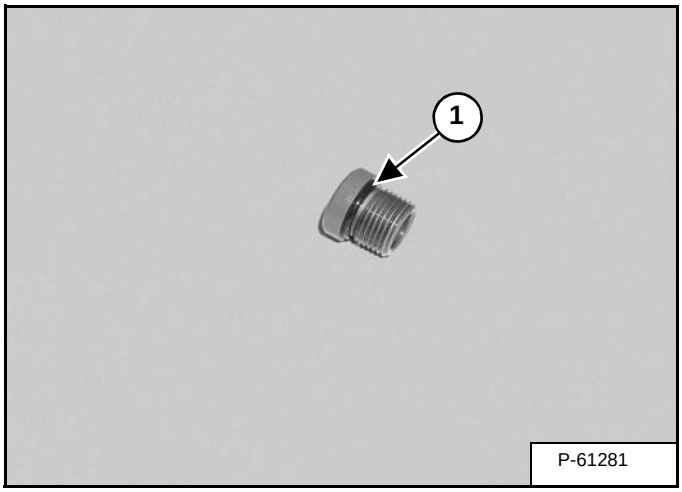
Figure 20-41-128



Remove the plugs (Item 1) **[Figure 20-41-128]** from the port relief valves.

Installation: Tighten the plugs to 22-26 ft.-lbs. (30-35 Nm) torque.

Figure 20-41-129

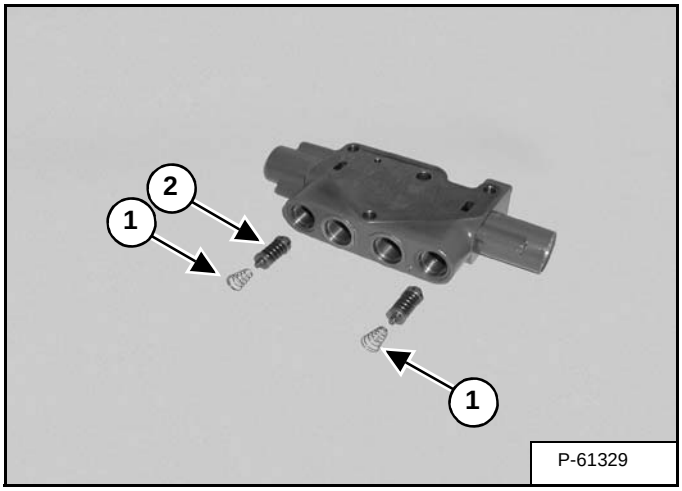


Remove the O-ring (Item 1) **[Figure 20-41-129]** from the plugs.

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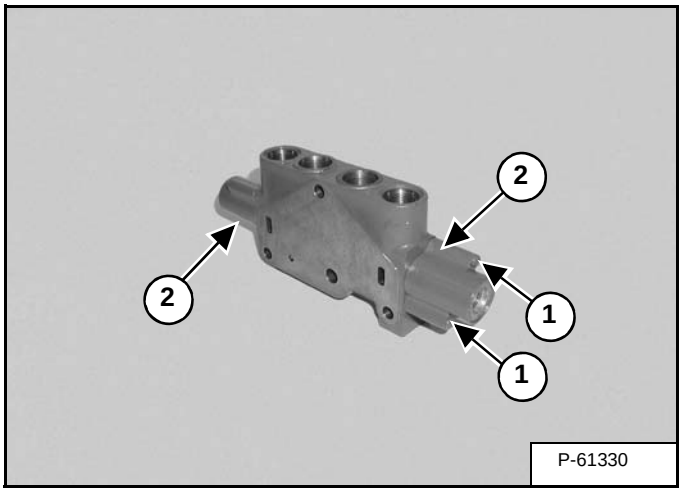
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-130



Remove the springs (Item 1) and valves (Item 2) **[Figure 20-41-130]**.

Figure 20-41-131

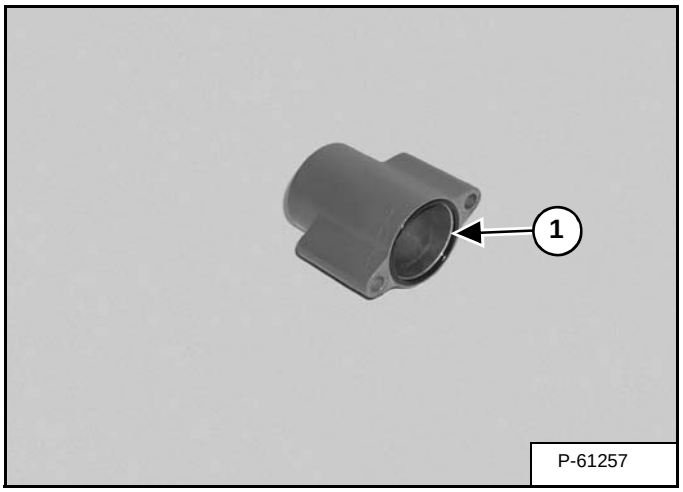


Remove the screws (Item 1) from both end caps (Item 2) **[Figure 20-41-131]**.

Remove the end caps.

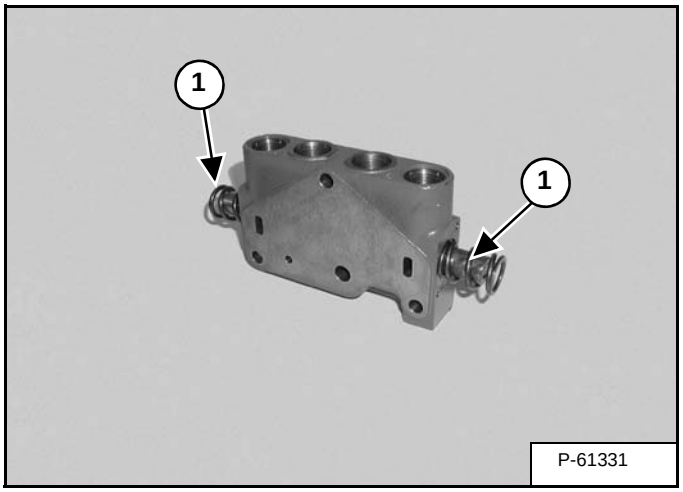
Installation: Tighten the screws to 27 in-.lbs. (3 Nm) torque.

Figure 20-41-132



Remove the O-ring (Item 1) **[Figure 20-41-132]** from the end cap.

Figure 20-41-133

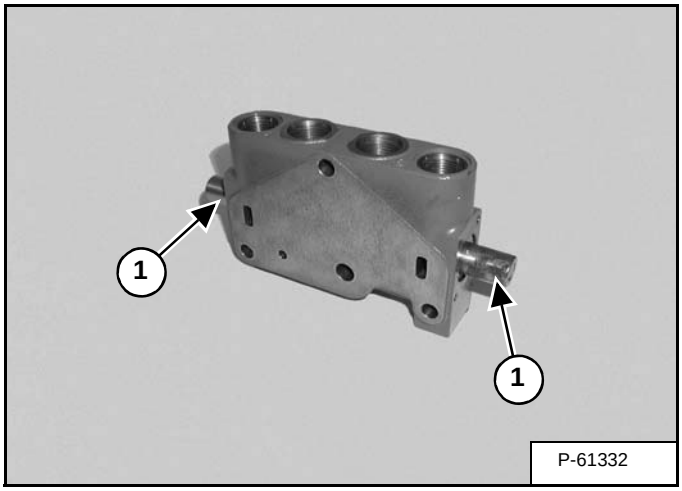


Remove the centering springs (Item 1) **[Figure 20-41-133]** from both ends of the valve spool.

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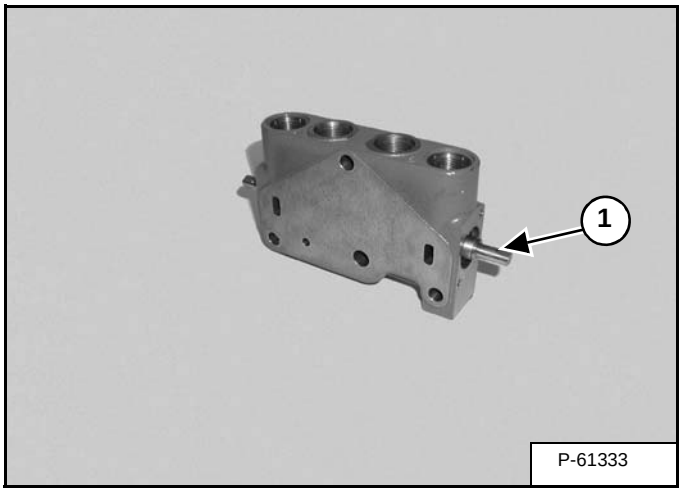
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-134



Remove the spring guides (Item 1) **[Figure 20-41-134]** from both ends of the valve spool.

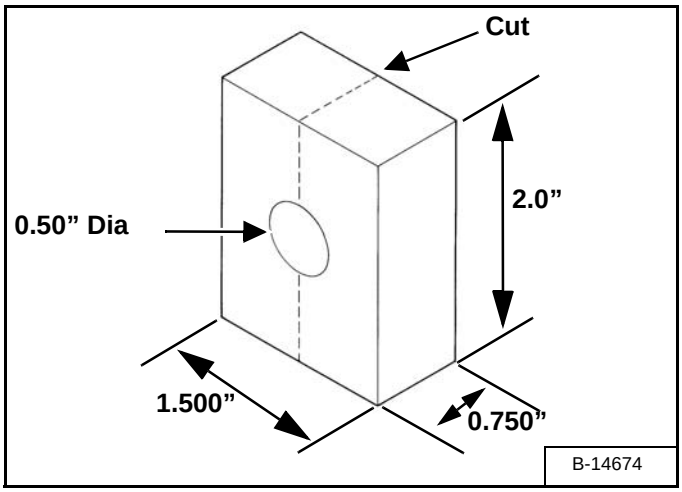
Figure 20-41-135



Record the orientation of the spool (Item 1) **[Figure 20-41-135]**. Remove the spool from the valve section.

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

Figure 20-41-136



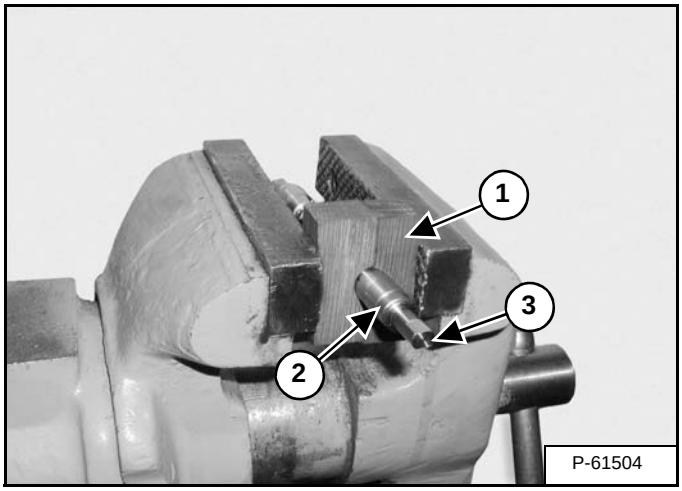
To remove the plugs from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.500 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-41-136]**.

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

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Bucket Valve Section Disassembly And Assembly (Cont'd)

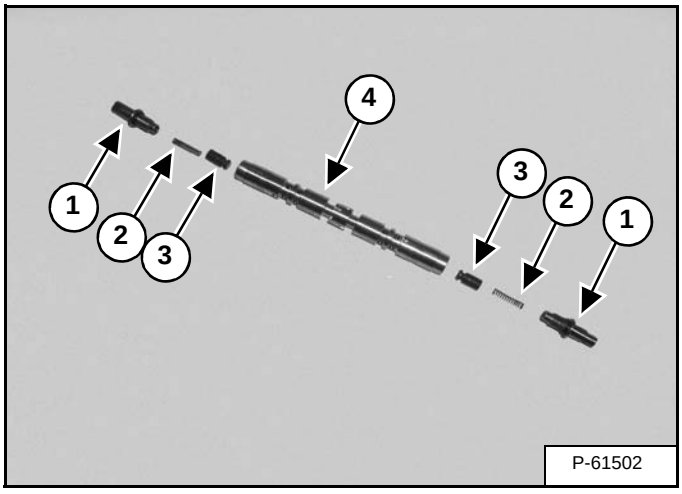
Figure 20-41-137



Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the plugs (Item 3) **[Figure 20-41-137]**. (Both ends)

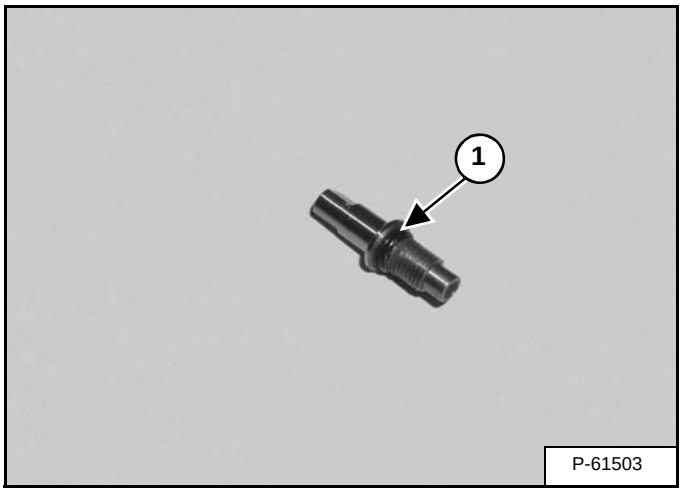
Installation: Apply thread lock adhesive (Loctite 262) or equivalent to the threads. Tighten the plugs to 44 in.-lbs. (5 Nm) torque.

Figure 20-41-138



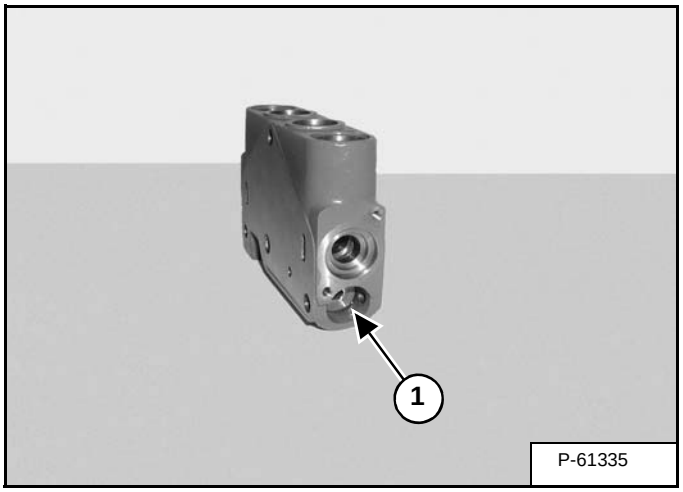
Remove the plugs (Item 1), springs (Item 2) and poppets (Item 3) from the spool (Item 4) **[Figure 20-41-138]**.

Figure 20-41-139



Remove the O-ring (Item 1) **[Figure 20-41-139]** from the plugs.

Figure 20-41-140



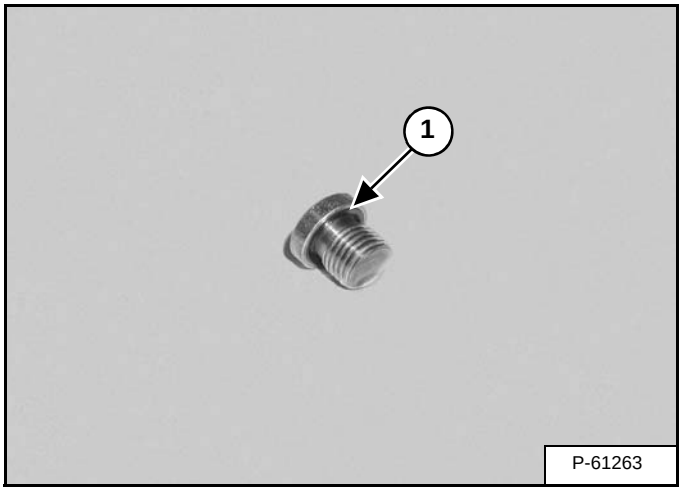
Remove the plug (Item 1) **[Figure 20-41-140]** from the top of the valve section.

Installation: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

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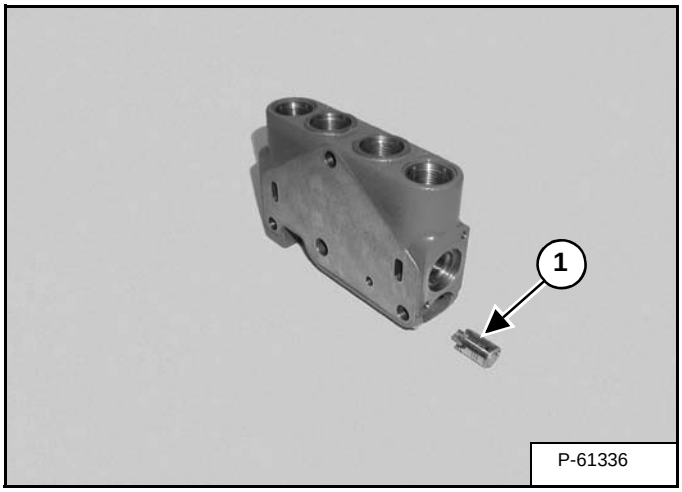
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-141



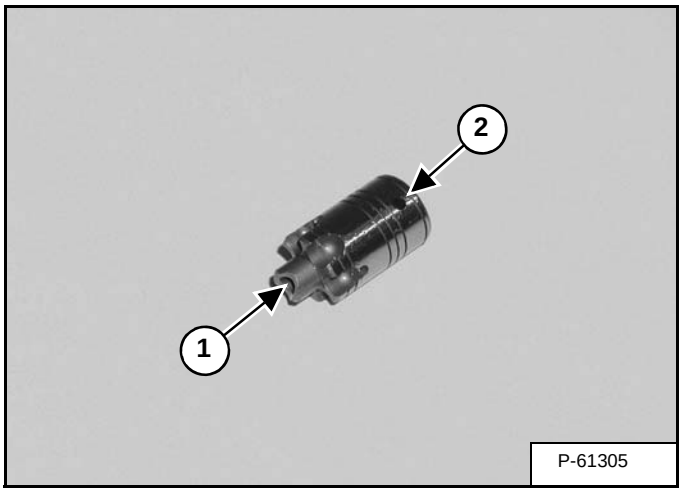
Remove the O-ring (Item 1) **[Figure 20-41-141]** from the plug.

Figure 20-41-142



Remove the compensator (Item 1) **[Figure 20-41-142]** from the valve section.

Figure 20-41-143



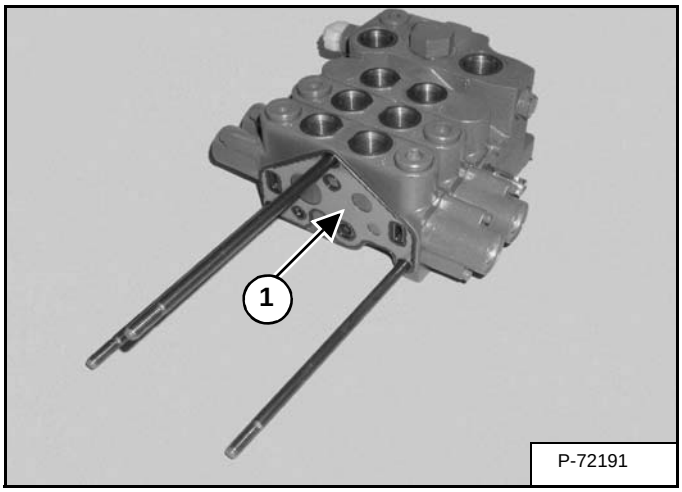
Check the orifice (Item 1) **[Figure 20-41-143]** in the compensator to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-41-143]** to be sure it is not plugged.

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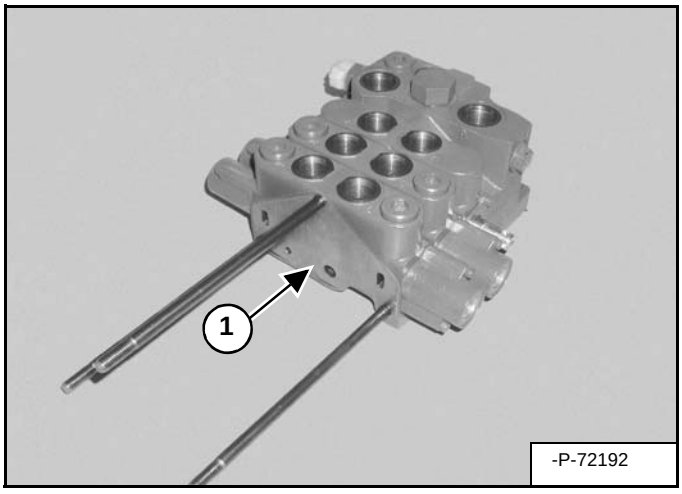
Arm Valve Section Disassembly And Assembly

Figure 20-41-144



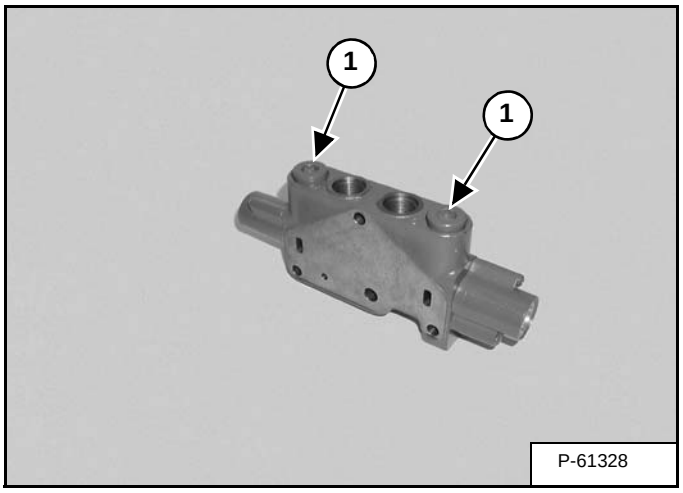
Remove the gasket (Item 1) **[Figure 20-41-144]** from the valve section.

Figure 20-41-145



Remove the arm valve section (Item 1) **[Figure 20-41-145]** from the control valve.

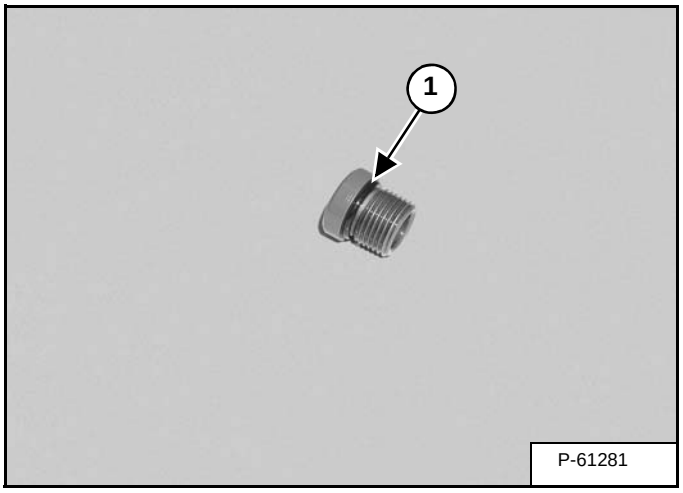
Figure 20-41-146



Remove the plugs (Item 1) **[Figure 20-41-146]** from the port relief valves.

Installation: Tighten the plugs to 22-26 ft.-lbs. (30-35 Nm) torque.

Figure 20-41-147

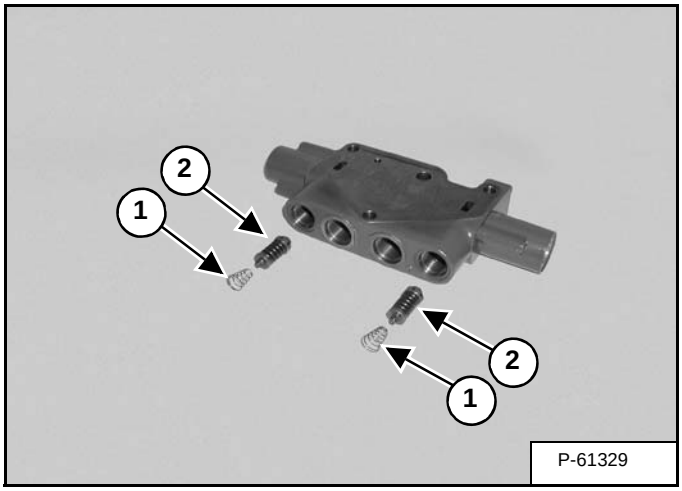


Remove the O-ring (Item 1) **[Figure 20-41-147]** from the plugs.

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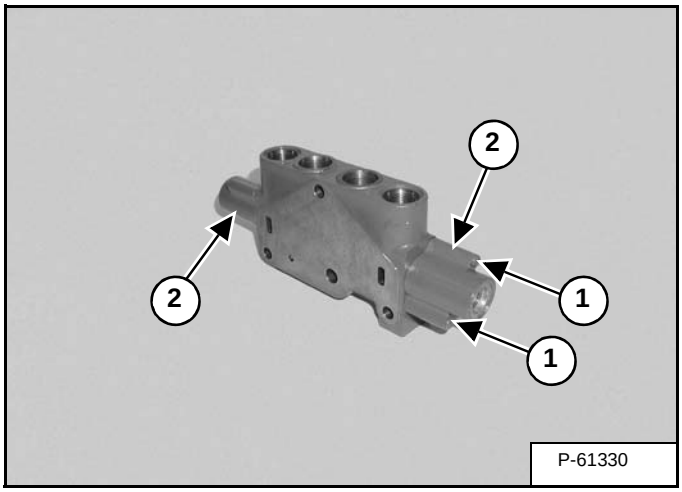
Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-148



Remove the springs (Item 1) and valves (Item 2) **[Figure 20-41-148]**.

Figure 20-41-149

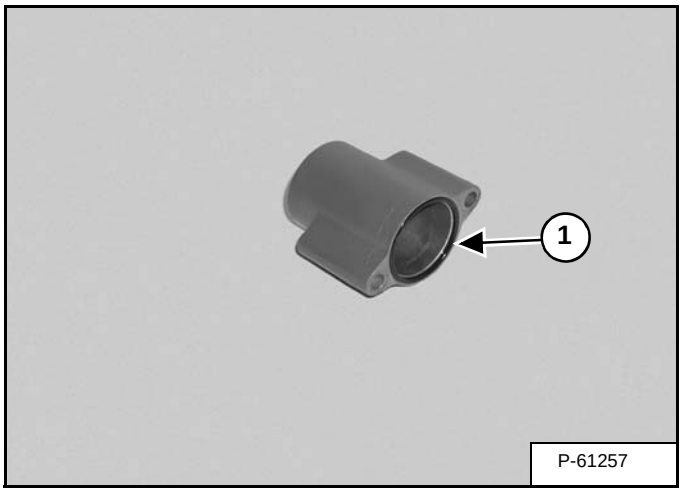


Remove the screws (Item 1) from both valve section end caps (Item 2) **[Figure 20-41-149]**.

Installation: Tighten the screws to 27 in.-lbs (3 Nm) torque.

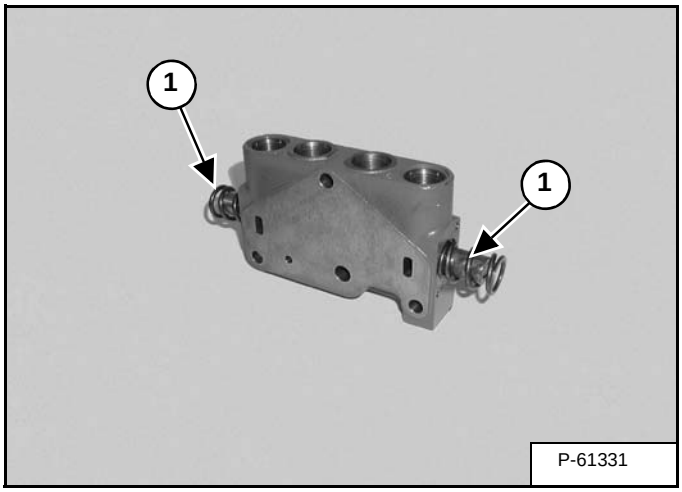
Remove the end caps.

Figure 20-41-150



Remove the O-ring (Item 1) **[Figure 20-41-150]** from the end caps.

Figure 20-41-151

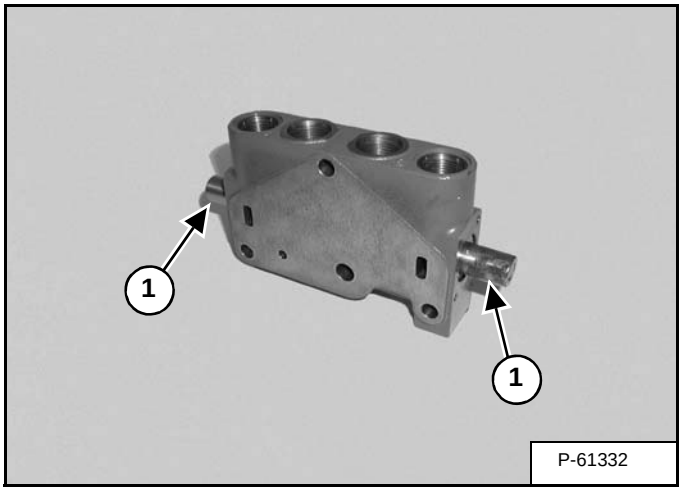


Remove the centering spring (Item 1) **[Figure 20-41-151]** from both ends of the valve spool.

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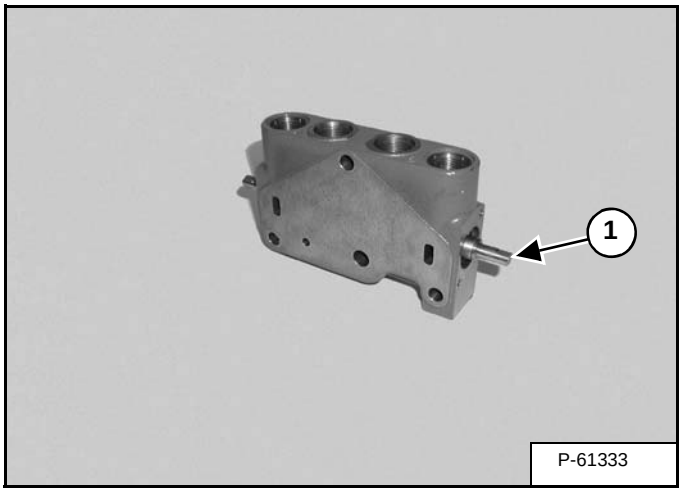
Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-152



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

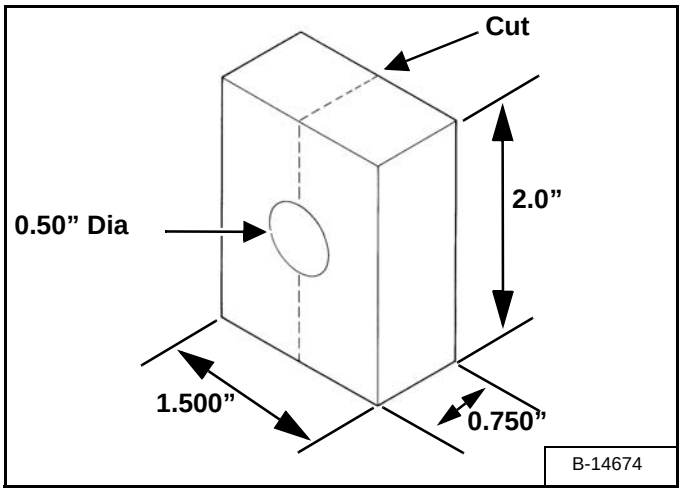
Figure 20-41-153



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

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

Figure 20-41-154



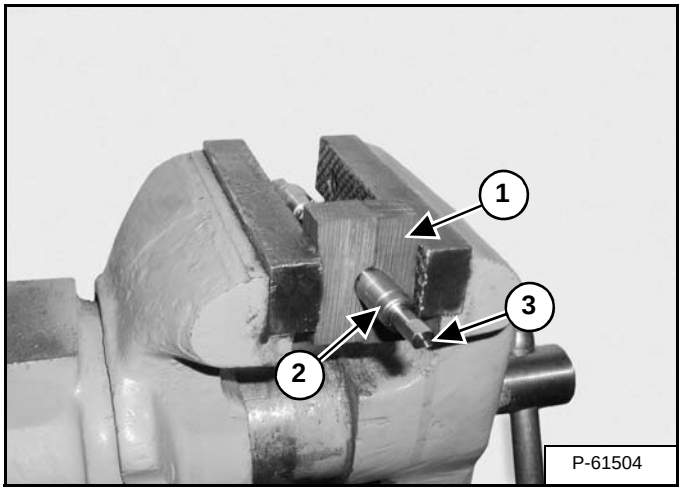
To remove the plugs from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.500 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-41-154]**.

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

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Arm Valve Section Disassembly And Assembly (Cont'd)

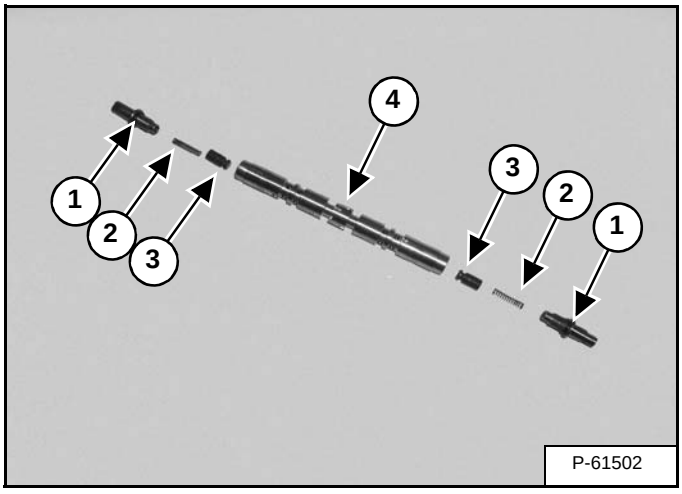
Figure 20-41-155



Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the plug (Item 3) **[Figure 20-41-155]**. (Both ends)

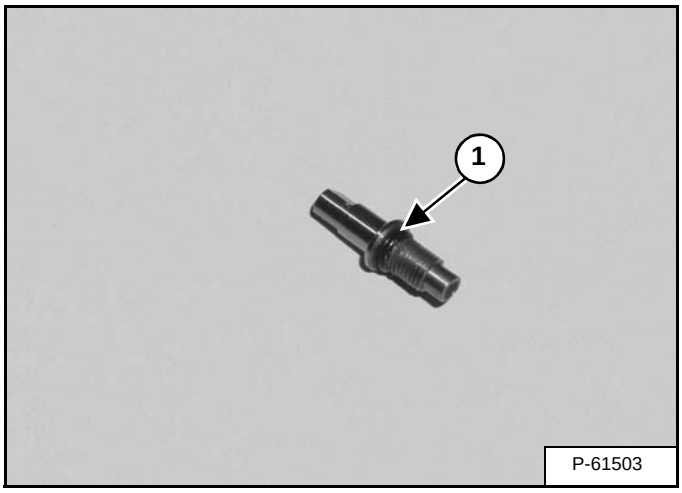
Installation: Apply thread lock adhesive (Loctite 262) or equivalent to the threads. Tighten the plugs to 44 in.-lbs. (5 Nm) torque.

Figure 20-41-156



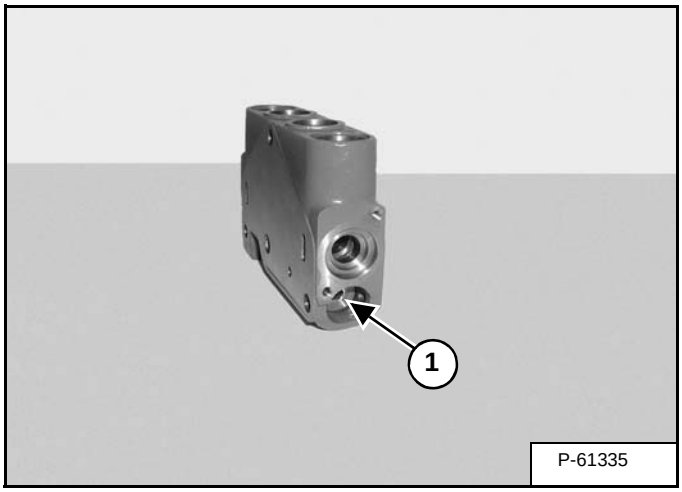
Remove the plugs (Item 1), springs (Item 2), and poppet (Item 3) from the spool (Item 4) **[Figure 20-41-156]**.

Figure 20-41-157



Remove the O-ring (Item 1) **[Figure 20-41-157]** from the plugs.

Figure 20-41-158



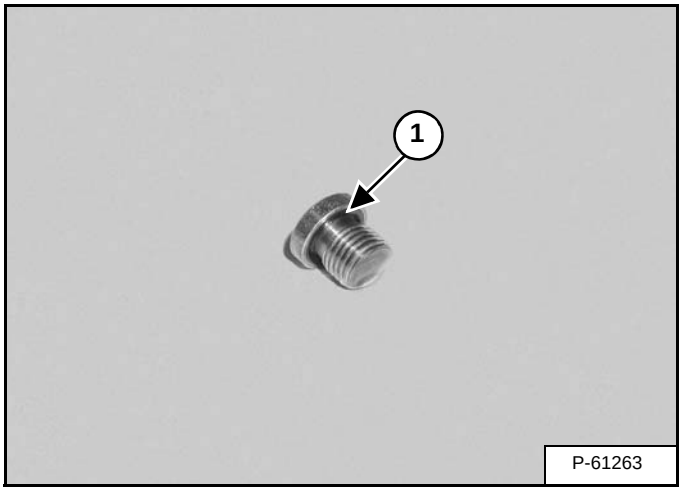
Remove the plug (Item 1) **[Figure 20-41-158]** from the top of the valve section.

Installation: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

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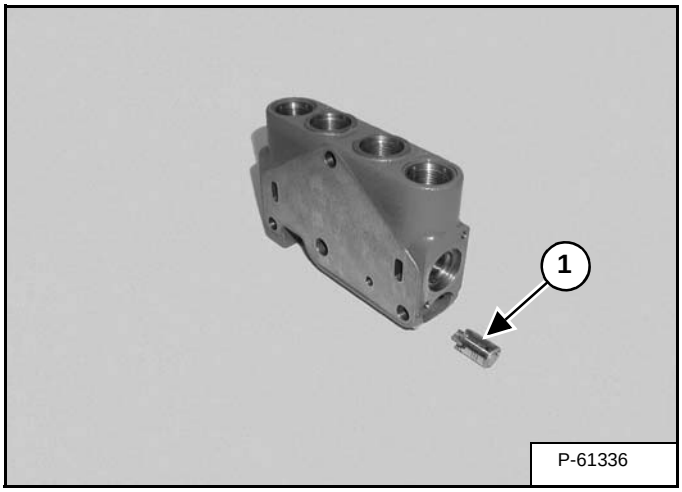
Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-159



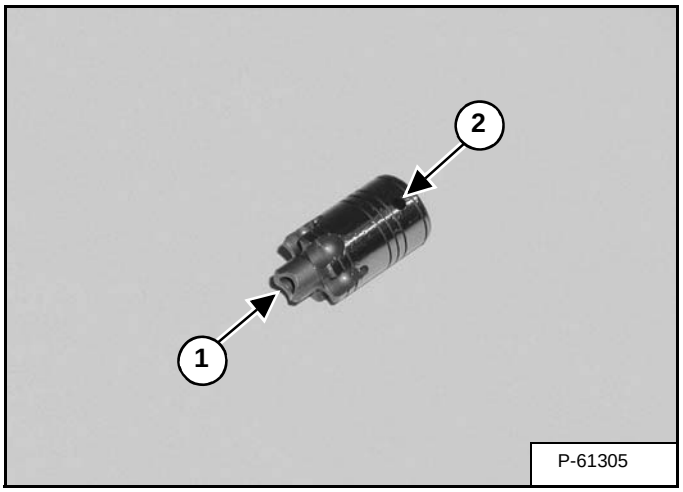
Remove the O-ring (Item 1) **[Figure 20-41-159]** from the plug.

Figure 20-41-160



Remove the compensator (Item 1) **[Figure 20-41-160]** from the valve section.

Figure 20-41-161



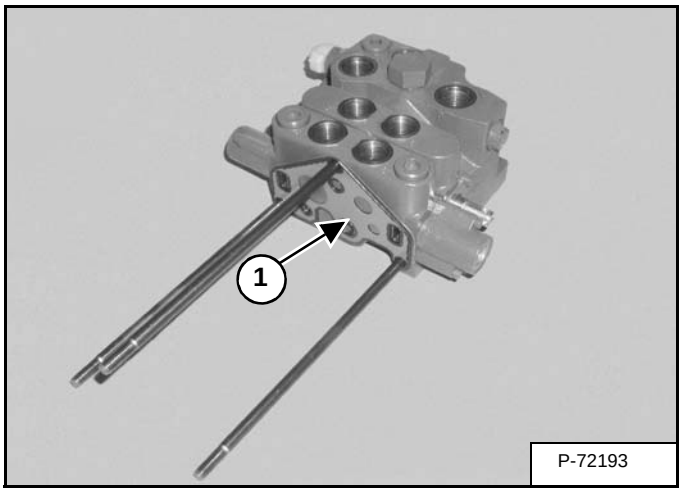
Check the orifice (Item 1) **[Figure 20-41-161]** in the compensator to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-41-161]** to be sure it is not plugged.

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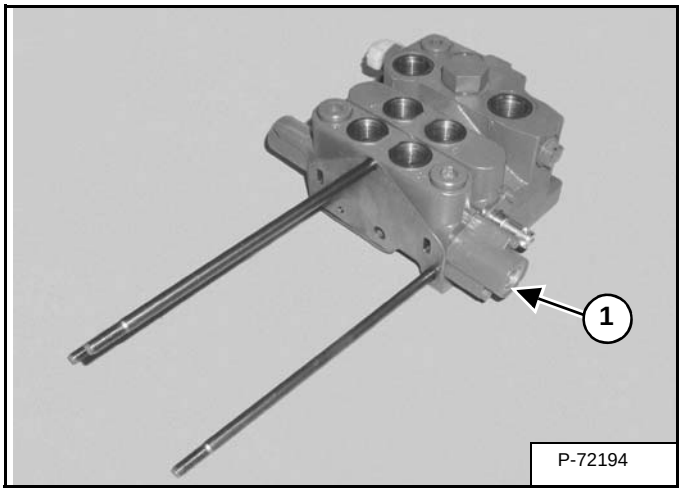
Boom Valve Section Disassembly And Assembly

Figure 20-41-162



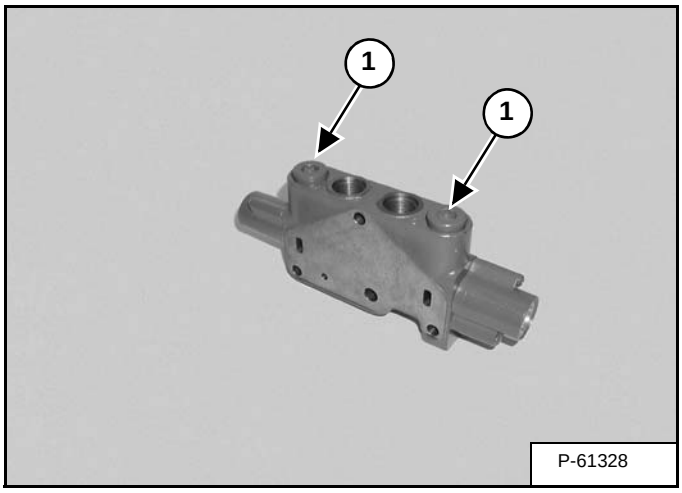
Remove the gasket (Item 1) **[Figure 20-41-162]** from the valve section.

Figure 20-41-163



Remove the boom valve section (Item 1) **[Figure 20-41-163]** from the control valve.

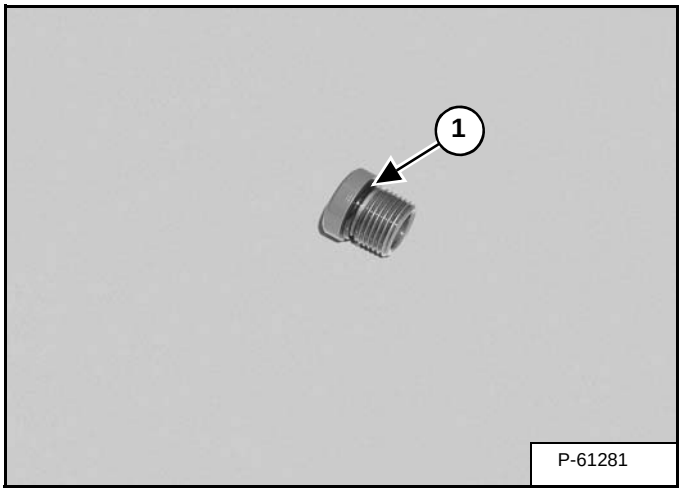
Figure 20-41-164



Remove the plugs (Item 1) **[Figure 20-41-164]** from the port relief valves.

Installation: Tighten the plugs to 22-26 ft.-lbs. (30-35 Nm) torque.

Figure 20-41-165

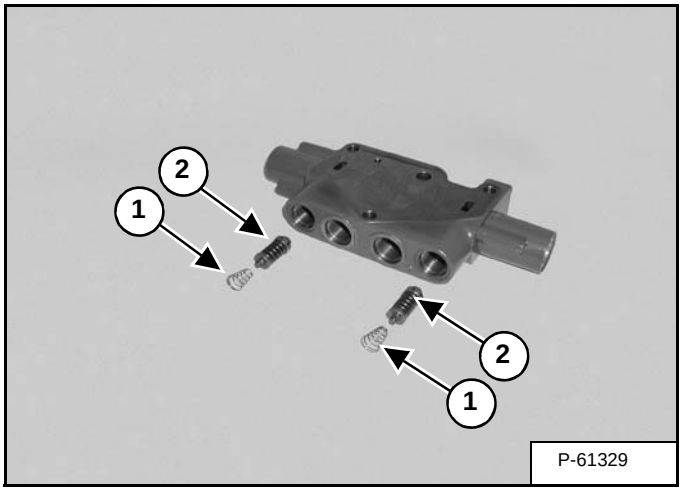


Remove the O-ring **[Figure 20-41-165]** from the plugs.

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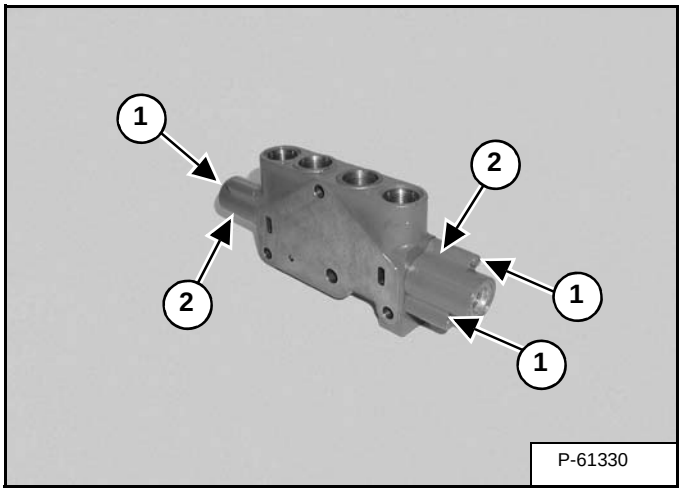
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-166



Remove the springs (Item 1) and valves (Item 2) **[Figure 20-41-166]**.

Figure 20-41-167

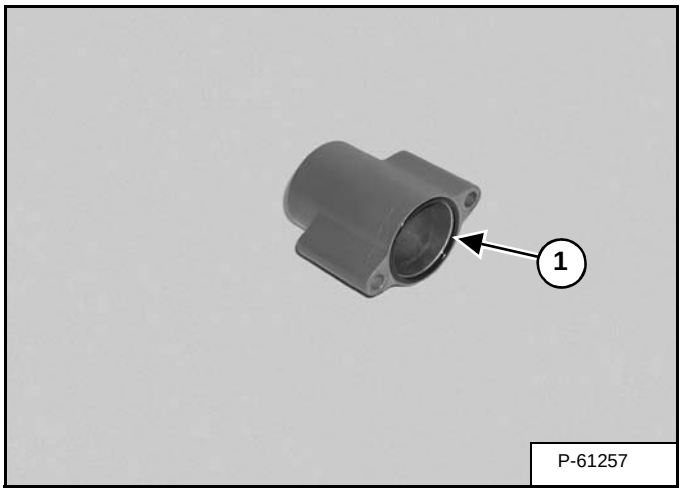


Remove the screws (Item 1) from both end caps (Item 2) **[Figure 20-41-167]**.

Installation: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

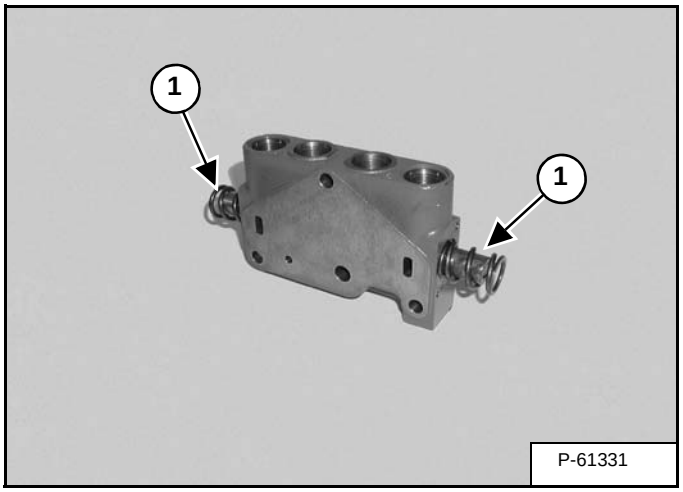
Remove the end caps.

Figure 20-41-168



Remove the O-ring (Item 1) **[Figure 20-41-168]** from the end caps.

Figure 20-41-169

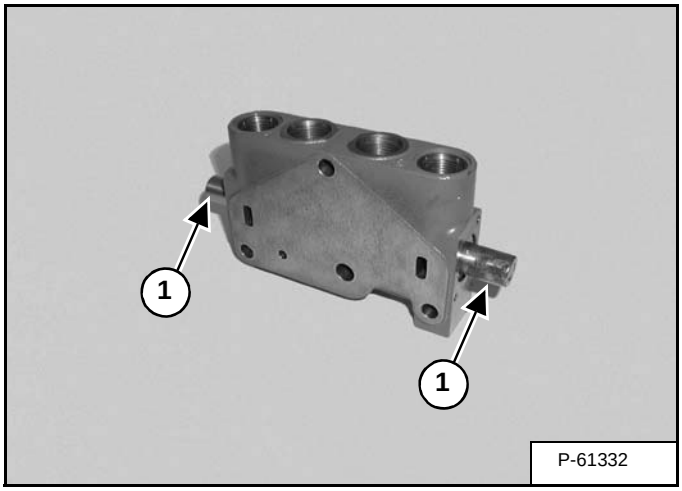


Remove the centering spring (Item 1) **[Figure 20-41-169]** from both ends of the valve spool.

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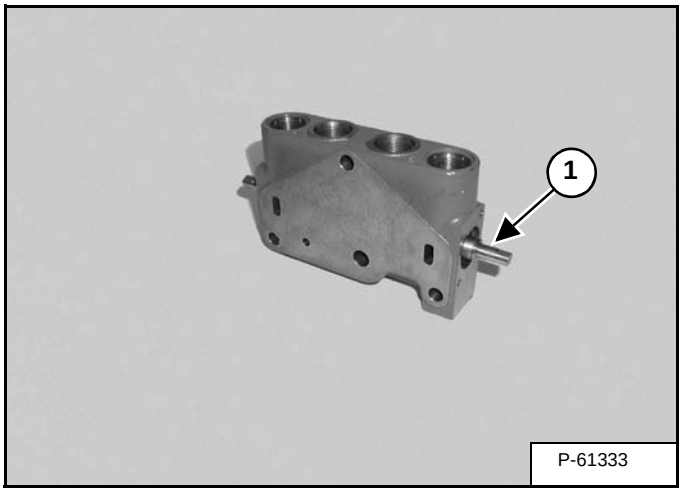
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-170



Remove the spring guides (Item 1) **[Figure 20-41-170]** from both ends of the valve spool.

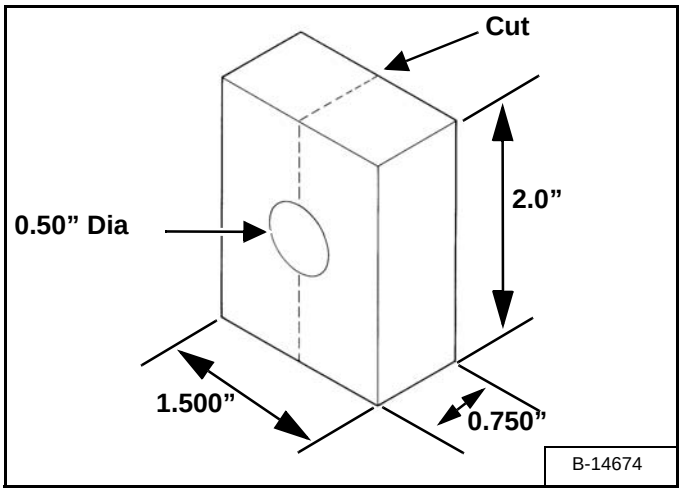
Figure 20-41-171



Record the orientation of the spool (Item 1) **[Figure 20-41-171]**. Remove the spool from the valve section.

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

Figure 20-41-172



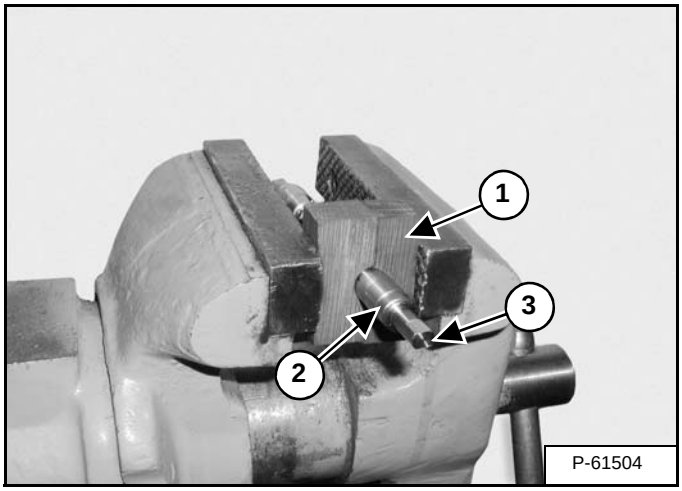
To remove the plugs from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.500 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-41-172]**.

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

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Boom Valve Section Disassembly And Assembly (Cont'd)

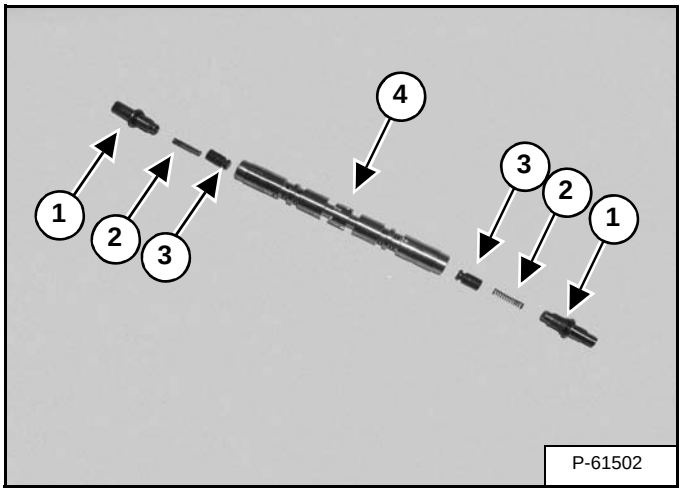
Figure 20-41-173



Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the plugs (Item 3) **[Figure 20-41-173]**. (Both ends)

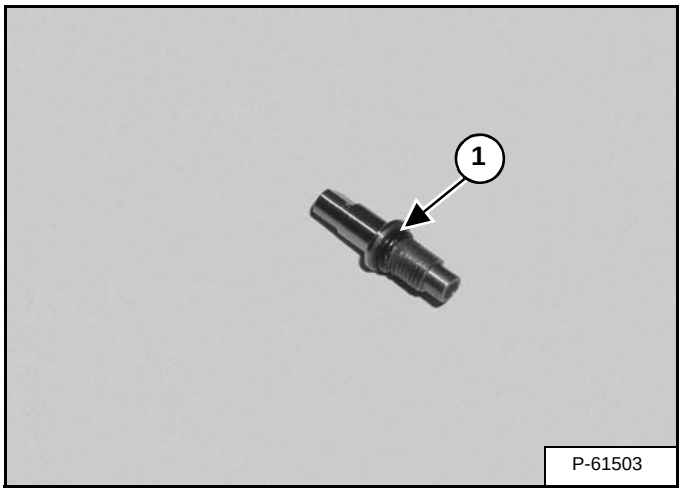
Installation: Apply thread lock adhesive (Loctite 262) or equivalent to the threads. Tighten the plugs to 44 in.-lbs. (5 Nm) torque.

Figure 20-41-174



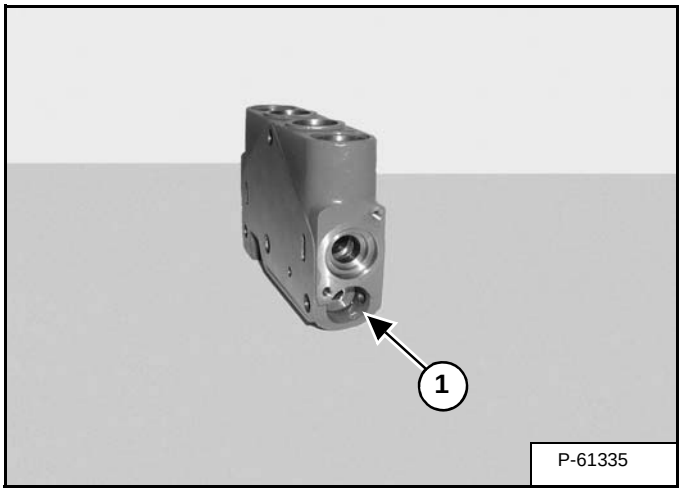
Remove the plugs (Item 1), springs (Item 2), and poppet (Item 3) from the spool (Item 4) **[Figure 20-41-174]**.

Figure 20-41-175



Remove the O-ring (Item 1) **[Figure 20-41-175]** from the plugs.

Figure 20-41-176



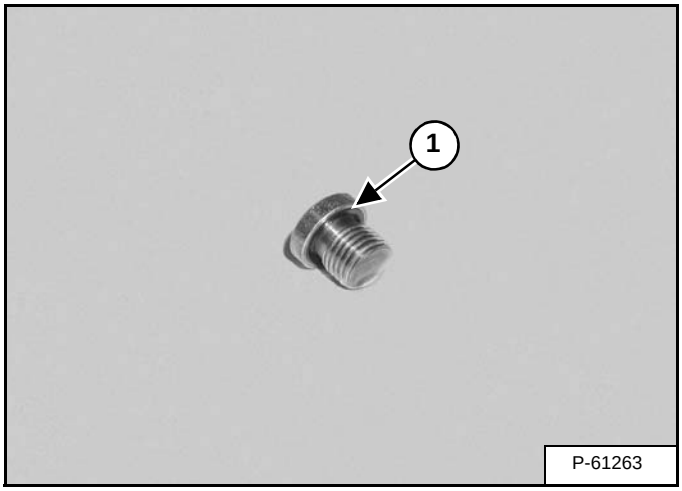
Remove the plug (Item 1) **[Figure 20-41-176]** from the top of the valve section.

Installation: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

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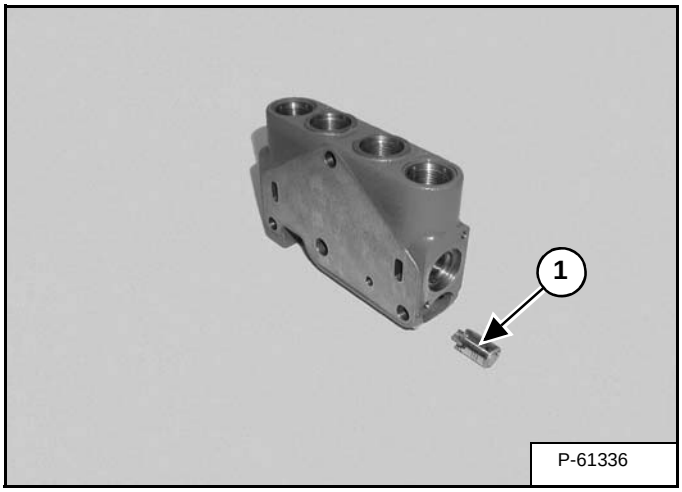
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-177



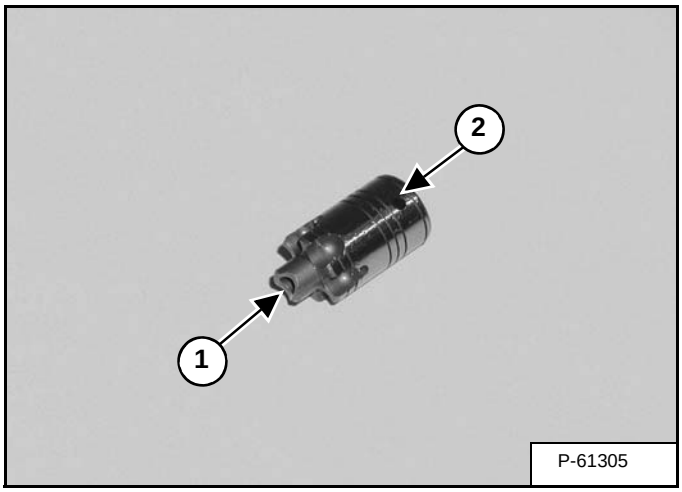
Remove the O-ring (Item 1) **[Figure 20-41-177]** from the plug.

Figure 20-41-178



Remove the compensator (Item 1) **[Figure 20-41-178]** from the valve section.

Figure 20-41-179



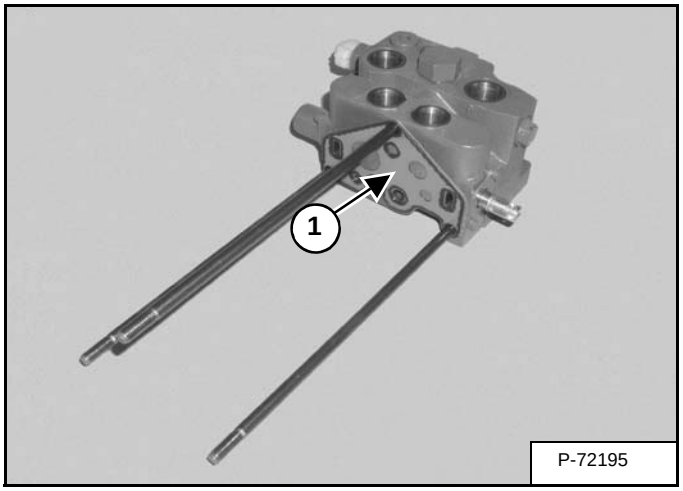
Check the orifice (Item 1) **[Figure 20-41-179]** in the compensator to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-41-179]** to be sure it is not plugged.

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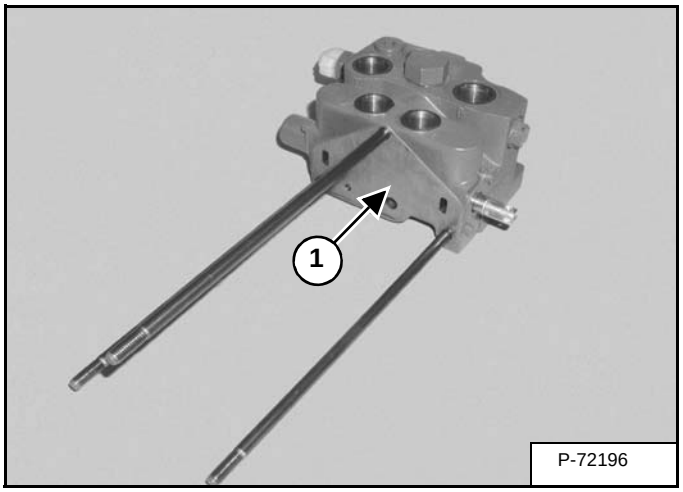
Boom Swing Valve Section Disassembly And Assembly

Figure 20-41-180



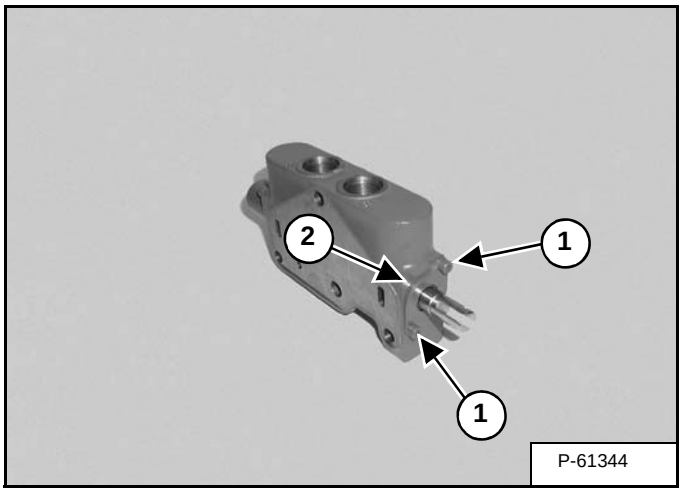
Remove the gasket (Item 1) **[Figure 20-41-180]** from the valve section.

Figure 20-41-181



Remove the boom swing valve section (Item 1) **[Figure 20-41-181]** from the control valve.

Figure 20-41-182

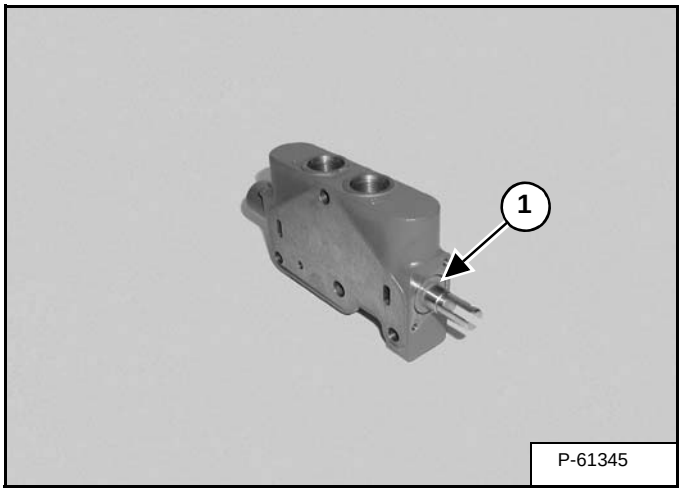


Remove the screws (Item 1) from the valve spool retainer (Item 2) **[Figure 20-41-182]**.

Installation: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

Remove the retainer.

Figure 20-41-183

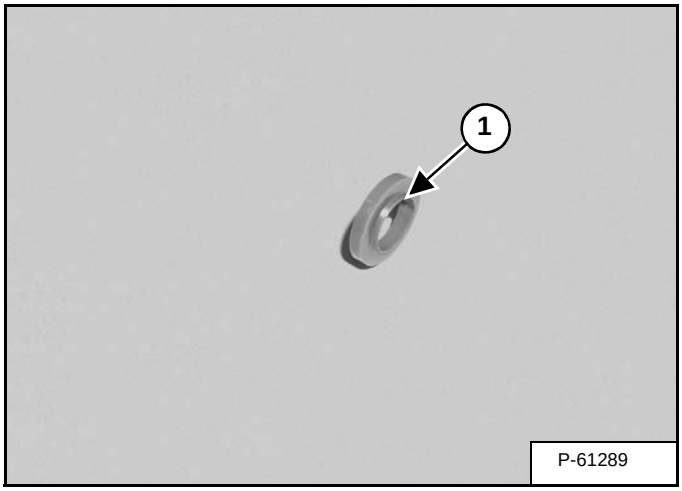


Remove the seal (Item 1) **[Figure 20-41-183]** from the spool.

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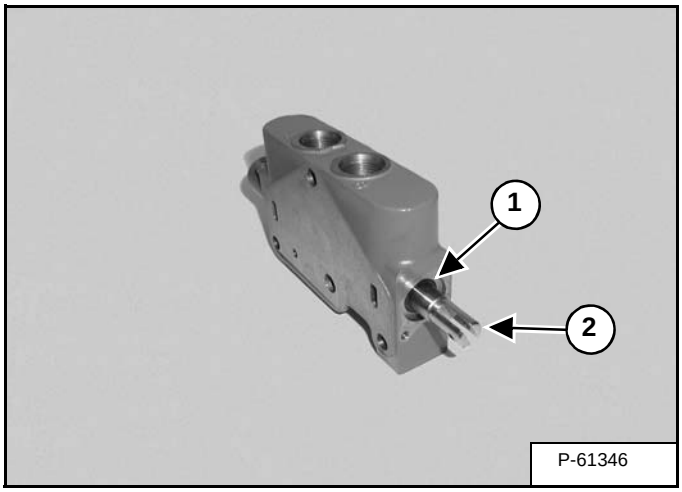
Boom Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-184



Assembly: Install the seal on the spool with the flange (Item 1) **[Figure 20-41-184]** toward the outside of the valve section.

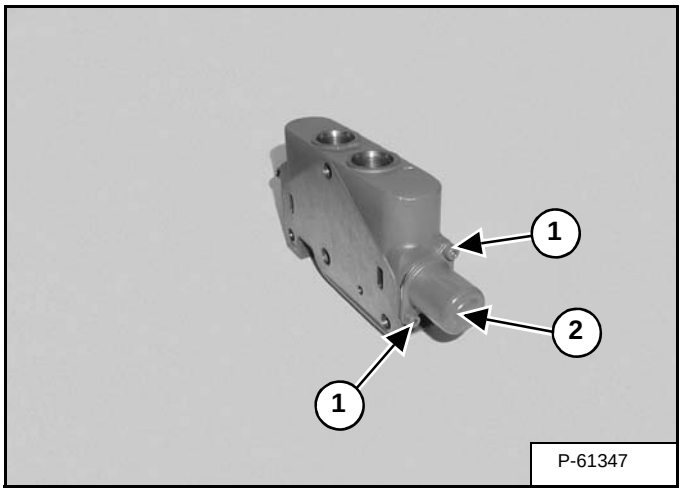
Figure 20-41-185



Remove the O-ring (Item 1) **[Figure 20-41-185]** from the valve spool.

NOTE: The valve spool (Item 2) [Figure 20-41-185] can only be removed from the valve section from the spring end of the valve section.

Figure 20-41-186

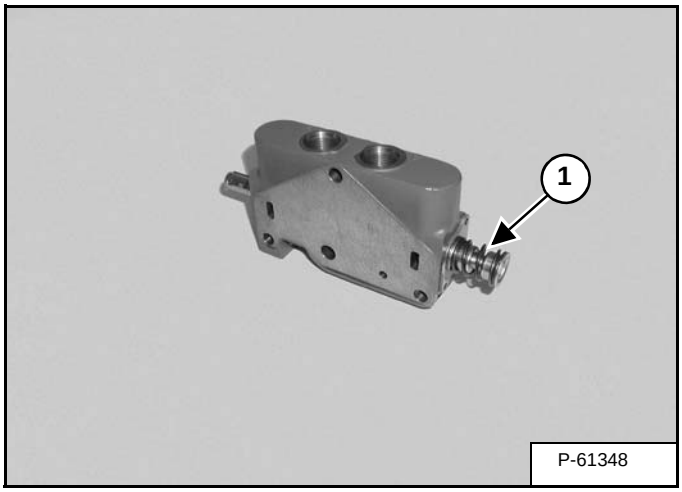


Remove the screws (Item 1) from the end cap (Item 2) **[Figure 20-41-186]**.

Installation: Tighten the screws to 27 in.-lbs. (3 Nm) torque.

Remove the end cap.

Figure 20-41-187

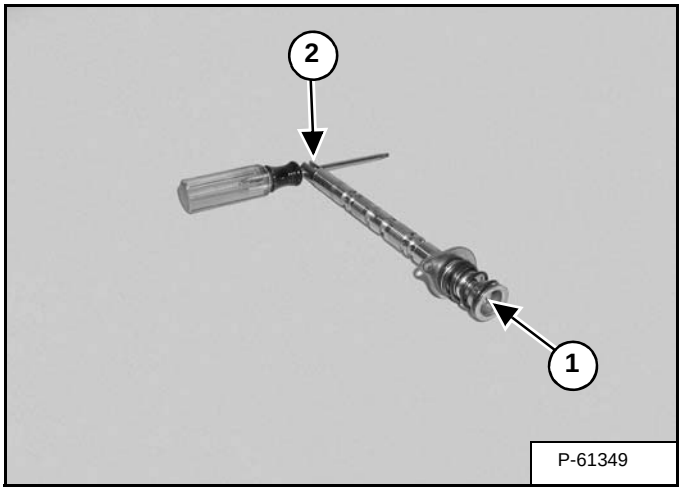


Remove the spool assembly (Item 1) **[Figure 20-41-187]**.

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

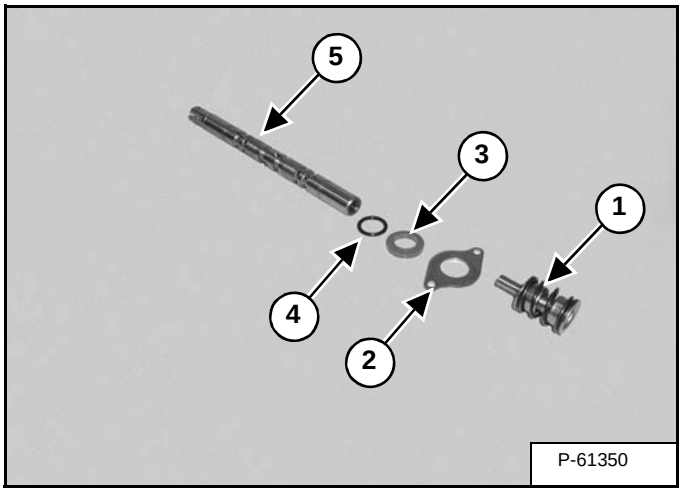
Figure 20-41-188



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

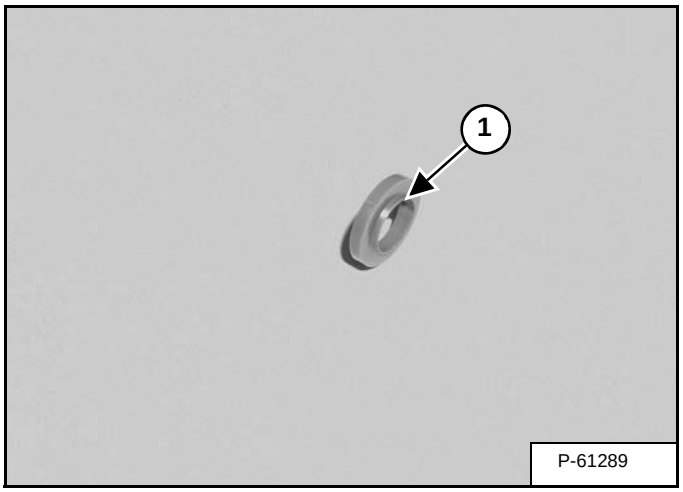
NOTE: To remove the bolt, the spool must be held on the linkage end (Item 2) [Figure 20-41-188], to keep the spool from rotating.

Figure 20-41-189



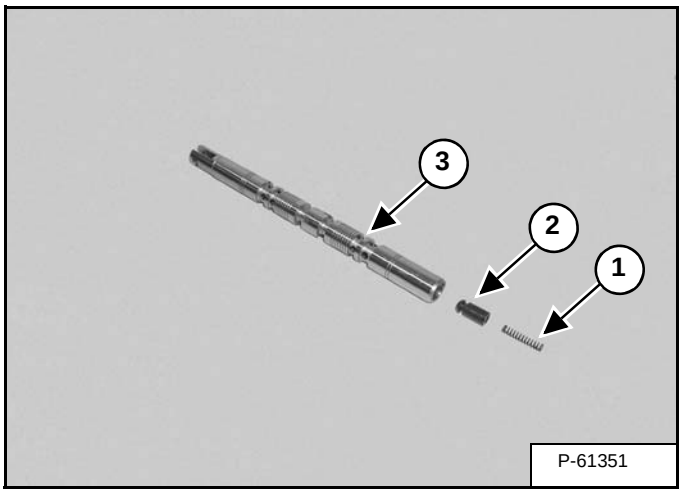
Remove the spring assembly (Item 1), retainer (Item 2), seal (Item 3) and O-ring (Item 4) from the spool (Item 5) **[Figure 20-41-189]**.

Figure 20-41-190



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

Figure 20-41-191

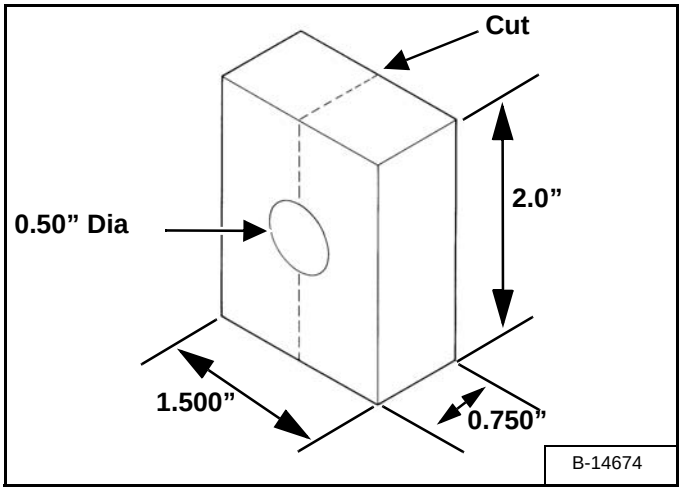


Remove the spring (Item 1) and poppet (Item 2) from the spool (Item 3) **[Figure 20-41-191]**.

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

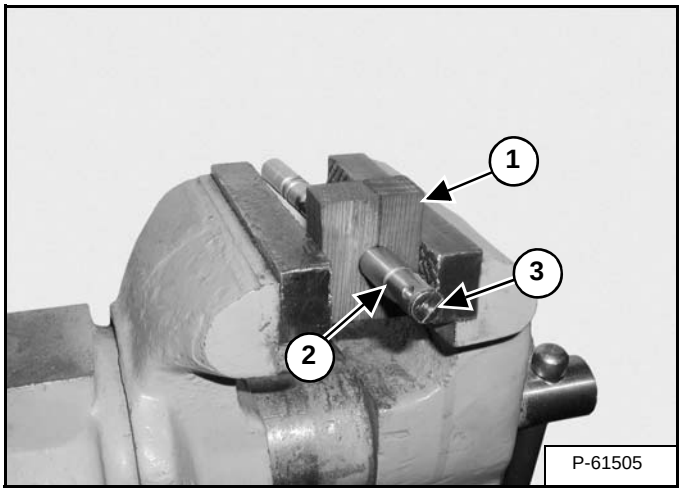
Figure 20-41-192



To remove the linkage end from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.50 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-41-192]**.

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

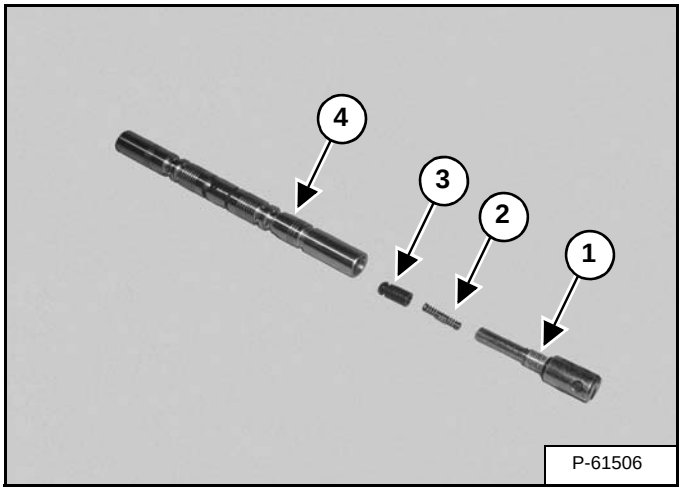
Figure 20-41-193



Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the linkage end (Item 3) **[Figure 20-41-193]**.

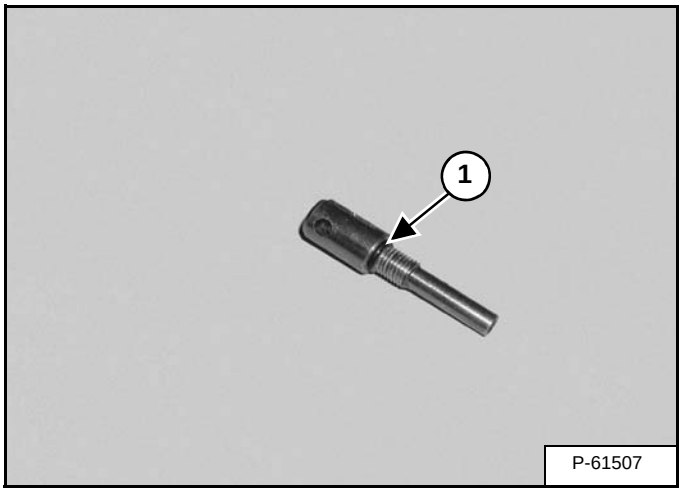
Installation: Apply thread lock adhesive (Loctite 262) or equivalent to the threads. Tighten the linkage end to 44 in.-lbs. (5 Nm) torque.

Figure 20-41-194



Remove the linkage end (Item 1), spring (Item 2), and poppet (Item 3) from the spool (Item 4) **[Figure 20-41-194]**.

Figure 20-41-195

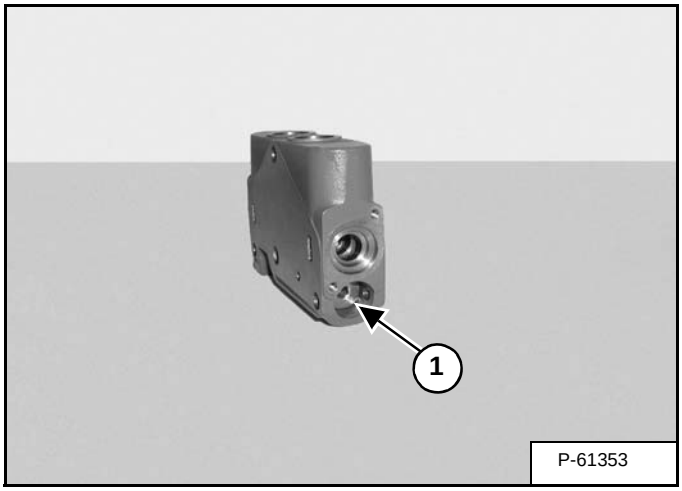


Remove the O-ring (Item 1) **[Figure 20-41-195]** from the linkage end.

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

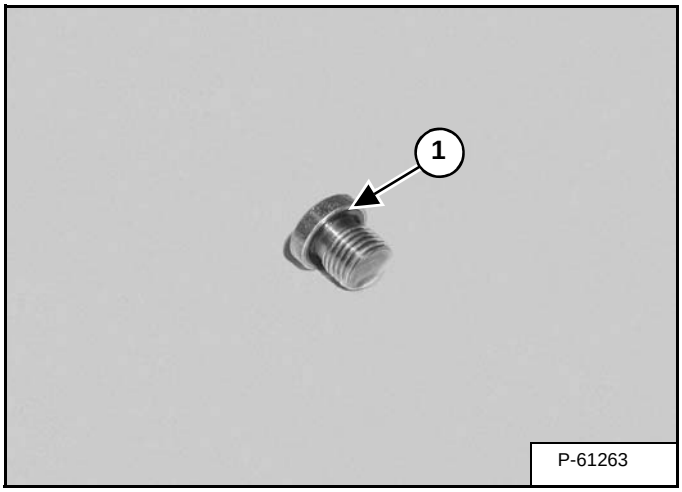
Figure 20-41-196



Remove the plug (Item 1) **[Figure 20-41-196]** from the valve section.

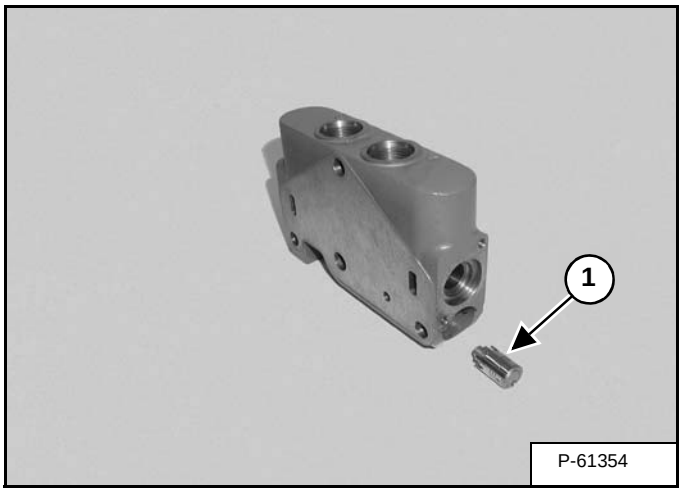
Installation: Tighten the plug to 22 ft.-lbs. (30 Nm) torque.

Figure 20-41-197



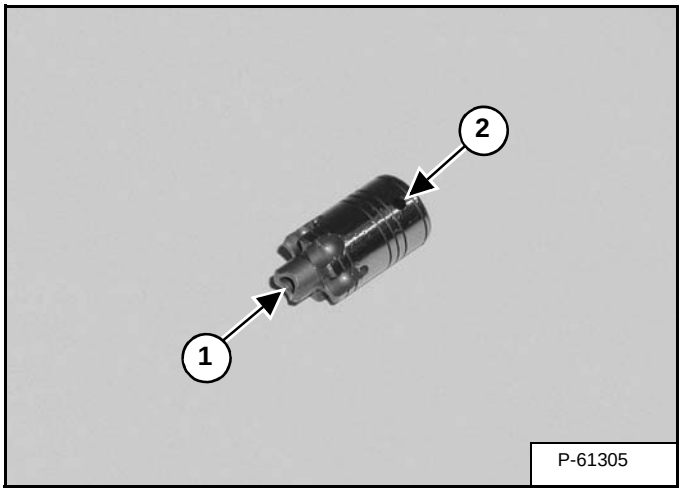
Remove the O-ring (Item 1) **[Figure 20-41-197]** from the plug.

Figure 20-41-198



Remove the compensator (Item 1) **[Figure 20-41-198]** from the valve section.

Figure 20-41-199



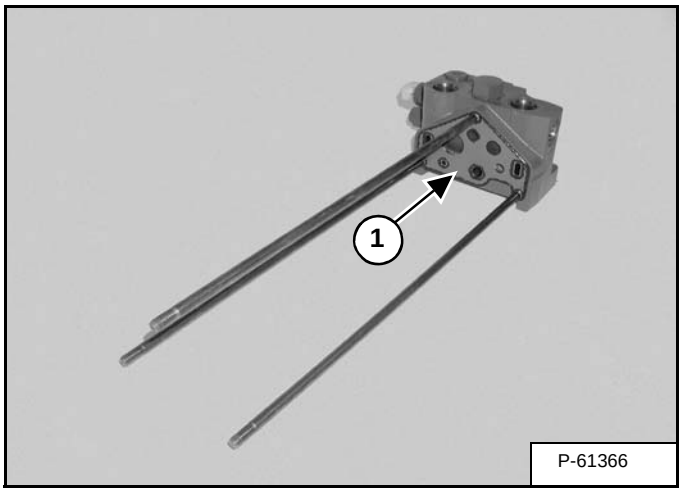
Check the orifice (Item 1) **[Figure 20-41-199]** in the compensator to be sure it is not plugged.

Check the crossport hole (Item 2) **[Figure 20-41-199]** to be sure it is not plugged.

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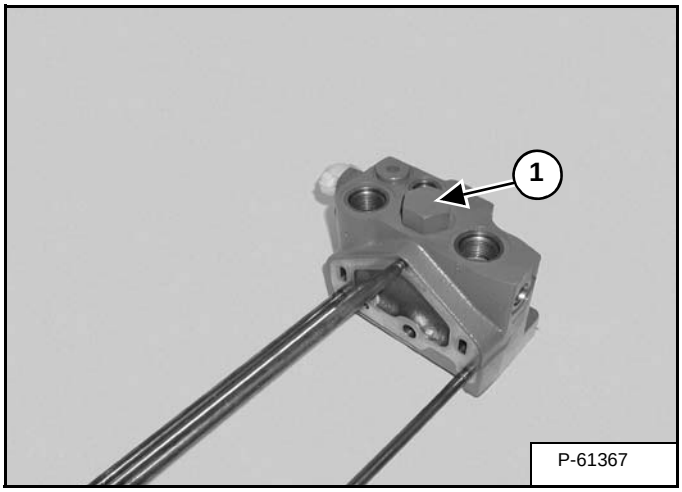
Inlet Section Disassembly And Assembly

Figure 20-41-200



Remove the gasket (Item 1) **[Figure 20-41-200]**.

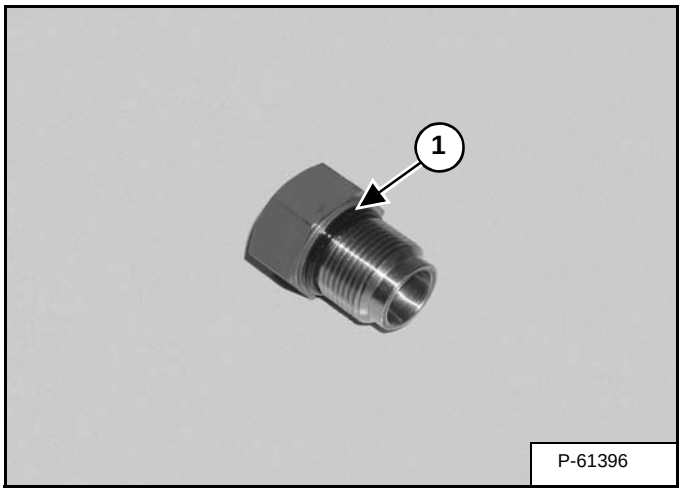
Figure 20-41-201



Remove the plug (Item 1) **[Figure 20-41-201]** from the open center valve.

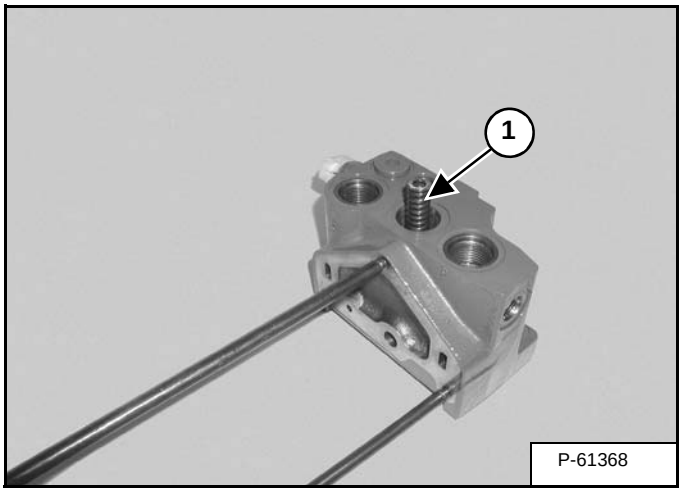
Installation: Tighten the plug to 52 ft.-lbs. (70 Nm) torque.

Figure 20-41-202



Remove the O-ring (Item 1) **[Figure 20-41-202]** from the plug.

Figure 20-41-203

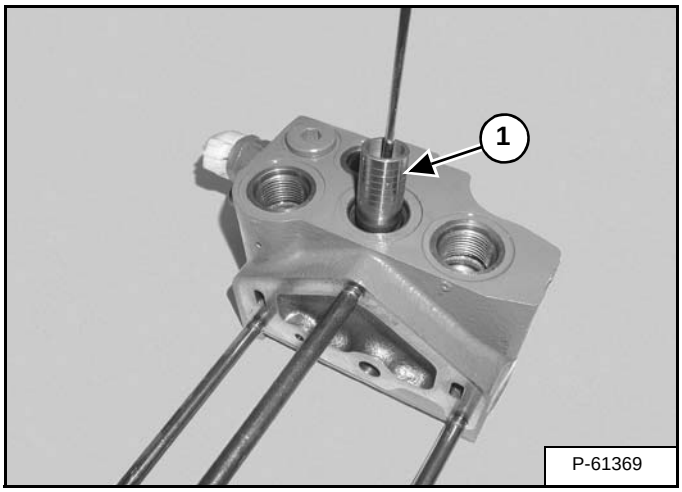


Remove the spring (Item 1) **[Figure 20-41-203]**.

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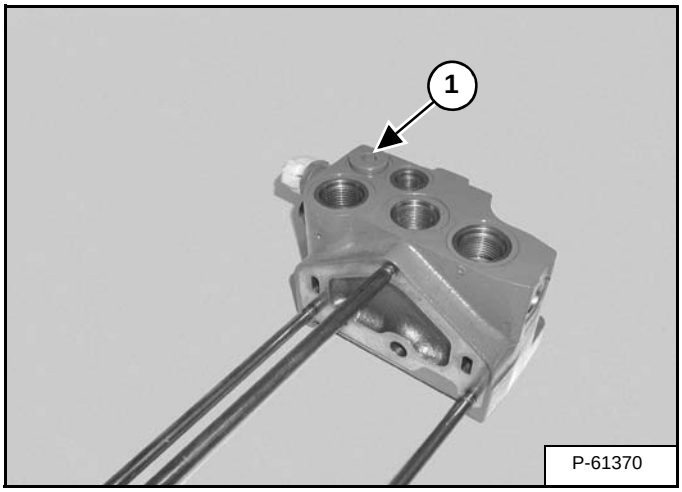
Inlet Section Disassembly And Assembly (Cont'd)

Figure 20-41-204



Remove the spool (Item 1) **[Figure 20-41-204]**.

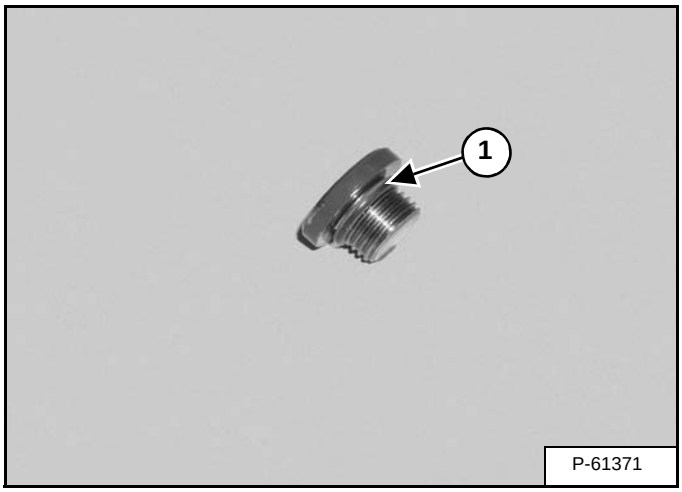
Figure 20-41-205



Remove the plug (Item 1) **[Figure 20-41-205]**.

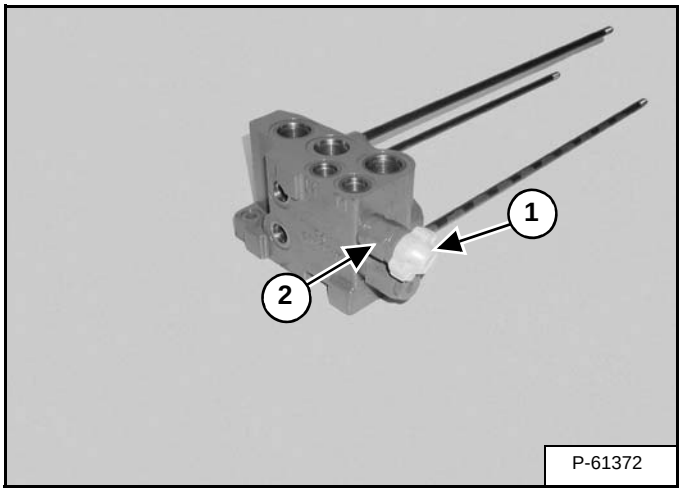
Installation: Tighten the plug to 15 ft.-lbs. (20 Nm) torque.

Figure 20-41-206



Remove the O-ring (Item 1) **[Figure 20-41-206]** from the plug.

Figure 20-41-207



Remove the protective cover (Item 1) from the main relief valve (Item 2) **[Figure 20-41-207]**.

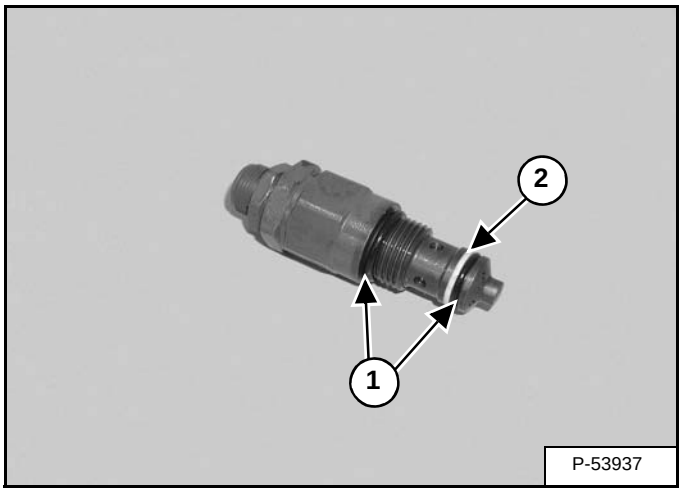
Remove the main relief valve from the inlet section.

Installation: Tighten the main relief valve to 33 ft.-lbs. (45 Nm) torque.

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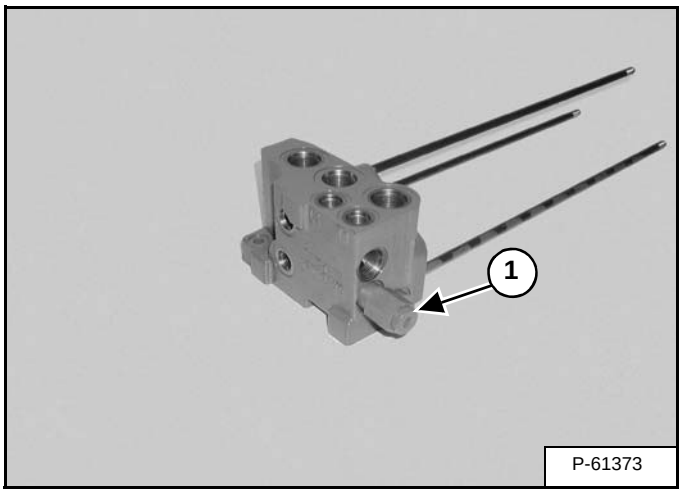
Inlet Section Disassembly And Assembly (Cont'd)

Figure 20-41-208



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-41-208]** from the relief valve.

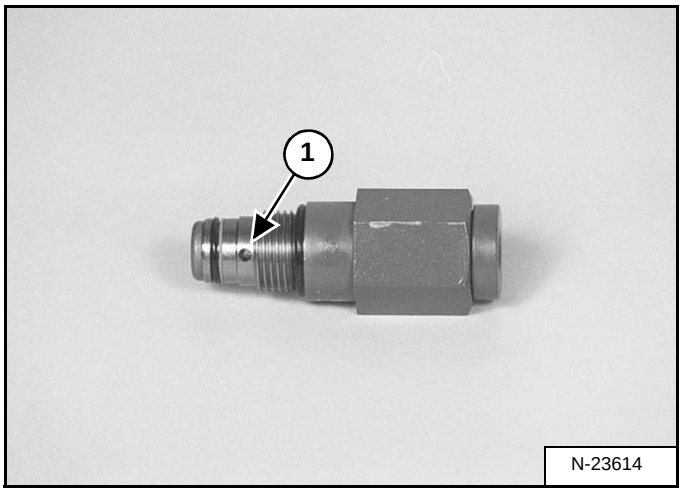
Figure 20-41-209



Remove the load sense bleed valve (Item 1) **[Figure 20-41-209]** from the inlet section.

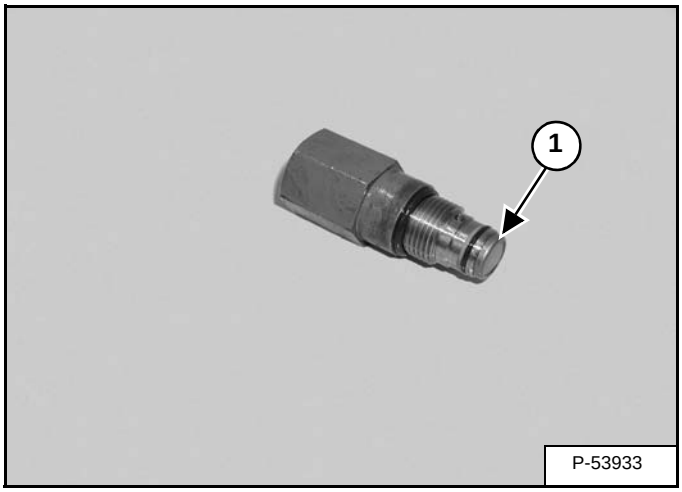
Installation: Tighten the load sense bleed valve to 15 ft.-lbs. (20 Nm) torque.

Figure 20-41-210



Check the port (Item 1) **[Figure 20-41-210]** in the load sense bleed valve to be sure it is not plugged.

Figure 20-41-211

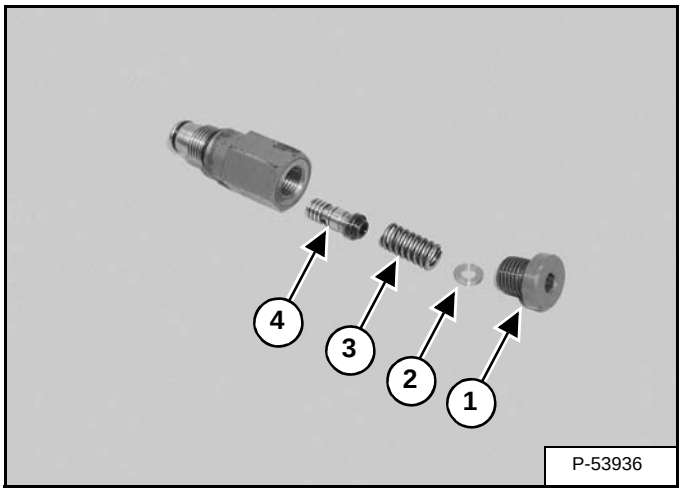


Remove the filter (Item 1) **[Figure 20-41-211]** from the end of the load sense bleed valve.

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Inlet Section Disassembly And Assembly (Cont'd)

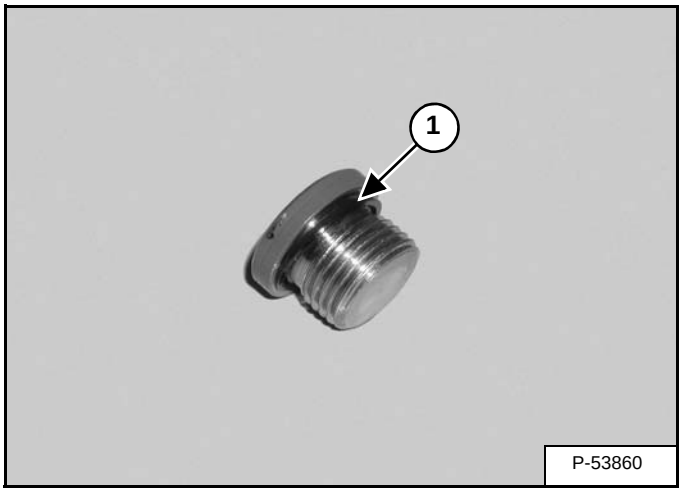
Figure 20-41-212



Remove the plug (Item 1), shims (Item 2), spring (Item 3) and spool (Item 4) **[Figure 20-41-212]** from the load sense bleed valve.

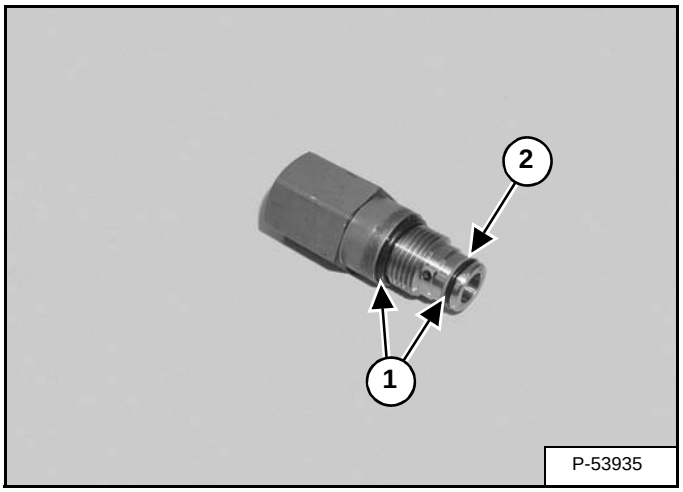
Installation: Tighten the plug to 15 ft.-lbs. (20 Nm) torque.

Figure 20-41-213



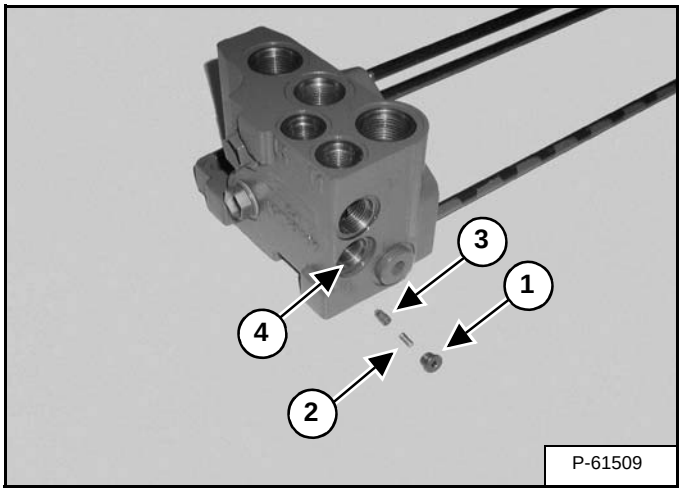
Remove the O-ring (Item 1) **[Figure 20-41-213]** from the plug.

Figure 20-41-214



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-41-214]**.

Figure 20-41-215

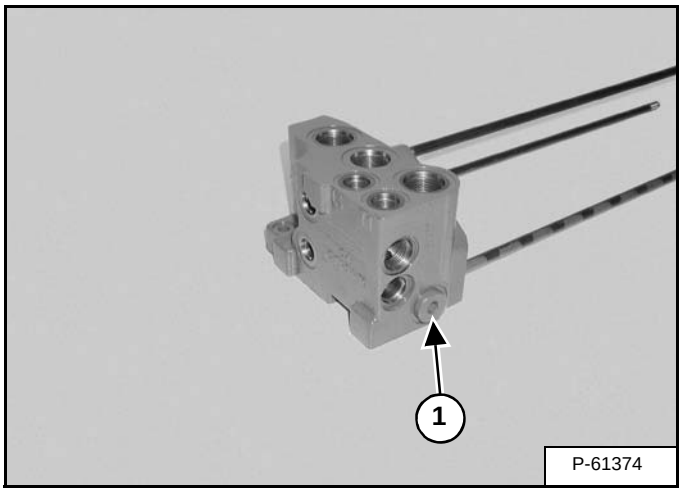


Remove the plug (Item 1), spring (Item 2) and poppet (Item 3) from the port (Item 4) **[Figure 20-41-215]**.

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Inlet Section Disassembly And Assembly (Cont'd)

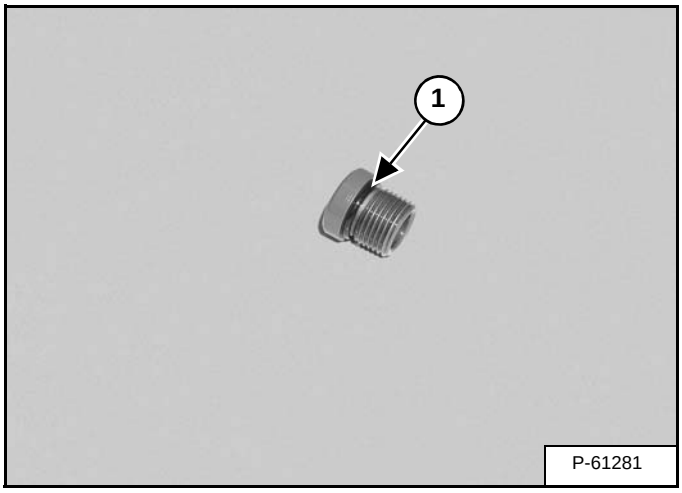
Figure 20-41-216



Remove the plug (Item 1) **[Figure 20-41-216]**.

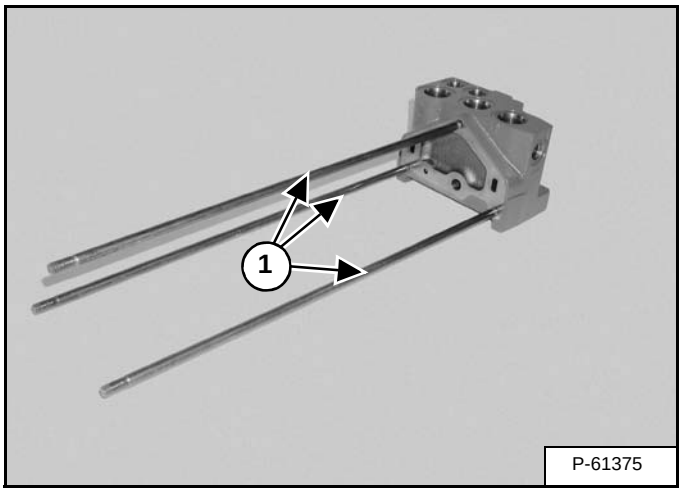
Installation: Tighten the plug to 15 ft.-lbs. (20 Nm) torque.

Figure 20-41-217



Remove the O-ring (Item 1) **[Figure 20-41-217]** from the plug.

Figure 20-41-218



Remove the tie rods (Item 1) **[Figure 20-41-218]** from the inlet section.

Installation: Tighten the tie rods to 11 ft.-lbs. (15 Nm) torque.

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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.

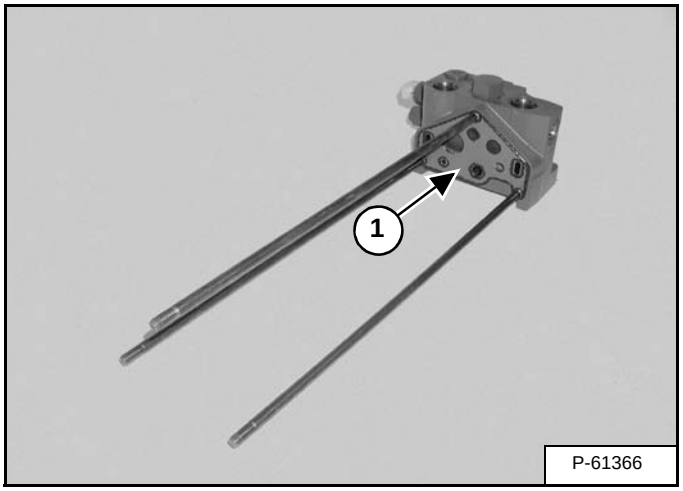
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

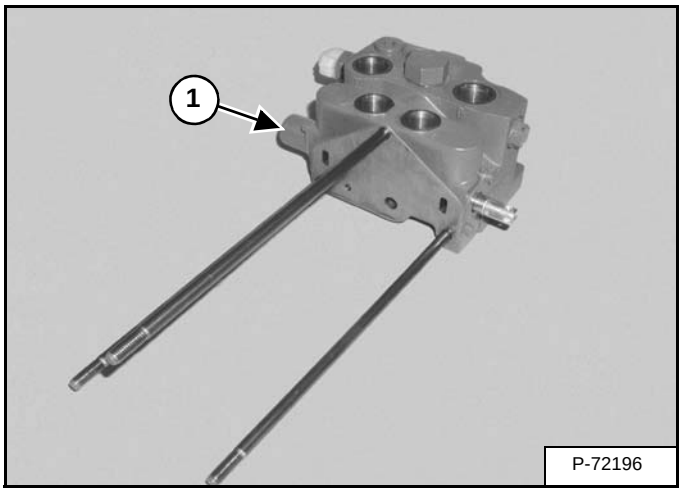
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-41-219



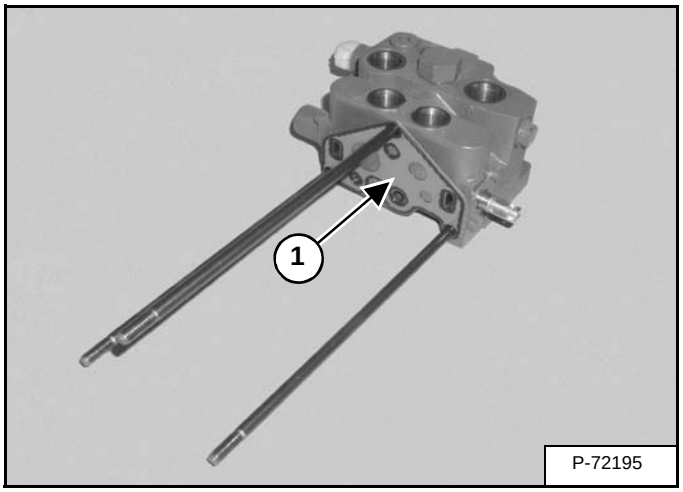
Install the gasket (Item 1) **[Figure 20-41-219]** on the inlet section.

Figure 20-41-220



Install the boom swing valve section (Item 1) **[Figure 20-41-220]** on the tie rods.

Figure 20-41-221

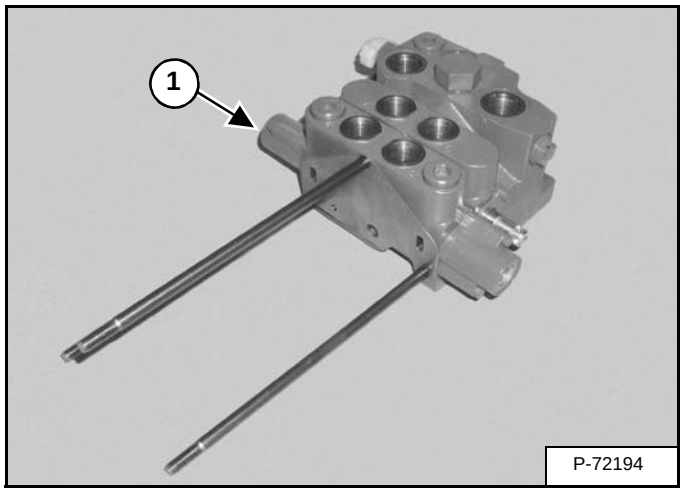


Install the gasket (Item 1) **[Figure 20-41-221]** on the boom swing valve section.

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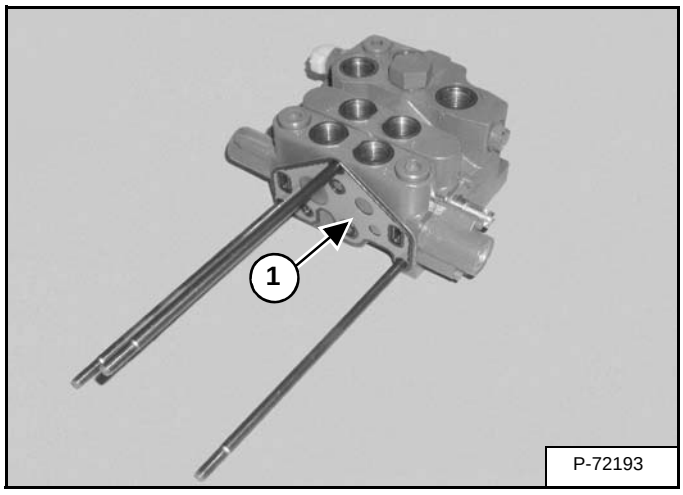
Assembly (Cont'd)

Figure 20-41-222



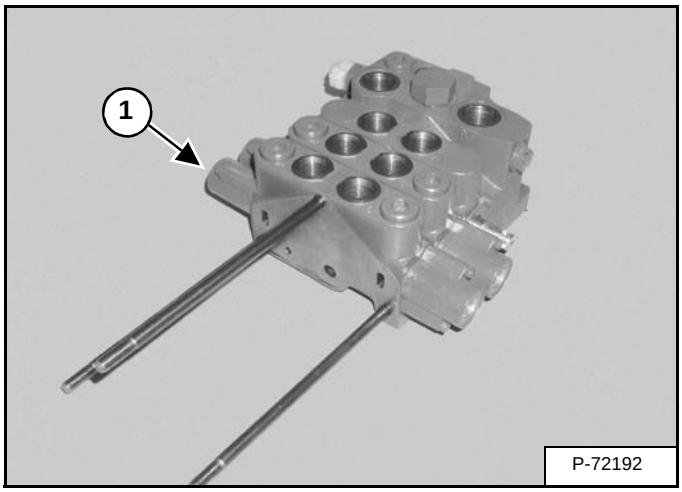
Install the boom valve section (Item 1) **[Figure 20-41-222]** on the tie rods.

Figure 20-41-223



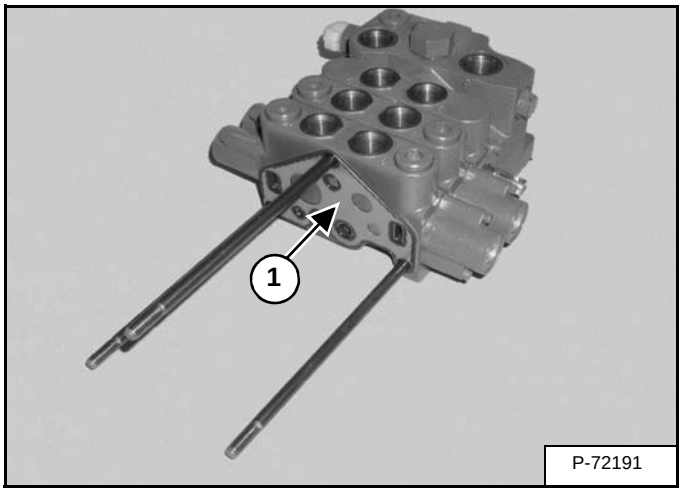
Install the gasket (Item 1) **[Figure 20-41-223]** on the boom valve section.

Figure 20-41-224



Install the arm valve section (Item 1) **[Figure 20-41-224]** on the tie rods.

Figure 20-41-225

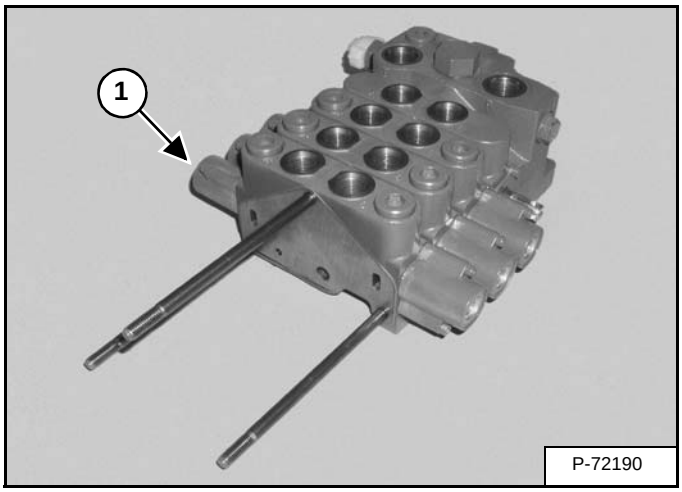


Install the gasket (Item 1) **[Figure 20-41-225]** on the arm valve.

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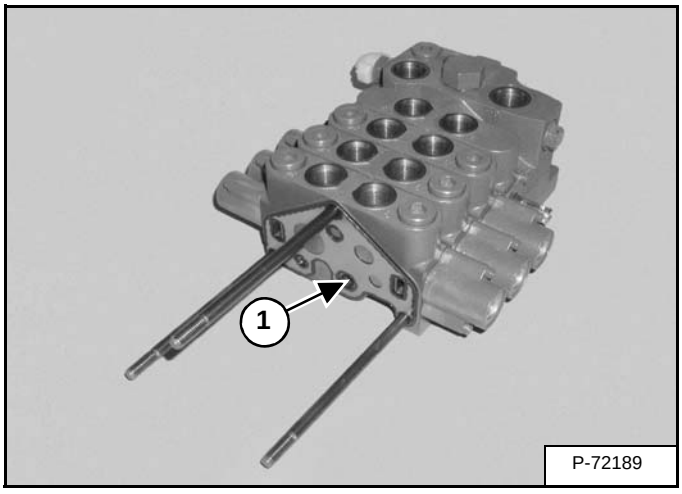
Assembly (Cont'd)

Figure 20-41-226



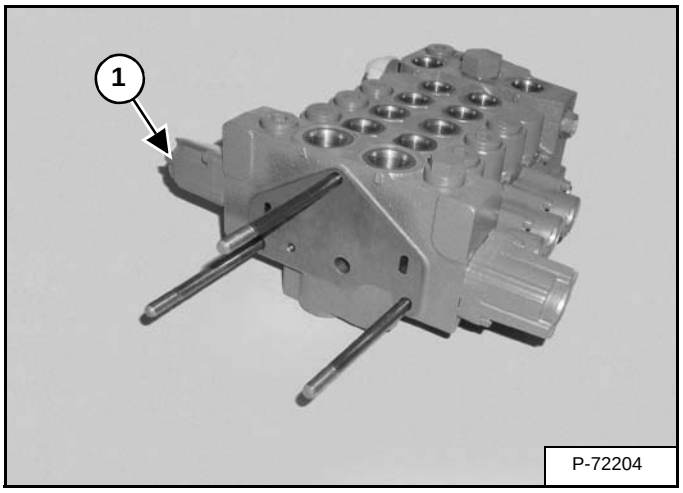
Install the bucket valve section (Item 1) **[Figure 20-41-226]** on the tie rods.

Figure 20-41-227



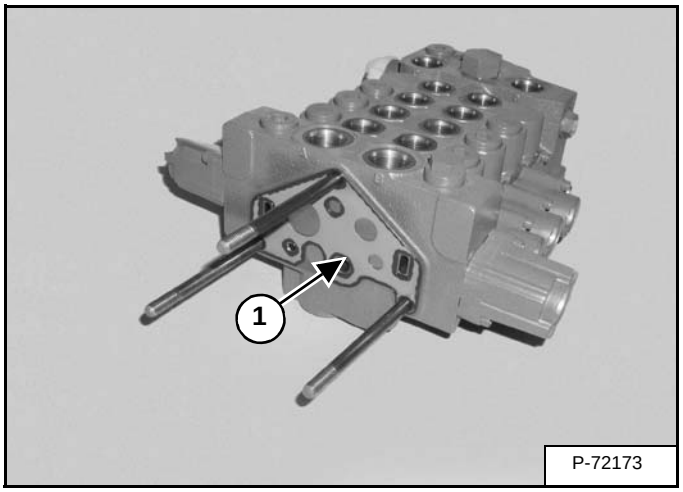
Install the gasket (Item 1) **[Figure 20-41-227]** on the bucket valve section.

Figure 20-41-228



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

Figure 20-41-229

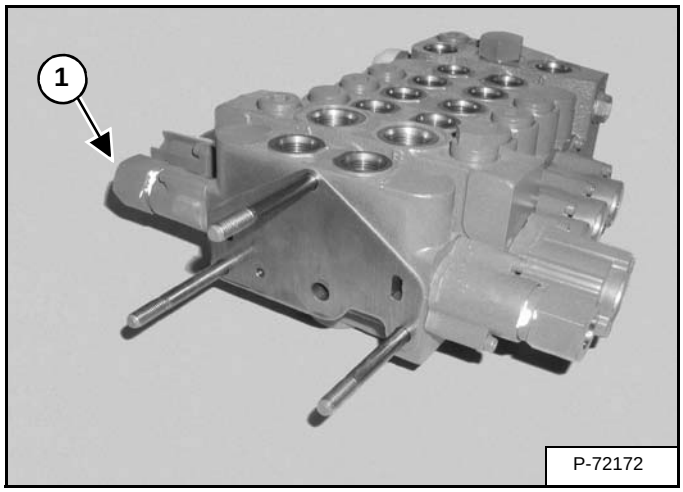


Install the gasket (Item 1) **[Figure 20-41-229]** on the auxiliary valve section.

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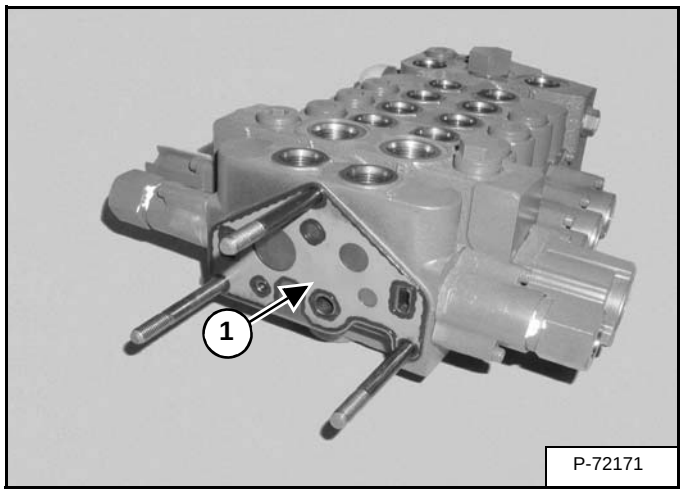
Assembly (Cont'd)

Figure 20-41-230



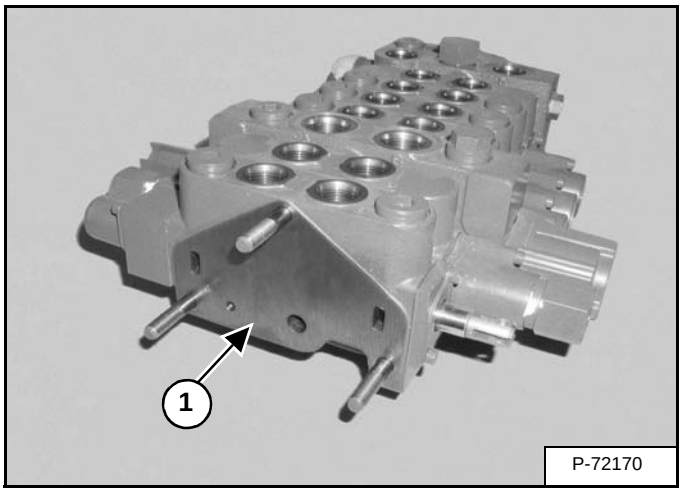
Install the slew valve section (Item 1) **[Figure 20-41-230]** on the tie rods.

Figure 20-41-231



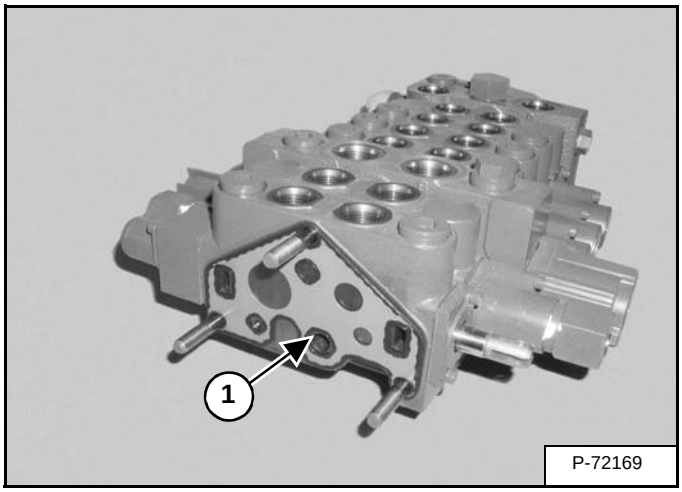
Install the gasket (Item 1) **[Figure 20-41-231]** on the slew valve section.

Figure 20-41-232



Install the blade valve section (Item 1) **[Figure 20-41-232]** on the tie rods.

Figure 20-41-233

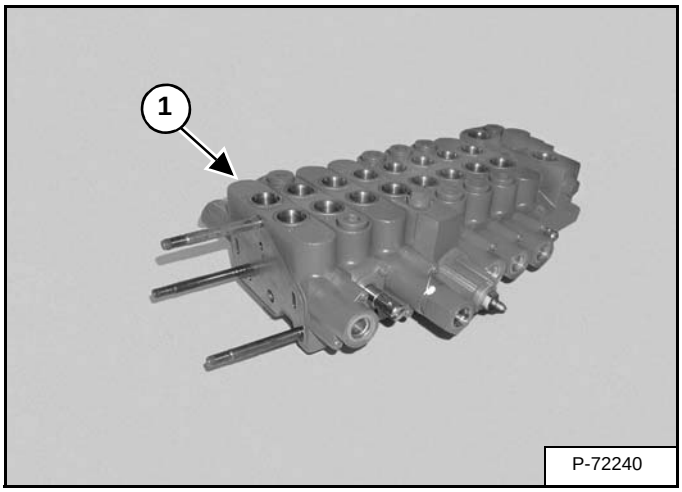


Install the gasket (Item 1) **[Figure 20-41-233]** on the blade valve section.

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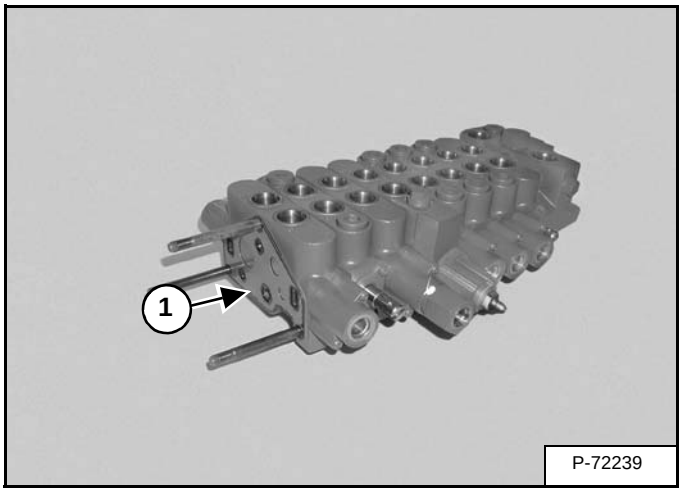
Assembly (Cont'd)

Figure 20-41-234



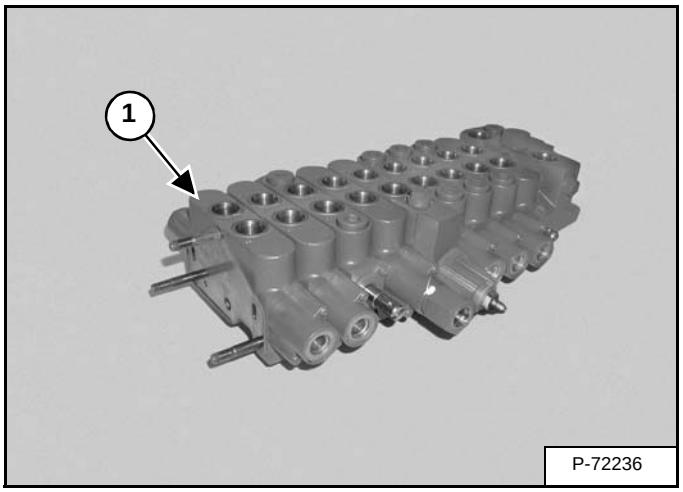
Install the left travel valve section (Item 1) **[Figure 20-41-234]** on the tie rods.

Figure 20-41-235



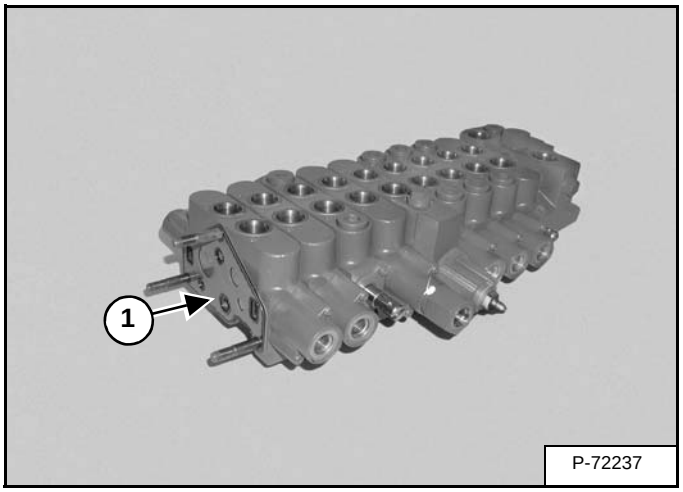
Install the gasket (Item 1) **[Figure 20-41-235]** on the left travel valve section.

Figure 20-41-236



Install the right travel valve section (Item 1) **[Figure 20-41-236]** on the tie rods.

Figure 20-41-237



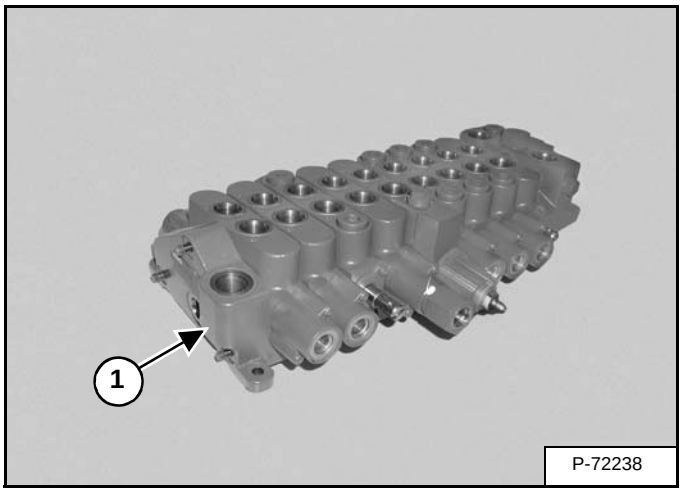
Install the gasket (Item 1) **[Figure 20-41-237]** on the right travel valve section.

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

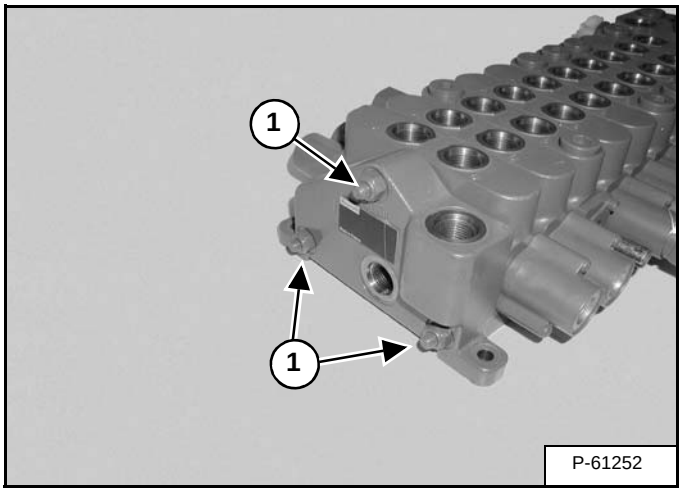
Assembly (Cont'd)

Figure 20-41-238



Install the end cap (Item 1) **[Figure 20-41-238]** on the tie rods.

Figure 20-41-239



Install the nuts (Item 1) **[Figure 20-41-239]** on the tie rods, finger tight.

Be sure the valve assembly does not rock on a flat surface.

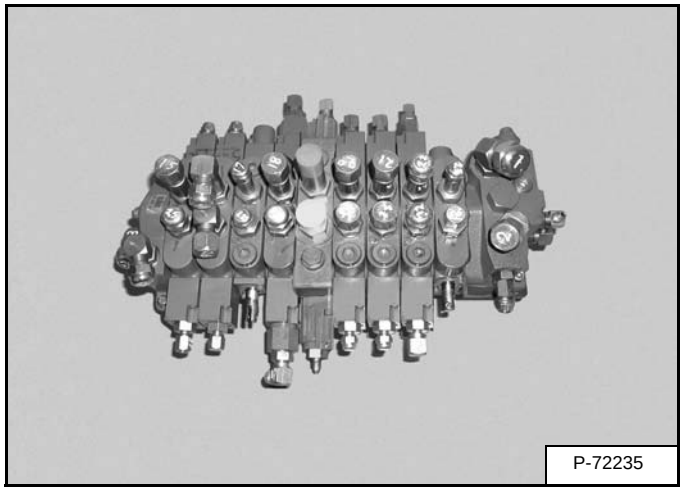
Initially tighten the tie rod nuts (Item 1) to 5 ft.-lbs. (7 Nm) torque in a crisscross manner. Final tighten the tie rod nuts (Item 1) **[Figure 20-41-239]** to 11 ft.-lbs. (15 Nm) torque.

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 stick, loosen the tie rod nuts and tighten per above information.

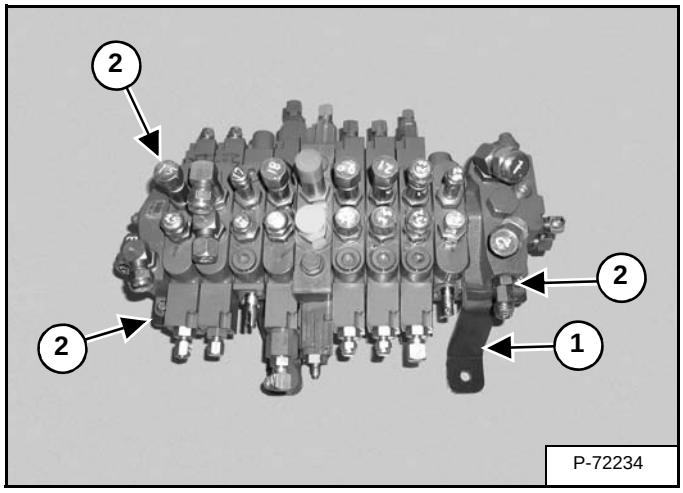
Recheck the control valve assembly for level settings.

Figure 20-41-240



Install the fittings and hose **[Figure 20-41-240]**.

Figure 20-41-241



Install the mount plate (Item 1) with three bolts and nuts (Item 2) **[Figure 20-41-241]**.

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HYDRAULIC PUMP

Description

IMPORTANT

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

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Figure 20-50-1

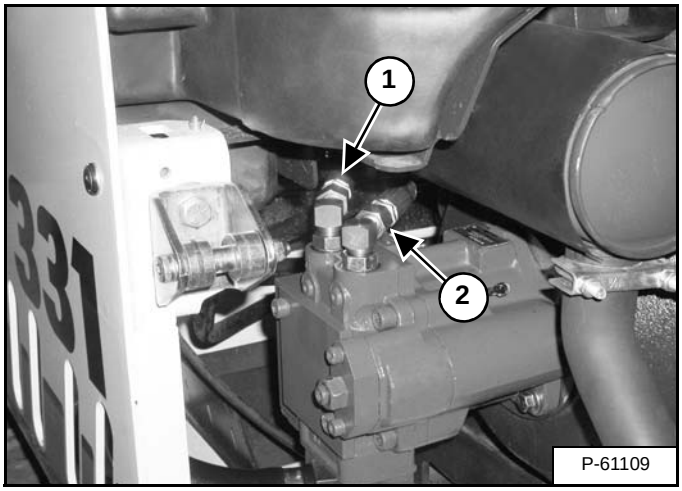
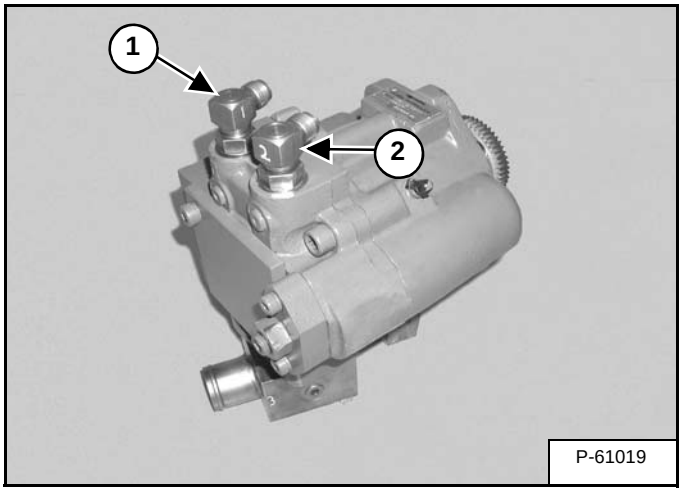


Figure 20-50-2



Pump outlet one (Item 1) and pump outlet 2 (Item 2) **[Figure 20-50-1]** & **[Figure 20-50-2]** provides hydraulic fluid to the hydraulic control valve and manifold assembly.

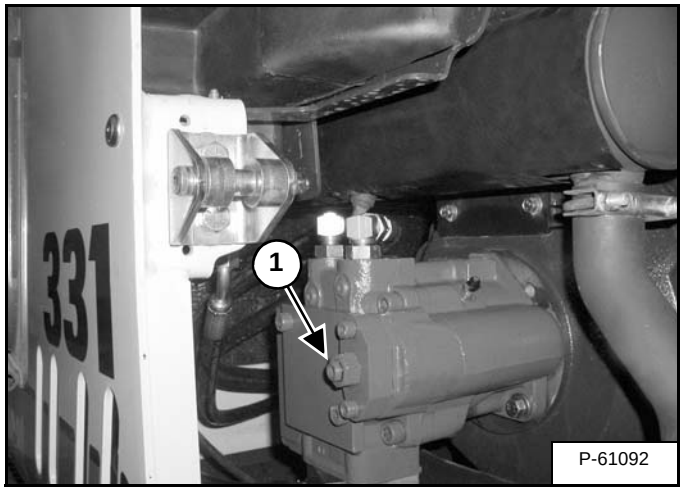
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Torque Adjustment

Prior to making any torque adjustment, all piston and gear pump tests must be completed and are to rated specifications. (See the following pages for pump tests.)

Prior to making any torque adjustment, make sure the no load engine RPM is correct.

Figure 20-50-3



The adjustment screw (Item 1) **[Figure 20-50-3]** is used to match the maximum hydraulic horsepower of the pump to the maximum rated engine horsepower.

Remove any auxiliary hydraulic attachments from the excavator.

Engage the slew lock.

Start the engine and move the speed control to the high idle position.

Engage the following hydraulic functions, and continue to engage the functions.

Engage the auxiliary hydraulics.
Extend the bucket cylinder.
Extend the arm cylinder.
Extend the boom cylinder.
Extend the boom swing cylinder.
Engage the upperstructure slew.

With all the above hydraulic functions engaged, the engine speed must maintain 2400 RPM.

Loosen the nut (Item 2) **[Figure 20-50-3]** and turn the adjustment screw clockwise to increase pump torque. counterclockwise to decrease pump torque.

Tighten the nut and retest the pump.

Increase or decrease pump torque until correct engine RPM is maintained.

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Testing The Piston Pump

All pump testing is done with the hydraulic oil at operating temperature and with the engine high speed setting of 2550-2620 RPM.

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

MEL10003 - Hydraulic Tester

Stop the engine.

Open the tailgate.

Figure 20-50-4

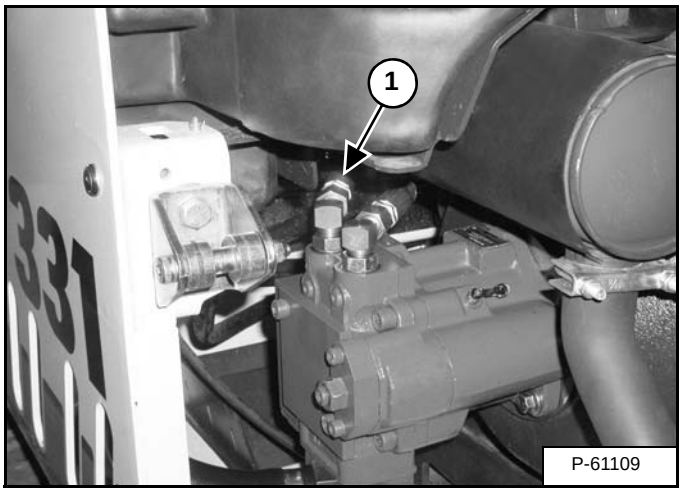
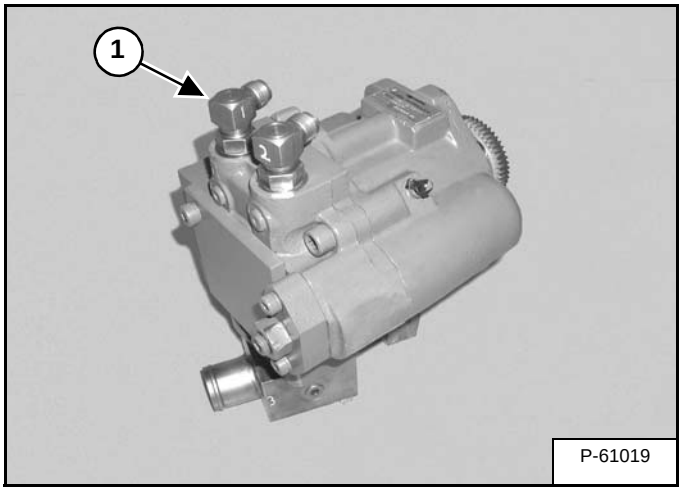
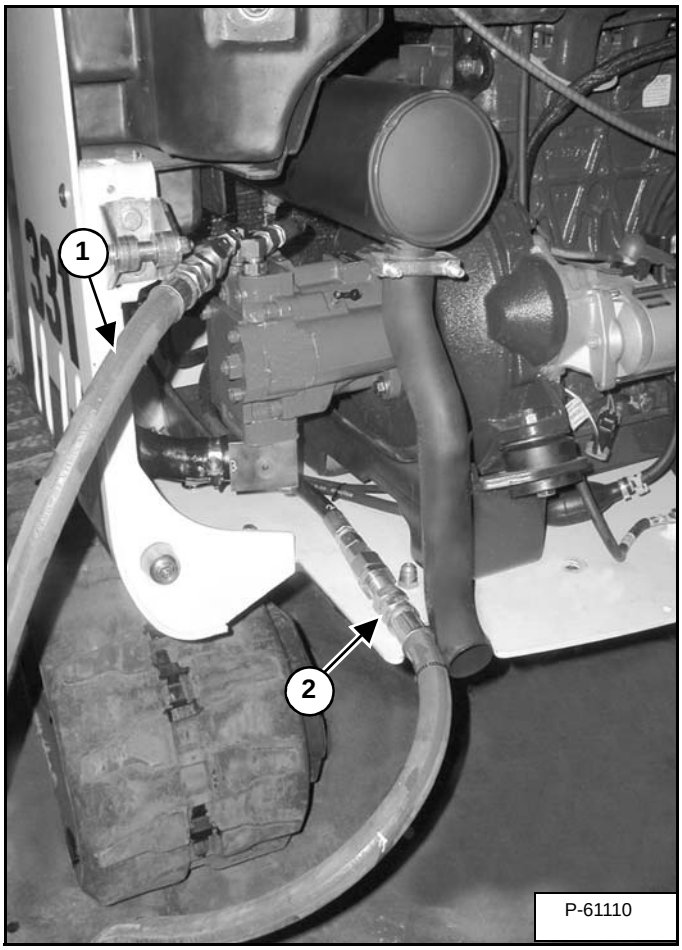


Figure 20-50-5



Remove the outlet hose (Item 1) **[Figure 20-50-4]** & **[Figure 20-50-5]** from the hydraulic pump being tested.

Figure 20-50-6



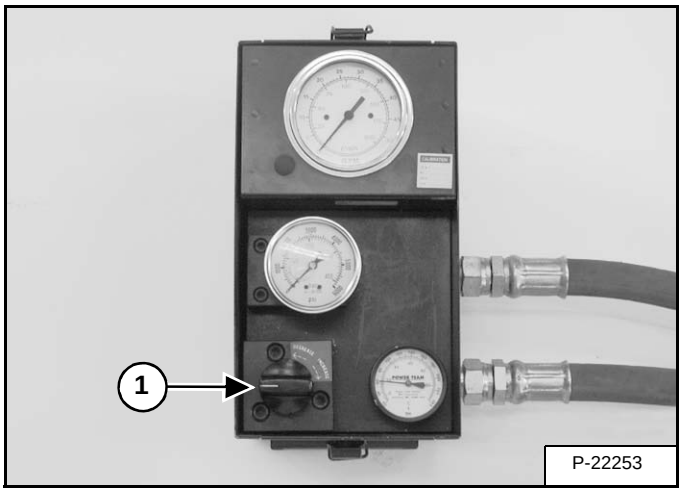
Connect the inlet side (Item 1) **[Figure 20-50-6]** of the tester to the pump.

Connect the outlet side of the tester to the hose (Item 2) **[Figure 20-50-6]** that was removed from the pump.

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Testing The Piston Pump (Cont'd)

Figure 20-50-7



NOTE: Open the flow control knob (Item 1) [Figure 20-50-7] fully to prevent pump damage. This is a direct pump test. There is no relief valve in the system.

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

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

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

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

Pump flow on a new piston pump is 10.1 gpm (38.2 L/min.).

Close the flow control knob (Item 1) **[Figure 20-50-7]** slowly to 100 PSI below the relief valve setting (2650 PSI [180 bar]).

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

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

$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \text{ x100}$$

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

Repeat the procedure for pump outlet two.

The pump free flow and pump pressure flow must be equal between outlet one and two.

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Testing Auxiliary Hydraulic Flow

The auxiliary hydraulic flow for the 331/331E/334 Excavators is the combined flow of pump outlet two and pump outlet three.

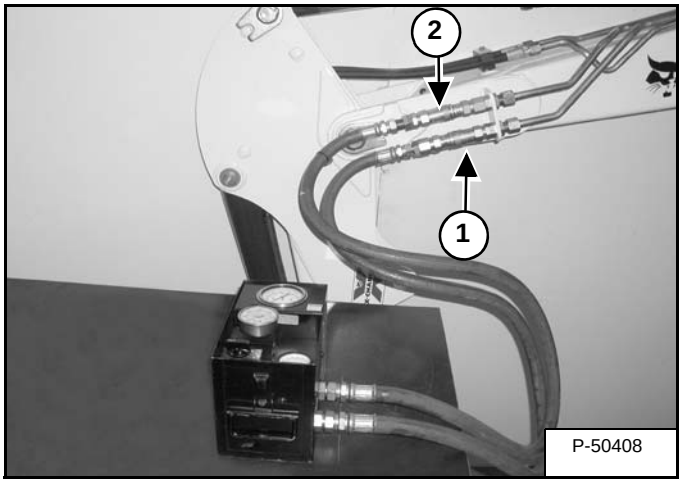
All testing is done with the hydraulic oil at operating temperature and the engine high speed setting of 2550-2620 RPM.

The following tool will be needed for the auxiliary hydraulic flow test:

MEL10003-Hydraulic Tester.

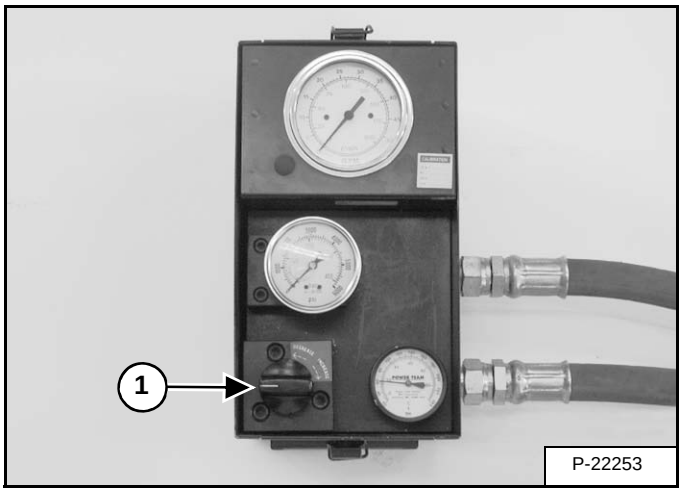
Stop the engine.

Figure 20-50-8



Connect the inlet side of the tester to the female coupler (Item 1). Connect the out side of the tester to the male coupler (Item 2) **[Figure 20-50-8]**.

Figure 20-50-9



NOTE: Open the flow control knob (Item 1) [Figure 20-50-9] fully.

Start the engine, and run at low RPM. Engage the auxiliary hydraulic circuit.

NOTE: When engaging the auxiliary hydraulic circuit, make sure the female coupler is pressure and the male coupler is return.

Make sure the tester is connected correctly. If no flow is indicated at the tester, the hoses are connected wrong.

Increase the engine speed to full RPM. Warm the hydraulic fluid to 150° F (66° C) by turning the restrictor valve until the gauge reads about 1000 PSI (193 bar). Do not exceed system pressure.

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

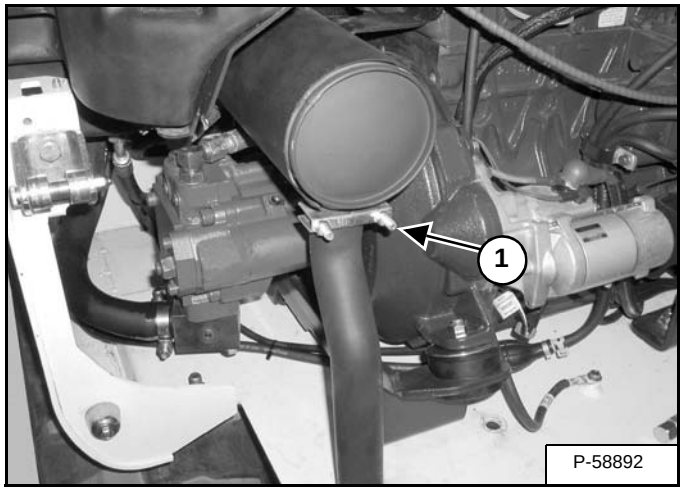
Record the auxiliary hydraulic free flow GPM (L/min.).

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Removal And Installation

Drain the hydraulic reservoir. (See Checking And Adding Hydraulic Fluid on Page 10-100-1.)

Figure 20-50-10



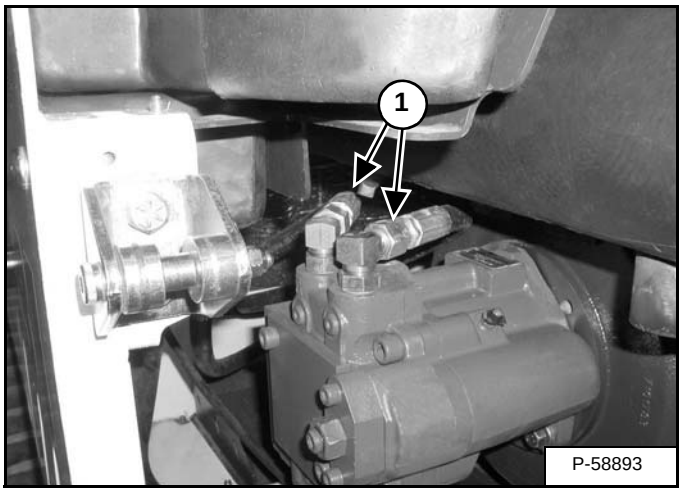
Remove the clamp (Item 1) **[Figure 20-50-10]** and tailpipe.

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, tube lines and ports to keep dirt out. Dirt can quickly damage the system.

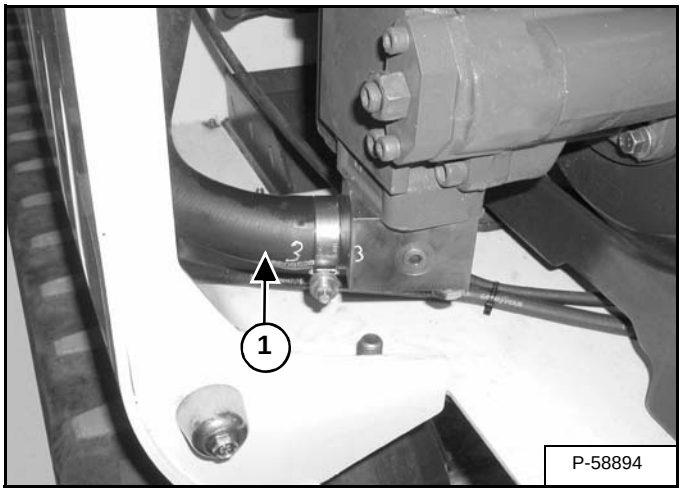
I-2003-0888

Figure 20-50-11



Mark and remove the two hoses (Item 1) **[Figure 20-50-11]**.

Figure 20-50-12

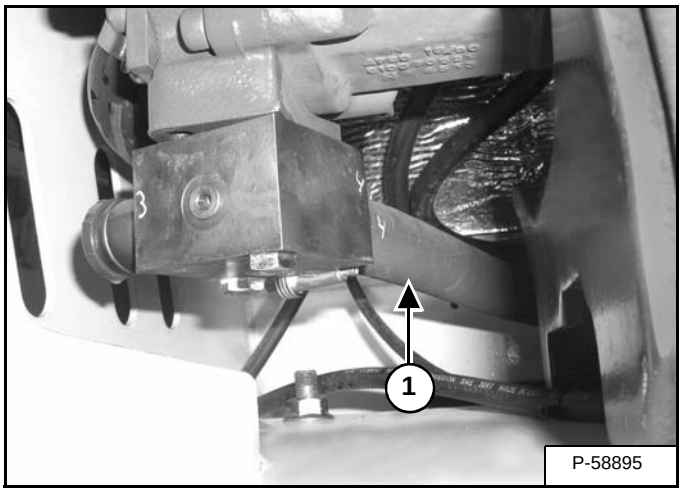


Remove the hydraulic reservoir to pump hose (Item 1) **[Figure 20-50-12]**.

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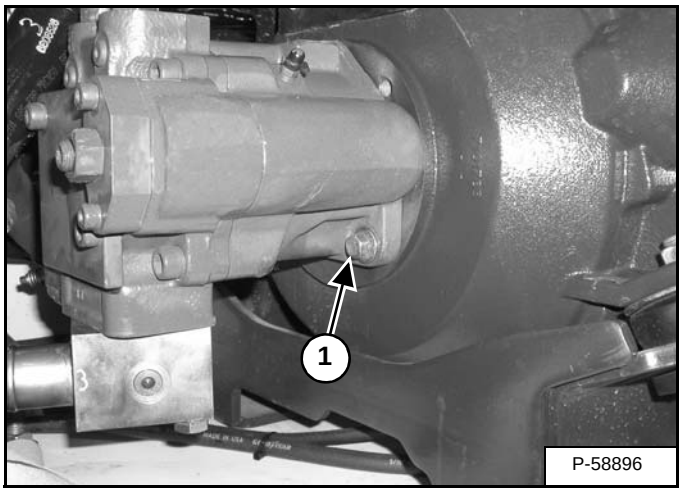
Removal And Installation (Cont'd)

Figure 20-50-13



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

Figure 20-50-14

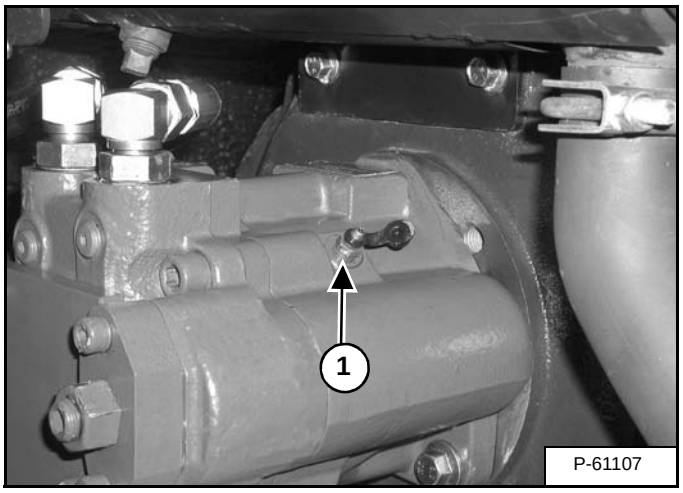


Remove the two bolts (Item 1) **[Figure 20-50-14]**.

Installation: Tighten the bolts to 55-60 ft.-lbs. (75-85 Nm) torque.

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

Figure 20-50-15

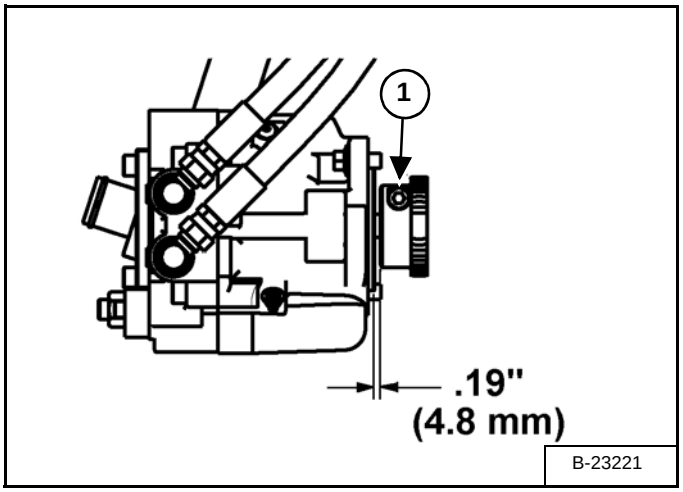


Open the bleed valve (Item 1) **[Figure 20-50-15]** on the hydraulic pump. Close the valve after a steady stream of hydraulic fluid free of any air drains from the valve.

Tighten the bleed valve.

Coupler Removal And Installation

Figure 20-50-16



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

Slide the coupler off of the pump shaft.

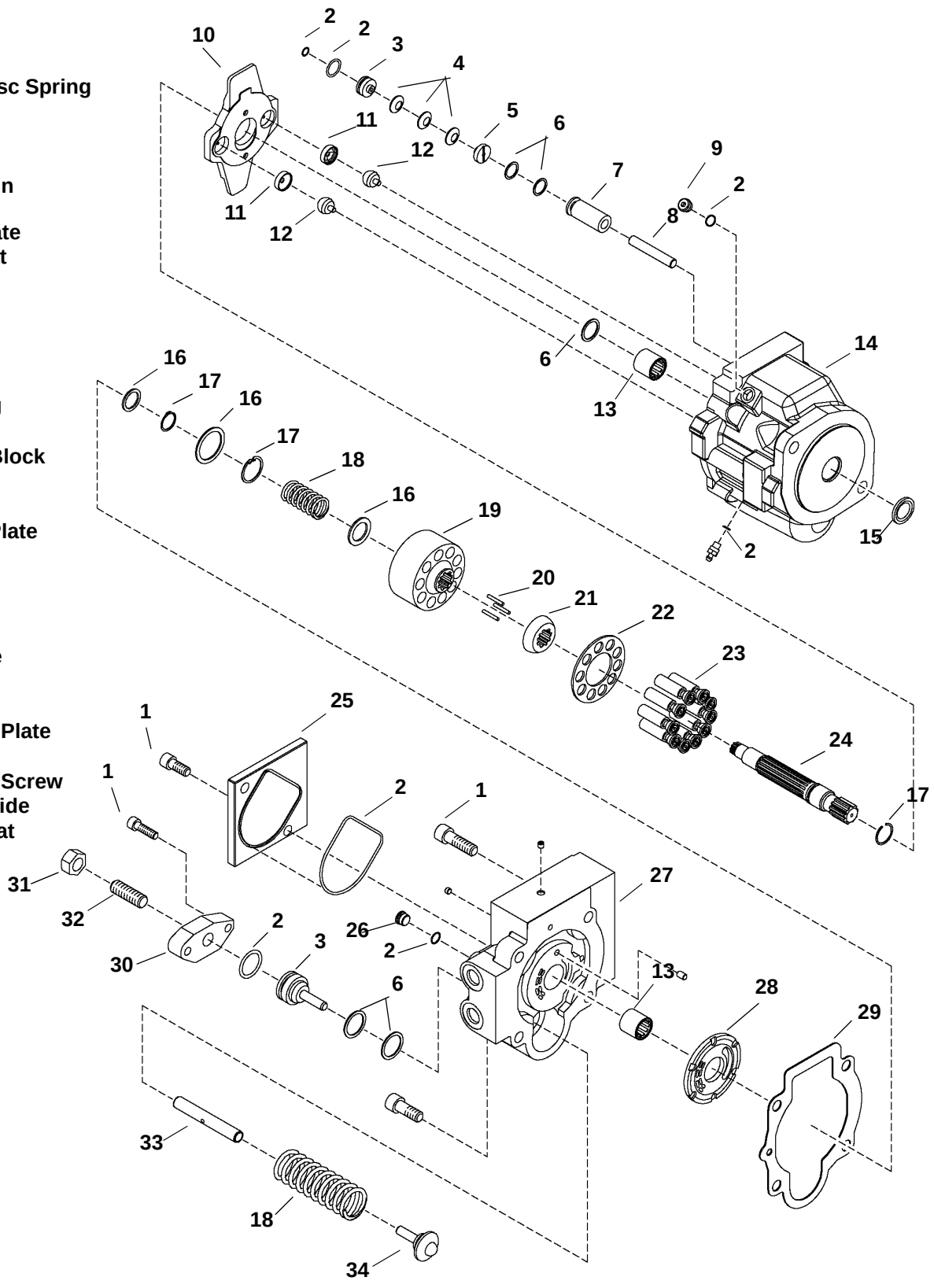
When installing the coupler, maintain 0.19 inch (4,8 mm) gap from the pump mount flange to the coupler.

Tighten the bolt (Item 1) **[Figure 20-50-16]** to 36-40 ft.-lbs. (49-54 Nm) torque.

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Parts Identification

1. Bolt
2. O-ring
3. Piston
4. Coned Disc Spring
5. Spacer
6. Shim
7. Sleeve
8. Parallel Pin
9. Fitting
10. Swash Plate
11. Guide Seat
12. Guides
13. Bearing
14. Housing
15. Seal
16. Washer
17. Snap Ring
18. Spring
19. Cylinder Block
20. Pins
21. Retainer
22. Retainer Plate
23. Pistons
24. Shaft
25. Plate
26. Plug
27. Face Plate
28. Port Plate
29. Gasket
30. Adjusting Plate
31. Nut
32. Adjusting Screw
33. Spring Guide
34. Spring Seat



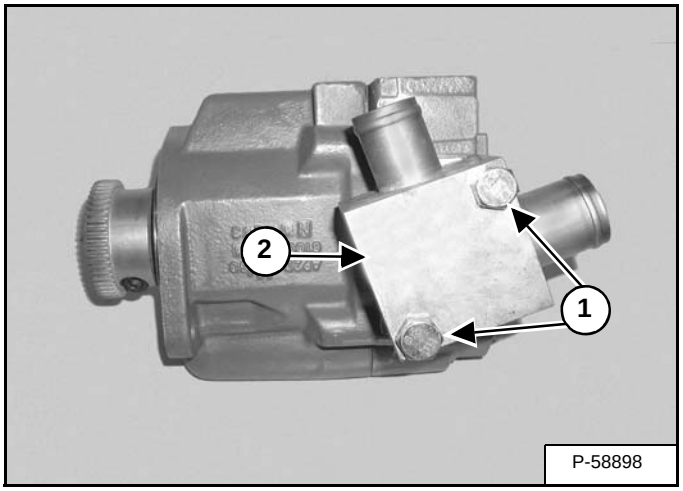
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Disassembly

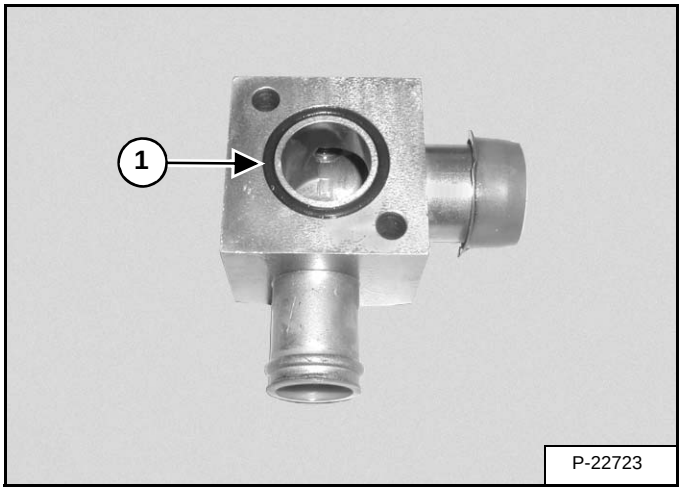
Clean the outside of the hydraulic pump before disassembly.

Figure 20-50-17



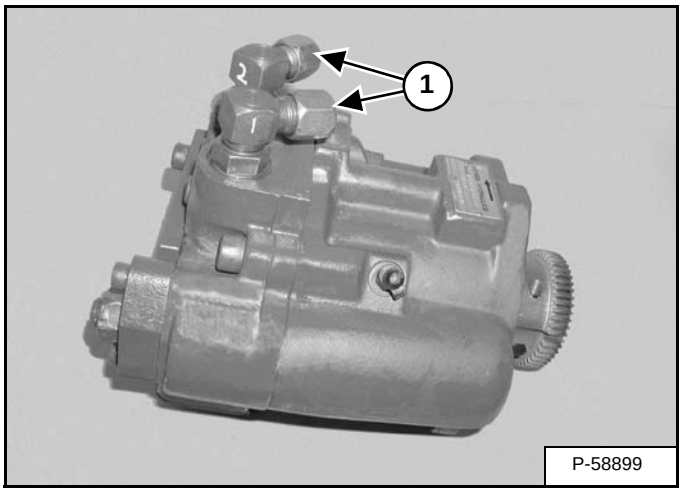
Remove the two bolts (Item 1) and the fitting (Item 2) **[Figure 20-50-17]**.

Figure 20-50-18



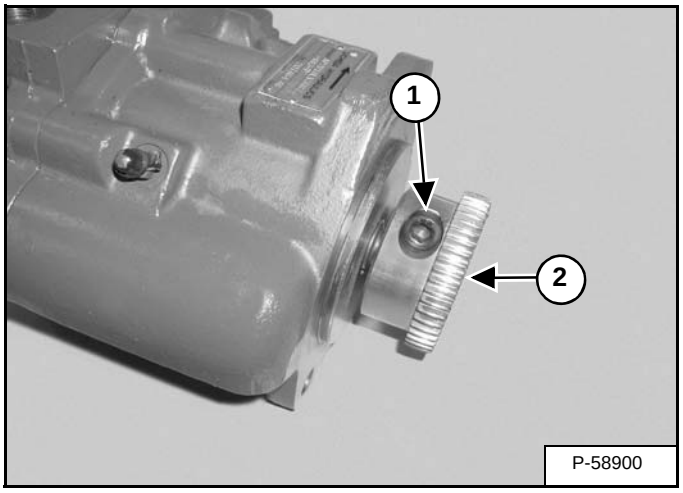
Remove the O-ring (Item 1) **[Figure 20-50-18]** from the fitting.

Figure 20-50-19



Remove the two fittings (Item 1) **[Figure 20-50-19]**.

Figure 20-50-20



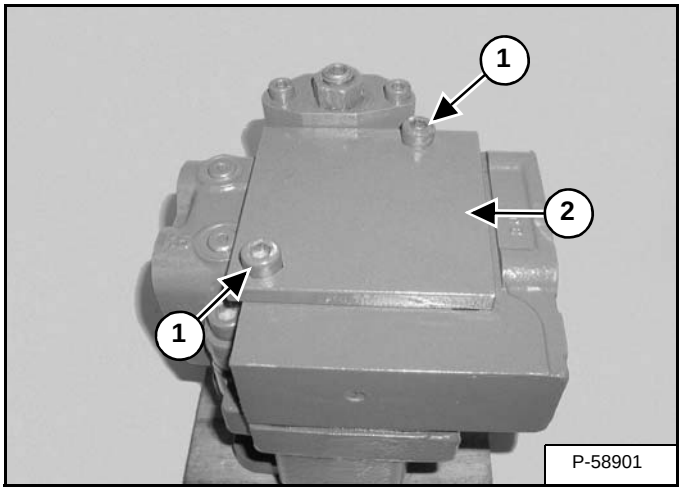
Remove the bolt (Item 1) and coupler (Item 2) **[Figure 20-50-20]**.

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Disassembly (Cont'd)

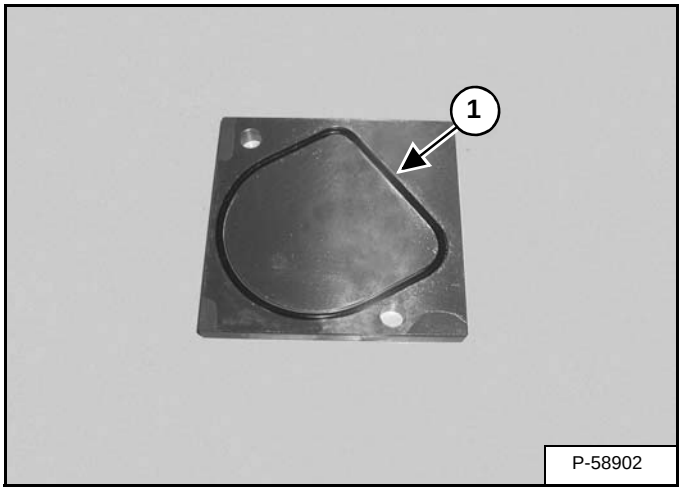
Clean the outside of the pump before disassembly.

Figure 20-50-21



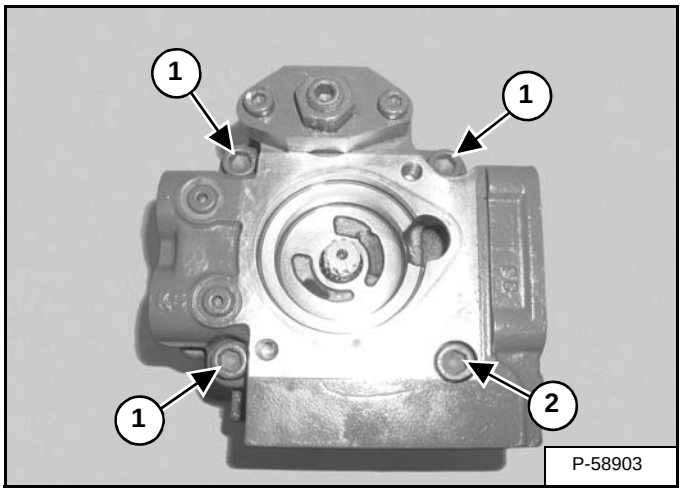
Remove the bolts (Item 1) and plate (Item 2) **[Figure 20-50-21]**.

Figure 20-50-22



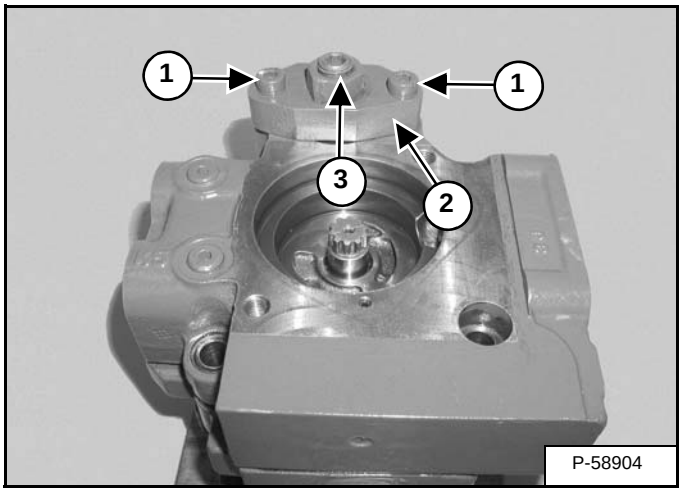
Remove the O-ring (Item 1) **[Figure 20-50-22]**.

Figure 20-50-23



Mark and remove the three short bolts (Item 1) and one long bolt (Item 2) **[Figure 20-50-23]**.

Figure 20-50-24



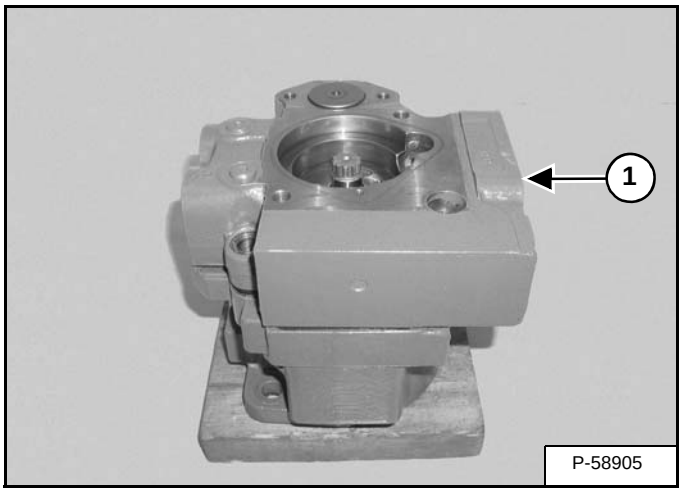
Remove the bolts (Item 1) from the adjusting plate (Item 2) **[Figure 20-50-24]** and remove the adjusting plate.

NOTE: Do not turn the adjusting screw (Item 3) [Figure 20-50-24]. The pressure setting may be changed causing damage to the hydraulic system.

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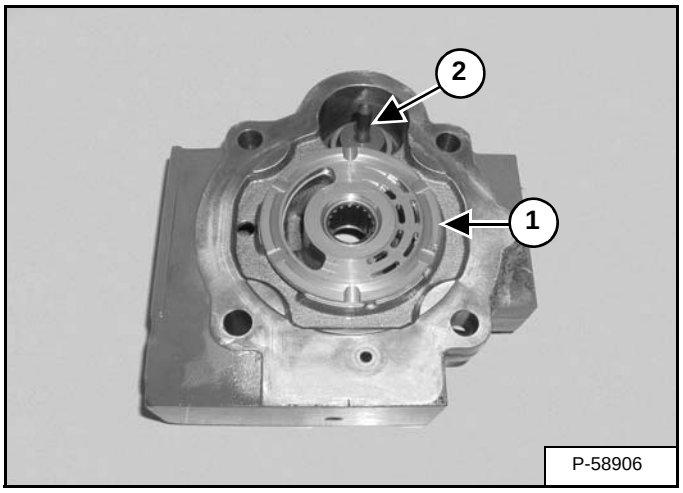
Disassembly (Cont'd)

Figure 20-50-25



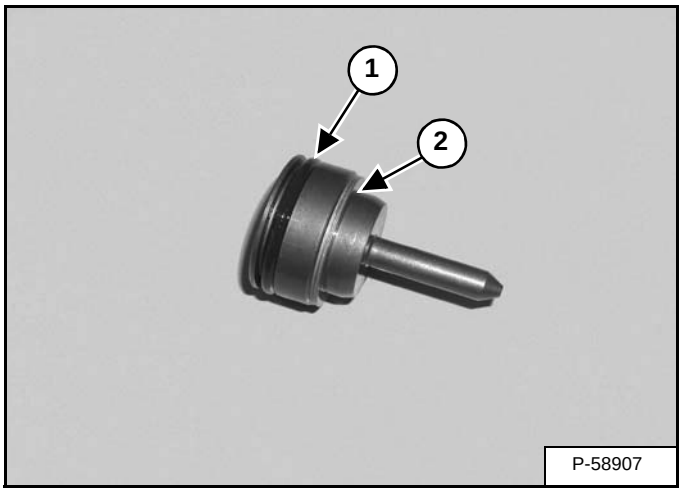
Remove the face plate (Item 1) **[Figure 20-50-25]** from the pump housing.

Figure 20-50-26



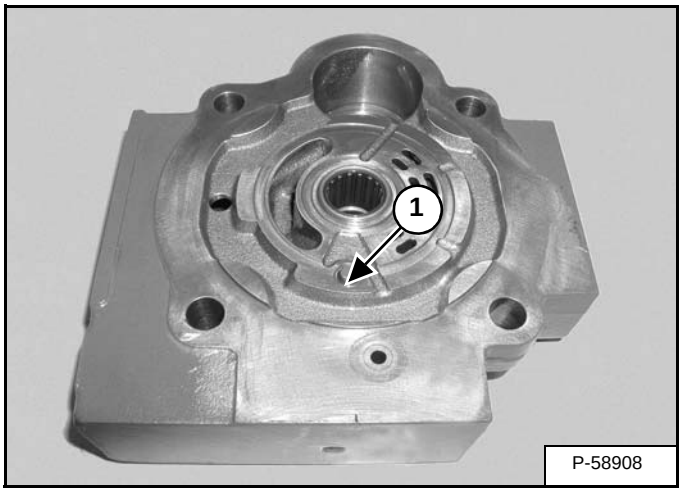
Remove the port plate (Item 1) and piston (Item 2) **[Figure 20-50-26]** from the face plate.

Figure 20-50-27



Remove the O-ring (Item 1) and two shims (Item 2) **[Figure 20-50-27]** from the piston.

Figure 20-50-28

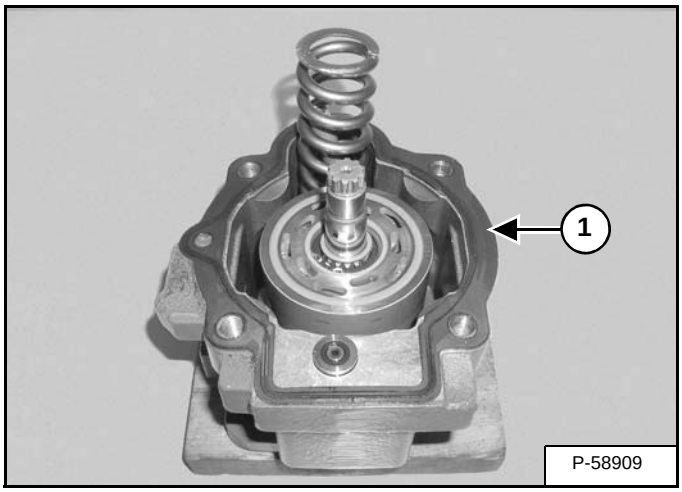


Remove the needle bearing (Item 1) **[Figure 20-50-28]** from the face plate.

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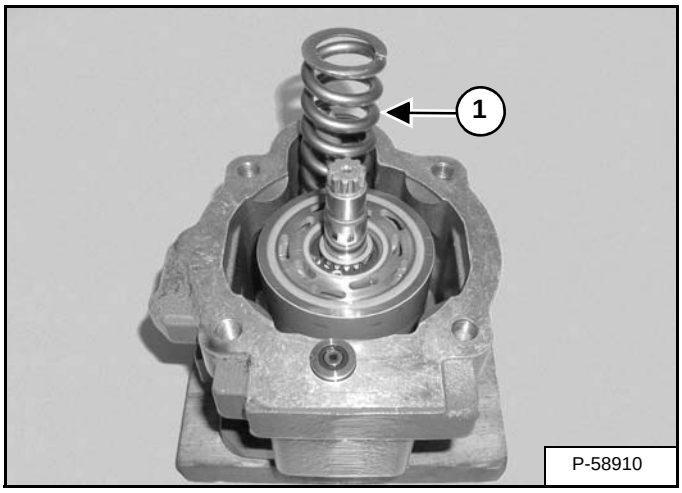
Disassembly (Cont'd)

Figure 20-50-29



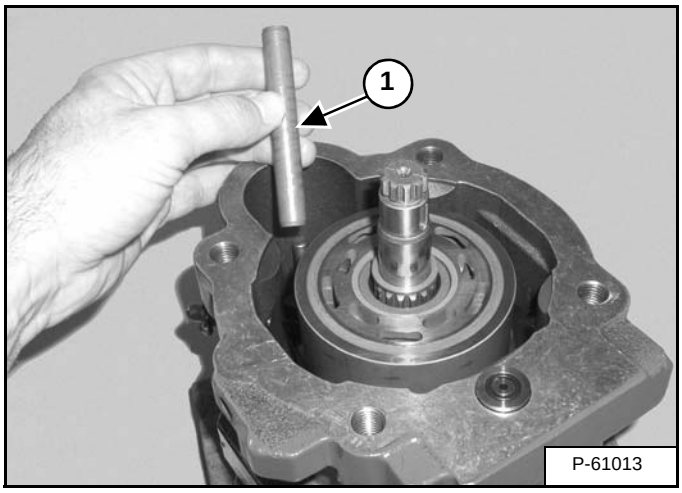
Remove the gasket (Item 1) **[Figure 20-50-29]**.

Figure 20-50-30



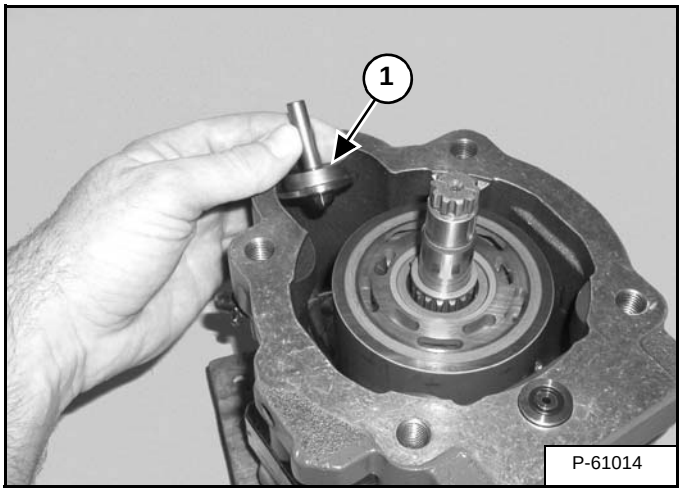
Remove the spring (Item 1) **[Figure 20-50-30]**.

Figure 20-50-31



Remove the spring guide (Item 1) **[Figure 20-50-31]**.

Figure 20-50-32

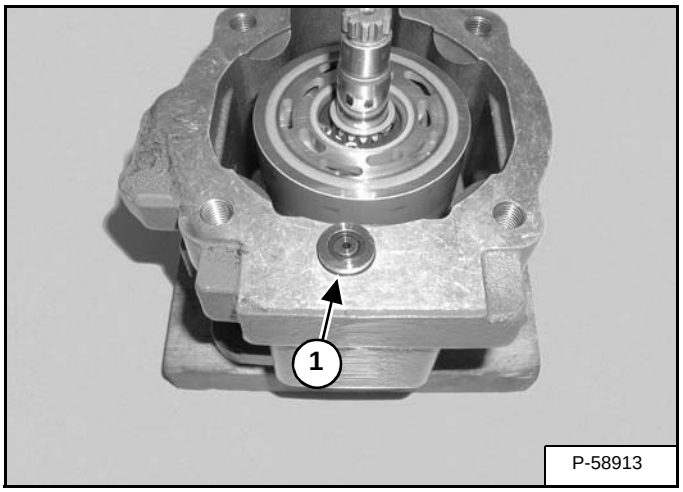


Remove the spring seat (Item 1) **[Figure 20-50-32]**.

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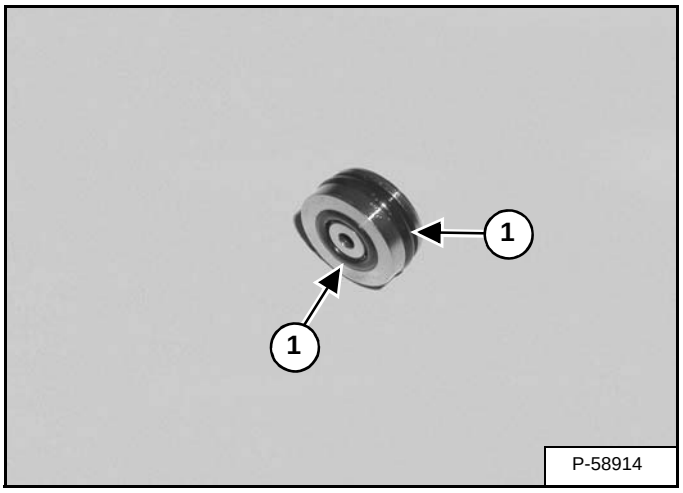
Disassembly (Cont'd)

Figure 20-50-33



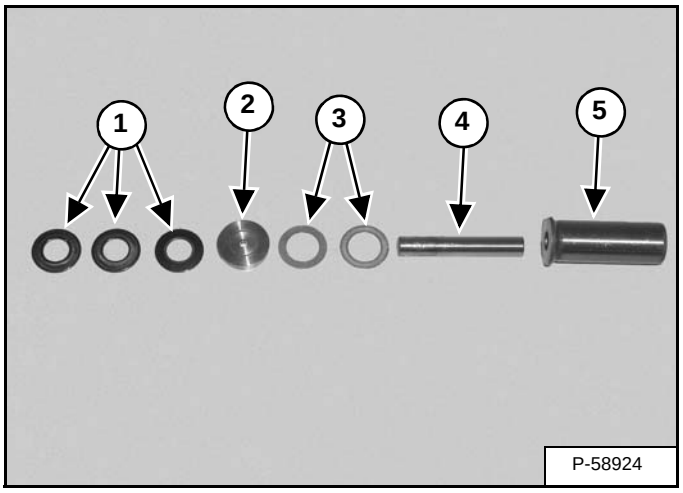
Remove the piston (Item 1) **[Figure 20-50-33]** from the pump housing.

Figure 20-50-34



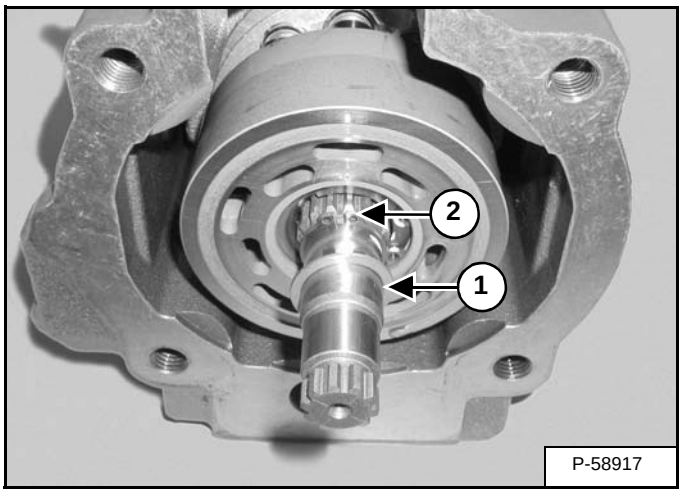
Remove the two O-rings (Item 1) **[Figure 20-50-34]**.

Figure 20-50-35



Remove the three coned disc springs (Item 1), spacer (Item 2), shims (Item 3), parallel pin (Item 4) and sleeve (Item 5) **[Figure 20-50-35]**.

Figure 20-50-36

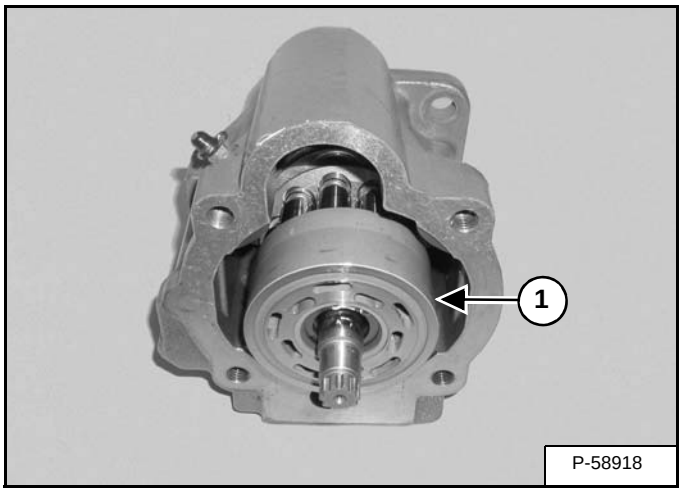


Lay the pump assembly on its side and remove the washer (Item 1) and snap ring (Item 2) **[Figure 20-50-36]**.

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Disassembly (Cont'd)

Figure 20-50-37

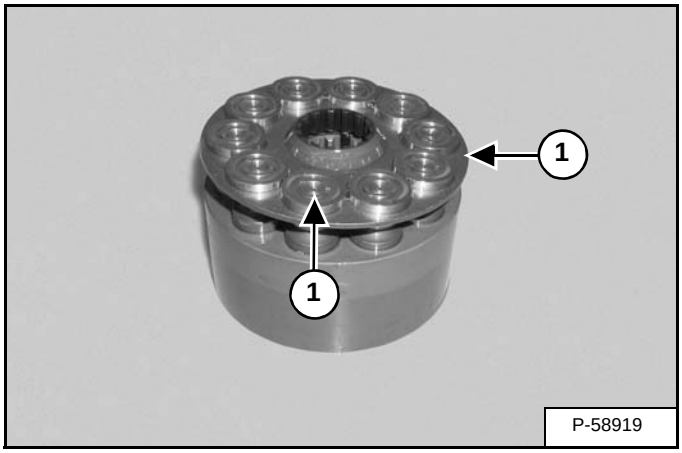


Remove the rotating group (Item 1) **[Figure 20-50-37]**.

NOTE: The following procedure shown is to disassemble the rotating group for inspection only. The rotating group parts cannot be ordered separately and must be ordered as an assembly.

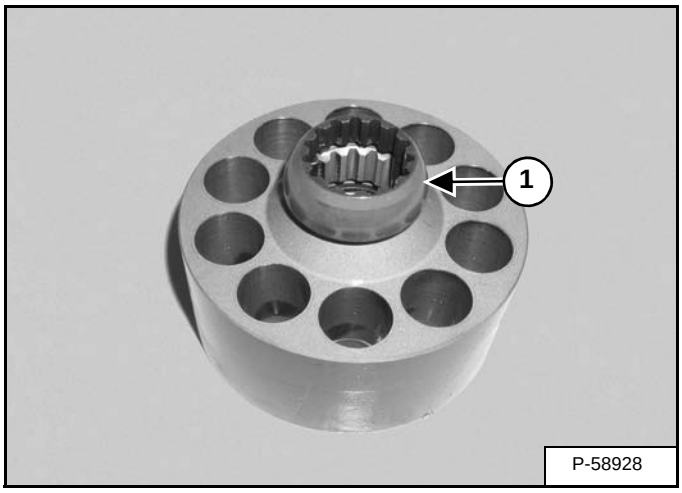
NOTE: Check for scratches or damage on the sliding surfaces.

Figure 20-50-38



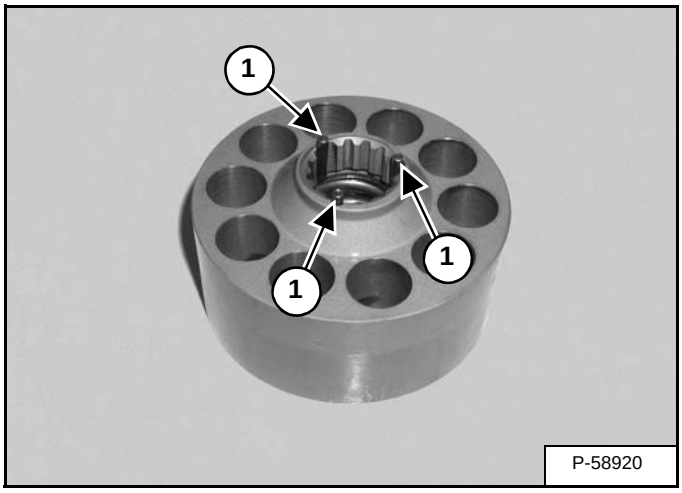
Remove the retainer plate (Item 1) and pistons (Item 2) **[Figure 20-50-38]** from the cylinder block.

Figure 20-50-39



Remove the retainer (Item 1) **[Figure 20-50-39]**.

Figure 20-50-40

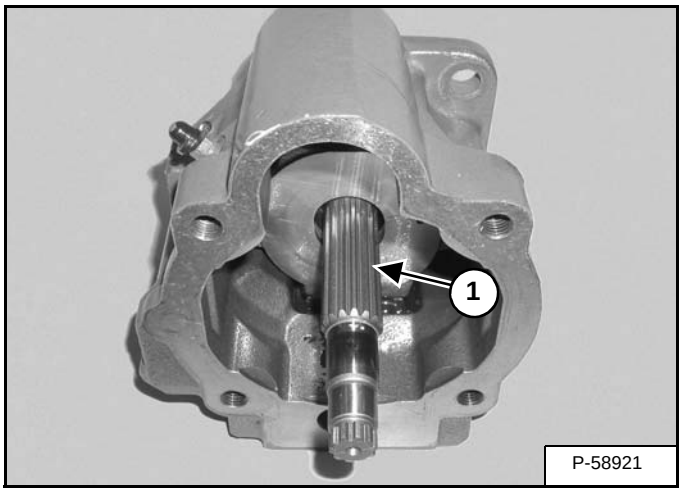


Inspect the pins (Item 1) **[Figure 20-50-40]** for wear or damage.

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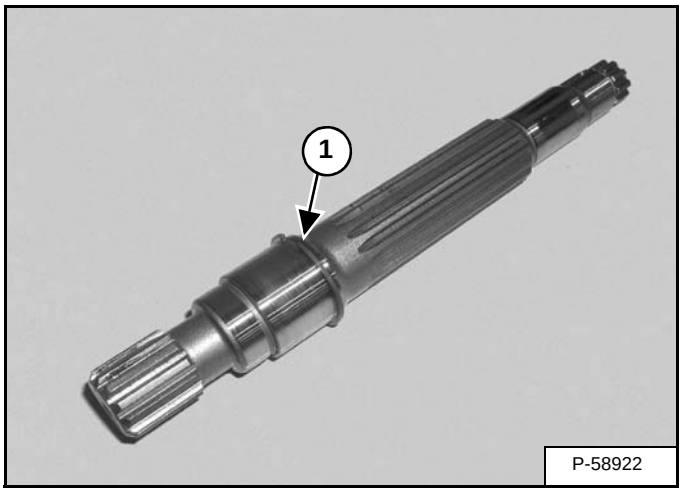
Disassembly (Cont'd)

Figure 20-50-41



Remove the shaft (Item 1) **[Figure 20-50-41]** from the pump housing.

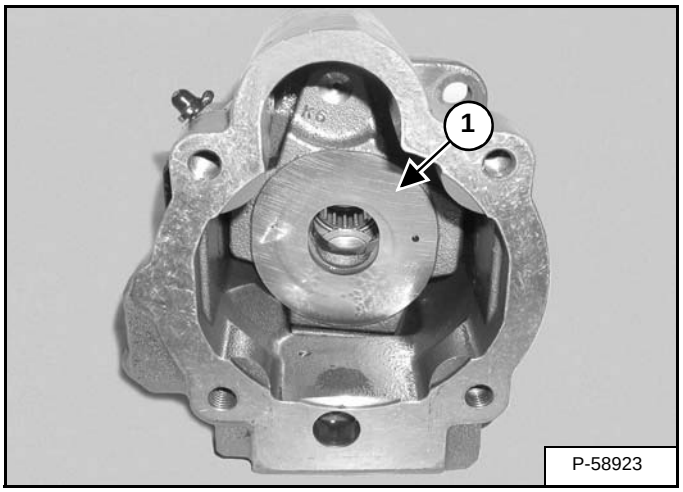
Figure 20-50-42



Remove the snap ring (Item 1) **[Figure 20-50-42]** from the shaft.

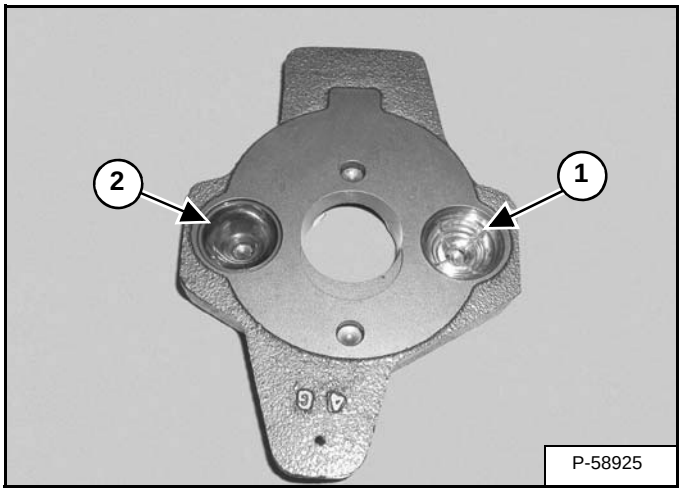
NOTE: Inspect the shaft for damage or wear. Replace shaft if damaged or worn.

Figure 20-50-43



Remove the swash plate (Item 1) **[Figure 20-50-43]**.

Figure 20-50-44

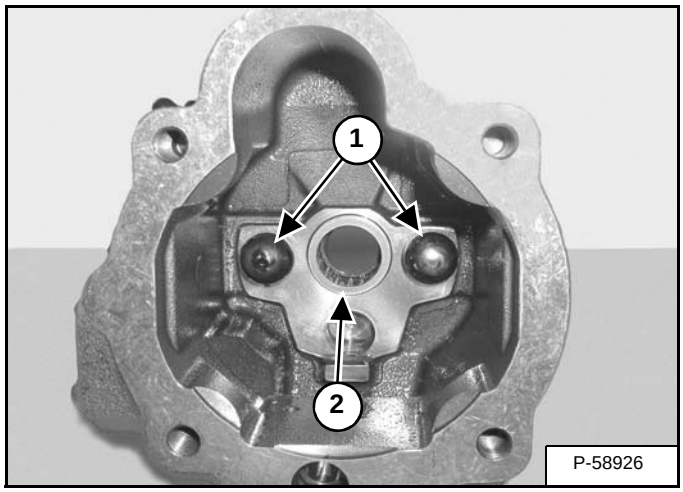


Remove the brass guide seat (Item 1) and steel guide seat (Item 2) **[Figure 20-50-44]** from the swash plate.

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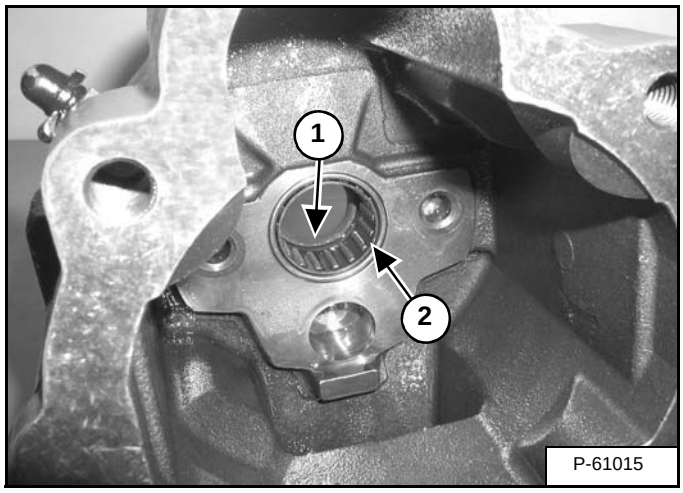
Disassembly (Cont'd)

Figure 20-50-45



Remove the guides (Item 1) and shim (Item 2) **[Figure 20-50-45]** from the pump housing.

Figure 20-50-46



Remove the seal (Item 1) and bearing (Item 2) **[Figure 20-50-46]**.

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Assembly

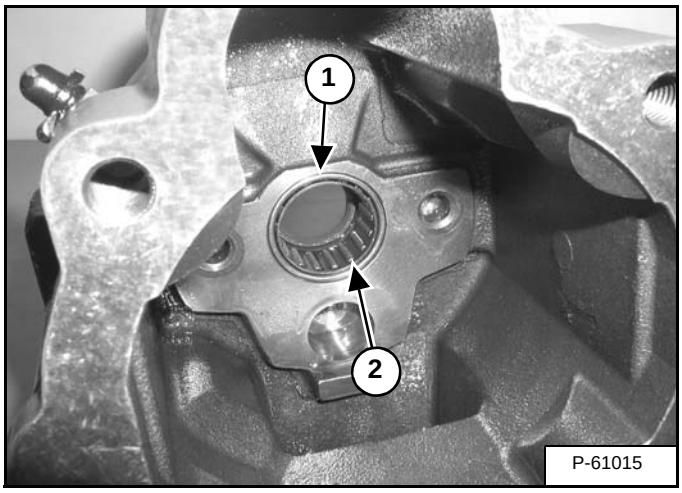
Clean all parts in solvent and dry with compressed air. Do not use compressed air to dry the bearings.

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

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

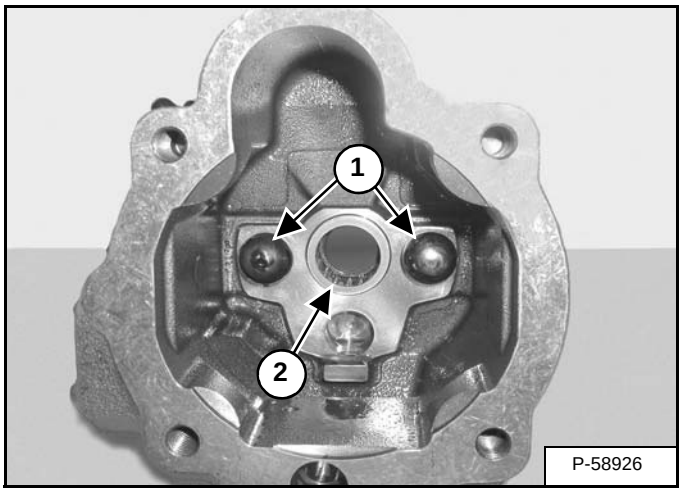
Apply a thin coat of hydraulic fluid to all components before assembly.

Figure 20-50-47



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

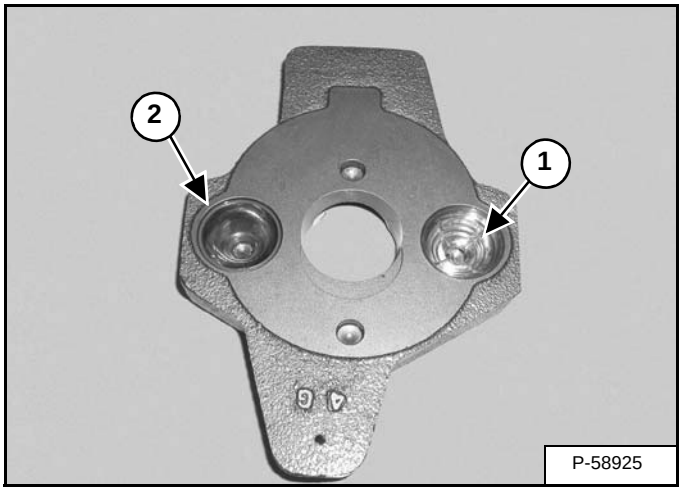
Figure 20-50-48



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

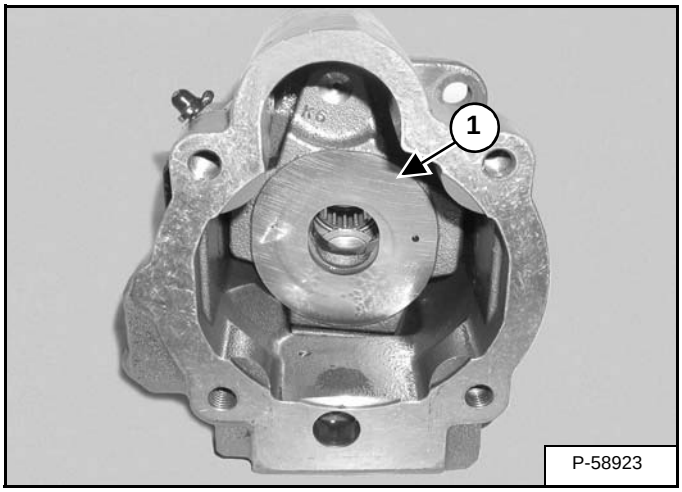
NOTE: Apply assembly lube to the shim for ease of assembly.

Figure 20-50-49



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

Figure 20-50-50

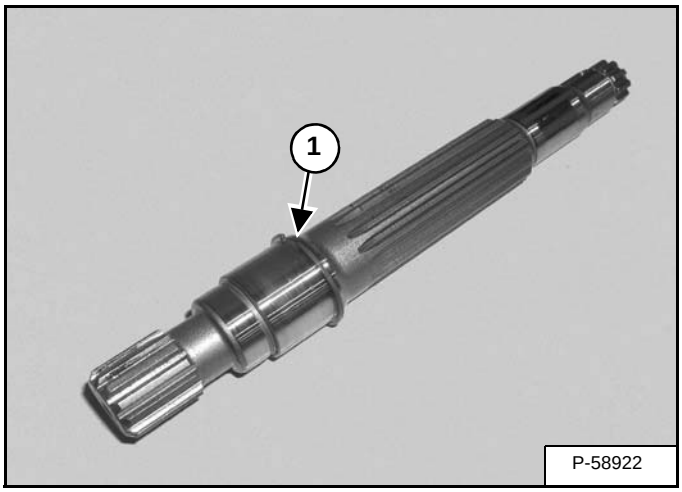


Install the swash plate (Item 1) **[Figure 20-50-50]** in the pump housing.

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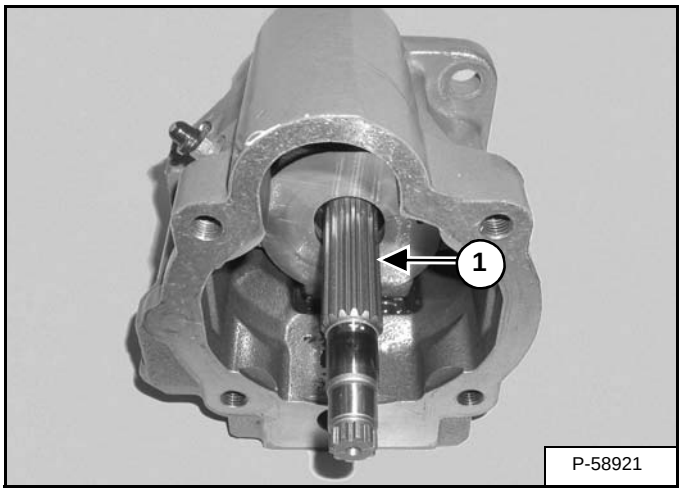
Assembly (Cont'd)

Figure 20-50-51



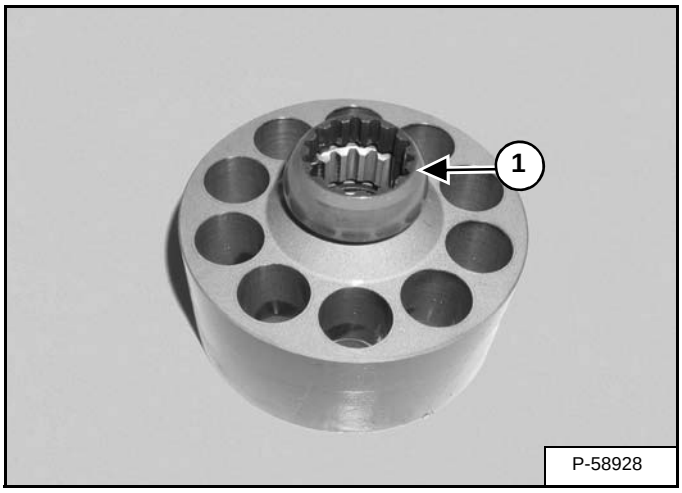
Install the snapring (Item 1) **[Figure 20-50-51]** on the shaft.

Figure 20-50-52



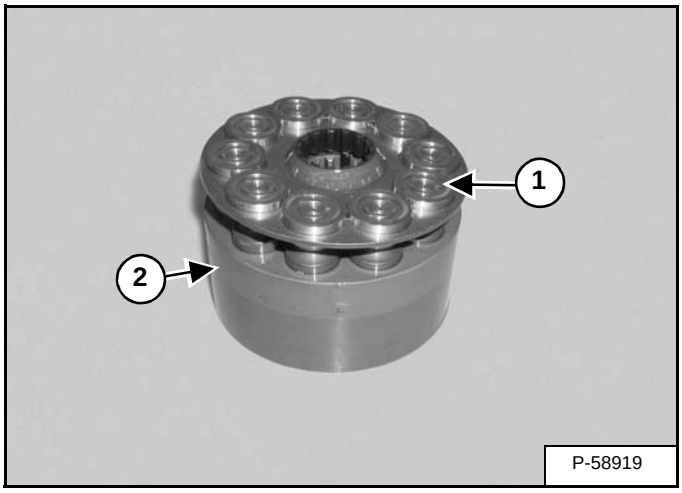
Install the shaft (Item 1) **[Figure 20-50-52]** in the pump housing.

Figure 20-50-53



Install the retainer (Item 1) **[Figure 20-50-53]** on the pins.

Figure 20-50-54



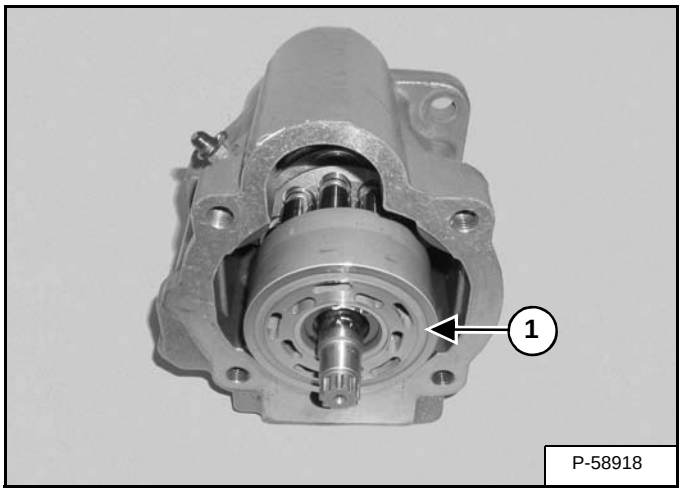
Install the retainer and piston assembly (Item 1) in the cylinder block (Item 2) **[Figure 20-50-54]**.

NOTE: It is NOT important that the pistons are installed in their original positions.

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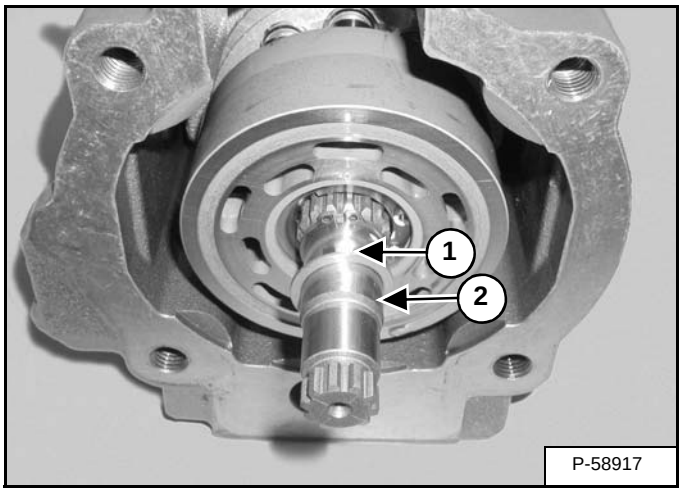
Assembly (Cont'd)

Figure 20-50-55



Lay the pump housing on its side and install the rotary group (Item 1) **[Figure 20-50-55]**.

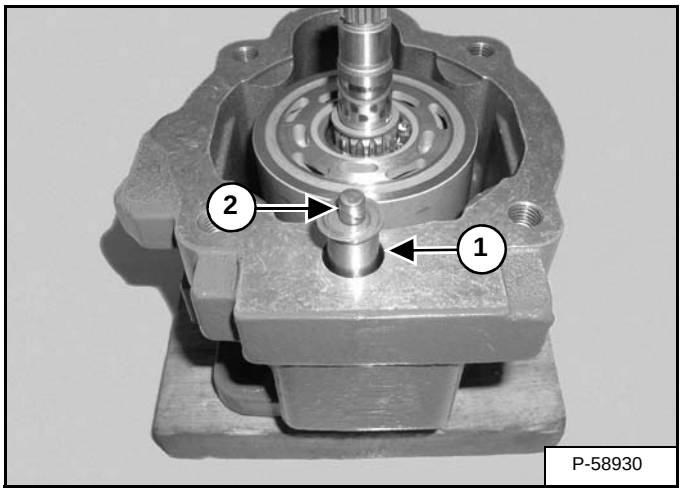
Figure 20-50-56



Install the snap ring (Item 1) and washer (Item 2) **[Figure 20-50-56]**.

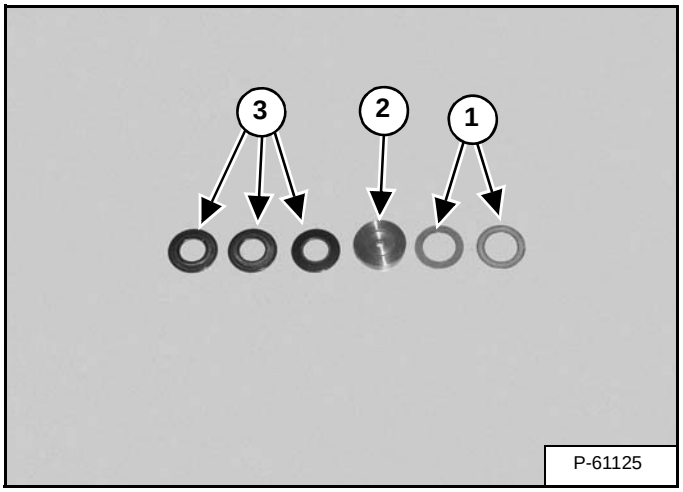
Set the pump housing up.

Figure 20-50-57



Install the sleeve (Item 1) and parallel pin (Item 2) **[Figure 20-50-57]** in the pump housing.

Figure 20-50-58

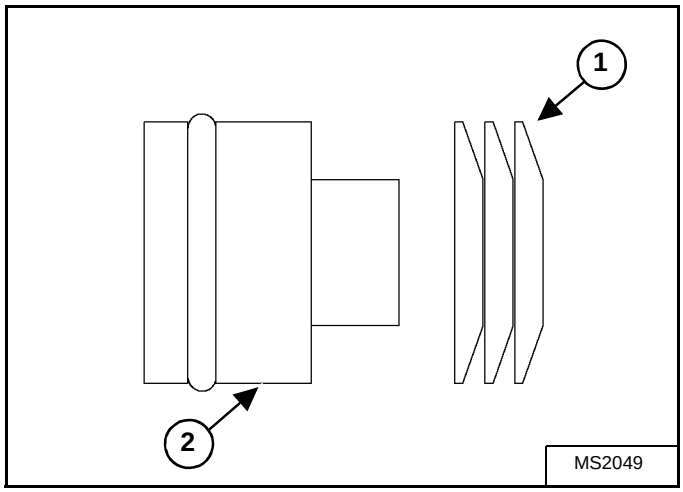


Install the shims (Item 1), spacer (Item 2) and three zoned disc springs (Item 3) **[Figure 20-50-58]**.

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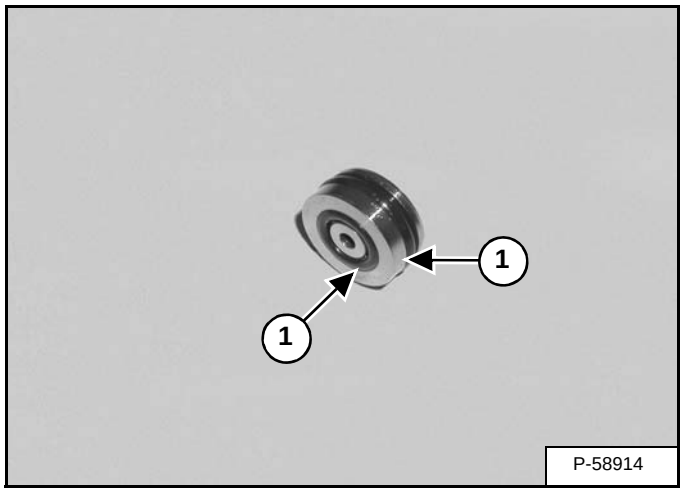
Assembly (Cont'd)

Figure 20-50-59



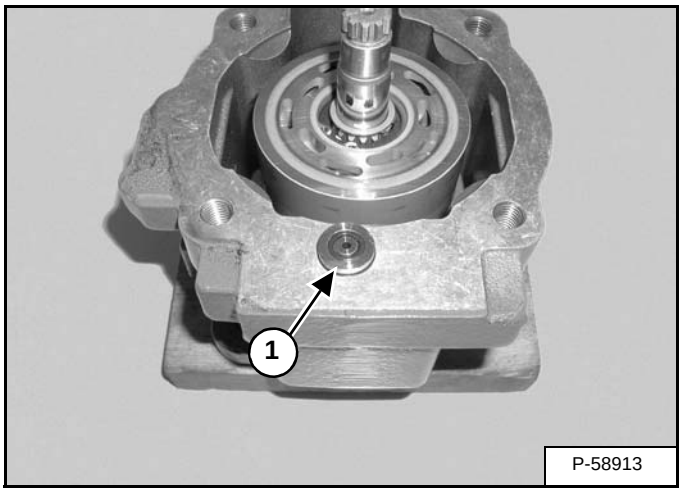
The three coned disc springs (Item 1) must face the piston (Item 2) **[Figure 20-50-59]** as shown.

Figure 20-50-60



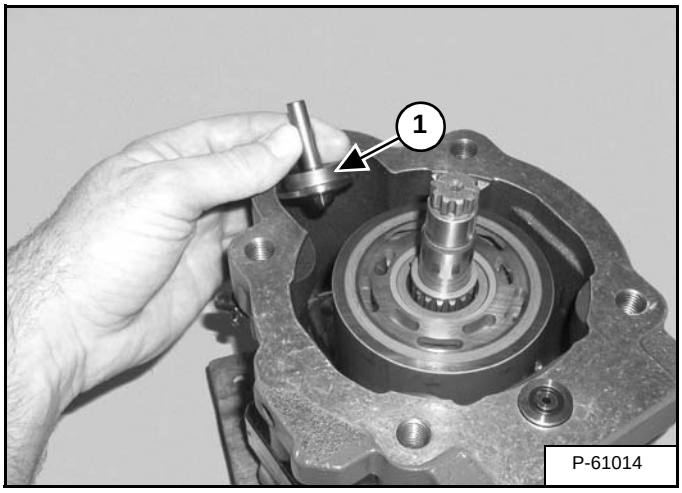
Install the O-rings (Item 1) **[Figure 20-50-60]** on the piston.

Figure 20-50-61



Install the piston (Item 1) **[Figure 20-50-61]**.

Figure 20-50-62

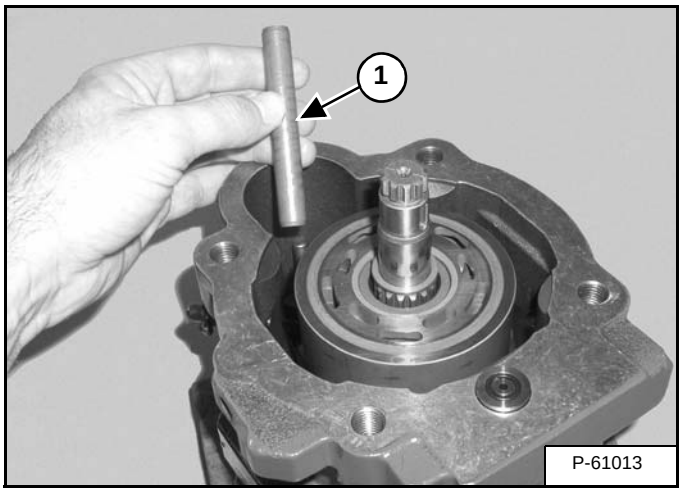


Install the spring seat (Item 1) **[Figure 20-50-62]**.

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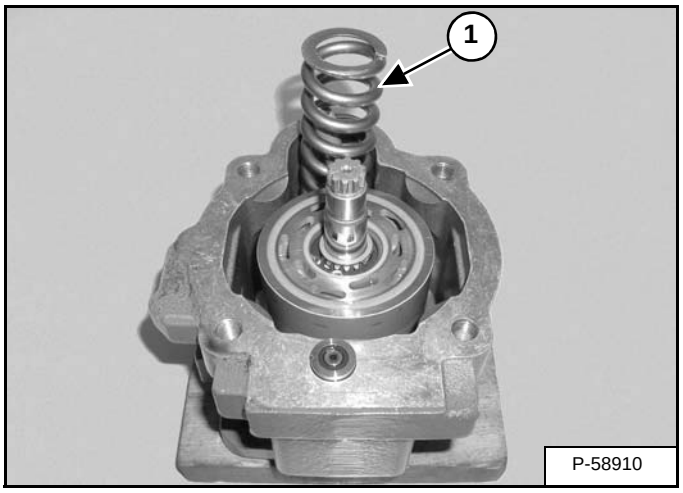
Assembly (Cont'd)

Figure 20-50-63



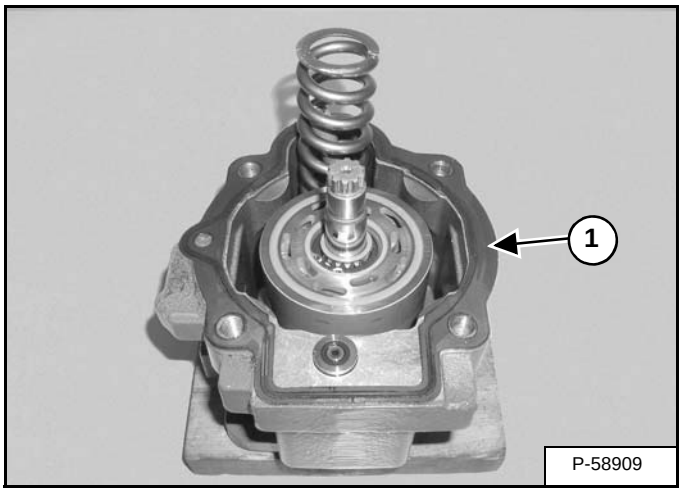
Install the spring guide (Item 1) **[Figure 20-50-63]**.

Figure 20-50-64



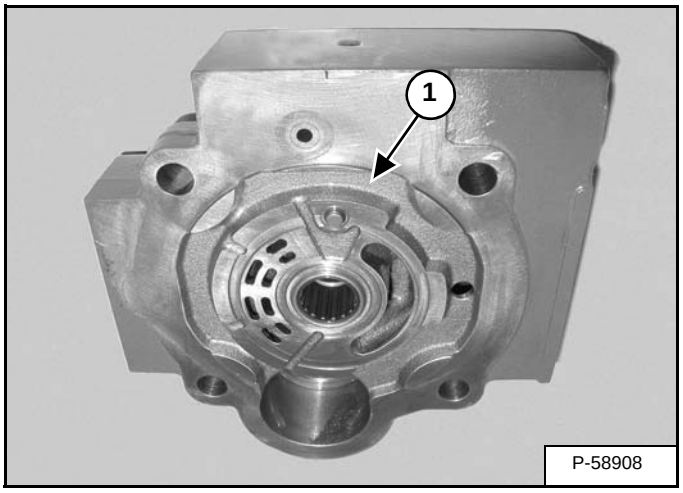
Install the spring (Item 1) **[Figure 20-50-64]**.

Figure 20-50-65



Install the gasket (Item 1) **[Figure 20-50-65]**.

Figure 20-50-66

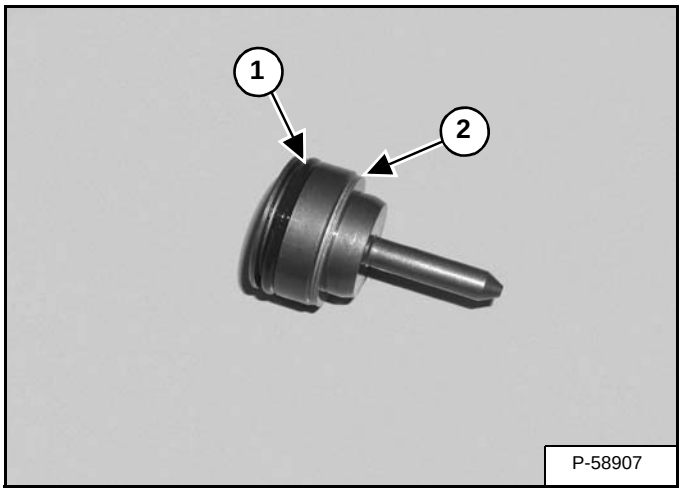


Install the needle bearing (Item 1) **[Figure 20-50-66]** in the face plate.

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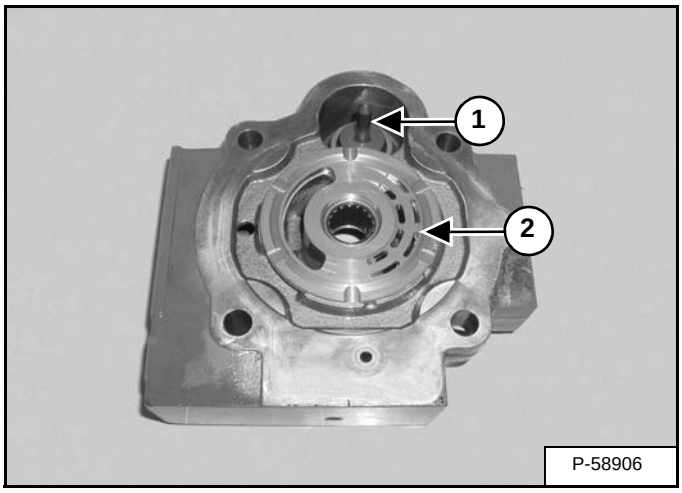
Assembly (Cont'd)

Figure 20-50-67



Install the O-ring (Item 1) and two shims (Item 2) **[Figure 20-50-67]** on the piston.

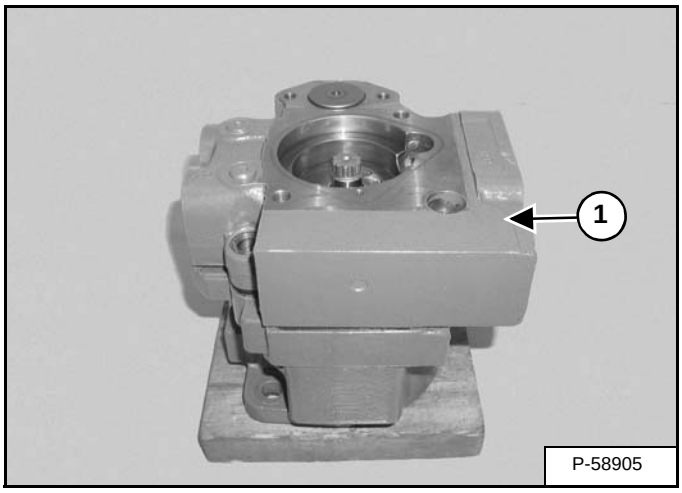
Figure 20-50-68



Install the piston (Item 1) **[Figure 20-50-68]**.

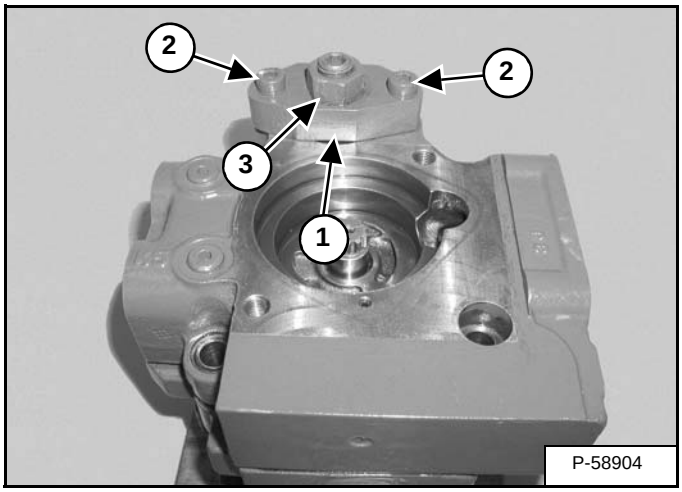
Apply assembly grease on and install the port plate (Item 2) **[Figure 20-50-68]** and install.

Figure 20-50-69



Install the face plate (Item 1) **[Figure 20-50-69]** on the pump housing.

Figure 20-50-70



Install the adjusting plate (Item 1) and bolts (Item 2) **[Figure 20-50-70]**.

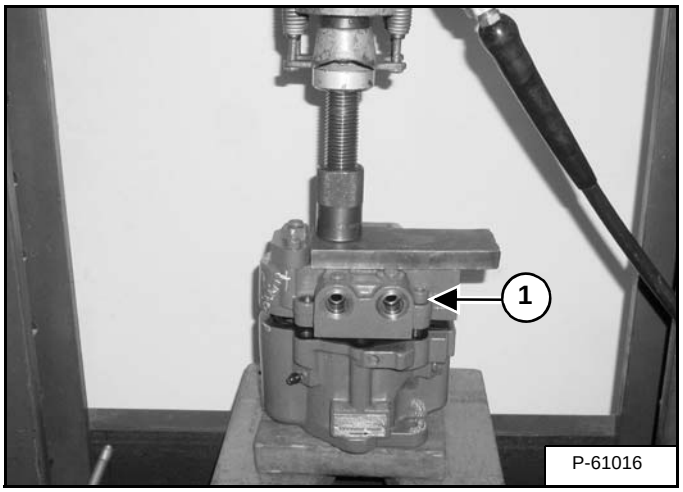
Tighten the bolts to 21-26 ft.-lbs. (28-35 Nm) torque.

NOTE: Do not turn the adjusting screw (Item 3) [Figure 20-50-70] unless necessary. The pressure setting may be changed causing damage to the hydraulic system.

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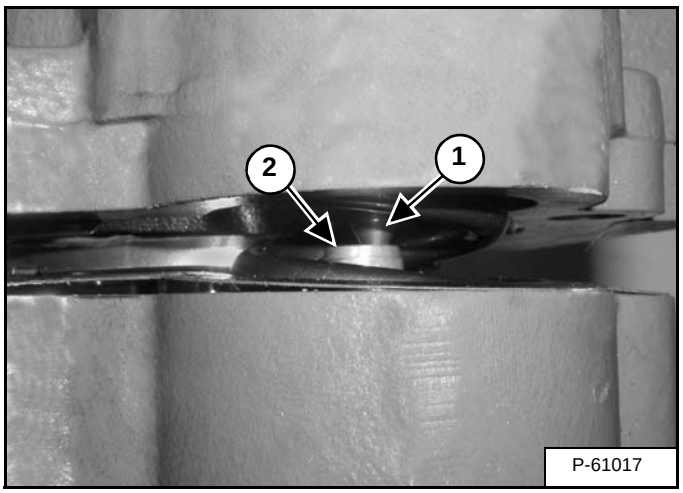
Assembly (Cont'd)

Figure 20-50-71



Place the pump assembly in a press. Apply enough pressure to slightly compress the spring. Install the bolts (Item 1) **[Figure 20-50-71]**. Do not compress the spring enough to start the bolts.

Figure 20-50-72

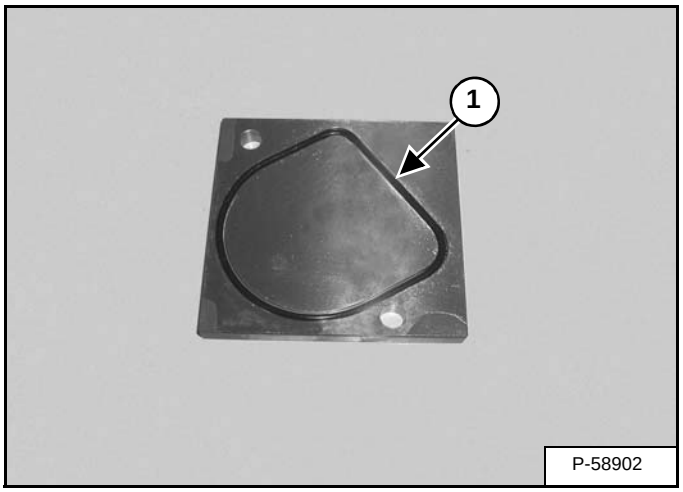


Continue to compress the spring, positioning the end of the piston (Item 1) into the spring guide (Item 2) **[Figure 20-50-72]**.

Fully compress the spring and tighten the bolts to 72-90 ft.-lbs. (98-123 Nm) torque.

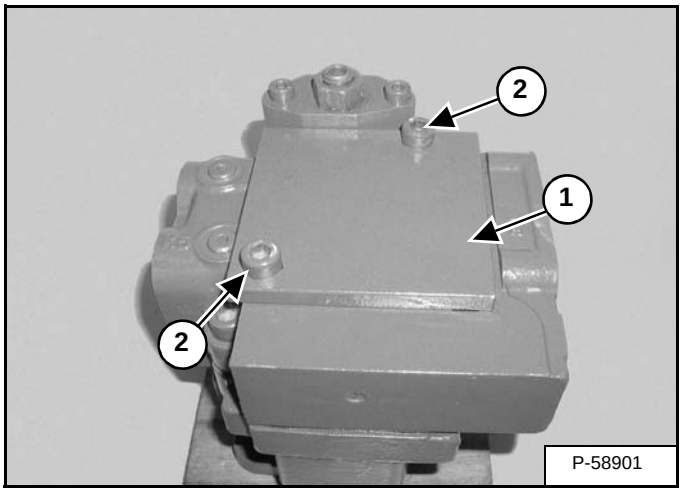
Remove the pump from the press.

Figure 20-50-73



Install the O-ring (Item 1) **[Figure 20-50-73]** in the cover.

Figure 20-50-74



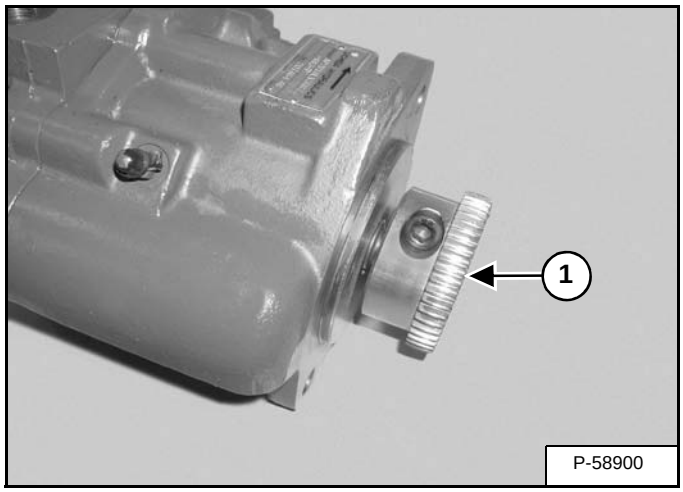
Install the cover (Item 1) **[Figure 20-50-74]**.

Install the bolts (Item 2) **[Figure 20-50-74]**. Tighten the bolts to 41-51 ft.-lbs. (55-69 Nm) torque.

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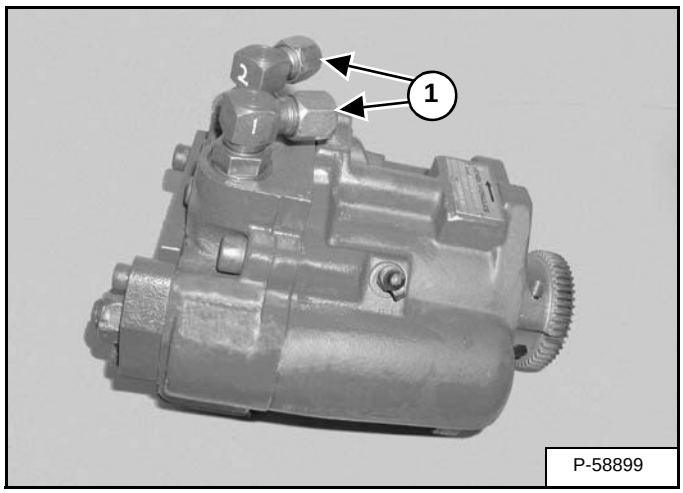
Assembly (Cont'd)

Figure 20-50-75



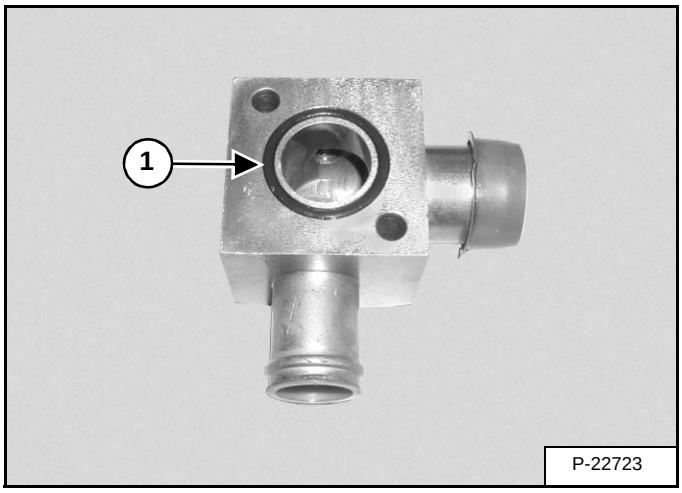
Install the coupler (Item 1) **[Figure 20-50-75]** on the pump. See Coupler Removal And Installation for correct coupler installation. (See Coupler Removal And Installation on Page 20-50-7.)

Figure 20-50-76



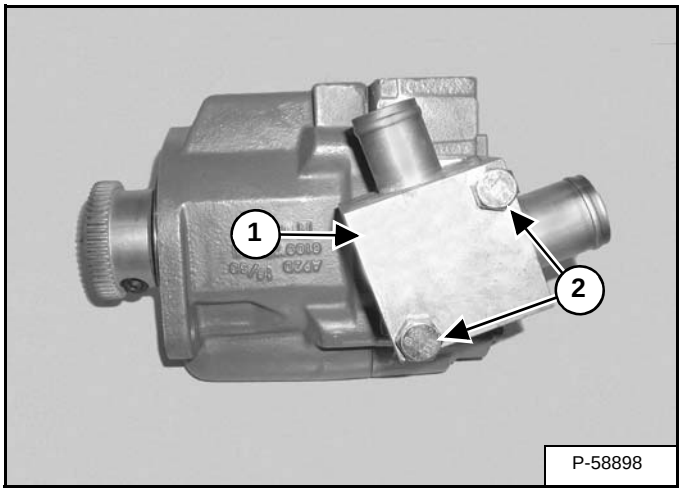
Install the fittings (Item 1) **[Figure 20-50-76]**.

Figure 20-50-77



Install the O-ring (Item 1) **[Figure 20-50-77]** in the fitting.

Figure 20-50-78



Install the fitting (Item 1) and bolts (Item 2) **[Figure 20-50-78]**.

Tighten the bolts to 55-60 ft.-lbs. (75-85 Nm) torque.

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MANIFOLD ASSEMBLY/ ACCUMULATOR

Description

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

The body is connected to the accumulator.

The manifold supplies target pressure of 435 PSI (30 bar) with an acceptable range of 406-450 PSI (28-31 bar) to the joysticks to activate the control valve spools.

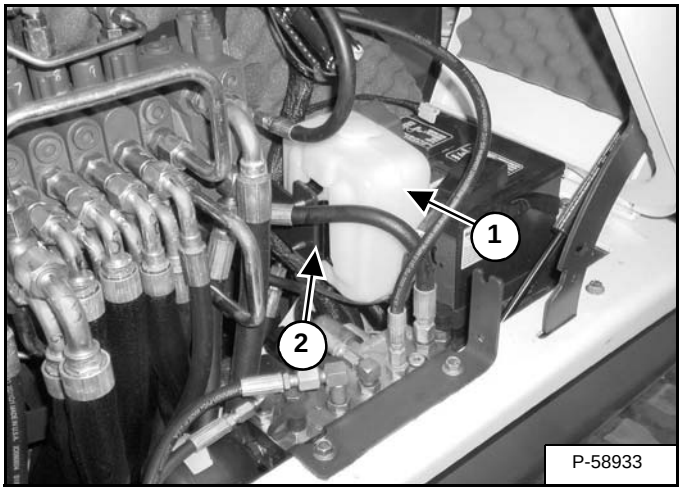
The accumulator provides short term reserve pressure for joystick function with the engine off and the key in the ON position.

Removal And Installation

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

Drain the hydraulic reservoir. (See Checking And Adding Hydraulic Fluid on Page 10-100-1.)

Figure 20-60-1



For models equipped with a windshield washer, lift up on the windshield washer fluid reservoir (Item 1) and remove the reservoir from the bracket (Item 2) **[Figure 20-60-1]**. Reposition the reservoir away from the manifold 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.

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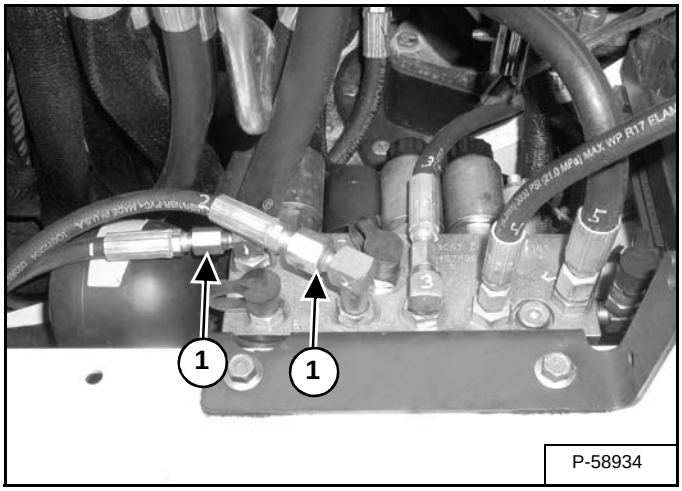
Mark the hoses for correct installation.

⚠ 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 20-60-2

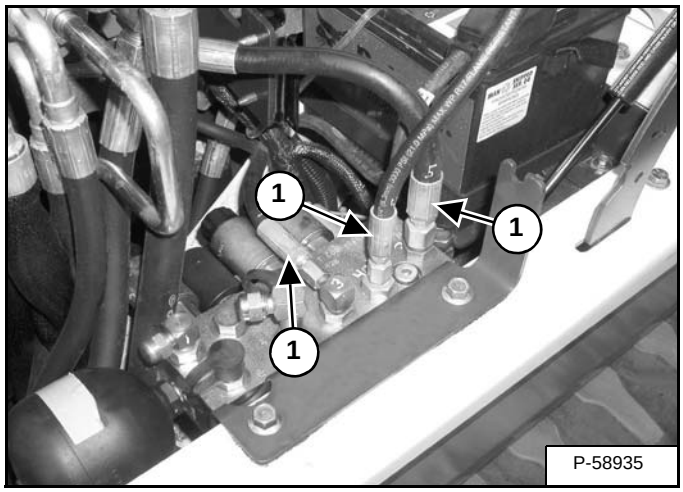


Remove the hoses (Item 1) **[Figure 20-60-2]**.

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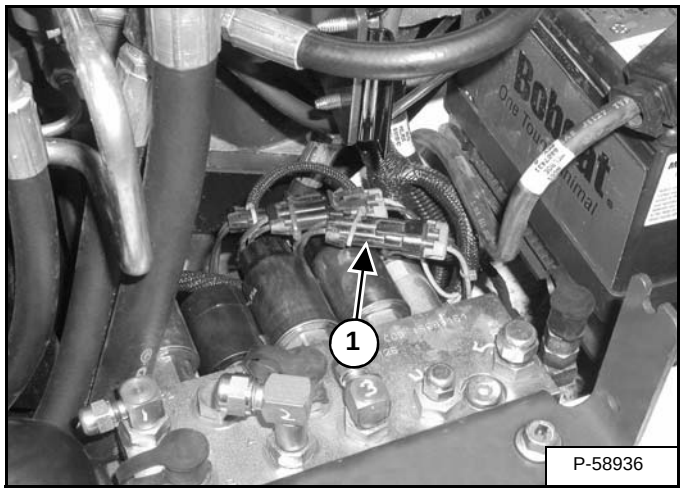
Removal And Installation (Cont'd)

Figure 20-60-3



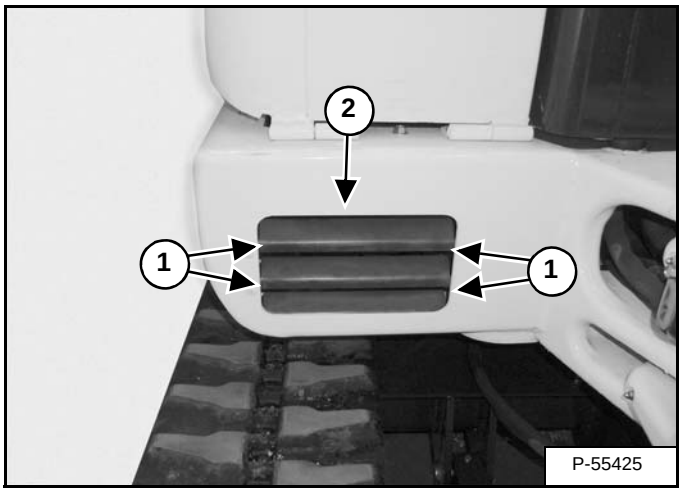
Remove the hoses (Item 1) **[Figure 20-60-3]**.

Figure 20-60-4



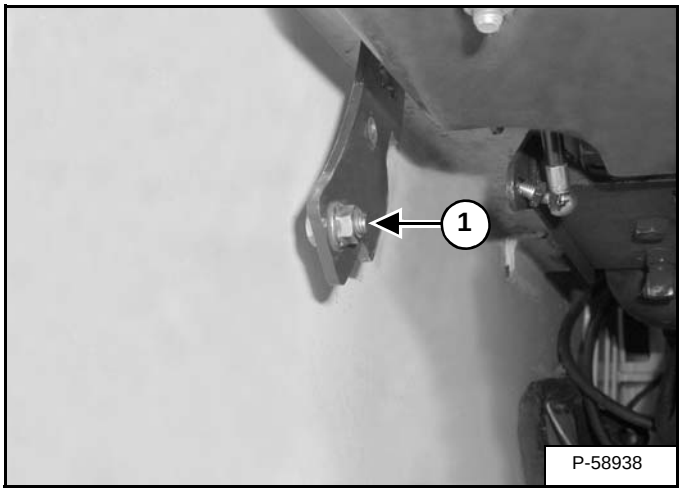
Remove the five wire harnesses (Item 1) **[Figure 20-60-4]**.

Figure 20-60-5



Remove the bolts (Item 1) and louver (Item 2) **[Figure 20-60-5]**.

Figure 20-60-6

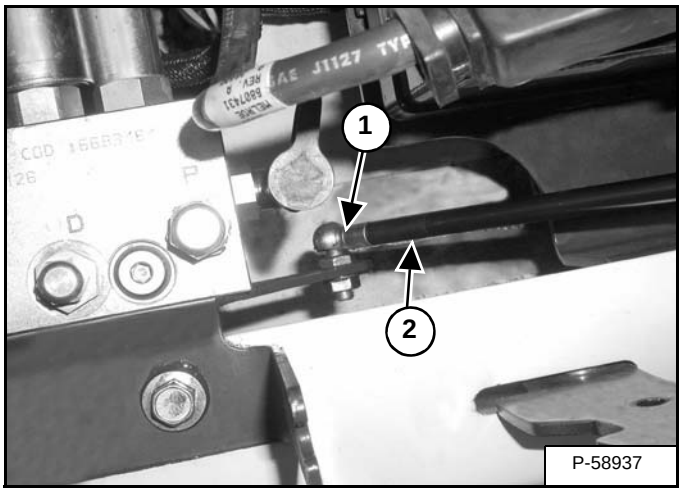


Remove the bolt and nut (Item 1) **[Figure 20-60-6]**.

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Removal And Installation (Cont'd)

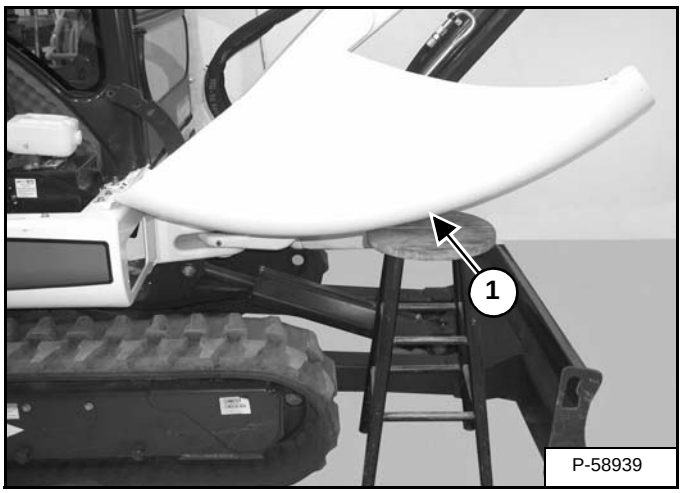
Figure 20-60-7



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

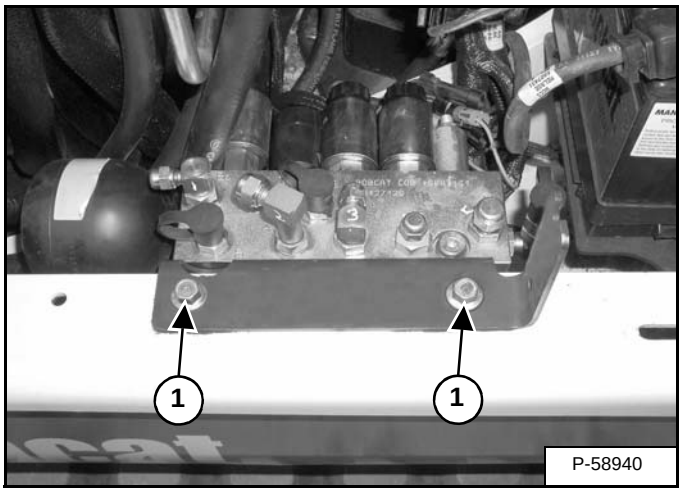
Rotate the gas spring toward the front of the excavator.

Figure 20-60-8



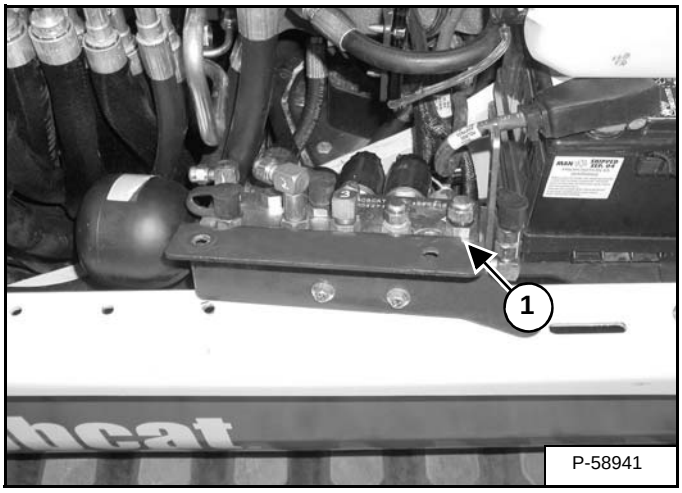
Fully open and support the cover (Item 1) **[Figure 20-60-8]**.

Figure 20-60-9



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

Figure 20-60-10

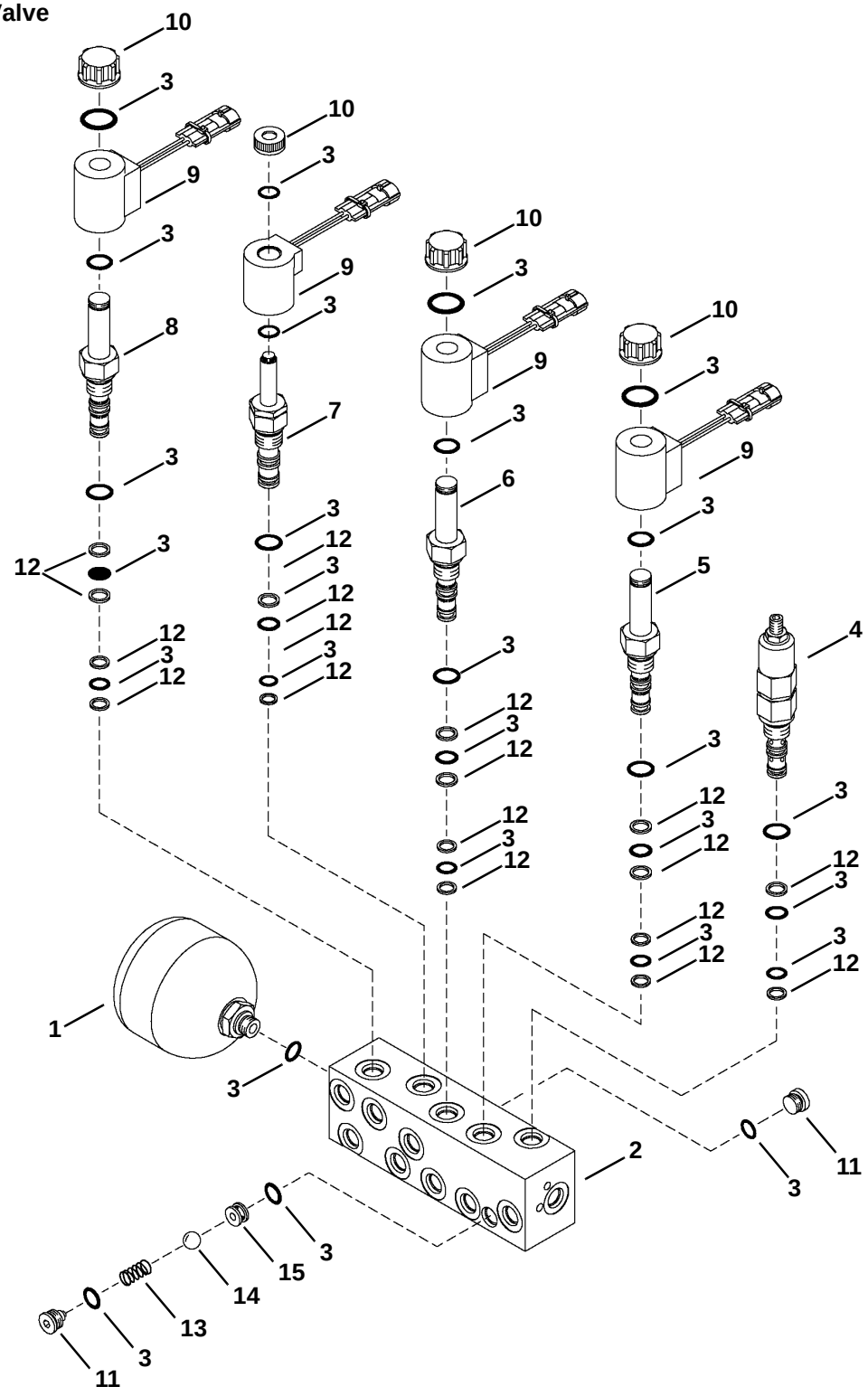


Remove the manifold assembly (Item 1) **[Figure 20-60-10]**.

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Parts Identification

1. Accumulator
2. Valve Body
3. O-Ring
4. Pressure Reducing Valve
5. Aux. Male Spool
6. Aux. Female Spool
7. Two Speed Spool
8. Pilot Supply Spool
9. Coil
10. Nut
11. Plug
12. Backup Ring
13. Spring
14. Ball
15. Seat



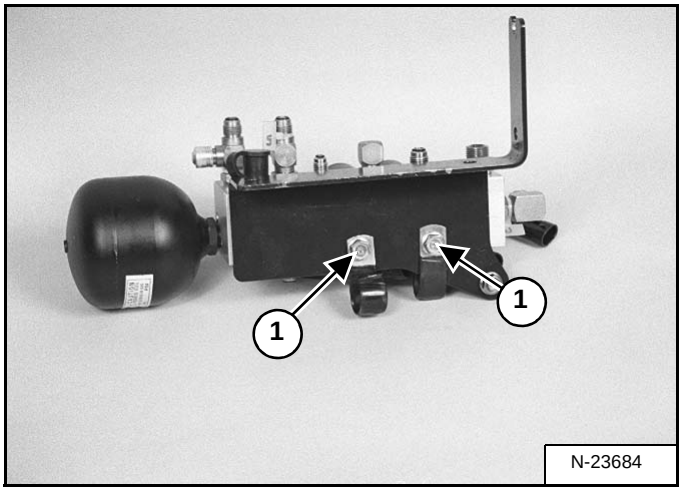
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Disassembly And Assembly

Clean the outside of the manifold assembly/accumulator before disassembly.

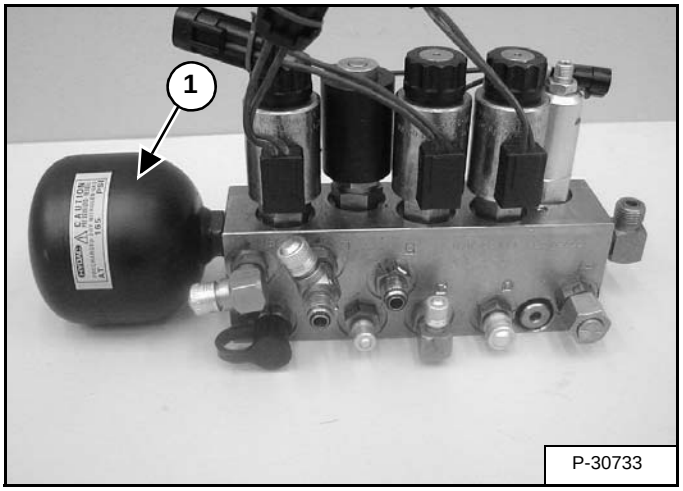
Figure 20-60-11



Remove the mounting bolts (Item 1) **[Figure 20-60-11]** from the manifold mount bracket.

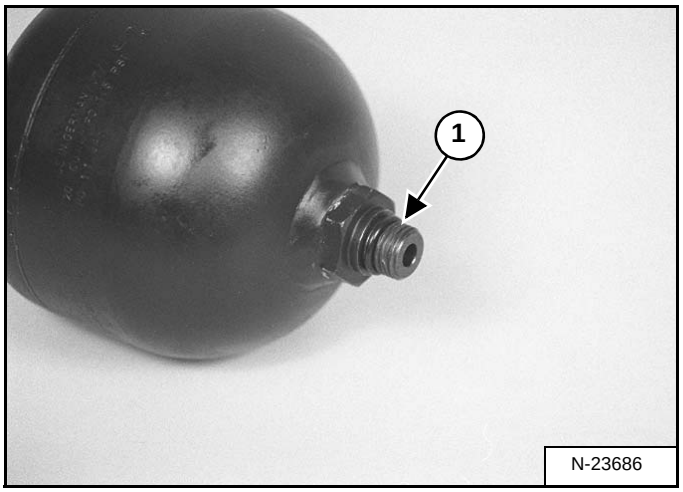
Remove the mount bracket from the manifold.

Figure 20-60-12



Remove the accumulator (Item 1) **[Figure 20-60-12]** from the valve body.

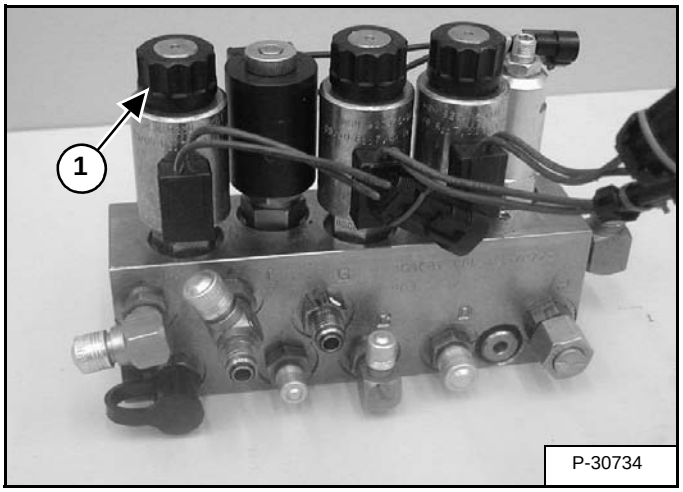
Figure 20-60-13



Remove the O-ring (Item 1) **[Figure 20-60-13]** from the accumulator.

Installation: Tighten the accumulator to 22-24 ft.-lbs. (29-33 Nm) torque.

Figure 20-60-14



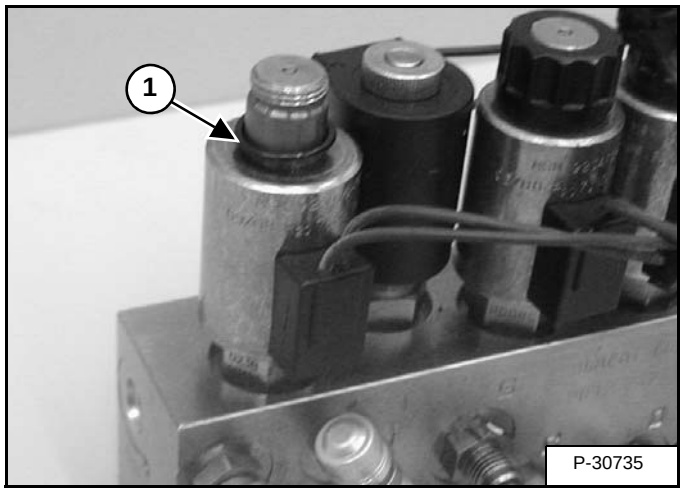
Remove the nut (Item 1) **[Figure 20-60-14]**.

Installation: Tighten the solenoid nut to 36-54 in.-lbs. (4,1-6,1 Nm) torque.

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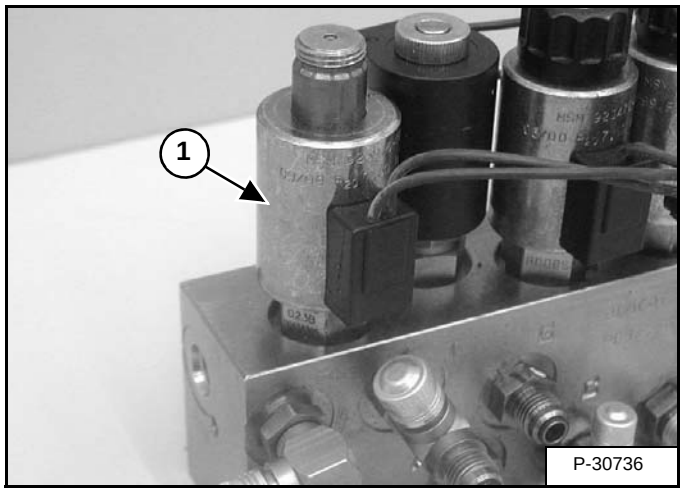
Disassembly And Assembly (Cont'd)

Figure 20-60-15



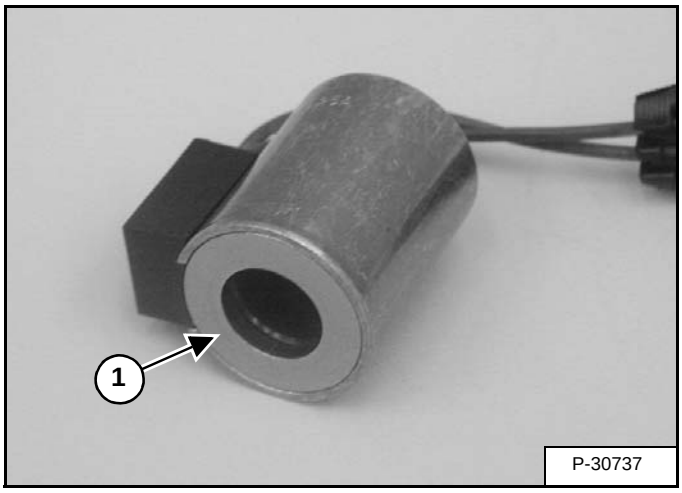
Remove the O-ring (Item 1) **[Figure 20-60-15]** from the spool.

Figure 20-60-16



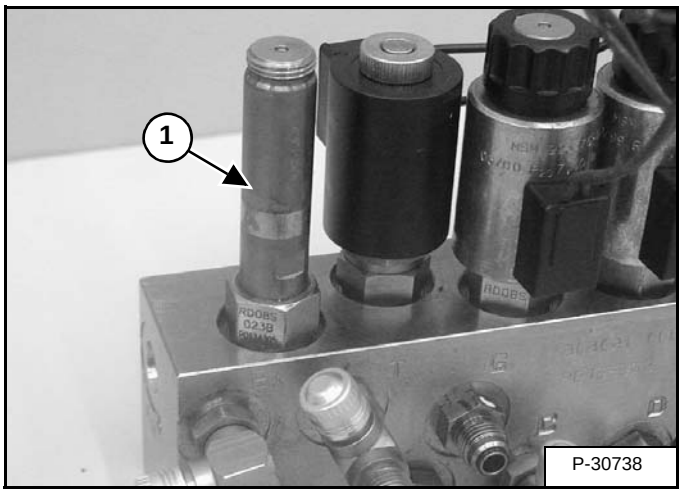
Remove the solenoid (Item 1) **[Figure 20-60-16]** from the spool.

Figure 20-60-17



Installation: Install the solenoid with the metal base (Item 1) **[Figure 20-60-17]**, down toward the base of the spool.

Figure 20-60-18



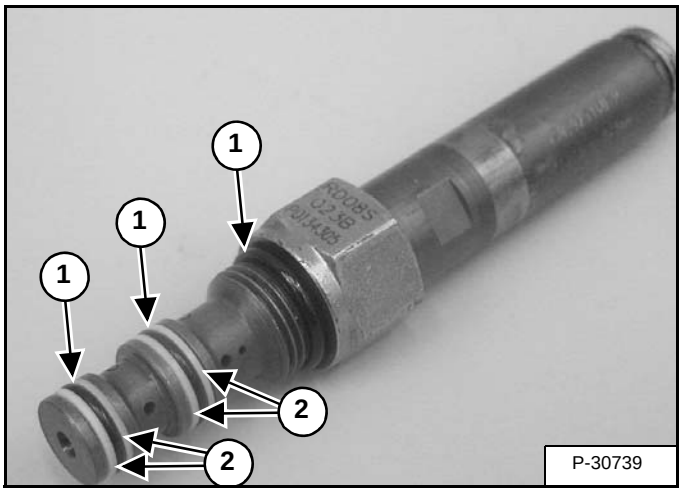
Remove the spool (Item 1) **[Figure 20-60-18]**.

Installation: Tighten the spool to 22 ft.-lbs. (30 Nm) torque.

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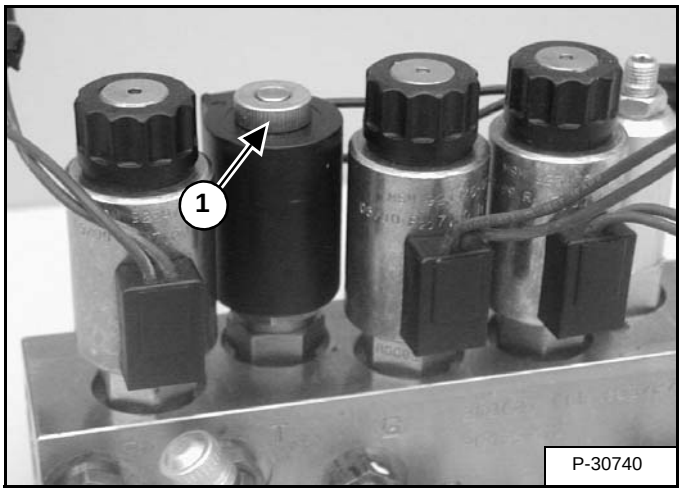
Disassembly And Assembly (Cont'd)

Figure 20-60-19



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-60-19]**.

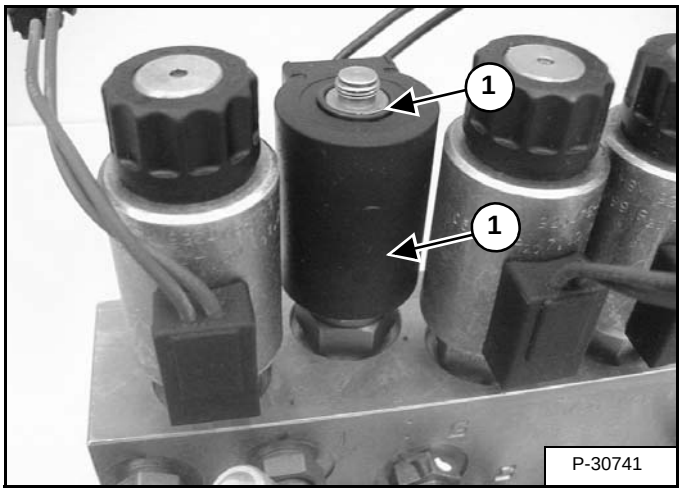
Figure 20-60-20



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

Installation: Tighten the nut to 36-54 in.-lbs. (4,1-6,1 Nm) torque.

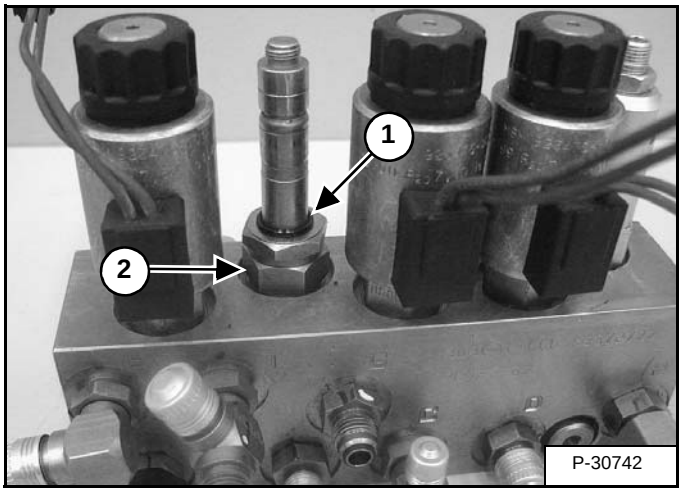
Figure 20-60-21



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

Remove the solenoid (Item 2) **[Figure 20-60-21]** from the spoon.

Figure 20-60-22



Remove the O-ring (Item 1) **[Figure 20-60-22]**.

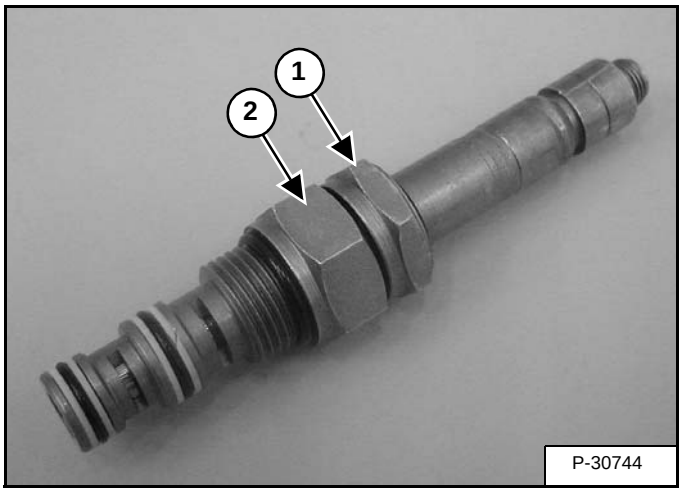
Remove the spool from the manifold, by loosening the bottom of the spool (Item 2) **[Figure 20-60-22]**.

Installation: Tighten the spool to 22 ft.-lbs. (30 Nm) torque.

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Disassembly And Assembly (Cont'd)

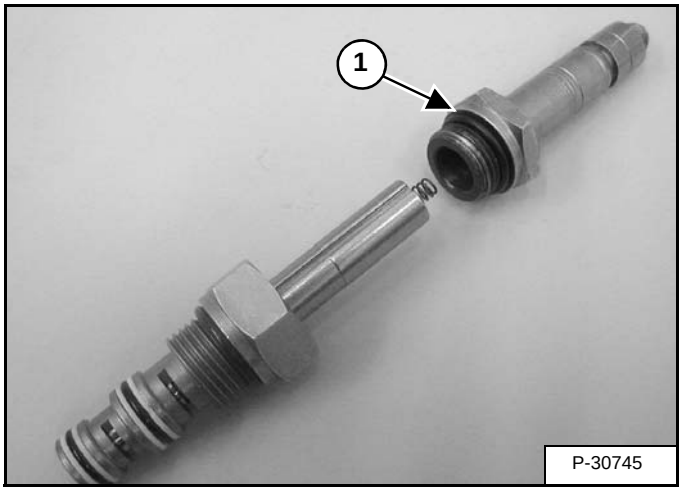
Figure 20-60-23



Remove the top of the spool (Item 1) from the base of the spool (Item 2) **[Figure 20-60-23]**.

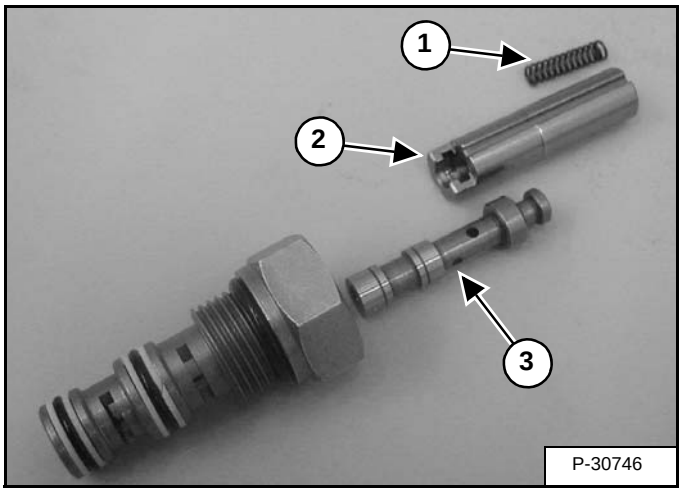
Installation: Tighten the top of the spool (Item 1) **[Figure 20-60-23]** to 30 ft.-lbs. (40 Nm) torque.

Figure 20-60-24



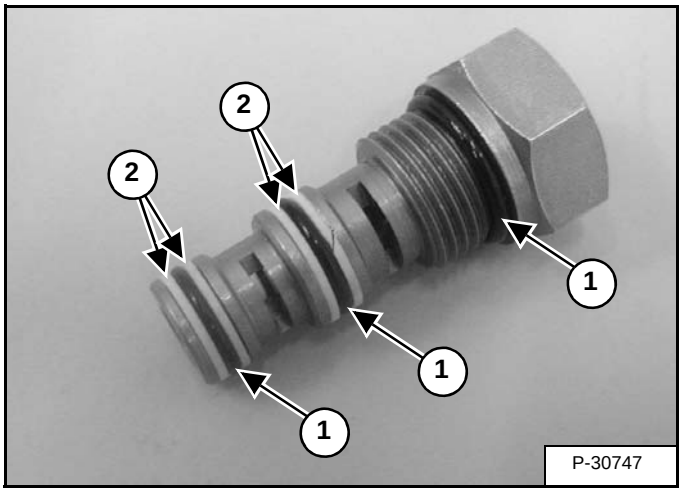
Remove the O-ring (Item 1) **[Figure 20-60-24]** from the spool.

Figure 20-60-25



Remove the spring (Item 1), spool guide (Item 2) and spool (Item 3) **[Figure 20-60-25]**.

Figure 20-60-26

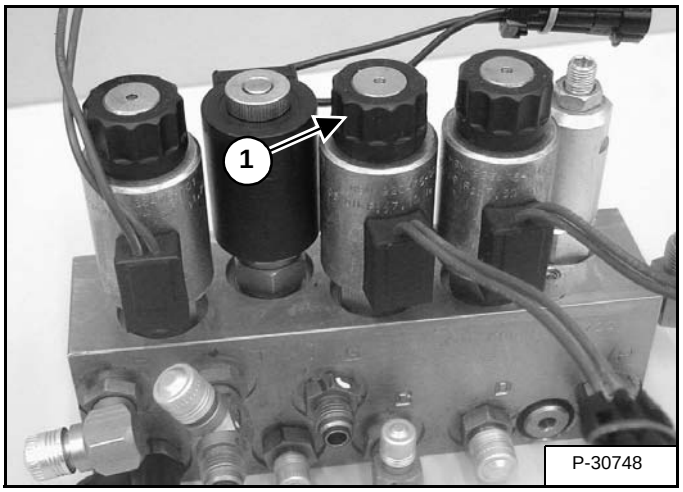


Remove the three O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-60-26]**.

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Disassembly And Assembly (Cont'd)

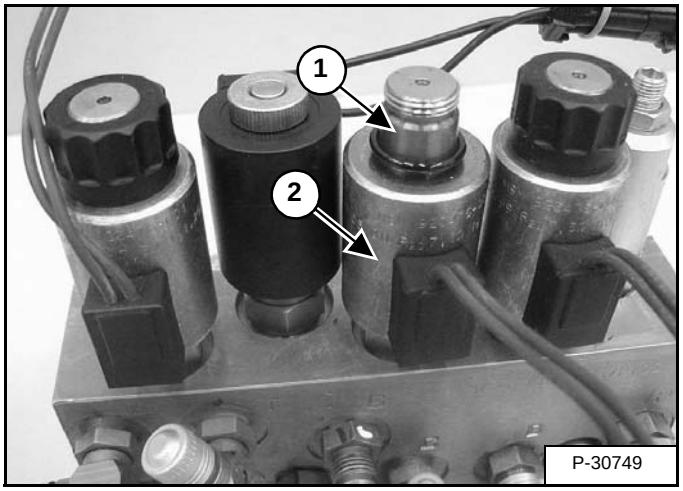
Figure 20-60-27



Remove the nut (Item 1) **[Figure 20-60-27]** from the solenoid for the auxiliary female coupler.

Installation: Tighten the nut to 36-54 in.-lbs. (4,1-6,1 Nm) torque.

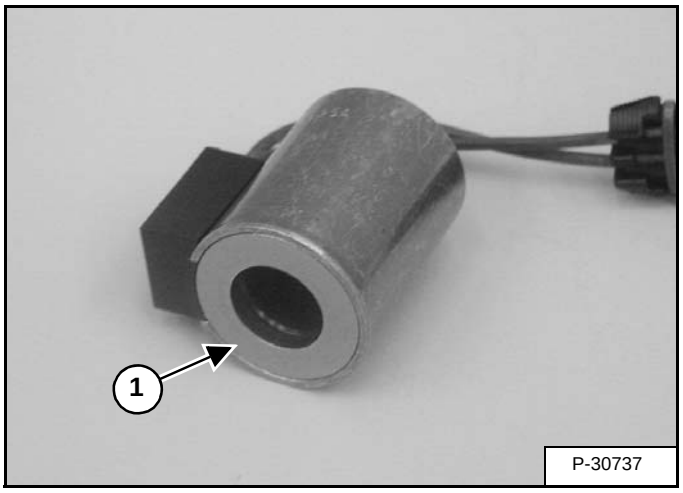
Figure 20-60-28



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

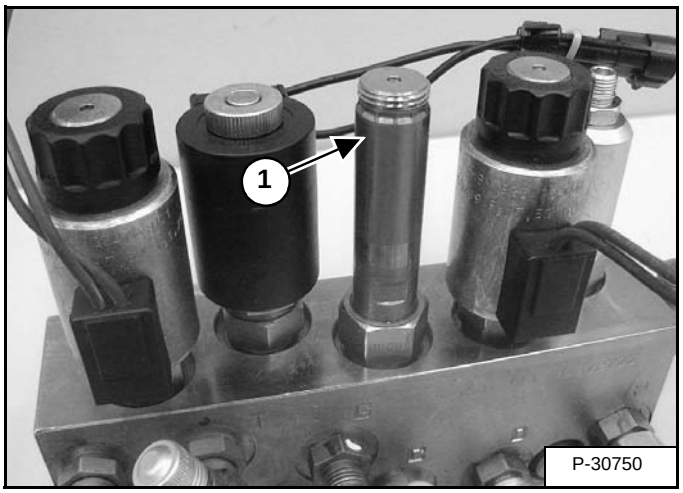
Remove the solenoid (Item 2) **[Figure 20-60-28]** from the spool.

Figure 20-60-29



Installation: Install the solenoid with the metal base (Item 1) **[Figure 20-60-29]**, down toward the base of the spool.

Figure 20-60-30



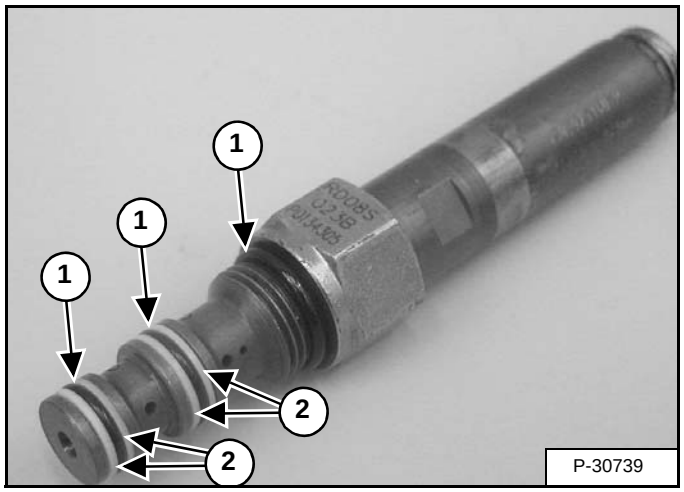
Remove the spool (Item 1) **[Figure 20-60-30]**.

Installation: Tighten the spool to 22 ft.-lbs. (30 Nm) torque.

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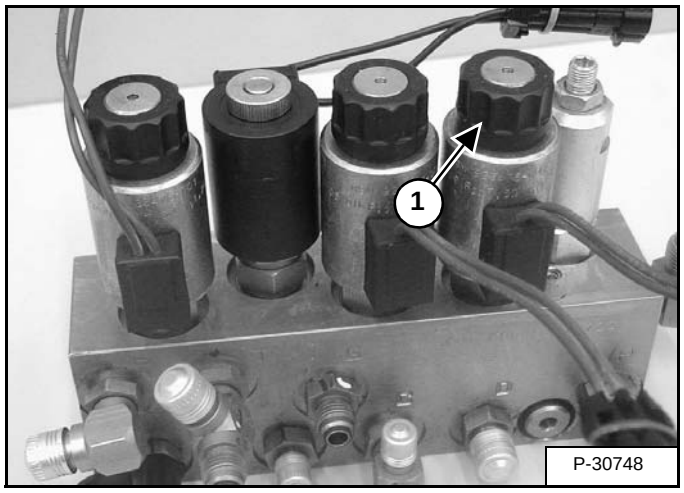
Disassembly And Assembly (Cont'd)

Figure 20-60-31



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-60-31]**.

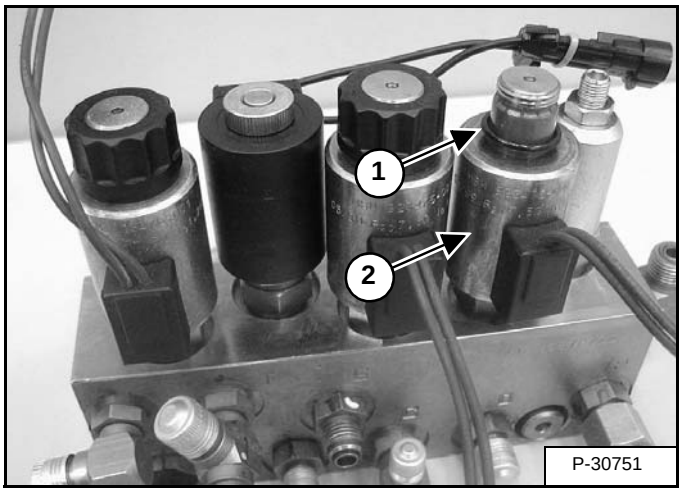
Figure 20-60-32



Remove the nut (Item 1) **[Figure 20-60-32]** from the spool for the auxiliary male coupler.

Installation: Tighten the nut to 36-54 in.-lbs. (4,1-6,1 Nm) torque.

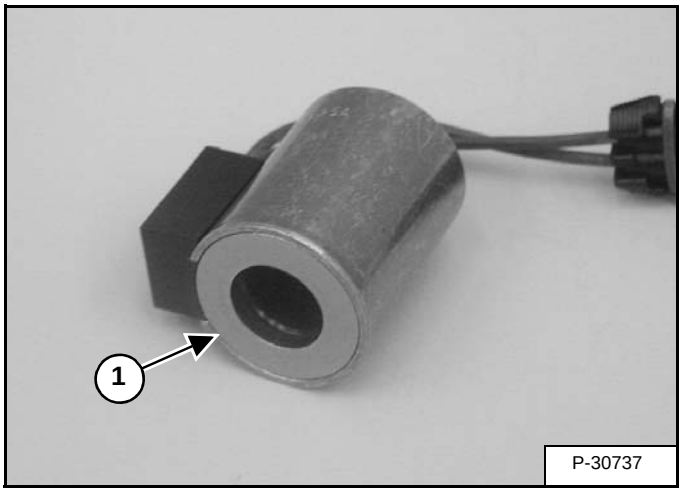
Figure 20-60-33



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

Remove the solenoid (Item 2) **[Figure 20-60-33]**.

