Bobcat®

325
328

Service Manual

S/N 232511001 & Above
S/N 232411001 & Above
(D Series)

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Ingersoll Rand
Compact Vehicle Technologies

6901138 (2-06)
Printed in U.S.A.
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MAINTENANCE SAFETY

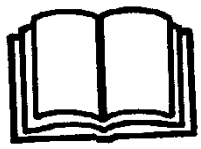
WARNING

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

W-2003-0903

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

CORRECT



B-10731a

- **Never service the Bobcat Hydraulic Excavator without instructions.**

CORRECT



B-15797

- **Use the correct procedure to lift and support the excavator.**
- **Always lift the blade fully before installing jackstands.**

CORRECT



B-15798

- **Cleaning and maintenance are required daily.**

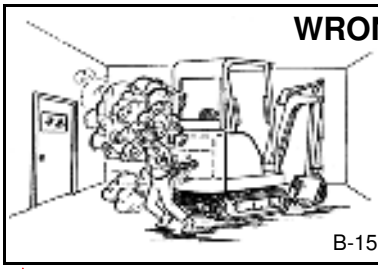
WRONG



B-15799

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

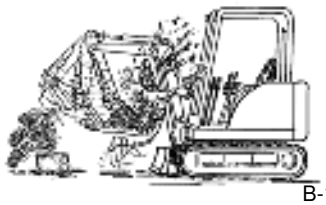
WRONG



B-15800

- **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-15801

- **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-15802

- **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-15780

- **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 protection approved for type of welding.**
- **Keep rear door closed except for service. Close and latch door before operating the excavator.**

WRONG



B-6589

- **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.

MSW21-0805

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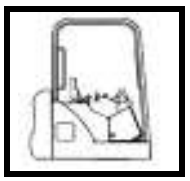
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FOREWORD

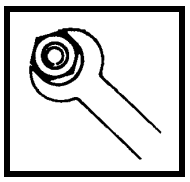
This manual is for the Bobcat Hydraulic excavator mechanic. It provides necessary servicing and adjustment procedures for the hydraulic excavator and its component parts and systems. Refer to the Operation & Maintenance Manual for operating instructions, starting procedure, daily checks, etc.

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

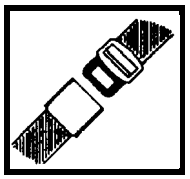
1. Check lift arm support device, replace if damaged. (Stored Position)



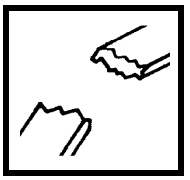
2. Check that ROPS/TOPS mounting hardware is tightened and is Bobcat approved.



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



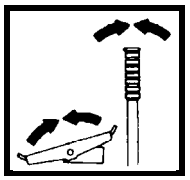
4. Inspect for loose or broken parts or connections.



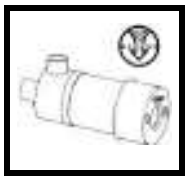
5. Machine signs must be legible and in the correct location.



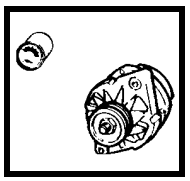
6. Steering levers, control levers and foot pedals must return to neutral. Check that foot pedals lock and control lever locks are in working order.



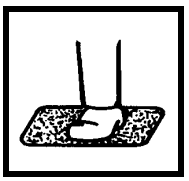
7. Inspect the air cleaner for damage or leaks. Check the condition of the element.



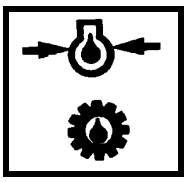
8. Check the electrical charging system.



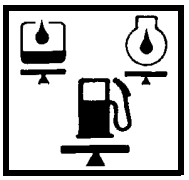
9. Safety treads must be in good condition.



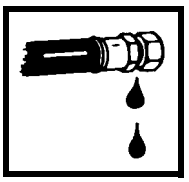
10. Check for correct function of indicator lamps (Optional on some models).



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



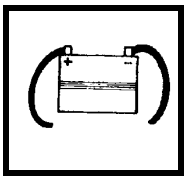
12. Inspect for fuel, oil or hydraulic fluid leaks.



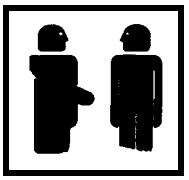
13. Lubricate the excavator.



14. Check the condition of the battery and cables.



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



CALIFORNIA
PROPOSITION 65 WARNING

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

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SAFETY INSTRUCTIONS

Safety Alert Symbol

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

WARNING

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

W-2003-0903

WARNING

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

W-2044-1285

IMPORTANT

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

I-2019-0284

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

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

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



Call Before You Dig

1-888-258-0808

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

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SAFETY INSTRUCTIONS (CONT'D)

Fire Prevention

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

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

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

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

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

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

- Check fuel and hydraulic tubes, hoses and fittings for damage and leakage. Never use open flame or bare skin to check for leaks. Tighten or replace any parts that show leakage. Always clean fluid spills. Do not use gasoline or diesel fuel for cleaning parts. Use commercial nonflammable solvents.

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

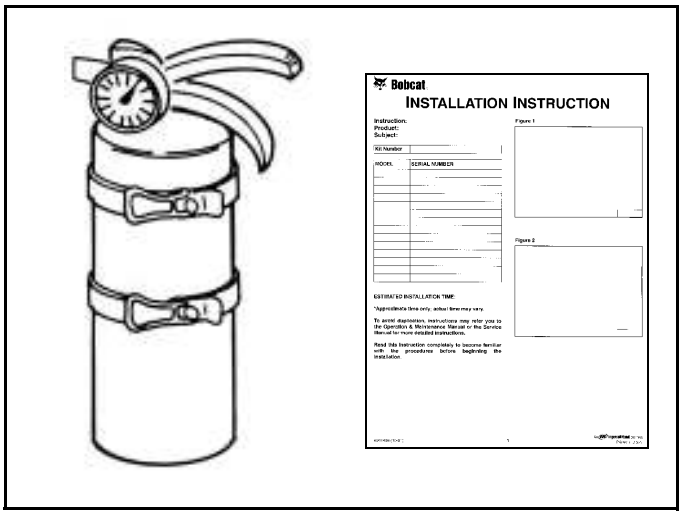
- Always clean the machine, disconnect the battery, and disconnect the wiring from the controllers before welding. Cover rubber hoses, battery and all other flammable parts. Keep a fire extinguisher near the machine when welding. Have good ventilation when grinding or welding painted parts. Wear a dust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

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

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

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

Figure 1



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

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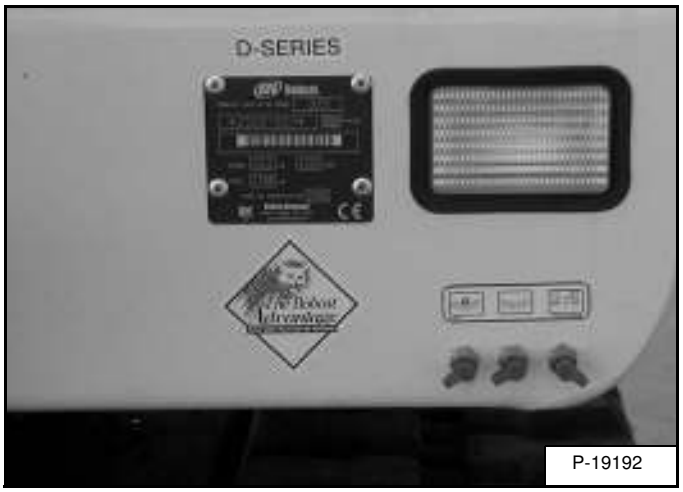
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SERIAL NUMBER LOCATIONS

Always use the FULL serial number (including the first four digits) when requesting service 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.

Bobcat Excavator Serial Number

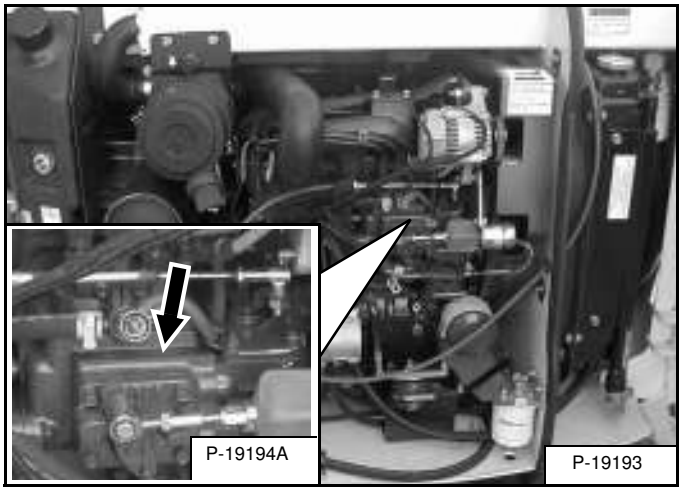
Figure 1



The Bobcat Excavator serial number is on the frame of the machine in the location shown **[Figure 1]**.

Engine Serial Number

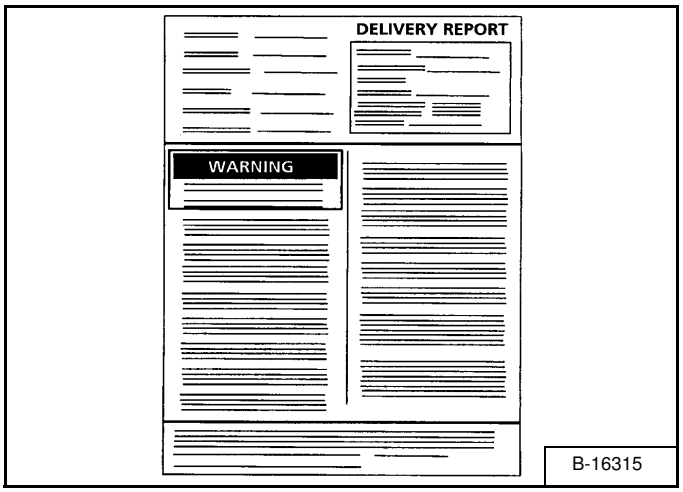
Figure 2



The engine serial number is located on the engine in the location shown **[Figure 2]**.

DELIVERY REPORT

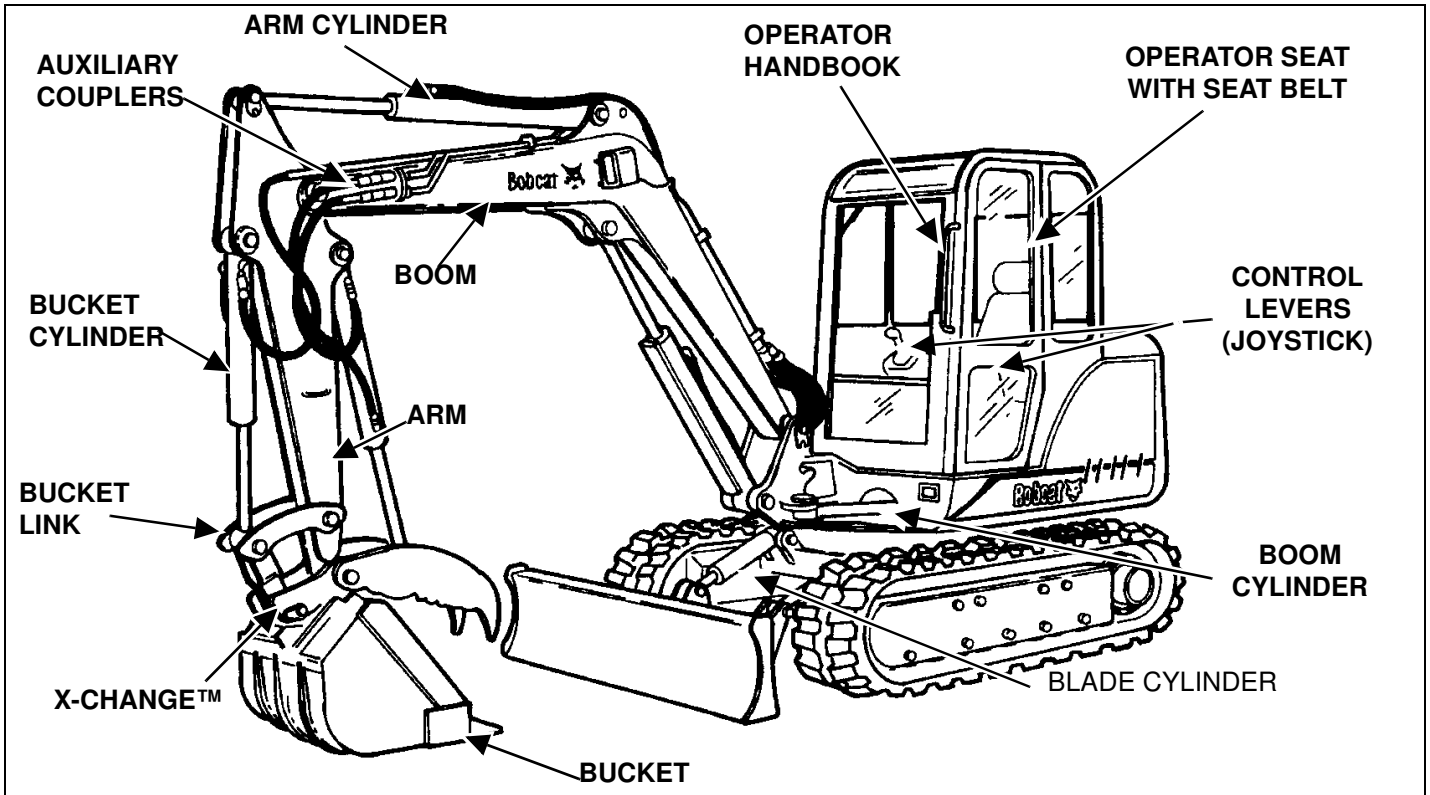
Figure 3

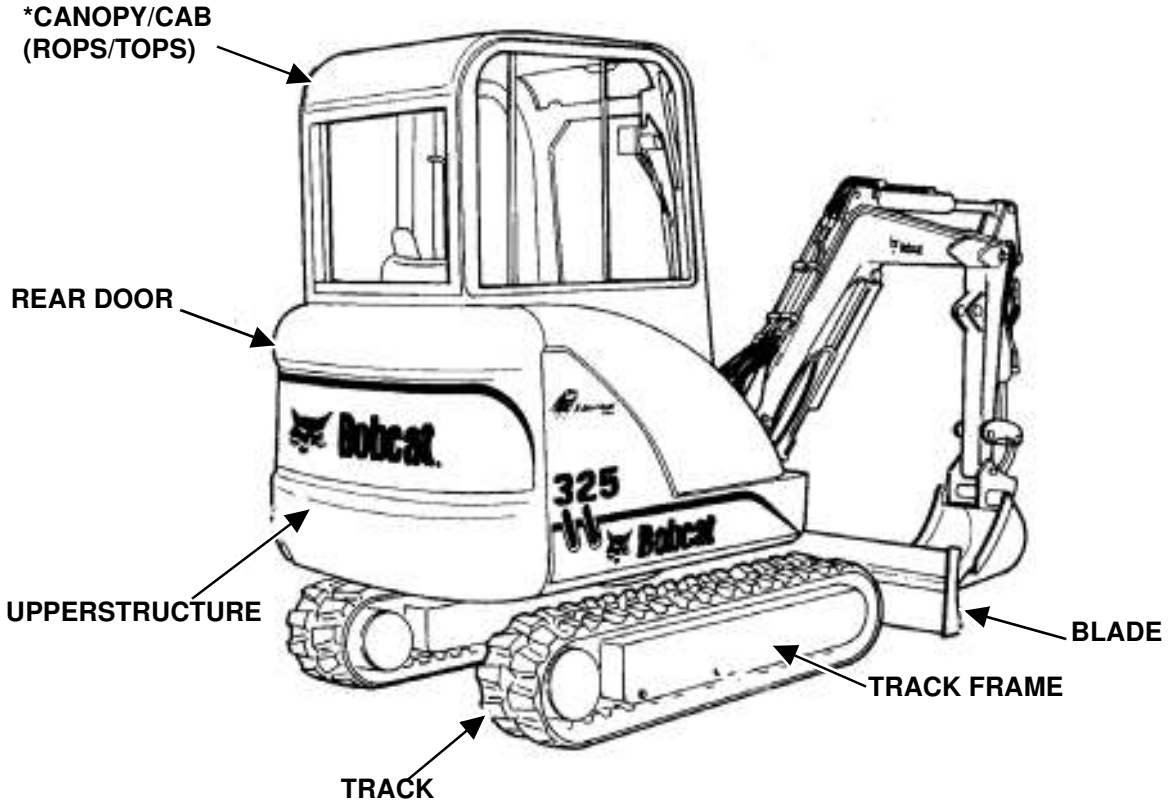


The Delivery Report items must be explained to the owner/operator by the dealer. The dealer is to fill out the form and the owner/operator signs the form to indicate his understanding **[Figure 3]**.

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BOBCAT EXCAVATOR IDENTIFICATION





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

B-14970
B-14971

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AIR CLEANER SERVICE 10-60-1
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Opening And Closing The Tailgate (Later Models) 10-40-2

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LIFTING AND BLOCKING THE EXCAVATOR

Procedure

Always park the machine on a level surface.

⚠ WARNING

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

W-2218-1195

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2142-0189

Figure 10-10-1



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

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

Stop the engine.

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SWING LOCK

Operation

WARNING

AVOID INJURY

The swing lock lever must be engaged when transporting the machine.

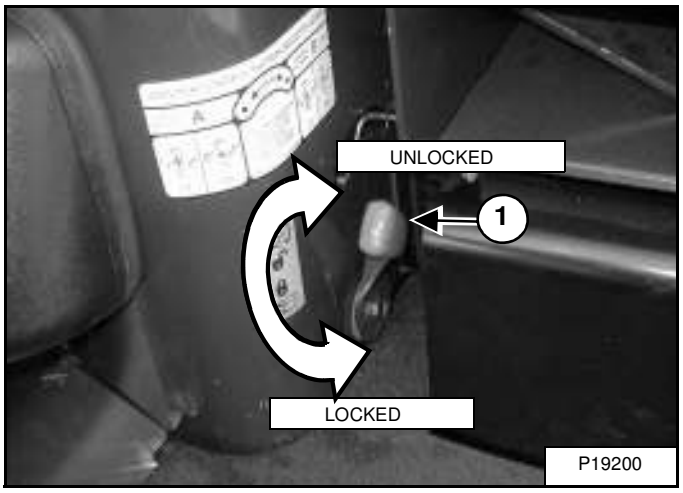
W-2197-0595

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

Figure 10-11-1



Move the lever (Item 1) **[Figure 10-11-1]** *down* to engage the Swing Lock. When the Swing Lock is engaged (locked), the upperstructure of the excavator is locked to the track frame and will not swing. The upper structure must be parallel to the track frame to engage the Swing Lock.

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

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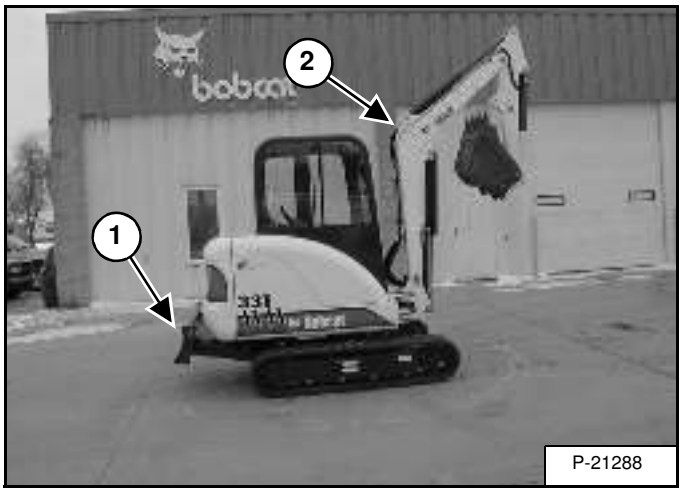


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LIFTING THE EXCAVATOR

Procedure

Figure 10-12-1



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

Raise the blade all the way.

Put the all control levers in neutral and engage the swing lock. (See Operation on Page 10-11-1.)

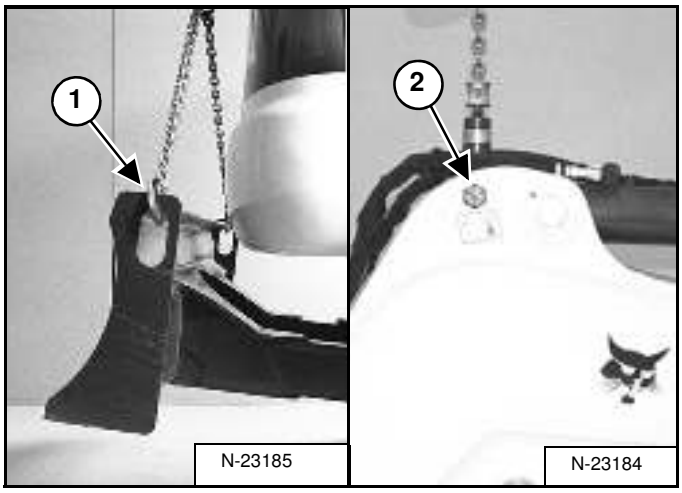
⚠ WARNING

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.**

W-2202-0595

Figure 10-12-2



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

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

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OPERATOR CAB (ROPS / TOPS) (IF EQUIPPED)

Emergency Exit

Figure 10-20-1

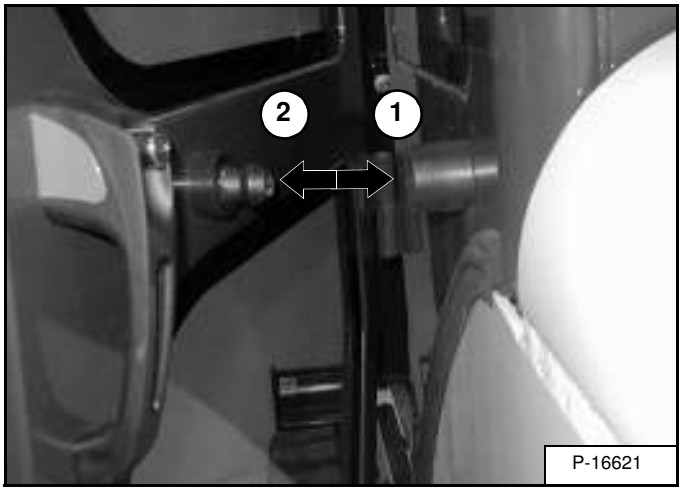


The left door and right side window provide exits.

Slide the window to the front of the excavator and exit through the side window **[Figure 10-20-1]**.

Cab Door

Figure 10-20-2



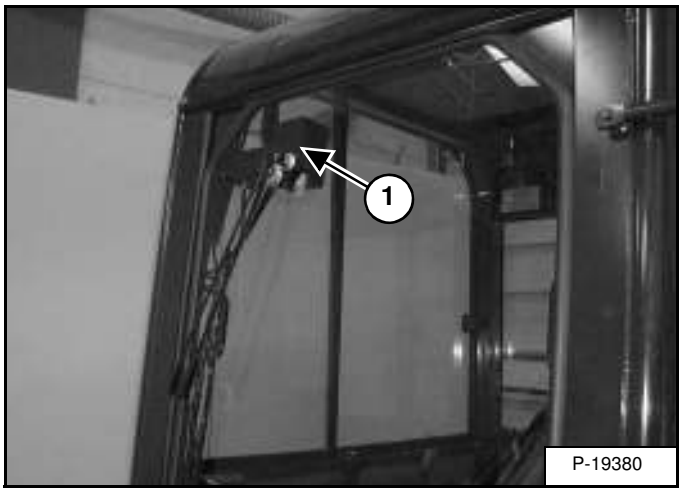
The cab door can be locked with the same key as the starter switch (if equipped).

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

Firmly pull the door away from the cab (Item 2) **[Figure 10-20-2]** to disengage the latch and close the door.

Front Window

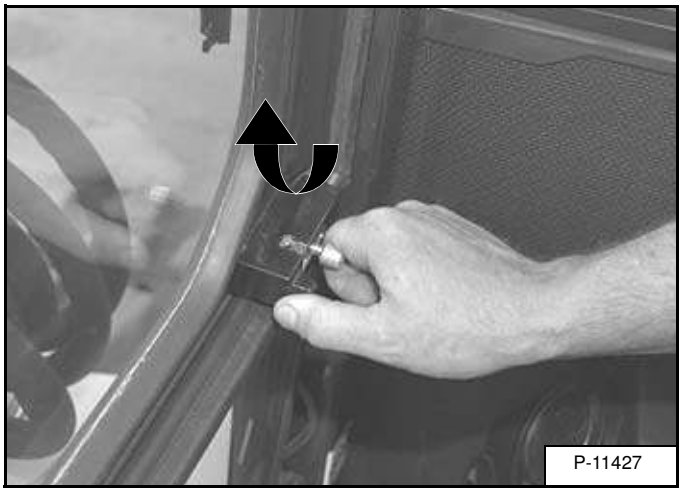
Figure 10-20-3



The front window is equipped with a wiper (Item 1) **[Figure 10-20-3]** and washer.

Opening The Front Window

Figure 10-20-4



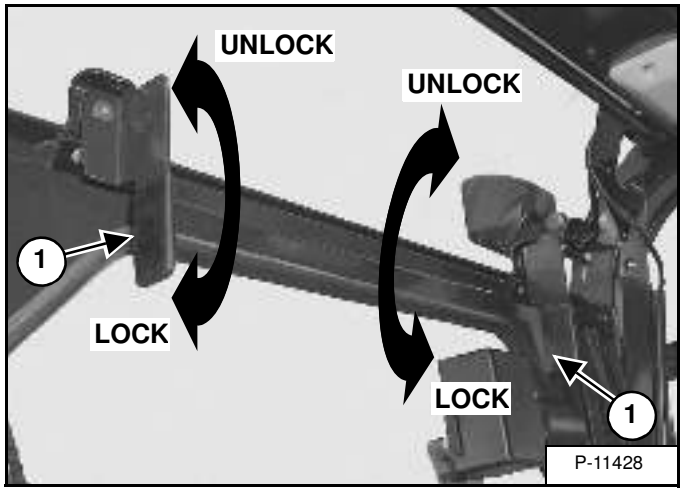
Release the lower window latch pins and turn to the unlocked position **[Figure 10-20-4]**.

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Front Window (Cont'd)

Opening The Front Window (Cont'd)

Figure 10-20-5



Turn the two top latches (Item 1) **[Figure 10-20-5]** to the unlocked position.

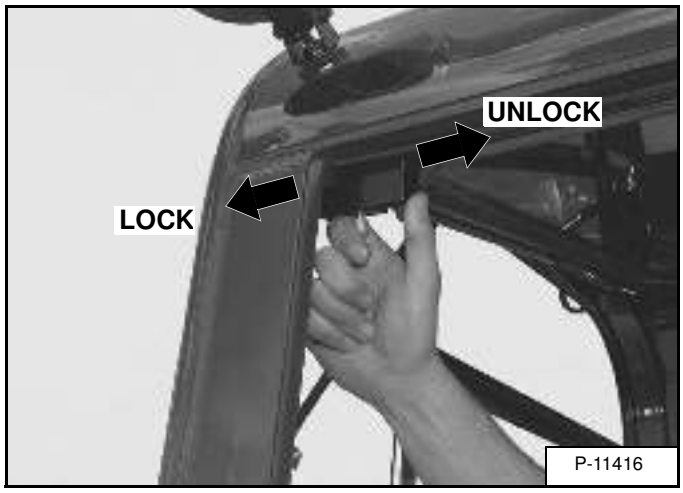
Figure 10-20-6



Use both window grab handles to pull the top of the window in **[Figure 10-20-6]**.

Continue moving the window in and up over the operator's head until the window engages the pocket at the top, rear of the cab.

Figure 10-20-7



Hold the bottom of the window up and lock the two window latch pins. Make sure that the pins are secured to hold the window up **[Figure 10-20-7]**.

Closing The Front Window

Hold the bottom of the window up and release both window latch pins and put them in the unlocked position **[Figure 10-20-7]**.

Use both window grab handles to pull the window down **[Figure 10-20-6]**.

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

Lock the window latch pins **[Figure 10-20-4]** at the bottom of the window.

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TRANSPORTING THE EXCAVATOR

Procedure

⚠ 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

Figure 10-30-1



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.

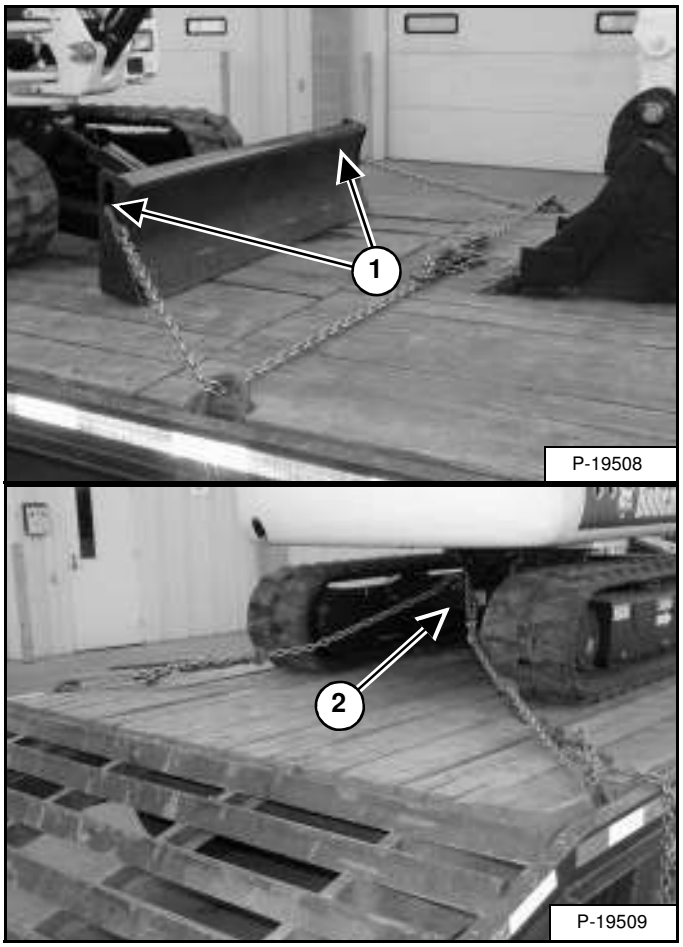
Use ramps that are the correct length and width, and can support the weight of the machine.

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).

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

Figure 10-30-2



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.

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

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TAILGATE

Opening And Closing The Tailgate (Early Models)

⚠ WARNING

AVOID INJURY OR DEATH

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

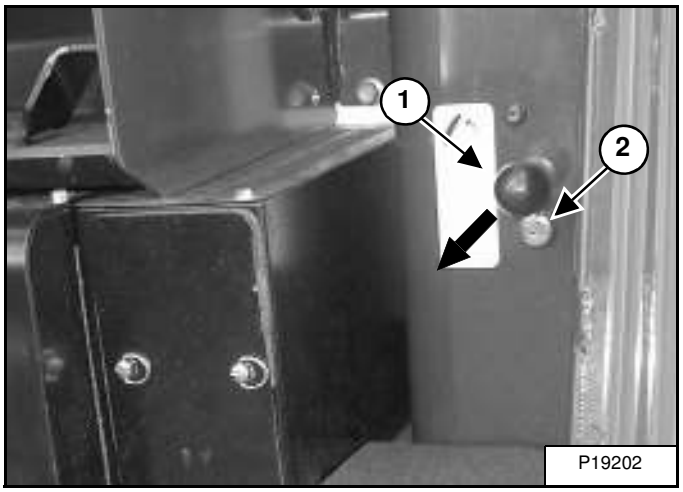
W-2012-0497

⚠ WARNING

Keep the engine cover closed when operating the machine.

W-2141-0189

Figure 10-40-1



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

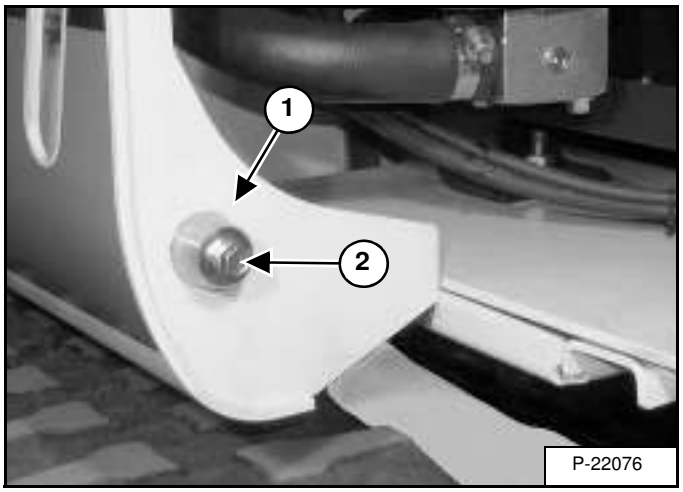
Pull the tailgate open to provide access for service.

Firmly push the tailgate closed to engage the latch.

The tailgate release can be locked (Item 2) **[Figure 10-40-1]**. Use the start key to unlock.

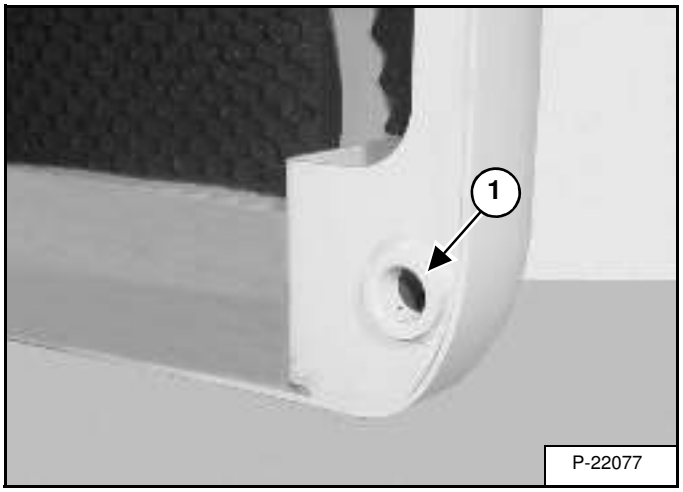
Adjusting The Bumper (Early Models)

Figure 10-40-2



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

Figure 10-40-3



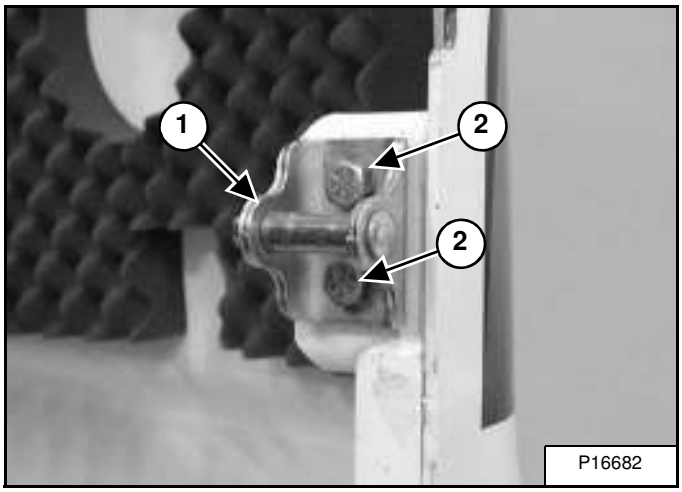
Loosen the bolt (Item 2) **[Figure 10-40-2]** and nut, and position the bumper so it is centered in the socket (Item 1) **[Figure 10-40-3]** on the lower corner of the door. Tighten the bolt and nut.

Close the rear door before operating the excavator.

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Adjusting The Tailgate Latch (Early Models)

Figure 10-40-4



The door catch (Item 1) **[Figure 10-40-4]** can be adjusted in either direction for alignment with the door latch.

Loosen the bolts (Item 2) **[Figure 10-40-4]**. Move the door catch as needed and tighten the bolts.

Opening And Closing The Tailgate (Later Models)

WARNING

AVOID INJURY OR DEATH

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

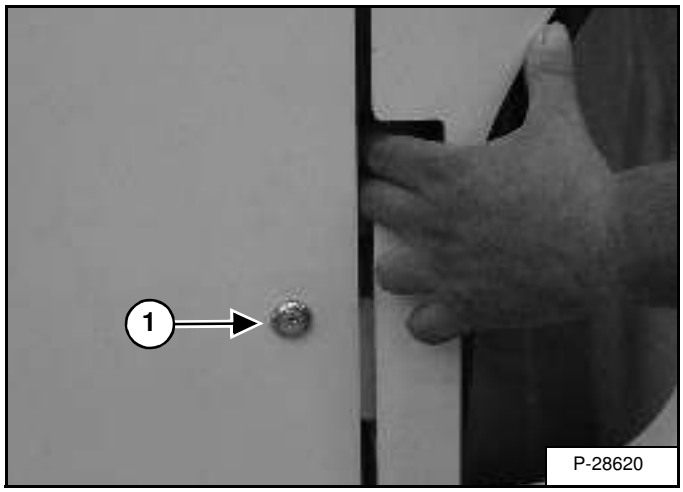
W-2012-0497

WARNING

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

W-2020-1285

Figure 10-40-5



Release the latch **[Figure 10-40-5]** and pull the tailgate open.

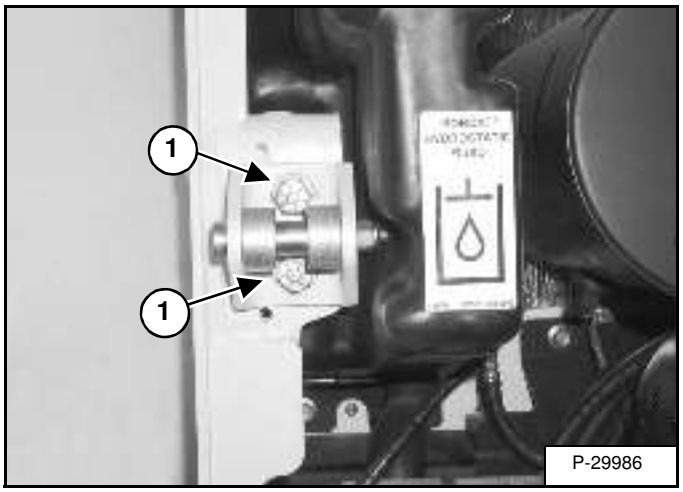
Push firmly to close the tailgate.

The tailgate can be locked (Item 1) **[Figure 10-40-5]**. Use the start key to lock/unlock the tailgate.

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Adjusting The Tailgate Latch (Later Models)

Figure 10-40-6



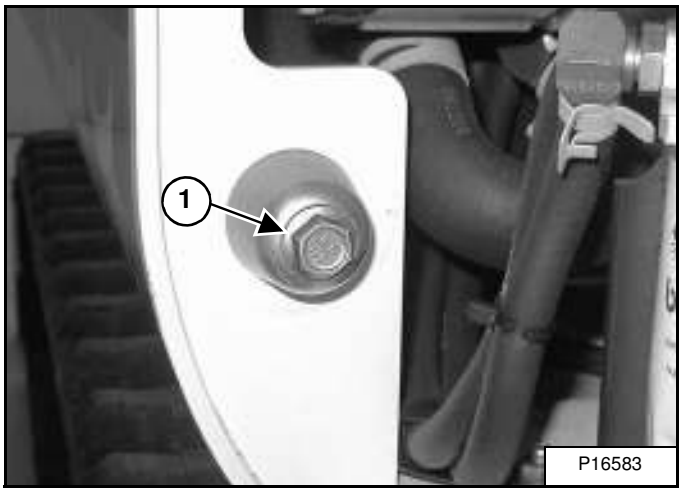
Loosen the two bolts (Item 1) **[Figure 10-40-6]** and move the roller bracket up or down and side to side as needed.

Tighten the bolts.

Close the rear door before operating the excavator.

Adjusting The Bumper (Later Models)

Figure 10-40-7



Loosen the bolt (Item 1) **[Figure 10-40-7]** and adjust the bumper to align with the socket in the door. Tighten the bolt.

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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, 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

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.	■					
Control Console Lockout(s)	Check for correct operation.	■					
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. (21 Places)	■					
Cab Heater Air Filter	Clean the filter as needed.	■					
Swing Circle and Pinion	Grease three fittings.		■				
Fuel Tank & Filter	Drain water and sediment from fuel tank and fuel filter.		■				
Battery	Check battery, cables, connections and electrolyte level. Add distilled water as needed.		■				
Alternator / Fan Belt	Check condition of belt and adjust as needed.		●	■			
Spark Arrestor Muffler	Clean the spark chamber.			■			
Engine Oil and Filter	Replace oil & filter. Use CD or better grade oil and Bobcat filter.		●		■		
Fuel Filter	Replace fuel filter.				■		
Final Drive Case	Check lubricant level in both final drive cases.			®	■		
Radiator, oil cooler, *A/C	Clean debris from the radiator fins.					■	
Hydraulic Filter	Replace the filter element.			®		■	
Alternator & Starter	Check the alternator and starter connections.		●			■	
Engine Valves	Check and adjust the engine valve clearance.					■	
Case Drain Filter	Replace the filter.					■	
Final Drive Case	Replace lubricant in both final drive cases.						■
Engine Cooling System	Drain and flush the cooling system. Replace the coolant.						■
Hydraulic System	Replace the hydraulic fluid and filter. Clean the reservoir.			®			■

*** If equipped.**
● Also at first 50 hours.
▼ Also at first 100 hours.
■ Or every 6 months.

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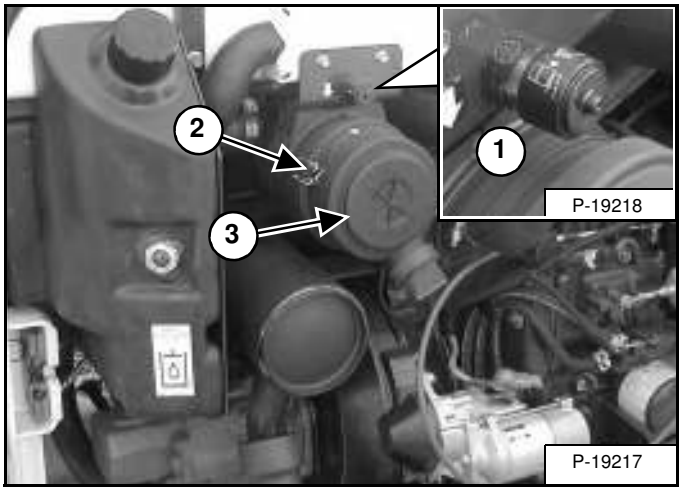
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AIR CLEANER SERVICE

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

Daily Check

Figure 10-60-1



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

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

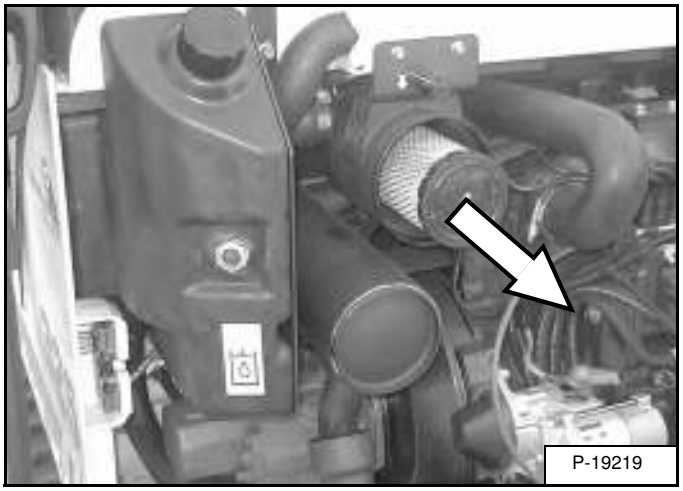
Replacing The Filters

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 from the air cleaner housing **[Figure 10-60-2]**.

Check the housing for damage.

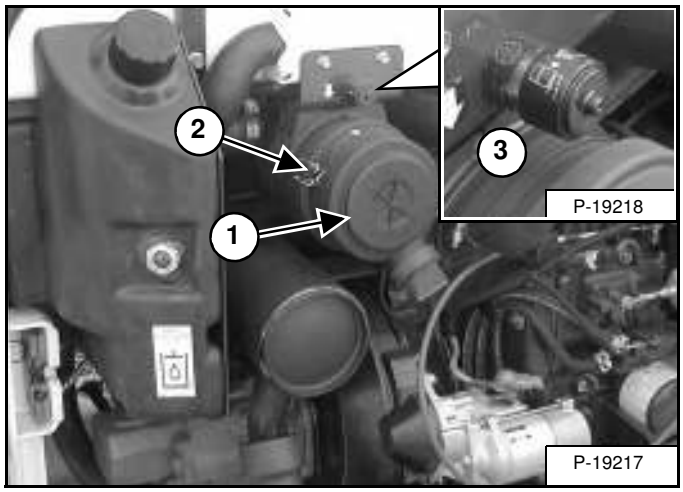
Clean the housing and the seal surface. Do Not use compressed air.

Install a new element.

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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

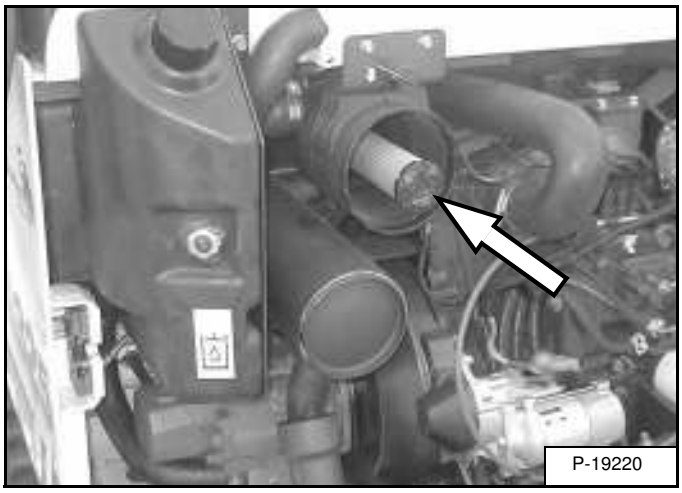
Only replace the inner filter element under the following conditions:

- Replace the inner filter element every third time the outer filter is replaced.
- After the outer element 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 element.

Remove the dust cup, outer filter and inner filter.

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

Figure 10-60-4



Install the new inner element **[Figure 10-60-4]**.

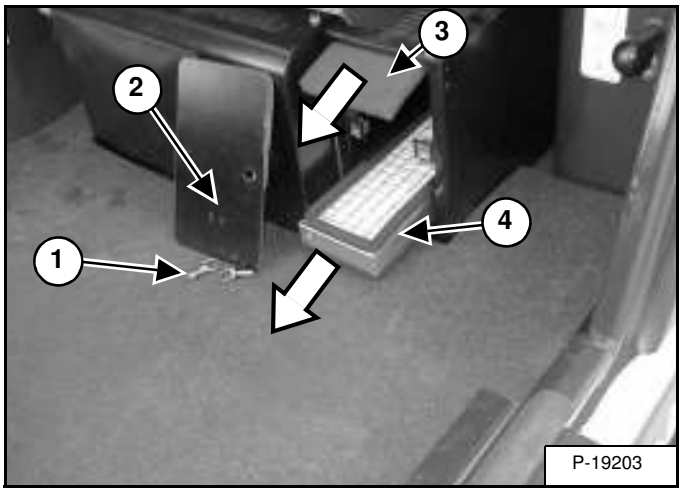
Install the outer element and the dust cup **[Figure 10-60-3]**.

Press the button on the condition indicator (Item 3) **[Figure 10-60-3]** to remove the red ring.

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HEATER AIR FILTERS (WITH CAB OPTION ONLY)

Figure 10-61-1



The heater filters must be cleaned regularly. The filters are located at the left of the operator seat **[Figure 10-61-1]**.

Recirculation Filter

Remove the screws and cover (Items 1 & 2). Remove the filter (Item 3) **[Figure 10-61-1]** and wash the filter with a mild detergent and water. Dry the filter before installing.

Fresh Air Filter

Remove the filter (Item 4) **[Figure 10-61-1]**. Use low air pressure to clean the filter; or replace when very dirty.

Install the filter, cover and screws.

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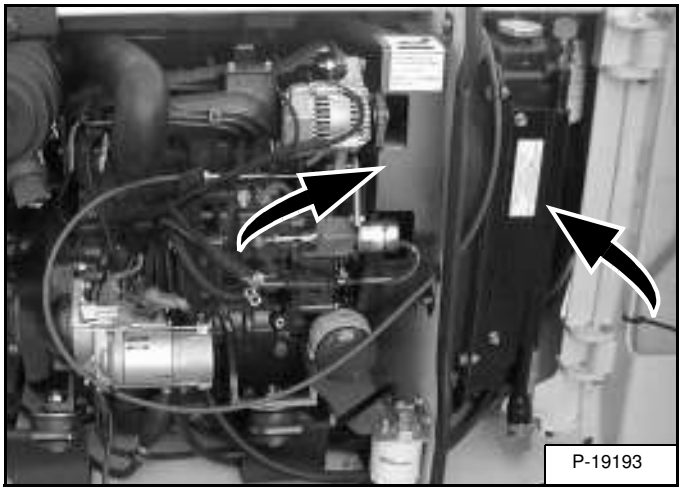
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ENGINE COOLING SYSTEM

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

Cleaning The Cooling System

Figure 10-70-1



Open the tailgate.

Use air pressure or water pressure to clean the radiator and oil cooler **[Figure 10-70-1]**. Be careful not to damage fins when cleaning.

Checking The Coolant Level

⚠ WARNING

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

W-2070-1285

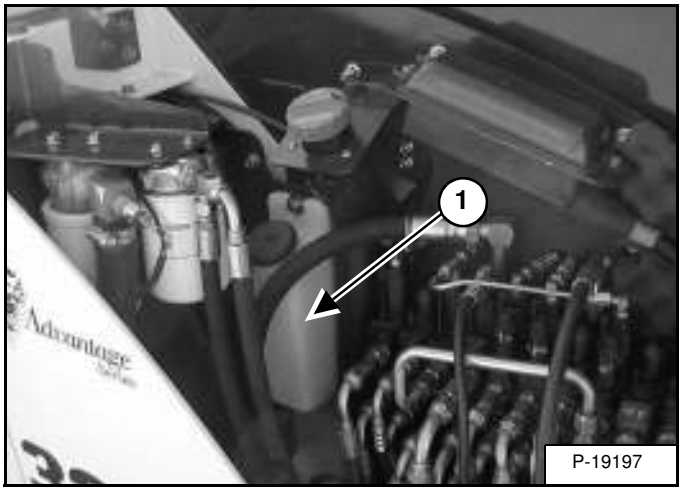
⚠ WARNING

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

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

W-2019-1285

Figure 10-70-2



Open the right side cover.

Check the coolant level in the coolant recovery tank (Item 1) **[Figure 10-70-2]**.

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.

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Checking Coolant Level (Cont'd)

IMPORTANT

AVOID ENGINE DAMAGE

Always use the correct ratio of water to antifreeze.

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

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

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

I-2124-0497

Replacing The Coolant

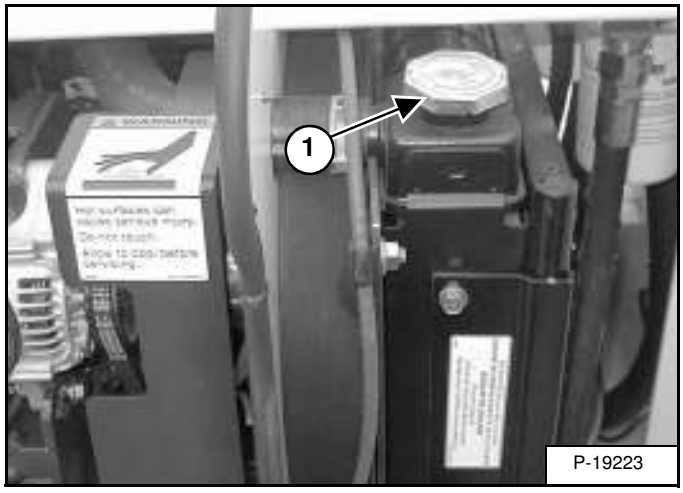
See SERVICE SCHEDULE on Page 10-50-1 for the correct service intervals.

⚠ WARNING

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

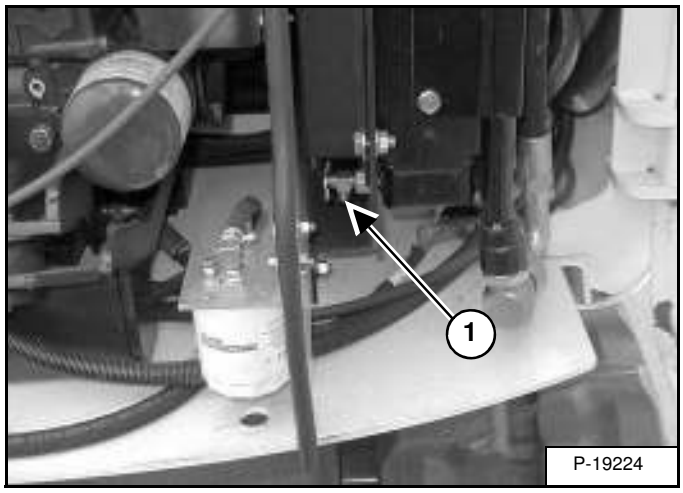
W-2070-1285

Figure 10-70-3



When the engine is cool, loosen and remove the radiator cap (Item 1) **[Figure 10-70-3]**.

Figure 10-70-4

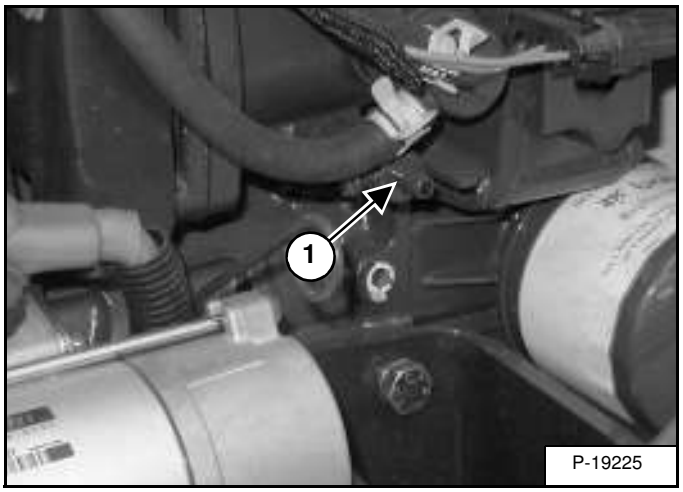


Put a hose on the drain valve at the bottom of the radiator. Open the drain valve (Item 1) **[Figure 10-70-4]** and drain the coolant into a container.

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Replacing The Coolant (Cont'd)

Figure 10-70-5



Put a hose on the drain valve on the engine block. Open the drain valve (Item 1) **[Figure 10-70-5]** 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 Chart on Page SPEC-60-1 for correct capacity.)

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. (See Checking The Coolant Level on Page 10-70-1, refer to **IMPORTANT**.)

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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FUEL SYSTEM

Fuel Specification

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

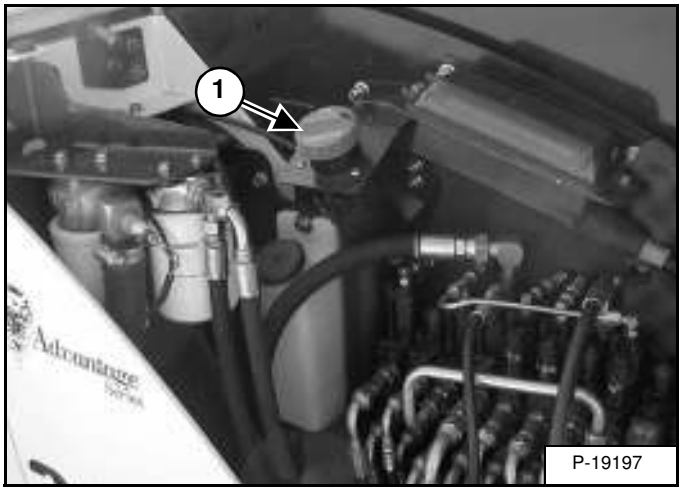
The following is a suggested blending guideline which should prevent fuel gelling problems during cold weather use.

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

For local recommendations, the operator can contact his fuel supplier.

Filling The Fuel Tank

Figure 10-80-1



Open the 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. Close the side door.

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

⚠ WARNING

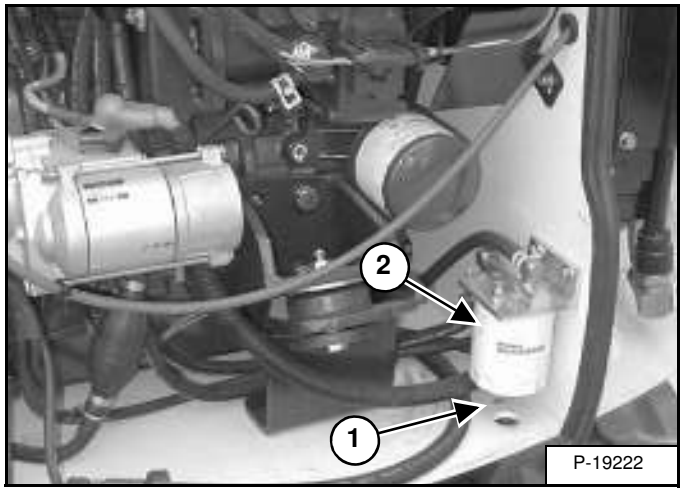
Stop and cool the engine before adding fuel. NO SMOKING! Failure to obey warnings can cause an explosion or fire.

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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 element to drain water from the filter.

Fuel Filter

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

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

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

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

Clean the area around the filter housing.

Put oil on the seal of the new filter element.

Install the fuel filter, and hand tighten.

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

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Removing Air From The Fuel System

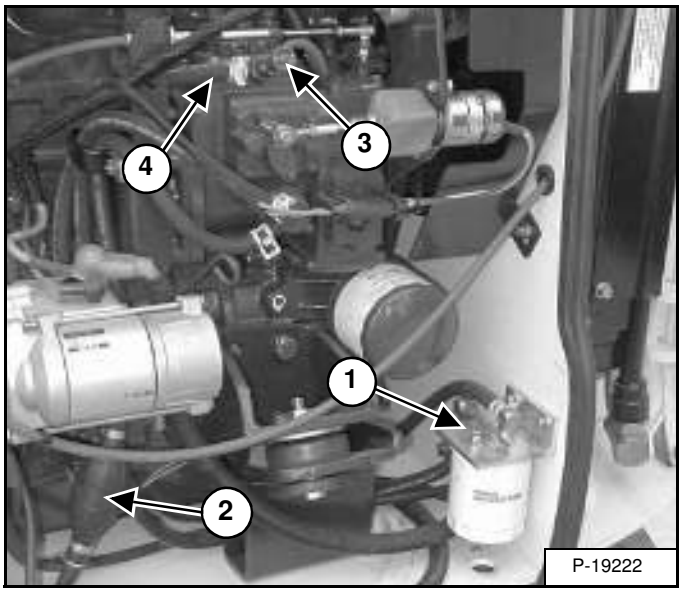
⚠ WARNING

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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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 10-80-3



Open the fuel filter vent (Item 1) **[Figure 10-80-3]**.

Operate the hand pump (priming bulb) (Item 2) **[Figure 10-80-3]** until the fuel flows from the vent with no air bubbles.

Close the vent (Item 1) **[Figure 10-80-3]**.

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

Draining The Fuel Tank

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

Remove the hose (Item 4) **[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.

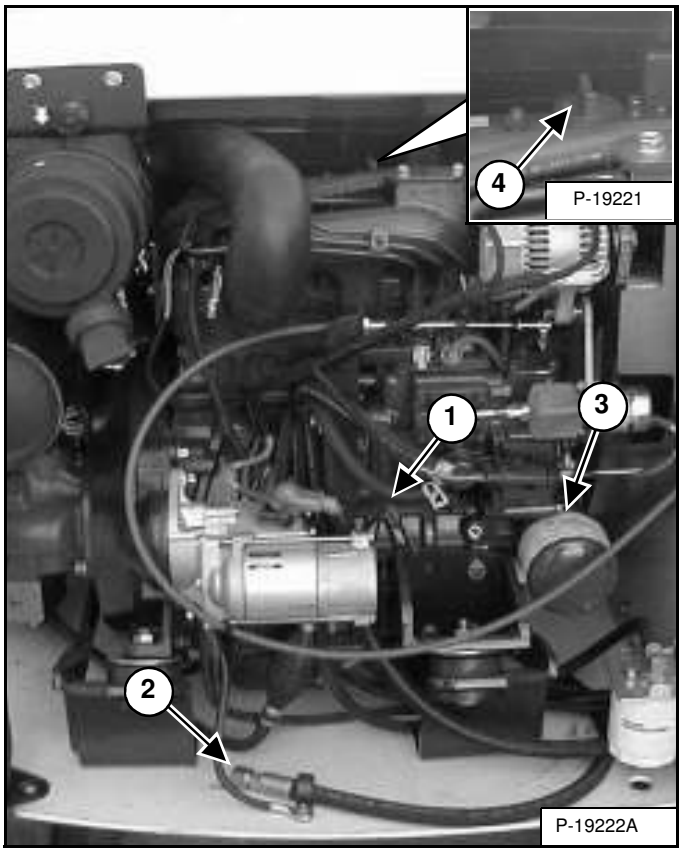
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ENGINE LUBRICATION SYSTEM

Checking Engine Oil

Figure 10-90-1



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

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

Keep the oil level between the marks on the dipstick.

Use a good quality motor oil that meets the correct API Service Classification. (See Chart on Page SPEC-60-1.)

Replacing Oil And Filter

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

Route the drain hose our the tailgate and run the engine until it is at operating temperature. Stop the engine.

Open the tailgate.

Route the drain hose out the tailgate. Remove the drain cap (Item 2) **[Figure 10-90-1]**. Drain the oil into a container.

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

Remove the oil filter (Item 3) **[Figure 10-90-1]** and clean the filter housing surface.

Use a genuine Bobcat replacement filter element.

Put clean oil on the filter gasket. Install the filter and hand tighten.

Install and tighten the oil drain cap.

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

Put oil in the engine. (See Chart 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

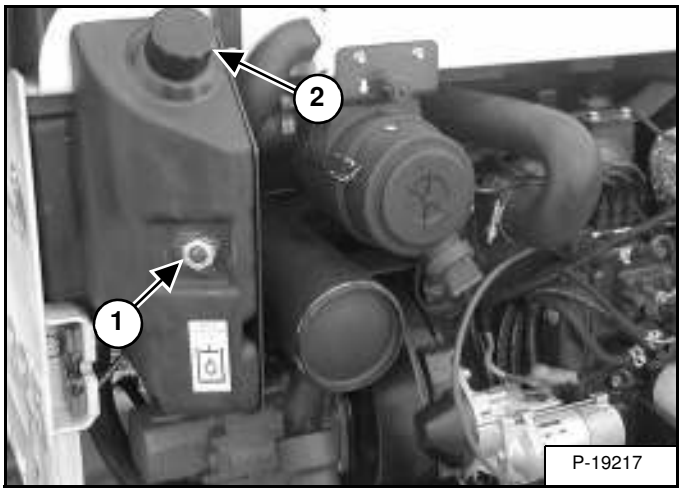
Checking And Adding Fluid

Put the machine on a flat level surface.

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

Open the tailgate.

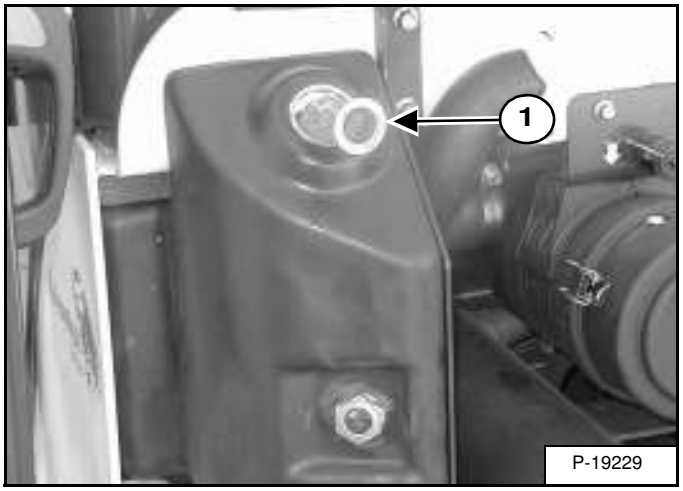
Figure 10-100-1



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 oil.

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

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

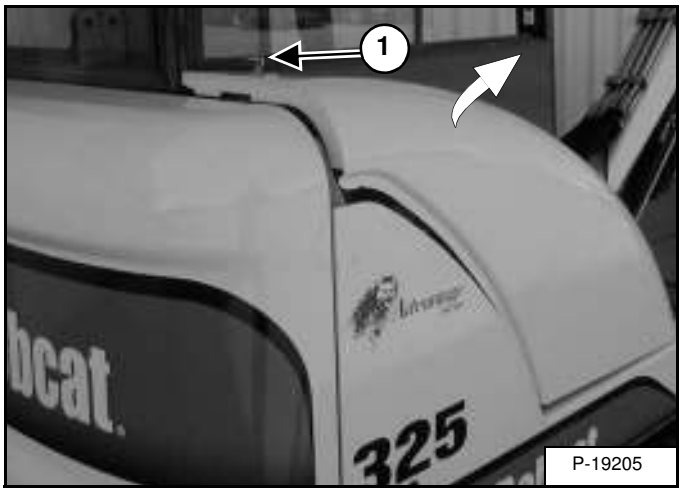
Install the reservoir cap.

Close the tailgate.

Replacing the Hydraulic Filter

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

Figure 10-100-3



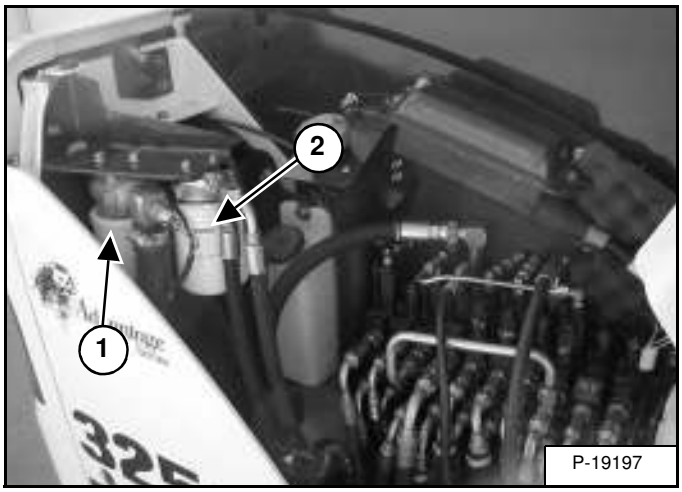
Pull the latch (Item 1) **[Figure 10-100-3]** and open the right side cover.

Tilt the cover forward until the stop engages.

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Replacing the Hydraulic Filter (Cont'd)

Figure 10-100-4



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

Clean the housing where the filter gasket makes contact.

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

Replacing the Case Drain Filter

Open the right side cover **[Figure 10-100-3]**.

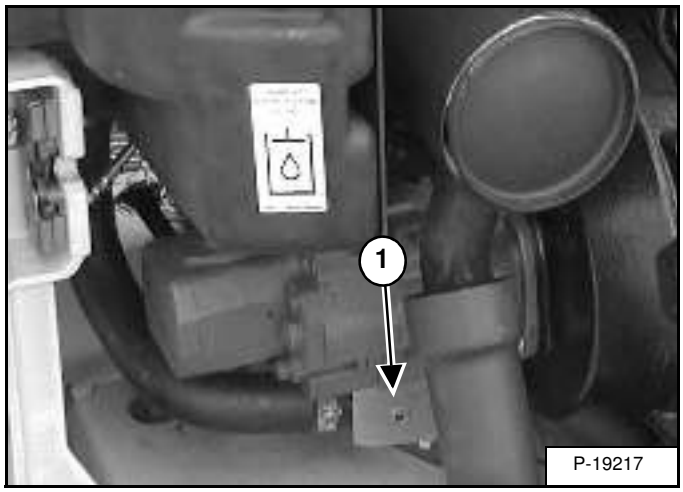
Remove the filter element (Item 2) **[Figure 10-100-4]**.

Clean the housing where the filter gasket makes contact.

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

Replacing the Hydraulic Fluid

Figure 10-100-5



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

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

Open the tailgate.

Remove the drain plug (Item 1) **[Figure 10-100-5]**.

Drain the fluid into a container.

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

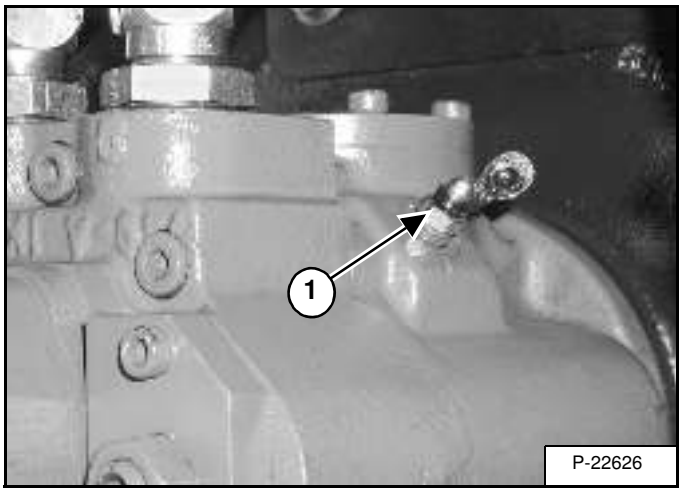
Install the drain plug (Item 1) **[Figure 10-100-5]**.

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

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Replacing the Hydraulic Fluid

Figure 10-100-6



Open the bleed valve (Item 1) **[Figure 10-100-6]** 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.

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

⚠ 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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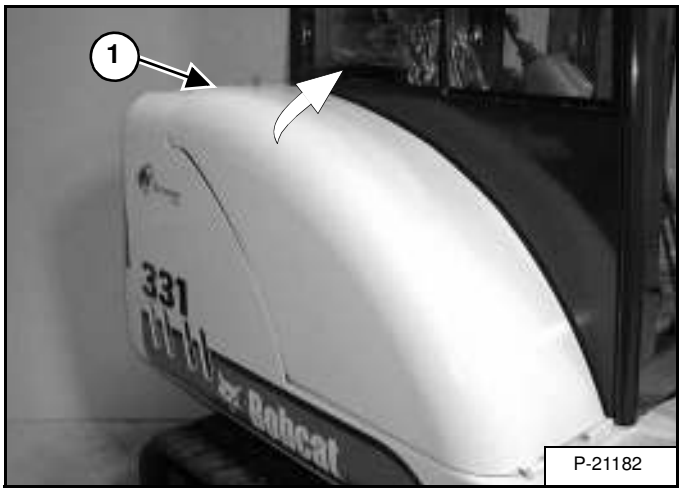
⚠ WARNING

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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Diagnostic Couplers

Figure 10-100-7



Open the side cover **[Figure 10-100-7]**.

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Diagnostic Couplers (Cont'd)

Figure 10-100-8

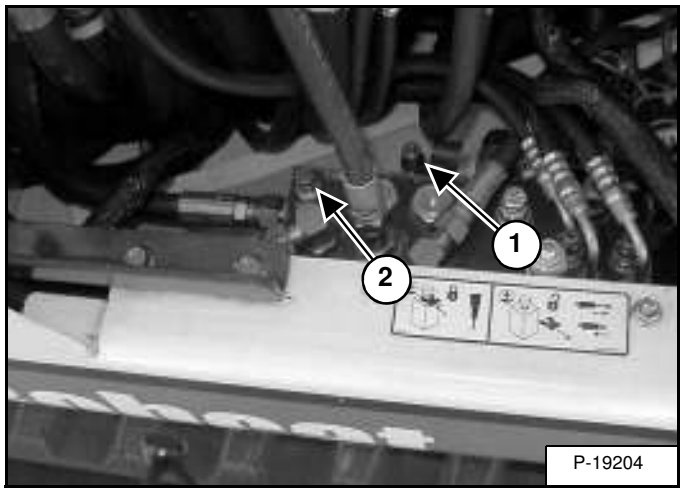
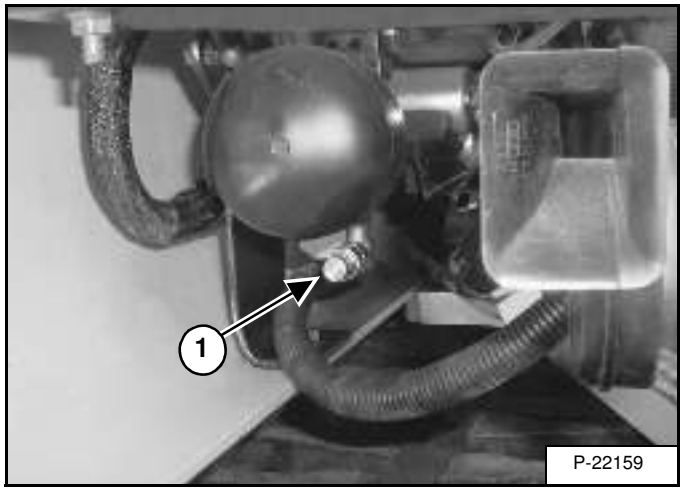


Figure 10-100-9



Diagnostic couplers (Item 1) **[Figure 10-100-8]** & **[Figure 10-100-9]** are located on the hydraulic circuitry .

The couplers can be used to check circuit pressures (Refer to the Service Manual).

The coupler (Item 2) **[Figure 10-100-8]** is used during the manufacturing of the excavator.

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LUBRICATING THE EXCAVATOR

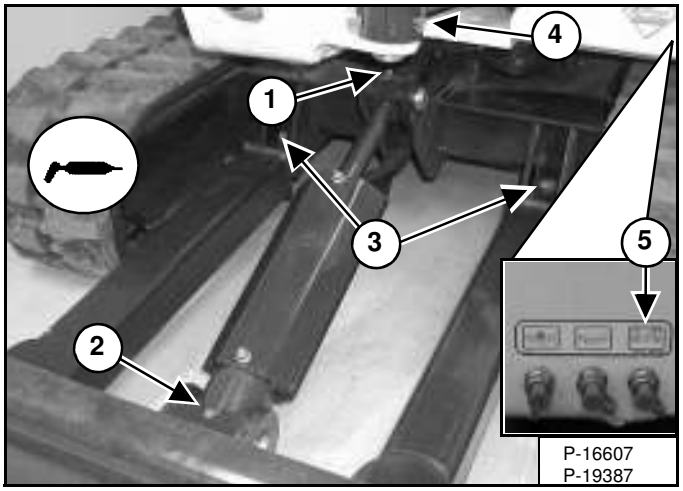
Procedure

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

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

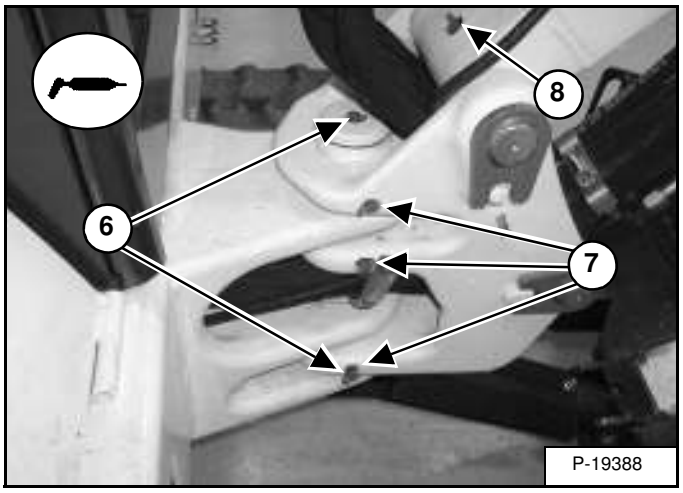
Lubricate the following locations on the Hydraulic Excavator **EVERY 8-10 HOURS:**

Figure 10-110-1



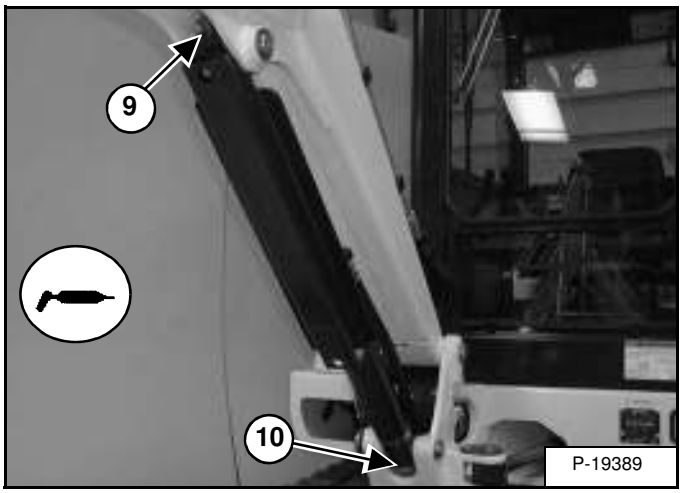
1. Blade Cylinder Rod End (1) **[Figure 10-110-1]** .
2. Blade Cylinder Base End (1) **[Figure 10-110-1]** .
3. Blade Pivots (2) **[Figure 10-110-1]**
4. Boom Swing Cylinder Rod End (1) **[Figure 10-110-1]**.
5. Boom Swing Cylinder Base End (1) **[Figure 10-110-1]**.

Figure 10-110-2



6. Boom Swing pin (2) **[Figure 10-110-2]**.
7. Boom Swing Pivot (3) **[Figure 10-110-2]**.
8. Boom / Swing Frame Pivot (1) **[Figure 10-110-2]**.

Figure 10-110-3

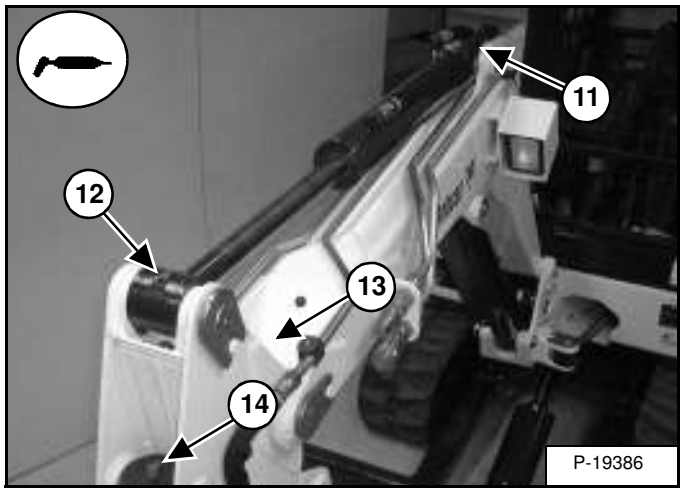


9. Boom Cylinder Base End (1)**[Figure 10-110-3]**.
10. Boom Cylinder Rod End (1) **[Figure 10-110-3]**.

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Procedure (Cont'd)

Figure 10-110-4



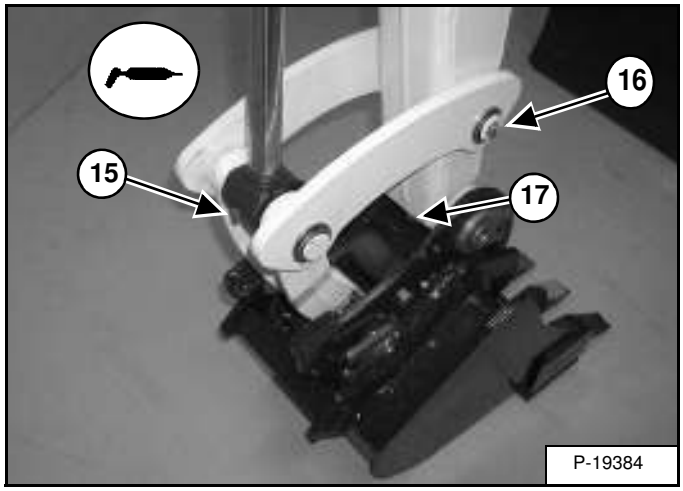
11. Arm Cylinder Base End (1) **[Figure 10-110-4]**.

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

13. Arm / Boom Pivot (1) **[Figure 10-110-4]**.

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

Figure 10-110-5

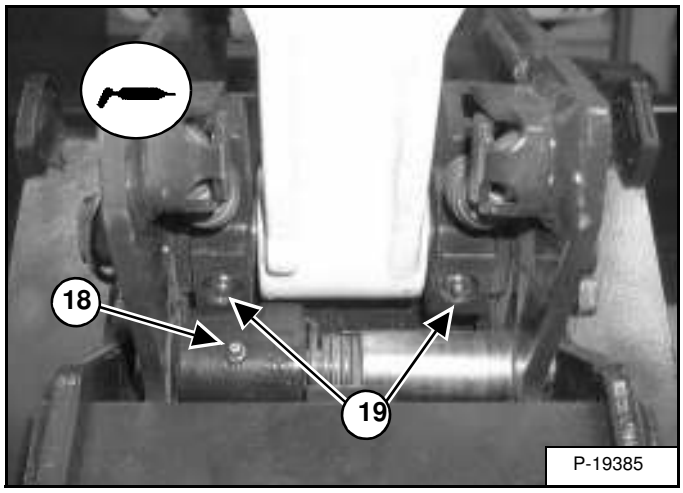


15. Bucket Cylinder Rod End (1) **[Figure 10-110-5]**.

16. Bucket Link Pins (1) **[Figure 10-110-5]**.

17. Bucket / Arm Pivot (1) **[Figure 10-110-5]**.

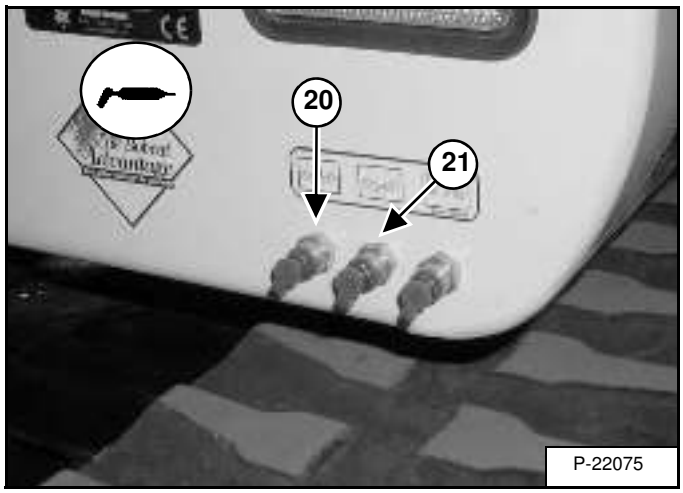
Figure 10-110-6



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

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

Figure 10-110-7



*Lubricate the following locations on the Hydraulic Excavator **EVERY 50 Hours:**

20. Swing Circle Ball Bearings (1) **[Figure 10-110-7]**

NOTE: Do not over grease the swing circle or damage to the seals could result. Install four to five pumps of grease from a grease gun into the grease fitting. Rotate the upperstructure 90° and repeat the procedure three more times.

21. Swing Circle Pinion (1) **[Figure 10-110-7]**.

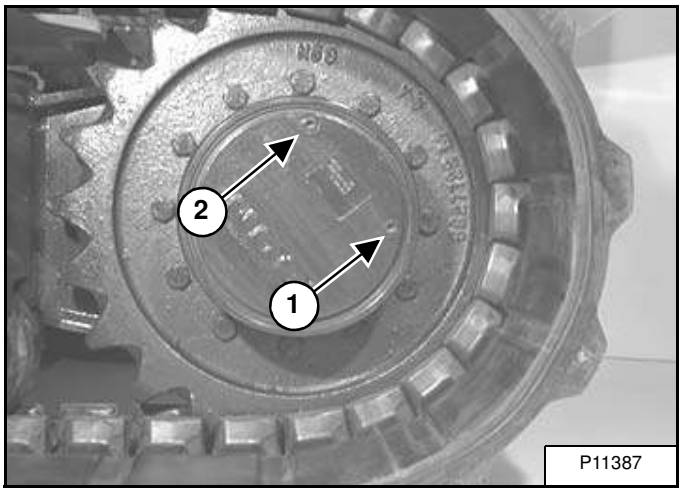
Install four pumps of grease from a grease gun into the grease fitting. Rotate the upperstructure 180° and install four more pumps of grease into the grease fitting.

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TRAVEL MOTOR

Checking Oil Level

Figure 10-120-1



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

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

Add gear lube through the hole (Item 2) until oil just begins to flow from the hole (Item 1) **[Figure 10-120-1]**. (See Chart on Page SPEC-60-1 for the capacity and the type.)

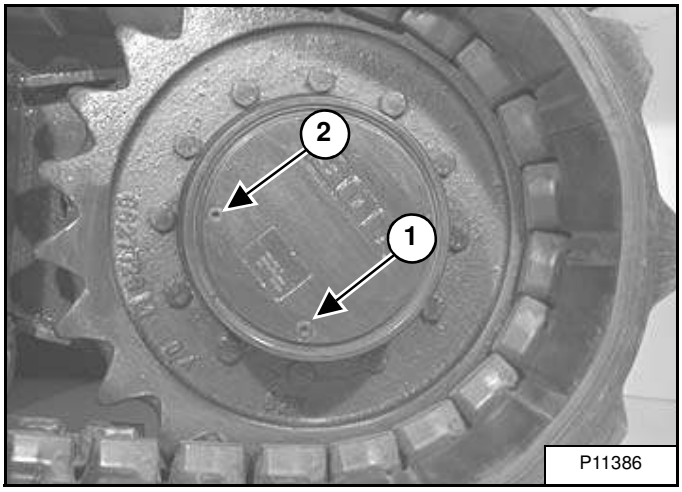
Install the plugs.

Repeat the procedure for the other side.

Draining The Travel Motor

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

Figure 10-120-2



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

Remove both plugs (Items 1 & 2) **[Figure 10-120-2]** and drain into a container. Recycle or dispose of the fluid in an environmentally safe manner.

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

Add gear lube to the plug hole (Item 2) until the gear lube level is at the bottom edge of the plug hole (Item 2) **[Figure 10-120-2]**. Install and tighten the plugs.

Repeat the procedure for the other side.

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SPARK ARRESTOR MUFFLER (IF EQUIPPED)

Cleaning The Spark Arrestor Muffler

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

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.

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⚠ WARNING

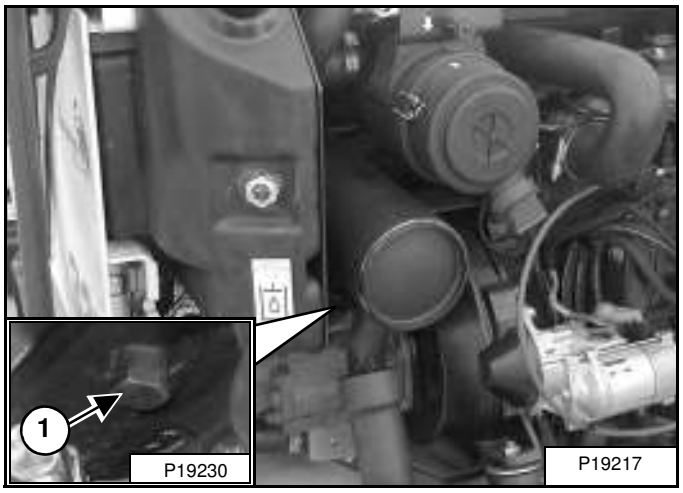
When the engine is running during service, the steering levers must be in neutral.

Failure to do so can cause injury or death.

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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.

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.

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HYDRAULIC/HYDROSTATIC SCHEMATIC
325 (S/N 232311001 - 232312386)
328 (S/N 232411001 - 232412117, & 232412128 & 232412129)

(PRINTED JULY 2002
V-0055legend

LEGEND

(1) HYDRAULIC RESERVOIR (PRESSURIZED)with FILL STRAINER
Capacity . . . . . 19.2 Qts. (18,2 L)

(2) PRESSURIZED BREATHER/FILL CAP with FILTER
5 PSI (34 kPa) - Outlet
0.435 PSI (3 kPa) - Inlet

(3) SOLENOID VALVE - SYSTEM BY-PASS

(4) MAIN RELIEF VALVE
3820 PSI (26345 kPa)

(5) AUXILIARY SELECTOR VALVE (Option)

(6) HYDRAULIC FILTER ELEMENT
15 Micron

(7) FILTER BY-PASS 50 PSI (344 kPa)

(8) SWING MOTOR CROSS PORT RELIEF VALVE . . . . . 1700 PSI (11721 kPa)
When Tested 2150 PSI (14814 kPa)

(9) HYDRAULIC PUMP . Triple Section - Variable Displacement Piston Pump
Sections 1 & 2:
5.23 GPM (19,8 L/min.)
Gear Pump Section 3:
7.03 GPM (26,6 L/min.)

(10) TRAVEL MOTOR SPOOL - RIGHT HAND

(11) TRAVEL MOTOR SPOOL - LEFT HAND

(12) CHECK VALVE

(13) PORT RELIEF VALVE
Boom Cylinder (Rod End)
3400 PSI (23442 kPa)

(14) PORT RELIEF VALVE
Boom Cylinder (Base End)
2950 PSI (20340 kPa)

(15) PORT RELIEF VALVE
Bucket Cylinder (Rod End)
3400 PSI (23442 kPa)

(16) PORT RELIEF VALVE
Bucket Cylinder (Base End)
2950 PSI (20340 kPa)

(17) PORT RELIEF VALVE
Arm Cylinder (Base End)
2950 PSI (20340 kPa)

(18) PORT RELIEF VALVE
Arm Cylinder (Rod End)
2950 PSI (20340 kPa)

(19) LOAD CHECK VALVE
Boom Swing Cylinder

(20) PRESSURE REDUCING VALVE
435 PSI (3000 kPa)

(21) ACCUMULATOR
165 PSI (1138 kPa)

(22) PORT RELIEF VALVE
Blade Cylinder (Base End)
3400 PSI (23442 kPa)

(23) ORIFICE . . . . . 0.065" (1.75 mm)

(24) ORIFICE . . . . . 0.065" (1.75 mm)

(25) HYDRAULIC FILTER ELEMENT
25 Micron

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

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

(28) FILTER BY-PASS . . . . 20 PSI (138 kPa)

(29) MAIN RELIEF VALVE 2500 PSI (17237 kPa)

(30) MAIN RELIEF VALVE 2500 PSI (17237 kPa)

(31) BUILD-UP VALVE 150 PSI (1034 kPa)

(32) TEST PORT - "G1" Port - Pilot Pressure Test Port

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

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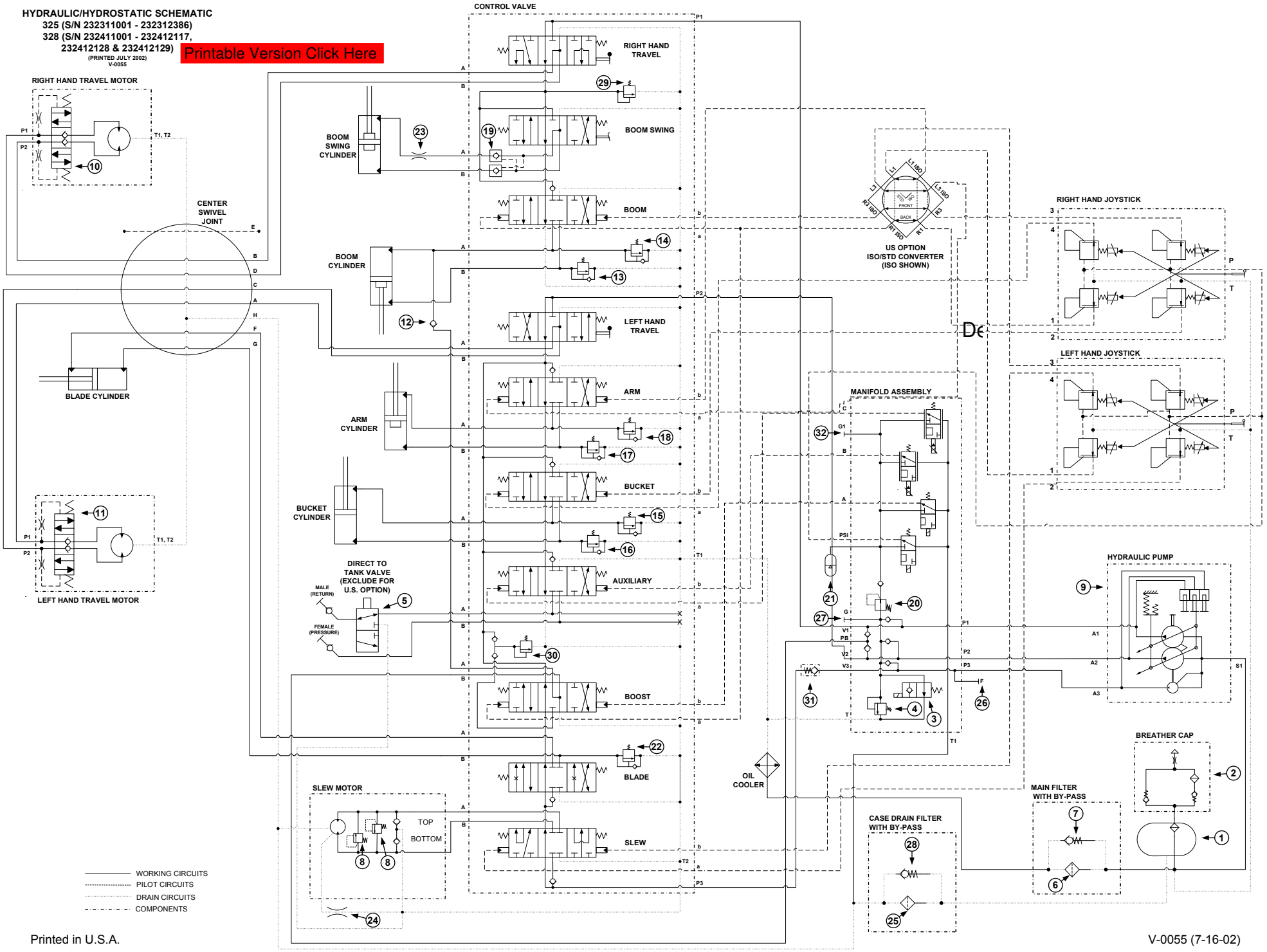
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HYDRAULIC/HYDROSTATIC SCHEMATIC

325 (S/N 232311001 - 232312386)
328 (S/N 232411001 - 232412117,
232412128 & 232412129)

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V-0055 (7-16-02)

HYDRAULIC/HYDROSTATIC SCHEMATIC
325 (S/N 232312387 AND ABOVE)
328 (S/N 232412118 - 232412127 &
& 232412130 AND ABOVE)

(PRINTED JULY 2002
V-0194legend

LEGEND

(1) HYDRAULIC RESERVOIR (PRESSURIZED)with FILL STRAINER
Capacity . . . . . 19.2 Qts. (18,2 L)

(2) PRESSURIZED BREATHER/FILL CAP with FILTER
5 PSI (34 kPa) - Outlet
0.435 PSI (3 kPa) - Inlet

(3) SOLENOID VALVE - SYSTEM BY-PASS

(4) MAIN RELIEF VALVE
3820 PSI (26345 kPa)

(5) AUXILIARY SELECTOR VALVE (Option)

(6) HYDRAULIC FILTER ELEMENT
15 Micron

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(10) TRAVEL MOTOR SPOOL - RIGHT HAND

(11) TRAVEL MOTOR SPOOL - LEFT HAND

(12) CHECK VALVE

(13) PORT RELIEF VALVE
Boom Cylinder (Rod End)
3335 PSI (22994 kPa)

(14) PORT RELIEF VALVE
Boom Cylinder (Base End)
2900 PSI (19995 kPa)

(15) PORT RELIEF VALVE
Bucket Cylinder (Rod End)
3335 PSI (22994 kPa)

(16) PORT RELIEF VALVE
Bucket Cylinder (Base End)
2900 PSI (19995 kPa)

(17) PORT RELIEF VALVE
Arm Cylinder (Base End)
2900 PSI (19995 kPa)

(18) PORT RELIEF VALVE
Arm Cylinder (Rod End)
2900 PSI (19995 kPa)

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Boom Swing Cylinder

(20) PRESSURE REDUCING VALVE
435 PSI (3000 kPa)

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Blade Cylinder (Base End)
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(31) BUILD-UP VALVE 150 PSI (1034 kPa)

(32) TEST PORT - "G1" Port - Pilot Pressure Test Port

(33) RELIEF VALVE - Boost 2540 PSI (17513 kPa)

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

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HYDRAULIC/HYDROSTATIC SCHEMATIC
325 (S/N 232312387 AND ABOVE)
328 (S/N 232412118 - 232412127 &
& 232412130 AND ABOVE)

(PRINTED JULY 2002
V-0194legend

LEGEND

(1) HYDRAULIC RESERVOIR (PRESSURIZED)with FILL STRAINER
Capacity . . . . . 19.2 Qts. (18,2 L)

(2) PRESSURIZED BREATHER/FILL CAP with FILTER
5 PSI (34 kPa) - Outlet
0.435 PSI (3 kPa) - Inlet

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(4) MAIN RELIEF VALVE
3820 PSI (26345 kPa)

(5) AUXILIARY SELECTOR VALVE (Option)

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15 Micron

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Gear Pump Section 3:
7.03 GPM (26,6 L/min.)

(10) TRAVEL MOTOR SPOOL - RIGHT HAND

(11) TRAVEL MOTOR SPOOL - LEFT HAND

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(13) PORT RELIEF VALVE
Boom Cylinder (Rod End)
3335 PSI (22994 kPa)

(14) PORT RELIEF VALVE
Boom Cylinder (Base End)
2900 PSI (19995 kPa)

(15) PORT RELIEF VALVE
Bucket Cylinder (Rod End)
3335 PSI (22994 kPa)

(16) PORT RELIEF VALVE
Bucket Cylinder (Base End)
2900 PSI (19995 kPa)

(17) PORT RELIEF VALVE
Arm Cylinder (Base End)
2900 PSI (19995 kPa)

(18) PORT RELIEF VALVE
Arm Cylinder (Rod End)
2900 PSI (19995 kPa)

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Boom Swing Cylinder

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435 PSI (3000 kPa)

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165 PSI (1138 kPa)

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(28) FILTER BY-PASS . . . . 20 PSI (138 kPa)

(29) MAIN RELIEF VALVE 2500 PSI (17237 kPa)

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(31) BUILD-UP VALVE 150 PSI (1034 kPa)

(32) TEST PORT - "G1" Port - Pilot Pressure Test Port

(33) RELIEF VALVE - Boost 2540 PSI (17513 kPa)

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

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HYDRAULIC/HYDROSTATIC SCHEMATIC
325 (S/N 232312387 AND ABOVE)
328 (S/N 232412118 - 232412127, 232412130 AND ABOVE)

(PRINTED JULY 2002)
V-0194

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R.H. TRAVEL MOTOR

T1, T2 P2 P1 V 10

CENTER SWIVEL JOINT

BLADE CYLINDER

L.H. TRAVEL MOTOR

T1, T2 P2 P1 V 11

BOOM SWING CYLINDER 23

BOOM CYLINDER 12

ARM CYLINDER

BUCKET CYLINDER

DIRECT TO TANK VALVE (EXCLUDE FOR U.S. OPTION)

MALE (RETURN) 5

FEMALE (PRESSURE)

SLEW MOTOR

TOP

BOTTOM

8 8 24

RH TRAVEL 29

BOOM SWING 19

BOOM 14 13

LH TRAVEL

ARM 18 17

BUCKET 15 16

AUX 30 33

BOOST

BLADE 22

SLEW

P1 P2 P3 T1 T2

US OPTION
ISO/STD CONVERTER
(ISO SHOWN)

L3 ISO L2 L1 ISO R1 ISO R2 R3 ISO FRONT BACK

RH JOYSTICK

LH JOYSTICK

RIGHT FRONT REAR LEFT P T

32 G1 27 20 21 PSI V1 PB V2 V3 P1 P2 P3 31 26 3 4 T T1

A3 A2 A1 S1 9 HYDRAULIC PUMP

OIL COOLER

PRESSURIZED BREATHER 2 1

MAIN FILTER WITH BY-PASS 7 6

CASE DRAIN FILTER WITH BY-PASS 28 25

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

V-0194 (7/18/02)

Glossary Of Hydraulic / Hydrostatic Symbols

SYMBOL | DESCRIPTION

FLOW LINES and CONNECTIONS

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

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

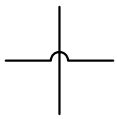
DRAIN CIRCUITS - Dotted Line - Drain Line (drain or bleed line - line conducting fluid from a component housing to the reservoir.

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

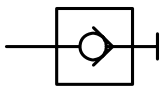
MECHANICAL CONNECTIONS - Double Line (Shaft, Lever, Piston Rod).



CONNECTED JUNCTION OF OIL LINES (Flow Line Connection).



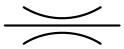
OIL LINES CROSSING (NOT Connected).



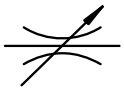
COUPLER - Quick - Acting Coupling (uncoupled, closed by non-return valve).

SYMBOL | DESCRIPTION

BASIC and MISCELLANEOUS SYMBOLS



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



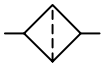
VARIABLE ADJUSTMENT RESTRICTION - Regulated or Variable Restriction.



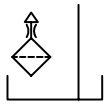
TEMPERATURE CONTROL - (Indication of temperature).



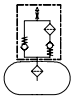
TEMPERATURE INDICATOR - (temperature measurement - thermometer).



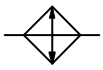
FILTER (strainer or screen) - For fluid conditioning.



VENTED AND FILTERED RESERVOIR (reservoir open to atmosphere).



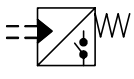
PRESSURIZED, VENTED AND FiLTERED RESERVOIR (Reservoir uses a pressured cap).



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



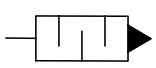
PRESSURE SENSOR - Varies electric signal with pressure.



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



PRESSURE SWITCH - Switch activates when pressure reaches specified level.



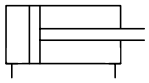
MUFFLER (silencer) - Reduces noise.

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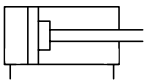
Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

SYMBOL DESCRIPTION

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

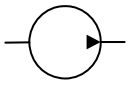


DOUBLE ACTING HYDRAULIC CYLINDER, UNEQUAL DISPLACEMENT - With single piston rod.

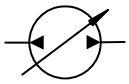


DOUBLE ACTING HYDRAULIC CYLINDER, UNEQUAL DISPLACEMENT and CUSHION ON ONE END - With single piston rod.

PUMP: To convert mechanical energy into hydraulic energy.

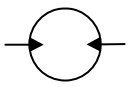


FIXED CAPACITY DISPLACEMENT HYDRAULIC PUMP - With one direction of flow.



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

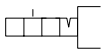
MOTOR: To convert hydraulic energy into rotary mechanical energy.



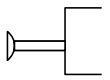
FIXED CAPACITY DISPLACEMENT BIDIRECTIONAL HYDRAULIC MOTOR - With two directions of flow (bidirectional.

SYMBOL DESCRIPTION

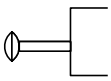
CONTROL MECHANISMS



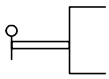
CONTROL VALVE WITH DETENT (Holds Valve in Position) - device for maintaining a given position (mechanical).



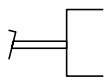
CONTROL VALVE ACTIVATED BY A PULL BUTTON (manual).



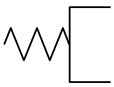
CONTROL VALVE ACTIVATED BY A PUSH-PULL BUTTON (manual).



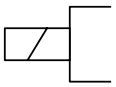
CONTROL VALVE ACTIVATED BY A LEVER (manual).



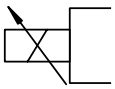
CONTROL VALVE ACTIVATED BY A PEDAL (manual).



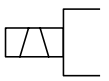
CONTROL VALVE WITH SPRING RETURN (mechanical).



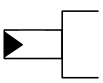
CONTROL VALVE ACTIVATED BY AN ELECTRIC SOLENOID (electrical).



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



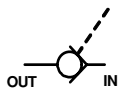
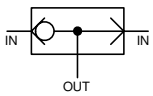
CONTROL VALVE ACTIVATED BY DUAL ELECTRICAL SOLENOID (electrical).

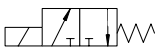
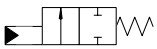
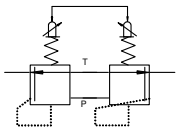
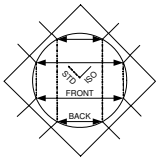
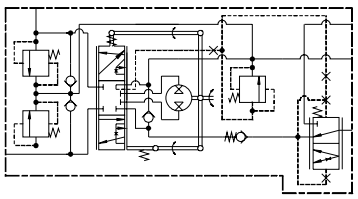


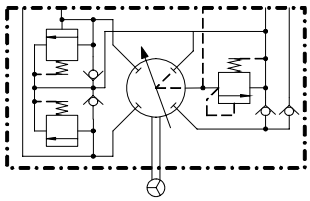
CONTROL VALVE ACTIVATED BY PILOT PRESSURE (indirect control, pilot actuated by application of pressure).

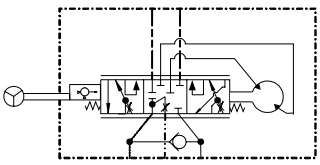
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Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

SYMBOL	DESCRIPTION
	NON-RETURN VALVE, SHUTTLE VALVE: Valve which allows free flow in one direction only.
	NON-RETURN VALVE (Check Valve) - Used as Replenishing Valve, Lock Check Valve or Anticavitation Valve - Opens if the Inlet pressure is higher than the Outlet pressure. Often contains internal spring which has NO significant pressure value.
	SPRING LOADED VALVE (bypass Valve) - Opens if the Inlet pressure is greater than the Outlet pressure plus the spring pressure.
	PILOT CONTROLLED NON-RETURN VALVE- It is possible to open the valve by pilot pressure.
	SHUTTLE VALVE - The Inlet port connected to the higher pressure is automatically connected to the Outlet port while the other Inlet port is closed.

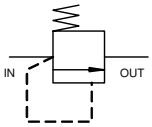
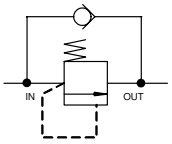
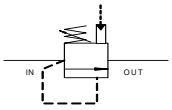
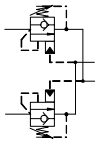
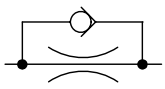
SYMBOL	DESCRIPTION
	DIRECTIONAL CONTROL VALVE: Valve providing for the opening (fully or restricted) or the closing of one or more flow paths (represented by several squares).
	TWO PORTS and CLOSED FLOW PATHS
	SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (Two Position) - controlled by an electric solenoid (with return spring).
	PILOT ACTIVATED DIRECTIONAL CONTROL VALVE (Two Position) - controlled by pressure (with return spring).
	MANUALLY ACTIVATED DIRECTION CONTROL VALVE (Variable Position) Joystick Controlled, variable pressure to shift the pilot activated directional control valve spool.
	MANUALLY ACTIVATED FLOW CONTROL VALVE (Two Position) allows for changing pilot flow to control switching joystick functions for STD / ISO Control (Excavators Only).
	STEERING CONTROL VALVE (Variable Position) - Used for controlling the hydraulic flow for the steering cylinders in relationship to the amount the steering wheel is rotated.

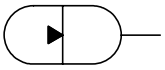




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Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

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

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

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Troubleshooting Chart

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.	Check, 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.
Hydraulic speed too slow.	Hydraulic oil level or viscosity incorrect.	Refill or replace.
	Engine RPM reduced.	Readjust or replace.
	Control valve linkage defective.	Check, repair or replace
	Hydraulic pump volume low.	Check, repair or replace.
Oil temperature too high.	Oil cooler or radiator fins plugged.	Clean oil cooler external surface.
	Hydraulic oil level low.	Refill or replace
	Non recommended hydraulic oil	Replace
	Relief valve excessively activated.	Use proper operating procedures.
	One or more relief valves not set correctly.	Test, readjust or replace.
	Extreme operating conditions. High ambient temperature (IE: enclosed structure).	

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Troubleshooting Chart (Cont'd)

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

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Troubleshooting Chart (Cont'd)

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

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Troubleshooting Chart (Cont'd)

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

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BOOM CYLINDER

Checking The Boom Cylinder

Figure 20-20-1

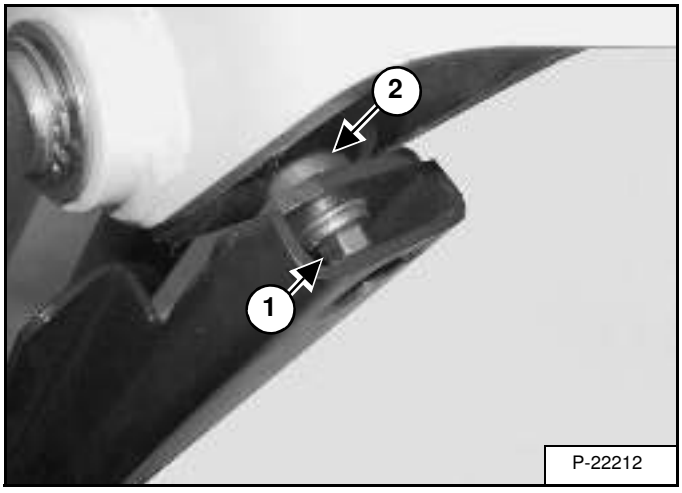


Lower the bucket and blade to the ground.

Stop the engine. Raise the control console.

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

Figure 20-20-2



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

Figure 20-20-3

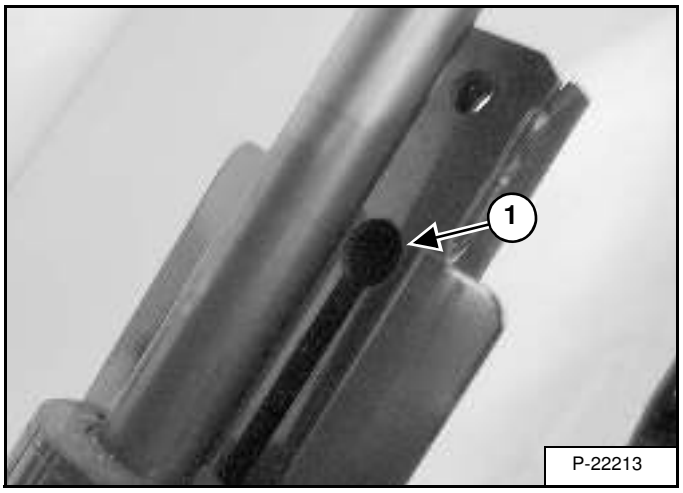
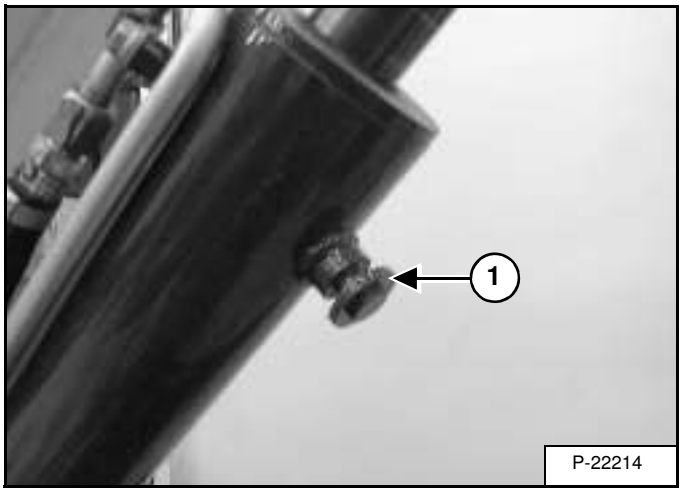


Figure 20-20-4



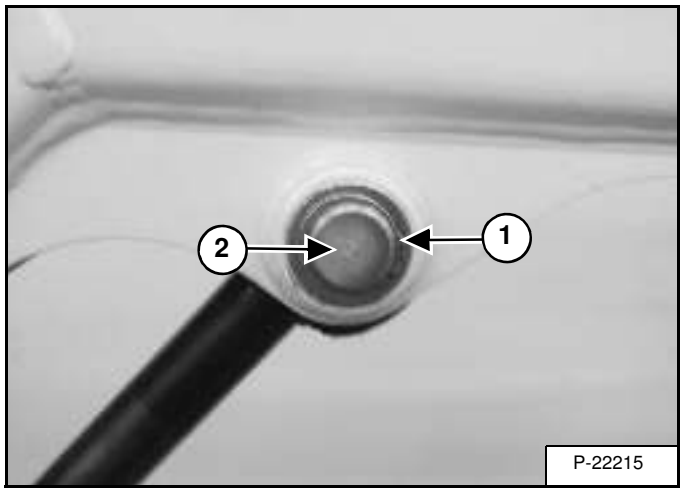
Slide the shield down until the keyhole (Item 1) **[Figure 20-20-3]** in the shield lines up with the mounting stud (Item 1) **[Figure 20-20-4]** on the cylinder.

Remove the shield.

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Checking The Boom Cylinder (Cont'd)

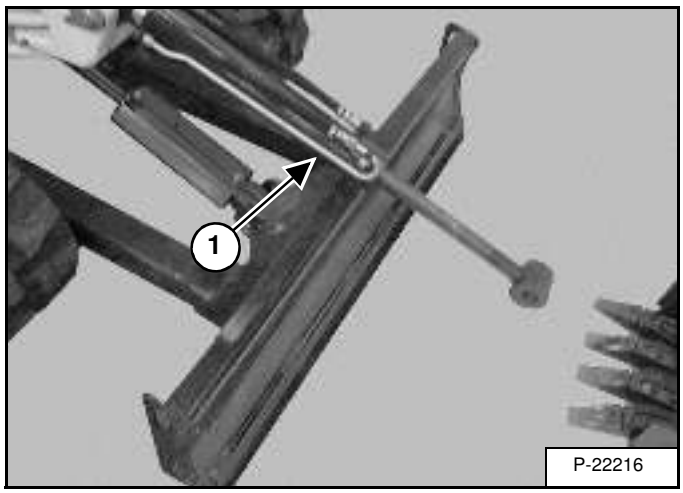
Figure 20-20-5



Remove the retaining ring (Item 1) **[Figure 20-20-5]** and washer from the rod end pivot pin.

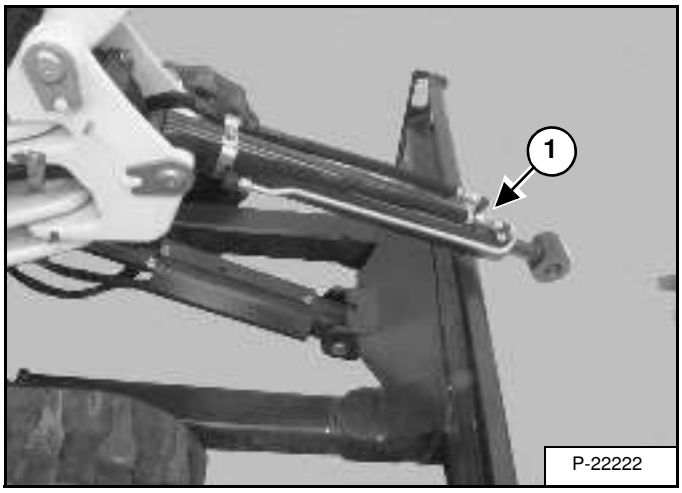
Remove the pivot pin (Item 2) **[Figure 20-20-5]**.

Figure 20-20-6



Lower the cylinder (Item 1) **[Figure 20-20-6]** until it rests on the blade.

Figure 20-20-7



Lower control console and fasten the seat belt. Start the engine and retract the boom cylinder **[Figure 20-20-7]**.

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

⚠ WARNING

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

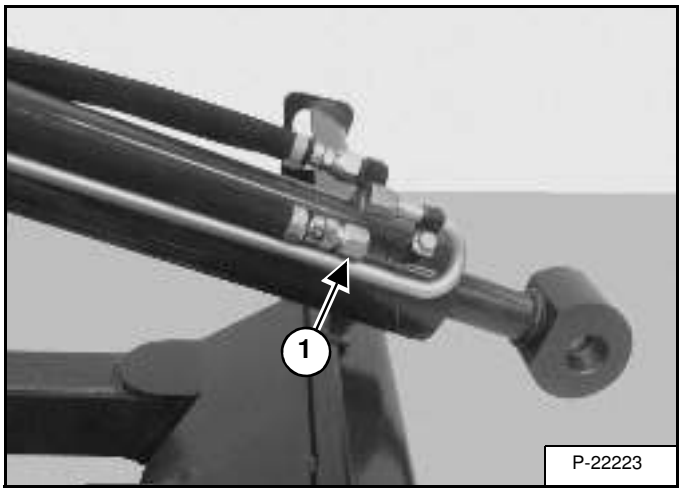
W-2145-0290

Disconnect the boom cylinder base and end hose (Item 1) **[Figure 20-20-7]** at the hose tube line connection.

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Checking The Boom Cylinder (Cont'd)

Figure 20-20-8



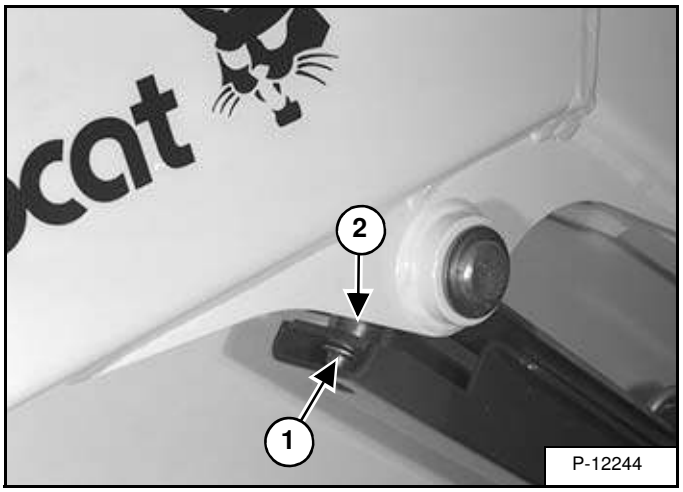
Install a cap (Item 1) **[Figure 20-20-8]**on the hose fitting and tighten.

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

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

Removal And Installation

Figure 20-20-9



Remove the bolt (Item 1) and spacer (Item 2) **[Figure 20-20-9]** from the end of the boom cylinder.

Slide the shield off of the boom cylinder retaining tab.

Put the bucket on the floor. Stop the engine.

Move the hydraulic controls to release the hydraulic pressure.

⚠ WARNING

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

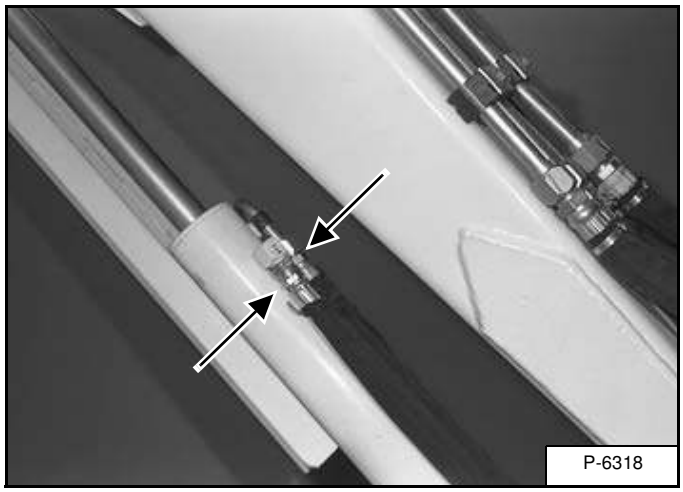
W-2145-0290

Install a chain hoist at the boom lift area.

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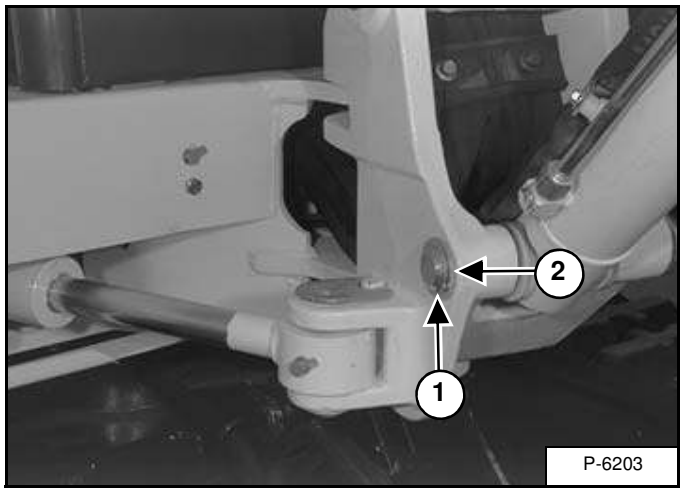
Removal And Installation (Cont'd)

Figure 20-20-10



Disconnect the two hoses from the boom cylinder **[Figure 20-20-10]**.

Figure 20-20-11

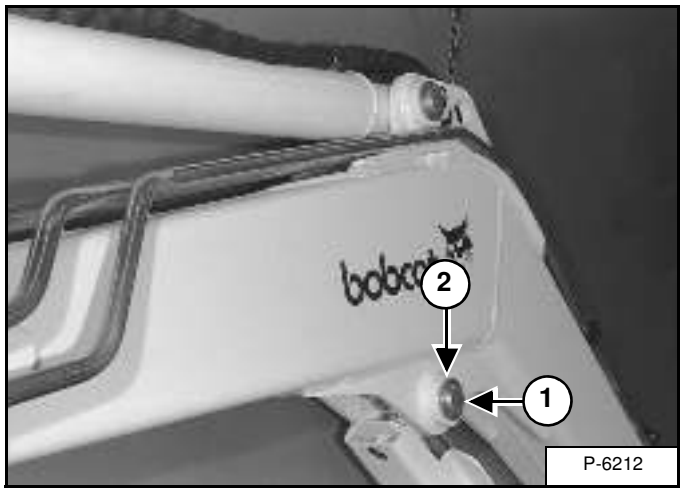


Remove the snap ring (Item 1) and washer (Item 2) **[Figure 20-20-11]** from the boom cylinder base end pin.

Remove the cylinder base end pin.

Lower the base end of the boom cylinder to the floor.

Figure 20-20-12



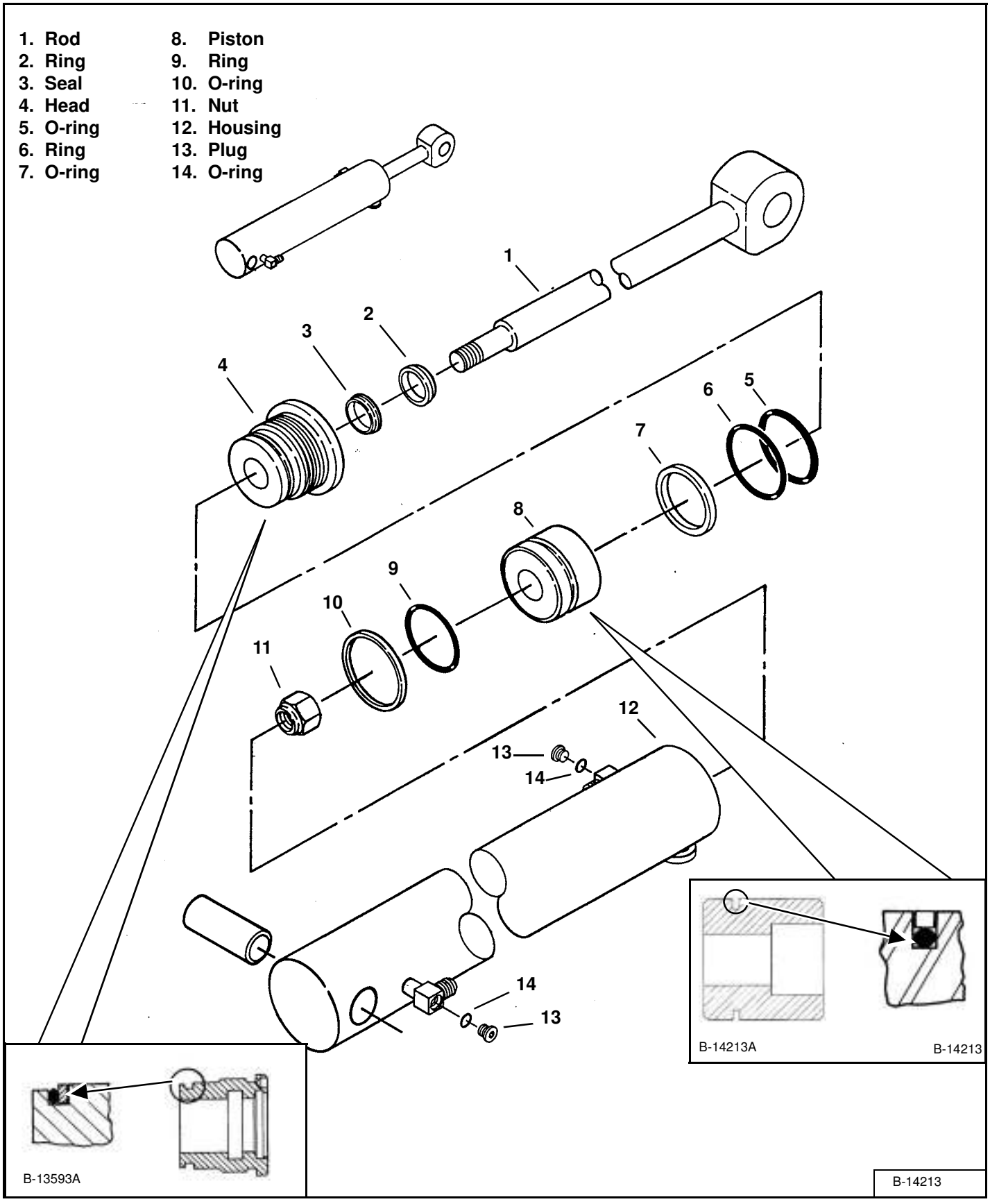
Remove the snap ring (Item 1) and washer (Item 2) **[Figure 20-20-12]** from the cylinder rod end pin.

Remove the cylinder rod end pin. Remove the boom cylinder from the boom.

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Parts Identification

1. Rod
2. Ring
3. Seal
4. Head
5. O-ring
6. Ring
7. O-ring
8. Piston
9. Ring
10. O-ring
11. Nut
12. Housing
13. Plug
14. O-ring



Dealer Copy -- Not for Resale

Disassembly

Use the following tools to disassemble the cylinder:

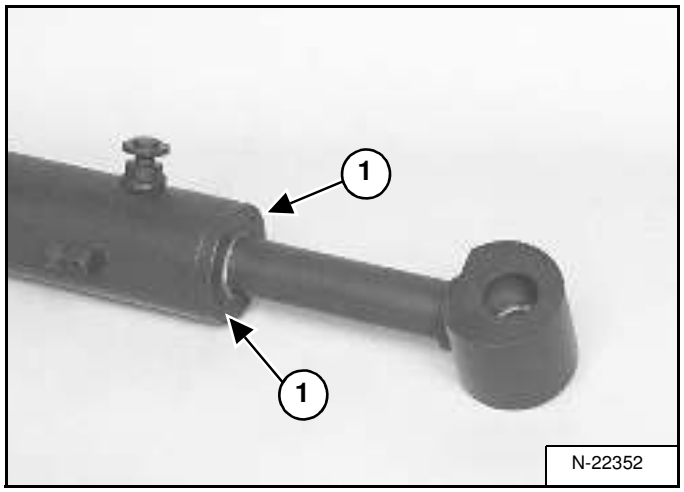
MEL1074 - O-ring Seal Hook
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

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.

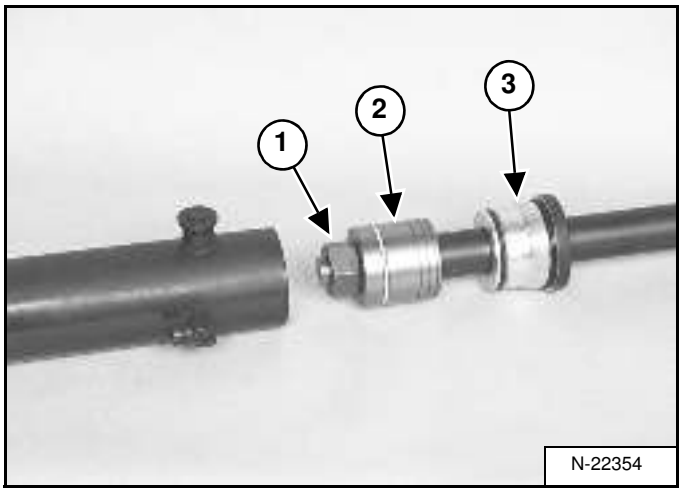
Be careful not to damage the cylinder tube.

Figure 20-20-13



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

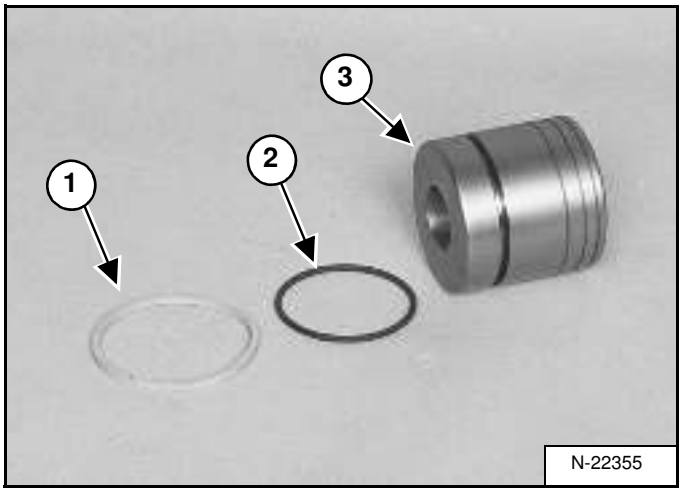
Figure 20-20-14



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

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

Figure 20-20-15

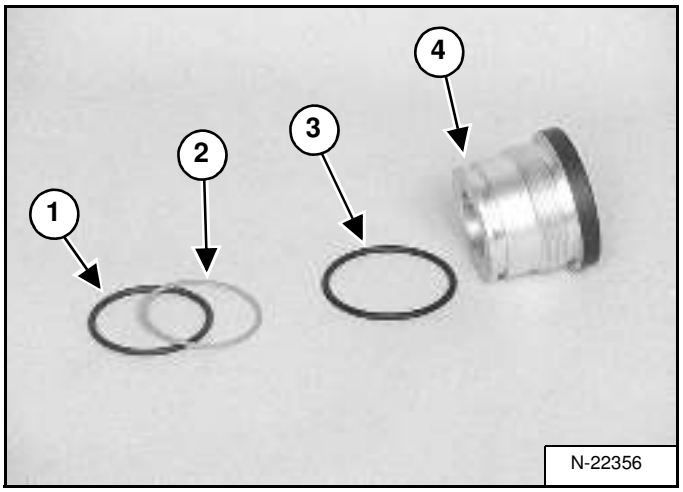


Cushion Piston: Remove the back-up (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-20-15]**.

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Disassembly (Cont'd)

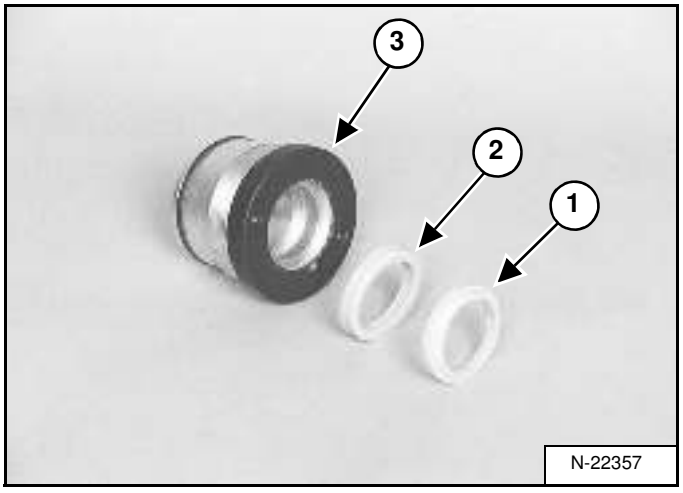
Figure 20-20-16



Remove the thick O-ring (Item 1) and the back-up washer (Item 2) from the groove in the head (Item 4) **[Figure 20-20-16]**.

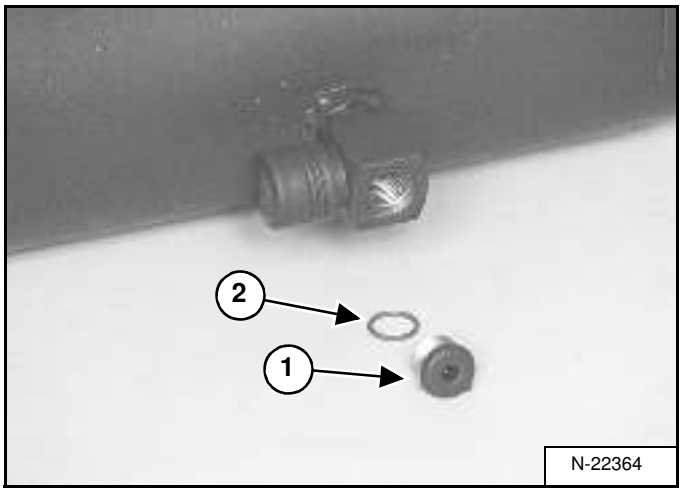
Remove the thin O-ring (Item 3) **[Figure 20-20-16]**.

Figure 20-20-17



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

Figure 20-20-18



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

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Assembly

Use the following tools to assemble the cylinder:

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

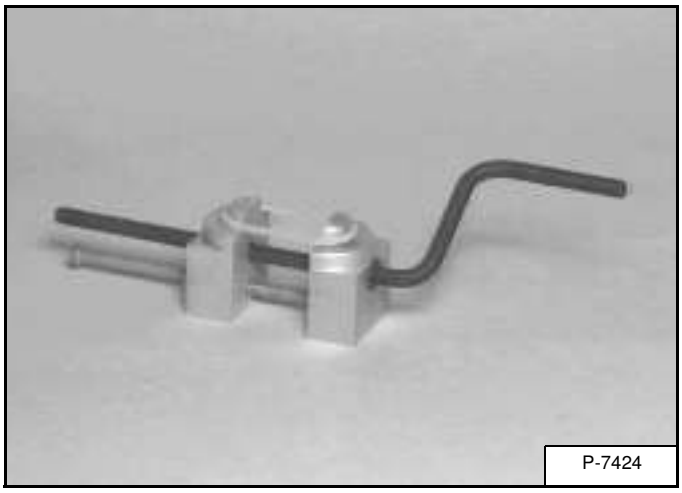
Wash the cylinder parts in solvent and air dry them.

Inspect the cylinder parts for nicks, scratches or other 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.

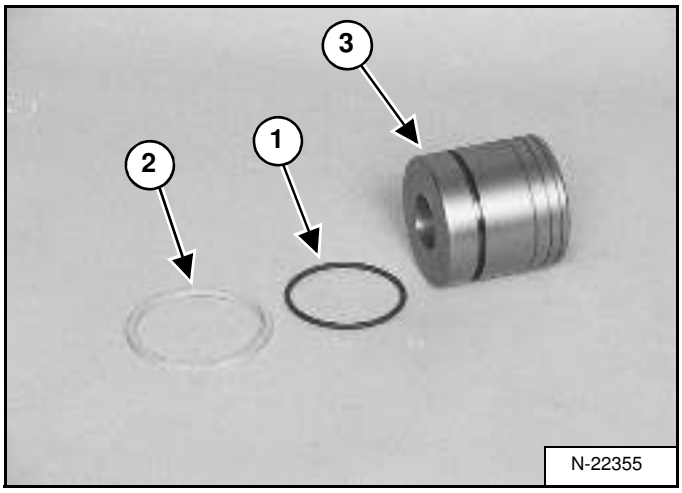
Figure 20-20-19



Install the new seal on the tool and slowly stretch it until it fits the piston **[Figure 20-20-19]**.

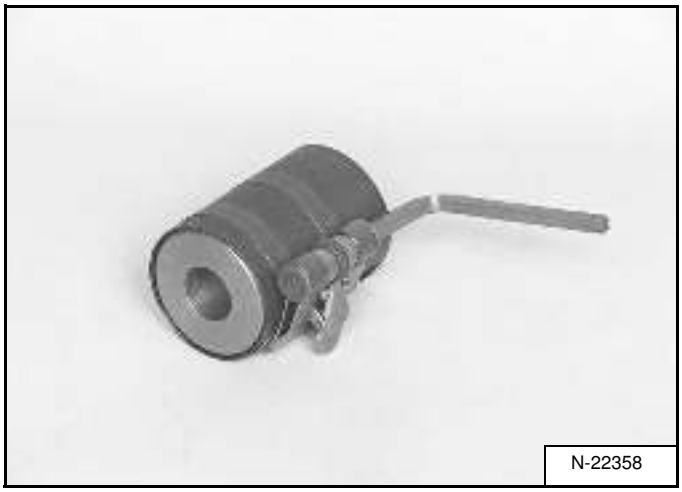
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-20-20



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

Figure 20-20-21

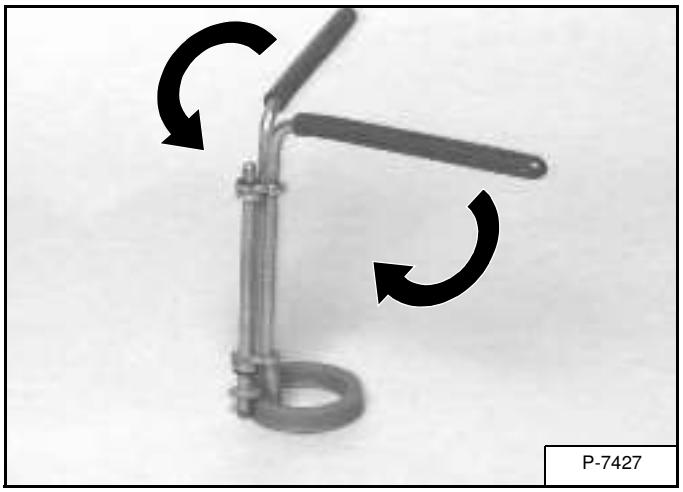


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-20-21]**.

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Assembly (Cont'd)

Figure 20-20-22

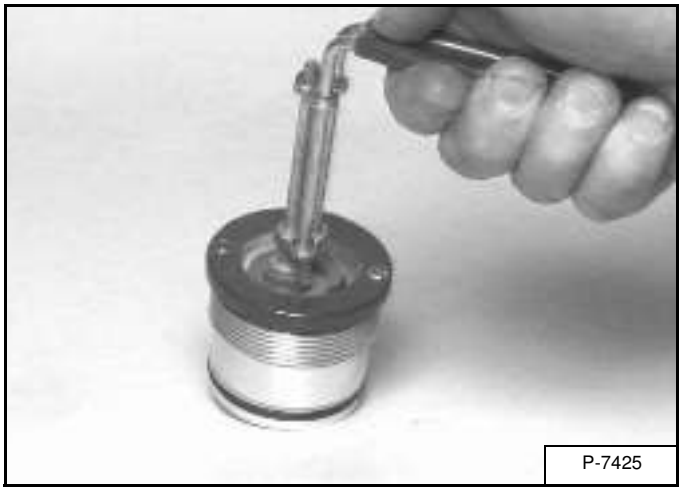


Install the rod seal on the rod seal tool **[Figure 20-20-22]**.

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

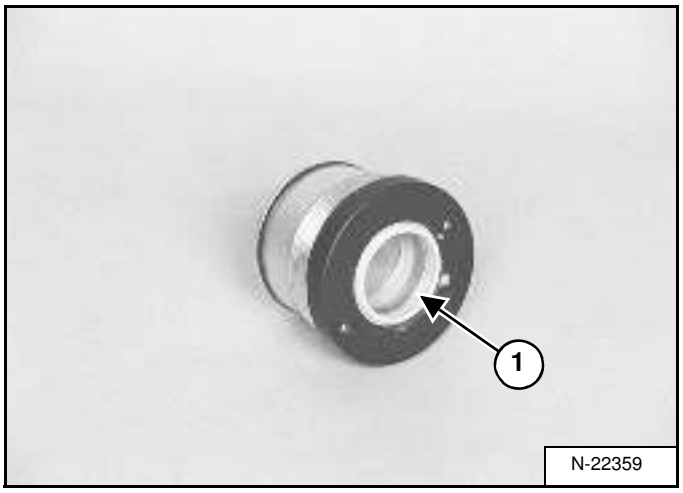
Rotate the handles to collapse the rod seal **[Figure 20-20-22]**.

Figure 20-20-23



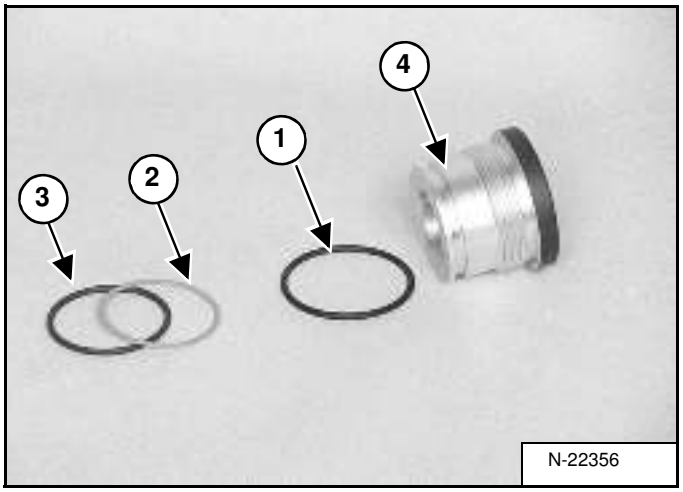
Install the rod seal in the head **[Figure 20-20-23]**.

Figure 20-20-24



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

Figure 20-20-25



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

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

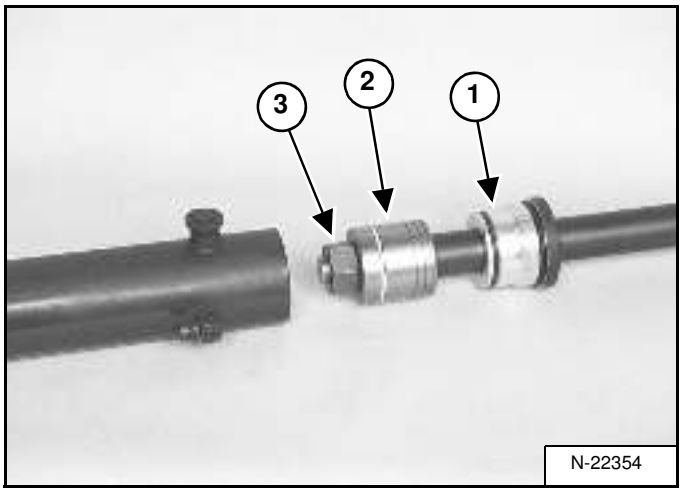
NOTE: Clean and dry the rod threads, from the kit install a NEW NUT with pre-applied LOCTITE.

Reclean thread area for LOCTITE residue.

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Assembly (Cont'd)

Figure 20-20-26



Install the head (Item 1) and the piston (Item 2) **[Figure 20-20-26]**. Install the piston on the rod as shown.

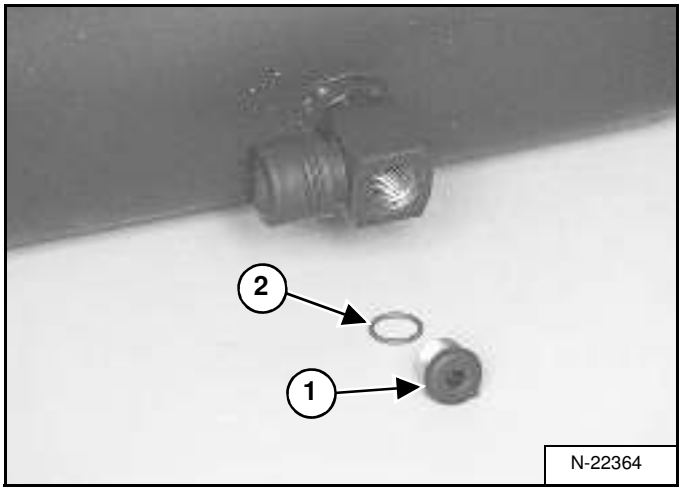
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-20-26]**.

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

Figure 20-20-27



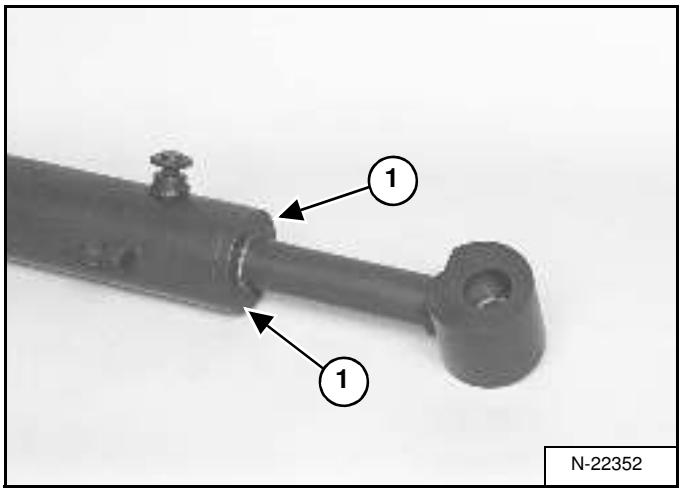
Install plug (Item 1) and O-ring (Item 2) **[Figure 20-20-27]**.

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

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

Be careful not to damage the cylinder tube.

Figure 20-20-28



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-20-28]** to tighten the head. Head to be torqued until flush with end of tube assembly.

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ARM CYLINDER

Checking The Arm Cylinder

Figure 20-21-1

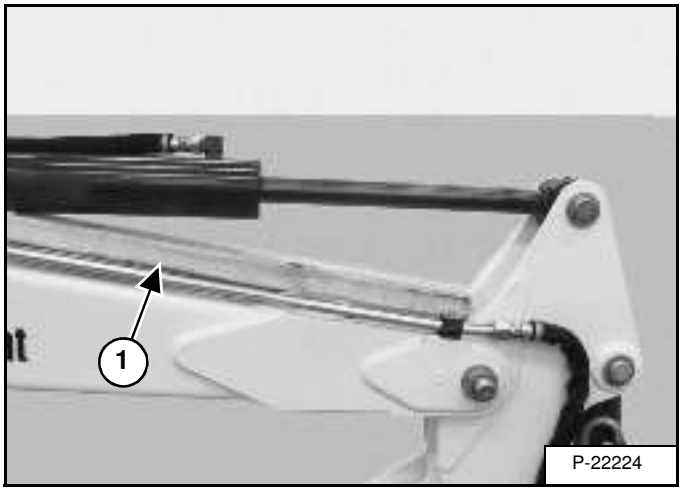


Lower the bucket and blade to the ground.

Stop the engine. Raise the control console.

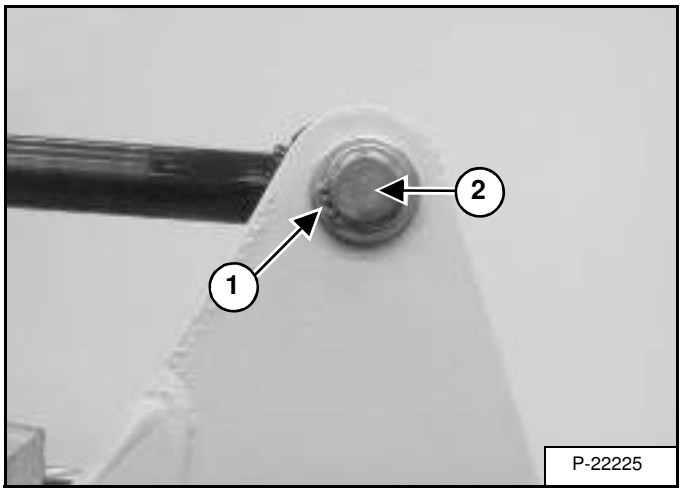
Support the boom using a chain hoist **[Figure 20-21-1]**.

Figure 20-21-2



Support the arm cylinder (Item 1) **[Figure 20-21-2]**.

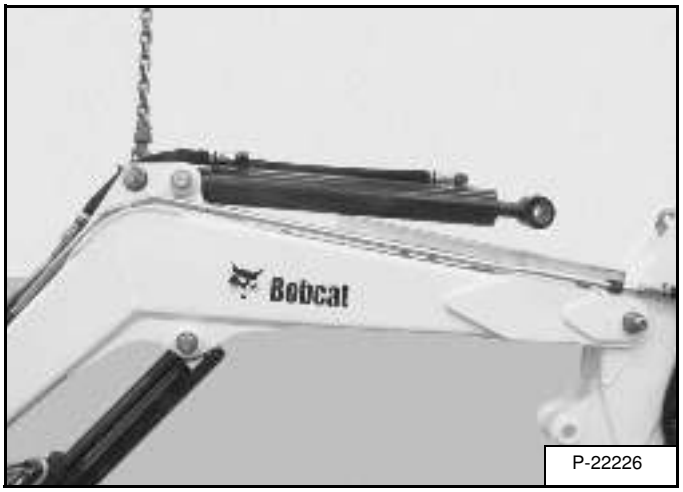
Figure 20-21-3



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

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

Figure 20-21-4



Lower control console and fasten the seat belt. Start the engine and retract the arm cylinder **[Figure 20-21-4]**.

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

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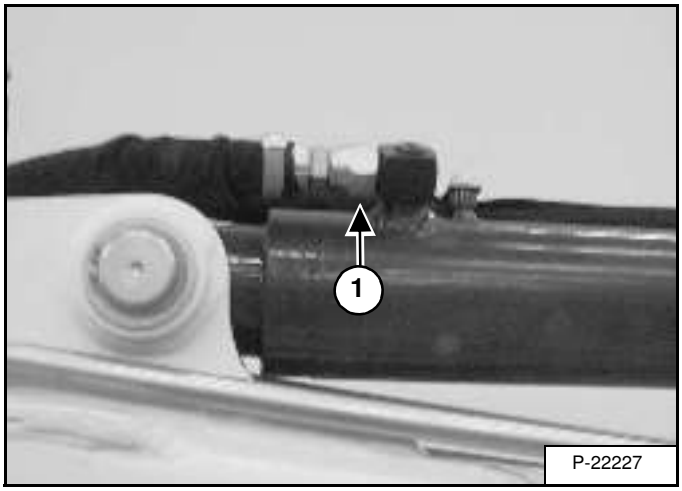
Checking The Arm Cylinder (Cont'd)

⚠ 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.

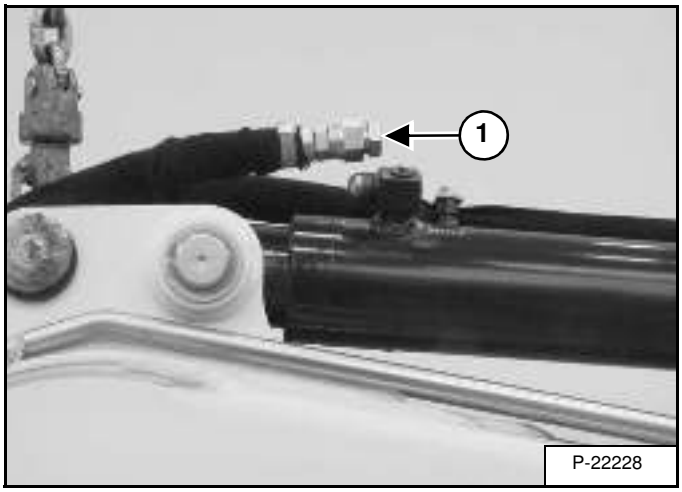
W-2145-0290

Figure 20-21-5



Disconnect the boom cylinder base end hose (Item 1) **[Figure 20-21-5]**.

Figure 20-21-6



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

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

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

Dealer Copy -- Not for Resale

Removal And Installation

Put the bucket on the floor. Stop the engine.

Move the hydraulic controls to release the hydraulic pressure.

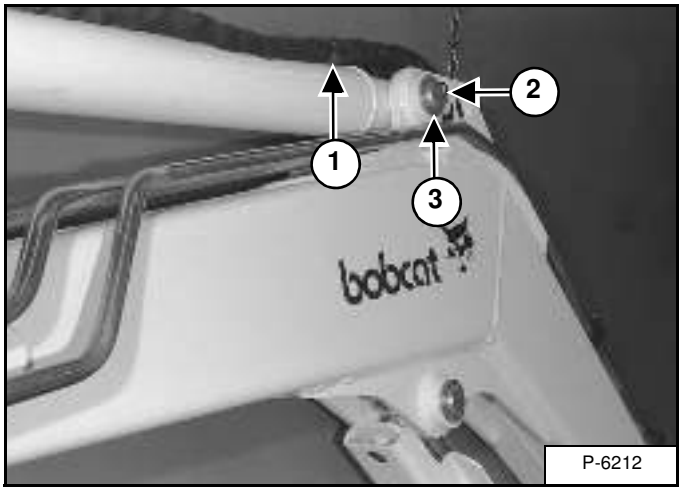
IMPORTANT

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

I-2003-0888

Install a chain hoist to the boom lift point.

Figure 20-21-7

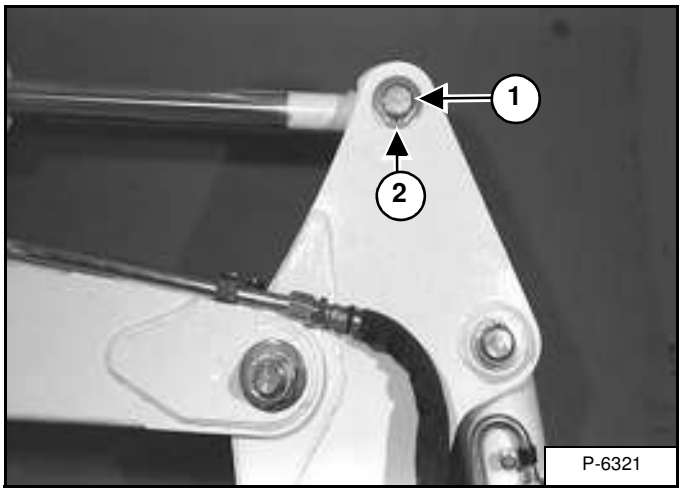


Disconnect the two hoses (Item 1) **[Figure 20-21-7]** from the arm cylinder.

Remove the snap ring (Item 2) and washer (Item 3) **[Figure 20-21-7]** from the cylinder base end pin.

Remove the cylinder base end pin.

Figure 20-21-8



Remove the snap ring (Item 1) and washer (Item 2) **[Figure 20-21-8]** from the cylinder rod end pin.

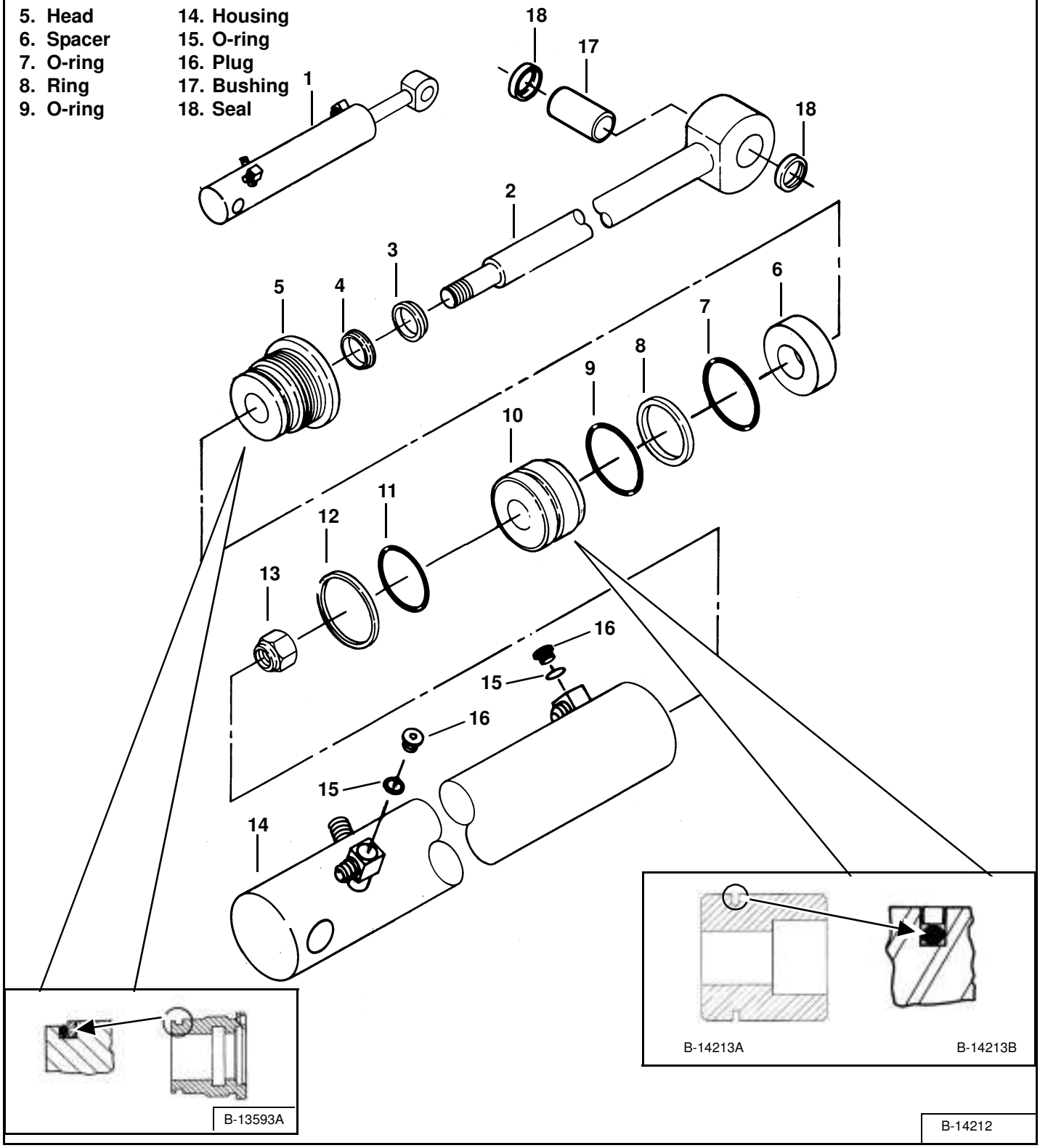
Remove the cylinder rod end pin.

Remove the cylinder from the arm.

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Parts Identification

1. Cylinder
2. Rod
3. Ring
4. Seal
5. Head
6. Spacer
7. O-ring
8. Ring
9. O-ring
10. Piston
11. O-ring
12. Ring
13. Nut
14. Housing
15. O-ring
16. Plug
17. Bushing
18. Seal



Dealer Copy -- Not for Resale

Disassembly

Use the following tools to disassemble the cylinder:

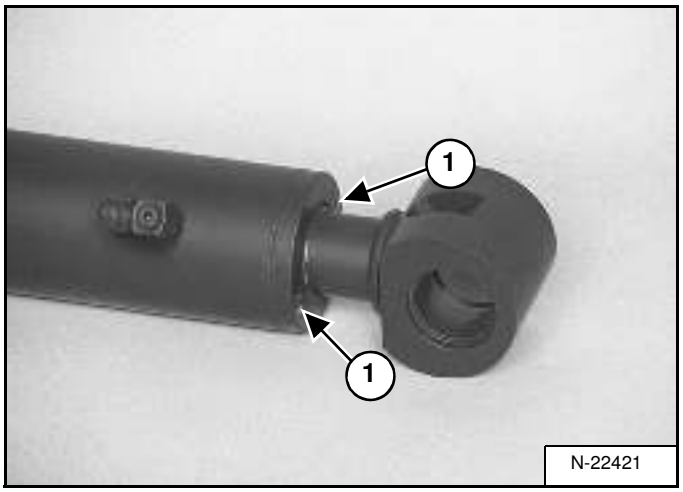
MEL1074 - O-ring Seal Hook
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

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.

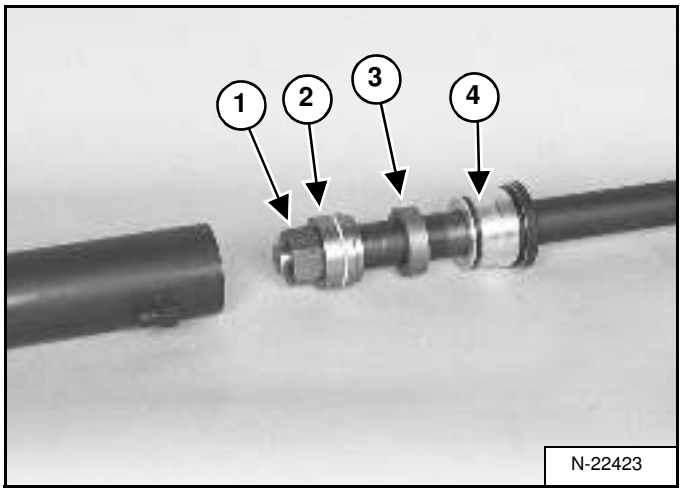
Be careful not to damage the cylinder tube.

Figure 20-21-9



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-21-9]** to loosen the head.

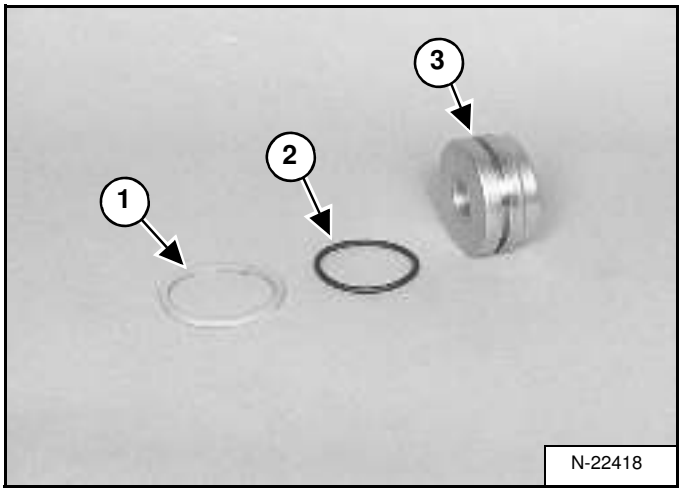
Figure 20-21-10



Remove the head and the rod assembly from the cylinder **[Figure 20-21-10]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2), spacer (Item 3) and head (Item 4) **[Figure 20-21-10]**.

Figure 20-21-11

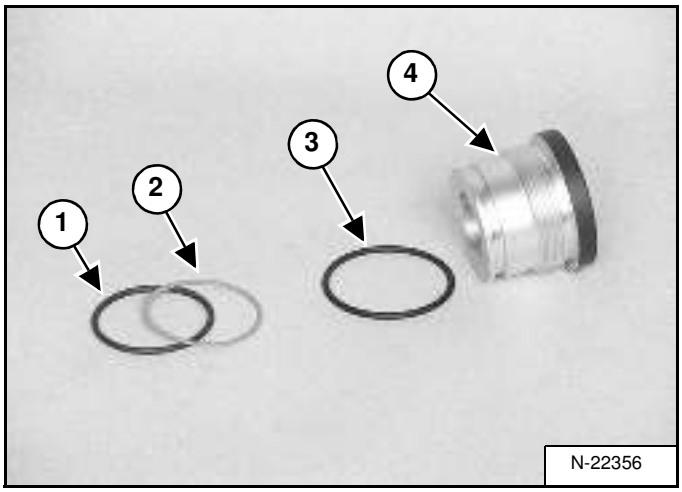


Standard Piston: Remove the back-up ring (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-21-11]**.

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Disassembly (Cont'd)

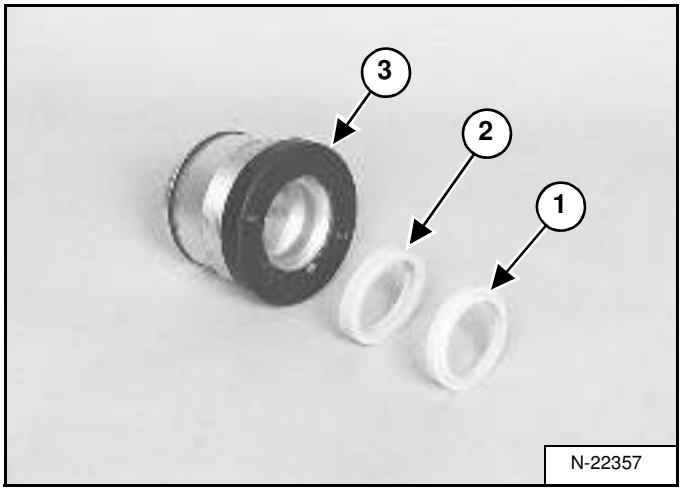
Figure 20-21-12



Remove the thick O-ring (Item 1) and the back-up washer (Item 2) from the groove in the head (Item 4) **[Figure 20-21-12]**.

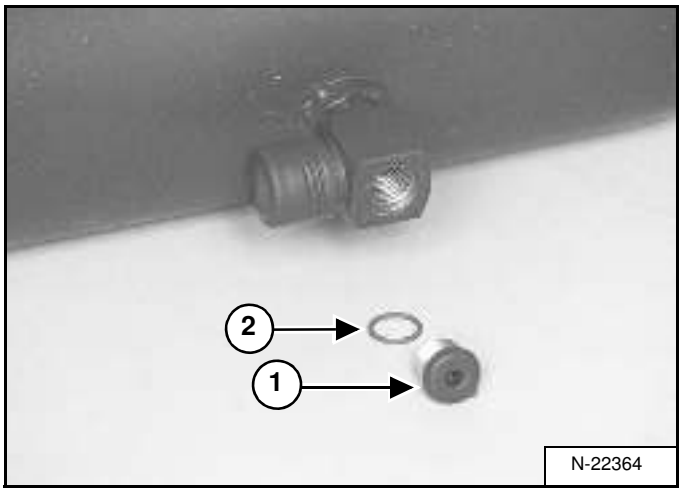
Remove the thin O-ring (Item 3) **[Figure 20-21-12]**.

Figure 20-21-13



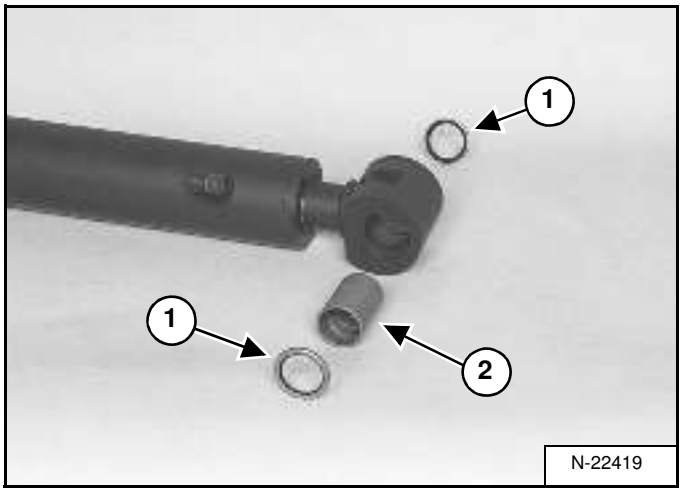
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-21-13]**.

Figure 20-21-14



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-21-14]**.

Figure 20-21-15



Remove the seals (Item 1) and bushing (Item 2) **[Figure 20-21-15]**.

Be sure grease zerks are functional.

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Assembly

Use the following tools to assemble the cylinder:

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

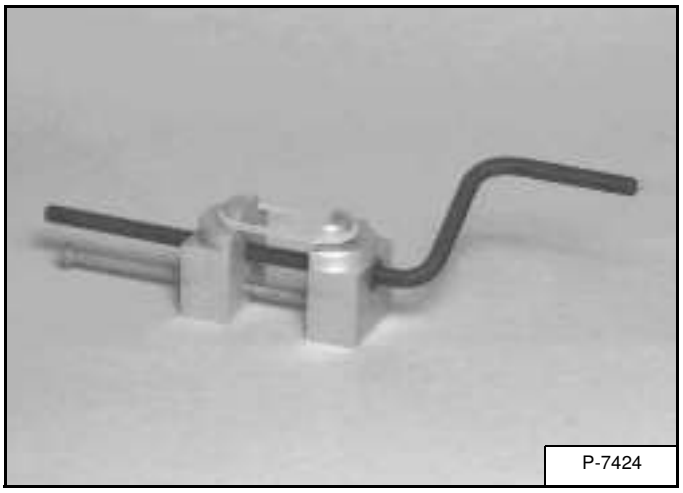
Wash the cylinder parts in solvent and air dry them.

Inspect the cylinder parts for nicks, scratches or other 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.

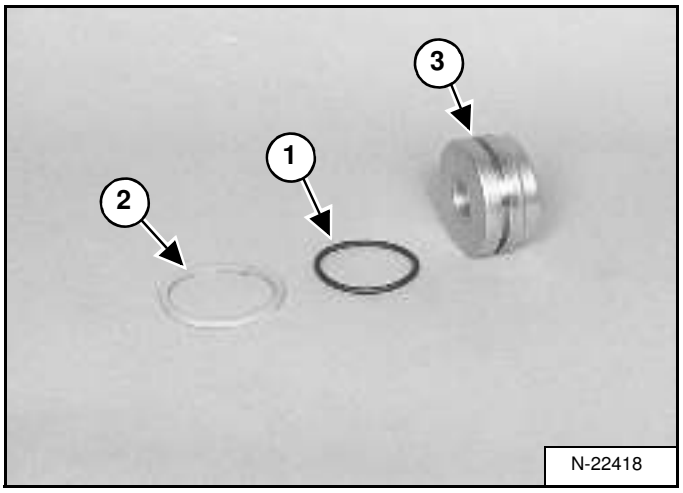
Figure 20-21-16



Install the new seal on the tool and slowly stretch it until it fits the piston **[Figure 20-21-16]**.

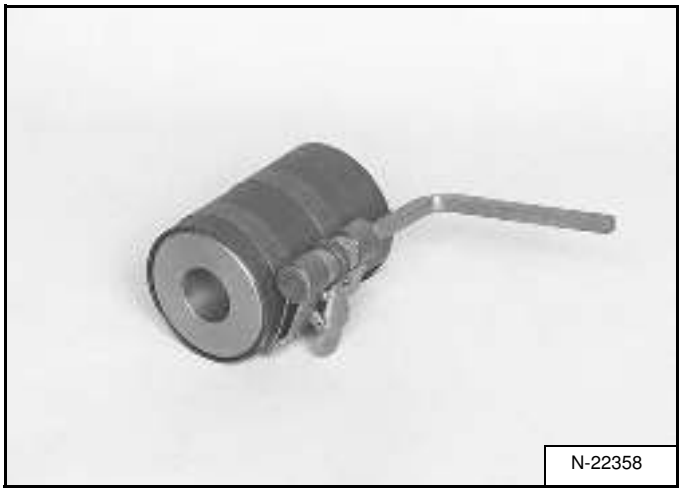
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-21-17



Standard Piston: Install the O-ring (Item 1) and back-up ring (Item 2) on the piston (Item 3) **[Figure 20-21-17]**.

Figure 20-21-18

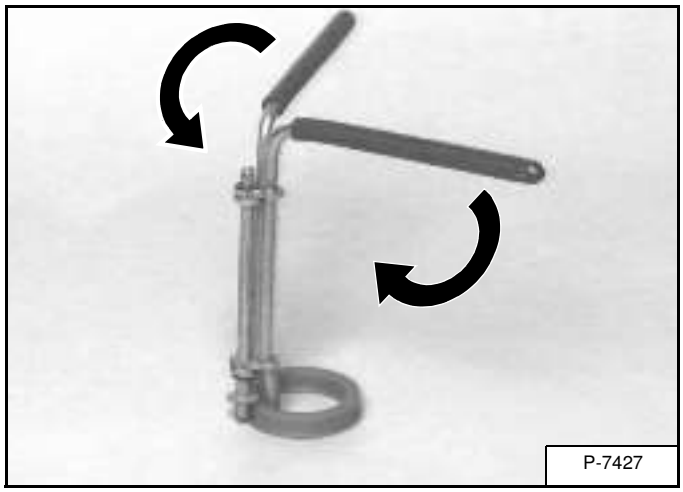


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-21-18]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-21-19

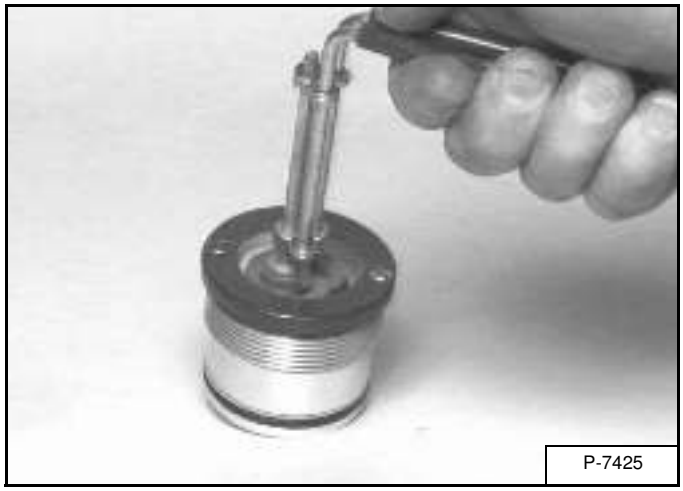


Install the rod seal on the rod seal tool **[Figure 20-21-19]**.

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

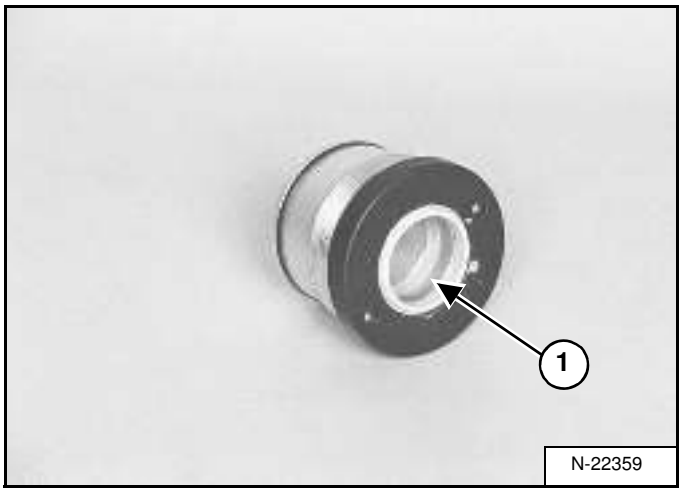
Rotate the handles to collapse the rod seal **[Figure 20-21-19]**.

Figure 20-21-20



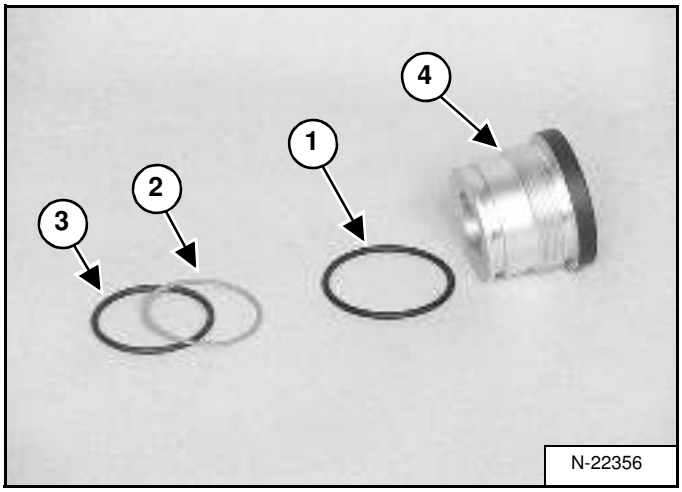
Install the rod seal in the head **[Figure 20-21-20]**.

Figure 20-21-21



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

Figure 20-21-22



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

Install the back-up washer (Item 2) and thick O-ring (Item 3) into the groove on the head (Item 4) **[Figure 20-21-22]**.

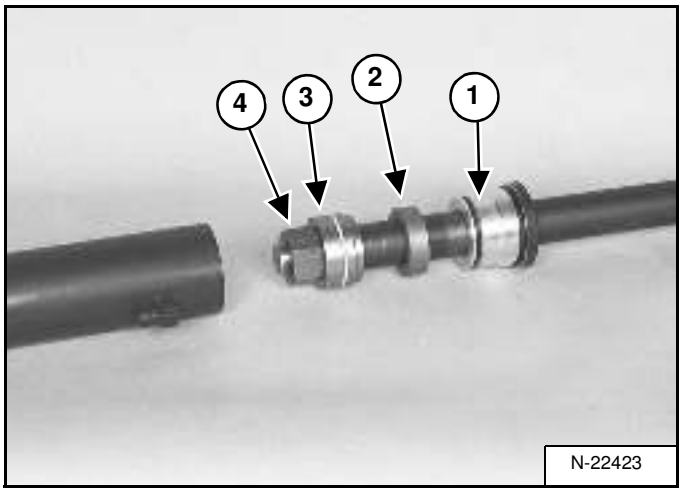
NOTE: Clean and dry the rod threads, from the kit install a NEW NUT with pre-applied LOCTITE.

Reclean thread area for LOCTITE residue.

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Assembly (Cont'd)

Figure 20-21-23



Install the head (Item 1), spacer (Item 2) and the piston (Item 3) **[Figure 20-21-23]**. Install the piston on the rod as shown.

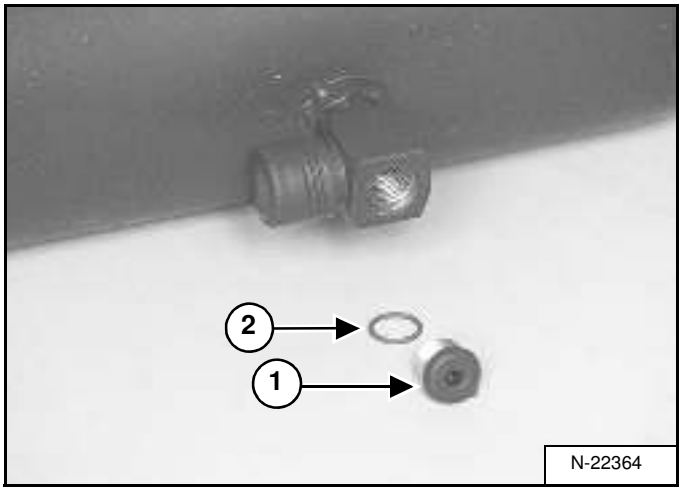
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

Install the nut (Item 4) **[Figure 20-21-23]**.

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

Figure 20-21-24

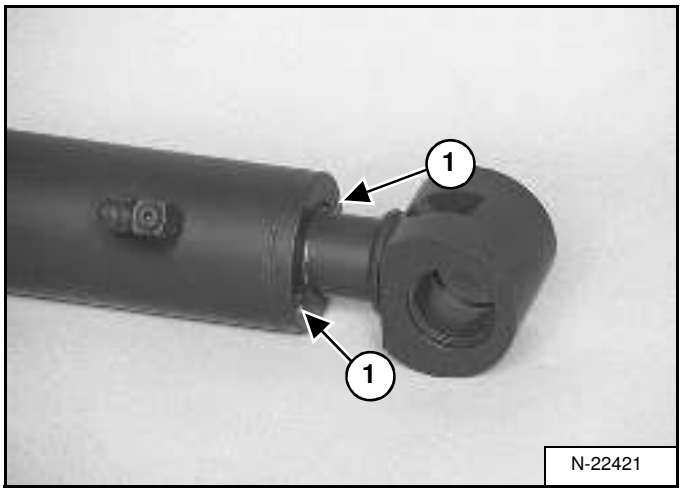


Install plug (Item 1) and O-ring (Item 2) **[Figure 20-21-24]**.

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

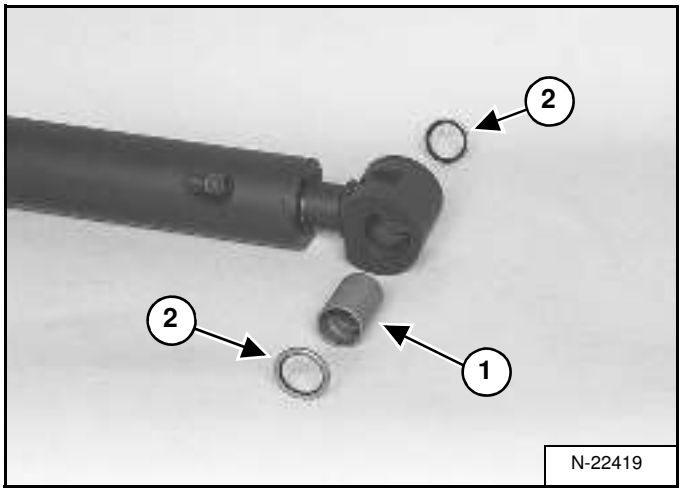
Put the base end of the hydraulic cylinder in a vise.

Figure 20-21-25



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-21-25]** to tighten the head. Head to be torqued until flush with end of tube assembly.

Figure 20-21-26



Install the bushing (Item 1) **[Figure 20-21-26]** and make sure the bushing is aligned with the grease channel in the cylinder

Install the seals (Item 2) **[Figure 20-21-26]** with the lips facing out.

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BOOM OFFSET CYLINDER

Checking The Boom Offset Cylinder

Figure 20-22-1

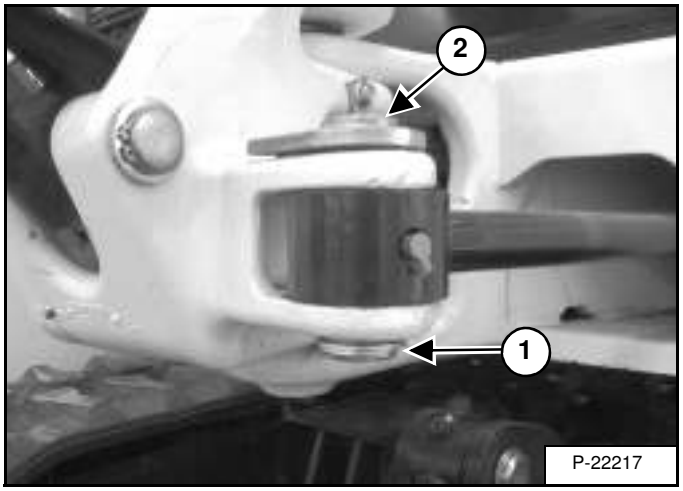


Lower the bucket and blade to the ground.

Stop the engine. Raise the control console.

Support the boom using a chain hoist **[Figure 20-22-1]**.

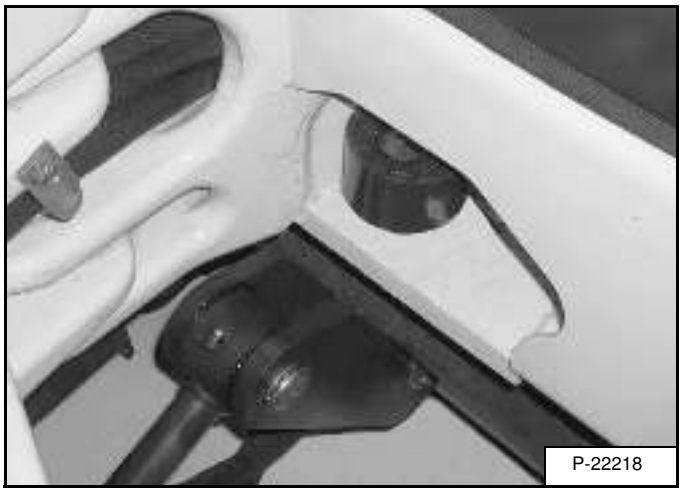
Figure 20-22-2



Remove the retaining ring (Item 1) **[Figure 20-22-2]** and washer.

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

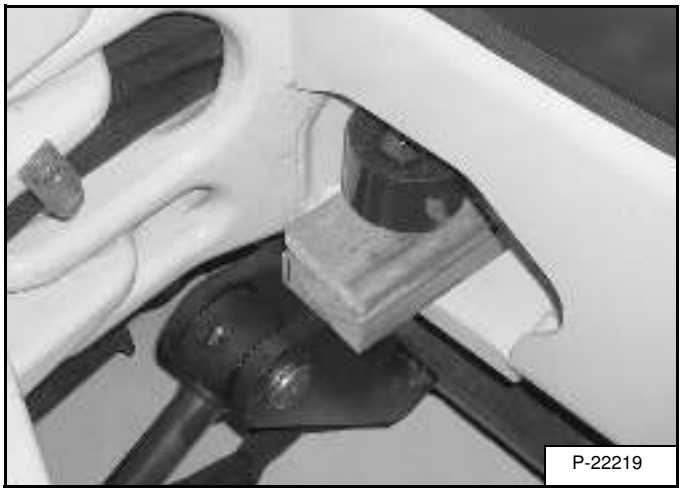
Figure 20-22-3



Lower the control console and fasten the seat belt. Start the engine and retract the swing cylinder **[Figure 20-22-3]**.

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

Figure 20-22-4



Support the rod end of the cylinder **[Figure 20-22-4]**.

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Checking The Boom Offset Cylinder (Cont'd)

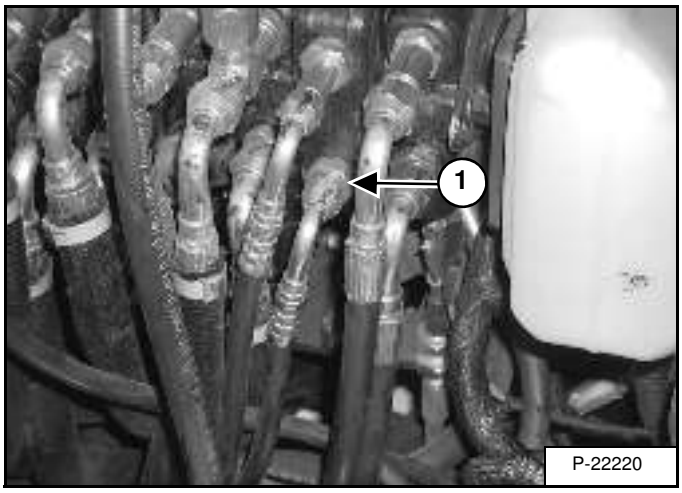
Open the right side cover.

⚠ 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.

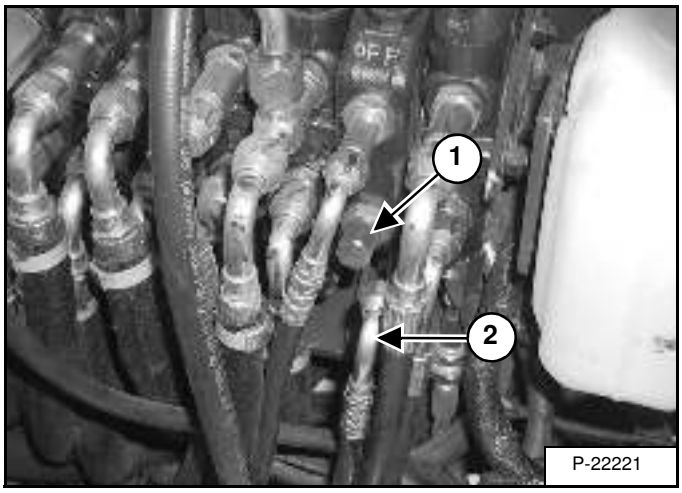
W-2145-0290

Figure 20-22-5



Disconnect the boom cylinder base end hose (Item 1) **[Figure 20-22-5]** at the hose tubeline connection.

Figure 20-22-6



Install a cap (Item 1) **[Figure 20-22-6]** on the control valve assembly fitting and tighten.

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

If there is any leakage from the base end hose (Item 2) **[Figure 20-22-6]** on the swing cylinder, remove the cylinder for repair or replacement.

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Removal And Installation

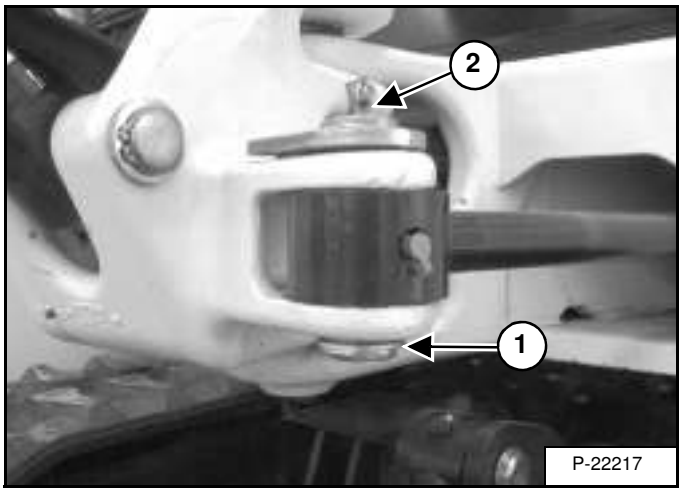
IMPORTANT

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

I-2003-0888

Remove the floor mat and floor pan. (See Removal And Installation on Page 40-110-1.)

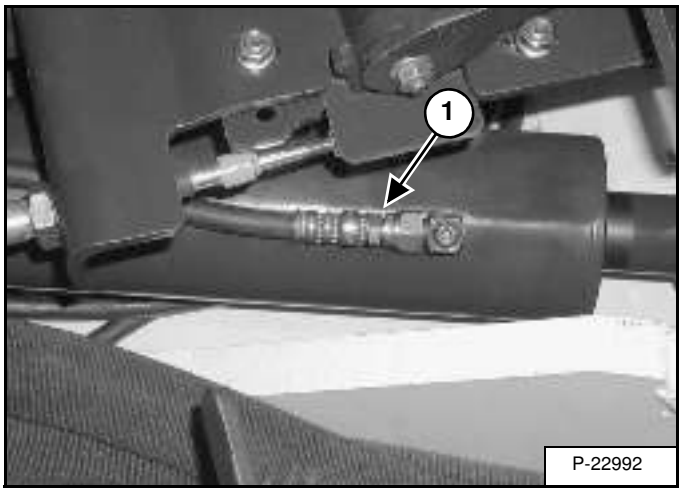
Figure 20-22-7



Remove the retaining ring (Item 1) **[Figure 20-22-7]** and washer.

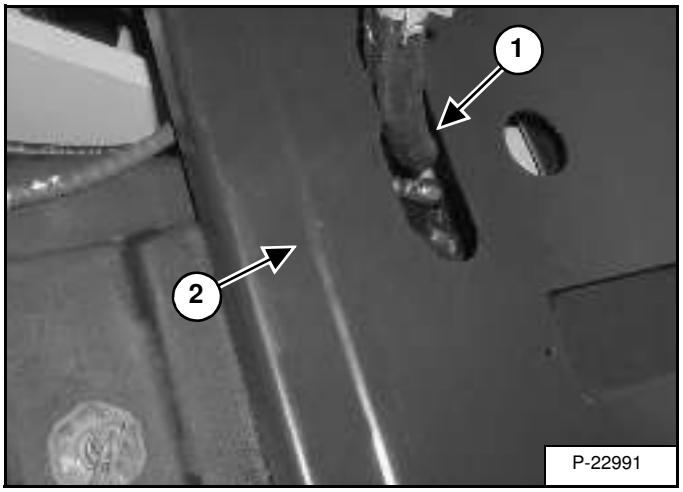
Remove the pivot pin (Item 2) **[Figure 20-22-7]**.

Figure 20-22-8



Remove the rod end hose (Item 1) **[Figure 20-22-8]** and orifice.

Figure 20-22-9



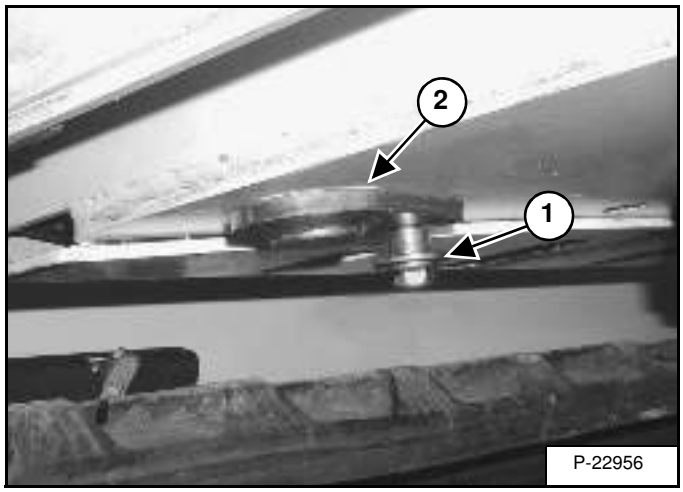
Remove the base end hose (Item 1) **[Figure 20-22-9]**.

NOTE: If the machine is equipped with a cab heater, access the base end hose from in front of the floor pan (Item 2) [Figure 20-22-9].

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Removal And Installation (Cont'd)

Figure 20-22-10



Remove the bolt, washer and spacer (Item 1) **[Figure 20-22-10]**.

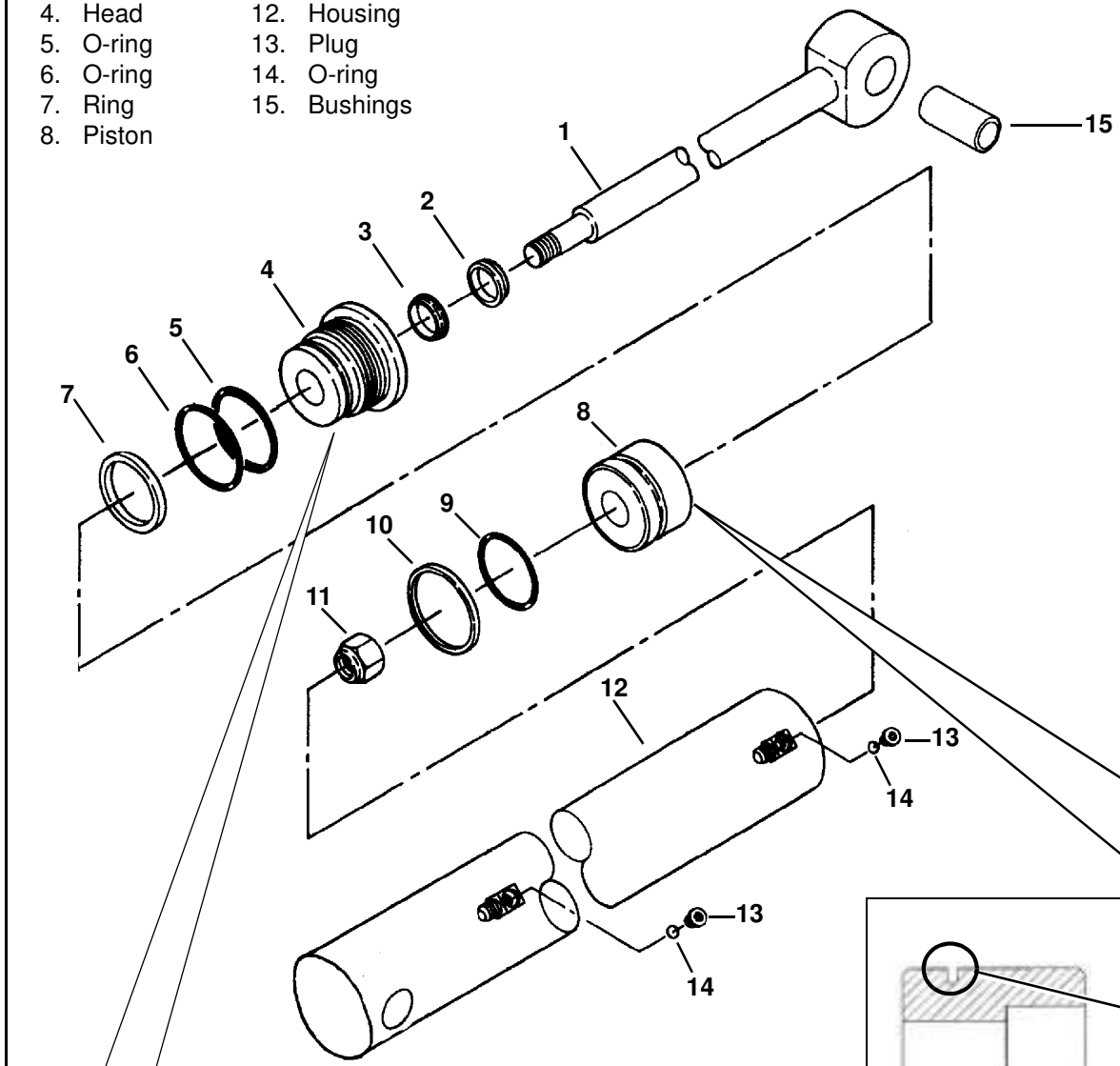
Remove the pivot pin (Item 2) **[Figure 20-22-10]**.

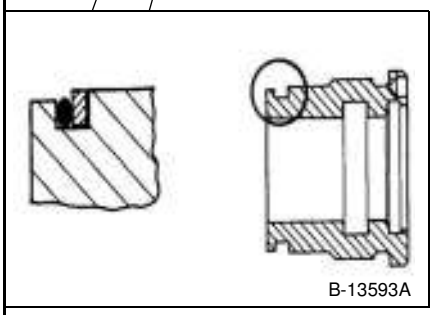
Remove the cylinder.

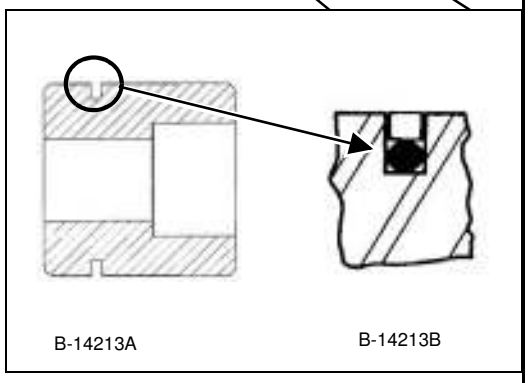
Dealer Copy -- Not for Resale

Parts Identification

1. Rod
2. Seal
3. Seal
4. Head
5. O-ring
6. O-ring
7. Ring
8. Piston
9. O-ring
10. Ring
11. Nut
12. Housing
13. Plug
14. O-ring
15. Bushings







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Dealer Copy -- Not for Resale

Disassembly

Use the following tools to disassemble the cylinder:

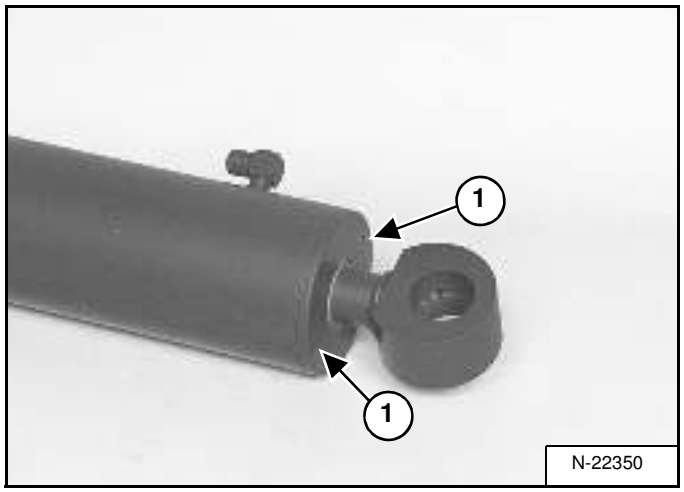
MEL1074 - O-ring Seal Hook
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

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.

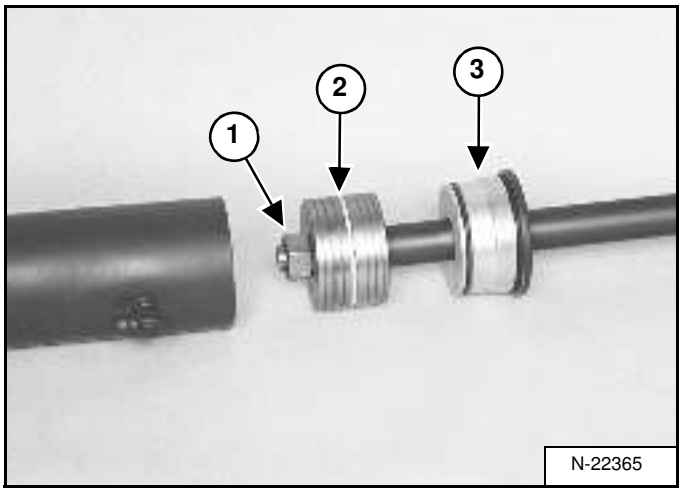
Be careful not to damage the cylinder tube.

Figure 20-22-11



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-22-11]** to loosen the head.

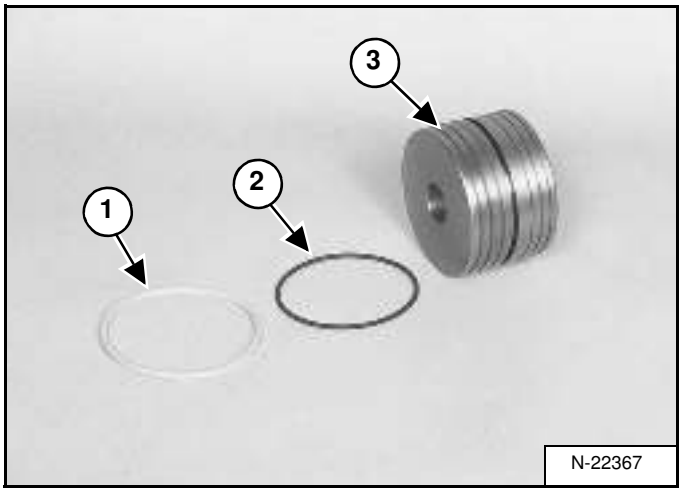
Figure 20-22-12



Remove the head and rod assembly from the cylinder **[Figure 20-22-12]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-22-12]**.

Figure 20-22-13

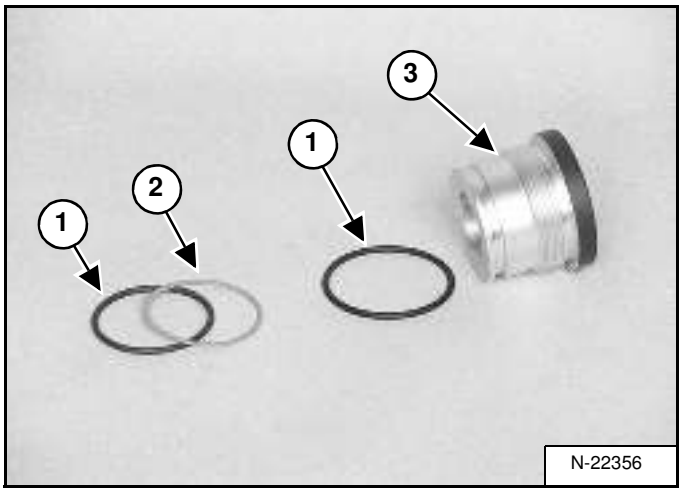


Cushion Piston: Remove the back-up ring (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-22-13]**.

Dealer Copy -- Not for Resale

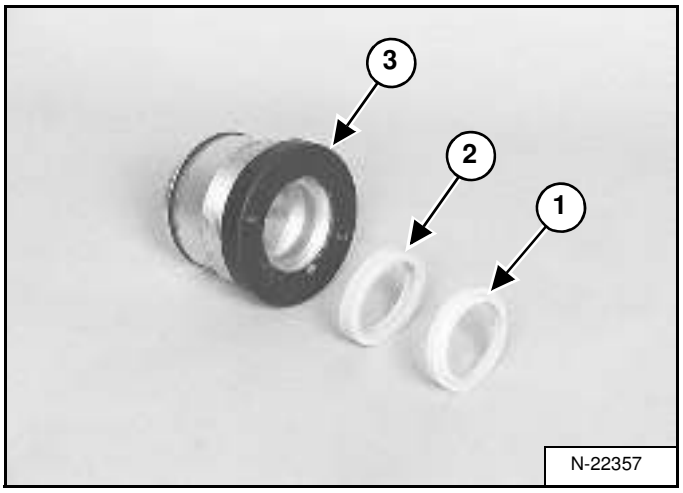
Disassembly (Cont'd)

Figure 20-22-14



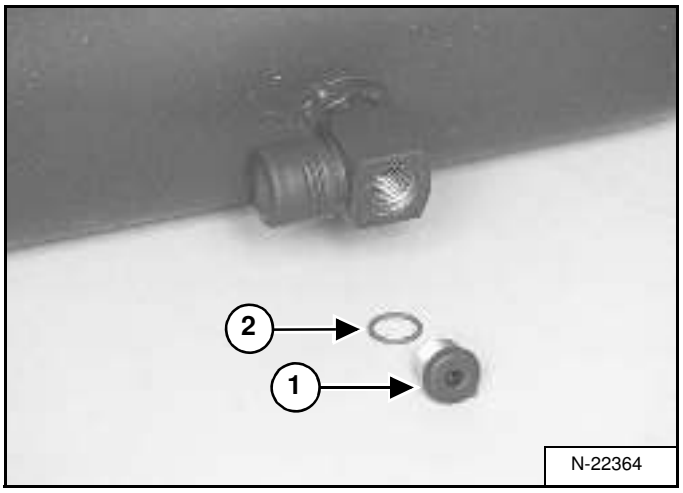
Remove the O-rings (Item 1) and the back-up washer (Item 2) from the head (Item 3) **[Figure 20-22-14]**.

Figure 20-22-15



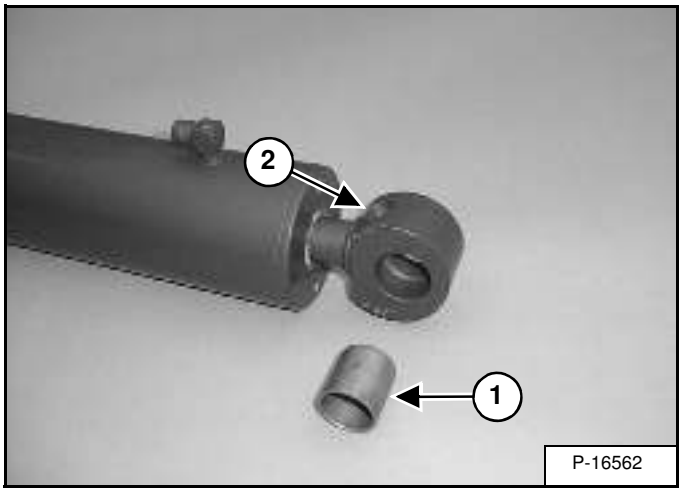
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-22-15]**.

Figure 20-22-16



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-22-16]**.

Figure 20-22-17



Remove the bushing (Item 1) **[Figure 20-22-17]**.

Inspect the condition of the grease fitting (Item 2) **[Figure 20-22-17]**.

Dealer Copy -- Not for Resale

Assembly

Use the following tools to assemble the cylinder:

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

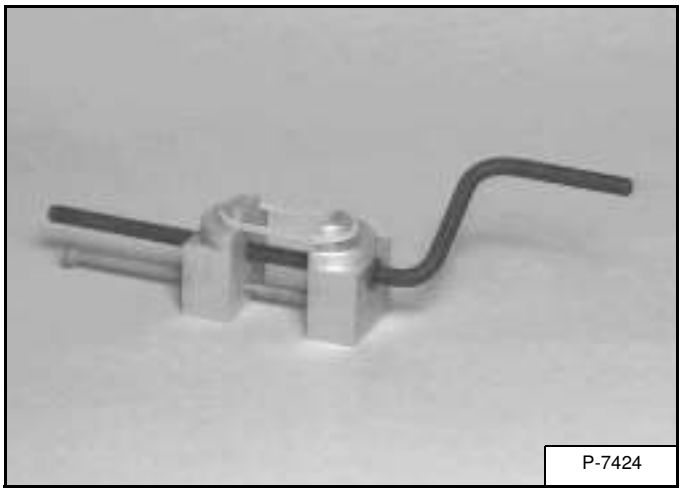
Wash the cylinder parts in solvent and air dry them.

Inspect the cylinder parts for nicks, scratches or other 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.

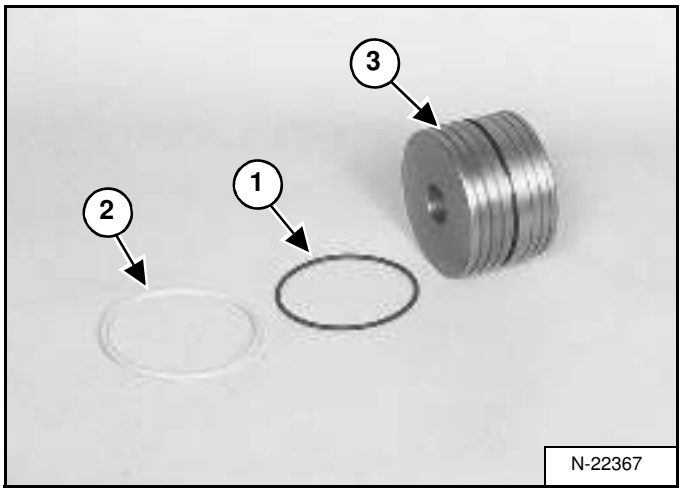
Figure 20-22-18



Install the new seal on the tool and slowly stretch it until it fits the piston **[Figure 20-22-18]**.

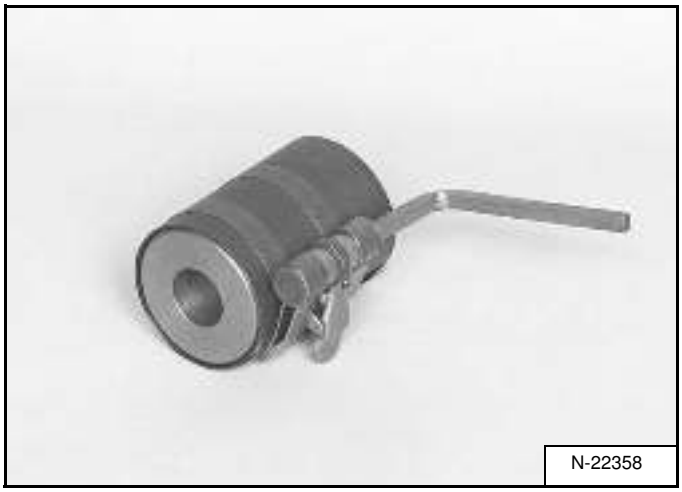
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-22-19



Cushion Piston: Install the O-ring (Item 1) and back-up ring (Item 2) on the piston (Item 3) **[Figure 20-22-19]**.

Figure 20-22-20

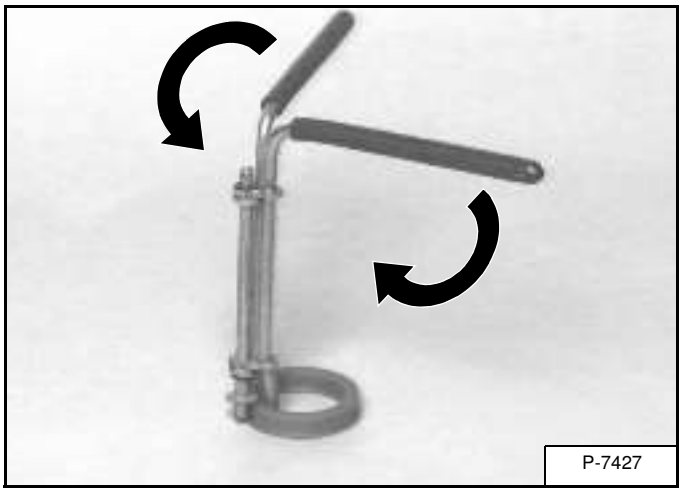


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-22-20]**.

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Assembly (Cont'd)

Figure 20-22-21

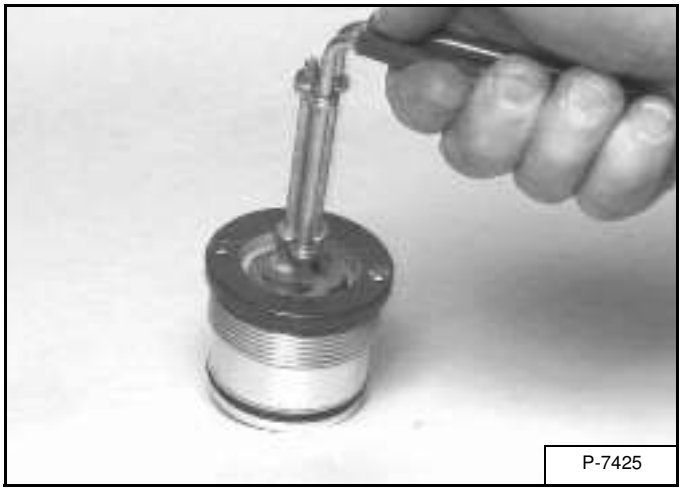


Install the rod seal on the rod seal tool **[Figure 20-22-21]**.

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

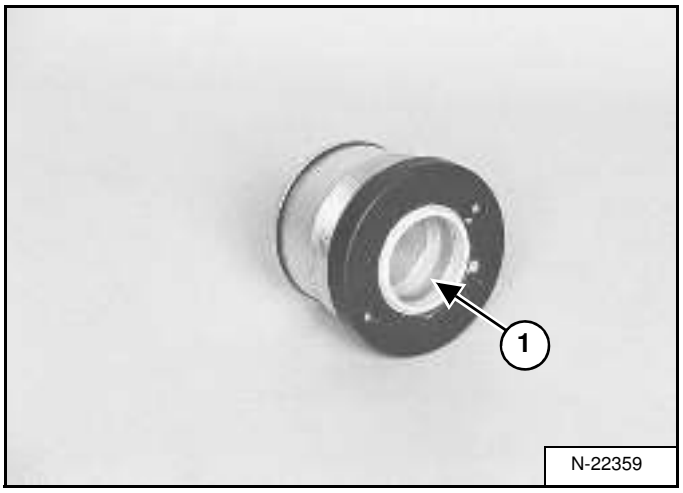
Rotate the handles to collapse the rod seal **[Figure 20-22-21]**.

Figure 20-22-22



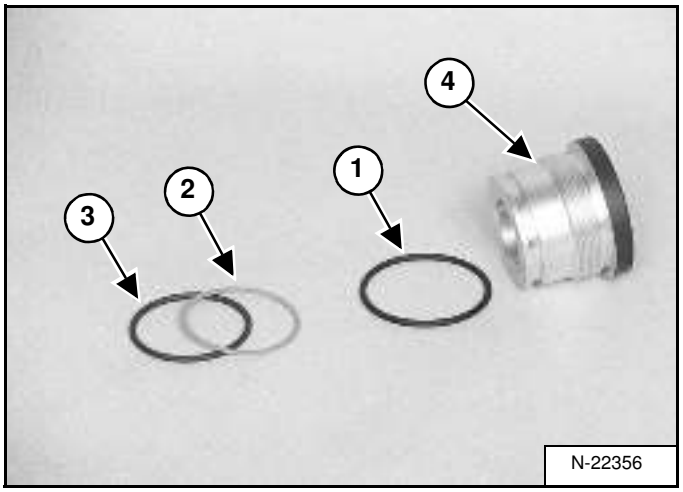
Install the rod seal in the head **[Figure 20-22-22]**.

Figure 20-22-23



Install the wiper seal with the wiper (Item 1) **[Figure 20-22-23]** toward the outside of the head.

Figure 20-22-24



Install the thin O-ring (Item 1) **[Figure 20-22-24]**.

Install the back-up washer (Item 2) and thick O-ring (Item 3) into the groove on the head (Item 4) **[Figure 20-22-24]**.

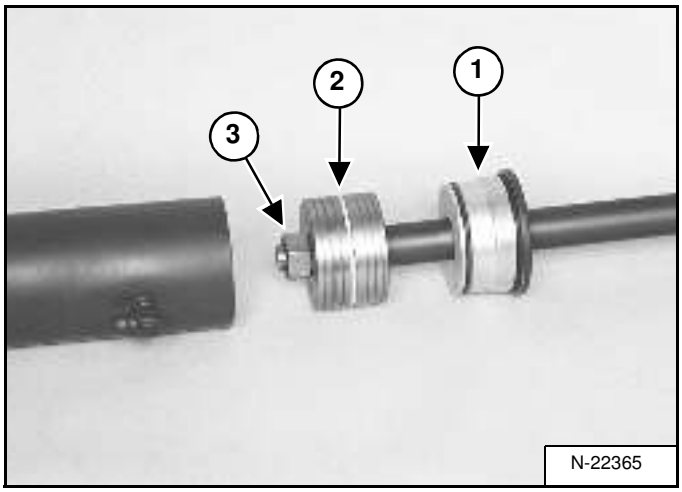
NOTE: Clean and dry the rod threads, from the kit install a NEW NUT with pre-applied LOCTITE.

Reclean thread area for LOCTITE residue.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-22-25



Install the head (Item 1) and the piston (Item 2) **[Figure 20-22-25]**. Install the piston on the rod as shown.

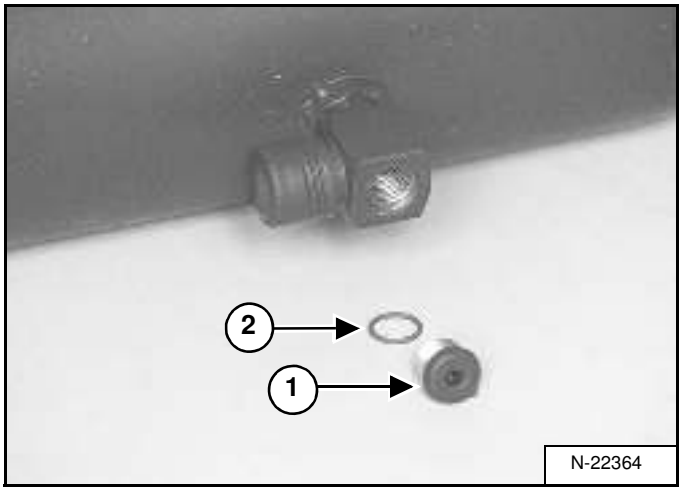
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-22-25]**.

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

Figure 20-22-26



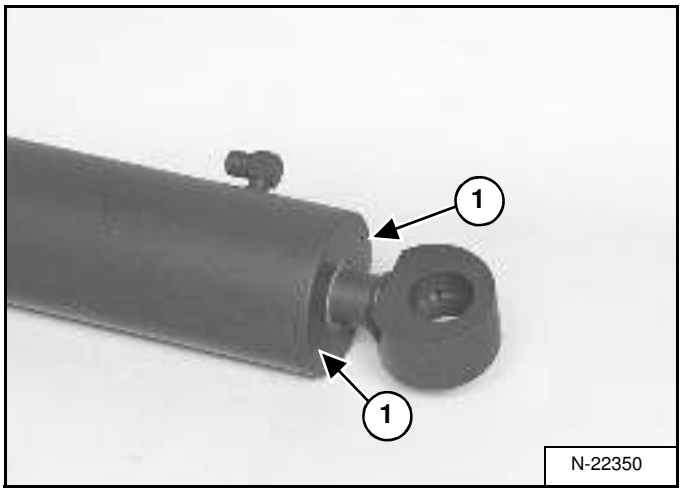
Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-22-26]**.

Tighten the plug to 15 ft.-lbs. (20,34 Nm) torque.

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

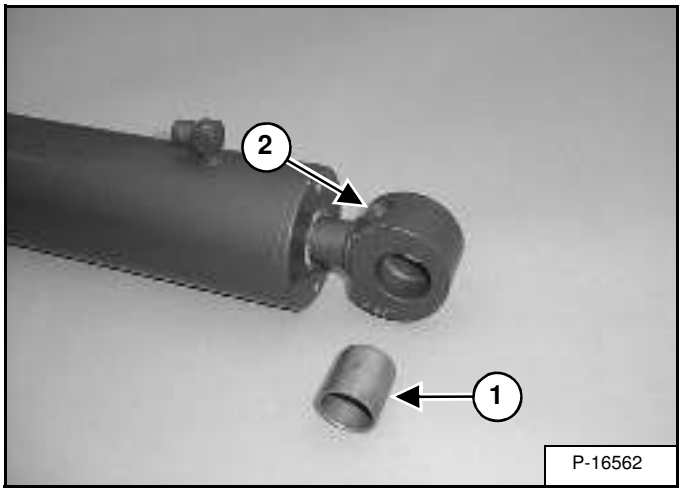
Be careful not to damage the cylinder tube.

Figure 20-22-27



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-22-27]** to tighten the head. Head to be torqued until flush with end of tube assembly.

Figure 20-22-28



Install the bushing (Item 1) **[Figure 20-22-28]** and make sure the bushing is aligned with the grease channel in the cylinder.

Inspect the condition of the grease fitting (Item 2) **[Figure 20-22-28]**.

Dealer Copy -- Not for Resale

BUCKET CYLINDER

Checking The Bucket Cylinder

Figure 20-23-1

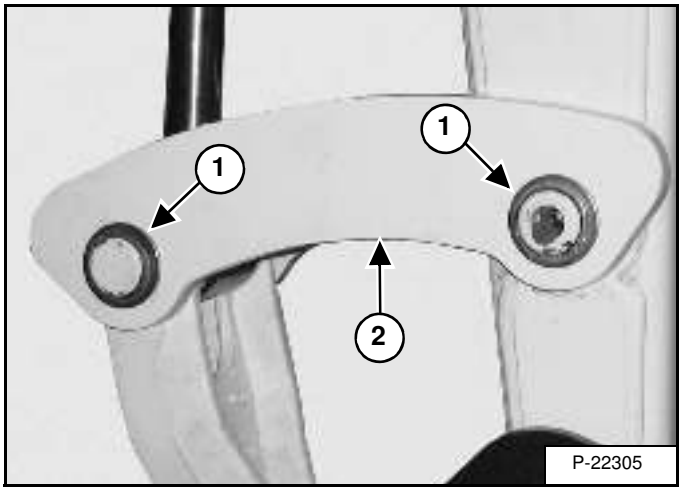


Lower the bucket and blade to the ground.

Stop the engine. Raise the control console.

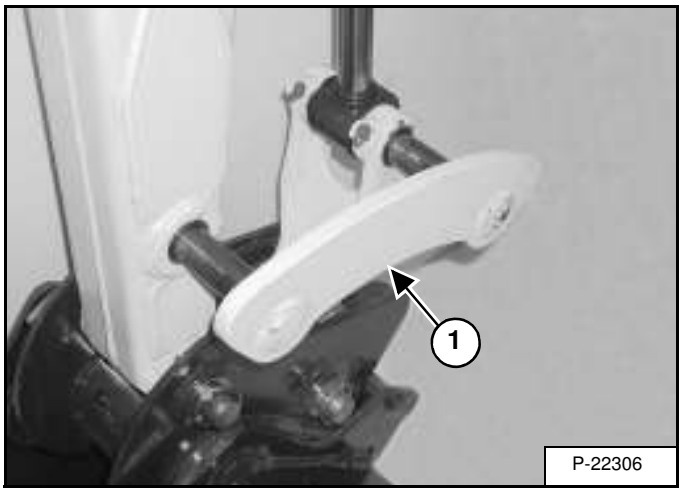
Support the boom using a chain hoist **[Figure 20-23-1]**.

Figure 20-23-2



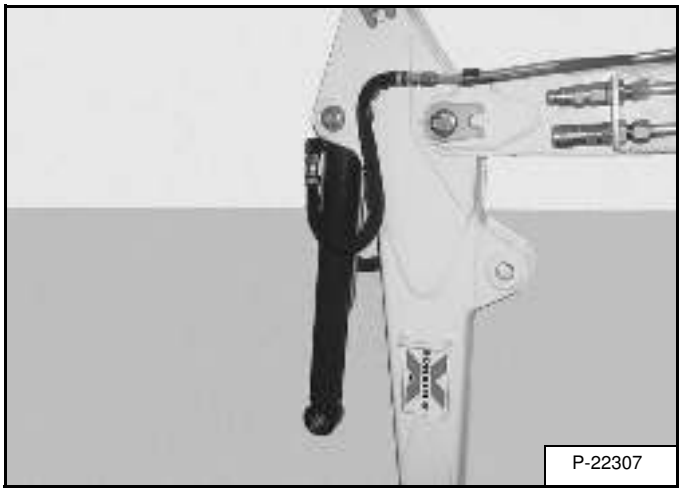
Remove the retaining rings (Item 1), washers and plate (Item 2) **[Figure 20-23-2]**.

Figure 20-23-3



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

Figure 20-23-4



Lower the control console and fasten the seat belt. Start the engine and retract the bucket cylinder **[Figure 20-23-4]**.

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

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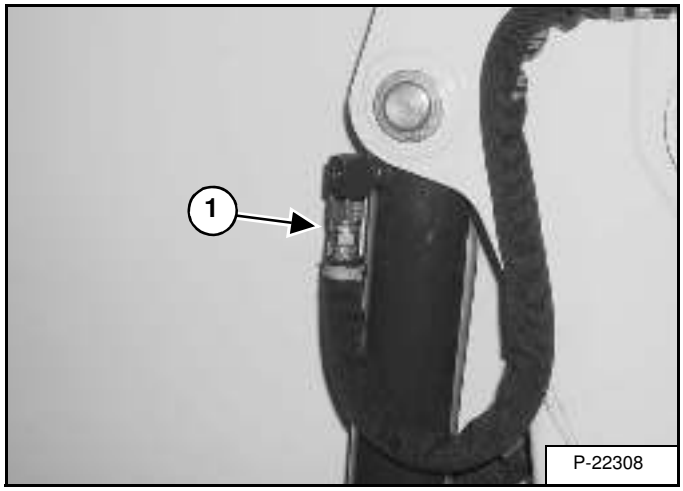
Checking The Bucket Cylinder (Cont'd)

⚠ 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.

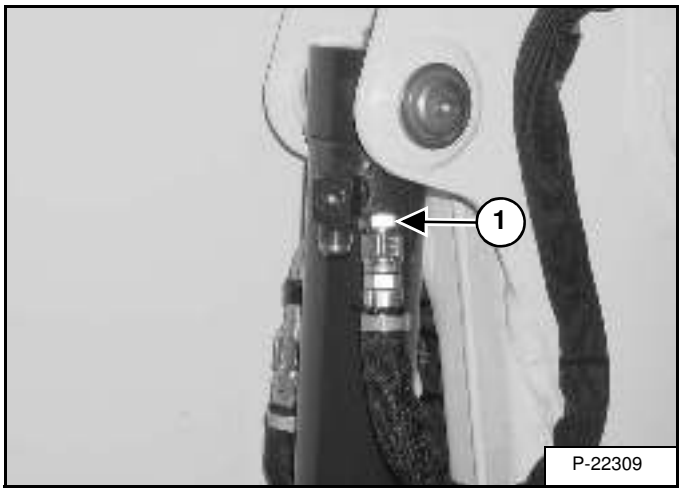
W-2145-0290

Figure 20-23-5



Disconnect the bucket cylinder base end hose (Item 1) **[Figure 20-23-5]**.

Figure 20-23-6



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

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

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

Dealer Copy -- Not for Resale

Removal And Installation

Put the bucket on the floor. Stop the engine.

Move the hydraulic controls to release the hydraulic pressure.

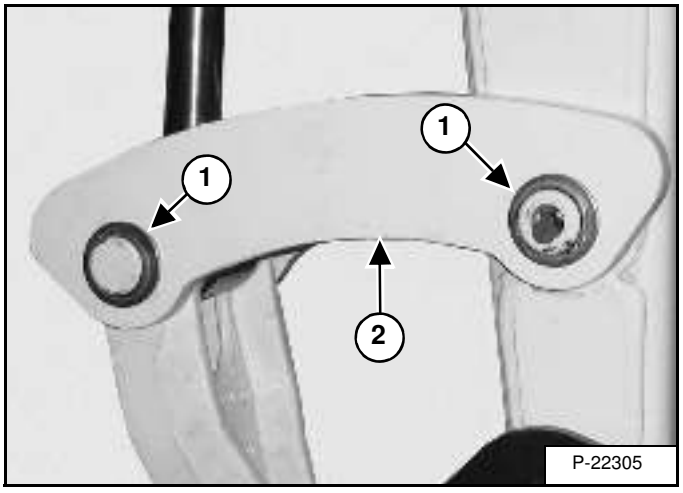
IMPORTANT

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

I-2003-0888

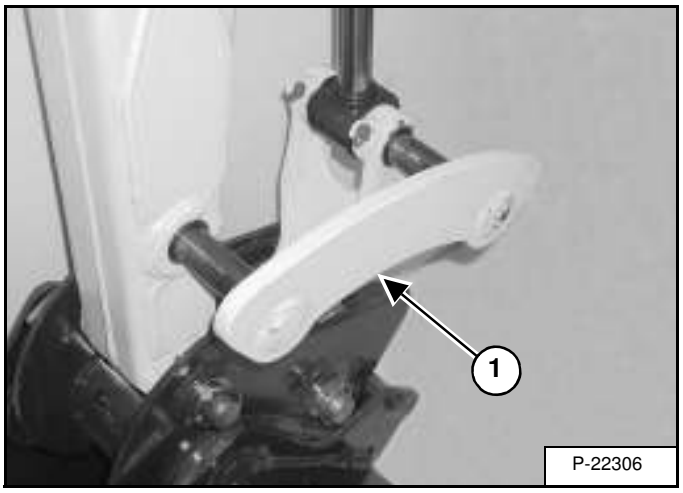
Install a chain hoist to the boom lift point.

Figure 20-23-7



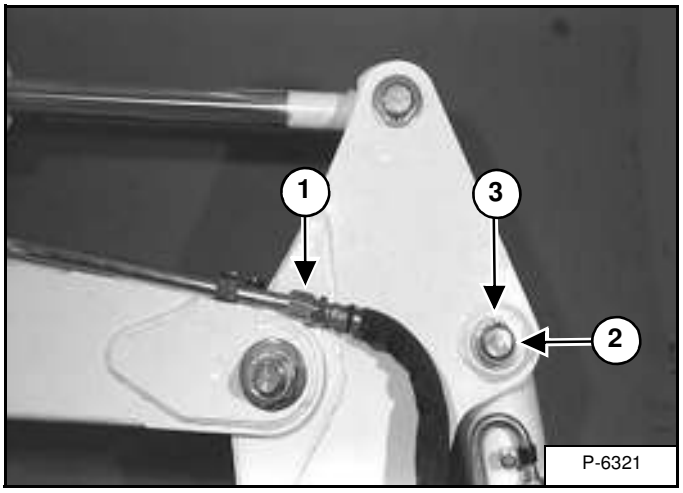
Remove the retaining rings (Item 1), washers and plate (Item 2) **[Figure 20-23-7]**.

Figure 20-23-8



Remove the link (Item 1) **[Figure 20-23-8]**.

Figure 20-23-9



Disconnect the two hoses (Item 1) **[Figure 20-23-9]** from the bucket cylinder.

Remove the snap ring (Item 2) and washer (Item 3) **[Figure 20-23-9]** from the cylinder base end pin.

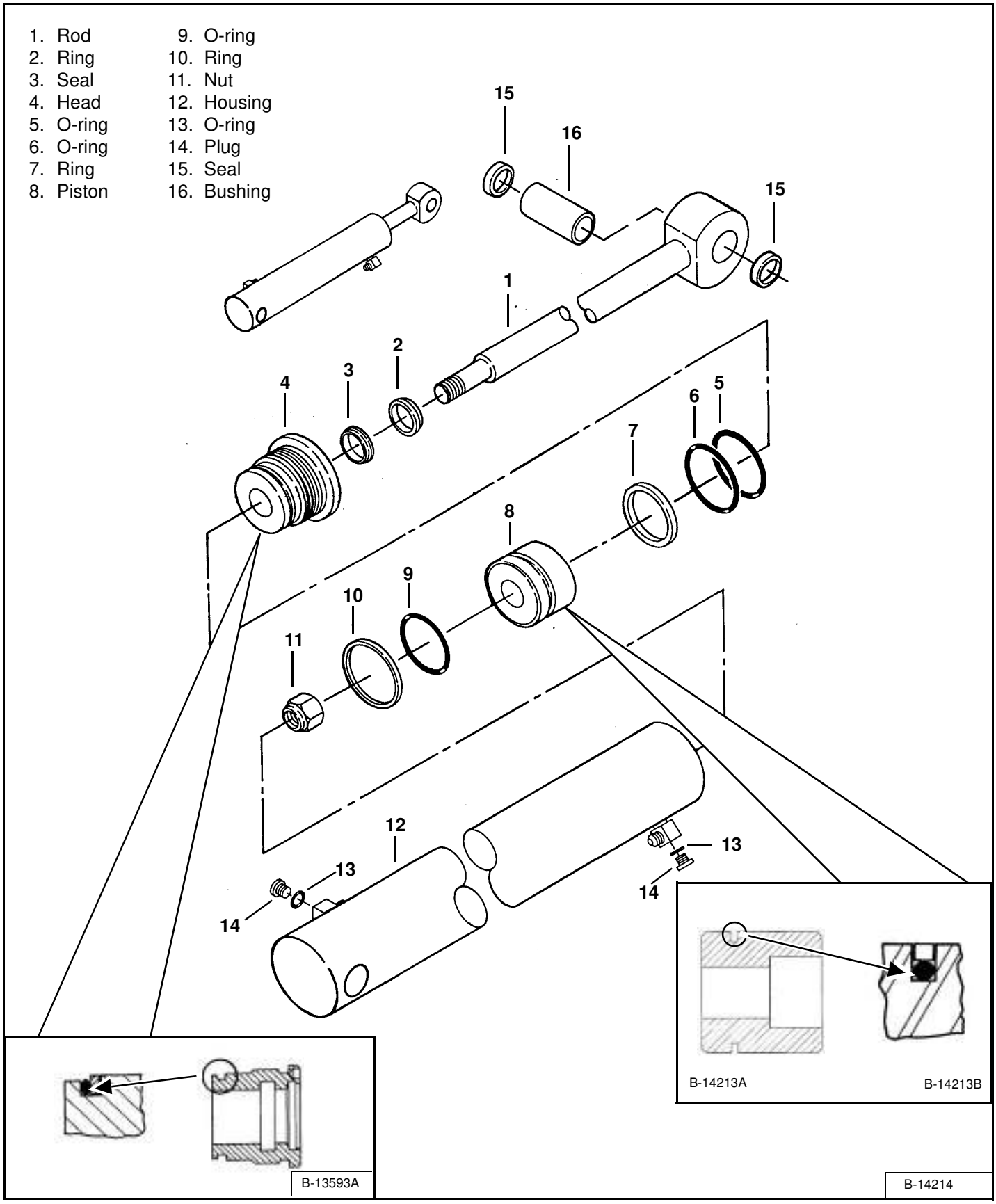
Remove the cylinder base end pin.

Remove the bucket cylinder.

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Parts Identification

1. Rod
2. Ring
3. Seal
4. Head
5. O-ring
6. O-ring
7. Ring
8. Piston
9. O-ring
10. Ring
11. Nut
12. Housing
13. O-ring
14. Plug
15. Seal
16. Bushing



Dealer Copy -- Not for Resale

Disassembly

Use the following tools to disassemble the cylinder:

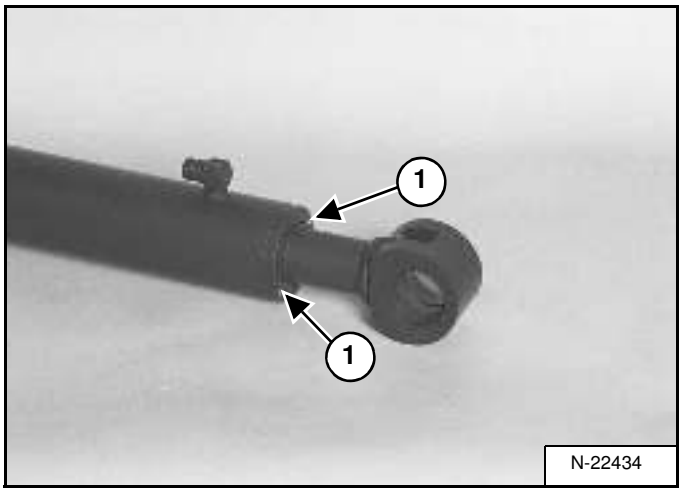
MEL1074 - O-ring Seal Hook
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

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.

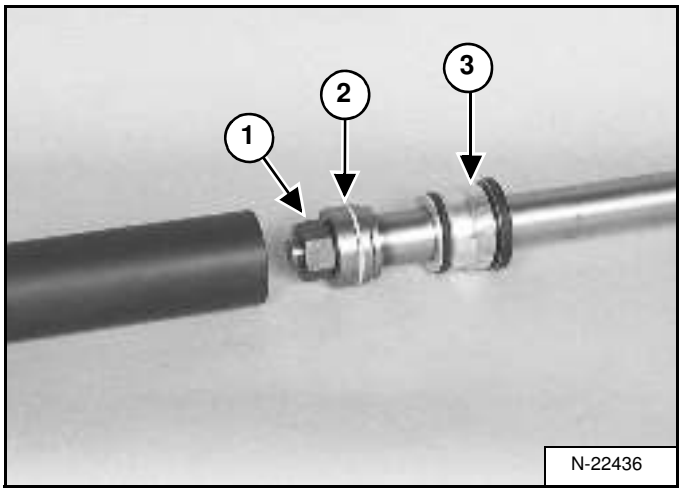
Be careful not to damage the cylinder tube.

Figure 20-23-10



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-23-10]** to loosen the head.

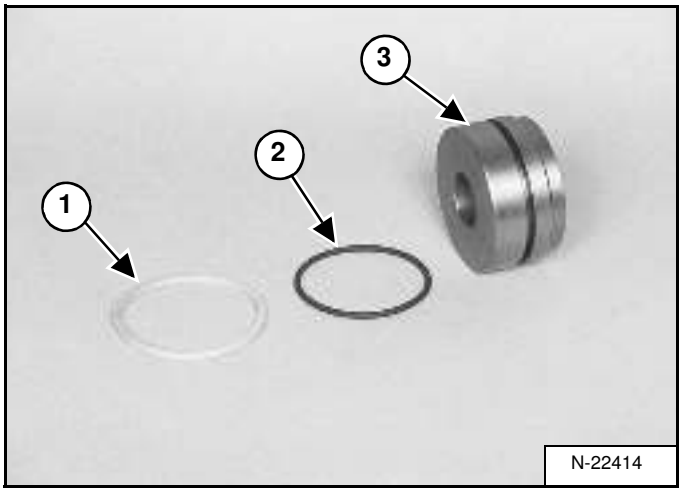
Figure 20-23-11



Remove the head and the rod assembly from the cylinder **[Figure 20-23-11]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-23-11]**.

Figure 20-23-12

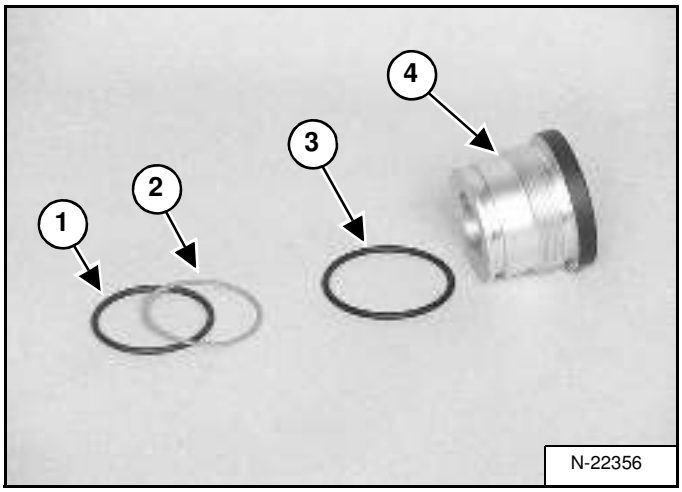


Standard Piston: Remove the back-up (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-23-12]**.

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Disassembly (Cont'd)

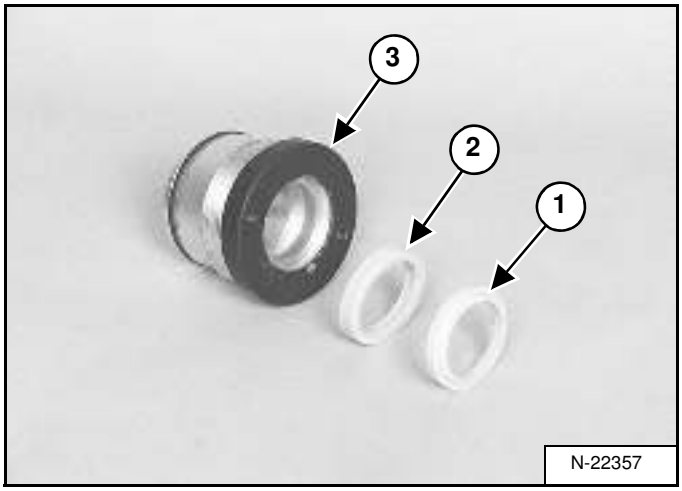
Figure 20-23-13



Remove the thick O-ring (Item 1) and the back-up washer (Item 2) from the groove in the head (Item 4) **[Figure 20-23-13]**.

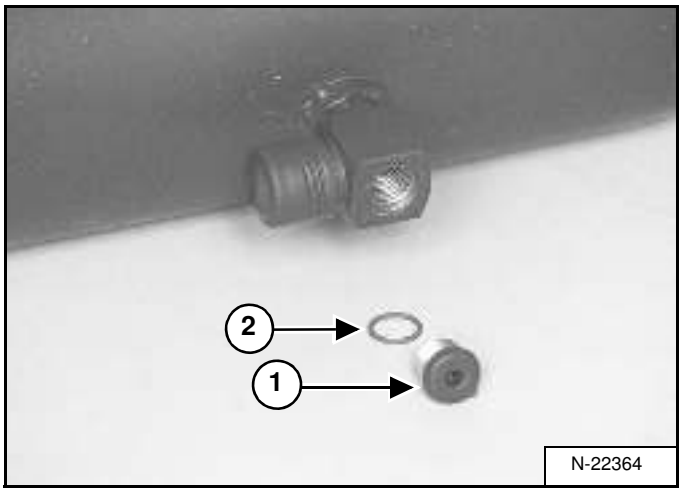
Remove the thin O-ring (Item 3) **[Figure 20-23-13]**.

Figure 20-23-14



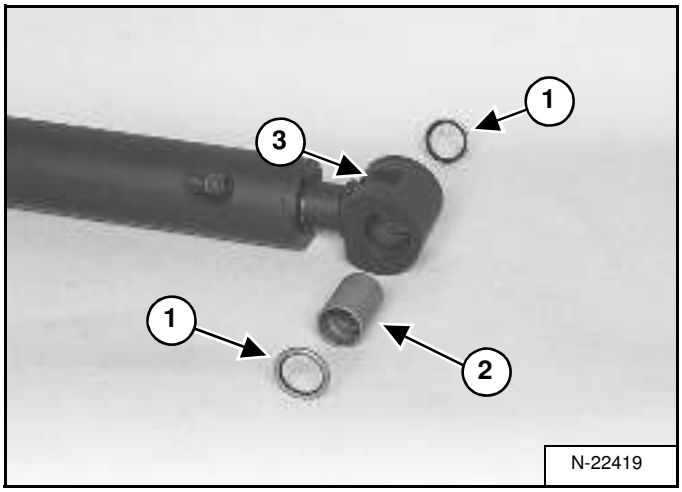
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-23-14]**.

Figure 20-23-15



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-23-15]**.

Figure 20-23-16



Remove the seals (Item 1) and bushing (Item 2) **[Figure 20-23-16]**.

Inspect the condition of the grease zerk (Item 3) **[Figure 20-23-16]**.

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Assembly

Use the following tools to assemble the cylinder:

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

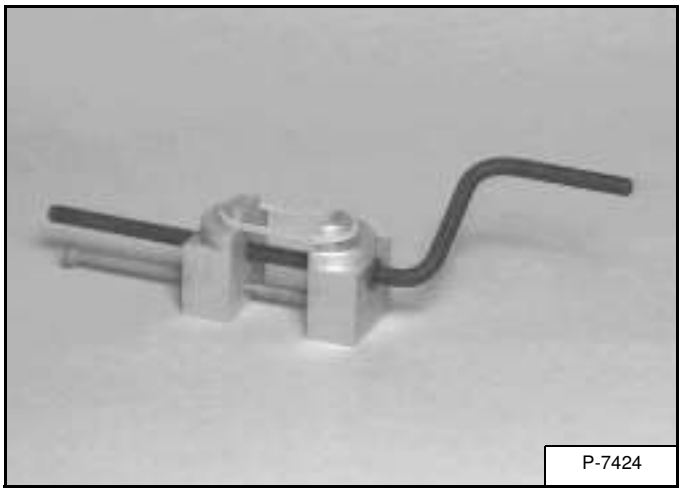
Wash the cylinder parts in solvent and air dry them.

Inspect the cylinder parts for nicks, scratches or other 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.

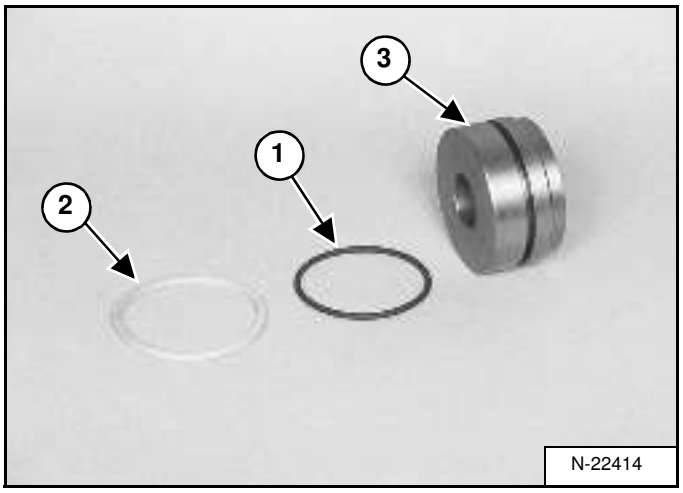
Figure 20-23-17



Install the new seal on the tool and slowly stretch it until it fits the piston **[Figure 20-23-17]**.

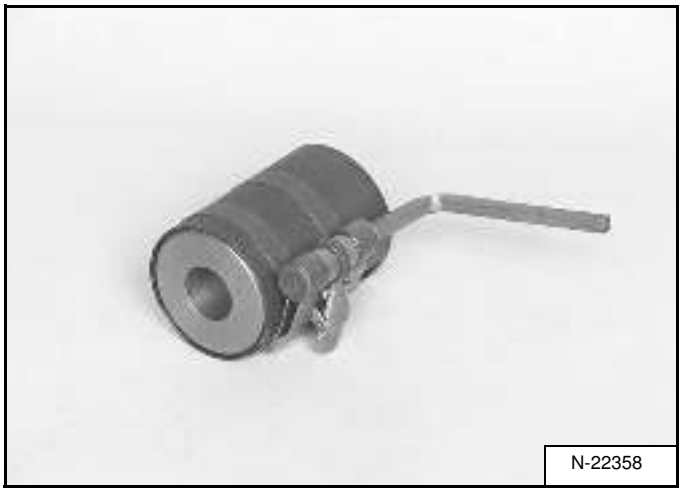
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-23-18



Standard Piston: Install the O-ring (Item 1) and back-up ring (Item 2) on the piston (Item 3) **[Figure 20-23-18]**.

Figure 20-23-19

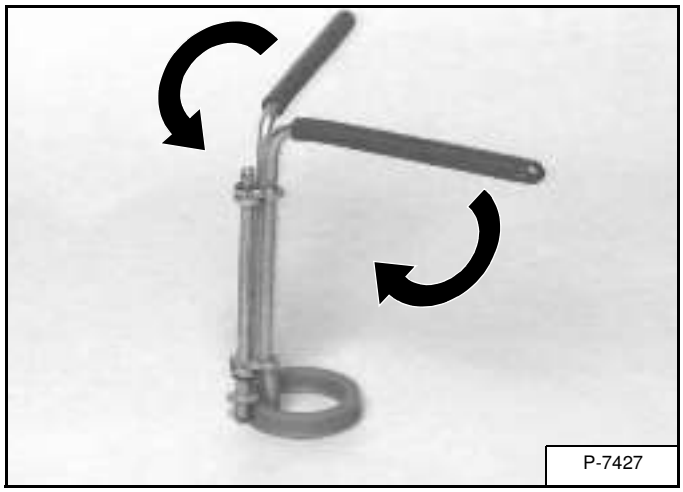


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-23-19]**.

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Assembly (Cont'd)

Figure 20-23-20

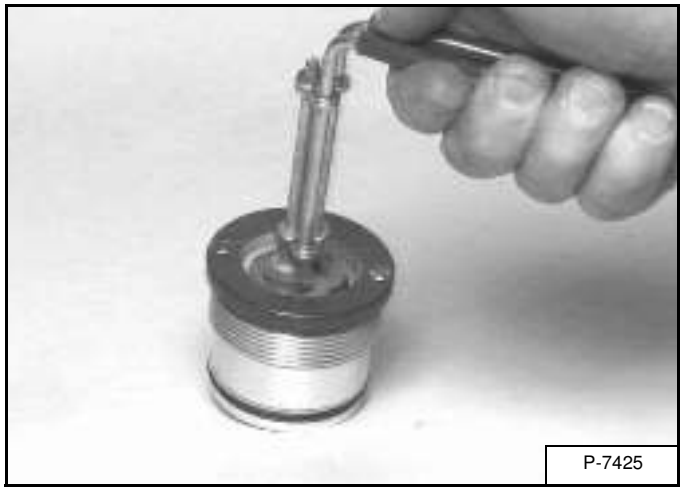


Install the rod seal on the rod seal tool **[Figure 20-23-20]**.

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

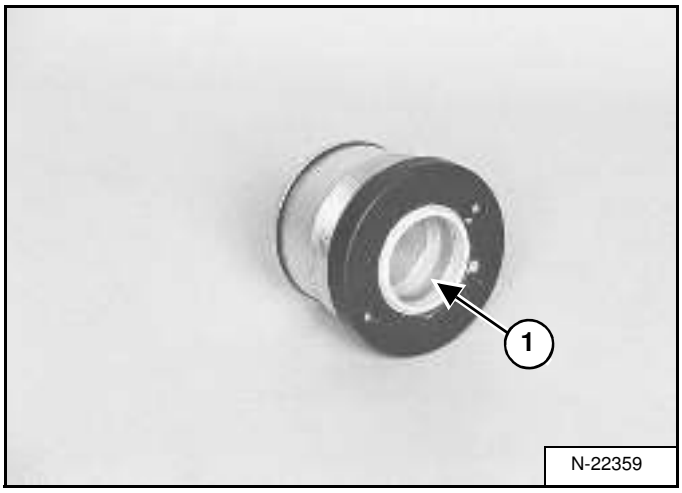
Rotate the handles to collapse the rod seal **[Figure 20-23-20]**.

Figure 20-23-21



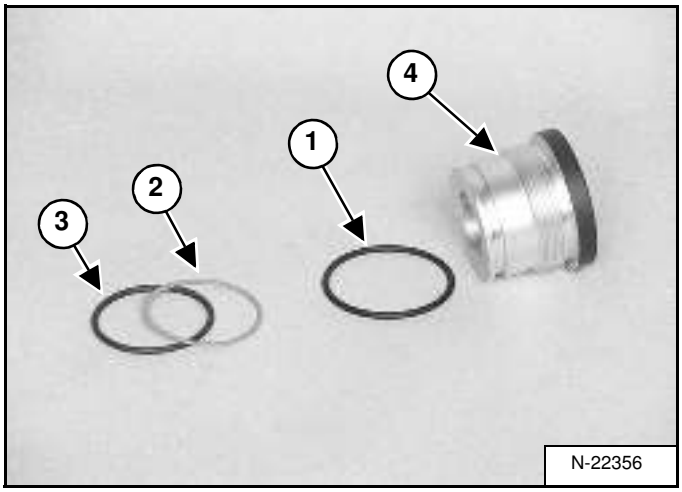
Install the rod seal in the head **[Figure 20-23-21]**.

Figure 20-23-22



Install the wiper seal with the wiper (Item 1) **[Figure 20-23-22]** toward the outside of the head.

Figure 20-23-23



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

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

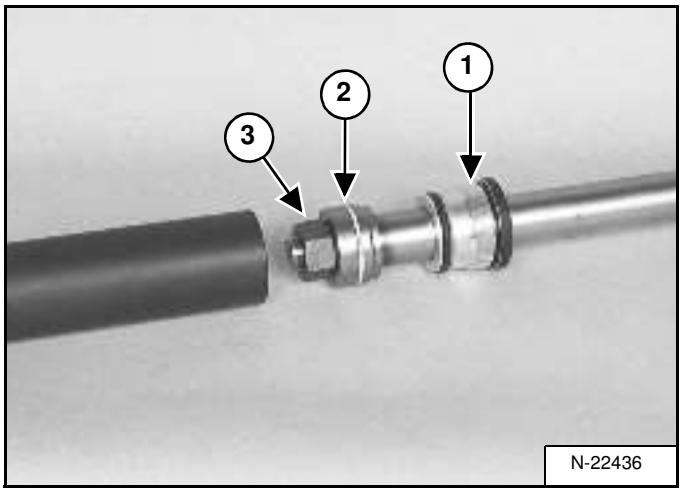
NOTE: Clean and dry the rod threads, from the kit install a NEW NUT with pre-applied LOCTITE.

Reclean thread area for LOCTITE residue.

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Assembly (Cont'd)

Figure 20-23-24



Install the head (Item 1) and the piston (Item 2) **[Figure 20-23-24]**. Install the piston on the rod as shown.

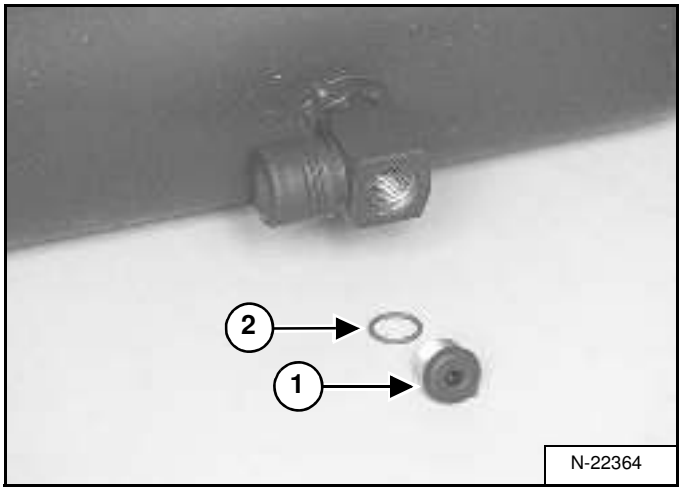
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-23-24]**.

Tighten the nut to 600 ft.-lbs. (813 Nm) torque.

Figure 20-23-25



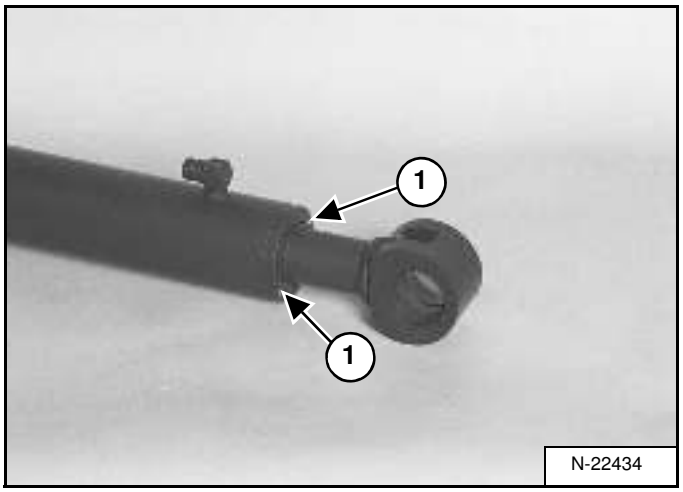
Install plug (Item 1) and O-ring (Item 2) **[Figure 20-23-25]**.

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

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

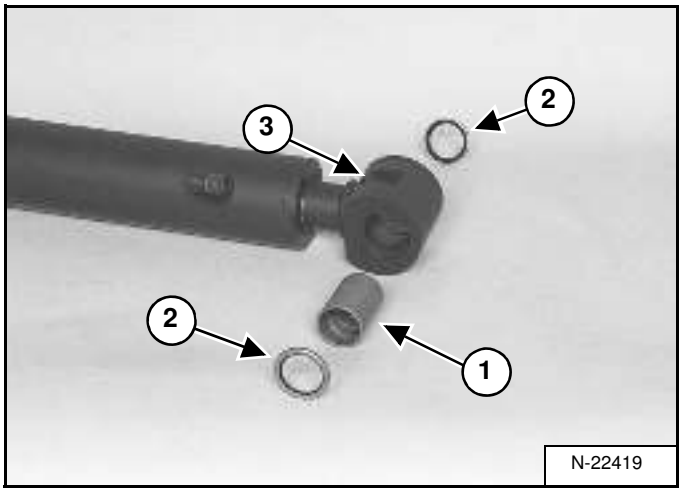
Be careful not to damage the cylinder tube.

Figure 20-23-26



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-23-26]** to tighten the head. Head to be torqued until flush with end of tube assembly.

Figure 20-23-27



Install the bushing (Item 1) **[Figure 20-23-27]** and make sure the bushing is aligned with the grease channel in the cylinder.

Install the seals (Item 2) **[Figure 20-23-27]** with the lips facing out.

Inspect the condition of the grease zerk (Item 3) **[Figure 20-23-27]**.

Dealer Copy -- Not for Resale



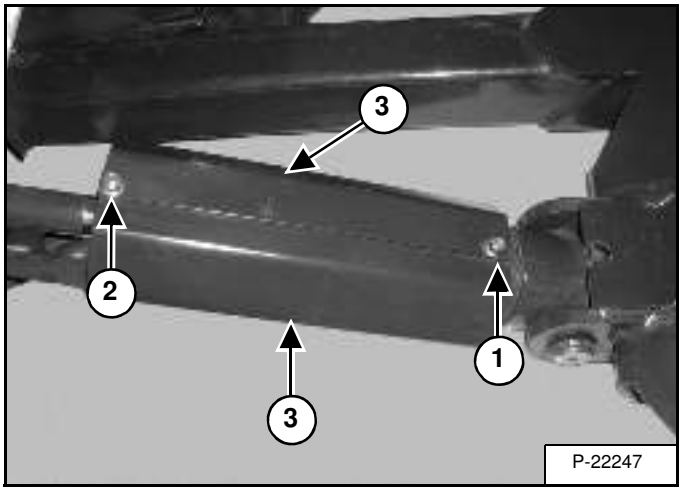
Dealer Copy -- Not for Resale

BLADE CYLINDER

Checking The Blade Cylinder

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

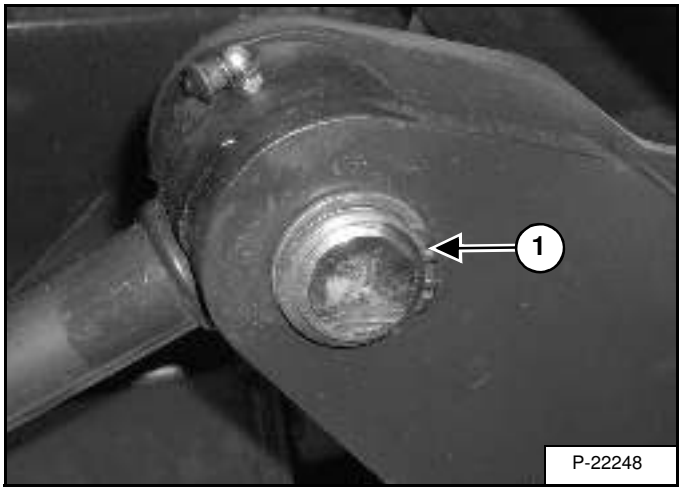


Remove the two nuts (Item 1) **[Figure 20-24-1]** from the studs.

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

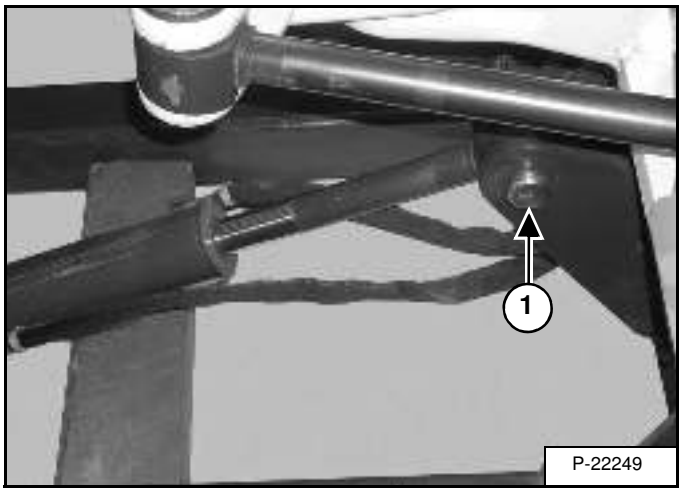
Remove the shields (Item 3) **[Figure 20-24-1]**.

Figure 20-24-2



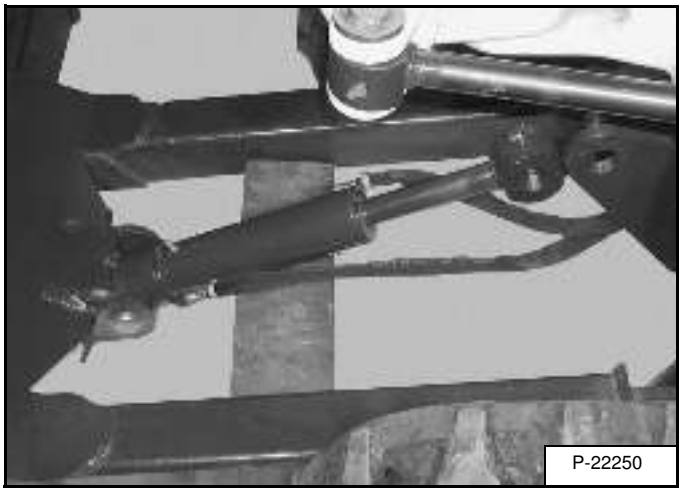
Remove the retaining ring (Item 1) **[Figure 20-24-2]** and washer from the cylinder rod end.

Figure 20-24-3



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

Figure 20-24-4



Lower the control console and fasten the seat belt. Start the engine and retract the blade cylinder **[Figure 20-24-4]**.

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

Dealer Copy -- Not for Resale

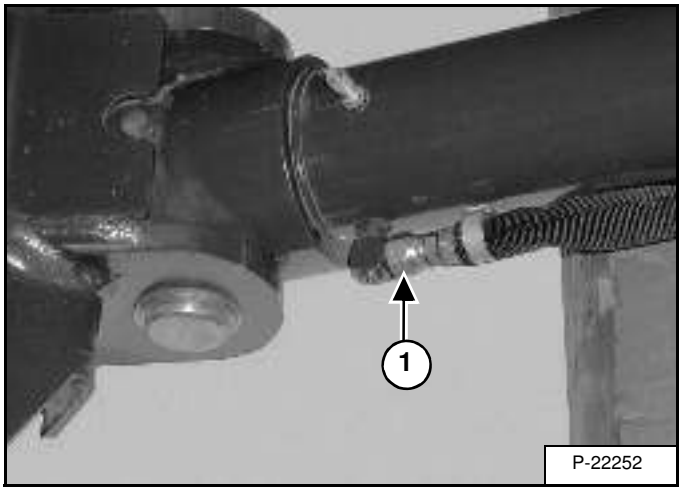
Checking The Blade Cylinder (Cont'd)

⚠ 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.

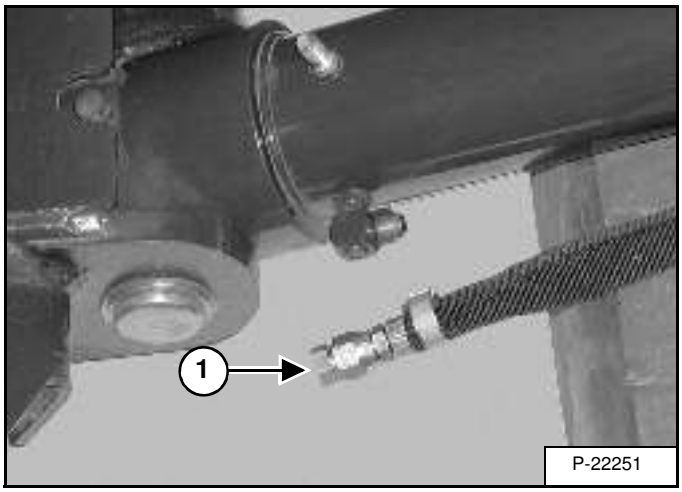
W-2145-0290

Figure 20-24-5



Disconnect 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.

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

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

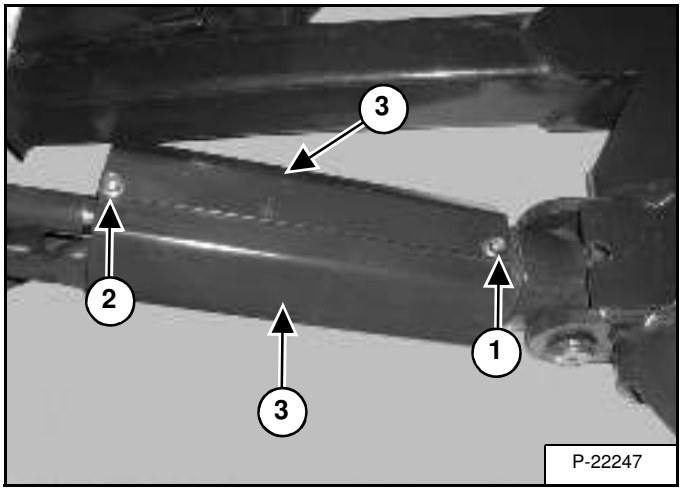
Dealer Copy -- Not for Resale

BLADE CYLINDER (CONT'D)

Removal And Installation

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

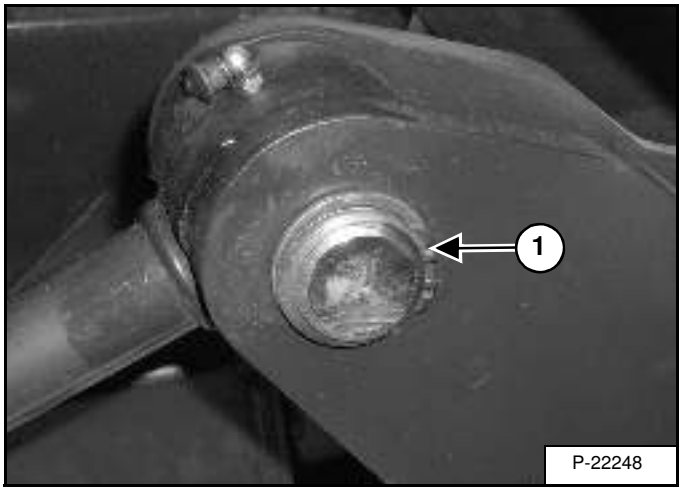


Remove the two nuts (Item 1) **[Figure 20-24-7]** from the studs.

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

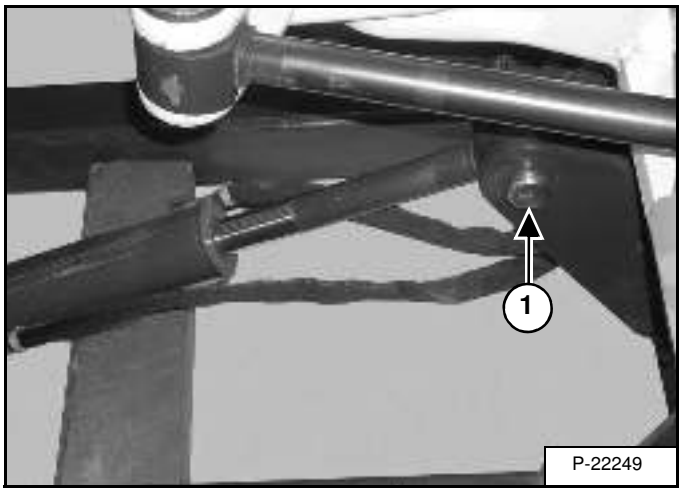
Remove the shields (Item 3) **[Figure 20-24-7]**.

Figure 20-24-8



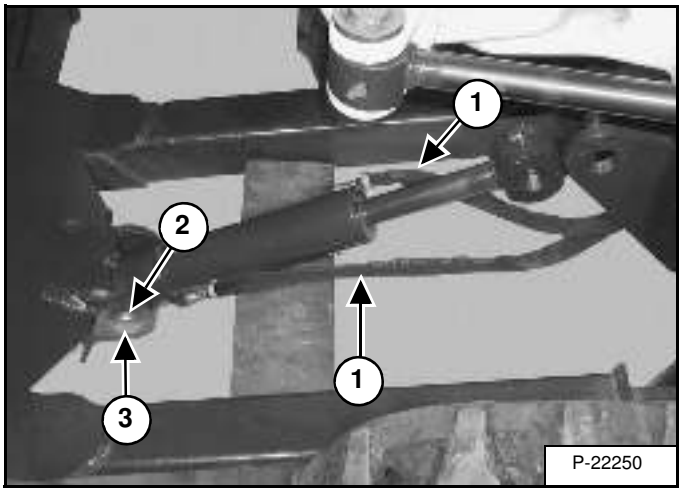
Remove the retaining ring (Item 1) **[Figure 20-24-8]** and washer from the cylinder rod end.

Figure 20-24-9



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

Figure 20-24-10



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

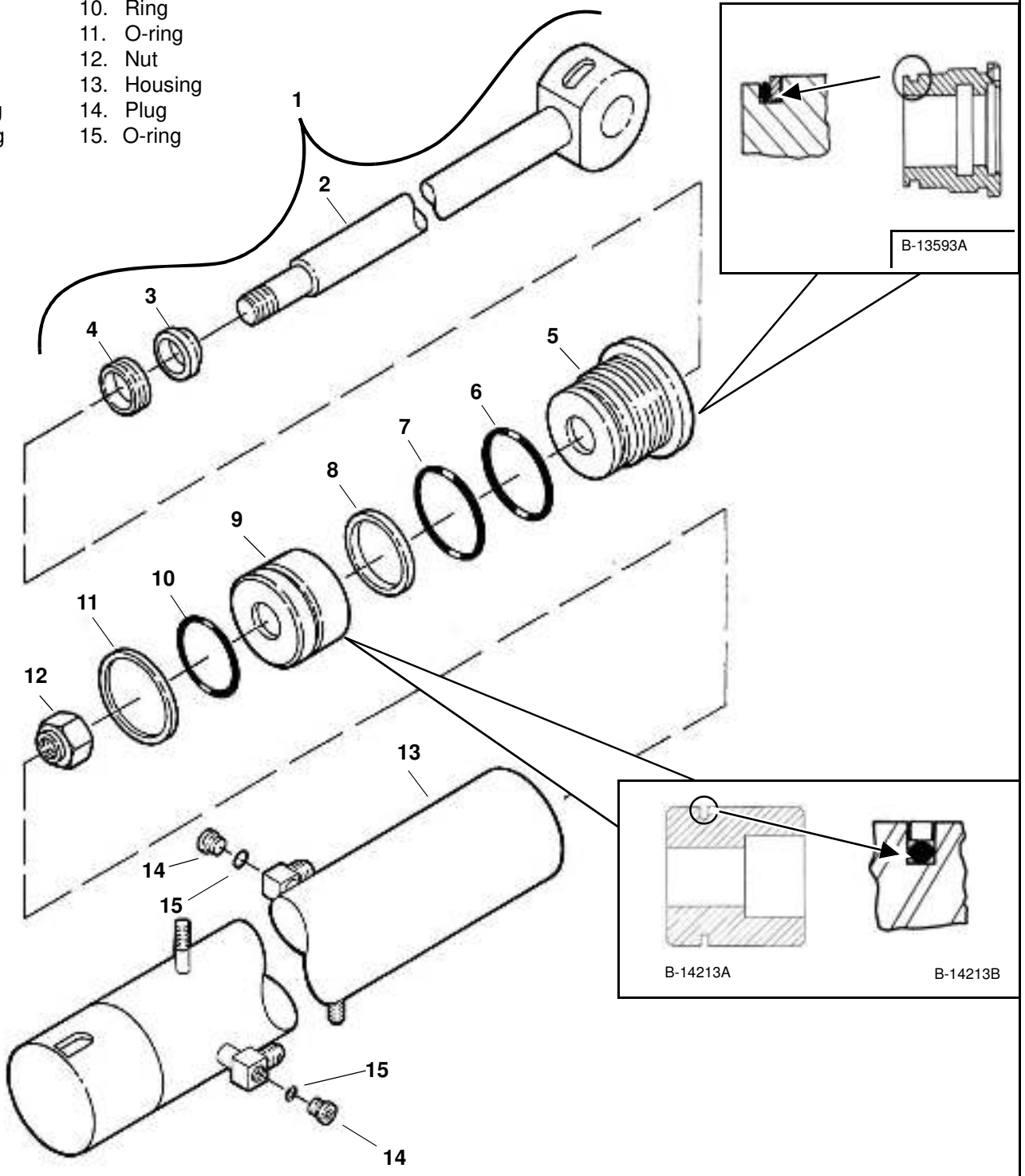
Remove the base end retaining ring and washer (Item 2) **[Figure 20-24-10]**.

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

Dealer Copy -- Not for Resale

Parts Identification

1. Cylinder
2. Rod
3. Ring
4. Seal
5. Head
6. P-ring
7. O-ring
8. Ring
9. Piston
10. Ring
11. O-ring
12. Nut
13. Housing
14. Plug
15. O-ring



Dealer Copy -- Not for Resale

Disassembly

Use the following tools to disassemble the cylinder:

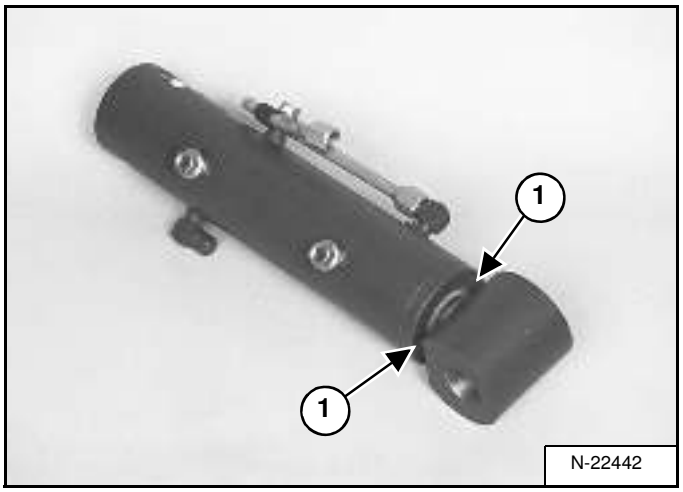
MEL1074 - O-ring Seal Hook
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

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.

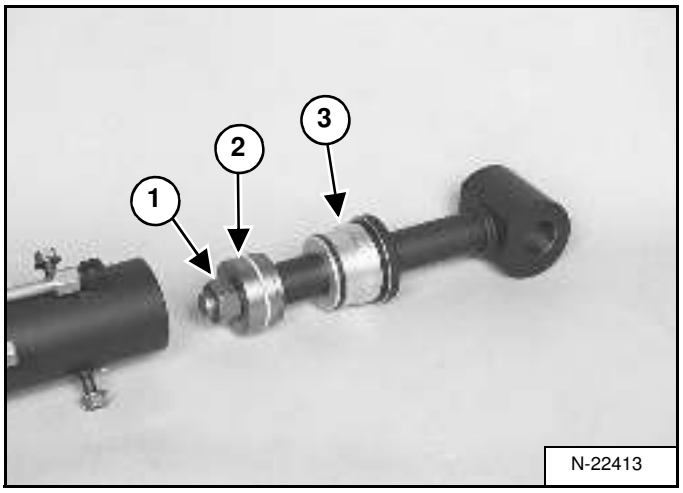
Be careful not to damage the cylinder tube.

Figure 20-24-11



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

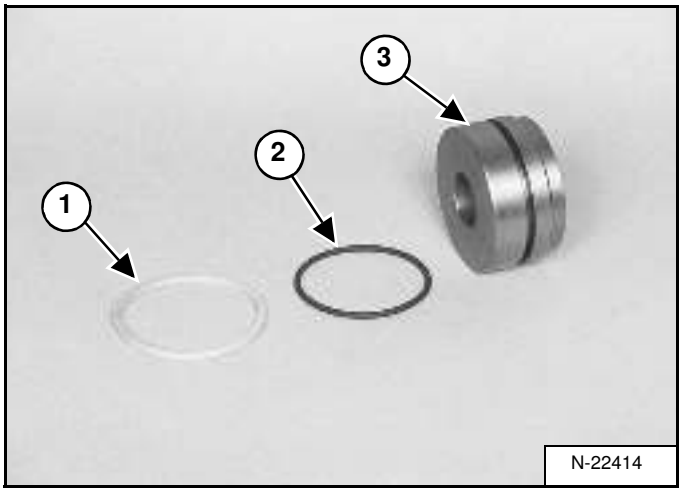
Figure 20-24-12



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

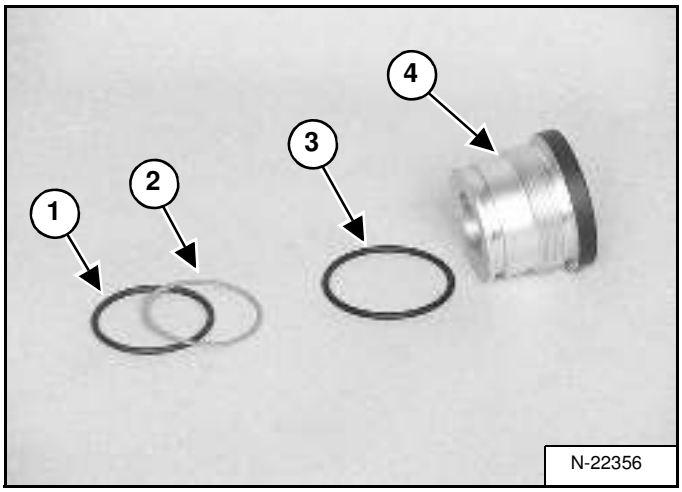


Standard Piston: Remove the back-up ring (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-24-13]**.

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Disassembly (Cont'd)

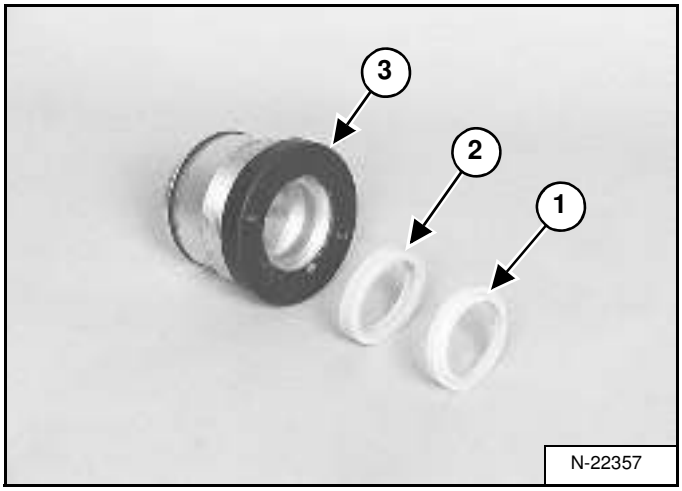
Figure 20-24-14



Remove the thick O-ring (Item 1) and the back-up washer (Item 2) from the groove in the head (Item 4) **[Figure 20-24-14]**.

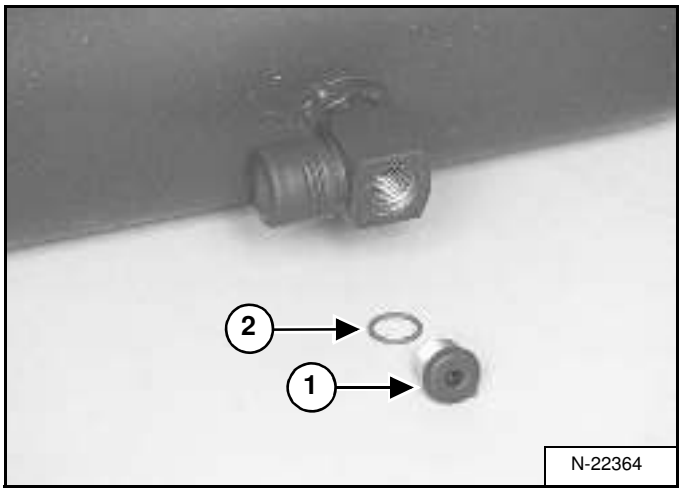
Remove the thin O-ring (Item 3) **[Figure 20-24-14]**.

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

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

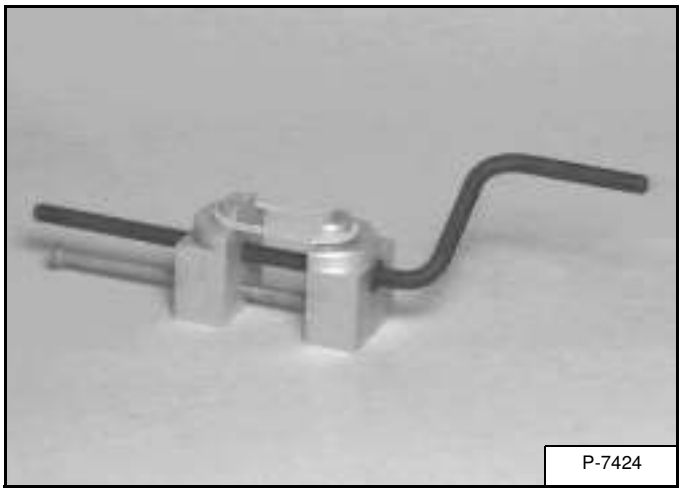
Wash the cylinder parts in solvent and air dry them.

Inspect the cylinder parts for nicks, scratches or other 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.