Figure 20-60-34

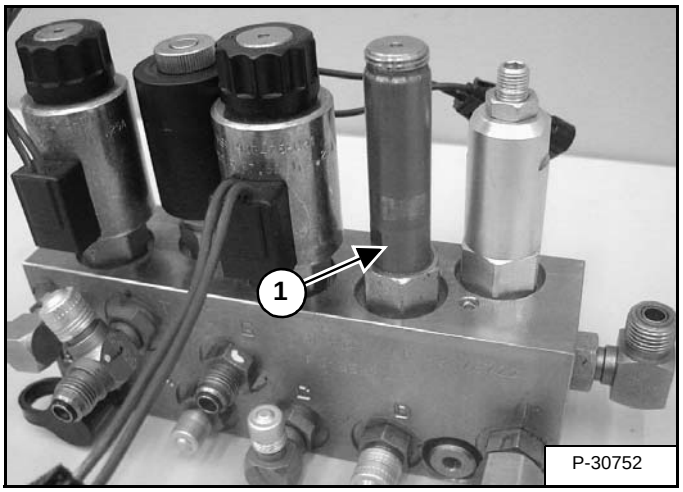


Installation: Install the solenoid with the metal base (Item 1) **[Figure 20-60-34]** down toward the base of the spool.

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Disassembly And Assembly (Cont'd)

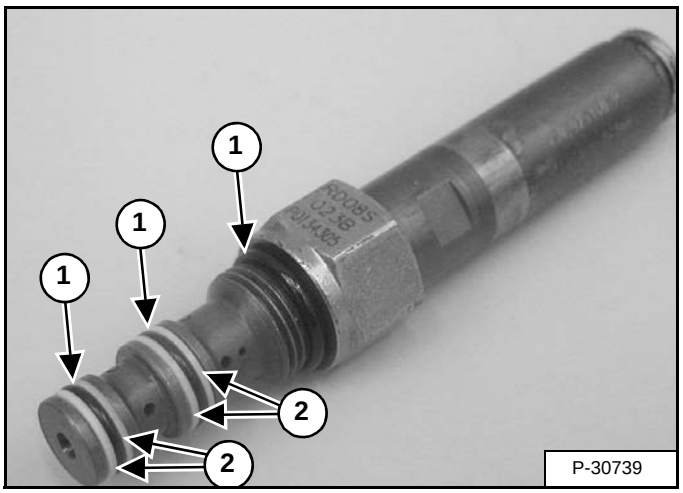
Figure 20-60-35



Remove the spool (Item 1) **[Figure 20-60-35]**.

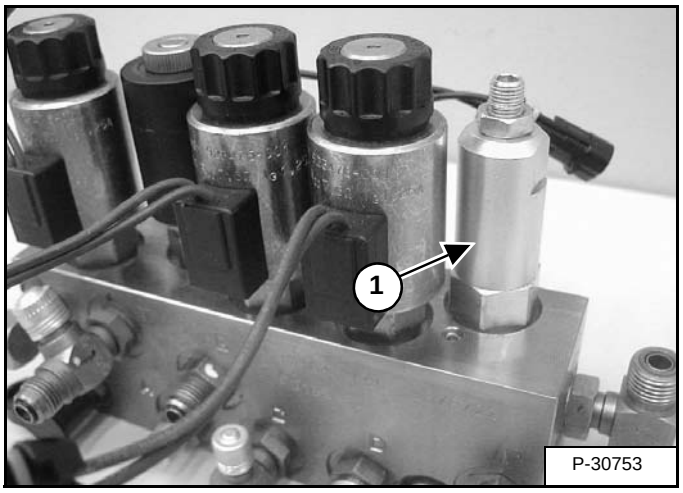
Installation: Tighten the spool to 22 ft.-lbs. (30 Nm) torque.

Figure 20-60-36



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-60-36]**.

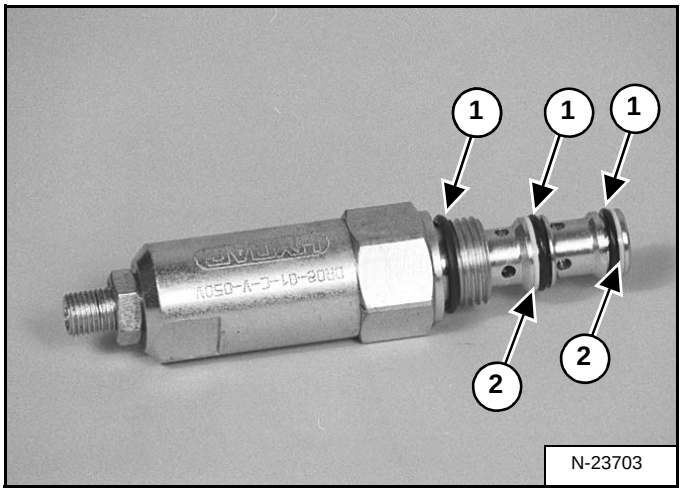
Figure 20-60-37



Remove the pressure reducing valve (Item 1) **[Figure 20-60-37]** from the manifold assembly.

Installation: Tighten the pressure reducing valve to 22 ft.-lbs. (30 Nm) torque.

Figure 20-60-38

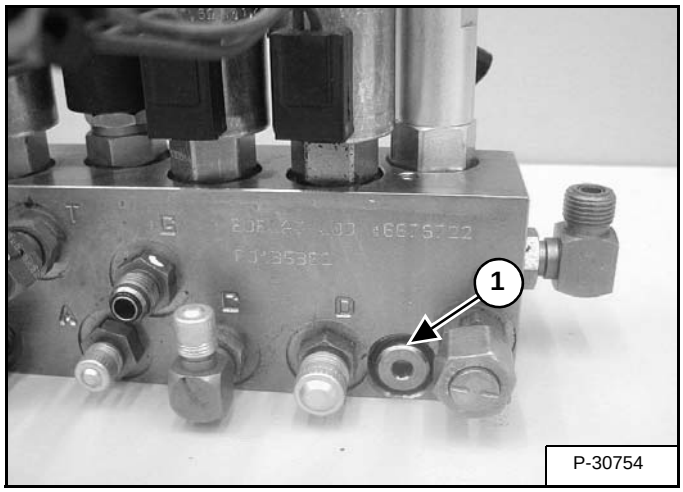


Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-60-38]** from the pressure reducing valve.

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Disassembly And Assembly (Cont'd)

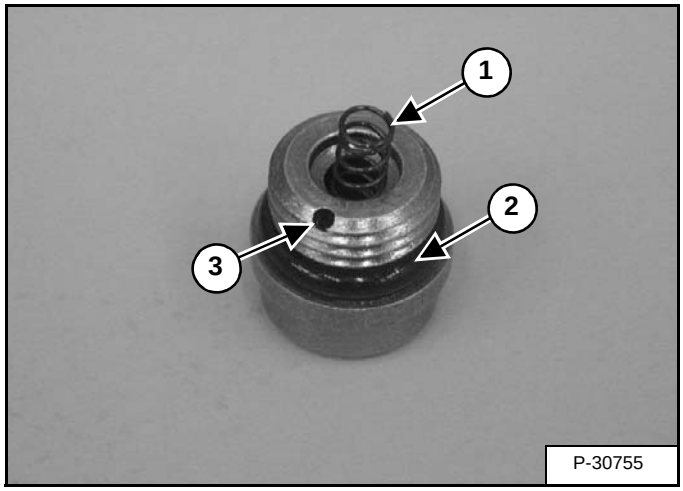
Figure 20-60-39



Remove the plug (Item 1) **[Figure 20-60-39]** from the check valve in the manifold assembly.

Installation: Tighten the plug to 29 ft.-lbs. (40 Nm) torque.

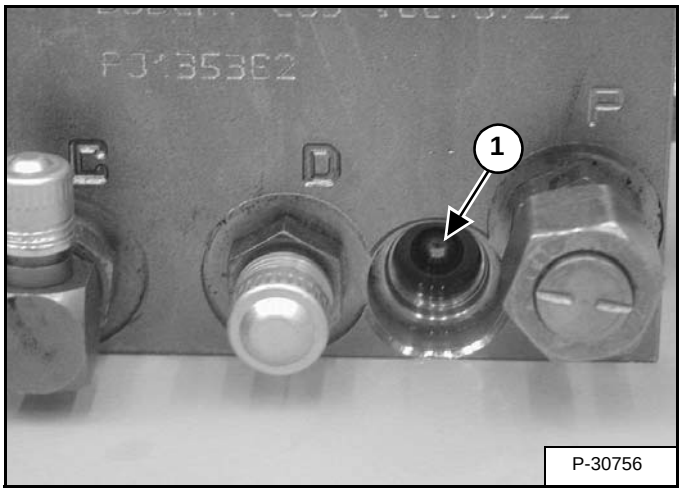
Figure 20-60-40



Remove the spring (Item 1) and O-ring (Item 2) **[Figure 20-60-40]**.

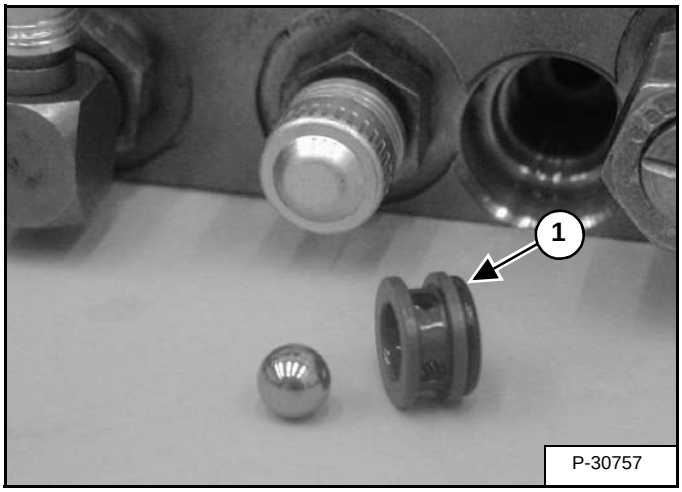
Check that the orifice (Item 3) **[Figure 20-60-40]** to be sure it is not plugged.

Figure 20-60-41



Remove the ball and seat (Item 1) **[Figure 20-60-41]** from the block.

Figure 20-60-42

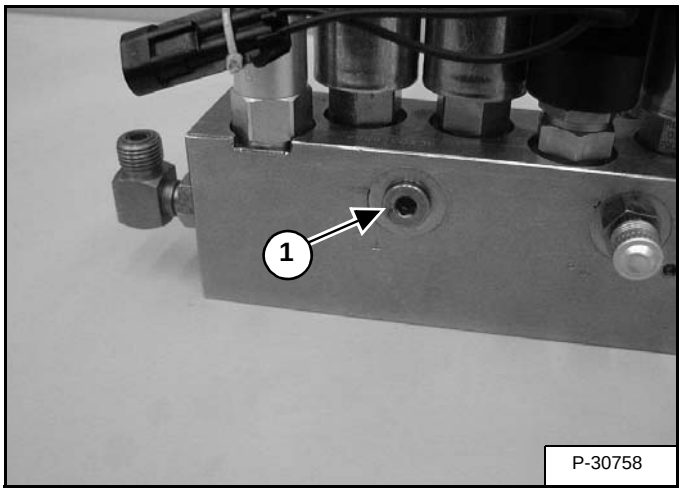


Remove the O-ring (Item 1) **[Figure 20-60-42]** from the seat.

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Disassembly And Assembly (Cont'd)

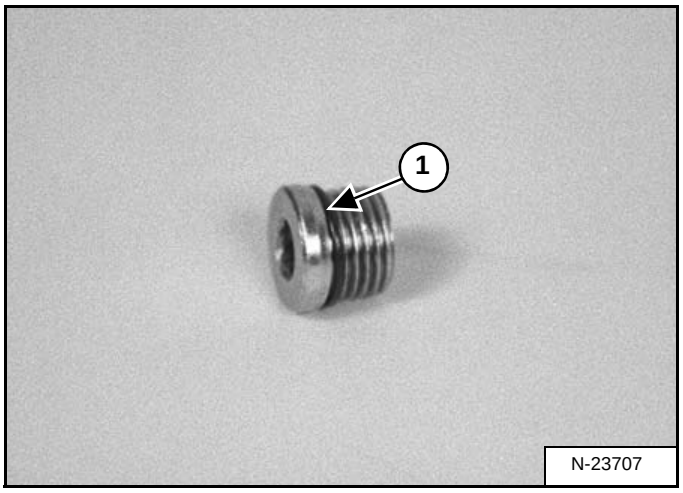
Figure 20-60-43



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

Installation: Tighten the plug to 29 ft.-lbs. (40 Nm) torque.

Figure 20-60-44



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

Clean all parts in solvent and dry with compressed air.

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

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

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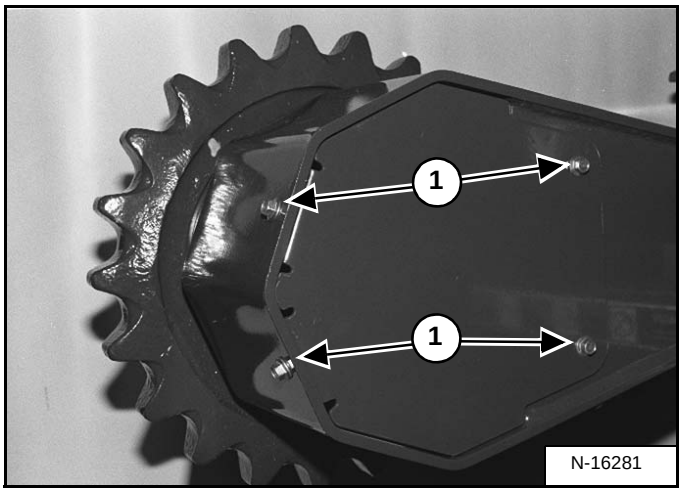
TRAVEL MOTOR

Removal And Installation

Lift and block the side of the track frame where the travel motor will be removed.

Release the track tension and remove the track. (See Rubber Track Removal And Installation on Page 30-20-4.))

Figure 20-70-1



Remove the bolts (Item 1) **[Figure 20-70-1]** from the track frame cover.

Installation: Tighten the bolts to 20-25 ft.-lbs. (27-34 Nm) torque.

Remove the cover.

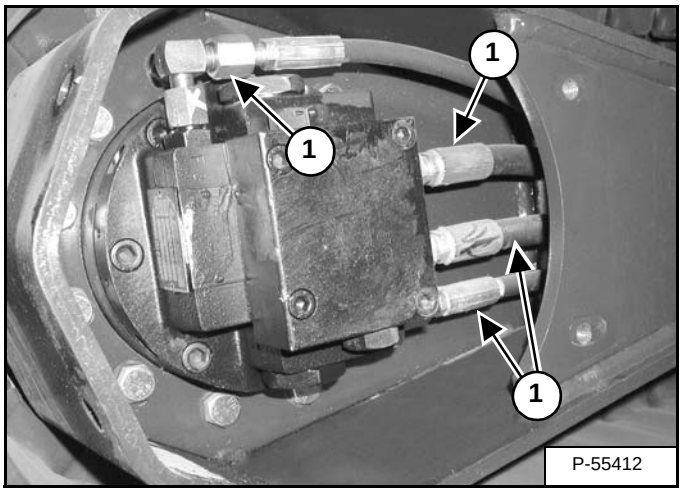
IMPORTANT

When making repairs on 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-2003-0284

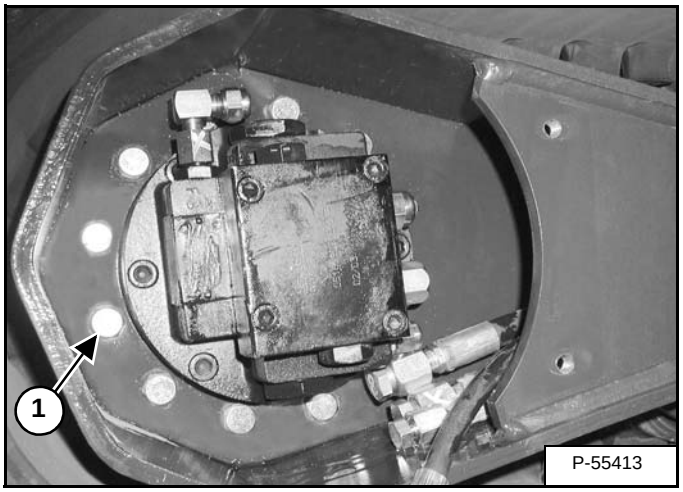
Mark the hoses for correct installation.

Figure 20-70-2



Remove the hoses (Item 1) **[Figure 20-70-2]** from the travel motor.

Figure 20-70-3



Remove the bolts (Item 1) **[Figure 20-70-3]** from the travel motor.

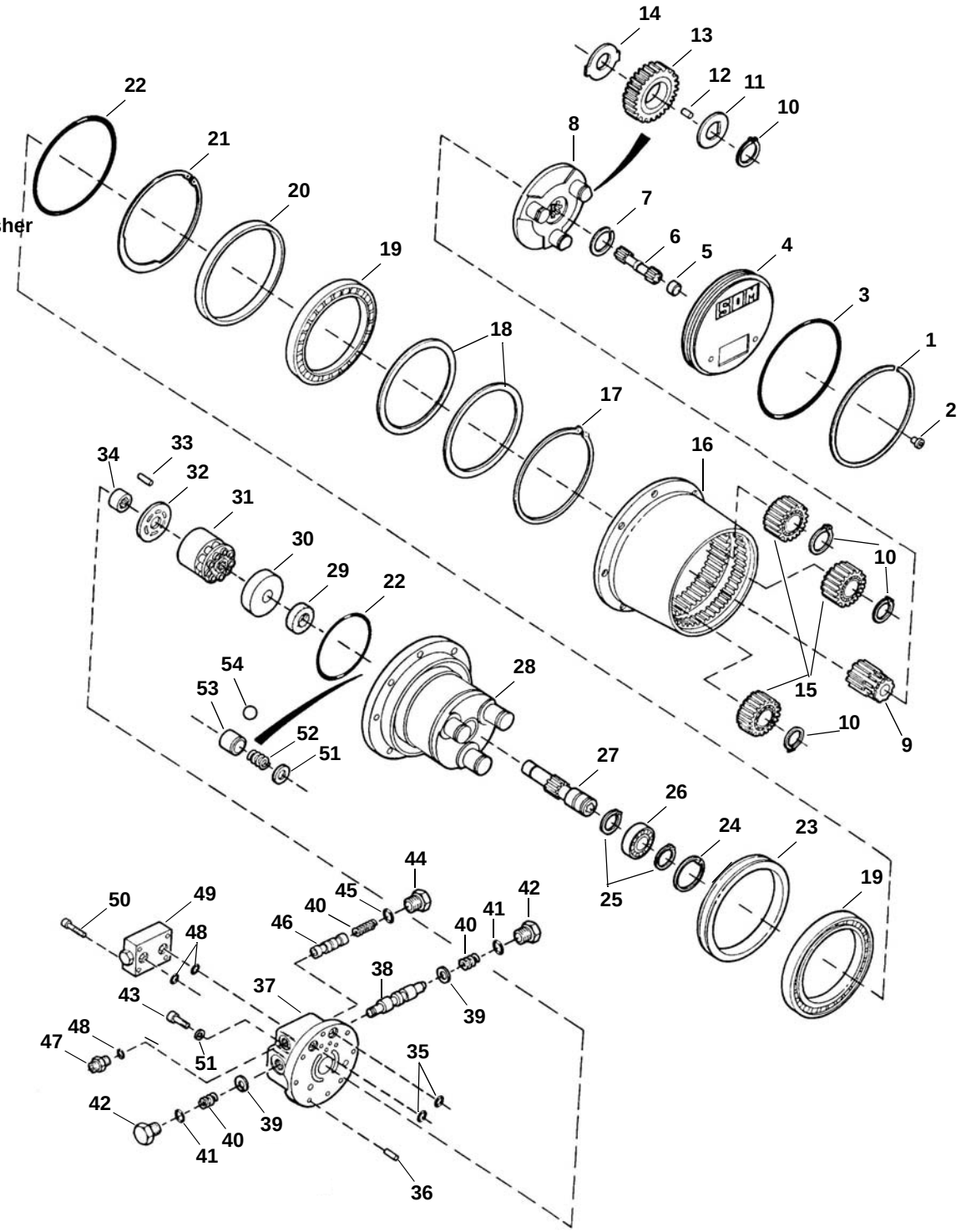
Installation: Apply thread lock (LOCTITE #242) to the bolts and tighten to 74-81 ft.-lbs. (100-110 Nm) torque.

Remove the travel motor from the track frame.

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Parts Identification

1. Snap Ring
2. Plug
3. O-Ring
4. Cover
5. Bushing
6. Drive Shaft
7. Snap Ring
8. Planetary Carrier
9. Sun Gear
10. Snap Ring
11. Anti-Rotation Washer
12. Bearing
13. Planetary Gear
14. Thrust Washer
15. Planetary Gear
16. Ring Gear
17. Snap Ring
18. Shim(s)
19. Bearings
20. Spacer
21. Snap Ring
22. O-Ring
23. Seal Ring
24. Snap Ring
25. Snap Ring
26. Bearing
27. Drive Shaft
28. Hub
29. Seal
30. Swash Plate
31. Rotating Block
32. Motor Plate
33. Alignment Pin
34. Bearing
35. O-Ring
36. Alignment Pin
37. Motor Cover
38. Spool
39. Washer
40. Spring
41. O-Ring
42. Plug
43. Bolt
44. Plug
45. O-Ring
46. Spool
47. Fitting
48. O-Ring
49. Relief Valve
50. Bolt
51. Washer
52. Spring
53. Piston
54. Ball



D-2373A

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Disassembly

IMPORTANT

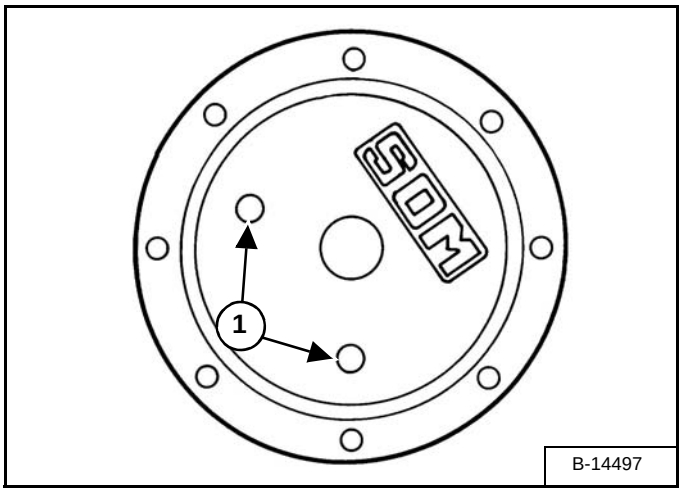
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tube lines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

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

MEL1519 for torque ring and seal ring assembly.

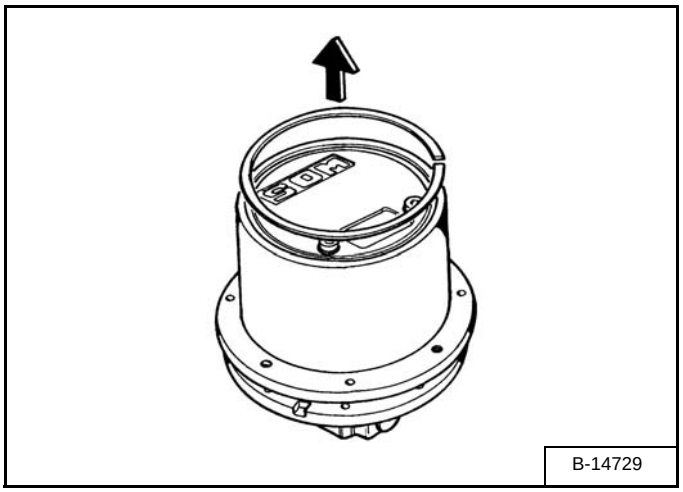
Figure 20-70-4



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

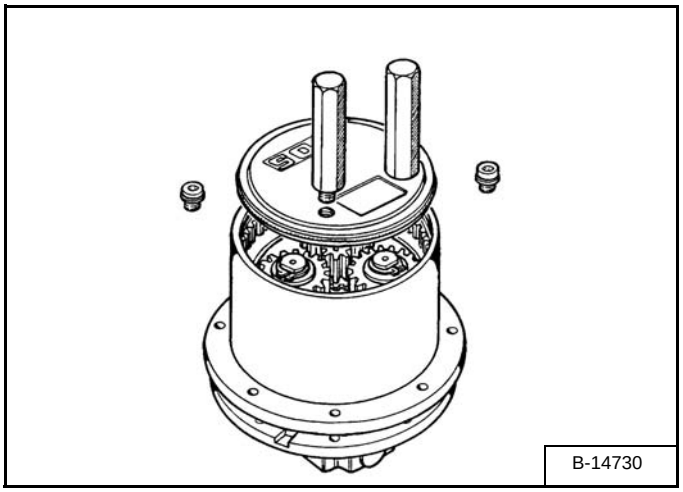
Drain the oil into a container.

Figure 20-70-5



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

Figure 20-70-6



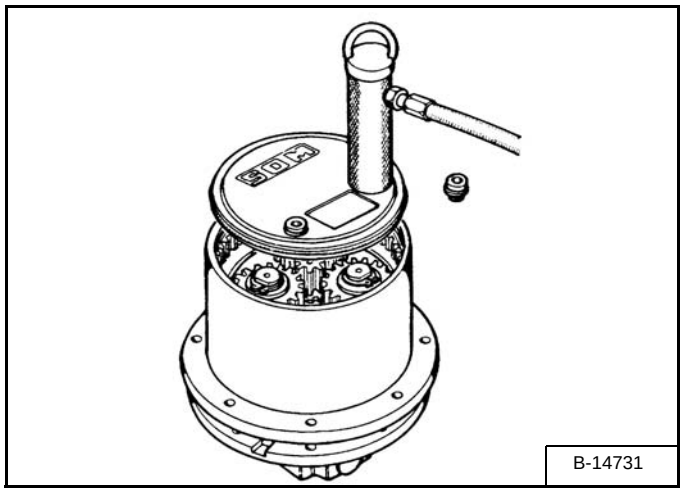
To remove the cover, install two threaded pins in the drain holes and lift the cover off **[Figure 20-70-6]**.

Air pressure may also be used to remove the cover.

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Disassembly (Cont'd)

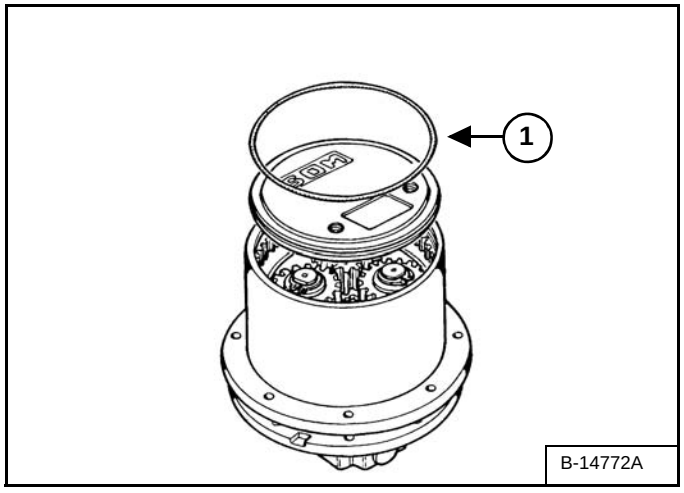
Figure 20-70-7



Screw the adapter in a drain hole and apply 8-11 psi **[Figure 20-70-7]**.

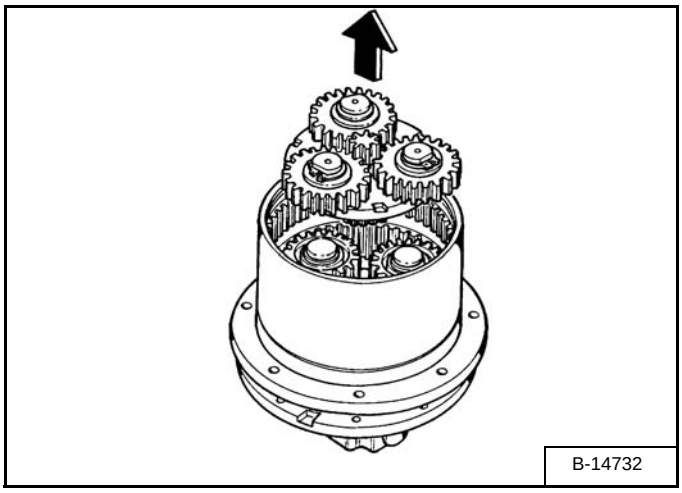
NOTE: Do not use excess pressure or seal damage may result.

Figure 20-70-8



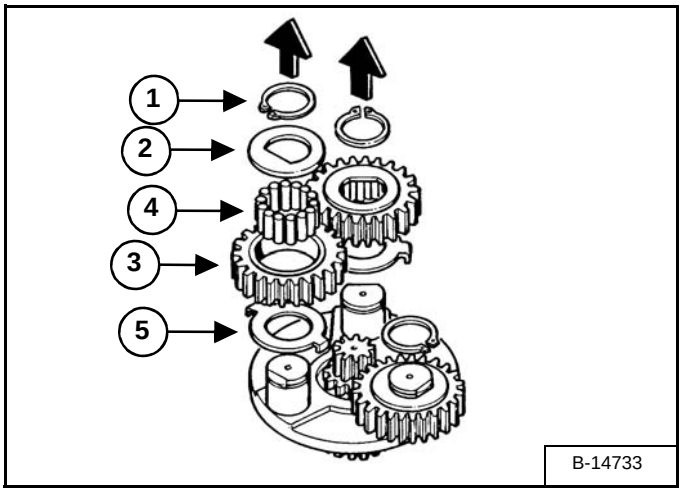
Remove the O-ring (Item 1) **[Figure 20-70-8]** from the cover.

Figure 20-70-9



Remove the planetary carrier **[Figure 20-70-9]**.

Figure 20-70-10

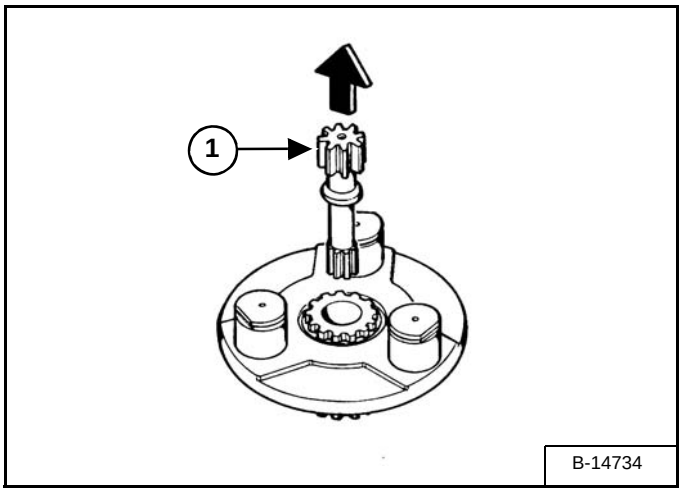


Remove the snap rings (Item 1), the anti-rotation washers (Item 2), the gears (Item 3), the bearings (Item 4) and the bottom thrust washers (Item 5) **[Figure 20-70-10]** from the planetary carrier assembly.

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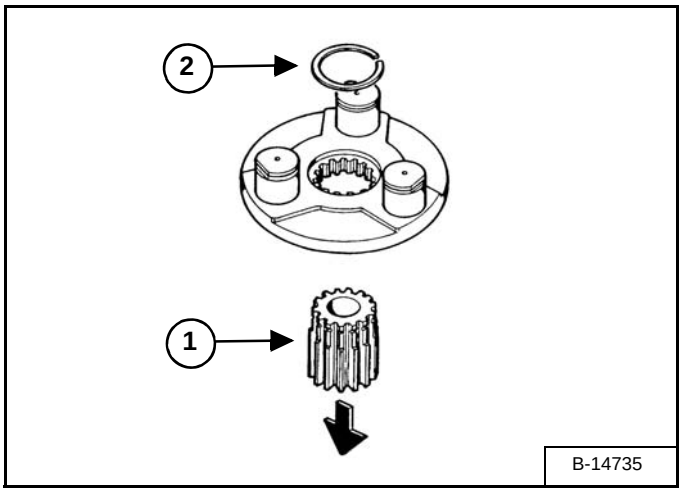
Disassembly (Cont'd)

Figure 20-70-11



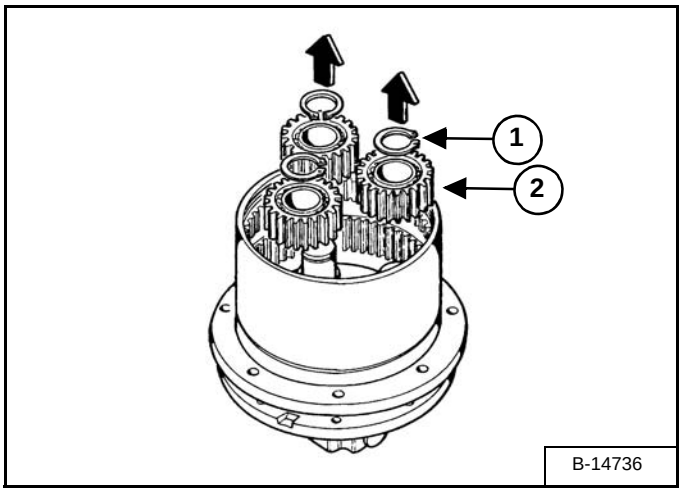
Remove the sun gear (Item 1) **[Figure 20-70-11]** from the carrier.

Figure 20-70-12



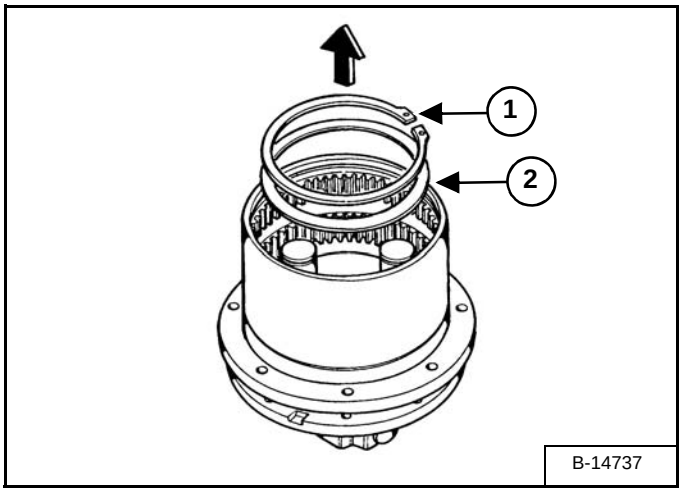
Remove the sun gear (Item 1) from the planetary carrier, by removing the snap ring (Item 2) and pushing the sun gear (Item 1) **[Figure 20-70-12]** out of the carrier.

Figure 20-70-13



Remove the snap rings (Item 1) and the gears/bearings (Item 2) **[Figure 20-70-13]**.

Figure 20-70-14



Remove the external snap ring (Item 1) and the shim(s) (Item 2) **[Figure 20-70-14]**.

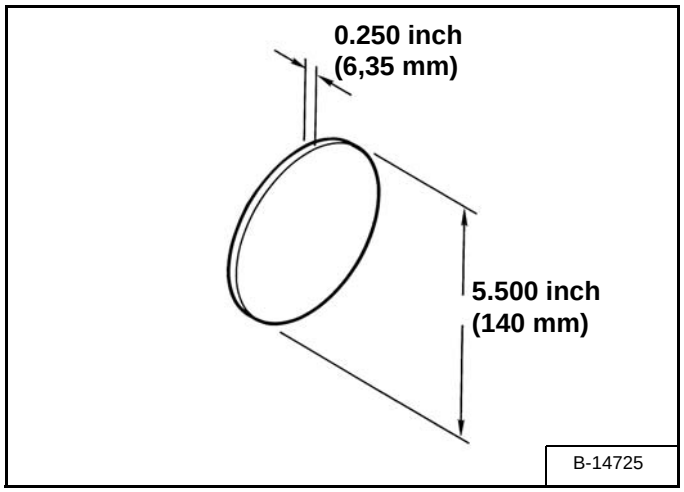
Before the ring gear can be pulled from the hub, a plate must be placed on the three pins of the planetary carrier.

The plate will provide support for the three jaw puller.

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Disassembly (Cont'd)

Figure 20-70-15

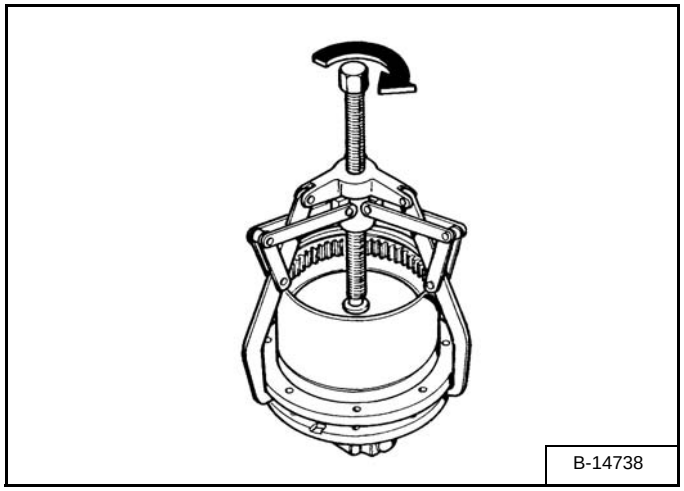


Fabricate or obtain the plate **[Figure 20-70-15]** locally.

The dimensions of the plate are as follows:

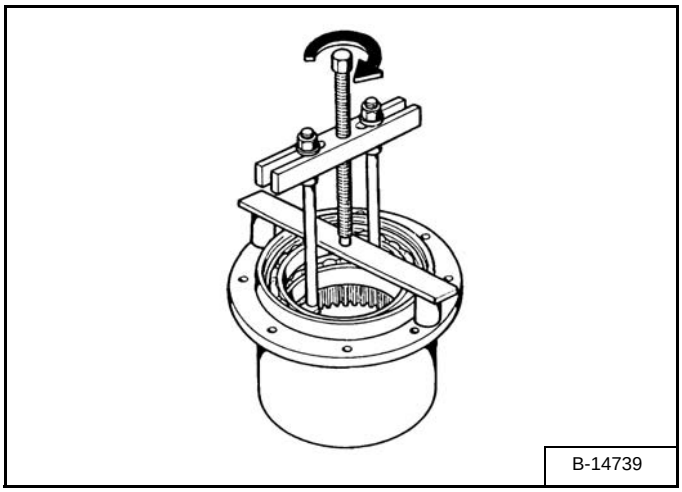
Diameter 5.500 inches (140 mm)
Thickness 0.250 inch (6.35 mm)

Figure 20-70-16



Using a three jaw puller, separate the hub and the ring gear assembly **[Figure 20-70-16]**.

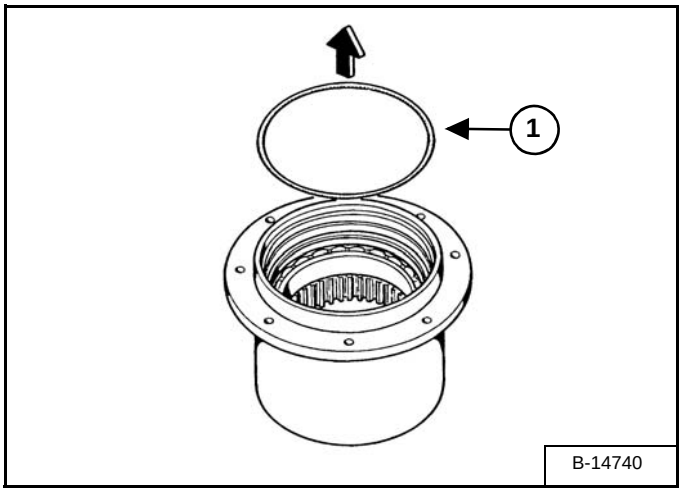
Figure 20-70-17



Remove the ball bearing from the ring gear **[Figure 20-70-17]**.

NOTE: Do not damage the top surface of the bearing as it is lapped (polished) to mate with the front seal ring.

Figure 20-70-18

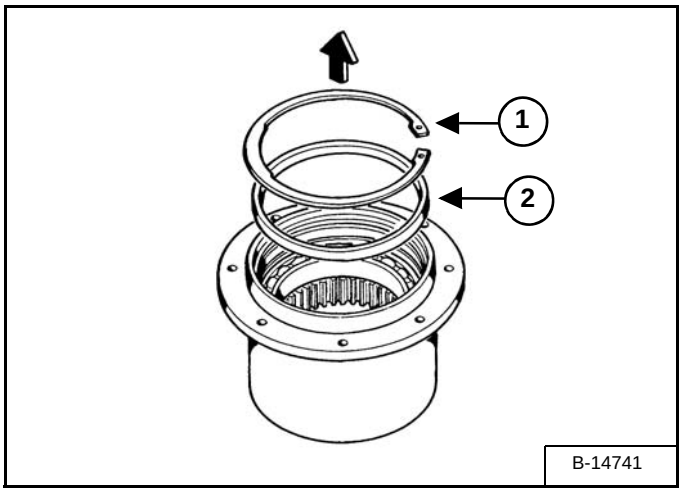


Remove the O-ring (Item 1) **[Figure 20-70-18]** from the ring gear.

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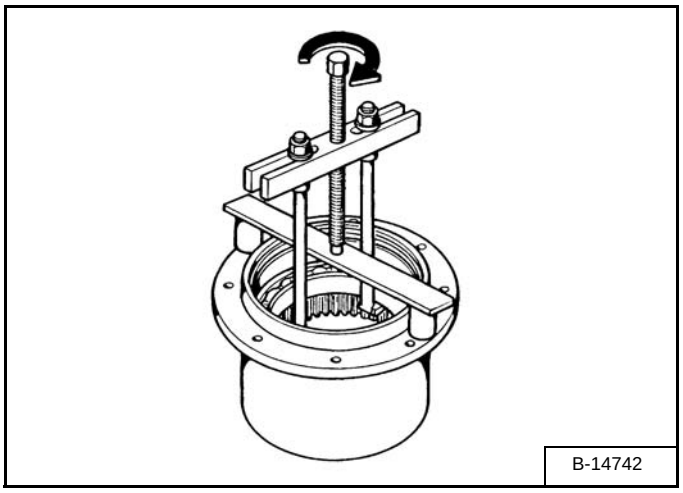
Disassembly (Cont'd)

Figure 20-70-19



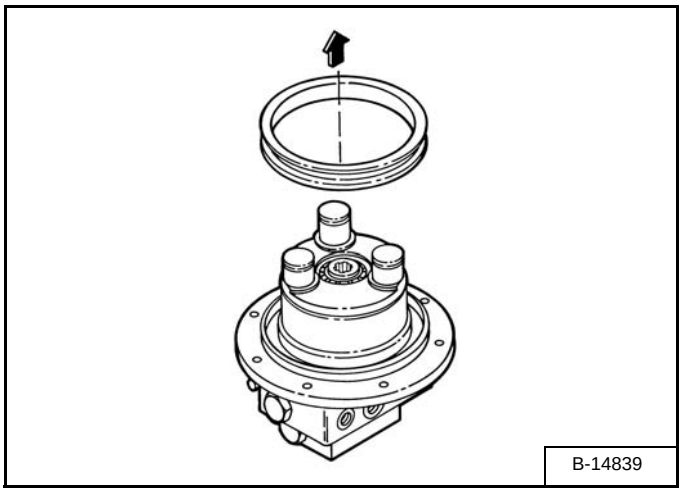
Remove the internal snap ring (Item 1) and spacer (Item 2) **[Figure 20-70-19]**.

Figure 20-70-20



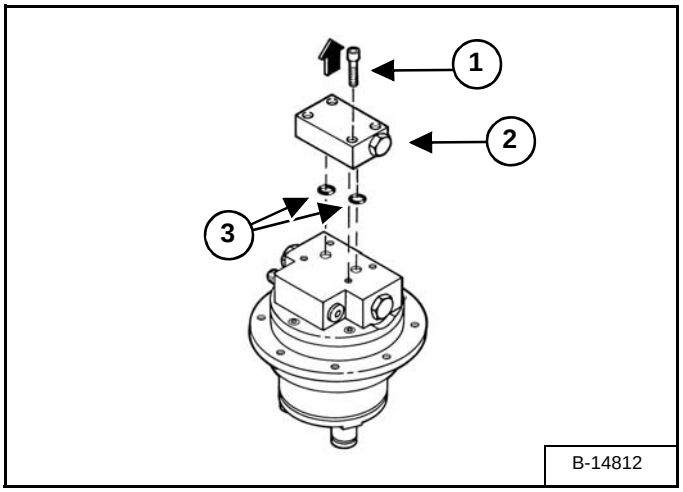
Remove the second bearing from the ring gear **[Figure 20-70-20]**.

Figure 20-70-21



Remove the front seal ring from the motor hub **[Figure 20-70-21]**.

Figure 20-70-22



Remove the four bolts (Item 1) from the relief valve block (Item 2) **[Figure 20-70-22]**.

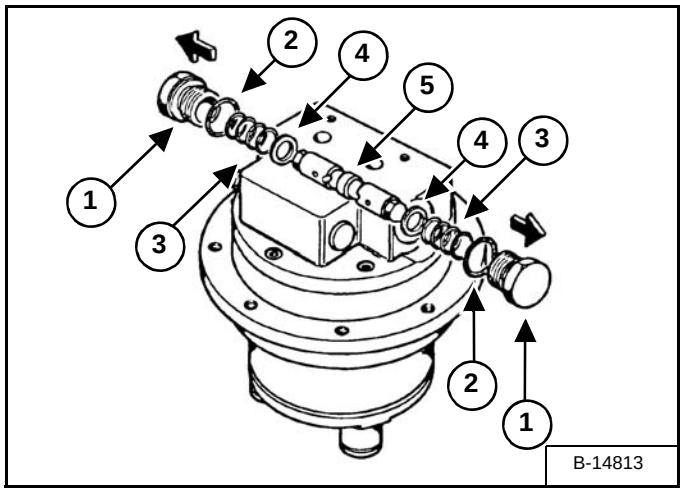
Remove the two O-rings (Item 3) **[Figure 20-70-22]**.

NOTE: The relief valve block assembly (Item 2) [Figure 20-70-22] and the relief valves are not serviceable. If any of these parts are damaged, order a new relief valve block assembly.

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Disassembly (Cont'd)

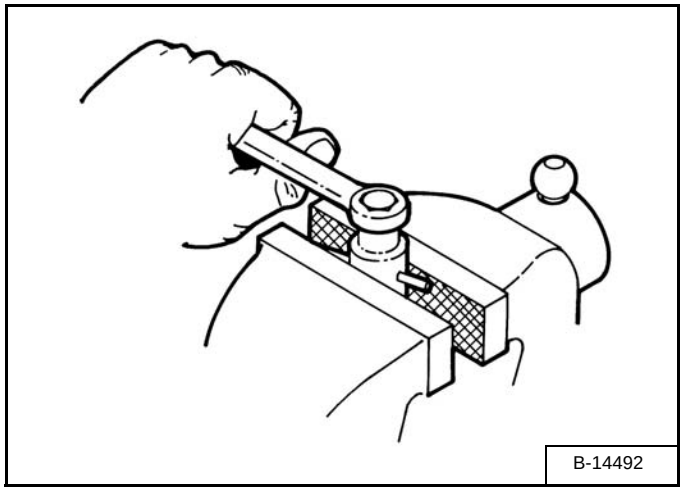
Figure 20-70-23



Remove the plugs (Item 1), O-rings (Item 2), springs (Item 3) and washers (Item 4) **[Figure 20-70-23]** from both ends of the spool.

Remove the spool (Item 5) **[Figure 20-70-23]**.

Figure 20-70-24

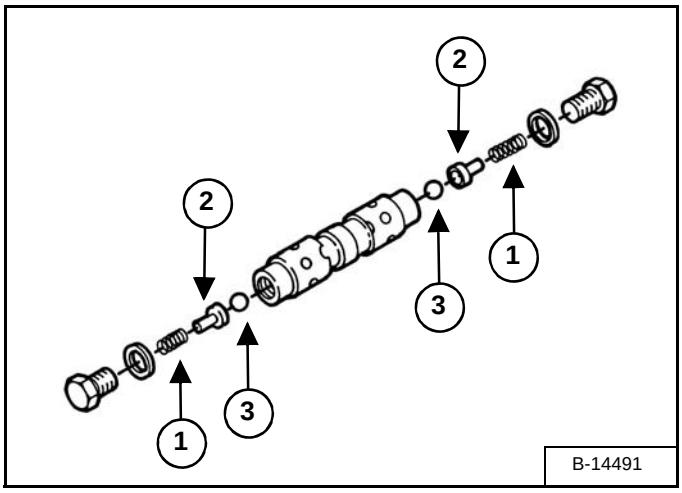


To disassemble the spool, insert a hardened pin through the hole in the spool and use a vise with protective jaws to hold the spool **[Figure 20-70-24]**.

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

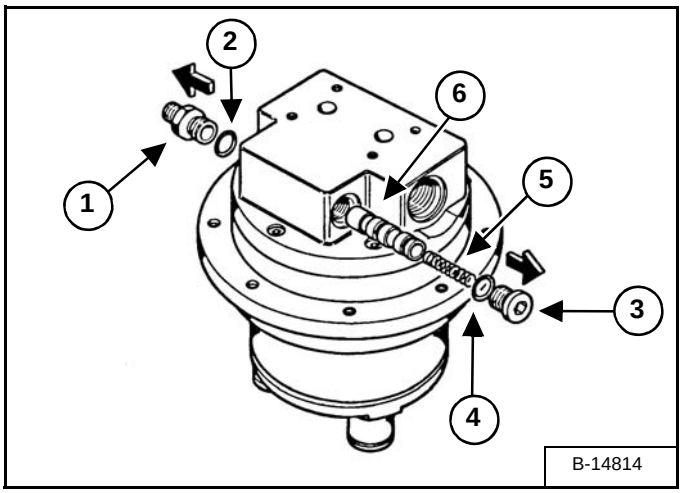
Remove the plug from both ends of the spool **[Figure 20-70-24]**.

Figure 20-70-25



Remove the spring (Item 1), the poppet (Item 2) and the check ball (Item 3) **[Figure 20-70-25]** from both ends of the spool.

Figure 20-70-26

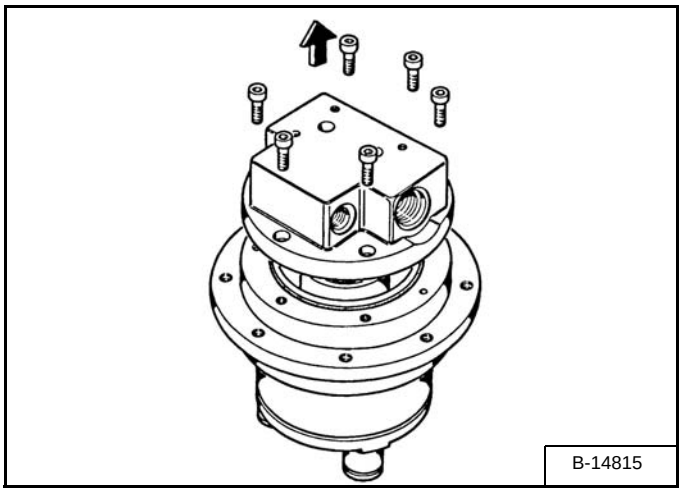


Remove the fitting (Item 1) and O-ring (Item 2). Remove the plug (Item 3), O-ring (Item 4), spring (Item 5) and spool (Item 6) **[Figure 20-70-26]**.

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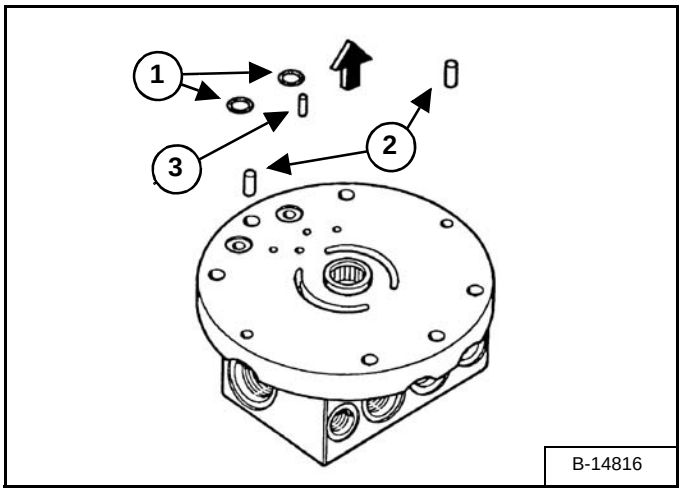
Disassembly (Cont'd)

Figure 20-70-27



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

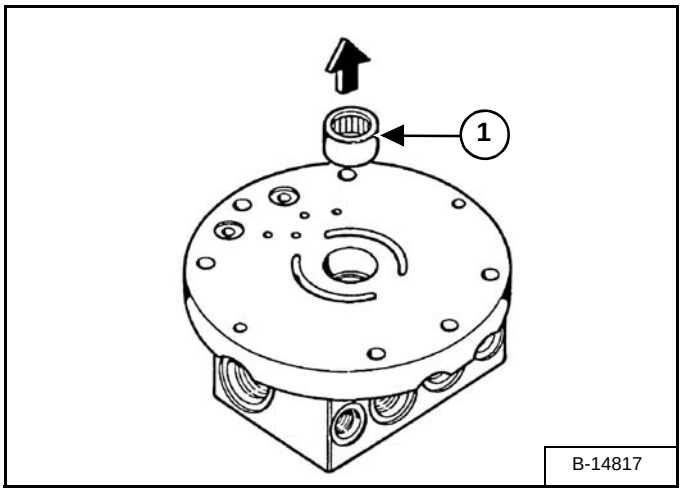
Figure 20-70-28



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

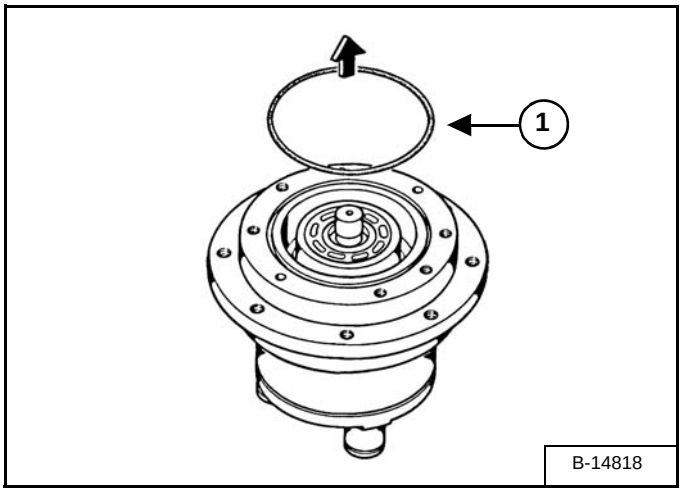
Remove the alignment pin (Item 3) **[Figure 20-70-28]**.

Figure 20-70-29



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

Figure 20-70-30

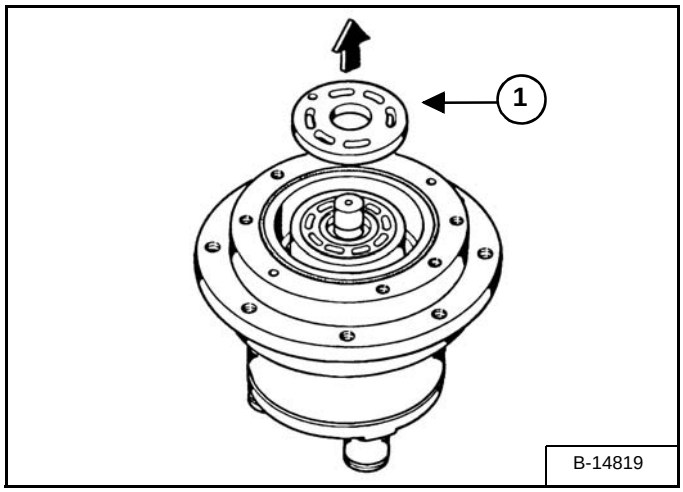


Remove the O-ring (Item 1) **[Figure 20-70-30]**.

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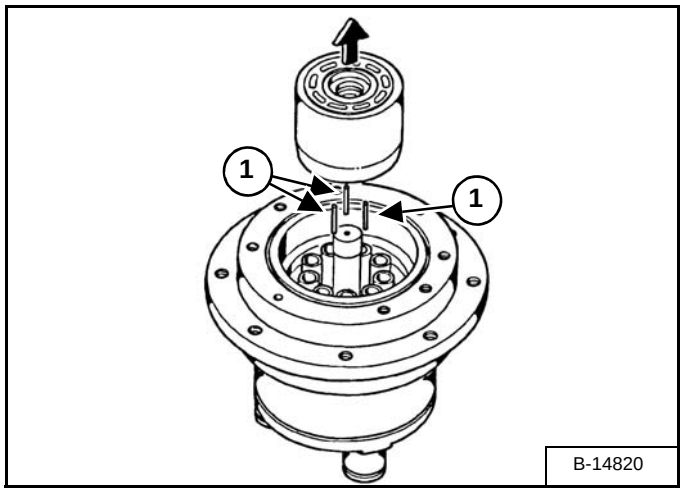
Disassembly (Cont'd)

Figure 20-70-31



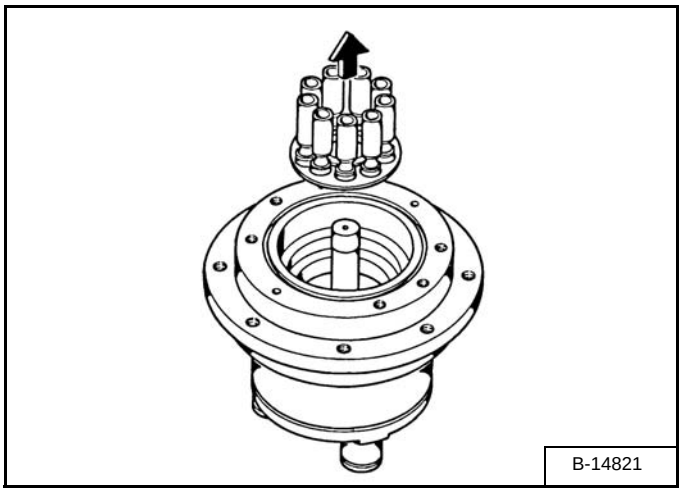
Remove the valve plate (Item 1) **[Figure 20-70-31]**.

Figure 20-70-32



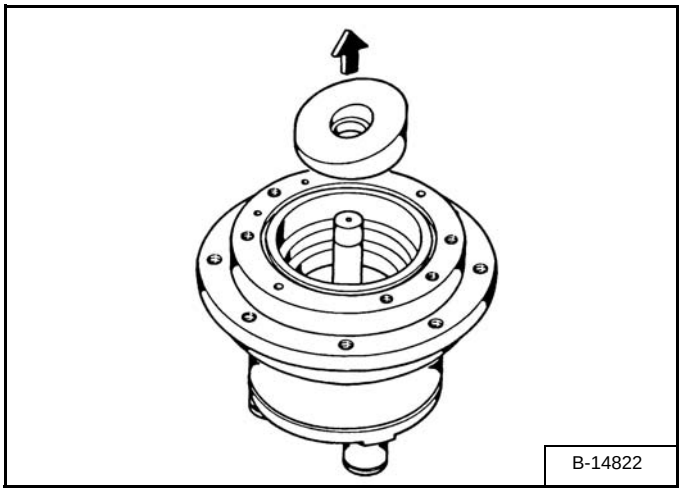
Remove the rotating block and the three dowel pins (Item 1) **[Figure 20-70-32]**.

Figure 20-70-33



Remove the piston assembly **[Figure 20-70-33]**.

Figure 20-70-34

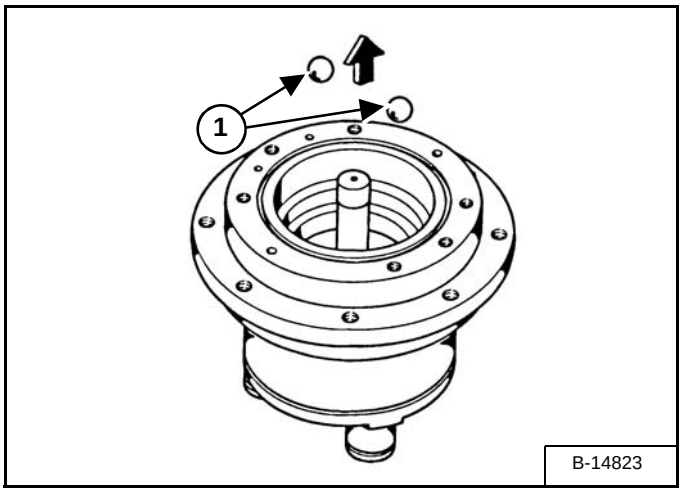


Remove the swash plate **[Figure 20-70-34]**.

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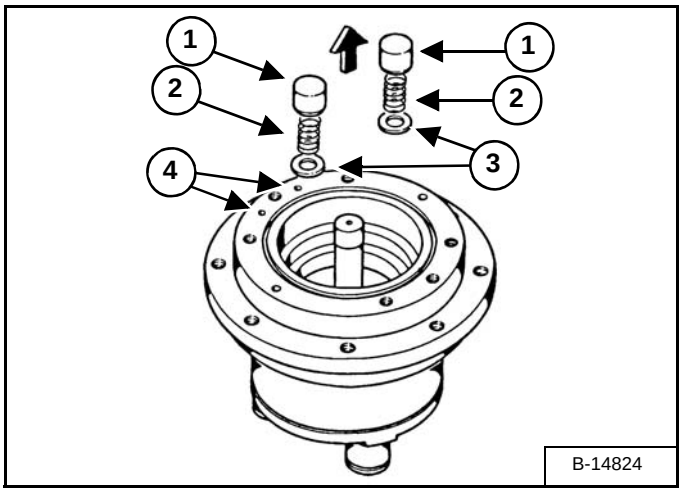
Disassembly (Cont'd)

Figure 20-70-35



Remove the balls (Item 1) **[Figure 20-70-35]**.

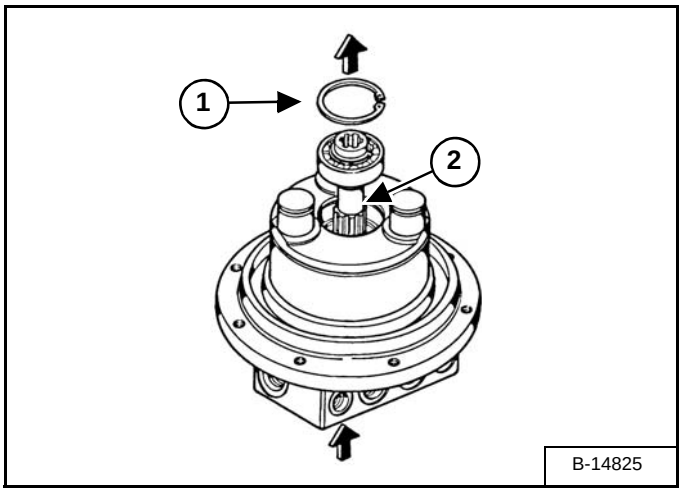
Figure 20-70-36



Remove the displacement control pistons (Item 1), the springs (Item 2) and the washers (Item 3) **[Figure 20-70-36]**.

NOTE: To ease removal of the pistons, apply low air pressure to the oil holes (Item 4) [Figure 20-70-36].

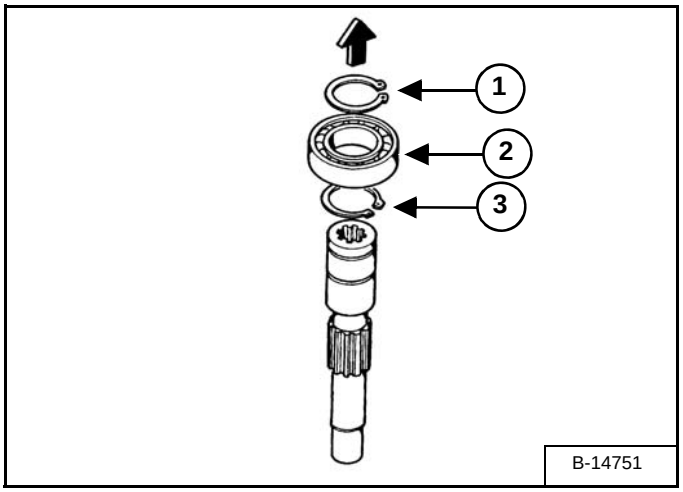
Figure 20-70-37



Remove the internal snap ring (Item 1) **[Figure 20-70-37]** that retain the bearing/drive shaft to the hub.

Push the drive shaft (Item 2) **[Figure 20-70-37]** from the bottom to remove the shaft from the hub.

Figure 20-70-38

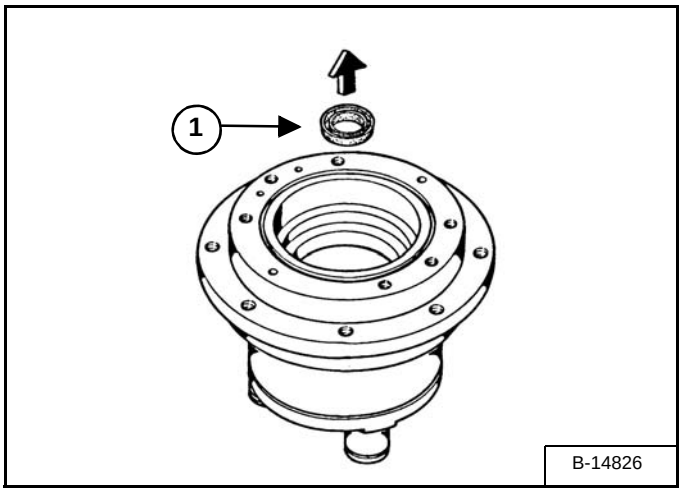


Remove the snap ring (Item 1), the bearing (Item 2) and the snap ring (Item 3) **[Figure 20-70-38]** from the drive shaft.

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Disassembly (Cont'd)

Figure 20-70-39



Remove the seal (Item 1) **[Figure 20-70-39]** from the hub.

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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 the sun gear from the planetary assembly that is damaged.

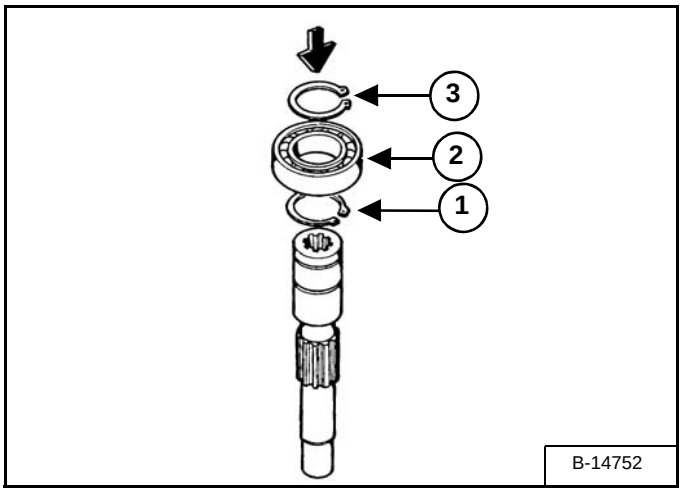
One damaged gear can cause a microscopic fatigue crack in the mating teeth and cause premature failure after servicing.

Apply oil to all O-rings (as noted) and light grease to the ball and roller bearings before installation.

The following tools will be needed to assemble the travel motor:

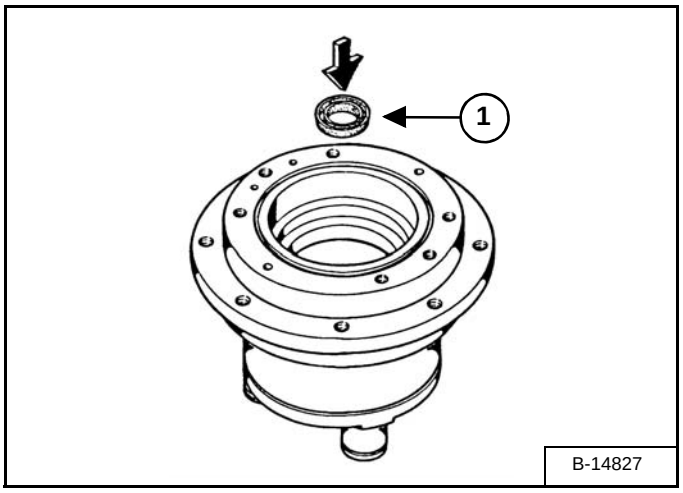
MEL1519- Seal Installation Tool.

Figure 20-70-40



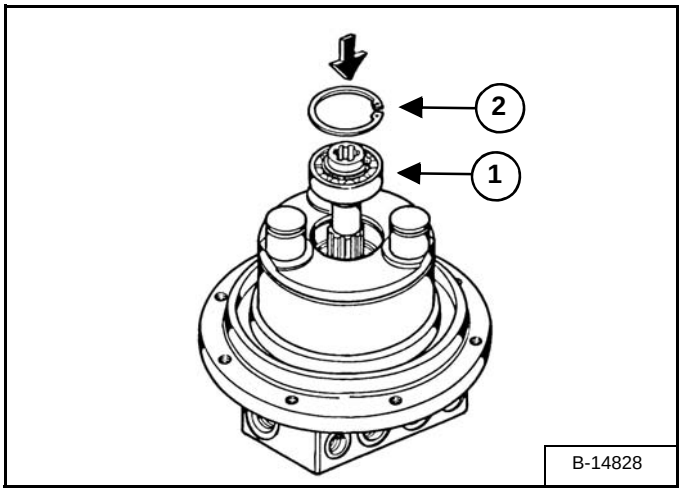
Install the snap ring (Item 1), bearing (Item 2) and snap ring (Item 3) **[Figure 20-70-40]** on the drive shaft.

Figure 20-70-41



Apply oil to the inside diameter of the oil seal and install the oil seal (Item 1) **[Figure 20-70-41]** in the hub.

Figure 20-70-42



Install the drive shaft/bearing assembly (Item 1) **[Figure 20-70-42]** in the hub.

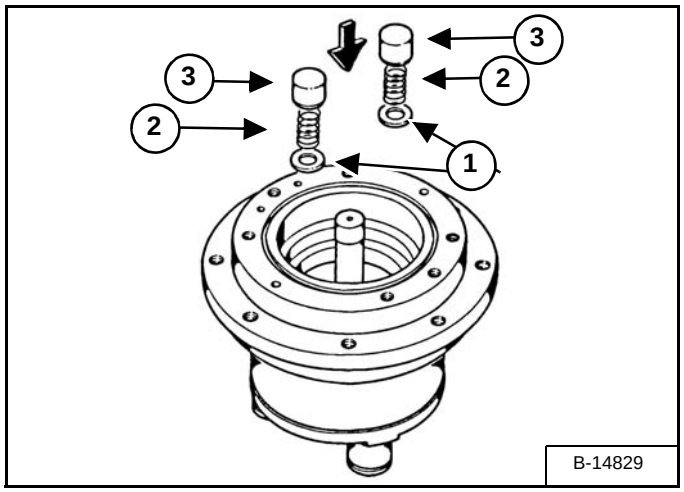
NOTE: Make sure the bearing is seated in the hub.

Install the snap ring (Item 2) **[Figure 20-70-42]**.

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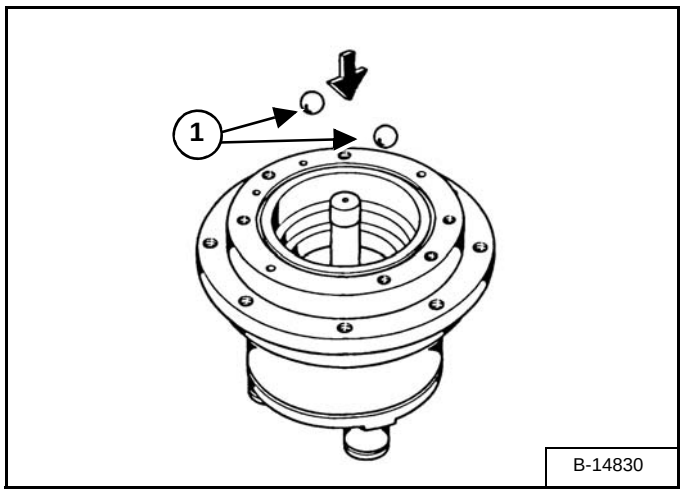
Assembly (Cont'd)

Figure 20-70-43



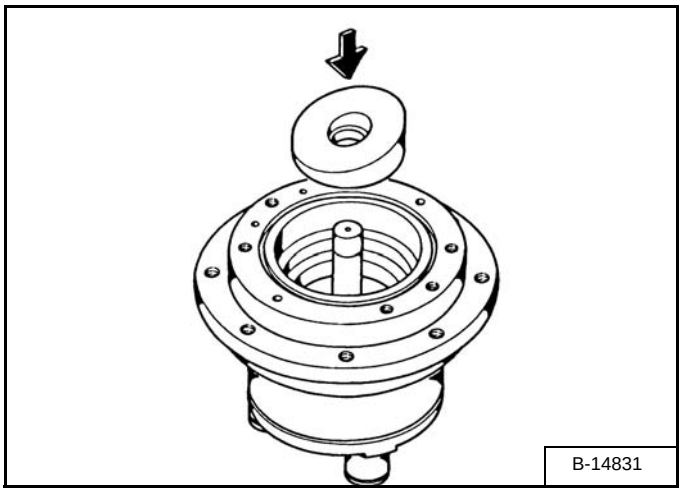
Install the washers (Item 1) and the springs (Item 2). Apply oil on the displacement control pistons (Item 3) **[Figure 20-70-43]** and install the pistons in the piston bore.

Figure 20-70-44



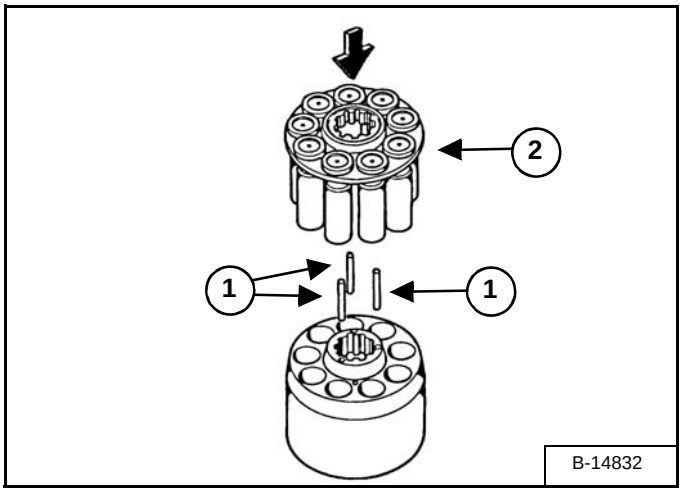
Install the balls (Item 1) **[Figure 20-70-44]** in the hub.

Figure 20-70-45



Install the swash plate in the hub **[Figure 20-70-45]**.

Figure 20-70-46



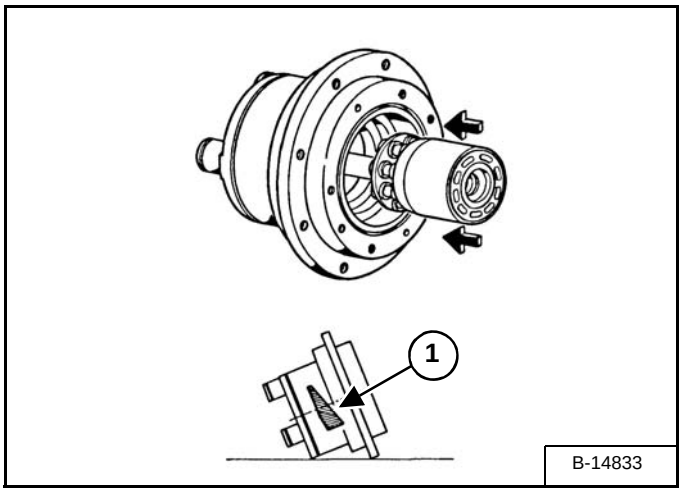
Install the dowel pins (Item 1) **[Figure 20-70-46]** in the rotating block.

Apply oil to the piston assembly (Item 2) **[Figure 20-70-46]** and install the piston assembly in the rotating block.

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Assembly (Cont'd)

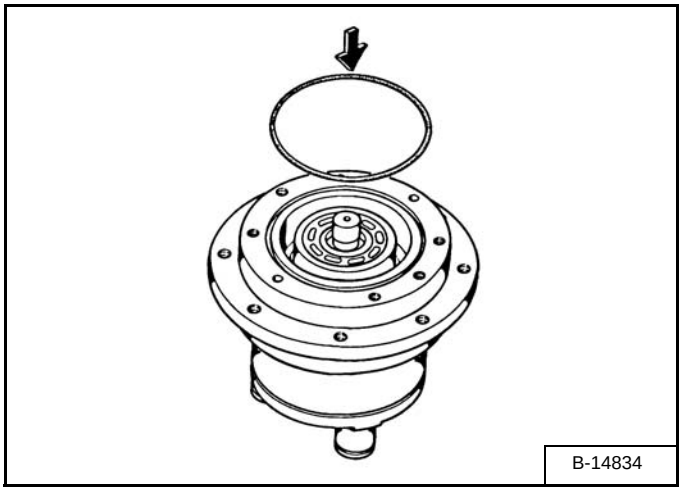
Figure 20-70-47



Tip the motor housing on its side. Make sure the thick side of the swash plate (Item 1) **[Figure 20-70-47]** is to the bottom.

Install the rotating block assembly in the hub **[Figure 20-70-47]**.

Figure 20-70-48



Apply oil to and install the O-ring (Item 1) **[Figure 20-70-48]** on the hub.

Figure 20-70-49

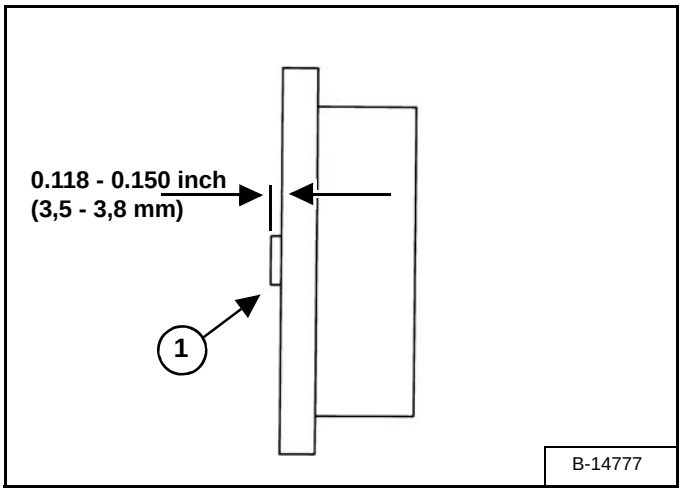
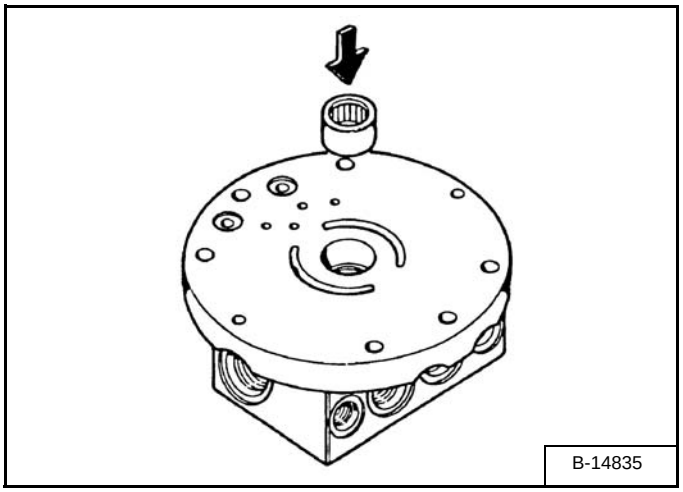


Figure 20-70-50



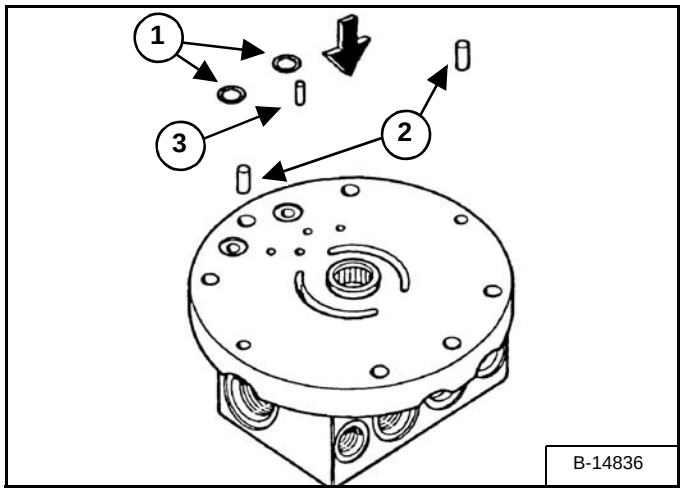
Press the bearing (Item 1) **[Figure 20-70-49]** & **[Figure 20-70-50]** in the motor cover.

The bearing (Item 1) **[Figure 20-70-49]** must extend from the face of the motor cover 0.118 - 0.150 inch (3,5-3,8 mm).

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Assembly (Cont'd)

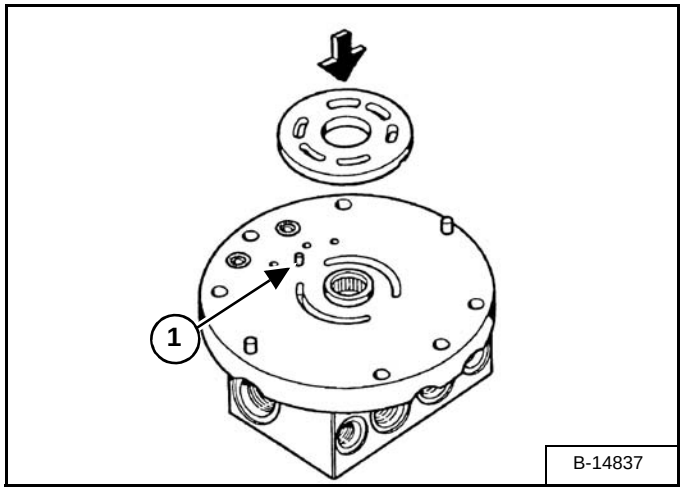
Figure 20-70-51



Apply oil to the two O-rings (Item 1) **[Figure 20-70-51]** and install the O-rings on the motor cover.

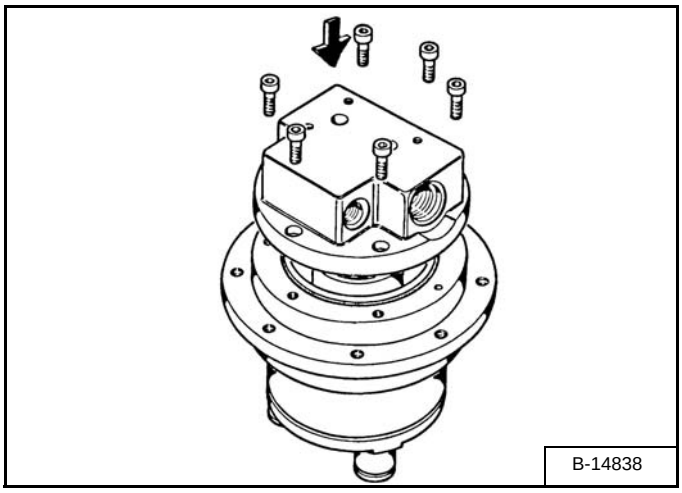
Install the alignment pins (Item 2) and the valve plate pin (Item 3) **[Figure 20-70-51]** on the motor cover.

Figure 20-70-52



Apply light grease to the valve plate. Install the valve plate on the motor cover, over the valve plate alignment pin (Item 1) **[Figure 20-70-52]**.

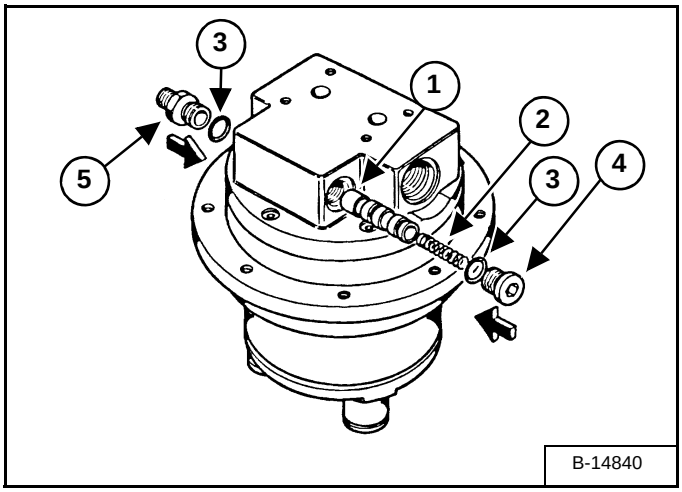
Figure 20-70-53



Lubricate the bearing with oil and install the motor cover on the hub with the bolts **[Figure 20-70-53]**.

Tighten the bolts in a crisscross manner to 18-22 ft.-lbs. (25-30 Nm) torque.

Figure 20-70-54



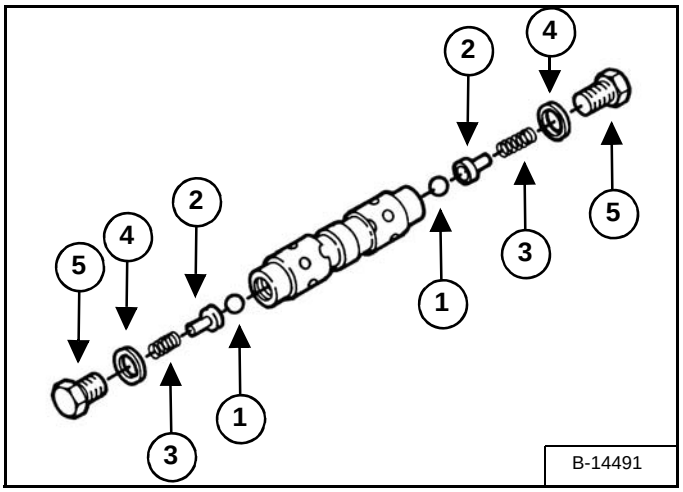
Apply oil to and install the two speed spool (Item 1) and spring (Item 2) **[Figure 20-70-54]**.

Apply oil to and install the O-rings (Item 3) on the plug (Item 4) and the adapter (Item 5). Install the plug (Item 4) and the adapter (Item 5) **[Figure 20-70-54]**.

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Assembly (Cont'd)

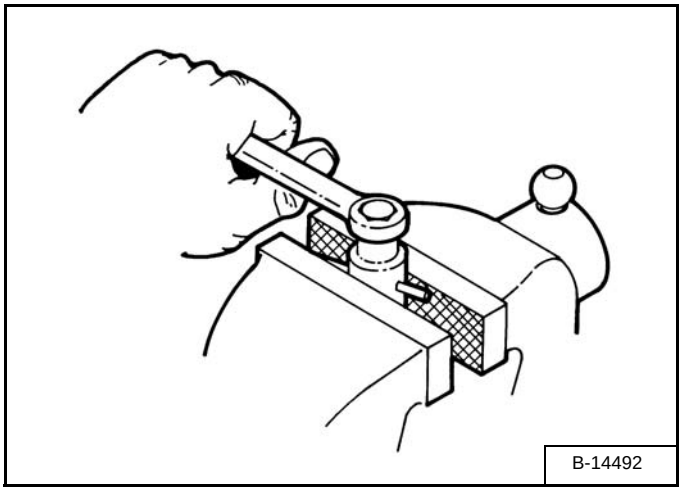
Figure 20-70-55



Install the check ball (Item 1), the poppet (Item 2) and the spring (Item 3) **[Figure 20-70-55]** in both ends of the spool.

Apply oil to, and install the O-rings (Item 4) on the plugs (Item 5) **[Figure 20-70-55]**.

Figure 20-70-56



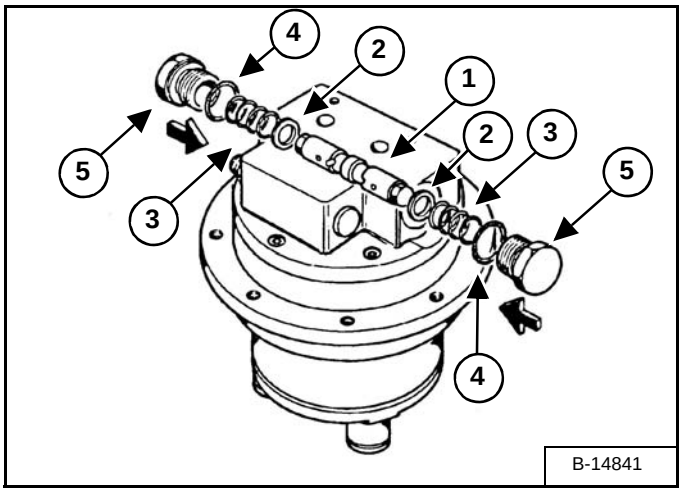
To assemble the spool, insert a hardened pin through the hole in the spool and use a vise with protective jaws to hold the spool **[Figure 20-70-56]**.

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

Install the plug in both ends of the spool **[Figure 20-70-56]**.

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

Figure 20-70-57



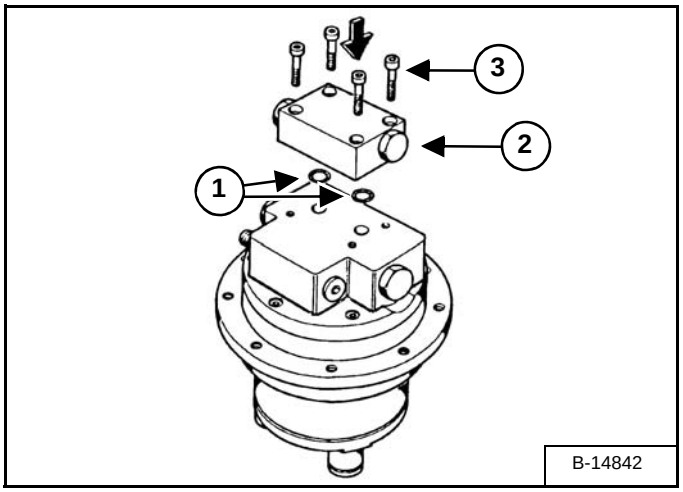
Apply oil to and install the spool (Item 1) **[Figure 20-70-57]** in the motor cover.

Install the washers (Item 2) and the springs (Item 3) on both ends of the spool (Item 1) **[Figure 20-70-57]**.

Apply oil to and install the O-rings (Item 4) on the plugs (Item 5) **[Figure 20-70-57]**.

Install the plugs (Item 5) **[Figure 20-70-57]** in the motor cover.

Figure 20-70-58



Apply oil to and install the two O-rings (Item 1) **[Figure 20-70-58]**.

Install the relief valve block assembly (Item 2) and the bolts (Item 3) **[Figure 20-70-58]**. Tighten the bolts to 18-21 ft.-lbs. (25-28 Nm) torque.

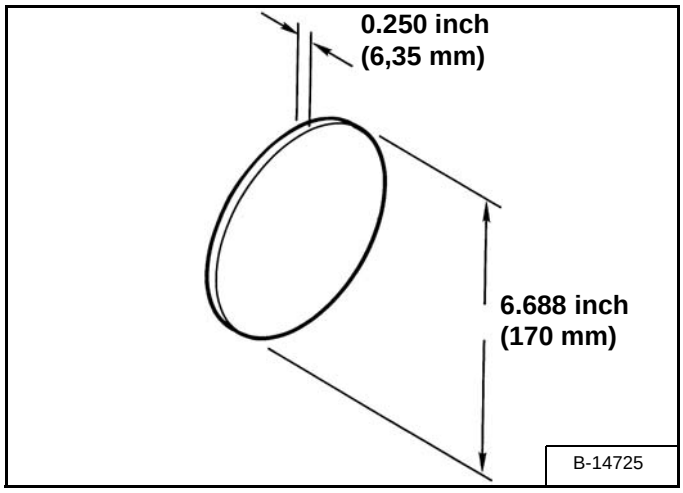
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Assembly (Cont'd)

To install the bearings, a bearing installation tool will be needed.

This tool is placed on the top of the bearing inner and outer race and a press is used to seat the bearings.

Figure 20-70-59

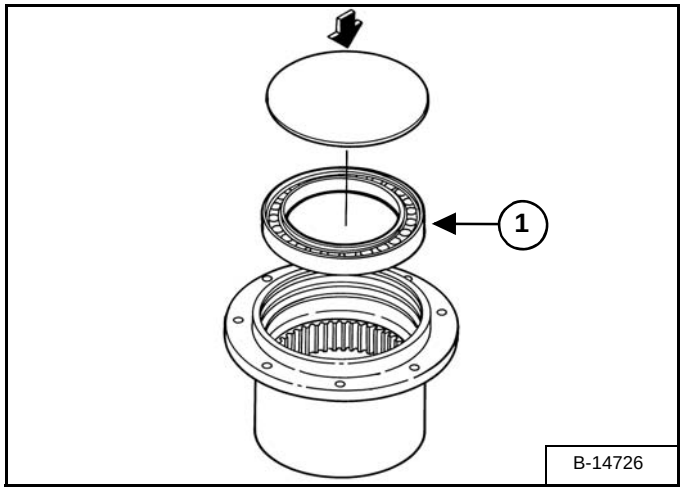


Obtain the tool locally **[Figure 20-70-59]**.

The dimensions are as follows:

Diameter 6.688 inch (170 mm)
Thickness 0.250 inch (6,35 mm)

Figure 20-70-60



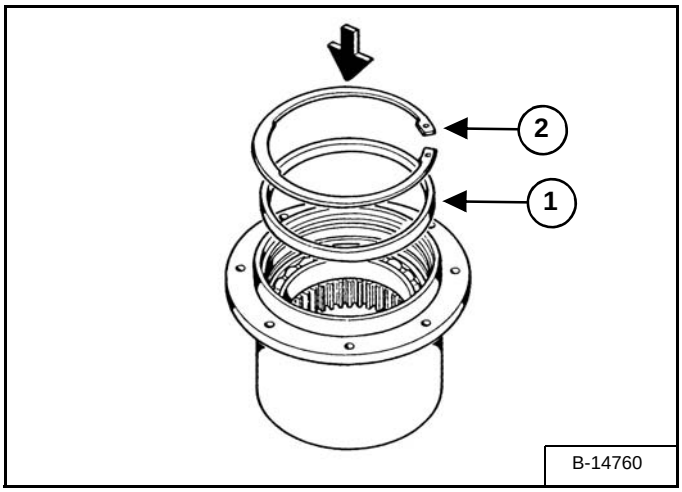
Lubricate the outer edge of the bearing and press the bearing (Item 1) **[Figure 20-70-60]** in the housing, using the bearing installation tool.

NOTE: If either the top or bottom bearing has been replaced, measure the thickness of the old and new bearing. If the difference is greater than ± 0.002 inch (0,05 mm) add or subtract shims to match the new bearing thickness to the old bearing thickness.

If shims are needed, order the appropriate shim(s) from Bobcat Parts:

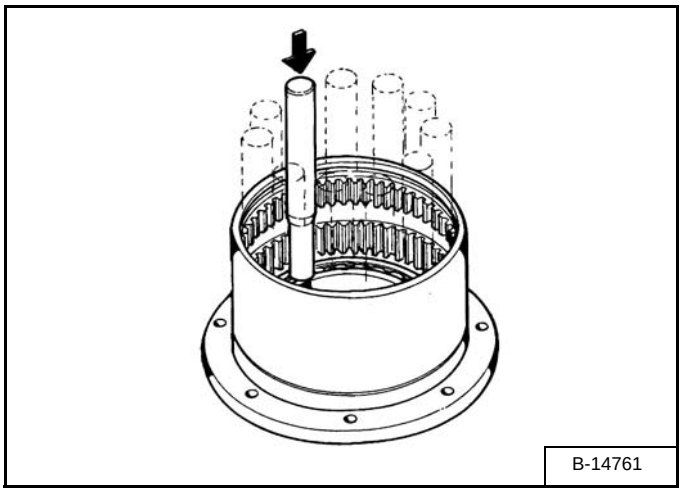
P/N 6669119	0.0079 inch (0,2 mm)
P/N 6669120	0.0118 inch (0,3)
P/N 6669121	0.0157 inch (0,4 mm)
P/N 6669122	0.0354 inch (0,9 mm)
P/N 6669123	0.0374 inch (0,95 mm)

Figure 20-70-61



Install the spacer (Item 1) and snap ring (Item 2) **[Figure 20-70-61]**.

Figure 20-70-62

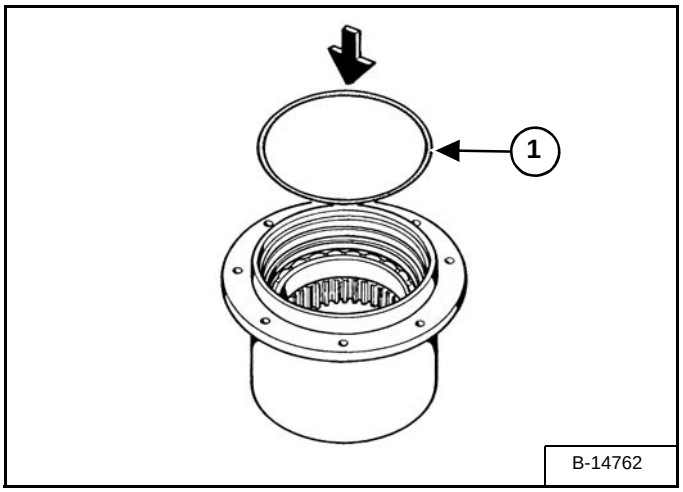


Turn the housing over and using a brass drift, seat the bearing against the spacer **[Figure 20-70-62]**.

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Assembly (Cont'd)

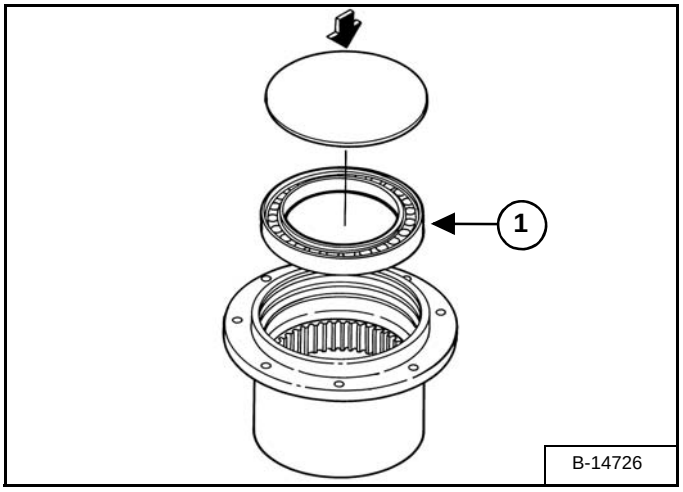
Figure 20-70-63



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

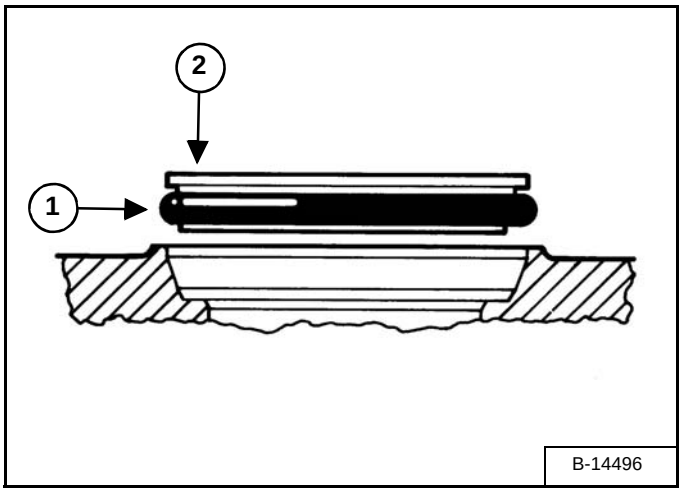
NOTE: Make sure the O-ring (Item 1) [Figure 20-70-63] is correctly installed in the housing groove so it is not damaged when the second bearing is installed.

Figure 20-70-64



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

Figure 20-70-65

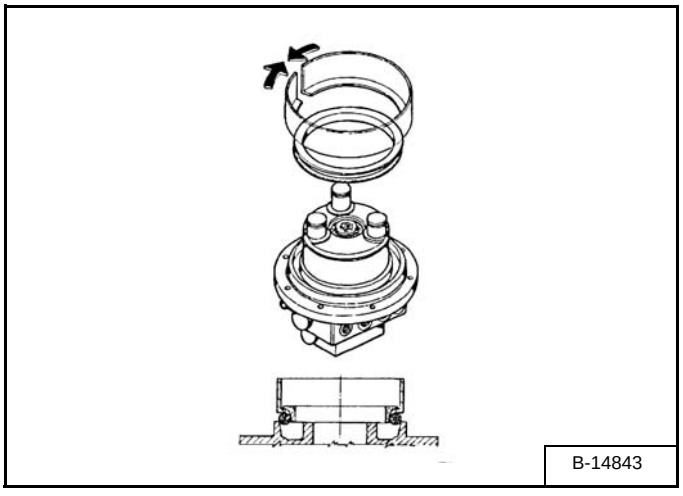


Install the O-ring (Item 1) on the seal ring (Item 2) **[Figure 20-70-65]**.

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

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

Figure 20-70-66



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

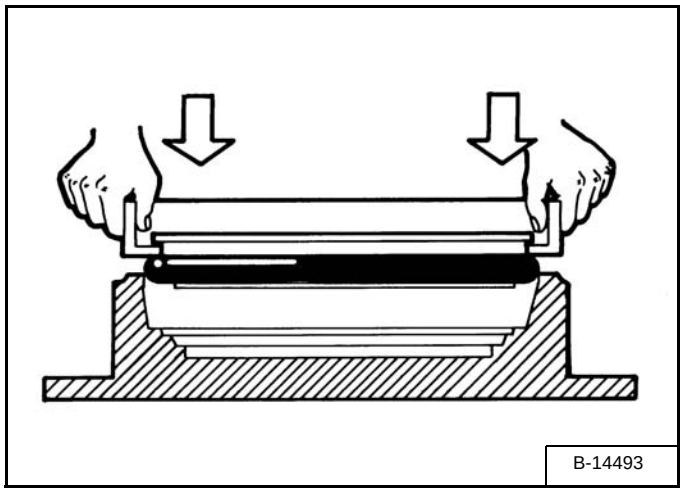
The O-ring and seal ring assembly has to be lubricated with alcohol so the O-ring will slip past the housing retaining ring and seal uniformly in the motor housing radius **[Figure 20-70-66]**. Do not use oil to lubricate the O-ring.

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

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Assembly (Cont'd)

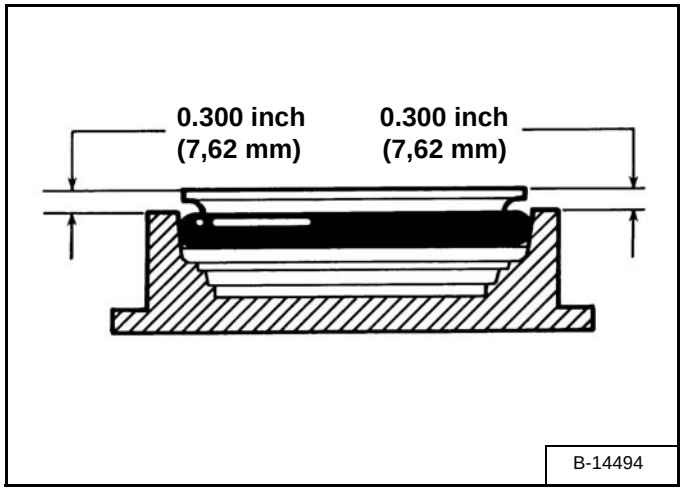
Figure 20-70-67



Shake off the excess alcohol and install the seal ring assembly on the motor **[Figure 20-70-67]**.

Use firm even pressure on the installation tool (MEL1519) to install the O-ring in the motor housing.

Figure 20-70-68



After the seal ring is installed, check the stand out height **[Figure 20-70-68]** in four places, 90° apart.

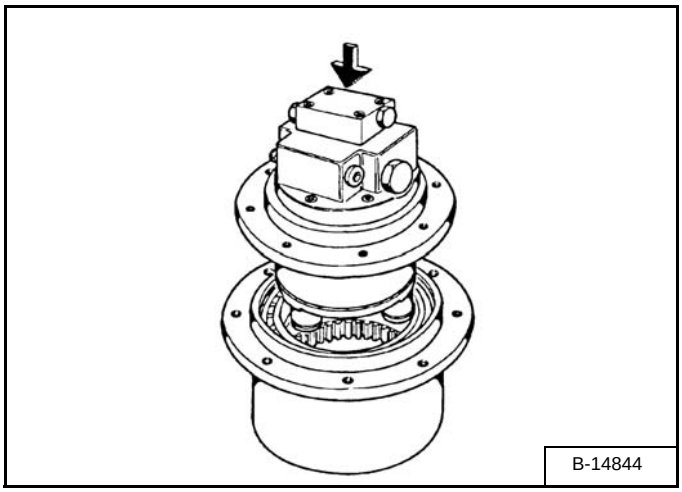
The stand out height is 0.300 ± 0.020 inches (7,62 ± 0,5 mm).

NOTE: If the seal ring does not meet the height specifications inspect the O-ring for twists or obvious bulges. Remove and reinstall the seal ring if the O-ring is twisted or bulged.

Apply a light film of oil to the seal ring and lapped face of the bearing.

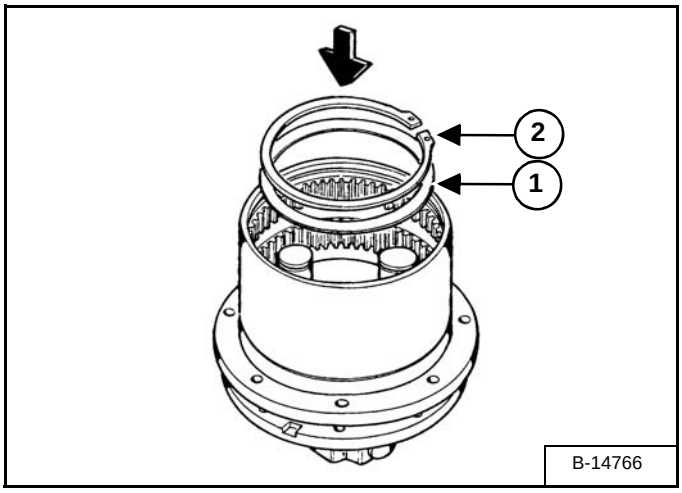
NOTE: Do not get any oil on the rubber O-ring.

Figure 20-70-69



Press the reduction unit and motor assembly in the bearings **[Figure 20-70-69]**. The inner bearing may move deeper into the housing as the motor assembly is pressed in the housing. If this happens, tap the inner bearing down to its original position using a brass drift.

Figure 20-70-70



Install the shim(s) (Item 1) and snap ring (Item 2) **[Figure 20-70-70]** in the motor reduction unit.

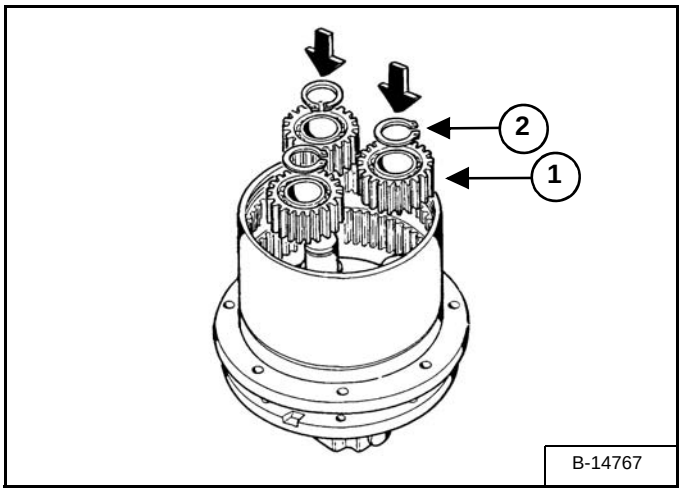
The shim(s) (Item 1) **[Figure 20-70-70]** are used to remove any end play between the ring gear and reduction unit.

The snap ring (Item 2) must be snug against the shim(s) (Item 1) **[Figure 20-70-70]** and fully seated in the snap ring groove.

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Assembly (Cont'd)

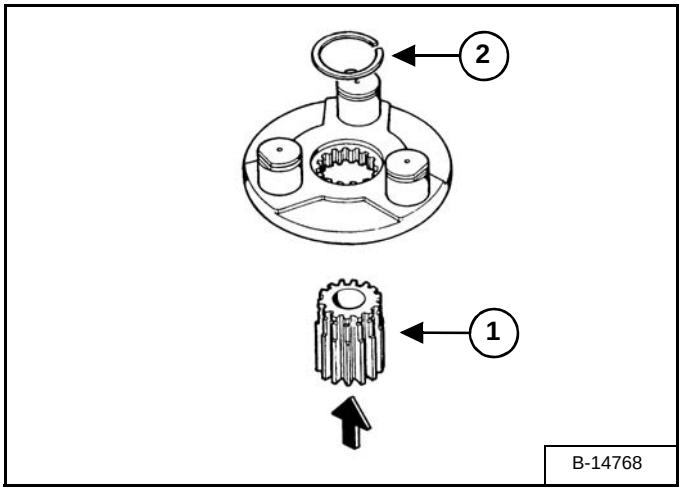
Figure 20-70-71



Install the planetary gears/bearings (Item 1) and the snap rings (Item 2) **[Figure 20-70-71]**.

NOTE: The second stage planetary gears/bearings must be installed with the bearing race flare facing down to match the shoulder on the pins.

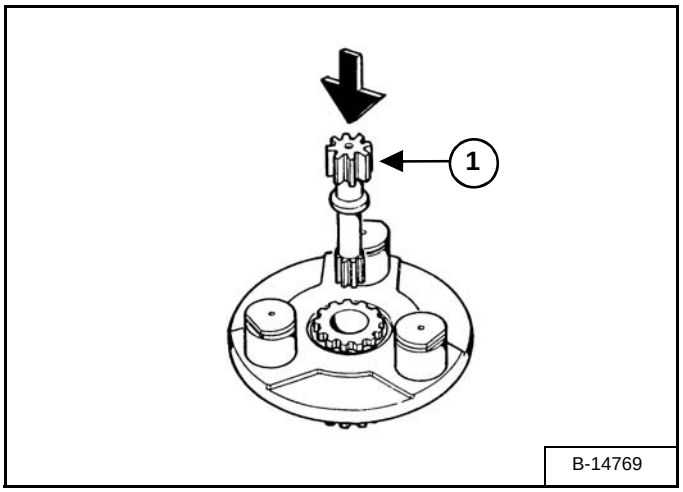
Figure 20-70-72



Install the sun gear (Item 1) **[Figure 20-70-72]** into the outer planetary carrier.

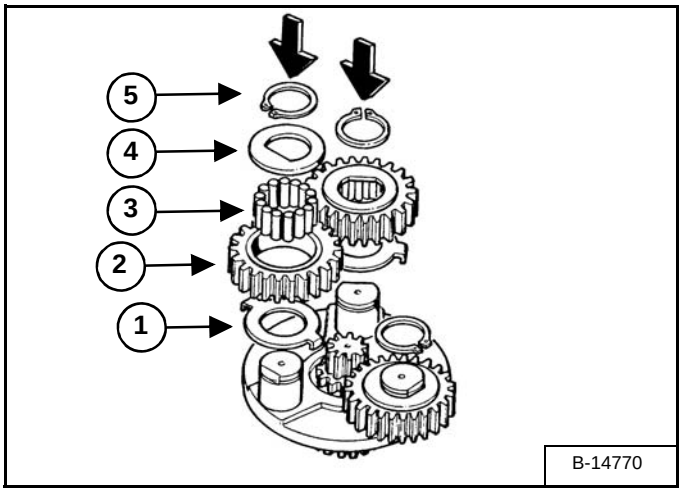
Install the snap ring (Item 2) on the sun gear (Item 1) **[Figure 20-70-72]**.

Figure 20-70-73



Install the drive shaft (Item 1) **[Figure 20-70-73]**.

Figure 20-70-74



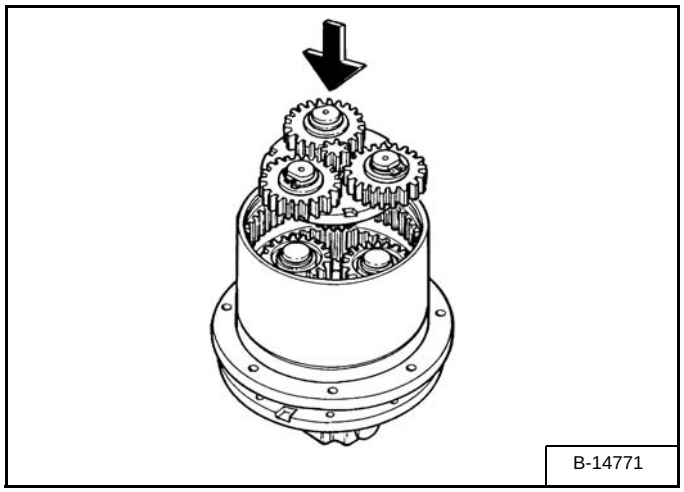
Install the thrust washers (Item 1), planetary gears (Item 2), bearings (Item 3), anti-rotation washers (Item 4) and snap rings (Item 5) **[Figure 20-70-74]**.

Install the snap rings (Item 5) **[Figure 20-70-74]** so the opening of the snap ring is towards the outside.

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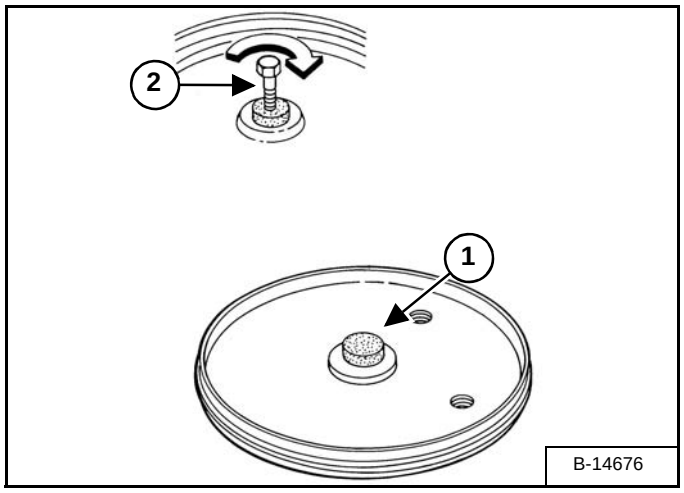
Assembly (Cont'd)

Figure 20-70-75



Install the planetary assembly in the hub **[Figure 20-70-75]**.

Figure 20-70-76



Inspect the cover bushing (Item 1) **[Figure 20-70-76]** for wear.

If the bushing (Item 1) **[Figure 20-70-76]** needs to be replaced, drill a hole, using a number 3 drill bit, in the center of the bushing.

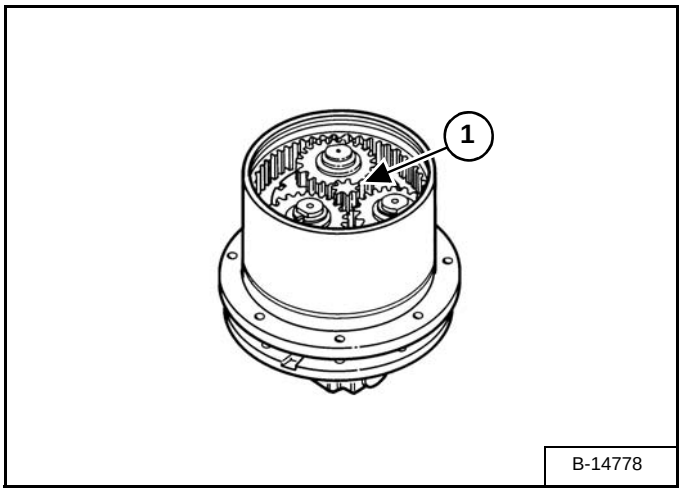
Thread the hole with a 0.250 x 28 inch NF tap.

Install a 0.250 x 28 inch bolt (Item 2) **[Figure 20-70-76]** 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 0.016-0.024 inches (0,4-0,6 mm).

Figure 20-70-77



Place a 0.500 inch (13 mm) long piece of 0.062 inch (1,5 mm) solder (Item 1) **[Figure 20-70-77]** on the end of the sun gear.

Seat the cover in the hub.

Remove the cover and measure the solder.

If the clearance between the sun gear and cover bushing does not meet specifications, order the appropriate bushing shim from Bobcat Parts.

P/N 6669597 0.20 inch (0,5 mm)
P/N 6669598 0.30 inch (0,76 mm)
P/N 6669699 0.050 inch (1,27 mm)

Remove the bushing.

Install the correct shim under the bushing and install the bushing.

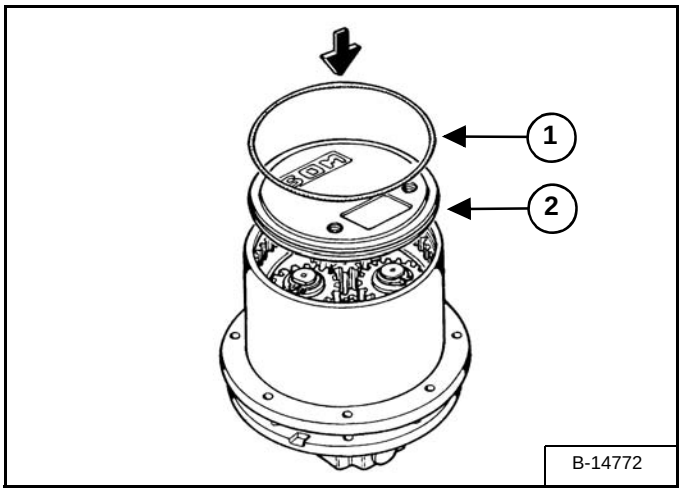
NOTE: Make sure there are no burrs on the bushing face from bushing removal.

Repeat the procedure for checking clearance between the sun gear and cover bushing.

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Assembly (Cont'd)

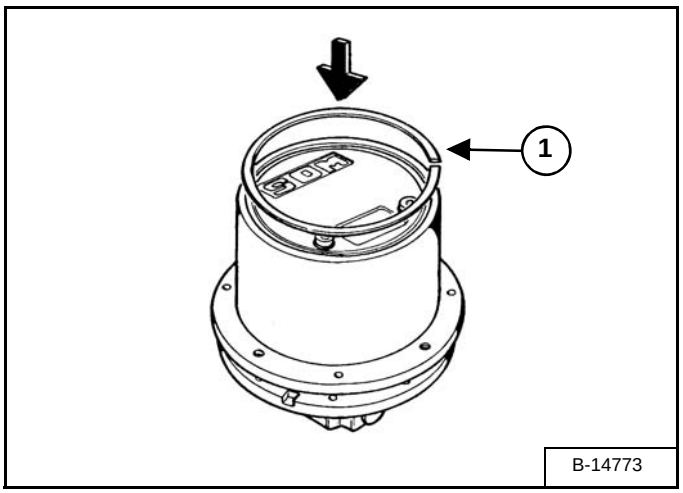
Figure 20-70-78



Apply oil to and install the O-ring (Item 1) **[Figure 20-70-78]** on the cover.

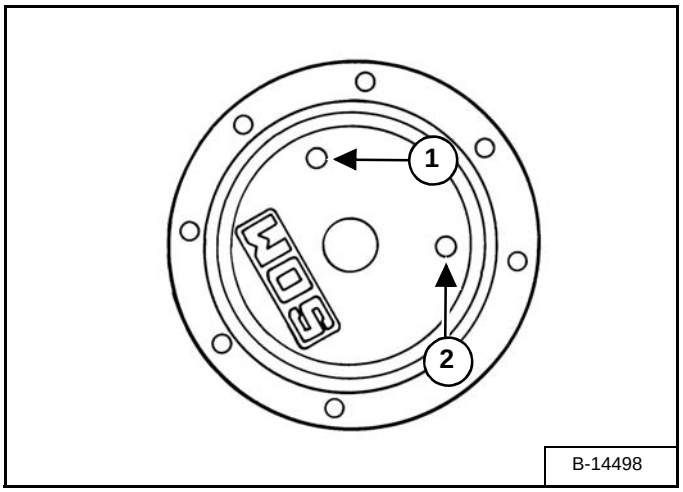
Install the cover (Item 2) **[Figure 20-70-78]** on the hub.

Figure 20-70-79



Install the snap ring (Item 1) **[Figure 20-70-79]**.

Figure 20-70-80



Add approximately 0.55 quarts (0.5 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 20-70-80]**.

Install and tighten the two plugs.

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SWIVEL JOINT

Description

The swivel joint is a rotary hydraulic swivel which diverts hydraulic oil, under pressure, to the travel motors and the blade cylinder.

Removal And Installation

⚠ 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

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

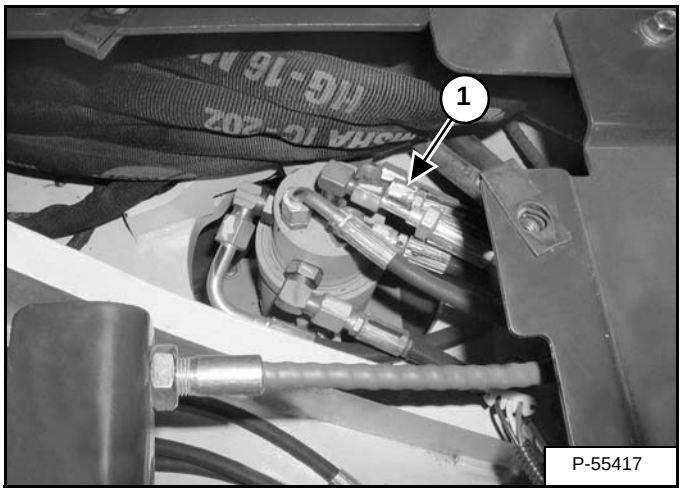
IMPORTANT

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

I-2003-0888

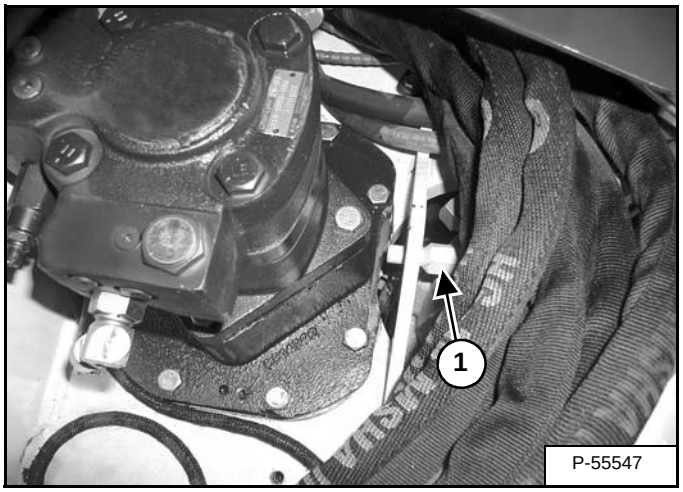
Mark the hoses for ease of installation.

Figure 20-80-1



Remove the hoses (Item 1) **[Figure 20-80-1]** from the top of the swivel joint.

Figure 20-80-2



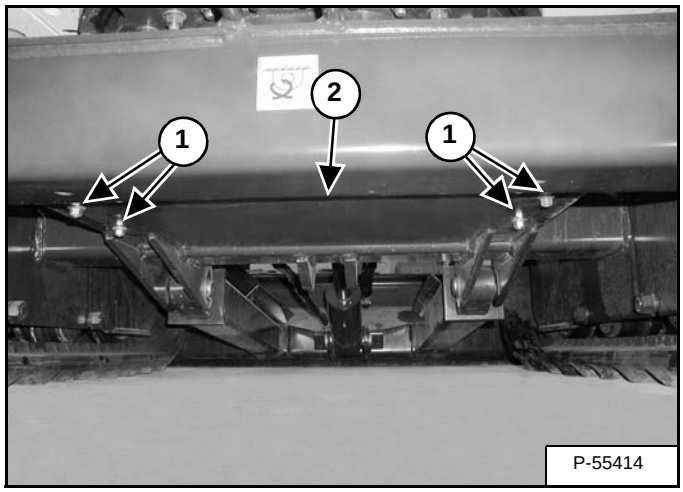
Remove the nut and swivel joint stop bolt (Item 1) **[Figure 20-80-2]**.

Installation: Apply thread lock adhesive (LOCTITE 242) to the swivel joint stop bolt and install the nut and the bolt in the swivel joint. Tighten the nut completely on the bolt threads. Tighten the bolt to 110-125 ft.-lbs. (150-175 Nm) torque.

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Removal And Installation (Cont'd)

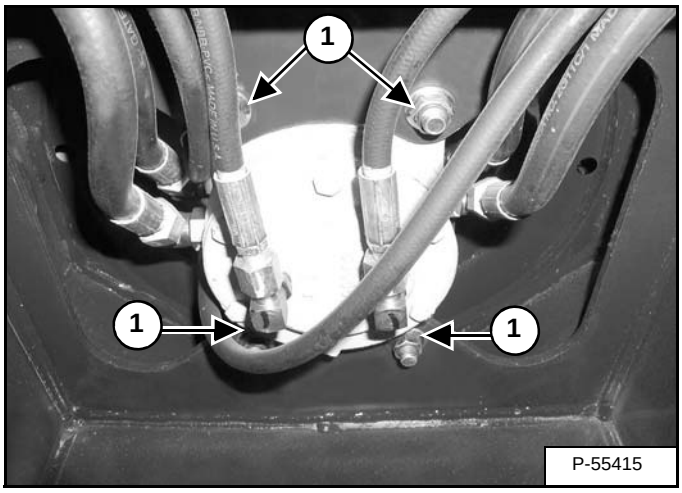
Figure 20-80-3



Remove the bolts (Item 1) **[Figure 20-80-3]**.

Remove the access plate (Item 2) **[Figure 20-80-3]** from the bottom of the undercarriage.

Figure 20-80-4



Remove the hoses from the lower end of the swivel joint **[Figure 20-80-4]**.

Remove the bolts (Item 1) **[Figure 20-80-4]**.

Support the swivel joint with a jack.

Rotate the swivel joint 90° to allow clearance between the swivel joint and the mount brackets.

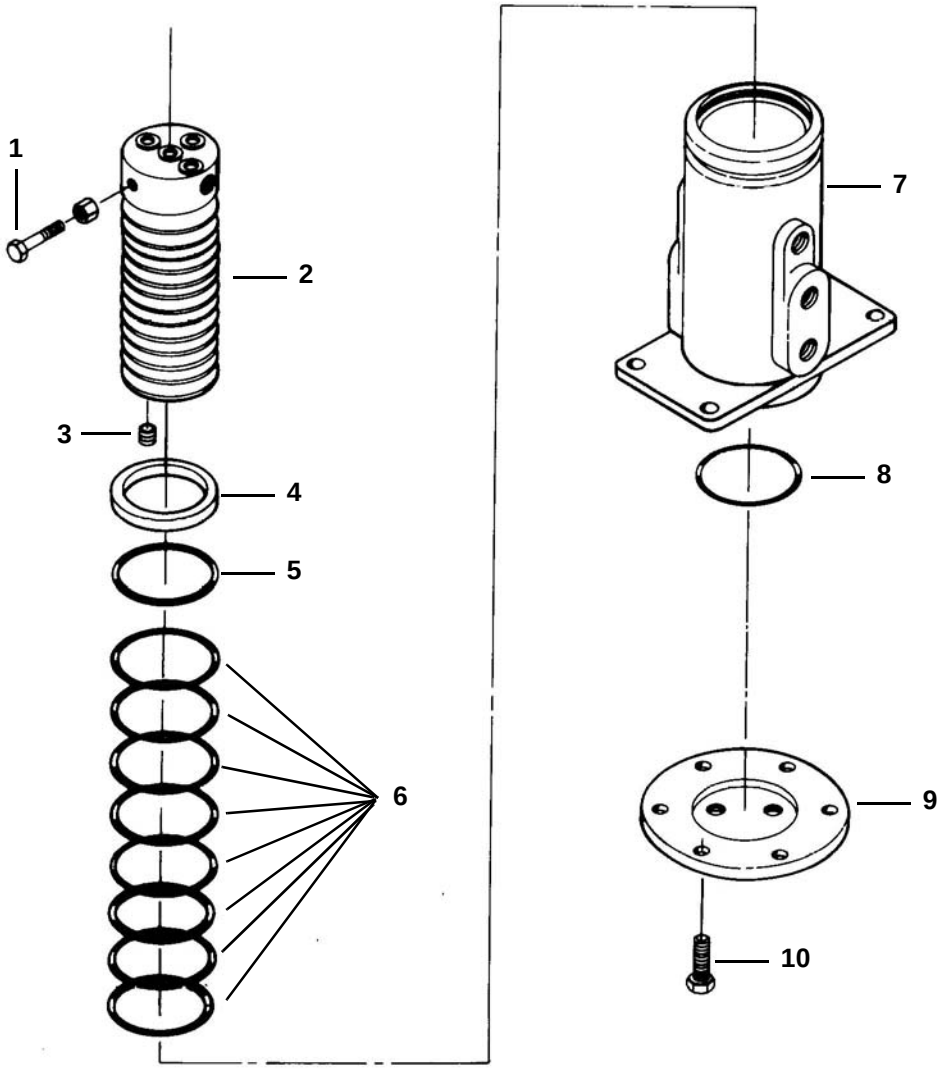
Installation: Apply thread lock adhesive (LOCTITE 242) to the bolts. Tighten the bolts to 48-55 ft.-lbs. (65-75 Nm) torque.

Lower the swivel joint through the bottom of the undercarriage.

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Parts Identification

1. Bolt
2. Rotor
3. Plug
4. Seal
5. Seal
6. Seal
7. Body
8. O-Ring
9. Cover
10. Bolt



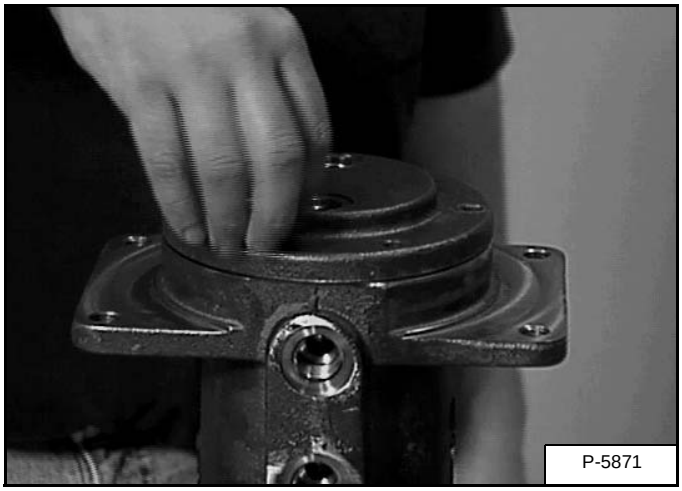
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Disassembly

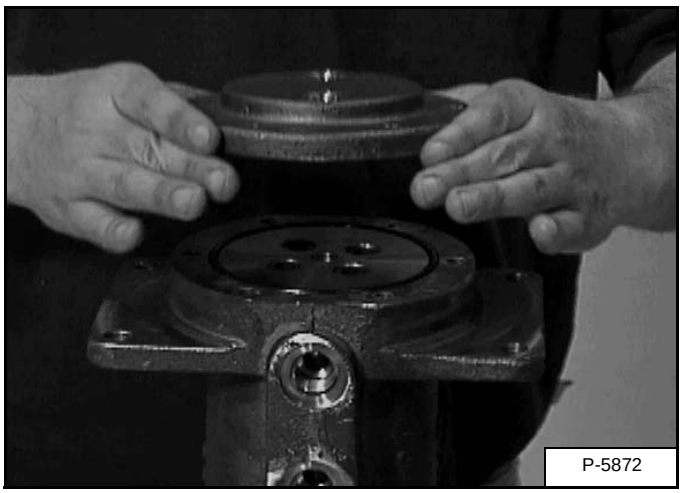
Clean the outside of the swivel joint before disassembly. Mark the cover and body for ease of assembly.

Figure 20-80-5



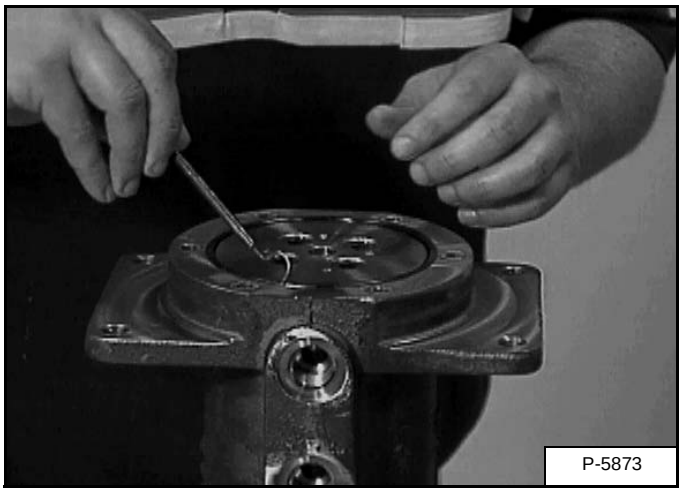
Remove the bolts from the cover **[Figure 20-80-5]**.

Figure 20-80-6



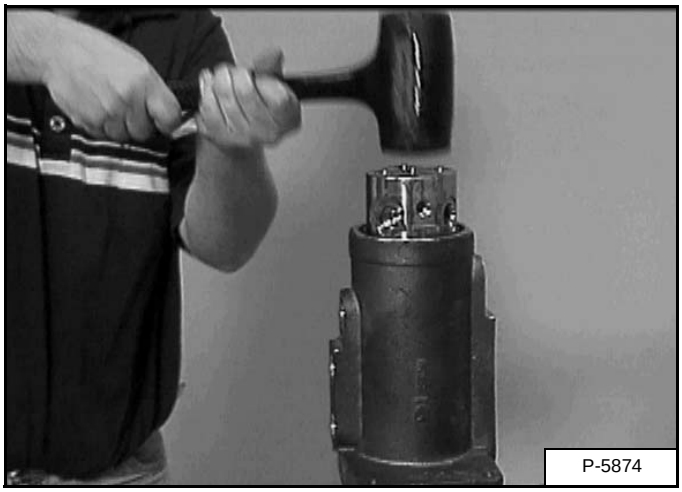
Remove the cover **[Figure 20-80-6]**.

Figure 20-80-7



Remove the O-ring from the O-ring groove **[Figure 20-80-7]**.

Figure 20-80-8



Clamp the swivel joint, base end down in a vise, and drive the rotor out of the body with a soft faced hammer **[Figure 20-80-8]**.

Remove all the O-rings and glid rings from the rotor.

NOTE: Use care not to scratch the rotor surface as damage to the finished surface could cause internal leakage.

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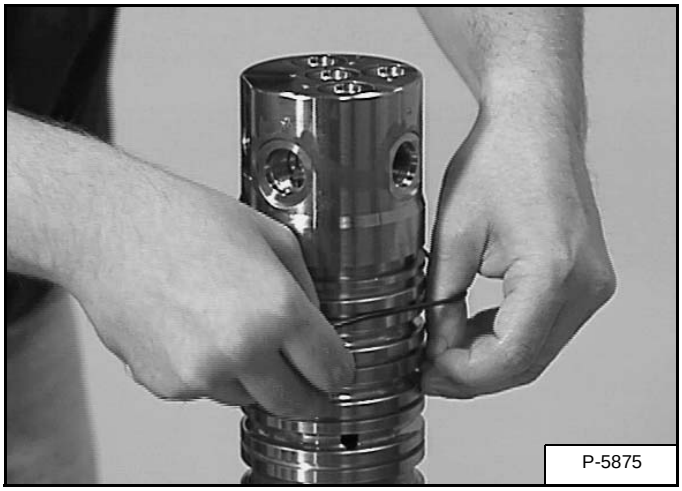
Assembly

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.

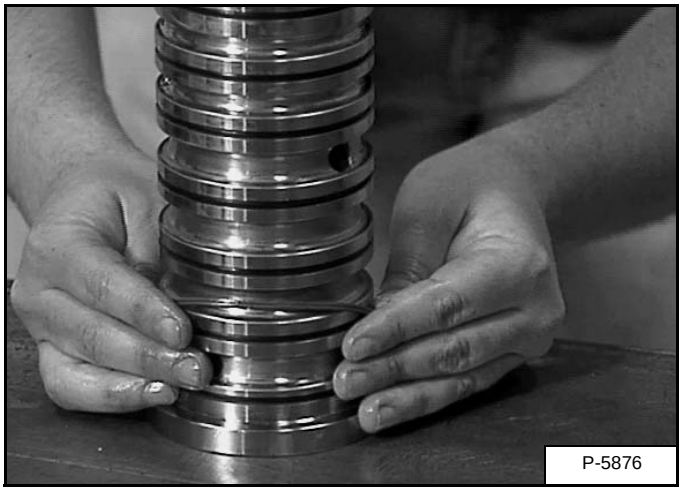
Figure 20-80-9



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

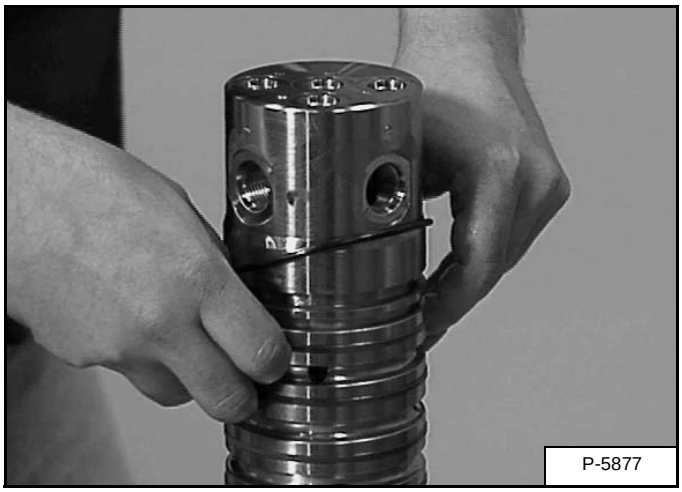
Heat the glid rings and crown seal in hydraulic oil for three minutes at 130° F (54° C).

Figure 20-80-10



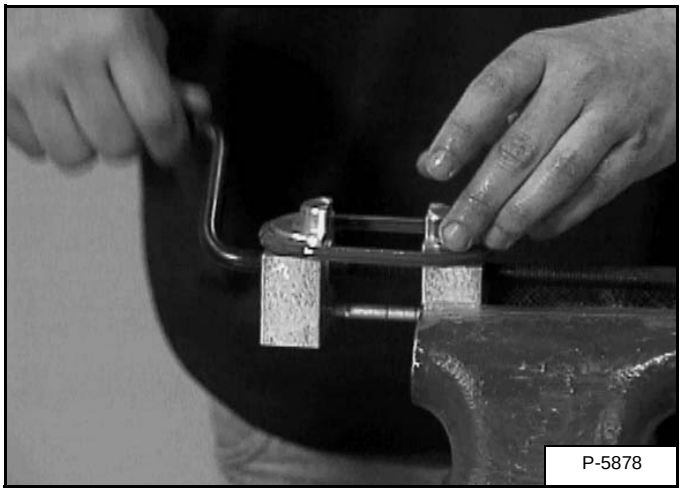
Stretch the heated glid rings to 4.0 inch (101,6 mm) and install on the rotor **[Figure 20-80-10]**.

Figure 20-80-11



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

Figure 20-80-12



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

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SWIVEL JOINT (CONT'D)

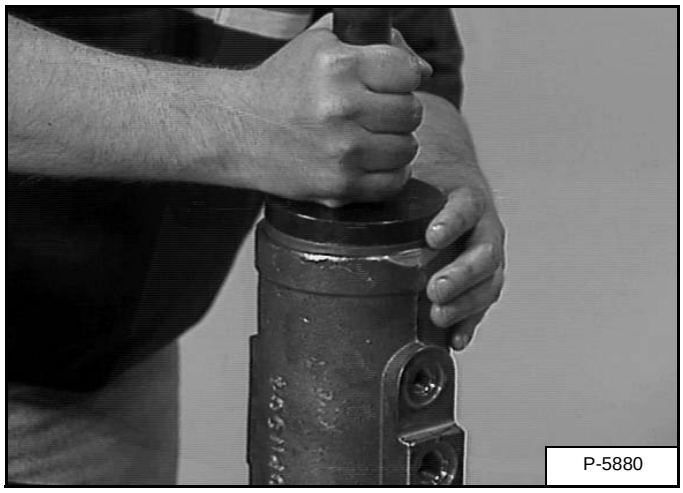
Assembly (Cont'd)

Figure 20-80-13



Work the crown seal on the rotor and down to the top groove **[Figure 20-80-13]**.

Figure 20-80-14

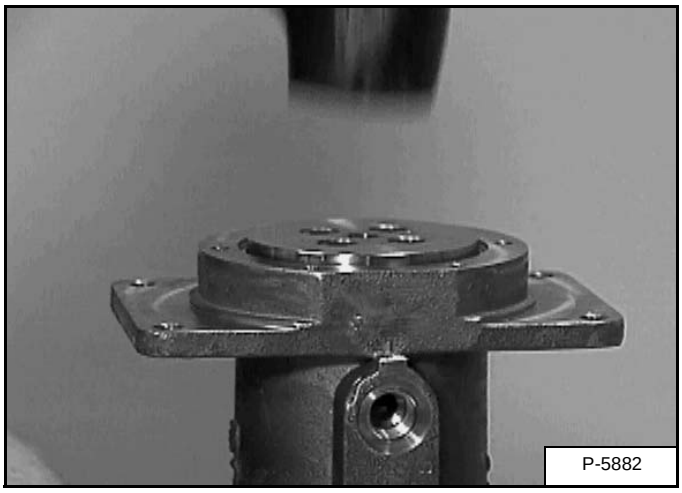


Press the wiper seal in the body **[Figure 20-80-14]**.

Lubricate the inside of the body and the rotor with hydraulic oil or light grease.

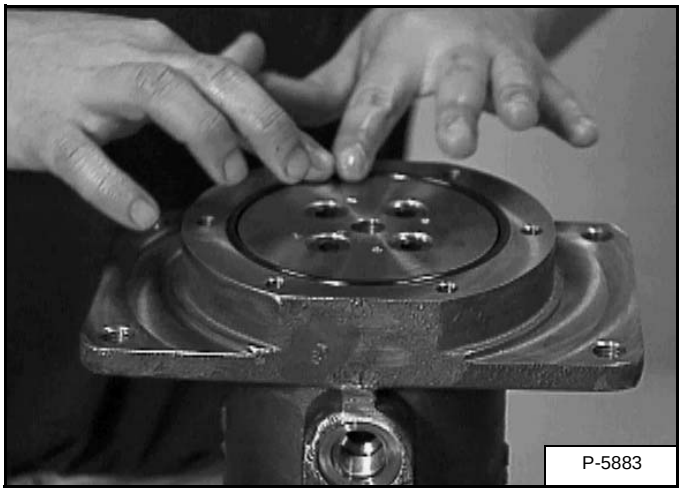
Slide the rotor in the body.

Figure 20-80-15



Seat the rotor using a soft faced hammer **[Figure 20-80-15]**.

Figure 20-80-16

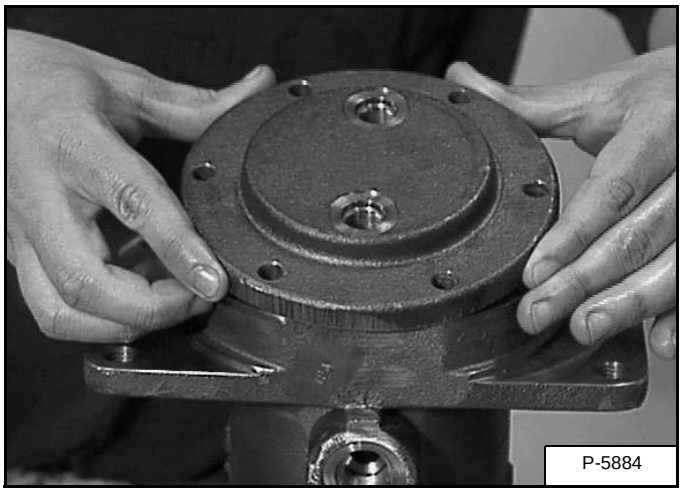


Install the O-ring in the groove on the bottom of the body **[Figure 20-80-16]**.

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Assembly (Cont'd)

Figure 20-80-17



Install the cover on the body **[Figure 20-80-17]**.

Figure 20-80-18



Apply thread lock adhesive (LOCTITE 242) to the bolt threads, and install the cover bolts. Tighten the bolts to 18 ft.-lbs. (24 Nm) torque **[Figure 20-80-18]**.

Figure 20-80-19



Check the breakaway torque of the swivel joint **[Figure 20-80-19]**.

The breakaway torque of the swivel joint is 50-90 ft.-lbs. (68-122 Nm).

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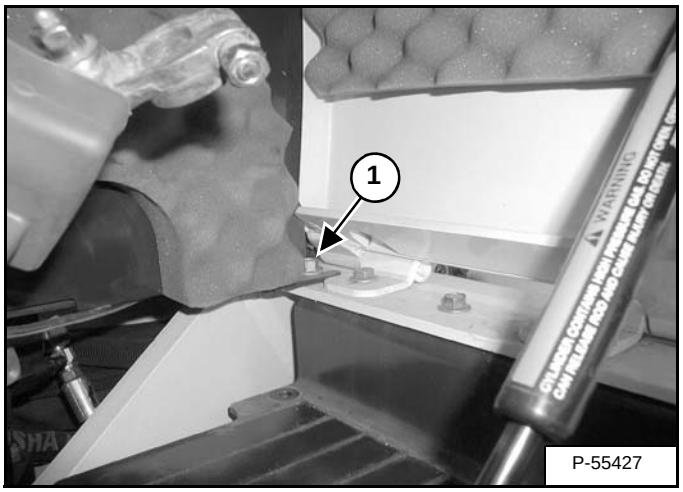
SWING MOTOR

Removal And Installation

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

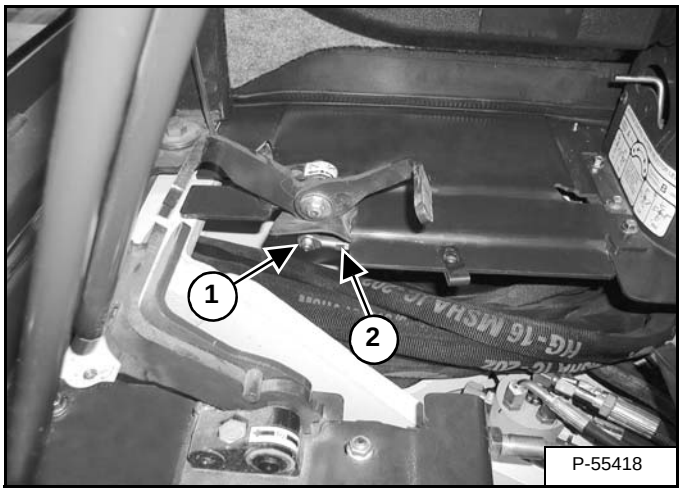
Remove the battery. (See Removal And Installation on Page 50-20-2.)

Figure 20-90-1



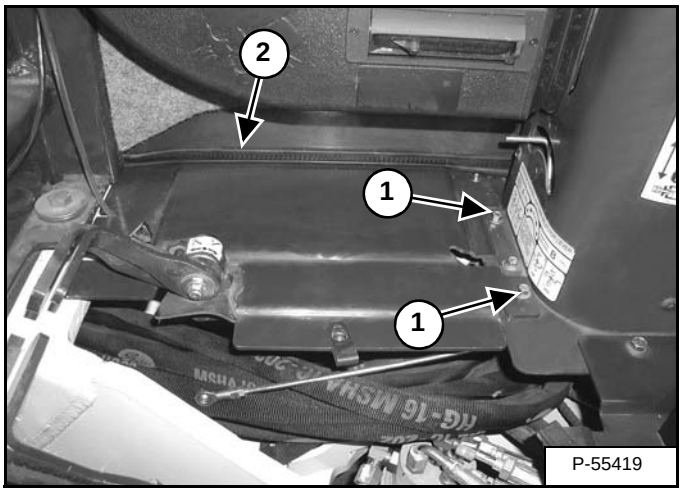
Remove the bolt (Item 1) **[Figure 20-90-1]**.

Figure 20-90-2



Remove the nut (Item 1) from the ball joint on the right pedal linkage (Item 2) **[Figure 20-90-2]**. Remove the linkage from the pedal.

Figure 20-90-3



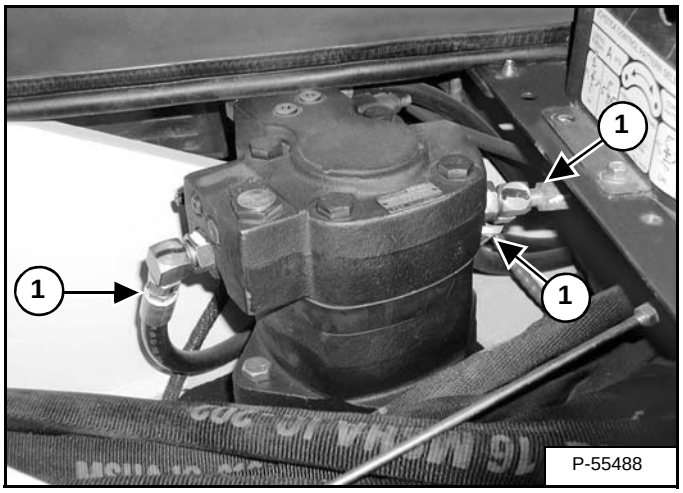
Remove the bolts (Item 1) from the right floor plate (Item 2) **[Figure 20-90-3]**. Remove the right floor plate.

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 20-90-4

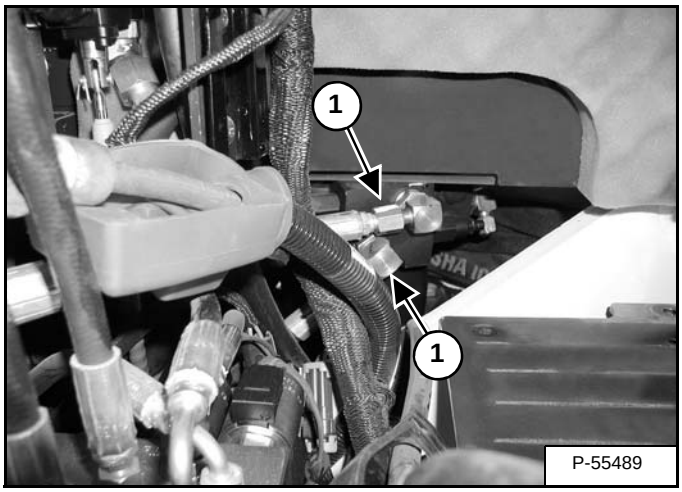


Remove the three hoses (Item 1) **[Figure 20-90-4]**.

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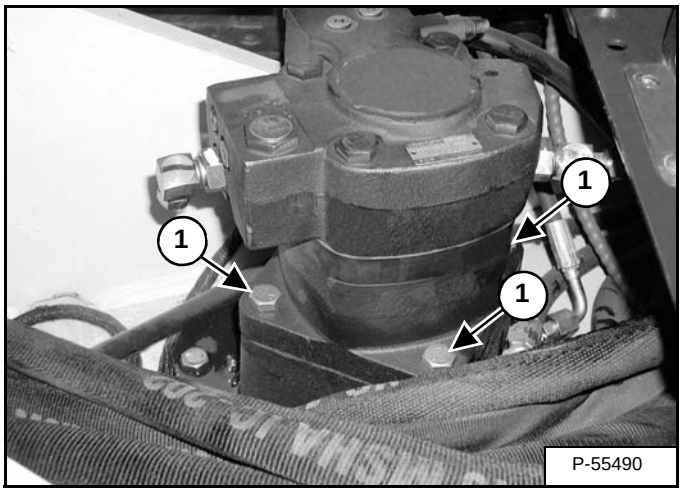
Removal And Installation (Cont'd)

Figure 20-90-5



Remove the hoses (Item 1) **[Figure 20-90-5]**.

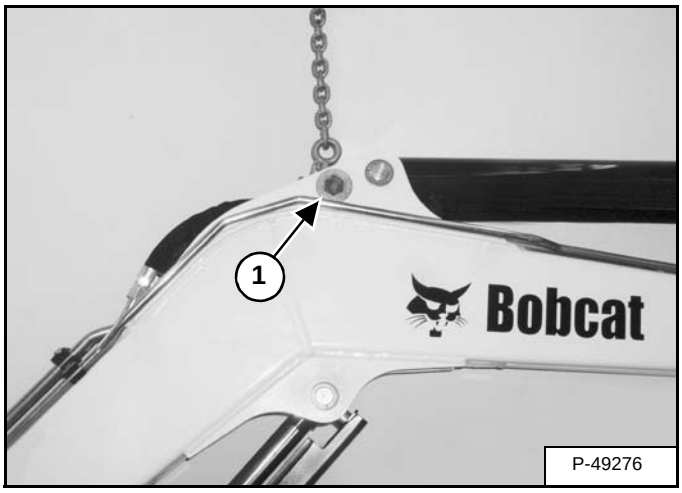
Figure 20-90-6



Remove the four bolts (Item 1) **[Figure 20-90-6]**.

Installation: Apply thread lock adhesive (Loctite 242) to the bolt threads. Tighten the bolts to 90-100 ft.-lbs. (125-135 Nm) torque.

Figure 20-90-7



Install a hoist (Item 1) on the boom (Item 2) **[Figure 20-90-7]**.

Raise the hoist until the boom/bucket is off the ground.

Figure 20-90-8



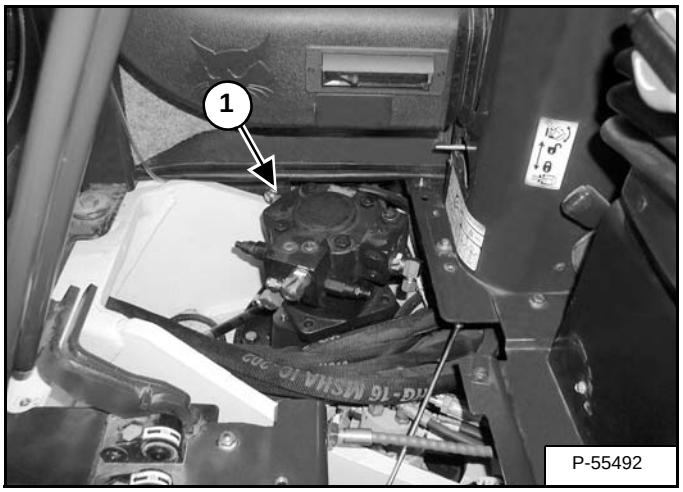
Rotate the upperstructure until the swing motor is in the position shown **[Figure 20-90-8]**.

Lower the boom/bucket to the ground.

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Removal And Installation (Cont'd)

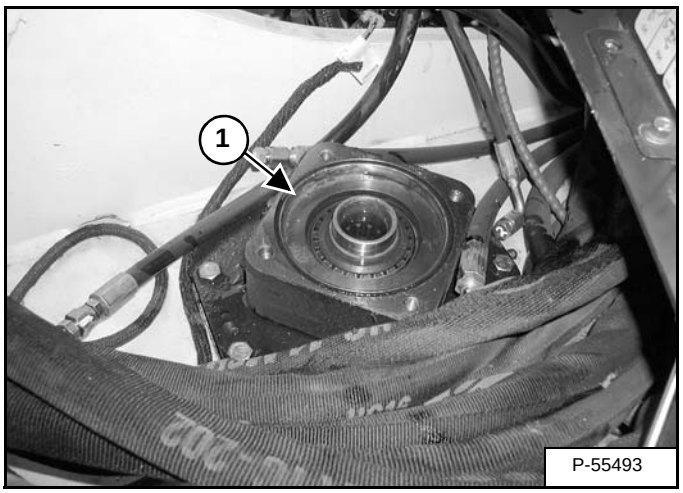
Figure 20-90-9



Raise and tilt the motor (Item 1) **[Figure 20-90-9]** toward the left side of the excavator.

Remove the swing motor.

Figure 20-90-10

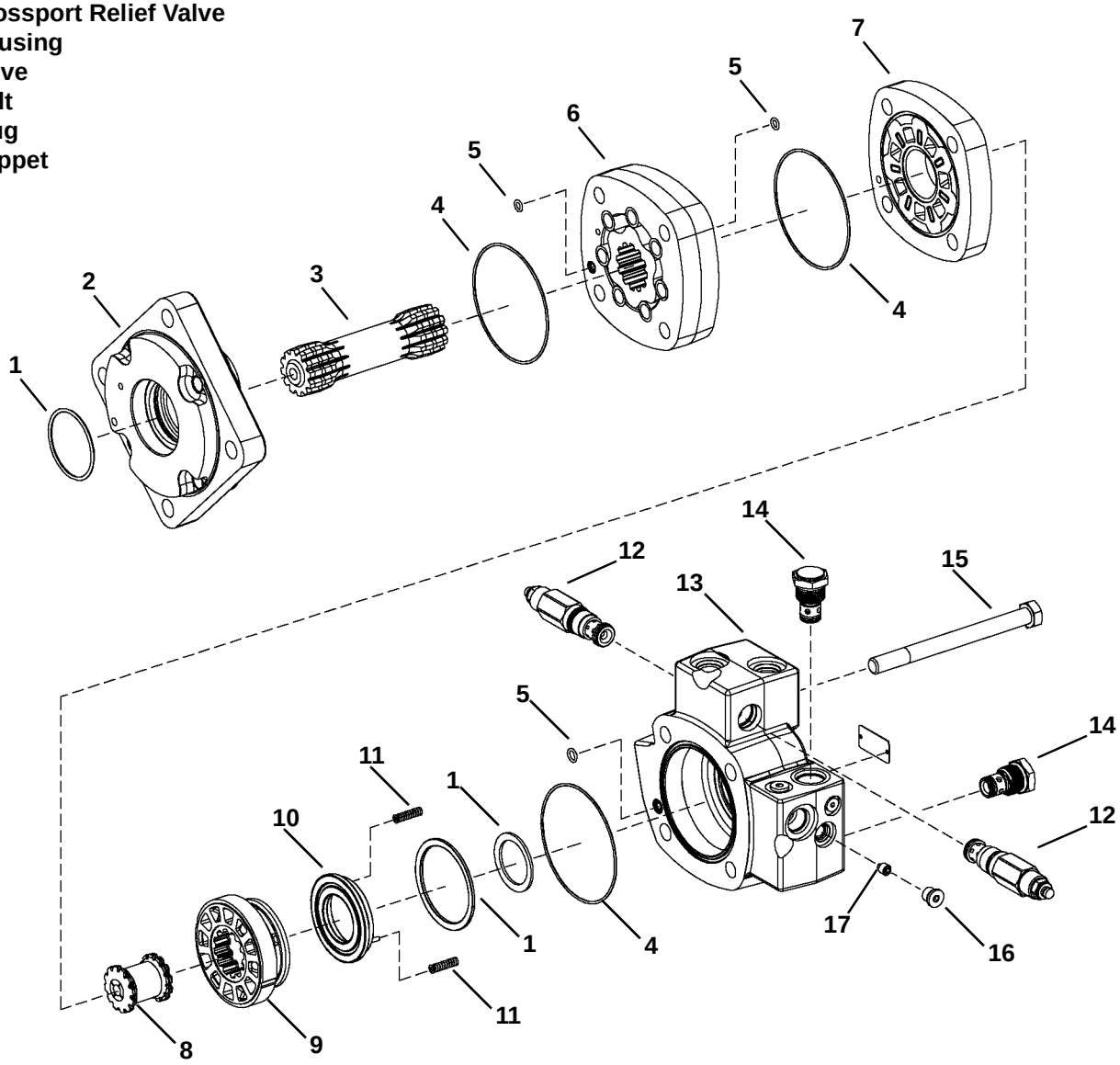


Remove the O-ring (Item 1) **[Figure 20-90-10]**.

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Parts Identification

1. Seal
2. Housing
3. Drive Shaft
4. O-Ring
5. O-Ring
6. Geroler
7. Plate
8. Drive
9. Valve
10. Valve Plate
11. Spring
12. Crossport Relief Valve
13. Housing
14. Valve
15. Bolt
16. Plug
17. Poppet

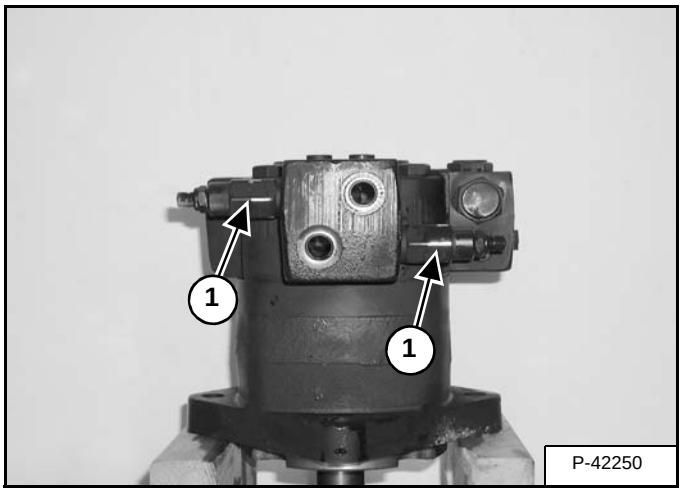


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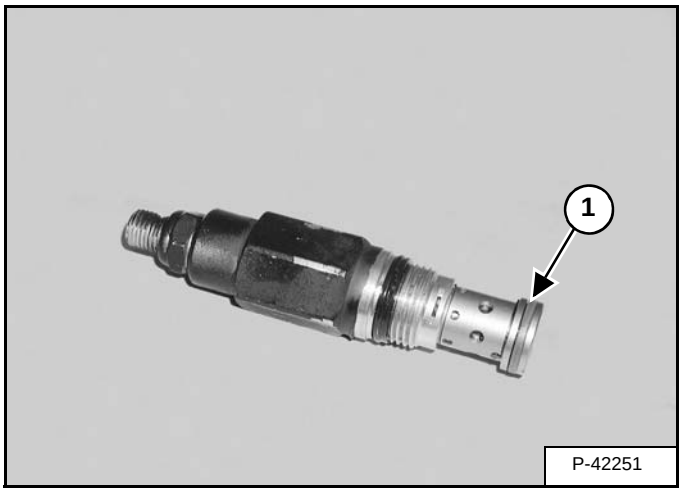
Disassembly

Figure 20-90-11



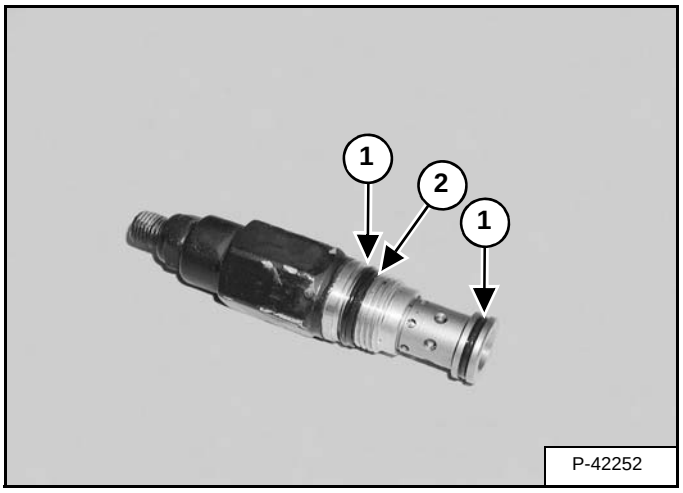
Remove the crossport relief valves (Item 1) **[Figure 20-90-11]**.

Figure 20-90-12



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

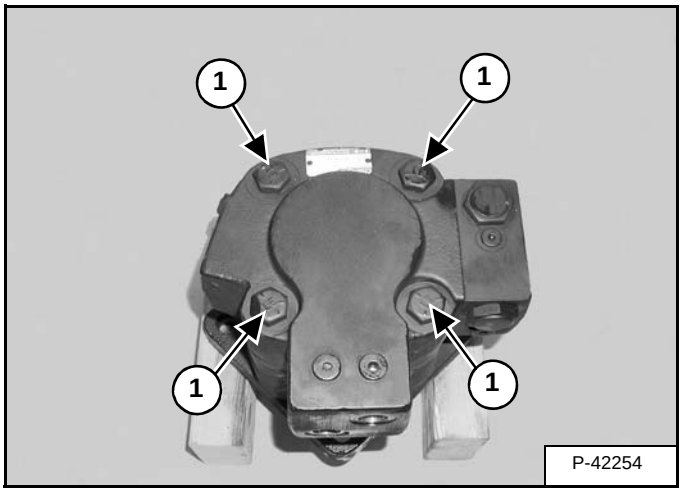
Figure 20-90-13



Remove the two O-rings (Item 1) and backup ring (Item 2) **[Figure 20-90-13]**.

Mark the housing for ease of assembly.

Figure 20-90-14

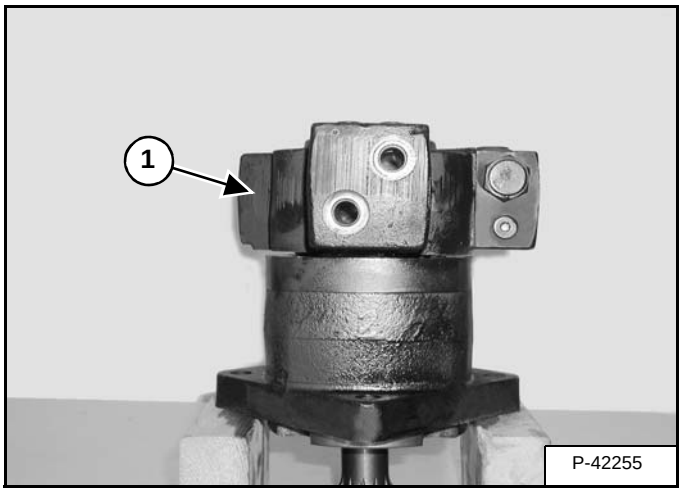


Remove the bolts (Item 1) **[Figure 20-90-14]**.

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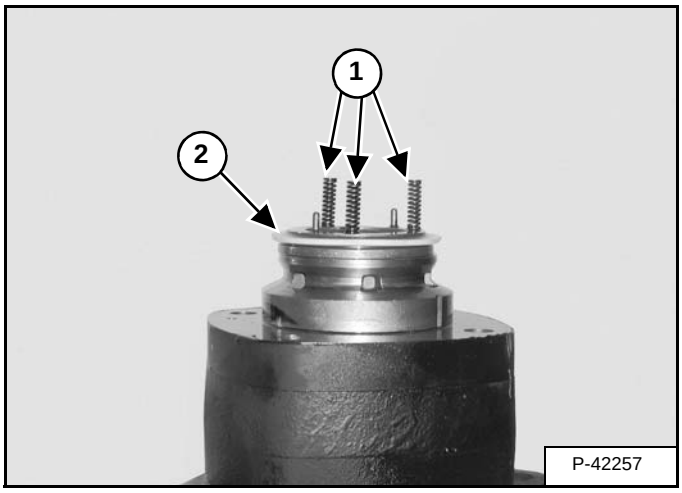
Disassembly (Cont'd)

Figure 20-90-15



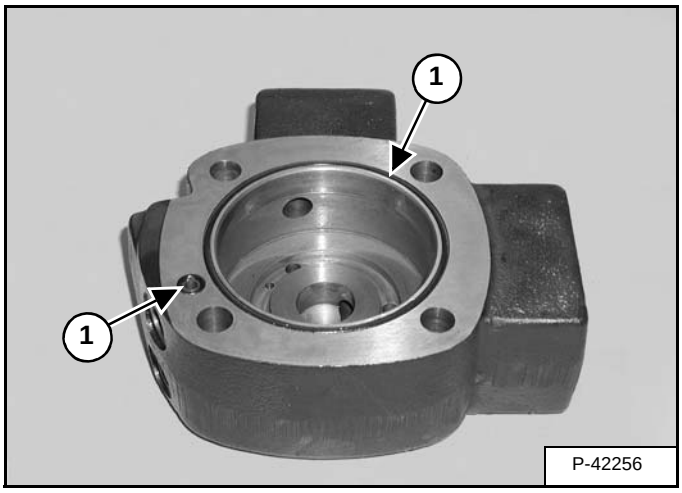
Remove the valve housing (Item 1) **[Figure 20-90-15]**.

Figure 20-90-16



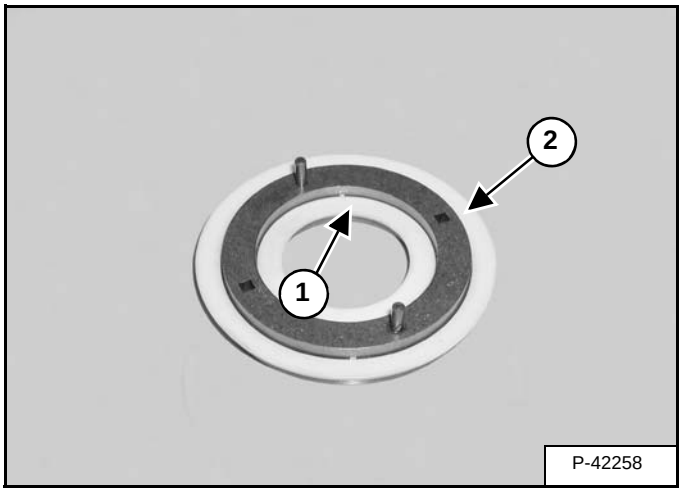
Lift the housing straight up. If done carefully the springs (Item 1) and balance ring sub-assembly (Item 2) **[Figure 20-90-16]** will remain on the valve for easy removal. Remove the springs and balance ring.

Figure 20-90-17



Remove the O-rings (Item 1) **[Figure 20-90-17]**.

Figure 20-90-18

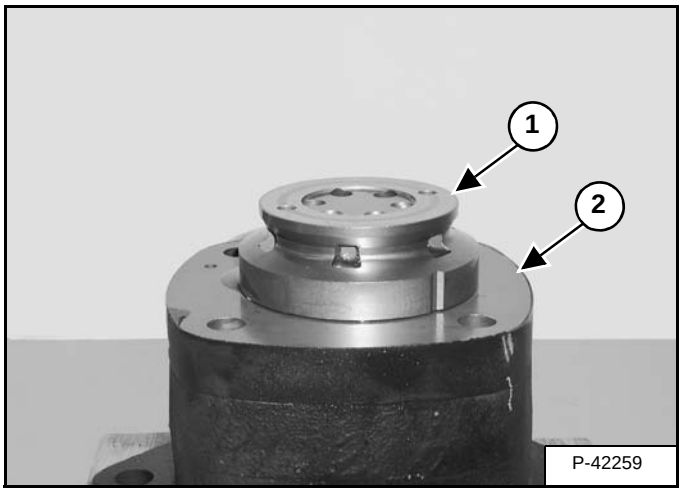


Remove the inner seal (Item 1) and outer seal (Item 2) **[Figure 20-90-18]**.

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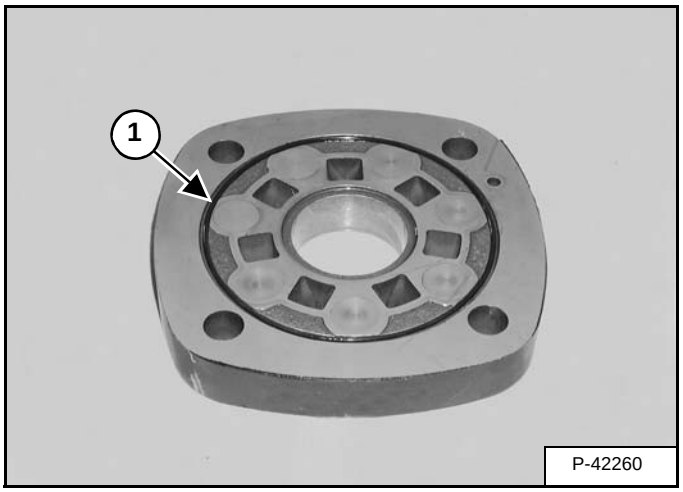
Disassembly (Cont'd)

Figure 20-90-19



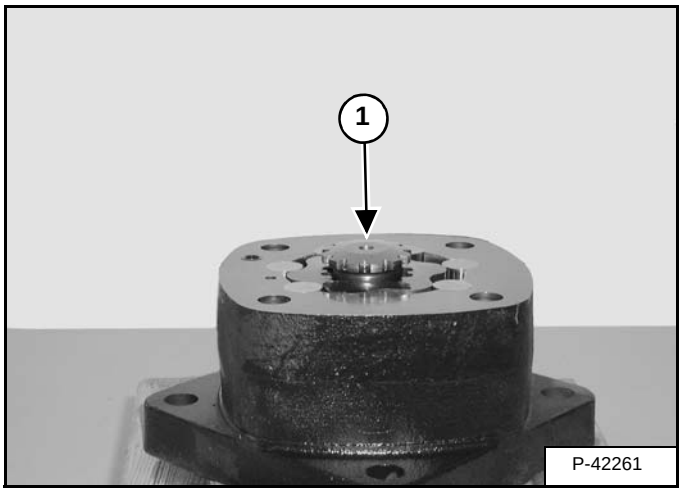
Remove the valve (Item 1) and valve plate (Item 2) **[Figure 20-90-19]**.

Figure 20-90-20



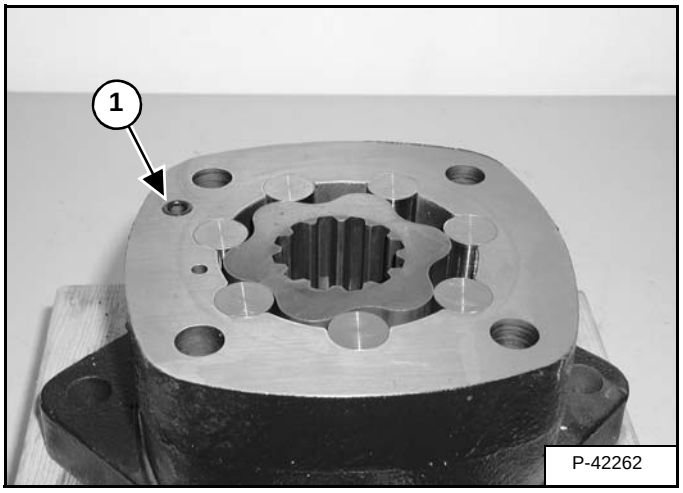
Turn the valve plate over and remove the O-ring (Item 1) **[Figure 20-90-20]**.

Figure 20-90-21



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

Figure 20-90-22

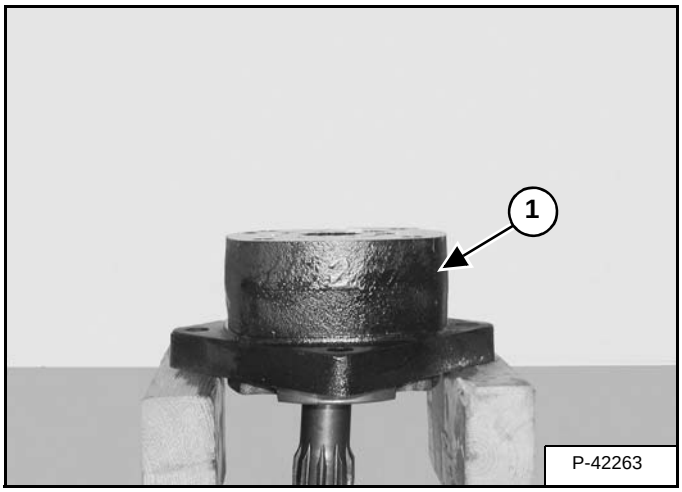


Remove the O-ring (Item 1) **[Figure 20-90-22]** from the geroler.

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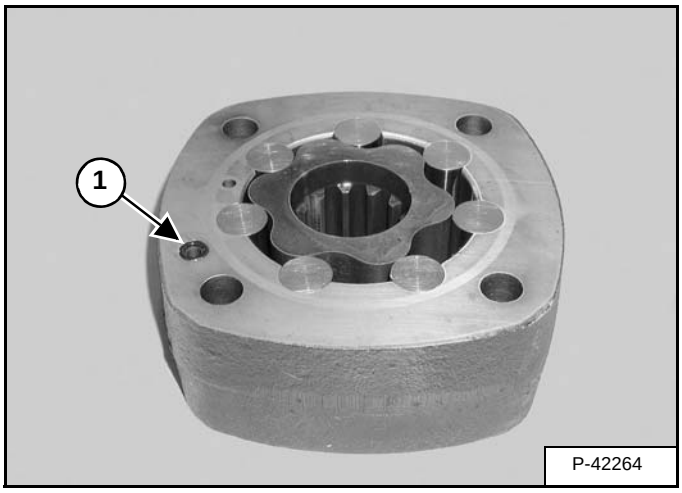
Disassembly (Cont'd)

Figure 20-90-23



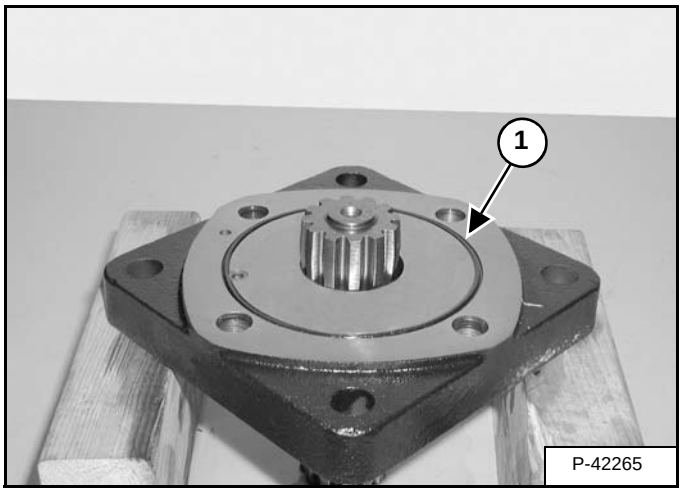
Remove the geroler (Item 1) **[Figure 20-90-23]**.

Figure 20-90-24



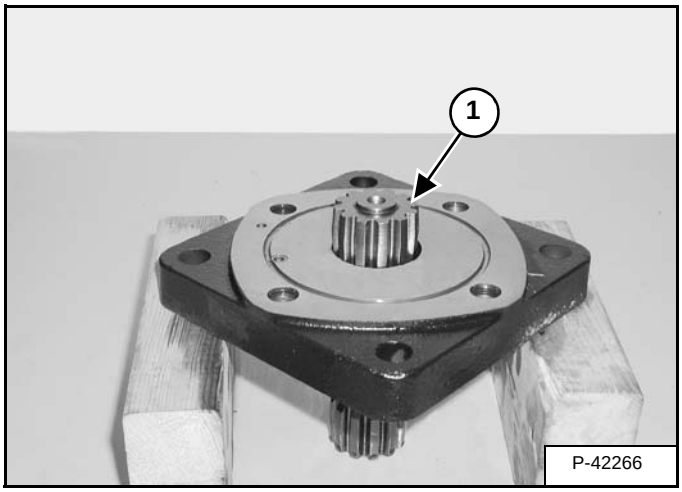
Turn the geroler over and remove the O-ring (Item 1) **[Figure 20-90-24]**.

Figure 20-90-25



Remove the O-ring (Item 1) **[Figure 20-90-25]** from the housing.

Figure 20-90-26

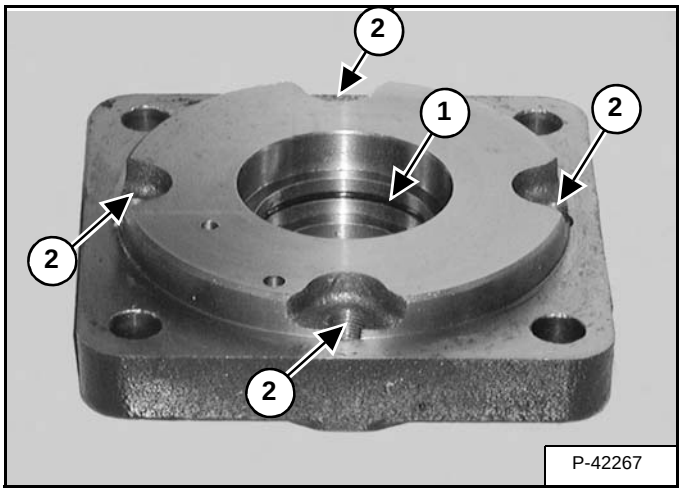


Remove the drive shaft (Item 1) **[Figure 20-90-26]**.

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Disassembly (Cont'd)

Figure 20-90-27



Remove the O-ring (Item 1) **[Figure 20-90-27]**.

Use a tap to remove all the old thread adhesive from the bolt hole threads (Item 2) **[Figure 20-90-27]**.

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Assembly

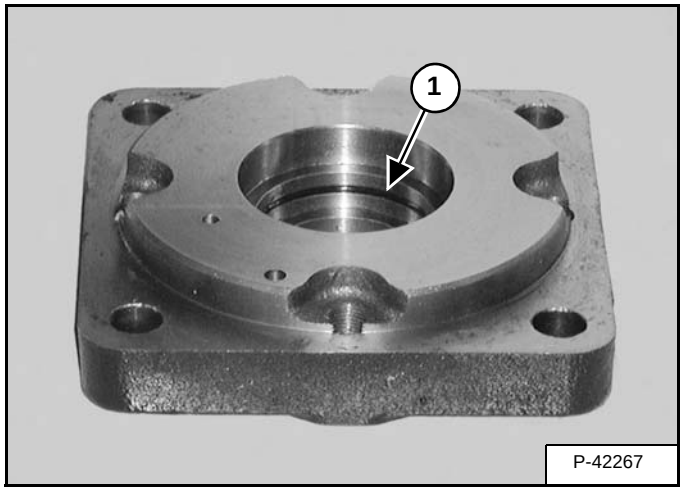
Clean all parts in solvent and dry with compressed air.

Check the components for damage or wear.

Always use new O-rings and seals.

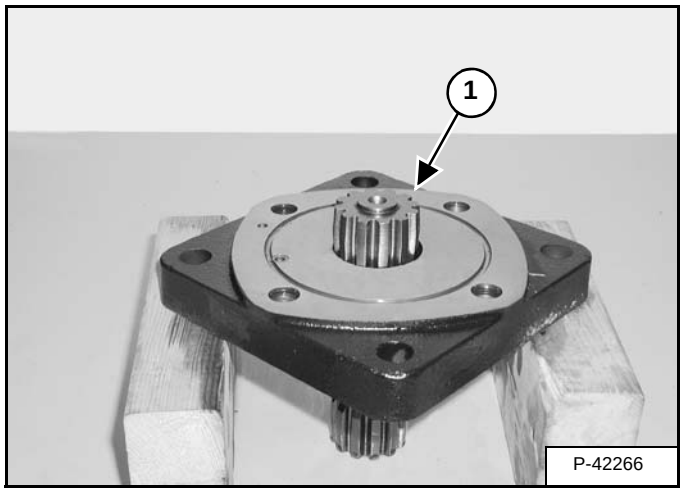
Apply clean hydraulic oil to the components during installation.

Figure 20-90-28



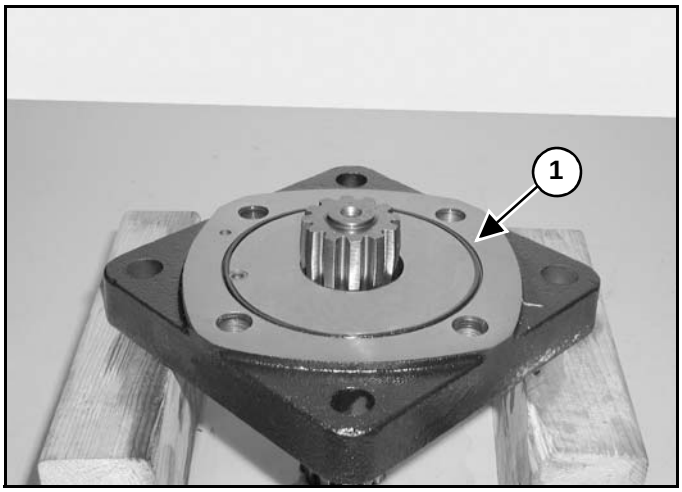
Install the O-ring (Item 1) **[Figure 20-90-28]**.

Figure 20-90-29



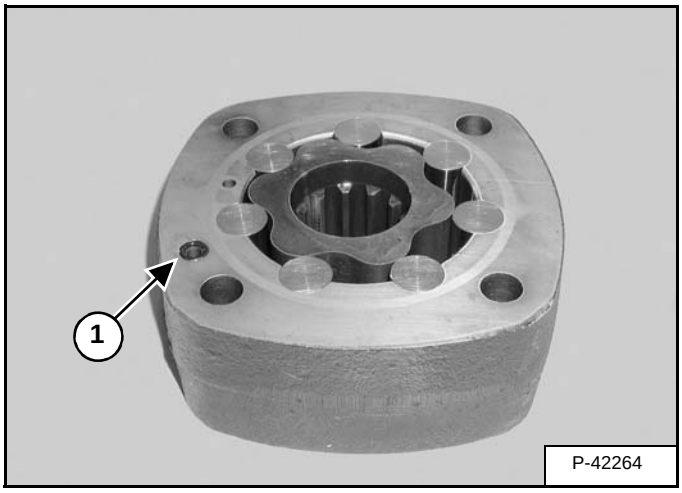
Install the drive shaft (Item 1) **[Figure 20-90-29]**.

Figure 20-90-30



Install the O-ring (Item 1) **[Figure 20-90-30]**.

Figure 20-90-31

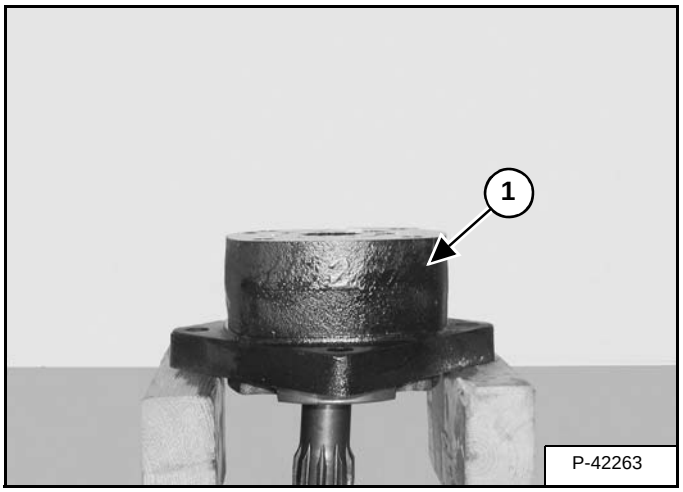


Install the O-ring (Item 1) **[Figure 20-90-31]** on the geroler.

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Assembly (Cont'd)

Figure 20-90-32



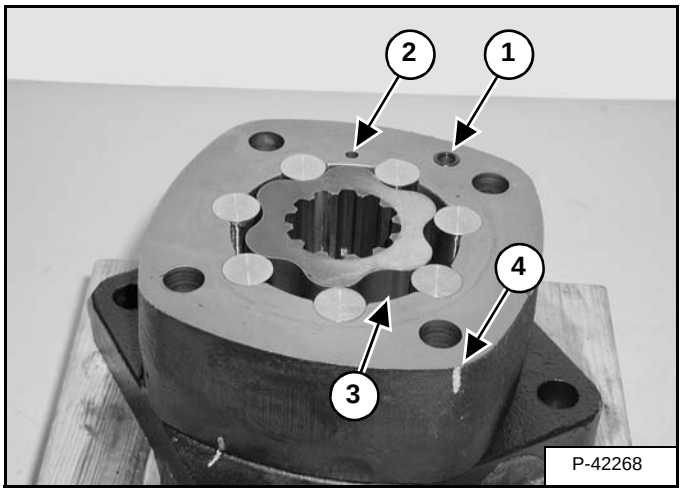
Turn the geroler over and install the geroler (Item 1) **[Figure 20-90-32]** on the housing.

Timing the hydraulic motor:

The timing parts include:

1. Geroler
2. Valve drive
3. Valve plate
4. Valve

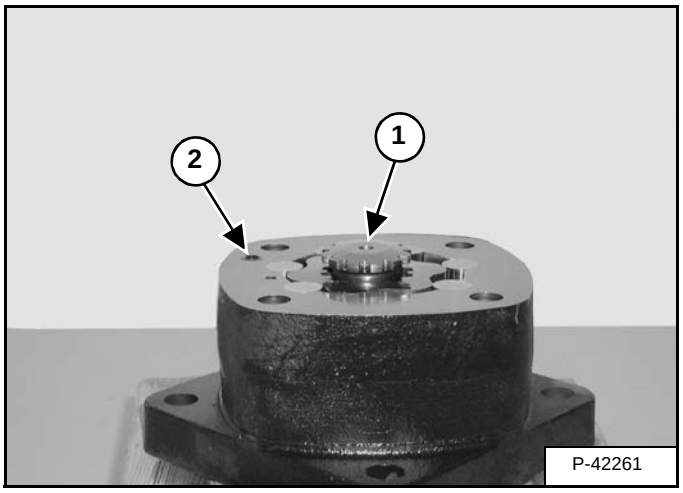
Figure 20-90-33



Align the case drain hole (Item 1) and the pressure relief hole (Item 2) **[Figure 20-90-33]** in the geroler with the case drain hole and pressure relief hole in the housing.

Locate the largest opening in the geroler (Item 3), and mark the location on the outside edge of the geroler (Item 4) **[Figure 20-90-33]**.

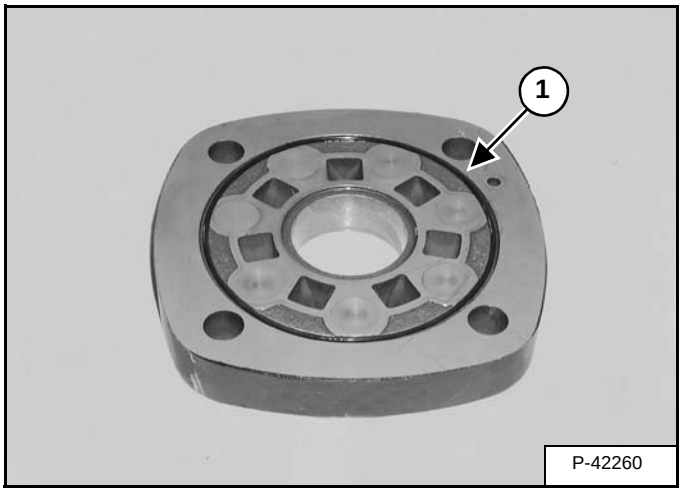
Figure 20-90-34



Install the valve drive (Item 1) **[Figure 20-90-34]** in the geroler.

Install the O-ring (Item 2) **[Figure 20-90-34]**.

Figure 20-90-35

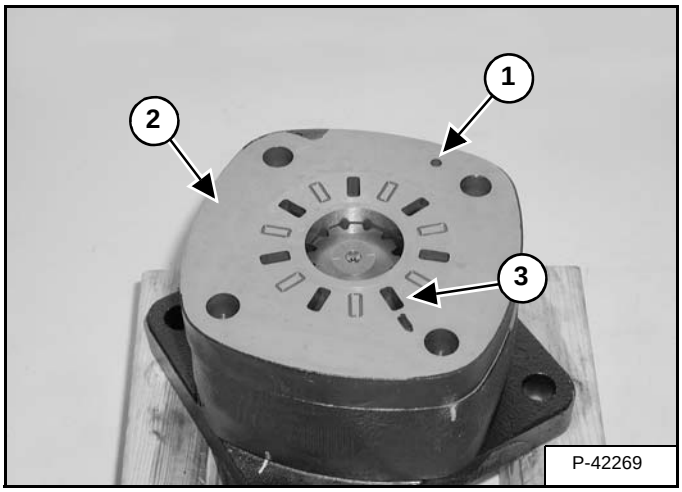


Install the O-ring (Item 1) **[Figure 20-90-35]** on the valve plate.

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Assembly (Cont'd)

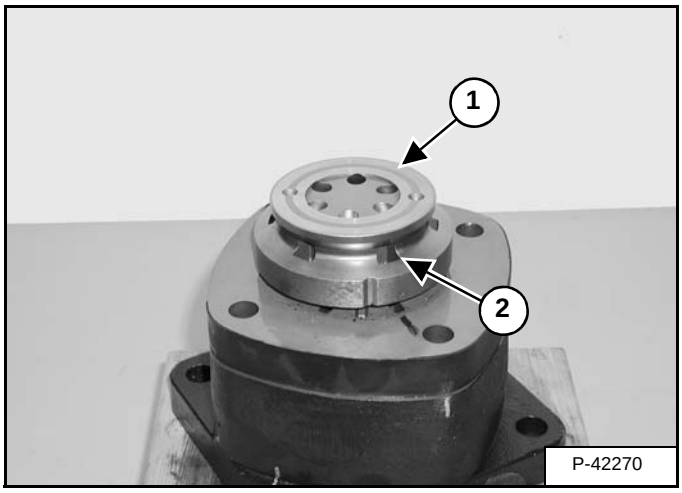
Figure 20-90-36



Align the case drain hole (Item 1) in the valve plate (Item 2) **[Figure 20-90-36]** with the case drain hole in the geroler. Install the valve plate (seal side toward geroler) on the geroler.

NOTE: Locate the slot opening (Item 3) [Figure 20-90-36] in the valve plate which is in line with the largest opening (marked earlier) in the geroler.

Figure 20-90-37



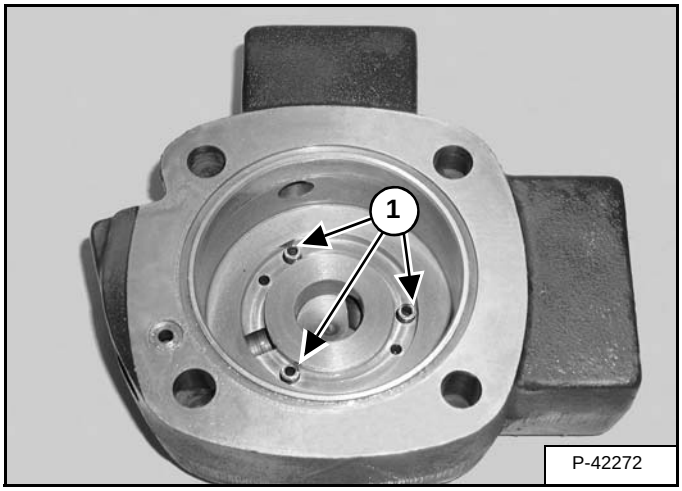
Install the valve (Item 1) **[Figure 20-90-37]**.

Locate any one of the side openings of the valve (Item 2) **[Figure 20-90-37]** that goes through to the face of the valve.

Line up this side opening with the open slot of the valve plate that is in line with the largest opening of the geroler (marked earlier).

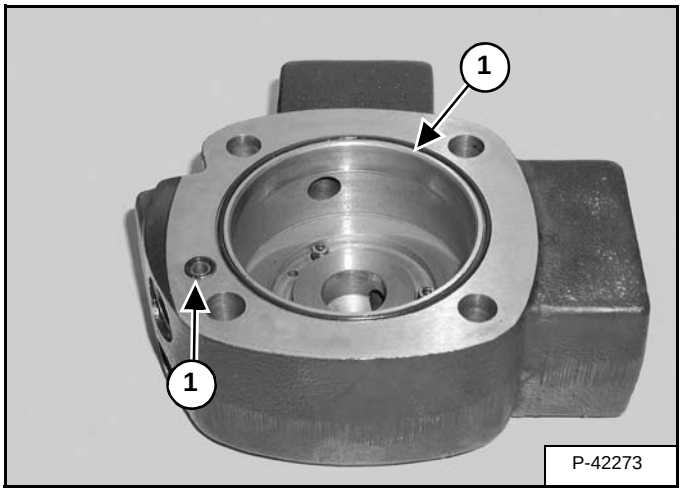
Rotate the valve clockwise until the spline teeth engage in the valve.

Figure 20-90-38



Apply clean grease on the three balance ring assembly springs (Item 1) **[Figure 20-90-38]** and install the springs in the holes located inside of the valve housing.

Figure 20-90-39

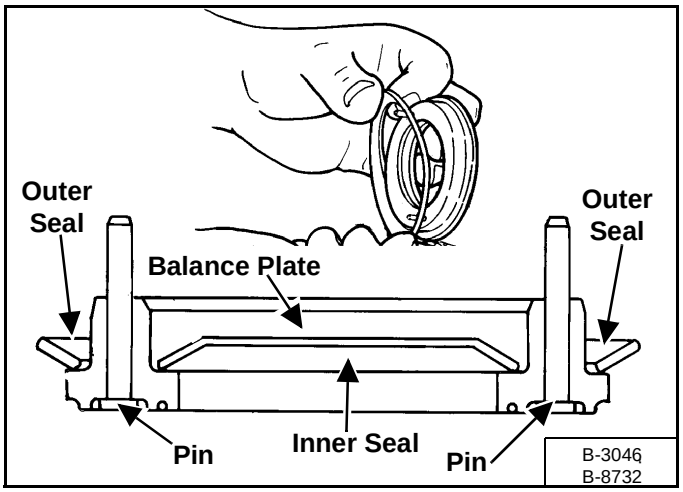


Install the O-rings (Item 1) **[Figure 20-90-39]** on the valve housing.

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Assembly (Cont'd)

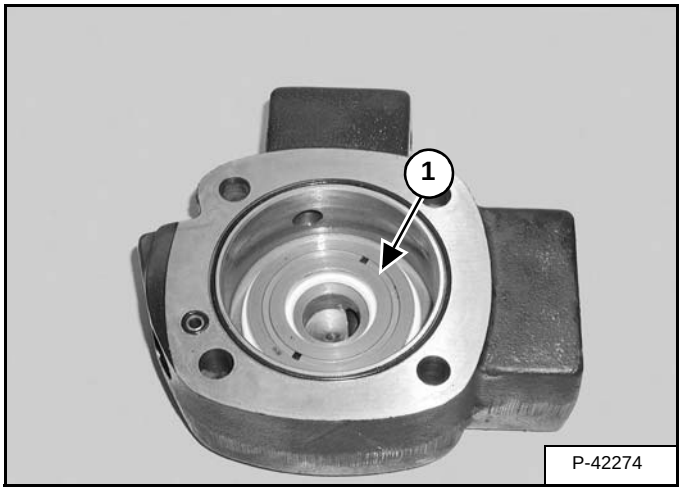
Figure 20-90-40



Install the inner and outer face seals on the balance ring **[Figure 20-90-40]**.

NOTE: Install the face seals as shown in [Figure 20-90-40], or the motor will not operate properly. Any damage to these seals will affect the operation of the motor.

Figure 20-90-41



Align the balance ring assembly pins with the two holes in the valve housing, and install the balance ring sub-assembly (Item 1) **[Figure 20-90-41]** in the valve housing.

Figure 20-90-42

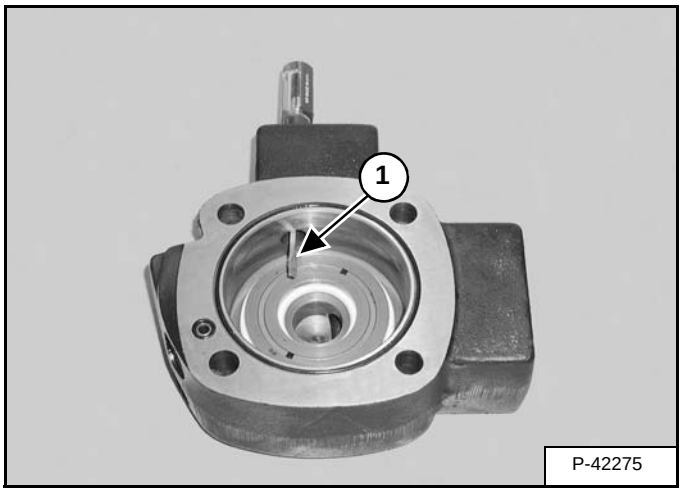
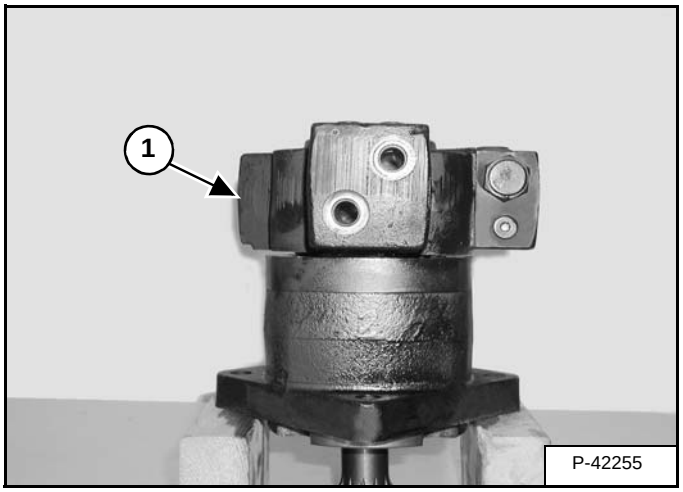


Figure 20-90-43



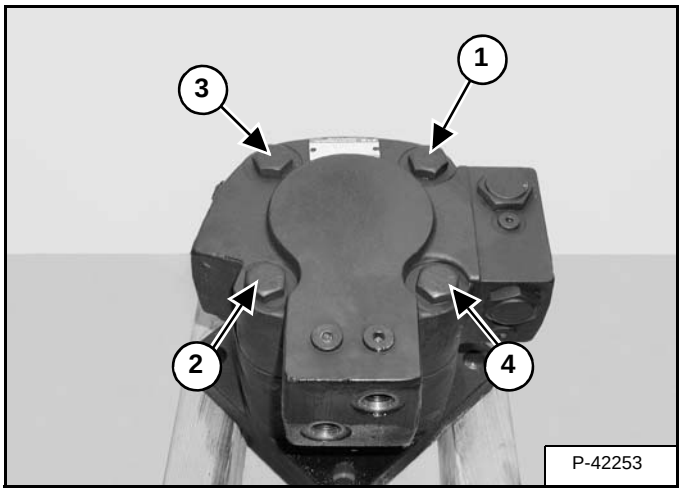
Insert a small screw driver (Item 1) **[Figure 20-90-42]** through the port in the housing. Apply pressure to side of the balance ring assembly until the valve housing is in place. Align the case drain hole in the housing with the case drain hole in the valve plate. Install the valve housing (Item 1) **[Figure 20-90-43]** against the valve plate and remove the screwdriver.

NOTE: Check that the O-rings on the motor sections are in place before the bolts are installed. If the O-rings are out of position the swing motor will leak between the sections.

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Assembly (Cont'd)

Figure 20-90-44

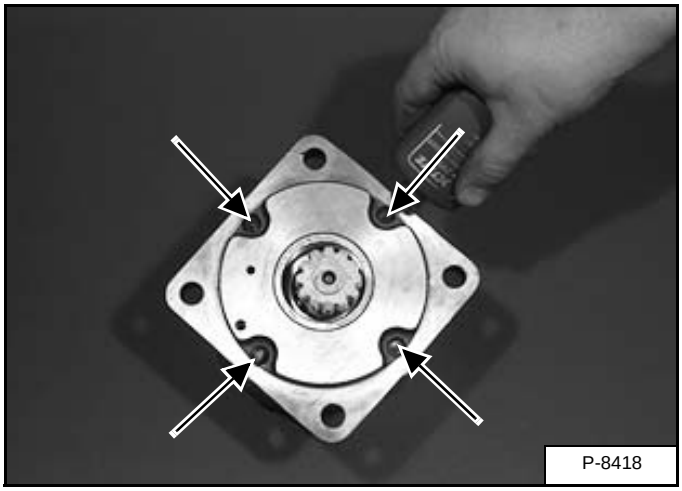


Install the four bolts. Tighten the bolts in sequence (Item 1) **[Figure 20-90-44]** to 63 ft.-lbs. (86 Nm) of torque.

Follow these procedures:

Important: This motor requires LOCTITE in threaded holes of the mounting flange.

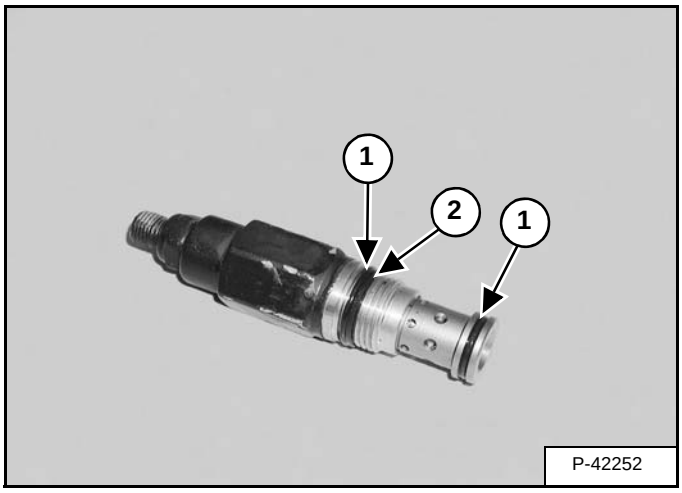
Figure 20-90-45



Adequate LOCTITE penetration and sealing depends highly on cleanliness and dryness of the threads. Use a non-petroleum base solvent to clean excess oil from threads of the flange after disassembly. Apply two to three drops of LOCTITE 290 at the top of the threaded holes **[Figure 20-90-45]**.

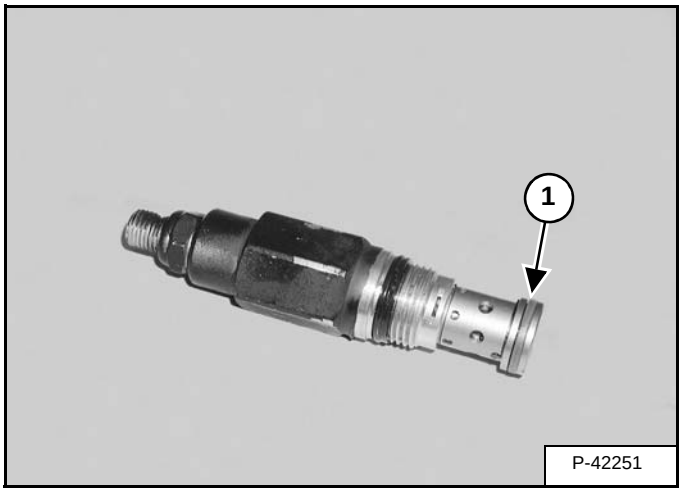
NOTE: Allow the LOCTITE five minutes for thread penetration before installing the motor on the swing motor carrier.

Figure 20-90-46



Install the O-rings (Item 1) and backup rings (Item 2) **[Figure 20-90-46]** on both crossport relief valves.

Figure 20-90-47

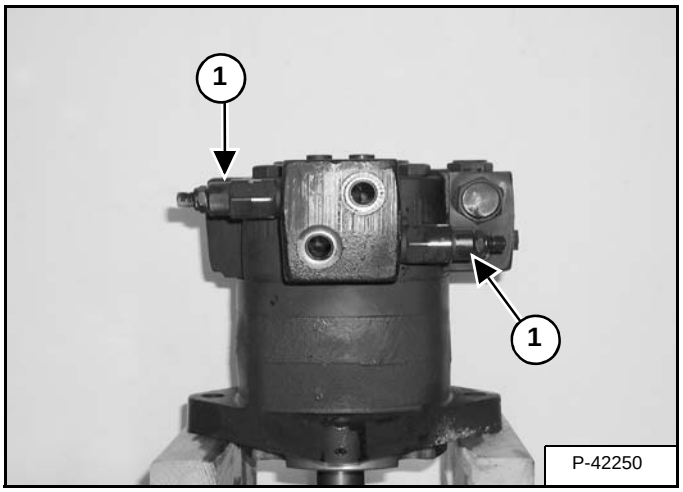


Install the glid rings (Item 1) **[Figure 20-90-47]**.

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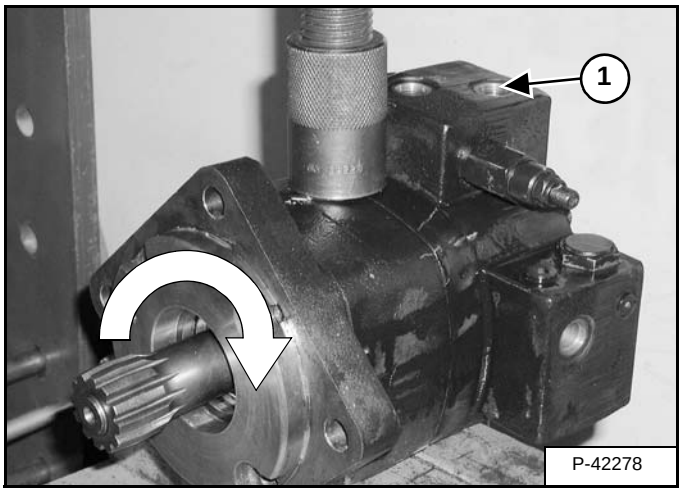
Assembly (Cont'd)

Figure 20-90-48



Install the relief valves (Item 1) **[Figure 20-90-48]**.

Figure 20-90-49



Clamp the motor in a press. Turn the shaft in a clockwise direction. If the motor is correctly timed, there will be suction at the top port (Item 1) **[Figure 20-90-49]**.

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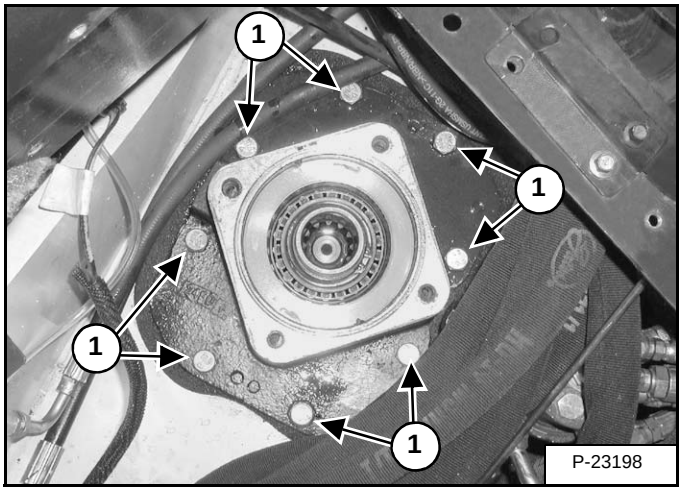
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SWING MOTOR DRIVE CARRIER

Removal And Installation

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

Figure 20-91-1

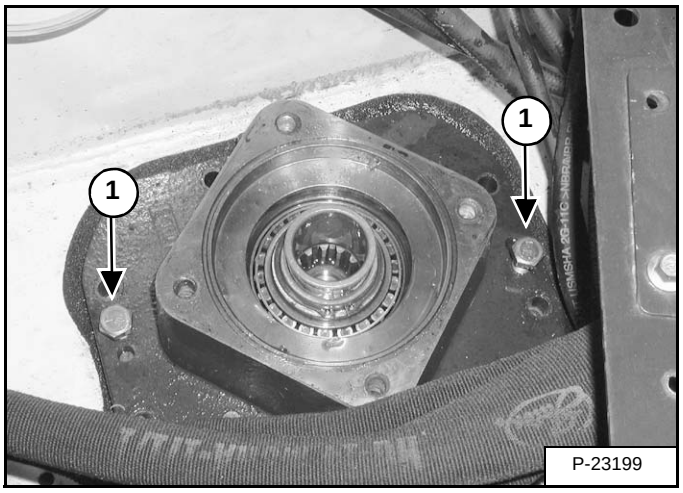


Mark and remove the eight bolts (Item 1) **[Figure 20-91-1]**.

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

Installation: Apply LOCTITE 242 to the bolt threads and tighten the bolts to 78-85 ft.-lbs. (105-115 Nm) torque.

Figure 20-91-2

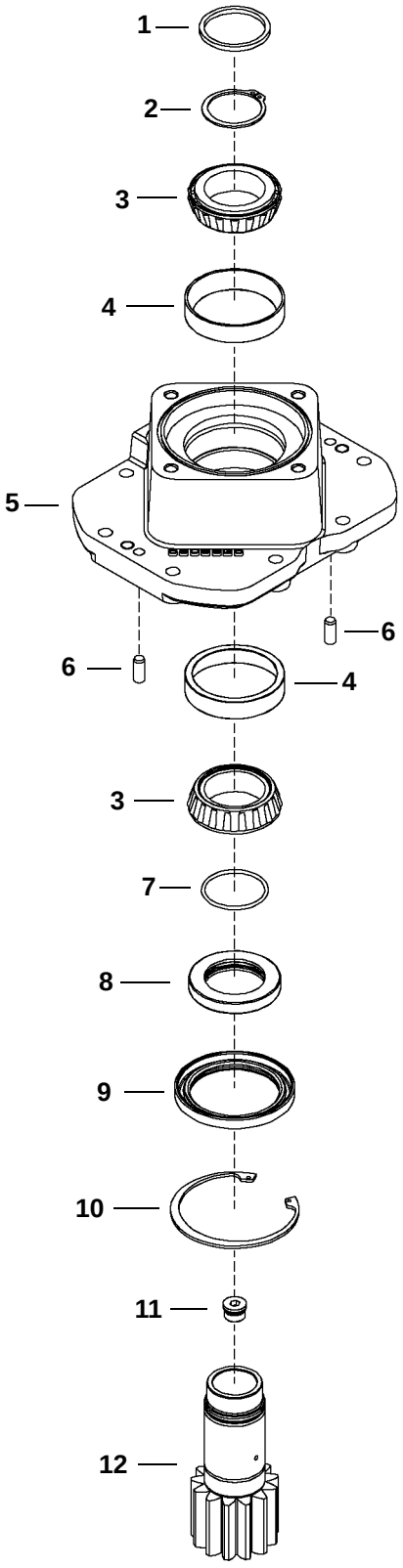


Install two of the short mount bolts (Item 1) **[Figure 20-91-2]** in the threaded holes in the carrier. Tighten the bolts to push the carrier off of the two alignment pins. The pins may stay in either the carrier or the upperstructure.

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Parts Identification

1. Snap Ring
2. Spacer Bearing
3. Bearing
4. Bearing Cup
5. Housing
6. Dowel Pin
7. O-Ring
8. Spacer
9. Seal
10. Snap Ring
11. Plug
12. Shaft



PE-1154

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Disassembly

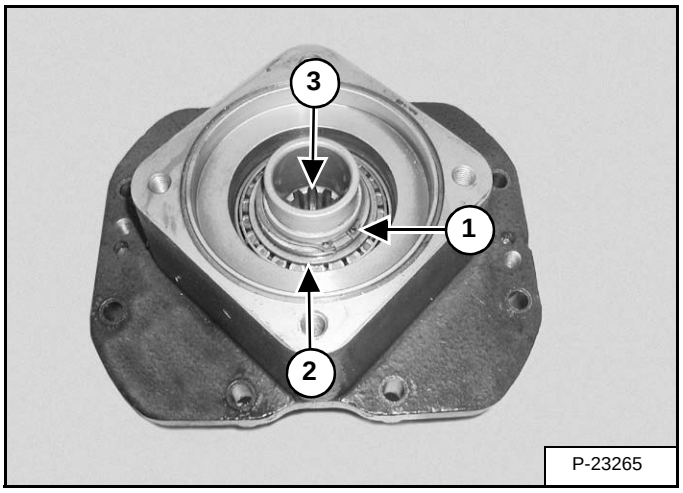
IMPORTANT

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

I-2003-0888

Drain the lubrication oil from the assembly. Tip the carrier over, allowing the oil to drain through the top bearing.

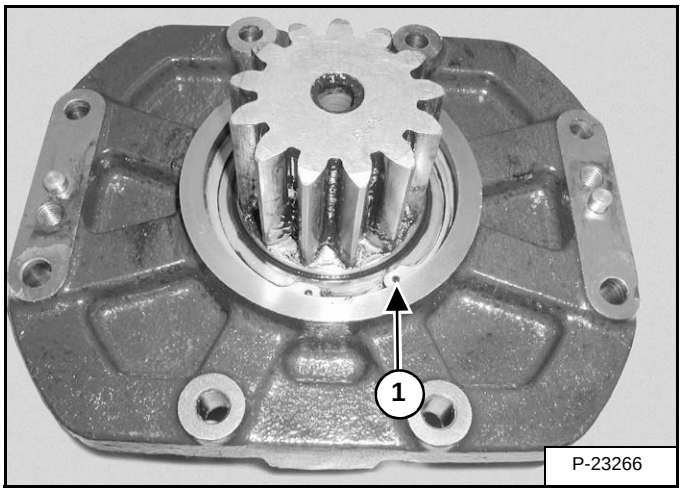
Figure 20-91-3



Remove the snap ring (Item 1) and the spacer (Item 2) **[Figure 20-91-3]** from the top of the drive shaft.

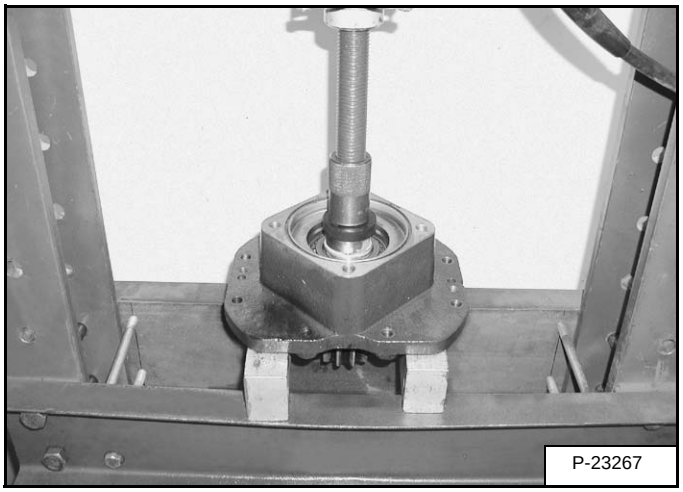
Remove the drain plug (Item 3) **[Figure 20-91-3]** from the bottom of the drive shaft.

Figure 20-91-4



Remove the snap ring (Item 1) **[Figure 20-91-4]** from the bottom of the carrier.

Figure 20-91-5

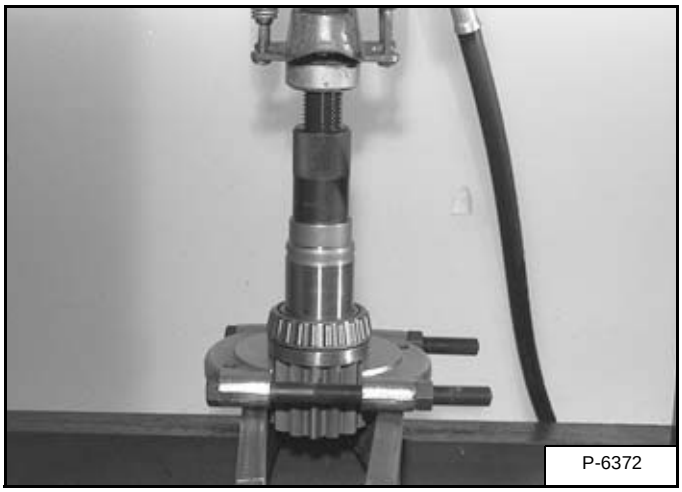


Support the motor carrier on two support blocks and press the drive shaft out the bottom of the carrier to remove the top bearing and bottom seal **[Figure 20-91-5]**.

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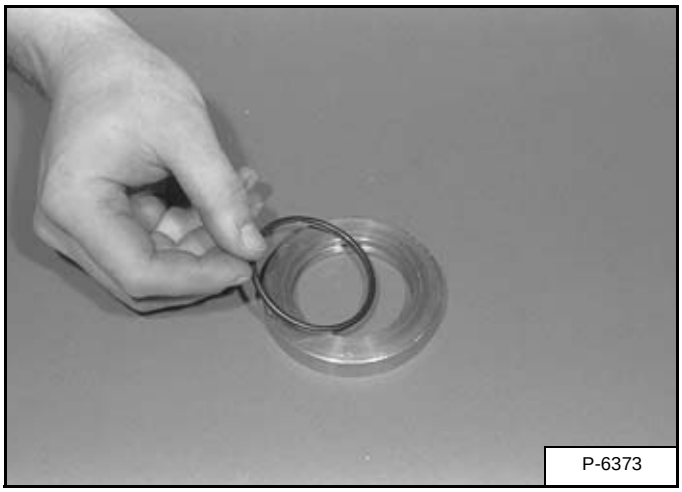
Disassembly (Cont'd)

Figure 20-91-6



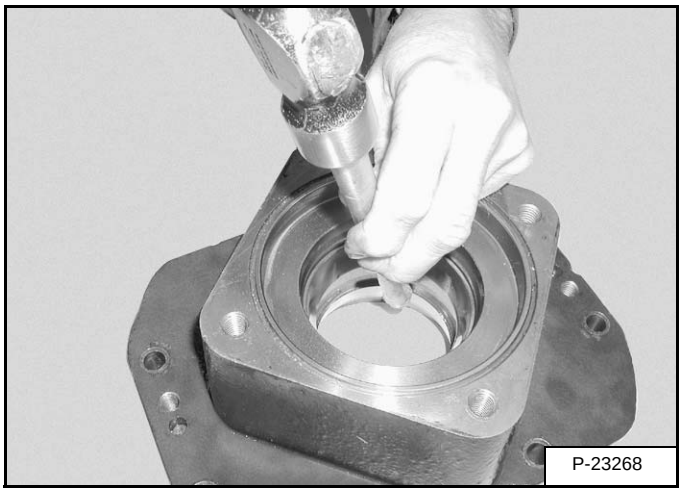
Remove the bottom bearing and spacer by supporting the spacer and pressing the shaft through it **[Figure 20-91-6]**.

Figure 20-91-7



Remove the O-ring located inside the spacer **[Figure 20-91-7]**.

Figure 20-91-8



Using a hammer and brass punch, remove the bearing cups from the top and bottom of the carrier **[Figure 20-91-8]**.

Clean all parts in solvent and dry with compressed air.

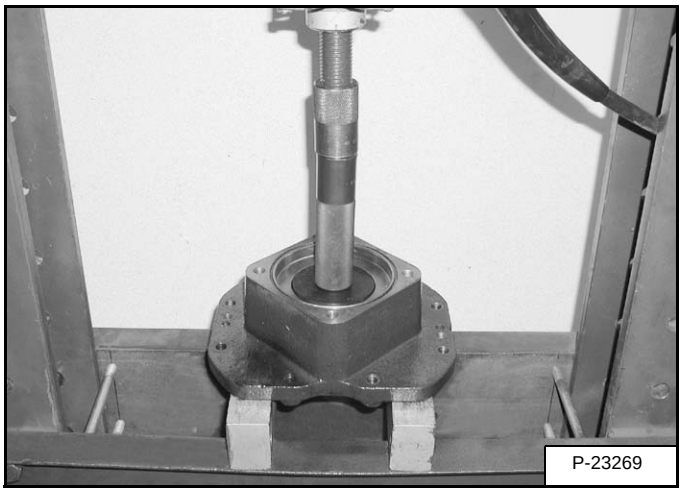
After cleaning, inspect the following components for damage and wear:

Bearings and Bearing Cups
Drive Shaft
Housing
Washer
Spacer
Snap Rings

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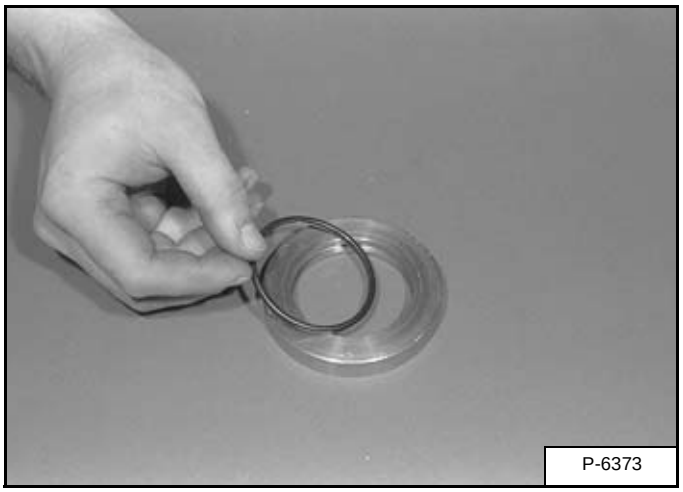
Assembly

Figure 20-91-9



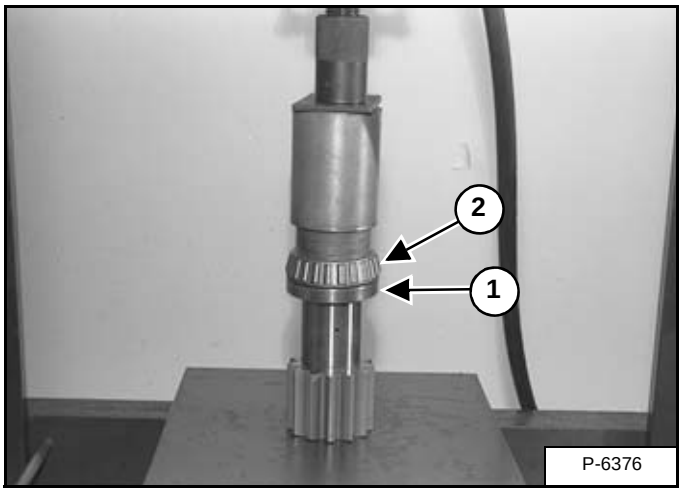
Apply a light film of grease to the outside of the new bearing cups, and press the top and bottom cups into the carrier **[Figure 20-91-9]**.

Figure 20-91-10



Oil and install a new O-ring inside the spacer **[Figure 20-91-10]**.

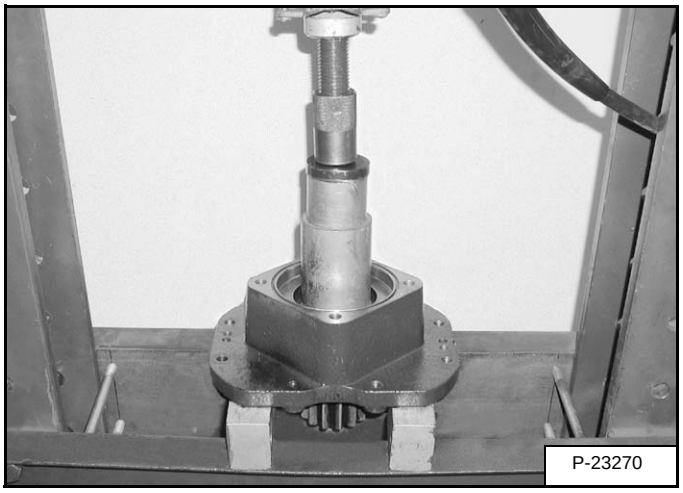
Figure 20-91-11



Press the spacer (Item 1) and a new bearing (Item 2) **[Figure 20-91-11]** on to the drive shaft.

Install the drive shaft with the spacer and the new bearing installed, through the bottom of the carrier.

Figure 20-91-12

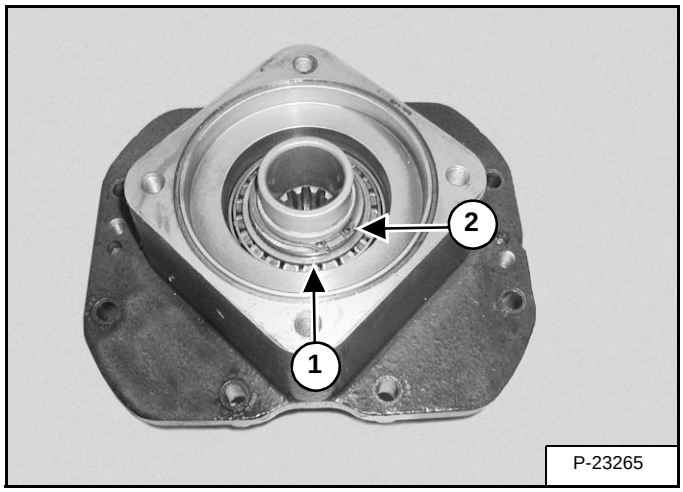


Press a new bearing on the top of the drive shaft **[Figure 20-91-12]**.

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Assembly (Cont'd)

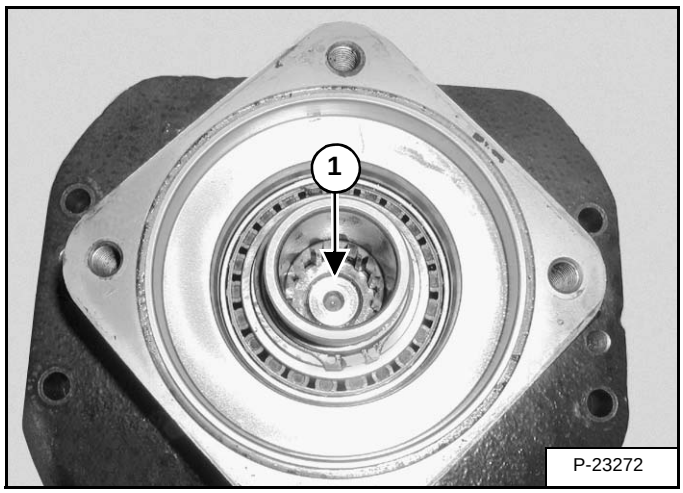
Figure 20-91-13



Install the washer (Item 1) and the snap ring (Item 2) **[Figure 20-91-13]** on the drive shaft.

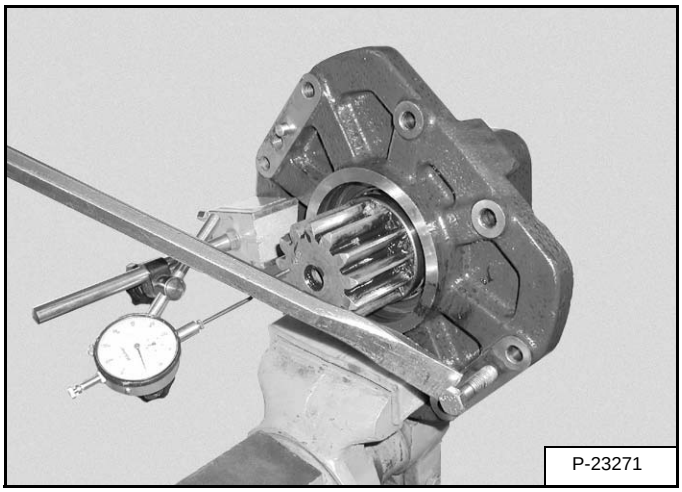
Oil and install a new O-ring on the drain plug.

Figure 20-91-14



Apply thread adhesive (LOCTITE 242) on the plug threads and install the plug (Item 1) **[Figure 20-91-14]** in the bottom of the drive shaft.

Figure 20-91-15



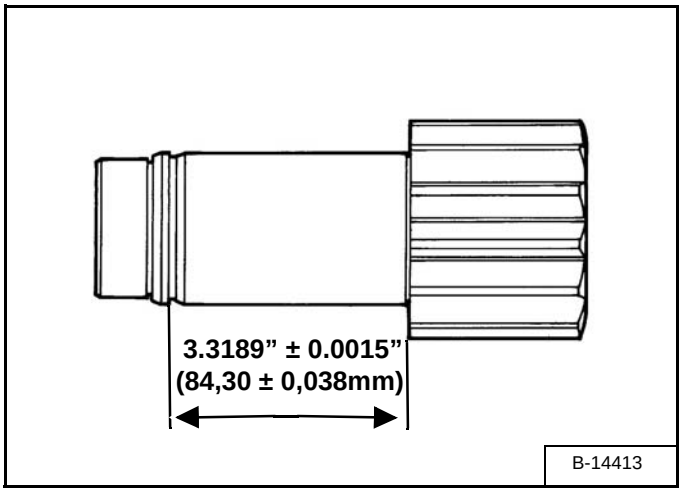
Clamp the carrier in a vise that has padded jaws. Thread a bolt in the threaded hole in the carrier flange. Setup a dial indicator so the end play of the drive shaft can be checked, by placing a pry bar under the head of the installed bolt and across the end of the drive shaft **[Figure 20-91-15]**.

End play should not be more than 0.009 inch (.229 mm) and the shaft should rotate smoothly.

If the end play is greater than 0.009 inch (.229 mm) the carrier assembly has to be disassembled and the following components checked;

Snap Ring	0.078 ± 0.002 inch (1.98 ± 0.05 mm)
Washer	0.0178 ± 0.001 inch (4.52 ± 0.03 mm)
Spacer	0.472 ± 0.002 inch (12.0 ± 0.05 mm)

Figure 20-91-16

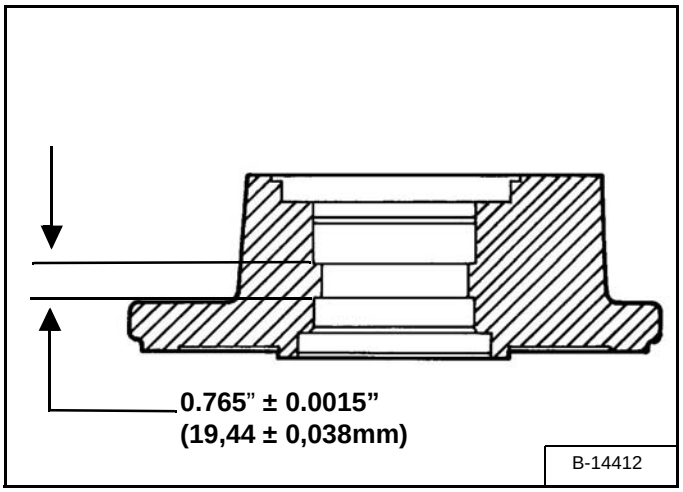


Length of drive shaft from top of snap ring groove to top of splined section 3.3189 inches ± 0.0015 inch (84.3 ± 0.038 mm) **[Figure 20-91-16]**.

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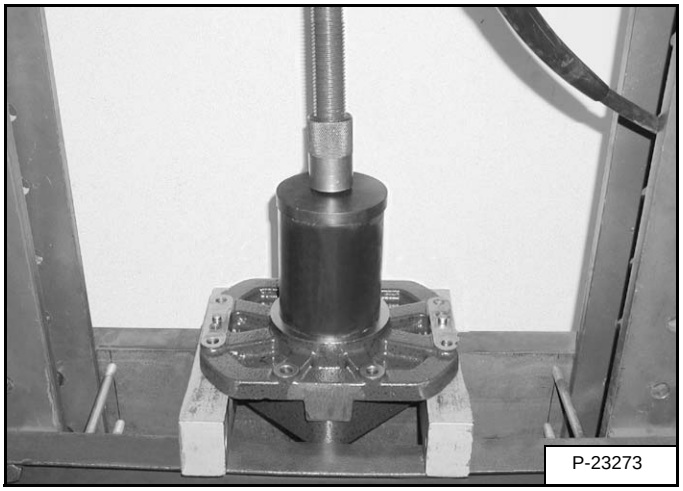
Assembly (Cont'd)

Figure 20-91-17



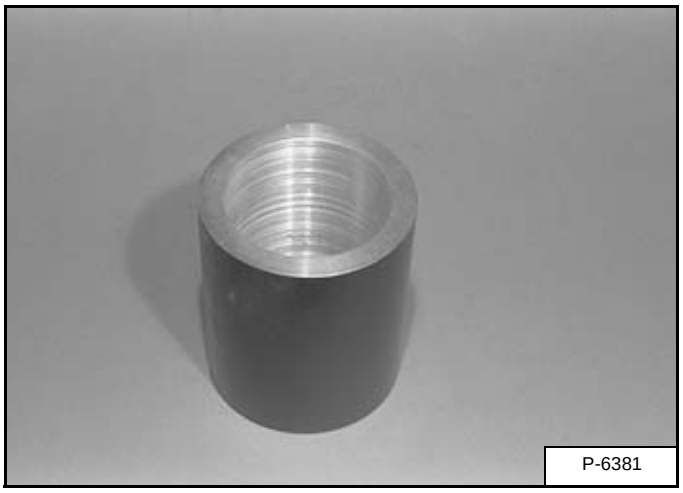
Housing top bearing cup seat to bottom bearing cup seat 0.765 inches ± 0.0015 inch (19.44 ± 0.038 mm) **[Figure 20-91-17]**.

Figure 20-91-18



Install the seal in the bottom of the carrier **[Figure 20-91-18]**.

Figure 20-91-19

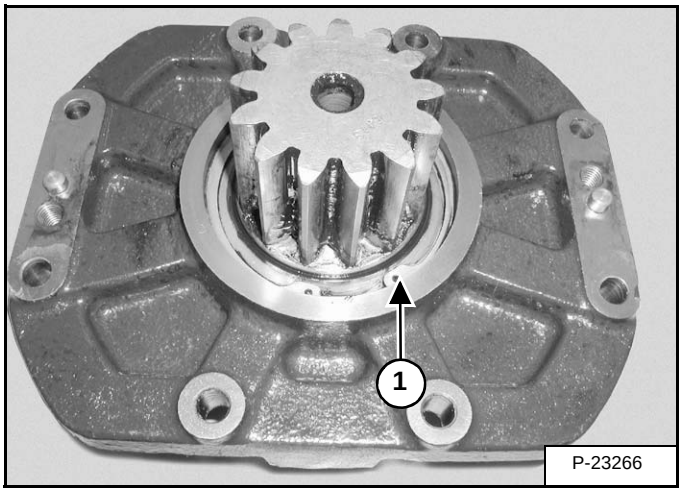


A seal installation tool can be made locally **[Figure 20-91-19]**.

Dimensions of the seal installation tool:

I.D.	3.250 inches (82,55 mm)
O.D.	4.0 inches (101,6 mm)
Height	5.0 inches (127 mm)

Figure 20-91-20



Install the bottom snap ring (Item 1) **[Figure 20-91-20]**.

After the drive assembly has been installed in the excavator, fill the carrier with enough hydraulic fluid to cover the top bearing, before installing the swing motor.

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CONTROL PATTERN SELECTOR VALVE

Removal And Installation

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

Remove the right console base. (See Console Base Removal And Installation on Page 40-50-2.)

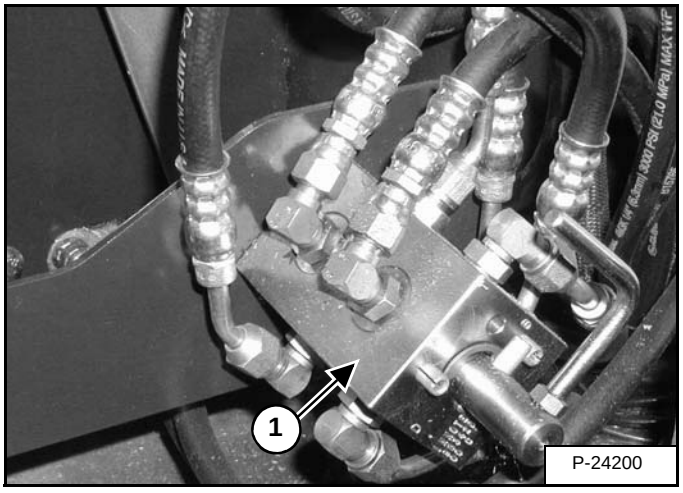
Mark all hydraulic hoses for proper installation.

IMPORTANT

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

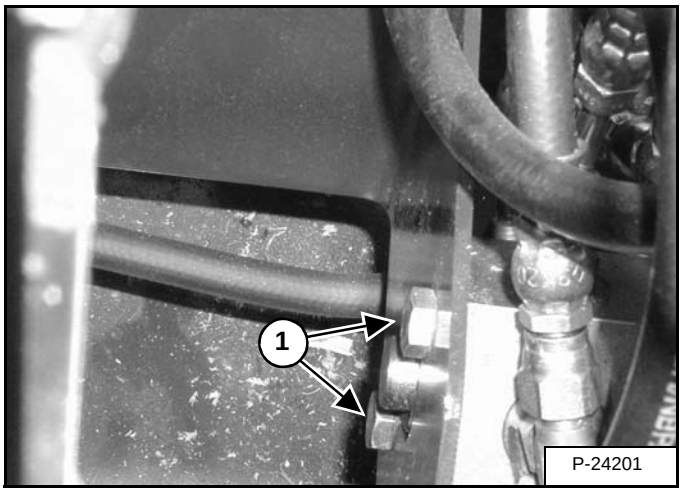
I-2003-0888

Figure 20-100-1



Remove the eight hydraulic hose from the control pattern selector valve (Item 1) **[Figure 20-100-1]**.

Figure 20-100-2



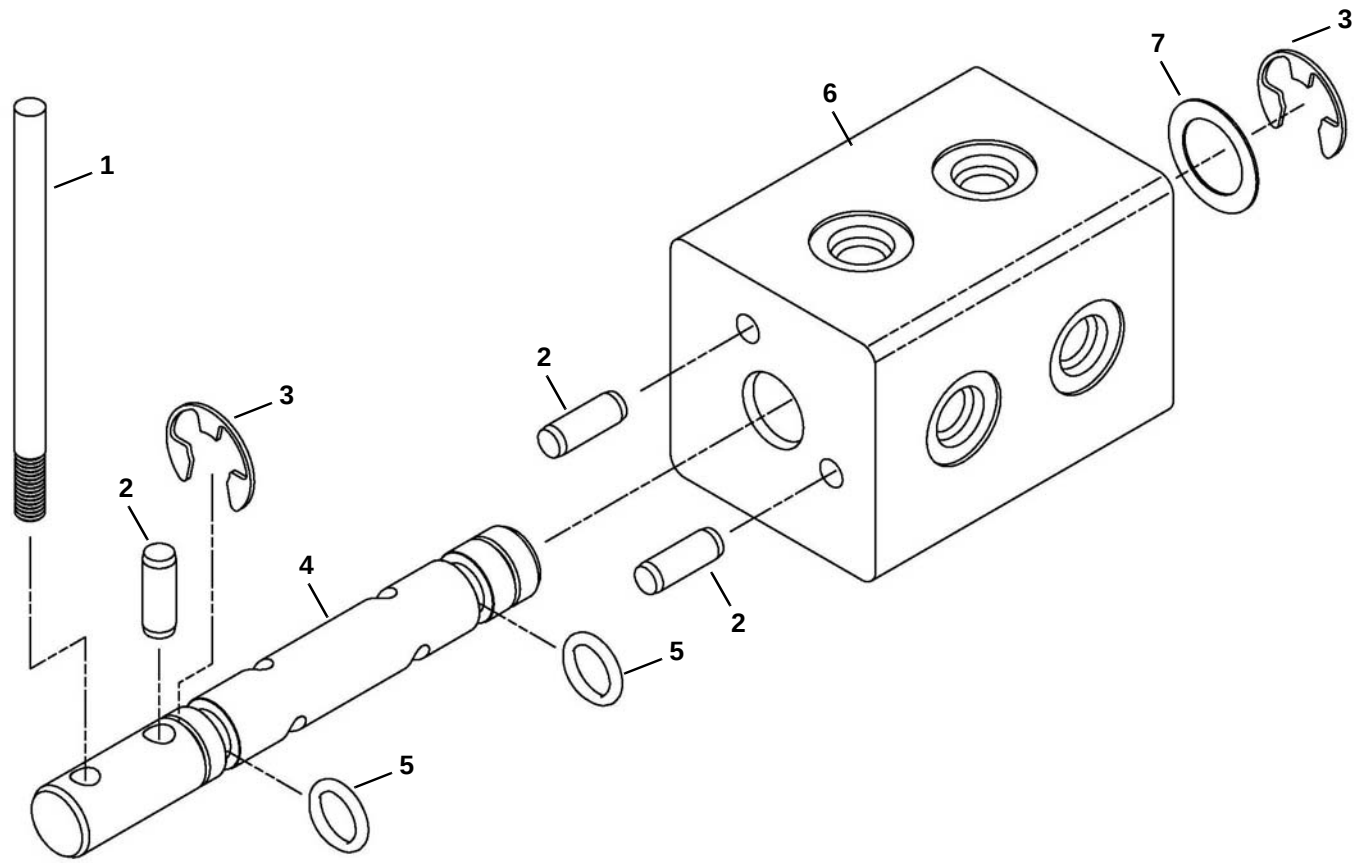
Remove the bolts (Item 1) **[Figure 20-100-2]**.

Remove the control pattern selector valve from the excavator.

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Parts Identification

1. Handle
2. Roll Pin
3. Snap Ring
4. Spool
5. O-Ring
6. Valve Block
7. Washer



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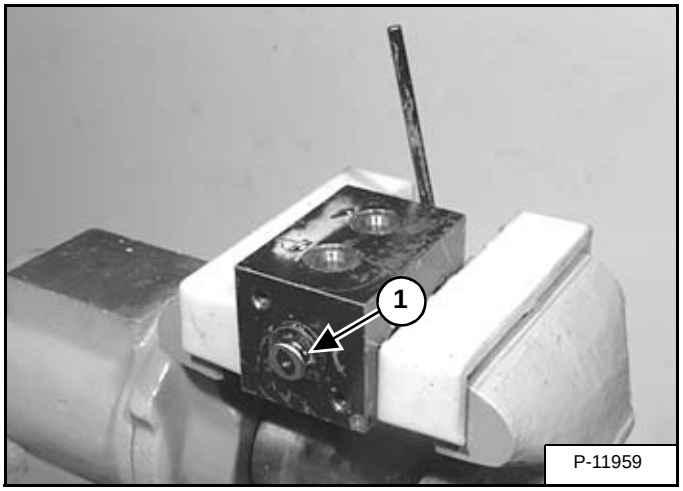
CONTROL PATTERN SELECTOR VALVE (CONT'D)

Disassembly

Clean the outside of the valve before disassembly.

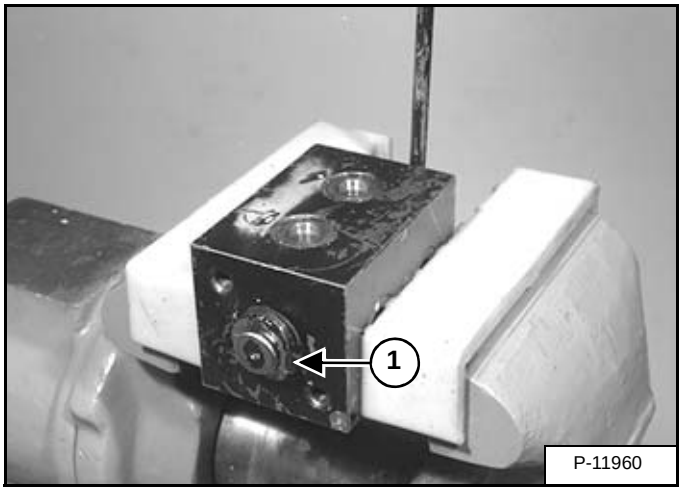
Clamp the valve in a vise equipped with padded jaws.

Figure 20-100-3



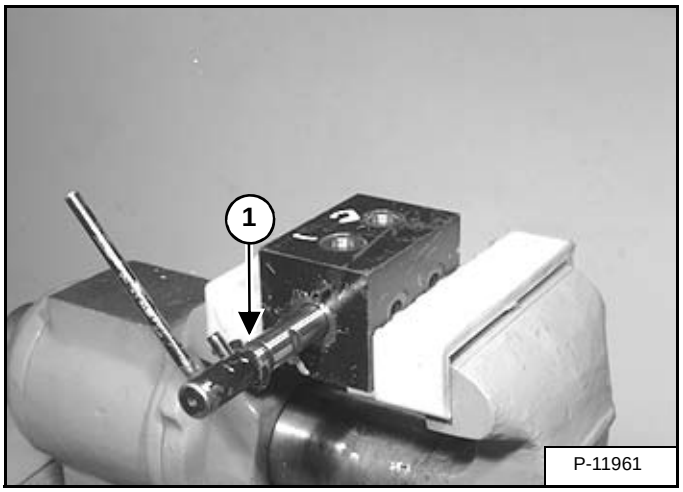
Remove the snap ring (Item 1) **[Figure 20-100-3]**.

Figure 20-100-4



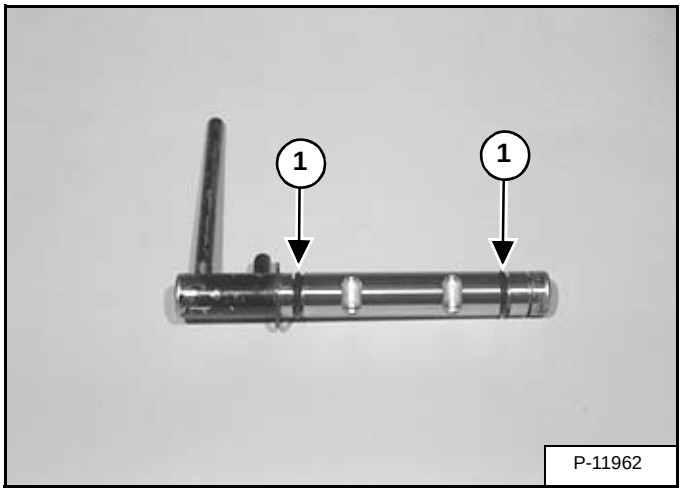
Remove the wave washer (Item 1) **[Figure 20-100-4]**.

Figure 20-100-5



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

Figure 20-100-6



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

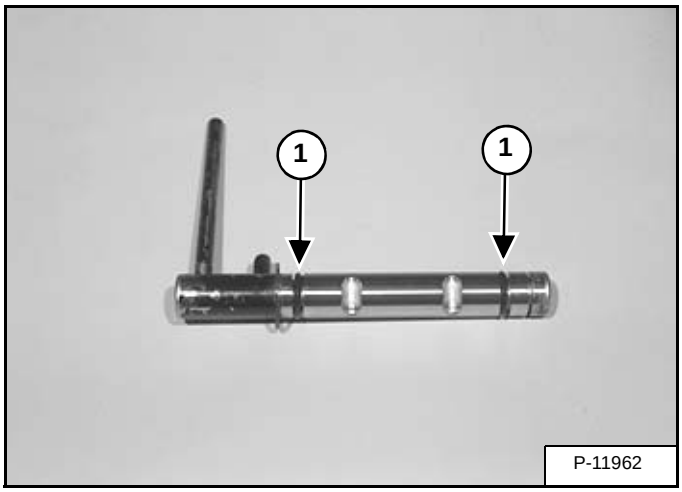
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Assembly

Clean all parts in solvent and dry with compressed air. Inspect all parts for wear or damage. Replace any worn or damaged parts.

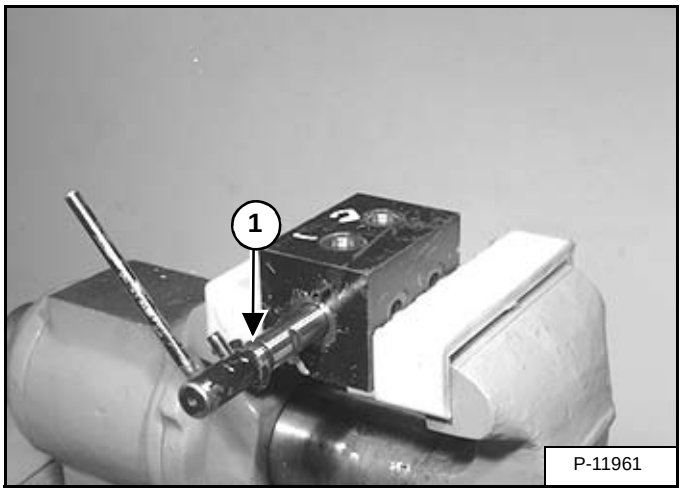
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-100-7



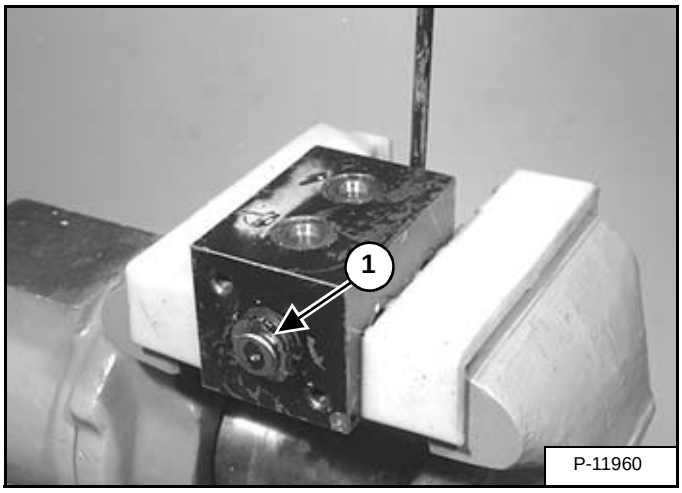
Install the O-rings (Item 1) **[Figure 20-100-7]** on the spool.

Figure 20-100-8



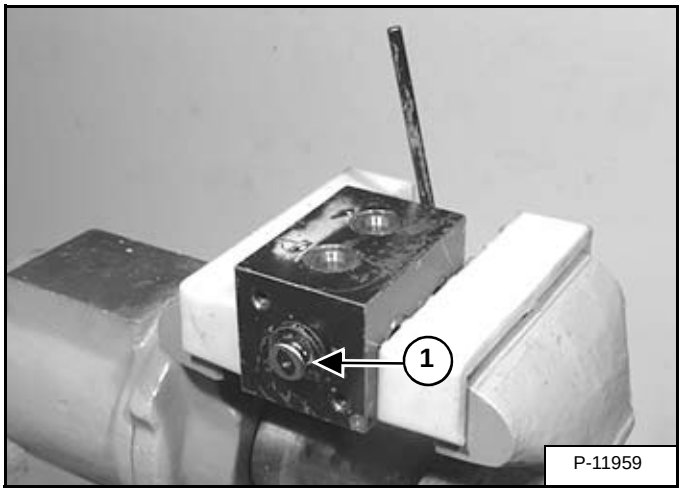
Apply oil to and install the spool (Item 1) **[Figure 20-100-8]** in the valve body.

Figure 20-100-9



Install the wave washer (Item 1) **[Figure 20-100-9]** on the end of the spool.

Figure 20-100-10



Install the snap ring (Item 1) **[Figure 20-100-10]** on the spool.

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RIGHT CONTROL LEVER (JOYSTICK)

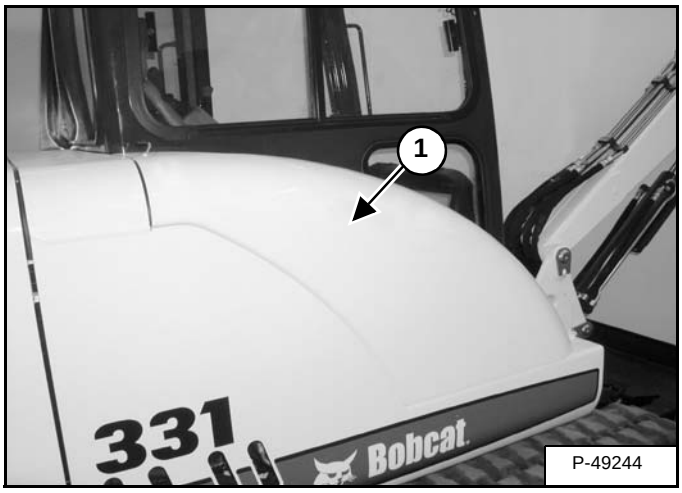
Testing

The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

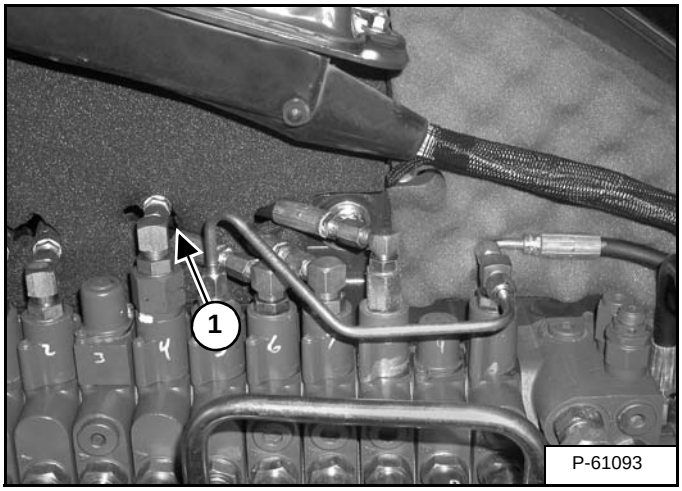
Stop the engine.

Figure 20-110-11



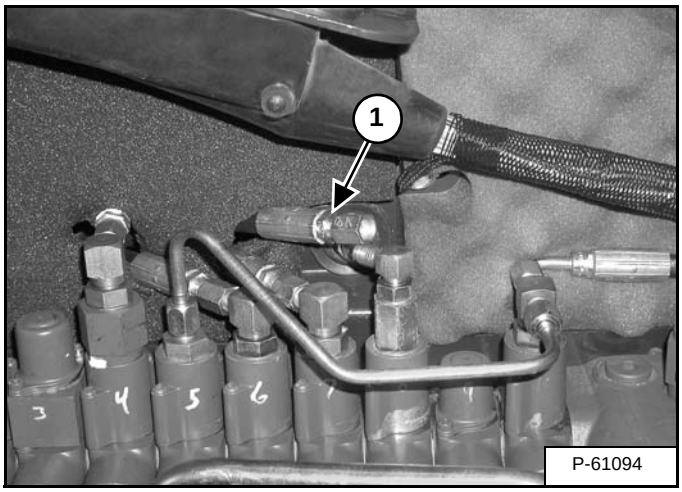
Open the right side cover (Item 1) **[Figure 20-110-11]**.

Figure 20-110-12



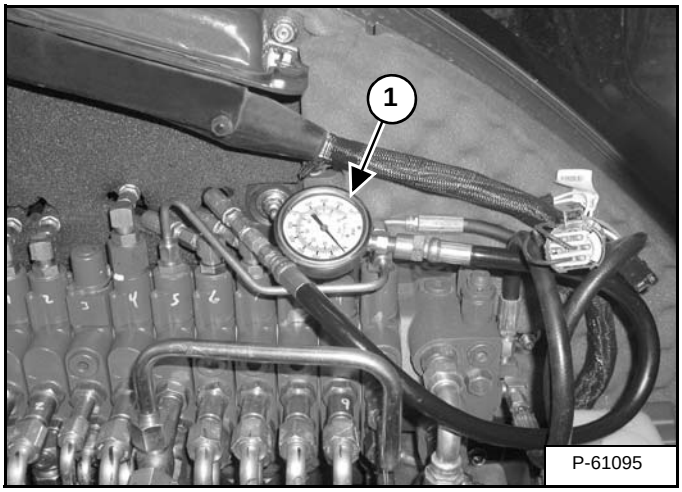
At the control valve assembly (Item 1) **[Figure 20-110-12]**, find the pilot line of the control lever (joystick) that is to be checked. (Boom, Arm, Slew, Bucket)

Figure 20-110-13



Disconnect the hydraulic hose (Item 1) **[Figure 20-110-13]** from the control valve.

Figure 20-110-14



From the test kit Install a 500 PSI (35 bar) gauge (Item 1) **[Figure 20-110-14]** on the pilot line. Start the excavator, and warm the hydraulic oil to operating temperature.

Engage the circuit to be tested. Record the operating pressure.

The operating pressure should be approximately 435 PSI (30 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.)

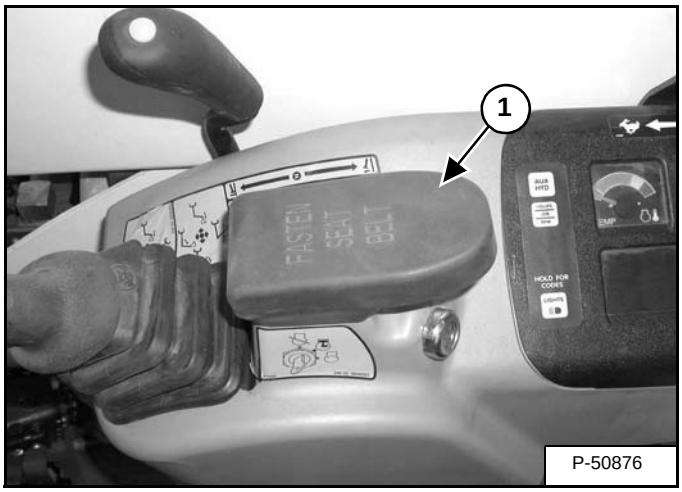
If the pressure is still incorrect replace the pressure reducing valve. (See Testing And Adjusting The Pressure Reducing Valve on Page 20-33-1.)

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RIGHT CONTROL LEVER (JOYSTICK) (CONT'D)

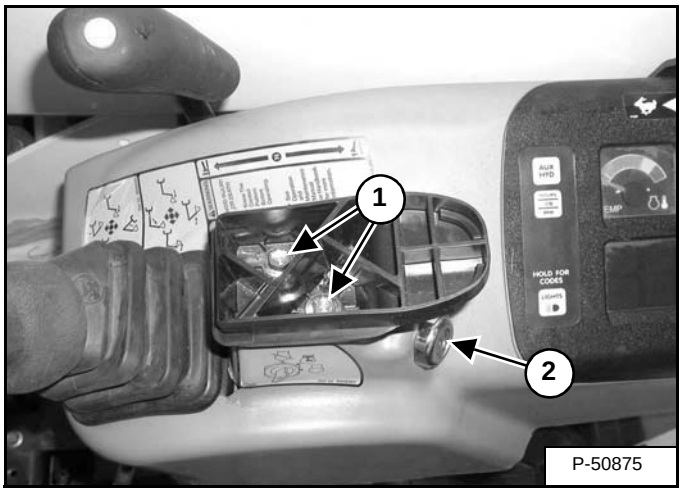
Handle Removal And Installation

Figure 20-110-15



Remove the cover (Item 1) **[Figure 20-110-15]** from the arm rest.

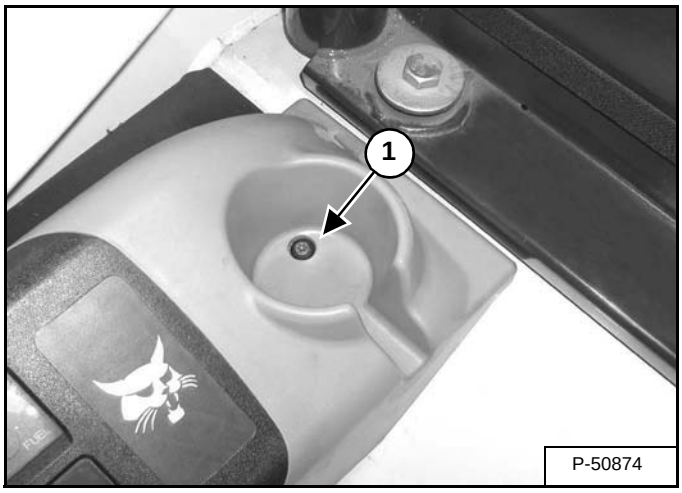
Figure 20-110-16



Remove the two bolts (Item 1) **[Figure 20-110-16]** from the arm rest.

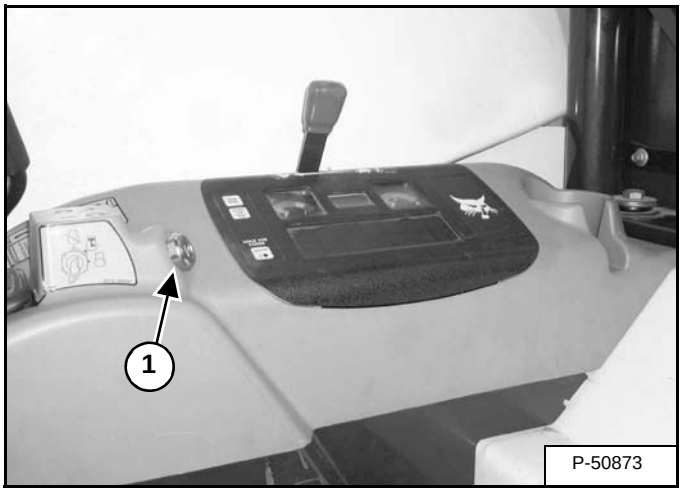
Remove the arm rest.

Figure 20-110-17



Remove the screw (Item 1) **[Figure 20-110-17]** from the cup holder.

Figure 20-110-18



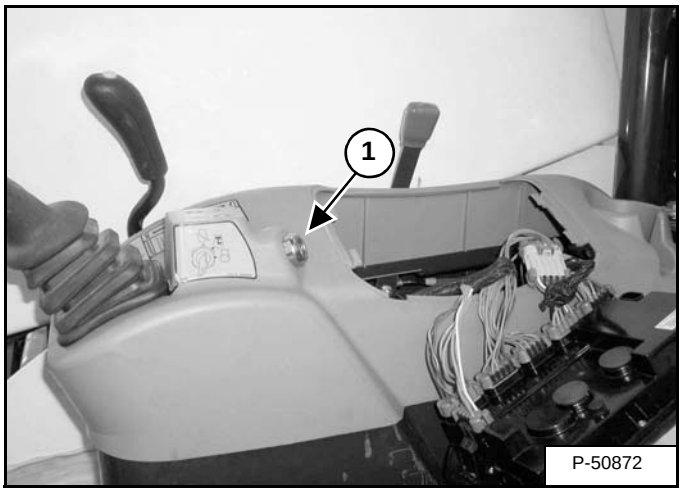
Remove the nut (Item 1) **[Figure 20-110-18]** from the key switch. Allow the keyswitch to drop inside the console.

Lift the console cover up and over the joystick.

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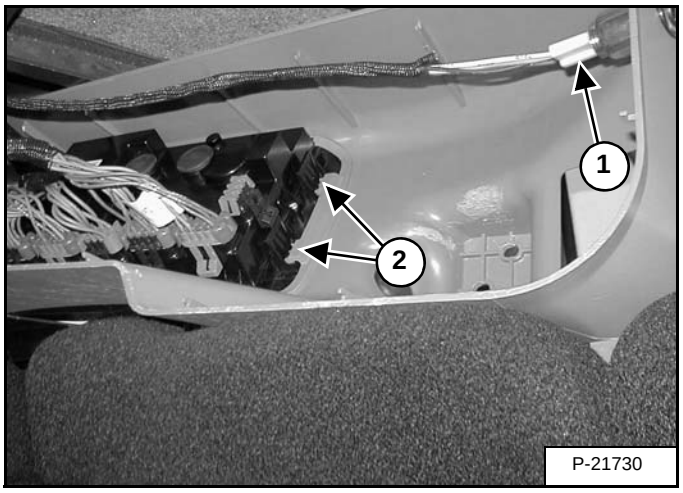
Handle Removal And Installation (Cont'd)

Figure 20-110-19



Installation: Install the keyswitch and nut (Item 1) **[Figure 20-110-19]** before installing the controller.

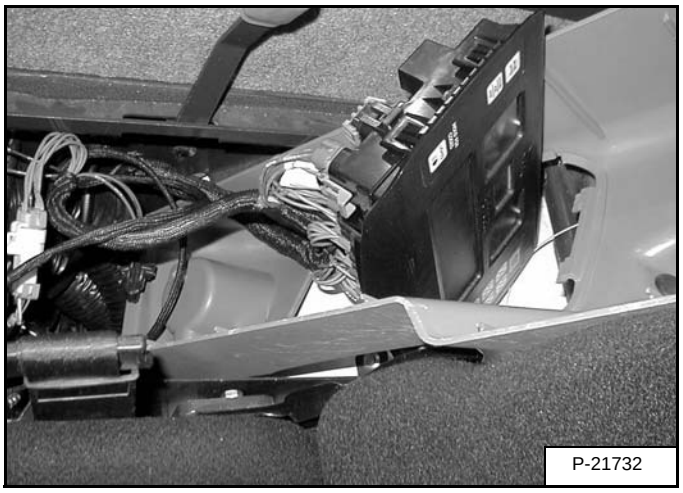
Figure 20-110-20



Disconnect the accessory outlet electrical connector (Item 1) **[Figure 20-110-20]**.

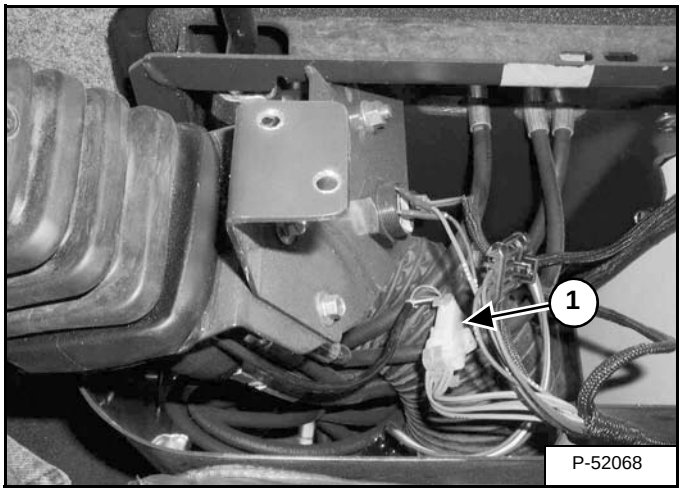
Depress the four tabs (Item 2) **[Figure 20-110-20]** and remove the controller.

Figure 20-110-21



Turn the controller to allow it to pass through the console cover **[Figure 20-110-21]**.

Figure 20-110-22

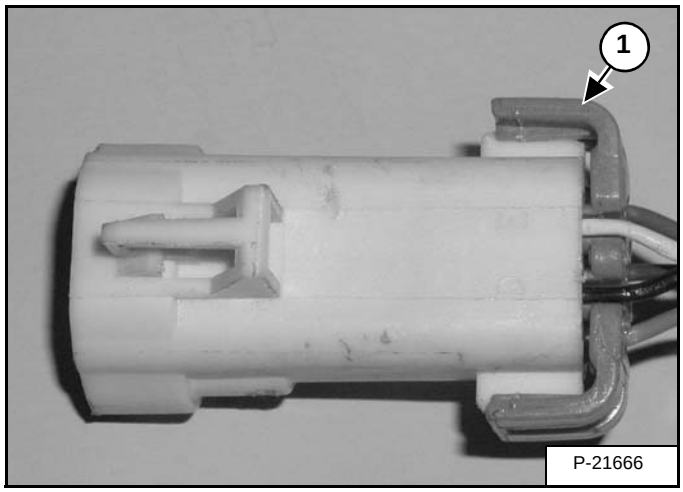


Disconnect the electrical connector (Item 1) **[Figure 20-110-22]** from the excavator wiring harness.

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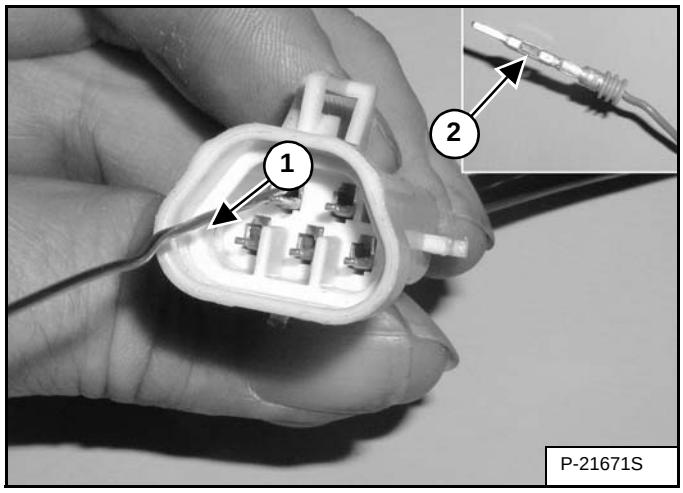
Handle Removal And Installation (Cont'd)

Figure 20-110-23



Remove the lock (Item 1) **[Figure 20-110-23]** from the electrical connector.

Figure 20-110-24

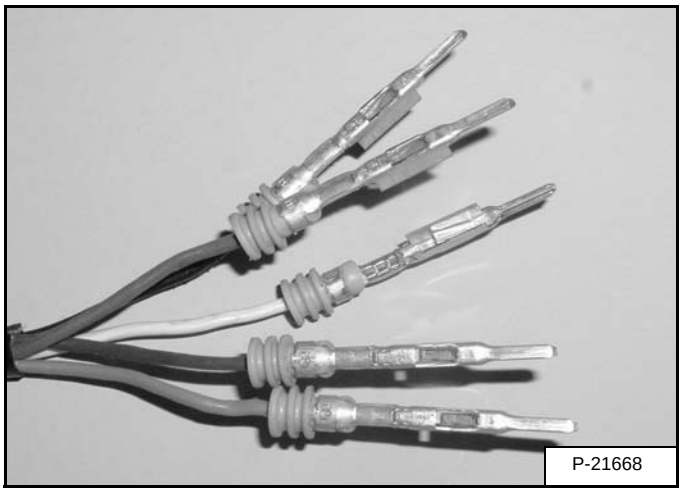


With a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 20-110-24]**.

Carefully remove the individual wires from the back of the electrical connector.

Installation: Use a small piece of wire and re-bend the tab (Item 2) **[Figure 20-110-24]**. on each wire before installing the electrical connector.

Figure 20-110-25

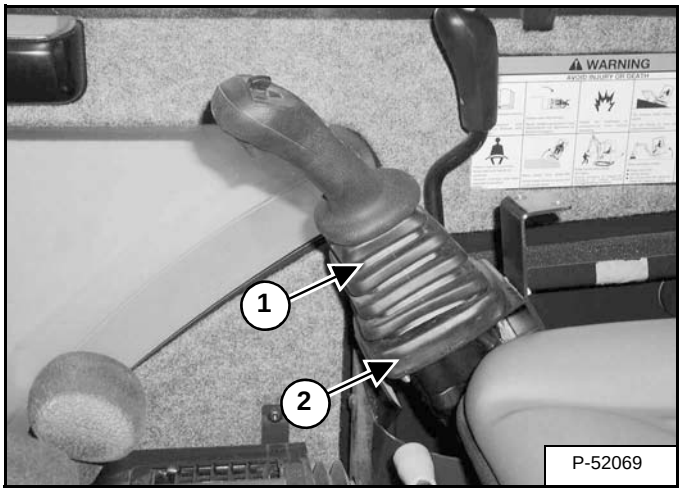


Installation: The wires **[Figure 20-110-25]** must be installed in the proper locations in the wire connector, listed below.

A Green
B Brown
C Pink
D Black
E White

Check each wire to be certain the tab locks into position.

Figure 20-110-26



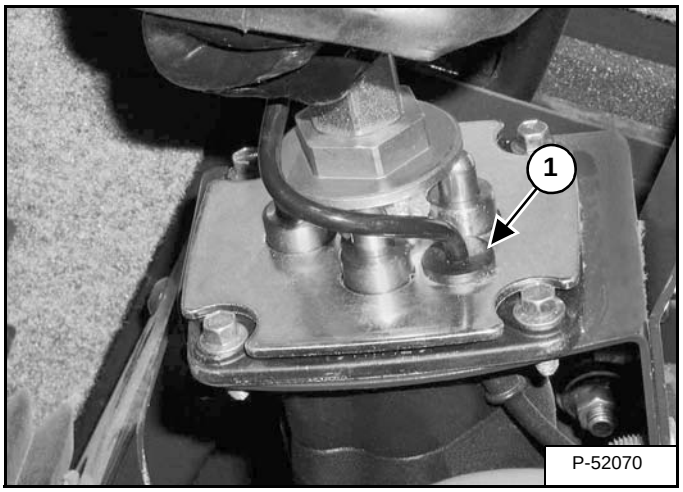
Pull the boot (Item 1) **[Figure 20-110-26]** up.

Installation: The top of the boot is molded to fit over the flange of the joystick. It has tabs that fit between the handle and joystick flange (Item 2) **[Figure 20-110-26]**. Install the boot properly before installing the console cover.

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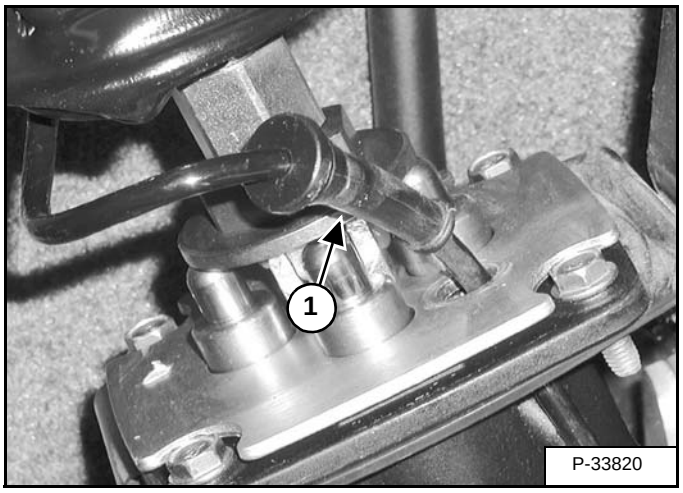
Handle Removal And Installation (Cont'd)

Figure 20-110-27



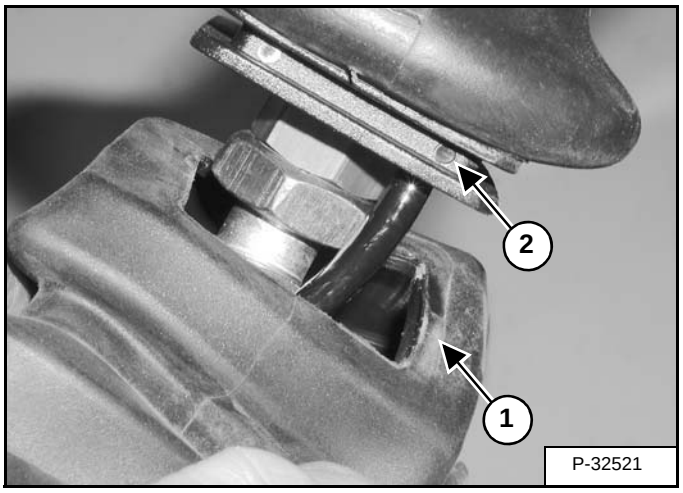
Lift the grommet (Item 1) **[Figure 20-110-27]** from the mount plate.

Figure 20-110-28



Remove the wire and grommet (Item 1) **[Figure 20-110-28]**.

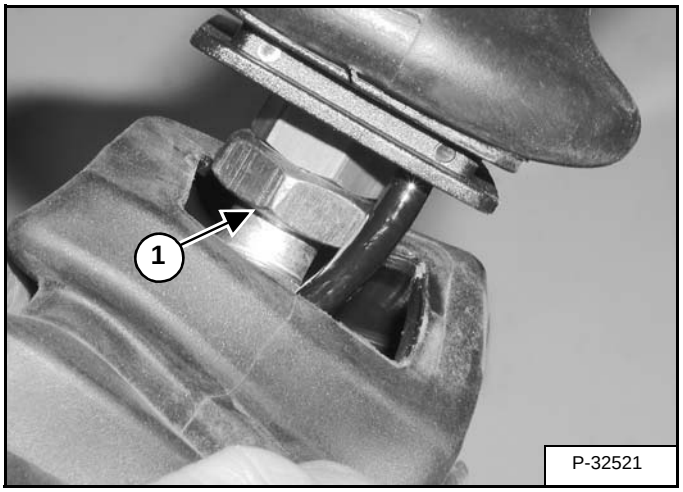
Figure 20-110-29



Pull the boot (Item 1) **[Figure 20-110-29]** down.

Installation: The top of the boot is molded to fit over the flange of the joystick. It has tabs that fit between the handle and joystick flange (Item 2) **[Figure 20-110-29]**. Install the boot properly before installing the console cover.

Figure 20-110-30



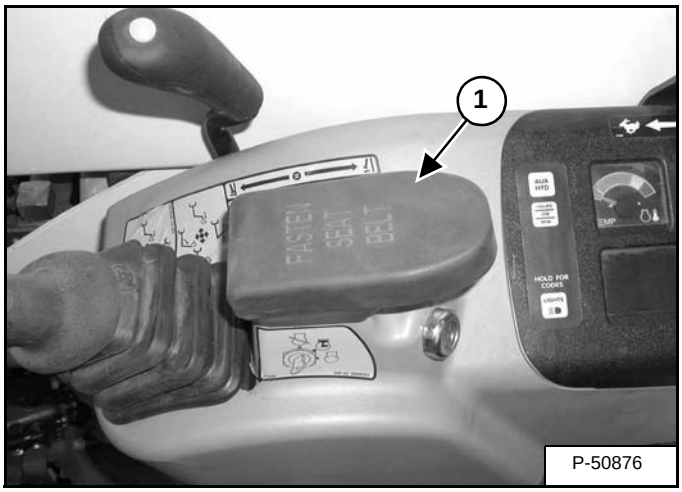
Loosen the nut (Item 1) **[Figure 20-110-30]**.

Remove the handle.

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Joystick Assembly Removal And Installation

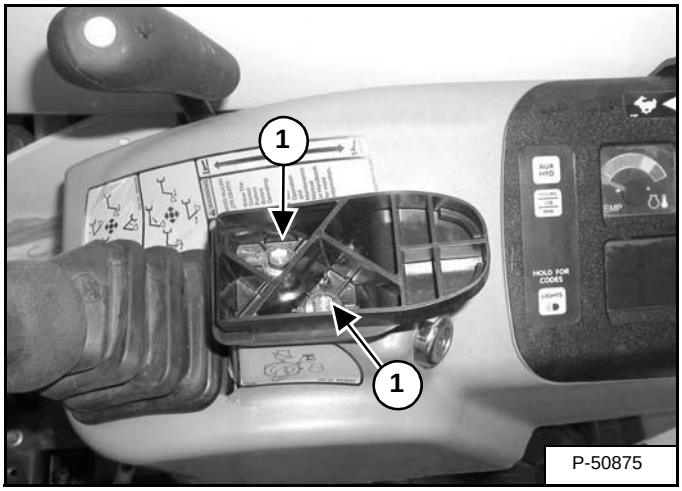
Figure 20-110-31



Remove the cover (Item 1) **[Figure 20-110-31]** from the arm rest.

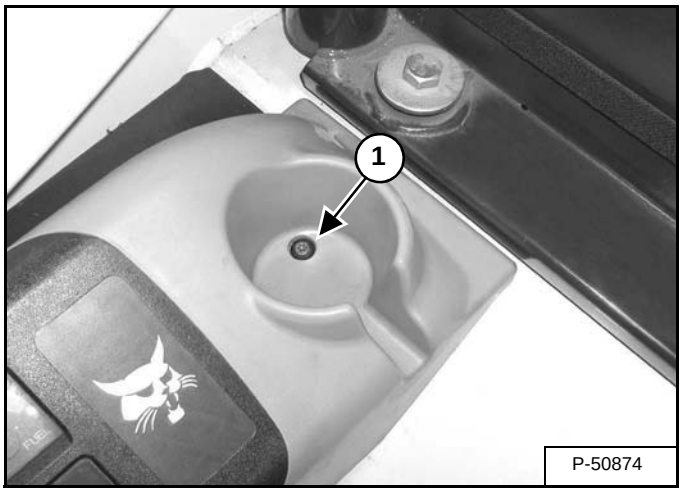
Lift up on the rear of the cover and slide the cover ahead to remove it.

Figure 20-110-32



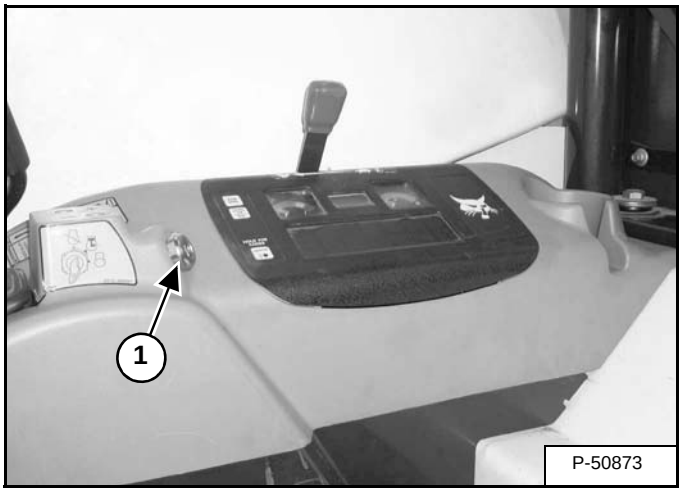
Remove the two bolts (Item 1) **[Figure 20-110-32]** from the arm rest. Remove the arm rest.

Figure 20-110-33



Remove the screw (Item 1) **[Figure 20-110-33]** from the cup holder.

Figure 20-110-34



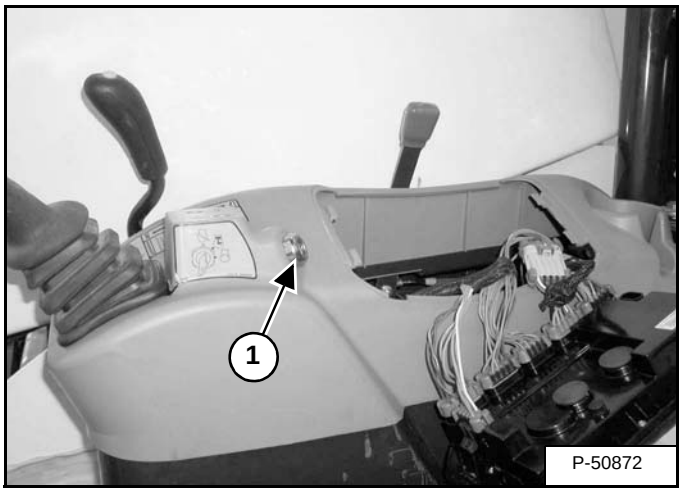
Remove the nut from the key switch (Item 1) **[Figure 20-110-34]** (if equipped). Allow the switch to drop inside the console.

Lift the console up and over the joystick.

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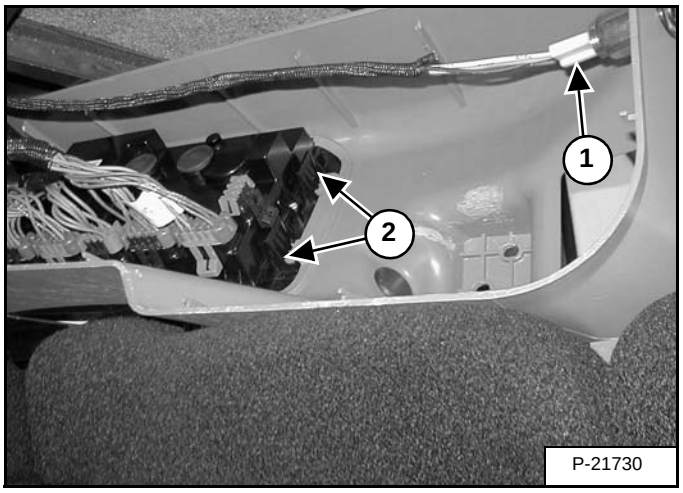
Joystick Assembly Removal And Installation (Cont'd)

Figure 20-110-35



Installation: Install the keyswitch and nut (Item 1) **[Figure 20-110-35]** before installing the controller.

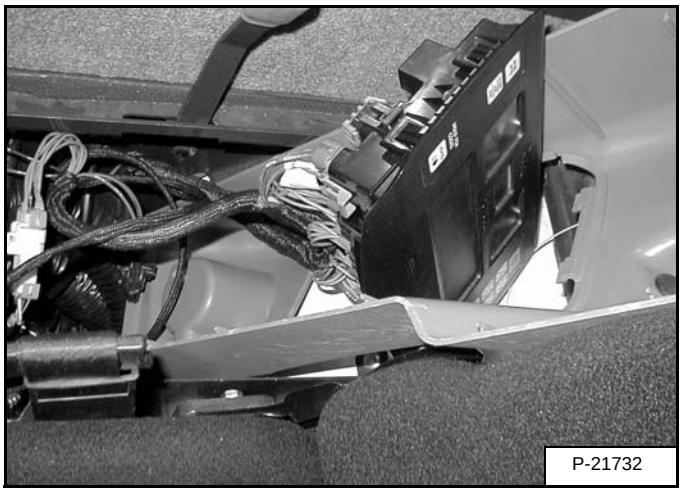
Figure 20-110-36



Disconnect the accessory outlet electrical connector (Item 1) **[Figure 20-110-36]**.

Remove the controller from the console cover by pressing the mounting tabs (Item 2) **[Figure 20-110-36]**.

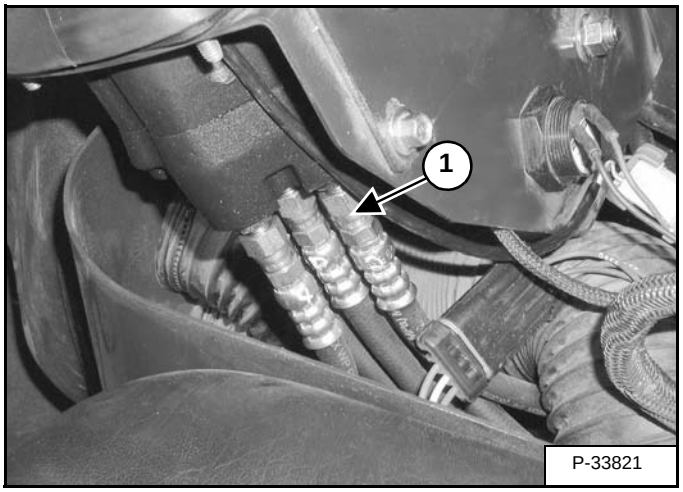
Figure 20-110-37



Turn the controller to allow it to pass through the console cover **[Figure 20-110-37]**.

Remove the console cover.

Figure 20-110-38



Mark the hoses for proper installation. Remove the six hoses (Item 1) **[Figure 20-110-38]** from the housing.