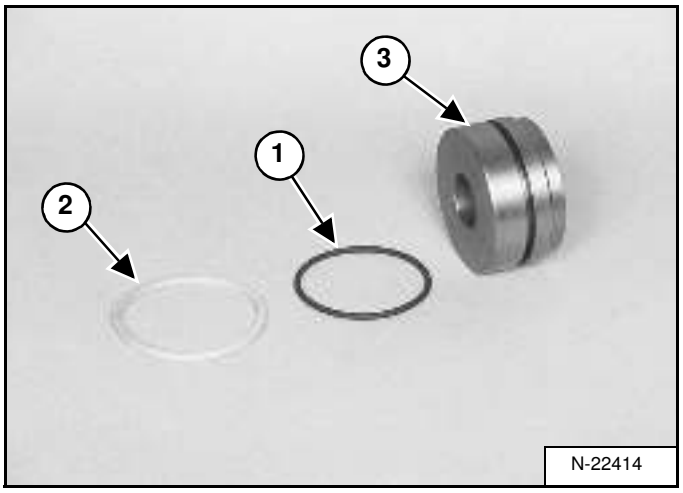
Figure 20-24-17



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

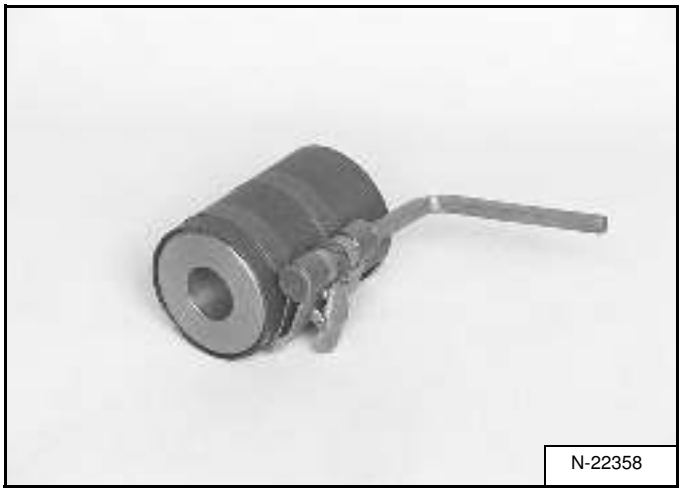
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-24-18



Standard Piston: Install the O-ring (Item 1) and back-up ring (Item 2) on the piston (Item 3) **[Figure 20-24-18]**.

Figure 20-24-19

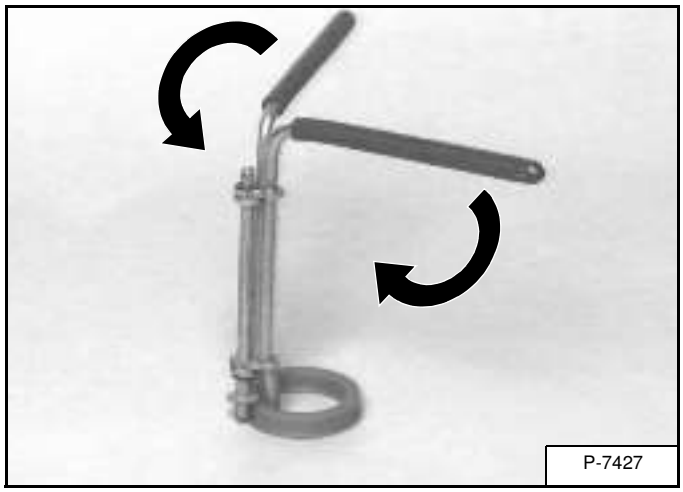


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-24-19]**.

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Assembly (Cont'd)

Figure 20-24-20

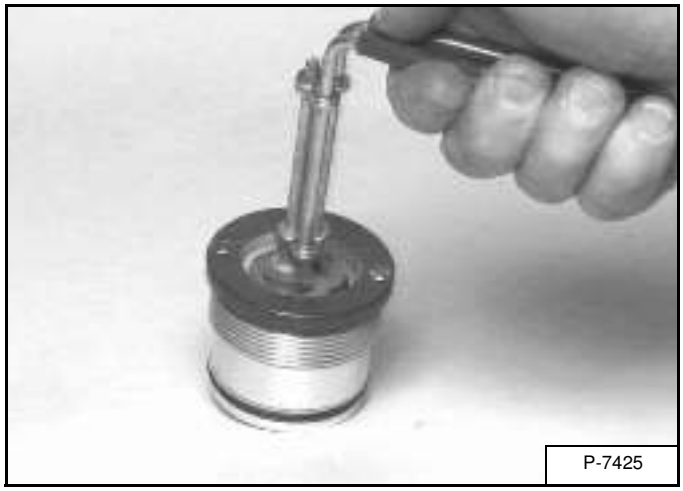


Install the rod seal on the rod seal tool **[Figure 20-24-20]**.

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

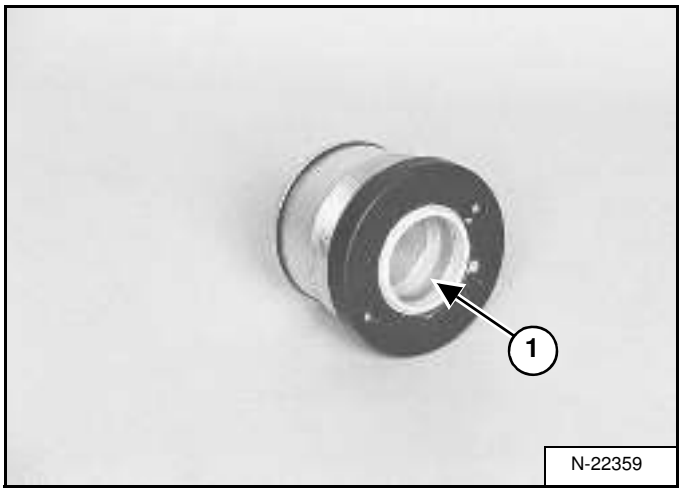
Rotate the handles to collapse the rod seal **[Figure 20-24-20]**.

Figure 20-24-21



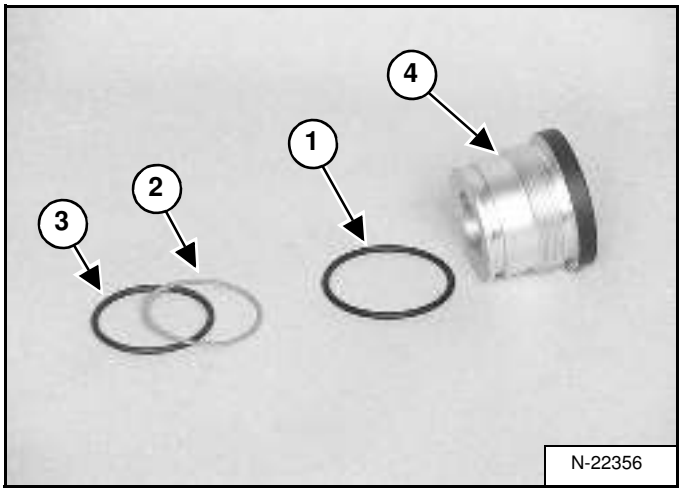
Install the rod seal in the head **[Figure 20-24-21]**.

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

Install the back-up washer (Item 2) and thick O-ring (Item 3) into the groove on the head (Item 4) **[Figure 20-24-23]**.

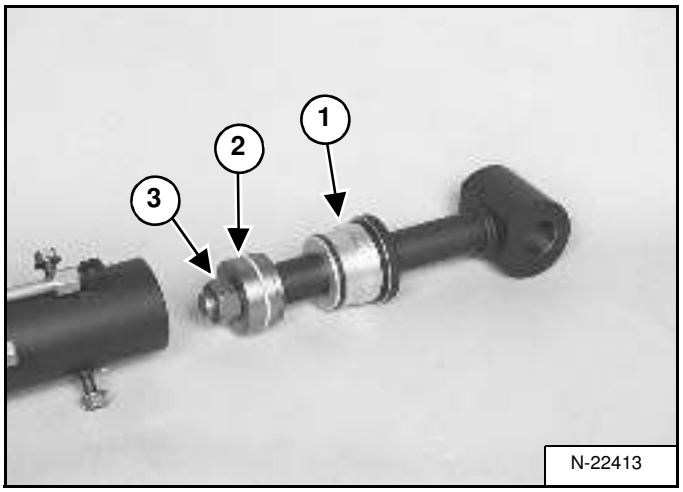
NOTE: Clean and dry the rod threads, from the kit install a NEW NUT with pre-applied LOCTITE.

Reclean thread area for LOCTITE residue.

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Assembly (Cont'd)

Figure 20-24-24



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

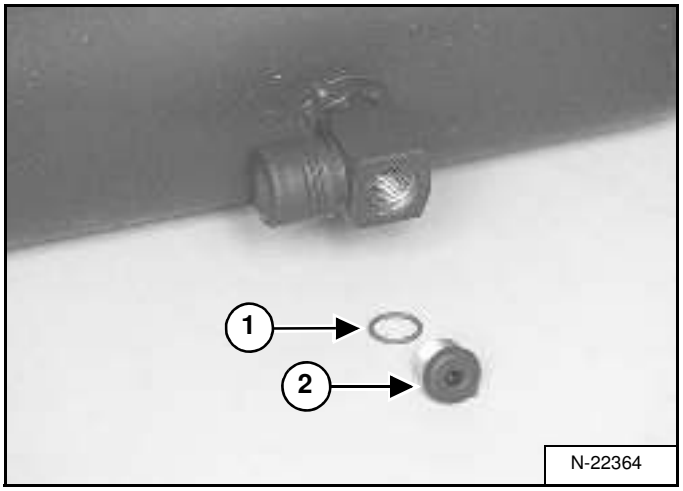
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

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

Gray Iron Piston: Tighten the nut to 600 ft.-lbs. (814 Nm) torque.

Figure 20-24-25

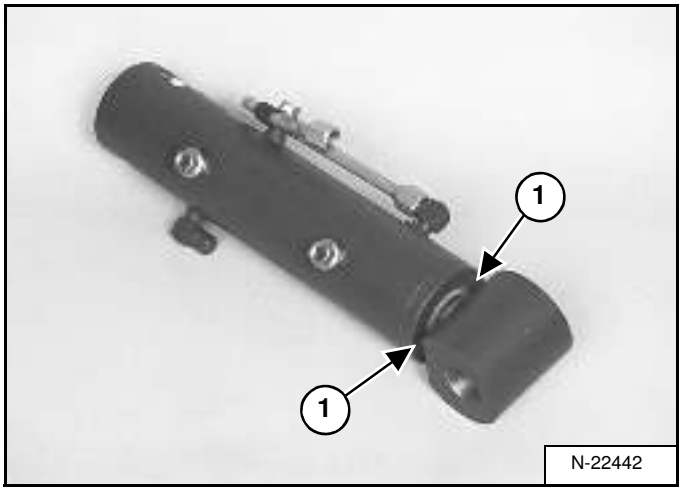


Install plug (Item 1) **[Figure 20-24-25]** and O-ring (Item 2) **[Figure 20-24-25]**.

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

Put the base end of the hydraulic 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 end of tube assembly.

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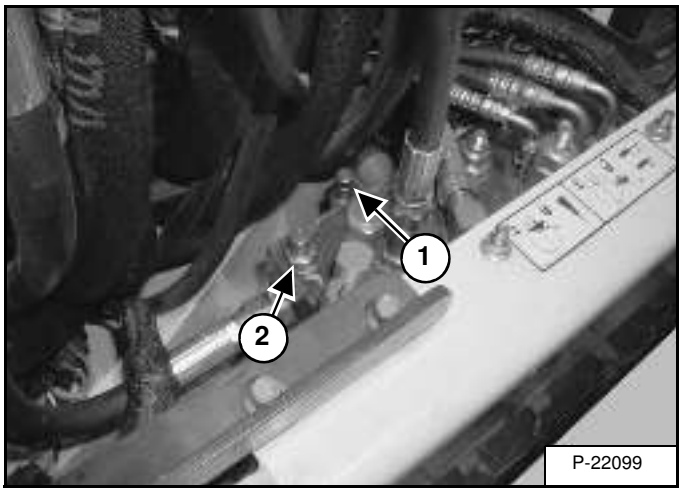
Dealer Copy -- Not for Resale

MAIN RELIEF VALVES

Testing And Adjusting The Main Relief Valves (S/N 232312386 & Below, 232412117 & Below, 232412128 And 232412129)

All testing is done with the hydraulic oil at operating temperature and the engine high speed setting of 2315-2385 RPM.

Figure 20-30-1



There is one diagnostic coupler (Item 1) that is used to check all three main relief valves. The second coupler (Item 2) **[Figure 20-30-1]** is used in assembly of the excavator.

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. 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	GI	428	406 - 450
PRESSURE BUILD - UP VALVE	NONE - CONSOLE DOWN	P3	G	450	380 - 520
SYSTEM BY - PASS	NONE - CONSOLE UP	DUMP TO TANK	G	60	MAX ALLOWABLE 100
MAIN RELIEF ON MANIFOLD BLOCK	SWING AND ARM	P3 & P2	G	3800	3700 - 3850
MAIN RELIEF ON CONTROL VALVE - FRONT	BOOM OFFSET	P1	G	2650	2550 - 2700
MAIN RELIEF ON CONTROL VALVE - REAR	ARM	P3 & P2	G	2900	2800 - 2950
SWING MOTOR - CROSS PORT RELIEF	SWING RIGHT	P3	G	2450	2300 - 2600
SWING MOTOR - CROSS PORT RELIEF	SWING LEFT	P3	G	2450	2300 - 2600

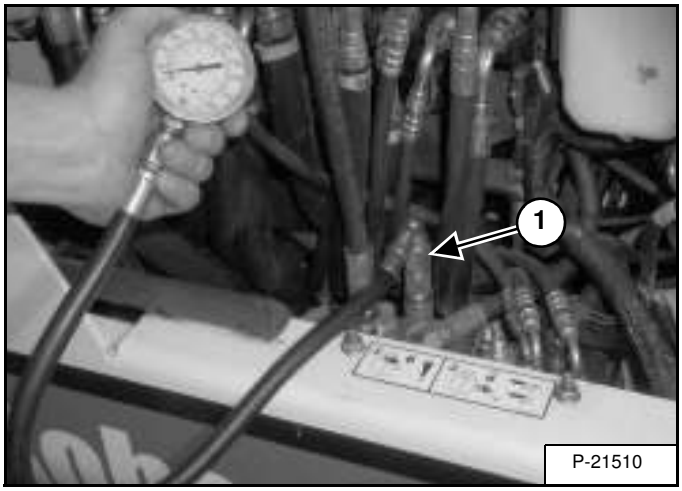
Dealer Copy -- Not for Resale

MAIN RELIEF VALVES (CONT'D)

Testing And Adjusting The Main Relief Valves (S/N 232312386 & Below, 232412117 & Below, 232412128 And 232412129) (Cont'd)

Open the right side cover.

Figure 20-30-2



Connect the test gauge coupler from the test kit to the 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 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 pressure build up valve pressure of 450 PSI (3103 kPa).

Relief Number One (Right Hand Travel, Boom Offset and Boom Valve Sections)

Engage the Boom Offset circuit over relief and record the pressure.

Figure 20-30-3

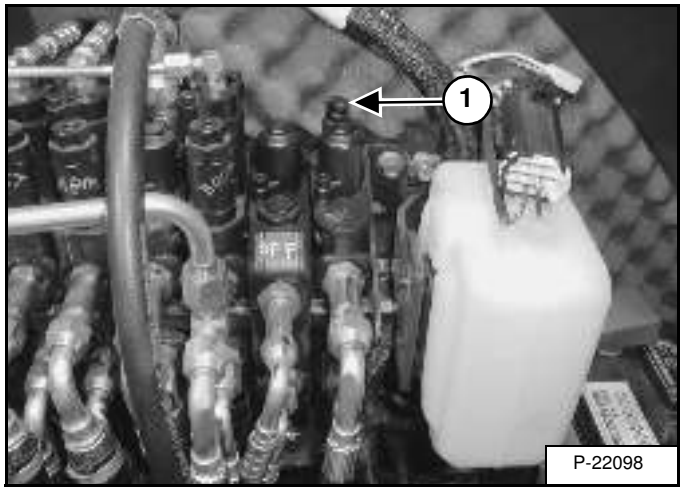
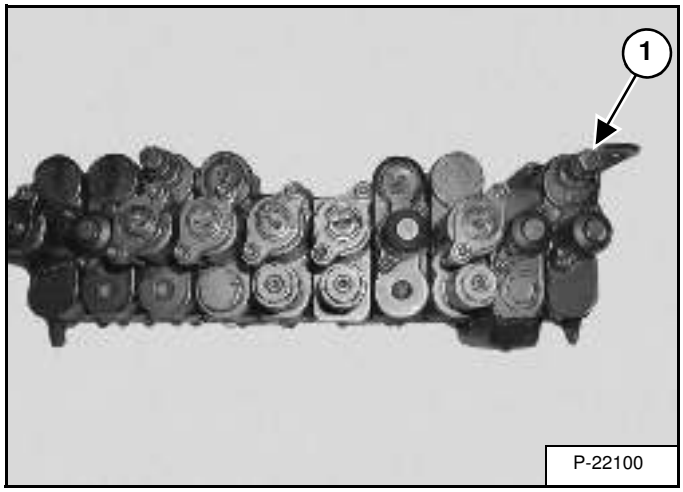


Figure 20-30-4



The main relief valve (Item 1) **[Figure 20-30-3]** & **[Figure 20-30-4]** pressure should be as follows:

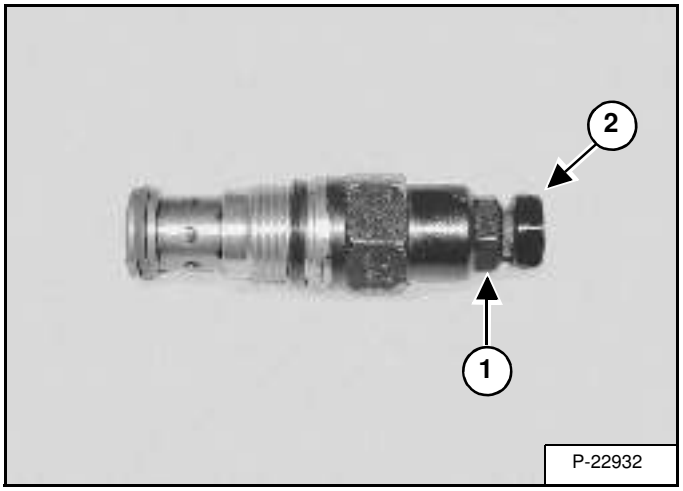
A target pressure of 2650 PSI (18,272 kPa) with an acceptable range of 2550 -2700 PSI (17582-18616 kPa)

Stop the engine.

Dealer Copy -- Not for Resale

Testing And Adjusting The Main Relief Valves (S/N 232312386 & Below, 232412117 & Below, 232412128 And 232412129) (Cont'd)

Figure 20-30-5



If adjustment is needed, loosen the jam 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: One full turn in clockwise rotation will increase pressure approximately 300 PSI (2069 kPa).

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

Retest the main relief valve after adjustment.

Relief Number Two (Left Hand Travel, Arm, Bucket And Auxiliary Valve Sections)

Engage the arm retract circuit over relief and record the pressure.

Figure 20-30-6

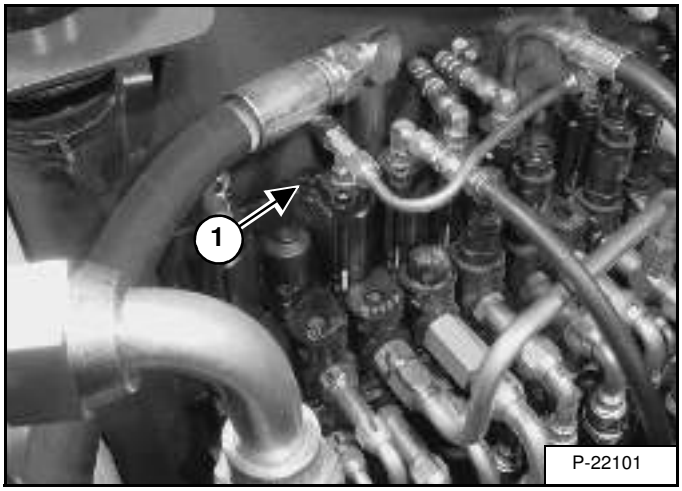
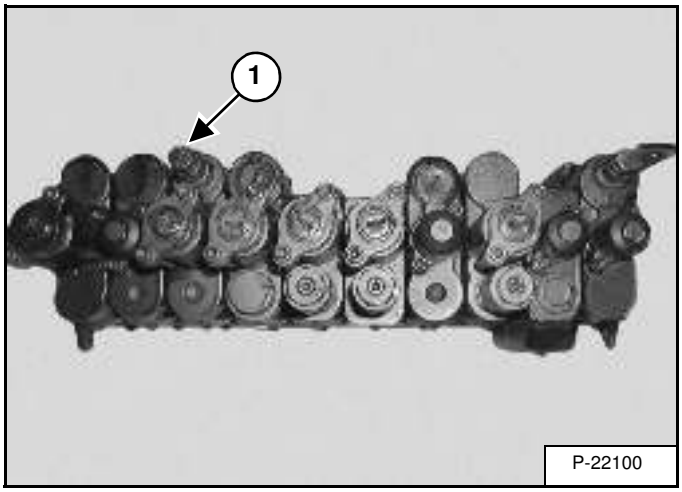


Figure 20-30-7



The main relief valve (Item 1) **[Figure 20-30-6]** & **[Figure 20-30-7]** pressure should be as follows:

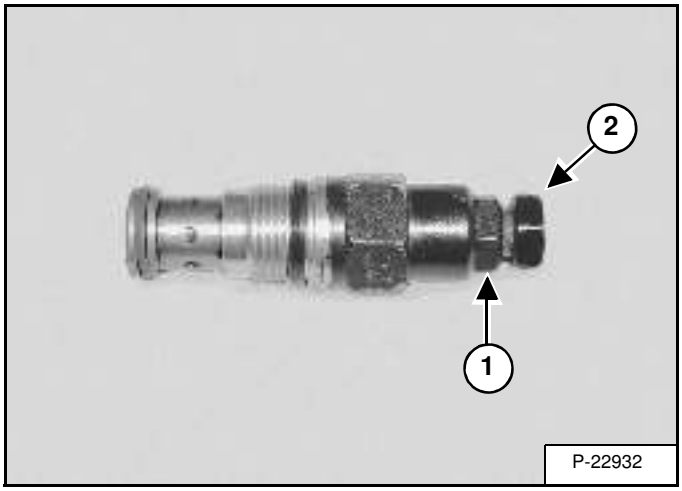
A target pressure of 2900 PSI (19,996 kPa) with an acceptable range of 2800 - 2950 PSI (19306-20340 kPa)

Stop the engine.

Dealer Copy -- Not for Resale

Testing And Adjusting The Main Relief Valves (S/N 232312386 & Below, 232412117 & Below, 232412128 And 232412129) (Cont'd)

Figure 20-30-8



If adjustment is needed, loosen the jam nut (Item 1) **[Figure 20-30-8]**.

Turn the adjustment screw (Item 2) **[Figure 20-30-8]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

NOTE: One full turn in clockwise rotation will increase pressure approximately 300 PSI (2069 kPa).

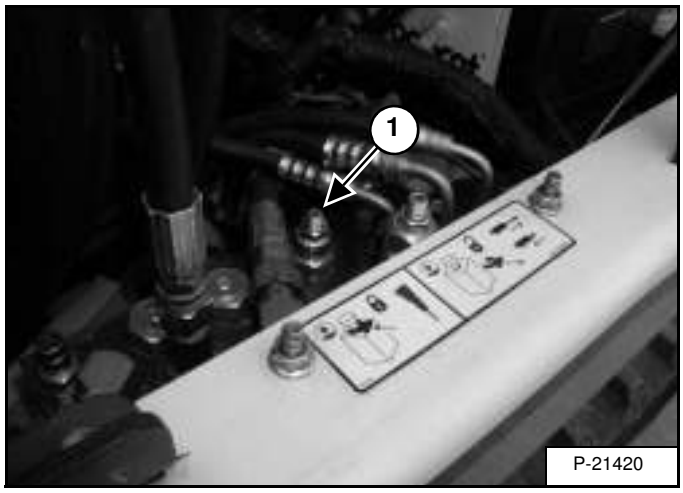
Tighten the jam nut (Item 1) **[Figure 20-30-8]**.

Retest the main relief valve after adjustment.

Relief Number Three (Upperstructure Swing, Blade And Boost Valve Sections)

Engage the swing lock lever See Operation on Page 10-11-1 to prevent the upperstructure from turning. Engage the swing section circuit and arm retract circuit over relief at the same time and record the pressure.

Figure 20-30-9

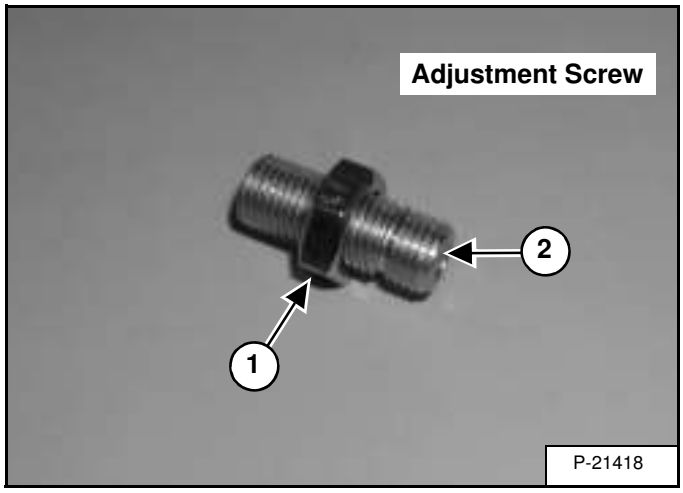


The main relief valve (Item 1) **[Figure 20-30-9]** pressure should be as follows:

A target pressure of 3800 PSI (26,201 kPa) with an acceptable range of 3700-3850 PSI (25511-26545 kPa)

Stop the engine.

Figure 20-30-10



If adjustment is needed, loosen the jam nut (Item 1) **[Figure 20-30-10]**.

Turn the adjustment screw (Item 2) **[Figure 20-30-10]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

NOTE: One full turn in clockwise rotation will increase pressure approximately 600 PSI (4137 kPa).

Tighten the jam nut (Item 1) **[Figure 20-30-10]**.

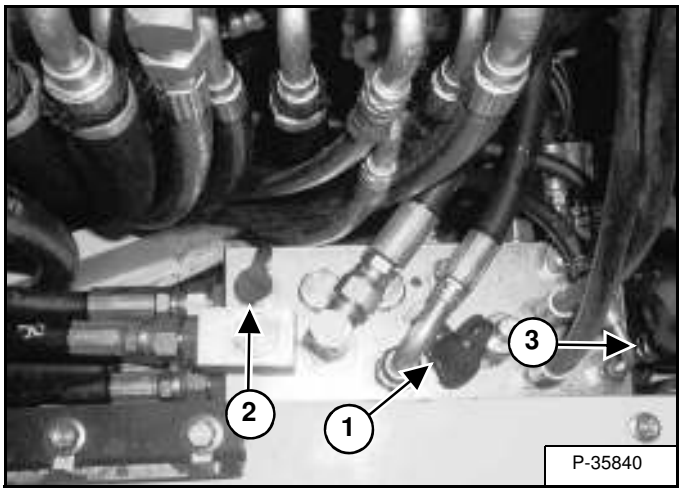
Retest the main relief valve after adjustment.

Dealer Copy -- Not for Resale

Testing And Adjusting The Main Relief Valves (S/N 232312387 & Above, 232412118-232412127 And 232412130 & Above)

All testing is done with the hydraulic oil at operating temperature and the engine high speed setting of 2315-2385 RPM.

Figure 20-30-11



There is one diagnostic coupler (Item 1) that is used to check all three main relief valves. The second coupler (Item 2) is used in assembly of the excavator. The third coupler (Item 3) **[Figure 20-30-11]** 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. 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.

Dealer Copy -- Not for Resale

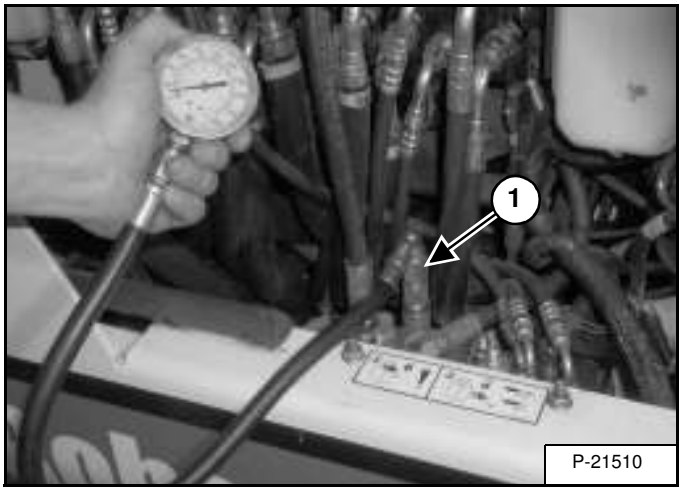
SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET (PSI)	ACCEPTABLE RANGE (PSI)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	GI	428	406 - 450
PRESSURE BUILD - UP VALVE	NONE - CONSOLE DOWN	P3	G	450	380 - 520
SYSTEM BY - PASS	NONE - CONSOLE UP	DUMP TO TANK	G	60	MAX ALLOWABLE 100
MAIN RELIEF ON MANIFOLD BLOCK	SWING AND ARM	P3 & P2	G	3800	3700 - 3850
MAIN RELIEF ON CONTROL VALVE - FRONT	BOOM OFFSET	P1	G	2650	2550 - 2700
MAIN RELIEF ON CONTROL VALVE - REAR	ARM	P3 & P2	G	2900	2800 - 2950
SWING MOTOR - CROSS PORT RELIEF	SWING RIGHT	P3	G	2450	2300 - 2600
SWING MOTOR - CROSS PORT RELIEF	SWING LEFT	P3	G	2450	2300 - 2600

MAIN RELIEF VALVES (CONT'D)

Testing And Adjusting The Main Relief Valves (S/N 232312387 & Above, 232412118-232412127 And 232412130 & Above) (Cont'd)

Open the right side cover.

Figure 20-30-12



Connect the test gauge coupler from the test kit to the diagnostic coupler (Item 1) **[Figure 20-30-12]**.

Lower the 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 pressure build up valve pressure of 450 PSI (3103 kPa).

Relief Number One (Right Hand Travel, Boom Offset and Boom Valve Sections)

Engage the Boom Offset circuit over relief and record the pressure.

Figure 20-30-13

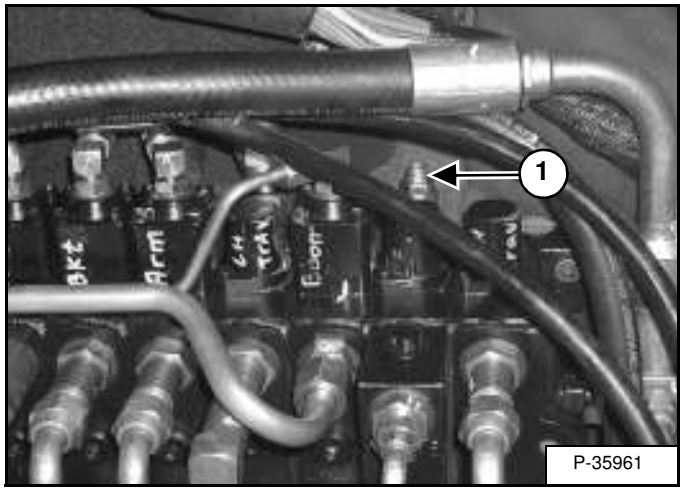
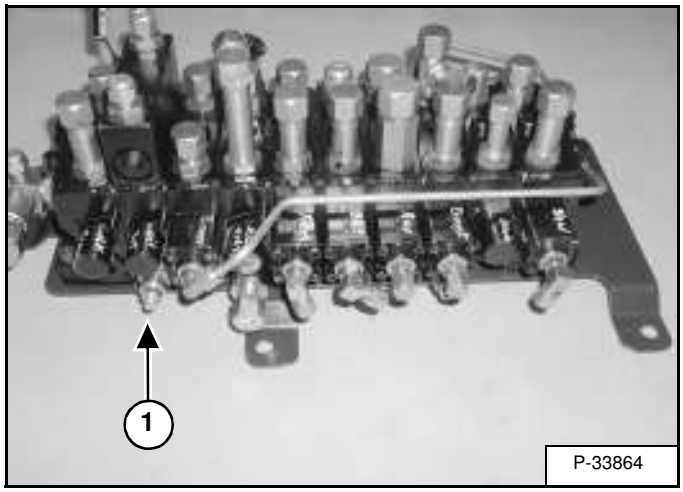


Figure 20-30-14



The main relief valve (Item 1) **[Figure 20-30-13]** & **[Figure 20-30-14]**pressure should be as follows:

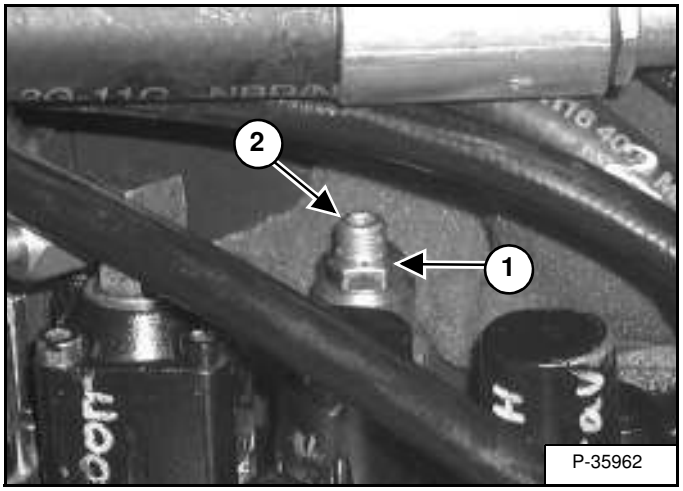
A target pressure of 2650 PSI (18,272 kPa) with an acceptable range of 2550 -2700 PSI (17582-18616 kPa)

Stop the engine.

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Testing And Adjusting The Main Relief Valves (S/N 232312387 & Above, 232412118-232412127 And 232412130 & Above) (Cont'd)

Figure 20-30-15



If adjustment is needed, loosen the jam nut (Item 1) **[Figure 20-30-15]**.

Turn the adjustment screw (Item 2) **[Figure 20-30-15]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

NOTE: One full turn in clockwise rotation will increase pressure approximately 500 PSI (3447 kPa).

Tighten the jam nut (Item 1) **[Figure 20-30-15]**.

Retest the main relief valve after adjustment.

Relief Number Two (Left Hand Travel, Arm, Bucket And Auxiliary Valve Sections)

Engage the arm retract circuit over relief and record the pressure.

Figure 20-30-16

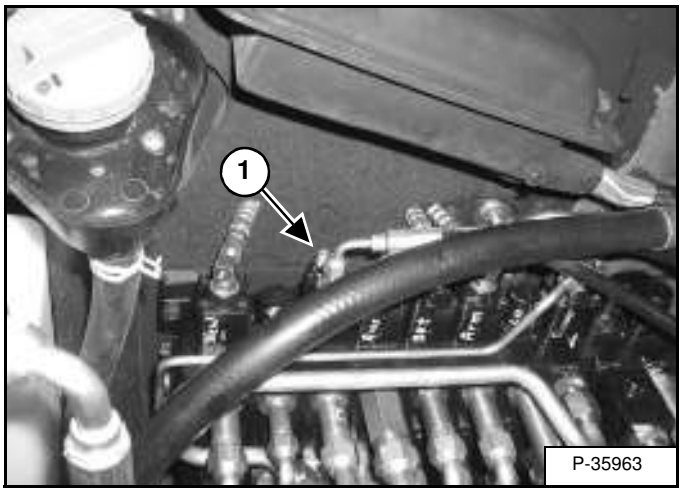
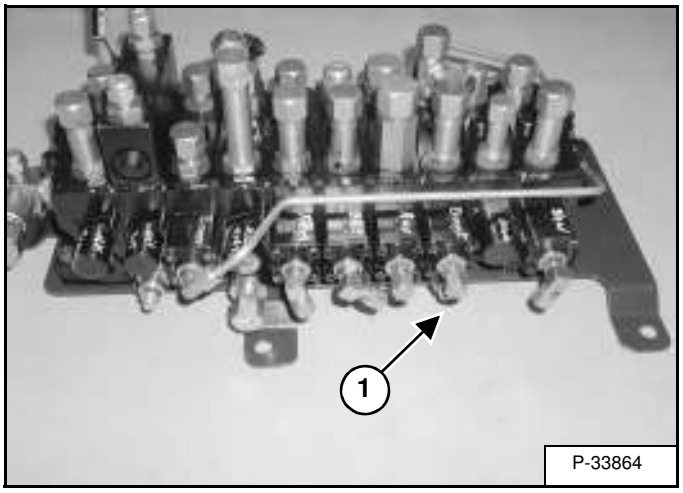


Figure 20-30-17



The main relief valve (Item 1) **[Figure 20-30-16]** & **[Figure 20-30-17]** pressure should be as follows:

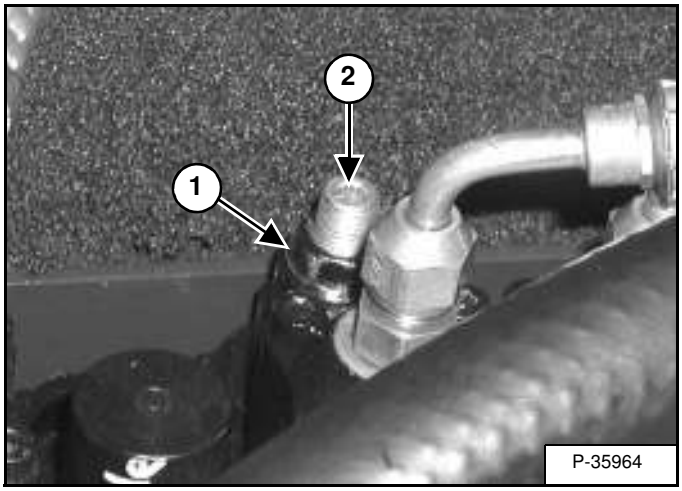
A target pressure of 2900 PSI (19,996 kPa) with an acceptable range of 2800 - 2950 PSI (19306-20340 kPa)

Stop the engine.

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Testing And Adjusting The Main Relief Valves (S/N 232312387 & Above, 232412118-232412127 And 232412130 & Above) (Cont'd)

Figure 20-30-18



If adjustment is needed, loosen the jam nut (Item 1) **[Figure 20-30-18]**.

Turn the adjustment screw (Item 2) **[Figure 20-30-18]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

NOTE: One full turn in clockwise rotation will increase pressure approximately 500 PSI (3447 kPa).

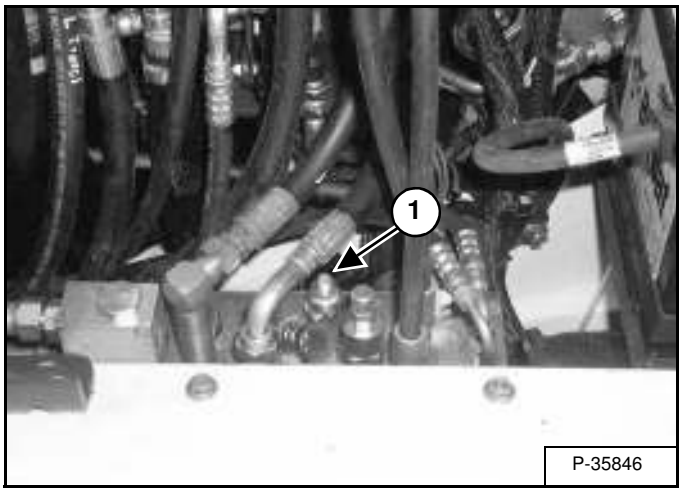
Tighten the jam nut (Item 1) **[Figure 20-30-18]**.

Retest the main relief valve after adjustment.

Relief Number Three (Upperstructure Swing, Blade And Boost Valve Sections)

Engage the swing lock lever (see Operation on page 10-11-1) to prevent the upperstructure from turning. Engage the swing section circuit and arm retract circuit over relief at the same time and record the pressure.

Figure 20-30-19

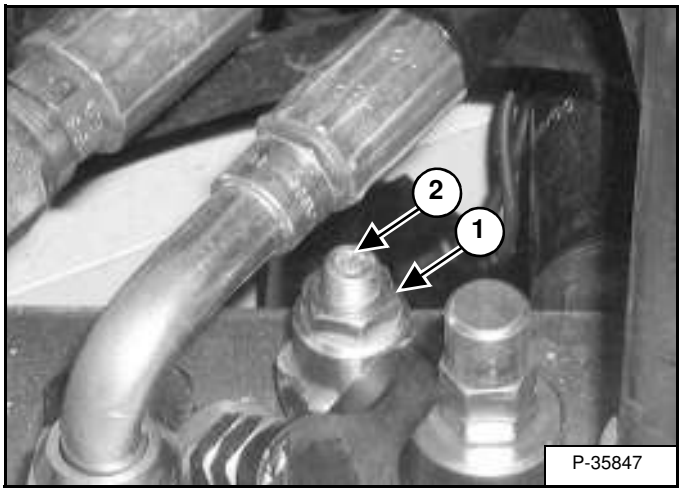


The main relief valve (Item 1) **[Figure 20-30-19]** pressure should be as follows:

A target pressure of 3800 PSI (26,201 kPa) with an acceptable range of 3700-3850 PSI (25511-26545 kPa)

Stop the engine.

Figure 20-30-20



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

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

NOTE: One full turn in clockwise rotation will increase pressure approximately 500 PSI (3447 kPa).

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

Retest the main relief valve after adjustment.

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PORT RELIEF VALVES

Testing And Adjusting Port Relief Valve Pressure (S/N 232312386 & Below And 232412117 & Below, 232412128 And 232412129)

Figure 20-31-1

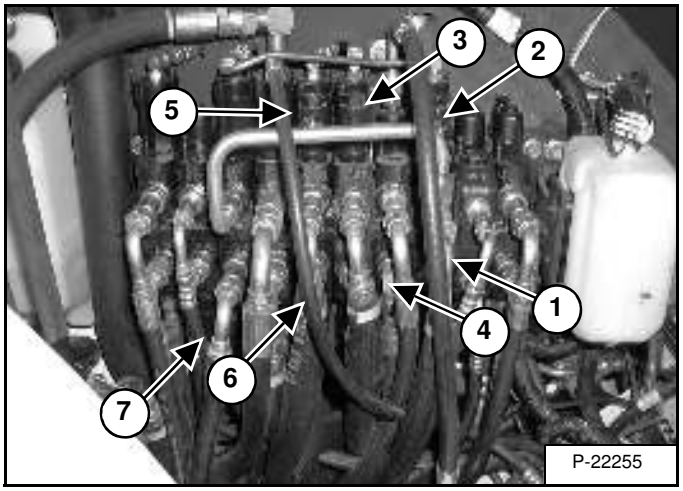
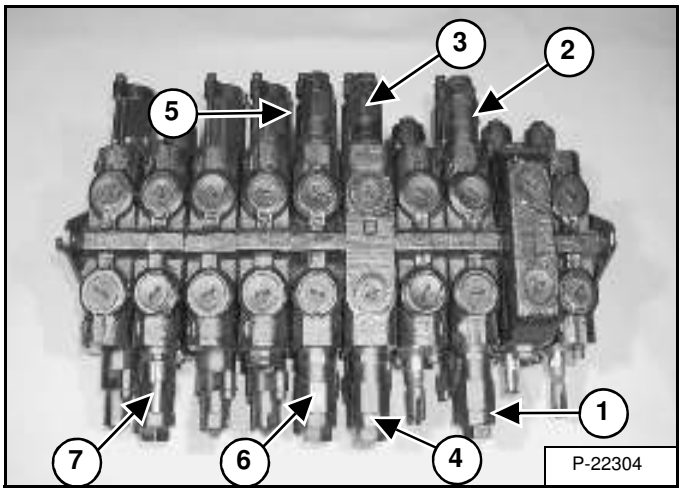


Figure 20-31-2



Boom Port Relief set at:

Rod End (Item 1) **[Figure 20-31-1]** & **[Figure 20-31-2]** - 3400 PSI (23443 kPa)

Base End (Item 2) **[Figure 20-31-1]** & **[Figure 20-31-2]** - 2950 PSI (20340 kPa)

Arm Port Relief set at:

Rod End (Item 3) **[Figure 20-31-1]** & **[Figure 20-31-2]** - 2950 PSI (20340 kPa)

Base End (Item 4) **[Figure 20-31-1]** & **[Figure 20-31-2]** - 2950 PSI (20340 kPa)

Bucket Port Relief set at:

Rod End (Item 5) **[Figure 20-31-1]** & **[Figure 20-31-2]** - 3400 PSI (23443 kPa)

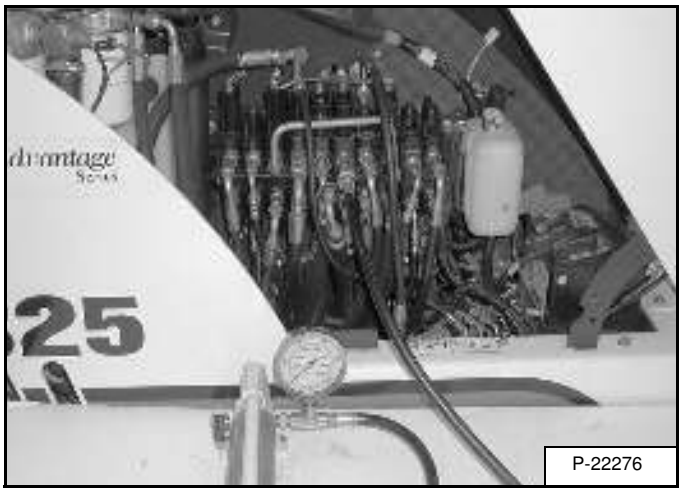
Base End (Item 6) **[Figure 20-31-1]** & **[Figure 20-31-2]** - 2950 PSI (20340 kPa)

Blade Port Relief set at:

Base End (Item 7) **[Figure 20-31-1]** & **[Figure 20-31-2]** - 3400 PSI (23443 kPa)

A portable hydraulic hand pump will be used to test the work port relief valves. The hand pump must have clean hydraulic fluid that is compatible with the Bobcat hydraulic fluid or use SAE 10W-30 motor oil.

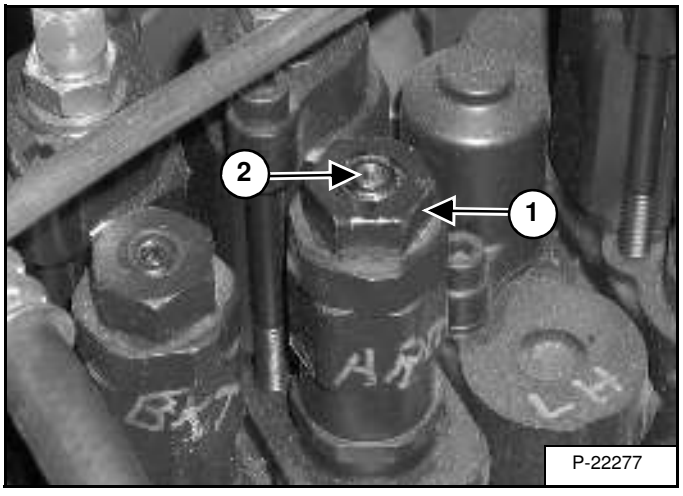
Figure 20-31-3



Install the hand pump hose and a pressure gauge (minimum of 5000 PSI (34475 kPa) into the valve section work port in which the port relief valve is located **[Figure 20-31-3]**. Slowly pressurize this section with the hand pump until the port relief valve opens and make a note of the pressure reading.

If the port relief pressure setting needs to be adjusted, release the hand pump pressure valve.

Figure 20-31-4



Loosen the lock nut (Item 1) **[Figure 20-31-4]**.

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Testing And Adjusting Port Relief Valve Pressure (S/N 232312386 & Below And 232412117 & Below, 232412128 And 232412129) (Cont'd)

Turn the adjusting screw (Item 2) **[Figure 20-31-4 on Page 1]** clockwise to increase the pressure and counterclockwise to reduce the pressure.

NOTE: 1/4 turn is approximately 300 PSI (2069 kPa) when the correct pressure setting is obtained, tighten the locknut while holding the adjustment screw from turning.

Adjust the port relief valve until the correct setting is obtained.

⚠ 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

Testing Port Relief Valve Pressure (S/N 232312387 & Above And 232412118-232412127 And 232412130 & Above)

Figure 20-31-5

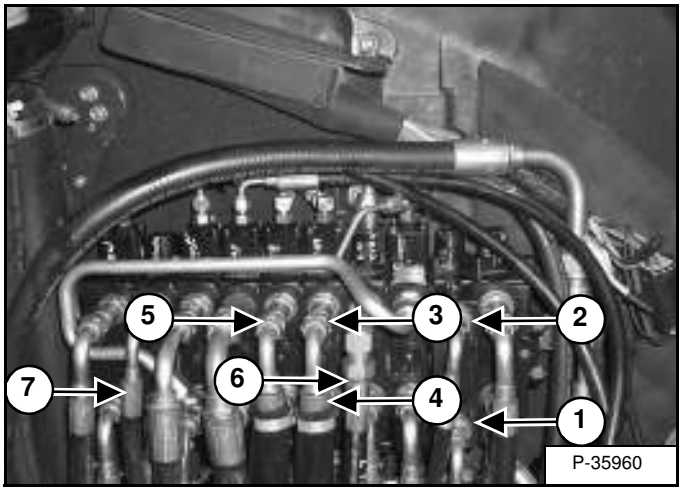
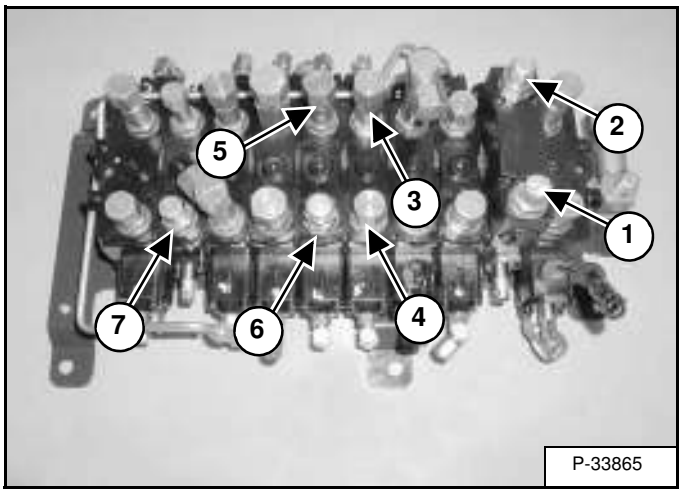


Figure 20-31-6



Boom Port Relief set at:

Rod End (Item 1) **[Figure 20-31-5]** & **[Figure 20-31-6]** - 3335 PSI (22995 kPa)

Base End (Item 2) **[Figure 20-31-5]** & **[Figure 20-31-6]** - 2900 PSI (19996 kPa)

Arm Port Relief set at:

Rod End (Item 3) **[Figure 20-31-5]** & **[Figure 20-31-6]** - 2900 PSI (19996 kPa)

Base End (Item 4) **[Figure 20-31-5]** & **[Figure 20-31-6]** - 2900 PSI (19996 kPa)

Bucket Port Relief set at:

Rod End (Item 5) **[Figure 20-31-5]** & **[Figure 20-31-6]** - 3335 PSI (22995 kPa)

Base End (Item 6) **[Figure 20-31-5]** & **[Figure 20-31-6]** - 2900 PSI (19996 kPa)

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Testing Port Relief Valve Pressure (S/N 232312387 & Above And 232412118-232412127 And 232412130 & Above) (Cont'd)

Blade Port Relief set at:

Base End (Item 7) **[Figure 20-31-5 on Page 2]** & **[Figure 20-31-6 on Page 2]** - 3335 PSI (22995 kPa)

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 (345 kPa).

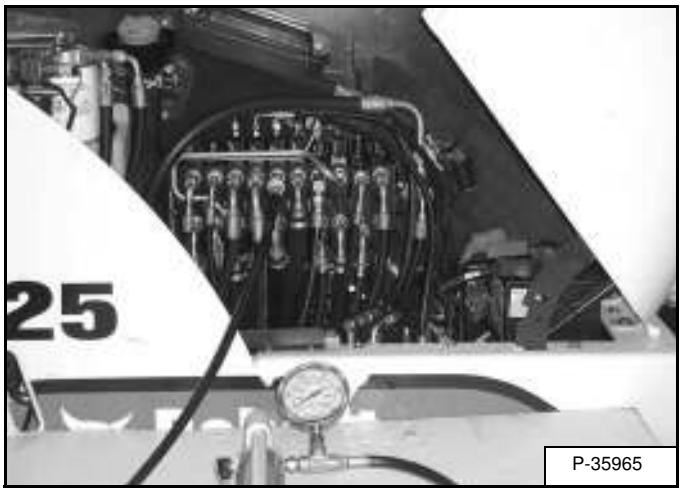
When testing port relief valves with a hydraulic hand pump, relief valve crack pressure should be observed.

For 2900 psi (19996 kPa) relief valves, crack pressure is 2765 ± 50 psi (19065 ± 345 kPa).

For 3335 psi (22995 kPa) relief valves, crack pressure is 3220 ± 50 psi (22202 ± 345 kPa)

A portable hydraulic hand pump will be used to test the work port relief valves. The hand pump must have clean hydraulic fluid that is compatible with the Bobcat hydraulic fluid or use SAE 10W-30 motor oil.

Figure 20-31-7



Install the hand pump hose and a pressure gauge (minimum of 5000 PSI (34475 kPa) into the valve section work port in which the port relief valve is located **[Figure 20-31-7]**. Slowly pressurize this section with the hand pump until the port relief valve opens and make a note of the pressure reading.

Relief valves are not adjustable. When testing the relief valves and pressure is not per the above pressure settings, 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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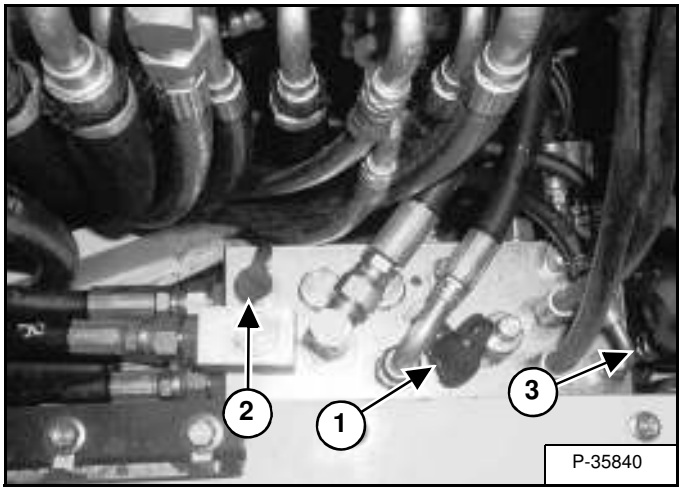
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CROSSPORT RELIEF VALVES

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 2315-2385 RPM.

Figure 20-32-1



There is one diagnostic coupler (Item 1) that is used to check all three main 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. 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.

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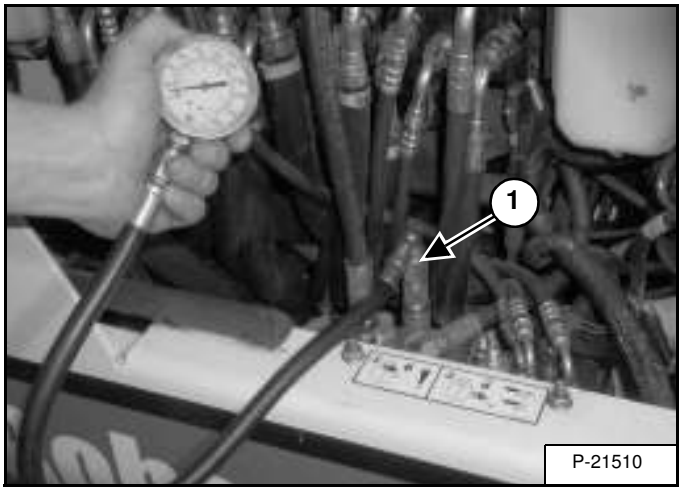
SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET (PSI)	ACCEPTABLE RANGE (PSI)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	GI	428	406 - 450
PRESSURE BUILD - UP VALVE	NONE - CONSOLE DOWN	P3	G	450	380 - 520
SYSTEM BY - PASS	NONE - CONSOLE UP	DUMP TO TANK	G	60	MAX ALLOWABLE 100
MAIN RELIEF ON MANIFOLD BLOCK	SWING AND ARM	P3 & P2	G	3800	3700 - 3850
MAIN RELIEF ON CONTROL VALVE - FRONT	BOOM OFFSET	P1	G	2650	2550 - 2700
MAIN RELIEF ON CONTROL VALVE - REAR	ARM	P3 & P2	G	2900	2800 - 2950
SWING MOTOR - CROSS PORT RELIEF	SWING RIGHT	P3	G	2450	2300 - 2600
SWING MOTOR - CROSS PORT RELIEF	SWING LEFT	P3	G	2450	2300 - 2600

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 from the test kit to the diagnostic coupler (Item 1) **[Figure 20-32-2]**.

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

With the console lowered, and the engine at full RPM there is 600 PSI (4137 kPa) system back pressure.

The crossport relief valves are preset to 1700 PSI (11721 kPa) and are not adjustable. Adding the pressure build up valve pressure raises the gauge readings.

Engage the swing lock lever (see Operation on page 10-11-1) to prevent the upperstructure from turning.

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

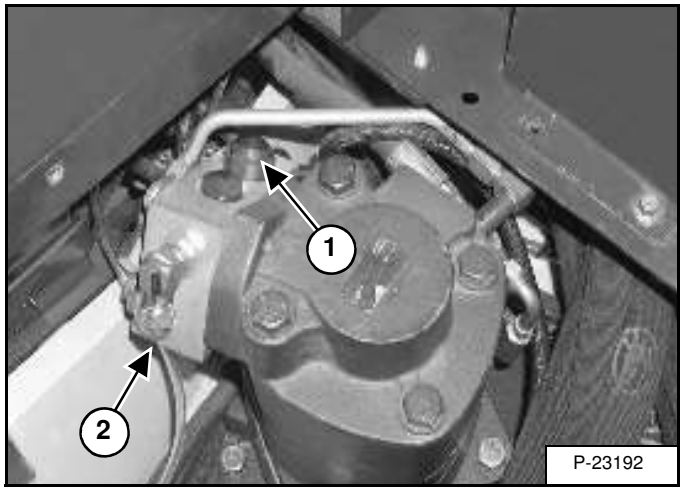
Repeat the procedure to the left and record the pressure.

The crossport relief valve pressure should be as follows:

A target pressure of 2450 PSI (16, 893 kPa) with an acceptable range of 2300-2600 PSI (15858-17927 kPa)

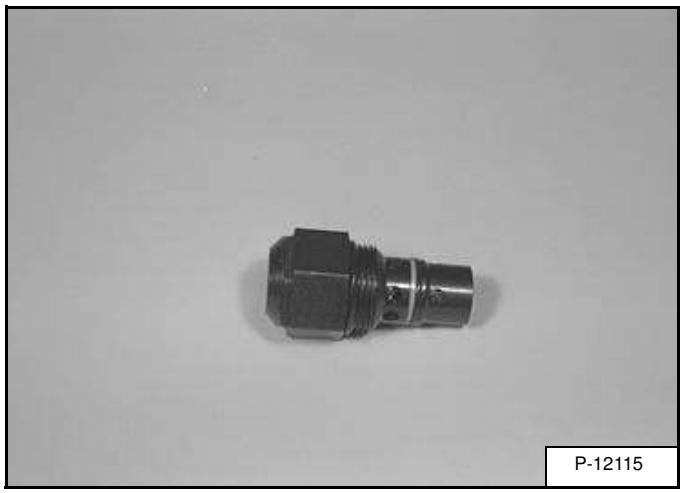
If the amount of oil pressure is at or over the service limits, it is an indication of worn O-rings and back-up rings on the crossport relief valve or a stuck crossport relief valve.

Figure 20-32-3



Inspect the port of the left crossport relief valve (Item 1) or right crossport relief valve (Item 2) **[Figure 20-32-3]** on the housing to verify no damage. If damaged replace the housing.

Figure 20-32-4



Inspect the O-rings and backup rings on the crossport relief valve **[Figure 20-32-4]**. If O-rings and back-up rings are worn or damaged, replace the O-rings and back-up rings. (See Cross Port Relief Valve Assembly on Page 20-90-15.)

Reinstall the crossport relief valve in the housing. Repeat the crossport relief valve test.

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

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PRESSURE REDUCING VALVE (S/N 232312386 & BELOW AND 232412117 & BELOW, 232412128 AND 232412129)

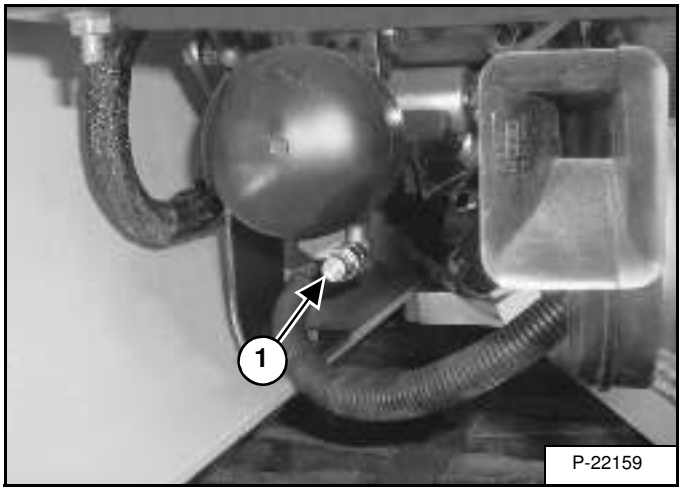
Testing And Adjusting The Pressure Reducing Valve

The pressure reducing valve supplies joystick pilot pressure.

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

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

Figure 20-33-1

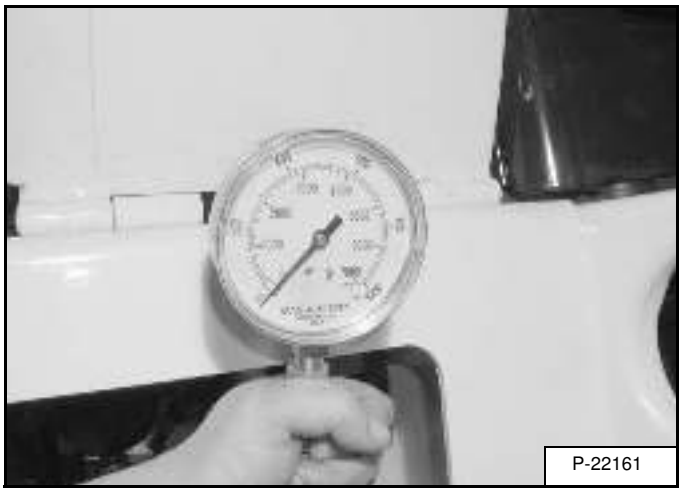


The diagnostic port (Item 1) **[Figure 20-33-1]** located on the bottom of the manifold block will be used to check the pressure reducing valve.

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 (6895 kPa) gauge on the diagnostic port **[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 blade raise circuit and fully raise the blade. Continue to engage the circuit after the blade has been completely raised.

The pressure reducing valve pressure should be as follows:

A target pressure of 428 PSI (2951 kPa) with an acceptable range of 406-450 PSI (2799-3103 kPa).

Stop the engine.

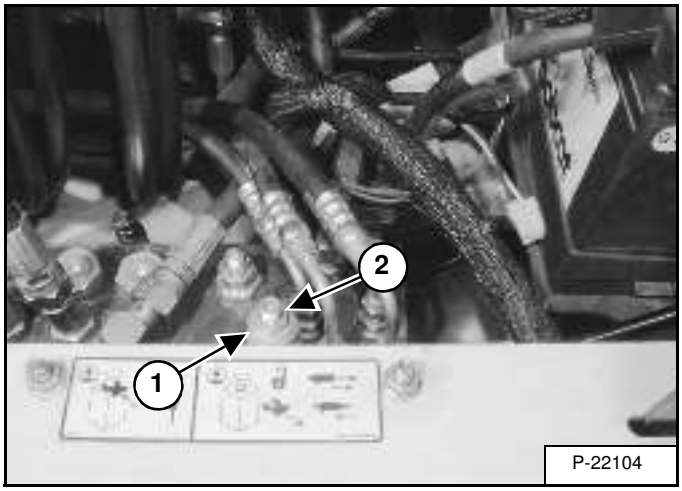
With the engine off, and the key in the run position, lower the left console and move both joysticks to relieve hydraulic pressure.

Dealer Copy -- Not for Resale

PRESSURE REDUCING VALVE (S/N 232312386 & BELOW AND 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

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

Figure 20-33-3



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

Turn the adjustment screw (Item 2) **[Figure 20-33-3]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

NOTE: 1/2 turn in a clockwise rotation will increase pressure approximately 20 PSI (138 kPa).

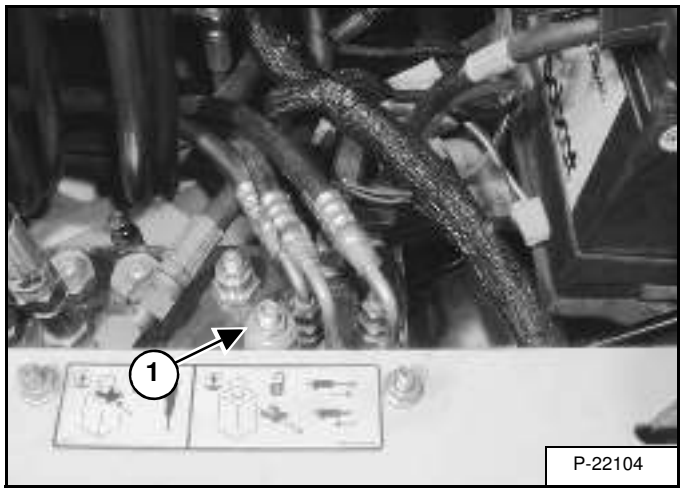
Tighten the jam nut (Item 1) **[Figure 20-33-3]**.

Retest the pressure reducing valve after adjustment.

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

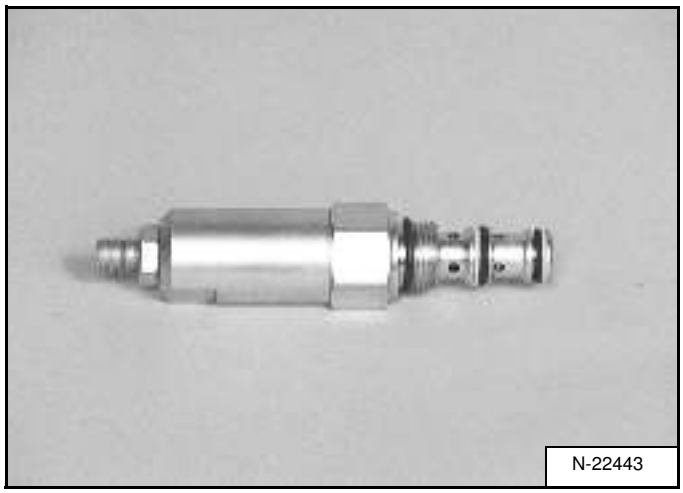
If the amount of oil pressure is at or over the service limits, it is an indication of worn O-rings and back-up rings on the pressure reducing valve or a stuck pressure reducing valve.

Figure 20-33-4



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 on Page 20-61-2.)

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

Repeat the pressure reducing valve test.

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

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PRESSURE REDUCING VALVE (S/N 232312387 & ABOVE AND 232412118-232412127 AND 232412130 & ABOVE)

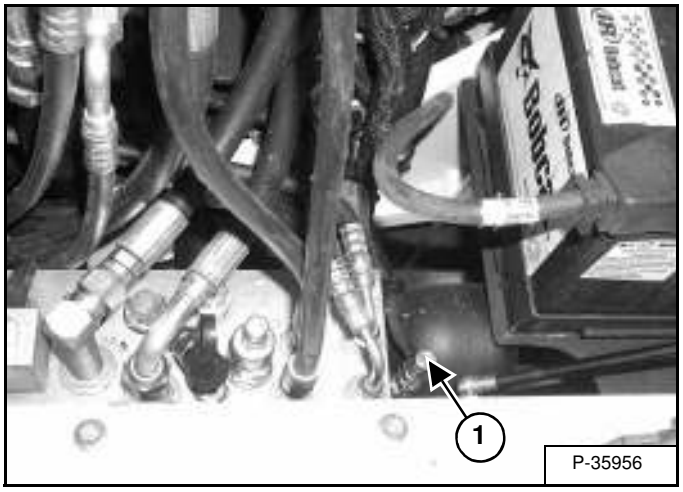
Testing And Adjusting The Pressure Reducing Valve

The pressure reducing valve supplies joystick pilot pressure.

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

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

Figure 20-33-6

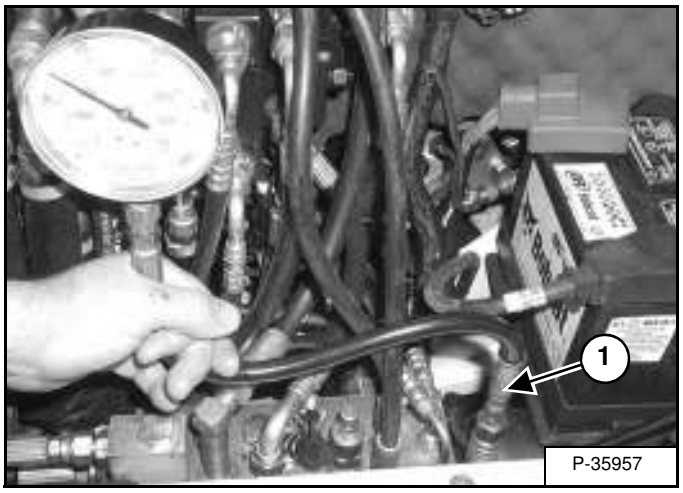


The diagnostic port (Item 1) **[Figure 20-33-6]** located on the end of the manifold block will be used to check the pressure reducing valve.

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

Open the right side cover.

Figure 20-33-7



Install a 1000 PSI (6895 kPa) gauge on the diagnostic port (Item 1) **[Figure 20-33-7]**.

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 blade raise circuit and fully raise the blade. Continue to engage the circuit after the blade has been completely raised.

The pressure reducing valve pressure should be as follows:

A target pressure of 428 PSI (2951 kPa) with an acceptable range of 406-450 PSI (2799-3103 kPa).

Stop the engine.

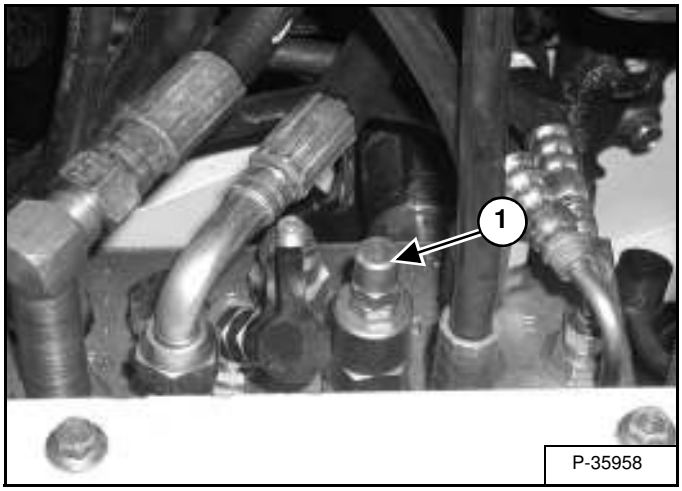
With the engine off and the key in the on position, lower the left console and move both joysticks to relieve hydraulic pressure.

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PRESSURE REDUCING VALVE (S/N 232312387 & ABOVE AND 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

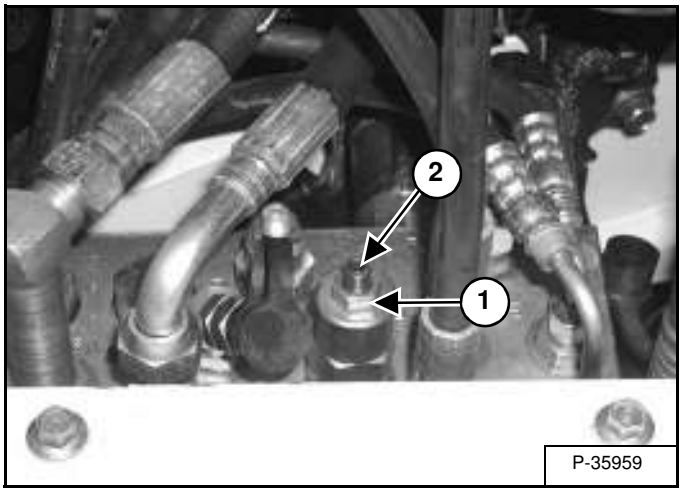
Testing And Adjusting The Pressure Reducing Valve (Cont'd)

Figure 20-33-8



If adjustment is needed, remove the cap (Item 1) **[Figure 20-33-8]**.

Figure 20-33-9



Loosen the jam nut (Item 1) **[Figure 20-33-9]**.

Turn the adjustment screw (Item 2) **[Figure 20-33-9]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

NOTE: 1/2 turn in a clockwise rotation will increase pressure approximately 40 PSI (276 kPa).

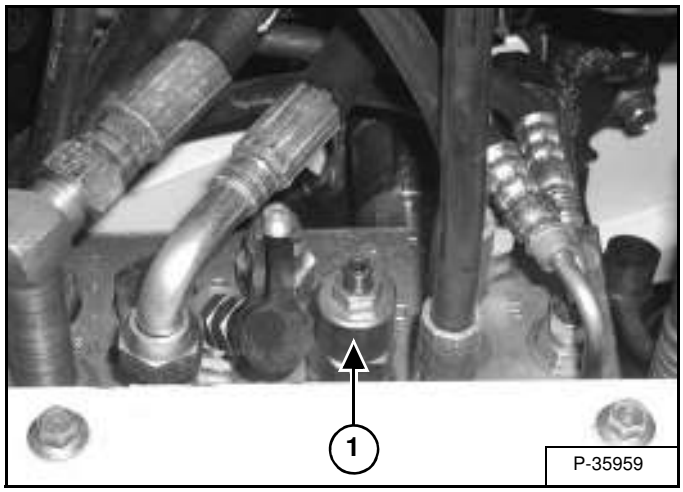
Tighten the jam nut (Item 1) **[Figure 20-33-9]**.

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.

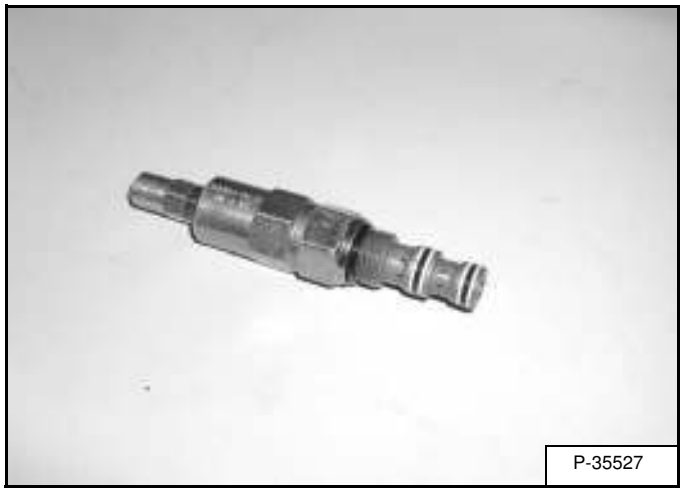
If the amount of oil pressure is at or over the service limits, it is an indication of worn O-rings and back-up rings on the pressure reducing valve or a stuck pressure reducing valve.

Figure 20-33-10



Inspect the port of the pressure reducing valve (Item 1) **[Figure 20-33-10]** on the manifold assembly to verify no damage. If damaged replace the manifold assembly.

Figure 20-33-11



Inspect the O-rings and back-up rings on the pressure reducing valve **[Figure 20-33-11]**. If O-rings and back-up rings are worn or damaged, replace O-rings and back-up rings. (See Disassembly on Page 20-61-2.)

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

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

Repeat the pressure reducing valve test.

If the O-rings and back-up 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 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129)

Description

The hydraulic control valve has two main relief valves that operate at 2800 PSI (19306 kPa). The boom, arm, bucket and blade sections have 2950 PSI (20340 kPa) and/or 3400 PSI (23442 kPa) work port reliefs.

Removal And Installation

IMPORTANT

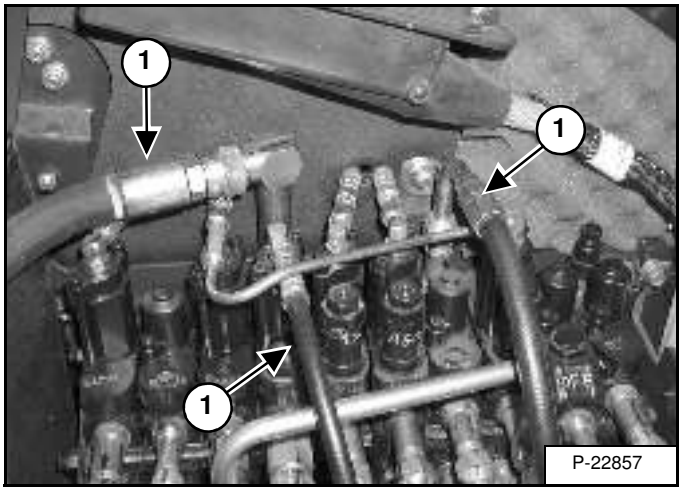
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tube lines and ports to keep dirt out. Dirt can quickly damage the system.

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

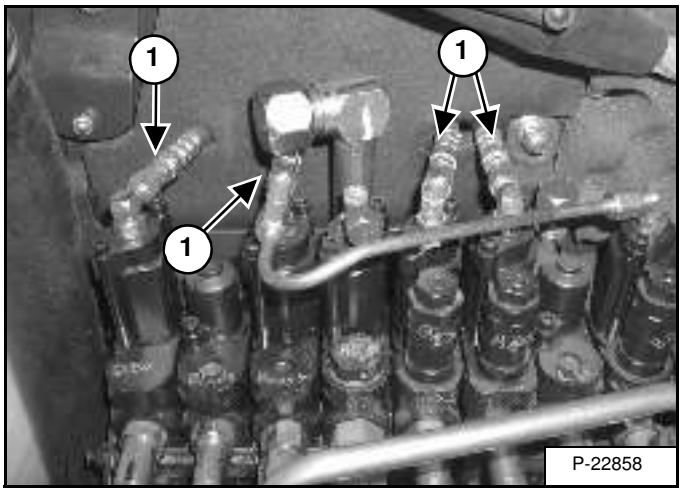
Mark all hoses for ease of assembly.

Figure 20-40-1



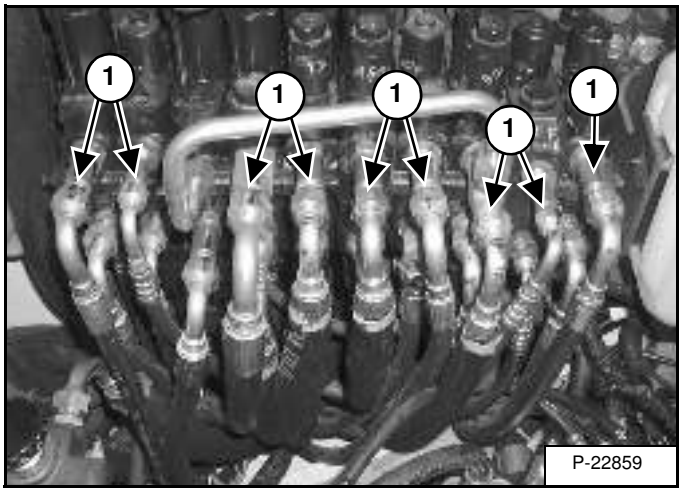
Remove the three hoses (Item 1) **[Figure 20-40-1]**.

Figure 20-40-2



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

Figure 20-40-3



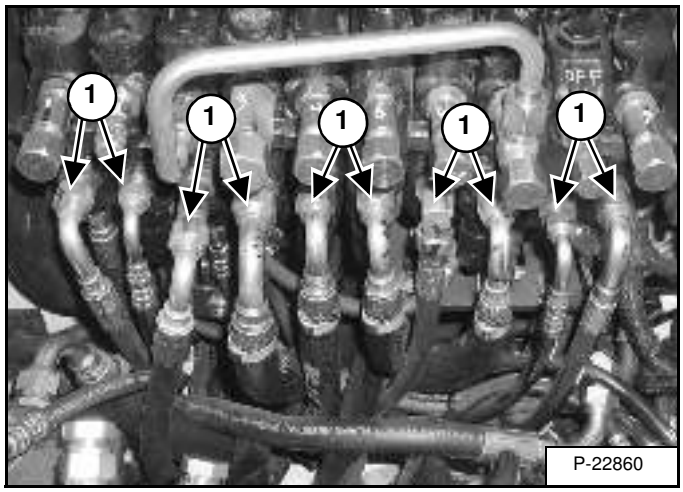
Remove the nine hoses (Item 1) **[Figure 20-40-3]** from the A ports of the valve.

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HYDRAULIC CONTROL VALVE (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

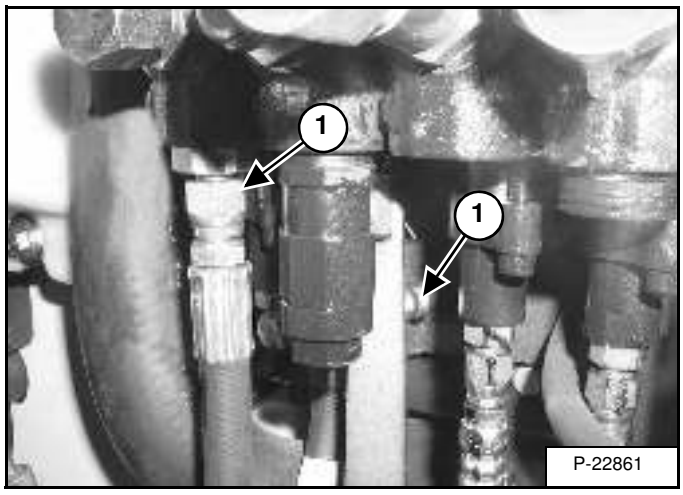
Removal And Installation (Cont'd)

Figure 20-40-4



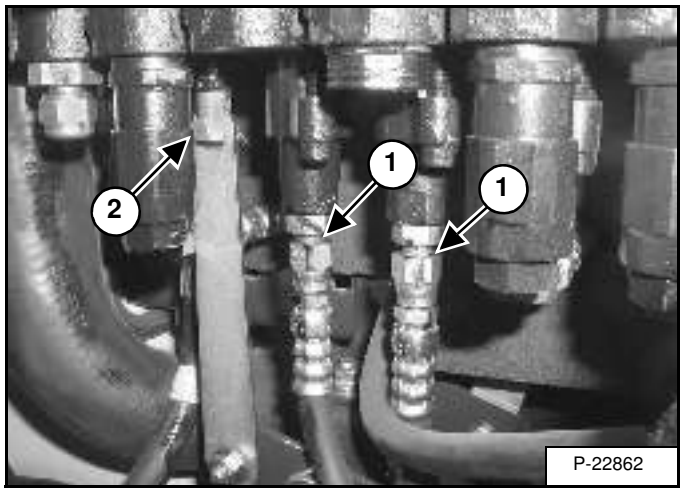
Remove the ten hoses (Item 1) **[Figure 20-40-4]** from the B ports of the valve.

Figure 20-40-5



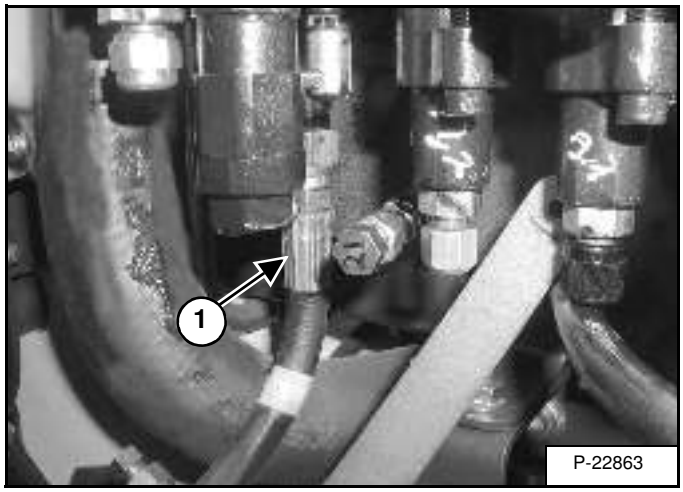
Remove the two hoses (Item 1) **[Figure 20-40-5]**.

Figure 20-40-6



Remove the two hoses (Item 1). Remove the cotter pin and clevis pin (Item 2) **[Figure 20-40-6]**.

Figure 20-40-7

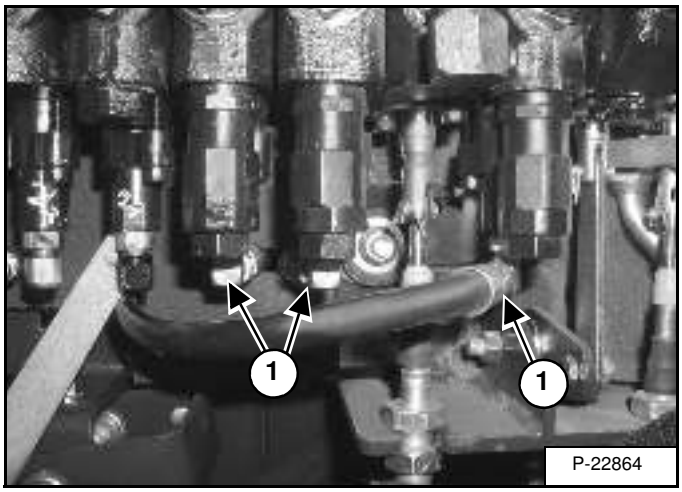


Remove the hose (Item 1) **[Figure 20-40-7]**.

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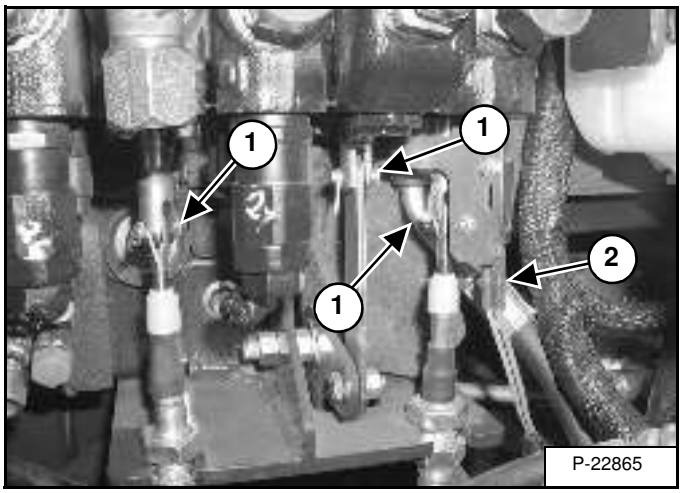
Removal And Installation (Cont'd)

Figure 20-40-8



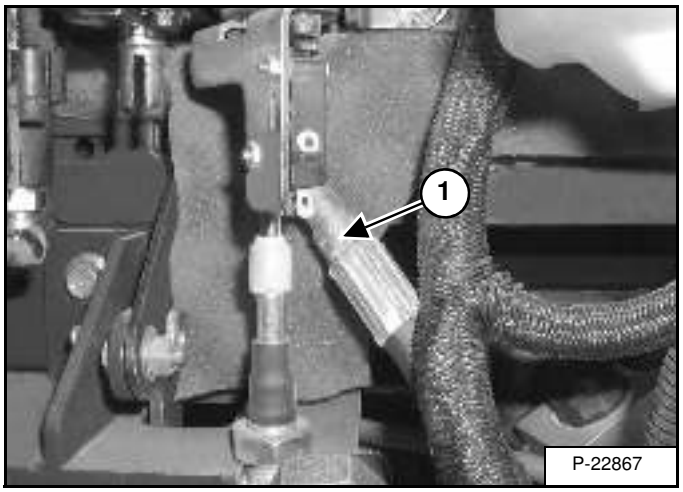
Remove the three hoses (Item 1) **[Figure 20-40-8]**.

Figure 20-40-9



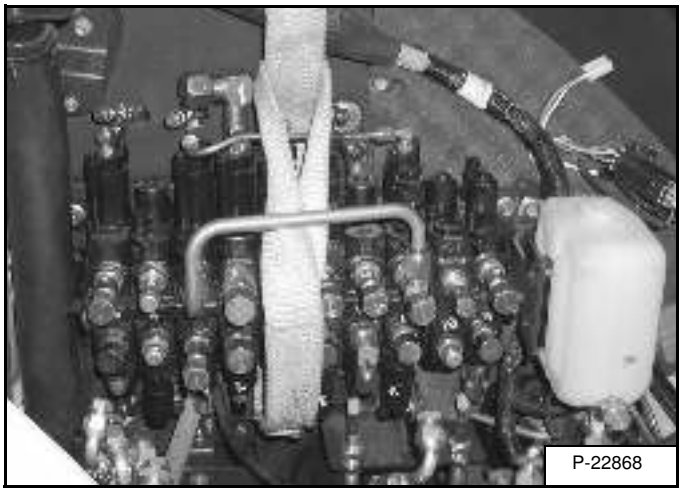
Remove the three cotter pins and clevis pins (Item 1). Mark and remove the wire harness (Item 2) **[Figure 20-40-9]**.

Figure 20-40-10



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

Figure 20-40-11

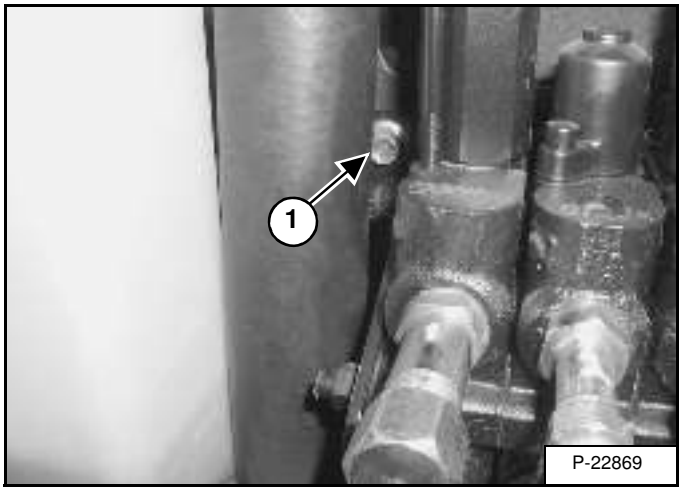


Install a sling around the center of the valve assembly. Attach a hoist to the sling **[Figure 20-40-11]**.

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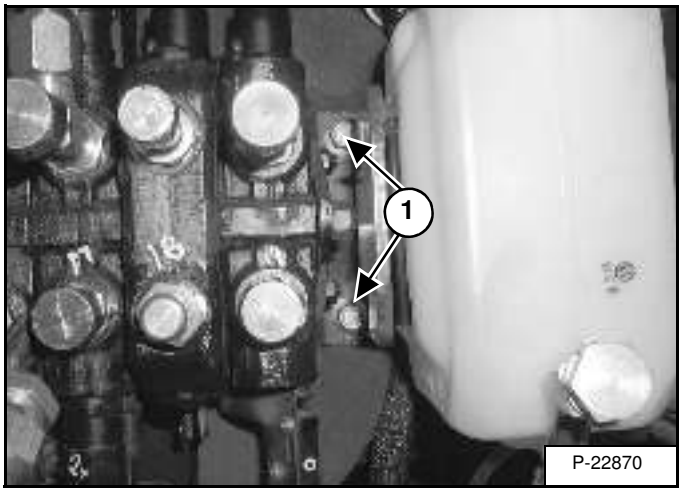
Removal And Installation (Cont'd)

Figure 20-40-12



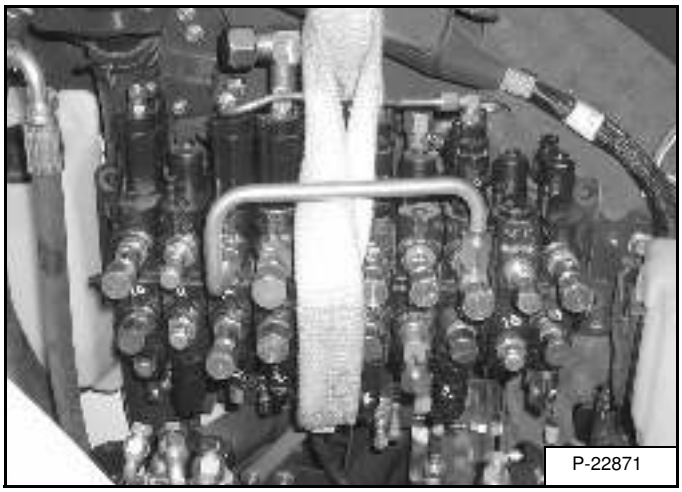
Remove the left bolt (Item 1) **[Figure 20-40-12]**.

Figure 20-40-13



Remove the two right bolts (Item 1) **[Figure 20-40-13]**.

Figure 20-40-14



Remove the valve from the excavator **[Figure 20-40-14]**.

Figure 20-40-15



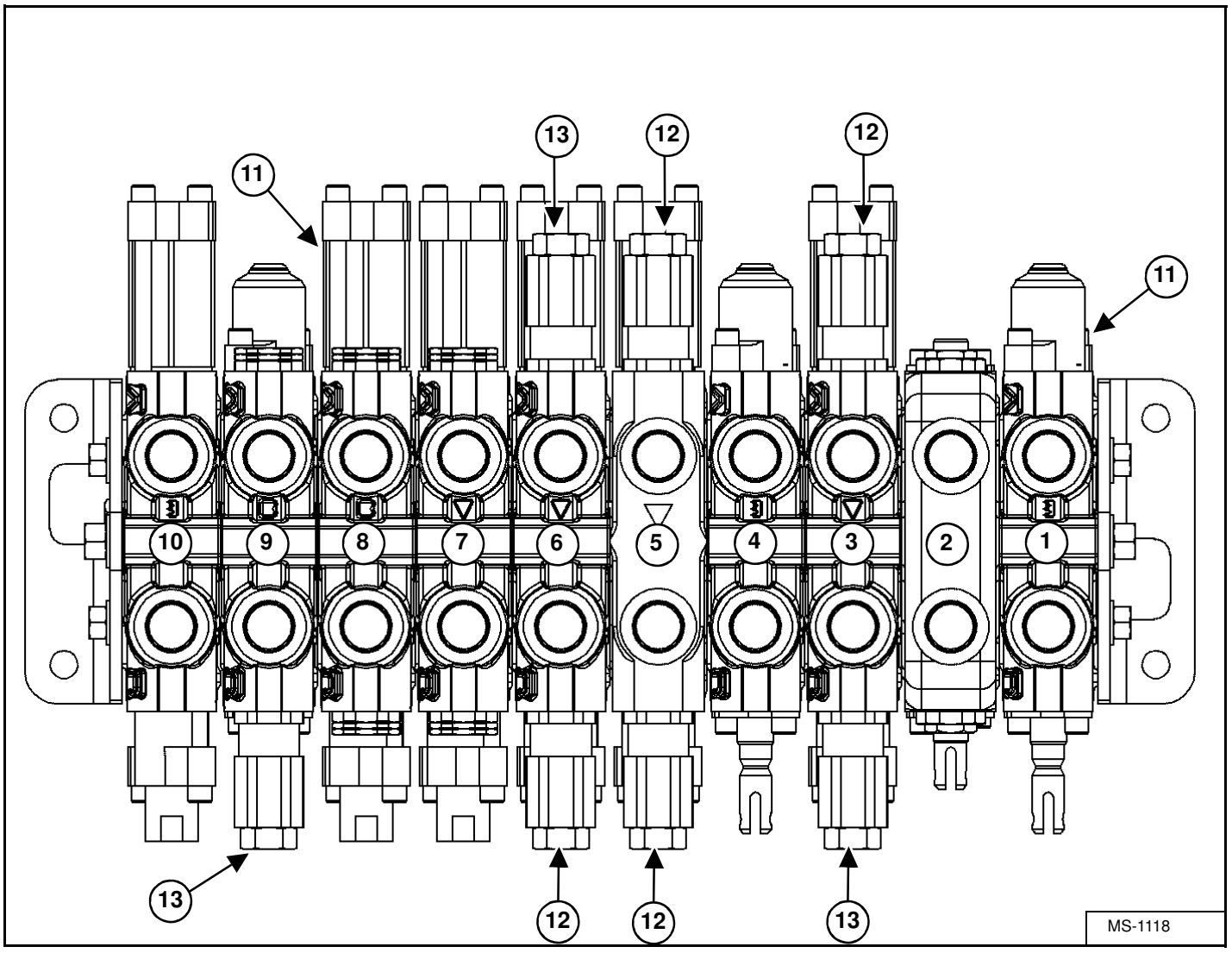
Mark and remove the fittings and tubelines before disassembling the valve **[Figure 20-40-15]**.

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Control Valve Identification

Item	Description
1.	Right Travel Section
2.	Boom Swing Section
3.	Boom Section
4.	Left Travel Section
5.	Arm Section
6.	Bucket Section
7.	Auxiliary Section
8.	Boost Section
9.	Blade Section
10.	Swing Section
11.	Main Relief Valve 2800 PSI (19306 kPa)
12.	Port Relife Valve 2950 PSI (20340 kPa)
13.	Port Relief Valve 3400 PSI (23442 kPa)

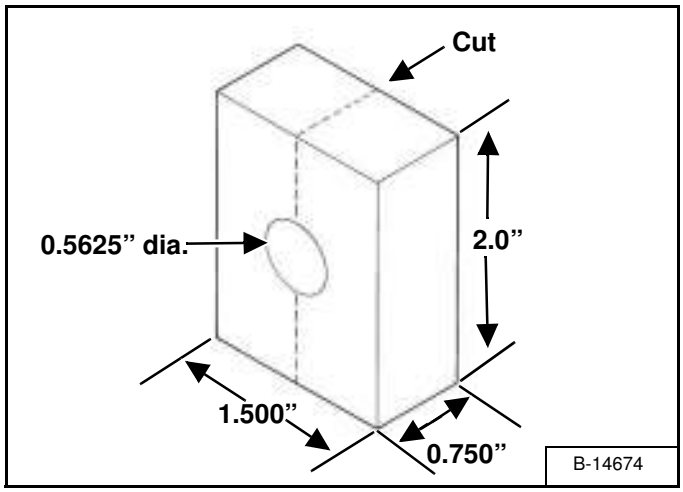
Figure 20-40-16



Dealer Copy -- Not for Resale

Disassembly

Figure 20-40-17



To remove the end cover 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 0.5625 inch (14 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-17]**.

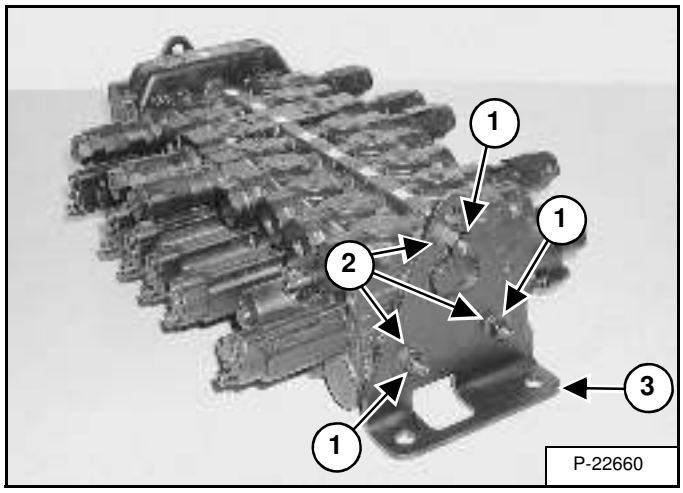
IMPORTANT

Do not use parts from one assembly to repair another assembly. Hydraulic and hydrostatic parts develop specific wear patterns. Used parts must be installed in the exact location that they were removed from.

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

Figure 20-40-18



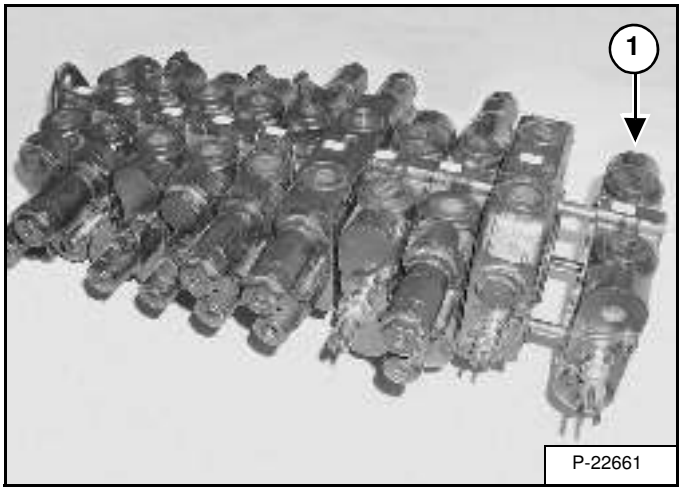
Remove the three nuts (Item 1) and washers (Item 2) **[Figure 20-40-18]** from the tie rods.

Remove the bracket (Item 3) **[Figure 20-40-18]** from the control valve assembly.

Dealer Copy -- Not for Resale

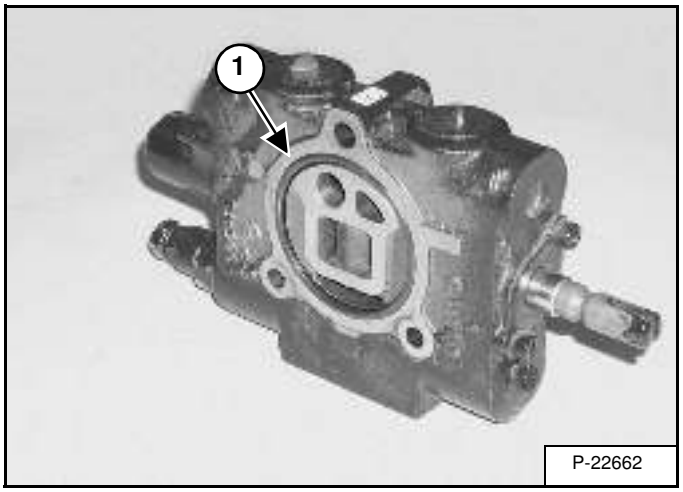
Right Travel Valve Section Disassembly And Assembly

Figure 20-40-19



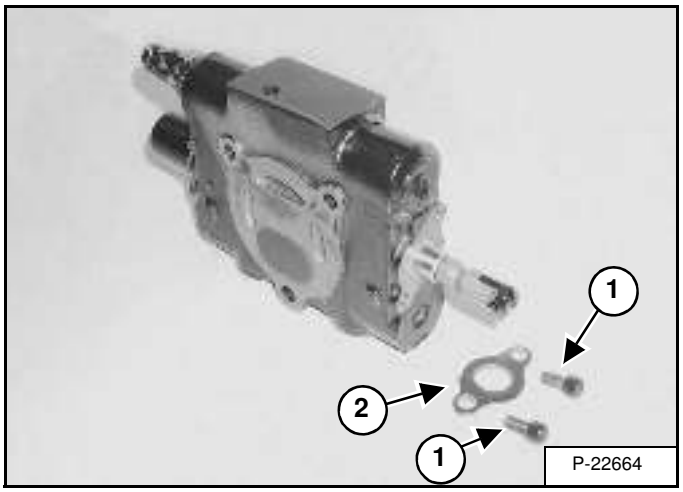
Remove the right travel valve (Item 1) **[Figure 20-40-19]** from the control valve assembly.

Figure 20-40-20



Remove the O-ring (Item 1) **[Figure 20-40-20]** from the right travel valve block.

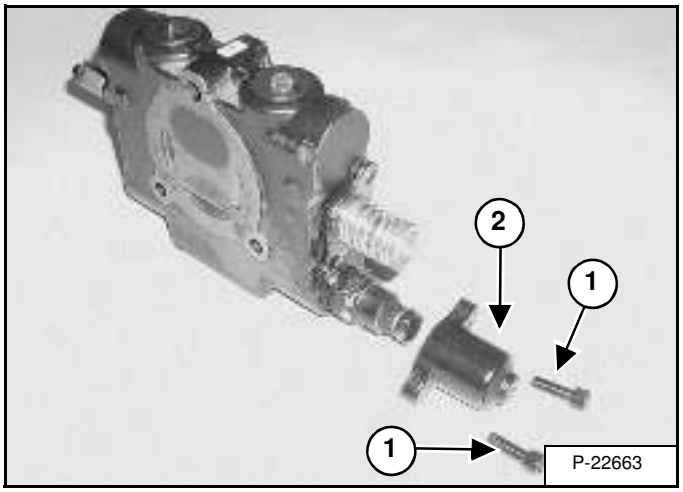
Figure 20-40-21



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

Installation: Tighten the two bolts to 7 ft.-lbs. (9,5 Nm) torque.

Figure 20-40-22



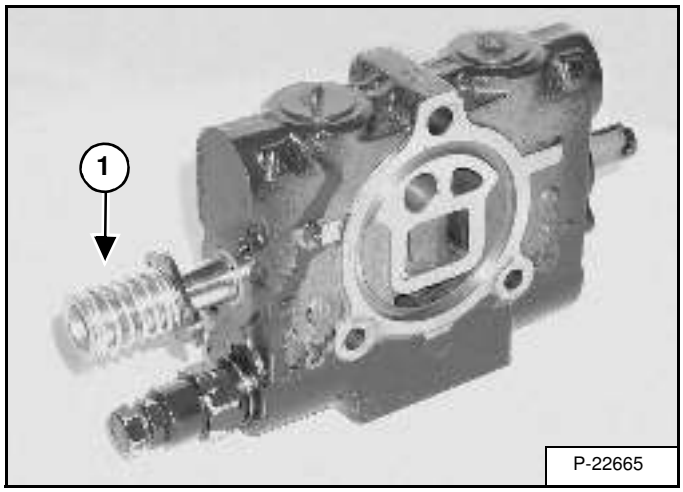
Remove the two screws (Item 1) and end cap (Item 2) **[Figure 20-40-22]**.

Installation: Tighten the two screws to 7 ft.-lbs. (9,5 Nm) torque.

Dealer Copy -- Not for Resale

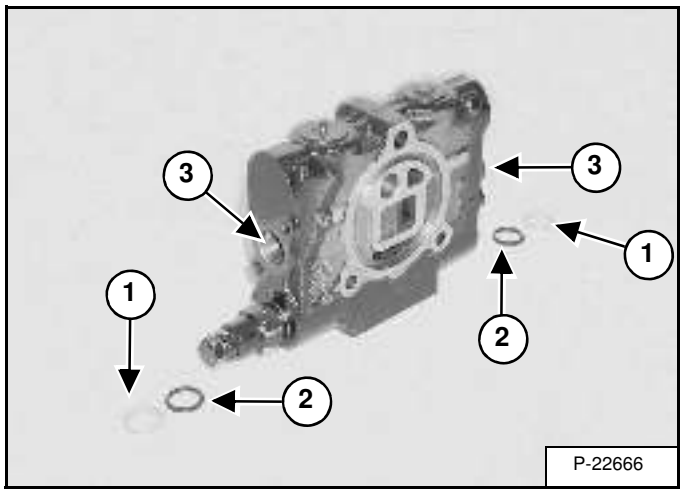
Right Travel Section (Cont'd)

Figure 20-40-23



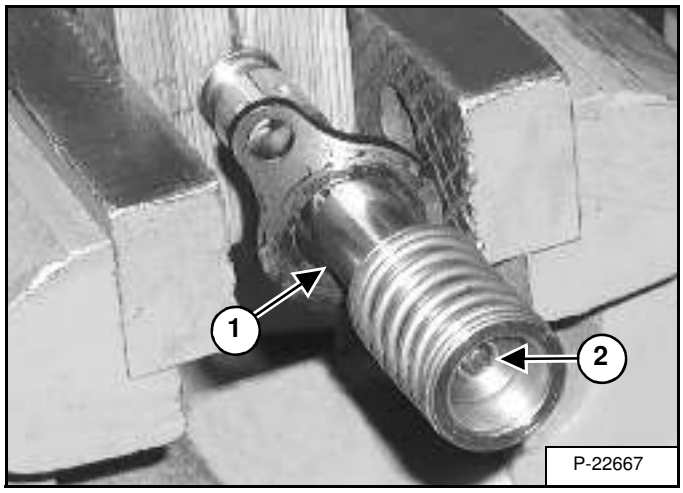
Remove the spool (Item 1) **[Figure 20-40-23]** from the right travel valve block.

Figure 20-40-24



Remove the wipers (Item 1) and O-rings (Item 2) from the spool ports (Item 3) **[Figure 20-40-24]** of the valve block.

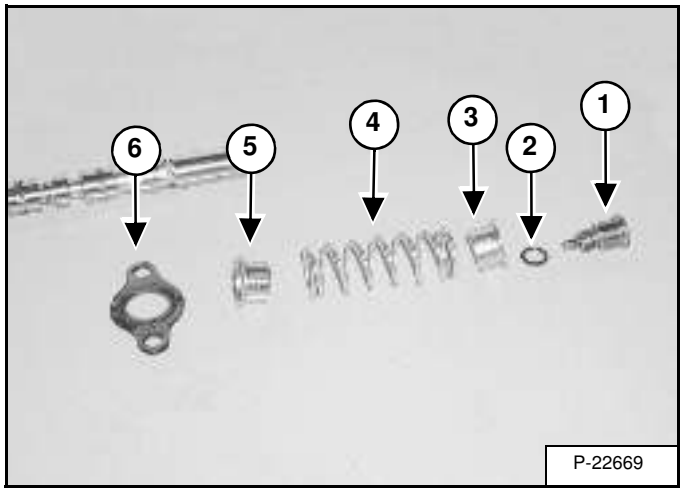
Figure 20-40-25



Clamp the spool (Item 1) in a vise and loosen the spring retaining screws (Item 2) **[Figure 20-40-25]**.

NOTE: The spring is under pressure, use care when removing the spring retaining screw.

Figure 20-40-26



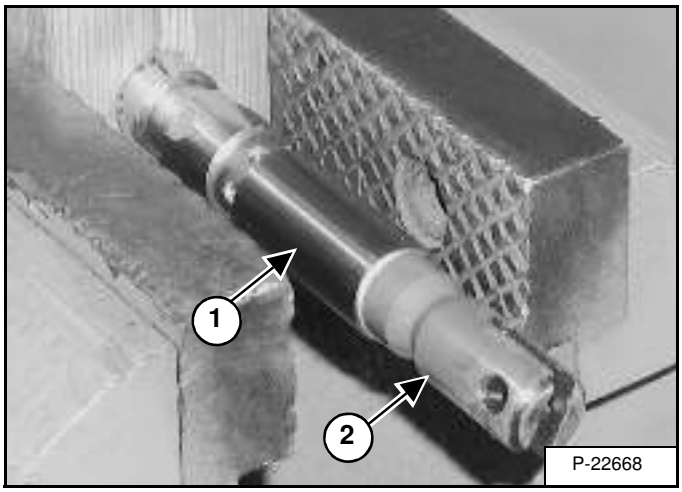
Remove the spring retaining screw (Item 1), O-ring (Item 2), spring retainer (Item 3), spring (Item 4), spring retainer (Item 5) and retaining plate (Item 6) **[Figure 20-40-26]** from the spool.

Installation: Apply thread lock adhesive (LOCTITE 242) to the threads of the spring retaining screw and tighten to 7 ft.-lbs. (9 Nm) torque.

Dealer Copy -- Not for Resale

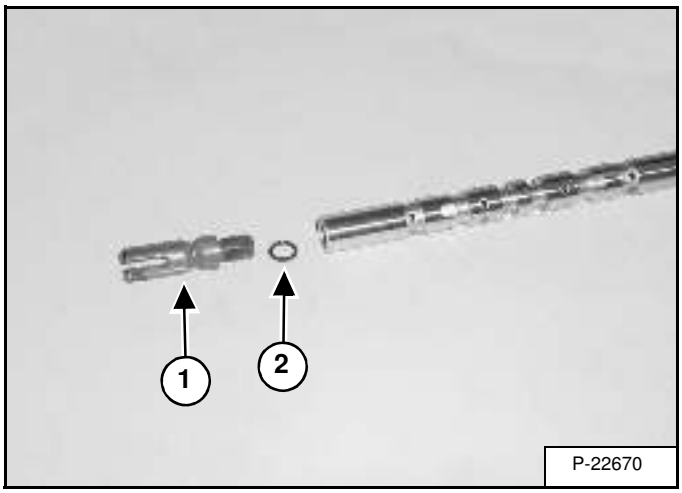
Right Travel Section (Cont'd)

Figure 20-40-27



Clamp the spool (Item 1) in a vise and loosen the yoke (Item 2) **[Figure 20-40-27]**.

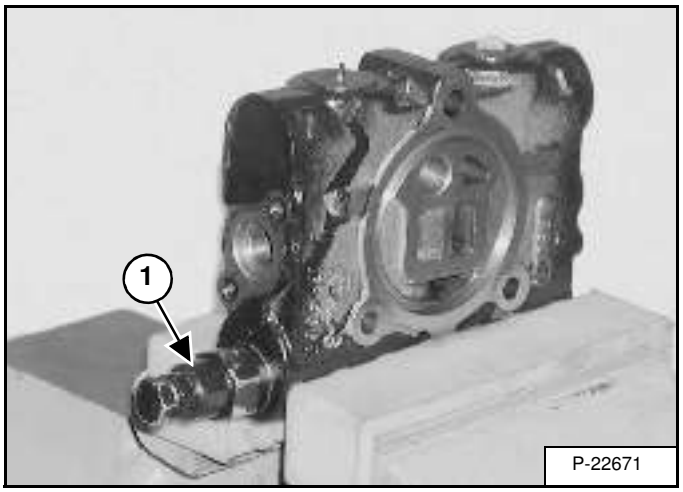
Figure 20-40-28



Remove the yoke (Item 1) and O-ring (Item 2) **[Figure 20-40-28]** from the spool.

Installation: Apply thread lock adhesive (LOCTITE 242) to the threads of the spring retaining screw and tighten to 7 ft.-lbs. (9 Nm) torque.

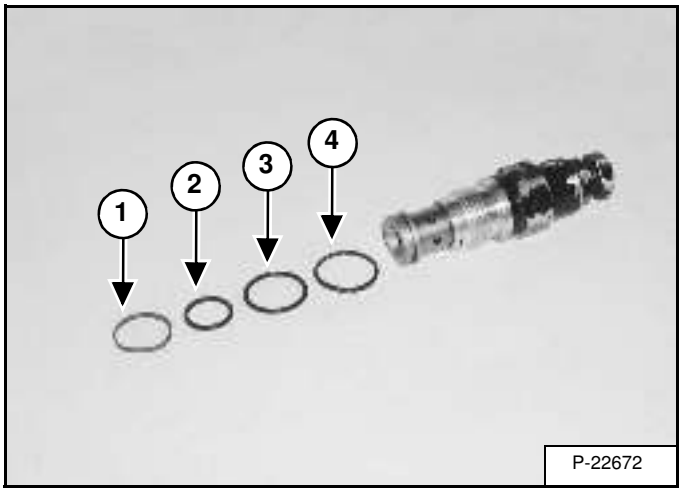
Figure 20-40-29



Remove the main relief valve (Item 1) **[Figure 20-40-29]** from the right travel valve block.

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

Figure 20-40-30

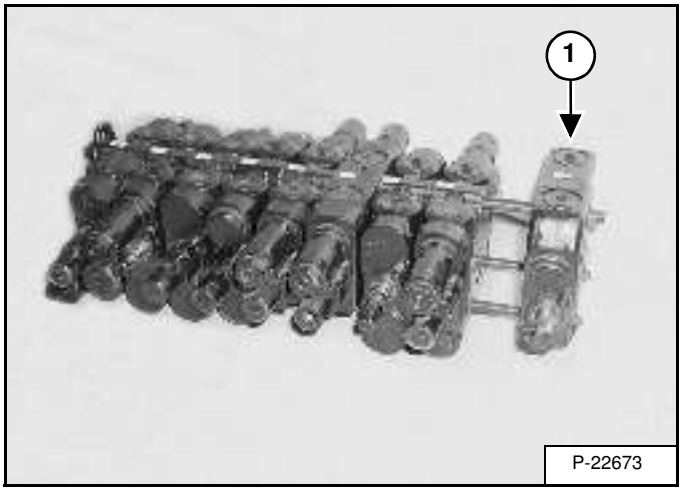


Remove the glide ring (Item 1), O-ring (Item 2), O-ring (Item 3), and back-up ring (Item 4) **[Figure 20-40-30]** from the main relief valve.

Dealer Copy -- Not for Resale

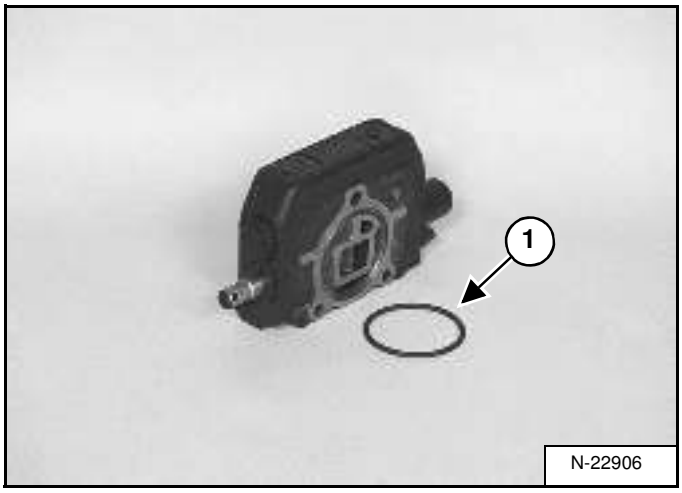
Boom Offset Valve Section Disassembly And Assembly

Figure 20-40-31



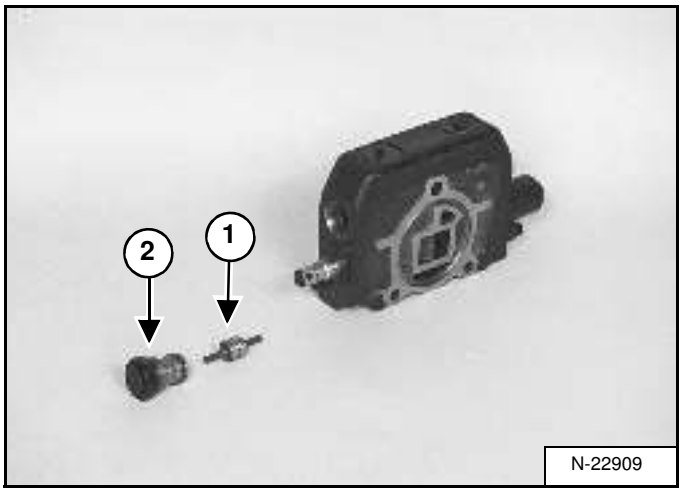
Remove the boom offset valve (Item 1) **[Figure 20-40-31]** from the control valve assembly.

Figure 20-40-32



Remove the O-ring (Item 1) **[Figure 20-40-32]** from the boom offset valve block.

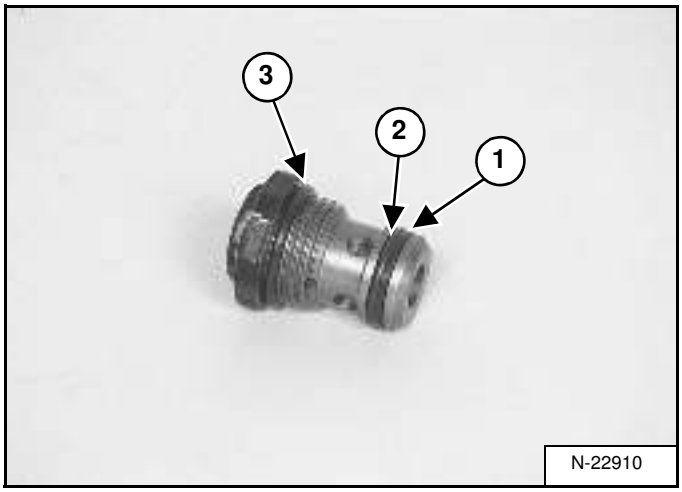
Figure 20-40-33



Remove the lock out valve (Item 1) and spool (Item 2) **[Figure 20-40-33]** from the boom offset valve.

Installation: Tighten the lockout valve to 48 ft.-lbs. (65 Nm) torque.

Figure 20-40-34

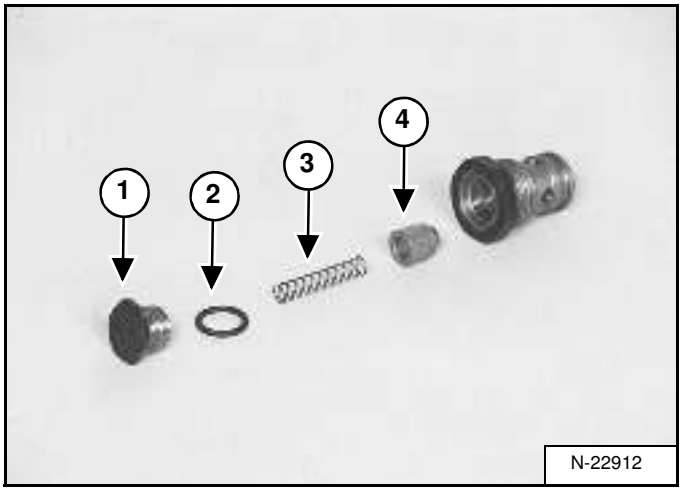


Remove the back-up ring (Item 1) O-ring (Item 2) and O-ring (Item 3) **[Figure 20-40-34]** from the lockout valve.

Dealer Copy -- Not for Resale

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

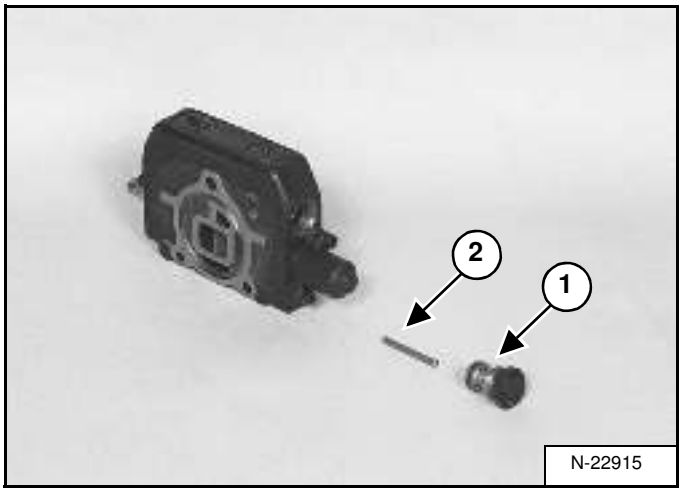
Figure 20-40-35



Remove the plug (Item 1), O-ring (Item 2), spring (Item 3) and poppet (Item 4) **[Figure 20-40-35]** from the lock out valve assembly.

Installation: Tighten the plug to 15 ft.-lbs. (20 Nm) torque.

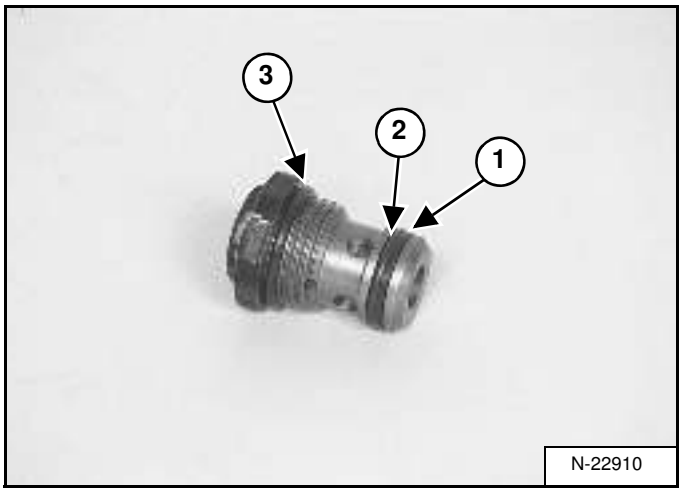
Figure 20-40-36



Remove the lock out valve assembly (Item 1) and pin (Item 2) **[Figure 20-40-36]** from the boom offset valve block.

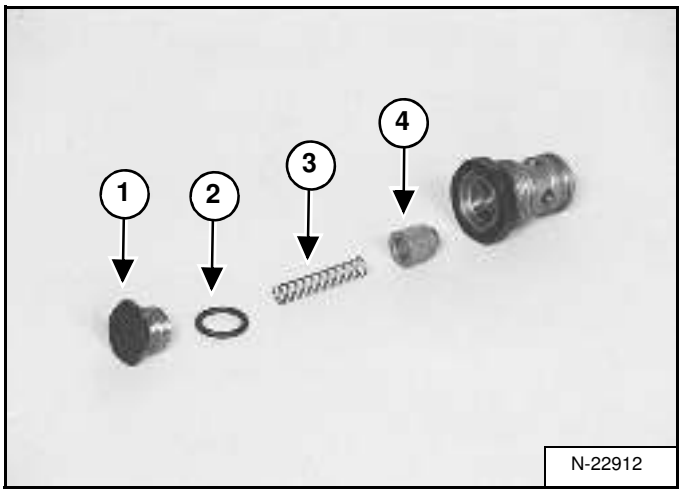
Installation: Tighten the valve assembly to 48 ft.-lbs (65 Nm) torque.

Figure 20-40-37



Remove the back-up ring (Item 1) and O-ring (Item 2) and O-ring (Item 3) **[Figure 20-40-37]** from the lock out valve.

Figure 20-40-38



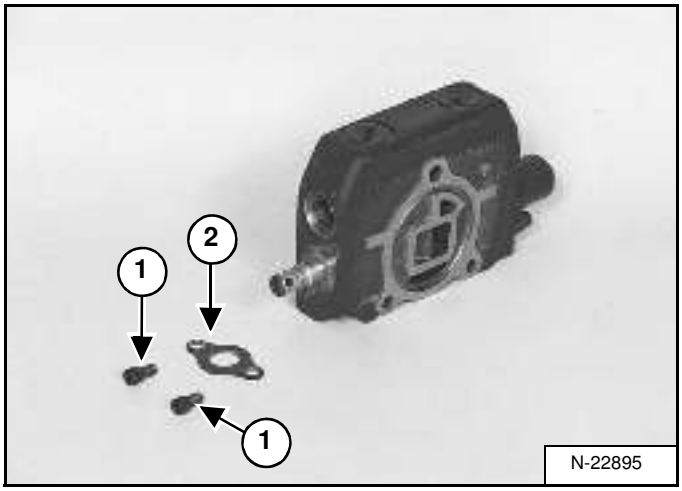
Remove the plug (Item 1), O-ring (Item 2), spring (Item 3) .and poppet (Item 4) **[Figure 20-40-38]** from the lock out valve.

Installation: Tighten the plug to 15 ft.-lbs. (20 Nm) torque.

Dealer Copy -- Not for Resale

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

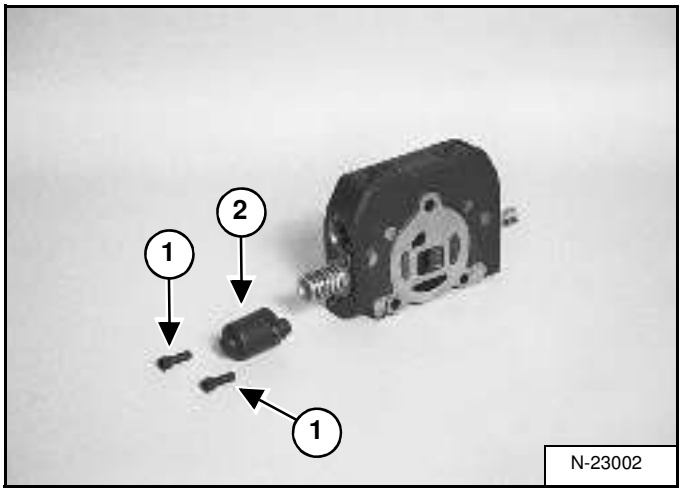
Figure 20-40-39



Remove the two screws (Item 1) and retaining plate (Item 2) **[Figure 20-40-39]** from the actuating end of the spool.

Installation: Tighten the screws to 7 ft.-lbs (9,5 Nm) torque.

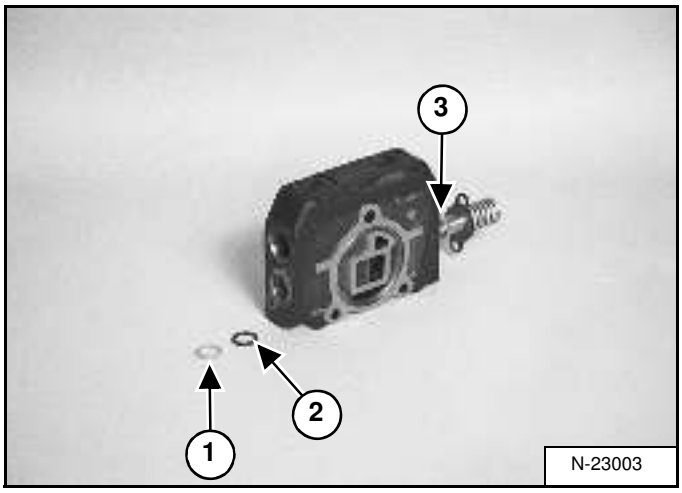
Figure 20-40-40



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

Installation: Tighten the screws to 7 ft.-lbs (9,5 Nm) torque.

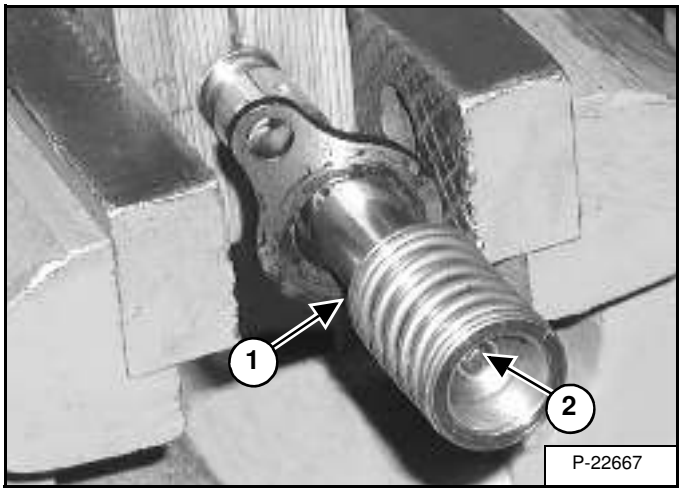
Figure 20-40-41



Remove the wiper (Item 1) and O-ring (Item 2) **[Figure 20-40-41]** from the actuating end of the spool.

Remove the spool (Item 3) **[Figure 20-40-41]**.

Figure 20-40-42

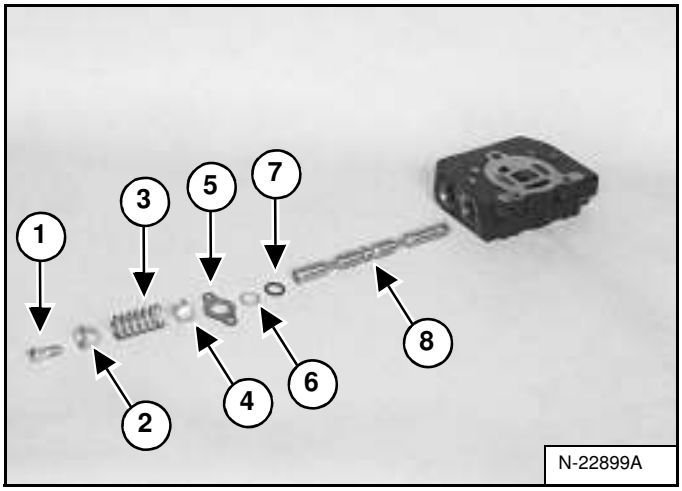


Clamp the spool (Item 1) in a vise and loosen the spring retaining screw (Item 2) **[Figure 20-40-42]**.

Dealer Copy -- Not for Resale

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

Figure 20-40-43



Remove the spring retaining screw (Item 1), spring retainer (Item 2), spring (Item 3), spring retainer (Item 4), retaining plate (Item 5), wiper (Item 6), and O-ring (Item 7) from the spool (Item 8) **[Figure 20-40-43]**.

The spool and valve block are not serviced separately.

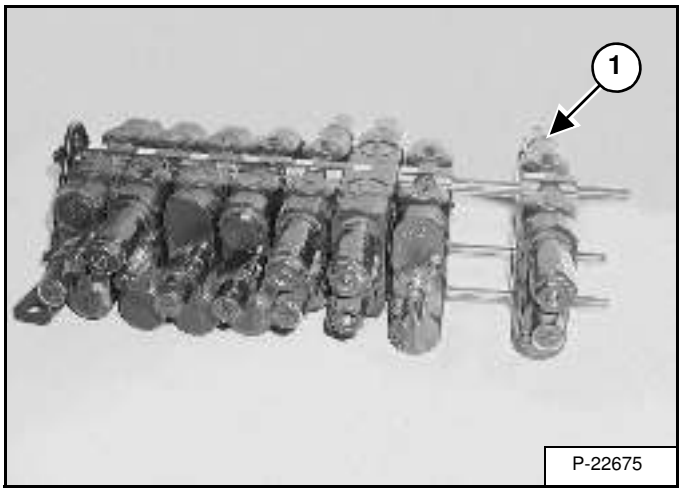
NOTE: The spring is under pressure, use care when removing the spring retaining screw.

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

Installation: Apply thread lock adhesive (LOCTITE 242) to the spring retaining screw (Item 1) **[Figure 20-40-43]** threads. Tighten the spring retaining screw to 7 ft.-lbs (9,5 Nm) torque.

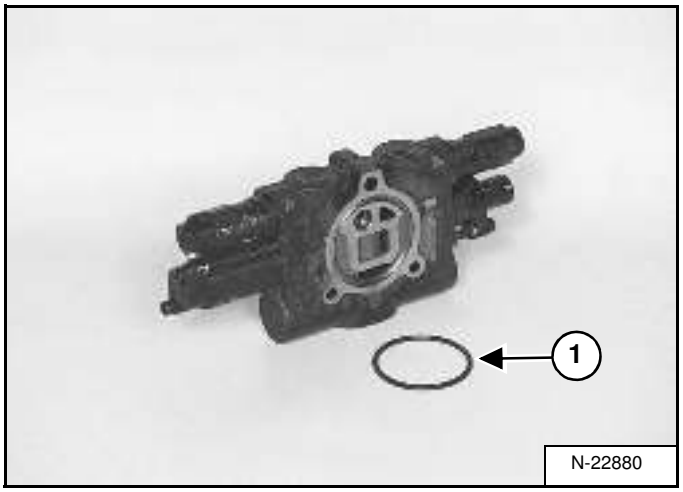
Boom Valve Section Disassembly And Assembly

Figure 20-40-44



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

Figure 20-40-45

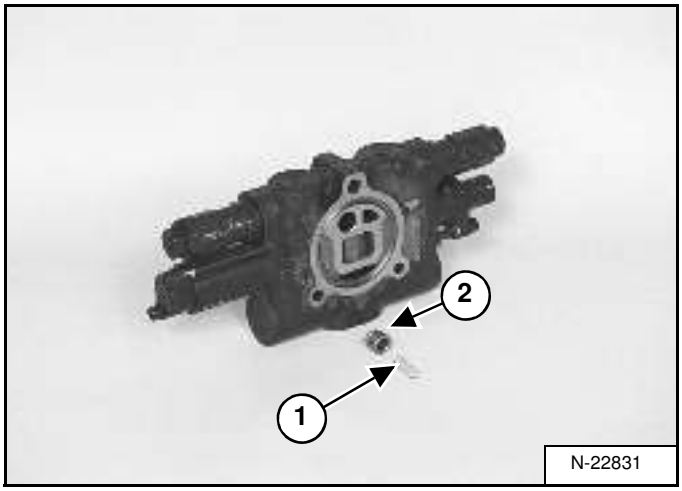


Remove the O-ring (Item 1) **[Figure 20-40-45]** from the boom valve block.

Dealer Copy -- Not for Resale

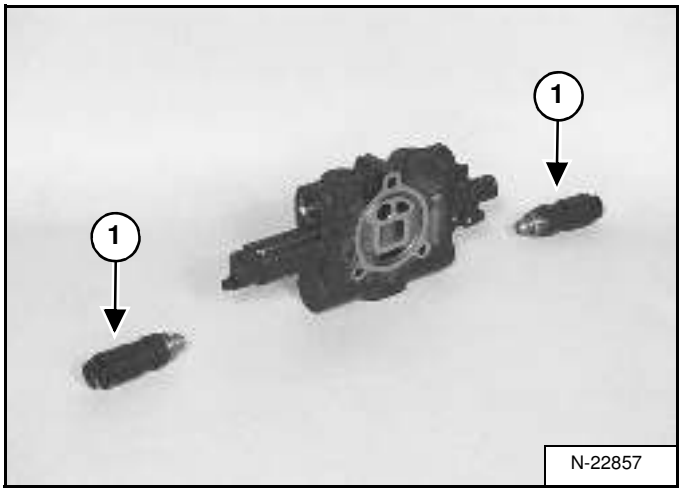
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-46



Remove the spring (Item 1) and poppet (Item 2) **[Figure 20-40-46]**.

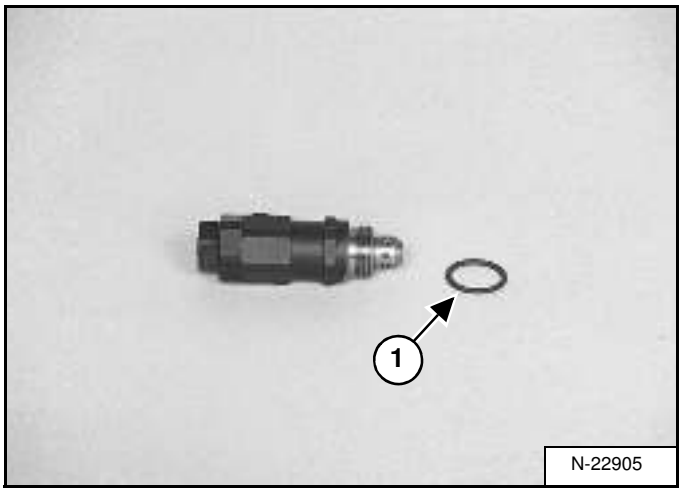
Figure 20-40-47



Remove the two relief valves (Item 1) **[Figure 20-40-47]**.

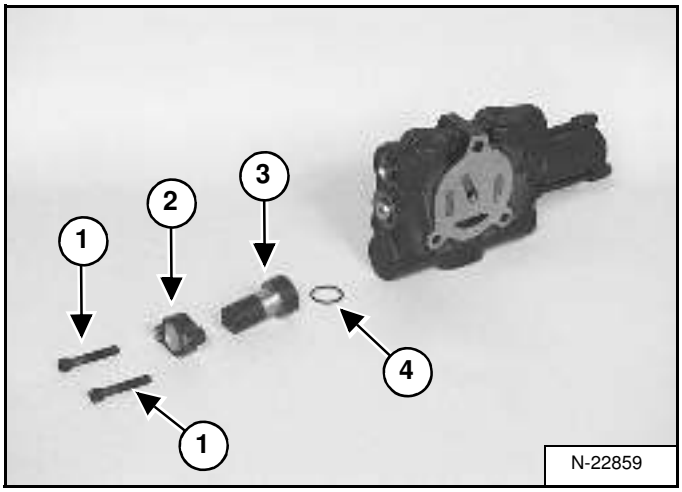
Installation: Tighten the relief valves to 33 ft.-lbs (45 Nm) torque.

Figure 20-40-48



Remove the O-ring (Item 1) **[Figure 20-40-48]** from the relief valves.

Figure 20-40-49



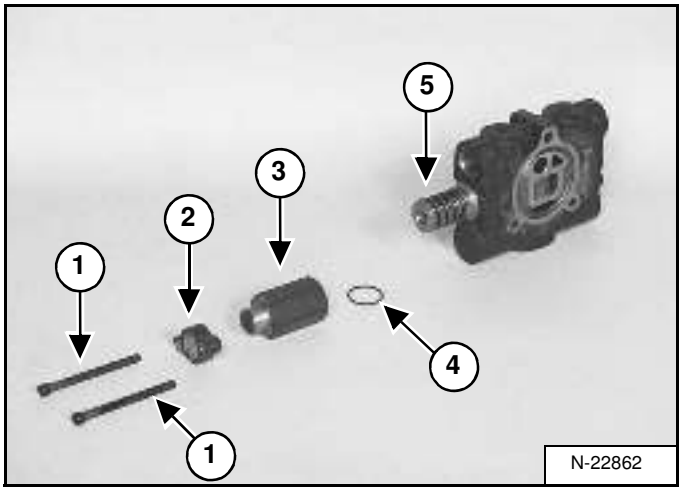
Remove the two screws (Item 1), retaining mount (Item 2), end cover (Item 3) and O-ring (Item 4) **[Figure 20-40-49]**.

Installation: Tighten the screws to 7 ft.-lbs (9,5 Nm) torque.

Dealer Copy -- Not for Resale

Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-50

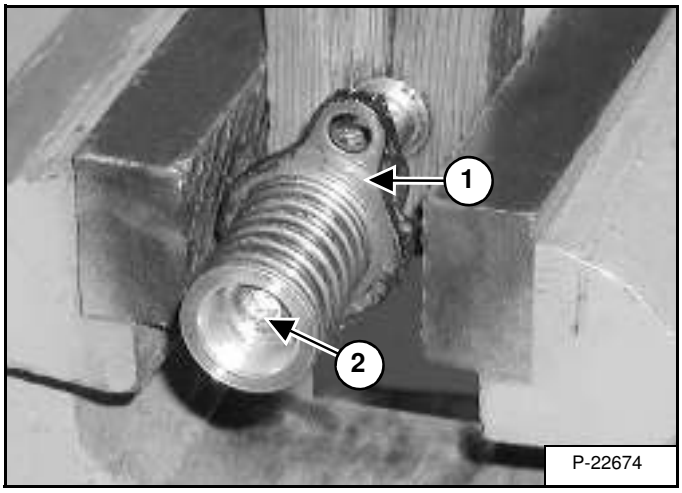


Remove the two screws (Item 1), retaining mount (Item 2), end cover (Item 3) and O-ring (Item 4) **[Figure 20-40-50]**.

Installation: Tighten the screws to 7 ft.-lbs (9,5 Nm) torque.

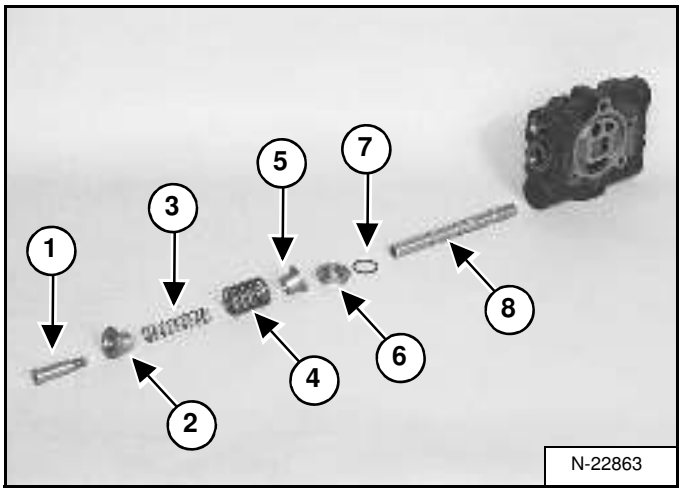
Remove the spool (Item 5) **[Figure 20-40-50]**.

Figure 20-40-51



Clamp the spool (Item 1) in a vise and loosen the spring retaining screw (Item 2) **[Figure 20-40-51]**.

Figure 20-40-52



Remove the spring retaining screw (Item 1), spring retainer (Item 2), small spring (Item 3), large spring (Item 4), spring retainer (Item 5), retainer (Item 6) and O-ring (Item 7) from the spool (Item 8) **[Figure 20-40-52]**.

The spool and valve block are not serviced separately.

NOTE: The spring is under pressure, use care when removing the spring retaining screw.

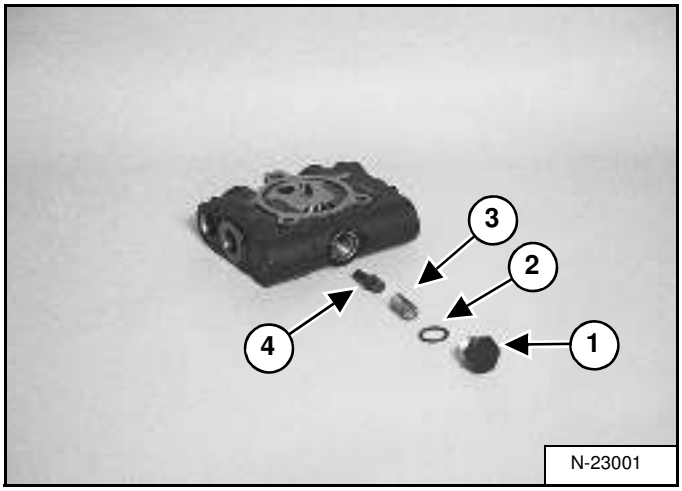
NOTE: When the spool is removed, use care not to scratch the spool surface and do not interchange spools and valve blocks.

Installation: Apply thread lock adhesive (LOCTITE 242) to the spring retaining screw (Item 1) **[Figure 20-40-52]** threads. Tighten the spring retaining screw to 7 ft.-lbs (9,5 Nm) torque.

Dealer Copy -- Not for Resale

Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-53

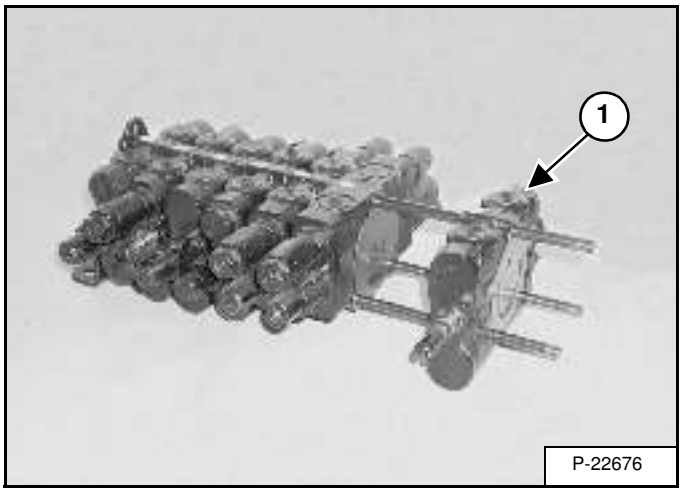


Remove the plug (Item 1), O-ring (Item 2), spring (Item 3) and piston (Item 4) **[Figure 20-40-53]** from the bottom of the bucket valve.

Installation: Tighten the plug to 33 ft.-lbs (44,7 Nm) torque.

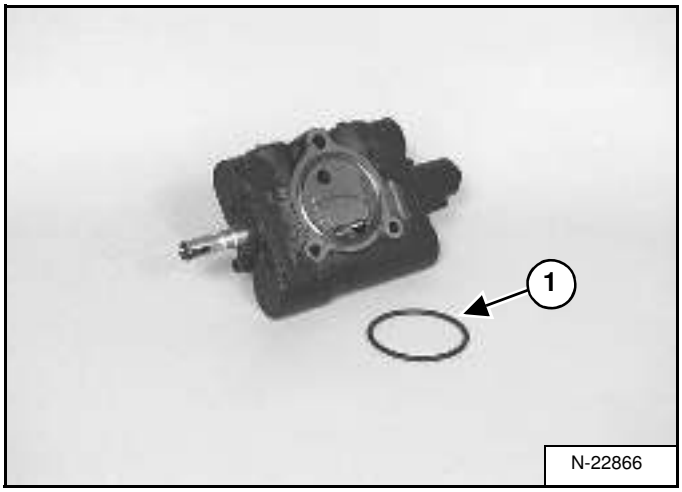
Left Travel Valve Section Disassembly And Assembly

Figure 20-40-54



Remove the left travel valve section (Item 1) **[Figure 20-40-54]** from the control valve assembly.

Figure 20-40-55

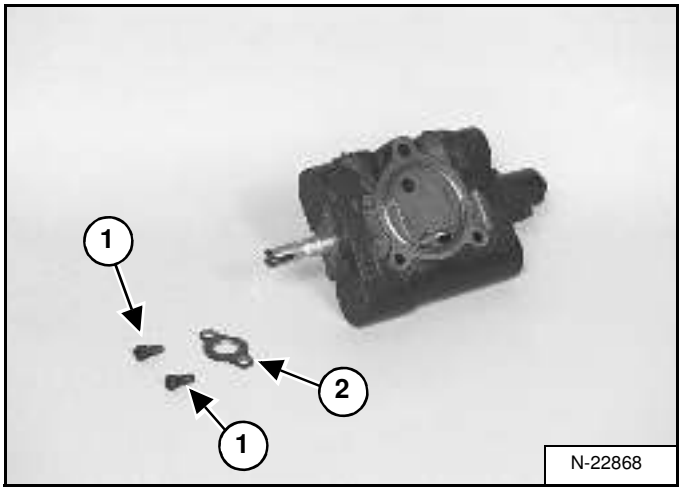


Remove the O-ring (Item 1) **[Figure 20-40-55]** from the left travel valve block.

Dealer Copy -- Not for Resale

Boom Valve Section Disassembly And Assembly (Cont'd)

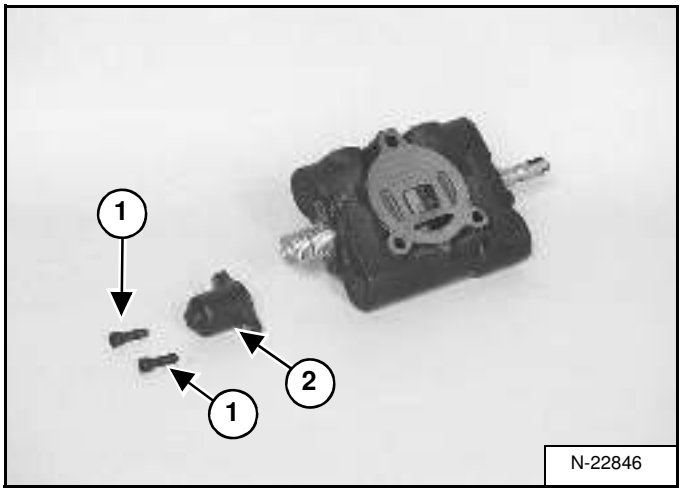
Figure 20-40-56



Remove the two screws (Item 1) and retaining plate (Item 2) **[Figure 20-40-56]** from the actuating end of the spool.

Installation: Tighten the screws to 7 ft.-lbs (9,5 Nm) torque.

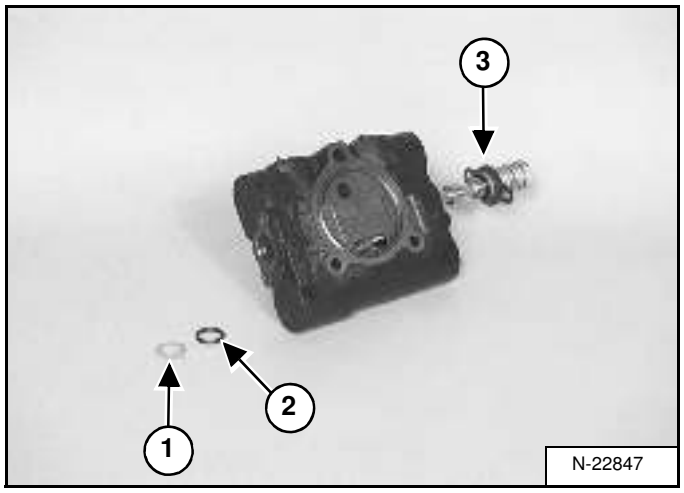
Figure 20-40-57



Remove the two screws (Item 1) and end cap (Item 2) **[Figure 20-40-57]**.

Installation: Tighten the screws to 7 ft.-lbs (9,5 Nm) torque.

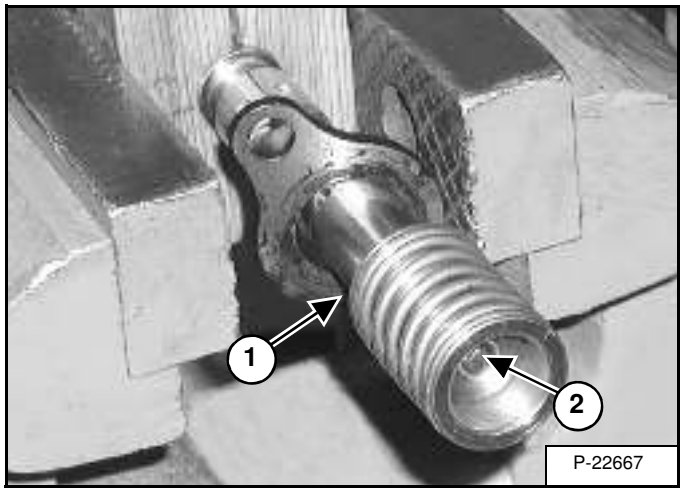
Figure 20-40-58



Remove the wiper (Item 1) and O-ring (Item 2) **[Figure 20-40-58]** from the actuating end of the spool.

Remove the spool (Item 3) **[Figure 20-40-58]**.

Figure 20-40-59

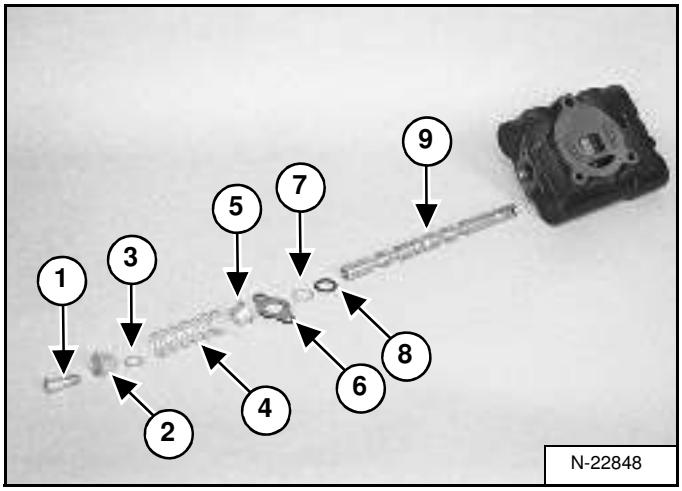


Clamp the spool (Item 1) in a vise and loosen the spring retaining screw (Item 2) **[Figure 20-40-59]**.

Dealer Copy -- Not for Resale

Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-60



Remove the spring retaining screw (Item 1), spring retainer (Item 2), washer (Item 3), spring (Item 4), spring retainer (Item 5), retaining plate (Item 6), wiper (Item 7), and O-ring (Item 8) from the spool (Item 9) **[Figure 20-40-60]**.

The spool and valve block are not serviced separately.

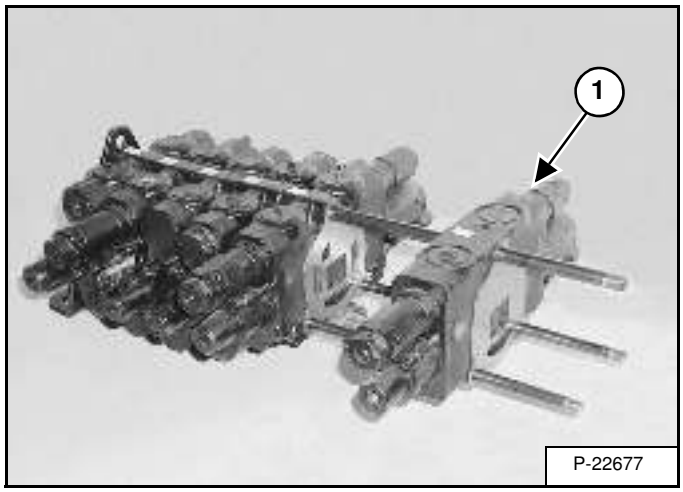
NOTE: The spring is under pressure, use care when removing the spring retaining screw.

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

Installation: Apply thread lock adhesive (LOCTITE 242) to the spring retaining screw (Item 1) **[Figure 20-40-60]** threads. Tighten the spring retaining screw to 7 ft.-lbs (9,5 Nm) torque.

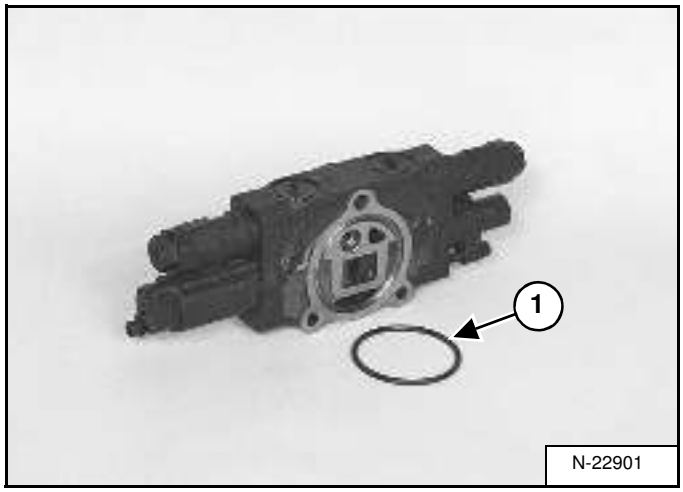
Arm Valve Section Disassembly And Assembly

Figure 20-40-61



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

Figure 20-40-62

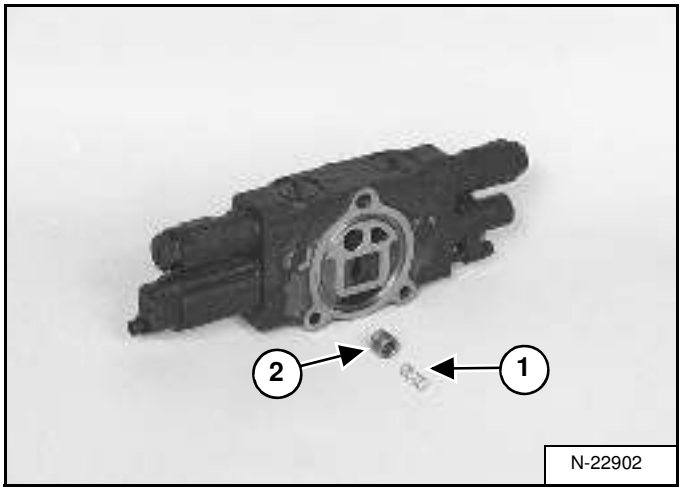


Remove the O-ring (Item 1) **[Figure 20-40-62]** from the arm valve block.

Dealer Copy -- Not for Resale

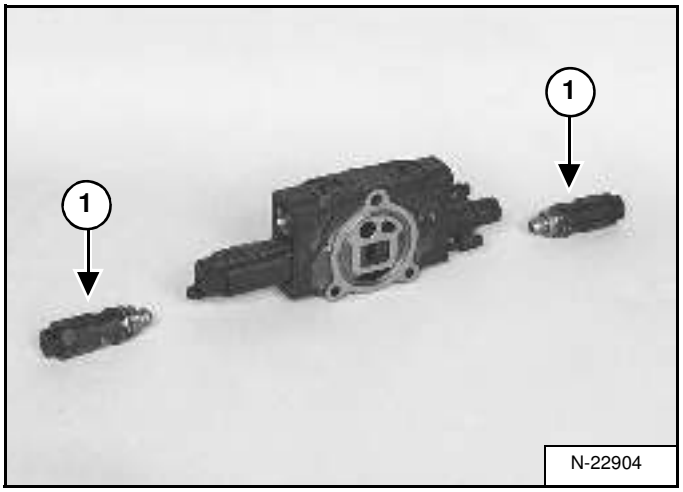
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-63



Remove the spring (Item 1) and poppet (Item 2) **[Figure 20-40-63]**.

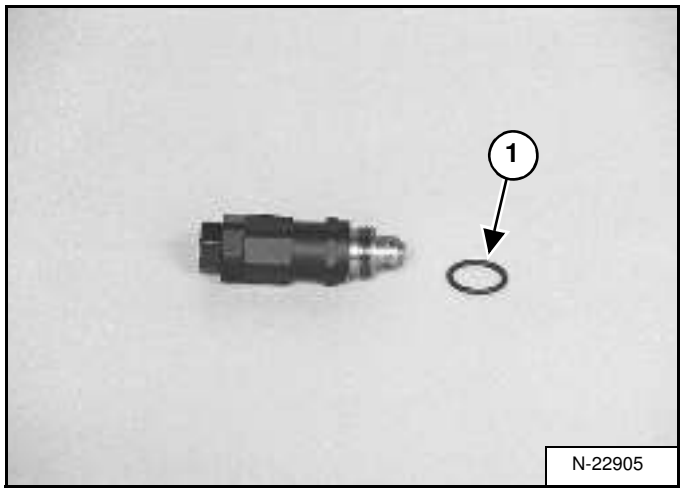
Figure 20-40-64



Remove the two relief valves (Item 1) **[Figure 20-40-64]**.

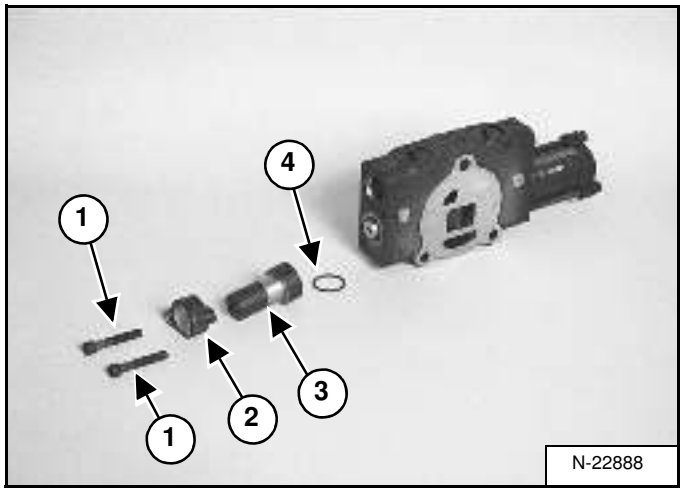
Installation: Tighten the relief valves to 33 ft.-lbs (44 Nm) torque.

Figure 20-40-65



Remove the O-ring (Item 1) **[Figure 20-40-65]** from the relief valves.

Figure 20-40-66



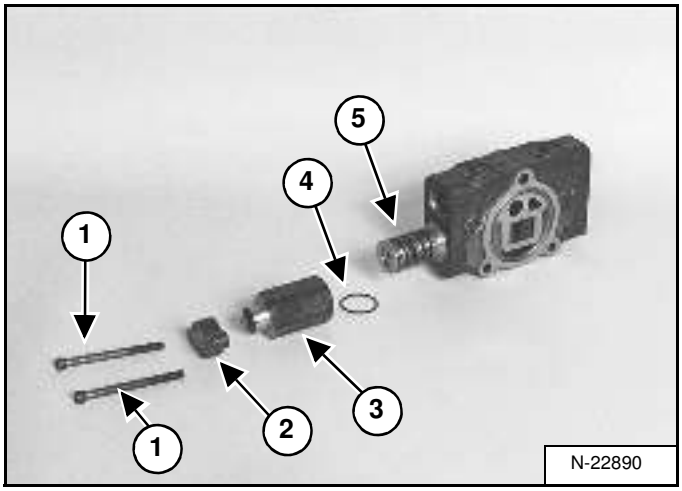
Remove the two screws (Item 1), retaining mount (Item 2), end cover (Item 3) and O-ring (Item 4) **[Figure 20-40-66]**.

Installation: Tighten the screws to 7 ft.-lbs (9,5 Nm) torque.

Dealer Copy -- Not for Resale

Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-67

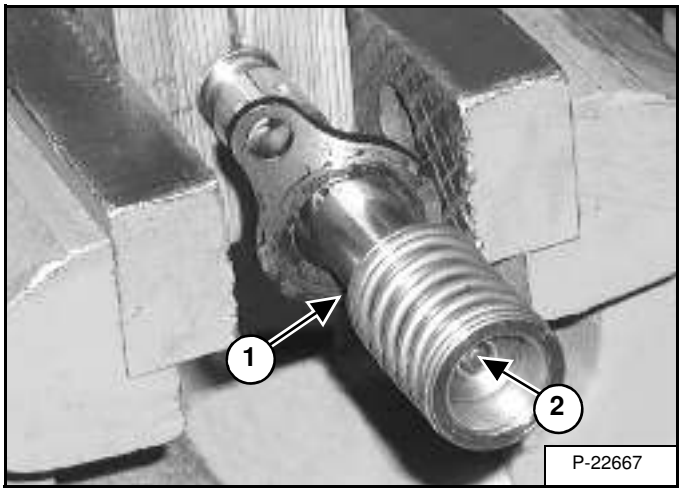


Remove the two screws (Item 1), retaining mount (Item 2), end cover (Item 3) and O-ring (Item 4) **[Figure 20-40-67]**.

Installation: Tighten the screws to 7 ft.-lbs (9,5 Nm) torque.

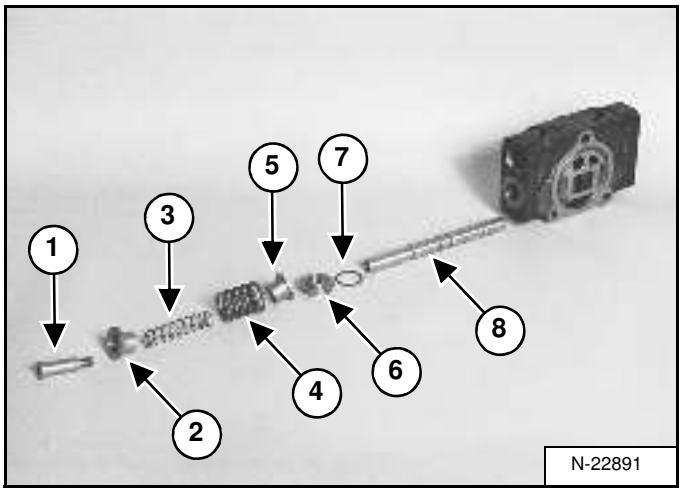
Remove the spool (Item 5) **[Figure 20-40-67]** from the arm valve block.

Figure 20-40-68



Clamp the spool (Item 1) in a vise and loosen the spring retaining screws (Item 2) **[Figure 20-40-68]**.

Figure 20-40-69



Remove the spring retaining screw (Item 1), spring retainer (Item 2), small spring (Item 3), large spring (Item 4), spring retainer (Item 5), retainer (Item 6), and O-ring (Item 7) from the spool (Item 8) **[Figure 20-40-69]**.

The spool and valve block are not serviced separately.

NOTE: The spring is under pressure, use care when removing the spring retaining screw.

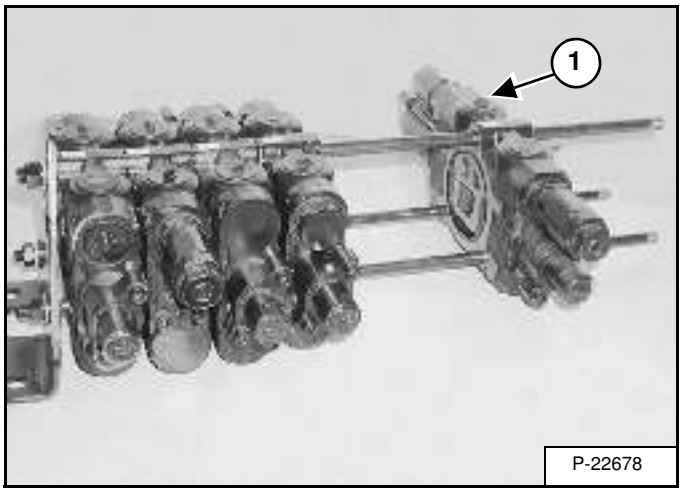
NOTE: When the spool is removed, use care not to scratch the spool surface and do not interchange spools and valve blocks.

Installation: Apply thread lock adhesive (LOCTITE 242) to the spring retaining screw (Item 1) **[Figure 20-40-69]** threads. Tighten the spring retaining screw to 7 ft.-lbs (9,5 Nm) torque.

Dealer Copy -- Not for Resale

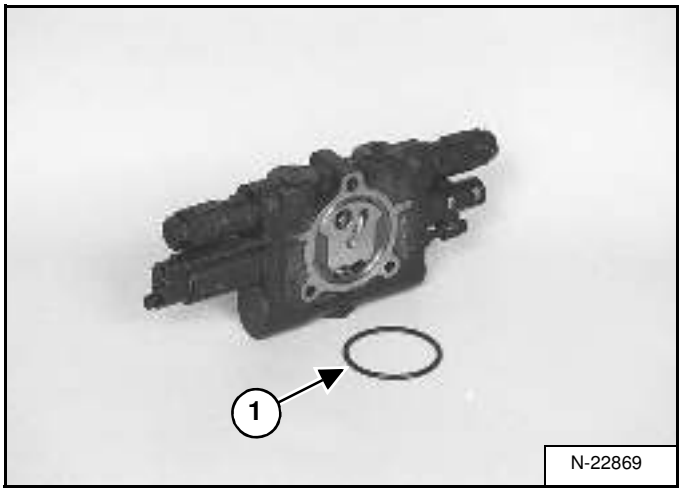
Bucket Valve Section Disassembly And Assembly

Figure 20-40-70



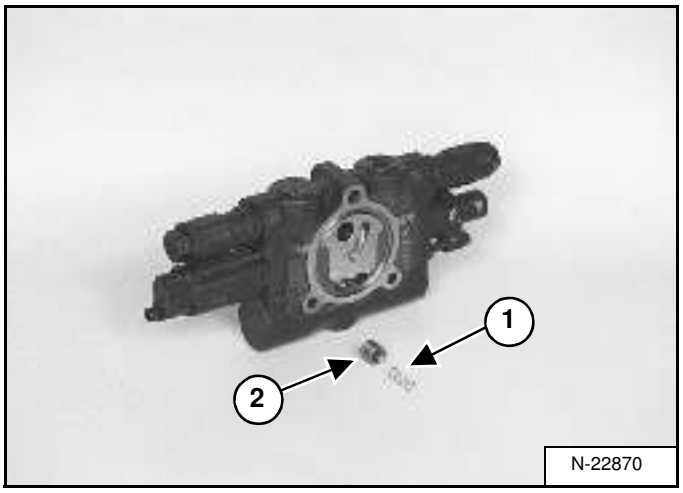
Remove the bucket valve (Item 1) **[Figure 20-40-70]** from the valve assembly.

Figure 20-40-71



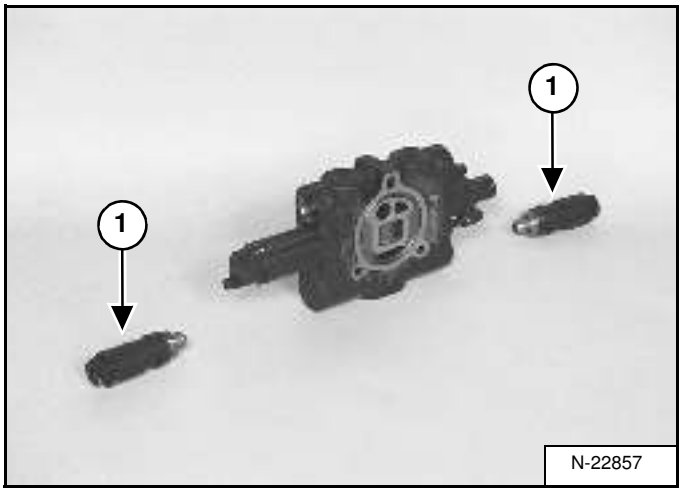
Remove the O-ring (Item 1) **[Figure 20-40-71]** from the bucket valve block.

Figure 20-40-72



Remove the spring (Item 1) and poppet (Item 2) **[Figure 20-40-72]**.

Figure 20-40-73



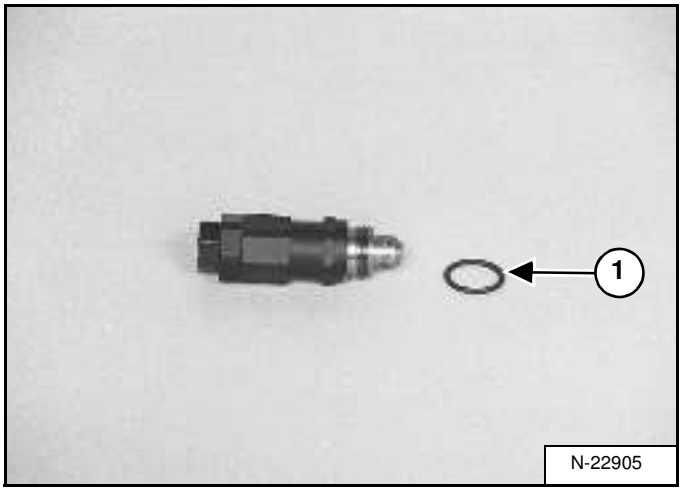
Remove the two relief valves (Item 1) **[Figure 20-40-73]**.

Installation: Tighten the relief valves to 33 ft.-lbs (44 Nm) torque.

Dealer Copy -- Not for Resale

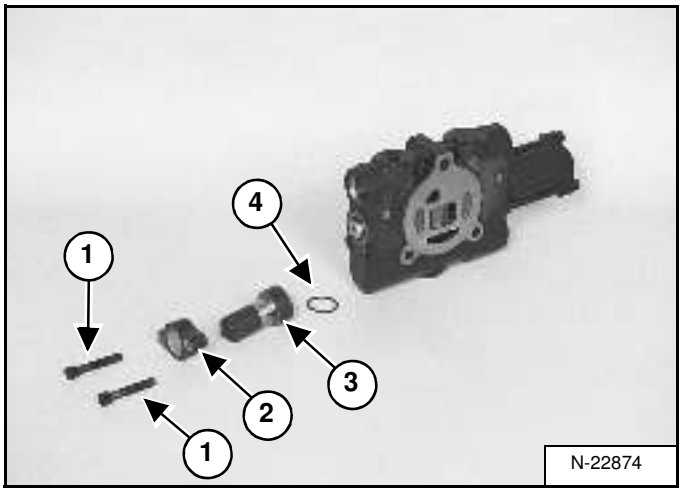
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-74



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

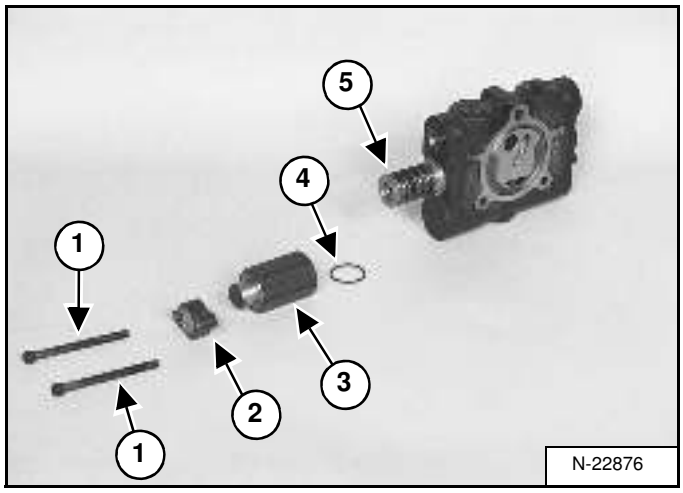
Figure 20-40-75



Remove the two screws (Item 1), retaining mount (Item 2), end cover (Item 3) and O-ring (Item 4) **[Figure 20-40-75]**.

Installation: Tighten the screws to 7 ft.-lbs (9,5 Nm) torque.

Figure 20-40-76

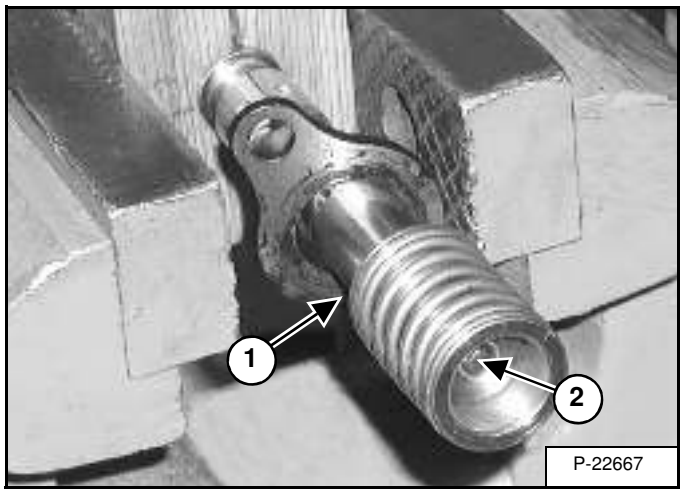


Remove the two screws (Item 1), retaining mount (Item 2), end cover (Item 3) and O-ring (Item 4) **[Figure 20-40-76]**.

Installation: Tighten the screws to 7 ft.-lbs (9,5 Nm) torque.

Remove the spool (Item 5) **[Figure 20-40-76]** from the arm valve block.

Figure 20-40-77

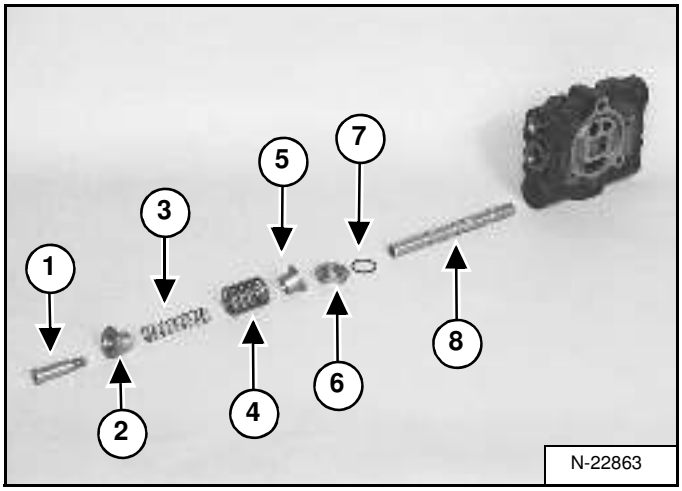


Clamp the spool (Item 1) in a vise and loosen the spring retaining screw (Item 2) **[Figure 20-40-77]**.

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Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-78



Remove the spring retaining screw (Item 1), spring retainer (Item 2), small spring (Item 3), large spring (Item 4), spring retainer (Item 5), retainer (Item 6), O-ring (Item 7) from the spool (Item 8) **[Figure 20-40-78]**.

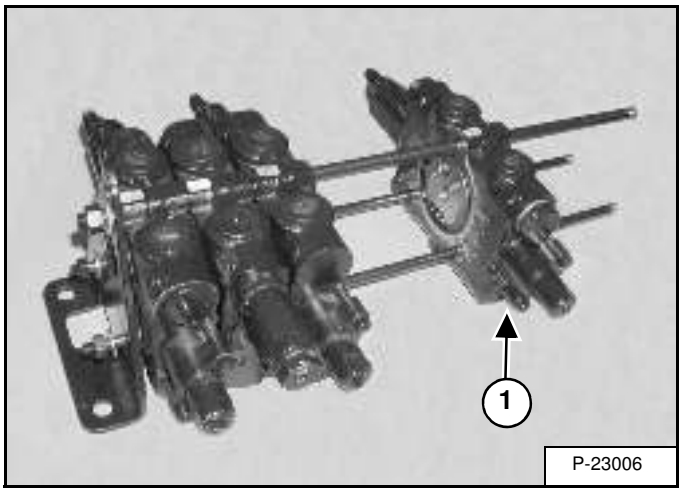
NOTE: The spring is under pressure, use care when removing the spring retaining screw.

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

Installation: Apply thread lock adhesive (LOCTITE 242) to the spring retaining screw (Item 1) **[Figure 20-40-78]** threads. Tighten the spring retaining screw to 7 ft.-lbs (9,5 Nm) torque.

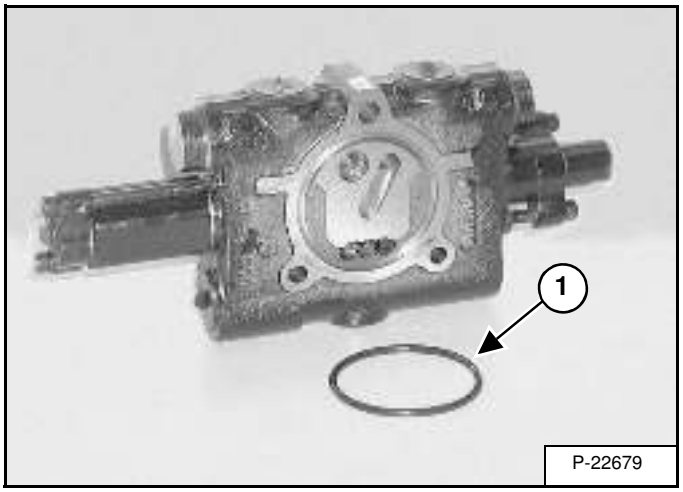
Auxiliary Valve Section Disassembly And Assembly

Figure 20-40-79



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

Figure 20-40-80

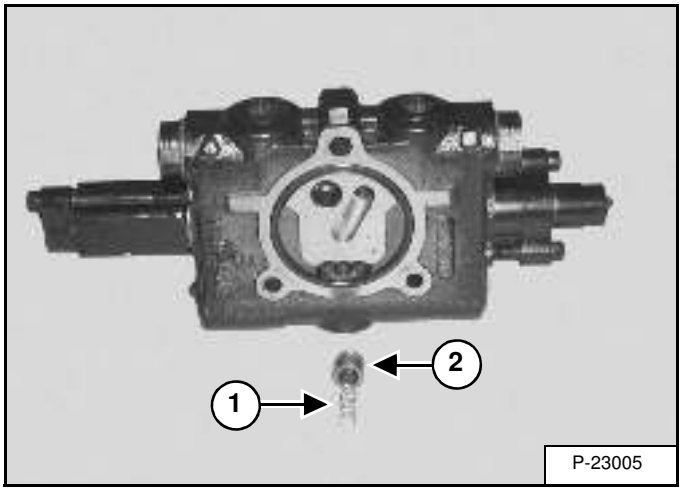


Remove the O-ring (Item 1) **[Figure 20-40-80]** from the auxiliary valve block.

Dealer Copy -- Not for Resale

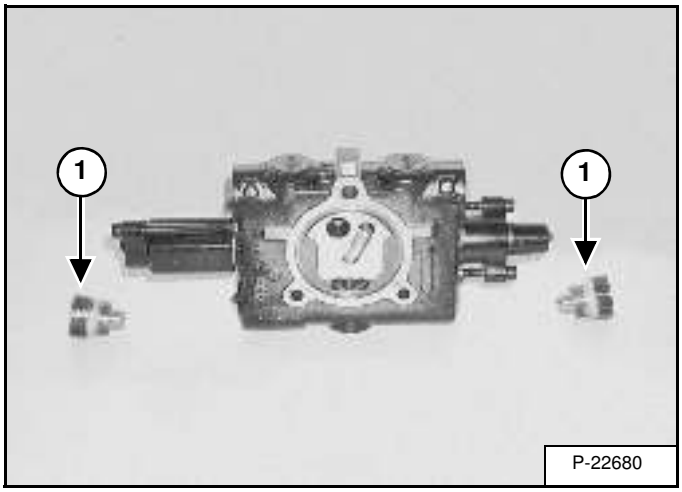
Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-81



Remove the spring (Item 1) and poppet (Item 2) **[Figure 20-40-81]**.

Figure 20-40-82

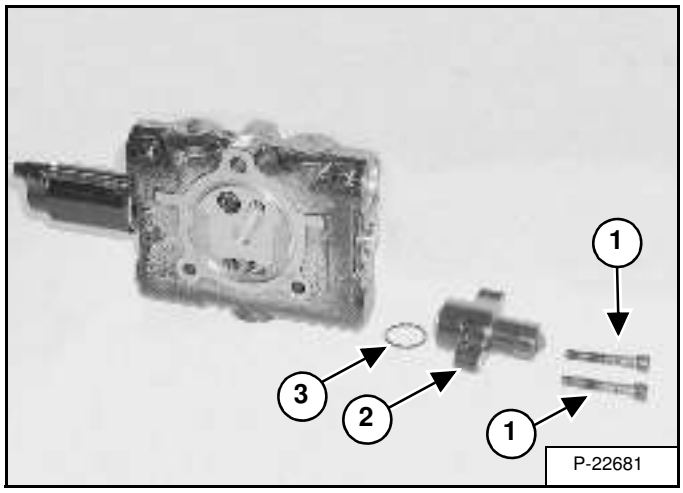


Remove the shut-off plug assemblies (Item 1) **[Figure 20-40-82]**.

NOTE: The shut off plug assembly is serviced only as an assembly.

Installation: Tighten the shut-off plug to 33 ft.-lbs (44,7 Nm) torque.

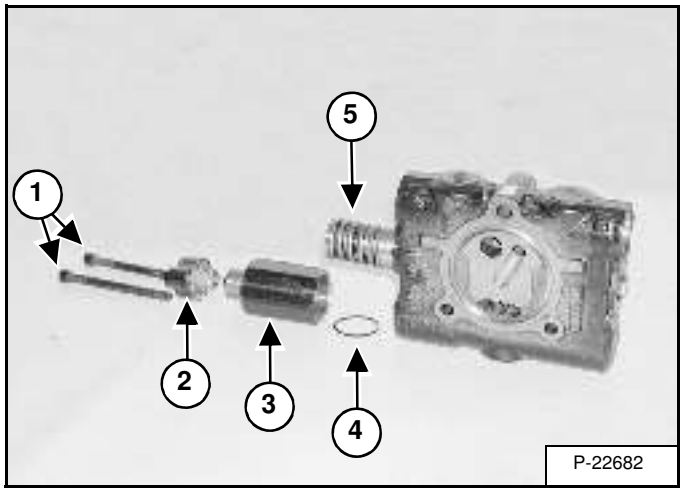
Figure 20-40-83



Remove the two screws (Item 1) end cap (Item 2) and O-ring (Item 3) **[Figure 20-40-83]** from the actuating end of the spool.

Installation: Tighten the screws to 7 ft.-lbs (9,5 Nm) torque.

Figure 20-40-84



Remove the two screws (Item 1) retaining mount (Item 2), end cap (Item 3) and O-ring (Item 4) **[Figure 20-40-84]**.

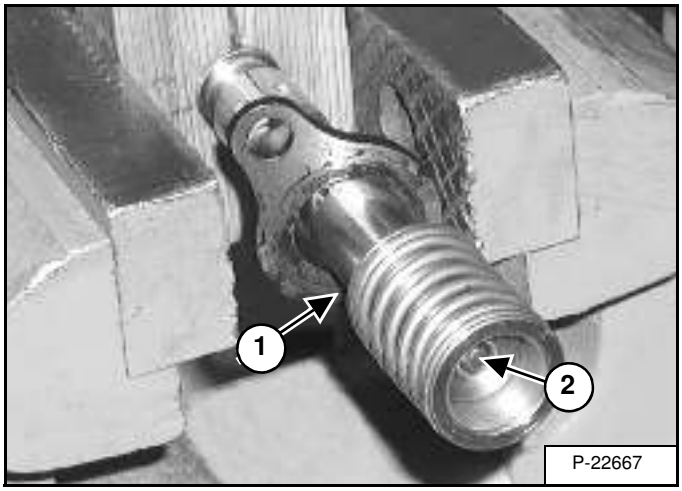
Installation: Tighten the screws to 7 ft.-lbs (9,5 Nm) torque.

Remove the spool (Item 5) **[Figure 20-40-84]**.

Dealer Copy -- Not for Resale

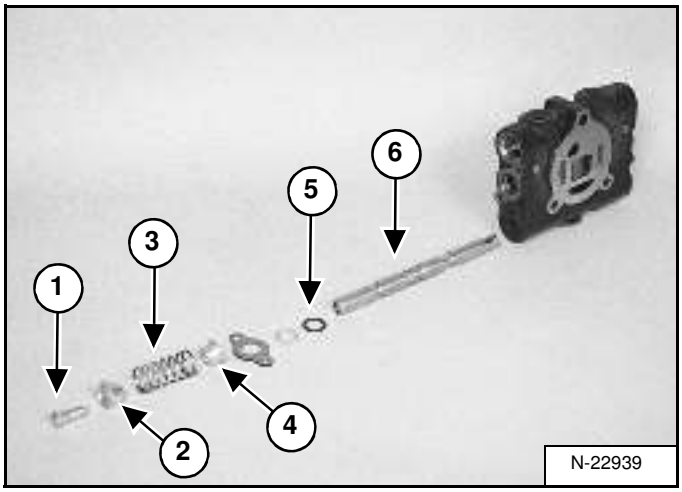
Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-85



Clamp the spool (Item 1) in a vise and loosen the spring retaining screw (Item 2) **[Figure 20-40-85]**.

Figure 20-40-86



Remove the spring retaining screw (Item 1), spring retainer (Item 2), spring (Item 3), spring retainer (Item 4), and O-ring (Item 5), from the spool (Item 6) **[Figure 20-40-86]**.

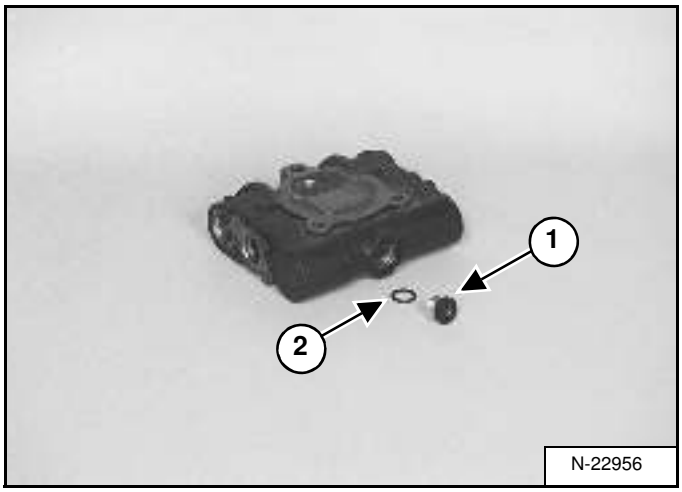
The spool and valve block are not serviced separately.

NOTE: The spring is under pressure, use care when removing the spring retaining screw.

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

Installation: Apply thread lock adhesive (LOCTITE 242) to the spring retaining screw (Item 1) **[Figure 20-40-86]** threads. Tighten the spring retaining screw to 7 ft.-lbs. (9,5 Nm) torque.

Figure 20-40-87



Remove the plug (Item 1) and O-ring (Item 2) **[Figure 20-40-87]** from the bottom of the auxiliary valve.

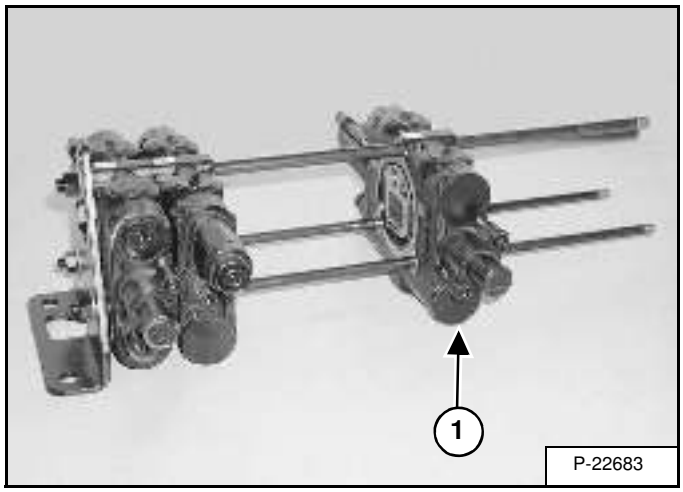
Installation: Tighten the plug to 18 ft.-lbs. (24,4 Nm) torque.

Dealer Copy -- Not for Resale

HYDRAULIC CONTROL VALVE (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

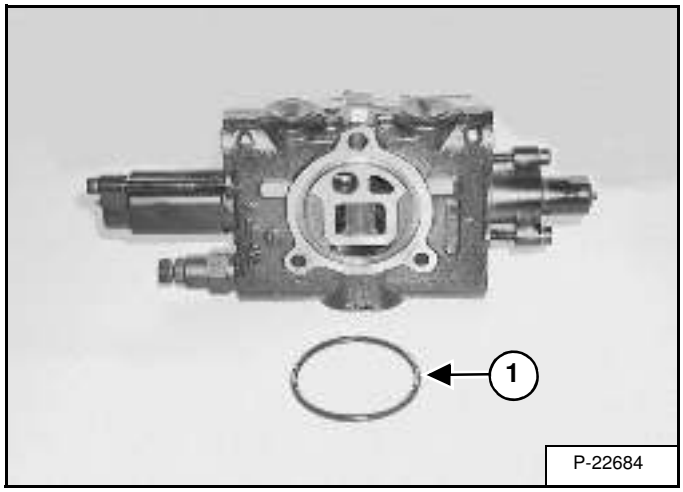
Boost Valve Section Disassembly And Assembly

Figure 20-40-88



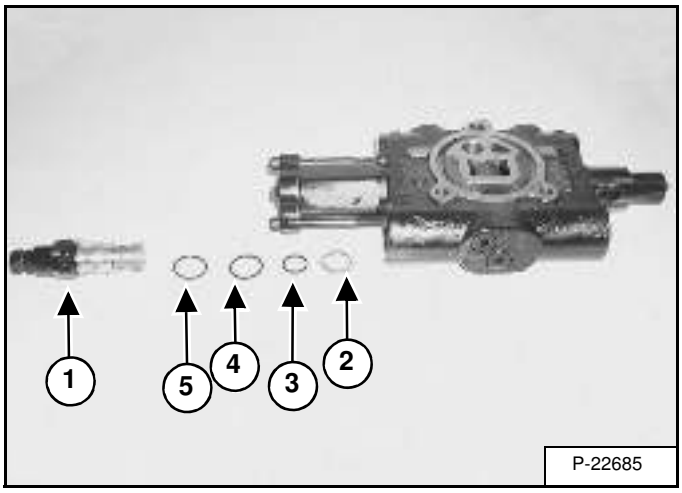
Remove the boost valve section (Item 1) **[Figure 20-40-88]** from the control valve.

Figure 20-40-89



Remove the O-ring (Item 1) **[Figure 20-40-89]** from the boost valve block.

Figure 20-40-90

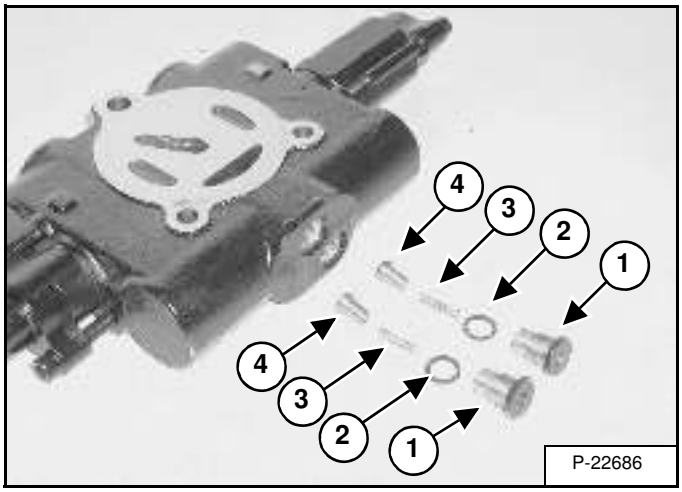


Remove the main relief valve (Item 1) **[Figure 20-40-90]**.

Installation: Tighten the main relief valve to 22 ft.-lbs. (30 Nm) torque.

Remove the glide ring (Item 2), O-ring (Item 3), O-ring (Item 4) and back-up ring (Item 5) from the main relief valve (Item 1) **[Figure 20-40-90]**.

Figure 20-40-91



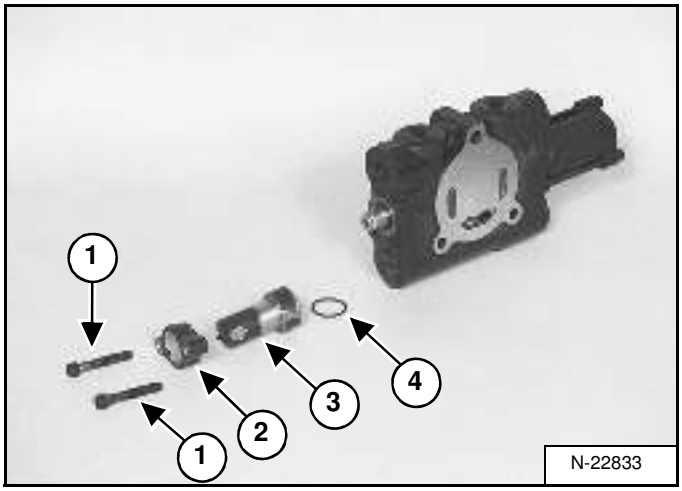
Remove the build-up valves (Item 1), O-rings (Item 2), springs (Item 3) and poppets (Item 4) **[Figure 20-40-91]** from the boost valve.

Installation: Tighten the build-up valves to 22 ft.-lbs. (30 Nm) torque.

Dealer Copy -- Not for Resale

Boost Valve Section Disassembly And Assembly (Cont'd)

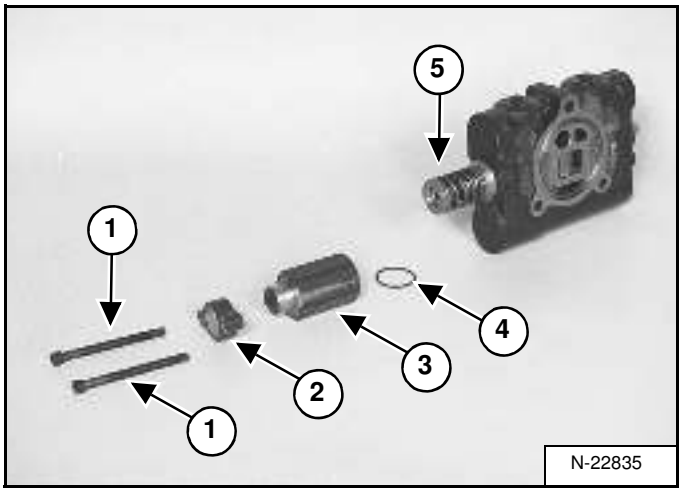
Figure 20-40-92



Remove the two screws (Item 1), retaining mount (Item 2), end cover (Item 3) and O-ring (Item 4) **[Figure 20-40-92]**.

Installation: Tighten the screws to 7 ft.-lbs (9 Nm) torque.

Figure 20-40-93

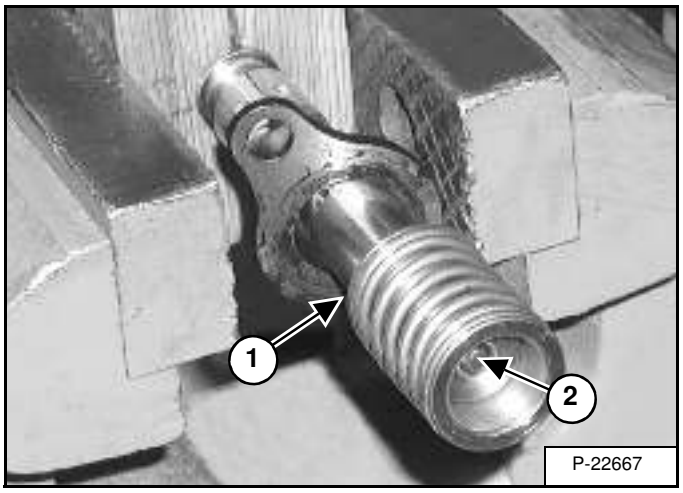


Remove the two screws (Item 1), retaining mount (Item 2), end cover (Item 3) and O-ring (Item 4) **[Figure 20-40-93]**.

Installation: Tighten the screws to 7 ft.-lbs (9 Nm) torque.

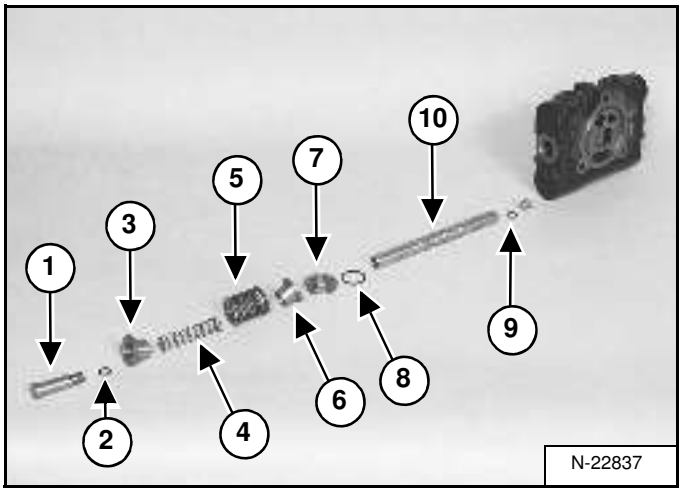
Remove the spool (Item 5) **[Figure 20-40-93]**.

Figure 20-40-94



Clamp the spool (Item 1) in a vise and loosen the spring retaining screw (Item 2) **[Figure 20-40-94]**.

Figure 20-40-95



Remove the spring retaining screw (Item 1), O-ring (Item 2), spring retainer (Item 3), small spring (Item 4), large spring (Item 5), spring retainer (Item 6), retainer (Item 7), O-ring (Item 8), and O-ring (Item 9) from the spool (Item 10) **[Figure 20-40-95]**.

The spool and valve block are not serviced separately.

NOTE: The spring is under pressure, use care when removing the spring retaining screw.

Dealer Copy -- Not for Resale

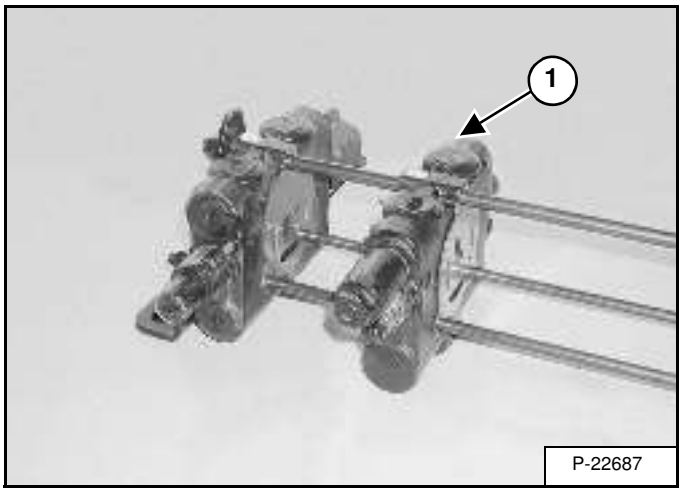
Boost Valve Section Disassembly And Assembly (Cont'd)

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

Installation: Apply thread lock adhesive (LOCTITE 242) to the spring retaining screw (Item 1) **[Figure 20-40-95 on Page 27]** threads. Tighten the spring retaining screw to 7 ft.-lbs (9 Nm) torque.

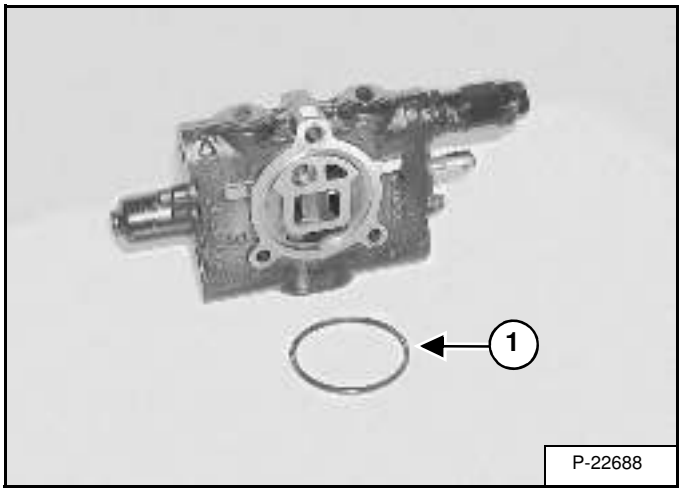
Blade Valve Section Disassembly And Assembly

Figure 20-40-96



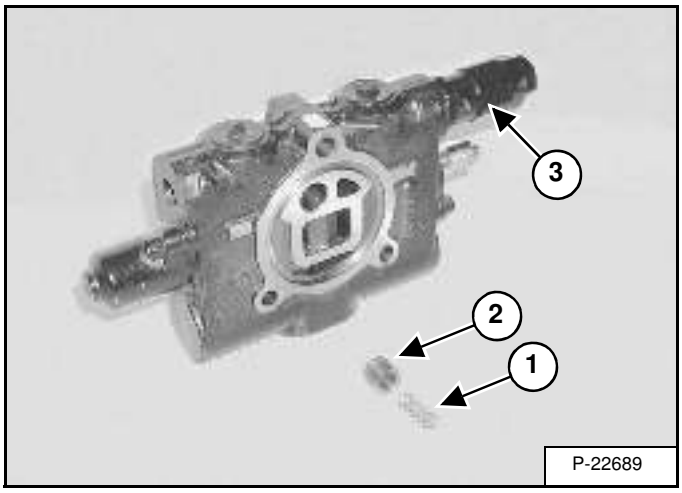
Remove the blade valve section (Item 1) **[Figure 20-40-96]** from the valve assembly.

Figure 20-40-97



Remove the O-ring (Item 1) **[Figure 20-40-97]** from the blade valve block.

Figure 20-40-98

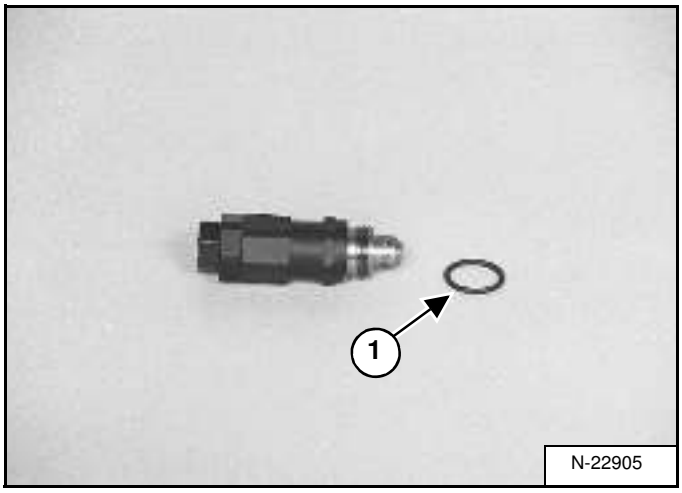


Remove the spring (Item 1) and poppet (Item 2) **[Figure 20-40-98]**.

Remove the relief valve (Item 3) **[Figure 20-40-98]**.

Installation: Tighten the relief valve to 33 ft.-lbs. (45 Nm) torque.

Figure 20-40-99

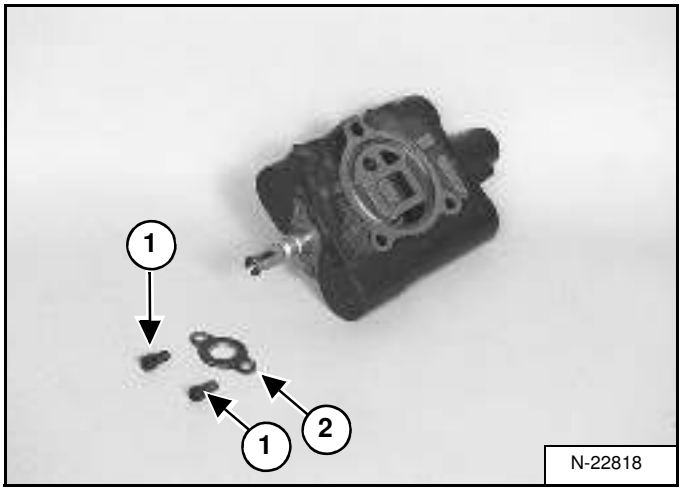


Remove the O-ring (Item 1) **[Figure 20-40-99]** from the relief valve.

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Blade Valve Section Disassembly And Assembly (Cont'd)

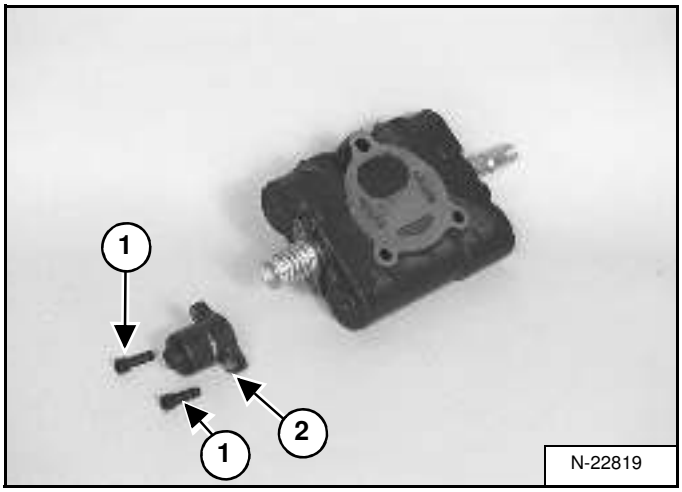
Figure 20-40-100



Remove the two screws (Item 1) and retaining plate (Item 2) **[Figure 20-40-100]** from the actuating end of the spool.

Installation: Tighten the screws to 7 ft.-lbs. (9 Nm) torque.

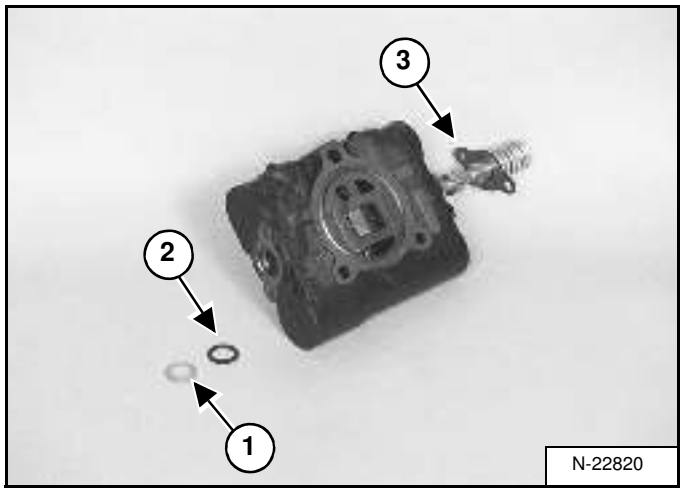
Figure 20-40-101



Remove the two screws (Item 1) and end cap (Item 2) **[Figure 20-40-101]**.

Installation: Tighten the screws to 7 ft.-lbs. (9 Nm) torque.

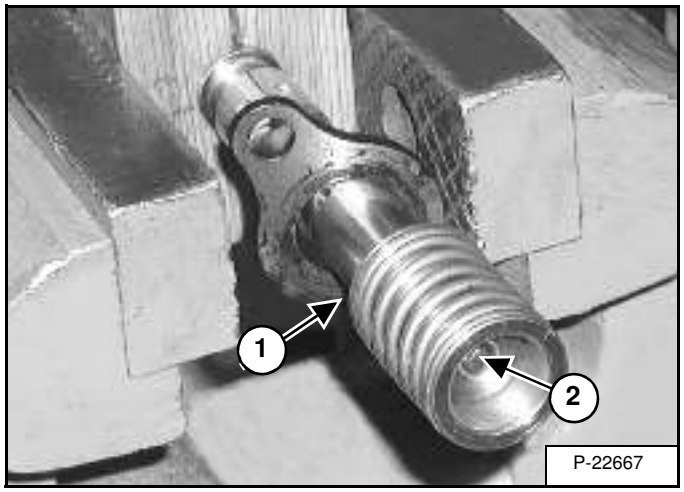
Figure 20-40-102



Remove the wiper (Item 1) and O-ring (Item 2) **[Figure 20-40-102]** from the actuating end of spool.

Remove the spool (Item 3) **[Figure 20-40-102]**.

Figure 20-40-103

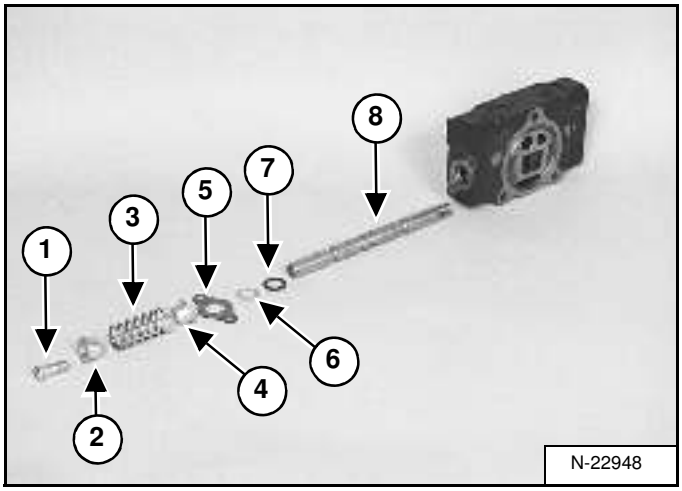


Clamp the spool (Item 1) in a vise and loosen the spring retaining screw (Item 2) **[Figure 20-40-103]**.

Dealer Copy -- Not for Resale

Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-104



Remove the spring retaining screw (Item 1), spring retainer (Item 2), spring (Item 3), spring retainer (Item 4), retaining plate (Item 5), wiper (Item 6), and O-ring (Item 7) from the spool (Item 8) **[Figure 20-40-104]**.

The spool and valve block are not serviced separately.

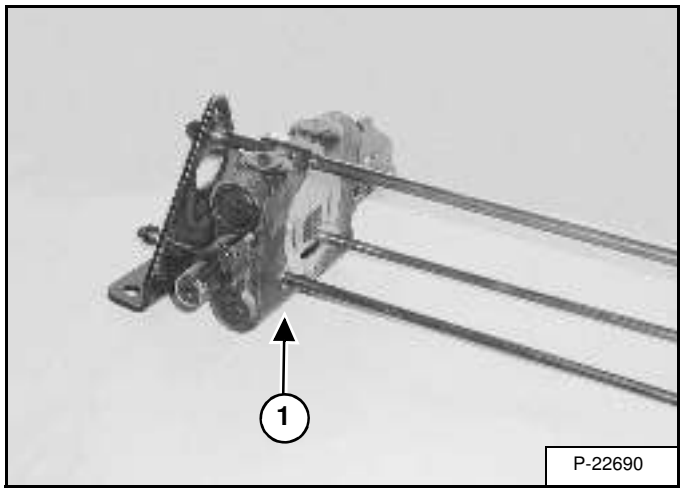
NOTE: The spring is under pressure, use care when removing the spring retaining screw.

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

Installation: Apply thread lock adhesive (LOCTITE 242) to the spring retaining screw (Item 1) **[Figure 20-40-104]** threads. Tighten the spring retaining screw to 7 ft.-lbs (9,5 Nm) torque.

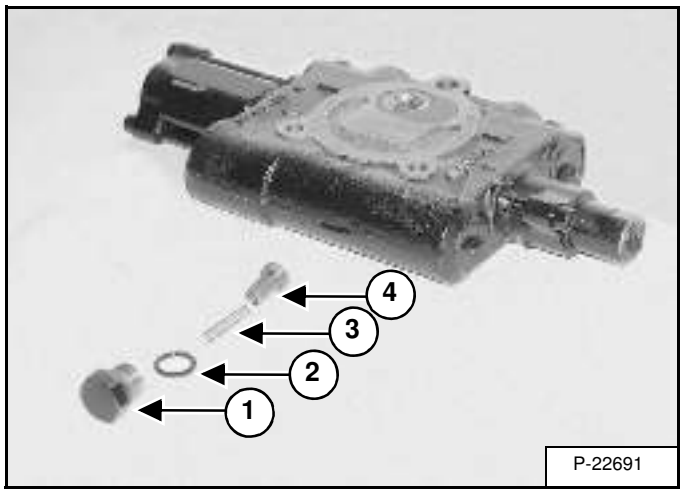
Swing Valve Section Disassembly And Assembly

Figure 20-40-105



Remove the swing valve section (Item 1) **[Figure 20-40-105]** from the valve assembly.

Figure 20-40-106



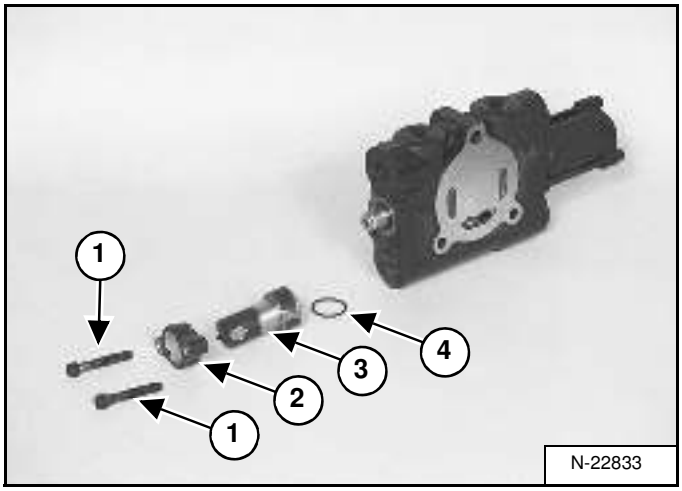
Remove the cap (Item 1), O-ring (Item 2), spring (Item 3) and poppet (Item 4) **[Figure 20-40-106]** from the swing valve block.

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

Dealer Copy -- Not for Resale

Swing Valve Section Disassembly And Assembly (Cont'd)

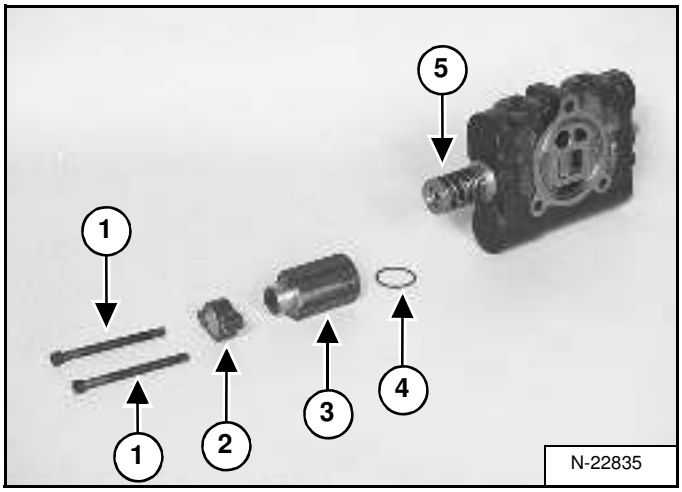
Figure 20-40-107



Remove the two screws (Item 1), retaining mount (Item 2), end cover (Item 3) and O-ring (Item 4) **[Figure 20-40-107]**.

Installation: Tighten the screws to 7 ft.-lbs (9 Nm) torque.

Figure 20-40-108

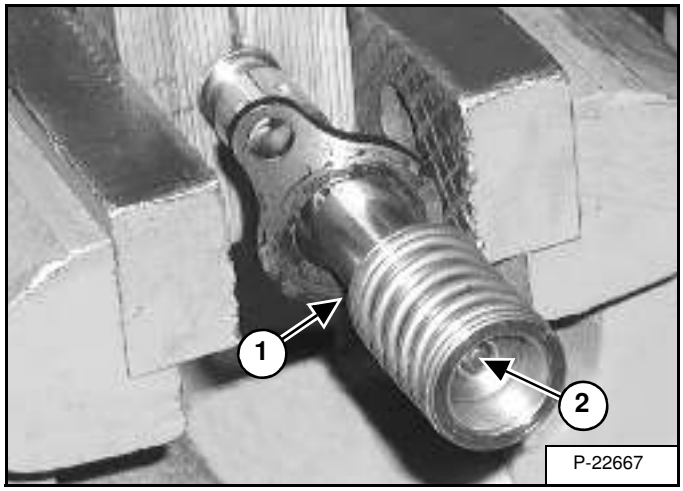


Remove the two screws (Item 1), retaining mount (Item 2), end cover (Item 3) and O-ring (Item 4) **[Figure 20-40-108]**.

Installation: Tighten the screws to 7 ft.-lbs (9 Nm) torque.

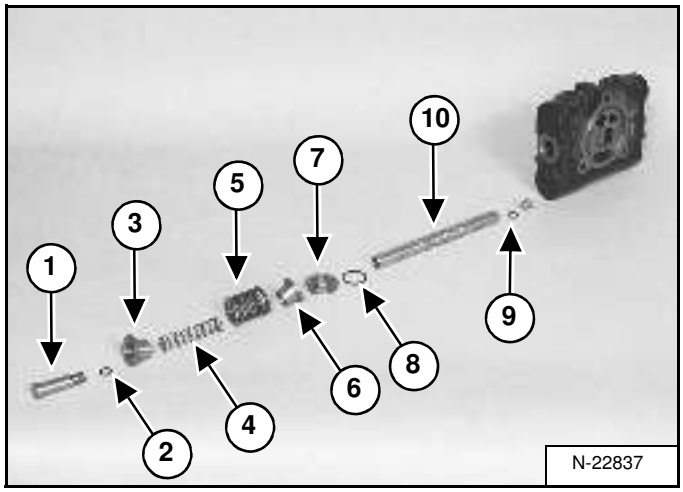
Remove the spool (Item 5) **[Figure 20-40-108]**.

Figure 20-40-109



Clamp the spool (Item 1) in a vise and loosen the spring retaining screw (Item 2) **[Figure 20-40-109]**.

Figure 20-40-110



Remove the spring retaining screw (Item 1), O-ring (Item 2), spring retainer (Item 3), small spring (Item 4), large spring (Item 5), spring retainer (Item 6), retainer (Item 7), O-ring (Item 8), and O-ring (Item 9) from the spool (Item 10) **[Figure 20-40-110]**.

Dealer Copy -- Not for Resale

Swing Valve Section Disassembly And Assembly (Cont'd)

The spool and valve block are not serviced separately.

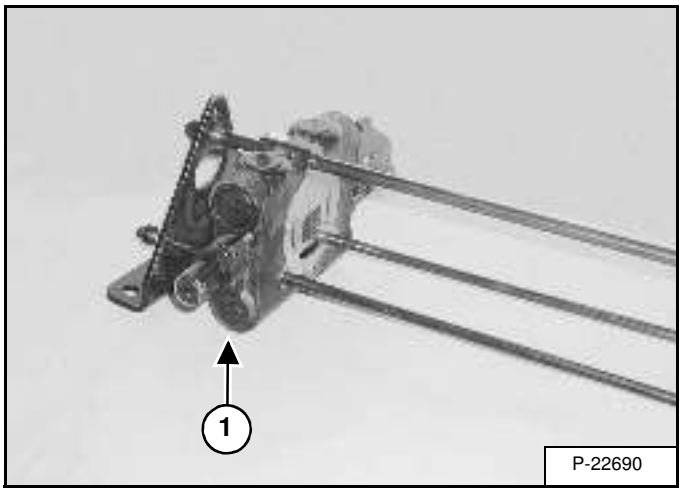
NOTE: The spring is under pressure, use care when removing the spring retaining screw.

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

Installation: Apply thread lock adhesive (LOCTITE 242) to the spring retaining screw (Item 1) **[Figure 20-40-110 on Page 31]** threads. Tighten the spring retaining screw to 7 ft.-lbs (9 Nm) torque.

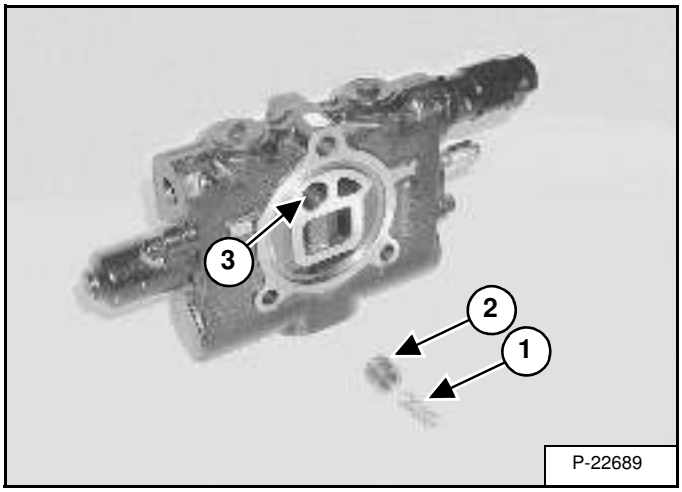
Assembly

Figure 20-40-111



Install the swing valve (Item 1) **[Figure 20-40-111]** on the tie rods.

Figure 20-40-112

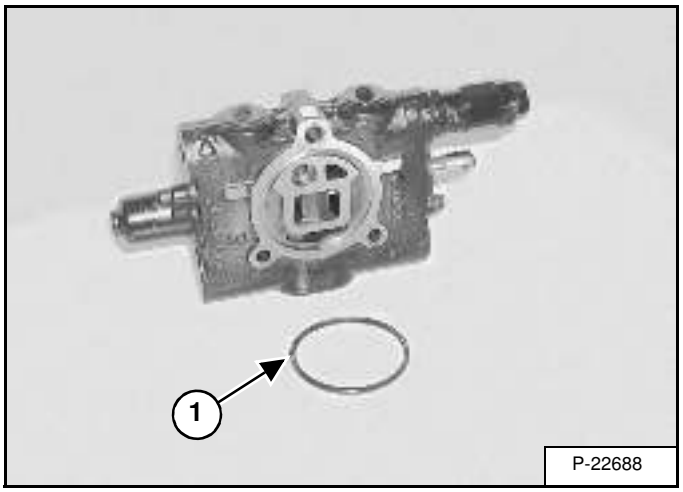


Lubricate and install the poppet (Item 1) and spring (Item 2) in the bore (Item 3) **[Figure 20-40-112]** of the blade valve.

Dealer Copy -- Not for Resale

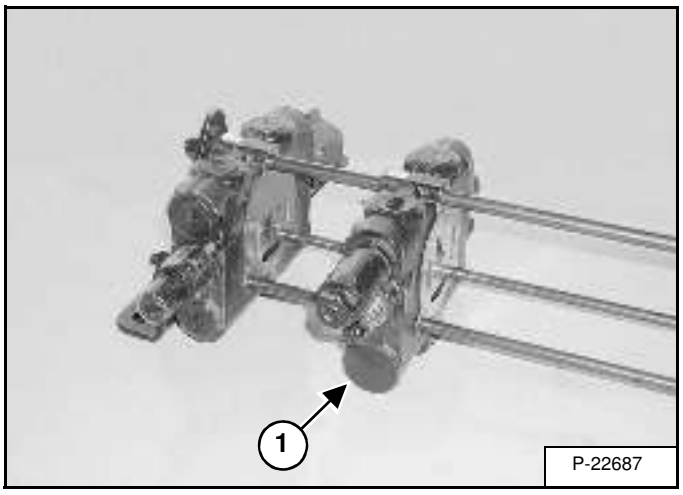
Assembly (Cont'd)

Figure 20-40-113



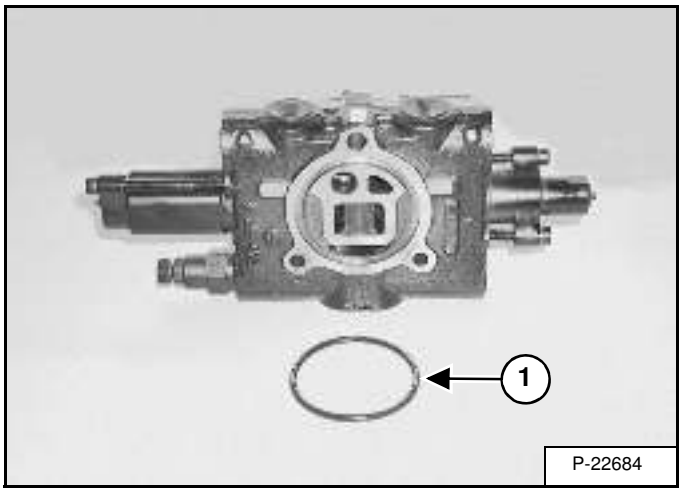
Lubricate and install a new O-ring (Item 1) **[Figure 20-40-113]** on the blade valve.

Figure 20-40-114



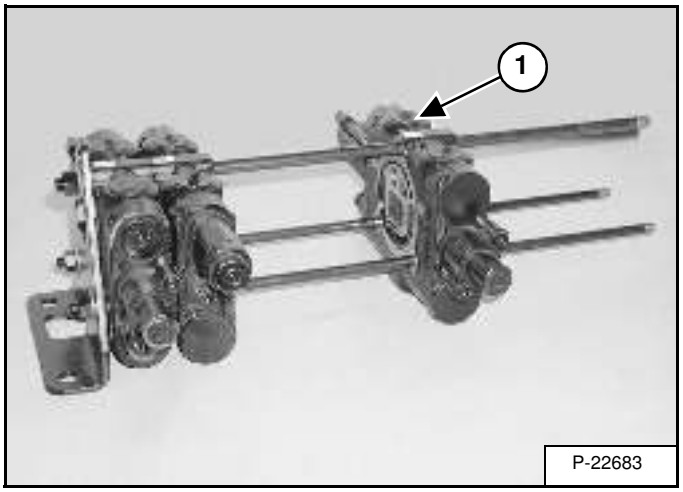
Install the blade valve on the tie rods (Item 1) **[Figure 20-40-114]**.

Figure 20-40-115



Lubricate and install a new O-ring (Item 1) **[Figure 20-40-115]** on the boost valve.

Figure 20-40-116

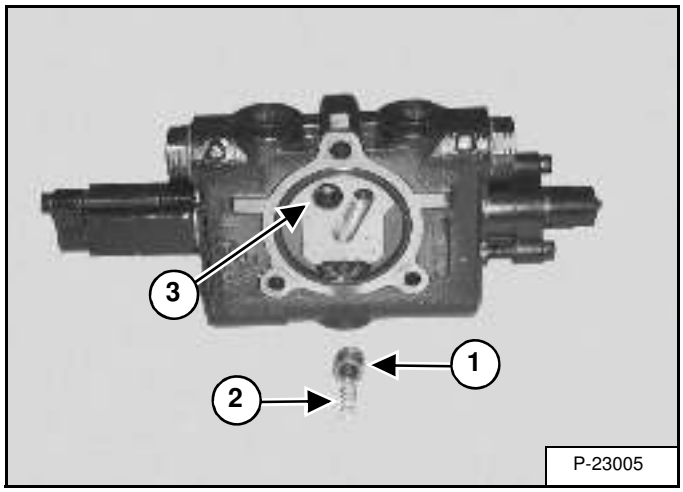


Install the boost valve (Item 1) **[Figure 20-40-116]** on the tie rods.

Dealer Copy -- Not for Resale

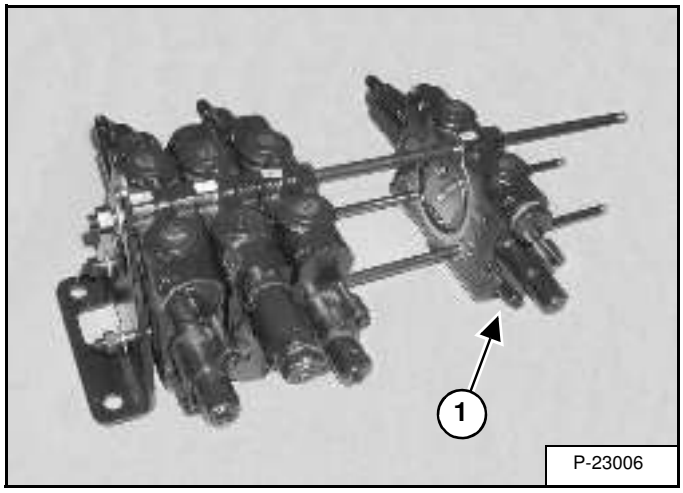
Assembly (Cont'd)

Figure 20-40-117



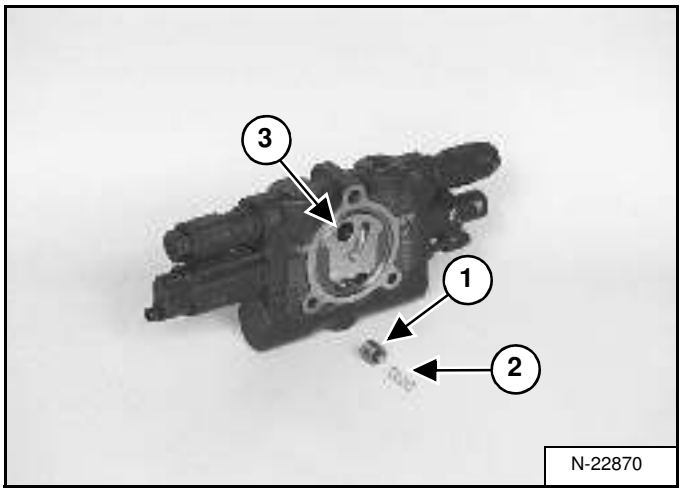
Lubricate and install the poppet (Item 1) and spring (Item 2) in the port (Item 3) **[Figure 20-40-117]** of the auxiliary valve.

Figure 20-40-118



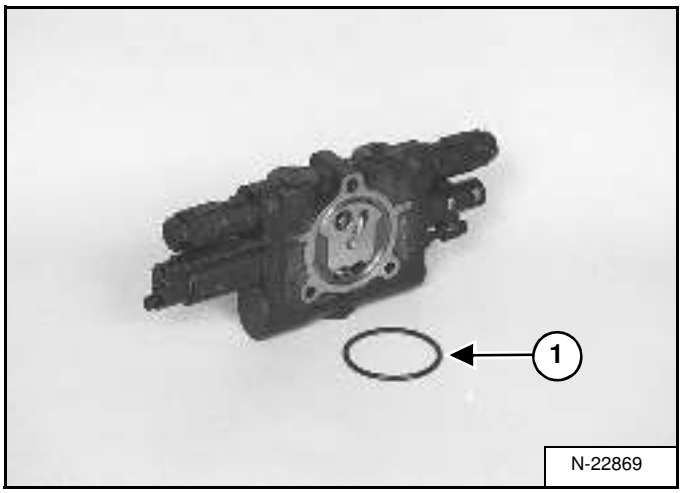
Install the auxiliary valve (Item 1) **[Figure 20-40-118]** on the tie rods.

Figure 20-40-119



Lubricate and install the poppet (Item 1) and spring (Item 2) in the port (Item 3) **[Figure 20-40-119]** of the bucket valve.

Figure 20-40-120

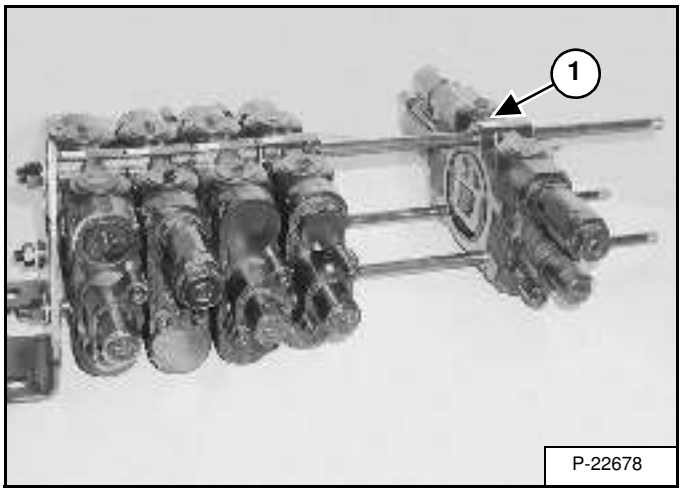


Lubricate and install a new O-ring (Item 1) **[Figure 20-40-120]** on the bucket valve.

Dealer Copy -- Not for Resale

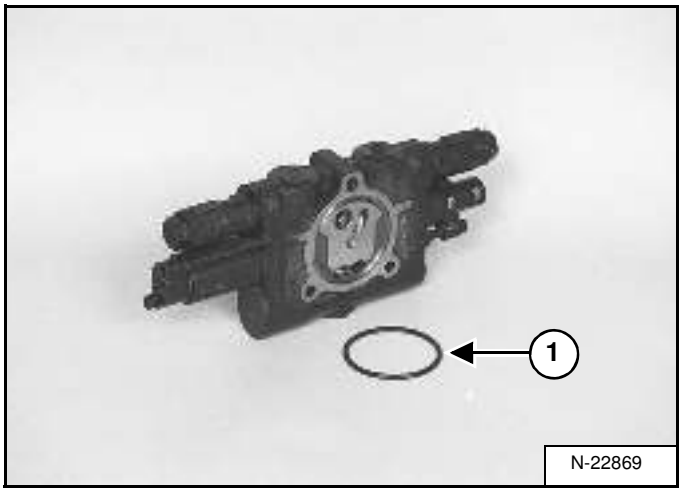
Assembly (Cont'd)

Figure 20-40-121



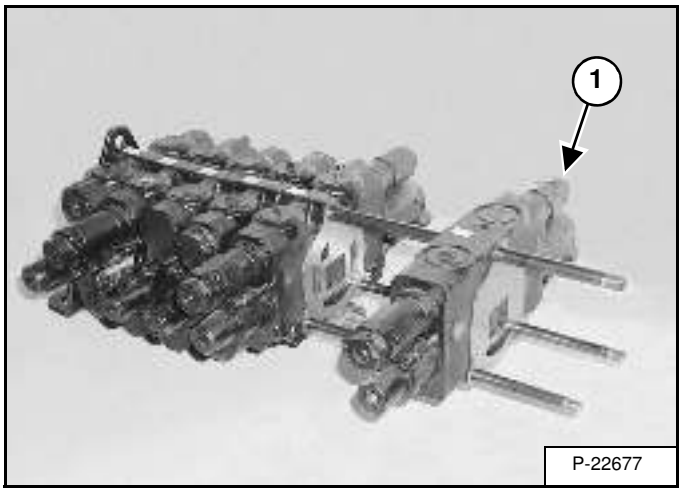
Install the bucket valve (Item 1) **[Figure 20-40-121]** on the tie rods.

Figure 20-40-122



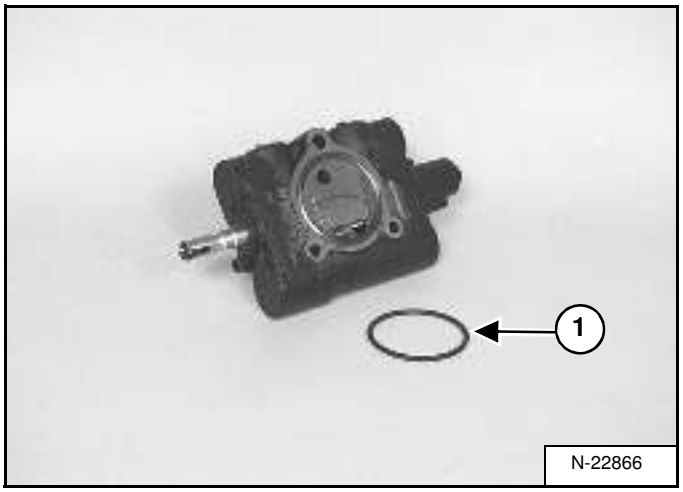
Lubricate and install an O-ring (Item 1) **[Figure 20-40-122]** on the arm valve.

Figure 20-40-123



Install the arm valve (Item 1) **[Figure 20-40-123]** on the tie rods.

Figure 20-40-124

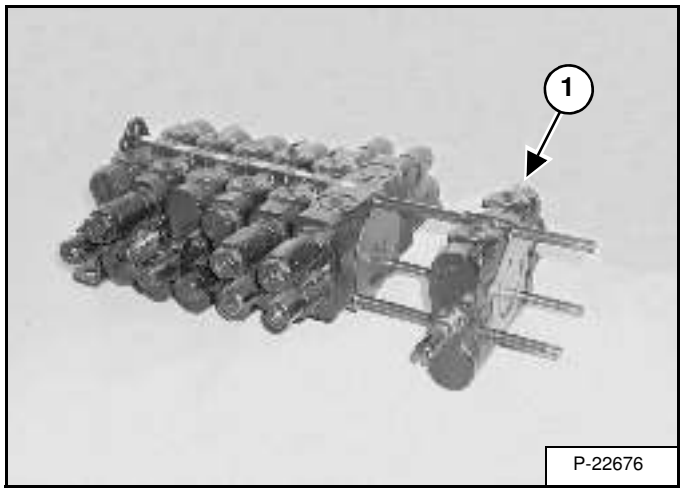


Lubricate and install a new O-ring (Item 1) **[Figure 20-40-124]** on the left travel valve.

Dealer Copy -- Not for Resale

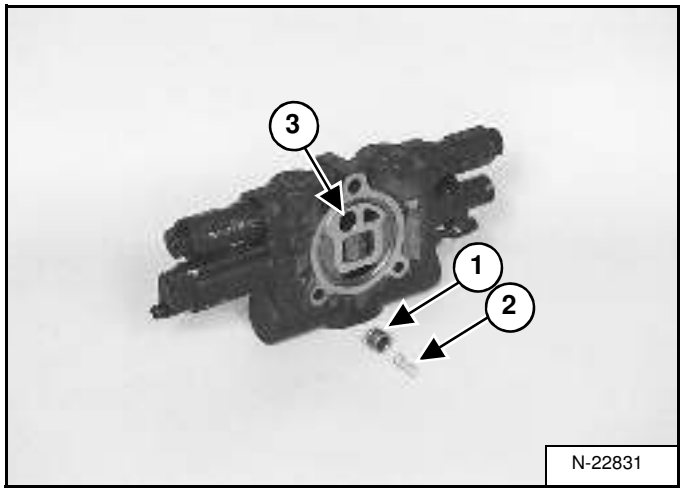
Assembly (Cont'd)

Figure 20-40-125



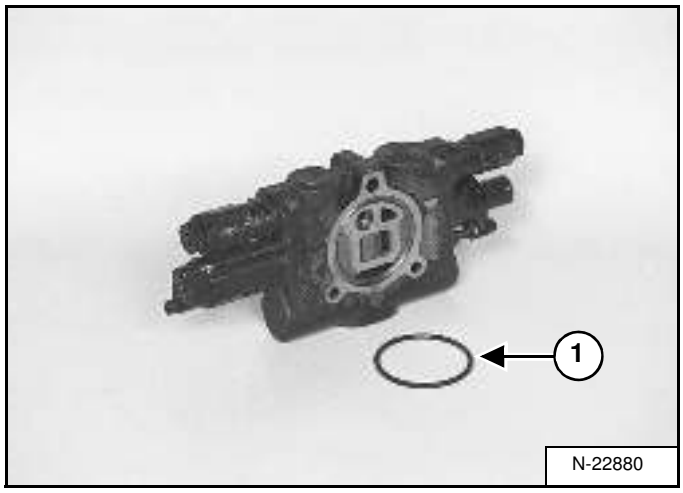
Install the left travel valve (Item 1) **[Figure 20-40-125]** on the tie rods.

Figure 20-40-126



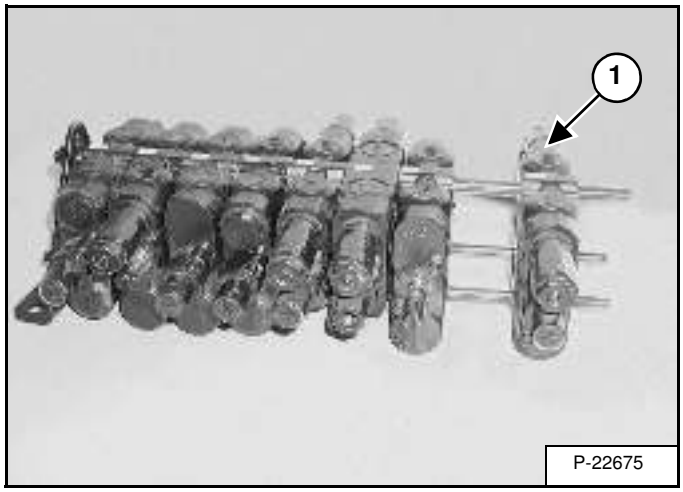
Lubricate and install the poppet (Item 1) and spring (Item 2) in the port (Item 3) **[Figure 20-40-126]** of the boom valve.

Figure 20-40-127



Lubricate and install a new O-ring (Item 1) **[Figure 20-40-127]** on the boom valve.

Figure 20-40-128

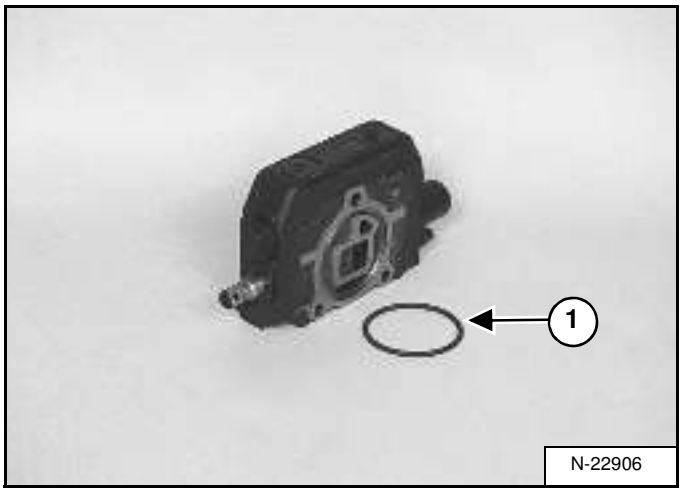


Install the boom valve (Item 1) **[Figure 20-40-128]** on the tie rods.

Dealer Copy -- Not for Resale

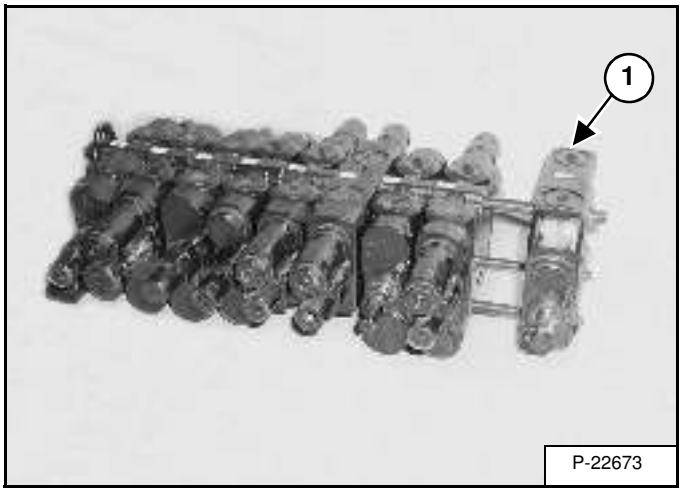
Assembly (Cont'd)

Figure 20-40-129



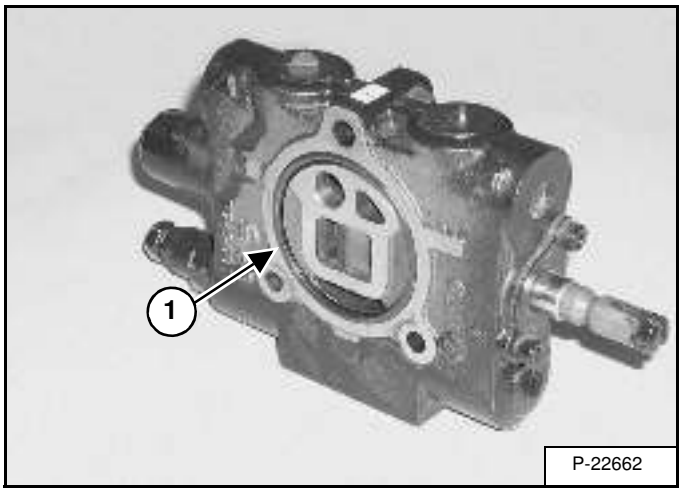
Lubricate and install a new O-ring (Item 1) **[Figure 20-40-129]** on the boom swing valve.

Figure 20-40-130



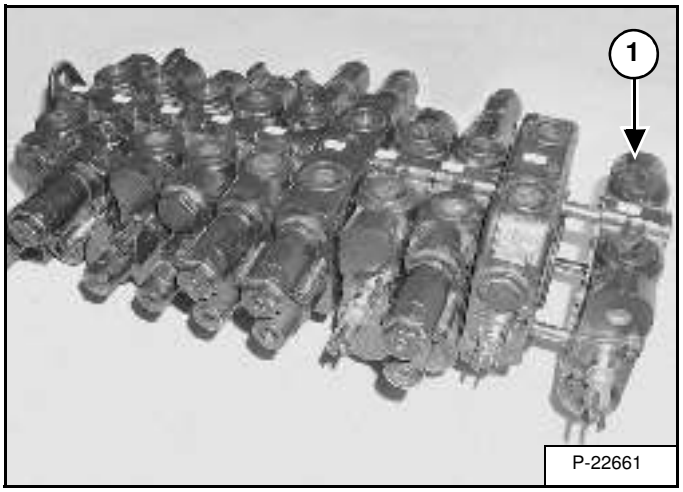
Install the boom swing valve (Item 1) **[Figure 20-40-130]** on the tie rods.

Figure 20-40-131



Lubricate and install a new O-ring (Item 1) **[Figure 20-40-131]** on the right travel valve.

Figure 20-40-132

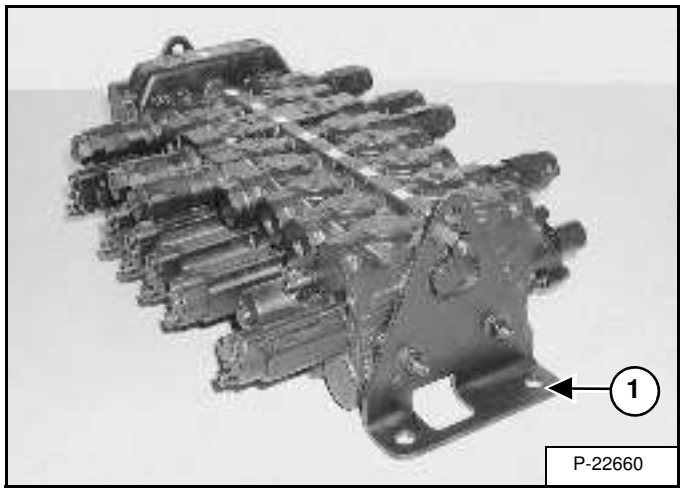


Install the right travel valve (Item 1) **[Figure 20-40-132]** on the tie rods.

Dealer Copy -- Not for Resale

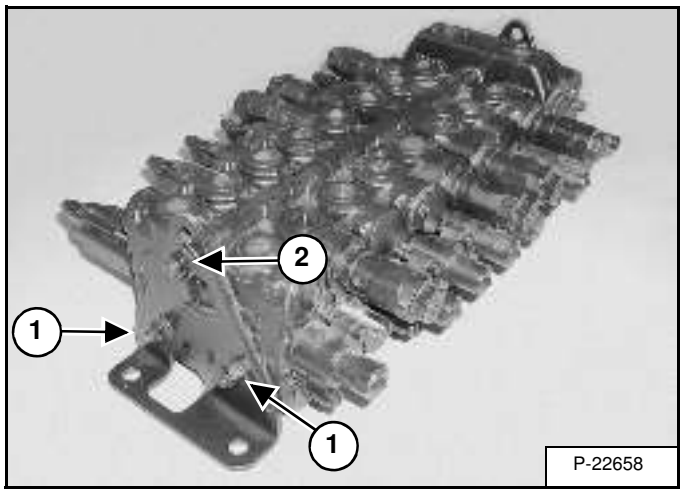
Assembly (Cont'd)

Figure 20-40-133



Install the mount bracket (Item 1) **[Figure 20-40-133]**.

Figure 20-40-134



Install the three washers and nuts (Items 1 & 2) **[Figure 20-40-134]** on the ends of the tie rods, finger tight.

Be sure the valve mounting brackets do not rock on a flat surface.

Tighten the tie rod nuts to 10 ft.-lbs (13 Nm) torque in a crisscross manner **[Figure 20-40-134]**.

Tighten the two 5/16 inch diameter tie rod nuts (Item 1) **[Figure 20-40-134]** to 14 ft.-lbs (19 Nm) torque.

Tighten the one 3/8 inch diameter tie rod nut (Item 2) **[Figure 20-40-134]** to 33 ft.-lbs (44.7 Nm) torque.

The valve must not have any spacing between the valve sections and the spools must be free when pushed in and released.

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

Recheck the mounting brackets for level settings.

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HYDRAULIC CONTROL VALVE (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE)

Description

The hydraulic control valve has two main relief valves that operate at 2800 PSI (19306 kPa). The boom, arm, bucket and blade sections have 2950 PSI (20340 kPa) and/or 3400 PSI (23442 kPa) work port reliefs.

Removal And Installation

Set the boom/bucket on the work surface.

Stop the engine.

Relieve hydraulic pressure.

Engage the parking brake and exit the excavator.

⚠ WARNING

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

W-2145-0290

IMPORTANT

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

I-2003-0888

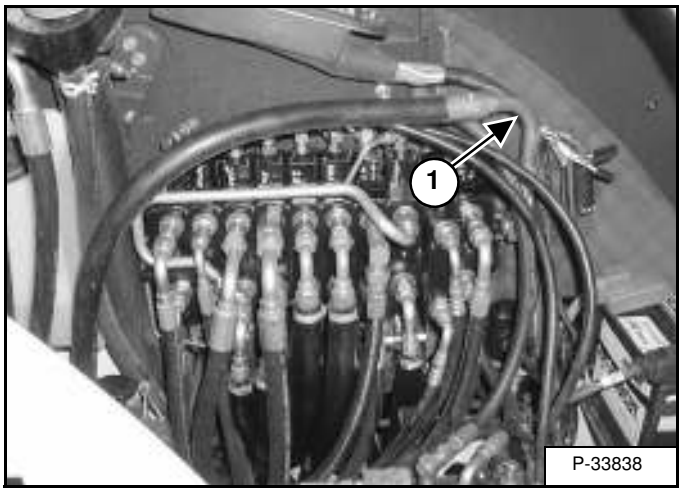
Drain the hydraulic reservoir. (See Replacing the Hydraulic Fluid on Page 10-100-2.)

Open the right side cover.

Mark all hoses and tubelines for ease of assembly.

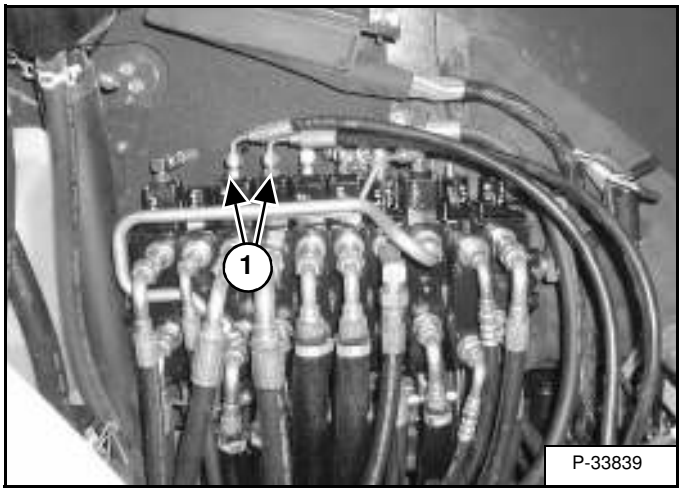
Install caps and plugs on all hoses and fittings.

Figure 20-41-1



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

Figure 20-41-2

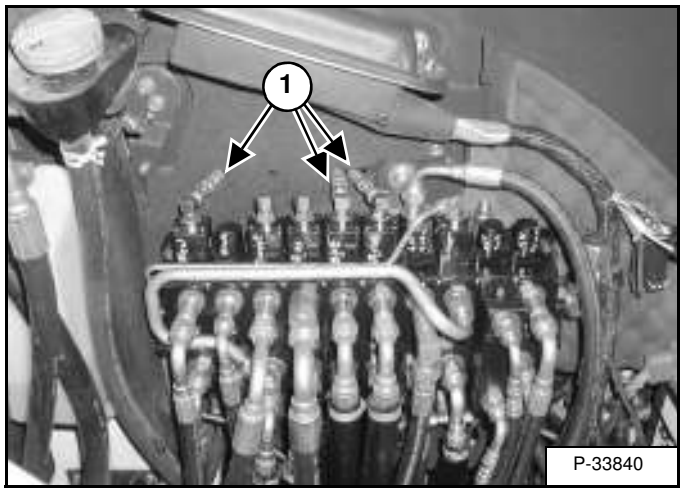


Remove the two hoses (Item 1) **[Figure 20-41-2]**

Dealer Copy -- Not for Resale

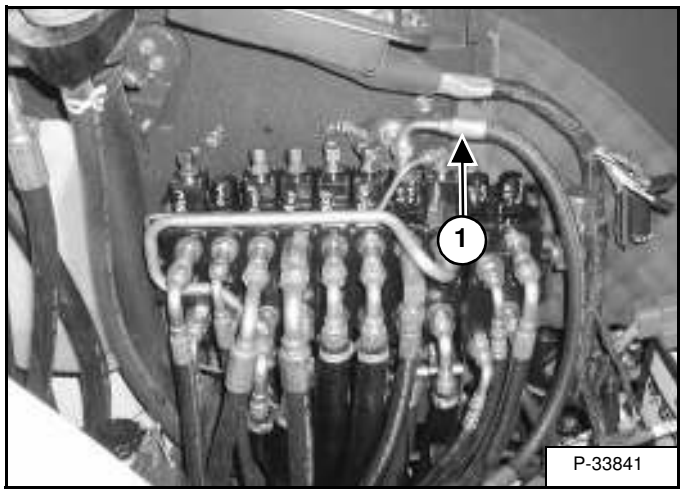
Removal And Installation (Cont'd)

Figure 20-41-3



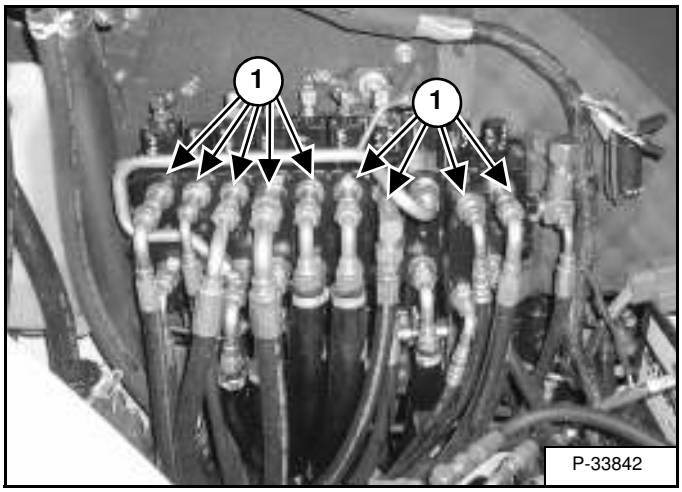
Remove the three hoses (Item 1) **[Figure 20-41-3]**.

Figure 20-41-4



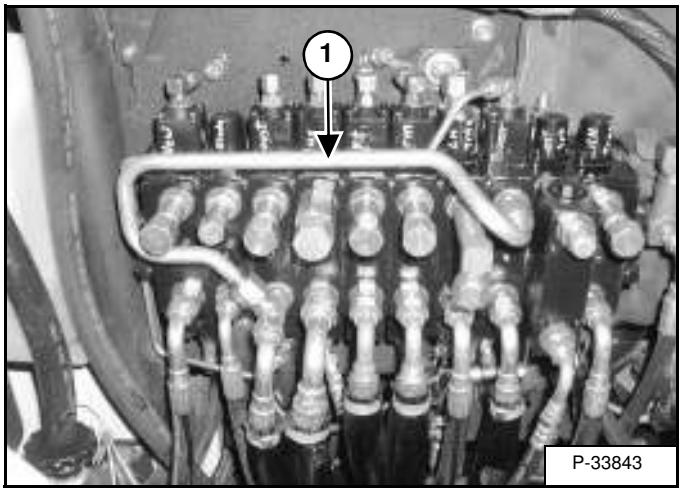
Remove the hose (Item 1) **[Figure 20-41-4]**.

Figure 20-41-5



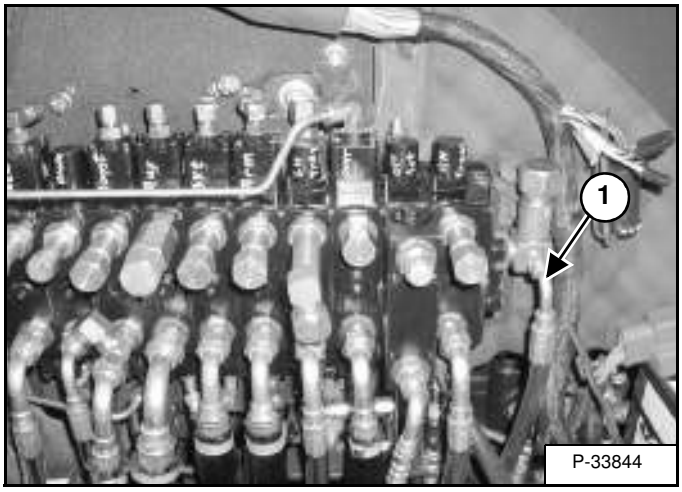
Remove the nine hoses (Item 1) **[Figure 20-41-5]**.

Figure 20-41-6



Remove the tubeline (Item 1) **[Figure 20-41-6]**.

Figure 20-41-7

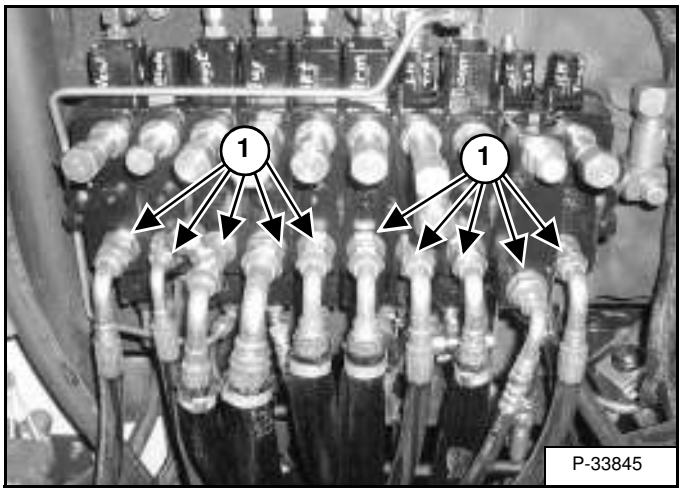


Remove the hose (Item 1) **[Figure 20-41-7]**.

Dealer Copy -- Not for Resale

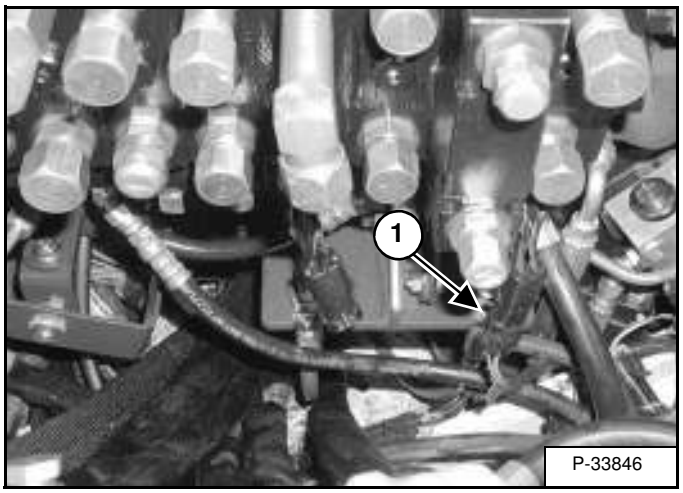
Removal And Installation (Cont'd)

Figure 20-41-8



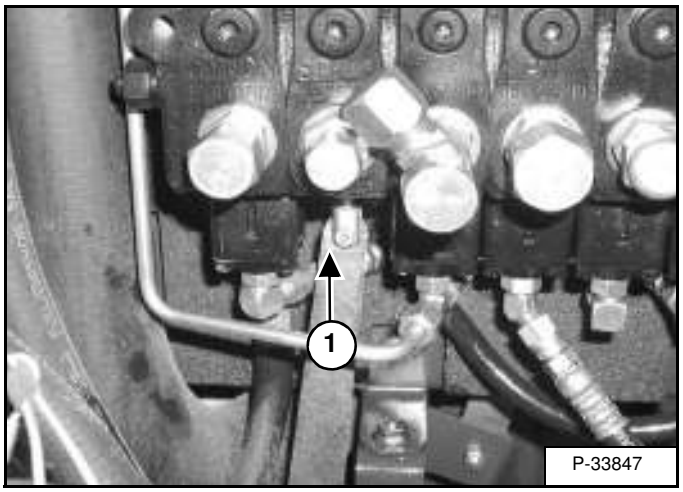
Remove the ten hoses (Item 1) **[Figure 20-41-8]**.

Figure 20-41-9



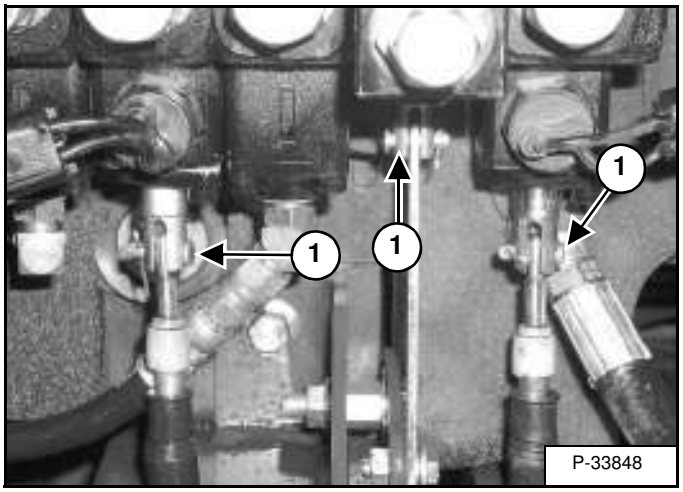
Disconnect the wire harness (Item 1) **[Figure 20-41-9]**.

Figure 20-41-10



Remove the cotter pin and clevis pin (Item 1) **[Figure 20-41-10]**.

Figure 20-41-11

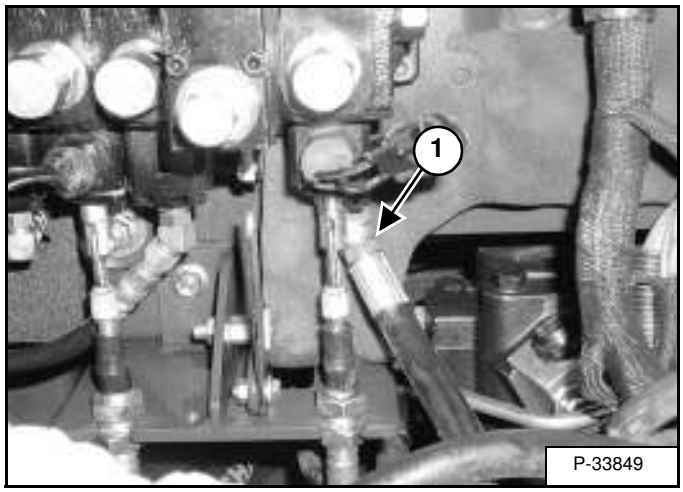


Remove the three cotter pins and clevis pins (Item 1) **[Figure 20-41-11]**.

Dealer Copy -- Not for Resale

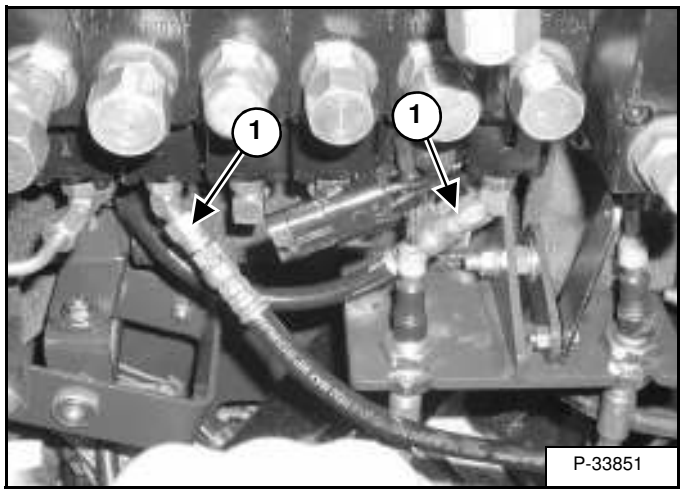
Removal And Installation (Cont'd)

Figure 20-41-12



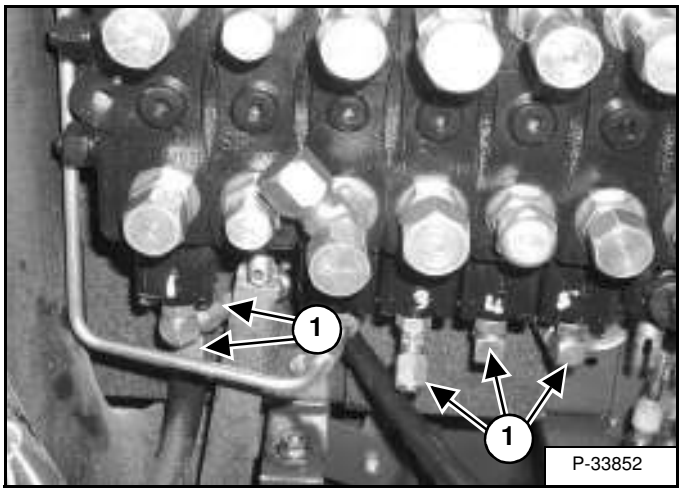
Remove the hose (Item 1) **[Figure 20-41-12]**.

Figure 20-41-13



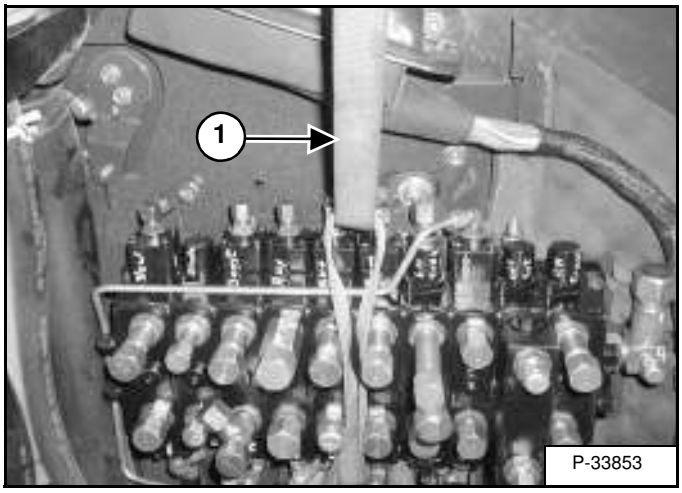
Remove the two hoses (Item 1) **[Figure 20-41-13]**.

Figure 20-41-14



Remove the five hoses (Item 1) **[Figure 20-41-14]**.

Figure 20-41-15



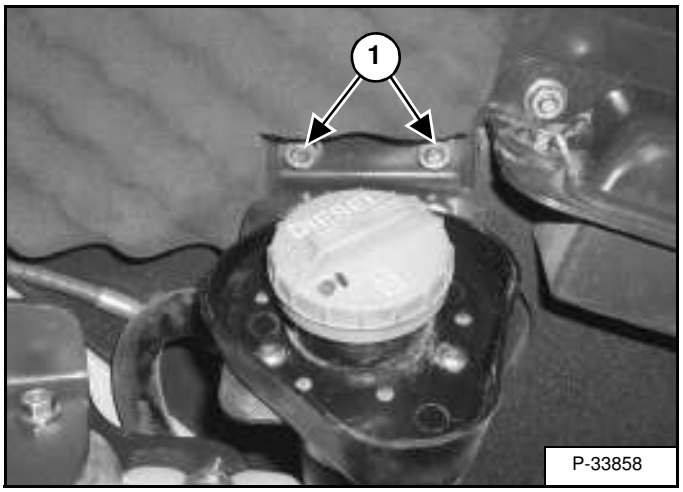
Install a hoist (Item 1) **[Figure 20-41-15]** on the control valve.

NOTE: Use care not to damage the fittings or tubelines.

Dealer Copy -- Not for Resale

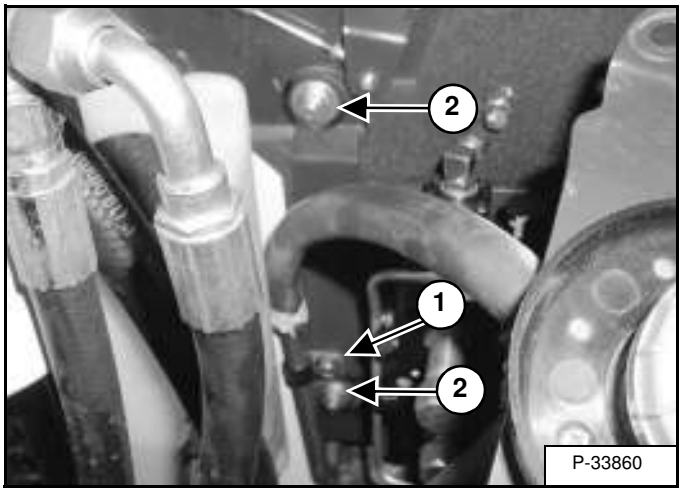
Removal And Installation (Cont'd)

Figure 20-41-16



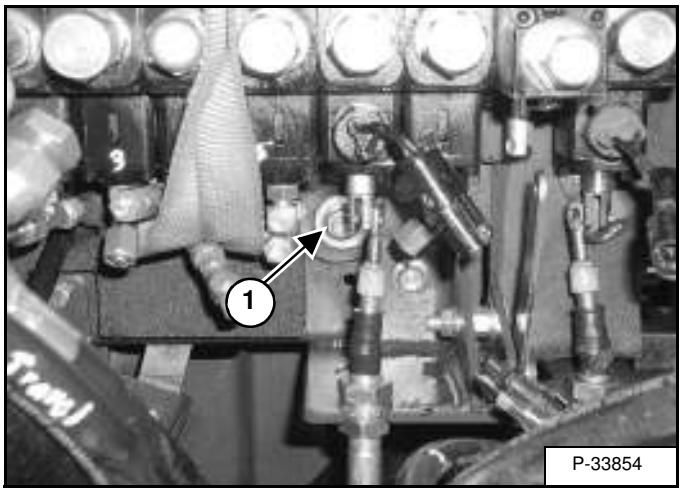
Remove the two bolts (Item 1) **[Figure 20-41-16]** from the fuel hose mount bracket.

Figure 20-41-17



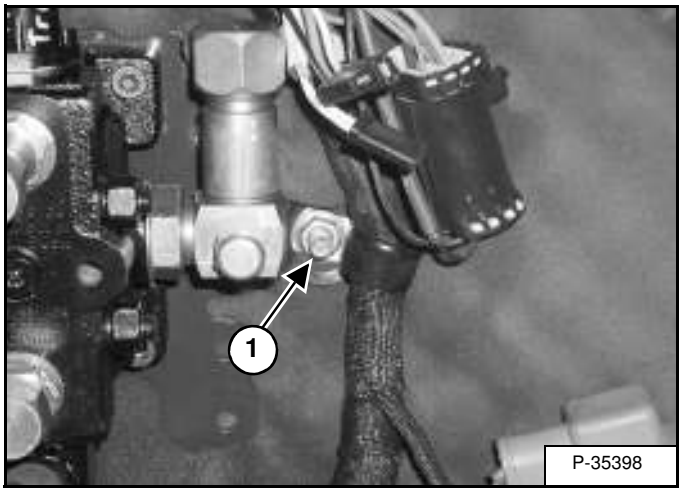
Pull the hose out and remove the fuel tank vent hose mount bolt (Item 1) and two control valve mount bolts (Item 2) **[Figure 20-41-17]**.

Figure 20-41-18



Remove the mount bolt (Item 1) **[Figure 20-41-18]** from the bottom of the control valve.

Figure 20-41-19

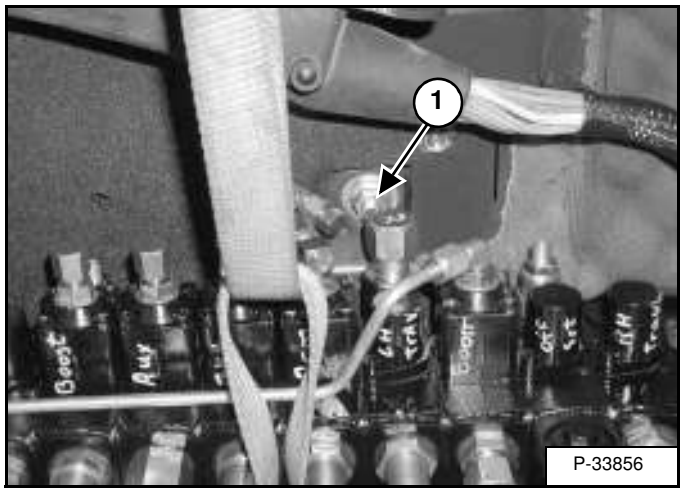


Remove the mount bolt (Item 1) **[Figure 20-41-19]** from the right side of the control valve.

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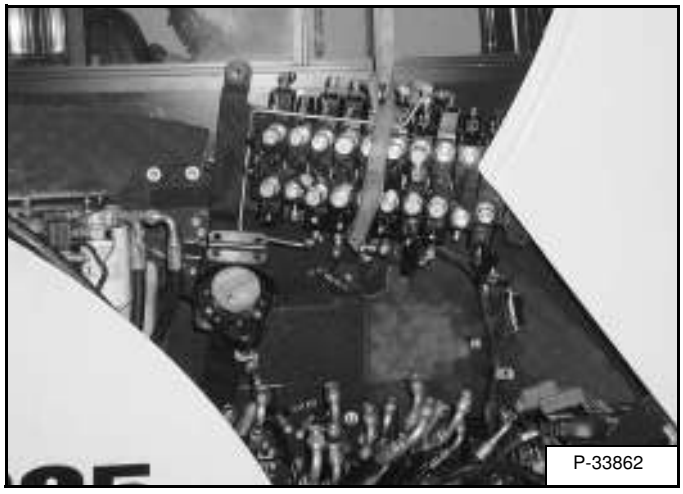
Removal And Installation (Cont'd)

Figure 20-41-20



Remove the mount bolt (Item 1) **[Figure 20-41-20]** from the top of the control valve.

Figure 20-41-21



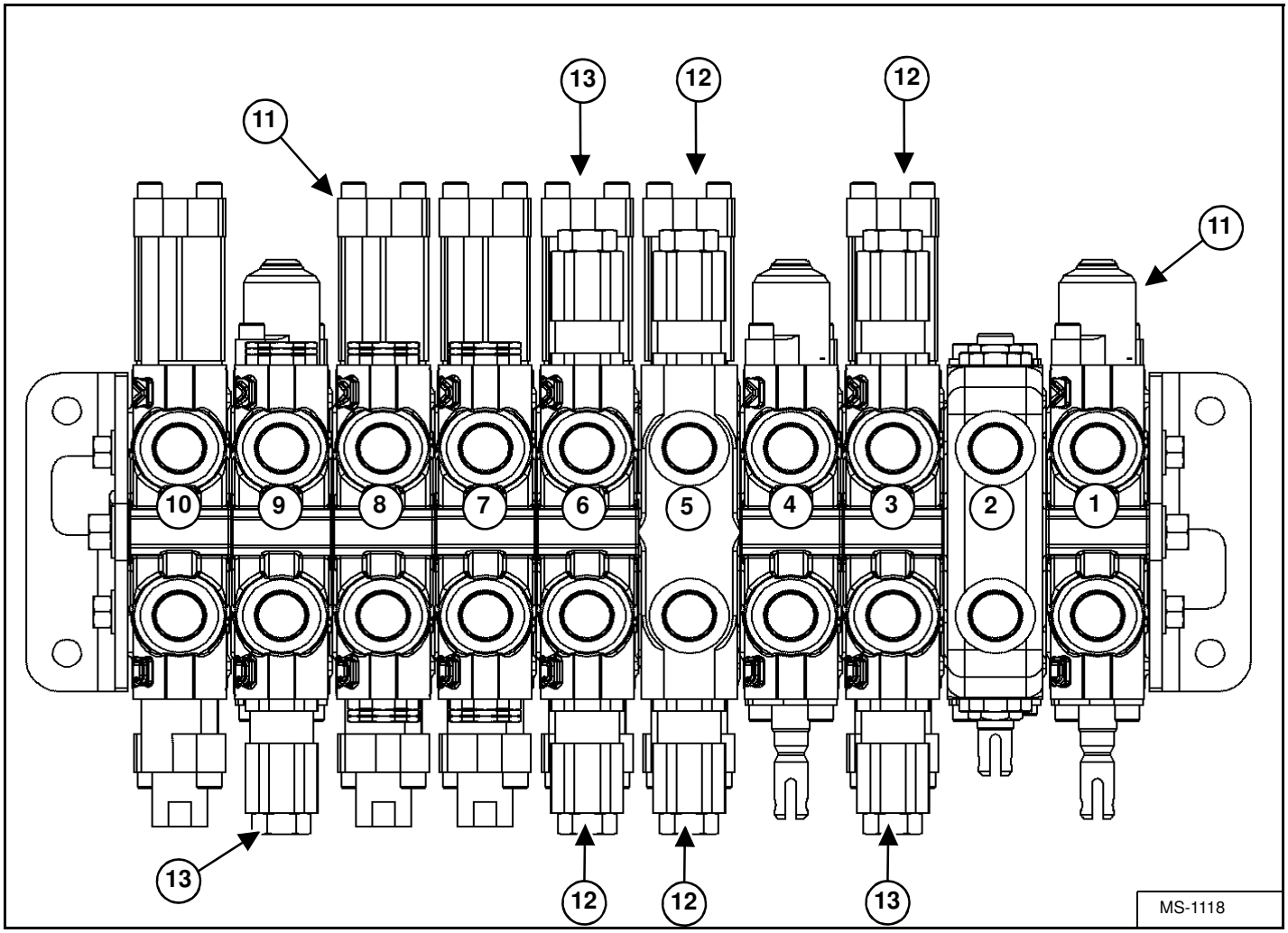
Raise the hoist and remove the control valve **[Figure 20-41-21]**.