IMPORTANT

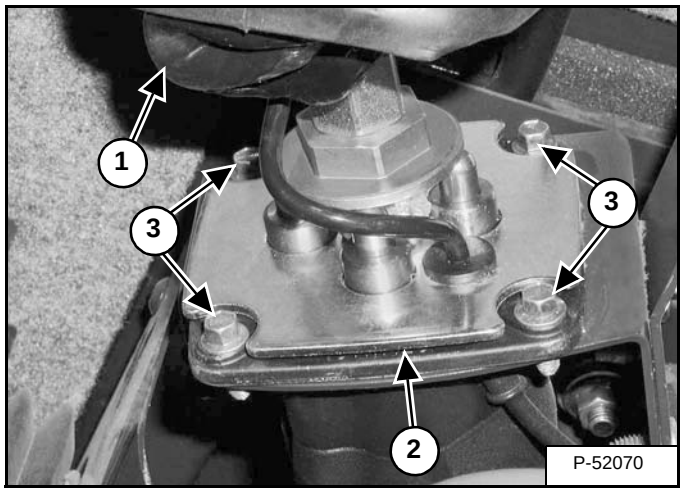
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

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Joystick Assembly Removal And Installation (Cont'd)

Figure 20-110-39

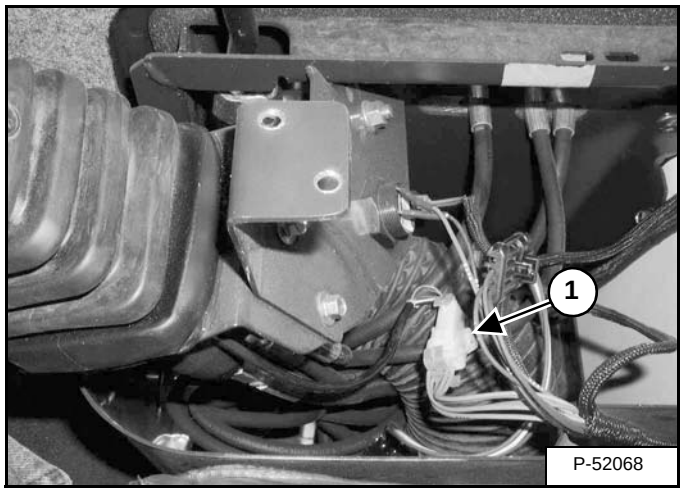


Pull the boot (Item 1) **[Figure 20-110-39]** up.

Installation: The bottom of the boot is molded to fit over the flange of the joystick. It has tabs that fit between the joystick flange (Item 2) **[Figure 20-110-39]** and the mounting plate. Position the boot properly before installing the console cover.

Remove the four mount bolts (Item 3) **[Figure 20-110-39]** from the housing.

Figure 20-110-40



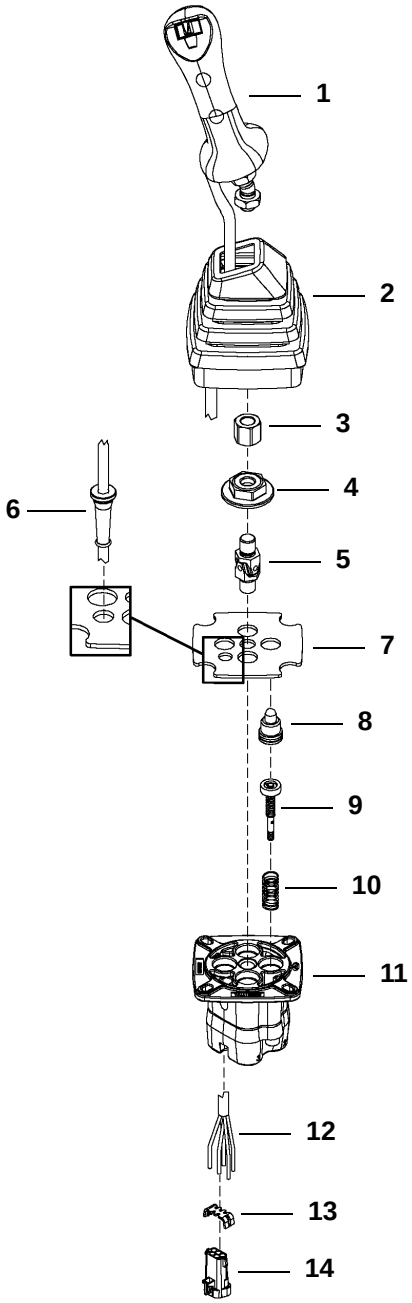
Disconnect the accessory outlet electrical connector (Item 1) **[Figure 20-110-40]**.

Remove the joystick assembly.

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Parts Identification

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



MS-1352

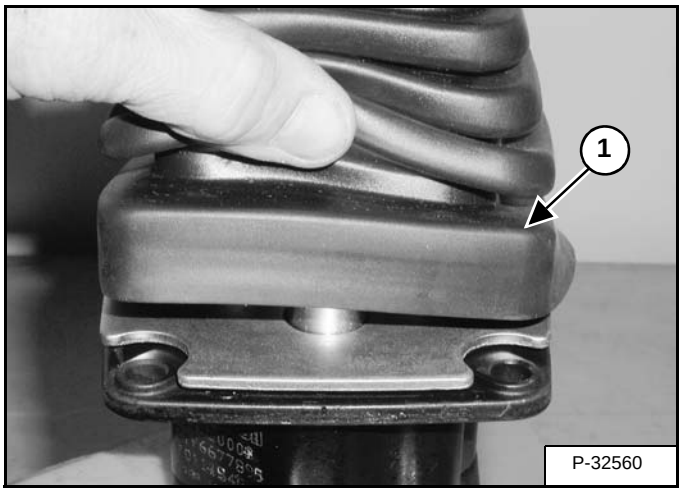
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Disassembly

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

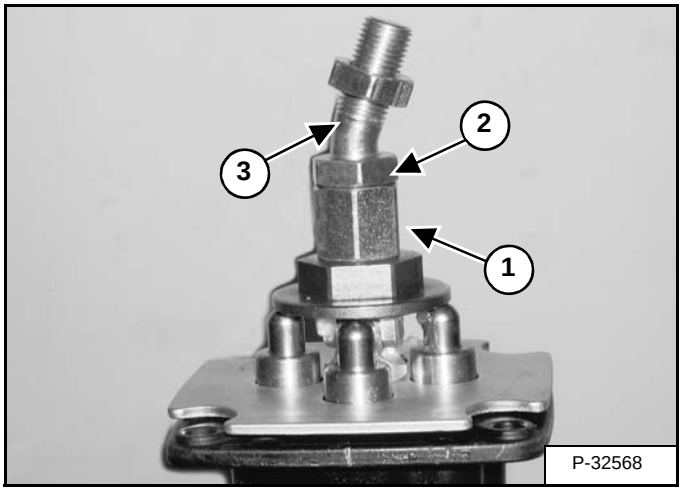
Clean the outside of the control lever before disassembly.

Figure 20-110-41



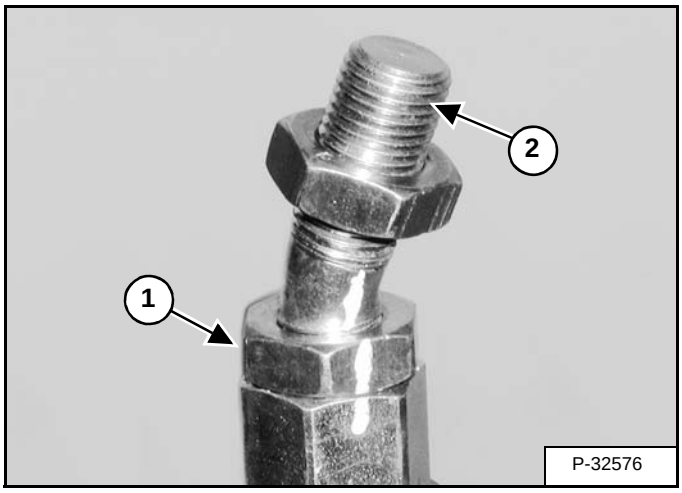
Remove the boot (Item 1) **[Figure 20-110-41]**.

Figure 20-110-42



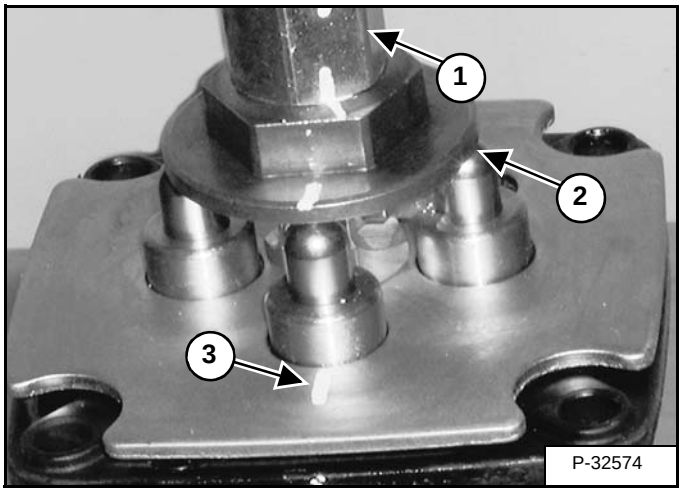
Mark the coupler (Item 1), nut (Item 2), and connector (Item 3) **[Figure 20-110-42]** for correct assembly.

Figure 20-110-43



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-110-43]**.

Figure 20-110-44

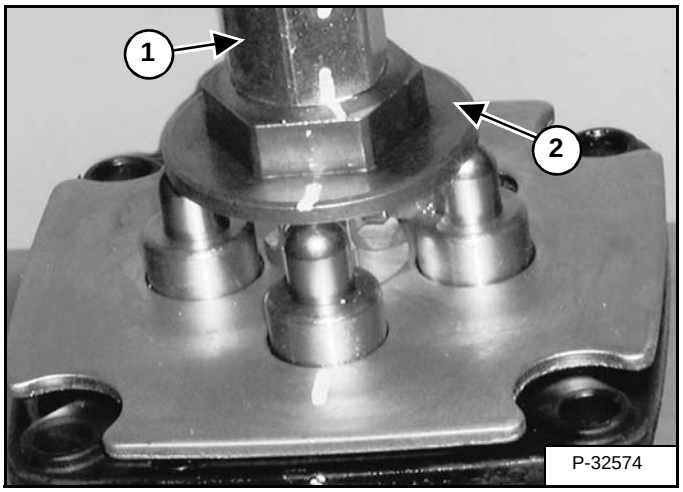


Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-110-44]** for ease of assembly.

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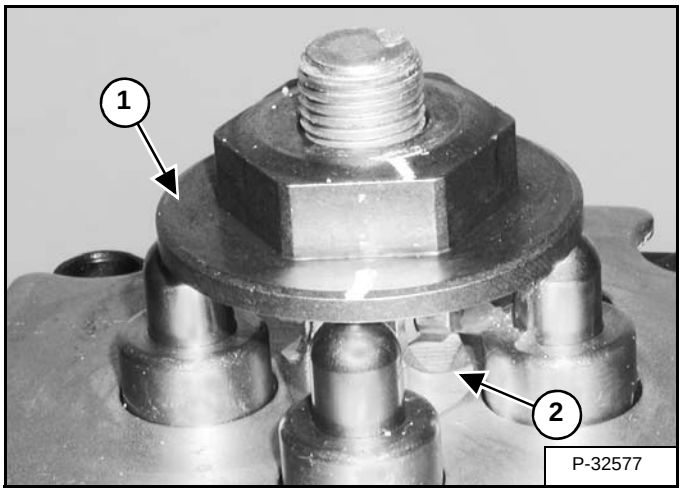
Disassembly (Cont'd)

Figure 20-110-45



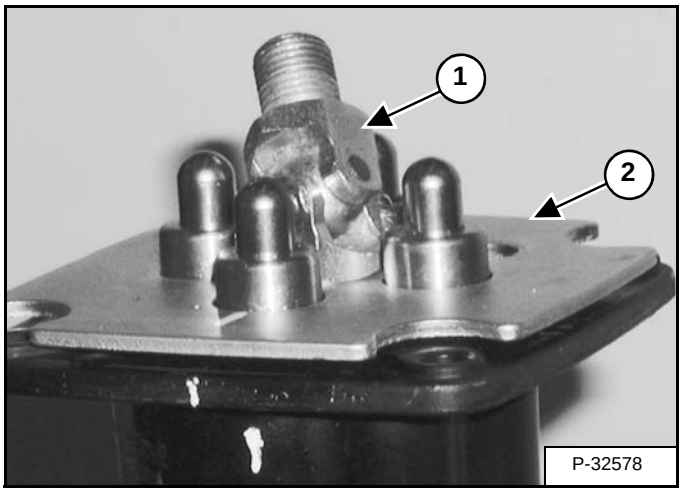
Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-110-45]**.

Figure 20-110-46



Remove the control plate (Item 1) from the U-Joint (Item 2) **[Figure 20-110-46]**.

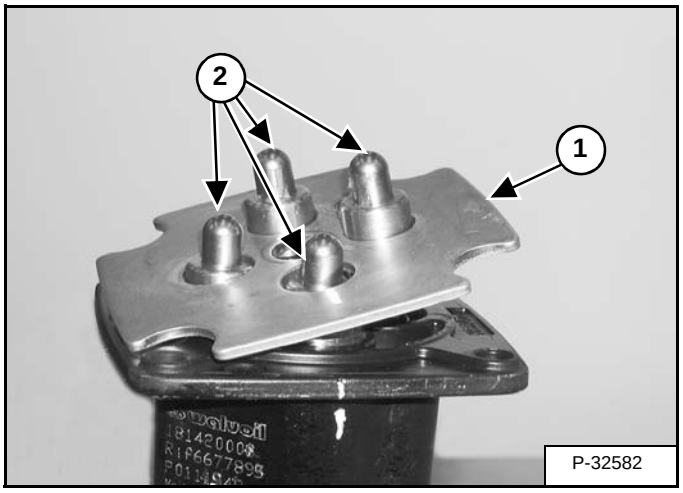
Figure 20-110-47



Mark the plate and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-110-47]**.

NOTE: The plate (Item 2) [Figure 20-110-47] is spring loaded and will come up as the U-joint is removed.

Figure 20-110-48



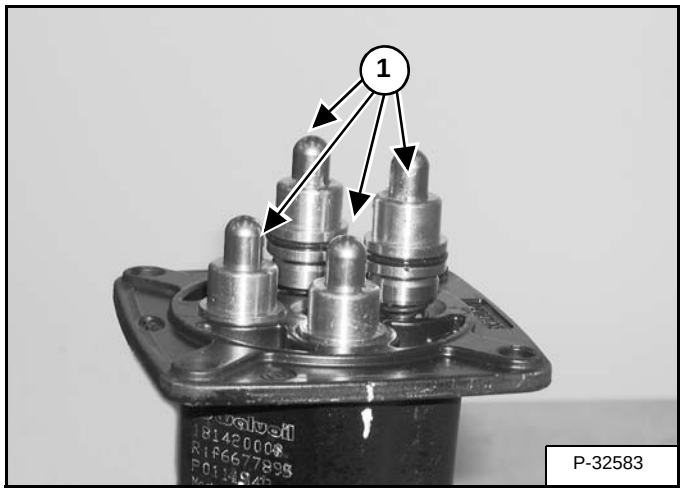
Remove the plate (Item 1) **[Figure 20-110-48]**.

NOTE: Use care while removing the plate. The plungers (Item 2) [Figure 20-110-48] are spring loaded.

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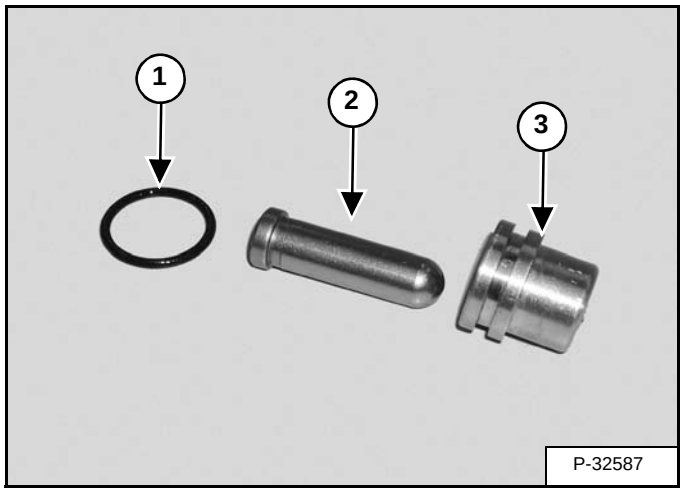
Disassembly (Cont'd)

Figure 20-110-49



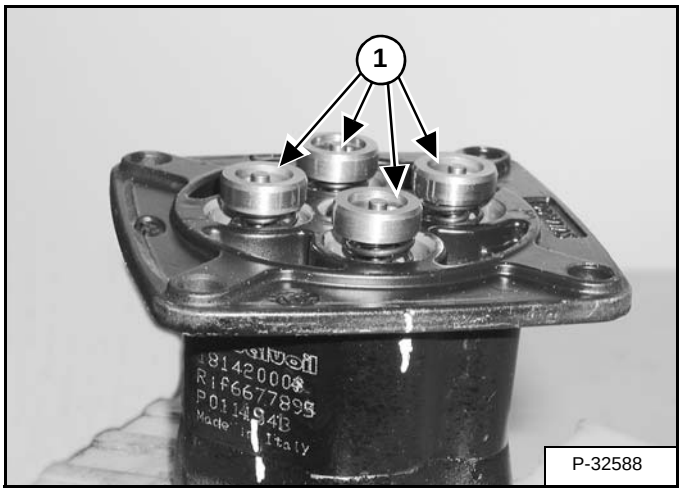
Remove the plunger assemblies (Item 1) **[Figure 20-110-49]**.

Figure 20-110-50



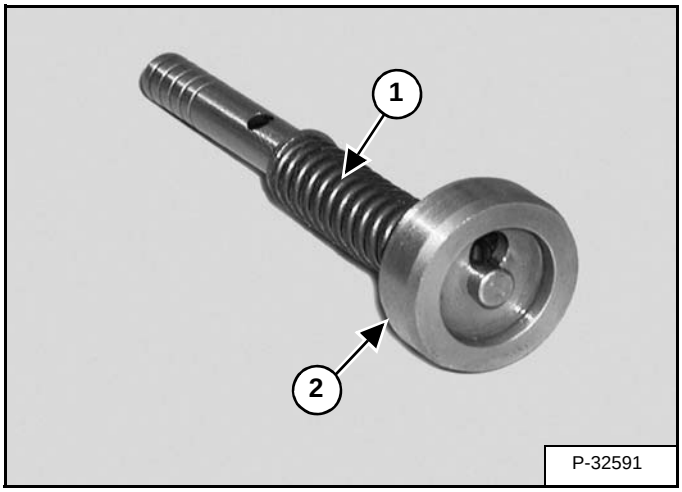
Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-110-50]**.

Figure 20-110-51



Remove the spool assemblies (Item 1) **[Figure 20-110-51]**.

Figure 20-110-52

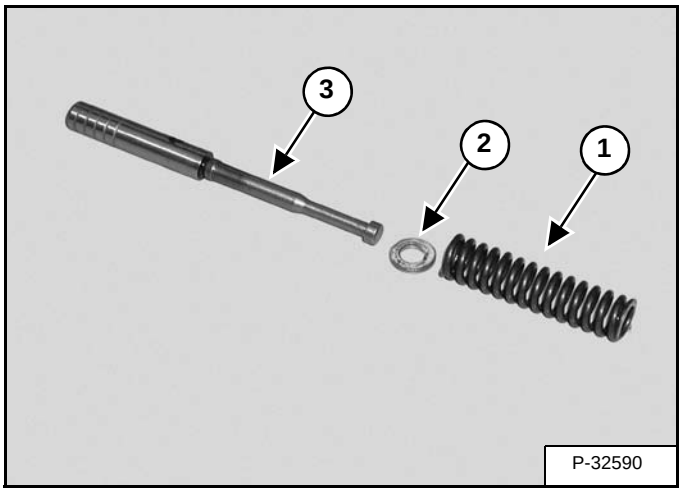


Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-110-52]**.

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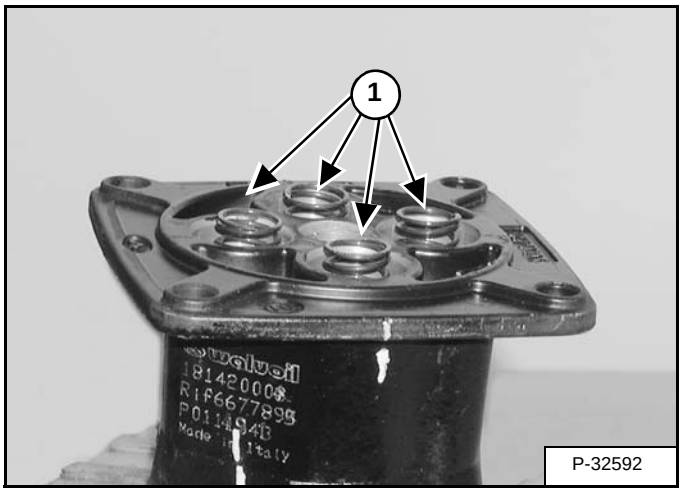
Disassembly (Cont'd)

Figure 20-110-53



Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-110-53]**.

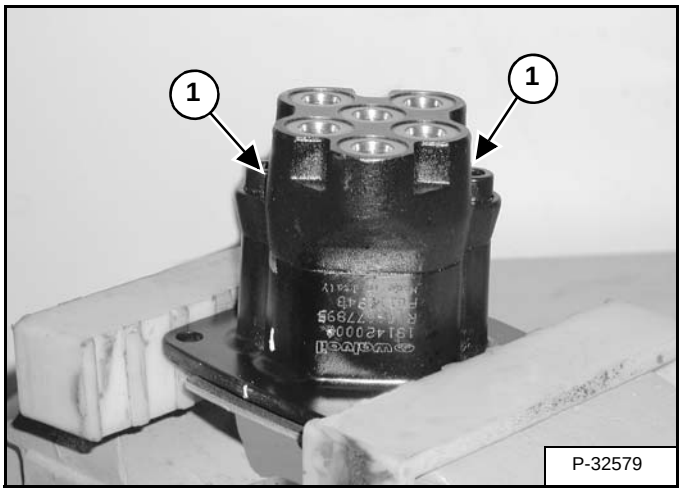
Figure 20-110-54



Remove the springs (Item 1) **[Figure 20-110-54]** from the housing.

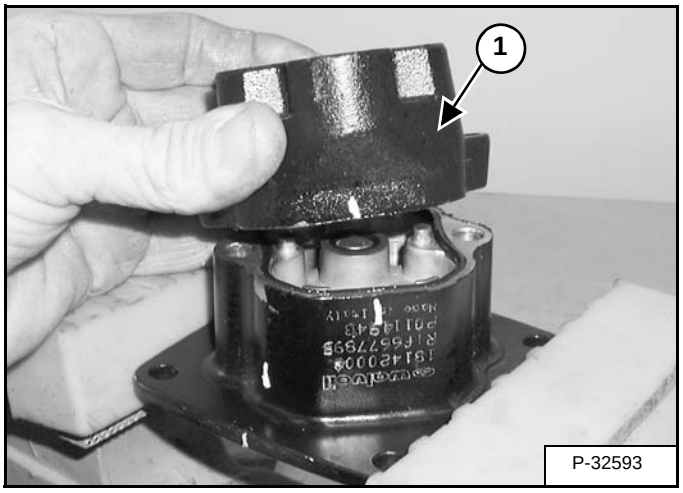
Clamp the housing in a vise that is equipped with padded jaws.

Figure 20-110-55



Remove the two bolts (Item 1) **[Figure 20-110-55]**.

Figure 20-110-56

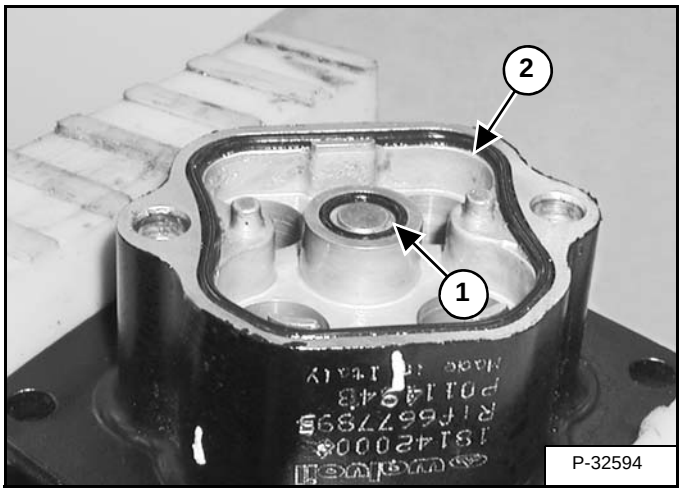


Remove the end cap (Item 1) **[Figure 20-110-56]**.

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Disassembly (Cont'd)

Figure 20-110-57



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-110-57]**.

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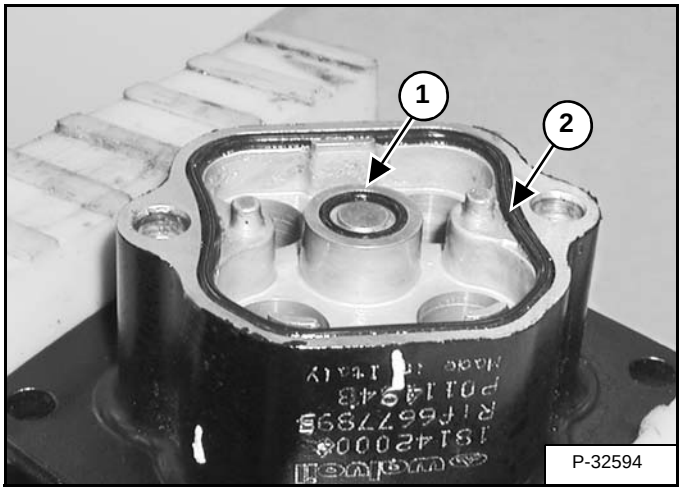
Assembly

Clean all parts in solvent and dry with compressed air.

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

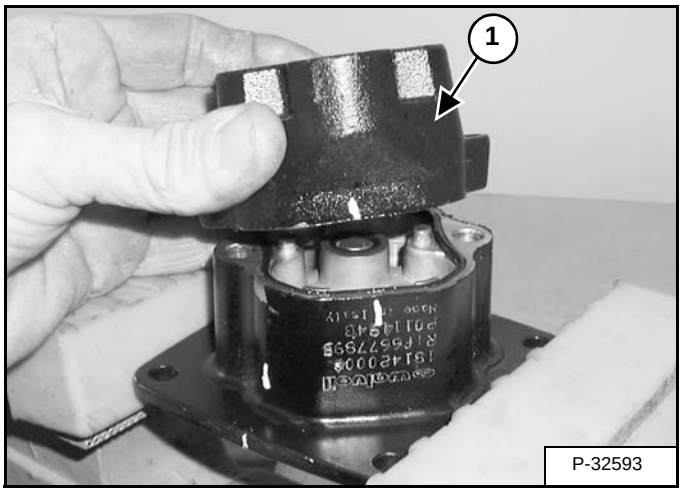
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-110-58



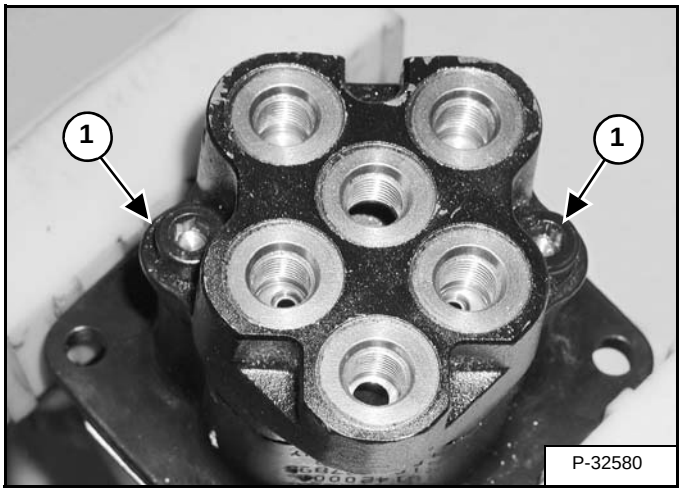
Clamp the housing in a vise equipped with padded jaws. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-110-58]**.

Figure 20-110-59



Install the end cap (Item 1) **[Figure 20-110-59]**.

Figure 20-110-60



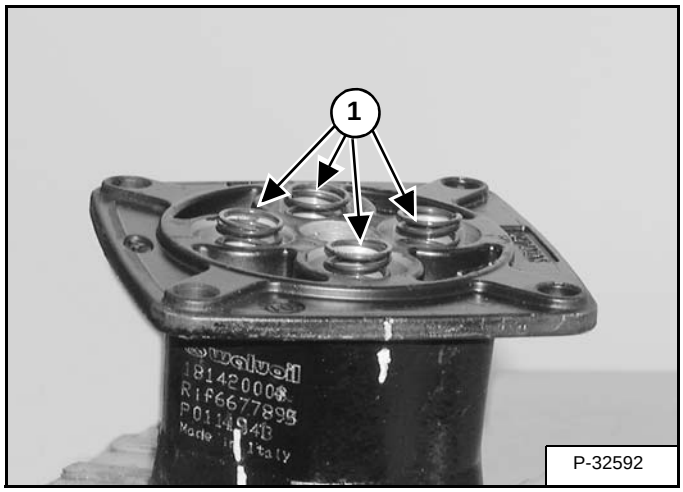
Install the two bolts (Item 1) **[Figure 20-110-60]**.

Turn the housing over.

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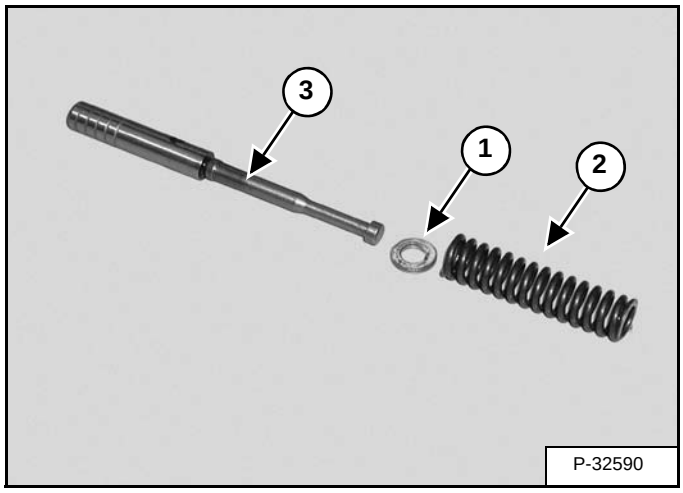
Assembly (Cont'd)

Figure 20-110-61



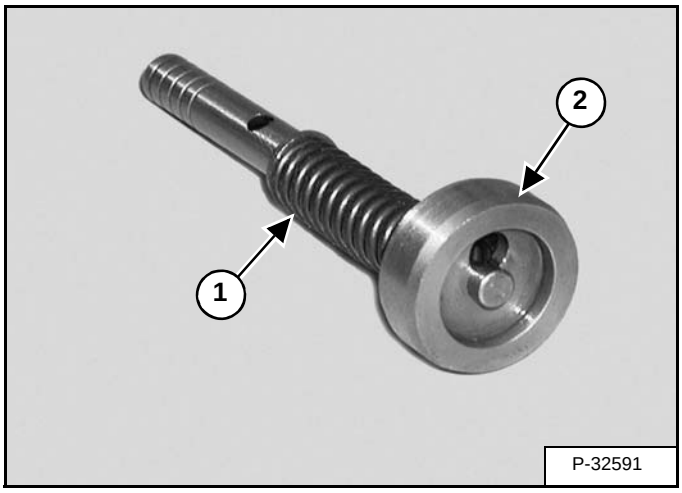
Install the springs (Item 1) **[Figure 20-110-61]**.

Figure 20-110-62



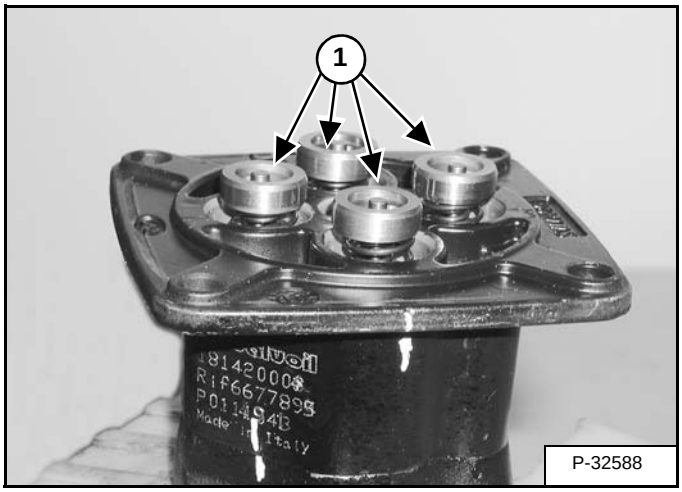
Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-110-62]**.

Figure 20-110-63



Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-110-63]**.

Figure 20-110-64

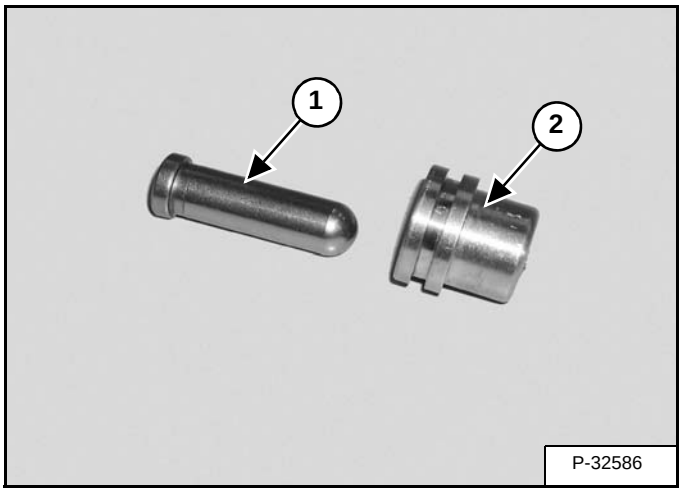


Install the spool assemblies (Item 1) **[Figure 20-110-64]** into the housing.

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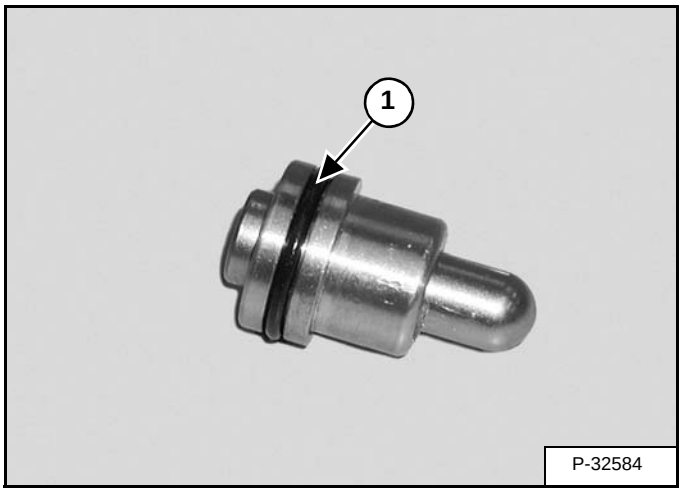
Assembly (Cont'd)

Figure 20-110-65



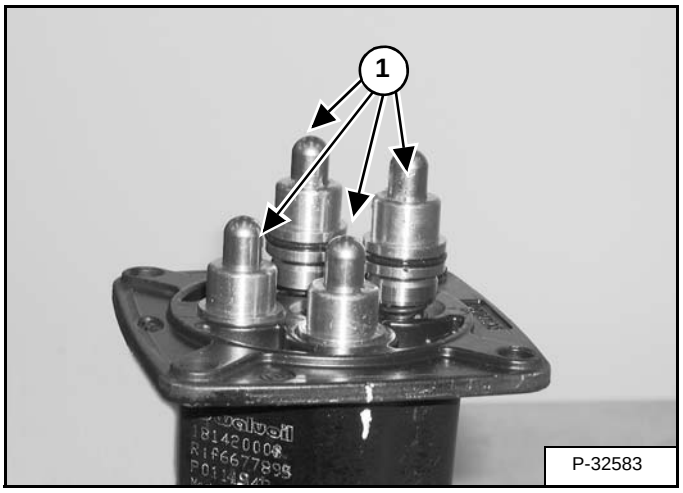
Install the plunger (Item 1) into the bushing (Item 2) **[Figure 20-110-65]**.

Figure 20-110-66



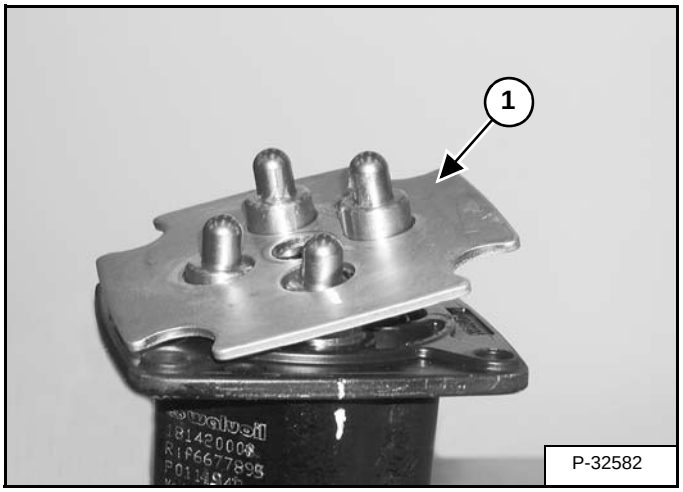
Install the O-ring (Item 1) **[Figure 20-110-66]** on the bushing.

Figure 20-110-67



Install the plunger assemblies (Item 1) **[Figure 20-110-67]** into the housing.

Figure 20-110-68



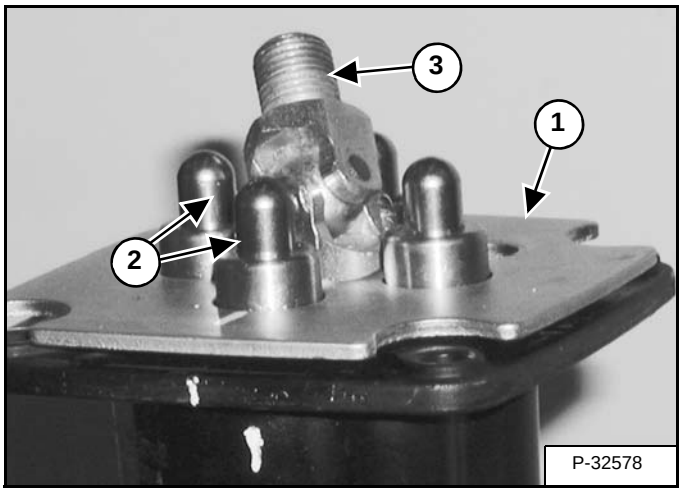
Install the plate (Item 1) **[Figure 20-110-68]**.

NOTE: Spring pressure can dislodge the plunger assemblies until the plate is secured in place.

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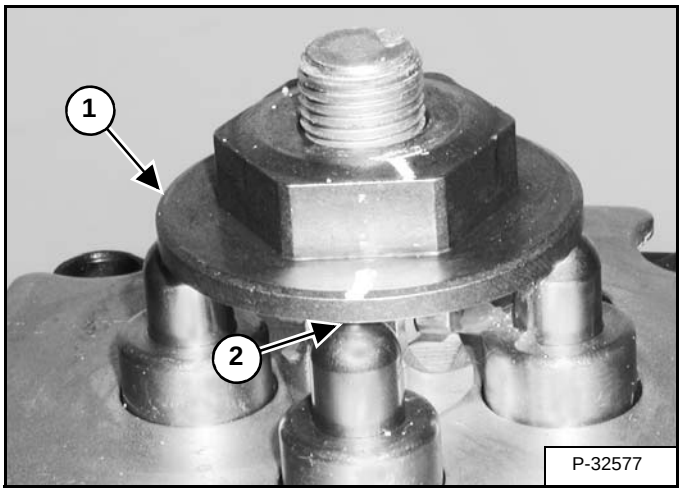
Assembly (Cont'd)

Figure 20-110-69



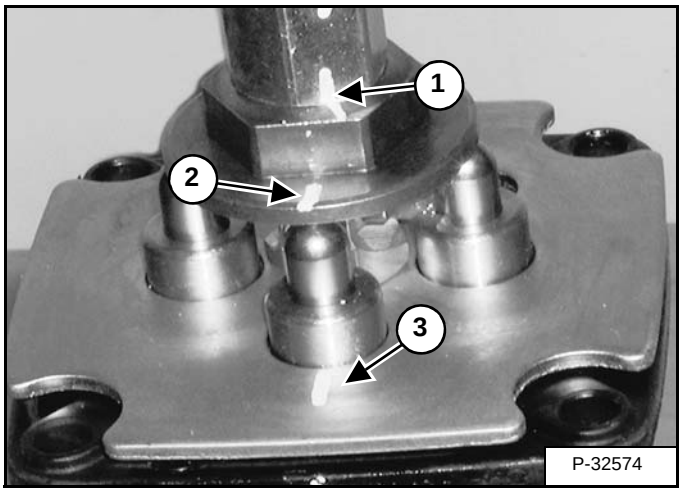
Press down on the plate (Item 1) keeping the plunger assemblies (Item 2) fully seated and install the U-joint (Item 3) **[Figure 20-110-69]**.

Figure 20-110-70



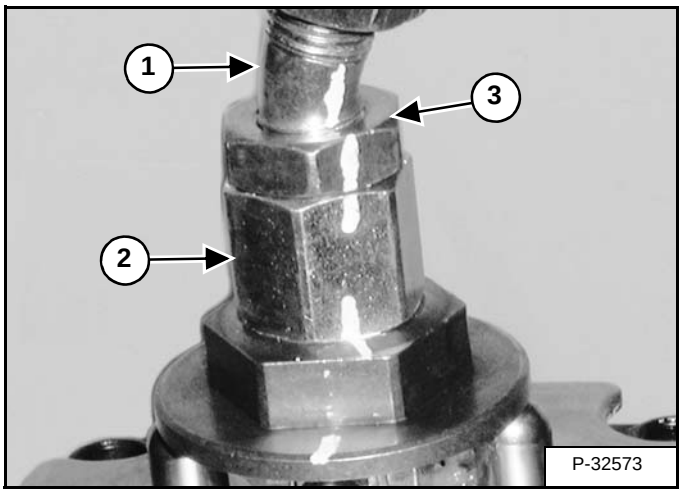
Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-110-70]**.

Figure 20-110-71



Align the coupler (Item 1) with the control plate (Item 2) and plate (Item 3) **[Figure 20-110-71]**. Tighten the coupler.

Figure 20-110-72



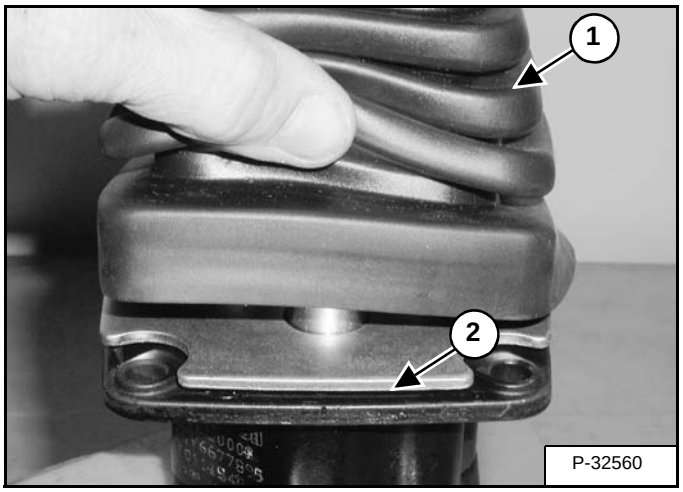
Install the connector (Item 1) **[Figure 20-110-72]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-110-72]**.

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Assembly (Cont'd)

Figure 20-110-73



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

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

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LEFT CONTROL LEVER (JOYSTICK)

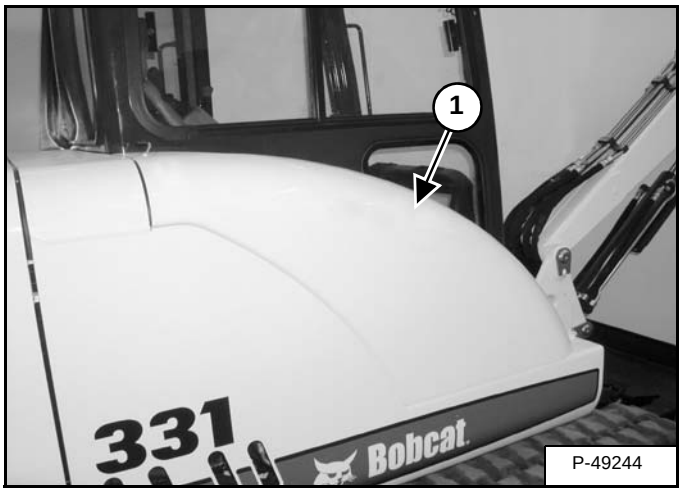
Testing

The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

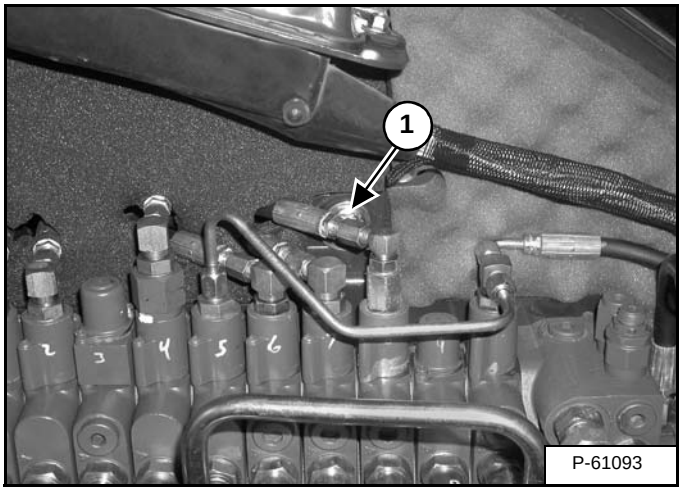
Stop the engine.

Figure 20-111-1



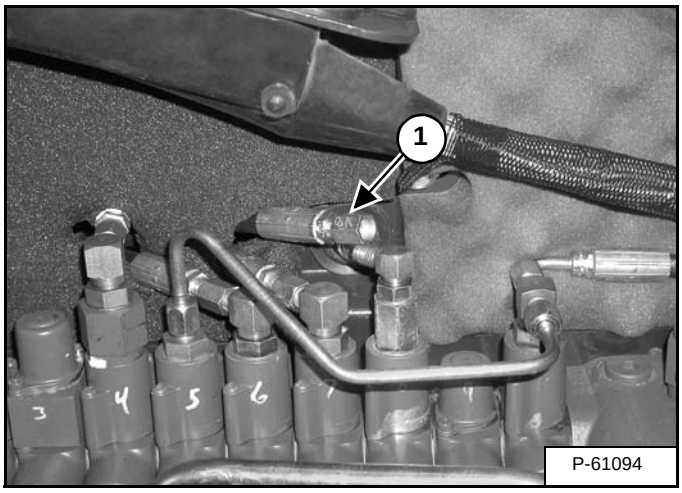
Open the right side cover (Item 1) **[Figure 20-111-1]**.

Figure 20-111-2



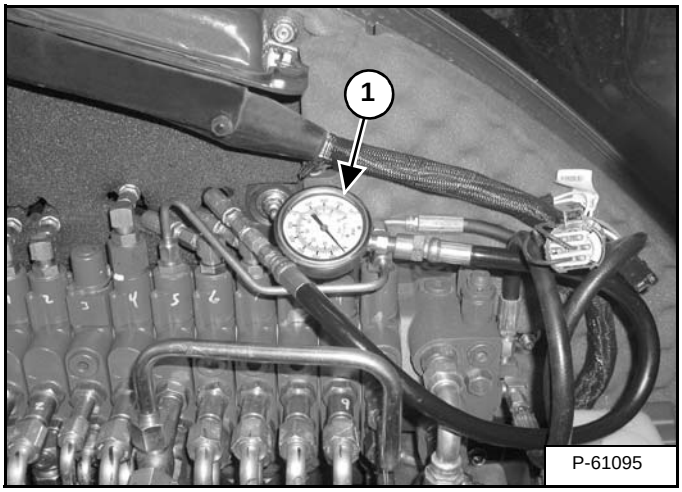
At the control valve assembly (Item 1) **[Figure 20-111-2]**, find the pilot line of the control lever (joystick) that is to be checked. (Boom, Arm, Slew, Bucket)

Figure 20-111-3



Disconnect the hydraulic hose (Item 1) **[Figure 20-111-3]** from the control valve.

Figure 20-111-4



From the test kit install a 500 PSI (35 bar) gauge (Item 1) **[Figure 20-111-4]** on the pilot line. Start the excavator, and warm the hydraulic oil to operating temperature.

Engage the circuit to be tested. Record the operating pressure.

The operating pressure should be approximately 435 PSI (30 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.)

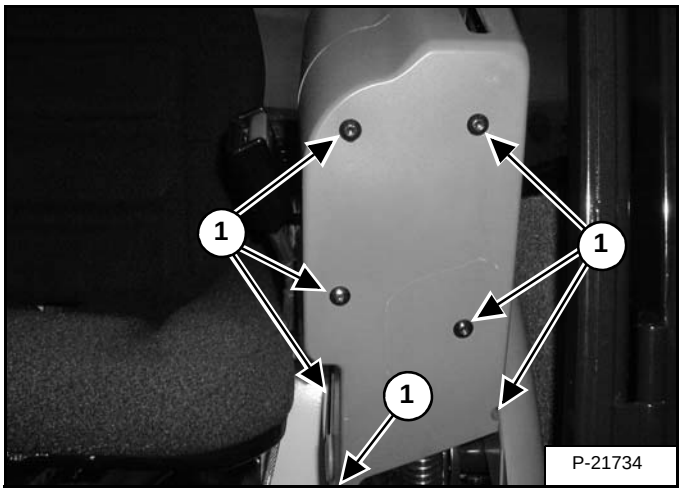
If the pressure is still incorrect replace the pressure reducing valve. (See Testing And Adjusting The Pressure Reducing Valve on Page 20-33-1.)

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LEFT CONTROL LEVER (JOYSTICK) (CONT'D)

Handle Removal And Installation

Figure 20-111-5

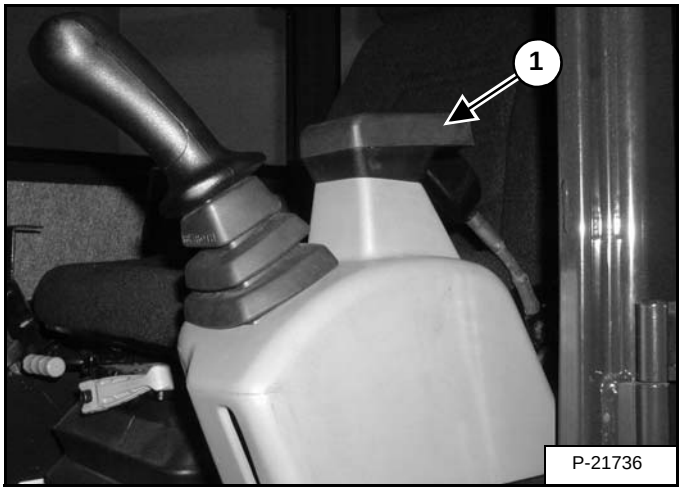


Remove the seven mounting bolts (Item 1) **[Figure 20-111-5]** from the lower half of the operator console.

Remove the bottom of the console.

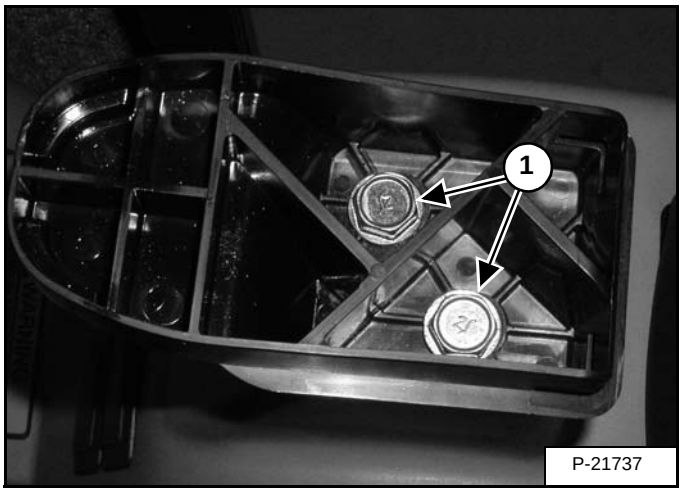
Lower the console.

Figure 20-111-6



Remove the cover (Item 1) **[Figure 20-111-6]** from the arm rest.

Figure 20-111-7

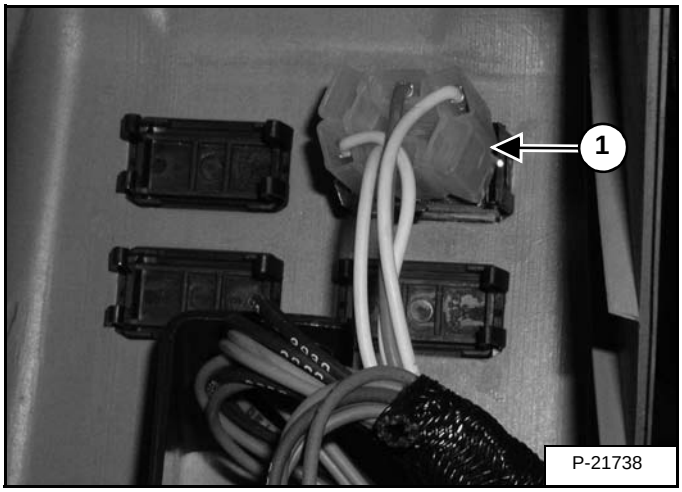


Remove the bolts (Item 1) **[Figure 20-111-7]** from the arm rest.

Remove the arm rest.

Raise the top of the console cover.

Figure 20-111-8



Disconnect the wire harness (Item 1) **[Figure 20-111-8]**.

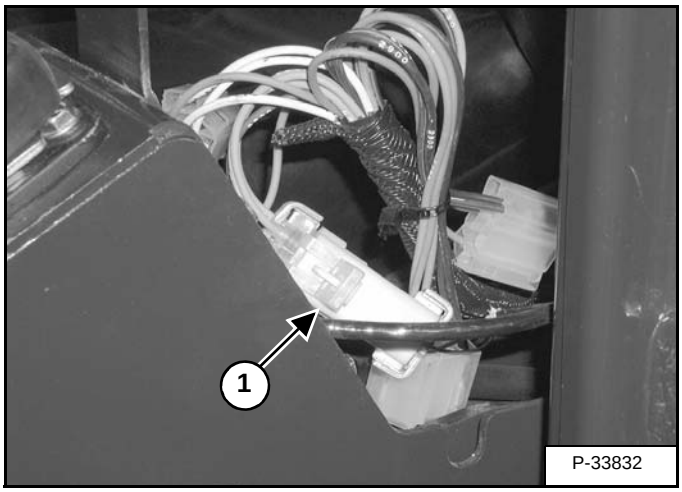
NOTE: These connectors are keyed so they can be plugged in only one way.

Remove the console cover.

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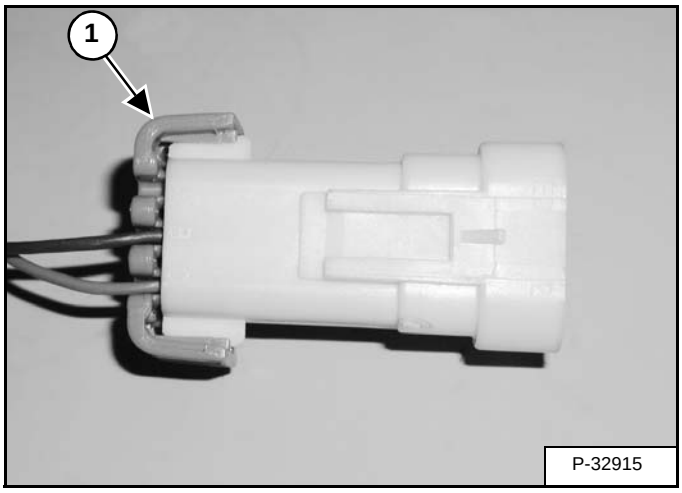
Handle Removal And Installation (Cont'd)

Figure 20-111-9



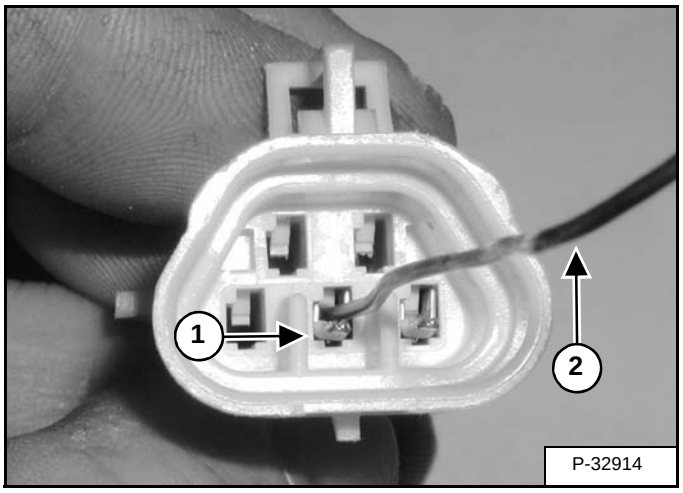
Disconnect the wire harness (Item 1) **[Figure 20-111-9]**.

Figure 20-111-10



Remove the lock (Item 1) **[Figure 20-111-10]** from the electrical connector.

Figure 20-111-11



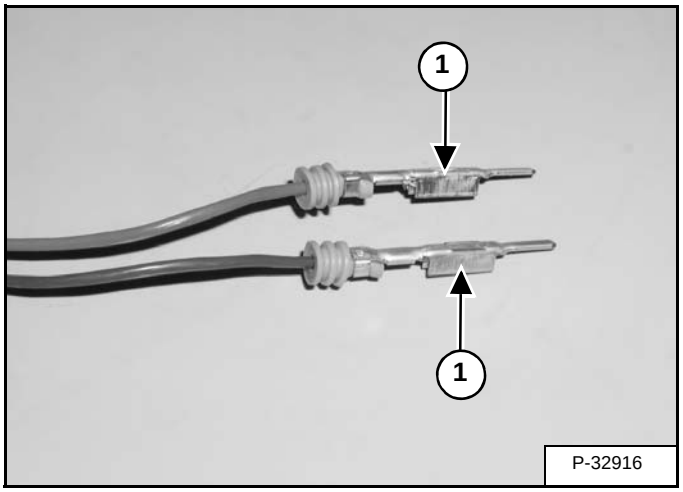
Using a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 20-111-11]**.

Carefully remove the individual wires from the back of the electrical connector.

Remove the control handle (joystick) assembly from the excavator.

Installation: Use a small piece of wire and rebend the tab on each wire before installing it in the electrical connector.

Figure 20-111-12



Installation: The wires **[Figure 20-111-12]** must be installed in the proper locations in the wire connector, listed below.

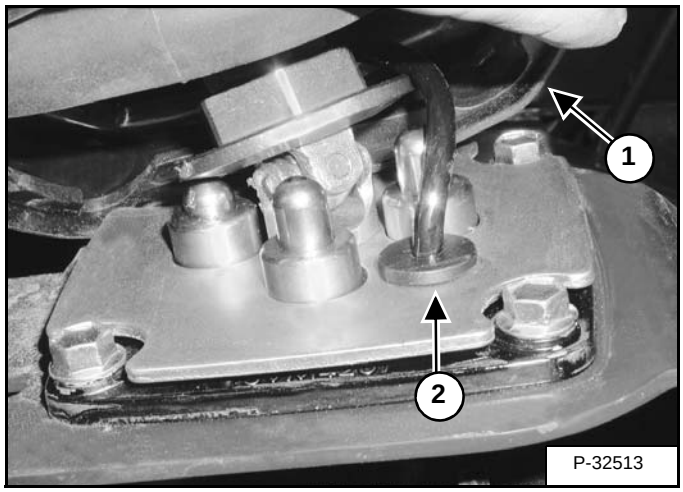
C Red
D Black

Check each wire to be certain the tab (Item 1) **[Figure 20-111-12]** locks into position.

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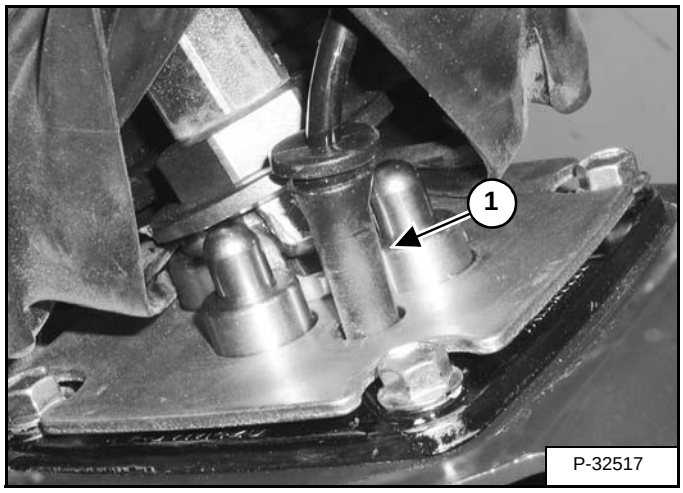
Handle Removal And Installation (Cont'd)

Figure 20-111-13



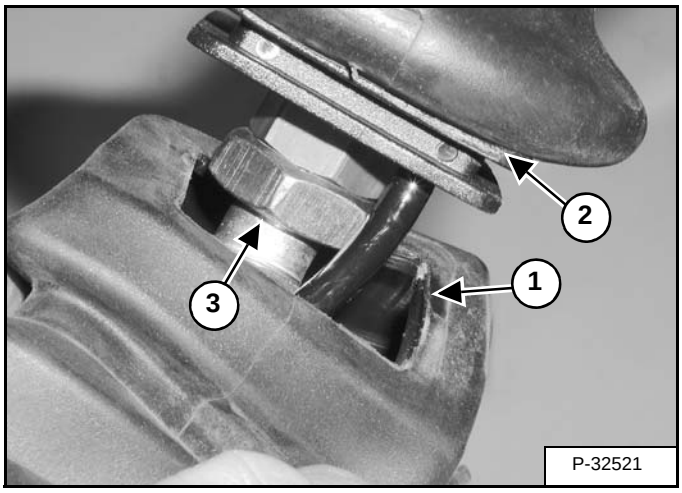
Raise the boot (Item 1) and pull the grommet (Item 2) up **[Figure 20-111-13]**.

Figure 20-111-14



Remove the grommet and wire (Item 1) **[Figure 20-111-14]** from the mount plate.

Figure 20-111-15



Remove the boot (Item 1) **[Figure 20-111-15]** from the joystick handle.

Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-111-15]**.

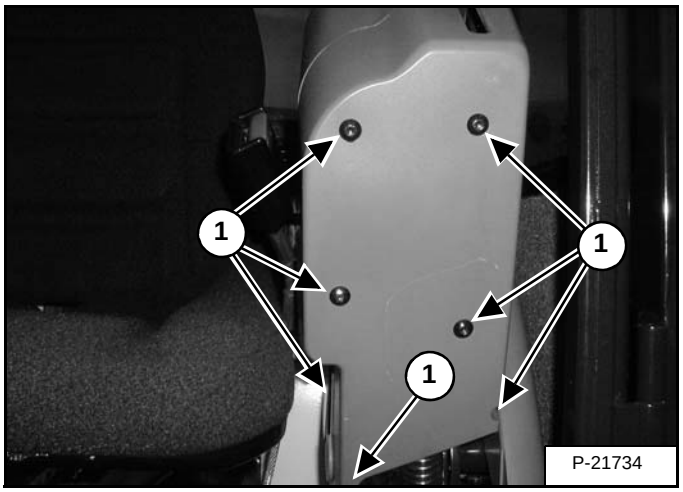
Hold the boot down and loosen the nut (Item 3) **[Figure 20-111-15]**.

Remove the handle.

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Joystick Assembly Removal And Installation

Figure 20-111-16

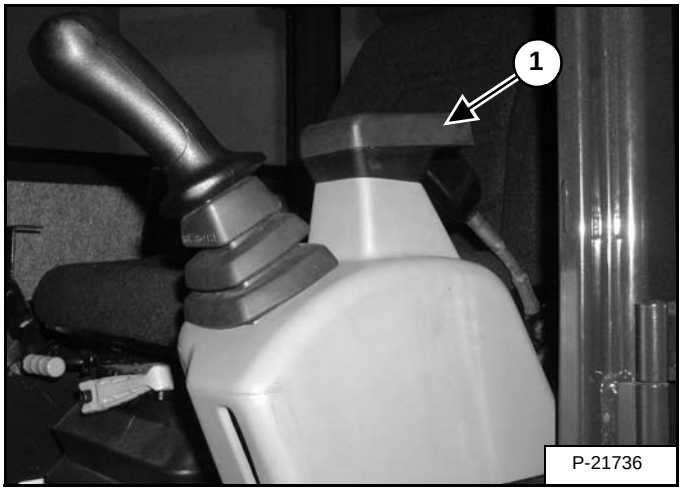


Remove the seven mounting bolts (Item 1) **[Figure 20-111-16]** from the bottom of the operator console.

Remove the bottom of the console cover.

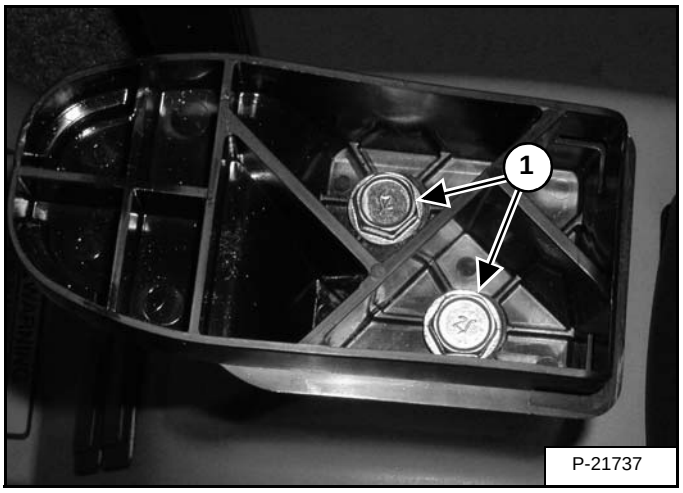
Lower the console.

Figure 20-111-17



Remove the cover (Item 1) **[Figure 20-111-17]** from the arm rest.

Figure 20-111-18

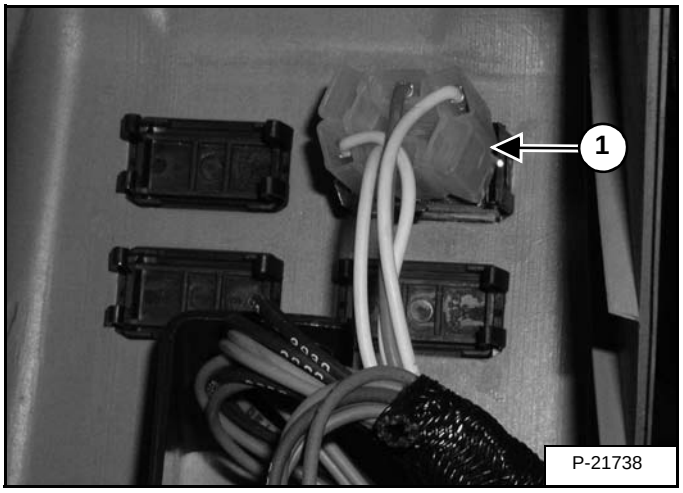


Remove the bolts (Item 1) **[Figure 20-111-18]** from the arm rest.

Remove the arm rest.

Raise the top of the console cover.

Figure 20-111-19



Disconnect the wire harness (Item 1) **[Figure 20-111-19]**.

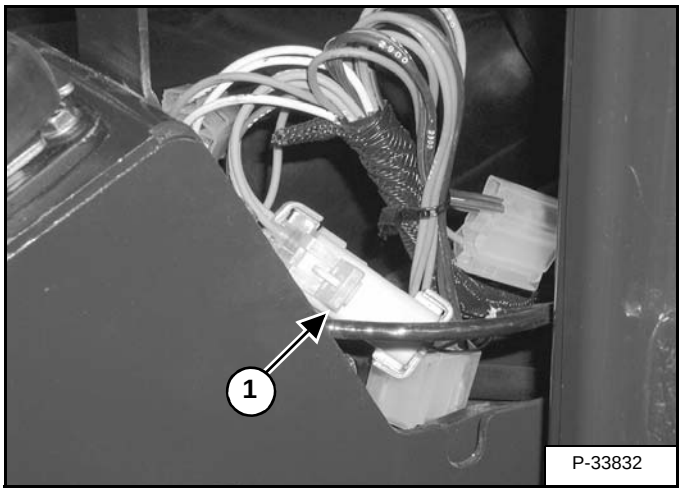
NOTE: These connectors are keyed so they can be plugged in only one way.

Remove the console cover.

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Joystick Assembly Removal And Installation (Cont'd)

Figure 20-111-20



Disconnect the wire harness (Item 1) **[Figure 20-111-20]**.

Figure 20-111-21



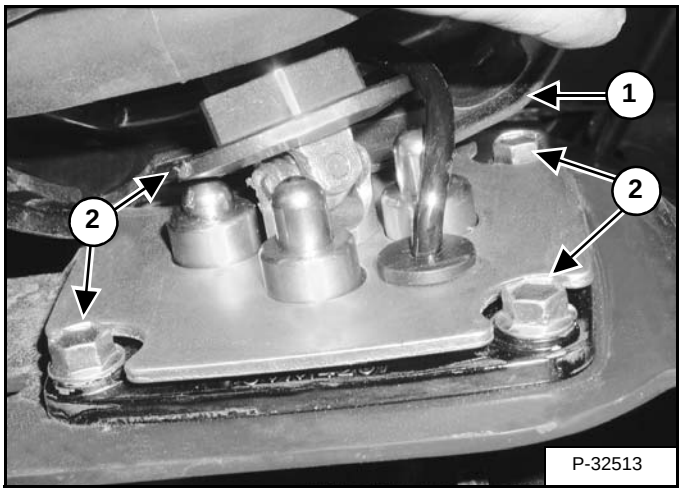
Mark and remove the hoses **[Figure 20-111-21]**.

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 20-111-22



Pull the boot (Item 1) **[Figure 20-111-22]** up from the mounting plate.

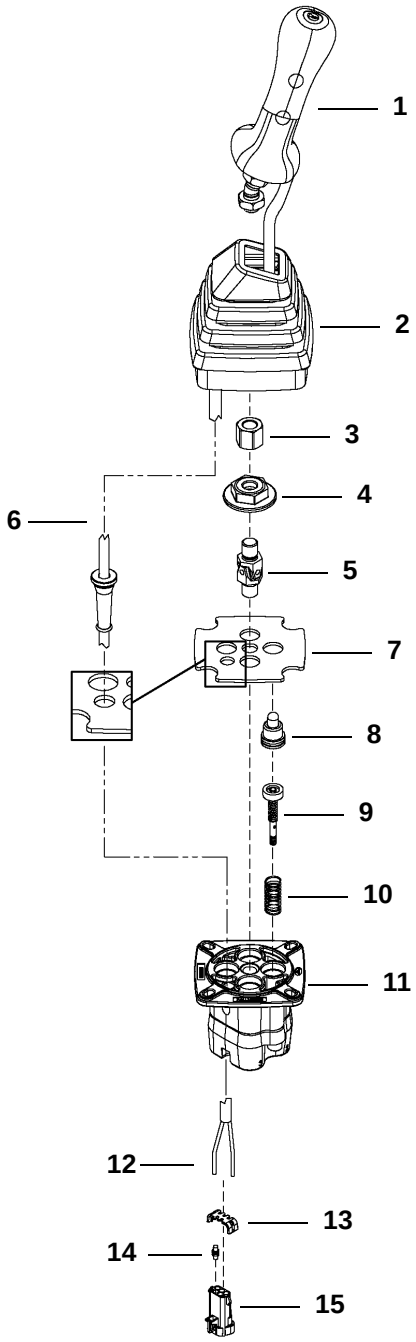
Remove the bolts (Item 2) **[Figure 20-111-22]** from the mounting plate.

Remove the joystick assembly.

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Parts Identification

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



MS1354

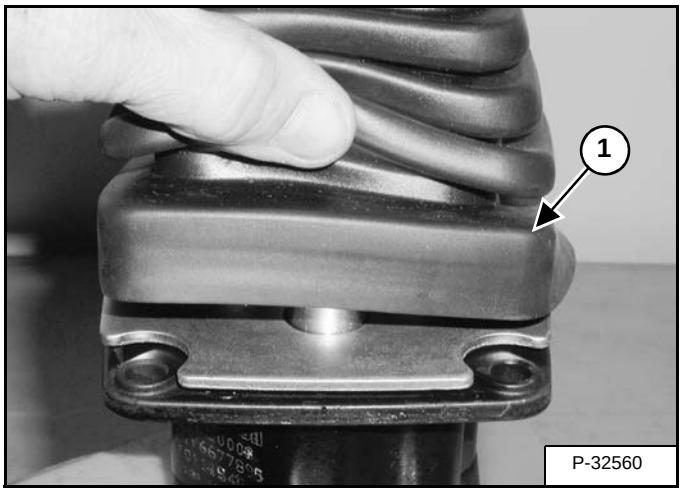
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Disassembly

Remove the left handle. (See Handle Removal And Installation on Page 20-111-2.)

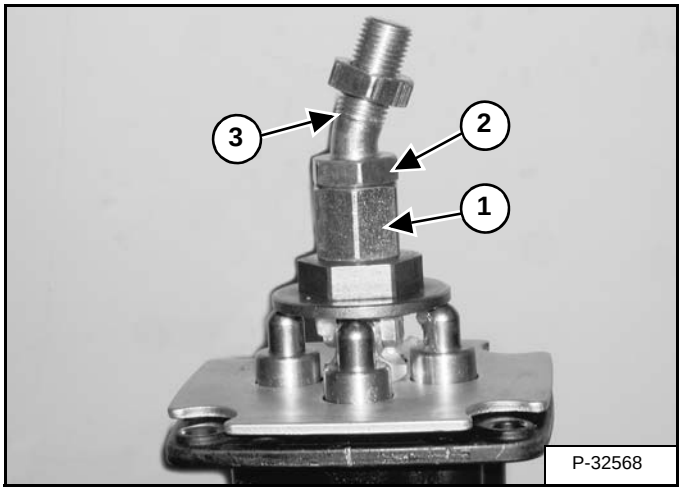
Clean the outside of the control lever before disassembly.

Figure 20-111-23



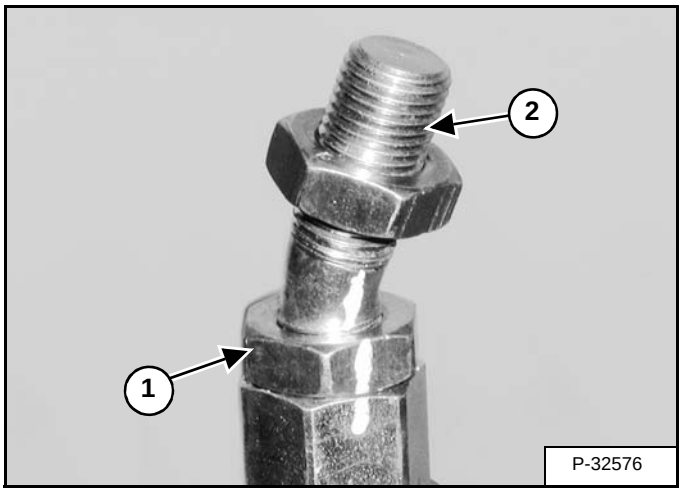
Remove the boot (Item 1) **[Figure 20-111-23]**.

Figure 20-111-24



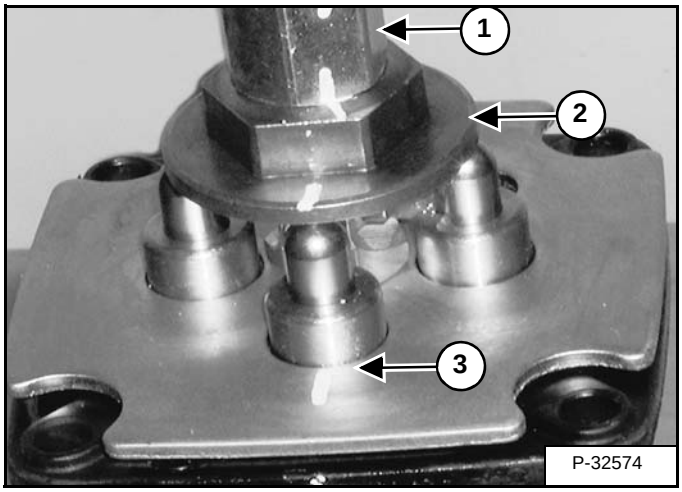
Mark the coupler (Item 1), nut (Item 2), and connector (Item 3) **[Figure 20-111-24]** for ease of assembly.

Figure 20-111-25



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-111-25]**.

Figure 20-111-26

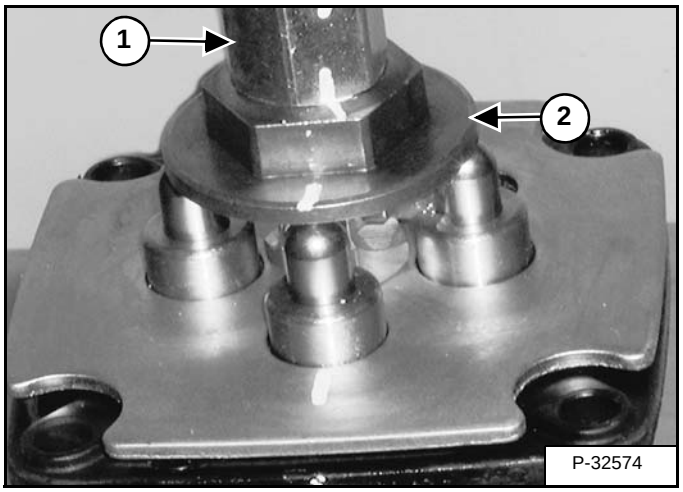


Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-111-26]** for ease of assembly.

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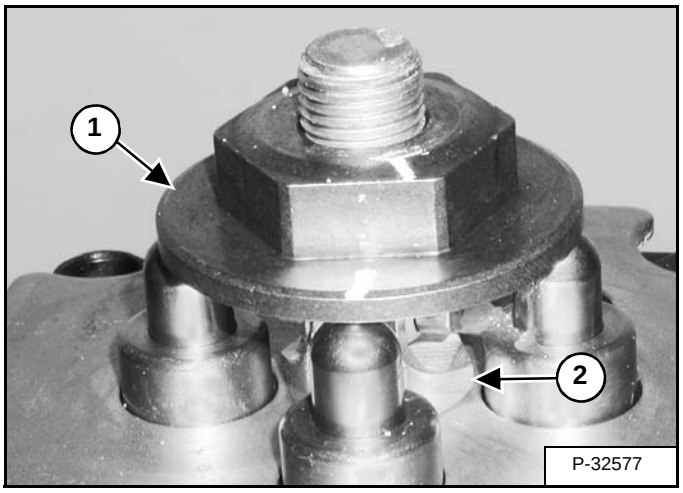
Disassembly (Cont'd)

Figure 20-111-27



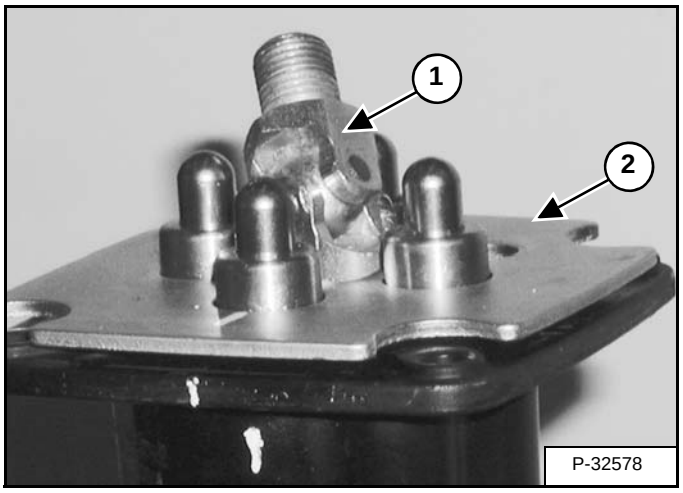
Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-111-27]**.

Figure 20-111-28



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

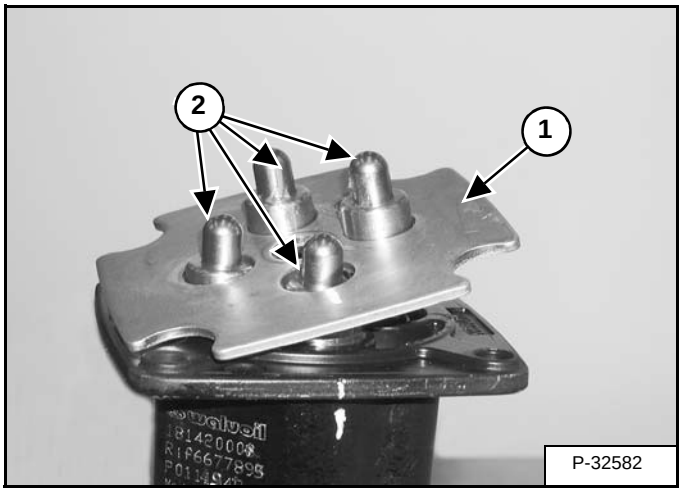
Figure 20-111-29



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

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

Figure 20-111-30



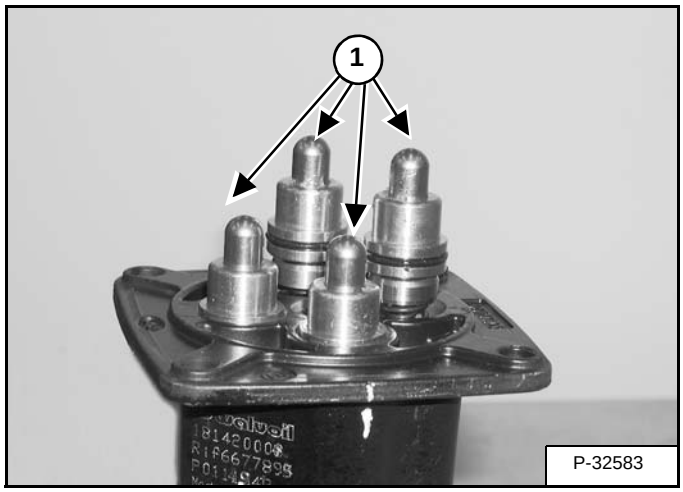
Remove the plate (Item 1) **[Figure 20-111-30]**.

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

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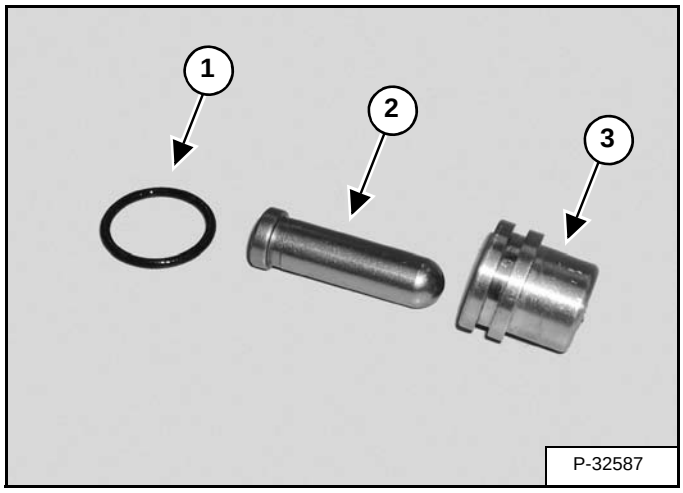
Disassembly (Cont'd)

Figure 20-111-31



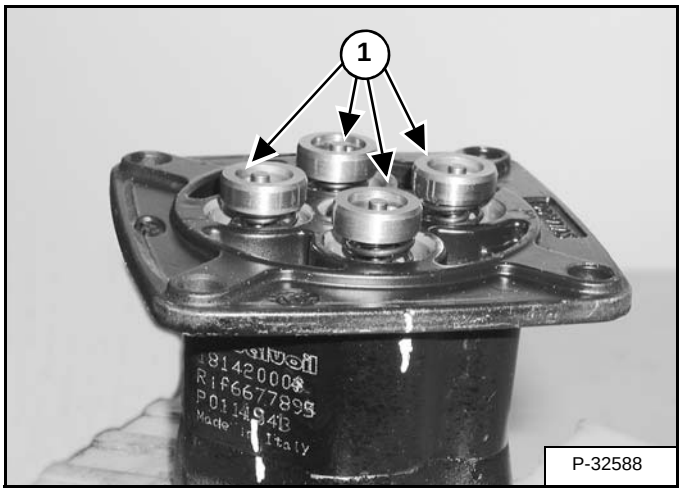
Remove the plunger assemblies (Item 1) **[Figure 20-111-31]**.

Figure 20-111-32



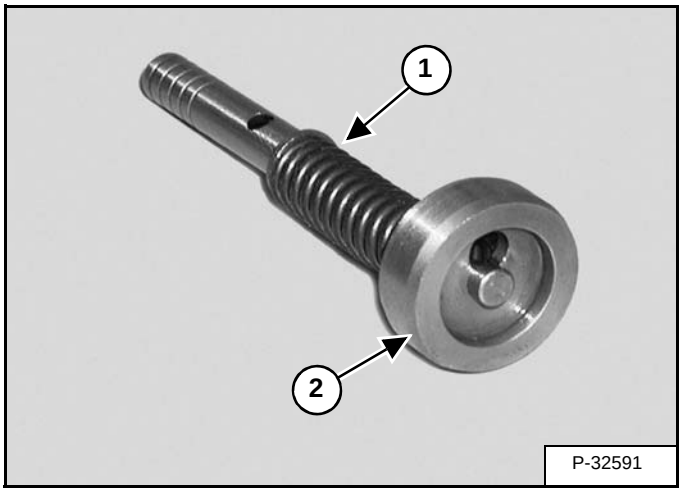
Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-111-32]**.

Figure 20-111-33



Remove the spool assemblies (Item 1) **[Figure 20-111-33]**.

Figure 20-111-34

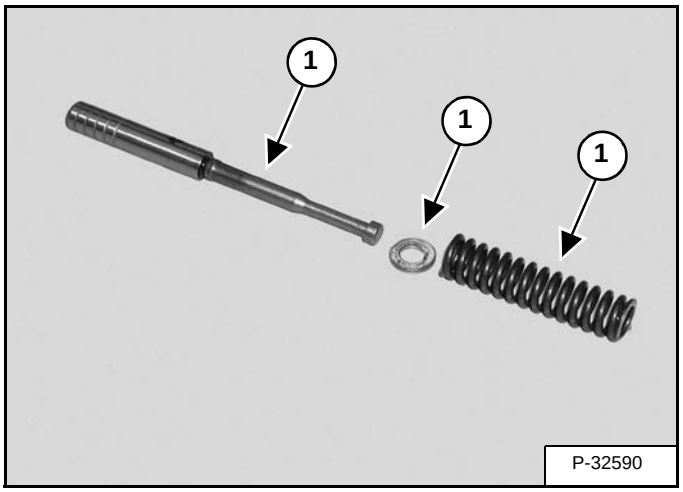


Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-111-34]**.

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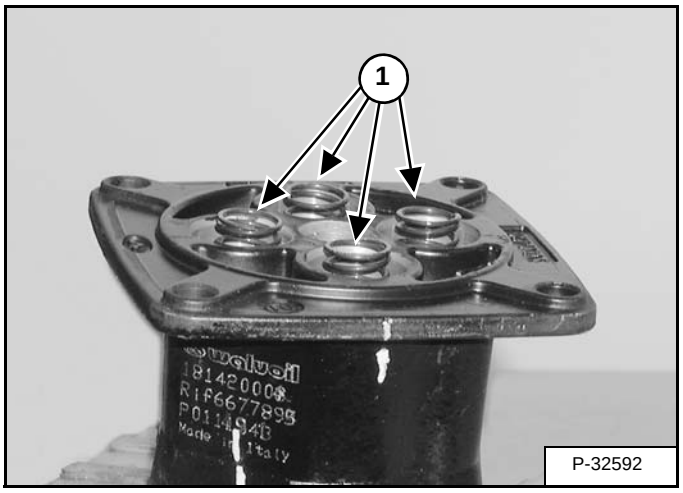
Disassembly (Cont'd)

Figure 20-111-35



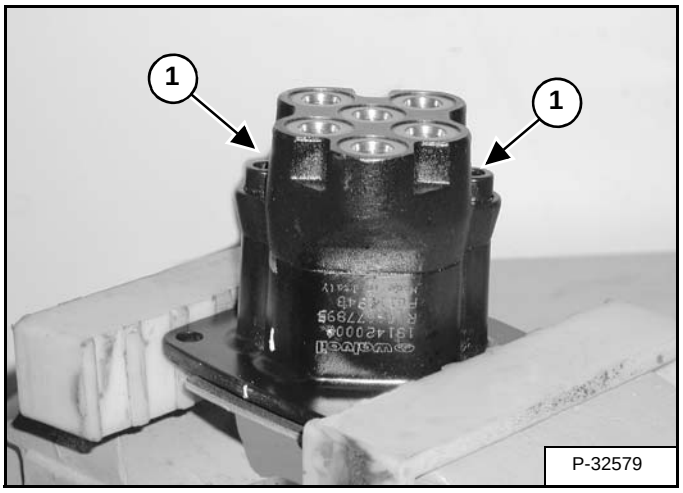
Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-111-35]**.

Figure 20-111-36



Remove the springs (Item 1) **[Figure 20-111-36]** from the housing.

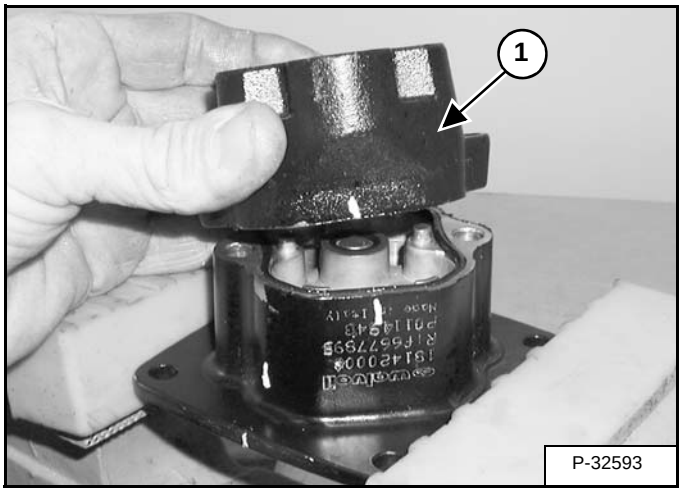
Figure 20-111-37



Clamp the housing in a vise that is equipped with padded jaws **[Figure 20-111-37]**.

Remove the two bolts (Item 1) **[Figure 20-111-37]**.

Figure 20-111-38

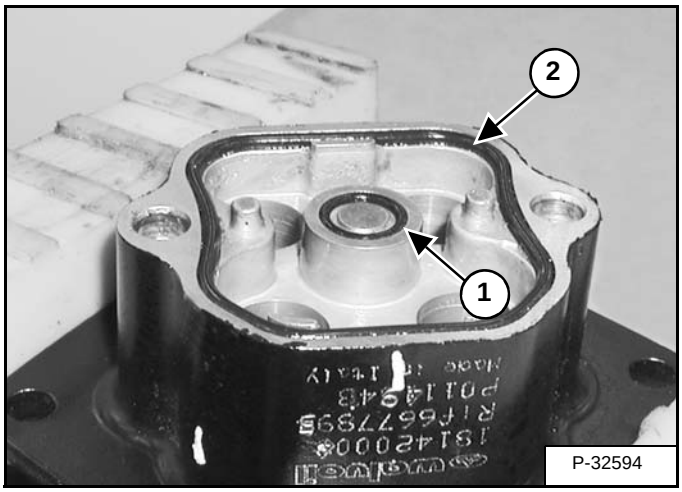


Remove the end cap (Item 1) **[Figure 20-111-38]**.

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Disassembly (Cont'd)

Figure 20-111-39



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-111-39]**.

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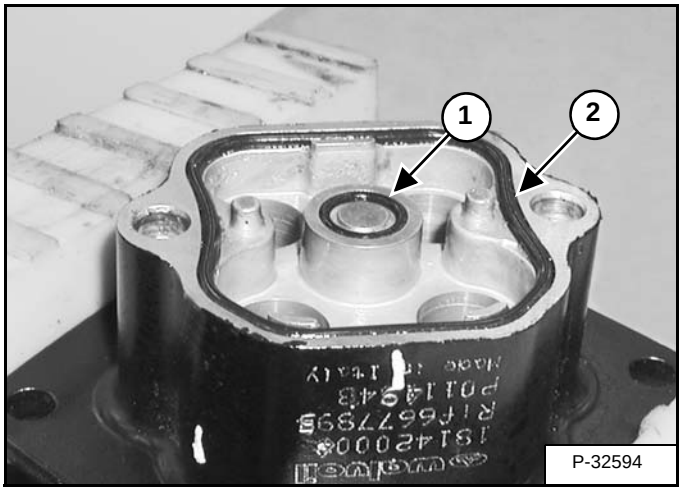
Assembly

Clean all parts in solvent and dry with compressed air.

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

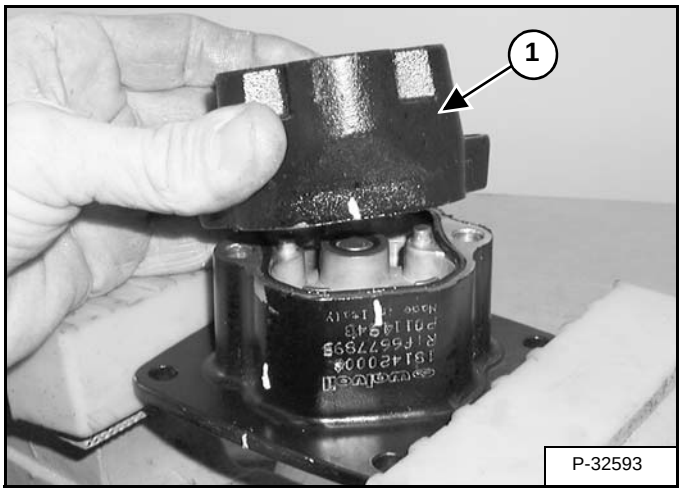
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-111-40



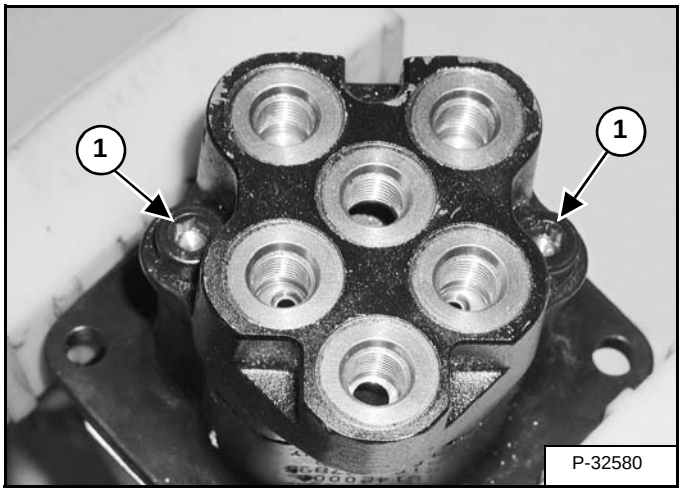
Clamp the housing in a vise equipped with padded jaws. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-111-40]**.

Figure 20-111-41



Install the end cap (Item 1) **[Figure 20-111-41]**.

Figure 20-111-42



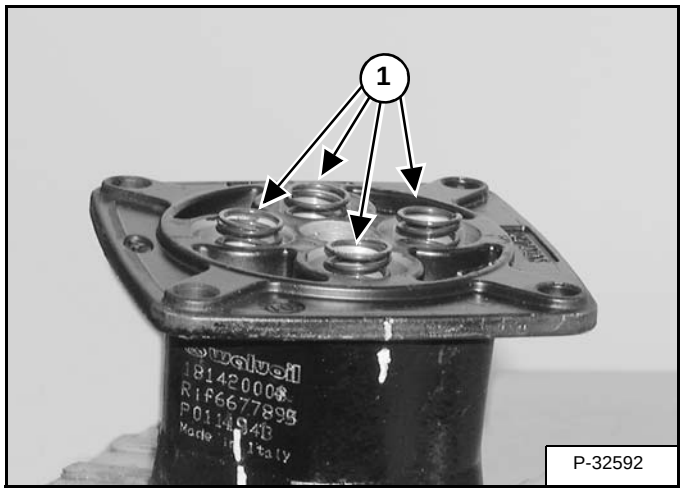
Install the bolts (Item 1) **[Figure 20-111-42]**.

Turn the housing over.

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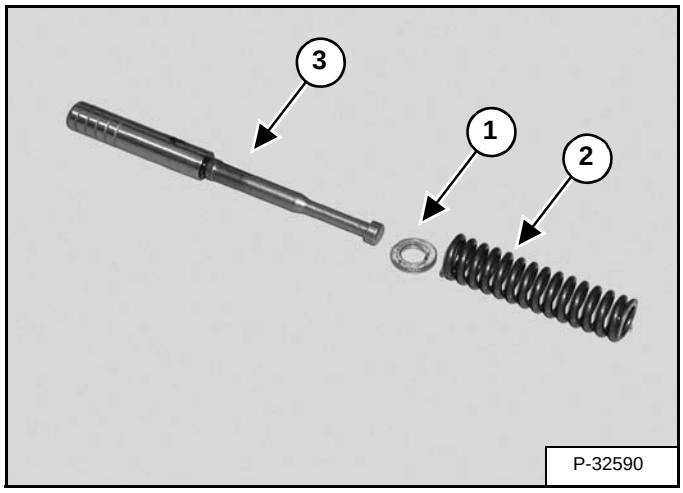
Assembly (Cont'd)

Figure 20-111-43



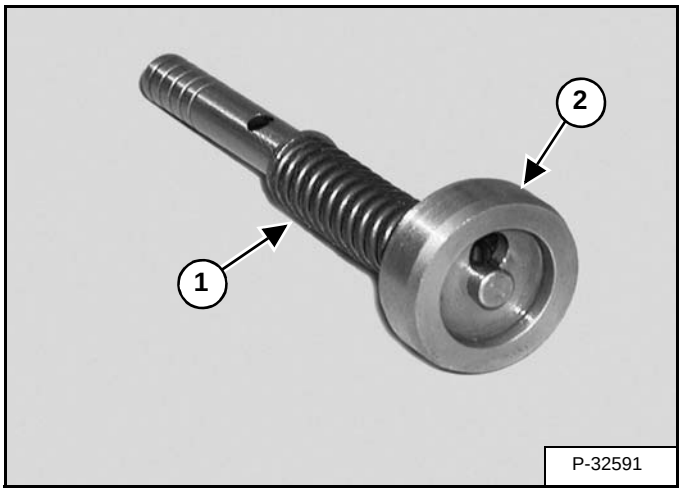
Install the springs (Item 1) **[Figure 20-111-43]**.

Figure 20-111-44



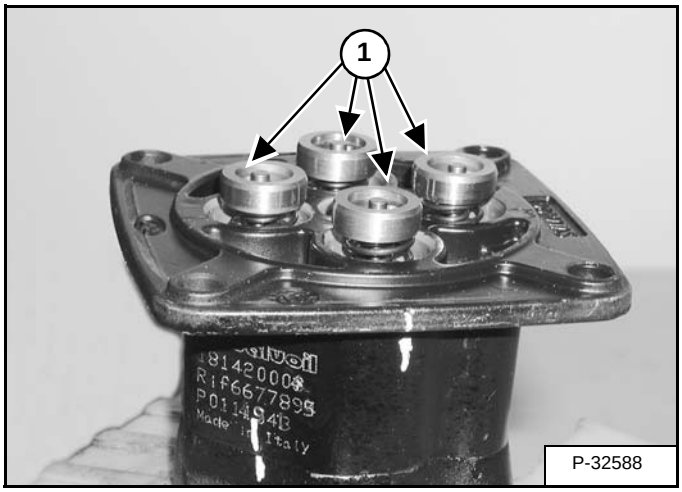
Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-111-44]**.

Figure 20-111-45



Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-111-45]**.

Figure 20-111-46

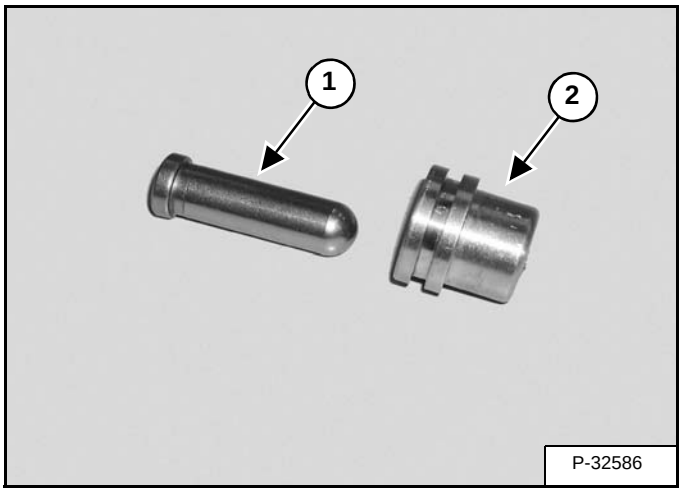


Install the spool assemblies (Item 1) **[Figure 20-111-46]** into the housing.

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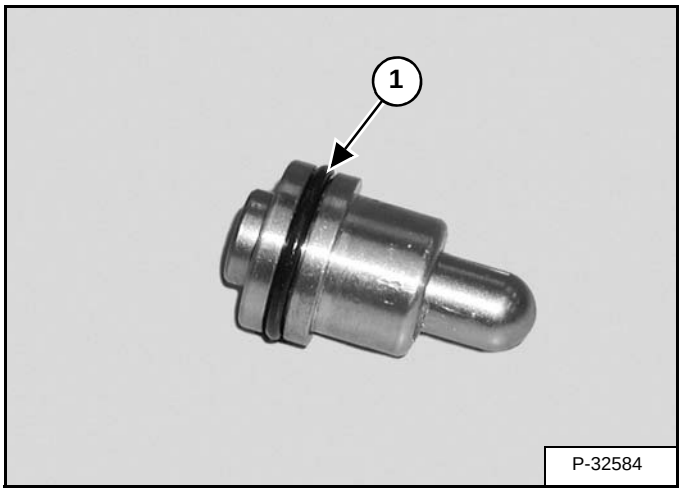
Assembly (Cont'd)

Figure 20-111-47



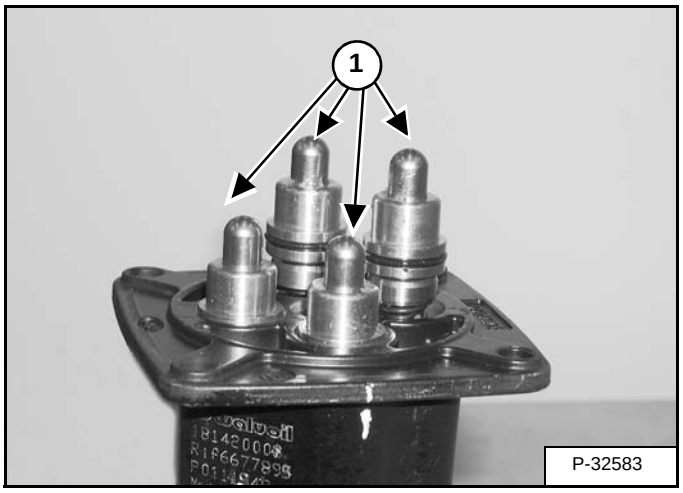
Install the plunger (Item 1) into the bushing (Item 2) **[Figure 20-111-47]**.

Figure 20-111-48



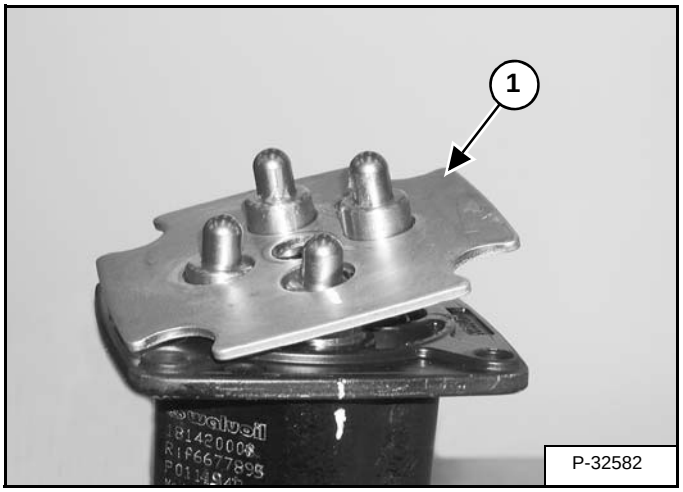
Install the O-ring (Item 1) **[Figure 20-111-48]** on the bushing.

Figure 20-111-49



Install the plunger assemblies (Item 1) **[Figure 20-111-49]** into the housing.

Figure 20-111-50



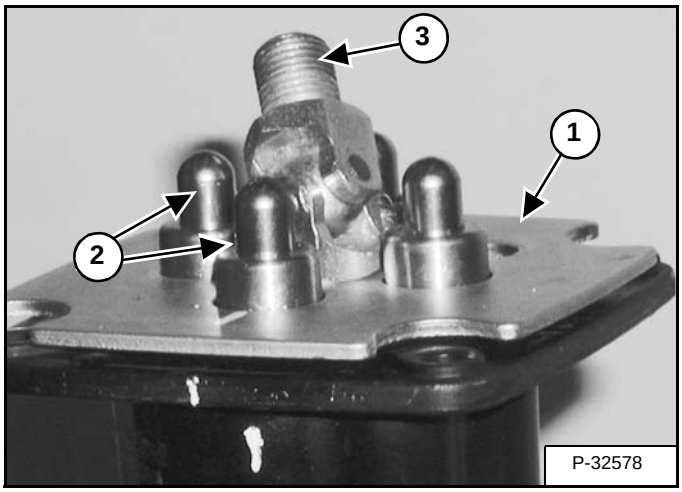
Install the plate (Item 1) **[Figure 20-111-50]**.

NOTE: Spring pressure can dislodge the plunger assemblies until the plate is secured in place.

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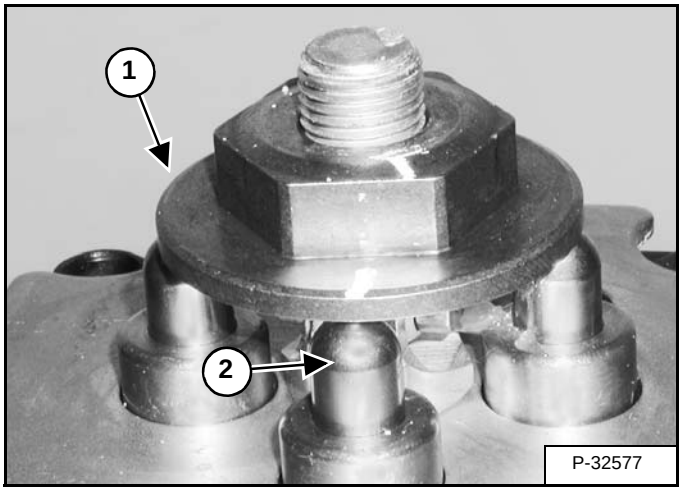
Assembly (Cont'd)

Figure 20-111-51



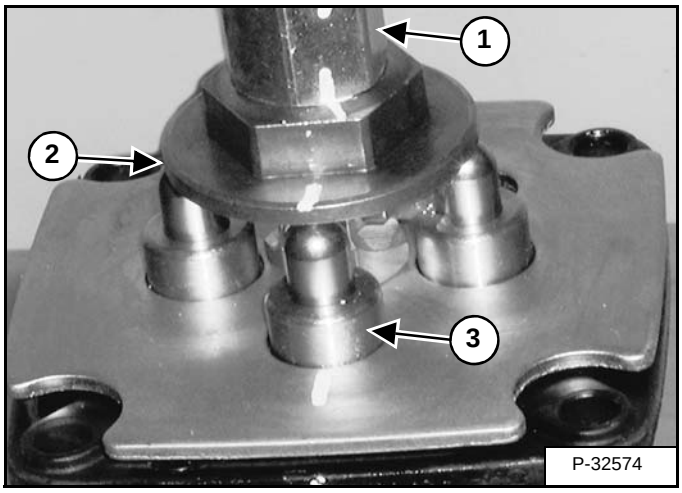
Press down on the plate (Item 1) keeping the plunger assemblies (Item 2) fully seated and install the U-joint (Item 3) **[Figure 20-111-51]**.

Figure 20-111-52



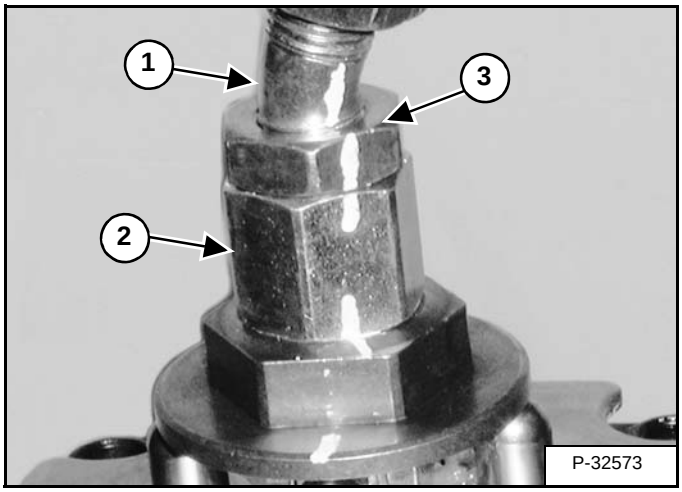
Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-111-52]**.

Figure 20-111-53



Align the coupler (Item 1) with the control plate (Item 2) and plunger (Item 3) **[Figure 20-111-53]**. Tighten the coupler.

Figure 20-111-54



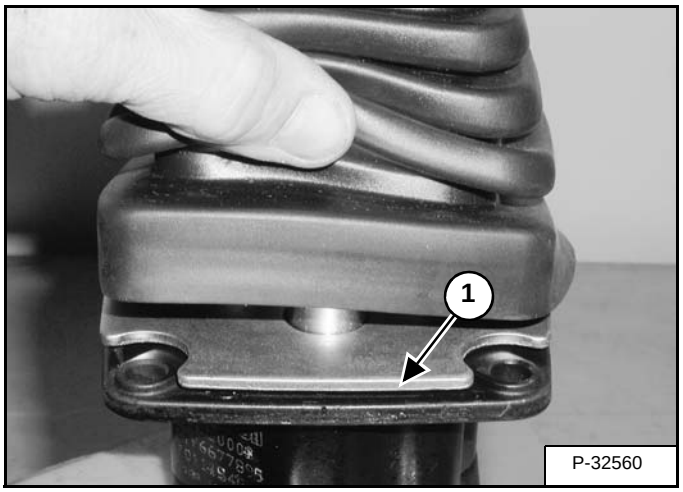
Install the connector **[Figure 20-111-54]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-111-54]**.

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Assembly (Cont'd)

Figure 20-111-55



Install the tabs of the boot in between the joystick flange and the mounting plate (Item 1) **[Figure 20-111-55]**.

Install the handle. (See Handle Removal And Installation on Page 20-111-2.)

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HYDRAULIC FILTER MOUNT

Removal And Installation

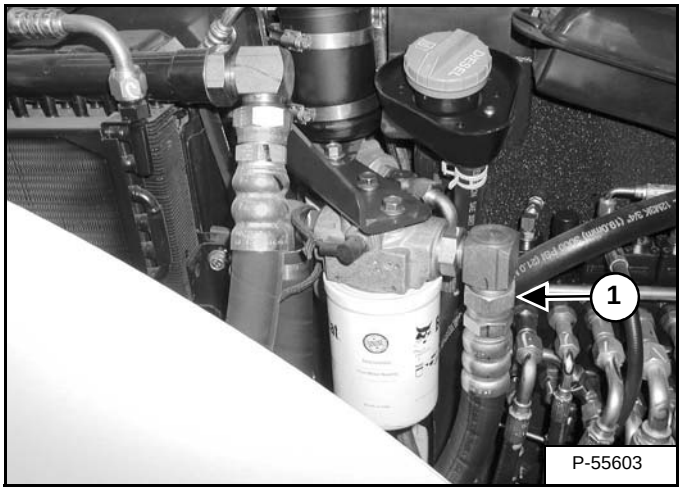
IMPORTANT

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

I-2003-0888

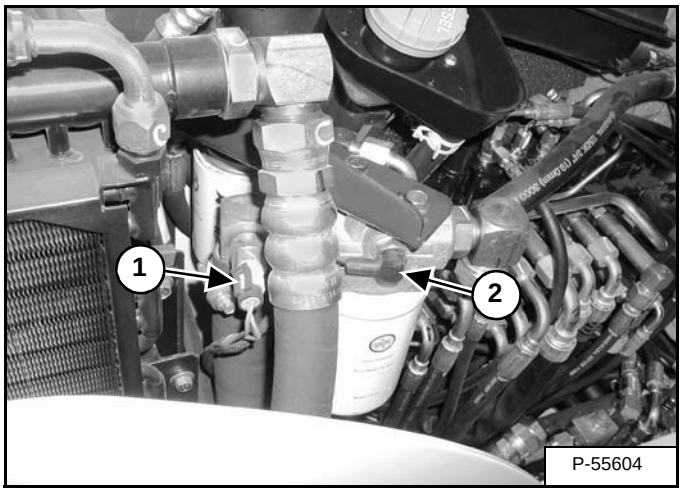
Open the right side cover.

Figure 20-120-1



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

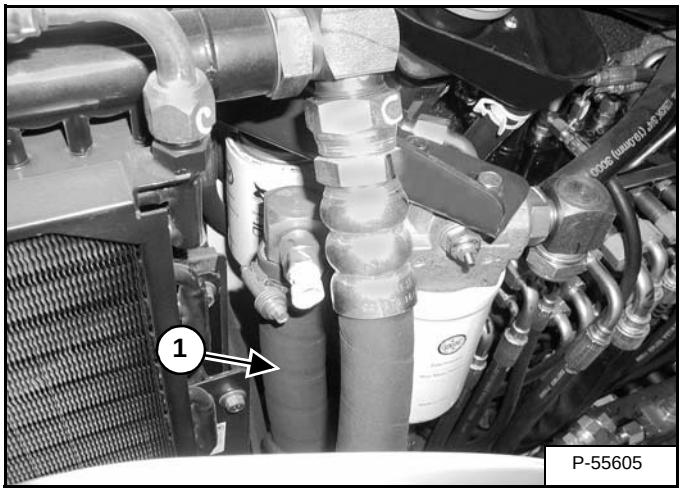
Figure 20-120-2



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

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

Figure 20-120-3

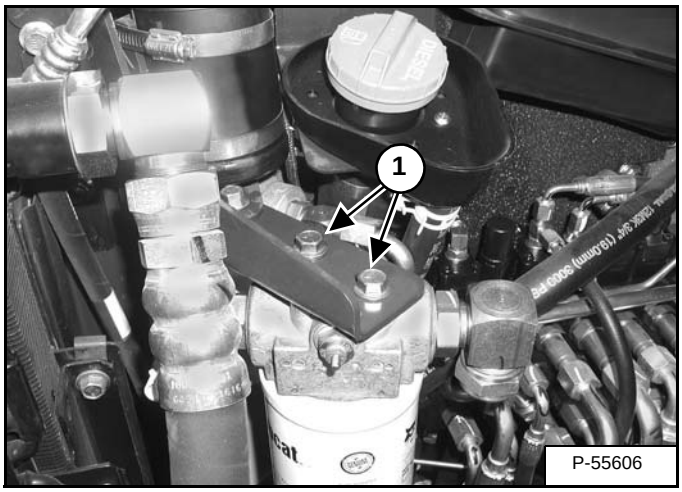


Loosen the hose clamp and remove the hose (Item 1) **[Figure 20-120-3]**.

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Removal And Installation (Cont'd)

Figure 20-120-4



Remove the bolts (Item 1) **[Figure 20-120-4]**.

Remove the filter and filter mount.

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HYDRAULIC RESERVOIR

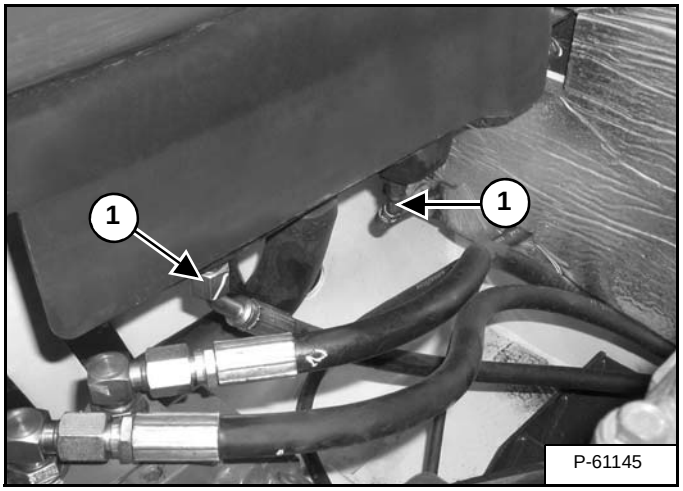
Removal And Installation

Drain the reservoir. (See Checking And Adding Hydraulic Fluid on Page 10-100-1.)

Remove the air cleaner. (See Removal And Installation on Page 60-30-1.)

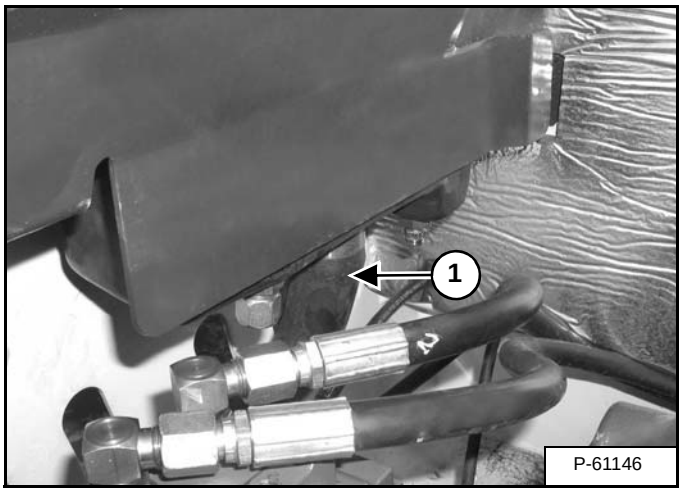
Remove the muffler. (See Removal And Installation on Page 60-20-1.)

Figure 20-130-1



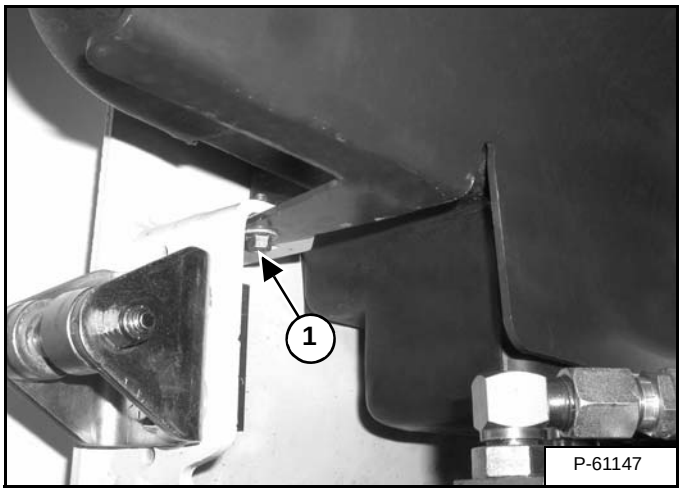
Remove the hoses (Item 1) **[Figure 20-130-1]**.

Figure 20-130-2



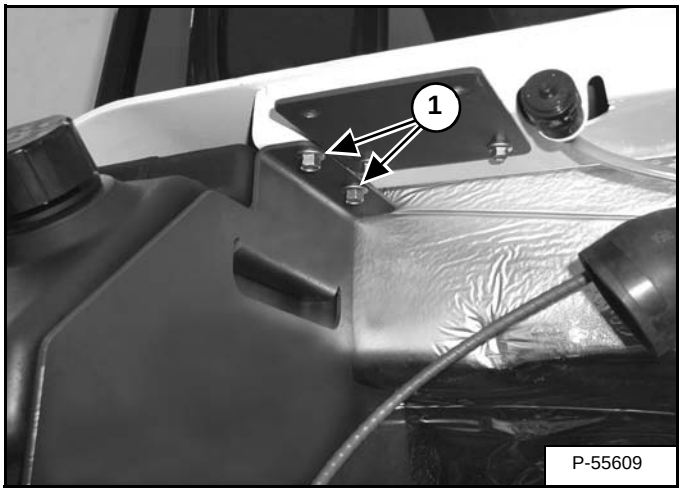
Remove the suction hose (Item 1) **[Figure 20-130-2]**.

Figure 20-130-3



Remove the bolt (Item 1) **[Figure 20-130-3]**.

Figure 20-130-4

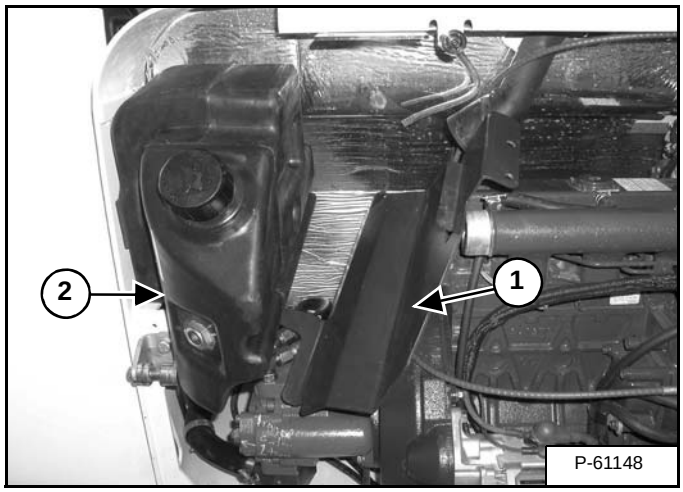


Remove the bolts (Item 1) **[Figure 20-130-4]**.

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Removal And Installation (Cont'd)

Figure 20-130-5



Remove the mount (Item 1) **[Figure 20-130-5]**.

Remove the hydraulic reservoir (Item 2) **[Figure 20-130-5]**.

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OIL COOLER

Removal And Installation

WARNING

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

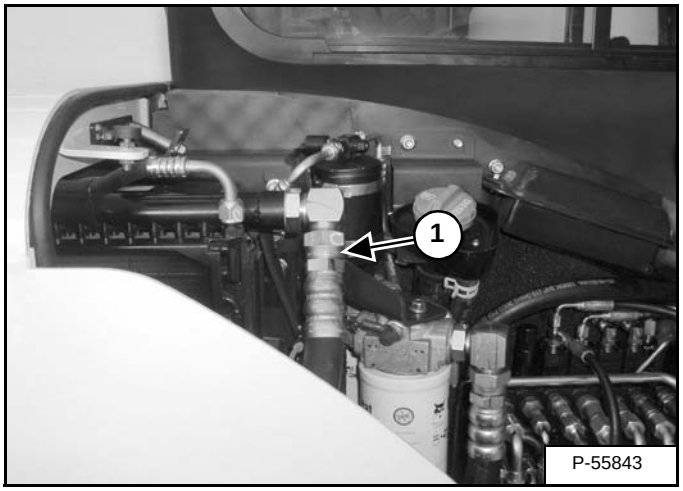
I-2003-0888

Open the right side cover.

Open the tailgate.

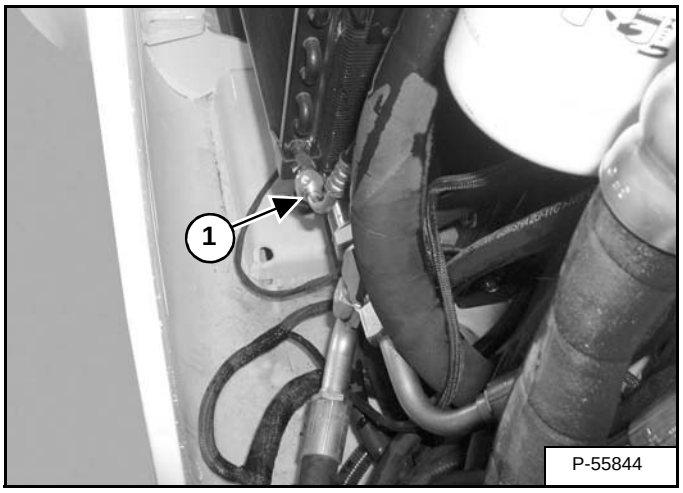
Drain the hydraulic reservoir.(See Checking And Adding Hydraulic Fluid on Page 10-100-1.)

Figure 20-140-1



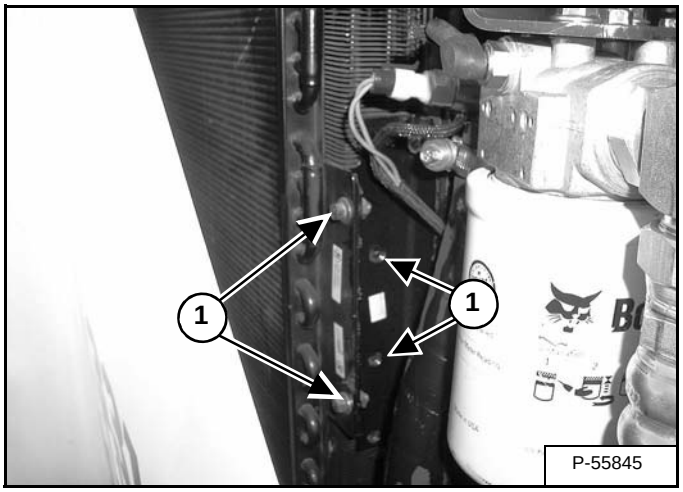
Remove the hose (Item 1) **[Figure 20-140-1]** that goes from the filter housing to the top of the oil cooler.

Figure 20-140-2



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

Figure 20-140-3

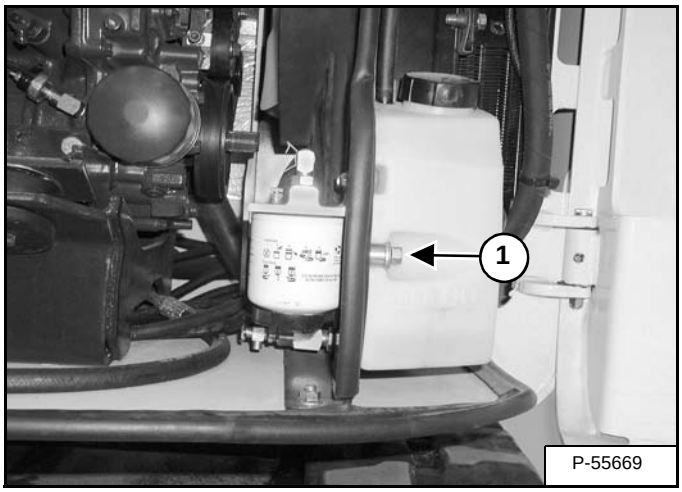


Remove the bolts (Item 1) **[Figure 20-140-3]** from the oil cooler.

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Removal And Installation (Cont'd)

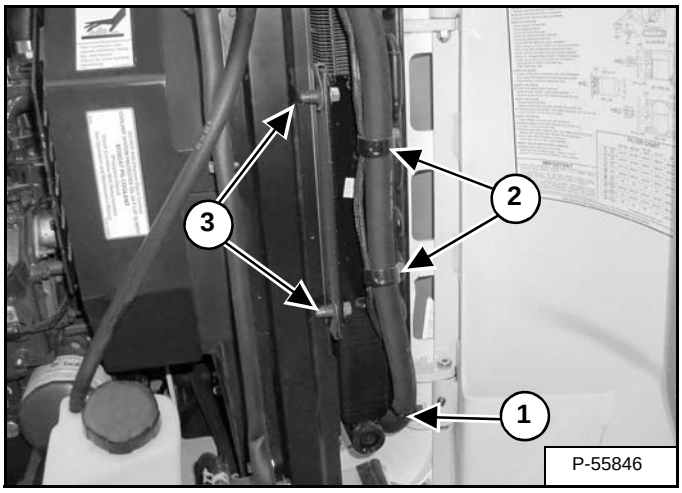
Figure 20-140-4



Remove the bolt (Item 1) **[Figure 20-140-4]** from the coolant recovery tank.

Move the coolant recovery tank to the side to allow clearance for the oil cooler to be removed.

Figure 20-140-5



If equipped with A/C, remove the tie-strap (Item 1) and two bolts (Item 2) **[Figure 20-140-5]** from the A/C hose, and move the hose to allow clearance for the oil cooler to be removed.

Remove the two bolts (Item 3) **[Figure 20-140-5]** from the oil cooler.

Move the A/C condenser away from the oil cooler. (If equipped.)

Remove the oil cooler from the excavator.

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DIRECT TO TANK VALVE

Removal And Installation

Drain the hydraulic reservoir. (See Checking And Adding Hydraulic Fluid on Page 10-100-1.)

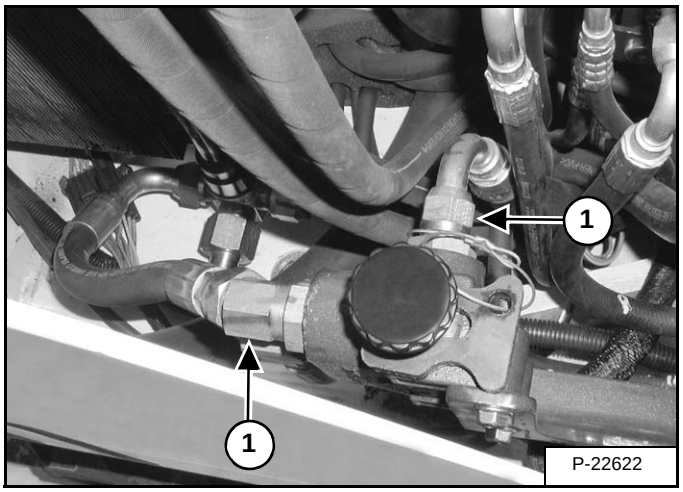
Open the right side cover.

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, tube lines and ports to keep dirt out. Dirt can quickly damage the system.

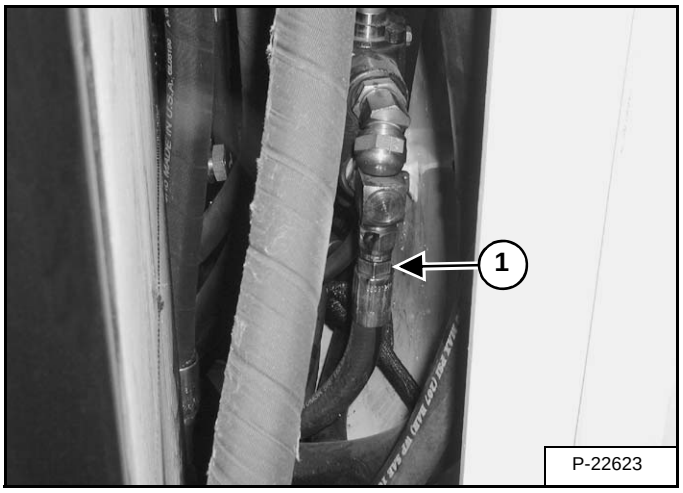
I-2003-0888

Figure 20-150-1



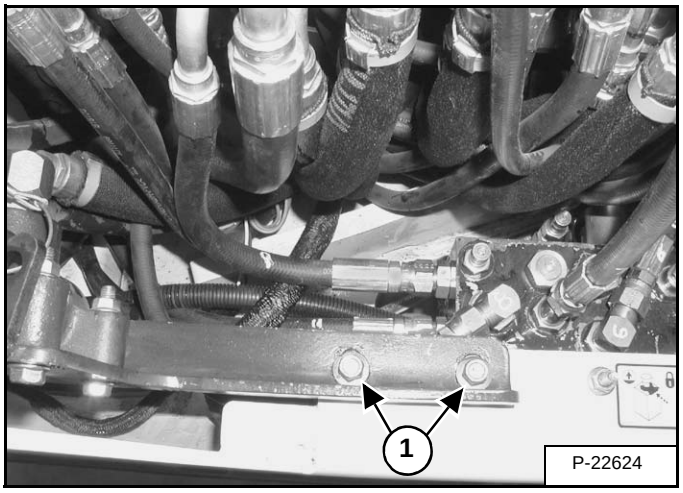
Remove the 2 hoses (Item 1) **[Figure 20-150-1]**.

Figure 20-150-2



Remove the lower hose (Item 1) **[Figure 20-150-2]**.

Figure 20-150-3



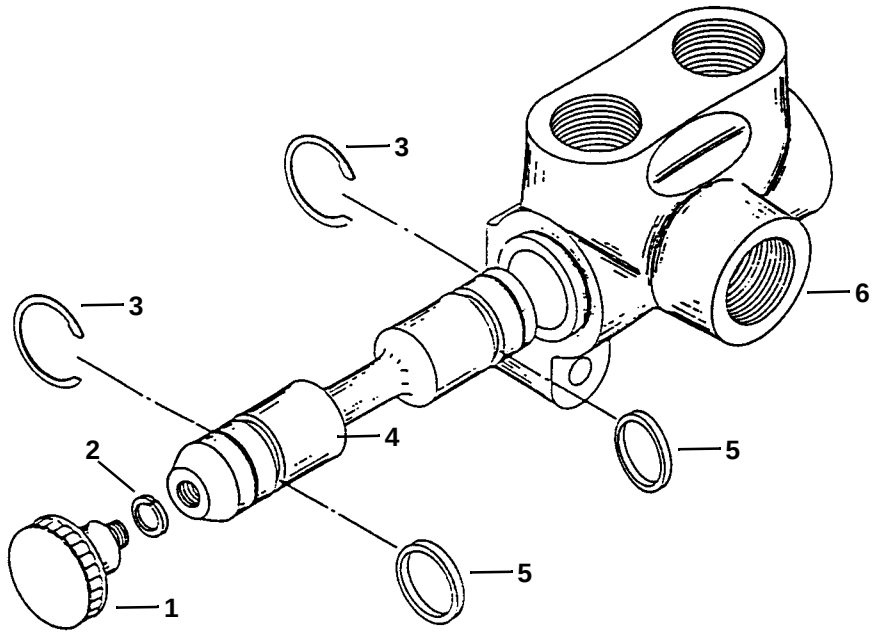
Remove the bolts (Item 1) **[Figure 20-150-3]**.

Remove the valve.

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Parts Identification

1 Control Knob
2 Washer
3 Snap Ring
4 Spool
5 O-Ring
6 Housing



b-13660

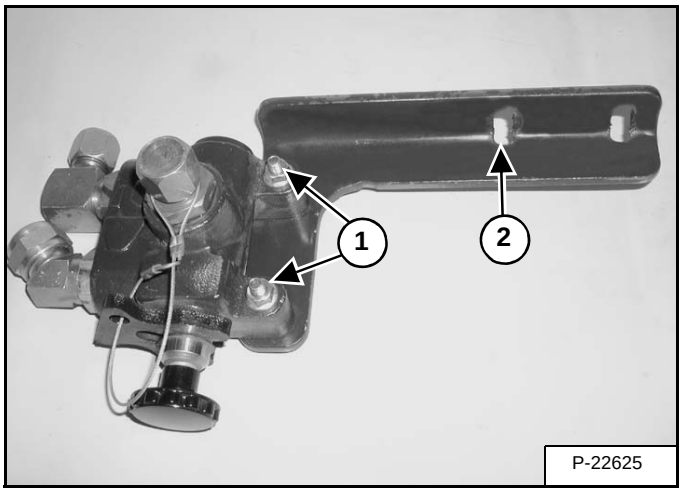
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Disassembly And Assembly

Clean the outside of the direct to tank valve before disassembly.

NOTE: The photos may appear different. The procedure is the same.

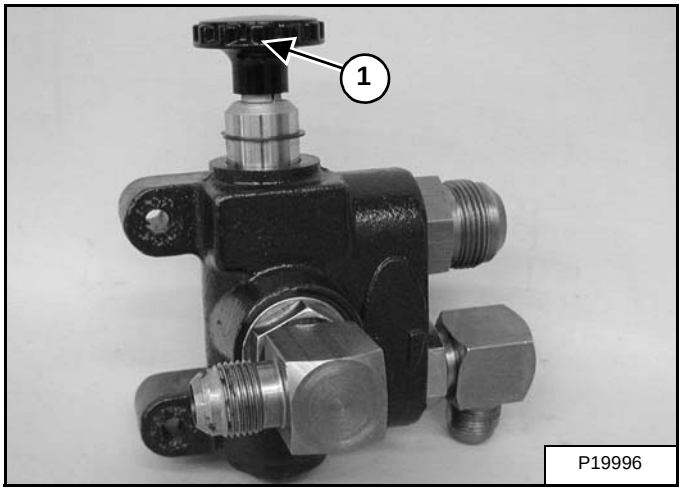
Figure 20-150-4



Remove the mount bracket bolts (Item 1) **[Figure 20-150-4]**.

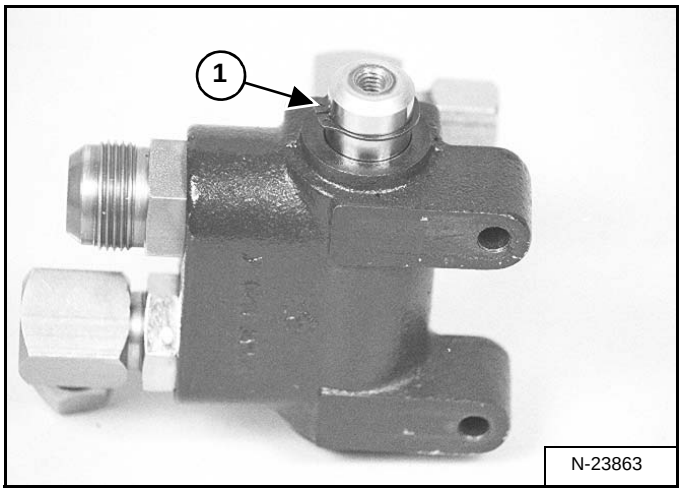
Remove the mount bracket (Item 2) **[Figure 20-150-4]** from the valve.

Figure 20-150-5



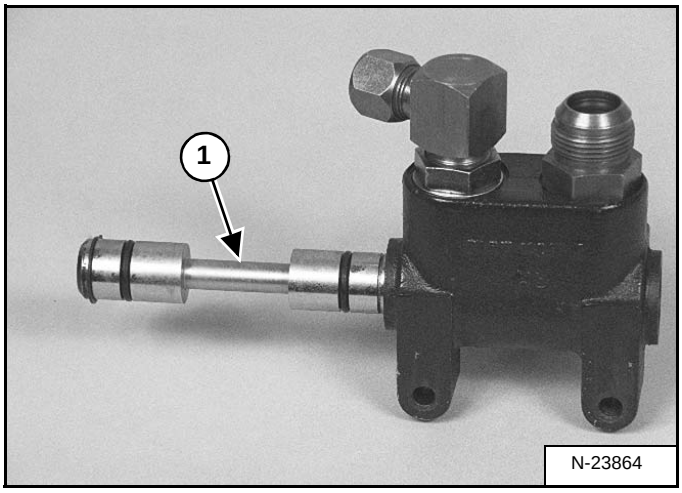
Remove the control knob (Item 1) **[Figure 20-150-5]** from the valve spool.

Figure 20-150-6



Remove the snap ring (Item 1) **[Figure 20-150-6]**.

Figure 20-150-7

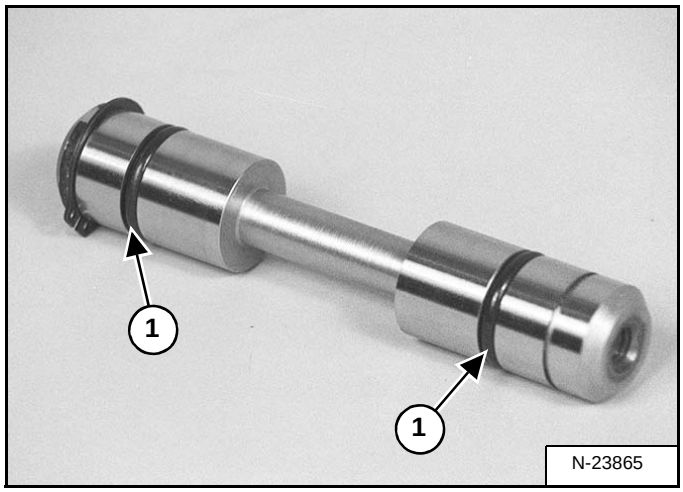


Remove the spool (Item 1) **[Figure 20-150-7]** from the valve.

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Disassembly And Assembly (Cont'd)

Figure 20-150-8



Remove the O-rings (Item 1) **[Figure 20-150-8]**.

Clean all parts in solvent and dry with compressed air.

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

Always install new O-rings. Lubricate the spool, valve spool bore and O-rings with clean hydraulic fluid before installation.

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CASE DRAIN FILTER

Removal And Installation

IMPORTANT

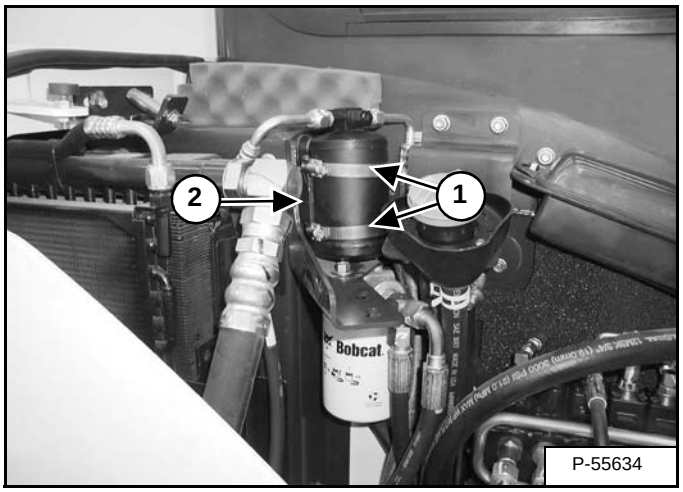
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tube lines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

Open the right side cover.

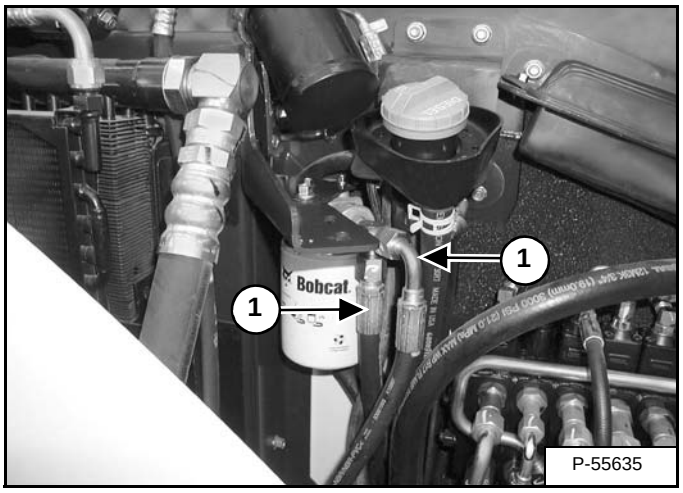
Remove the hydraulic filter mount. (See Removal And Installation on Page 20-120-1.)

Figure 20-160-9



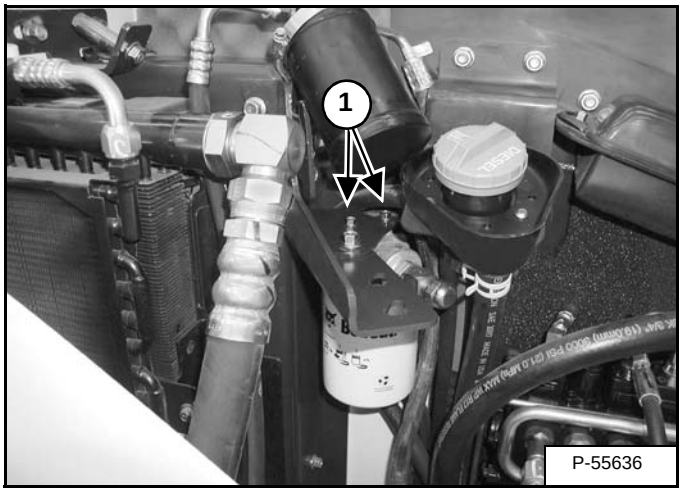
Loosen the clamps (Item 1). Reposition the receiver/dryer (Item 2) **[Figure 20-160-9]**.

Figure 20-160-10



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

Figure 20-160-11



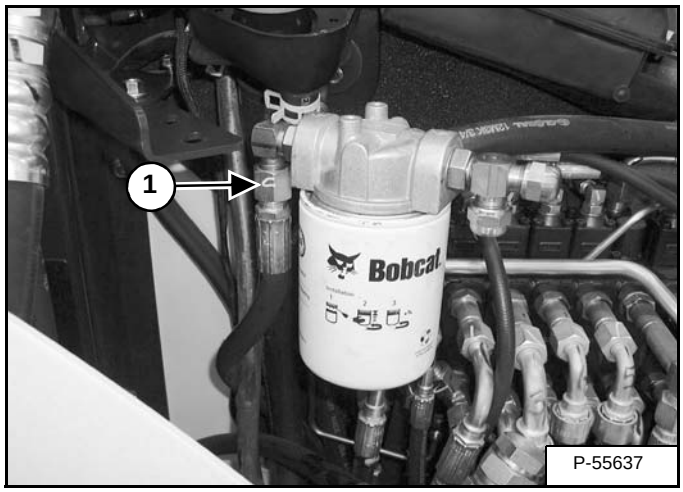
Remove the bolts (Item 1) **[Figure 20-160-11]**.

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CASE DRAIN FILTER (CONT'D)

Removal And Installation (Cont'd)

Figure 20-160-12



Lower the filter and remove the hose (Item 1) **[Figure 20-160-12]**.

Remove the filter and filter mount.

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BOOM SWING LOCK VALVE

Removal And Installation

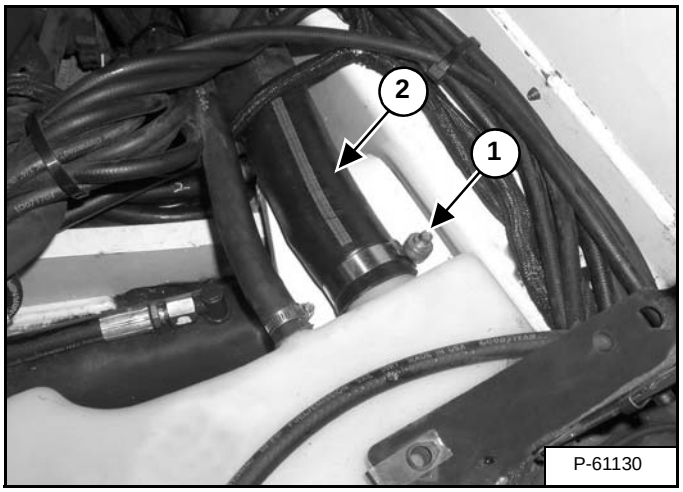
Remove the floor mat and floor panel. (See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

IMPORTANT

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

I-2003-0888

Figure 20-170-1

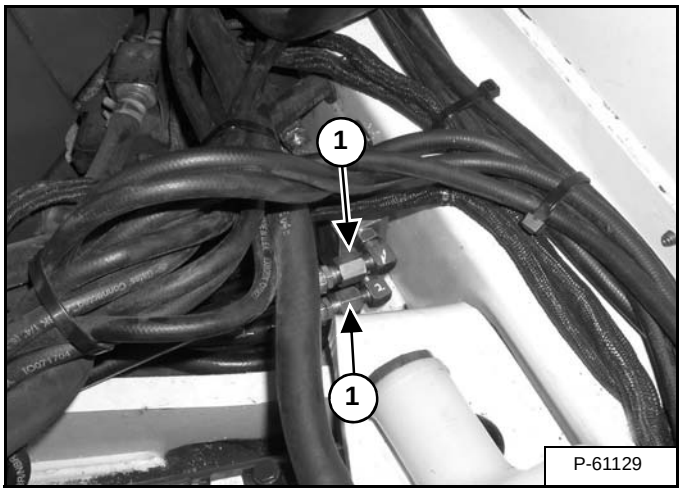


Loosen the clamp (Item 1) and remove the fuel fill hose (Item 2) **[Figure 20-170-1]**.

Reposition the hose to gain access to the lock valve.

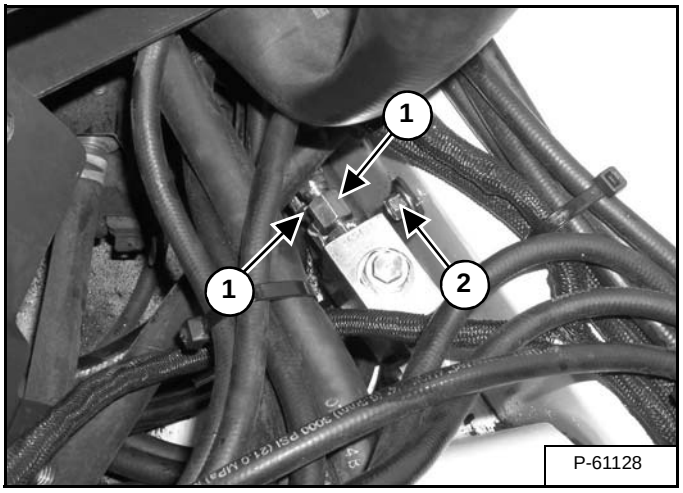
NOTE: Plug the fuel tank inlet to prevent contamination from entering the tank.

Figure 20-170-2



Remove the hoses (Item 1) **[Figure 20-170-2]**.

Figure 20-170-3



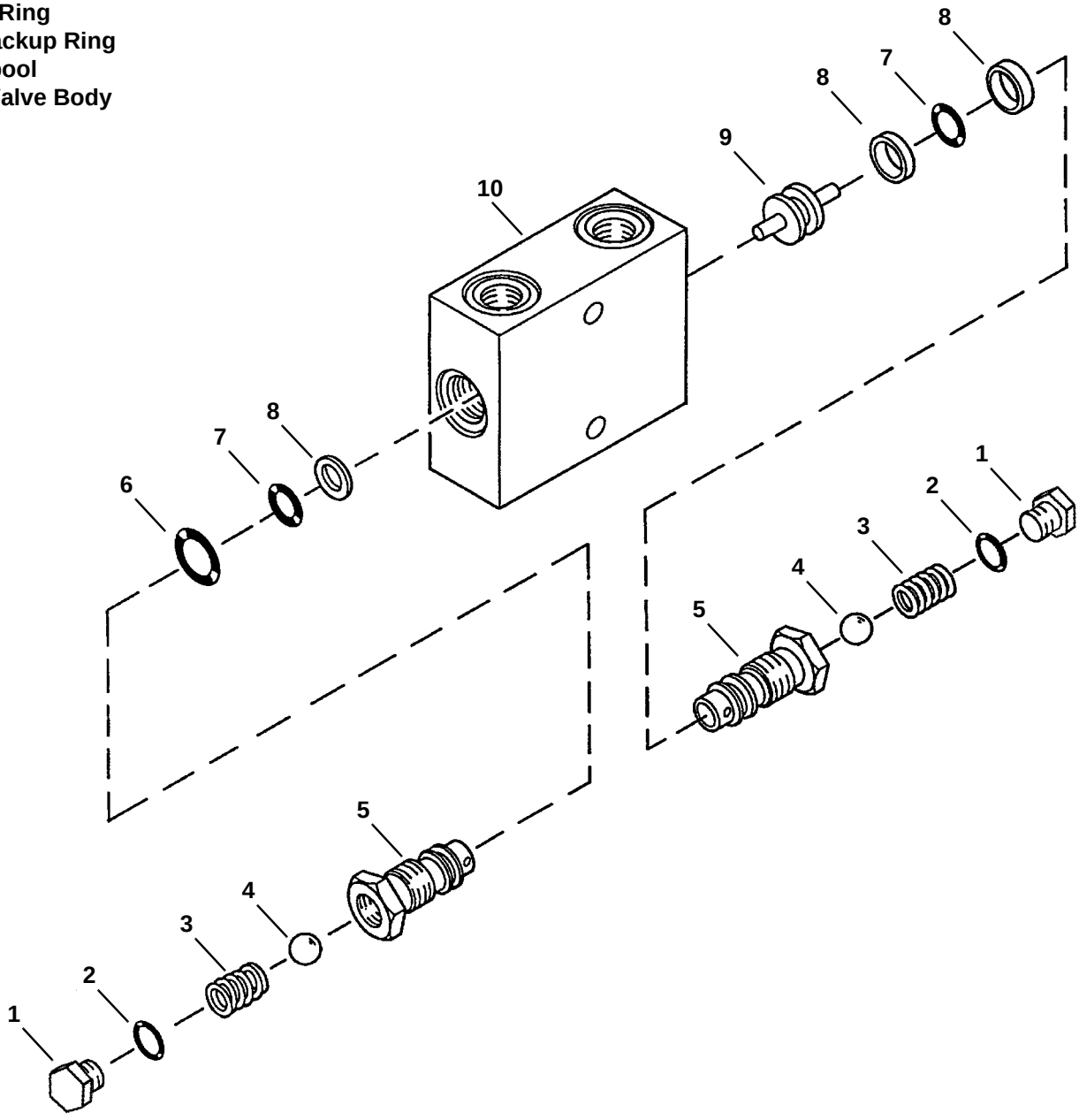
Remove the hoses (Item 1) **[Figure 20-170-3]**.

Remove the bolt (Item 2) **[Figure 20-170-3]** and remove the lock valve.

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Parts Identification

1. Plug
2. O-Ring
3. Spring
4. Ball
5. Body
6. O-Ring
7. O-Ring
8. Backup Ring
9. Spool
10. Valve Body

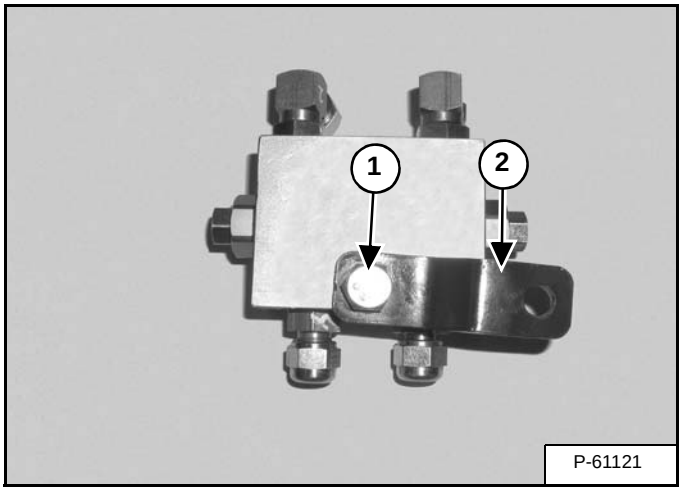


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Disassembly

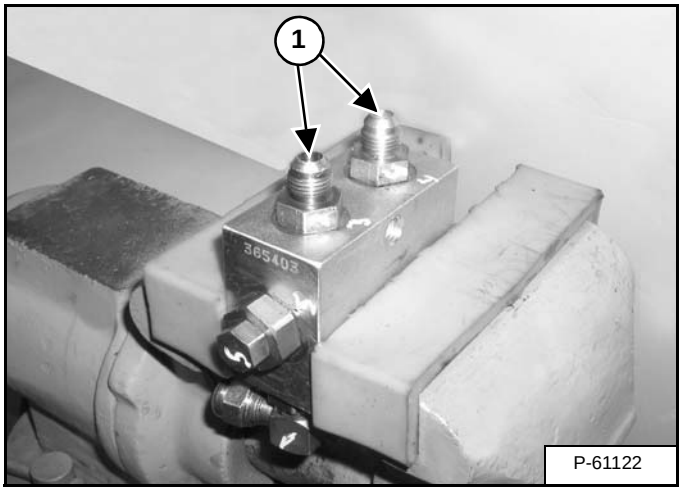
Clean the outside of the boom swing lock valve before disassembly.

Figure 20-170-4



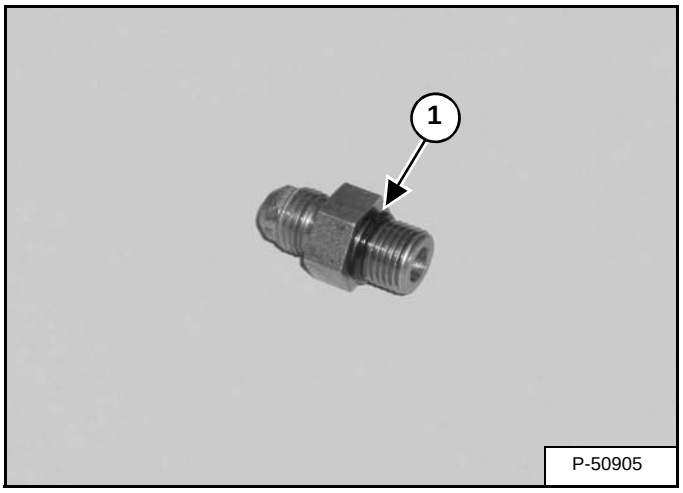
Remove the bolt (Item 1) and bracket (Item 2) **[Figure 20-170-4]**.

Figure 20-170-5



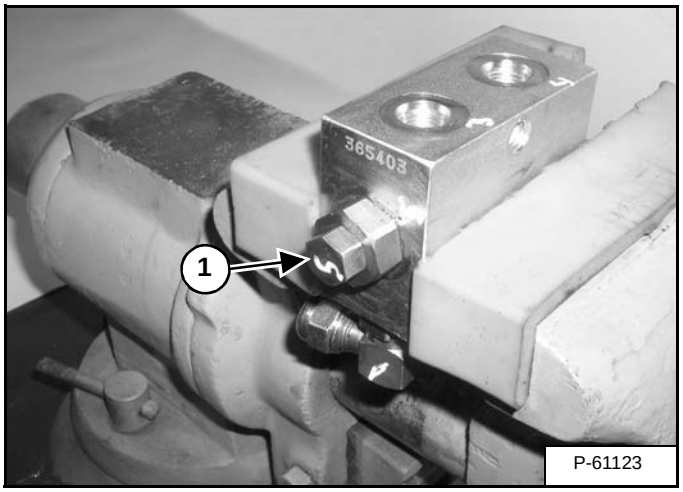
Remove the four fittings (Item 1) **[Figure 20-170-5]** (two per side) from the valve housing.

Figure 20-170-6



Remove the O-ring (Item 1) **[Figure 20-170-6]** from the fittings.

Figure 20-170-7

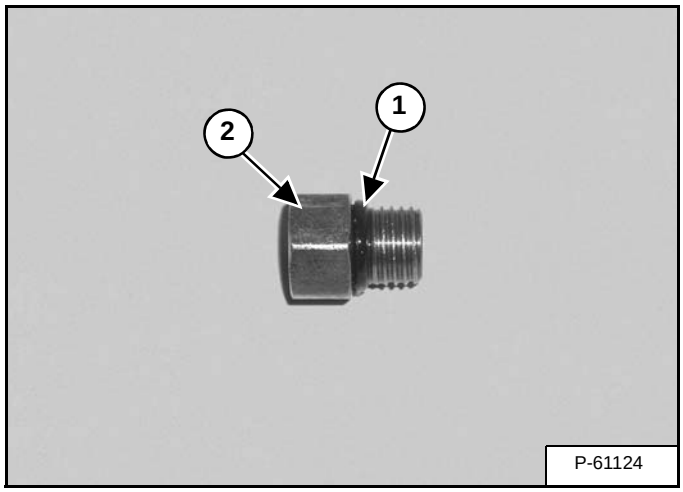


Remove the plug (Item 1) **[Figure 20-170-7]** from both ends of the valve body.

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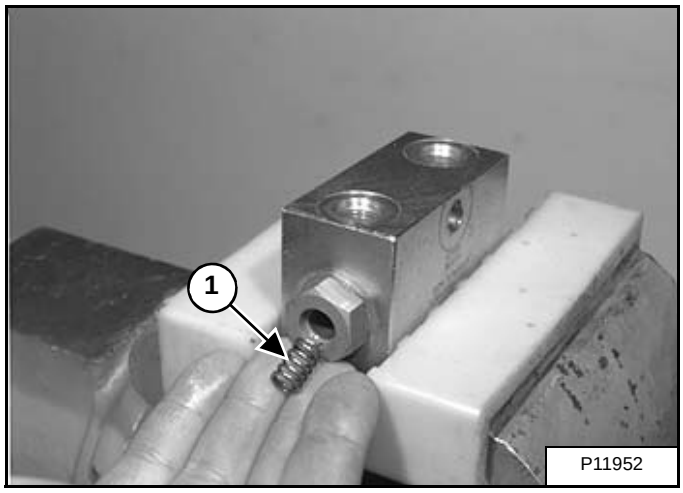
Disassembly (Cont'd)

Figure 20-170-8



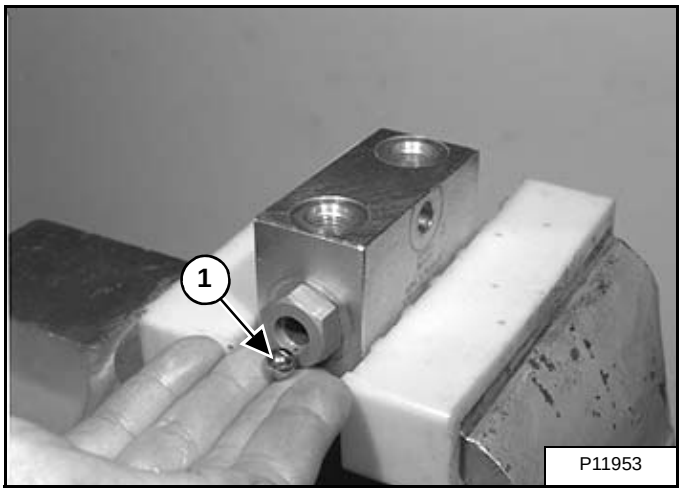
Remove the O-ring (Item 1) from the plugs (Item 2) **[Figure 20-170-8]**.

Figure 20-170-9



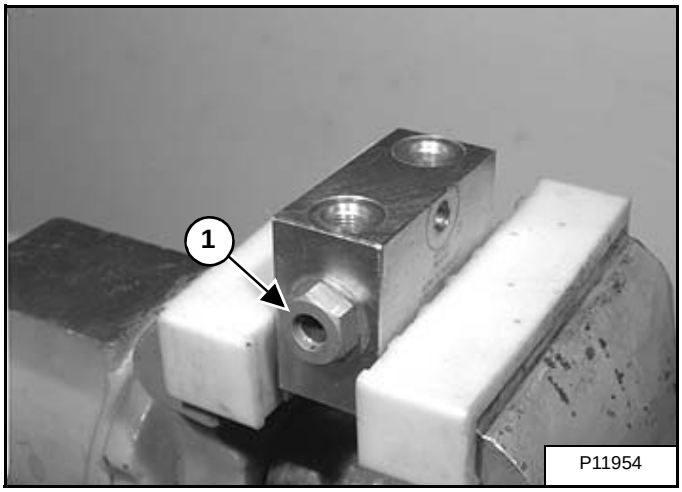
Remove the spring (Item 1) **[Figure 20-170-9]** from both ends of the valve body.

Figure 20-170-10



Remove the ball (Item 1) **[Figure 20-170-10]** from both ends of the valve body.

Figure 20-170-11

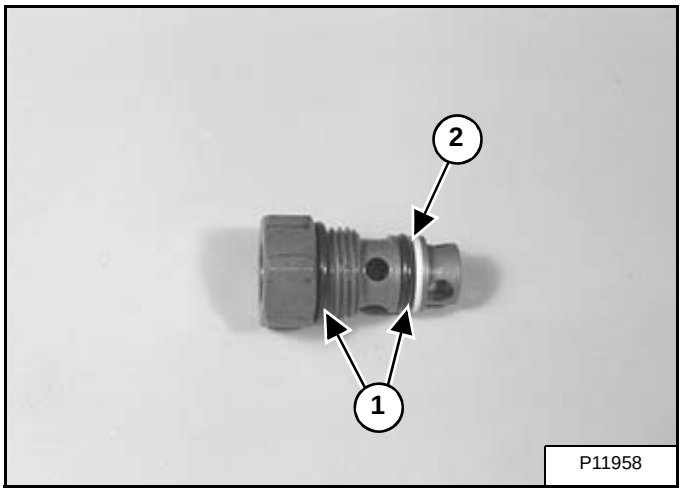


Remove the valve bodies (Item 1) **[Figure 20-170-11]** from both ends of the valve housing.

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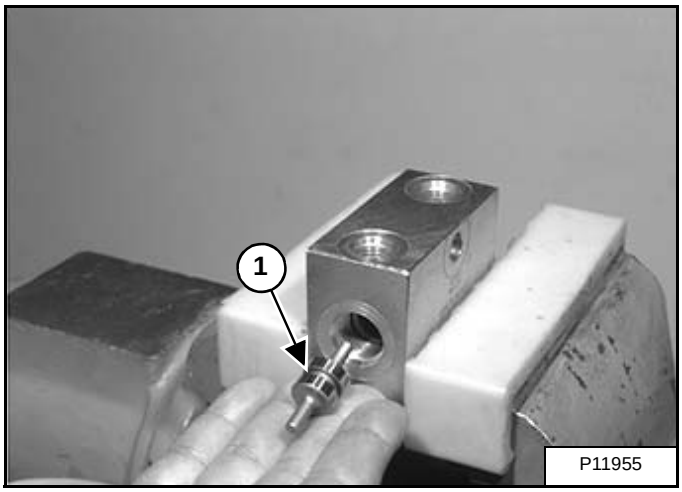
Disassembly (Cont'd)

Figure 20-170-12



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-170-12]** from the valve bodies.

Figure 20-170-13



Remove the spool (Item 1) **[Figure 20-170-13]**.

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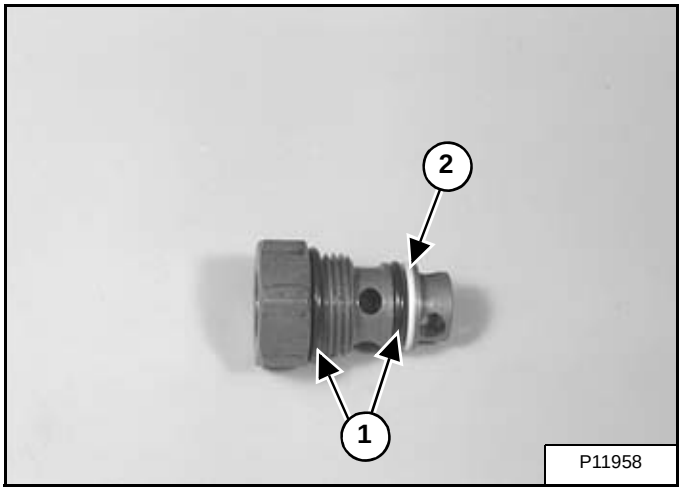
Assembly

Clean all parts in clean solvent and dry with compressed air.

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

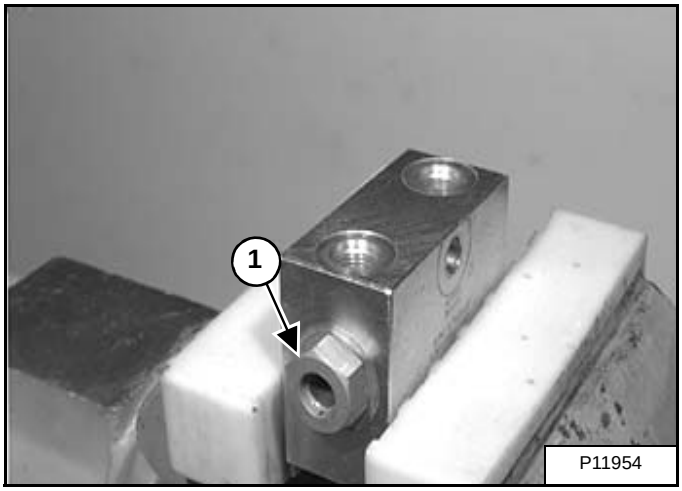
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-170-14



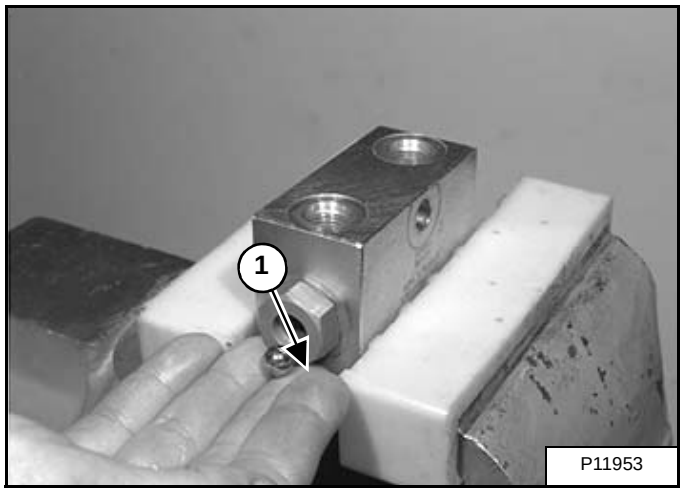
Install the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-170-14]** on the valve body.

Figure 20-170-15



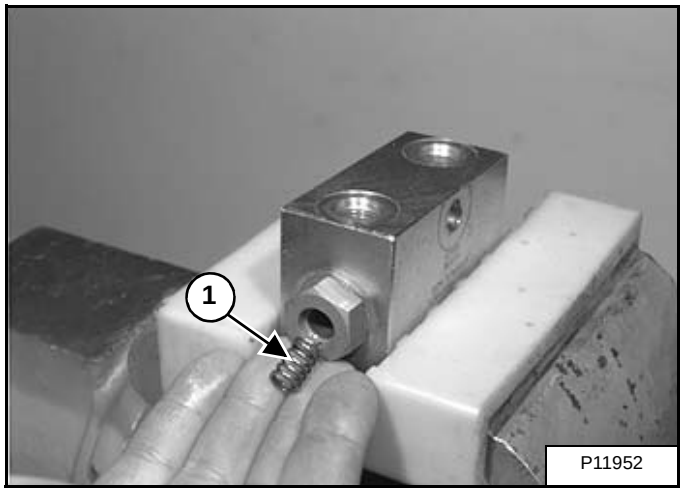
Install the valve body (Item 1) **[Figure 20-170-15]** into the valve housing. Tighten to 15-20 ft.-lbs. (20-27 Nm) torque.

Figure 20-170-16



Put oil on the ball (Item 1) **[Figure 20-170-16]** and install in the valve body.

Figure 20-170-17

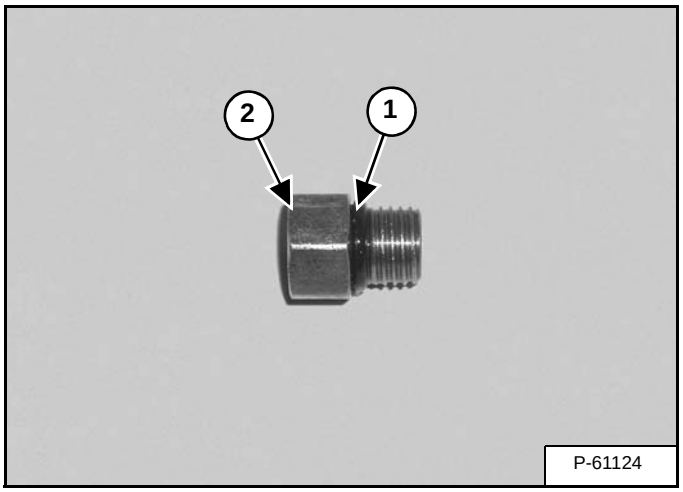


Install the spring (Item 1) **[Figure 20-170-17]**.

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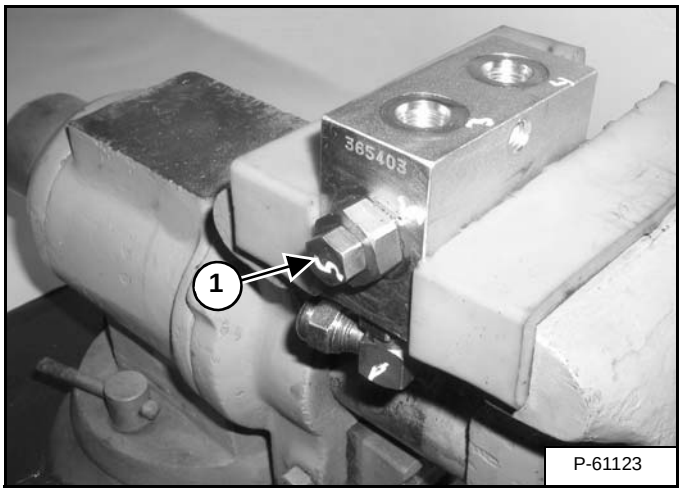
Assembly (Cont'd)

Figure 20-170-18



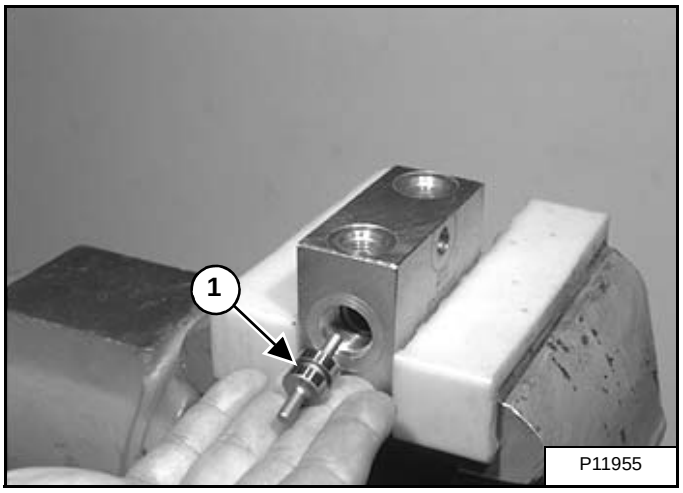
Install the O-ring (Item 1) on the plug (Item 2) **[Figure 20-170-18]**.

Figure 20-170-19



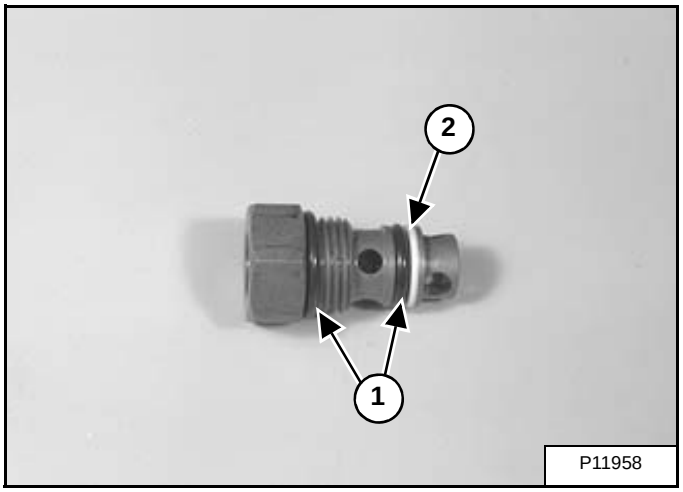
Install the plug (Item 1) **[Figure 20-170-19]** in the valve body. Tighten to 85-100 in.-lbs. (9,6-11,3 Nm) torque.

Figure 20-170-20



Apply oil to the spool (Item 1) **[Figure 20-170-20]** and install the spool in the opposite end of the valve housing.

Figure 20-170-21

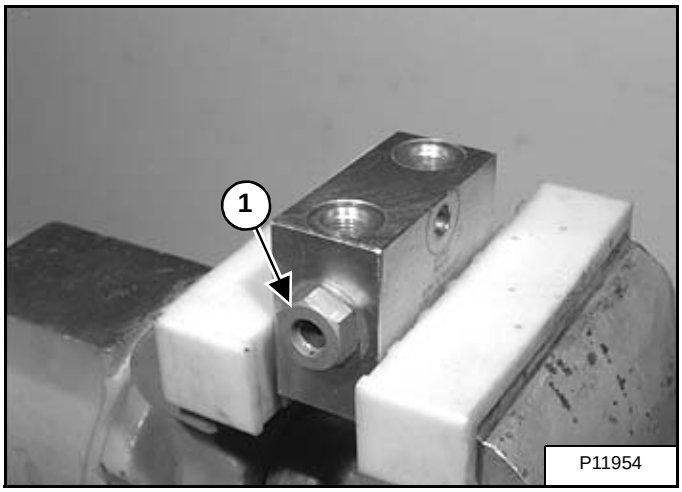


Install the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-170-21]** on the valve body.

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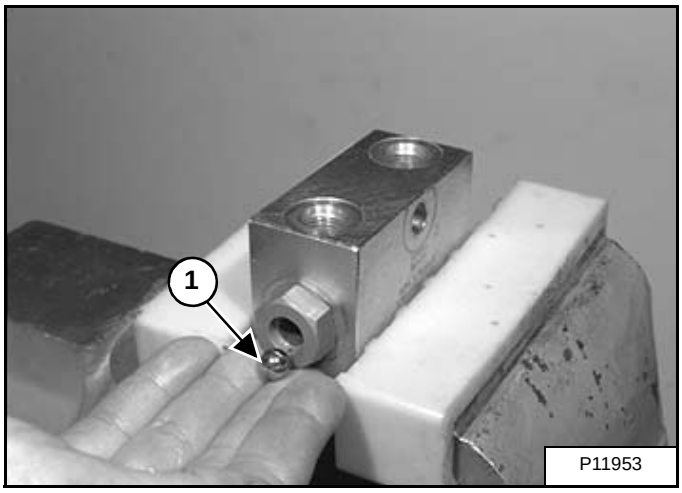
Assembly (Cont'd)

Figure 20-170-22



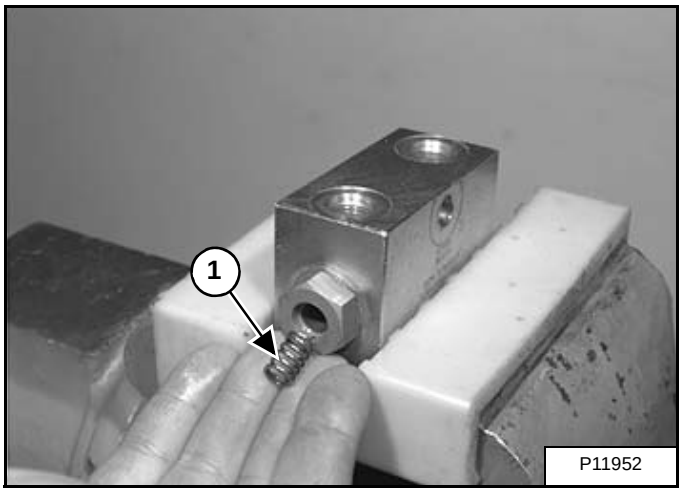
Install the valve body (Item 1) **[Figure 20-170-22]**. Tighten to 15-20 ft.-lbs. (20-27 Nm) torque.

Figure 20-170-23



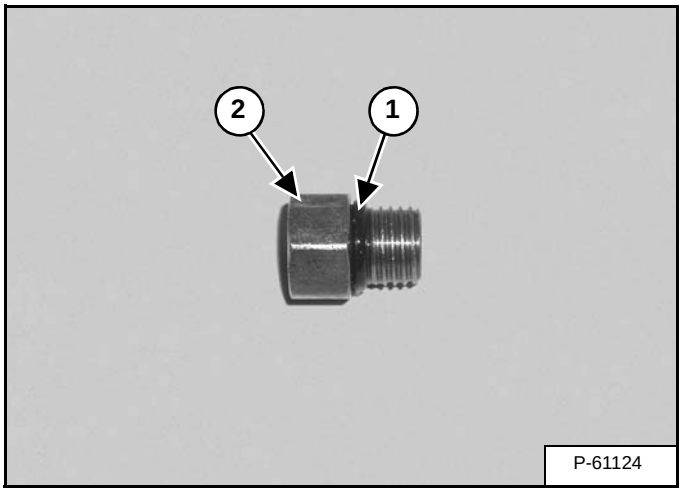
Install the ball (Item 1) **[Figure 20-170-23]**.

Figure 20-170-24



Install the spring (Item 1) **[Figure 20-170-24]**.

Figure 20-170-25

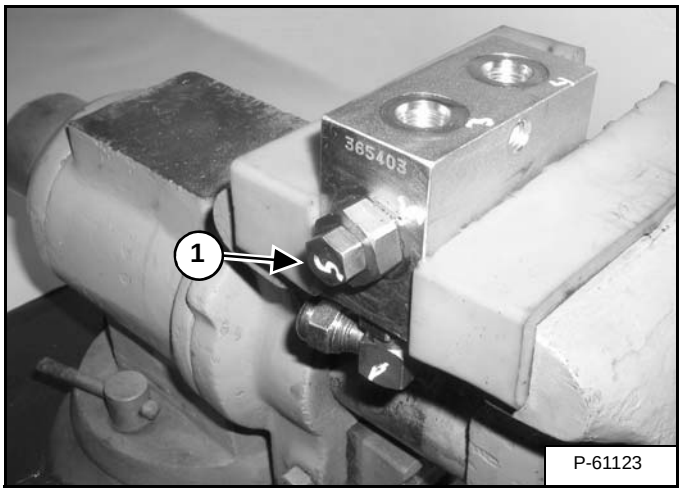


Install the O-ring (Item 1) on the plug (Item 2) **[Figure 20-170-25]**.

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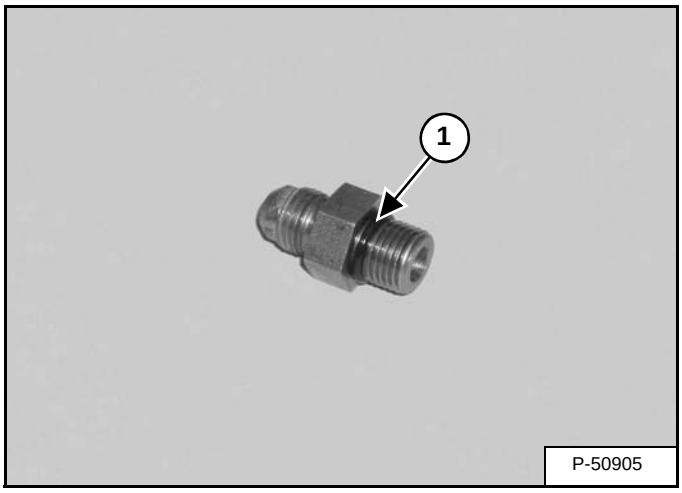
Assembly (Cont'd)

Figure 20-170-26



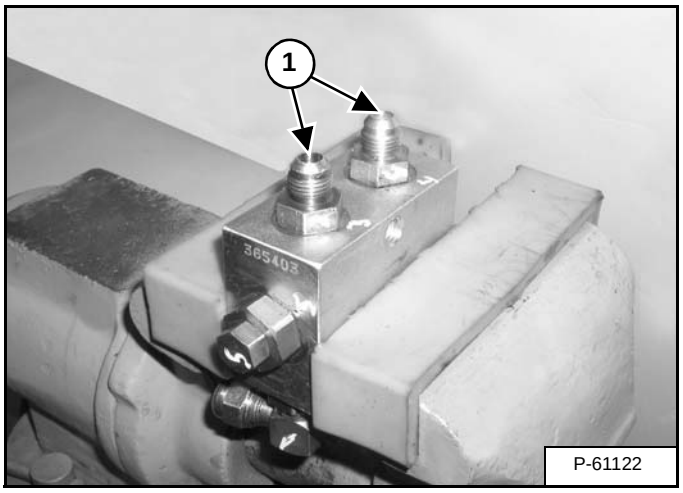
Install the plug (Item 1) **[Figure 20-170-26]**. Tighten to 7-8 in.-lbs. (9,6-11,3 Nm) torque.

Figure 20-170-27



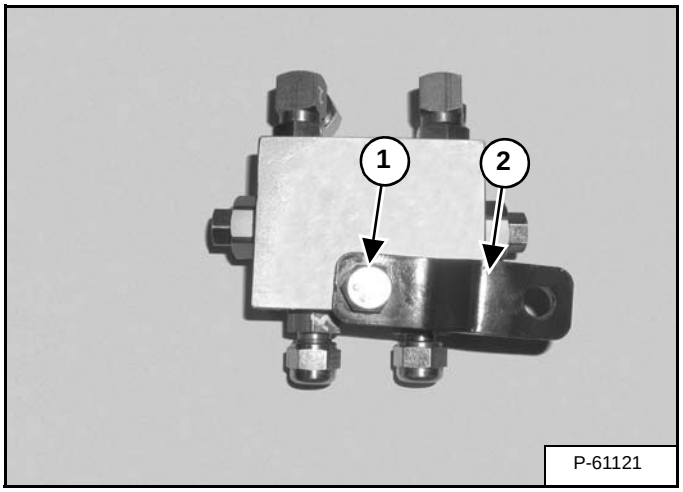
Install the O-ring (Item 1) **[Figure 20-170-27]** on the fittings.

Figure 20-170-28



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

Figure 20-170-29



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

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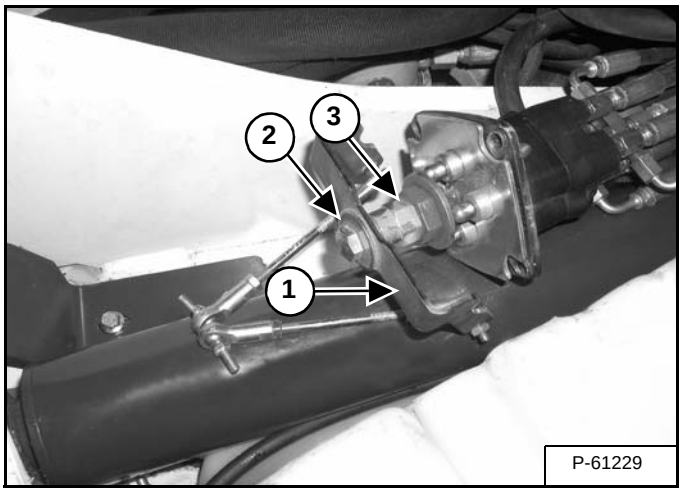
TRAVEL CONTROL VALVE

Removal and Installation

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

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

Figure 20-180-30



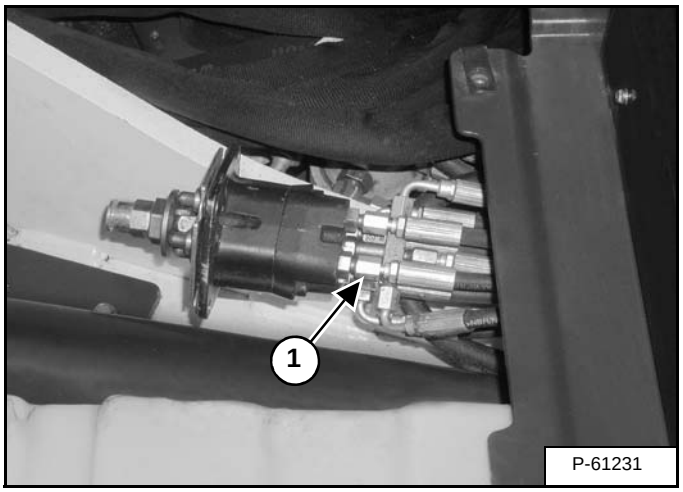
Hold the nut (Item 1) and remove the bolt (Item 2) and washer. Remove the control linkage (Item 3) **[Figure 20-180-30]**.

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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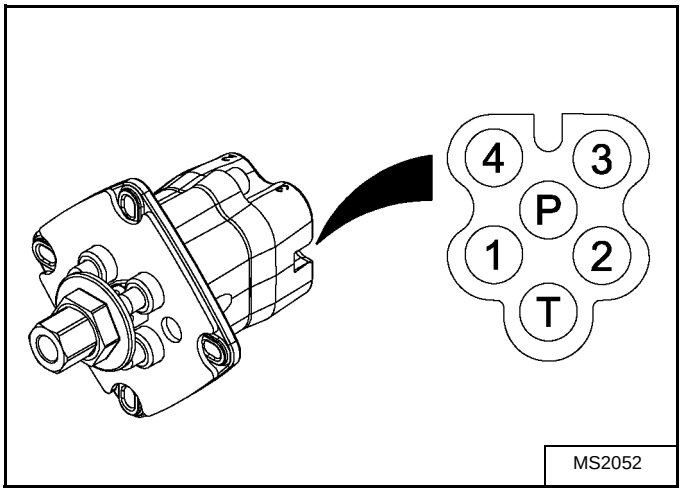
Figure 20-180-31



Mark and remove the hoses (Item 1) **[Figure 20-180-31]** from the control valve.

Remove the control valve from the excavator.

Figure 20-180-32

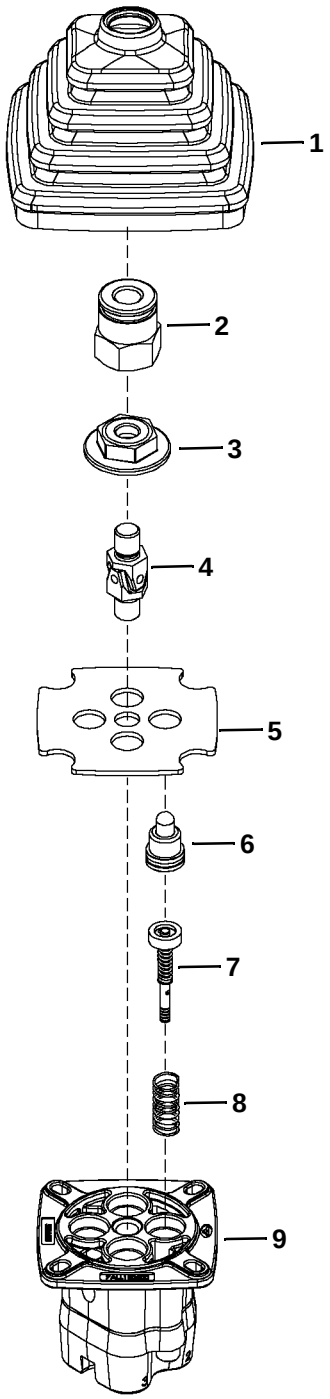


Installation: Install the hoses in the correct port **[Figure 20-180-32]**.

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Parts Identification

1 Dust Boot
2 Coupler
3 Control Plate
4 Swivel Joint
5 Plate
6 Plunger Assembly
7 Spool Assembly
8 Spring
9 Housing



MS1351

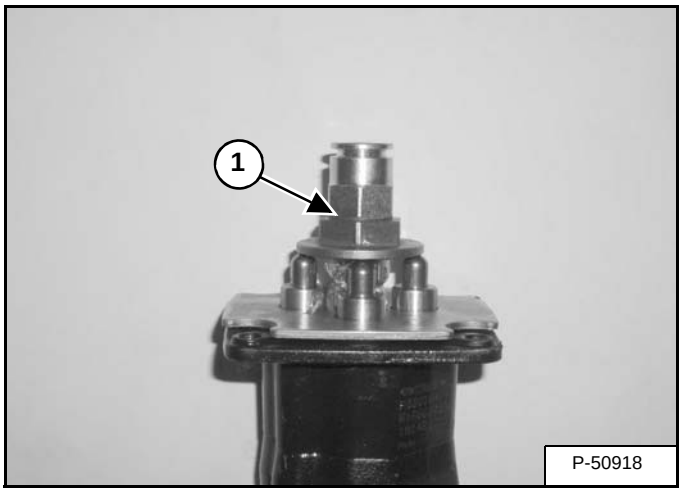
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Disassembly And Assembly

Clean the outside of the travel control valve before disassembly.

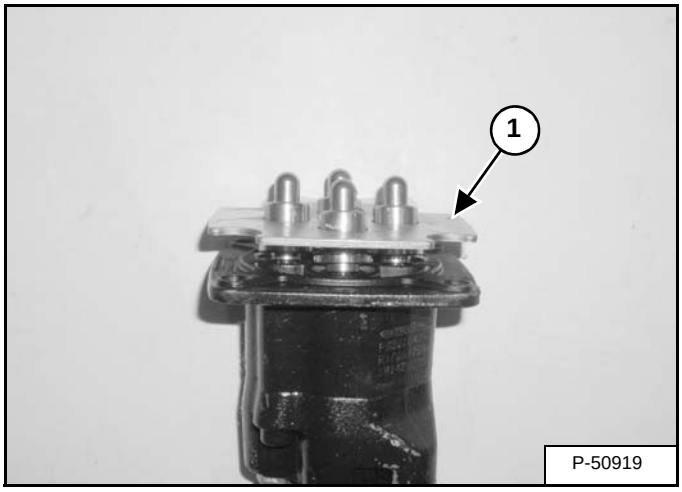
Mark the outside of the travel control valve for ease of assembly.

Figure 20-180-33



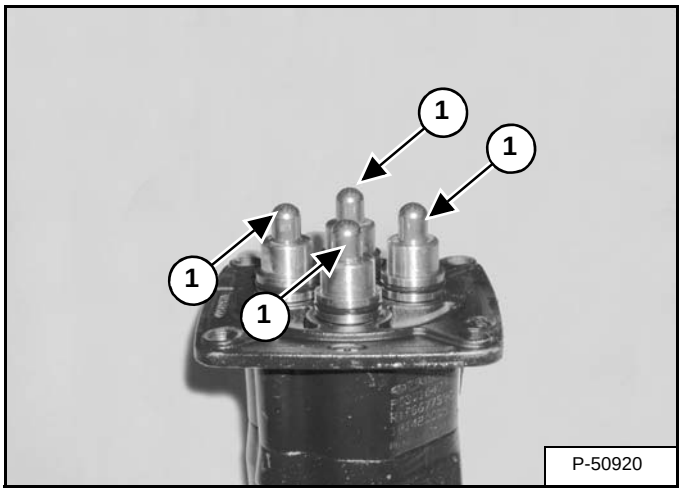
Remove the swivel joint (Item 1) **[Figure 20-180-33]**.

Figure 20-180-34



Remove the plate (Item 1) **[Figure 20-180-34]**.

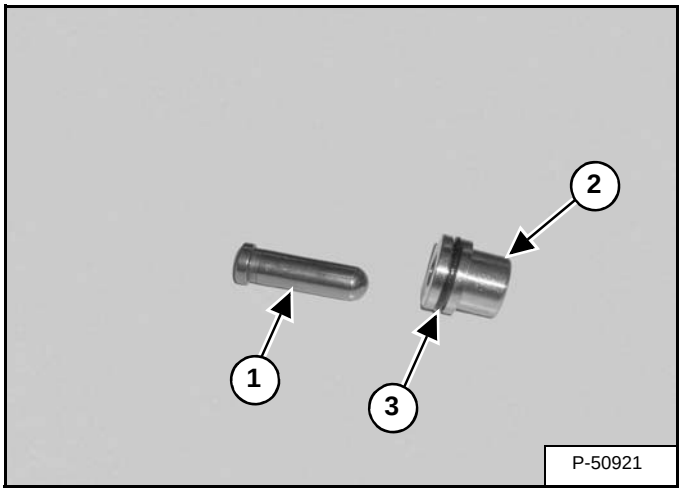
Figure 20-180-35



Remove the plunger assemblies (Item 1) **[Figure 20-180-35]** from the valve body.

NOTE: Install the plunger assemblies in the same bore from which they are removed.

Figure 20-180-36



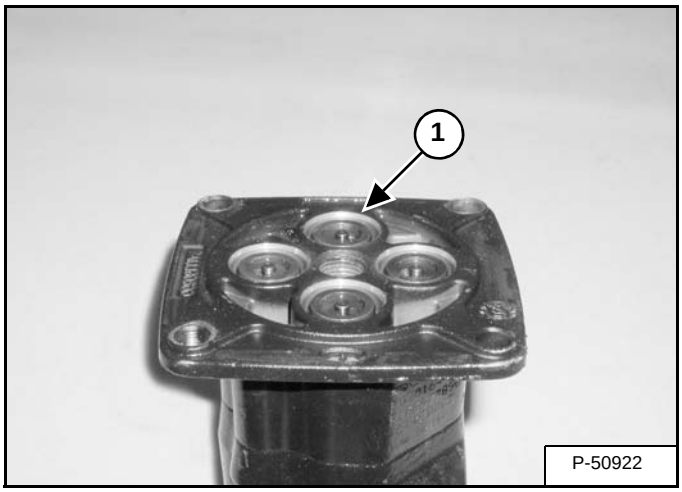
Remove the plunger (Item 1) from the plunger body (Item 2) **[Figure 20-180-36]**.

Remove the O-ring (Item 3) **[Figure 20-180-36]**.

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Disassembly And Assembly (Cont'd)

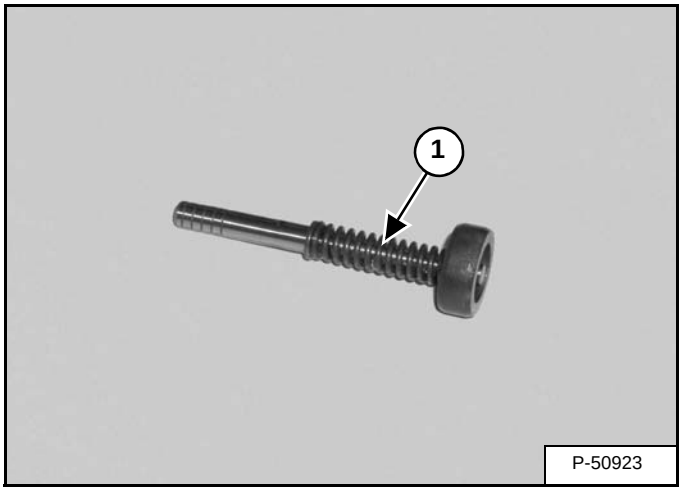
Figure 20-180-37



Remove the spool assemblies (Item 1) **[Figure 20-180-37]**.

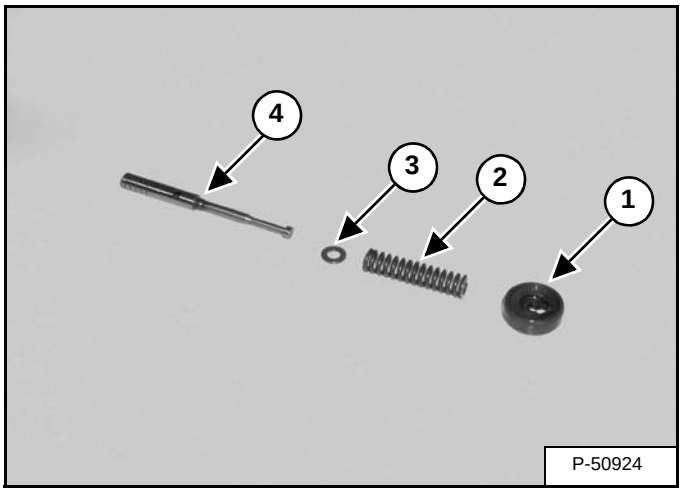
NOTE Install the spool assemblies in the same bore from which they are removed.

Figure 20-180-38



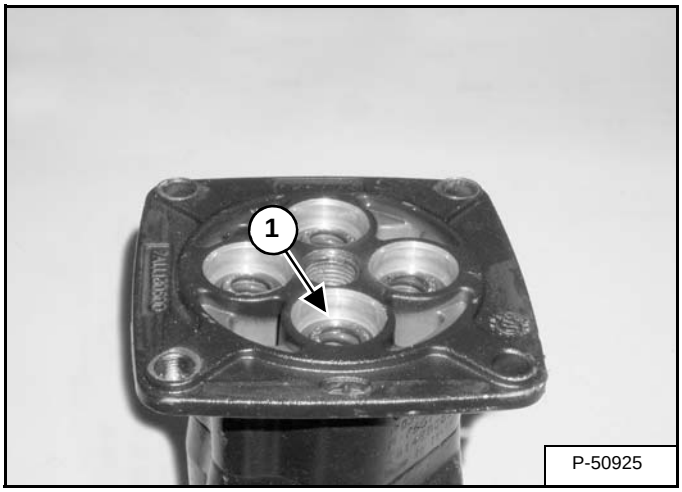
Compress the spring (Item 1) **[Figure 20-180-38]**.

Figure 20-180-39



Remove the piston (Item 1), spring (Item 2) and washer (Item 3) from the spool (Item 4) **[Figure 20-180-39]**.

Figure 20-180-40

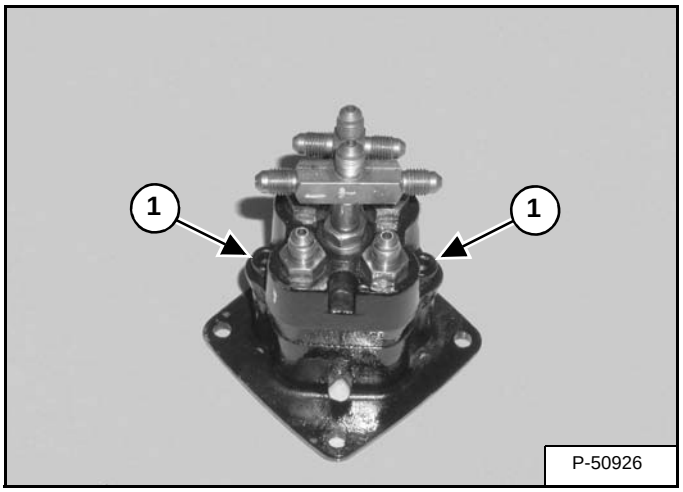


Remove the centering springs (Item 1) **[Figure 20-180-40]**.

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Disassembly And Assembly (Cont'd)

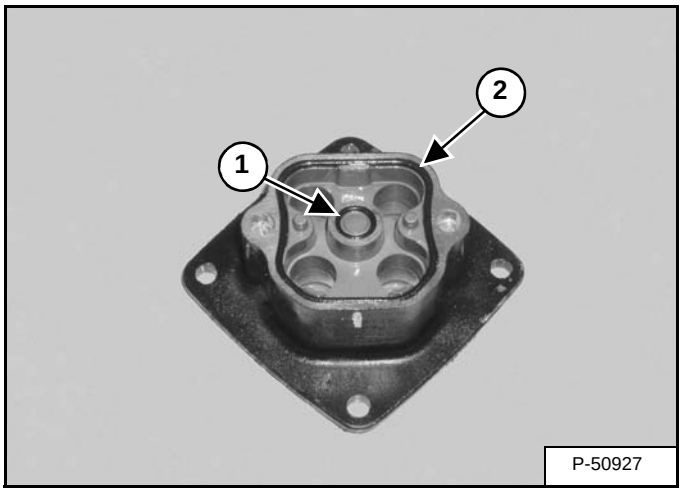
Figure 20-180-41



Remove the bolts (Item 1) **[Figure 20-180-41]**.

Separate the housing sections.

Figure 20-180-42



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-180-42]** from the housing.

Assembly

Clean all parts in solvent and dry with compressed air.

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

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

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HYDRAULIC X-CHANGE VALVE

Removal And Installation

IMPORTANT

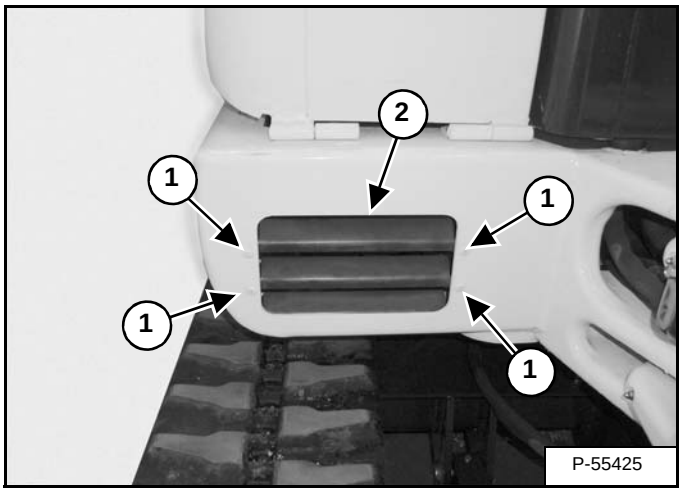
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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Lower the boom and blade to the ground.

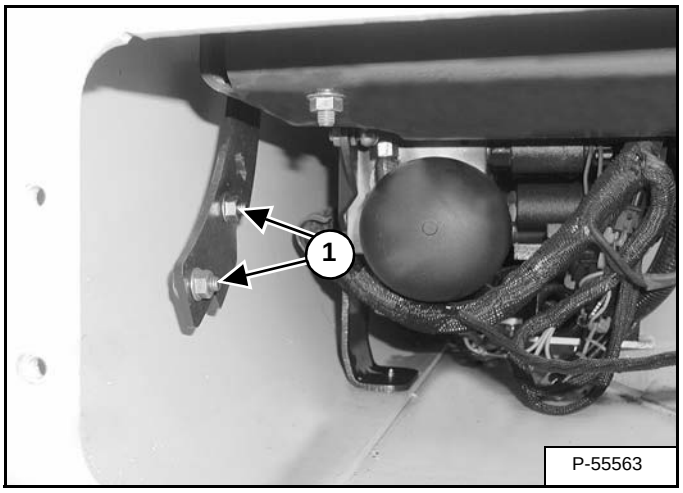
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic.

Figure 20-190-1



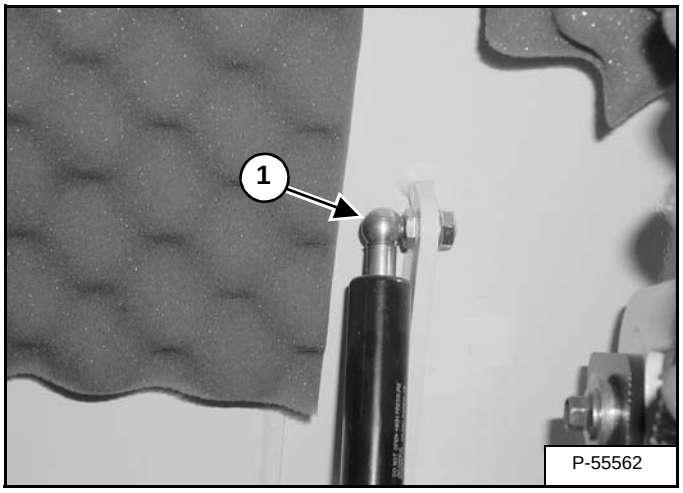
Locate the swing lock valve (Item 1) **[Figure 20-190-1]**, on the boom swing cylinder.

Figure 20-190-2



Remove the bolts and nuts (Item 1) **[Figure 20-190-2]**.

Figure 20-190-3

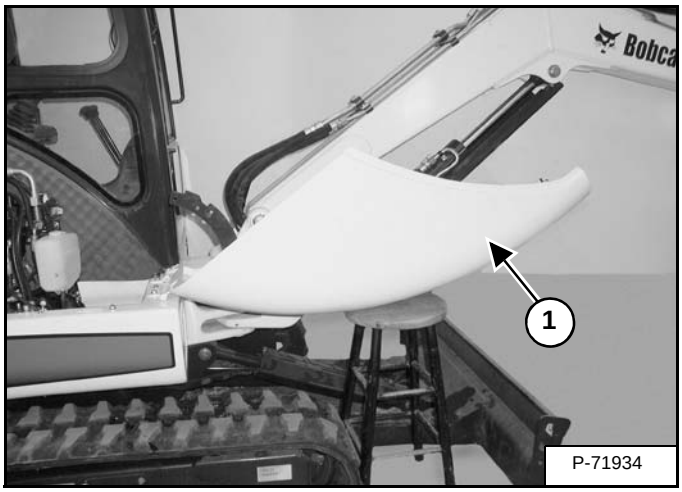


Remove the gas spring retaining clip (Item 1) **[Figure 20-190-3]** and remove the gas spring.

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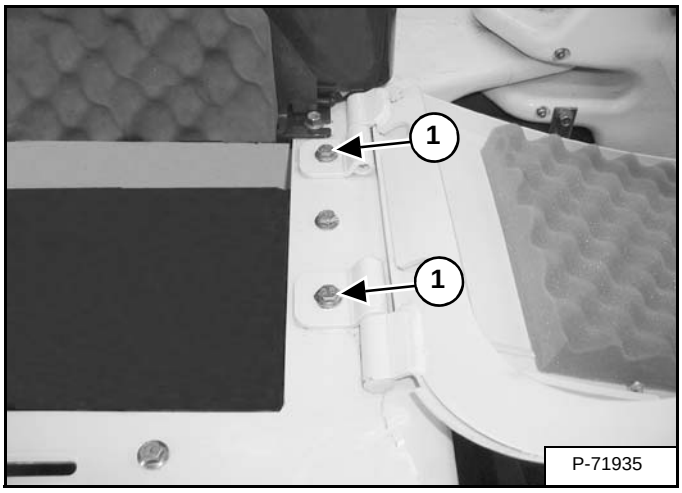
Removal And Installation (Cont'd)

Figure 20-190-4



Fully open and support the cover (Item 1) **[Figure 20-190-4]**.

Figure 20-190-5

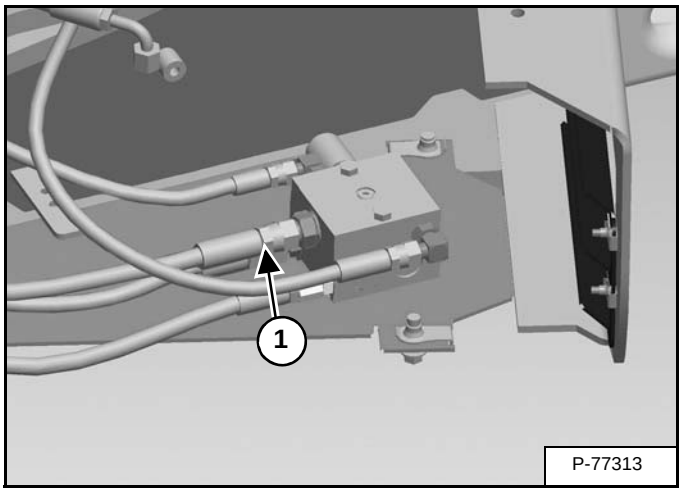


Remove the nuts and bolts (Item 1) **[Figure 20-190-5]**.

Remove the cover.

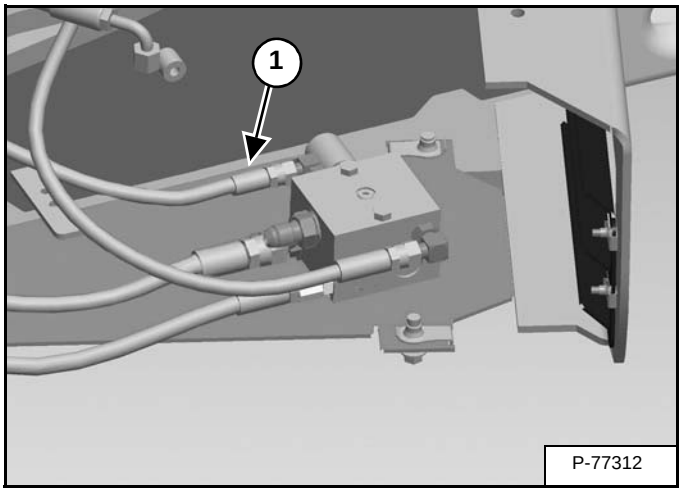
Mark all hoses for proper installation

Figure 20-190-6



Remove the hose (Item 1) **[Figure 20-190-6]** from the P port on the X-change valve.

Figure 20-190-7

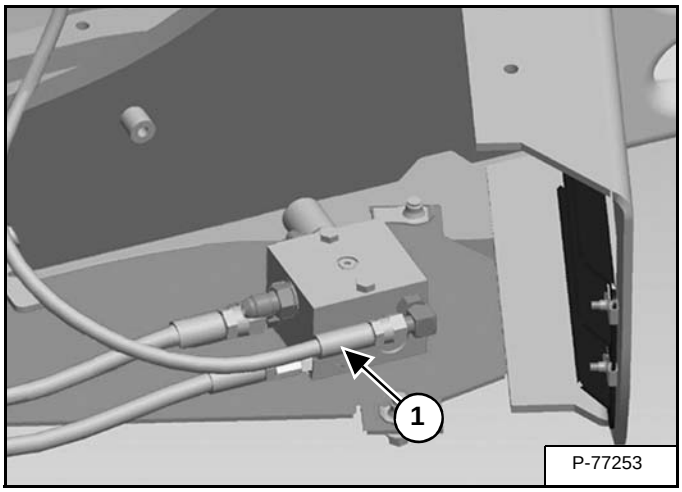


Remove the hose (Item 1) **[Figure 20-190-7]** from the T port on the exchange valve.

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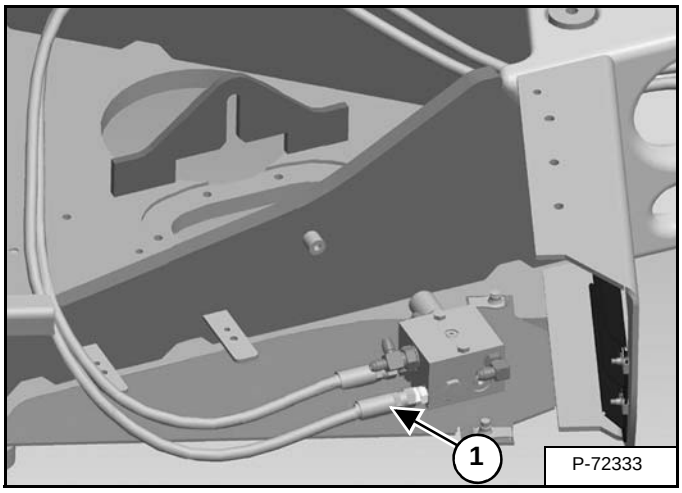
Removal And Installation (Cont'd)

Figure 20-190-8



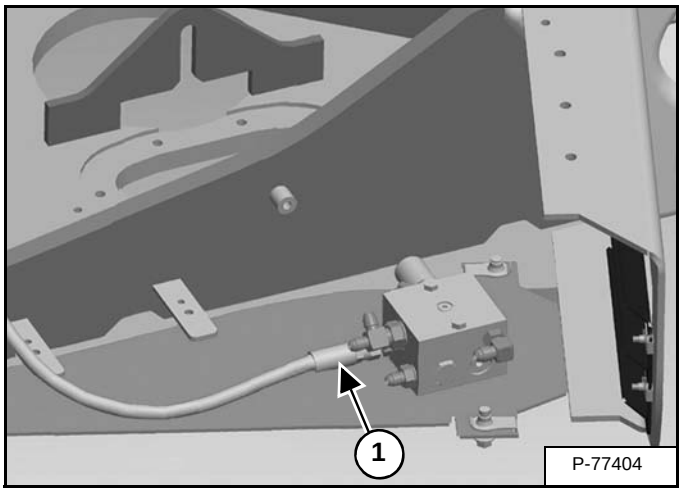
Remove the hose (Item 1) **[Figure 20-190-8]** from the LS port on the X-change valve.

Figure 20-190-9



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

Figure 20-190-10

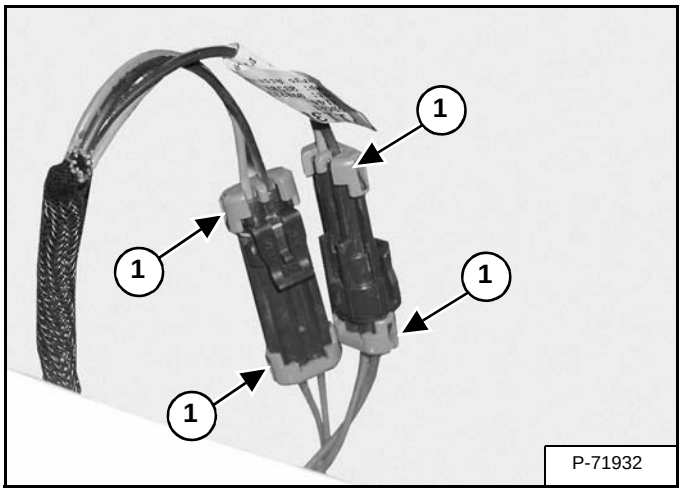


Remove the hose (Item 1) **[Figure 20-190-10]** from the B port on the X-change valve.

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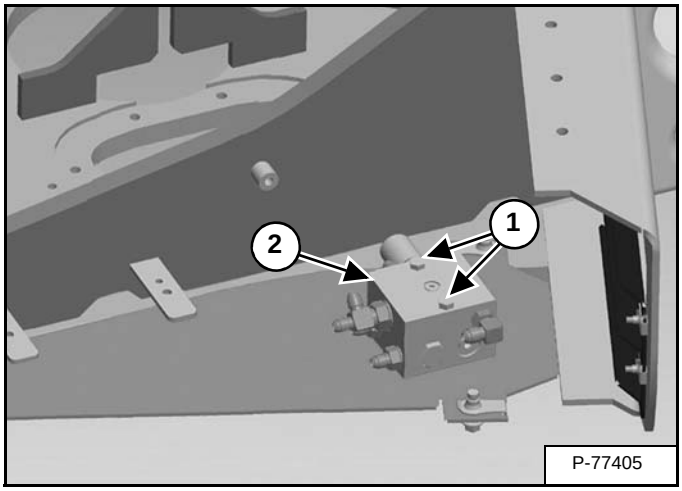
Removal And Installation (Cont'd)

Figure 20-190-11



Disconnect the two harness connectors (Item 1) from the X-change valve solenoid connectors (Item 2) **[Figure 20-190-11]**.

Figure 20-190-12



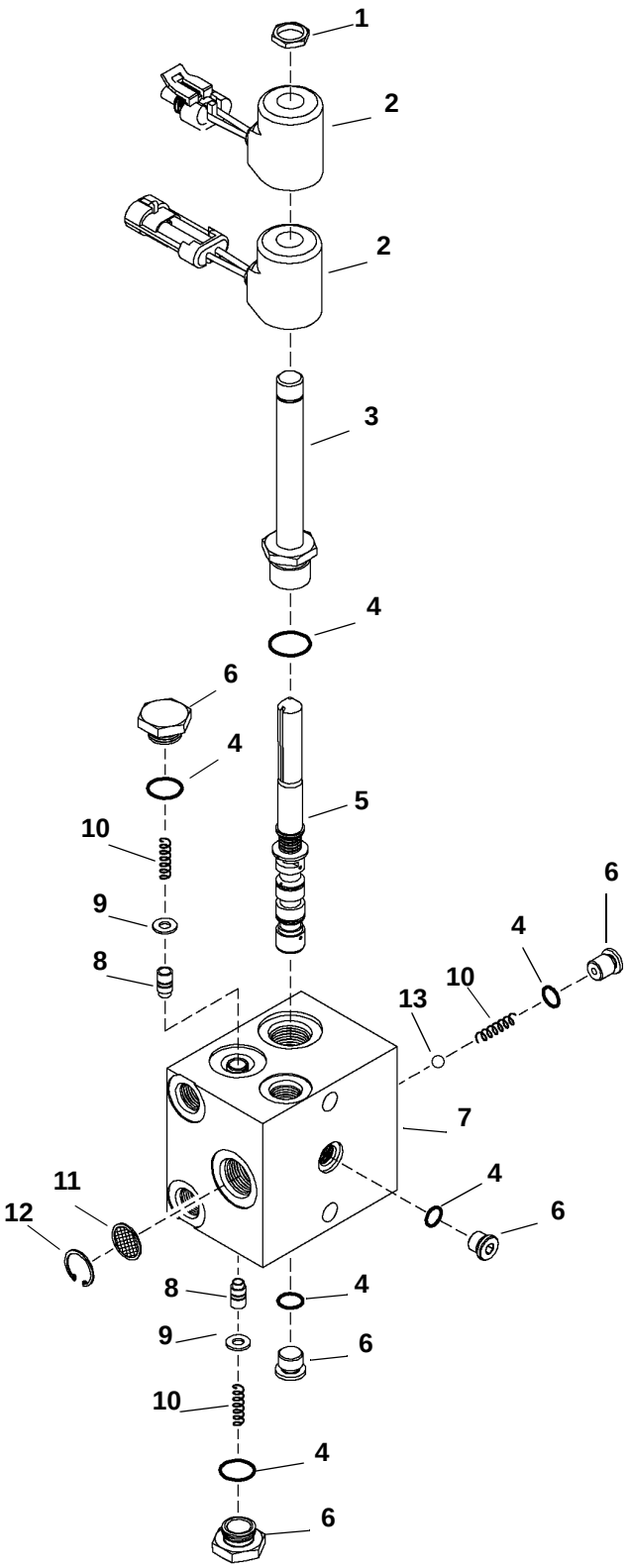
Remove the two mounting nuts and bolts (Item 1) **[Figure 20-190-12]**.

Remove the X-change valve (Item 2) **[Figure 20-190-12]**.

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Parts Identification

1. Nut
2. Solenoid
3. Spool
4. O-Ring
5. Actuator Assembly
6. Plug
7. Valve
8. Poppet
9. Flat Washer
10. Spring
11. Screen
12. Snap Ring
13. Ball



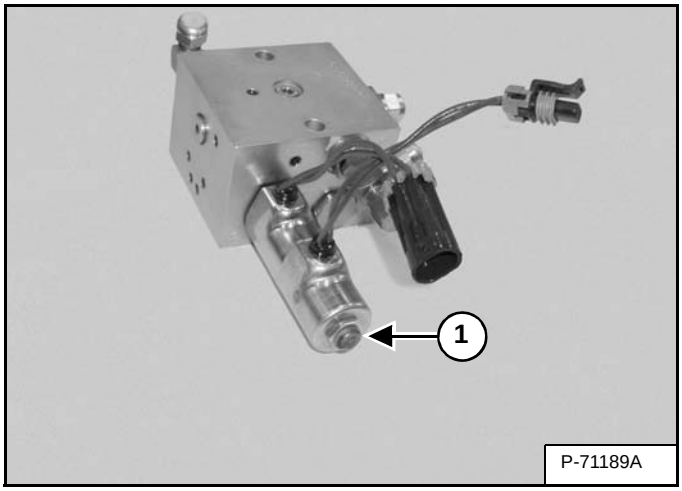
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Disassembly

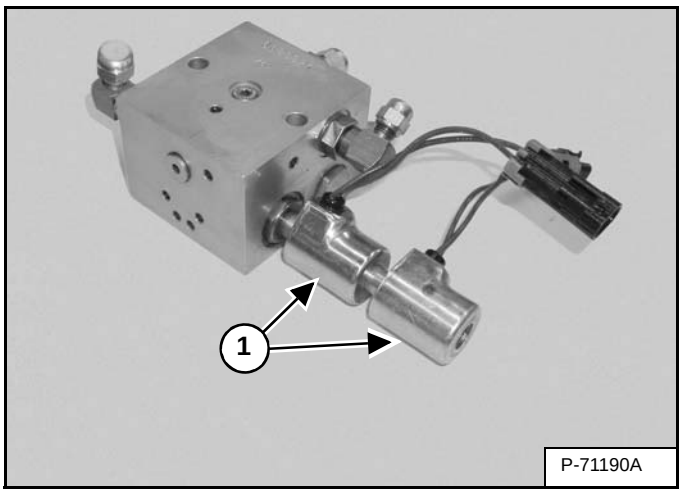
Clean the outside of the hydraulic X-Change valve before disassembly.

Figure 20-190-13



Remove the nut (Item 1) **[Figure 20-190-13]**.

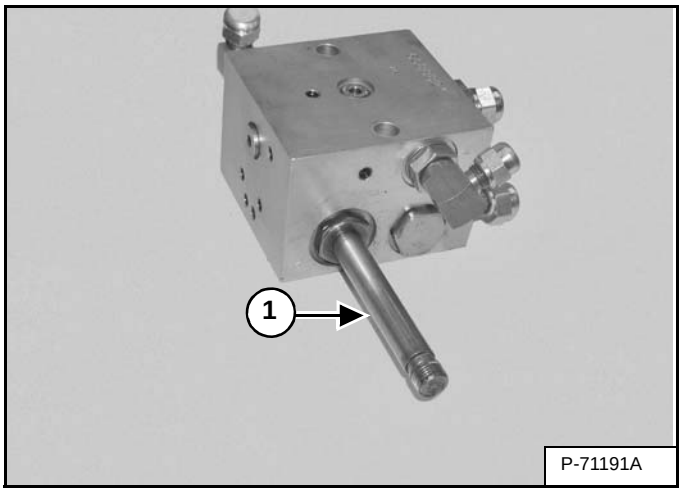
Figure 20-190-14



Remove the two solenoids (Item 1) **[Figure 20-190-14]**.

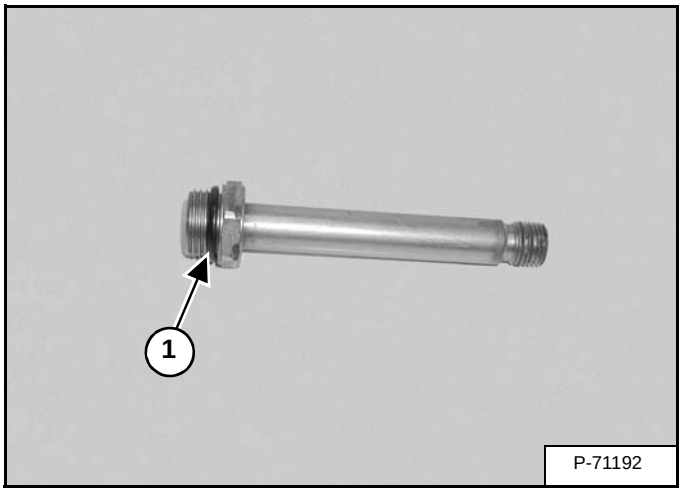
NOTE: Mark the solenoids for correct assembly.

Figure 20-190-15



Remove the spool (Item 1) **[Figure 20-190-15]**.

Figure 20-190-16

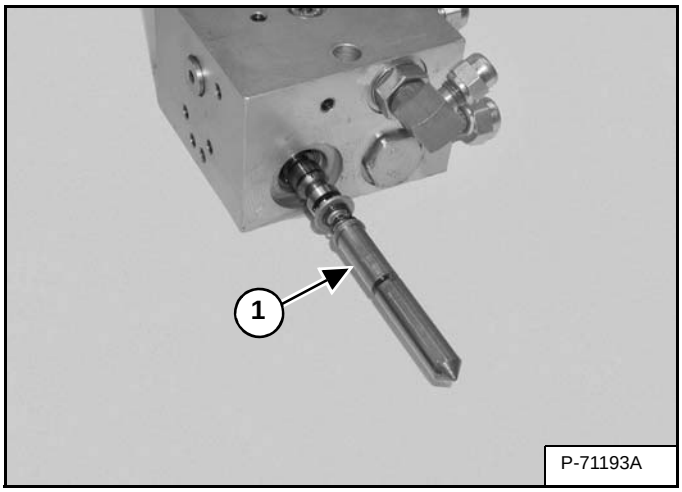


Remove the O-ring (Item 1) **[Figure 20-190-16]** from the spool.

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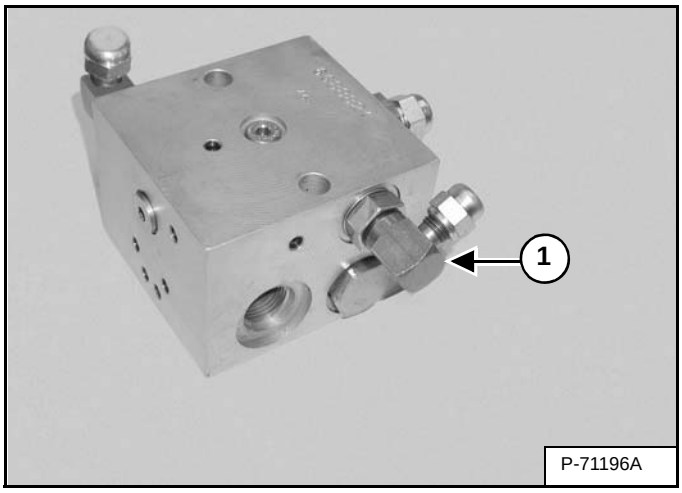
Disassembly (Cont'd)

Figure 20-190-17



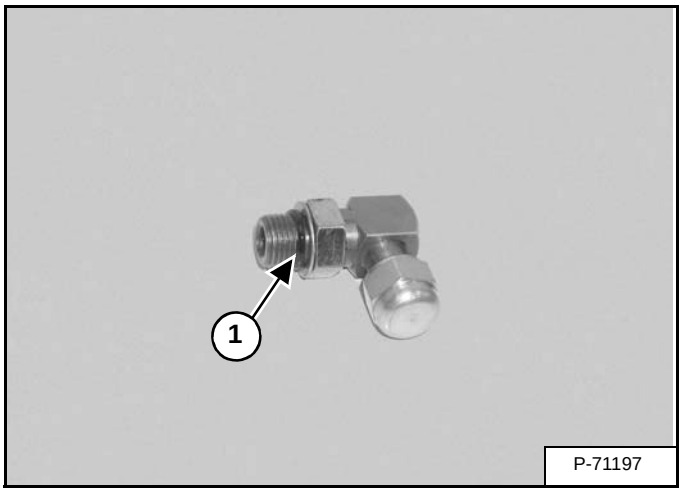
Remove the actuator assembly (Item 1) **[Figure 20-190-17]**.

Figure 20-190-18



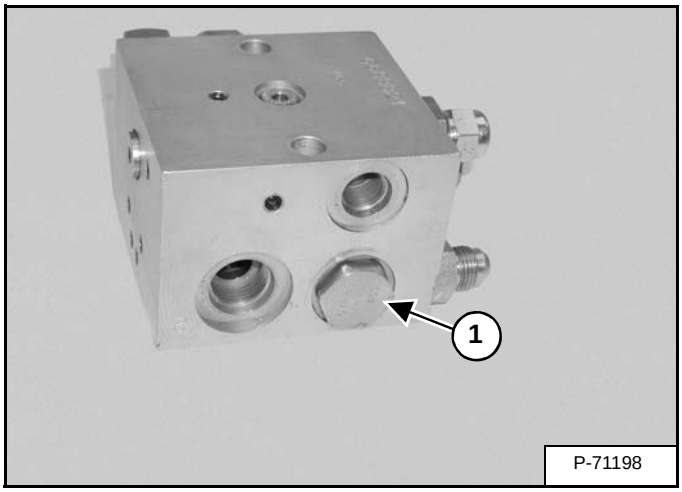
Remove the fitting (Item 1) **[Figure 20-190-18]**.

Figure 20-190-19



Remove the O-ring (Item 1) **[Figure 20-190-19]** from the fitting.

Figure 20-190-20

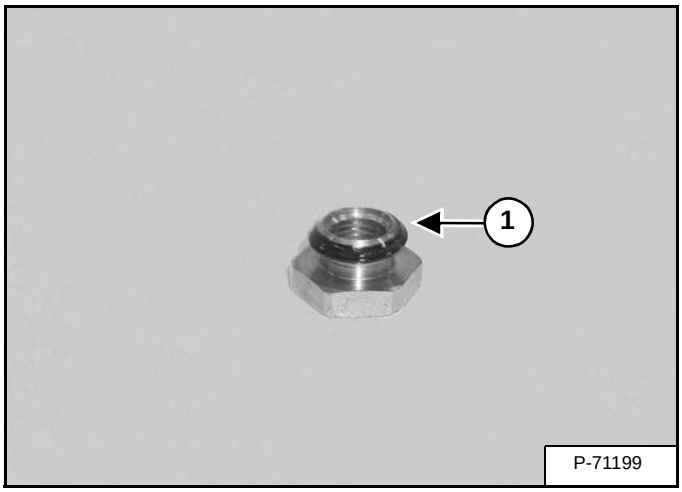


Remove the plug (Item 1) **[Figure 20-190-20]**.

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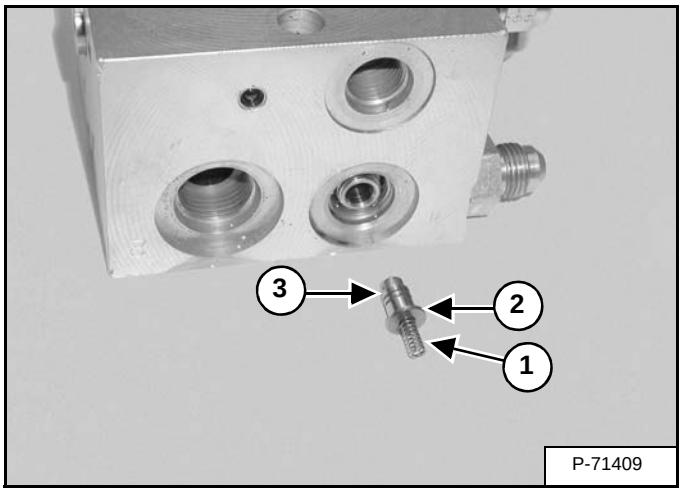
Disassembly (Cont'd)

Figure 20-190-21



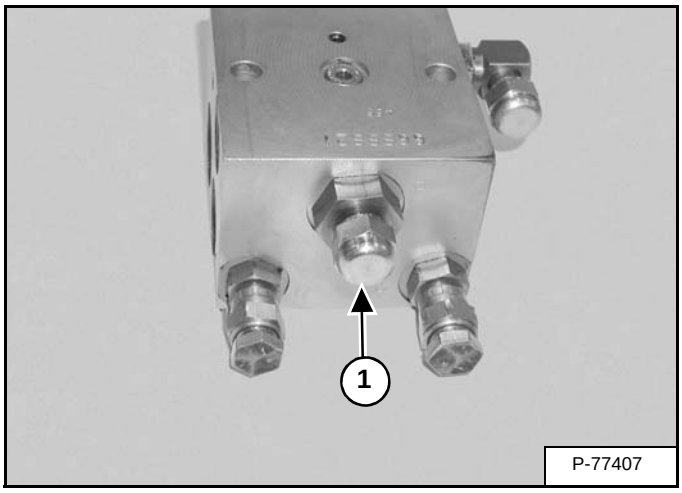
Remove the O-ring (Item 1) **[Figure 20-190-21]** from the plug.

Figure 20-190-22



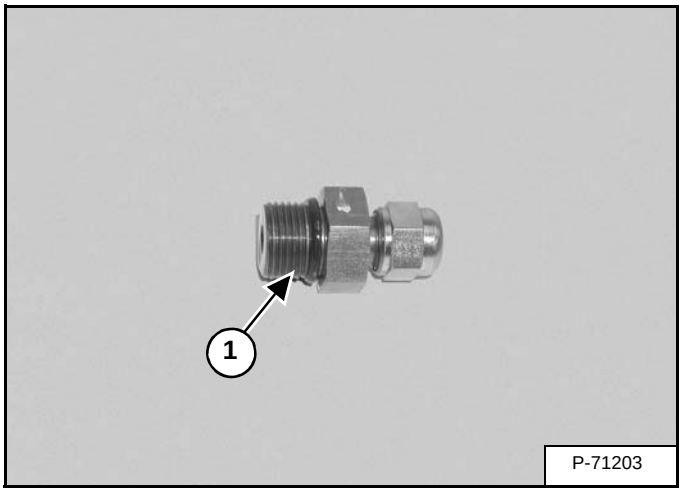
Remove the spring (Item 1), flat washer (Item 2) and poppet (Item 3) **[Figure 20-190-22]**.

Figure 20-190-23



Remove the fitting (Item 1) **[Figure 20-190-23]**.

Figure 20-190-24

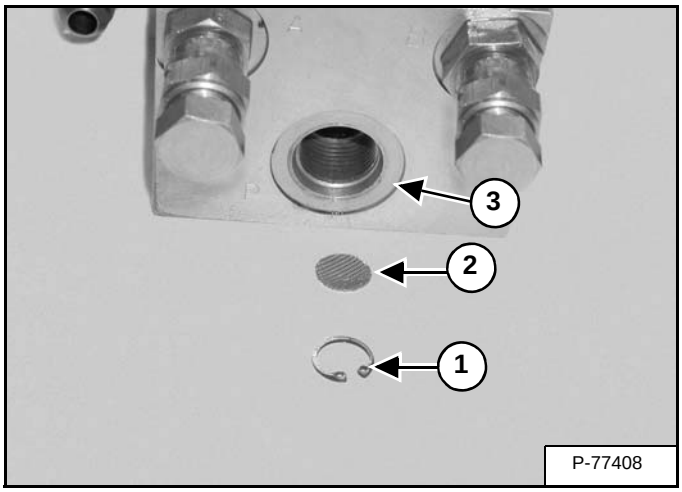


Remove the O-ring (Item 1) **[Figure 20-190-24]** from the fitting.

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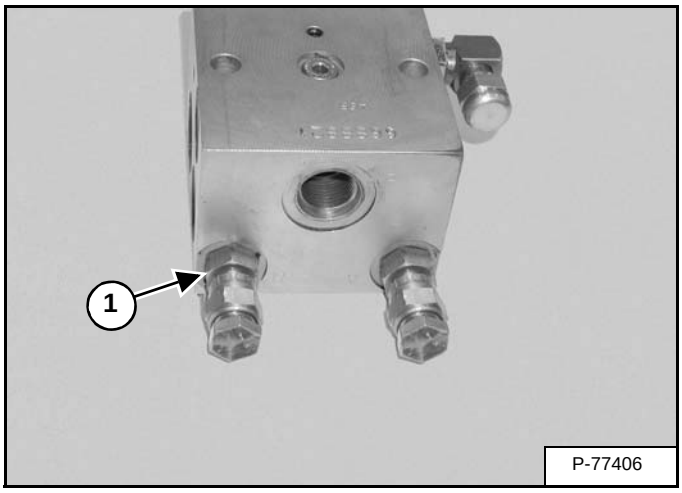
Disassembly (Cont'd)

Figure 20-190-25



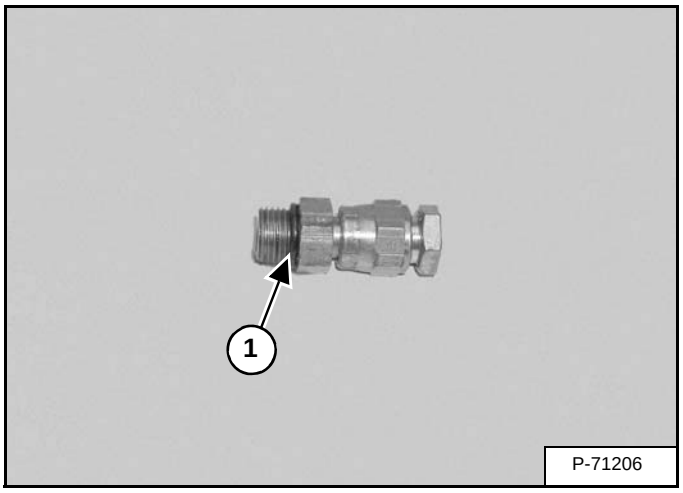
Remove the snap ring (Item 1) and screen (Item 2) from the "S" port (Item 3) **[Figure 20-190-25]**.

Figure 20-190-26



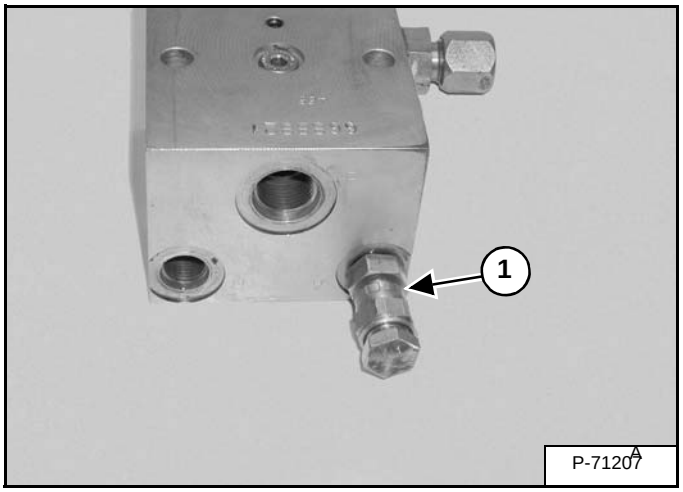
Remove the fitting (Item 1) **[Figure 20-190-26]**.

Figure 20-190-27



Remove the O-ring (Item 1) **[Figure 20-190-27]** from the fitting.

Figure 20-190-28

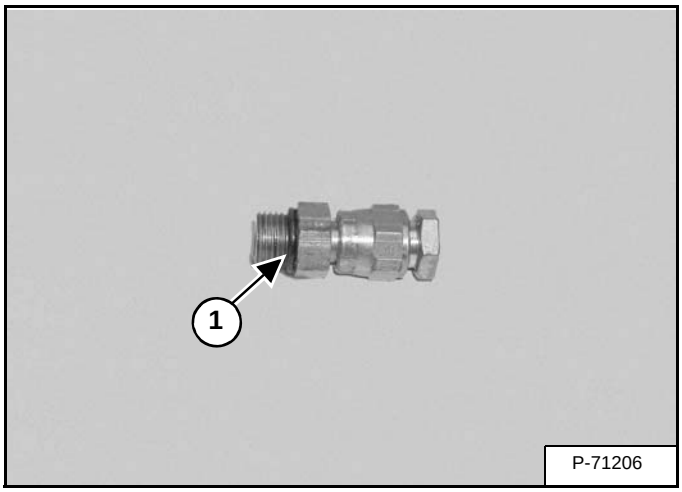


Remove the fitting (Item 1) **[Figure 20-190-28]**.

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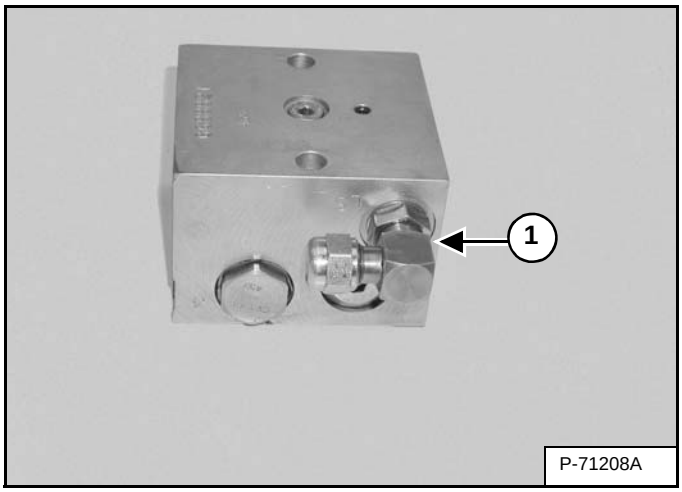
Disassembly (Cont'd)

Figure 20-190-29



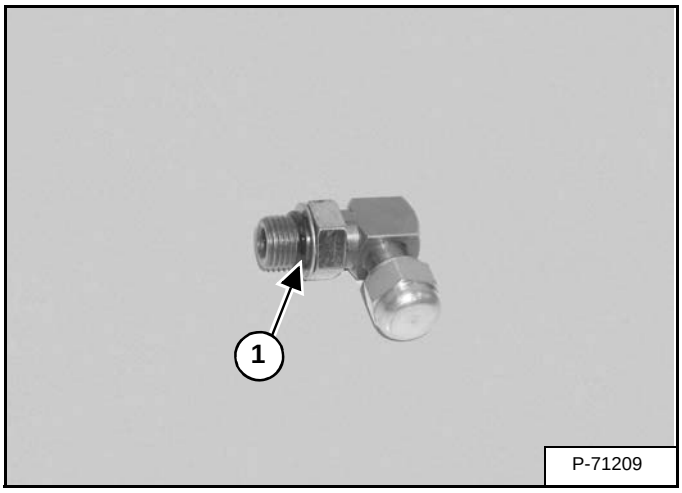
Remove the O-ring (Item 1) **[Figure 20-190-29]** from the fitting.

Figure 20-190-30



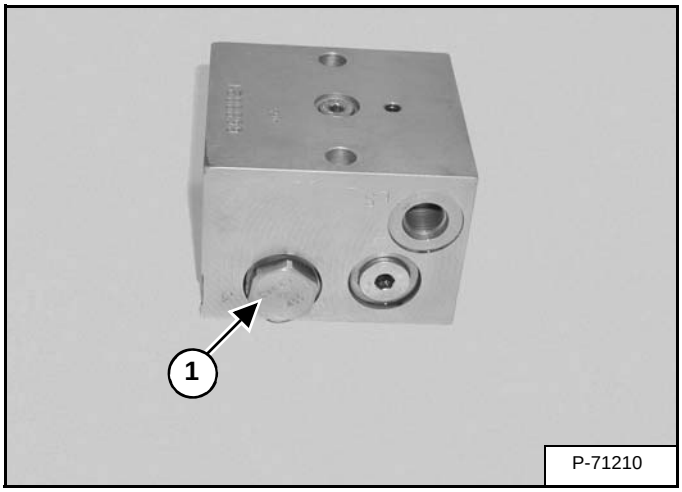
Remove the fitting (Item 1) **[Figure 20-190-30]**.

Figure 20-190-31



Remove the O-ring (Item 1) **[Figure 20-190-31]** from the fitting.

Figure 20-190-32

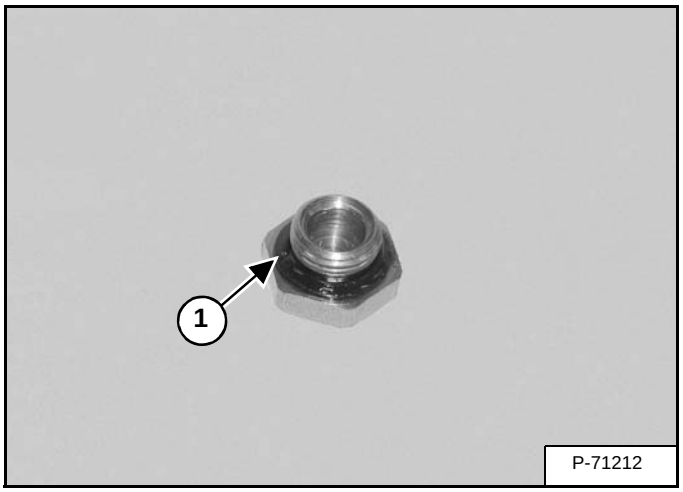


Remove the plug (Item 1) **[Figure 20-190-32]**.

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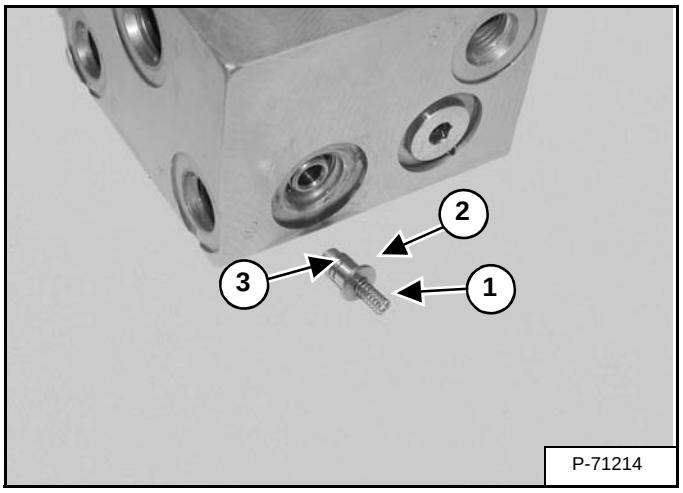
Disassembly (Cont'd)

Figure 20-190-33



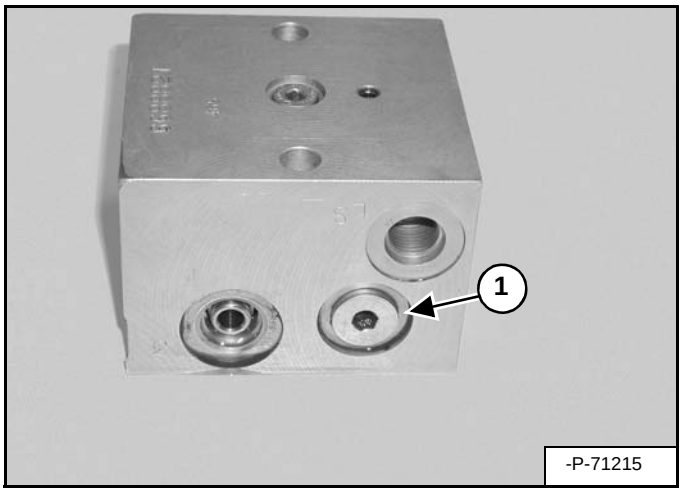
Remove the O-ring (Item 1) **[Figure 20-190-33]** from the plug.

Figure 20-190-34



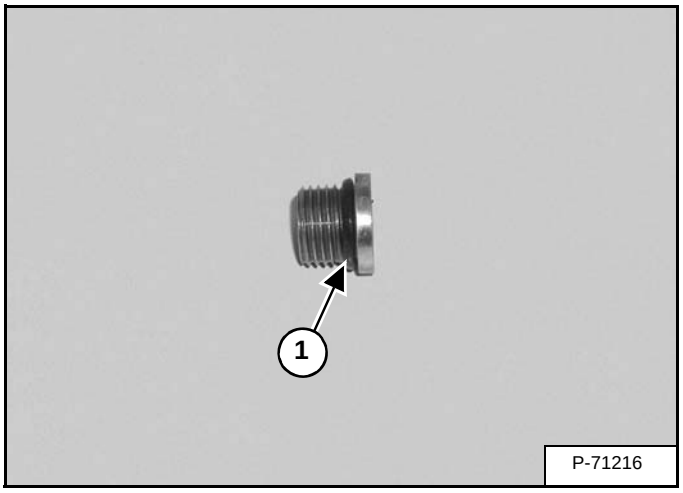
Remove the spring (Item 1), flat washer (Item 2) and poppet (Item 3) **[Figure 20-190-34]**.

Figure 20-190-35



Remove the plug (Item 1) **[Figure 20-190-35]**.

Figure 20-190-36

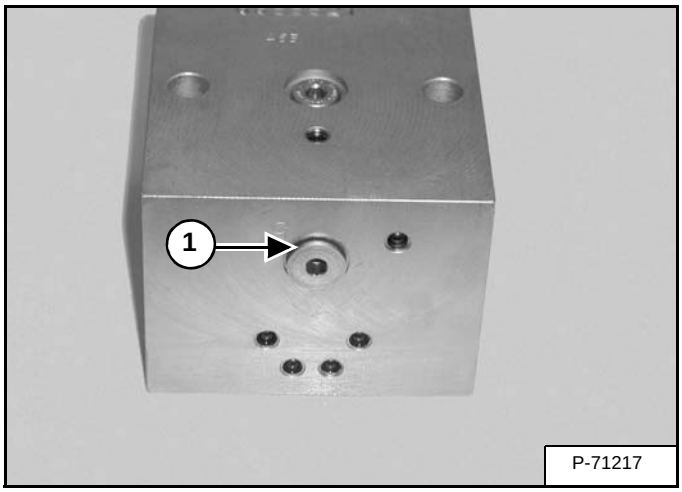


Remove the O-ring (Item 1) **[Figure 20-190-36]** from the plug.

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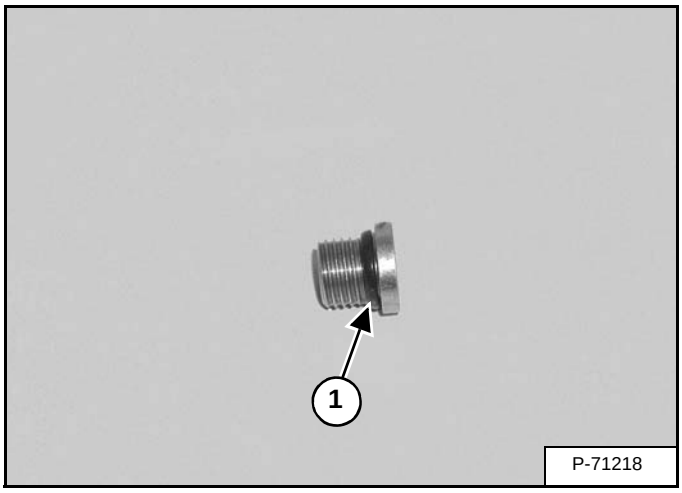
Disassembly (Cont'd)

Figure 20-190-37



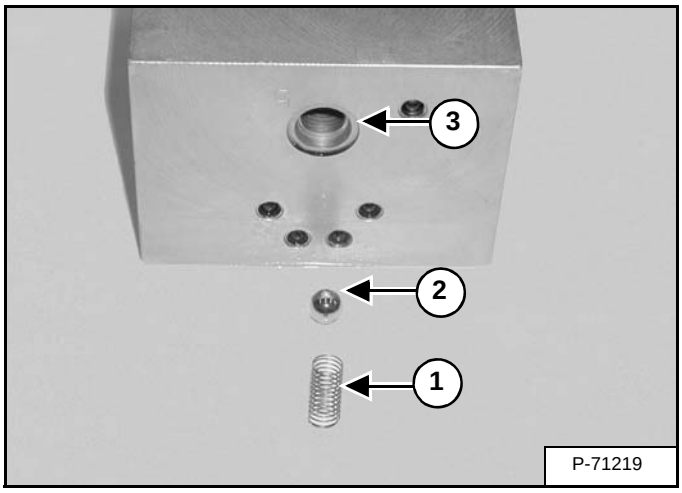
Remove the plug (Item 1) **[Figure 20-190-37]**.

Figure 20-190-38



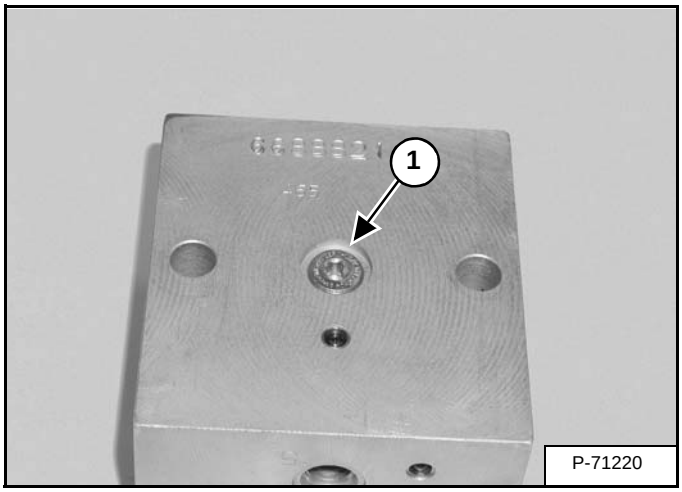
Remove the O-ring (Item 1) **[Figure 20-190-38]** from the plug.

Figure 20-190-39



Remove the spring (Item 1) and ball (Item 2) from port 5 (Item 3) **[Figure 20-190-39]**.

Figure 20-190-40

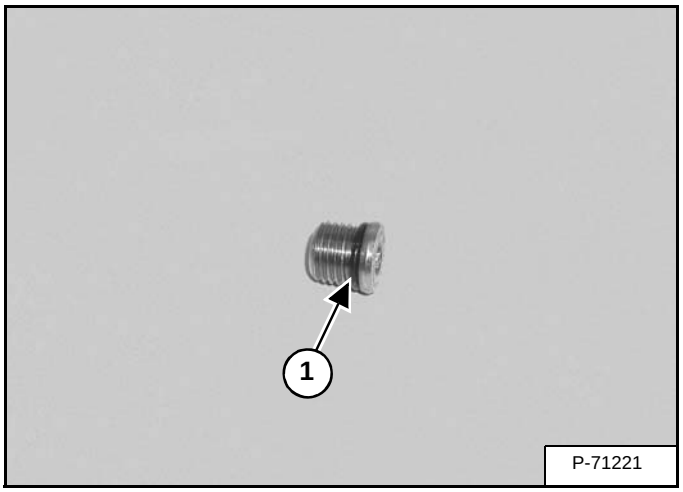


Remove the plug (Item 1) **[Figure 20-190-40]**.

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Disassembly (Cont'd)

Figure 20-190-41



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

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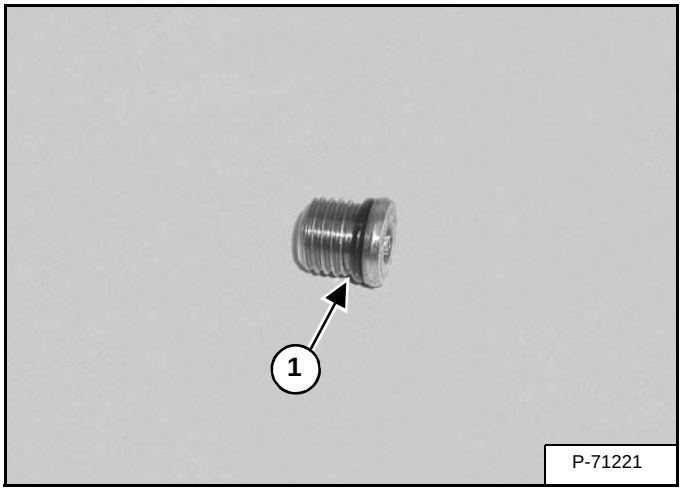
Assembly

Clean all parts in solvent and dry with compressed air.

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

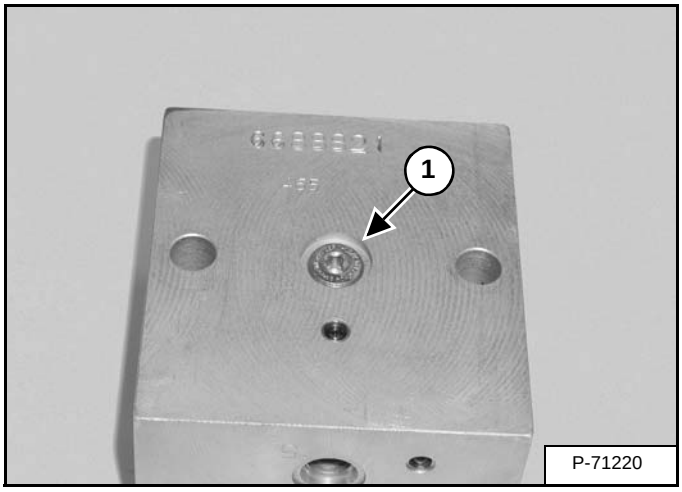
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-190-42



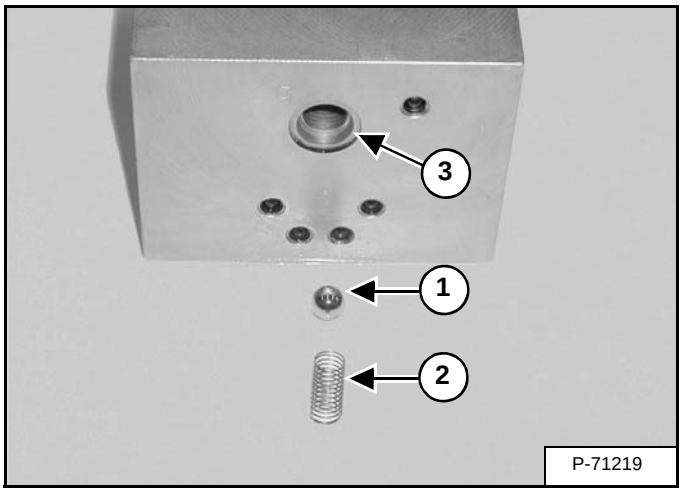
Install the O-ring (Item 1) **[Figure 20-190-42]** on the plug.

Figure 20-190-43



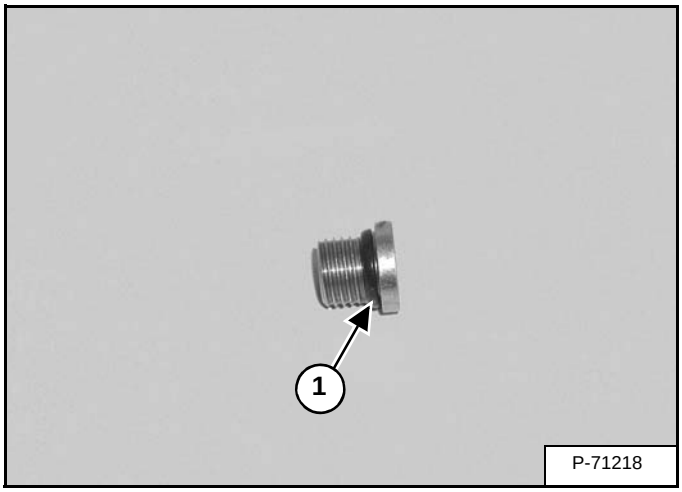
Install the plug (Item 1) **[Figure 20-190-43]**.

Figure 20-190-44



Install the ball (Item 1) and spring (Item 2) into port 5 (Item 3) **[Figure 20-190-44]**.

Figure 20-190-45

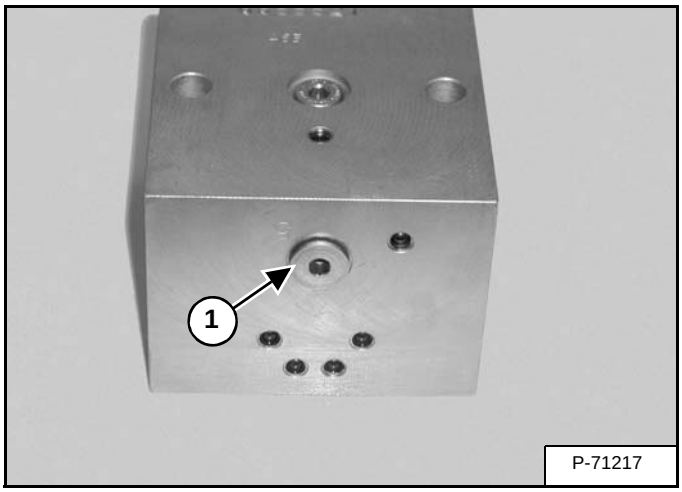


Install the O-ring (Item 1) **[Figure 20-190-45]** on the plug.

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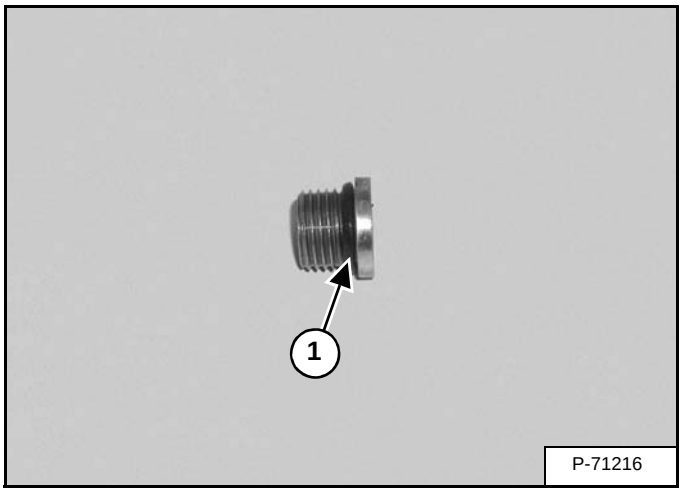
Assembly (Cont'd)

Figure 20-190-46



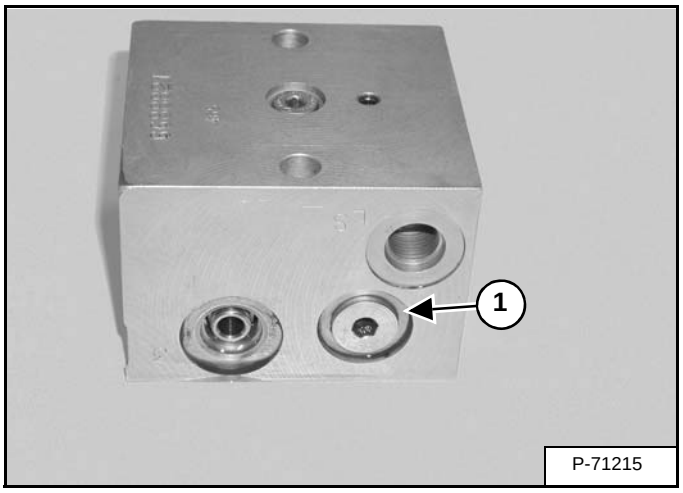
Install the plug (Item 1) **[Figure 20-190-46]**.

Figure 20-190-47



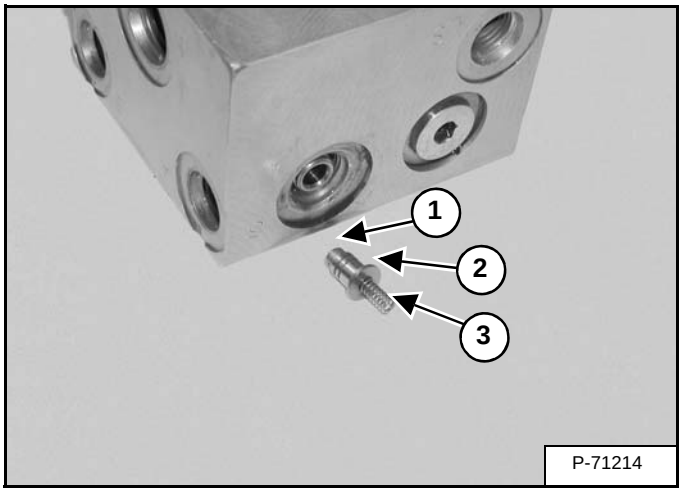
Install the O-ring (Item 1) **[Figure 20-190-47]** on the plug.

Figure 20-190-48



Install the plug (Item 1) **[Figure 20-190-48]**.

Figure 20-190-49

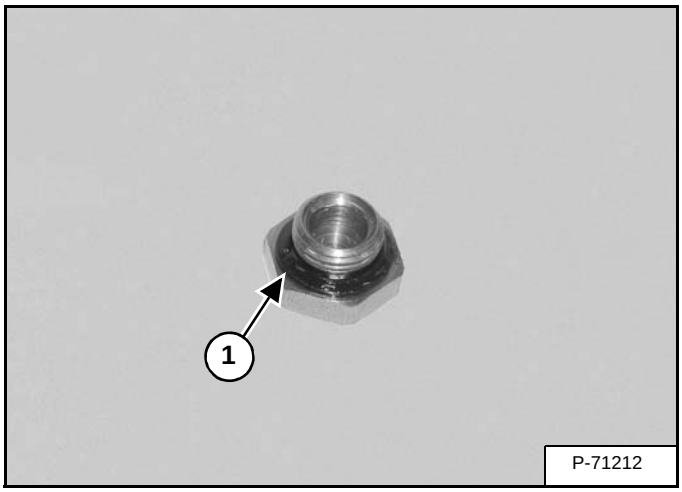


Install the poppet (Item 1), flat washer (Item 2) and spring (Item 3) **[Figure 20-190-49]**.

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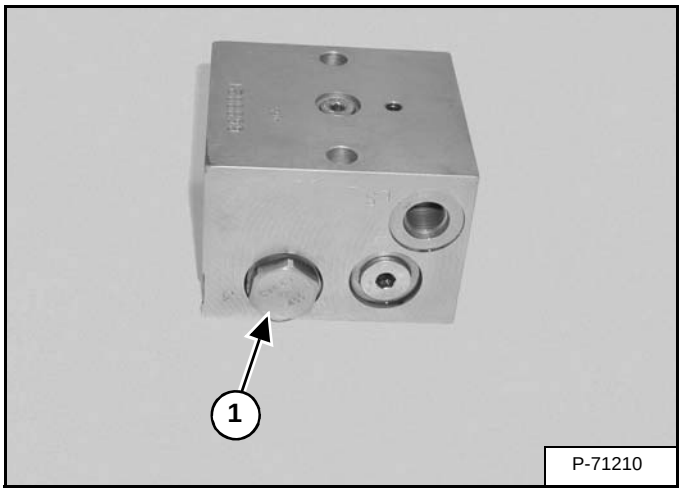
Assembly (Cont'd)

Figure 20-190-50



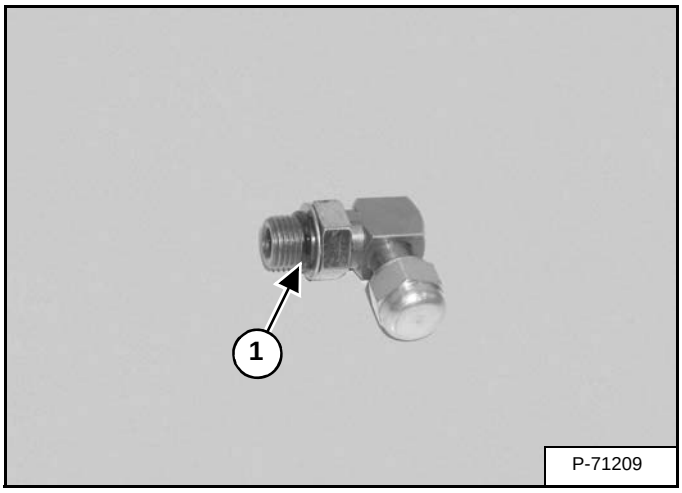
Install the O-ring (Item 1) **[Figure 20-190-50]**.

Figure 20-190-51



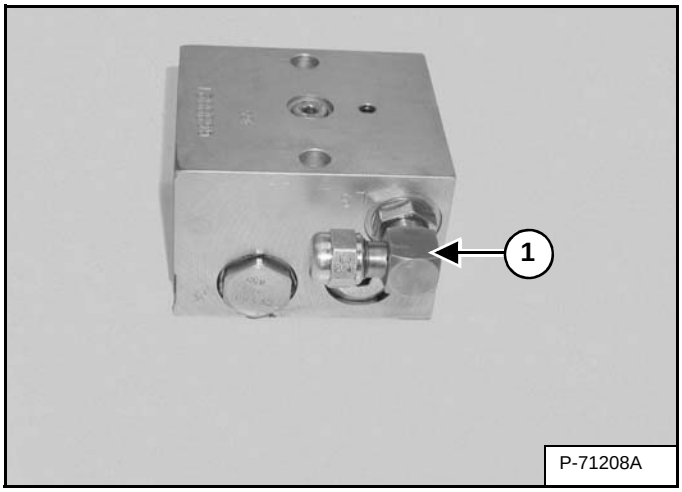
Install the plug (Item 1) **[Figure 20-190-51]**.

Figure 20-190-52



Install the O-ring (Item 1) **[Figure 20-190-52]** on the fitting.

Figure 20-190-53

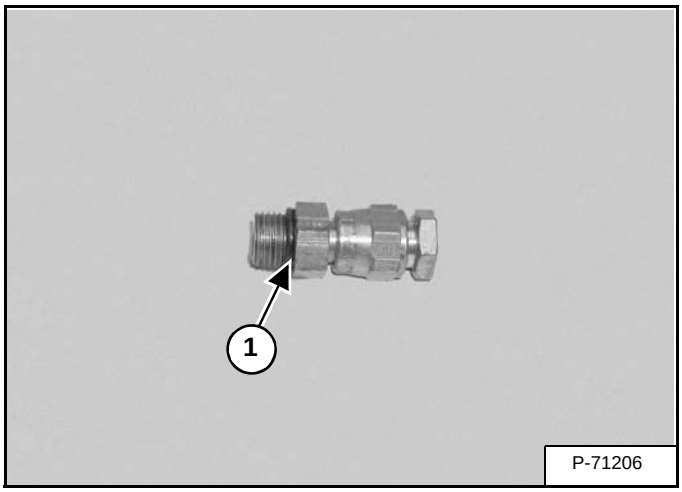


Install the fitting (Item 1) **[Figure 20-190-53]**.

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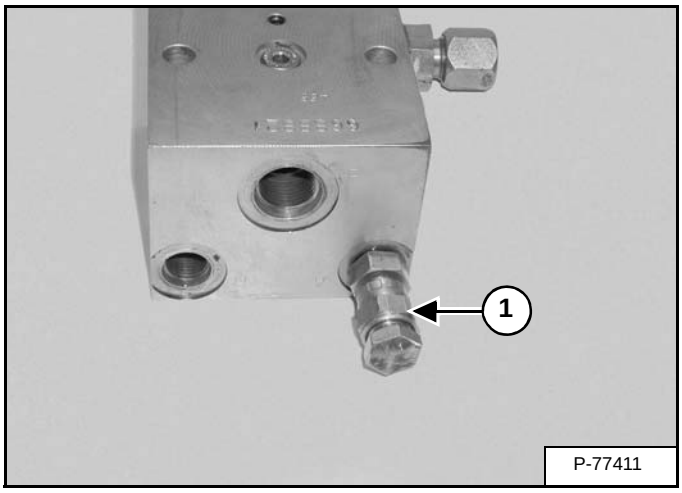
Assembly (Cont'd)

Figure 20-190-54



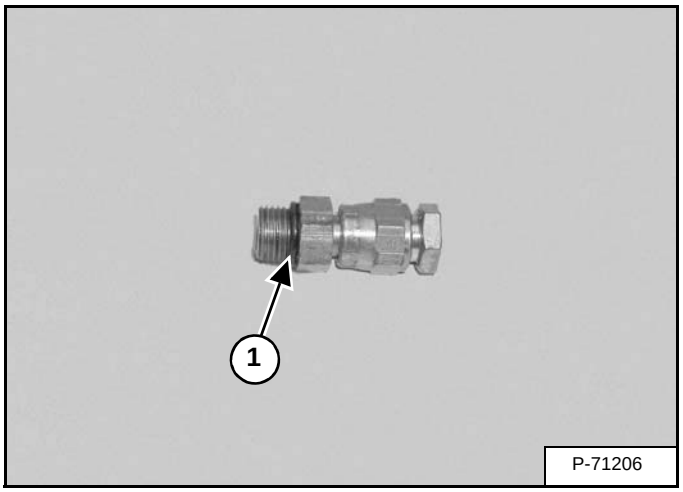
Install the O-ring (Item 1) **[Figure 20-190-54]** on the fitting.

Figure 20-190-55



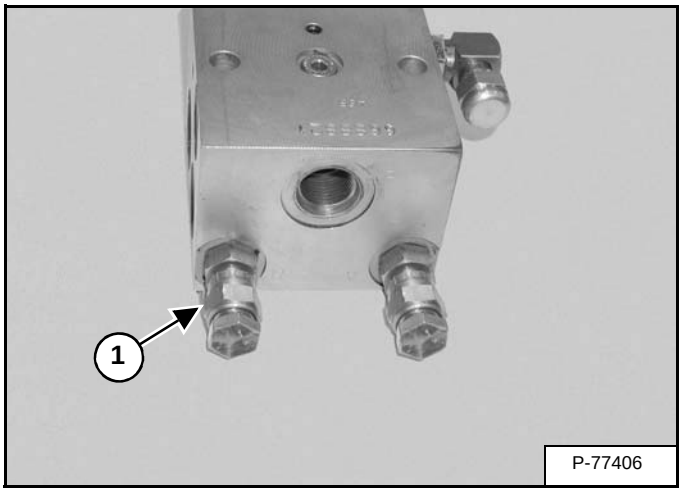
Install the fitting (Item 1) **[Figure 20-190-55]**.

Figure 20-190-56



Install the O-ring (Item 1) **[Figure 20-190-56]** on the fitting.

Figure 20-190-57

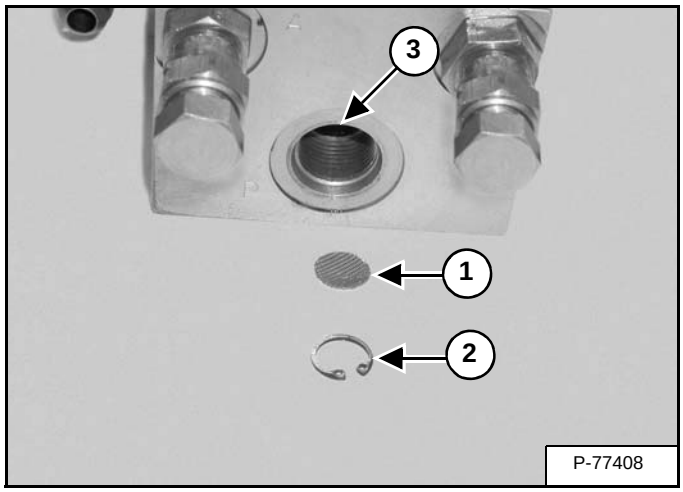


Install the fitting (Item 1) **[Figure 20-190-57]**.

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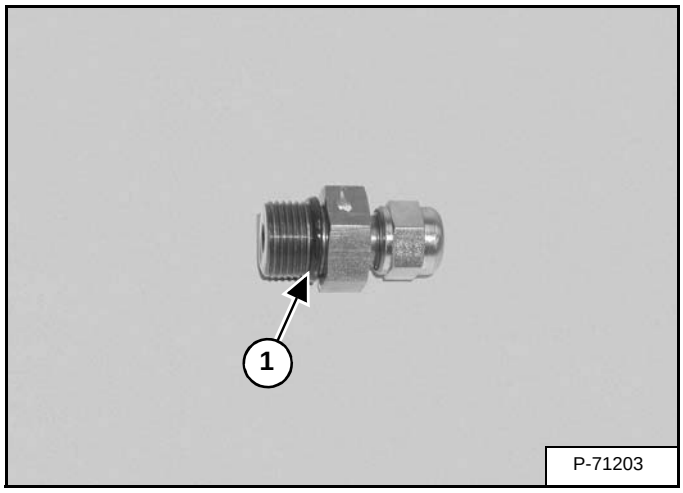
Assembly (Cont'd)

Figure 20-190-58



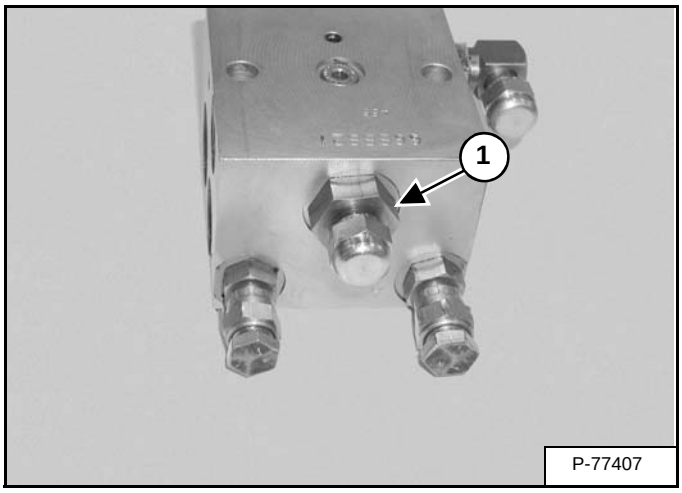
Install the screen (Item 1) and the snap ring (Item 2) into the "S" port (Item 3) **[Figure 20-190-58]**.

Figure 20-190-59



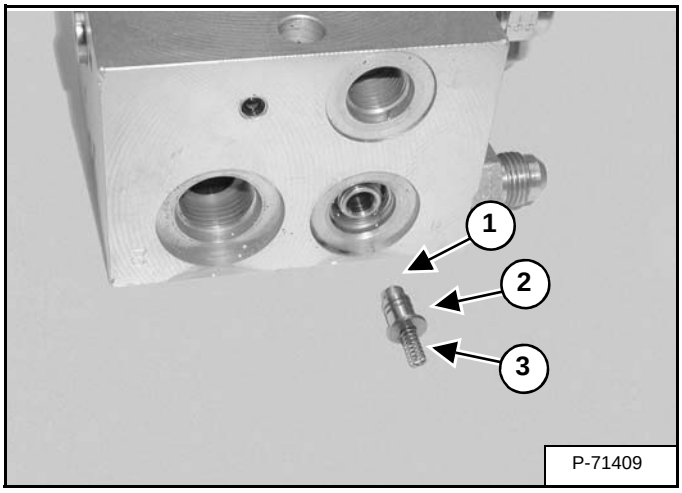
Install the O-ring (Item 1) **[Figure 20-190-59]** on the fitting.

Figure 20-190-60



Install the fitting (Item 1) **[Figure 20-190-60]**.

Figure 20-190-61

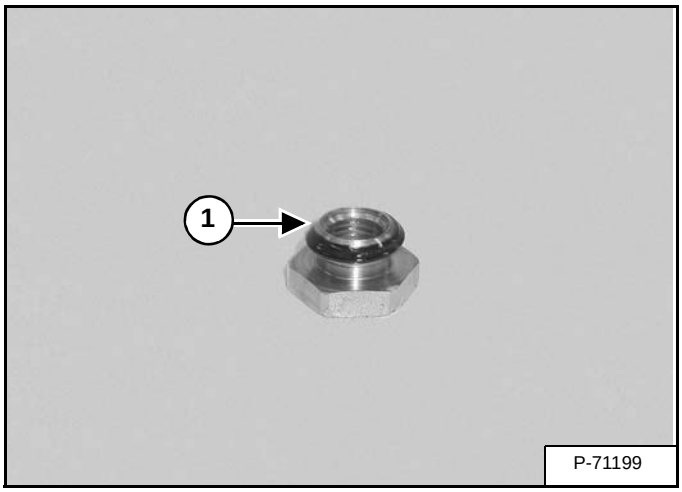


Install the poppet (Item 1), flat washer (Item 2) and spring (Item 3) **[Figure 20-190-61]**.

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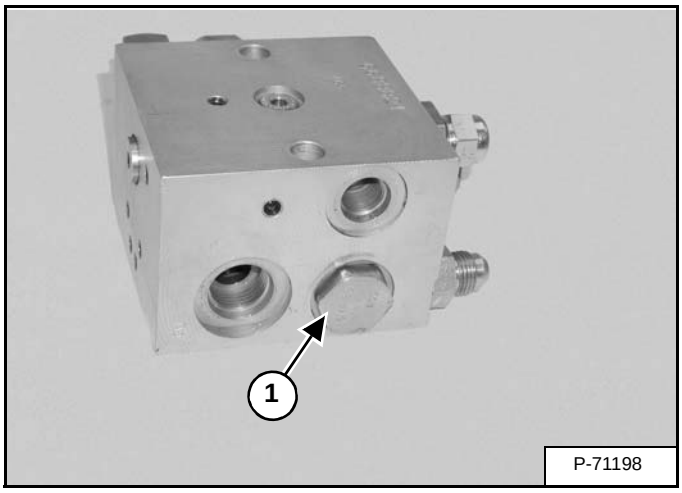
Assembly (Cont'd)

Figure 20-190-62



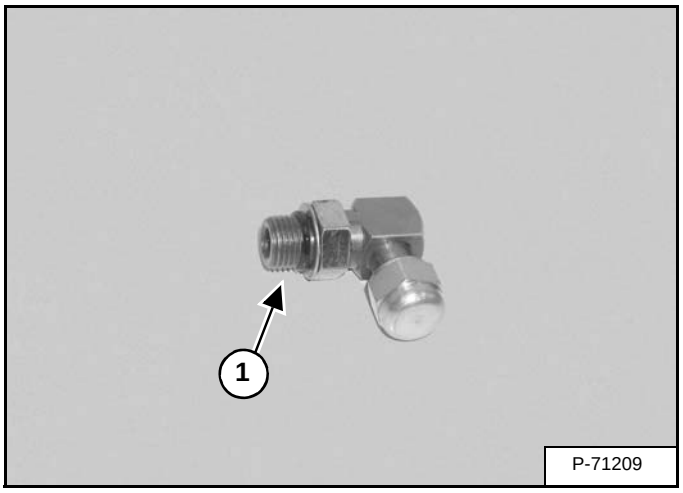
Install the O-ring (Item 1) **[Figure 20-190-62]** on the plug.

Figure 20-190-63



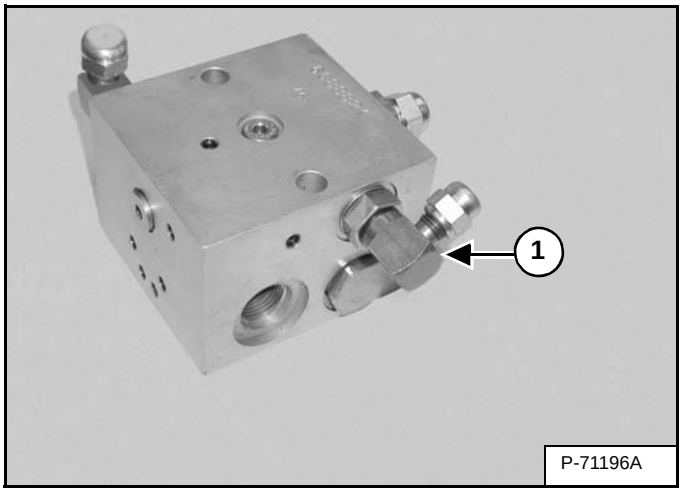
Install the plug (Item 1) **[Figure 20-190-63]**.

Figure 20-190-64



Install the O-ring (Item 1) **[Figure 20-190-64]** on the fitting.

Figure 20-190-65

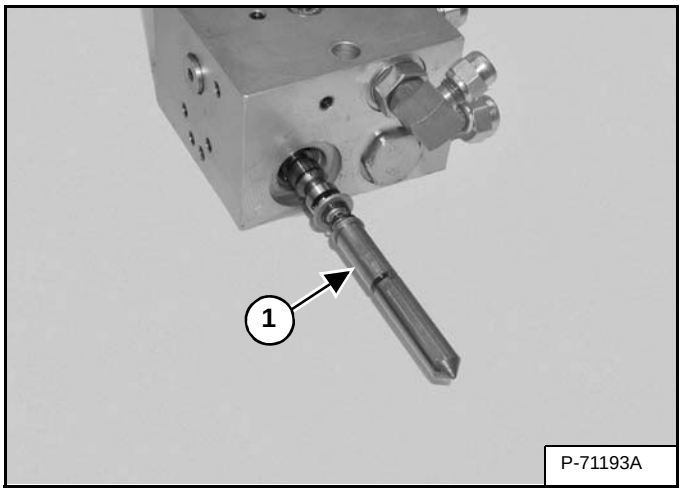


Install the fitting (Item 1) **[Figure 20-190-65]**.

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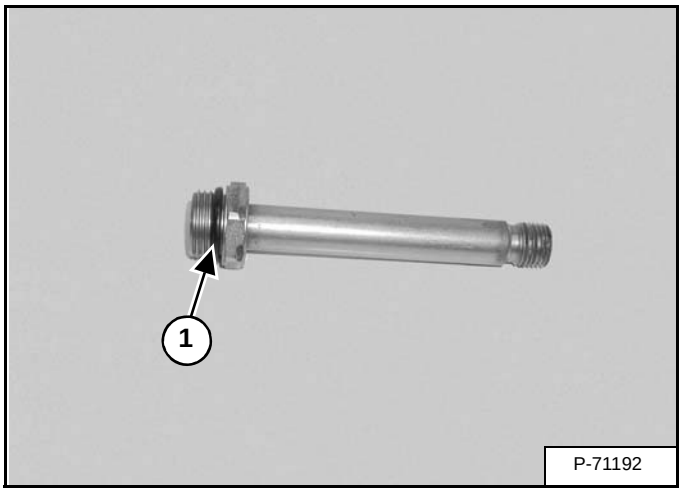
Assembly (Cont'd)

Figure 20-190-66



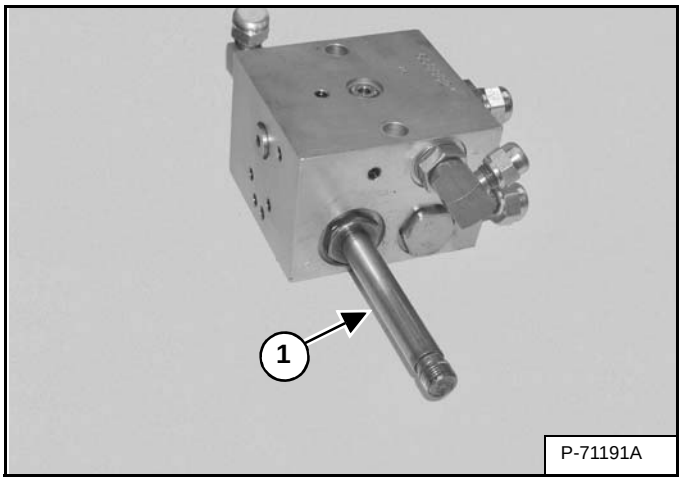
Install the actuator assembly (Item 1) **[Figure 20-190-66]**.

Figure 20-190-67



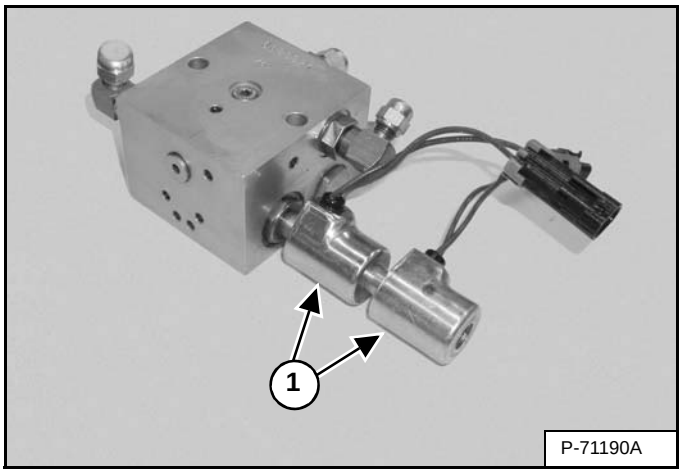
Install the O-ring (Item 1) **[Figure 20-190-67]** on the spool.