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Control Valve Identification

Item	Description
1.	Right Travel Section
2.	Boom Offset Section
3.	Boom Section
4.	Left Travel Section
5.	Arm Section
6.	Bucket Section
7.	Auxiliary Section
8.	Boost Section
9.	Blade Section
10.	Swing Section
11.	Main Relief Valve 2800 PSI (19306 kPa)
12.	Port Relife Valve 2950 PSI (20340 kPa)
13.	Port Relief Valve 3400 PSI (23442 kPa)

Figure 20-41-22



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Disassembly

IMPORTANT

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

I-2003-0888

Figure 20-41-23

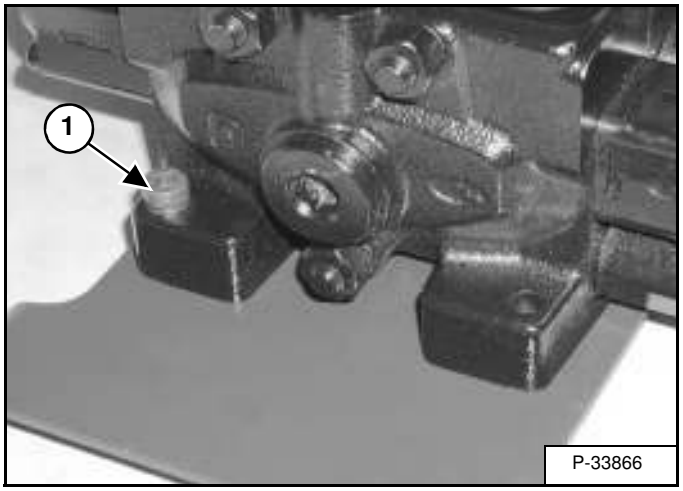
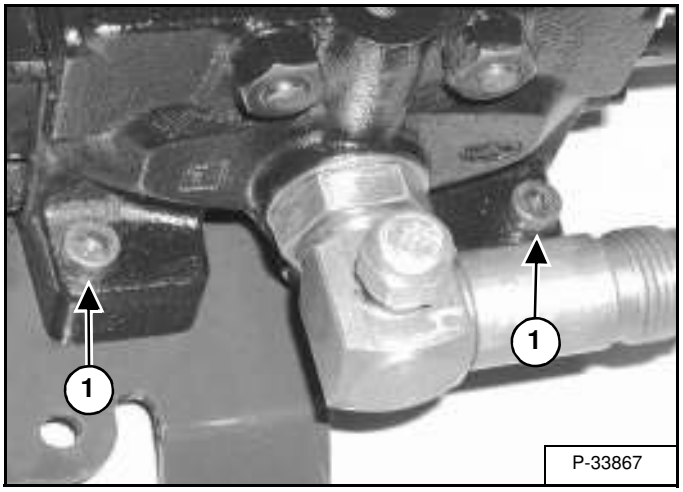
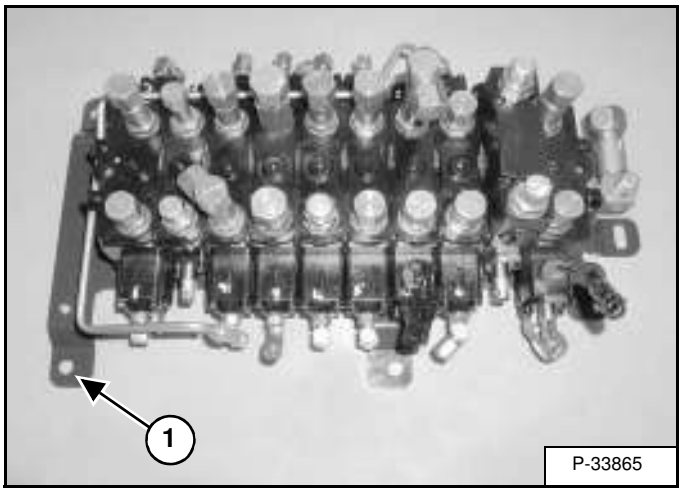


Figure 20-41-24



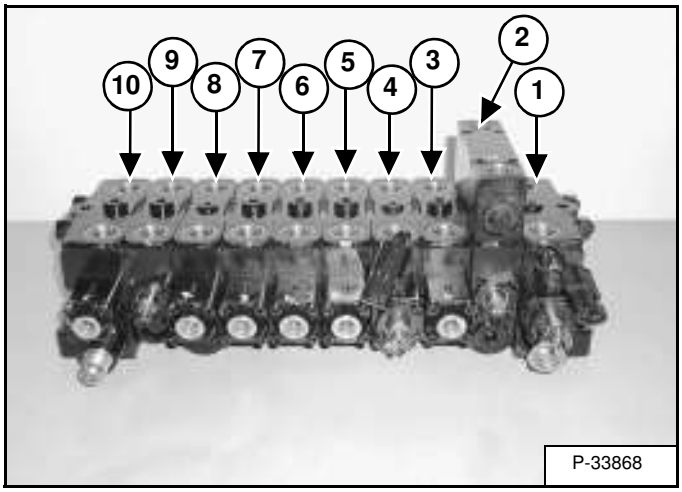
Remove the three bolts and nuts (Item 1) **[Figure 20-41-23]** & **[Figure 20-41-24]** from the mount plate.

Figure 20-41-25



Remove the mount plate (Item 1) tubelines and fittings **[Figure 20-41-25]**.

Figure 20-41-26



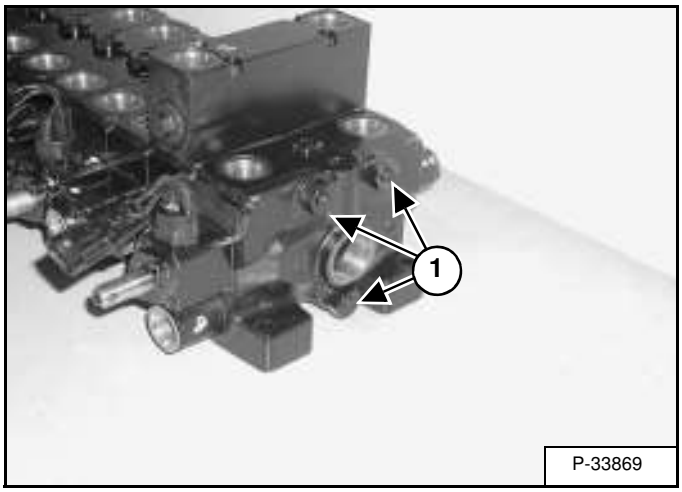
Mark the valve sections for ease of assembly **[Figure 20-41-26]**.

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

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Disassembly (Cont'd)

Figure 20-41-27



Remove the three tie rod nuts (Item 1) **[Figure 20-41-27]** and lock washers.

Right Travel Valve Section Disassembly And Assembly

IMPORTANT

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

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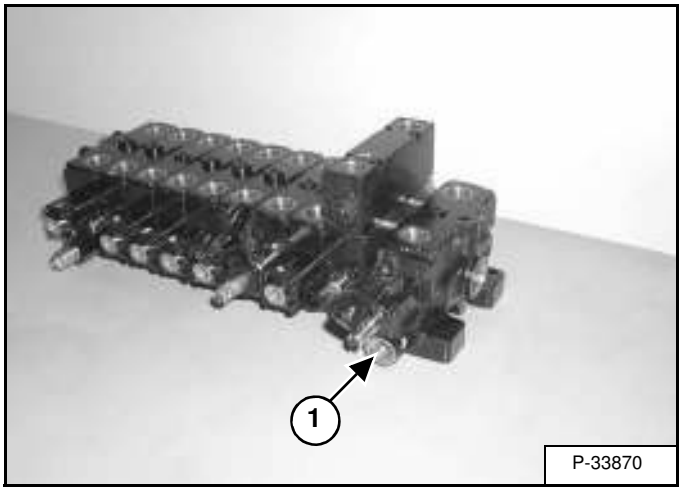
Clean all components with solvent and dry with compressed air.

Check all components for burrs, scratches or other damage and replace if necessary.

Use new O-rings and back-up rings.

Apply clean hydraulic fluid to the O-rings and back-up rings during assembly.

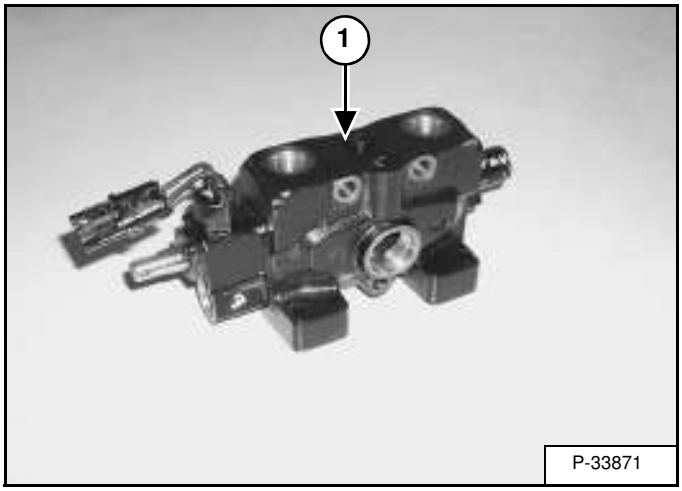
Figure 20-41-28



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

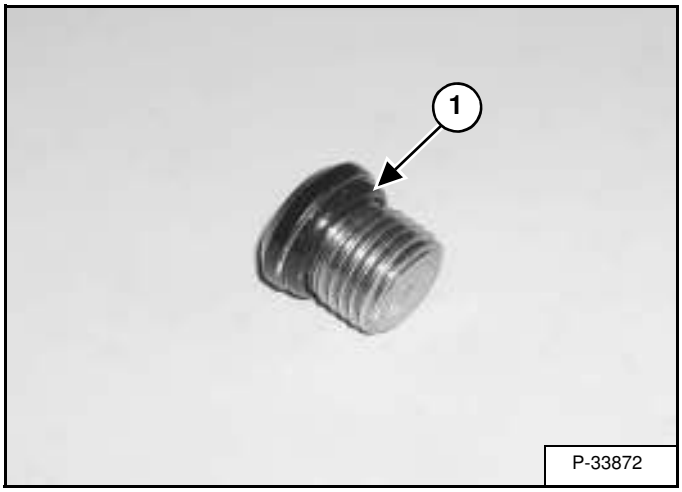
Figure 20-41-29



Remove the plug (Item 1) **[Figure 20-41-29]** from the right travel valve block (Item 1) **[Figure 20-41-28]**.

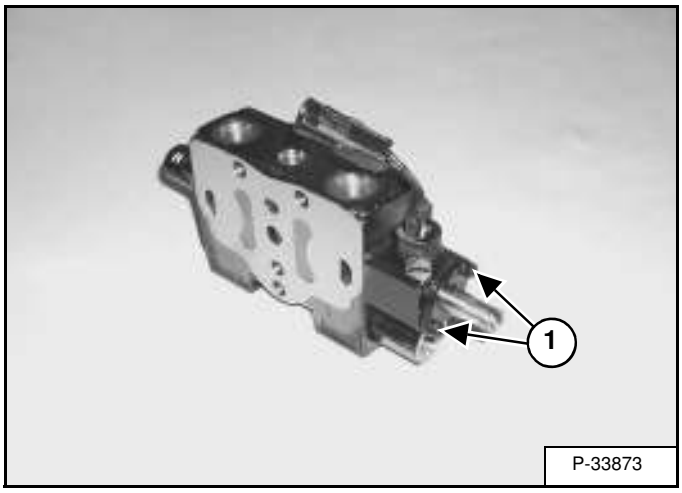
Installation: Tighten the plug to 18 ft.-lbs. (24 Nm) torque.

Figure 20-41-30



Remove the O-ring (Item 1) **[Figure 20-41-30]** from the plug.

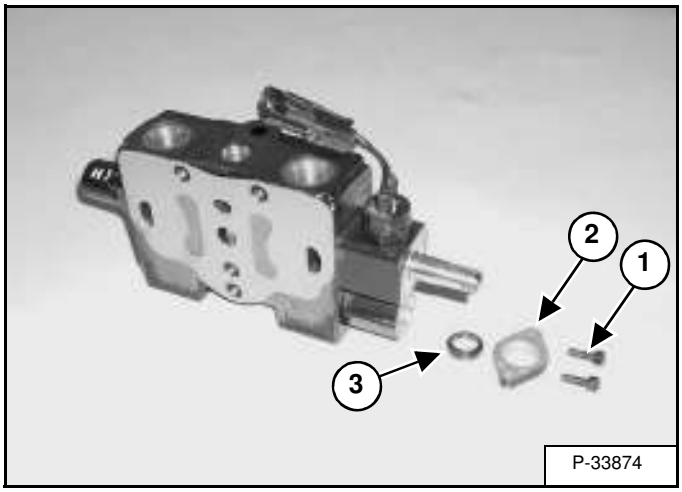
Figure 20-41-31



Loosen the two screws (Item 1) **[Figure 20-41-31]**.

Installation: Tighten the screws to 5 ft.-lbs. (6,6 Nm) torque.

Figure 20-41-32

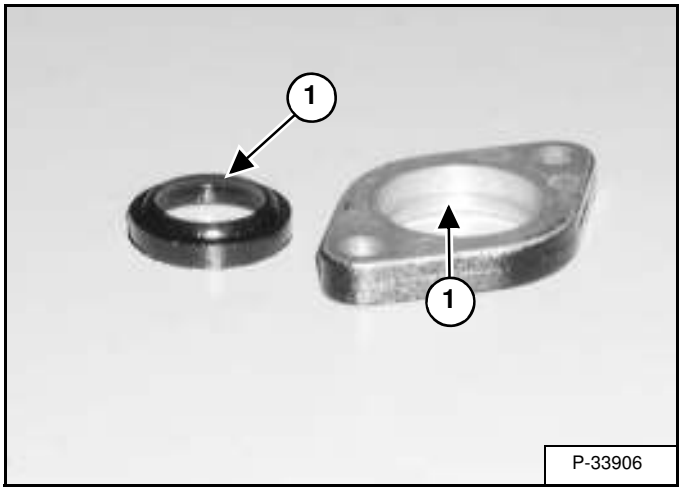


Remove the two bolts (Item 1), retaining plate (Item 2) and seal (Item 3) **[Figure 20-41-32]**.

Dealer Copy -- Not for Resale

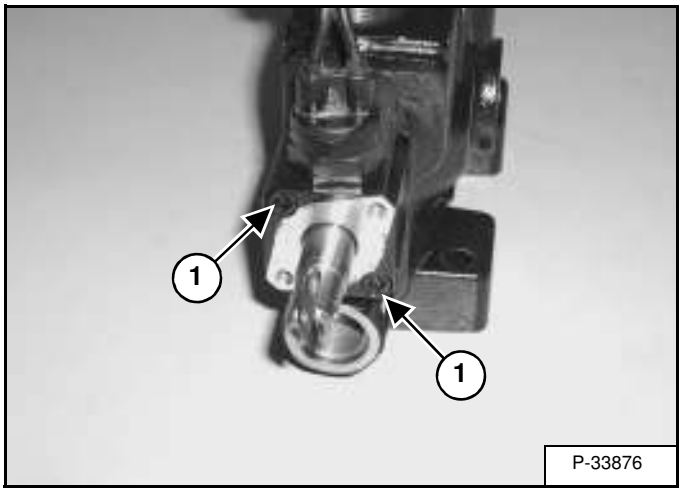
Right Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-33



Installation: Make sure the lip (Item 1)of the seal fits inside the lip on the retaining plate (Item 2) **[Figure 20-41-33]**.

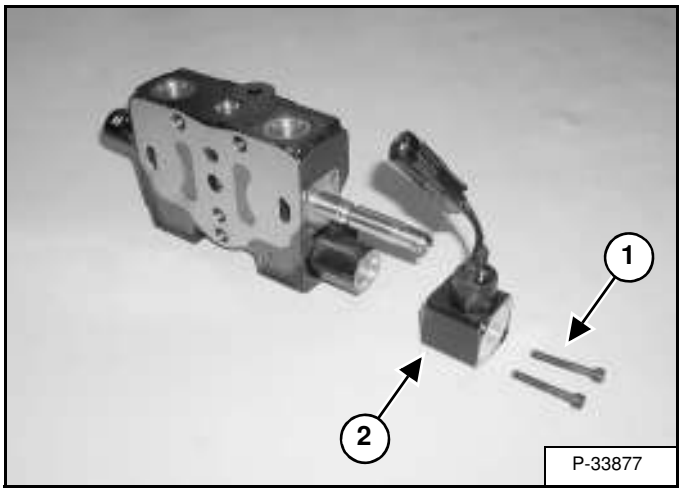
Figure 20-41-34



Loosen the two bolts (Item 1) **[Figure 20-41-34]** on the actuator.

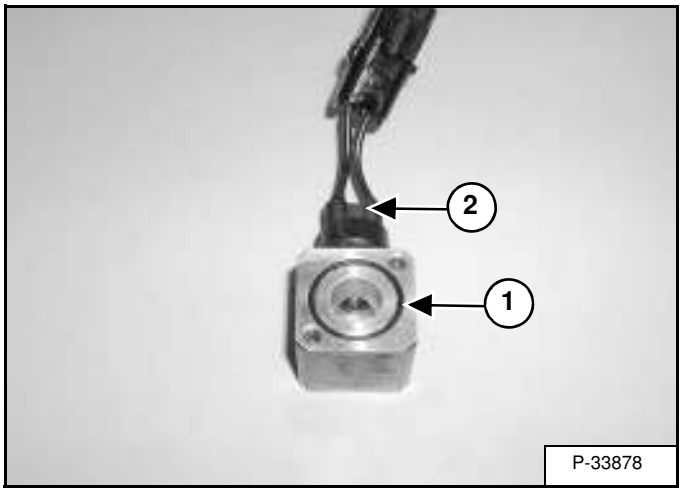
Installation: Tighten the bolts to 5 ft.-lbs. (6,6 Nm) torque.

Figure 20-41-35



Remove the two bolts (Item 1) and actuator (Item 2) **[Figure 20-41-35]**.

Figure 20-41-36



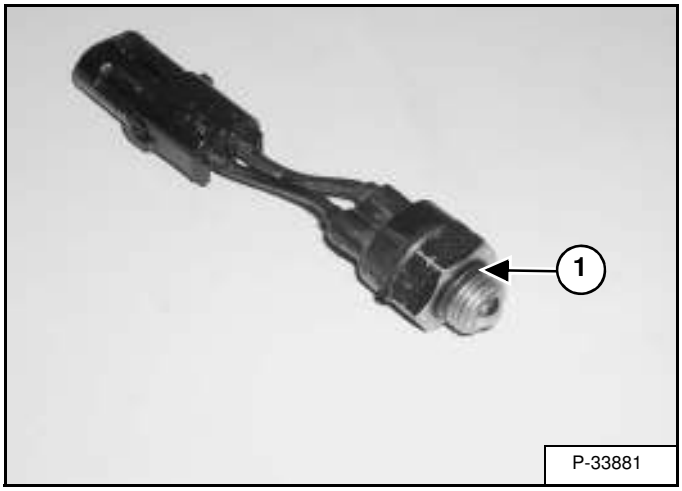
Remove the O-ring (Item 1) and electrical switch (Item 2) **[Figure 20-41-36]** from the actuator.

Installation: Tighten the switch to 31 ft.-lbs. (42 Nm) torque.

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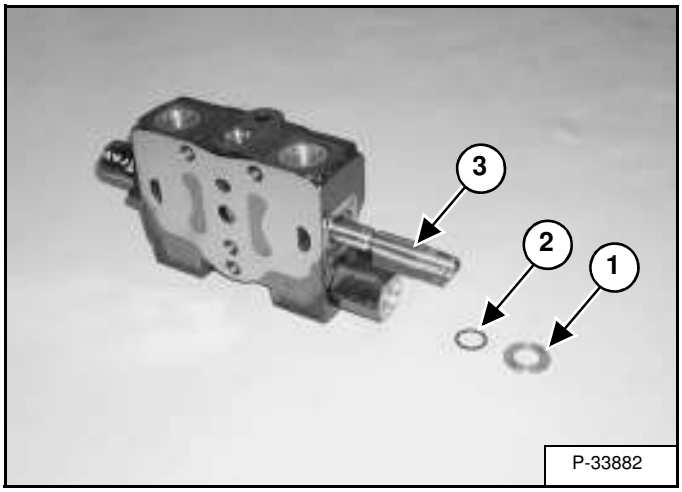
Right Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-37



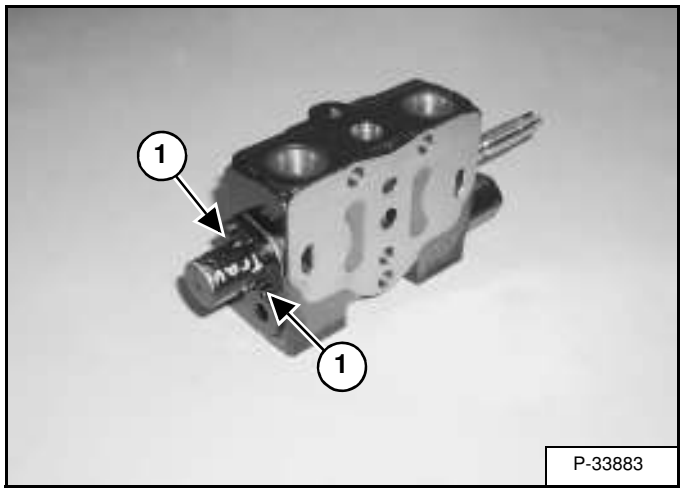
Remove the O-ring (Item 1) **[Figure 20-41-37]** from the switch.

Figure 20-41-38



Remove the washer (Item 1) and O-ring (Item 2) from the spool (Item 3) **[Figure 20-41-38]**.

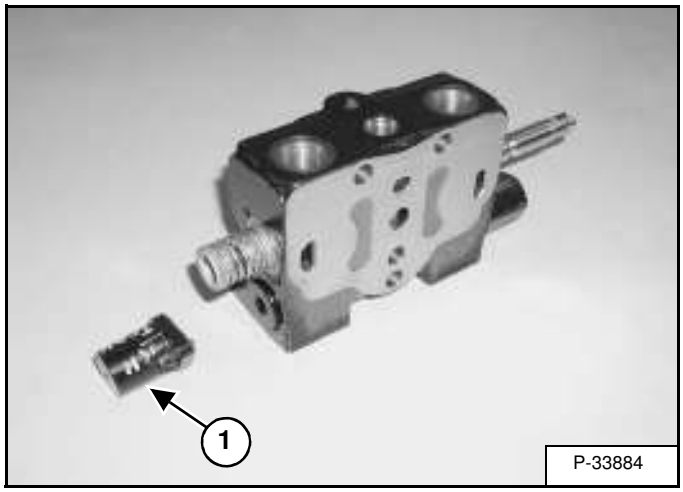
Figure 20-41-39



Loosen the two screws (Item 1) **[Figure 20-41-39]** on the cap.

Installation: Tighten the screws to 5 ft.-lbs. (6,6 Nm) torque.

Figure 20-41-40

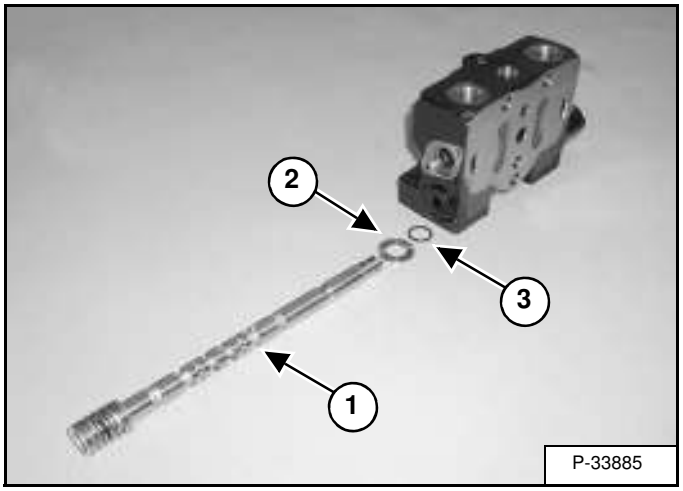


Remove the two screws and cap (Item 1) **[Figure 20-41-40]**.

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

Figure 20-41-41

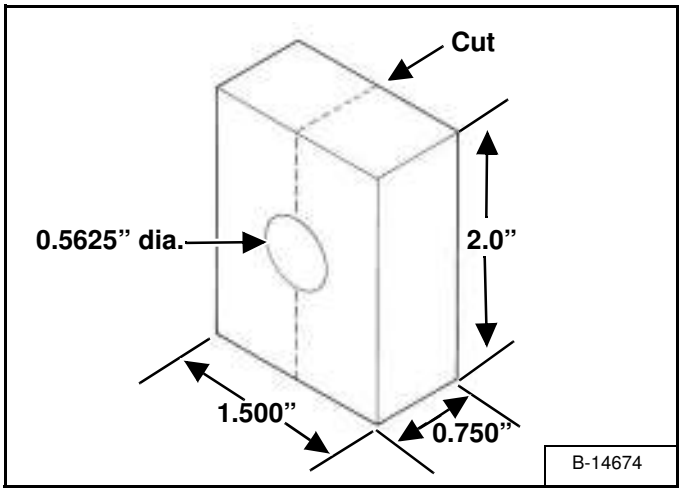


Remove the spool assembly (Item 1), washer (Item 2) and O-ring (Item 3) **[Figure 20-41-41]**.

The spool and valve block are not serviced separately.

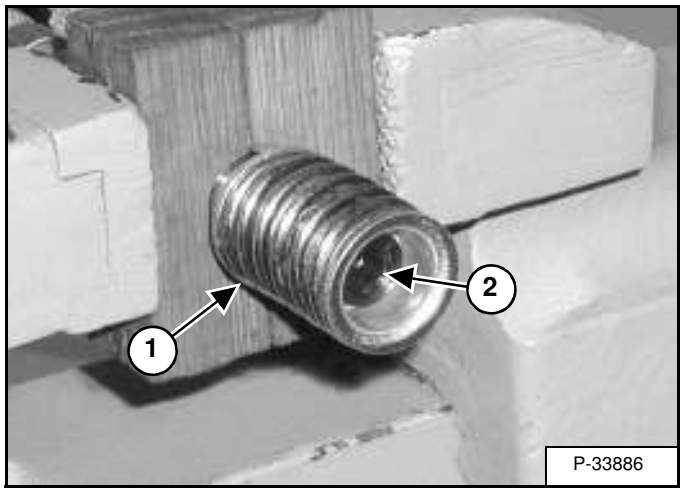
NOTE: When the spool is removed, use care not to scratch the spool surface and do not interchange spools and valve blocks.

Figure 20-41-42



To remove the spring assembly from the spool a holding fixture will have to be made from a .750 inch thick x 1.500 inch wide x 2.0 inch long (1.9 mm thick x 38 mm wide x 51 mm long) piece of hardwood. Drill a 0.5625 inch (14 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-41-42]**.

Figure 20-41-43



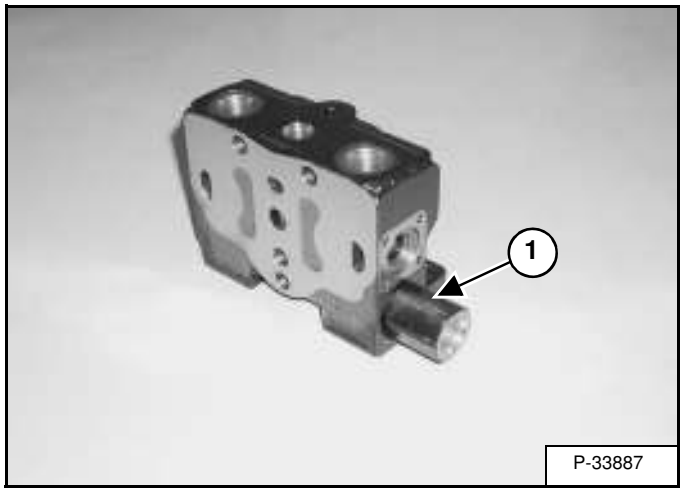
Using the wood blocks clamp the spool (Item 1) **[Figure 20-41-43]** in a vise.

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

Remove the spring assembly (Item 2) **[Figure 20-41-43]** from the spool.

Installation: Tighten the spring assembly to 7 ft.-lbs. (9,8 Nm) torque.

Figure 20-41-44



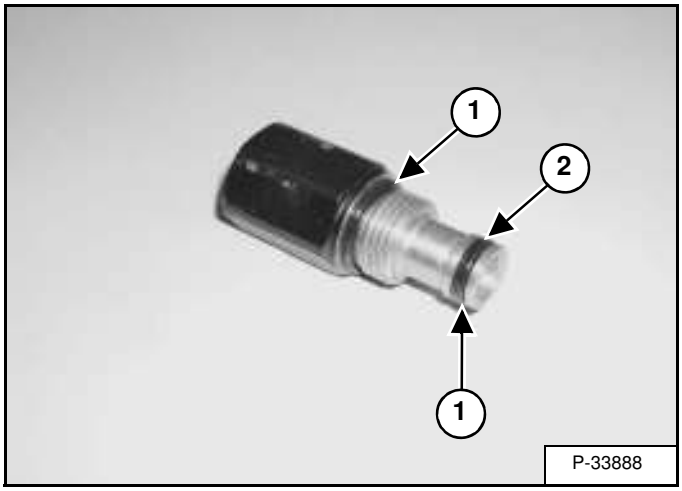
Remove the fitting (Item 1) **[Figure 20-41-44]**.

Installation: Tighten the fitting to 31 ft.-lbs. (42 Nm) torque.

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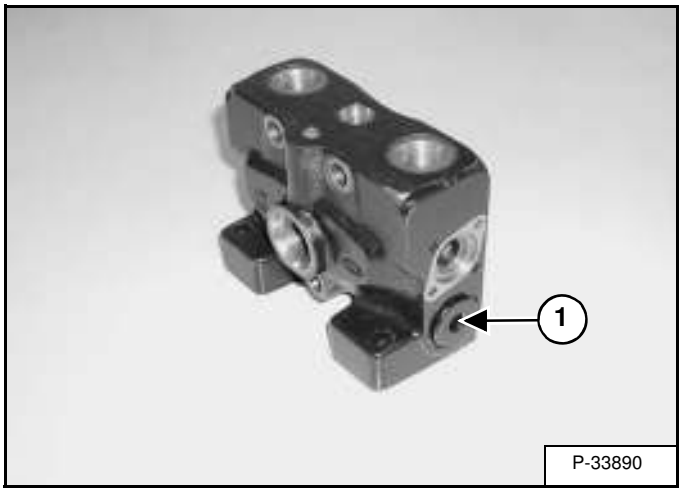
Right Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-45



Remove the two O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-41-45]** from the fitting.

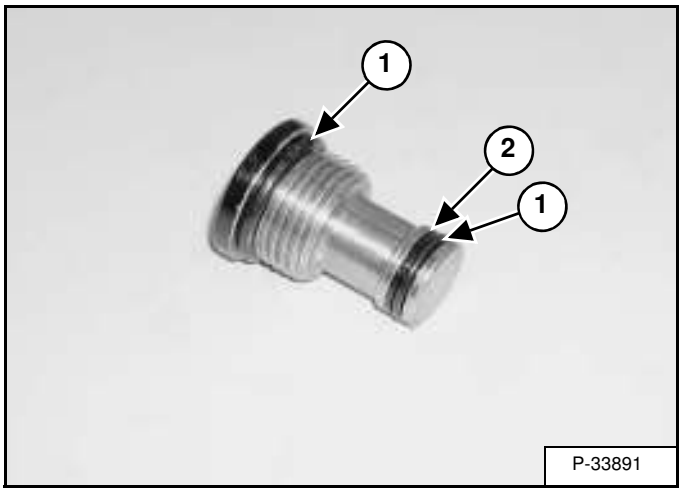
Figure 20-41-46



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

Installation: Tighten the plug to 31 ft.-lbs. (42 Nm) torque.

Figure 20-41-47



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

Dealer Copy -- Not for Resale

Boom Offset Valve Section Disassembly And Assembly

IMPORTANT

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

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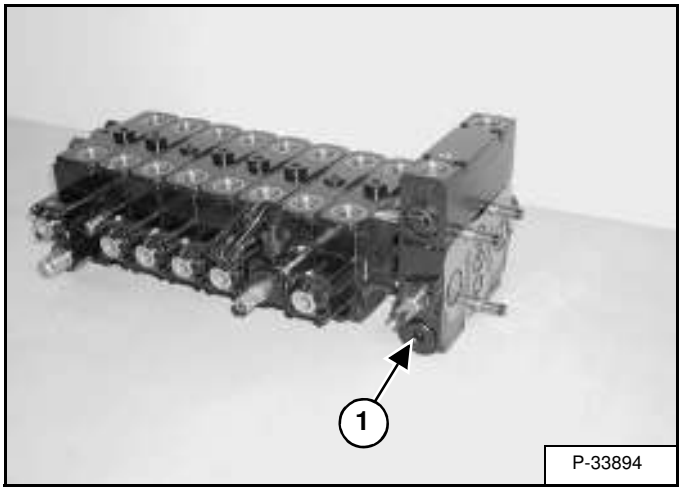
Clean all components with solvent and dry with compressed air.

Check all components for burrs, scratches or other damage and replace if necessary.

Use new O-rings and back-up rings.

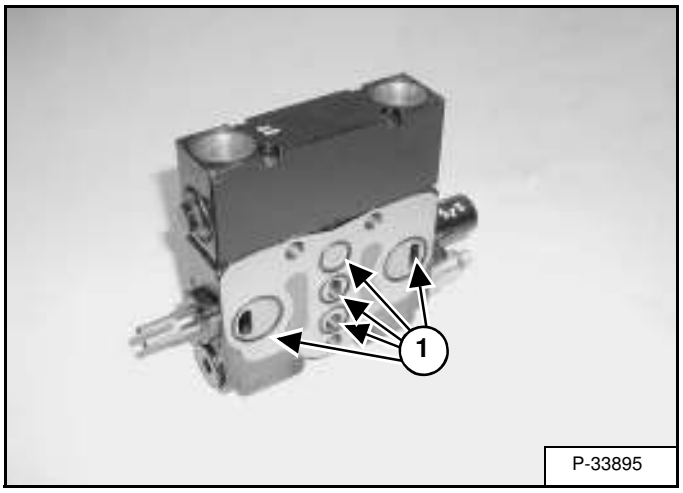
Apply clean hydraulic fluid to the O-rings and back-up rings during assembly.

Figure 20-41-48



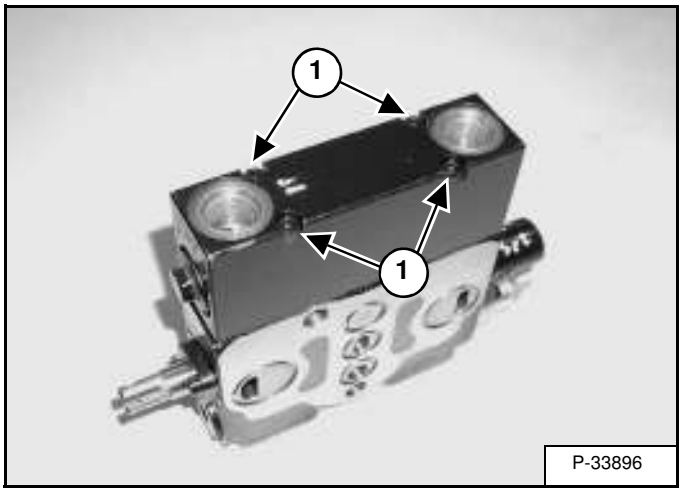
Remove the boom offset valve section (Item 1) **[Figure 20-41-48]** from the valve assembly.

Figure 20-41-49



Remove the five O-rings (Item 1) **[Figure 20-41-49]** from the boom offset valve block.

Figure 20-41-50



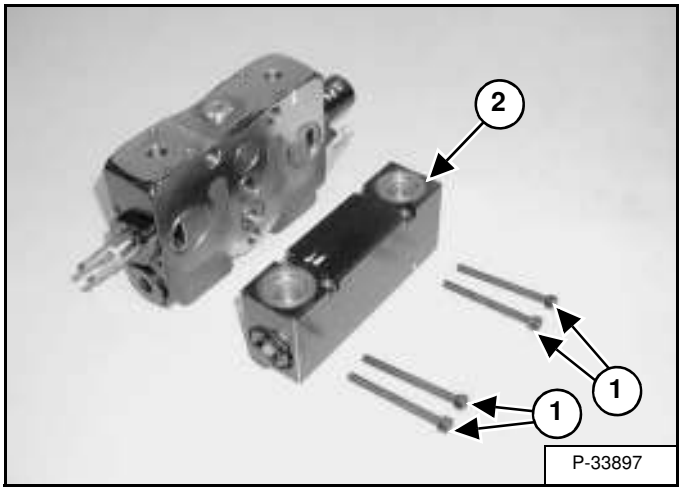
Loosen the four bolts (Item 1) **[Figure 20-41-50]** from the spool control block.

Installation: Tighten the bolts to 7 ft.-lbs. 9,8 Nm) torque.

Dealer Copy -- Not for Resale

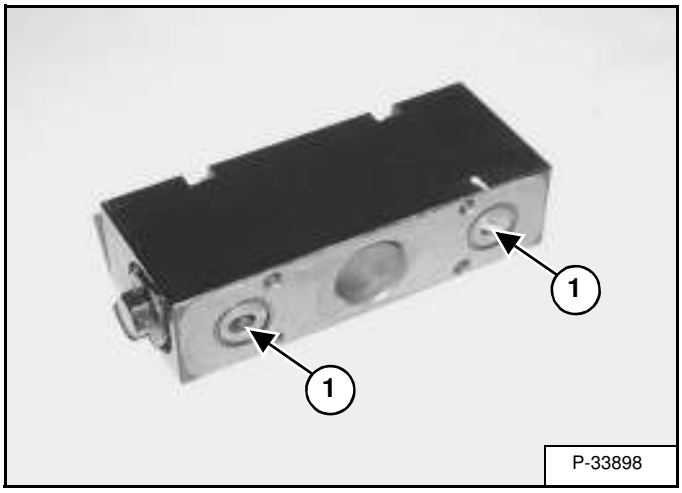
Boom Offset Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-51



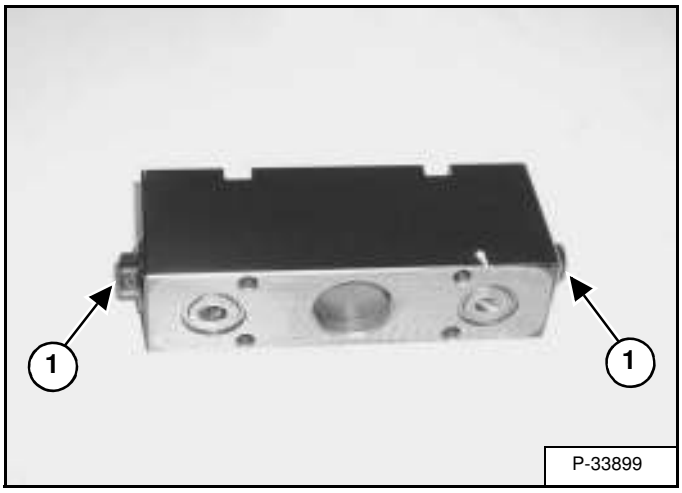
Mark the control block for correct installation. Remove the four bolts (Item 1) and control block (Item 2) **[Figure 20-41-51]**.

Figure 20-41-52



Remove the two O-rings (Item 1) **[Figure 20-41-52]** from the spool control block.

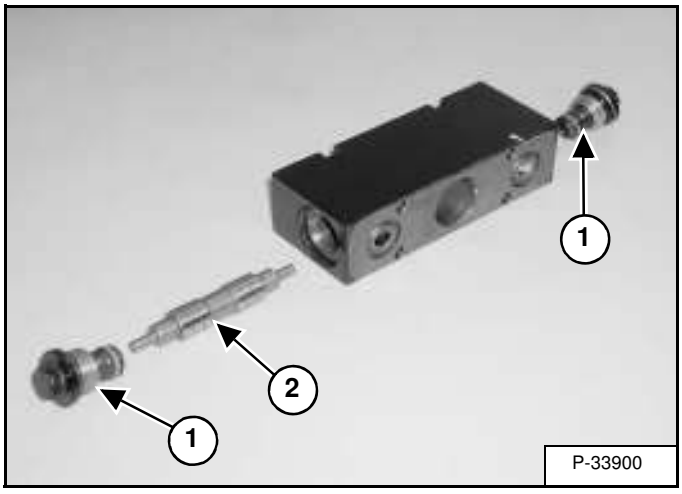
Figure 20-41-53



Loosen the two caps (Item 1) **[Figure 20-41-53]**.

Installation: Tighten the plugs to 31 ft.-lbs. (42 Nm) torque.

Figure 20-41-54

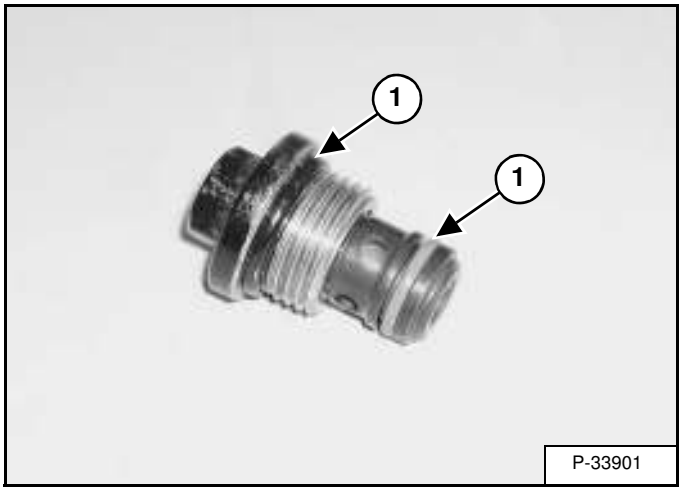


Remove the two caps (Item 1) and spool (Item 2) **[Figure 20-41-54]**.

Dealer Copy -- Not for Resale

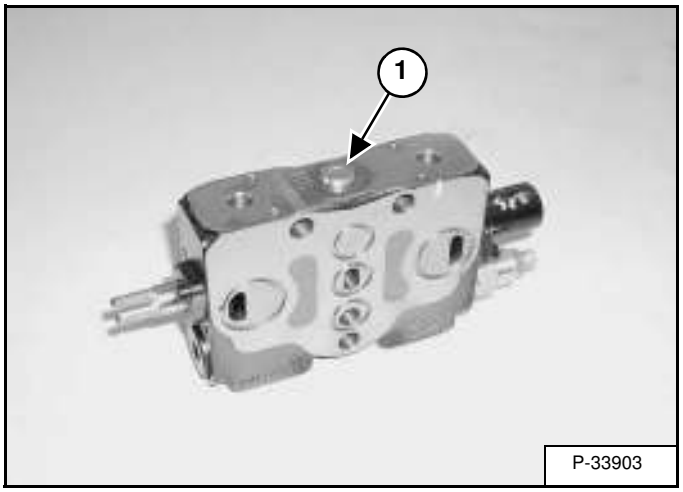
Boom Offset Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-55



Remove the two O-rings (Item 1) **[Figure 20-41-55]** from the caps.

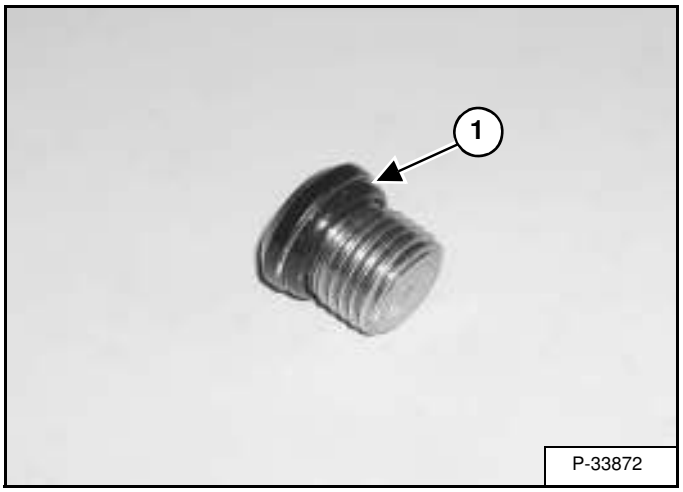
Figure 20-41-56



Remove the plug (Item 1) **[Figure 20-41-56]**.

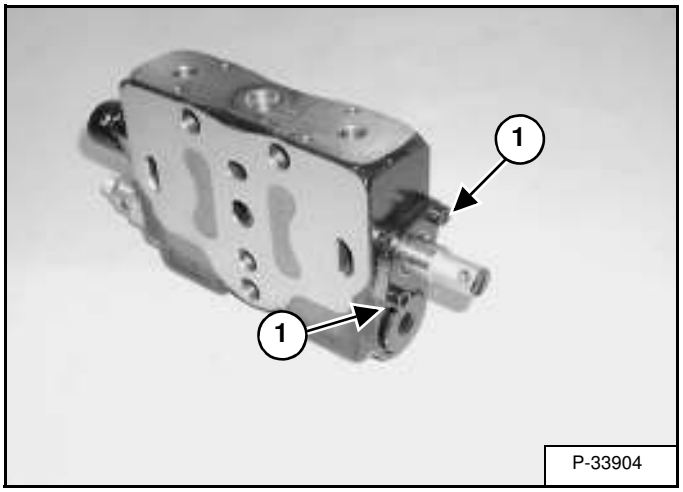
Installation: Tighten the plug to 18 ft.-lbs. (24 Nm) torque.

Figure 20-41-57



Remove the O-ring (Item 1) **[Figure 20-41-57]** from the plug.

Figure 20-41-58



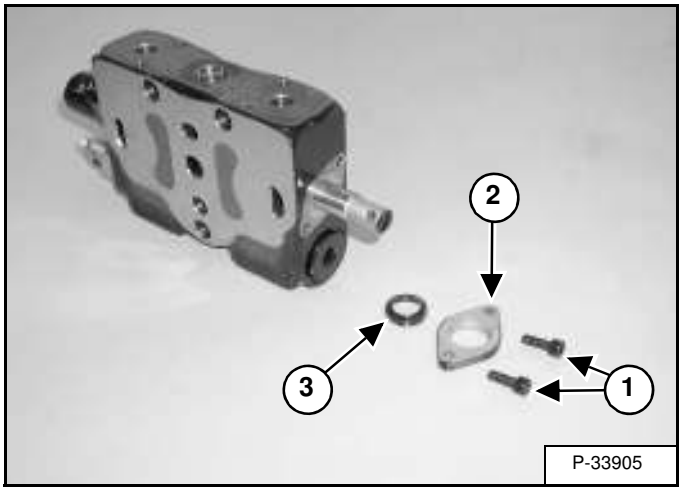
Loosen the two bolts (Item 1) **[Figure 20-41-58]** on the actuator retainer.

Installation: Tighten the bolts to 5 ft.-lbs. (6,6 Nm) torque.

Dealer Copy -- Not for Resale

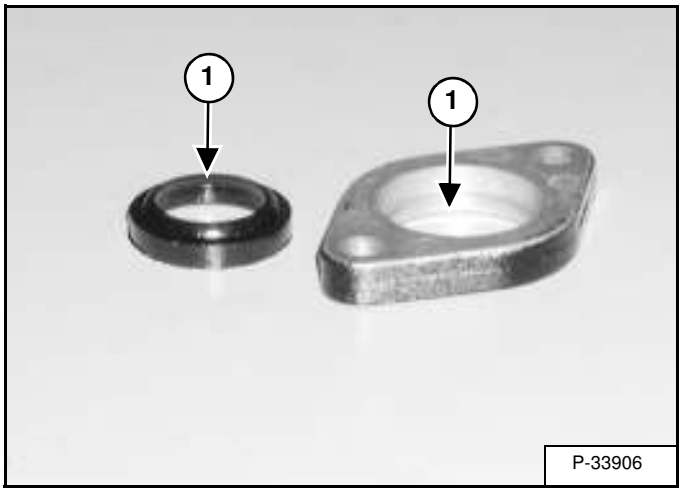
Boom Offset Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-59



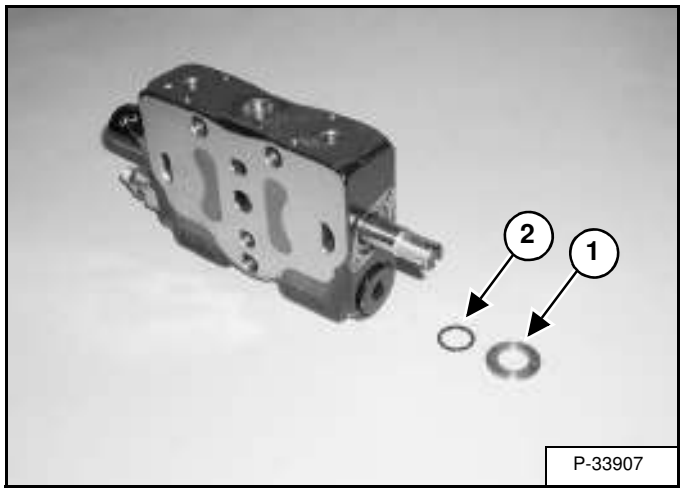
Remove the two bolts (Item 1), retainer (Item 2) and seal (Item 3) **[Figure 20-41-59]**.

Figure 20-41-60



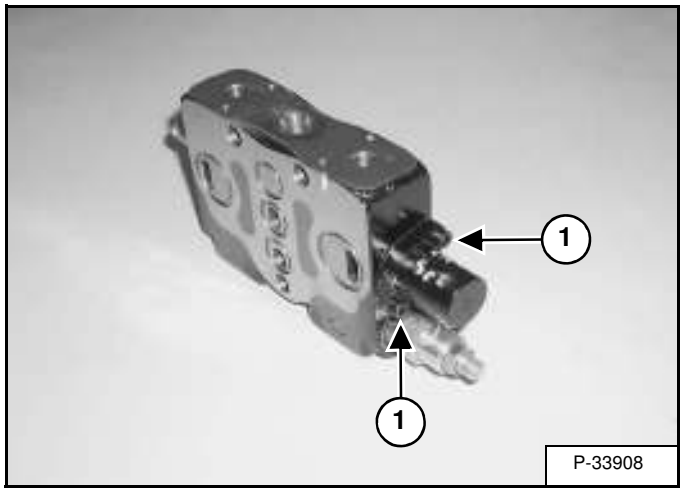
Installation: Make sure the lip (Item 1) **[Figure 20-41-60]** on the seal fits into the lip on the retainer (Item 2) **[Figure 20-41-59]**.

Figure 20-41-61



Remove the washer (Item 1) and O-ring (Item 2) **[Figure 20-41-61]** from the actuating end of the spool.

Figure 20-41-62



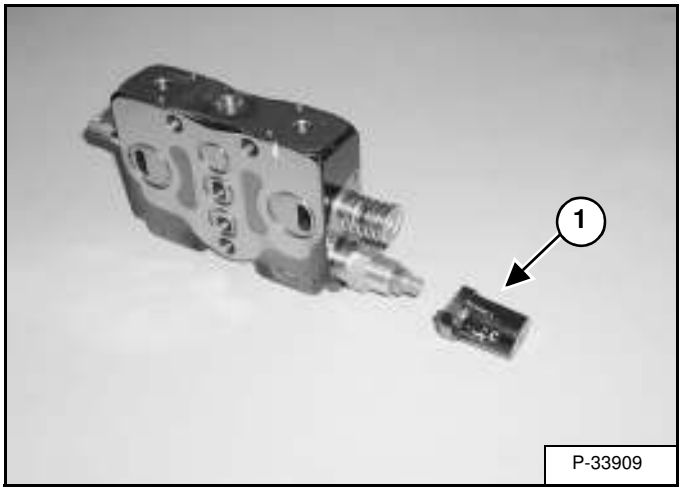
Loosen the two bolts (Item 1) on the cap (Item 2) **[Figure 20-41-62]**.

Installation: Tighten the bolts to 5 ft.-lbs. (6,6 Nm) torque.

Dealer Copy -- Not for Resale

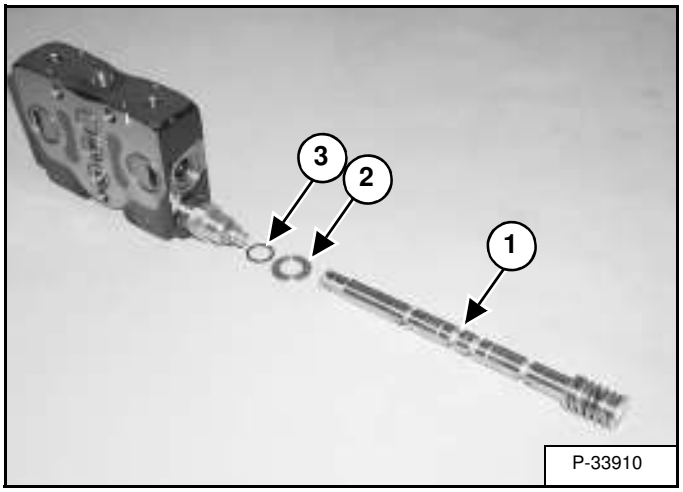
Boom Offset Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-63



Remove the two bolts and cap (Item 1) **[Figure 20-41-63]**.

Figure 20-41-64

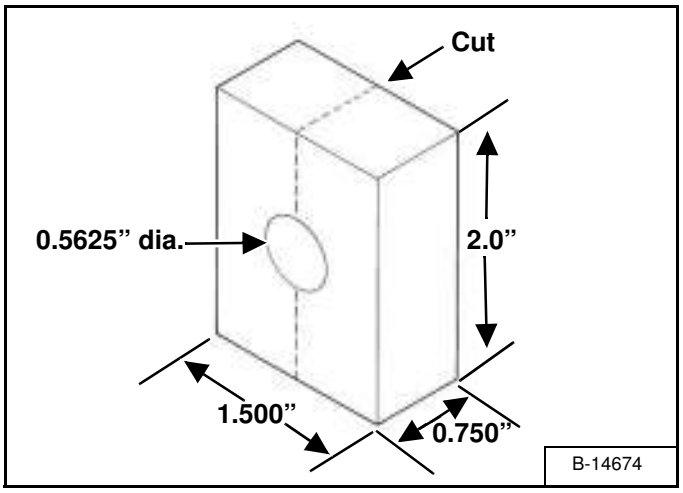


Remove the spool assembly (Item 1), washer (Item 2) and O-ring (Item 3) **[Figure 20-41-64]**.

The spool and valve block are not serviced separately.

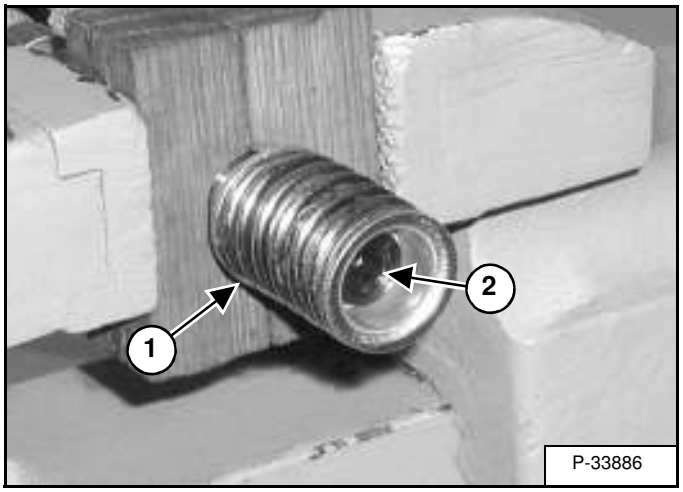
NOTE: When the spool is removed, use care not to scratch the spool surface and do not interchange spools and valve blocks.

Figure 20-41-65



To remove the spring assembly from the spool a holding fixture will have to be made from a .750 inch thick x 1.500 inch wide x 2.0 inch long (19 mm thick x 38 mm wide x 51 mm long) piece of hardwood. Drill a 0.5625 inch (14 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-41-65]**.

Figure 20-41-66



Using the wood blocks clamp the spool (Item 1) in a vise and remove the spring assembly (Item 2) **[Figure 20-41-66]**.

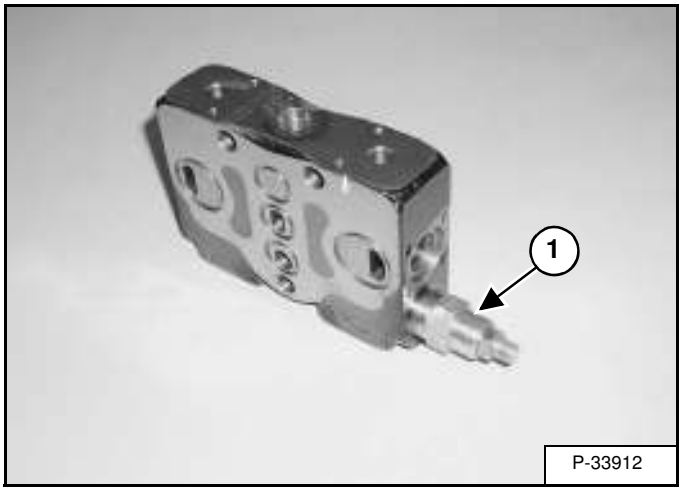
NOTE: Do not use anything other than hardwood blocks to grip the spool, or the spool will be damaged.

Installation: Tighten the spring assembly to 7 ft.-lbs. (9,8 Nm) torque.

Dealer Copy -- Not for Resale

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

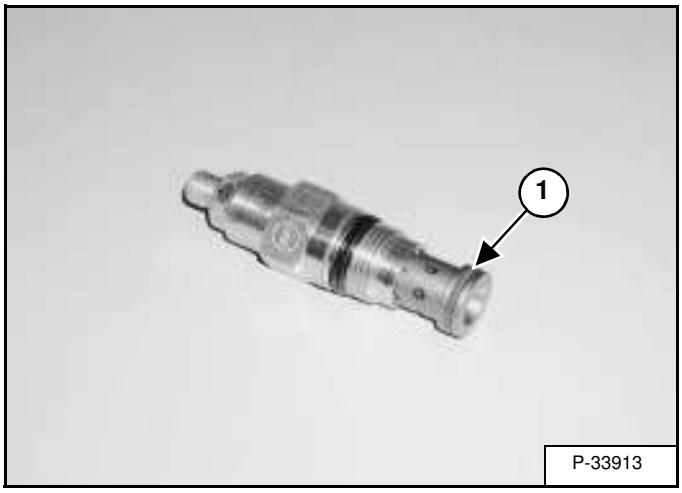
Figure 20-41-67



Remove the main relief valve (Item 1) **[Figure 20-41-67]**.

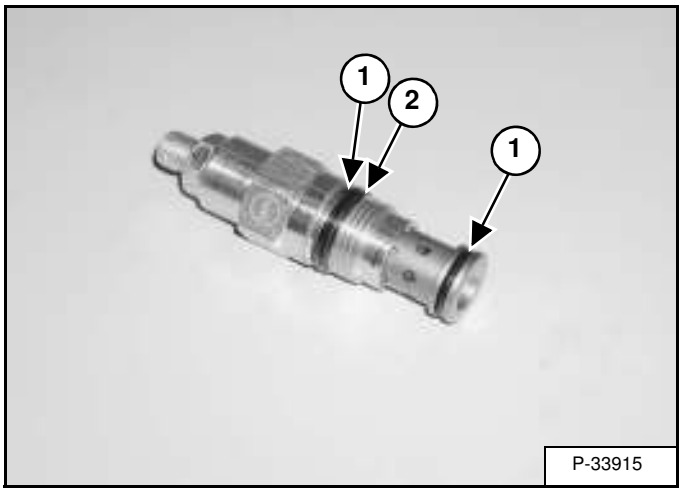
Installation: Tighten the main relief valve to 31 ft.-lbs. (42 Nm) torque.

Figure 20-41-68



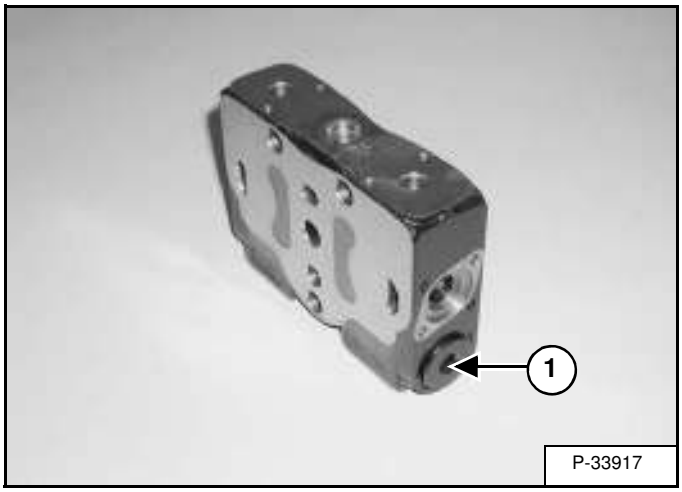
Remove the seal (Item 1) **[Figure 20-41-68]** from the main relief valve.

Figure 20-41-69



Remove the two O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-41-69]**.

Figure 20-41-70



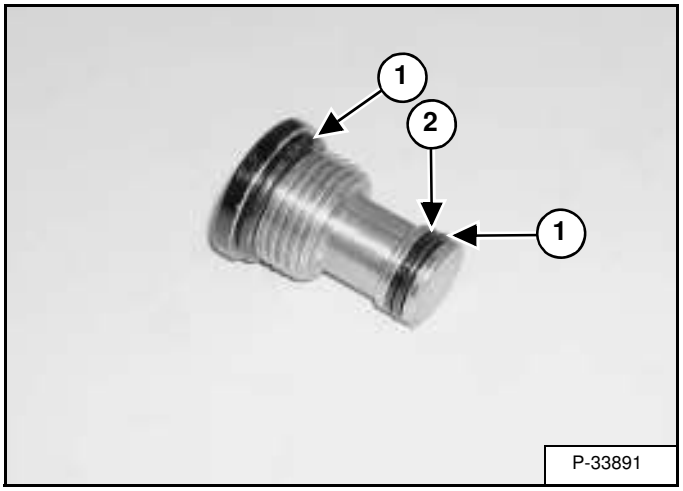
Remove the plug (Item 1) **[Figure 20-41-70]**.

Installation: Tighten the plug to 31 ft.-lbs. (42 Nm) torque.

Dealer Copy -- Not for Resale

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

Figure 20-41-71



Remove the two O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-41-71]** from the plug.

Boom Valve Section Disassembly And Assembly

IMPORTANT

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

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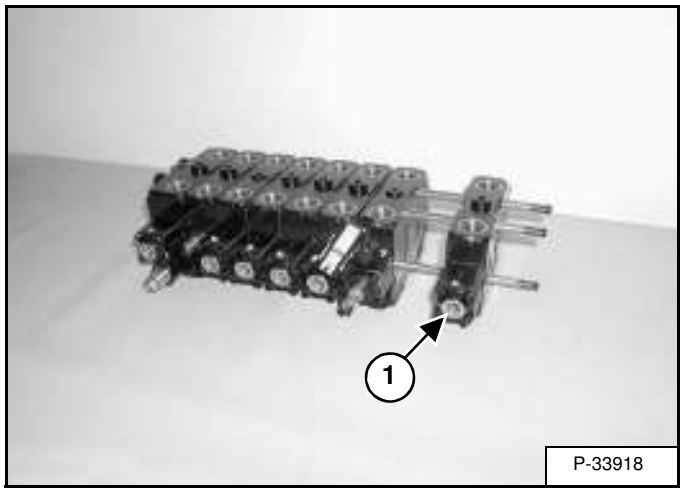
Clean all components with solvent and dry with compressed air.

Check all components for burrs, scratches or other damage and replace if necessary.

Use new O-rings and back-up rings.

Apply clean hydraulic fluid to the O-rings and back-up rings during assembly.

Figure 20-41-72

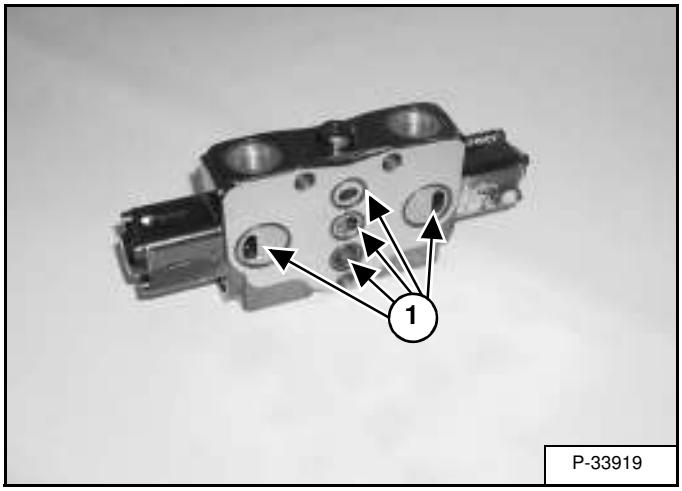


Remove the boom valve section (Item 1) **[Figure 20-41-72]** from the boom valve block.

Dealer Copy -- Not for Resale

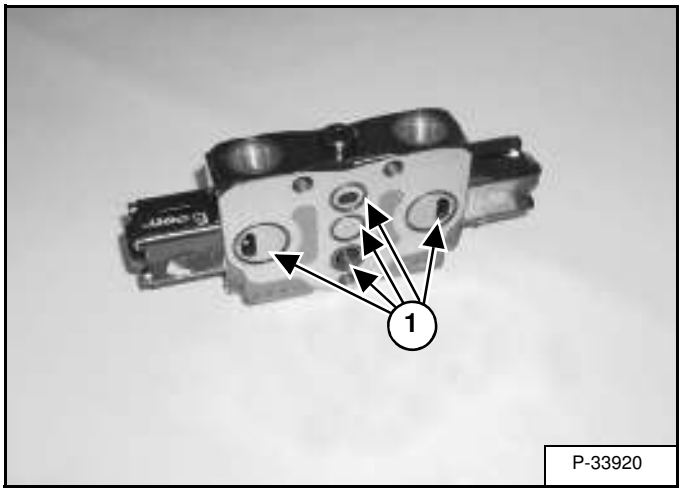
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-73



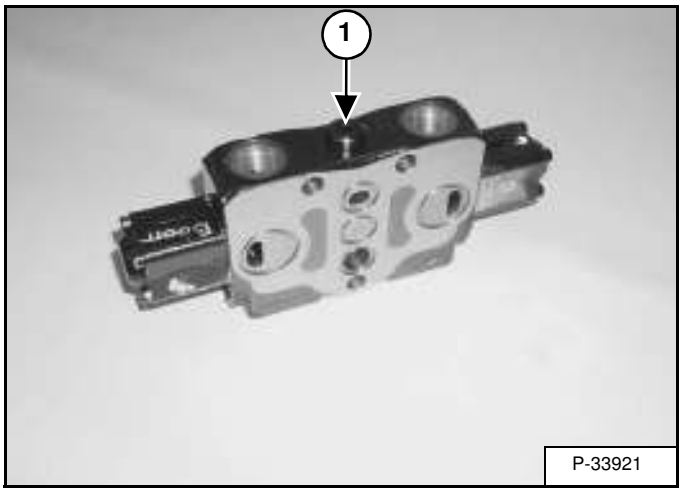
Remove the five O-rings (Item 1) **[Figure 20-41-73]** from the right side of the boom valve block.

Figure 20-41-74



Remove the five O-rings (Item 1) **[Figure 20-41-74]** from the left side of the boom valve block.

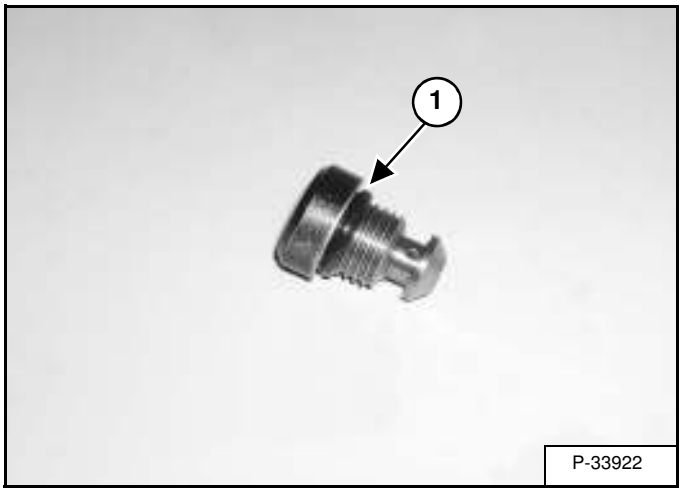
Figure 20-41-75



Remove the load check valve (Item 1) **[Figure 20-41-75]**.

Installation: Tighten the load check valve to 18 ft.-lbs. (24 Nm) torque.

Figure 20-41-76



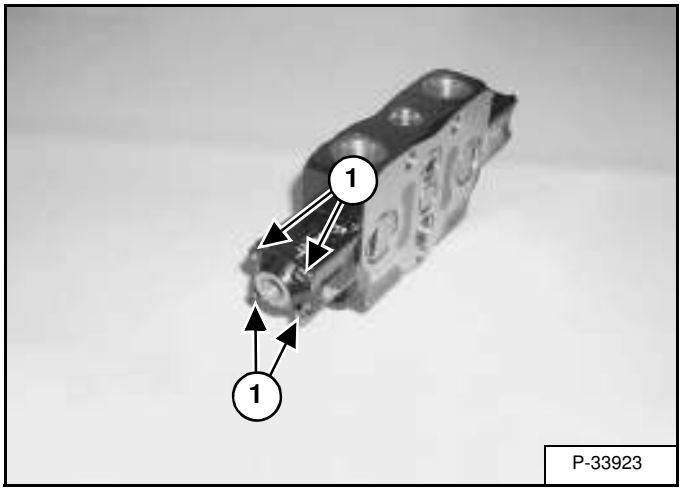
Remove the O-ring (Item 1) **[Figure 20-41-76]** from the load check valve.

Dealer Copy -- Not for Resale

HYDRAULIC CONTROL VALVE (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

Boom Valve Section Disassembly And Assembly (Cont'd)

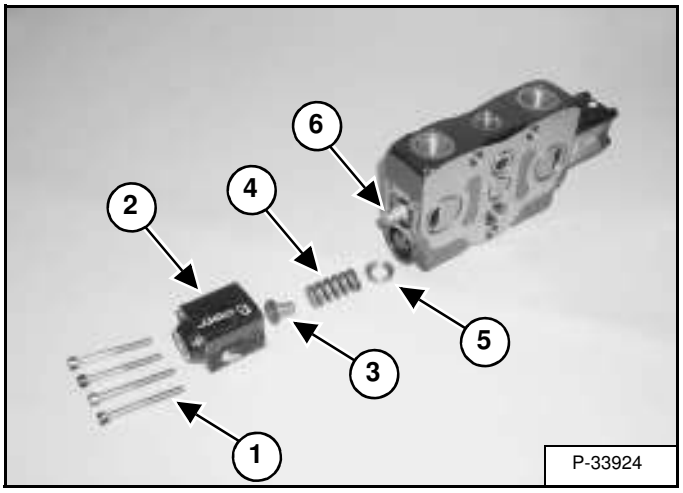
Figure 20-41-77



Loosen the four bolts (Item 1) **[Figure 20-41-77]**.

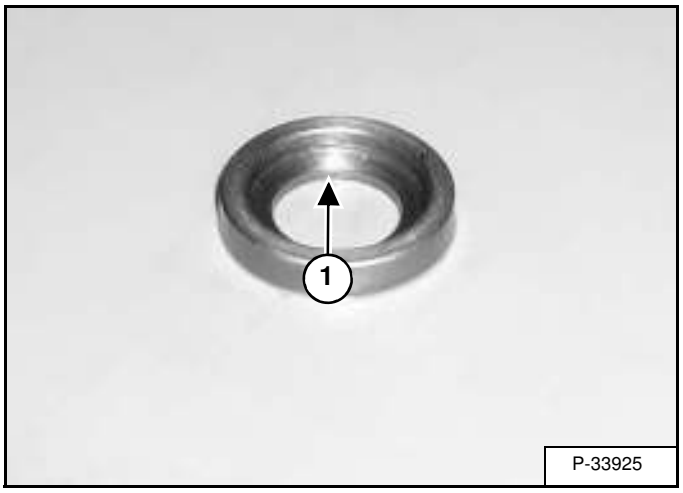
Installation: Tighten the bolts to 5 ft.-lbs. (6,6 Nm) torque.

Figure 20-41-78



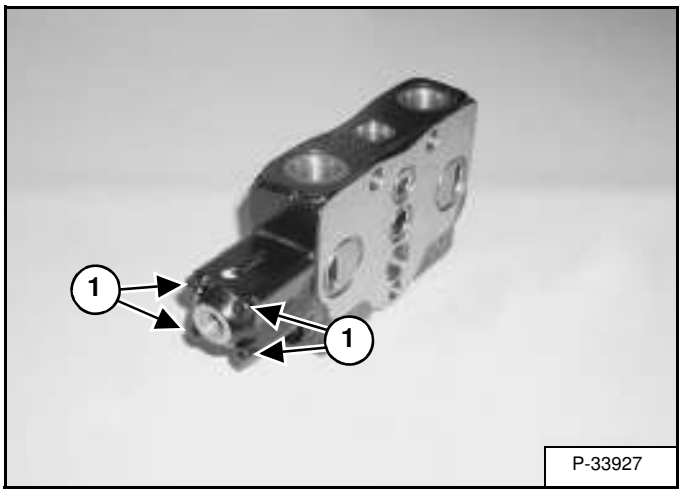
Remove the four bolts (Item 1), actuator (Item 2), spring retainer (Item 3), spring (Item 4) and spring retainer (Item 5) **[Figure 20-41-78]**.

Figure 20-41-79



Installation: Make sure the lip (Item 1) **[Figure 20-41-79]** on the spring retainer (Item 5) **[Figure 20-41-78]** fits over the spool (Item 6) **[Figure 20-41-78]**.

Figure 20-41-80



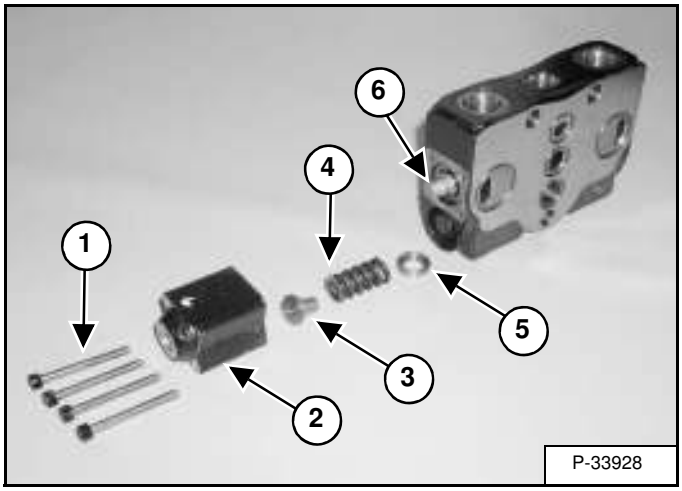
Loosen the four bolts (Item 1) **[Figure 20-41-80]**.

Installation: Tighten the bolts to 5 ft.-lbs. (6,6 Nm) torque.

Dealer Copy -- Not for Resale

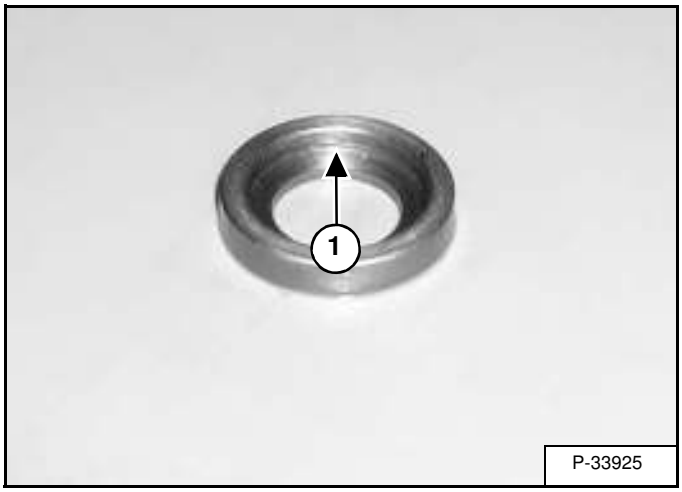
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-81



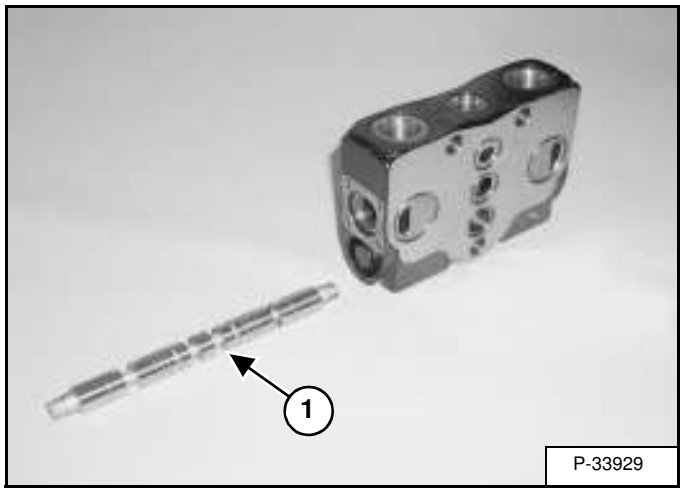
Remove the four bolts (Item 1), actuator (Item 2), spring retainer (Item 3), spring (Item 4) and spring retainer (Item 5) **[Figure 20-41-81]**.

Figure 20-41-82



Installation: Make sure the lip (Item 1) **[Figure 20-41-82]** on the spring retainer (Item 5) **[Figure 20-41-81]** fits over the spool (Item 6) **[Figure 20-41-81]**.

Figure 20-41-83

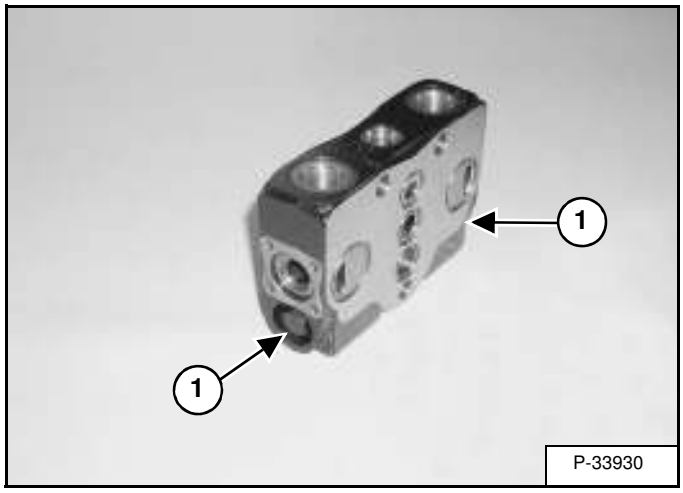


Remove the spool (Item 1) **[Figure 20-41-83]**.

The spool and valve block are not serviced separately.

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

Figure 20-41-84



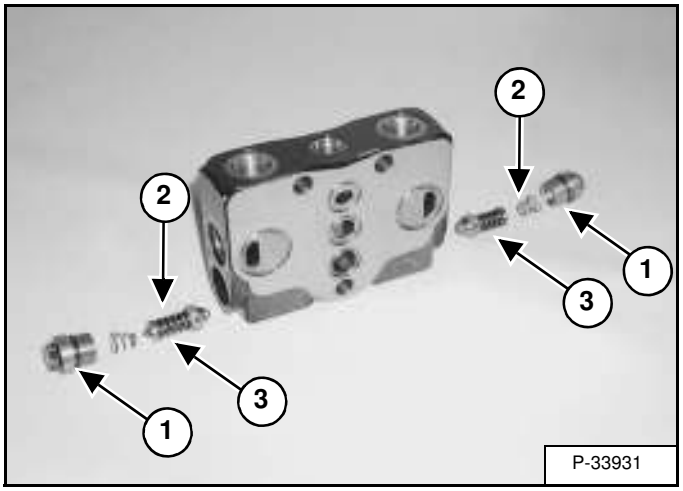
Loosen the relief valve caps (Item 1) **[Figure 20-41-84]** (both sides).

Installation: Tighten the relief valve caps to 18 ft.-lbs. (24 Nm) torque.

Dealer Copy -- Not for Resale

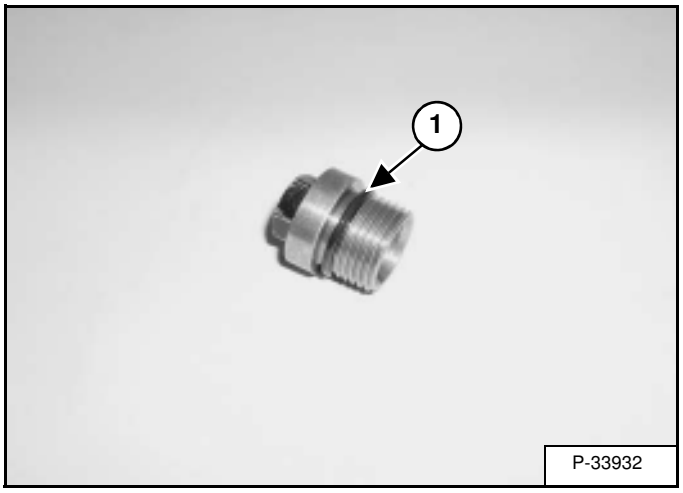
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-85



Remove the cap (Item 1), spring (Item 2) and spring assembly (Item 3) **[Figure 20-41-85]** from both relief valve ports.

Figure 20-41-86



Remove the O-ring (Item 1) **[Figure 20-41-86]** from the caps.

Left Travel Valve Section Disassembly And Assembly

IMPORTANT

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

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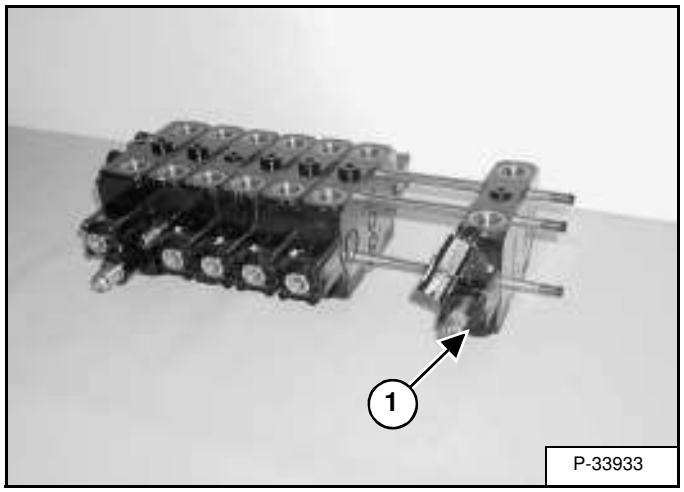
Clean all components with solvent and dry with compressed air.

Check all components for burrs, scratches or other damage and replace if necessary.

Use new O-rings and back-up rings.

Apply clean hydraulic fluid to the O-rings and back-up rings during assembly.

Figure 20-41-87

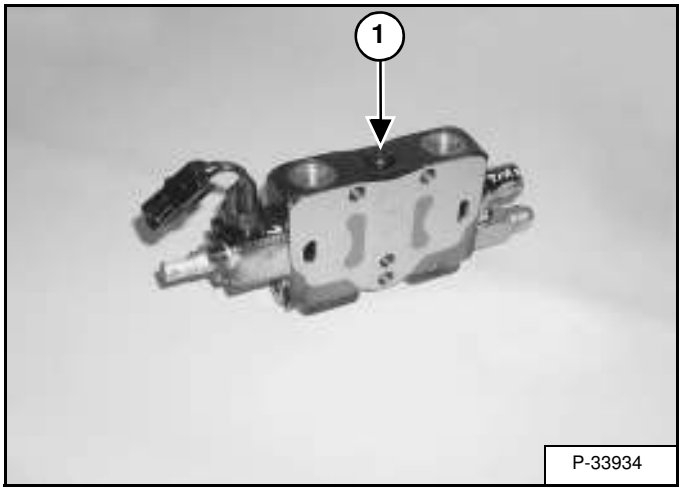


Remove the left travel valve section (Item 1) **[Figure 20-41-87]** from the valve assembly.

Dealer Copy -- Not for Resale

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

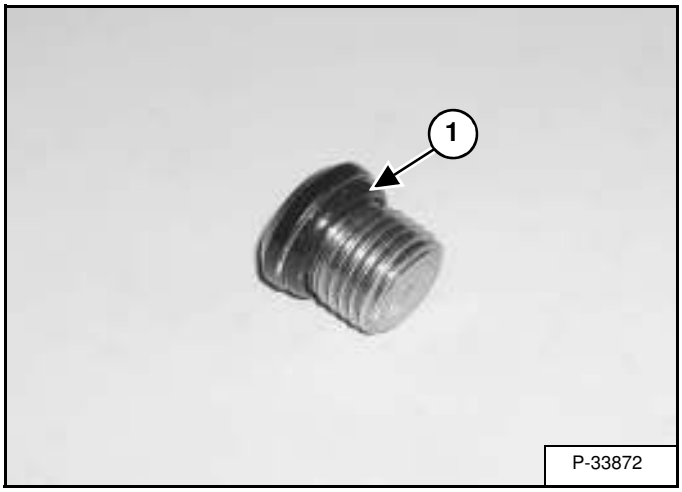
Figure 20-41-88



Remove the plug (Item 1) **[Figure 20-41-88]** from the left travel valve block.

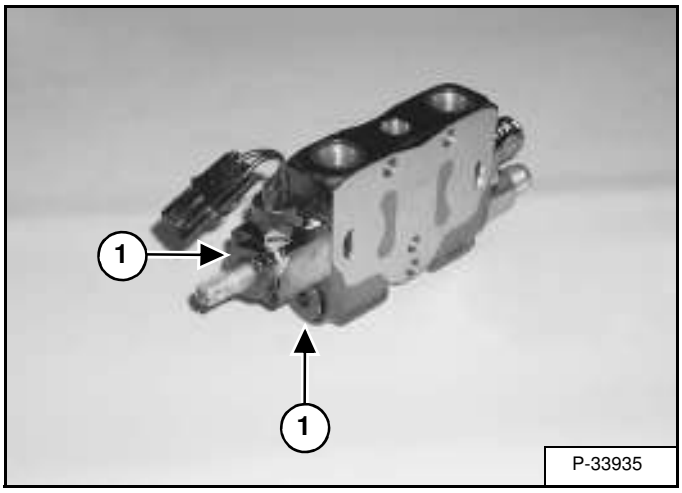
Installation: Tighten the plug to 18 ft.-lbs. (24 Nm) torque.

Figure 20-41-89



Remove the O-ring (Item 1) **[Figure 20-41-89]** from the plug.

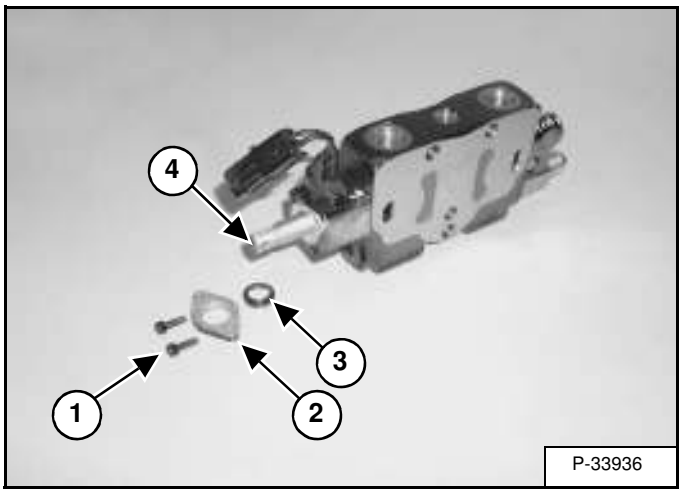
Figure 20-41-90



Loosen the two screws (Item 1) **[Figure 20-41-90]**.

Installation: Tighten the screws to 5 ft.-lbs. (6,6 Nm).

Figure 20-41-91

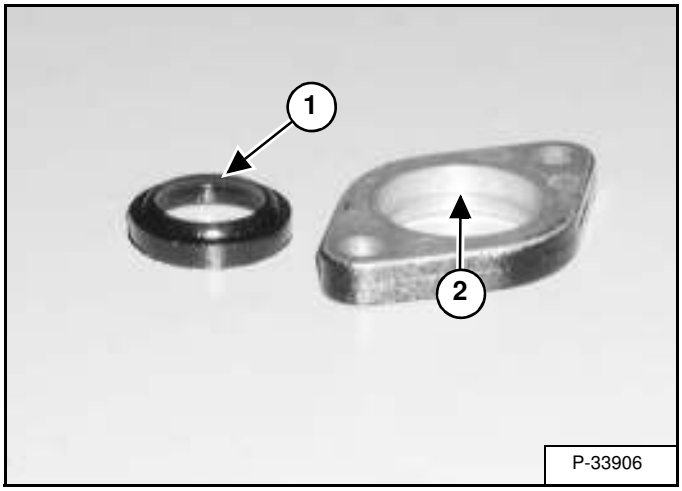


Remove the two screws (Item 1), retainer (Item 2) and seal (Item 3) from the spool (Item 4) **[Figure 20-41-91]**.

Dealer Copy -- Not for Resale

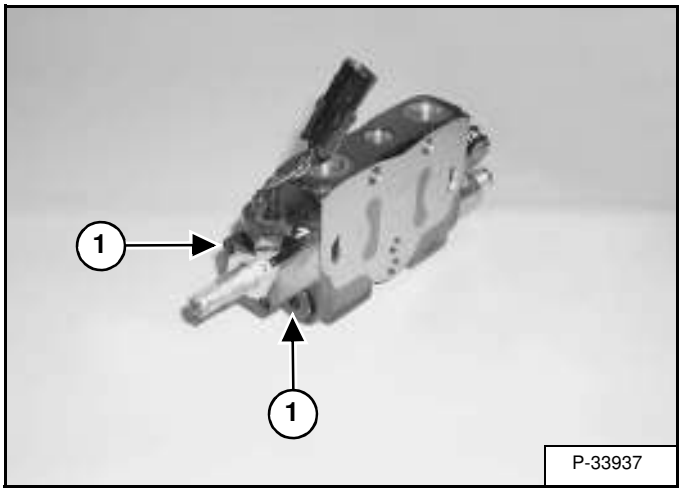
Left Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-92



Installation: Make sure the lip (Item 1) of the seal fits inside the retainer (Item 2) **[Figure 20-41-92]**.

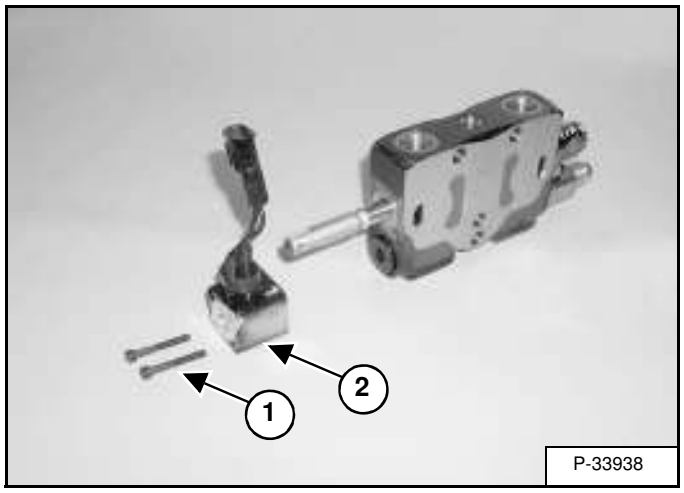
Figure 20-41-93



Loosen the two bolts (Item 1) **[Figure 20-41-93]** on the two speed switch.

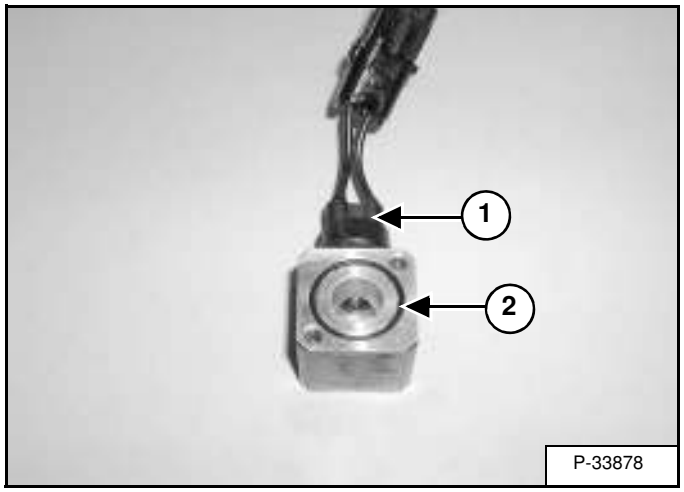
Installation: Tighten the two bolts to 5 ft.-lbs. (6,6 Nm) torque.

Figure 20-41-94



Remove the two bolts (Item 1) and actuator (Item 2) **[Figure 20-41-94]**.

Figure 20-41-95



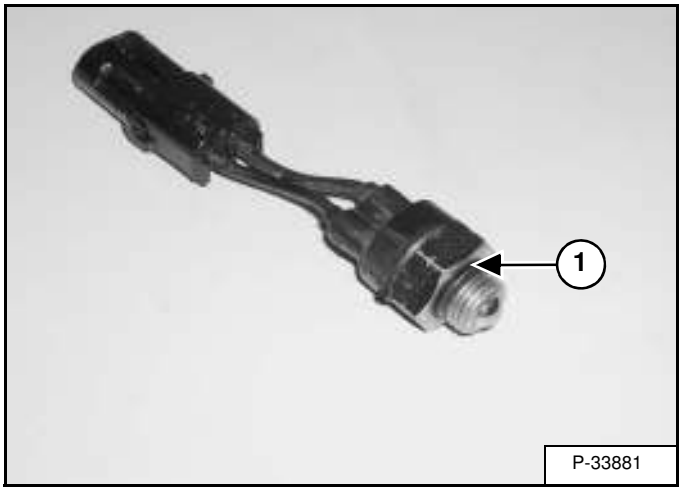
Remove the electrical connector (Item 1) and O-ring (Item 2) **[Figure 20-41-95]** from the actuator.

Installation: Tighten the connector to 31 ft.-lbs. (42 Nm) torque.

Dealer Copy -- Not for Resale

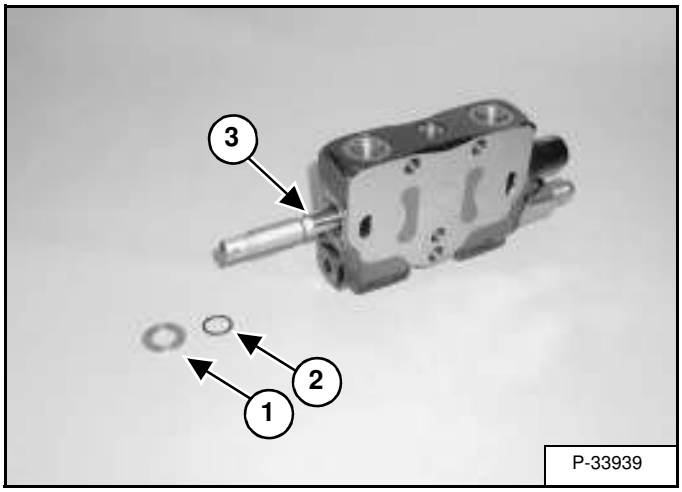
Left Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-96



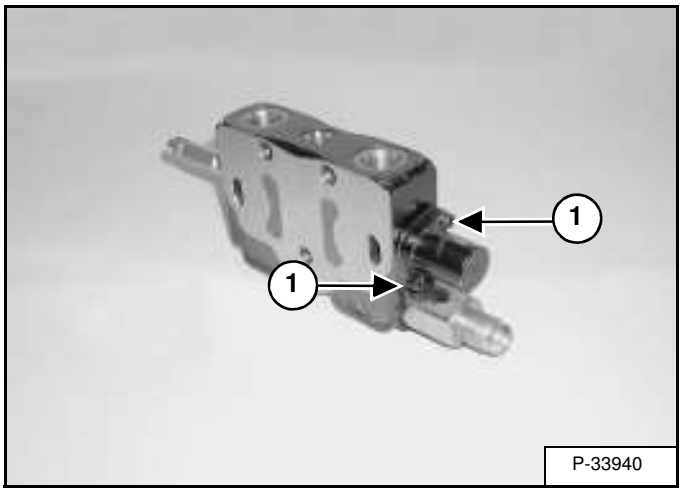
Remove the O-ring (Item 1) **[Figure 20-41-96]** from the connector.

Figure 20-41-97



Remove the washer (Item 1) and O-ring (Item 2) from the actuating end of the spool (Item 3) **[Figure 20-41-97]**.

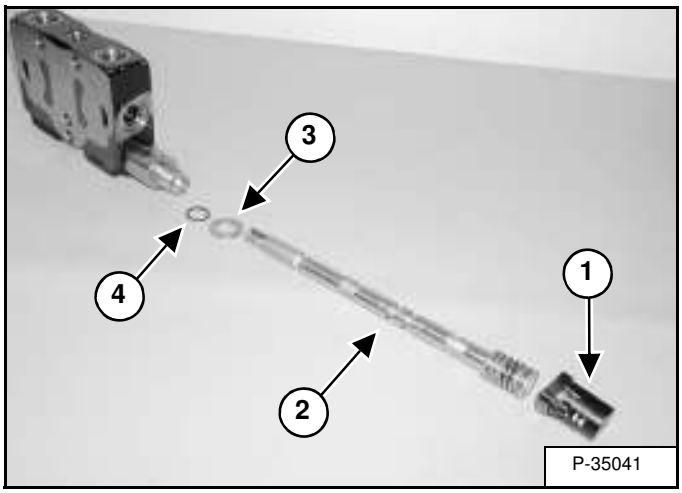
Figure 20-41-98



Loosen the two bolts (Item 1) **[Figure 20-41-98]** on the cover.

Installation: Tighten the bolts to 5 ft.-lbs. (6,6 Nm) torque.

Figure 20-41-99



Remove the cap and bolts (Item 1), spool assembly (Item 2), washer (Item 3) and O-ring (Item 4) **[Figure 20-41-99]**.

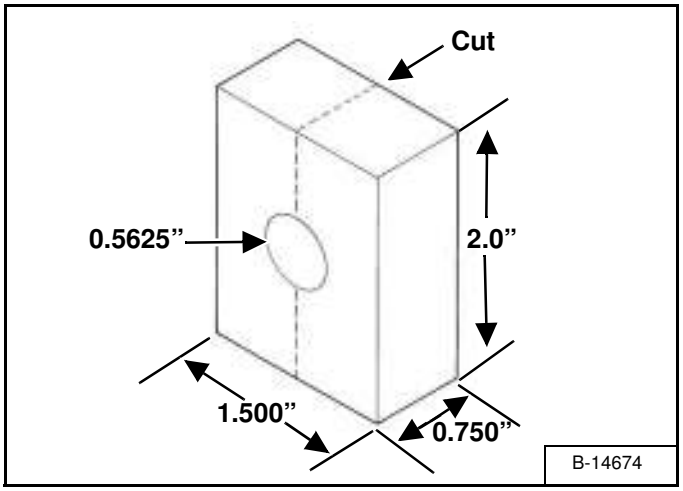
The spool and valve block are not serviced separately.

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

Dealer Copy -- Not for Resale

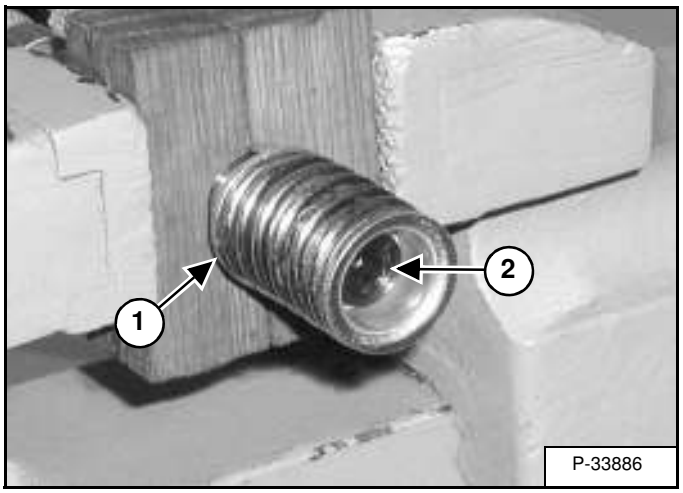
Left Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-100



To remove the spring assembly from the spool a holding fixture will have to be made from a .750 inch thick x 1.500 inch wide x 2.0 inch long (19 mm thick x 38 mm wide x 51 mm long) piece of hardwood. Drill a 0.5625 inch (14 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-41-100]**.

Figure 20-41-101



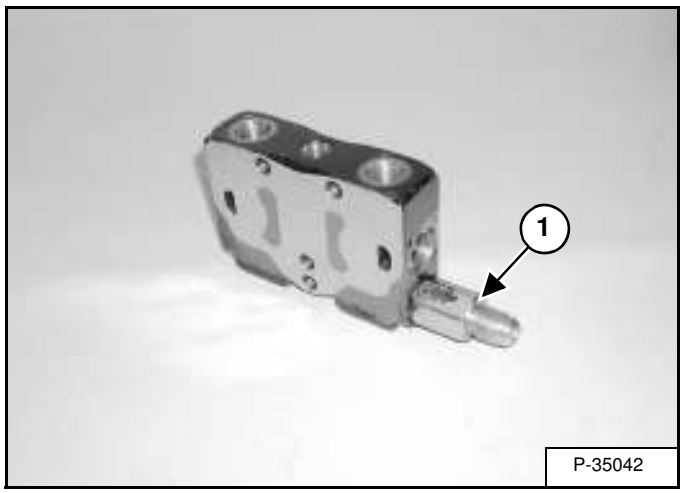
Using the wood blocks clamp the spool (Item 1) **[Figure 20-41-101]** in a vise.

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

Remove the spring assembly (Item 2) **[Figure 20-41-101]**.

Installation: Tighten the spring assembly to 7 ft.-lbs. (9,8 Nm) torque.

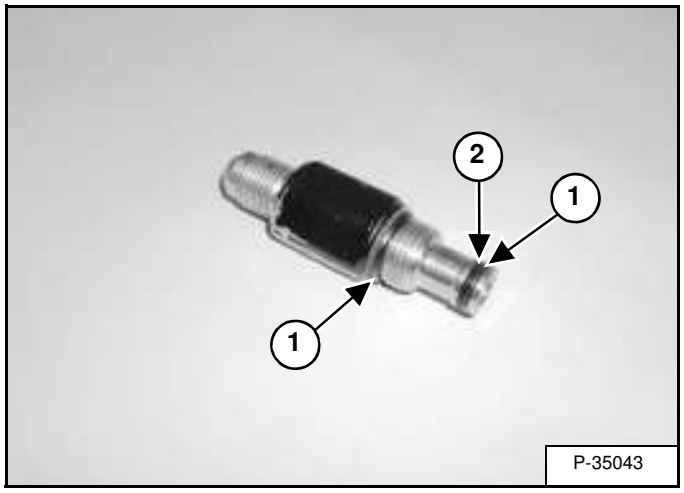
Figure 20-41-102



Remove the fitting (Item 1) **[Figure 20-41-102]**.

Installation: Tighten the fitting to 31 ft.-lbs. (42 Nm) torque.

Figure 20-41-103

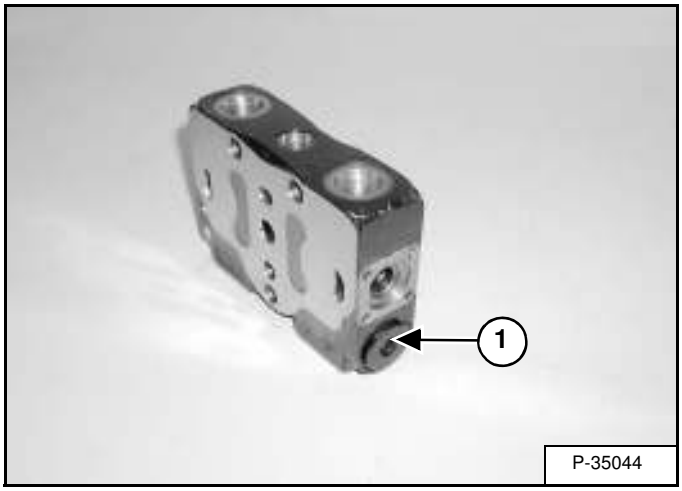


Remove the two O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-41-103]** from the fitting.

Dealer Copy -- Not for Resale

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

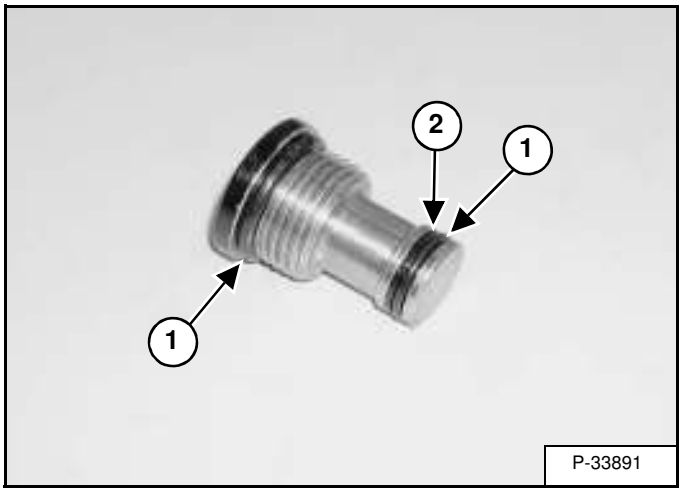
Figure 20-41-104



Remove the plug (Item 1) **[Figure 20-41-104]**.

Installation: Tighten the plug to 31 ft.-lbs. (42 Nm) torque.

Figure 20-41-105



Remove the two O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-41-105]** from the plug.

Arm Valve Section Disassembly And Assembly

IMPORTANT

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

I-2003-0888

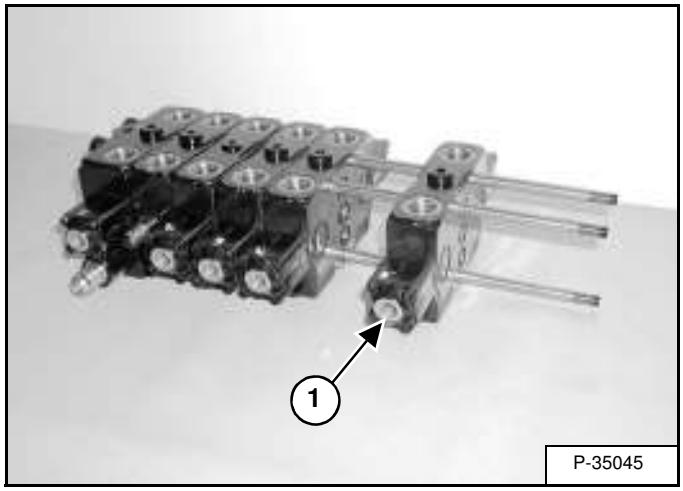
Clean all components with solvent and dry with compressed air.

Check all components for burrs, scratches or other damage and replace if necessary.

Use new O-rings and back-up rings.

Apply clean hydraulic fluid to the O-rings and back-up rings during assembly.

Figure 20-41-106

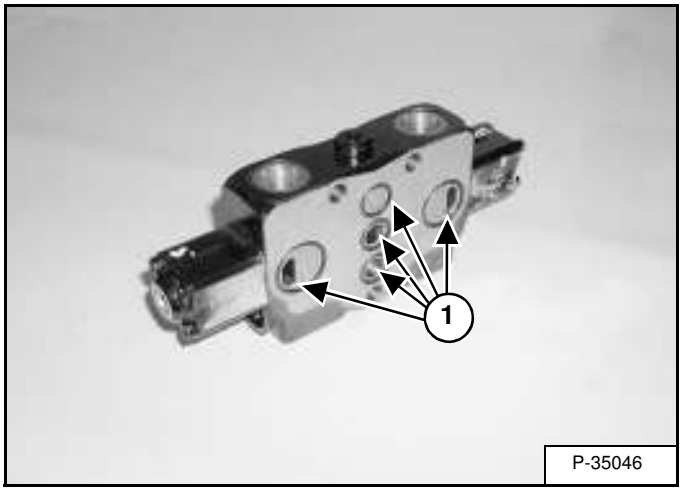


Remove the arm valve section (Item 1) **[Figure 20-41-106]** from the valve assembly.

Dealer Copy -- Not for Resale

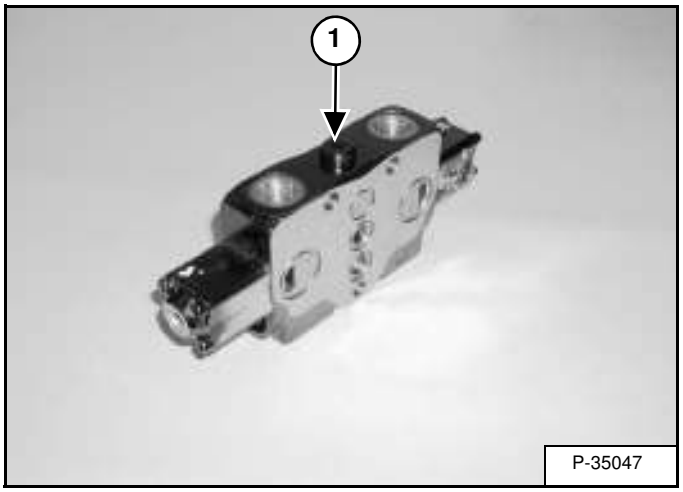
Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-107



Remove the five O-rings (Item 1) **[Figure 20-41-107]** from the arm valve block.

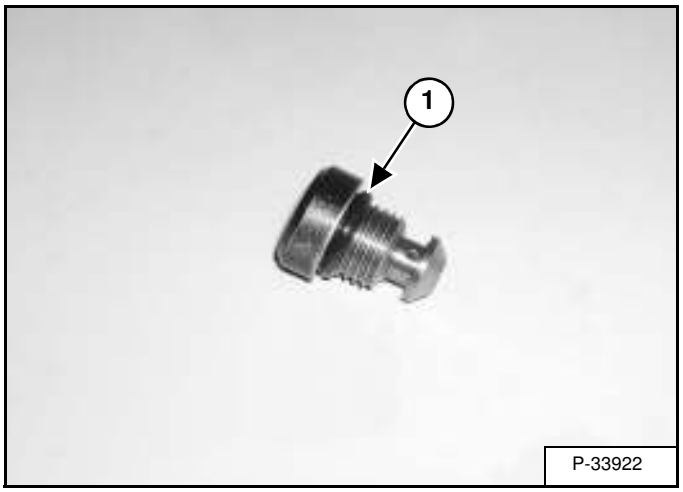
Figure 20-41-108



Remove the load check valve (Item 1) **[Figure 20-41-108]**.

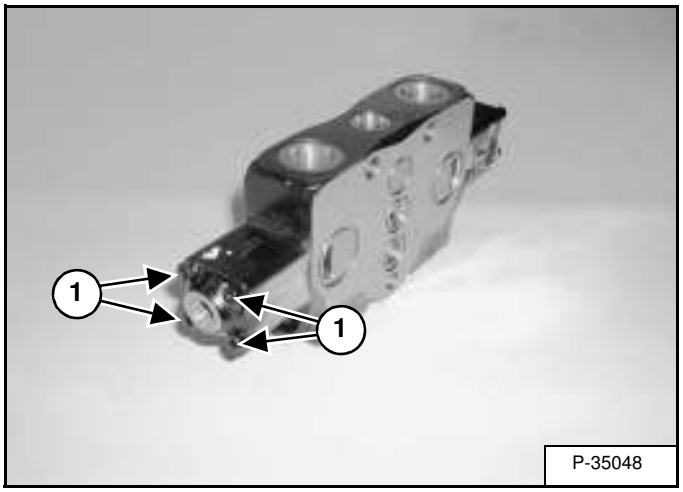
Installation: Tighten the load check valve to 18 ft.-lbs. (24 Nm) torque.

Figure 20-41-109



Remove the O-ring (Item 1) **[Figure 20-41-109]** from the load check valve.

Figure 20-41-110



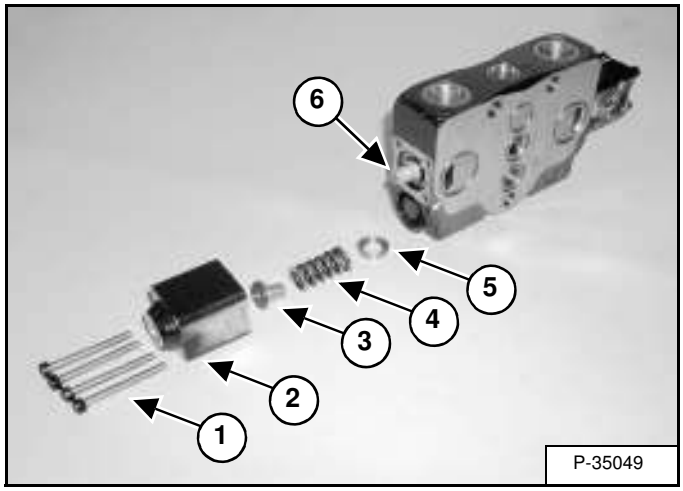
Loosen the four bolts (Item 1) **[Figure 20-41-110]** on the actuator.

Installation: Tighten the bolts to 5 ft.-lbs. (6,6 Nm) torque.

Dealer Copy -- Not for Resale

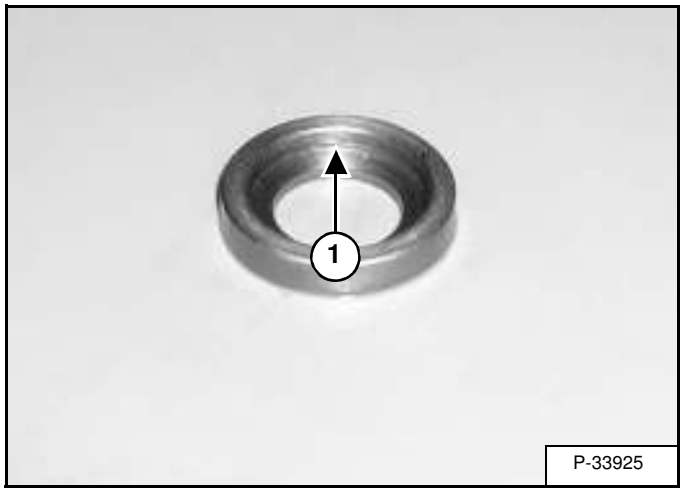
Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-111



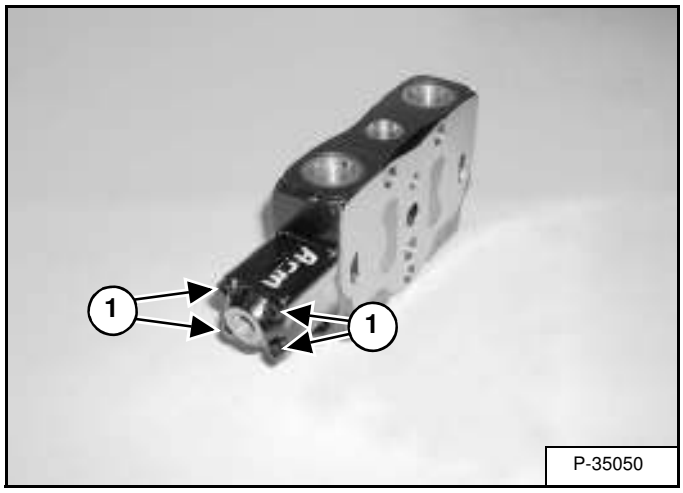
Remove the four bolts (Item 1), actuator (Item 2), spring retainer (Item 3), spring (Item 4) and spring retainer (Item 5) **[Figure 20-41-111]**.

Figure 20-41-112



Installation: Make sure the lip (Item 1) **[Figure 20-41-112]** on the spring retainer (Item 5) **[Figure 20-41-111]** fits over the spool (Item 6) **[Figure 20-41-111]**.

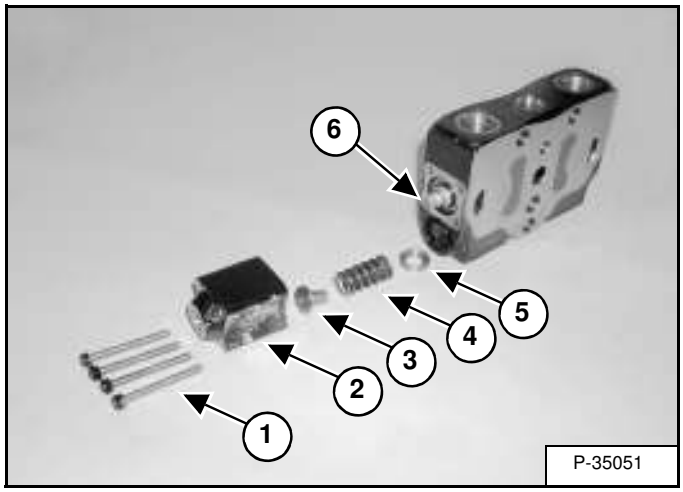
Figure 20-41-113



Loosen the four bolts (Item 1) **[Figure 20-41-113]** on the actuator.

Installation: Tighten the bolts to 5 ft.-lbs. (6,6 Nm) torque.

Figure 20-41-114

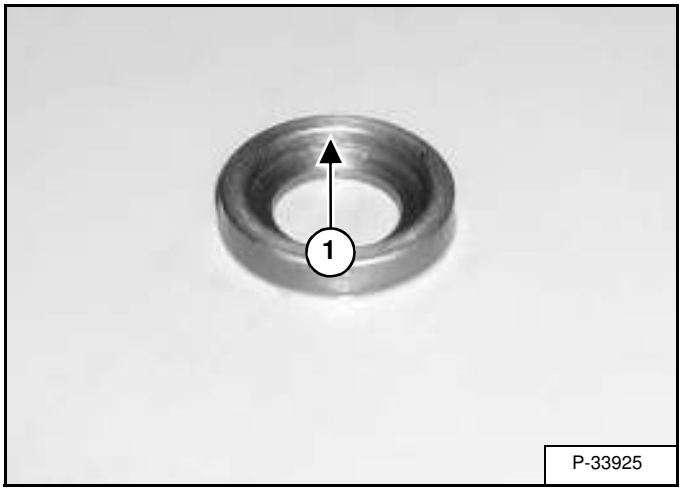


Remove the four bolts (Item 1), actuator (Item 2), spring retainer (Item 3), spring (Item 4) and spring retainer (Item 5) **[Figure 20-41-114]**.

Dealer Copy -- Not for Resale

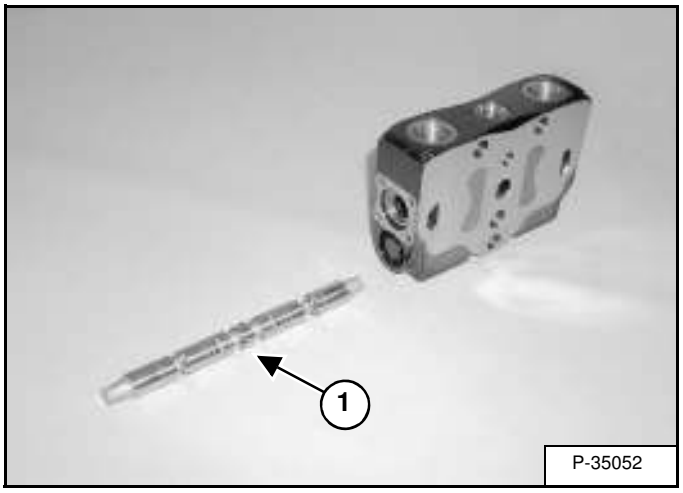
Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-115



Installation: Make sure the lip (Item 1) **[Figure 20-41-115]** on the spring retainer (Item 5) **[Figure 20-41-114 on Page 32]** fits over the spool (Item 6) **[Figure 20-41-114 on Page 32]**.

Figure 20-41-116

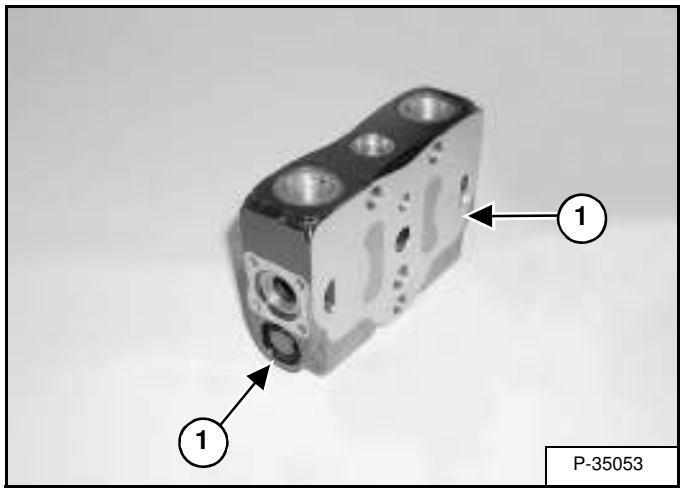


Remove the spool (Item 1) **[Figure 20-41-116]**.

The spool and valve block are not serviced separately.

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

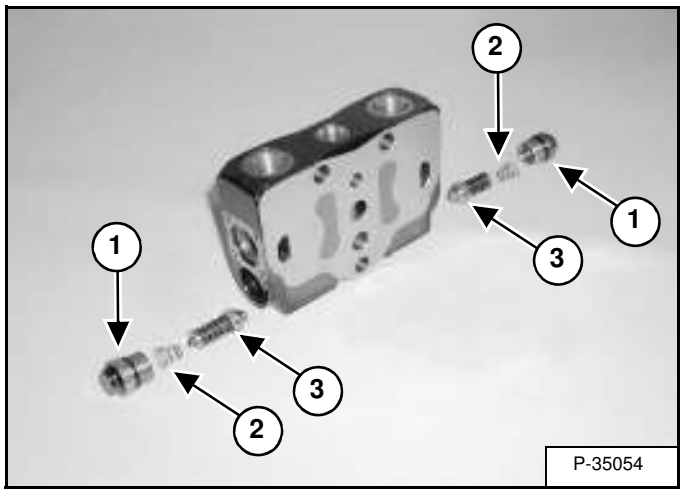
Figure 20-41-117



Loosen the relief valve caps (Item 1) **[Figure 20-41-117]** (front and rear).

Installation: Tighten the relief valve caps to 18 ft.-lbs. (24 Nm) torque.

Figure 20-41-118

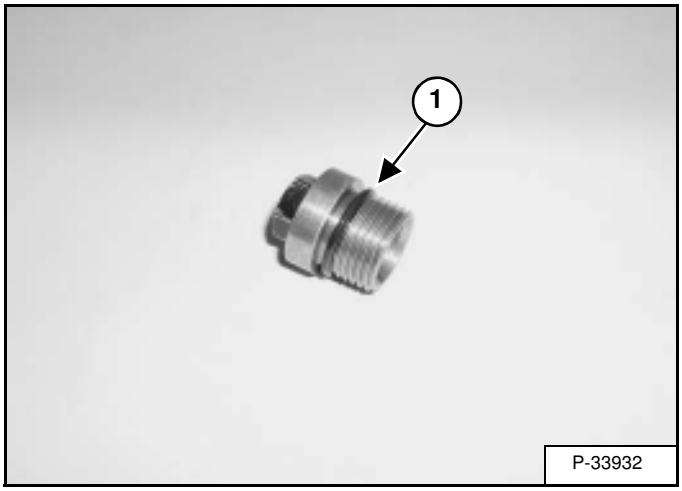


Remove the caps (Item 1) springs (Item 2) and spring assemblies (Item 3) **[Figure 20-41-118]**.

Dealer Copy -- Not for Resale

Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-119



Remove the O-ring (Item 1) **[Figure 20-41-119]** from the caps.

Bucket Valve Section Disassembly And Assembly

IMPORTANT

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

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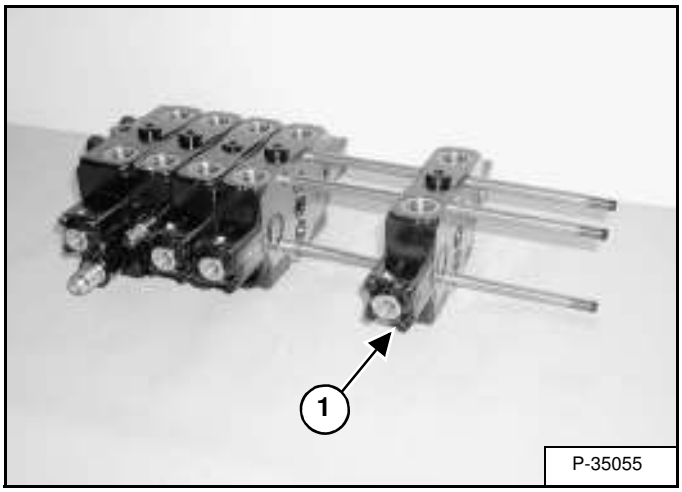
Clean all components with solvent and dry with compressed air.

Check all components for burrs, scratches or other damage and replace if necessary.

Use new O-rings and back-up rings.

Apply clean hydraulic fluid to the O-rings and back-up rings during assembly.

Figure 20-41-120

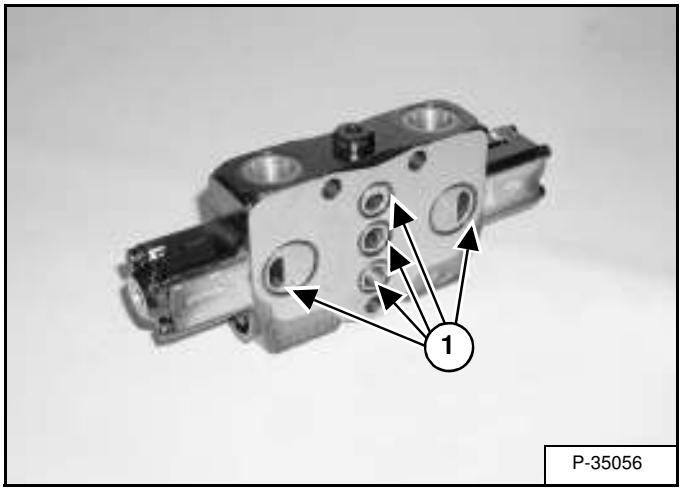


Remove the bucket valve section (Item 1) **[Figure 20-41-120]** from the valve assembly.

Dealer Copy -- Not for Resale

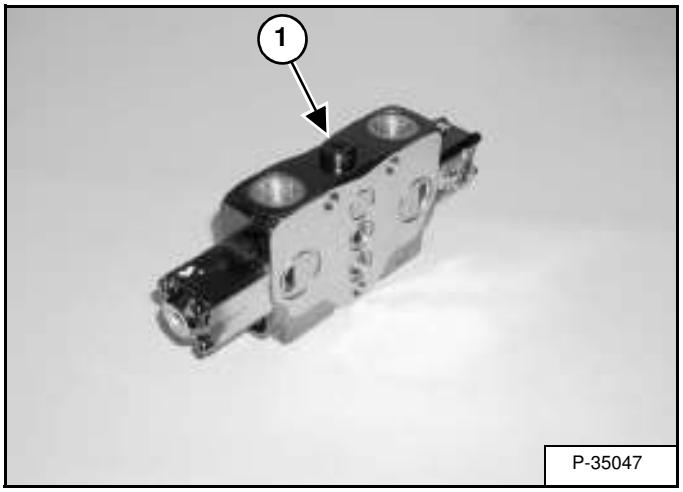
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-121



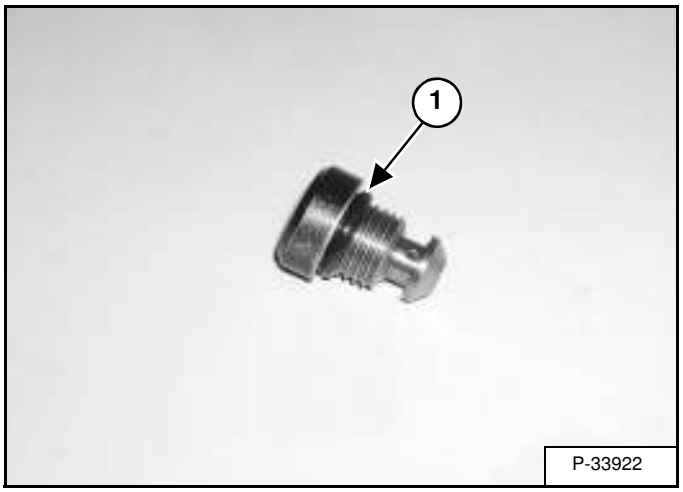
Remove the five O-rings (Item 1) **[Figure 20-41-121]** from the bucket valve block.

Figure 20-41-122



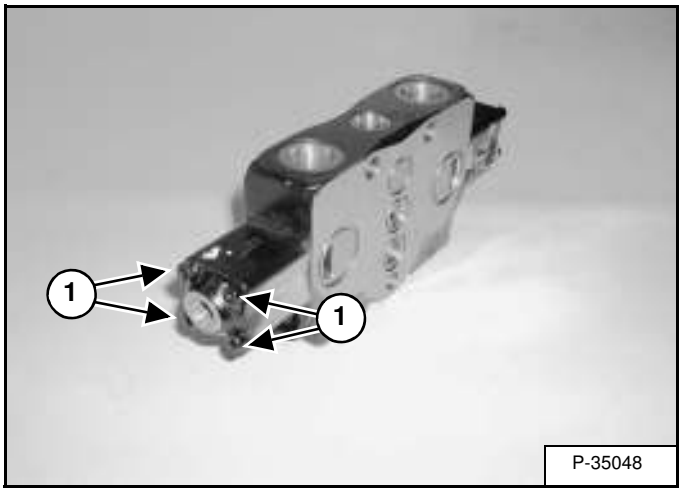
Remove the load check valve (Item 1) **[Figure 20-41-122]**.

Figure 20-41-123



Remove the O-ring (Item 1) **[Figure 20-41-123]** from the load check valve.

Figure 20-41-124



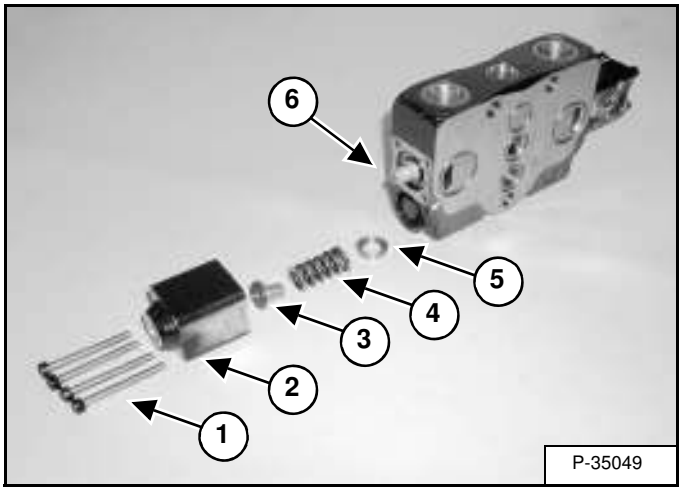
Loosen the four bolts (Item 1) **[Figure 20-41-124]** on the actuator.

Installation: Tighten the bolts to 5 ft.-lbs. (6,6 Nm) torque.

Dealer Copy -- Not for Resale

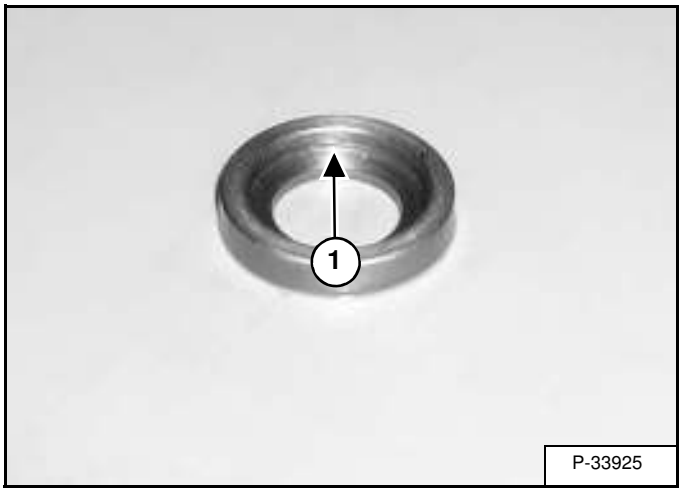
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-125



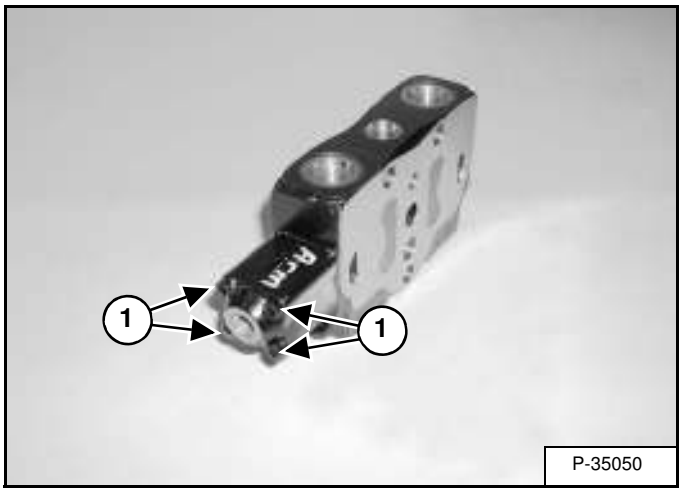
Remove the four bolts (Item 1) **[Figure 20-41-124 on Page 35]**, actuator (Item 2) **[Figure 20-41-125]**, spring retainer (Item 3) **[Figure 20-41-125]**. spring (Item 4) **[Figure 20-41-125]** and spring retainer (Item 5) **[Figure 20-41-125]**.

Figure 20-41-126



Installation: Make sure the lip (Item 1) **[Figure 20-41-126]** on the spring retainer (Item 5) **[Figure 20-41-125]** fits over the spool (Item 6) **[Figure 20-41-125]**.

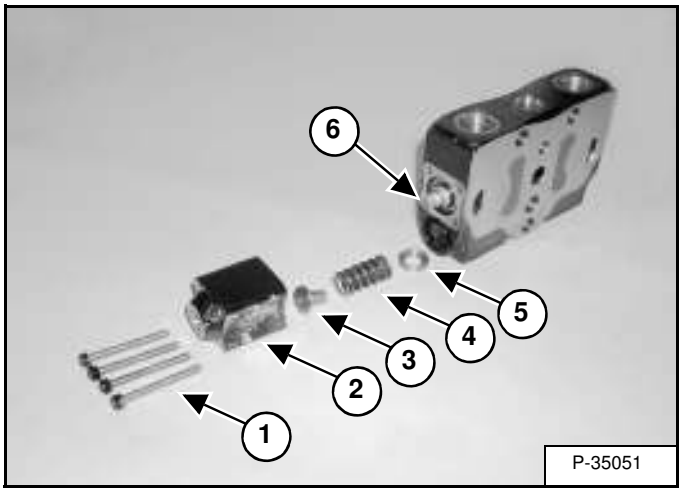
Figure 20-41-127



Loosen the four bolts (Item 1) **[Figure 20-41-127]** on the actuator.

Installation: Tighten the bolts to 5 ft.-lbs. (6,6 Nm) torque.

Figure 20-41-128

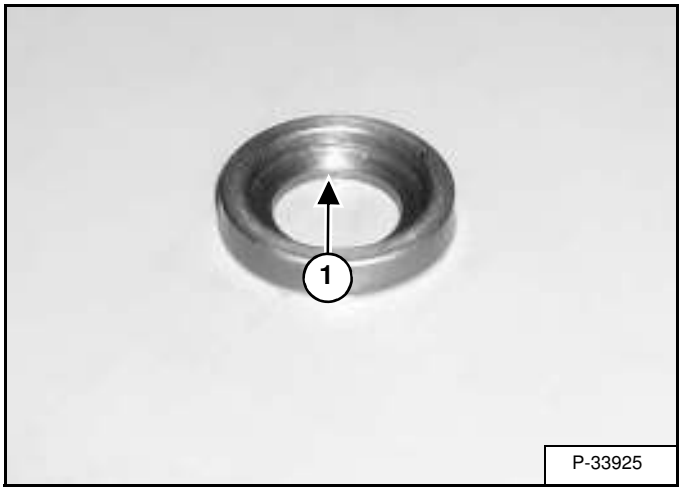


Remove the four bolts (Item 1), actuator (Item 2), spring retainer (Item 3), spring (Item 4) and spring retainer (Item 5) **[Figure 20-41-128]**.

Dealer Copy -- Not for Resale

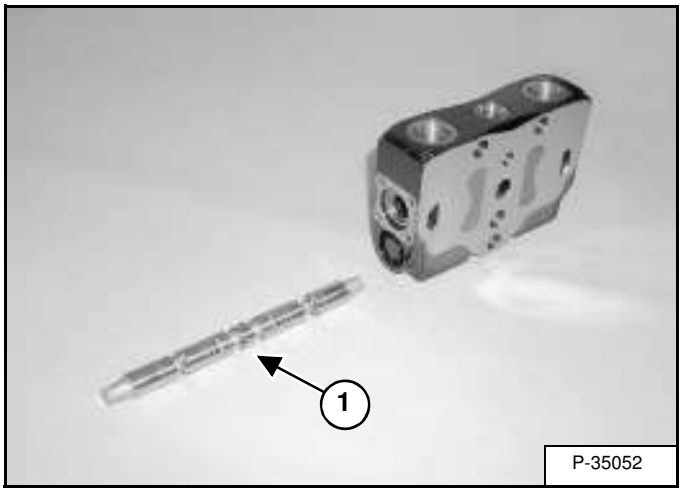
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-129



Installation: Make sure the lip (Item 1) **[Figure 20-41-129]** on the spring retainer (Item 5) **[Figure 20-41-128 on Page 36]** fits over the spool (Item 6) **[Figure 20-41-128 on Page 36]**.

Figure 20-41-130

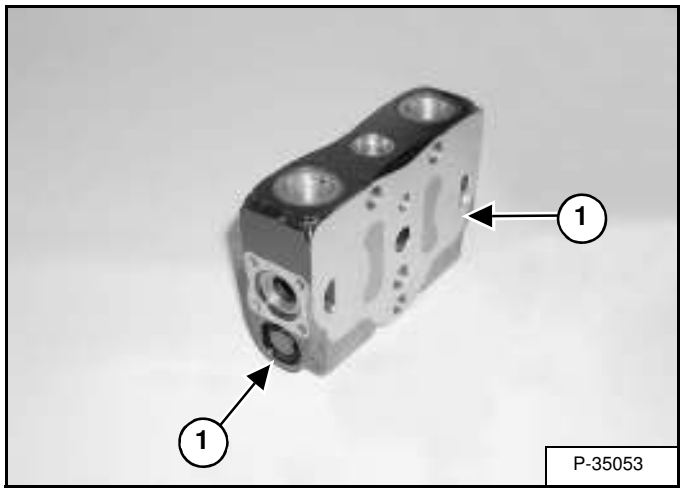


Remove the spool (Item 1) **[Figure 20-41-130]**.

The spool and valve block are not serviced separately.

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

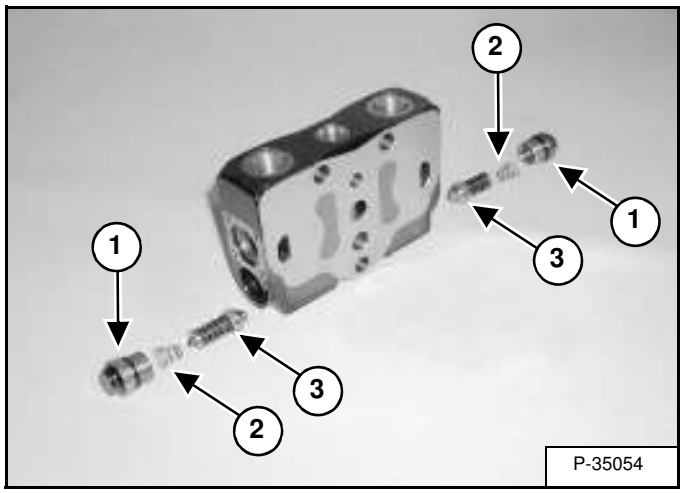
Figure 20-41-131



Loosen the relief valve caps (Item 1) **[Figure 20-41-131]** (front and back).

Installation: Tighten the relief valve caps to 18 ft.-lbs. (24 Nm) torque.

Figure 20-41-132

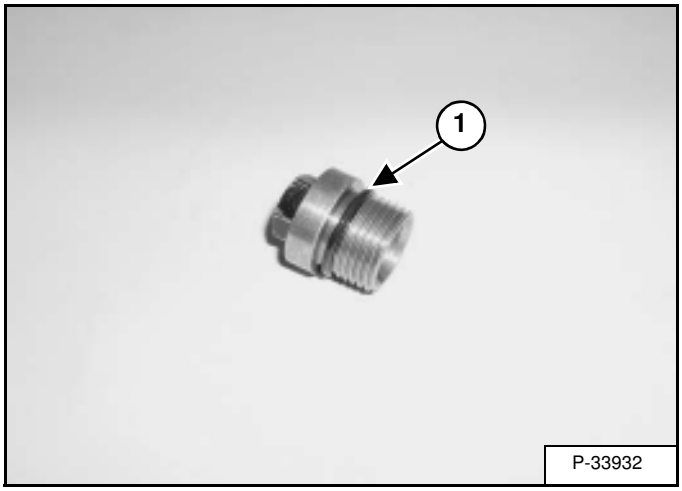


Remove the cap (Item 1), spring (Item 2) and valve assembly (Item 3) **[Figure 20-41-132]** from both ends of the bucket valve section.

Dealer Copy -- Not for Resale

Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-133



Remove the O-ring (Item 1) **[Figure 20-41-133]** from both caps.

Auxiliary Valve Section Disassembly And Assembly

IMPORTANT

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

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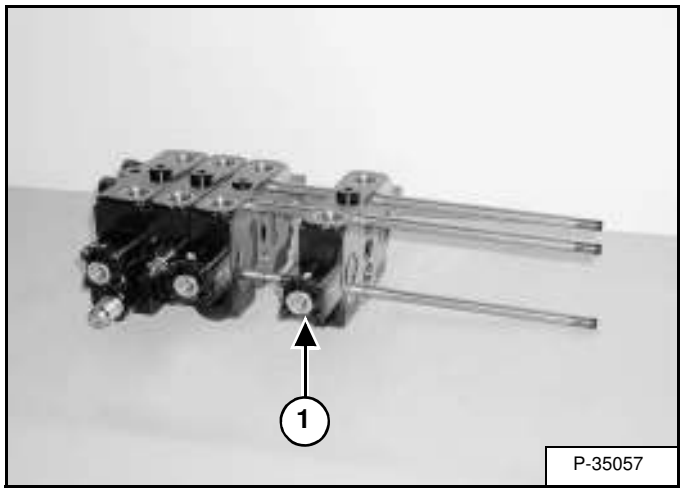
Clean all components with solvent and dry with compressed air.

Check all components for burrs, scratches or other damage and replace if necessary.

Use new O-rings and back-up rings.

Apply clean hydraulic fluid to the O-rings and back-up rings during assembly.

Figure 20-41-134

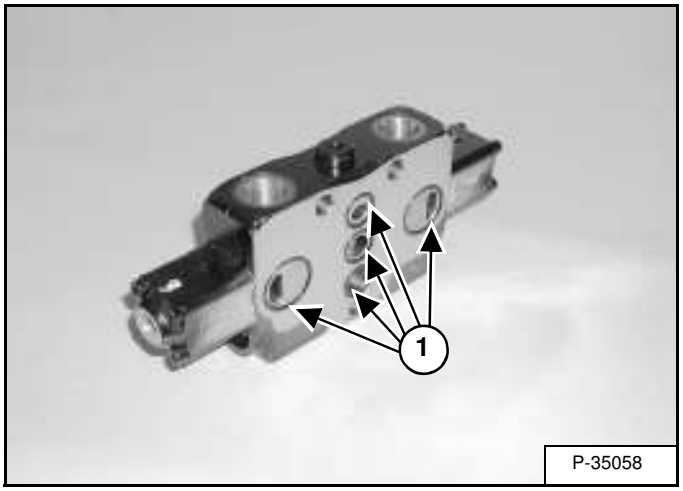


Remove the auxiliary valve section (Item 1) **[Figure 20-41-134]** from the valve assembly.

Dealer Copy -- Not for Resale

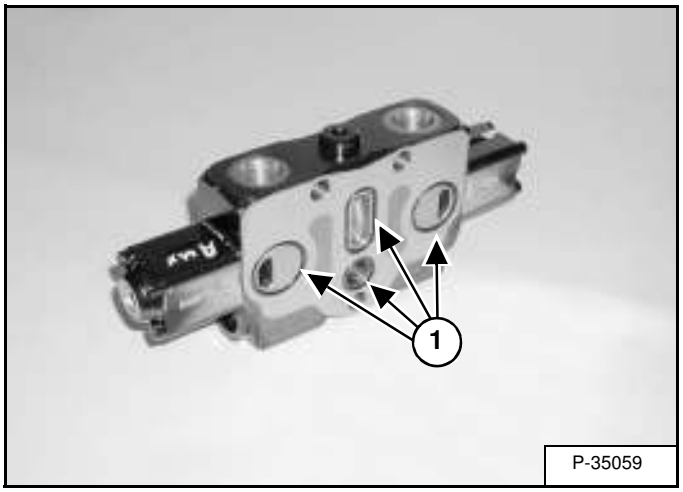
Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-135



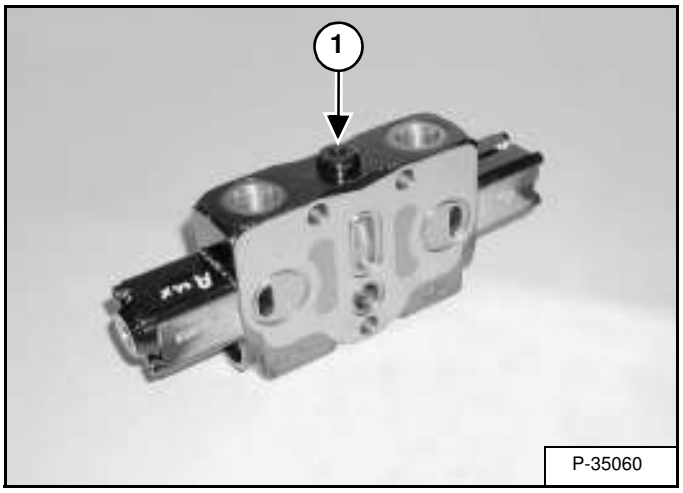
Remove the five O-rings (Item 1) **[Figure 20-41-135]** from the right side of the valve block.

Figure 20-41-136



Remove the four O-rings (Item 1) **[Figure 20-41-136]** from the left side.

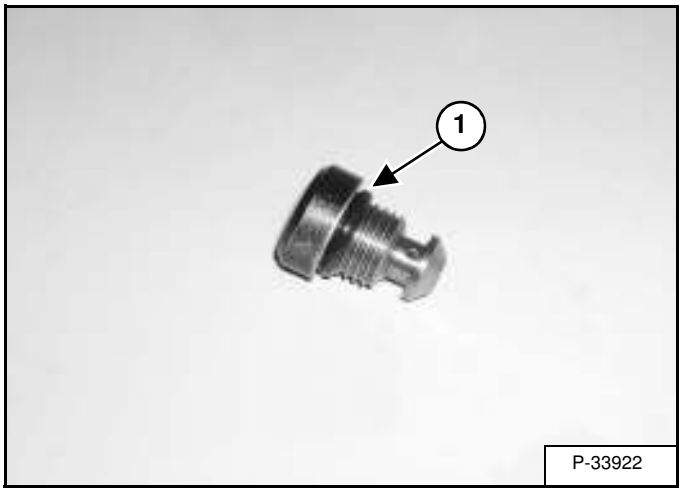
Figure 20-41-137



Remove the load check valve assembly (Item 1) **[Figure 20-41-137]**.

Installation: Tighten the load check valve to 18 ft.-lbs. (24 Nm) torque.

Figure 20-41-138

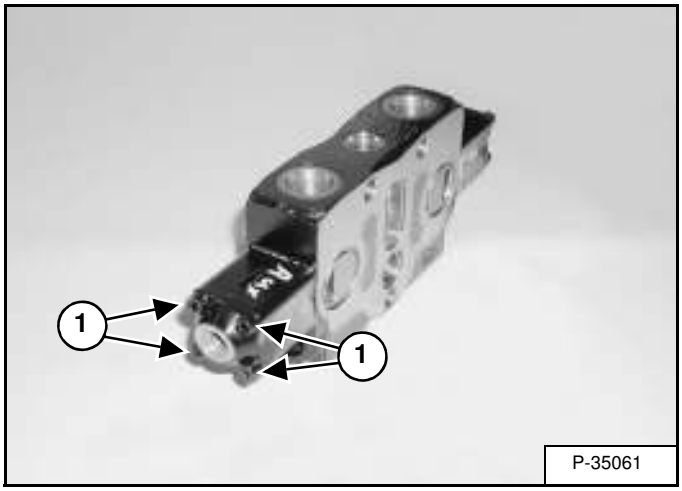


Remove the O-ring (Item 1) **[Figure 20-41-138]** from the load check valve.

Dealer Copy -- Not for Resale

Auxiliary Valve Section Disassembly And Assembly (Cont'd)

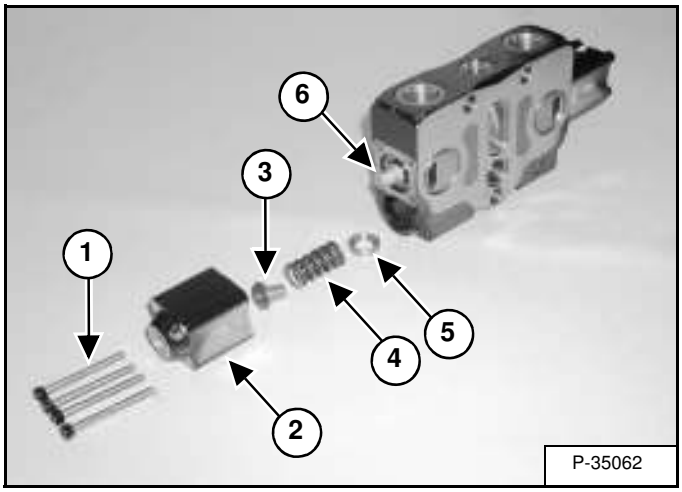
Figure 20-41-139



Loosen the four bolts (Item 1) **[Figure 20-41-139]** on the actuator.

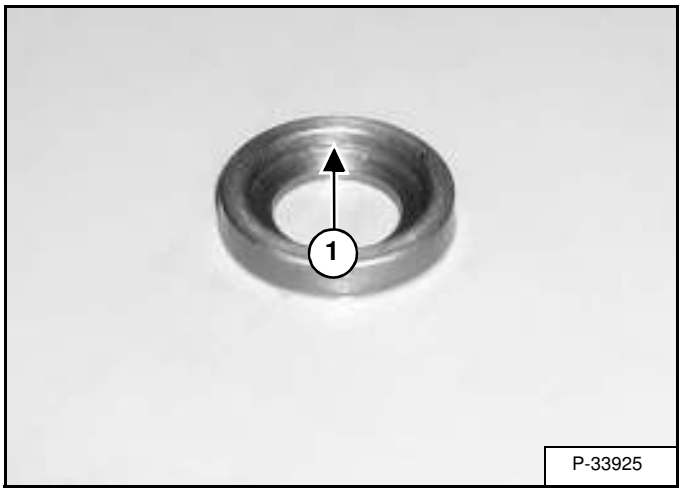
Installation: Tighten the bolts to 5 ft.-lbs. (6,6 Nm) torque.

Figure 20-41-140



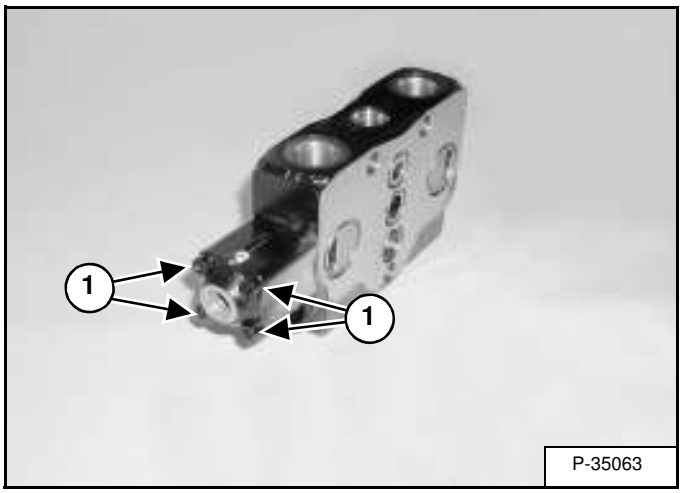
Remove the four bolts (Item 1), actuator (Item 2), spring retainer (Item 3), spring (Item 4) and spring retainer (Item 5) **[Figure 20-41-140]**.

Figure 20-41-141



Installation: Make sure the lip (Item 1) **[Figure 20-41-141]**on the spring retainer (Item 5) **[Figure 20-41-140]** fits over the spool (Item 6) **[Figure 20-41-140]**.

Figure 20-41-142



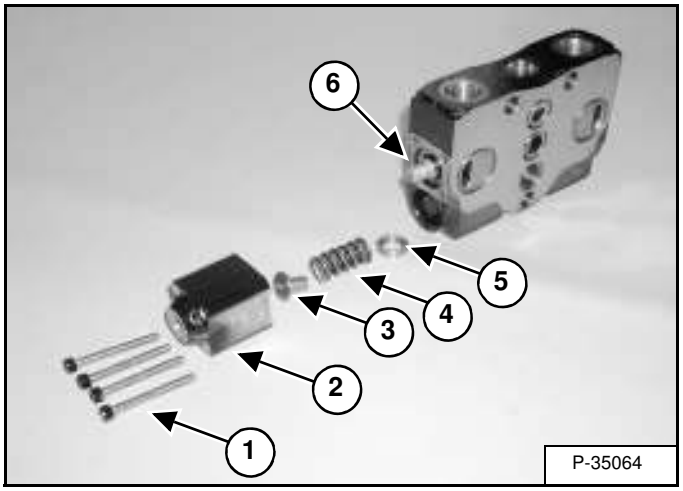
Loosen the four bolts (Item 1) **[Figure 20-41-142]** from the actuator.

Installation: Tighten the bolts to 5 ft.-lbs. (6,6 Nm) torque.

Dealer Copy -- Not for Resale

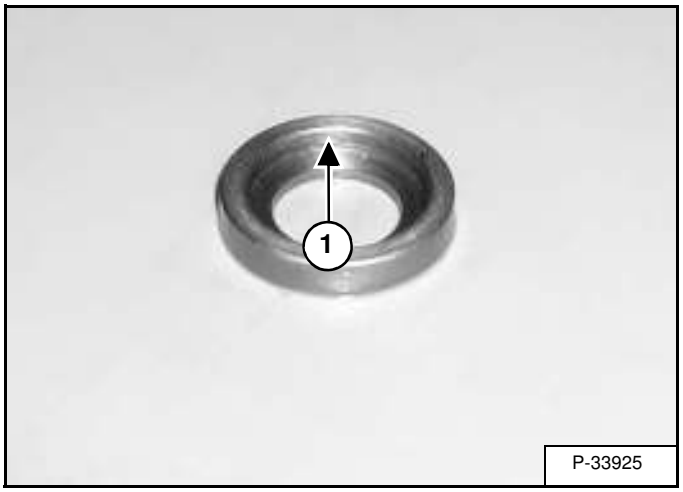
Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-143



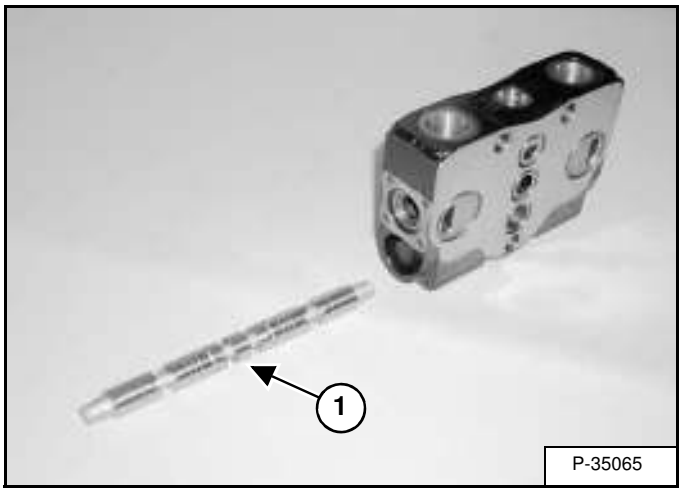
Remove the four bolts (Item 1), actuator (Item 2), spring retainer (Item 3), spring (Item 4) and spring retainer (Item 5) **[Figure 20-41-143]**.

Figure 20-41-144



Installation: Make sure the lip (Item 1) **[Figure 20-41-144]** on the spring retainer (Item 5) **[Figure 20-41-143]** fits over the spool (Item 6) **[Figure 20-41-143]**.

Figure 20-41-145

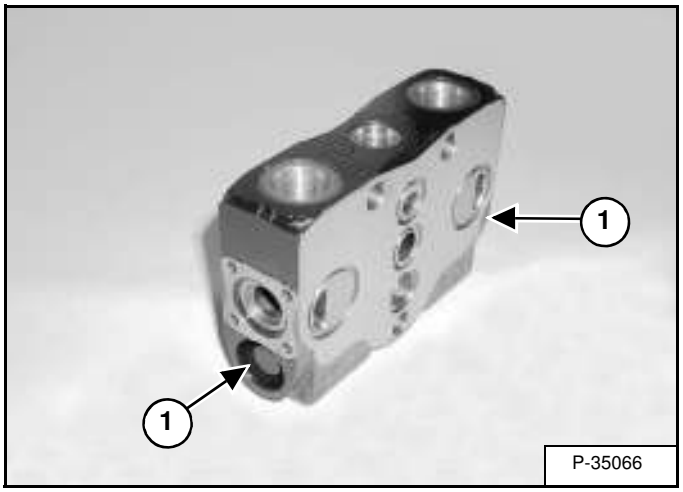


Remove the spool (Item 1) **[Figure 20-41-145]**.

The spool and valve block are not serviced separately.

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

Figure 20-41-146



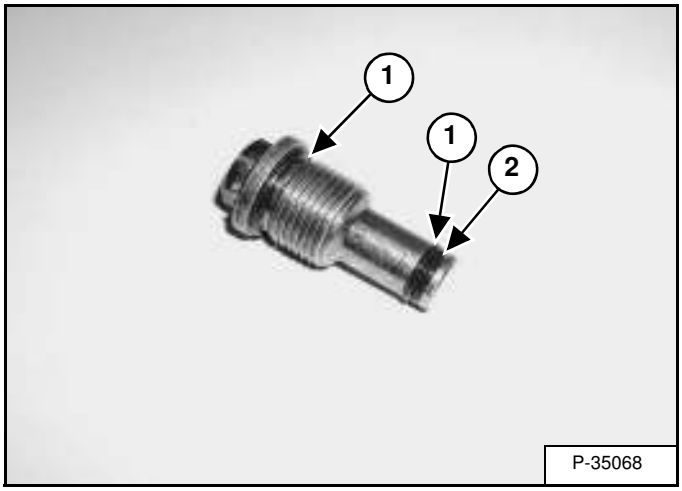
Remove the plugs (Item 1) **[Figure 20-41-146]**.

Installation: Tighten the plugs to 18 ft.-lbs. (24 Nm) torque.

Dealer Copy -- Not for Resale

Auxiliary Valve Section Disassembly And Assembly (Cont'd)

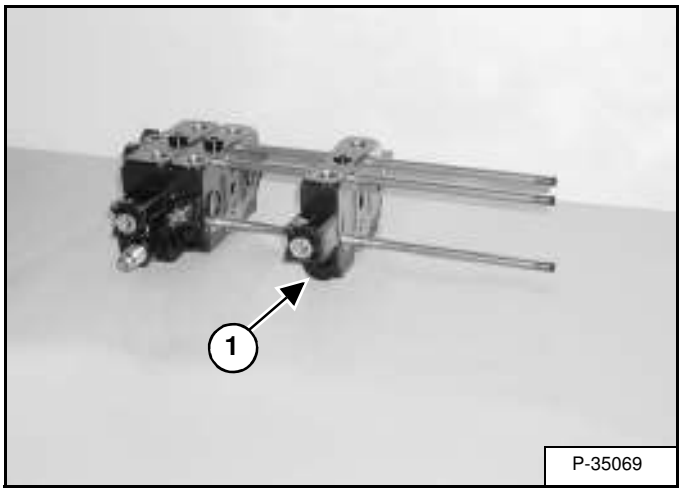
Figure 20-41-147



Remove the two O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-41-147]** from the plugs.

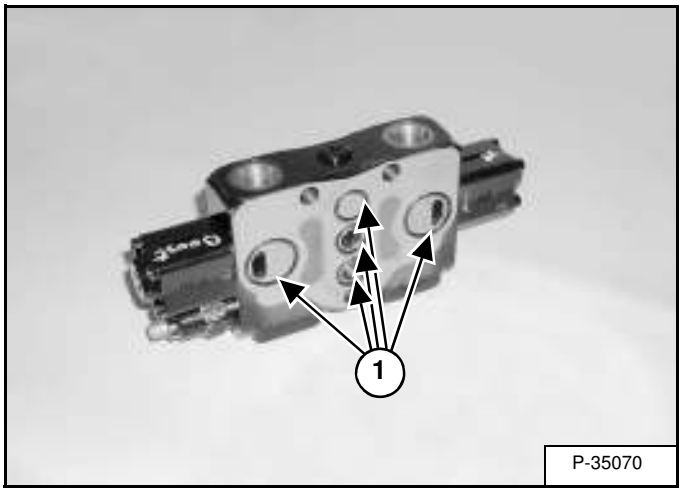
Boost Valve Section Disassembly And Assembly

Figure 20-41-148



Remove the boost valve section (Item 1) **[Figure 20-41-148]**.

Figure 20-41-149

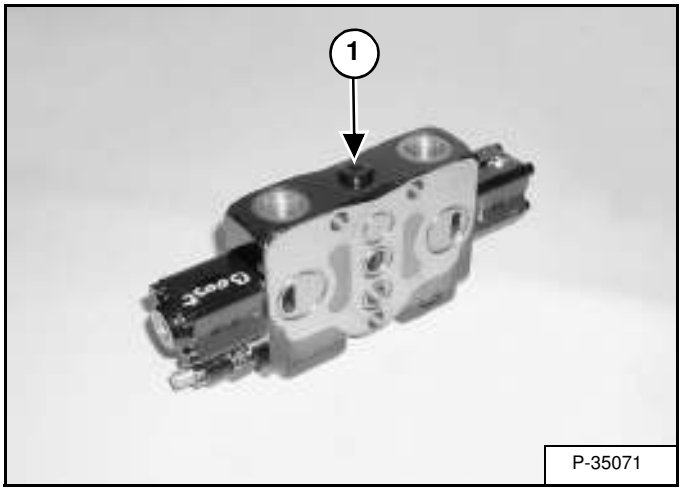


Remove the five O-rings (Item 1) **[Figure 20-41-149]** from the boost valve block.

Dealer Copy -- Not for Resale

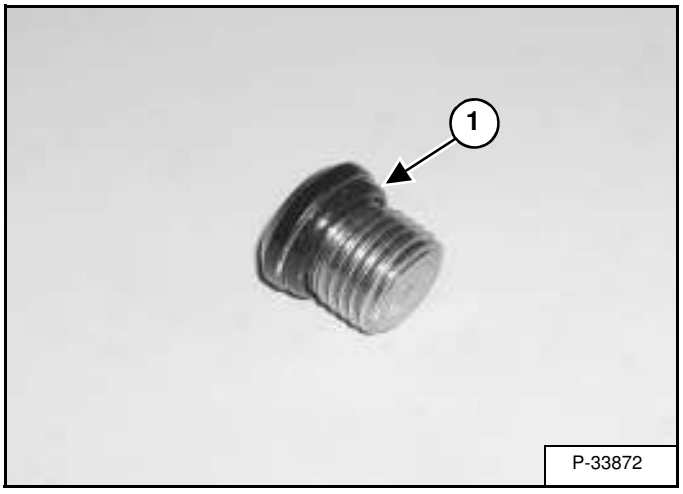
Boost Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-150



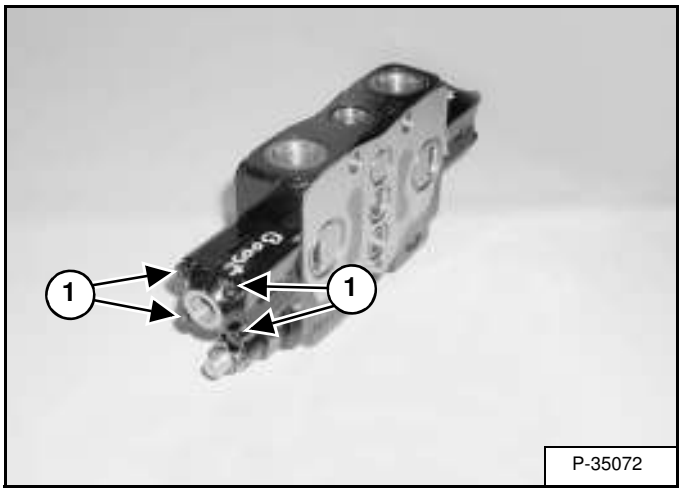
Remove the plug (Item 1) **[Figure 20-41-150]**.

Figure 20-41-151



Remove the O-ring (Item 1) **[Figure 20-41-151]** from the plug.

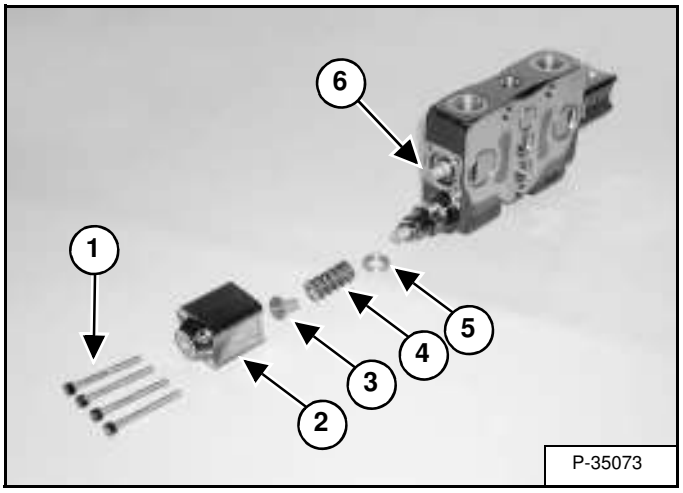
Figure 20-41-152



Loosen the four bolts (Item 1) **[Figure 20-41-152]** on the actuator.

Installation: Tighten the bolts to 5 ft.-lbs. (6,6 Nm) torque.

Figure 20-41-153

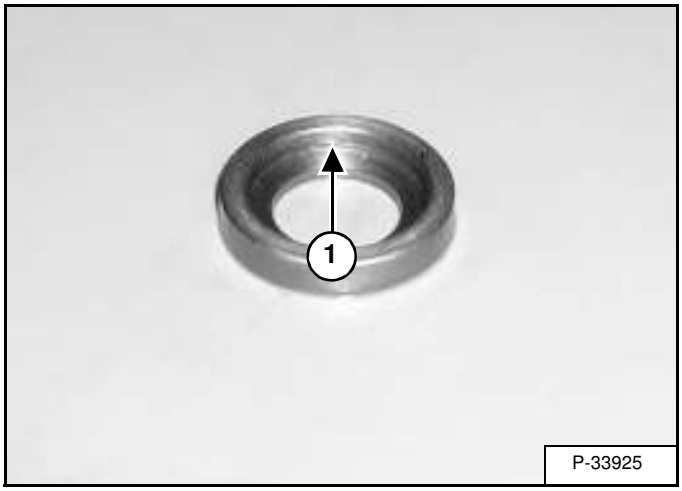


Remove the four bolts (Item 1), actuator (Item 2), spring retainer (Item 3), spring (Item 4) and spring retainer (Item 5) **[Figure 20-41-153]**.

Dealer Copy -- Not for Resale

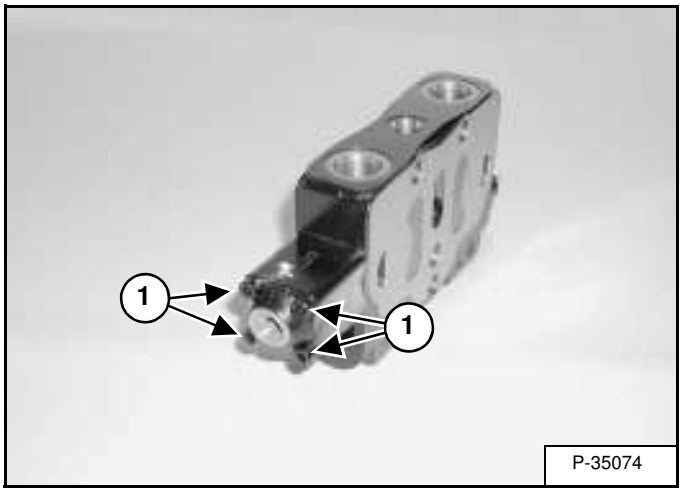
Boost Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-154



Installation: Ensure the lip (Item 1) **[Figure 20-41-154]** on the spring retainer (Item 5) **[Figure 20-41-153 on Page 43]** fits over the spool (Item 6) **[Figure 20-41-153 on Page 43]** .

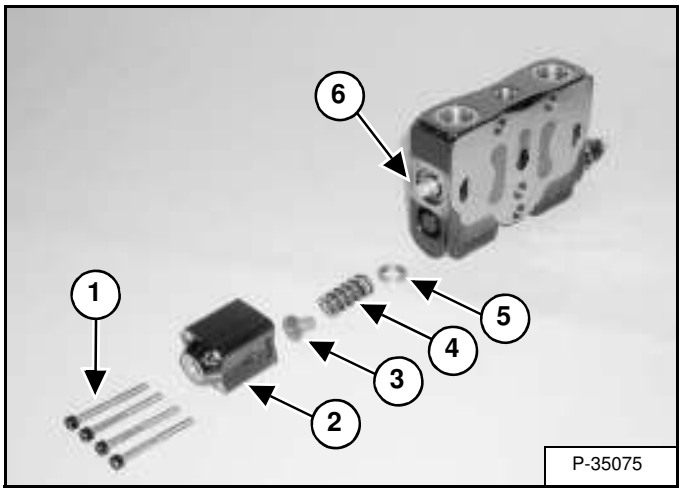
Figure 20-41-155



Loosen the four bolts (Item 1) **[Figure 20-41-155]** on the actuator.

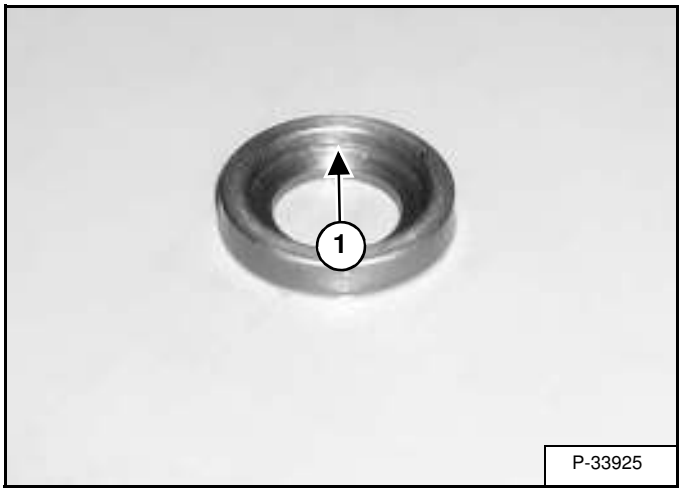
Installation: Tighten the bolts to 5 ft.-lbs. (6,6 Nm) torque.

Figure 20-41-156



Remove the four bolts (Item 1), actuator (Item 2), spring retainer (Item 3), spring (Item 4) and spring retainer (Item 5) **[Figure 20-41-156]**.

Figure 20-41-157

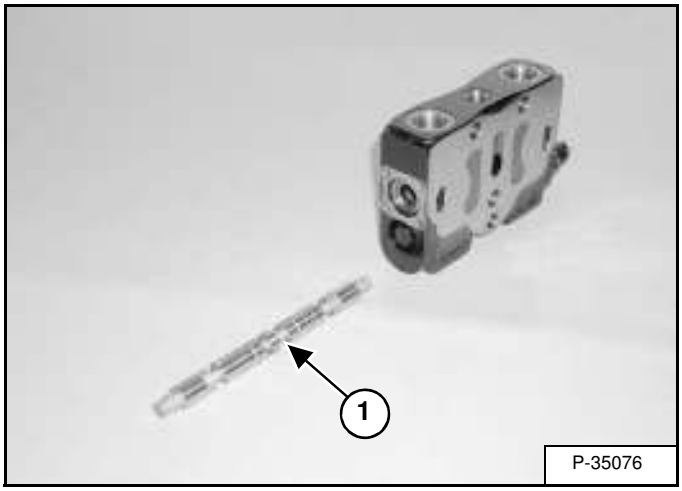


Installation: Ensure the lip (Item 1) **[Figure 20-41-157]** on the spring retainer (Item 5) **[Figure 20-41-156]** fits over the spool (Item 6) **[Figure 20-41-156]**.

Dealer Copy -- Not for Resale

Boost Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-158

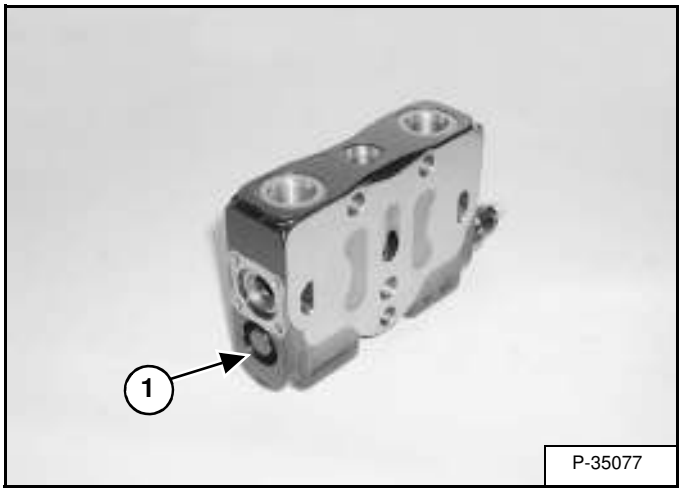


Remove the spool (Item 1) **[Figure 20-41-158]**.

The spool and valve block are not serviced separately.

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

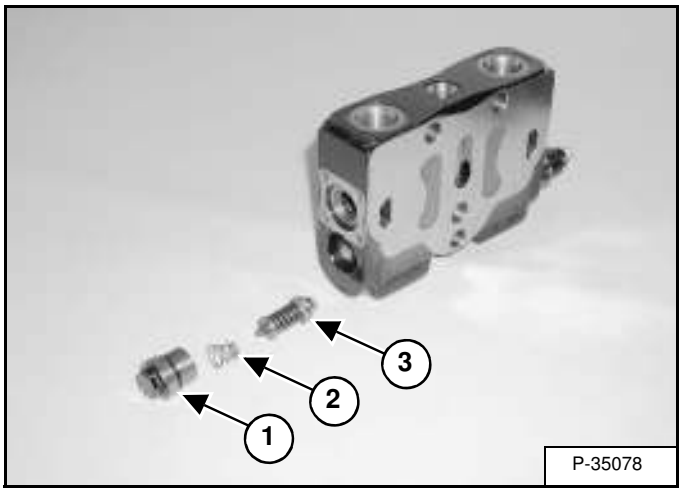
Figure 20-41-159



Loosen the cap (Item 1) **[Figure 20-41-159]** on the relief valve.

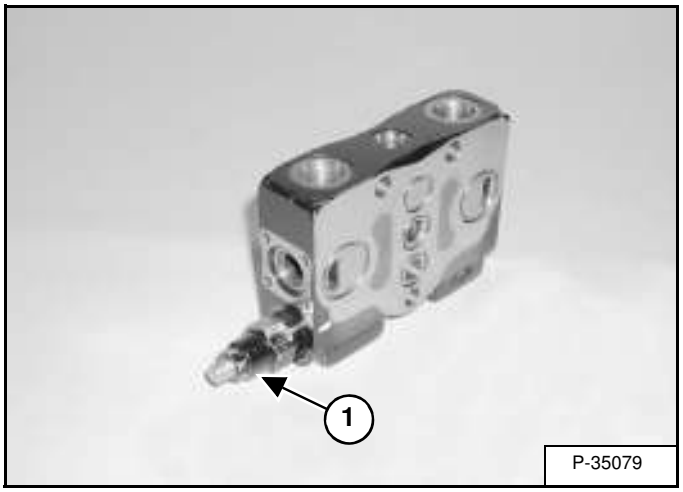
Installation: Tighten the cap to 18 ft.-lbs. (24 Nm) torque.

Figure 20-41-160



Remove the cap (Item 1), spring (Item 2) and spring assembly (Item 3) **[Figure 20-41-160]**.

Figure 20-41-161



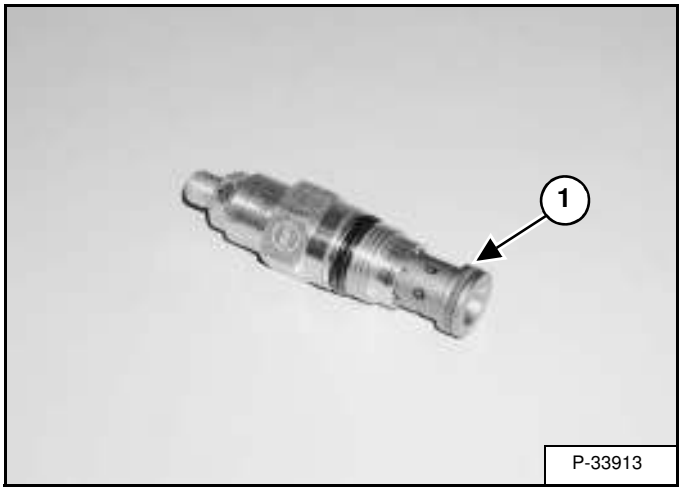
Loosen and remove the main relief valve (Item 1) **[Figure 20-41-161]**.

Installation: Tighten the valve to 31 ft.-lbs. (42 Nm) torque.

Dealer Copy -- Not for Resale

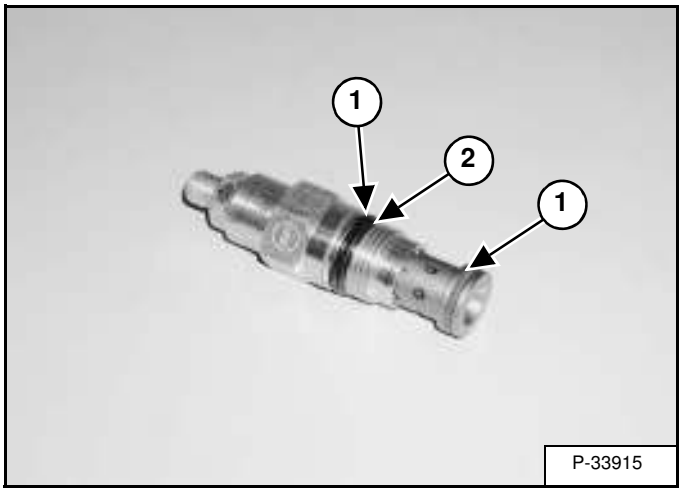
Boost Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-162



Remove the seal (Item 1) **[Figure 20-41-162]** from the main relief valve.

Figure 20-41-163



Remove the two O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-41-163]**.

Blade Valve Section Disassembly And Assembly

IMPORTANT

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

I-2003-0888

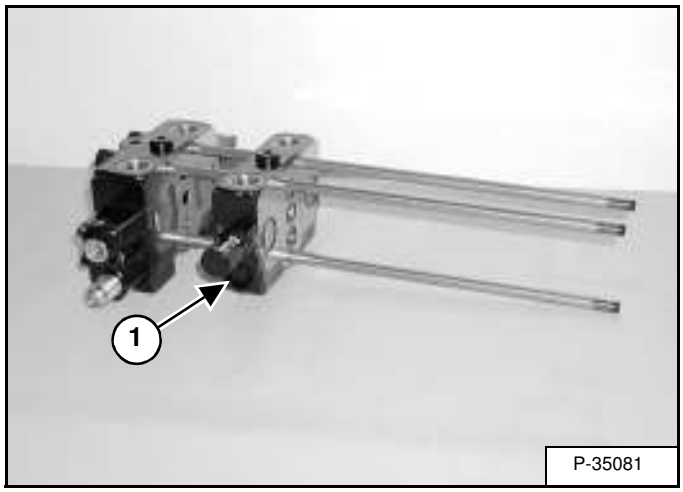
Clean all components with solvent and dry with compressed air.

Check all components for burrs, scratches or other damage and replace if necessary.

Use new O-rings and back-up rings.

Apply clean hydraulic fluid to the O-rings and back-up rings during assembly.

Figure 20-41-164

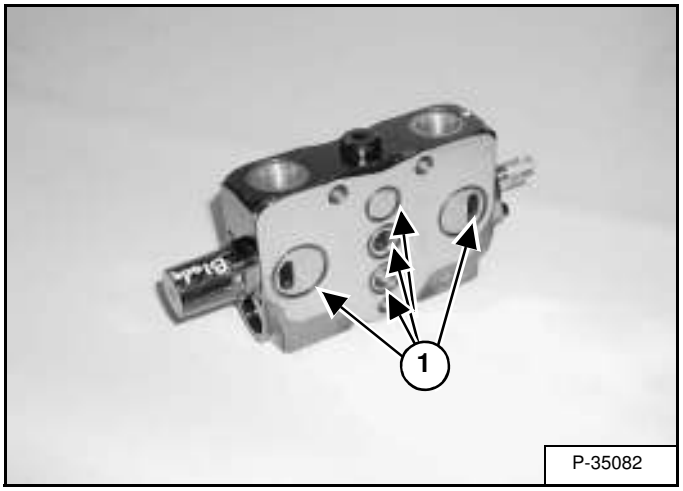


Remove the blade valve section (Item 1) **[Figure 20-41-164]** from the valve assembly.

Dealer Copy -- Not for Resale

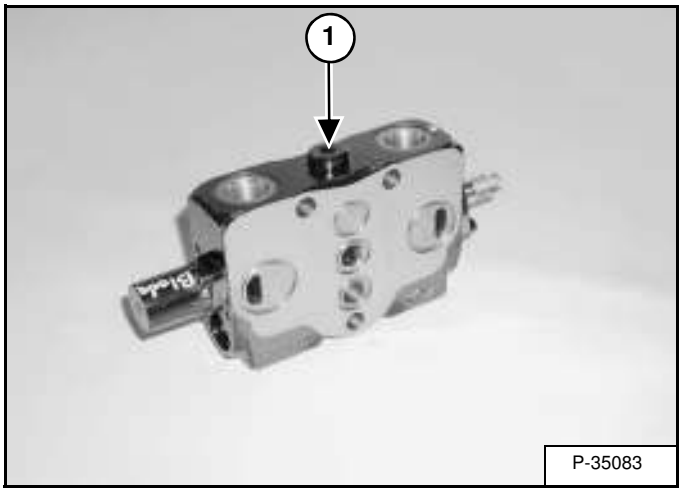
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-165



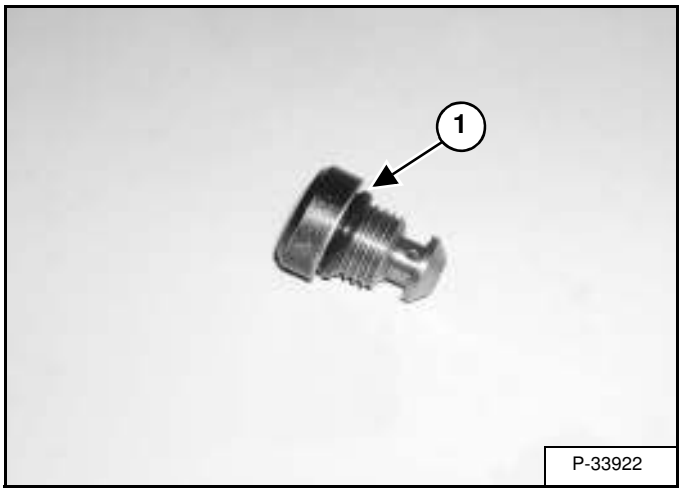
Remove the five O-rings (Item 1) **[Figure 20-41-165]** from the blade valve block.

Figure 20-41-166



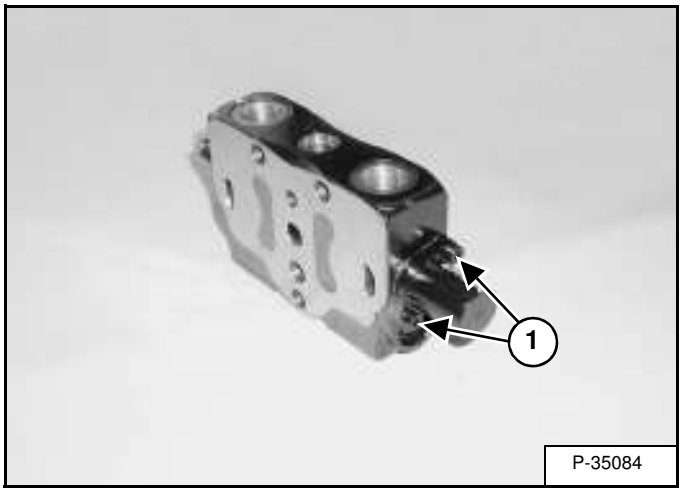
Remove the load check valve (Item 1) **[Figure 20-41-166]**.

Figure 20-41-167



Remove the O-ring (Item 1) **[Figure 20-41-167]** from the load check valve.

Figure 20-41-168



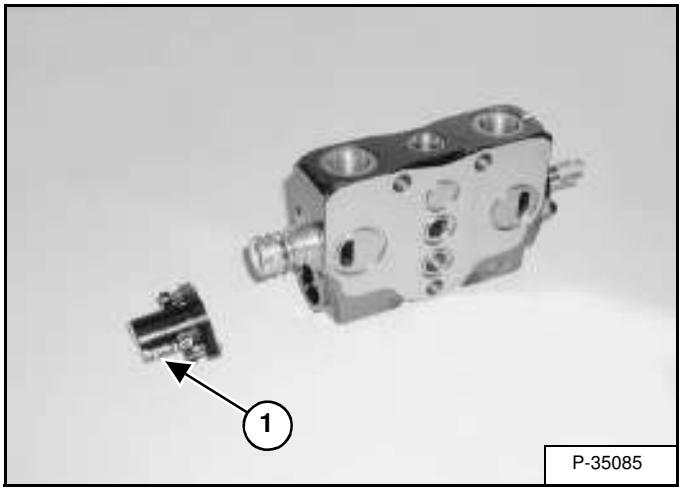
Loosen the two bolts (Item 1) on the cover (Item 1) **[Figure 20-41-168]**.

Installation: Tighten the bolts to 5 ft.-lbs. (6,6 Nm) torque.

Dealer Copy -- Not for Resale

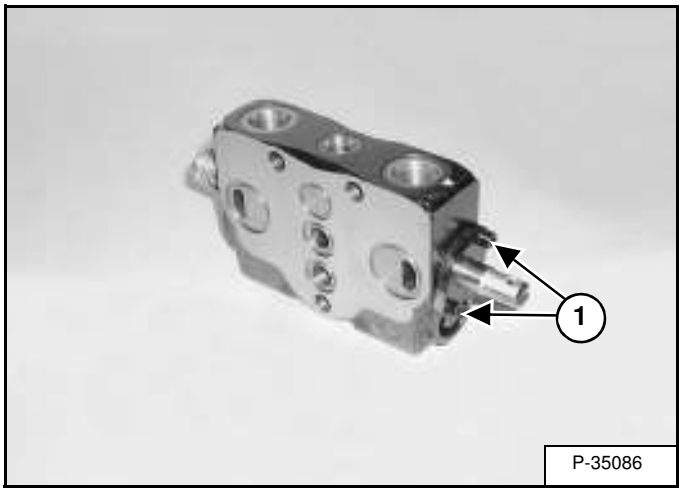
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-169



Remove the bolts and cover (Item 1) **[Figure 20-41-169]**.

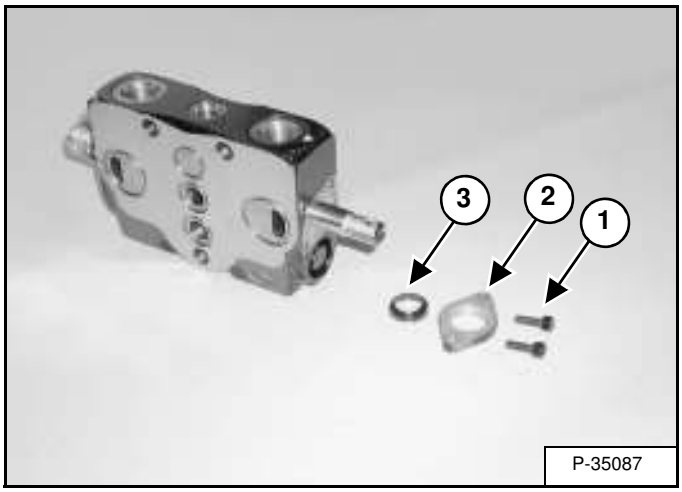
Figure 20-41-170



Loosen the two bolts (Item 1) **[Figure 20-41-170]** on the actuating end of the spool.

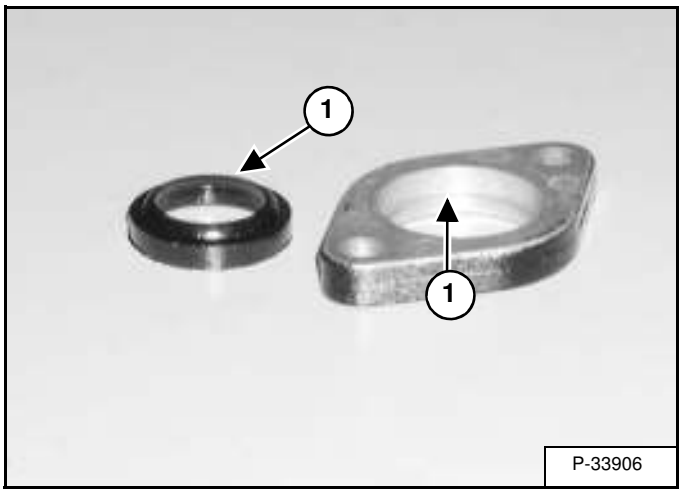
Installation: Tighten the bolts to 5 ft.-lbs. (6,6 Nm) torque.

Figure 20-41-171



Remove the two bolts (Item 1), spool retainer (Item 2) and seal (Item 3) **[Figure 20-41-171]** from the actuating end of the spool.

Figure 20-41-172

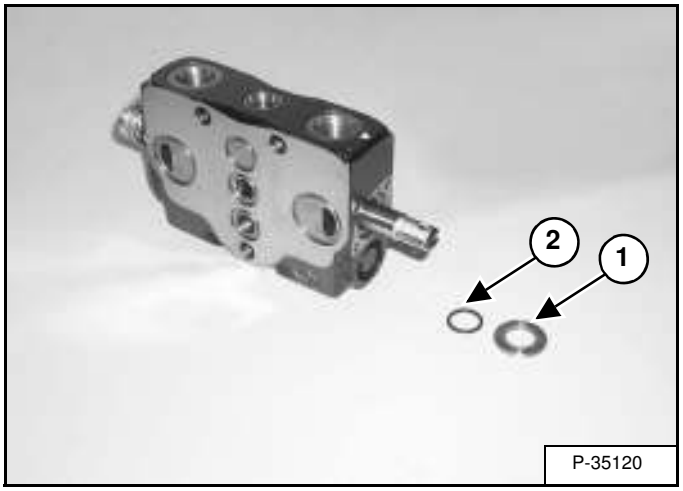


Installation: Make sure the lip (Item 1) on the seal fits inside the lip (Item 2) **[Figure 20-41-172]** on the retainer.

Dealer Copy -- Not for Resale

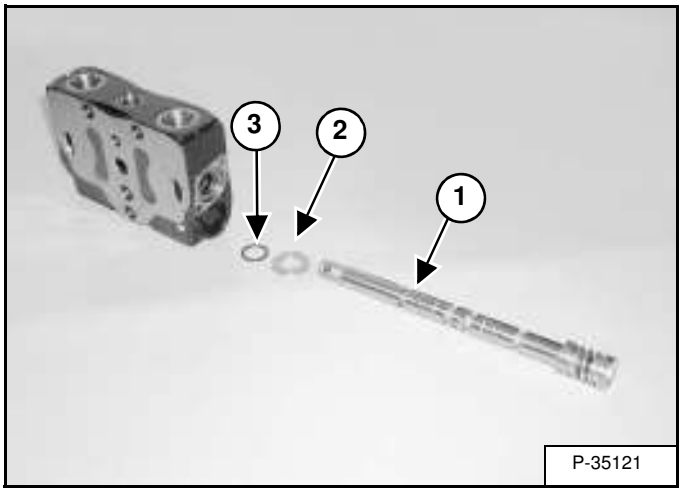
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-173



Remove the washer (Item 1) and O-ring (Item 2) **[Figure 20-41-173]** from the spool.

Figure 20-41-174

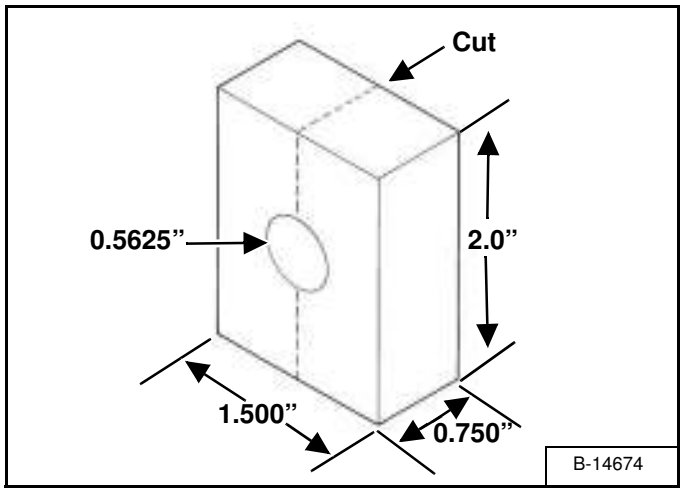


Remove the spool assembly (Item 1), washer (Item 2) and O-ring (Item 3) **[Figure 20-41-174]**.

The spool and valve block are not serviced separately.

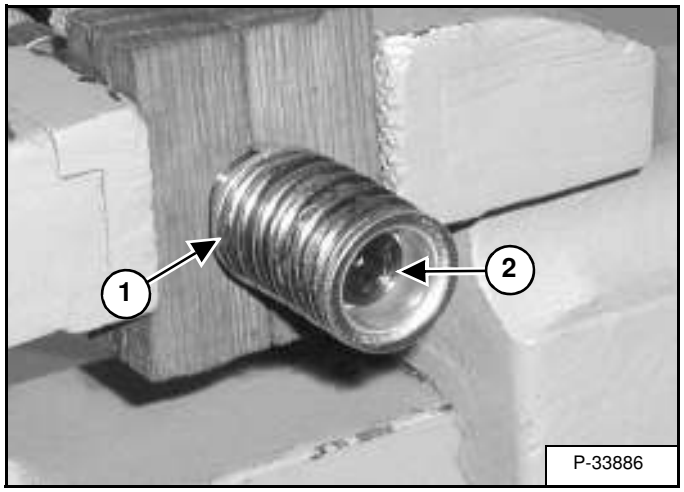
NOTE: When the spool is removed, use care not to scratch the spool surface and do not interchange spools and valve blocks.

Figure 20-41-175



To remove the spring assembly from the spool a holding fixture will have to be made from a .750 inch thick x 1.500 inch wide x 2.0 inch long (19 mm thick x 38 mm wide x 51 mm long) piece of hardwood. Drill a 0.5625 inch (14 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-41-175]**.

Figure 20-41-176



Using the wood blocks clamp the spool (Item 1) in a vise and remove the spring assembly (Item 2) **[Figure 20-41-176]**.

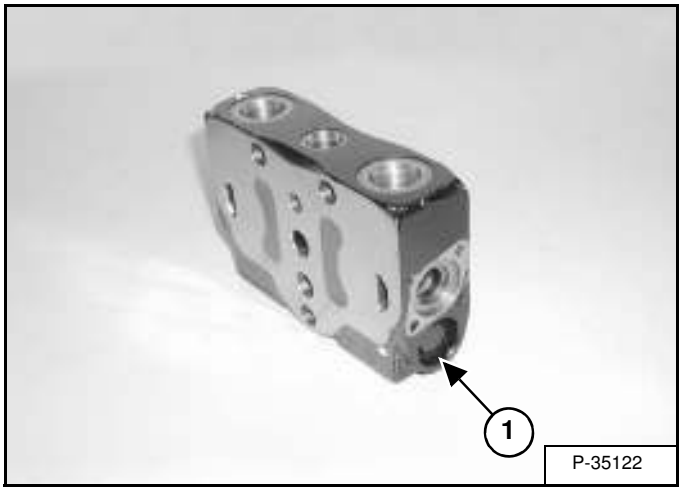
NOTE: Do not use anything other than hardwood blocks to grip the spool, or the spool will be damaged.

Installation: Tighten the spring assembly to 7 ft.-lbs. (9,8 Nm) torque.

Dealer Copy -- Not for Resale

Blade Valve Section Disassembly And Assembly (Cont'd)

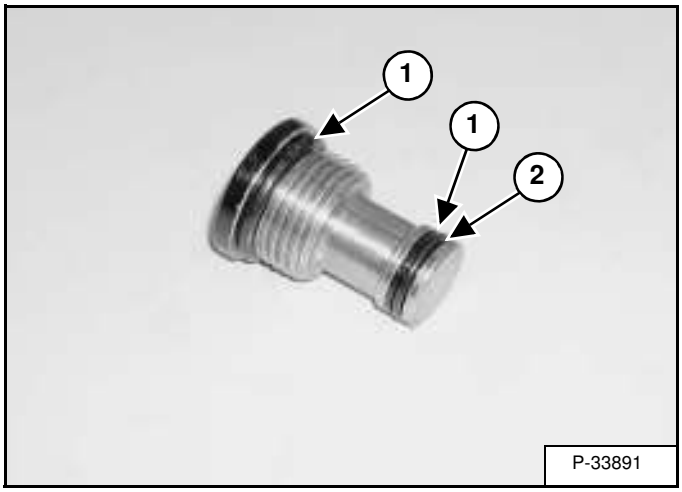
Figure 20-41-177



Loosen and remove the plug (Item 1) **[Figure 20-41-177]**.

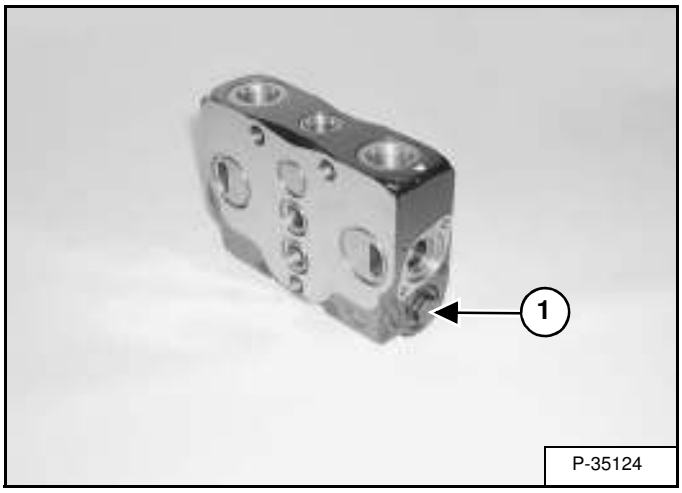
Installation: Tighten the plug to 18 ft.-lbs. (24 Nm) torque.

Figure 20-41-178



Remove the two O-rings (Item 1) **[Figure 20-41-178]** and backup ring from the plug.

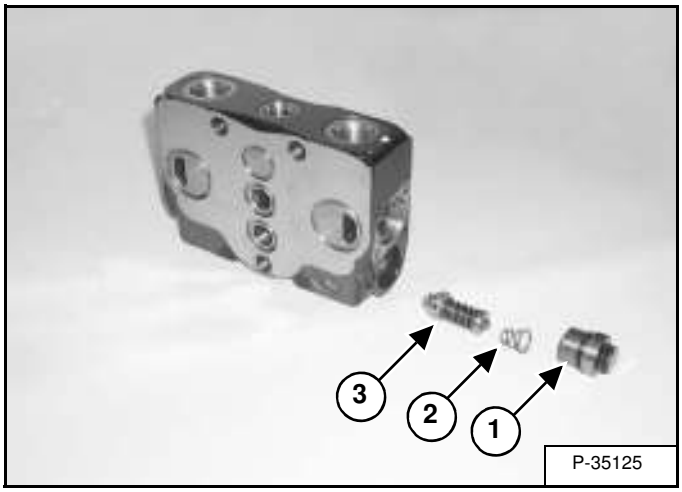
Figure 20-41-179



Loosen the cap (Item 1) **[Figure 20-41-179]** on the relief valve.

Installation: Tighten the cap to 18 ft.-lbs. (24 Nm) torque.

Figure 20-41-180

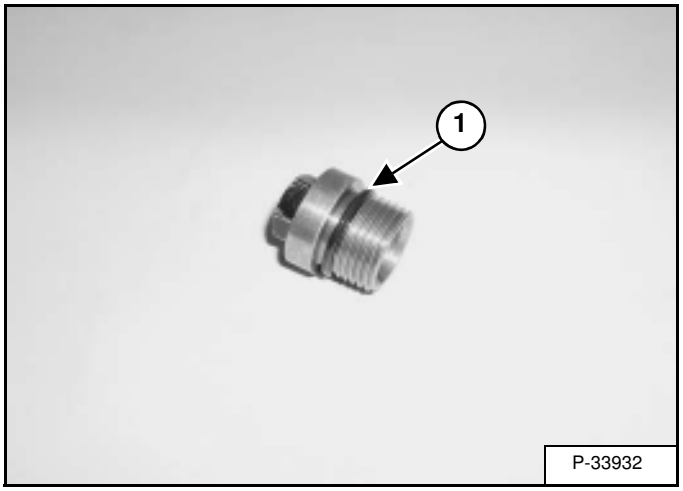


Remove the cap (Item 1), spring (Item 2) and spring assembly (Item 3) **[Figure 20-41-180]**.

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Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-181



Remove the O-ring (Item 1) **[Figure 20-41-181]** from the cap.

Swing Valve Section Disassembly And Assembly

IMPORTANT

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

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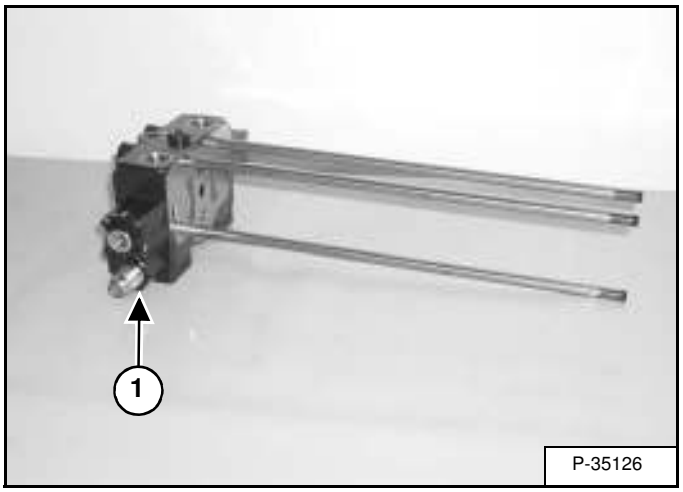
Clean all components with solvent and dry with compressed air.

Check all components for burrs, scratches or other damage and replace if necessary.

Use new O-rings and back-up rings.

Apply clean hydraulic fluid to the O-rings and back-up rings during assembly.

Figure 20-41-182

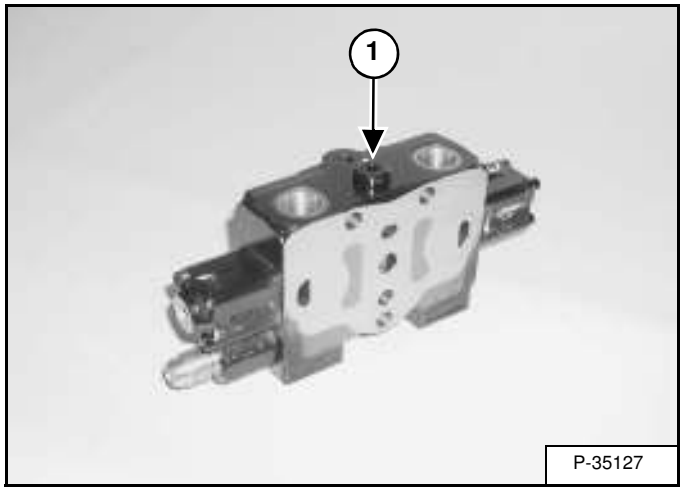


Remove the swing valve section (Item 1) **[Figure 20-41-182]** from the valve assembly.

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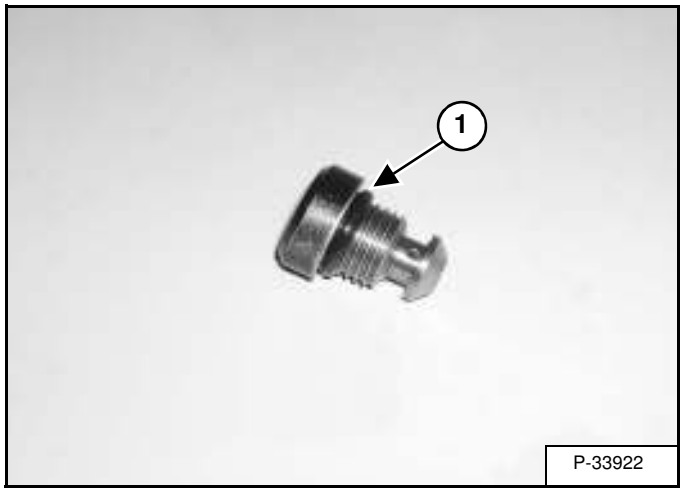
Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-183



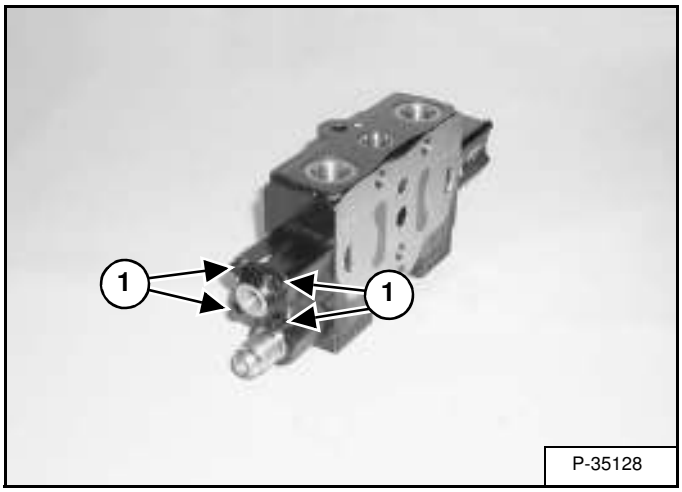
Remove the load check valve (Item 1) **[Figure 20-41-183]**.

Figure 20-41-184



Remove the O-ring (Item 1) **[Figure 20-41-184]** from the load check valve.

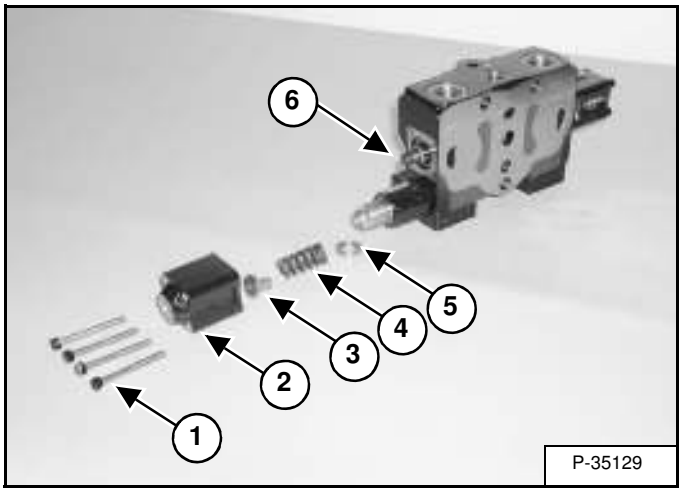
Figure 20-41-185



Loosen the four bolts (Item 1) **[Figure 20-41-185]** on the actuator.

Installation: Tighten the four bolts to 5 ft.-lbs. (6,6 Nm) torque.

Figure 20-41-186

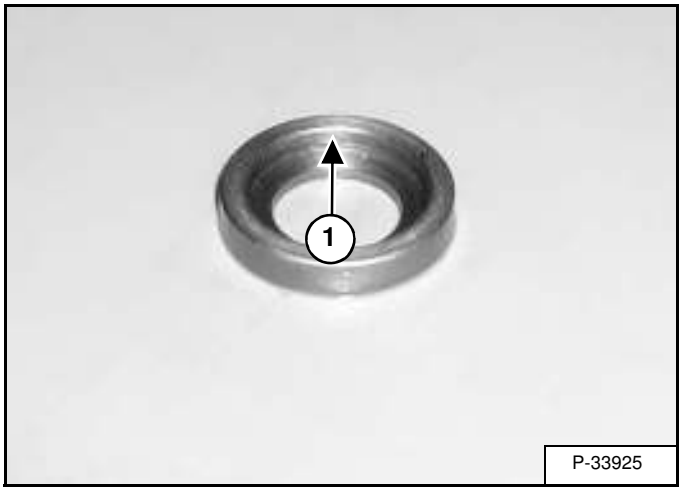


Remove the four bolts (Item 1), actuator (Item 2), spring retainer (Item 3), spring (Item 4) and spring retainer (Item 5) **[Figure 20-41-186]**.

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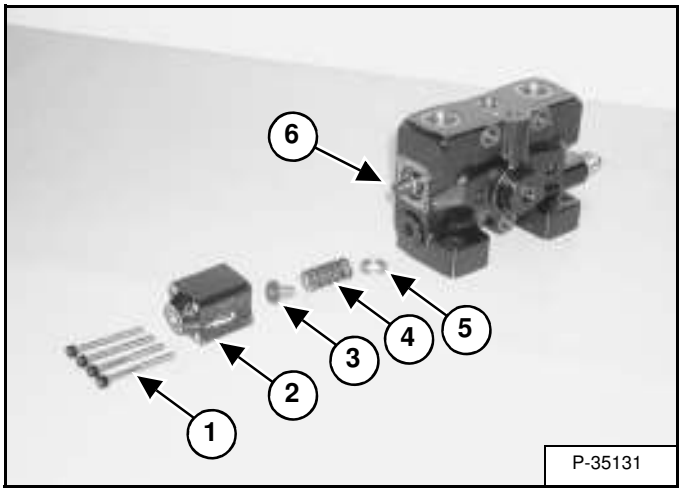
Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-187



Installation: The lip (Item 1) **[Figure 20-41-187]** on the retainer (Item 5) **[Figure 20-41-186 on Page 52]** fits over the spool (Item 6) **[Figure 20-41-186 on Page 52]**.

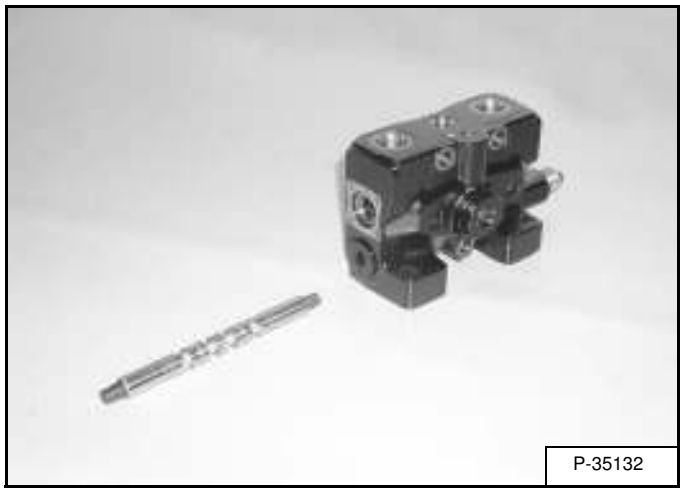
Figure 20-41-188



Remove the four bolts (Item 1), actuator (Item 2), spring retainer (Item 3), spring (Item 4) and spring retainer (Item 5) **[Figure 20-41-188]**.

Installation: The lip (Item 1) **[Figure 20-41-187 on Page 53]** on the spring retainer (Item 5) **[Figure 20-41-188]** fits over the spool (Item 6) **[Figure 20-41-188]**. Tighten the bolts to 5 ft.-lbs. (6,6 Nm) torque.

Figure 20-41-189

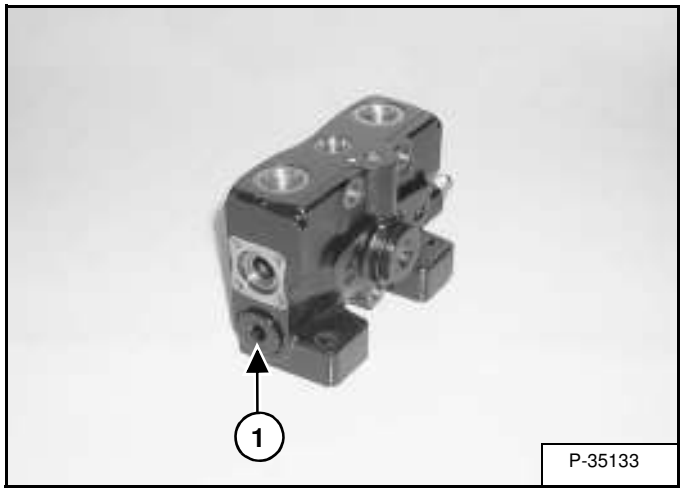


Remove the spool (Item 1) **[Figure 20-41-189]**.

The spool and valve block are not serviced separately.

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

Figure 20-41-190



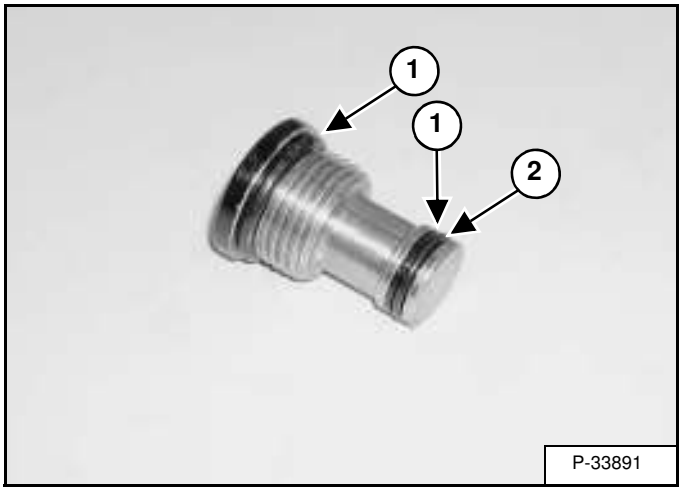
Remove the plug (Item 1) **[Figure 20-41-190]**.

Installation: Tighten the plug to 31 ft.-lbs. (42 Nm) torque.

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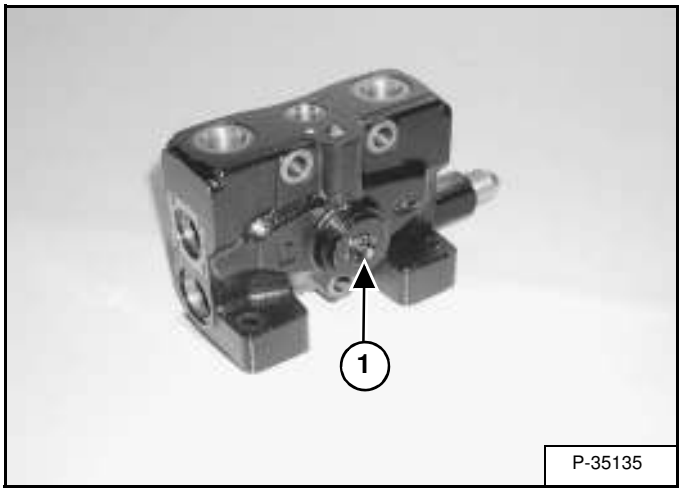
Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-191



Remove the two O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-41-191]** from the plug.

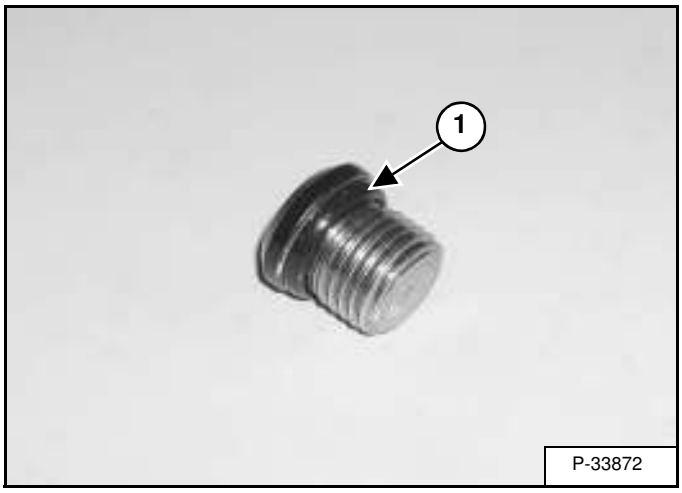
Figure 20-41-192



Remove the plug (Item 1) **[Figure 20-41-192]**.

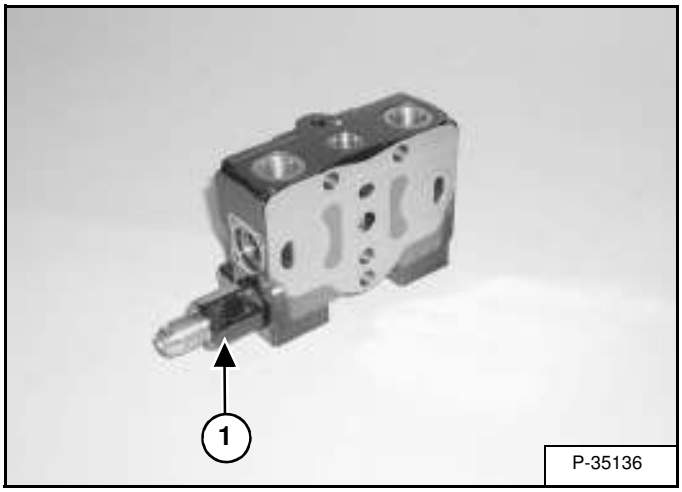
Installation: Tighten the plug to 31 ft.-lbs. (42 Nm) torque.

Figure 20-41-193



Remove the O-ring (Item 1) **[Figure 20-41-193]** from the plug.

Figure 20-41-194



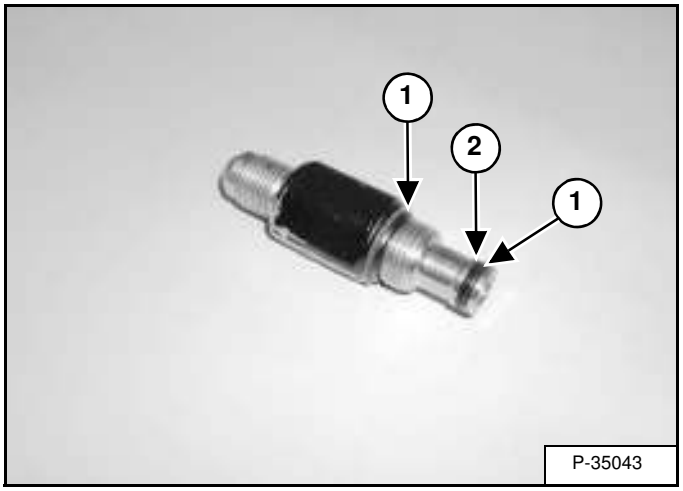
Remove the fitting (Item 1) **[Figure 20-41-194]**.

Installation: Tighten the fitting to 31 ft.-lbs. (42 Nm) torque.

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Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-195



Remove the two O-rings (Item 1) and backup ring (Item 2) **[Figure 20-41-195]** from the fitting.

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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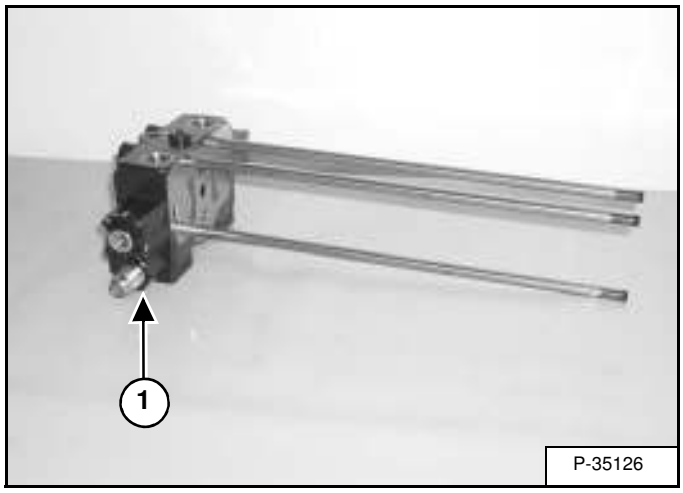
Make sure all components are clean and dry.

Check all components for burrs, scratches or other damage and replace if necessary.

Use new O-rings.

Apply clean hydraulic fluid to the O-rings during assembly.

Figure 20-41-196

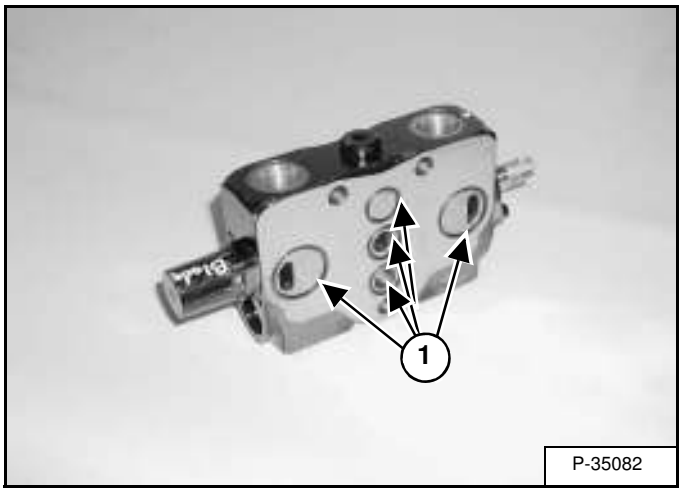


Install the swing valve section (Item 1) **[Figure 20-41-196]** on the tie rods.

Dealer Copy -- Not for Resale

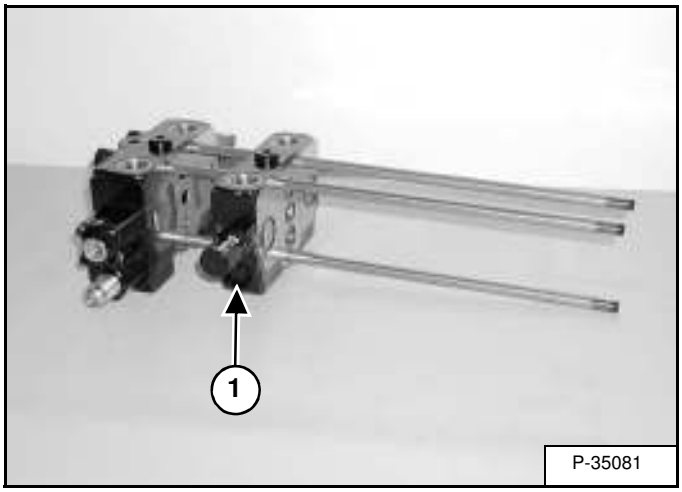
Assembly (Cont'd)

Figure 20-41-197



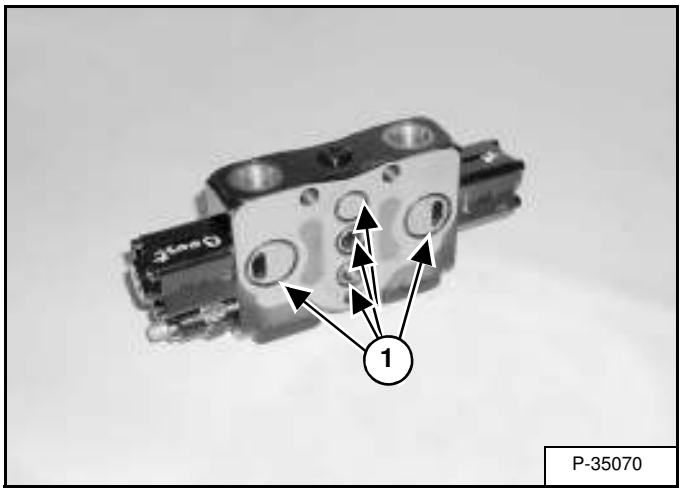
Install the five O-rings (Item 1) **[Figure 20-41-197]** on the blade valve section.

Figure 20-41-198



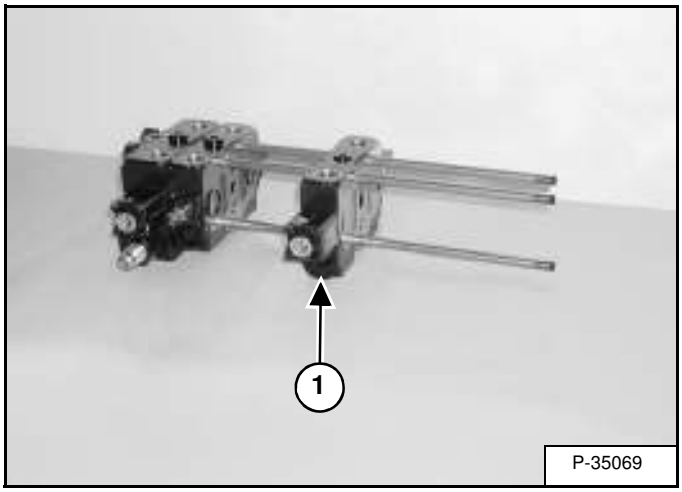
Install the blade valve section (Item 1) **[Figure 20-41-198]** on the tie rods.

Figure 20-41-199



Install the five O-rings (Item 1) **[Figure 20-41-199]** on the boost valve section.

Figure 20-41-200

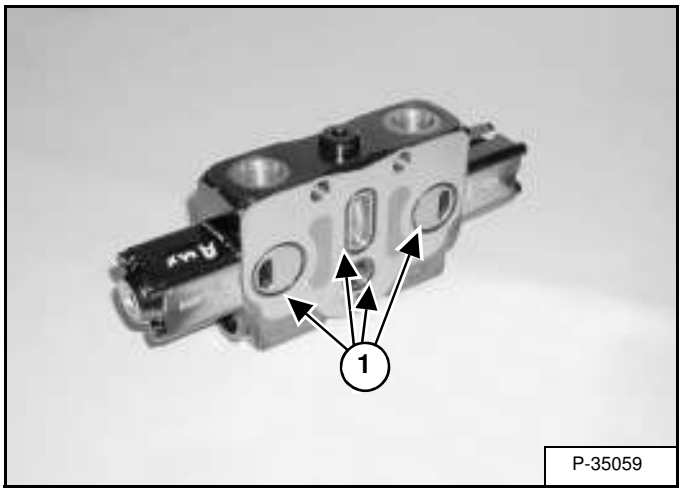


Install the boost valve section (Item 1) **[Figure 20-41-200]** on the tie rods.

Dealer Copy -- Not for Resale

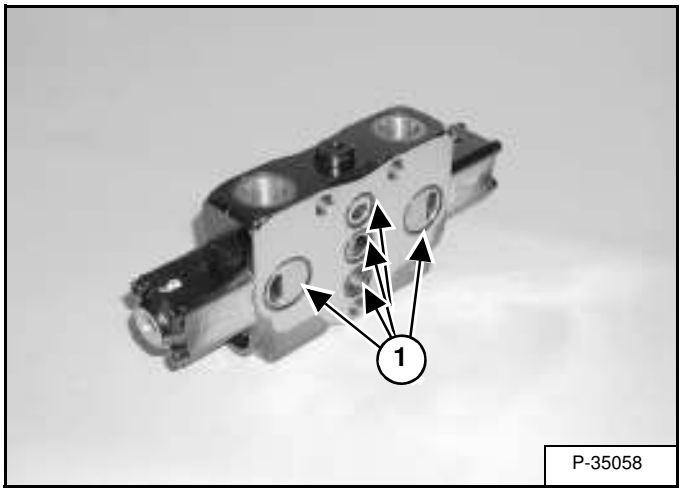
Assembly (Cont'd)

Figure 20-41-201



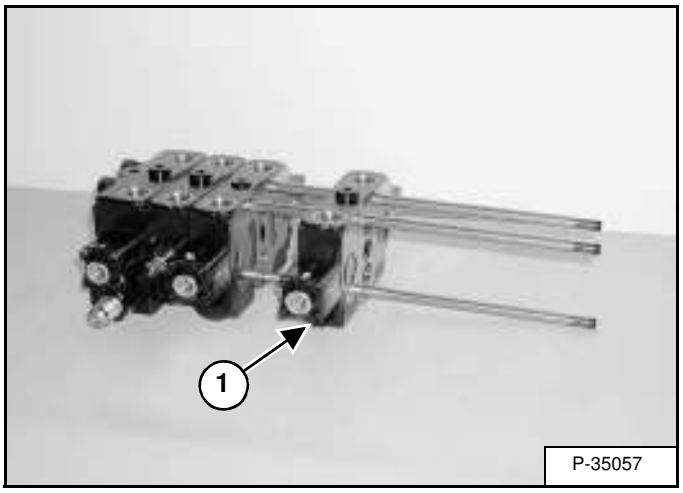
Install the four O-rings (Item 1) **[Figure 20-41-201]** on the left side of the auxiliary valve section.

Figure 20-41-202



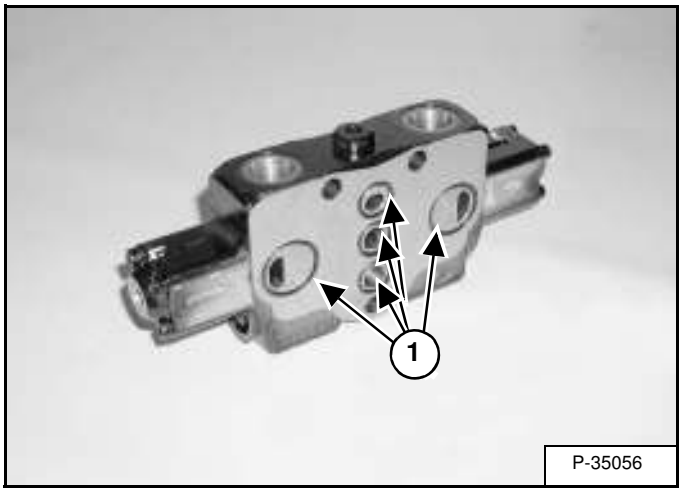
Install the five O-rings (Item 1) **[Figure 20-41-202]** on the right side of the auxiliary valve section.

Figure 20-41-203



Install the auxiliary valve section (Item 1) **[Figure 20-41-203]** on the tie rods.

Figure 20-41-204

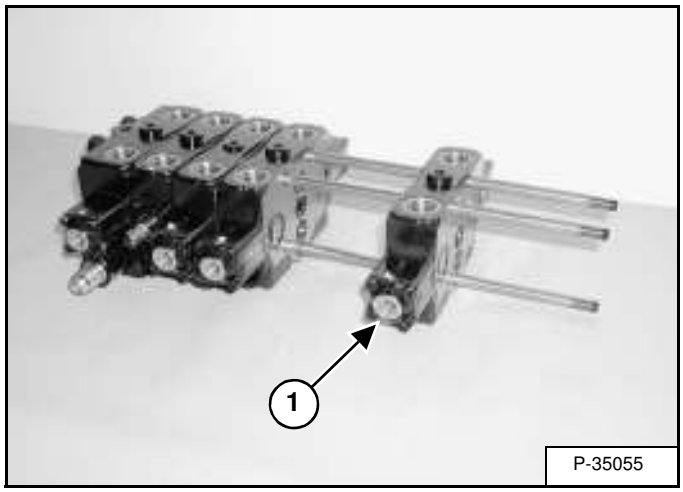


Install the five O-rings (Item 1) **[Figure 20-41-204]** on the bucket valve section.

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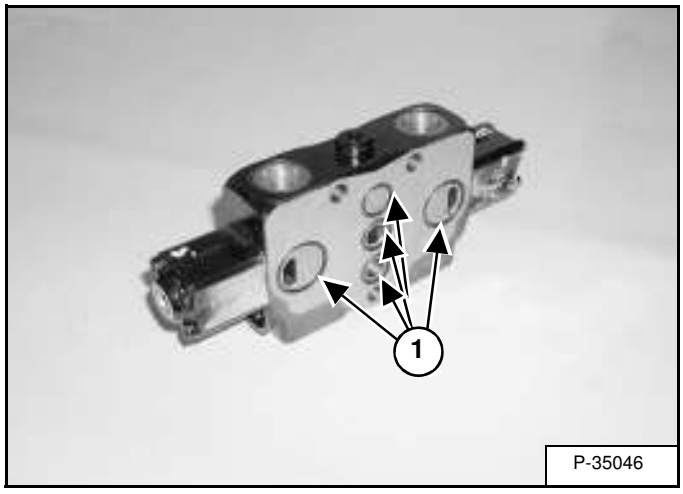
Assembly (Cont'd)

Figure 20-41-205



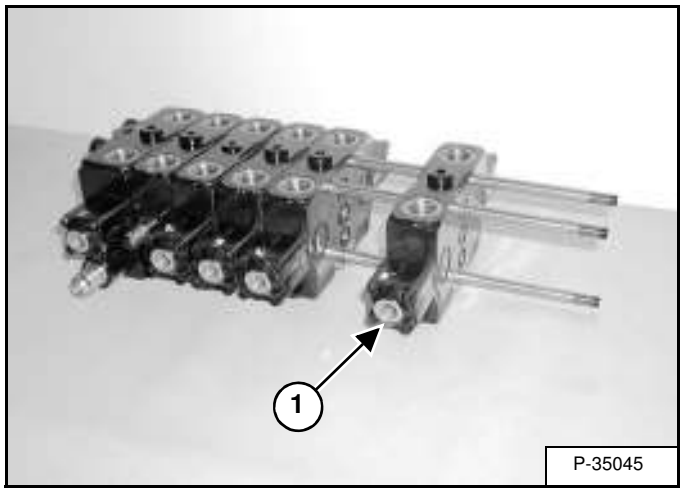
Install the bucket valve section (Item 1) **[Figure 20-41-205]** on the tie rods.

Figure 20-41-206



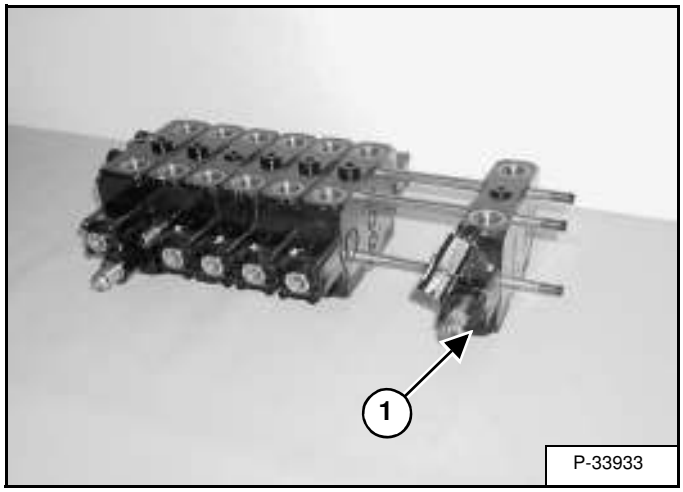
Install the five O-rings (Item 1) **[Figure 20-41-206]** on the arm valve section.

Figure 20-41-207



Install the arm valve section (Item 1) **[Figure 20-41-207]** on the tie rods.

Figure 20-41-208

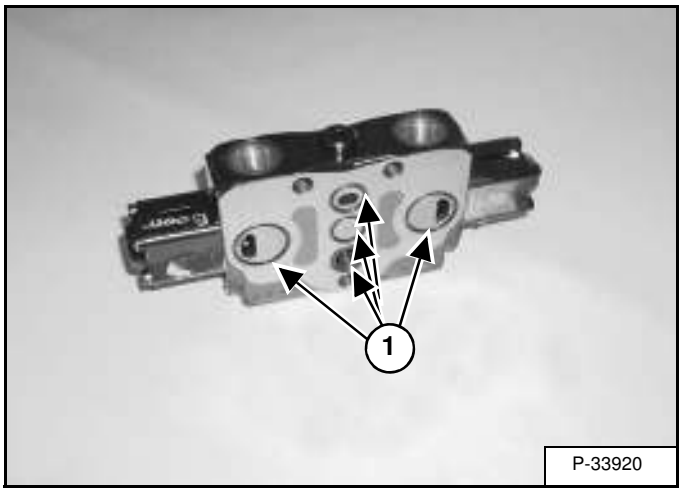


Install the left travel valve section (Item 1) **[Figure 20-41-208]** on the tie rods.

Dealer Copy -- Not for Resale

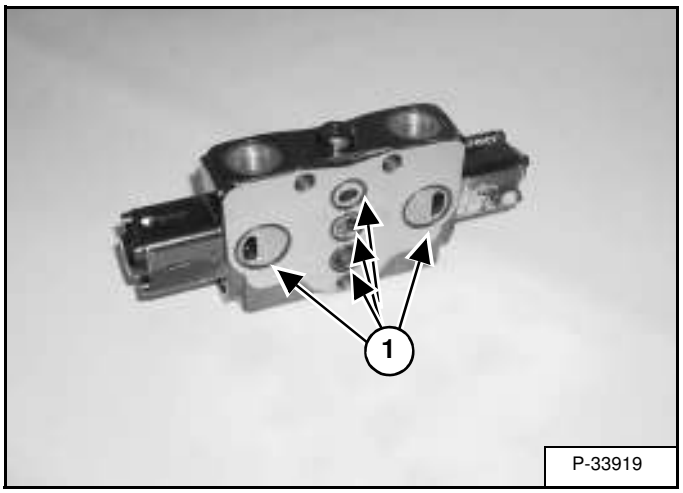
Assembly (Cont'd)

Figure 20-41-209



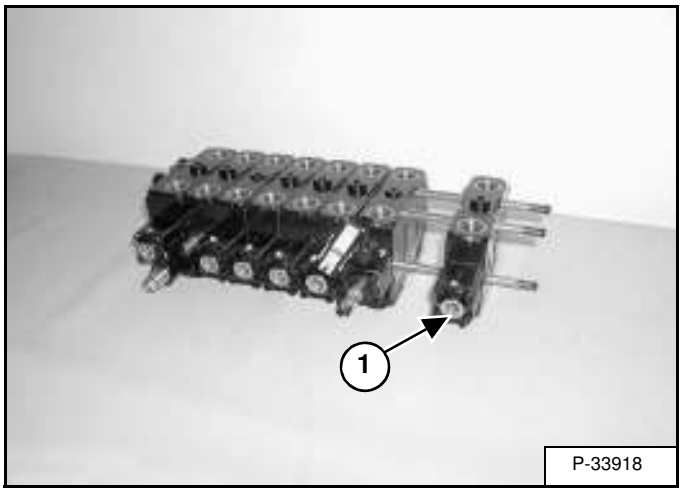
Install the five O-rings (Item 1) **[Figure 20-41-209]** on the left side of the boom valve section.

Figure 20-41-210



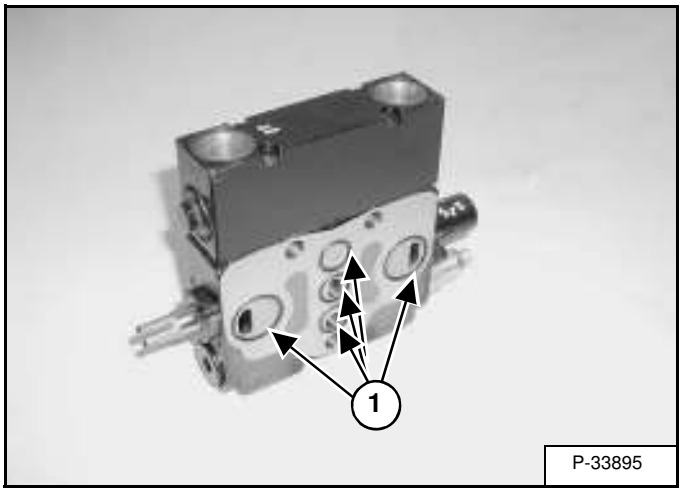
Install the five O-rings (Item 1) **[Figure 20-41-210]** on the right side of the boom valve section.

Figure 20-41-211



Install the boom valve section (Item 1) **[Figure 20-41-211]** on the tie rods.

Figure 20-41-212

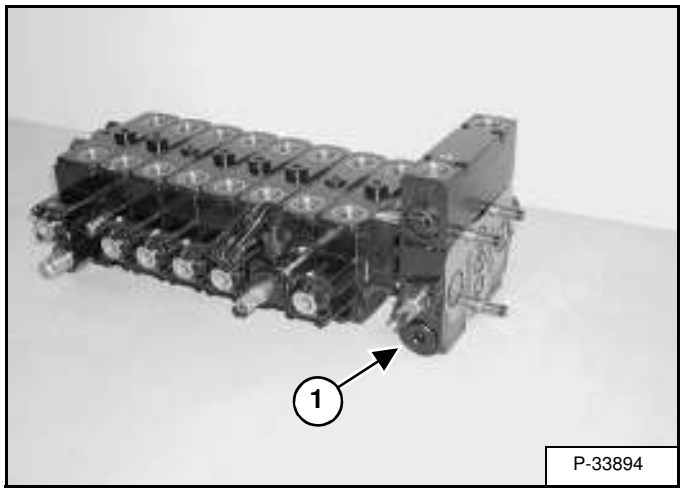


Install the five O-rings (Item 1) **[Figure 20-41-212]** on the boom swing valve.

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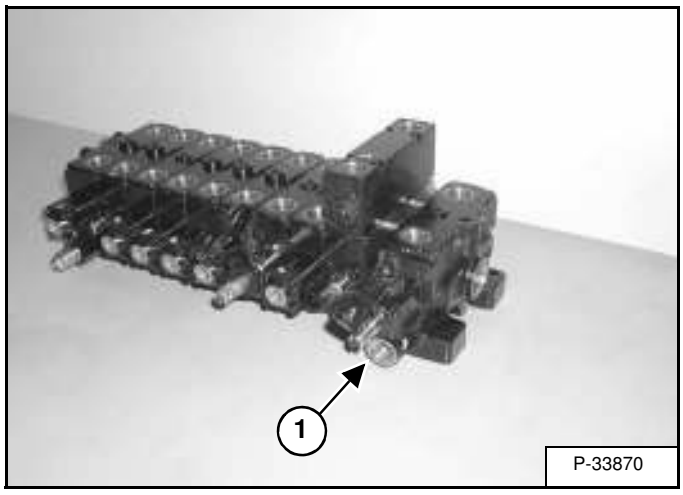
Assembly (Cont'd)

Figure 20-41-213



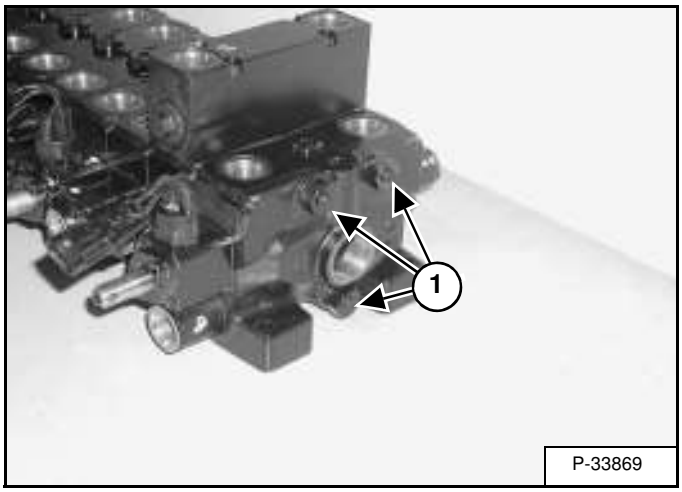
Install the boom swing valve section (Item 1) **[Figure 20-41-213]** on the tie rods.

Figure 20-41-214



Install the right travel valve section (Item 1) **[Figure 20-41-214]** on the tie rods.

Figure 20-41-215



Install the three washers and nuts (Item 1) **[Figure 20-41-215]** on the ends of the tie rods, finger tight.

Be sure the valve assembly does not rock on a flat surface.

Pretighten the three tie rod nuts (Item 1) **[Figure 20-41-215]** to 10 ft.-lbs. (13 Nm) torque.

Tighten the tie rod nuts to 26 ft.-lbs. (35 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.

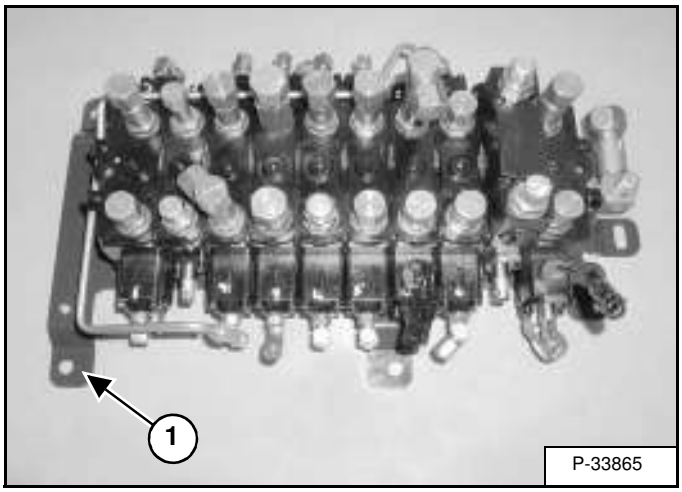
The spools must not stick, if the spools do stick, loosen the tie rod nuts and tighten per above information.

Recheck the control valve assembly for level settings.

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Assembly (Cont'd)

Figure 20-41-216



Install the hoses and fittings **[Figure 20-41-216]**.

Install the control valve assembly on the mount plate (Item 1) **[Figure 20-41-216]**.

Figure 20-41-217

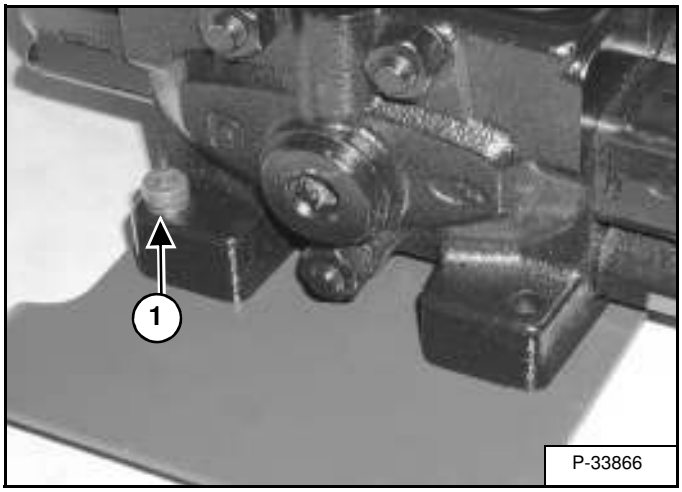
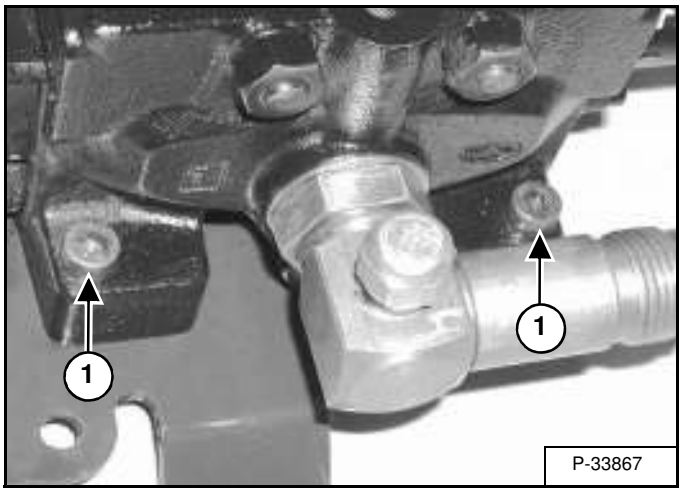


Figure 20-41-218



Install the three mount bolts (Item 1) **[Figure 20-41-217]** & **[Figure 20-41-218]** on the control valve assembly. Tighten the bolts to 18-19 ft.-lbs. (24-26 Nm) torque.

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HYDRAULIC PUMP

Description

Figure 20-50-1

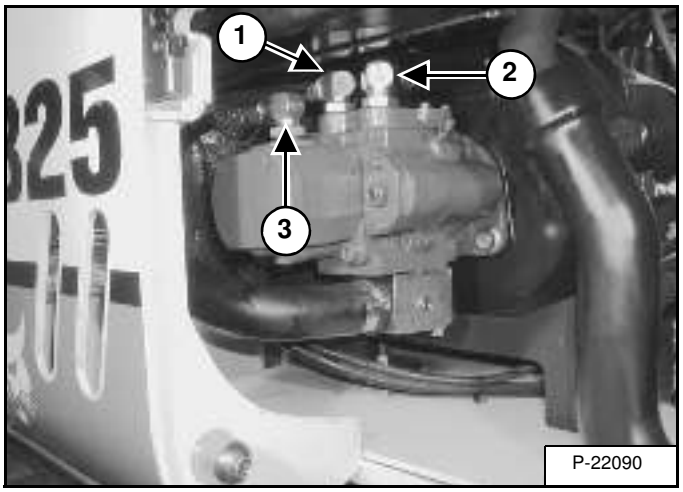
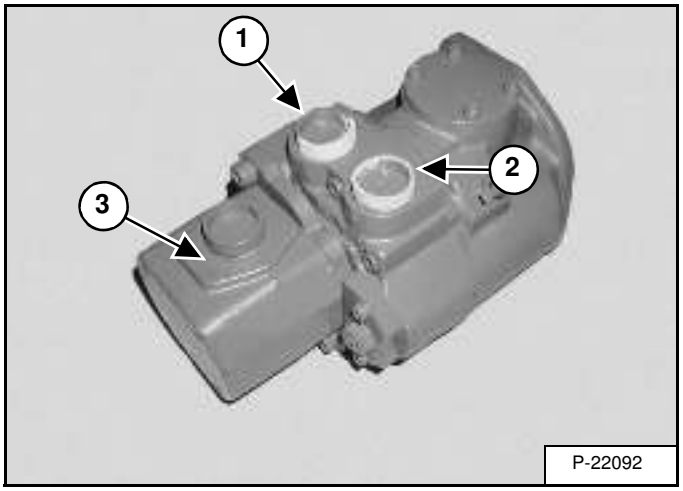


Figure 20-50-2



Pump outlet one (Item 1) **[Figure 20-50-1]** & **[Figure 20-50-2]** provides hydraulic fluid to the right hand travel, boom swing and boom valve sections.

Pump outlet two (Item 2) **[Figure 20-50-1]** & **[Figure 20-50-2]** provides hydraulic fluid flow to the left hand travel, arm and bucket valve sections.

Pump outlet three (gear pump) (Item 3) **[Figure 20-50-1]** & **[Figure 20-50-2]** provides hydraulic fluid flow to the upperstructure swing, blade and boost valve sections.

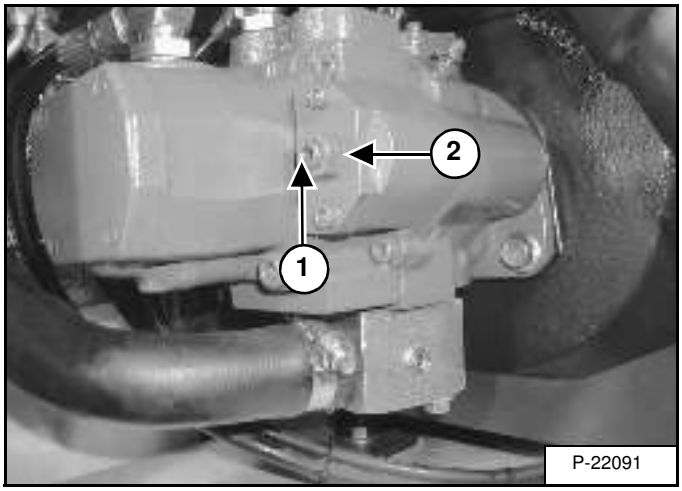
Hydraulic flow from pump outlet two (Item 2) **[Figure 20-50-1]** & **[Figure 20-50-2]** and three (Item 3) **[Figure 20-50-1]** & **[Figure 20-50-2]** are combined for the auxiliary hydraulic flow.

Torque Adjustment

Prior to making any torque adjustment, insure all piston and gear pump tests have been completed and they are to rate specifications. (See the following pages for pump tests.)

Prior to making any torque adjustment, make sure the no load engine RPM is correct.

Figure 20-50-3



The adjustment screw (Item 1) **[Figure 20-50-3]** is used to match the maximum hydraulic horsepower of the pump to the maximum rated engine horsepower.

Remove any auxiliary hydraulic attachments from the excavator.

Engage the swing lock.

Start the engine and move the speed control to the high RPM position.

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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Description (Cont'd)

Engage the following hydraulic functions, and continue to engage the functions.

Engage the auxiliary hydraulics.
Extend the bucket cylinder.
Extend the arm cylinder.
Extend the boom cylinder.
Extend the boom swing cylinder.
Engage the upperstructure swing.

With all the above hydraulic functions engaged, the engine speed must maintain 1950-2050 RPM.

To adjust the hydraulic pump torque, loosen the lock nut (Item 2) **[Figure 20-50-3 on Page 1]** and turn the adjustment screw clockwise to increase pump torque. counterclockwise to decrease pump torque.

Tighten the locknut and retest the pump.

Increase or decrease pump torque until correct engine RPM is maintained.

Testing The Piston Pump

All pump testing is done with the hydraulic oil at operating temperature and with the engine high speed setting of 2315-2385 RPM.

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

MEL10003 - Hydraulic Tester

Stop the engine.

Open the engine cover.

Figure 20-50-4

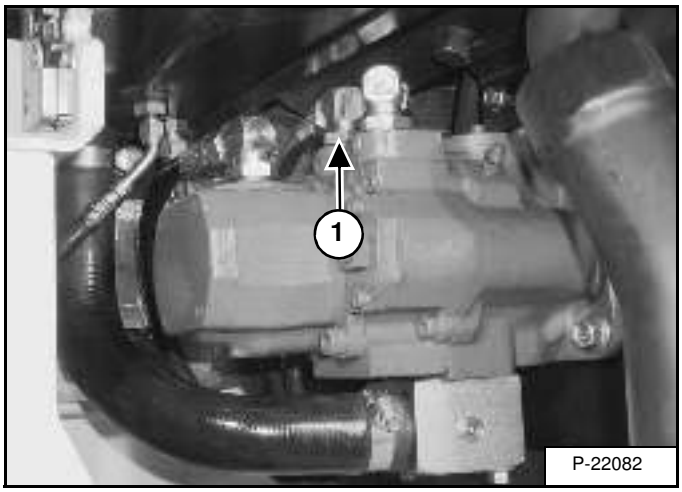
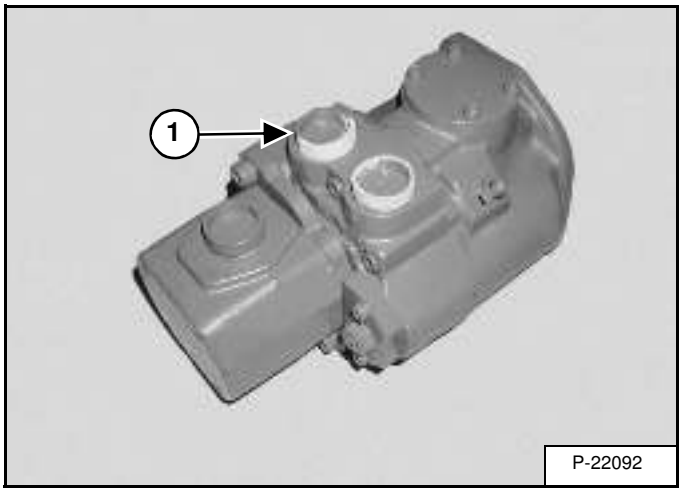


Figure 20-50-5

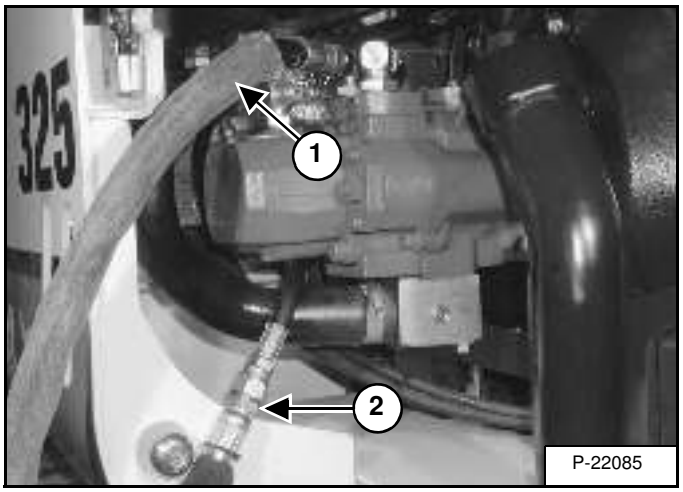


Remove the outlet hose (Item 1) **[Figure 20-50-4]** & **[Figure 20-50-5]** from the hydraulic pump being tested.

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Testing The Piston Pump (Cont'd)

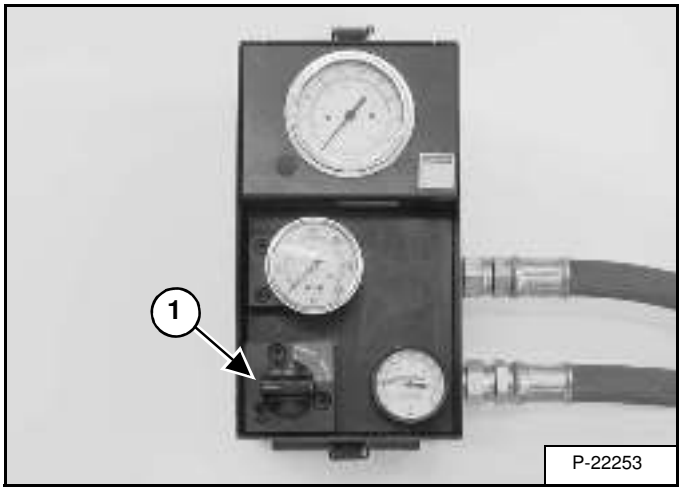
Figure 20-50-6



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.

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 140-160°F (60-71°C) by turning the restrictor valve until the gauge reads about 1000 PSI (6895 kPa). 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 5.23 gpm (19.8 Lpm).

Repeat the procedure for pump outlet two.

The pump flow must be equal between outlet one and two.

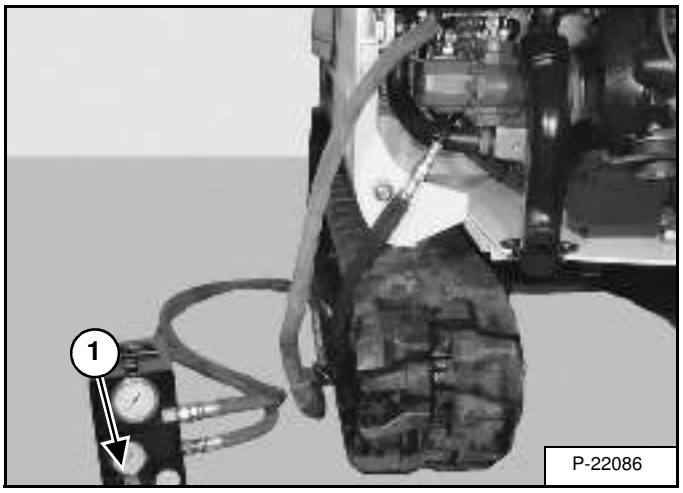
Start the engine and run at low RPM. Make sure the tester is connected correctly. If no flow is indicated at the tester, the hoses are connected wrong.

Increase the engine speed to full RPM. Warm the hydraulic fluid to 140-160°F (60-71°C) by turning the restrictor valve until the gauge reads about 1000 PSI (6895 kPa). Do not exceed system pressure.

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

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

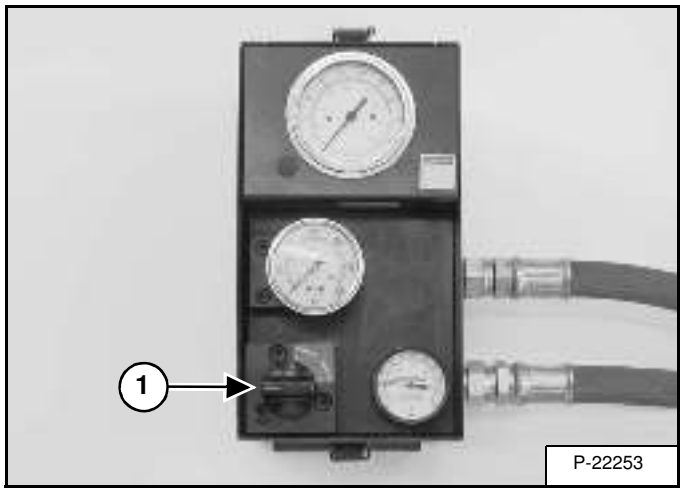
Figure 20-50-8



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Testing The Piston Pump (Cont'd)

Figure 20-50-9



Close the flow control knob (Item 1) **[Figure 20-50-8 on Page 3]** & **[Figure 20-50-9]** slowly to 100 PSI below the relief valve setting (2800 PSI [19306 kPa]).

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

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

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

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

Repeat the procedure for pump outlet two.

The pump flow must be equal between outlet one and two.

Testing The Gear Pump

All pump testing is done with the hydraulic oil at operating temperature and with the engine high speed setting of 2315-2385 RPM.

Figure 20-50-10

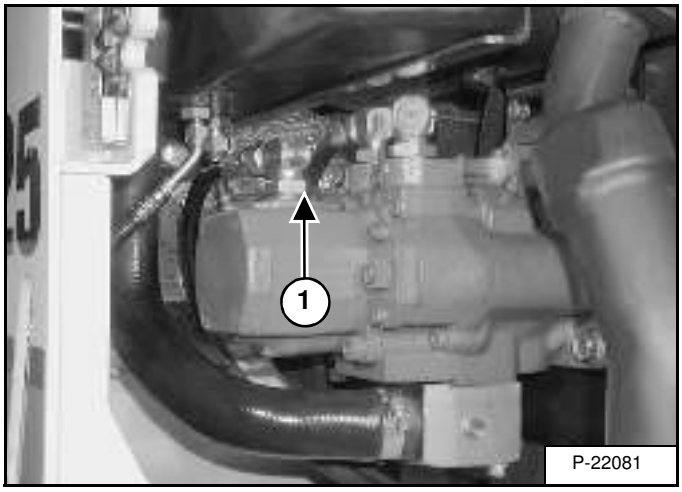
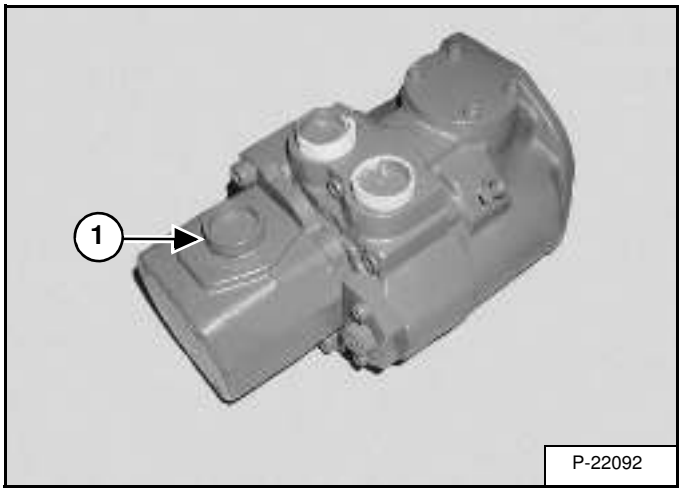


Figure 20-50-11

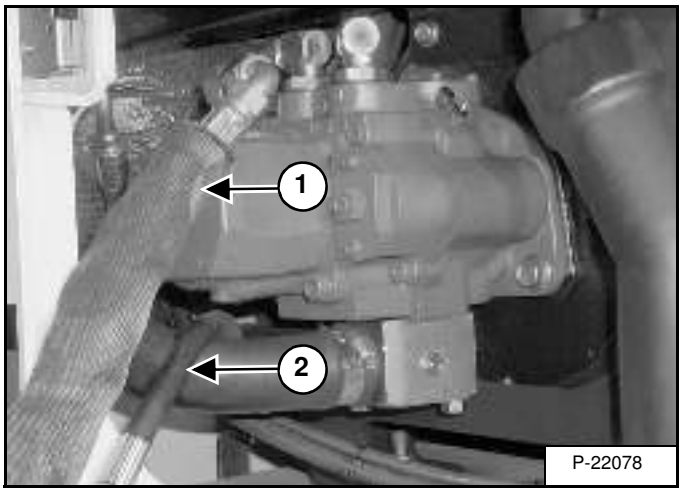


Remove the outlet hose (Item 1) **[Figure 20-50-10]** & **[Figure 20-50-11]** from pump number three.

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Testing The Gear Pump (Cont'd)

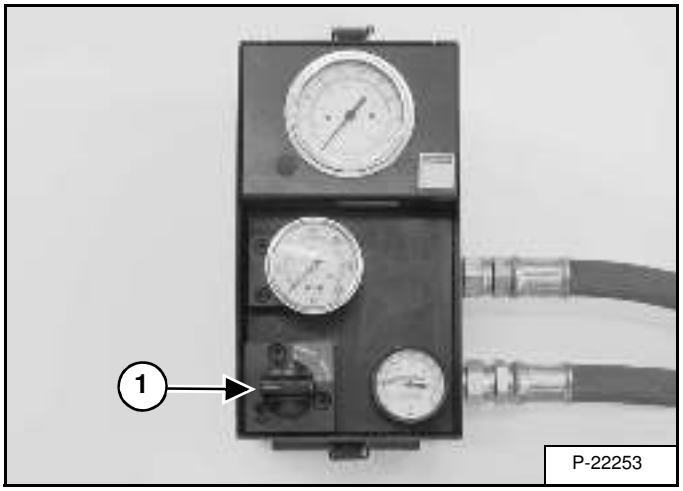
Figure 20-50-12



Connect the inlet side (Item 1) **[Figure 20-50-12]** of the testor to the gear pump.

Connect the outlet side (Item 2) **[Figure 20-50-12]** of the testor to the hose that was removed from the gear pump.

Figure 20-50-13



NOTE: Open the flow control knob (Item 1) [Figure 20-50-13] 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 140-160°F (60-71°C) by turning the restrictor valve until the gauge reads about 1000 PSI (6895 kPa). 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 gear pump is 7.06 GPM (26.6 L/min).

Figure 20-50-14

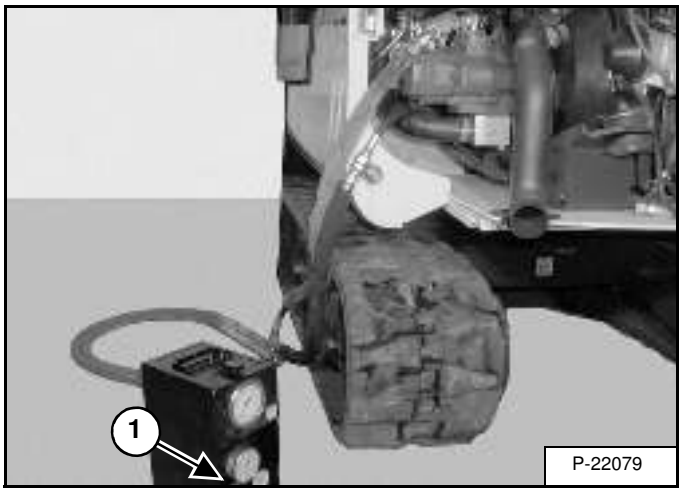
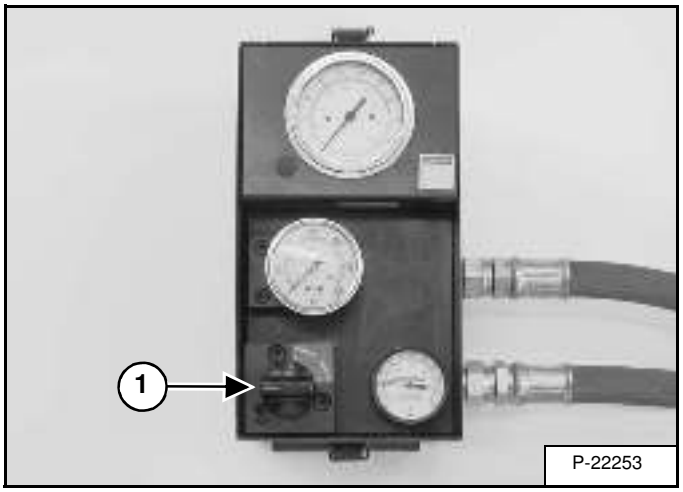


Figure 20-50-15



Close the flow control knob (Item 1) **[Figure 20-50-14]** & **[Figure 20-50-15]** slowly to 100 PSI below the relief valve setting (3750-3850 PSI [25856-26546 kPa]).

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

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

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

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

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Testing The Auxiliary Hydraulic Flow

The auxiliary hydraulic flow for the 325/328 excavators is the combined flow of pump outlet two and pump outlet three.

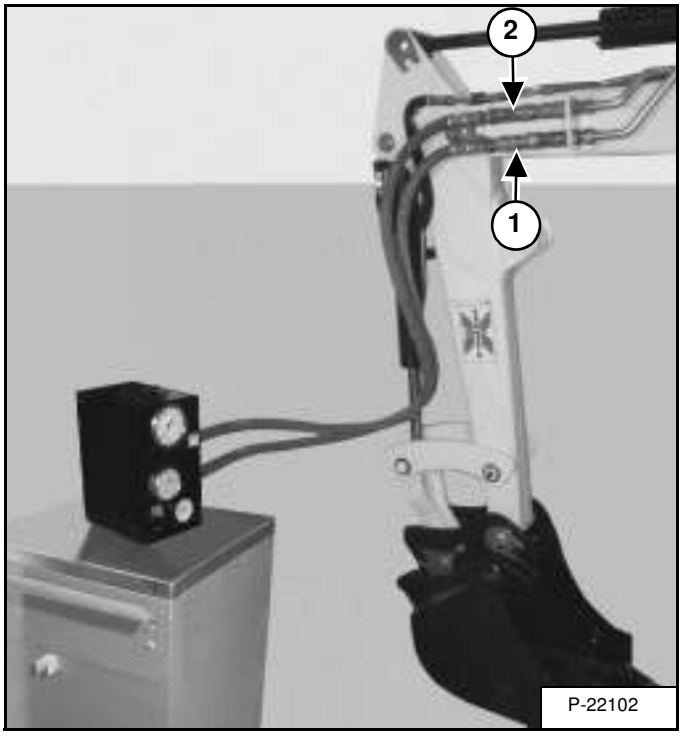
All testing is done with the hydraulic oil at operating temperature and the engine high speed setting of 2315-2385 RPM.

The following tool will be needed for the auxiliary hydraulic flow test:

MEL10003-Hydraulic Tester.

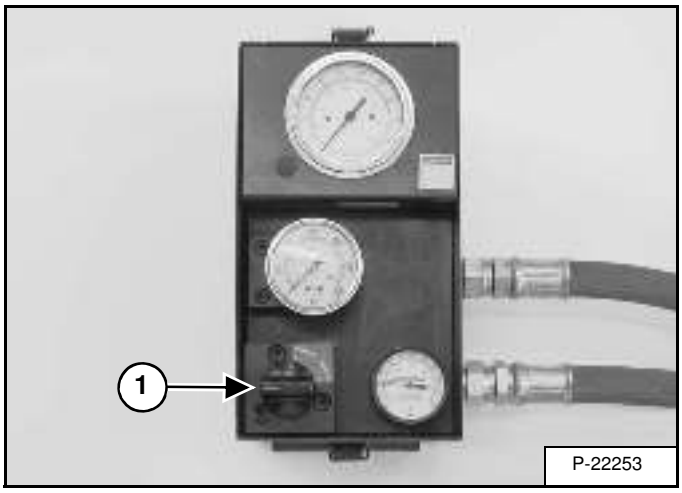
Stop the engine.

Figure 20-50-16



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 20-50-16]**.

Figure 20-50-17



NOTE: Open the flow control knob (Item 1) [Figure 20-50-17] 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 140-160°F (60-71°C) by turning the restrictor valve until the gauge reads about 1000 PSI (6895 kPa). 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 Replacing the Hydraulic Fluid on Page 10-100-2.)

Figure 20-50-18

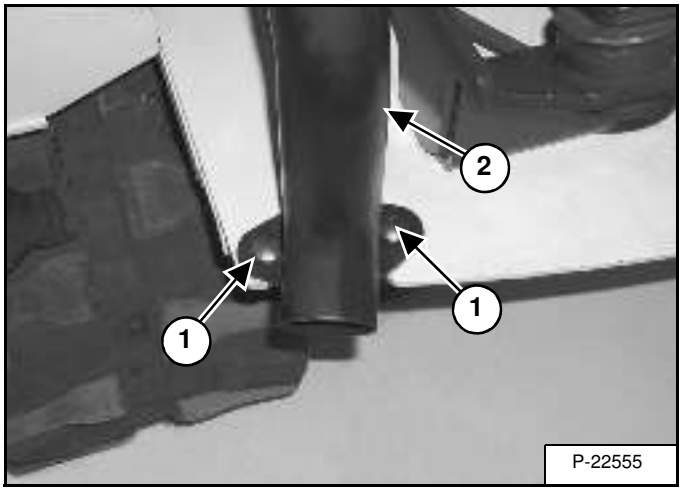
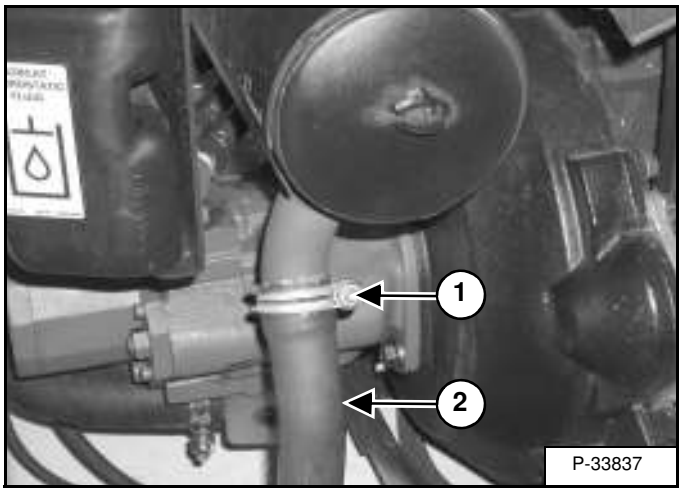


Figure 20-50-19



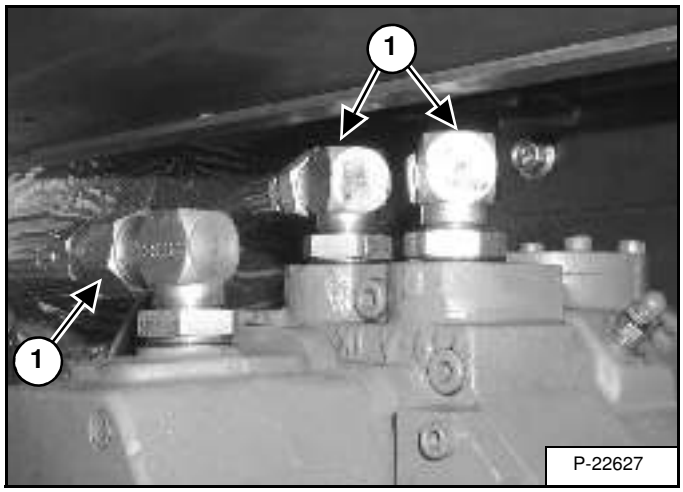
Remove the two nuts (Item 1) **[Figure 20-50-18]** (Early Models) or the clamp (Item 1) **[Figure 20-50-19]** (Later Models) and remove the tailpipe (Item 2) **[Figure 20-50-18]** & **[Figure 20-50-19]**.

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.

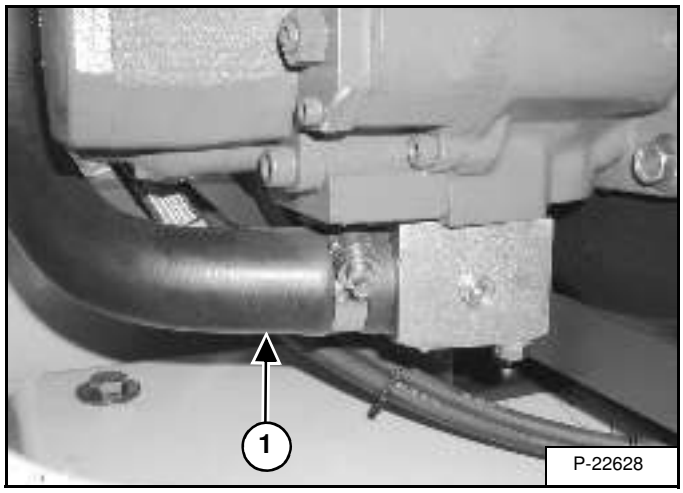
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Figure 20-50-20



Mark and remove the three hoses (Item 1) **[Figure 20-50-20]**.

Figure 20-50-21

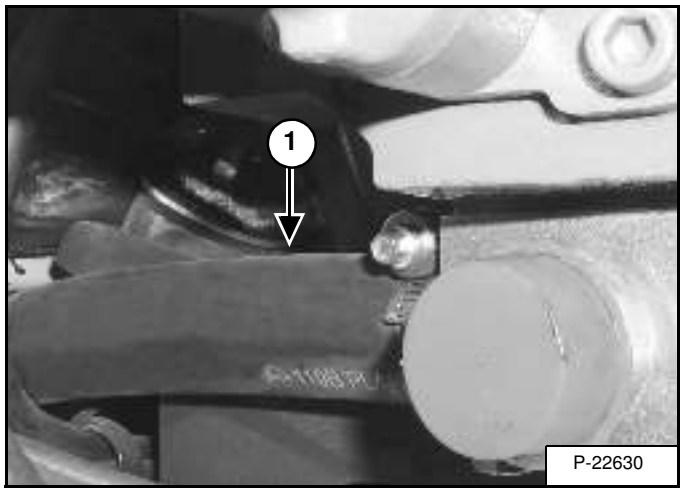


Remove the hydraulic reservoir to pump hose (Item 1) **[Figure 20-50-21]**.

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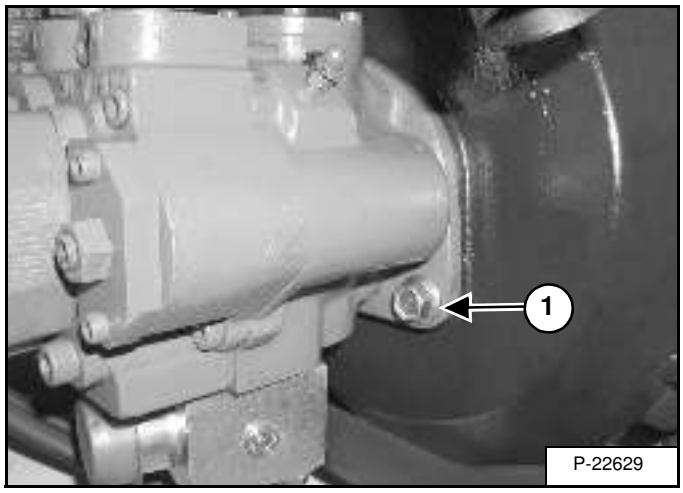
Removal And Installation (Cont'd)

Figure 20-50-22



Remove the hydraulic filter to pump hose (Item 1) **[Figure 20-50-22]**.

Figure 20-50-23

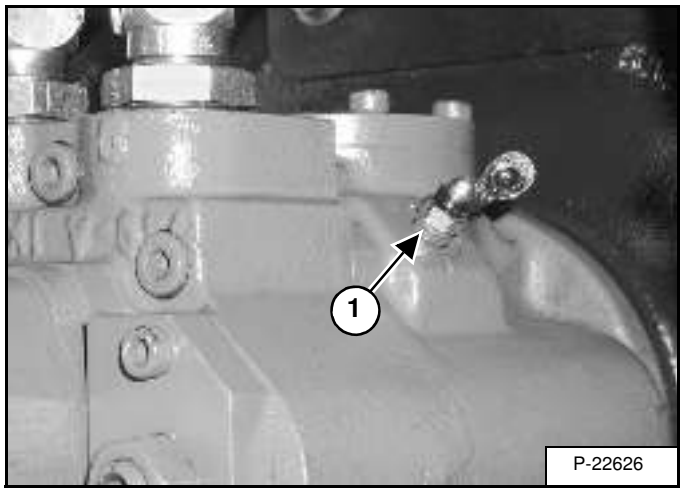


Remove the two bolts (Item 1) **[Figure 20-50-23]**.

Installation: Tighten the bolts to 78-85 ft.-lbs. (105-115 Nm) torque.

Pump Installation: Whenever the hydraulic system has been drained and refilled, the hydraulic pump must be purged of air.

Figure 20-50-24

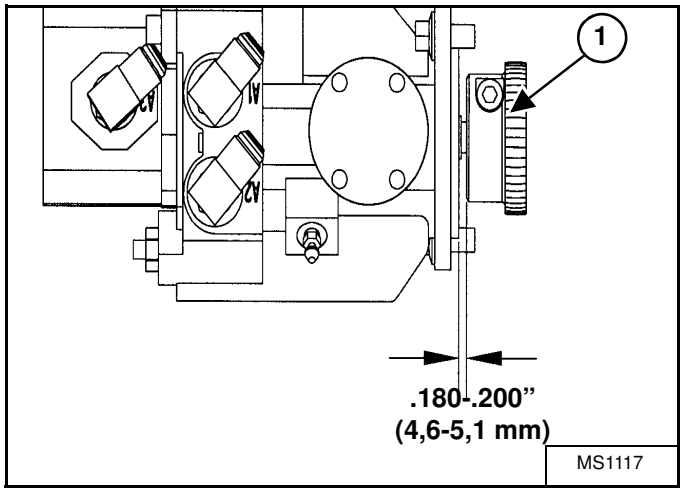


Open the bleed valve (Item 1) **[Figure 20-50-24]** on the hydraulic pump. Close the valve after a steady stream of hydraulic fluid free of any air drains from the valve.

Tighten the bleed valve.

Coupler Removal And Installation

Figure 20-50-25



Loosen the cap screw (Item 1) **[Figure 20-50-25]** from the coupler.

Slide the coupler off of the pump shaft.