Figure 20-190-68



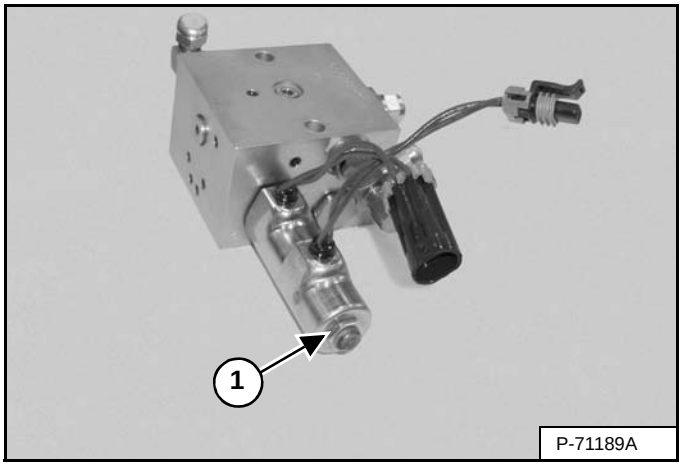
Install the spool (Item 1) **[Figure 20-190-68]**.

Figure 20-190-69



Install the solenoids (Item 1) **[Figure 20-190-69]**.

Figure 20-190-70



Install the nut (Item 1) **[Figure 20-190-70]**.

Do not overtighten.

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UNDERCARRIAGE

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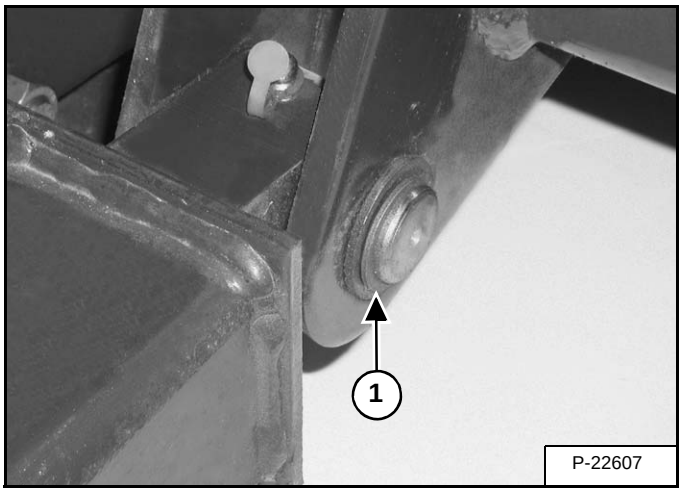
BLADE

Removal And Installation

Lower the blade and bucket to the ground.

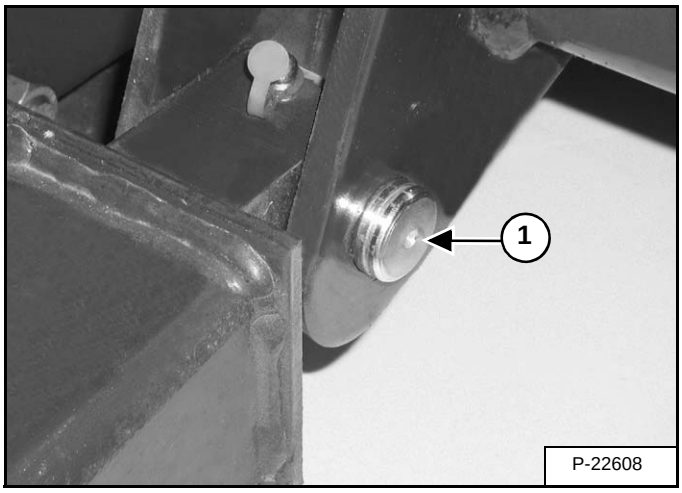
Remove the blade cylinder. (See Removal And Installation on Page 20-24-3.)

Figure 30-10-1



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

Figure 30-10-2



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

Remove the blade.

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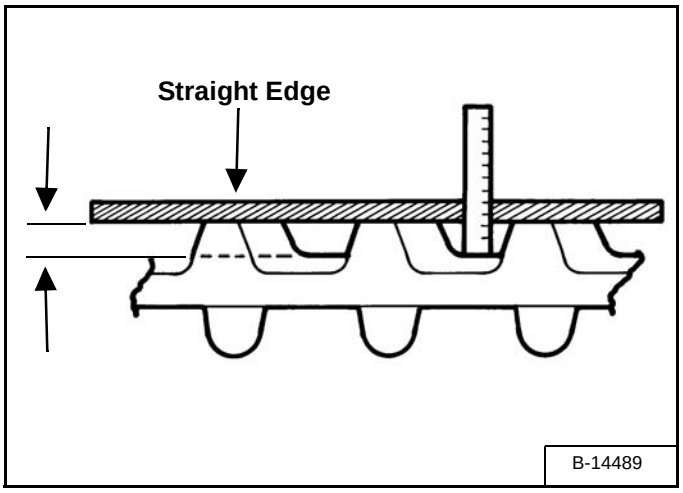
TRACKS

Track Lug Height

Rubber Track

The lug height of a new rubber track is 0.984 inch (25,0 mm).

Figure 30-20-1



To find the percentage of wear on a excavator track, measure the height of the lug by placing a straight edge across the top of three lugs and measure the distance from the base of the track to the bottom of the straight edge **[Figure 30-20-1]**.

Divide this measurement by the new track height and multiply by 100. This will give the percentage of track lug left.

Example: lug height 0.787 inch (20,0 mm)

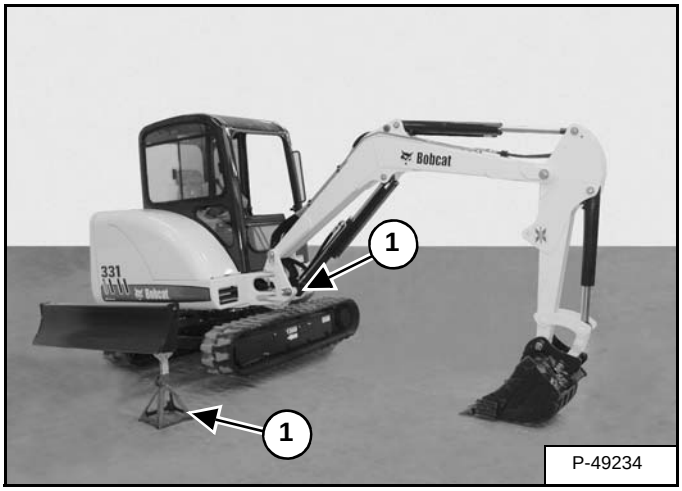
$$\frac{0.787}{0.984} \times 100 = 80$$

80% of the track lug is remaining with 20% wear on the track lugs.

Adjustment

NOTE: The wear of the pins and bushings on the undercarriage vary with the working conditions and the different types of soil conditions. It is necessary to inspect track tension to maintain the correct tension. See Service Schedule for the correct service interval. (See SERVICE SCHEDULE on Page 10-50-1.)

Figure 30-20-2



Raise the side of the machine (approximately four inches 102 mm) using the boom and arm **[Figure 30-20-2]**.

Raise the blade fully and install jack stands under the blade and track frame (Item 1) **[Figure 30-20-2]**. Raise the boom until all machine weight is on the jack stands.

Stop the engine.

⚠ WARNING

AVOID INJURY OR DEATH

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

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Adjustment (Cont'd)

Rubber Track Clearance

Figure 30-20-3

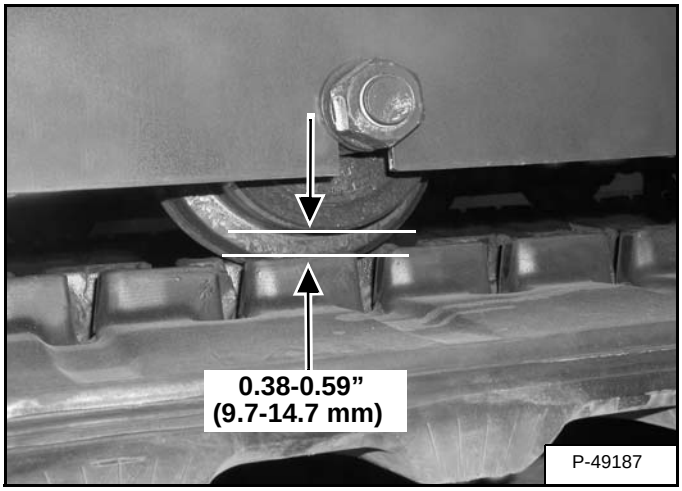
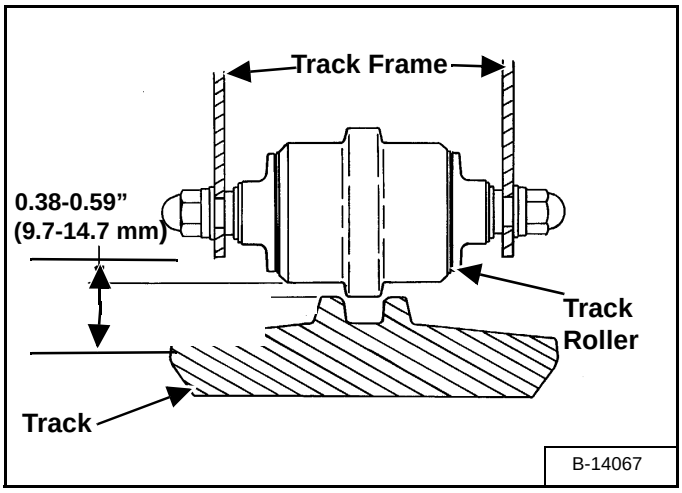


Figure 30-20-4

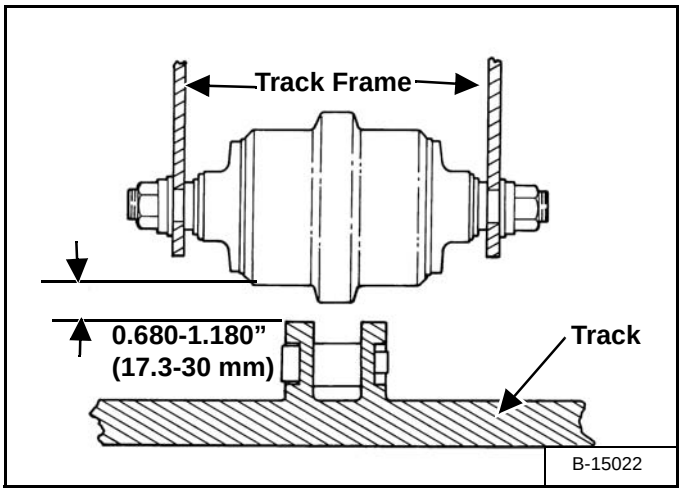


Measure the clearance at the middle track roller. Do not get fingers into pinch points between the track and the track roller. Use a bolt or a dowel of the appropriate size to check the gap between the contact edge of the roller and the top edge of the track guide **[Figure 30-20-3]** & **[Figure 30-20-4]**.

Rubber Track Clearance	-	0.38-0.59 inch (9.7-14.7mm)

Steel Track Clearance

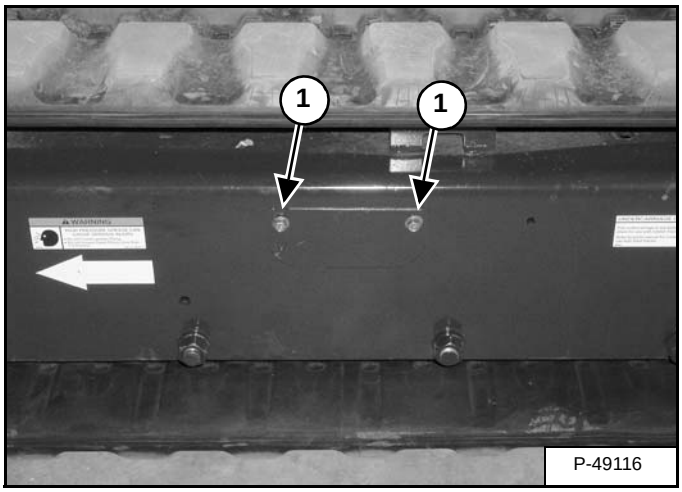
Figure 30-20-5



Measure the clearance at the middle track roller. Do not get fingers into pinch points between the track and the track roller. Use a bolt or a dowel of the appropriate size to check the gap between the contact edge of the roller and the top edge of the track guide **[Figure 30-20-5]**.

Steel Track Clearance	-	0.680-1.180 inch (17.3-30 mm)

Figure 30-20-6



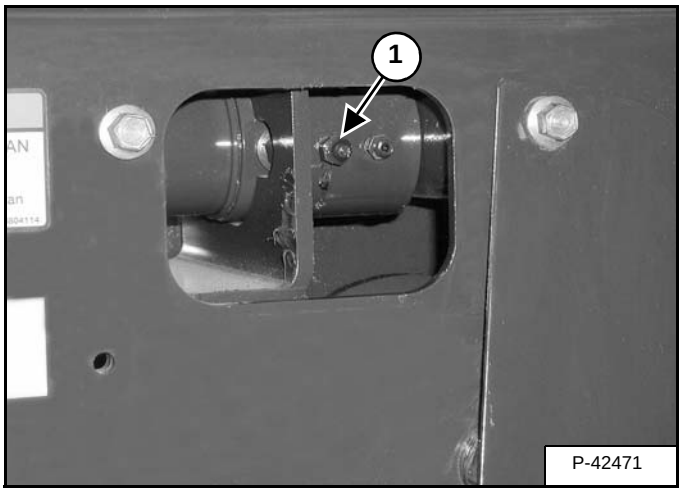
Loosen the two bolts on the cover (Item 1) **[Figure 30-20-6]**. Pivot the cover downward.

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Adjustment (Cont'd)

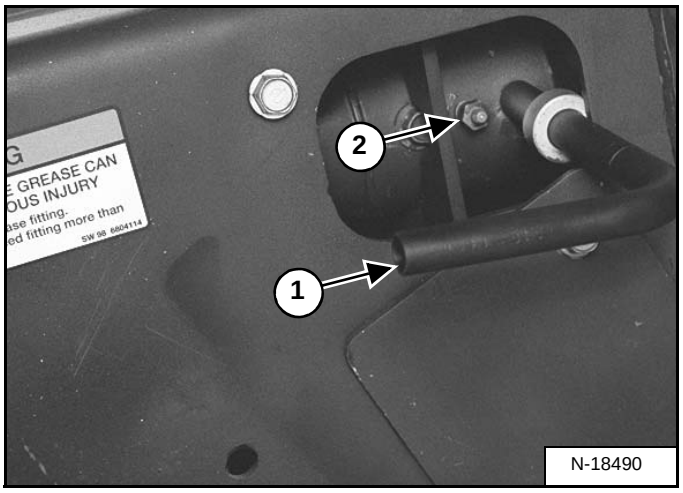


Figure 30-20-7



Add grease to the fitting (Item 1) **[Figure 30-20-7]** until the track tension is correct.

Figure 30-20-8



Use tool MEL1560 (Item 1) to loosen the bleed fitting (Item 2) **[Figure 30-20-8]** to release tension from the track.

NOTE: Do not loosen the grease fitting (Item 2) [Figure 30-20-8].

Repeat the procedure for the other side.

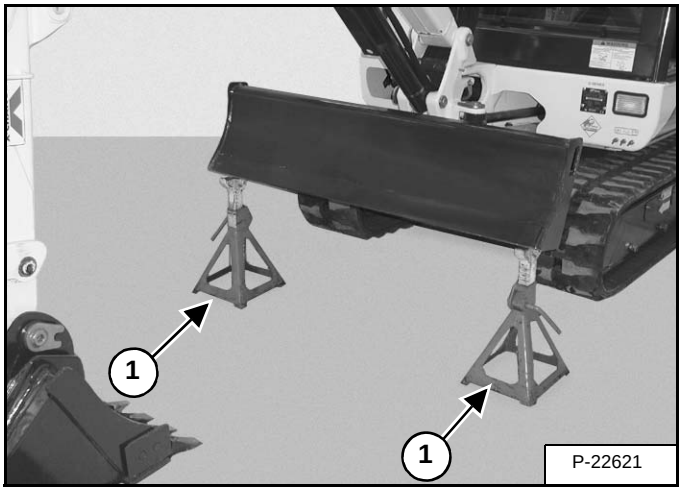
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Rubber Track Removal And Installation

Lift and block both sides of the machine as follows:

Raise the blade fully.

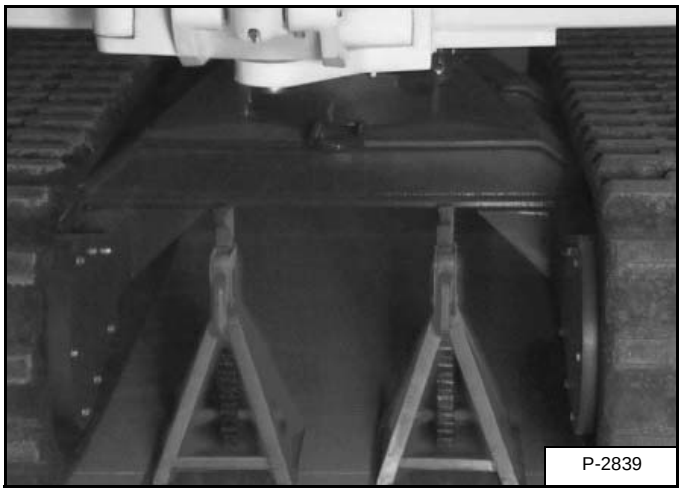
Figure 30-20-9



Use the boom and arm to lift the blade end of the machine up about 3.0 inches (75 mm) and install jack stands (Item 1) **[Figure 30-20-9]** under the blade.

Raise the boom.

Figure 30-20-10



Swing the upperstructure 180° and use the boom and arm to slowly lift the opposite end of the undercarriage and install jack stands under the undercarriage **[Figure 30-20-10]**.

Raise the boom until the weight of the machine is supported by the jackstands.

WARNING

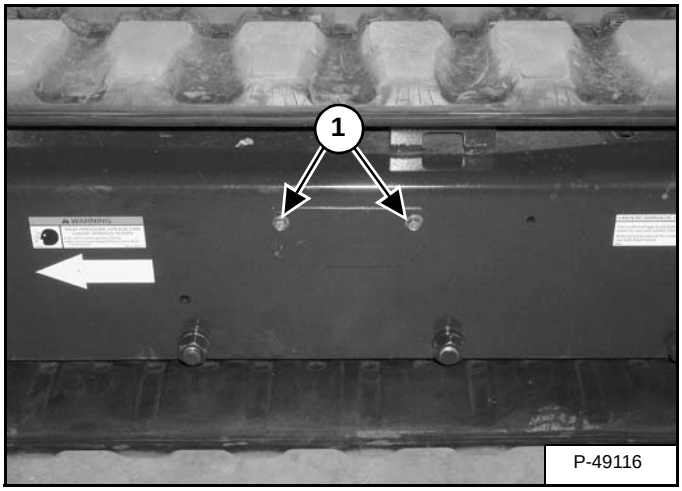
AVOID INJURY OR DEATH

Put jack stands 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.

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Stop the engine.

Figure 30-20-11



Loosen the two bolts (Item 1) **[Figure 30-20-11]** on the cover. Pivot the cover downwards.

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Rubber Track Removal And Installation (Cont'd)

Figure 30-20-12

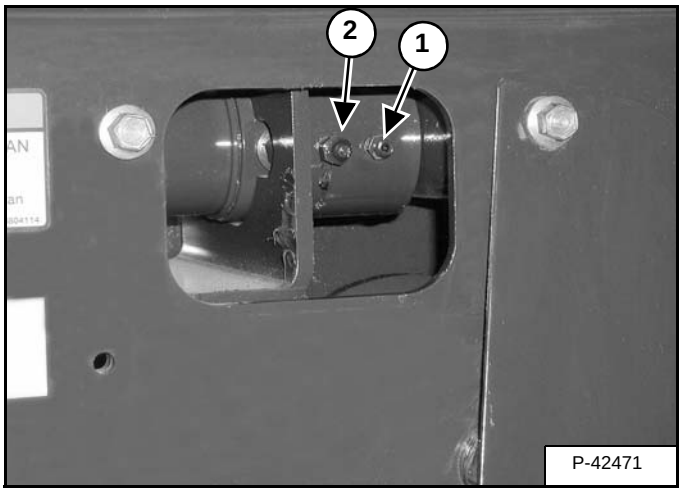
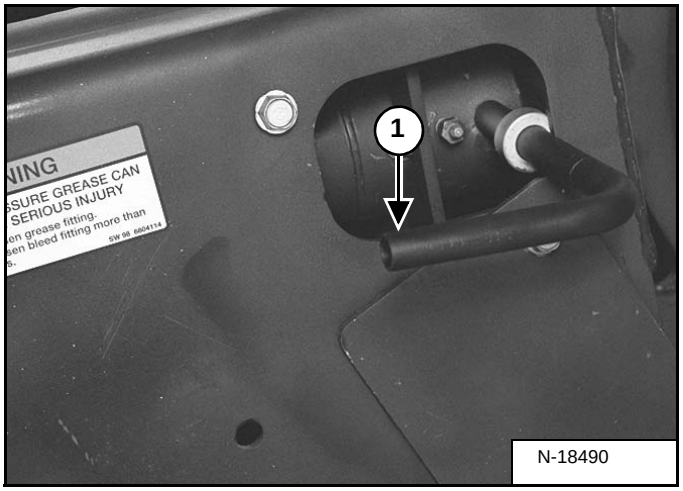


Figure 30-20-13



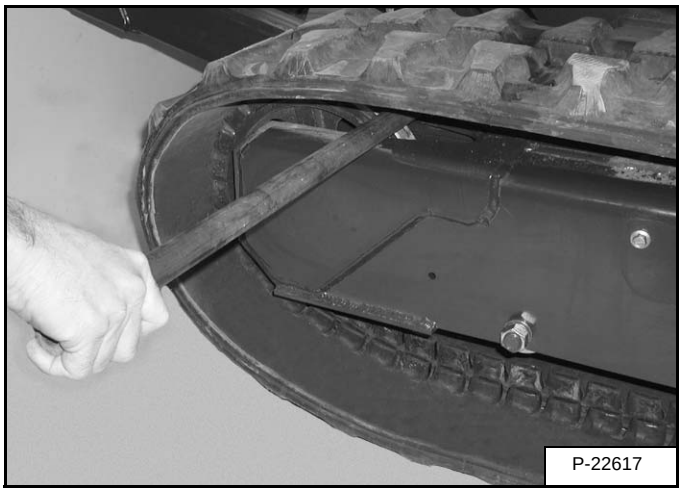
Using MEL-1650, loosen the bleed fitting (Item 1) **[Figure 30-20-12]** and **[Figure 30-20-13]** (a maximum of 1-1/2 turns) to release the tension from the grease spring.

NOTE: Do not loosen the grease fitting (Item 2) [Figure 30-20-12].

Start the engine.

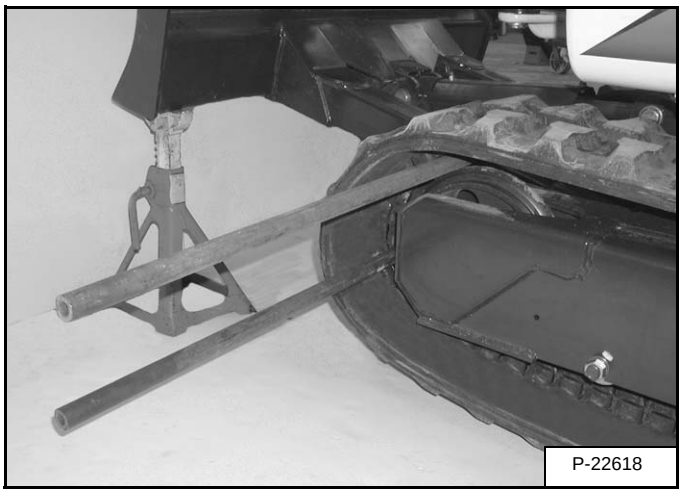
Slowly turn the track in the forward direction.

Figure 30-20-14



Insert a steel rod or pipe (Approximately 1.250 inch [30 mm] diameter) between the track and the idler wheel **[Figure 30-20-14]**.

Figure 30-20-15



Insert a second steel rod or pipe, at a distance of two lugs, between the track and the idler wheel **[Figure 30-20-15]**. Continue to turn the track until the first pipe contacts the track frame.

Stop the engine.

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Rubber Track Removal And Installation (Cont'd)

Figure 30-20-16



Insert a pry bar between the track and the idler wheel and pry out on the track until the track slides off the idler wheel **[Figure 30-20-16]**.

Remove the track.

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

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Steel Track Removal And Installation

With the excavator raised and the bleed fitting loosened, start the excavator. (See Adjustment on Page 30-20-1.)

Slowly turn the track. This will force more grease out of the grease spring.

Stop the engine.

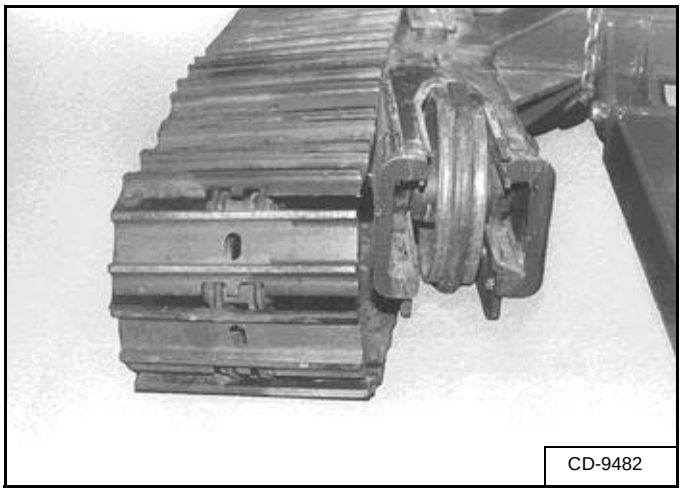
⚠ WARNING

AVOID INJURY OR DEATH
Keep fingers and hands out of pinch points when removing the track.

W-2173-0195

The track can be removed either as a complete assembly or by removing a connecting pin and separating the track.

Figure 30-20-17



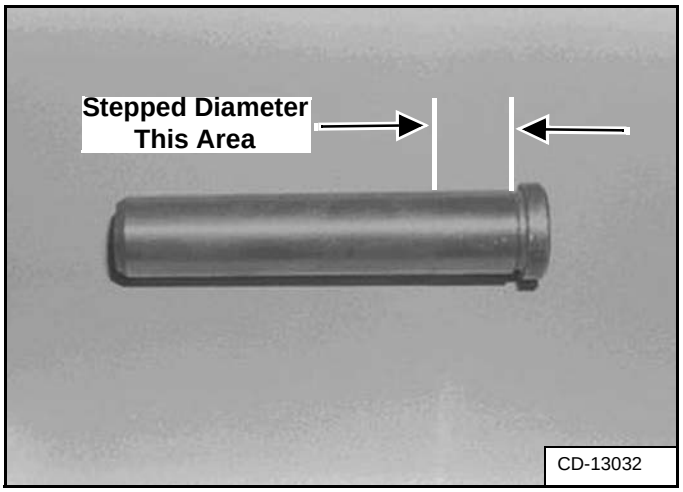
To remove the track as a compete assembly, install a pry bar between the track and the front idler wheel and pry out on the track **[Figure 30-20-17]**.

Installation: Put the track over the drive sprocket lugs. Then position the front of the track over the front idler wheel.

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

To remove the track by removing a connecting pin:

Figure 30-20-18



There is no master link or master connecting pin with this track. The connecting pins have a stepped diameter **[Figure 30-20-18]**. The smaller diameter is a slip fit into the track connecting links and the larger diameter is a press fit.

To remove a connecting pin, hold a heavy steel block on the connecting link near the pin being removed. Use a heavy hammer and a punch to drive out the connecting pin.

⚠ WARNING

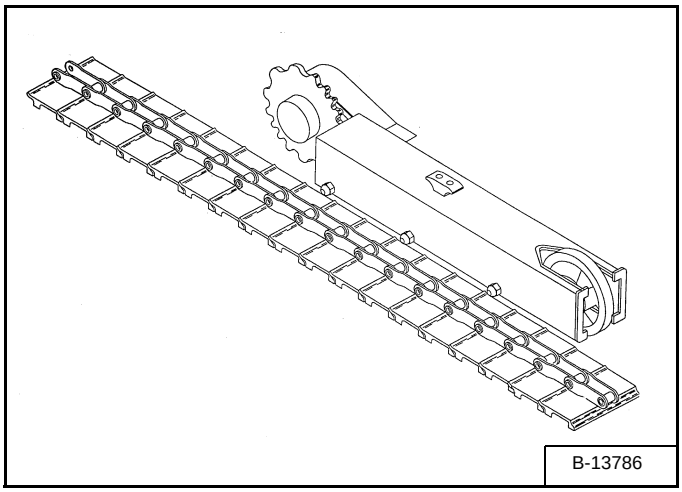
Wear safety glasses to prevent eye injury when any of the following conditions exist:
- **When fluids are under pressure.**
- **Flying debris or loose material is present.**
- **Engine is running.**
- **Tools are being used.**

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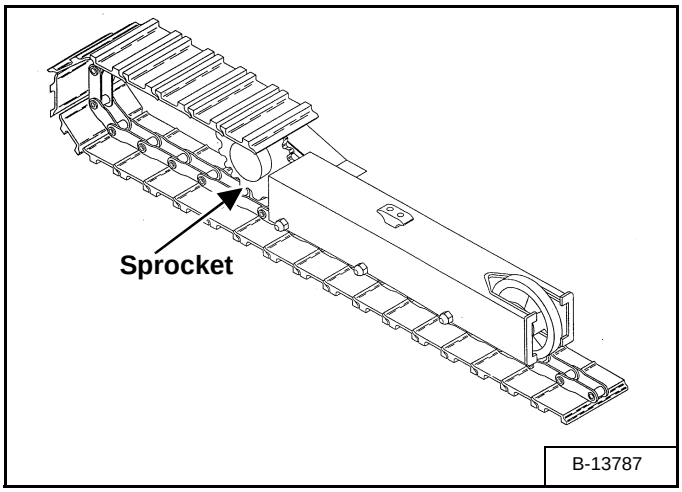
Steel Track Removal And Installation (Cont'd)

Figure 30-20-19



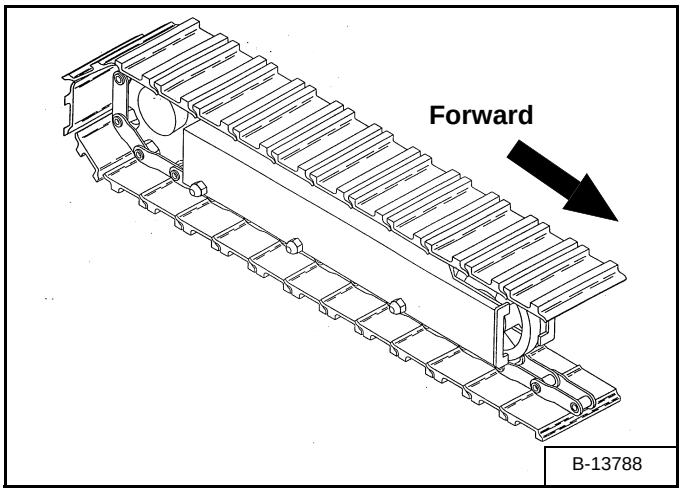
Installation: Put the steel track under the track frame so the front end of the track extends approximately three links in front of idler wheel **[Figure 30-20-19]**.

Figure 30-20-20



Pull the opposite end of the track up and forward and position the end links of the steel track onto the sprocket **[Figure 30-20-20]**.

Figure 30-20-21



With the help of a second person, start the excavator. Make sure that the slew locking lever is in the locked position. Use the travel lever (on which side the track is being installed) to slowly turn the drive motor in the forward direction. Hold the end of the track upwards as the drive motor slowly moves the track forward. Guide the end of the track over the top of the guide block and up to the front idler wheel **[Figure 30-20-21]**.

Stop the engine.

⚠ WARNING

AVOID INJURY OR DEATH

Drive motor must be operated slowly to avoid any sudden movements that could cause injury or death.

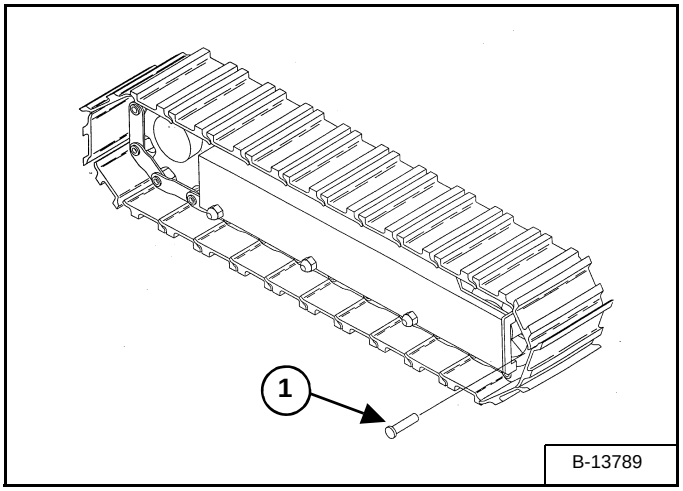
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Steel Track Removal And Installation (Cont'd)

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

Figure 30-20-22



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

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

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

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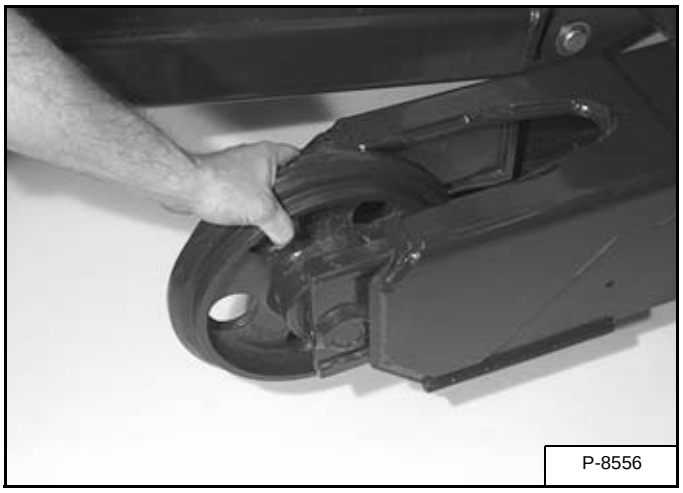
TRACK FRAME

Disassembly And Assembly

Use the following procedure to remove the different parts from the track frame.

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

Figure 30-30-1



Slide the front track idler out of the track frame **[Figure 30-30-1]**.

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY (Item 1) **[Figure 30-30-2]**.

⚠ WARNING



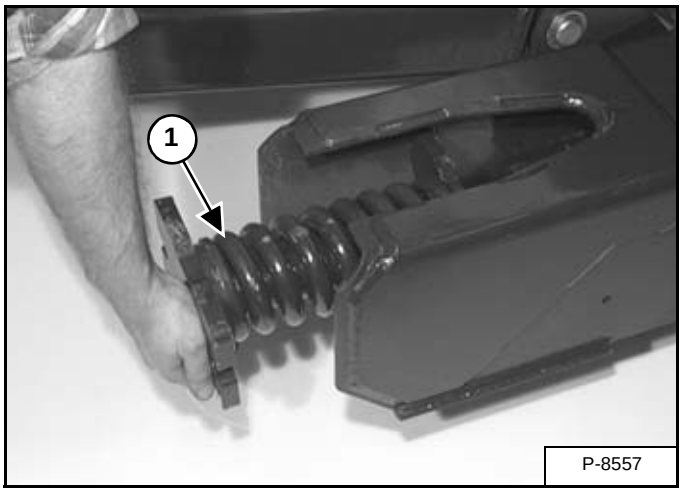
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AVOID INJURY OR DEATH

- **Spring loaded components under pressure can cause serious injury or death.**
- **Do not disassemble the coil spring assembly.**

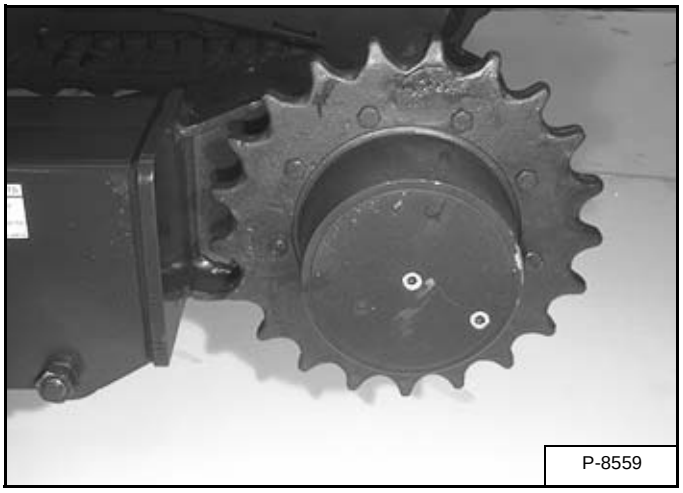
W-2617-1004

Figure 30-30-2



Remove the recoil spring (Item 1) **[Figure 30-30-2]**.

Figure 30-30-3



Remove the drive sprocket bolts **[Figure 30-30-3]**.

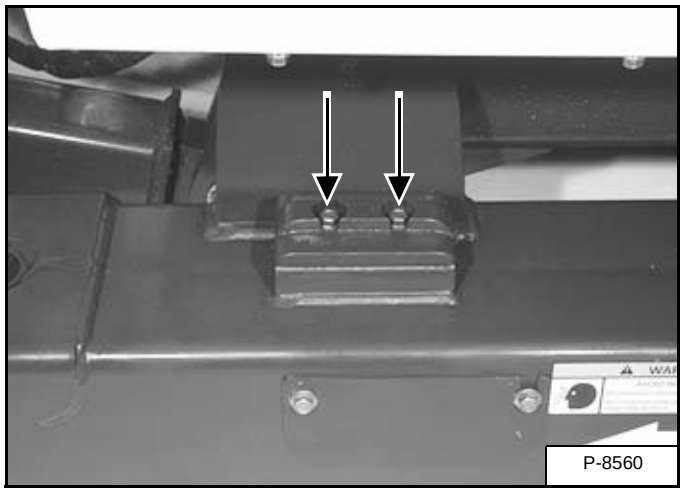
Installation: Put thread adhesive (LOCTITE™ 242) on the bolts and tighten to 80 ft.-lb. (108 N•m) torque.

Remove the drive sprocket from the travel motor.

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Disassembly And Assembly (Cont'd)

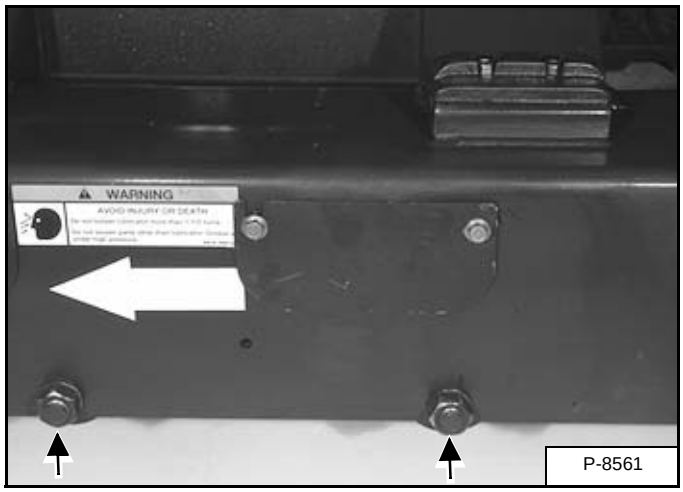
Figure 30-30-4



Remove the guide block bolts **[Figure 30-30-4]**.

Remove the guide block.

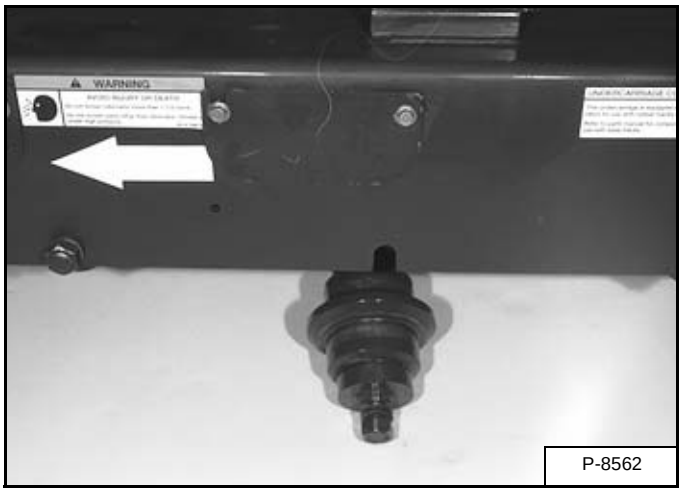
Figure 30-30-5



Loosen the nuts on the track roller on both sides of the track frame **[Figure 30-30-5]**.

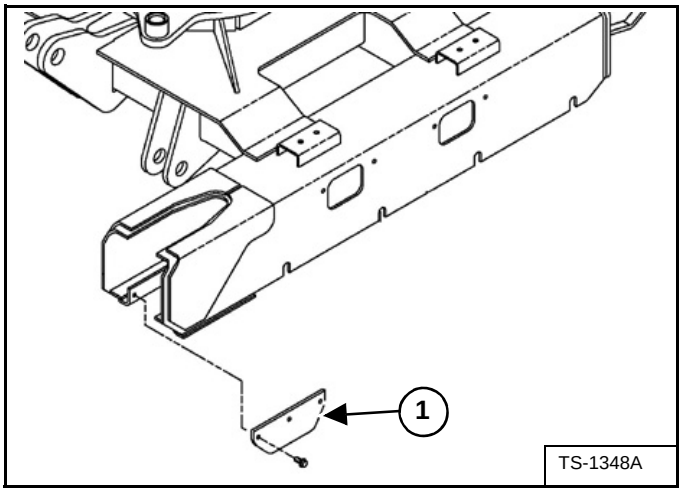
Installation: Tighten the nuts to 125-140 ft.-lb. (170-190 N•m) torque.

Figure 30-30-6



Remove the track roller **[Figure 30-30-6]**.

Figure 30-30-7



Remove the four guide plates (two per side) (Item 1) **[Figure 30-30-7]** from the track frame (steel tracks only).

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Recoil Spring Cylinder

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY (Item 2) **[Figure 30-30-8]**.

⚠ WARNING



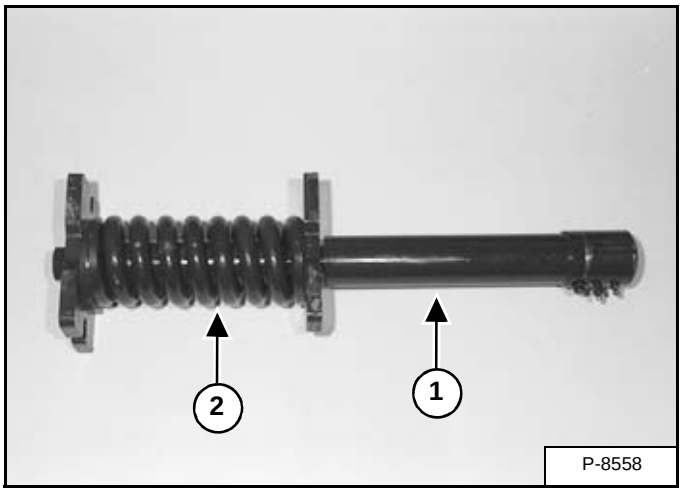
P-62574

AVOID INJURY OR DEATH

- **Spring loaded components under pressure can cause serious injury or death.**
- **Do not disassemble the coil spring assembly.**

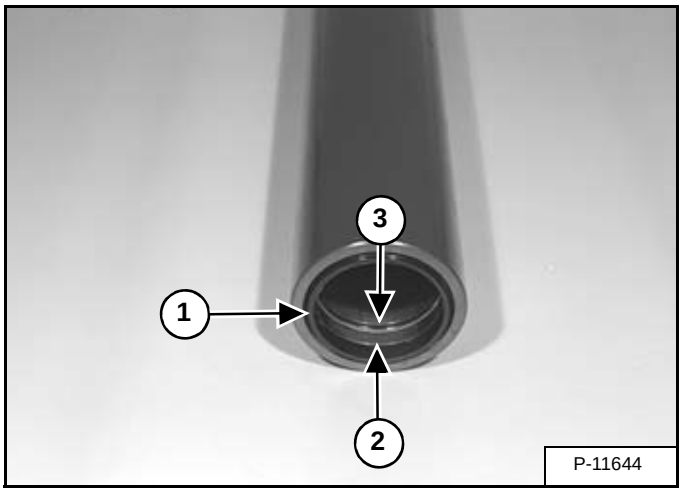
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Figure 30-30-8



Slide the cylinder (Item 1) **[Figure 30-30-8]** off the shaft.

Figure 30-30-9



Remove the seal (Item 1) back-up ring (Item 2) and O-ring (Item 3) **[Figure 30-30-9]** from the cylinder.

Installation: Apply oil to the O-ring, back-up ring and seal before installation.

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TRACK DAMAGE IDENTIFICATION

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.

Cutting Of Steel Cords

Figure 30-40-1

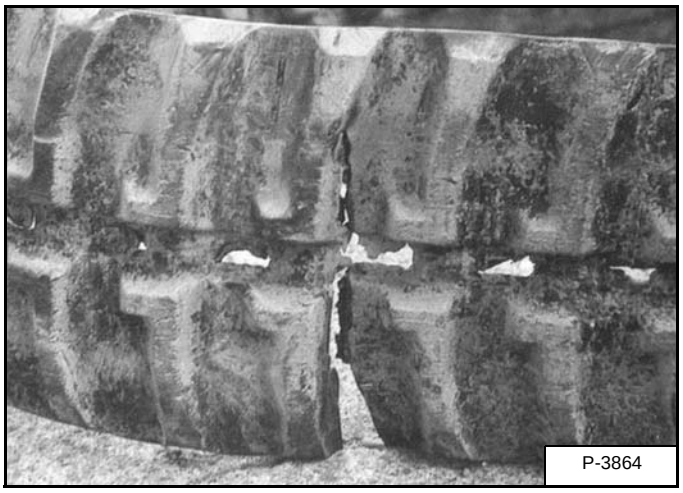
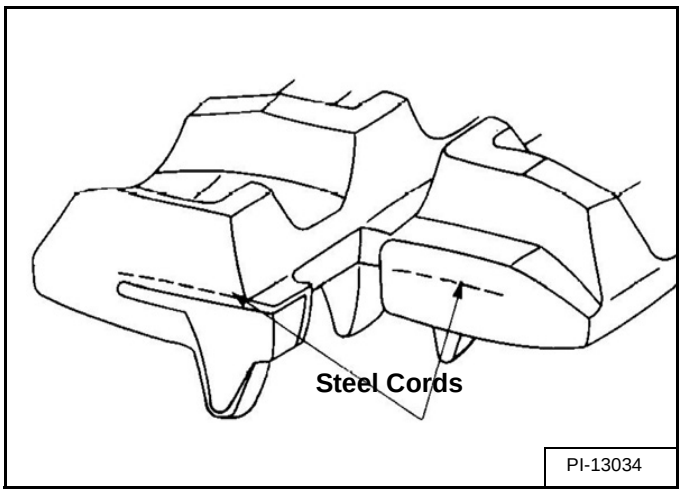


Figure 30-40-2



Damage:

Embedded steel cords are cut off **[Figure 30-40-1]** & **[Figure 30-40-2]**.

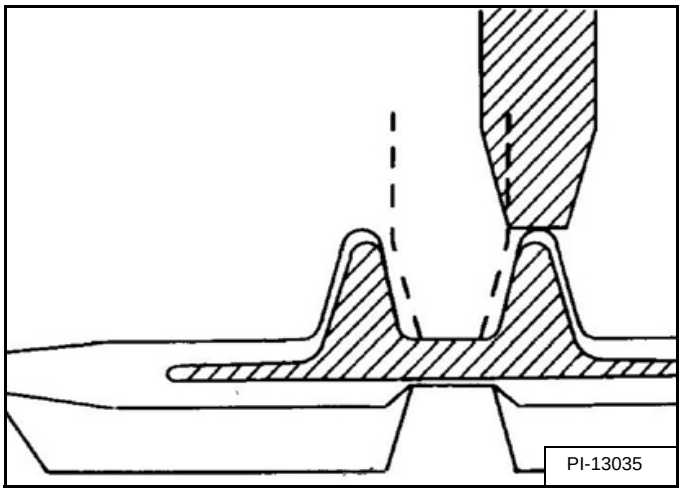
Replacement:

Replacement is required.

Causes of the damage:

When applied to rubber tracks under the following circumstances, tension in excess of the breaking strength of the embedded steel cords causes steel cords to be cut:

Figure 30-40-3



When the rubber track is detracting, the idler or sprocket rides on the projections of the embedded metal **[Figure 30-40-3]**.

When the rubber track is detracted, projections of rubber tracks get stuck between the frame of the undercarriage.

The rubber track is clogged with stones or foreign obstacles.

When moisture 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 Adjustment on Page 30-20-1.)

Avoiding quick turns on bumpy and rocky fields.

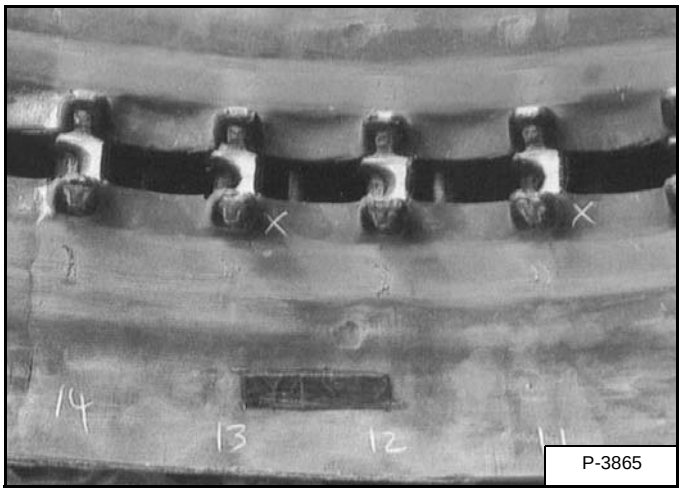
Drive carefully to avoid having stones and other articles clog the rubber tracks.

Driving over sharp objects should be avoided. If this is impossible, do not make turns while driving over sharp objects.

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Abrasion Of Embedded Metals

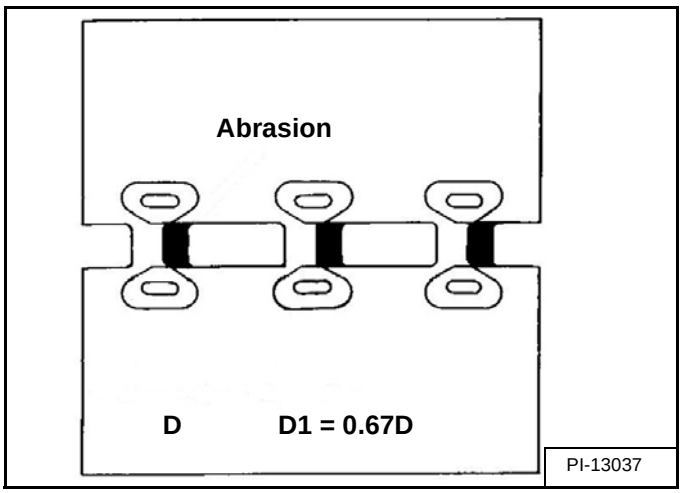
Figure 30-40-4



Damage:

In proportion to the service time, embedded metals will gradually wear away by friction **[Figure 30-40-4]**.

Figure 30-40-5



Replacement:

Replacement is required when the width of the embedded metals (D1) becomes 67% of their original width (D) **[Figure 30-40-5]**.

Causes of the damage:

When the track rollers, sprockets and idler gears roll over the embedded metals, abrasion of embedded metals is inevitable. The following cases sometimes accelerate their abrasion:

Rubber tracks are driven with an extraordinary heavy load on them.

Rubber tracks are used on sandy fields.

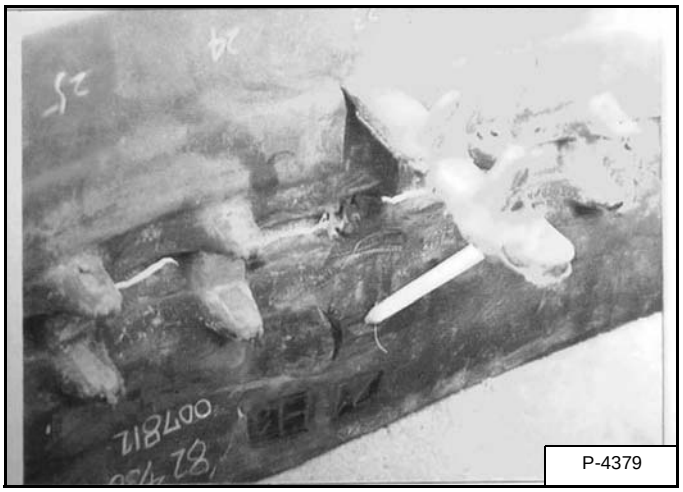
Prevention:

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.

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Separation Of Embedded Metals

Figure 30-40-6



Damage:

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

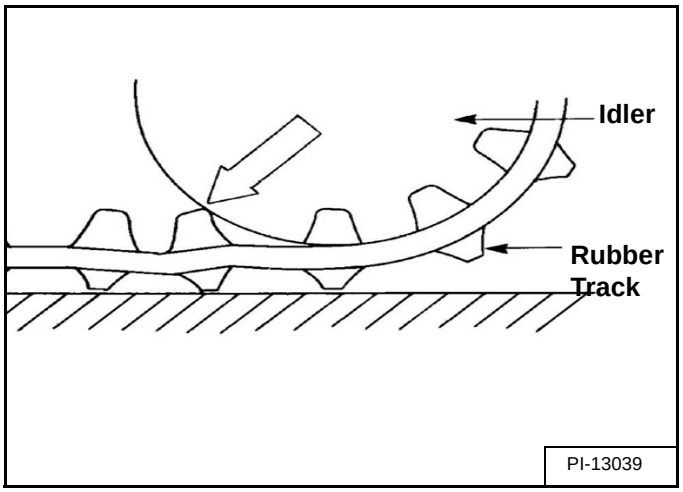
Replacement:

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

Causes of the damage:

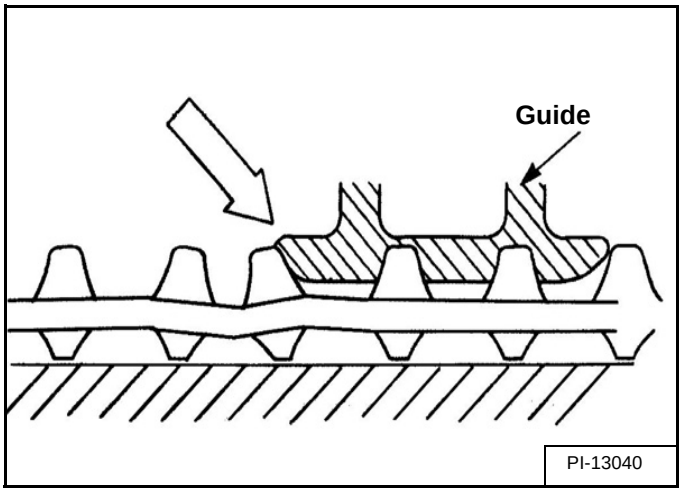
Embedded metals are adhered between the steel cords and the rubber body. The following cases generate external forces greater than the adhesion strength, causing separation of the embedded metals:

Figure 30-40-7



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

Figure 30-40-8

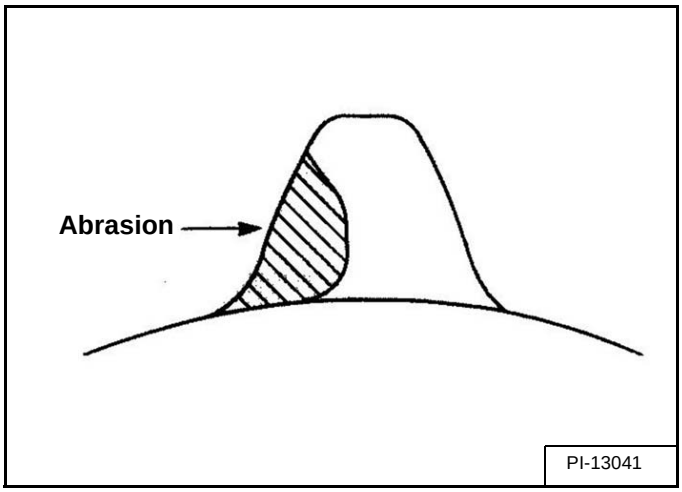


When a rubber track is detracted, it becomes stuck between the guide or the undercarriage frame, causing the separation of embedded metals **[Figure 30-40-8]**.

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Separation Of Embedded Metals (Cont'd)

Figure 30-40-9



Abnormally worn sprockets will pull embedded metals out **[Figure 30-40-9]**.

Prevention:

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

Track tension should be periodically checked. (See Adjustment on Page 30-20-1.)

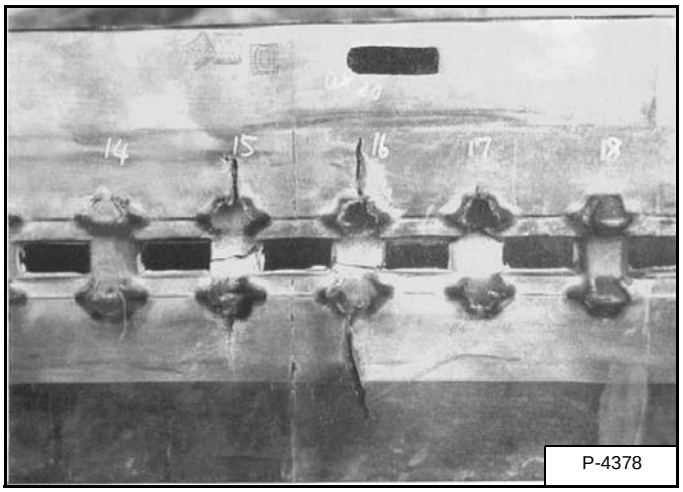
Quick turns on bumpy and rocky fields should be avoided.

If abnormal wear of sprockets is observed, they should be immediately replaced.

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Separation Of Embedded Metals Due To Corrosion

Figure 30-40-10



Damage:

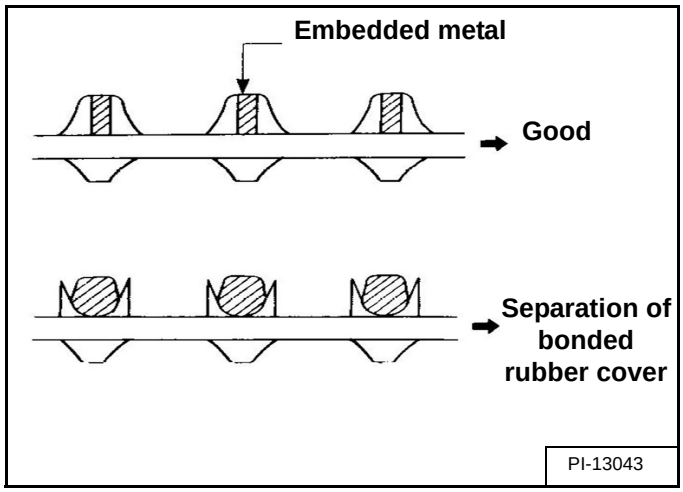
Due to corrosion of embedded metals, the adhesion to the rubber body deteriorates, resulting in complete separation **[Figure 30-40-10]**.

Replacement:

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

Causes of the damage:

Figure 30-40-11



Embedded metals are bonded to the rubber body. The following operating conditions cause embedded metals to corrode, causing deterioration of the bonding, and finally resulting in separation of the embedded metals from the rubber body **[Figure 30-40-11]**.

Excessively salty fields, like the sea shore.

Strong acidic or alkali soil conditions

Compost spread grounds

On tracks that are out of adjustment, the track rollers, idlers and sprockets will gradually wear the rubber surface at track roller side, causing exposure of the embedded metals. Consequently the embedded metals will corrode resulting in their separation from the rubber body.

Prevention:

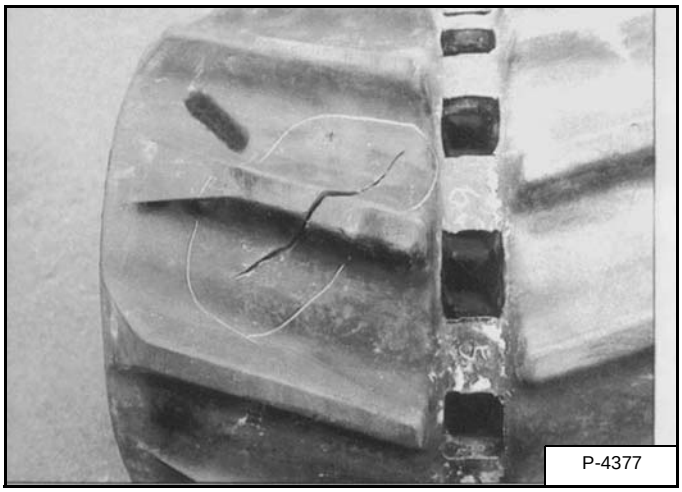
If rubber tracks are used under such field conditions as described under (Causes of the damage). The tracks should be washed with plenty of water. After being completely dried, they should be stored correctly.

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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Cuts On The Lug Side Rubber

Figure 30-40-12



Damage:

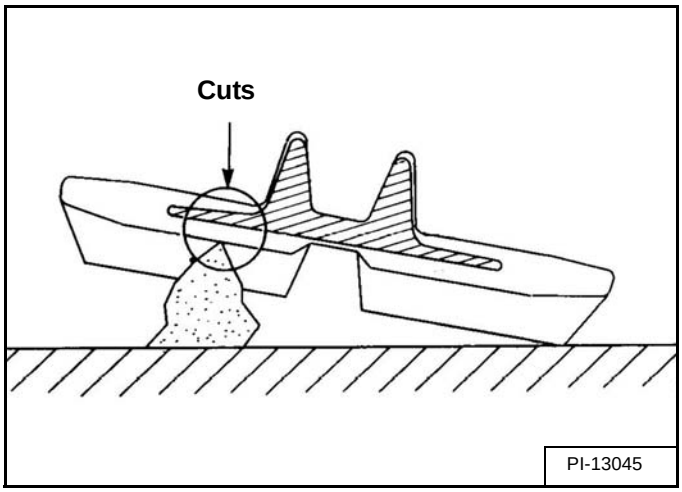
Cuts on the lug side rubber often occurs as one of the most typical failure modes **[Figure 30-40-12]**

Replacement:

When a cut on the lug side rubber reaches the embedded steel cords, it should be immediately repaired with cold vulcanization rubber.

Causes of the damage:

Figure 30-40-13



When rubber tracks drive over projections or sharp stones in the fields, the concentrated forces applied cause cuts on the lug side rubber surface. In case of making turns on projections, the lug side rubber surface will have an even higher chance to be cut. If the cuts run through the embedded steel cords, it might result in the 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 30-40-13]**.

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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Cracks On The Lug Side Rubber Due To Fatigue

Figure 30-40-14

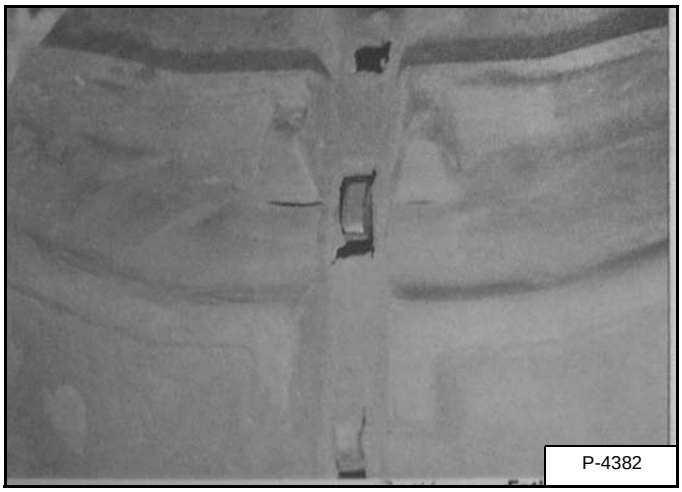
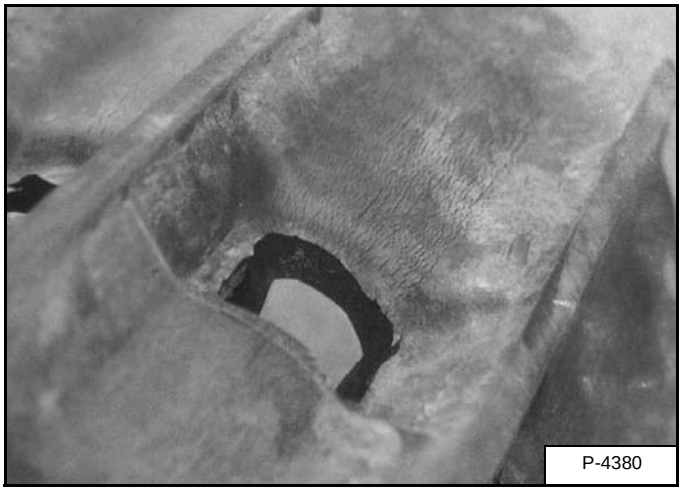


Figure 30-40-15



Damage:

Small cracks around the root of the lug as a result from operation fatigue **[Figure 30-40-14]** & **[Figure 30-40-15]**.

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. 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. 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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Lug Abrasion

Figure 30-40-16

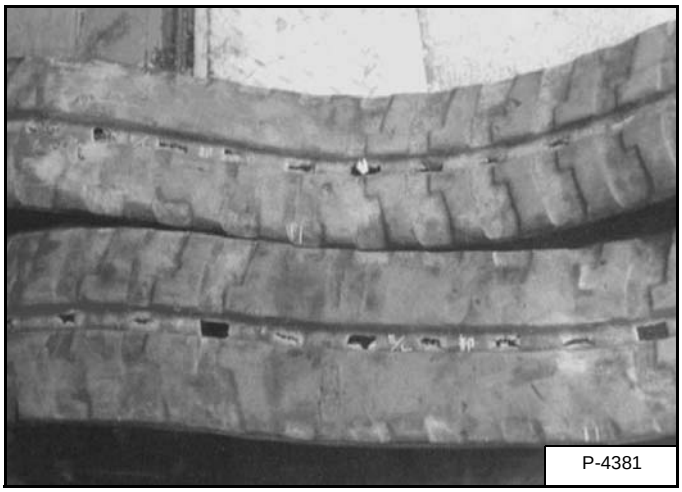
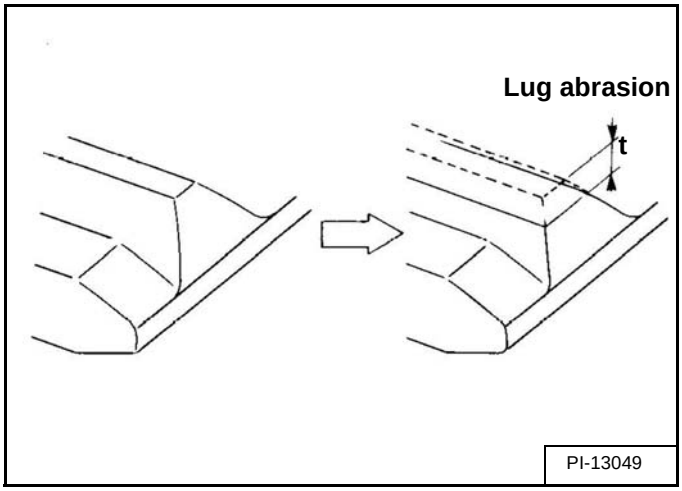


Figure 30-40-17



Damage:

As its service time proceeds, the lug side inevitably undergoes abrasion **[Figure 30-40-16]** & **[Figure 30-40-17]**.

Replacement:

No replacement is required.

Causes of the damage:

Lug abrasion is inevitable. Even if lug abrasion is proceeding, the rubber track can be used. 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 0.197 inch (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

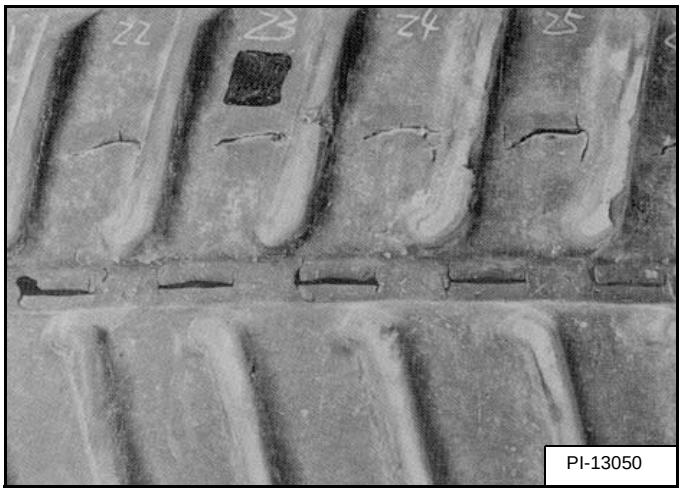
Driving up and down hilly paths with slippage

Making frequent turns on paths covered with rocks and wood

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Cracks And Cuts On The Lug Side Rubber

Figure 30-40-18



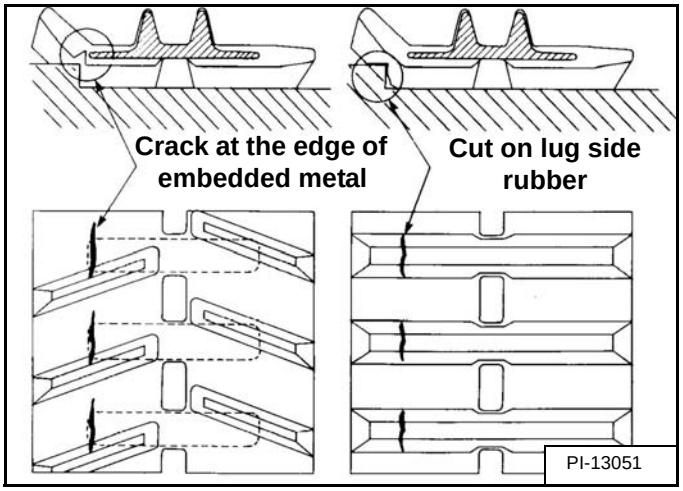
Damage:

Sometimes cracks and cuts on the lug side rubber at the edges of the embedded metals can be observed **[Figure 30-40-18]**.

Replacement:

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.

Figure 30-40-19



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 30-40-19]**.

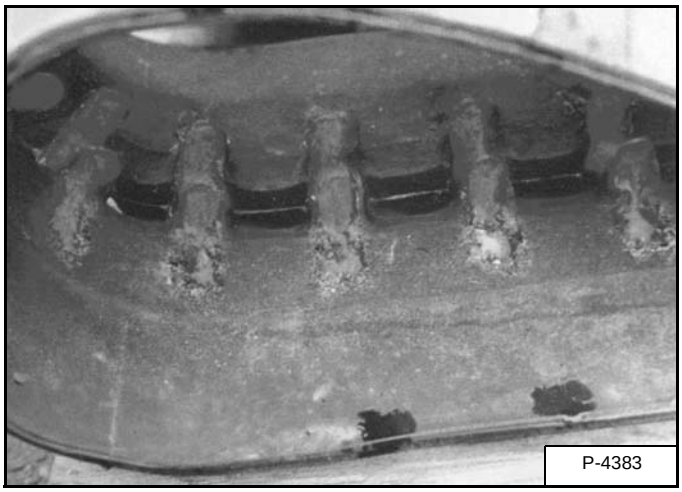
Prevention:

To avoid extensive stress applied to the lug root where metals are embedded, machine operators are requested to avoid driving over stumps and ridges.

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Abrasion Of The Track Roller Side

Figure 30-40-20



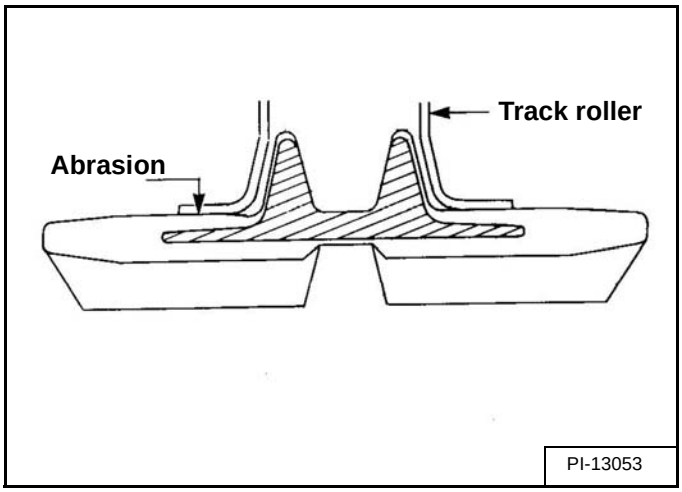
Damage:

The rubber surface on which track rollers run is gradually abraded. It will end in the exposure of the embedded metals **[Figure 30-40-20]**.

Replacement:

It is recommended to replace the rubber track when more than half of the embedded metals are completely exposed.

Figure 30-40-21



Causes of the damage:

The abrasion of the track roller side rubber surface occurs because of sand and gravel being clogged between the rubber and the outside surface of the track rollers. The stress pushes the sand and gravel against the side of the rubber track to cause the abrasion **[Figure 30-40-21]**.

The level of abrasion is highly dependent on terrain conditions. A higher level of abrasion will occur when the rubber tracks are operated in fields covered with many stones and gravel. Small stones hardened with mud, stuck to the track rollers increase the abrasion level. After an extended period of abrasion, it will be more likely for exposed embedded metals to catch moisture through the inside steel cords, which can cause breakage of steel cords and separation of the metals from the rubber body.

Prevention:

After operation in wet fields containing many small stones, wash off the mud that is stuck to the track rollers completely. When operating on gravel paths and stony grounds, machines should be driven slowly and the turning radius should be big enough to prevent stones and gravel from getting stuck to the track roller side rubber.

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Cuts On The Edges Of Track Roller Side

Figure 30-40-22

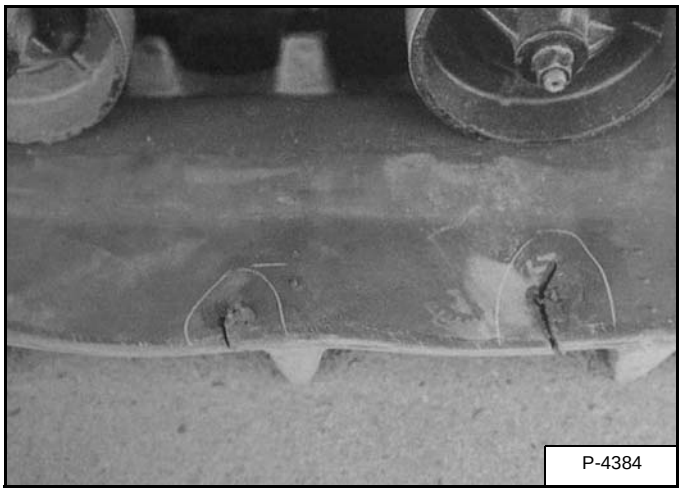
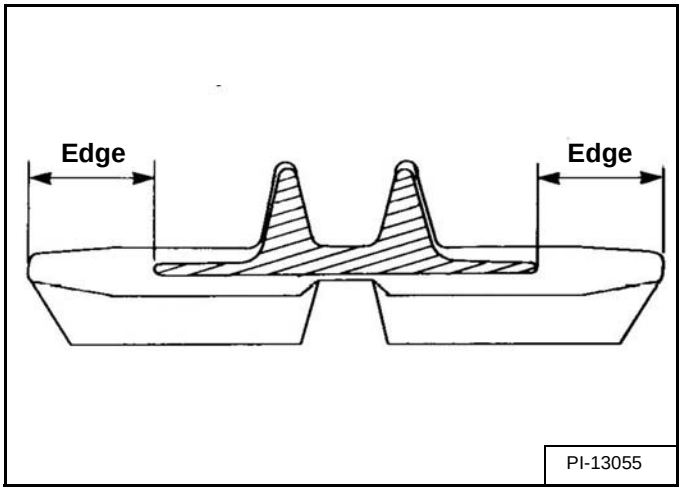


Figure 30-40-23



Damage:

Both edges of the rubber track have no special reinforcements. It sometimes occurs during operation that they are cut or torn off **[Figure 30-40-22]** & **[Figure 30-40-23]**.

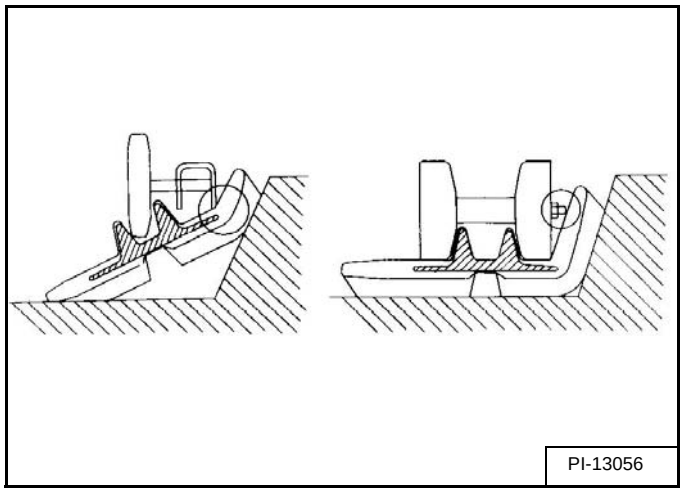
Replacement:

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.

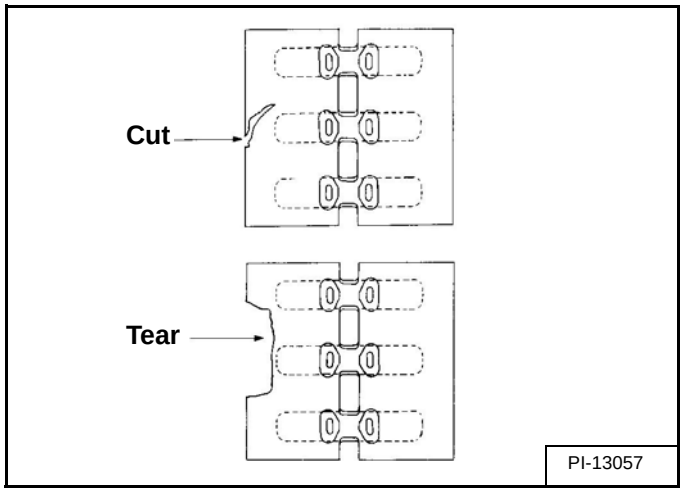
Figure 30-40-24



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. When a machine drives over concrete ridges, this type of damage easily occurs **[Figure 30-40-24]**.

Figure 30-40-25



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. When a machine travels along side slopes, the rubber tracks are deformed so much that they come into contact with the machine frame and undercarriage parts, which causes cutting, gouging and rubbing of rubber tracks in the end **[Figure 30-40-25]**.

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Cuts On The Edges Of Track Roller Side (Cont'd)

Prevention:

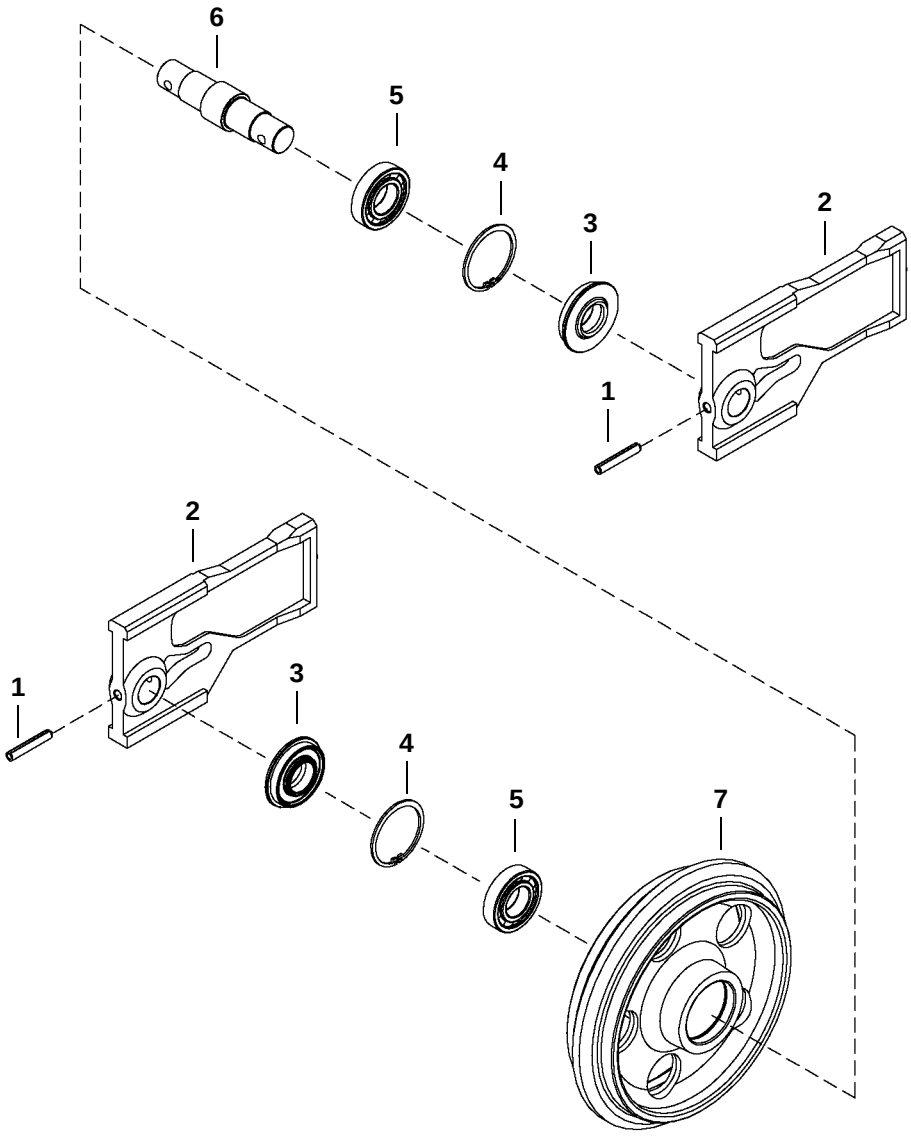
When traveling, a machine operator should be careful not to drive over any projections on the ground. He should also prevent rubber tracks from coming into contact with concrete walls, ditches and ridges. If rubber tracks are detracked, the machine should be stopped immediately for retracking.

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TRACK IDLER

Parts Identification

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



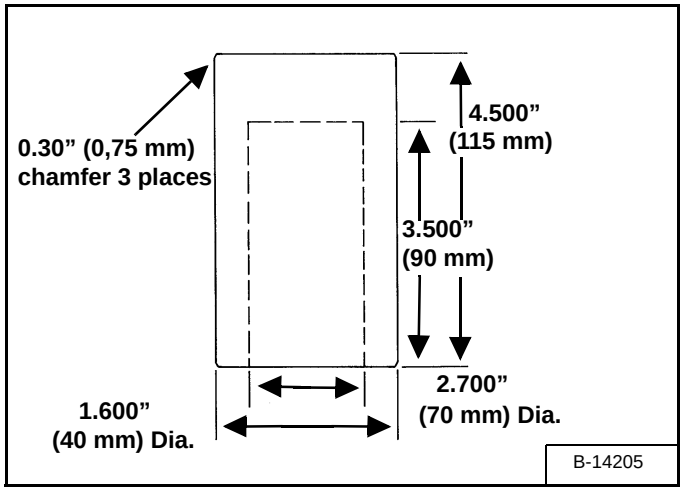
PE1801S

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Disassembly

The following tools must be fabricated for this procedure:

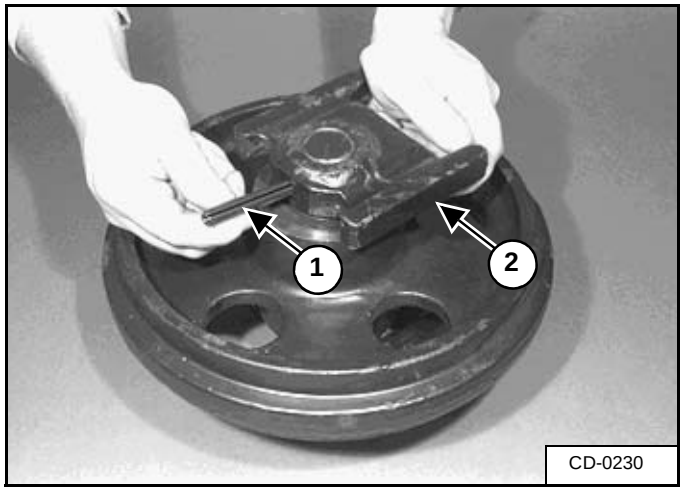
Figure 30-50-1



1. Driver Tool - see figure **[Figure 30-50-1]**.

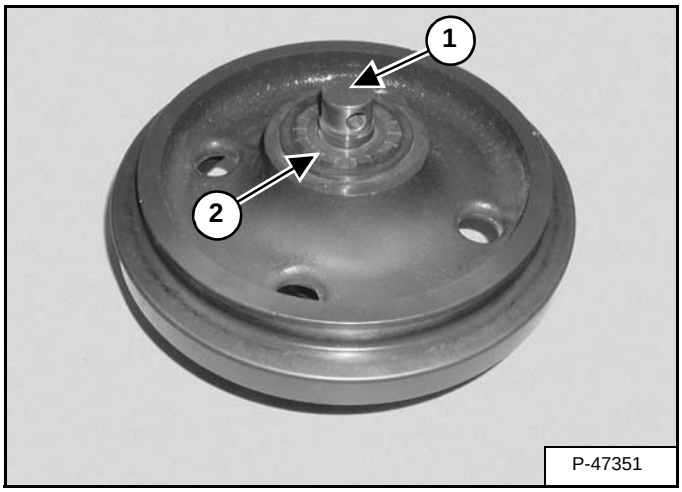
2. Support Fixture - Tube, 3.0 inches ID x 0.250 inch wall x 6.0 inches long. (90 mm ID x 6,35 mm wall x 162,4 mm long)

Figure 30-50-2



Remove the roll pin (Item 1) and block (Item 2) from both sides of the shaft **[Figure 30-50-2]**.

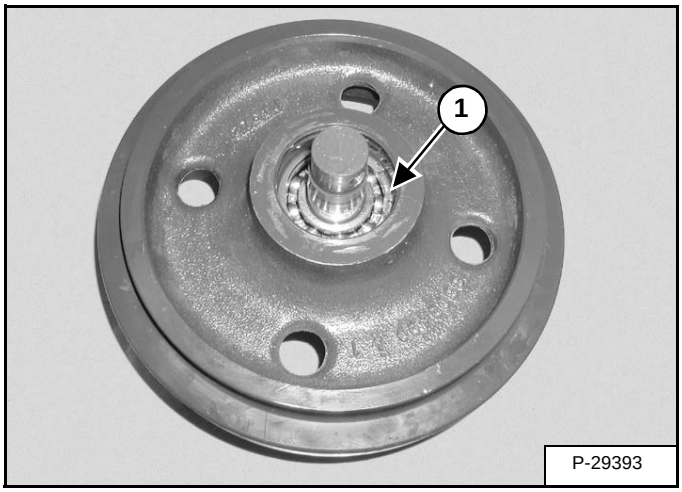
Figure 30-50-3



Remove any corrosion or paint from both ends of the exposed shaft (Item 1) **[Figure 30-50-3]** that could affect seal removal or damage the new seal during installation.

Remove the seal (Item 2) **[Figure 30-50-3]** from both sides of the idler.

Figure 30-50-4

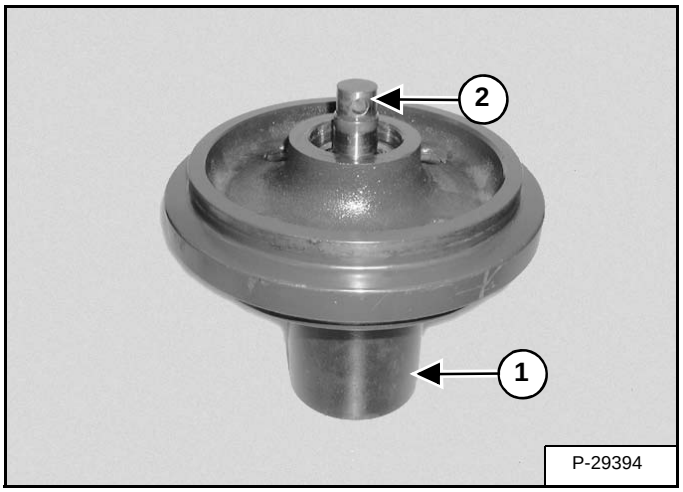


Remove the snap ring (Item 1) **[Figure 30-50-4]** from both sides of the idler.

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Disassembly (Cont'd)

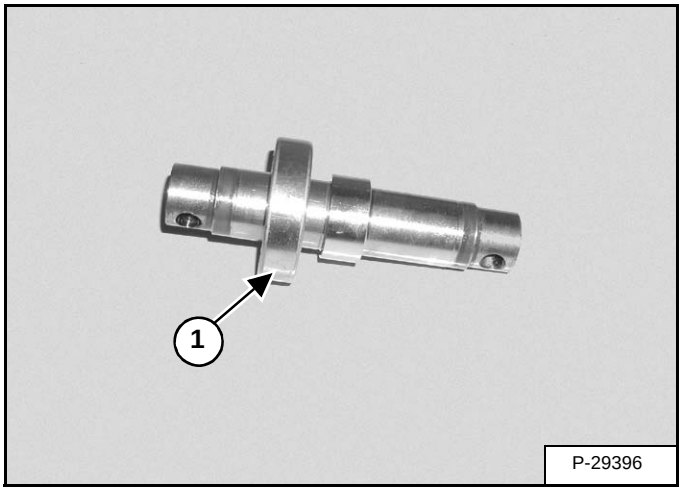
Figure 30-50-5



Place the idler on the support fixture (Item 1) **[Figure 30-50-5]**.

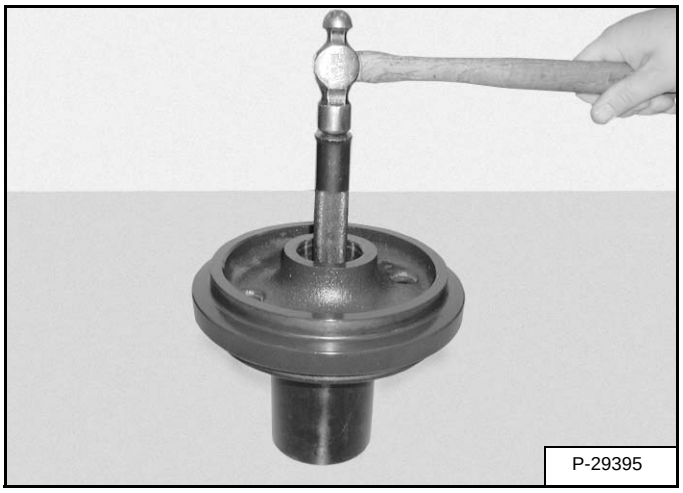
Using a soft faced hammer, tap the shaft (Item 1) **[Figure 30-50-5]** and bearing out the bottom of the idler.

Figure 30-50-6



Slide the bearing (Item 1) **[Figure 30-50-6]** off the shaft.

Figure 30-50-7



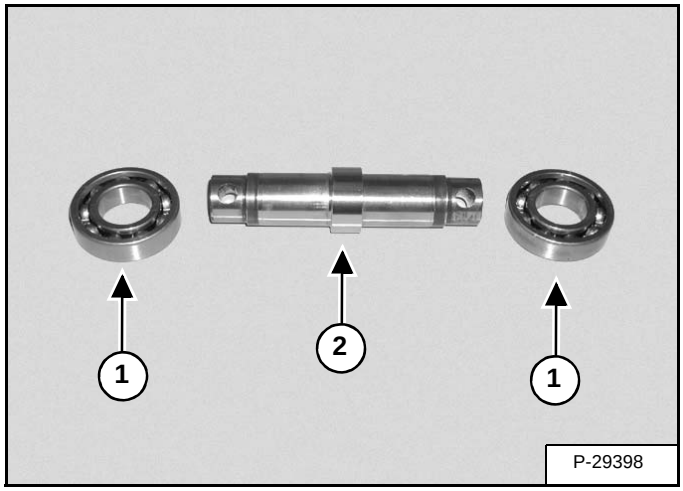
Turn the idler over, and using a bearing driver, remove the second bearing (Item 1) **[Figure 30-50-7]**.

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Assembly

Clean all parts in solvent and dry with compressed air.

Figure 30-50-8

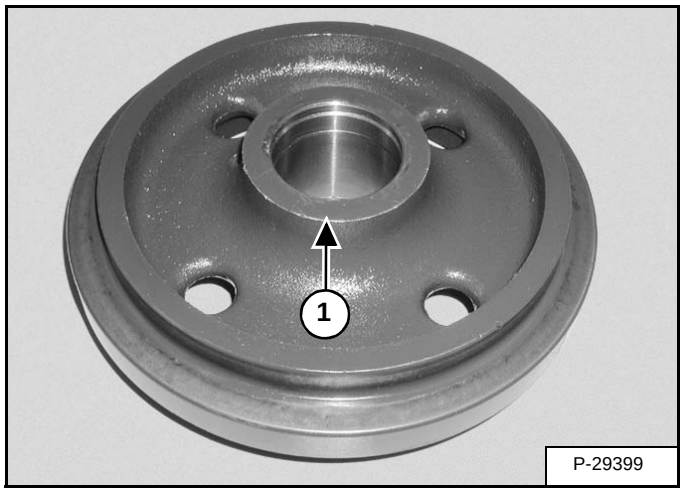


Inspect the bearings (Item 1) and shaft (Item 2) **[Figure 30-50-8]** for wear or damage.

The bearings are sealed. If the bearings do not roll smoothly, or if the seals are damaged, replace the bearings.

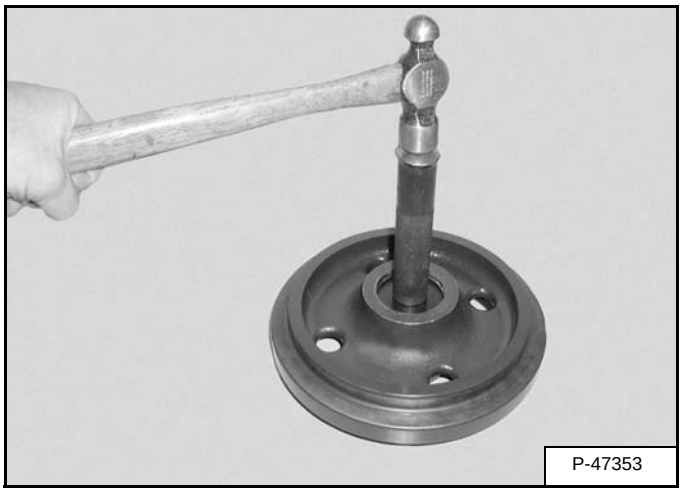
Replace any worn or damaged parts.

Figure 30-50-9



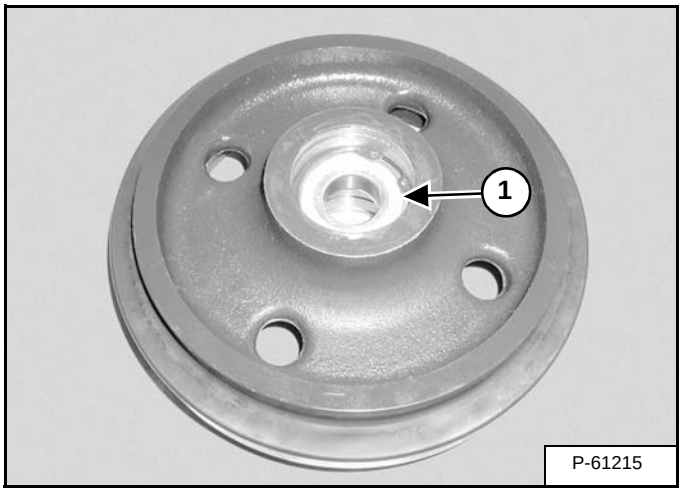
Remove all paint and corrosion from the seal surface (Item 1) **[Figure 30-50-9]** on both sides of the idler.

Figure 30-50-10



Using a bearing driver, install the bearing in the idler **[Figure 30-50-10]**.

Figure 30-50-11

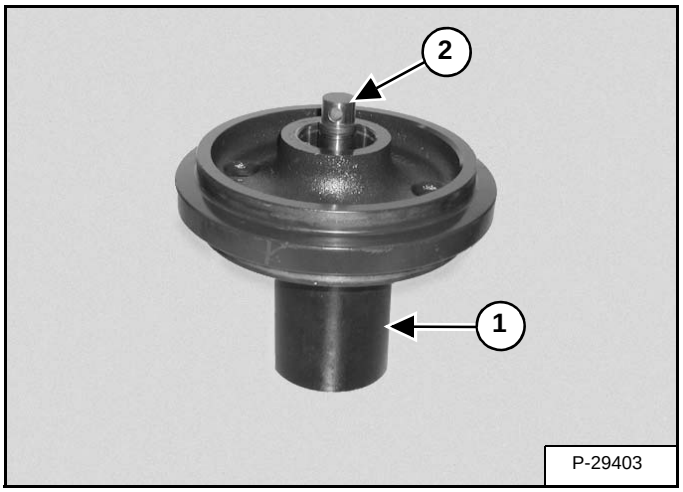


Install the snap ring (Item 1) **[Figure 30-50-11]**.

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Assembly (Cont'd)

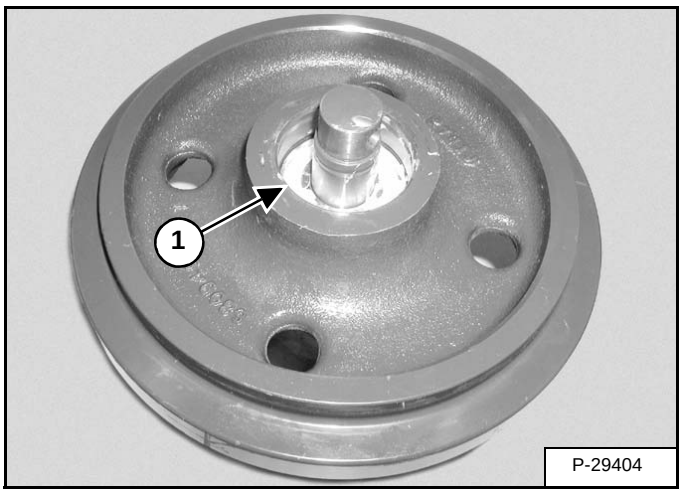
Figure 30-50-12



Turn the idler over and place the idler on the support fixture (Item 1) **[Figure 30-50-12]**.

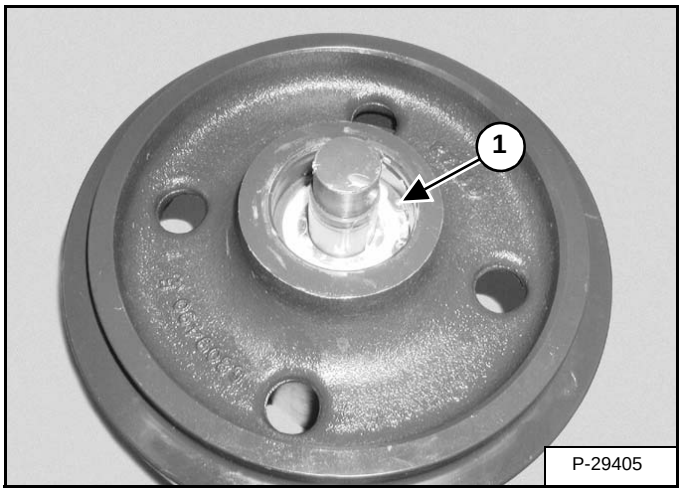
Install the shaft (Item 2) **[Figure 30-50-12]**.

Figure 30-50-13



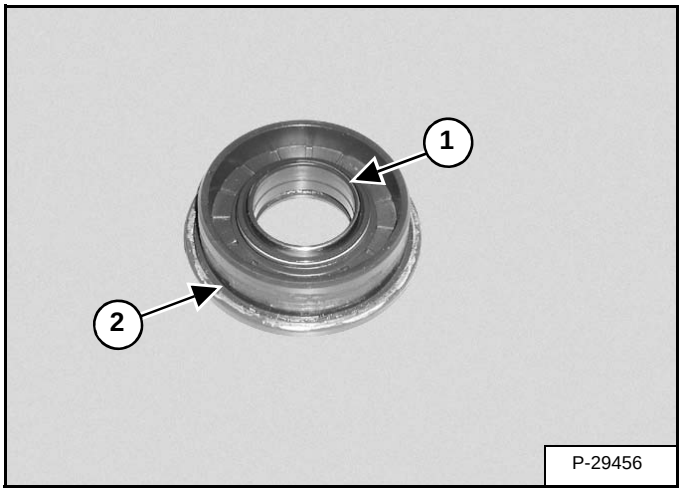
Install the bearing (Item 1) **[Figure 30-50-13]**. Use a brass drift to seat the bearing.

Figure 30-50-14



Install the snap ring (Item 1) **[Figure 30-50-14]**.

Figure 30-50-15



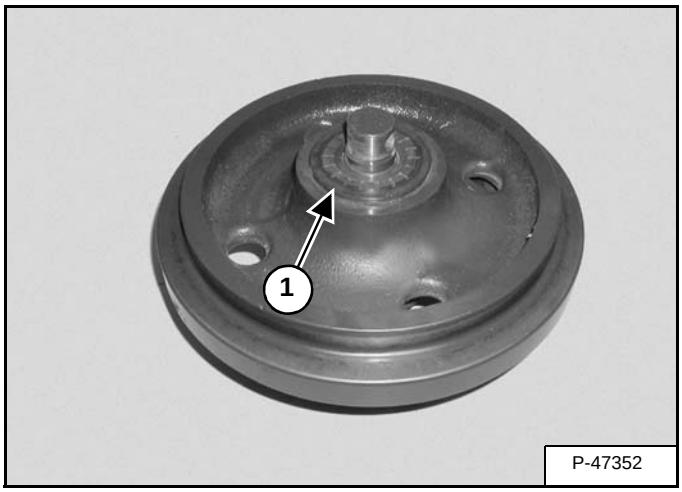
Apply assembly lube to the inside diameter (Item 1) **[Figure 30-50-15]** of the seal.

Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-50-15]** of the seal.

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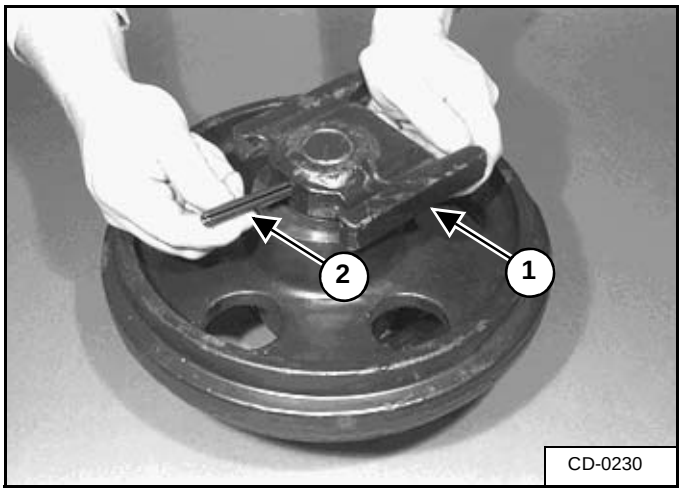
Assembly (Cont'd)

Figure 30-50-16



Using the driving tool, install the seal (Item 1) **[Figure 30-50-16]** on both sides of the idler.

Figure 30-50-17



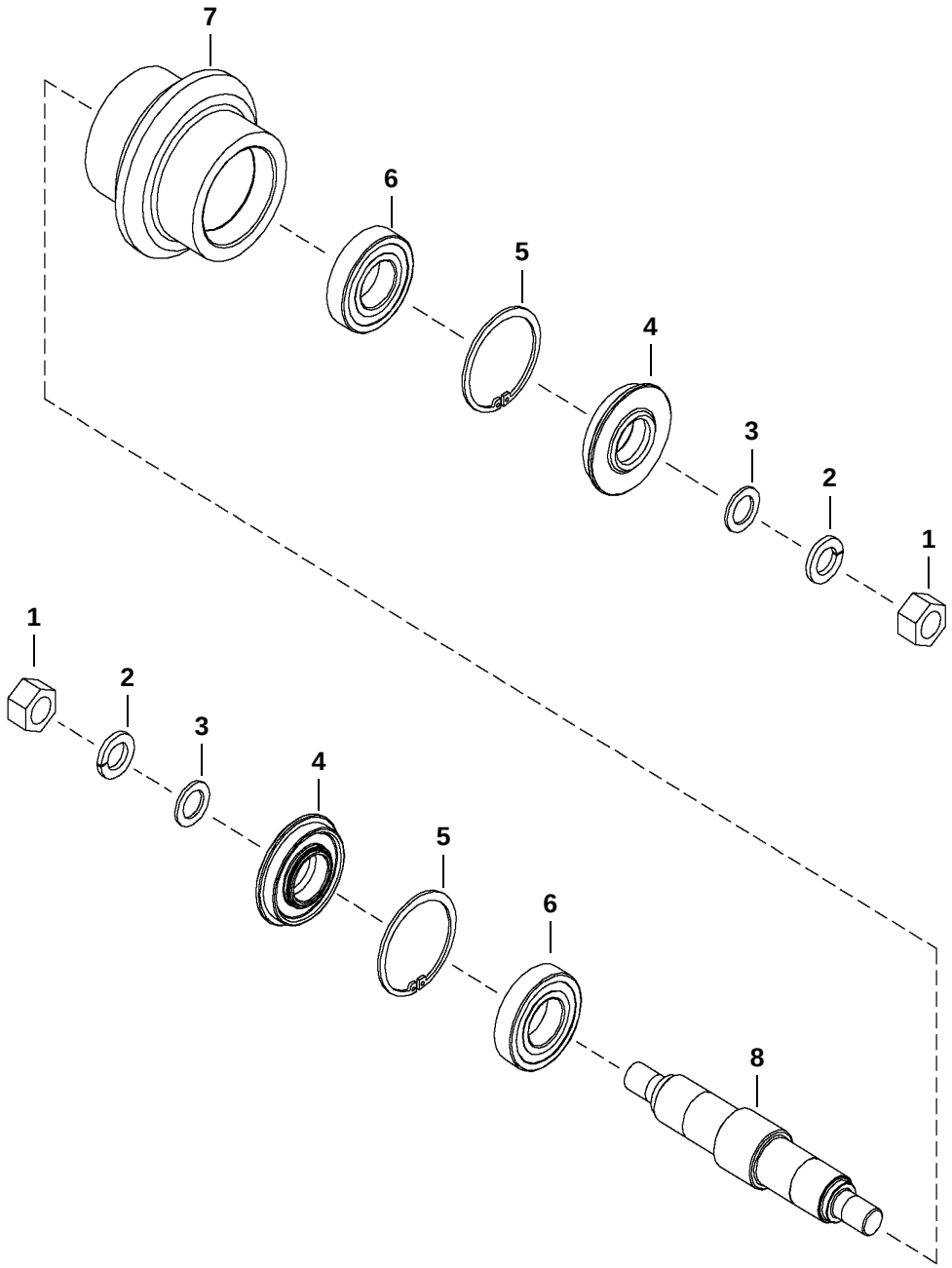
Install the block (Item 1) and roll pin (Item 2) **[Figure 30-50-17]** on both sides of the shaft.

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TRACK ROLLER

Parts Identification

1. Nut
2. Lock Washer
3. Washer
4. Seal
5. Snapring
6. Bearing
7. Roller
8. Shaft



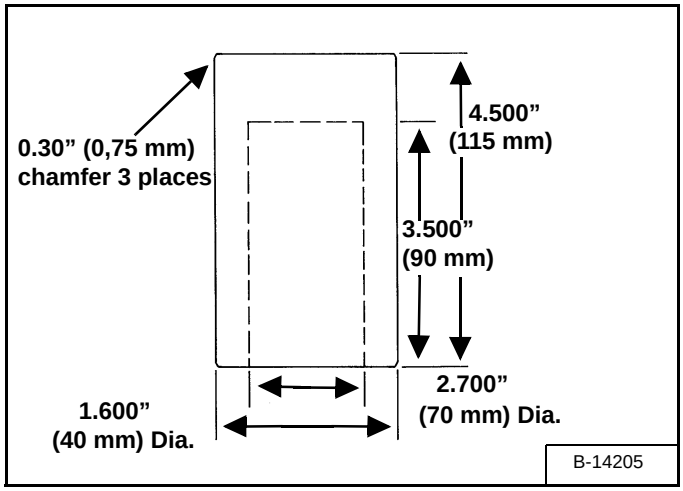
PE1914S

chodina@live.co.uk

Disassembly

The following tools must be fabricated for this procedure:

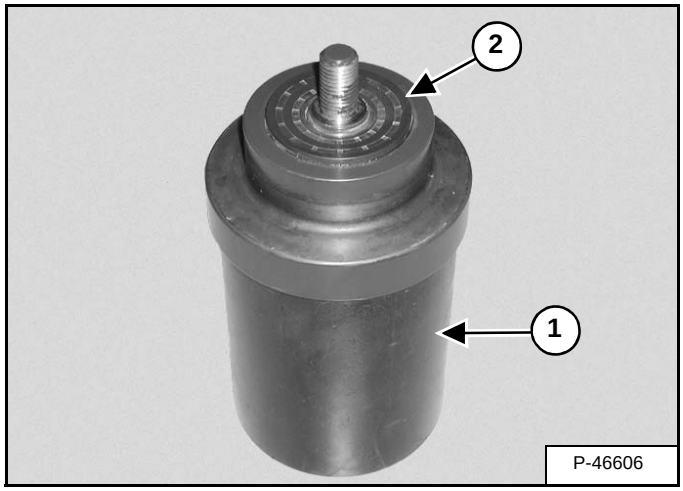
Figure 30-60-1



1. Driver Tool - See **[Figure 30-60-1]**.

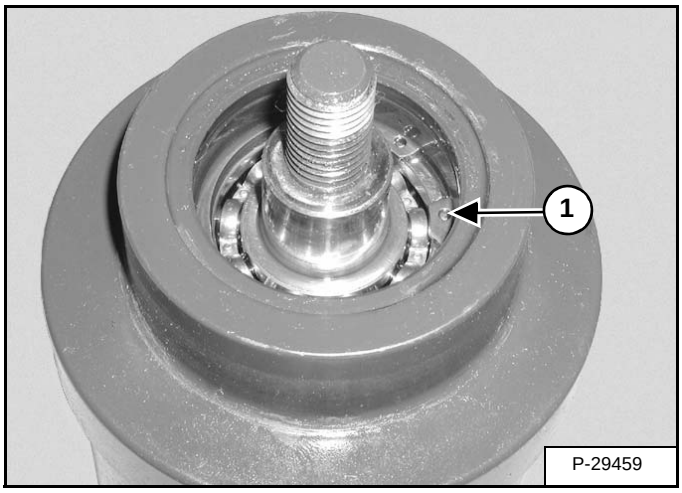
2. Support Fixture - Tubing, 3.0 inches ID x 0.250 inches wall x 6.0 inches long. (76,2 mm ID x 6,35 mm wall x 152,4 mm long)

Figure 30-60-2



Support the roller in the support fixture (Item 1). Remove the seal (Item 2) **[Figure 30-60-2]** from both sides of the roller.

Figure 30-60-3

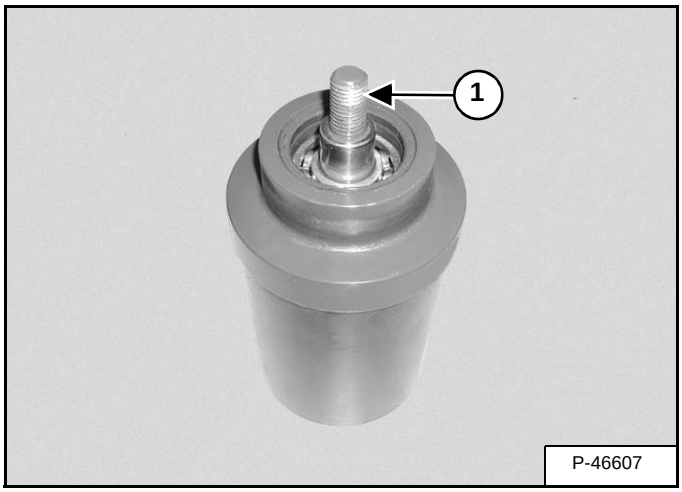


Remove the snap ring (Item 1) **[Figure 30-60-3]** from both sides of the roller.

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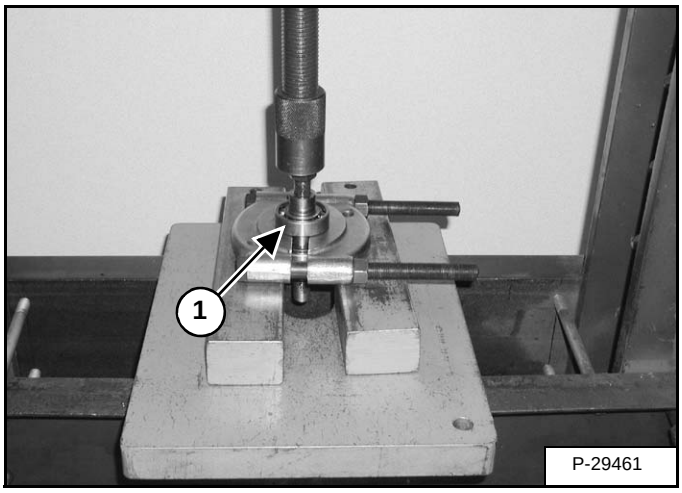
Disassembly (Cont'd)

Figure 30-60-4



Tap the shaft (Item 1) **[Figure 30-60-4]** and bearings out of the roller.

Figure 30-60-5



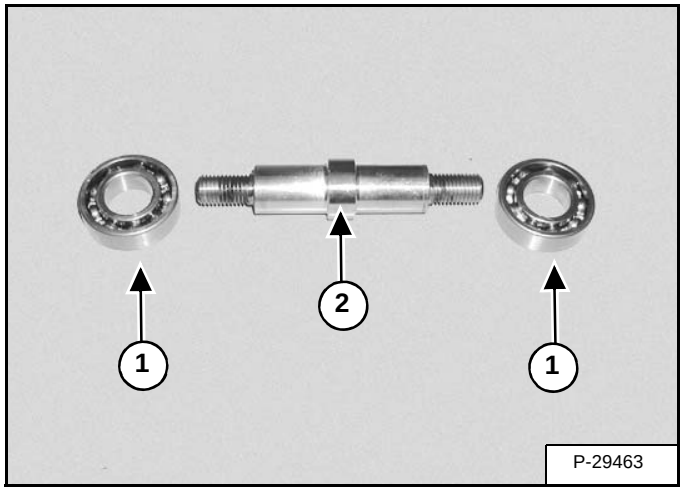
Press the bearings (Item 1) **[Figure 30-60-5]** off the shaft.

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Assembly

Clean all parts in solvent and dry with compressed air.

Figure 30-60-6

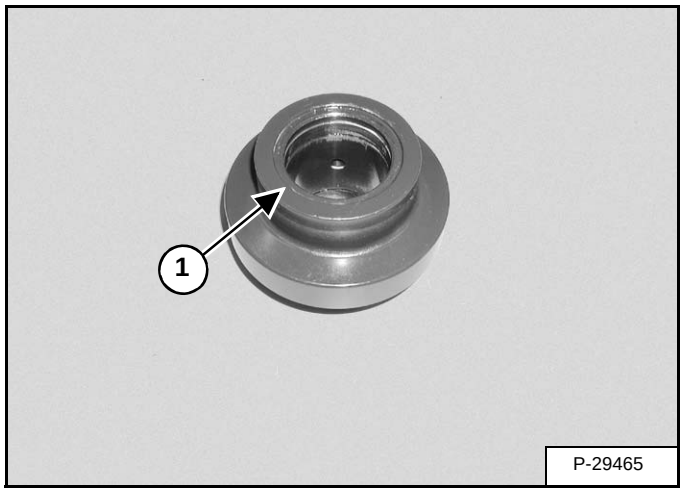


Inspect the bearings (Item 1) and shaft (Item 2) **[Figure 30-60-6]** for wear or damage.

The bearings are sealed. If the bearings do not roll smoothly or if the seals are damaged, replace the bearings.

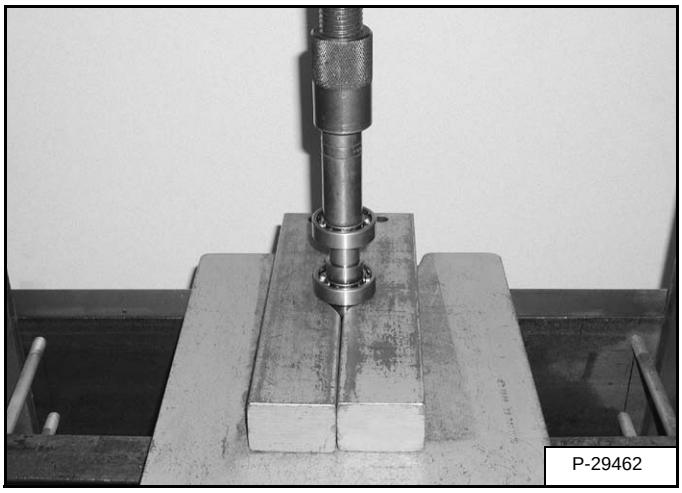
Replace any worn or damaged parts.

Figure 30-60-7



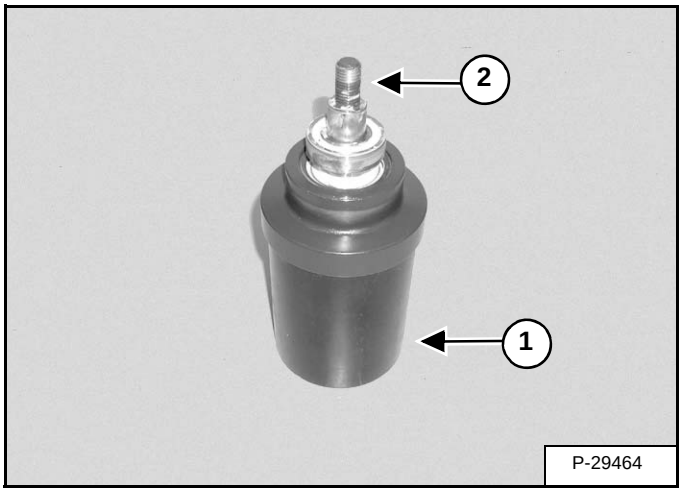
Remove all paint and corrosion from the seal surface (Item 1) **[Figure 30-60-7]** on both sides of the roller.

Figure 30-60-8



Press the bearings (Item 1) **[Figure 30-60-8]** on the shaft.

Figure 30-60-9



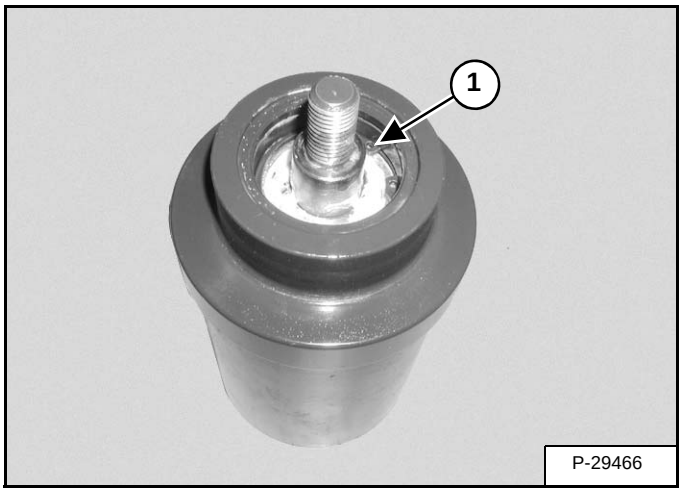
Place the roller on the support fixture (Item 1) **[Figure 30-60-9]**.

Tap the shaft and bearing assembly (Item 2) **[Figure 30-60-9]** into the roller.

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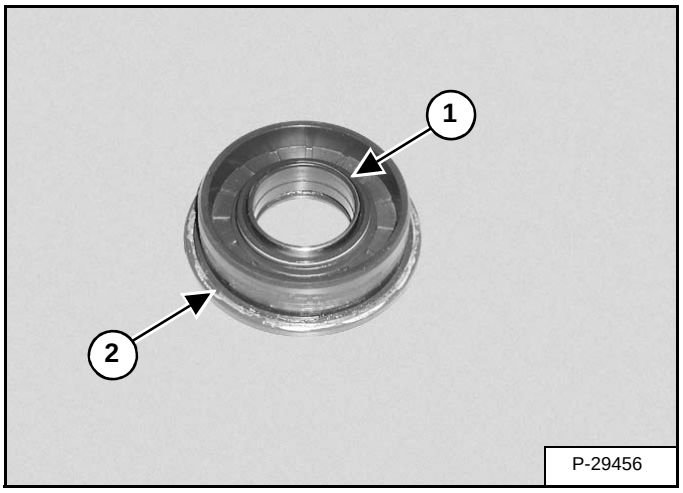
Assembly (Cont'd)

Figure 30-60-10



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

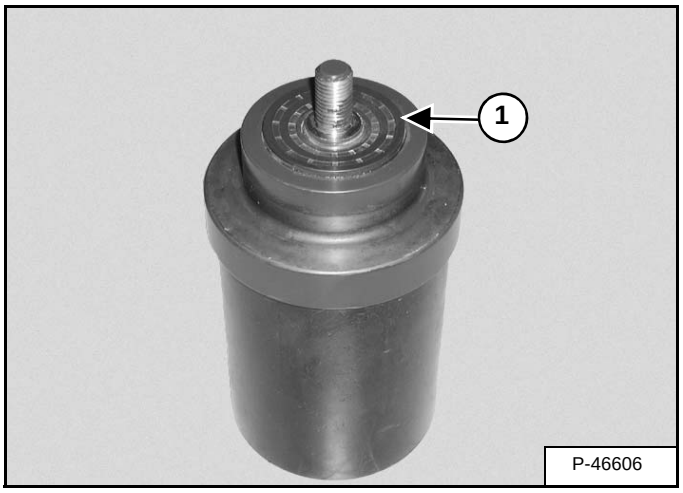
Figure 30-60-11



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

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

Figure 30-60-12



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

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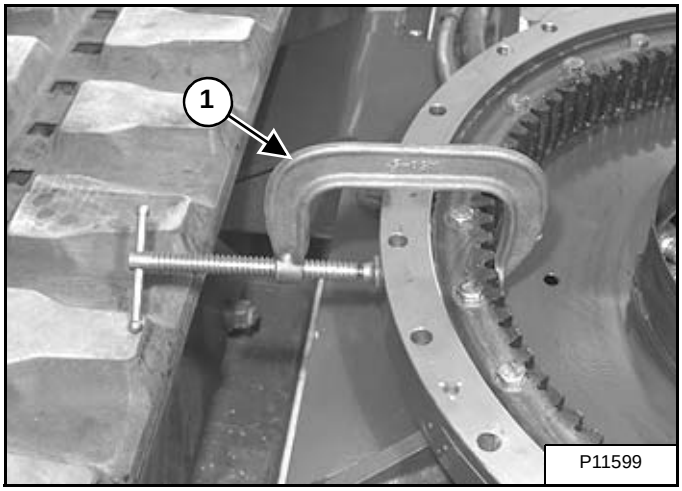
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SWING CIRCLE GEAR

Swing Bearing Removal

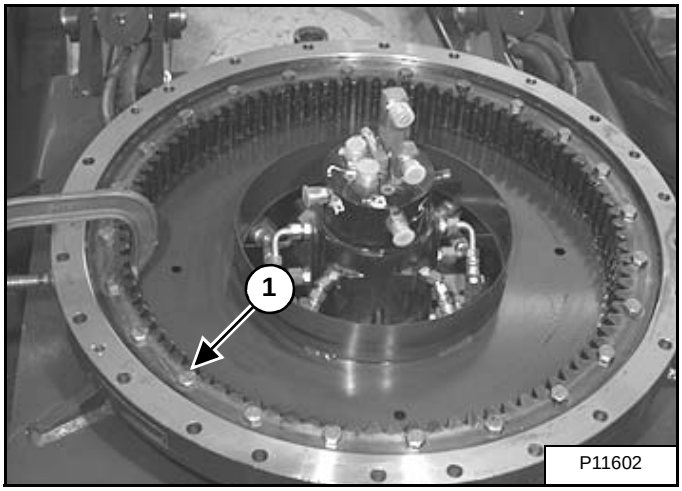
Remove the upperstructure. (See Removal on Page 40-10-1.)

Figure 30-70-1



Install a C-clamp (Item 1) **[Figure 30-70-1]** to prevent the swing bearing from turning while being removed.

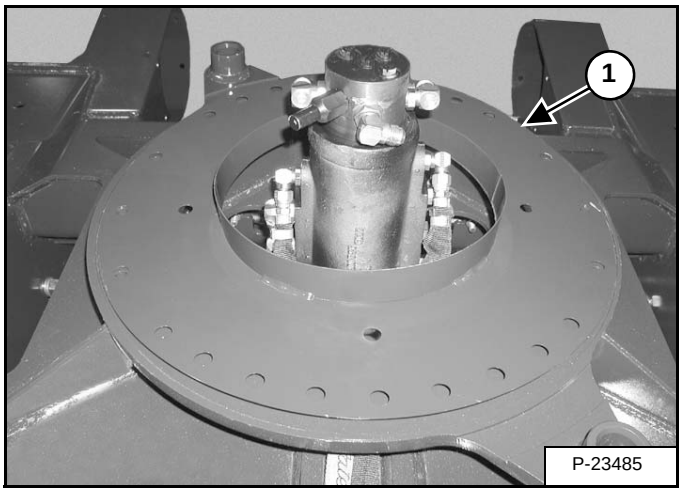
Figure 30-70-2



Remove the 24 bolts and nuts that hold the swing bearing to the track frame (Item 1) **[Figure 30-70-2]**.

Remove the swing bearing.

Figure 30-70-3



Remove the grease cover (Item 1) **[Figure 30-70-3]** from the track frame.

Clean and inspect the grease cover for damage. Replace as necessary.

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SWING CIRCLE GEAR

Swing Bearing Installation

Figure 30-70-4

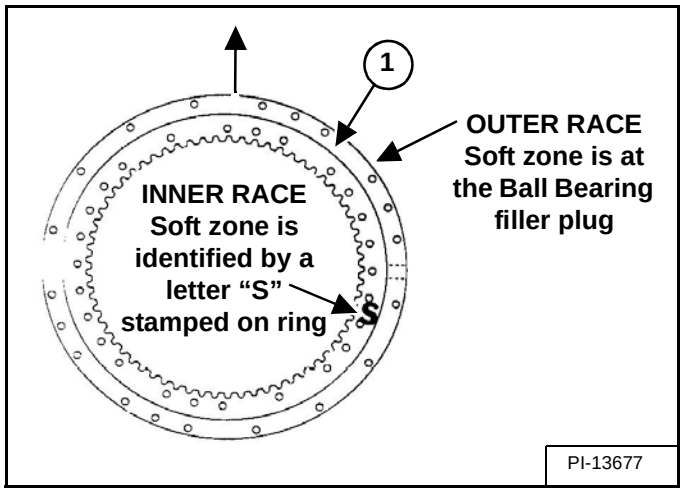
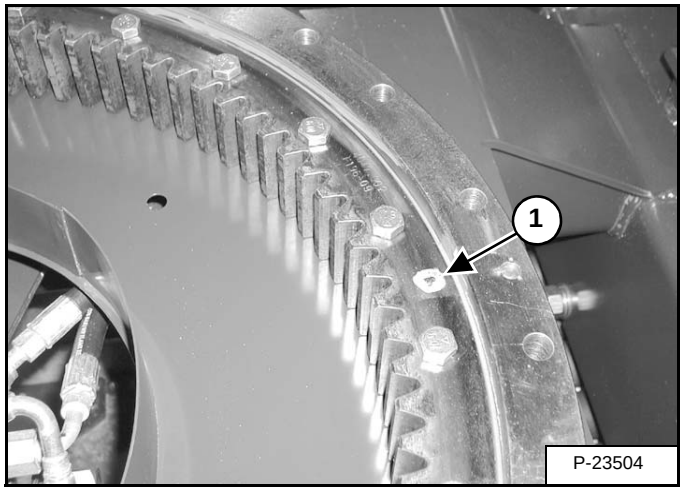


Figure 30-70-5

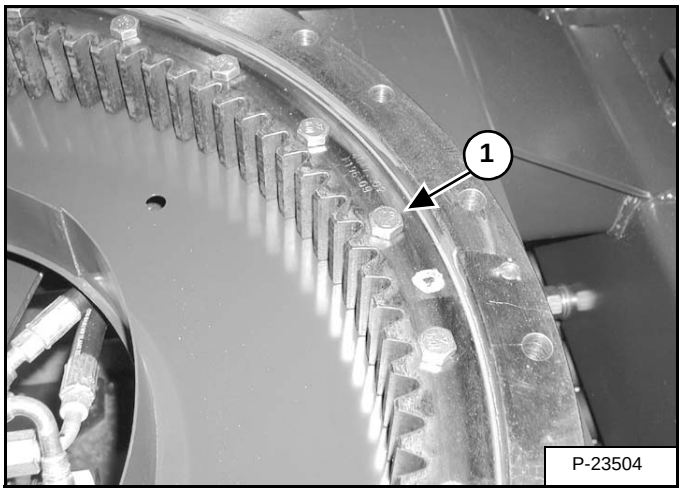


If reusing the existing swing bearing, use top, side and edge aligning marks to put the swing bearing in the correct location. If installing a new swing bearing find the soft zone area (Item 1) **[Figure 30-70-4]** & **[Figure 30-70-5]**.

Install the swing bearing so the inside soft zone (Item 1) **[Figure 30-70-4]** & **[Figure 30-70-5]** is at the right hand side of the excavator.

NOTE: Do not put the soft zone to the front or rear of the excavator.

Figure 30-70-6



Install the swing bearing bolts (Item 1) **[Figure 30-70-6]** and lock nuts.

Tighten the bolts to 78-85 ft.-lbs. (106-115 Nm) torque.

Put lubriplate grease or equivalent on the swing bearing gear.

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UPPERSTRUCTURE & SWING SECTION

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Linkage Bar Removal And Installation 40-80-4
Linkage Removal And Installation 40-80-2
Lower Linkage Removal And Installation 40-80-6

BOOM 40-150-1
Removal And Installation 40-150-1

BUCKET 40-170-1
Bucket Side Cutting Edge Removal And Installation 40-170-2
Bucket Teeth Removal And Installation 40-170-1

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Glass Installation 40-30-13
Glass Removal 40-30-12
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Right Side Front Sliding Window Removal And Installation 40-30-10
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Removal And Installation 40-30-1

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FUEL TANK 40-120-1
Removal And Installation 40-120-1

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Lock Lever Removal And Installation 40-60-7
Lower Console Cover Removal And Installation 40-60-1
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RIGHT CONSOLE 40-50-1
Console Base Removal And Installation 40-50-2
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Bushing Removal 40-140-6
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Assembly 40-191-10
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Parts Identification 40-191-4
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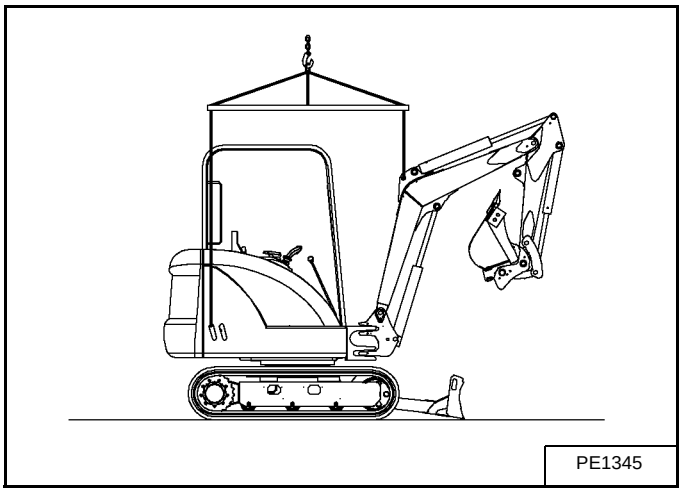


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UPPERSTRUCTURE

Removal

Figure 40-10-1



Fully extend the cylinders of the bucket, arm, and boom so that the excavator is in the position as shown **[Figure 40-10-1]**.

Lower the blade all the way.

Put all the control levers in neutral.

The boom must be in full raised position and centered to the front of the excavator **[Figure 40-10-1]**.

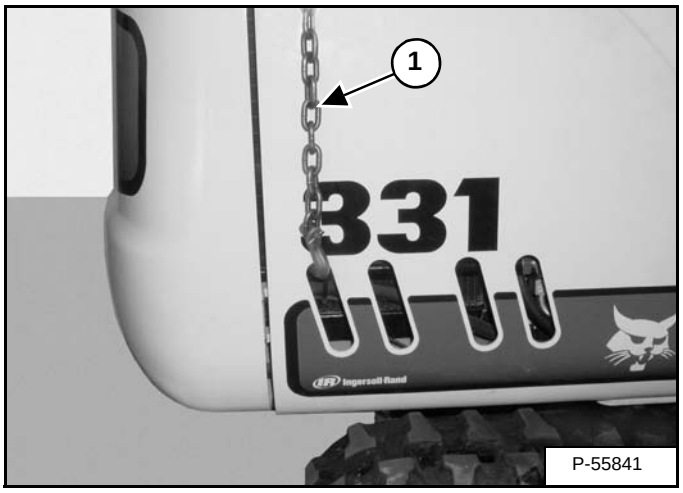
⚠ WARNING

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.**

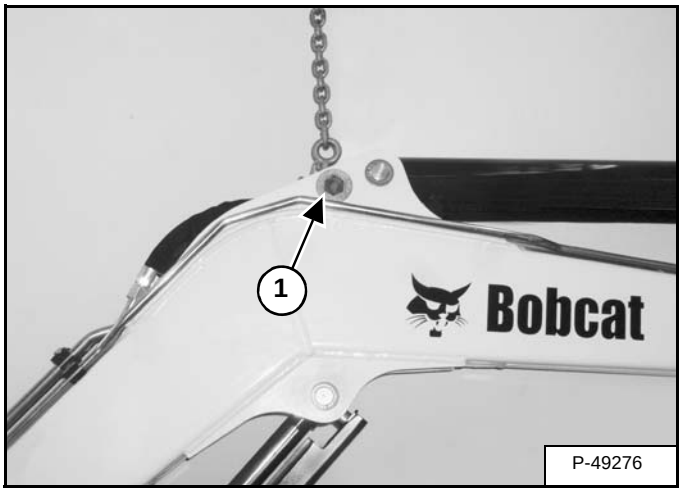
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Figure 40-10-2



Fasten chains to the rear of the upperstructure on both sides (Item 1) **[Figure 40-10-2]** and up to a lifting fixture above the canopy/cab **[Figure 40-10-1]**. The lifting fixture must extend over the sides of the canopy/cab to prevent the chains from hitting the ROPS/TOPS.

Figure 40-10-3



Install a one inch (25 mm) bolt and nut (Grade 5 or 8) through the hole at the boom (Item 1) **[Figure 40-10-3]**.

Fasten a chain from the bolt to the lift fixture **[Figure 40-10-1]**.

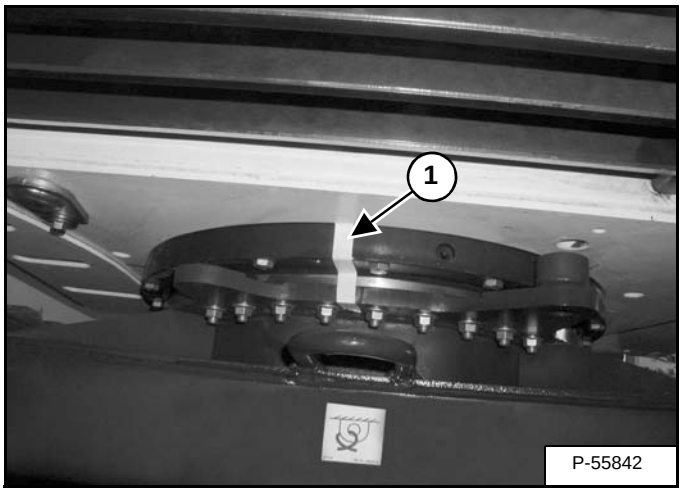
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Removal (Cont'd)

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

Remove the swing motor drive carrier. (See Removal And Installation on Page 20-91-1.)

Figure 40-10-4



Mark the upperstructure to the swing bearing and to the track frame for assembly (Item 1) **[Figure 40-10-4]**.

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.

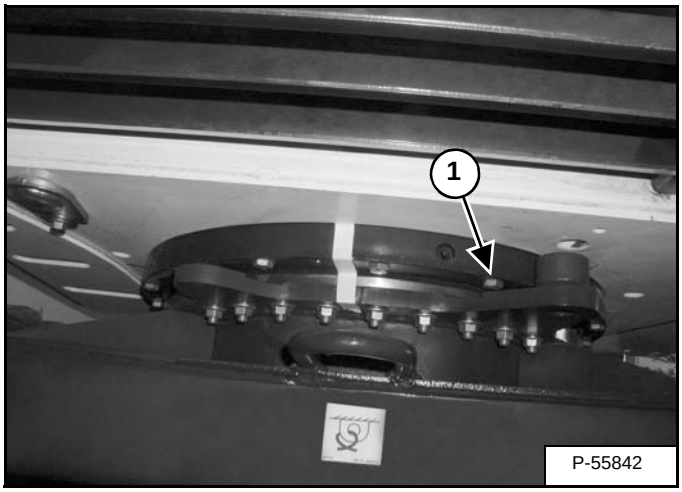
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Figure 40-10-5



Mark and remove the hoses **[Figure 40-10-5]** from the swivel joint.

Figure 40-10-6



Partially disassemble the upperstructure from the swing bearing by removing all but four bolts which are spaced at 90° from each other (Item 1) **[Figure 40-10-6]**.

The upperstructure must be rotated to gain access to the bolts for removal. With the help of a second person, manually turn the upperstructure to provide clearance for bolt removal.

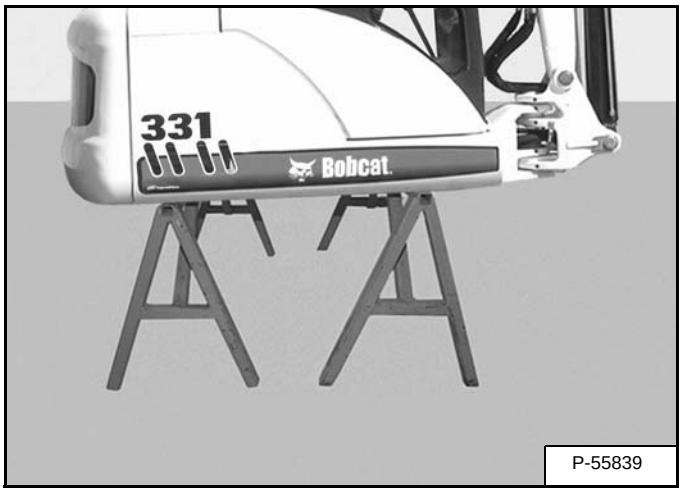
NOTE: For disassembly safety a minimum of four evenly spaced bolts must remain installed, to be removed later.

Apply a small amount of lifting pressure to the upperstructure with the lift sling. Remove the four remaining bolts holding the upperstructure to the swing bearing.

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Removal (Cont'd)

Figure 40-10-7



Lift the upperstructure off of the swing bearing. Put the upperstructure on suitable supporting stands or blocks **[Figure 40-10-7]**.

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Installation

Figure 40-10-8

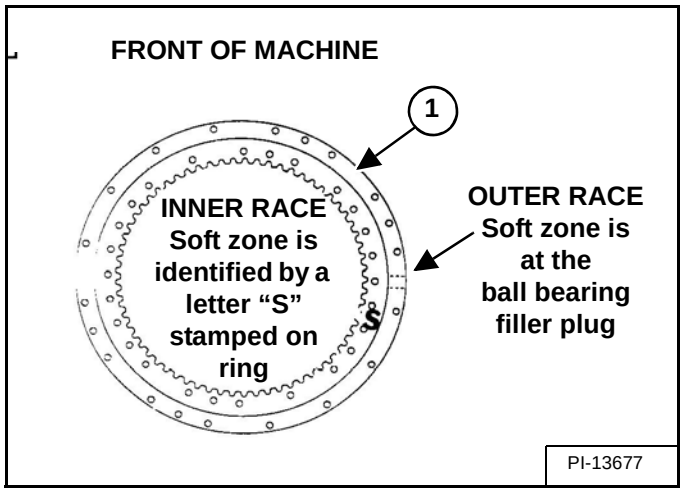
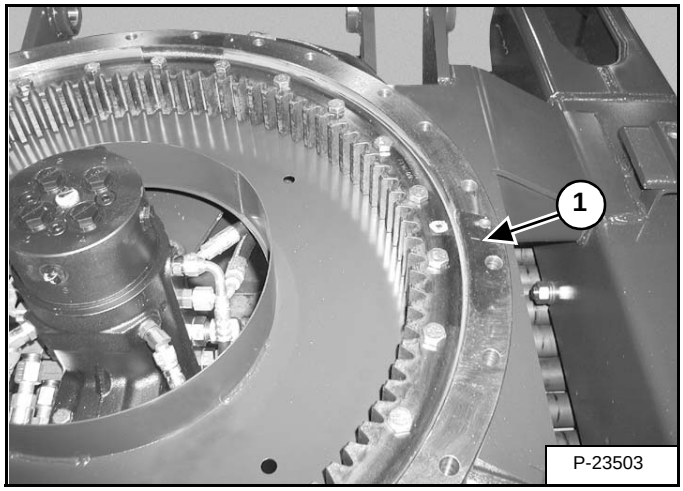


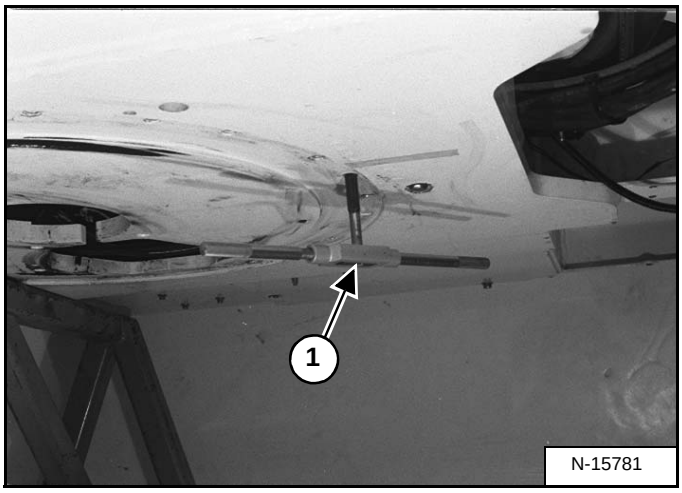
Figure 40-10-9



Rotate the swing bearing so the outside soft zone (Item 1) **[Figure 40-10-8]** & **[Figure 40-10-9]** is to the right hand side of the excavator.

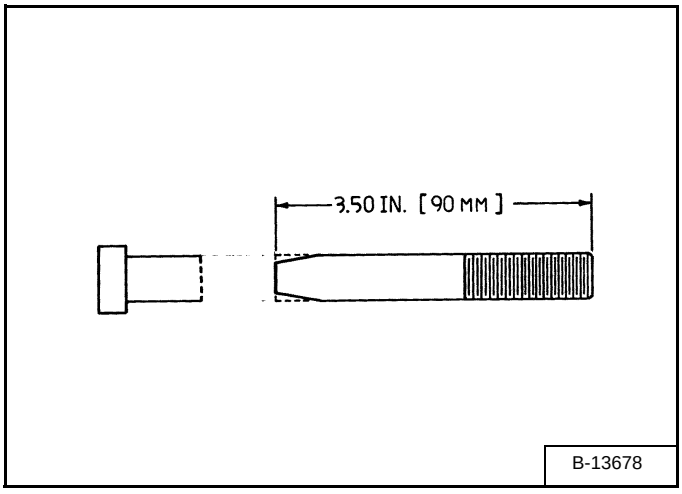
NOTE: The upperstructure can only be installed on the swing bearing in one position. Match the mount holes in the swing bearing to the mount holes in the upperstructure.

Figure 40-10-10



Use a tap (12 mm) in the holes (Item 1) **[Figure 40-10-10]** in the upperstructure to remove any dried thread lock adhesive.

Figure 40-10-11

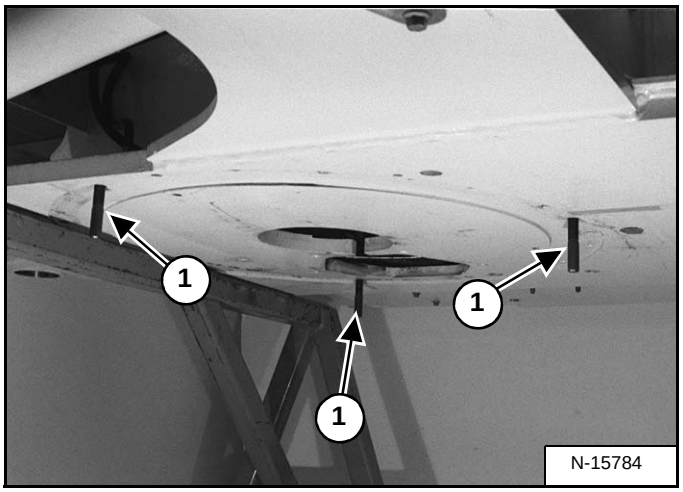


Make three alignment pins by using M12 X 110 mm (P/N 7GM-12110) long bolts. Cut the head off of these bolts at 3.50 inch (90 mm), then taper the end of the bolts **[Figure 40-10-11]**.

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Installation (Cont'd)

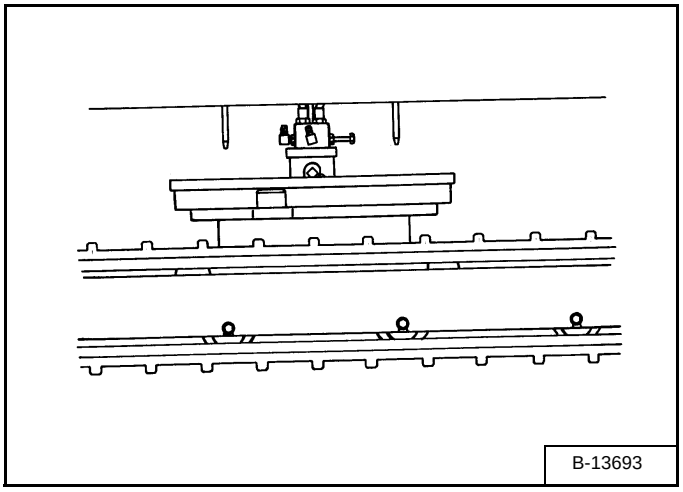
Figure 40-10-12



Install the pins (Item 1) **[Figure 40-10-12]** into the upperstructure at approximately 120° apart. These will act as alignment pins while lowering the upperstructure onto the swing bearing.

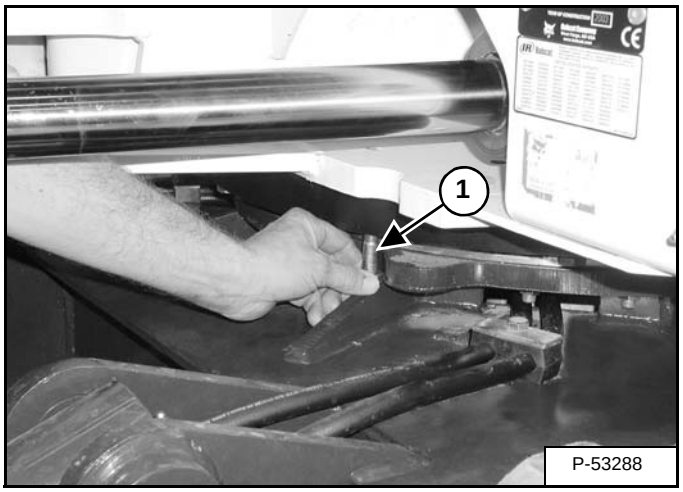
Install the upperstructure onto the swing bearing using the alignment marks and the alignment pins.

Figure 40-10-13



Make sure the swivel joint is centered into the upperstructure access hole **[Figure 40-10-13]**.

Figure 40-10-14



Install the three tapered head alignment bolts (Item 1) **[Figure 40-10-14]** through the swing bearing and into the upperstructure. These bolts should be spaced at approximately 120°.

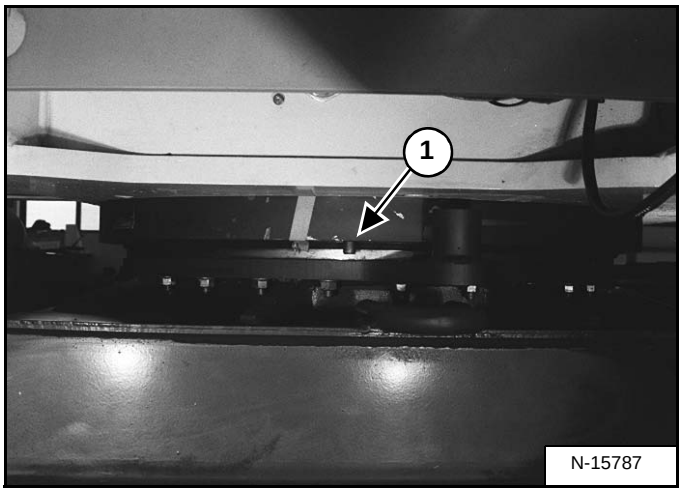
This procedure will correctly align the upperstructure for correct swing motor gear to swing bearing ring gear clearance.

Tighten these three tapered bolts to 60 ft.-lbs. (81 Nm) torque.

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Installation (Cont'd)

Figure 40-10-15



Remove the three, 3.50 inch (90 mm) alignment pins (Item 1) **[Figure 40-10-15]** from the upperstructure.

These headless pins can be removed from the bottom.

Apply thread adhesive (LOCTITE #242) to the threads of the bolts. Install the bolts into all holes (except the three with the alignment bolts installed). Tighten these bolts to 78-85 ft.-lbs. (106-115 Nm) torque.

Remove the three alignment bolts. Install the three remaining bolts. Tight these bolts to 78-85 ft.-lbs. (106-115 Nm) torque.

Figure 40-10-16



Install the hoses **[Figure 40-10-16]** on the swivel joint.

Remove the chains and lifting fixture.

Install the swing motor drive carrier. (See Removal And Installation on Page 20-91-1.)

Check the backlash between the gears by moving the frame back and forth at several points throughout 360° of frame rotation. There must be some backlash present.

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

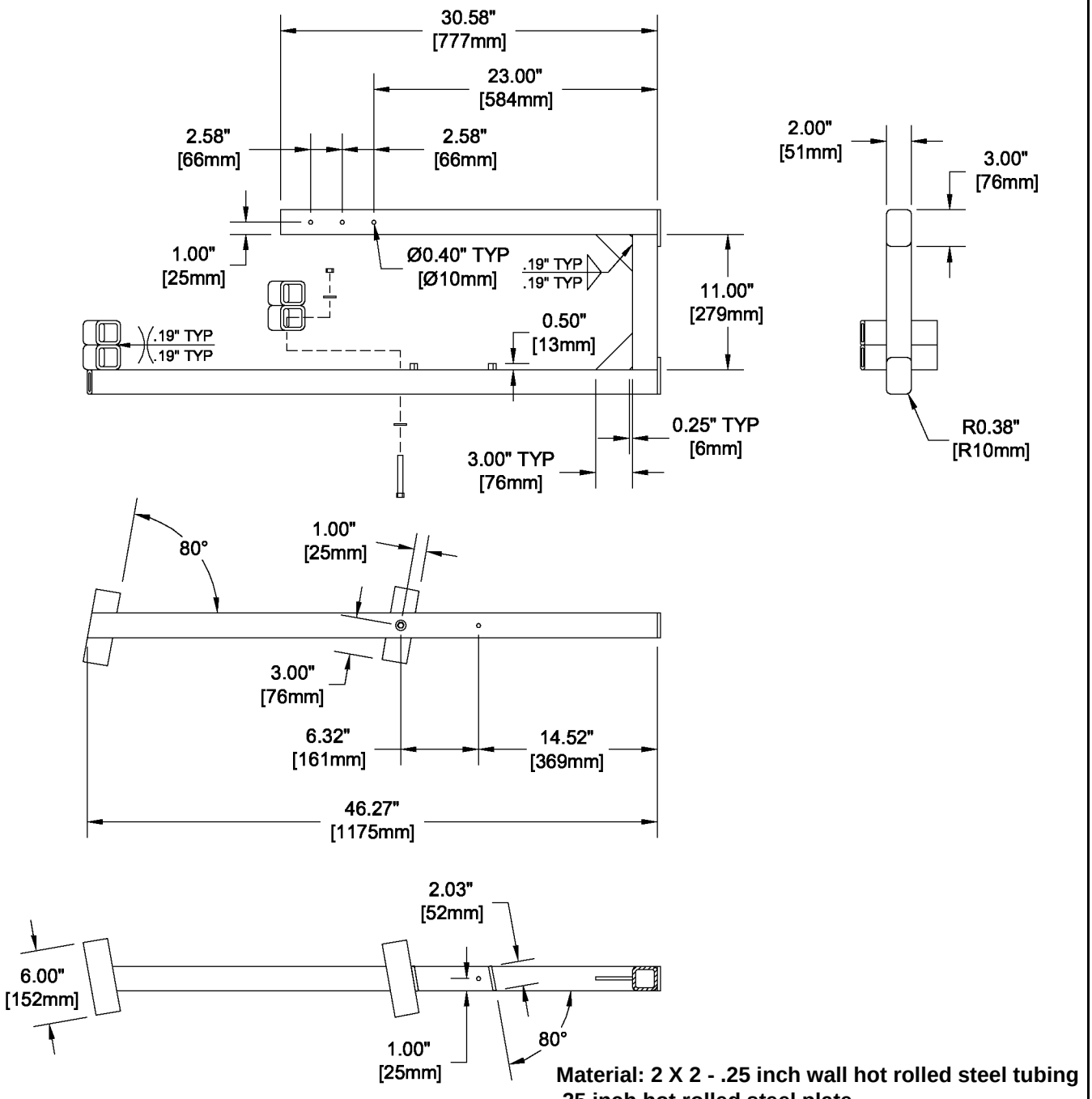
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ROPS CANOPY

Removal And Installation

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.

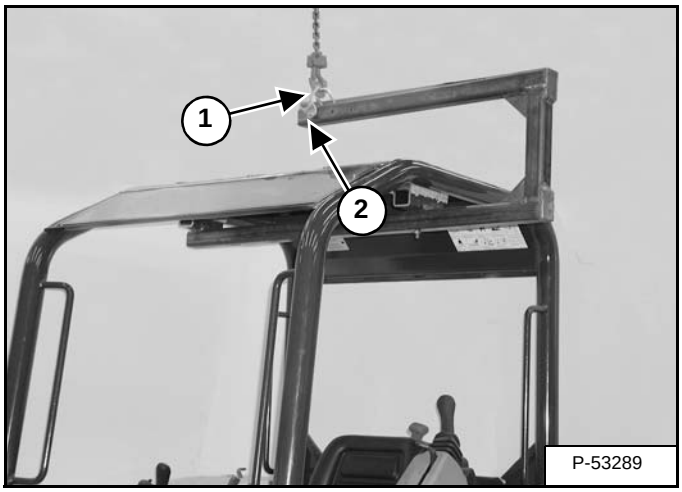
Figure 40-20-1



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Removal And Installation (Cont'd)

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 canopy **[Figure 40-20-2]**.

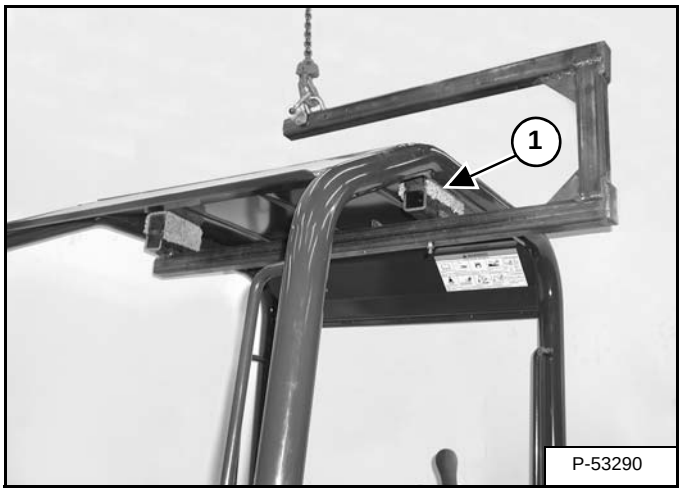
NOTE: Use a chain hoist of sufficient capacity.

⚠ 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.

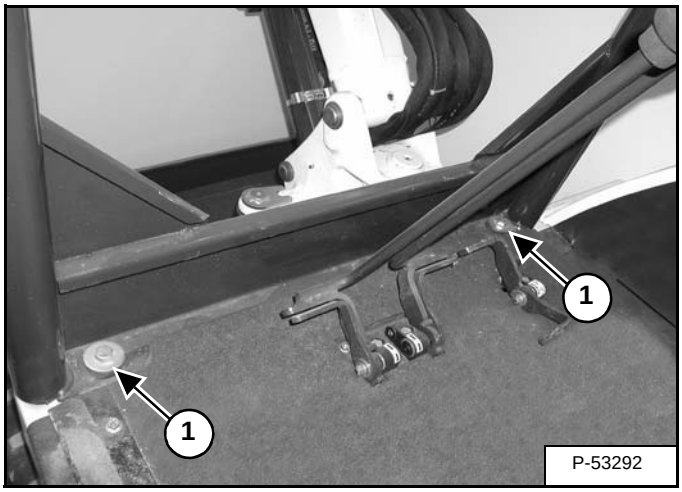
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Figure 40-20-3



Adjust the lifting bracket to the proper width by moving the bracket (Item 1) **[Figure 40-20-3]**.

Figure 40-20-4



Remove the bolts and washers (Item 1) **[Figure 40-20-4]** from the front of the canopy.

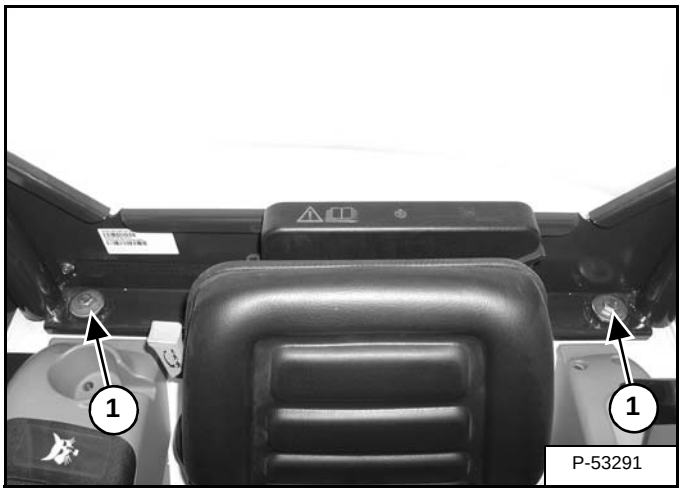
Installation: Tighten the bolts to 118-133 ft.-lbs. (160-180 Nm) torque.

Remove the canopy.

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Removal And Installation (Cont'd)

Figure 40-20-5



Remove the bolts and washers (Item 1) **[Figure 40-20-5]** from the rear of the canopy.

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

Raise the hoist.

Remove the canopy.

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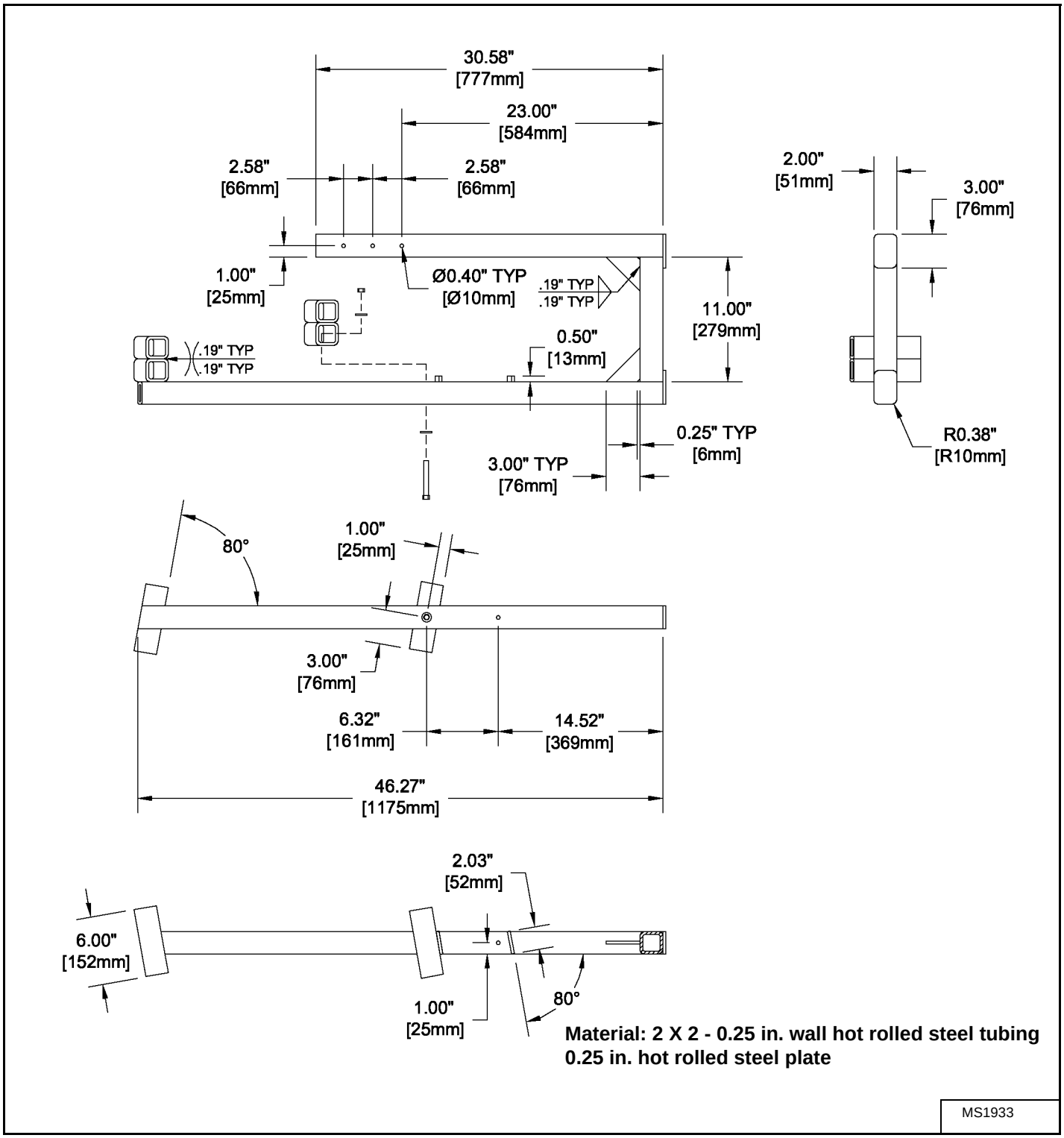


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Removal And Installation

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

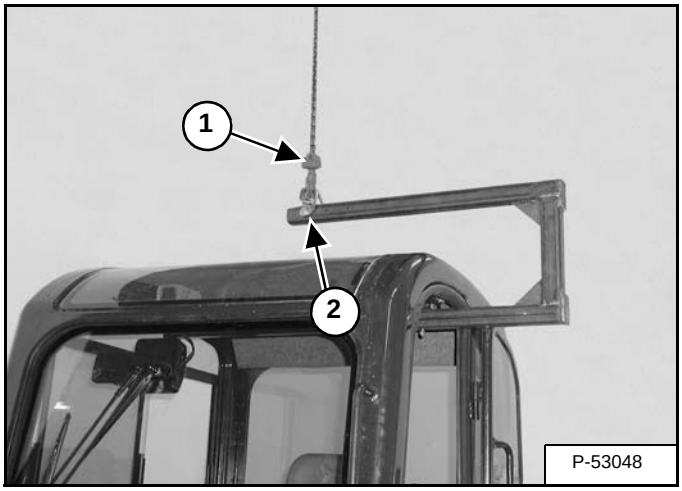


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Removal And Installation (Cont'd)

Remove the upperstructure light.

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]**.

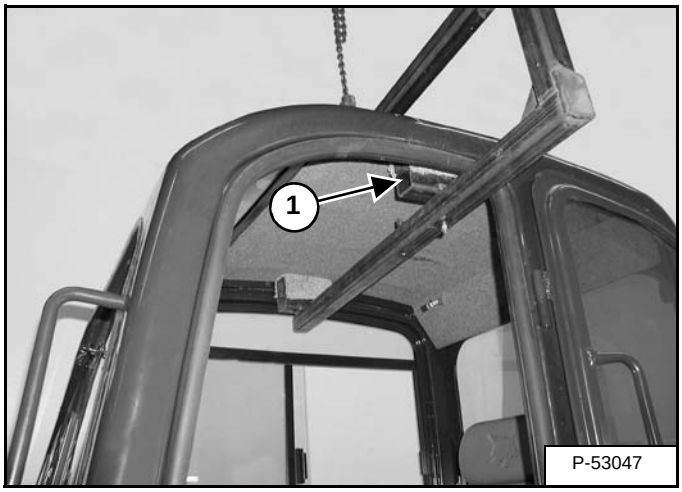
NOTE: Use a chain hoist of sufficient capacity.

⚠ 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.

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Figure 40-30-3

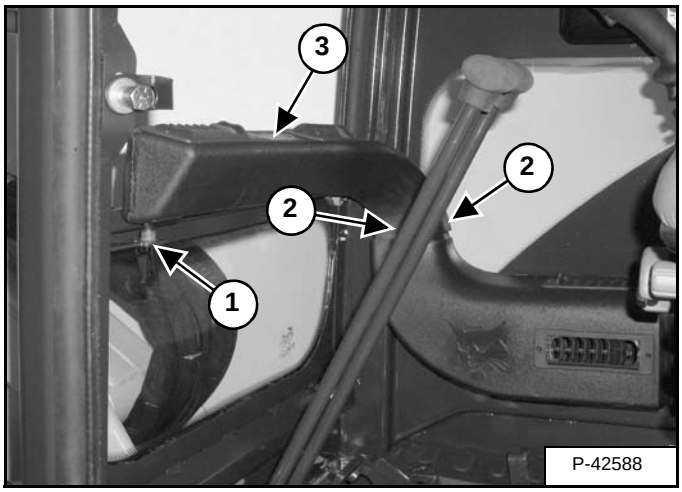


Adjust the lifting bracket to the proper width by moving the bracket (Item 1) **[Figure 40-30-3]**.

The cab may be equipped with either the A/C or heater duct.

A/C Duct

Figure 40-30-4

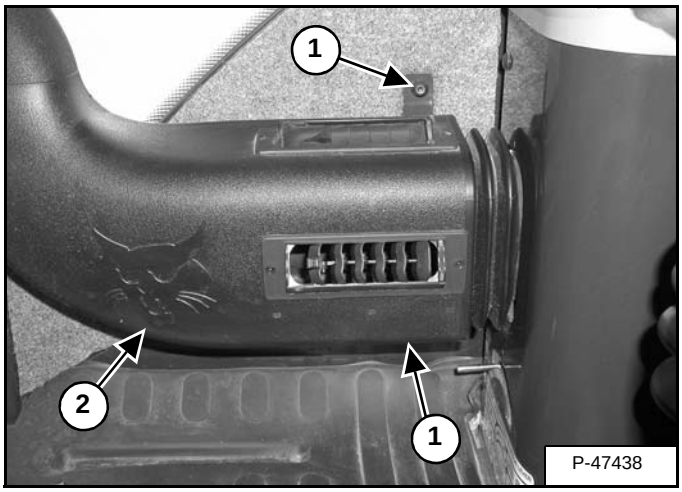


Pull down on the lock (Item 1), remove the screws (Item 2), and remove the A/C duct (Item 3) **[Figure 40-30-4]**.

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Removal And Installation (Cont'd)

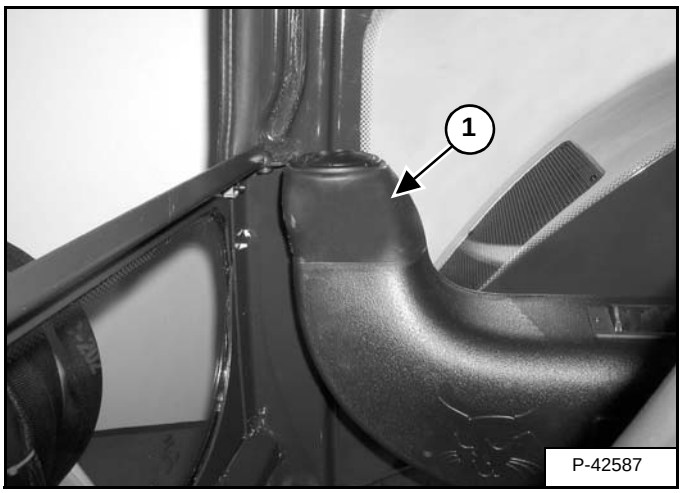
Figure 40-30-5



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

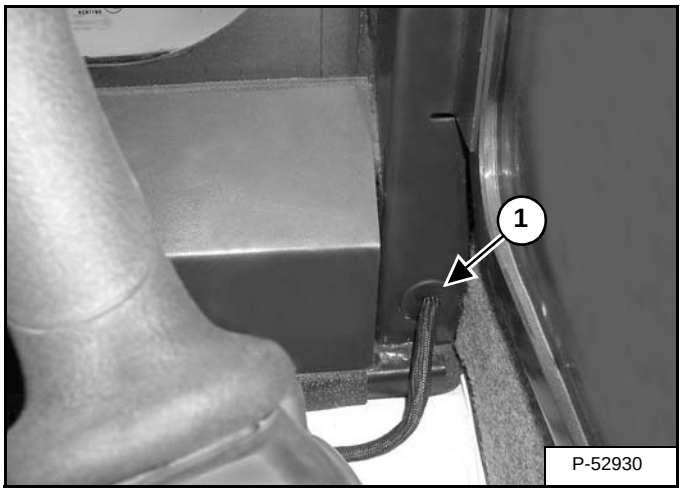
Heater Duct

Figure 40-30-6



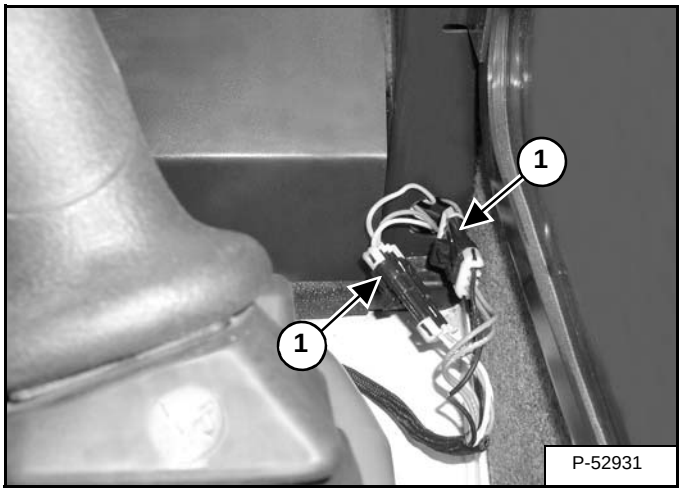
Remove the screws and pull straight up to remove the heater duct (Item 1) **[Figure 40-30-6]**.

Figure 40-30-7



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

Figure 40-30-8

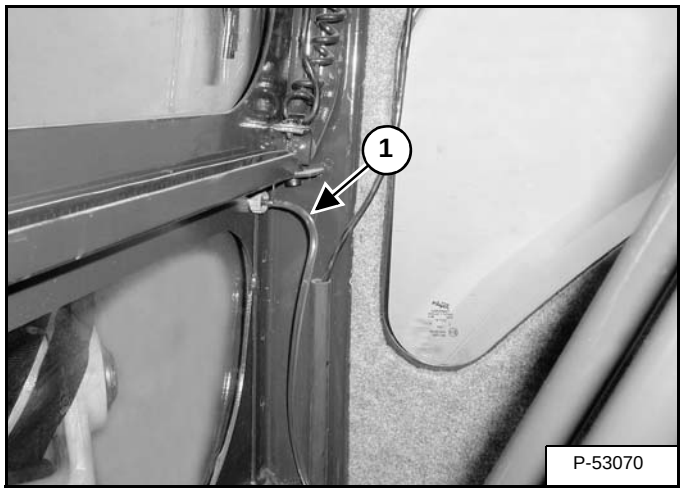


Remove the wire harness from the cab frame. Disconnect the wire harness (Item 1) **[Figure 40-30-8]**.

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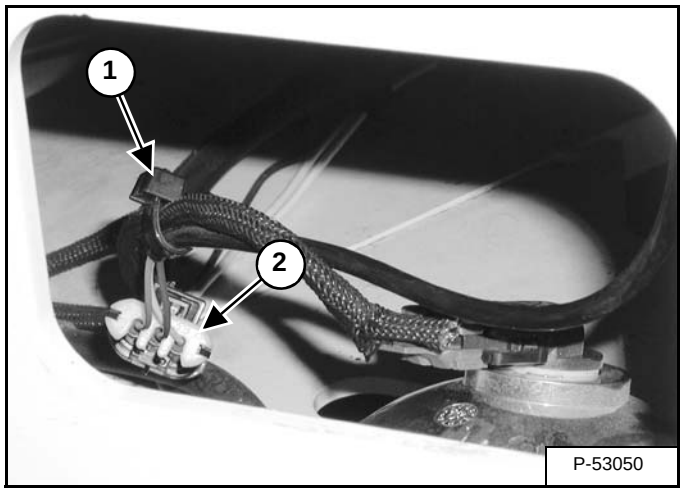
Removal And Installation (Cont'd)

Figure 40-30-9



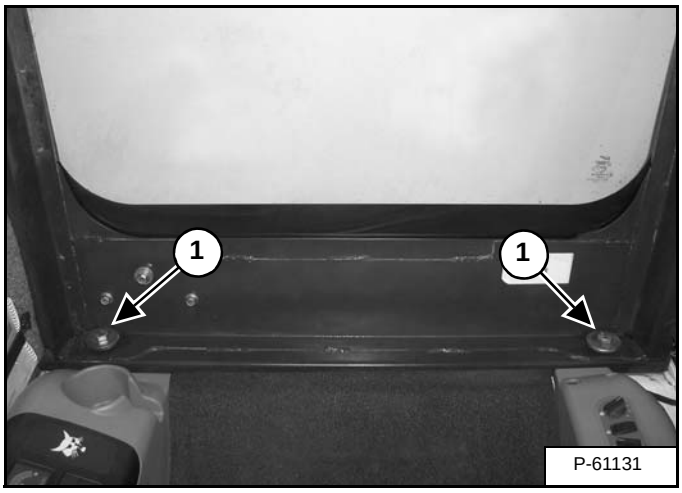
Remove the windshield washer hose (Item 1) **[Figure 40-30-9]** from the nozzle.

Figure 40-30-10



Remove the tie strap (Item 1) and disconnect the wire harness (Item 2) **[Figure 40-30-10]**.

Figure 40-30-11



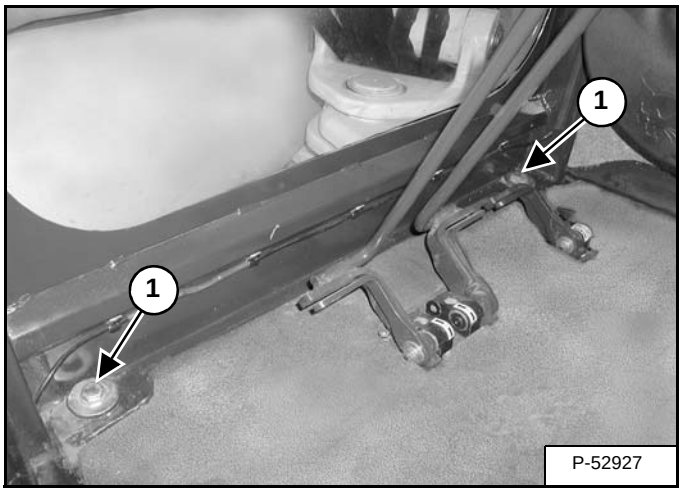
Remove the bolts and washers (Item 1) **[Figure 40-30-11]** from the rear of the cab.

Installation: Tighten the bolts to 118-133 ft.-lb. (160-180 N•m) torque.

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Removal And Installation (Cont'd)

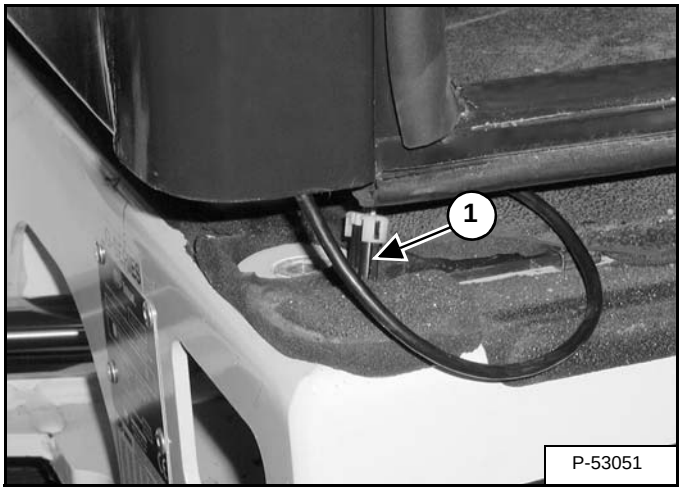
Figure 40-30-12



Remove the bolts and washers (Item 1) **[Figure 40-30-12]** from the front of the cab.

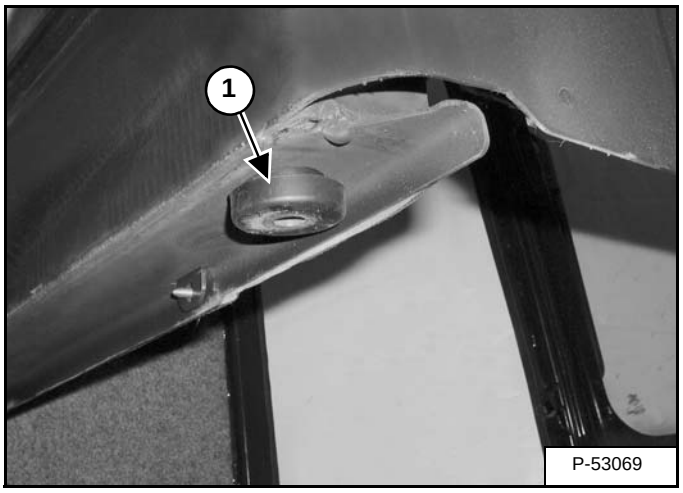
Installation: Tighten the bolts to 118-133 ft.-lb. (160-180 N•m) torque.

Figure 40-30-13



Guide the wiring harness (Item 1) **[Figure 40-30-13]** through the upperstructure as the cab is being removed.

Figure 40-30-14



Installation: Install the cab mounts (Item 1) **[Figure 40-30-14]** on the four corners of the cab.

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Door Removal And Installation

Figure 40-30-15



The door can be removed from the cab by slowly swinging the door back and forth while lifting up on the door **[Figure 40-30-15]**.

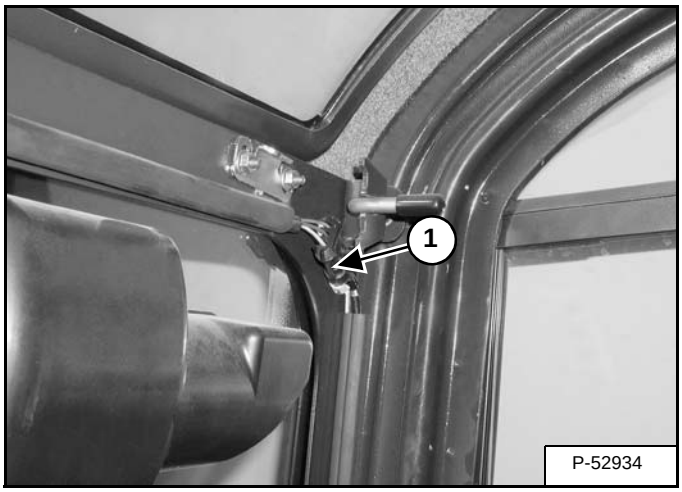
Installation: Align the hinges and swing the door back and forth until the door weight settles the hinges to full engagement.

NOTE: Early style door with 1 piece glass is shown. Later model doors have 2 pieces of glass. The procedure is the same for both styles of doors.

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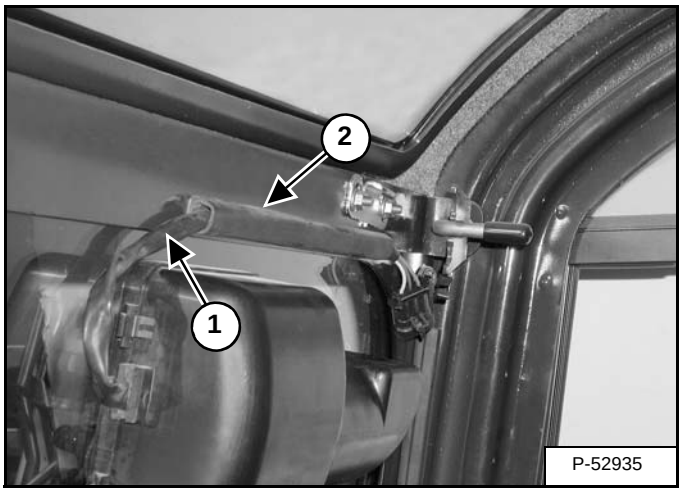
Front Window Removal And Installation

Figure 40-30-16



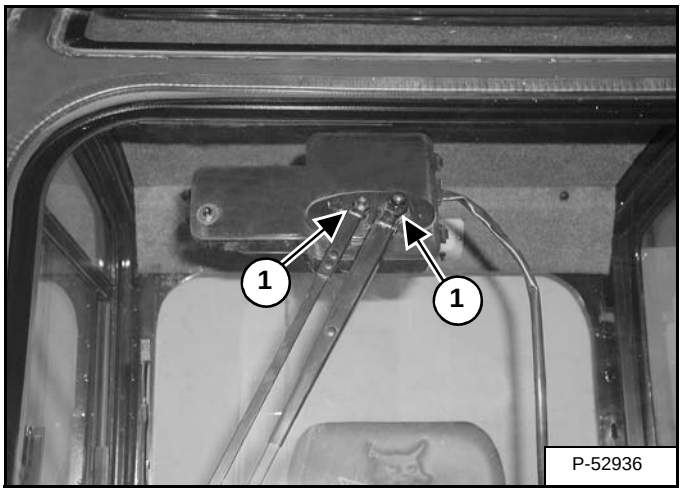
Disconnect the wire harness (Item 1) **[Figure 40-30-16]**.

Figure 40-30-17



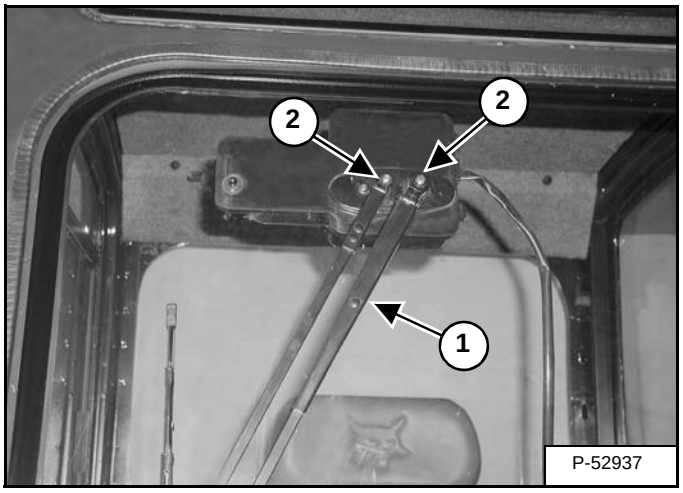
Remove the wire harness (Item 1) from the channel (Item 2) **[Figure 40-30-17]**.

Figure 40-30-18



Remove the nuts (Item 1) **[Figure 40-30-18]**.

Figure 40-30-19

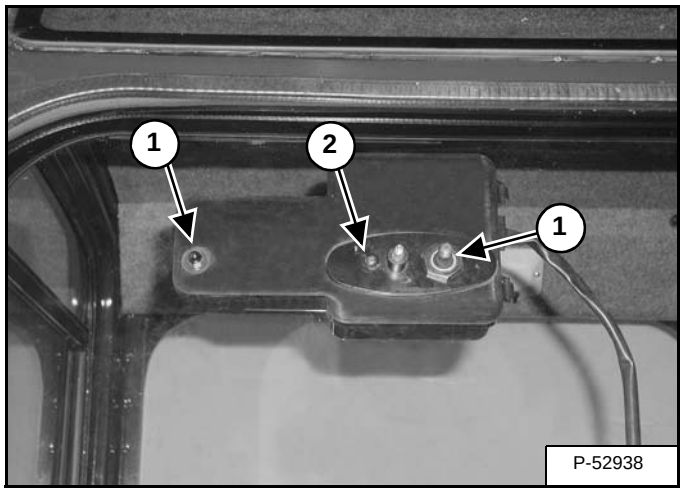


Remove the wiper assembly (Item 1) from the pivot mounts (Item 2) **[Figure 40-30-19]**.

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Front Window Removal And Installation (Cont'd)

Figure 40-30-20

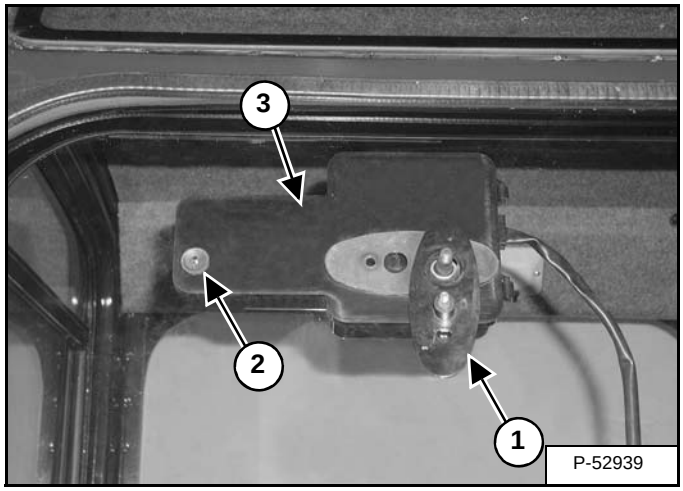


Remove the nuts and washers (Item 1) **[Figure 40-30-20]**.

Remove the bolt (Item 2) **[Figure 40-30-20]**.

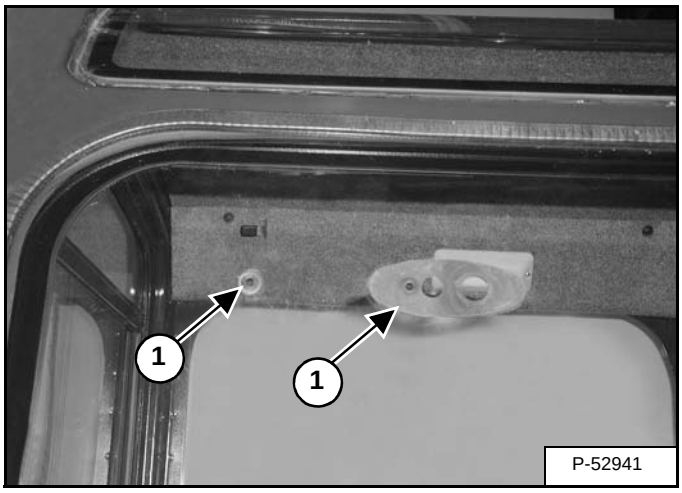
NOTE: Support the wiper motor before removing the mounting hardware.

Figure 40-30-21



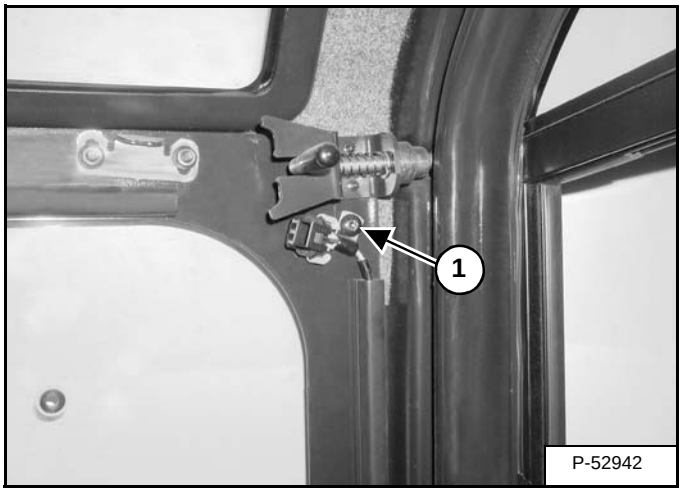
Remove the plate (Item 1), washer (Item 2), and wiper motor (Item 3) **[Figure 40-30-21]**.

Figure 40-30-22



Remove the seals (Item 1) **[Figure 40-30-22]**.

Figure 40-30-23

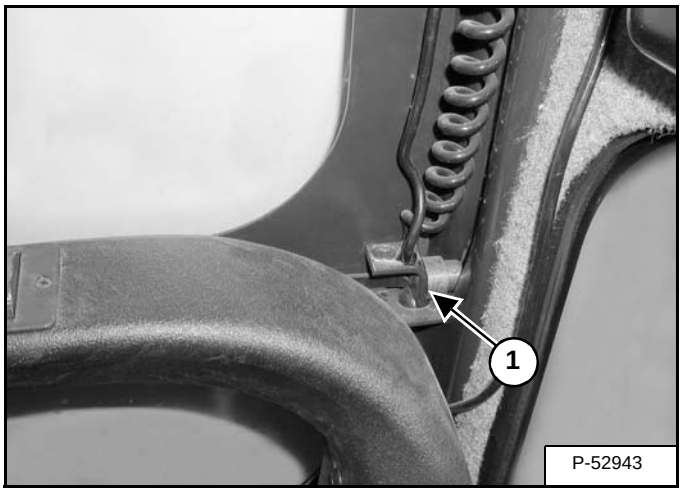


Remove the bolt (Item 1) **[Figure 40-30-23]** holding the wire harness clamp to the top of the front window.

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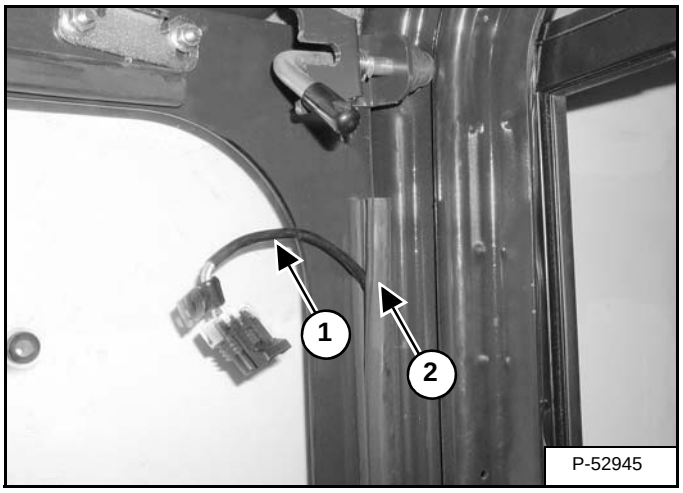
Front Window Removal And Installation (Cont'd)

Figure 40-30-24



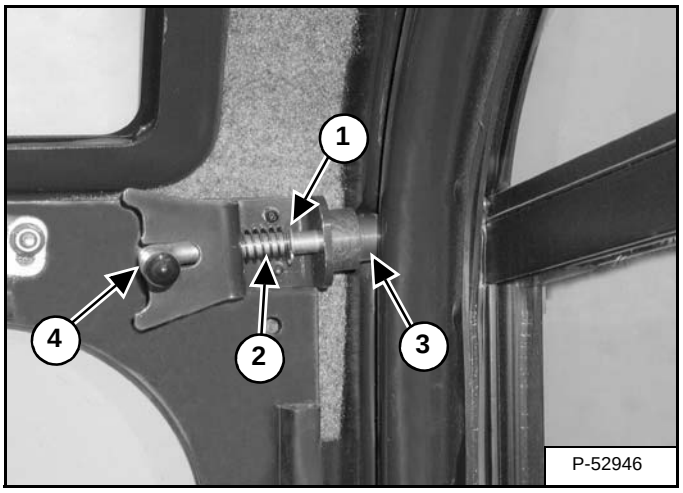
Remove the bolt (Item 1) **[Figure 40-30-24]** holding the wire harness clamp to the bottom of the front window.

Figure 40-30-25



Remove the wire harness (Item 1) from the channel (Item 2) **[Figure 40-30-25]**.

Figure 40-30-26



With the help of a second person supporting the front window, remove the retainer (Item 1), spring (Item 2), roller (Item 3), and handle (Item 4) **[Figure 40-30-26]** from both sides of the front window.

Figure 40-30-27



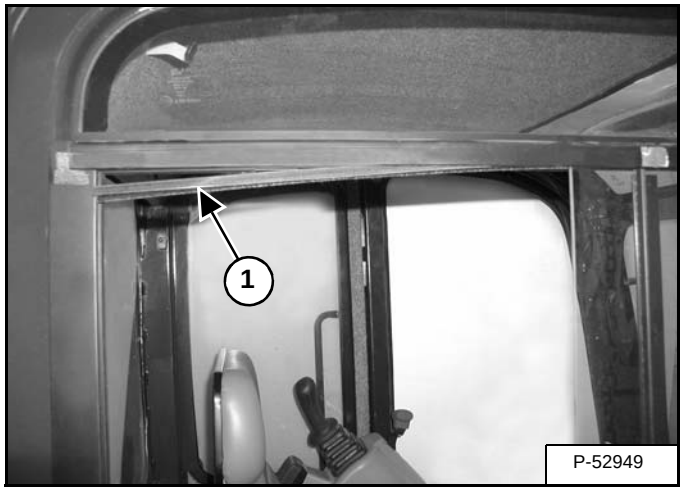
Tilt the front window (Item 1) **[Figure 40-30-27]**. Remove the front window from the cab frame.

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Right Side Rear Sliding Window Removal And Installation

Close and latch the front and rear sliding windows.

Figure 40-30-28



Use a pick to pull the felt (Item 1) **[Figure 40-30-28]** from the top window channel.

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

Figure 40-30-29



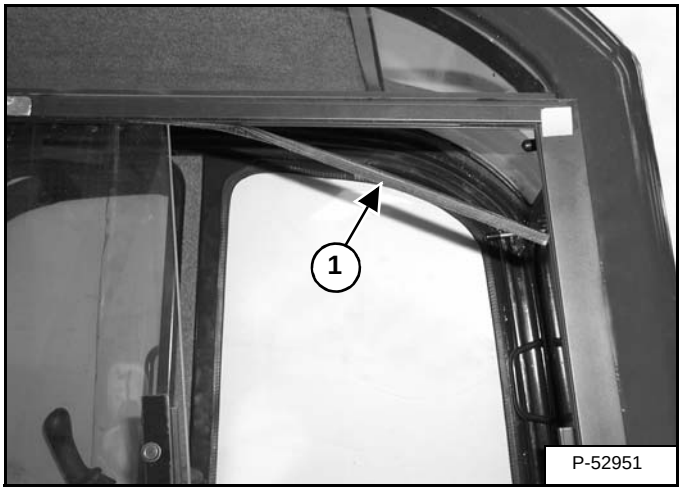
Lift the window up into the top channel and tilt the bottom edge out **[Figure 40-30-29]**. Remove the window from the cab.

Right Side Front Sliding Window Removal And Installation

NOTE: The rear sliding window must be removed before the front sliding window can be removed.

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

Figure 40-30-30



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

Figure 40-30-31



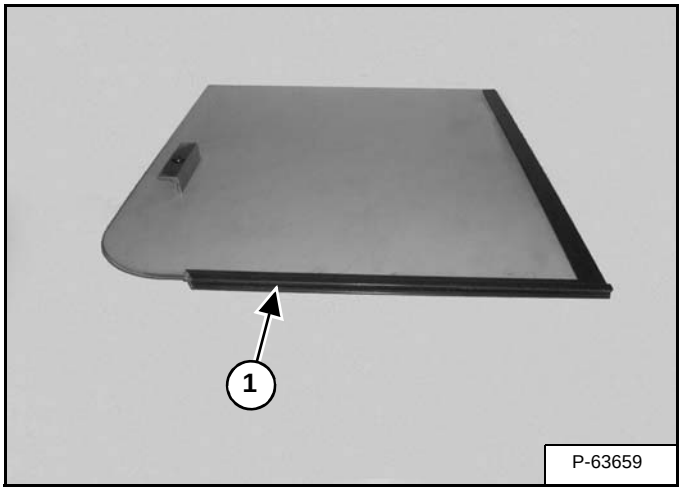
Lift the window up into the channel and tilt the bottom edge out **[Figure 40-30-31]**. Remove the window from the cab.

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Right Side Front And Rear Sliding Window Weather Strip Removal And Installation

Remove the window.

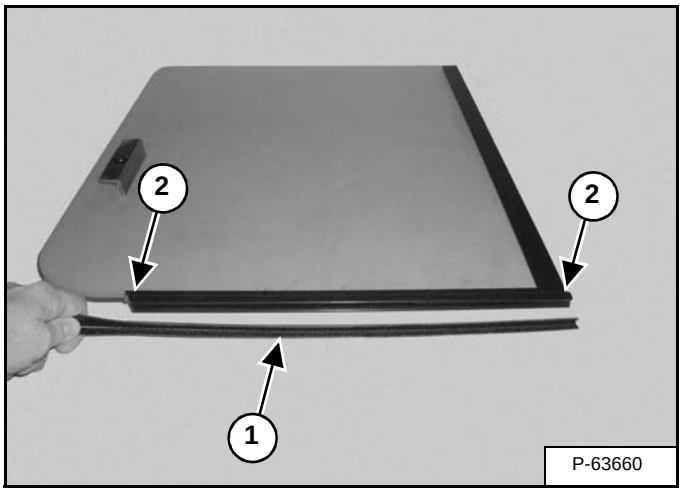
Figure 40-30-32



Remove the weather strip (Item 1) **[Figure 40-30-32]** from the bottom channel of the window.

Installation: Clean the bottom channel. Apply a bead of adhesive in the channel.

Figure 40-30-33

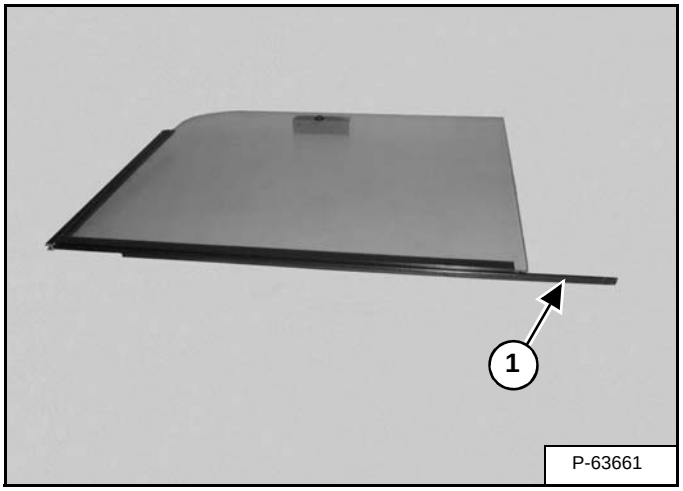


Install the new weather strip (Item 1). Cut the weather strip flush with the ends of the window channel (Item 2) **[Figure 40-30-33]**.

Right Side Front And Rear Sliding Window Wiper Strip Removal And Installation

Remove the window.

Figure 40-30-34



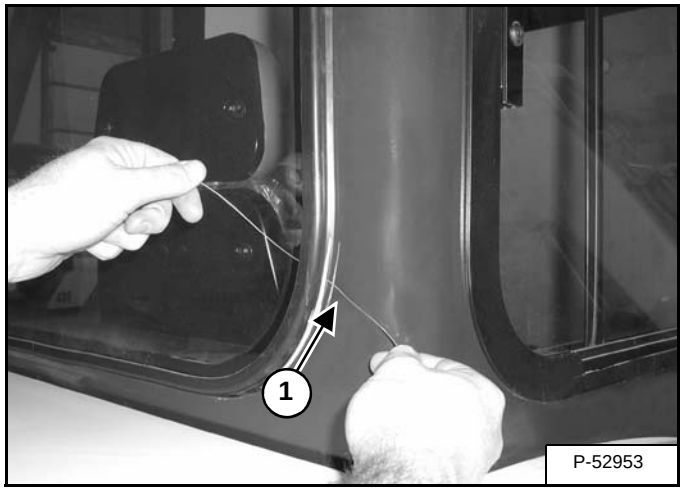
Remove the wiper strip (Item 1) **[Figure 40-30-34]** from the window channel.

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Glass Removal

Use the following procedure to remove the glass from the cab and right side window assembly.

Figure 40-30-35



Push a small diameter wire (Item 1) **[Figure 40-30-35]** 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.

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CAB (CONT'D)

Glass Installation

Rear and front lower glass

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

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

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

Prime and paint any bare metal or scratches.

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

Figure 40-30-36

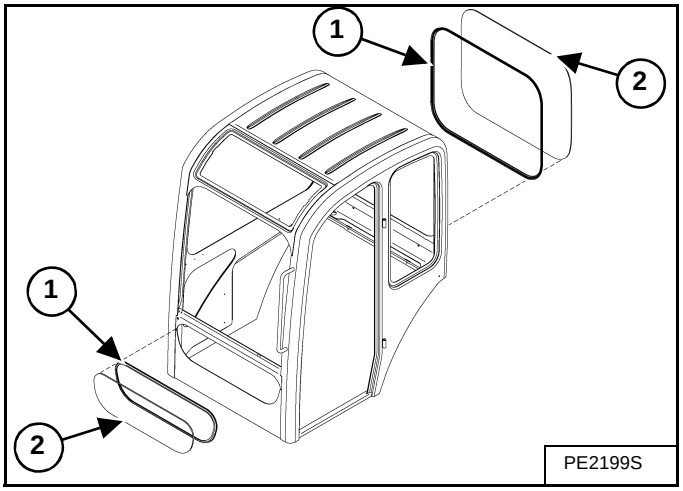
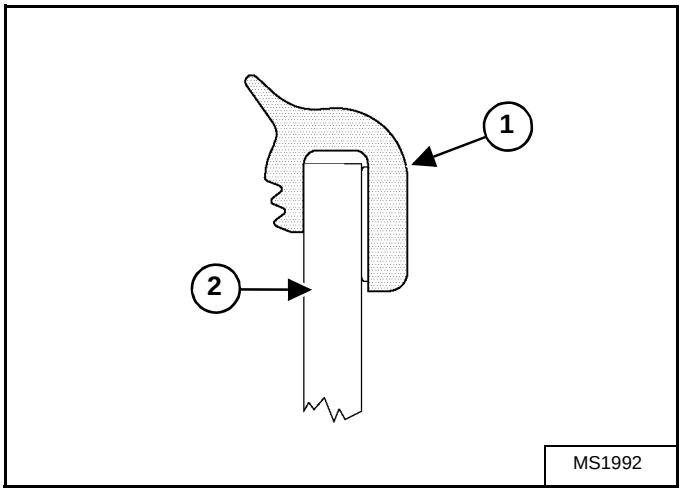


Figure 40-30-37



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

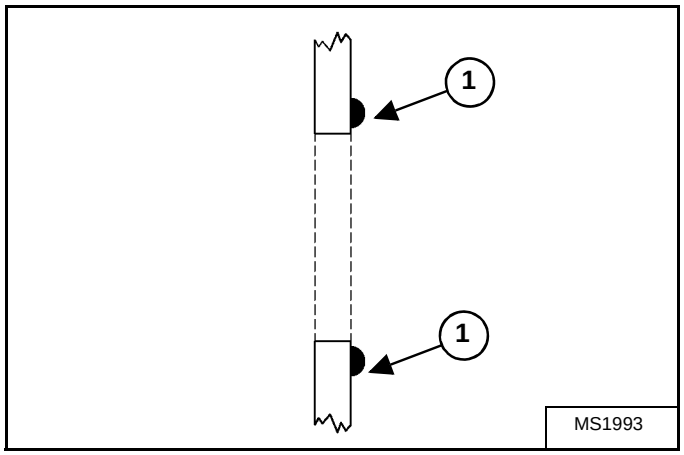
Shake the combo primer for one minute.

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

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

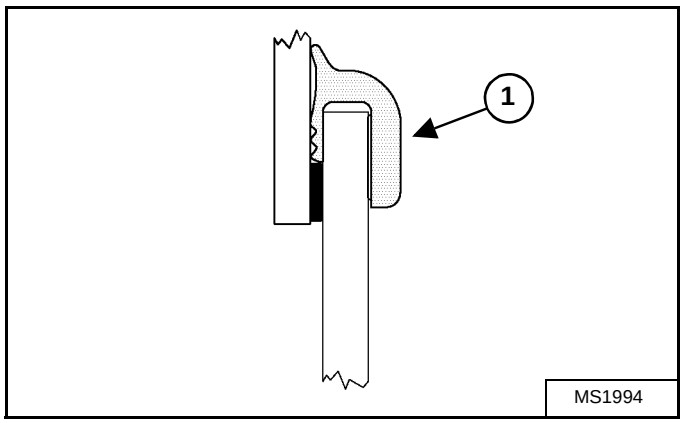
Cut the tip of the adhesive tube to the desired shape and size to provide a bead height sufficient to give good contact with the glass around the entire perimeter.

Figure 40-30-38



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

Figure 40-30-39



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

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

Remove the tape after the adhesive is cured.

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Glass Installation (Cont'd)

Top, right side and left side glass

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

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

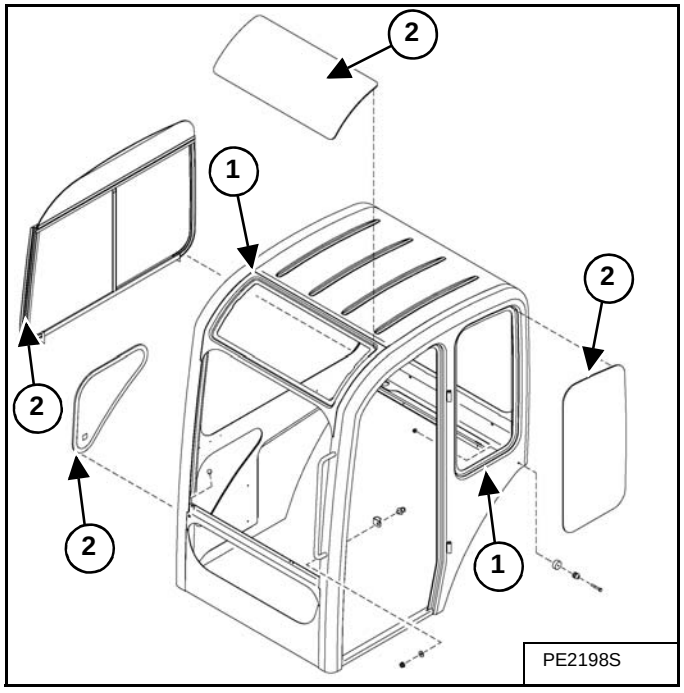
NOTE: Leave a thin film (0.03 in. (0,79 mm) thick) of the old urethane on the cab frame, fresh urethane will bond to the remaining film.

Prime and paint any bare metal or scratches.

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

Shake the combo primer for one minute.

Figure 40-30-40



Apply the combo primer to the perimeter of the cab opening (Item 1) and glass (Item 2) **[Figure 40-30-40]**.

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

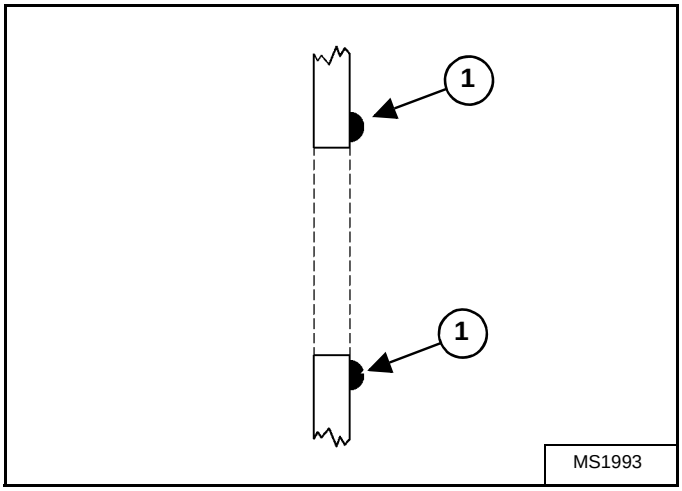
Install the bumpers evenly around the perimeter of the cab opening. (The bumpers are used to space the glass away from the metal so there is no glass to metal contact.)

IMPORTANT

If the glass has direct contact with the metal frame, the glass may break due to machine vibration.

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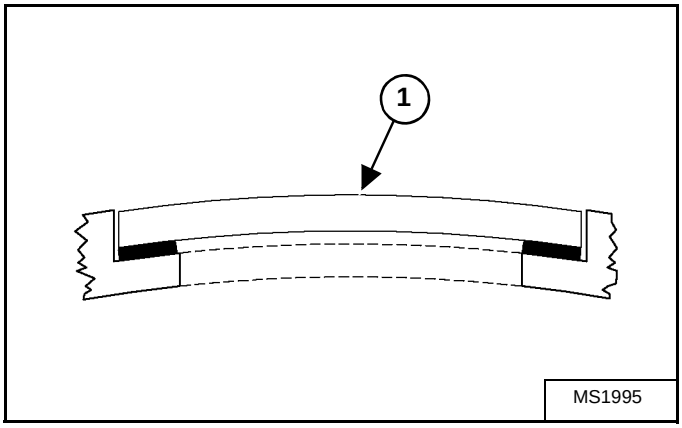
Figure 40-30-41



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.

Apply a 0.25 X 0.375 in (6.4 X 9.5 mm) triangle shaped bead of urethane adhesive (Item 1) **[Figure 40-30-41]** to the perimeter of the cab.

Figure 40-30-42



Install the glass (Item 1) **[Figure 40-30-42]**. Press the glass into the cab to make complete contact with the adhesive. Tape the glass in place.

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

Remove the tape after the adhesive is cured.

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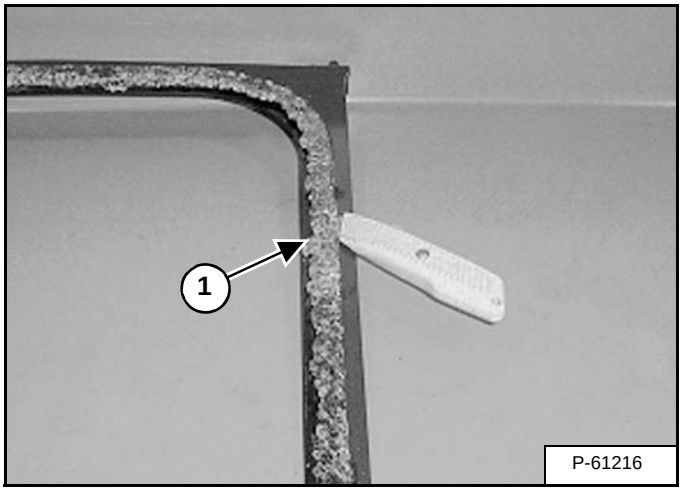
Glass Installation (Cont'd)

Door and front window glass

NOTE: The door and front windows are supplied as kits that include the glass, urethane adhesive, combo primer, glass cleaner and bumpers for correctly installing the new glass.

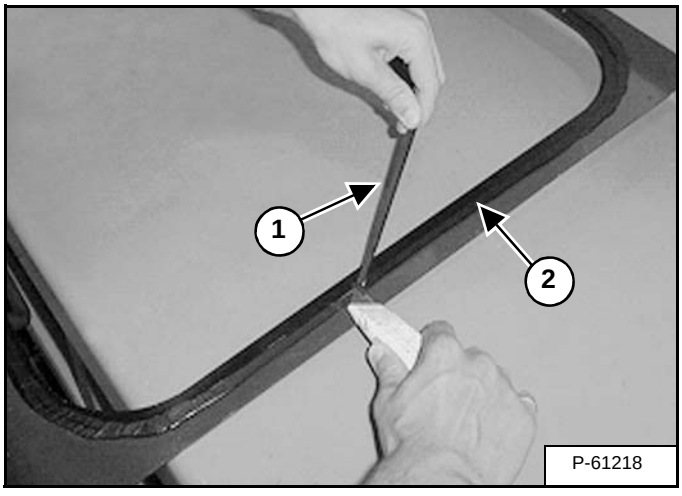
Remove the front window or door that is to be repaired from the excavator.

Figure 40-30-43



Remove the broken glass (Item 1) **[Figure 40-30-43]**.

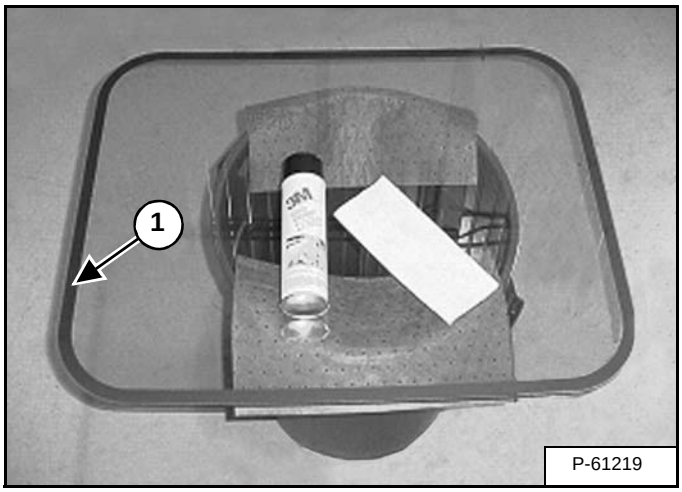
Figure 40-30-44



Cut and remove the old urethane adhesive (Item 1) leaving less than a 0.03 in. (0.79 mm) thick layer (Item 2) **[Figure 40-30-44]** for the new adhesive to bond to.

NOTE: Use care not to scratch the paint on the frame.

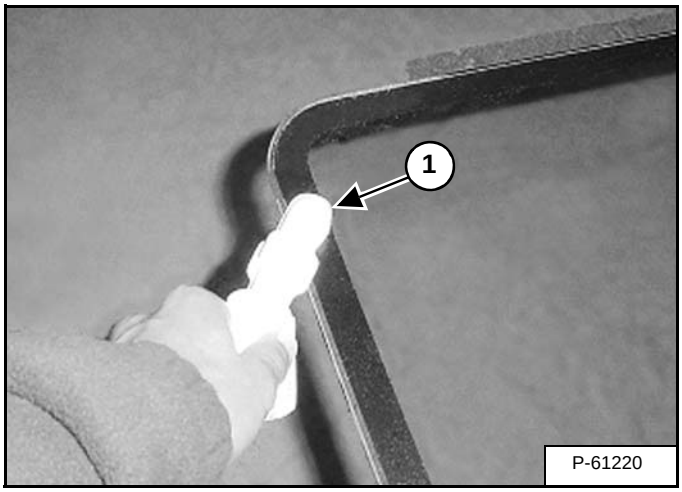
Figure 40-30-45



Place the glass on a flat surface with the painted side of the glass (Item 1) **[Figure 40-30-45]** facing up.

Thoroughly clean the entire glass with glass cleaner.

Figure 40-30-46



Apply one coat of combo primer (Item 1) **[Figure 40-30-46]** on the painted edge of the glass.

Apply the combo primer to any scratches on the door/ front window frame in the area where the glass is installed.

Allow the primer to dry for a minimum of 15 minutes.

Excess primer may be removed from the glass using a razor blade.

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Glass Installation (Cont'd)

Figure 40-30-47

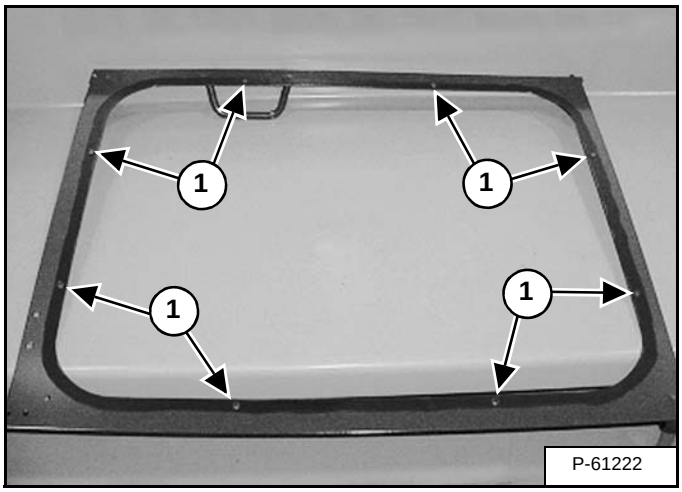
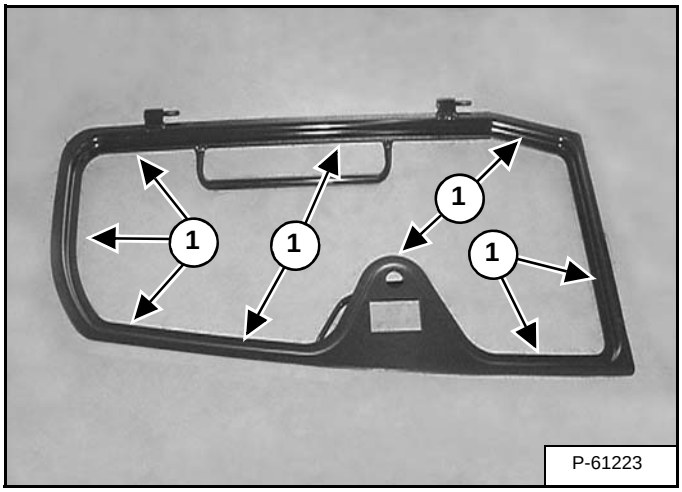


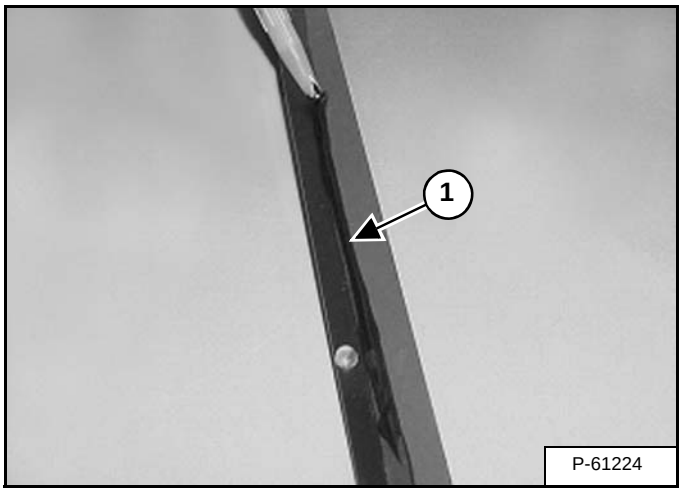
Figure 40-30-48



Install the bumpers (Item 1) **[Figure 40-30-47]** on the front window frame or (Item 1) **[Figure 40-30-48]** on the door frame. (The bumpers are used to space the glass away from the metal so there is no glass to metal contact.)

NOTE: Early style door with 1 piece glass is shown. Later model doors have 2 pieces of glass. The procedure is the same for both styles of doors.

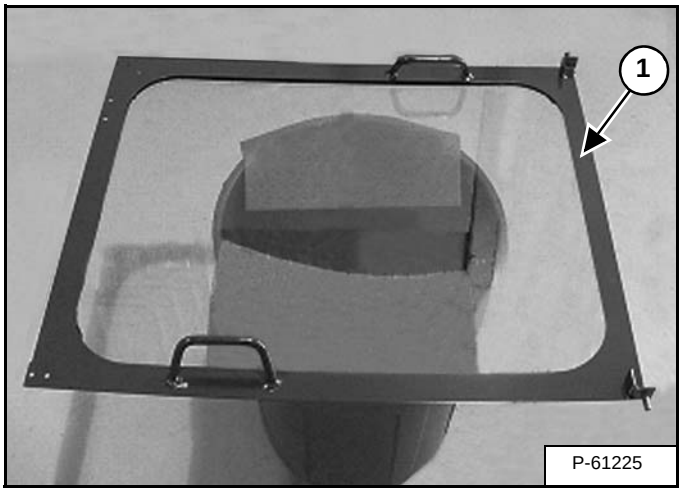
Figure 40-30-49



Apply a 0.25 X 0.375 in (6.4 X 9.5 mm) triangle shaped bead of urethane adhesive (Item 1) **[Figure 40-30-49]** around the front window/door frame.

Apply the adhesive directly on top of the old adhesive.

Figure 40-30-50



Place the frame (Item 1) **[Figure 40-30-50]** on the glass. The frame must be centered on the glass, and the glass must not have direct contact with the front window/door frame.

IMPORTANT

If the glass has direct contact with the metal frame, the glass may break due to machine vibration.

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Glass Installation (Cont'd)

Figure 40-30-51

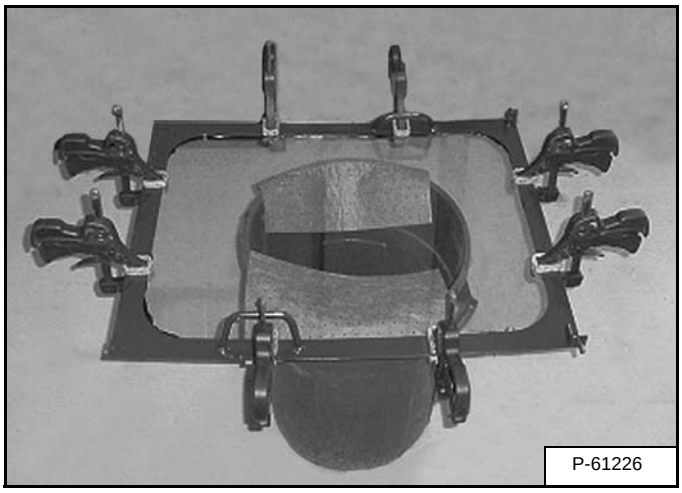
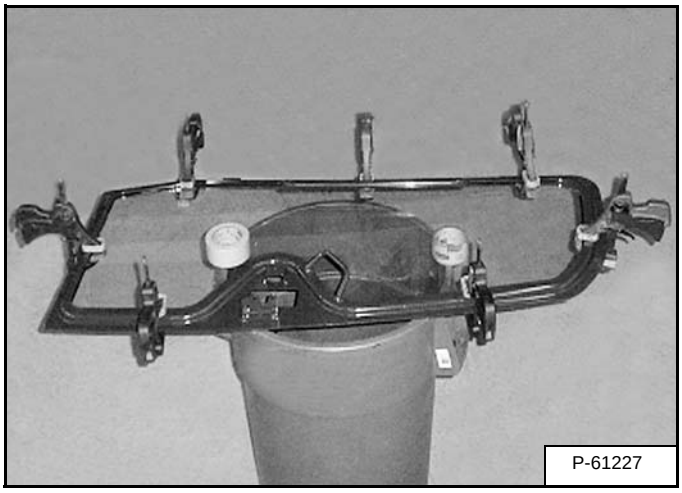


Figure 40-30-52



Clamp the frame and glass together **[Figure 40-30-51]** & **[Figure 40-30-52]**.

Place the clamps over the frame where the rubber bumpers are installed.

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

Install the front window/door on the excavator. (See the correct Service Manual for installation procedure)

Install the wiper assembly on the front window. (See the correct Service Manual for installation procedure)

NOTE: Early style door with 1 piece glass is shown. Later model doors have 2 pieces of glass. The procedure is the same for both styles of doors.

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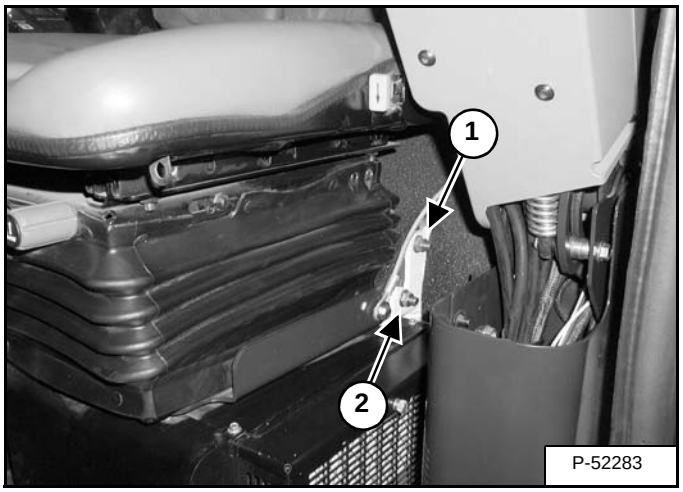


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SEAT AND SEAT MOUNT

Removal And Installation

Figure 40-40-1

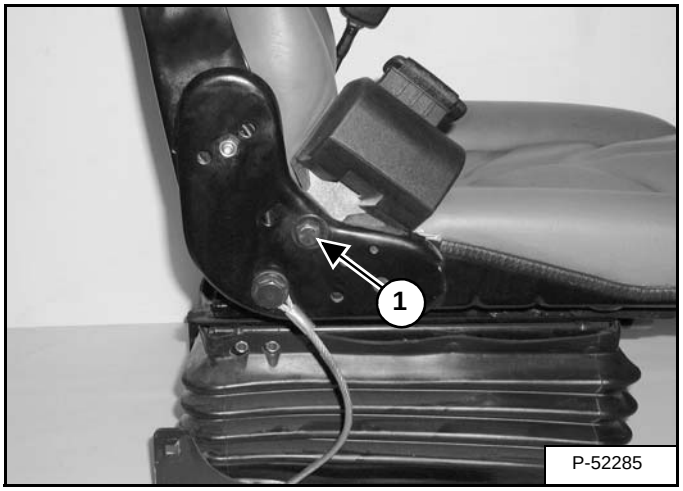


Remove the top bolt (Item 1) **[Figure 40-40-1]**. (Both sides)

Loosen the bottom bolt (Item 2) **[Figure 40-40-1]**. (Both sides)

Remove the seat and seat mount from the excavator.

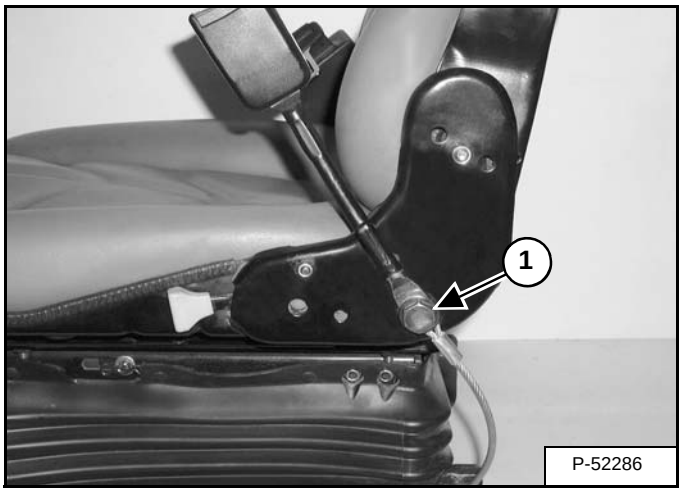
Figure 40-40-2



Remove the seat belt mounting bolt (Item 1) **[Figure 40-40-2]**.

Remove the seat belt.

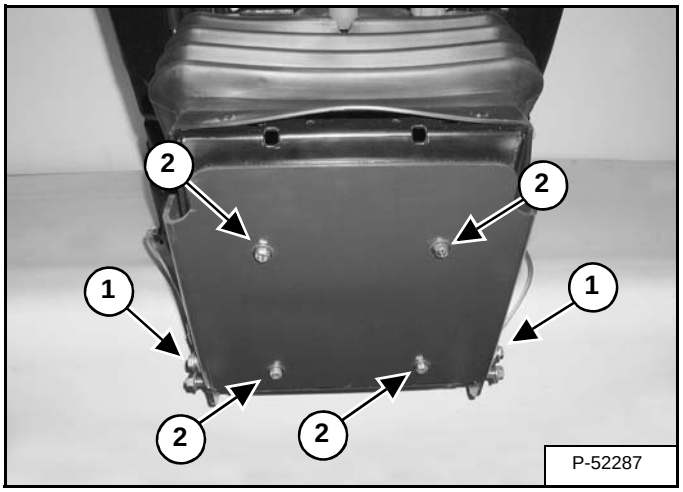
Figure 40-40-3



Remove the seat belt mounting bolt (Item 1) **[Figure 40-40-3]**.

Remove the seat belt.

Figure 40-40-4



Remove the bolts (Item 1) **[Figure 40-40-4]** from the seat cables.

Remove the seat mount bolts (Item 2) **[Figure 40-40-4]**.

Remove the seat mount from the seat.

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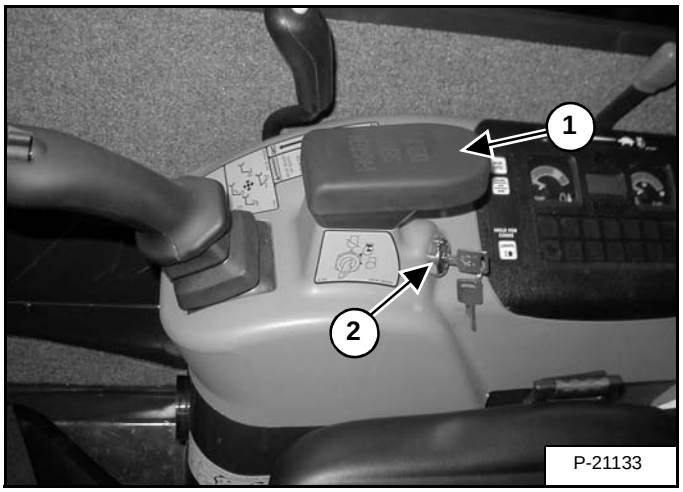
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RIGHT CONSOLE

Console Cover Removal And Installation

Figure 40-50-1



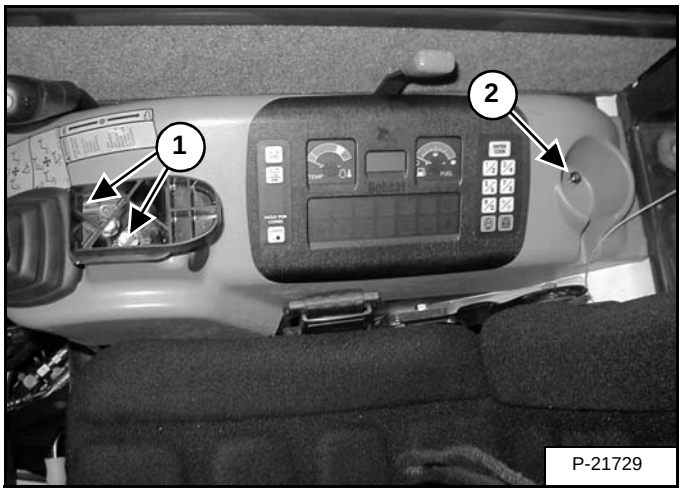
Remove the cover (Item 1) **[Figure 40-50-1]** from the arm rest.

Lift up on the rear of the cover and slide the cover ahead to remove it.

Remove the key and nut from the key switch (Item 2) **[Figure 40-50-1]** (if equipped). Allow the switch to drop inside the console.

NOTE: The key switch must be removed to remove and install the console cover. It interferes with the arm rest bracket.

Figure 40-50-2



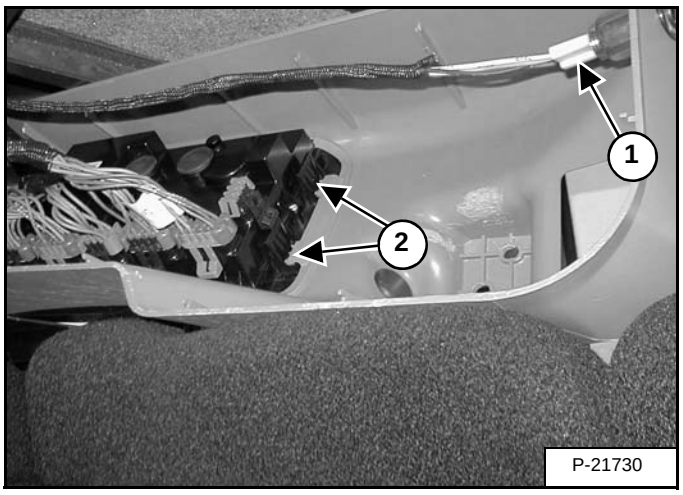
Remove the two bolts (Item 1) **[Figure 40-50-2]** from the arm rest.

Remove the arm rest.

Remove the screw (Item 2) **[Figure 40-50-2]** from the cup holder.

Lift the console cover up and over the joystick lever.

Figure 40-50-3



Disconnect the accessory outlet electrical connector (Item 1) **[Figure 40-50-3]**.

Remove the controller from the console cover by pressing the four mounting tabs (Item 2) **[Figure 40-50-3]**.

Figure 40-50-4



Turn the controller to allow it to pass through the console cover **[Figure 40-50-4]**.

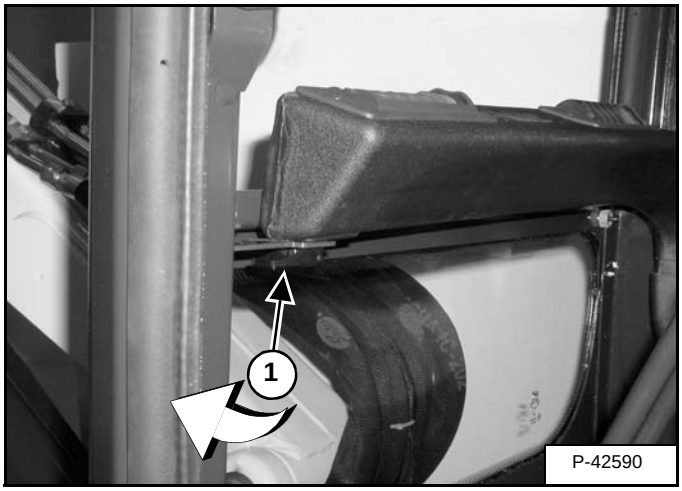
Remove the console cover.

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Console Base Removal And Installation

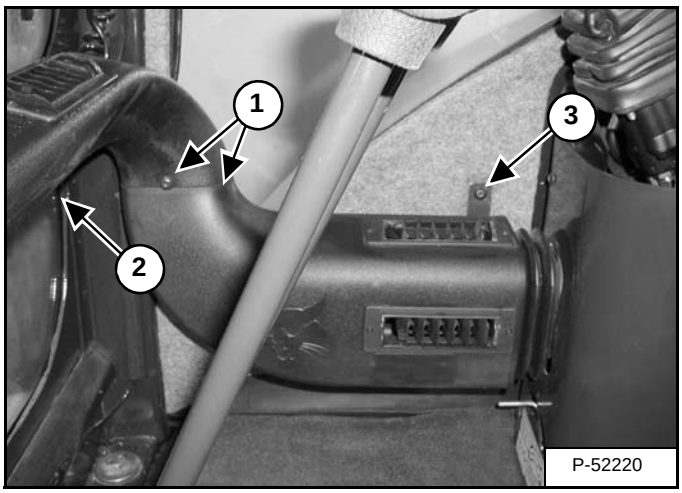
Remove the right console cover. (See Console Cover Removal And Installationn Page 40-50-1.)

Figure 40-50-5



Rotate the lock (Item 1) **[Figure 40-50-5]**.

Figure 40-50-6

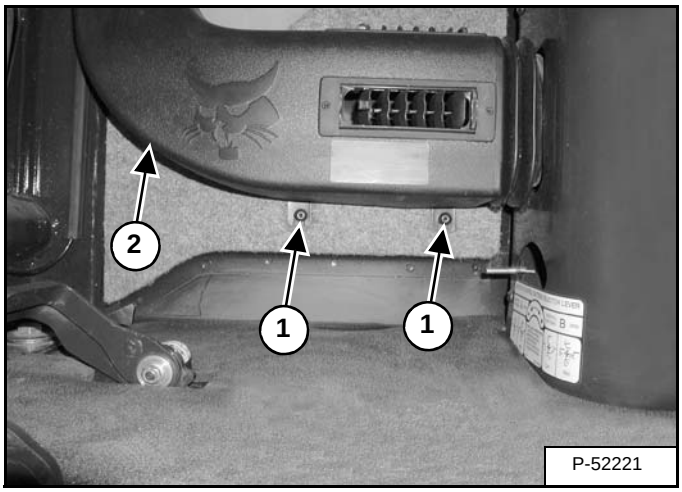


Remove the screws (Item 1) **[Figure 40-50-6]**.

Remove the air conditioning duct (Item 2) **[Figure 40-50-6]**.

Remove the screw (Item 3) **[Figure 40-50-6]**.

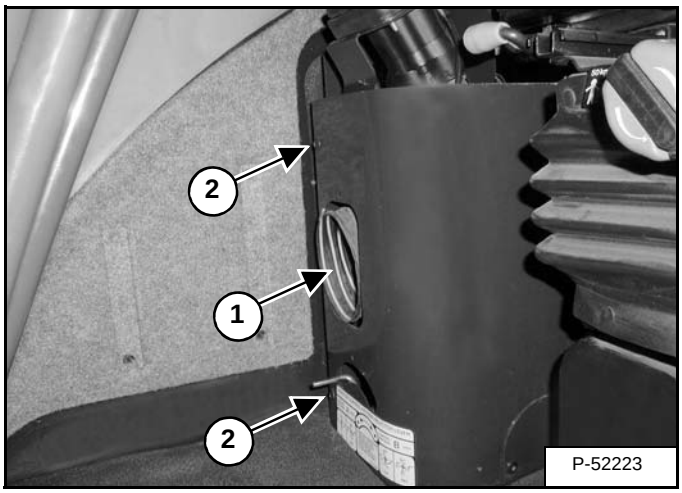
Figure 40-50-7



Remove the screws (Item 1) **[Figure 40-50-7]**.

Remove the duct (Item 2) **[Figure 40-50-7]**.

Figure 40-50-8



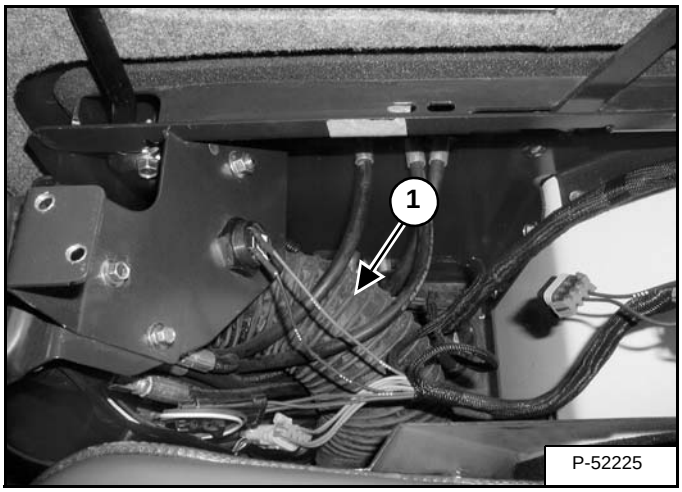
Push the hose (Item 1) **[Figure 40-50-8]** inside the console base.

Remove the bolts (Item 2) **[Figure 40-50-8]**.

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Console Base Removal And Installation (Cont'd)

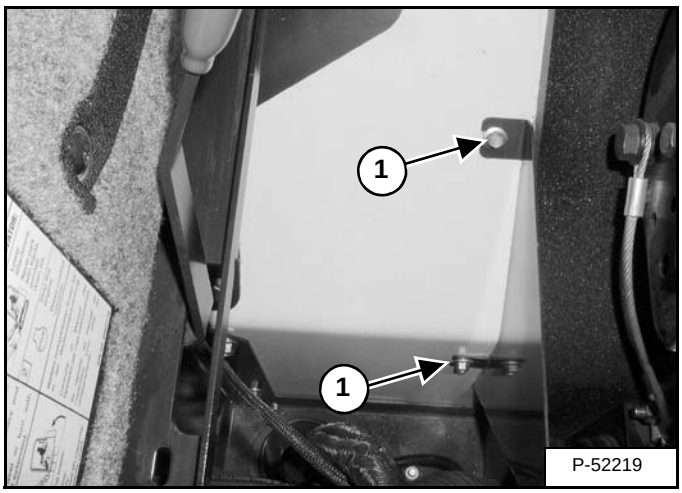
Figure 40-50-9



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

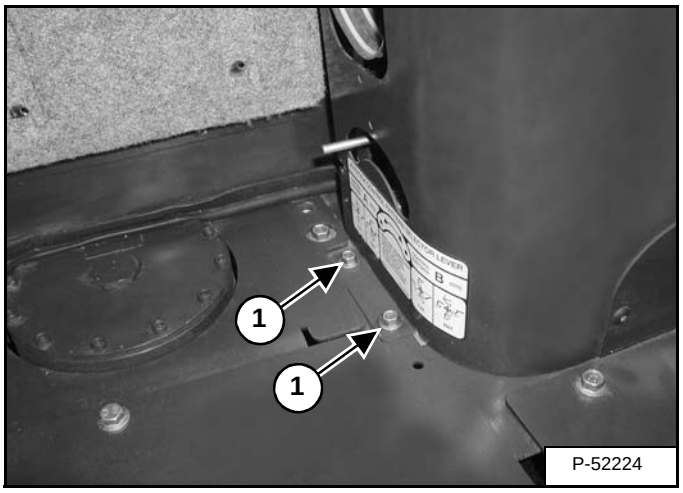
Remove the floor mat. (See Removal And Installation (Cab Equipped Excavators)n Page 40-110-2.)

Figure 40-50-10



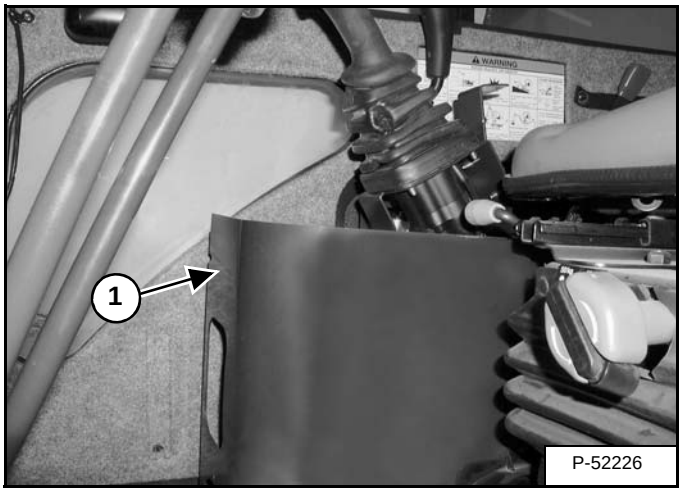
Remove the bolts (Item 1) **[Figure 40-50-10]**.

Figure 40-50-11



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

Figure 40-50-12



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

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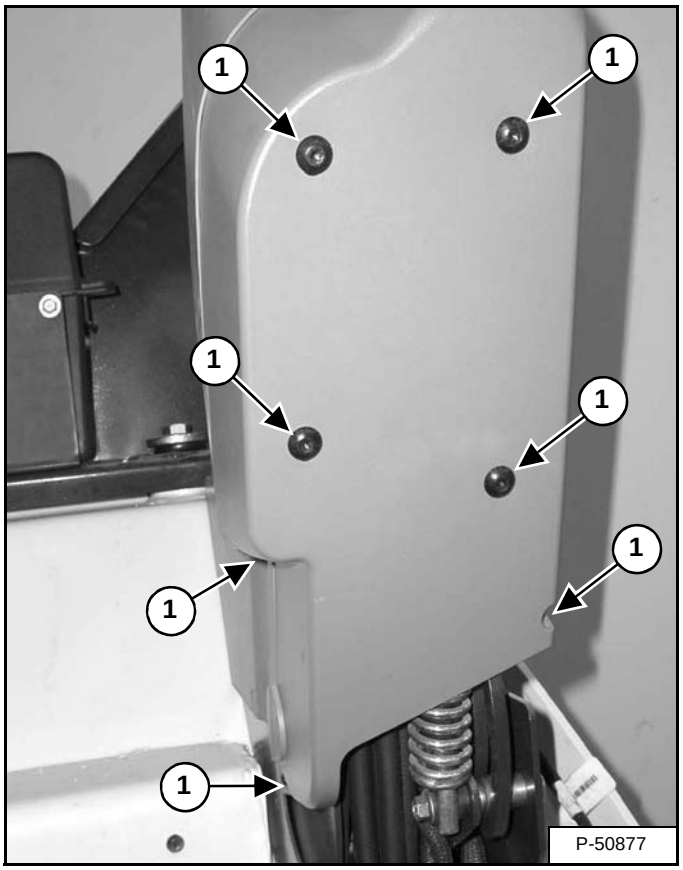


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LEFT CONSOLE

Lower Console Cover Removal And Installation

Figure 40-60-1

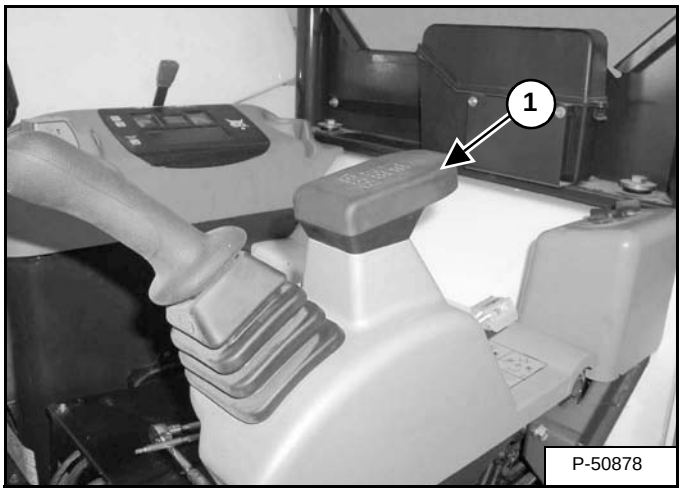


Remove the screws (Item 1) **[Figure 40-60-1]** from the lower half of the console cover.

Remove the lower half of the console cover.

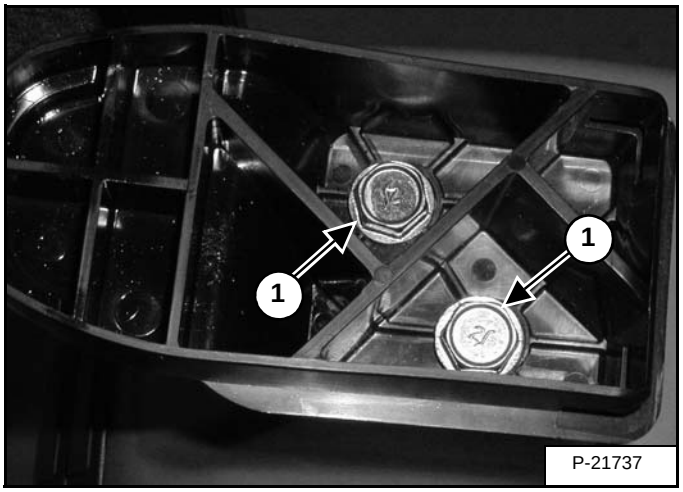
Lower the console.

Figure 40-60-2



Remove the cover (Item 1) **[Figure 40-60-2]** from the arm rest.

Figure 40-60-3



Remove the bolts (Item 1) **[Figure 40-60-3]** from the arm rest.

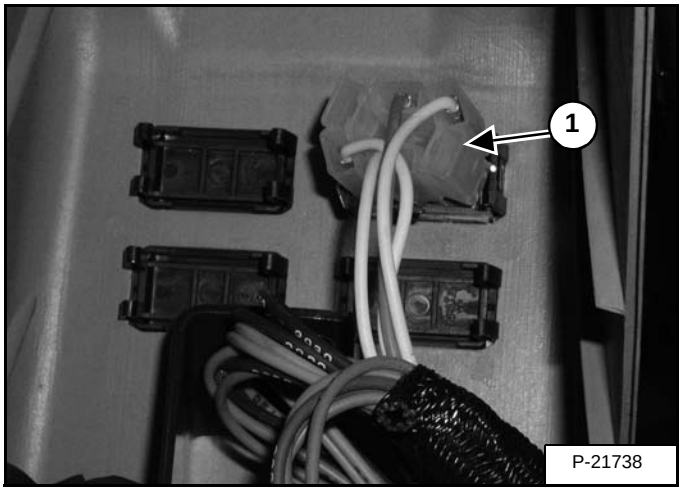
Remove the arm rest.

Raise the upper half of the console cover.

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Lower Console Cover Removal And Installation (Cont'd)

Figure 40-60-4



Disconnect the electrical connector (Item 1) **[Figure 40-60-4]**.

NOTE: These connectors are keyed so they can be plugged in only one way.

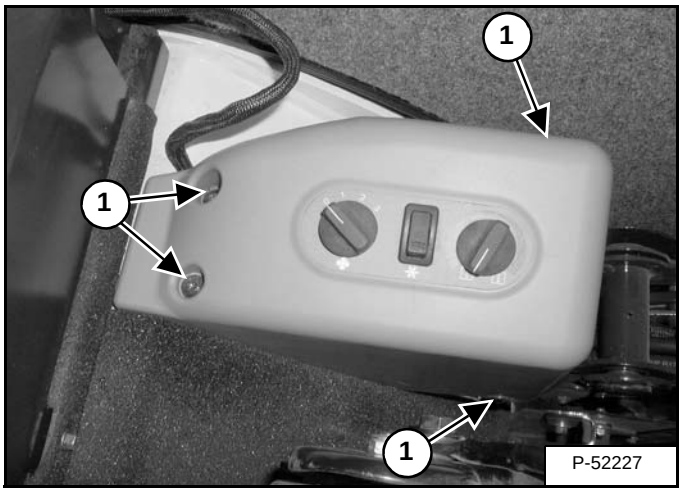
Remove the console cover.

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LEFT CONSOLE (CONT'D)

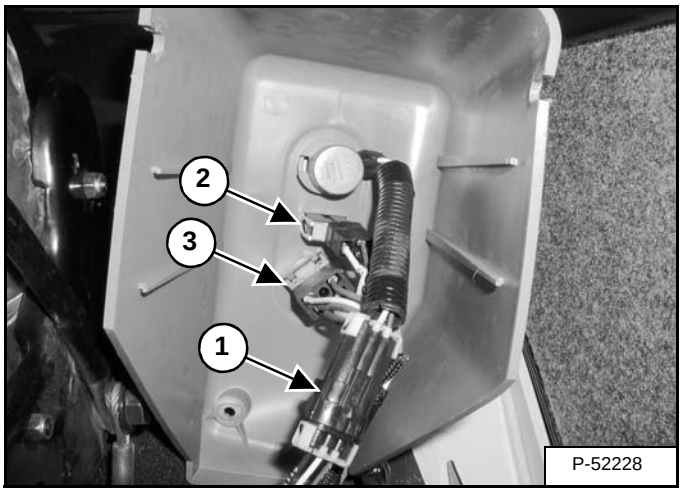
Upper Console Cover Removal And Installation

Figure 40-60-5



Remove the four console cover screws (Item 1) **[Figure 40-60-5]**.

Figure 40-60-6



Lift the console cover and disconnect the harness (Item 1) **[Figure 40-60-6]** from the potentiometer harness. (If equipped with Heater/AC.)

Disconnect the harness (Item 2) **[Figure 40-60-6]** from the A/C switch. (If equipped with AC.)

Disconnect the harness (Item 3) **[Figure 40-60-6]** from the blower switch. (If equipped with Heater/AC.)

Remove the console from the excavator.

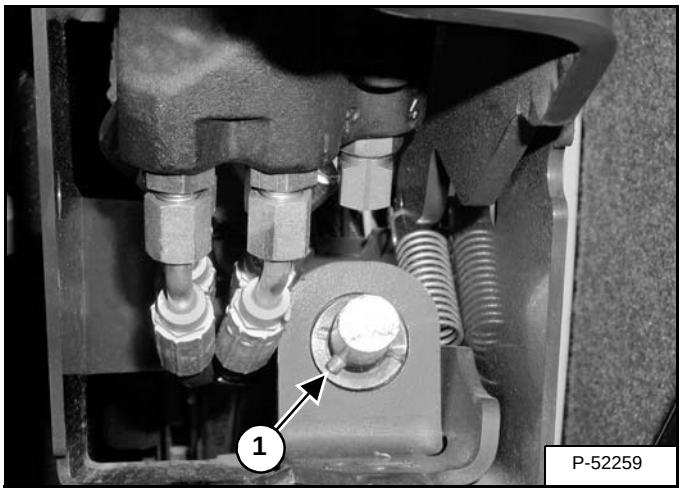
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Compression Spring Removal And Installation

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

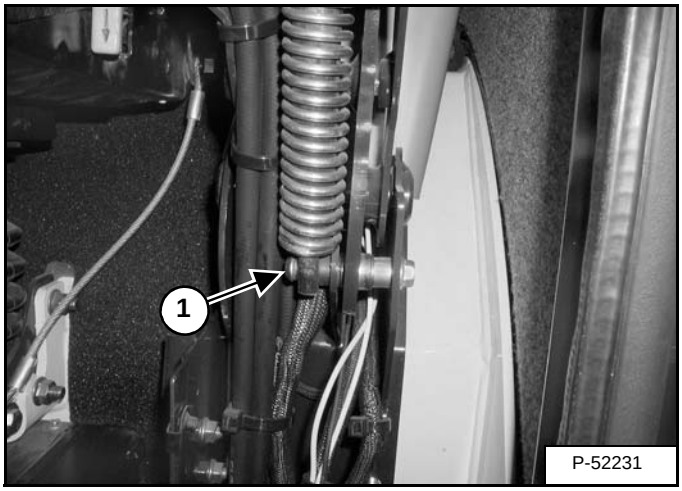
Lower the console.

Figure 40-60-7



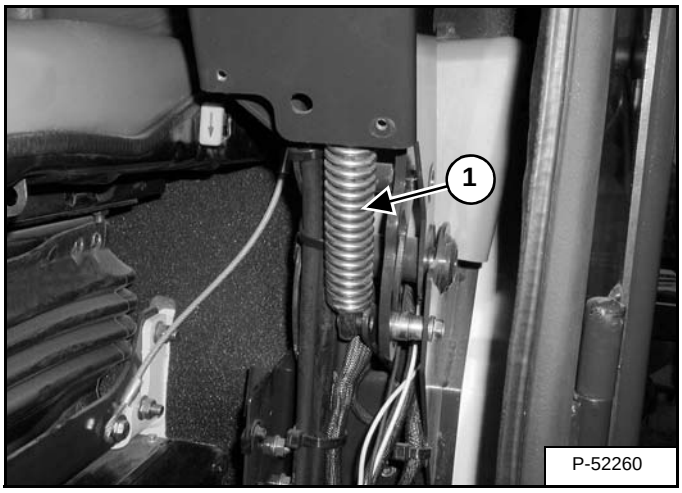
Install a pin (Item 1) **[Figure 40-60-7]** in the top of the compression spring rod.

Figure 40-60-8



Support the console in the raised position. Remove the bolt (Item 1) **[Figure 40-60-8]**.

Figure 40-60-9

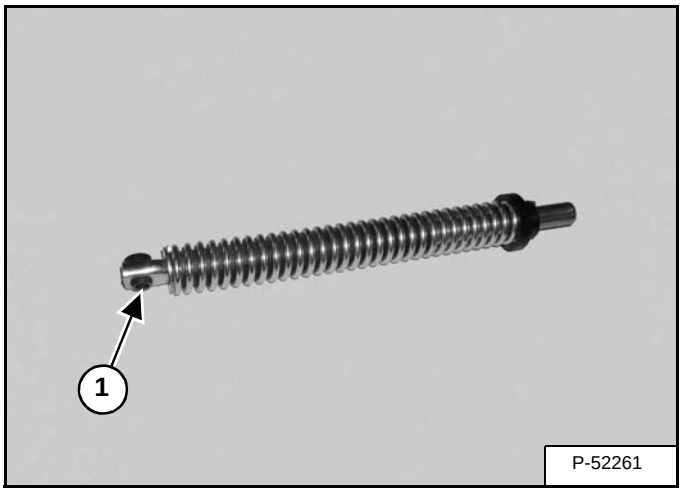


Remove the spring assembly (Item 1) **[Figure 40-60-9]** from the console.

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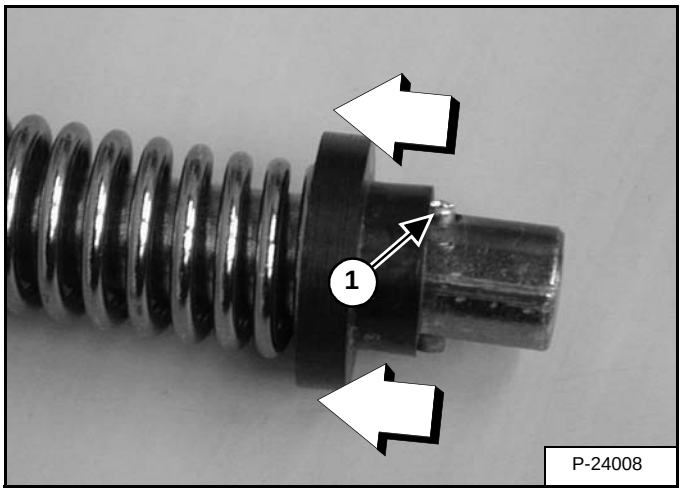
Compression Spring Disassembly And Assembly

Figure 40-60-10



Remove the bushing (Item 1) **[Figure 40-60-10]**.

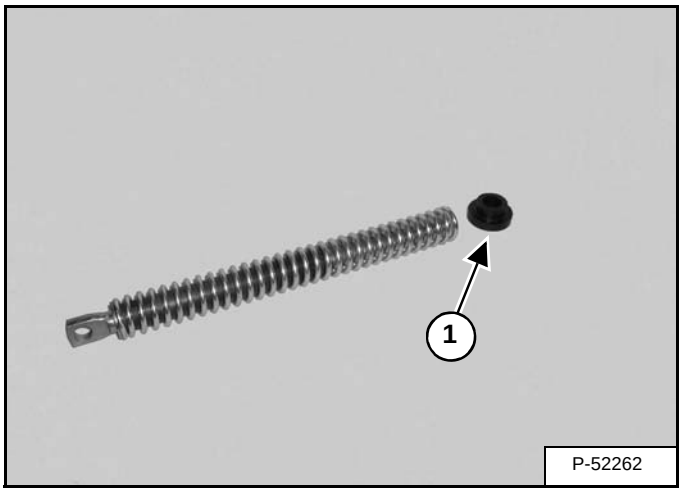
Figure 40-60-11



Apply pressure against the spring, and remove the pin (Item 1) **[Figure 40-60-11]** from the shaft.

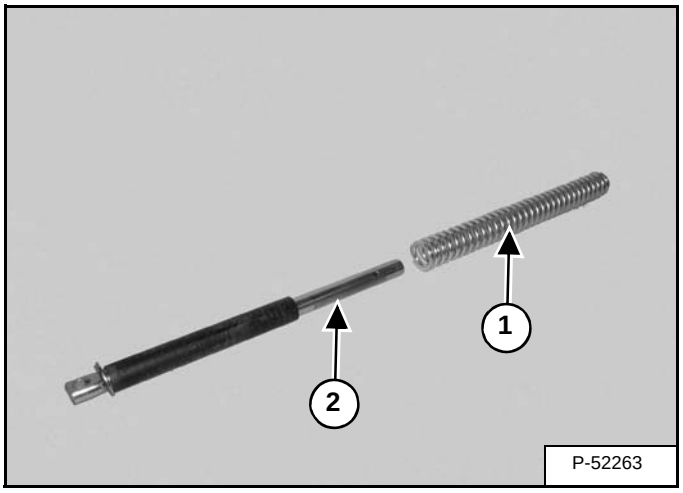
Release the pressure from the spring.

Figure 40-60-12



Remove the bushing (Item 1) **[Figure 40-60-12]**.

Figure 40-60-13

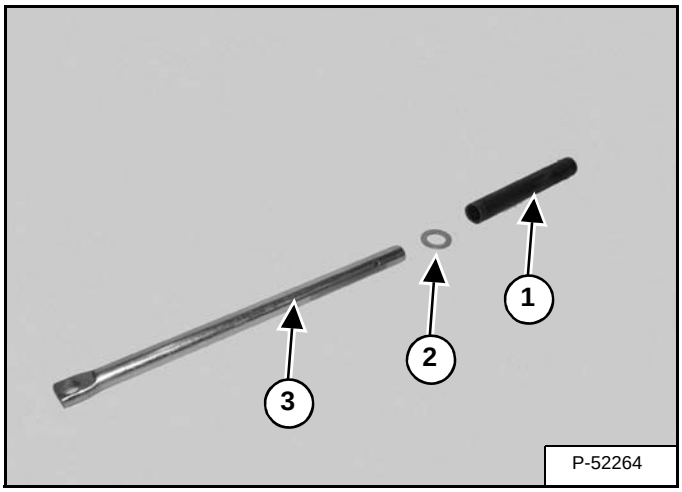


Remove the spring (Item 1) from the shaft (Item 2) **[Figure 40-60-13]**.

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Compression Spring Disassembly And Assembly (Cont'd)

Figure 40-60-14



Remove the sleeve (Item 1) and washer (Item 2) from the shaft (Item 3) **[Figure 40-60-14]**.

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Lock Lever Removal And Installation

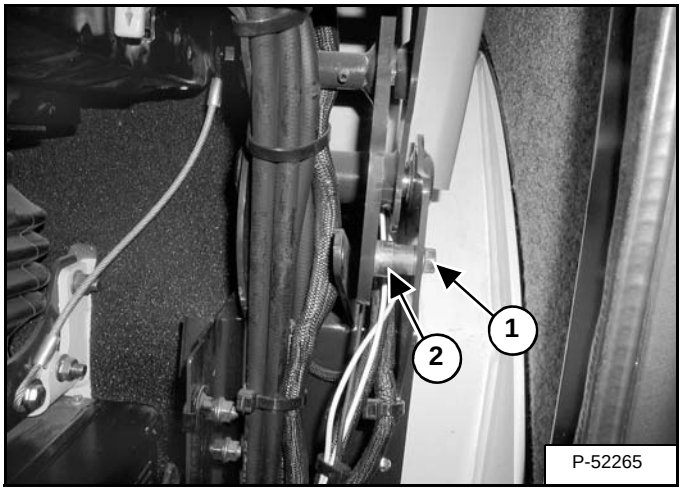
Remove the upper console cover. (See Upper Console Cover Removal And Installation on Page 40-60-3.)

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

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

Remove the compression spring assembly from the console. (See Compression Spring Disassembly And Assembly on Page 40-60-5.)

Figure 40-60-15

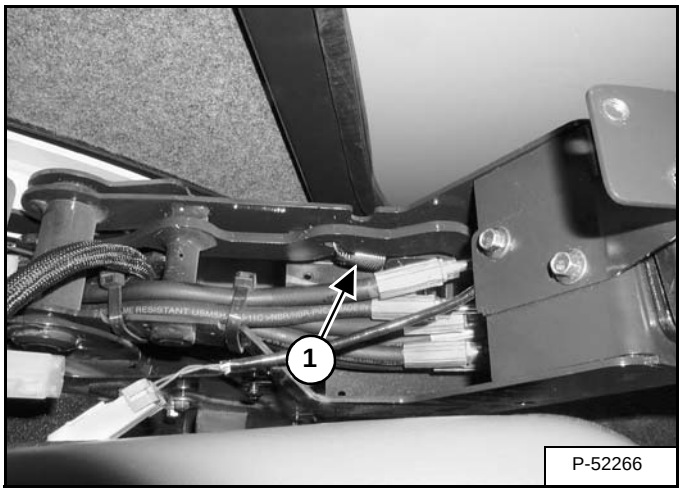


Remove the bolt (Item 1) from the lock lever bearing (Item 2) **[Figure 40-60-15]**.

Remove the bearing.

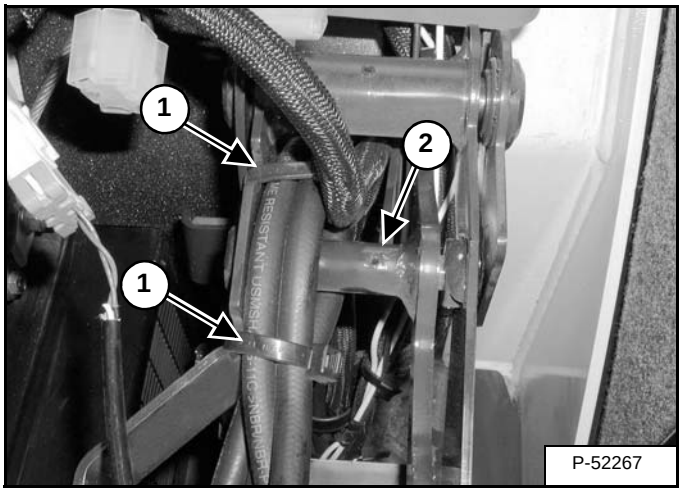
Lower the console.

Figure 40-60-16



Remove the spring (Item 1) **[Figure 40-60-16]**.

Figure 40-60-17



Remove the tie straps (Item 1) **[Figure 40-60-17]**.

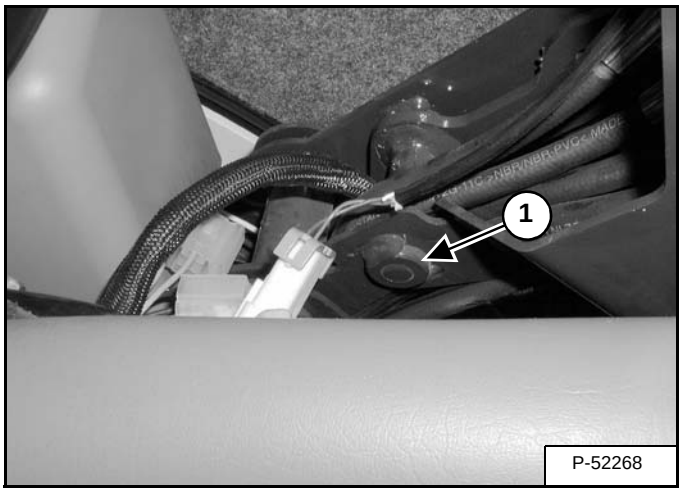
Remove the roll pin (Item 2) **[Figure 40-60-17]** from the lock lever pivot pin.

Raise and support the console.

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Lock Lever Removal And Installation (Cont'd)

Figure 40-60-18



Remove the pivot pin (Item 1) **[Figure 40-60-18]** from the lever assembly.

Remove the lock lever.

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Console Removal And Installation

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

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

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

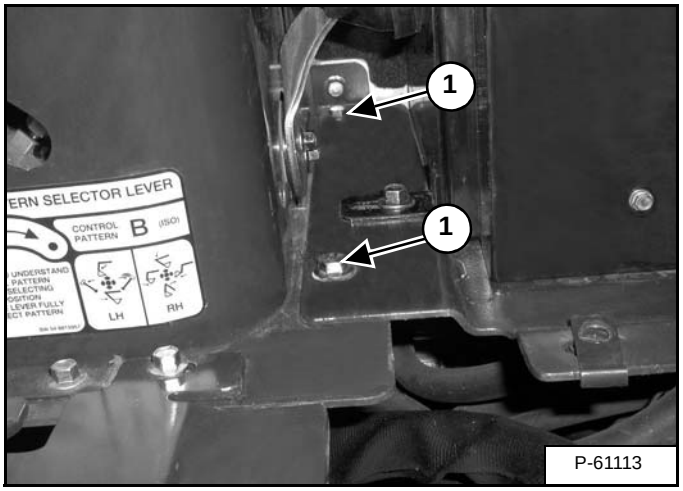
Remove the lower console cover. (See Lower Console Cover Removal And Installation on Page 40-60-1.)

IMPORTANT

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

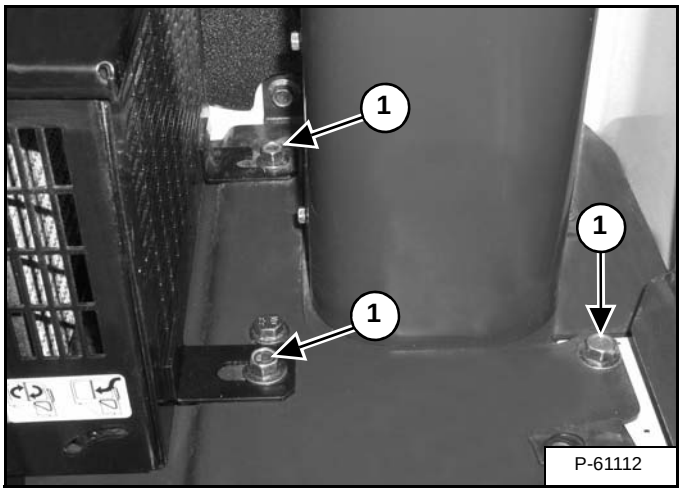
I-2003-0888

Figure 40-60-19



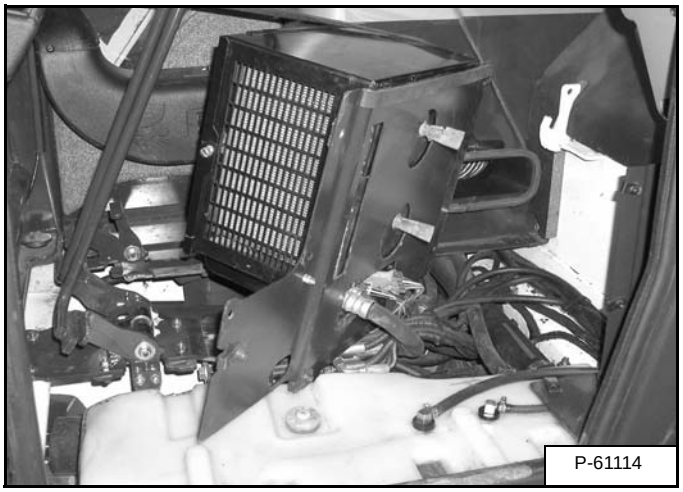
Remove the bolts (Item 1) **[Figure 40-60-19]** from the right side of the evaporator/heater unit.

Figure 40-60-20



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

Figure 40-60-21



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

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

IMPORTANT

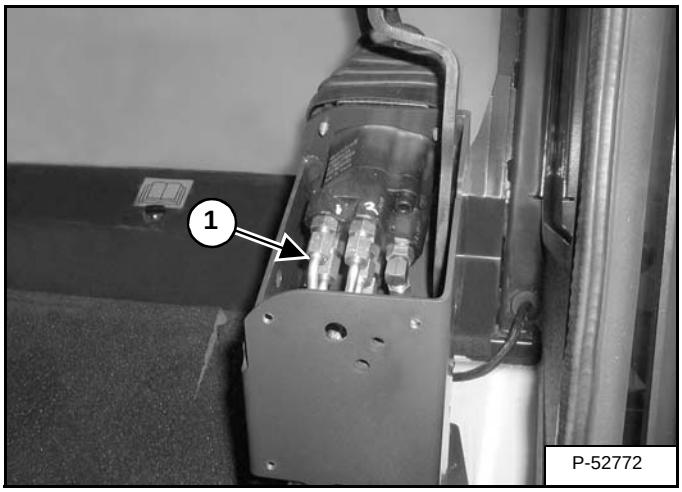
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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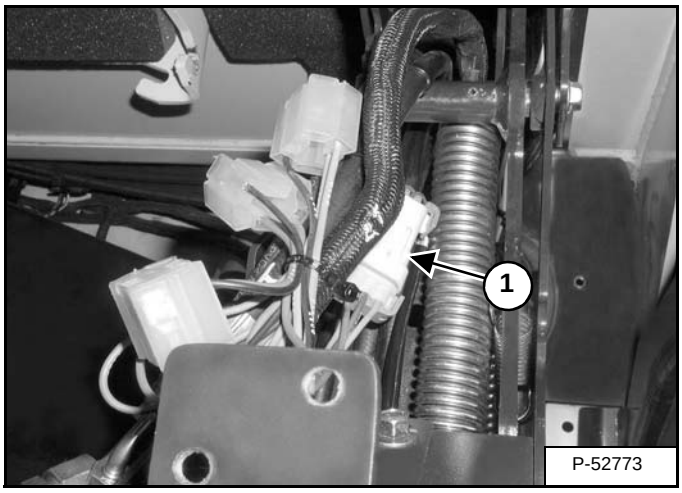
Console Removal And Installation (Cont'd)

Figure 40-60-22



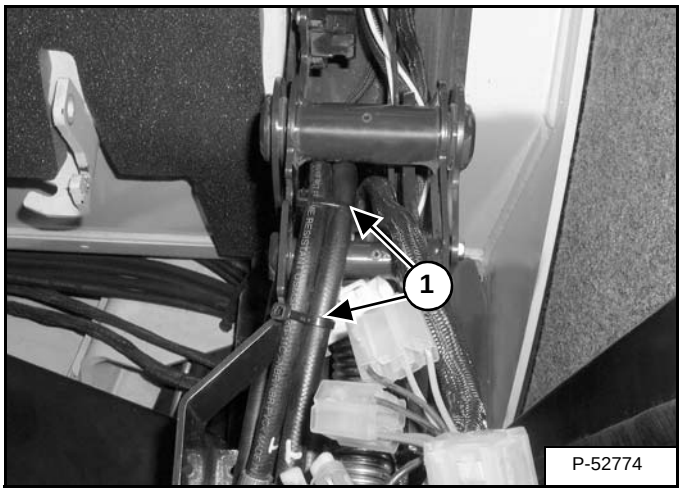
Remove the six hoses (Item 1) **[Figure 40-60-22]** from the joystick.

Figure 40-60-23



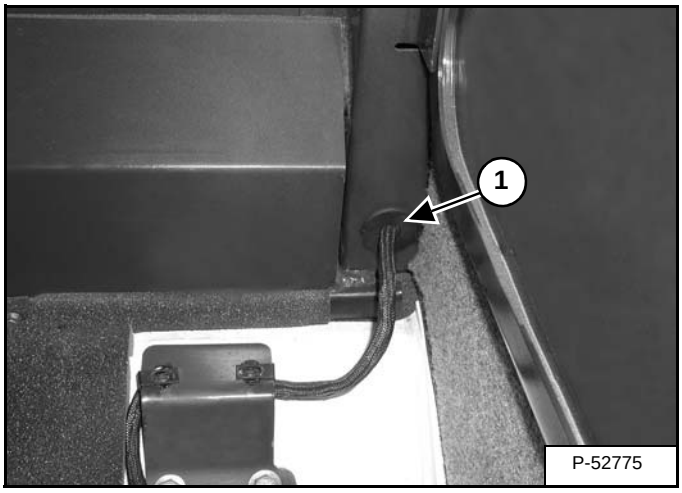
Lower the console. Disconnect the joystick wire harness (Item 1) **[Figure 40-60-23]**.

Figure 40-60-24



Remove the tie straps (Item 1) **[Figure 40-60-24]**.

Figure 40-60-25

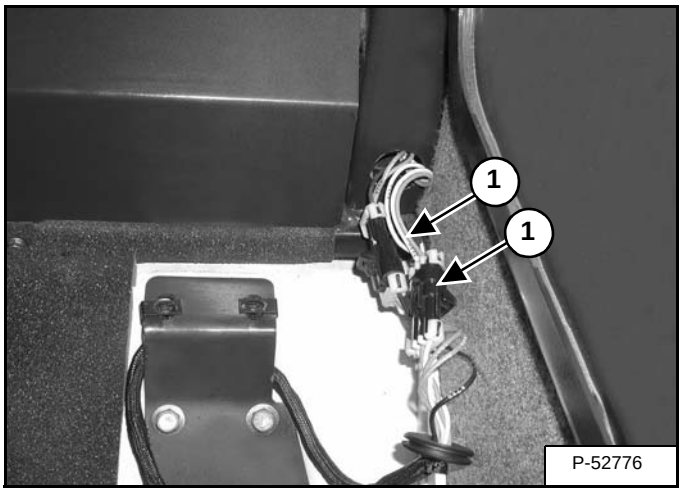


Remove the grommet (Item 1) **[Figure 40-60-25]**.

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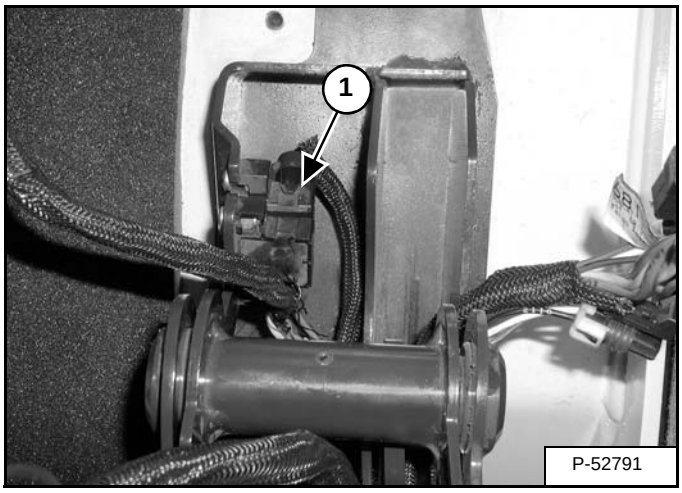
Console Removal And Installation (Cont'd)

Figure 40-60-26



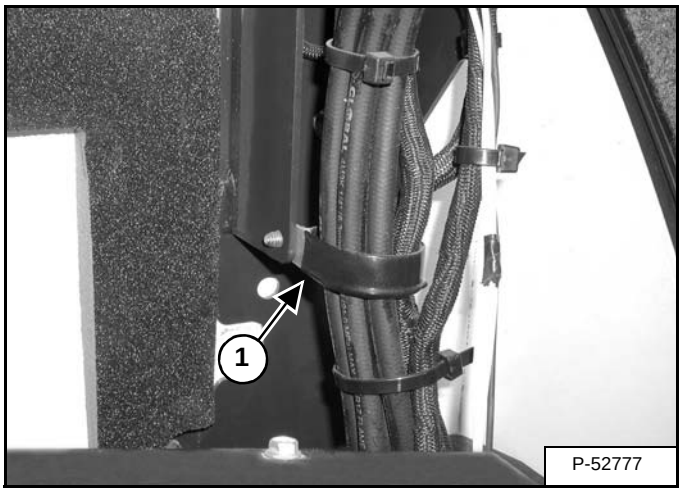
Pull the wire harness out and disconnect the wire harness (Item 1) **[Figure 40-60-26]**.

Figure 40-60-27



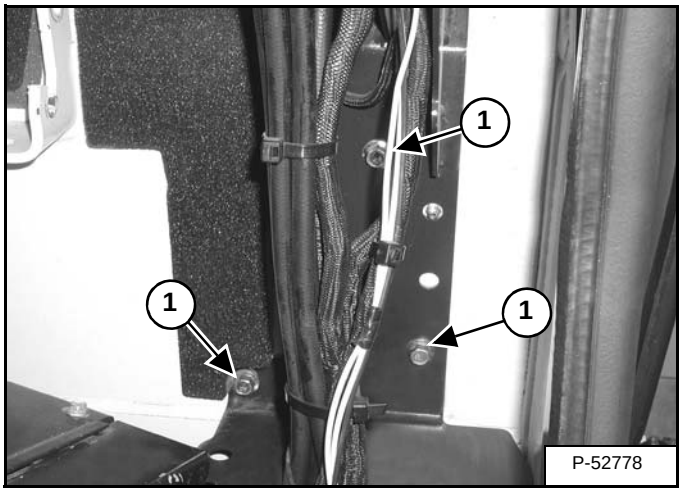
Disconnect the wire harness (Item 1) **[Figure 40-60-27]** from the console lockout switch.

Figure 40-60-28



Remove the hose clamp (Item 1) **[Figure 40-60-28]**.

Figure 40-60-29

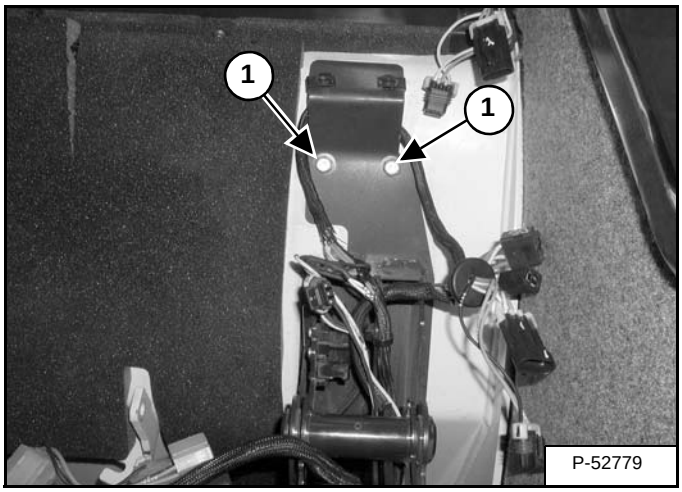


Remove the bolts (Item 1) **[Figure 40-60-29]**.

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Console Removal And Installation (Cont'd)

Figure 40-60-30



Remove the bolts (Item 1) **[Figure 40-60-30]**.

Figure 40-60-31

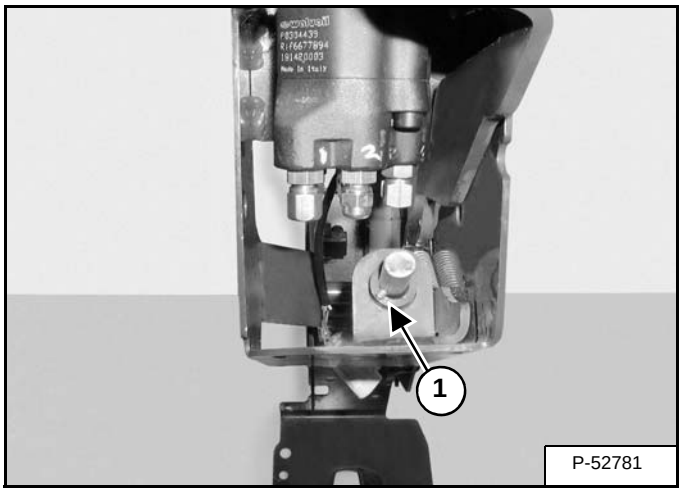


Remove the console (Item 1) **[Figure 40-60-31]**.

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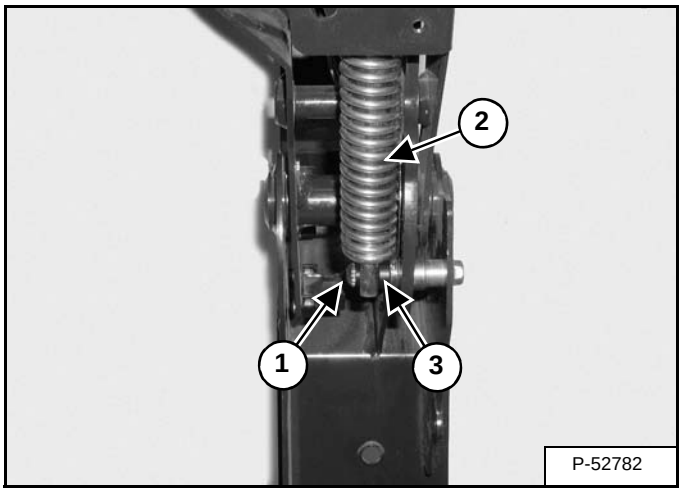
Disassembly And Assembly

Figure 40-60-32



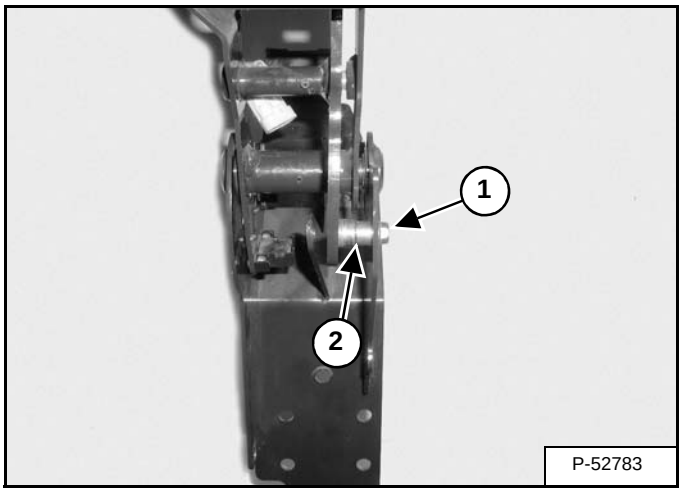
Install a pin (Item 1) **[Figure 40-60-32]** in the shaft.

Figure 40-60-33



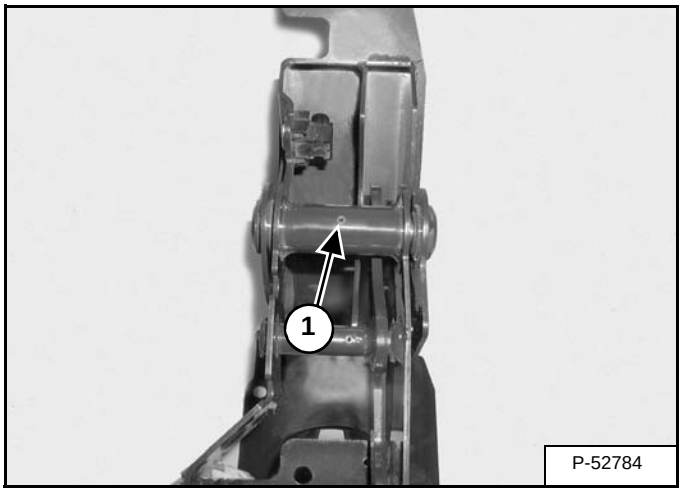
Remove the bolt (Item 1), spring assembly (Item 2), and bushing (Item 3) **[Figure 40-60-33]**.

Figure 40-60-34



Remove the bolt (Item 1) and bearing (Item 2) **[Figure 40-60-34]**.

Figure 40-60-35

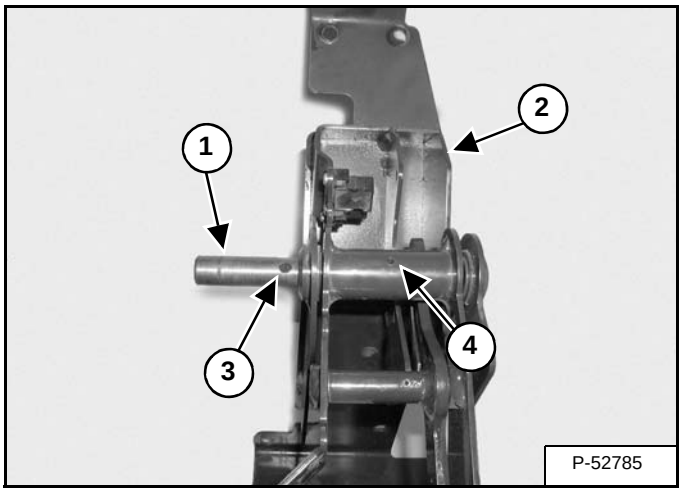


Remove the roll pin (Item 1) **[Figure 40-60-35]**.

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Disassembly And Assembly (Cont'd)

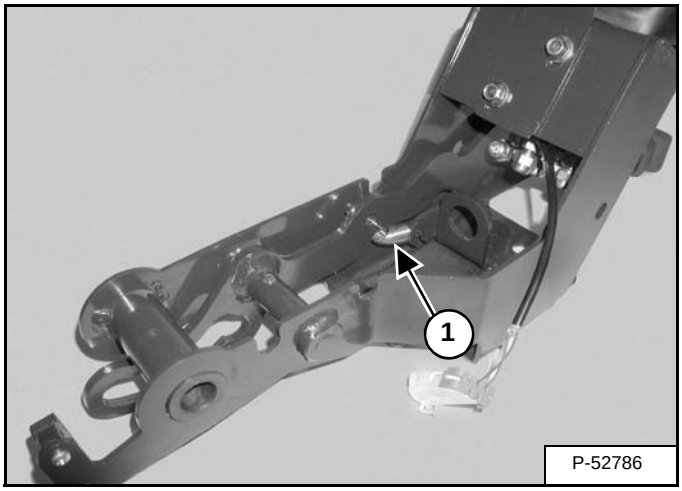
Figure 40-60-36



Remove the pin (Item 1). Remove the bracket (Item 2) **[Figure 40-60-36]**.