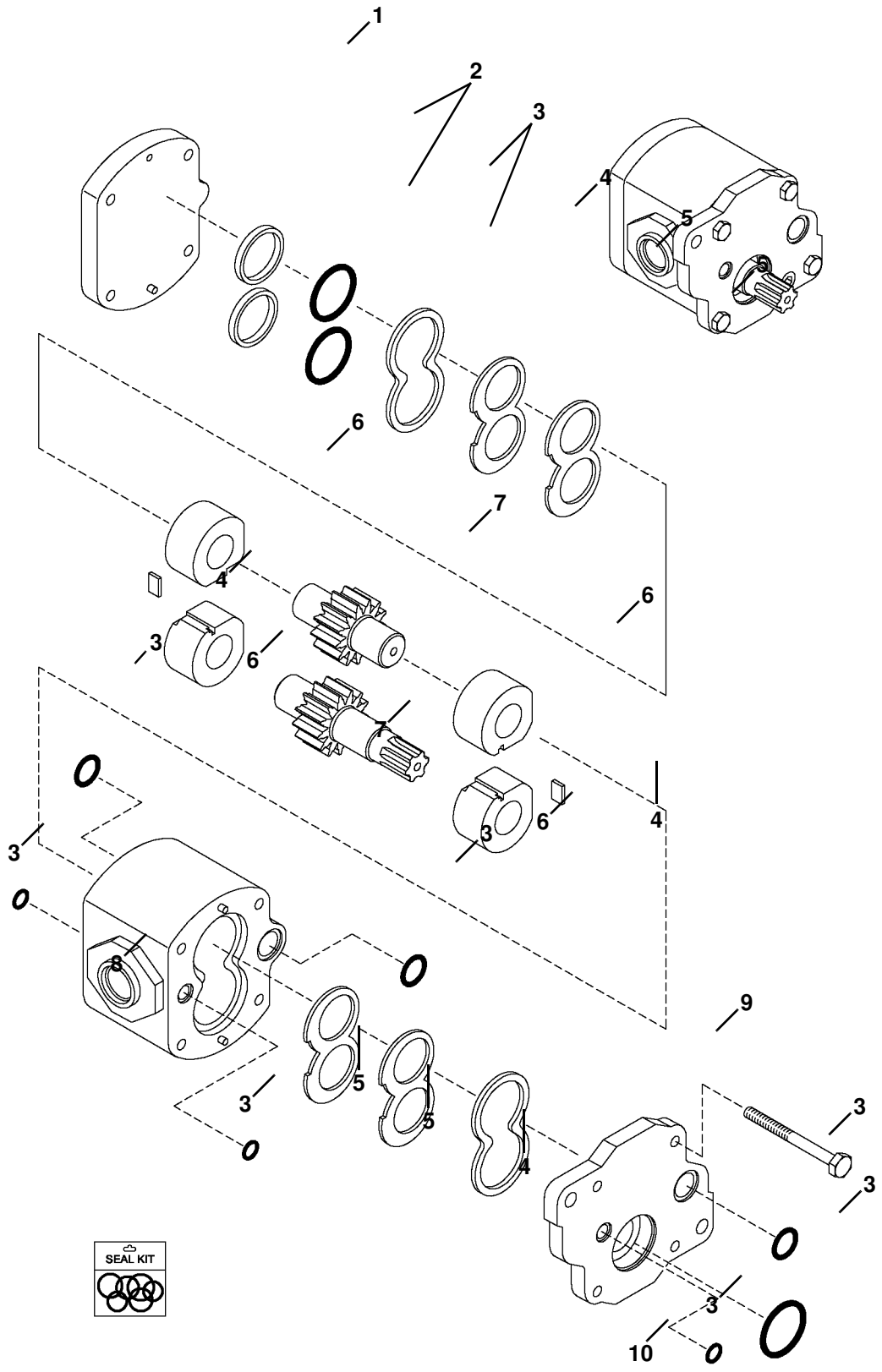
When installing the coupler, maintain .18-.20 inch (4,6-5,1 mm) gap from the pump mount flange to the coupler.

Tighten the cap screw (Item 1) **[Figure 20-50-25]** to 36-40 ft.-lbs. (49-54 Nm) torque.

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Gear Pump Parts Identification

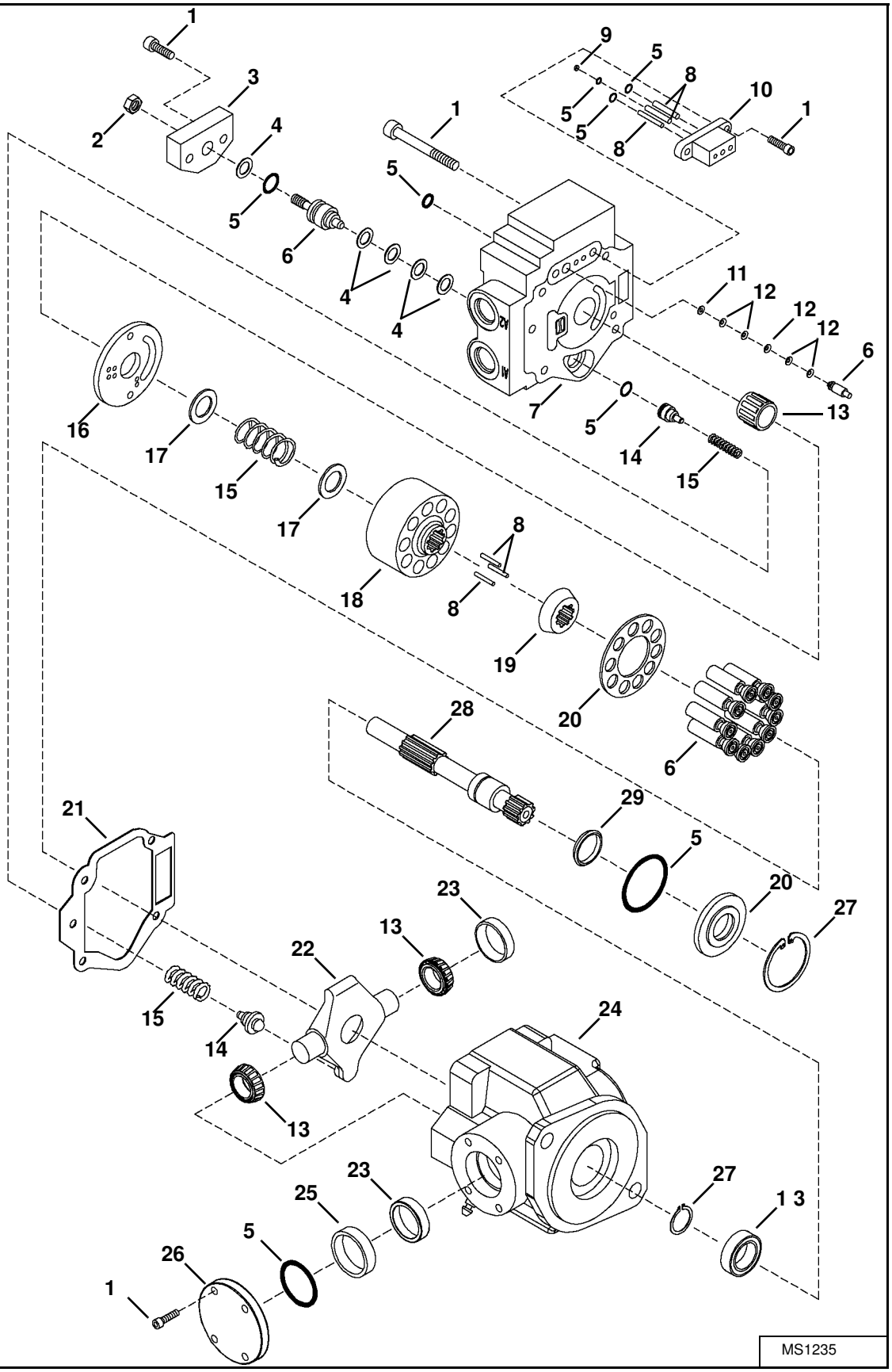
1. End Plate
2. Guide
3. O-Ring
4. Seal
5. Spacer
6. Bearing
7. Gear
8. Housing
9. Port Plate
10. Bolt



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Piston Pump Parts Identification

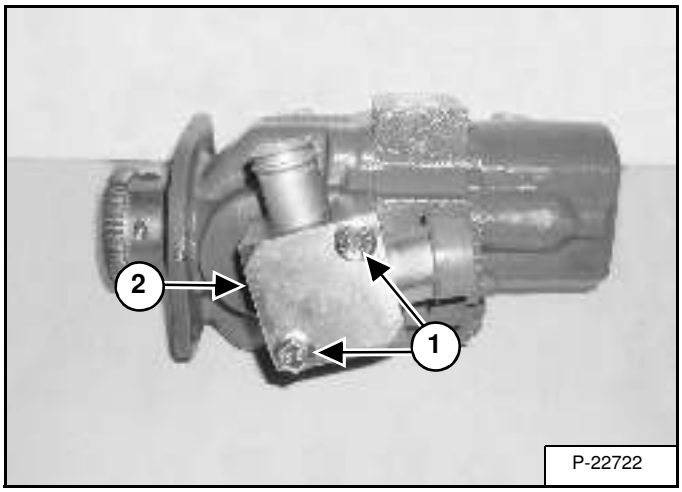
1. Bolt
2. Nut
3. Adjusting Plate
4. Shim
5. O-Ring
6. Piston
7. Face Plate
8. Pin
9. Poppet
10. Control Plate
11. Seat
12. Coned Spring
13. Bearing
14. Spring Guide
15. Spring
16. Port Plate
17. Washer
18. Cylinder Block
19. Retainer
20. Retainer Plate
21. Gasket
22. Swash Plate
23. Bearing Race
24. Housing
25. Spacer
26. Side Plate
27. Snap Ring
28. Drive Shaft
29. Seal



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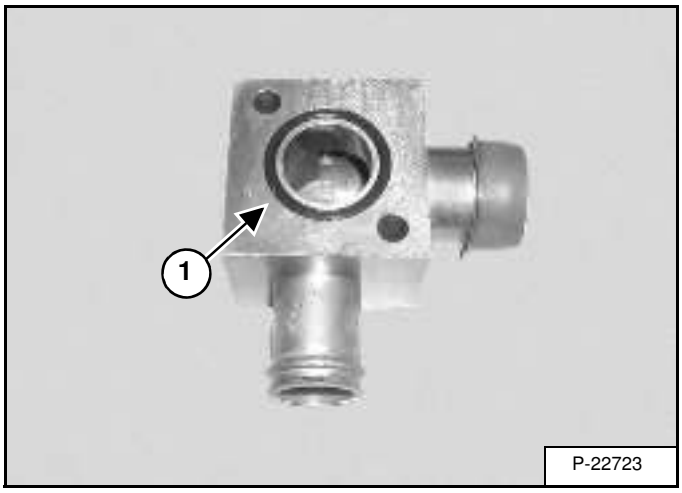
Disassembly

Figure 20-50-26



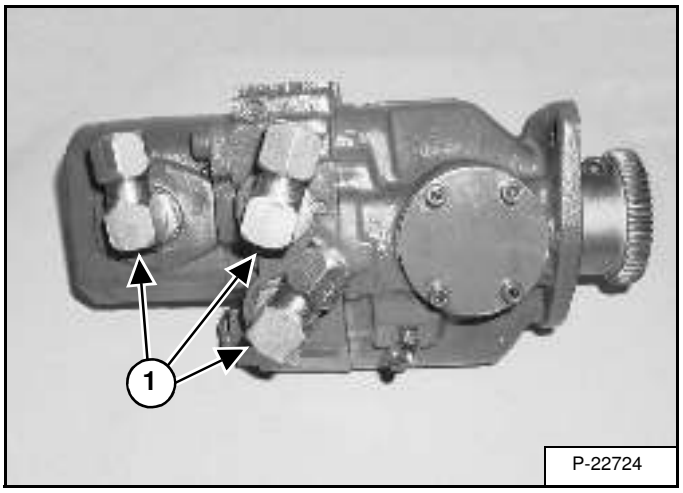
Remove the two bolts (Item 1) and the fitting (Item 2) **[Figure 20-50-26]**.

Figure 20-50-27



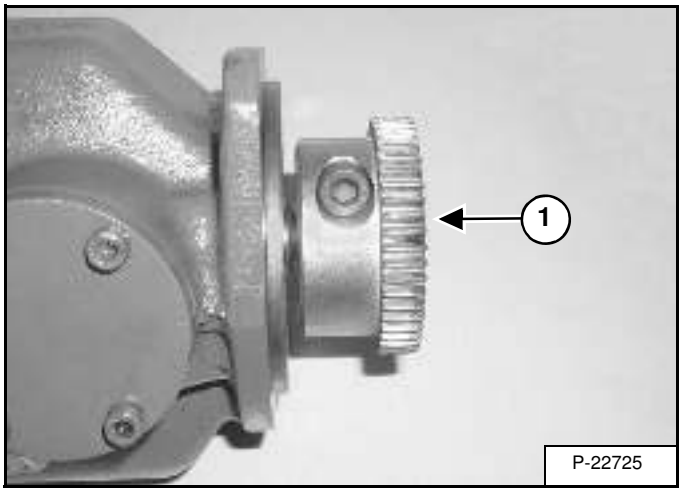
Remove the O-ring (Item 1) **[Figure 20-50-27]** from the fitting.

Figure 20-50-28



Remove the three fittings (Item 1) **[Figure 20-50-28]**.

Figure 20-50-29



Remove the coupler (Item 1) **[Figure 20-50-29]**.

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Gear Pump Disassembly

IMPORTANT

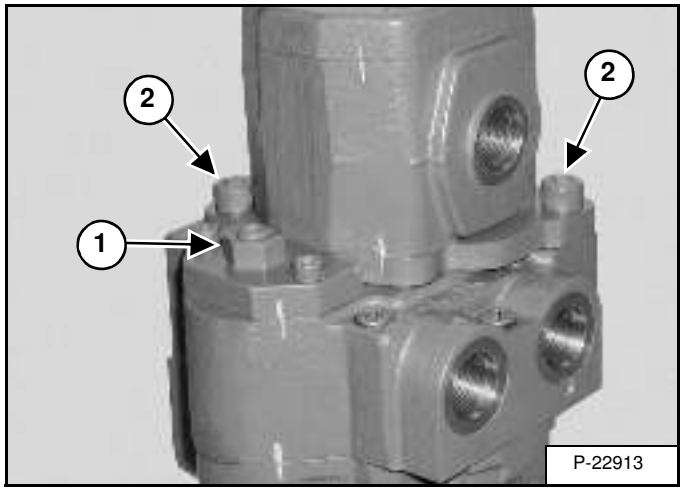
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tube lines and ports to keep dirt out. Dirt can quickly damage the system.

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Prior to disassembly:

Clean the outside of the pump select a clean environment and handle the parts with care. Mark the pump housing for ease of assembly.

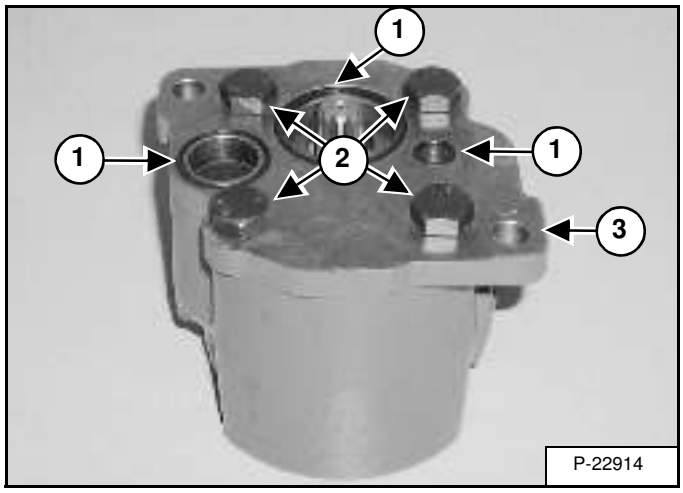
Figure 20-50-30



NOTE: Do not turn the adjusting screw (Item 1) [Figure 20-50-30] unless necessary. The pressure setting may be changed causing damage to the hydraulic system.

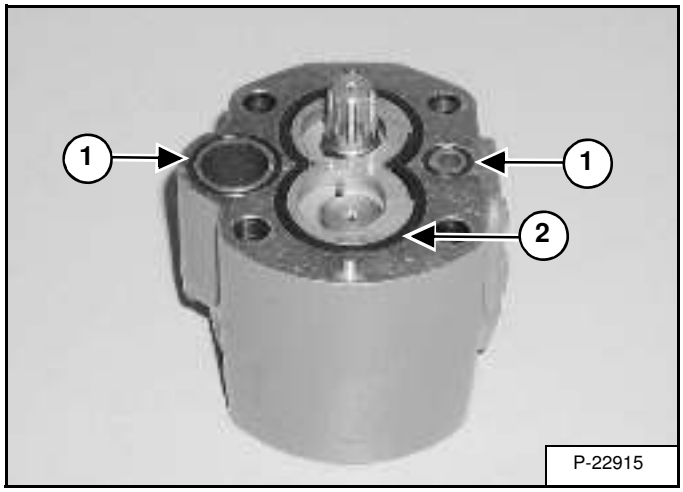
Remove the two socket head screws (Item 2) **[Figure 20-50-30]** and remove the gear pump.

Figure 20-50-31



Remove the O-rings (Item 1) and four bolts (Item 2). Remove the port plate (Item 3) **[Figure 20-50-31]**.

Figure 20-50-32

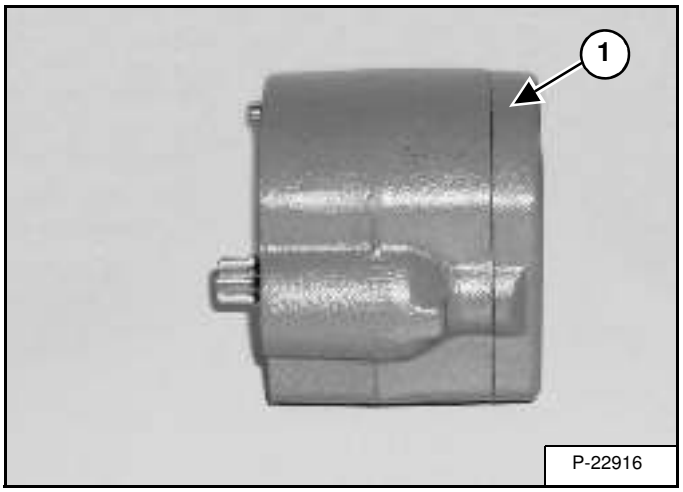


Remove the O-rings (Item 1) and seal (Item 2) **[Figure 20-50-32]** from the pump housing.

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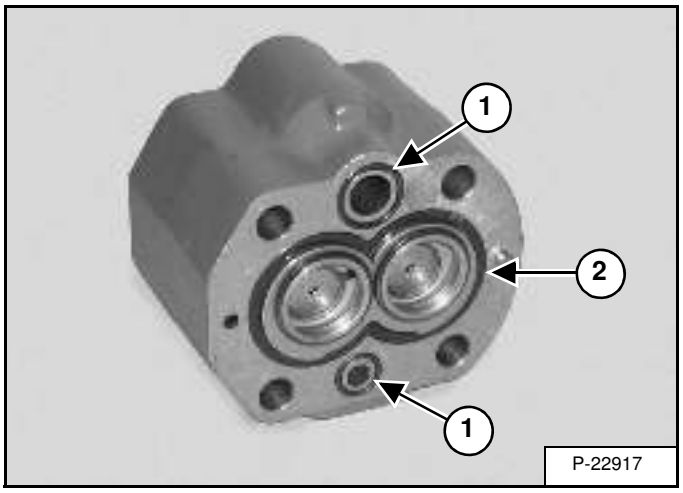
Gear Pump Disassembly (Cont'd)

Figure 20-50-33



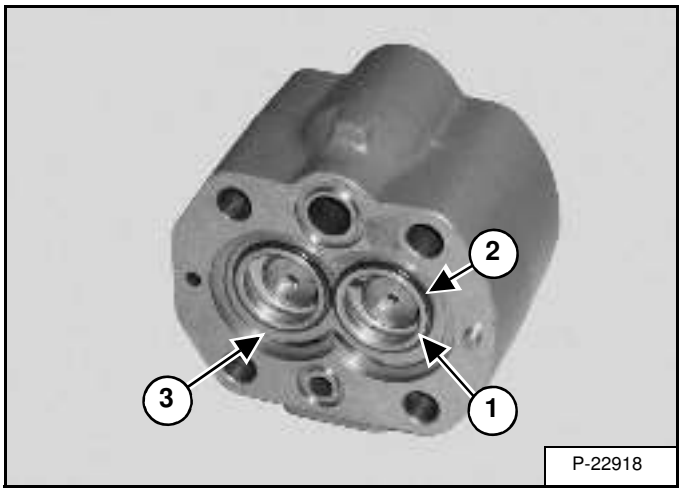
Remove the end plate (Item 1) **[Figure 20-50-33]** from the pump housing.

Figure 20-50-34



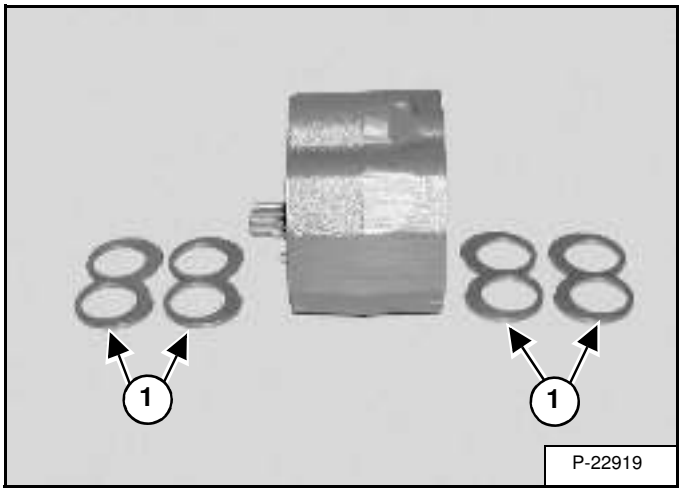
Remove the O-rings (Item 1) and seal (Item 2) **[Figure 20-50-34]** from the pump housing.

Figure 20-50-35



Remove the guides (Item 1) and O-rings (Item 2) from the spacers (Item 3) **[Figure 20-50-35]**.

Figure 20-50-36

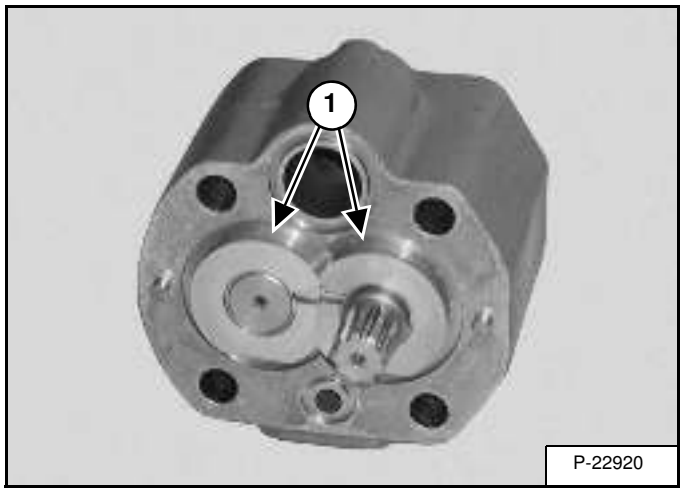


Remove the spacers (Item 1) **[Figure 20-50-36]**, two on each end, from the pump housing.

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Gear Pump Disassembly (Cont'd)

Figure 20-50-37



Remove the gear assembly (Item 1) **[Figure 20-50-37]** from the pump housing.

Figure 20-50-38

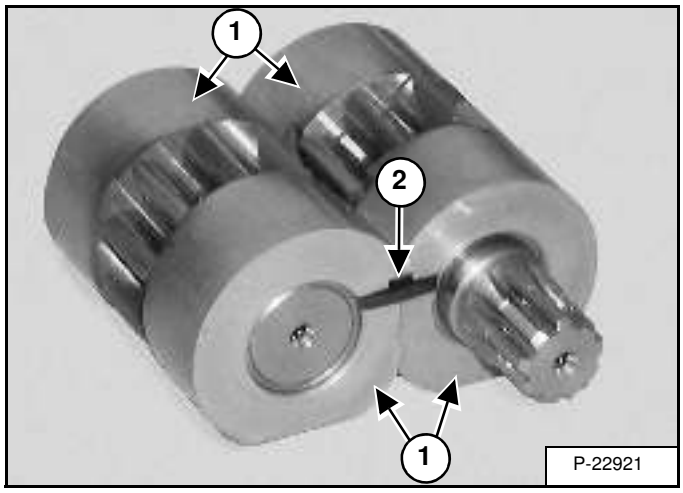
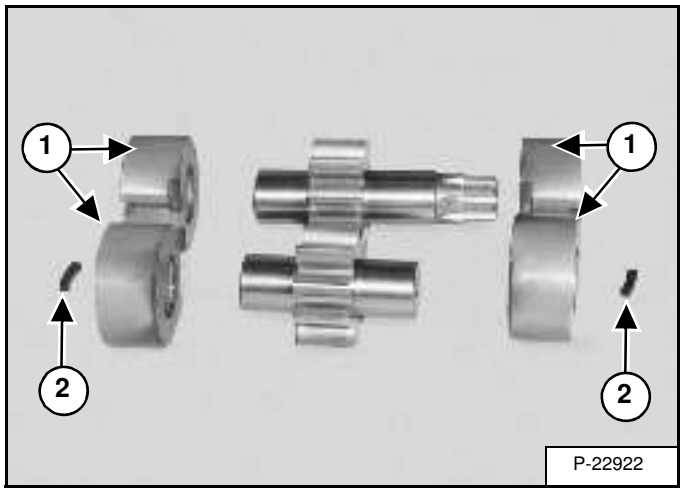


Figure 20-50-39



Remove the bearings (Item 1) **[Figure 20-50-38]** & **[Figure 20-50-39]** and seals (Item 2) **[Figure 20-50-38]** & **[Figure 20-50-39]** from the gear shafts.

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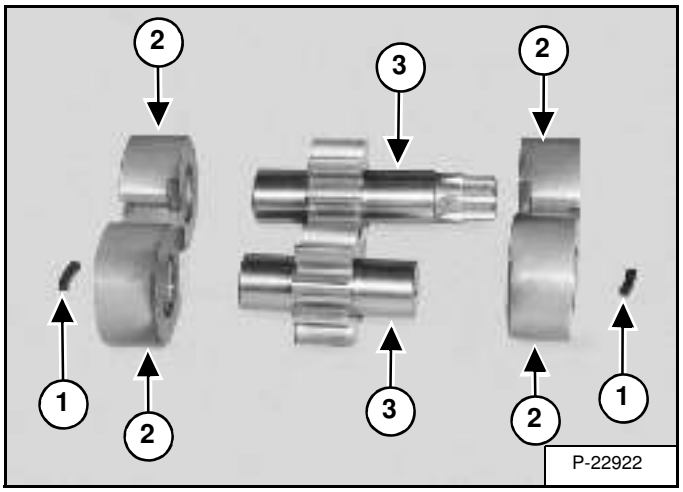
Gear Pump Assembly

Clean all parts in solvent and dry with compressed air.

Always use new seals and O-rings.

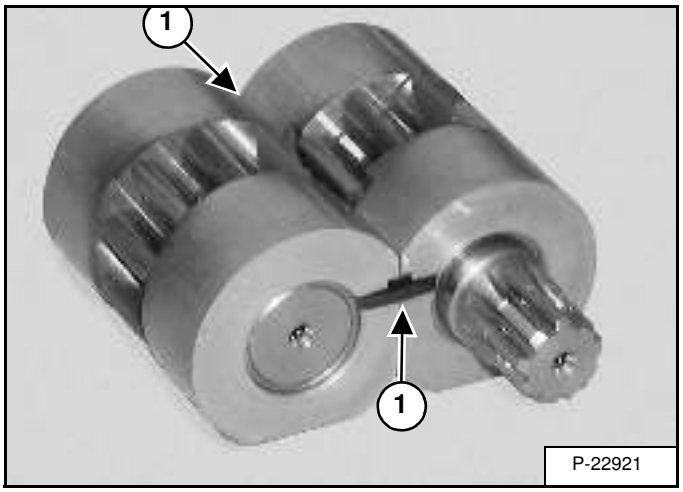
Lightly lubricate all parts with hydraulic oil before assembly.

Figure 20-50-40



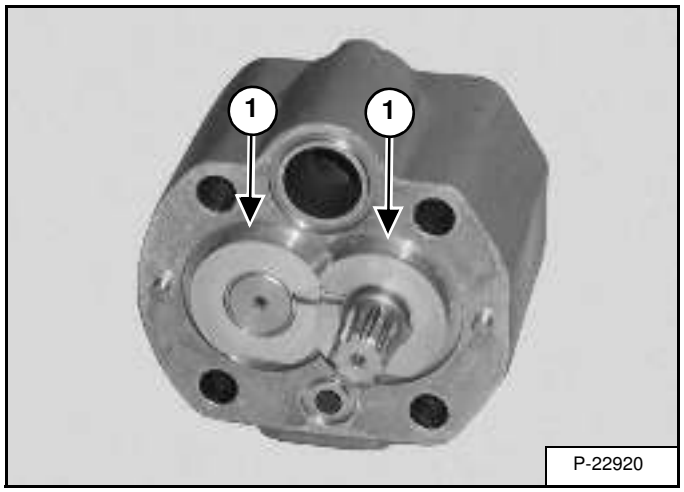
Install the bearings (Item 2) on the gear shafts (Item 3) **[Figure 20-50-40]**.

Figure 20-50-41



Install the seal (Item 1) **[Figure 20-50-40]** & **[Figure 20-50-41]** in the bearings.

Figure 20-50-42



Install the gear assembly (Item 1) **[Figure 20-50-42]** into the pump housing.

Figure 20-50-43

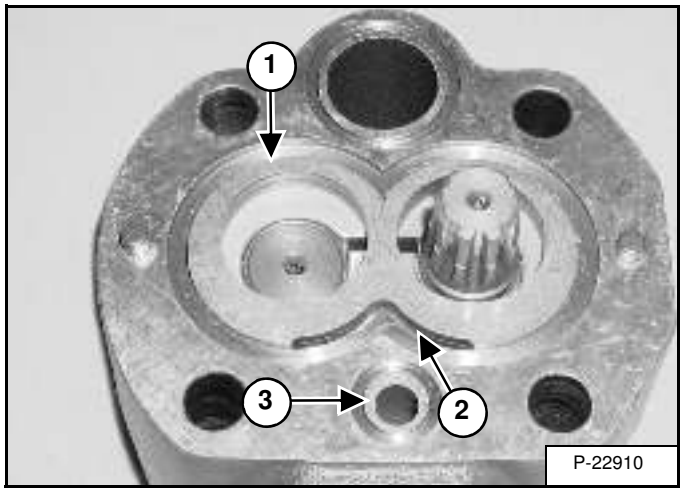
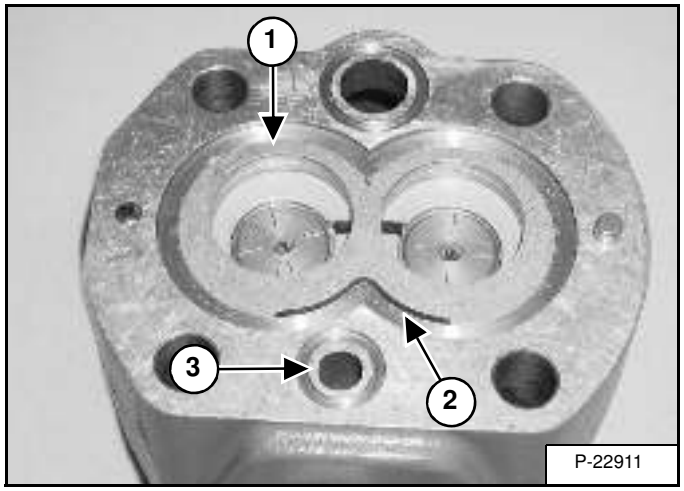


Figure 20-50-44



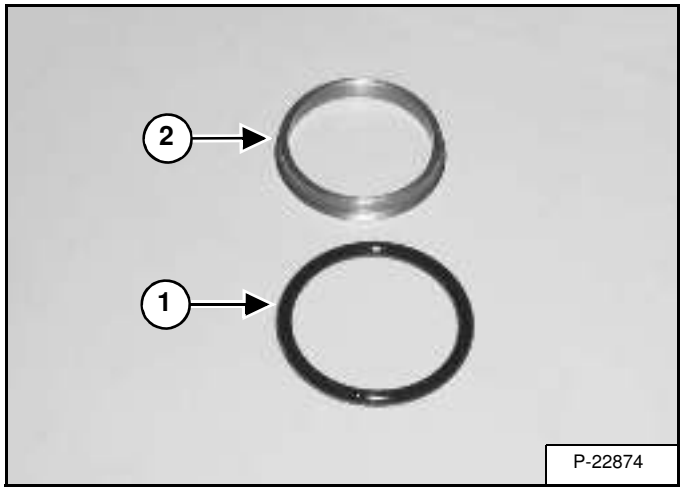
Dealer Copy -- Not for Resale

Gear Pump Assembly (Cont'd)

Install the spacers (Item 1) **[Figure 20-50-43 on Page 15]** & **[Figure 20-50-44 on Page 15]** with the notches (Item 2) **[Figure 20-50-43 on Page 15]** & **[Figure 20-50-44 on Page 15]** toward the pressure (small) port (Item 3) **[Figure 20-50-43 on Page 15]** & **[Figure 20-50-44 on Page 15]** of the pump housing.

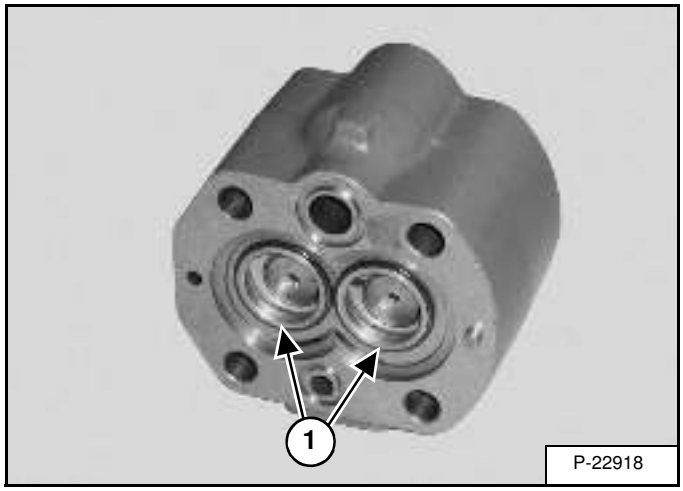
NOTE: There are two spacers on each side of the gear assembly.

Figure 20-50-45



Install the O-rings (Item 1) on the guides (Item 2) **[Figure 20-50-45]**.

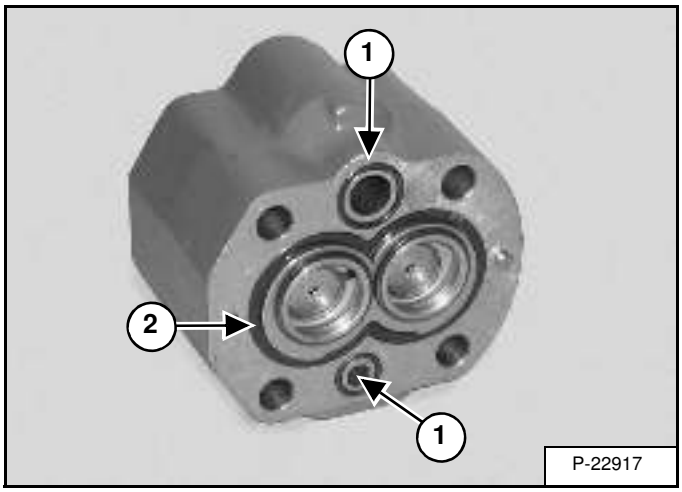
Figure 20-50-46



Install the guides with the O-rings installed (Item 1) **[Figure 20-50-46]** into the spacers (Item 1) **[Figure 20-50-44 on Page 15]**.

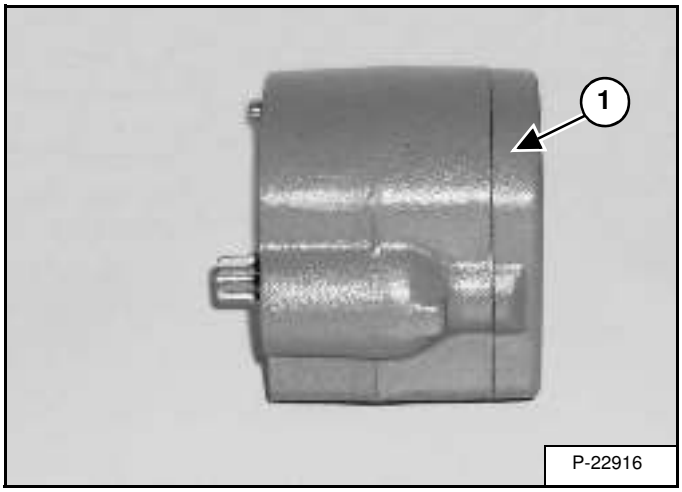
NOTE: The flanges on the guides must face out.

Figure 20-50-47



Install the O-rings (Item 1) and the seal (Item 2) **[Figure 20-50-47]** in the pump housing.

Figure 20-50-48

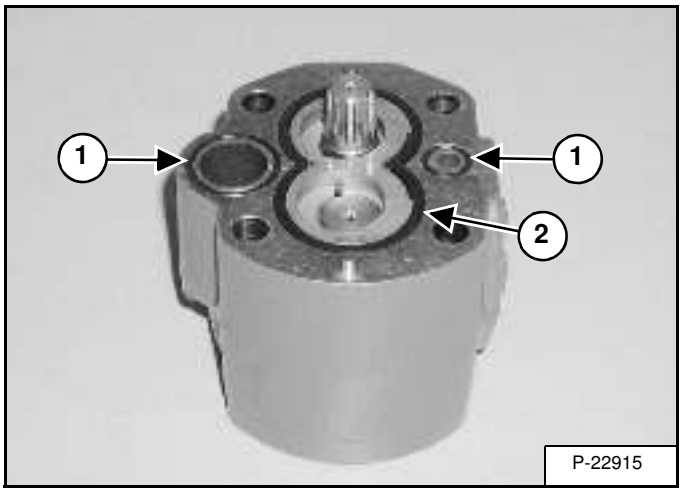


Install the end plate (Item 1) **[Figure 20-50-48]** on the pump housing.

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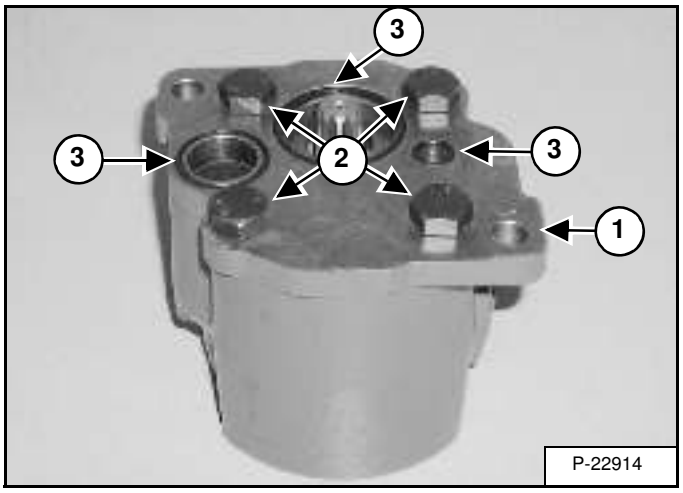
Gear Pump Assembly (Cont'd)

Figure 20-50-49



Install the O-rings (Item 1) and the seal (Item 2) **[Figure 20-50-49]** in the pump housing.

Figure 20-50-50

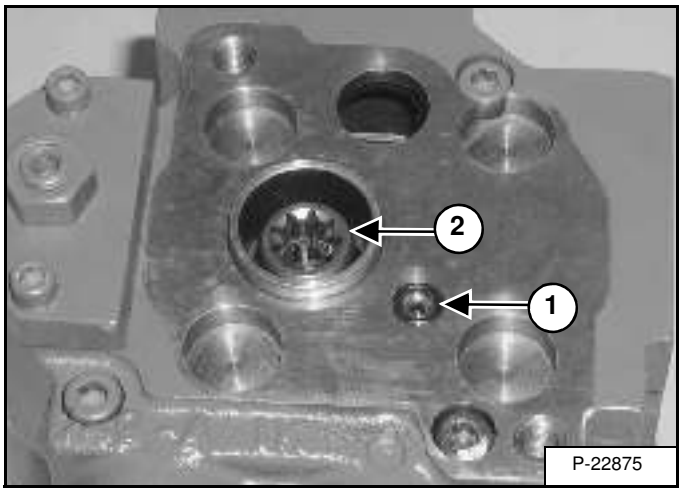


Install the face plate (Item 1) on the pump housing. Install the four bolts (Item 2) **[Figure 20-50-50]** and tighten to 41-47 ft.-lbs. (57-63 Nm) torque.

Install the O-rings (Item 3) **[Figure 20-50-50]** in the face plate.

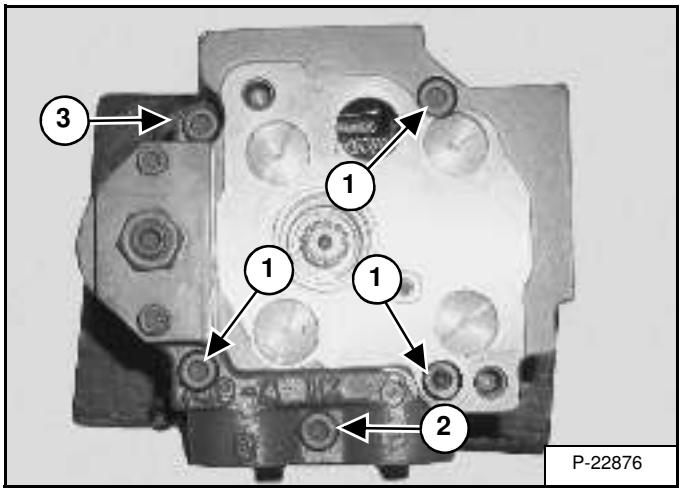
Piston Pump Disassembly

Figure 20-50-51



Remove the O-ring (Item 1) and coupler (Item 2) **[Figure 20-50-51]** from the face plate.

Figure 20-50-52

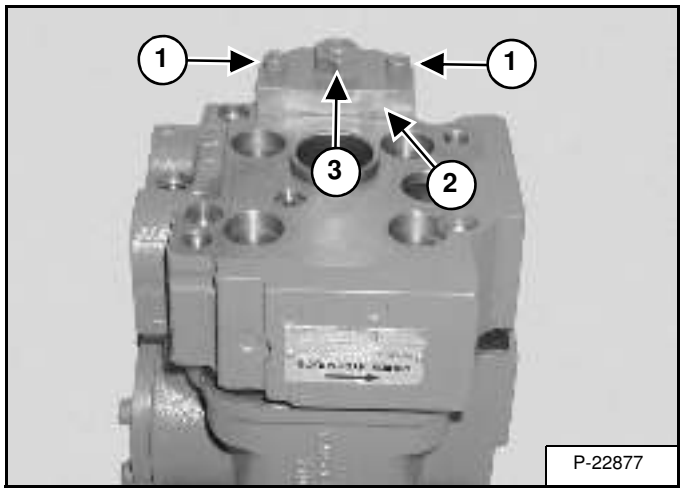


Remove the three long (Item 1), medium (Item 2) and short (Item 3) **[Figure 20-50-52]** socket head screws from the face plate.

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Piston Pump Disassembly (Cont'd)

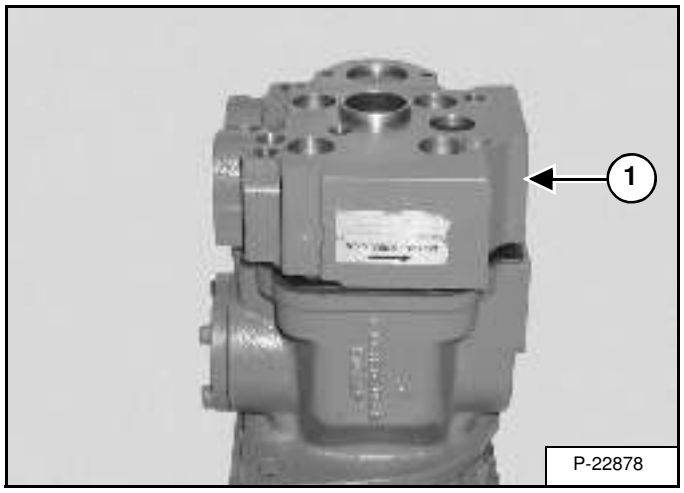
Figure 20-50-53



Remove the two socket head screws (Item 1) from the adjusting plate (Item 2) **[Figure 20-50-53]** and remove the adjusting plate.

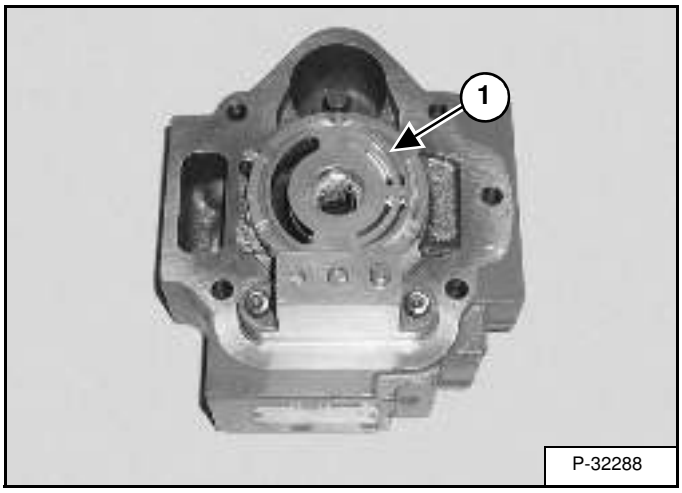
NOTE: Do not turn the adjusting screw (Item 3) [Figure 20-50-53]. The pressure setting may be changed causing damage to the hydraulic system.

Figure 20-50-54



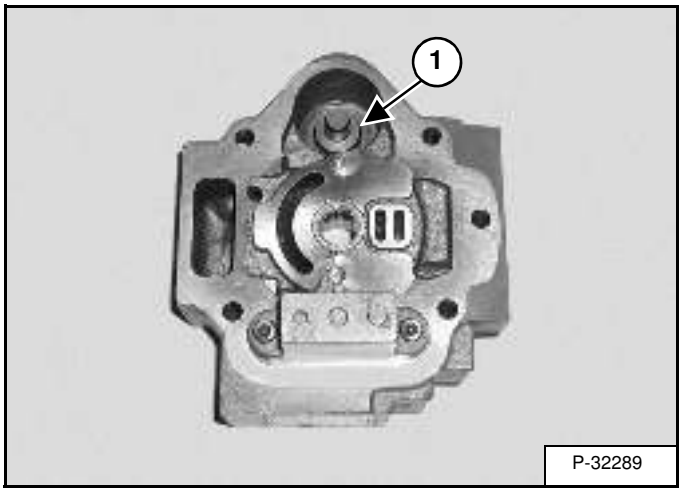
Remove the face plate (Item 1) **[Figure 20-50-54]** from the pump housing.

Figure 20-50-55



Remove the port plate (Item 1) **[Figure 20-50-55]**.

Figure 20-50-56

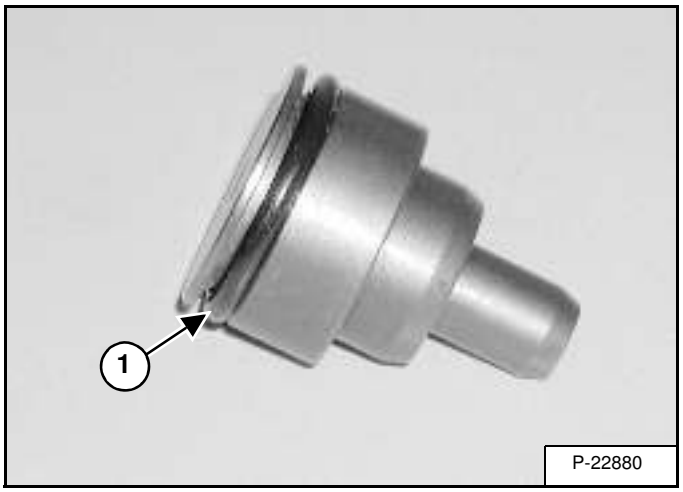


Remove the piston (Item 1) **[Figure 20-50-56]** from the face plate.

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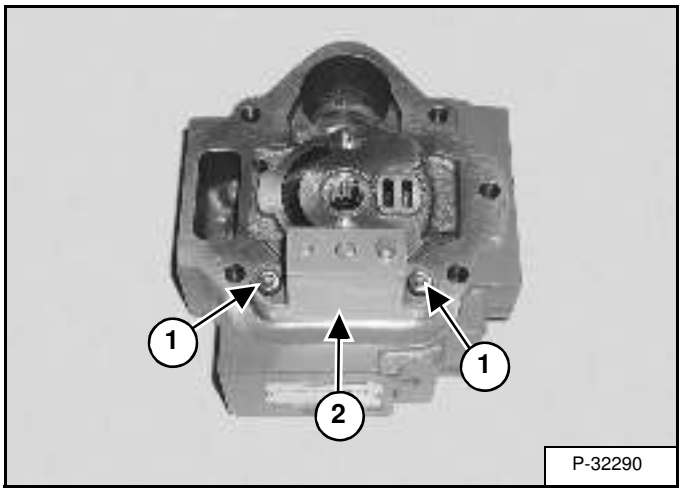
Piston Pump Disassembly (Cont'd)

Figure 20-50-57



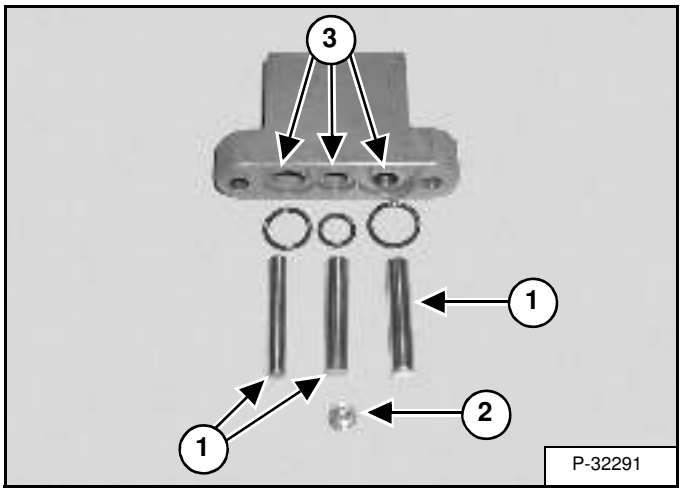
Remove the O-ring (Item 1) **[Figure 20-50-57]** from the piston.

Figure 20-50-58



Remove the two socket head screws (Item 1) from the control block (Item 2) **[Figure 20-50-58]** and remove the control block.

Figure 20-50-59



Remove the pins (Item 1), poppet (Item 2) and O-rings (Item 3) **[Figure 20-50-59]** from the control block.

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Piston Pump Disassembly (Cont'd)

Figure 20-50-60

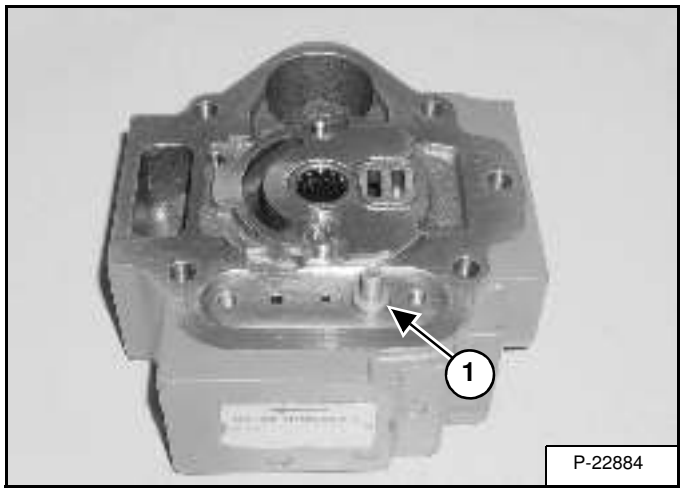
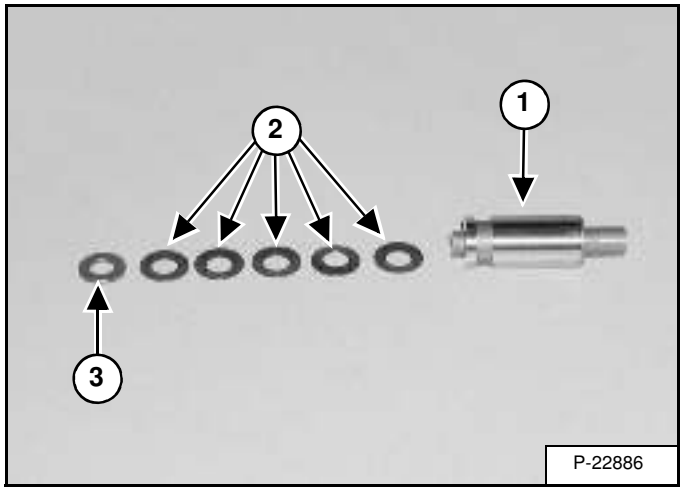
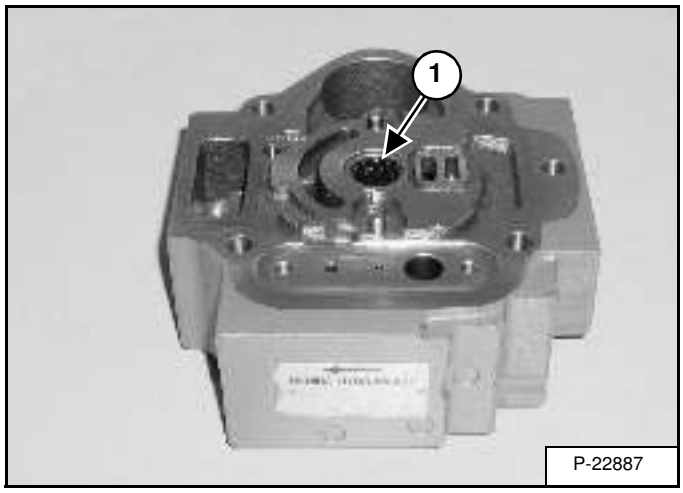


Figure 20-50-61



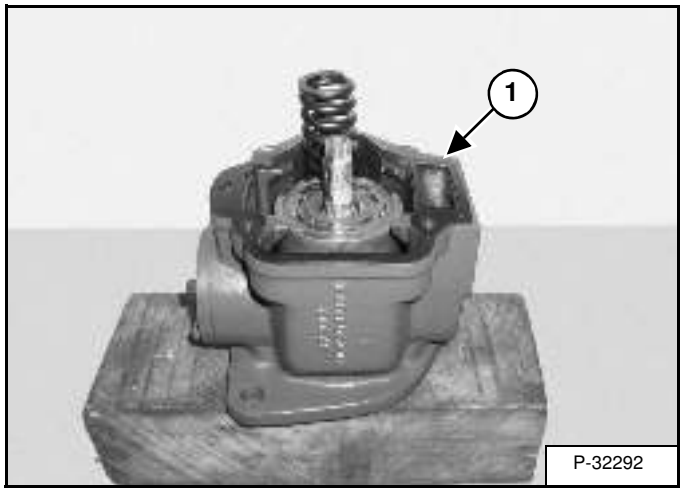
Remove the piston (Item 1) **[Figure 20-50-60]** & **[Figure 20-50-61]**, coned disc springs (Item 2) **[Figure 20-50-61]** and spring seat (Item 3) **[Figure 20-50-61]** from the face plate.

Figure 20-50-62



Remove the needle bearing (Item 1) **[Figure 20-50-62]** from the face plate.

Figure 20-50-63

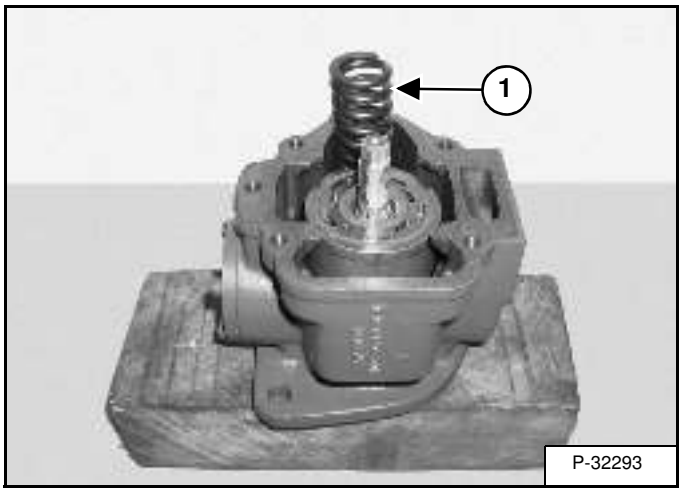


Remove the gasket (Item 1) **[Figure 20-50-63]** from the pump housing.

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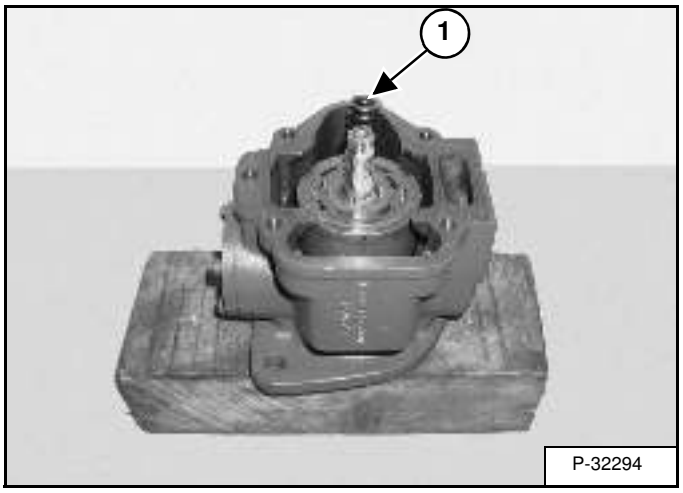
Piston Pump Disassembly (Cont'd)

Figure 20-50-64



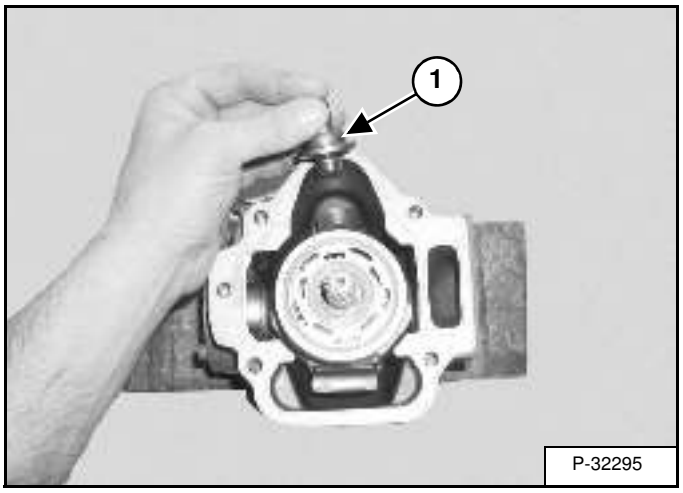
Remove the large spring (Item 1) **[Figure 20-50-64]**.

Figure 20-50-65



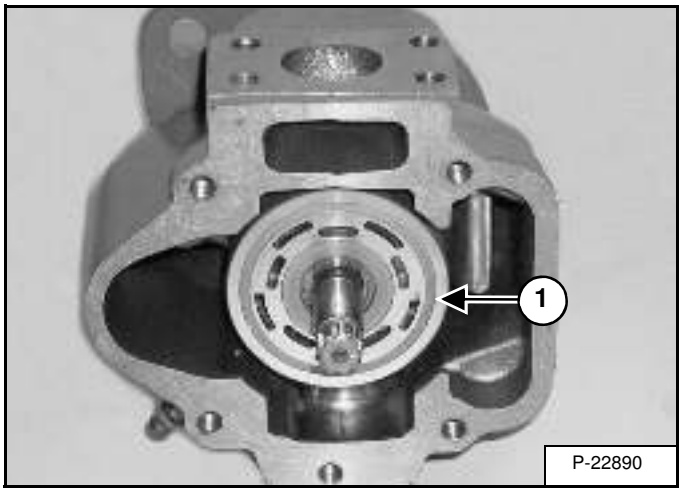
Remove the small spring (Item 1) **[Figure 20-50-65]**.

Figure 20-50-66



Remove the spring guide (Item 1) **[Figure 20-50-66]**.

Figure 20-50-67



Lay the pump assembly on its side and remove the rotating group (Item 1) **[Figure 20-50-67]**.

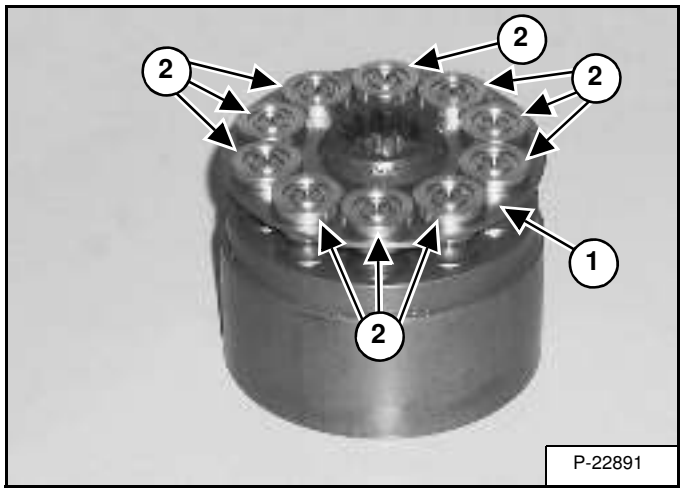
NOTE: The following procedure shown is to disassemble the rotating group for inspection only. The rotating group parts cannot be ordered separately and must be ordered as an assembly.

NOTE: Check for scratches or damage on the sliding surfaces.

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Piston Pump Disassembly (Cont'd)

Figure 20-50-68



Remove the retainer plate (Item 1) and pistons (Item 2) **[Figure 20-50-68]** from the cylinder block.

Figure 20-50-69

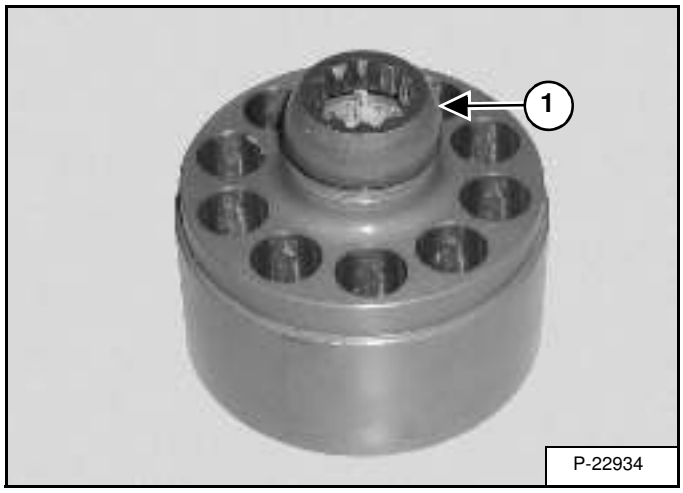
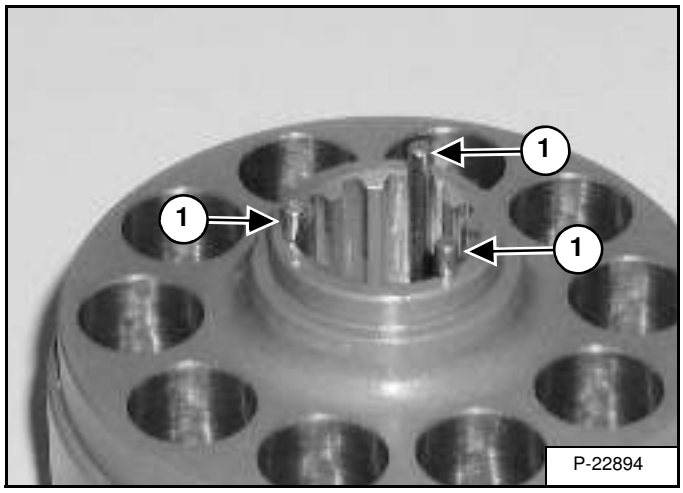
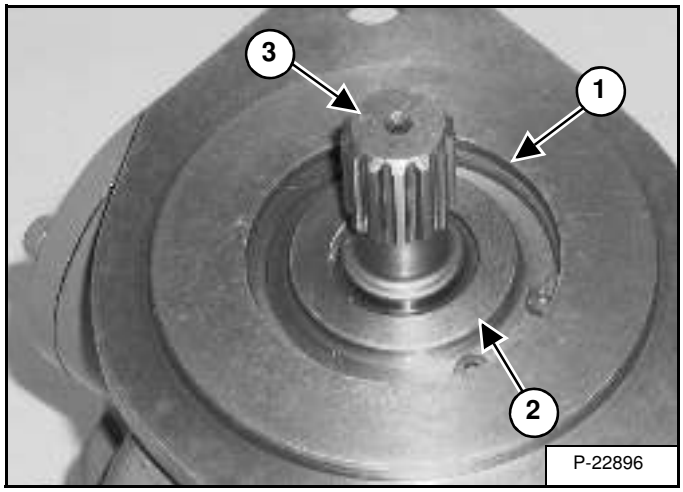


Figure 20-50-70



Remove the retainer (Item 1) **[Figure 20-50-69]** and pins (Item 1) **[Figure 20-50-70]** from the cylinder block.

Figure 20-50-71

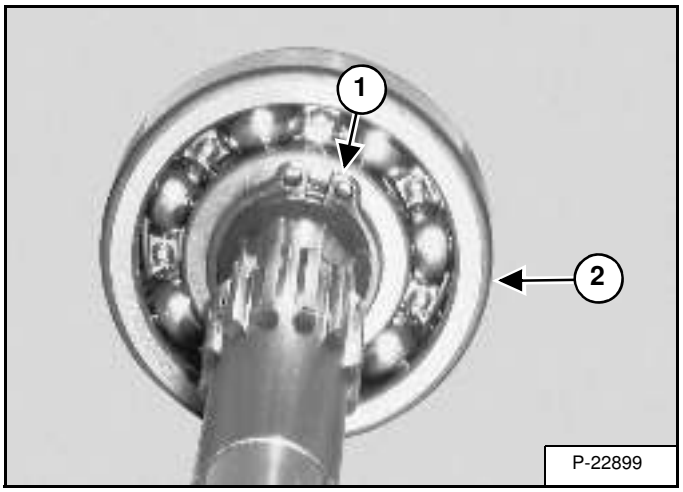


Remove the snap ring (Item 1) cap (Item 2) and shaft (Item 3) **[Figure 20-50-71]** from the pump housing.

Dealer Copy -- Not for Resale

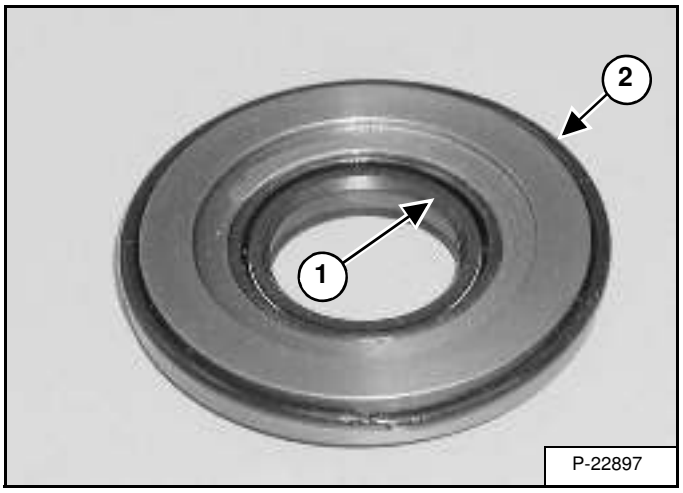
Piston Pump Disassembly (Cont'd)

Figure 20-50-72



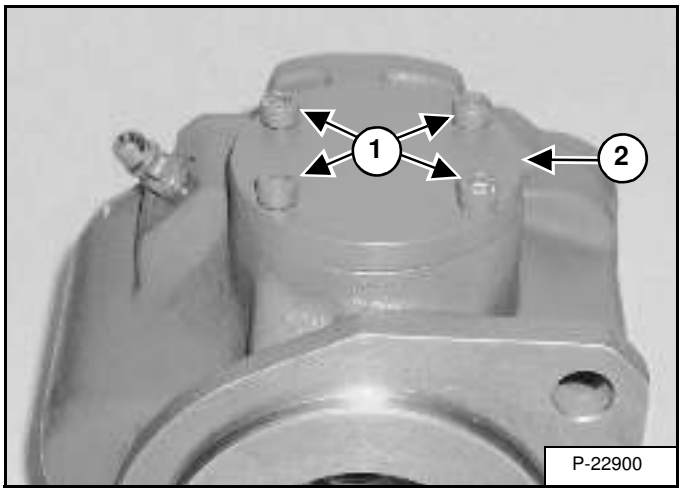
Remove the snap ring (Item 1) and bearing (Item 2) **[Figure 20-50-72]** from the shaft.

Figure 20-50-73



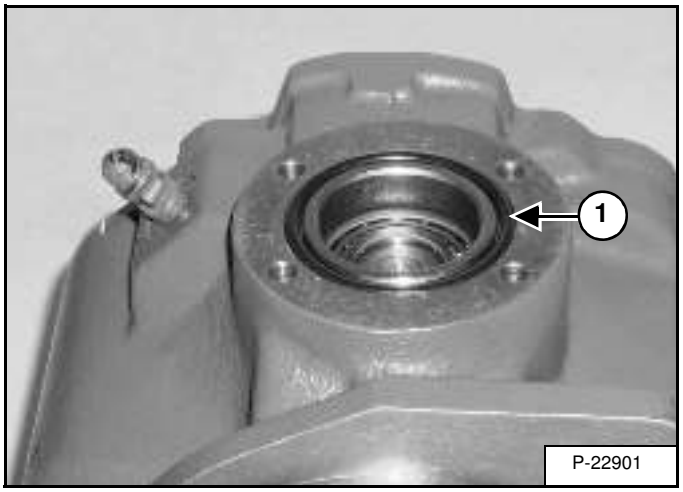
Remove the seal (Item 1) and O-ring (Item 2) **[Figure 20-50-73]** from the cap.

Figure 20-50-74



Remove the four bolts (Item 1) from the side plate (Item 2) **[Figure 20-50-74]** and remove the slide plate.

Figure 20-50-75

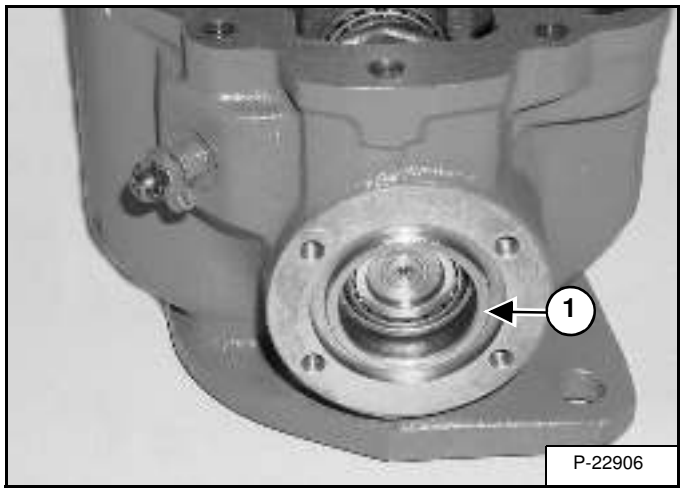


Remove the O-ring (Item 1) **[Figure 20-50-75]** from the pump housing.

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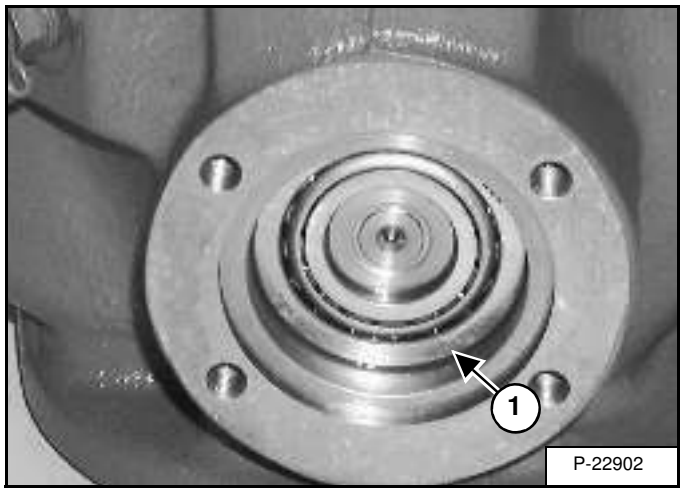
Piston Pump Disassembly (Cont'd)

Figure 20-50-76



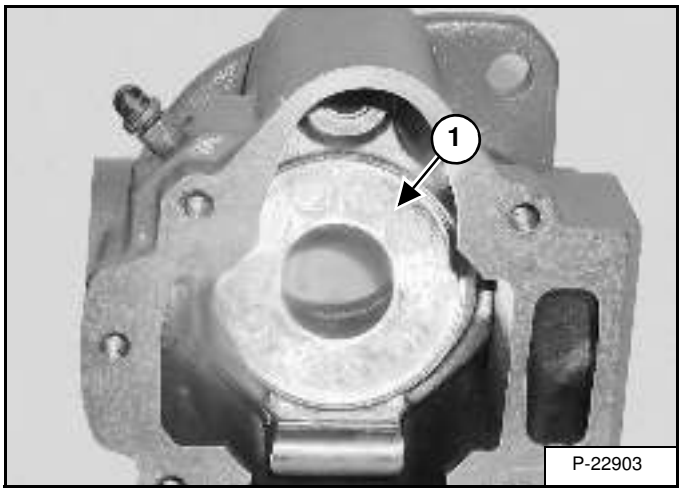
Remove the spacer (Item 1) **[Figure 20-50-76]**.

Figure 20-50-77



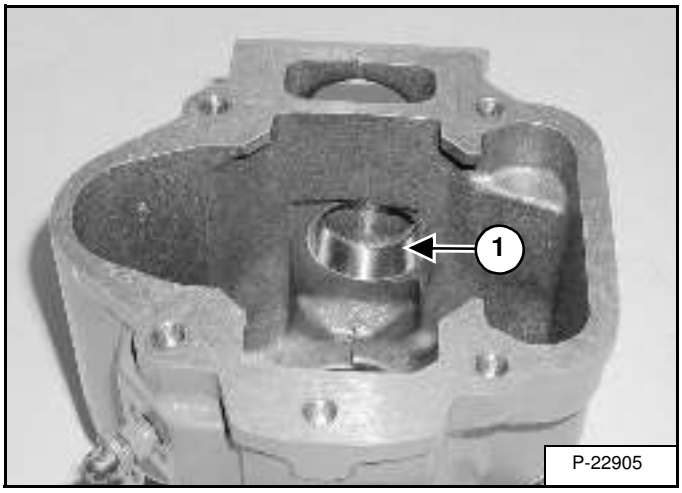
Remove the bearing race (Item 1) **[Figure 20-50-77]**.

Figure 20-50-78



Remove the swash plate (Item 1) **[Figure 20-50-78]**.

Figure 20-50-79

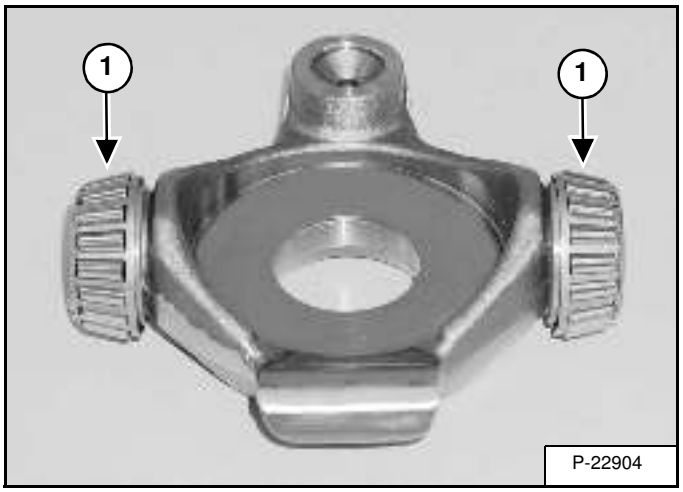


Remove the bearing race (Item 1) **[Figure 20-50-79]** from the pump housing.

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Piston Pump Disassembly (Cont'd)

Figure 20-50-80



Remove the bearings (Item 1) **[Figure 20-50-80]** from the swash plate.

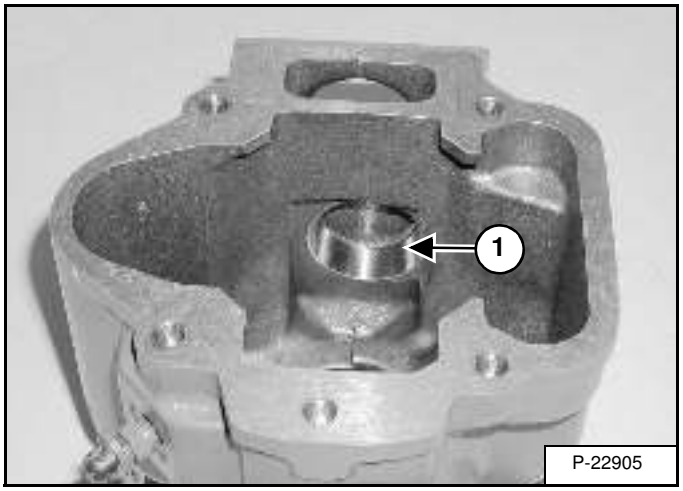
Piston Pump Assembly

Clean all parts in solvent and air dry. Do not use compressed air to dry the bearings.

Always install new seals and O-rings.

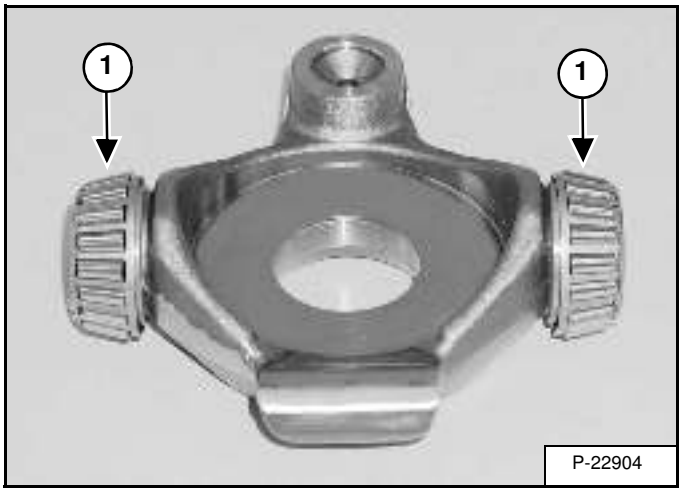
Apply a thin coat of hydraulic fluid to all components before assembly.

Figure 20-50-81



Install the bearing race (Item 1) **[Figure 20-50-81]** in the pump housing.

Figure 20-50-82

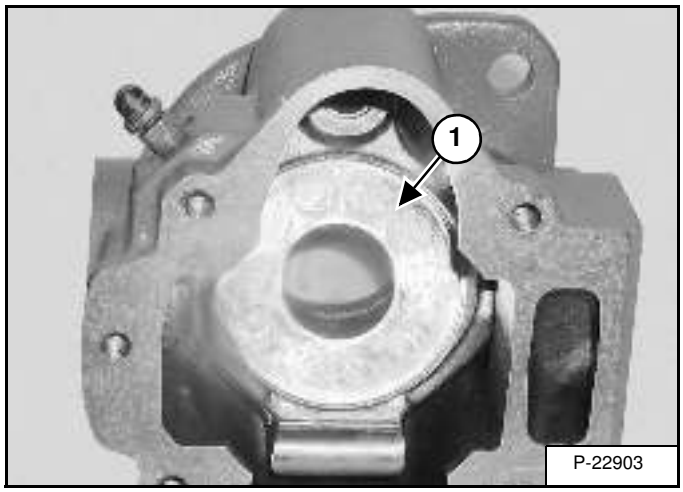


Install the bearings (Item 1) **[Figure 20-50-82]** on the swash plate.

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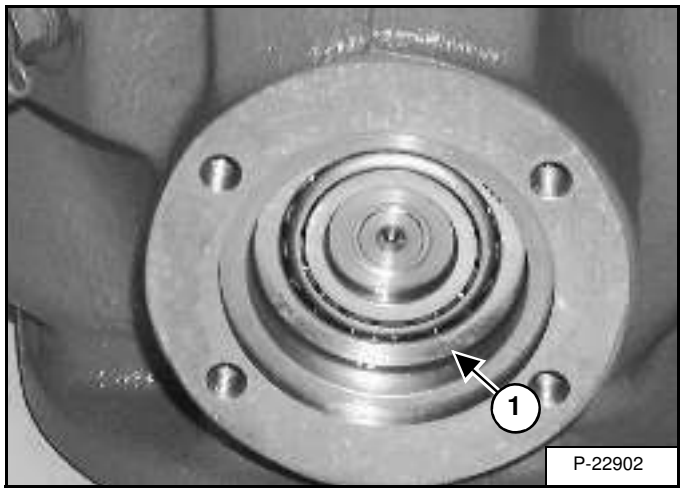
Piston Pump Assembly (Cont'd)

Figure 20-50-83



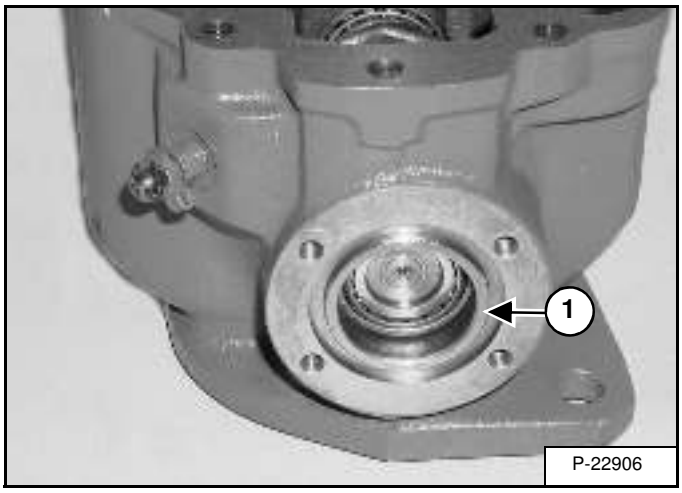
Install the swash plate (Item 1) **[Figure 20-50-83]** in the pump housing.

Figure 20-50-84



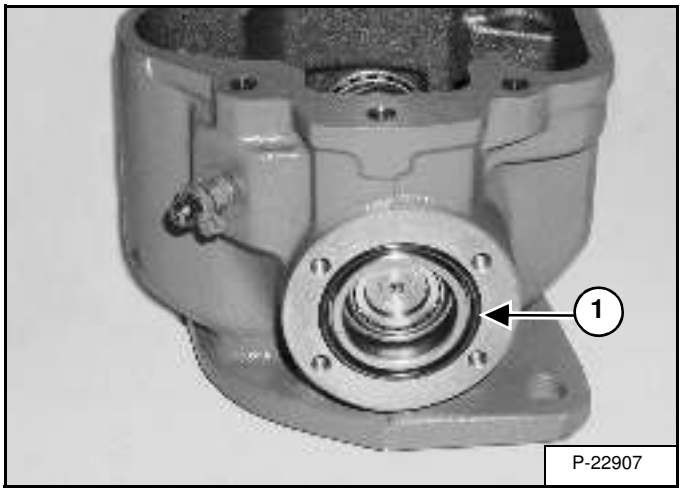
Install the race (Item 1) **[Figure 20-50-84]** in the pump housing.

Figure 20-50-85



Install the spacer (Item 1) **[Figure 20-50-85]** in the pump housing.

Figure 20-50-86

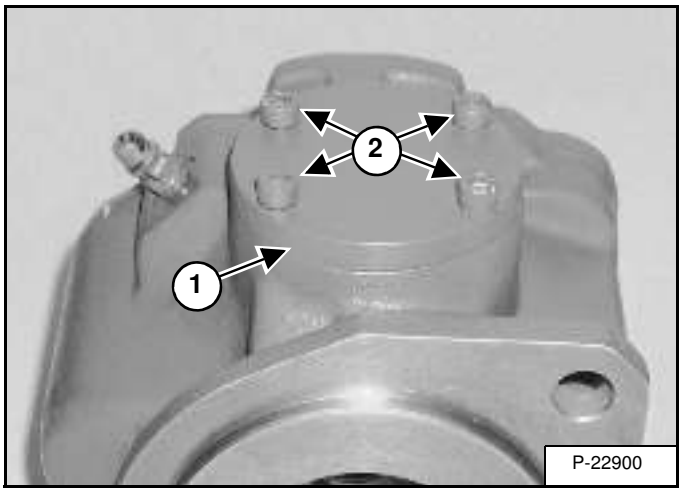


Install the O-ring (Item 1) **[Figure 20-50-86]** on the bearing housing.

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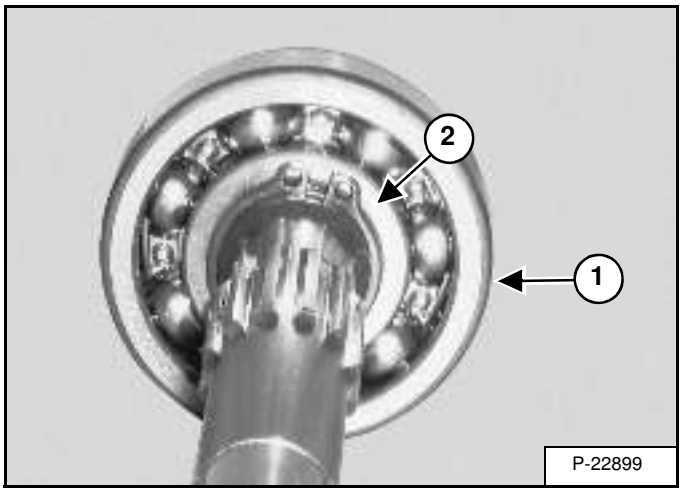
Piston Pump Assembly (Cont'd)

Figure 20-50-87



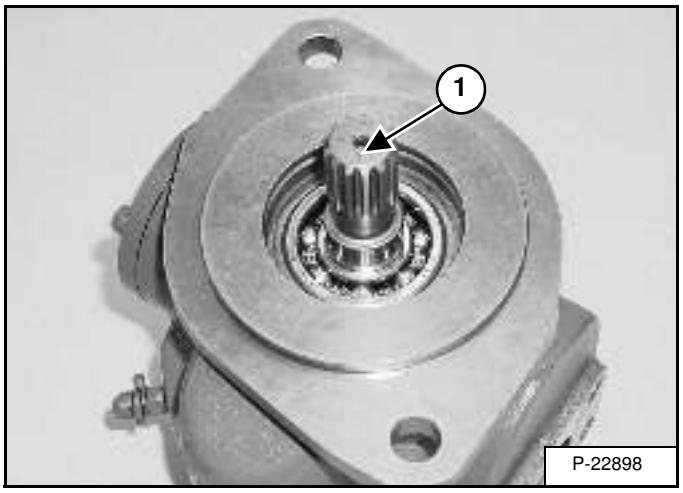
Install the side plate (Item 1) with four bolts (Item 2) **[Figure 20-50-87]** and tighten to 9-11 ft.-lbs. (12-15 Nm) torque.

Figure 20-50-88



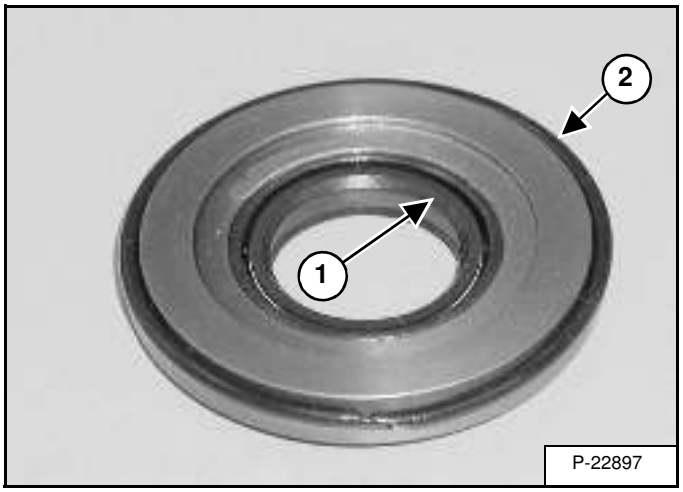
Install the bearing (Item 1) and snap ring (Item 2) **[Figure 20-50-88]** on the shaft.

Figure 20-50-89



Install the shaft (Item 1) **[Figure 20-50-89]** in the pump housing.

Figure 20-50-90

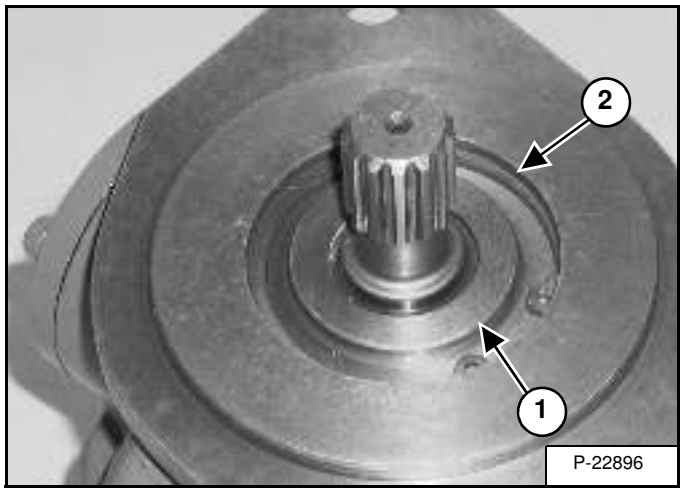


Install the seal (Item 1) and O-ring (Item 2) **[Figure 20-50-90]** on the end plate.

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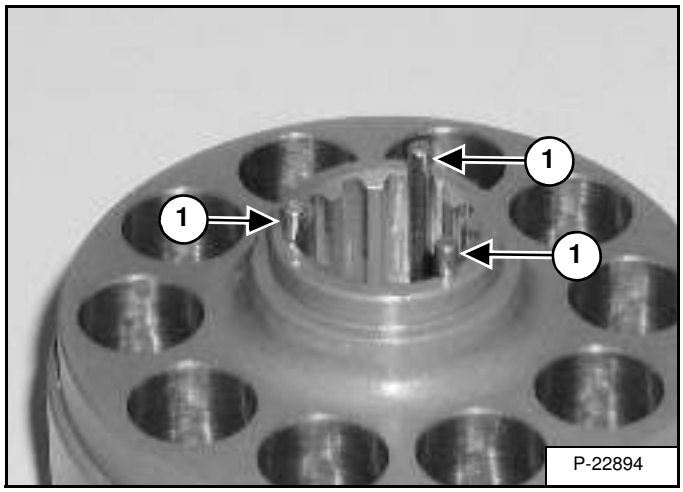
Piston Pump Assembly (Cont'd)

Figure 20-50-91



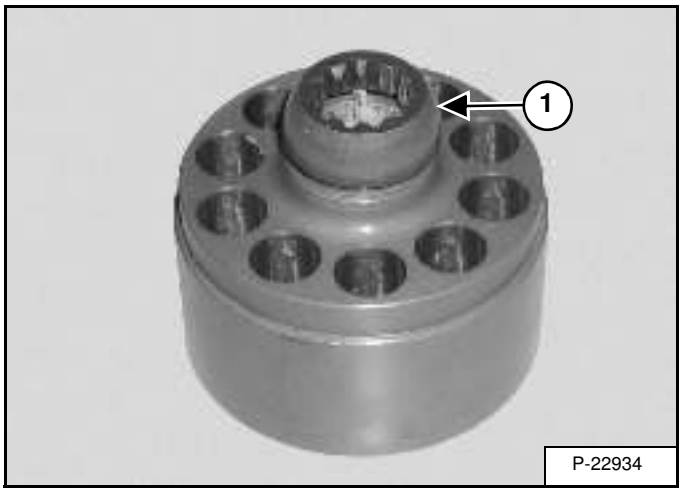
Install the end plate (Item 1) in the pump housing with the O-ring toward the inside of the pump housing and install the snap ring (Item 2) **[Figure 20-50-91]**.

Figure 20-50-92



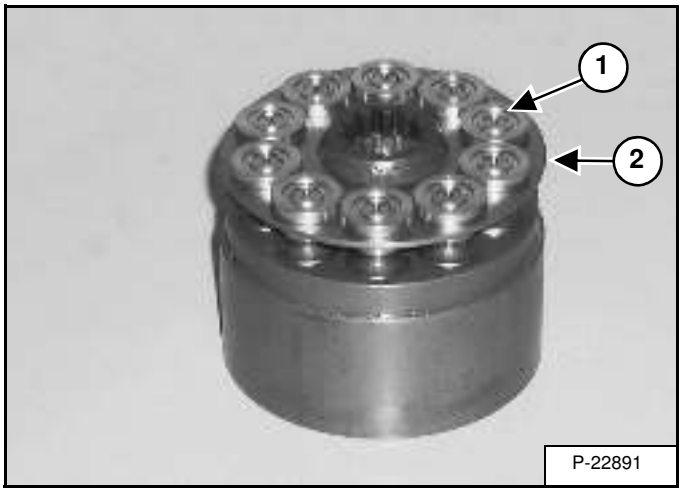
Install the three pins (Item 1) **[Figure 20-50-92]** in the cylinder block.

Figure 20-50-93



Install the retainer (Item 1) **[Figure 20-50-93]** on the pins.

Figure 20-50-94



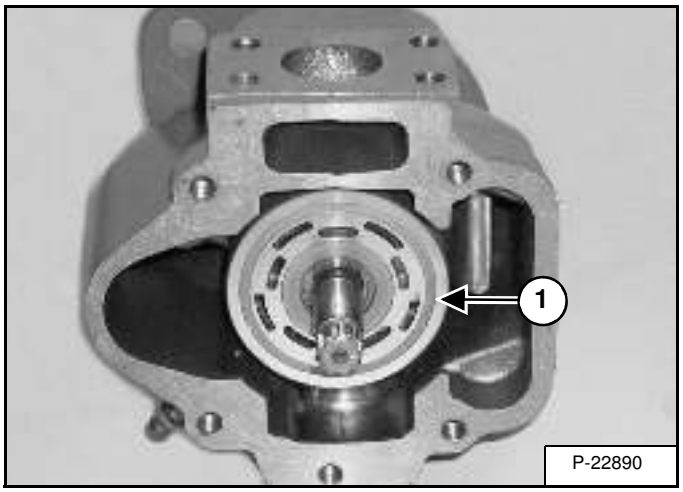
Install the retainer and piston assembly (Item 1) in the cylinder block (Item 2) **[Figure 20-50-94]**.

NOTE: It is NOT important that the pistons be installed in their original positions.

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Piston Pump Assembly (Cont'd)

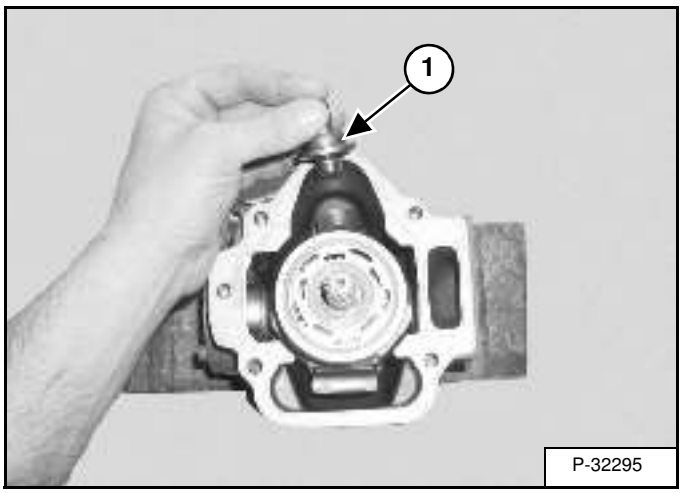
Figure 20-50-95



Lay the pump housing on its side and install the rotary group (Item 1) **[Figure 20-50-95]**.

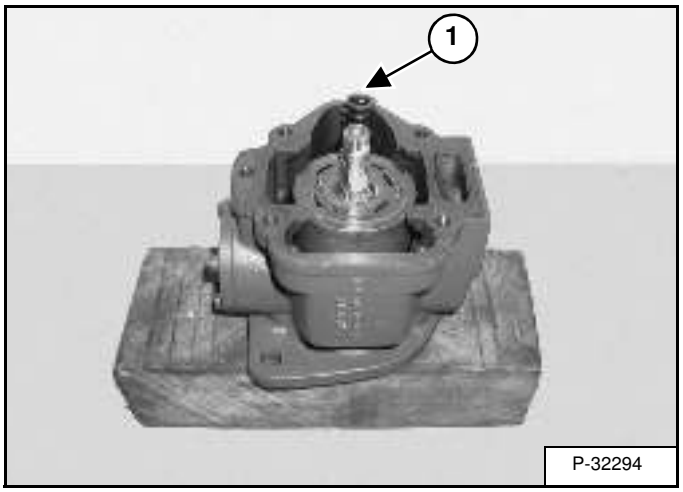
Set the pump housing up.

Figure 20-50-96



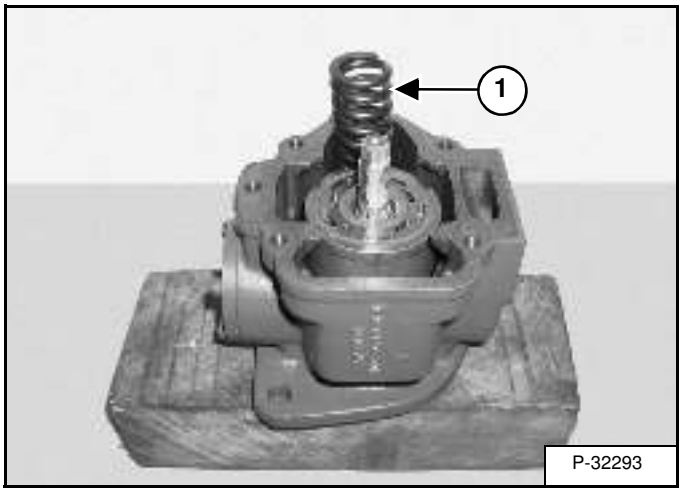
Install the spring retainer (Item 1) **[Figure 20-50-96]** in the pump housing.

Figure 20-50-97



Install the small spring (Item 1) **[Figure 20-50-97]** in the pump housing.

Figure 20-50-98

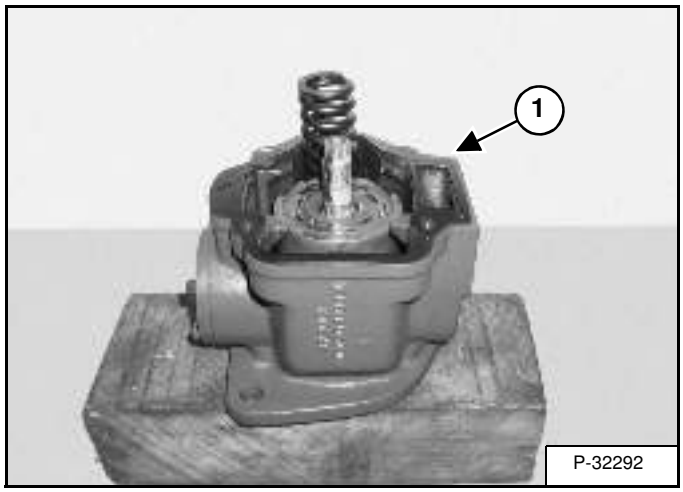


Install the large spring (Item 1) **[Figure 20-50-98]**.

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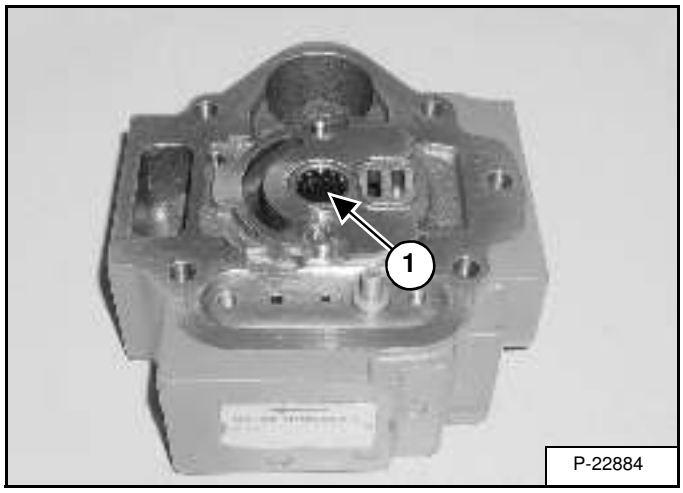
Piston Pump Assembly (Cont'd)

Figure 20-50-99



Install the gasket (Item 1) **[Figure 20-50-99]** on the pump housing.

Figure 20-50-100



Install the needle bearing (Item 1) **[Figure 20-50-100]** into the face plate.

Figure 20-50-101

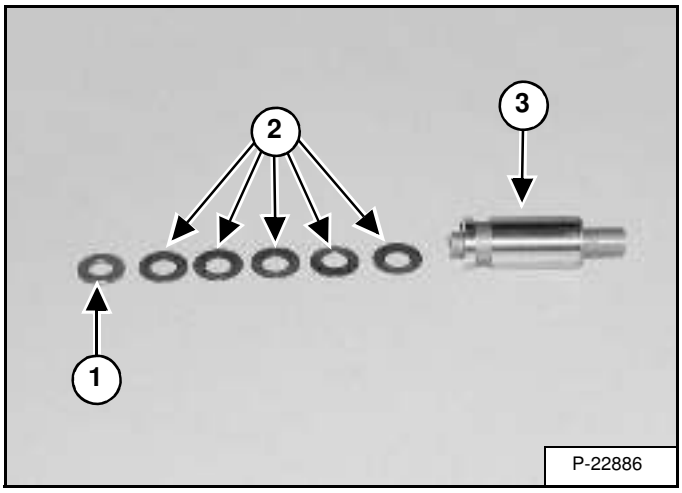
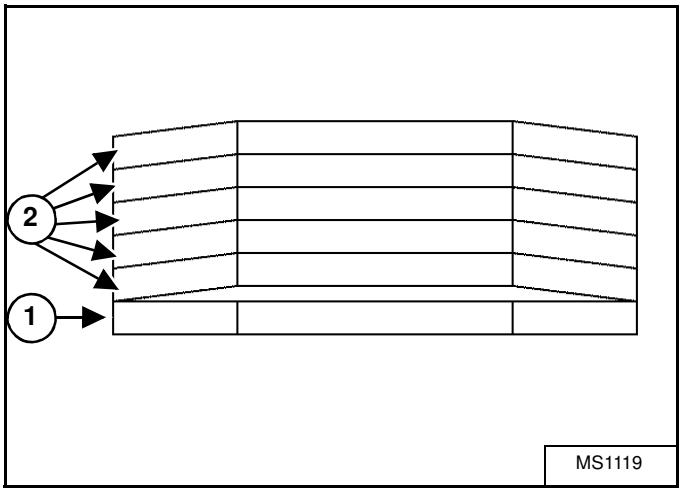


Figure 20-50-102

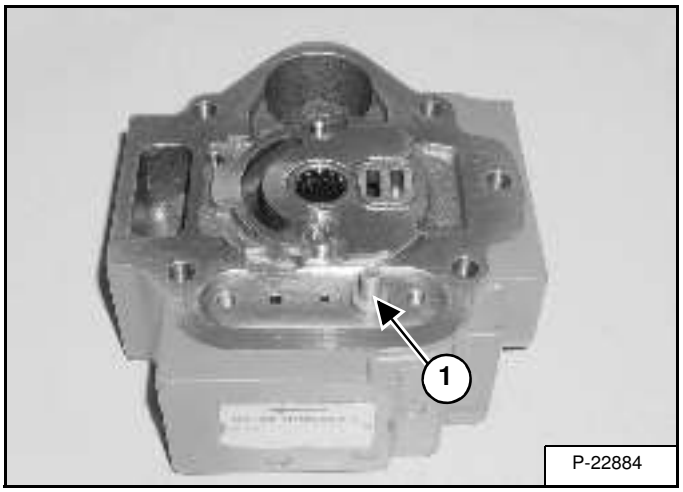


Install the coned disc springs (Item 1) **[Figure 20-50-101]** & **[Figure 20-50-102]** and spring seat (Item 2) **[Figure 20-50-101]** & **[Figure 20-50-102]** on the piston.

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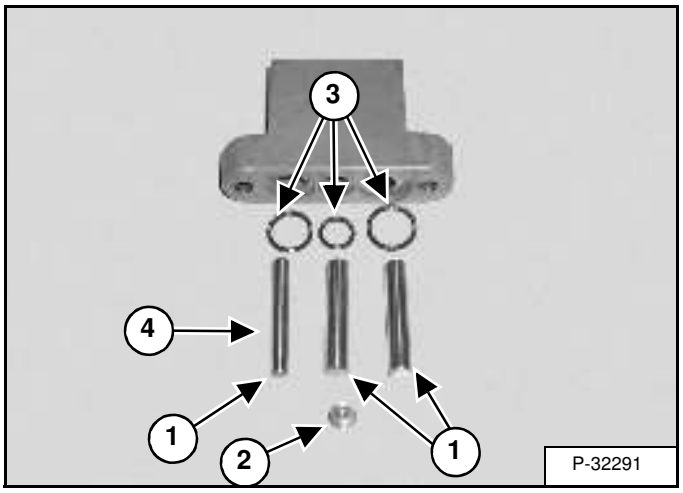
Piston Pump Assembly (Cont'd)

Figure 20-50-103



Install the piston assembly (Item 1) **[Figure 20-50-103]** into the face plate.

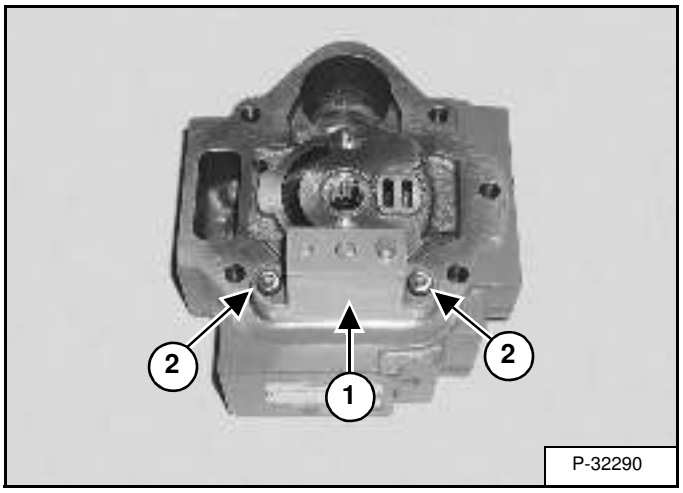
Figure 20-50-104



Install the pins (Item 1), poppet (Item 2) and O-rings (Item 3) **[Figure 20-50-104]** into the control block.

NOTE: Make sure the shoulder (Item 4) [Figure 20-50-104] is toward the outside of the control block.

Figure 20-50-105

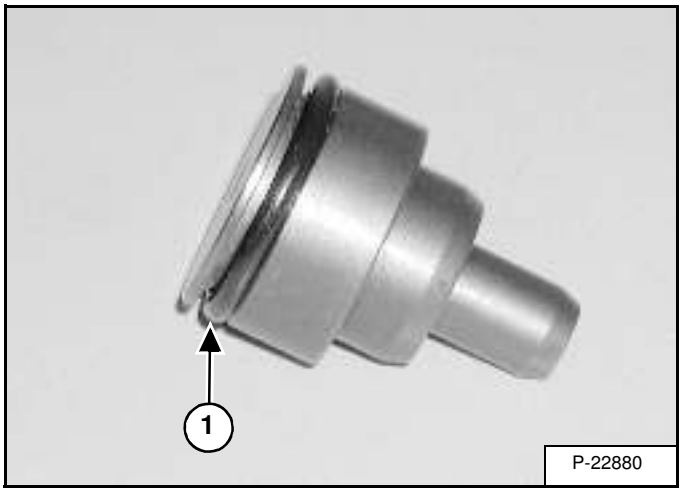


Install the control block (Item 1) **[Figure 20-50-105]** on the face plate.

Coat the threads of the two bolts (Item 2) **[Figure 20-50-105]** with LOCTITE 272 and install the bolts into the control block.

Tighten the bolts to 21-26 ft.-lbs. (28-35 Nm) torque.

Figure 20-50-106

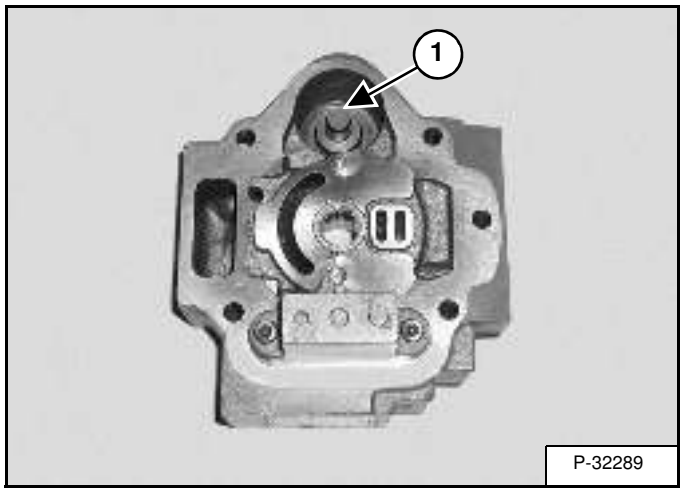


Install an O-ring (Item 1) **[Figure 20-50-106]** on the piston.

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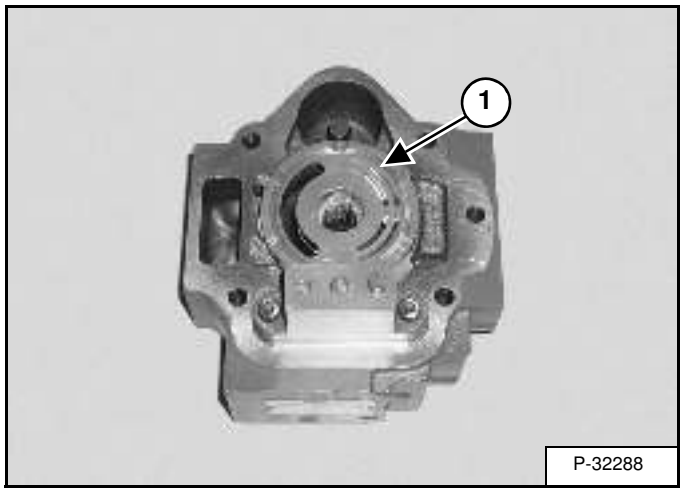
Piston Pump Assembly (Cont'd)

Figure 20-50-107



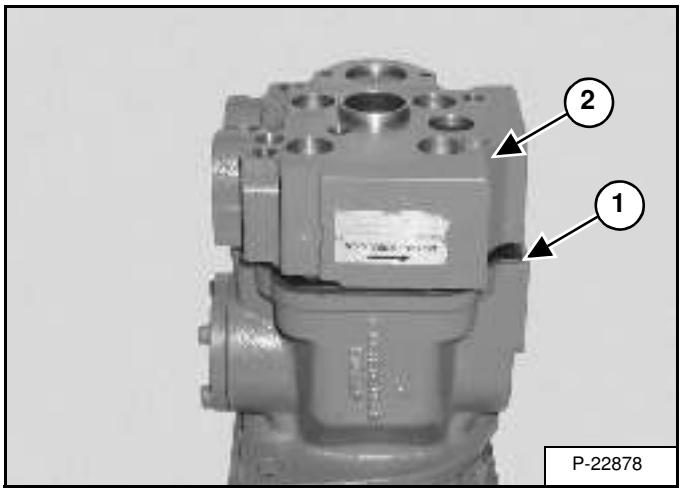
Install the piston (Item 1) **[Figure 20-50-107]** in the face plate.

Figure 20-50-108



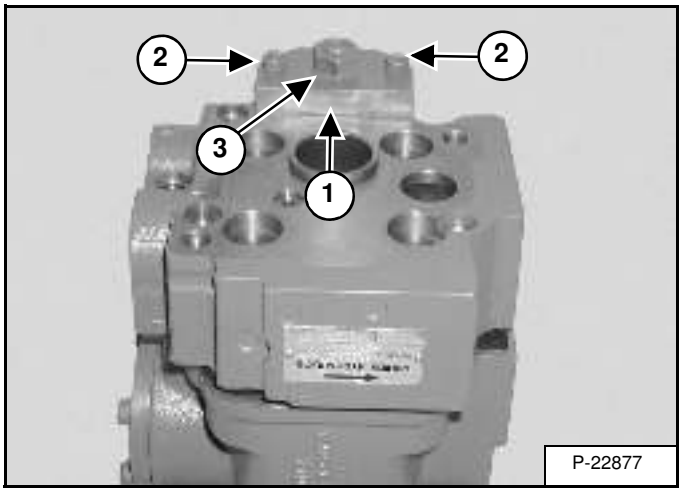
Install the port plate (Item 1) **[Figure 20-50-108]**.

Figure 20-50-109



Install the face plate (Item 1) **[Figure 20-50-109]** onto the pump housing.

Figure 20-50-110



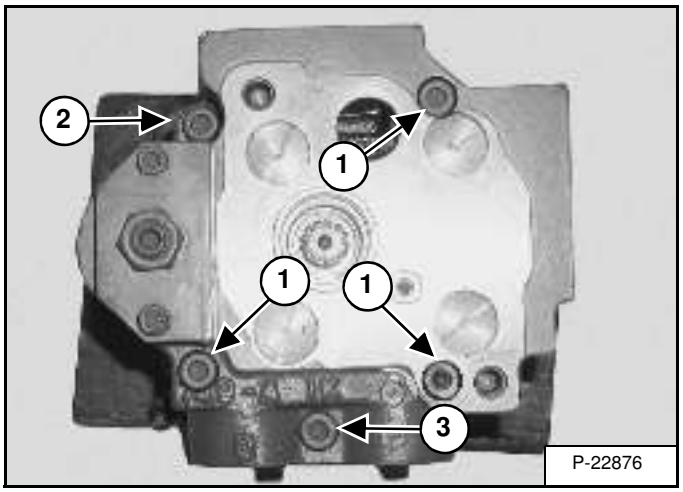
Install the adjusting plate (Item 1) using the two bolts (Item 2) **[Figure 20-50-110]** and tighten to 20-26 ft.-lbs. (28-35 Nm) torque.

NOTE: Do not turn the adjusting screw (Item 3) [Figure 20-50-110] unless necessary. The pressure setting may be changed causing damage to the hydraulic system.

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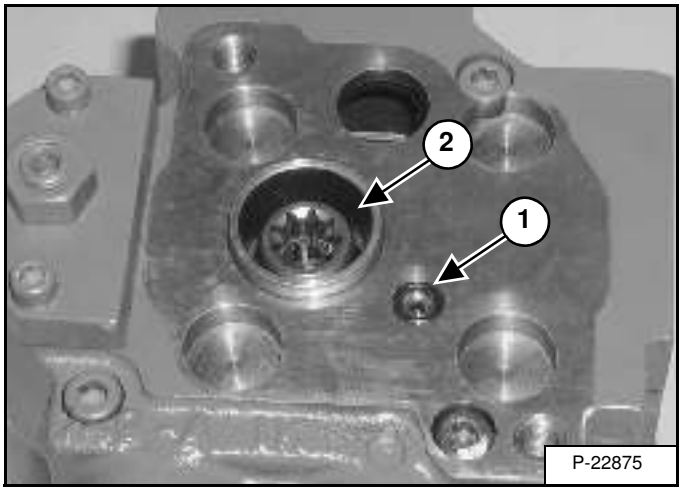
Piston Pump Assembly (Cont'd)

Figure 20-50-111



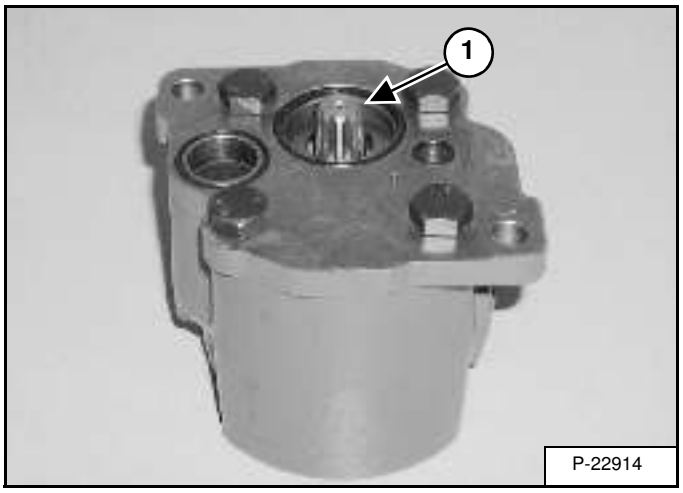
Install the three long (Item 1), one short (Item 2) and one medium (Item 3) **[Figure 20-50-111]** length bolts and tighten to 72-91 ft.-lbs. (98-123 Nm) torque.

Figure 20-50-112



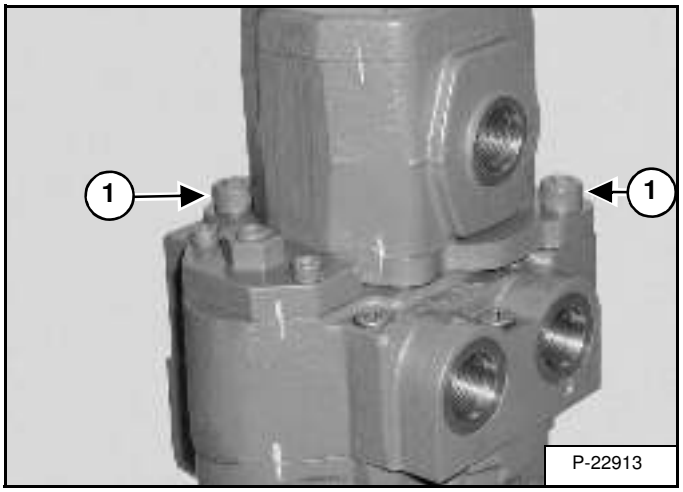
Install the O-ring (Item 1) and coupler (Item 2) **[Figure 20-50-112]** on the face plate.

Figure 20-50-113



Align the splines on the gear pump shaft (Item 1) **[Figure 20-50-113]** with the splines in the coupler (Item 2) **[Figure 20-50-112]** and install the gear pump on the piston pump.

Figure 20-50-114

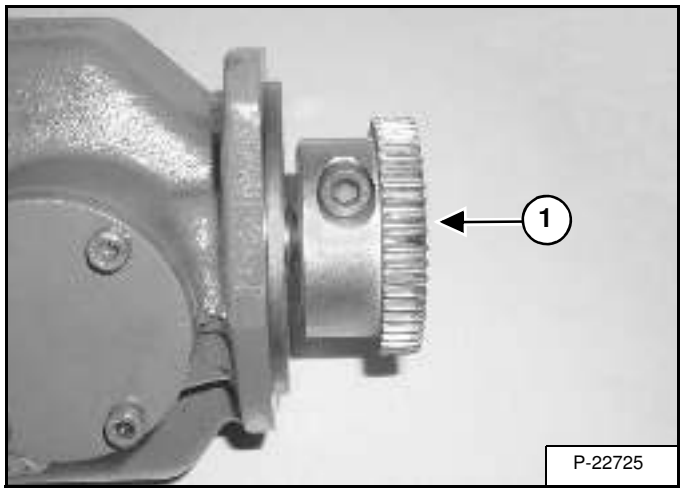


Install the two bolts (Item 1) **[Figure 20-50-114]** and tighten to 41-51 ft.-lbs. (55-69 Nm) torque.

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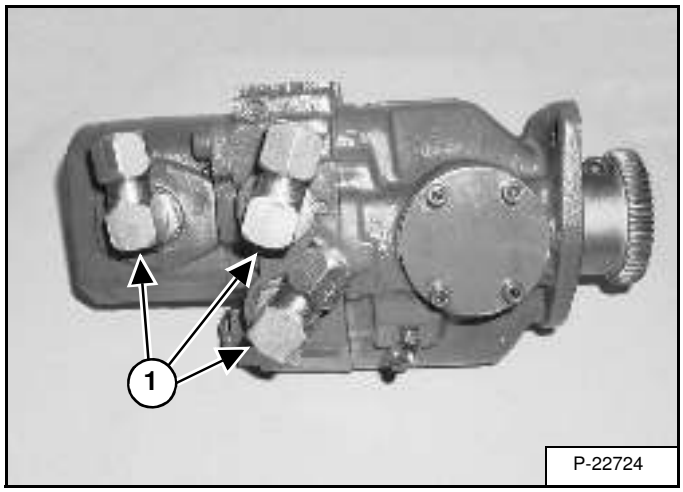
Assembly

Figure 20-50-115



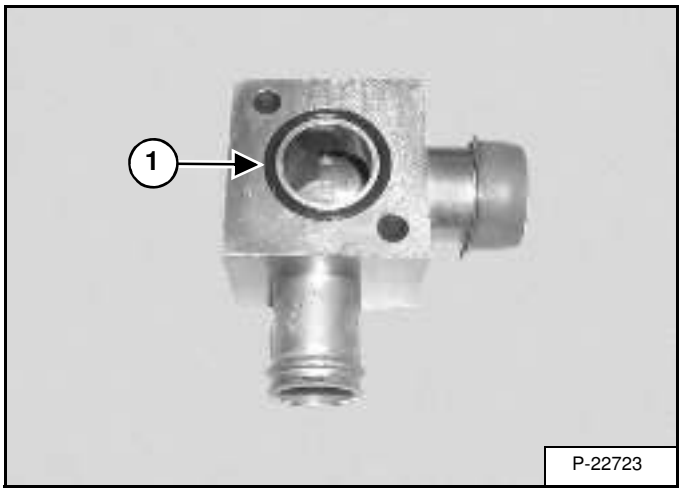
Install the coupler (Item 1) **[Figure 20-50-115]** on the pump. (See Coupler Removal And Installation on Page 20-50-8 for correct coupler installation.)

Figure 20-50-116



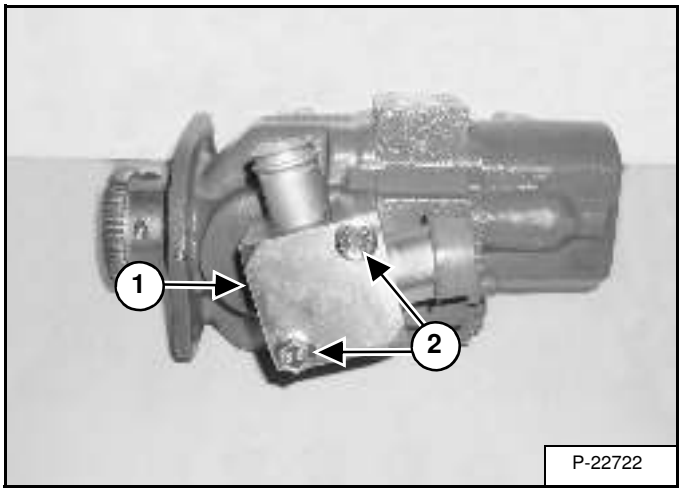
Install the three fittings (Item 1) **[Figure 20-50-116]**.

Figure 20-50-117



Install the O-ring (Item 1) **[Figure 20-50-117]** on the fitting.

Figure 20-50-118



Install the fitting (Item 1) and two bolts (Item 2) **[Figure 20-50-118]**.

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MANIFOLD ASSEMBLY/ACCUMULATOR (S/N 232311950 & BELOW AND 232411763 & BELOW)

Manifold Description

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

The body is connected to the accumulator.

The manifold supplies target pressure of 428 PSI (2951 kPa) with an acceptable range of 406-450 PSI (2799-3103 kPa) to the joysticks to activate the control valve spools.

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

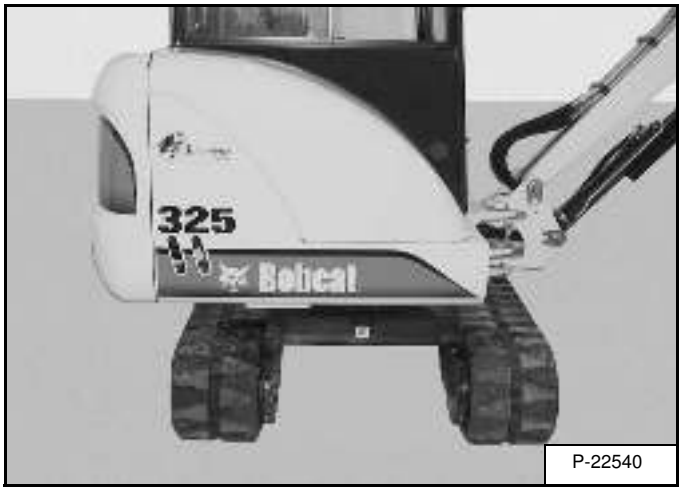
Removal And Installation

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

Figure 20-60-1



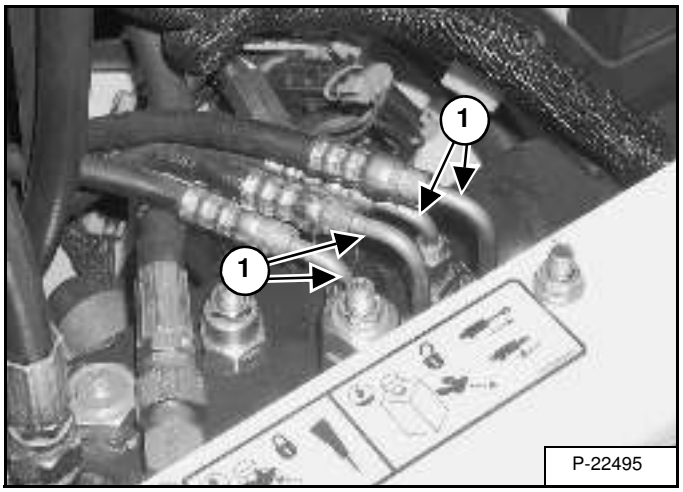
Position the excavator as shown **[Figure 20-60-1]**.

From the operator's seat, drain the residual pressure from the accumulator by stroking a function.

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

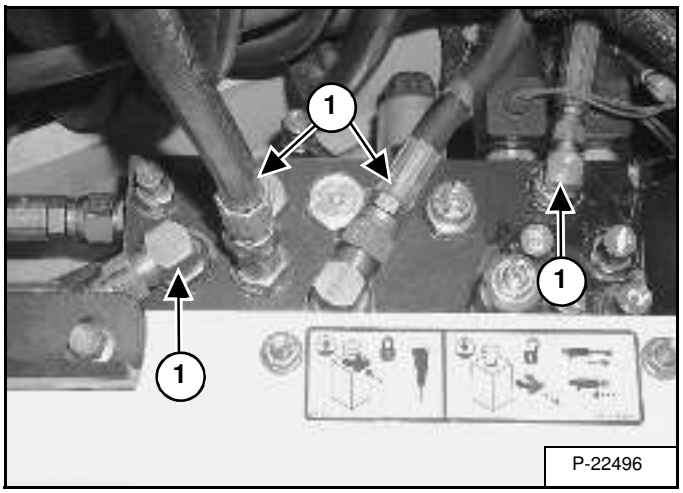
Open the right side cover.

Figure 20-60-2



Mark and remove the four hoses (Item 1) **[Figure 20-60-2]**.

Figure 20-60-3



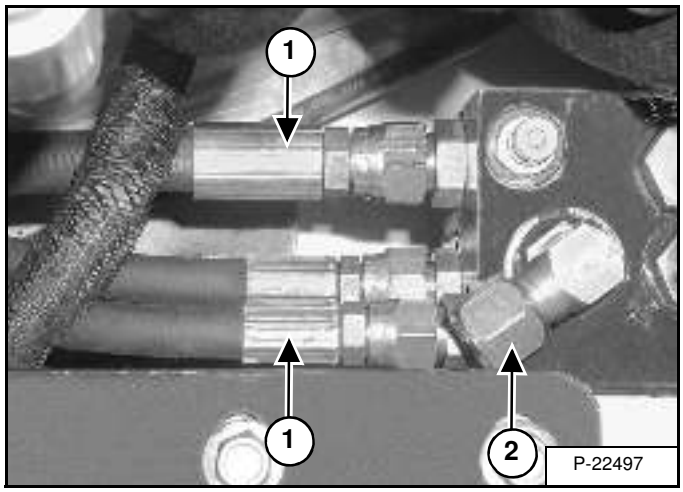
Remove the remaining four hoses (Item 1) **[Figure 20-60-3]** from the top of the manifold.

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MANIFOLD ASSEMBLY/ACCUMULATOR (S/N 232311950 & BELOW AND 232411763 & BELOW) (CONT'D)

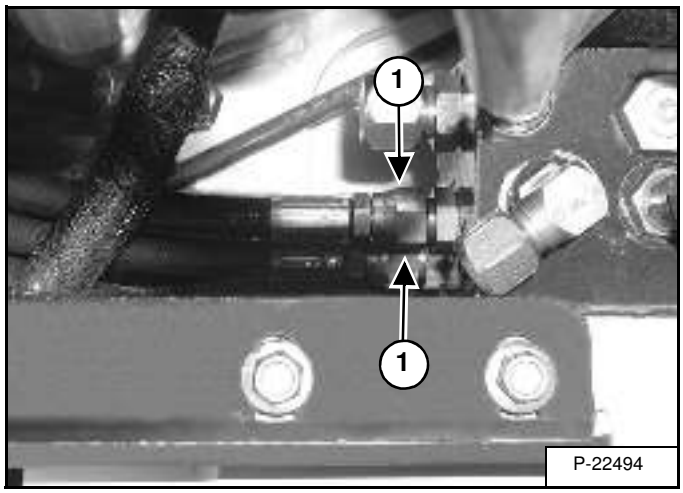
Removal And Installation (Cont'd)

Figure 20-60-4



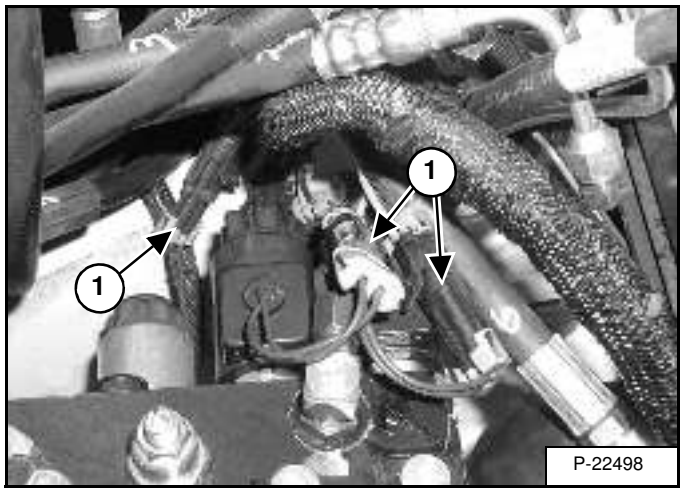
Remove the two hoses (Item 1). Remove the fitting (Item 2) **[Figure 20-60-4]**.

Figure 20-60-5



Remove the remaining two hoses (Item 1) **[Figure 20-60-5]** from the end of the manifold.

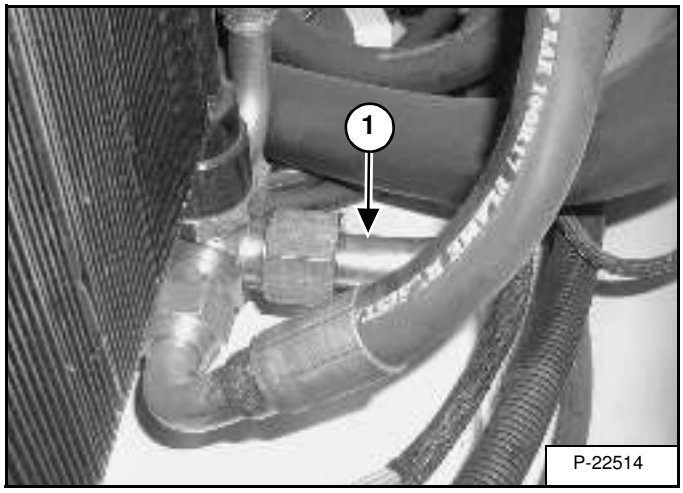
Figure 20-60-6



Mark and disconnect the five electrical connectors (Item 1) **[Figure 20-60-6]**.

NOTE: Access two of the connectors from under the excavator frame.

Figure 20-60-7



Remove the hose (Item 1) **[Figure 20-60-7]** from the oil cooler.

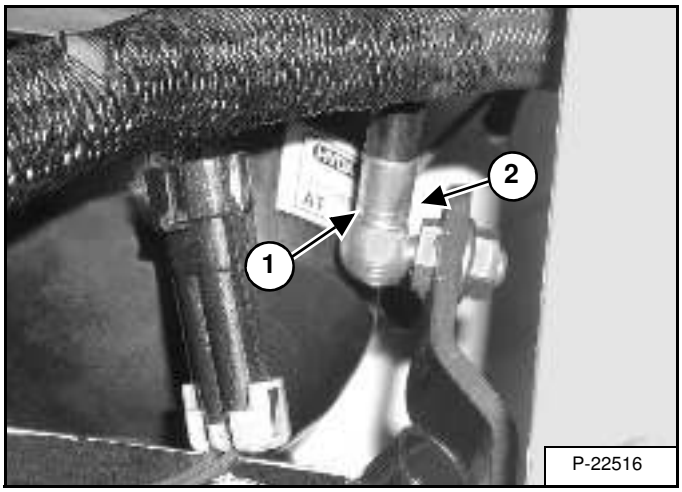
NOTE: The hose will be removed with the manifold.

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MANIFOLD ASSEMBLY/ACCUMULATOR (S/N 232311950 & BELOW AND 232411763 & BELOW) (CONT'D)

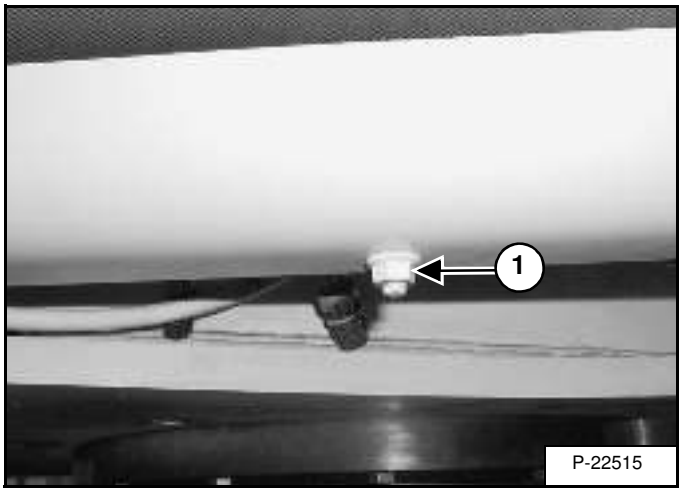
Removal And Installation (Cont'd)

Figure 20-60-8



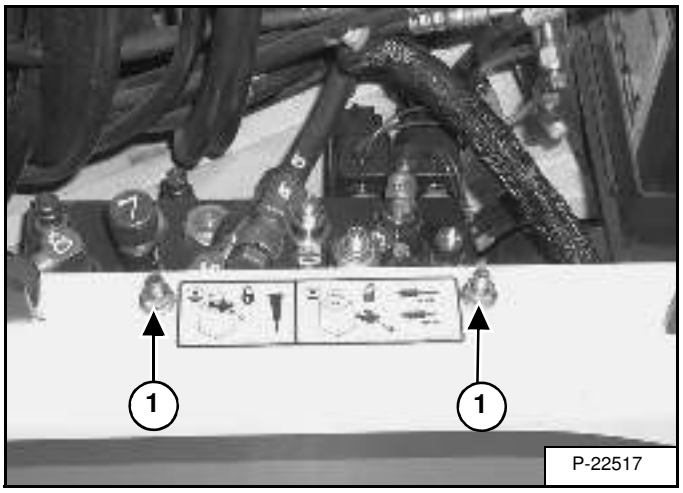
Remove the retaining clip (Item 1) from the right side cover gas spring. Remove the gas spring (Item 2) **[Figure 20-60-8]** from the mount.

Figure 20-60-9



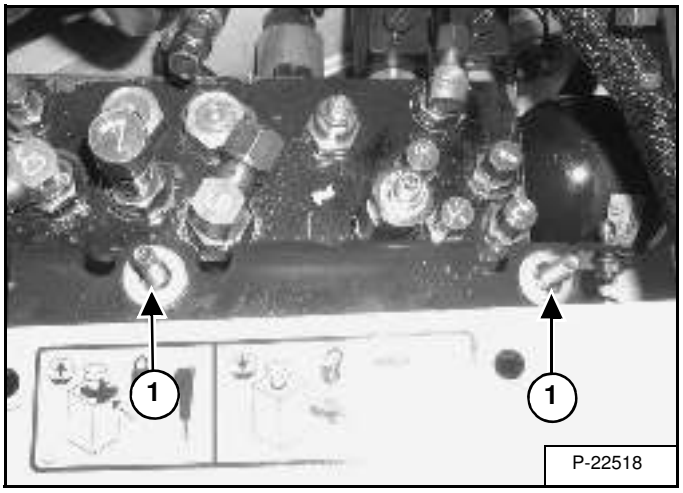
Remove the bottom bolt and nut (Item 1) **[Figure 20-60-9]**.

Figure 20-60-10



Remove the top two nuts (Item 1) **[Figure 20-60-10]**.

Figure 20-60-11

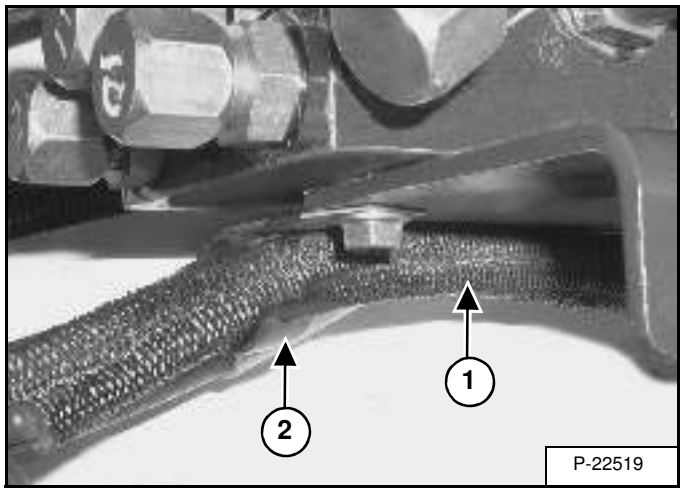


Push the bottom of the manifold toward the excavator and lower the manifold until the two mount bolts (Item 1) **[Figure 20-60-11]** are clear of the frame.

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Removal And Installation (Cont'd)

Figure 20-60-12

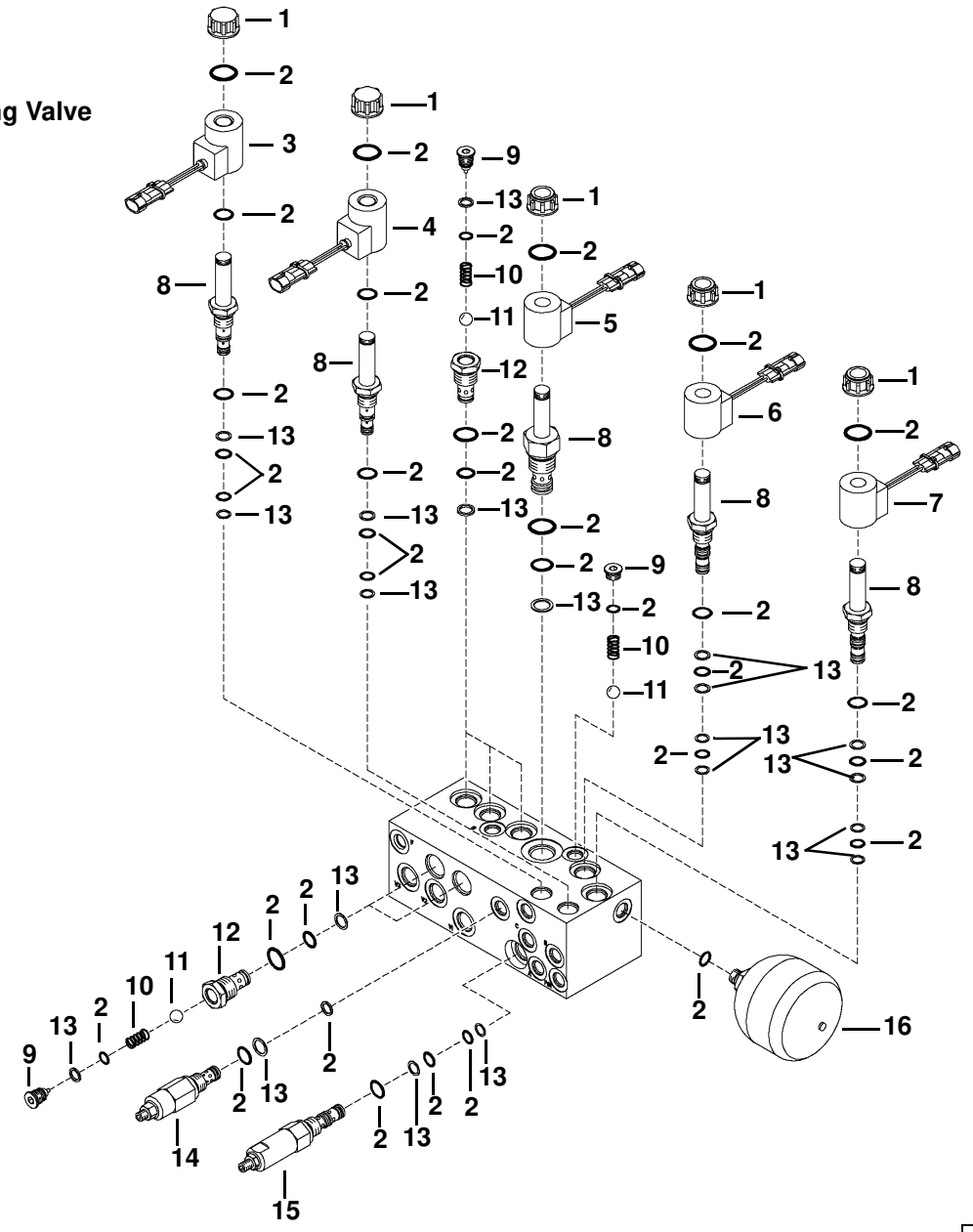


Remove the wire harness (Item 1) from the clamps (Item 2) **[Figure 20-60-12]**. Lower the manifold through the bottom of the excavator.