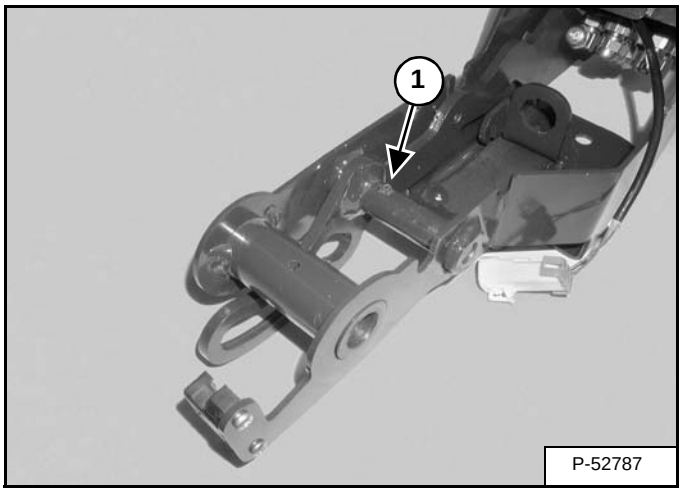
Installation: Align the hole (Item 3) in the pin with the hole (Item 4) **[Figure 40-60-36]** in the bracket.

Figure 40-60-37



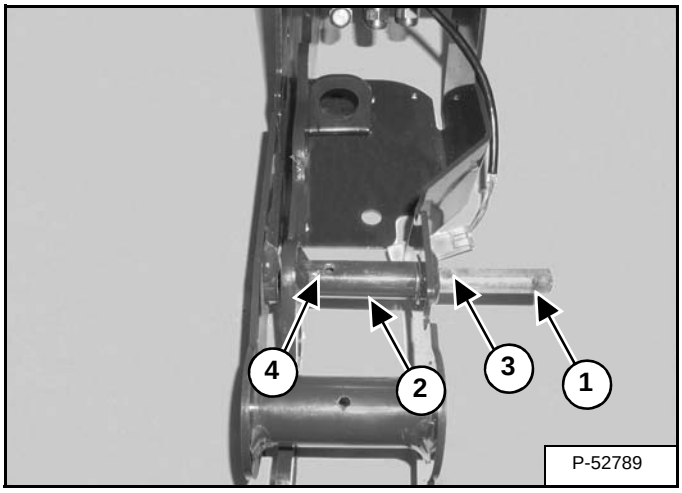
Remove the spring (Item 1) **[Figure 40-60-37]**.

Figure 40-60-38



Remove the rollpin (Item 1) **[Figure 40-60-38]**.

Figure 40-60-39



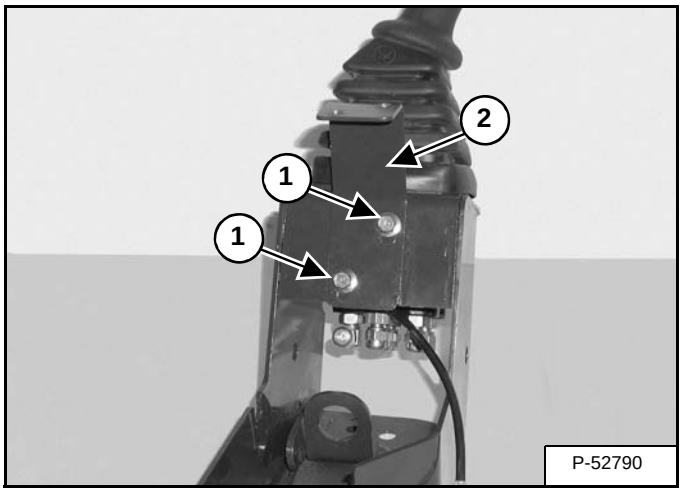
Remove the pin (Item 1) from the bracket (Item 2) **[Figure 40-60-39]**.

Installation: Align the hole (Item 3) in the pin with the hole (Item 4) **[Figure 40-60-39]** in the bracket.

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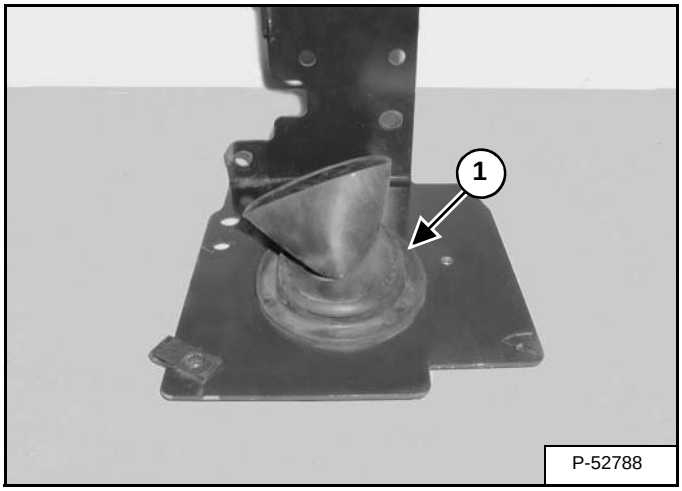
Disassembly And Assembly (Cont'd)

Figure 40-60-40



Remove the bolts (Item 1). Remove the bracket (Item 2) **[Figure 40-60-40]**.

Figure 40-60-41



Remove the dust boot (Item 1) **[Figure 40-60-41]**.

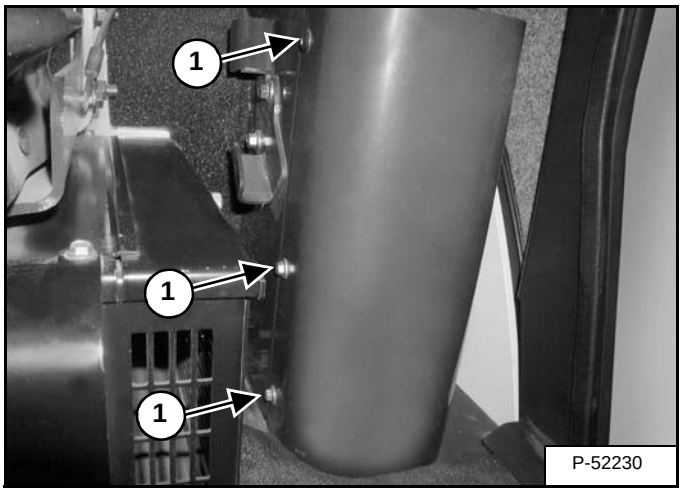
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Console Base Removal And Installation

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

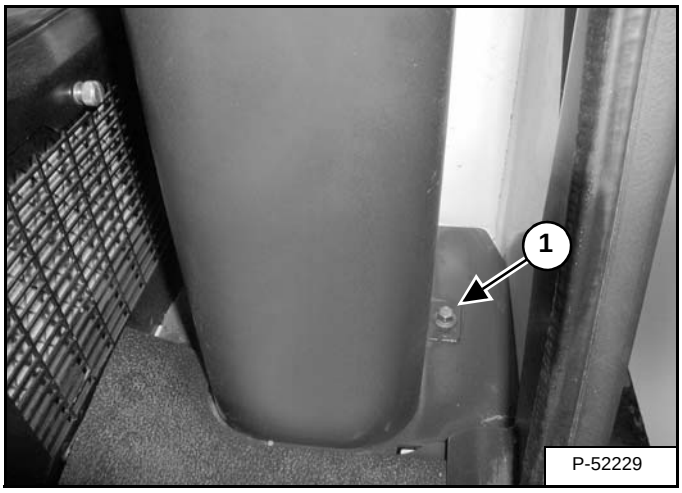
Remove the lower console cover. (See Lower Console Cover Removal And Installation on Page 40-60-1.)

Figure 40-60-42



Remove the bolts (Item 1) **[Figure 40-60-42]** from the console base cover.

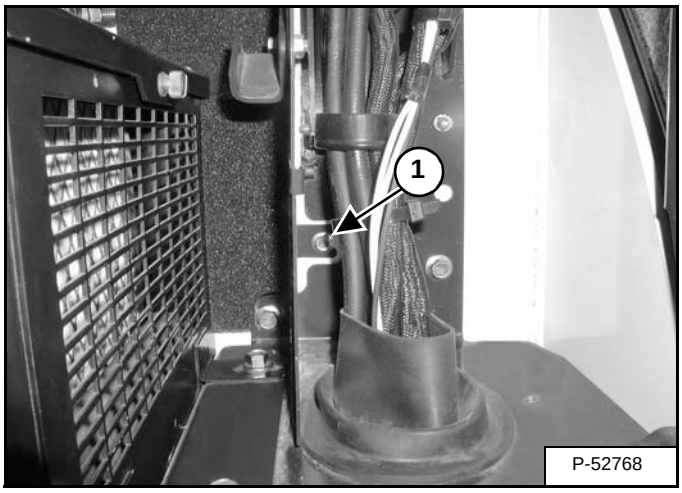
Figure 40-60-43



Remove the bolt (Item 1) **[Figure 40-60-43]** from the console base cover.

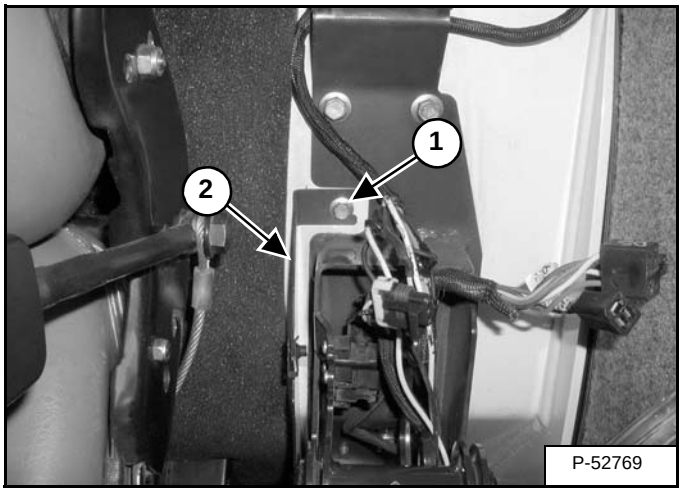
Remove the console base cover.

Figure 40-60-44



Remove the bolt (Item 1) **[Figure 40-60-44]**.

Figure 40-60-45



Remove the bolt (Item 1) from the bracket (Item 2) **[Figure 40-60-45]**.

Remove the console base mount bracket.

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ENGINE SPEED CONTROL

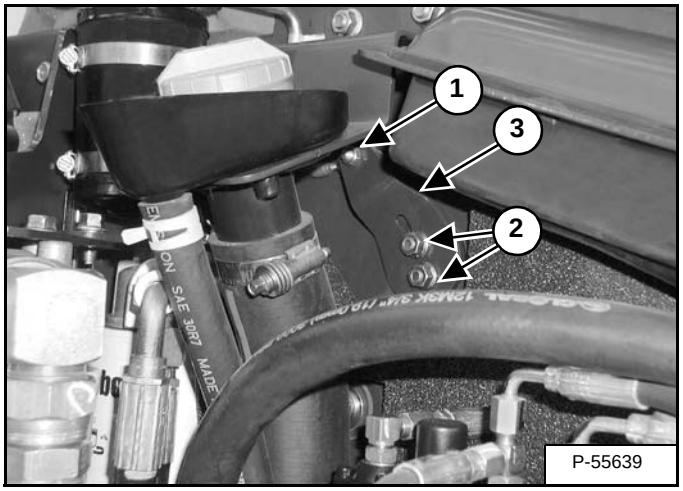
Removal And Installation

NOTE: The removal and installation procedure for the engine speed control is the same for both early and later models. Early model is shown.

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

Open the right side cover.

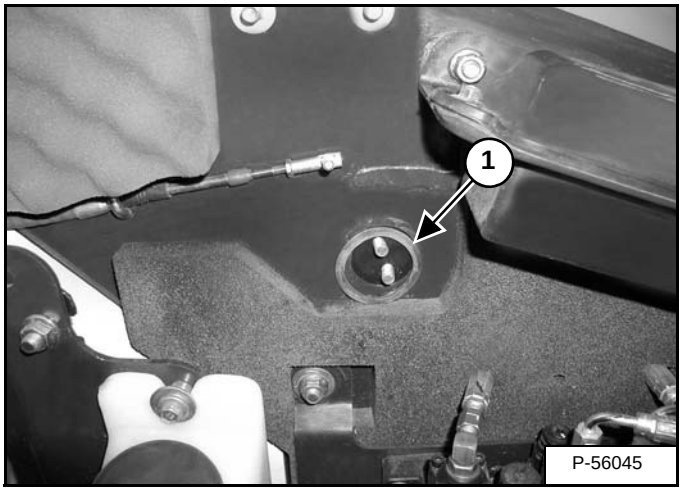
Figure 40-70-1



Remove the linkage cable nut (Item 1) **[Figure 40-70-1]**.

Remove the nuts (Item 2) and bracket (Item 3) **[Figure 40-70-1]**.

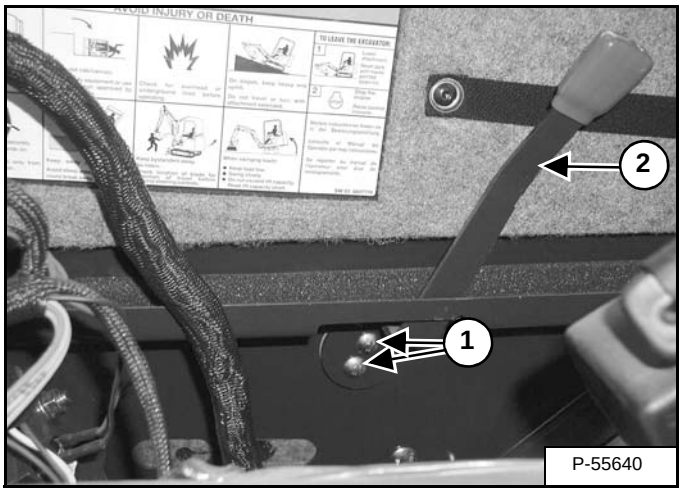
Figure 40-70-2



Remove the wave washers (Item 1) **[Figure 40-70-2]**.

NOTE: The fuel fill is shown removed for photo clarity.

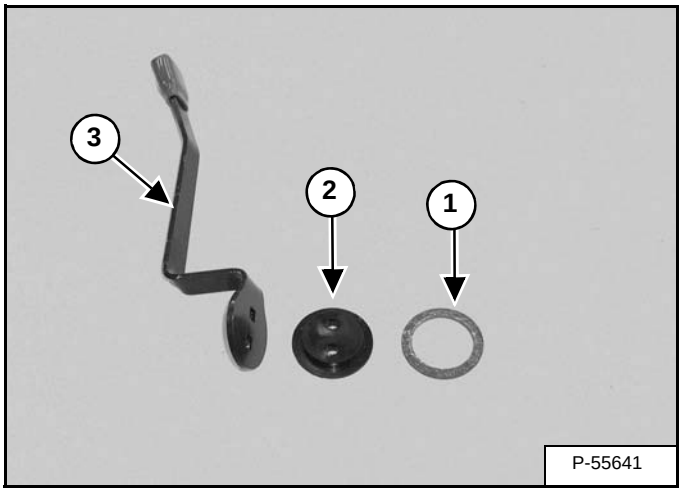
Figure 40-70-3



Remove the bolts (Item 1) **[Figure 40-70-3]**.

Remove the speed control lever (Item 2) **[Figure 40-70-3]**

Figure 40-70-4



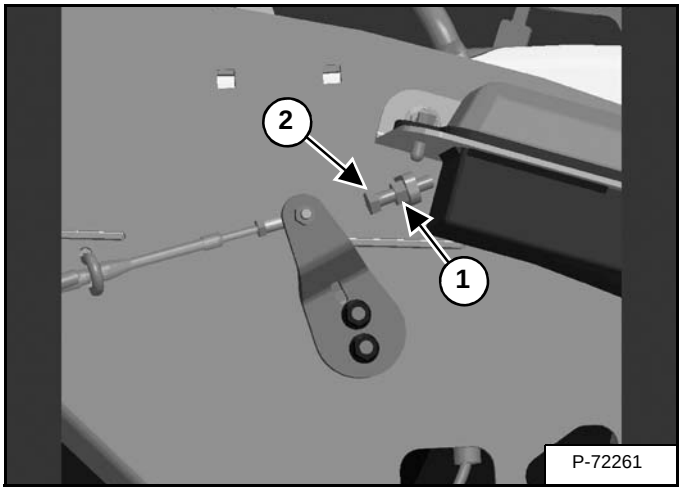
Remove the washer (Item 1) and spacer (Item 2) from the lever (Item 3) **[Figure 40-70-4]**.

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Adjustment (Later Models)

Open the engine cover.

Figure 40-70-5



Loosen the jam nut (Item 1) and adjust the bolt (Item 2) **[Figure 40-70-5]** until the engine runs at 2615 RPM.

Tighten the jam nut (Item 1) **[Figure 40-70-5]**.

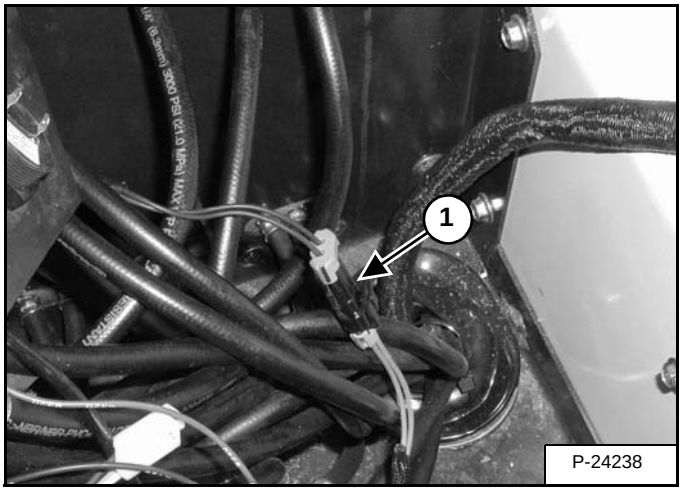
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BLADE CONTROL

Lever Removal And Installation

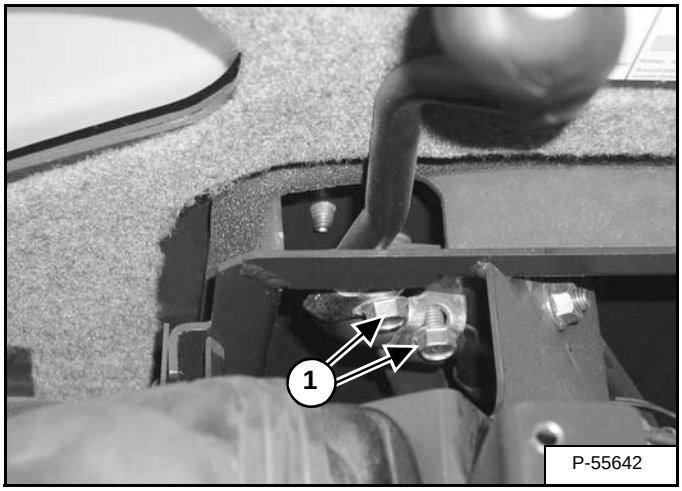
Remove the right console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 40-80-1



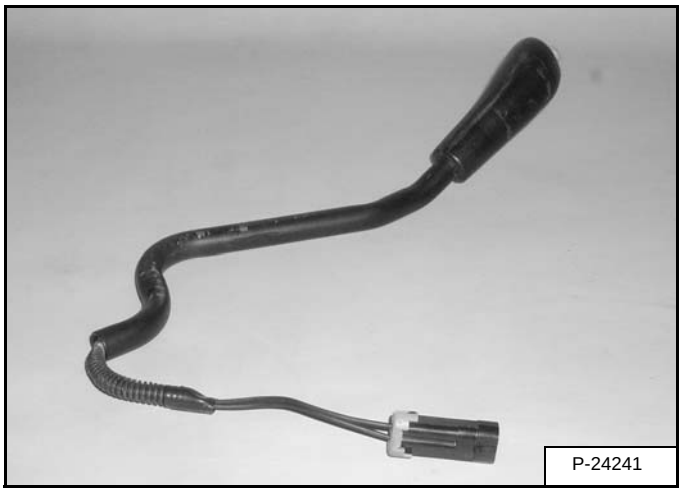
Disconnect the two speed wire harness (Item 1) **[Figure 40-80-1]**.

Figure 40-80-2



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

Figure 40-80-3



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

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

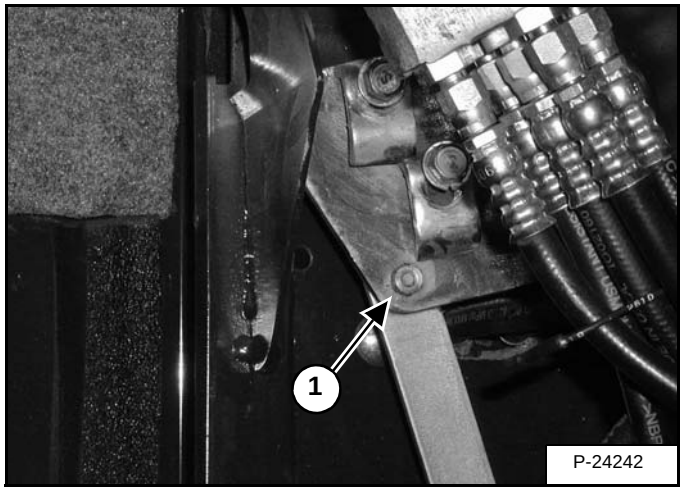
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BLADE CONTROL (CONT'D)

Linkage Removal And Installation

Remove the blade control lever. (See Lever Removal And Installation on Page 40-80-1.)

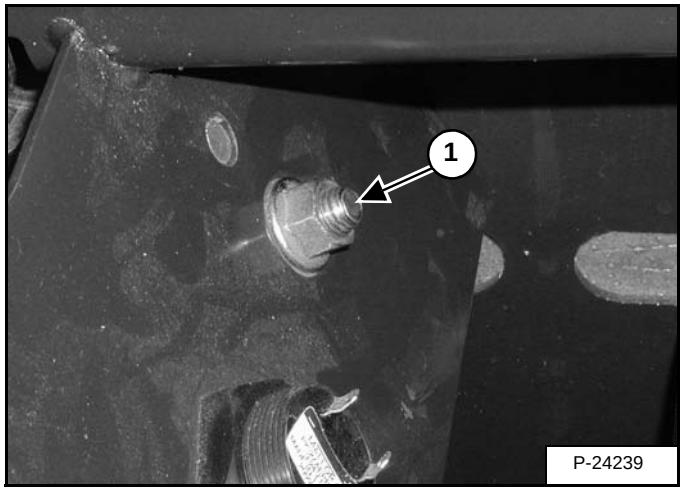
Figure 40-80-4



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

NOTE: The console base has been removed for photo clarity.

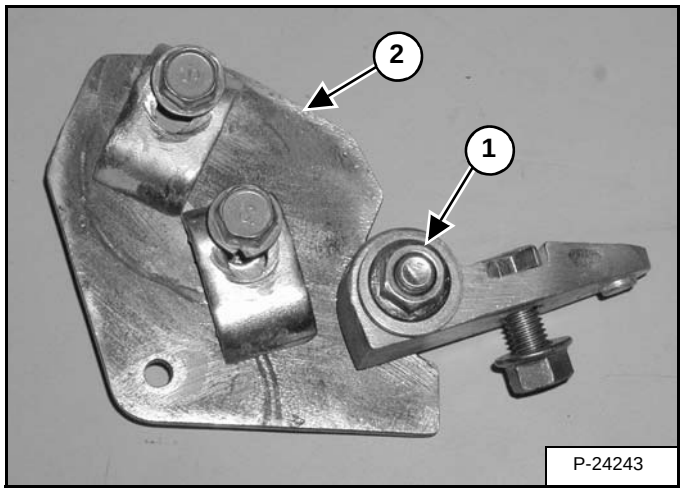
Figure 40-80-5



Remove the bolt (Item 1) **[Figure 40-80-5]** from the blade control pivot mount.

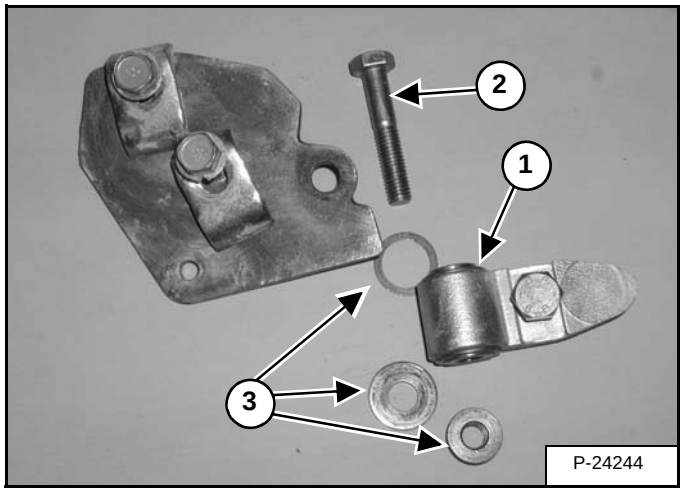
Remove the blade control pivot mount.

Figure 40-80-6



Remove the nut (Item 1) from the mount plate (Item 2) **[Figure 40-80-6]**.

Figure 40-80-7

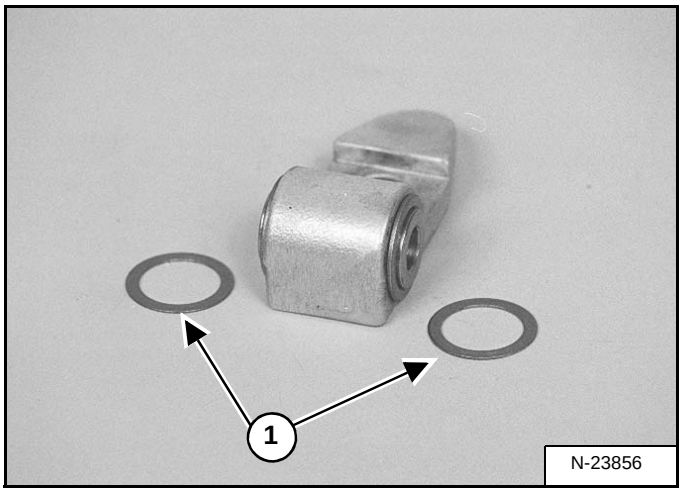


Remove the pivot mount (Item 1) bolt (Item 2) and washers (Item 3) **[Figure 40-80-7]**.

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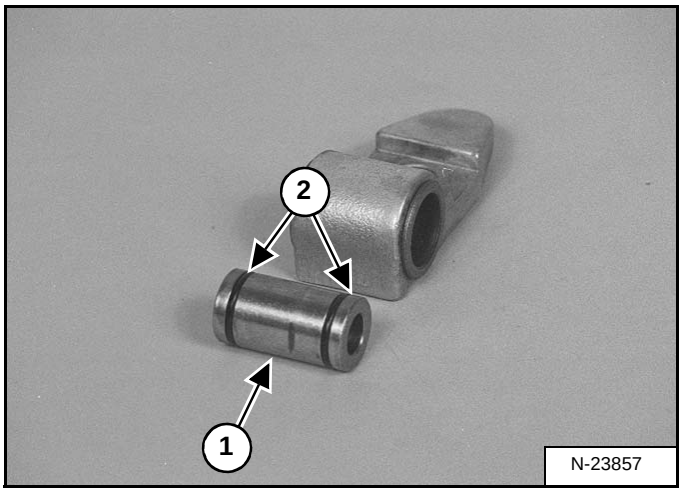
Linkage Removal And Installation (Cont'd)

Figure 40-80-8



Remove the washers (Item 1) **[Figure 40-80-8]** from the pivot mount.

Figure 40-80-9



Remove the sleeve (Item 1) **[Figure 40-80-9]** from the pivot mount.

Inspect the O-rings (Item 2) **[Figure 40-80-9]** and replace parts as needed.

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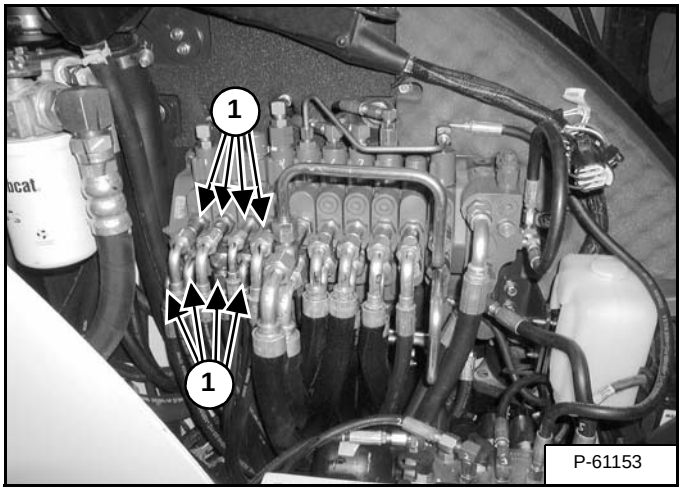
Linkage Bar Removal And Installation

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

Remove the blade control lever. (See Lever Removal And Installation on Page 40-80-1.)

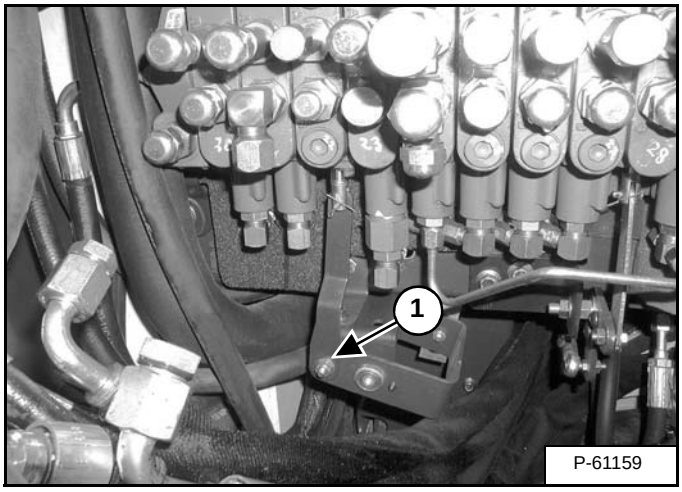
Open the right side cover.

Figure 40-80-10



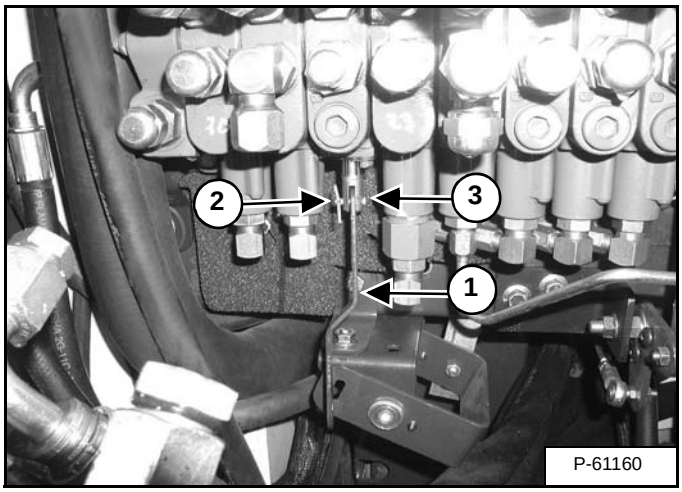
Remove the hoses (Item 1) **[Figure 40-80-10]**.

Figure 40-80-11



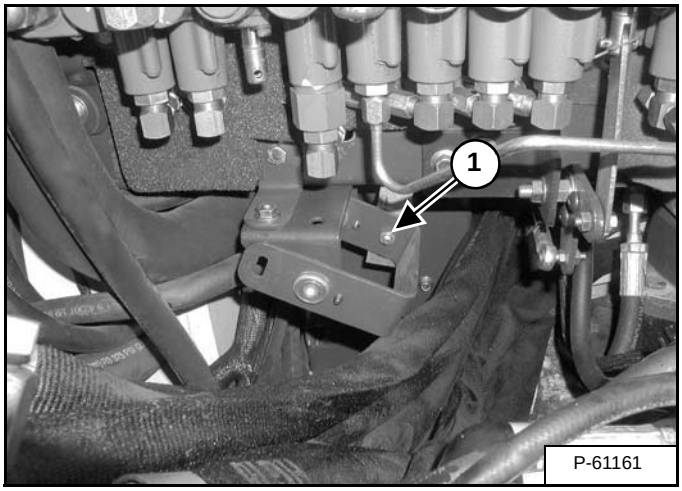
Remove the nut (Item 1) **[Figure 40-80-11]** bolt, washer and spacer.

Figure 40-80-12



Turn the linkage (Item 1) 90°. Remove the cotter pin (Item 2) and clevis pin (Item 3) **[Figure 40-80-12]**. Remove the linkage.

Figure 40-80-13

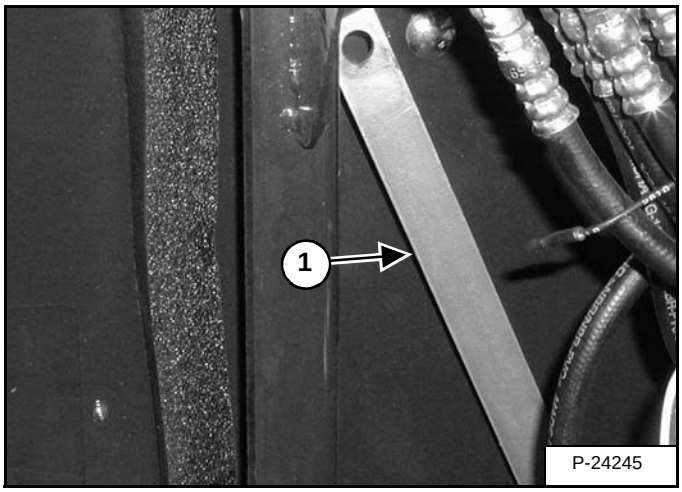


Remove the nut (Item 1) **[Figure 40-80-13]**, bolt, washer and spacer.

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Linkage Bar Removal And Installation (Cont'd)

Figure 40-80-14



Remove the linkage bar (Item 1) **[Figure 40-80-14]** from the top.

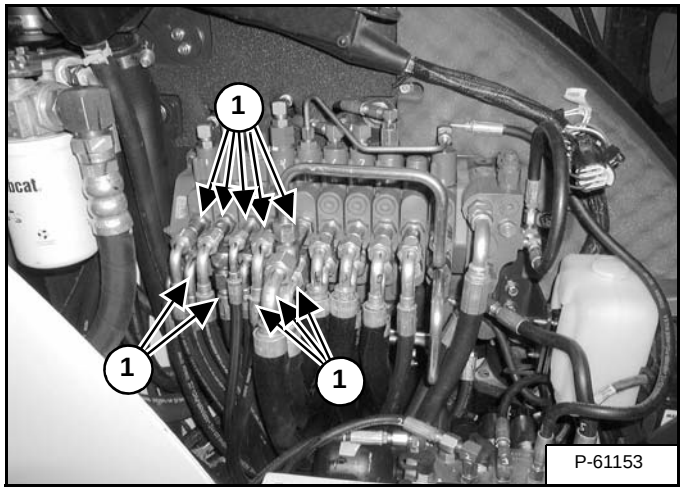
NOTE: The console base has been removed for photo clarity.

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Lower Linkage Removal And Installation

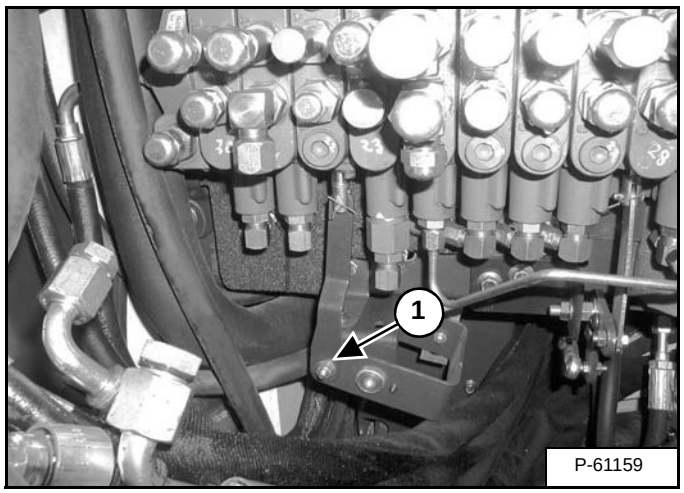
Remove the right console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 40-80-15



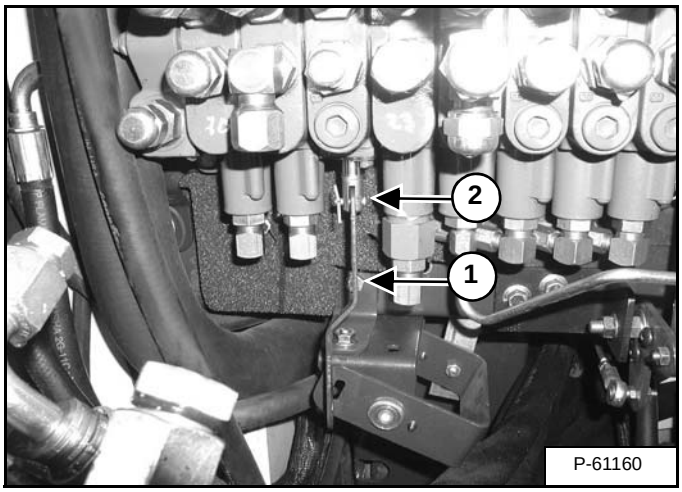
Remove the hoses (Item 1) **[Figure 40-80-15]**.

Figure 40-80-16



Remove the nut (Item 1) **[Figure 40-80-16]** bolts, washers and spacer.

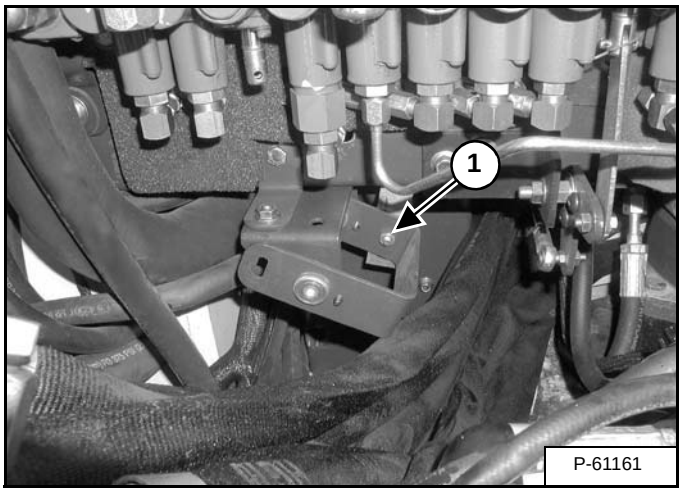
Figure 40-80-17



Turn the linkage (Item 1) 90°. Remove the cotter pin and clevis pin (Item 2) **[Figure 40-80-17]**.

Remove the linkage.

Figure 40-80-18



Remove the nut (Item 1) **[Figure 40-80-18]** bolts, washer and spacer.

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Lower Linkage Removal And Installation (Cont'd)

Figure 40-80-19

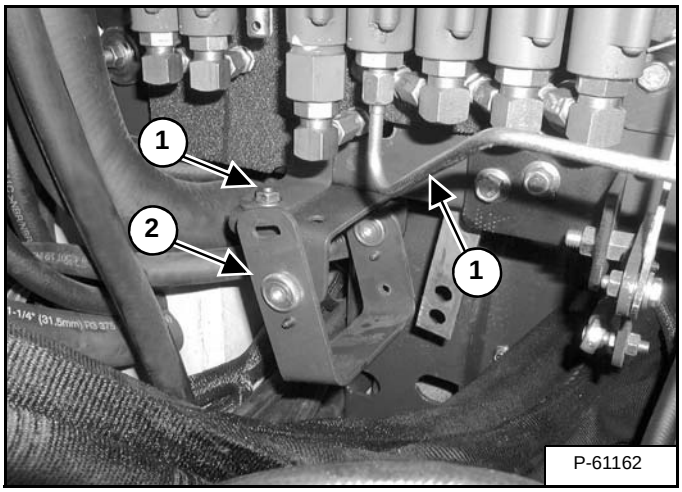
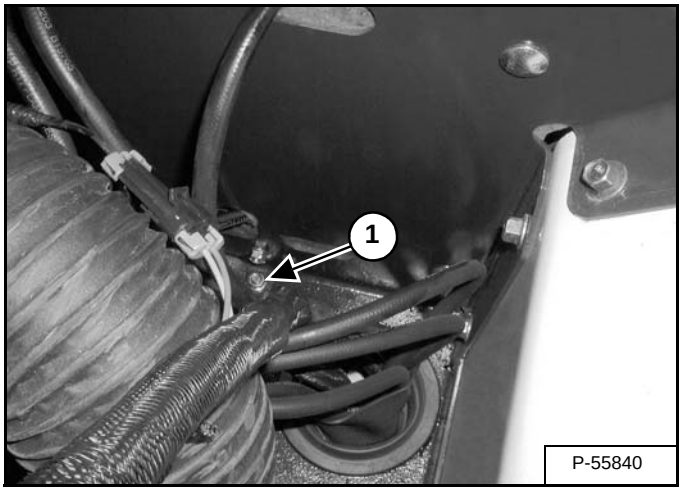


Figure 40-80-20



Remove the nuts (Item 1) **[Figure 40-80-19]** and bolts.

NOTE: Access the bolt (Item 1) [Figure 40-80-20] through the right console in the cab.

Remove the linkage assembly (Item 2) **[Figure 40-80-19]**.

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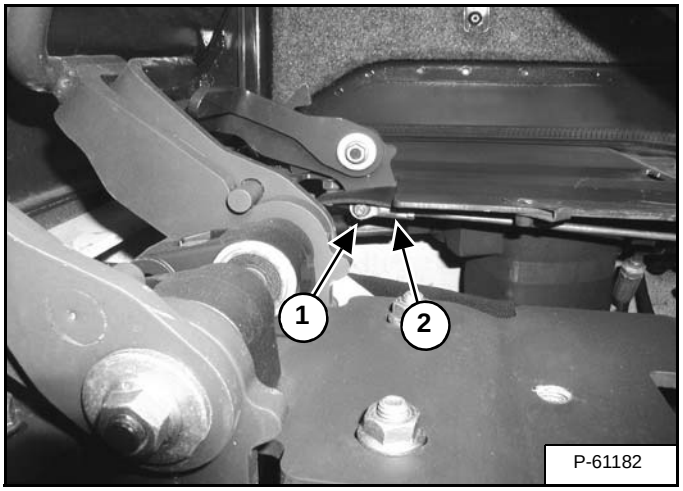
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RIGHT PEDAL AND LINKAGE

Pedal Removal And Installation

Remove the floor mat and floor panel. (See Removal And Installation (Cab Equipped Excavators) on Page40-110-2.)

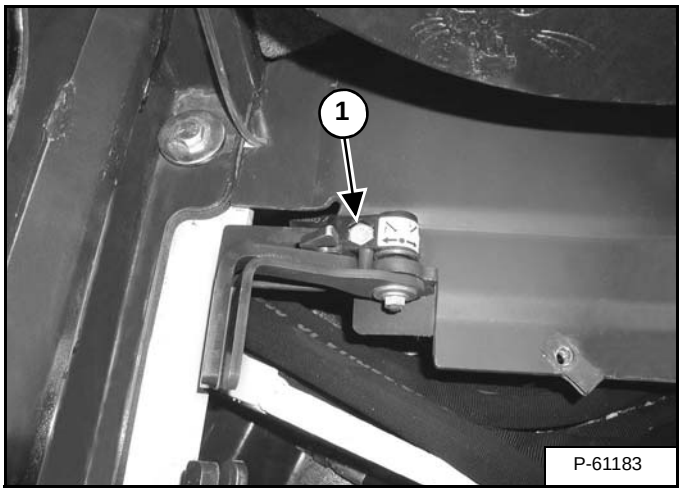
Figure 40-90-1



Remove the nut (Item 1), and washers from the pedal linkage (Item 2) **[Figure 40-90-1]**.

Remove the linkage.

Figure 40-90-2



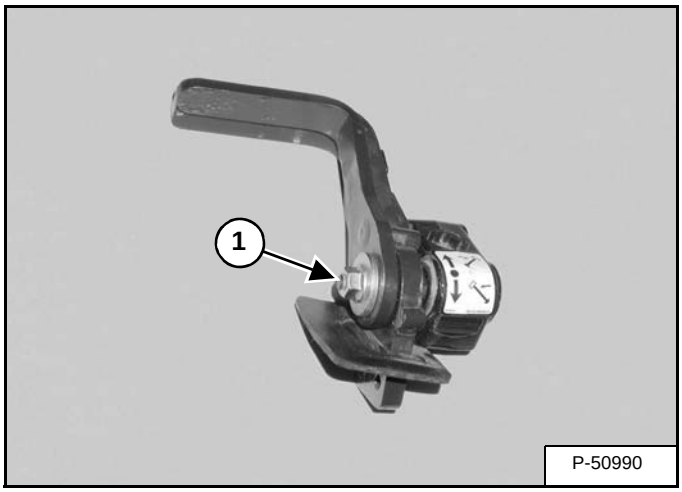
Remove the bolt (Item 1) **[Figure 40-90-2]** and nut.

Remove the right pedal.

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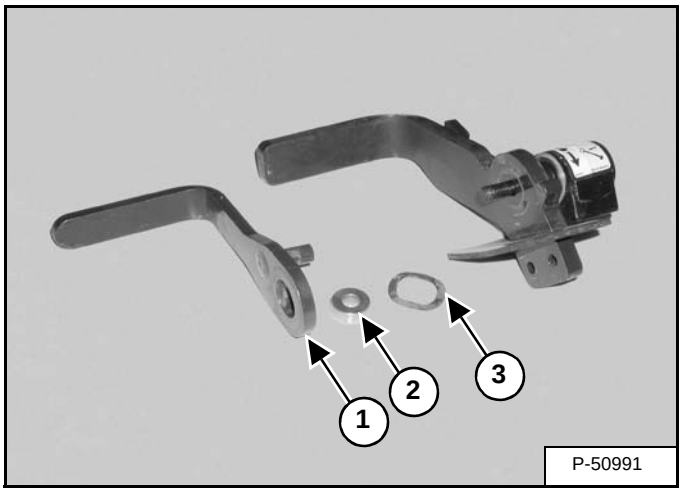
Pedal Disassembly And Assembly

Figure 40-90-3



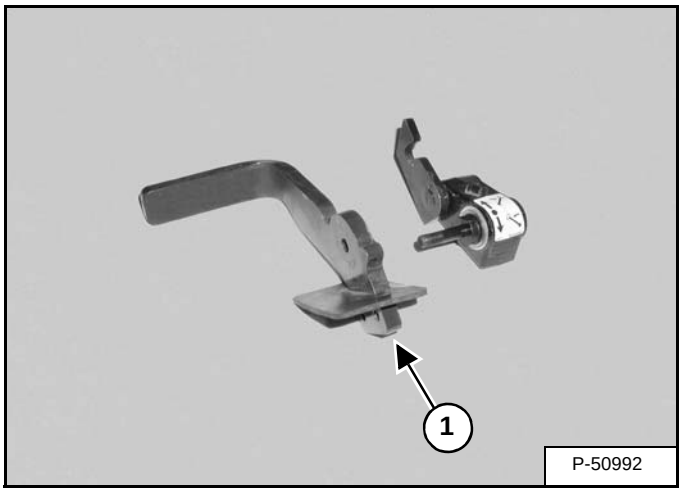
Remove the nut and washer (Item 1) **[Figure 40-90-3]**.

Figure 40-90-4



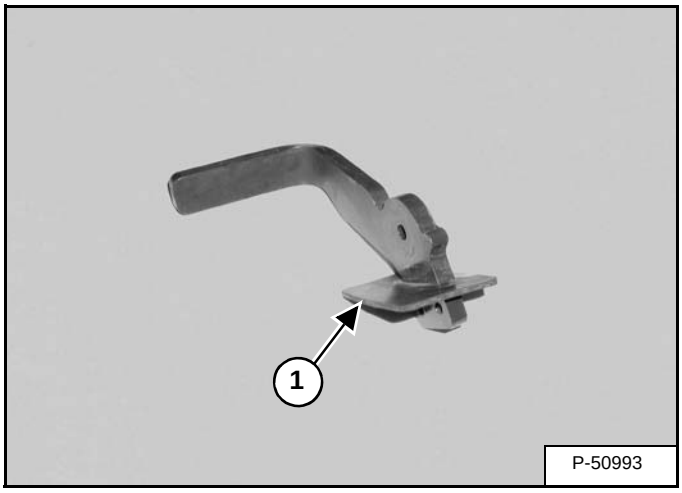
Remove the rear pedal (Item 1) bushing (Item 2) and wave washer (Item 3) **[Figure 40-90-4]**.

Figure 40-90-5



Remove the front pedal (Item 1) **[Figure 40-90-5]**.

Figure 40-90-6

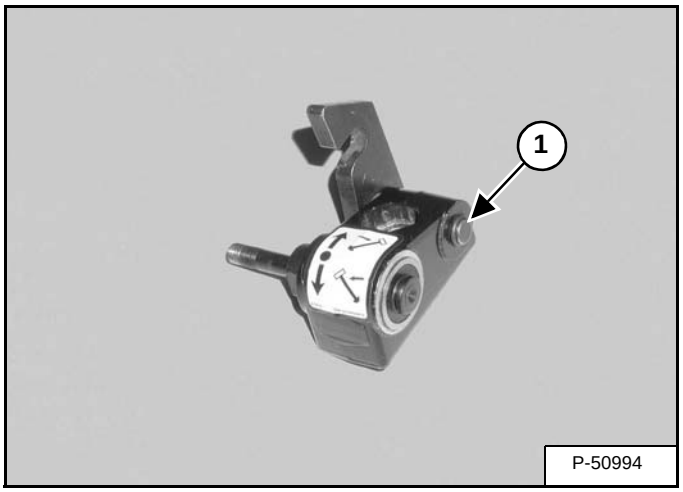


Remove the dust cover (Item 1) **[Figure 40-90-6]**.

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Pedal Disassembly And Assembly (Cont'd)

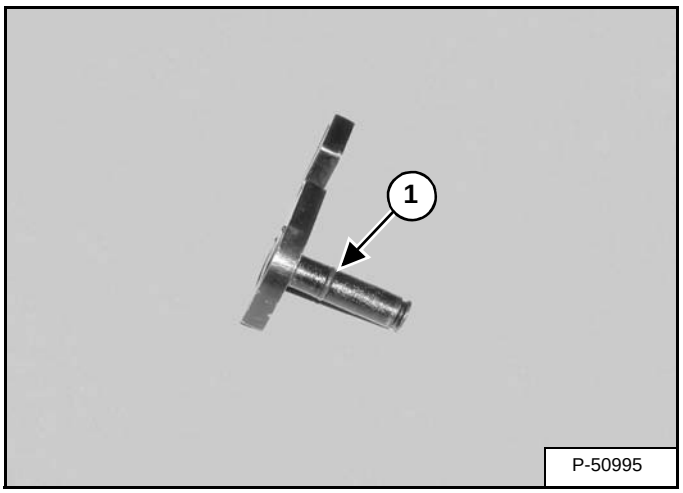
Figure 40-90-7



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

Remove the pedal lock from the pedal mount.

Figure 40-90-8



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

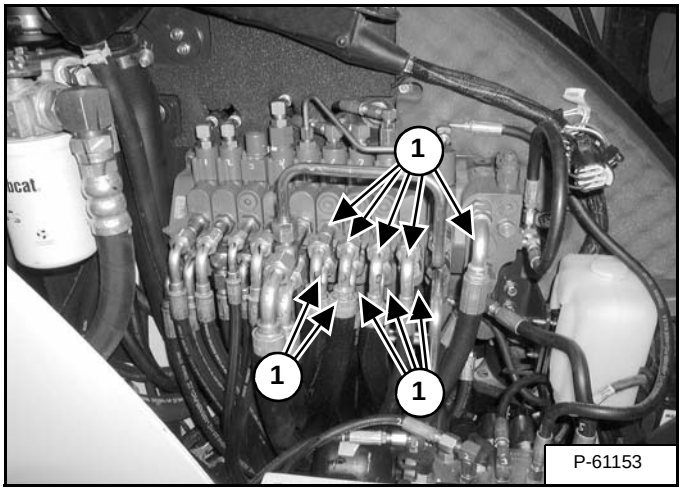
NOTE: Do not lubricate the O-rings (Item 1) [Figure 40-90-7] and [Figure 40-90-8]. The O-rings provide a friction fit to prevent the lock from moving freely.

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Linkage Removal And Installation

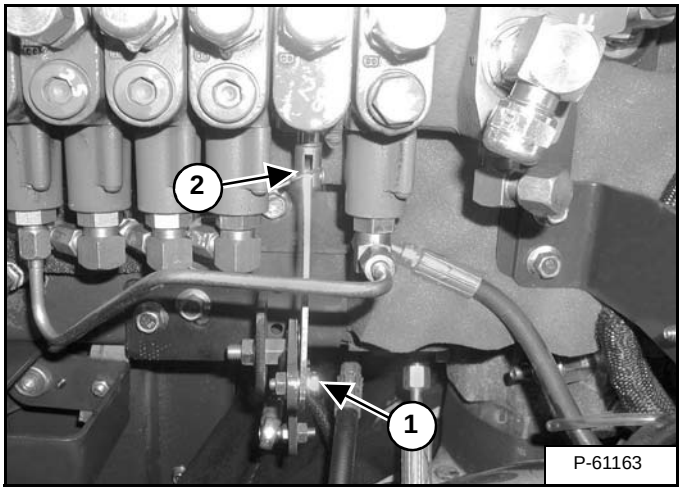
Open the right side cover.

Figure 40-90-9



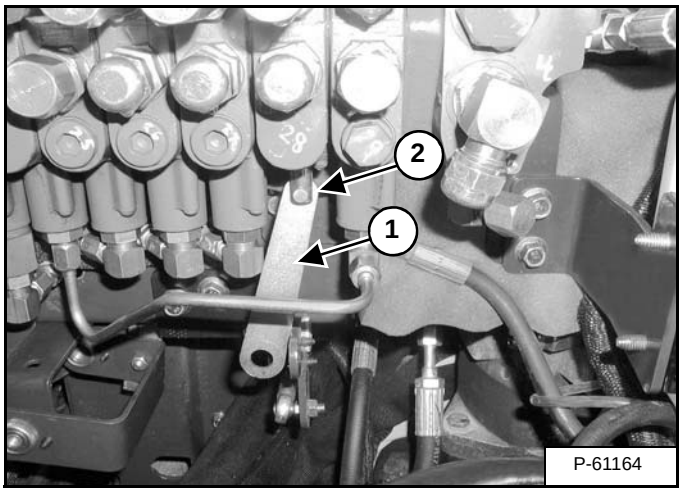
Remove the hoses (Item 1) **[Figure 40-90-9]**.

Figure 40-90-10



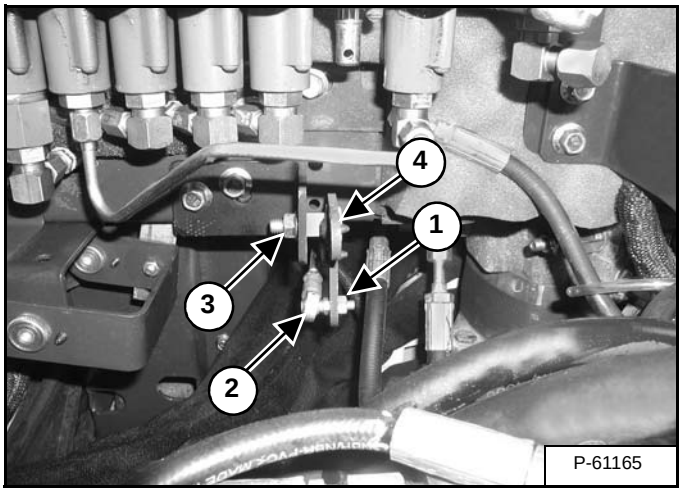
Remove the nut and bolt (Item 1). Remove the cotter pin (Item 2) **[Figure 40-90-10]**.

Figure 40-90-11



Turn the linkage (Item 1) 90°. Remove the clevis pin (Item 2) **[Figure 40-90-11]**. Remove the linkage.

Figure 40-90-12



Remove the nut (Item 1) and turnbuckle (Item 2). Remove the nut (Item 3) and linkage (Item 4) **[Figure 40-90-12]**.

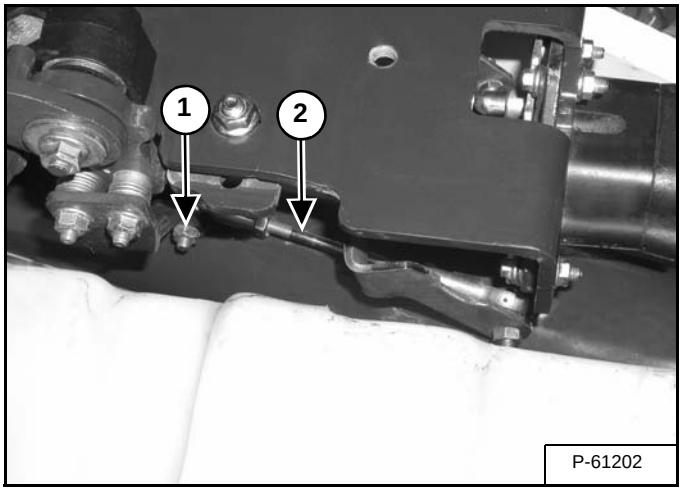
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TRAVEL CONTROLS

Removal And Installation

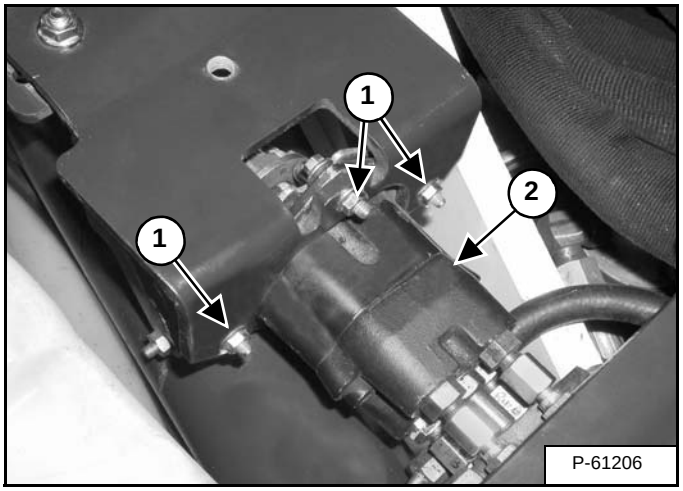
Remove the floormat and floor panel. (See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

Figure 40-100-1



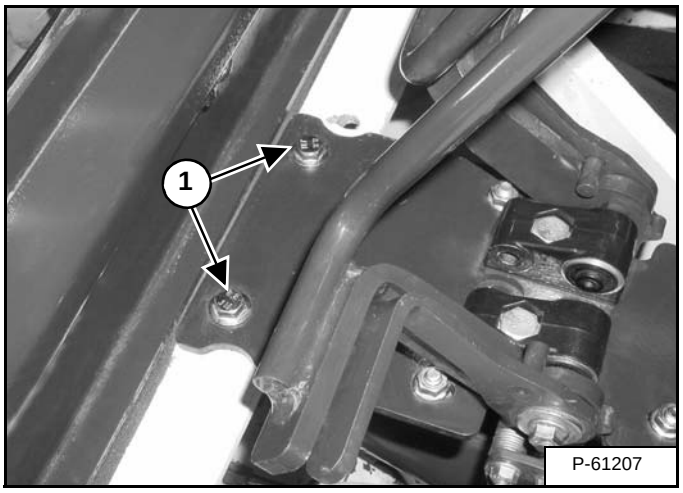
Remove the nut (Item 1) from both the left and right linkage rods. Remove the linkage rods (Item 2) **[Figure 40-100-1]**.

Figure 40-100-2



Remove the bolts (Item 1) and lower the travel control valve (Item 2) **[Figure 40-100-2]**.

Figure 40-100-3



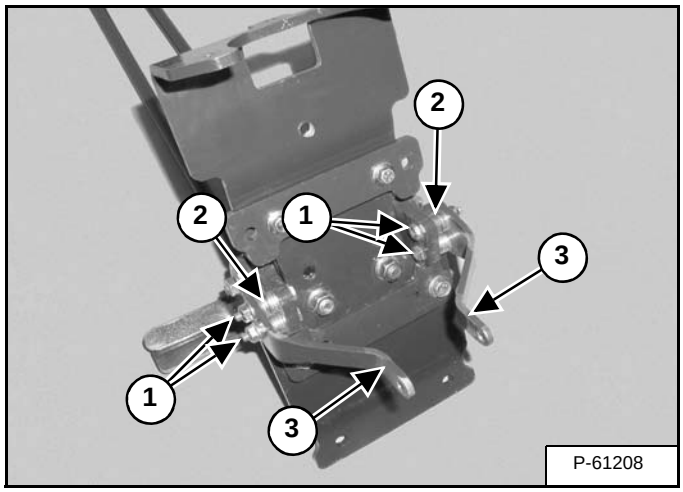
Remove the bolts (Item 1) **[Figure 40-100-3]**.

Remove the travel controls.

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Disassembly And Assembly

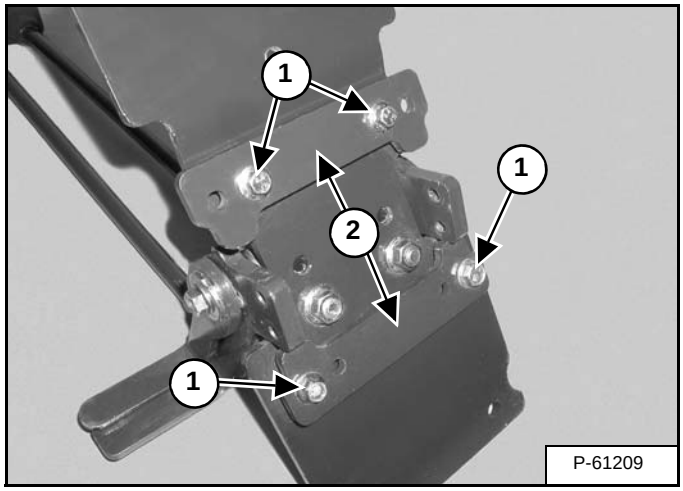
Figure 40-100-4



Remove the bolts (Item 1), spacers (Item 2) and linkage bars (Item 3) **[Figure 40-100-4]**.

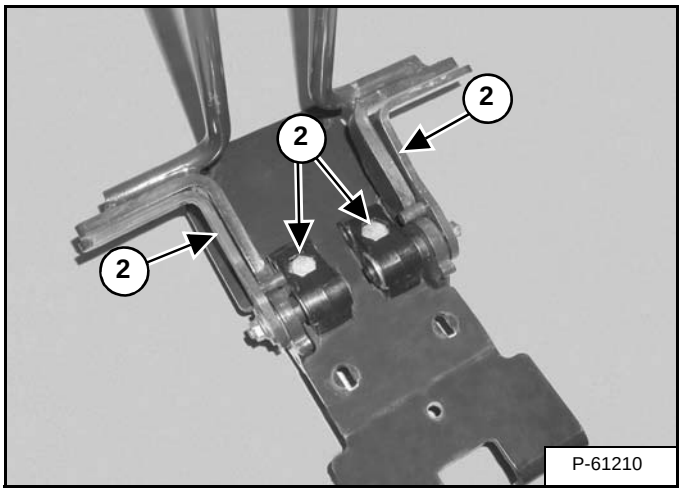
Installation: Tighten the nut to eliminate side play while allowing free travel of the pedals.

Figure 40-100-5



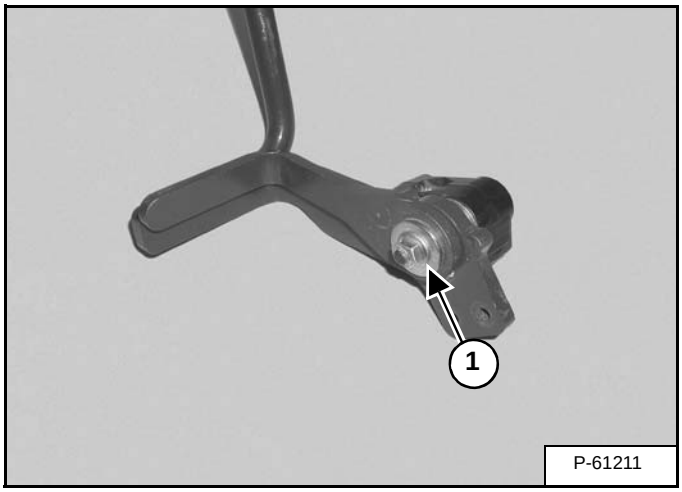
Remove the bolts (Item 1) and stop plates (Item 2) **[Figure 40-100-5]**.

Figure 40-100-6



Remove the bolts (Item 1) and nuts. Remove the left and right travel levers (Item 2) **[Figure 40-100-6]**.

Figure 40-100-7

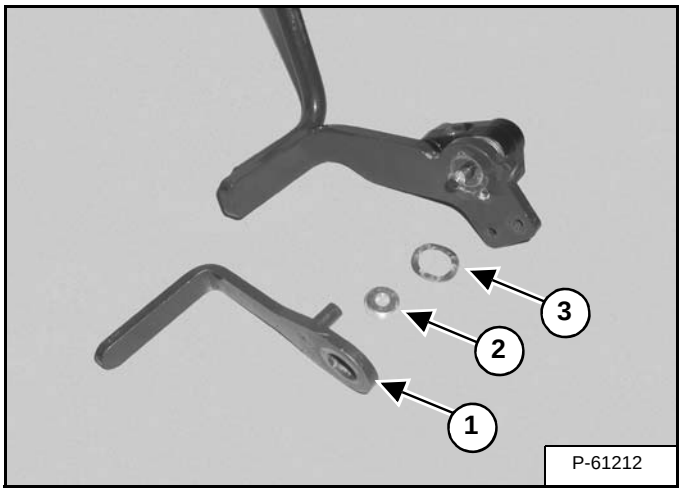


Remove the bolt and washer (Item 1) **[Figure 40-100-7]**.

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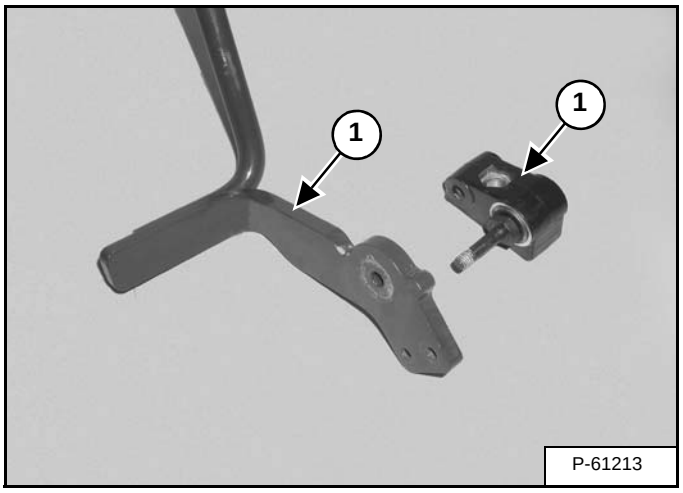
Disassembly And Assembly (Cont'd)

Figure 40-100-8



Remove the foot pedal (Item 1), bushing (Item 2) and wave washer (Item 3) **[Figure 40-100-8]**.

Figure 40-100-9



Remove the lower mount (Item 1) from the control lever (Item 2) **[Figure 40-100-9]**.

NOTE: After the lever components are installed in the excavator, the levers must be adjusted for neutral, forward, and reverse. (See Adjustment on Page 40-100-4.)

Installation: Clean the bolt threads and apply thread lock adhesive (LOCTITE 242). Tighten the bolts to 32-35 ft.-lbs. (43-47 Nm) torque.

Assembly

Clean all parts in solvent and dry with compressed air.

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

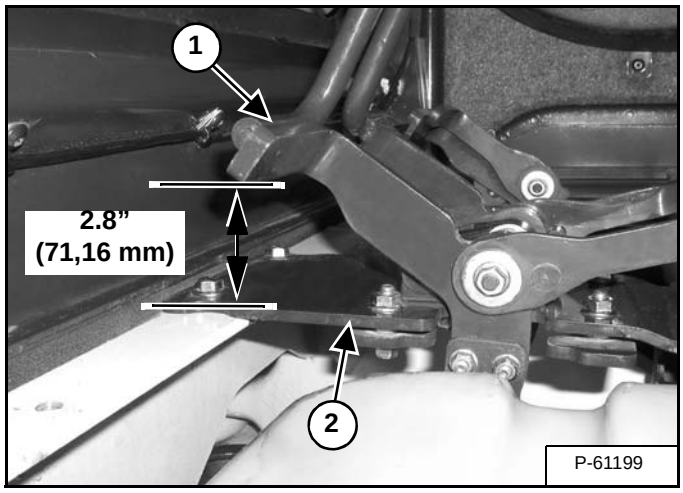
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Adjustment

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

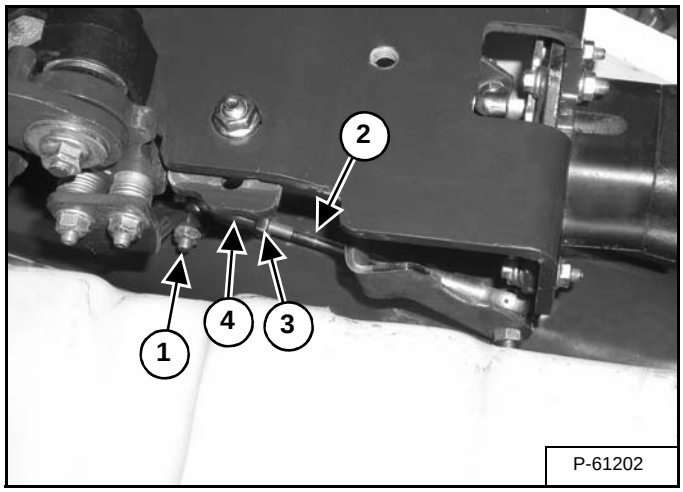
Neutral

Figure 40-100-10



Neutral position is 2.8 inches (71,16 mm) from the travel lever (Item 1) to the top of the pedal mount plate (Item 2) **[Figure 40-100-10]** on the travel linkage.

Figure 40-100-11



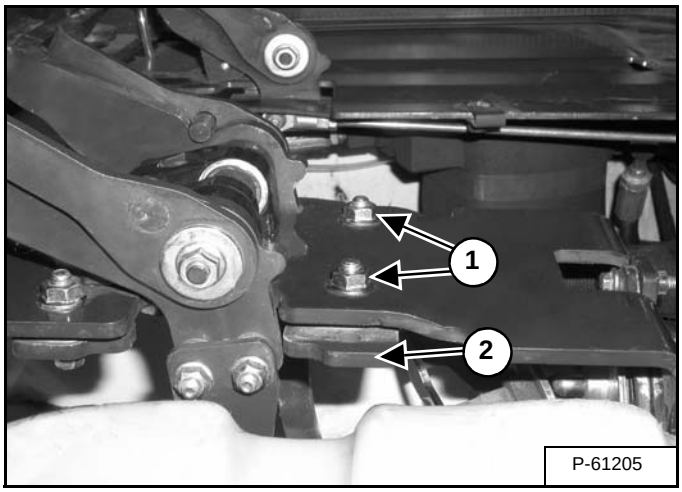
Remove the nut (Item 1) and linkage rod (Item 2). Loosen the nut (Item 3) and turn the ball joint (Item 4) **[Figure 40-100-11]** to adjust the linkage rod length.

Tighten the nut and install the linkage rod.

Repeat the procedure for the opposite travel lever.

Forward Lever Stop:

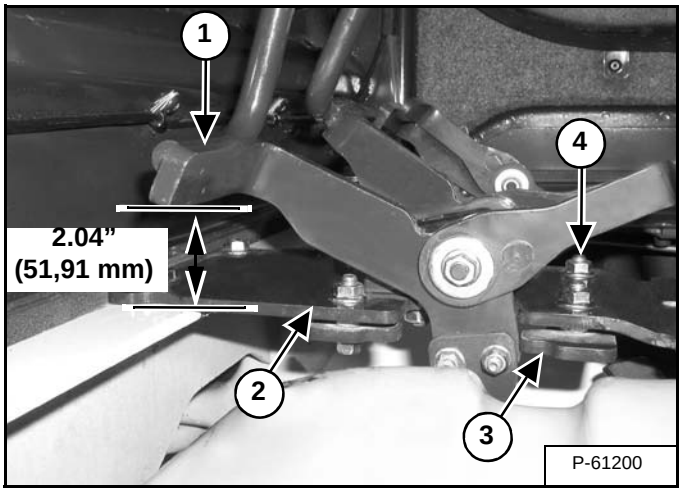
Figure 40-100-12



Loosen the bolts (Item 1) on the rear pedal stop (Item 2) **[Figure 40-100-12]**.

Hold both travel levers in the forward position.

Figure 40-100-13



Forward position is 2.04 inch (51,91 mm) from the travel lever (Item 1) to the top of the pedal mount plate (Item 2) **[Figure 40-100-13]**.

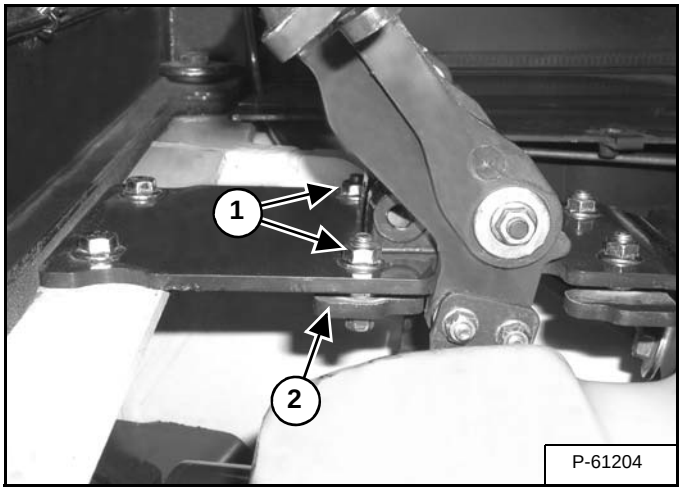
Slide the rear pedal stop (Item 3) forward until it contacts both travel levers. Tighten the bolts (Item 4) **[Figure 40-100-13]**.

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Adjustment (Cont'd)

Reverse Lever Stop:

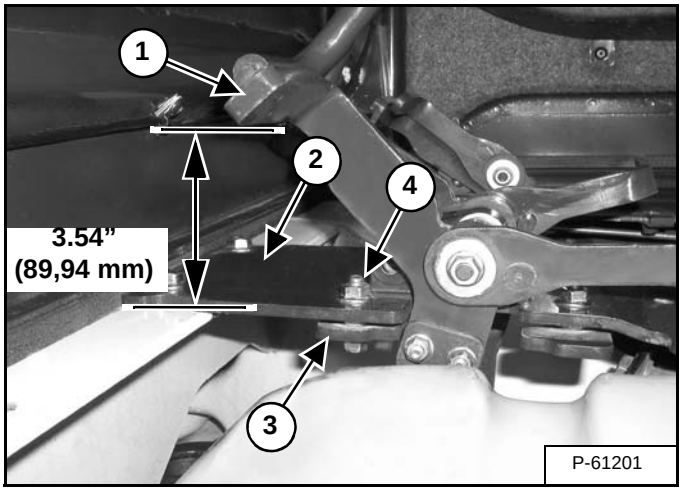
Figure 40-100-14



Loosen the bolts (Item 1) on the front pedal stop (Item 2) **[Figure 40-100-14]**.

Hold both travel levers in the reverse position.

Figure 40-100-15



Reverse position is 3.54 inch (89,9 mm) from the travel lever (Item 1) to the top of the pedal mount plate (Item 2) **[Figure 40-100-15]**.

Slide the front pedal stop (Item 3) rearward until it contacts both travel levers. Tighten the bolts (Item 4) **[Figure 40-100-15]**.

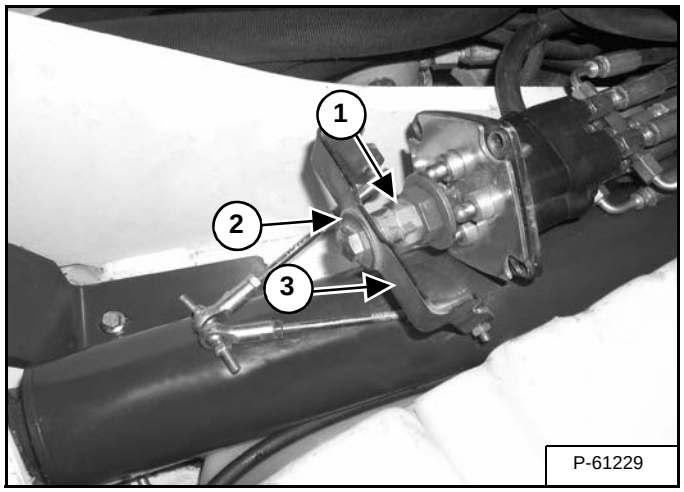
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Control Linkage Removal And Installation

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

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

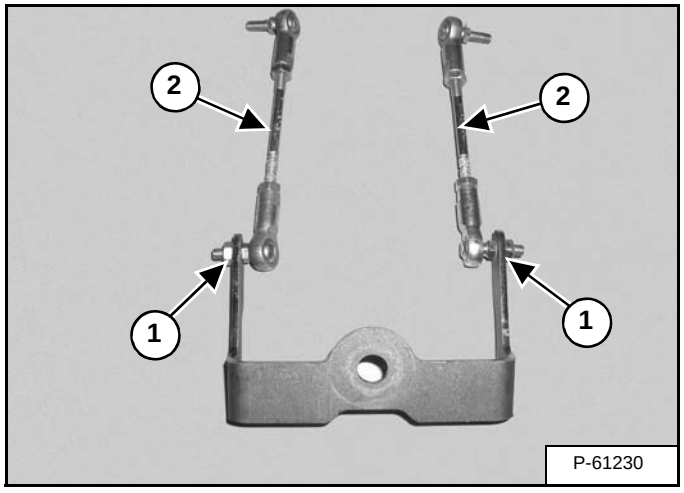
Figure 40-100-16



Hold the nut (Item 1). Remove the bolts and washer (Item 2) **[Figure 40-100-16]**.

Remove the control linkage (Item 3) **[Figure 40-100-16]** from the excavator.

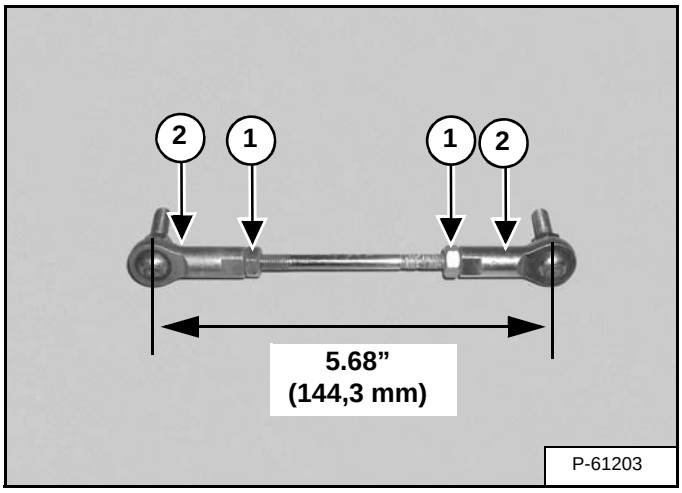
Figure 40-100-17



Remove the nuts (Item 1) and the linkage rods (Item 2) **[Figure 40-100-17]** from the mounting plate.

Inspect the ball joints, and replace as needed.

Figure 40-100-18



Loosen the nuts (Item 1). Remove the ball joints (Item 2) **[Figure 40-100-18]**.

Installation: The distance between the linkage ball joints is 5.68 inches (144,3mm) **[Figure 40-100-18]**.

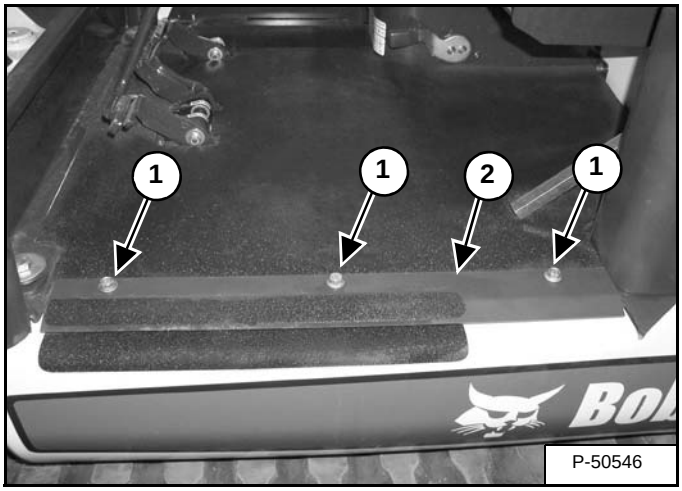
The travel controls must be adjusted for neutral, forward and reverse. (See Removal And Installation on Page 40-100-1.)

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FLOOR MAT AND FLOOR PLATE

Removal And Installation (Canopy Equipped Excavators)

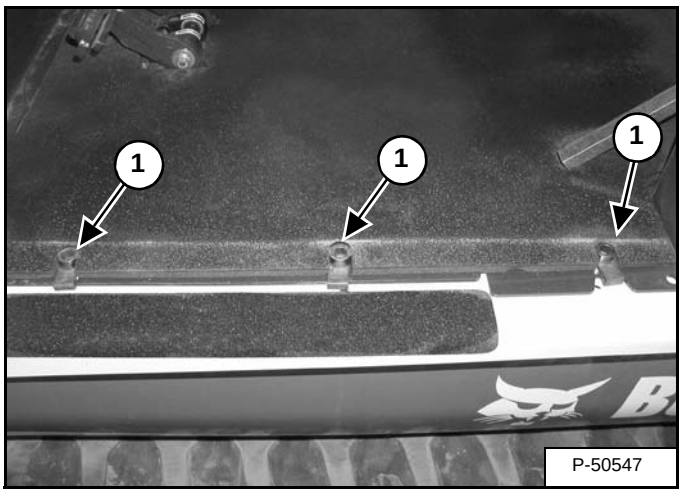
Figure 40-110-1



Remove the three bolts (Item 1) **[Figure 40-110-1]**.

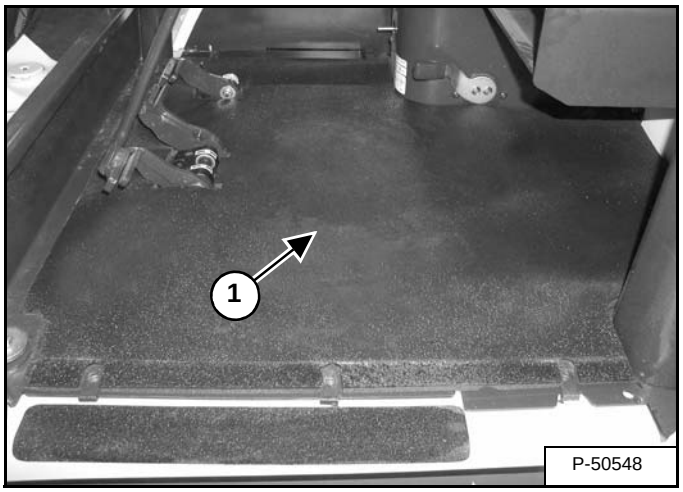
Remove the retaining plate (Item 2) **[Figure 40-110-1]**.

Figure 40-110-2



Remove the three spacers (Item 1) **[Figure 40-110-2]**.

Figure 40-110-3



Remove the floor mat (Item 1) **[Figure 40-110-3]**.

Figure 40-110-4



Remove the five mount bolts (Item 1) **[Figure 40-110-4]** from the floor panel.

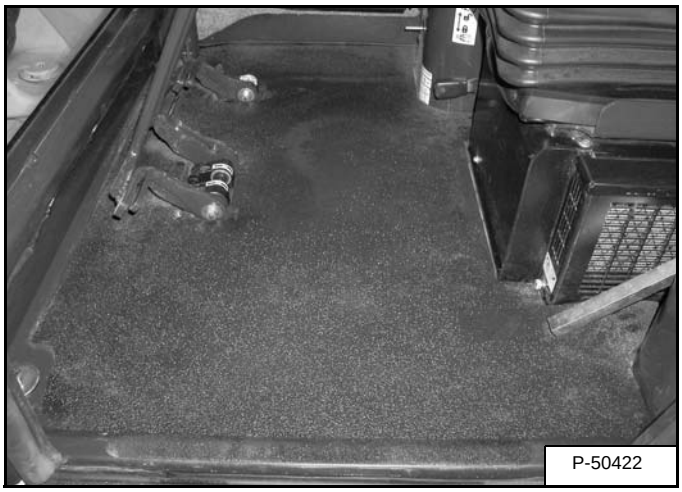
Remove the floor plate.

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FLOOR MAT AND FLOOR PLATE (CONT'D)

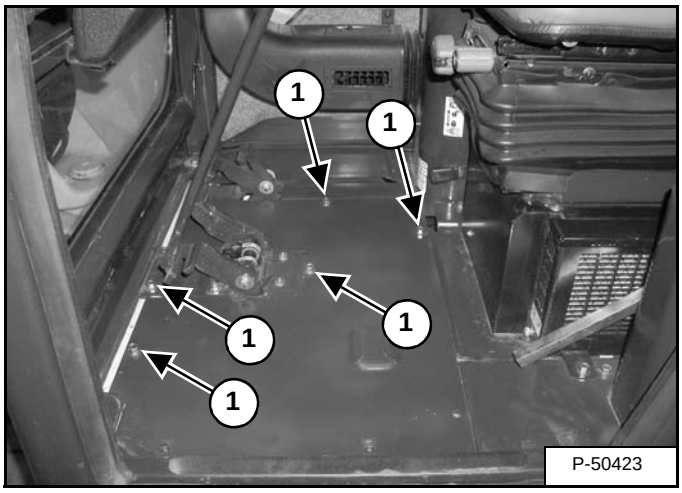
Removal And Installation (Cab Equipped Excavators)

Figure 40-110-5



Remove the floor mat **[Figure 40-110-5]** from the cab.

Figure 40-110-6



Remove the five bolts (Item 1) **[Figure 40-110-6]**.

Remove the floor plate.

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FUEL TANK

Removal And Installation

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

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

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

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

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

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

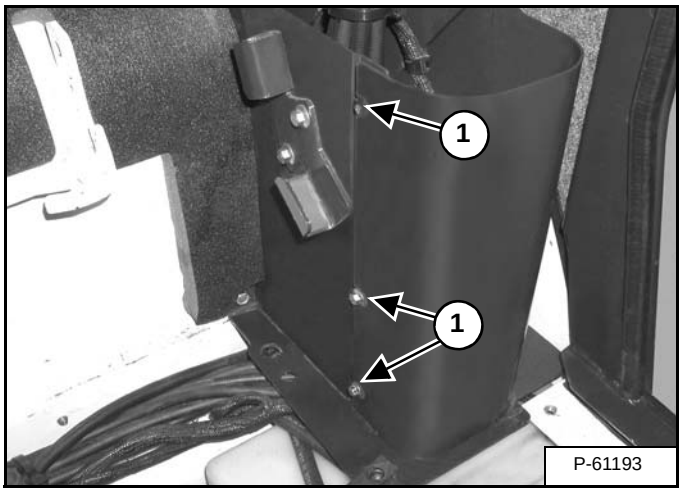
Drain the fuel tank. (See Removal And Installation on Page 40-120-1.)

⚠ WARNING

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.

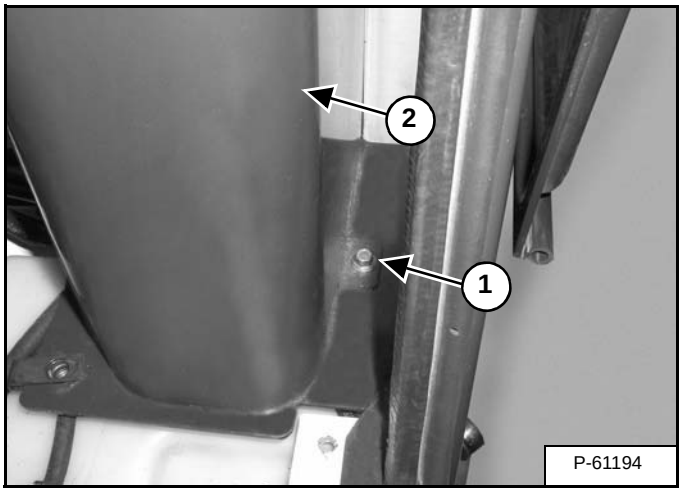
W-2103-1285

Figure 40-120-1



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

Figure 40-120-2

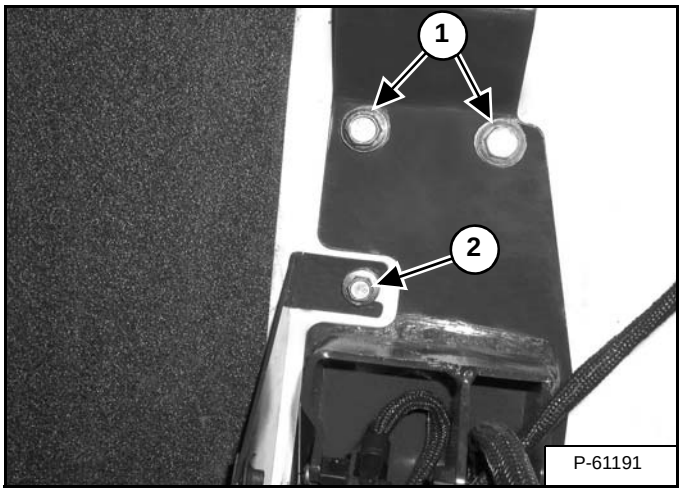


Remove the bolt (Item 1) and cover (Item 2) **[Figure 40-120-2]**.

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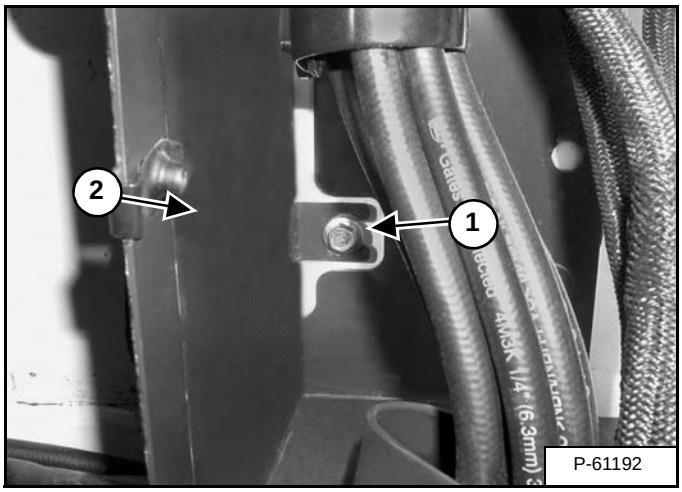
Removal And Installation (Cont'd)

Figure 40-120-3



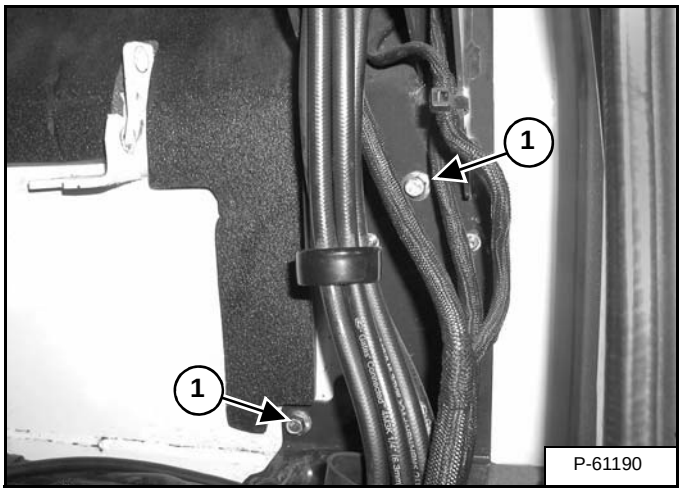
Remove the bolts (Item 1) and loosen the bolt (Item 2) **[Figure 40-120-3]**

Figure 40-120-4



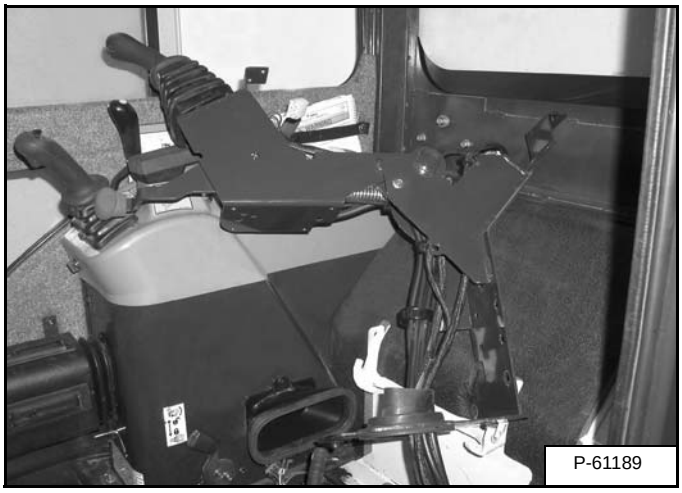
Loosen the bolt (Item 1) and remove the console side frame (Item 2) **[Figure 40-120-4]**.

Figure 40-120-5



Remove the bolts (Item 1) **[Figure 40-120-5]**.

Figure 40-120-6

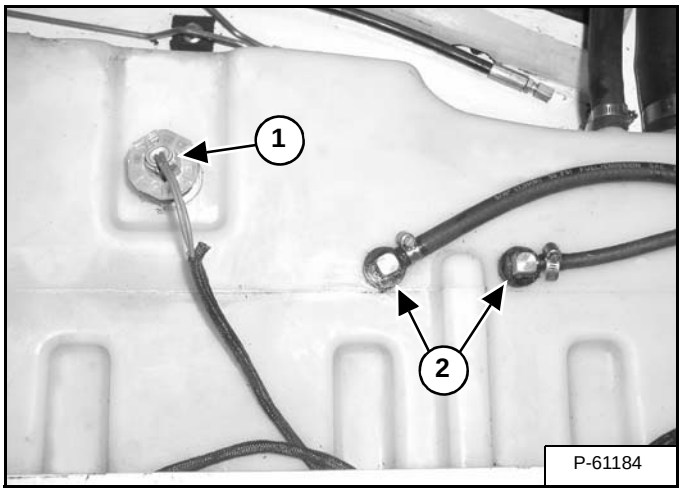


Reposition the left console as shown **[Figure 40-120-6]**.

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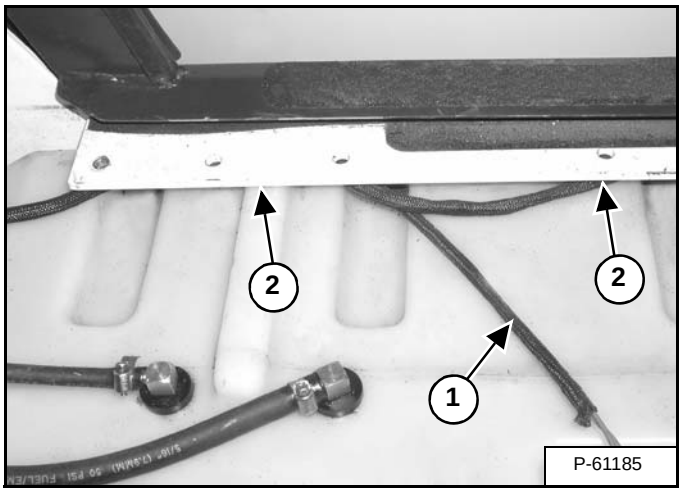
Removal And Installation (Cont'd)

Figure 40-120-7



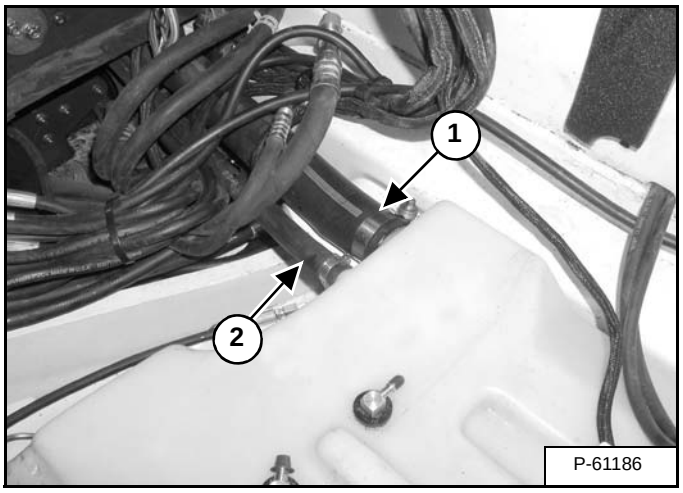
Remove the fuel sending unit wire harness (Item 1) and hoses (Item 2) **[Figure 40-120-7]**.

Figure 40-120-8



Installation: Route the wire harness (Item 1) between the ribbed sections (Item 2) **[Figure 40-120-8]** of the fuel tank.

Figure 40-120-9

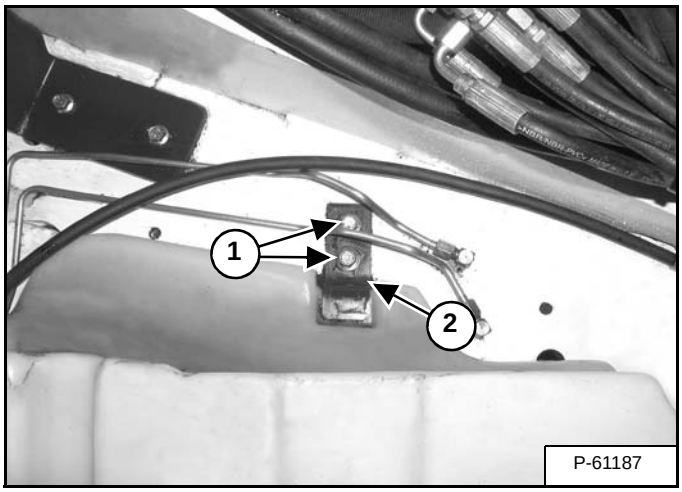


Remove the fuel fill hose (Item 1) and vent hose (Item 2) **[Figure 40-120-9]**.

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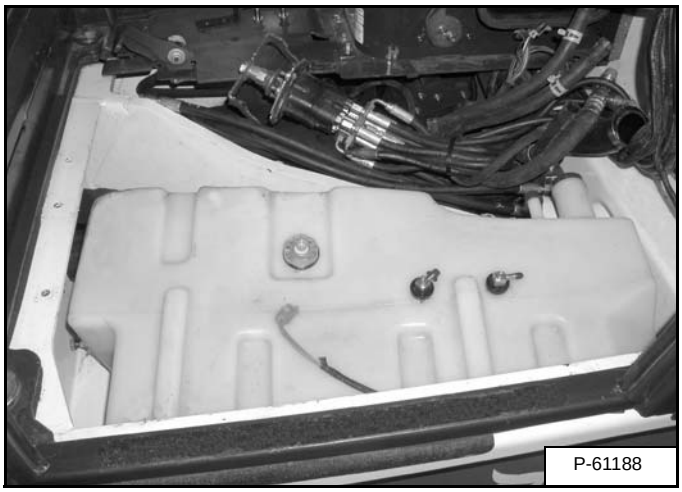
Removal And Installation (Cont'd)

Figure 40-120-10



Remove the bolts (Item 1) and fuel tank mount (Item 2) **[Figure 40-120-10]**.

Figure 40-120-11



Remove the fuel tank **[Figure 40-120-11]**.

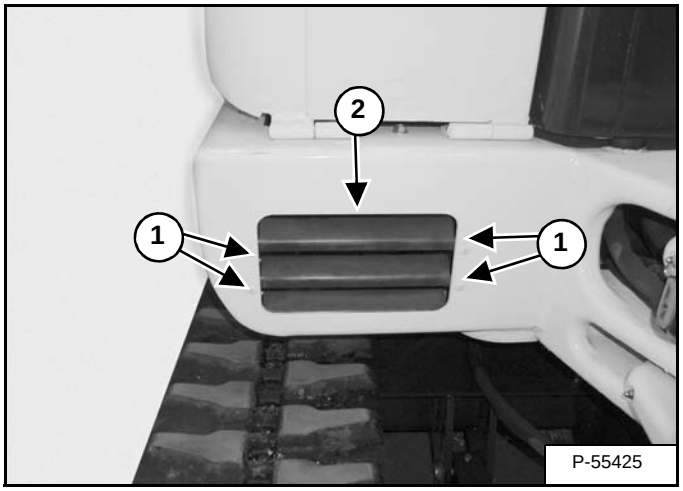
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HORN

Removal And Installation (Early Models)

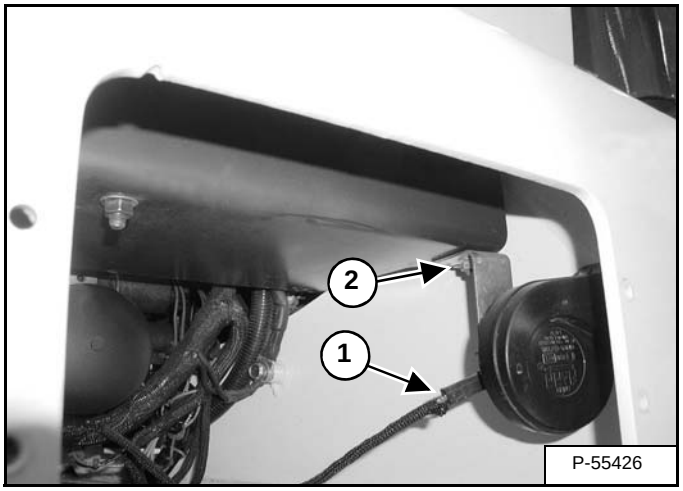
Access the horn through the right front side of the upperstructure.

Figure 40-130-1



Remove the bolts (Item 1). Remove the cover (Item 2) **[Figure 40-130-1]**.

Figure 40-130-2



Disconnect the wire harness from the horn (Item 1) **[Figure 40-130-2]**.

Remove the bolt (Item 2) **[Figure 40-130-2]** and remove the horn.

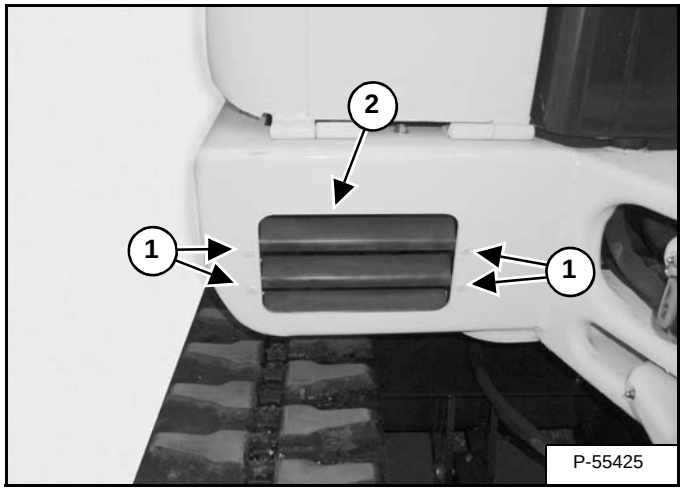
NOTE: The bolt is also the left battery clamp bolt.

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Removal And Installation (Later Models)

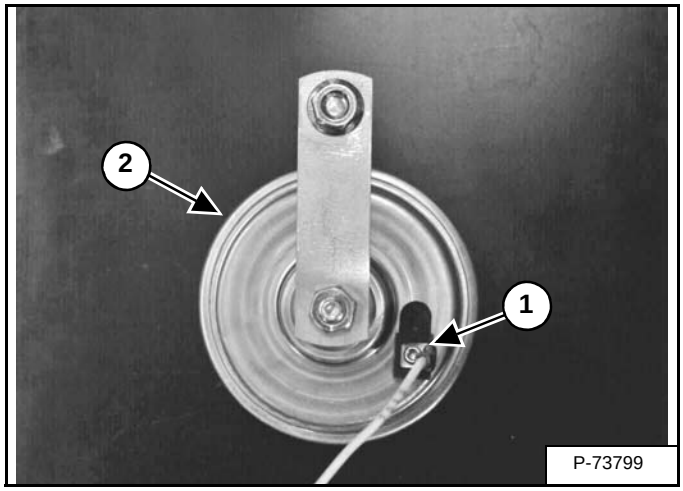
Access the horn through the right front side of the upperstructure.

Figure 40-130-3



Remove the bolts (Item 1). Remove the cover (Item 2) **[Figure 40-130-3]**.

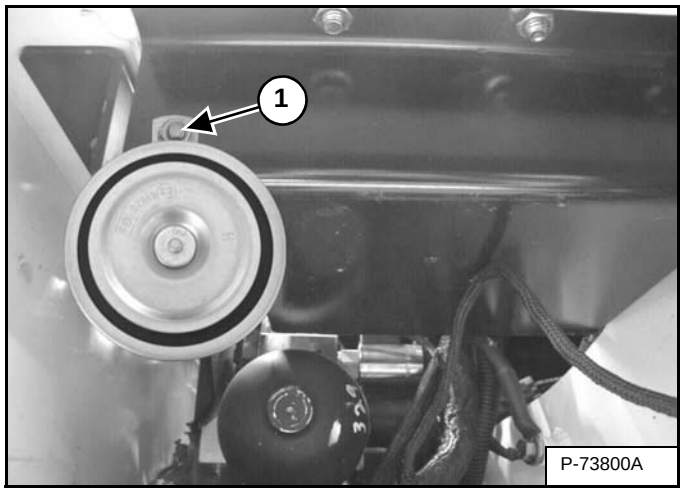
Figure 40-130-4



NOTE: Horn shown removed for visual clarity [Figure 40-130-4].

Disconnect the wire harness (Item 1) from the horn (Item 2) **[Figure 40-130-4]**.

Figure 40-130-5



Remove the nut (Item 1) **[Figure 40-130-3]** and remove the horn.

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SWING FRAME

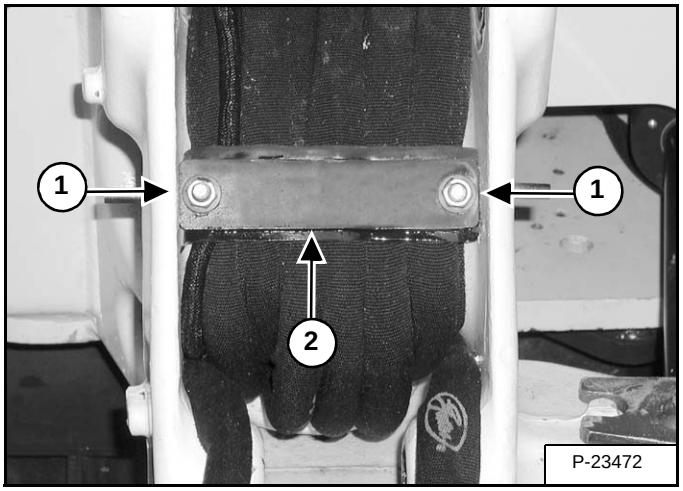
Removal And Installation

Rotate the upperstructure so the blade is to the rear of the excavator.

Remove the arm. (See Removal And Installation on Page 40-161-1.)

Remove the boom. (See Removal And Installation on Page 40-150-1.)

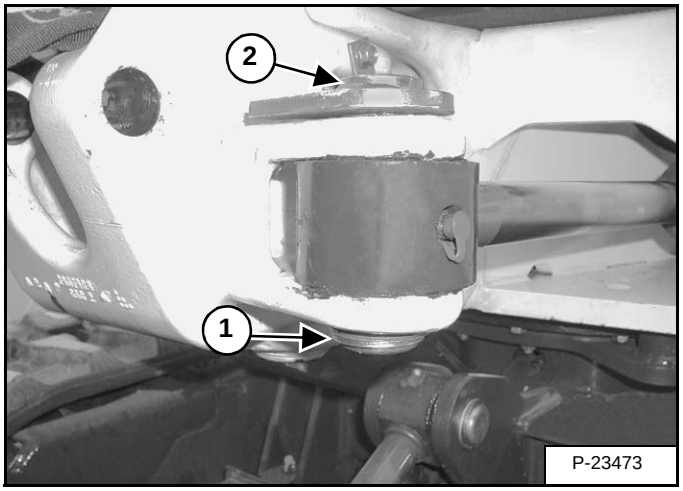
Figure 40-140-1



Remove the bolts (Item 1) and the clamp (Item 2) **[Figure 40-140-1]**.

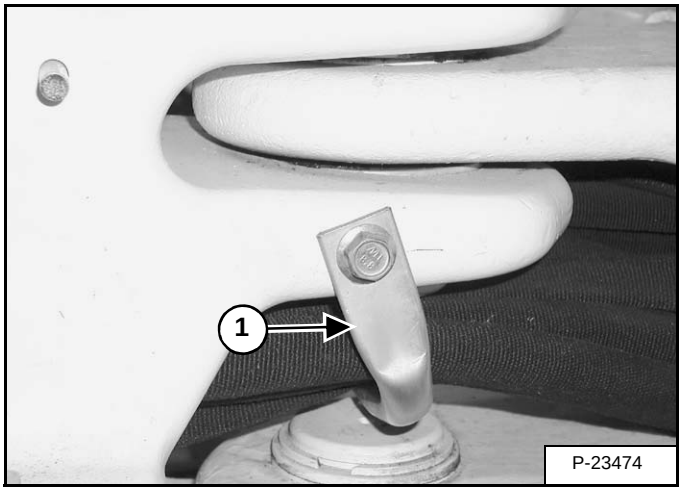
NOTE: When the hoses have been removed from the clamped position, the hoses must be measured for correct clamped length and position. (See Boom Swing Frame Hose Routing on Page 40-140-5.)

Figure 40-140-2



Remove the snap ring (Item 1), washer, and pin (Item 2) **[Figure 40-140-2]** from the swing frame.

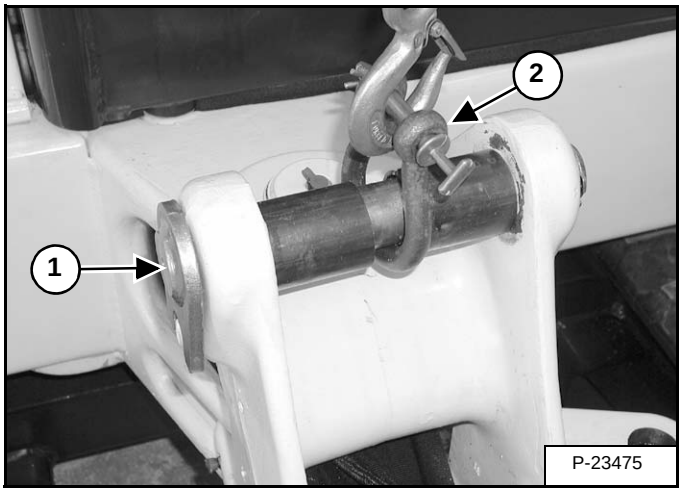
Figure 40-140-3



Remove the hose bracket (Item 1) **[Figure 40-140-3]**.

Reposition the hoses to gain clearance.

Figure 40-140-4



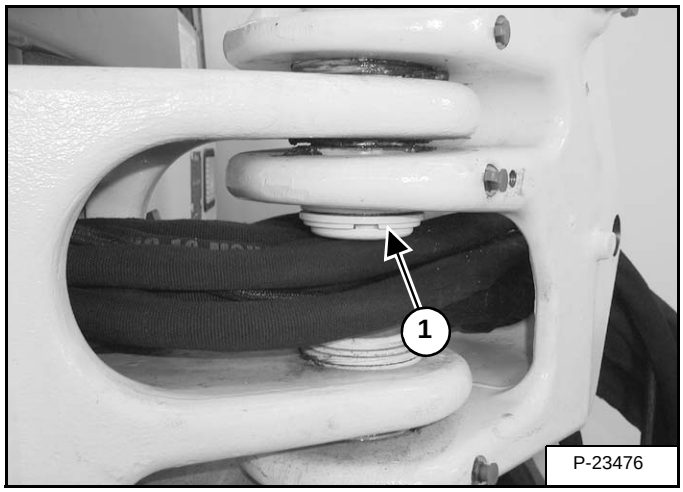
Install the boom pin (Item 1) using spacers to position a lifting clevis (Item 2) **[Figure 40-140-4]** on the center of the boom pin.

NOTE: The spacers will prevent the clevis from sliding on the boom pin causing the swing frame to tip from side to side.

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Removal And Installation (Cont'd)

Figure 40-140-5



Remove the snap ring (Item 1) **[Figure 40-140-5]** and washer from the top pin.

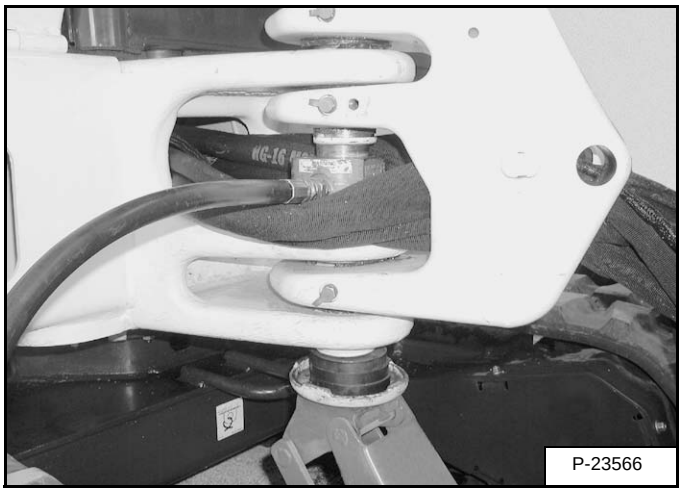
IMPORTANT

Do Not use a porta-power to press out the swing bracket pivot pins without the lower pin being supported. Excess pressure can cause the swing bracket casting to crack.

I-2092-1195

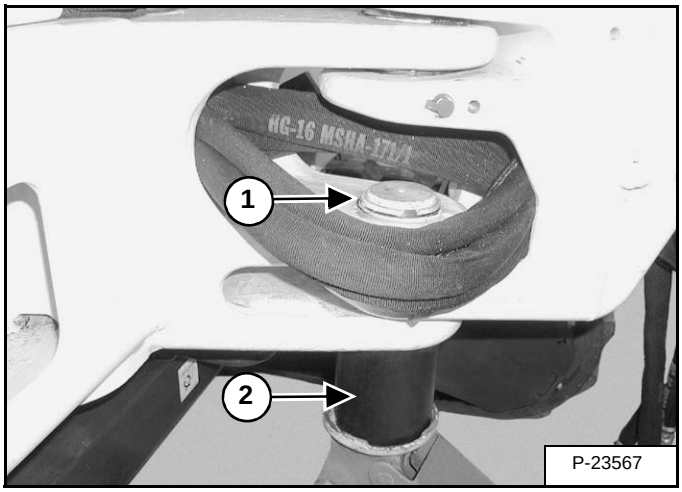
Support the bottom pin with a jack.

Figure 40-140-6



Install a porta-power between the top and bottom pins and press the top pin out **[Figure 40-140-6]**.

Figure 40-140-7



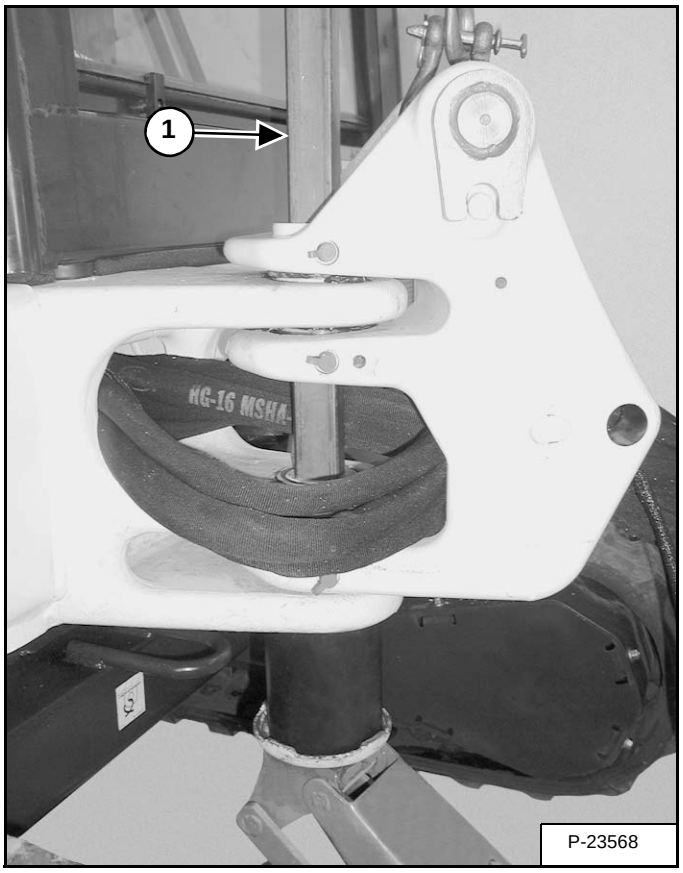
Remove the snap ring (Item 1) **[Figure 40-140-7]** and washer from the pin.

Install a spacer tube (Item 2) **[Figure 40-140-7]** and jack under the swing frame to support the casting. The spacer tube must be large enough to allow the pin to be driven in the center of the spacer for pin removal.

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Removal And Installation (Cont'd)

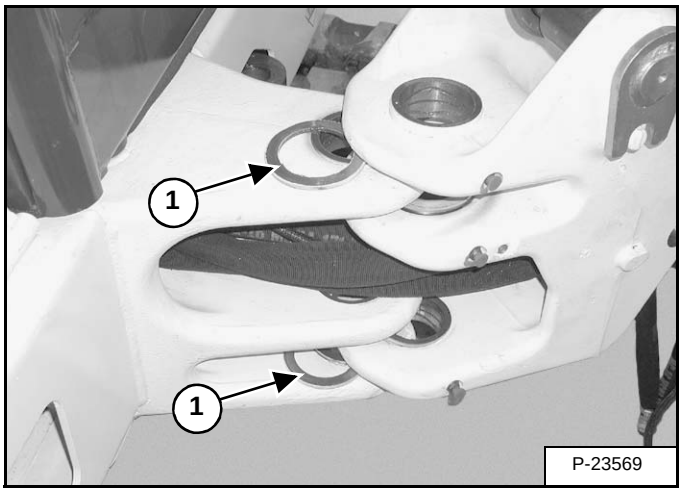
Figure 40-140-8



Use a large punch (Item 1) **[Figure 40-140-8]** and drive the bottom swing frame pin out.

NOTE: Do not use a porta-power to press out the bottom pin because the top casting cannot be supported and possible damage to the casting could occur.

Figure 40-140-9



Remove the top and bottom spacer (Item 1) **[Figure 40-140-9]** from the swing frame.

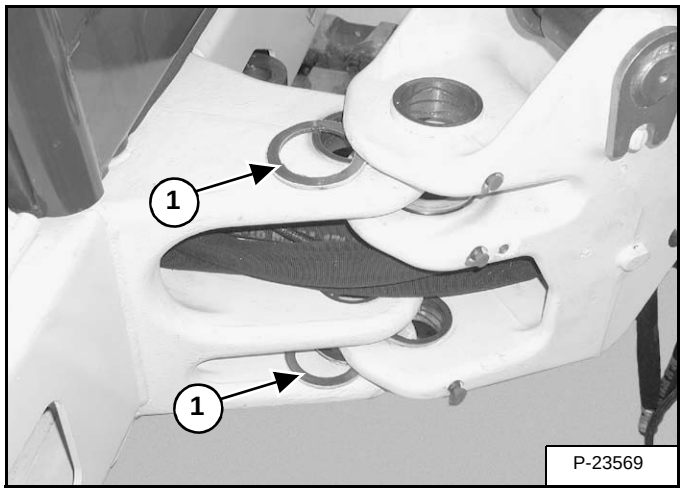
Remove the swing frame.

Inspect the bushings for damage. Replace damaged bushings as necessary. (See Bushing Removal on Page 40-140-6.)

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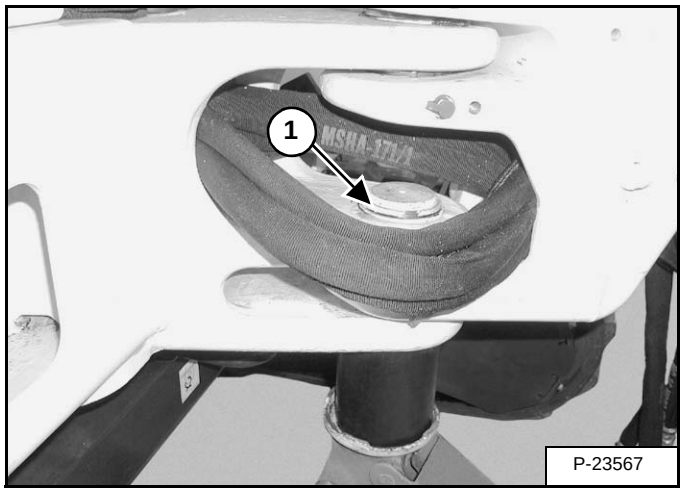
Removal And Installation (Cont'd)

Figure 40-140-10



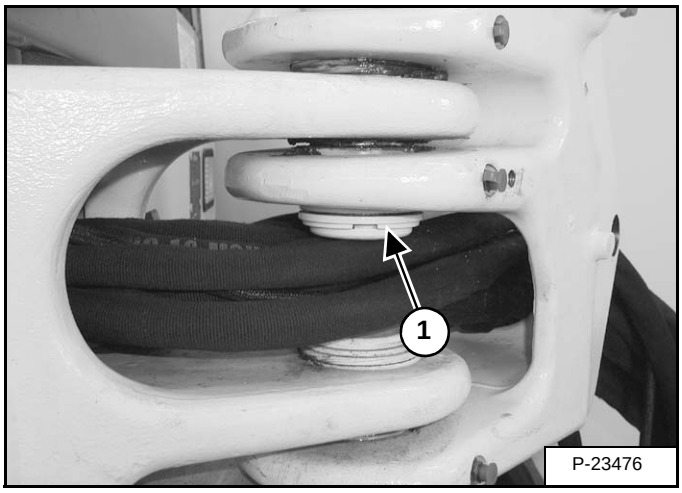
Installation: Install the top and bottom spacer (Item 1) **[Figure 40-140-10]** on the swing frame. Install the swing frame.

Figure 40-140-11



Installation: Align the boom swing frame and install the lower pin. Install the washer and snap ring (Item 1) **[Figure 40-140-11]**. Lift up on the boom swing frame.

Figure 40-140-12

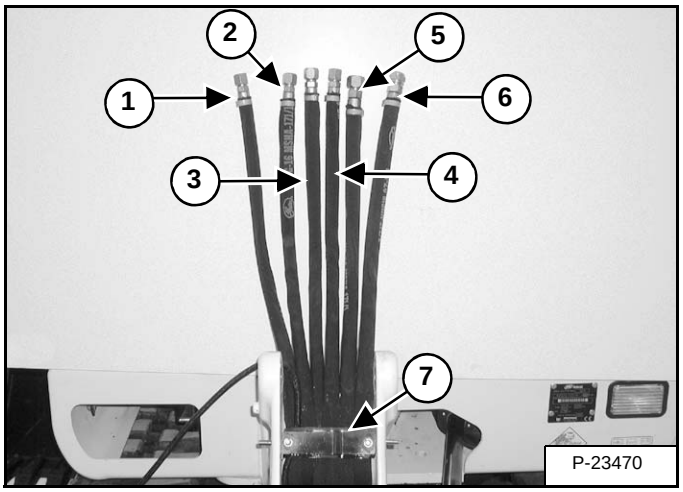


Installation: Install the top pin, washer and snap ring (Item 1) **[Figure 40-140-12]**.

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Boom Swing Frame Hose Routing

Figure 40-140-13



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

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

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

Figure 40-140-14



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

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

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Bushing Removal

IMPORTANT

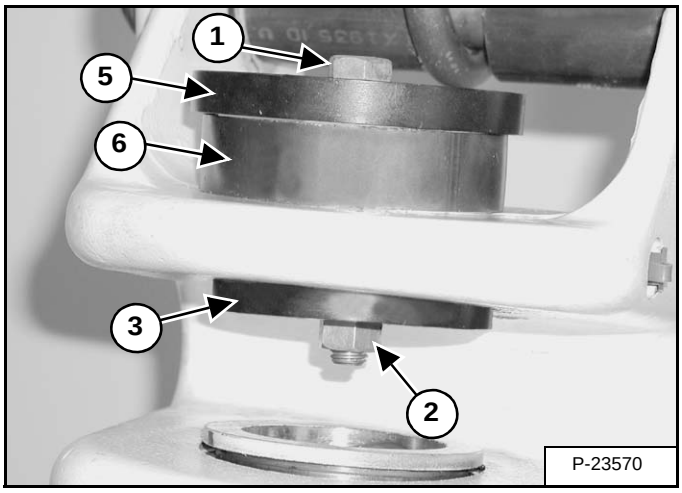
Do Not point (hammer) on the boom swing bracket. Excess pressure can cause the casting to crack.

I-2095-1195

The following parts will be needed for removal and installation of the swing frame bushings:

1. Bolt - 3/4 x 6 inches or (19 x 153 mm) long.
2. Nut - 3/4 inch or (19 mm).
3. Washer -7/8 I.D. x 3-1/8 O.D. x 3/8 inch thick or (22 mm I.D. x 79 mm O.D. x 10 mm thick.
4. Washer - 7/8 I.D. x 3-1/2 O.D. x 3/8 inch thick or (22 mm I.D. x 89 mm O.D. x 10 mm thick).
5. Washer - 7/8 I.D. x 4-1/2 O.D. x 1/2 inch thick or (22 mm I.D. 114 mm O.D. x 13 mm thick).
6. Spacer - 3-1/2 I.D. x 4-1/4 O.D. x 1-1/2 inch thick or (89 mm I.D. x 108 mm O.D. x 38 mm thick).

Figure 40-140-15



Install the spacer (Item 6) and washer (Item 5) **[Figure 40-140-15]** over the flanged end of the bushing.

The spacer (Item 6) **[Figure 40-140-15]** must be centered over the bushing to avoid contact between the bushing and the spacer during removal.

Install the washer (Item 3) **[Figure 40-140-15]** onto the opposite end of the bushing. This washer must be centered on the bushing and must not contact the casting.

Install the bolt (Item 1) and the nut (Item 2) **[Figure 40-140-15]** through the washers and the spacer.

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

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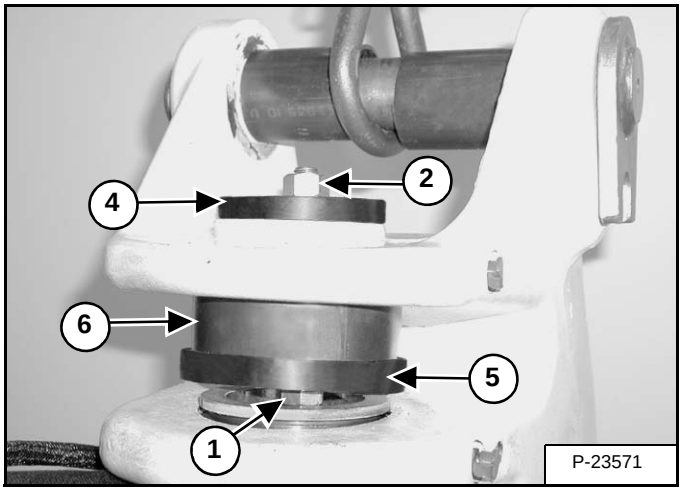
Bushing Installation

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

Center the bushing on the casting hole.

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

Figure 40-140-16



Put the washer (Item 4) **[Figure 40-140-16]** over the flanged end of the bushing.

Put the spacer (Item 6) and the washer (Item 5) **[Figure 40-140-16]** over the bushing hole casting. Center the spacer and the washer over the bushing hole.

Install the bolt (Item 1) through the washers, the spacer and the bushing. Install the nut (Item 2) **[Figure 40-140-16]**.

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

Figure 40-140-17

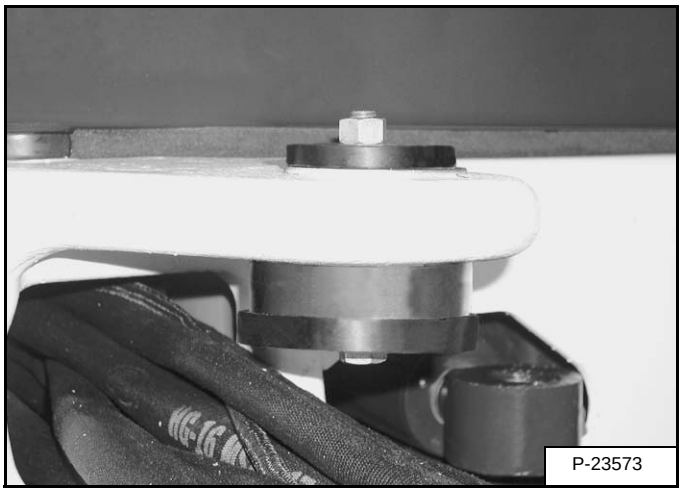
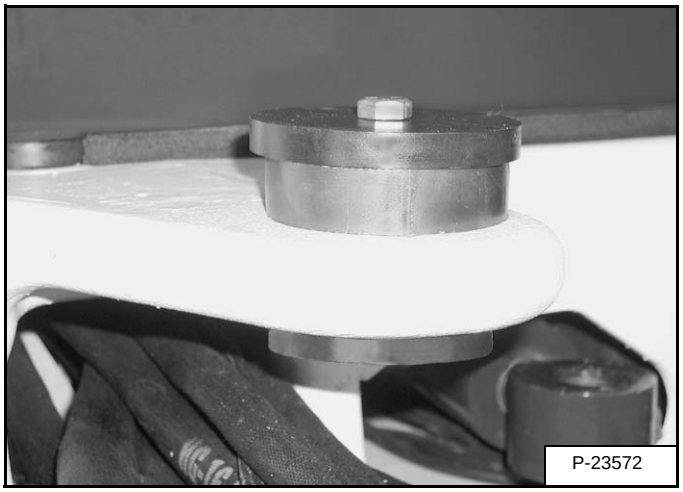


Figure 40-140-18



The same procedure is used to remove and install the bushings in the frame castings **[Figure 40-140-17]** & **[Figure 40-140-18]**.

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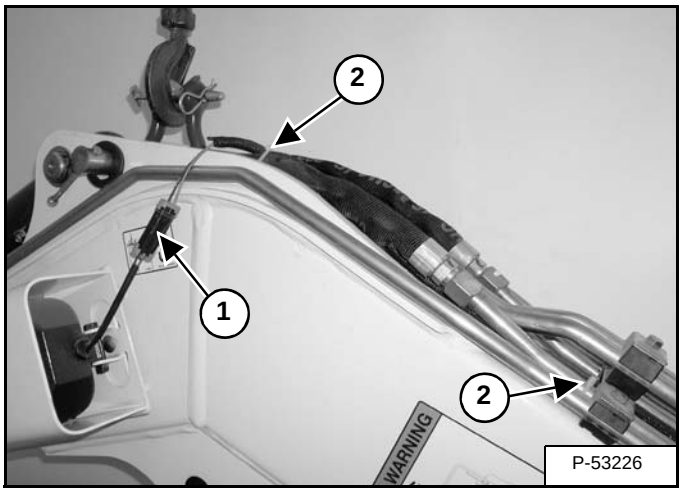
BOOM

Removal And Installation

Remove the arm.(See Removal And Installation on Page 40-161-1.)

Remove the boom cylinder. (See Removal And Installation on Page 20-20-4.)

Figure 40-150-1



Disconnect the wire harness (Item 1) **[Figure 40-150-1]**.

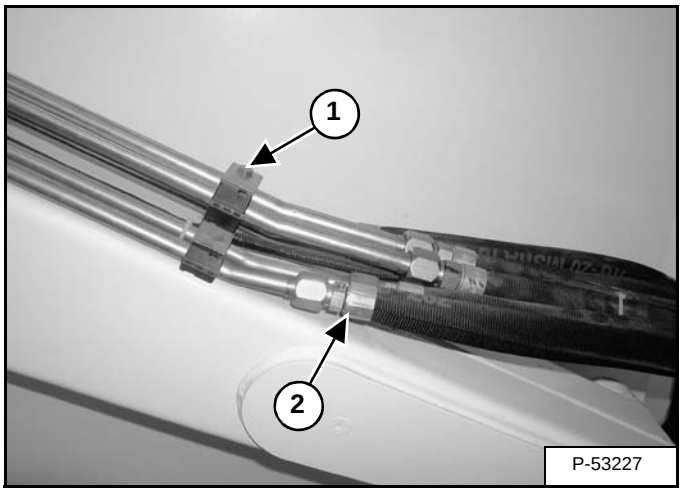
Cut and remove the cable ties (Item 2) **[Figure 40-150-1]**.

IMPORTANT

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

I-2003-0888

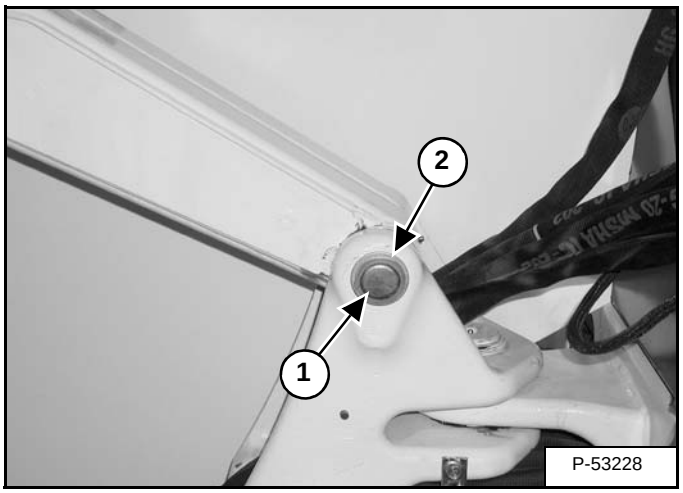
Figure 40-150-2



Remove the tubeline clamp (Item 1) **[Figure 40-150-2]**.

Mark and remove the hoses (Item 2) **[Figure 40-150-2]**.

Figure 40-150-3



Remove the snapring (Item 1), washers (Item 2) **[Figure 40-150-3]** and pin.

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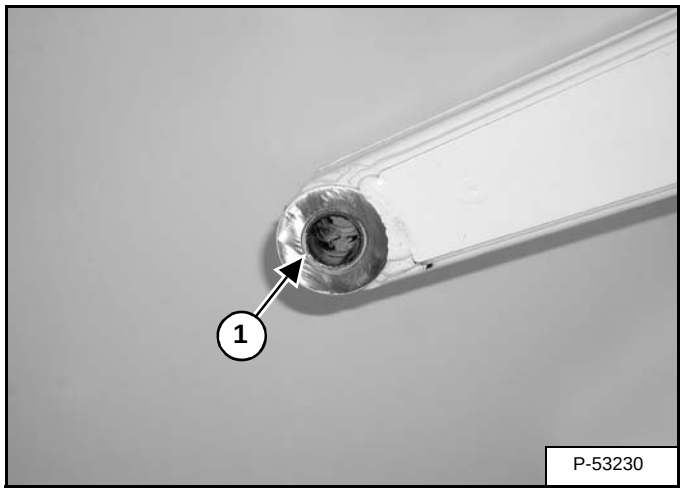
Removal And Installation (Cont'd)

Figure 40-150-4



Remove the boom **[Figure 40-150-4]**.

Figure 40-150-5

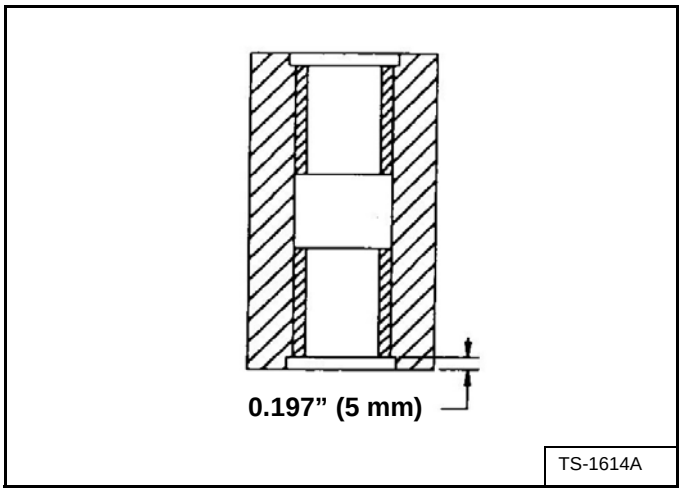


Remove the seals (Item 1) **[Figure 40-150-5]** from both sides of the boom.

Remove the bushings from both sides of the boom.

Install the new bushings in the boom.

Figure 40-150-6



Install the bushings until they are seated 0.197 inch (5 mm) in the pin boss **[Figure 40-150-6]**. (Both sides)

Install new seals on both sides of the boom.

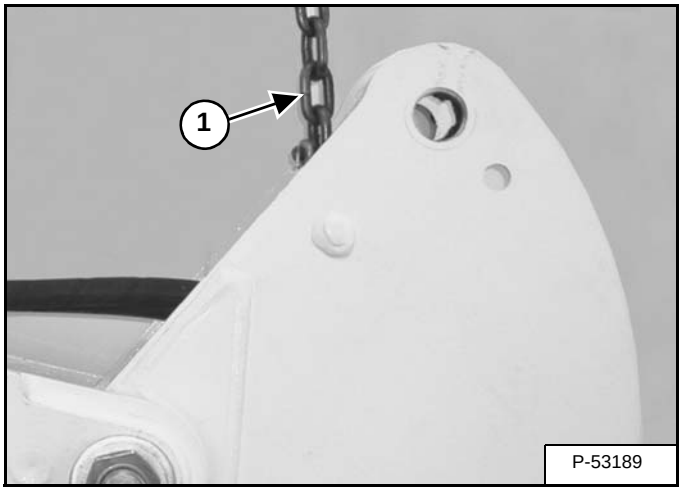
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STANDARD AND LONG ARM

Removal And Installation

Remove the arm cylinder. (See Removal And Installation on Page 20-21-3.)

Figure 40-160-1



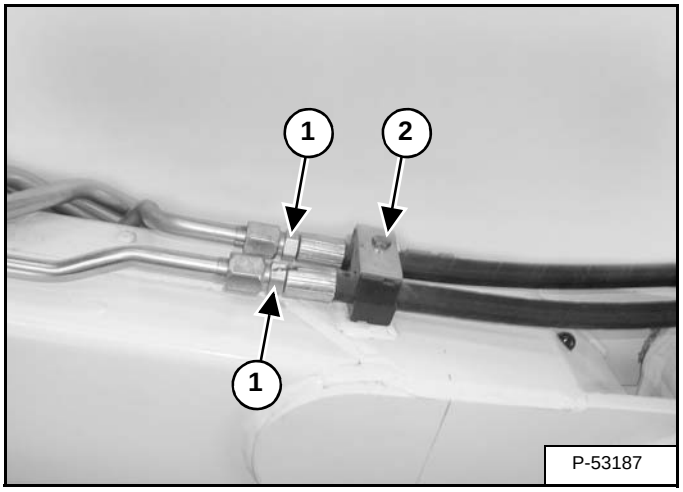
Support the arm with a chain hoist (Item 1) **[Figure 40-160-1]**.

IMPORTANT

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

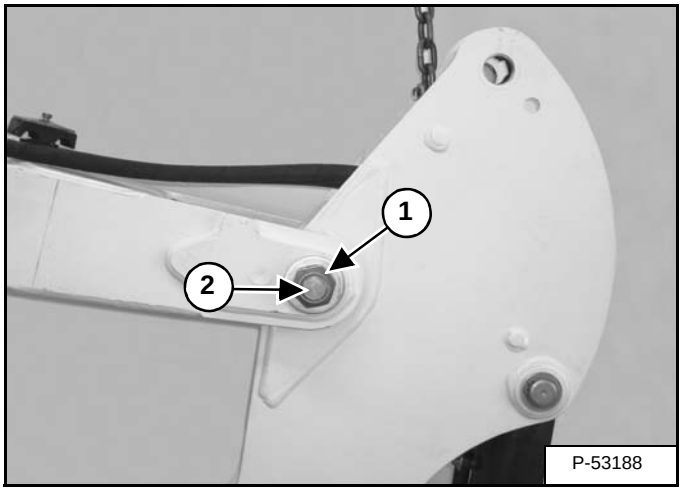
I-2003-0888

Figure 40-160-2



Mark and remove the hoses (Item 1). Remove the bolt (Item 2) **[Figure 40-160-2]** and tubeline clamps.

Figure 40-160-3



Remove the nut (Item 1) **[Figure 40-160-3]** and washer.

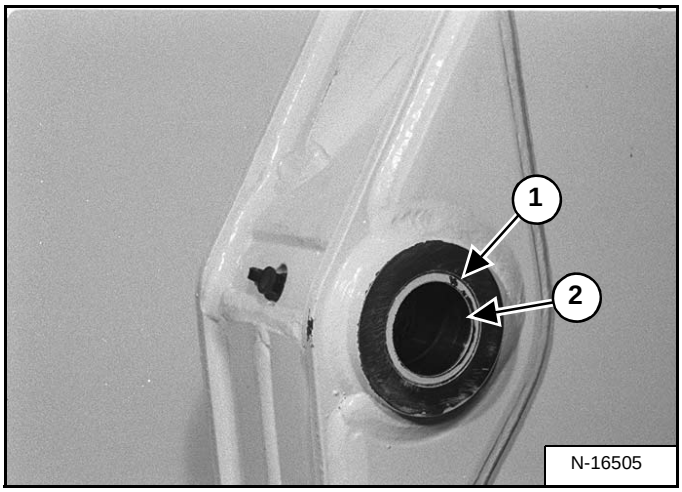
Installation: Tighten the nut until it is seated firmly against the boom. Do not over tighten and deflect the boom mounting plates.

Remove the pin (Item 2) **[Figure 40-160-3]**.

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Arm To Boom Bushing Removal And Installation

Figure 40-160-4

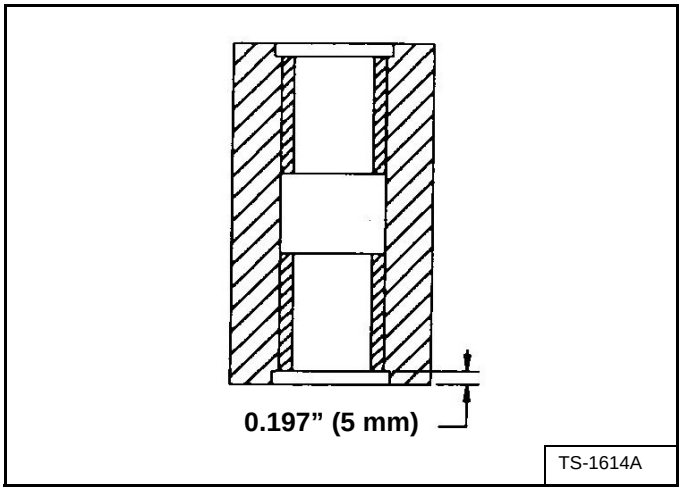


Remove the seals (Item 1) **[Figure 40-160-4]** from both sides of the arm.

Remove the bushings (Item 2) **[Figure 40-160-4]** from both sides of the arm.

Install the new bushings in the arm.

Figure 40-160-5



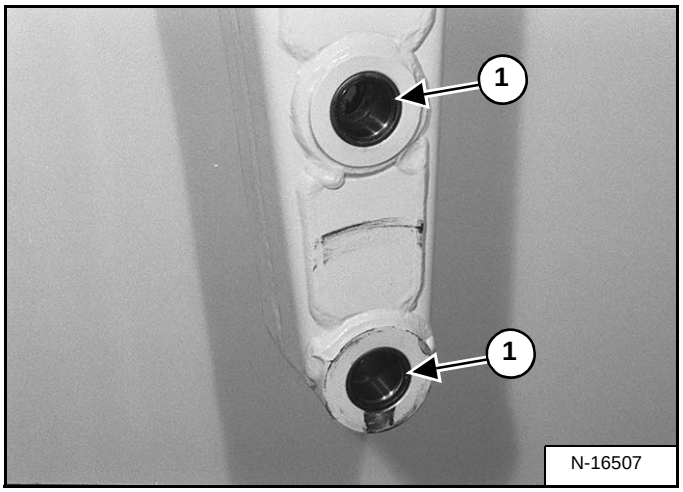
Install the bushings until they are seated 0.197 inches (5 mm) in the pin boss **[Figure 40-160-5]** (both sides).

Install new seals on both sides of the arm.

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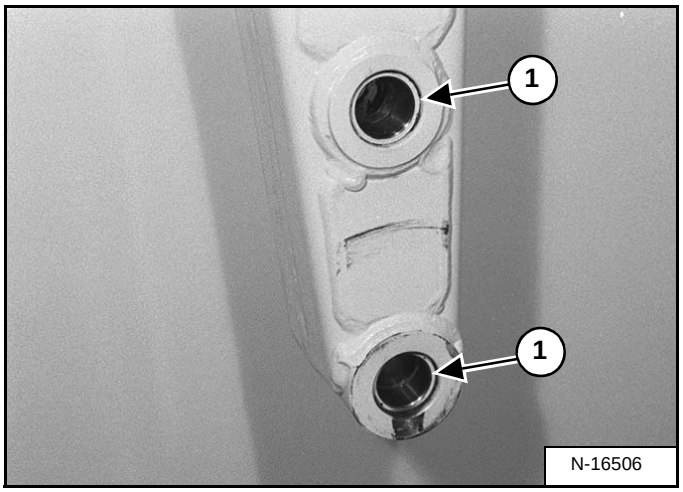
Arm To Bucket And Bucket Link Bushing Removal And Installation (Early Models)

Figure 40-160-6



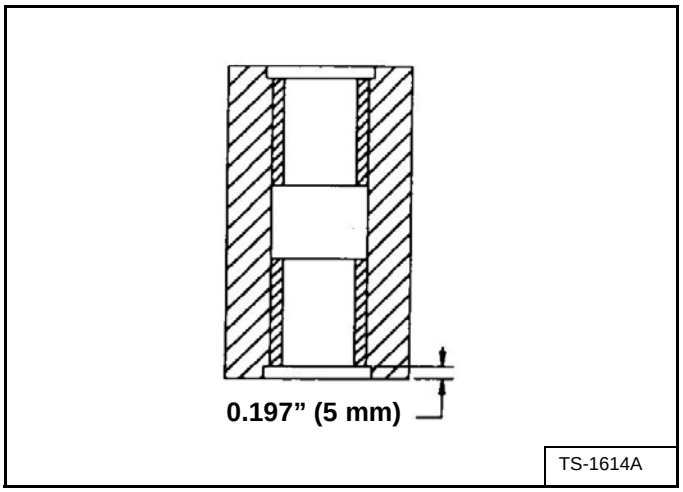
Remove the seals (Item 1) **[Figure 40-160-6]** from both sides of the arm.

Figure 40-160-7



Remove the bushings (Item 1) **[Figure 40-160-7]** from both sides of the arm.

Figure 40-160-8



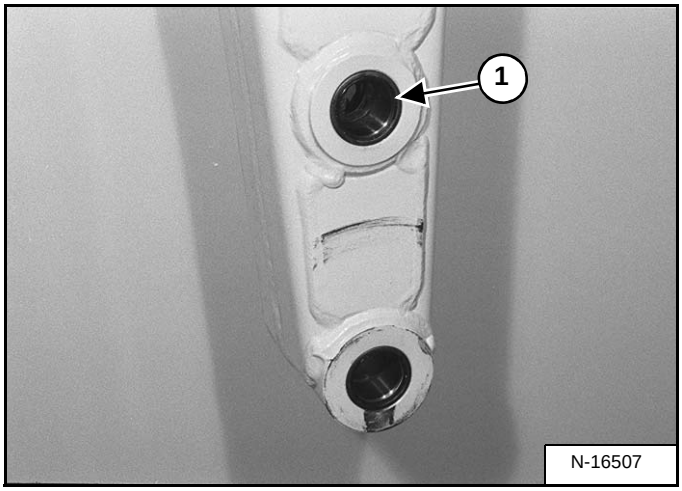
Install the bushings until they are seated 0.197 inches (5 mm) in the pin boss **[Figure 40-160-8]** (both sides).

Install new seals on both sides of the arm.

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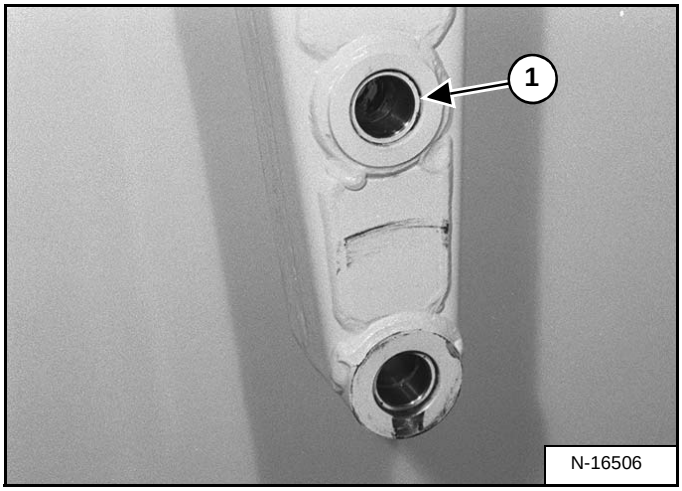
Arm To Bucket And Bucket Link Bushing Removal And Installation (Later Models)

Figure 40-160-9



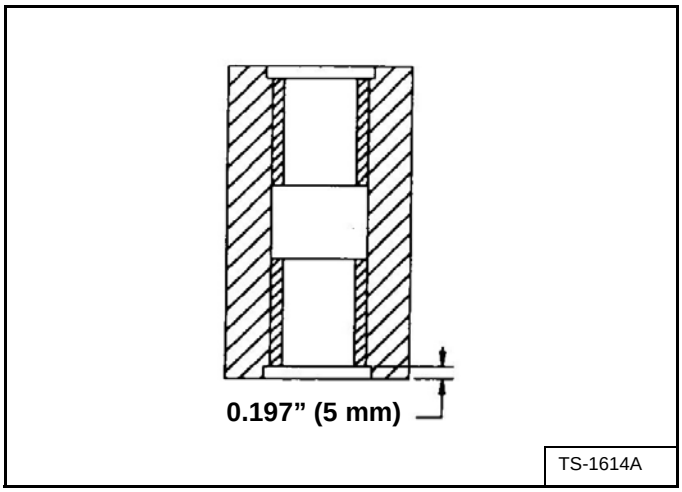
Remove the seals (Item 1) **[Figure 40-160-9]** from both sides of the arm.

Figure 40-160-10



Remove the bushings (Item 1) **[Figure 40-160-10]** from both sides of the arm.

Figure 40-160-11



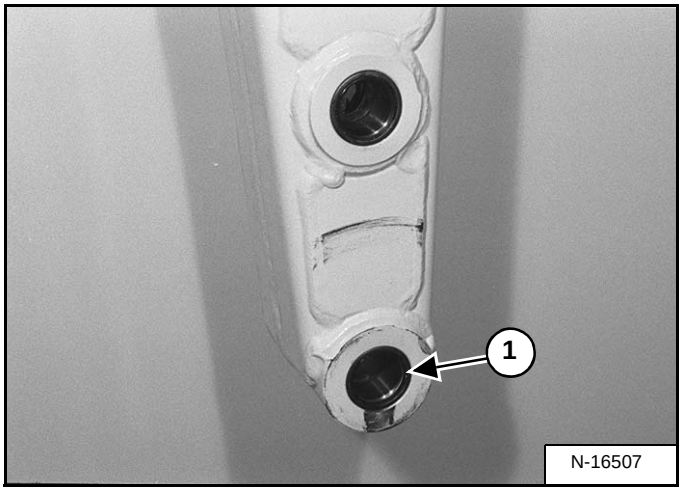
Install the bushings until they are seated 0.197 inches (5 mm) in the pin boss **[Figure 40-160-11]** (both sides).

Install new seals on both sides of the arm.

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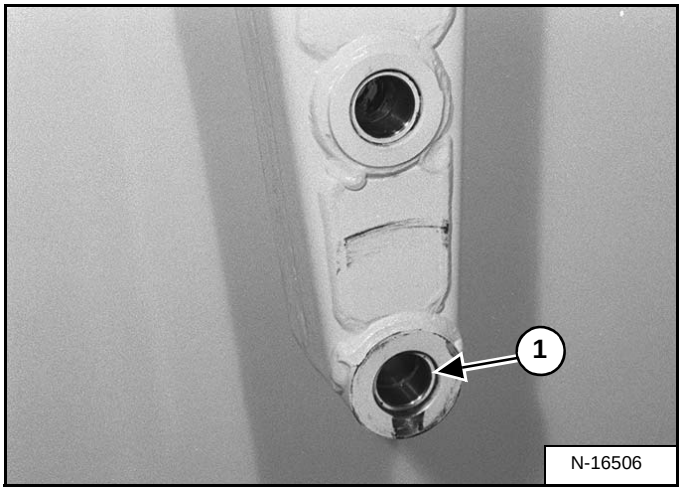
Arm To Bucket And Bucket Link Bushing Removal And Installation (Later Models) (Cont'd)

Figure 40-160-12



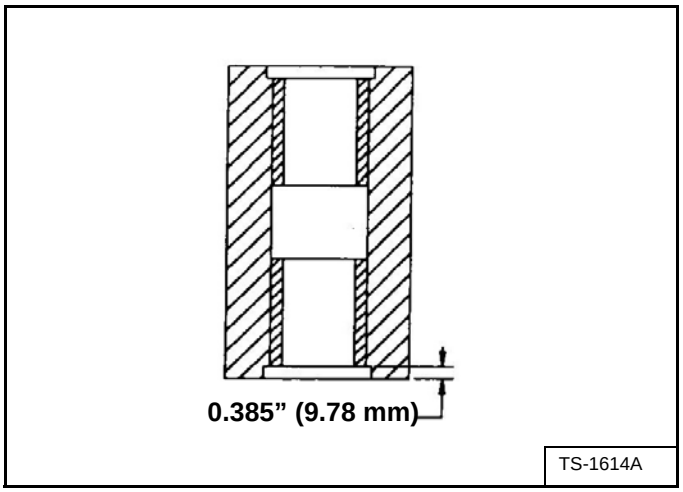
Remove the seals (Item 1) **[Figure 40-160-12]** from both sides of the arm.

Figure 40-160-13



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

Figure 40-160-14



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

Install new seals on both sides of the arm.

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EXTENDIBLE ARM

Removal And Installation

Remove the bucket.

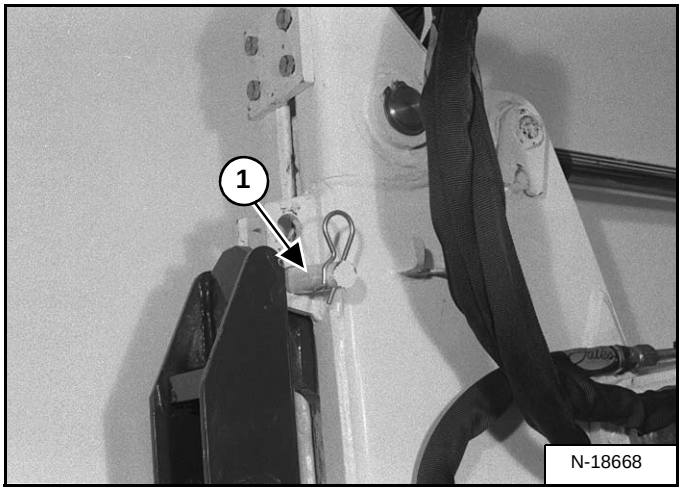
Remove the X-Change. (See Removal And Installation on Page 40-190-1.)

Remove the bucket cylinder. (See Removal And Installation (Standard And Long Arm) on Page 20-23-3.)

Remove the extendible arm cylinder. (See Removal And Installation on Page 20-21-3.)

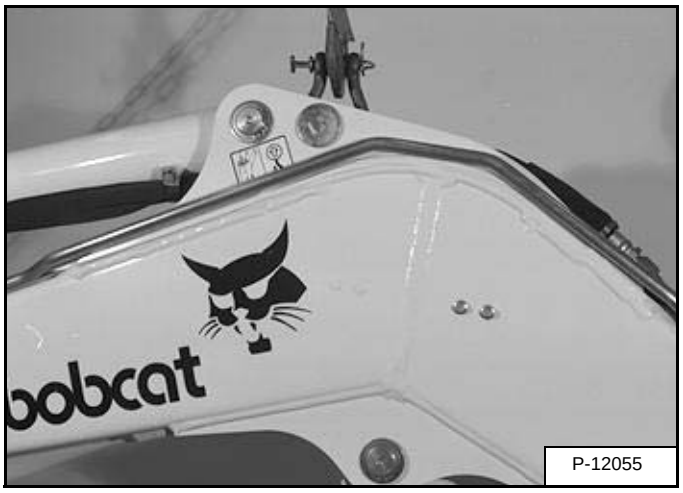
NOTE: The arm may be removed without removing the extendible arm and bucket cylinders. If the arm is going to be disassembled, remove both cylinders before removing the arm.

Figure 40-161-1



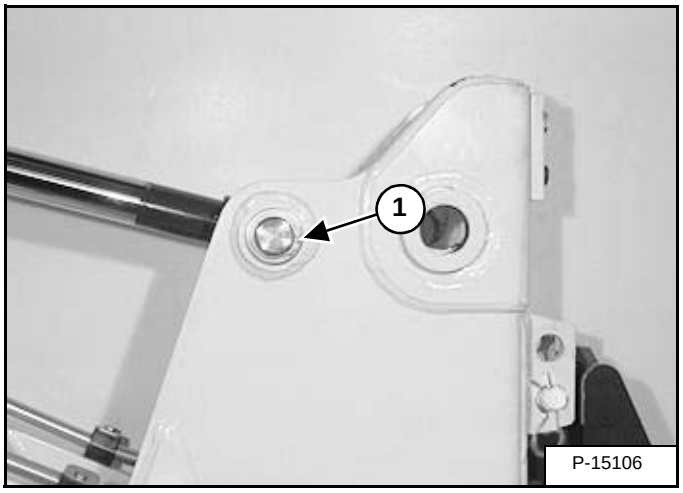
Fully retract the inner arm. Install the pin (Item 1) **[Figure 40-161-1]** in the lower hole locking the inner and outer arm together.

Figure 40-161-2



Support the boom **[Figure 40-161-2]**.

Figure 40-161-3

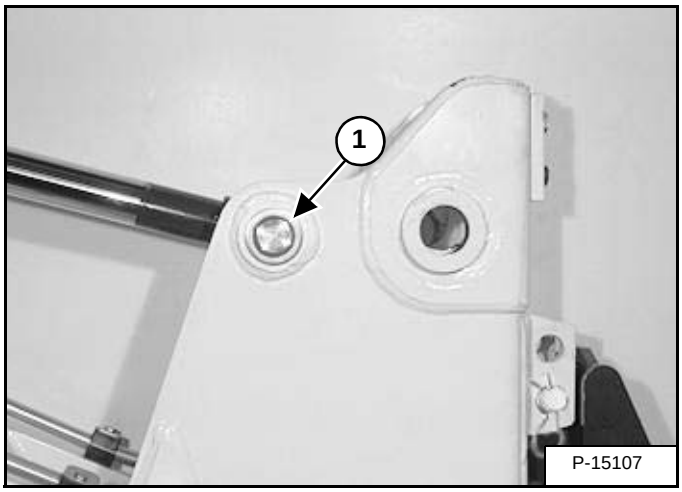


Remove the snap ring (Item 1) **[Figure 40-161-3]**.

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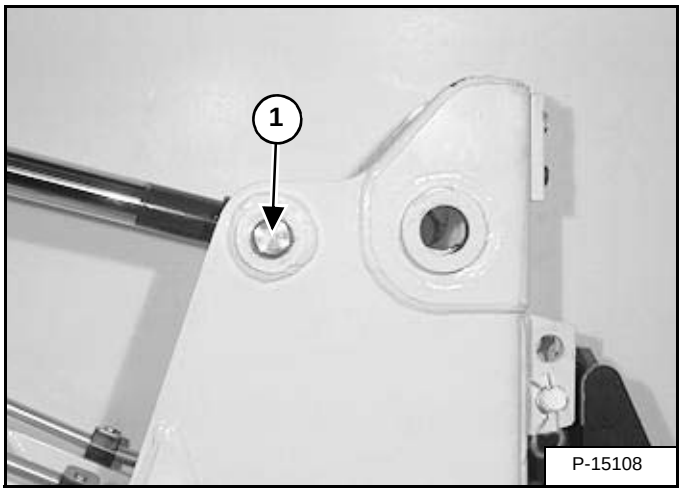
Removal And Installation (Cont'd)

Figure 40-161-4



Remove the washer (Item 1) **[Figure 40-161-4]**.

Figure 40-161-5

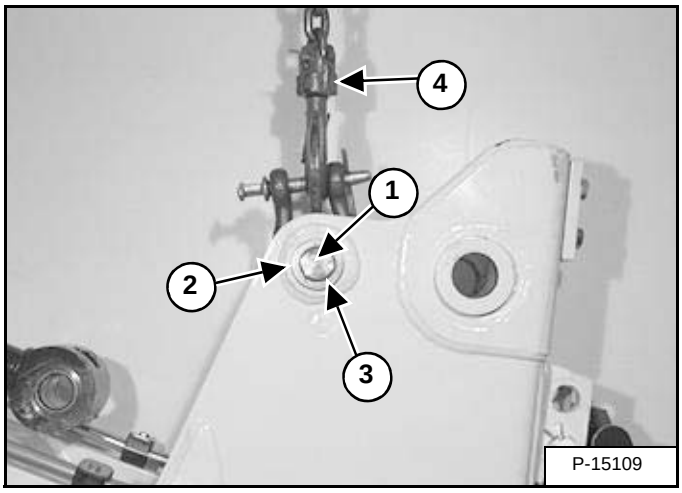


Remove the rod end pin (Item 1) **[Figure 40-161-5]**.

Start the excavator and retract the arm cylinder rod end.

Stop the excavator.

Figure 40-161-6



Reinstall the pin (Item 1), washer (Item 2) and snap ring (Item 3). Install a chain hoist (Item 4) **[Figure 40-161-6]** on the pin.

IMPORTANT

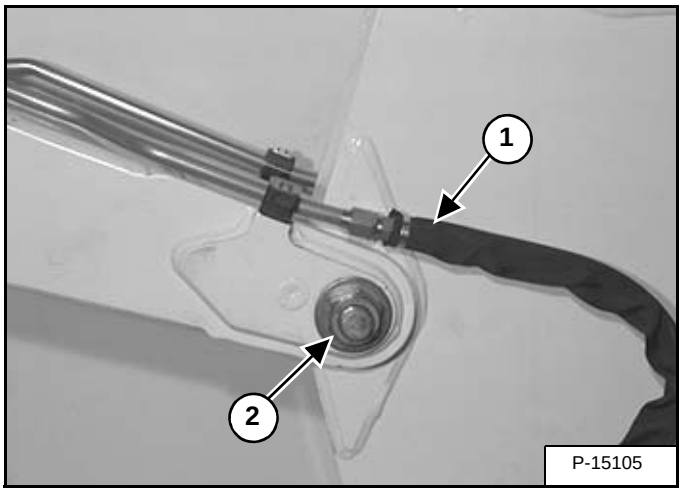
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tube lines and ports to keep dirt out. Dirt can quickly damage the system.

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Removal And Installation (Cont'd)

Figure 40-161-7

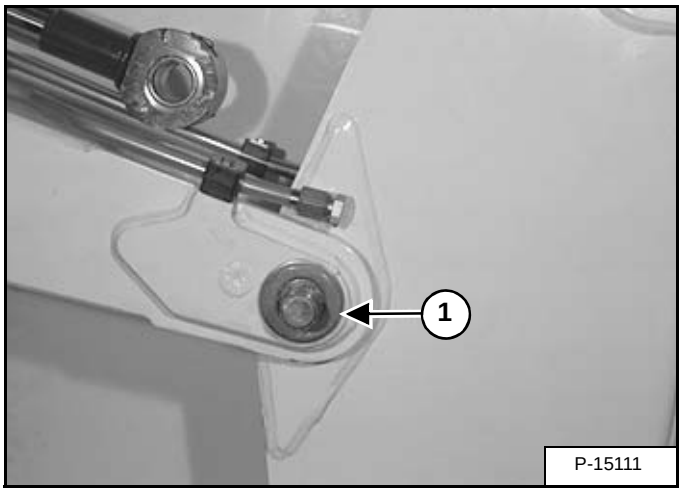


Remove the bucket cylinder hoses (Item 1) **[Figure 40-161-7]**.

Remove the nut (Item 2) **[Figure 40-161-7]**.

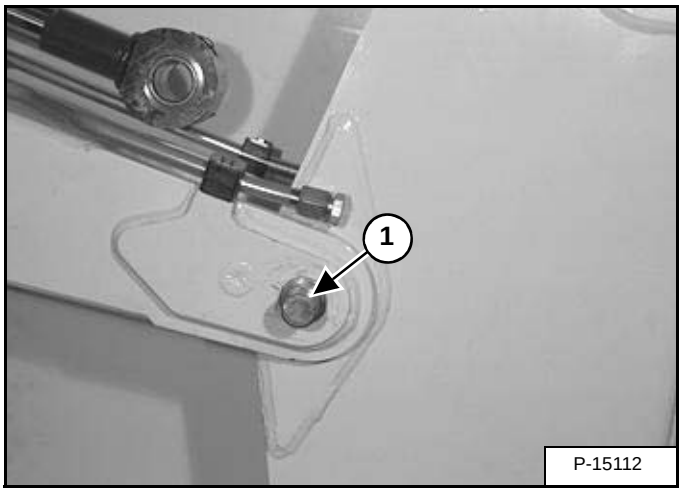
Installation: Tighten the nut until it is seated firmly against the boom. Do not over tighten and deflect the boom mounting plates. The arm must pivot freely.

Figure 40-161-8



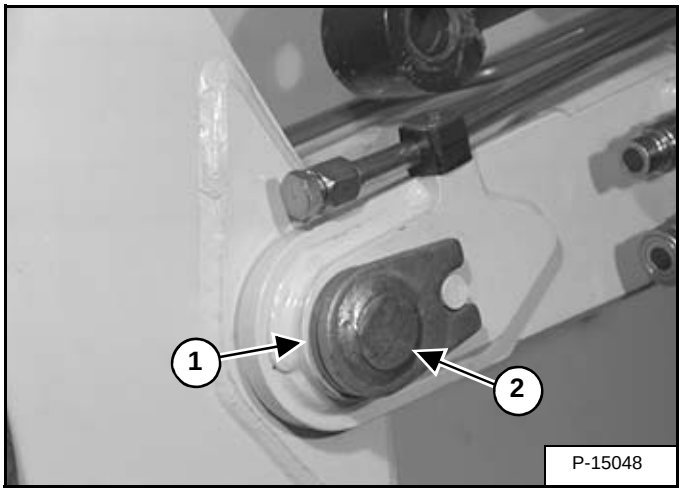
Remove the washer (Item 1) **[Figure 40-161-8]**.

Figure 40-161-9



Remove the pin (Item 1) **[Figure 40-161-9]**.

Figure 40-161-10

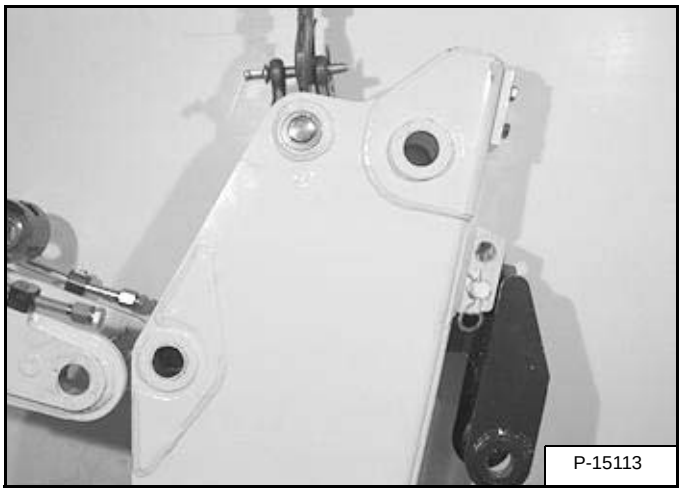


Installation: Install the washer (Item 1) on the pin (Item 2). Install the pin (Item 2) **[Figure 40-161-10]** through the boom and arm.

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Removal And Installation (Cont'd)

Figure 40-161-11

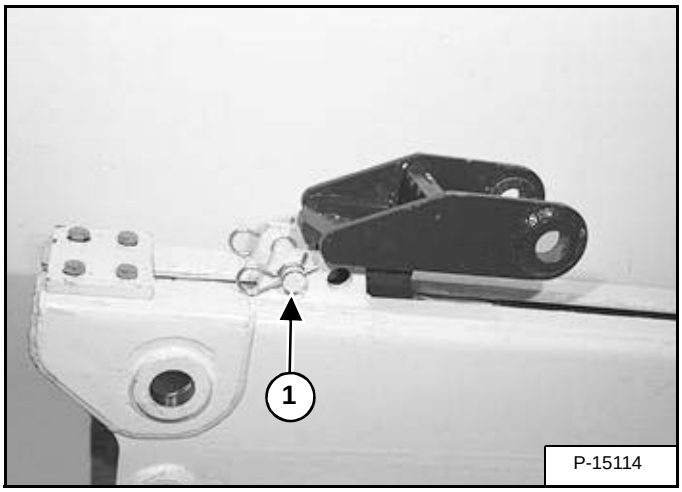


Remove the arm **[Figure 40-161-11]**.

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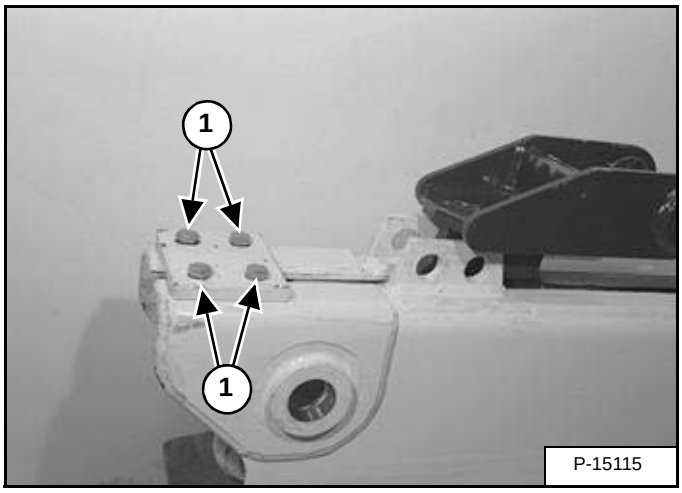
Disassembly And Assembly

Figure 40-161-12



Remove the lock pin (Item 1) **[Figure 40-161-12]**.

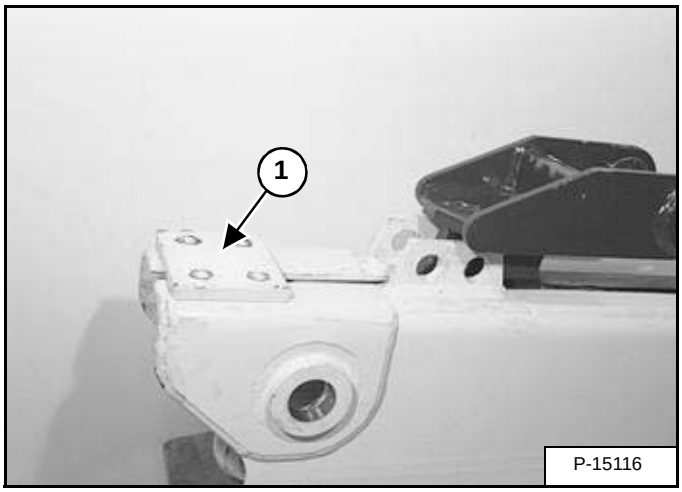
Figure 40-161-13



Remove the bolts (Item 1) **[Figure 40-161-13]** and nuts.

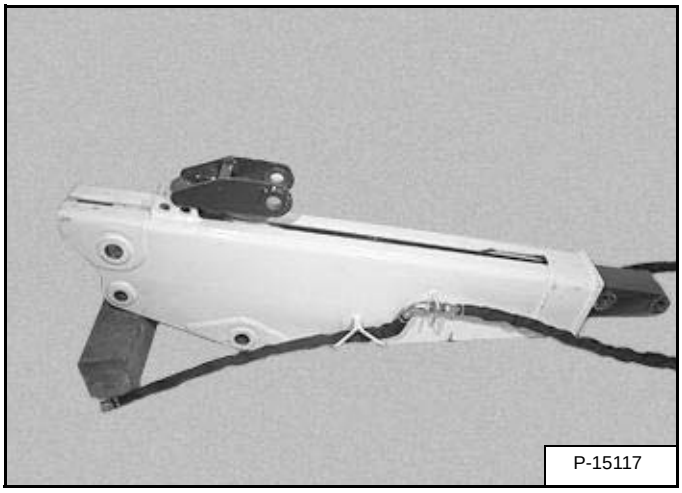
Installation: Tighten the bolts to 65 - 70 ft. lbs. (88 - 95 Nm) torque.

Figure 40-161-14



Remove the plate (Item 1) **[Figure 40-161-14]**.

Figure 40-161-15



Slide the inner arm out the top of the outer arm **[Figure 40-161-15]**.

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BUCKET

Bucket Teeth Removal And Installation

⚠ WARNING

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

- **Pressurized fluids and springs or other stored energy components.**
- **Flying debris or loose material is present.**
- **Engine is running.**
- **Tools are being used.**

W-2505-0604

Position the bucket so the bucket teeth are at a 30° angle up from the ground for accessibility to the teeth.

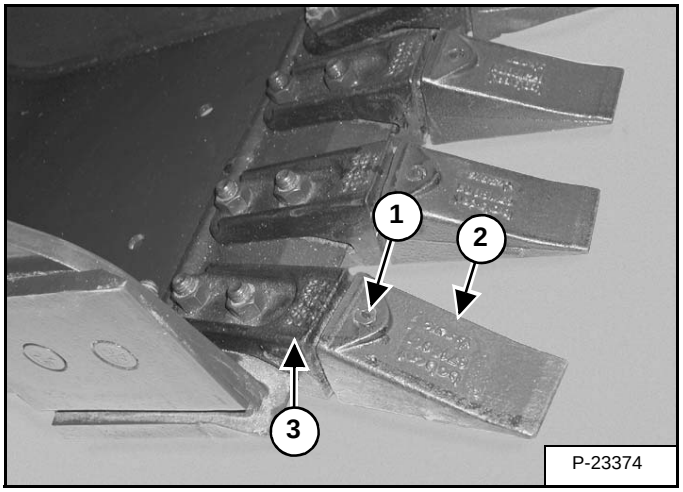
Lower the boom until the bucket is fully on the ground.

Stop the engine and exit the excavator.

NOTE: Early and later style tooth points and retaining pins are not interchangeable.

Early Style bucket Teeth

Figure 40-170-1

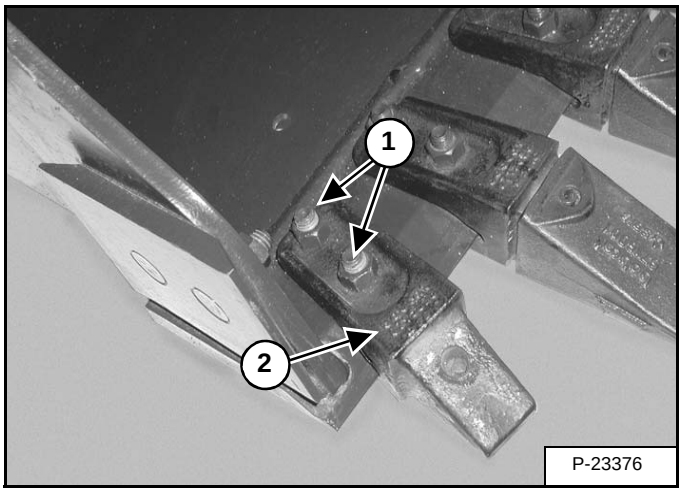


Remove the retaining pin (Item 1) from the tooth point (Item 2) **[Figure 40-170-1]**.

Remove the tooth point (Item 2) from the shank (Item 3) **[Figure 40-170-1]**.

Installation: Position the new tooth point on the shank and install a new retaining pin. Install the retaining pin until it is flush with the top of the point.

Figure 40-170-2



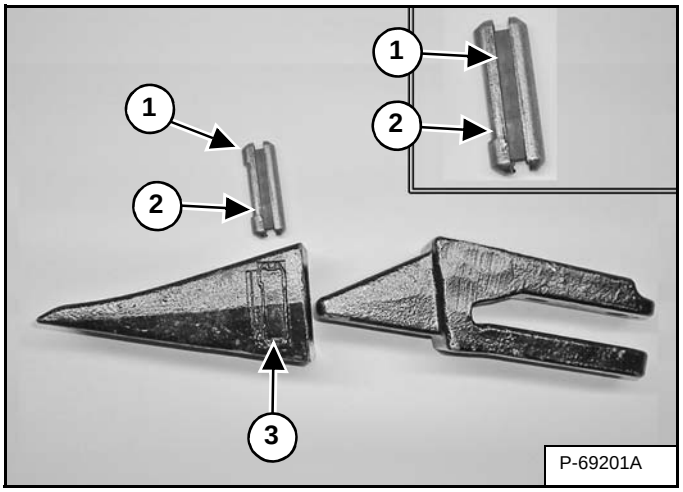
Remove the two nuts (Item 1) and bolts from the tooth shank (Item 2) **[Figure 40-170-2]**. Remove the tooth shank.

Installation: Tighten the nuts to 90-100 ft.-lb. (125-135 N•m) torque.

Later Style Bucket Teeth

The removal and installation procedure for the later style tooth point and tooth assembly is the same as the early. style.

Figure 40-170-3



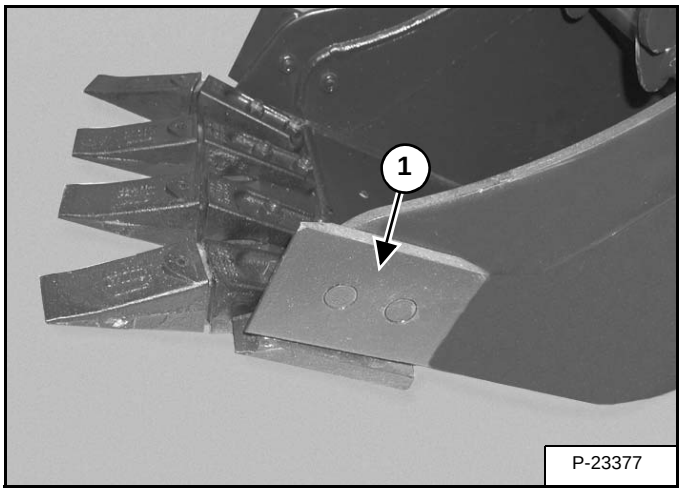
The later style tooth has a unique retaining pin (Item 1). The retaining pin must be installed as shown [notch (Item 2) to the front] for proper fit and tooth retention. The side of the tooth point (Item 3) **[Figure 40-170-3]** also shows the correct orientation of the retaining pin.

Installation: Position the new tooth point on the shank and install a new retaining pin. Install the retaining pin until it is flush with the top of the point.

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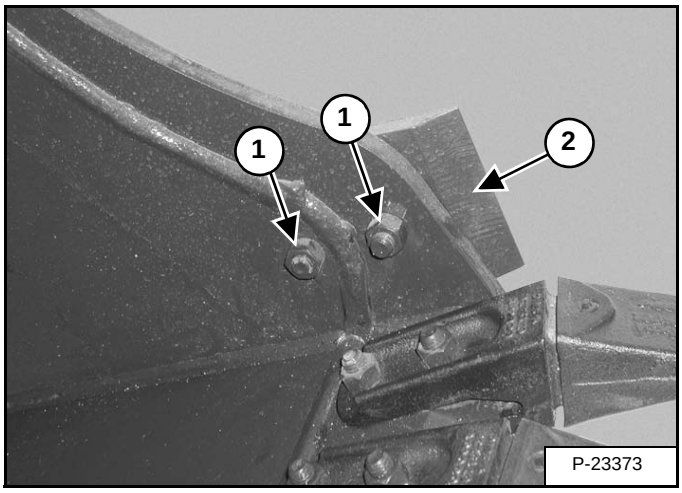
Bucket Side Cutting Edge Removal And Installation

Figure 40-170-4



The bucket side cutting edges (Item 1) **[Figure 40-170-4]** are reversible.

Figure 40-170-5



Remove the two bolts and nuts (Item 1) **[Figure 40-170-5]**.

Installation: Tighten the nuts to 90-100 ft.-lb. (125 - 135 N•m) torque.

Remove the cutting edge (Item 2) **[Figure 40-170-5]**.

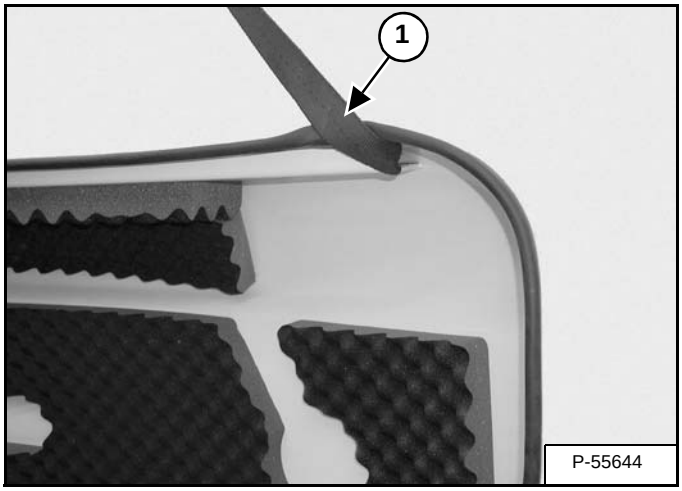
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TAILGATE

Removal And Installation

Open the tailgate.

Figure 40-180-1



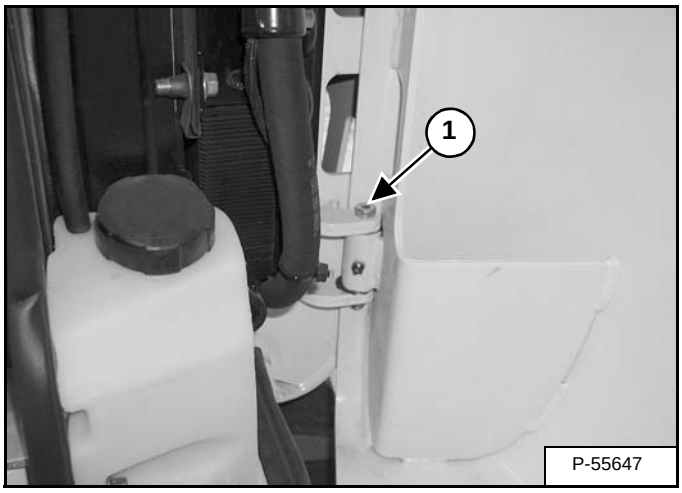
Install a sling (Item 1) **[Figure 40-180-1]** through the top tailgate brace.

Figure 40-180-2



Install an overhead hoist on the sling **[Figure 40-180-2]**.

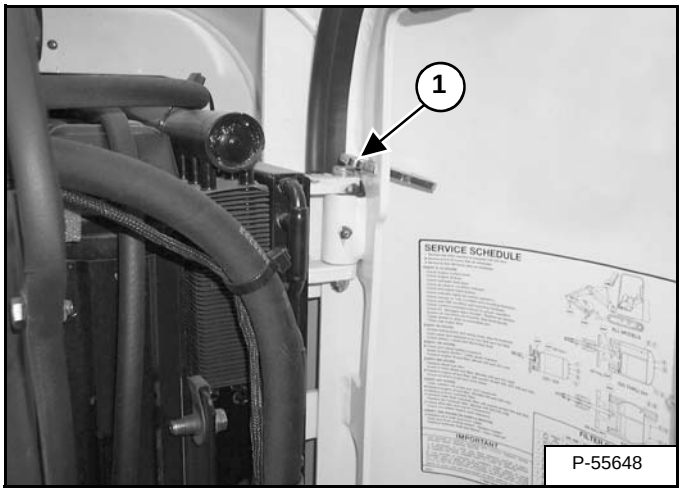
Figure 40-180-3



Remove the bottom bolt (Item 1) **[Figure 40-180-3]** and nut.

Installation: Tighten the bolt to 25-28 ft.-lbs. (34-38 Nm) torque.

Figure 40-180-4



Remove the top bolt (Item 1) **[Figure 40-180-4]** and nut.

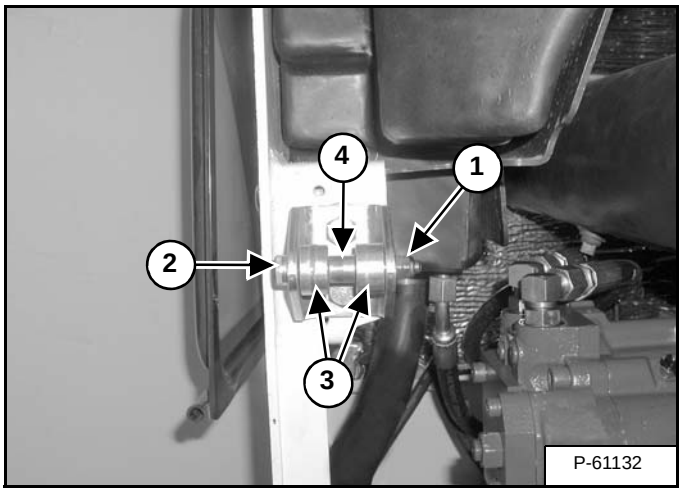
Installation: Tighten the bolt to 25-28 ft.-lbs. (34-38 Nm) torque.

Remove the tailgate.

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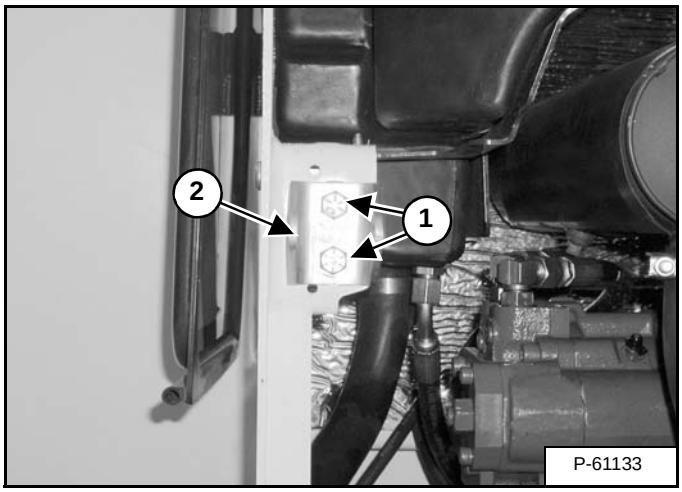
Latch Removal And Installation

Figure 40-180-5



Remove the nut (Item 1), bolt (Item 2), outer rollers (Item 3) and inner roller (Item 4) **[Figure 40-180-5]**.

Figure 40-180-6

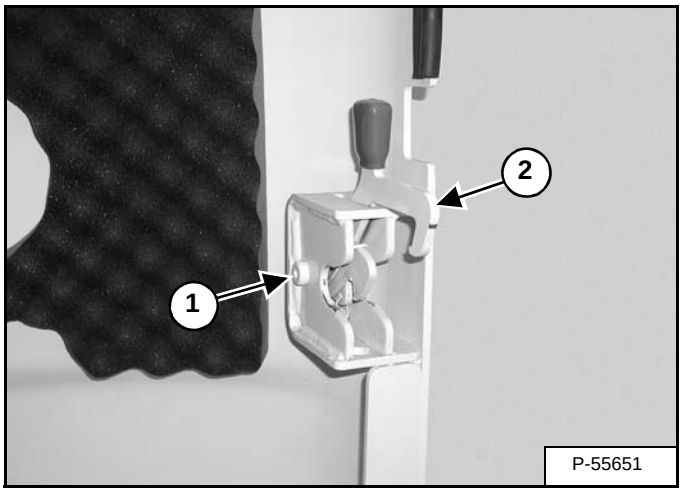


For ease of installation, mark around the outside edge **[Figure 40-180-6]** of the bracket.

Remove the bolts (Item 1), latch bracket (Item 2) **[Figure 40-180-6]** and washers.

NOTE: After installing the latch assembly. (See Adjusting The Latch on Page 10-40-1.)

Figure 40-180-7



Remove the bolt (Item 1). Remove the latch assembly (Item 2) **[Figure 40-180-7]** from the tailgate.

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X-CHANGE™

Removal And Installation

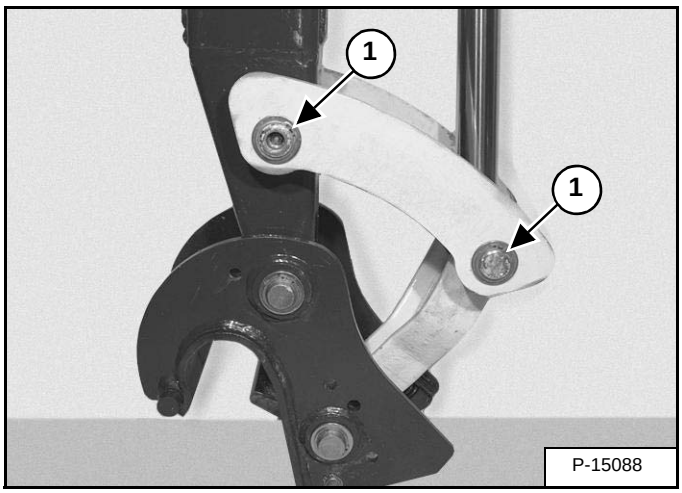
Remove the bucket. (See the Operation & Maintenance Manual for the correct removal procedure.)

Figure 40-190-1



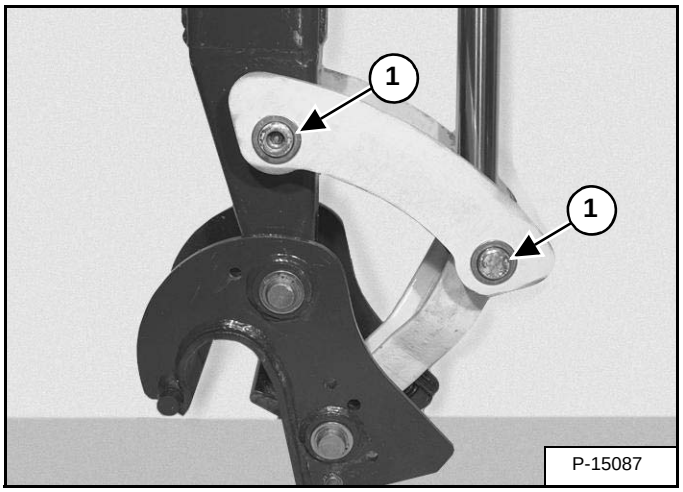
Support the boom with a hoist **[Figure 40-190-1]**.

Figure 40-190-2



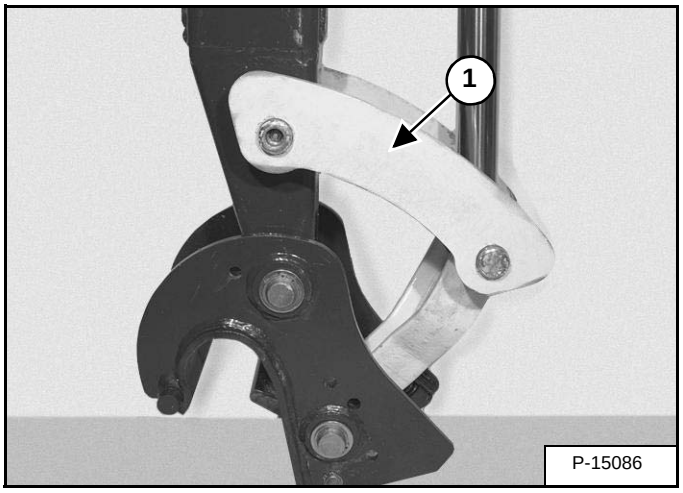
Remove the snap rings (Item 1) **[Figure 40-190-2]**.

Figure 40-190-3



Remove the washers (Item 1) **[Figure 40-190-3]**.

Figure 40-190-4

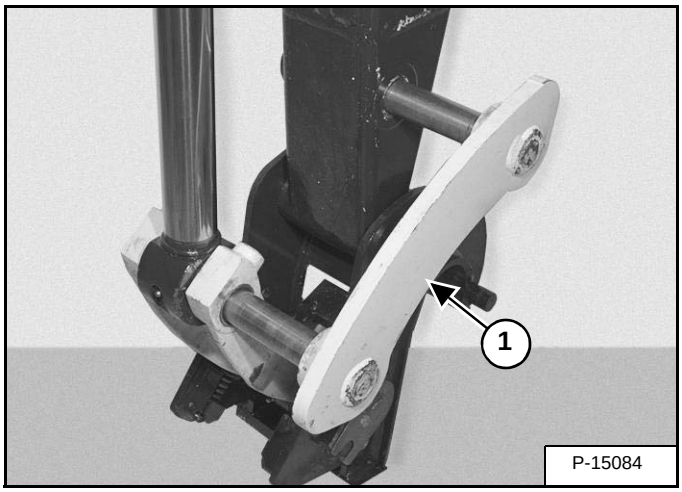


Remove the plate (Item 1) **[Figure 40-190-4]**.

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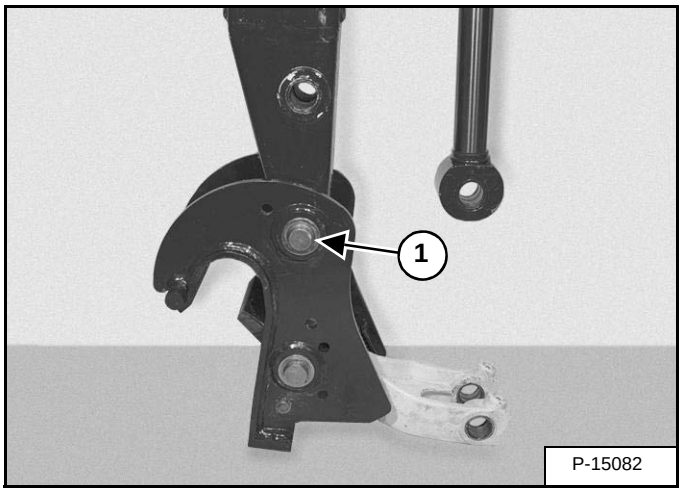
Removal And Installation (Cont'd)

Figure 40-190-5



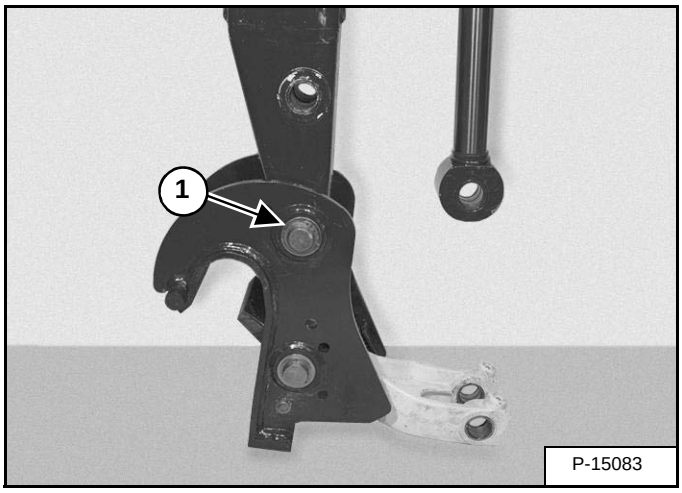
Remove the link (Item 1) **[Figure 40-190-5]**.

Figure 40-190-6



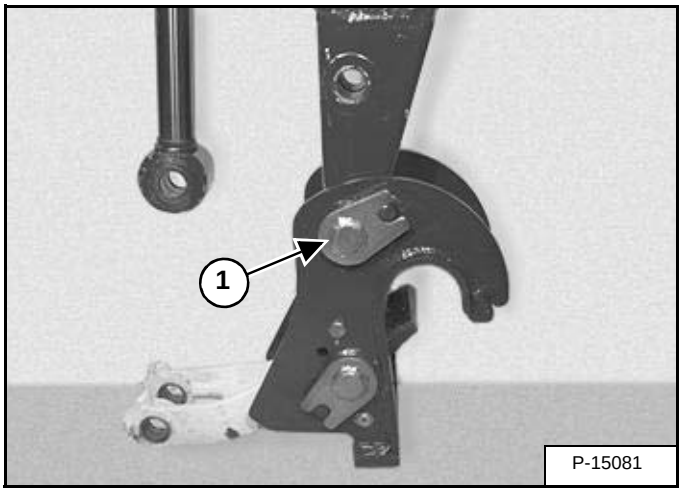
Remove the snap ring (Item 1) **[Figure 40-190-6]**.

Figure 40-190-7



Remove the washer (Item 1) **[Figure 40-190-7]**.

Figure 40-190-8

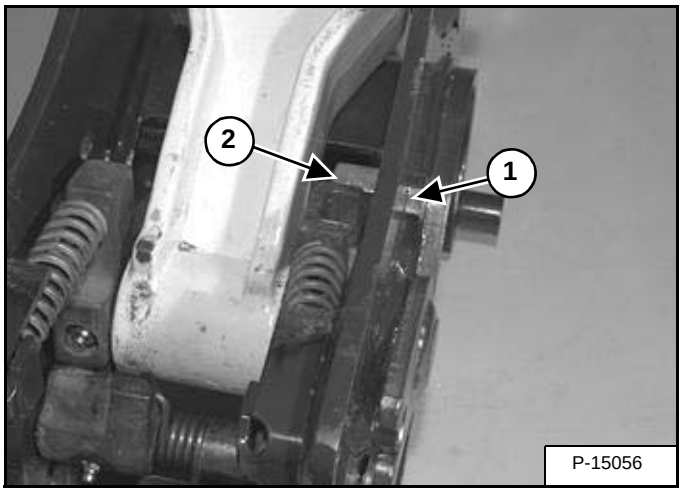


Remove the pin (Item 1) **[Figure 40-190-8]** and remove the X-Change™ from the arm.

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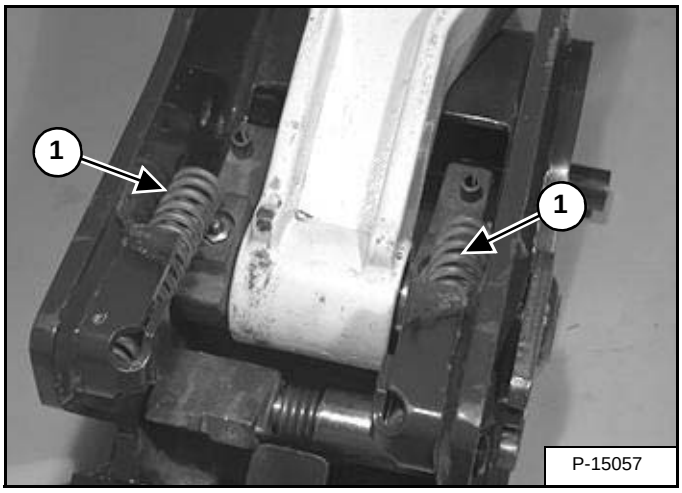
Disassembly

Figure 40-190-9



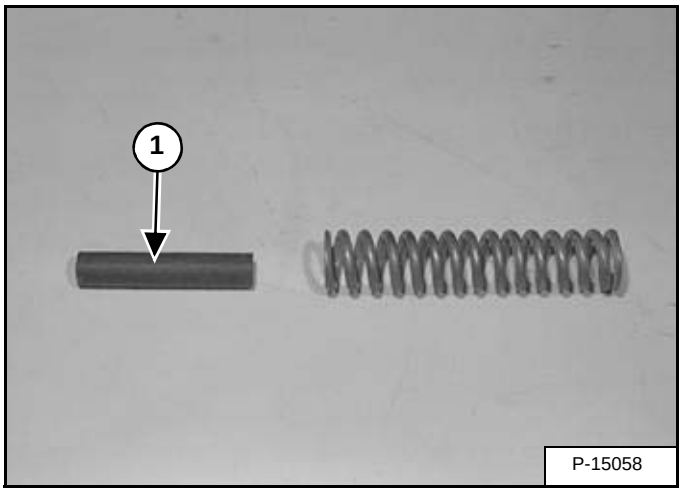
Remove the bolt (Item 1) and nut (Item 2) **[Figure 40-190-9]**.

Figure 40-190-10



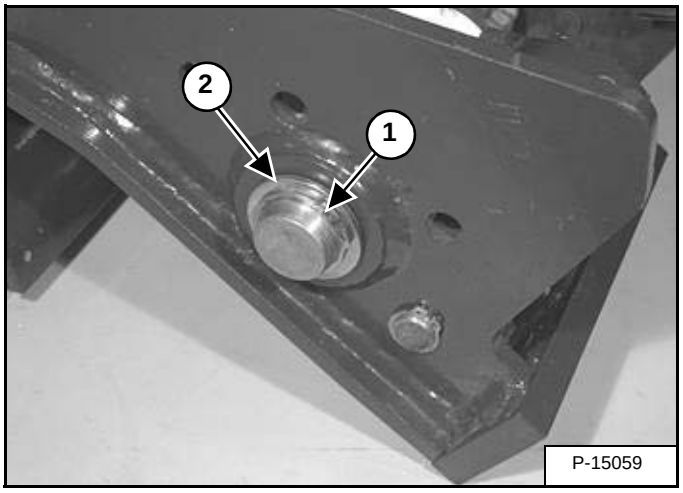
Remove the springs (Item 1) **[Figure 40-190-10]**.

Figure 40-190-11



Remove the rubber hose (Item 1) **[Figure 40-190-11]**.

Figure 40-190-12

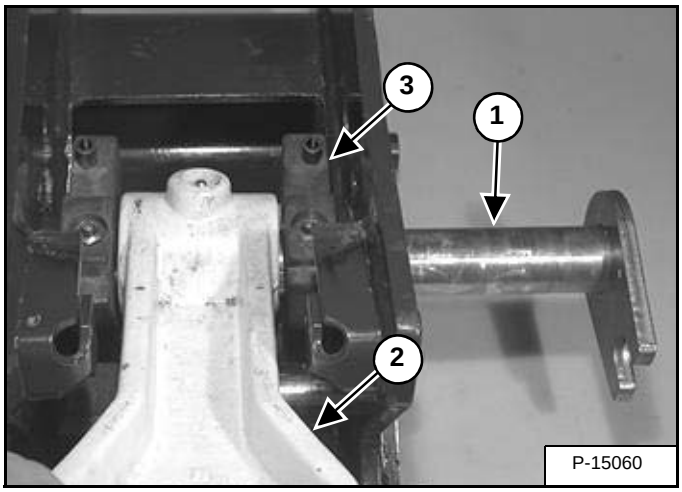


Remove the snap ring (Item 1) and washer (Item 2) **[Figure 40-190-12]**.

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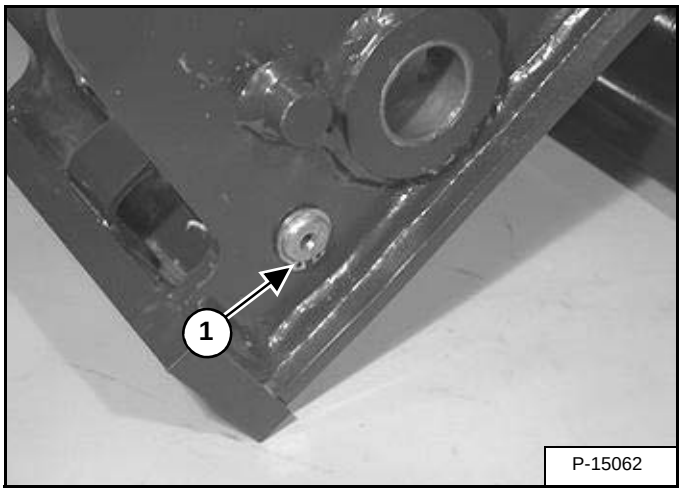
Disassembly (Cont'd)

Figure 40-190-13



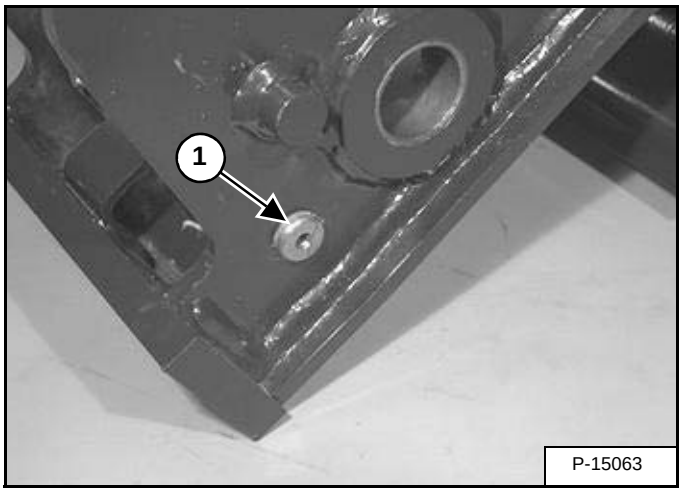
Remove the pin (Item 1), link (Item 2) and latch (Item 3) **[Figure 40-190-13]**.

Figure 40-190-14



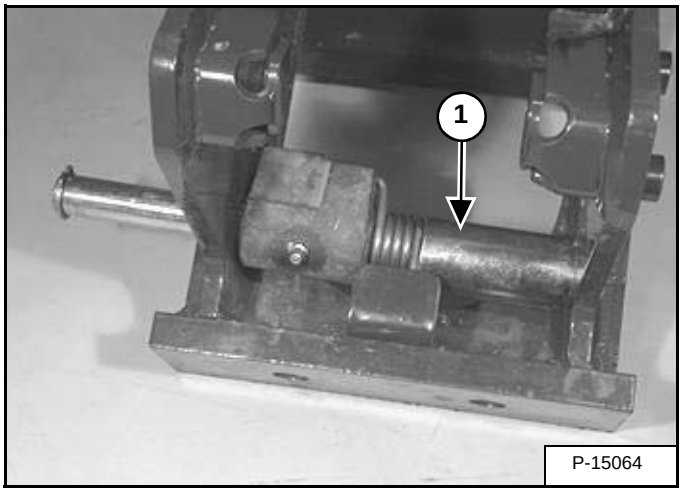
Remove the snap ring (Item 1) **[Figure 40-190-14]**.

Figure 40-190-15



Partially remove the pin (Item 1) **[Figure 40-190-15]**.

Figure 40-190-16

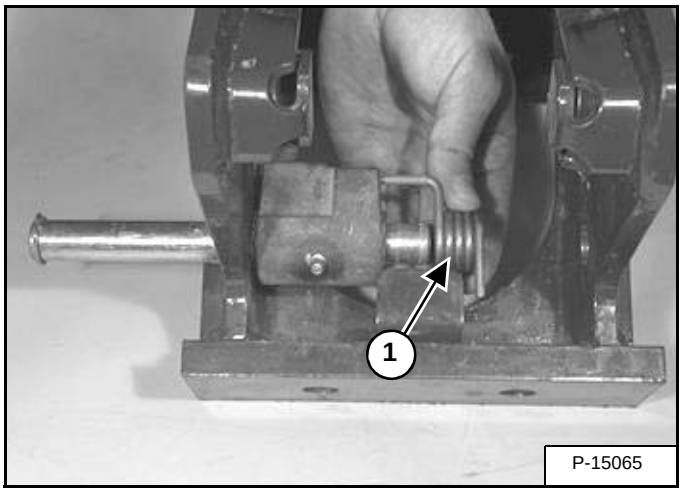


Remove the pin far enough to remove the spacer (Item 1) **[Figure 40-190-16]**.

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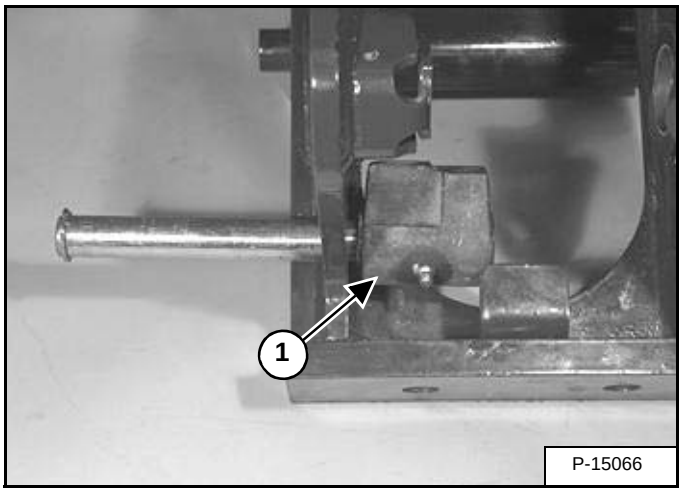
Disassembly (Cont'd)

Figure 40-190-17



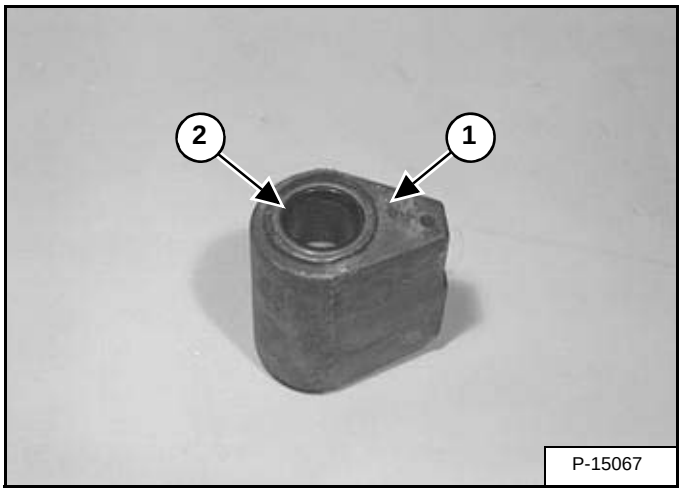
Remove the spring (Item 1) **[Figure 40-190-17]**.

Figure 40-190-18



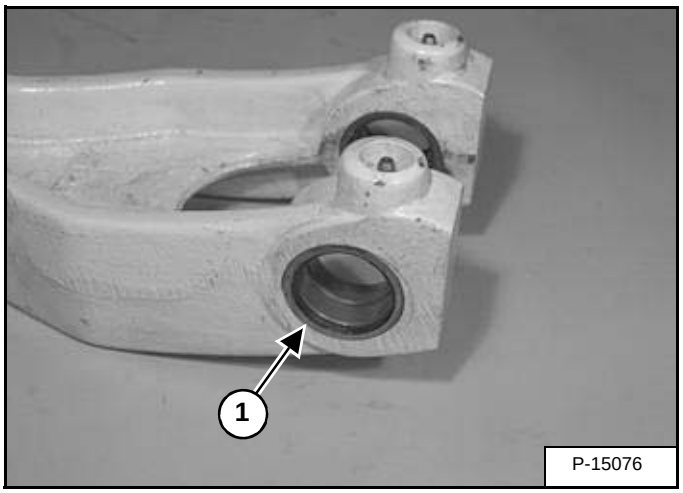
Completely remove the pin and remove the catch (Item 1) **[Figure 40-190-18]**.

Figure 40-190-19



Remove the seal (Item 1) from both sides of the catch. Remove the bushings (Item 2) **[Figure 40-190-19]** from inside the catch.

Figure 40-190-20

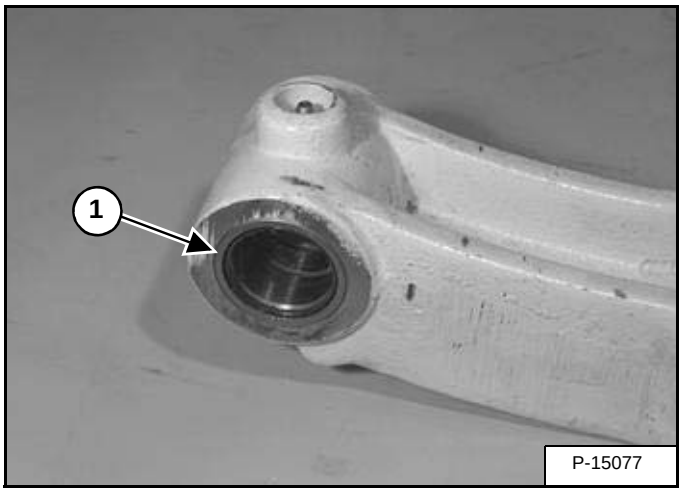


Remove the four seals (two per side) (Item 1) **[Figure 40-190-20]** from the top pivot point of the link.

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Disassembly (Cont'd)

Figure 40-190-21



Remove the two seals (one per side) (Item 1) **[Figure 40-190-21]** from the bottom pivot point of the link.

Figure 40-190-22

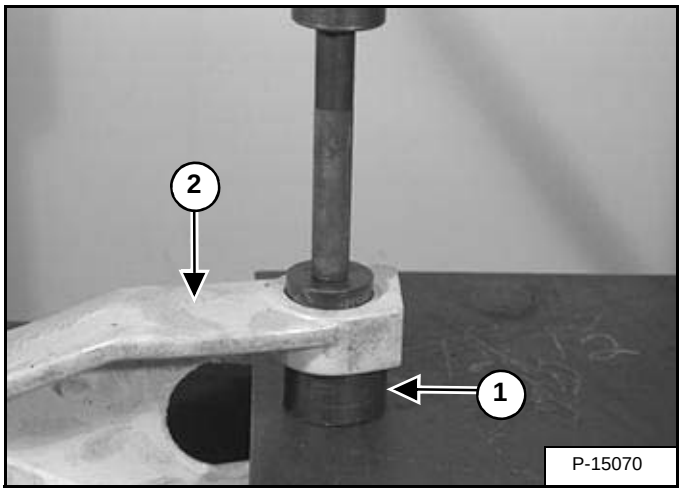
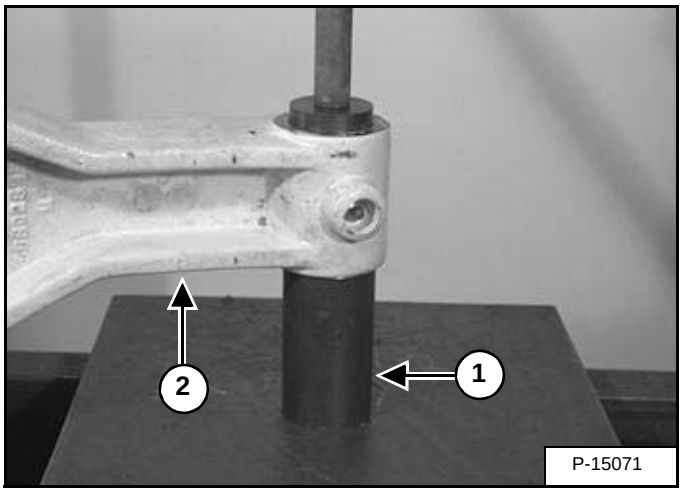


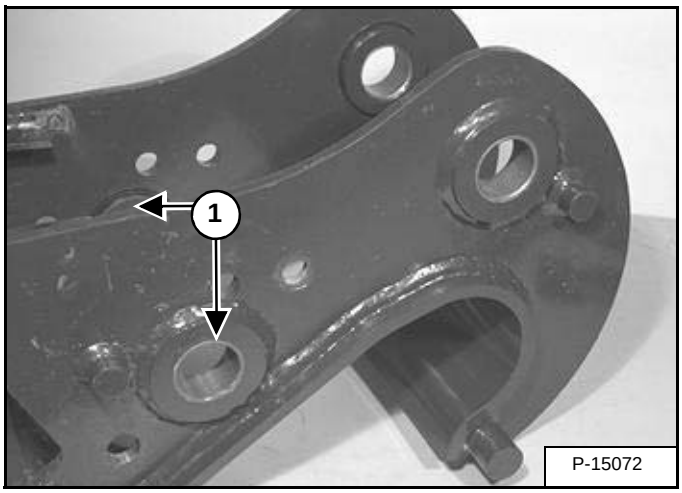
Figure 40-190-23



Use thick walled tubing (Item 1) **[Figure 40-190-22]** & **[Figure 40-190-23]** with an inside diameter larger than the outside diameter of the link bushings to support the link (Item 2) **[Figure 40-190-22]** & **[Figure 40-190-23]** and remove the bushings.

NOTE: Properly support the cast link to prevent damage when installing or removing the bushings.

Figure 40-190-24

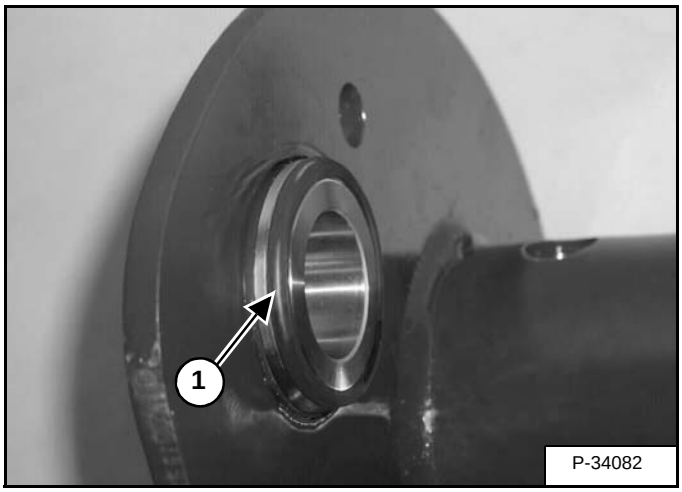


Remove the bushings (Item 1) **[Figure 40-190-24]** from the X-Change™ frame.

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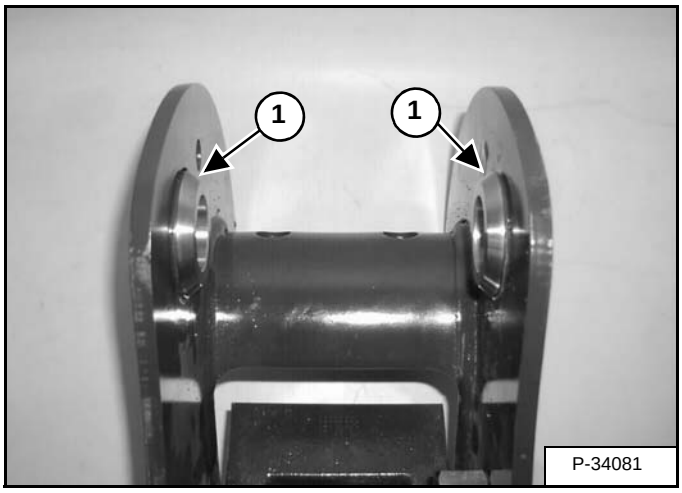
Disassembly (Cont'd)

Figure 40-190-25



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

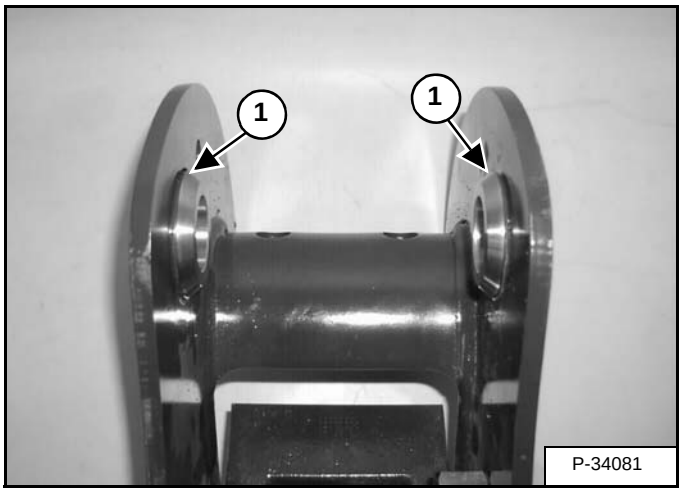
Figure 40-190-26



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

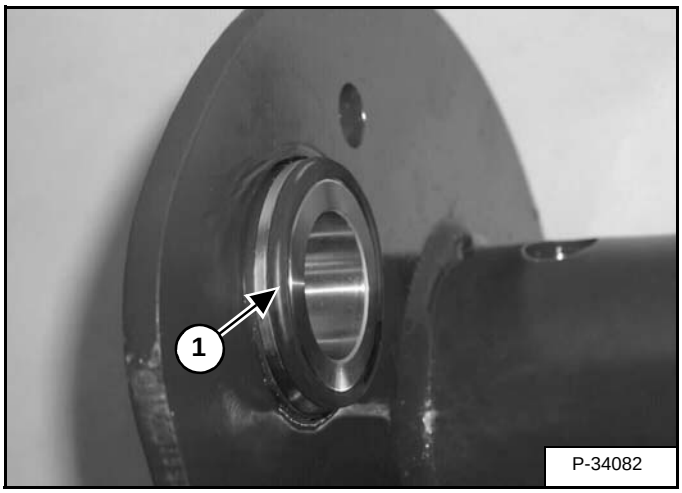
Assembly

Figure 40-190-27



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

Figure 40-190-28

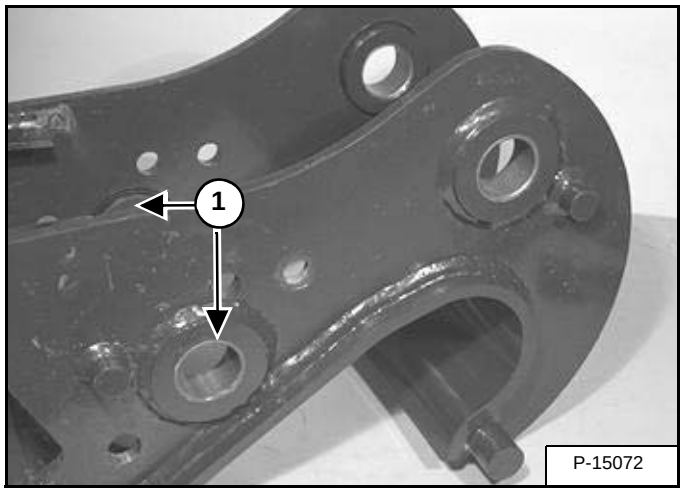


Install the O-ring (Item 1) **[Figure 40-190-28]** (both sides). Use grease to hold the O-rings in place.

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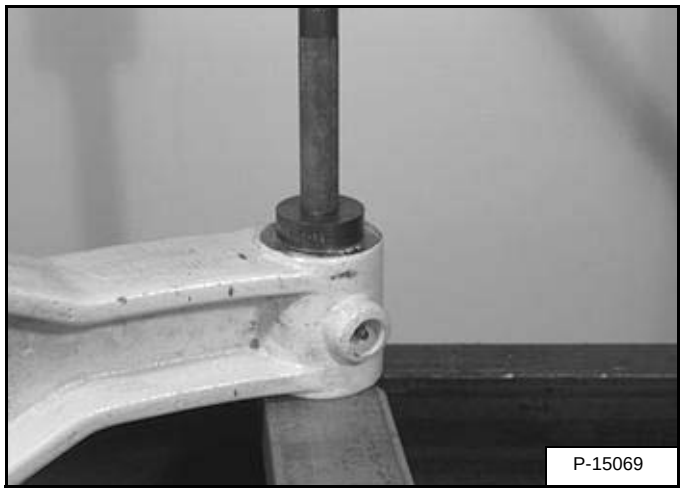
Assembly (Cont'd)

Figure 40-190-29



Install the two bushings (Item 1) **[Figure 40-190-29]** and apply grease to all four bushings.

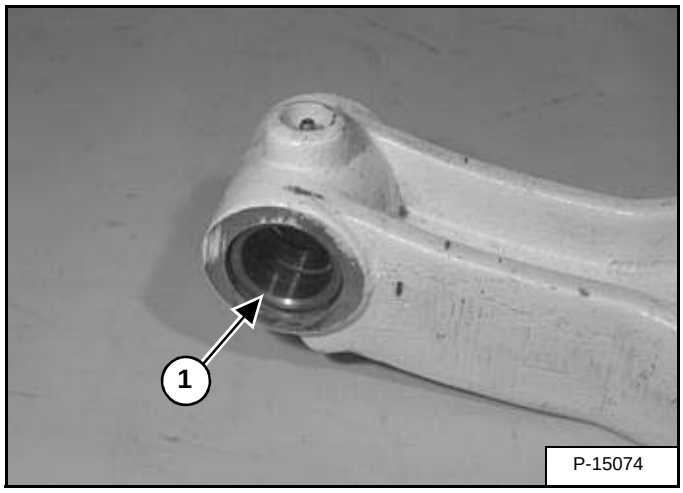
Figure 40-190-30



Install the bushings in both sides of the link **[Figure 40-190-30]**.

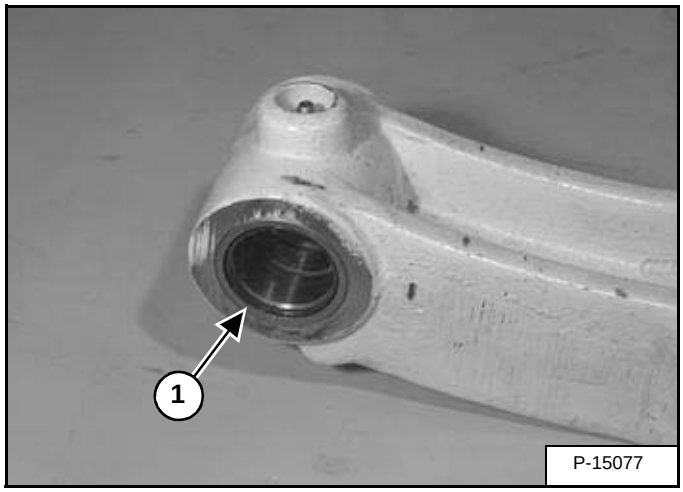
NOTE: Properly support the cast link to prevent damage when installing or removing the bushings.

Figure 40-190-31



Press the bushings (Item 1) **[Figure 40-190-31]** in until the seal will fit flush in the link.

Figure 40-190-32

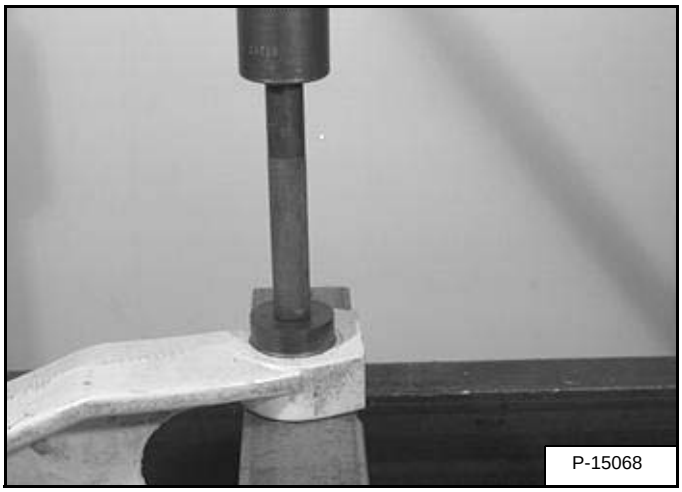


Install the two seals (Item 1) **[Figure 40-190-32]** (one per side).

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Assembly (Cont'd)

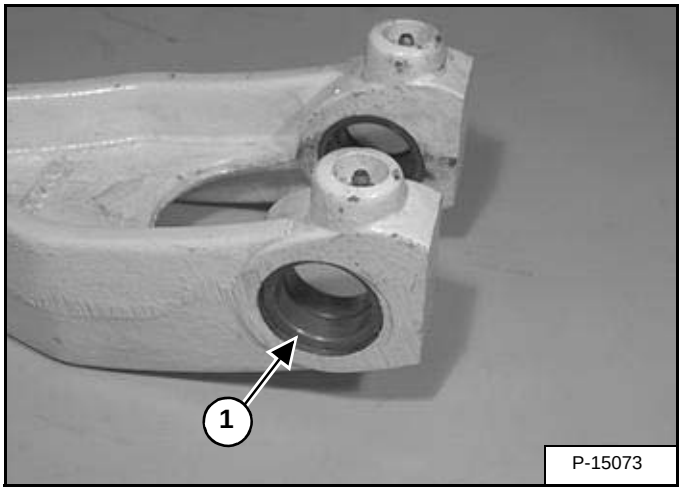
Figure 40-190-33



Install the bushings in both sides of the link **[Figure 40-190-33]**.

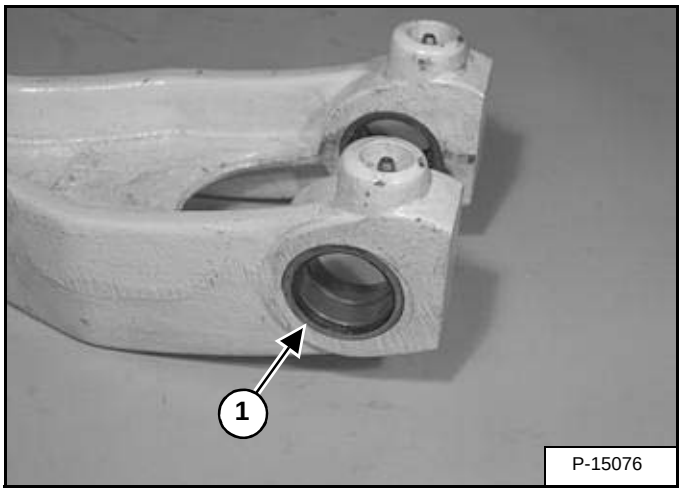
NOTE: Properly support the cast link to prevent damage when installing or removing the bushings.

Figure 40-190-34



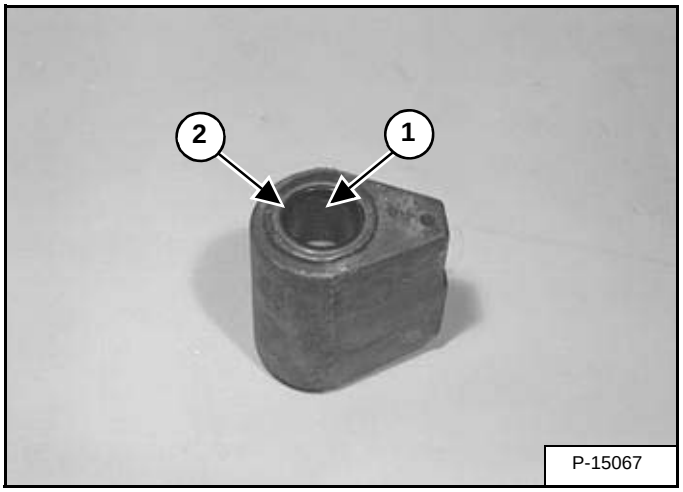
Press the bushings (Item 1) **[Figure 40-190-34]** in until the seal will fit flush.

Figure 40-190-35



Install the four seals (Item 1) **[Figure 40-190-35]** (one per side).

Figure 40-190-36



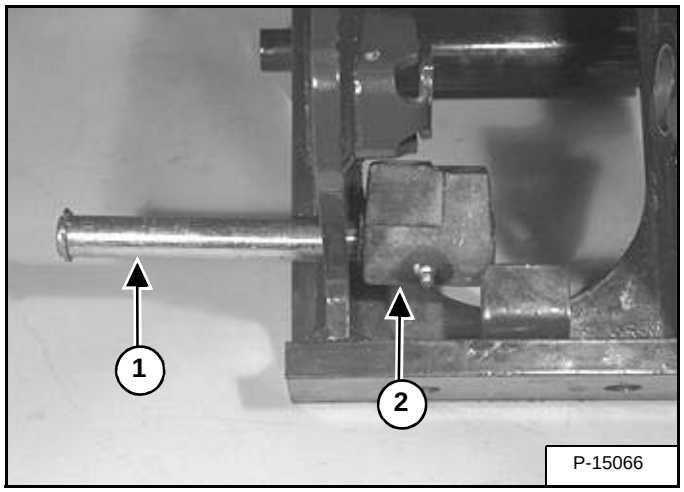
Install the bushings (Item 1) **[Figure 40-190-36]** in the catch.

Install the seal (Item 2) **[Figure 40-190-36]** on both sides of the catch.

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Assembly (Cont'd)

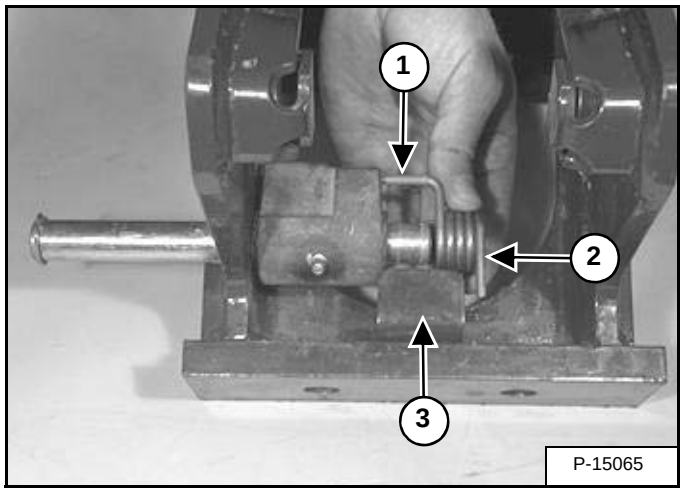
Figure 40-190-37



Partially install the pin (Item 1) **[Figure 40-190-37]**.

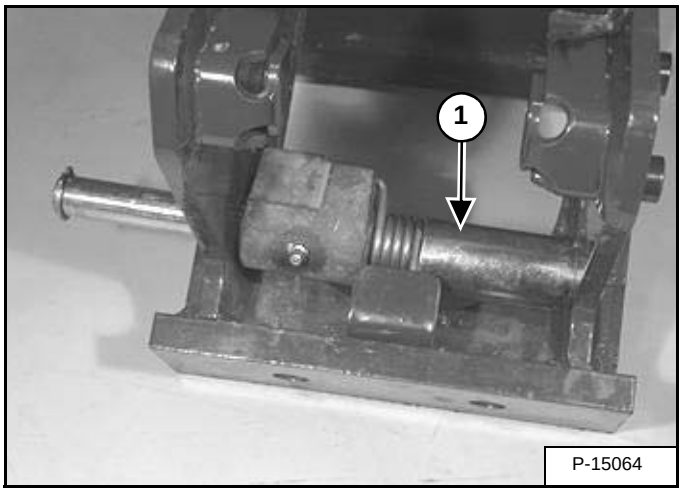
Install the catch (Item 2) **[Figure 40-190-37]** on the pin.

Figure 40-190-38



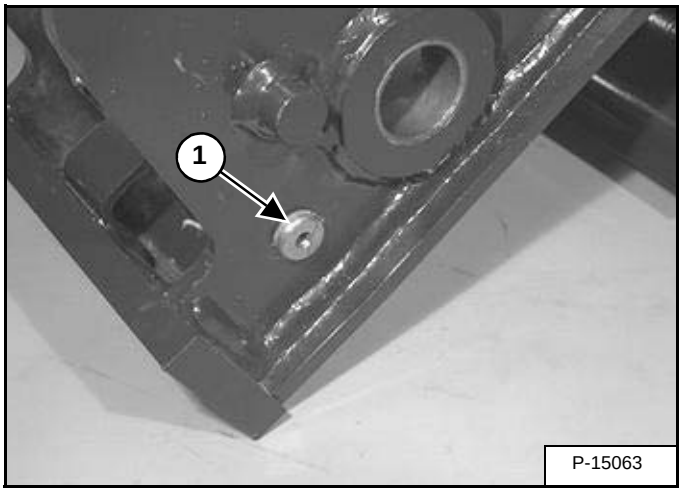
Install the spring on the pin, with the angled end of the spring (Item 1) engaging the hole in the catch. Put the straight end of the spring (Item 2) under the spring retainer (Item 3) **[Figure 40-190-38]**.

Figure 40-190-39



Install the spacer (Item 1) **[Figure 40-190-39]**.

Figure 40-190-40

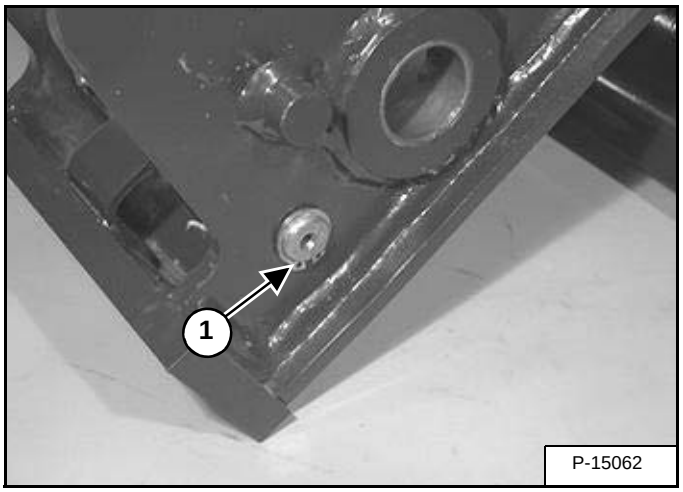


Completely install the pin (Item 1) **[Figure 40-190-40]**.

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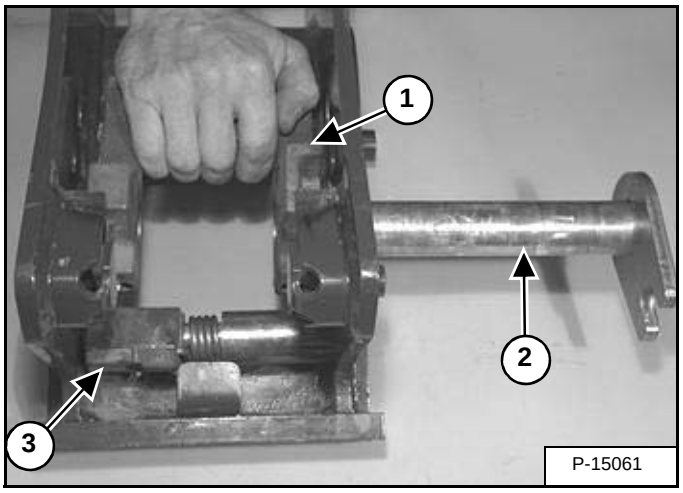
Assembly (Cont'd)

Figure 40-190-41



Install the snap ring (Item 1) **[Figure 40-190-41]**.

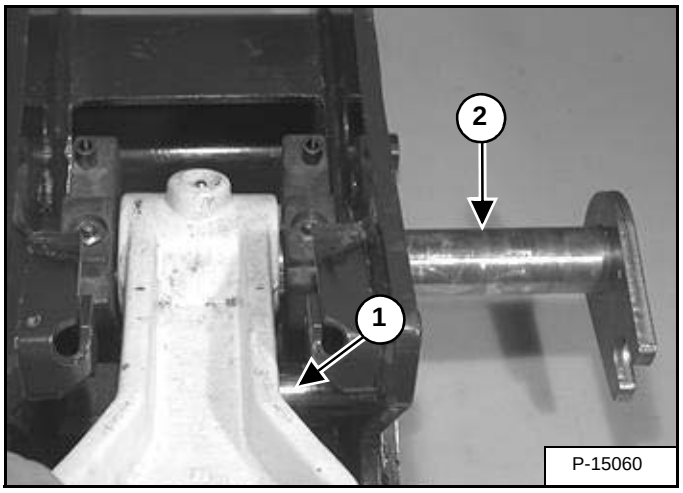
Figure 40-190-42



Align the latch (Item 1) and partially install the pin (Item 2) **[Figure 40-190-42]**.

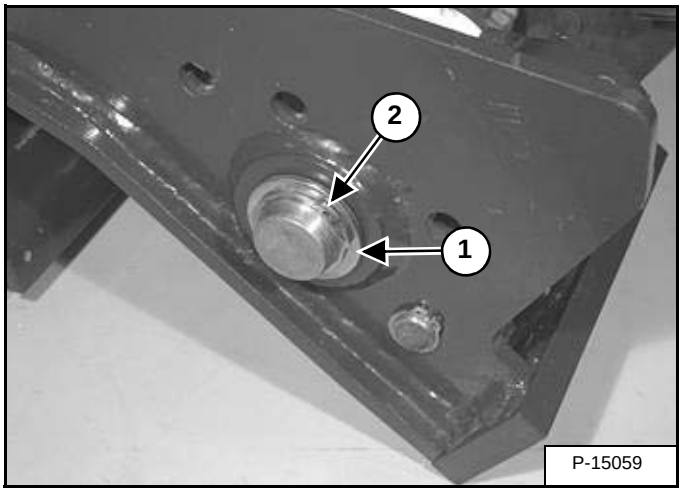
Rotate the catch toward the latch so the end of the catch (Item 3) **[Figure 40-190-42]** is under the latch.

Figure 40-190-43



Install the link (Item 1) and completely install the pin (Item 2) **[Figure 40-190-43]**.

Figure 40-190-44

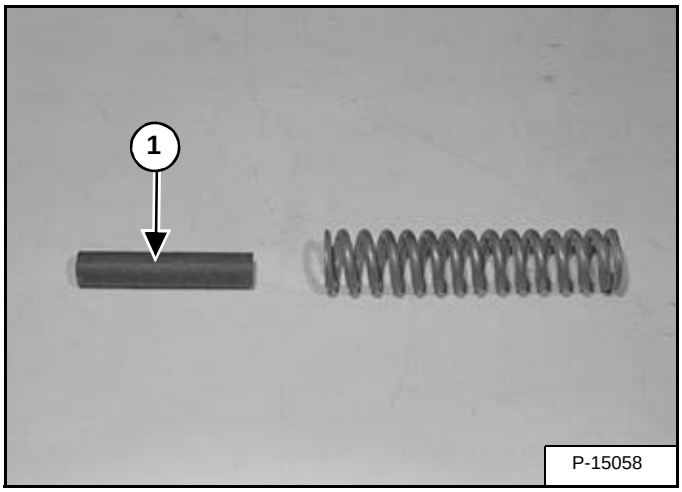


Install the washer (Item 1) and snap ring (Item 2) **[Figure 40-190-44]**.

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Assembly (Cont'd)

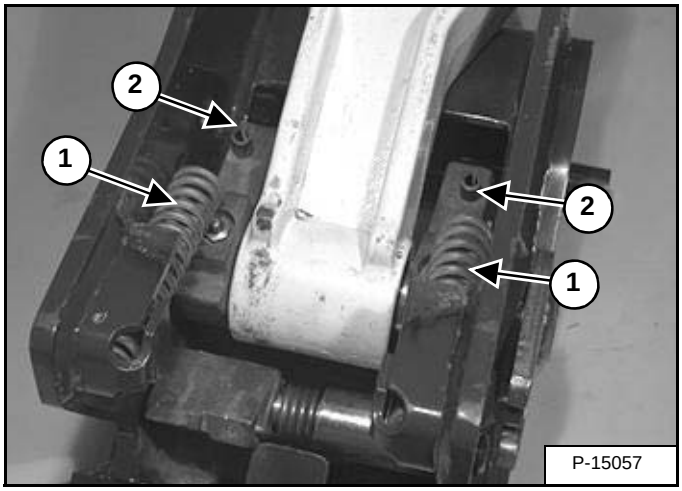
Figure 40-190-45



Install the hose (Item 1) **[Figure 40-190-45]** in the spring.

NOTE: The hose helps prevent the spring from being filled with dirt or mud. When replacing the hose, cut to a length of 2.750 - 3.0 inches (108 - 118 mm).

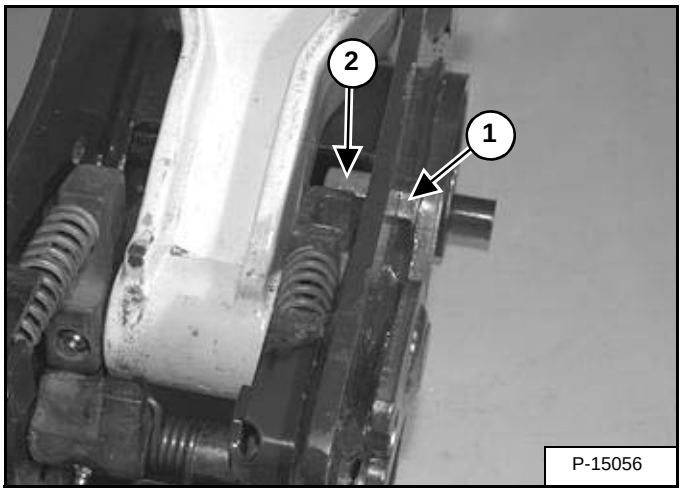
Figure 40-190-46



Install the springs (Item 1) **[Figure 40-190-46]** in the X-Change™.

Pull the latch up until the springs (Item 1) seat over the roll pins (Item 2) **[Figure 40-190-46]**.

Figure 40-190-47



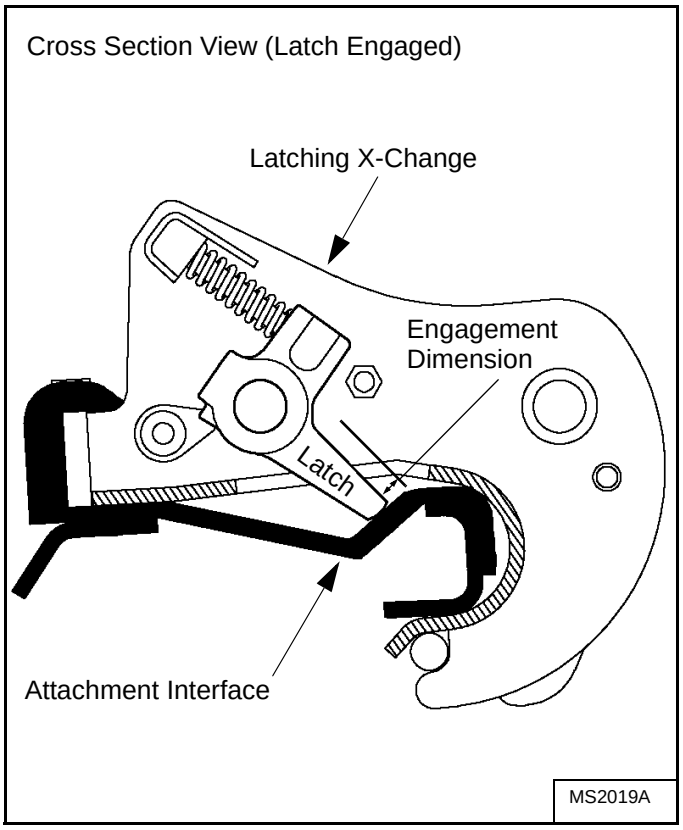
Apply thread adhesive (LOCTITE 242) to the bolt threads and install the bolt (Item 1) and nut (Item 2) **[Figure 40-190-47]**.

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

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Check Proper Latch Engagement

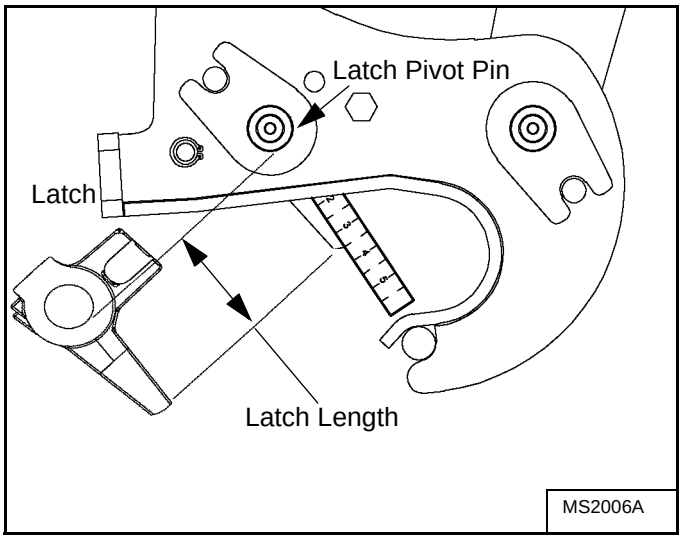
Figure 40-190-48



Maximum latch length and minimum latch engagement dimensions are provided. ***Latch length must be checked before checking latch engagement*** **[Figure 40-190-48]**.

Before making any measurements, clean the excavator X-Change and the attachment interface. Inspect both components to be certain they are free of debris and are not damaged.

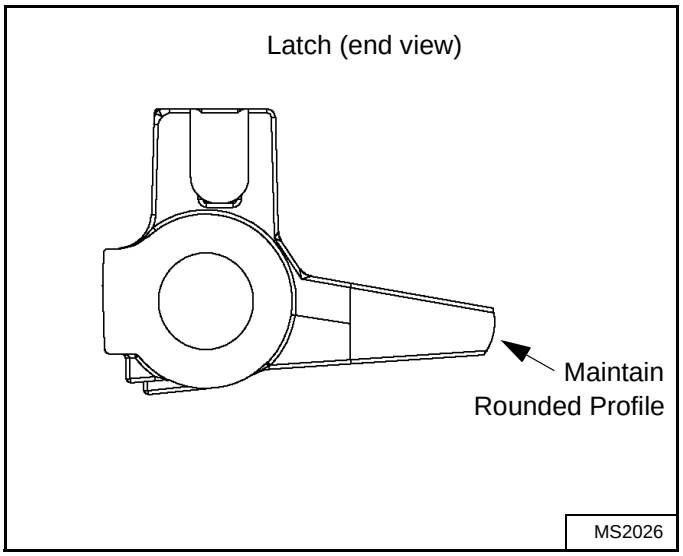
Figure 40-190-49



Measure the installed latch length. Measure from the edge of the latch pivot pin to the end of the latch. ***The latch does not need to be removed to measure. Maximum latch length is 3.52 inches (89,4 mm)*** **[Figure 40-190-49]**.

If the latch length is greater than maximum, it should be replaced or the end can be ground to achieve maximum latch length.

Figure 40-190-50



If you grind the latch, maintain the rounded profile of the end **[Figure 40-190-50]**.

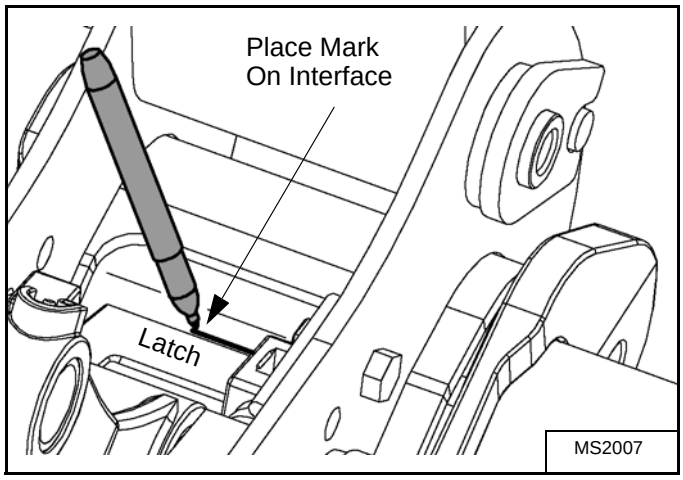
After verifying the latch length, check the attachment interface.

Install the attachment.

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Check Proper Latch Engagement (Cont'd)

Figure 40-190-51

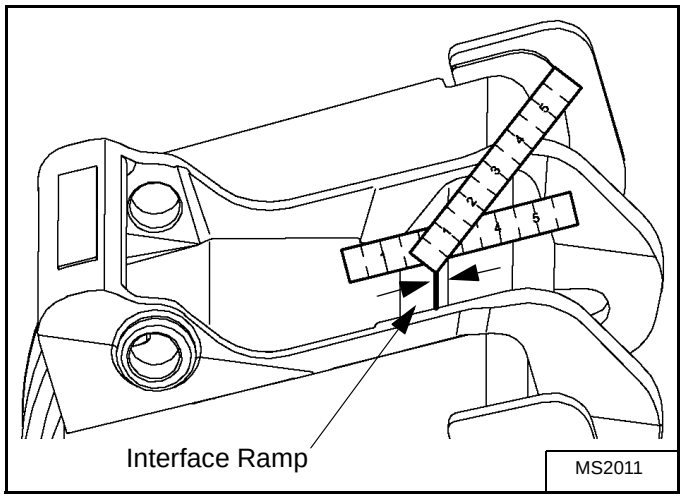


With the attachment installed on the machine and lowered to the ground, place a mark on the interface just above the latch **[Figure 40-190-51]**.

Note: The mark should reflect the line of sight across the top edge of the latch. It is not intended to reflect the actual contact point of the latch and interface.

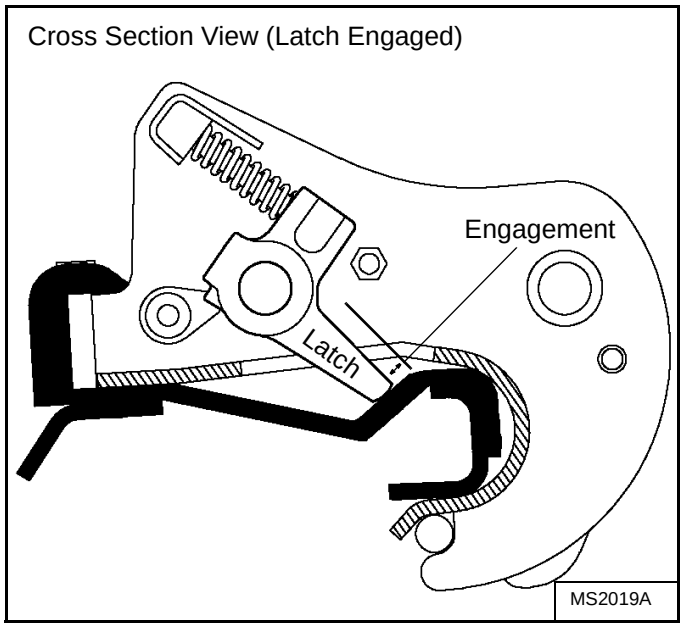
Remove the attachment.

Figure 40-190-52



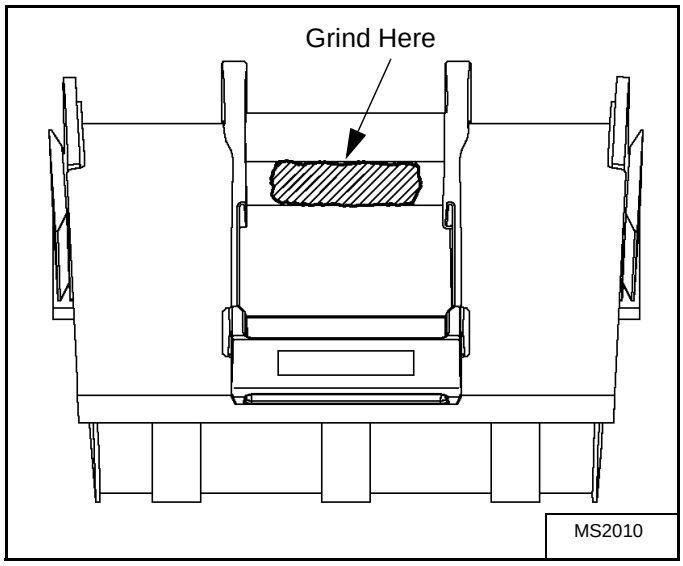
Measure the latch engagement. Measure from the mark previously made to the center of the radius at the top of the interface ramp. Two rulers are required. **Minimum latch engagement is 0.50 inches (12.7 mm) [Figure 40-190-52]**.

Figure 40-190-53



If latch engagement is less than 0.50 Inches (12.7 mm), remove material from the ramp of the interface **[Figure 40-190-52]** & **[Figure 40-190-53]**.

Figure 40-190-54



Using a grinder, remove material from the interface ramp in the area shown. ***The grind area must be wider than the latch, but does not need to extend all the way to the sides of the interface.*** Maintain the original profile and flatness of the ramp. Remove between 0.06 - 0.12 inches (1.5 - 3.0 mm) of material **[Figure 40-190-54]**.

Install the attachment on the machine, mark the interface **[Figure 40-190-51]** and measure the new latch engagement **[Figure 40-190-52]**.

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Check Proper Latch Engagement (Cont'd)

⚠ WARNING

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

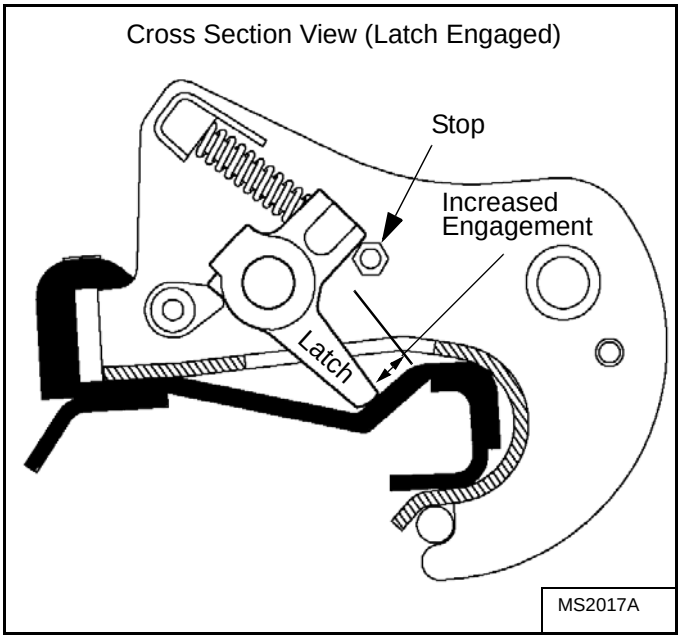
- **When fluids are under pressure.**
- **Flying debris or loose material is present.**
- **Engine is running.**
- **Tools are being used.**

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If latch engagement is less than 0.50 Inches (12.7 mm), remove more material from the ramp of the interface.

Install the attachment on the machine, mark the interface and measure the new latch engagement again to verify latch engagement is 0.50 Inches (12.7 mm) or more.

Figure 40-190-55



The latch may wear and become shorter, increasing latch engagement. Latch wear is dependent on the type of attachment used and the application. If wear becomes excessive, the latch will rest on the stop. The attachment will remain securely installed on the machine in this position, however the attachment can exhibit rattling noise during operation because the attachment interface is shifting slightly within the X-Change. Visual inspection can detect if the latch is resting on the stop without measurement. Latch replacement is recommended when wear becomes this excessive. **[Figure 40-190-55]**

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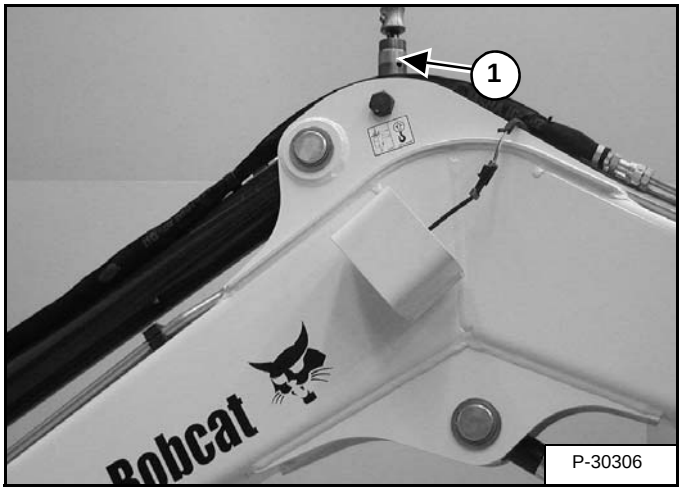
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X-CHANGE (HYDRAULIC)

Removal And Installation

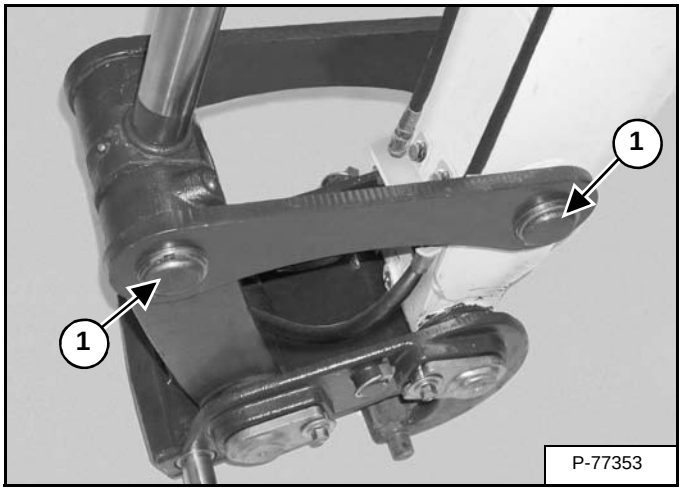
Remove the bucket. (See Operation & Maintenance Manual for the correct removal procedure.)

Figure 40-191-1



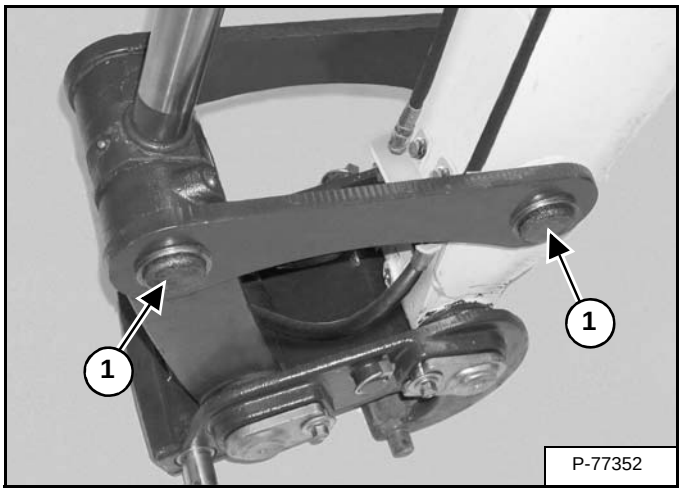
Support the boom with a hoist (Item 1) **[Figure 40-191-1]** and release the pressure on the boom cylinder.

Figure 40-191-2



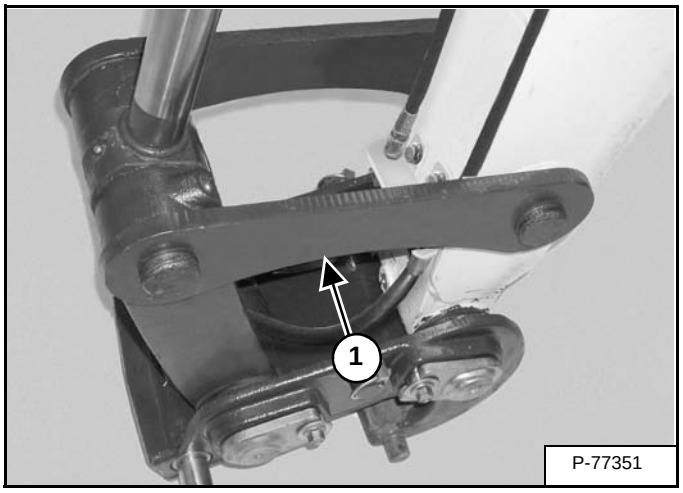
Remove the snap rings (Item 1) **[Figure 40-191-2]**.

Figure 40-191-3



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

Figure 40-191-4

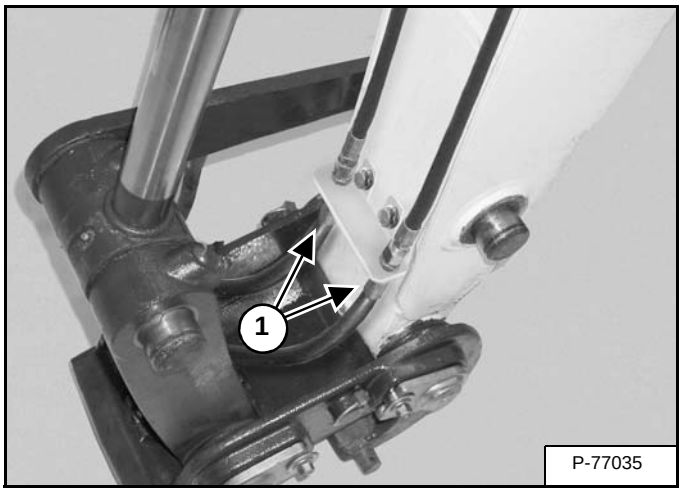


Remove the plate (Item 1) **[Figure 40-191-4]**.

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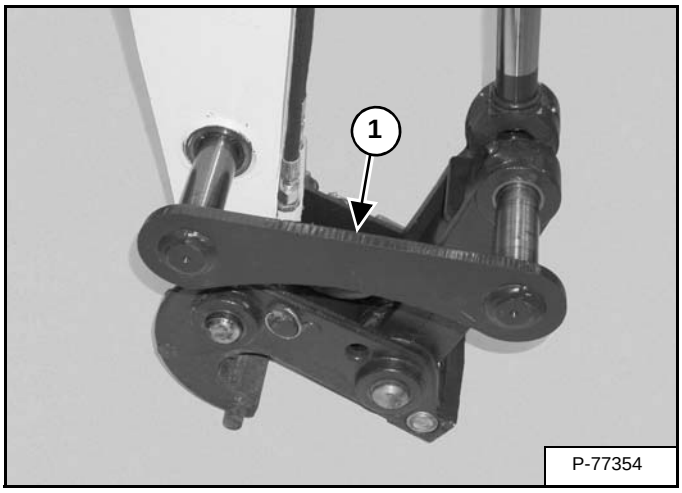
Removal And Installation (Cont'd)

Figure 40-191-5



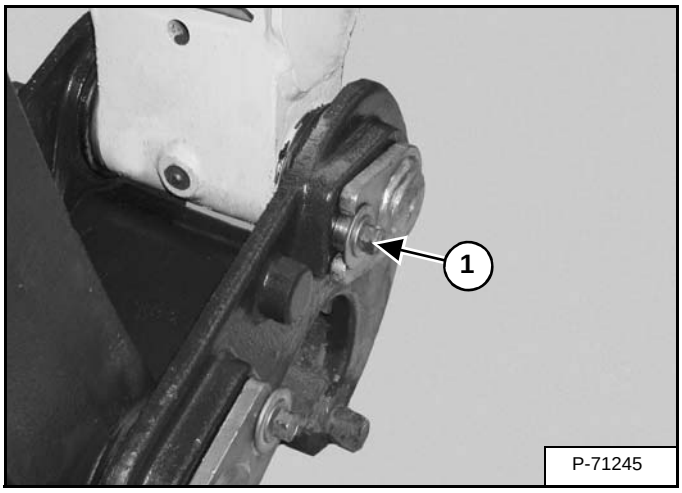
Remove the two hydraulic hoses (Item 1) **[Figure 40-191-5]** from the tubelines.

Figure 40-191-6



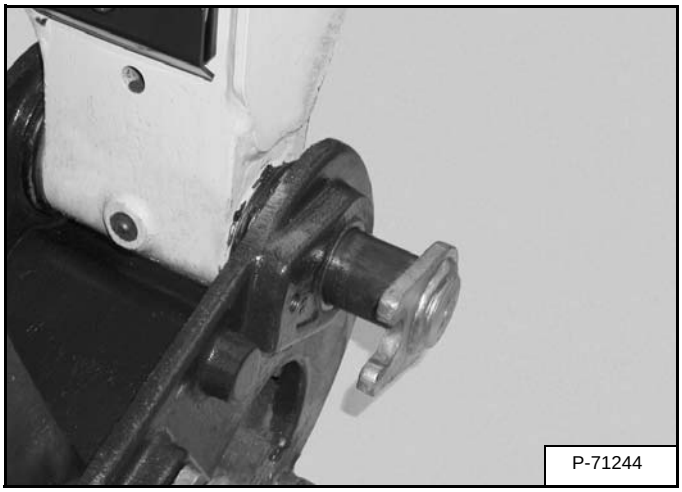
Remove the link (Item 1) **[Figure 40-191-6]**.

Figure 40-191-7



Remove the bolt, washer and spacer (Item 1) **[Figure 40-191-7]**.

Figure 40-191-8



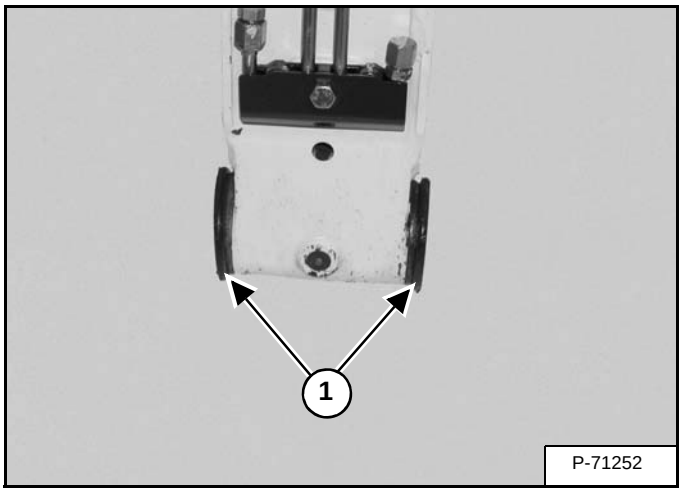
Remove the pin (Item 1) **[Figure 40-191-8]**.

Remove the hydraulic X-Change.

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Removal And Installation (Cont'd)

Figure 40-191-9

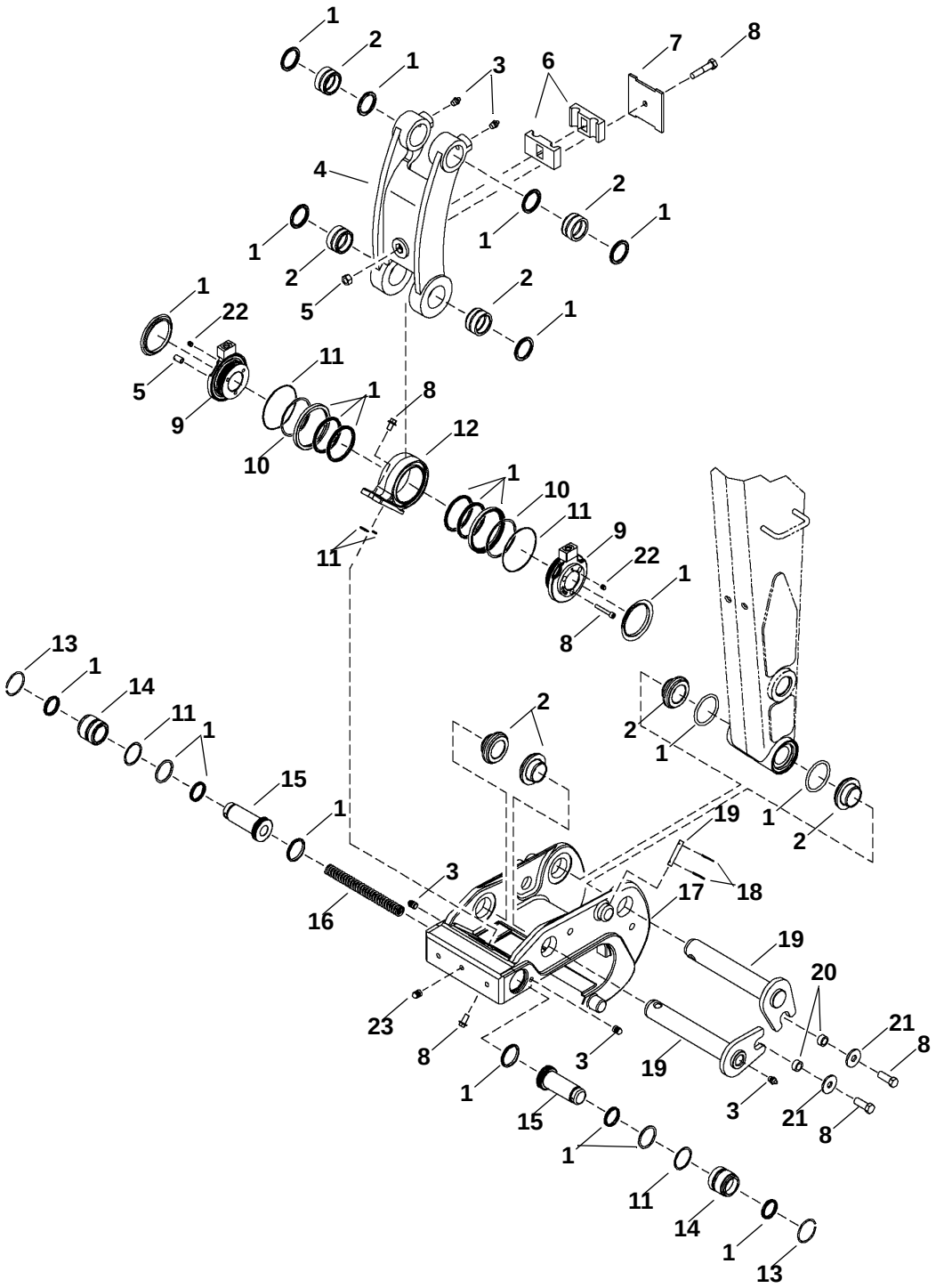


Remove the O-rings (Item 1) **[Figure 40-191-9]** from the arm.

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Parts Identification

1. Seal
2. Bushing
3. Grease Fitting
4. Bucket Link
5. Nut
6. Rubber Block
7. Cover
8. Bolt
9. Swivel End
10. Wear Ring
11. O-Ring
12. Swivel Base
13. Retaining Ring
14. Piston Head
15. Piston
16. Spring
17. X-Change Assembly
18. Clip
19. Pin
20. Spacer
21. Washer
22. Dowel Pin
23. Expansion Plug

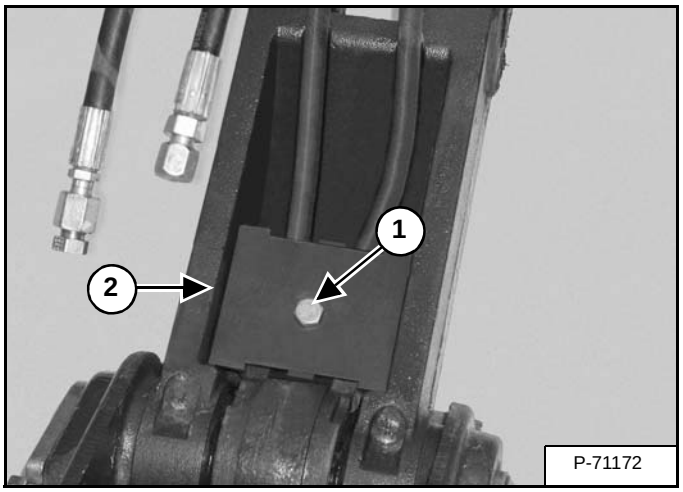


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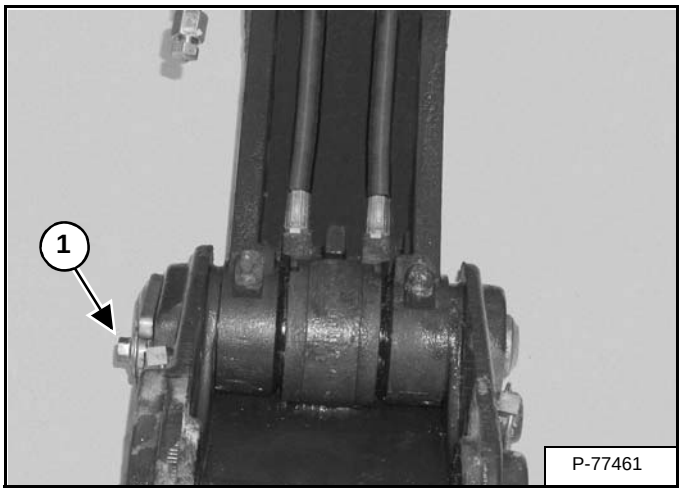
Disassembly

Figure 40-191-10



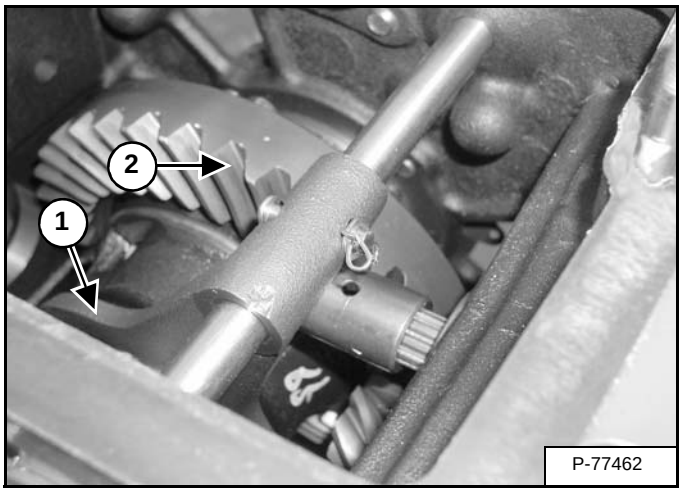
Remove the two bolts (Item 1) and the cover (Item 2) **[Figure 40-191-10]**.

Figure 40-191-11



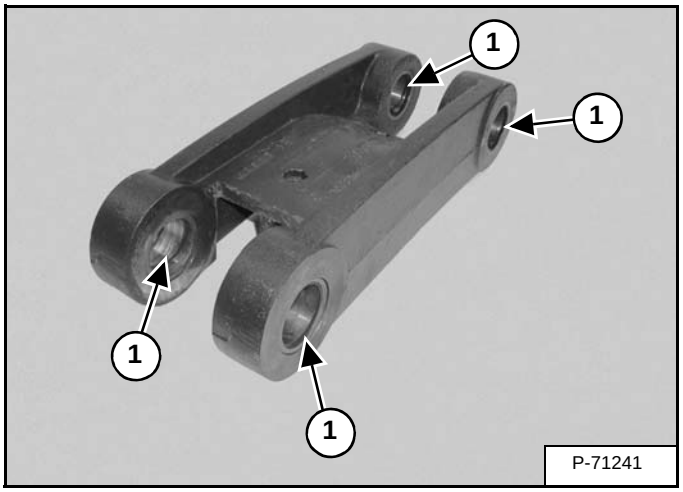
Remove the bolt (Item 1) **[Figure 40-191-11]** washer and spacer.

Figure 40-191-12



Remove the pin (Item 1) and the bucket link (Item 2) **[Figure 40-191-12]**.

Figure 40-191-13

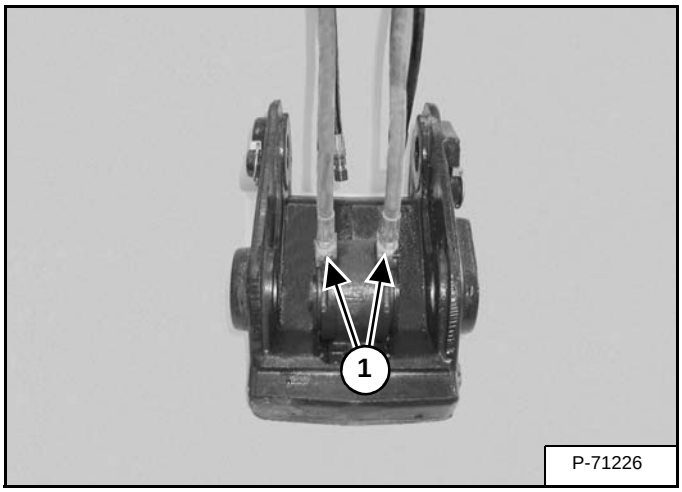


Remove the dust seals and bushings (Item 1) **[Figure 40-191-13]** from the bucket link.

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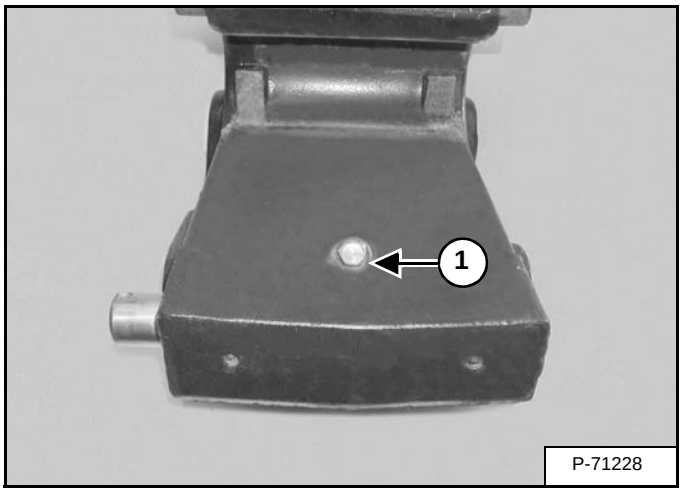
Disassembly (Cont'd)

Figure 40-191-14



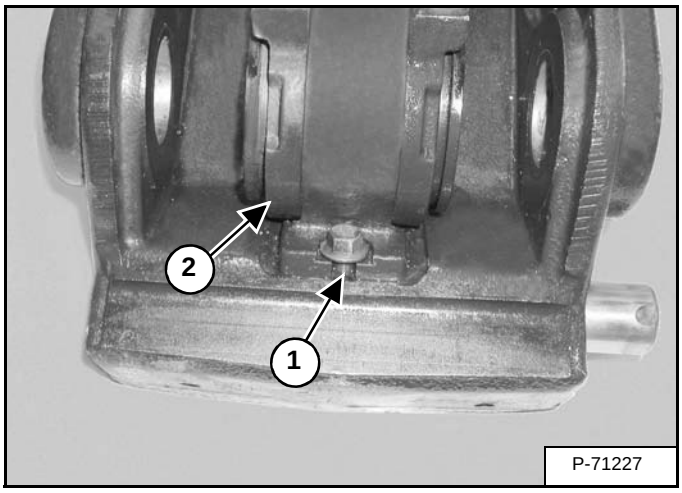
Remove the two hydraulic hoses (Item 1) **[Figure 40-191-14]** from the swivel ends.

Figure 40-191-15



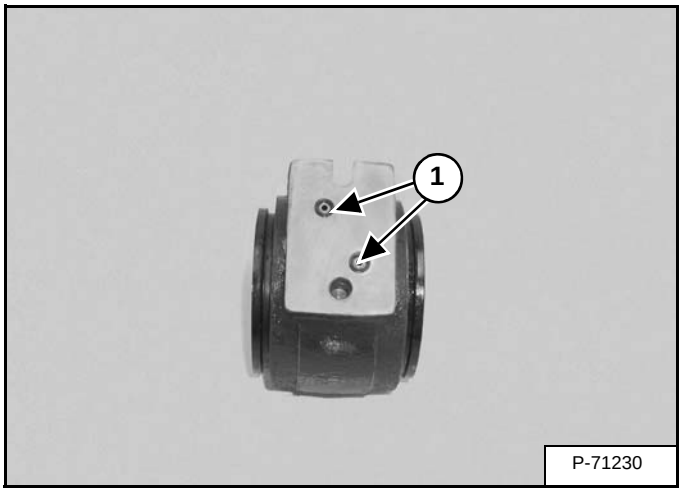
Remove the bolt (Item 1) **[Figure 40-191-15]**.

Figure 40-191-16



Remove the bolt (Item 1), nut, and the swivel assembly (Item 2) **[Figure 40-191-16]**.

Figure 40-191-17

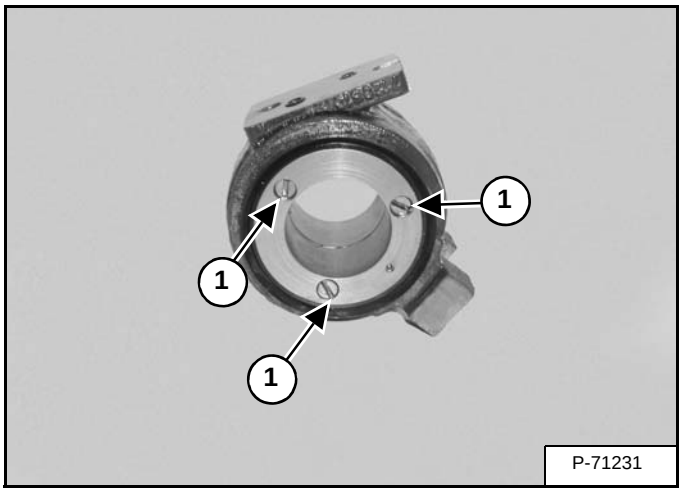


Remove the O-rings (Item 1) **[Figure 40-191-17]** from the swivel assembly.

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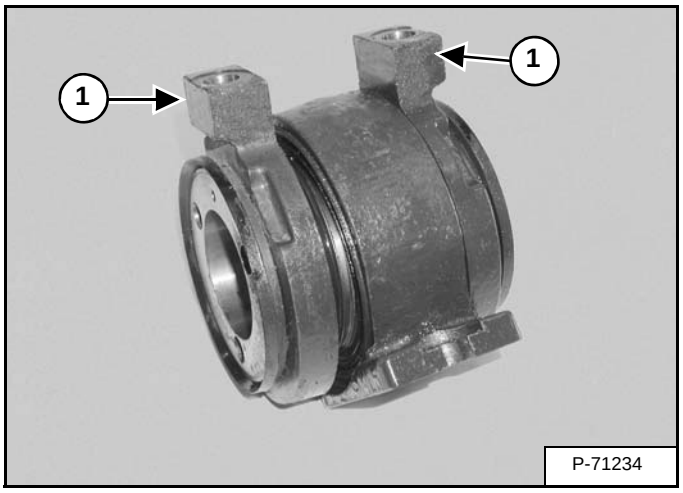
Disassembly (Cont'd)

Figure 40-191-18



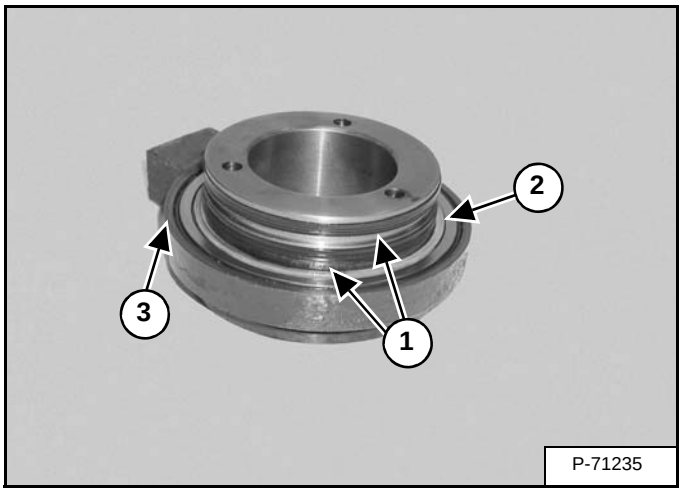
Remove the screws (Item 1) **[Figure 40-191-18]** and nuts from the swivel assembly.

Figure 40-191-19



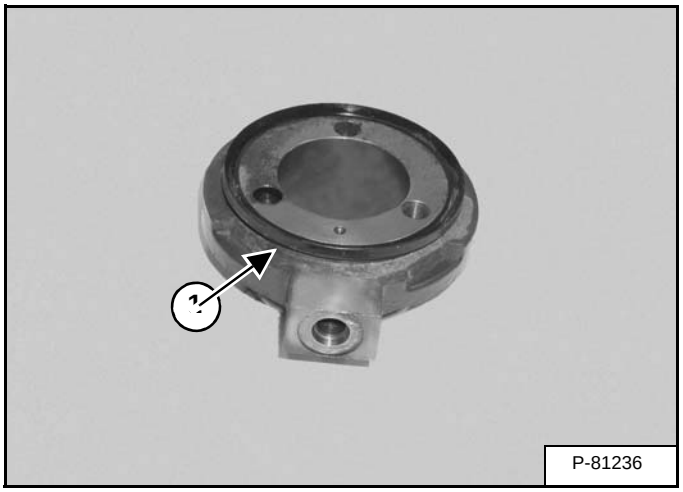
Remove the two swivel ends (Item 1) **[Figure 40-191-19]**.

Figure 40-191-20



Remove the seals (Item 1), wear ring (Item 2) and the O-ring (Item 3) **[Figure 40-191-20]** from the swivel end.

Figure 40-191-21

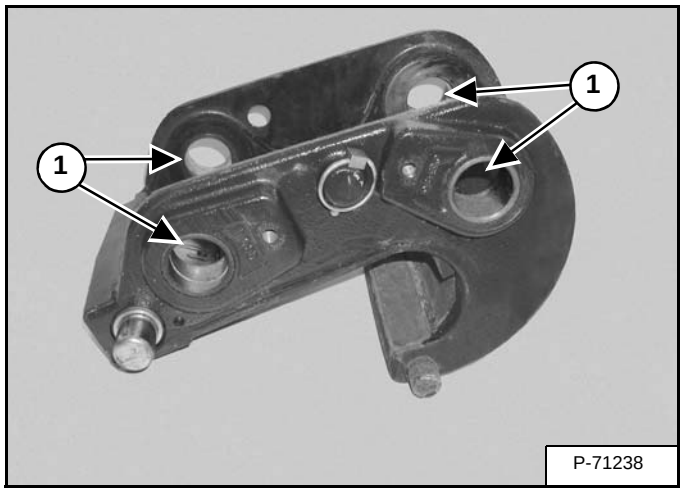


Remove the dust seal (Item 1) **[Figure 40-191-21]**. (Both swivel ends)

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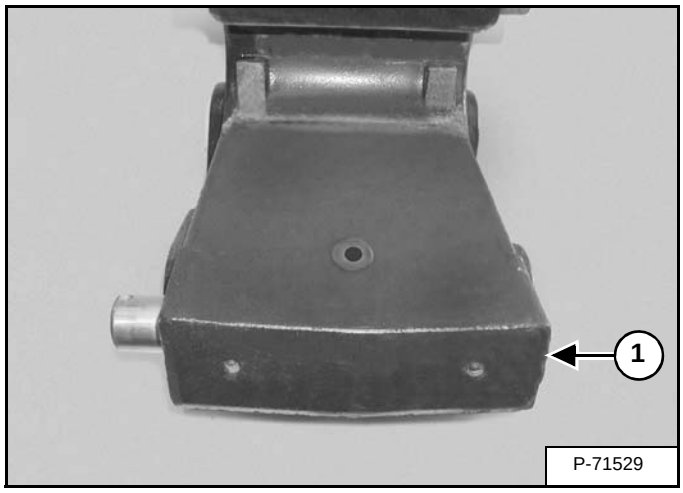
Disassembly (Cont'd)

Figure 40-191-22



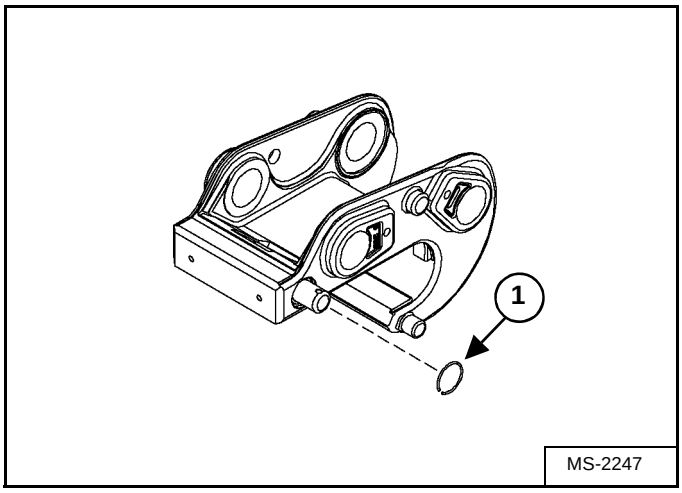
Remove the four bushings (Item 1) **[Figure 40-191-22]**.

Figure 40-191-23



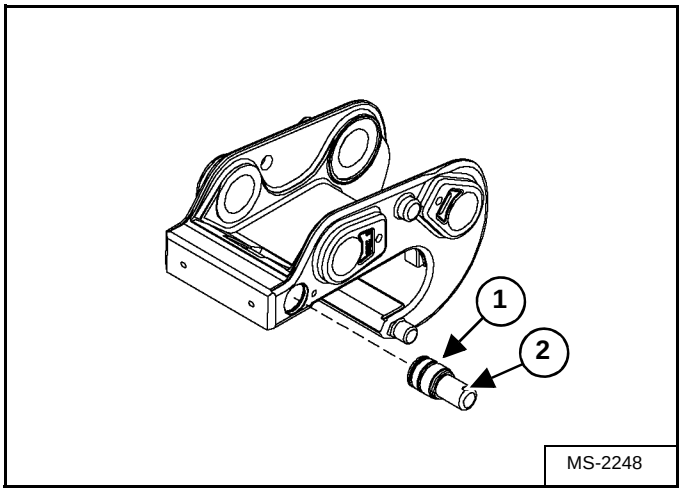
Apply inward pressure on the piston (Item 1) **[Figure 40-191-23]**. (Both sides)

Figure 40-191-24



Remove the retaining ring (Item 1) **[Figure 40-191-24]**. (Both sides)

Figure 40-191-25



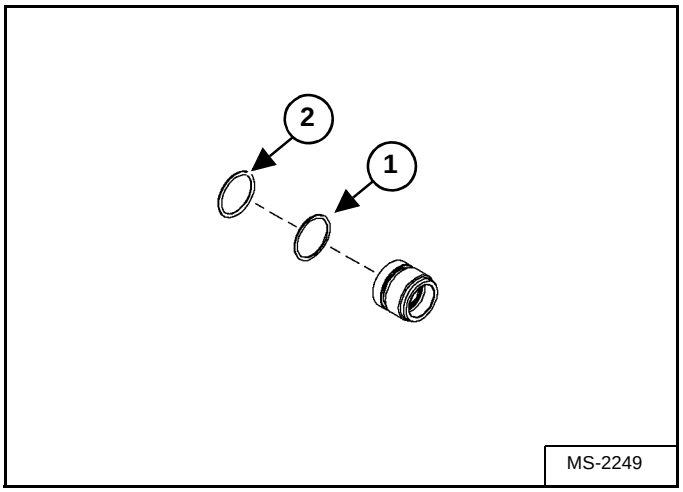
Remove the piston head (Item 1) and the piston (Item 2) **[Figure 40-191-25]**. (Both sides)

Separate the piston head (Item 1) and the piston (Item 2) **[Figure 40-191-25]**. (Both sides)

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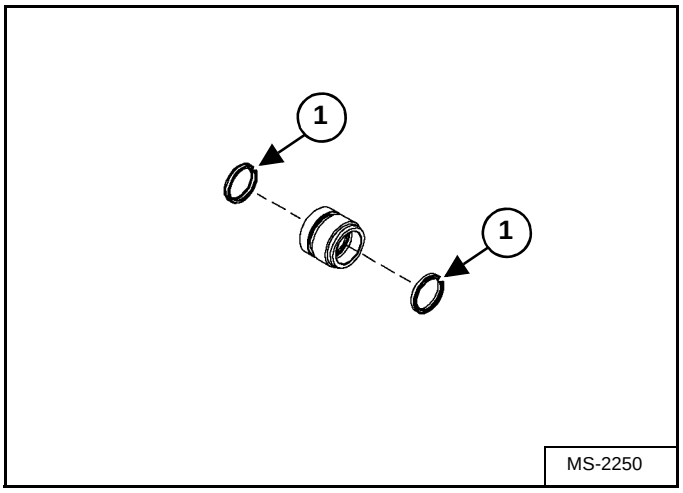
Disassembly (Cont'd)

Figure 40-191-26



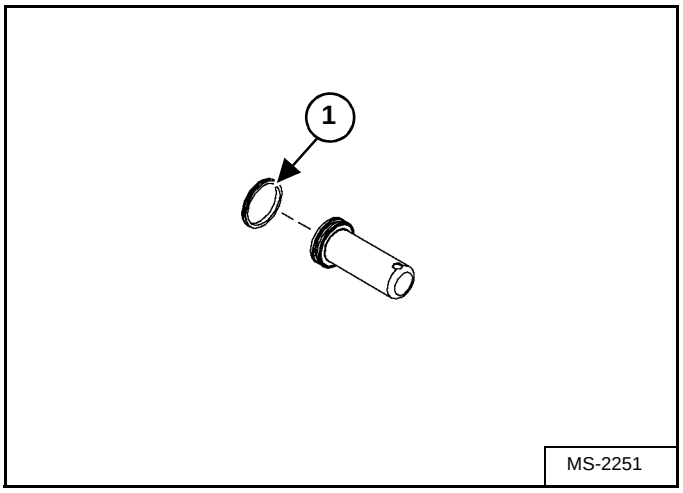
Remove the back-up ring (Item 1) and the O-ring (Item 2) **[Figure 40-191-26]** from the piston head.

Figure 40-191-27



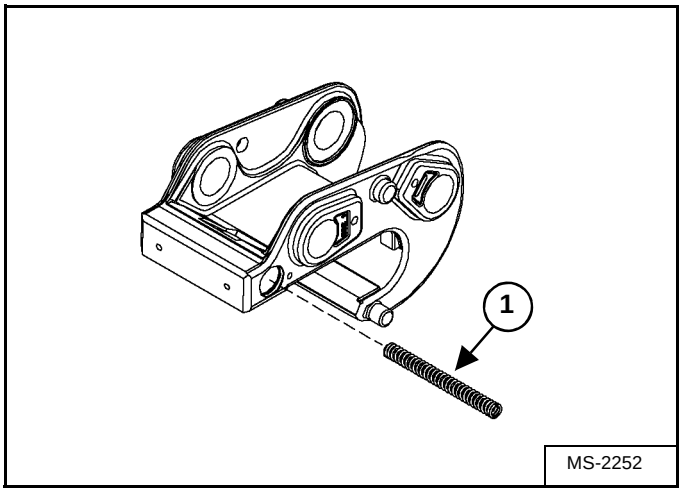
Remove the two pin seals (Item 1) **[Figure 40-191-27]** from inside the piston head.

Figure 40-191-28



Remove the piston seal (Item 1) **[Figure 40-191-28]** from the piston.

Figure 40-191-29



Remove the compression spring (Item 1) **[Figure 40-191-29]**.

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Assembly

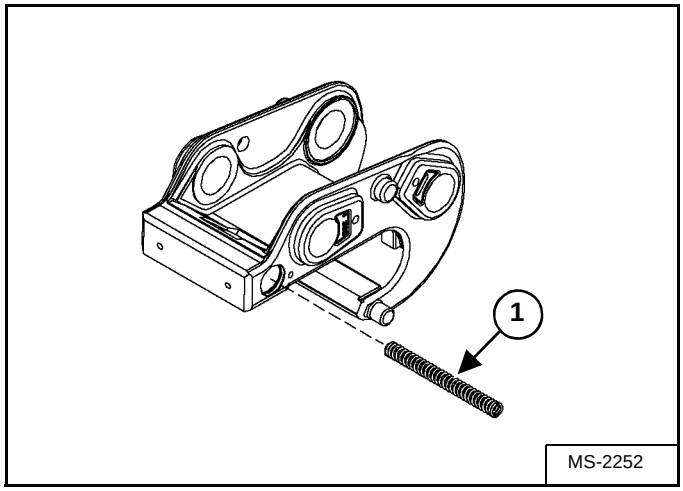
Clean all parts in solvent and dry with compressed air.

Inspect the cylinder parts for wear or damage. Replace any worn or damaged parts.

Always install new O-rings and seals.

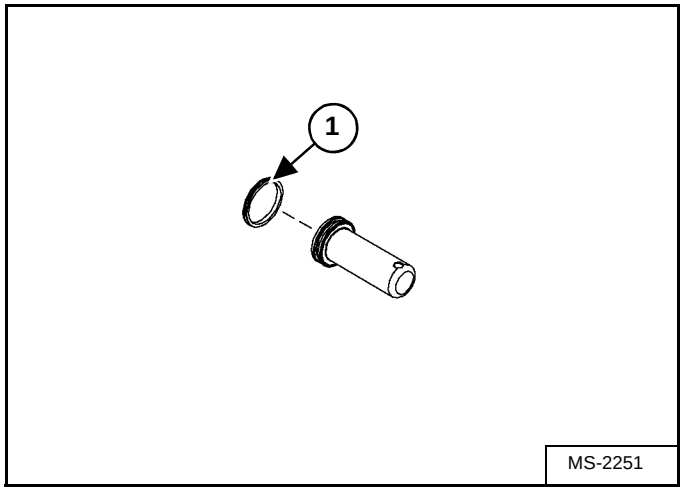
Lubricate all O-rings and seals with hydraulic oil during installation.

Figure 40-191-30



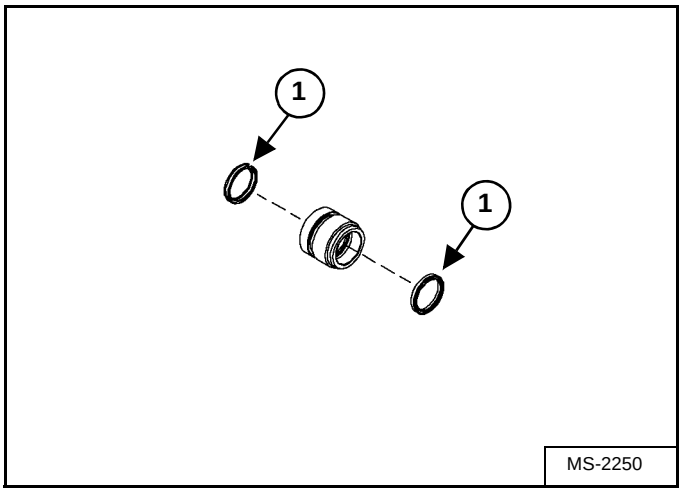
Install the compression spring (Item 1) **[Figure 40-191-30]**.

Figure 40-191-31



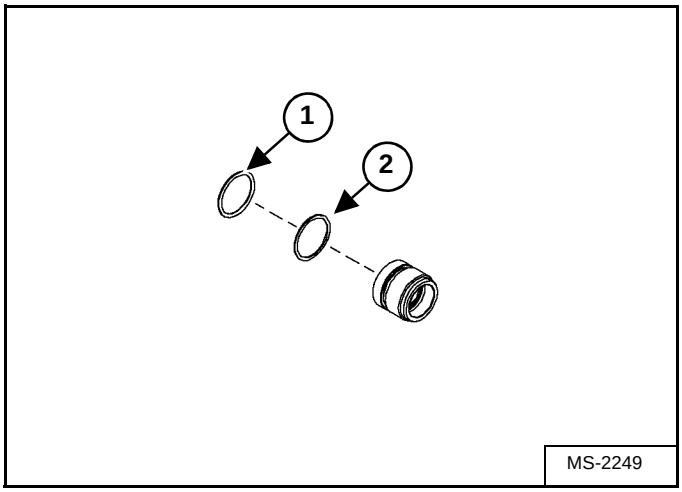
Install the piston seal (Item 1) **[Figure 40-191-31]** on the piston.

Figure 40-191-32



Install the two pin seals (Item 1) **[Figure 40-191-32]** on the inside of the piston head.

Figure 40-191-33

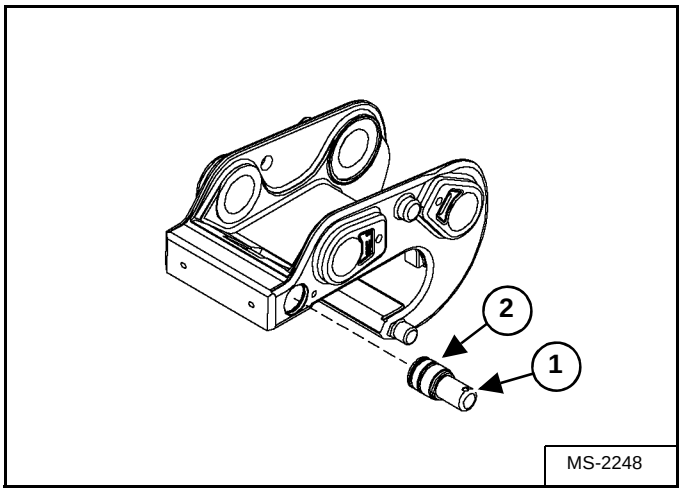


Install the O-ring (Item 1) and back-up ring (Item 2) **[Figure 40-191-33]** on the piston head.

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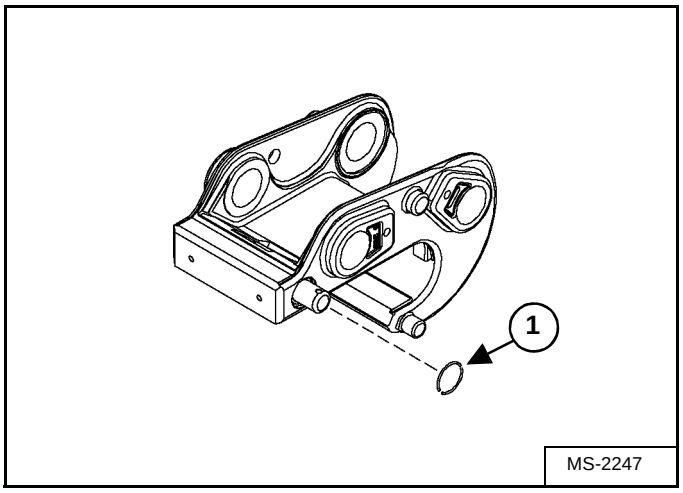
Assembly (Cont'd)

Figure 40-191-34



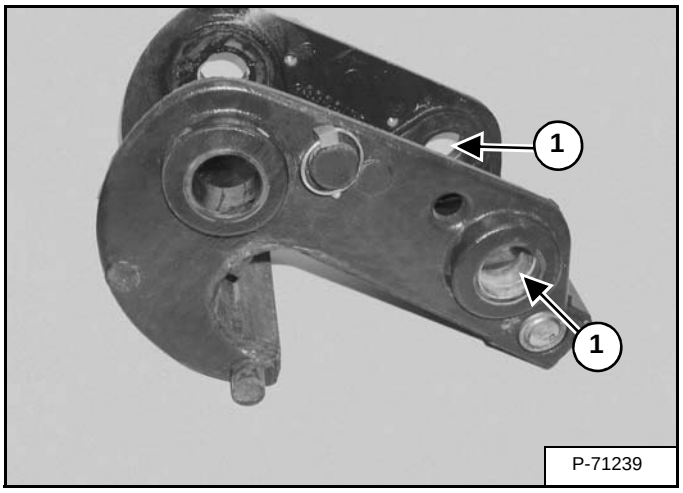
Install the piston (Item 1) and the piston head (Item 2) **[Figure 40-191-34]**.

Figure 40-191-35



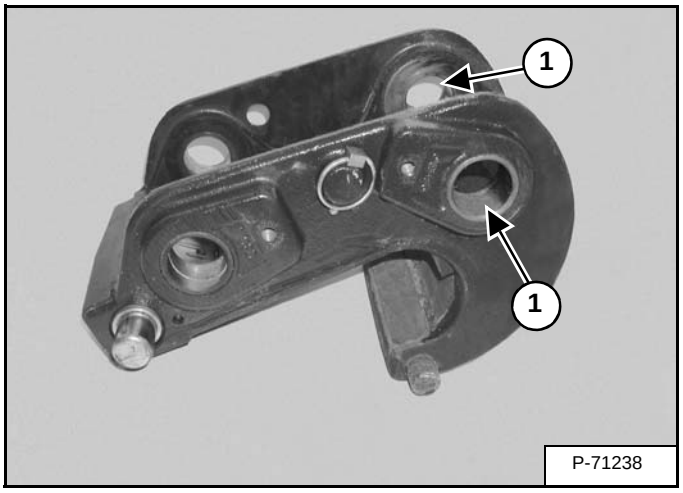
Apply inward pressure on the piston and install the retaining ring (Item 1) **[Figure 40-191-35]**.

Figure 40-191-36



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

Figure 40-191-37

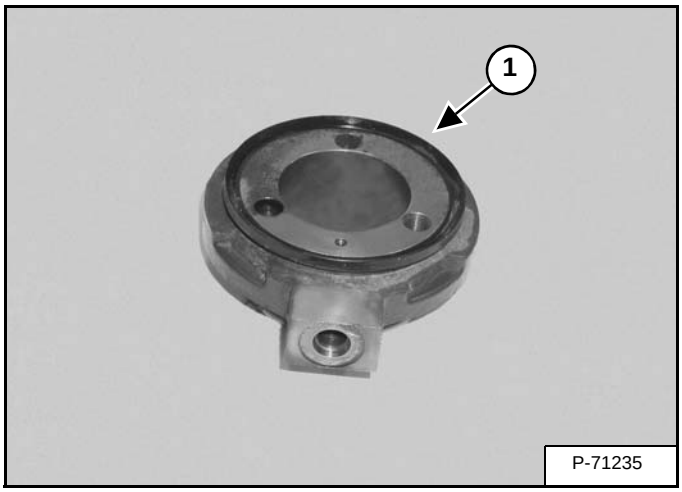


Install the bushings (Item 1) **[Figure 40-191-37]**.

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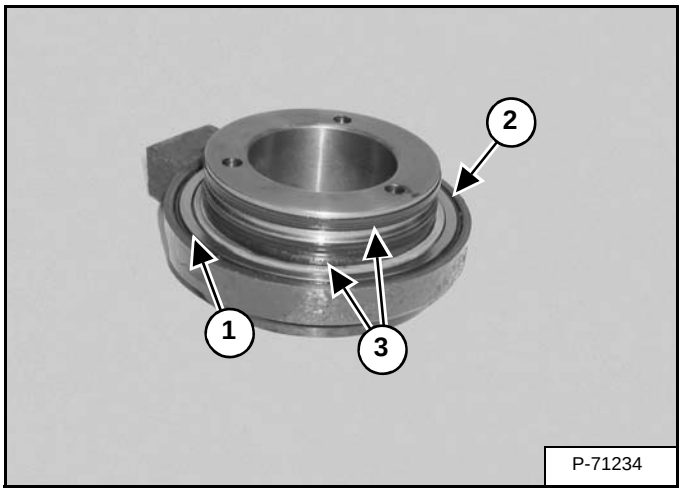
Assembly (Cont'd)

Figure 40-191-38



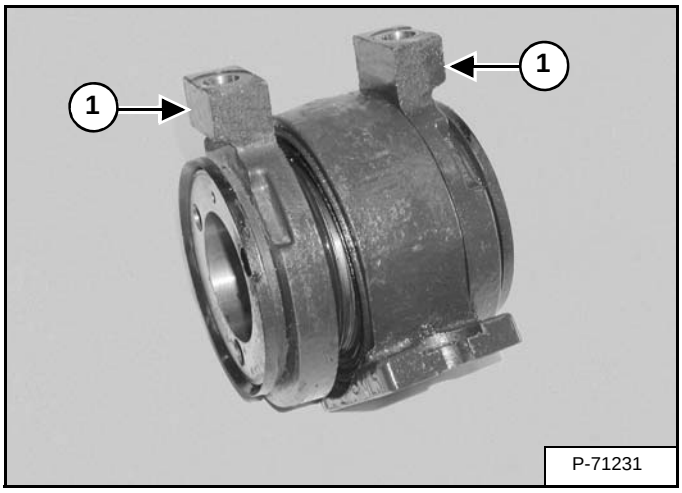
Install the dust seal (Item 1) **[Figure 40-191-38]** on the swivel.

Figure 40-191-39



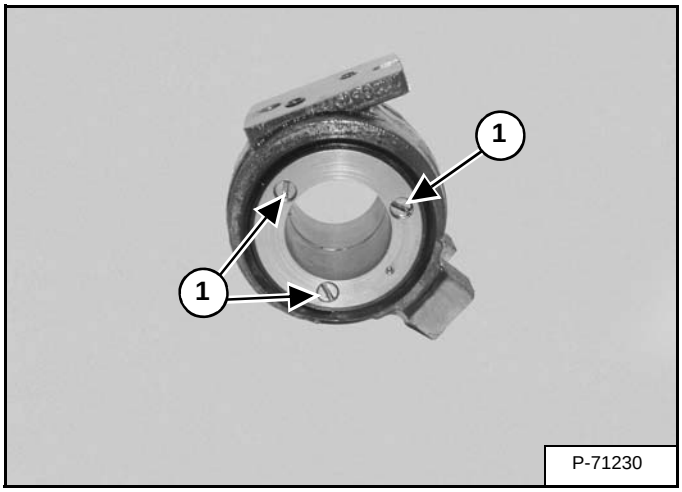
Install the O-ring (Item 1) wear ring (Item 2) and the seals (Item 3) **[Figure 40-191-39]**.

Figure 40-191-40



Install the swivel ends (Item 1) **[Figure 40-191-40]** onto the base.

Figure 40-191-41

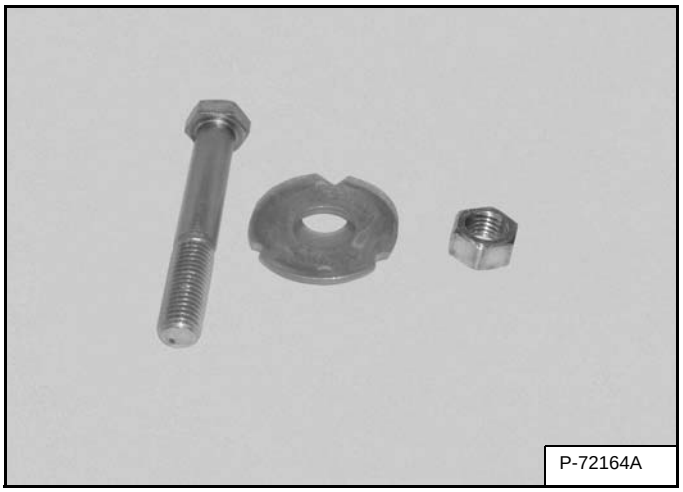


Install the screws (Item 1) **[Figure 40-191-41]** and nuts in the swivel assembly. Do not tighten at this time.

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Assembly (Cont'd)

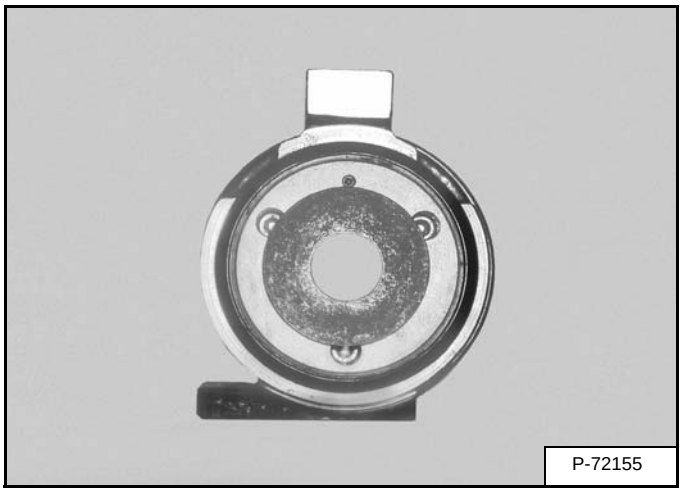
Figure 40-191-42



It is necessary to fabricate a preload tool to get the proper torque on the swivel assembly screws. The tool consists of a 5/8 x 5 in. course thread bolt, two 5/8 x 2 in. flat washers and a 5/8 course thread nut **[Figure 40-191-42]**.

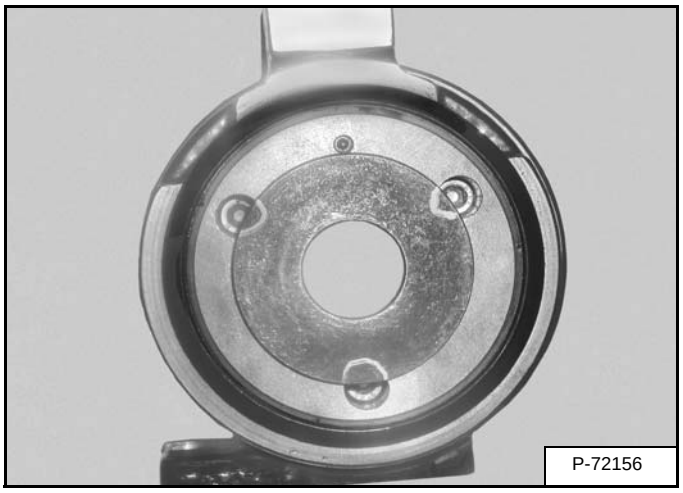
NOTE: This procedure must be followed to ensure the swivel assembly screws are tightened to the proper torque value.

Figure 40-191-43



Center a 2 in. flat washer on one side of the swivel assembly **[Figure 40-191-43]**.

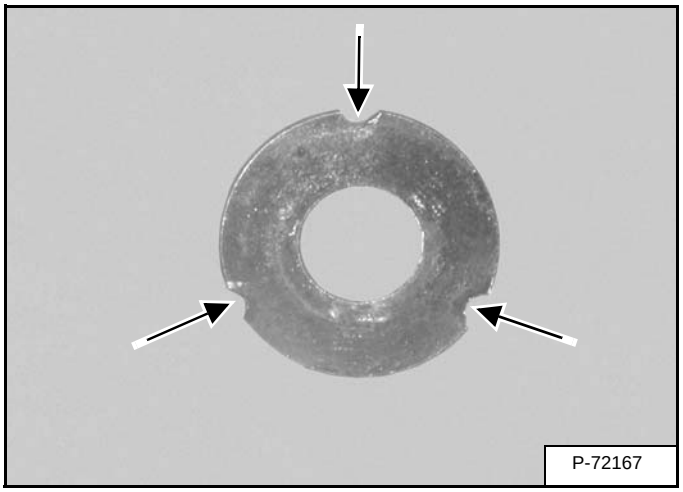
Figure 40-191-44



Using a marker, mark the three screw holes on the washer **[Figure 40-191-44]**.

Repeat for the opposite side.

Figure 40-191-45



Using a grinder, remove material identified in the previous step **[Figure 40-191-45]**.

⚠ WARNING

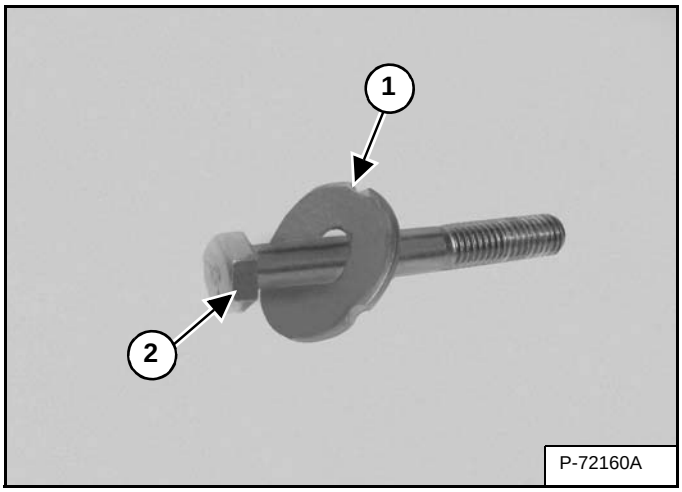
Eye and body protection is required when welding or grinding. Wear approved goggles, helmet and clothing. Failure to wear eye and body protection can result in serious injury.

W-2009-1285

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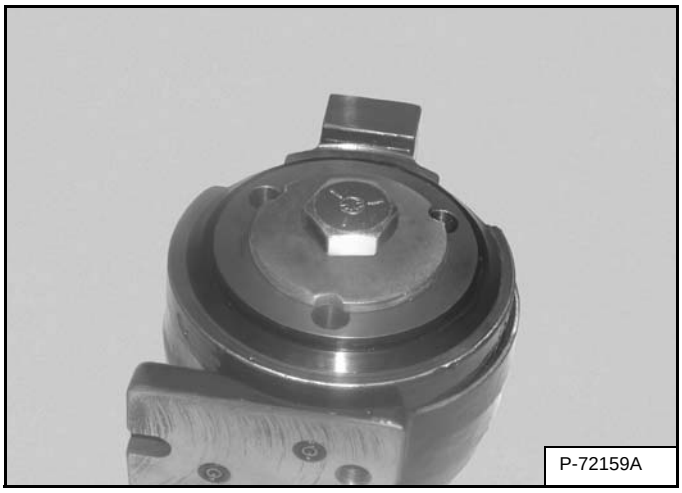
Assembly (Cont'd)

Figure 40-191-46



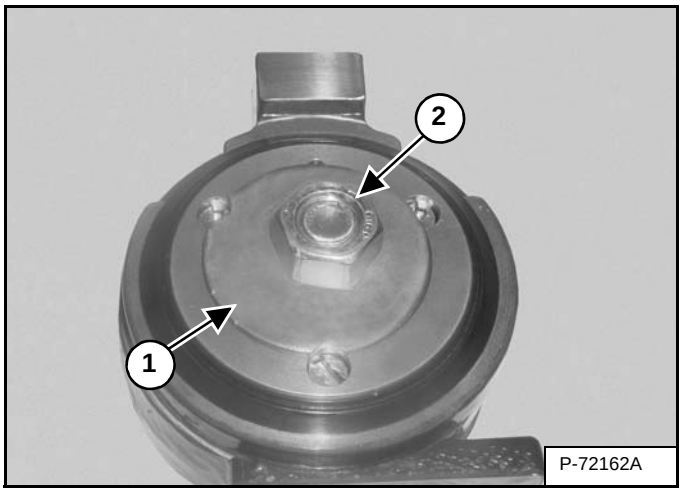
Install a 2 in. flat washer (Item 1) onto the bolt (Item 2) **[Figure 40-191-46]**.

Figure 40-191-47



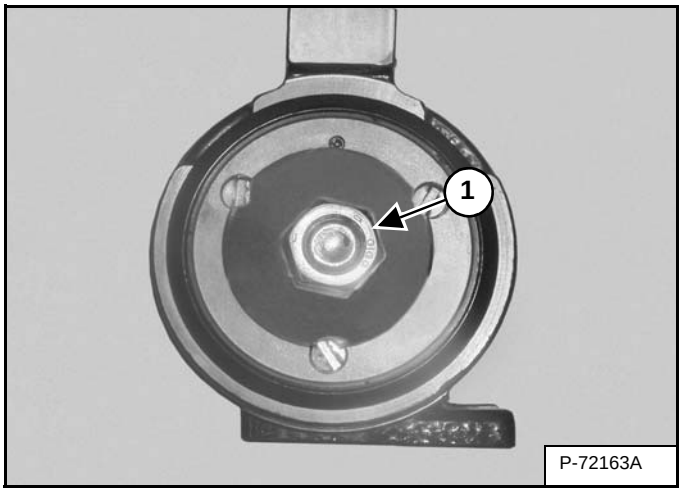
Insert the bolt through the center of the swivel assembly aligning the notches in the flat washer with the screw holes **[Figure 40-191-47]**.

Figure 40-191-48



Turn the swivel assembly over and install the remaining 2 in. flat washer (Item 1) and nut (Item 2) **[Figure 40-191-48]**.

Figure 40-191-49



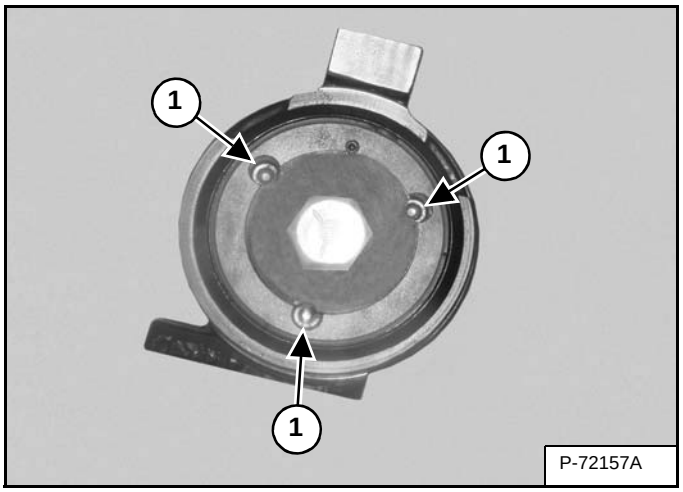
NOTE: Ensure the notches in both washers are aligned with the screw holes on the swivel assembly [Figure 40-191-49].

Tighten the preload tool nut (Item 1) **[Figure 40-191-49]** to 83 ft.-lb. (112.5 N•m) torque.

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Assembly (Cont'd)

Figure 40-191-50

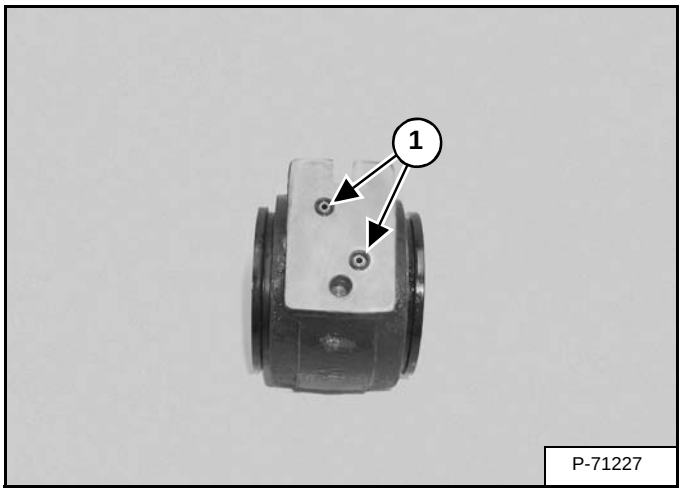


Tighten the swivel assembly screws (Item 1) **[Figure 40-191-50]** to 10.4-11.6 ft.-lb. (14,2-15,8 N•m) torque.

NOTE: This procedure must be followed to ensure the swivel assembly screws are tightened to the proper torque value.

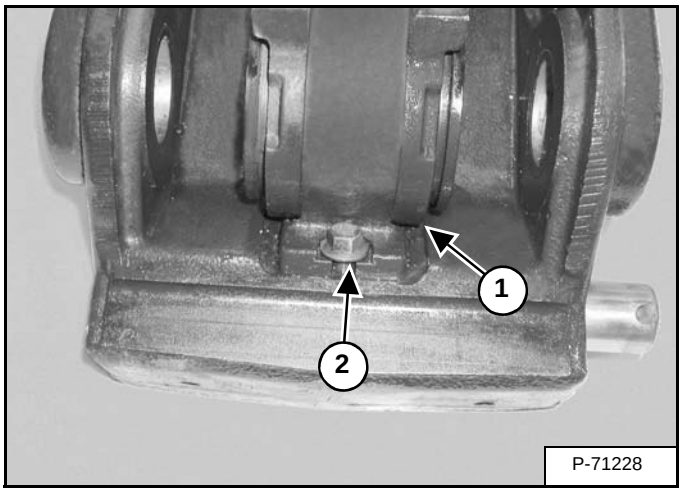
Remove the preload tool.

Figure 40-191-51



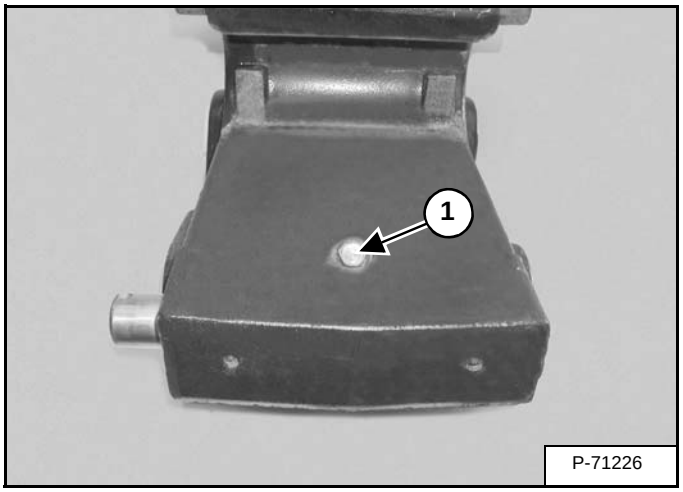
Install the two O-rings (Item 1) **[Figure 40-191-51]** into the swivel assembly.

Figure 40-191-52



Install the swivel assembly (Item 1) using the bolt (Item 2) **[Figure 40-191-52]**.

Figure 40-191-53

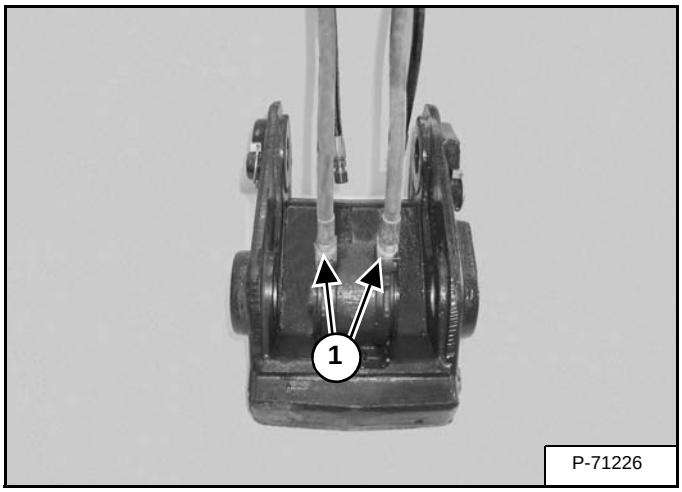


Install the bolt (Item 1) **[Figure 40-191-53]** and nut.

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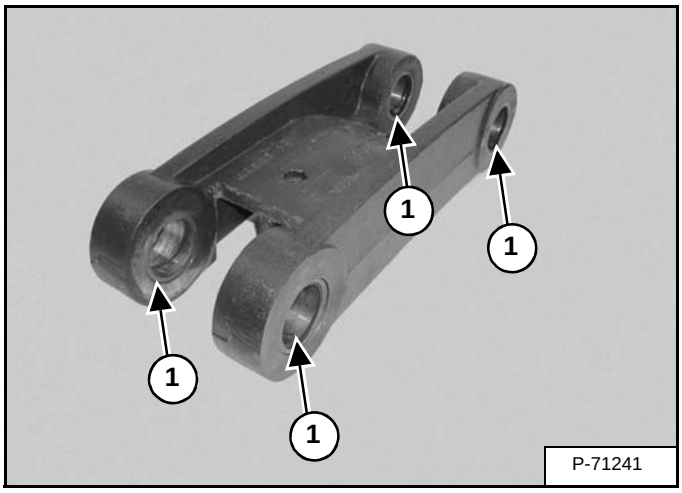
Assembly (Cont'd)

Figure 40-191-54



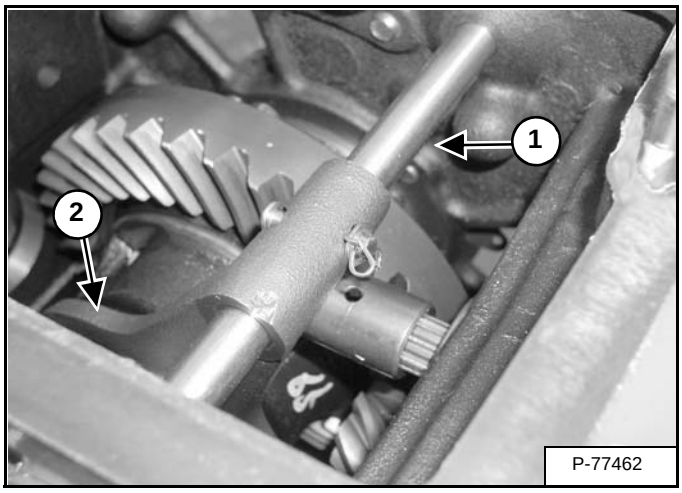
Install the hydraulic hoses (Item 1) **[Figure 40-191-54]** onto the swivel ends.

Figure 40-191-55



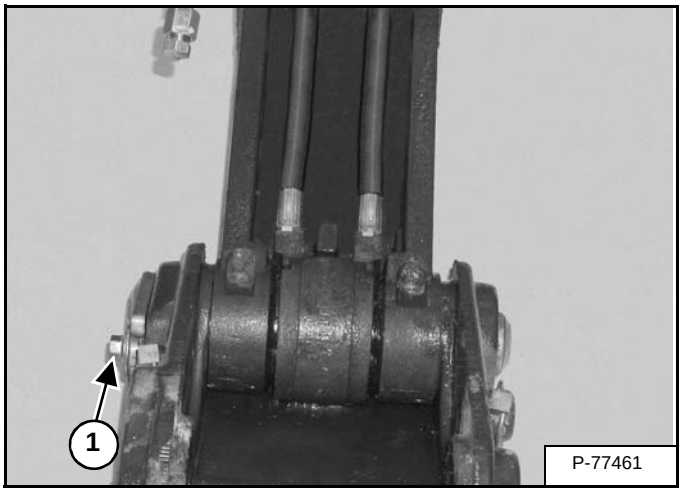
Install the bushings (Item 1) **[Figure 40-191-55]** and dust seals into the bucket link.

Figure 40-191-56



Install the bucket link (Item 1) and pin (Item 2) **[Figure 40-191-56]**.

Figure 40-191-57

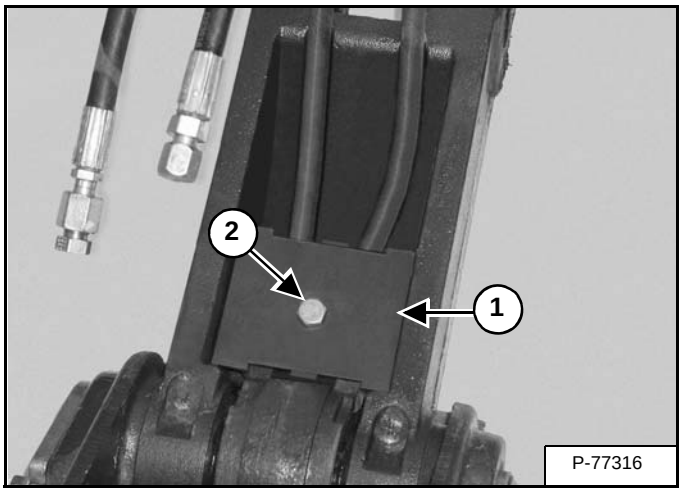


Install the spacer, flat washer and bolt (Item 1) **[Figure 40-191-57]**.

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Assembly (Cont'd)

Figure 40-191-58



Install the foam block and cover (Item 1) using the bolt (Item 2) **[Figure 40-191-58]** and nut.

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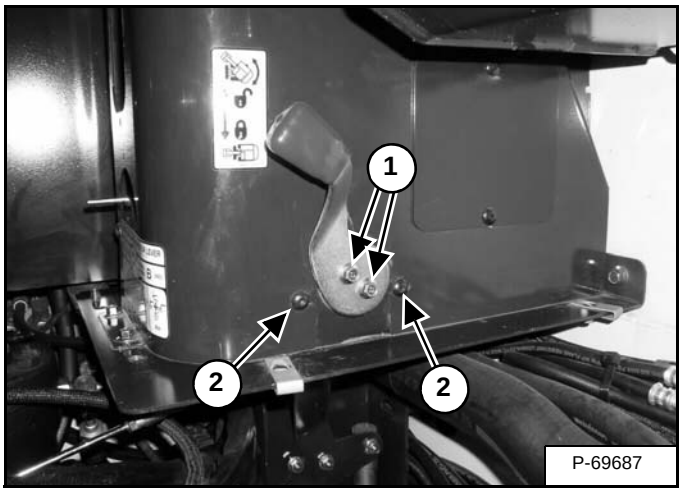
UPPERSTRUCTURE SLEW LOCK

Removal And Installation (Early Models)

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

Remove the floor mat and floor panels. (See FLOOR MAT AND FLOOR PLATE on Page 40-110-1.)

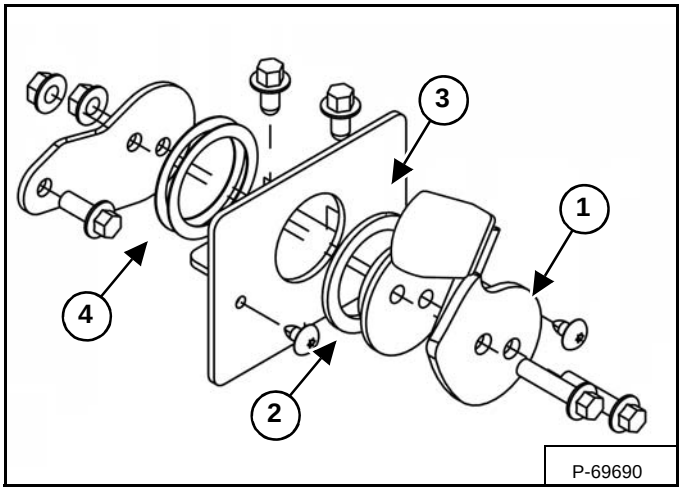
Figure 40-200-1



Remove the bolts (Item 1) and (Item 2) **[Figure 40-200-1]** from the slew lock lever assembly.

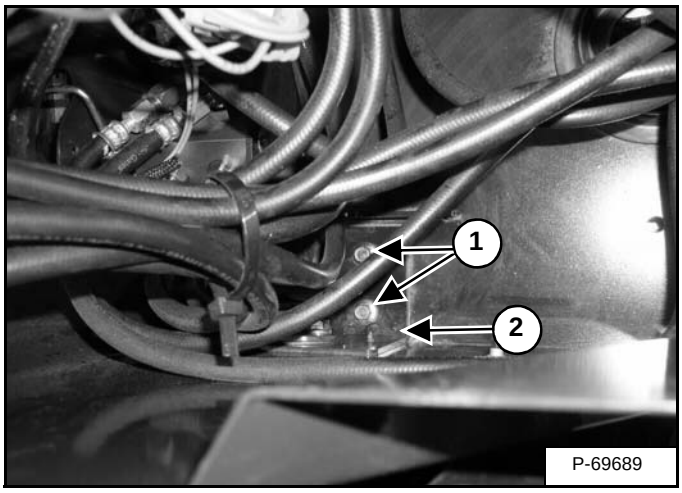
Installation: Tighten the bolts (Item 1) **[Figure 40-200-1]** to 5.5 ft.-lb. (7,5 N•m) torque.

Figure 40-200-2



Remove the lever (Item 1), spacer (Item 2), washer (Item 3) and wave washers (Item 4) **[Figure 40-200-2]** from the slew lock lever assembly.

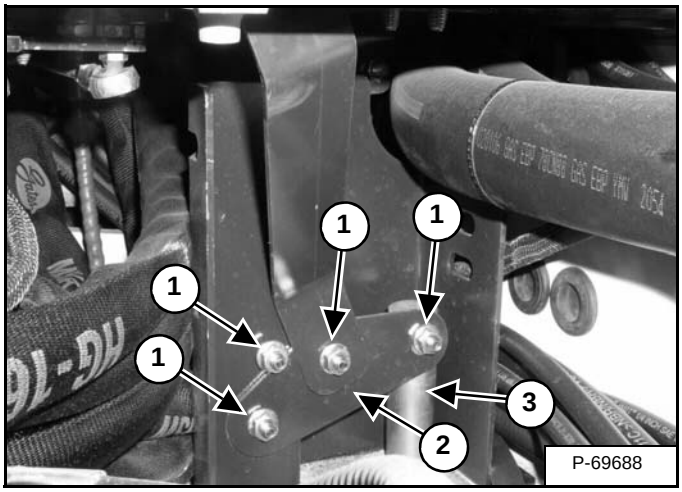
Figure 40-200-3



Looking down into the bottom of the right console remove the bolts (Item 1) **[Figure 40-200-3]** from the slew lock lever bracket.

Remove the bracket (Item 2) **[Figure 40-200-3]**.

Figure 40-200-4



Remove the bolts, nuts, and spacers (Item 1) **[Figure 40-200-4]** from the slew lock lever.

Remove the lever (Item 2) and remove the pin (Item 3) **[Figure 40-200-4]** from the slew lock lever assembly.

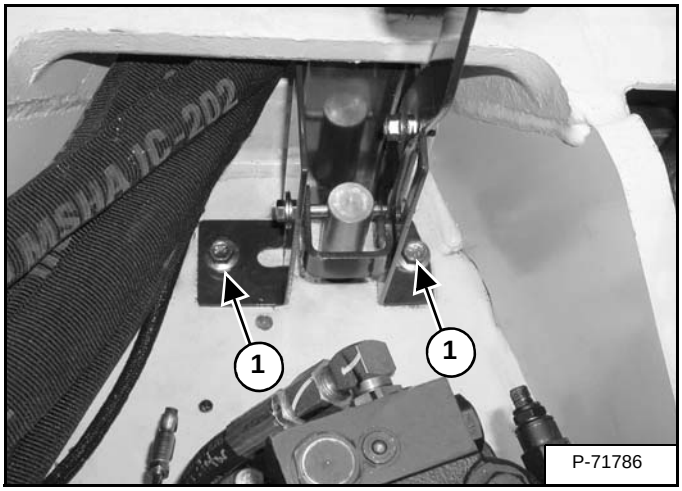
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UPPERSTRUCTURE SLEW LOCK (CONT'D)

Removal And Installation (Later Models)

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

Figure 40-200-5

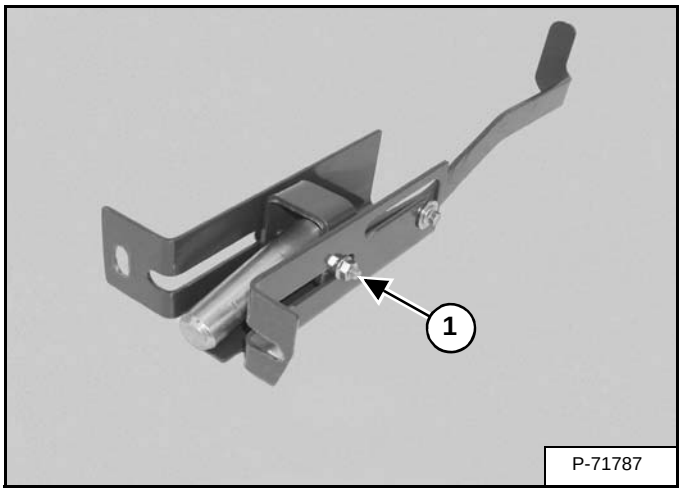


Remove the two bolts (Item 1) **[Figure 40-200-5]**.

Remove the upperstructure slew lock.

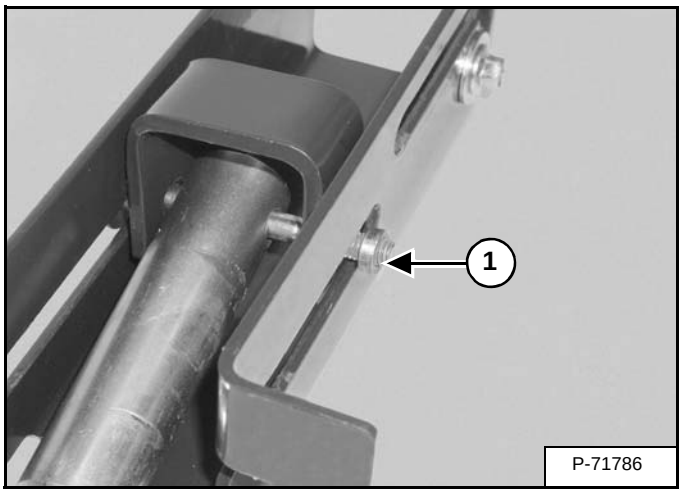
Disassembly And Assembly (Later Models)

Figure 40-200-6



Remove the nut (Item 1) **[Figure 40-200-6]**.

Figure 40-200-7

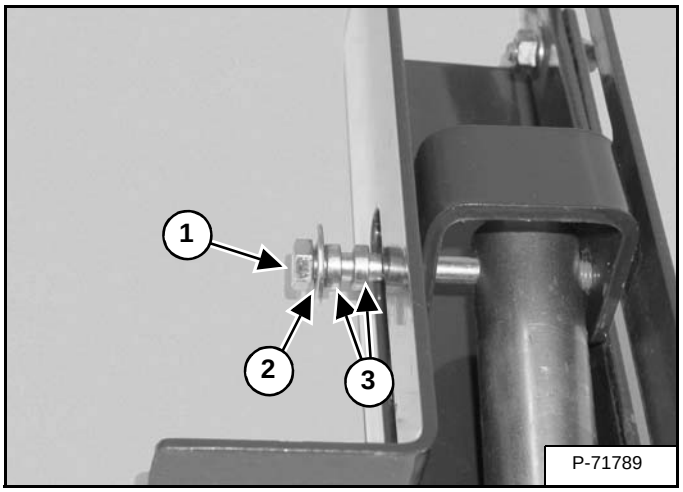


Remove the spacer (Item 1) **[Figure 40-200-7]**.

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

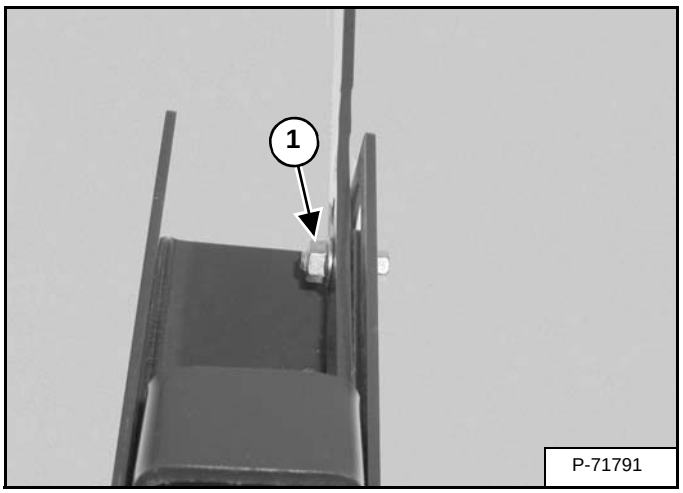
Figure 40-200-8



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

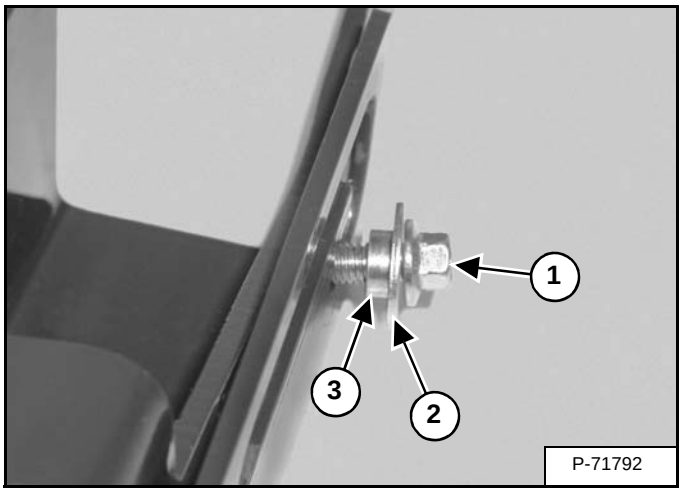
Remove the pin.

Figure 40-200-9



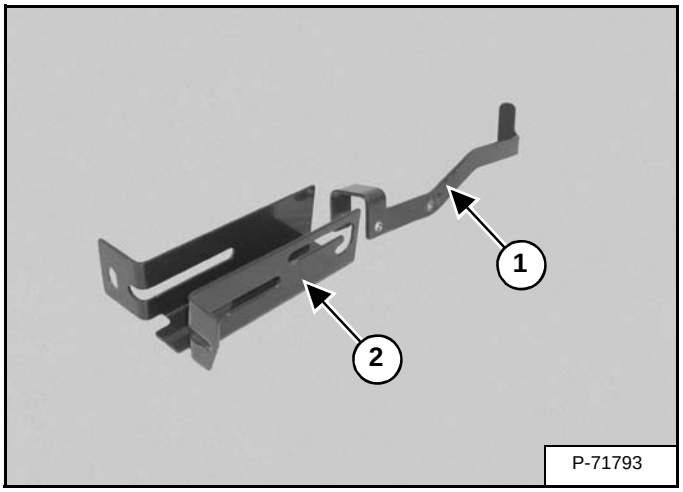
Remove the nut (Item 1) **[Figure 40-200-9]**.

Figure 40-200-10



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

Figure 40-200-11



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

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Bobcat®

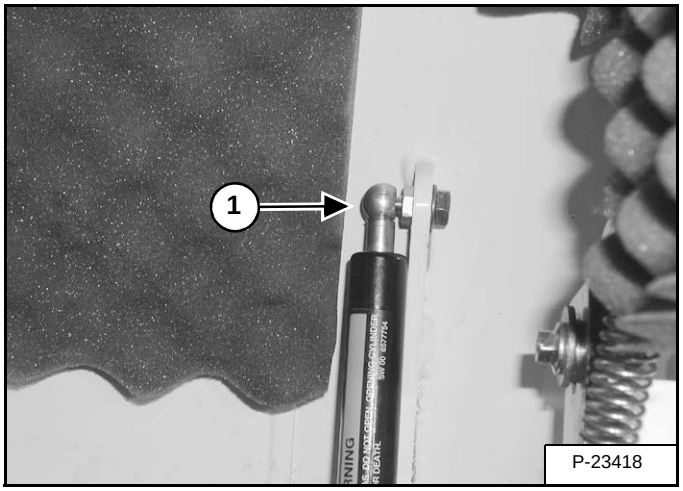
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RIGHT SIDE COVER

Removal And Installation

Open the cover.

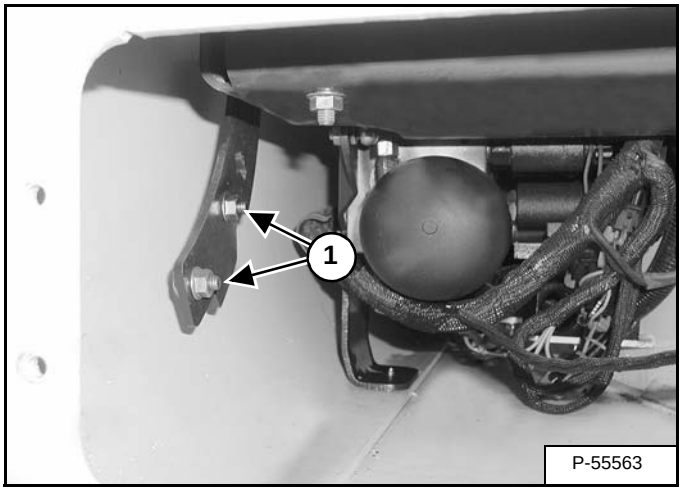
Figure 40-210-1



Remove the gas spring retaining clip (Item 1) **[Figure 40-210-1]** and disconnect the gas spring.

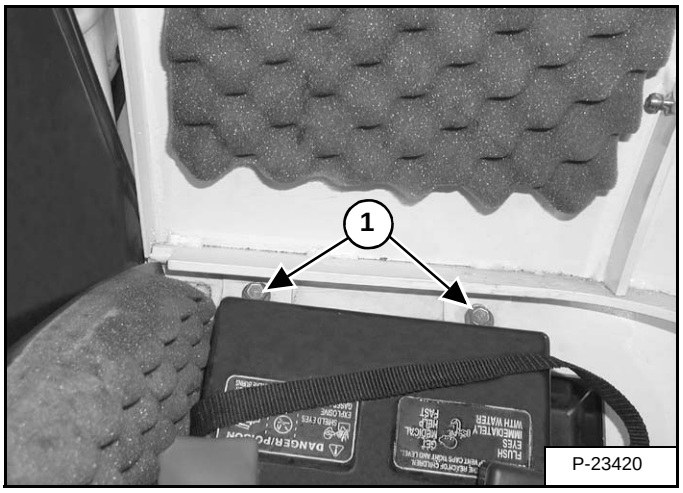
Rotate the gas spring towards the rear of the excavator.

Figure 40-210-2



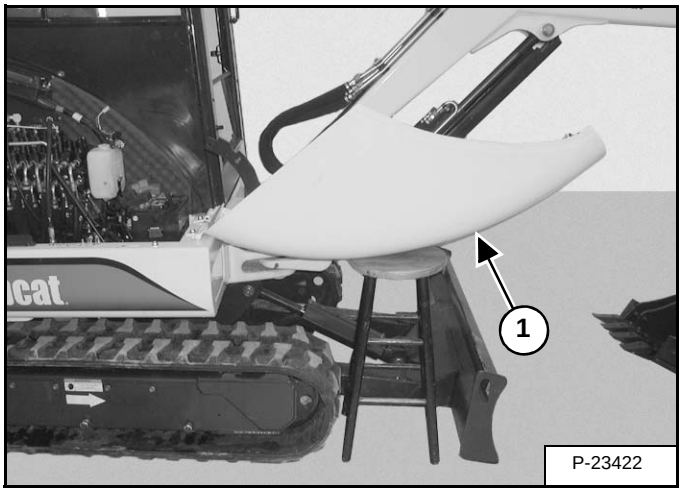
Close the cover. Remove the stop bolts and nuts (Item 1) **[Figure 40-210-2]**.

Figure 40-210-3



Open the cover. Loosen the two bolts (Item 1) **[Figure 40-210-3]** and nuts.

Figure 40-210-4

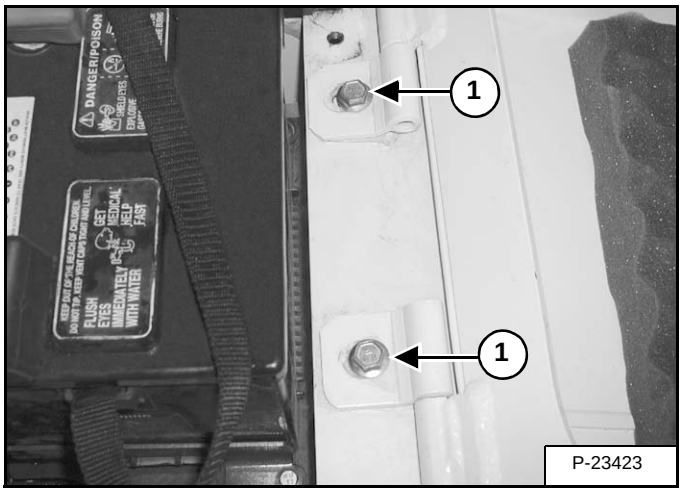


Fully open and support the cover (Item 1) **[Figure 40-210-4]**.

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Removal And Installation (Cont'd)

Figure 40-210-5



Remove the two nuts and bolts (Item 1) **[Figure 40-210-5]**.

Remove the cover.

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WIRING SCHEMATIC

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331 (S/N 234313000 - 234313120)
331E (S/N 234412000 - 234412010)
334 (S/N 234513000 - 234513112)
(PRINTED NOVEMBER 2006)
V-0639

WIRES CONNECT BY LETTER ACROSS CONNECTORS

SOME CONNECTOR BODIES NOT SHOWN FOR DRAWING CLARITY

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

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

CONTROL MODULE CONNECTORS J1-J6

J3: F L POT SIGNAL, G SENSOR POWER (+8V), D CONSOLE, C HYD TEMP, H SENSOR GROUND, A FUEL SENDER, B ENGINE TEMP, E SPARE ANG #1
J4: F HYD OIL FILTER, K ENGINE SPEED VR, G ENG OIL PRESS, H TRAVEL PEDAL SWITCH, D STARTER STATUS, A ENGINE SPEED HALL, B GLOW PLUG STATUS, J CRANK, C FUEL PULL STATUS, E KEY
J1: K SWITCHED POWER RELAY, G GROUND, J FUEL PULL, B FUEL HOLD, C LIGHT, D GROUND, A STARTER, E BATTERY, F BATTERY, H GLOW PLUG
J5: J L SKI UP, H L SKI DOWN, K CAN SHIELD, A CAN LOW, B CAN HIGH, L R POT SIGNAL, M 2 SPEED, E DETENT, G R SKI DOWN, D R SKI UP, C
J6: F UNUSED #3, E UNUSED #2, D UNUSED #1, C SPARE DIG #2, B SPARE DIG #1, A SPARE ANG #2
J2: K LOAD MOMENT, J PIEZO OUT, G DIVERTER OUT, E 2 SPEED PWM, C PWM HYDROGROUP D37, H WORKGROUP D25 AND D31, D SPARE RELAY OUT, A FRONT ROD, B FRONT BASE, F SPARE RETLESS SOL

RIGHT HAND CONSOLE HARNESS 6809046

RIGHT HANDLE: DETENT, PWM
C456: B BRN, C RED, E WHT, A GRN, D BLK
TWO-SPEED (BLADE LEVER)
TRAVEL PEDAL SWITCH
BUZZER
DIVERTER FOR 2ND AUX (OPTIONAL) — C413
TWO-SPEED — C414 — YELLOW TIE STRAP
WORK GROUP LOCKOUT — C414 — ORANGE TIE STRAP
WORK GROUP LOCKOUT — C414 — GREEN TIE STRAP
FRONT ROD — C419 — BLUE TIE STRAP
FRONT BASE — C420 — RED TIE STRAP
8 ohm nominal at 12 VDC
8 ohm nominal at 12 VDC (325/328)
6 ohm mominal at 12VDC (331/331E/334)

C455: WHT, DGN, RED
IGNITION SWITCH: START, RUN, OFF

120 ohm
ACD & REMOTE START CONNECTOR — C453

LH CONSOLE HARNESS 6817244

LEFT HANDLE: DETENT, RED, BRN — C467
FUEL SENDER 20-270 ohm — C158
CONSOLE SENSOR
LOAD MOMENT (OPTIONAL)
FRAME LIGHT
BEACON SWITCH (OPTIONAL)
WIPER SWITCH (OPTIONAL)
C457
C458: TRAVEL ALARM (OPTIONAL)
HYD TEMP SENDER 538-1824 ±30 ohm
HYD FILTER SWITCH
HORN
C461
C465: AUX SOCKET
C462: WASHER BOTTLE
C460

CAB AND WIPER WIRING (IF SO EQUIPPED) HARNESS 7100772 AND 7100774

BEACON
CAB LIGHT CONN
WIPER MOTOR
GROUND SPLICE
DOME LIGHT
7100772
BOOM LIGHT HARNESS 6808415
BOOM LIGHT

ENGINE HARNESS 6817272 331/331E/334

FUEL SHUTOFF SOLENOID (EARLY MODELS)
FUEL SHUT OFF WHT TO BLK = 0.26 OHM, RED TO BLK = 10.9 OHM
C101
FUEL SHUT OFF HOLD = 0.33 OHM, PULL = 24.5 OHM
FUEL SHUTOFF SOLENOID (LATER MODELS)
C450
C451
GLOW PLUGS 0.4 ohm
SPEED SENSOR (VR) — C160
ENGINE OIL PRESSURE SWITCH
ENGINE COOLANT SENDER 500-3000 ± 30 ohm — C169
STARTER
ALTERNATOR
GROUNDS
BATTERY

C161 HEATER
ACD POWER — FUSE 4 25A
WIPER POWER — FUSE 1 5A
ALT / HEATER — FUSE 3 25A
SWITCH POWER — FUSE 2 20A
SWITCHED POWER
STARTER
FUEL SHUTOFF
LIGHT RELAY
GLOW PLUG
RADIO MEMORY
RADIO CONN
RELAY GROUNDS 2000-2050 ARE CONNECTED IN SERIES

FUSE 6 25A
FUSE 8 25A
FUSE 11 20A
FUSE 9 25A
FUSE 12 15A
FUSE 7 5A
FUSE 10 25A

GROUNDS: 2310 — 2000, 2330, 2340, 2450, 2480, 2510, 2520,2650, 2710, 2820, 2830, 2940; 2300 — 2100, 2110, 2610, 2740, 2790, 2840, 2930
POWER LEADS: 1150, 1070, 1330, 1310, 1060, 1360 — 1040, 1030

FUSE BLOCK: 15A ACC FUSE 12; 20A LIGHTS FUSE 11; 25A ACC FUSE 10; 25A CONTROLLER FUSE 9; STARTER; GLOW PLUGS; LIGHTS; FUEL PULL; SWITCH POWER; 25A ACC FUSE 4; 25A FUEL FUSE 8; 20A ALTHEATER FUSE 3; 5A IGN FUSE 7; 20A IGN POWER FUSE 2; 25A HEATER FUSE 6; 5A WIPER FUSE 1; FUSE 5

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V-0639 (11-1-06)

WIRING SCHEMATIC

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331 (S/N 234313121 AND ABOVE)
331E (S/N 234412011 AND ABOVE)
334 (S/N 234513113 AND ABOVE)
(PRINTED JULY 2007)
V-0634

WIRES CONNECT BY LETTER ACROSS CONNECTORS

SOME CONNECTOR BODIES NOT SHOWN FOR DRAWING CLARITY

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

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

CONTROL MODULE CONNECTORS J1-J6

J3: L POT SIGNAL, SENSOR POWER (+8V), CONSOLE, HYD TEMP, SENSOR GROUND, FUEL SENDER, ENGINE TEMP, SPARE ANG #1
J4: HYD OIL FILTER, ENGINE SPEED VR, ENG OIL PRESS, TRAVEL PEDAL SWITCH, STARTER STATUS, ENGINE SPEED HALL, GLOW PLUG STATUS, CRANK, FUEL PULL STATUS, KEY
J1: SWITCHED POWER RELAY, GROUND, FUEL PULL, FUEL HOLD, LIGHT, GROUND, STARTER, BATTERY, BATTERY, GLOW PLUG
J5: L SKI UP, L SKI DOWN, CAN SHIELD, CAN LOW, CAN HIGH, R POT SIGNAL, 2 SPEED, DETENT, R SKI DOWN, R SKI UP
J6: UNUSED #3, UNUSED #2, UNUSED #1, SPARE DIG #2, SPARE DIG #1, SPARE ANG #2
J2: LOAD MOMENT, PIEZO OUT, DIVERTER OUT, 2 SPEED PWM, PWM WORKGROUP D37, WORKGROUP D25 AND D31, SPARE RELAY OUT, FRONT ROD, FRONT BASE, SPARE KEYLESS SOL

RIGHT HAND CONSOLE HARNESS 6810761

RIGHT HANDLE: DETENT, PWM (BRN, RED, WHT, GRN, BLK)
TWO-SPEED (BLADE LEVER)
TRAVEL PEDAL SWITCH
BUZZER

LH CONSOLE HARNESS 6817244

LEFT HANDLE: DETENT, RED, BRN
FUEL SENDER 20-270 ohm
CONSOLE SENSOR
LOAD MOMENT (OPTIONAL)
FRAME LIGHT
BEACON SWITCH (OPTIONAL)
WIPER SWITCH (OPTIONAL)
LOAD MOMENT (OPTIONAL)
HORN
TRAVEL ALARM (OPTIONAL)
HYD TEMP SENDER 538-1824 ±30 ohm
HYD FILTER SWITCH

HYDRAULIC X-CHANGE OPTION CONNECTOR C413

8 ohm nominal at 12 VDC (325/328)
6 ohm nominal at 12VDC (331/331E/334)
TWO-SPEED C414 — YELLOW TIE STRAP
WORK GROUP LOCKOUT C415A — 8 ohm nominal at 12 VDC — ORANGE TIE STRAP
WORK GROUP LOCKOUT C415B — 8 ohm nominal at 12 VDC — GREEN TIE STRAP
FRONT ROD C419 — 6 ohm nominal at 12 VDC — BLUE TIE STRAP
FRONT BASE C420 — 6 ohm nominal at 12 VDC — RED TIE STRAP

CAB HARNESS 7102834 (IF EQUIPPED)

DOME LIGHT
RADIO CONNECTOR: LEFT SPEAKER, RIGHT SPEAKER
BEACON
WORK LIGHT HARNESS
LEFT WORK LIGHT (OPT)
RIGHT WORK LIGHT (OPT)
WIPER HARNESS 7100772
MOTOR WIPER: PARK, HIGH, GROUND

ENGINE HARNESS 6817272 331/331E/334

FUEL SHUTOFF SOLENOID (EARLY MODELS)
FUEL SHUTOFF SOLENOID (LATER MODELS)
GLOW PLUGS 0.4 ohm
SPEED SENSOR (VR)
ENGINE OIL PRESSURE SWITCH
ENGINE COOLANT SENDER 500-3000 ± 30 ohm
STARTER
ALTERNATOR
GROUNDS
BATTERY

C161 HEATER
AUX SOCKET
WASHER BOTTLE
BOOM LIGHT HARNESS 6808415
BOOM LIGHT

RELAY GROUNDS 2000-2050 ARE CONNECTED IN SERIES

ACD POWER FUSE 4 25A
WIPER POWER FUSE 1 5A
ALT / HEATER FUSE 3 25A
SWITCH POWER FUSE 2 20A
RADIO CONN
SWITCHED POWER
STARTER
FUEL SHUTOFF
LIGHT RELAY
GLOW PLUG
RADIO MEMORY

120 ohm
ACD & REMOTE START CONNECTOR C453
IGNITION SWITCH: START, RUN, OFF

GROUNDS: 2310 — 2000, 2330, 2340, 2450, 2480, 2510, 2520,2650, 2710, 2820, 2830, 2940; 2300 — 2100, 2110, 2610, 2740, 2790, 2840, 2930
POWER LEADS: 1150, 1070, 1330, 1310, 1060, 1360 — 1040, 1030

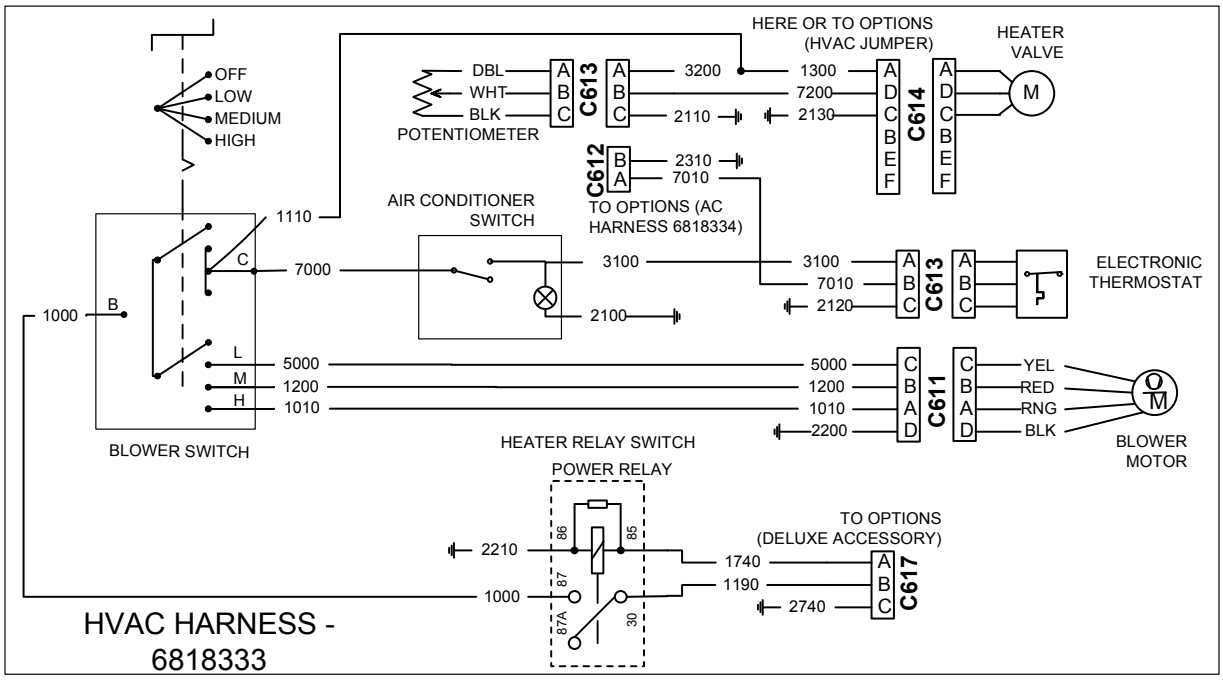
FUSE 12 15A AUX — STARTER
FUSE 11 20A LIGHTS — GLOW PLUGS
FUSE 10 25A ACD — LIGHTS
FUSE 9 25A CONTROLLER — FUEL PULL
FUSE 4 25A ACD
FUSE 8 5A FUEL
FUSE 3 25A ALTHEATER
FUSE 7 5A HORN
FUSE 2 20A SW POWER — SWITCH POWER
FUSE 6 25A HEATER
FUSE 1 5A WIPER
FUSE 5

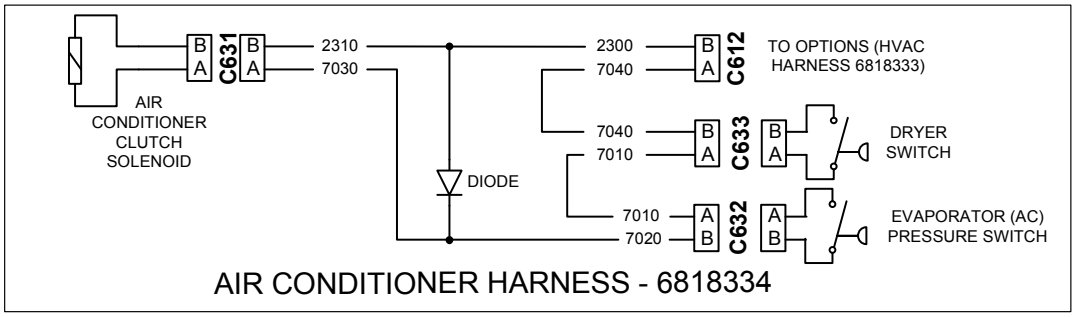
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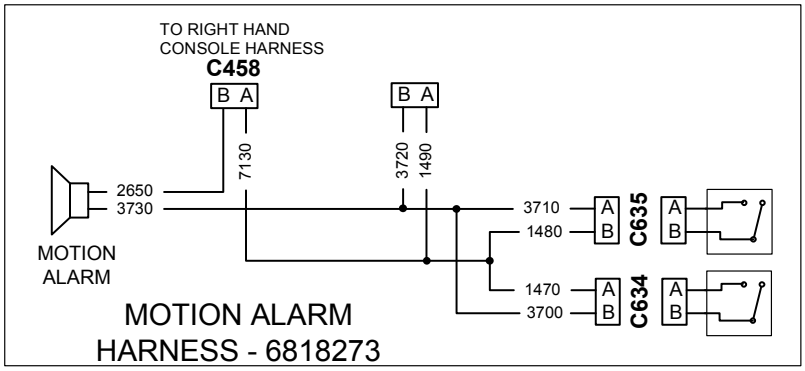
WIRING SCHEMATIC
331 (S/N 234313000 AND ABOVE)
331E (S/N 234412000 AND ABOVE)
334 (S/N 234513000 AND ABOVE)

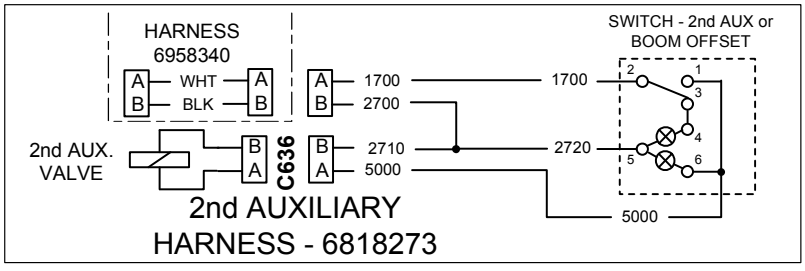
(PRINTED NOVEMBER 2006)

V-0635









V-0635 (10-31-06)

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ELECTRICAL SYSTEM INFORMATION

Troubleshooting Chart

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

⚠ WARNING

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual, 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-2003-0199

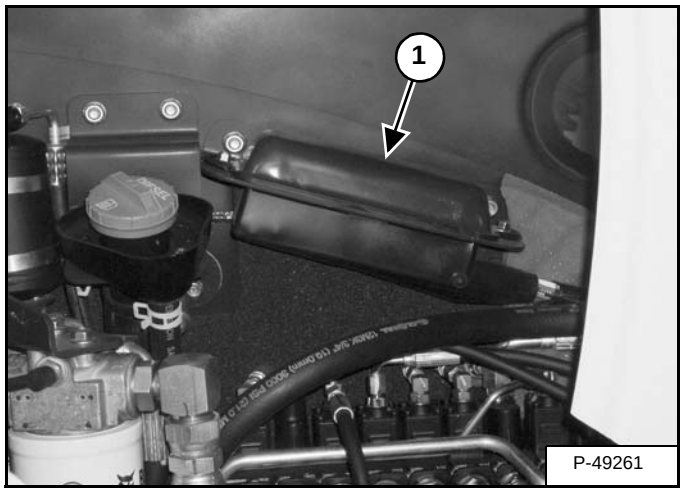
PROBLEM	CAUSE
Battery will not take charge.	1, 2, 3, 4, 5
Alternator will not charge.	1, 2, 5
Starter will not turn engine.	2, 3, 4, 6, 7, 8, 9

KEY TO CORRECT THE CAUSE
1. Alternator 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 50-10-1



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

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

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

⚠ WARNING

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.

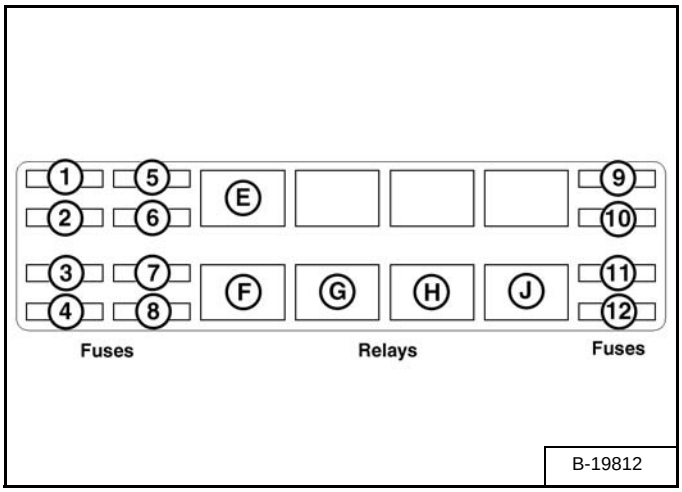
W-2065-1296

Fuse And Relay Location

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

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

Figure 50-10-2



The location and sizes are shown below and **[Figure 50-10-2]**.

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

Always replace fuses using the same type and capacity.

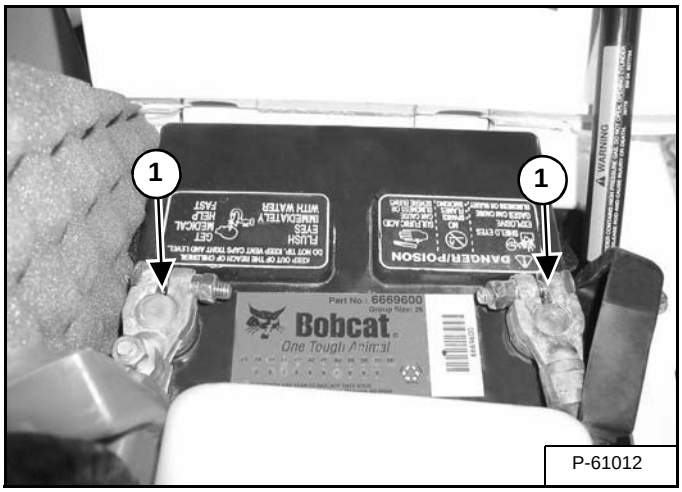
REF	DESCRIPTION
E	Switch Power
F	Fuel Solenoid
G	Lights
H	Glow Plug
J	Starter

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BATTERY

Servicing

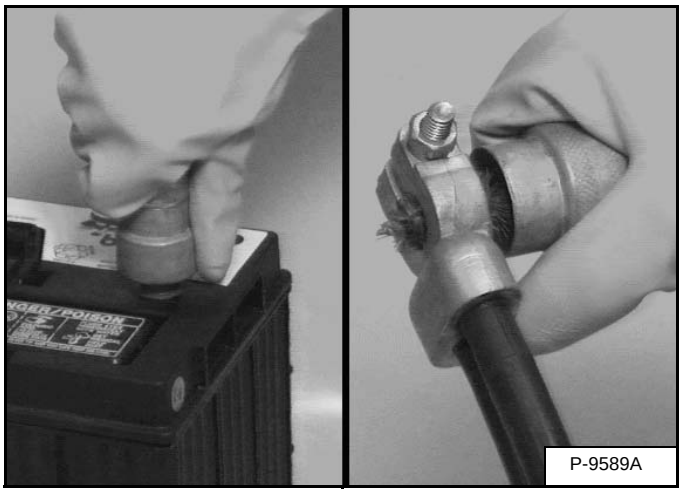
Figure 50-20-1



The battery is located under the right side cover **[Figure 50-20-1]**.

The battery cables (Item 1) **[Figure 50-20-1]** must be clean and tight. 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.

Figure 50-20-2



Clean the battery terminals and cable ends even when installing a new battery **[Figure 50-20-2]**.

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 electrolyte level is lower than 1/2 inch (13 mm) above the plates, add distilled water only.

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

⚠ 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

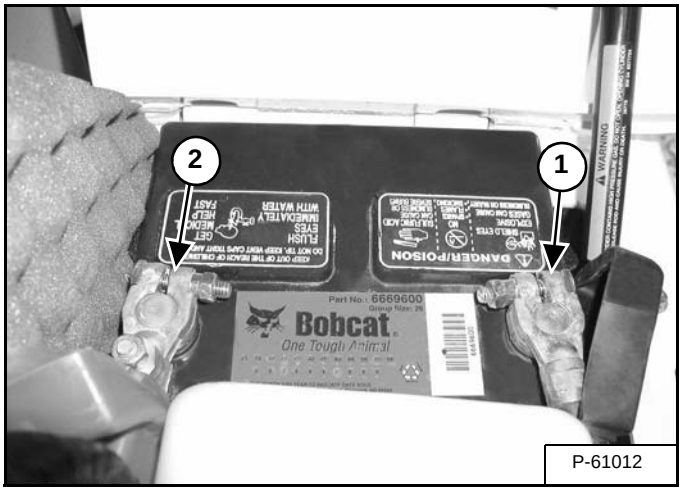
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BATTERY (CONT'D)

Removal And Installation

Open the right side cover.

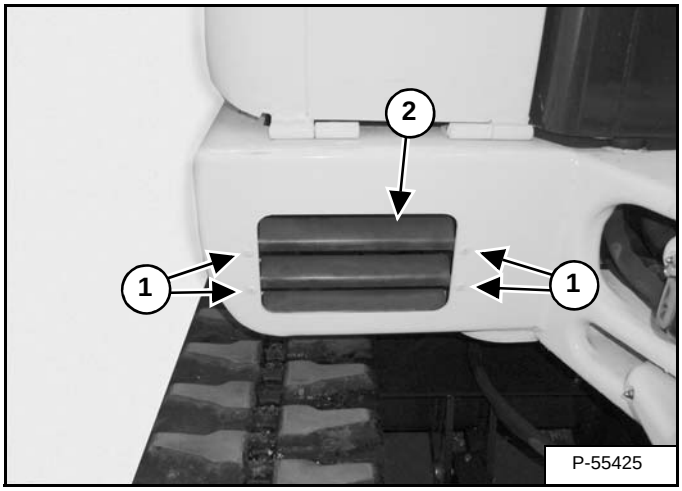
Figure 50-20-3



Disconnect the negative (-) cable (Item 1) **[Figure 50-20-3]** first.

Disconnect the positive (+) cable (Item 2) **[Figure 50-20-3]**.

Figure 50-20-4



Remove the bolts (Item 1) and louver (Item 2) **[Figure 50-20-4]**.

WARNING

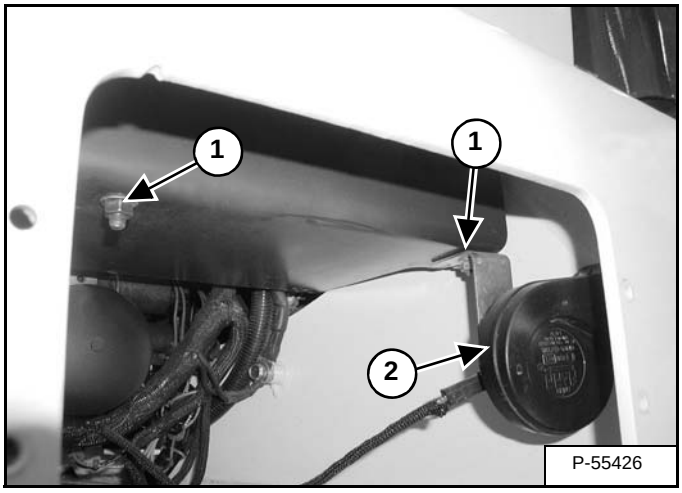
Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

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 50-20-5



Remove the nuts (Item 1) and bolts (Item 2) **[Figure 50-20-5]**. Reposition the horn.

Remove the hold down clamp and 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 last to prevent sparks.

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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. Make sure the second machine is NOT running while using the glow plugs. High voltage spikes from a running machine can burn out the glow plugs.

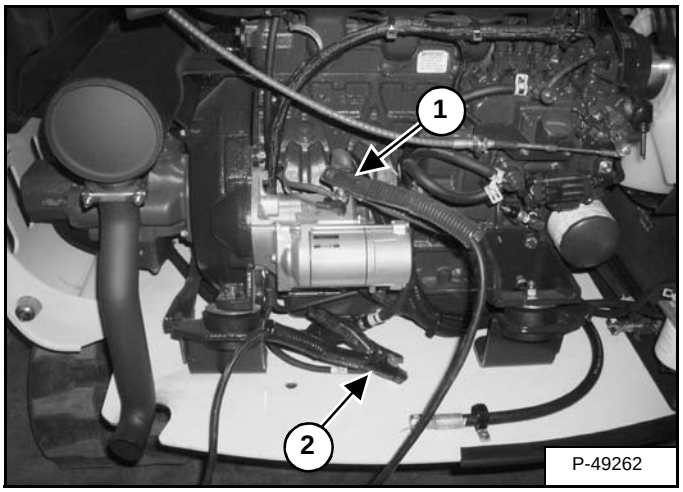
I-2060-0195

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.

Be sure the key switch is OFF. The booster battery must be 12 volt.

Open the tailgate.

Figure 50-20-6



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 50-20-6]** of the excavator starter.

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 excavator cable (Item 2) **[Figure 50-20-6]** where it is fastened to the frame.

Start the engine. After the engine has started, remove the ground (-) cable first (Item 2) **[Figure 50-20-6]**.

Disconnect the cable from the excavator starter (Item 1) **[Figure 50-20-6]**.

⚠ 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 engine 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-2066-1296

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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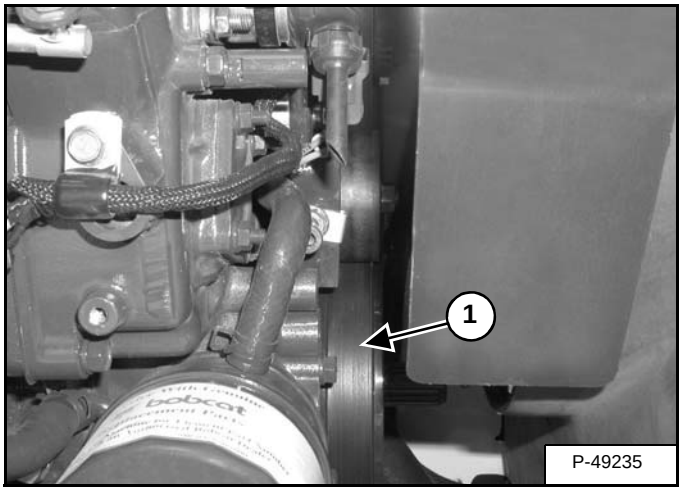
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ALTERNATOR

Engine Accessory Drive Belt

Open the tailgate.

Figure 50-30-1



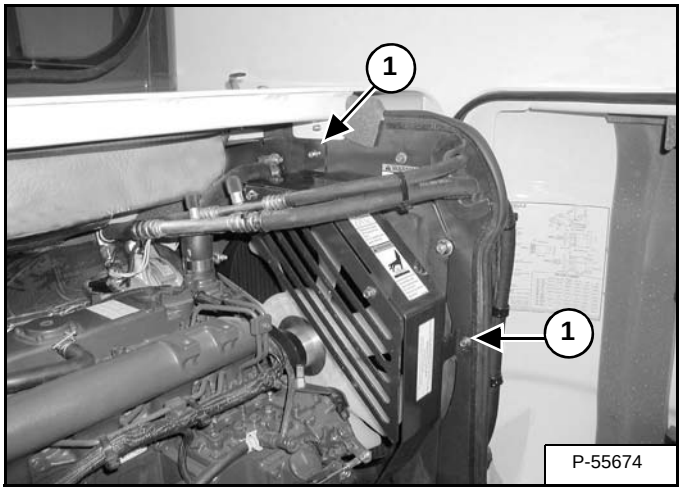
The engine accessory drive belt (Item 1) **[Figure 50-30-1]** must be checked and adjusted as needed, every 100 hours of operation. (See Belt Adjustment on Page 10-140-1.)

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Removal And Installation

Open the tailgate.

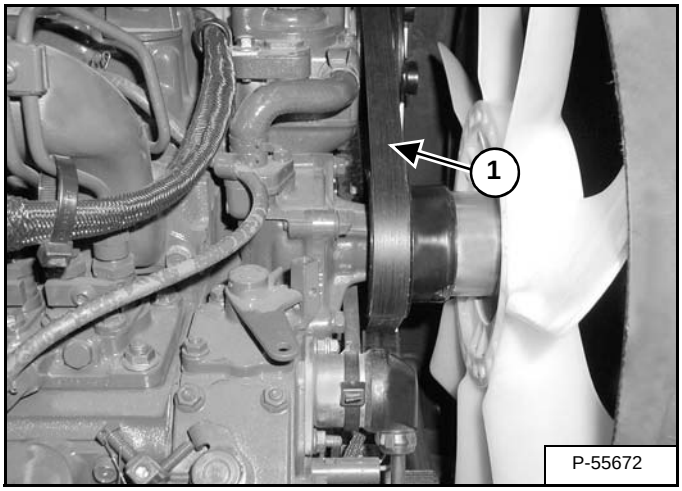
Figure 50-30-2



Remove the two bolts (Item 1) **[Figure 50-30-2]** from the fan shield.

Remove the fan shield from the engine.

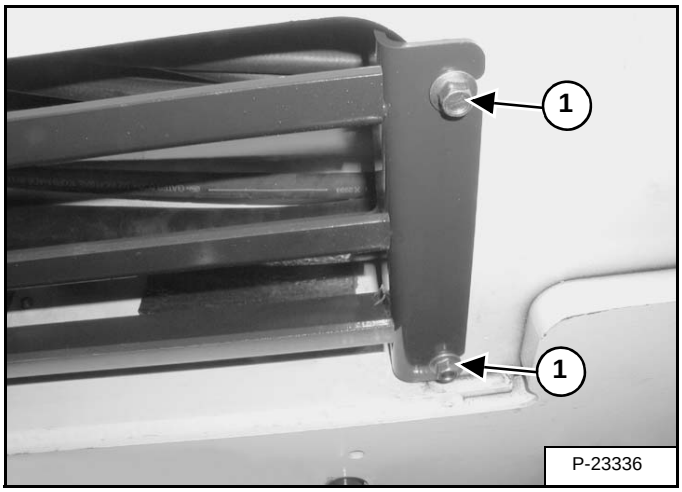
Figure 50-30-3



Remove the engine accessory drive belt (Item 1) **[Figure 50-30-3]** from the engine. (See Belt Tension on Page 10-140-1.)

Installation: Adjust the engine accessory drive belt after installation. (See Belt Tension on Page 10-140-1.)

Figure 50-30-4

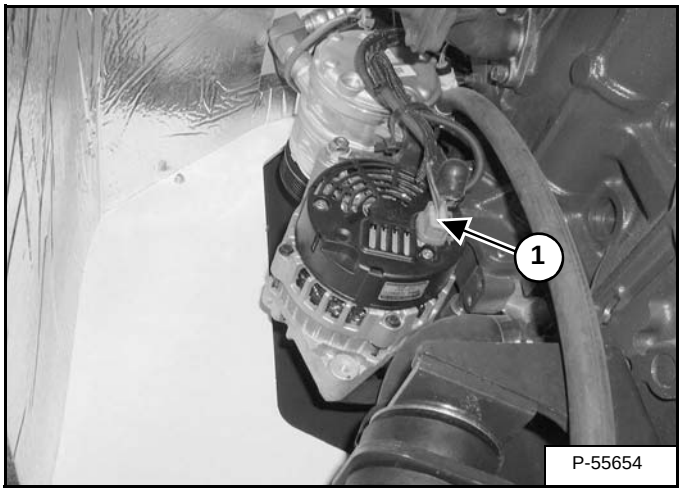


On the bottom of the excavator, loosen the two bolts on the left side. Remove the two bolts (Item 1) **[Figure 50-30-4]** on the right side.

Remove the louver from the bottom of the excavator.

NOTE: Access to the alternator is obtained from underneath the excavator.

Figure 50-30-5

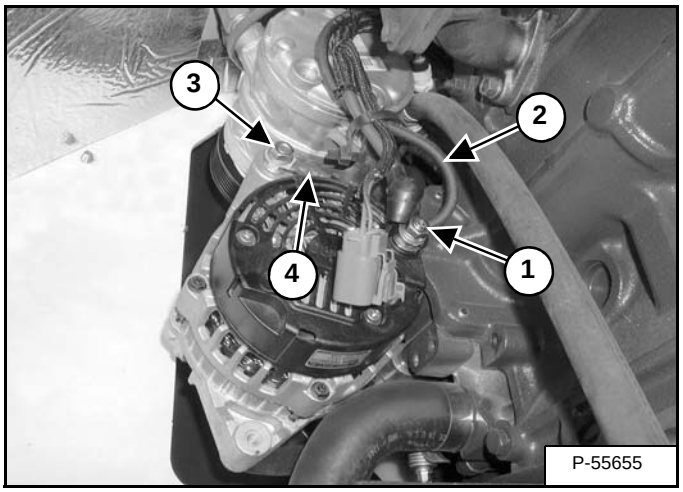


Disconnect the wire harness (Item 1) **[Figure 50-30-5]** from the alternator.

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Removal And Installation (Cont'd)

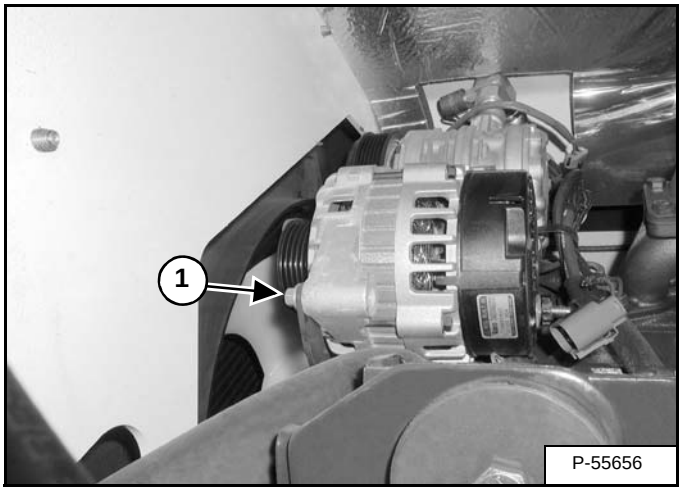
Figure 50-30-6



Remove the nut (Item 1) and wire (Item 2) **[Figure 50-30-6]**.

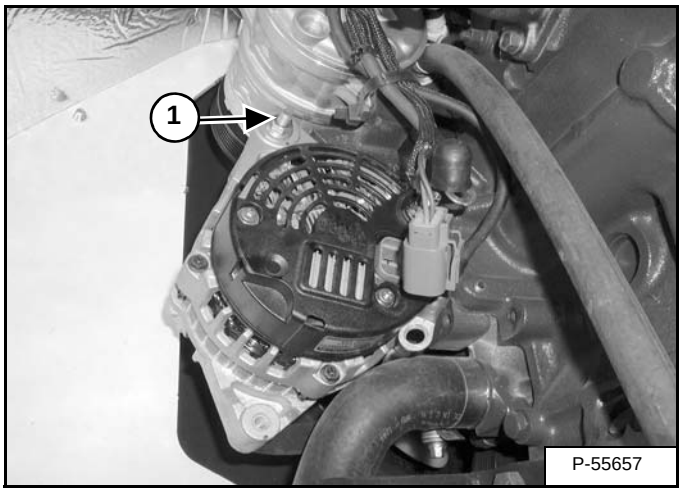
Remove the nut (Item 3) and ground cable (Item 4) **[Figure 50-30-6]**.

Figure 50-30-7



Remove the bolt (Item 1) **[Figure 50-30-7]**.

Figure 50-30-8



Remove the bolt and nut (Item 1) **[Figure 50-30-8]**.

Remove the alternator.

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Alternator Identification

Figure 50-30-9

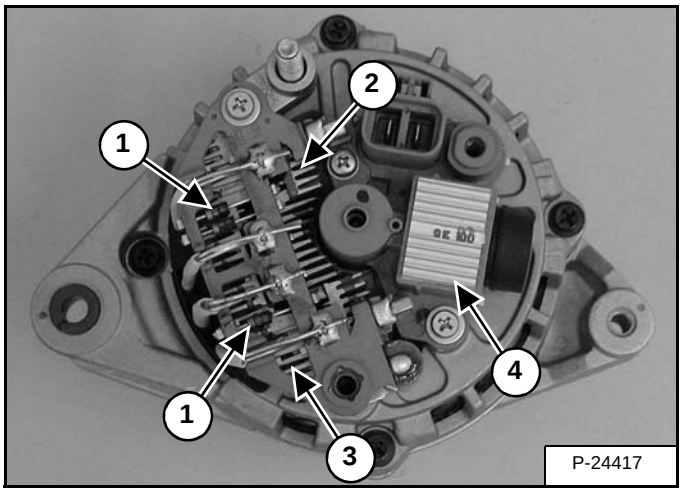
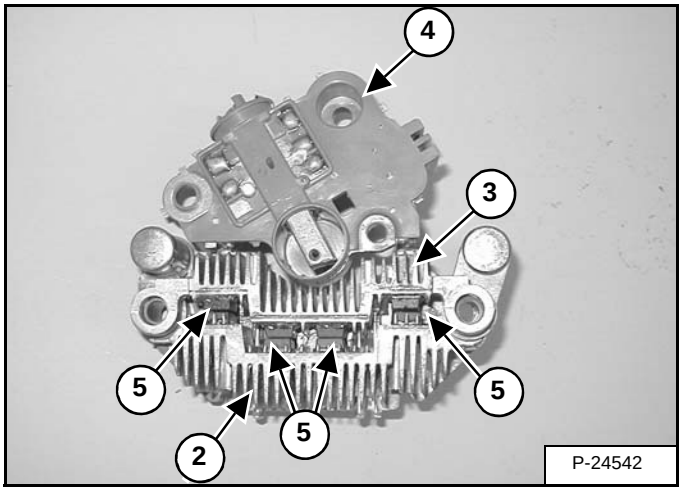


Figure 50-30-10



The cover has been removed to show alternator rectifier/ regulator assembly.

1. Field coil diodes (low current) (Item 1) **[Figure 50-30-9]**

2. Grounded heat sink (Item 2) **[Figure 50-30-9]** & **[Figure 50-30-10]**

3. B+ power heat sink (Item 3) **[Figure 50-30-9]** & **[Figure 50-30-10]**

4. Regulator (Item 4) **[Figure 50-30-9]** & **[Figure 50-30-10]**

5. Large power diodes (Item 5) **[Figure 50-30-10]**

NOTE: The rectifier/regulator assembly has been removed from the alternator and turned over for component identification [Figure 50-30-10].

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Charging System Check

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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If the charging system malfunctions check the following:

Check the condition and tension of the engine accessory drive belt. (See Belt Tension on Page 10-140-1.) If belt is worn or deteriorated replace the belt.

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 the fuse is burned, find the cause and repair/replace. If the fuse is in doubt, remove and check the fuse 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.

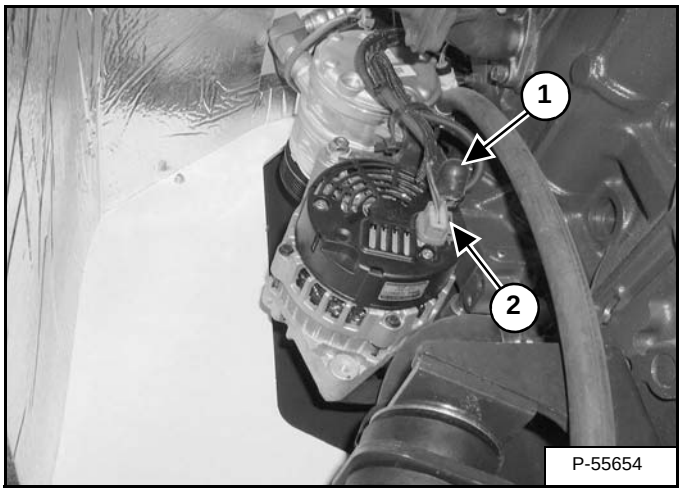
Disconnect the battery cables (negative first, then positive). Inspect the cable clamps and battery posts for corrosion. Remove acid or corrosion from the battery and cables with a sodium bicarbonate and water solution. Put grease on the cable ends and battery terminals to prevent corrosion. Reconnect the cable to the positive terminal.

With the key off, connect a test light between the negative battery post and the disconnected negative cable clamp.

1. If the test light does not light up, reattach the clamp and proceed to alternator voltage test.

2. If the test light lights up, there is a short (drain) in the electrical system of the excavator. The short must be repaired before the charging system can be checked.

Figure 50-30-11



3. Disconnect the alternator B+ terminal (Item 1) and L & S terminal connector (Item 2) **[Figure 50-30-11]**. If the test light goes out, the alternator is faulty. If the test light stays on, find the short in the system and repair it.

⚠ 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 engine 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.

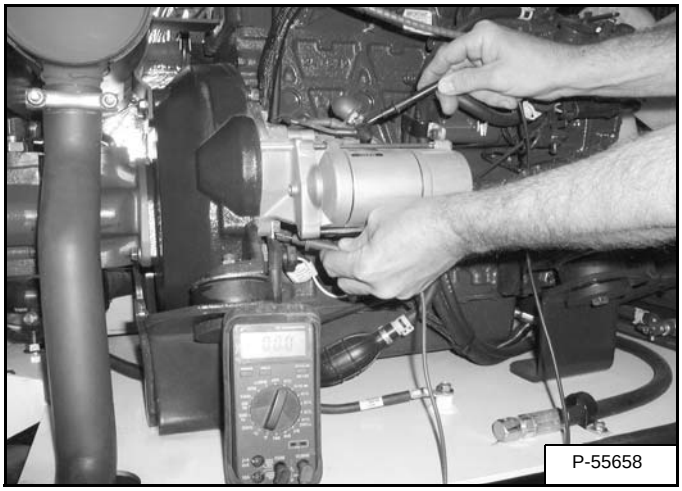
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Alternator Voltage Test

Open the tailgate.

Figure 50-30-12



Start the engine and run at low idle. With a voltmeter, check the voltage between the B+ terminal and ground at the starter **[Figure 50-30-12]**.

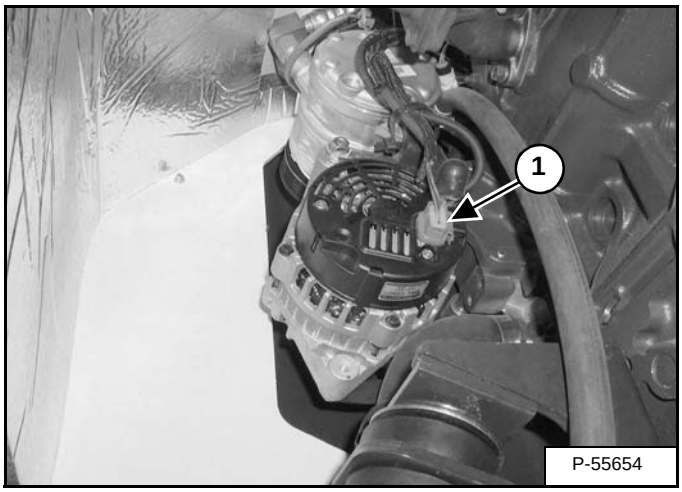
The voltage must be higher than 13.5 volts but lower than 14.7 volts at 70° F (Alternator Temperature).

If the voltage is higher than 14.7 volts, proceed to the high voltage test.

If the voltage is lower than 13.5 volts, run the engine at high idle and recheck voltage. If voltage is still below 13.5 volts, proceed to the low voltage test.

Low Voltage Test

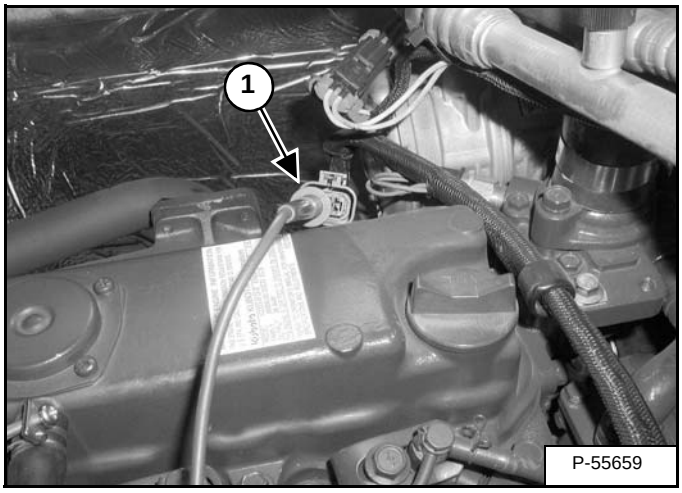
Figure 50-30-13



Turn engine OFF and remove the L & S terminal connector (Item 1) **[Figure 50-30-13]** from the alternator.

Turn the key to the ON position.

Figure 50-30-14

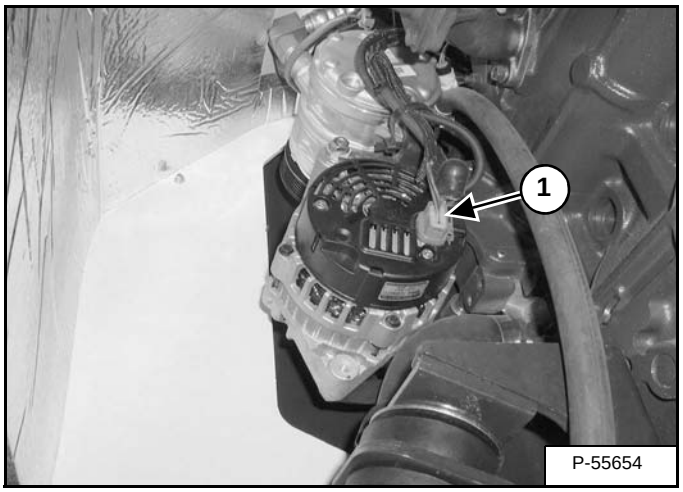


Check the voltage across the "L" terminal (Item 1) **[Figure 50-30-14]**. The voltage should be what the battery voltage is. If not, check the wire harness, relay, and fuses. If the wire harness, relay, and fuses are ok, remove the alternator for replacement or repair.

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High Voltage Test

Figure 50-30-15



Turn the engine OFF and remove the L & S Terminal connector (Item 1) **[Figure 50-30-15]** from the alternator.

Figure 50-30-16

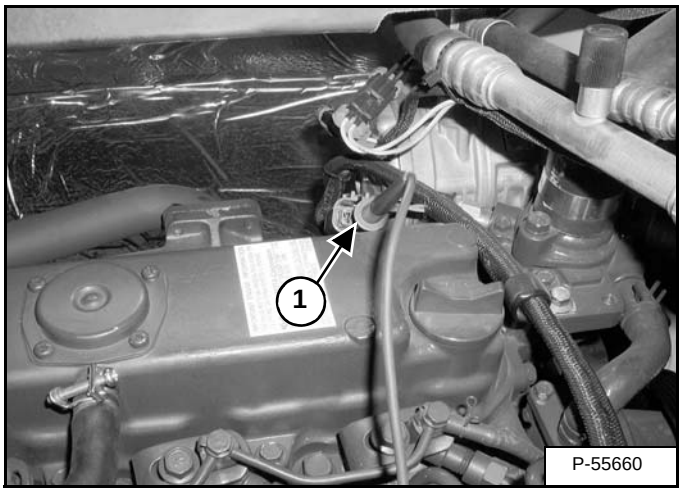
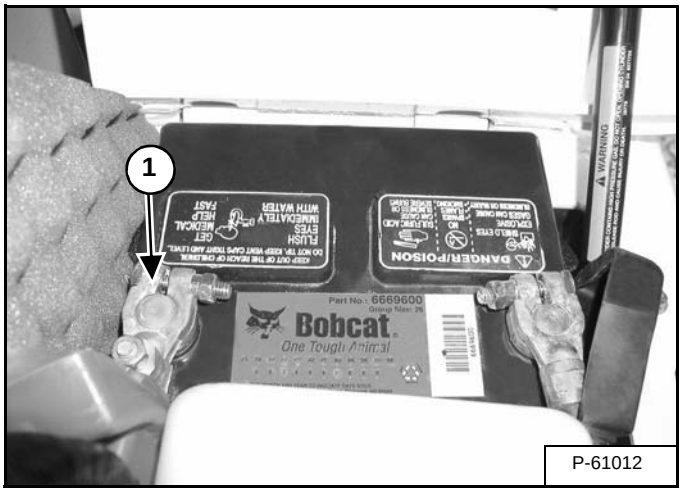


Figure 50-30-17



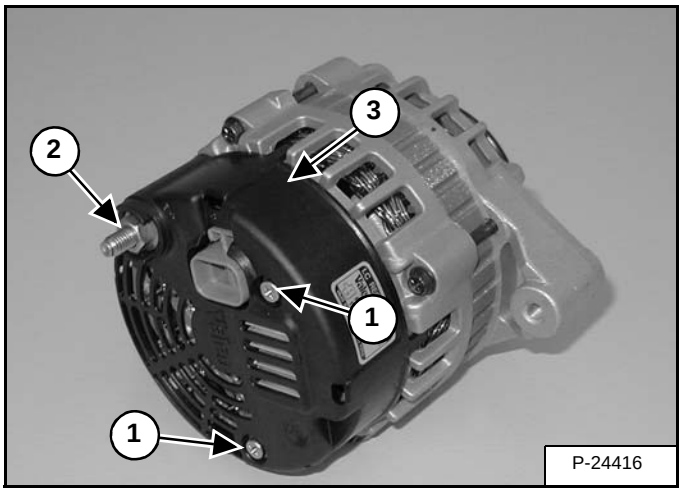
Check the continuity between the "S" terminal (Item 1) **[Figure 50-30-16]** and the positive (+) terminal on the battery or starter terminal (Item 1) **[Figure 50-30-17]**. There should be continuity. If there is no continuity, replace the wire harness.

If the voltage is still above 14.7 volts at 70° F (alternator temperature), then remove the alternator for replacement or repair.

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Rectifier Continuity (Diode) Test

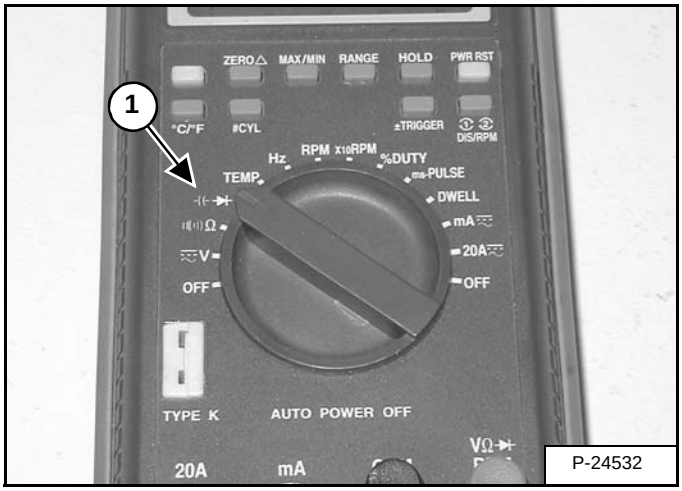
Figure 50-30-18



Remove the two screws (Item 1), nut/washer (Item 2) and the plastic cover (Item 3) **[Figure 50-30-18]** from the alternator.

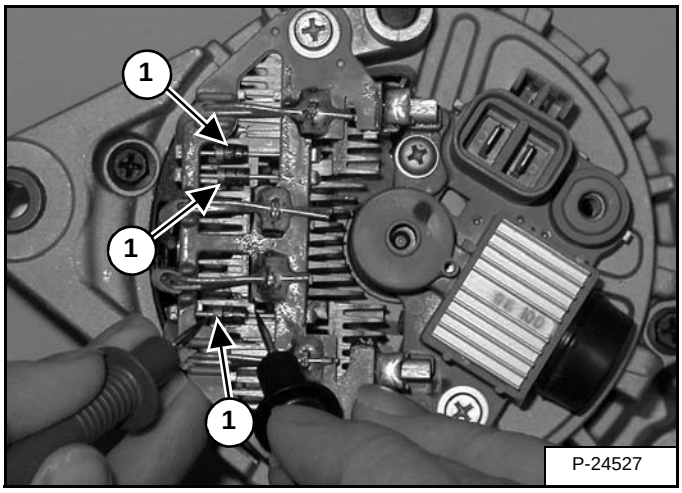
NOTE: In the diode tests there should be continuity in one direction only. Meter readings should be different when probes are reversed. If the diode being tested shows no continuity or continuity in both directions, replace the rectifier assembly.

Figure 50-30-19



NOTE: Use the diode function (Item 1) [Figure 50-30-19] on the multimeter.

Figure 50-30-20

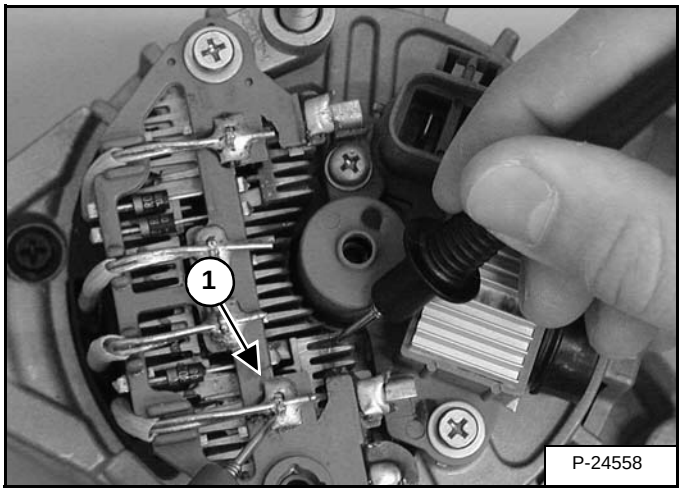


Touch the probes to the terminals (Item 1) **[Figure 50-30-20]** of each diode and read the meter.

Reverse the probes to check the diode in the other direction.

Meter readings should be different when probes are reversed.

Figure 50-30-21



Touch one probe to the diode (Item 1) **[Figure 50-30-21]** and the other probe to each heat sink and read the meter.

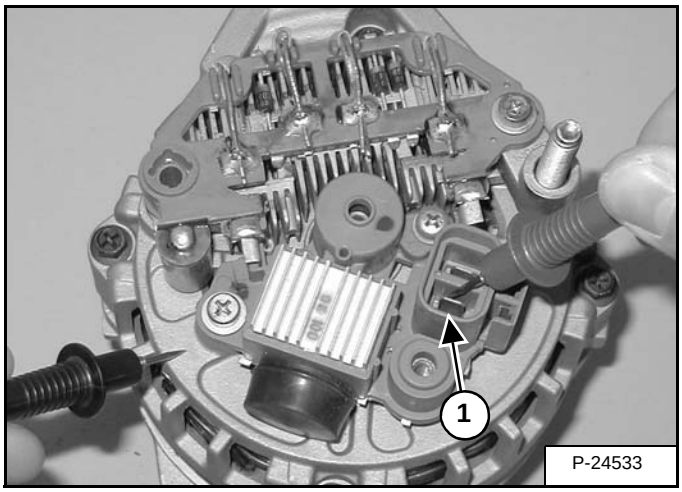
Reverse the probes to check the diode in the other direction.

Meter readings should be different when probes are reversed.

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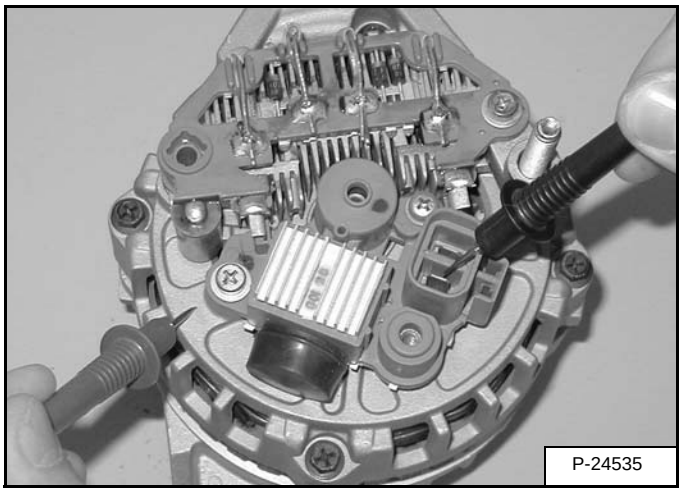
Alternator Regulator Test

Figure 50-30-22



Touch one probe to the "L" terminal (Item 1) and the other probe to the ground (Item 2) **[Figure 50-30-22]**.

Figure 50-30-23



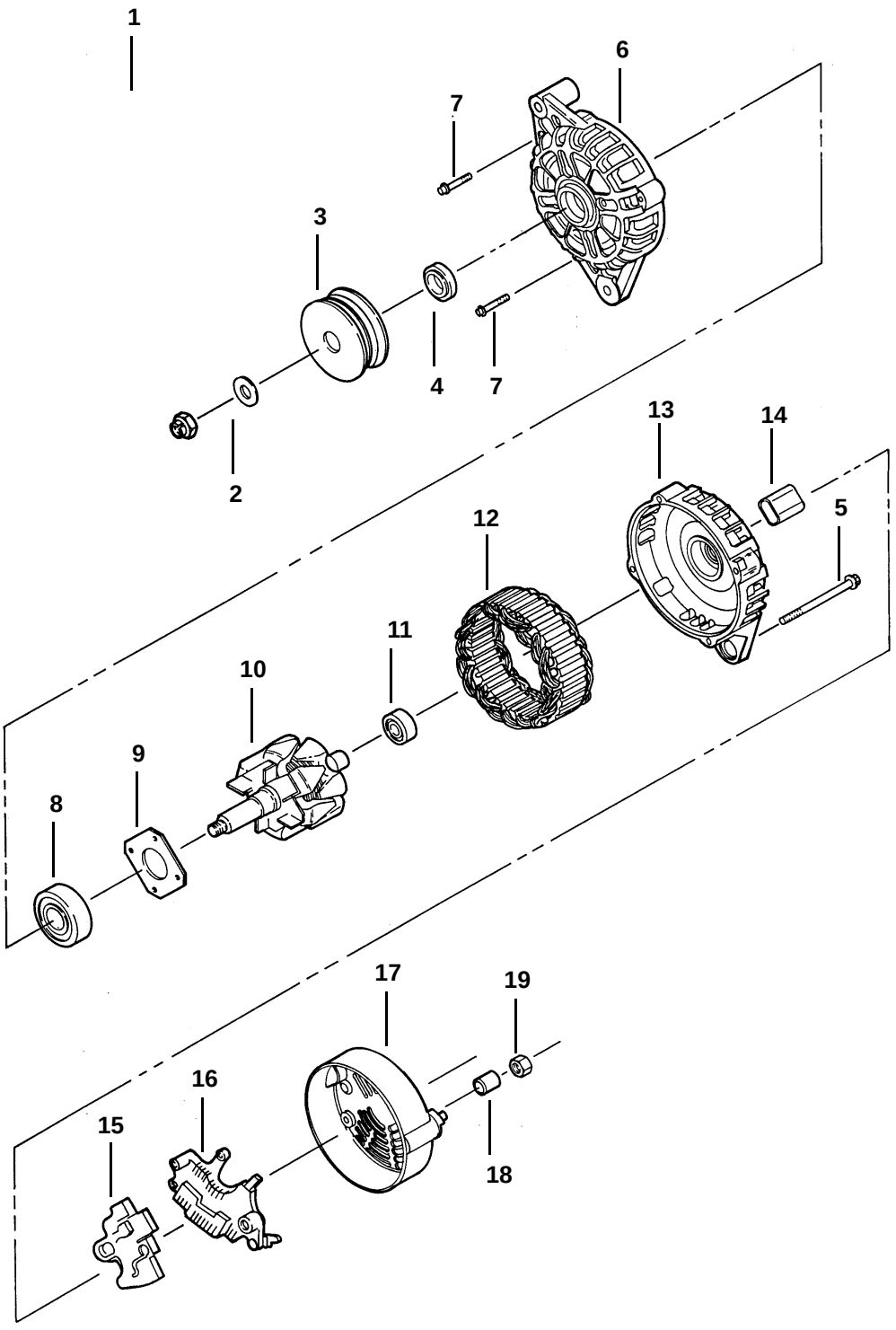
Reverse the probes to check in the other direction **[Figure 50-30-23]**.

There should be continuity in one direction only. Meter readings should be different when probes are reversed. if there is no continuity or continuity in both directions, replace the regulator.

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Parts Identification

1. Alternator
2. Nut
3. Pulley
4. Spacer
5. Bolt
6. Case half
7. Bolt
8. Bearing
9. Retainer
10. Rotor
11. Bearing
12. Stator
13. Case half
14. Sleeve
15. Regulator
16. Rectifier
17. Cover
18. Spacer
19. Nut



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Disassembly

Disassemble the alternator. (See Parts Identification on Page 50-30-10.)

Remove the regulator cover.

Remove the four bolts holding the brackets together.

Pry the brackets apart. (Use a press if needed)

Use a soft jaw vise to hold the rotor while removing the pulley nut.

Remove the front case half from the rotor using a soft faced hammer or press.

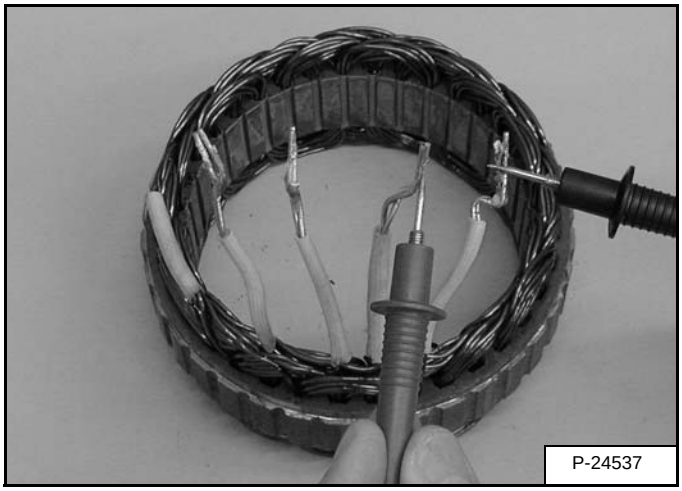
Unsolder the stator leads from the rectifier. Remove the stator.

Unsolder the two leads between the rectifier and regulator. Remove the regulator from the rectifier.

Stator Continuity Test

Use an ohm meter to test the stator.

Figure 50-30-24



Touch the probes to two of the bare stator wires **[Figure 50-30-24]**.

Move one of the probes to the third wire.

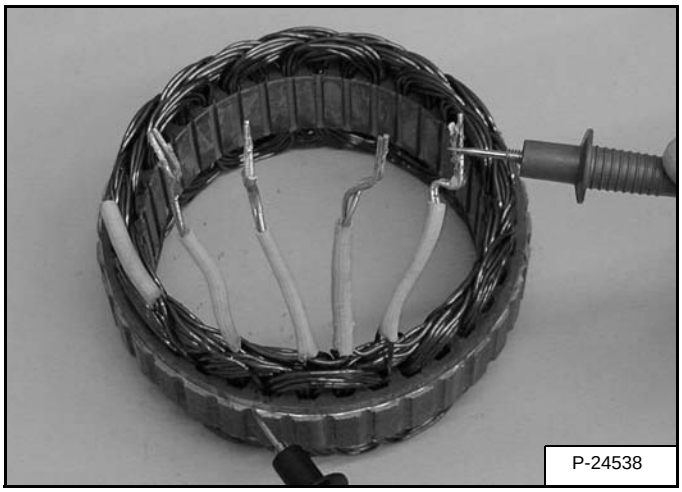
The readings should be the same.

If there is no continuity, replace the stator.

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Stator Ground Test

Figure 50-30-25



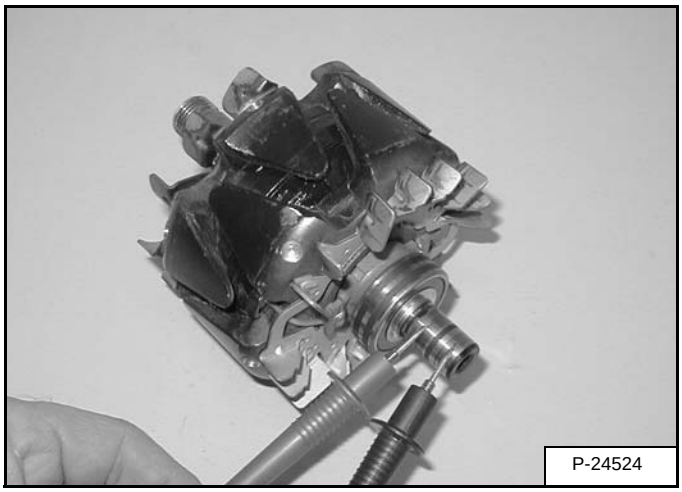
Touch one probe to a bare stator lead and the other probe to the bare metal surface of the stator **[Figure 50-30-25]**.

There should be no continuity.

Replace the stator if there is continuity.

Rotor Continuity Test

Figure 50-30-26



Touch the probes to the slip rings **[Figure 50-30-26]**.

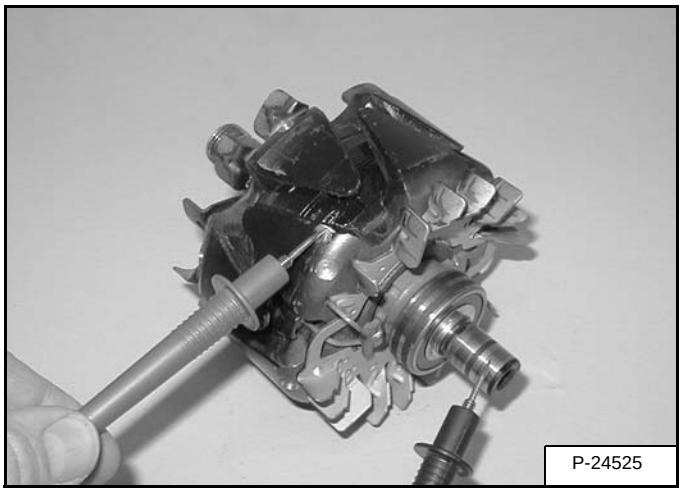
The ohm meter should read between 3.0-4.0 ohms.

If there is no continuity replace the rotor.

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Rotor Ground Test

Figure 50-30-27



Touch one probe to one of the slip rings and the other probe to the rotor shaft **[Figure 50-30-27]**.

There should be no continuity.

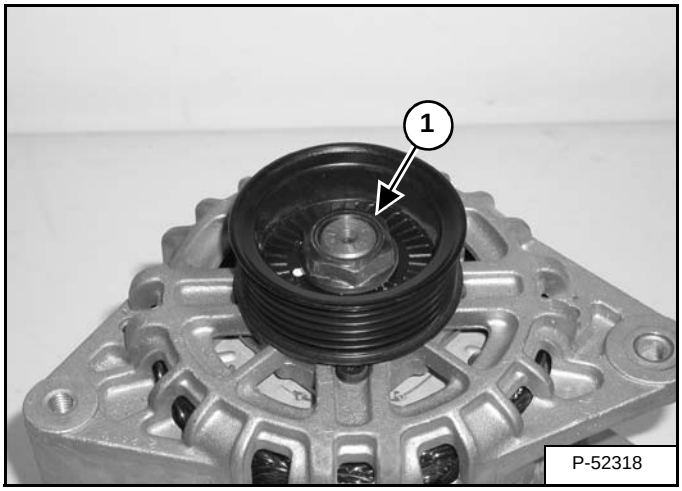
If there is continuity replace the rotor.

Assembly

Reverse the order of disassembly.

Do not assemble the rear case half.

Figure 50-30-28



Place the rotor in a vise equipped with soft jaws when tightening the shaft nut (Item 1) **[Figure 50-30-28]**.

Tighten to 72 ± 14.5 ft.-lbs. (98 ± 20 Nm) torque.

Install the rear case half and the remaining parts.

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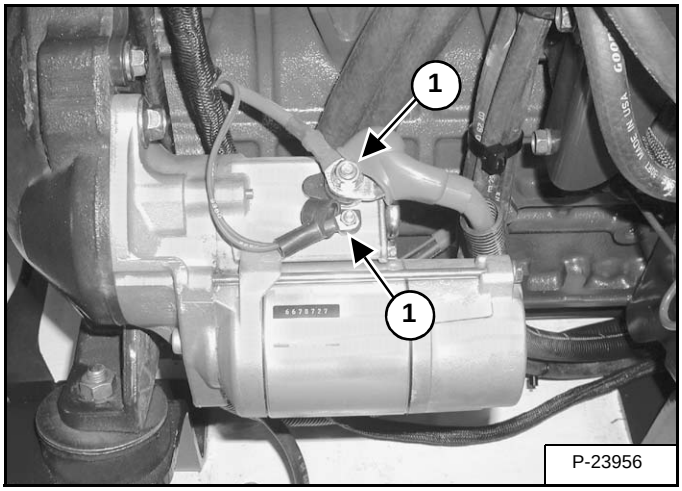
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STARTER

Removal And Installation

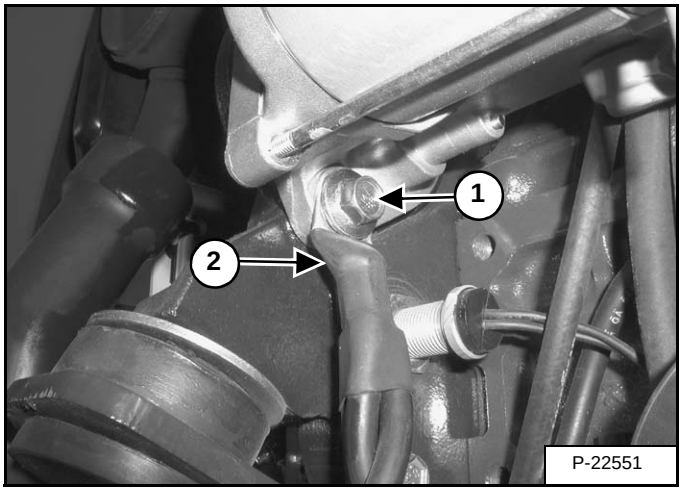
Disconnect the negative (-) cable from the battery. (See Contents Page 50-01.)

Figure 50-40-1



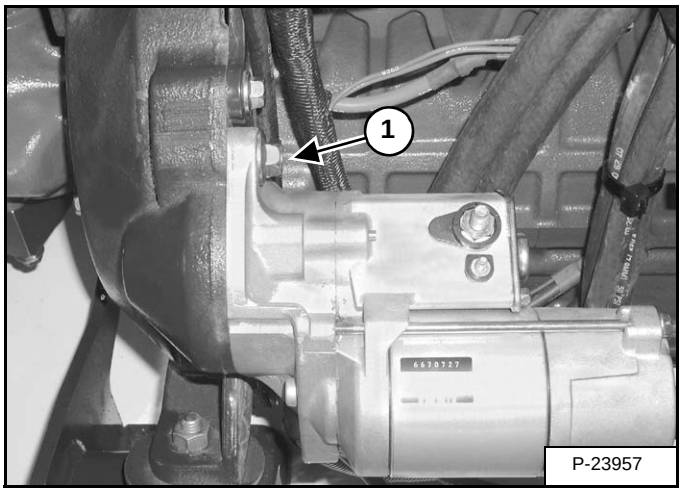
Disconnect the wires (Item 1) **[Figure 50-40-1]** from the starter.

Figure 50-40-2



Remove the bottom bolt (Item 1) and ground cable (Item 2) **[Figure 50-40-2]**.

Figure 50-40-3



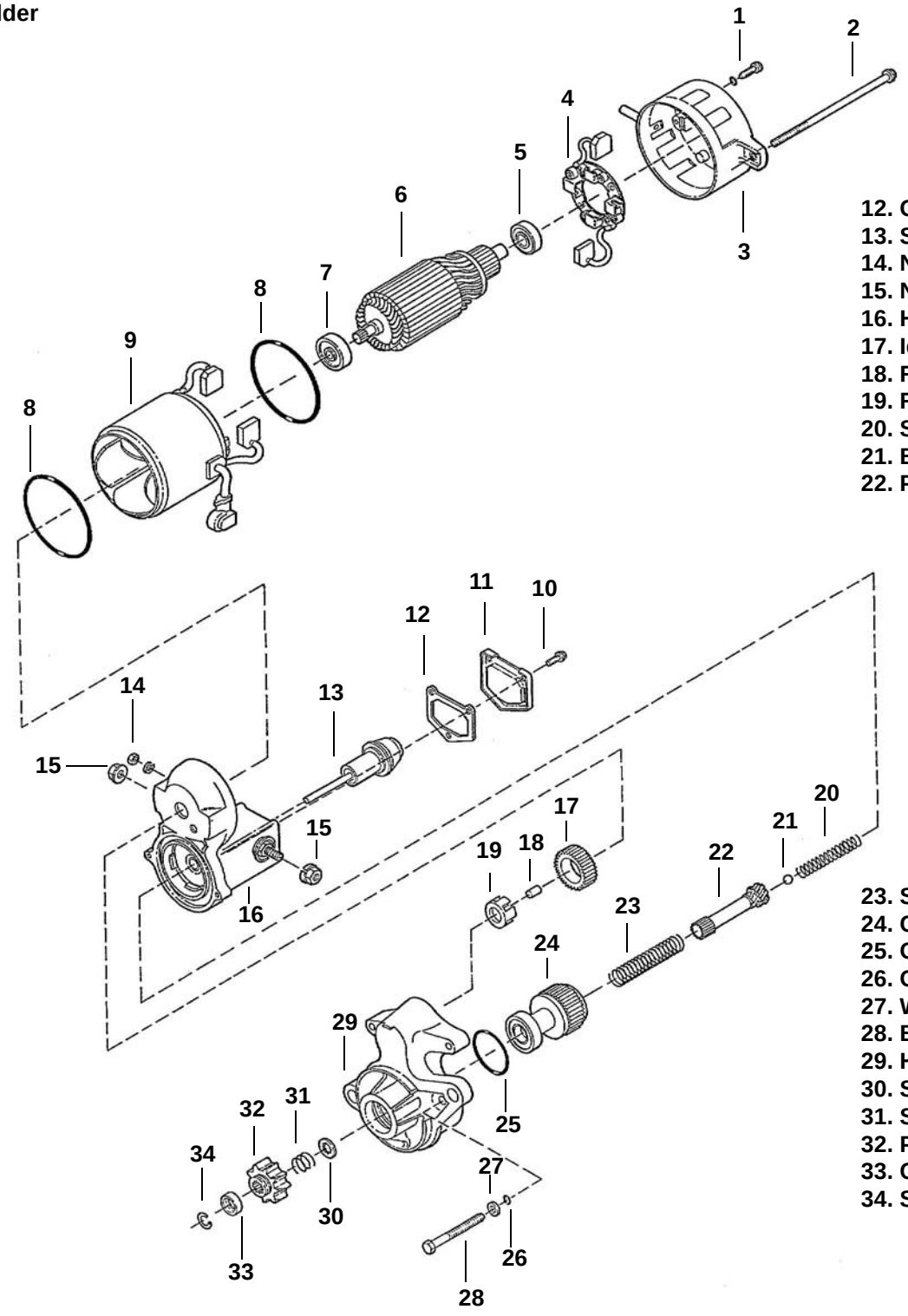
Remove the top bolt (Item 1) **[Figure 50-40-3]**.

Remove the starter.

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Parts Identification

1. Screw
2. Bolt
3. Brush Cover
4. Brush Holder
5. Bearing
6. Armature
7. Bearing
8. O-Ring
9. Frame
10. Bolt
11. Cover
12. Gasket
13. Switch
14. Nut
15. Nut
16. Housing
17. Idler Gear
18. Roller
19. Retainer
20. Spring
21. Ball
22. Pinion Shaft
23. Spring
24. Clutch
25. O-Ring
26. O-Ring
27. Washer
28. Bolt
29. Housing
30. Spring Seat
31. Spring
32. Pinion Gear
33. Collar
34. Snap Ring

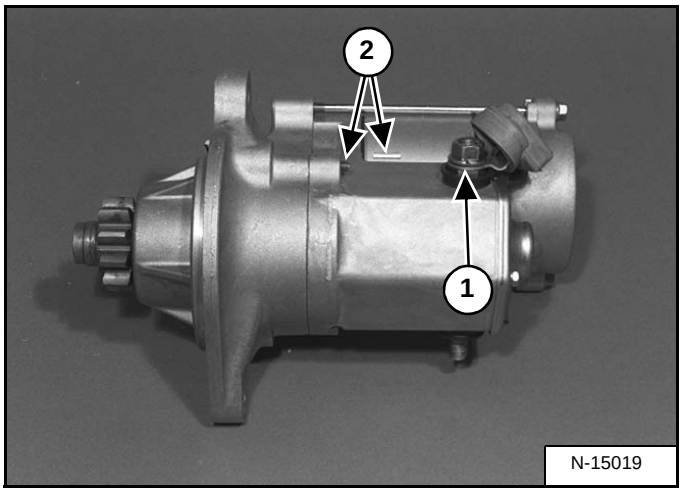


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Disassembly

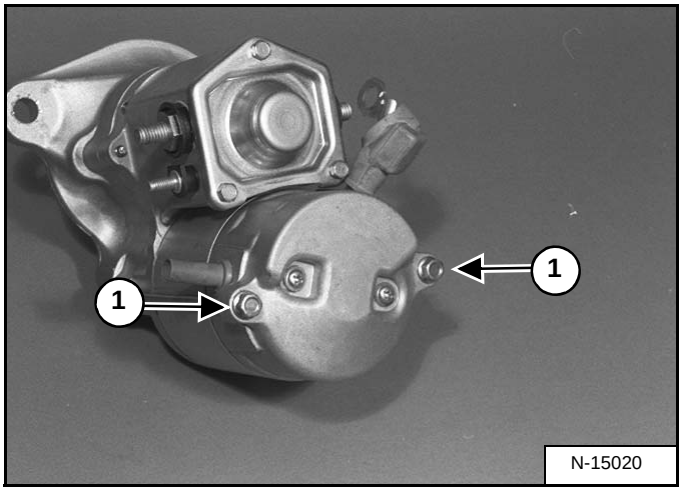
Figure 50-40-4



Remove the cable (Item 1) **[Figure 50-40-4]** from the magnetic switch.

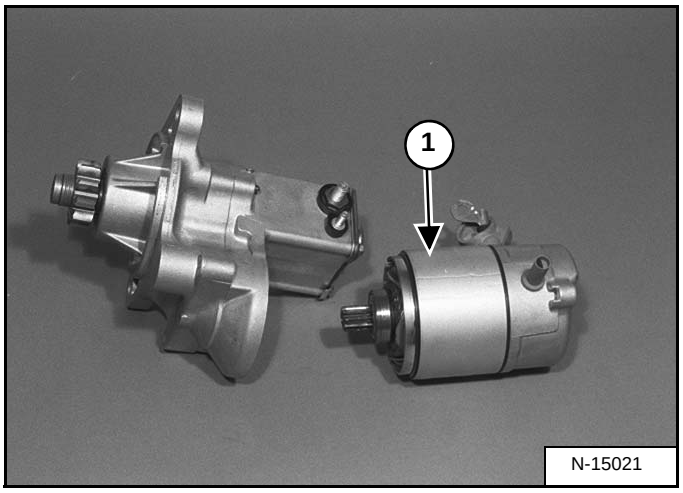
Mark the frame and magnetic switch (Item 2) **[Figure 50-40-4]** for ease of assembly.

Figure 50-40-5



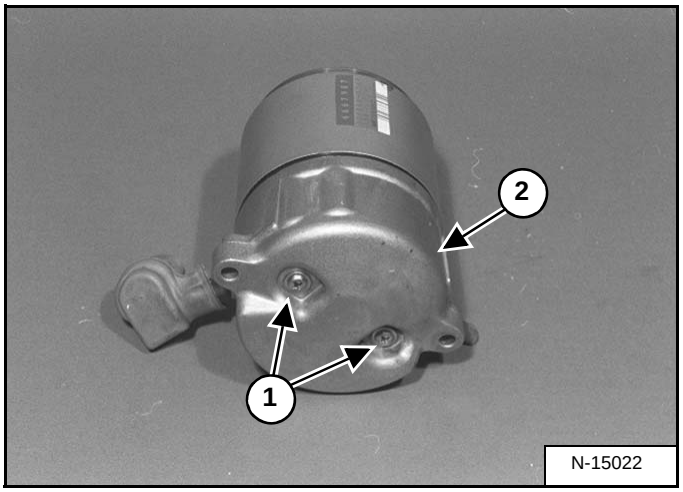
Remove the bolts (Item 1) **[Figure 50-40-5]**.

Figure 50-40-6



Remove the frame (Item 1) **[Figure 50-40-6]** from the magnetic switch.

Figure 50-40-7



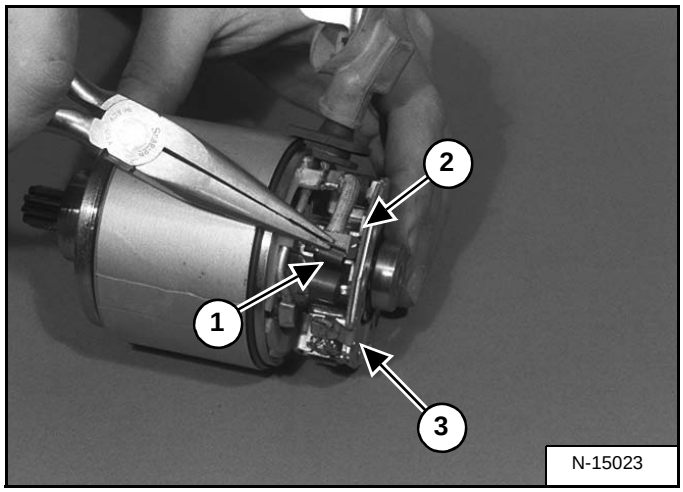
Remove the screws (Item 1) from the brush cover (Item 2) **[Figure 50-40-7]**.

Remove the cover (Item 2) **[Figure 50-40-7]**.

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Disassembly (Cont'd)

Figure 50-40-8

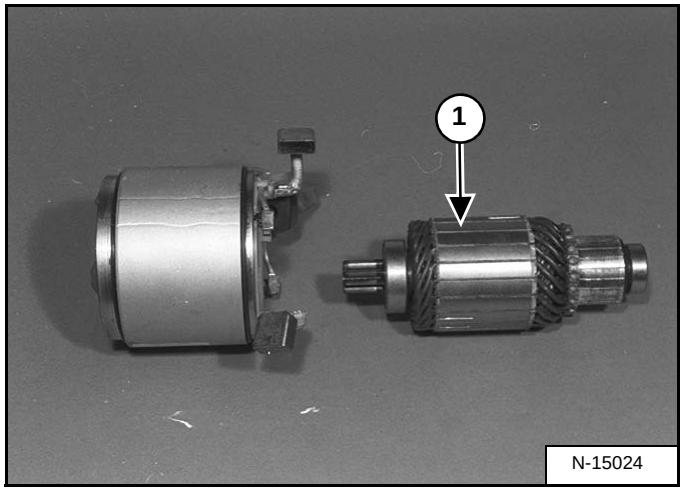


Using a needle nose pliers, pull the brush springs (Item 1) back and remove the brushes (Item 2) **[Figure 50-40-8]**.

NOTE: The brushes are non-replaceable, If the brushes are worn, order a new brush holder (for the negative brushes) and yolk (for the positive brushes).

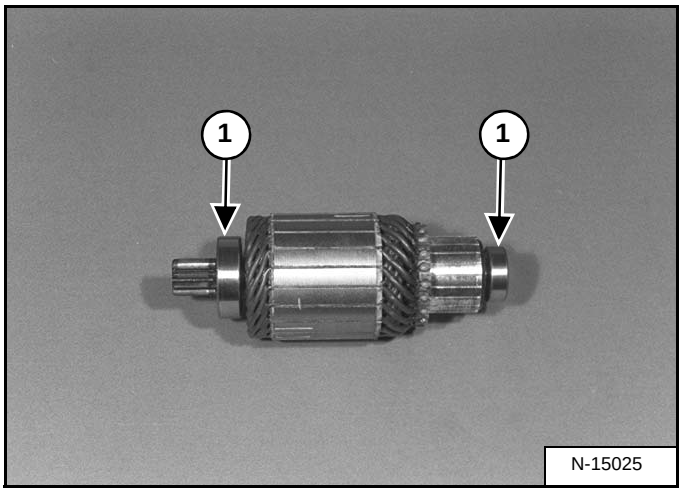
Remove the brush holder (Item 3) **[Figure 50-40-8]** from the end of the armature.

Figure 50-40-9



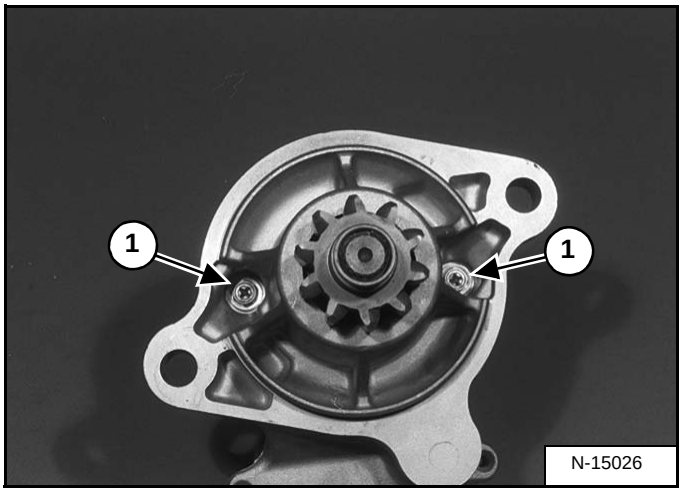
Remove the armature (Item 1) **[Figure 50-40-9]** from the frame.

Figure 50-40-10



Remove the bearings (Item 1) **[Figure 50-40-10]** from the armature.

Figure 50-40-11

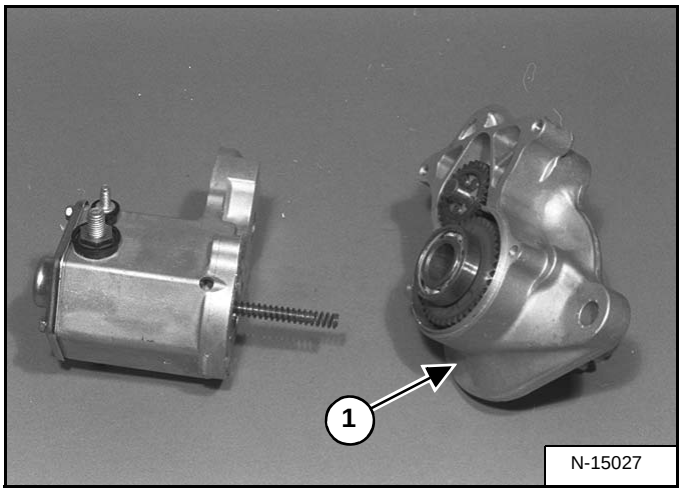


Remove the bolts (Item 1) **[Figure 50-40-11]** from the starter housing.

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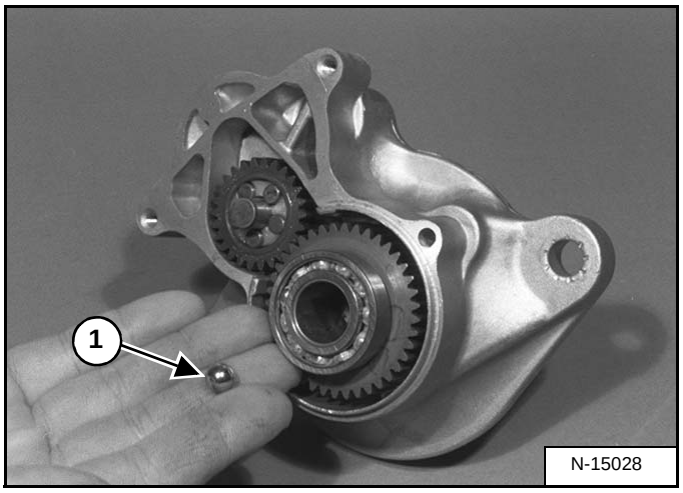
Disassembly (Cont'd)

Figure 50-40-12



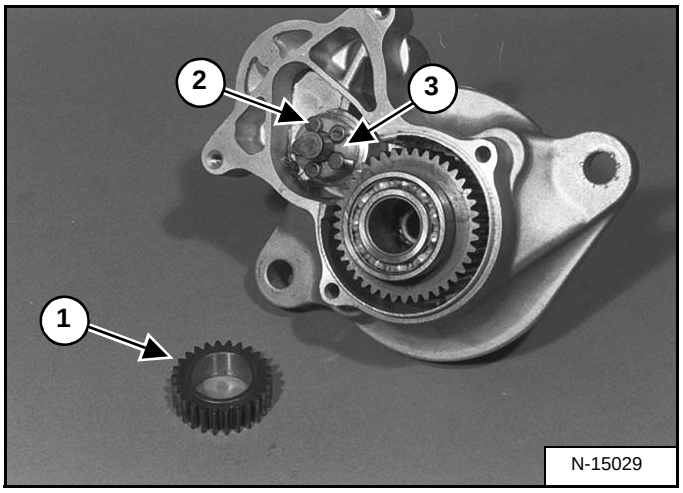
Remove the starter housing (Item 1) **[Figure 50-40-12]** from the magnetic switch housing.

Figure 50-40-13



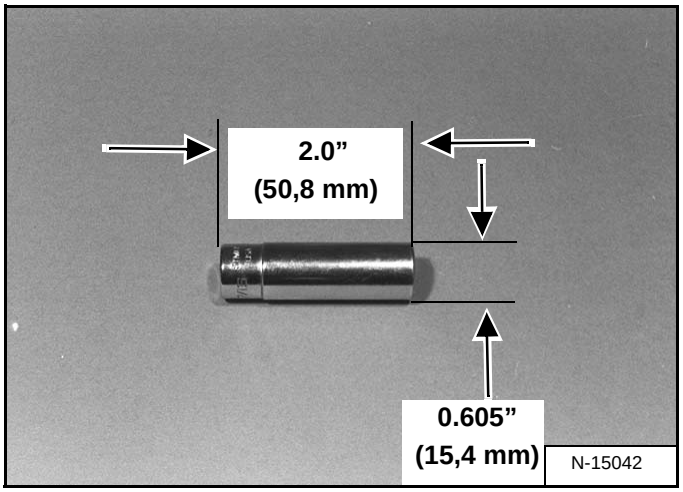
Remove the ball (Item 1) **[Figure 50-40-13]** from the pinion shaft.

Figure 50-40-14



Remove the idler gear (Item 1), rollers (Item 2) and retainer (Item 3) **[Figure 50-40-14]**.

Figure 50-40-15

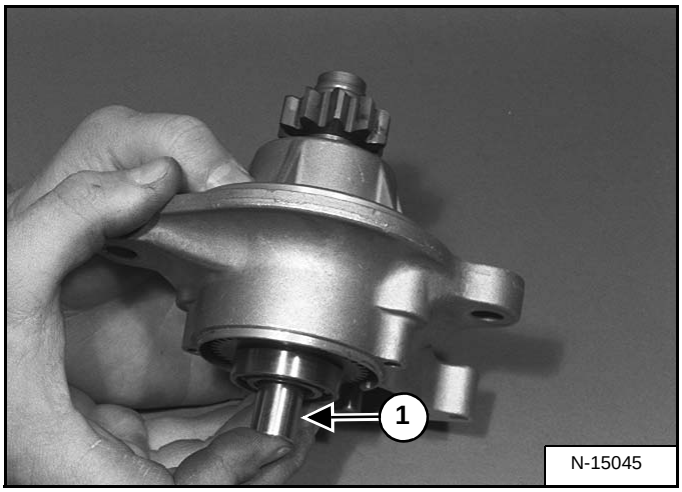


In order to remove the snap ring from the pinion shaft, a tube 0.605 inches (15,4 mm) in diameter by 2.0 inches (50,8 mm) in length is needed **[Figure 50-40-15]**.

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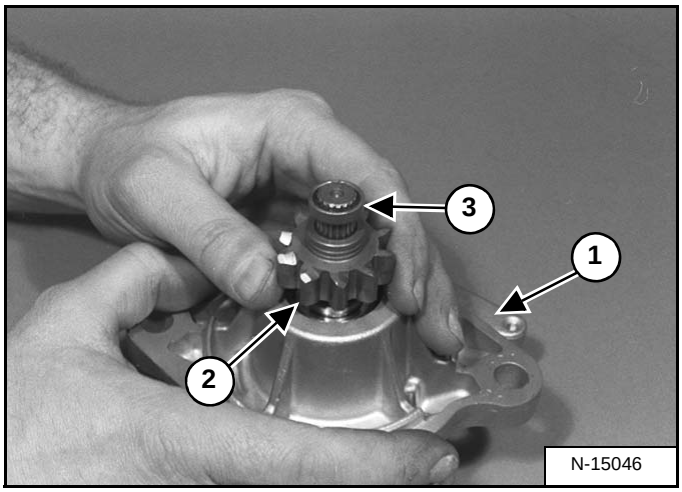
Disassembly (Cont'd)

Figure 50-40-16



Install the tube (Item 1) **[Figure 50-40-16]** in the over running clutch.

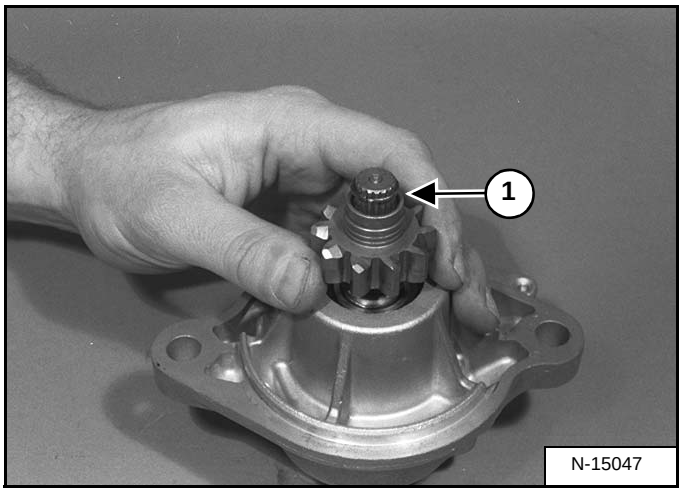
Figure 50-40-17



Press down on the starter carrier (Item 1) to extend the pinion shaft. Press down on the pinion (Item 2) **[Figure 50-40-17]**.

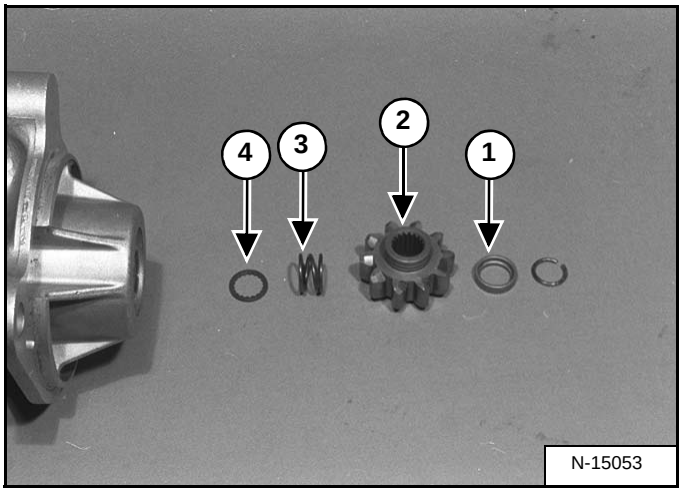
Press the collar (Item 3) **[Figure 50-40-17]** down to gain access to the snap ring.

Figure 50-40-18



Remove the snap ring (Item 1) **[Figure 50-40-18]**.

Figure 50-40-19

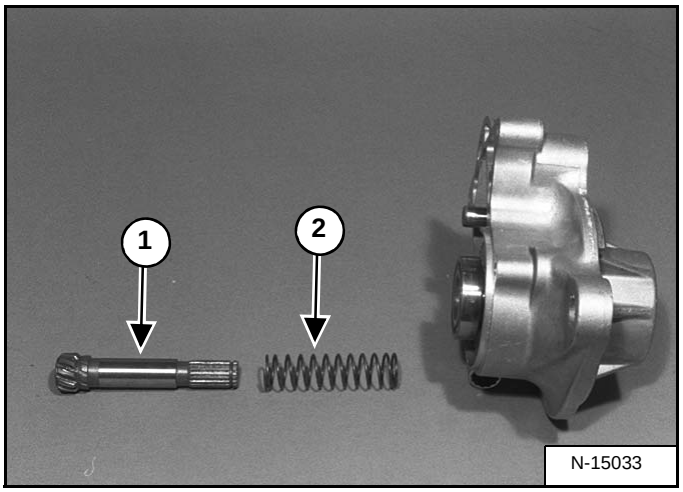


Remove the collar (Item 1), pinion (Item 2), spring (Item 3), and spring seat (Item 4) **[Figure 50-40-19]**.

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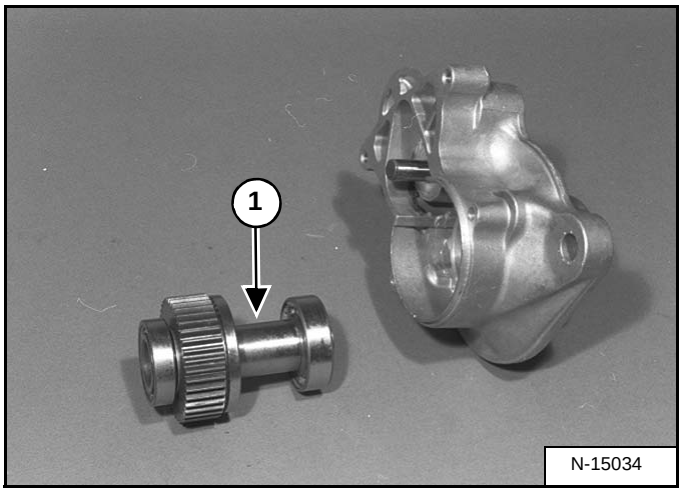
Disassembly (Cont'd)

Figure 50-40-20



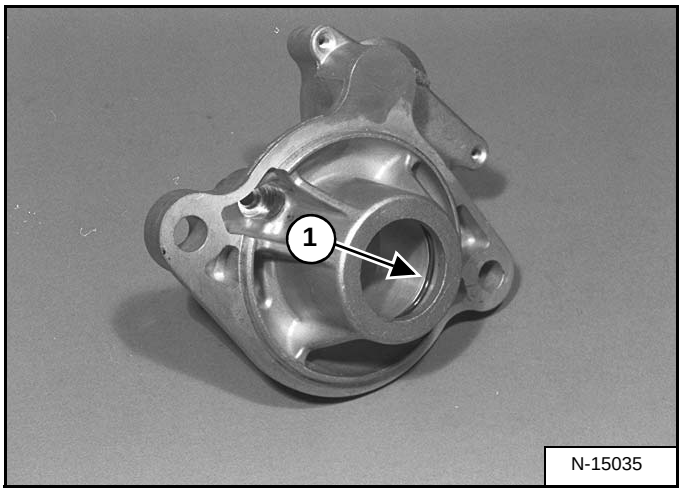
Remove the pinion shaft (Item 1) and spring (Item 2) **[Figure 50-40-20]** from the starter drive.

Figure 50-40-21



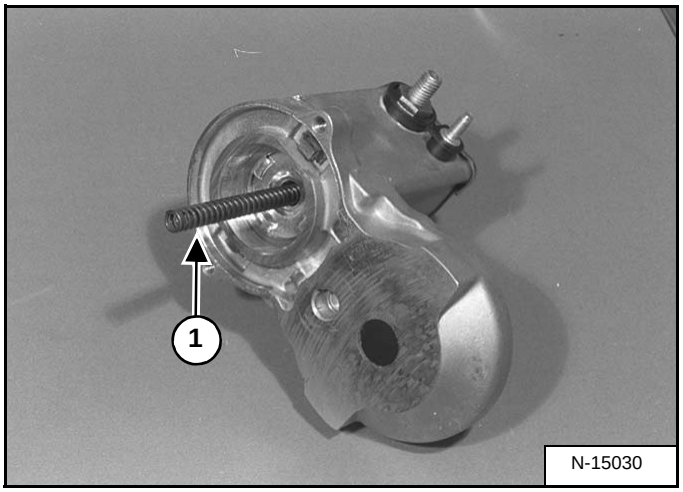
Remove the over running clutch (Item 1) **[Figure 50-40-21]**.

Figure 50-40-22



Remove the O-ring (Item 1) **[Figure 50-40-22]** from the starter housing.

Figure 50-40-23

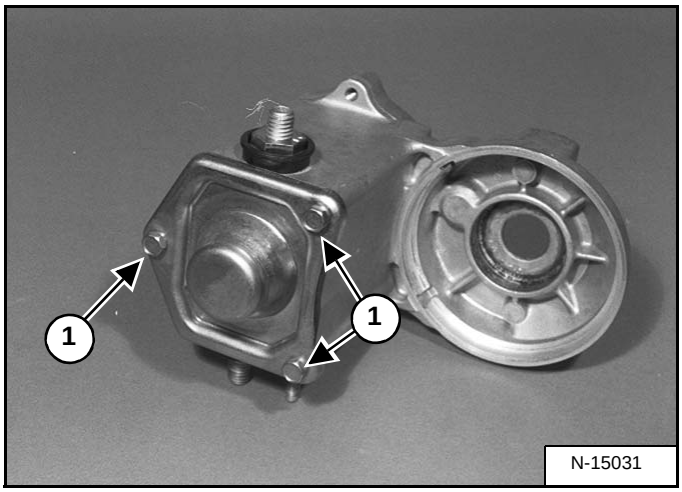


Remove the spring (Item 1) **[Figure 50-40-23]** from the magnetic switch.

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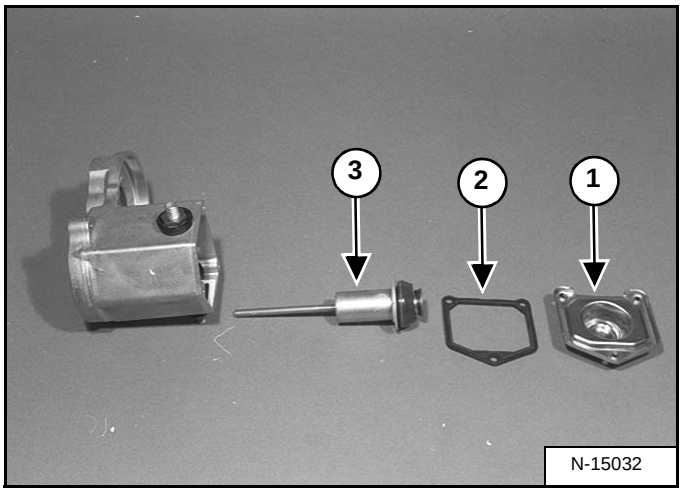
Disassembly (Cont'd)

Figure 50-40-24



Remove the bolts (Item 1) **[Figure 50-40-24]** from the magnetic switch cover.

Figure 50-40-25



Remove the cover (Item 1), gasket (Item 2) and switch (Item 3) **[Figure 50-40-25]**.

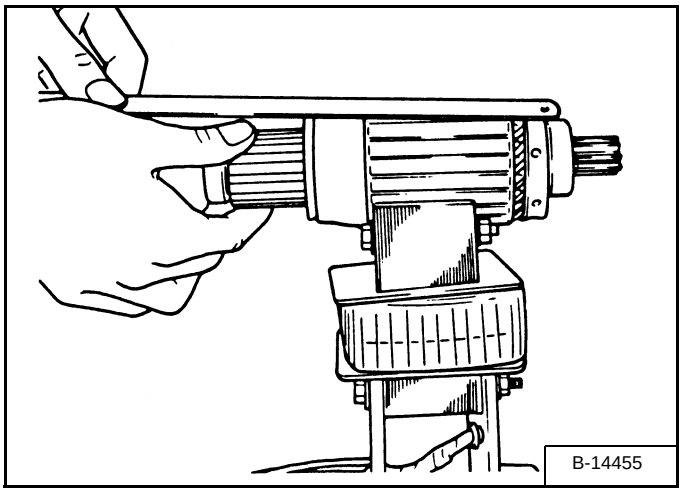
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Inspection And Repair

Inspect the brush cover for discoloration, indicating the starter has been overheated.

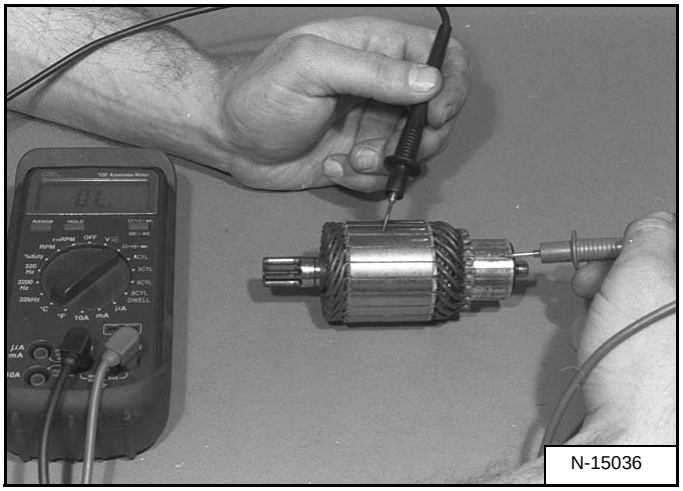
Inspect the pinion teeth for wear and damage.

Figure 50-40-26



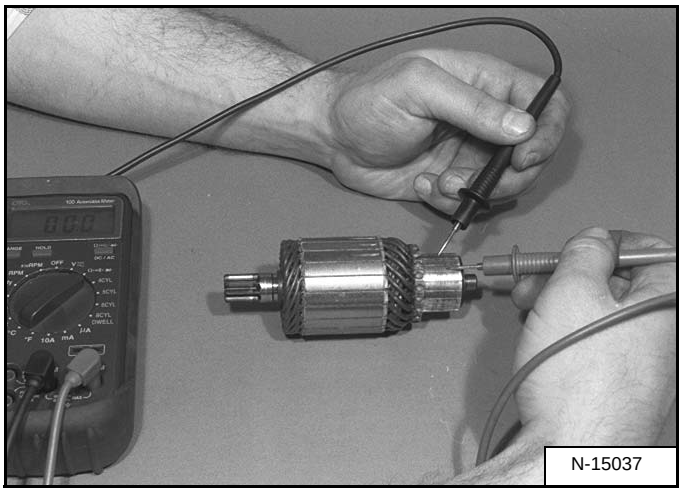
Armature Short-Circuit Test: Use a growler tester, put the armature on the growler and hold a hack saw blade against the armature core while slowly rotating the armature **[Figure 50-40-26]**. A short-circuited armature causes the blade to vibrate and be attracted to the core. An armature which is short-circuited must be replaced.

Figure 50-40-27



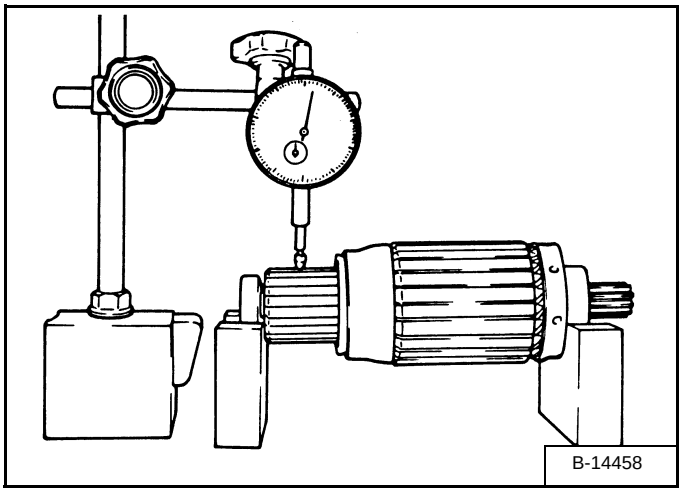
Armature Winding Ground Test: Use a circuit tester, touch one probe to a commutator segment and the other probe to the armature core **[Figure 50-40-27]**. There should be no continuity. If there is continuity, the armature is grounded and must be replaced.

Figure 50-40-28



Armature Winding Continuity Test: Use a circuit tester, touch the probes to two commutator segments **[Figure 50-40-28]**. There must be continuity at any point. If there is no continuity, the winding is open-circuited, replace the armature.

Figure 50-40-29



Commutator Run-Out Test: Check the commutator run-out as shown in **[Figure 50-40-29]**.

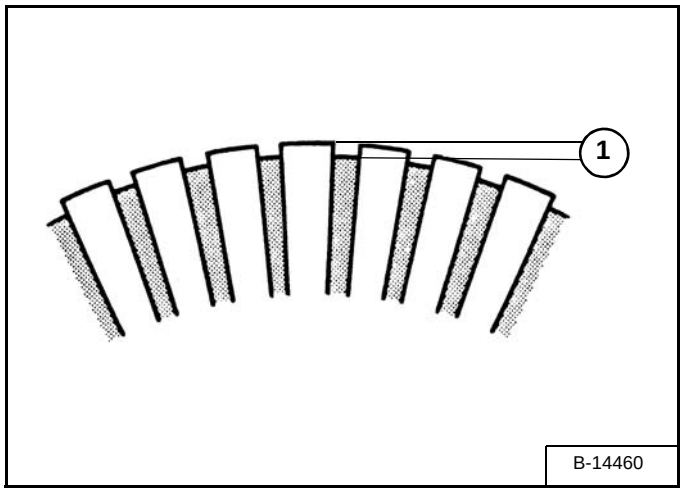
Service Limit - 0.020 inch (0,4 mm)

If the commutator exceeds the service limit, repair as needed.

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Inspection And Repair (Cont'd)

Figure 50-40-30



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

Service Limit - 0.008 inch (0,2 mm)

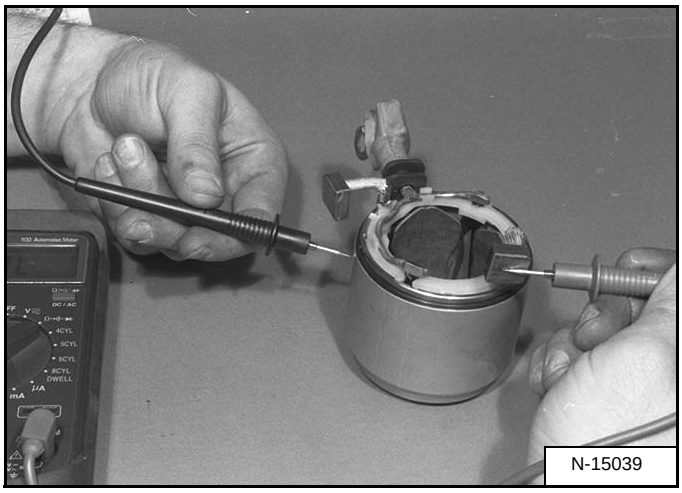
If it is worn, replace the armature.

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

Check the field windings for wear and damage.

Check all the connections for clean and tight solder joints.

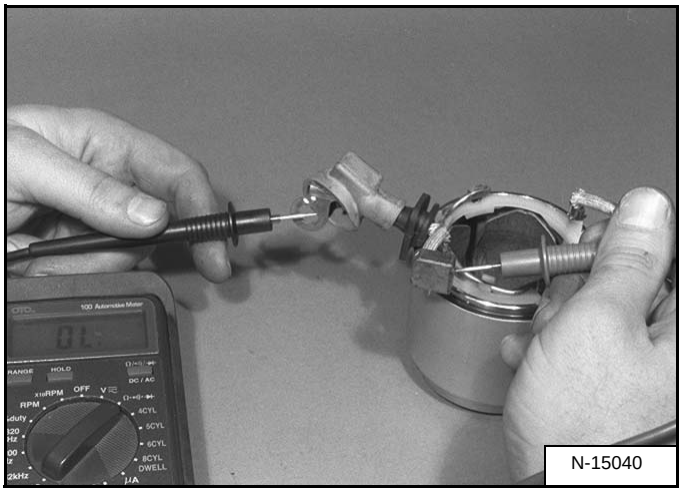
Figure 50-40-31



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

Replace the field windings.

Figure 50-40-32



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

Inspect the brushes for wear and damage.

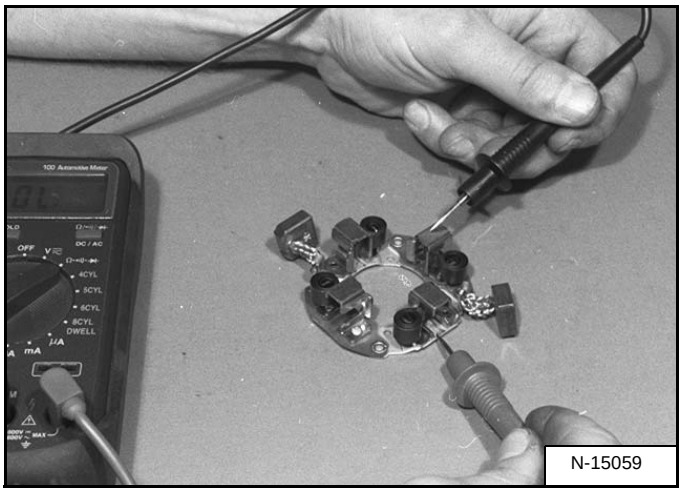
Replace the brush holder or yoke assembly if the brushes are worn or damaged.

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

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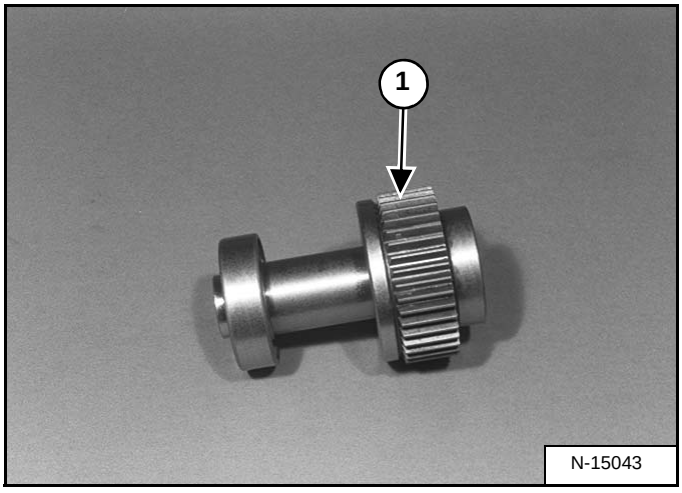
Inspection And Repair (Cont'd)

Figure 50-40-33



Brush Holder Insulation Test: Use a circuit tester, touch one probe to the positive brush holder plate and the other probe to the holder plate **[Figure 50-40-33]**. There should be no continuity. If there is continuity, replace or repair.

Figure 50-40-34



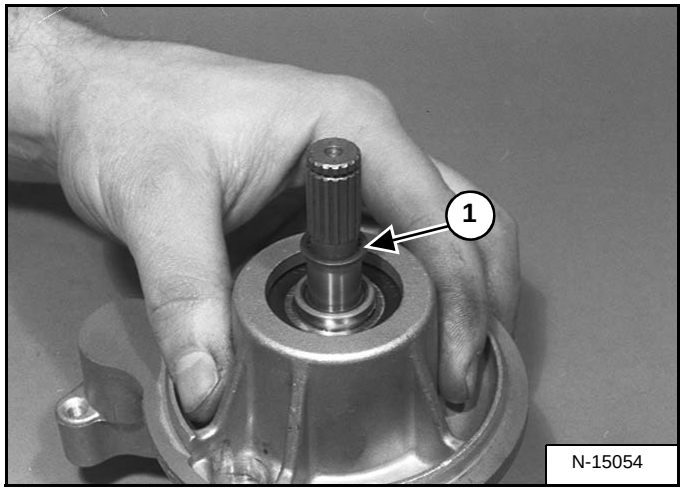
Inspect the over running clutch (Item 1) **[Figure 50-40-34]**, it must rotate freely in the direction of the starter rotation and locked in the opposite rotation.

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Assembly

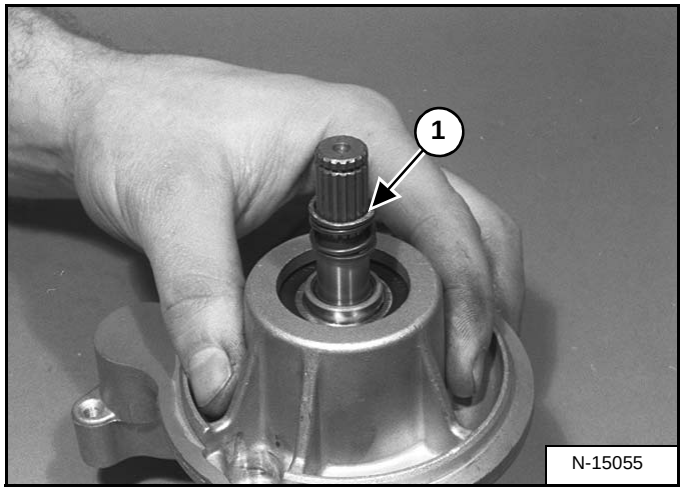
Place the starter drive on the bench, and press down on the starter drive housing.

Figure 50-40-35



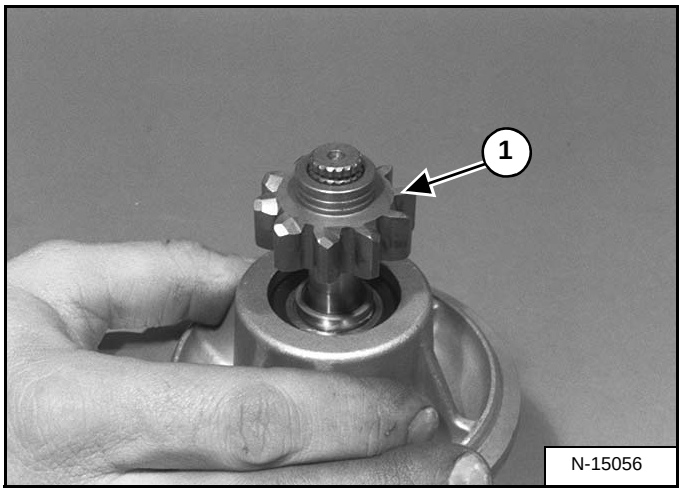
Install the spring seat (Item 1) **[Figure 50-40-35]** on the pinion shaft.

Figure 50-40-36



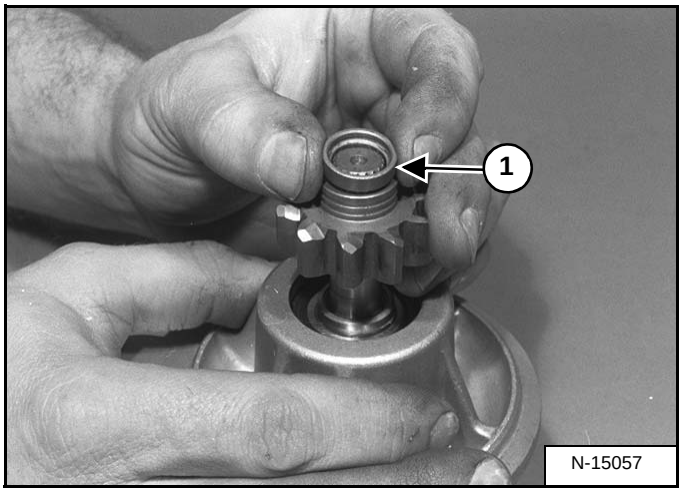
Install the spring (Item 1) **[Figure 50-40-36]**.

Figure 50-40-37



Install the pinion (Item 1) **[Figure 50-40-37]**.

Figure 50-40-38

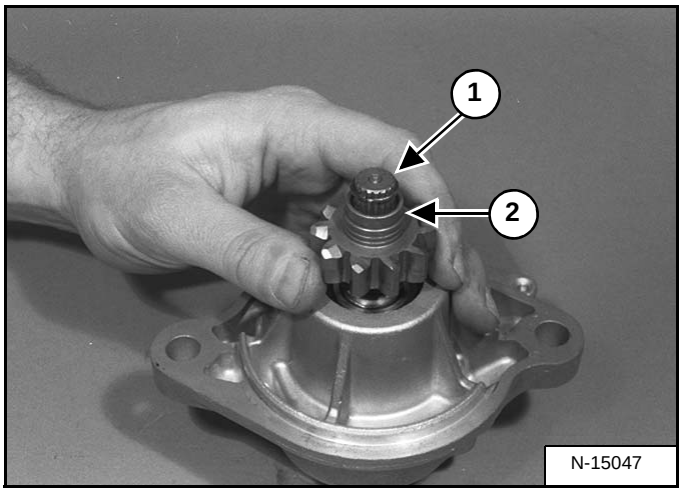


Install the collar (Item 1) **[Figure 50-40-38]**.

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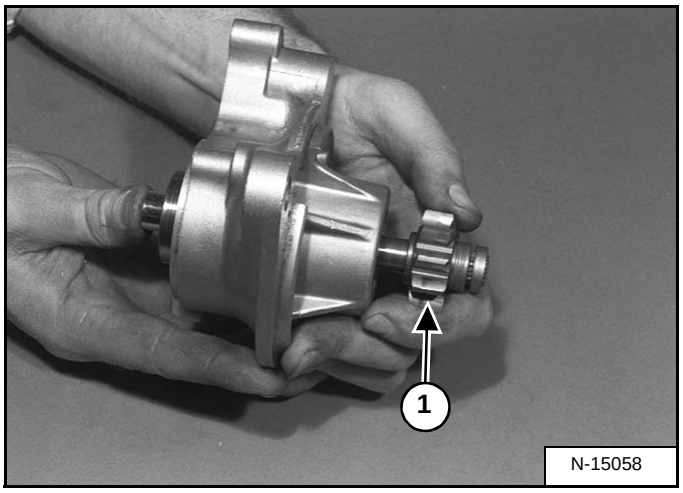
Assembly (Cont'd)

Figure 50-40-39



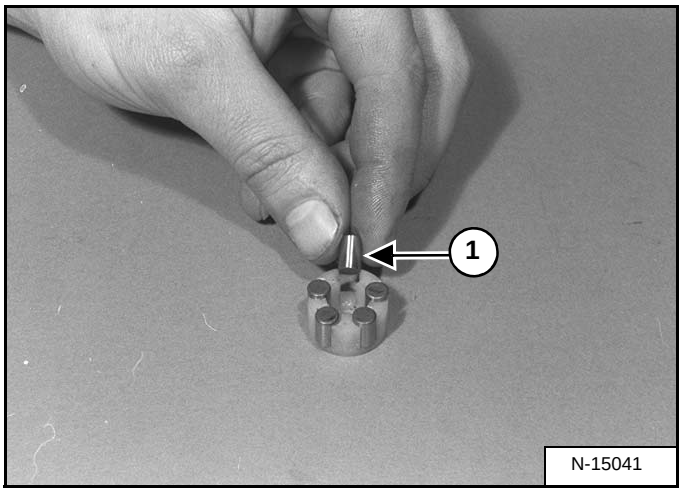
Install the snap ring (Item 1). Pull the collar (Item 2) **[Figure 50-40-39]** over the snap ring.

Figure 50-40-40



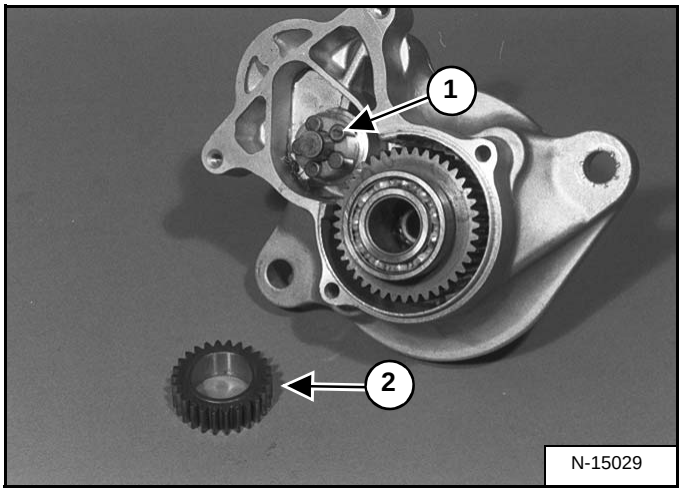
With the pinion shaft extended, extend and release the pinion (Item 1) **[Figure 50-40-40]**. The pinion must return to the fully retracted position.

Figure 50-40-41



Install the rollers (Item 1) **[Figure 50-40-41]** in the retainer.

Figure 50-40-42



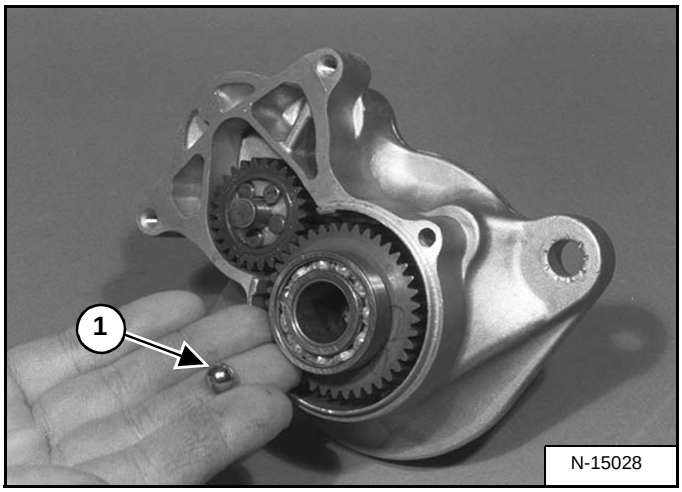
Install the roller/retainer assembly (Item 1) **[Figure 50-40-42]** on the starter housing.

Install the idler gear (Item 2) **[Figure 50-40-42]** over the roller/retainer assembly.

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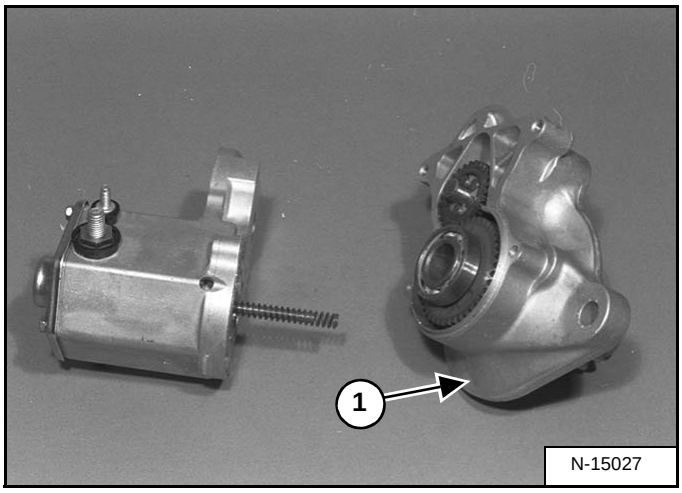
Assembly (Cont'd)

Figure 50-40-43



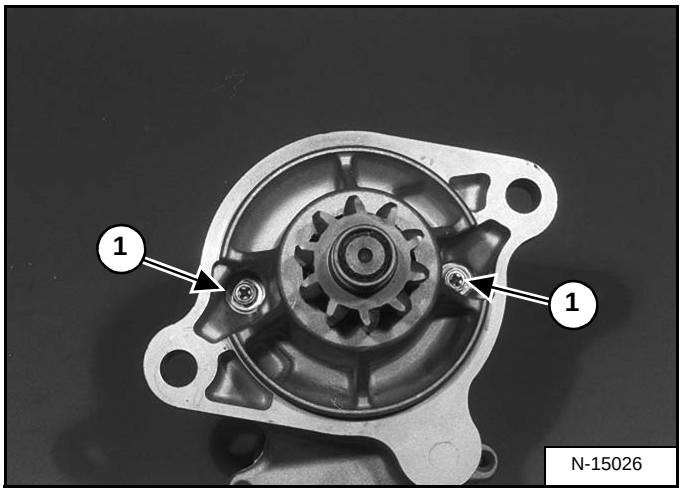
Install the ball (Item 1) **[Figure 50-40-43]** in the pinion shaft.

Figure 50-40-44



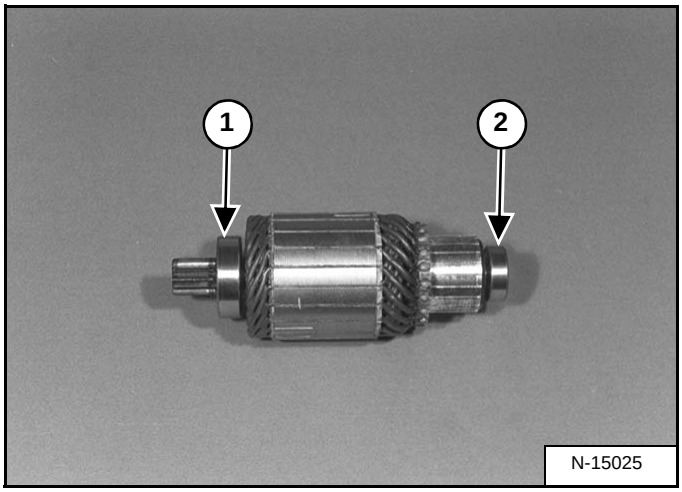
Install the starter drive (Item 1) **[Figure 50-40-44]** on the magnetic switch.

Figure 50-40-45



Install the bolts (Item 1) **[Figure 50-40-45]**. Tighten the bolts to 60-104 in.-lbs. (7-12 Nm) torque.

Figure 50-40-46

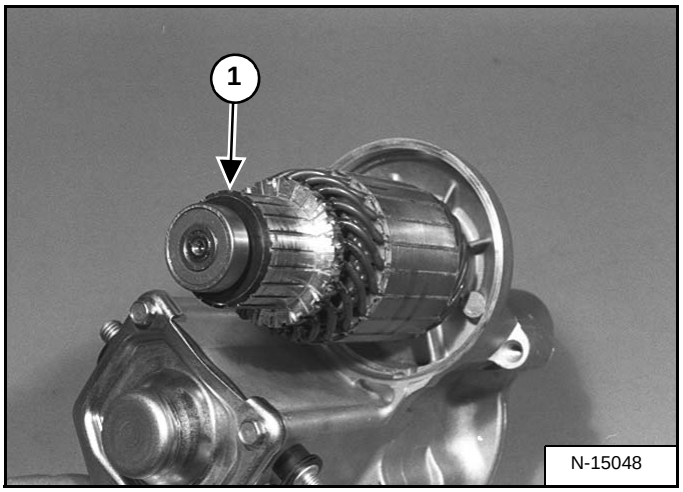


Install the bearings (Items 1 & 2) **[Figure 50-40-46]** on both ends of the armature.

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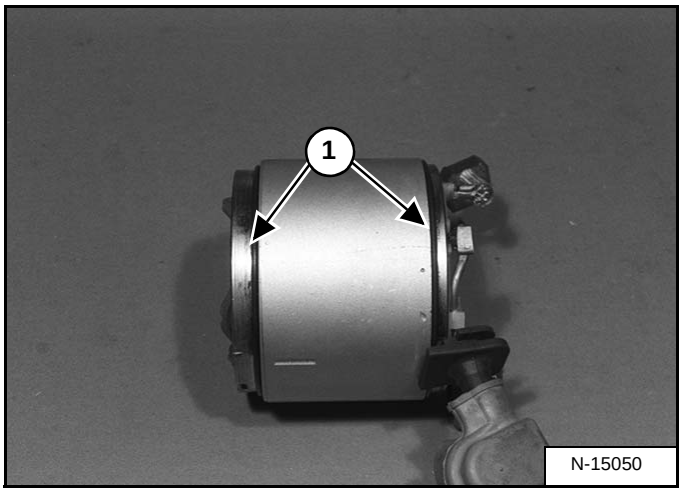
Assembly (Cont'd)

Figure 50-40-47



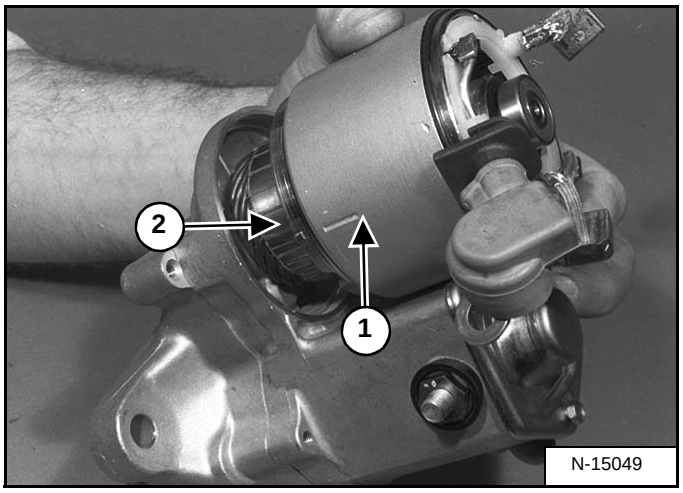
Install the armature (Item 1) **[Figure 50-40-47]** in the magnetic switch housing.

Figure 50-40-48



Install the O-rings (Item 1) **[Figure 50-40-48]** on the frame.

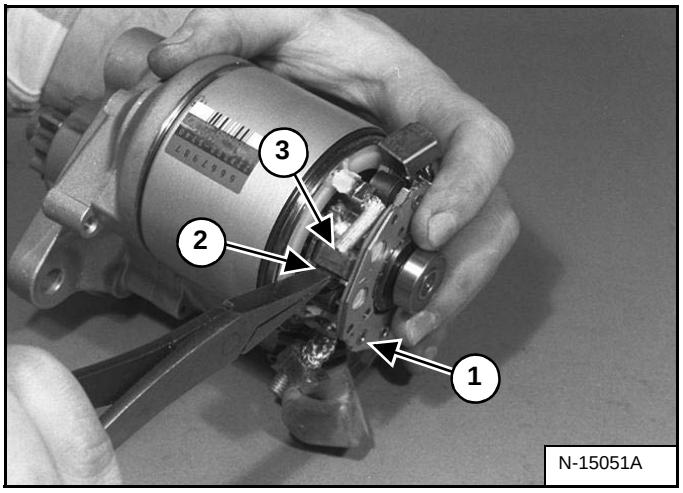
Figure 50-40-49



Install the frame (Item 1) **[Figure 50-40-49]** over the armature.

NOTE: Make sure the tab (Item 2) [Figure 50-40-49] on the frame is aligned with the slot in the magnetic switch housing.

Figure 50-40-50



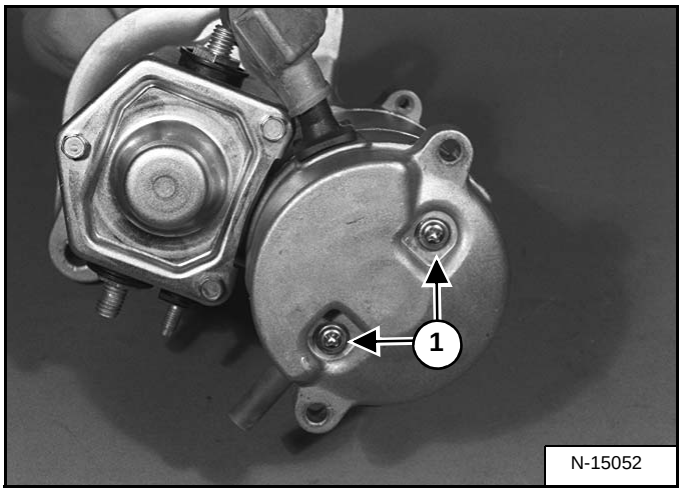
Install the brush holder (Item 1) **[Figure 50-40-50]** on the armature.

Using a needle nose pliers, pull the spring (Item 2) back and install the brushes (Item 3) **[Figure 50-40-50]**.

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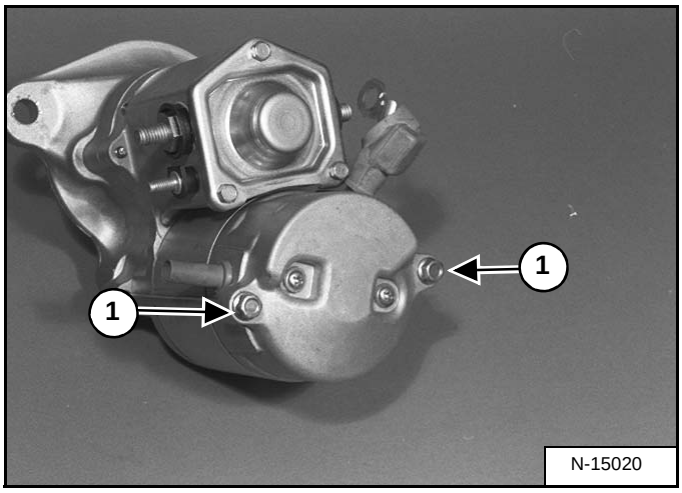
Assembly (Cont'd)

Figure 50-40-51



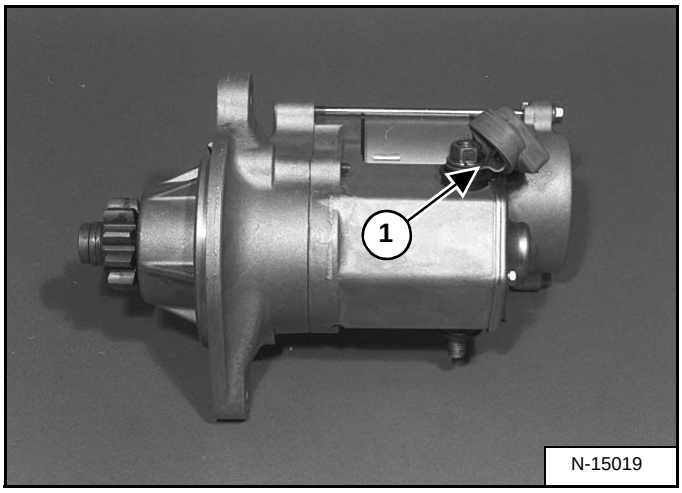
Install the brush cover and screws (Item 1) **[Figure 50-40-51]**.

Figure 50-40-52



Install the bolts (Item 1) **[Figure 50-40-52]**. Tighten the bolts to 60-104 in.-lbs. (7-12 Nm) torque.

Figure 50-40-53



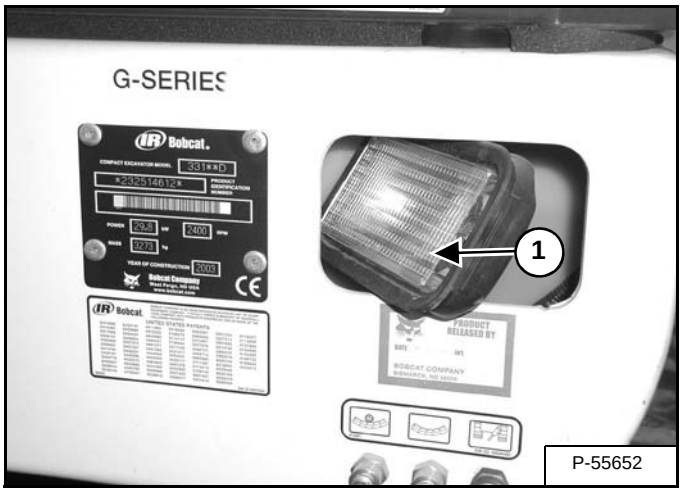
Install the cable (Item 1) **[Figure 50-40-53]** on the terminal. Tighten the terminal nut to 4-7 ft.-lbs. (5-9 Nm) torque.

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LIGHTS

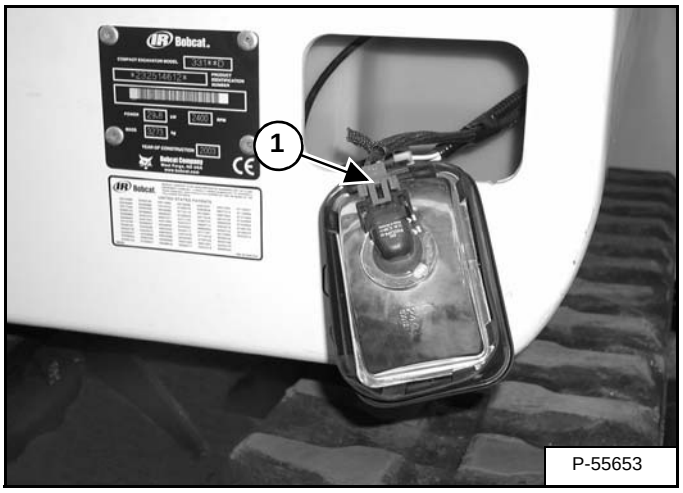
Removal And Installation

Figure 50-50-1



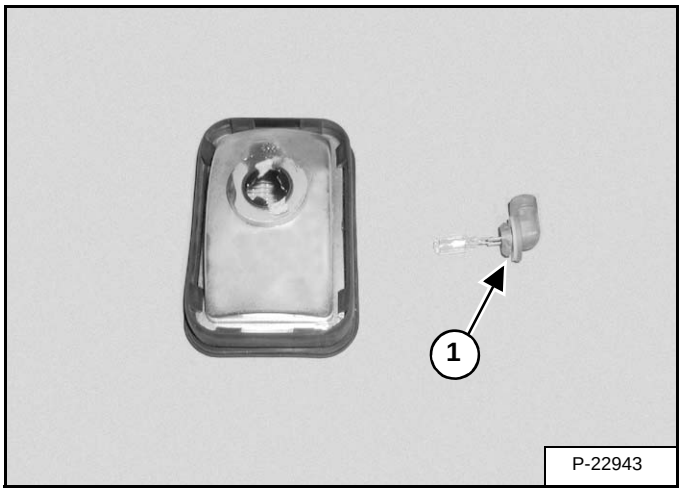
To remove the upperstructure light, pivot the light (Item 1) **[Figure 50-50-1]** back inside the frame.

Figure 50-50-2



Disconnect the wire harness (Item 1) **[Figure 50-50-2]**.

Figure 50-50-3

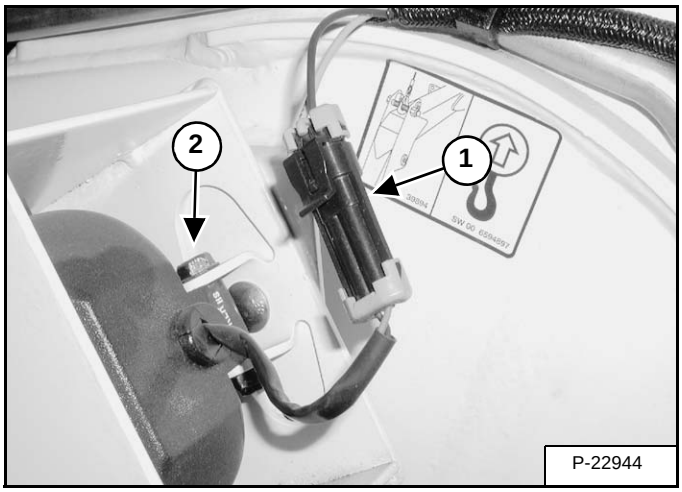


Remove the light bulb assembly (Item 1) **[Figure 50-50-3]** from the lens.

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Boom Light Removal And Installation (Early Models)

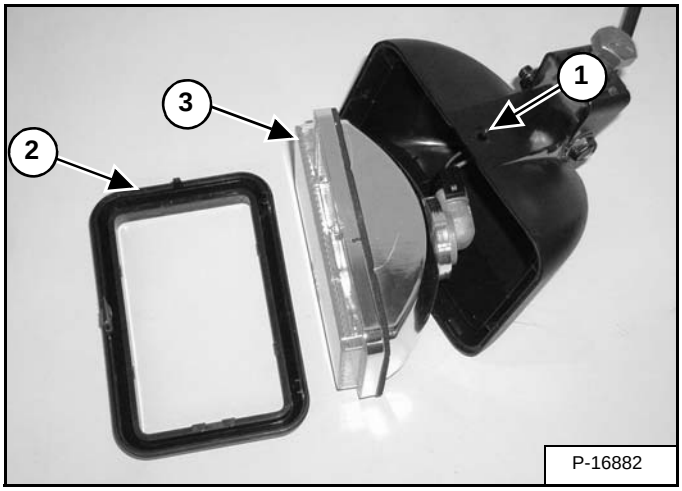
Figure 50-50-4



To remove the boom light, disconnect the wire harness (Item 1) and remove the nut and bolt (Item 2) **[Figure 50-50-4]**.

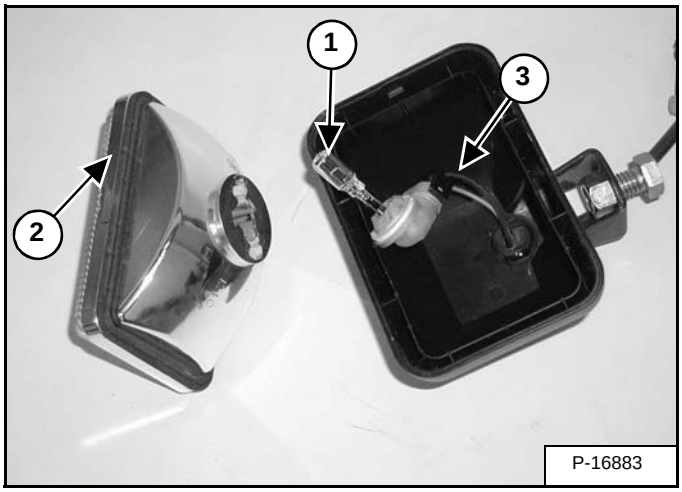
Boom Light Disassembly And Assembly (Early Models)

Figure 50-50-5



Remove the screw (Item 1), remove the cover (Item 2) and lens assembly (Item 3) **[Figure 50-50-5]**.

Figure 50-50-6



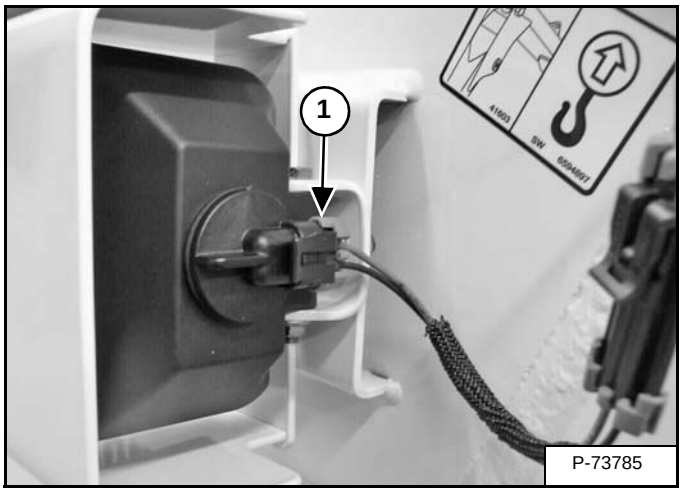
Remove the light bulb assembly (Item 1) from the lens assembly (Item 2) **[Figure 50-50-6]**.

Disconnect the wire harness (Item 3) **[Figure 50-50-6]** from the light bulb assembly.

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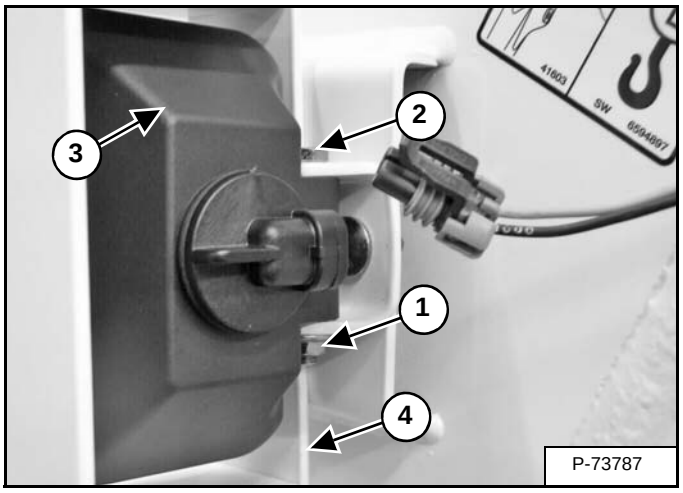
Boom Light Removal And Installation (Later Models)

Figure 50-50-7



Disconnect the wire harness (Item 1) **[Figure 50-50-7]**.

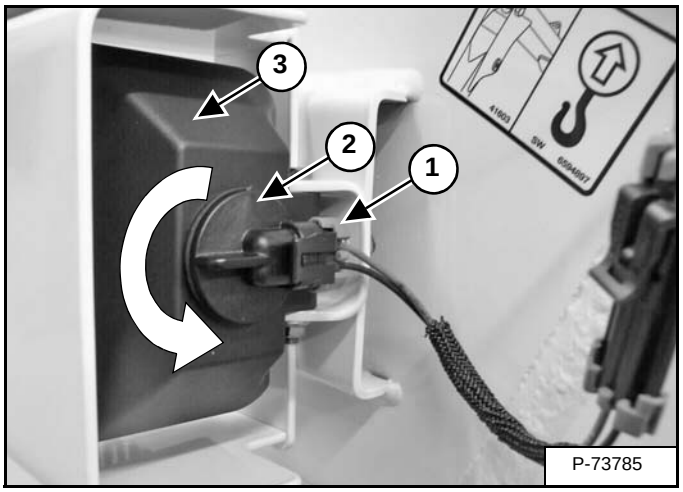
Figure 50-50-8



Remove the nut (Item 1) and bolt (Item 2). Remove the boom light (Item 3) from the boom light guard (Item 4) **[Figure 50-50-8]**.

Boom Light Bulb Replacement (Later Models)

Figure 50-50-9



Disconnect the wire harness (Item 1) **[Figure 50-50-9]**.

Rotate light bulb assembly (Item 2) counterclockwise and pull straight out from the boom light (Item 3) **[Figure 50-50-9]**.

Figure 50-50-10



NOTE: Do not touch glass of halogen bulb with your fingers or allow bulb to come in contact with oils. If contaminated, the bulb should be cleaned with mild alcohol and clean cloth [Figure 50-50-10].

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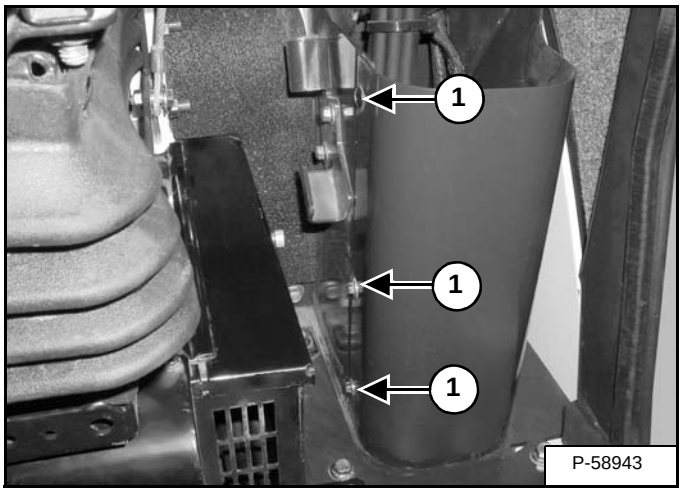
MAGNETIC LOCKOUT SENSOR

Removal And Installation

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

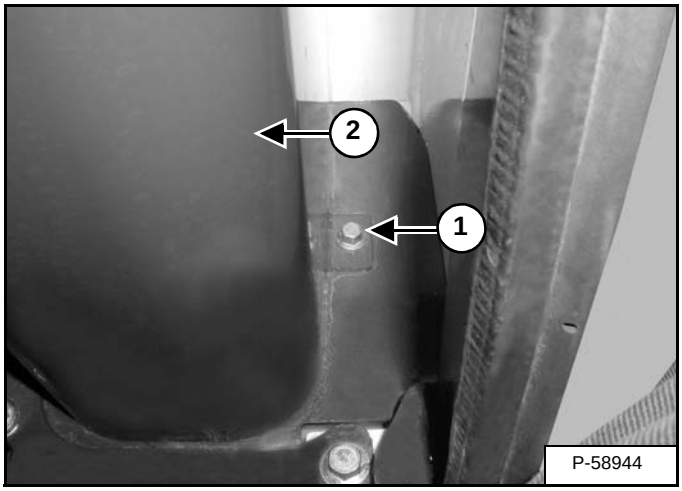
Remove the lower console cover. (See Lower Console Cover Removal And Installation on Page 40-60-1.)

Figure 50-60-1



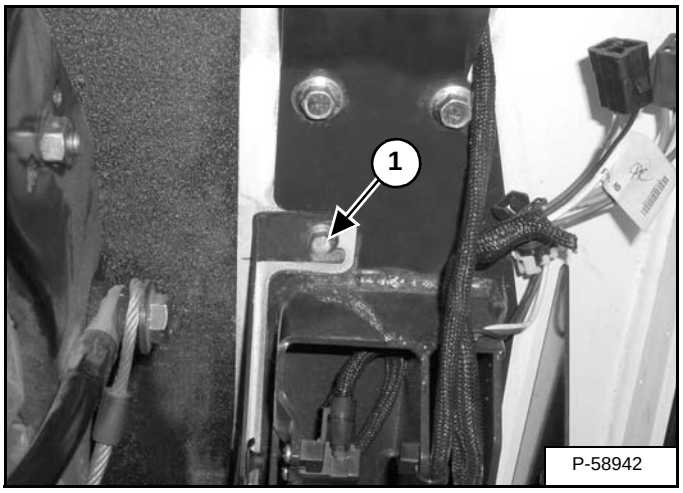
Remove the bolts (Item 1) **[Figure 50-60-1]**.

Figure 50-60-2



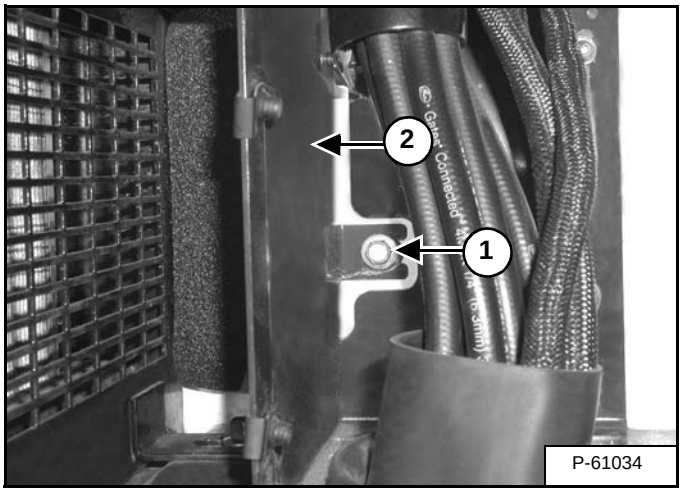
Remove the bolt (Item 1) and cover (Item 2) **[Figure 50-60-2]**.

Figure 50-60-3



Remove the bolt (Item 1) **[Figure 50-60-3]**.

Figure 50-60-4

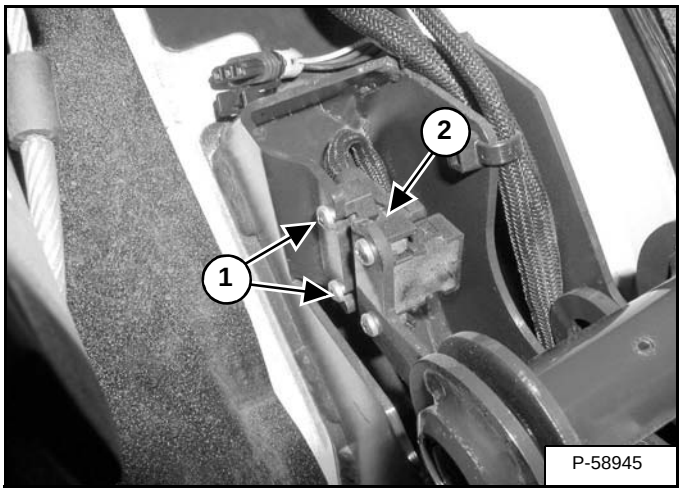


Remove the bolt (Item 1) and cover (Item 2) **[Figure 50-60-4]**.

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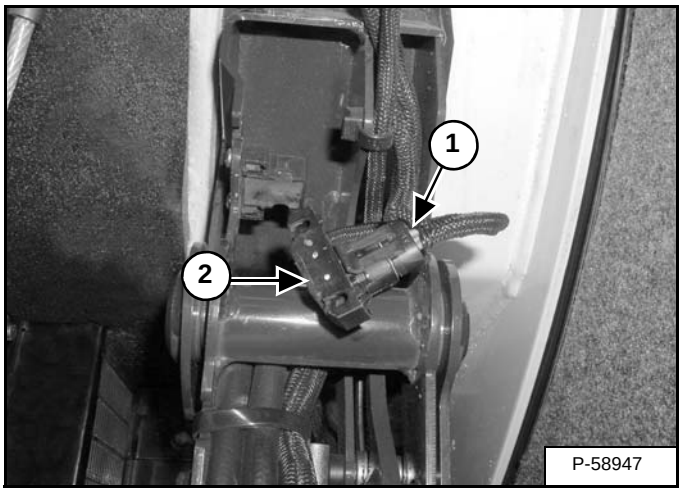
Removal And Installation (Cont'd)

Figure 50-60-5



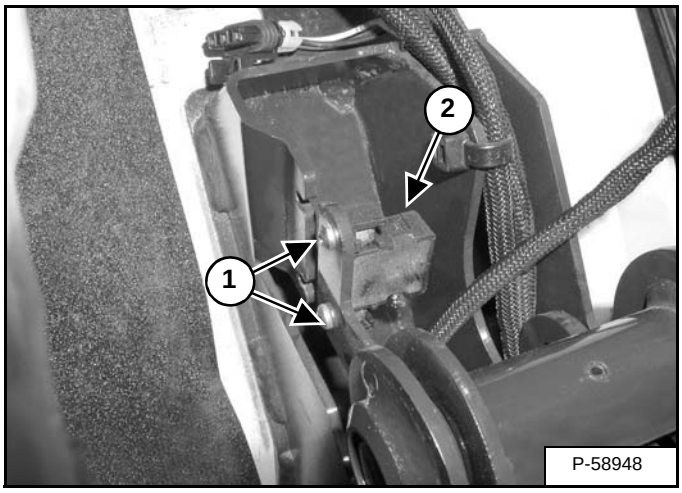
Remove the screws (Item 1) and nuts. Remove the magnetic lockout sensor (Item 2) **[Figure 50-60-5]**.

Figure 50-60-6



Disconnect the wire harness (Item 1) from the magnetic lockout sensor (Item 2) **[Figure 50-60-6]**.

Figure 50-60-7



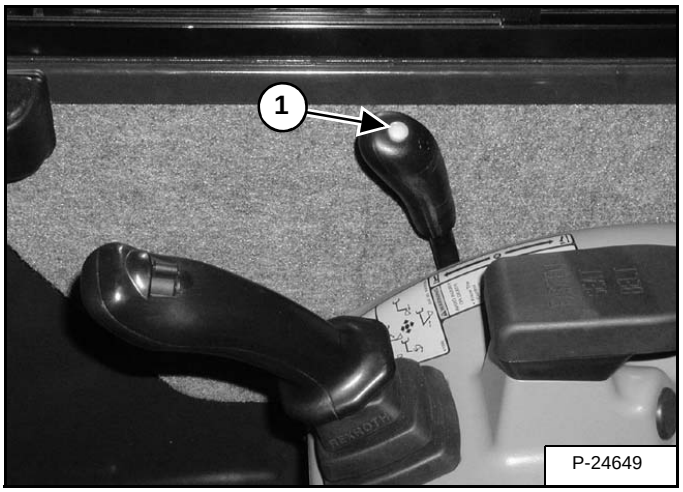
Remove the screws (Item 1) and nuts. Remove the magnet (Item 2) **[Figure 50-60-7]**.

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TWO SPEED SWITCH

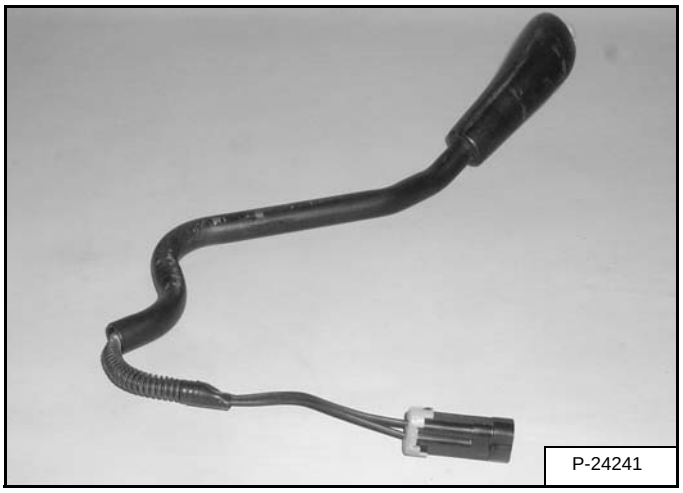
Removal And Installation

Figure 50-70-8



The two-speed switch (Item 1) **[Figure 50-70-8]** is located in the blade handle.

Figure 50-70-9



Remove the blade control lever from the excavator **[Figure 50-70-9]**. (See Lever Removal And Installation on Page 40-80-1.)

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

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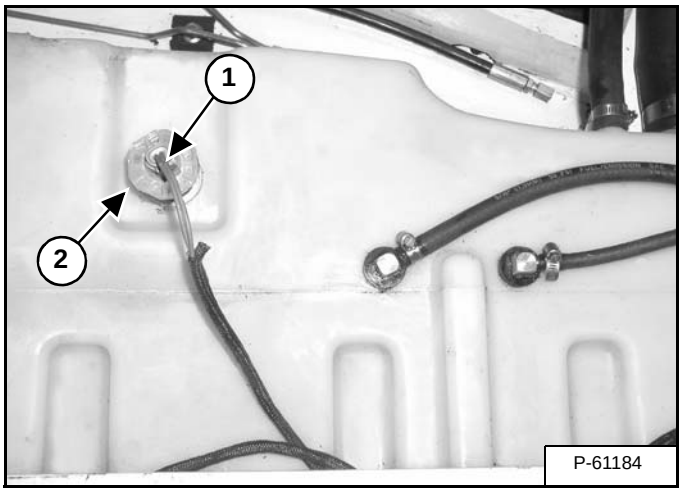
FUEL LEVEL SENDER

Removal And Installation

Remove the negative battery cable. (See Removal And Installation on Page 50-20-2.)

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

Figure 50-80-10



Disconnect the harness connector (Item 1) **[Figure 50-80-10]** from the fuel sender.

Remove the fuel sender (Item 2) **[Figure 50-80-10]**. The sender threads into the tank, use a wrench to remove the sender.

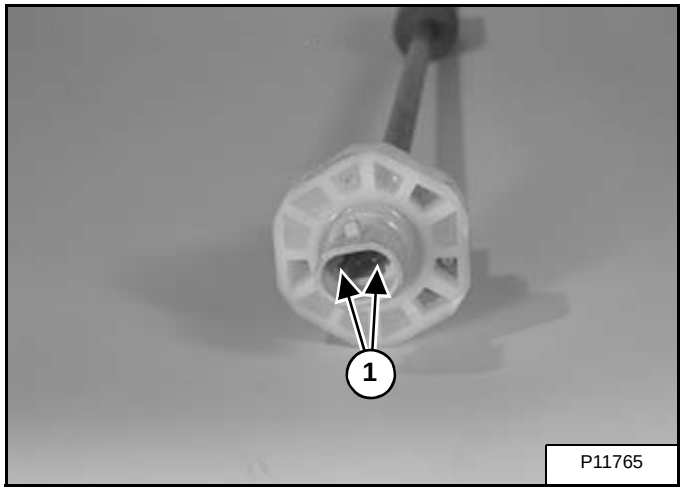
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FUEL LEVEL SENDER (CONT'D)

Testing

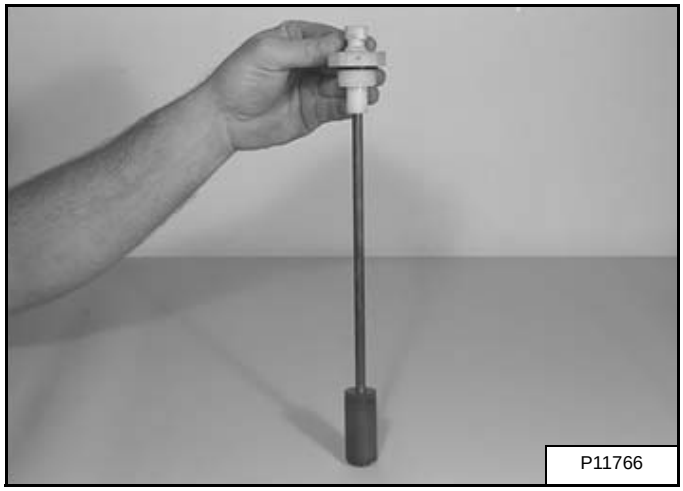
Use an ohmmeter to check the resistance of the fuel sender.

Figure 50-80-11



Insert one of the ohm tester leads into each of the fuel sender electrical connectors (Item 1) **[Figure 50-80-11]** in the end of the fuel sender.

Figure 50-80-12

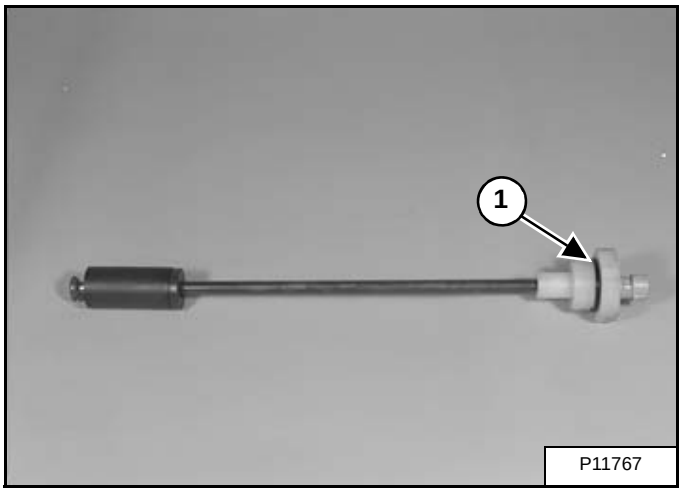


With the fuel sender in the position shown **[Figure 50-80-12]**, read the ohms in the empty position. Slide the float upwards and the ohm reading will decrease. See resistance chart below.

The resistance should read as follows:

FULL: 15-35 Ohms.
HALF: 82-97 Ohms.
EMPTY: 230-250 Ohms.

Figure 50-80-13



Inspect the O-ring (Item 1) **[Figure 50-80-13]** and replace as needed.

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DIAGNOSTICS SERVICE CODE

Number Codes List

CODE		CODE	
02-16	Hydraulic charge filter not connected	20-02	Two speed output error ON
02-17	Hydraulic charge filter plugged	20-03	Two speed output error OFF
03-09	Battery voltage low	21-02	Glow plug output error ON
03-10	Battery voltage high	21-03	Glow plug output error OFF
03-11	Battery voltage extremely high		
03-14	Battery voltage extremely low	22-02	Starter relay output error ON
03-22	Battery voltage out of range low	22-03	Starter relay output error OFF
04-14	Oil pressure extremely low	26-02	Front base output error ON
04-15	Oil pressure shutdown level	26-03	Front base output error OFF
05-09	Hydraulic charge pressure low	27-02	Front rod output error ON
05-14	Hydraulic charge pressure extremely low	27-03	Front rod output error OFF
05-15	Hydraulic charge pressure shutdown level		
05-21	Hydraulic charge pressure out of range high	28-02	Diverter output error ON
05-22	Hydraulic charge pressure out of range low	28-03	Diverter output error OFF
06-10	Engine speed high	30-28	Watch dog failure
06-11	Engine speed extremely high		
06-15	Engine speed shutdown level	31-28	Recovery mode failure
06-18	Engine speed out of range high		
		33-23	Controller not calibrated
07-10	Hydraulic oil temperature high		
07-11	Hydraulic oil temperature extremely high		
07-15	Hydraulic oil temperature shutdown level	60-21	Sec. aux. thumbswitch out of range high
07-21	Hydraulic oil temperature out of range high	60-22	Sec. aux. thumbswitch out of range low
07-22	Hydraulic oil temperature out of range low	60-23	Sec. aux. thumbswitch not calibrated
08-10	Engine coolant temperature high	62-04	Load moment monitoring in error
08-11	Engine coolant temperature extremely high		
08-15	Engine coolant temperature shutdown level	63-05	Work group/travel console sensor
08-21	Engine coolant temperature out of range high	63-06	Work group/travel console sensor
08-22	Engine coolant temperature out of range low		
		64-05	Switched power/acc. relay short to battery
09-09	Fuel level low	64-06	Switched power/acc. relay short to ground
09-21	Fuel level out of range high	64-07	Switched power/acc. relay open circuit
09-22	Fuel level out of range low		
		65-02	Work group/travel lockout solenoid error ON
12-21	Primary auxiliary PWM switch out of range high	65-03	Work group/travel lockout solenoid error OFF
12-22	Primary auxiliary PWM switch out of range low	65-05	Work group/travel lockout solenoid short to battery
12-23	primary auxiliary PWM switch not calibrated	65-06	Work group/travel lockout solenoid short to ground
		65-07	Work group/travel lockout solenoid open circuit
13-05	Fuel shut-off hold solenoid short to battery		
13-06	Fuel shut-off hold solenoid short to ground	66-05	Travel solenoid short to battery
		66-06	Travel solenoid short to ground
14-02	Fuel shut-off hold solenoid short to batter		
14-03	Fuel shut-off hold solenoid short to ground		

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DELUXE INSTRUMENT PANEL SETUP

Passwords

All new machines with Deluxe Instrumentation arrive at Bobcat Dealerships with the panel in locked mode. This means that a password must be used to start the engine.

For security purposes, your dealer may change the password and also set it in the locked mode. Your dealer will provide you with the password.

Master Password:
A permanent, randomly selected password is set at the factory which cannot be changed. This password is used for service by the Bobcat dealer if the Owner Password is not known; or to change the Owner Password.

Owner Password:
There is only one Owner Password (**CodE 0**). It must be used to change the owner or operator passwords. See below for changing the Owner Password.

Operator Password:
There can be up to three operator Passwords (**CodE 1, CodE 2, CodE 3**). See below for changing the Operator Password.

Password Entry (For Starting and Operating the Machine)

Press ENTER CODE button (Item 1). The panel will become lighted and there will be two short beeps. **CodE** will appear on the LCD (Item 2) **[Figure 50-100-1]**.

NOTE: After you press ENTER CODE you have 40 seconds to use the keypad (Item 3) [Figure 50-100-1] to enter the password. (If more than 40 seconds is used, the process will abort and you will need to start over.

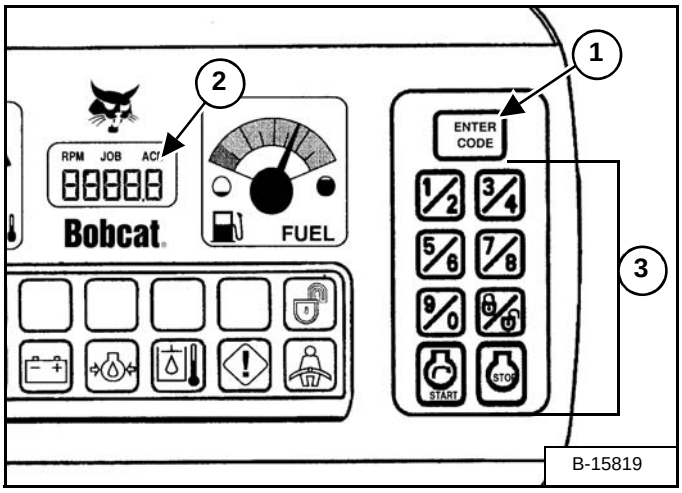
Enter the password. For each digit that you enter, a dash will appear on the LCD. If the password was entered correctly, there will be one long beep.

NOTE: If the password was incorrect there will be three short beeps and *Error* will appear on the LCD. Press the ENTER CODE button again and start over. After three failed attempts, you must wait three minutes to try again.

You are now ready to start and operate the machine.

If you will be changing passwords, do not start the engine. (See Changing The Password at right.)

Figure 50-100-1



Changing The Owner Or Operator Password

Perform Password Entry at left, but do not start the engine.

Press and hold the ENTER CODE button (Item 1) for three seconds. CodE 1 will appear on the LCD (Item 2) **[Figure 50-100-1]**.

Press the ENTER CODE button until the desired Code (**CodE 0, CodE 1, CodE 2, CodE 3**) appears. CodE 0 is Owner Password. The other codes are Operator passwords. You now have 40 seconds to use the keypad (Item 3) **[Figure 50-100-1]** to enter each digit of a new four digit password.

Enter the new four digit password. After the fourth digit is entered, there will be two short beeps and **rPEAt** will appear.

Re-enter the new four digit password to verify. If the new passwords match, there will be two short beeps, **Code** will appear for 1 second and then the LCD will return to HOURMETER function.

NOTE: If the new passwords do not match, there will be one long beep and Error will appear for 1 second and then the LCD will return to HOURMETER function.

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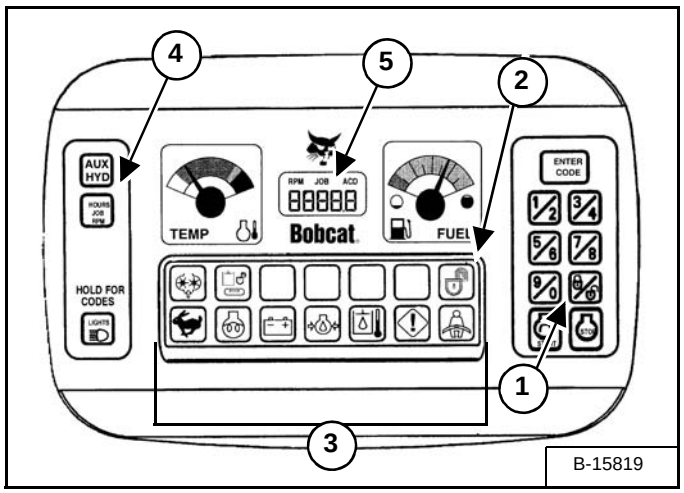
DELUXE INSTRUMENT PANEL SETUP (CONT'D)

Password Lockout Feature

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

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

Figure 50-100-2



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

Perform Password Entry again.

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

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

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

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

Job Clock

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

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

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

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

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

RPM

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

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

Engine RPM is now displayed in the LCD.

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

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ENGINE SERVICE

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Removal And Installation 60-30-1

ENGINE. 60-60-1
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Fuel Injection Pump Check 60-50-5
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ENGINE FLYWHEEL (LATER MODELS) 60-71-1
Flywheel Removal And Installation 60-71-1
Flywheel Ring Gear 60-71-3
Hydraulic Pump Coupler 60-71-3

RADIATOR 60-40-1
Removal And Installation 60-40-1

Continued On Next Page

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TROUBLESHOOTING

Chart

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

PROBLEM	CAUSE
Slow cranking speed	1, 2, 3, 4
Engine will not start	2, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 19, 27, 28, 29
Difficult to start	5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 25, 27, 28, 29
No power from engine	8, 9, 10, 11, 12, 13, 15, 16, 17, 21, 22, 24, 25, 26, 28, 29
Engine is mis-firing	8, 9, 11, 12, 13, 15, 16, 17, 21, 22, 24, 25, 26, 28
Too much fuel consumption	10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29
Black exhaust	10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29
Blue/white exhaust	4, 10, 15, 16, 17, 21, 23, 27, 29, 30, 50
Low oil pressure	4, 31, 32, 33, 34, 35, 37, 38, 39, 52
Engine knocking	13, 15, 16, 19, 22, 24, 25, 27, 29, 31, 40, 41, 53
Engine running rough	7, 8, 9, 10, 11, 12, 13, 17, 18, 22, 24, 25, 26, 29, 40, 53
Vibration	12, 13, 17, 21, 22, 25, 26, 29, 40, 42, 43
High oil pressure	4, 33, 36
Overheating	10, 12, 13, 15, 16, 20, 21, 40, 44, 45, 46, 47, 48, 51
Too much crankcase pressure	22, 27, 29, 30, 40, 49
Poor compression	10, 16, 21, 24, 25, 27, 28, 29, 30, 41, 53
Start and stop	9, 10, 11

KEY TO CORRECT THE CAUSE	
1. Battery capacity low	28. Worn valves and seat
2. Bad electrical connections	29. Broken or worn piston rings
3. Faulty starter motor	30. Worn valve stems or guides
4. Incorrect grade of oil	31. Worn or damaged bearings
5. Low cranking speed	32. Not enough oil in the oil pan
6. Fuel tank empty	33. Switch is defective
7. Faulty stop control operation	34. Oil pump worn
8. Plugged fuel line	35. Relief valve is stuck open
9. Plugged fuel filter	36. Relief valve is stuck closed
10. Restriction in the air cleaner	37. Broken relief valve spring
11. Air in the fuel system	38. Faulty suction pipe
12. Faulty fuel injection pump	39. Plugged oil filter
13. Faulty fuel injectors	40. Piston seizure
14. Broken injection pump drive	41. Incorrect piston height
15. Incorrect injection pump timing	42. Faulty engine mounting
16. Incorrect valve timing	43. Incorrect alignment of flywheel
17. Poor compression	44. Faulty thermostat
18. Plugged fuel tank vent	45. Restriction in water jacket
19. Incorrect grade of fuel	46. Loose alternator belt
20. Exhaust pipe restriction	47. Plugged radiator
21. Cylinder head gasket leaking	48. Plugged breather pipe
22. Over heating	49. Plugged breather pipe
23. Cold running	50. Damaged valve stem oil deflectors
24. Incorrect tappet adjustment	51. Coolant level too low
25. Sticking valves	52. Plugged oil pump pipe strainer
26. Incorrect high pressure fuel lines	53. Broken valve spring
27. Worn cylinder bores	

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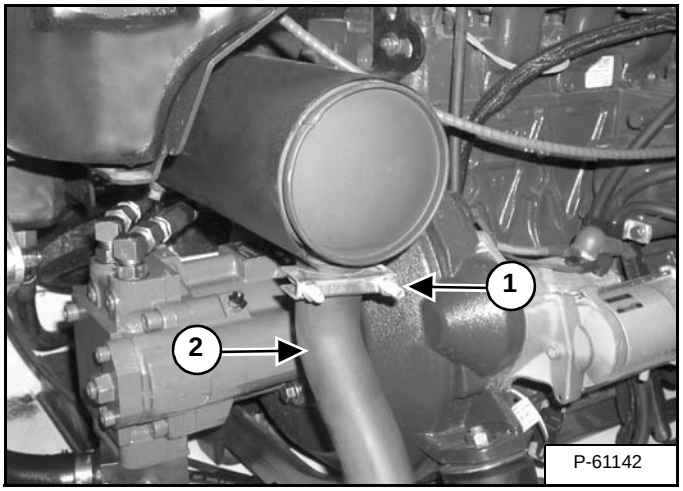
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SPARK ARRESTOR MUFFLER

Removal And Installation

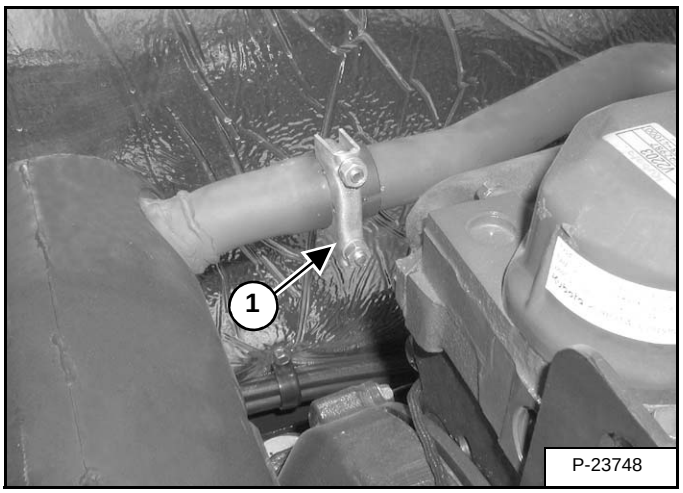
NOTE: The air cleaner is removed for photo clarity.

Figure 60-20-1



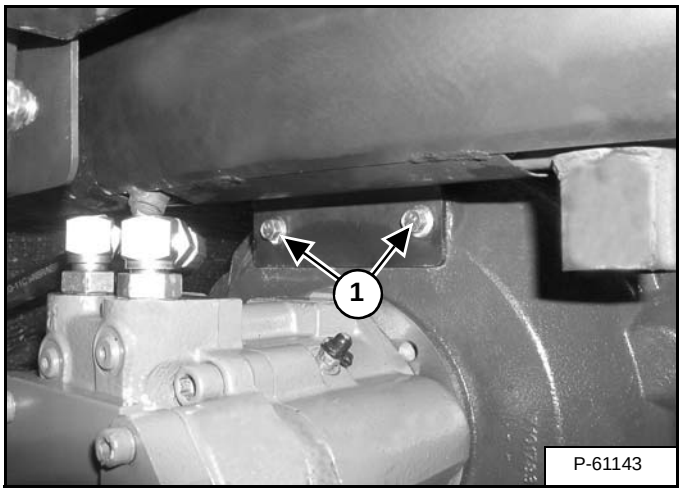
Remove the clamp (Item 1) and tailpipe (Item 2) **[Figure 60-20-1]**.

Figure 60-20-2



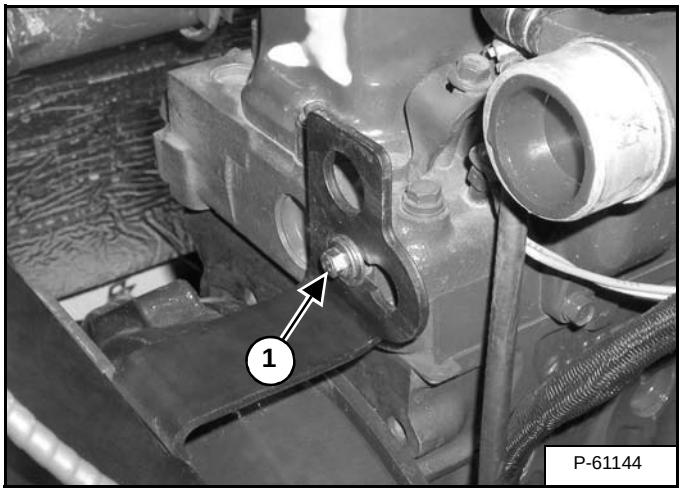
Remove the clamp (Item 1) **[Figure 60-20-2]**.

Figure 60-20-3



Remove the two bottom bolts (Item 1) **[Figure 60-20-3]**.

Figure 60-20-4



Remove the top bolt and washer (Item 1) **[Figure 60-20-4]**.

Remove the muffler.

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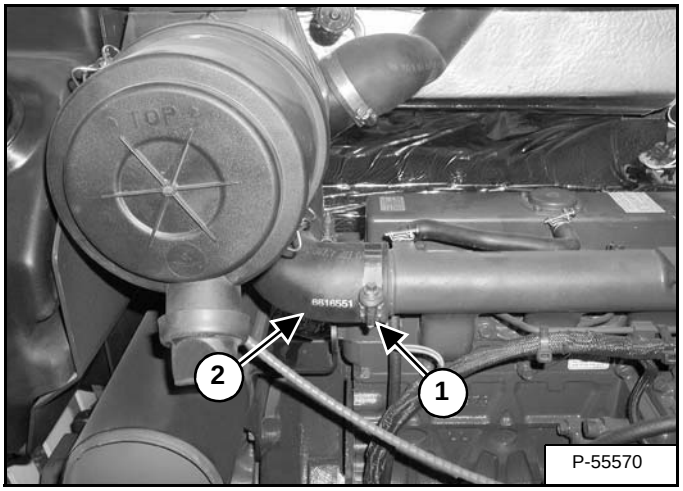
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AIR CLEANER

Removal And Installation

Open the tailgate.

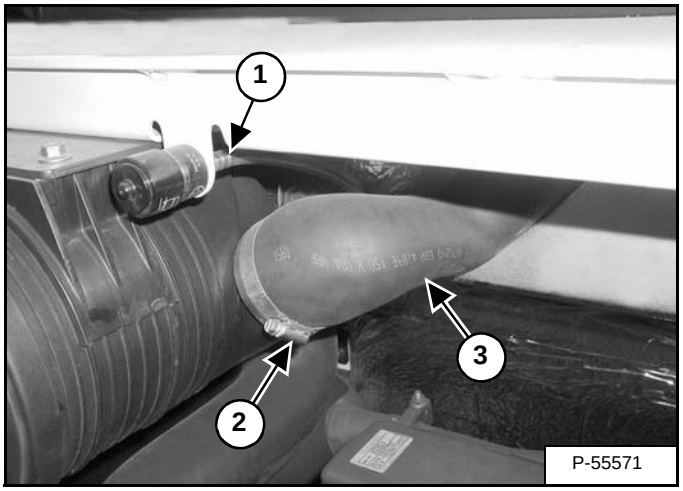
Figure 60-30-1



Loosen the clamp (Item 1) and remove the hose (Item 2) **[Figure 60-30-1]**.

NOTE: Plug the intake manifold hole to prevent any contamination from getting into the engine.

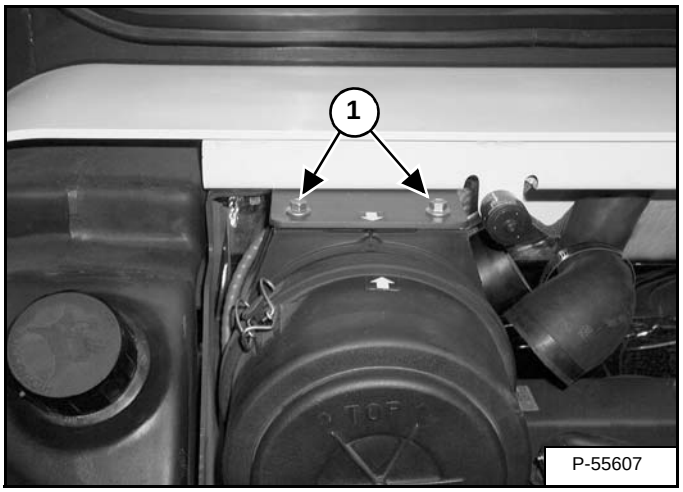
Figure 60-30-2



Remove the hose (Item 1) **[Figure 60-30-2]** from the air filter condition indicator.

Loosen the clamp (Item 2). Remove the hose (Item 3) **[Figure 60-30-2]**.

Figure 60-30-3



Remove the bolts (Item 1) **[Figure 60-30-3]**.

Remove the air cleaner and intake hose assembly.

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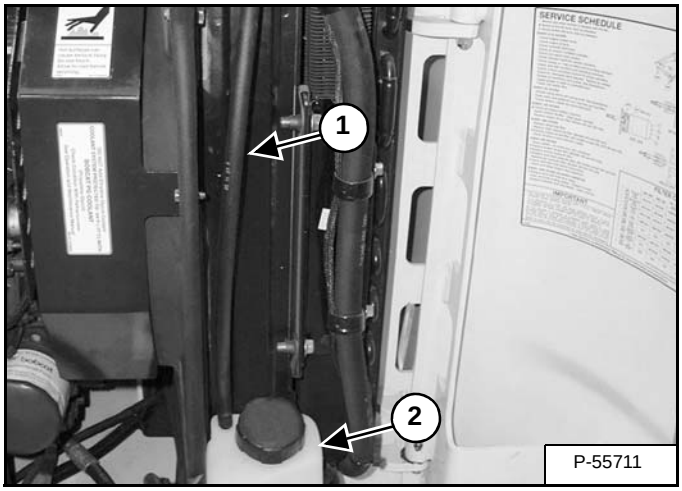
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RADIATOR

Removal And Installation

Open the tailgate.

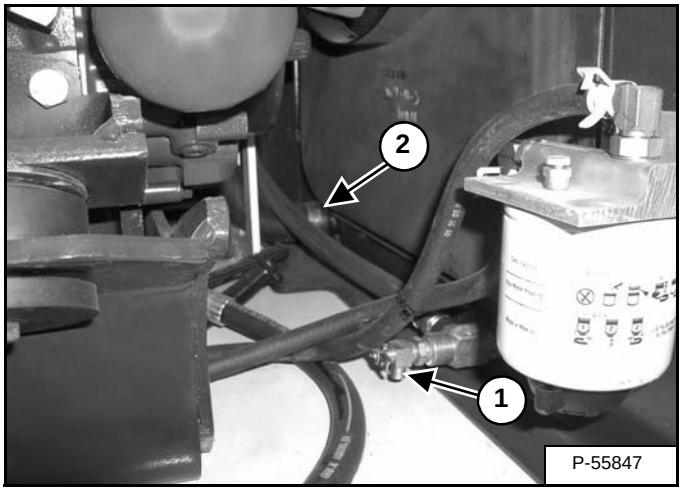
Figure 60-40-1



Remove the radiator over flow hose (Item 1) **[Figure 60-40-1]** from the radiator.

Remove the hose and overflow bottle (Item 2) **[Figure 60-40-1]**.

Figure 60-40-2

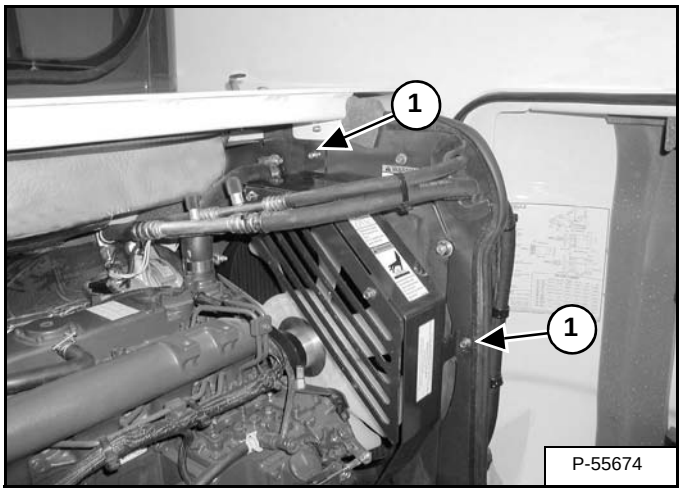


Install a rubber hose on the radiator drain (Item 1) **[Figure 60-40-2]** and drain the coolant from the radiator.

Remove the lower radiator hose clamp (Item 2) **[Figure 60-40-2]**.

Remove the lower radiator hose from the radiator.

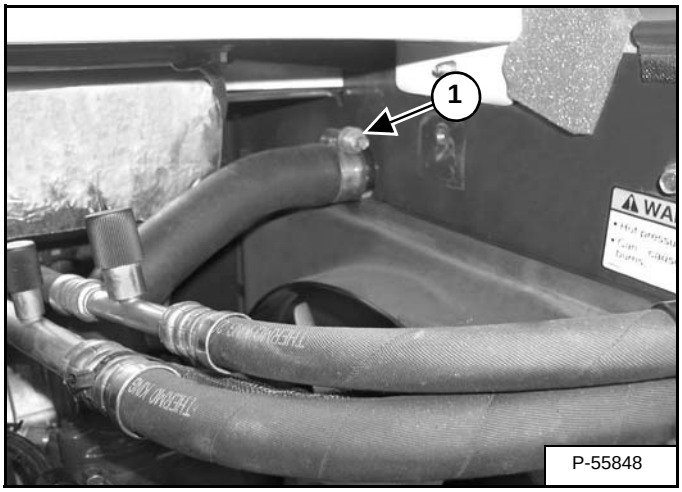
Figure 60-40-3



Remove the bolts (Item 1) **[Figure 60-40-3]** from the fan guard.

Remove the fan guard from the excavator.

Figure 60-40-4



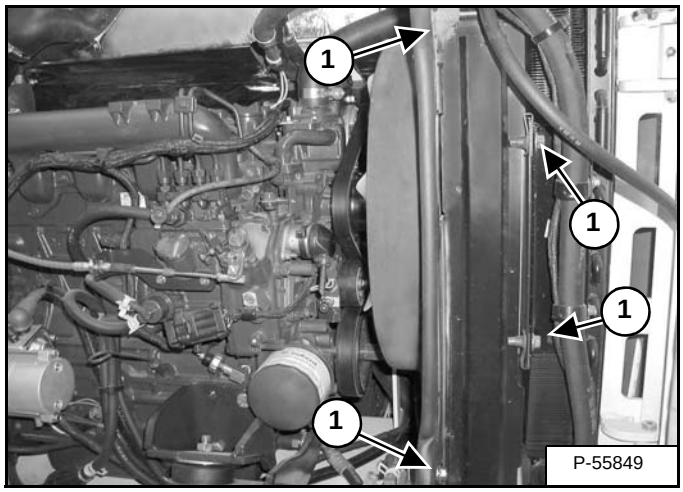
Remove the top radiator hose clamp (Item 1) **[Figure 60-40-4]**.

Remove the top radiator hose from the radiator.

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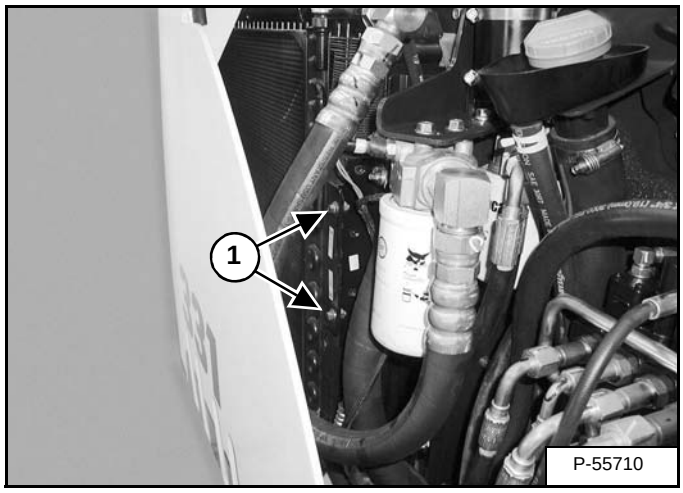
Removal And Installation (Cont'd)

Figure 60-40-5



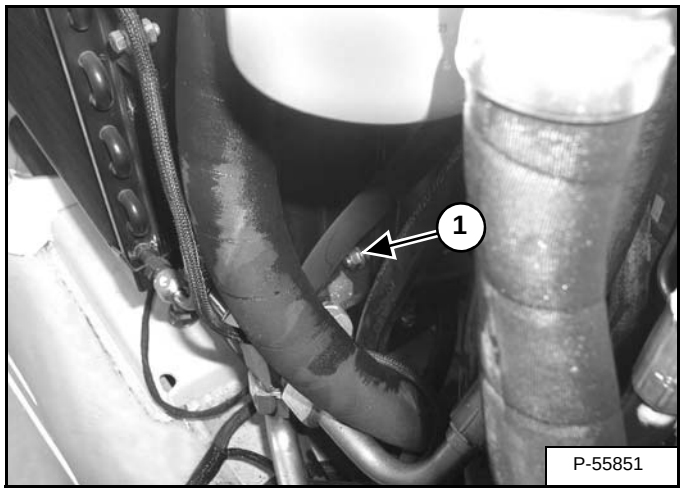
Remove the bolts (Item 1) **[Figure 60-40-5]** from the rear of the radiator.

Figure 60-40-6



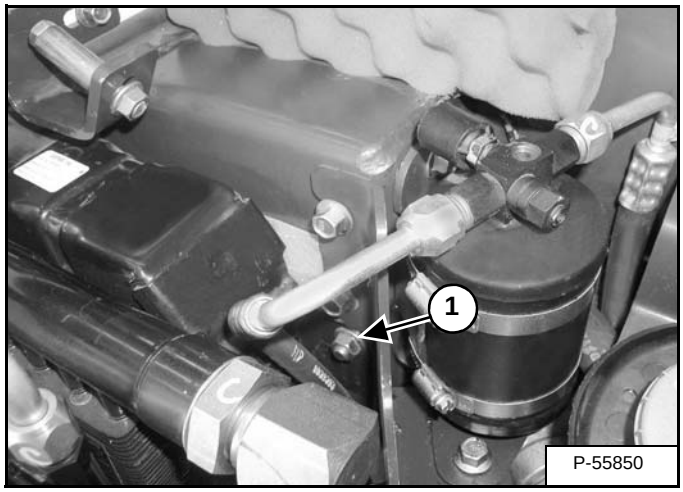
Remove the bolts (Item 1) **[Figure 60-40-6]**.

Figure 60-40-7



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

Figure 60-40-8



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

Remove the radiator from the excavator.

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Engine Compression Checking

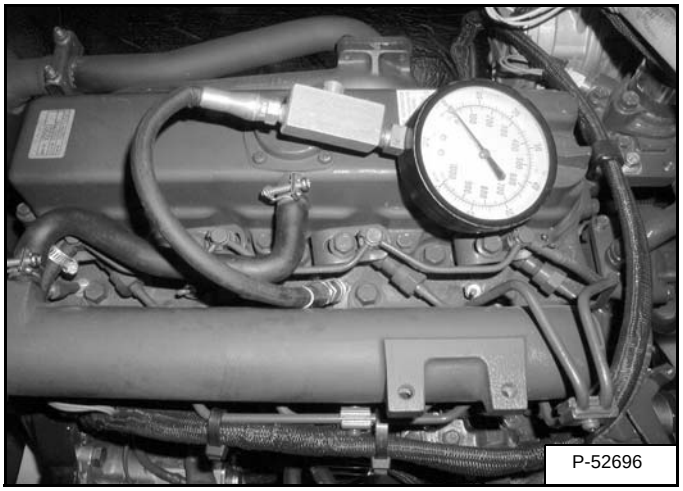
The tools listed will be needed to do the following procedure:

MEL10630 - Engine Compression Kit
MEL 1352 - Compression Adapter

The engine must be at operating temperature.

Remove the glow plugs. (See Glow Plugs Removal And Installation on Page 60-50-2.)

Figure 60-50-1



Install the correct compression adapter into the cylinder head **[Figure 60-50-1]**.

Connect the compression gauge **[Figure 60-50-1]**.

Make sure the speed control lever is at low engine idle.

Disconnect the fuel stop solenoid.

Crank the engine with the starter at 200-300 RPM.

Compression Pressure	512-583 PSI (35-40 bar)
Allowable Limit (minimum)	370 PSI (26 bar)

The compression must be no lower than the allowable limit, with no more than 10% variance among cylinders.

Connect the fuel stop solenoid.

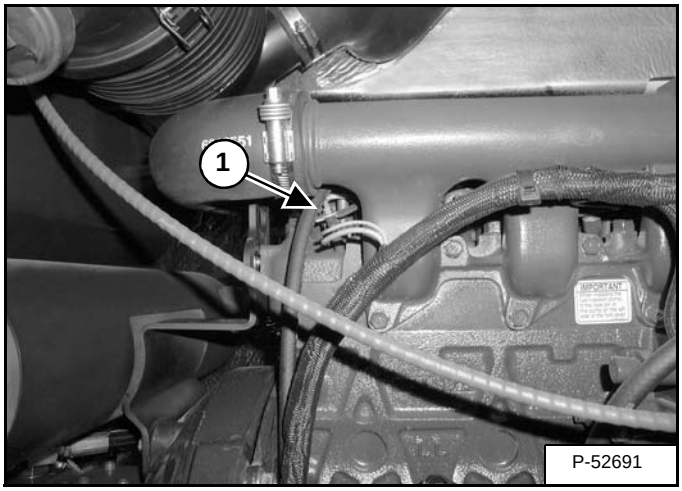
Install the glow plugs.

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Glow Plugs Removal And Installation

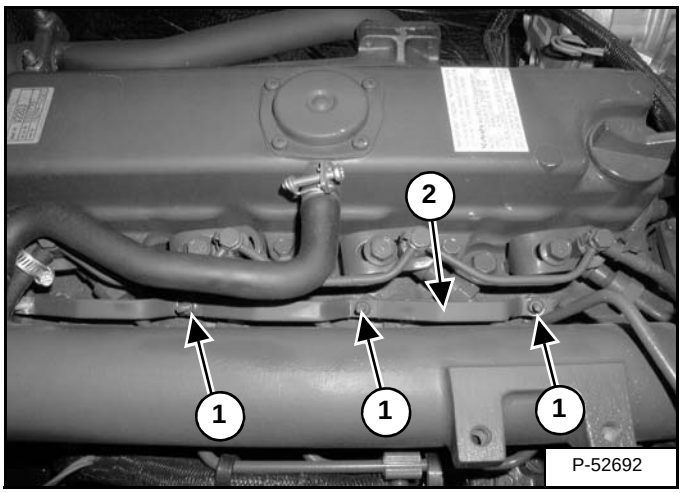
Disconnect the negative (-) cable from the battery.

Figure 60-50-2



Remove the nut and wire harness (Item 1) **[Figure 60-50-2]**.

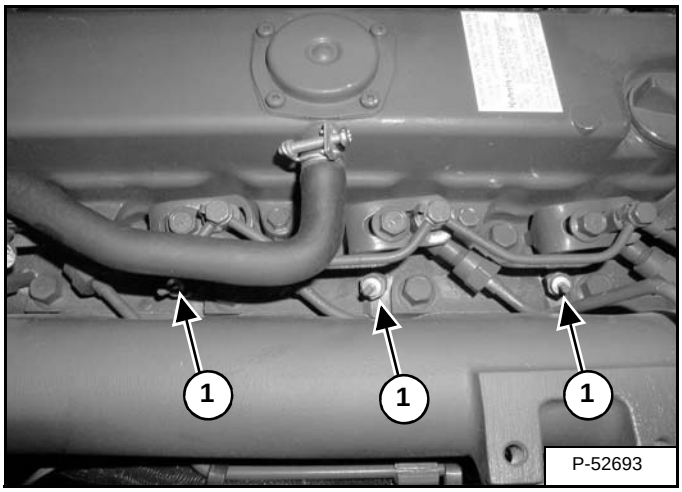
Figure 60-50-3



Remove the nuts (Item 1) **[Figure 60-50-3]** from the three remaining glow plugs.

Remove the connecting strap (Item 2) **[Figure 60-50-3]** from the glow plugs.

Figure 60-50-4



Remove the four glow plugs (Item 1) **[Figure 60-50-4]**.

Installation: Tighten the glow plugs to 15-18 ft.-lb. (20-25 N•m) torque.

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Checking The Glow Plug

Disconnect the glow plug wire harness and connecting strap.

Figure 60-50-5



Use an ohmmeter to check the glow plugs **[Figure 60-50-5]**.

Touch one probe to the end of the glow plug and the other probe to the body of the glow plug.

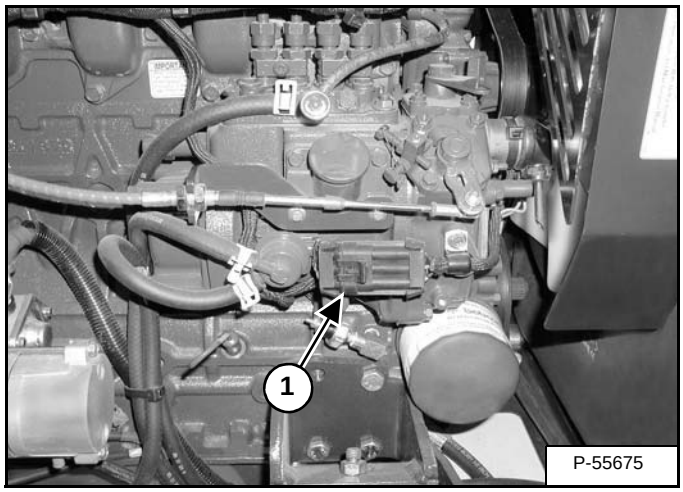
The reading should be approximately 1.0 ohm. If the resistance is infinite, the coil of the glow plug is broken. If the resistance is 0 the glow plug is short circuited.

Repeat the procedure for each glow plug.

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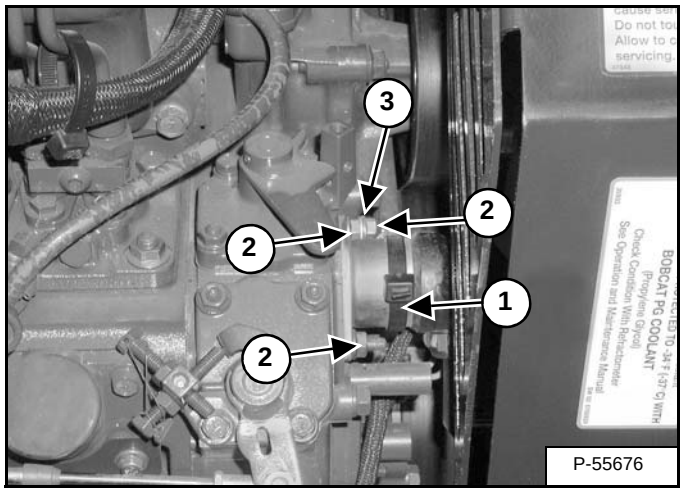
Fuel Shut-off Solenoid Removal And Installation

Figure 60-50-6



Disconnect the wire harness (Item 1) **[Figure 60-50-6]**.

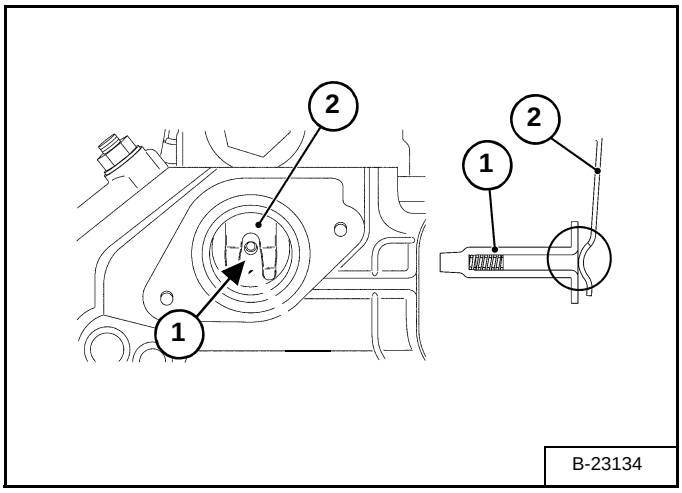
Figure 60-50-7



Remove the tie strap (Item 1), nuts (Item 2) and wire harness (Item 3) **[Figure 60-50-7]** from the solenoid mount bracket.

Remove the solenoid from the mount bracket.

Figure 60-50-8



Installation: The guide (Item 1) on the fuel shut-off solenoid must contact the boost lever (Item 2) **[Figure 60-50-8]**.

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Fuel Injection Pump Check

The injection pump contains parts which have a very close tolerance and its operation has a direct effect on the performance of the engine.

⚠ 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

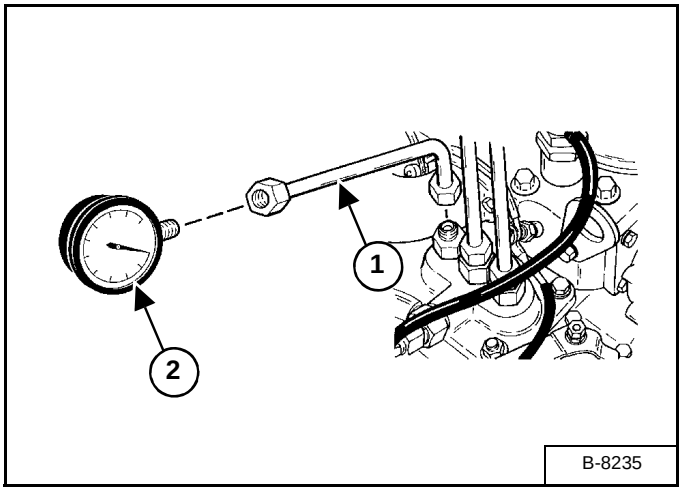
The tools listed will be needed to do the following procedure:

MEL 1237 - Adapter Fuel Line
MEL 1173-1 Pressure Gauge

To check the discharge pressure at the fuel injection pump, use the following procedure:

Disconnect a high pressure fuel line from the injection pump. Loosen the other end of the same fuel line so it can be turned away from the fitting.

Figure 60-50-9



Connect the adapter fuel line (Item 1) to the fitting and connect the pressure gauge (Item 2) **[Figure 60-50-9]**.

Move the speed control lever to the high engine idle position.

Turn the flywheel to increase the pressure. If the pressure can not reach the allowable limit, replace the injection pump assembly.

Fuel Tightness of Pump Element Allowable Limit	2702-2916 PSI (186-201 bar)

With the speed control lever at the low engine idle position, turn the flywheel until the pressure is at 2702-2916 PSI (186-201 bar).

Turn the flywheel back approximately one-half turn. Keep the flywheel at this position, and measure the time it takes the pressure to decrease from 1850 PSI (127.5 bar).

Fuel Tightness of Delivery Valve Allowable Limit	5 Seconds

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Fuel Injection Pump Removal And Installation

IMPORTANT

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

I-2029-0289

IMPORTANT

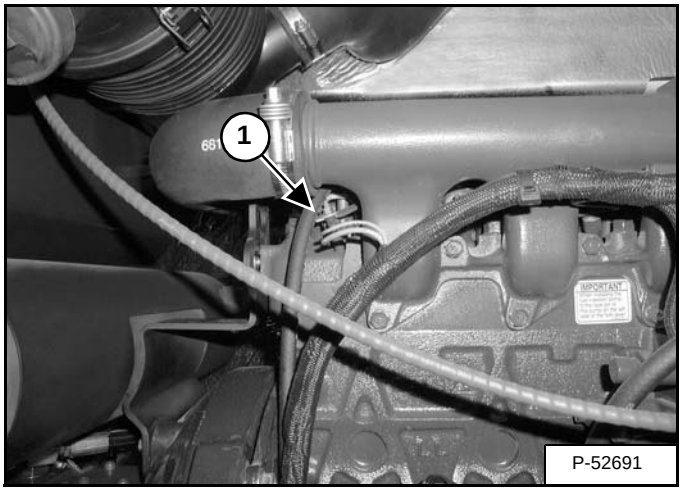
Do not attempt to maintain or adjust unless you are trained and have the correct equipment.

I-2028-0289

Disconnect the negative (-) cable from the battery.

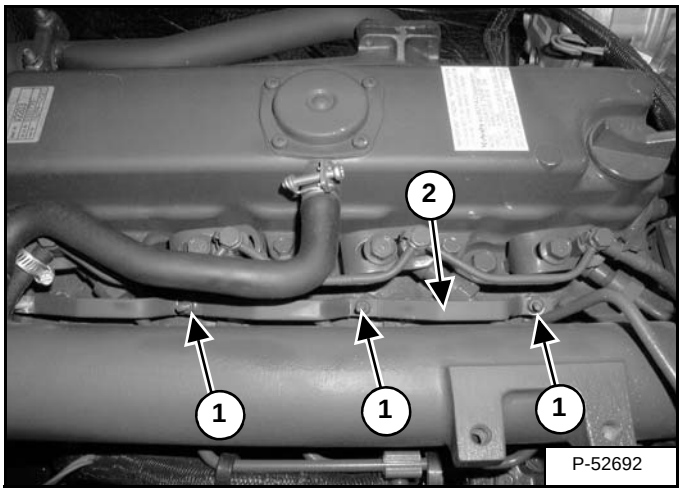
Clean around the injection pump.

Figure 60-50-10



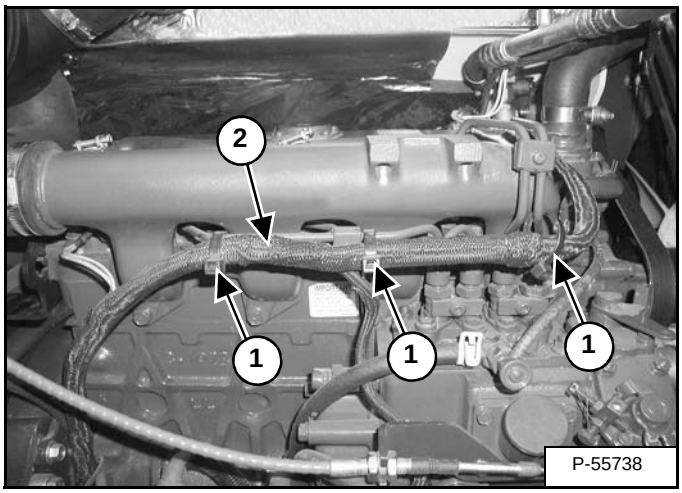
Remove the nut and wire harness (Item 1) **[Figure 60-50-10]** from the left glow plug.

Figure 60-50-11



Remove the nuts (Item 1) from the three remaining glow plugs. Remove the strap (Item 2) **[Figure 60-50-11]** from the glow plugs.

Figure 60-50-12

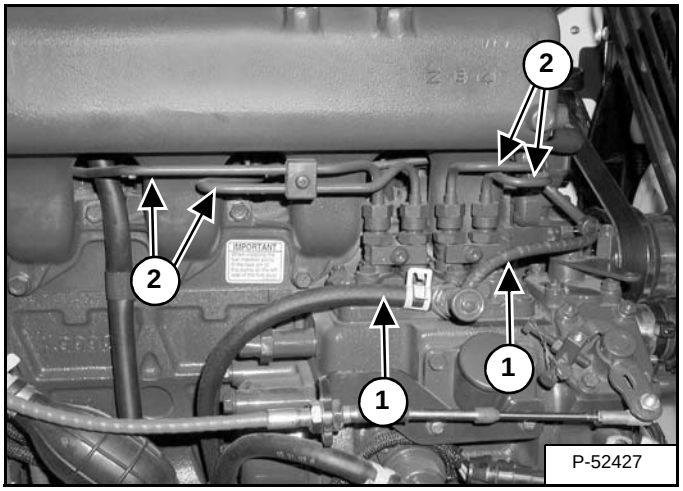


Remove the tie straps (Item 1) and reposition the wire harness (Item 2) **[Figure 60-50-12]**.

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Fuel Injection Pump Removal And Installation (Cont'd)

Figure 60-50-13

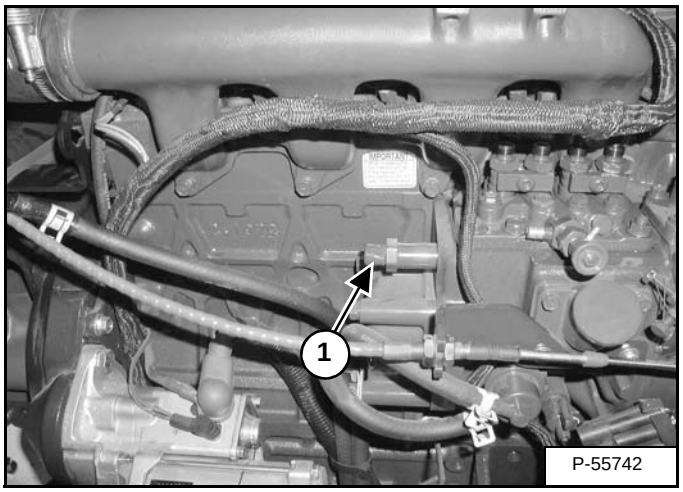


Remove the fuel lines (Item 1) **[Figure 60-50-13]**.

Disconnect the high pressure fuel lines (Item 2) **[Figure 60-50-13]** from the fuel injectors and fuel injection pump.

Remove the fuel shut-off solenoid. (See Fuel Shut-off Solenoid Removal And Installation on Page 60-50-4.)

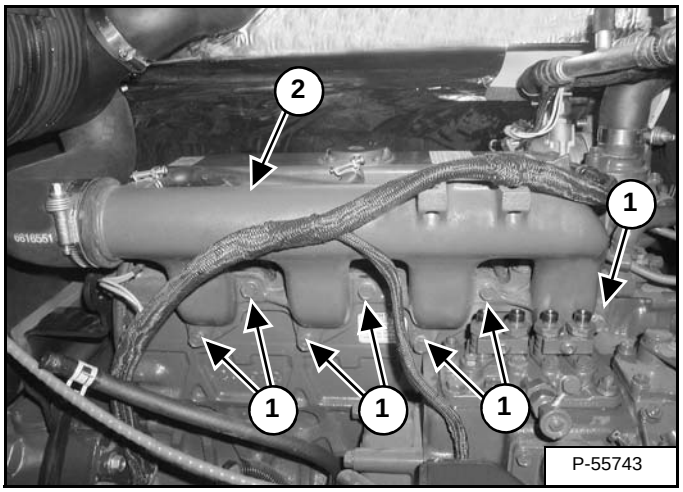
Figure 60-50-14



Remove the high idle body (Item 1) **[Figure 60-50-14]**.

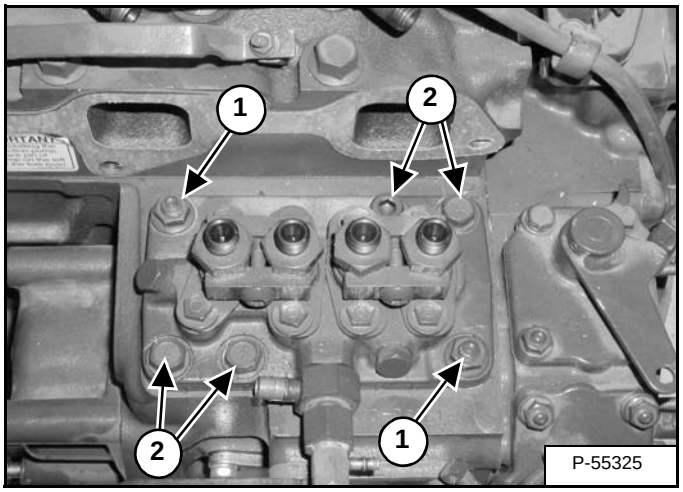
Installation: Tighten the high idle body to 33-36 ft.-lb. (44-49 N•m) torque.

Figure 60-50-15



Remove the bolts (Item 1) and remove the intake manifold (Item 2) **[Figure 60-50-15]**.

Figure 60-50-16



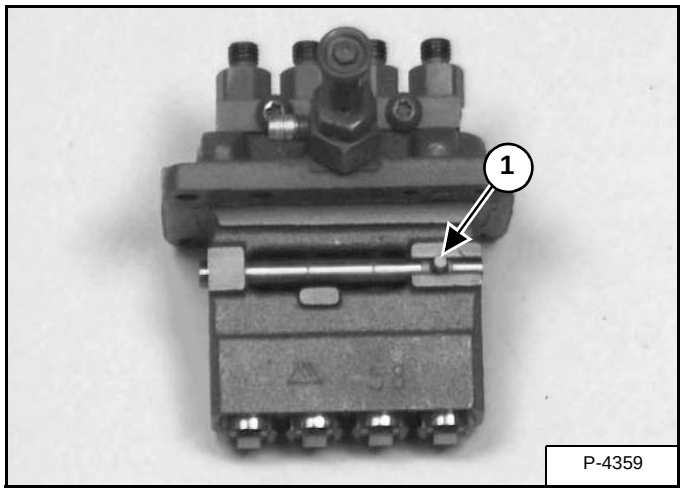
Remove the nuts (Item 1) and bolts (Item 2) **[Figure 60-50-16]**.

Remove the injection pump.

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Fuel Injection Pump Removal And Installation (Cont'd)

Figure 60-50-17



Installation: When the injection pump is installed, the rack pin (Item 1) **[Figure 60-50-17]** must be aligned with the slot in the engine block and positioned on the left side of the fork lever.

If the rack pin is not installed correctly engine damage can result.

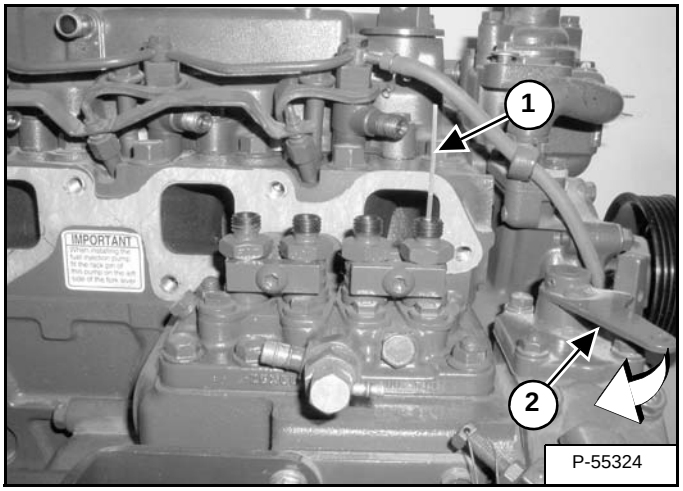
NOTE: Make sure the same number of shims with the same thickness are installed under the injection pump. The shims are used for engine timing.

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Fuel Injection Pump Timing

Timing the injection pump is done by changing the number of shims between the injection pump and engine block.

Figure 60-50-18



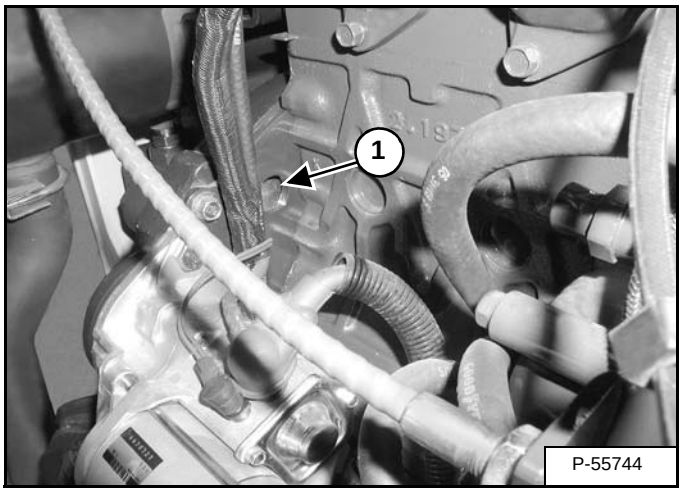
Turn the fuel supply lever to the ON position. Install a short plastic tube (Item 1) **[Figure 60-50-18]** in the fitting of the number one cylinder port. Point the tube up (vertical).

Turn the engine counterclockwise until fuel flows out of the injection pumps number 1 cylinder nozzle. (Install a tool on the crankshaft at the front of the engine to turn the engine.)

NOTE: The fuel must flow out of the nozzle for one firing cycle before timing can be attempted.

Pull the stop lever (Item 2) **[Figure 60-50-18]** 0.232-0.302 in. (5,9-7,7 mm) from the free position toward the stop position.

Figure 60-50-19



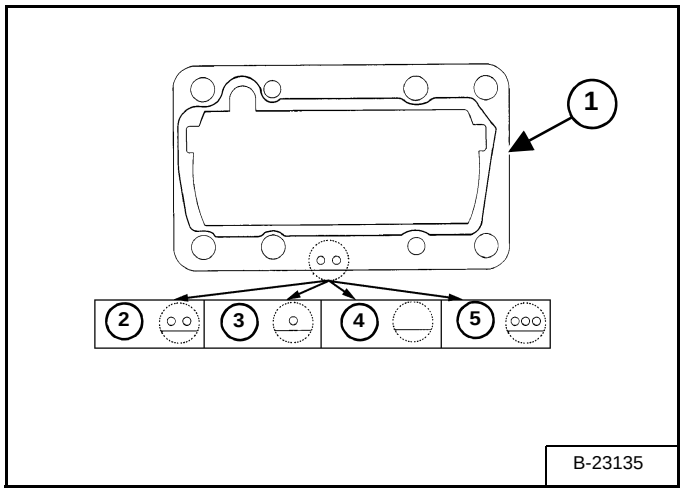
Continue to turn the engine slowly (for approximately one and three-quarter turns after fuel stops flowing from the injection pump nozzle), until the timing mark on the side of the flywheel is at the bottom edge of the timing hole (Item 1) **[Figure 60-50-19]** in the flywheel housing.

Slowly turn the engine counterclockwise: as soon as fuel starts to flow at the top of the injection pump nozzle, stop turning the engine.

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Fuel Injection Pump Timing (Cont'd)

Figure 60-50-20



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

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

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

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Fuel Injector Nozzles Removal And Installation

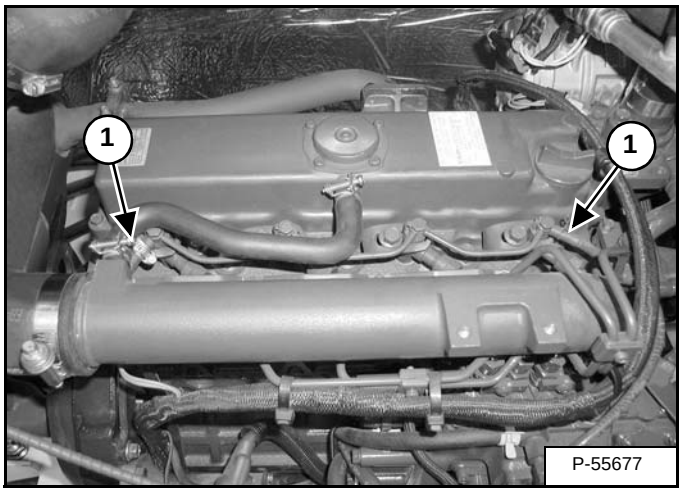
IMPORTANT

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

I-2029-0289

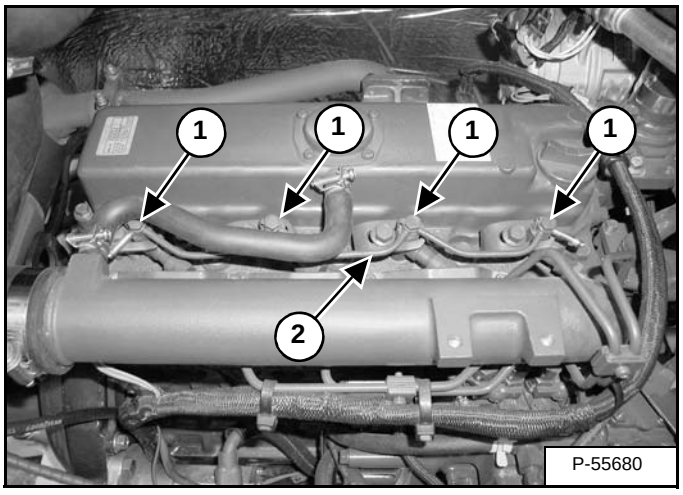
Open the tailgate.

Figure 60-50-21



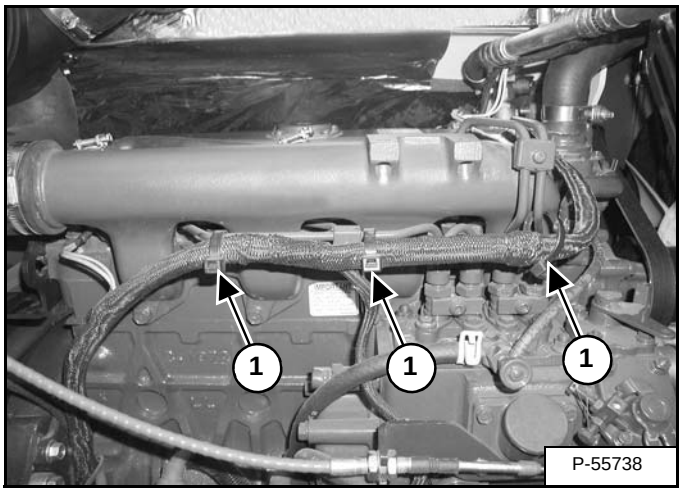
Remove the fuel lines (Item 1) **[Figure 60-50-21]**.

Figure 60-50-22



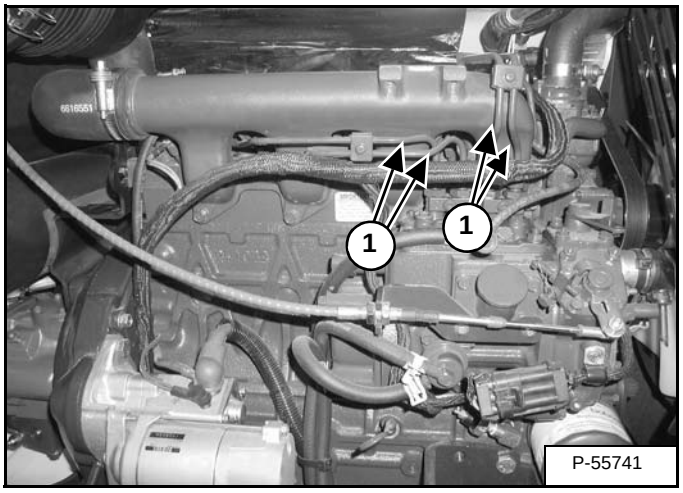
Remove the bolts (Item 1) and fuel line (Item 2) **[Figure 60-50-22]**.

Figure 60-50-23



Remove the tie straps (Item 1) **[Figure 60-50-23]**.

Figure 60-50-24



Disconnect the high pressure fuel lines (Item 1) **[Figure 60-50-24]** from the fuel injectors.

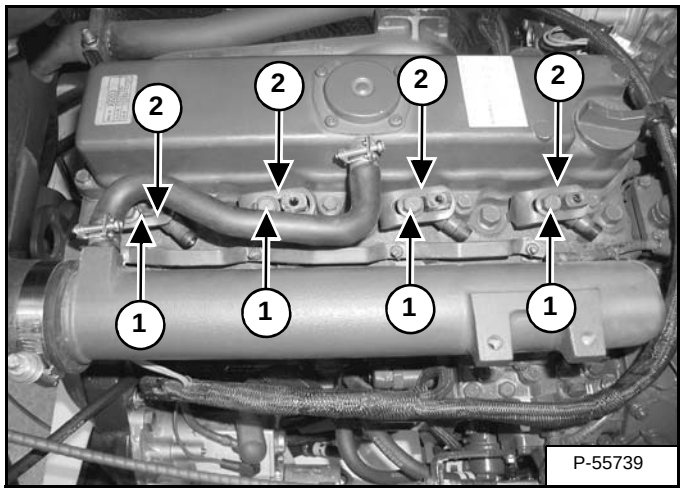
Disconnect the fuel lines from the fuel injection pump.

Remove the high pressure fuel lines.

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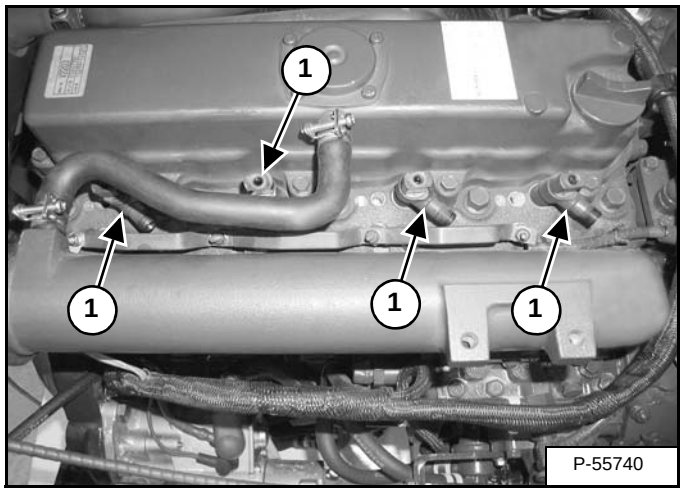
Fuel Injector Nozzles Removal And Installation (Cont'd)

Figure 60-50-25



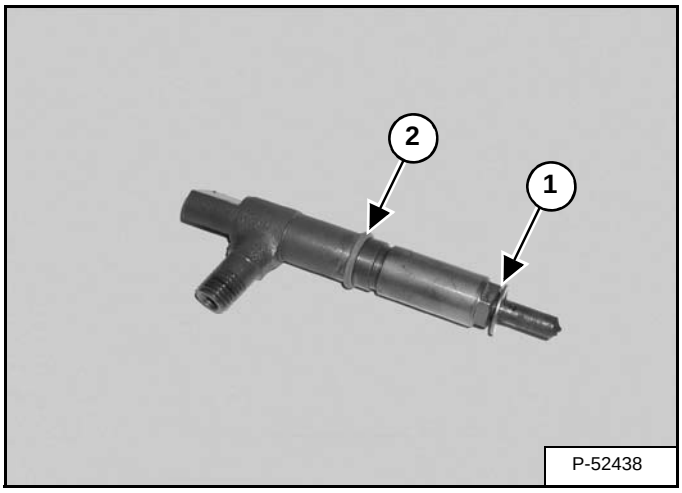
Remove the bolts (Item 1) and clamps (Item 2) **[Figure 60-50-25]**.

Figure 60-50-26



Remove the injector nozzles (Item 1) **[Figure 60-50-26]**.

Figure 60-50-27



NOTE: Replace the copper washer (Item 1) and O-ring (Item 2) [Figure 60-50-27] anytime new or used fuel injectors are installed.

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Fuel Injector Nozzle Check

IMPORTANT

During cold weather (32°F [0°C] and below), do not operate machine until the engine has run for at least five minutes at less than half throttle. This warm-up period is necessary for foot pedal operation and safe stopping. Do not operate controls during warm-up period.

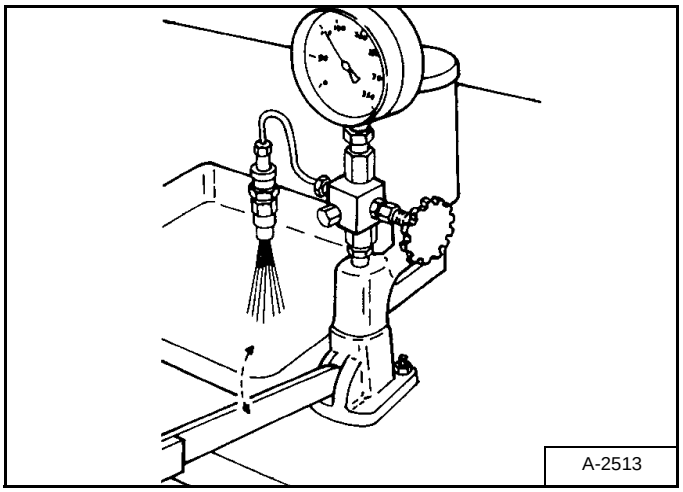
When temperatures are below -20°F (-30°C), the hydrostatic oil must be heated or kept warm. The hydrostatic system will not get enough oil at low temperatures. Park the machine in an area where the temperature will be above 0°F (-18°C) if possible.

W-2027-1285

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

MEL 10018 - Injector Nozzle Tester

Figure 60-50-28



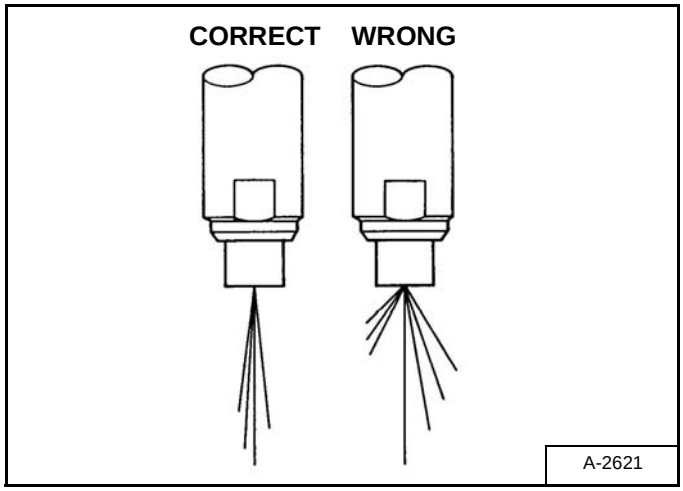
Connect the nozzle to the tester with the nozzle down **[Figure 60-50-28]**.

Operate the hand lever at a slow rate and record the opening pressure. If the pressure is not correct, replace the fuel injection nozzle.

Fuel Injection Pressure	2702-2916 PSI (186-201 bar)

Check for inside leakage. Operate the hand lever until the pressure is 1850 PSI (127.5 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.

Figure 60-50-29



Check that the spray pattern is correct **[Figure 60-50-29]**.

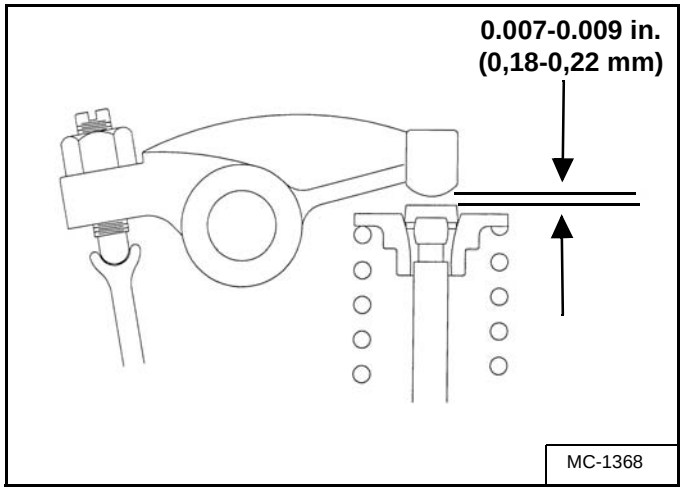
1. Fuel does not come out the side of the nozzle.
2. Drops of fuel are not present at the nozzle.
3. The injector has an even flow coming from the nozzle.

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Valve Clearance Adjustment

Adjust the valve clearance with the engine stopped and cold.

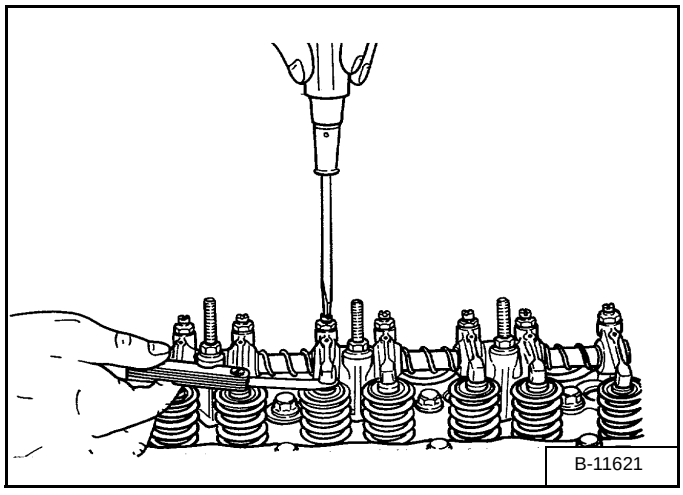
Figure 60-50-30



The correct valve clearance is 0.007-0.0087 in. (0,18-0,22 mm) **[Figure 60-50-30]**.

Make sure the piston is at T.D.C. when making the adjustment for the valves of the particular cylinder.

Figure 60-50-31



Put the correct size feeler gauge between the rocker arm and valve stem. Turn the adjustment bolt until the clearance is correct **[Figure 60-50-31]**.

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ENGINE

Removal And Installation

Disconnect the negative (-) cable on the battery. (See Contents Page 50-01.)

Drain the hydraulic reservoir. (See Checking And Adding Hydraulic Fluid on Page 10-100-1.)

Drain the radiator. (See Checking And Adding Hydraulic Fluid on Page 10-100-1.)

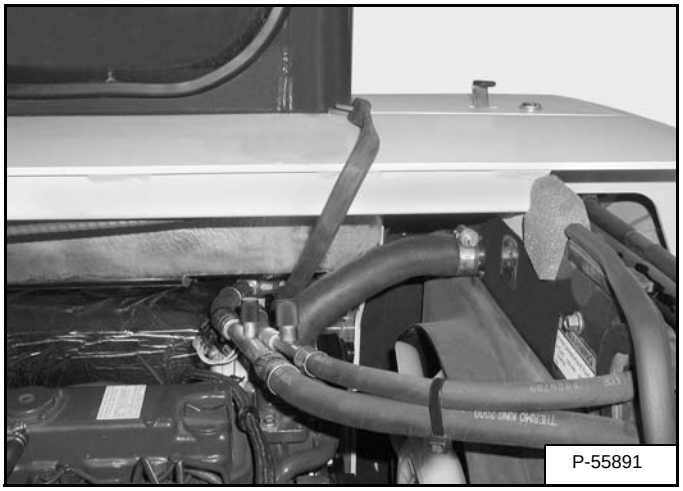
Remove the muffler. (See Removal And Installation on Page 60-20-1.)

Remove the air cleaner. (See Removal And Installation on Page 60-30-1.)

Remove the starter. (See Removal And Installation on Page 50-40-1.)

Remove the hydraulic pump. (See Removal And Installation on Page 20-50-6.)

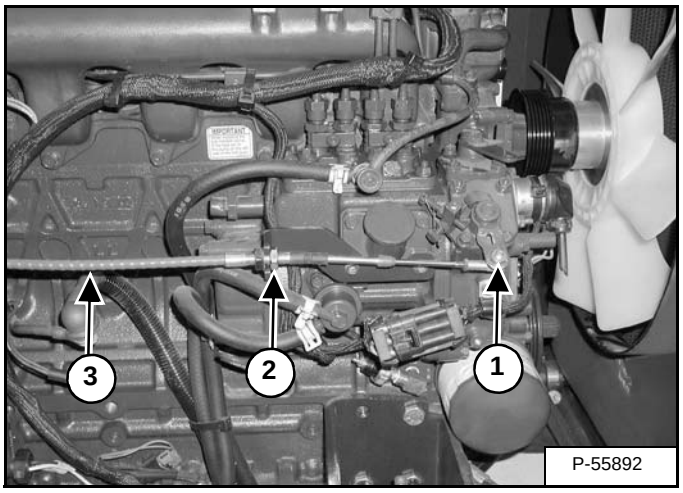
Figure 60-60-1



On machines equipped with A/C, remove and support the compressor as shown **[Figure 60-60-1]**.

NOTE: It is not necessary to evacuate the A/C system for engine removal.

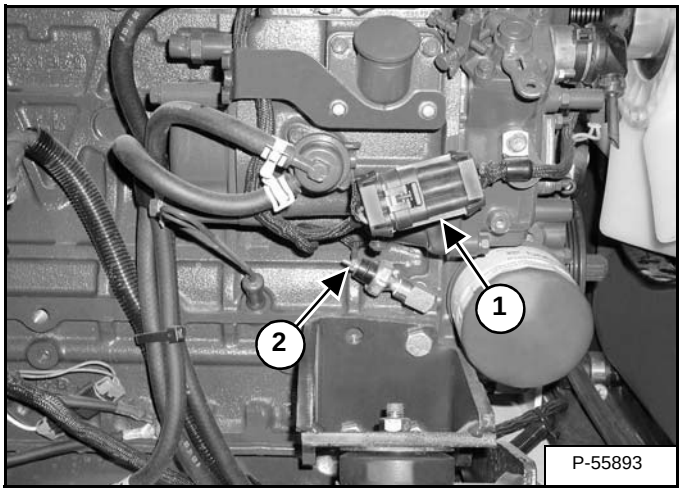
Figure 60-60-2



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

Loosen the nut (Item 2) and remove the engine speed control cable (Item 3) **[Figure 60-60-2]**.

Figure 60-60-3

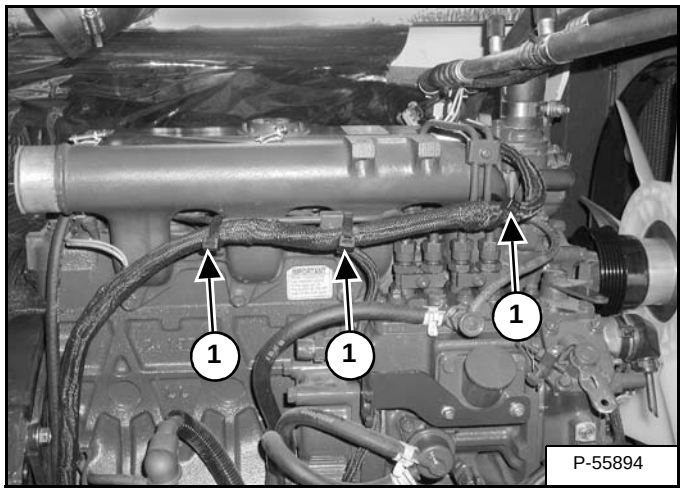


Disconnect the fuel shut off solenoid (Item 1) and oil pressure sending unit (Item 2) **[Figure 60-60-3]** connectors.

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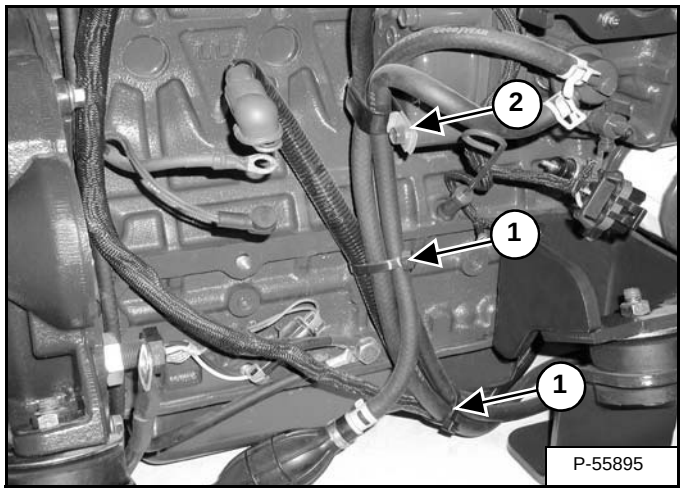
Removal And Installation (Cont'd)

Figure 60-60-4



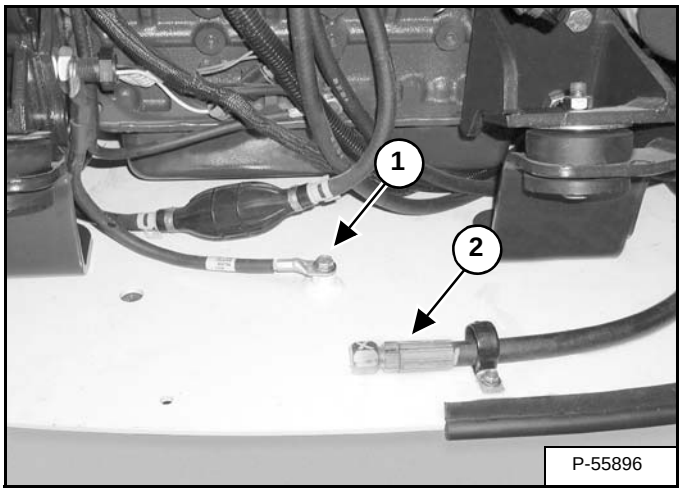
Remove the tie straps (Item 1) **[Figure 60-60-4]**.

Figure 60-60-5



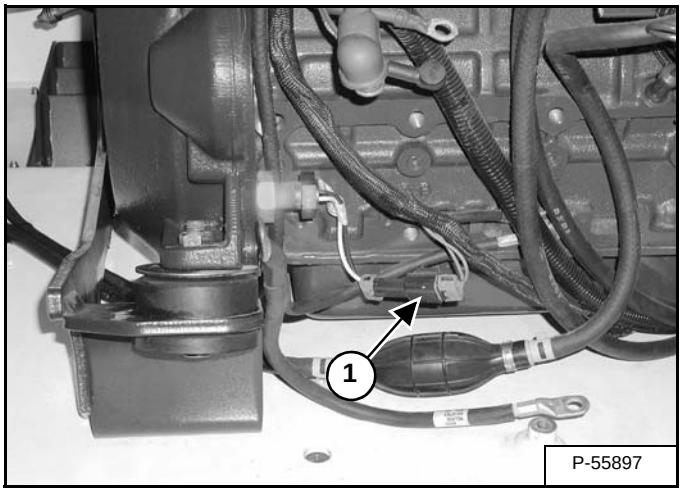
Remove the tie straps (Item 1) and hose clamp (Item 2) **[Figure 60-60-5]**.

Figure 60-60-6



Remove the ground cable (Item 1) and oil drain hose (Item 2) **[Figure 60-60-6]**.

Figure 60-60-7

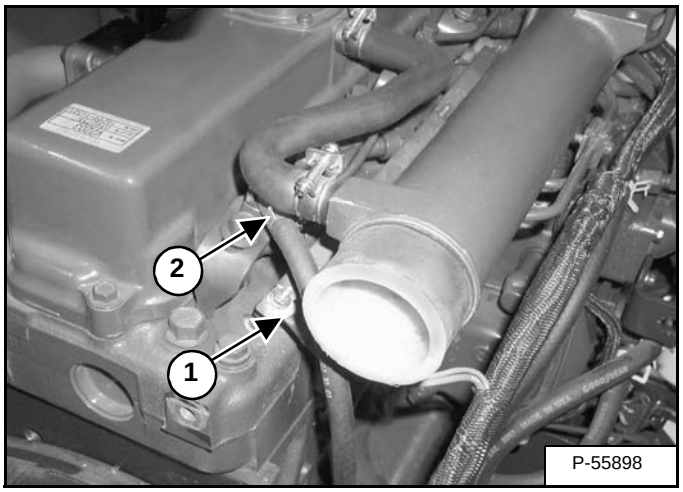


Disconnect the wire harness (Item 1) **[Figure 60-60-7]** from the engine speed sensor.

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Removal And Installation (Cont'd)

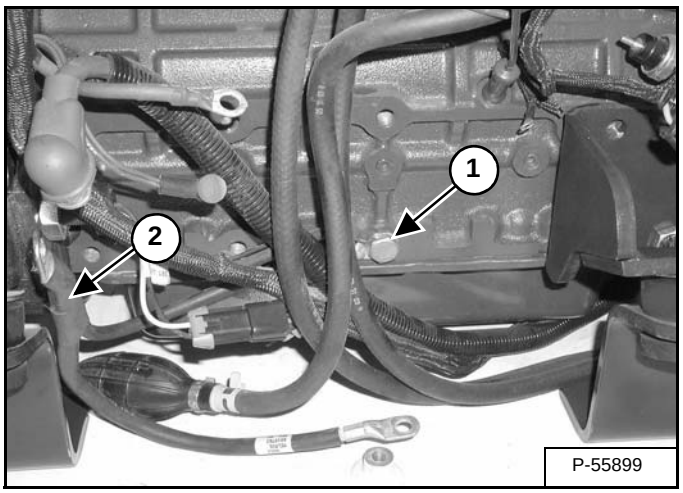
Figure 60-60-8



Remove the wire (Item 1) **[Figure 60-60-8]** from the glow plug.

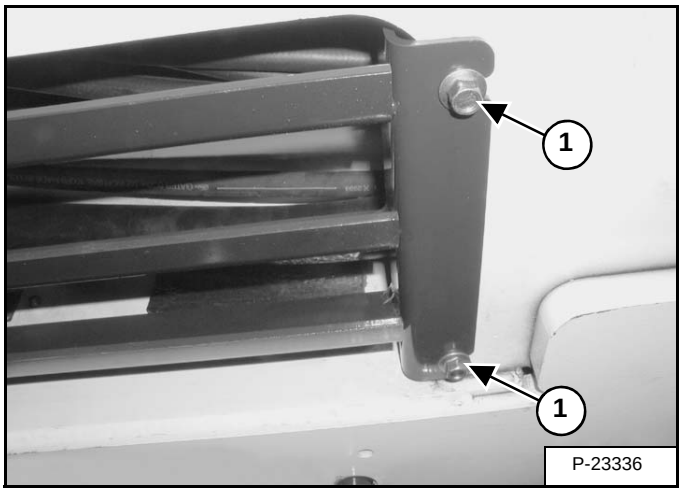
Remove the hose (Item 2) **[Figure 60-60-8]**.

Figure 60-60-9



Remove the bolt (Item 1) and ground cable (Item 2) **[Figure 60-60-9]**.

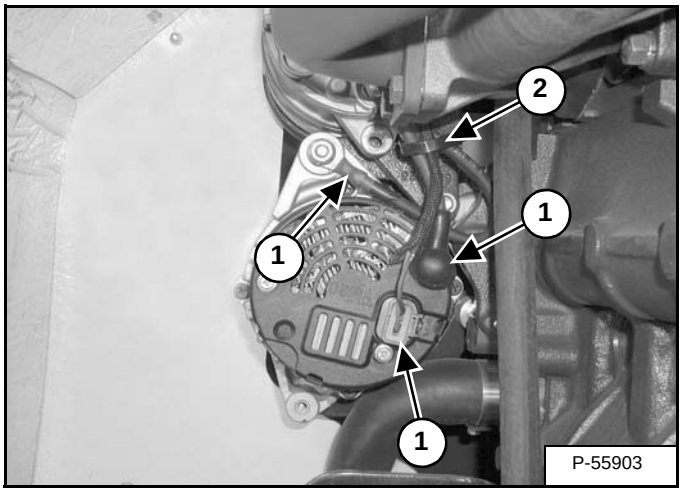
Figure 60-60-10



On the bottom of the excavator, loosen the two bolts on the left side. Remove the two bolts (Item 1) **[Figure 60-60-10]** on the right side.

Remove the louver from the bottom of the excavator.

Figure 60-60-11



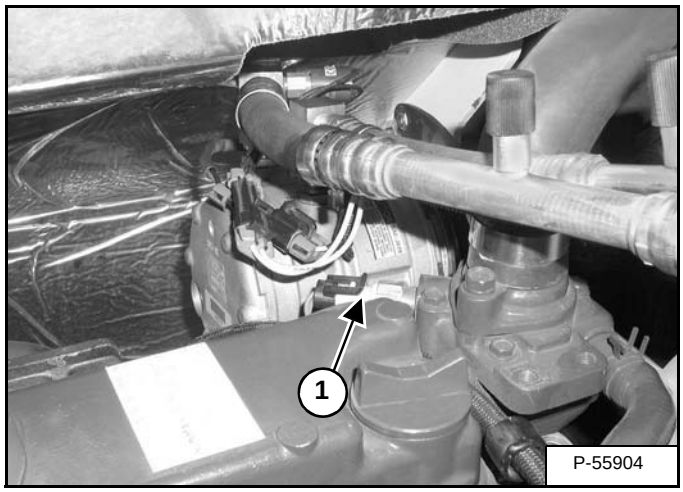
Remove the wires (Item 1) **[Figure 60-60-11]** from the alternator.

Remove the tie strap (Item 2) **[Figure 60-60-11]**.

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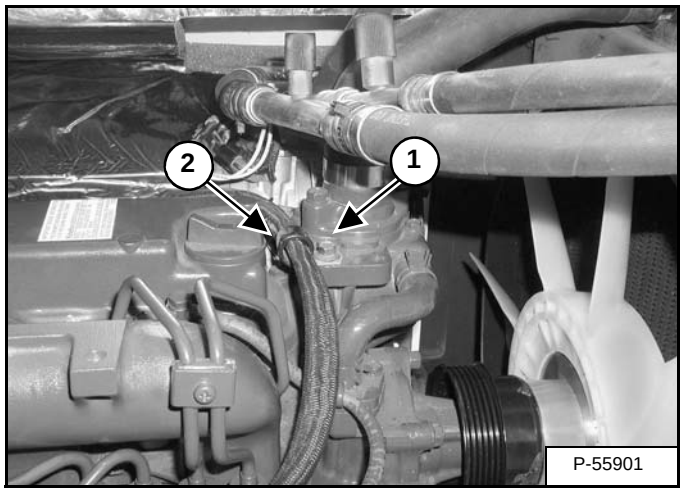
Removal And Installation (Cont'd)

Figure 60-60-12



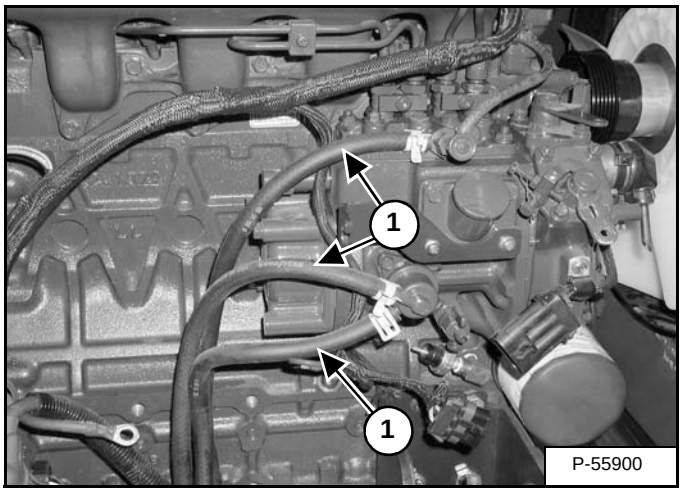
Remove the wire harness (Item 1) **[Figure 60-60-12]** from the temperature sensor.

Figure 60-60-13



Remove the bolt (Item 1) from the wire harness clamp (Item 2) **[Figure 60-60-13]**.

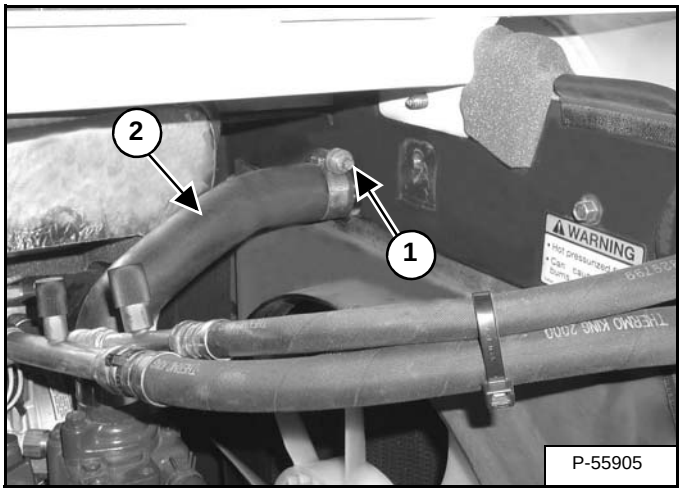
Figure 60-60-14



Mark and remove the fuel lines (Item 1) **[Figure 60-60-14]**.

Plug the fuel lines.

Figure 60-60-15

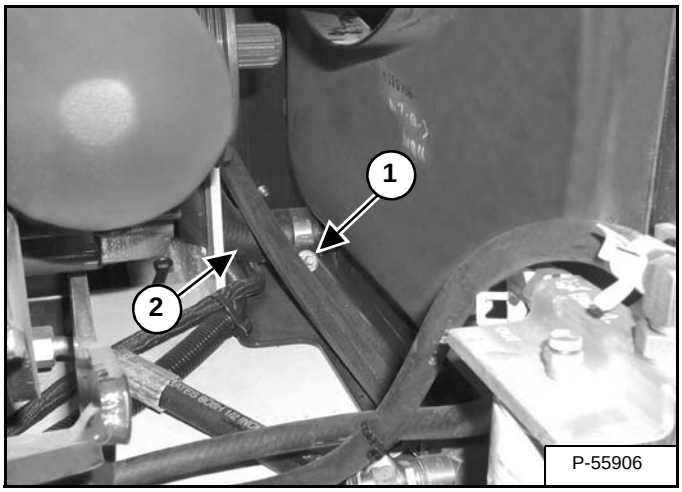


Loosen the hose clamp (Item 1) and remove the top radiator hose (Item 2) **[Figure 60-60-15]**.

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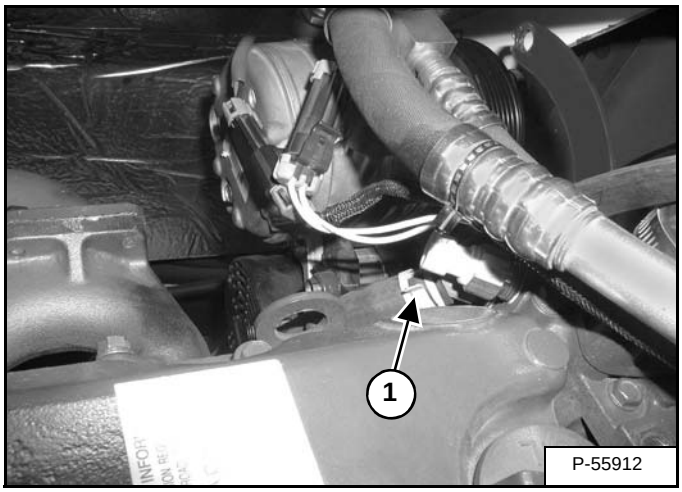
Removal And Installation (Cont'd)

Figure 60-60-16



Loosen the clamp (Item 1) and remove the lower radiator hose (Item 2) **[Figure 60-60-16]** from the radiator.

Figure 60-60-17



Remove the heater hose (Item 1) **[Figure 60-60-17]**.

Figure 60-60-18

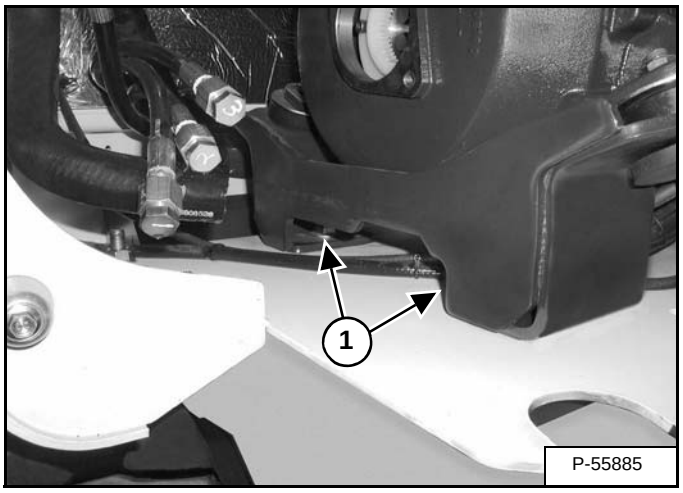
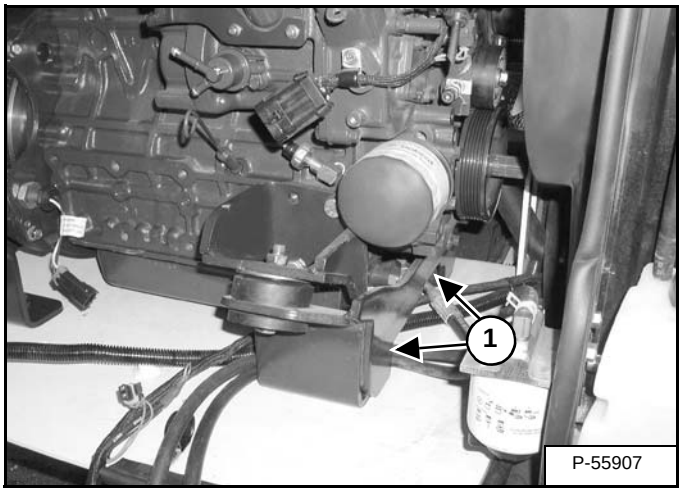


Figure 60-60-19

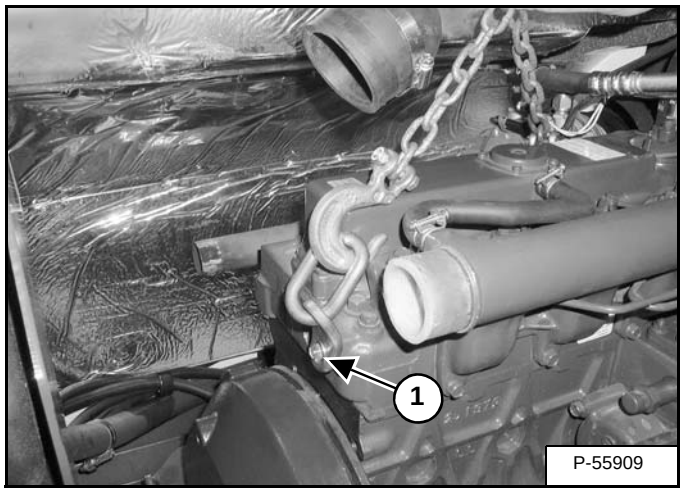


Remove the four engine mount bolts and nuts (Item 1) **[Figure 60-60-18]** & **[Figure 60-60-19]**.

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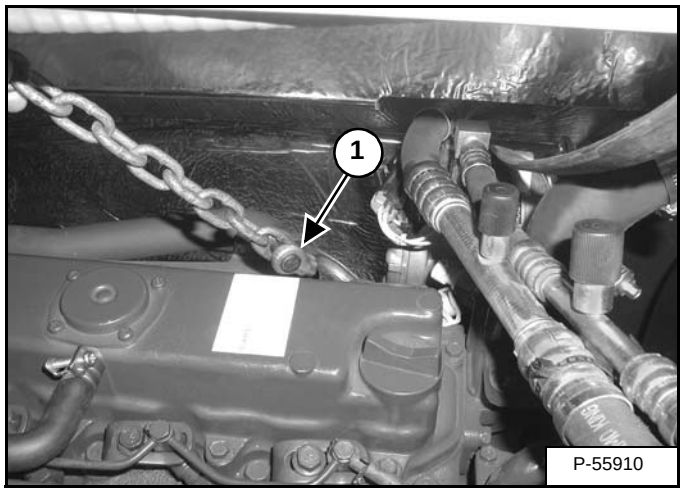
Removal And Installation (Cont'd)

Figure 60-60-20



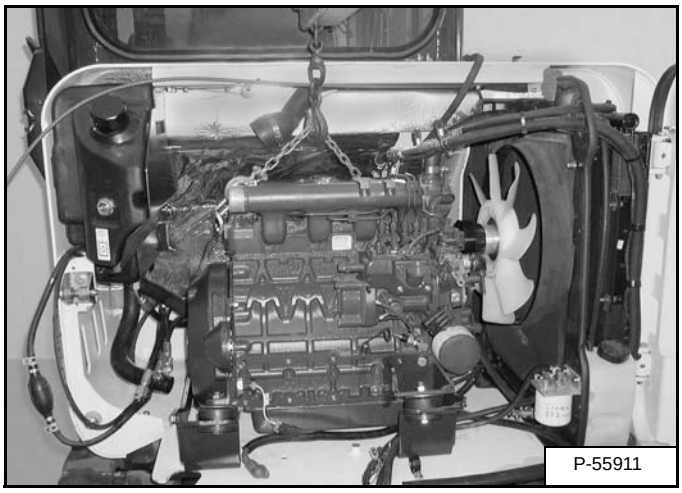
Attach a lifting bracket (Item 1) **[Figure 60-60-20]** and chain to the pump end of the engine.

Figure 60-60-21



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

Figure 60-60-22



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

Relocate all wires and hoses away from the engine.

Raise the hoist and remove the engine.

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ENGINE FLYWHEEL (EARLY MODELS)

Flywheel Removal And Installation

Open the tailgate.

Remove the air cleaner. (See Removal And Installation on Page 60-30-1.)

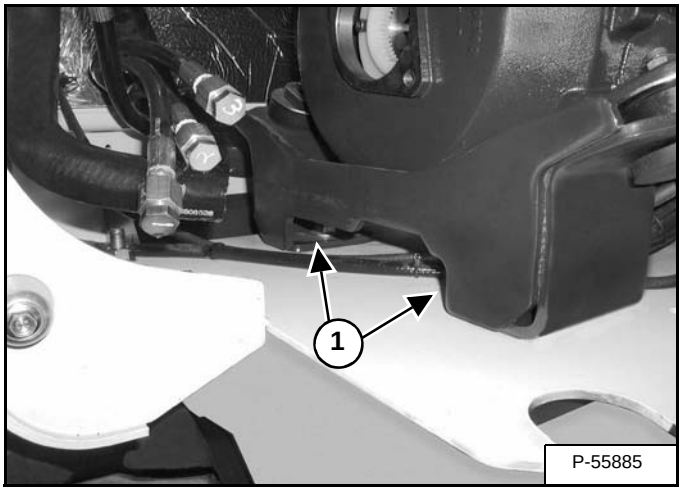
Drain the hydraulic reservoir. (See Checking And Adding Hydraulic Fluid on Page 10-100-1.)

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

Remove the hydraulic pump. (See Removal And Installation on Page 20-50-6.)

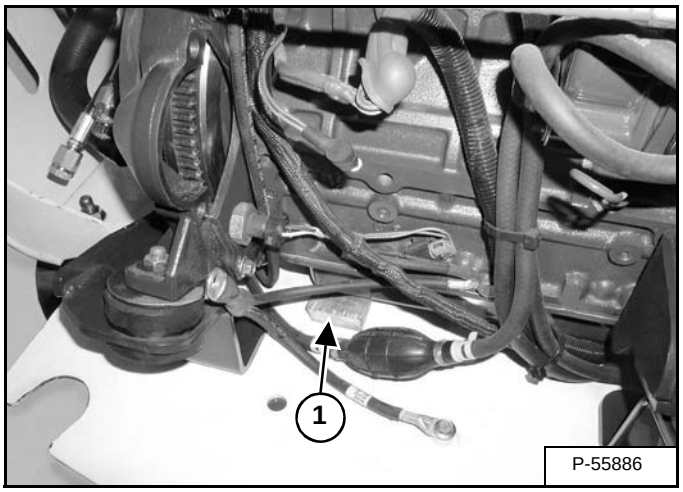
Remove the starter. (See Removal And Installation on Page 50-40-1.)

Figure 60-70-1



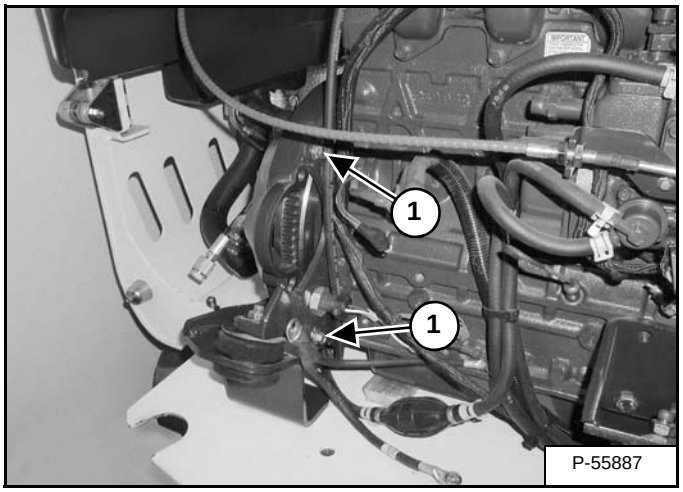
Remove the bolts (Item 1) **[Figure 60-70-1]** from the engine mounts.

Figure 60-70-2



Slightly raise the flywheel end of the engine, and place a support (Item 1) **[Figure 60-70-2]** under the oil pan.

Figure 60-70-3

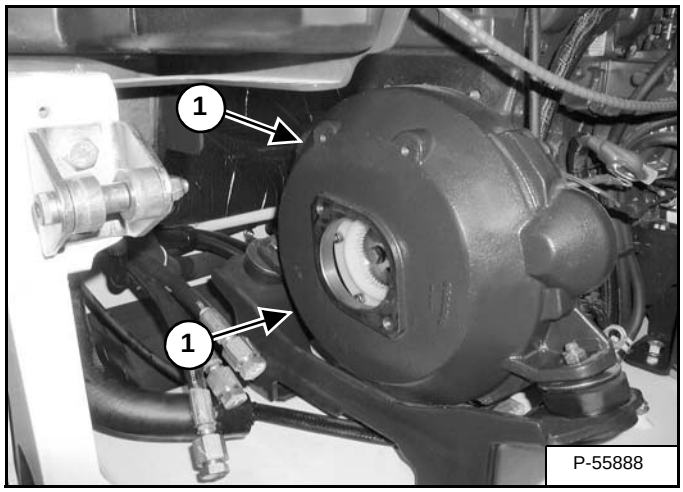


Remove the flywheel cover bolts (Item 1) **[Figure 60-70-3]**.

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Flywheel Removal And Installation (Cont'd)

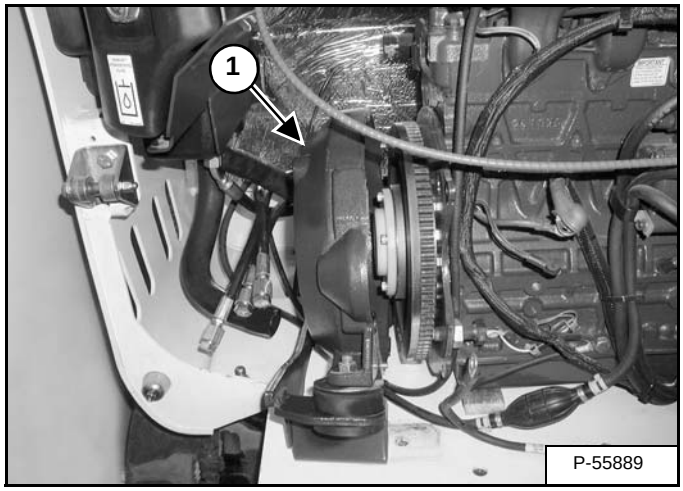
Figure 60-70-4



Remove the two flywheel housing bolts (Item 1) **[Figure 60-70-4]** from the front side of the engine.

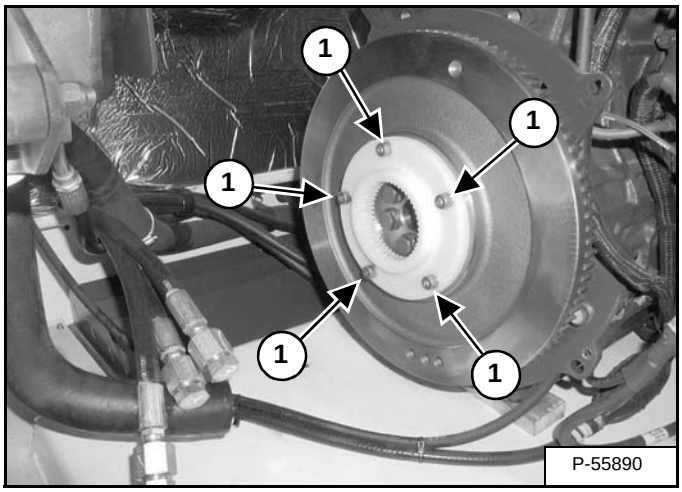
Installation: Position the housing over the alignment pins and tighten the bolts to 30-37 ft.-lb. (40-50 N•m) torque.

Figure 60-70-5



Remove the flywheel housing (Item 1) **[Figure 60-70-5]** from the engine.

Figure 60-70-6

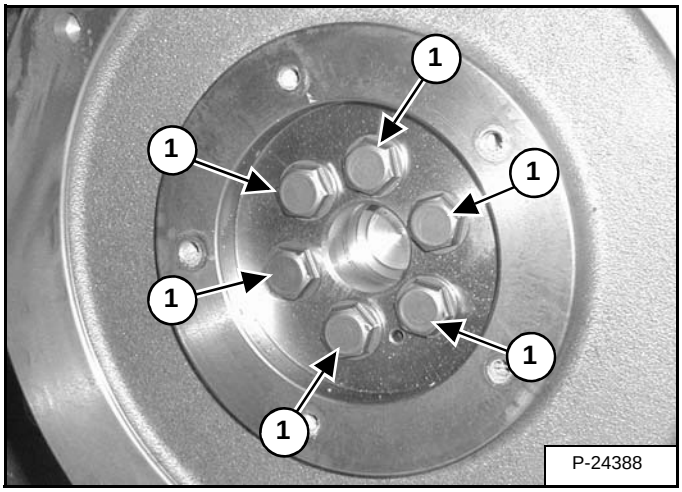


Remove the bolts (Item 1) **[Figure 60-70-6]** from the hydraulic pump coupler.

Installation: Tighten the bolts to 27-32 ft.-lb. (37-43 N•m) torque.

Remove the coupler.

Figure 60-70-7



Remove the bolts (Item 1) **[Figure 60-70-7]** from the flywheel.

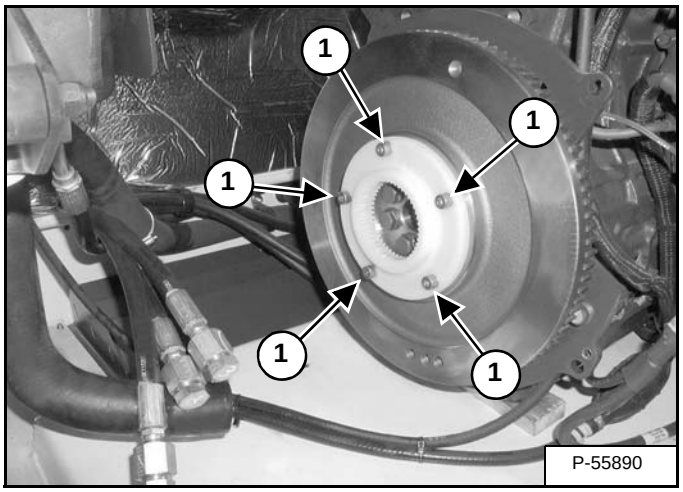
Installation: Tighten the bolts to 40-43 ft.-lb. (54-59 N•m) torque.

Remove the flywheel.

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Hydraulic Pump Coupler

Figure 60-70-8



Remove the bolts (Item 1) **[Figure 60-70-8]** from the flywheel.

Installation: Tighten the bolts to 27-32 ft.-lb. (37-43 N•m) torque.

Flywheel Ring Gear

⚠ 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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The ring gear on the flywheel is an interference fit. Heat the ring gear enough to expand it and hit it with a hammer evenly to remove it.

Clean the outer surface of the flywheel to give a smooth fit.

Clean the new ring gear and heat it to a temperature of 450-500° F (232-260° C).

Fit the ring gear over the flywheel. Make sure the gear is seated correctly.

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ENGINE FLYWHEEL (LATER MODELS)

Flywheel Removal And Installation

Open the tailgate.

Remove the air cleaner. (See Removal And Installation on Page 60-30-1.)

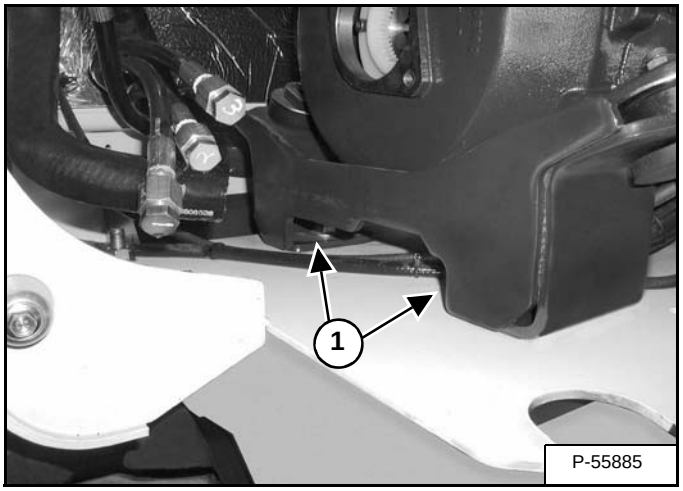
Drain the hydraulic reservoir. (See Checking And Adding Hydraulic Fluid on Page10-100-1.)

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

Remove the hydraulic pump. (See Removal And Installation on Page 20-50-6.)

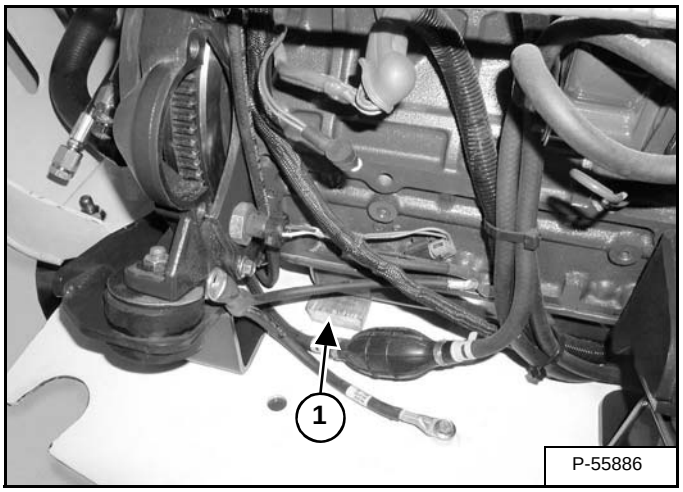
Remove the starter. (See Removal And Installation on Page 50-40-1.)

Figure 60-71-1



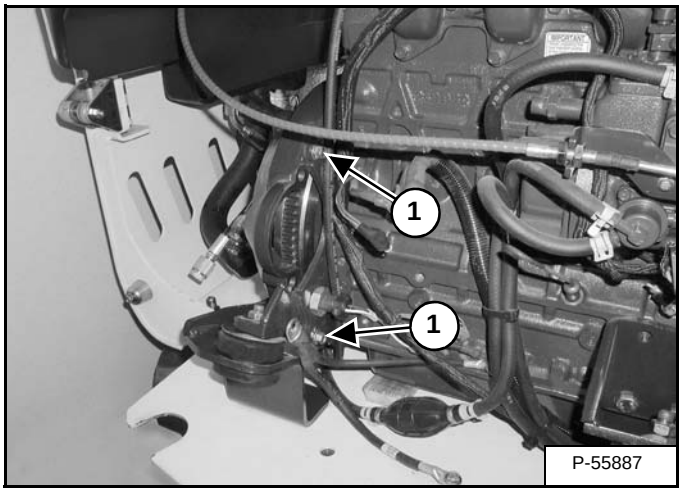
Remove the bolts (Item 1) **[Figure 60-71-1]** from the engine mounts.

Figure 60-71-2



Slightly raise the flywheel end of the engine, and place a support (Item 1) **[Figure 60-71-2]** under the oil pan.

Figure 60-71-3

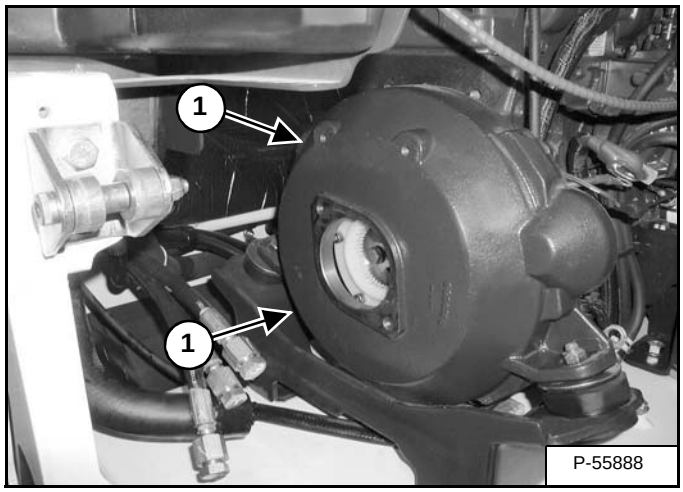


Remove the flywheel cover bolts (Item 1) **[Figure 60-71-3]**.

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Flywheel Removal And Installation (Cont'd)

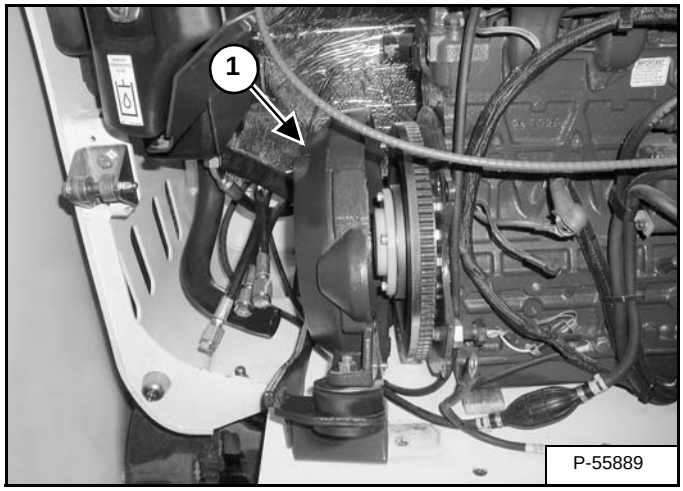
Figure 60-71-4



Remove the two flywheel housing bolts (Item 1) **[Figure 60-71-4]** from the front side of the engine.

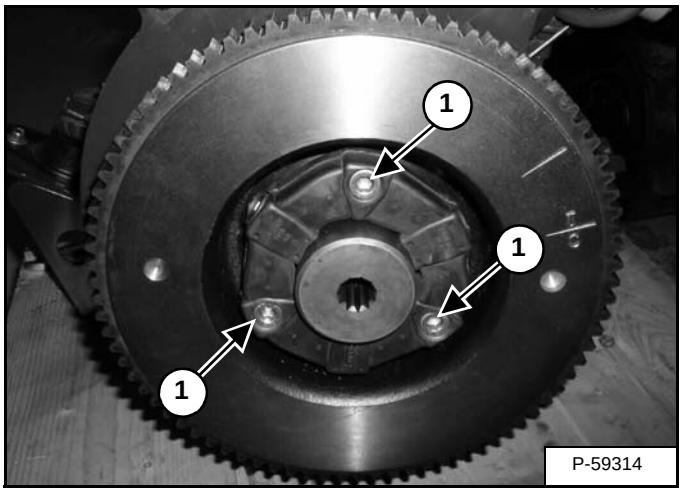
Installation: Position the housing over the alignment pins and tighten the bolts to 30-37 ft.-lb. (40-50 N•m) torque.

Figure 60-71-5



Remove the flywheel housing (Item 1) **[Figure 60-71-5]** from the engine.

Figure 60-71-6

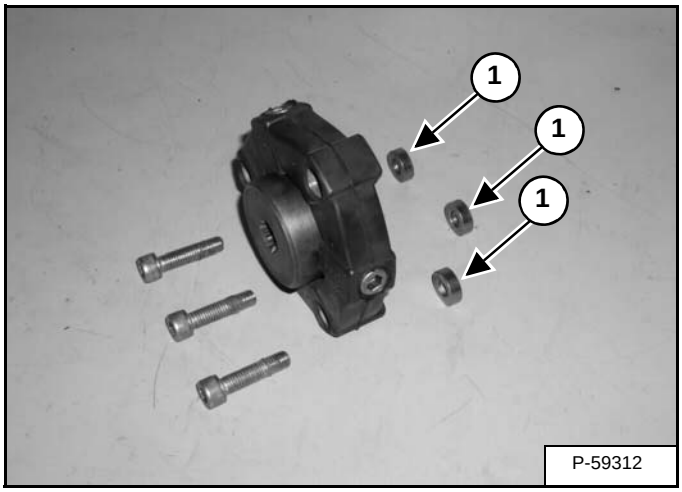


Remove the bolts (Item 1) **[Figure 60-71-6]** from the hydraulic pump coupler.

Installation: Apply LOCTITE 242™ (Blue) to bolts and tighten the bolts to 27-32 ft.-lb. (37-43 N•m) torque.

Remove the hydraulic pump coupler.

Figure 60-71-7

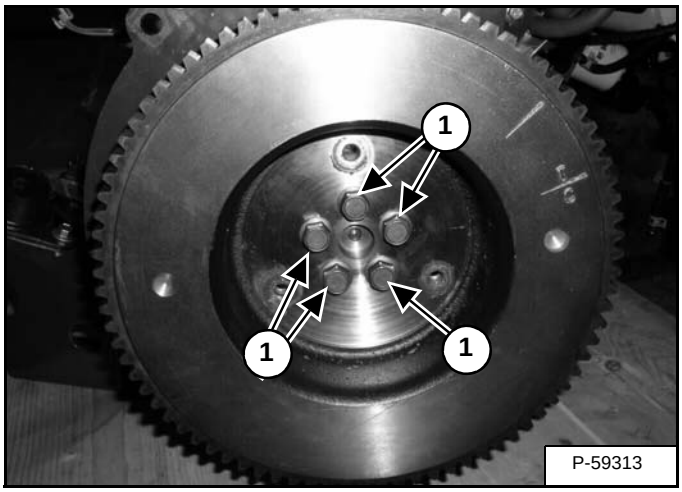


Each hydraulic pump coupler bolt has a spacer (Item 1) **[Figure 60-71-7]** between coupler and flywheel.

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Hydraulic Pump Coupler

Figure 60-71-8

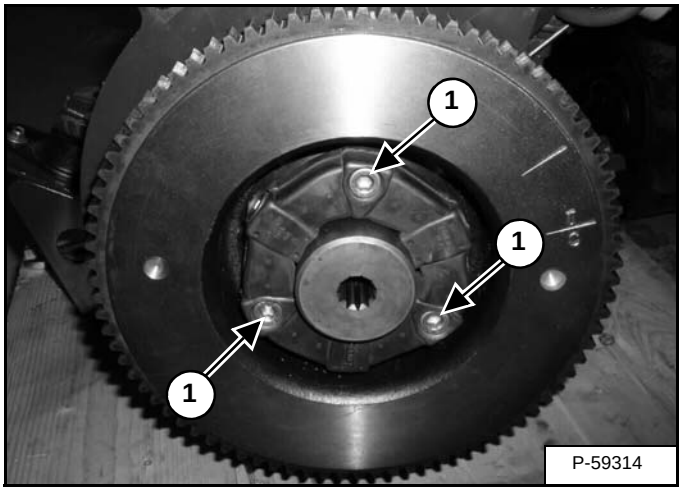


Remove the five bolts (Item 1) **[Figure 60-71-8]** from the flywheel.

Installation: Tighten the bolts to 40-43 ft.-lb. (54-59 N•m) torque.

Remove the flywheel.

Figure 60-71-9

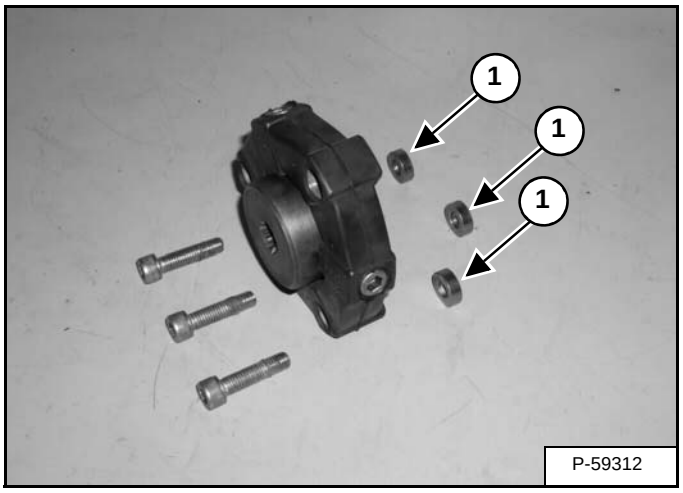


Remove the three bolts (Item 1) **[Figure 60-71-9]**

Installation: Apply LOCTITE 242™ (Blue) to bolts and tighten the bolts to 27-32 ft.-lb. (37-43 N•m) torque.

Remove the hydraulic pump coupler.

Figure 60-71-10



Each hydraulic pump coupler bolt has a spacer (Item 1) **[Figure 60-71-10]** between coupler and flywheel.

Flywheel Ring Gear

⚠ 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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The ring gear on the flywheel is an interference fit. Heat the ring gear enough to expand it and hit it with a hammer evenly to remove it.

Clean the outer surface of the flywheel to give a smooth fit.

Clean the new ring gear and heat it to a temperature of 450-500° F (232-260° C).

Fit the ring gear over the flywheel. Make sure the gear is seated correctly.

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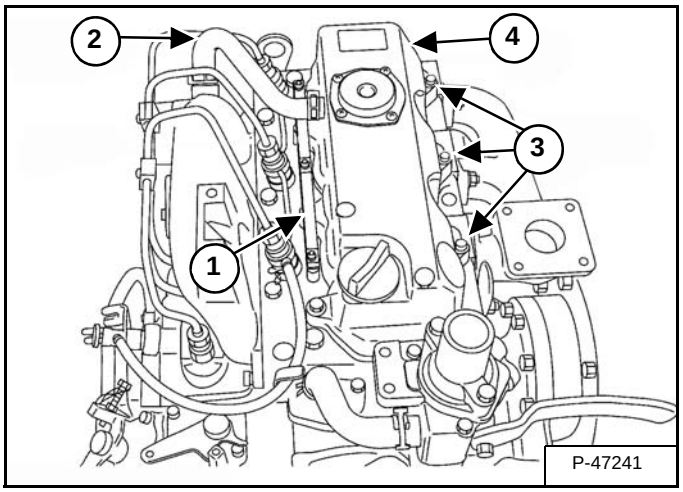


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RECONDITIONING THE ENGINE

Cylinder Head Removal And Installation

Figure 60-80-1

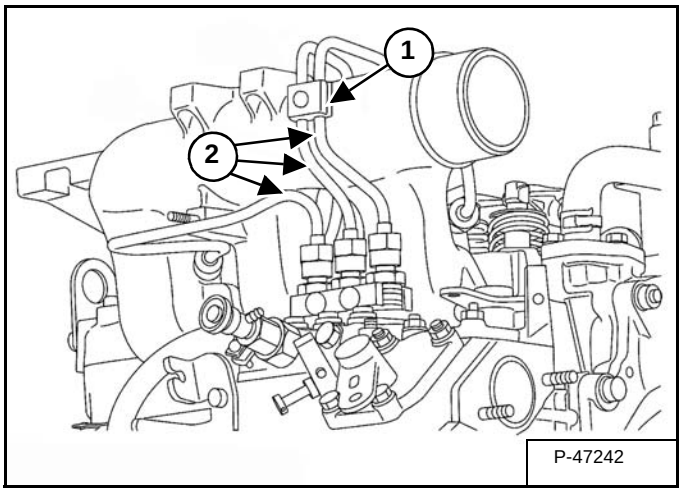


Remove the glow plug lead (Item 1), breather hose (Item 2), and valve cover bolts (Item 3) **[Figure 60-80-1]**.

Remove the valve cover (Item 4) **[Figure 60-80-1]** and gasket.

Installation: Tighten the valve cover bolts to 5-8 ft.-lb. (7-11 N•m)

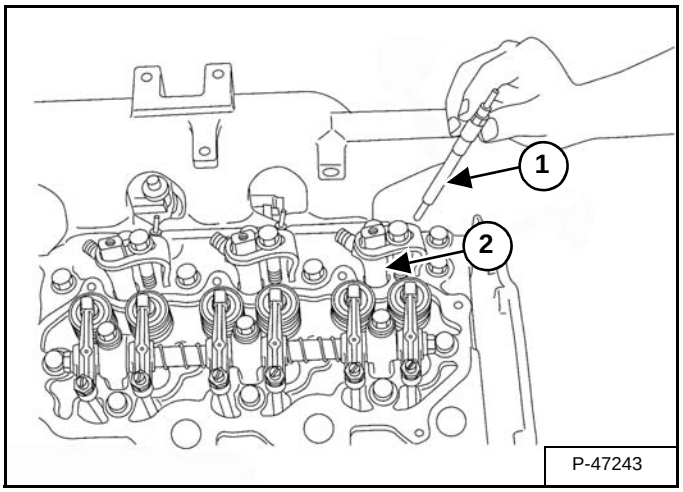
Figure 60-80-2



Loosen the bolts on the clamps (Item 1) and remove the injection tubes (Item 2) **[Figure 60-80-2]**.

Remove the overflow tube assembly.

Figure 60-80-3

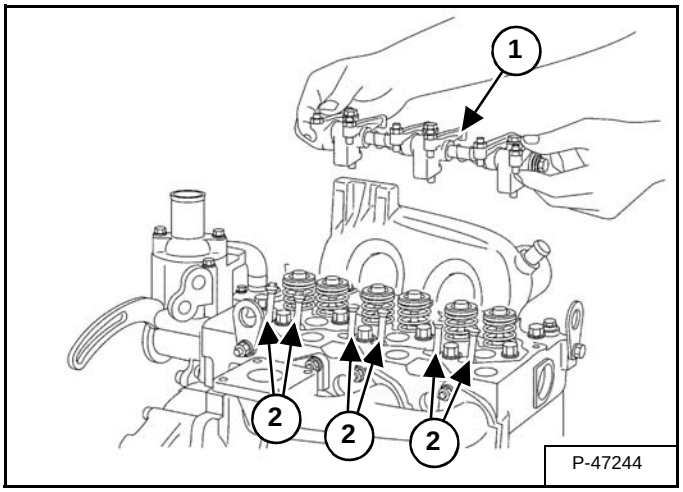


Remove the glow plugs (Item 1) and fuel injector holder assemblies (Item 2) **[Figure 60-80-3]**.

Installation: Tighten the glow plugs to 15-18 ft.-lb. (20-25 N•m) torque.

Tighten the injector holders to 19-22 ft.-lb. (26-29 N•m) torque.

Figure 60-80-4



Remove the rocker arm bolts and remove the rocker arm assembly (Item 1) **[Figure 60-80-4]**.

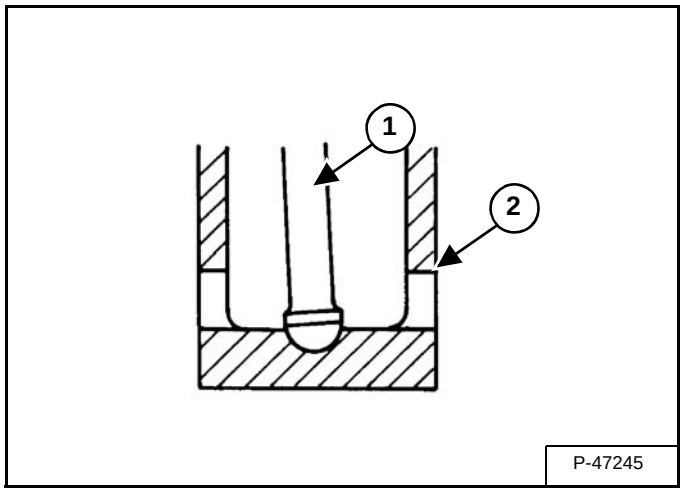
Installation: Tighten the bolts to 17-20 ft.-lb. (24 - 28 N•m) torque.

Remove the pushrods (Item 2) **[Figure 60-80-4]**.

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Cylinder Head Removal And Installation (Cont'd)

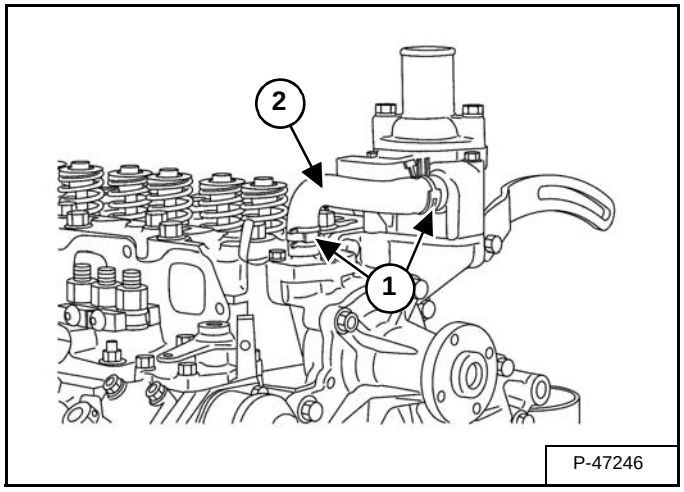
Figure 60-80-5



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

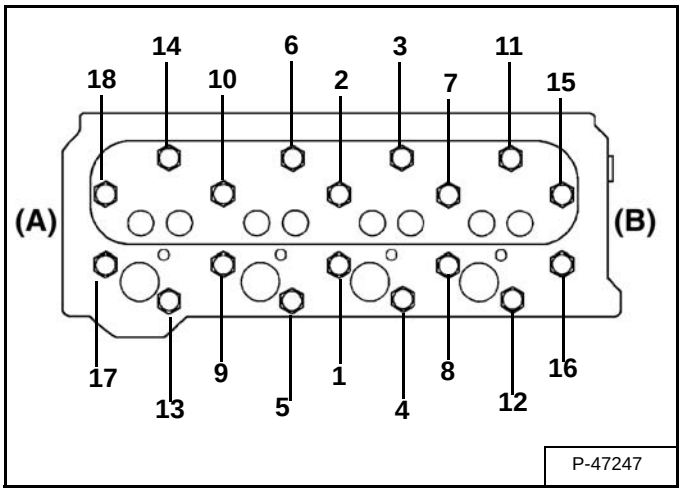
After installing the rocker arm assembly and push rods, the valve lash must be adjusted. (See Valve Clearance Adjustment on Page 60-50-14.)

Figure 60-80-6



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

Figure 60-80-7



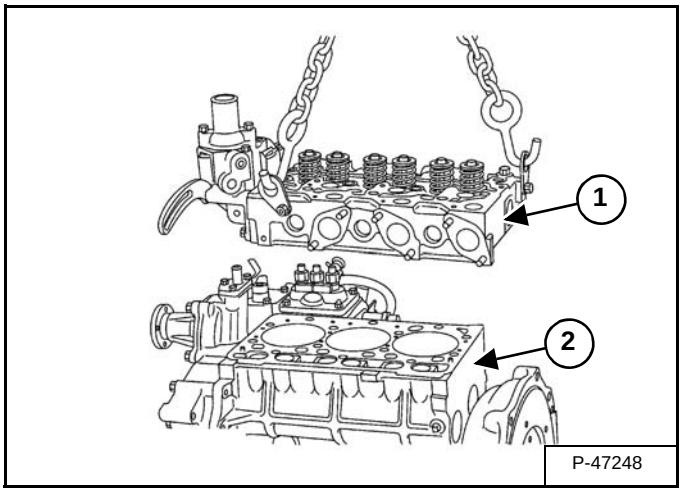
Remove the cylinder head bolts in order of #18 to #1 **[Figure 60-80-7]**.

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

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

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

Figure 60-80-8

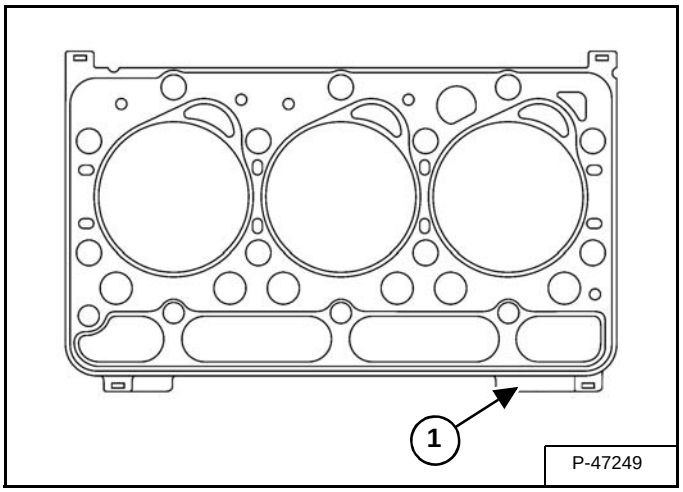


Remove the cylinder head (Item 1) and gasket (Item 2) **[Figure 60-80-8]**.

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Cylinder Head Removal And Installation (Cont'd)

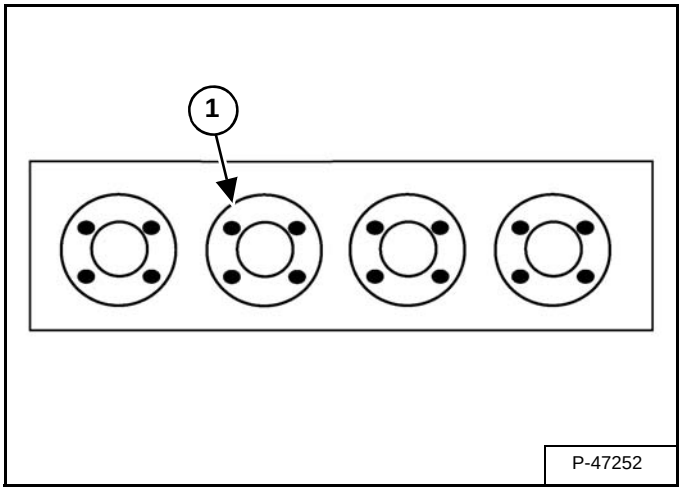
Figure 60-80-9



When replacing just the gasket, use a new gasket that has the same mark (Item 1) **[Figure 60-80-9]** as the original gasket.

When replacing the gasket after an engine rebuild, the piston protrusion must be measured. (See Cylinder Head Top Clearance on Page 60-80-5.)

Figure 60-80-10



Measure and record the protrusion of each piston in the four places shown (Item 1) **[Figure 60-80-10]**. Find the average of each piston, then find the combined average of the four pistons.

Figure 60-80-11

Gasket Size (Number)	Piston Protrusion
15	0,475 to 0,525 mm 0.0187 to 0.0207 in.
20	0,525 to 0,575 mm 0.0207 to 0.0226 in.
25	0,575 to 0,625 mm 0.0226 to 0.0246 in.
30	0,625 to 0,067 mm 0.0246 to 0.0266 in.
35	0,675 to 0,725 mm 0.0266 to 0.0285 in.

Select the correct gasket size (thickness) from the chart **[Figure 60-80-11]**.

Find the measurement of the highest piston protrusion and the lowest piston protrusion (recorded earlier) for each piston.

If the highest measurement exceeds the piston protrusion of the selected gasket, use the gasket which is one size larger. If the measurement exceeds gasket size 35, the engine must be disassembled, clearances checked, and reassembled.

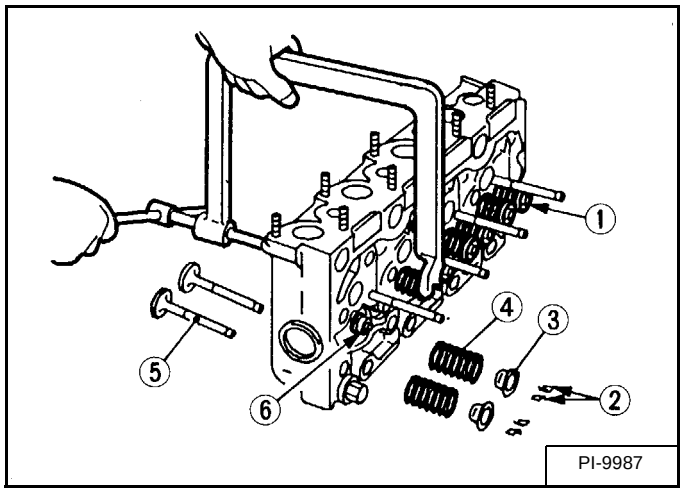
If the measurement is two sizes smaller than the selected gasket or smaller than gasket size 15, the engine must be disassembled, clearances checked, and reassembled.

After the gasket and cylinder head have been installed, turn the crankshaft by hand to be sure there is no interference between the piston, cylinder, and valves.

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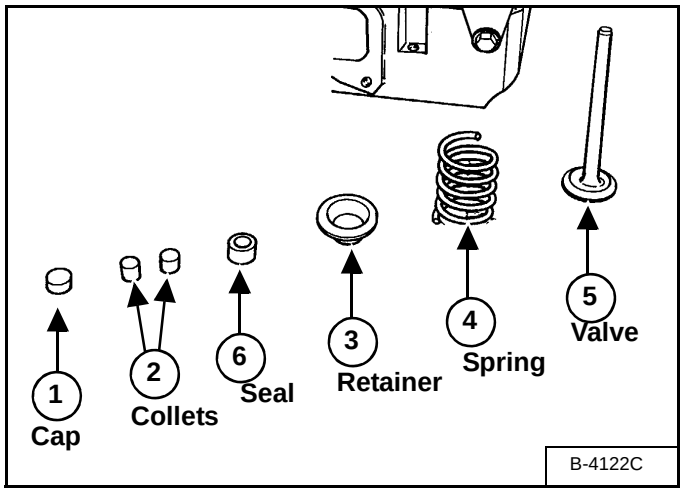
Cylinder Head Disassembly And Assembly

Figure 60-80-12



Use a valve spring compressor to compress the valve springs **[Figure 60-80-12]**.

Figure 60-80-13

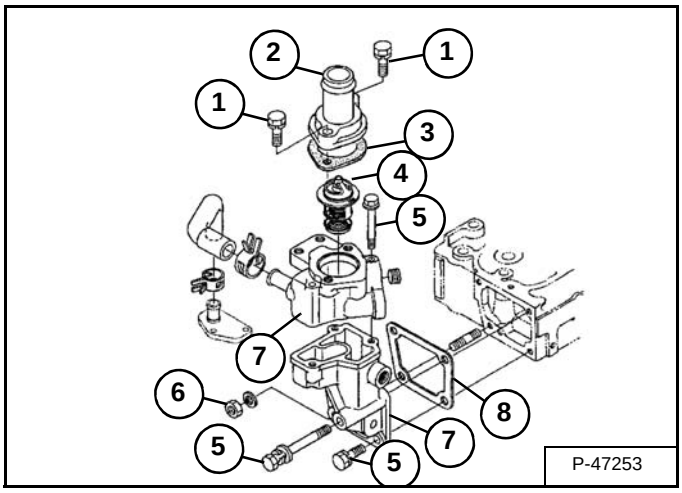


Remove the valve cap (Item 1) and valve spring collet (Item 2) **[Figure 60-80-12]** & **[Figure 60-80-13]**.

Remove the valve spring retainer (Item 3) and the spring (Item 4) **[Figure 60-80-12]** & **[Figure 60-80-13]**.

Remove the seal (Item 6) and the valve (Item 5) **[Figure 60-80-12]** & **[Figure 60-80-13]**.

Figure 60-80-14



Remove the bolts (Item 1), housing (Item 2), gasket (Item 3) and thermostat (Item 4) **[Figure 60-80-14]**.

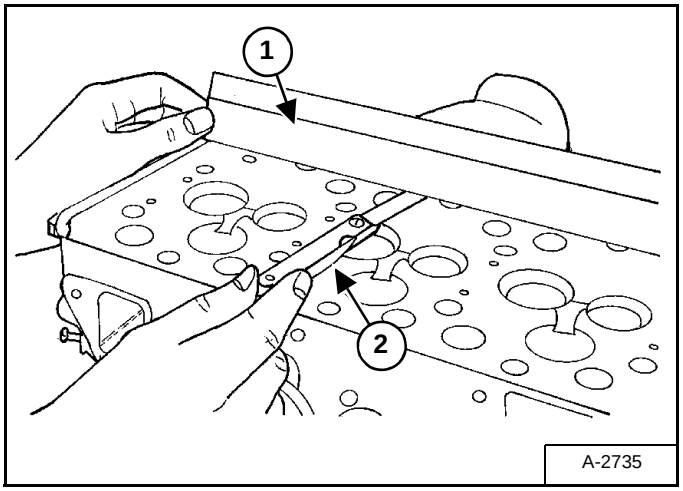
Remove bolts (Item 5), nut (Item 6), top and bottom housing (Item 7), and gasket (Item 8) from the cylinder head **[Figure 60-80-14]**.

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Cylinder Head Servicing

Clean the surface of the cylinder head.

Figure 60-80-15

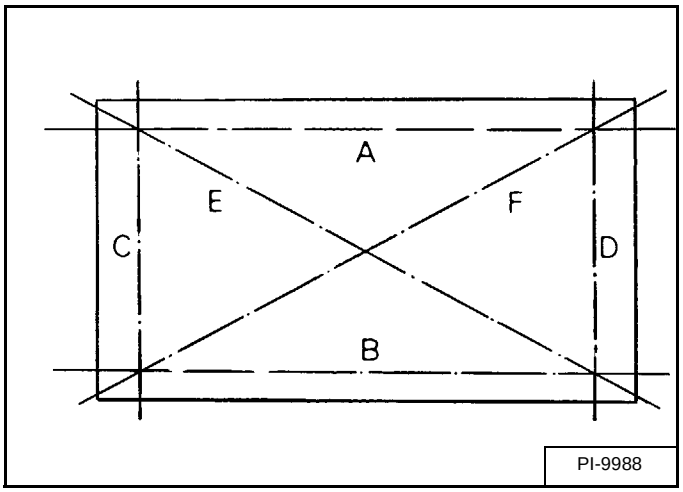


Put a straight edge (Item 1) **[Figure 60-80-15]** on the cylinder head.

NOTE: Do not put the straight edge across combustion chambers.

Put a feeler gauge (Item 2) **[Figure 60-80-15]** between the straight edge and the surface of the cylinder head.

Figure 60-80-16

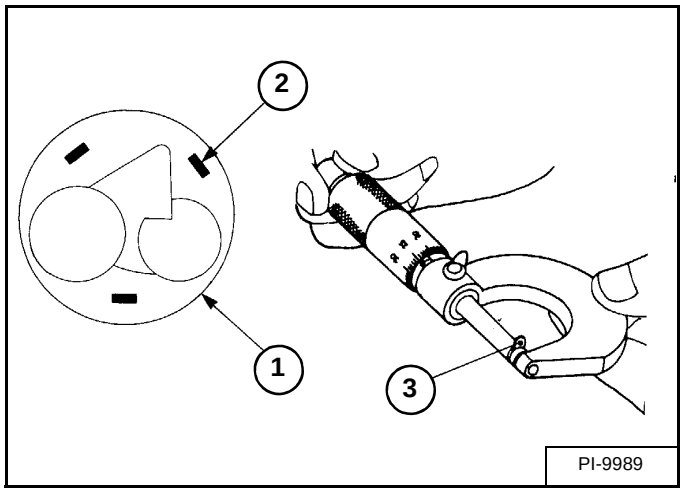


Put the straight edge on the cylinder head's four sides and two diagonal as shown in figure **[Figure 60-80-16]**.

The maximum distortion of the head surface is ± 0.002 in. (± 0,05 mm). If the measurement exceeds the specification, replace the cylinder head.

Cylinder Head Top Clearance

Figure 60-80-17



Install the cylinder head gasket. Put the piston (Item 1) **[Figure 60-80-17]** being checked at T.D.C.

Put 3 pieces of 0.06 in. (1,5 mm) diameter solder (Item 2) **[Figure 60-80-17]** on the top of the piston. Use grease to hold them in position.

NOTE: Put the solder in position so they do not touch the valves.

Turn the piston to bottom dead center.

Install the cylinder head and tighten to the correct torque in the correct sequence. (See Cylinder Head Removal And Installation on Page 60-80-1.)

Turn the crankshaft until the piston exceeds T.D.C. Remove the cylinder head.

Remove the solder wire (Item 3) **[Figure 60-80-17]** and measure it.

If the measurement exceeds the specifications, check the oil clearance of the crank pin journal or the piston pin.

Top Clearance	0.0236-0.0276 in. (0.60-0.70 mm)

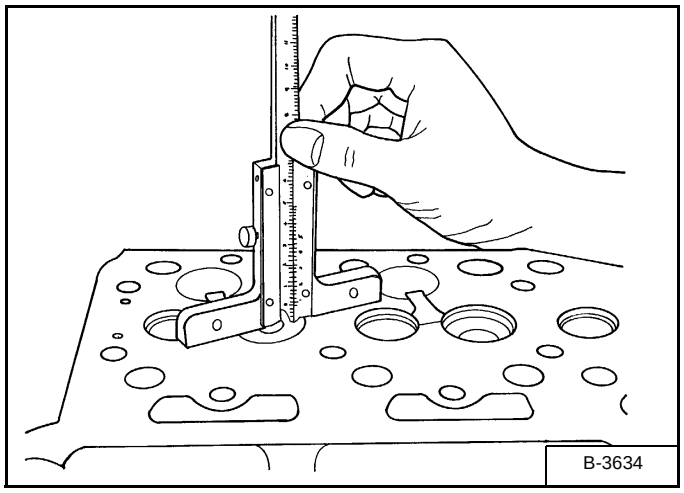
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Valve Guide Checking

Remove the valve and spring from the cylinder head. (See Cylinder Head Disassembly And Assembly on Page 60-80-4.)

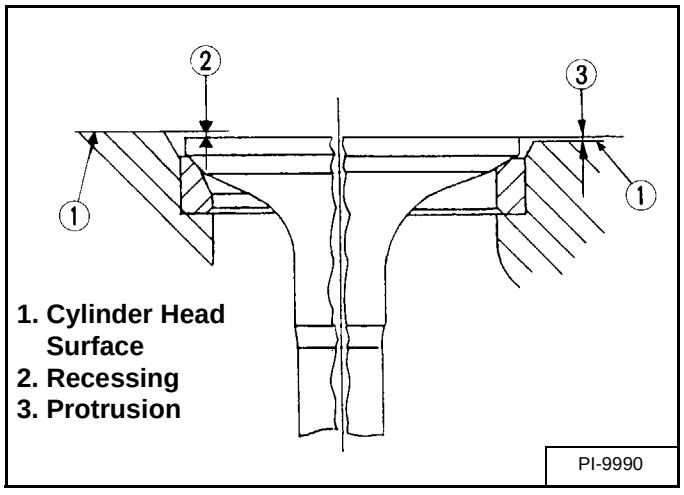
Clean the valve seat and combustion chamber.

Figure 60-80-18



Install the valve into the guide. Measure the valve recessing or protrusion with a depth gauge **[Figure 60-80-18]**.

Figure 60-80-19



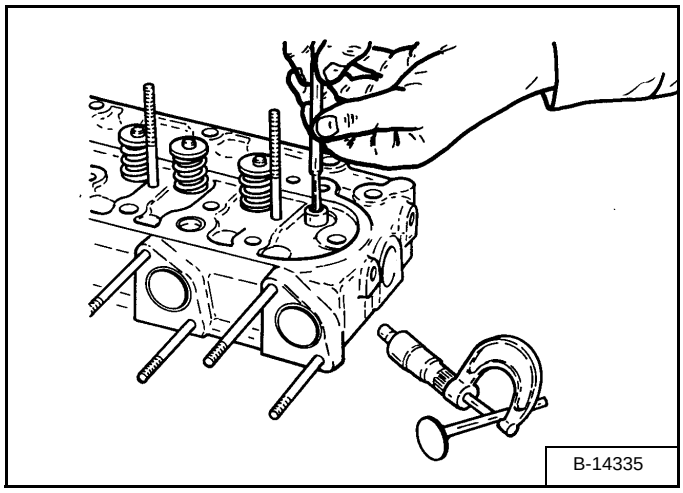
1. Cylinder Head Surface
2. Recessing
3. Protrusion

If the measurement exceeds the allowable limit, replace the valve or cylinder head **[Figure 60-80-19]**.

Protrusion	0.002 in. (0,5 mm)
Recessing	0.006 in. (0,15 mm)
Allowable Limit (Recessing)	0.0157 in. (0,4 mm)

Remove the carbon from the valve guide.

Figure 60-80-20



Measure the valve stem O.D. **[Figure 60-80-20]**.

Measure the valve guide I.D. **[Figure 60-80-20]**.

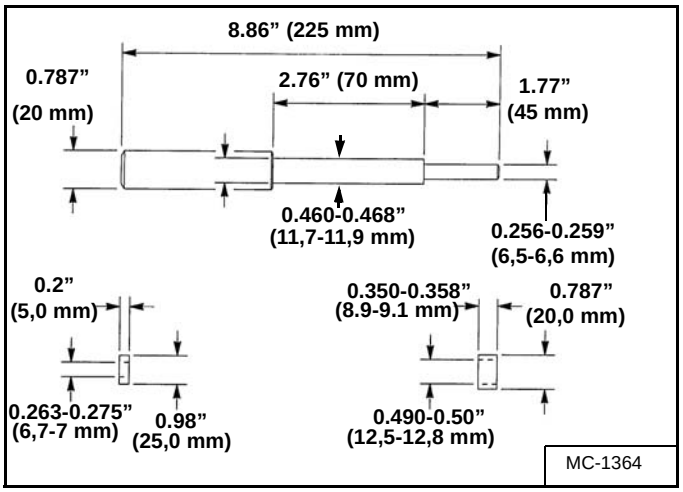
Calculate the clearance. If the clearance exceeds the allowable limit, replace the valve and/or valve guide.

Valve Guide I.D.	0.3156-0.3161 in. (8,015-8,03 mm)
Valve Stem O.D.	0.3134-0.3140 in. (7,96-7,98 mm)
Clearance Between Valve Stem and Guide	0.0016-0.0028 in. (0,04-0,07 mm)
Allowable Limit	0.0039 in. (0,1 mm)

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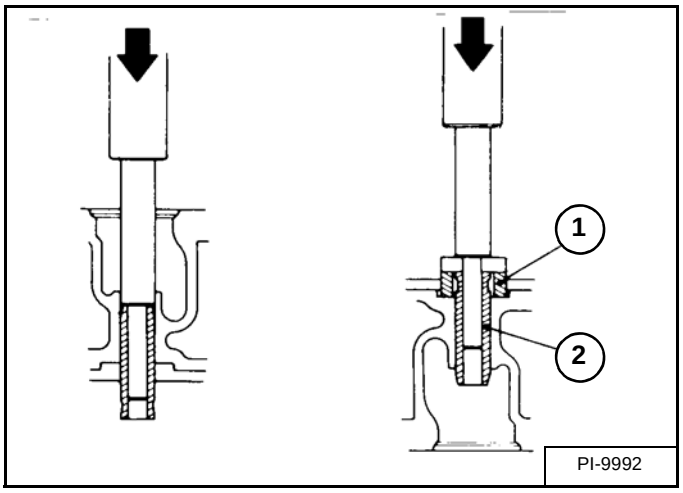
Valve Guide Checking (Cont'd)

Figure 60-80-21



To remove and replace the valve guide, make the driver tool as shown in **[Figure 60-80-21]**.

Figure 60-80-22



Press the used valve guide out of the cylinder head using the special driver tool **[Figure 60-80-22]**.

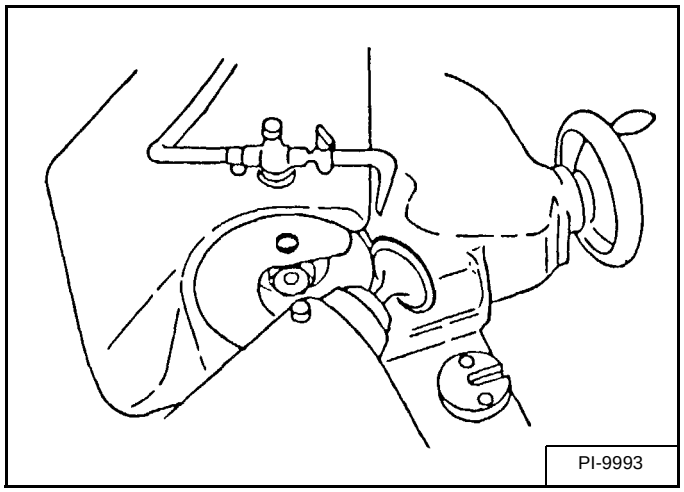
Put oil on the outside diameter of the new valve guide. Press the new valve guide into the cylinder head from the top side. Use the special driver tools (Items 1 & 2) **[Figure 60-80-22]**, press the new guide until the tool contacts the cylinder head.

Ream the valve guide to the correct specifications.

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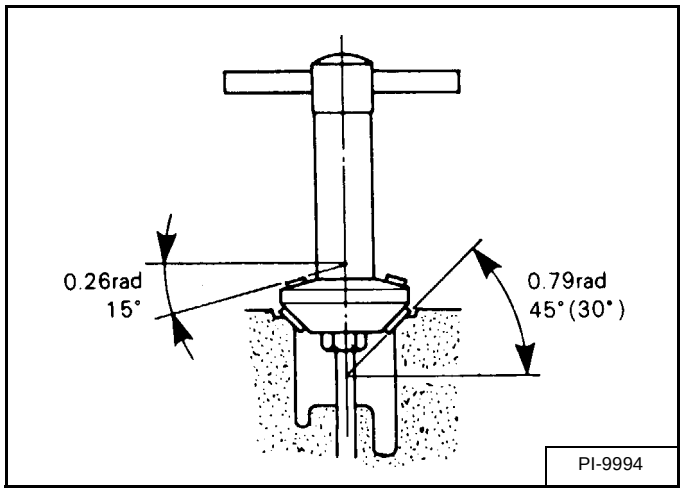
Reconditioning The Valve And Valve Seat

Figure 60-80-23



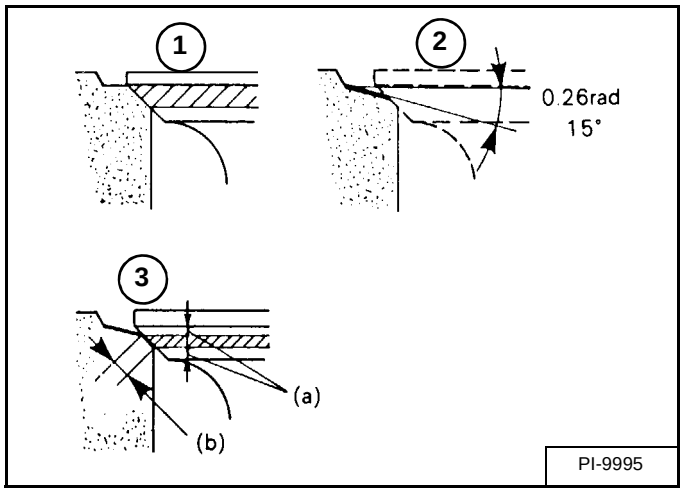
Grind the valve face to the correct angle using a valve refacer **[Figure 60-80-23]**.

Figure 60-80-24



Grind the valve seat surface in the cylinder head to the correct angle **[Figure 60-80-24]**.

Figure 60-80-25



Check the seat surface and valve face (Item 1) **[Figure 60-80-25]**.

If the seat surface is too wide, use a 15 degree cutter on the exhaust or 30 degree cutter on the intake (Item 2) to get the correct width (Item 3) **[Figure 60-80-25]**.

Valve Seat Width

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

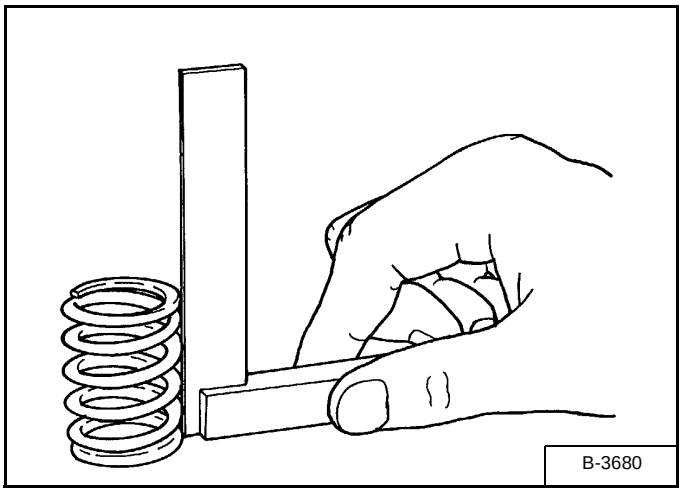
Valve Seat & Face Angle

Intake	60°
Exhaust	45°

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Valve Spring

Figure 60-80-26



Measure the length of the valve spring. If the measurement is less than the allowable limit, replace the spring **[Figure 60-80-26]**.

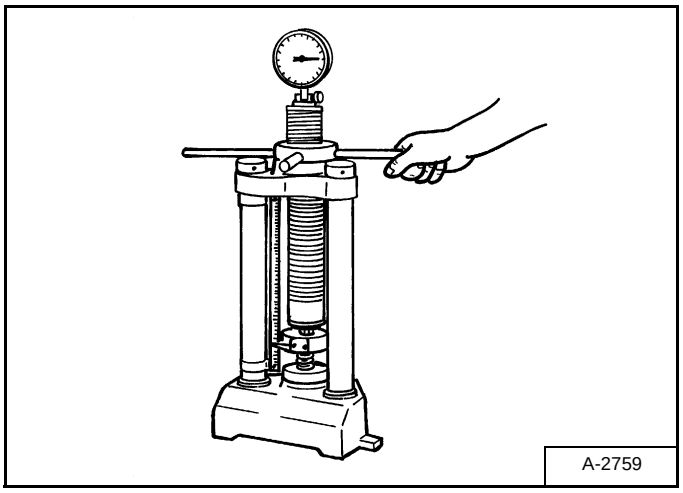
Free Length	1.642-1.661 in. (41,7-42,2 mm)
Allowable Limit	1.622 in. (41,2 mm)

Put the spring on a flat surface, place a square on the side of the spring **[Figure 60-80-26]**.

Rotate the spring and measure the maximum tilt. If the measurement exceeds the allowable limit, replace the spring.

Tilt	0.039 in. (1,0 mm)

Figure 60-80-27



Put the spring on a tester and compress to specified length **[Figure 60-80-27]**.

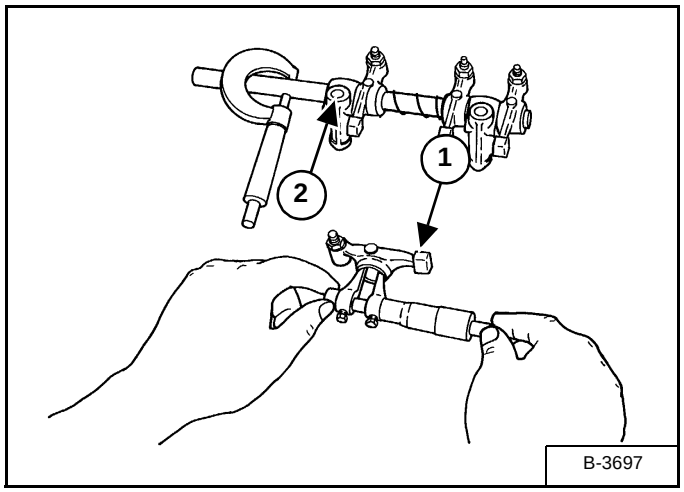
Read the compressed load on the gauge. If the measurement exceeds the allowable limit, replace the spring.

Setting Length	1.378 in. (35,0 mm)
Setting Load	26.4 lb. (117,6 N)
Allowable Limit	22.5 lb. (100,0 N)

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Rocker Arm And Shaft Checking

Figure 60-80-28



Measure the rocker arm I.D. (Item 1) **[Figure 60-80-28]** with an inside micrometer.

Measure the rocker arm shaft O.D. (Item 2) **[Figure 60-80-28]** with an outside micrometer.

If the clearance exceeds the allowable limit, replace the bushing.

If the clearance still exceeds the allowable limit after the bushing is replace, replace the rocker arm shaft.

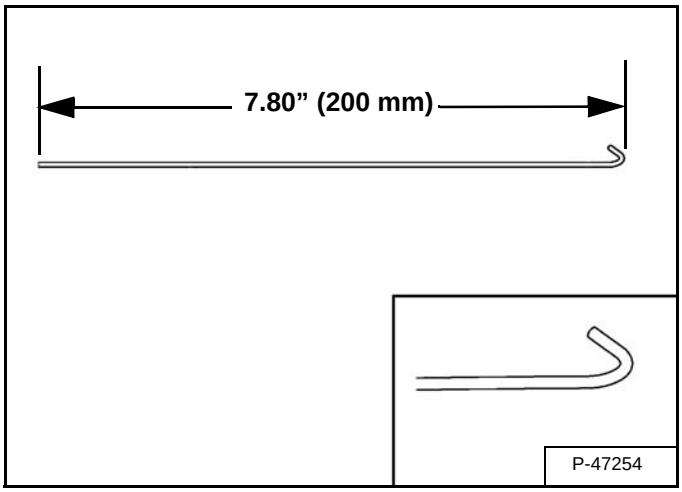
Oil Clearance Between Rocker Arm & Shaft	0.0006-0.0018 in. (0,02-0,05 mm)
Allowable Limit	0.004 in. (0,1 mm)
Rocker Arm Shaft O.D.	0.5501-0.5506 in. (13,97-13,98 mm)
Rocker Arm I.D.	0.5512-0.5519 in. (14,0-14,02 mm)

Timing Gearcase Cover Removal And Installation

Remove the fuel injection pump. (See Fuel Injection Pump Removal And Installation on Page 60-50-6.)

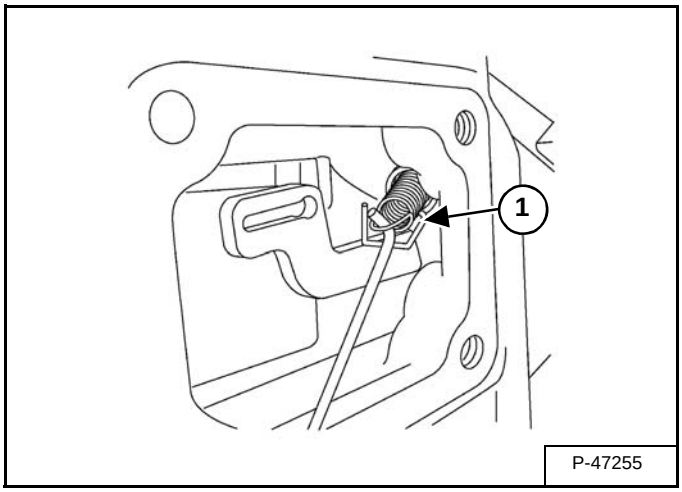
Remove the cylinder head, rocker arms and push rods. (See Cylinder Head Removal And Installation on Page 60-80-1.)

Figure 60-80-29



Bend a hook on the end of a 7.80 in. (200 mm) long, 0.050 in. (1.2 mm) diameter hard wire **[Figure 60-80-29]**.

Figure 60-80-30

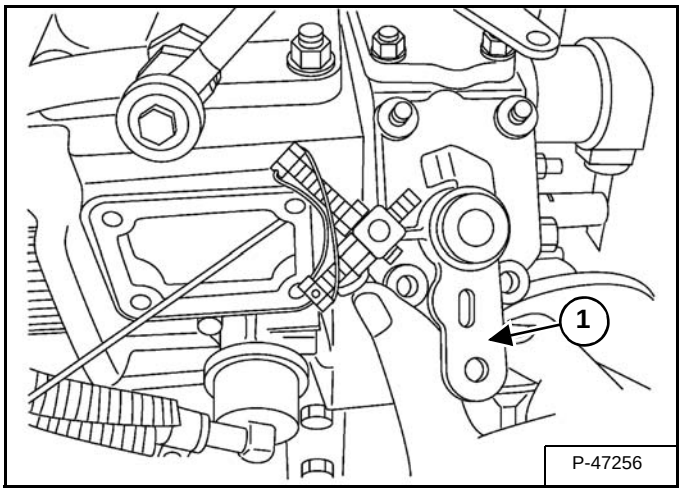


Disconnect the two governor springs (Item 1) **[Figure 60-80-30]**.

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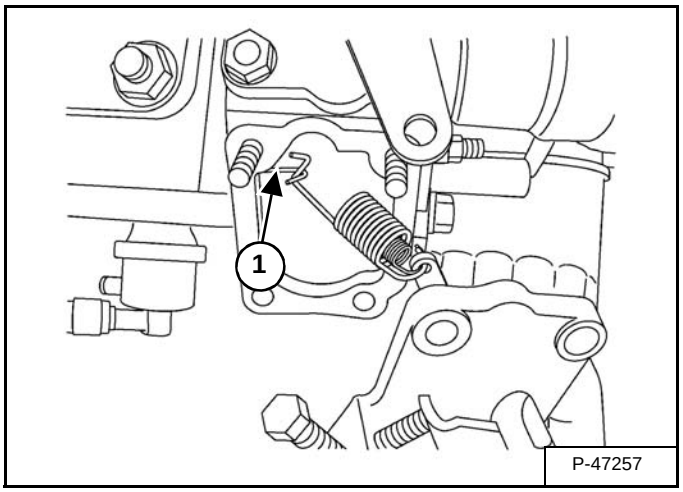
Timing Gearcase Cover Removal And Installation (Cont'd)

Figure 60-80-31



Remove the speed control plate (Item 1) **[Figure 60-80-31]**.

Figure 60-80-32



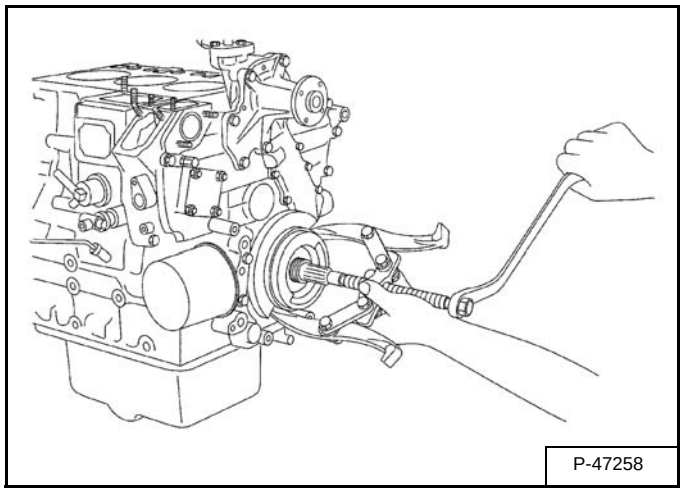
Remove the wire (Item 1) **[Figure 60-80-32]** from the springs.

Installation: Do not drop the governor springs into the gear case.

Remove the crankshaft pulley nut.

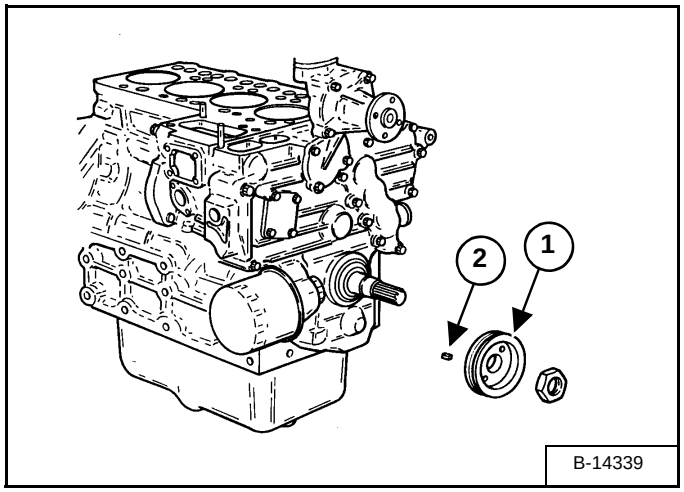
Installation: Tighten the nut to 101-116 ft.-lb. (137-157 N•m) torque.

Figure 60-80-33



Use a puller and remove the crankshaft pulley **[Figure 60-80-33]**.

Figure 60-80-34



Remove the crankshaft pulley (Item 1) and key (Item 2) **[Figure 60-80-34]**.

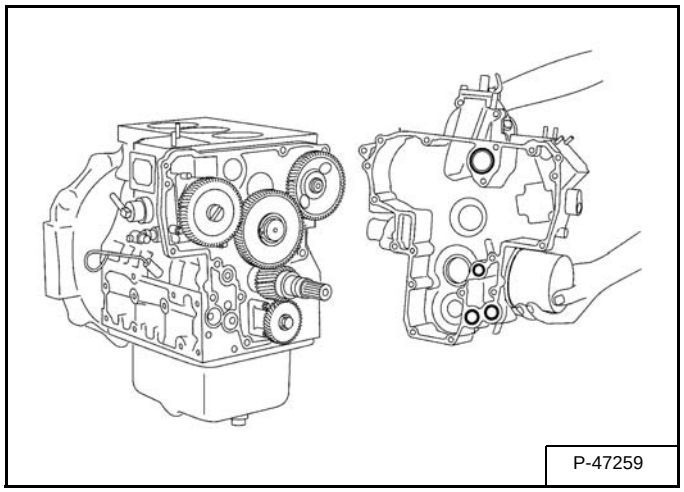
Remove the bolts from the timing gearcase cover.

Installation: Tighten the bolts to 13-15 ft.-lb. (18-20 N•m) torque.

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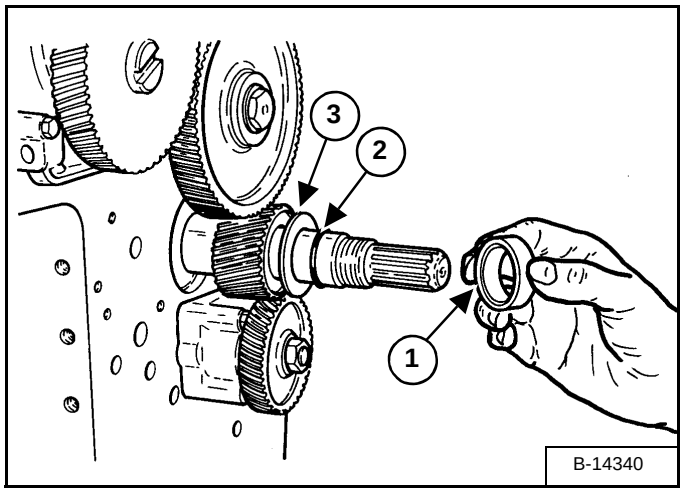
Timing Gearcase Cover Removal And Installation (Cont'd)

Figure 60-80-35



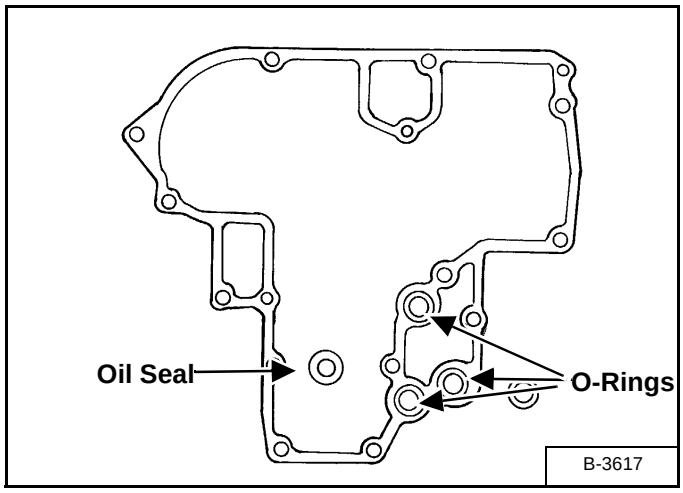
Remove the timing gearcase cover **[Figure 60-80-35]**.

Figure 60-80-36



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

Figure 60-80-37



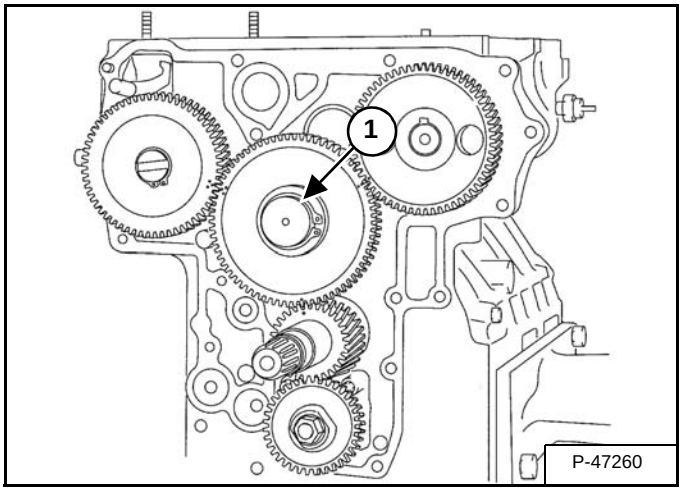
Installation: Install new O-rings and oil seal into the timing gearcase cover **[Figure 60-80-37]**.

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Idler Gear And Camshaft Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-80-10.)

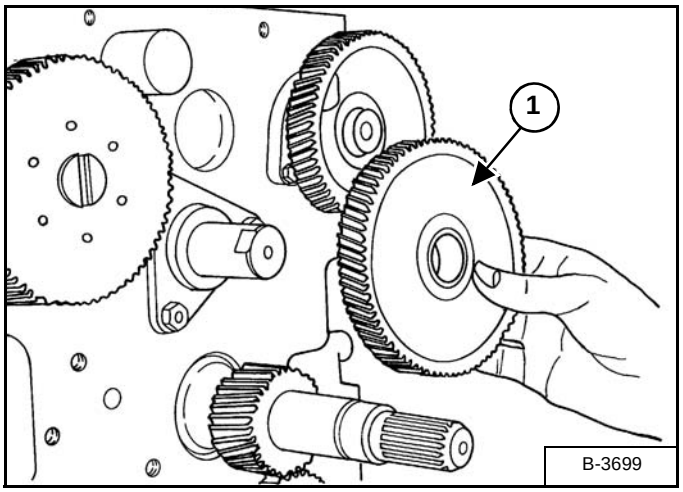
Figure 60-80-38



Remove the snap ring (Item 1) and collar from the idler gear shaft **[Figure 60-80-38]**.

Installation: Make sure the timing marks are in correct alignment when installing the timing gears **[Figure 60-80-38]**.

Figure 60-80-39

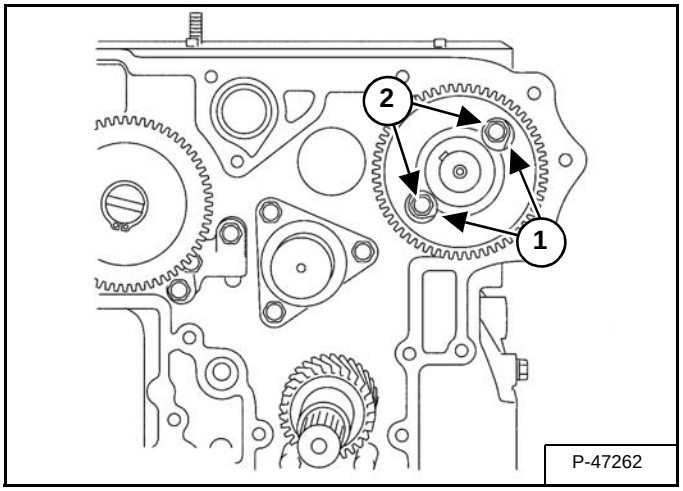


Remove the idler gear (Item 1) **[Figure 60-80-39]**.

Installation: Check the idler gear end play. If the clearance exceeds the allowable limit, replace the gear collar.

Idler Gear End Play	0.005-0.019 in. (0,12-0,48 mm)
Allowable Limit	0.035 in. (0,9 mm)

Figure 60-80-40

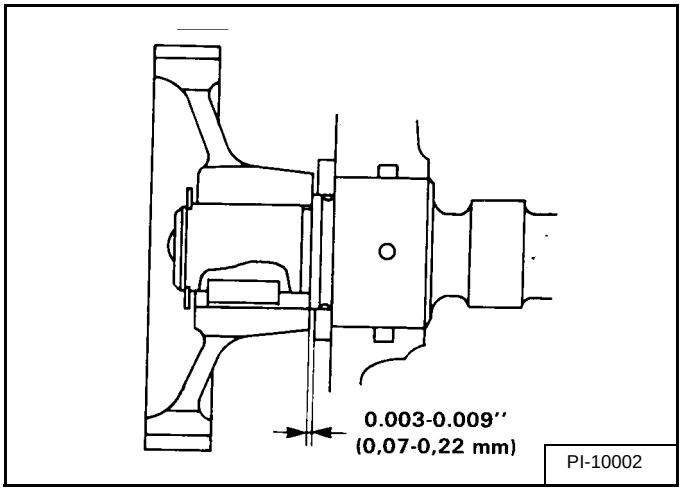


Align the holes (Item 1) on the camshaft gear with the camshaft retainer plate bolts (Item 2) **[Figure 60-80-40]**. Remove the bolts.

Installation: Tighten the camshaft retainer bolts to 17-20 ft.-lb. (24-28 N•m) torque.

Remove the camshaft from the engine block.

Figure 60-80-41



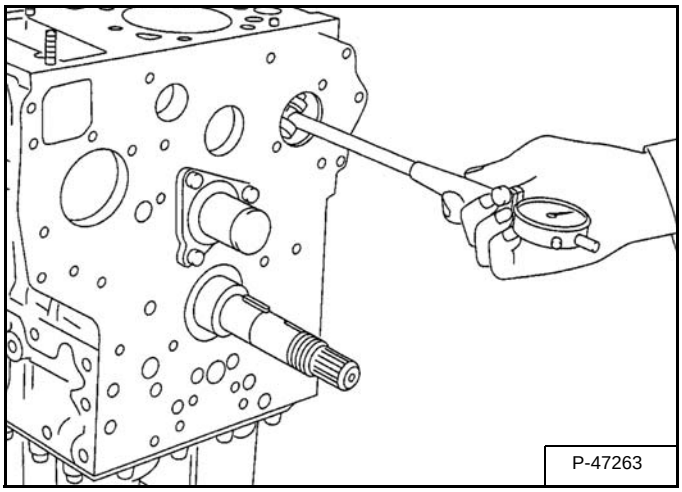
Installation: Check the camshaft end play. If clearance exceeds the allowable limit, replace the camshaft retainer plate **[Figure 60-80-41]**.

Camshaft End Play	0.0028-0.0087 in. (0,07-0,22 mm)
Allowable Limit	0.012 in. (0,3 mm)

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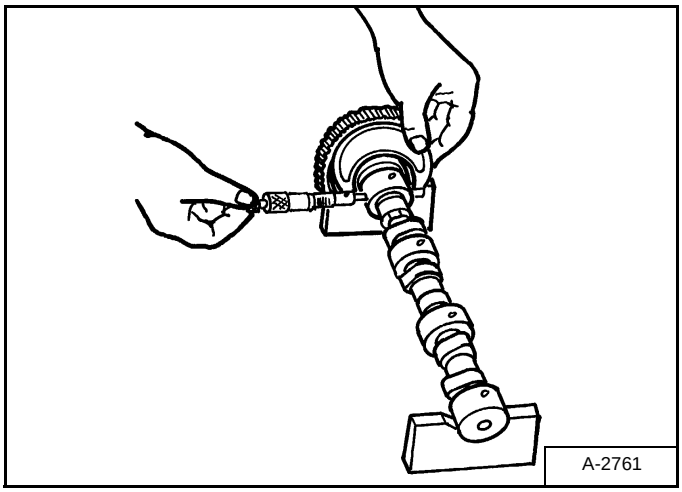
Camshaft Servicing

Figure 60-80-42



Measure the cylinder block bore in the engine block **[Figure 60-80-42]**.

Figure 60-80-43

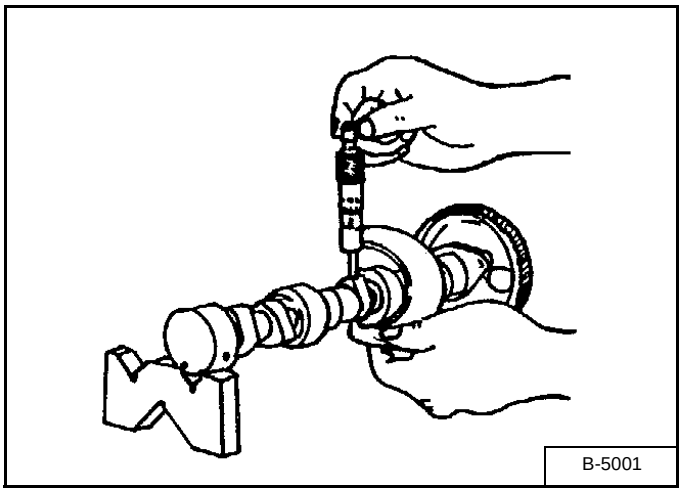


Measure the camshaft journal **[Figure 60-80-43]**.

Calculate the oil clearance. If the clearance exceeds the allowable limit, replace the camshaft.

Cylinder Block Bore I.D.	1.575-1.576 in. (40,0-40,025 mm)
Journal O.D.	1.572-1.573 in. (39,93-39,95 mm)
Oil Clearance of Camshaft Journal	0.002-0.0036 in. (0,05-0,091 mm)
Allowable Limit	0.006 in. (0,15 mm)

Figure 60-80-44

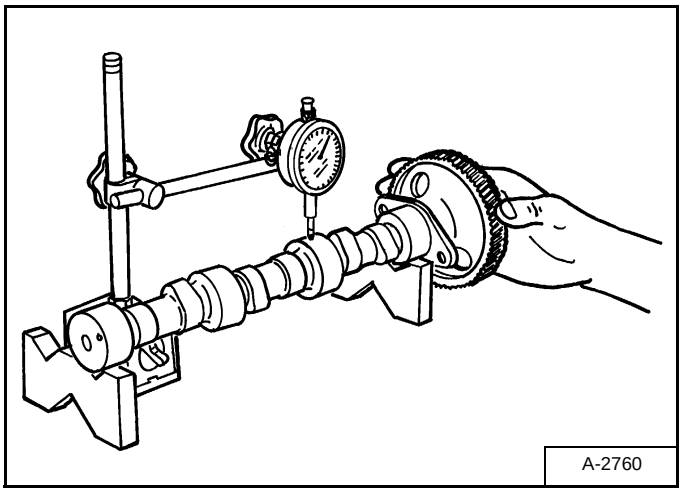


Measure the cam lobes at their highest point **[Figure 60-80-44]**.

If the measurement is less than the allowable limit, replace the camshaft.

Cam Lobe Height	1.335 in. (33,9 mm)
Allowable Limit	1.333 in. (33,85 mm)

Figure 60-80-45



Put the camshaft in V-blocks. Install a dial indicator **[Figure 60-80-45]**.

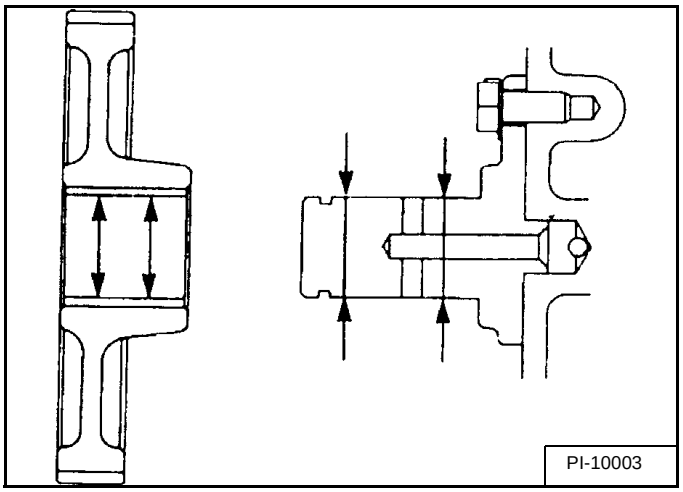
Turn the camshaft at a slow rate. If the misalignment exceeds the allowable limit, replace the camshaft.

Camshaft Alignment Allowable Limit	0.0004 in. (0,01 mm)

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Idler Gear And Shaft Servicing

Figure 60-80-46



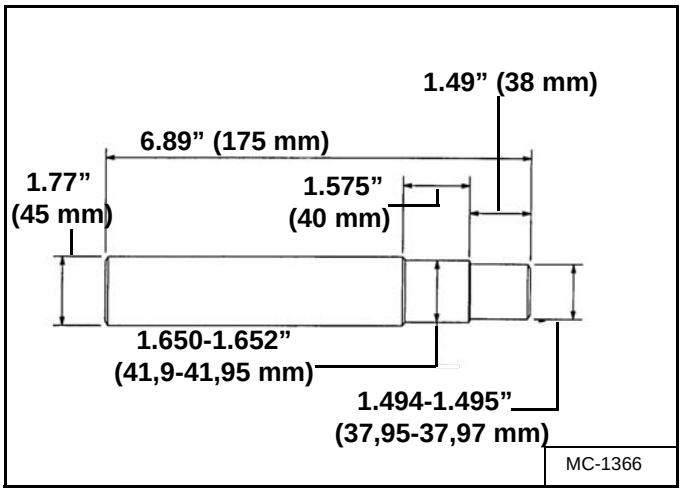
Measure the O.D. of the idler gear shaft **[Figure 60-80-46]**.

Measure the I.D. of the idler gear bushing **[Figure 60-80-46]**.

If the clearance exceeds the allowable limit, replace the bushing.

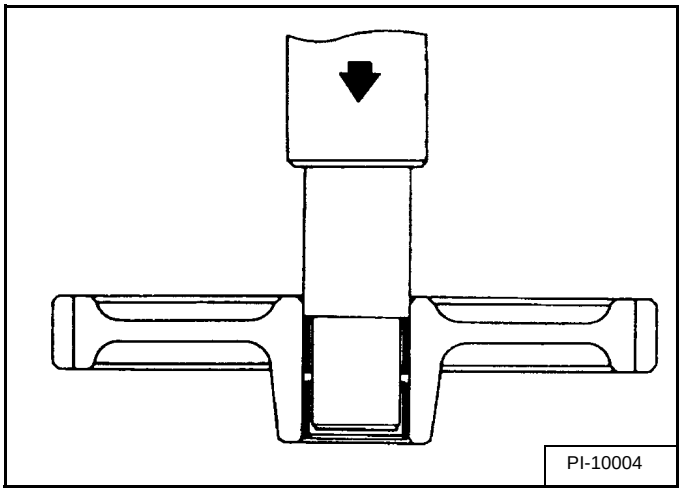
Idler Gear Shaft O.D.	1.494-1.495 in. (37,96-37,98 mm)
Idler Gear Bushing I.D.	1.496-1.497 in. (38,0-38,03 mm)
Clearance Between Idler Shaft & Gear Bushing	0.001-0.0026 in. (0,025-0,066 mm)
Allowable Limit	0.004 in. (0,1 mm)

Figure 60-80-47



To replace the idler gear bushing, make a driver tool as shown in figure **[Figure 60-80-47]**.

Figure 60-80-48



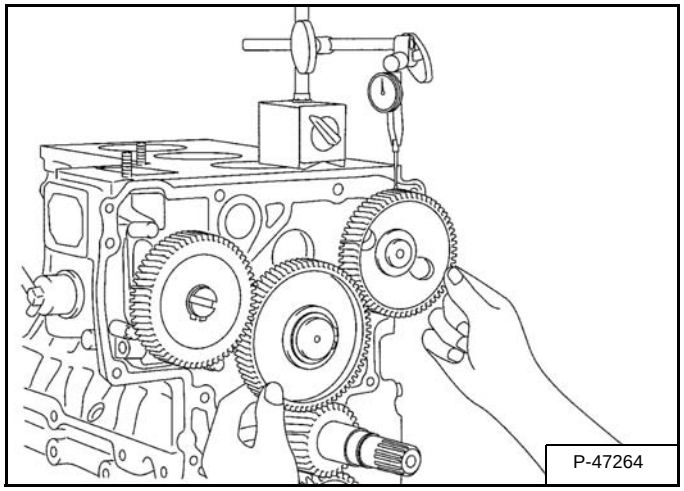
Use a press and special driver tool to remove the old bushing and install the new bushing **[Figure 60-80-48]**.

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Timing Gears Checking Backlash

When the gears are installed, check the backlash of the gears.

Figure 60-80-49



Install a dial indicator **[Figure 60-80-49]**.

Hold one gear while turning the other gear **[Figure 60-80-49]**.

If the backlash exceeds the allowable limit, check the oil clearance of the shaft and gear. If the oil clearance is correct, replace the gear.

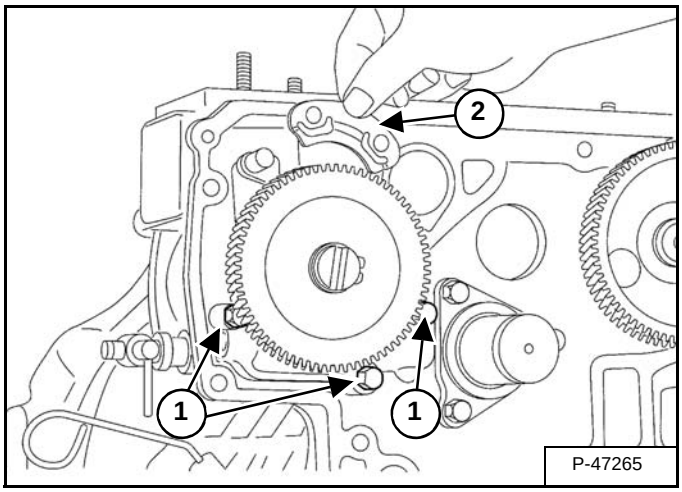
Crank Gear & Idler Gear	0.0016-0.0044 in. (0,042-0,112)
Allowable Limit	0.006 in. (0,15 mm)
Cam Gear & Idler Gear	0.0016-0.0045 in. (0,042-0,115 mm)
Allowable Limit	0.006 in. (0,15 mm)
Injection Pump Gear & Idler Gear	0.0016-0.0045 in. (0,042-0,115 mm)
Allowable Limit	0.006 in. (0,15 mm)
Oil Pump Gear & Crankgear	0.0016-0.0043 in. (0,042-0,109 mm)
Allowable Limit	0.006 in. (0,15 mm)

Fuel Camshaft Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-80-10.)

Remove the idler gear. (See Idler Gear And Camshaft Removal And Installation on Page 60-80-13.)

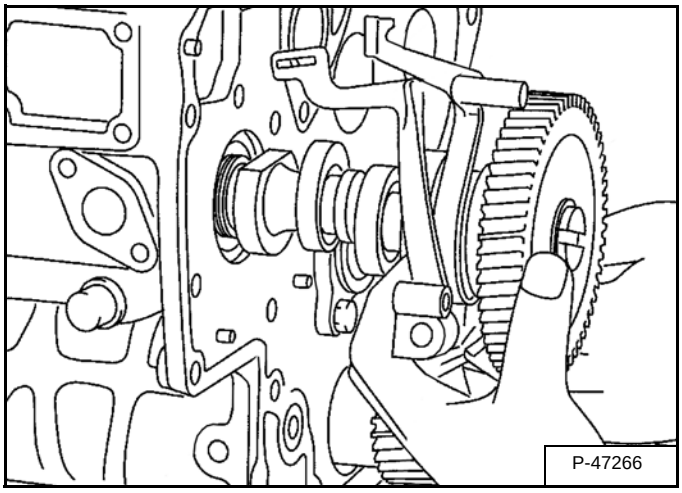
Figure 60-80-50



Remove the three bolts (Item 1) **[Figure 60-80-50]**.

Remove the two bolts and fuel camshaft retainer plate (Item 2) **[Figure 60-80-50]**.

Figure 60-80-51



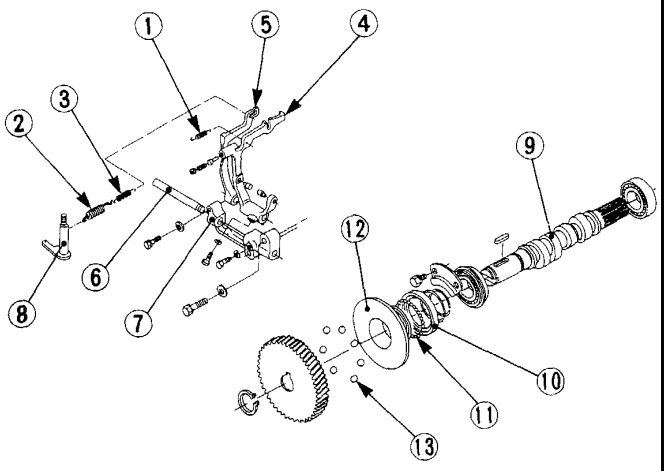
Remove the fuel camshaft and fork lever assembly at the same time **[Figure 60-80-51]**.

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Fuel Camshaft Governor

The governor serves to keep the engine speed constant by automatically adjusting the amount of fuel supplied to the engine according to changes in the load.

Figure 60-80-52



1. **Start Spring**
2. **Governor Spring**
3. **Governor Spring**
4. **Fork Lever**
5. **Fork Lever**
6. **Fork Lever Shaft**
7. **Fork Lever Holder**
8. **Governor Lever**
9. **Fuel Camshaft**
10. **Governor Ball Case**
11. **Steel Balls**
12. **Governor Sleeve**
13. **Steel Ball**

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Disassemble and assemble the governor and fuel camshaft as shown in figure **[Figure 60-80-52]**.

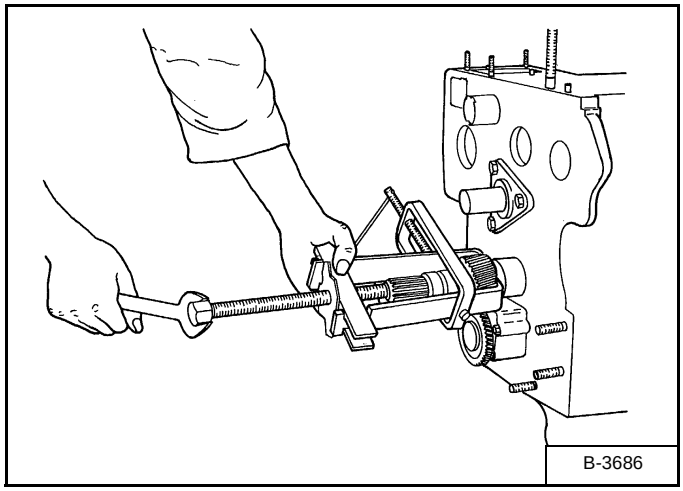
Check all the parts for wear or damage and replace as needed.

Crankshaft Gear Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-80-10.)

Remove the idler gear. (See Idler Gear And Camshaft Removal And Installation on Page 60-80-13.)

Figure 60-80-53



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Remove the crankshaft gear with a puller **[Figure 60-80-53]**.

Remove the crankshaft key.

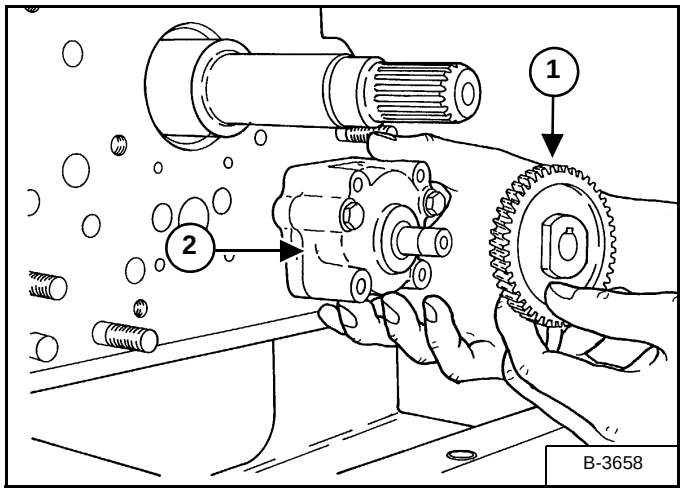
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Oil Pump Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-80-10.)

Remove the crankshaft gear.

Figure 60-80-54



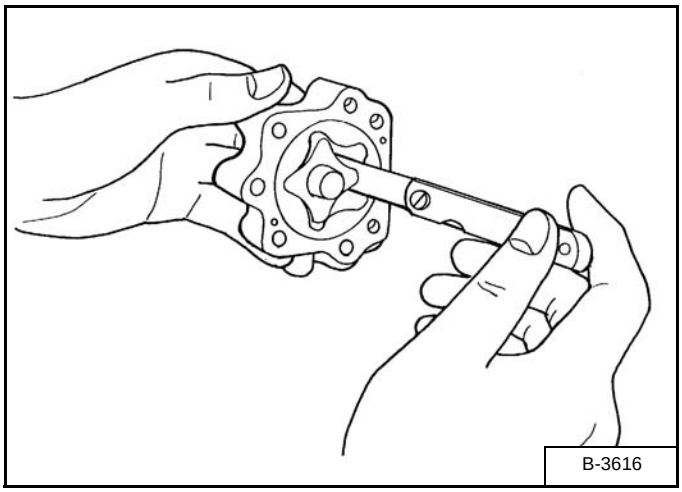
Remove the nut from the oil pump shaft. Use a puller to remove the oil pump gear (Item 1) **[Figure 60-80-54]**.

Remove the oil pump mounting bolts. Remove the oil pump (Item 2) **[Figure 60-80-54]**.

Installation: Tighten the oil pump mounting bolts to 60-72 in.-lb. (6,9-8,1 N•m) torque.

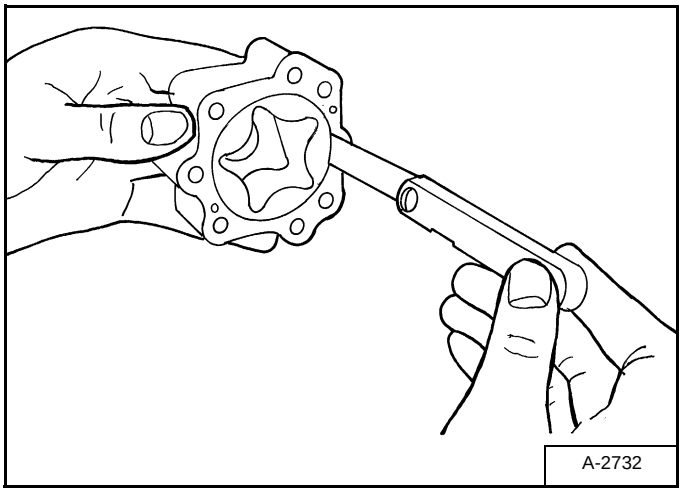
Oil Pump Service

Figure 60-80-55



Measure the clearance between the lobes of the inner rotor and outer rotor **[Figure 60-80-55]**.

Figure 60-80-56



Measure the clearance between the outer rotor and pump body **[Figure 60-80-56]**.

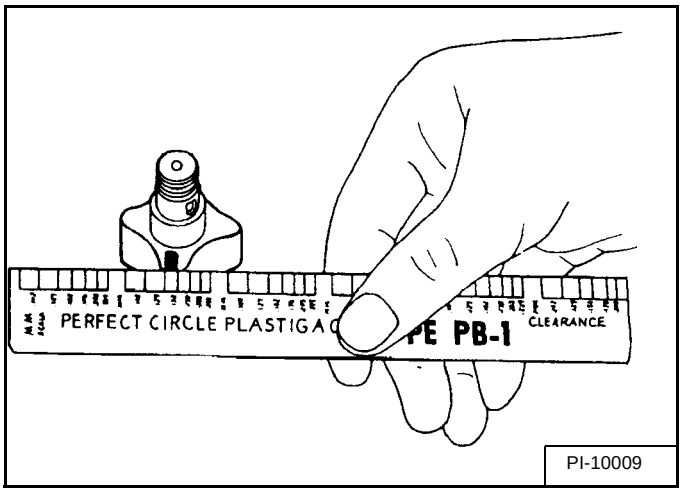
If the clearance exceeds the allowable limit, replace the oil pump.

Clearance Between Inner & Outer Rotor
0.0012-0.0055 in.
(0,03-0,14 mm)
Clearance Between Outer Rotor & Body
0.0043-0.0075 in.
(0,11-0,19 mm)

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Oil Pump Service (Cont'd)

Figure 60-80-57



Put a piece of press gauge on the rotor face **[Figure 60-80-57]**.

Install the cover and tighten the bolts.

Remove the cover carefully. Measure the width of the press gauge **[Figure 60-80-57]**.

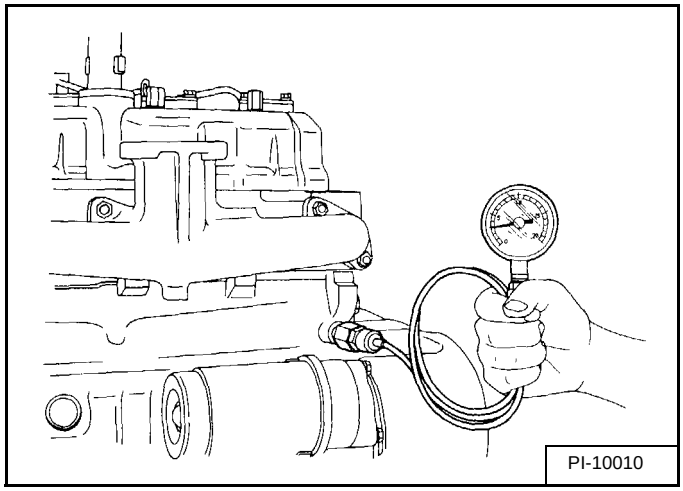
If the clearance exceeds the allowable limit replace the oil pump.

End Clearance	0.0041-0.0059 in. (0,105-0,15 mm)

Checking Engine Oil Pressure

Remove the oil pressure sender.

Figure 60-80-58



Install a pressure gauge **[Figure 60-80-58]**.

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

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

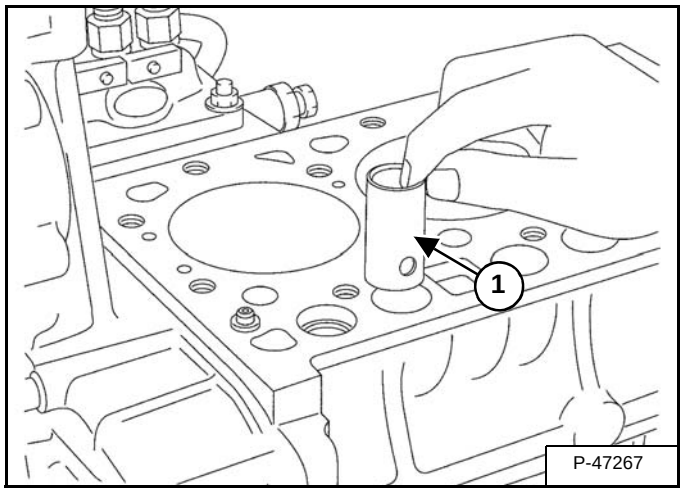
* Engine Oil Level Low
* Oil Pump Defective
* Oil Galley Plugged
* Oil Strainer Plugged
* Excessive Clearance at the Rod & Main Bearings
* Oil Pump Relief Valve Stuck

At Idle Speed Allowable Limit	7 PSI (0,48 bar)
At Rated Speed	43-64 PSI (2,94-4,4 bar)
Allowable Limit	36 PSI (2,5 bar)

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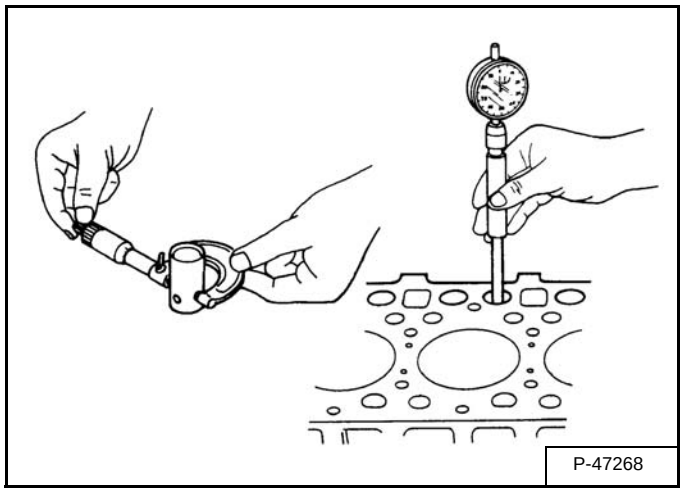
Valve Tappets

Figure 60-80-59



Remove the valve tappets (Item 1) **[Figure 60-80-59]**.

Figure 60-80-60



Measure the O.D. of the tappet **[Figure 60-80-60]**.

Measure the ID of the tappet bore **[Figure 60-80-60]**.

If the clearance exceeds the allowable limit, replace the tappets.

Tappet OD	0.943-0.944 in. (23,96-23,98 mm)
Tappet Bore ID	0.945-0.946 in. (24,0-24,021 mm)
Clearance Between Tappet and Tappet Bore	0.0008-0.0024 in. (0,02-0,062 mm)
Allowable Limit	0.0028 in. (0,07 mm)

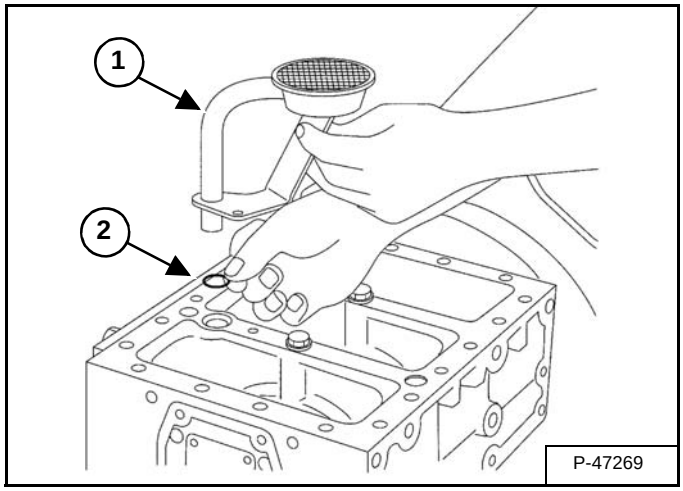
Piston And Connecting Rod Removal And Installation

Remove the cylinder head. (See Cylinder Head Removal And Installation on Page 60-80-1.)

Remove the top edge from the cylinder bore with a ridge reamer.

Remove the oil pan.

Figure 60-80-61



Remove the oil pump strainer (Item 1) and O-ring (Item 2) **[Figure 60-80-61]** by tapping the edge of the strainer with a soft faced hammer.

Turn the flywheel and put a pair of connecting rods at bottom dead center.

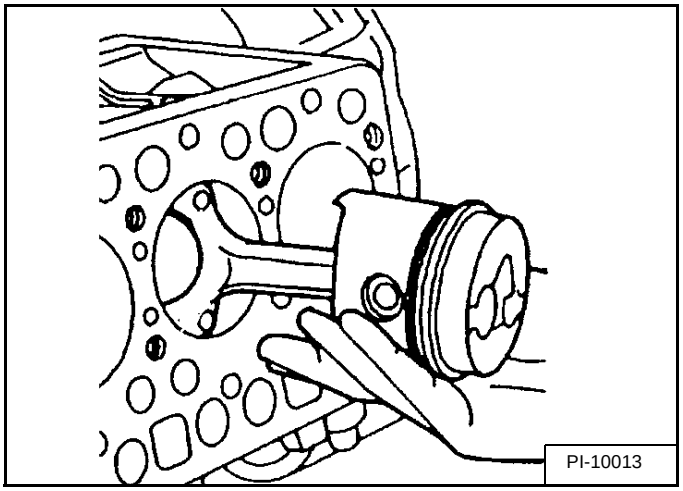
Remove the connecting rod bolts.

Installation: Tighten the connecting rod bolts to 33-36 ft.-lb. (44-49 N•m) torque.

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

Figure 60-80-62

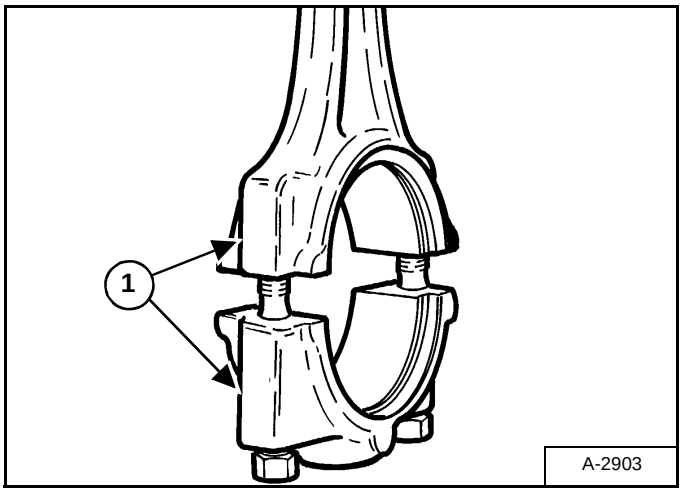


Remove the rod cap and bearing **[Figure 60-80-62]**.

Use a hammer handle and push the piston/connecting rod assembly out of the cylinder bore **[Figure 60-80-62]**.

NOTE: Make sure the pistons are marked so they will be returned to the same cylinder bore.

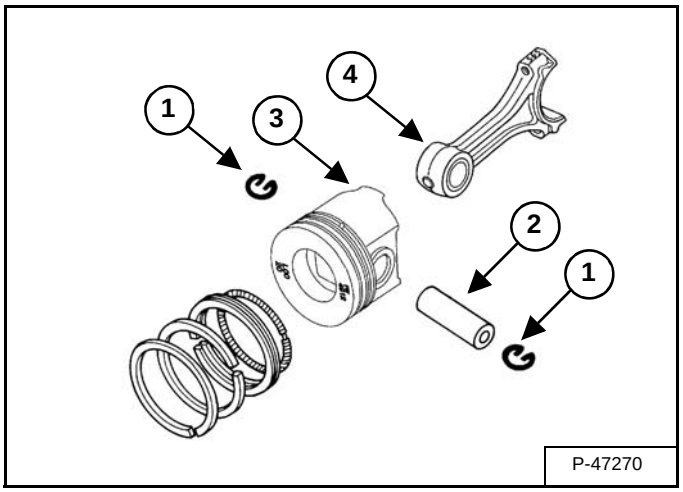
Figure 60-80-63



Installation: Make sure the marks on the connecting rod and bearing are aligned when installing the bearing cap (Item 1) **[Figure 60-80-63]**.

Repeat the procedure to remove the other piston/ connecting rod assemblies from the engine block.

Figure 60-80-64

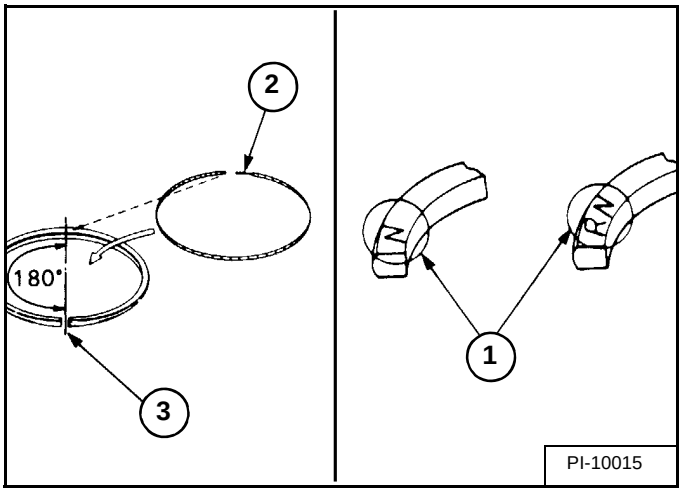


Remove the piston rings **[Figure 60-80-64]**.

Remove the snap ring (Item 1) and piston pin (Item 2) **[Figure 60-80-64]**.

Separate the piston (Item 3) from the connecting rod (Item 4) **[Figure 60-80-64]**.

Figure 60-80-65

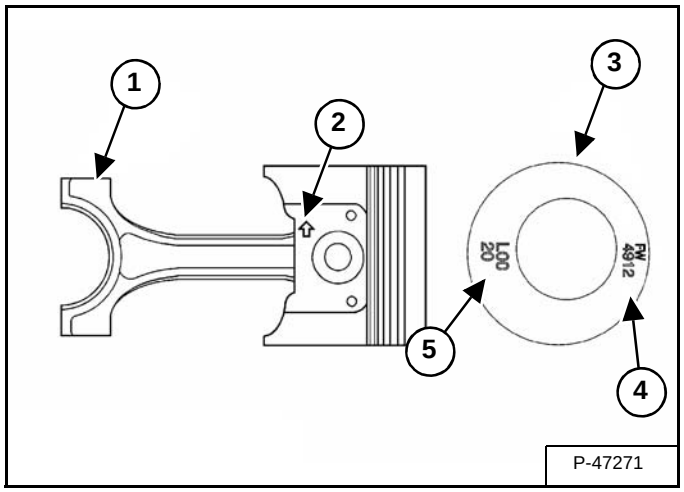


Installation: When installing new rings, assemble the ring so the mark (Item 1) near the gap faces the top of the piston. When installing the oil ring, place the expander joint (Item 2) on the opposite side of the oil ring gap (Item 3) **[Figure 60-80-65]**.

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

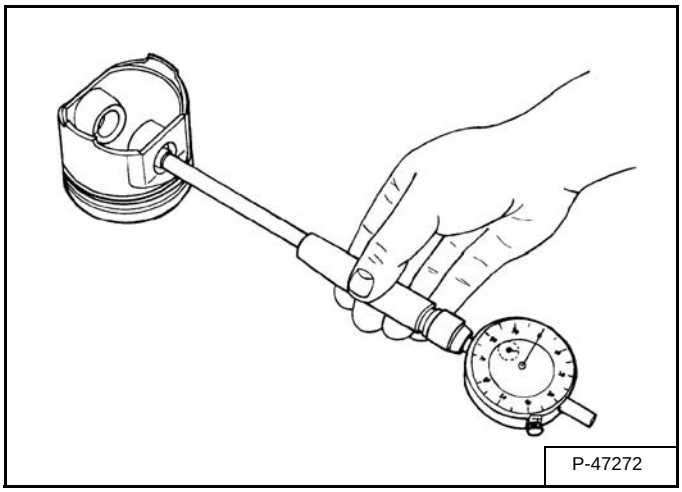
Figure 60-80-66



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

Piston And Connecting Rod Servicing

Figure 60-80-67

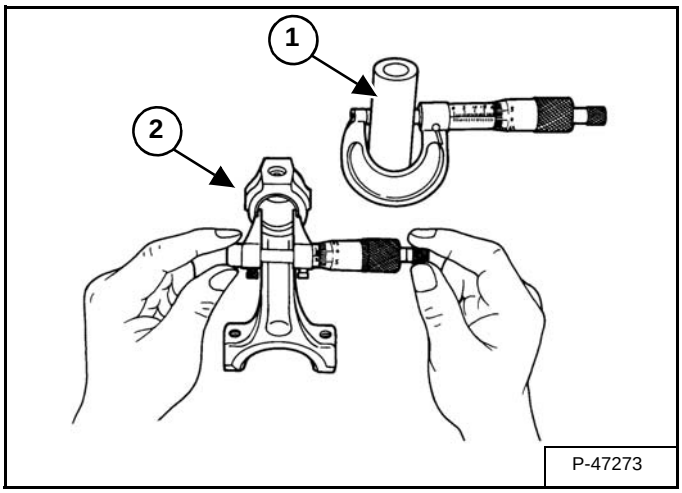


Measure the I.D. of the piston pin bore in both horizontal and vertical directions **[Figure 60-80-67]**.

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

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

Figure 60-80-68



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

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

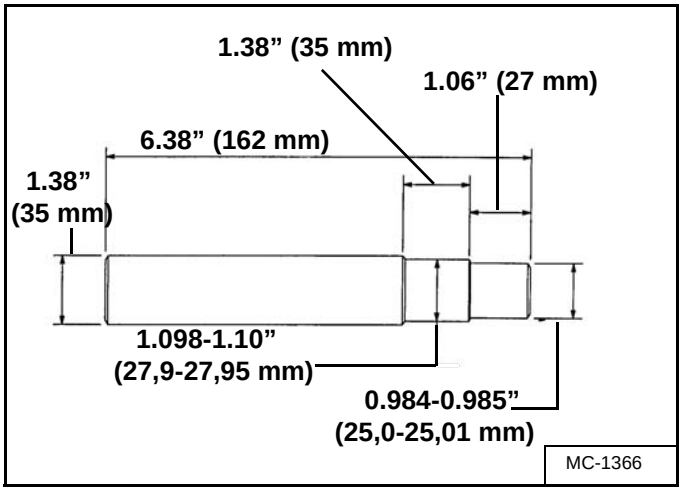
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Piston And Connecting Rod Servicing (Cont'd)

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

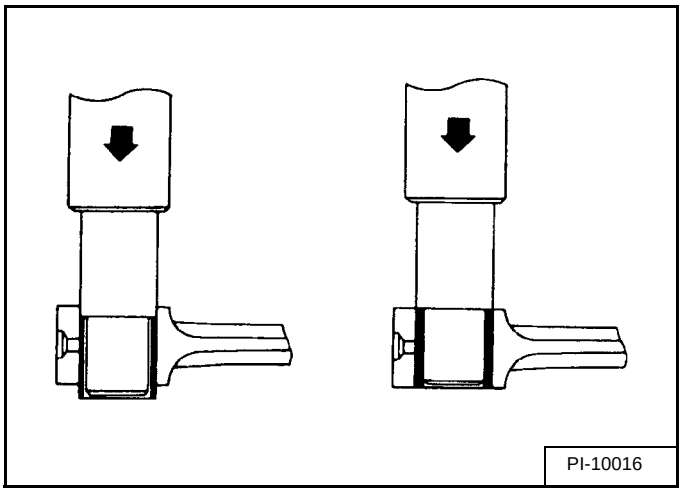
Piston Pin O.D.	0.984-0.985 in. (25,0-25,011 mm)
Bushing I.D.	0.985-0.986 in. (25,025-25,04 mm)
Oil Clearance Between Piston Pin & Bushing	0.0006-0.0015 in. (0,014-0,038 mm)
Allowable Limit	0.006 in. (0,15 mm)

Figure 60-80-69



To replace the connecting rod small end bushing, make a driver tool as shown in figure **[Figure 60-80-69]**.

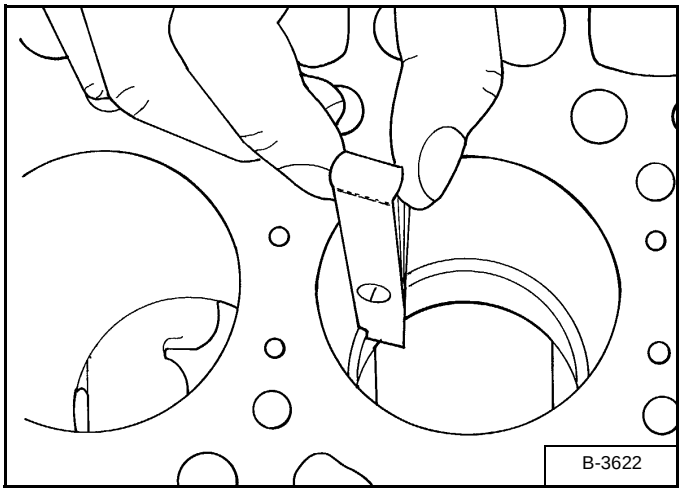
Figure 60-80-70



Use a press and special driver tool to remove the small end bushing **[Figure 60-80-70]**.

Installation: Clean the small end bushing and bore. Put oil on the bushing and press into the connecting rod until it is flush **[Figure 60-80-70]**.

Figure 60-80-71



Install a piston ring into the lower part of the cylinder bore. Measure the ring gap with a feeler gauge **[Figure 60-80-71]**.

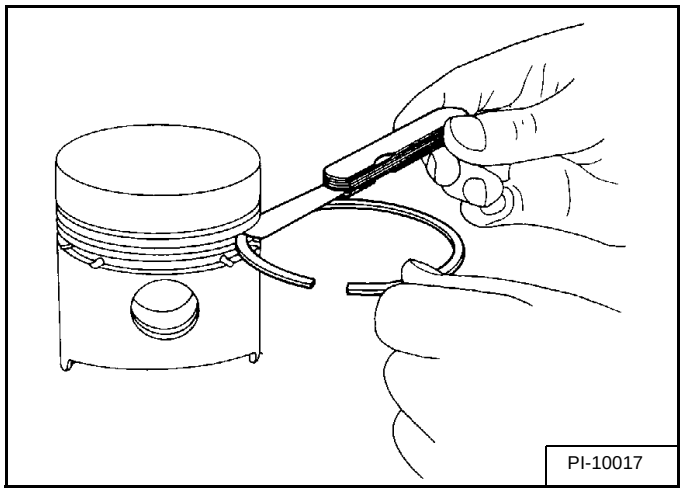
If the gap exceeds the allowable limit, replace the ring.

Top Ring Gap	0.008-0.0138 in. (0,2-0,35 mm)
Oil Ring Gap	0.0079-0.0157 in. (0,20-0,40 mm)
Allowable Limit	0.05 in. (1,25 mm)
Second Ring Gap	0.0138-0.0197 in. (0,35-0,50 mm)

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Piston And Connecting Rod Servicing (Cont'd)

Figure 60-80-72



Remove the carbon from the ring grooves. Measure the clearance between the ring and groove with a feeler gauge **[Figure 60-80-72]**.

If the clearance exceeds the allowable limit, replace the ring. If the clearance still exceeds the allowable limit, replace the piston.

Compression Rings	0.0020-0.0035 in. (0,050-0,090 mm)
Oil Ring	0.0012-0.0028 in. (0,03-0,07 mm)

Connecting Rod Alignment

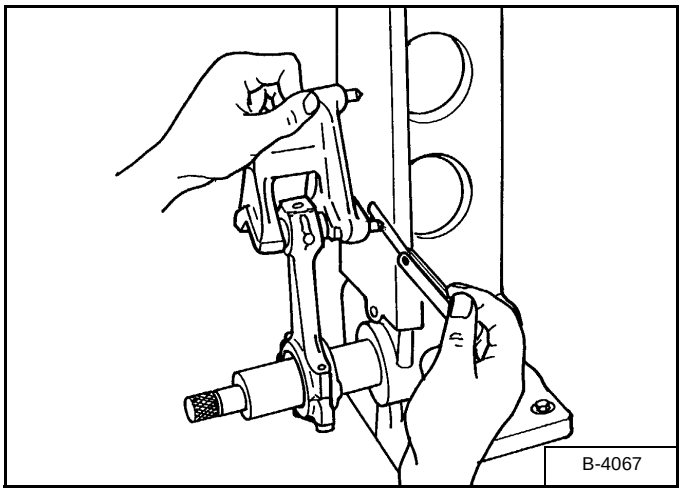
NOTE: The small end bushing is the basis of this check, check the bushing for wear before doing this check.

Install the piston pin into the connecting rod.

Install the connecting rod on an alignment tool.

Put the gauge over the piston pin and move it against the face plate.

Figure 60-80-73



If the gauge does not fit squarely against the face plate, measure the space between the gauge and face plate **[Figure 60-80-73]**.

If the measurement exceeds the allowable limit, replace the connecting rod.

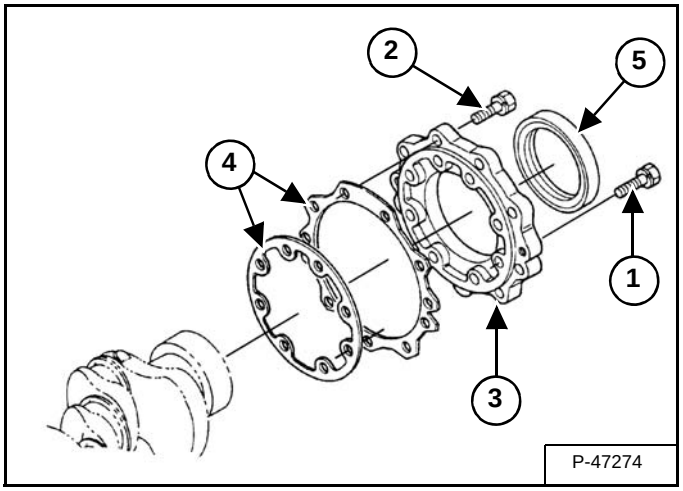
Rod Alignment	0.002 in. (0,05 mm)

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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 60-80-20.)

Figure 60-80-74



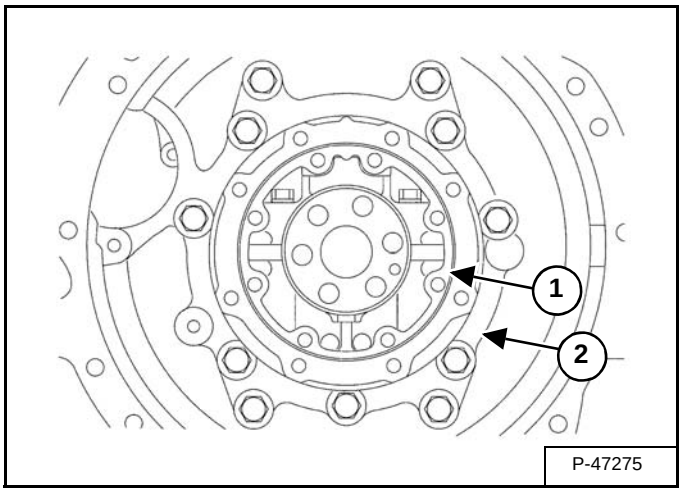
Mark and remove the inside screws (Item 1) first, then remove the outside screws (Item 2) **[Figure 60-80-74]**.

NOTE: The inside bolts are different length than the outside bolts.

Install two screws in the bearing case cover and remove the cover (Item 3) **[Figure 60-80-74]**.

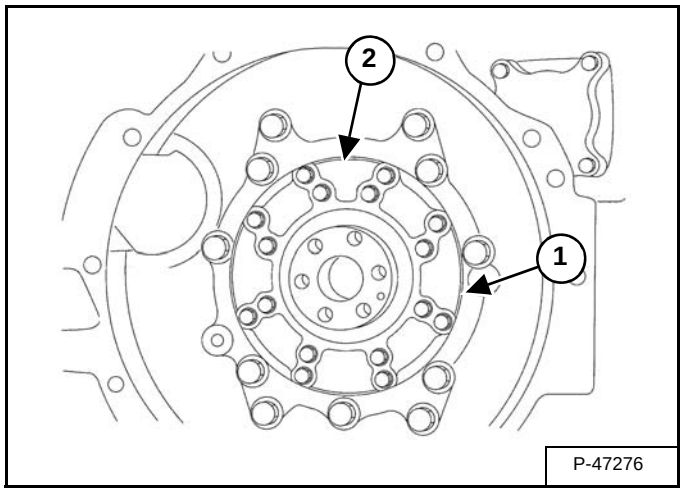
Remove the two gaskets (Item 4) and oil seal (Item 5) **[Figure 60-80-74]** from the cover.

Figure 60-80-75



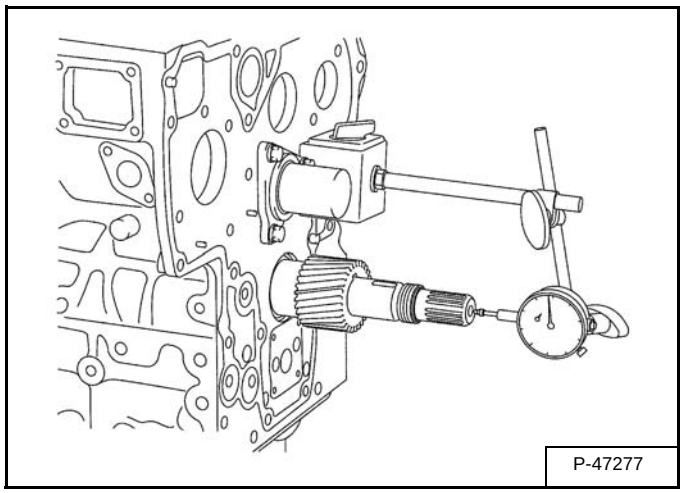
Installation: Install the gaskets (Item 1) & (Item 2) **[Figure 60-80-75]** as shown.

Figure 60-80-76



Install the bearing case cover (Item 1) with the casting mark (Item 2) **[Figure 60-80-76]** in the upward position. Tighten the bolts to 17-20 ft.-lb. (24-28 N•m) torque.

Figure 60-80-77



Before removing the crankshaft/main bearings, check the end play. Install a dial indicator. Move the crankshaft **[Figure 60-80-77]** to the flywheel side, zero the dial indicator. Measure the end play by pulling the crankshaft toward the gear case side.

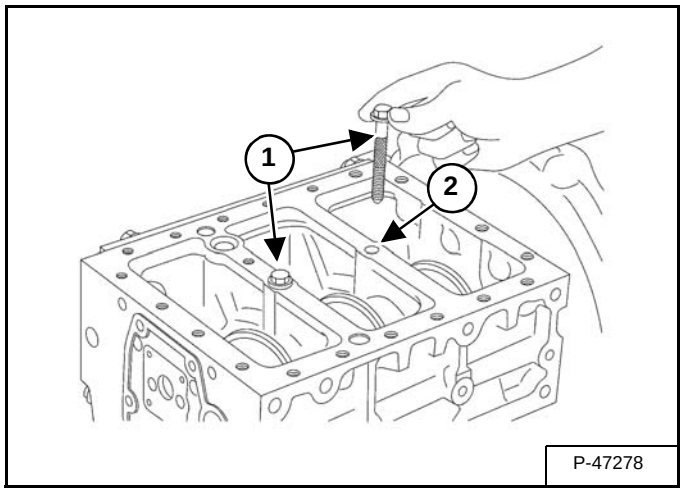
If the measurement exceeds the allowable limit, replace the thrust washers **[Figure 60-80-77]**.

End Play	0.006-0.014 in. (0,15-0,35 mm)
Allowable Limit	0.020 in. (0,5 mm)

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Crankshaft And Bearings Removal And Installation (Cont'd)

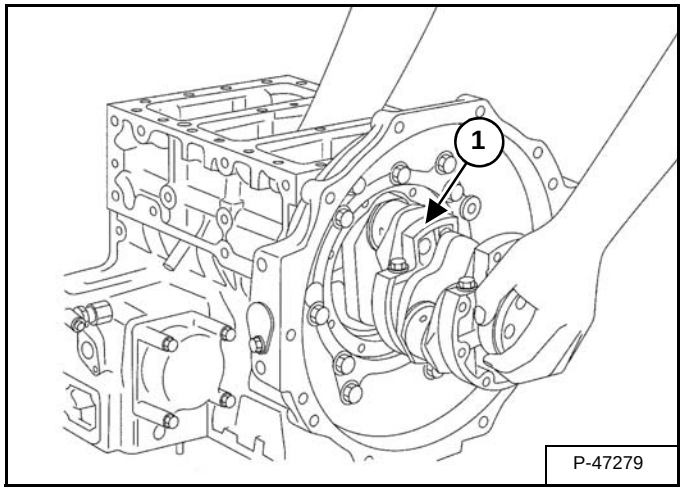
Figure 60-80-78



Remove the main bearing bolt (Item 1) **[Figure 60-80-78]**.

Installation: Align the bearing case hole with the hole in the block (Item 2) **[Figure 60-80-78]**. Put oil on the bolt threads and tighten to 51-54 ft.-lb. (69-74 N•m) torque.

Figure 60-80-79

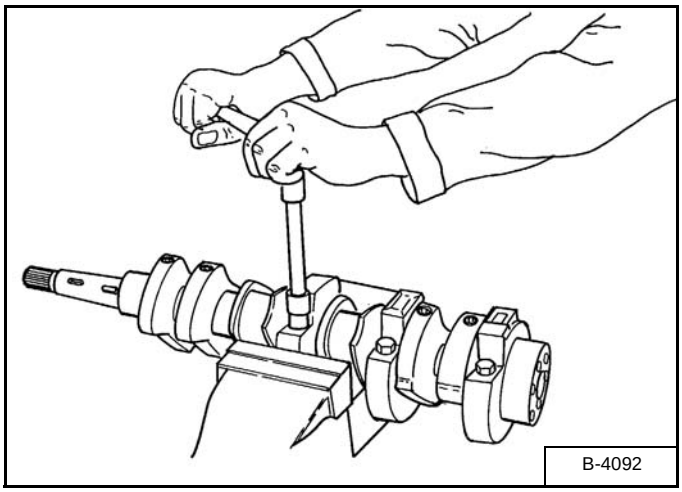


Remove the crankshaft/main bearing assembly from the engine block **[Figure 60-80-79]**.

NOTE: Turn the crankshaft as needed to allow the crank pin journals to pass through the cut out (Item 1) [Figure 60-80-79] of the engine block.

Mark the bearing case halves for correct installation.

Figure 60-80-80

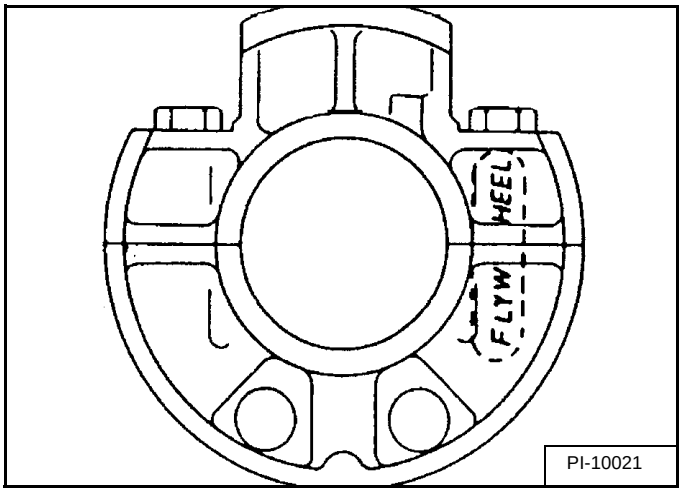


Remove the two bearing case bolts **[Figure 60-80-80]**.

Remove the bearing case and bearing.

Installation: Tighten the bearing case bolts to 34-38 ft.-lb. (46-51 N•m) torque.

Figure 60-80-81

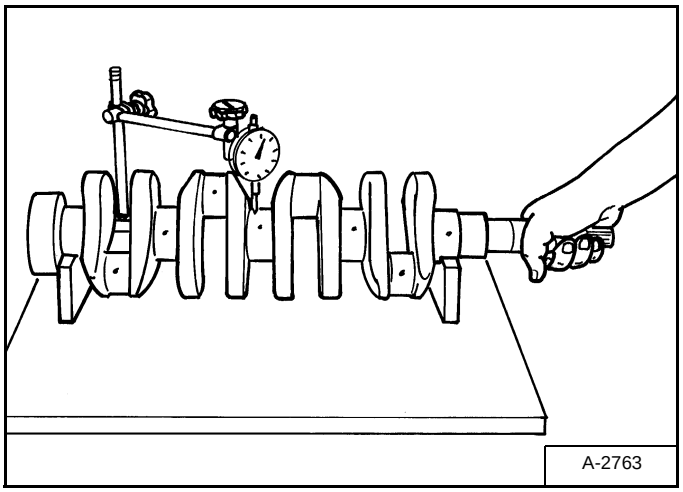


Installation: When installing the main bearing case assemblies, face the mark FLYWHEEL to the flywheel side of the engine block **[Figure 60-80-81]**. The thrust washers oil grooves must face outward.

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Crankshaft And Bearings Servicing

Figure 60-80-82



Put the crankshaft on V-blocks. Install a dial indicator on the center journal **[Figure 60-80-82]**.

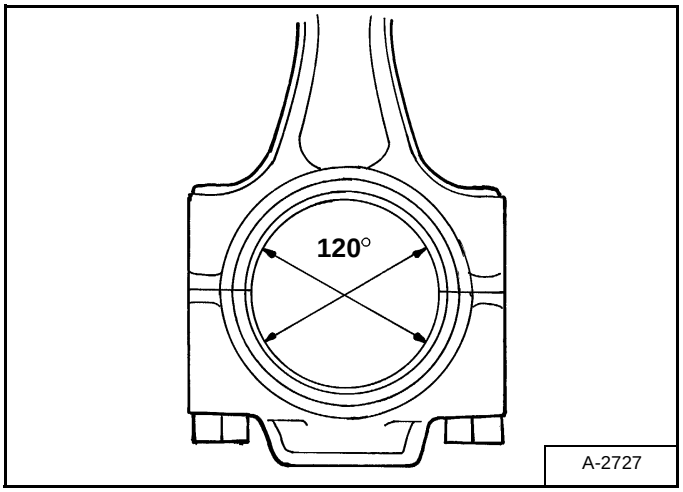
Turn the crankshaft at a slow rate to obtain the misalignment (one half of the alignment measurement).

If the misalignment exceeds the allowable limit, replace the crankshaft.

Alignment	0.0008 in. (0,02 mm)

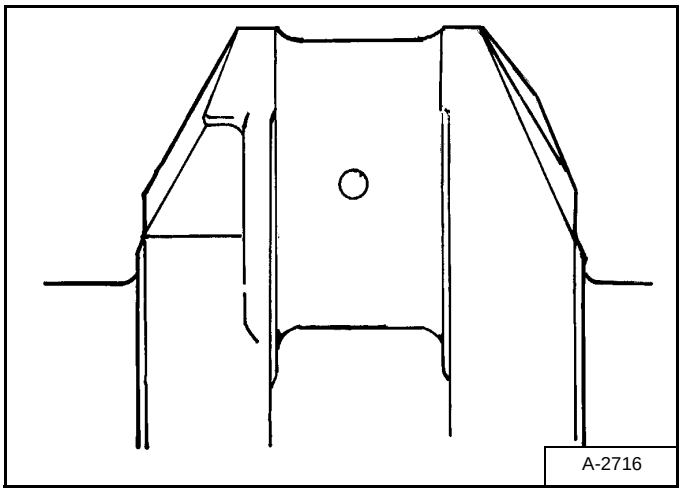
Tighten the connecting rod bolts to 33-36 ft.-lb. (44-49 N•m) torque.

Figure 60-80-83



Measure the crankpin bearing I.D. **[Figure 60-80-83]**.

Figure 60-80-84

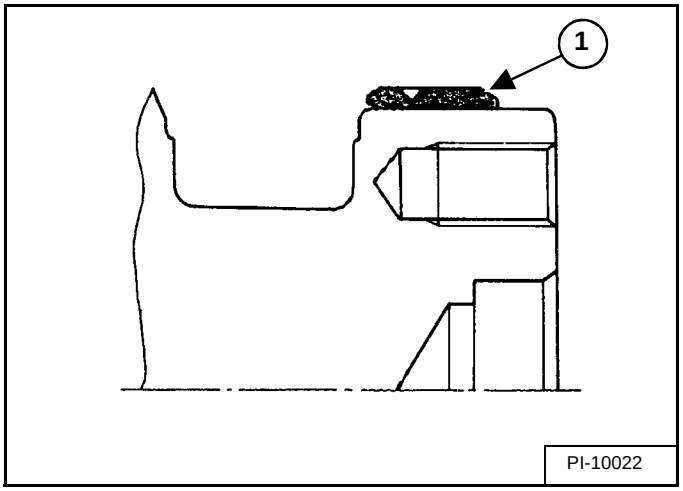


Measure the crankpin O.D. **[Figure 60-80-84]**.

Calculate the oil clearance.

Crankpin Bearing I.D.	1.850-1.852 in. (47,0-47,05 mm)
Crankpin O.D.	1.8488-1.8494 in. (49,96-46,98 mm)
Oil Clearance	0.001-0.0034 in. (0,025-0,087 mm)
Allowable Limit	0.008 in. (0,2 mm)

Figure 60-80-85



Check the wear on the crankshaft sleeve (Item 1) **[Figure 60-80-85]**.

If the wear exceeds the allowable limit or the seal leaks oil, replace the sleeve.

Wear of Sleeve	0.0039 in. (0,1 mm)

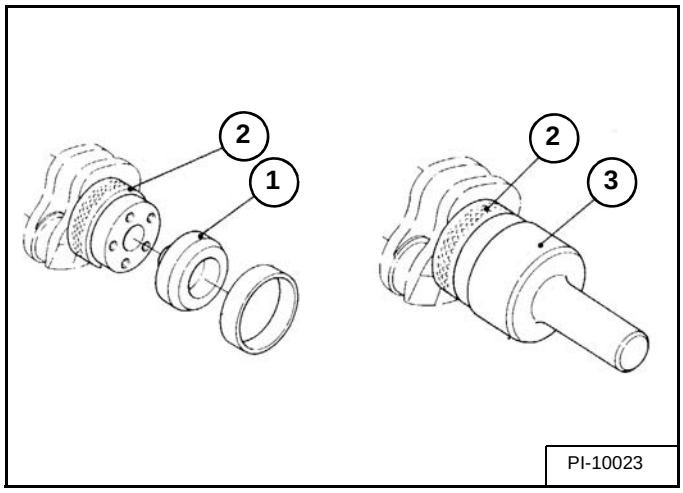
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Crankshaft And Bearings Servicing (Cont'd)

The special tool set will be needed to replace the crankshaft sleeve.

Remove the sleeve.

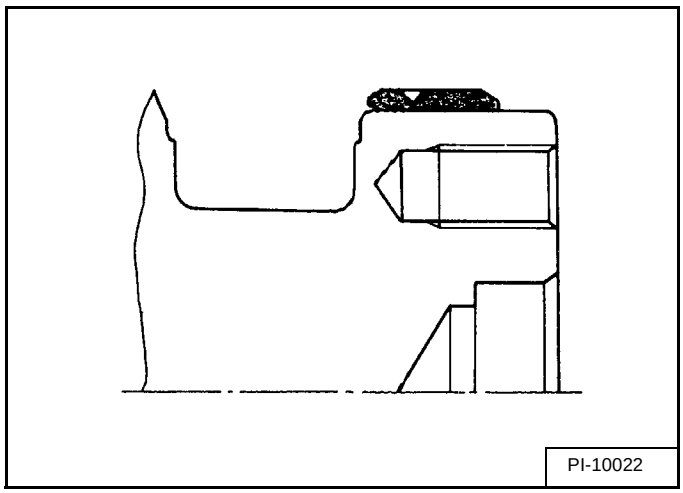
Figure 60-80-86



Install the sleeve guide (Item 1) and stop (Item 2) **[Figure 60-80-86]**.

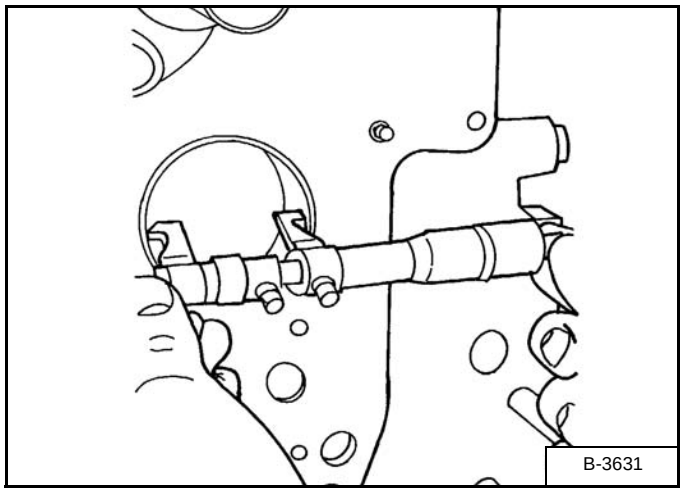
Heat the sleeve to approximately 302°-392° F (150°-200° C). Install the sleeve on the crankshaft using the special driver tool (Item 3) **[Figure 60-80-86]**.

Figure 60-80-87



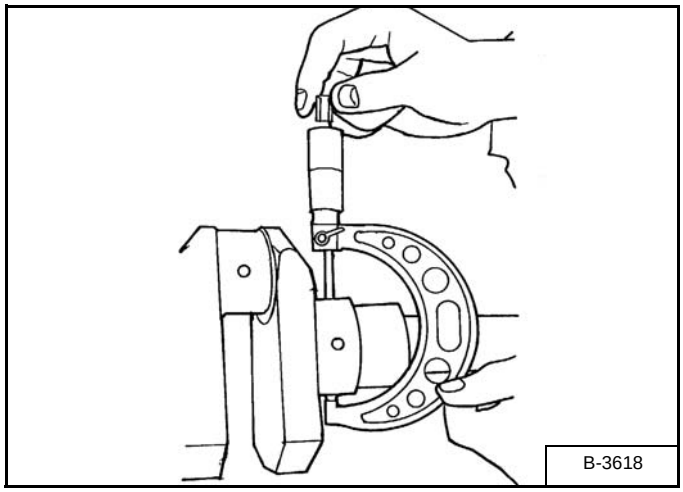
NOTE: The sleeve is installed with the larger chamfered surface to the front of the crankshaft (Item 1) [Figure 60-80-87].

Figure 60-80-88



Measure the I.D. of the No. 1 crankshaft bearing **[Figure 60-80-88]**.

Figure 60-80-89



Measure the O.D. of the crankshaft journal **[Figure 60-80-89]**.

Calculate the oil clearance.

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Crankshaft And Bearings Servicing (Cont'd)

If the clearance exceeds the allowable limit, replace the crankshaft bearing.

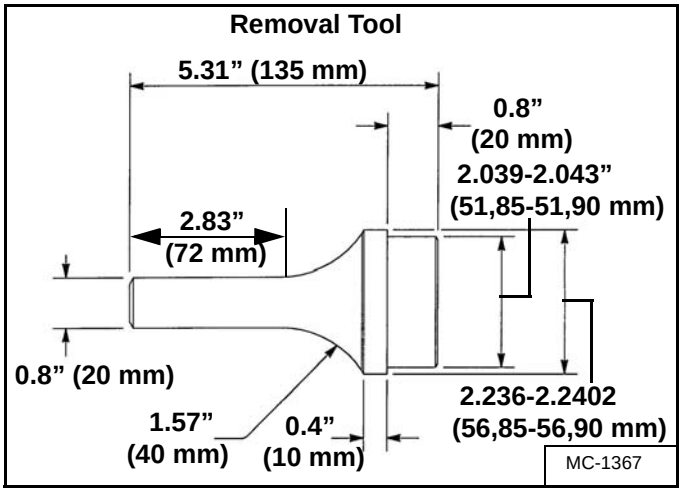
Engine S/N 3R9999 & Below

Bearing I.D.	2.046-0.049 in (51,98-52,04 mm)
Crankshaft Journal O.D.	2.044-2.045 in (51,92-51,94 mm)
Oil Clearance	0.0016-0.0041 in (0,04-0,104 mm)
Allowable Limit	0.008 in (0,2 mm)

Engine S/N 3S0001 & Above

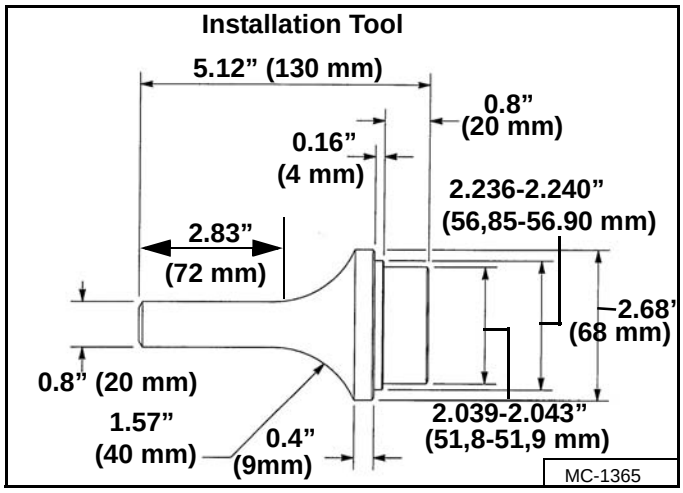
Bearing I.D.	2.3614-2.3637 in (59,98-60,039 mm)
Crankshaft Journal O.D.	2.3591-2.3598 in (59,921-59,940 mm)
Oil Clearance	0.0016-0.0041 in (0,04-0,104 mm)
Allowable Limit	0.008 in (0,2 mm)

Figure 60-80-90



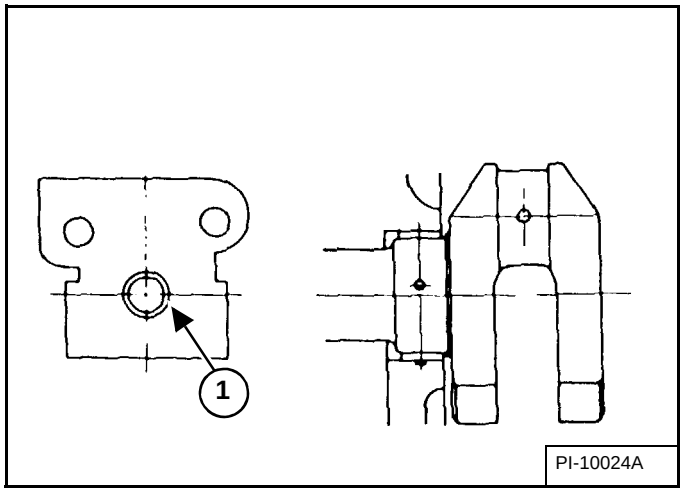
To remove the front bearing make the tool as shown in **[Figure 60-80-90]**.

Figure 60-80-91



To install the front bearing make the tool as shown in **[Figure 60-80-91]**.

Figure 60-80-92



Remove the front bearing with the special removal tool **[Figure 60-80-92]**.

Installation: Clean the new bearing and bore, apply oil to the bearing and bore. Install the new bearing with the seam (Item 1) **[Figure 60-80-92]** towards the exhaust manifold side, using the installation driver tool.

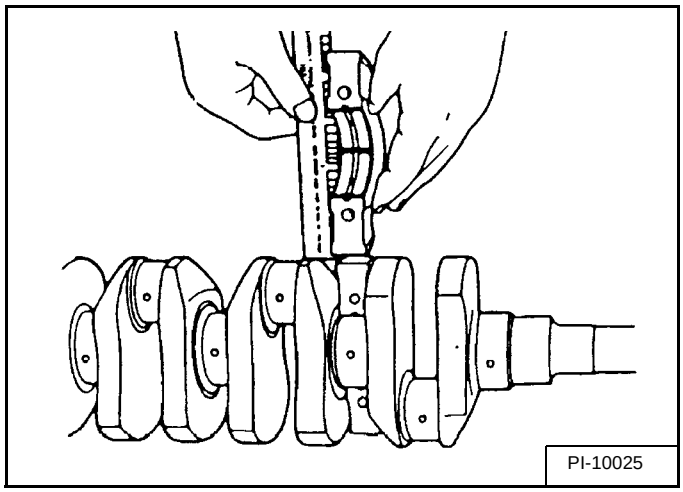
Clean the crankshaft journal and bearing. Put a strip of press gauge on the center journal.Install the main bearing case halves and tighten the bolts. Remove the bearing case halves.

NOTE: DO NOT turn the crankshaft with the press gauge installed. Incorrect measurements will be obtained.

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Crankshaft And Bearings Servicing (Cont'd)

Figure 60-80-93



Measure the flattened press gauge **[Figure 60-80-93]**.

If the clearance exceeds the allowable limit, replace the crankshaft bearing.

Engine S/N 3R9999 & Below

Crankshaft Journal O.D.	2.044-2.045 in (51,92-51,94 mm)
Bearing I.D.	2.046-2.048 in (51,98-52,03 mm)
Oil Clearance	0.001-0.0034 in (0,025-0,087 mm)
Allowable Limit	0.008 in (0,2 mm)

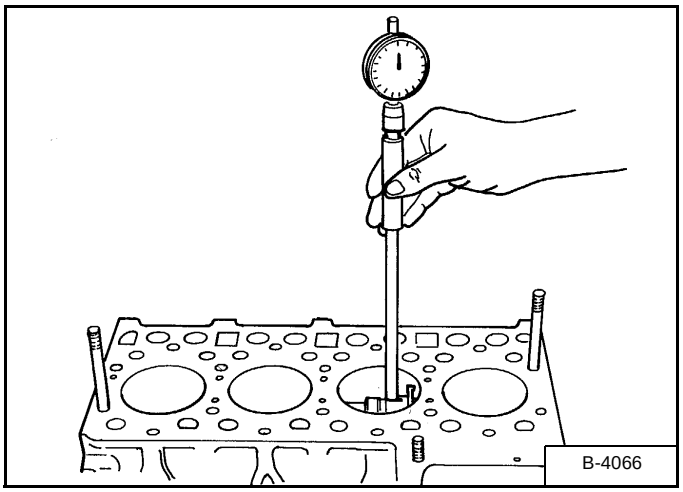
Engine S/N 3S0001 & Above

Crankshaft Journal O.D.	2.3591-2.3598 in (59,921-59,94 mm)
Bearing I.D.	2.3614-2.3632 in (59,98-60,025 mm)
Oil Clearance	0.001-0.0034 in (0.025-0.087 mm)
Allowable Limit	0.008 in (0,2 mm)

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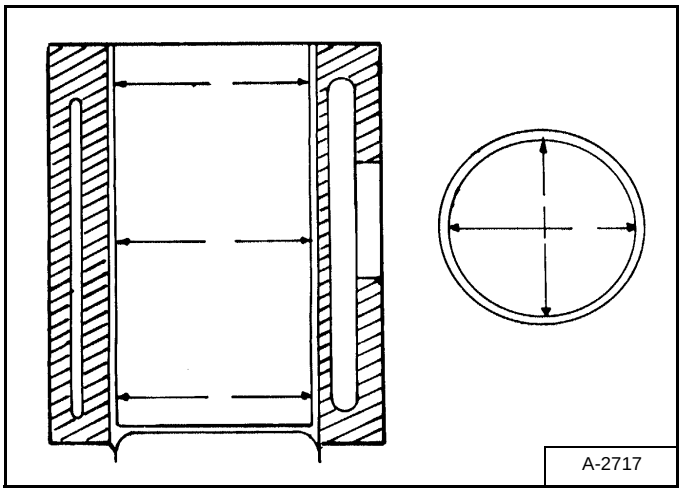
Cylinder Bore Checking

Figure 60-80-94



Use a gauge to check the inside measurement of the cylinder bore **[Figure 60-80-94]**.

Figure 60-80-95



Measure the six points as shown in **[Figure 60-80-95]** to find the maximum wear.

The specifications are 3.425-3.426 in. (87,0-87,02 mm). The wear limit is +0.006 in. (+0,15 mm).

If the cylinder bore is not within specifications, re-bore the cylinder for oversize piston.

Water Pump Removal And Installation

Drain the cooling system.

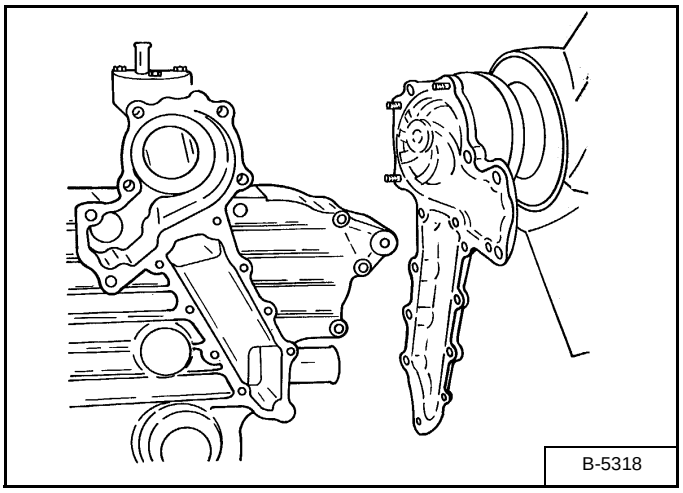
Remove the radiator. (See Removal And Installation on Page 60-40-1.)

Remove the alternator belt.

Remove the fan.

Remove the water pump bolts.

Figure 60-80-96



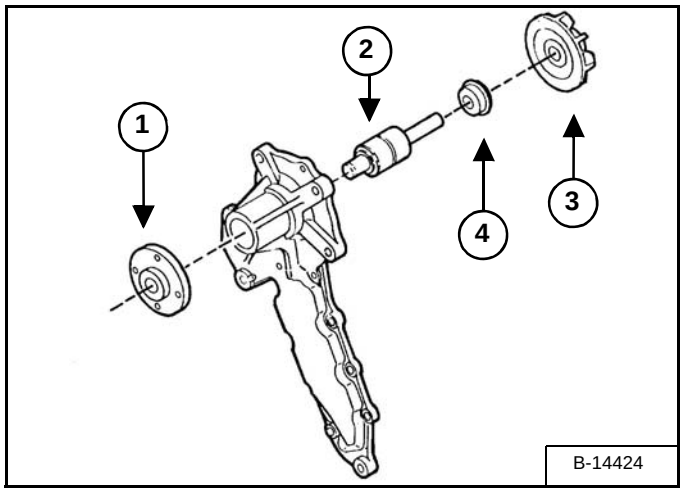
Remove the water pump **[Figure 60-80-96]**.

Installation: Always use a new gasket when installing the water pump.

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Water Pump Disassembly And Assembly

Figure 60-80-97



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

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

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

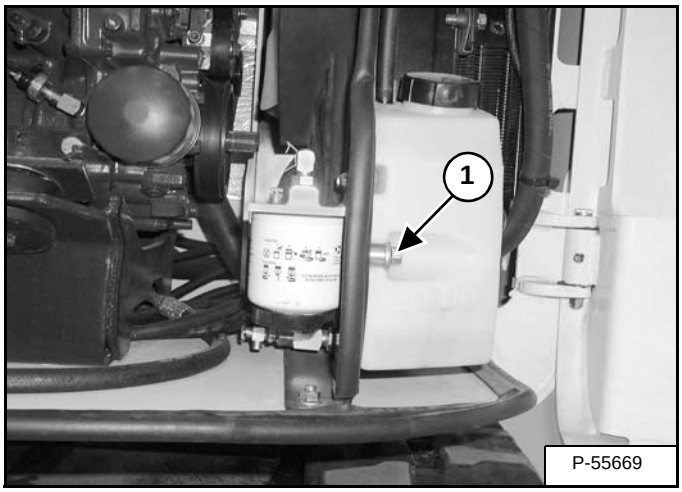
Remove the seal (Item 4) **[Figure 60-80-97]**.

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

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Fan Removal And Installation

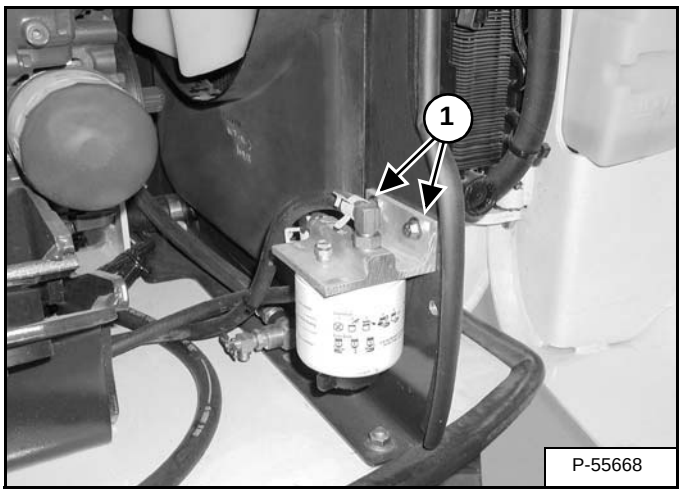
Figure 60-80-98



Remove the bolt (Item 1) **[Figure 60-80-98]** from the coolant recovery tank.

Relocate the coolant recovery tank.

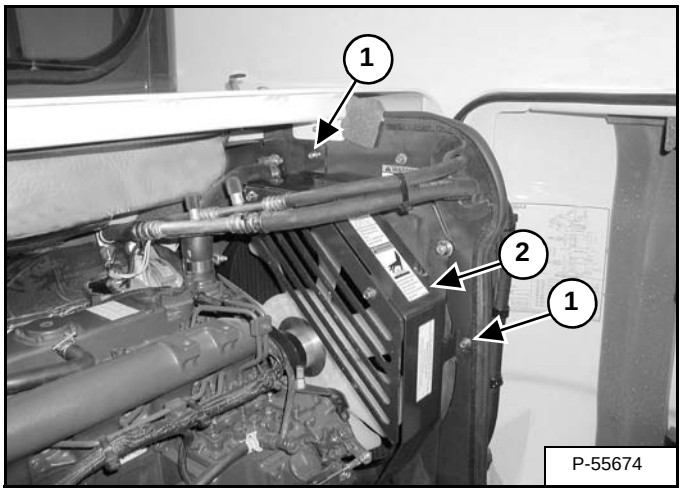
Figure 60-80-99



Remove the bolts (Item 1) **[Figure 60-80-99]** from the fuel filter mount.

Relocate the fuel filter mount.

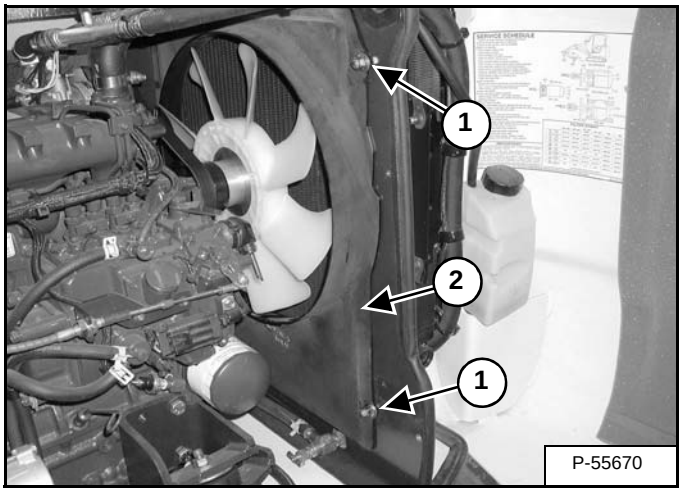
Figure 60-80-100



Remove the bolts (Item 1) from the fan shield (Item 2) **[Figure 60-80-100]**.

Remove the fan shield.

Figure 60-80-101

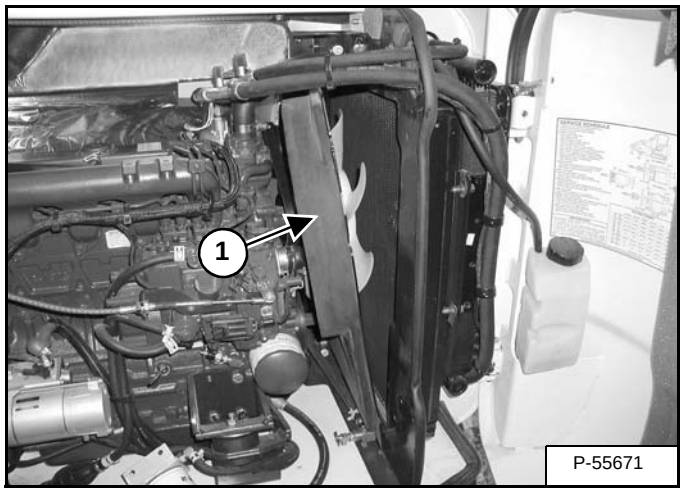


Remove the bolts (Item 1) from the shroud (Item 2) **[Figure 60-80-101]**.

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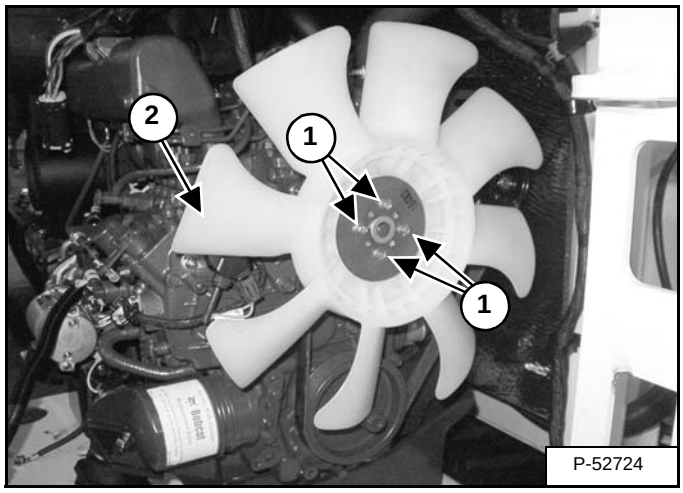
Fan Removal And Installation (Cont'd)

Figure 60-80-102



Position the shroud (Item 1) **[Figure 60-80-102]** as shown.

Figure 60-80-103



Remove the bolts (Item 1) **[Figure 60-80-103]**.

NOTE: The engine is shown removed for photo clarity.

Installation: Install new bolts with pre-applied thread adhesive. Tighten the bolts to 12-15 ft.-lb. (16,27 - 20,34 N•m) torque.

Remove the fan (Item 2) **[Figure 60-80-103]**.

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HEATING, VENTILATION, AIR CONDITIONING

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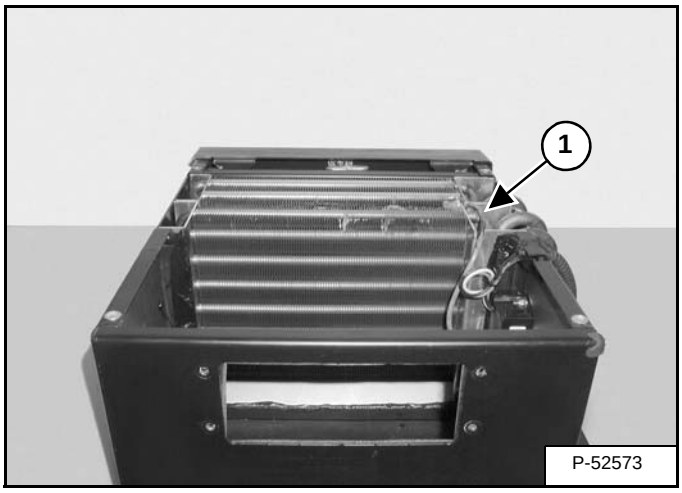
HEATER COIL (EARLY MODELS)

Removal And Installation With A/C

Remove the evaporator/heater unit from the excavator. (See Removal And Installation on Page 70-190-1.)

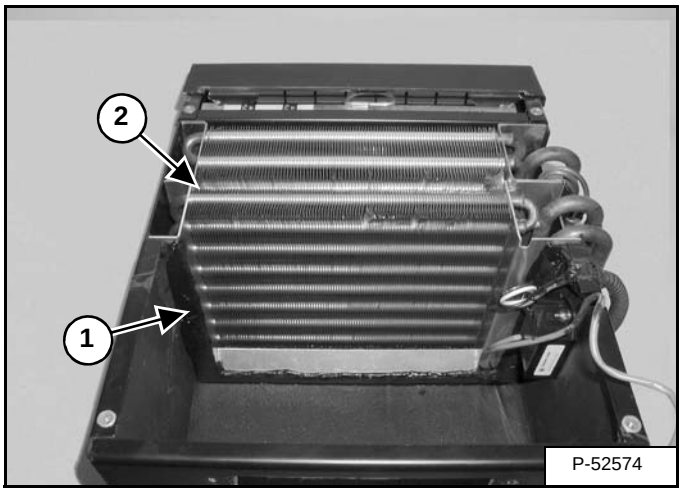
Remove the heater/AC fan. (See Removal And Installation on Page 70-20-1.)

Figure 70-10-1



Remove the thermostat probe (Item 1) **[Figure 70-10-1]** from the evaporator. Move the probe to allow clearance for the heater coil removal.

Figure 70-10-2



Remove the refrigerator tape (Item 1) **[Figure 70-10-2]** from the sides and bottom of the heater coil.

Lift the heater coil (Item 2) **[Figure 70-10-2]** straight up and remove it from the evaporator/heater unit.

Removal And Installation Without A/C

Not available at time of print.

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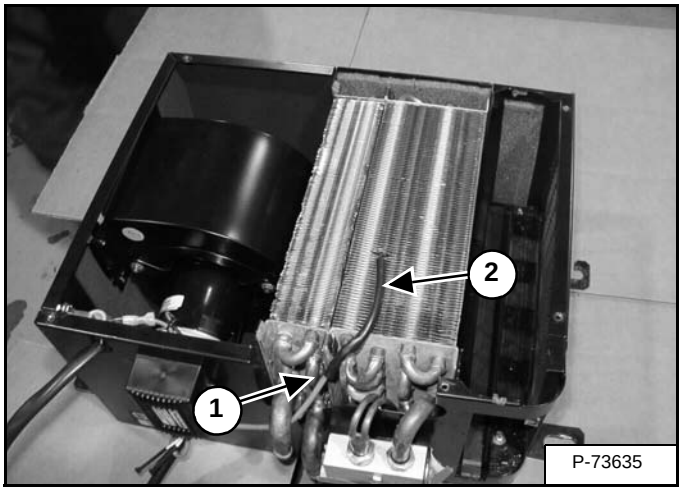
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HEATER COIL (LATER MODELS)

Removal And Installation With A/C

Remove the evaporator/heater unit from the excavator. (See Removal And Installation on Page 70-190-1.)

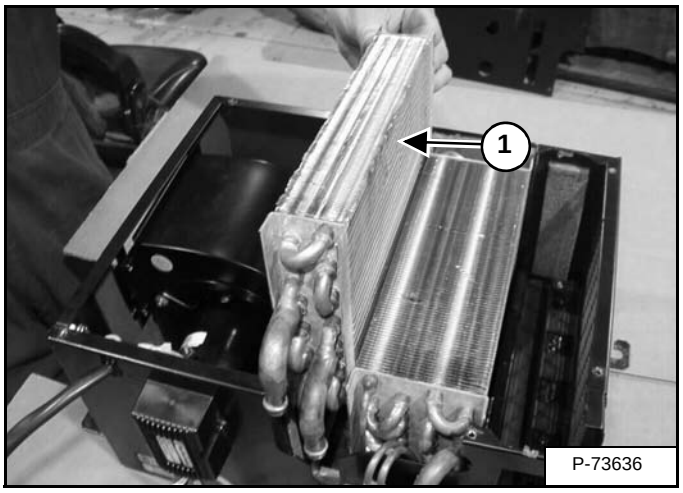
Figure 70-11-1



Remove the tie strap (Item 1) **[Figure 70-11-1]**.

Remove the thermostat probe (Item 2) **[Figure 70-11-1]** from the evaporator. Move the probe to allow clearance for the heater coil removal.

Figure 70-11-2

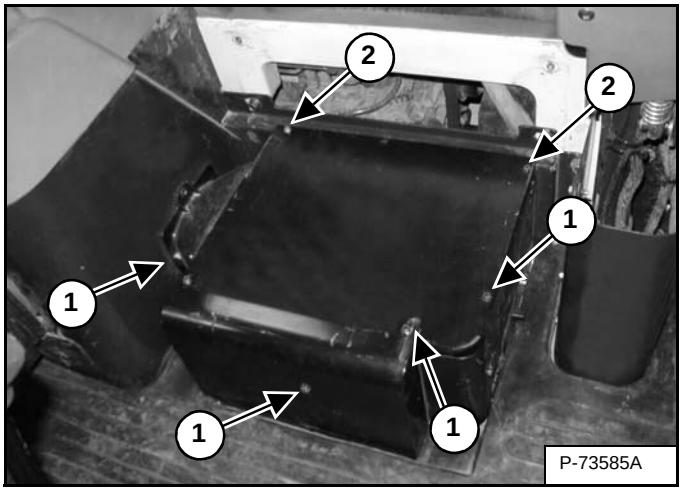


Lift the heater coil (Item 1) **[Figure 70-11-2]** straight up and remove it from the evaporator/heater unit.

Removal And Installation Without A/C

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

Figure 70-11-3

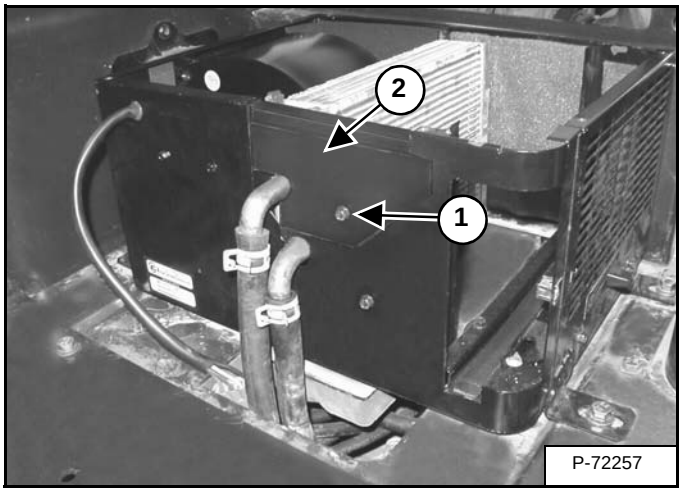


Remove the bolts (Item 1) **[Figure 70-11-3]** from the heater unit front cover.

Remove the front cover from the unit.

Remove the bolts (Item 2) **[Figure 70-11-3]** from the heater cover and remove cover.

Figure 70-11-4

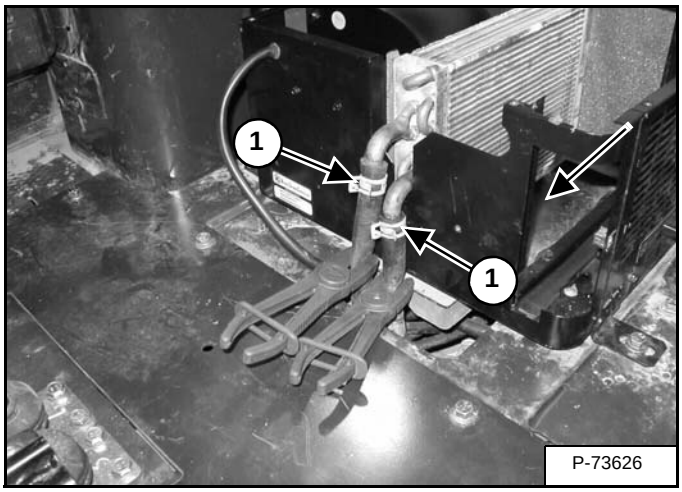


Remove the bolt (Item 1) and cover (Item 2) **[Figure 70-11-4]** from the unit.

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

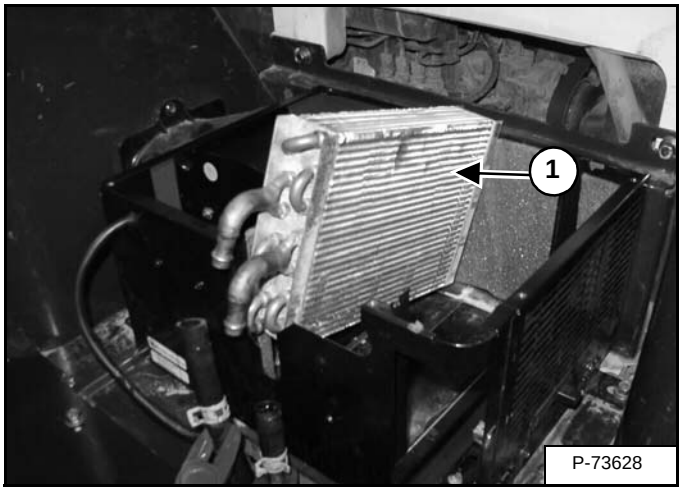
Figure 70-11-5



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

Remove the heater hoses from the heater coil.

Figure 70-11-6



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

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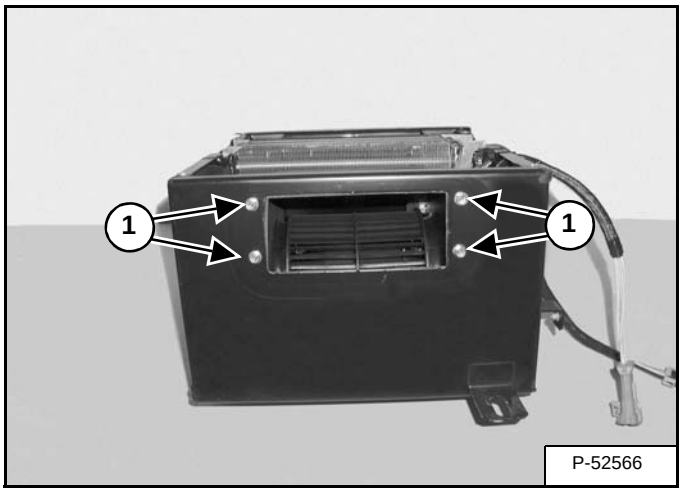
BLOWER FAN (EARLY MODELS)

Removal And Installation

Remove the heater/AC unit from the excavator. (See Removal And Installation on Page 70-10-1.)

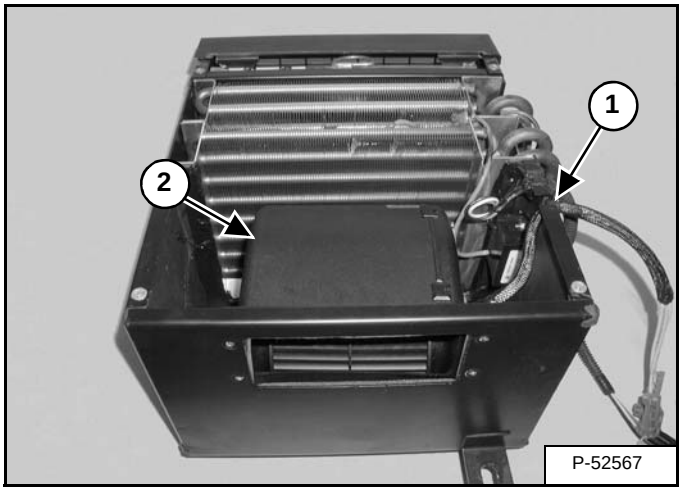
Remove the top cover from the heater/AC unit. (See Removal And Installation With A/C on Page 70-10-1.)

Figure 70-20-1



Remove the bolts (Item 1) **[Figure 70-20-1]**.

Figure 70-20-2



Remove the wire harness and grommet (Item 1) **[Figure 70-20-2]** from the housing.

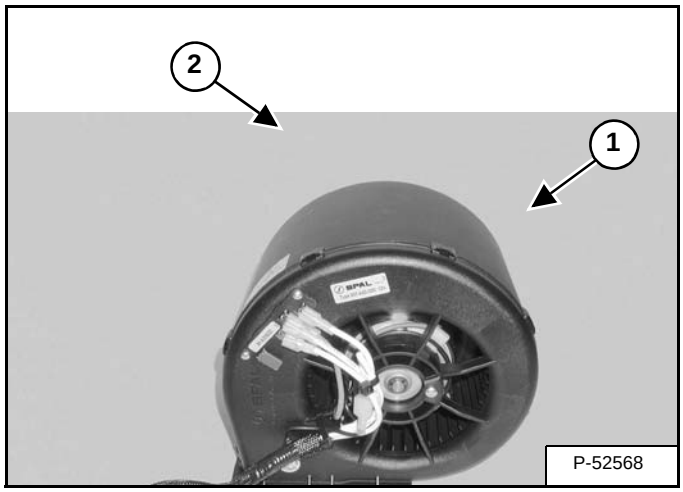
Remove the fan assembly (Item 2) **[Figure 70-20-2]**.

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BLOWER FAN (EARLY MODELS) (CONT'D)

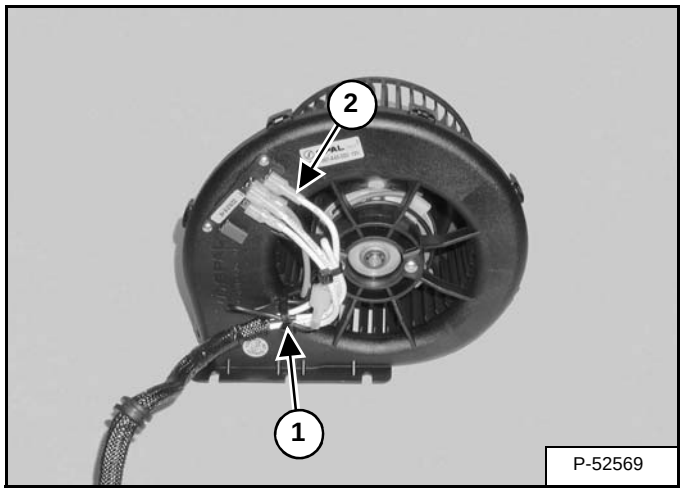
Disassembly And Assembly

Figure 70-20-3



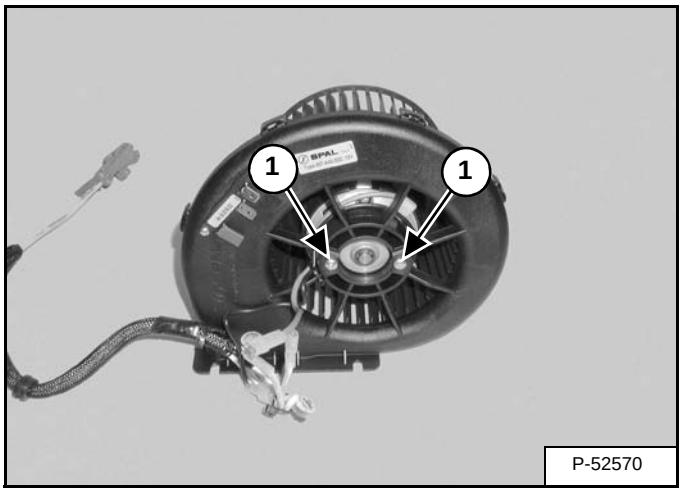
Release the clips (Item 1) on the housing (Item 2) **[Figure 70-20-3]**. Remove the housing.

Figure 70-20-4



Remove the tie strap (Item 1). Mark the wires for proper installation. Remove the wires (Item 2) **[Figure 70-20-4]**.

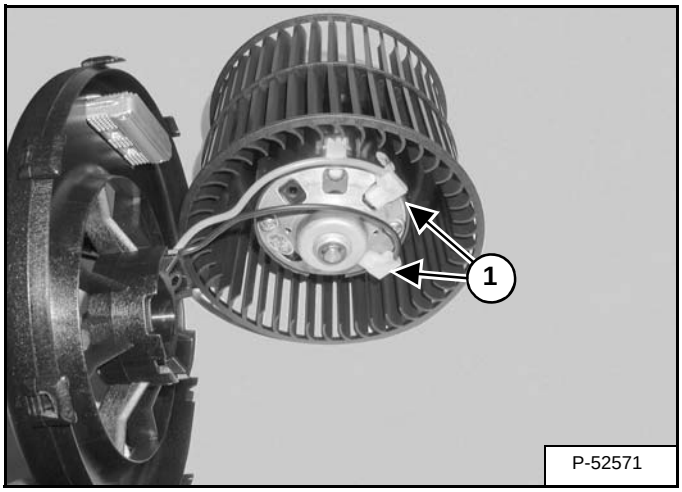
Figure 70-20-5



Remove the bolts (Item 1) **[Figure 70-20-5]** from the fan motor.

Mark the wires for proper installation.

Figure 70-20-6



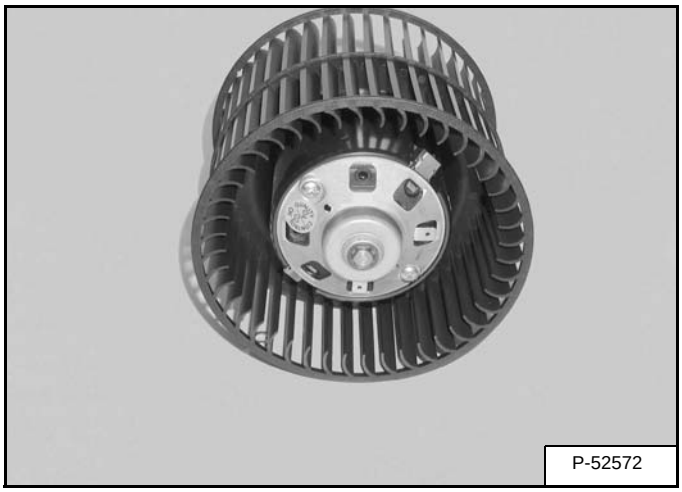
Remove the wires (Item 1) **[Figure 70-20-6]** from the fan motor.

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BLOWER FAN (EARLY MODELS) (CONT'D)

Disassembly And Assembly (Cont'd)

Figure 70-20-7



The fan/motor must be replaced as an assembly **[Figure 70-20-7]**.

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BLOWER FAN (LATER MODELS)

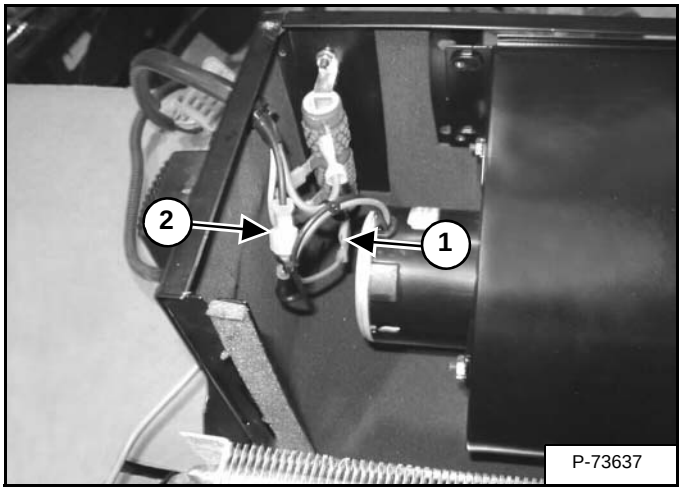
Removal And Installation

Remove the heater unit from the excavator. (See Disassembly And Assembly on Page 70-191-2.)

Remove the top cover from the heater unit. (See Disassembly And Assembly on Page 70-191-2.)

Remove the heater coil from the heater/AC unit. (See HEATER COIL (LATER MODELS) on Page 70-11-1.)

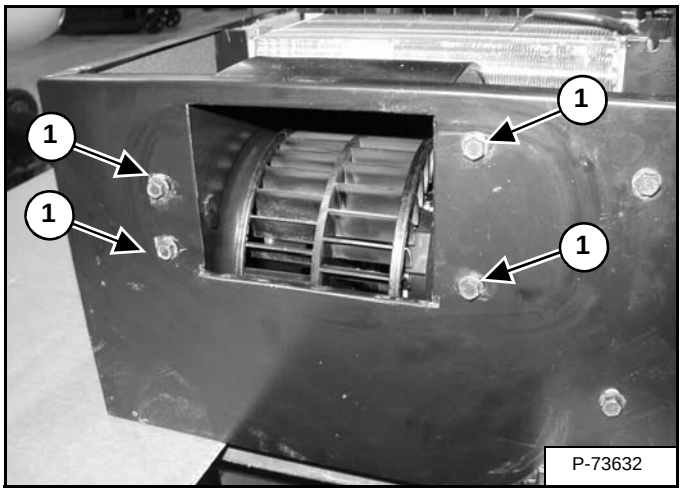
Figure 70-21-1



Disconnect the orange fan motor wire (Item 1) **[Figure 70-21-1]** from the resistor.

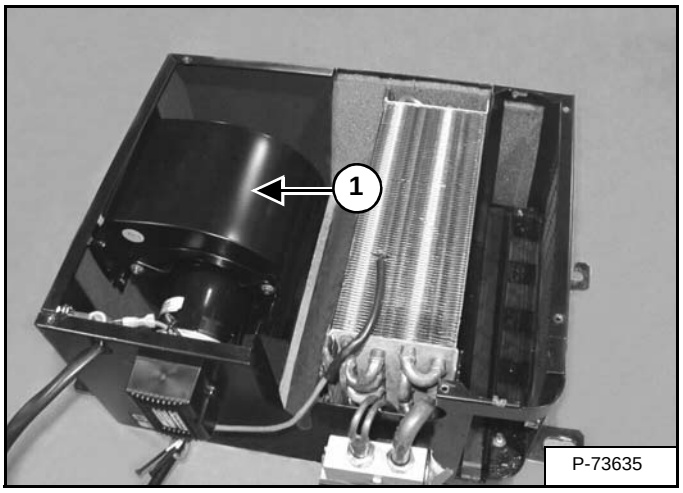
Disconnect the black fan motor wire (Item 2) **[Figure 70-21-1]** from the black wire on the wire harness.

Figure 70-21-2



Remove the four bolts (Item 1) **[Figure 70-21-2]** from the blower fan housing in the heater unit.

Figure 70-21-3



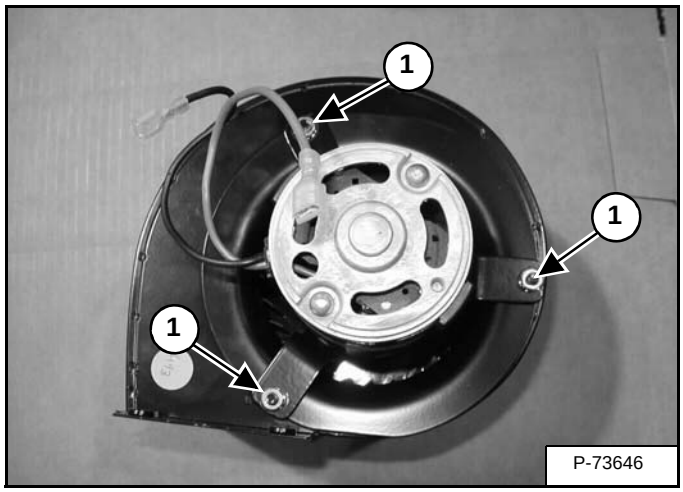
Remove the blower fan (Item 1) **[Figure 70-21-3]** from the heater unit.

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BLOWER FAN (LATER MODELS) (CONT'D)

Disassembly And Assembly

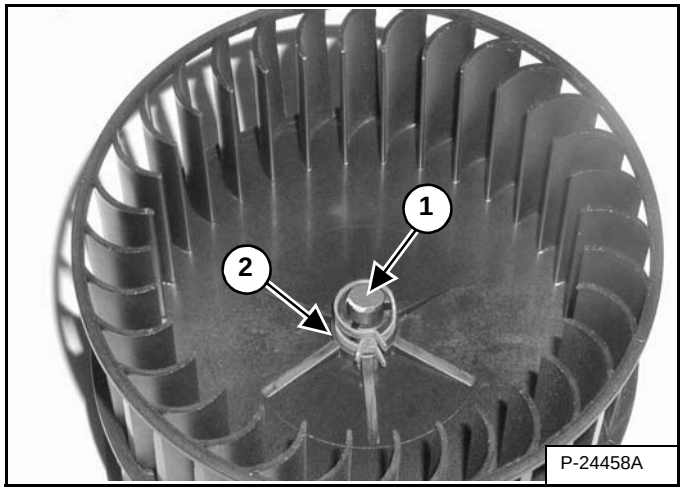
Figure 70-21-4



Remove the three mounting nuts (Item 1) **[Figure 70-21-4]** from the blower fan housing.

Remove the blower motor and fan from the blower housing unit.

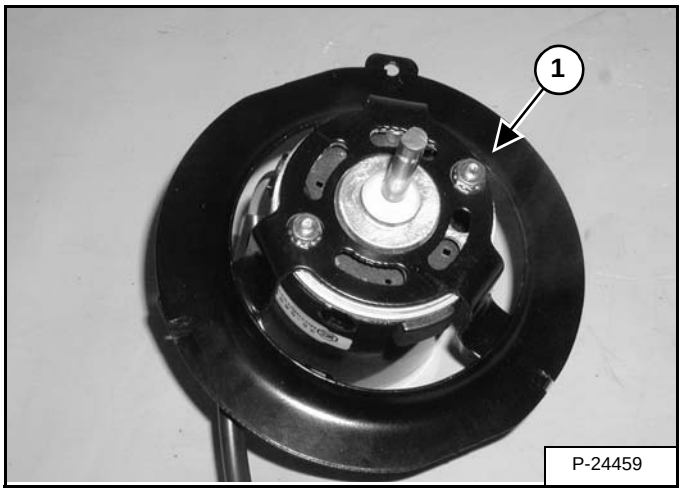
Figure 70-21-5



Mark the fan shaft (Item 1) **[Figure 70-21-5]** and blower wheel, for the proper installation of the blower wheel.

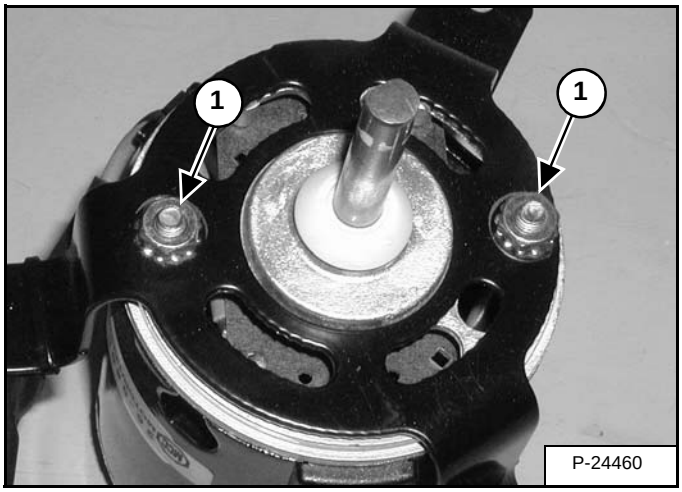
Remove the clamp (Item 2) **[Figure 70-21-5]** and remove the blower wheel from the fan shaft.

Figure 70-21-6



Remove the outside ring (Item 1) **[Figure 70-21-6]** from the fan motor.

Figure 70-21-7

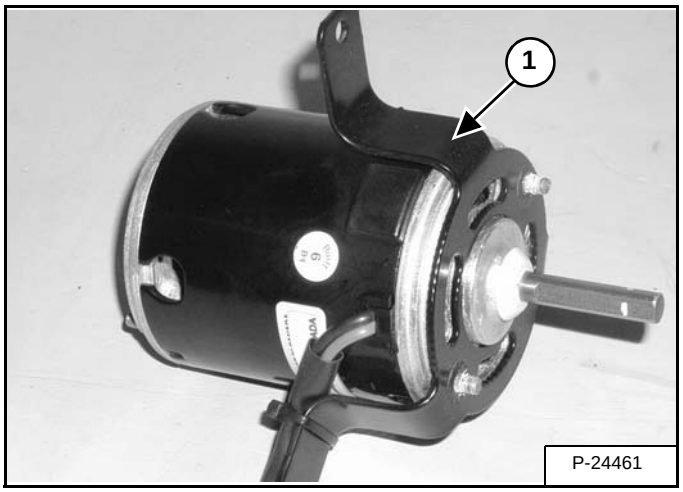


Remove the two mounting nuts (Item 1) **[Figure 70-21-7]** from the fan motor mount bracket.

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Disassembly And Assembly (Cont'd)

Figure 70-21-8

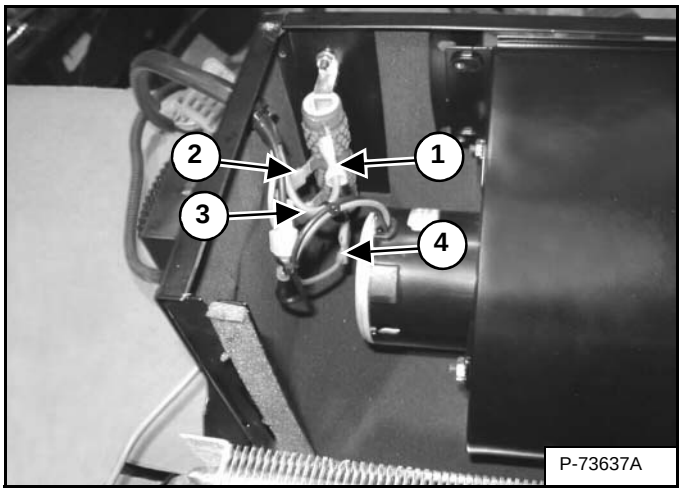


Remove the fan motor mount bracket (Item 2) **[Figure 70-21-8]** from the motor.

Inspect the fan motor, and if it needs replacing, it must be replaced as a complete unit.

Resistor Removal And Installation

Figure 70-21-9



Remove the four electrical wires from the resistor **[Figure 70-21-9]**.

Wire Installation

Install the Orange wire from the wire harness (Item 1) **[Figure 70-21-9]** on the top terminal of the resistor.

Install the Red wire from the wire harness (Item 2) **[Figure 70-21-9]** on the 2nd terminal of the resistor.

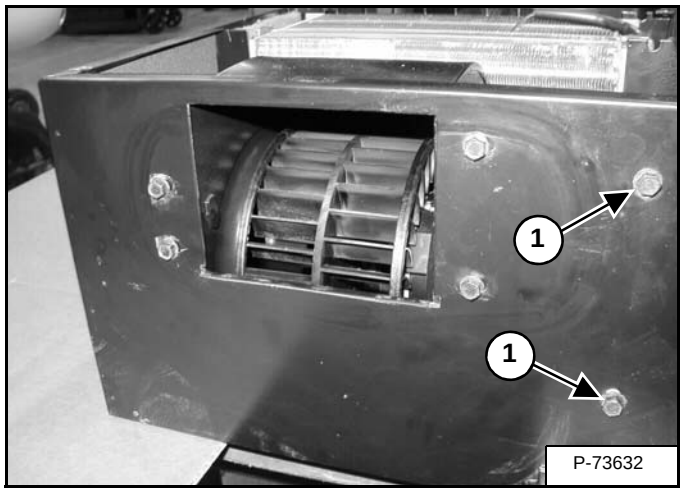
Install the Yellow wire from the wire harness (Item 3) **[Figure 70-21-9]** on the 3rd terminal of the resistor.

Install the Orange wire from the heater fan motor (Item 4) **[Figure 70-21-9]** on the bottom terminal of the resistor.

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Resistor Removal And Installation (Cont'd)

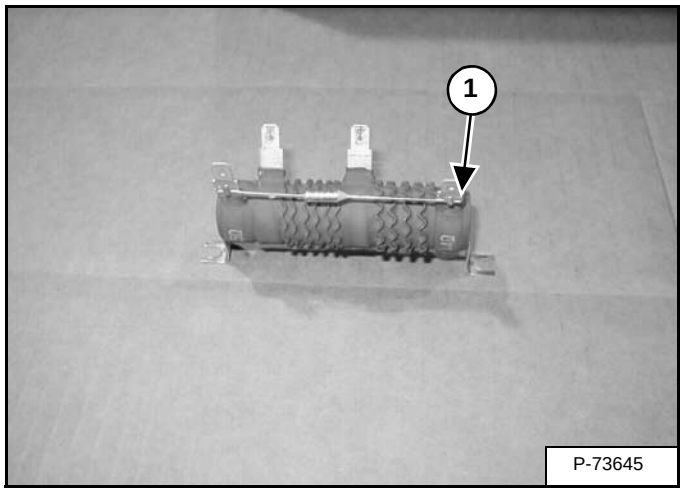
Figure 70-21-10



Loosen the two resistor mount bolts **[Figure 70-21-10]**.

Remove the resistor from the unit.

Figure 70-21-11



Inspect the resistor (Item 1) **[Figure 70-21-11]** and replace as needed.

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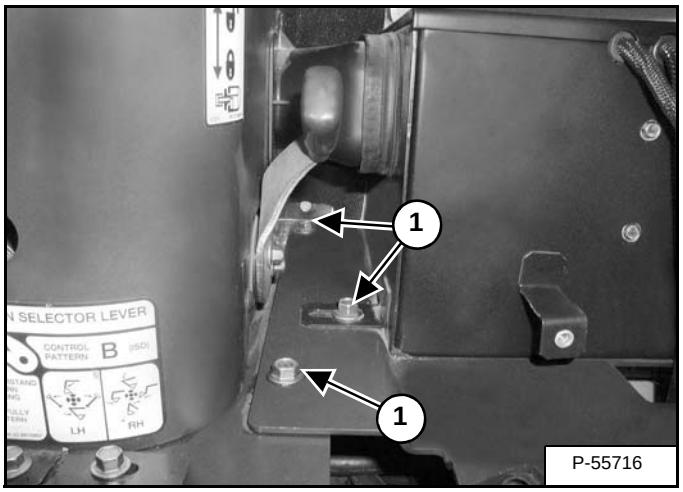
HEATER VALVE (EARLY MODELS)

Removal And Installation

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

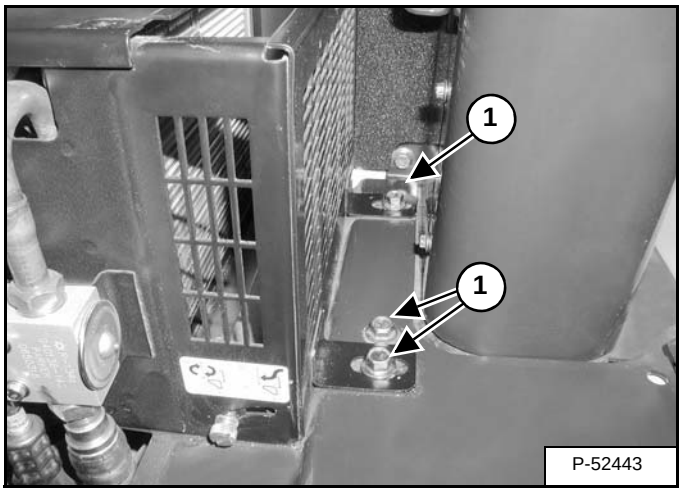
Remove the floormat and floor plate. (See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

Figure 50-30-1



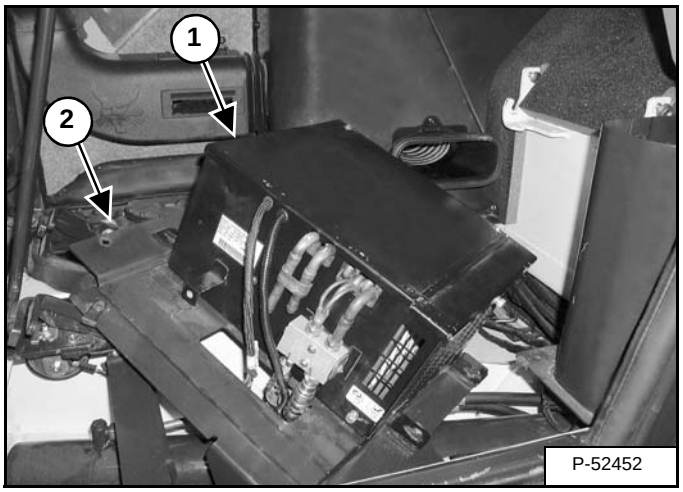
Remove the bolts (Item 1) **[Figure 50-30-1]** from the right side of the evaporator/heater unit.

Figure 70-30-2



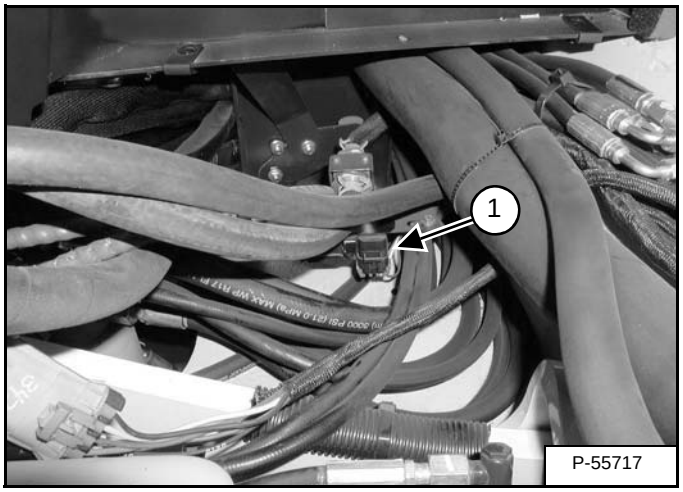
Remove the bolts (Item 1) **[Figure 70-30-2]** from the left side of the evaporator/heater unit.

Figure 70-30-3



Position the evaporator/heater unit (Item 1) and rear floor plate (Item 2) **[Figure 70-30-3]** as shown.

Figure 70-30-4

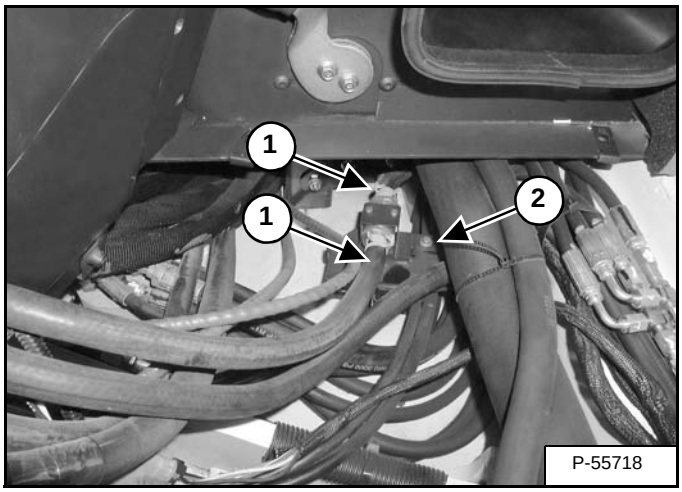


Disconnect the wire harness (Item 1) **[Figure 70-30-4]** from the heater valve.

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Removal And Installation (Cont'd)

Figure 70-30-5



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

Remove the heater valve from the excavator.

The heater valve is not serviceable and must be replaced as an assembly.

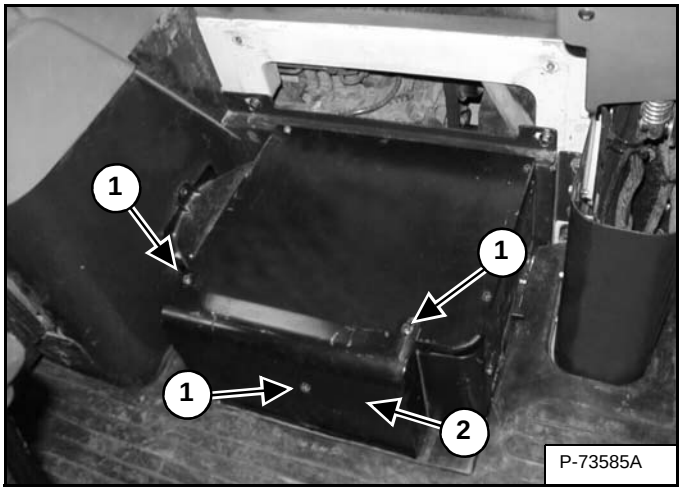
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HEATER VALVE (LATER MODELS)

Removal And Installation

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

Figure 70-31-1

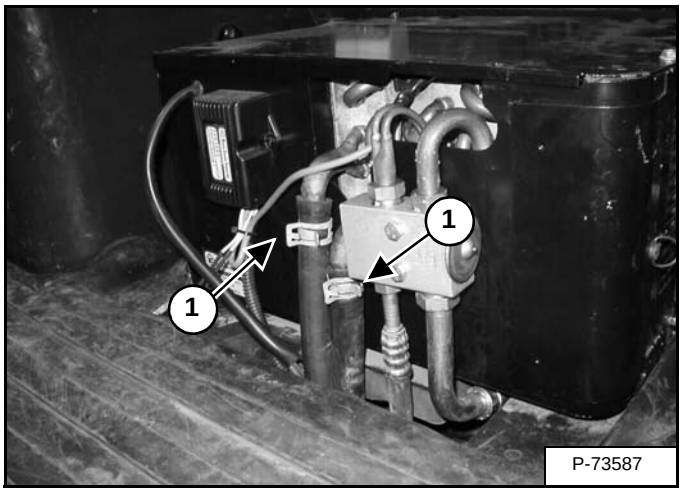


Remove the bolts (Item 1) from the cover (Item 2) **[Figure 70-31-1]**.

Remove the cover.

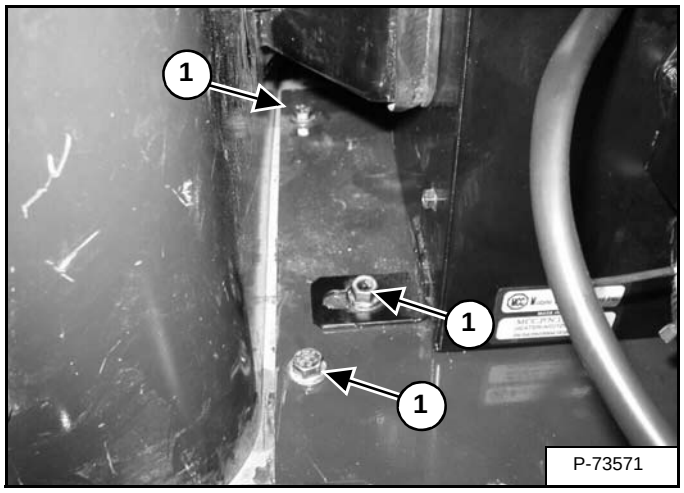
Remove the floormat and floor plate. (See Removal And Installation on Page 40-120-1.)

Figure 70-31-2



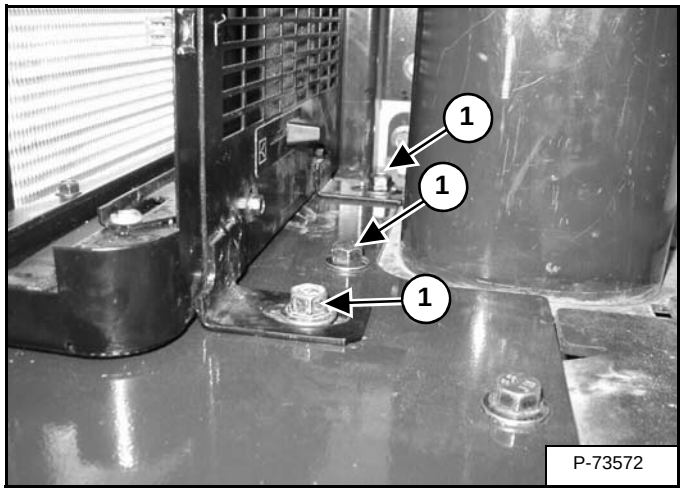
Mark and remove the heater hoses (Item 1) **[Figure 70-31-2]** from the evaporator/heater unit.

Figure 70-31-3



Remove the bolts (Item 1) **[Figure 70-31-3]**.

Figure 70-31-4

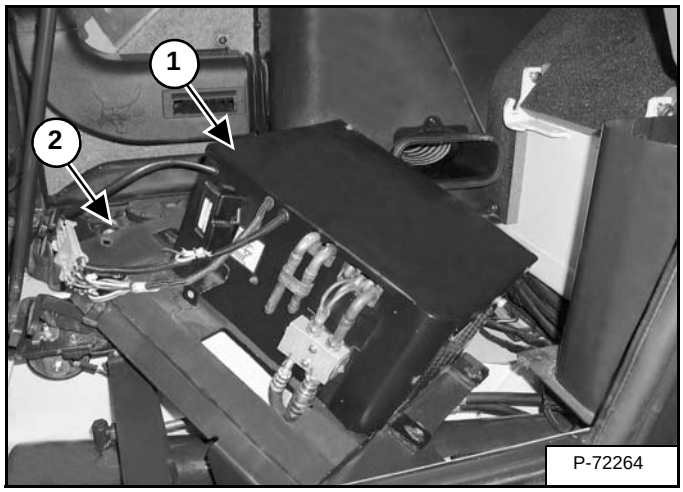


Remove the bolts (Item 1) **[Figure 70-31-4]**.

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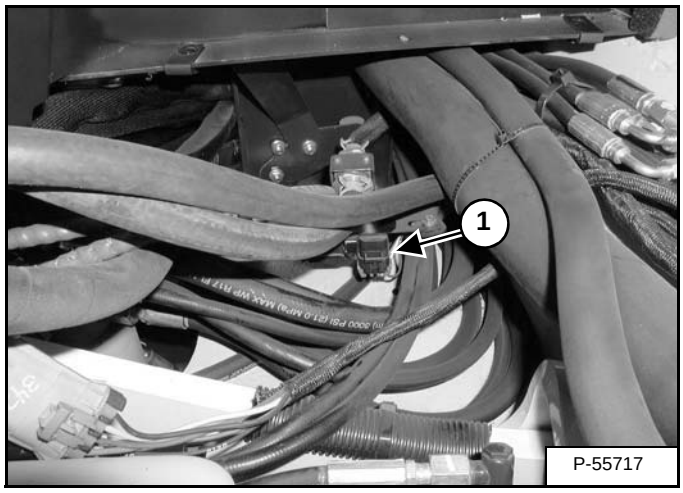
Removal And Installation (Cont'd)

Figure 70-31-5



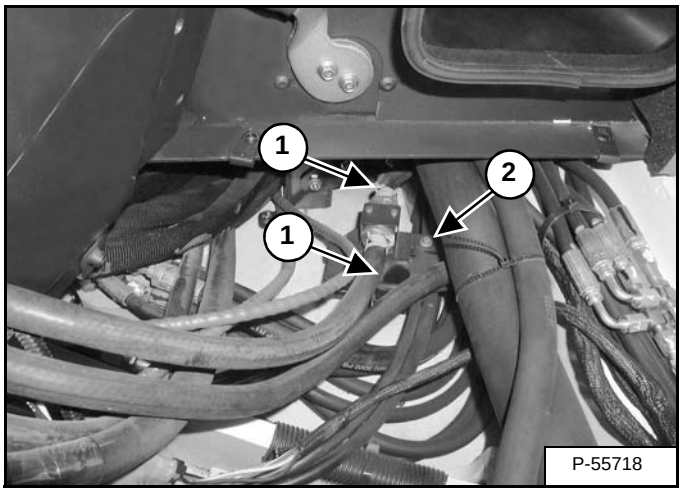
Position the evaporator/heater unit (Item 1) and rear floor plate (Item 2) **[Figure 70-31-5]** as shown.

Figure 70-31-6



Disconnect the wire harness (Item 1) **[Figure 70-31-6]** from the heater valve.

Figure 70-31-7



Mark and remove the hoses (Item 1). Remove the two bolts (Item 2) **[Figure 70-31-7]** from the heater valve.

Remove the heater valve from the excavator.

The heater valve is not serviceable and must be replaced as a complete unit.

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AIR CONDITIONING SYSTEM FLOW

Principals

In an air conditioning system the refrigerant is circulated under pressure through five major components in a closed circuit. At these five points in the system the refrigerant goes through pressure and temperature changes.

The compressor (Item 1) Page 70-40-3 takes in heated, low pressure refrigerant gas through the suction valve (low pressure side) and as the name indicates, pressurizes the heated refrigerant and forces it through the discharge valve (high pressure side) on the condenser (Item 2) Page 70-40-3.

Ambient air passing through the condenser removes the heat from refrigerant resulting in physical state change in the refrigerant from a gas to a liquid.

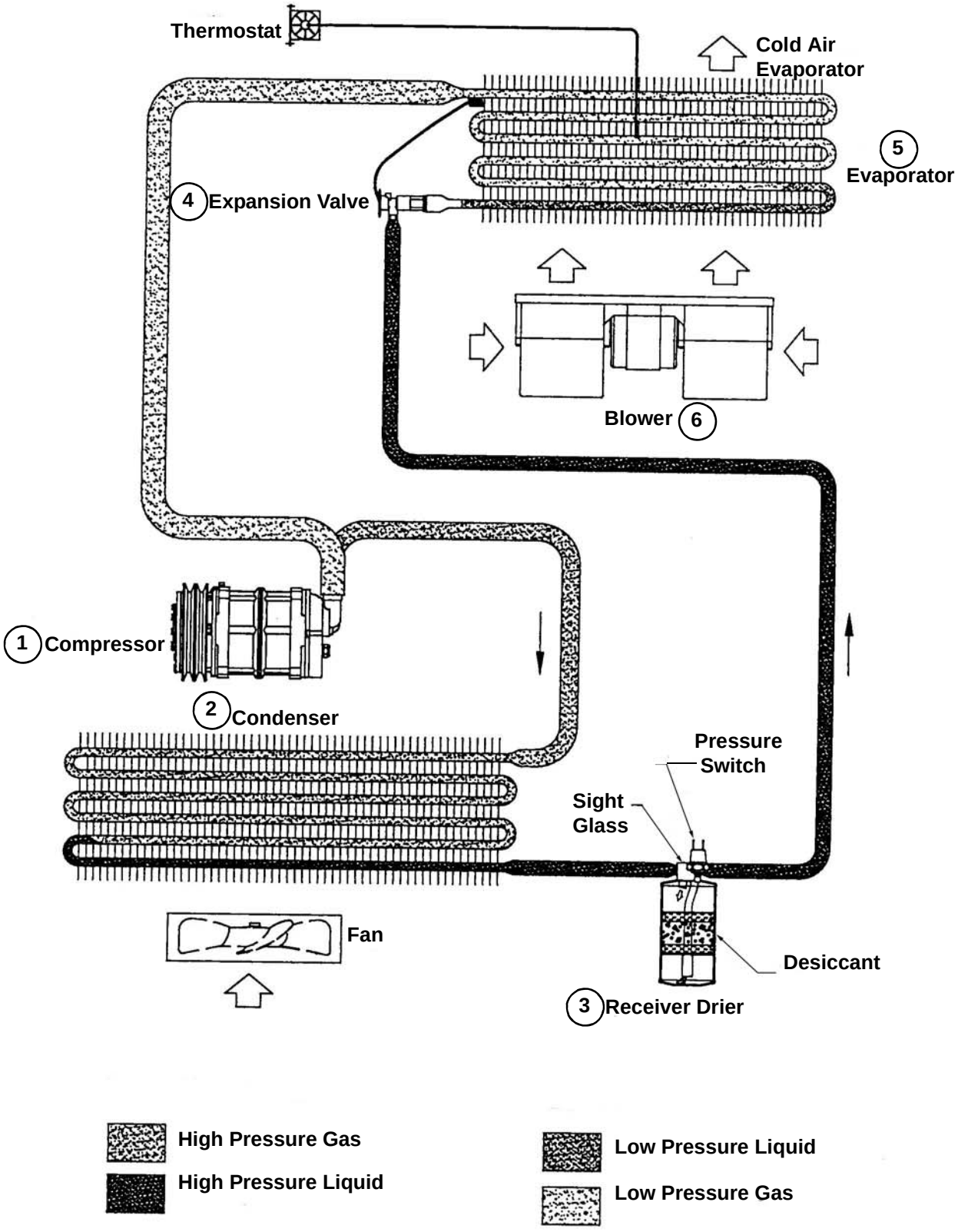
The liquid refrigerant moves on to the receiver/drier (Item 3) Page 70-40-3 where impurities such as moisture and dirt are filtered out. The receiver/drier also serves as the storage tank for the liquid refrigerant. The liquid refrigerant (still under high pressure) flows to the expansion valve (Item 4) Page Page 70-40-3.

The expansion valve meters the amount of refrigerant into the evaporator coil (Item 5) Page 70-40-3. As the refrigerant passes through the expansion valve, it again changes its physical state. It becomes a low temperature, low-pressure liquid and saturated vapor. The low pressure liquid immediately starts to boil and vaporize as it enters the evaporator. The hot humid air of the machine's cab is drawn through or blown into the evaporator by the evaporator fan (Item 6) Page 70-40-3. Since the refrigerant is colder than the air, it absorbs the heat from the air and produces cooled air, which is pushed into the cab by the fan. The moisture in the air condenses on the evaporator coil and drips into the drain pan, which directs the water out of the cab.

The refrigerant cycle is completed when the heated low pressure gas is again drawn into the compressor.

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Chart



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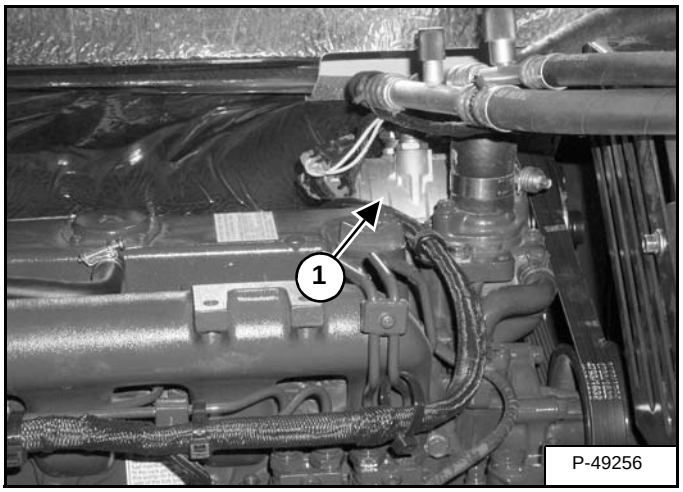


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COMPONENTS

Identification

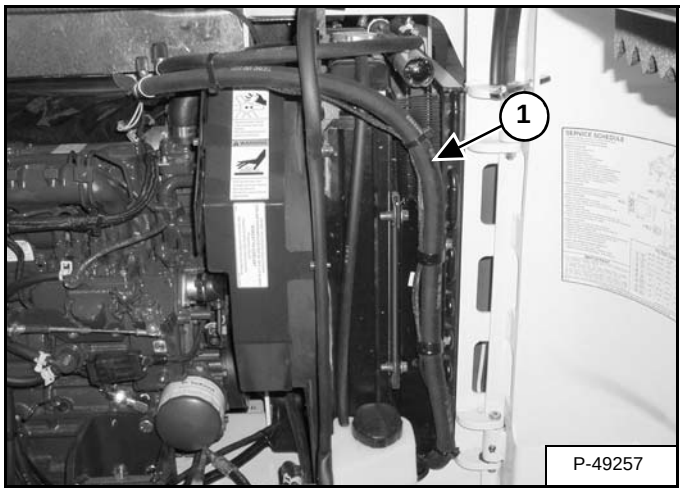
Figure 70-50-1



Compressor: The compressor (Item 1) **[Figure 70-50-1]** is the pump that circulates the refrigerant throughout the system. It raises the pressure of the refrigerant for heat transfer through the condenser and evaporator.

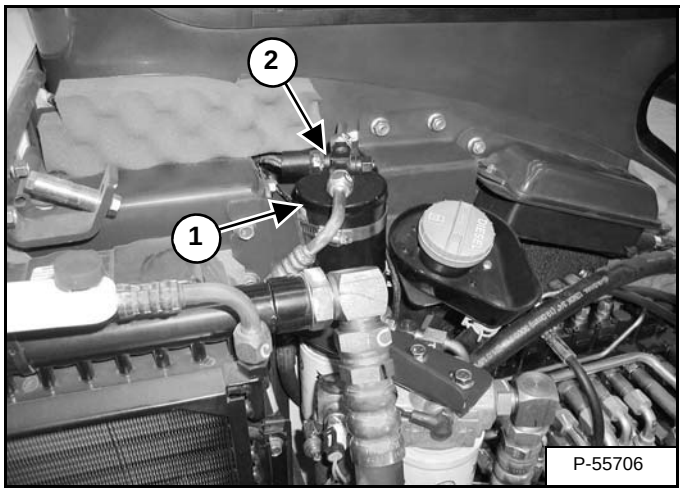
NOTE: The A/C system (Compressor) is recommended to be turned on for at least 5 minutes weekly throughout the year to lubricate the internal components.

Figure 70-50-2



Condenser: The condenser (Item 1) **[Figure 70-50-2]** is the unit that receives the high pressure, high temperature refrigerant vapor from the compressor and condenses it into a high temperature liquid.

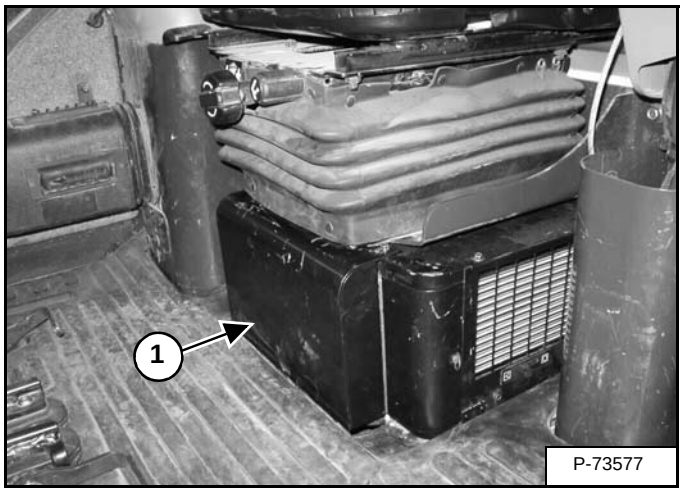
Figure 70-50-3



Receiver/Drier: The receiver/drier (Item 1) **[Figure 70-50-3]** is the unit that receives the liquid refrigerant from the condenser and removes moisture and foreign matter from the system. It also serves as a storage tank for the extra liquid refrigerant until it is needed by the evaporator.

Pressure Relief Valve: The pressure relief valve (Item 2) **[Figure 70-50-3]** is located on the receiver/drier assembly. This small brass valve is a safety feature that is designed to open and release the A/C charge if the pressure reaches 535 PSI.

Figure 70-50-4



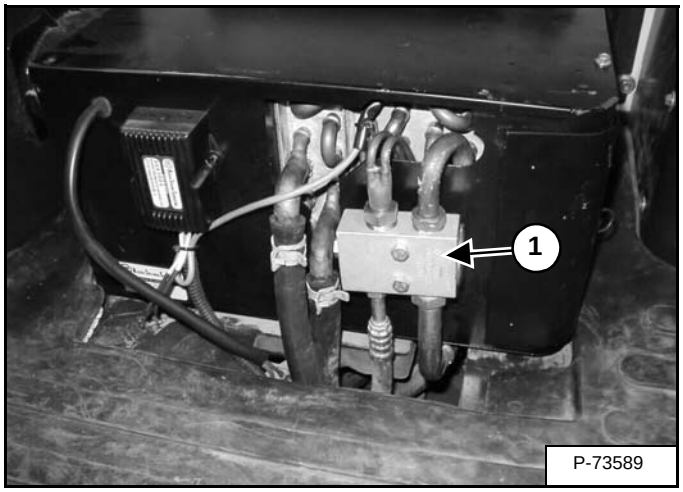
Evaporator/Heater Unit: The evaporator/heater unit (Item 1) **[Figure 70-50-4]** is located under the operator seat in the excavator cab. the unit delivers cold air for the A/C and warm air for heat into the cab. The unit contains the blower, heater coil, evaporator coil, thermostat, and expansion valve.

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COMPONENTS (CONT'D)

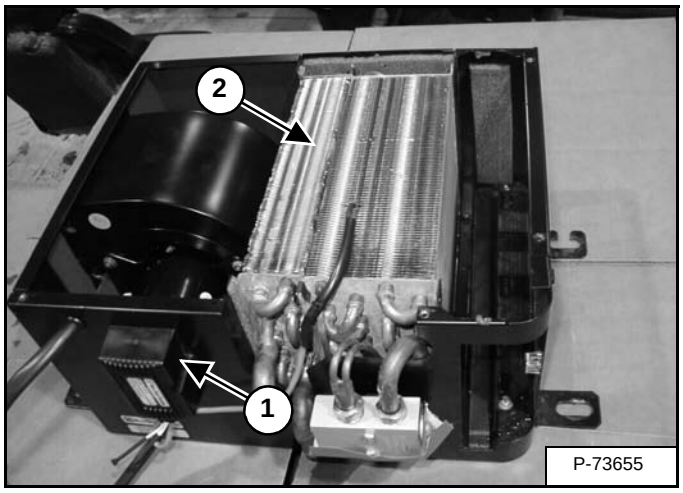
Identification (Cont'd)

Figure 70-50-5



Expansion Valve: The expansion valve (Item 1) **[Figure 70-50-5]** controls the amount of refrigerant entering the evaporator coil.

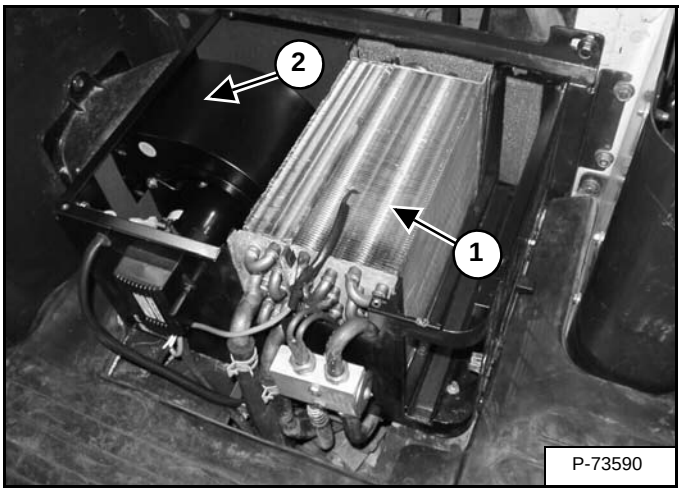
Figure 70-50-6



Thermostat: The thermostat (Item 1) **[Figure 70-50-6]** controls the temperature of the evaporator coil.

Heater Coil: The heater coil (Item 2) **[Figure 70-50-6]** supplies the warm air into the cab by passing air through the coil.

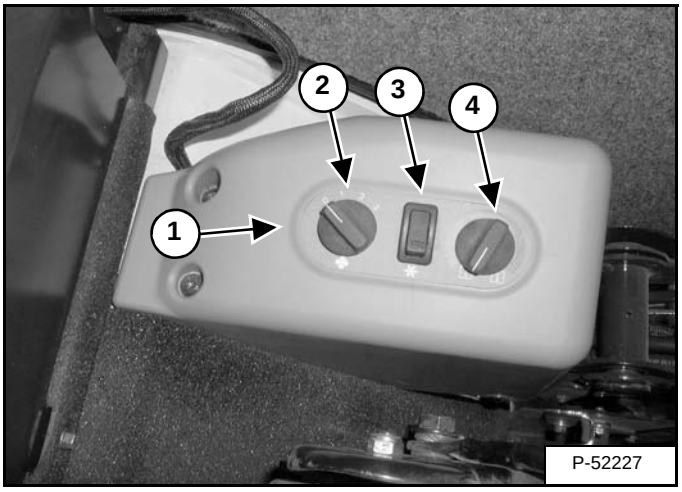
Figure 70-50-7



Evaporator Coil: The evaporator coil (Item 1) **[Figure 70-50-7]** cools and dehumidifies the air before it enters the cab.

Heater/Evaporator Blower: The blower (Item 2) **[Figure 70-50-7]** is used to push air through the heater and evaporator coils and into the cab.

Figure 70-50-8



Control Panel: The panel (Item 1) **[Figure 70-50-8]** has three separate components.

Fan Switch: This is a four position rotary switch (Item 2) **[Figure 70-50-8]**. When the fan switch is in the off position the A/C will not engage, but the heat valve will operate, as it is controlled by the ignition power.

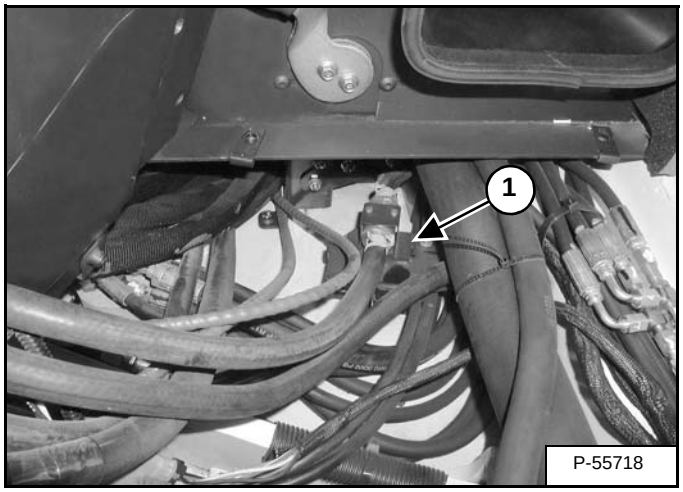
A/C Switch: The rocker switch (Item 3) **[Figure 70-50-8]** will be illuminated when the A/C is engaged.

Potentiometer: The potentiometer (Item 4) **[Figure 70-50-8]** controls the Heat Valve from fully Off to fully On. This can be used in conjunction with the A/C for defrost of the windows and temperature control.

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Identification (Cont'd)

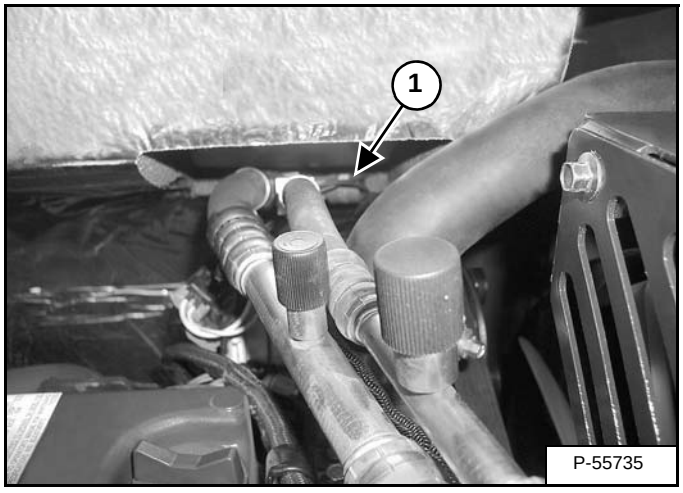
Figure 70-50-9



Heater Valve: The heater valve (Item 1) **[Figure 70-50-9]** is used to control the amount of engine coolant that flows to the heater coil.

The heater valve is located under the floor plate at the right side of the cab.

Figure 70-50-10



Pressure Switch: The pressure switch (Item 1) **[Figure 70-50-10]** will disengage the compressor clutch at high pressure readings over 384 PSI (26.5 bar) on the high side, or at very low pressure of 28 PSI (2 bar) or less on the high side, which indicates loss of refrigerant.

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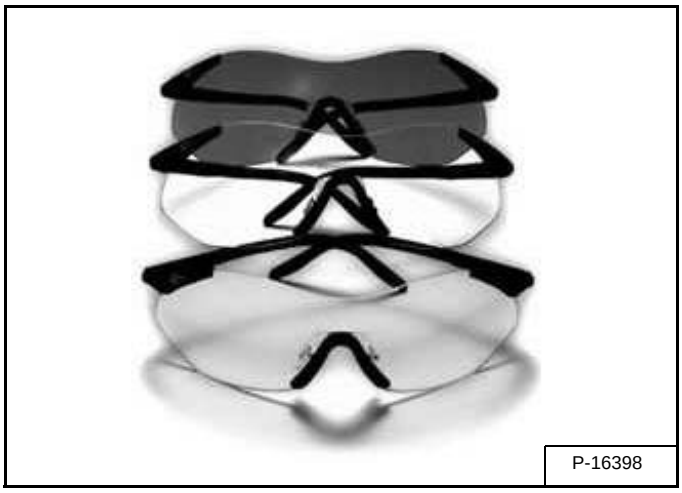


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Safety Equipment

In servicing A/C and heater systems you will be exposed to high pressures, temperatures and several chemical hazards. Moving belts and pulleys are normal shop hazards.

Figure 70-60-1



In addition to exercising caution in your work, **DO WEAR SAFETY GLASSES OR A FACE SHIELD [Figure 70-60-1]** when you are using R-134a or a leak detector, adjusting service valves or the manifold gage set connectors. Safety glasses or a transparent face shield are practical safety items and one or the other is absolutely required.

⚠ WARNING

In the event of a leakage, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R134a refrigerant gives a toxic gas.

W-2371-0500

Figure 70-60-2



R-134a inside a canister or in an A/C system is a liquid under pressure. When it escapes or releases into the air, **ITS TEMPERATURE DROPS TO 21.6° F "INSTANTLY".**

If it spills on your skin or in your eyes you should flood the area with cool water and **SEEK MEDICAL ATTENTION FAST!** It is a good idea to wear gloves **[Figure 70-60-2]** to prevent frost bite if you should get refrigerant on your hands.

⚠ WARNING

HFC 134A refrigerant can be dangerous if not properly handled. Liquid 134A may cause blindness if it contacts the eyes and may cause serious frostbite if it contacts the skin.

- **Gaseous 134A becomes lethal (phosgene) gas when it contacts open flame or very hot substances.**
- **NEVER SMOKE when there is the possibility of even small amounts of 134A in the air.**

Any servicing work that involves release or addition of 134A to the system must be done by a competent refrigeration dealer who has the proper equipment, knowledge, and experience to service refrigeration equipment.

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Heater Air Filter

Remove the Heat/AC filter. (See Removal And Installation on Page 10-61-1.)

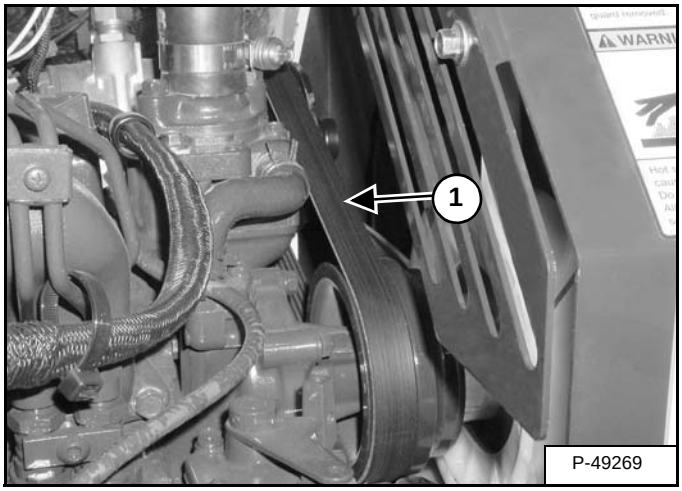
Clean the filter by shaking or using low air pressure.

Replace the filter two to four times per year under normal operating conditions, up to weekly under extremely dusty operating conditions.

Engine Accessory Drive Belt Inspection

Open the tailgate.

Figure 70-70-1



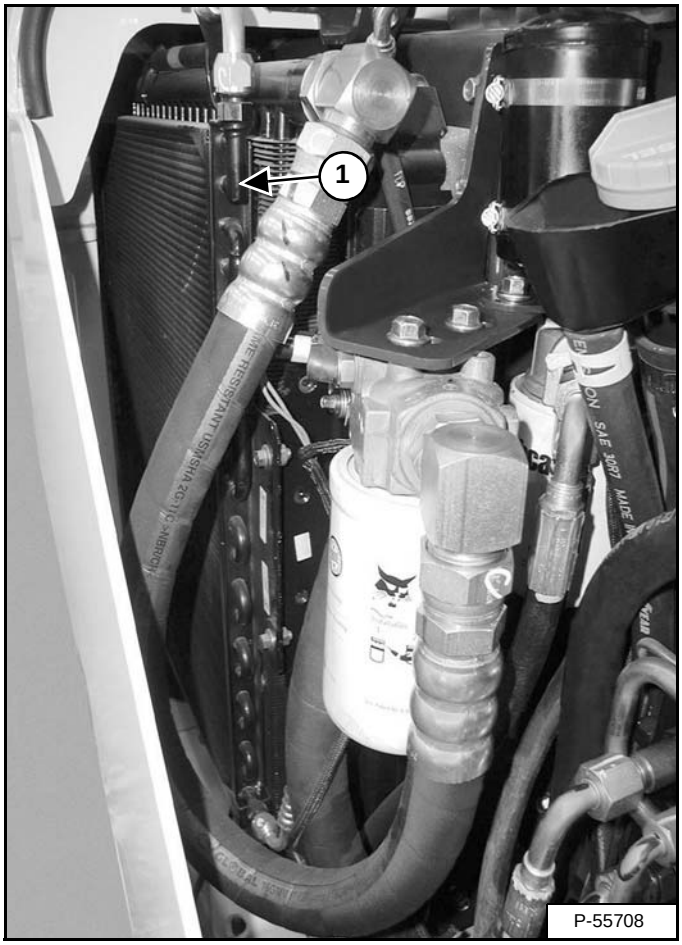
Check the condition of the belt (Item 1) **[Figure 70-70-1]** and adjust as needed every 100 hours of operation. (See Belt Adjustment on Page 10-140-1.)

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Cleaning The Condenser

Open the right side cover.

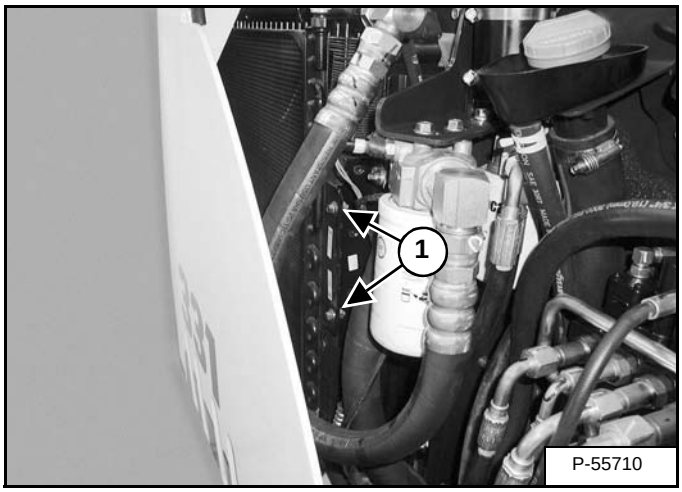
Figure 70-70-2



Check the condenser (Item 1) **[Figure 70-70-2]** for mud or dirt.

The condenser can be cleaned with low water or air pressure.

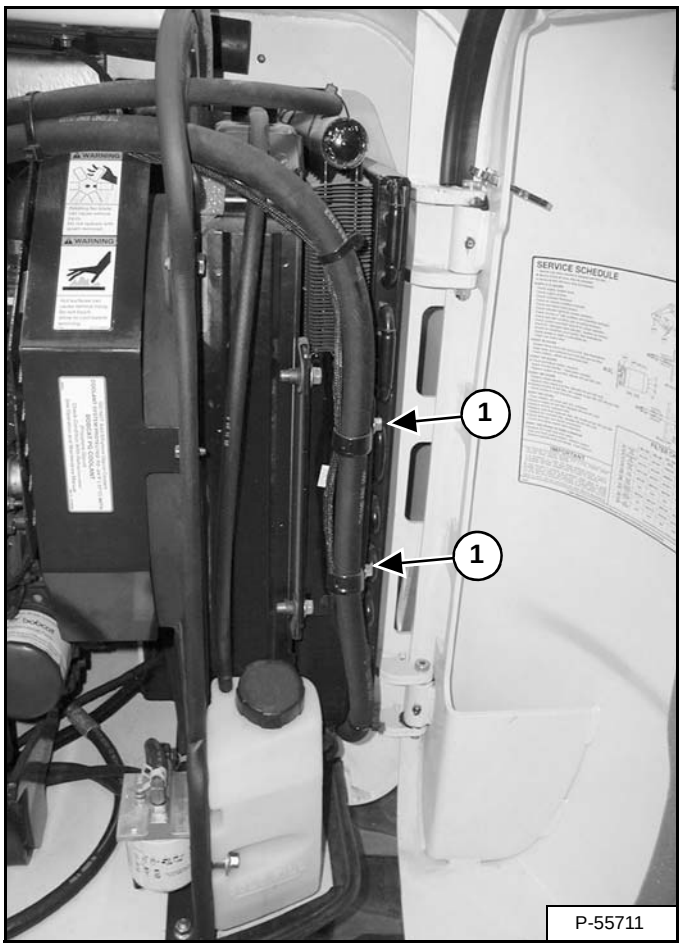
Figure 70-70-3



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

Open the tailgate.

Figure 70-70-4



Remove the bolts (Item 1) **[Figure 70-70-4]**. Slide the condenser toward the rear of the machine, far enough to allow the oil cooler and the condenser to be cleaned.

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BASIC TROUBLESHOOTING (EARLY MODELS)

Poor A/C Performance

Start the excavator. Engage the A/C system with the blower fan on high. Run the excavator at full RPM for approximately 15 minutes, with the cab door closed.

Figure 50-30-1

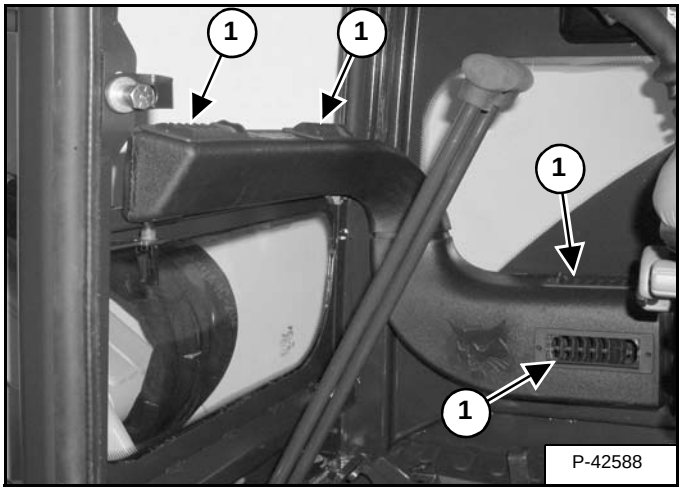
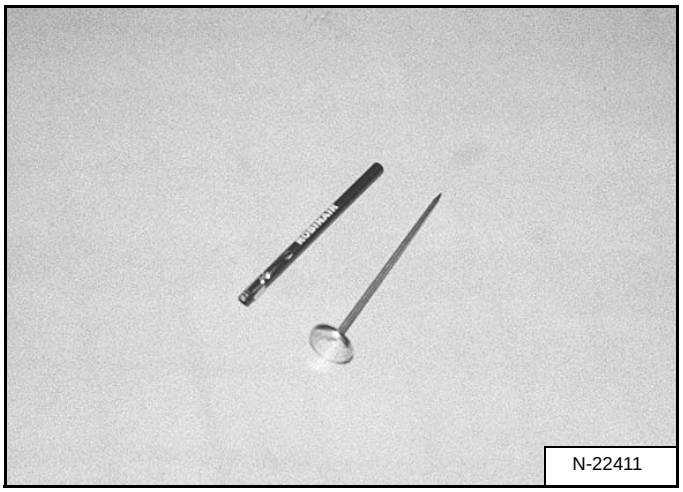


Figure 70-80-2



Check the temperature at the louvers (Item 1) **[Figure 50-30-1]** with a thermometer **[Figure 70-80-2]**.

The louver temperature should be between 36-53° F. (2,2 -11,6° C) depending on the amount of humidity in the air.

If louver temperature is too high. (See SYSTEM TROUBLESHOOTING CHART on Page 70-100-1.)

Check the fan for proper operation or noise, and replace if necessary. (See Removal And Installation on Page 70-20-1.)

Check the engine accessory drive belt tension. (See Belt Tension on Page 10-140-1.)

Check the A/C evaporator coil for dirt or mud, and clean if necessary. (See Removal And Installation on Page 70-220-1.)

Inspect the sight glass located on the receiver/drier for air bubbles. (See Removal And Installation on Page 70-160-1.)

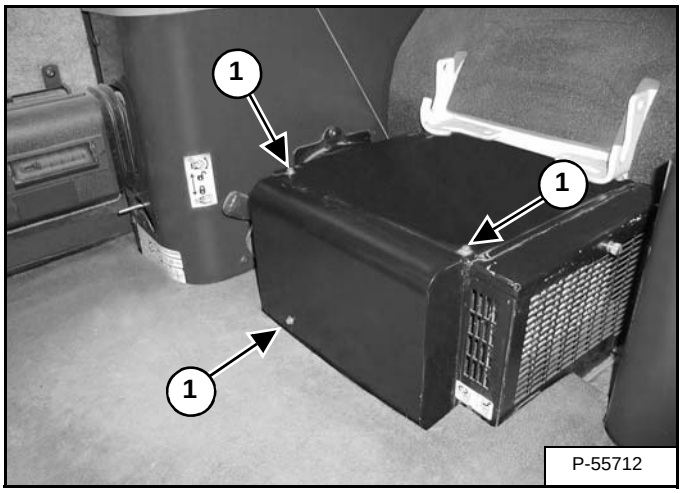
Check the engine coolant to see if it is bypassing the heater valve. (See Removal And Installation on Page 70-30-1.)

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Cleaning The A/C Evaporator Coil & Heater Coil

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

Figure 70-80-3



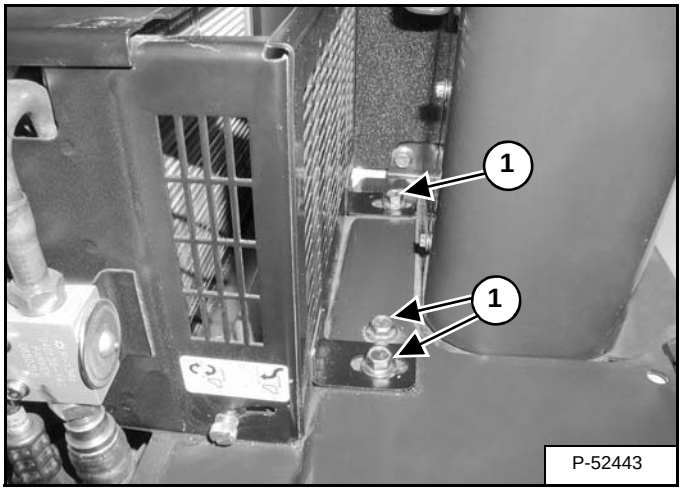
Remove the bolts (Item 1) **[Figure 70-80-3]**.

Remove the front cover.

Remove the fresh air filter from the unit. (See Heater Air Filter on Page 70-70-1.)

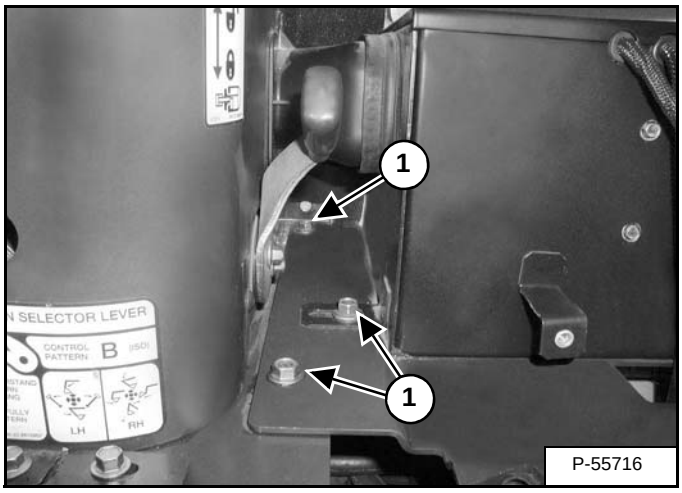
Remove the floormat and floor panel.(See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

Figure 70-80-4



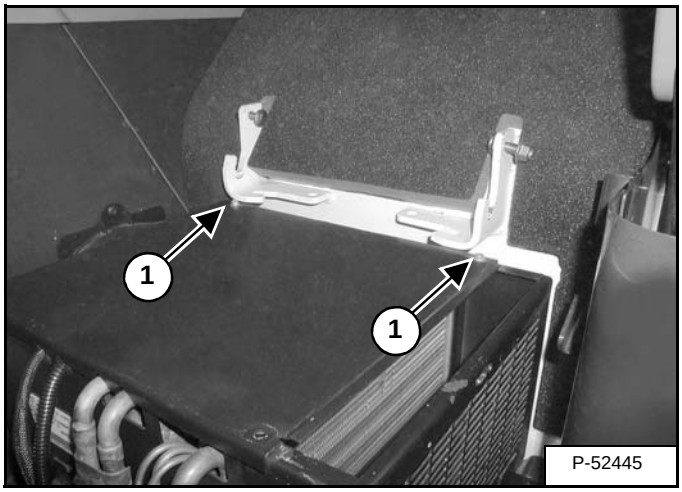
Remove the bolts (Item 1) **[Figure 70-80-4]** from the left side of the cab.

Figure 70-80-5



Remove the bolts (Item 1) **[Figure 70-80-5]** from the right side of the cab.

Figure 70-80-6



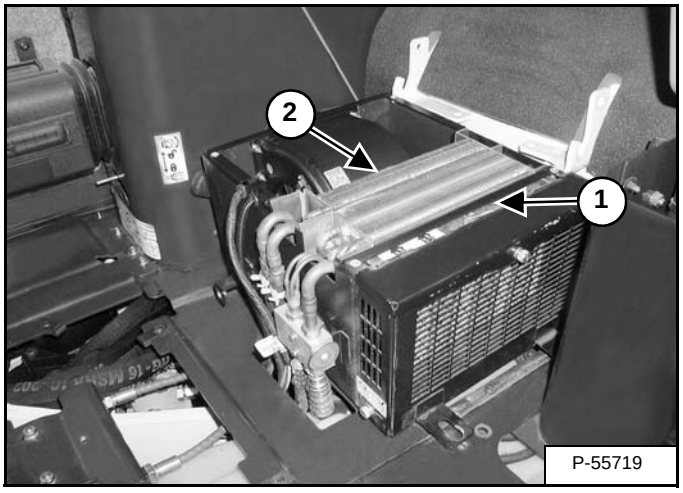
Move the unit forward. Remove the bolts (Item 1) **[Figure 70-80-6]** from the access cover.

Remove the access cover.

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Cleaning The A/C Evaporator Coil & Heater Coil (Cont'd)

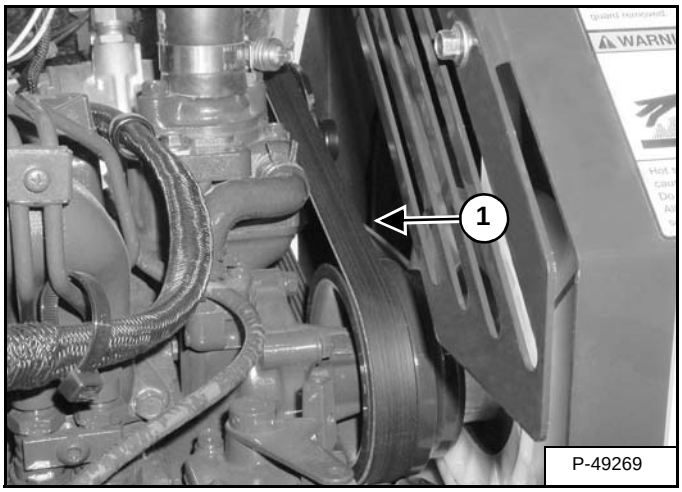
Figure 70-80-7



Clean the evaporator coil (Item 1) and heater coil (Item 2) **[Figure 70-80-7]** with low pressure air or water.

Engine Accessory Drive Belt Inspection

Figure 70-80-8



Inspect and adjust the engine accessory drive belt (Item 1) **[Figure 70-80-8]** every 100 hours of operation. (See Belt Adjustment on Page 10-140-1.)

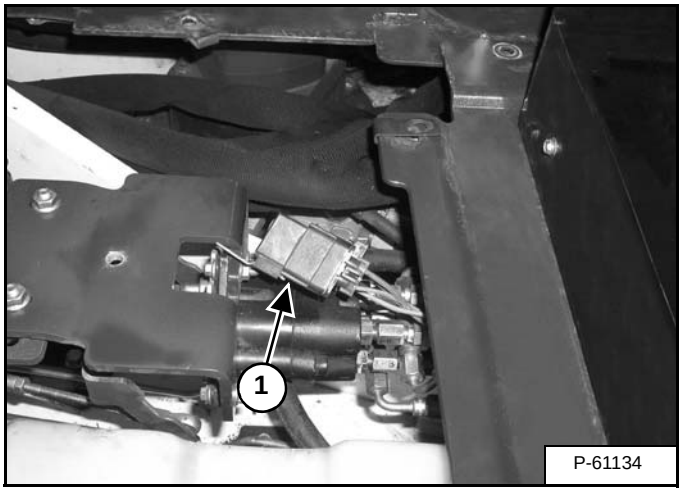
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Checking The Electrical System

If the excavator A/C system, shows no blower motor function, no A/C switch light and no A/C compressor function. Do the following checks at the A/C relay.

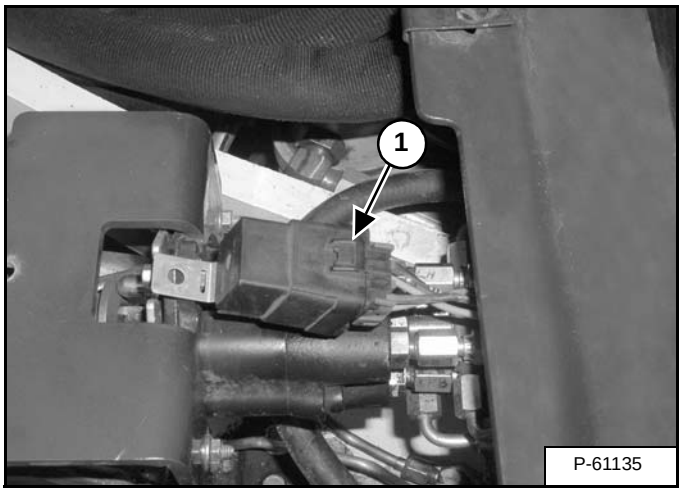
Remove the floormat and floor panel. (See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

Figure 70-80-9



The A/C relay (Item 1) **[Figure 70-80-9]** is located below the floor panel.

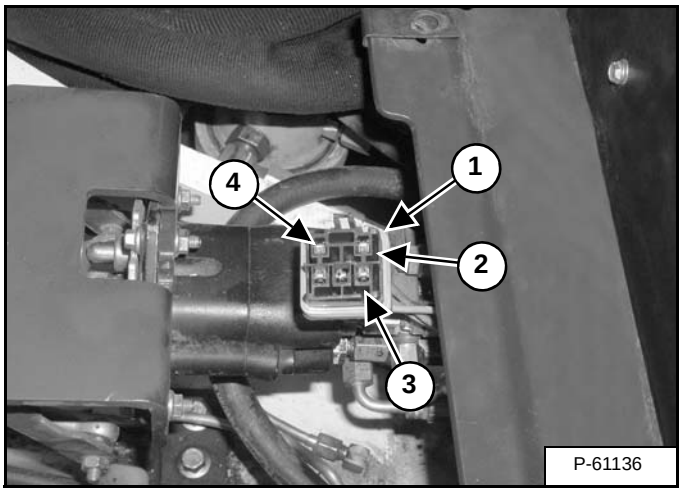
Figure 70-80-10



Depress the tab (Item 1) **[Figure 70-80-10]** on the relay.

Remove the relay from the wire harness.

Figure 70-80-11



With a multimeter, check the voltage at the excavator A/C relay wiring harness connector (Item 1) **[Figure 70-80-11]**.

The voltage at Pin 30 (Item 2) **[Figure 70-80-11]** (Red Wire # 1190) should be 12 volts at all times.

If there is no voltage, check the fuse #6, at the fuse box. **[Figure 70-80-14]**.

If the fuse is OK, refer to the electrical diagram to trace wire # 1190 to its source.

The voltage at pin 85 (Item 3) **[Figure 70-80-11]** (Orange Wire # 1740) should be 12 volts when the ignition key is in the ON position.

If there is no voltage check the fuse #3 at the fuse box. **[Figure 70-80-14]**.

If the fuse is OK, refer to the electrical diagram to trace wire #1740 to its source.

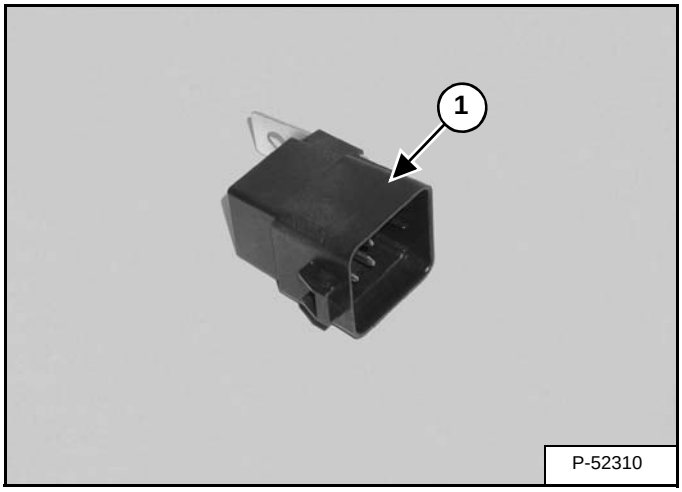
Pin 86 (Item 4) **[Figure 70-80-11]** (black Wire # 2210) is the ground wire. Check for continuity at Pin 86 to the ground.

If there is no continuity trace wire #2210 to its source using the electrical diagram.

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Checking The Electrical System (Cont'd)

Figure 70-80-12

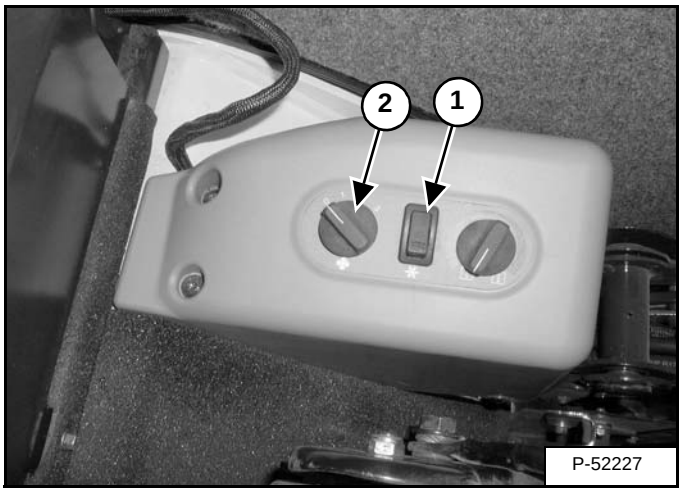


If the above voltages and continuity checks are OK, but the problem still persists, replace the A/C relay (Item 1) **[Figure 70-80-12]**.

Check to see if the compressor clutch is engaging.

With a person in the operator seat and the cab door open, turn the key switch to RUN (Standard panel) OR press the RUN/ENTER Button (Deluxe Panel), without starting the excavator.

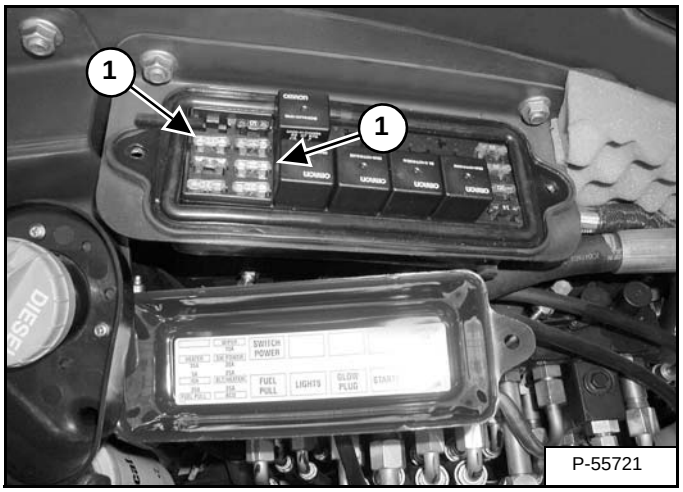
Figure 70-80-13



Push the A/C switch (Item 1) to the ON position. Turn the blower fan switch (Item 2) **[Figure 70-80-13]** to the first ON position.

The compressor clutch should make a *click* sound, which indicates the clutch is engaging.

Figure 70-80-14

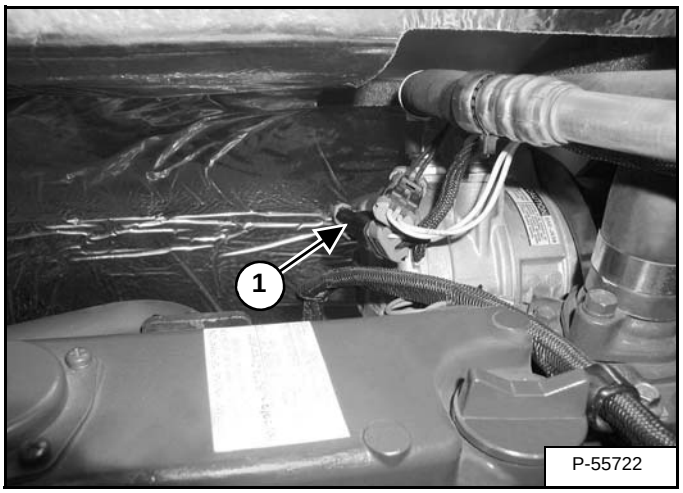


If the compressor clutch does not engage, check the fuses (Item 1) **[Figure 70-80-14]**.

Replace the fuse if burned out.

NOTE: The decal inside the fuse cover, refers to the fuses as HEATER and ALT/HEATER. These fuses control the power for both the Heater and the A/C systems.

Figure 70-80-15

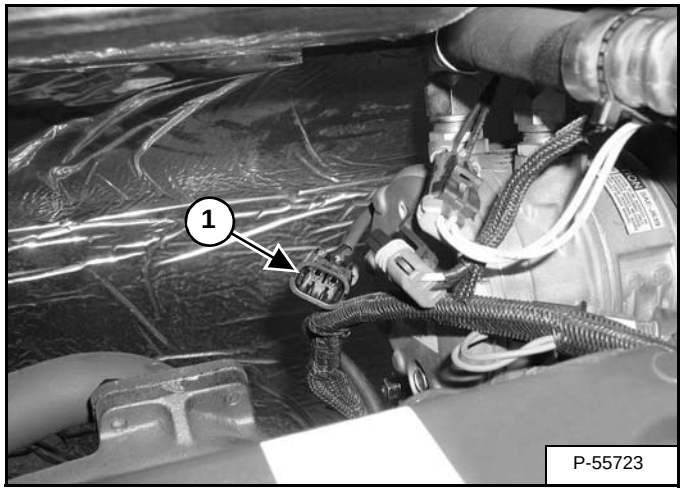


If the fuses are good, disconnect the wire harness (Item 1) **[Figure 70-80-15]** from the compressor clutch wire.

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Checking The Electrical System (Cont'd)

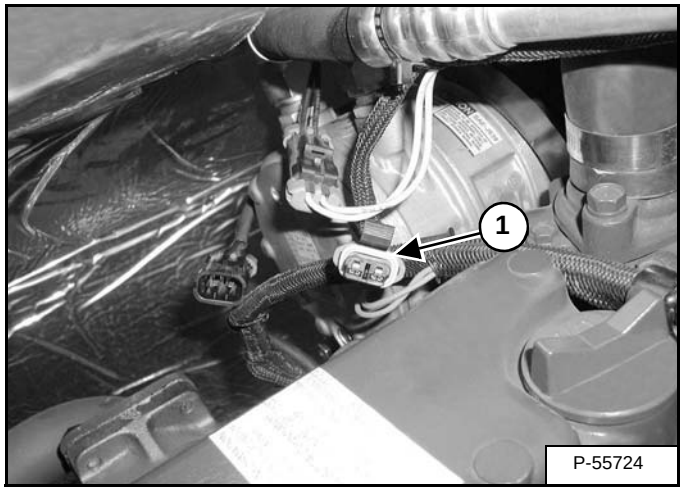
Figure 70-80-16



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

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

Figure 70-80-17

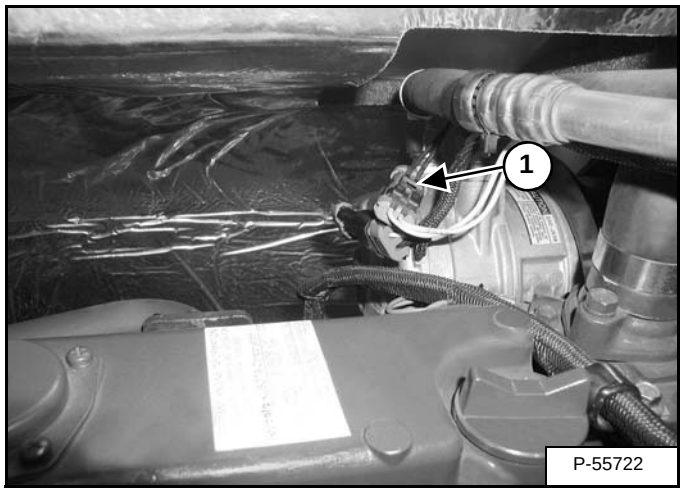


With a multimeter, check the voltage to the compressor clutch at the wire harness (Item 1) **[Figure 70-80-17]**.

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

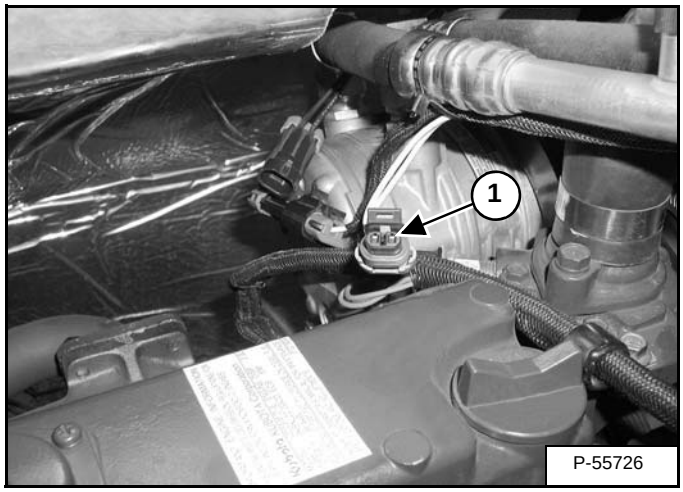
If there is no power at the clutch, reconnect the wiring harness to the compressor clutch.

Figure 70-80-18



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

Figure 70-80-19



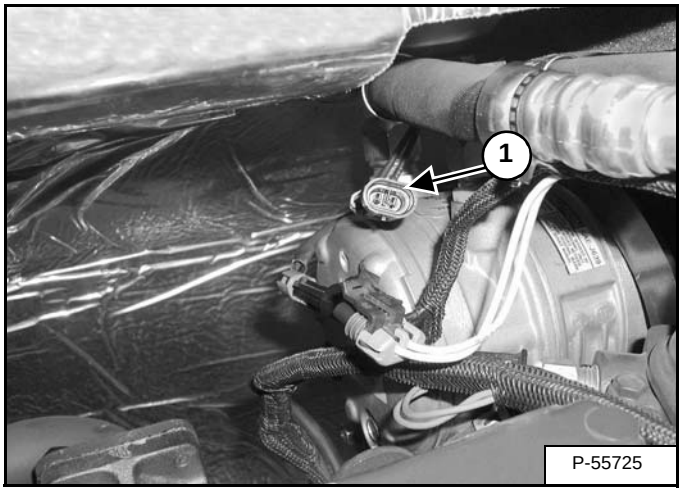
Using a multimeter check the wiring harness (Item 1) **[Figure 70-80-19]** for voltage.

The voltage should be approximately 12 volts.

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Checking The Electrical System (Cont'd)

Figure 70-80-20



If there is voltage at the harness, check the resistance at the pressure switch (Item 1) **[Figure 70-80-20]**.

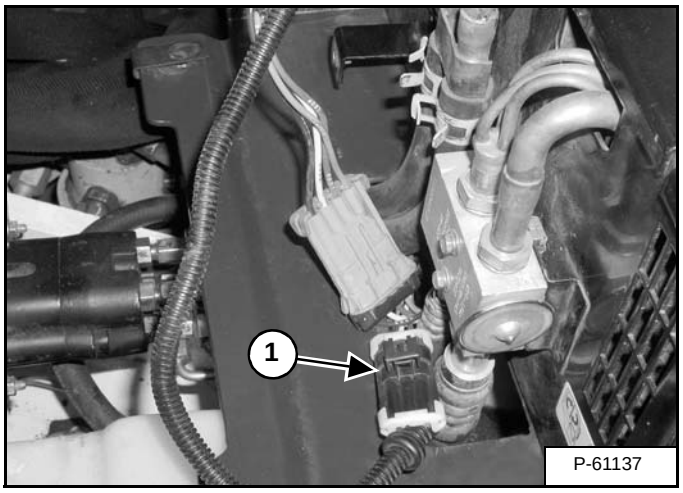
If there is no resistance value, check for low or high refrigerant levels in the system. (See Chart on Page 70-110-1.)

If a resistance value is observed, the pressure switch is good.

If there is no voltage at the wiring harness check the harness for broken wires. If there are no broken wires, reconnect the wire harness to the pressure switch.

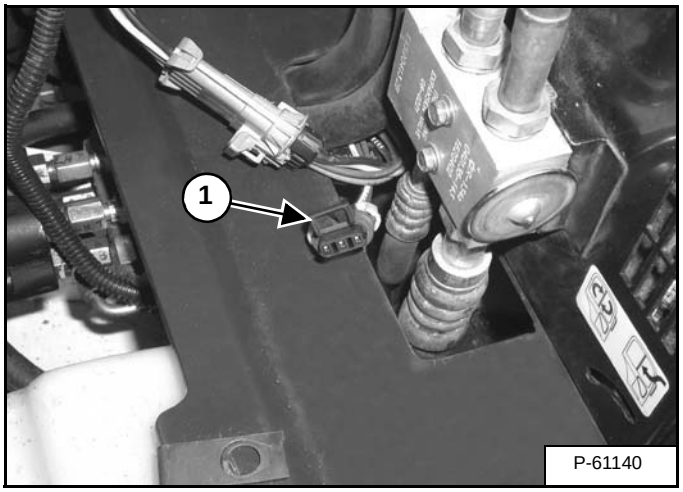
Remove the floormat and floor panel. (See Contents Page 40-01.)

Figure 70-80-21



Disconnect the thermostat/blower fan wire harness (Item 1) **[Figure 70-80-21]**.

Figure 70-80-22



Check the wire harness (Item 1) **[Figure 70-80-22]** for voltage. The voltage should be approximately 12 volts, from Pin A (Blue wire # 3100) to ground.

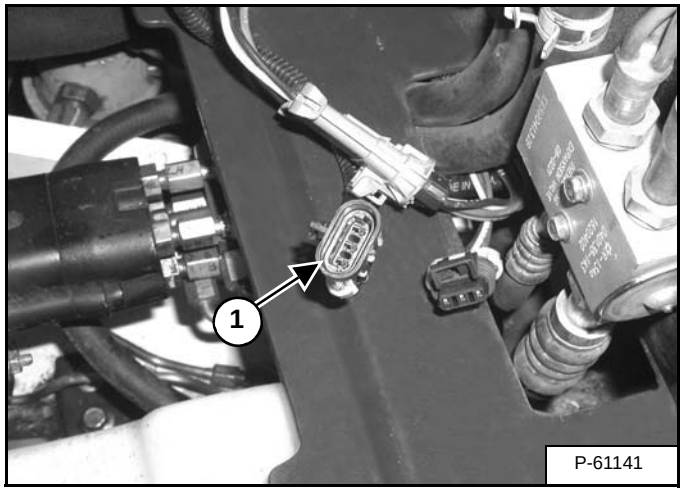
If there is no voltage at the wiring harness, check the harness for broken wires.

If there is voltage at the wiring harness, check the thermostat for resistance.

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Checking The Electrical System (Cont'd)

Figure 70-80-23



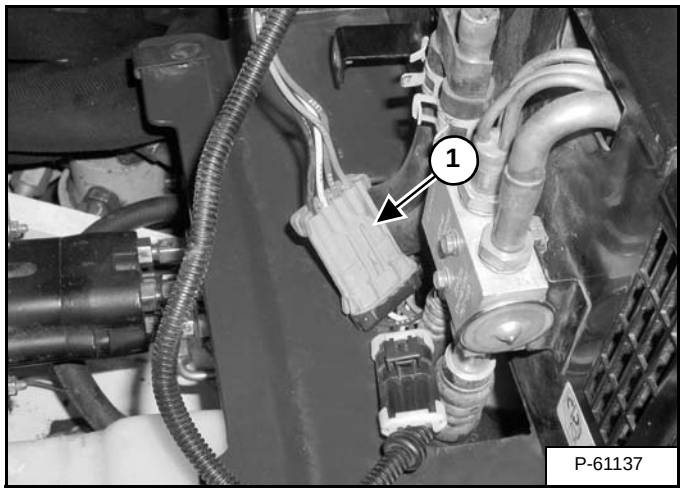
The resistance value of the thermostat should be 10 Ohms at 68° F (20° C), between Pin B & Pin A on the electrical connector (Item 1) **[Figure 70-80-23]** (Between WHITE wire # 7010 and BLUE wire # 3100)

If there is no resistance value, replace the thermostat. (See Removal And Installation on Page 70-200-1.)

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

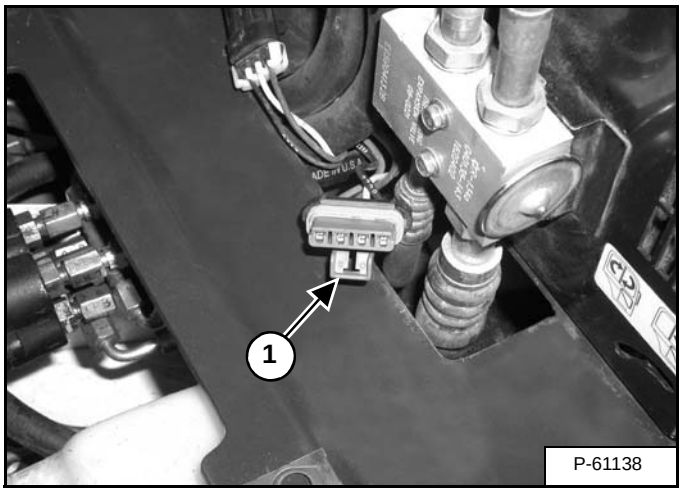
If there are no broken wires use the following procedure to check the blower fan and switch.

Figure 70-80-24



Disconnect the wire harness (Item 1) **[Figure 70-80-24]**.

Figure 70-80-25



Check the wire harness (Item 1) **[Figure 70-80-25]** for voltage to the blower fan.

In the cab, place the blower switch in position 1. Check for voltage at the harness connector (Item 1) **[Figure 70-80-25]**, Pin 3. (YELLOW wire # 5000). The voltage should be 12 volts.

In the cab, place the blower switch in position 2. Check for voltage at the harness connector (Item 1) **[Figure 70-80-25]**, Pin 2. (RED wire # 1200). The voltage should be 12 volts.

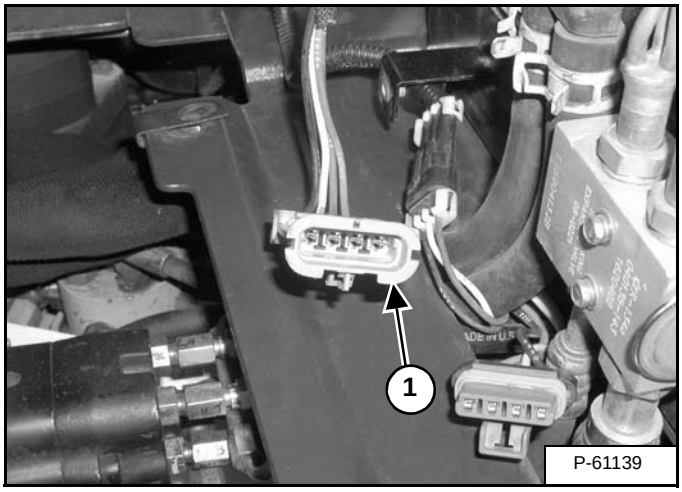
In the cab, place the blower switch in position 3. Check for voltage at the harness connector (Item 1) **[Figure 70-80-25]**, Pin 1. (ORANGE wire # 1010). The voltage should be 12 volts.

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

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Checking The Electrical System (Cont'd)

Figure 70-80-26



If there is voltage at the wiring harness, check the resistance to the blower fan at the thermostat/blower fan wiring connector (Item 1) **[Figure 70-80-26]**.

Check the resistance between Pin 4 (BLACK wire # 2200) and Pin 3 (YELLOW wire # 5000).

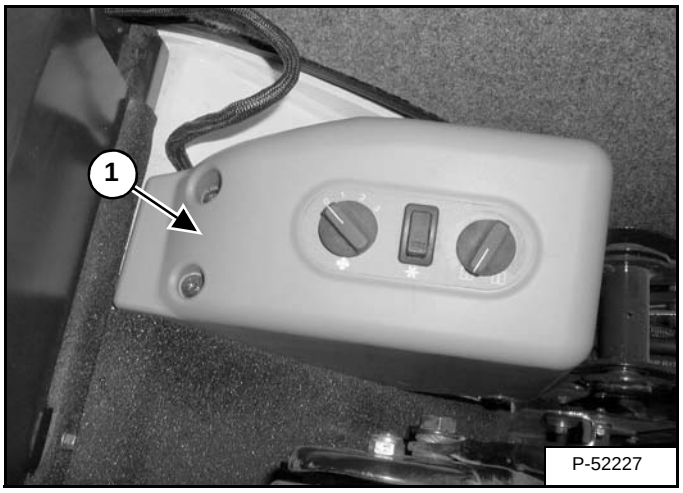
Check the resistance between Pin 4 (BLACK wire # 2200) and Pin 2 (RED wire # 1200).

Check the resistance between Pin 4 (BLACK wire # 2200) and Pin 1 (ORANGE wire # 1010).

If there is no resistance value at any of these pins, replace the blower fan. (See Removal And Installation on Page 70-20-1.)

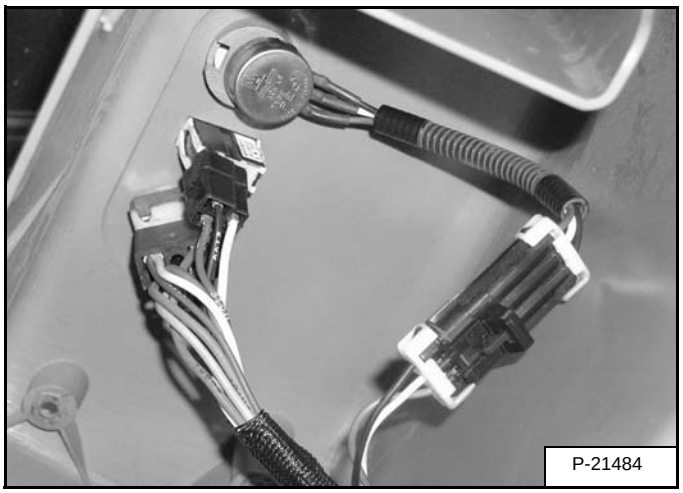
If there is resistance value at any of the pins, check the climate controls at the control panel inside the excavator cab.

Figure 70-80-27



Remove the upper left upper console (Item 1) **[Figure 70-80-27]**. (See Upper Console Cover Removal And Installation on Page 40-60-3.)

Figure 70-80-28

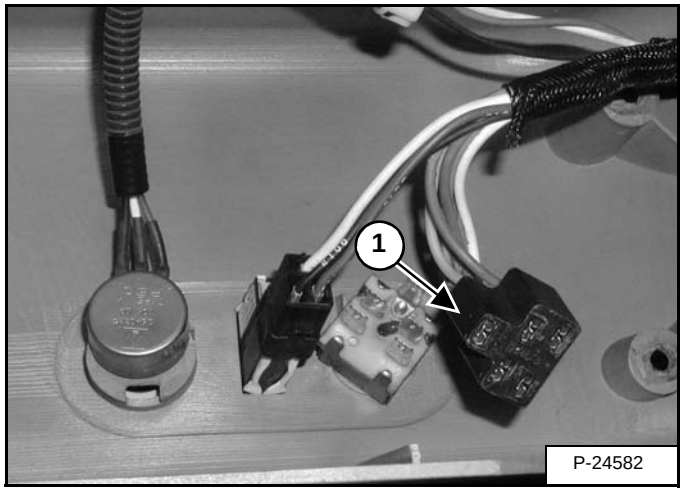


Position the console and wiring harness in the cab so the wiring harness can be checked **[Figure 70-80-28]**.

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Checking The Electrical System (Cont'd)

Figure 70-80-29

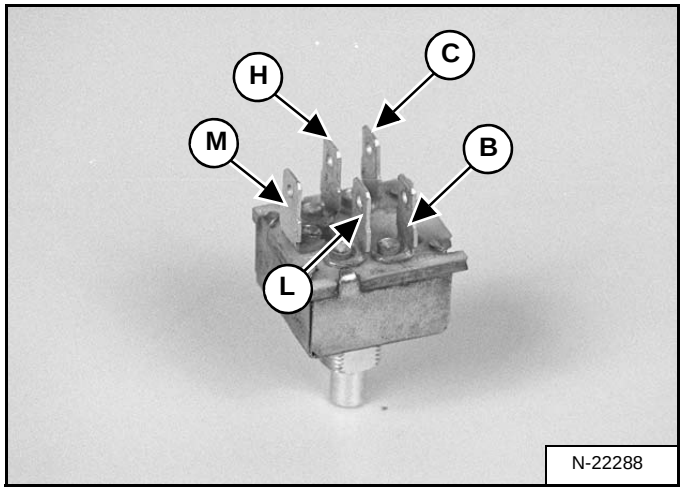


Disconnect the wiring harness (Item 1) **[Figure 70-80-29]** from the blower switch.

Check the harness for voltage. The voltage should be approximately 12 volts.

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

Figure 70-80-30



If there is voltage at the wiring harness, check the blower switch **[Figure 70-80-30]** for resistance.

With the switch in the OFF position, there should be zero resistance between all terminals.

With the switch in the **1** position, there should be resistance between **C** terminal and the **B** terminal. And also between the **C** terminal and the **L** terminal frame **[Figure 70-80-30]**.

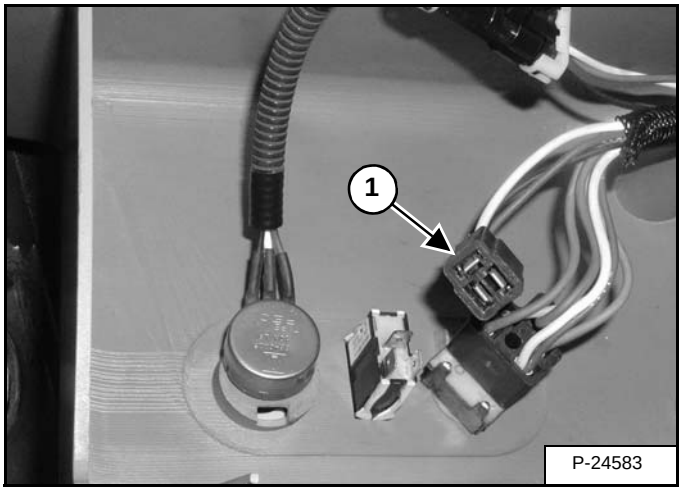
With the switch in the **2** position, there should be resistance between **C** terminal and the **B** terminal. And also between the **C** terminal and the **M** terminal frame **[Figure 70-80-30]**.

With the switch in the **3** position, there should be resistance between **C** terminal and the **B** terminal. And also between the **C** terminal and the **H** terminal frame **[Figure 70-80-30]**.

If any of the above resistance tests fail, replace the blower switch.

If the above resistance tests are good, check the A/C switch.

Figure 70-80-31



At the excavator cab, disconnect the wire harness (Item 1) **[Figure 70-80-31]** from the A/C switch.

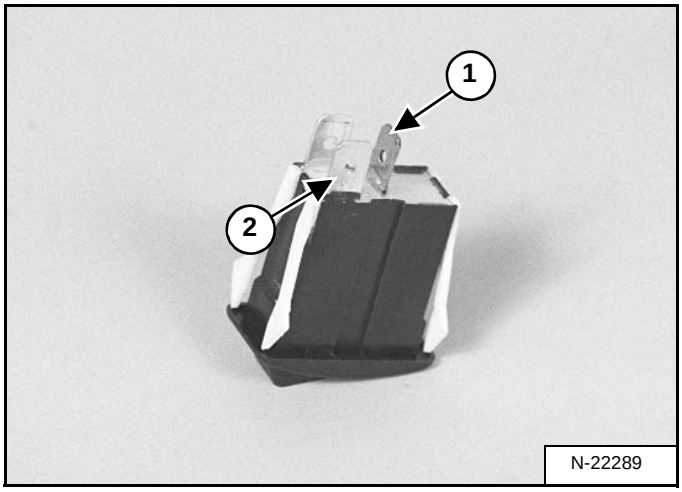
Check the harness for voltage. The voltage should be approximately 12 volts.

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

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Checking The Electrical System (Cont'd)

Figure 70-80-32



If there is voltage at the wiring harness, check the A/C switch **[Figure 70-80-32]** for resistance.

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

With the switch in the ON position there should be resistance between terminal (Item 1) and terminal (Item 2) **[Figure 70-80-32]**.

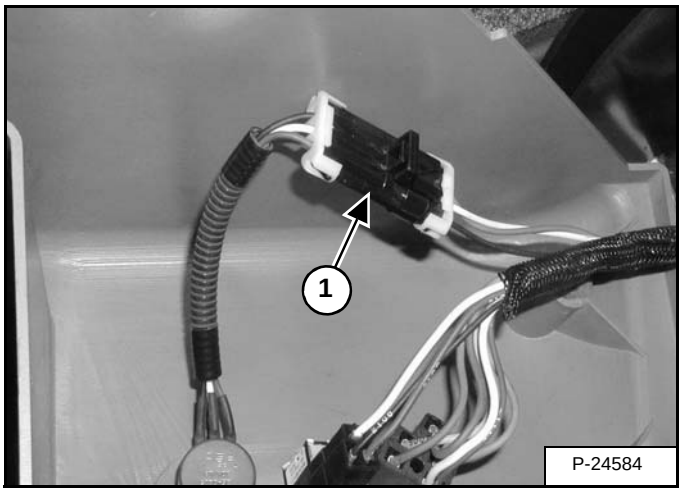
If no resistance value is found, replace the A/C switch.

If a resistance value is found, check the potentiometer.

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

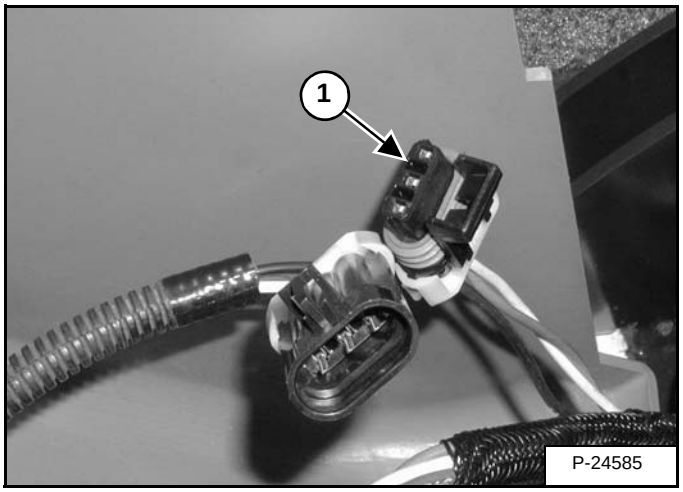
If the heater valve does not open, or close, or the A/C does not work, check the potentiometer.

Figure 70-80-33



Disconnect the wire harness (Item 1) **[Figure 70-80-33]** from the potentiometer.

Figure 70-80-34



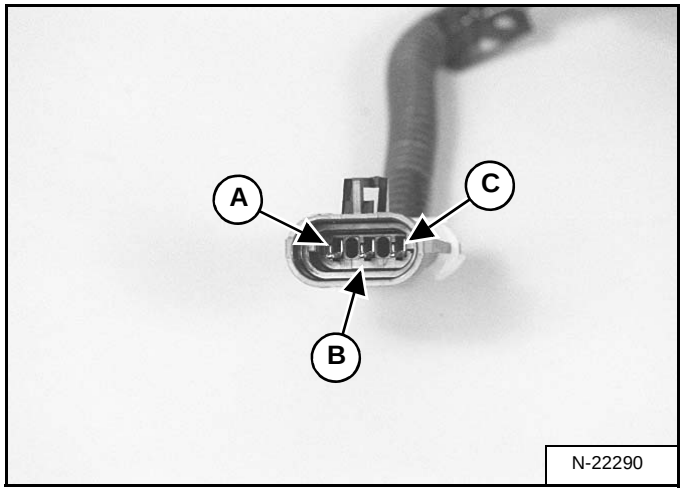
Check the wire harness (Item 1) **[Figure 70-80-34]** for voltage. Between pins **A** and **C** the voltage should be approximately 12 volts.

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

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Checking The Electrical System (Cont'd)

Figure 70-80-35

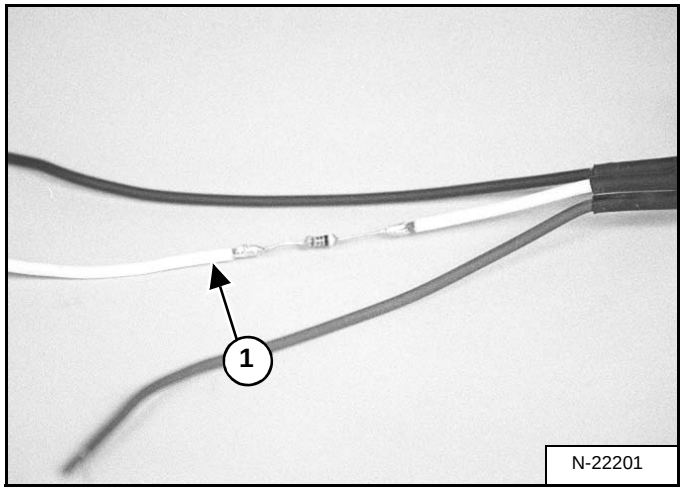


If there is voltage at the wiring harness, check the potentiometer **[Figure 70-80-35]** for resistance.

The resistance should be 10K Ohm's between wire terminal **A** and wire terminal **C** frame **[Figure 70-80-35]**.

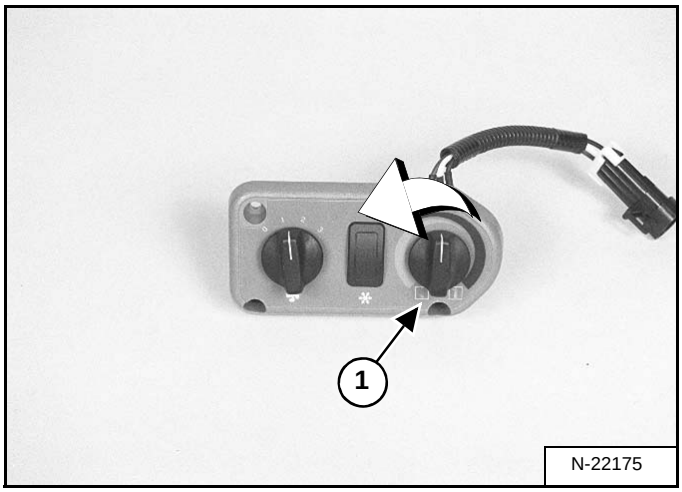
If no resistance is found replace the potentiometer.

Figure 70-80-36



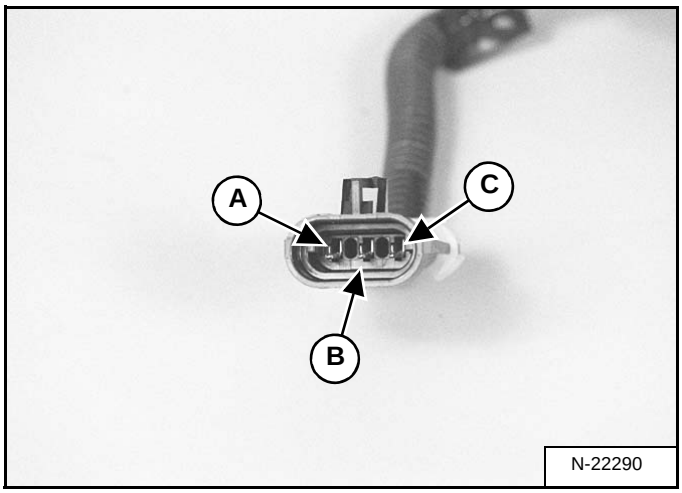
The white wire **B**, (Item 1) **[Figure 70-80-36]**, on the potentiometer, is a resister wire.

Figure 70-80-37



To check the resistance of the white wire, turn the potentiometer control (Item 1) **[Figure 70-80-37]** to the full A/C position.

Figure 70-80-38



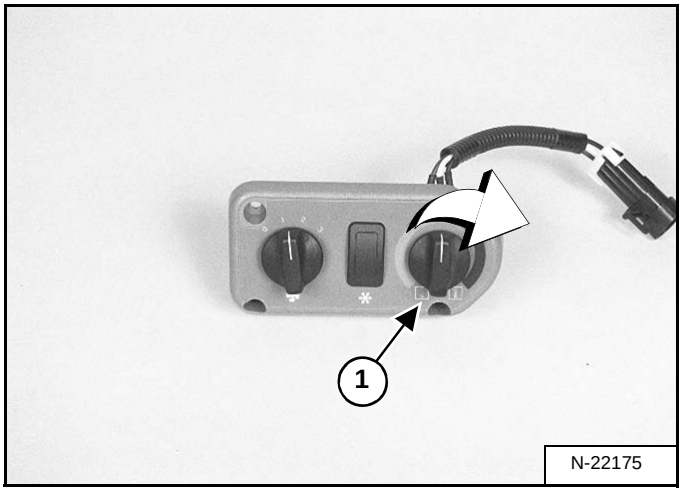
The resistance between the wire terminal **A** and wire terminal **B** frame **[Figure 70-80-38]** should be approximately 49K Ohm's.

Check the resistance between the wire terminal **C** and wire terminal **B** frame **[Figure 70-80-38]** should be approximately 39K Ohm's.

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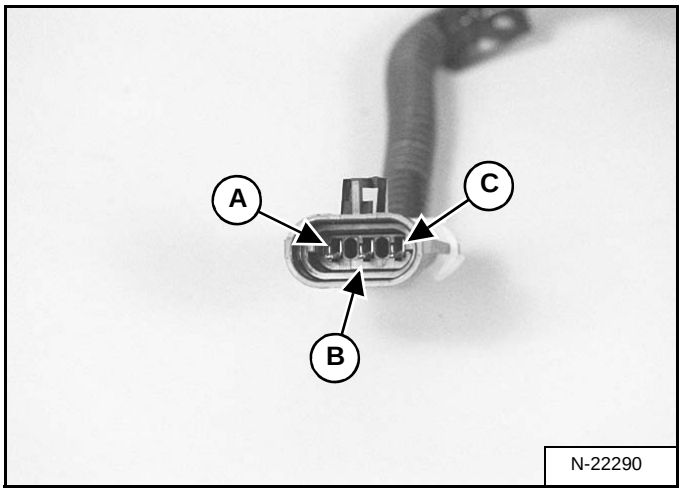
Checking The Electrical System (Cont'd)

Figure 70-80-39



To check the resistance of the white wire, turn the potentiometer control (Item 1) **[Figure 70-80-39]** to the full Heater position.

Figure 70-80-40



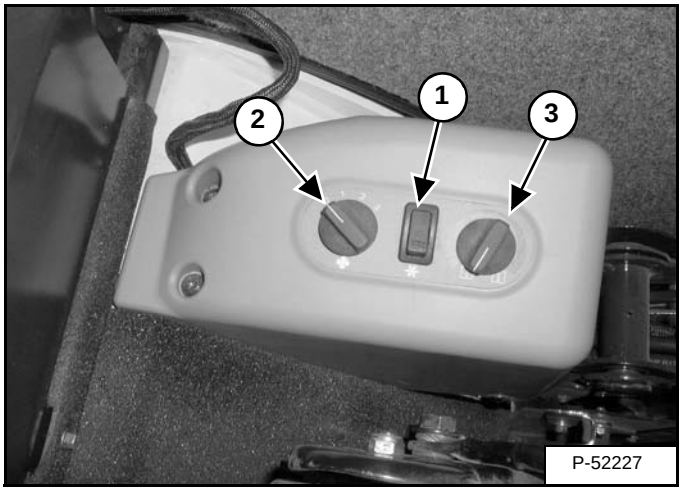
Check the resistance between the wire terminal A and wire terminal B frame **[Figure 70-80-40]** should be approximately 39K Ohm's.

Check the resistance between the wire terminal C and wire terminal B frame **[Figure 70-80-40]** should be approximately 49K Ohm's.

If the resistance is not found replace the potentiometer.

Engine Coolant By-Passing The Heater Valve

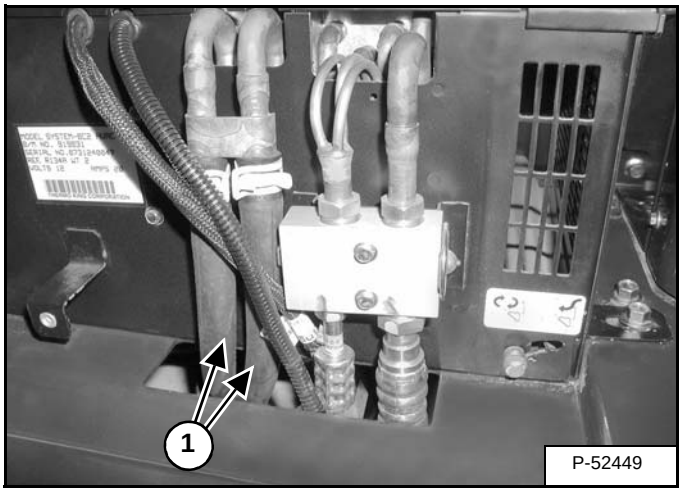
Figure 70-80-41



Push the A/C switch (Item 1) to the OFF position. Turn the fan switch (Item 2) to the High Speed position., Turn the temperature control (Item 3) **[Figure 70-80-41]** to the High A/C position, with the key switch OFF.

Start the excavator and run at high idle, for ten minutes.

Figure 70-80-42



Check the temperature of the heater hoses (Item 1) **[Figure 70-80-42]**.

If the hoses are hot, the heater valve is leaking internally, and needs to be replaced.

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BASIC TROUBLESHOOTING (LATER MODELS)

Poor A/C Performance

Start the excavator. Engage the A/C system with the blower fan on high. Run the excavator at full RPM for approximately 15 minutes, with the cab door closed.

Figure 70-81-1

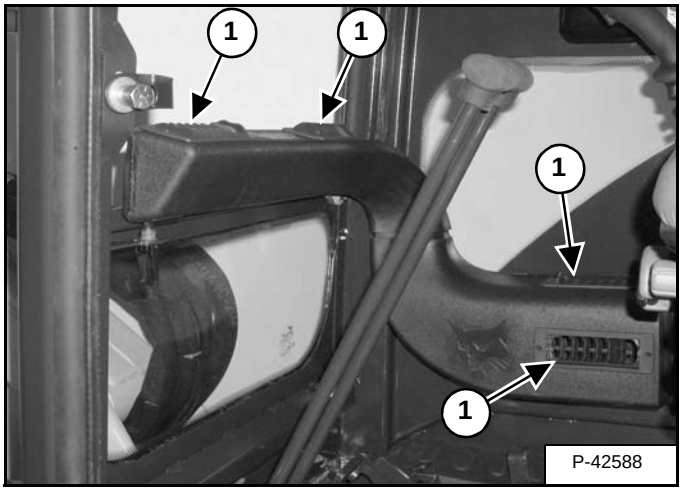
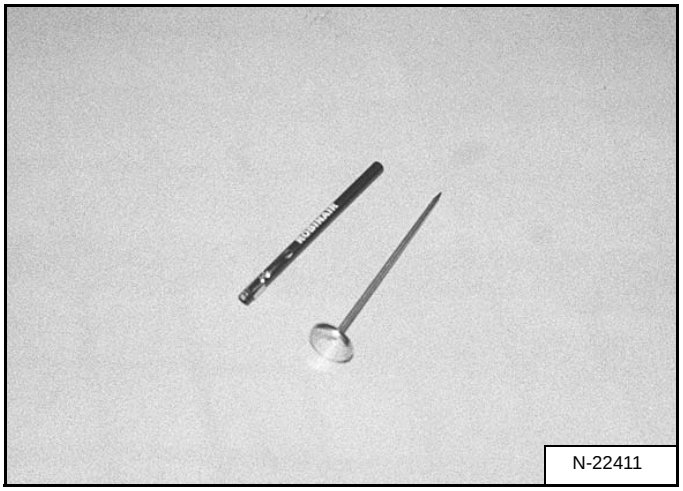


Figure 70-81-2



Check the temperature at the louvers (Item 1) **[Figure 70-81-1]** with a thermometer **[Figure 70-81-2]**.

The louver temperature should be between 36-53° F. (2,2 -11,6° C) depending on the amount of humidity in the air.

If louver temperature is too high see the System Troubleshooting Chart. (See SYSTEM TROUBLESHOOTING CHART on Page 70-100-1.)

Check the fan for proper operation or noise, and replace if necessary. (See BLOWER FAN (LATER MODELS) on Page 70-21-1.)

Check the engine accessory drive belt tension. (See ENGINE ACCESSORY DRIVE BELT on Page 10-140-1.)

Check the A/C evaporator coil for dirt or mud, and clean if necessary. (See Cleaning The A/C Evaporator Coil & Heater Coil on Page 70-81-2.)

Inspect the sight glass located on the receiver/drier for air bubbles. (See Blower Motor Does Not Operate on Page 70-100-1.)

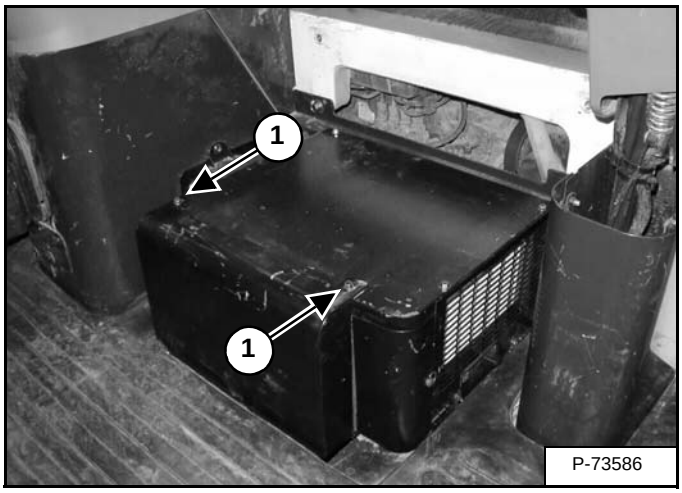
Check the engine coolant to see if it is bypassing the heater valve. (See Engine Coolant By-Passing The Heater Valve on Page 70-81-14.)

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Cleaning The A/C Evaporator Coil & Heater Coil

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

Figure 70-81-3



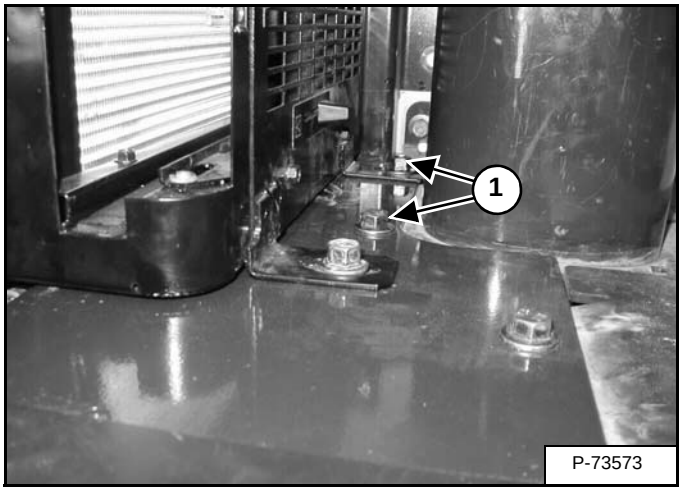
Remove the bolts (Item 1) **[Figure 70-81-3]**.

Remove the front cover.

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

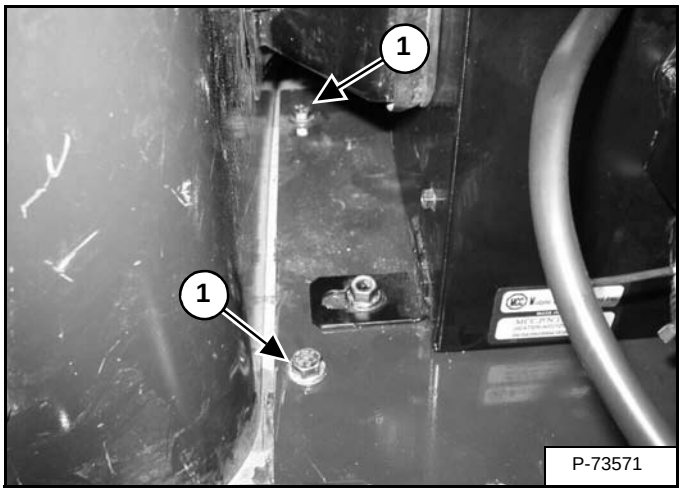
Remove the floormat and floor plate. (See Removal And Installation on Page 40-120-1.)

Figure 70-81-4



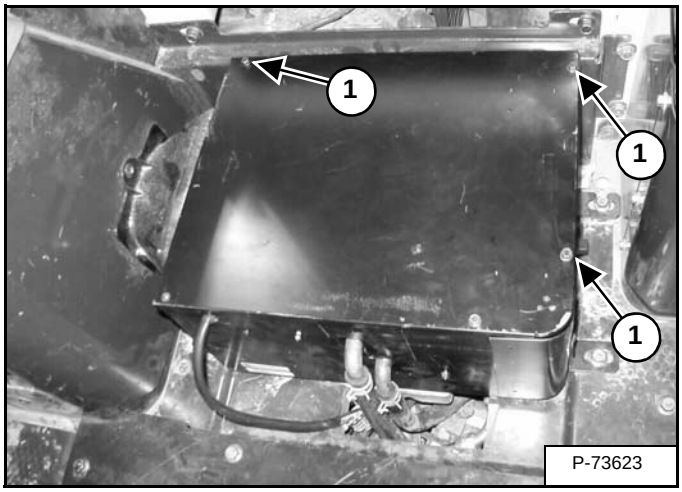
Remove the bolts (Item 1) **[Figure 70-81-4]** from the left side of the cab.

Figure 70-81-5



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

Figure 70-81-6



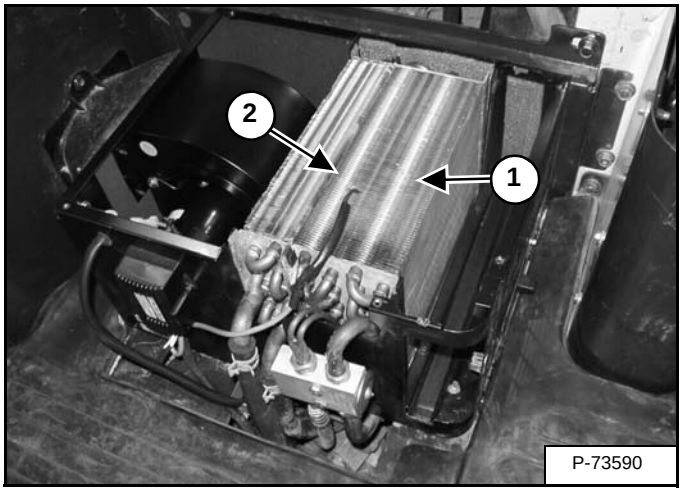
Move the unit forward. Remove the bolts (Item 1) **[Figure 70-81-6]** from the access cover.

Remove the access cover.

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Cleaning The A/C Evaporator Coil & Heater Coil (Cont'd)

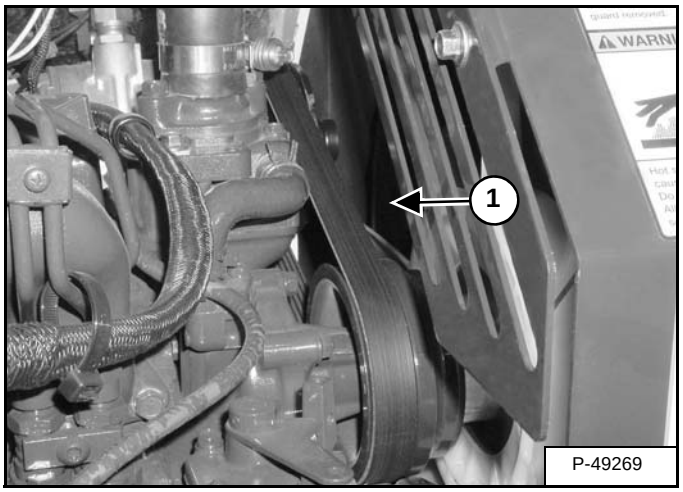
Figure 70-81-7



Clean the evaporator coil (Item 1) and heater coil (Item 2) **[Figure 70-81-7]** with low pressure air or water.

Engine Accessory Drive Belt Inspection

Figure 70-81-8



Inspect and adjust the engine accessory drive belt (Item 1) **[Figure 70-81-8]** every 100 hours of operation. (See ENGINE ACCESSORY DRIVE BELT on Page 10-140-1.)

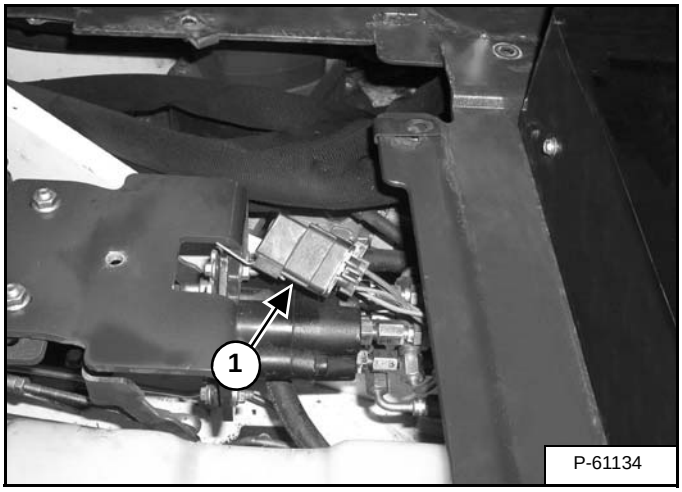
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Checking The Electrical System

If the excavator A/C system, shows no blower motor function, no A/C switch light and no A/C compressor function. Do the following checks at the A/C relay.

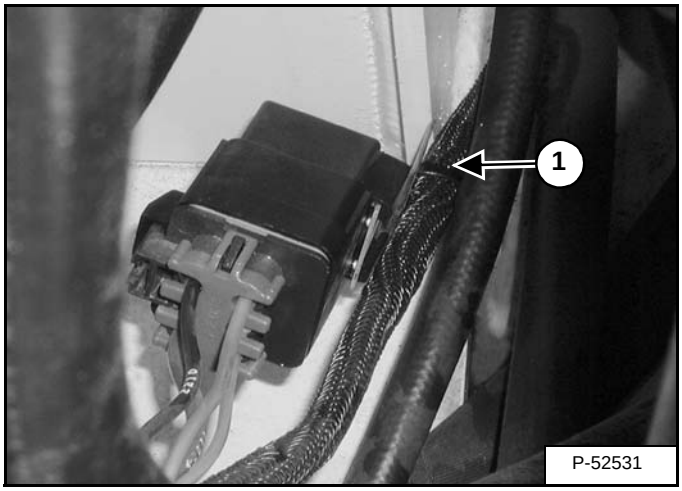
Open the right side cover.

Figure 70-81-9



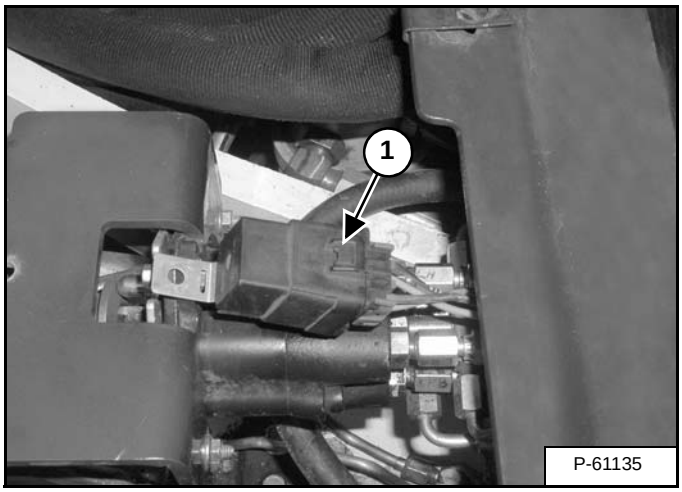
The A/C relay (Item 1) **[Figure 70-81-9]** is located below the floor panel.

Figure 70-81-10



Remove the tie strap (Item 1) **[Figure 70-81-10]** from the relay mount.

Figure 70-81-11



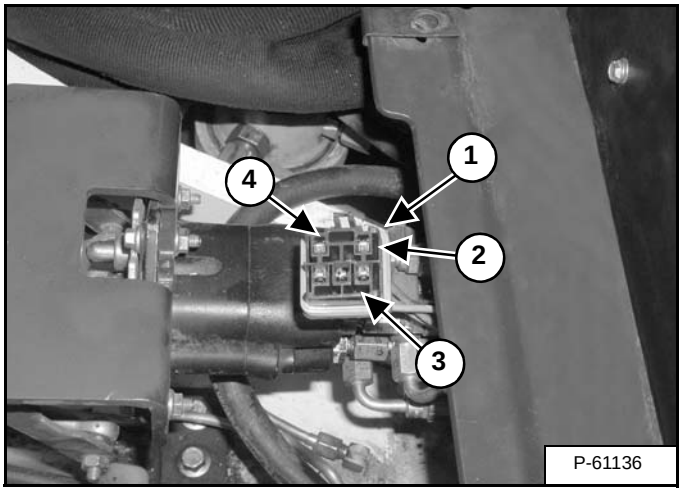
Depress the tab (Item 1) **[Figure 70-81-11]** on the relay.

Remove the relay from the wire harness.

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Checking The Electrical System (Cont'd)

Figure 70-81-12



With a multimeter, check the voltage at the excavator A/C relay wiring harness connector (Item 1) **[Figure 70-81-12]**.

The voltage at Pin 30 (Item 2) **[Figure 70-81-12]** (Red Wire # 1190) should be 12 volts at all times.

If there is no voltage check the fuse #6, at the fuse box. (See **[Figure 70-81-15 on Page 6]**)

If the fuse is OK, refer to the electrical diagram to trace wire # 1190 to its source.

The voltage at pin 85 (Item 3) **[Figure 70-81-12]** (Orange Wire # 1740) should be 12 volts when the ignition key is in the ON position.

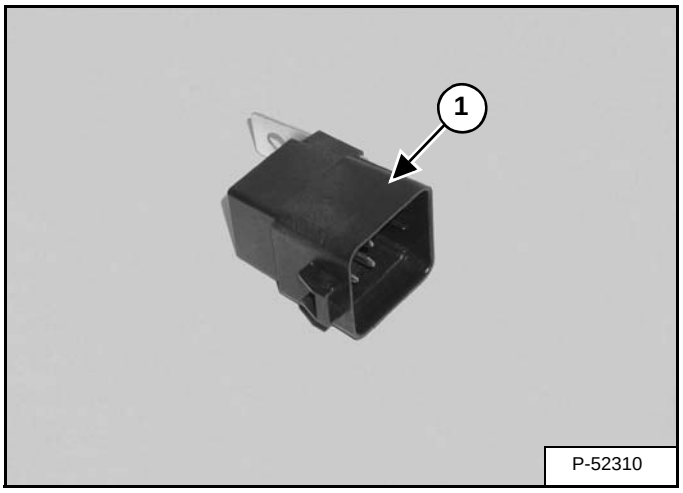
If there is no voltage check the fuse #3 at the fuse box. (See **[Figure 70-81-15 on Page 6]**)

If the fuse is OK, refer to the electrical diagram to trace wire #1740 to its source.

Pin 86 (Item 4) **[Figure 70-81-12]** (black Wire # 2210) is the ground wire. Check for continuity at Pin 86 to the ground.

If there is no continuity trace wire #2210 to its source using the electrical diagram.

Figure 70-81-13

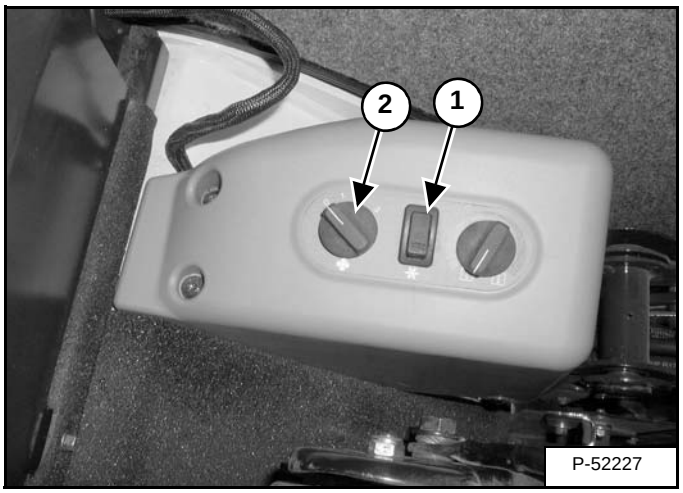


If the above voltages and continuity checks are OK, but the problem still persists, replace the A/C relay (Item 1) **[Figure 70-81-13]**.

Check to see if the compressor clutch is engaging.

With a person in the operator seat and the cab door open, turn the key switch to RUN (Standard panel) OR press the RUN/ENTER Button (Deluxe Panel), without starting the excavator.

Figure 70-81-14



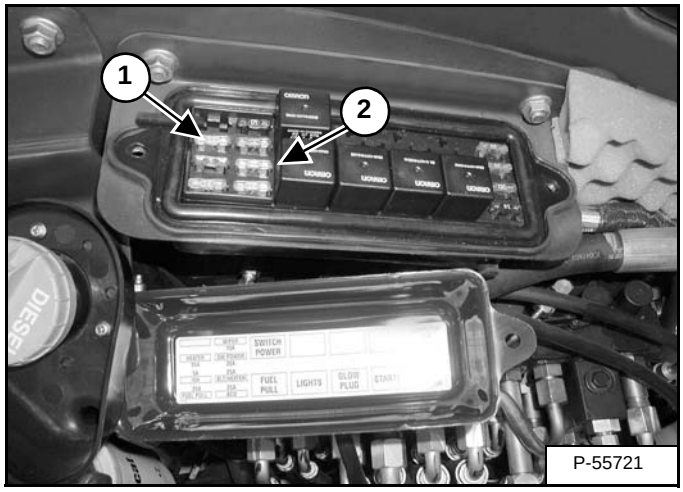
Push the A/C switch (Item 1) to the ON position. Turn the blower fan switch (Item 2) **[Figure 70-81-14]** to the first ON position.

The compressor clutch should make a *click* sound, which indicates the clutch is engaging.

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Checking The Electrical System (Cont'd)

Figure 70-81-15

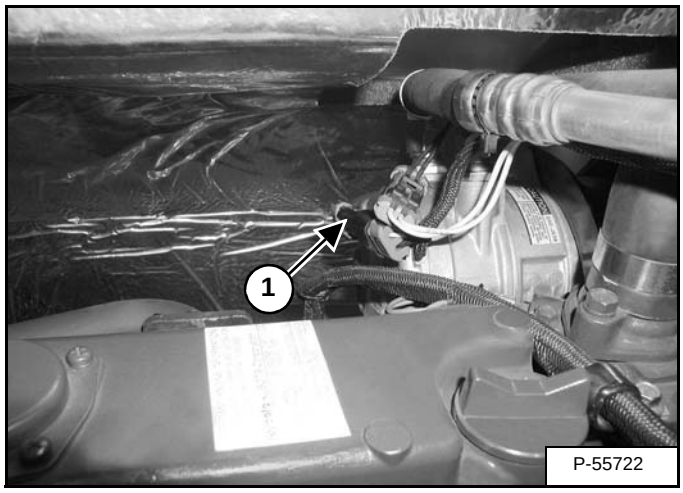


If the compressor clutch does not engage, check the fuses (Item 1 & 2) **[Figure 70-81-15]** located in the engine compartment.

Replace the fuse if burned out.

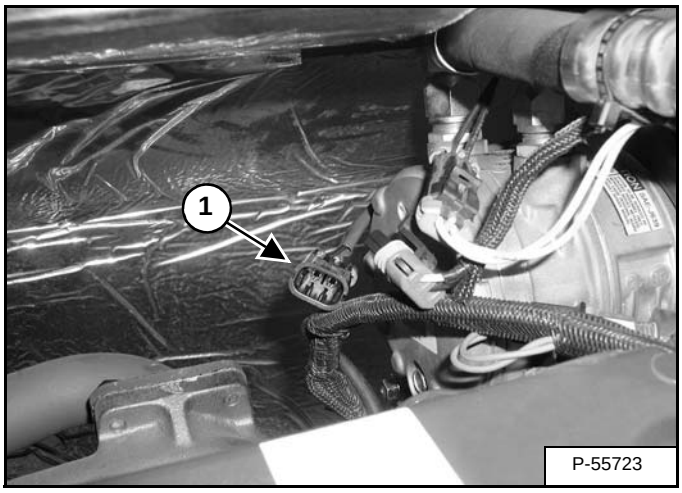
NOTE: The decal inside the fuse cover, refers to the fuses as HEATER and ALT/HEATER. These fuses control the power for both the Heater and the A/C systems.

Figure 70-81-16



If the fuses are good, disconnect the wire harness (Item 1) **[Figure 70-81-16]** from the compressor clutch wire.

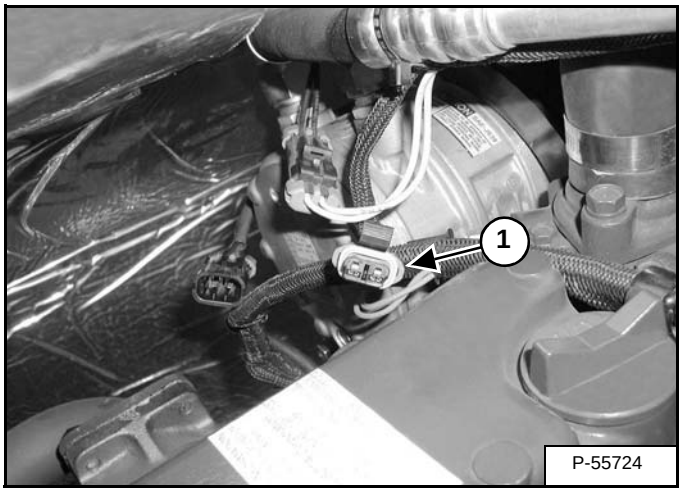
Figure 70-81-17



With a multimeter, check the resistance to the compressor clutch (Item 1) **[Figure 70-81-17]**.

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

Figure 70-81-18



With a multimeter, check the voltage to the compressor clutch at the wire harness (Item 1) **[Figure 70-81-18]**.

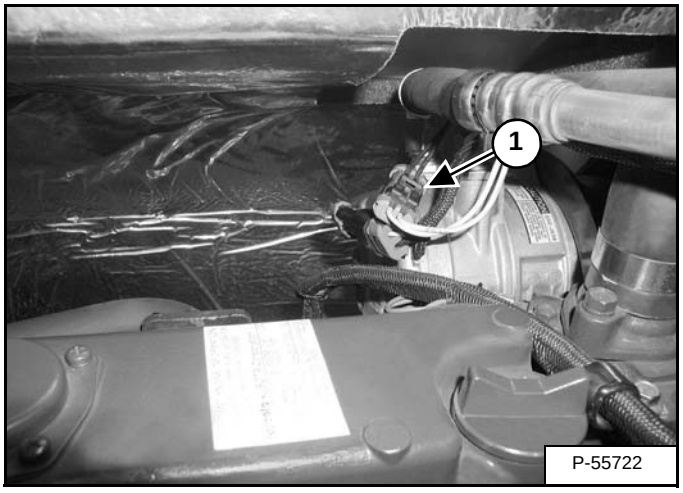
If the voltage reading is approximately 12 volts, the system is operating correctly.

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

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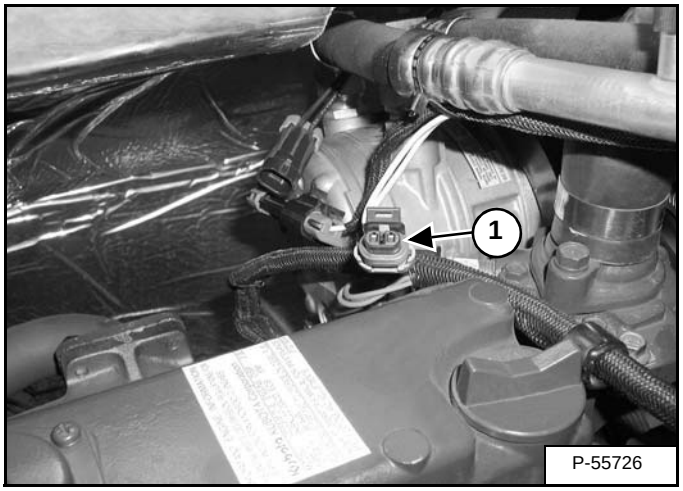
Checking The Electrical System (Cont'd)

Figure 70-81-19



Disconnect the wire harness (Item 1) from the pressure switch (Item 2) **[Figure 70-81-19]**.

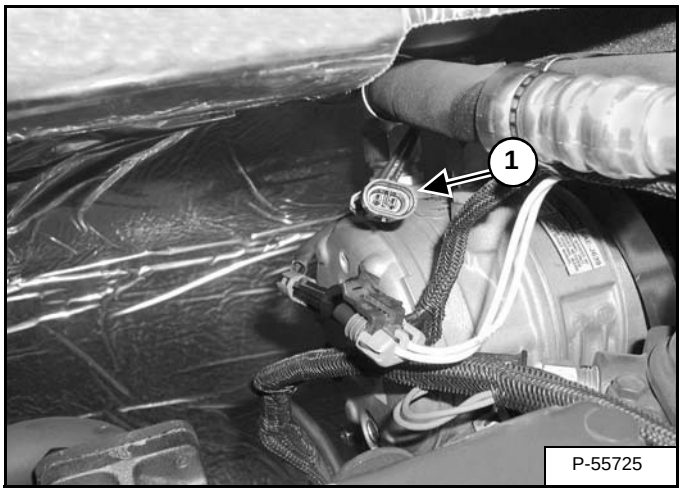
Figure 70-81-20



Using a multimeter check the wiring harness (Item 1) **[Figure 70-81-20]** for voltage.

The voltage should be approximately 12 volts.

Figure 70-81-21



If there is voltage at the harness, check the resistance at the pressure switch (Item 1) **[Figure 70-81-21]**.

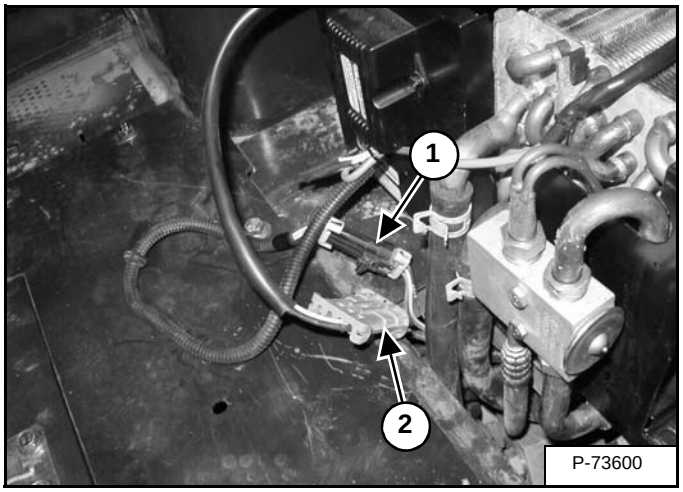
If there is no resistance value, check for low or high refrigerant levels in the system. (See GENERAL AIR CONDITIONING SERVICE GUIDELINES on Page 70-90-1.)

If a resistance value is observed, the pressure switch is good.

If there is no voltage at the wiring harness check the harness for broken wires. If there are no broken wires, reconnect the wire harness to the pressure switch.

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

Figure 70-81-22



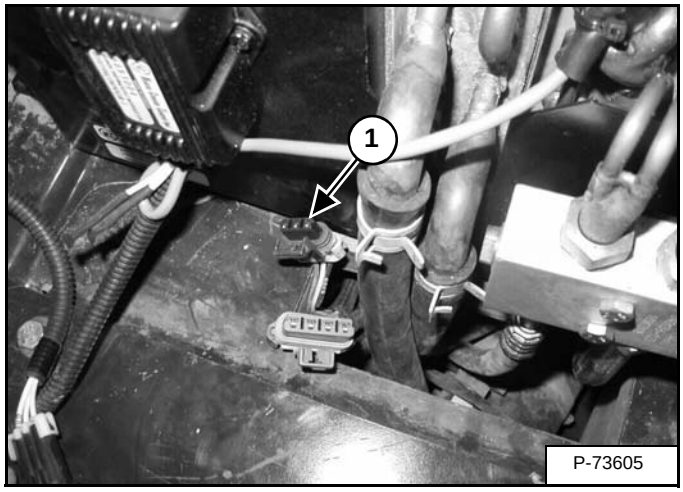
Relocate the two wire connectors (Item 1 & 2) **[Figure 70-81-22]** to the top of the floor plate

Disconnect the thermostat/blower fan wire harness (Item 1) **[Figure 70-81-22]**.

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Checking The Electrical System (Cont'd)

Figure 70-81-23

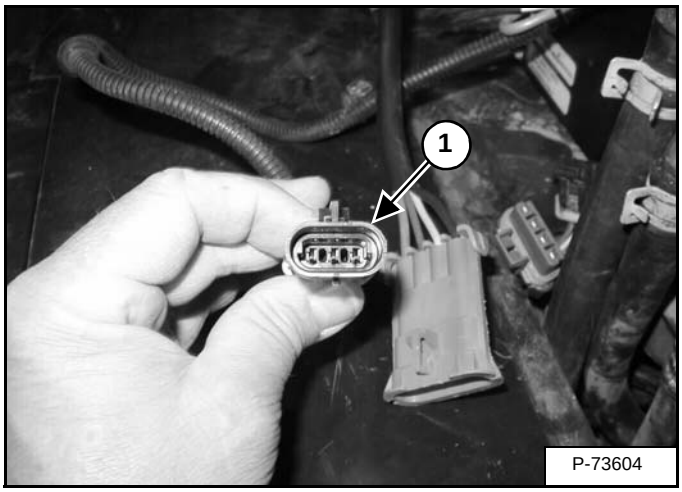


Check the wire harness (Item 1) **[Figure 70-81-23]** for voltage. The voltage should be approximately 12 volts, between the blue wire (#3100) and ground wire (#2120).

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

If there is voltage at the wiring harness, check the thermostat for resistance.

Figure 70-81-24



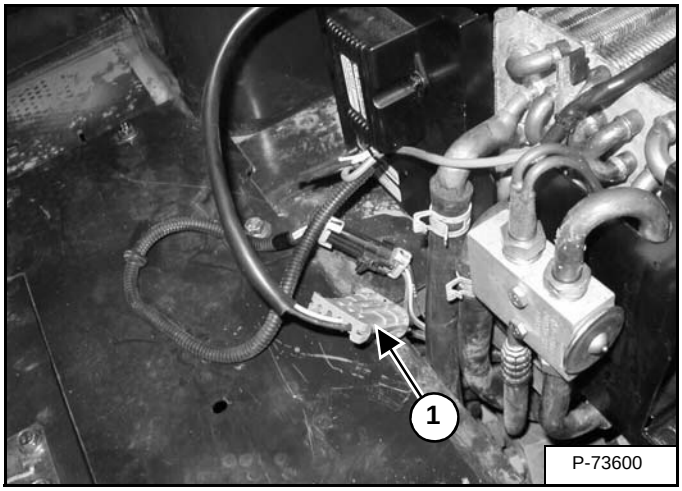
The resistance value of the thermostat should be 10 Ohms at 68° F (20° C), between the blue wire (#3100) and ground wire (#2120) at the electrical connector (Item 1) **[Figure 70-81-24]** (Between WHITE wire # 7010 and BLUE wire # 3100)

If there is no resistance value, replace the thermostat. (See Removal And Installation on Page 70-200-1.)

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

If there are no broken wires use the following procedure to check the blower fan and switch.

Figure 70-81-25

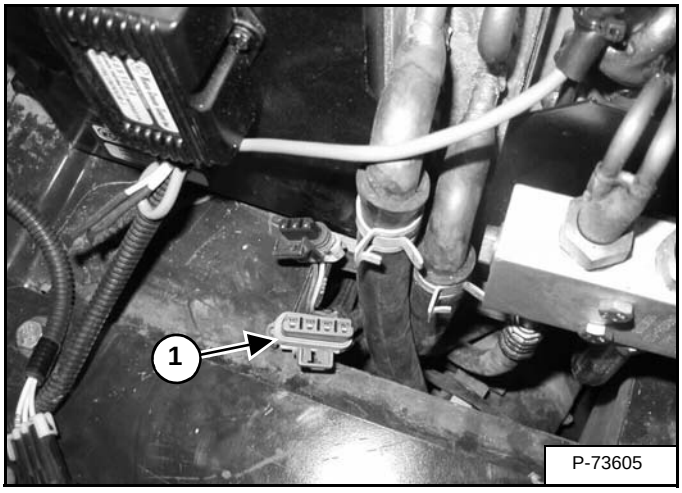


Disconnect the wire harness (Item 1) **[Figure 70-81-25]**.

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Checking The Electrical System (Cont'd)

Figure 70-81-26



Check the wire harness (Item 1) **[Figure 70-81-26]** for voltage to the blower fan.

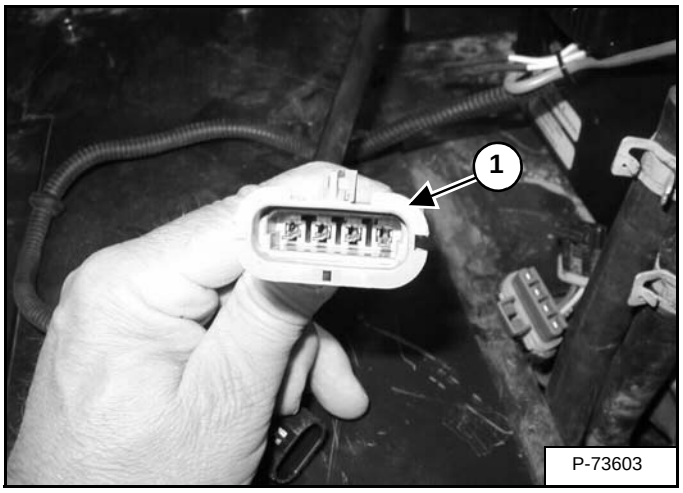
In the cab, place the blower switch in position 1. Check for voltage at the harness connector (Item 1) **[Figure 70-81-26]**, Pin 3. (YELLOW wire # 5000). The voltage should be 12 volts.

In the cab, place the blower switch in position 2. Check for voltage at the harness connector (Item 1) **[Figure 70-81-26]**, Pin 2. (RED wire # 1200). The voltage should be 12 volts.

In the cab, place the blower switch in position 3. Check for voltage at the harness connector (Item 1) **[Figure 70-81-26]**, Pin 1. (ORANGE wire # 1010). The voltage should be 12 volts.

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

Figure 70-81-27



If there is voltage at the wiring harness, check the resistance to the blower fan at the thermostat/blower fan wiring connector (Item 1) **[Figure 70-81-27]**.

Check the resistance between Pin 4 (BLACK wire # 2200) and Pin 3 (YELLOW wire # 5000).

Check the resistance between Pin 4 (BLACK wire # 2200) and Pin 2 (RED wire # 1200).

Check the resistance between Pin 4 (BLACK wire # 2200) and Pin 1 (ORANGE wire # 1010).

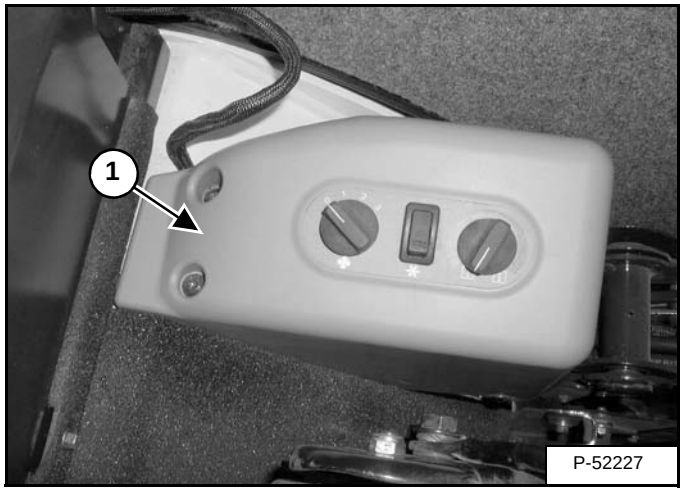
If there is no resistance value at any of these pins, replace the blower fan. (See Removal And Installation on Page 70-21-1.)

If there is resistance value at any of the pins, check the climate controls at the control panel inside the excavator cab.

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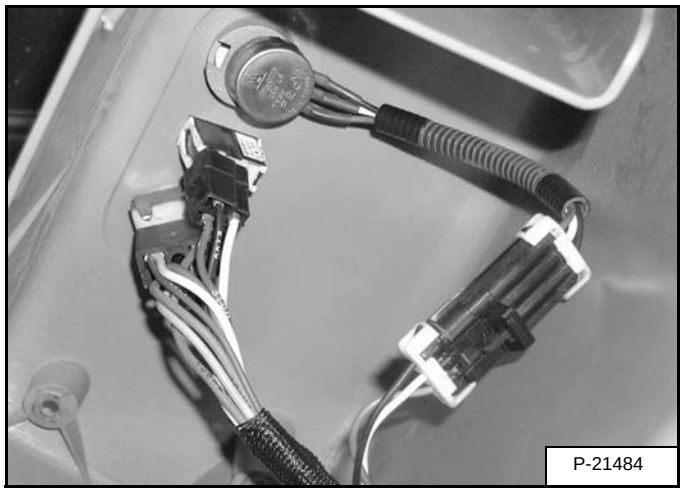
Checking The Electrical System (Cont'd)

Figure 70-81-28



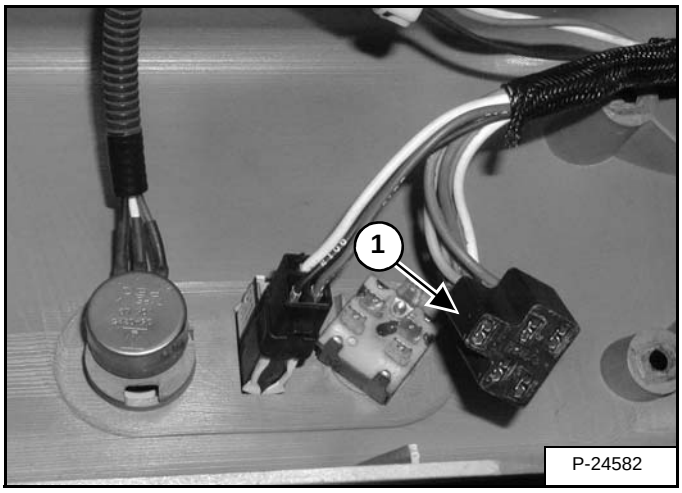
Remove the upper left upper console (Item 1) **[Figure 70-81-28]**. (See Upper Console Cover Removal And Installation on Page 40-60-3.)

Figure 70-81-29



Position the console and wiring harness in the cab so the wiring harness can be checked **[Figure 70-81-29]**.

Figure 70-81-30



Disconnect the wiring harness (Item 1) **[Figure 70-81-30]** from the blower switch.

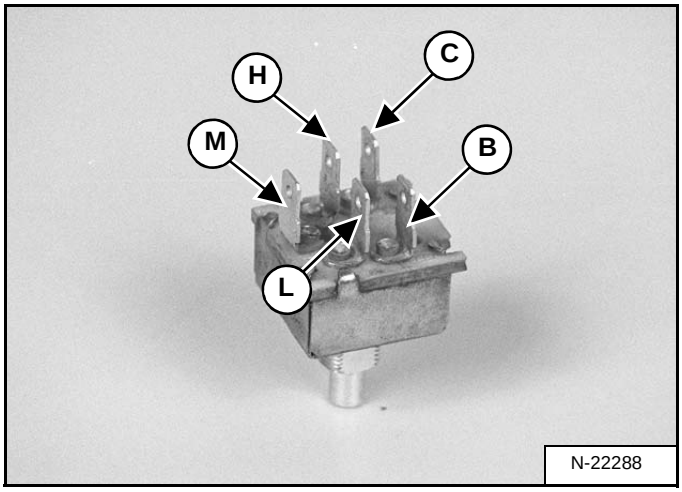
Check the harness for voltage. The voltage should be approximately 12 volts.

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

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Checking The Electrical System (Cont'd)

Figure 70-81-31



If there is voltage at the wiring harness, check the blower switch **[Figure 70-81-31]** for resistance.

With the switch in the OFF position, there should be zero resistance between all terminals.

With the switch in the **1** position, there should be resistance between **C** terminal and the **B** terminal. And also between the **C** terminal and the **L** terminal frame **[Figure 70-81-31]**.

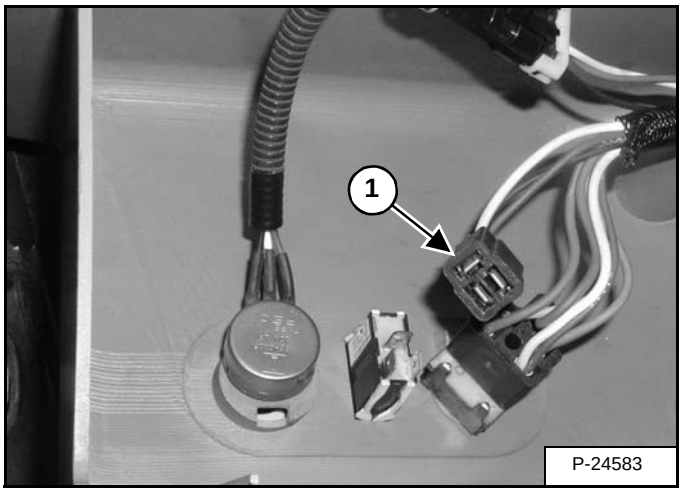
With the switch in the **2** position, there should be resistance between **C** terminal and the **B** terminal. And also between the **C** terminal and the **M** terminal frame **[Figure 70-81-31]**.

With the switch in the **3** position, there should be resistance between **C** terminal and the **B** terminal. And also between the **C** terminal and the **H** terminal frame **[Figure 70-81-31]**.

If any of the above resistance tests fail, replace the blower switch.

If the above resistance tests are good, check the A/C switch.

Figure 70-81-32



At the excavator cab, disconnect the wire harness (Item 1) **[Figure 70-81-32]** from the A/C switch.

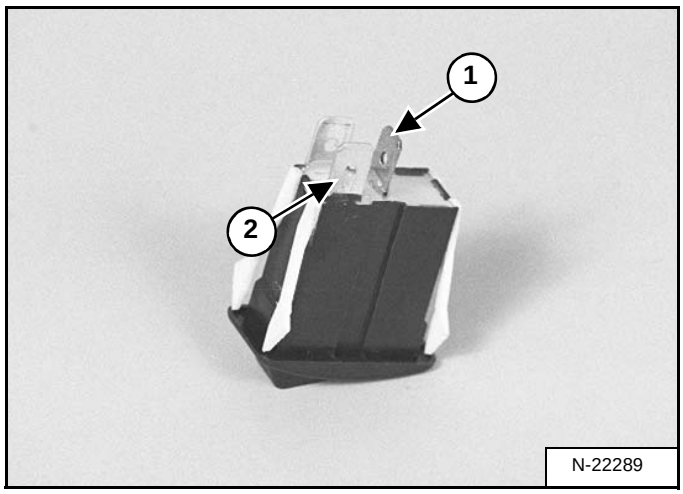
Check the harness for voltage. The voltage should be approximately 12 volts.

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

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Checking The Electrical System (Cont'd)

Figure 70-81-33



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

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

With the switch in the ON position there should be resistance between terminal (Item 1) and terminal (Item 2) **[Figure 70-81-33]**.

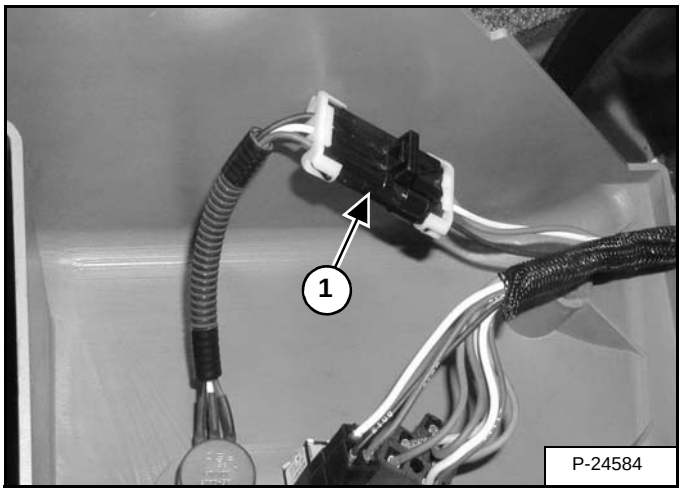
If no resistance value is found, replace the A/C switch.

If a resistance value is found, check the potentiometer.

The potentiometer will effect the A/C system and also effect the operation of the heater.

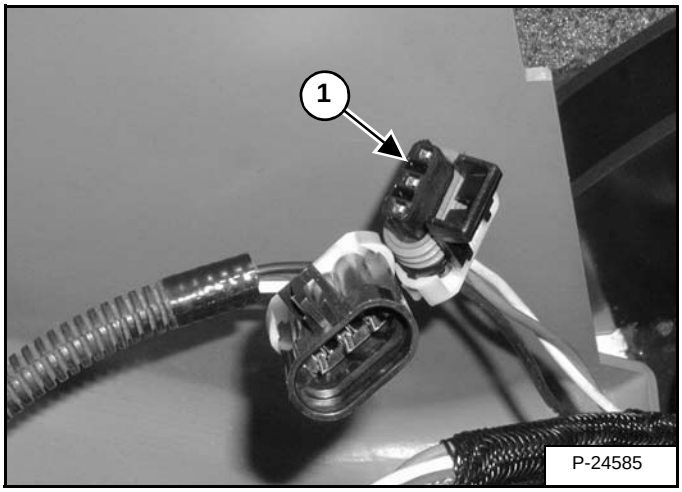
If the heater valve does not open, or close, or the A/C does not work, check the potentiometer.

Figure 70-81-34



Disconnect the wire harness (Item 1) **[Figure 70-81-34]** from the potentiometer.

Figure 70-81-35



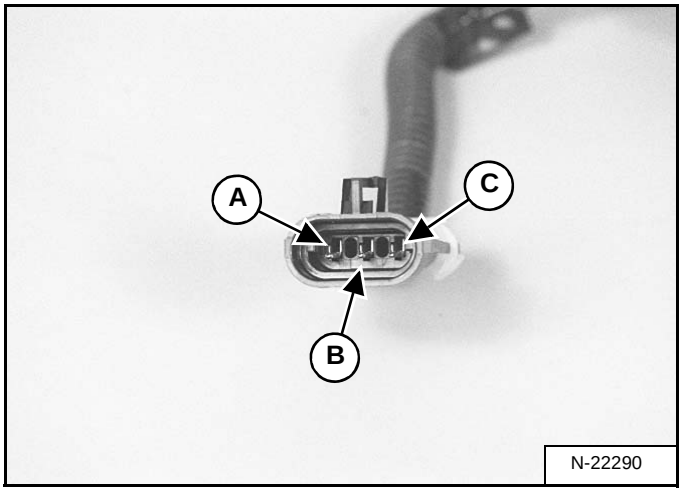
Check the wire harness (Item 1) **[Figure 70-81-35]** for voltage. Between pins **A** and **C** the voltage should be approximately 12 volts.

If there is no voltage at the wiring harness, check the harness for broken wires.

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Checking The Electrical System (Cont'd)

Figure 70-81-36

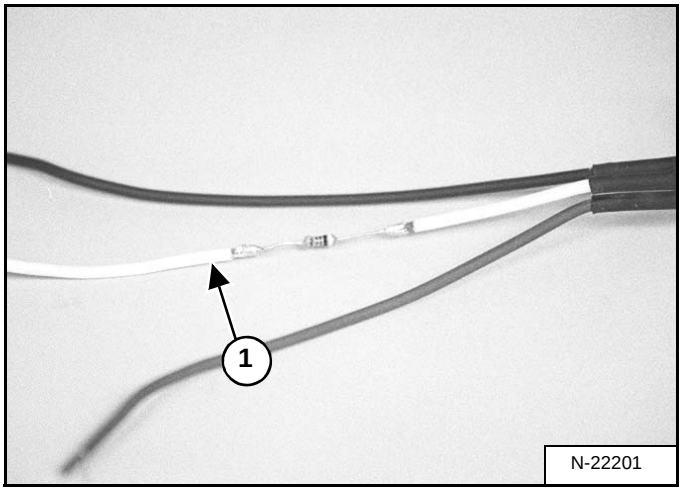


If there is voltage at the wiring harness, check the potentiometer **[Figure 70-81-36]** for resistance.

The resistance should be 10K Ohm's between wire terminal **A** and wire terminal **C** frame **[Figure 70-81-36]**.

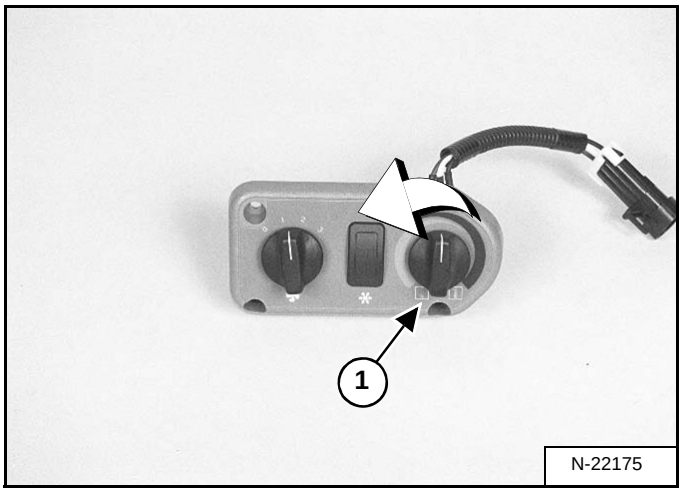
If no resistance is found replace the potentiometer.

Figure 70-81-37



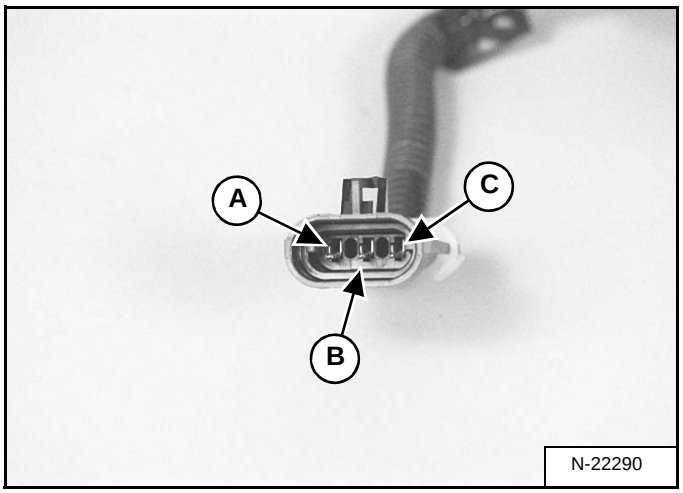
The white wire **B**, (Item 1) **[Figure 70-81-37]**, on the potentiometer, is a resister wire.

Figure 70-81-38



To check the resistance of the white wire, turn the potentiometer control (Item 1) **[Figure 70-81-38]** to the full A/C position.

Figure 70-81-39



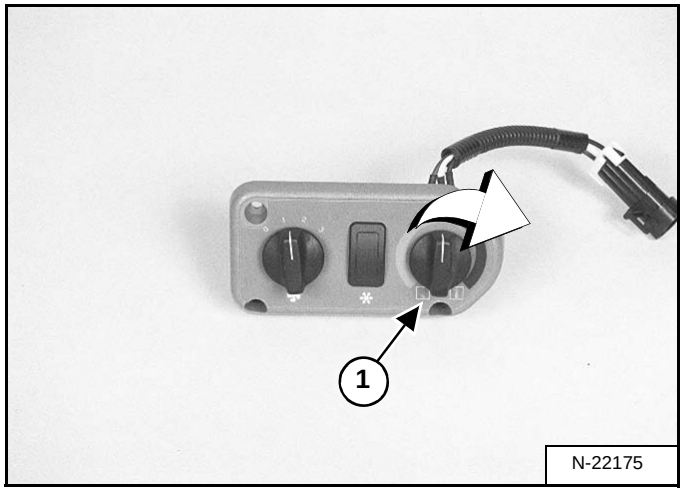
The resistance between the wire terminal **A** and wire terminal **B** frame **[Figure 70-81-39]** should be approximately 49K Ohm's.

Check the resistance between the wire terminal **C** and wire terminal **B** frame **[Figure 70-81-39]** should be approximately 39K Ohm's.

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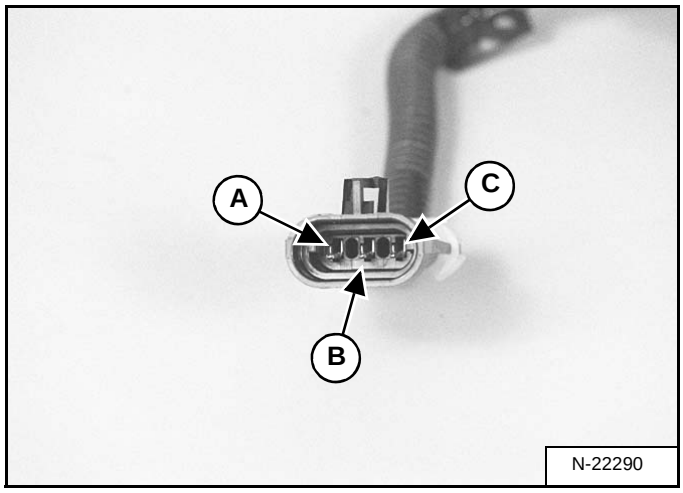
Checking The Electrical System (Cont'd)

Figure 70-81-40



To check the resistance of the white wire, turn the potentiometer control (Item 1) **[Figure 70-81-40]** to the full Heater position.

Figure 70-81-41



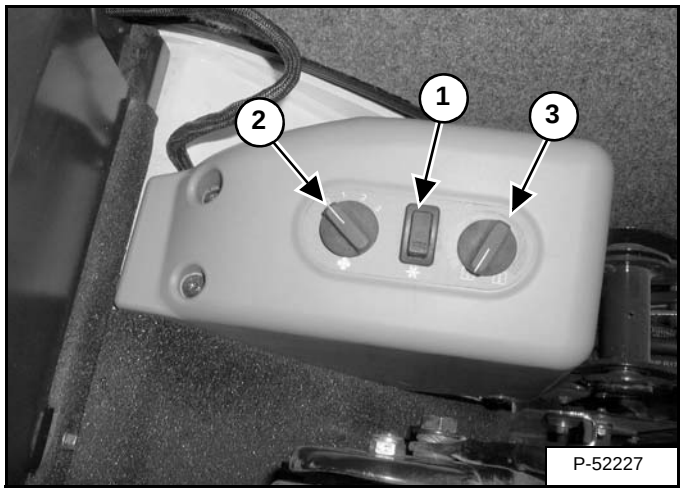
Check the resistance between the wire terminal A and wire terminal B frame **[Figure 70-81-41]** should be approximately 39K Ohm's.

Check the resistance between the wire terminal C and wire terminal B frame **[Figure 70-81-41]** should be approximately 49K Ohm's.

If the resistance is not found replace the potentiometer.

Engine Coolant By-Passing The Heater Valve

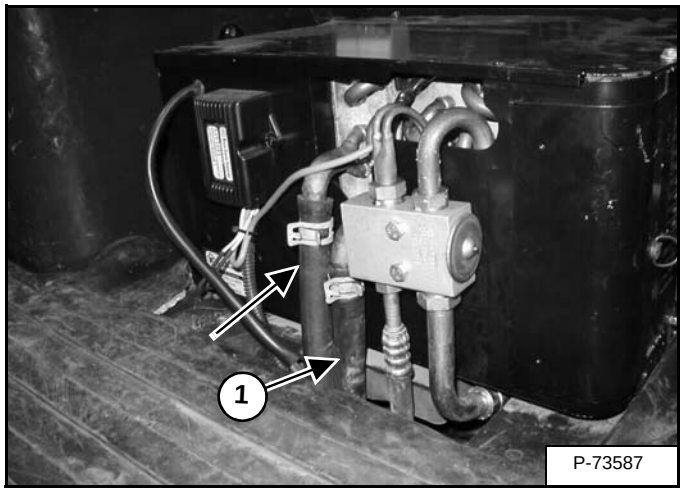
Figure 70-81-42



Push the A/C switch (Item 1) to the OFF position. Turn the fan switch (Item 2) to the High Speed position., Turn the temperature control (Item 3) **[Figure 70-81-42]** to the High A/C position, with the key switch OFF.

Start the excavator and run at high idle, for ten minutes.

Figure 70-81-43



Check the temperature of the heater hoses (Item 1) **[Figure 70-81-43]**.

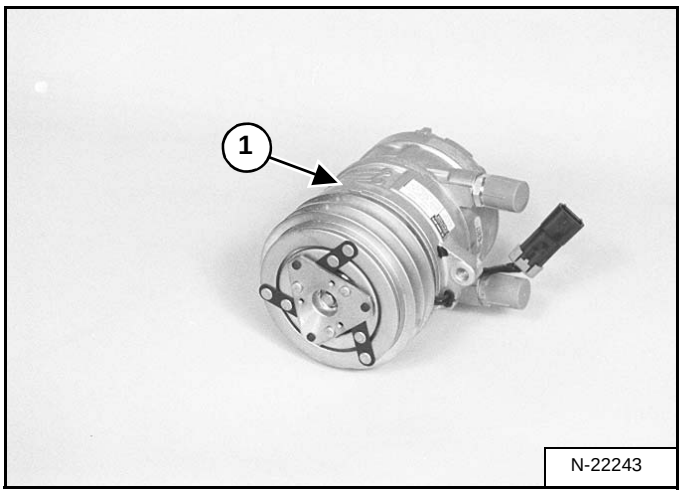
If the hoses are hot, the heater valve is leaking internally, and needs to be replaced.

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GENERAL AIR CONDITIONING SERVICE GUIDELINES

Compressor Oil

Figure 70-90-47



The compressor (Item 1) **[Figure 70-90-47]** is factory filled with **150-170 cc's** of PAG oil (Polyalkelene Glycol).

It is not necessary to frequently check or change the compressor oil.

It is necessary to check, replenish or replace the compressor oil in the following cases:

1. When the evaporator, condenser or receiver-drier is replaced.

2. When refrigerant has leaked from the system.

3. When refrigerant is suddenly released from the cooling cycle.

4. When any oil related problems occur in the cooling cycle.

When one of the components (the evaporator, condenser or receiver-drier) is replaced, **one ounce** (30 cc) of PAG oil should be added for each component replaced.

If the A/C compressor is changed, no oil should be added to the system, the compressor comes factory filled with oil.

NOTE: Only PAG oil should be used. Never mix R-12 and R-134a Oils.

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Compressor Oil Check

The compressor oil should be checked as follows when oil is being added to an in service excavator.

There is a close affinity between oil and refrigerant. During normal operation, part of the oil circulates with the refrigerant in the system. When checking the amount of oil in the system or replacing any system component, the compressor must be run in advance to insure return of oil to the compressor.

If the amount of refrigerant in the system has decreased, charge the system. (See Charging Procedure With A Manifold Gauge Set on Page 70-130-4.)

Open the cab door and windows.

Run the blower at maximum speed.

Run the compressor for at least 20 minutes at 800-1200 RPM.

Remove the compressor from the excavator. (See Removal And Installation on Page 70-140-1.)

Figure 70-90-48

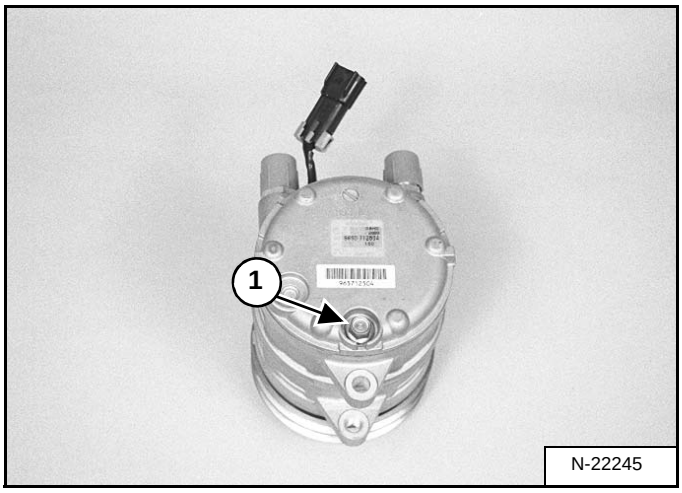
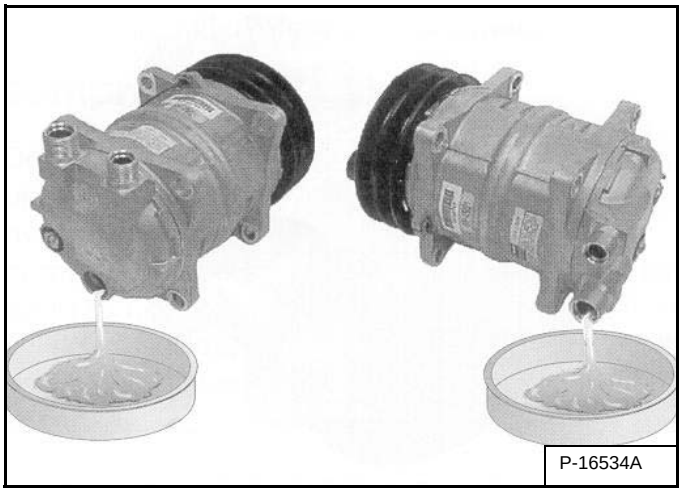


Figure 70-90-49



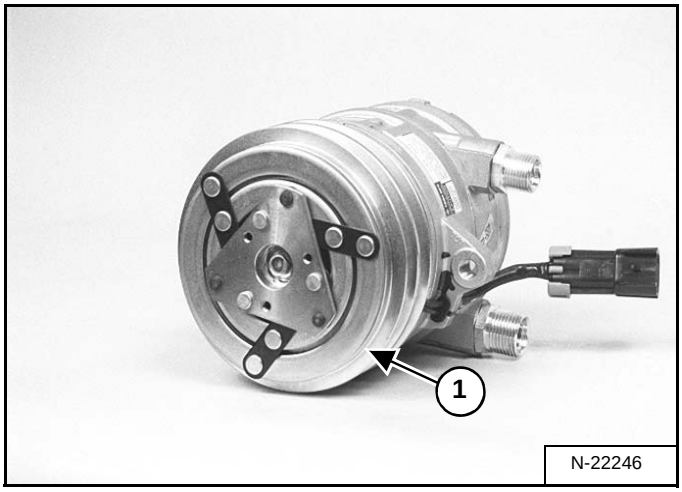
Remove the oil drain plug (Item 1) **[Figure 70-90-48]** and drain the oil through the connectors and the oil drain hole **[Figure 70-90-49]**.

Installation: Tighten the oil drain plug to 9.4-10.8 ft.-lbs. (13-15 Nm) torque.

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Compressor Oil Check (Cont'd)

Figure 70-90-50



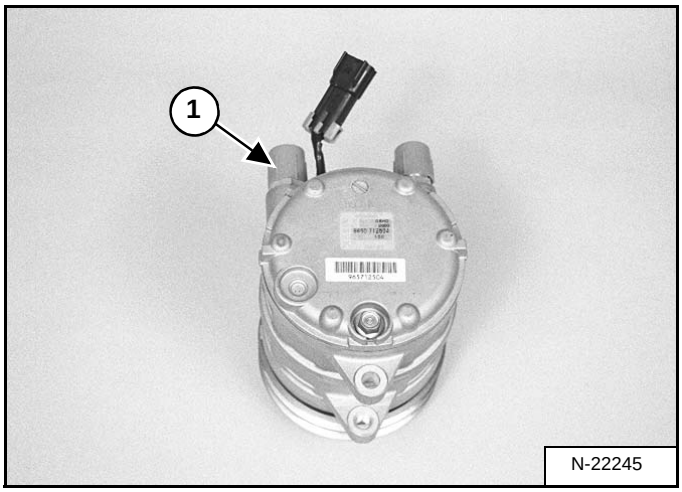
NOTE: After draining the oil through the drain hole and the connectors, extract the remaining oil through the discharge-side connector by rotating the drive pulley (Item 1) [Figure 70-90-50] several times by hand.

Measure the drained oil in a measuring cylinder.

Check the oil for contamination, dirt, metal shavings, or varnish color, discard the oil if contaminated.

NOTE: If metal shavings are found in the compressor oil, replace the complete compressor assembly.

Figure 70-90-51



Add new compressor oil through the suction side connector (Item 1) **[Figure 70-90-51]**.

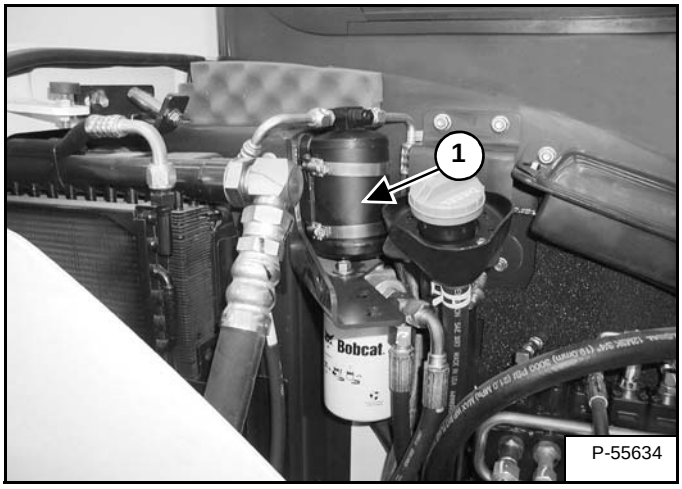
Installation: **Add 150 -170 cc's of PAG oil**.

NOTE: The suction port on the compressor is marked with an S and is the larger port on the compressor.

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Component Replacement And Refrigeration Leaks

Figure 70-90-52



Whenever the A/C system is opened to the atmosphere or there has been a leak in the system, the receiver/drier (Item 1) **[Figure 70-90-52]** must be changed.

Never leave hose fittings, compressor fittings or components uncapped while working on the A/C system.

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SYSTEM TROUBLESHOOTING CHART

Blower Motor Does Not Operate

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. Blown Fuse	Inspect the fuse/wiring	Replace fuse/repair wiring
2. Broken wiring or bad connection	Check the fan motor ground and connectors	Repair the wiring or connector
3. Fan Motor Malfunction	Check the lead wires from the motor with a circuit tester	Replace motor
4. Resistor Malfunction	Check resistor using a circuit tester	Replace resistor
5. Fan motor switch malfunction	Check power into and out of the fan switch	Replace fan switch

Blower Motor Operates Normally, But Air Flow Is Insufficient

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. Evaporator inlet obstruction	Check evaporator for plugging	Remove the obstruction and clean evaporator fins with air or water
2. Air leak	Check to make sure air hoses are properly hooked to Louvers and air ducts	Repair or adjust
3. Defective thermo switch (frozen evaporator)	Check thermostat using a circuit tester	Replace thermostat

Insufficient Cooling Although Air Flow And Compressor Operation Are Normal

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. System low on refrigerant	The high side pressure will be low and bubbles may be present in sight glass on receiver/drier	Repair any leaks and recharge the refrigerant to the correct level
2. Excessive Refrigerant	The high pressure side will be high	Use refrigerant recovery equipment to capture excess refrigerant. Charge to the correct refrigerant level

The Compressor Operates Improperly Or Not At All

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. Loose drive belt	The belt is vibrating or oscillating	Adjust tension
2. Internal compressor malfunction	The compressor is locked up and the belt slips	Replace compressor
	MAGNETIC CLUTCH RELATED	
3. Low battery voltage	Clutch slips	Recharge the battery
4. Faulty coil	Clutch slips	Replace the magnetic clutch
5. Oil on the clutch surface	Clutch slips	Replace or clean the clutch surface
6. Open oil	Clutch does not engage and there is not reading when a circuit tester is connected between the coil and terminals	Replace clutch
7. Broken wiring or poor ground	Clutch will not engage. Inspect the ground and connections.	Repair
8. Wiring harness components	Test the conductance of the pressure switch, thermostat, relay, etc.	Check operation

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SYSTEM TROUBLESHOOTING CHART (CONT'D)

Gauge Pressure Related Troubleshooting

Normal compressor suction (low side) and discharge (high side) pressure at ambient temperatures of 86-96° F (30-38° C) and compressor speed of approximately 2000 RPM are:

High pressure side pressure: 210-265 PSI

Low pressure side pressure: 15-33 PSI

As a rule of thumb the high side pressure will be around eight times greater then the low side pressure.

POSSIBLE CAUSE	INSPECTION	SOLUTION
Low Pressure Side Too High	The Low pressure side pressure normally becomes too high when the high pressure side pressure is too high. As this is explained below, the following inspection is only used when the low pressure side is too high.	
1. Expansion valve opens too far	Frost is present on the suction hose	Replace the expansion valve
2. Defective compressor	The high and low pressure side gauge pressures equalize when the magnetic clutch is disengaged	Replace compressor
Low Pressure Side Too Low		
1. Low refrigerant charge	The high side pressure will be low and bubbles may be present in sight glass on receiver/drier	Repair any leaks and recharge the refrigerant to the correct level
2. Clogged or closed expansion valve	The expansion valve's inlet side is frosted. Moisture or other contaminants can be the cause.	Clean or replace the expansion valve
3. Restriction between drier and expansion valve	Frost on the line between drier and expansion valve. A negative low pressure reading may be shown.	Flush system or replace hose
4. Thermostat malfunction	the evaporator is frozen	Adjust thermostat's temperature setting or probe placement or replace thermostat
High Pressure Side Too High		
1. Poor condenser performance	Dirty or clogged condenser fins. Condenser fans not operating.	Clean fins and/or repair the fan
2. Excessive refrigerant	The high pressure side pressure will be high	Use refrigerant recovery equipment to capture excess refrigerant. Charge to the correct refrigerant level.
3. Excessive oil charge	The high pressure side will be high	Evacuate system. Remove oil from condenser and compressor. Measure oil from compressor and add correct oil charge back into compressor. Flush system with nitrogen. Replace drier.
4. Air in system	Pressure is high on both high and low sides	Evacuate and recharge with refrigerant
5. Restriction in drier, condenser, or high pressure line	High pressure side will be high and low pressure side will be low	Evacuate and flush system replacing defective parts
High Pressure Side Too Low		
1. Low refrigerant charge	The high side pressure will be low and bubbles may be present in sight glass jon receiver/drier	Repair any leaks and recharge the refrigerant to the correct level.
System Pressure Equals		
1. Clutch not operating	See magnetic clutch related topics above	
2. Compressor not pumping	Equal high and low pressures	Replace compressor

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TEMPERATURE/PRESSURE

Chart

Normal Evaporator Range		Normal Condenser Range	
TEMP F.	**PSIG**	**TEMP F.**	**PSIG**
16	15.69	93	110.20
18	17.04	94	112.10
20	18.43	95	114.10
22	19.87	100	124.30
24	21.35	102	128.50
26	22.88	104	132.90
28	24.47	106	137.30
30	26.10	108	141.9
32	27.79	110	146.50
34	29.52	112	151.30
36	31.32	114	156.10
38	33.17	116	161.10
40	35.07	118	166.10
42	37.03	120	171.30
44	39.05	122	176.60
45	40.09	124	182.00
50	45.48	126	187.50
55	51.27	128	193.10
60	57.47	130	198.90
65	64.10	135	213.70
70	71.19	140	229.40
75	78.75	145	245.80
80	86.80	150	263.00
85	95.40	155	281.10
90	104.40	160	300.10
91	106.30	165	320.10
92	108.20	170	340.80

Evaporator

Pressures represent gas temperatures inside the coil, not the coil surface. For an estimate of the temperature of the air coming off the coil add 8-10° F. to the temperature on the chart.

Condenser

Temperatures are not ambient temperatures but condensing temperatures. Add 40° F. to the ambient temperature to get the condensing temperature and then refer to the pressure chart to see appropriate pressure for ambient temperature.

Example: Ambient Temperature = 90° F.

90° F
+ 40° F
130° F condenser temperature = 200 psig

Conditions and pressures will vary from system to system.

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Chart

Service Company Name/Phone Number:			
Date:			
Machine Model:			Machine Dealer:
Machine Serial Number:			Customer:
Machine Hours:			
Pre Service Conditions	15 Minutes	30 Minutes	Notes
Ambient Temperature:			
Louver Temperature:			
Cab Temperature At Head Position:			
Temperature Into Condenser:			
High Side Pressure:			
Low Side Pressure:			
Ambient Humidity:			
Observations:			
Explain services required:			
Post Service Conditions	15 Minutes	30 Minutes	Notes
Ambient Temperature:			
Louver Temperature:			
Cab Temperature At Head Position:			
Temperature Into Condenser:			
High Side Pressure:			
Low Side Pressure:			
Ambient Humidity:			
Observations:			

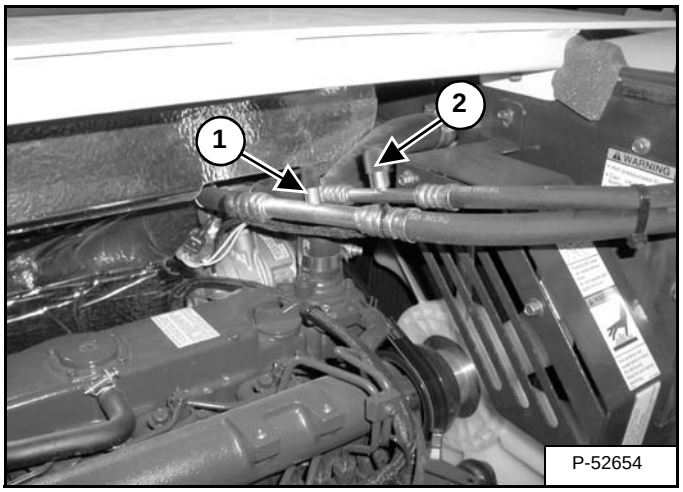
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Reclamation Procedure

Figure 70-130-1



Open the tailgate and locate the low pressure port (Item 1) and high pressure port (Item 2) **[Figure 70-130-1]**.

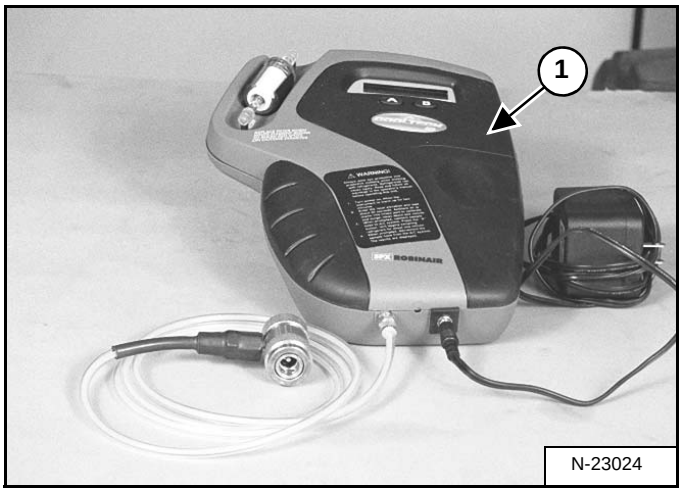
⚠ WARNING

In the event of a leakage, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R134a refrigerant gives a toxic gas.

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NOTE: This procedure is run with the excavator engine OFF, and the A/C switch in the OFF position.

Figure 70-130-2



NOTE: Before reclaiming a refrigeration system, it is recommended to identify the type of refrigerant that is in the A/C system and if it is pure enough to use. The tool MEL1592, Refrigerant Identifier (Item 1) [Figure 70-130-2] will determine the kind of refrigerant and any possible harmful or dangerous substances that may be present in the system. Thus preventing mixing of dangerous material with your reclaimed R-134a in your reclaimer, and further contamination to other A/C systems that are reclaimed and charged from your MEL 1581 Recovery/Recycling/Recharging Machine.

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Reclamation Procedure (Cont'd)

Figure 70-130-3



Remove the protective cap and connect the Refrigerant Identifier to the low pressure hose (Item 1) **[Figure 70-130-3]**.

Connect the refrigerant identifier to a power source.

Follow the steps displayed on the refrigerant identifier screen.

Allow two minutes for the refrigerant identifier to display the type of refrigerant and air content. An alarm will sound if potentially flammable hydrocarbons are present and will also indicate on the visual display.

Disconnect the refrigerant identifier from the excavator A/C.

If the refrigerant is dangerous or flammable, it must be evacuated from the A/C system into a separate container and properly and safely disposed of.

If R134a is found, evacuate the system.

IMPORTANT: Only A/C trained technicians should perform the reclaiming and recharging procedure.

⚠ WARNING

HFC 134A refrigerant can be dangerous if not properly handled. Liquid 134A may cause blindness if it contacts the eyes and may cause serious frostbite if it contacts the skin.

- **Gaseous 134A becomes lethal (phosgene) gas when it contacts open flame or very hot substances.**
- **NEVER SMOKE when there is the possibility of even small amounts of 134A in the air.**

Any servicing work that involves release or addition of 134A to the system must be done by a competent refrigeration dealer who has the proper equipment, knowledge, and experience to service refrigeration equipment.

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Figure 70-130-4



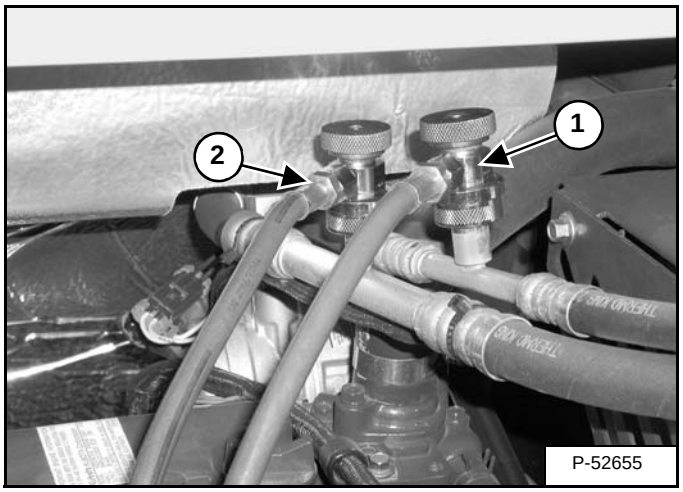
Use an approved recover/charging unit **[Figure 70-130-4]** to evacuate the system.

Connect the reclaimer to the excavator A/C charge ports.

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Reclamation Procedure (Cont'd)

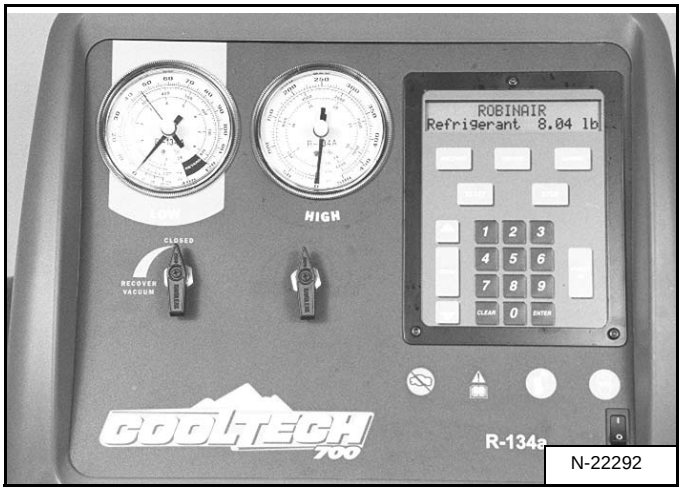
Figure 70-130-5



Connect the Red hose (Item 1) **[Figure 70-130-5]** to the high pressure port and open the valve.

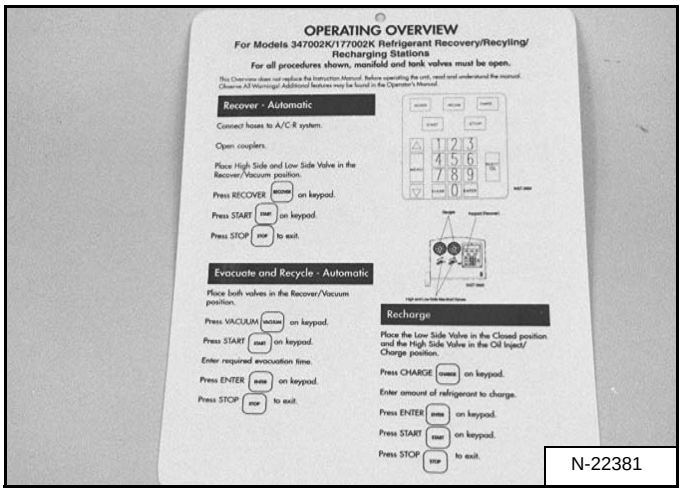
Connect the Blue hose (Item 1) **[Figure 70-130-5]** to the low pressure port and open the valve.

Figure 70-130-6



Turn the reclaimer unit to the ON position and follow the on screen instructions **[Figure 70-130-6]**.

Figure 70-130-7



NOTE: The reclaimer unit has a complete step by step set of instructions [Figure 70-130-7] to follow for reclamation and recharging of the A/C system. A trained technician should follow these instructions as they may very slightly depending on the model and brand of reclaimer used.

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Charging Procedure With A Manifold Gauge Set

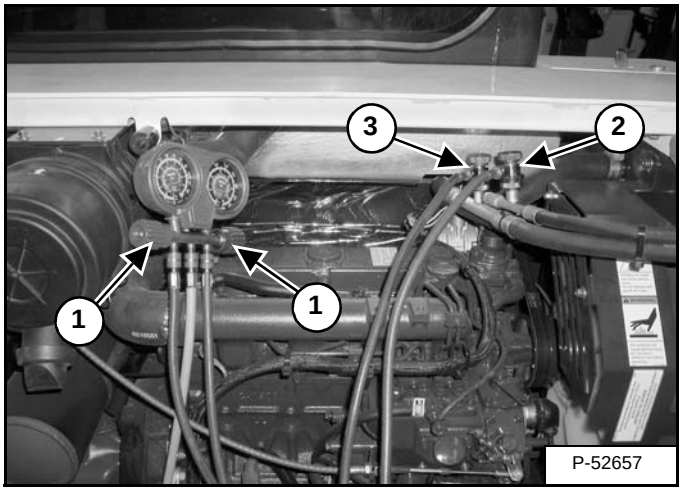
Open the tailgate.

⚠ WARNING

In the event of a leakage, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R134a refrigerant gives a toxic gas.

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Figure 70-130-8



Check to see that the hand valves (Item 1) **[Figure 70-130-8]** are closed on the manifold gauge set.

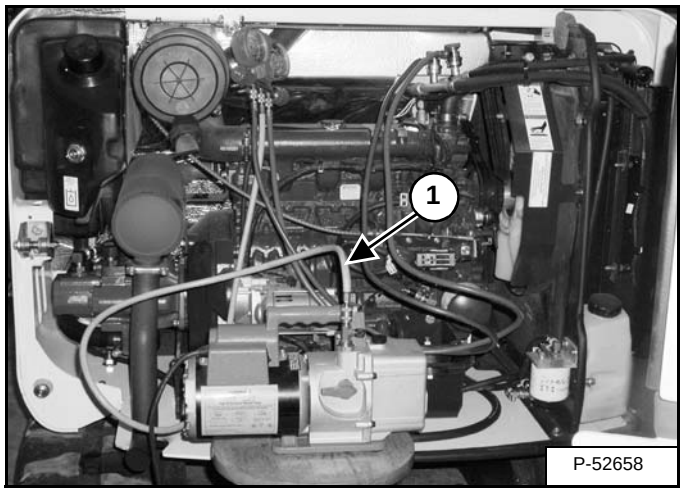
If there is any refrigerant in the A/C system, it must be recovered by an approved A/C reclamation procedure. (See Reclamation Procedure on Page 70-130-1.)

Connect the gauges to the excavator A/C charge ports.

Connect the Red hose (Item 2) **[Figure 70-130-8]** to the high pressure port and open the valve.

Connect the Blue hose (Item 3) **[Figure 70-130-8]** to the low pressure port and open the valve.

Figure 70-130-9

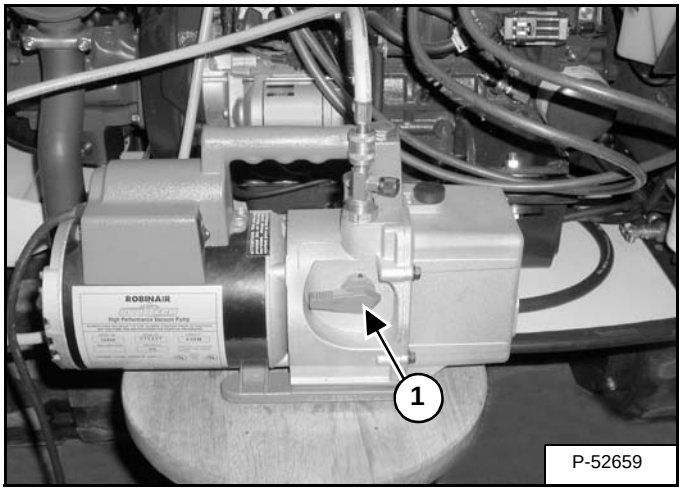


Connect the Yellow hose (Item 1) **[Figure 70-130-9]** to the vacuum pump.

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Charging Procedure With A Manifold Gauge Set (Cont'd)

Figure 70-130-10

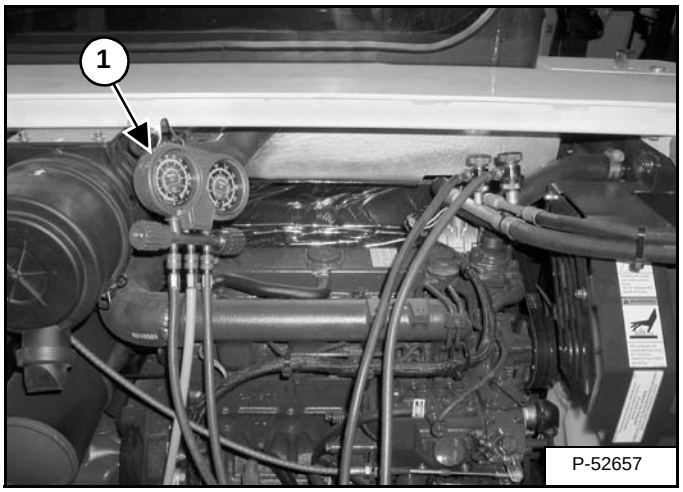


Start the vacuum pump and open ISO-valve (Item 1) **[Figure 70-130-10]** on the vacuum pump.

Run the vacuum pump for at least 5-10 minutes to make sure that a vacuum has been pulled on the system.

Close the ISO-valve (Item 1) **[Figure 70-130-10]** (which isolates the vacuum pump from the A/C system) and turn OFF the vacuum pump.

Figure 70-130-11

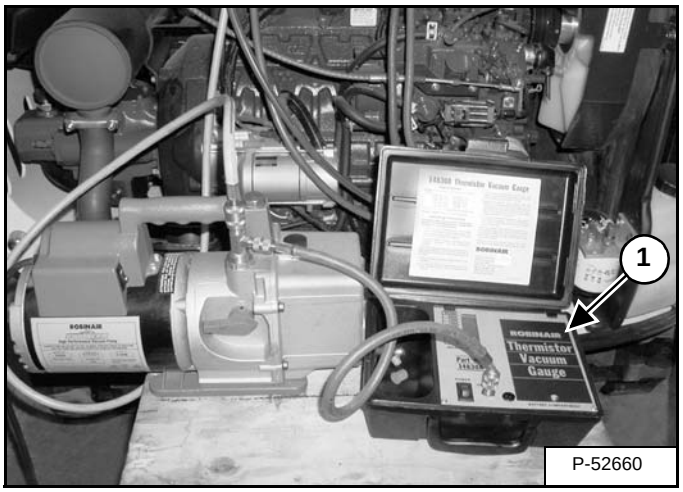


Note vacuum pressure indicated on the low pressure (Blue) gauge (Item 1) **[Figure 70-130-11]**. Let stand for 5-10 minutes and recheck the pressure for changes.

If the pressure drops, this may be an indication of a leak in the A.C system.

Determine the problem with the A/C system and repair it.

Figure 70-130-12



A thermistor vacuum gauge (Item 1) **[Figure 70-130-12]** can be used to determine the critical vacuum level during evacuation. it is a solid state instrument that constantly monitors and visually indicates the vacuum level.

The thermistor vacuum gauge is used with the vacuum pump **[Figure 70-130-12]**.

Start the vacuum pump and open ISO-valve on the vacuum pump.

Be sure that both hand valves, and both charge port valves are open.

Run the vacuum pump for at least 45 minutes to insure that all the moisture is boiled out of the system.

Stop the vacuum pump and close the ISO-valve on the vacuum pump.

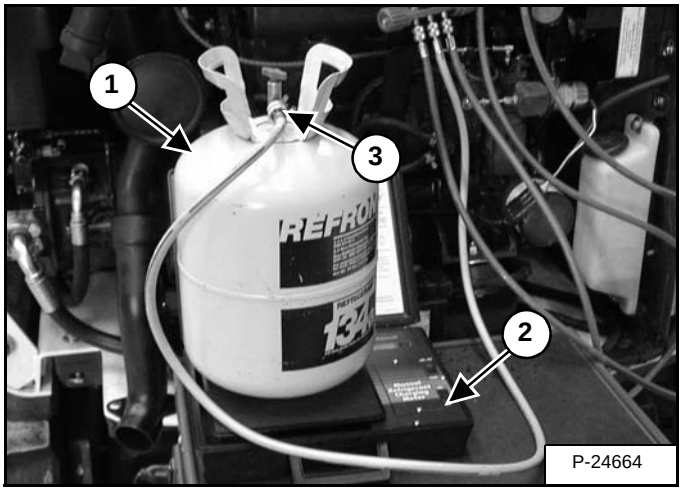
Close both hand valves on the manifold gauge set and remove the yellow hose from the vacuum pump that goes to the manifold gauge set.

Remove the vacuum pump and thermister vacuum gauge.

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Charging Procedure With A Manifold Gauge Set (Cont'd)

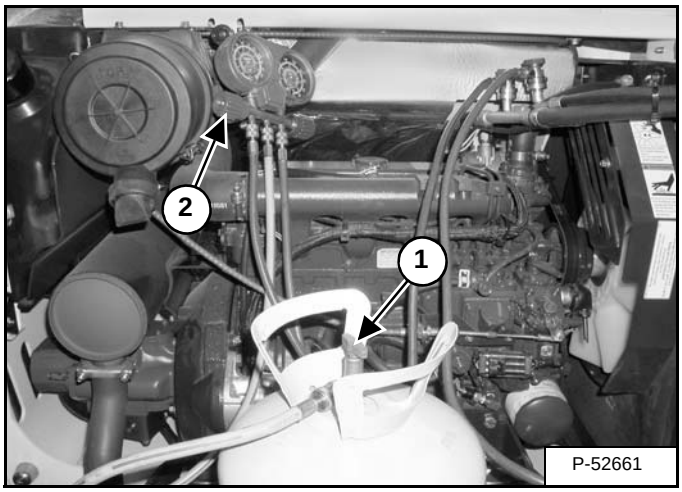
Figure 70-130-13



Place a refrigerant container with R134a (Item 1) on a charging scale (Item 2) **[Figure 70-130-13]** and zero out the scale.

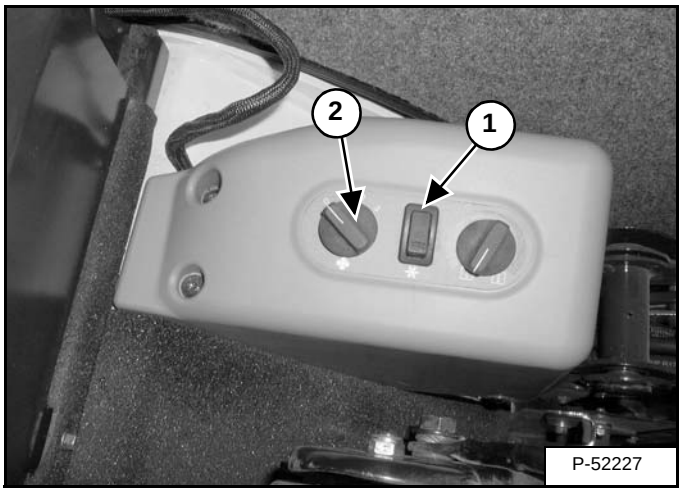
Connect the yellow hose (Item 3) **[Figure 70-130-13]** from the manifold gauge set to the valve on the refrigerant tank.

Figure 70-130-14



Open the valve on the refrigerant container (Item 1) and open the low pressure hand valve (Blue) (Item 2) **[Figure 70-130-14]** on the manifold gauge set. Allow the vacuum to pull in the refrigerant until the pressure stabilizes.

Figure 70-130-15



Press the A/C (Item 1) **[Figure 70-130-15]** switch to ON position.

Turn the fan switch (Item 2) **[Figure 70-130-15]** to HIGH position.

Start the engine, with the left console in the raised position, and run at medium speed.

Watch the scale and run the system until the predetermined amount of refrigerant is added to the A/C system.

The A/C system holds 2.0 lbs. (0,9 kg) of refrigerant.

Turn OFF the valve on the refrigerant container, and hand valves on the manifold gauge set.

Turn OFF the engine, and remove the A/C charging equipment from the excavator.

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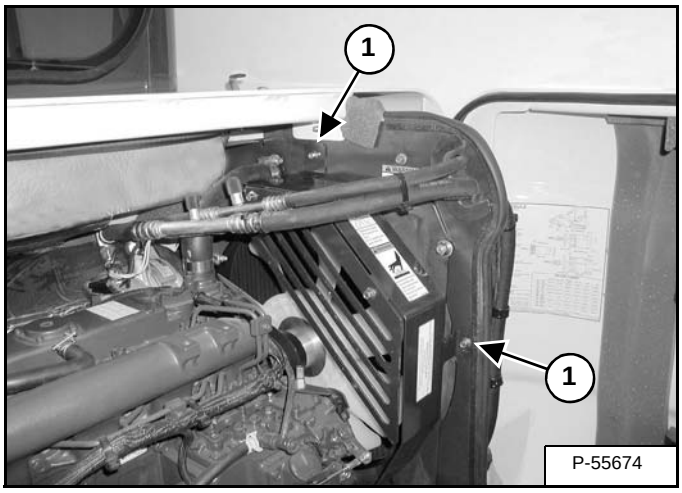
COMPRESSOR

Removal And Installation

Open the tailgate.

Evacuate the A/C system. (See Removal And Installation on Page 70-220-1.)

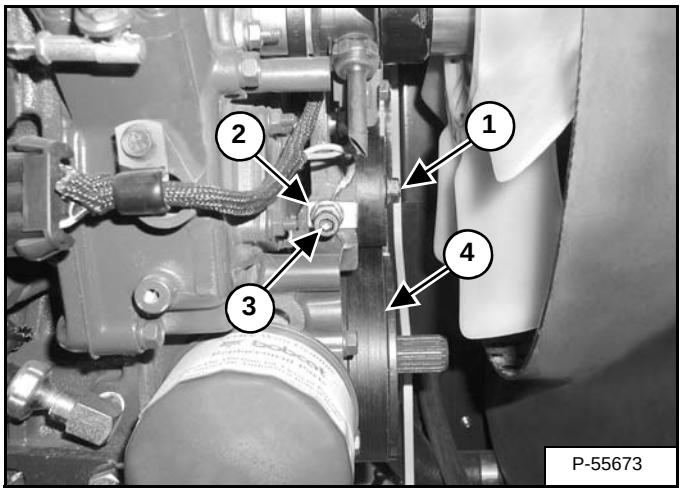
Figure 70-140-16



Remove the bolts (Item 1) **[Figure 70-140-16]** from the fan shield.

Remove the fan shield from the engine.

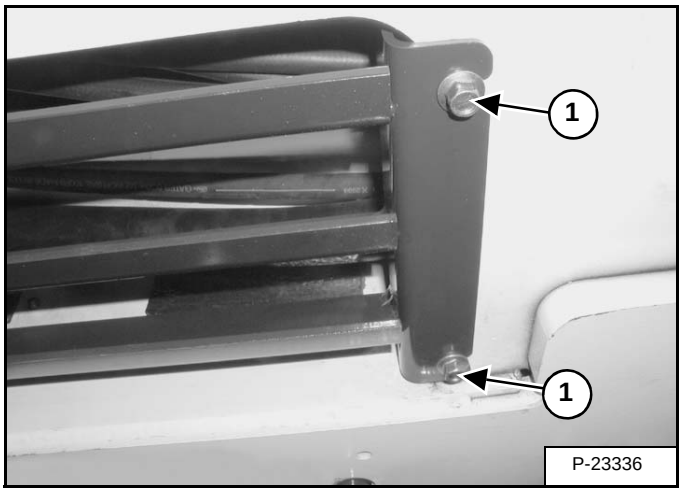
Figure 70-140-17



Loosen the nut (Item 1) on the belt idler pulley. Loosen the nut (Item 2) and bolt (Item 3) **[Figure 70-140-17]**.

Remove the engine accessory drive belt (Item 4) **[Figure 70-140-17]**.

Figure 70-140-18



On the bottom of the excavator, loosen the two bolts on the left side. Remove the two bolts (Item 1) **[Figure 70-140-18]** on the right side.

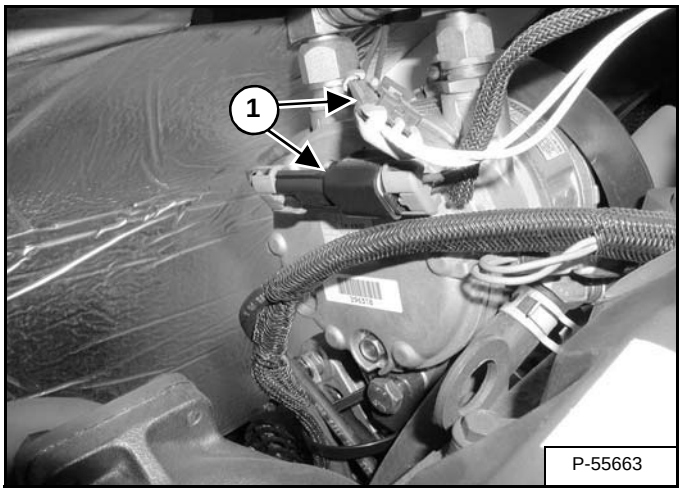
Remove the louver from the bottom of the excavator.

⚠ WARNING

In the event of a leakage, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R134a refrigerant gives a toxic gas.

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Figure 70-140-19

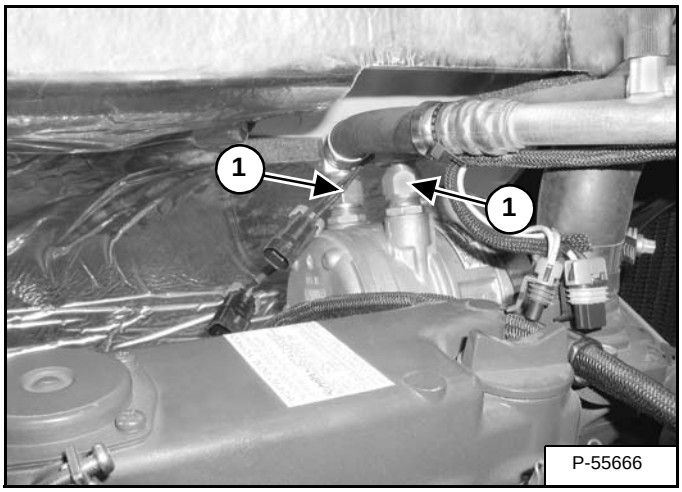


Disconnect the wire harness connectors (Item 1) **[Figure 70-140-19]**.

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Removal And Installation (Cont'd)

Figure 70-140-20

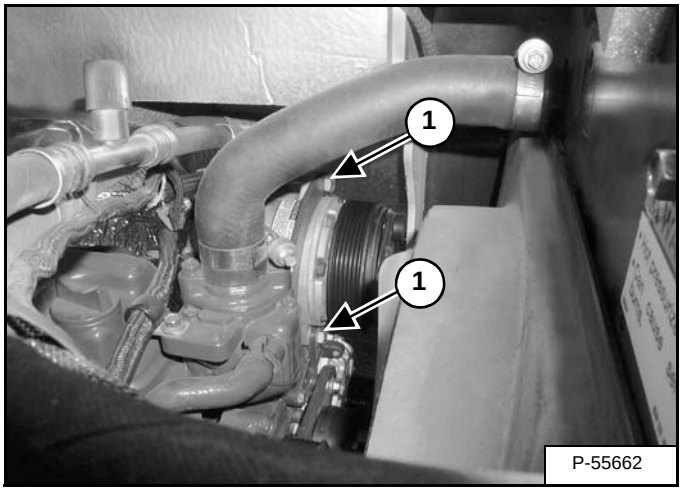


Remove the hoses (Item 1) **[Figure 70-140-20]**.

Installation: Tighten the compressor hoses to 22 ft.-lbs (29,8 Nm) torque.

Cap and plug the compressor hoses and the fittings with the proper A/C caps and plugs.

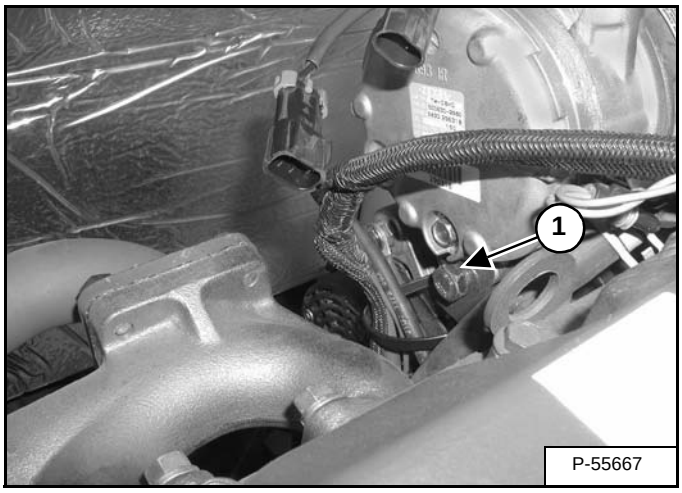
Figure 70-140-21



Remove the bolts (Item 1) **[Figure 70-140-21]**.

Installation: Tighten the bolts to 34 ft.-lbs. (46 nm) torque.

Figure 70-140-22



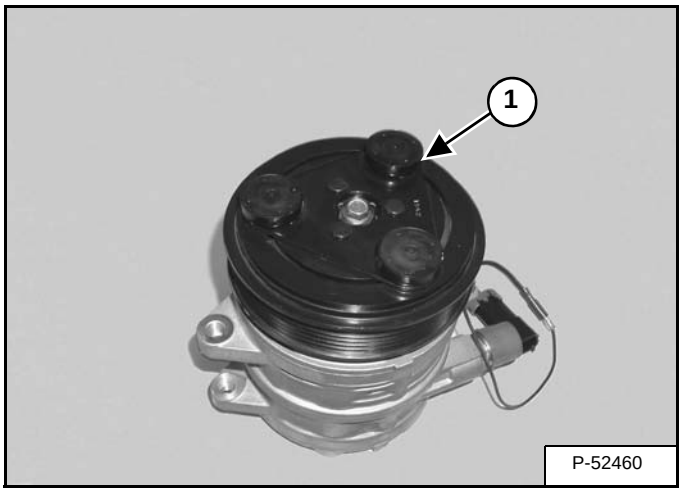
Remove the bolt (Item 1) **[Figure 70-140-22]**.

Lower and remove the compressor through the opening in the bottom of the excavator.

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Compressor Clutch Disassembly And Assembly

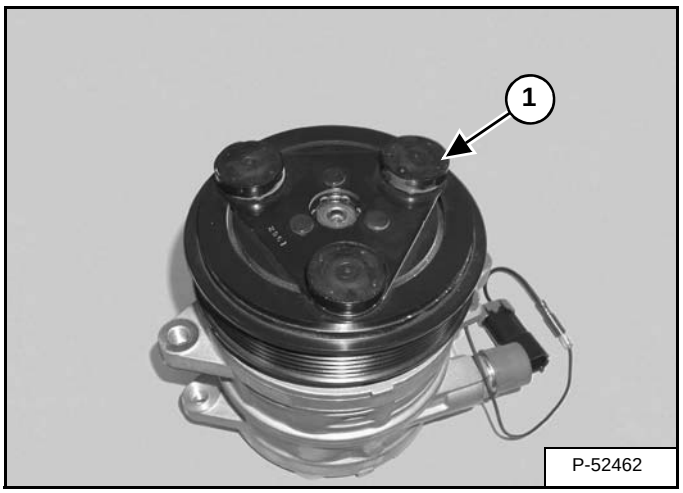
Figure 70-140-23



Remove the bolt (Item 1) **[Figure 70-140-23]**.

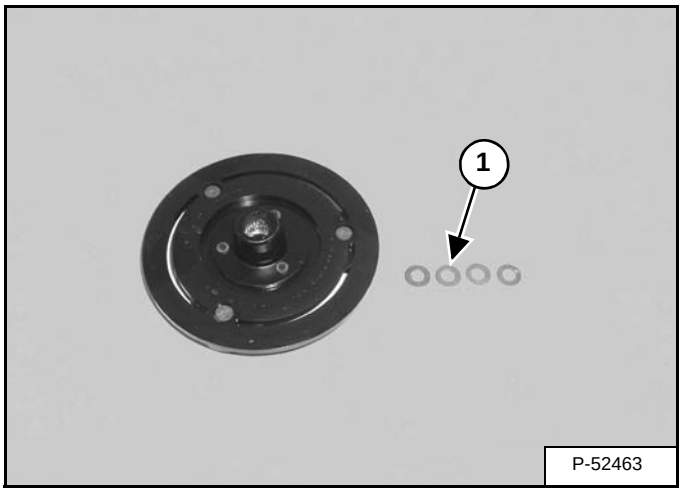
Installation: Tighten the bolt to 8-10 ft.-lbs. (12-14 Nm) torque.

Figure 70-140-24



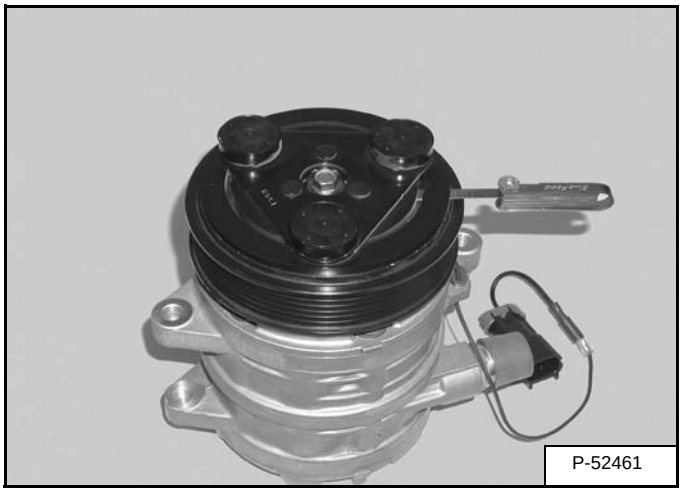
Pull straight up on the armature plate (Item 1) **[Figure 70-140-24]** and remove the armature plate from the compressor clutch.

Figure 70-140-25



Remove the shims (Item 1) **[Figure 70-140-25]** from either the armature shaft or armature plate.

Figure 70-140-26



Installation: Install the needed shims until the correct clearance between the armature plate and compressor clutch is obtained **[Figure 70-140-26]**.

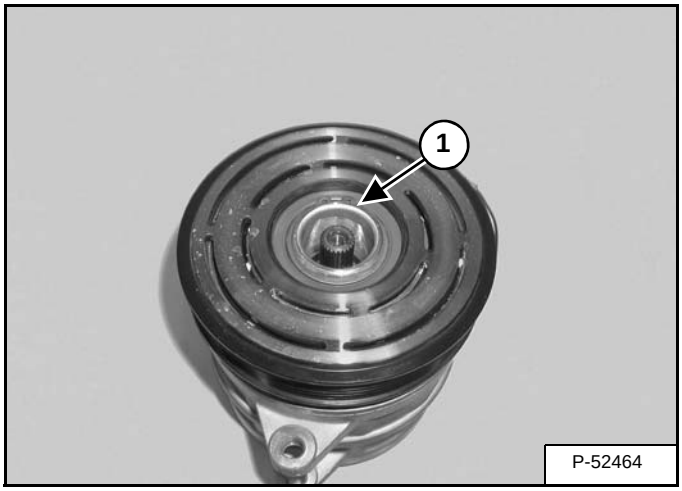
The specified clearance for the clutch is 0.01-0.02 in. (0.3-0.6 mm). Adjusting shims are available in the following thicknesses:

0.039 in (0.1 mm)
0.0118 in (0.3 mm)
0.0197 in (0.5 mm)

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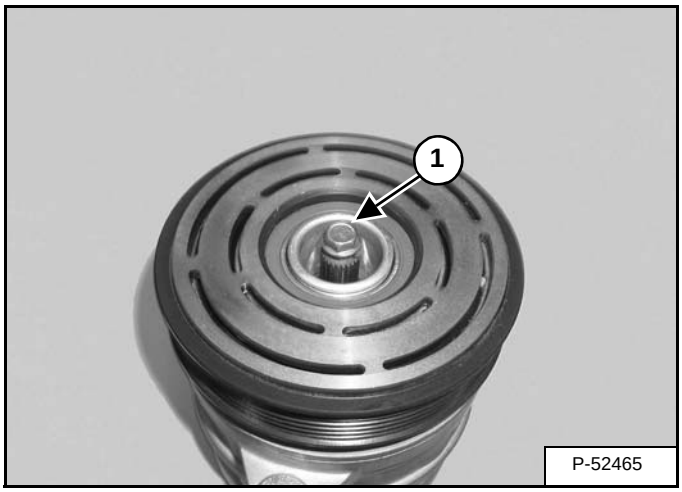
Compressor Clutch Disassembly And Assembly (Cont'd)

Figure 70-140-27



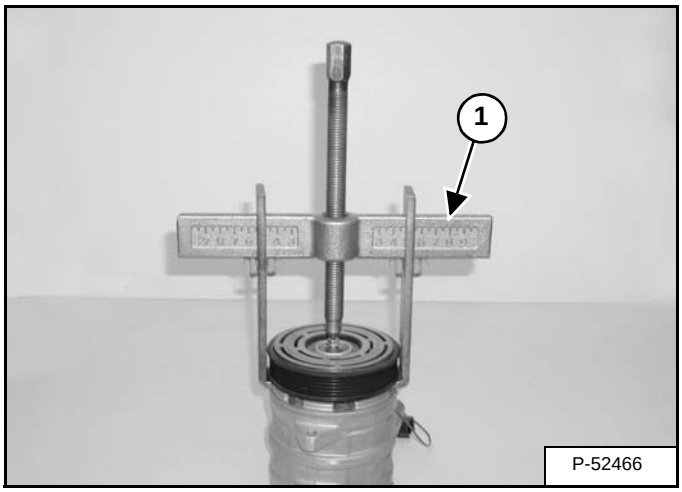
Remove the snap ring (Item 1) **[Figure 70-140-27]**.

Figure 70-140-28



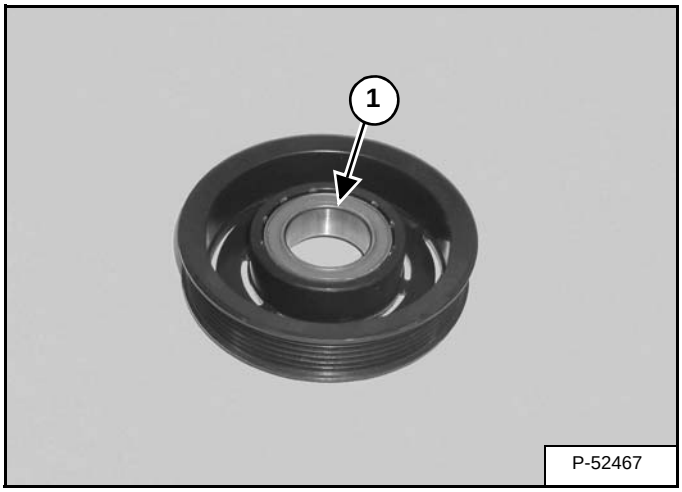
Install the bolt (Item 1) **[Figure 70-140-28]**.

Figure 70-140-29



Install a puller (Item 1) **[Figure 70-140-29]** on the pulley and remove the pulley/bearing assembly.

Figure 70-140-30

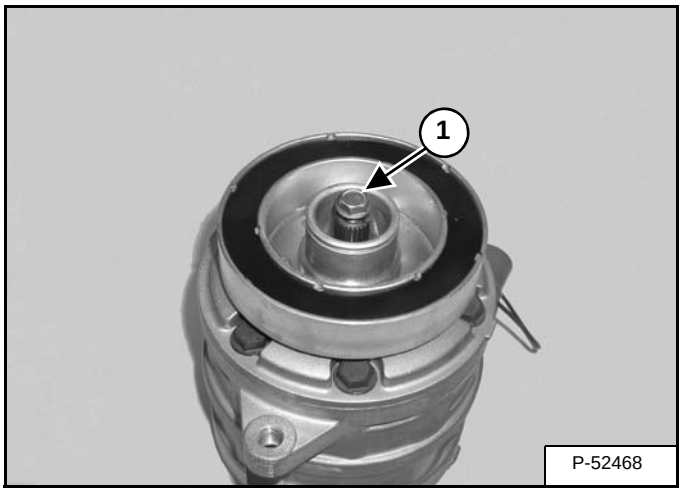


The bearing (Item 1) **[Figure 70-140-30]** is staked in to the pulley and is not serviceable separately.

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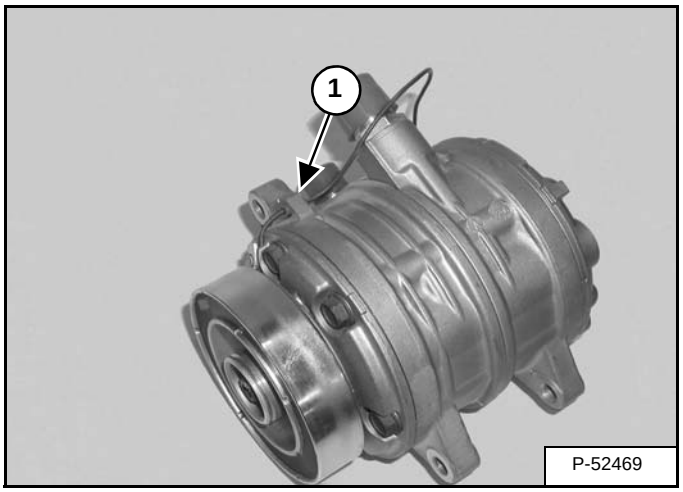
Compressor Clutch Disassembly And Assembly (Cont'd)

Figure 70-140-31



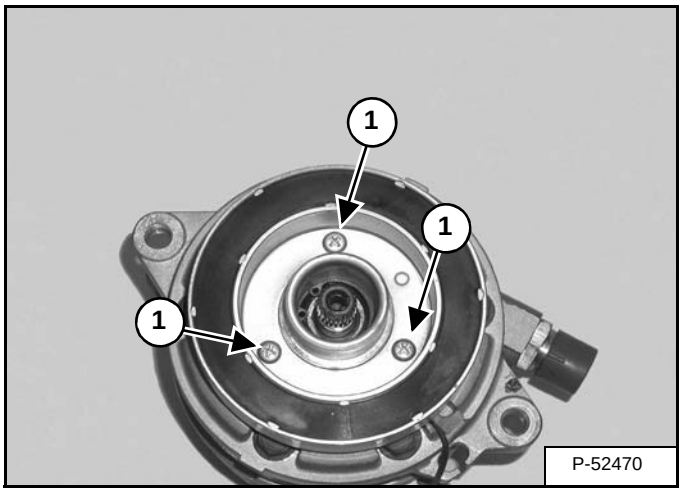
Remove the bolt (Item 1) **[Figure 70-140-31]** from the shaft.

Figure 70-140-32



Slide the grommet and wire harness (Item 1) **[Figure 70-140-32]** from the wire holder.

Figure 70-140-33



Remove the screws (Item 1) **[Figure 70-140-33]** from the compressor.

Installation: Tighten the screws to 2.9-4.3 ft.-lbs. (4-6 Nm) torque.

Remove the coil from the compressor.

The compressor is not serviceable and must be replaced as a complete unit.

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CONDENSER

Removal And Installation

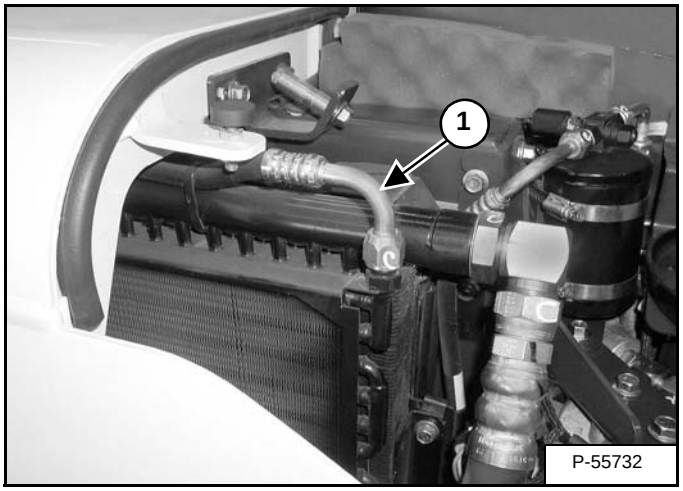
Open the tailgate.

Evacuate the A/C system. (See Removal And Installation on Page 70-220-1.)

Open the right side cover.

Mark the A/C hoses for proper installation.

Figure 70-150-1



Remove the top hose (Item 1) **[Figure 70-150-1]** from the condenser.

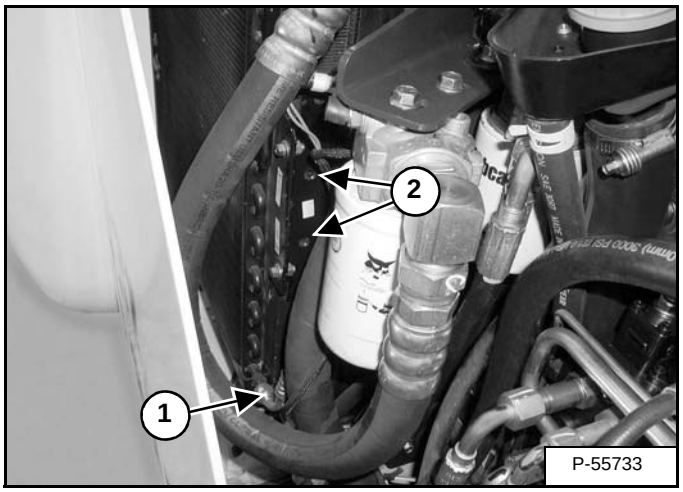
Cap the hose and plug the fitting on the condenser.

WARNING

In the event of a leakage, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R134a refrigerant gives a toxic gas.

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Figure 70-150-2

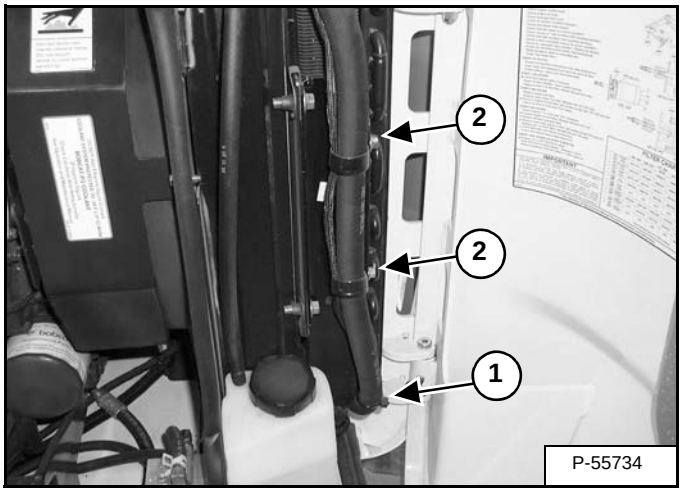


Remove the lower hose (Item 1) **[Figure 70-150-2]** from the condenser.

Cap the hose and plug the fitting on the condenser.

Remove the bolts (Item 2) **[Figure 70-150-2]**.

Figure 70-150-3



Remove the tie-strap (Item 1) **[Figure 70-150-3]**.

Remove the bolts (Item 2) **[Figure 70-150-3]**.

Move the hose to the side for condenser removal.

Remove the condenser from the excavator.

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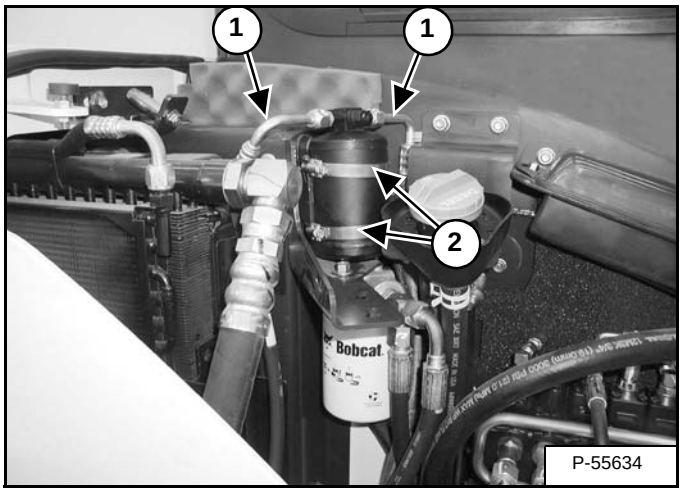
RECEIVER/DRIER

Removal And Installation

Evacuate the A/C system. (See Removal And Installation on Page 70-220-1.)

Open the right side cover.

Figure 70-160-4



Mark the hoses (Item 1) **[Figure 70-160-4]** for proper installation.

Both fittings on the drier are the same size, so the hoses can be hooked up incorrectly.

Note the flow direction on the drier for proper installation.

⚠ WARNING

In the event of a leakage, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R134a refrigerant gives a toxic gas.

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Remove the A/C hoses (Item 1) **[Figure 70-160-4]** from the receiver/drier.

Cap and plug the hoses and the receiver/drier fittings with the proper A/C caps and plugs.

Loosen the hose clamps (Item 2) **[Figure 70-160-4]** that hold the receiver/drier to the mount.

Remove the receiver/drier from the excavator.

NOTE: When replacing a receiver/drier in an A/C system 1 fl. oz. (30 cc) of PAG oil must be added to the system when recharging.

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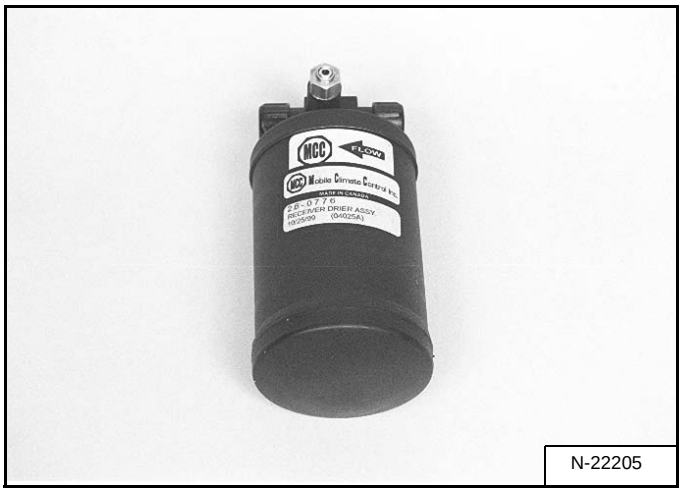


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PRESSURE RELIEF VALVE

Removal And Installation

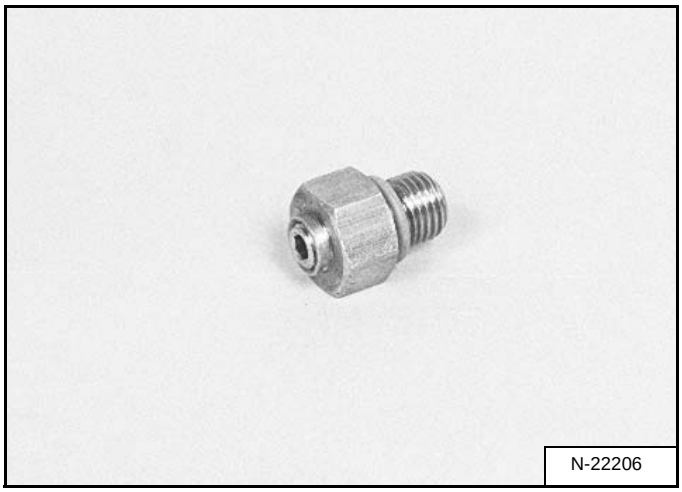
Figure 70-170-5



N-22205

The pressure relief valve (Item 1) **[Figure 70-170-5]** is located on the receiver/drier assembly.

Figure 70-170-6



N-22206

The pressure relief valve is designed to open and release the A/C charge if the pressure reaches 535 PSI (37 Bar) **[Figure 70-170-6]**.

This will cause the A/C system to shutdown, saving the compressor.

The pressure relief valve is a secondary protection device in the A/C system, with the Pressure Switch shutting down the system at 384 PSI (26.5 Bar).

NOTE: If a pressure relief valve is found open, check the A/C system for problems. Replace the complete receiver/drier unit.

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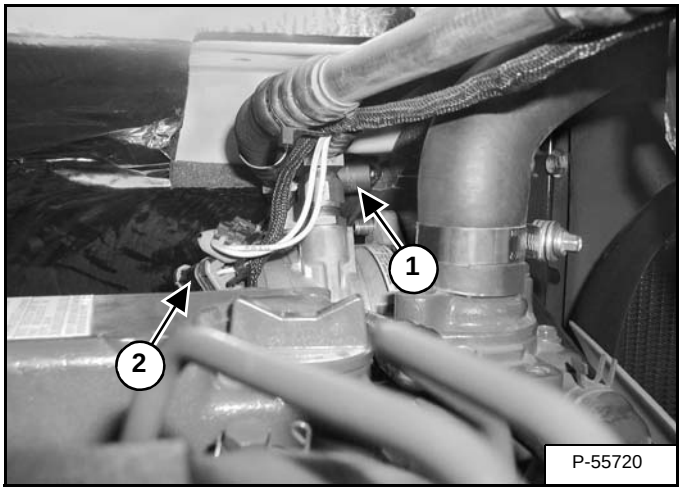
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PRESSURE SWITCH

Removal And Installation

Open the tailgate.

Figure 70-180-1



Locate the pressure switch (Item 1) **[Figure 70-180-1]**.

⚠ WARNING

In the event of a leakage, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R134a refrigerant gives a toxic gas.

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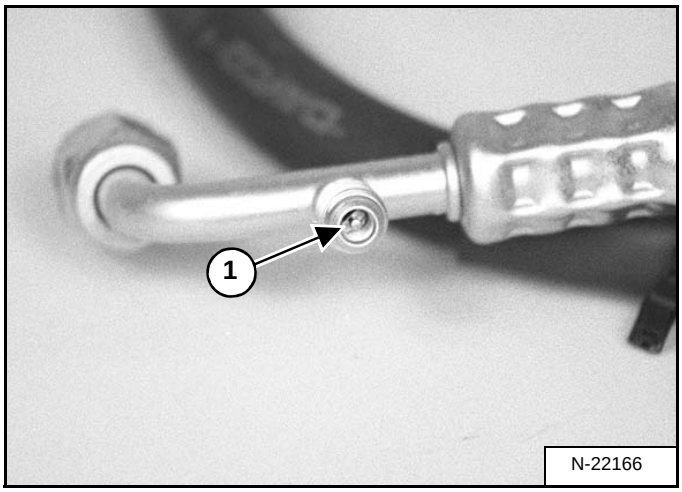
Disconnect the wire harness (Item 2) **[Figure 70-180-1]** from the pressure switch wire harness.

NOTE: The pressure switch can be changed without evacuating the A/C system.

Remove the pressure switch from the excavator.

Schrader Valve Removal And Installation

Figure 70-180-2



The schrader valve (Item 1) **[Figure 70-180-2]** is located in the A/C high pressure hose and is located under the pressure switch.

Evacuate the A/C system. (See Removal And Installation on Page 70-220-1.)

Remove the pressure switch.

With a tire valve core removal tool, remove the valve core from the hose.

Replace with a new core.

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EVAPORATOR/HEATER UNIT (EARLY MODELS)

Removal And Installation

Remove the operator seat and seat mount. (See Removal And Installation on Page 40-40-1.)

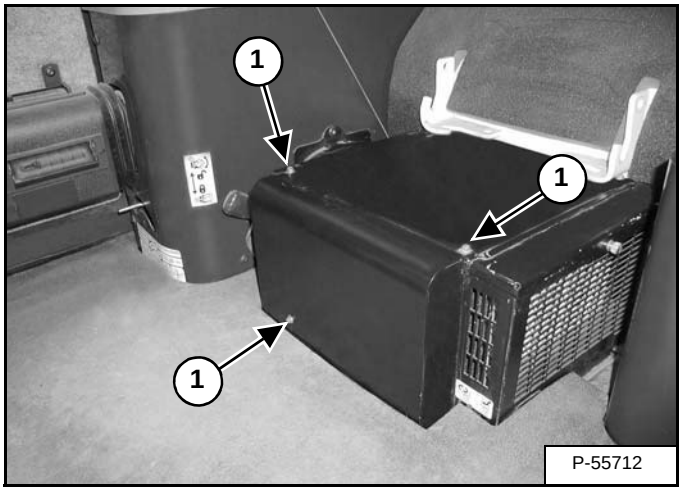
Evacuate the A/C system. (See Removal And Installation on Page 70-220-1.)

⚠ WARNING

In the event of a leakage, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R134a refrigerant gives a toxic gas.

W-2371-0500

Figure 70-190-3

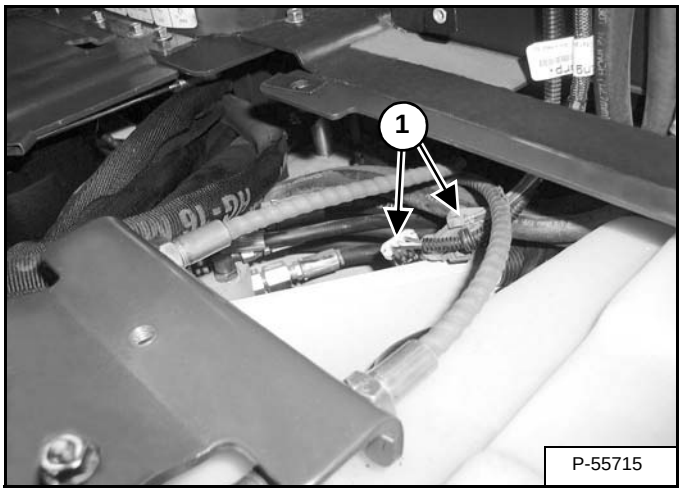


Remove the bolts (Item 1) **[Figure 70-190-3]** from the evaporator/heater unit front cover.

Remove the front cover from the unit.

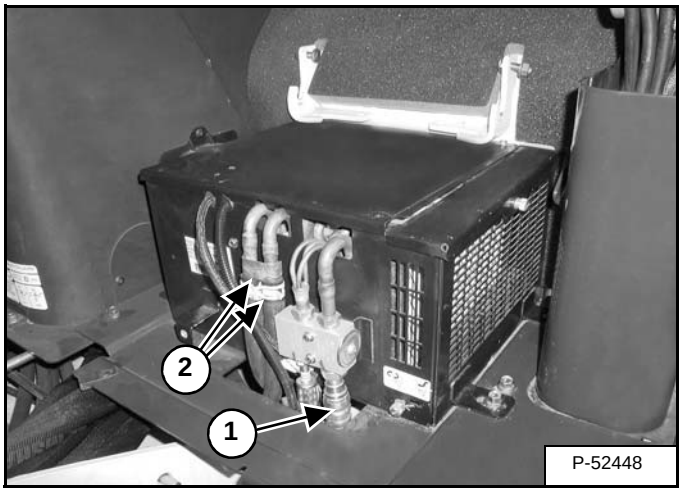
Remove the floormat and floor plate. (See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

Figure 70-190-4



Disconnect the wire harness (Item 1) **[Figure 70-190-4]**.

Figure 70-190-5



Remove the A/C hoses (Item 1) **[Figure 70-190-5]** from the expansion valve.

Installation: Tighten the A/C hoses to 22 ft.-lbs. (29,8 Nm) torque.

Cap and plug the hoses and the expansion valve fittings with the proper A/C caps and plugs.

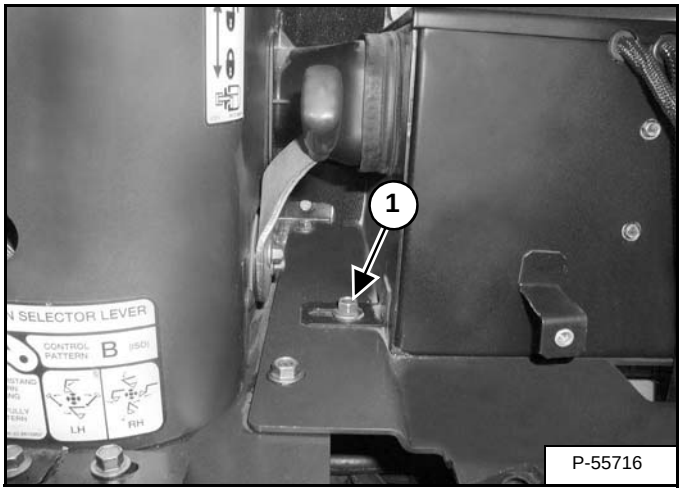
Remove the clamps (Item 2) **[Figure 70-190-5]** from the heater hoses.

Remove the heater hoses from the heater coil.

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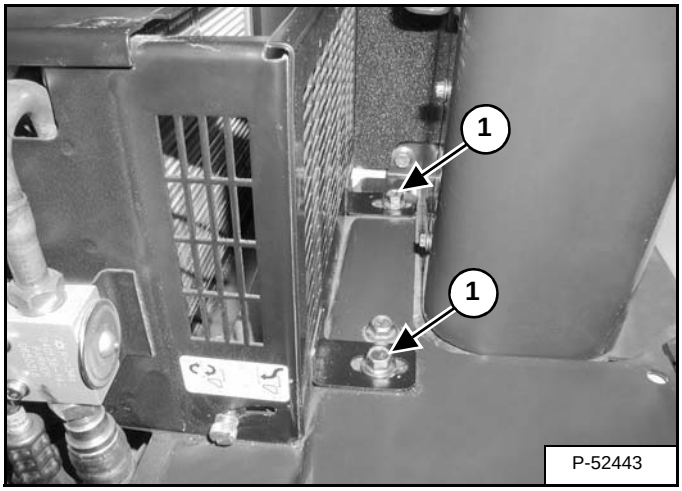
Removal And Installation (Cont'd)

Figure 70-190-6



Remove the bolt (Item 1) **[Figure 70-190-6]** on the right side of the evaporator/heater unit.

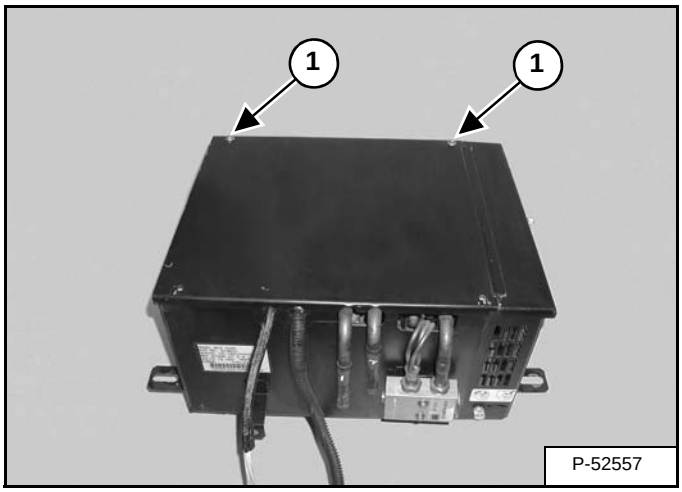
Figure 70-190-7



Remove the bolts (Item 1) **[Figure 70-190-7]** from the left side of the evaporator/heater unit and remove the unit from the excavator.

Disassembly And Assembly

Figure 70-190-8



Remove the bolts (Item 1) **[Figure 70-190-8]** from the evaporator/heater unit cover.

Remove the cover from the unit.

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EVAPORATOR/HEATER UNIT (LATER MODELS)

Removal And Installation

Remove the operator seat and seat mount. (See Removal And Installation on Page 40-40-1.)

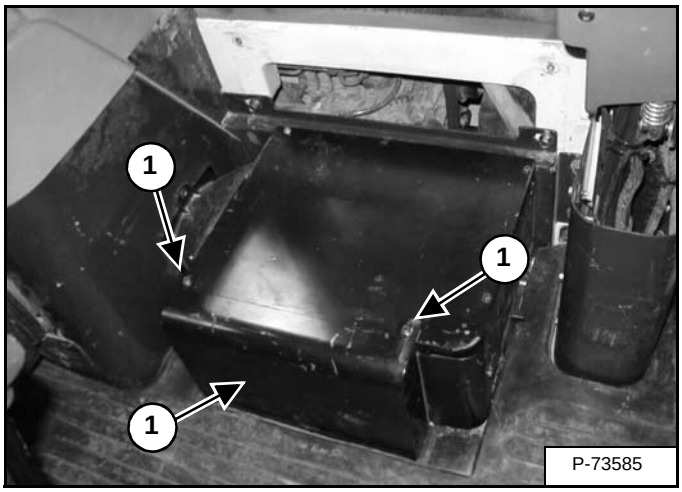
Evacuate the A/C system. (See Reclamation Procedure on Page 70-130-1.)

⚠ WARNING

In the event of a leakage, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R134a refrigerant gives a toxic gas.

W-2371-0500

Figure 70-191-1

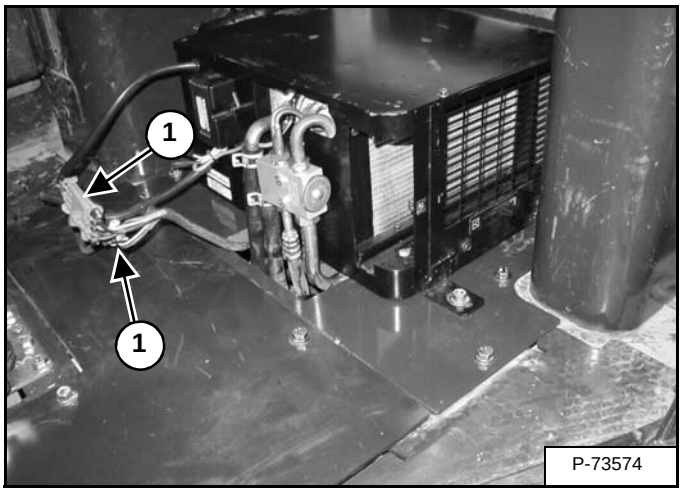


Remove the bolts (Item 1) **[Figure 70-191-1]** from the evaporator/heater unit front cover.

Remove the front cover from the unit.

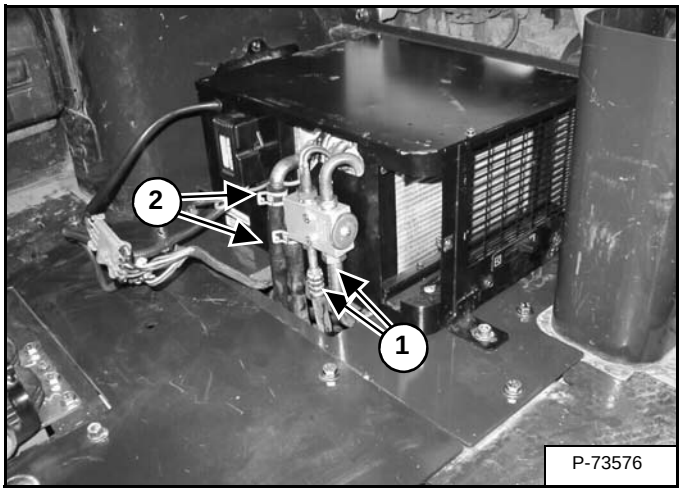
Remove the floormat and floor plate. (See Removal And Installation on Page 40-120-1.)

Figure 70-191-2



Disconnect the wire connectors (Item 1) **[Figure 70-191-2]**.

Figure 70-191-3



Remove the A/C hoses (Item 1) **[Figure 70-191-3]** from the expansion valve.

Installation: Tighten the A/C hoses to 22 ft.-lb. (29,8 N•m) torque.

Cap and plug the hoses and the expansion valve fittings with the proper A/C caps and plugs.

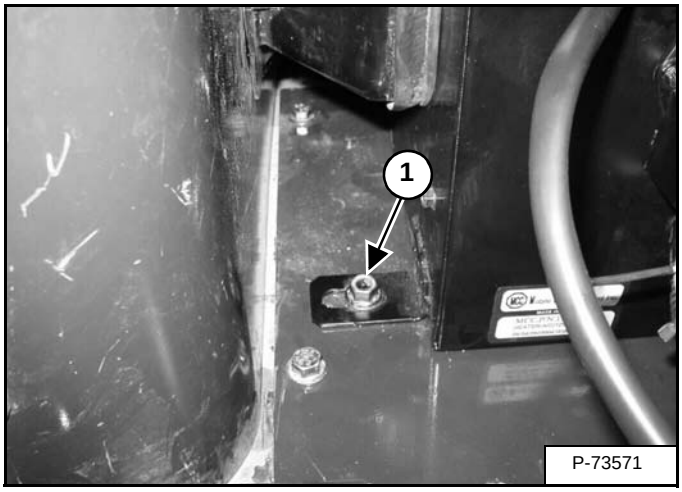
Remove the clamps (Item 2) **[Figure 70-191-3]** from the heater hoses.

Remove the heater hoses from the heater coil.

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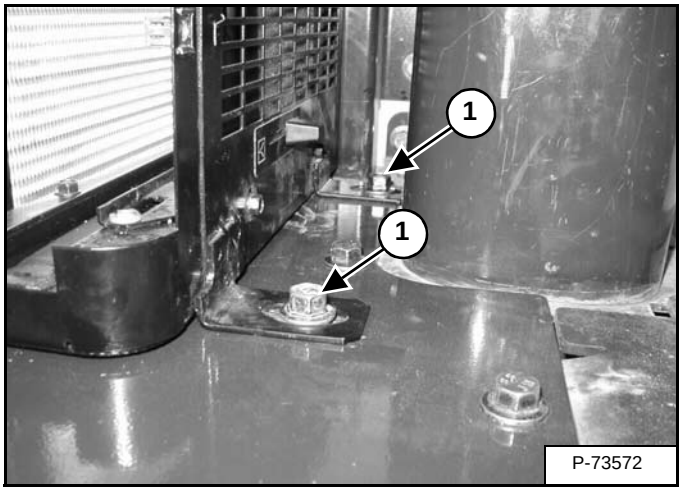
Removal And Installation (Cont'd)

Figure 70-191-4



Remove the bolt (Item 1) **[Figure 70-191-4]** on the right side of the evaporator/heater unit.

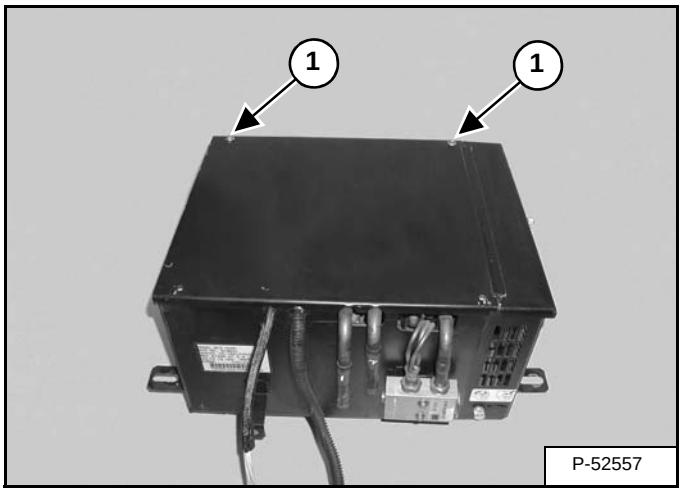
Figure 70-191-5



Remove the bolts (Item 1) **[Figure 70-191-5]** from the left side of the evaporator/heater unit and remove the unit from the excavator.

Disassembly And Assembly

Figure 70-191-6



Remove the bolts (Item 1) **[Figure 70-191-6]** from the evaporator/heater unit cover.

Remove the cover from the unit.

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THERMOSTAT (EARLY MODELS)

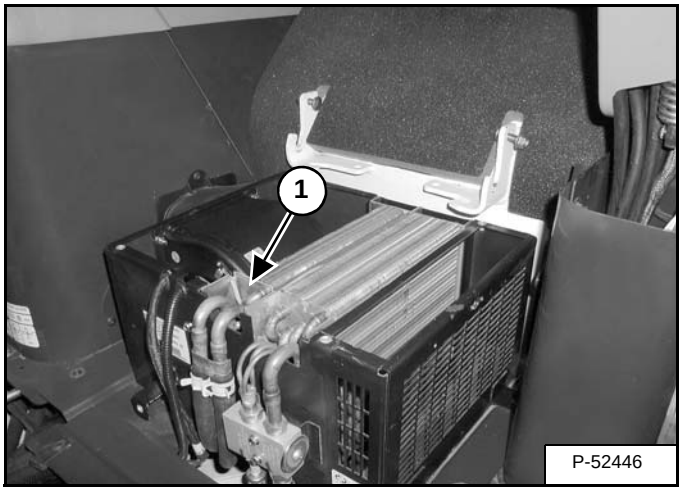
Removal And Installation

NOTE: The thermostat can be changed without evacuating the A/C system, or removing the evaporator/heater unit from the excavator.

Remove the seat and seat mount. (See Removal And Installation on Page 40-40-1.)

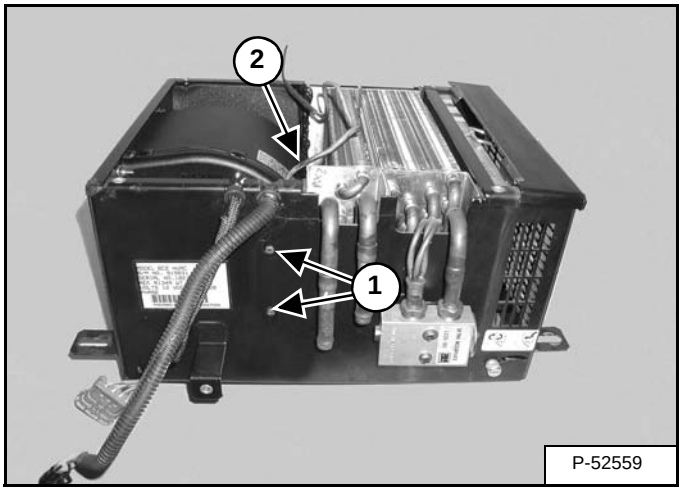
Remove the front and top covers from the evaporator/ heater unit. (See Removal And Installation on Page 70-190-1.)

Figure 70-200-9



Remove the thermostat probe (Item 1) **[Figure 70-200-9]** from the A/C evaporator coil.

Figure 70-200-10



Remove the bolts (Item 1) **[Figure 70-200-10]**.

Remove the thermostat (Item 2) **[Figure 70-200-10]** from the unit.

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THERMOSTAT (LATER MODELS)

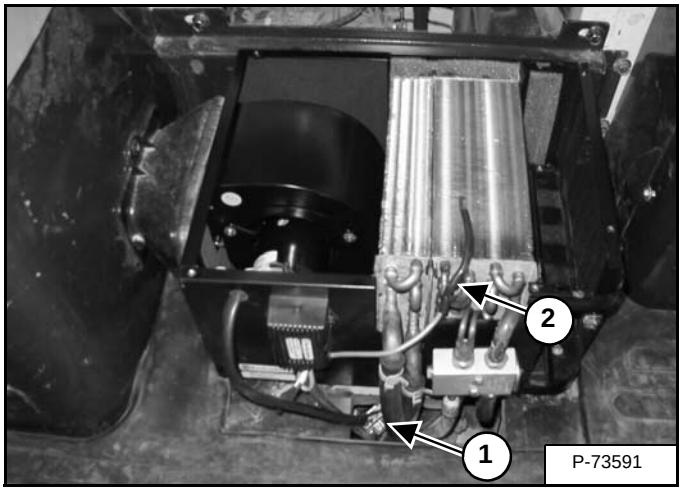
Removal And Installation

NOTE: The thermostat can be changed without evacuating the A/C system, or removing the evaporator/heater unit from the excavator.

Remove the seat and seat mount. (See Removal And Installation on Page 40-40-1.)

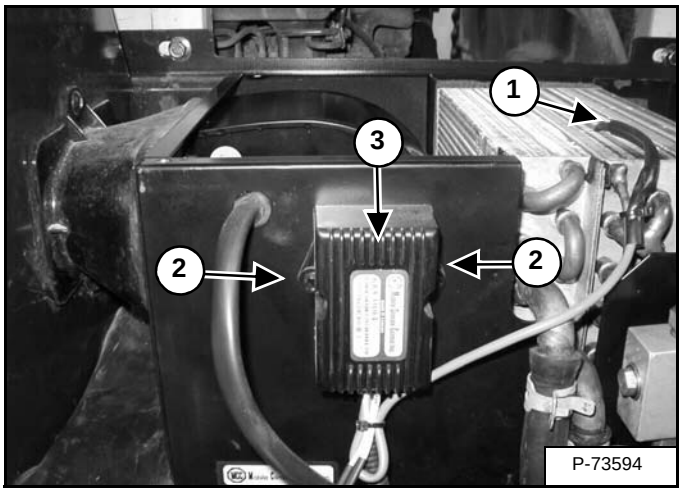
Remove the front and top covers from the evaporator/ heater unit. (See Disassembly And Assembly on Page 70-190-2.)

Figure 70-201-1



Disconnect the thermostat connector (Item 1) and remove the tie strap (Item 2) **[Figure 70-201-1]**.

Figure 70-201-2



NOTE: Mark the location of the probe before removal. Reinstall the probe in the same location. Moving the thermostat probe location in the evaporator coil will effect air conditioning performance.

Remove the thermostat probe (Item 1) **[Figure 70-201-2]** from the A/C evaporator coil.

Remove the two bolts (Item 2) **[Figure 70-201-2]**.

Remove the thermostat (Item 3) **[Figure 70-201-2]** from the unit.

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EXPANSION VALVE (EARLY MODELS)

Removal And Installation

Remove the seat and seat mount. (See Removal And Installation on Page 40-40-1.)

Remove the front and top covers from the evaporator/heater unit. (See Removal And Installation on Page 70-190-1.)

NOTE: The expansion valve can be changed without removing the evaporator/heater unit from the excavator.

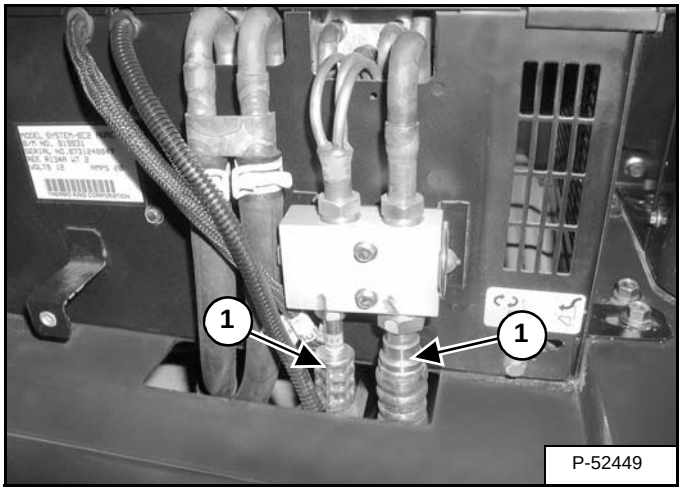
Evacuate the A/C system. (See Removal And Installation on Page 70-220-1.)

⚠ WARNING

In the event of a leakage, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R134a refrigerant gives a toxic gas.

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Figure 70-210-1



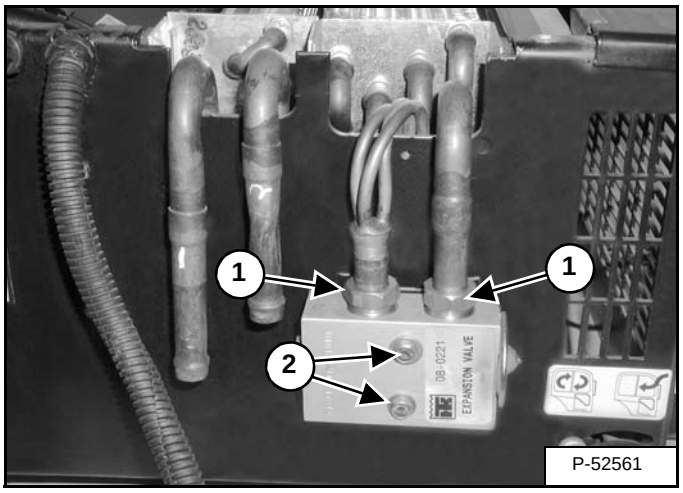
Remove the A/C hoses (Item 1) **[Figure 70-210-1]** from the expansion valve.

Installation: Tighten the A/C hose fittings to 22 ft.-lbs. (29,8 Nm) torque.

Cap and plug the hoses and the expansion valve fittings with proper A/C caps and plugs.

Mark the expansion valve for proper installation.

Figure 70-210-2



Remove the evaporator fittings (Item 1) **[Figure 70-210-2]** from the expansion valve.

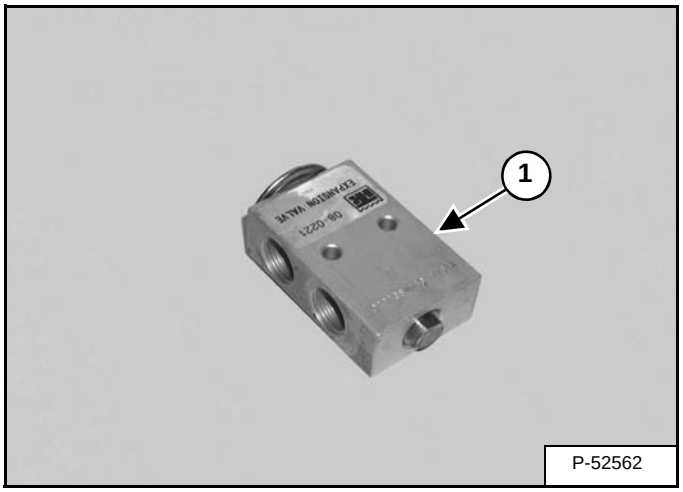
Installation: Tighten the evaporator fittings to 22 ft.-lbs. (29,8 Nm) torque.

Remove the bolts (Item 2) **[Figure 70-210-2]**.

Remove the expansion valve from the excavator.

Cap and plug the evaporator tubelines and the expansion valve fittings with the proper A/C caps and plugs.

Figure 70-210-3



The expansion valve is not serviceable and must be replaced as an assembly **[Figure 70-210-3]**.

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EVAPORATOR VALVE (LATER MODELS)

Removal And Installation

Evacuate the A/C system. (See Charging Procedure With A Manifold Gauge Set on Page 70-130-4.)

Remove the seat and seat mount. (See Removal And Installation on Page 40-40-1.)

Remove the front and top covers from the evaporator/ heater unit. (See Disassembly And Assembly on Page 70-190-2.)

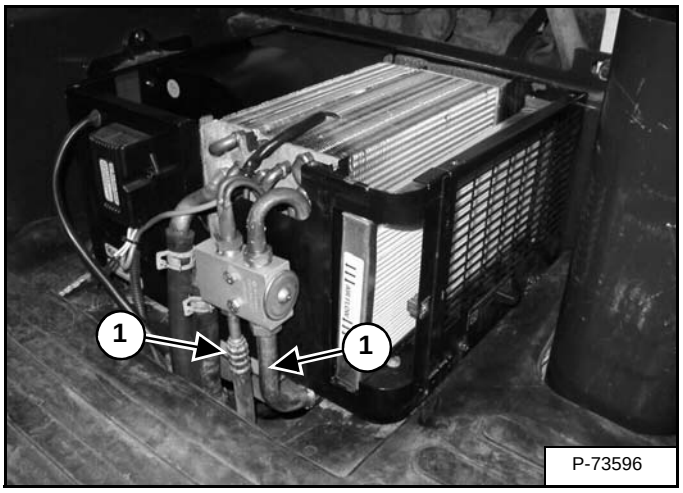
NOTE: The expansion valve can be changed without removing the evaporator/heater unit from the excavator.

⚠ WARNING

In the event of a leakage, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R134a refrigerant gives a toxic gas.

W-2371-0500

Figure 70-211-1



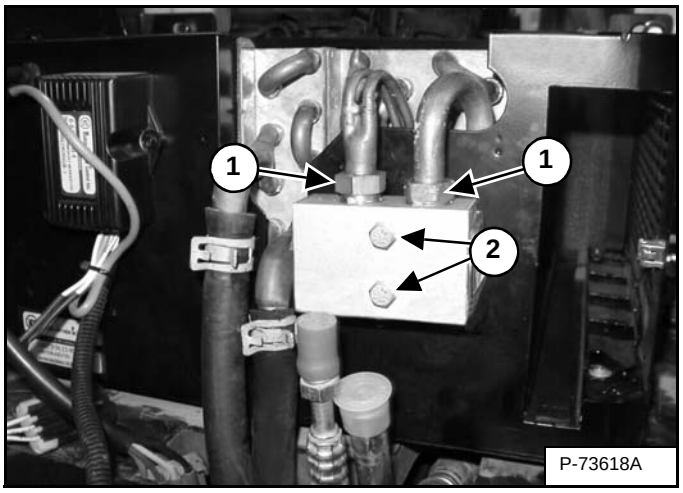
Remove the A/C hoses (Item 1) **[Figure 70-211-1]** from the expansion valve.

Installation: Tighten the A/C hose fittings to 22 ft.-lb. (29,8 N•m) torque.

Cap and plug the hoses and the expansion valve fittings with proper A/C caps and plugs.

Mark the expansion valve for proper installation.

Figure 70-211-2



Remove the evaporator fittings (Item 1) **[Figure 70-211-2]** from the expansion valve.

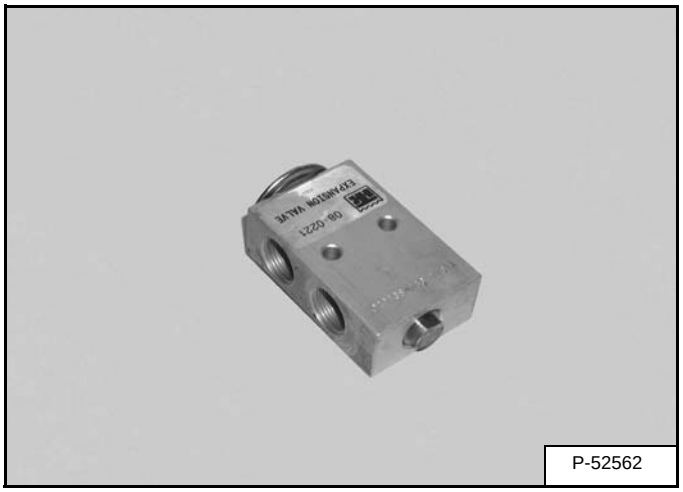
Installation: Tighten the evaporator fittings to 22 ft.-lb. (29,8 N•m) torque.

Remove the bolts (Item 2) **[Figure 70-211-2]**.

Remove the expansion valve from the excavator.

Cap and plug the evaporator tubelines and the expansion valve fittings with the proper A/C caps and plugs.

Figure 70-211-3



The expansion valve is not serviceable and must be replaced as an assembly **[Figure 70-211-3]**.

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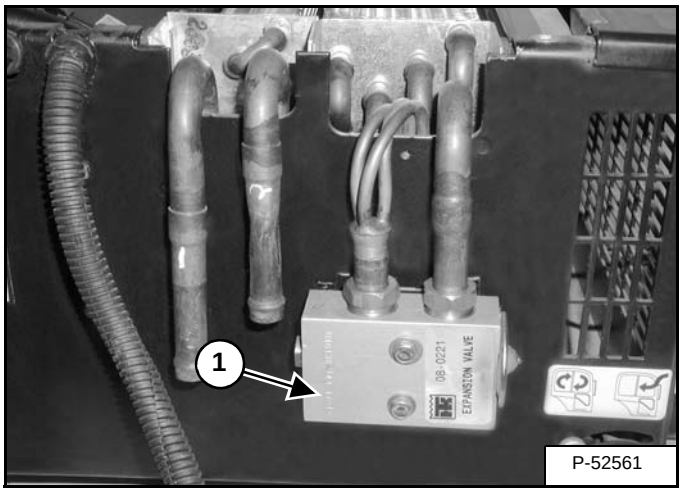
EVAPORATOR (EARLY MODELS)

Removal And Installation

Evacuate the A/C system.

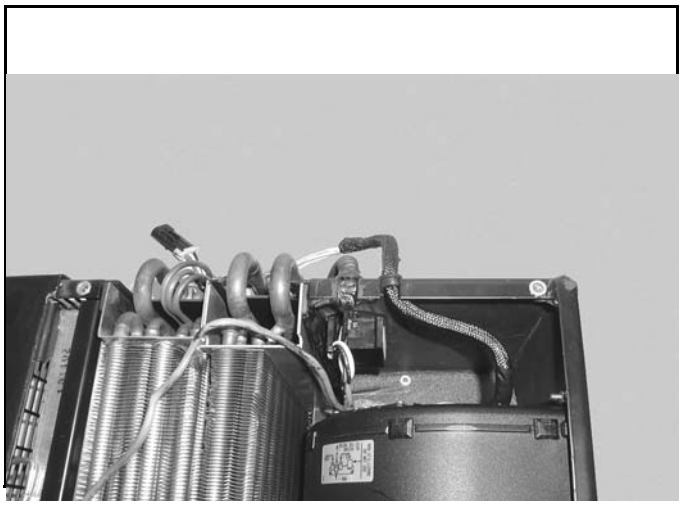
Remove the evaporator/heater unit from the excavator. (See Removal And Installation on Page 70-190-1.)

Figure 70-220-14



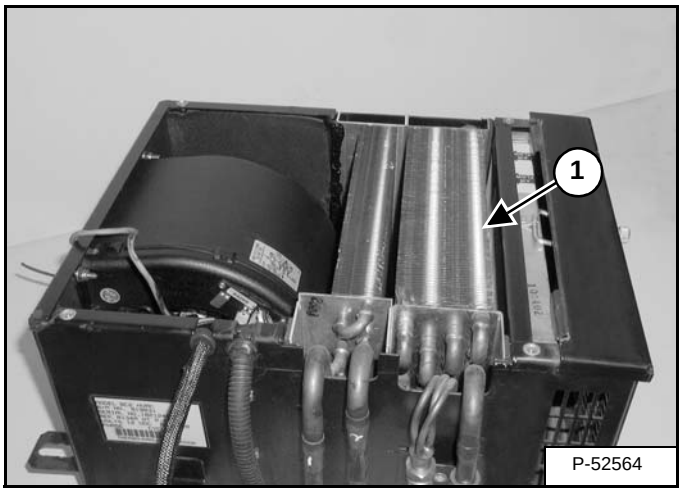
Remove the expansion valve (Item 1) **[Figure 70-220-14]** from the unit. (See Removal And Installation on Page 70-210-1.)

Figure 70-220-15



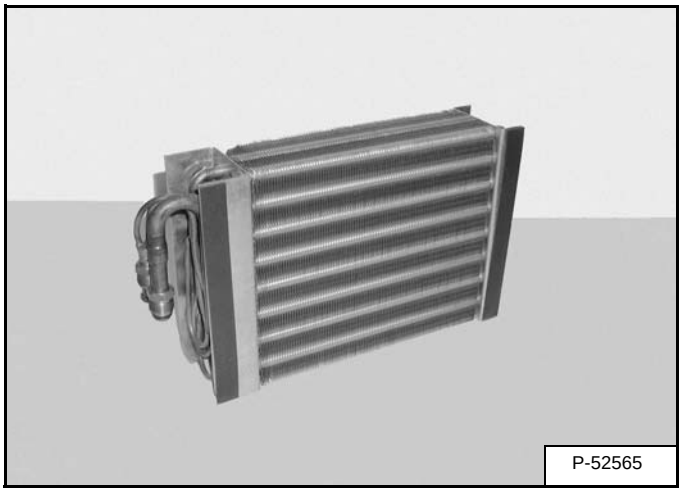
Remove the thermostat probe (Item 1) **[Figure 70-220-15]** from the evaporator.

Figure 70-220-16



Lift the evaporator (Item 1) **[Figure 70-220-16]** straight up from the evaporator/heater unit.

Figure 70-220-17



Inspect the evaporator coil **[Figure 70-220-17]** for leaks, and replace as needed.

Clean with low water or air pressure.

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EVAPORATOR (LATER MODELS)

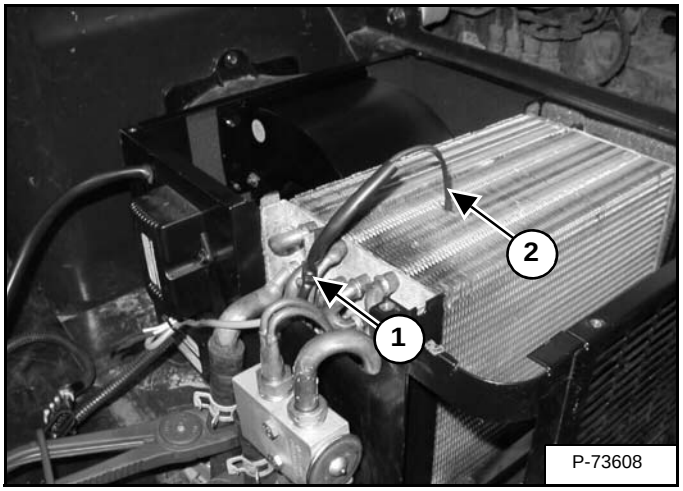
Removal And Installation

Evacuate the A/C system. (See Charging Procedure With A Manifold Gauge Set on Page 70-130-4.)

Remove the evaporator/heater unit from the excavator. (See Removal And Installation on Page 70-191-1.)

Remove the expansion valve. (See Removal And Installation on Page 70-211-1.)

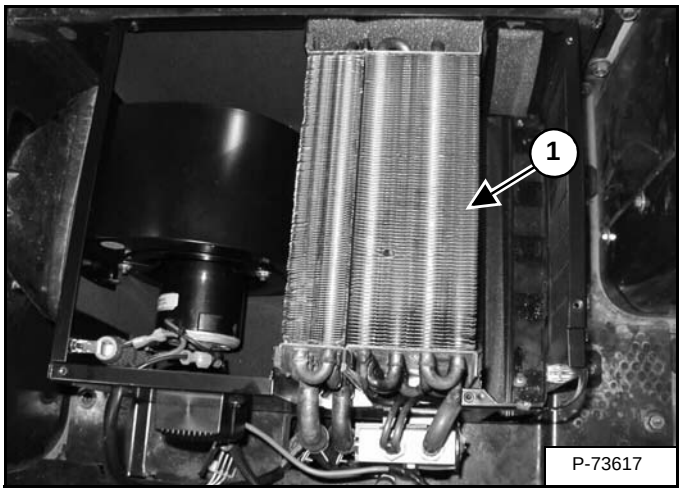
Figure 70-221-1



Remove the tie strap (Item 1) and thermostat probe (Item 2) **[Figure 70-221-1]** from the evaporator.

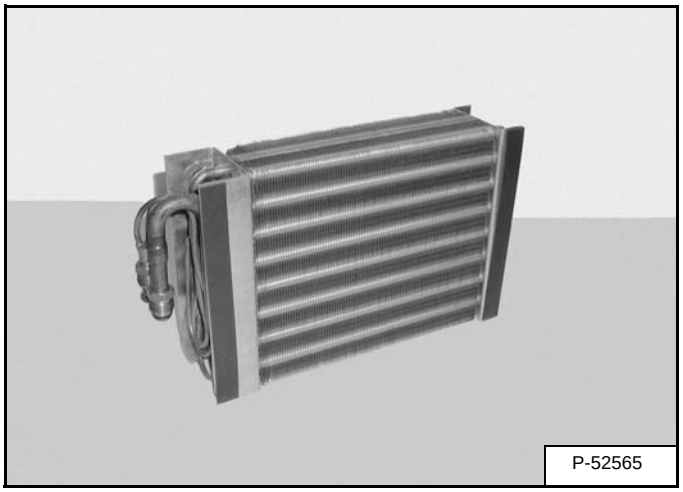
NOTE: Mark the location of the probe before removal. Reinstall the probe in the same location. Moving the thermostat probe location in the evaporator coil will effect air conditioning performance.

Figure 70-221-2



Lift the evaporator (Item 1) **[Figure 70-221-2]** straight up from the evaporator/heater unit.

Figure 70-221-3



Inspect the evaporator coil **[Figure 70-221-3]** for leaks, and replace as needed.

Clean with low water or air pressure.

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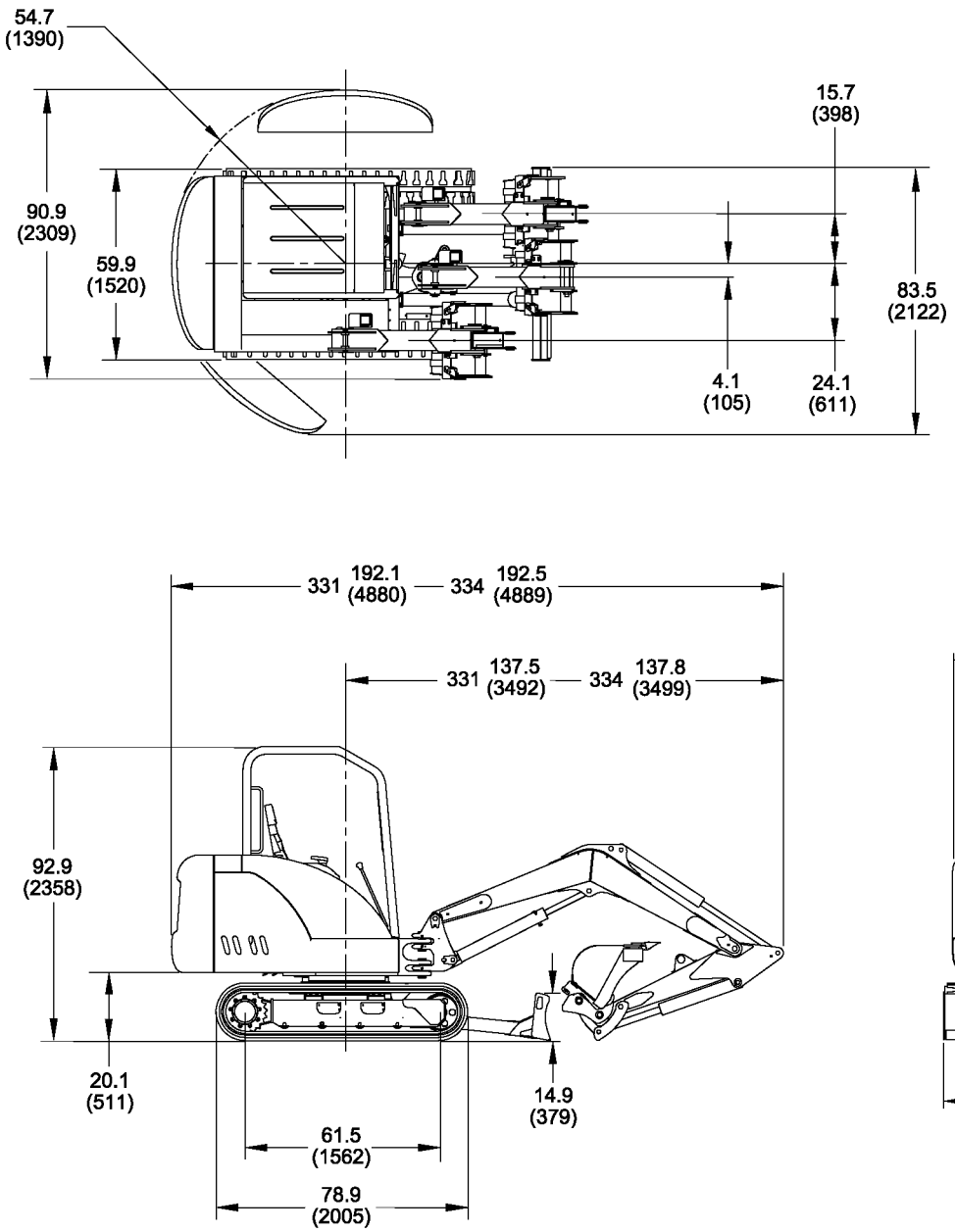
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- 331E Excavator Machine Dimensions SPEC-10-3
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331 & 334 Excavator Machine Dimensions

- 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.

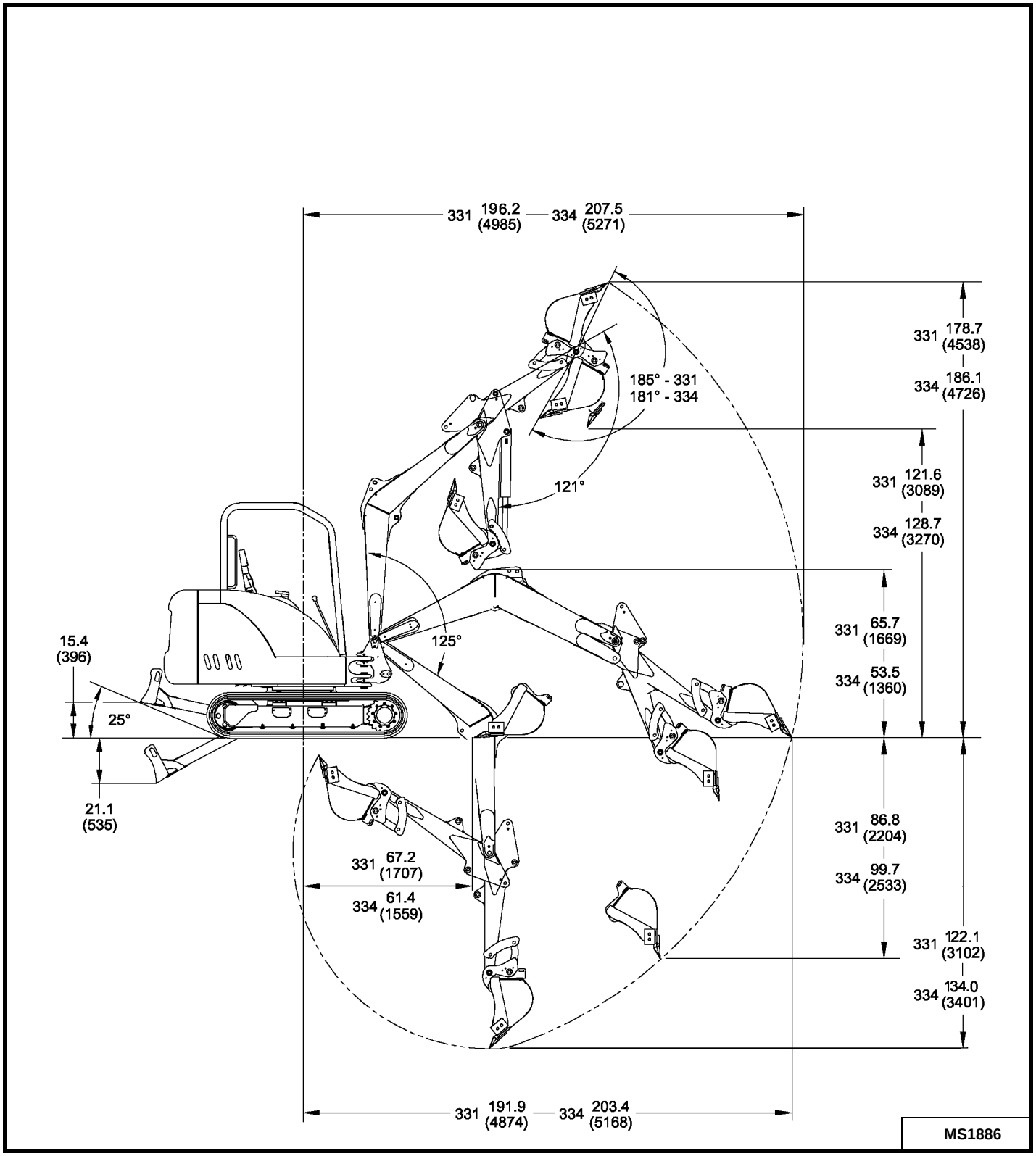


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331 & 334 Excavator Machine Dimensions (Cont'd)

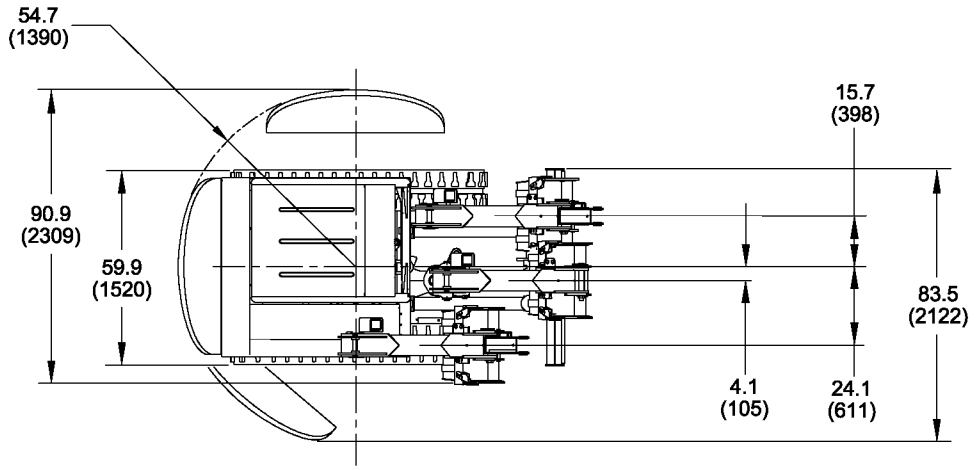
- All dimensions are shown in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.

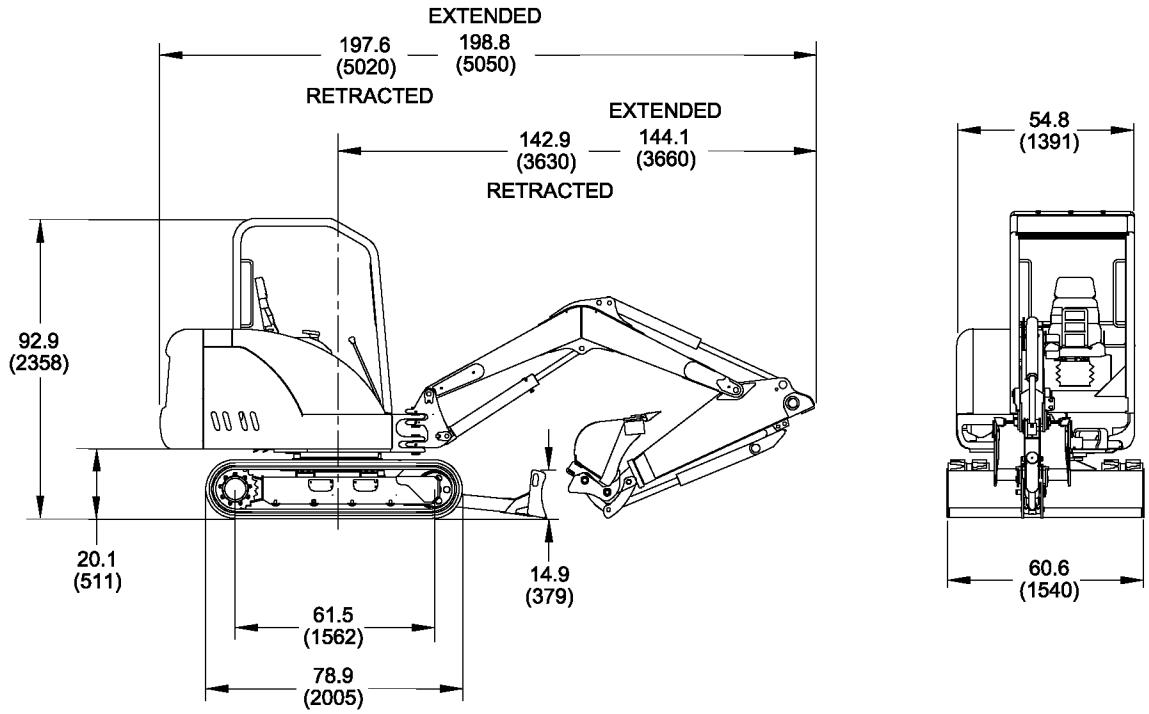


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331E Excavator Machine Dimensions

- 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.



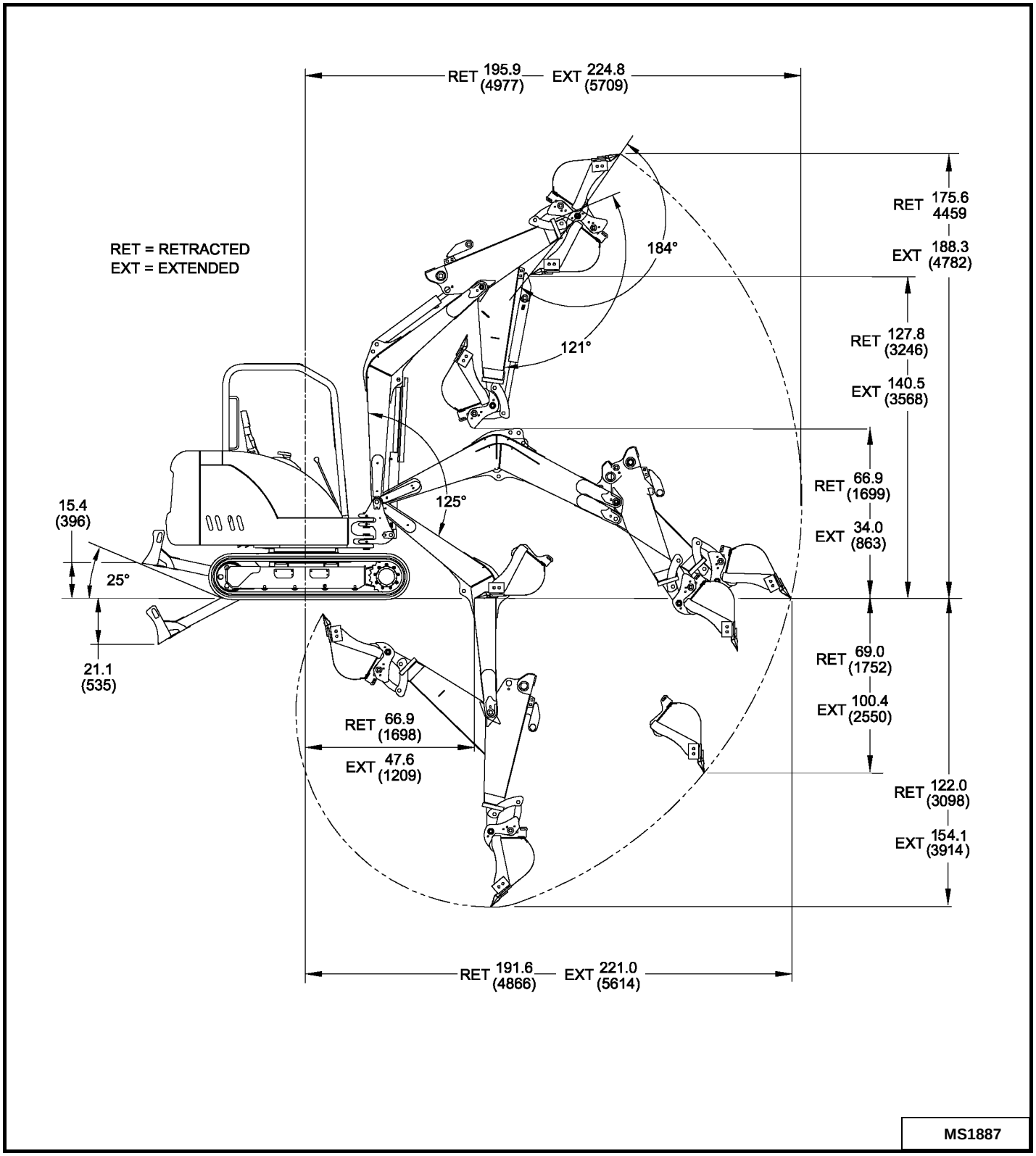


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331E Excavator Machine Dimensions (Cont'd)

- 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

331 operating weight w/ canopy, rubber tracks, and 24 in. (609 mm) bucket	7185 lb. (3259 kg)
331E w/ Long Arm operating weight w/ canopy, rubber tracks, and 24 in. (609 mm) bucket	7727 lb. (3505 kg)
334 operating weight w/ canopy, rubber tracks, and 24 in. (609 mm) bucket	7538 lb. (3419 kg)
Travel Speed	Low Range 1.70 mph (2,74 km/hr) High Range 3.20 mph (5,15 km/hr)
Steel tracks add 158 lb. (72 kg) Cab w/heater add 263 lb. (119 kg) Cab w/HVAC add 311 lb. (141 kg)	

Controls

Steering	Two hand levers or foot pedals
Hydraulics	Two hand operated levers (joysticks) control boom, bucket, arm and upperstructure slew
Auxiliary Hydraulics	Electric switch in right joystick
Blade	Right hand lever
Boom Swing	Right foot pedal
Upperstructure Slew Lock Service Holding	 Hydraulic lock on motor Mechanical pin lock
Vehicle Steering	Direction and speed controlled by two pilot operated hand levers/foot pedals.

Engine

Make/Model	Kubota V2203-M-DI-E
Fuel/Cooling	Diesel/Liquid
Horsepower, Maximum	40.6 HP (30.3 kw)
Maximum Governed Speed	2400 RPM
High Idle Speed	2620 RPM
Low Idle Speed	1195-1245 RPM
Maximum Torque	106.4 ft.lb. (144,2 N•m)
Number Of Cylinders	4
Displacement	134 cu. in. (2,2L)
Bore/Stroke	3.42 x 3.64 in. (87,0 x 92,4 mm)
Lubrication	Pressure System with Filter
Crankcase Ventilation	Closed Breathing
Air Cleaner	Dry replaceable paper dual cartridge
Ignition	Diesel-Compression

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Hydraulic System

Pump - Hydraulic	Engine driven, dual outlet variable displacement piston/gear pump
Pump Capacity Piston Pump (Two)	10.1 GPM (38,4 L/min.)
Auxiliary Flow	16.4 GPM (62,1 L/min.)
Control Valve	10 spool closed center individually compensated
Drive Motor (Two)	Axial Piston
Slew Motor	Orbit Motor
System Relief Pressure Piston Pump	3480 PSI (240 bar)
Slew Relief Pressure	3050 PSI (211 bar)
Joystick Pressure	435 PSI (30 bar)
Auxiliary Relief	2610 PSI (180 bar)
Arm Port Relief Base And Rod End	3625 PSI (250 bar)
Boom Port Relief Base End And Rod End	3915 PSI (270 bar)
Bucket Port Relief Base End And Rod End	3915 PSI (270 bar)
Blade Port Relief Base End	3915 PSI (270 bar)
Main Hydraulic Filter Bypass	50 PSI (3.5 bar)
Case Drain Filter Bypass	20 PSI (1.4 bar)

Hydraulic Cylinders

Cylinder	Bore	Rod	Stroke
Boom (Cushion Up)	3.00 in. (76,2 mm)	1.75 in. (44,5 mm)	25.09 in. (637,3 mm)
Arm (Cushion Retract)	2.75 in. (69,9 mm)	1.50 in. (38,1 mm)	23.62 in. (599,9 mm)
Bucket	2.75 in. (69,9 mm)	1.75 in. (44,5 mm)	18.39 in. (467,1 mm)
Boom Swing (Cushion Left/Right)	3.00 in. (76,2 mm)	1.50 in. (38,1 mm)	20.65 in. (524,5 mm)
Blade	3.50 in. (88,9 mm)	1.75 in. (44,5 mm)	7.28 in. (184,9 mm)

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Hydraulic Cycle Times

Bucket Curl	2.6 seconds
Bucket Dump	1.8 seconds
Arm Retract	3.3 seconds
Arm Extend	2.7 seconds
Boom Raise	4.6 seconds
Boom Lower	5.4 seconds
Boom Swing Left	6.2 seconds
Boom Swing Right	5.7 seconds
Blade Raise	2.9 seconds
Blade Lower	3.2 seconds
Extendable Arm Retract	1.4 seconds
Extendable Arm Extend	2.1 seconds
Slew	9.2 RPM

Drive System

Travel Motor	Each track is driven by hydrostatic axial piston motor
Drive Reduction	36.4:1 two stage planetary
Max Draw bar Pull (Theoretical @ 90% Efficiency)	7830 lbf. (34838 N)

Undercarriage

Crawler	Tractor Design
Rollers	Sealed rollers with box section track roller frame
Track Adjusters	Grease type track adjusters with shock absorbing recoil spring

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Track

Width	12.6 in. (320 mm)
Number of Shoes (steel track)	41
Number of Rollers	4 (on bottom)
331 Ground Pressure Rubber Track Steel Track	 4.22 PSI (0,291 bar) 4.31 PSI (0,297 bar)
331E w/Long Arm Ground Pressure Rubber Track Steel Track	 4.54 PSI (0,313 bar) 4.63 PSI (0,319 bar)
334 Ground Pressure Rubber Track Steel Track	 4.43 PSI (0,306 bar) 4.52 PSI (0,312 bar)

Electrical

Alternator	12 volts, 90 amp open frame w/ internal regulator
Battery	12 volt negative ground 12 volt, 530 CCA @ 0° F (-18° C), 75 minute reserve capacity
Starter	12 volt gear reduction 2.7 HP (2.0 kW)
Lights (2)	37.5 watts each

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ENGINE SPECIFICATIONS

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Fuel Injection Nozzles

Opening Pressure	2702-2916 PSI (186-201 bar)
Fuel Tightness Nozzle Seat	Dry Nozzle at 1850 PSI (127,5 bar)

Fuel Injection Pump

Fuel Tightness Plunger	10 sec: initial pressure 1850 PSI (127,5 bar)
Allowable Limit	5 seconds
Injection Timing	4.5-6.5 degrees B.T.D.C.
High Idle	2620 RPM
Low Idle	1195-1245 RPM

Cylinder Head

Cylinder Head Surface Distortion	0.002 (0,05) in 19.70 (500) Max.
Top Clearance (Piston to Head)	0.0236-0.0276 (0,60-0,70)
Compression	512-583 PSI (35-40 bar) @ 290 RPM
Allowable Limit	370 PSI (26 bar) @ 290 RPM
Allowable Difference Between Cylinders	10% or less

Valves

Valve Seat Width (Intake & Exhaust)	0.0835 (2,12)
O.D. of Valve Stems	0.3134-0.3140 (7,96-7,98)
I.D. of Valve Guides	0.3156-0.3161 (8,015-8,03)
Clearance Between Valve Stem & Guide	0.0016-0.0028 (0,04-0,07)
Allowable Limit	0.0039 (0,1)
Valve Clearance (Cold)	0.007-0.0087 (0,18-0,22)
Valve Recessing (Protrusion)	0.002 (0,05)
(Recess)	0.006 (0,15)
Allowable Limit (Recess)	0.0157 (0,4)
Valve Seat Angle (Int.)	60 degrees
Valve Seat Angle (Exh.)	45 degrees

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All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Valve Springs

Free Length	1.642-1.661 (41,7-42,2)
Allowable Limit	1.622 (41,2)
Fitted Length	1.378 (35,0)
Compress to Fitted Length	26.4 lb. (117,6 N)
Allowable Limit	22.5 lb. (100,0 N)
Inclination Allowable Limit	0.039 (1,0)

Valve Timing

Intake Valve (Open)	9 degrees B.T.D.C.
(Close)	45 degrees A.B.D.C.
Exhaust Valve (Open)	50 degrees B.B.D.C.
(Close)	12 degrees A.T.D.C.

Rocker Arms

O.D. of Rocker Arm Shaft	0.5501-0.5506 (13,97-13,98)
I.D. of Rocker Arm	0.5512-0.5519 (14,0-14,02)
Clearance Between Rocker Arm & Shaft	0.0006-0.0018 (0,02-0,05)
Allowable Limit	0.004 (0,1)

Camshaft

Journal O.D.	1.572-1.573 (39,93-39,95)
Cylinder Block Bore I.D.	1.575-1.576 (40,0-40,025)
Oil Clearance	0.002-0.0036 (0,05-0,091)
Allowable Limit	0.006 (0,15)
Alignment Allowable Limit	0.0004(0,01)
Cam Lobe Height	1.335 (33,9)
Allowable Limit	1.333 (33,85)
End Clearance	0.0028-0.0087 (0,07-0,22)
Allowable Limit	0.012 (0,3)

Tappet

Clearance Between Tappet & Guide	0.0008-0.0024 (0,02-0,062)
Allowable Limit	0.0028 (0,07)
Tappet O.D.	0.943-0.944 (23,96-23,98)
Tappet Guide I.D.	0.945-0.946 (24,0-24,021)

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All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Cylinders

Cylinder Bore I.D. (Standard)	3.425-3.426 (87,00-87,02)
Allowable Limit (Standard)	+0.006 (+0,15)
Cylinder Bore I.D. (Oversize)	3.435 -3.436 (87,25-87,27)
Allowable Limit (Oversize)	+0.006 (+0,15)

Piston Rings

Ring Gap (Top)	0.008-0.0138 (0,20-0,35)
Ring Gap (2nd Ring)	0.0138-0.0197 (0,35-0,50)
Ring Gap (Oil Ring)	0.0079-0.0157 (0,20-0,40)
Allowable Limit (All Rings)	0.05 (1,25)
Side Clearance of Ring Groove:	
2nd Ring	0.0020-0.0035 (0,050-0,090)
Allowable Limit	0.008 (0,20)
Oil Ring	0.0012-0.0028 (0,03-0,07)
Allowable Limit	0.006 (0,15)

Pistons

Piston Pin Bore	0.984-0.985 (25,0-25,013)
Allowable Limit	0.986 (25,05)

Connecting Rods

Piston Pin O.D.	0.984-0.985 (25,0-25,011)
Small End Bushing I.D.	0.985-0.986 (25,025-25,04)
Clearance Between Piston Pin & Small End Bushing	0.0006-0.0015 (0,014-0,038)
Connecting Rod Alignment Allowable Limit	0.002 (0,05)

Oil Pump

Oil Pressure at Rated RPM	43-64 PSI (2,94-4,4 bar)
Allowable Limit	36 PSI (2,5 bar)
Idle Speed Allowable Limit	7 PSI (0,48 bar)
Clearance Between Inner Rotor & Outer Rotor	0.0012-0.0055 (0,03-0,14 mm)
Clearance Between Outer Rotor & Pump Body	0.0043-0.0075 (0,11-0,19)
End Clearance Between Inner Rotor & Cover	0.0041-0.0059 (0,105-0,15)
Allowable Limit	0.008 (0,2)

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All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Crankshaft

	Engine S/N 3R9999 & Below	All Models	Engine S/N 3S0001 & Above
Crankshaft Alignment Allowable Limit		0.0008 (0,02)	
Oil Clearance Between Journal & Bearing #1		0.0016-0.0047 (0,04-0,118)	
Allowable Limit		0.008 (0,2)	
Journal O.D. #1	2.044-2.045 (51,92-51,94)		2.3591-2.3598 (59,921-59,940)
Bearing I.D. #1	2.046-2.049 (51,98-52,04)		2.3614-2.3637 (59,980-60,039)
Oil Clearance Between Journal & Bearing #2		0.0016-0.0041 (0,04-0,104)	
Allowable Limit		0.008 (0,2)	
Journal O.D. #2	2.044-2.045 (51,92-51,94)		2.3591-2.3598 (59,921-59,940)
Bearing I.D. #2	2.046-2.048 (51,98-52,03)		2.3614-2.3632 (59,980-60,025)
Oil Clearance Between Crank Pin & Bearing		0.001-0.0034 (0,025-0,087)	
Allowable Limit		0.008 (0,2)	
Crank Pin O.D.		1.8488-1.8494 (46,96-46,98)	
Crank Pin Bearing I.D.		1.850-1.852 (47,0-47,05)	
Crankshaft Side Clearance		0.006-0.014 (0,15-0,35)	
Allowable Limit		0.020 (0,5)	

Timing Gear

Timing Gear Backlash	
Crank Gear - Idle Gear	0.0016-0.0044 (0,042-0,112)
Idle Gear - Cam Gear	0.0016-0.0045 (0,042-0,115)
Idle Gear - Injection Pump Gear	0.0016-0.0045 (0,042-0,115)
Crank Gear - Oil Pump Gear	0.0016-0.0043 (0,042-0,109)
Allowable Limit	0.006 (0,15)
Clearance Between Idle Gear Shaft & Idle Gear Bushing	0.001-0.0026 (0,025-0,066)
Allowable Limit	0.004 (0,10)
Idler Gear Side Clearance	0.005-0.019 (0,12-0,48)

Thermostat

Valve Opening Temperature	177-182°F (81-84°C)
Valve Fully Open	203°F (95°C)

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All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Engine Bolt Torque

	ft.-lb.	**N•m**
Camshaft Retainer Plate Bolts	17-20	24-28
* Connecting Rod Bolts	33-36	44-49
* Crankshaft Nut	101-116	137-157
* Cylinder Head Bolts	69-72	93-98
* Flywheel Bolts	72-80	98-108
Fuel Injection Tubeline Fittings	11-18	15-25
Glow Plugs	15-18	20-25
* Idler Gear Shaft Bolt	17-20	23-28
Injection Nozzle Clamp	19-22	26-29
* Main Bearing Bolts	51-54	69-74
* Main Bearing Case Bolts	34-38	46-51
Oil Switch	11-15	15-20
Rear Bearing Case Cover Bolts	17-20	24-28

* Lightly Oiled Threads

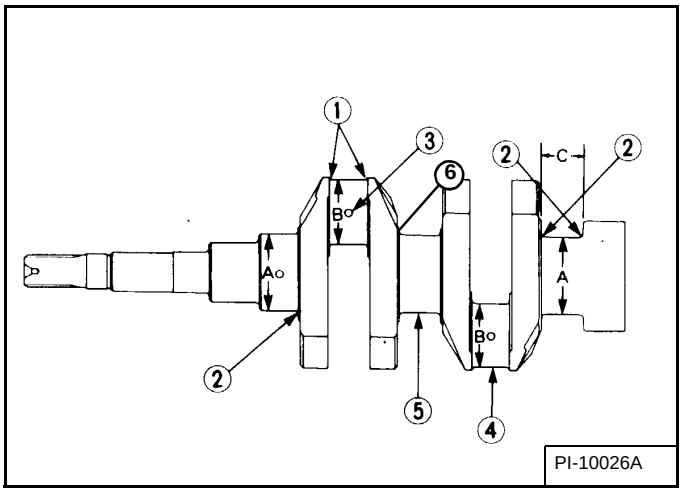
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Crankshaft Re-Grind Data

If the standard size bearing cannot be used due to excessive wear of the crankpin and crank journal use undersize or oversize bearings.

For undersize or oversize bearing use, follow the precautions noted below.

Figure SPEC-20-1



Grind the crankpin and journal with a wheel which has specified round corner and width without shoulder **[Figure SPEC-20-1]**.

1. 0.1299-0.1457" (3,3-3,7 mm) radius.
2. 0.1102-0.1260" (2,8-3,2 mm) radius.
3. Chamfer the oil hole circumference to 0.04-0.06" (1,0-1,5 mm) radius with an oil stone.
4. The crankpin must be fine finished to higher than (0,8S).
5. The crank journal must be fine-finished to higher than (0,8S).
6. The crank journal side surface must be fine-finished to higher than (0,8S).

SIZE	CODE NO.	NAME OF BEARING	BEARING MARK	CRANKSHAFT PROCESSING DIM.	
-0.008" (0,2 mm)	17311-23910	Crankshaft Bearing 1 0.008" minus (0,2 minus)	020 US	A	2.0363-2.037" (51,721-51,74 mm)
-0.008" (0,2 mm)	17311-23930	Crankshaft Bearing 2 0.008" minus (0,2 minus)	020 US		
-0.016" (0,4 mm)	17311-23920	Crankshaft Bearing 1 0.016" minus (0,4 minus)	040 US	A	2.0284-2.0291" (51,521-51.54 mm)
-0.016" (0,4 mm)	17311-23940	Crankshaft Bearing 2 0.016" minus (0,4 minus)	040 US		
-0.008" (0,2 mm)	17331-22970	Crank Pin Bearing 0.008" minus (0,2 minus)	020 US	B	1.8409-1.8415" (46,759-46,775 mm)
-0.016" (0,4 mm)	17331-22980	Crank Pin Bearing 0.016" minus (0,4 minus)	040 US	B	1.8330-1.8337" (46,559-46,575 mm)
+0.008" (+0,2 mm)	15521-23950	Thrust Bearing 1 - 0.008" plus (0,2 mm plus)	020 OS	C	1.0315-1.0335" (26,20-26,25 mm)
	19202-23970	Thrust Bearing 2 - 0.008" plus (0,2 mm plus)			
+0.016" (+0,4 mm)	15521-23960	Thrust Bearing 1 - 0.016" plus (0,4 mm plus)	040 OS	C	1.0394-1.0413" (26,4-26,45 mm)
	19202-23980	Thrust Bearing 2 - 0.016" plus (0,4 mm plus)			

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TORQUE SPECIFICATIONS

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 LBS. (Nm)	.250	80-90 (9,0-10,2)	110-120 (12,4-13,6)
	.3125	180-200 (20,3-22,6)	215-240 (24,2-27,1)
FOOT LBS. (Nm)	.375	25-28 (34-38)	35-40 (47-54)
	.4375	40-45 (54-61)	60-65 (81-88)
	.500	65-70 (88-95)	90-100 (122-136)
	.5625	90-100 (122-136)	125-140 (170-190)
	.625	125-140 (170-190)	175-190 (240-260)
	.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 (5830-6500)
	2.000	3800-4200 (5150-5700)	6500-7200 (8800-9800)

Torque For General Metric Bolts

Nominal Diameter	Grade	Standard Screw and Bolt 4			Special Screw and Bolt 7		
	Unit	Nm	kfg m	ft lbs	Nm	kgf m	ft lbs
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	48.1 to 55.9	4.9 to 5.7	35.4 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

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HYDRAULIC CONNECTION SPECIFICATIONS

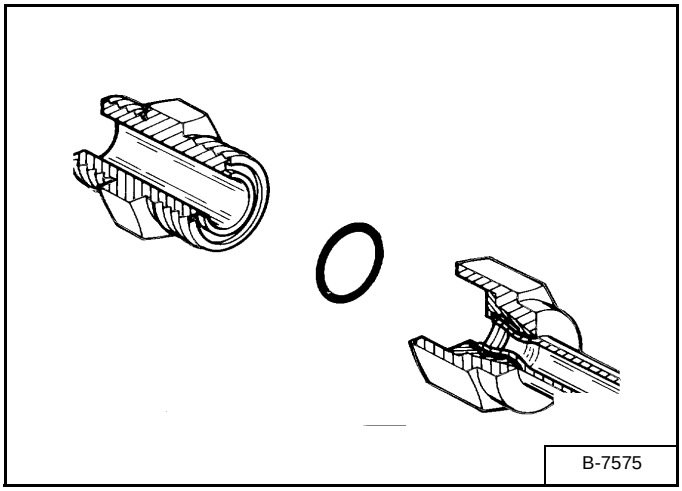
O-Ring Face Seal Connection

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, tube lines and ports to keep dirt out. Dirt can quickly damage the system.

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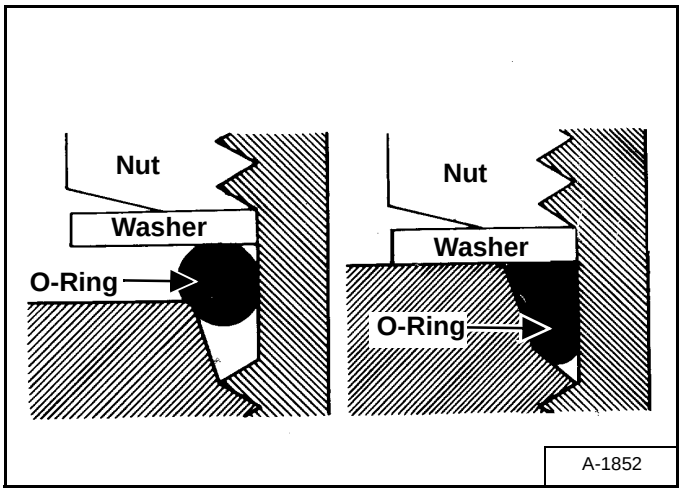
Figure SPEC-40-1



When the fitting is tightened, you can feel when the fitting is tight to eliminate leakage caused by under or over torqued fittings. Use vaseline petroleum jelly to hold the O-ring in position until the fittings are assembled **[Figure SPEC-40-1]**.

Straight Thread O-Ring Fitting

Figure SPEC-40- 2



Lubricate the O-ring before installing the fitting. Loosen the nut and install the fitting. Tighten the nut until the washer is tight against the surface **[Figure SPEC-40- 2]**.

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Tubelines And Hoses

Replace any tubelines that are bent or flattened. They will restrict flow, which will slow hydraulic action and cause heat.

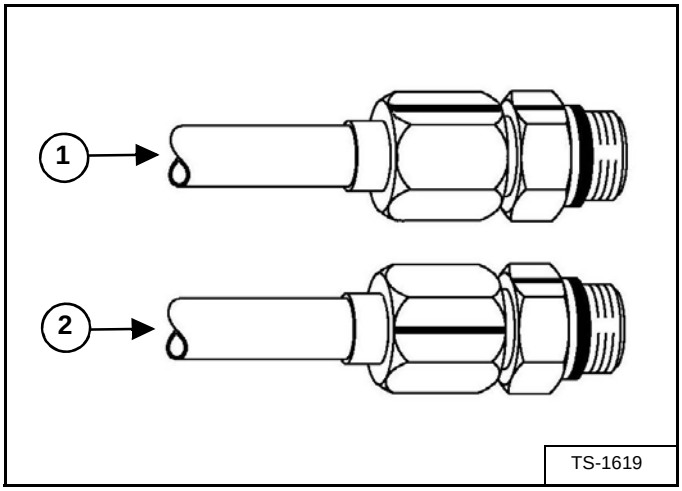
Replace hoses which show signs of wear, damage or weather cracked rubber.

Always use two wrenches when loosening and tightening hose or tubeline fittings.

Flare Fitting

Use the following procedure to tighten the flare fitting:

Figure SPEC-40- 3



Tighten the nut until it makes contact with the seat. Make a mark across the flats of both the male and female parts of the connection (Item 1) **[Figure SPEC-40- 3]**.

Use the chart below to find the correct tightness needed (Item 2) **[Figure SPEC-40- 3]**. If the fitting leaks after tightening, disconnect it and inspect the seat area for damage.

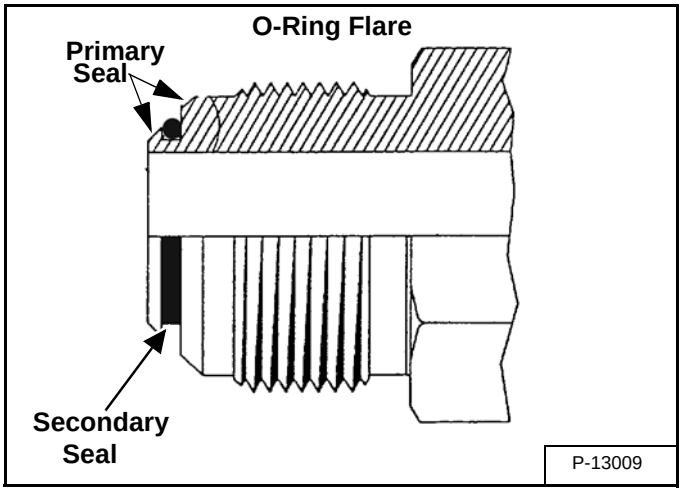
FLARE FITTING TIGHTENING TORQUE

Wrench Size	Tubeline Outside Diameter	Thread Size	TORQUE Ft.-lbs. (Nm)	NEW Rotate No. of Hex Flats	RE-ASSEMBLY Rotate No. of Hex Flats
5/8”	5/16”	1/2”-20	17 (23)	2-1/2	1
11/16”	3/8”	9/16”-18	22 (30)	2	1
7/8”	1/2”	3/4”-16	40 (54)	2	1
1”	5/8”	7/8”-14	60 (81)	1-1/2	1
1-1/4”	3/4”	1-1/16”-12	84 (114)	1	3/4
1-3/8”	1”	1-5/16”-12	118 (160)	3/4	3/4

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O-Ring Flare Fitting

Figure SPEC-40- 4

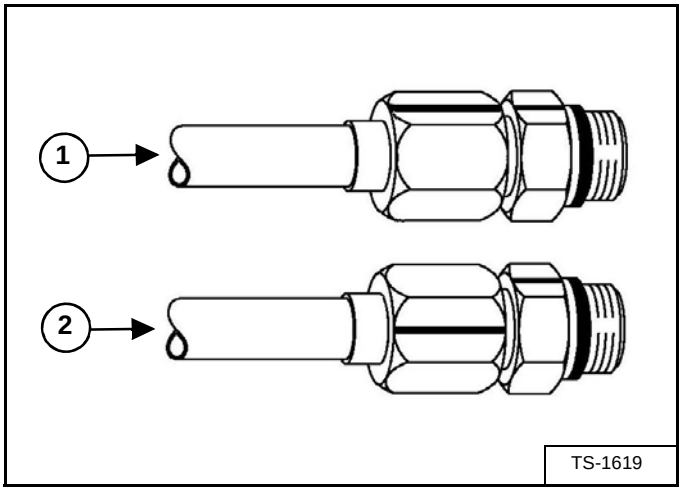


The flare is the primary seal, the O-ring is the secondary seal and helps absorb vibration and pressure pulses at the connection **[Figure SPEC-40- 4]**.

If necessary, the O-ring-flare fitting can be used without an O-ring.

Use the following procedure to tighten the O-ring flare fitting.

Figure SPEC-40- 5



Tighten the nut until it contacts with the seat. Make a mark across the flats of both the male and female parts of the connection (Item 1) **[Figure SPEC-40- 5]**.

Use the chart below to find the correct tightness needed (Item 2) **[Figure SPEC-40- 5]**. If the fitting leaks after tightening, disconnect it and inspect the seat area for damage.

O-RING FLARE FITTING TIGHTENING TORQUE					
			*	**	***
Wrench Size	**Tubeline Outside Diameter**	**Thread Size**	**TORQUE Ft.-lbs. (Nm)**	**NEW Rotate No. of Hex Flats**	**RE-ASSEMBLY Rotate No. of Hex Flats**
5/8”	5/16”	1/2”-20	17 (23)	2-1/2	1
11/16”	3/8”	9/16”-18	22 (30)	2	1
7/8”	1/2”	3/4”-16	40 (54)	2	1
1”	5/8”	7/8”-14	60 (81)	1-1/2	1
1-1/4”	3/4”	1-1/16”-12	84 (114)	1	3/4
1-3/8”	1”	1-5/16”-12	118 (160)	3/4	3/4

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O-Ring Flare Fitting (Cont'd)

*If a torque wrench is used to tighten a new fitting to a used hose/tubeline.

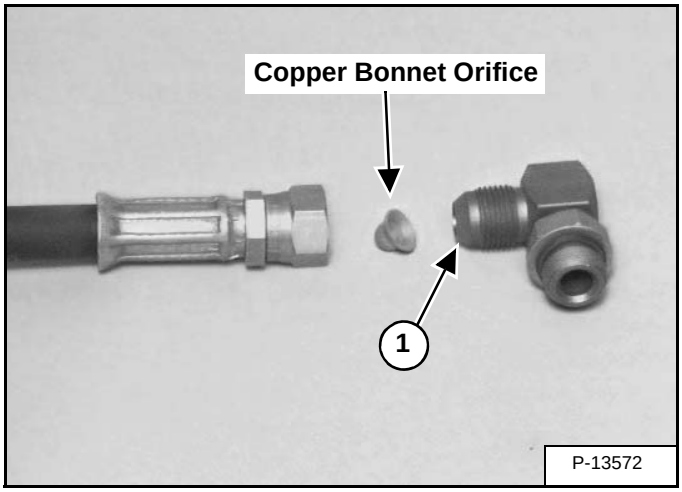
*If a torque wrench is used to tighten a used fitting to a new hose/tubeline.

*If a torque wrench is used to tighten a new fitting to a new hose/tubeline.

NOTE: O-ring flare fittings are not recommended in all applications. Use the standard flare fittings in these applications.

Do not use a O-ring flare fitting when a copper bonnet orifice is used. When tightened the connection at the bonnet may distort the flare face and prevent it from sealing.

Figure SPEC-40- 6



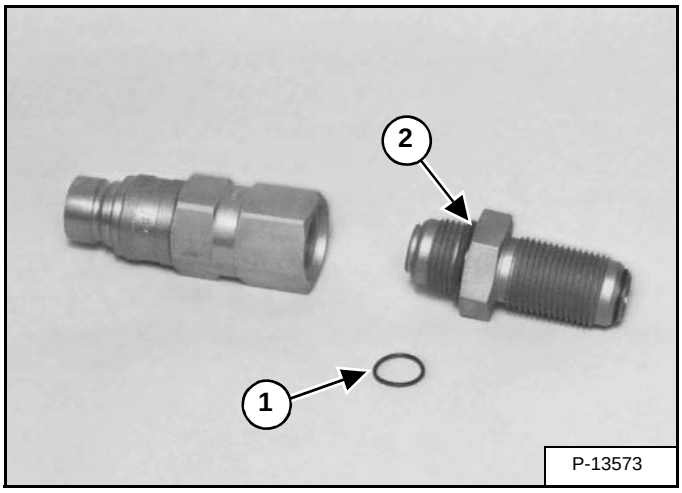
Use a standard flare fitting (Item 1) **[Figure SPEC-40- 6]** as shown.

**If using the hex flat tightening method to tighten a new fitting to a new hose/tubleline.

**If using the hex flat tightening method to tighten a new fitting to a used hose/tubeline.

***If using the hex flat tightening method to tighten a used fitting to a new hose/tubeline.

Figure SPEC-40- 7



When a O-ring flare fitting is used as a straight thread port adapter the O-ring flare face is not used to seal. The O-ring may come off the fitting and enter the system.

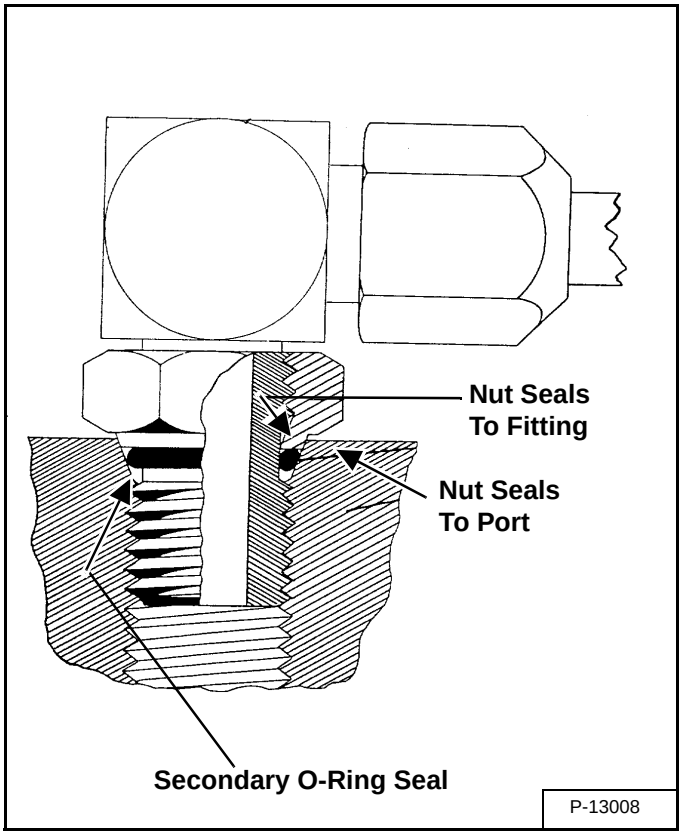
Always remove the O-ring (Item 1) **[Figure SPEC-40- 7]** from the flare face as shown.

An O-ring (Item 2) **[Figure SPEC-40- 7]** is added to the flat boss of the fitting to seal the connection in this application.

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Port Seal Fitting

Figure SPEC-40- 8



The nut is the primary seal, the O-ring is the secondary seal and helps absorb vibration and pressure pulses at the connection **[Figure SPEC-40- 8]**.

The hex portion of the nut does not contact the surface of the component when the nut is tight.

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.

If a torque wrench cannot be used, use the following method.

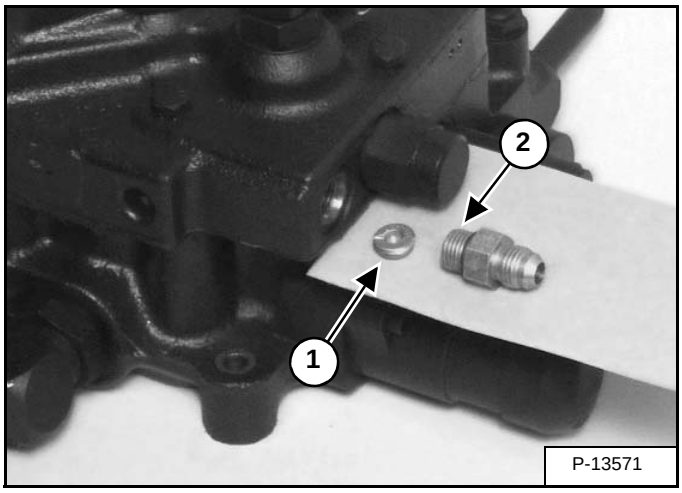
Tighten the nut until it just makes metal to metal contact, you can feel the resistance. Tighten the nut with a wrench no more than one hex flat maximum.

Do not over tighten the port seal fitting.

NOTE: If a torque wrench cannot be used, use the hex flat tightening method as an approximate guideline.

NOTE: Port seal fittings are not recommended in all applications. Use O-ring boss fittings in these applications.

Figure SPEC-40- 9



Do not use port seal fittings when a thread in orifice (Item 1) **[Figure SPEC-40- 9]** is used in the port. The orifice may interfere with the fitting and prevent it from sealing.

Use an O-ring boss fitting (Item 1) **[Figure SPEC-40- 9]** as shown.

PORT SEAL AND O-RING BOSS TIGHTENING TORQUE		
Fitting Nut Wrench Size	**Thread Size**	**TORQUE Ft.-lbs. (Nm)**
11/16”	9/16”-18	22 (30)
15/16”	3/4”-16	40 (50)
1-1/8”	7/8”-14	60 (81)
1-1/4”	1-1/16”-12	84 (114)
1-1/2”	1-5/16”	84 (114)

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HYDRAULIC FLUID SPECIFICATIONS

Specifications

Use only Bobcat hydraulic fluid.

DO NOT use automatic transmission fluids in the excavator or permanent damage to the hydraulic system will result.

Bobcat hydraulic fluid is available in:

- 2.5 gal (9.5 L) qty 2 (P/N 6903117)
- 5 gal (18.9 L) (P/N 6903118
- 55 gal (208 L) (P/N 6903119)

WARNING

Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical attention from a physician familiar with this injury.

W-2072-0496

When temperatures below 0° 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 (Indicated by hydraulic temp/pressure lights on) can cause system 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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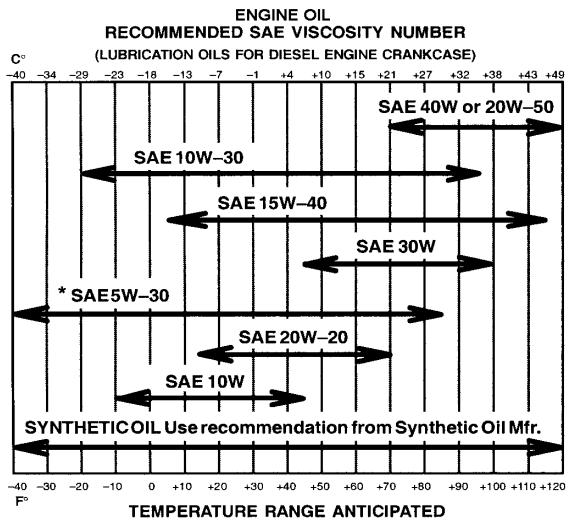


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FUEL, COOLANT AND LUBRICANTS

Chart

Use this chart for correct selection of Fuel, Coolant and Lubricants.

RESERVOIR	KIND OF FLUID	RECOMMENDED SAE VISCOSITY NUMBER (LUBRICATION OILS FOR DIESEL ENGINE CRANKCASE)	CAPACITY REFILL
Engine oil w/ filter	*Use SAE Viscosity Number as Listed With API Classification CD or Better		7.5 qts. (7,1 L)
Fuel Tank	Diesel Fuel	**Temp. F°** / **No. 2** / **No.1** +15° (9°) 100% 0% Down to -20° (-29°) 50% 50% Below -20° (-29°) 0% 100%	14.1 gal (53.3 L)
Cooling System	**Coolant Mixture		4.5 gal (17.0 L)
Hydraulic Tank	Bobcat Fluid	P/N 6903117 - 2.5 gal (9.5 L) P/N 6903118 - 5 gal (18.9 L) P/N 6903119 - 55 gal (208 L)	Tank Cap. 7.8 gal (29.5 L)
Travel Motor (each)	Gear Lube	SAE-90W	.55 qts. (.5 L)

ENGINE OIL SPECIFICATIONS

When fuel sulphur content is less than 0.5% change the engine oil and filter as shown in the SERVICE SCHEDULE. (See Chart on Page 10-50-1.)

Change engine oil and filter according to the following chart if fuel sulphur content is above 0.5%.

FUEL SULPHUR CONTENT	CHANGE INTERVAL OF ENGINE & OIL FILTER
0.5 to 1.0%	1/2 of Regular Interval
Above 1.0%	1/4 of Regular Interval

***** *COOLANT MIXTURE*

Propylene Glycol (Factory Installed)

Add premixed coolant; 47% water and 53% propylene glycol to the recovery tank if the coolant level is low.

One gallon and one pint of propylene glycol mixed with one gallon of water is the correct mixture of coolant to provide a -34°F (-37°C) freeze protection.

Use a refractometer to check the condition of propylene glycol in the cooling system.

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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
33/64	0.515625	13.097
17/32	0.53125	13.494
35/64	0.546875	13.891
9/16	0.5625	14.288
37/64	0.578125	14.684
19/32	0.59375	15.081
39/64	0.609375	15.478
5/8	0.6250	15.875
41/64	0.640625	16.272
21/32	0.65625	16.669
43/64	0.671875	17.066
11/16	0.6875	17.462
45/64	0.703125	17.859
23/32	0.71875	18.256
47/64	0.734375	18.653
3/4	0.7500	19.050
49/64	0.765625	19.447
25/32	0.78125	19.844
51/64	0.796875	20.241
13/16	0.8125	20.638
53/64	0.828125	21.034
27/32	0.84375	21.431
55/64	0.859375	21.828
7/8	0.8750	22.225
57/64	0.890625	22.622
29/32	0.90625	23.019
59/64	0.921875	23.416
15/16	0.9375	23.812
61/64	0.953125	24.209
31/32	0.96875	24.606
63/64	0.984375	25.003
1	1.000	25.400

1 mm = 0.03937”

0.001 = 0.0254 mm

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U.S. To Metric Conversion

	TO CONVERT	INTO	MULTIPLY BY
LINEAR MEASUREMENT	Miles	Kilometers	1.609
	Yards	Meters	0.9144
	Feet	Meters	0.3048
	Feet	Centimeters	30.48
	Inches	Meters	0.0254
	Inches	Centimeters	2.54
	Inches	Millimeters	25.4
AREA	Square Miles	Square Kilometers	2.59
	Square Feet	Square Meters	0.0929
	Square Inches	Square Centimeters	6.452
	Acre	Hectare	0.4047
VOLUME	Cubic Yards	Cubic Meters	0.7646
	Cubic Feet	Cubic Meters	0.02832
	Cubic Inches	Cubic Centimeters	16.39
WEIGHT	Tons (Short)	Metric Tons	0.9078
	Pounds	Kilograms	0.4536
	Ounces (Avdp.)	Grams	28.3495
PRESSURE	Pounds/Sq. In.	Kilopascal	6.895
WORK	Foot–Pounds	Newton–Meter	1.356
LIQUID VOLUME	Quarts	Liters	0.9463
	Gallons	Liters	3.785
LIQUID FLOW	Gallons/Minute	Liters/Minute	3.785
TEMPERATURE	Fahrenheit	Celsius	1.Subtract 32° 2. Multiply by 5/9

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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: **331/331E/334-1**
Date: **17 Jan 2005**
Product: **Bobcat Excavator**
Model: **331/331E/334**
Manual No: **6903830 (12-04)**

The following sections are a revision to the above Service Manual.

Take out existing sections and put in the new sections as listed below:

TAKE OUT	PUT IN	REVISION DESCRIPTION
20-01	20-01	Revised Text
20-40	20-40	Revised Text
20-180	20-180	Revised Text
30-30	30-30	Revised Text
40-01	40-01	Revised Text
	40-100	Added Section
40-120	40-120	Revised Text
	40-170	Added Section
50-80	50-80	Revised Text

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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: **331/331E/334-2**
Date: **17 May 2005**
Product: **Bobcat Excavator**
Model: **331/331E/334**
Manual No: **6903830 (12-04)**

The following sections are a revision to the above Service Manual.

Take out existing sections and put in the new sections as listed below:

TAKE OUT	PUT IN	REVISION DESCRIPTION
Alphabetical Index	Alphabetical Index	Revised Text
Contents	Contents	Revised Text
10-01	10-01	Revised Text
All Hydraulic Schematics	All Hydraulic Schematics	Revised
20-01	20-01	Revised Text
20-150	20-150	Revised Text
20-180	20-180	Revised Text
30-01	30-01	Revised Text
30-30	30-30	Revised Text
40-01	40-01	Revised Text
40-30	40-30	Revised Text
		Revised Text
50-01	50-01	Revised Text
	50-100	Added Text
All Electrical Schematics	All Electrical Schematics	Revised and Added Schematics
60-01	60-01	Revised Text
60-50	60-50	Revised Text
60-70	60-70	Revised Text
	60-71	Added Text
60-80	60-80	Revised Text
70-01	70-01	Revised Text
SPEC-01	SPEC-01	Revised Text
SPEC-10	SPEC-10	Revised Text
SPEC-20	SPEC-20	Revised Text

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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: 331/331E/334-3
Date: 24 March 2006
Product: Bobcat Excavator
Model: 331/331E/334
Manual No: 6903830 (12-04)

331/331E/334 Service Manual (P/N 6903830) Dated (2-06) contains updated service information which replaces the previous 331/331E/334 Service Manual (P/N 6903830) Dated (12-04)

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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: 331/331E/334-4
Date: 1 December 2006
Product: Bobcat Excavator
Model: 331/331E/334
Manual No: 6903830 (12-06)

The following Sections are a revision to the above Service Manual

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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: **331/331E/334-5**
Date: **15 March 2007**
Product: **Bobcat Excavator**
Model: **331/331E/334**
Manual No: **6903830 (3-07)**

The following Sections are a revision to the above Service Manual

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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: **331/331E/334-6**
Date: **11 July 2007**
Product: **Bobcat Excavator**
Model: **331/331E/334**
Manual No: **6903830 (3-07)**

The following Sections are a revision to the above Service Manual

. Cover

Section 20-190

Section 40-191

ELECTRICAL SCHEMATICS

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