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Parts Identification

1. Nut
2. O-Ring
3. Coil W/Blue Tie Strap
4. Coil W/ Red Tie Strap
5. Coil W/Brown Tie Strap
6. Coil W/Yellow Tie Strap
7. Coil W/Green Tie Strap
8. Solenoid
9. Plug
10. Spring
11. Ball
12. Body
13. Back-up Ring
14. Main Relief Valve
15. Pressure Reducing Valve
16. Accumulator



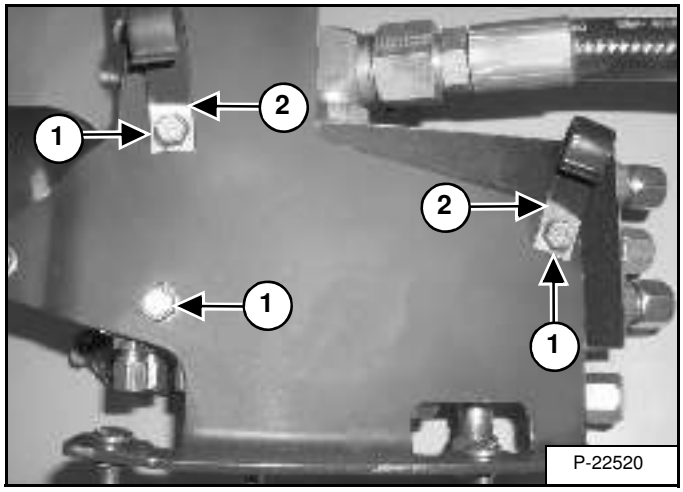
MS1108A

Dealer Copy -- Not for Resale

MANIFOLD ASSEMBLY (S/N 232311950 & BELOW AND 232411763 & BELOW) (CONT'D)

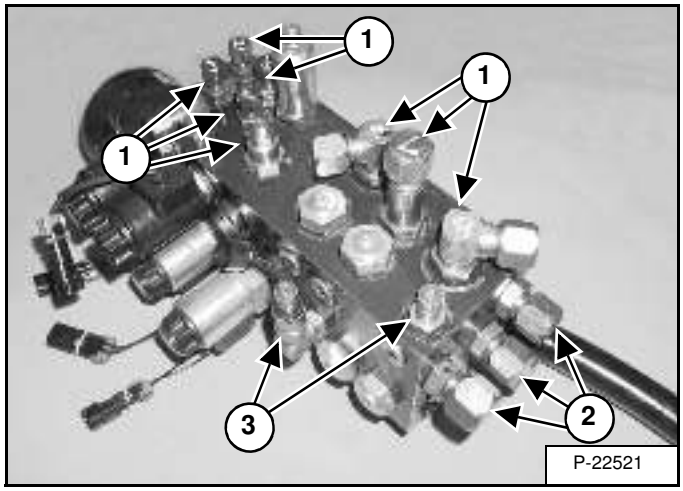
Disassembly

Figure 20-61-1



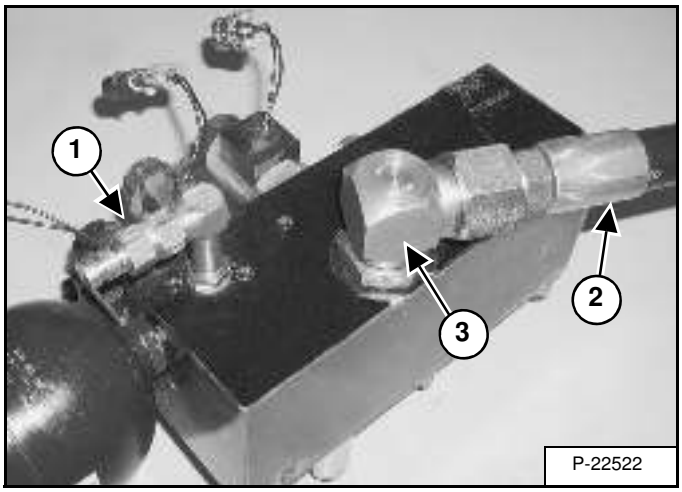
Remove the three mount bolts (Item 1), clamps (Item 2) **[Figure 20-61-1]** and mount from the manifold.

Figure 20-61-2



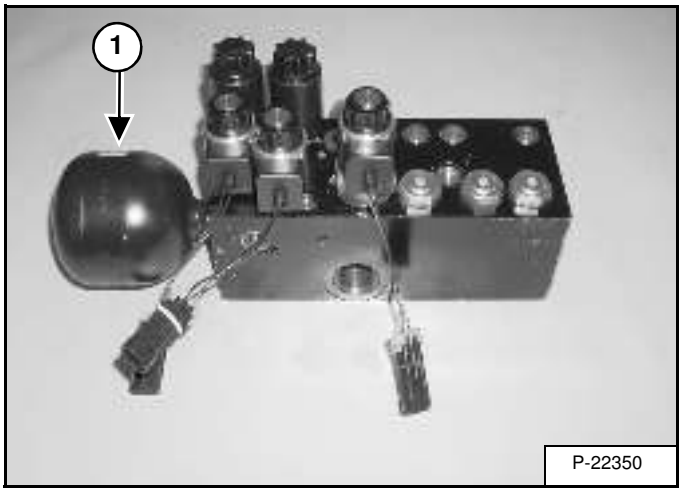
Remove the eight fittings (Item 1) from the top, four fittings (Item 2) from the end and the two diagnostic ports (Item 3) **[Figure 20-61-2]**.

Figure 20-61-3



Remove the diagnostic port (Item 1), hose (Item 2) and fitting (Item 3) **[Figure 20-61-3]**.

Figure 20-61-4



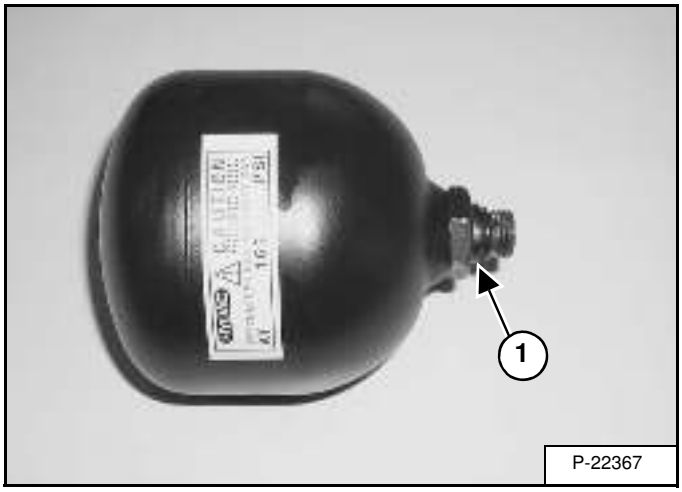
Remove the accumulator (Item 1) **[Figure 20-61-4]**.

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MANIFOLD ASSEMBLY (S/N 232311950 & BELOW AND 232411763 & BELOW) (CONT'D)

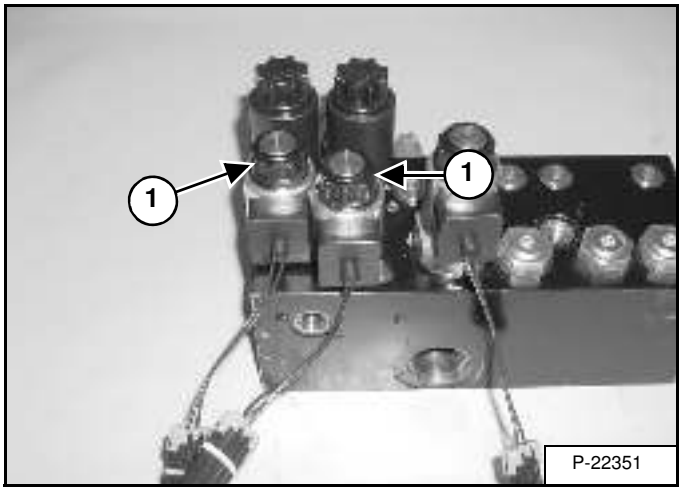
Disassembly (Cont'd)

Figure 20-61-5



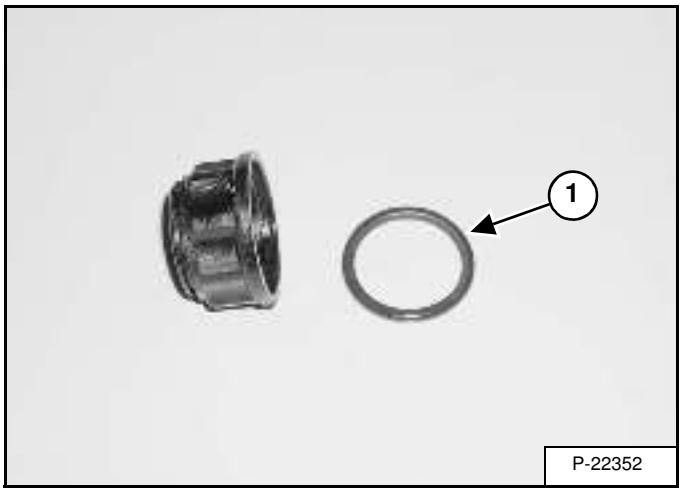
Remove the O-ring (Item 1) **[Figure 20-61-5]** from the accumulator.

Figure 20-61-6



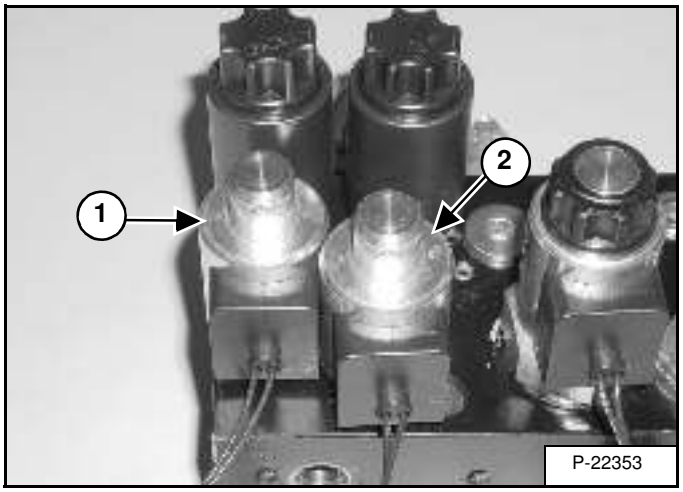
Remove the nuts (Item 1) **[Figure 20-61-6]** from the solenoids.

Figure 20-61-7



Remove the O-ring (Item 1) **[Figure 20-61-7]** from both nuts.

Figure 20-61-8



Remove the coil with the green tie strap (Item 1) **[Figure 20-61-8]** from the left solenoid.

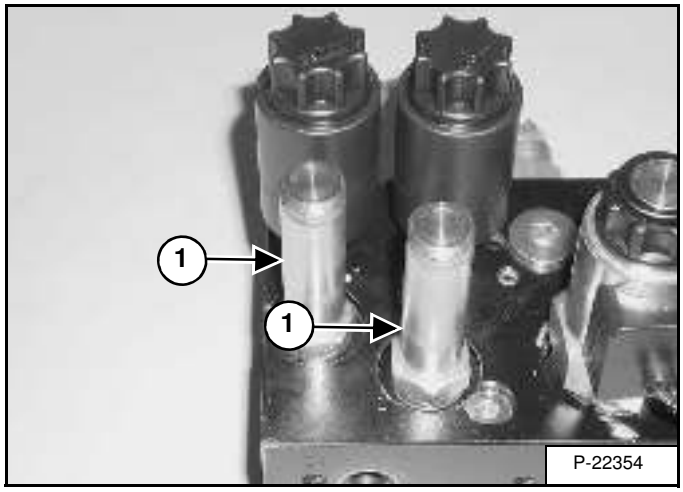
Remove the coil with the yellow tie strap (Item 2) **[Figure 20-61-8]** from the right solenoid.

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MANIFOLD ASSEMBLY (S/N 232311950 & BELOW AND 232411763 & BELOW) (CONT'D)

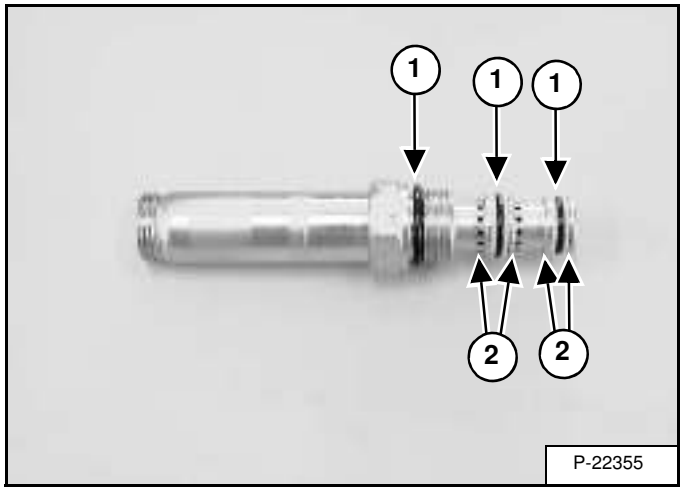
Disassembly (Cont'd)

Figure 20-61-9



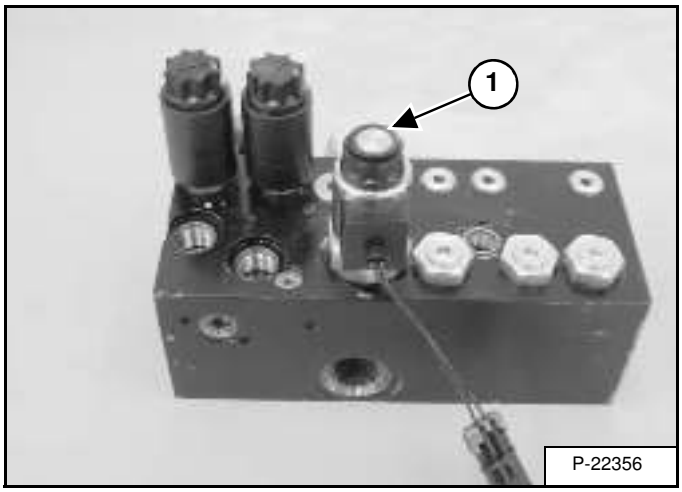
Remove both solenoids (Item 1) **[Figure 20-61-9]**.

Figure 20-61-10



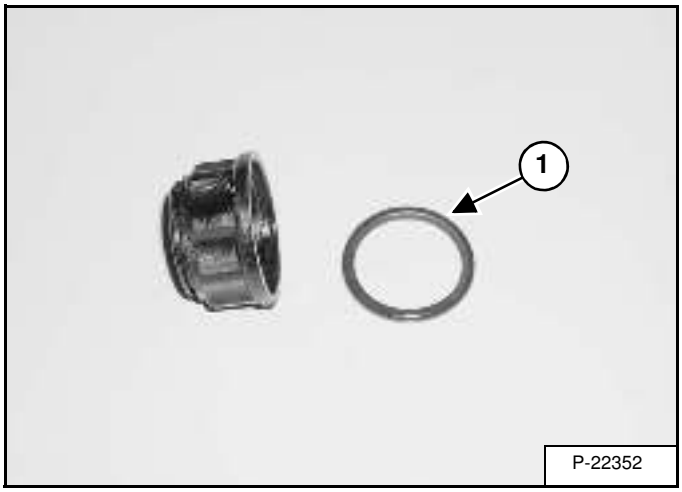
Remove the O-rings (Item 1) and back-up rings (Item 1) **[Figure 20-61-10]** from both solenoids.

Figure 20-61-11



Remove the nut (Item 1) **[Figure 20-61-11]** from the solenoid.

Figure 20-61-12



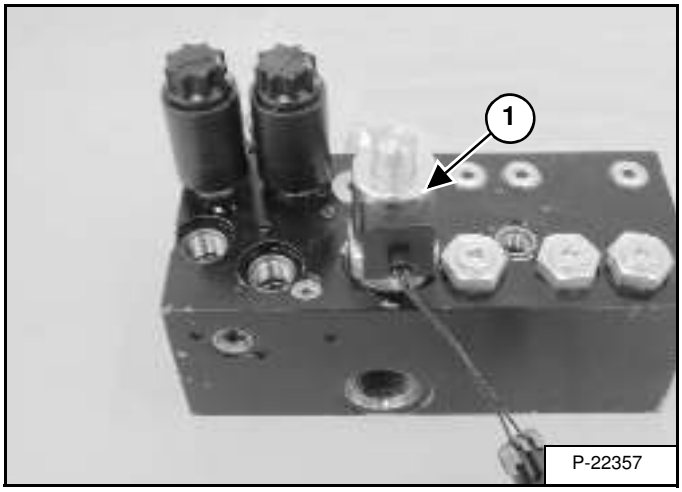
Remove the O-ring (Item 1) **[Figure 20-61-12]** from the nut.

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MANIFOLD ASSEMBLY (S/N 232311950 & BELOW AND 232411763 & BELOW) (CONT'D)

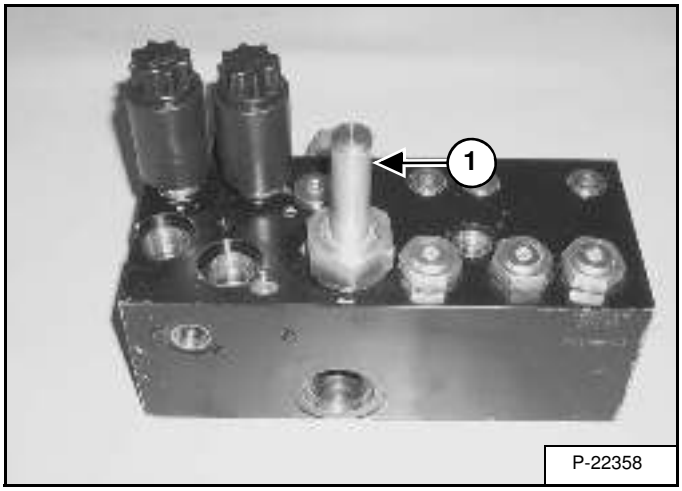
Disassembly (Cont'd)

Figure 20-61-13



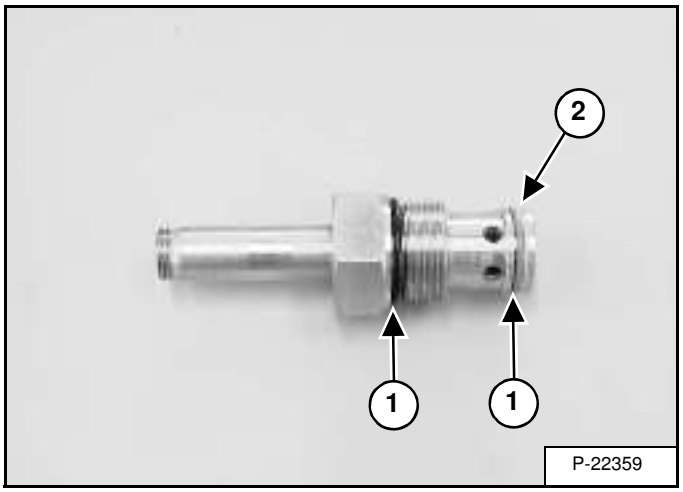
Remove the coil with the brown tie strap (Item 1) **[Figure 20-61-13]** from the solenoid.

Figure 20-61-14



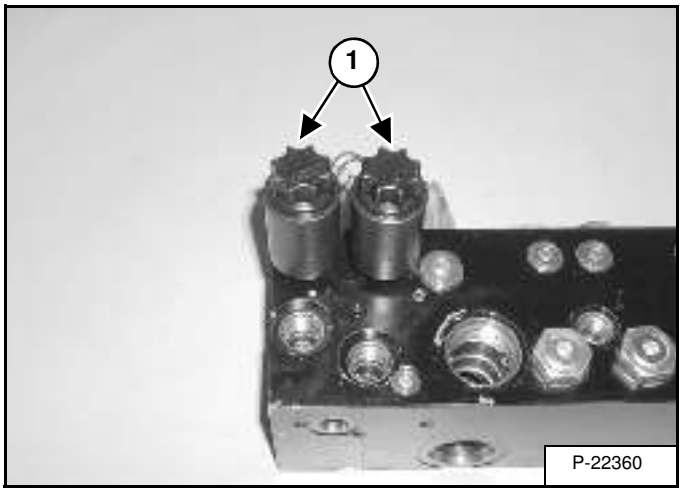
Remove the solenoid (Item 1) **[Figure 20-61-14]**.

Figure 20-61-15



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-61-15]** from the solenoid.

Figure 20-61-16



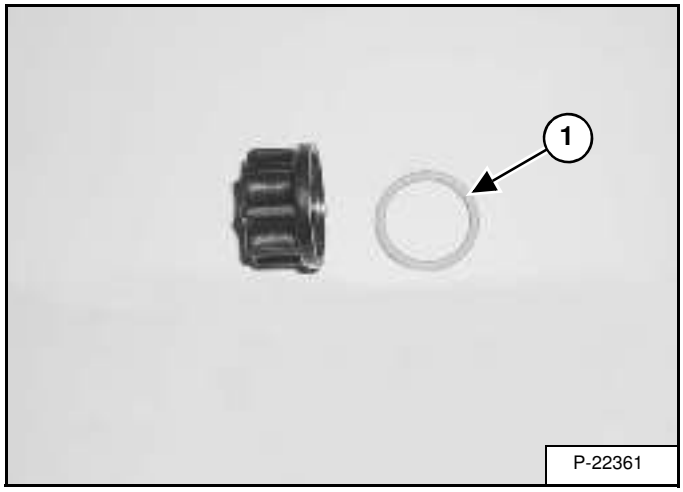
Remove the nuts (Item 1) **[Figure 20-61-16]** from the solenoids.

Dealer Copy -- Not for Resale

MANIFOLD ASSEMBLY (S/N 232311950 & BELOW AND 232411763 & BELOW) (CONT'D)

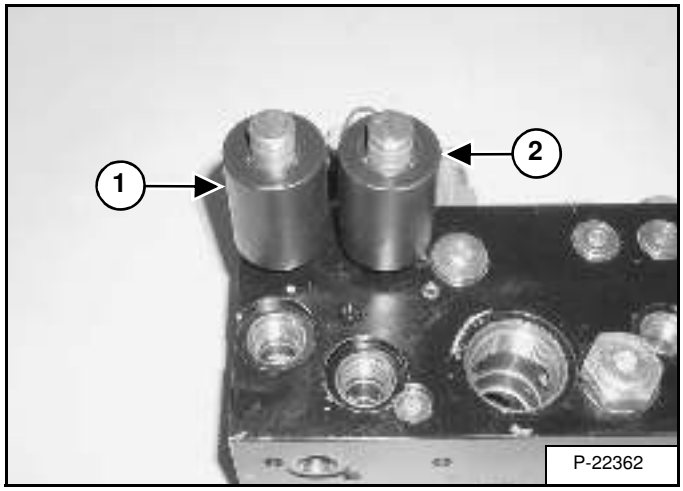
Disassembly (Cont'd)

Figure 20-61-17



Remove the O-ring (Item 1) **[Figure 20-61-17]** from both nuts.

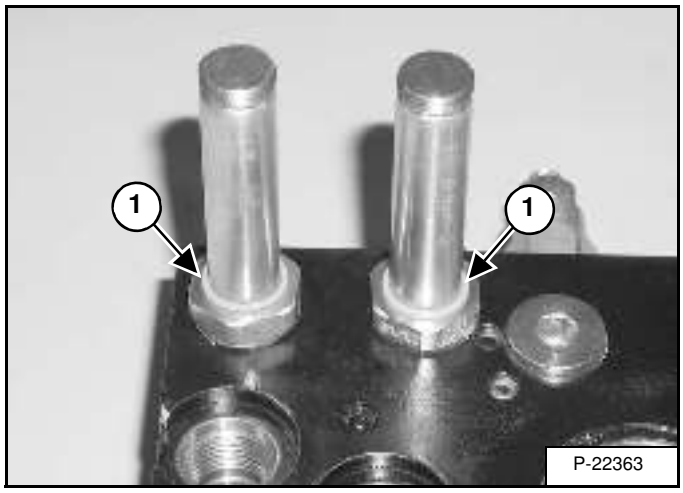
Figure 20-61-18



Remove the coil with the red tie strap (Item 1) **[Figure 20-61-18]** from the left solenoid.

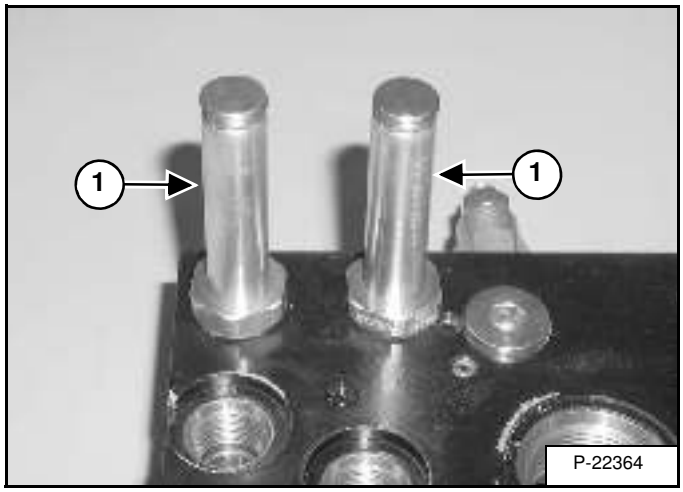
Remove the coil with the blue tie strap (Item 2) **[Figure 20-61-18]** from the right solenoid.

Figure 20-61-19



Remove the O-rings (Item 1) **[Figure 20-61-19]** from both solenoids.

Figure 20-61-20



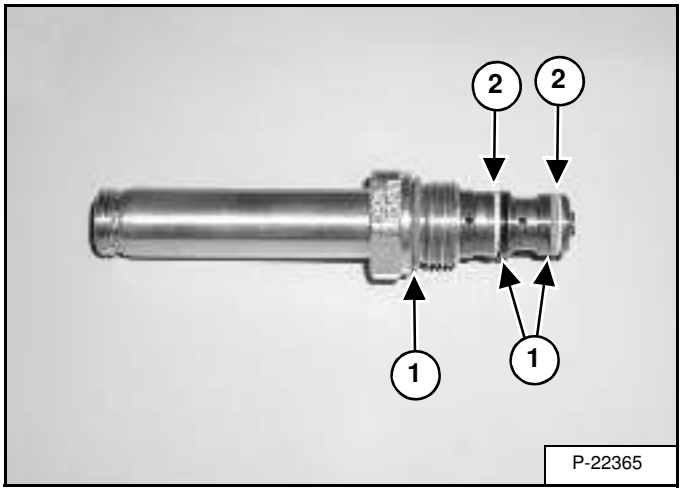
Remove the solenoids (Item 1) **[Figure 20-61-20]**.

Dealer Copy -- Not for Resale

MANIFOLD ASSEMBLY (S/N 232311950 & BELOW AND 232411763 & BELOW) (CONT'D)

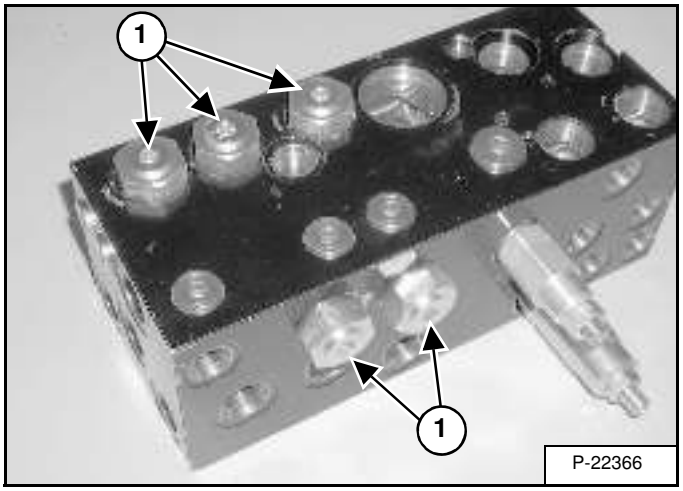
Disassembly (Cont'd)

Figure 20-61-21



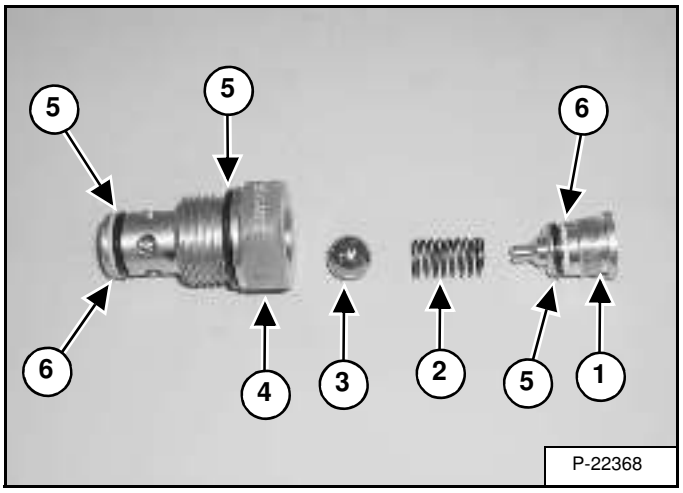
Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-61-21]** from both solenoids.

Figure 20-61-22



Remove the five check valves (Item 1) **[Figure 20-61-22]**.

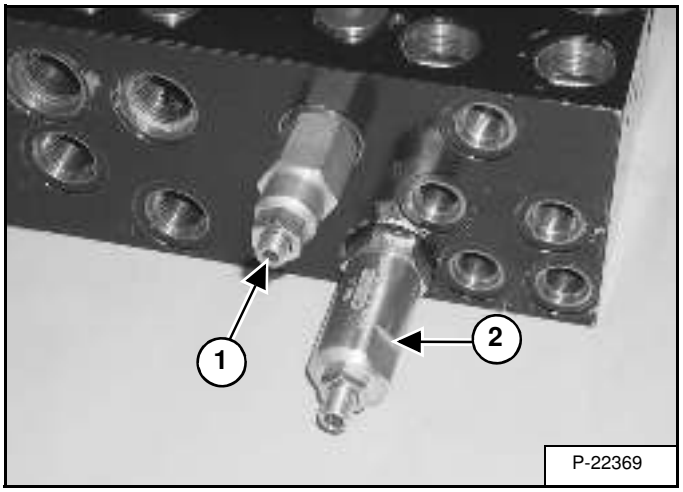
Figure 20-61-23



Remove the plug (Item 1), spring (Item 2) and ball (Item 3) from the valve body (Item 4) **[Figure 20-61-23]**.

Remove the O-rings (Item 5) and back-up rings (Item 6) **[Figure 20-61-23]** from the plug and valve body.

Figure 20-61-24

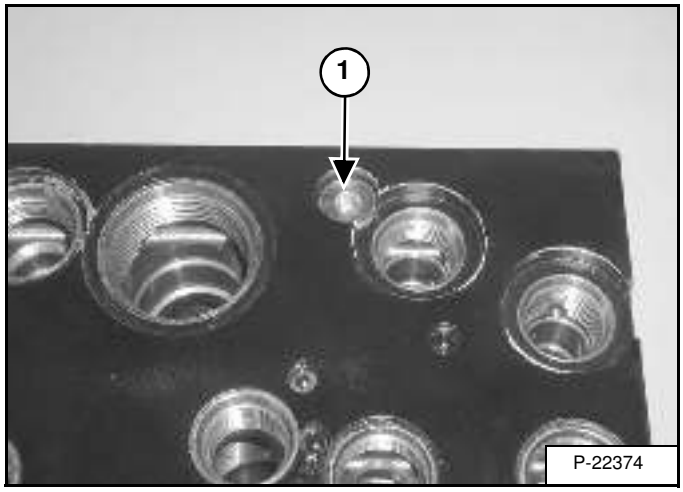


Remove the main relief valve (Item 1) and pressure reducing valve (Item 2) **[Figure 20-61-24]**.

Dealer Copy -- Not for Resale

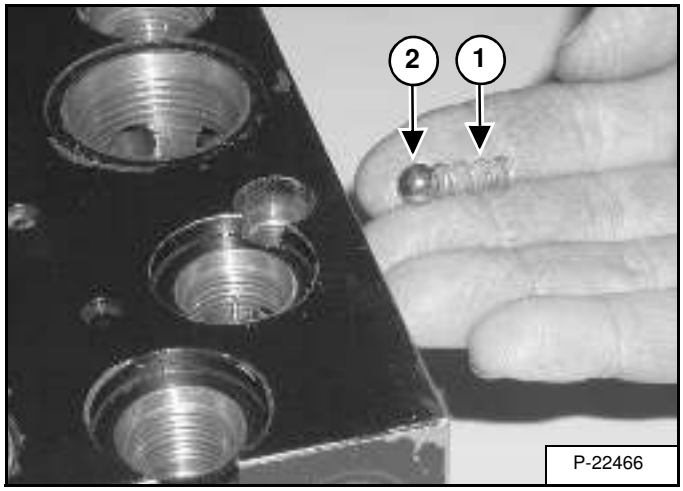
Disassembly (Cont'd)

Figure 20-61-25



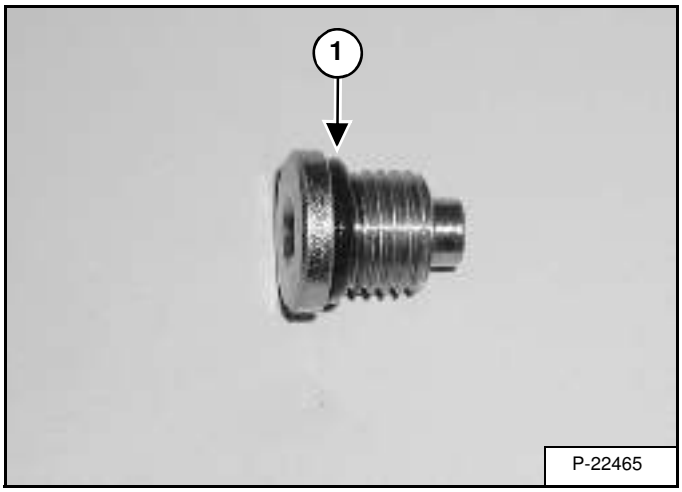
Remove the plug (Item 1) **[Figure 20-61-25]**.

Figure 20-61-26



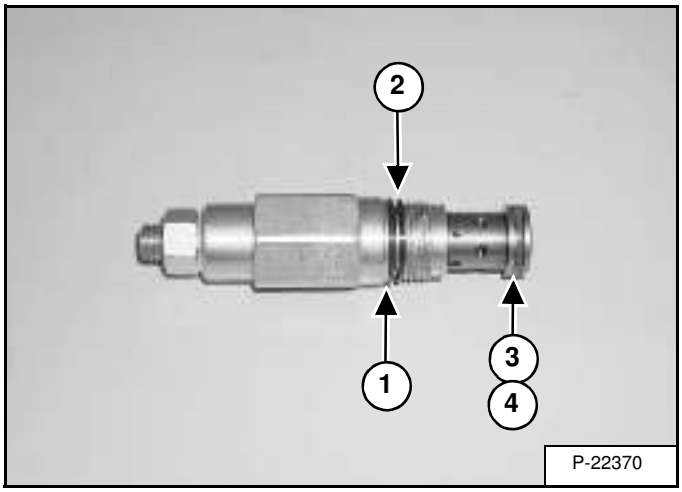
Remove the spring (Item 1) and ball (Item 2) **[Figure 20-61-26]** from the valve.

Figure 20-61-27



Remove the O-ring (Item 1) **[Figure 20-61-27]** from the plug.

Figure 20-61-28



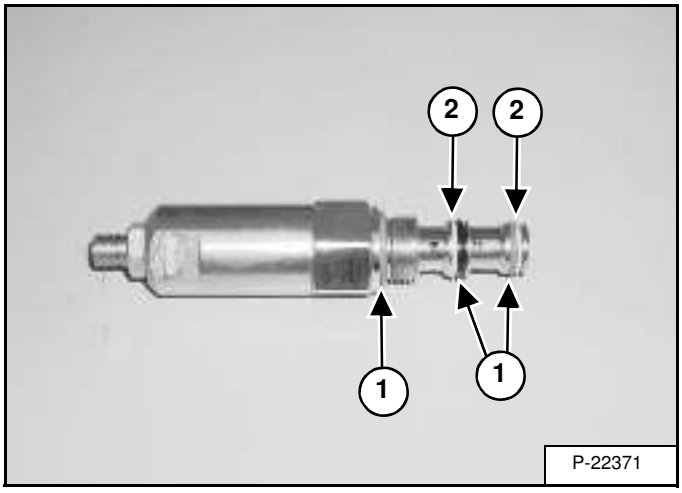
Remove the O-ring (Item 1) and back-up rings (Item 2) **[Figure 20-61-28]** from the main relief valve.

Remove the glide ring (Item 3) and O-ring (Item 4) **[Figure 20-61-28]** from the main relief valve.

Dealer Copy -- Not for Resale

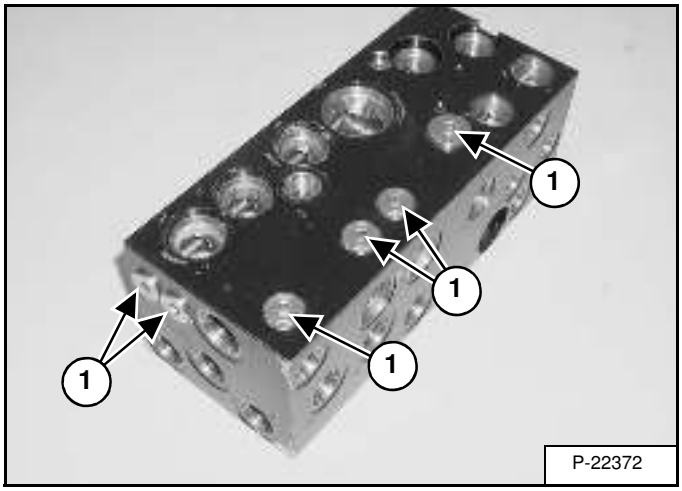
Disassembly (Cont'd)

Figure 20-61-29



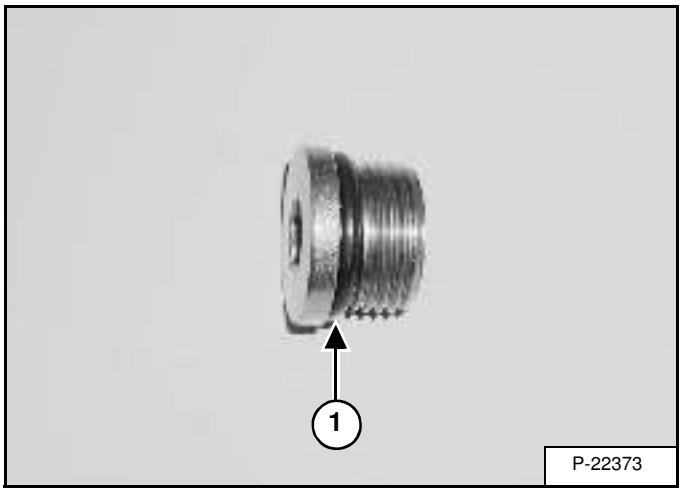
Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-61-29]** from the pressure reducing valve.

Figure 20-61-30



Remove the six plugs (Item 1) **[Figure 20-61-30]**.

Figure 20-61-31



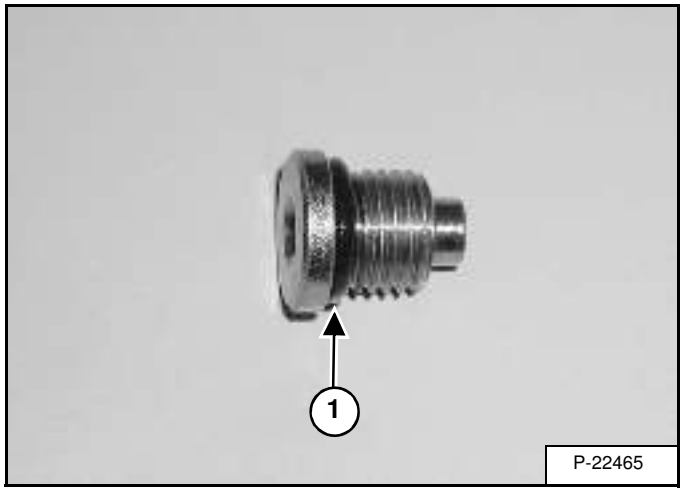
Remove the O-ring (Item 1) **[Figure 20-61-31]** from the plugs.

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Assembly

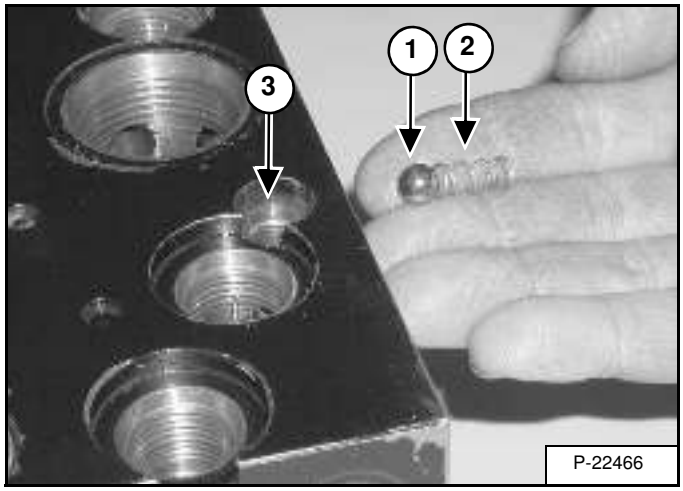
Clean all parts in solvent and dry with compressed air. Inspect all parts and replace any that are damaged. Discard all old O-rings and back-up rings. Apply clean hydraulic oil to the new O-rings and back-up rings before installation.

Figure 20-61-32



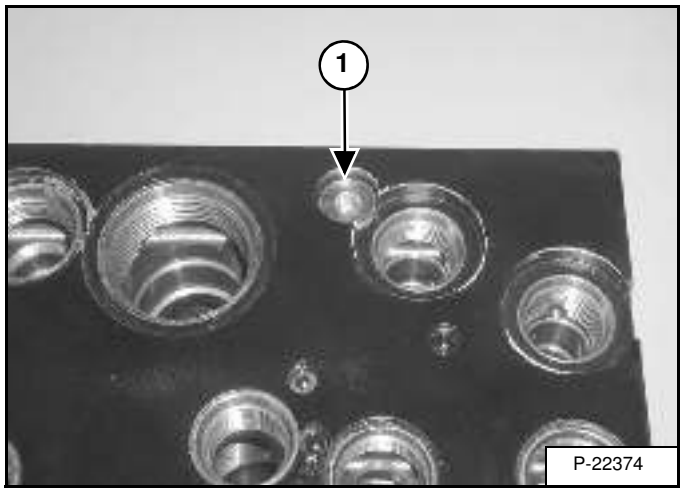
Install the O-ring (Item 1) **[Figure 20-61-32]** on the plug.

Figure 20-61-33



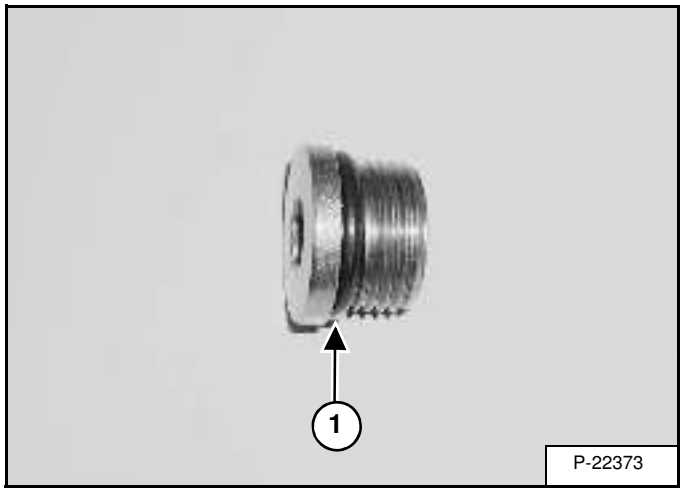
Install the ball (Item 1) and spring (Item 2) in the port (Item 3) **[Figure 20-61-33]**.

Figure 20-61-34



Install the plug (Item 1) **[Figure 20-61-34]**. Tighten the plug to 11-13 ft.-lbs. (14,9-17,6 Nm) torque.

Figure 20-61-35

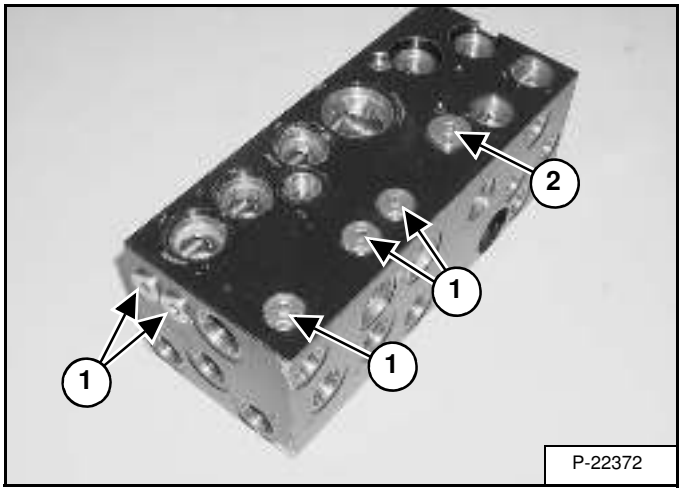


Install the O-ring (Item 1) **[Figure 20-61-35]** on the six plugs.

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Assembly (Cont'd)

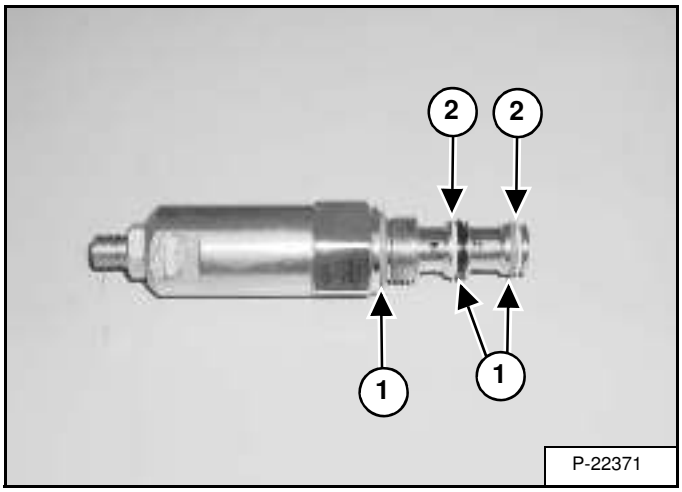
Figure 20-61-36



Install the five plugs (Item 1) **[Figure 20-61-36]**. Tighten the plugs to 18-20 ft.-lbs. (24,4-27,1 Nm) torque.

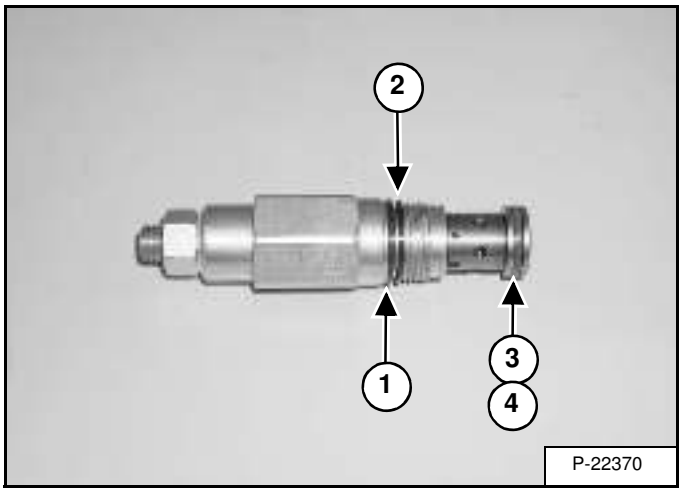
Install the plug (Item 2) **[Figure 20-61-36]**. Tighten the plug to 25-29 ft.-lbs. (34-39 Nm) torque.

Figure 20-61-37



Install the O-ring (Item 1) and back-up rings (Item 2) **[Figure 20-61-37]** on the pressure reducing valve.

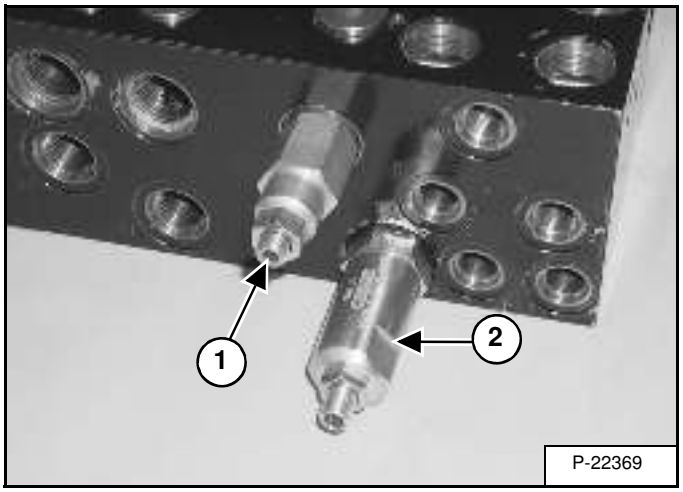
Figure 20-61-38



Install the O-ring (Item 1) and back-up rings (Item 2) **[Figure 20-61-38]** on the main relief valve.

Install the O-ring (item 3) and glide ring (Item 4) **[Figure 20-61-38]** on the main relief valve.

Figure 20-61-39



Install the main relief valve (Item 1) and pressure reducing valve (Item 2) **[Figure 20-61-39]**.

Tighten the main relief valve to 30-35 ft.-lbs. (40,7-47,5 Nm) torque.

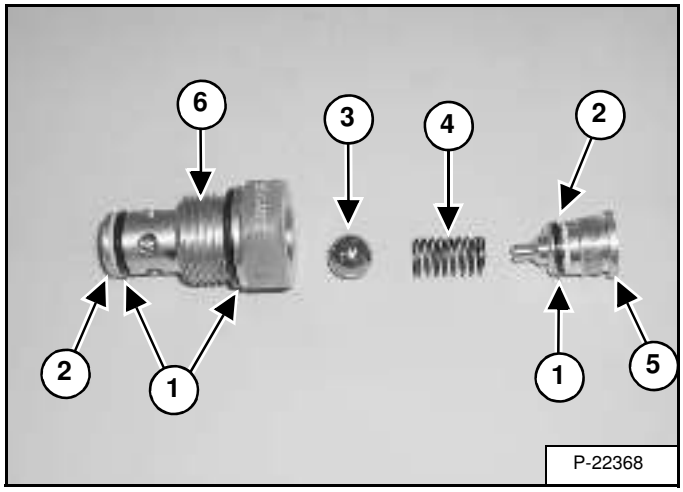
Tighten the pressure reducing valve to 19-22 ft.-lbs. (25,1-29,8 Nm) torque.

Dealer Copy -- Not for Resale

MANIFOLD ASSEMBLY (S/N 232311950 & BELOW AND 232411763 & BELOW) (CONT'D)

Assembly (Cont'd)

Figure 20-61-40

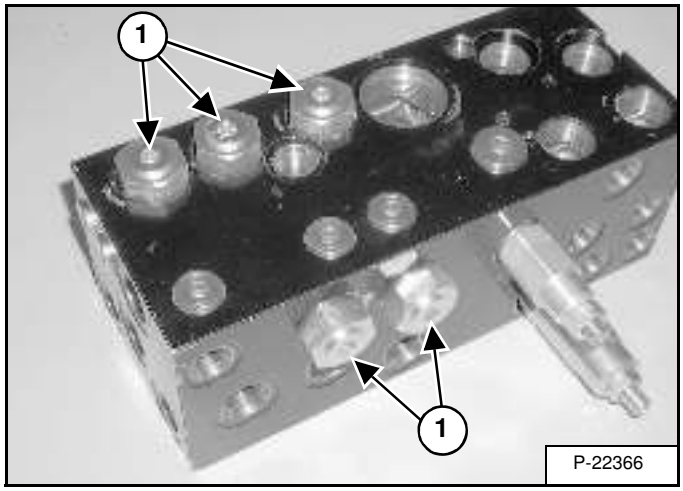


Install the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-61-40]** on the plug and valve body.

Install the ball (Item 3), spring (Item 4) and plug (Item 5) in the valve body (Item 6) **[Figure 20-61-40]**.

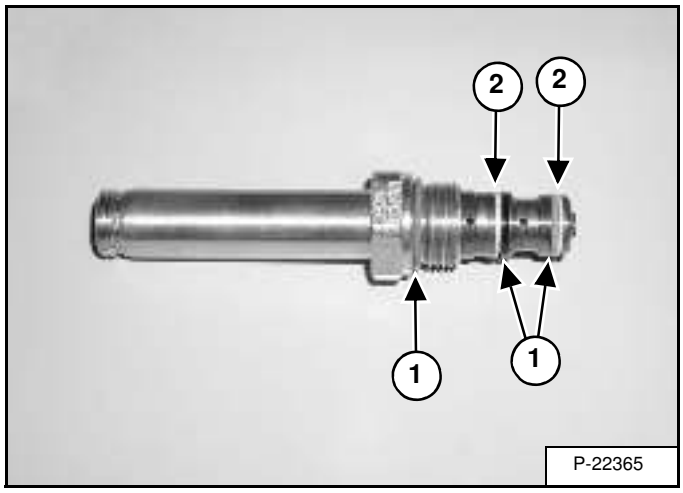
Tighten the plug.

Figure 20-61-41



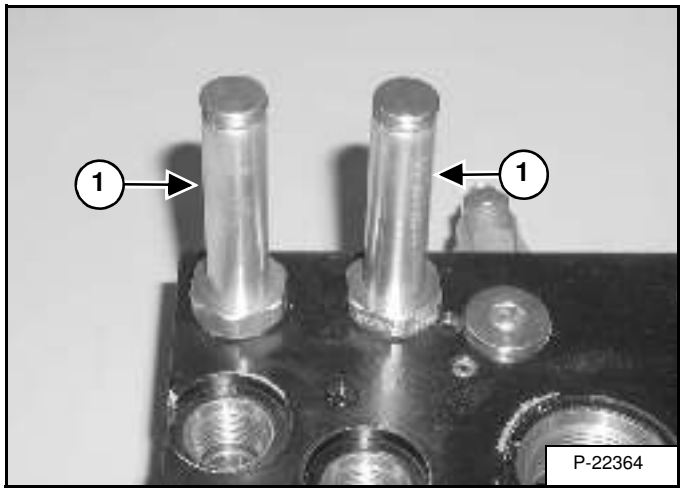
Install the five check valves (Item 1) **[Figure 20-61-41]**. Tighten the check valves to 19-22 ft.-lbs. (25,1-29,8 Nm) torque.

Figure 20-61-42



Install the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-61-42]** on the solenoid.

Figure 20-61-43



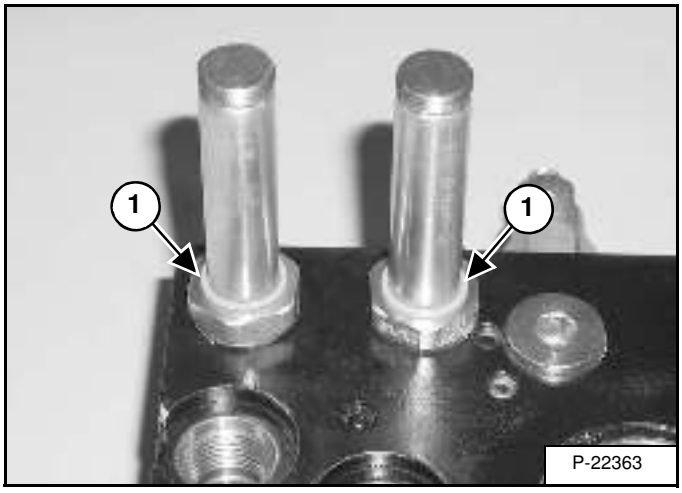
Install the solenoids (Item 1) **[Figure 20-61-43]**.

Tighten the solenoids to 19-22 ft.-lbs. (25,1-29,8 Nm) torque.

Dealer Copy -- Not for Resale

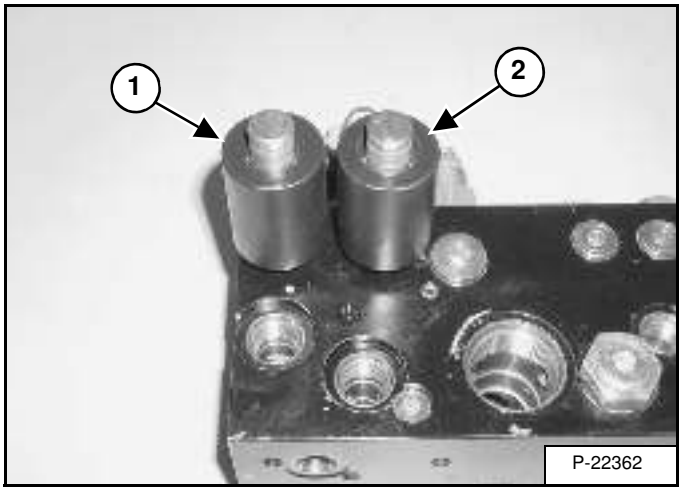
Assembly (Cont'd)

Figure 20-61-44



Install the O-rings (Item 1) **[Figure 20-61-44]** on the solenoids.

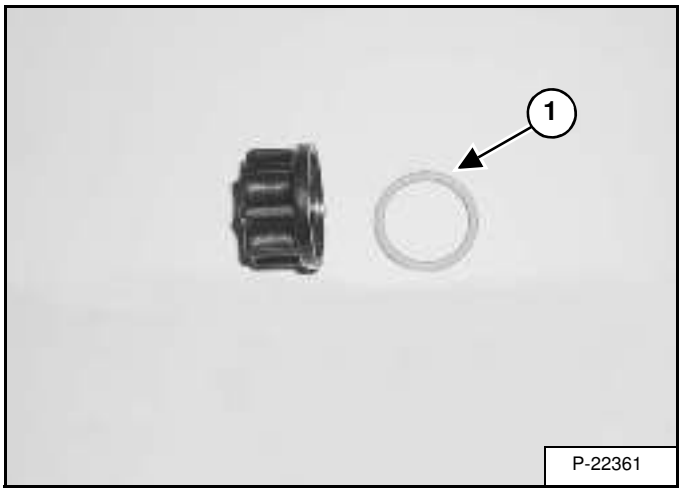
Figure 20-61-45



Install the coil with the red tie strap (Item 1) **[Figure 20-61-45]** on the solenoid.

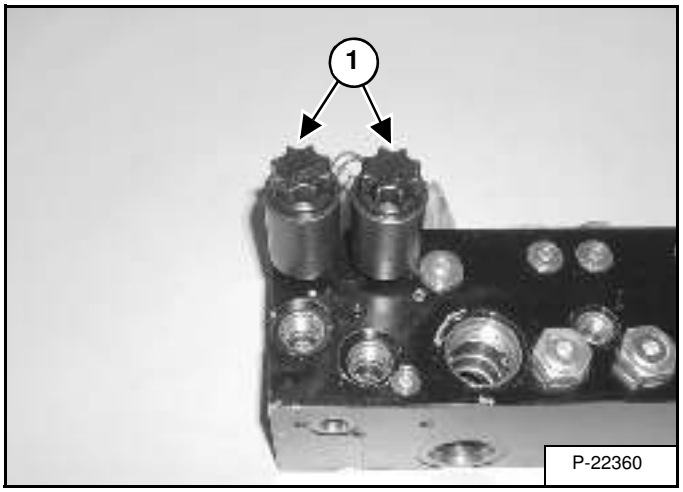
Install the coil with the blue tie strap (Item 2) **[Figure 20-61-45]** on the right solenoid.

Figure 20-61-46



Install the O-ring (Item 1) **[Figure 20-61-46]** on both coil nuts.

Figure 20-61-47



Install the nuts (Item 1) **[Figure 20-61-47]** on the solenoid.

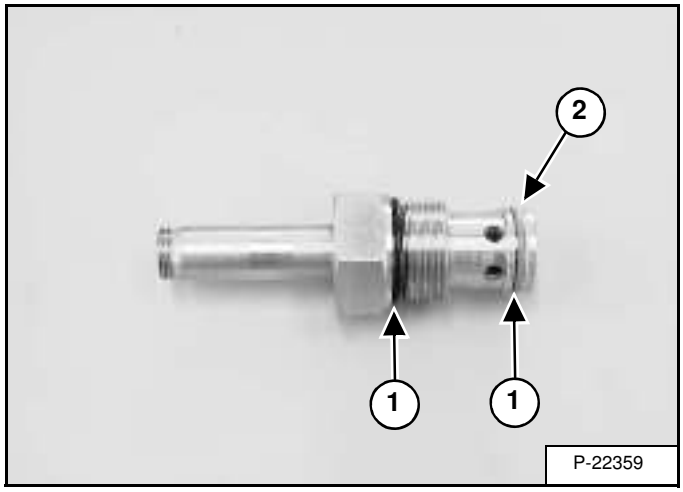
Tighten the nuts to 3-5 ft.-lbs. (4,1-6,1 Nm) torque.

NOTE: Overtightening the coil nuts (Item 1) [Figure 20-61-47] may cause spool or coil failure.

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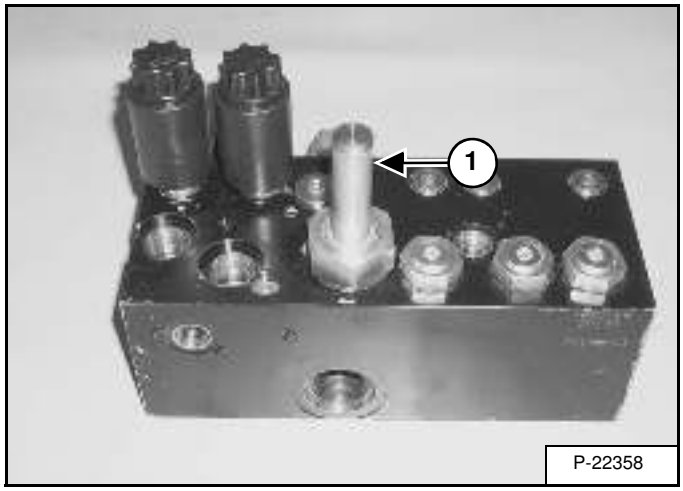
Assembly (Cont'd)

Figure 20-61-48



Install the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-61-48]** on the solenoid.

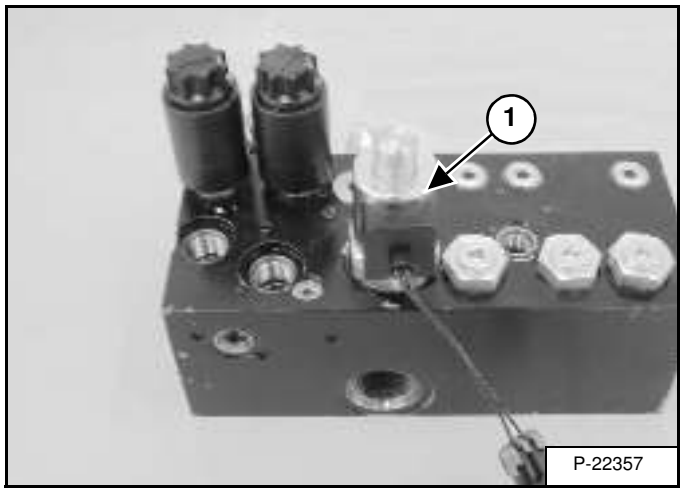
Figure 20-61-49



Install the solenoid (Item 1) **[Figure 20-61-49]**.

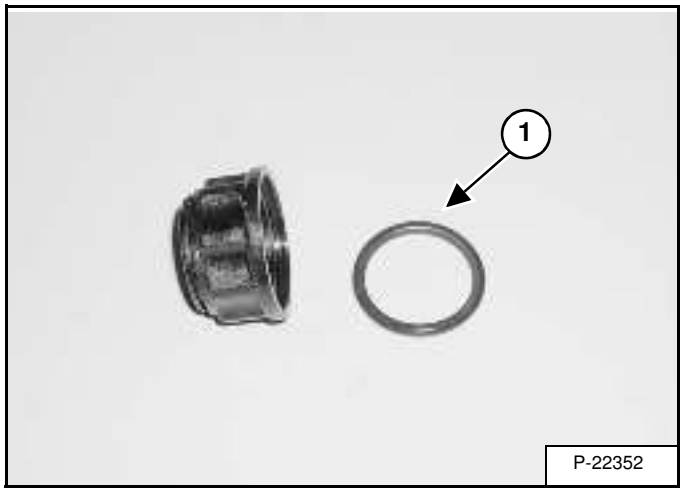
Tighten the solenoid to 60 ft.-lbs. (81 Nm) torque.

Figure 20-61-50



Install the coil with the brown tie strap (Item 1) **[Figure 20-61-50]** on the solenoid.

Figure 20-61-51



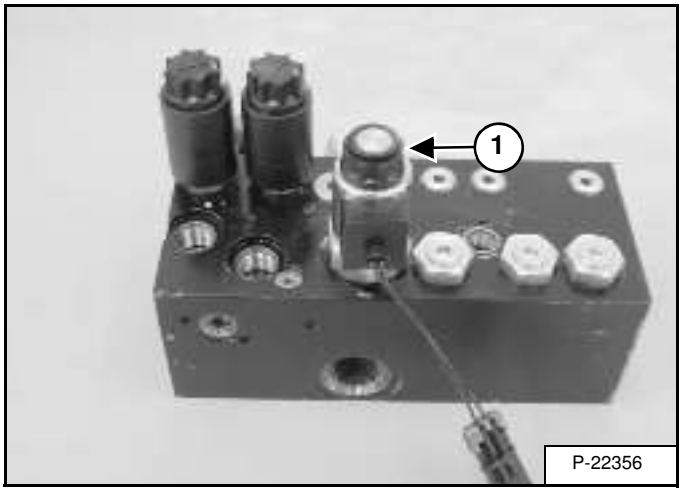
Install the O-ring (Item 1) **[Figure 20-61-51]** on the nut.

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MANIFOLD ASSEMBLY (S/N 232311950 & BELOW AND 232411763 & BELOW) (CONT'D)

Assembly (Cont'd)

Figure 20-61-52

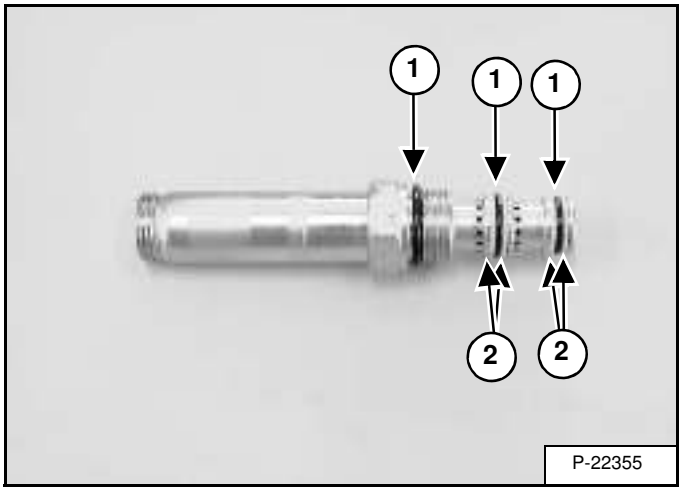


Install the nut (Item 1) **[Figure 20-61-52]** on the solenoid.

Tighten the nut to 3-5 ft.-lbs. (4,1-6,1 Nm) torque.

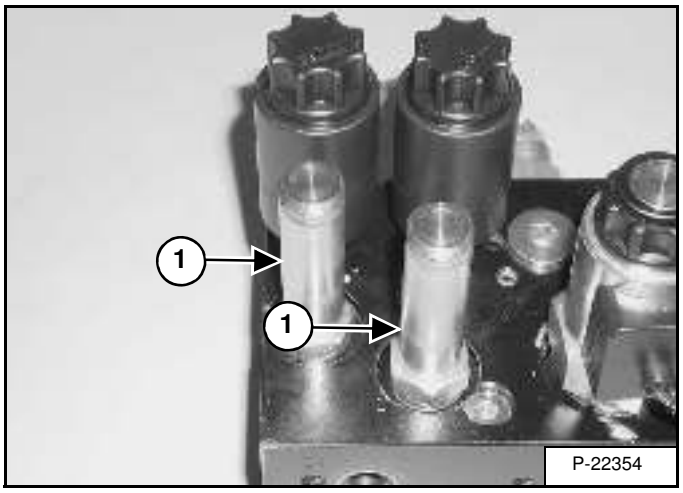
NOTE: Overtightening the coil nut (Item 1) [Figure 20-61-52] may cause spool or coil failure.

Figure 20-61-53



Install the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-61-53]** on both solenoids.

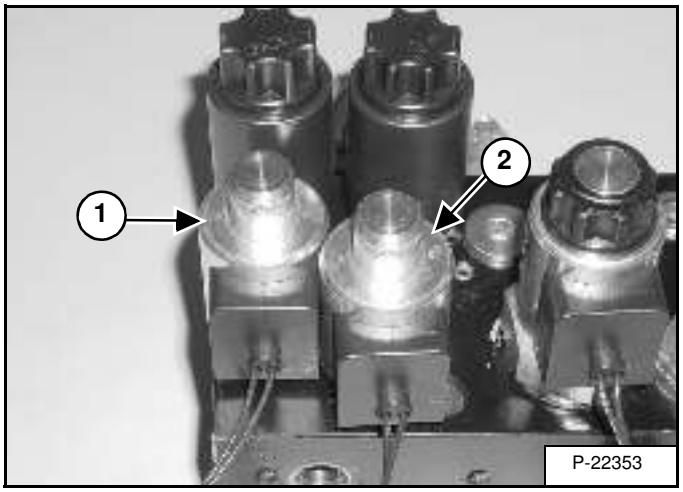
Figure 20-61-54



Install the solenoids (Item 1) **[Figure 20-61-54]**.

Tighten the solenoids to 19-22 ft.-lbs. (25,1-29,8 Nm) torque.

Figure 20-61-55



Install the coil with the green tie strap (Item 1) **[Figure 20-61-55]** on the left solenoid.

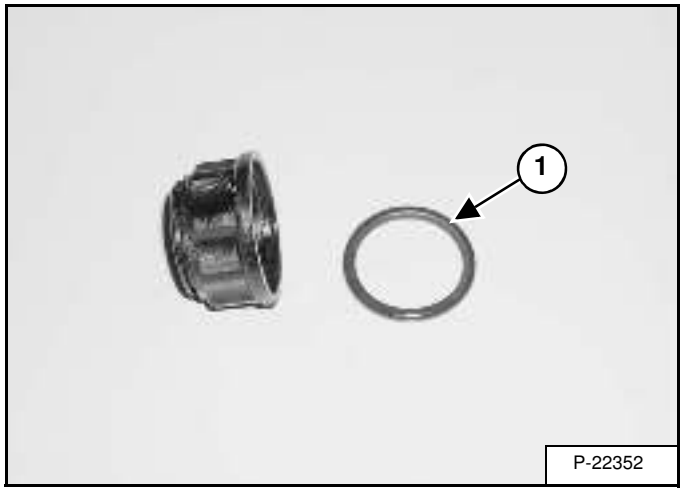
Install the coil with the yellow tie strap (Item 2) **[Figure 20-61-55]** on the right solenoid.

Dealer Copy -- Not for Resale

MANIFOLD ASSEMBLY (S/N 232311950 & BELOW AND 232411763 & BELOW) (CONT'D)

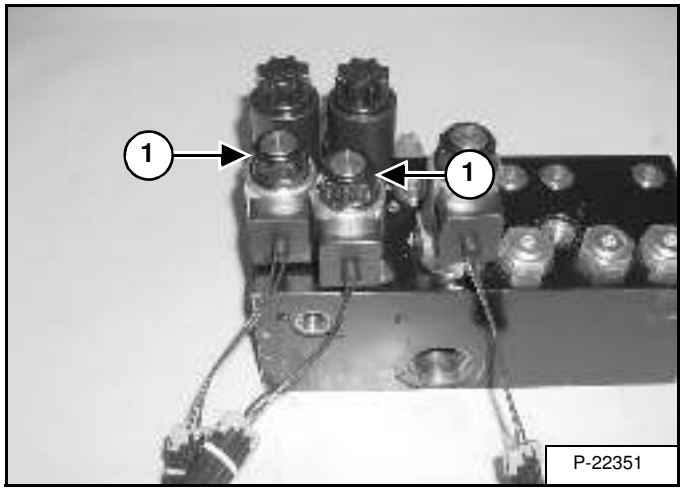
Assembly (Cont'd)

Figure 20-61-56



Install the O-ring (Item 1) **[Figure 20-61-56]** on both coil nuts.

Figure 20-61-57

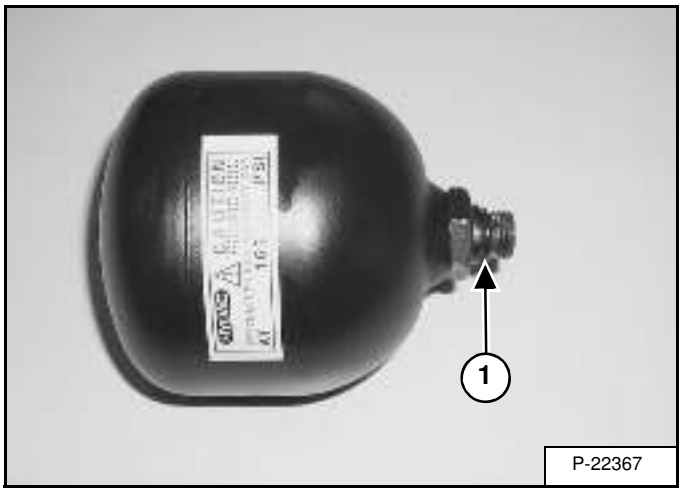


Install the nuts (Item 1) **[Figure 20-61-57]** on the solenoid.

Tighten the nuts to 3-5 ft.-lbs. (4,1-6,1 Nm) torque.

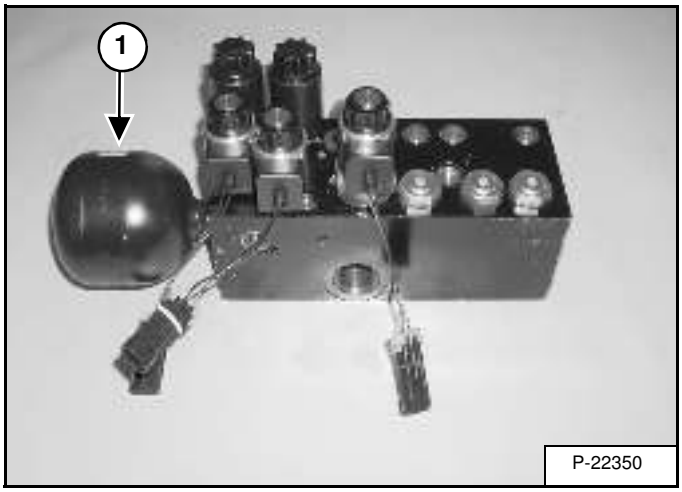
NOTE: Overtightening the coil nut (Item 1) [Figure 20-61-57] may cause spool or coil failure.

Figure 20-61-58



Install the O-ring (Item 1) **[Figure 20-61-58]** on the accumulator.

Figure 20-61-59



Install the accumulator (Item 1) **[Figure 20-61-59]**.

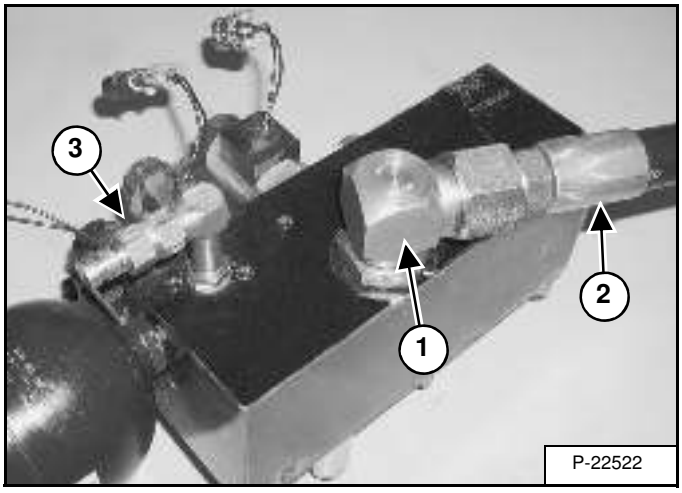
Tighten the accumulator to 22-24 ft.-lbs. (29-33 Nm) torque.

Dealer Copy -- Not for Resale

MANIFOLD ASSEMBLY (S/N 232311950 & BELOW AND 232411763 & BELOW) (CONT'D)

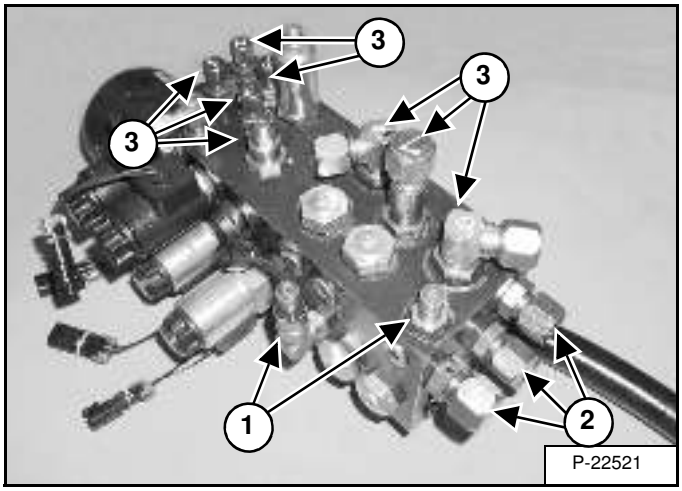
Assembly (Cont'd)

Figure 20-61-60



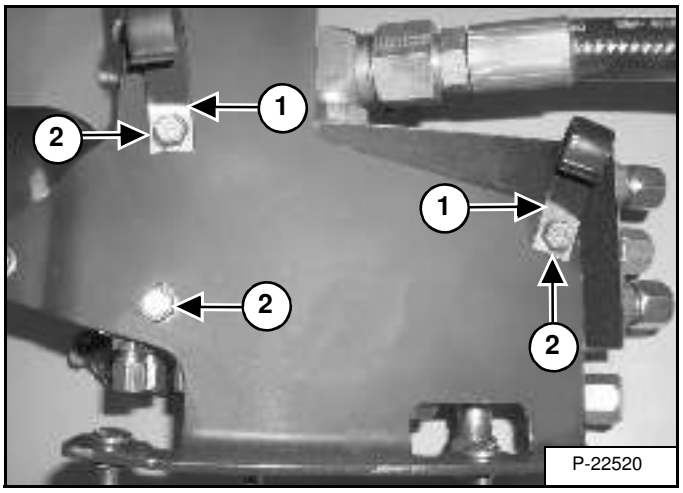
Install the fitting (Item 1), hose (Item 2) and diagnostic port (Item 3) **[Figure 20-61-60]**.

Figure 20-61-61



Install the two diagnostic ports (Item 1) four fittings on the end (Item 2) and the eight fittings (Item 3) **[Figure 20-61-61]** on the top.

Figure 20-61-62



Install the mount, clamps (Item 1) and bolts (Item 2) **[Figure 20-61-62]**.

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MANIFOLD ASSEMBLY/ACCUMULATOR (S/N 232311951 & ABOVE AND 232411764 & ABOVE)

Manifold Description

The manifold body contains three valves, the pressure reducing valve, main relief valve and buildup valve.

The manifold supplies 428 PSI (2951 kPa) 406-450 PSI (2799-3103 kPa) to the joysticks to activate the control valve spools.

The accumulator is connected to the manifold body.

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

Removal And Installation

IMPORTANT

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

I-2003-0888

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

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

Remove the right side cover. (See Removal And Installation on Page 40-200-1.)

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

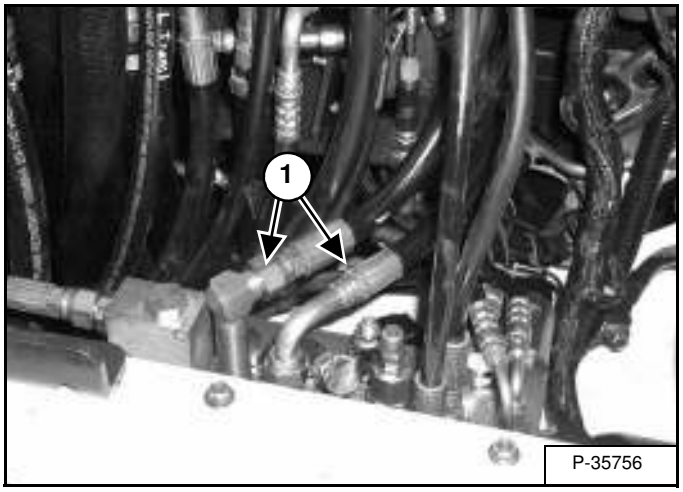
Mark the hoses for correct installation.

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.

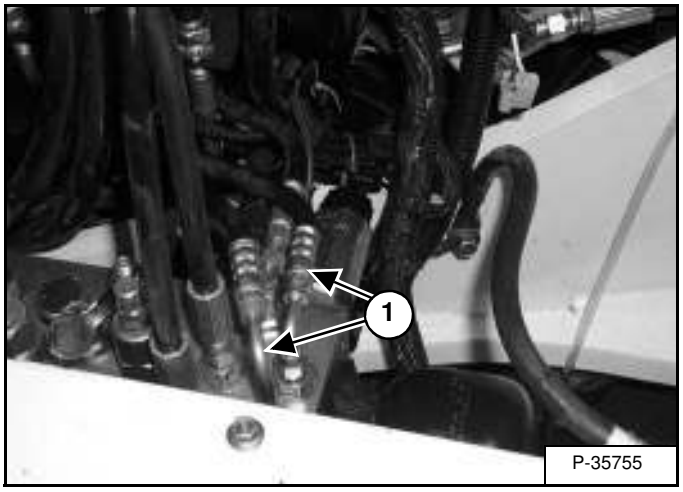
W-2145-0290

Figure 20-62-1



Remove the two hoses (Item 1) **[Figure 20-62-1]**.

Figure 20-62-2



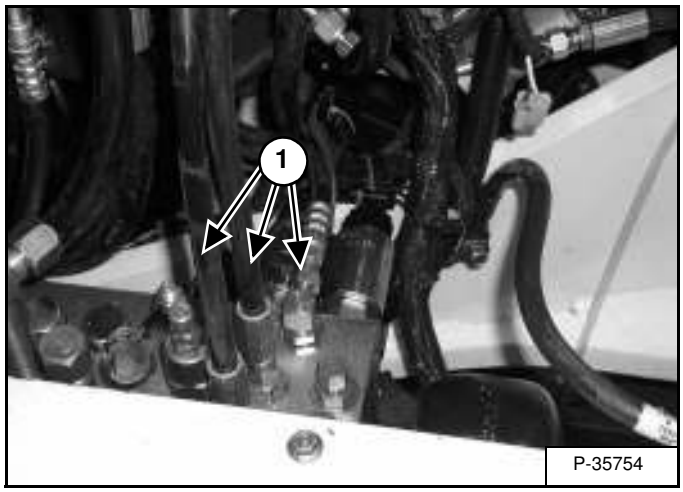
Remove the two hoses (Item 1) **[Figure 20-62-2]**.

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MANIFOLD ASSEMBLY/ACCUMULATOR (S/N 232311951 & ABOVE AND 232411764 & ABOVE) (CONT'D)

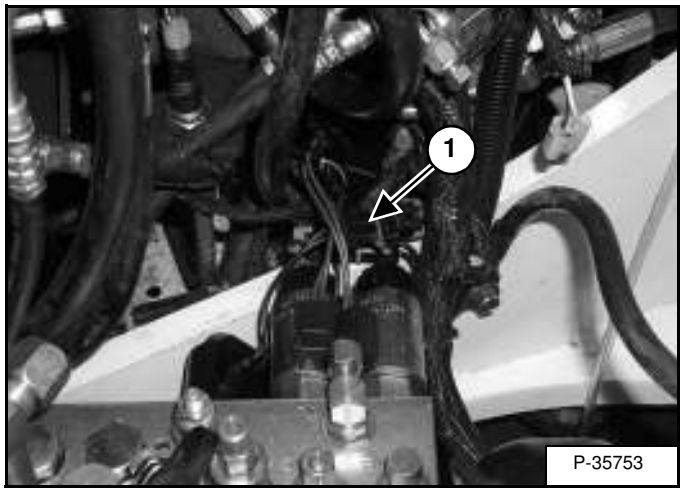
Removal And Installation (Cont'd)

Figure 20-62-3



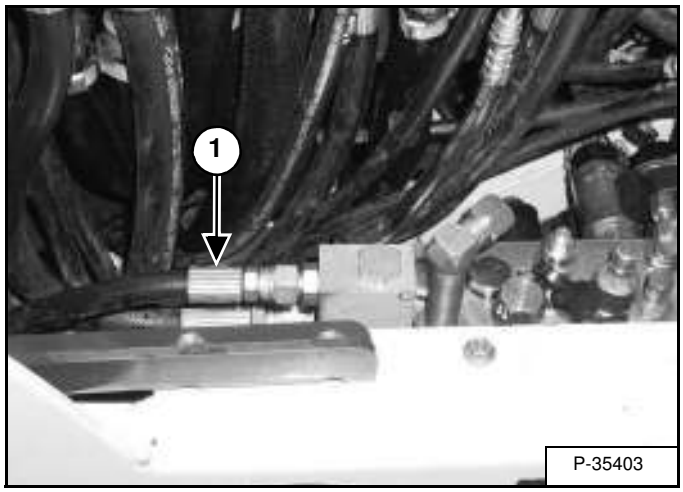
Remove the three hoses (Item 1) **[Figure 20-62-3]**.

Figure 20-62-4



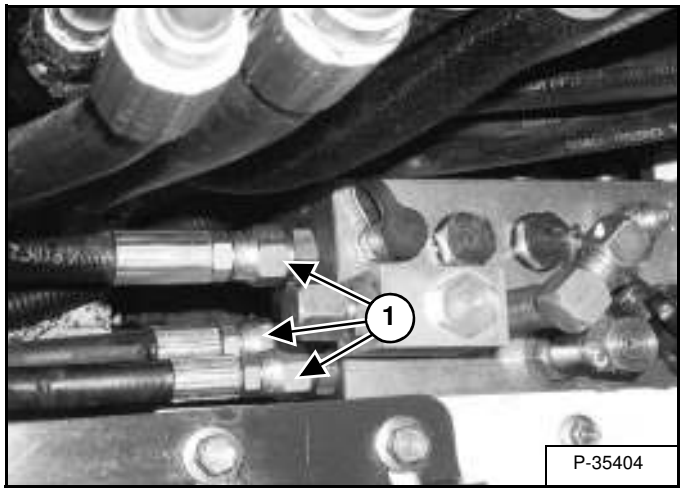
Disconnect the five electrical connectors (Item 1) **[Figure 20-62-4]**.

Figure 20-62-5



Remove the hose (Item 1) **[Figure 20-62-5]**.

Figure 20-62-6



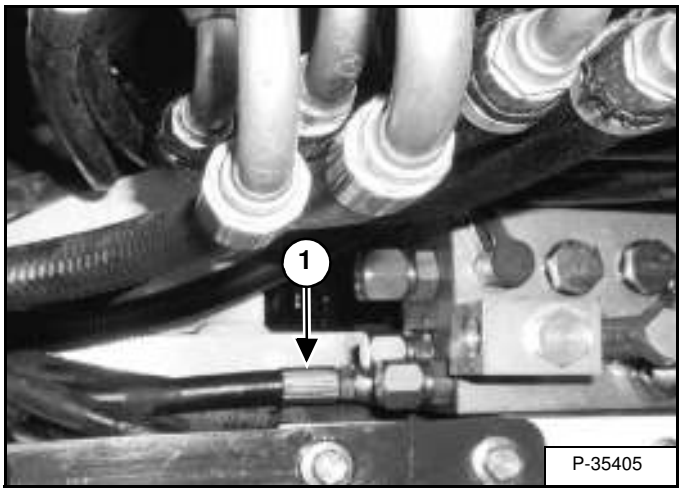
Remove the three hoses (Item 1) **[Figure 20-62-6]**.

Dealer Copy -- Not for Resale

MANIFOLD ASSEMBLY/ACCUMULATOR (S/N 232311951 & ABOVE AND 232411764 & ABOVE) (CONT'D)

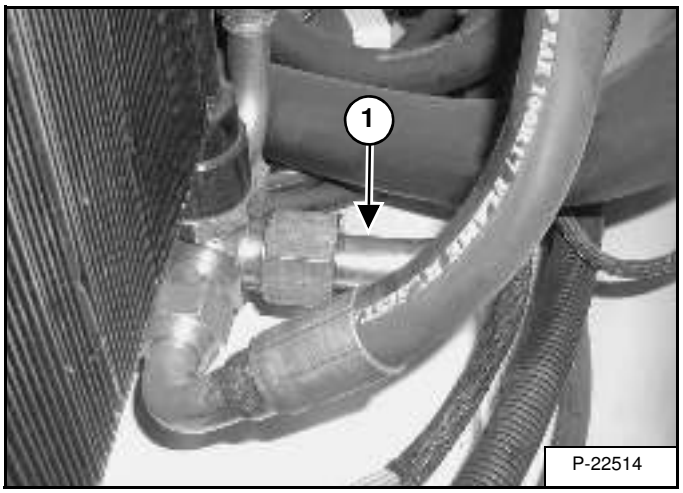
Removal And Installation (Cont'd)

Figure 20-62-7



Remove the hose (Item 1) **[Figure 20-62-7]**.

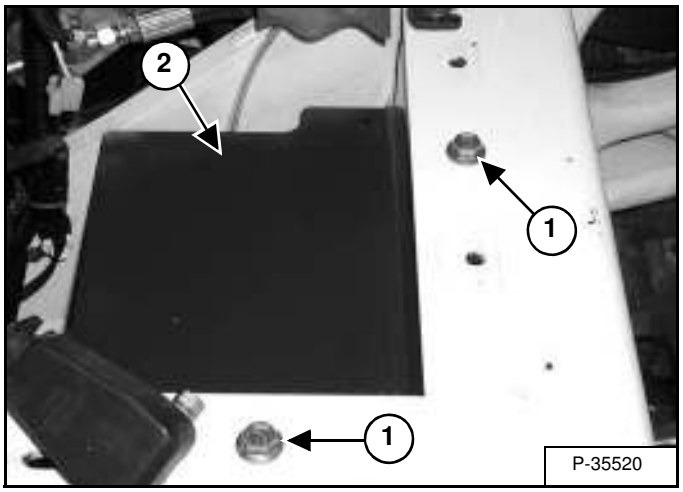
Figure 20-62-8



Remove the hose (Item 1) **[Figure 20-62-8]** from the oil cooler.

NOTE: The hose will be removed with the manifold.

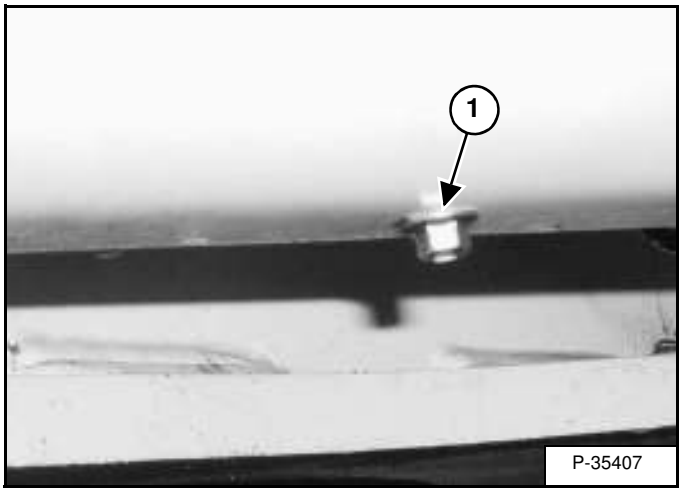
Figure 20-62-9



Remove the two bolts (Item 1) **[Figure 20-62-9]** from the battery holder (Item 2) **[Figure 20-62-9]**.

Remove the battery holder.

Figure 20-62-10



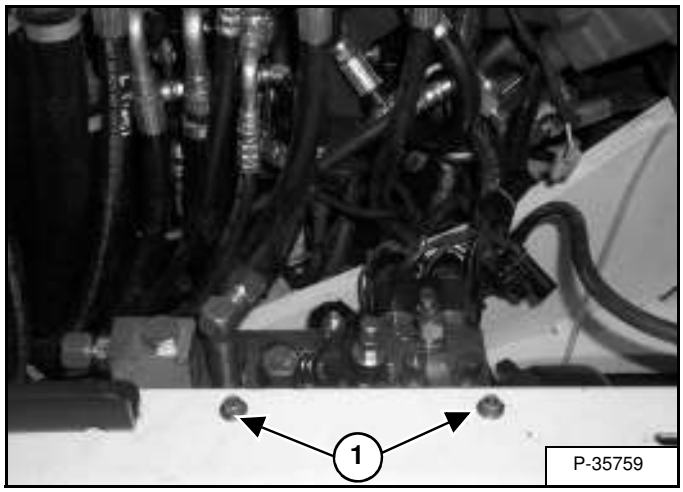
Remove the bottom bolt (Item 1) **[Figure 20-62-10]**.

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MANIFOLD ASSEMBLY/ACCUMULATOR (S/N 232311951 & ABOVE AND 232411764 & ABOVE) (CONT'D)

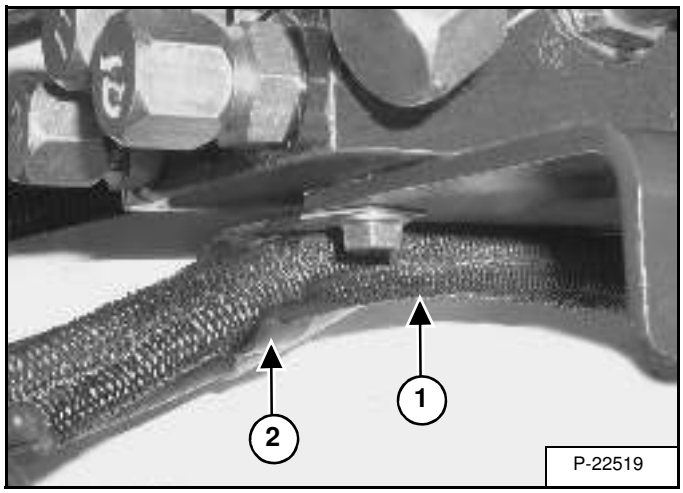
Removal And Installation (Cont'd)

Figure 20-62-11



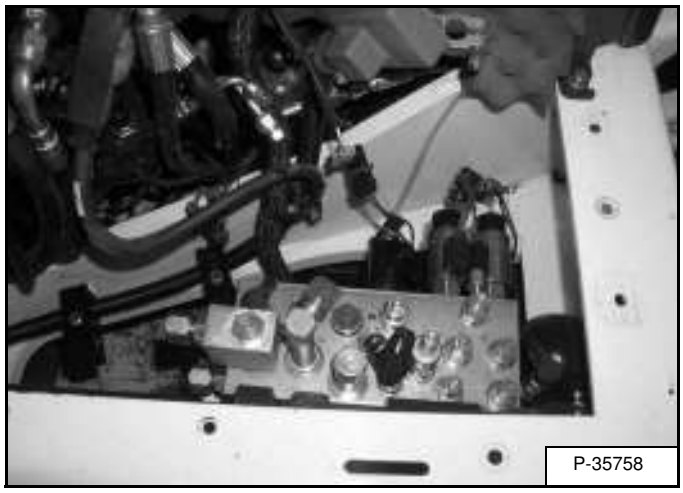
Remove the two top bolts (Item 1) **[Figure 20-62-11]**.

Figure 20-62-12



Push the manifold toward the excavator and remove the wire harness (Item 1) from the two clamps (Item 2) **[Figure 20-62-12]**.

Figure 20-62-13

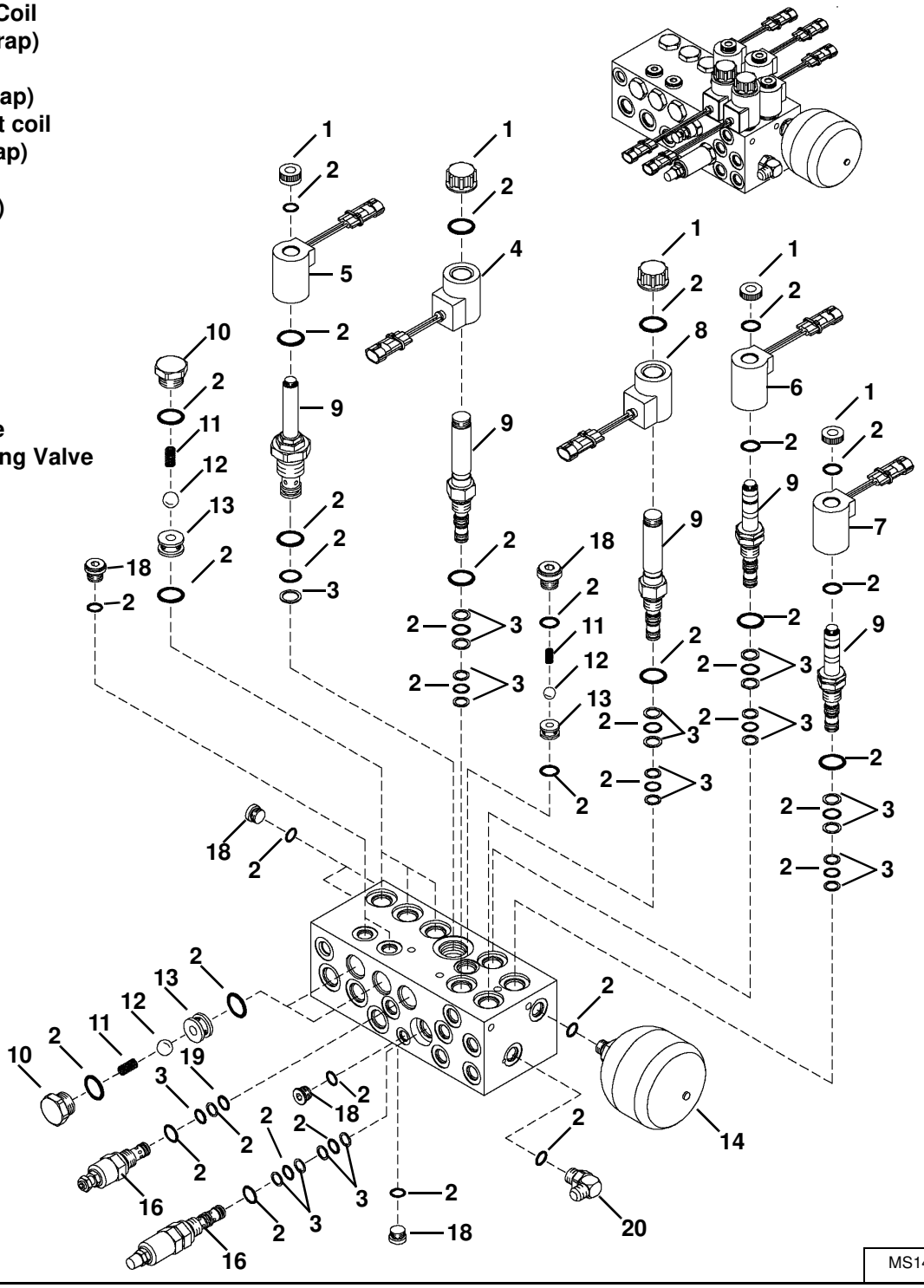


Move the manifold forward and remove the manifold from the excavator **[Figure 20-62-13]**.

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Parts Identification

1. Nut
2. O-Ring
3. Back-up Ring
4. Auxiliary Coil (w/Blue Tie Strap)
5. System Bypass Coil (w/ Brown Tie Strap)
6. 2-Speed Coil (w/Yellow Tie Strap)
7. Joystick Lockout coil (w/Green Tie Strap)
8. Auxiliary coil (w/Red Tie Strap)
9. Solenoid
10. Cap
11. Spring
12. Check Ball
13. Seat
14. Accumulator
15. Housing
16. Main Relief Valve
17. Pressure Reducing Valve
18. Plug
19. Glid Ring
20. Fitting



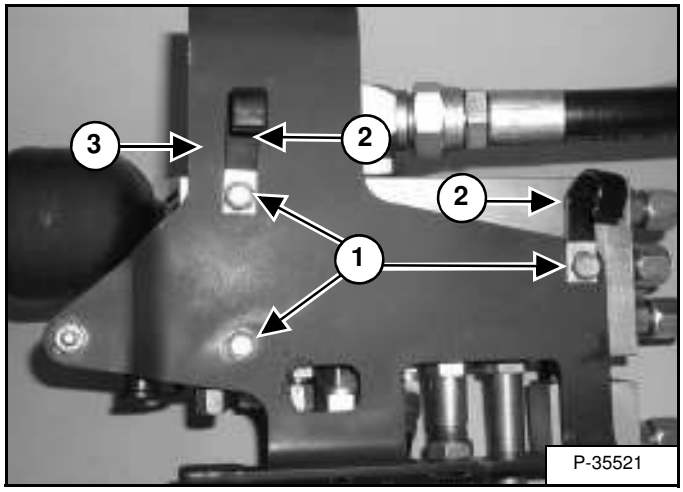
MS1402

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MANIFOLD ASSEMBLY (S/N 232311951 & ABOVE AND 232411764 & ABOVE) (CONT'D)

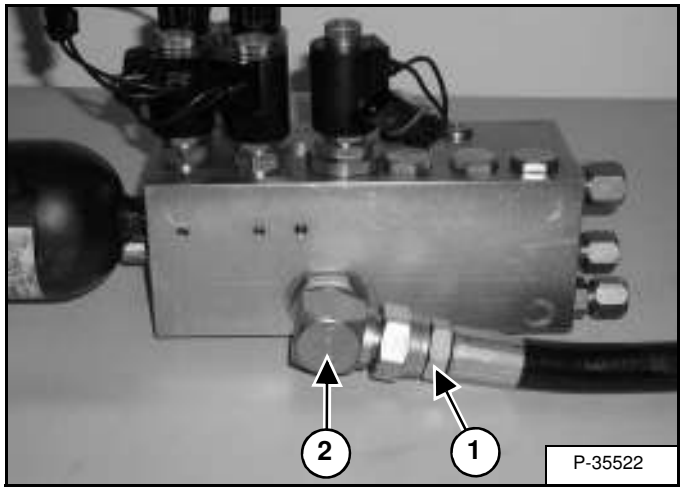
Disassembly

Figure 20-63-1



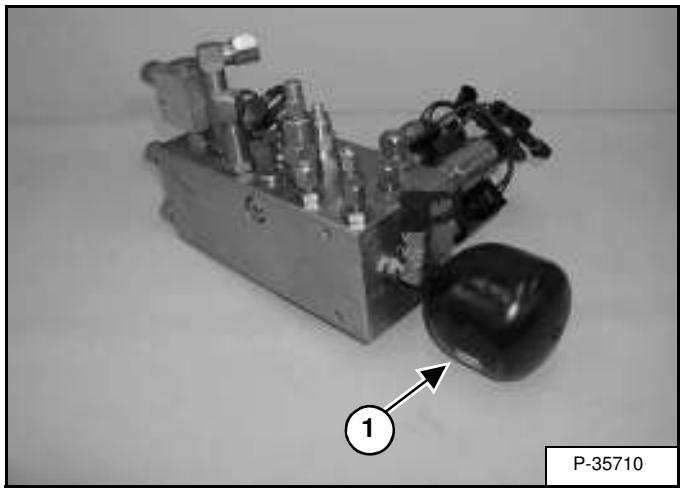
Remove the three bolts (Item 1), clamps (Item 2) and mount plate (Item 3) **[Figure 20-63-1]** from the manifold.

Figure 20-63-2



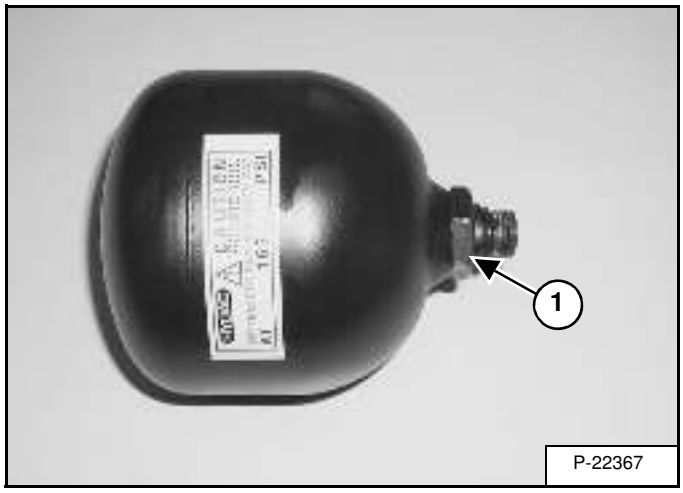
Remove the hose (Item 1) and fitting (Item 2) **[Figure 20-63-2]**.

Figure 20-63-3



Remove the accumulator (Item 1) **[Figure 20-63-3]**.

Figure 20-63-4



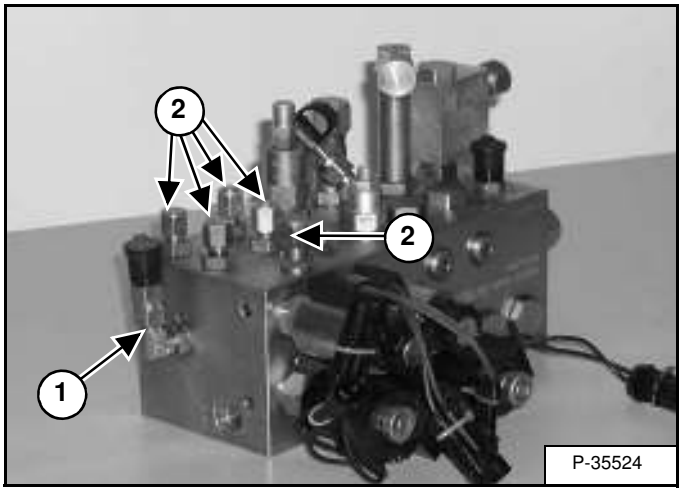
Remove the O-ring (Item 1) **[Figure 20-63-4]** from the accumulator.

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MANIFOLD ASSEMBLY (S/N 232311951 & ABOVE AND 232411764 & ABOVE) (CONT'D)

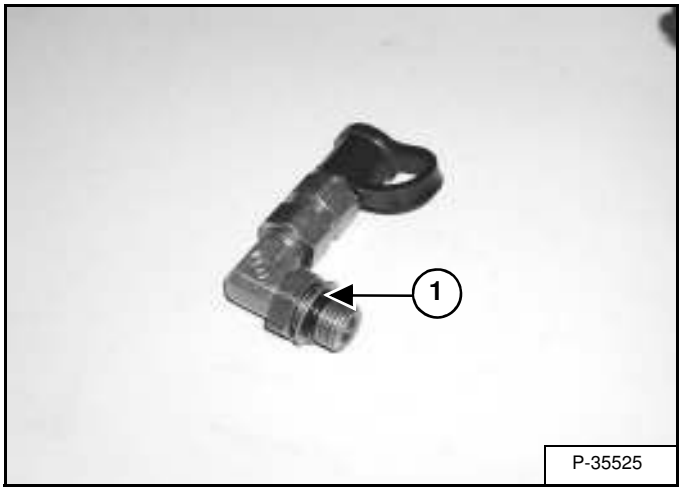
Disassembly (Cont'd)

Figure 20-63-5



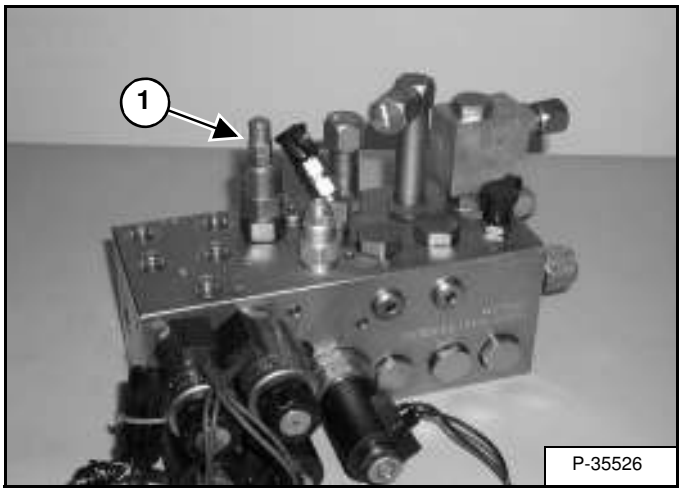
Remove the diagnostic port (Item 1) and five fittings (Item 2) **[Figure 20-63-5]**.

Figure 20-63-6



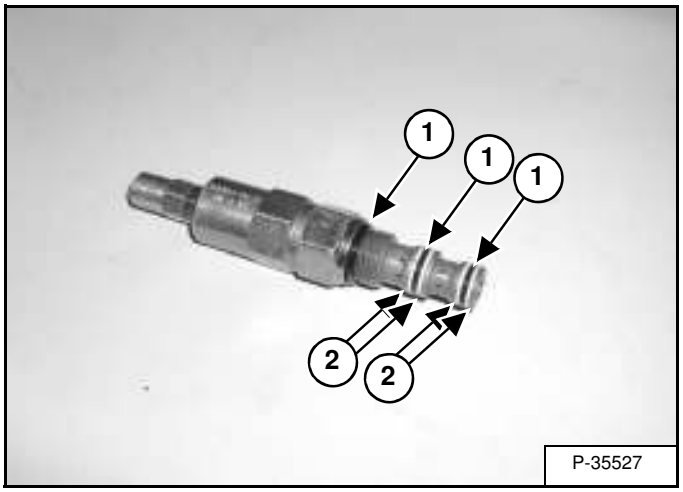
Remove the O-ring (Item 1) **[Figure 20-63-6]** from the diagnostic port and fittings.

Figure 20-63-7



Remove the pressure reducing valve (Item 1) **[Figure 20-63-7]**.

Figure 20-63-8

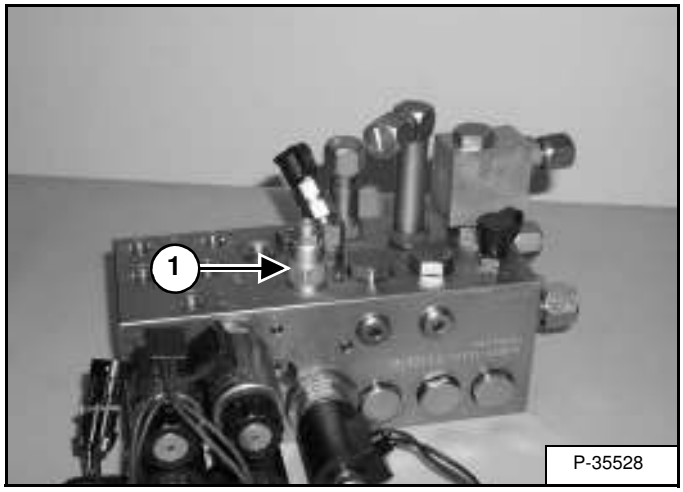


Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-63-8]** from the pressure reducing valve.

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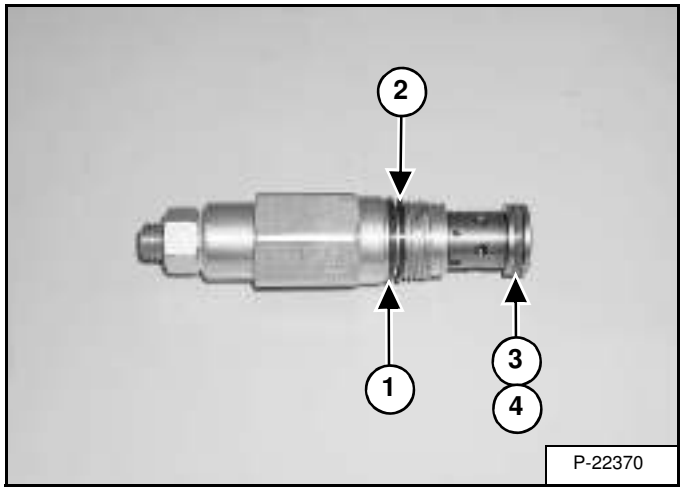
Disassembly (Cont'd)

Figure 20-63-9



Remove the main relief valve (Item 1) **[Figure 20-63-9]**.

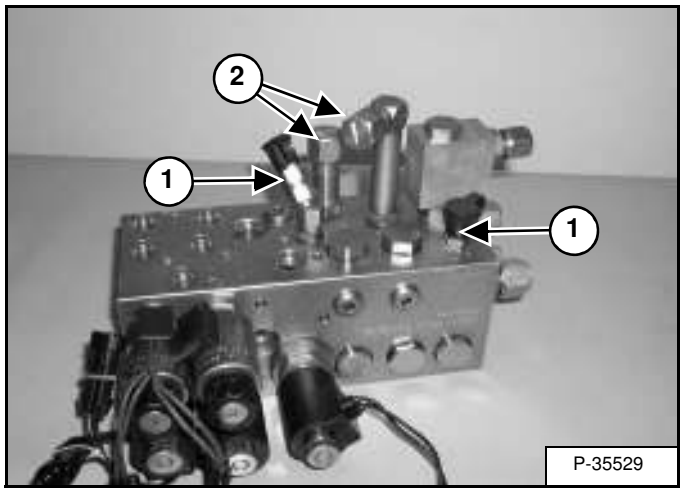
Figure 20-63-10



Remove the O-ring (Item 1) and backup rings (Item 2) **[Figure 20-63-10]** from the main relief valve.

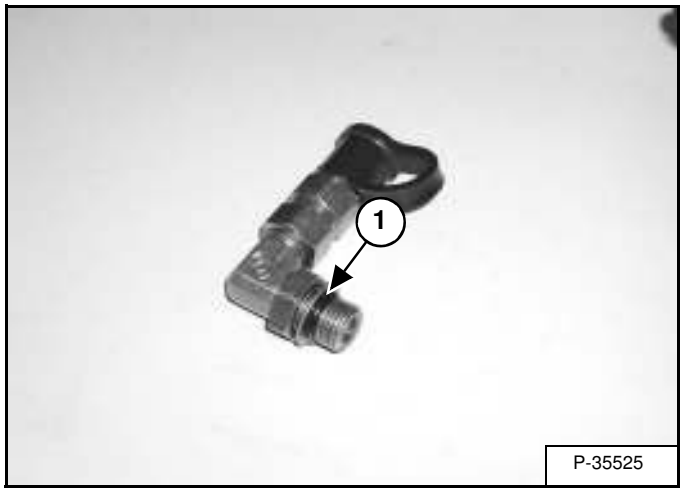
Remove the glid ring (Item 3) and O-ring (Item 4) **[Figure 20-63-10]** from the main relief valve.

Figure 20-63-11



Remove the two diagnostic ports (Item 1) and two fittings (Item 2) **[Figure 20-63-11]**.

Figure 20-63-12



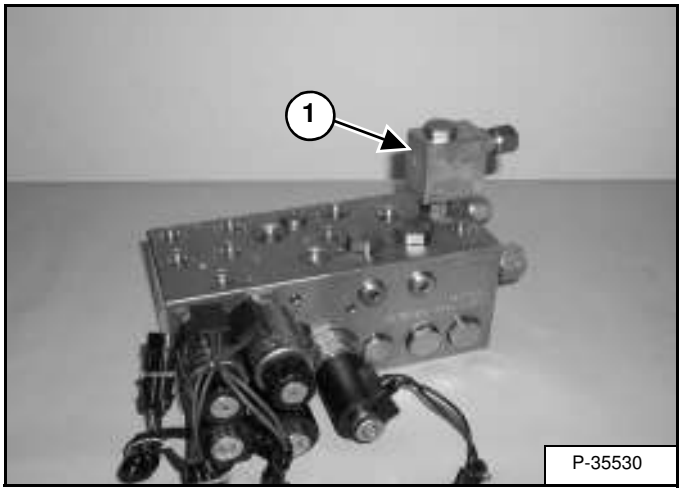
Remove the O-ring (Item 1) **[Figure 20-63-12]** from the diagnostic ports and fittings.

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MANIFOLD ASSEMBLY (S/N 232311951 & ABOVE AND 232411764 & ABOVE) (CONT'D)

Disassembly (Cont'd)

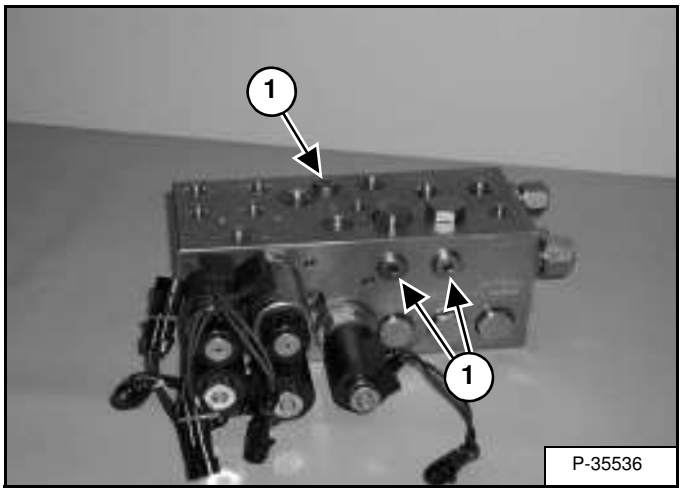
Figure 20-63-13



Remove the build up valve (Item 1) **[Figure 20-63-13]**.

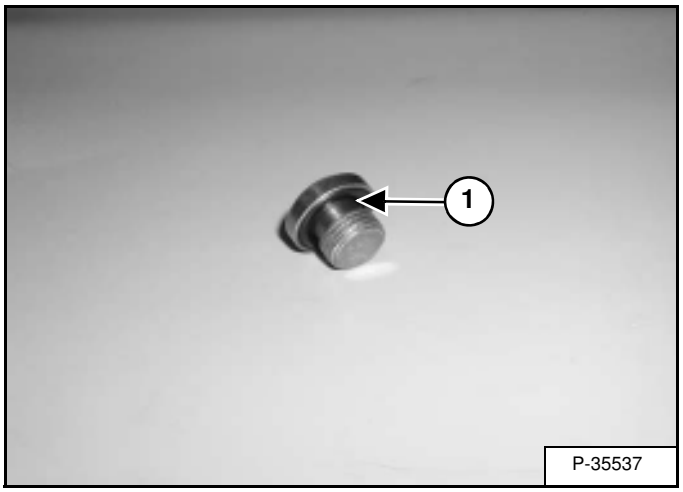
NOTE: See Disassembly And Assembly on Page 20-160-1 for build up valve disassembly.

Figure 20-63-14



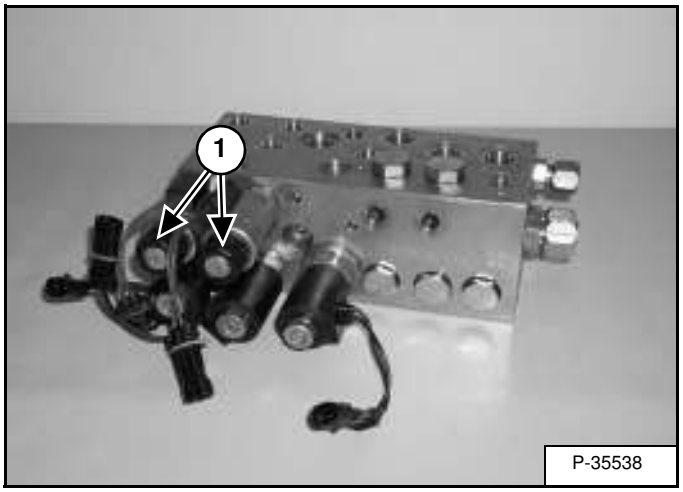
Remove the three plugs (Item 1) **[Figure 20-63-14]**.

Figure 20-63-15



Remove the O-ring (Item 1) **[Figure 20-63-15]** from the plugs.

Figure 20-63-16

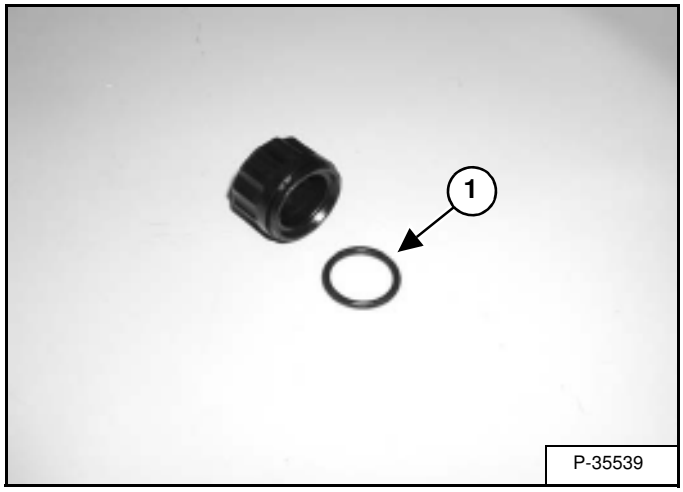


Remove the nuts (Item 1) **[Figure 20-63-16]** from the two solenoids.

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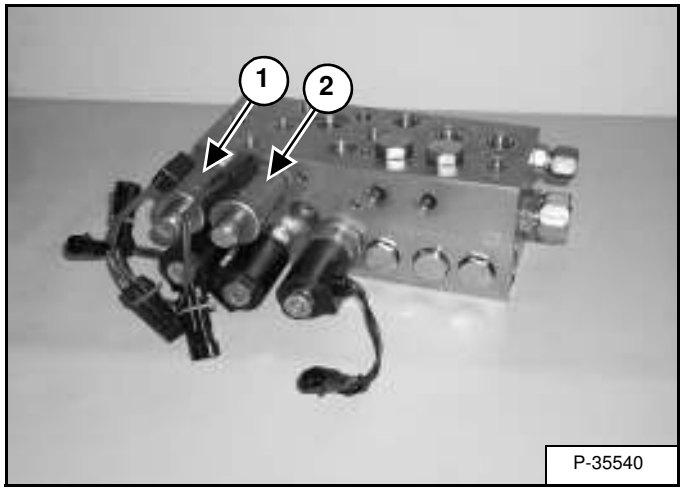
Disassembly (Cont'd)

Figure 20-63-17



Remove the O-ring (Item 1) **[Figure 20-63-17]** from both nuts.

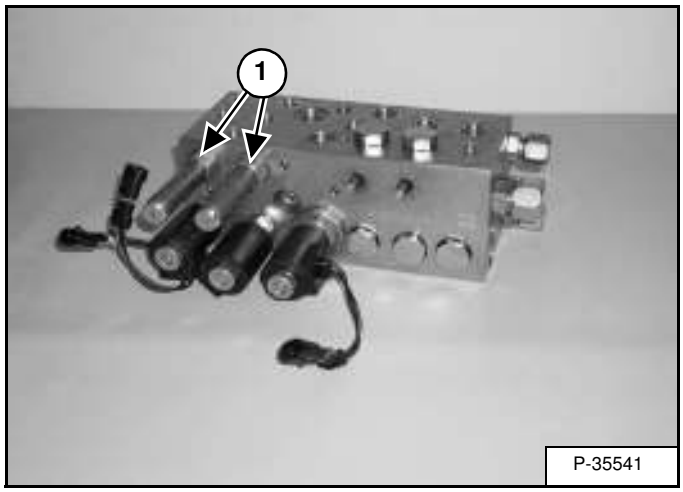
Figure 20-63-18



Remove the coil with the red tie strap (Item 1) **[Figure 20-63-18]** from the left solenoid.

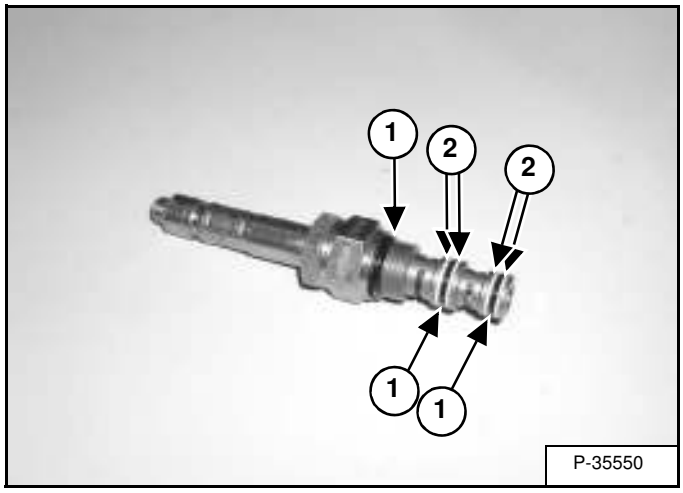
Remove the coil with the blue tie strap (Item 2) **[Figure 20-63-18]** from the right solenoid.

Figure 20-63-19



Remove the two solenoids (Item 1) **[Figure 20-63-19]**.

Figure 20-63-20

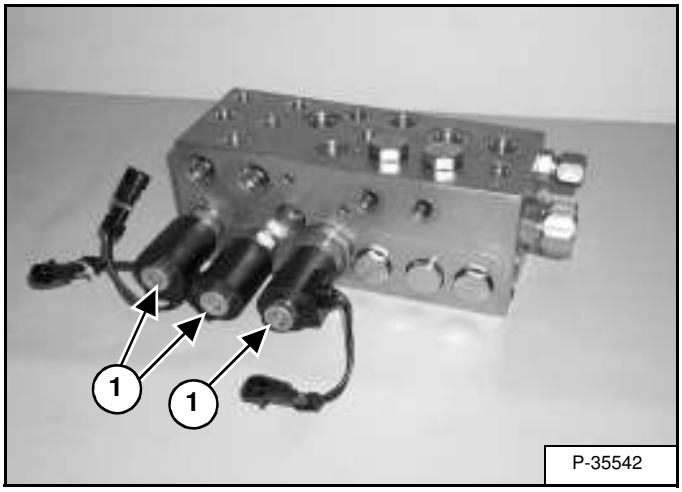


Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-63-20]** from both solenoids.

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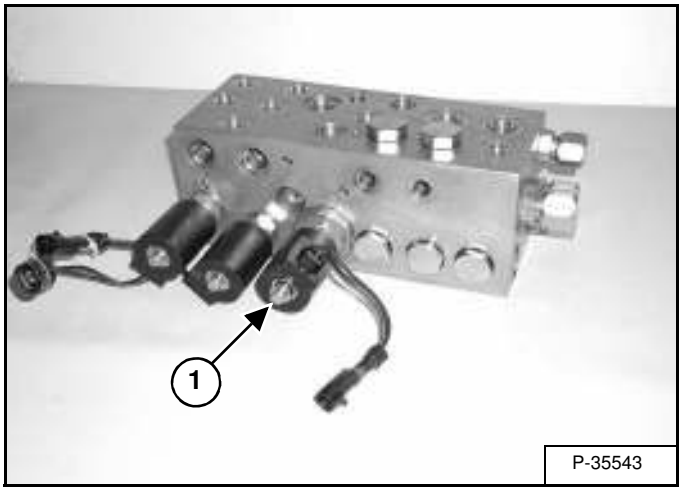
Disassembly (Cont'd)

Figure 20-63-21



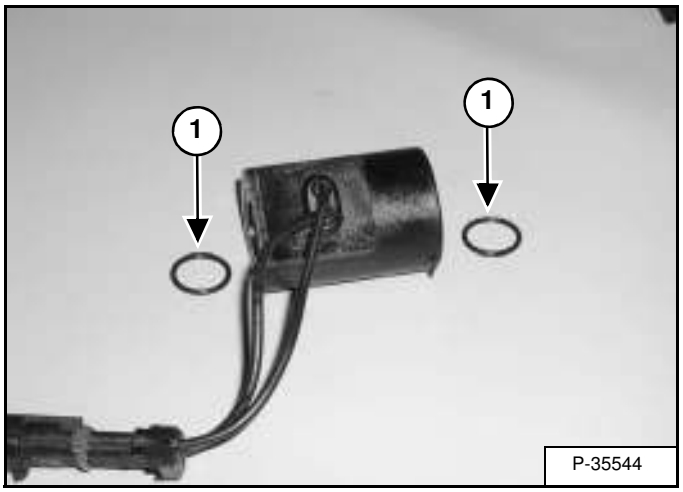
Remove the nut (Item 1) **[Figure 20-63-21]** from the three solenoids.

Figure 20-63-22



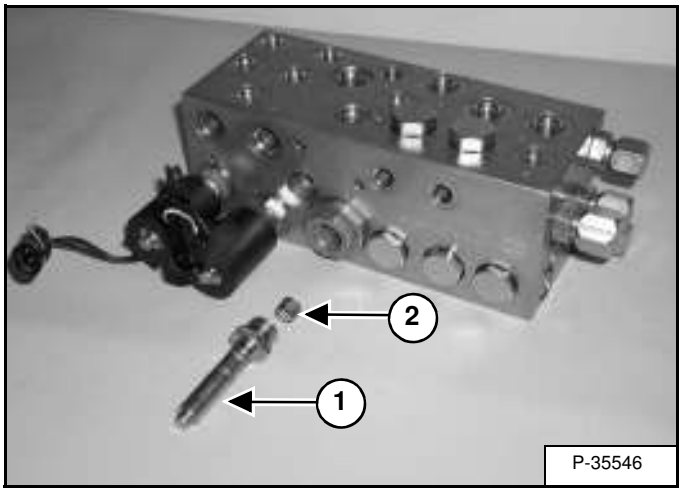
Remove the coil with the brown tie strap (Item 1) **[Figure 20-63-22]** from the solenoid.

Figure 20-63-23



Remove the O-rings (Item 1) **[Figure 20-63-23]** from the coil.

Figure 20-63-24

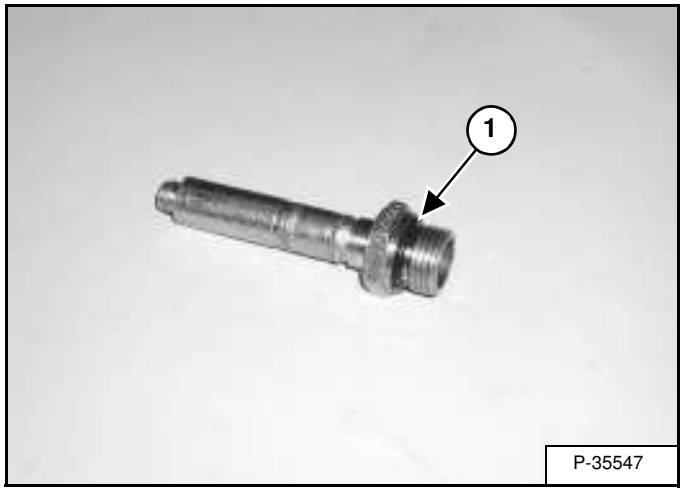


Remove the solenoid (Item 1) and spring (Item 2) **[Figure 20-63-24]**.

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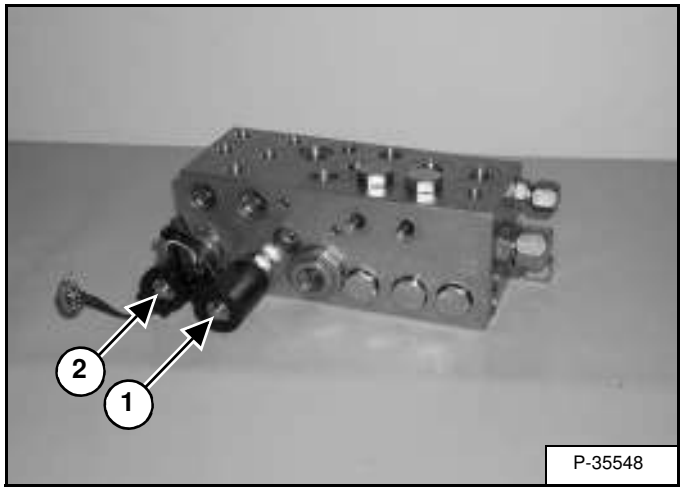
Disassembly (Cont'd)

Figure 20-63-25



Remove the O-ring (Item 1) **[Figure 20-63-25]** from the solenoid.

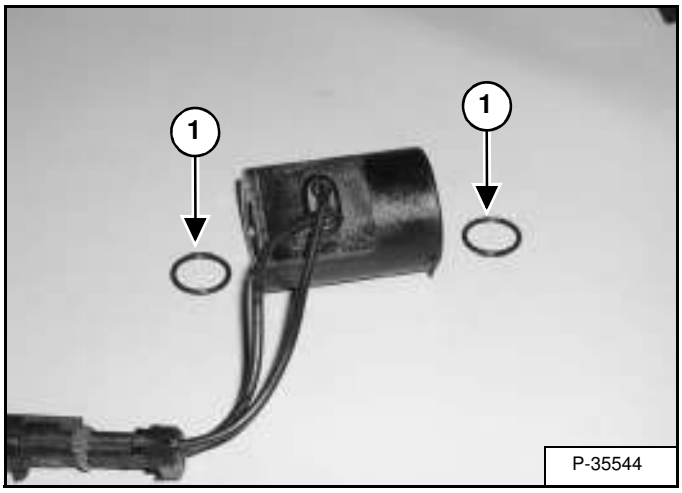
Figure 20-63-26



Remove the coil with the yellow tie strap (Item 1) **[Figure 20-63-26]** from the solenoid.

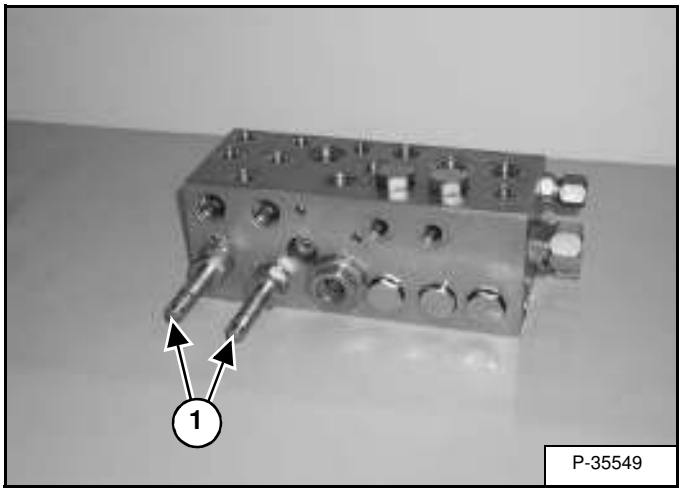
Remove the coil with the green tie strap (Item 2) **[Figure 20-63-26]** from the solenoid.

Figure 20-63-27



Remove the two O-rings (Item 1) **[Figure 20-63-27]** from the coils.

Figure 20-63-28



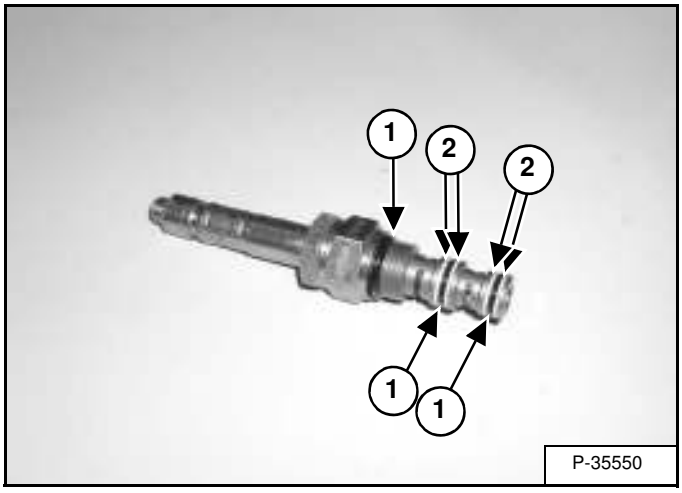
Remove the two solenoids (Item 1) **[Figure 20-63-28]**.

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MANIFOLD ASSEMBLY (S/N 232311951 & ABOVE AND 232411764 & ABOVE) (CONT'D)

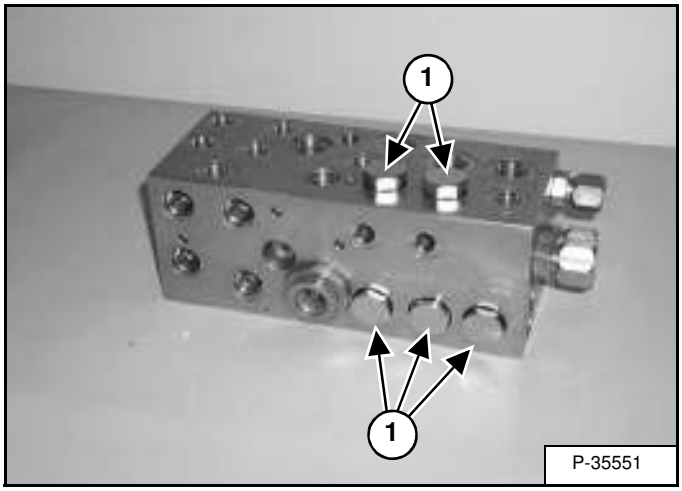
Disassembly (Cont'd)

Figure 20-63-29



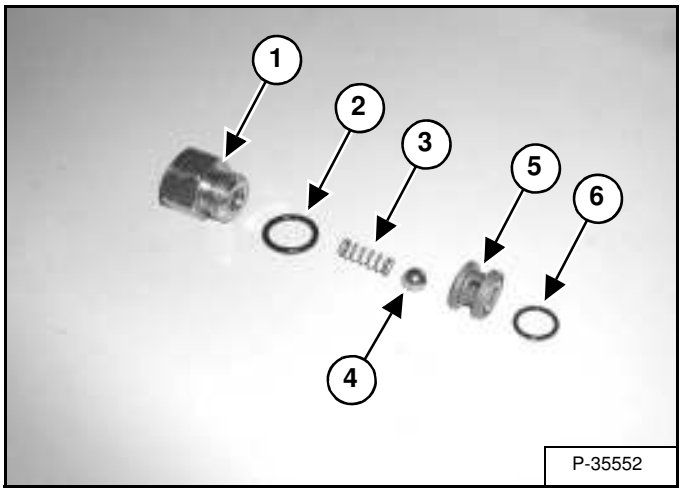
Remove the O-rings (Item 10) and back-up rings (Item 2) **[Figure 20-63-29]** from both solenoids.

Figure 20-63-30



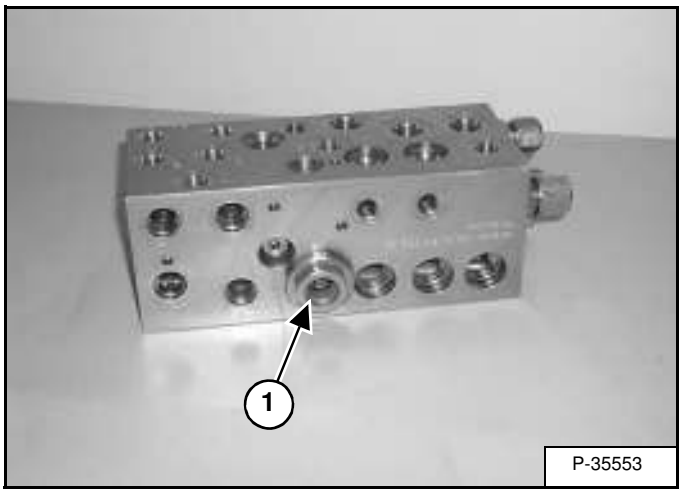
Loosen the five check valves (Item 1) **[Figure 20-63-30]**.

Figure 20-63-31



Remove the cap (Item 1). O-ring (Item 2), spring (Item 3), check ball (Item 4), seat (Item 5) and O-ring (Item 6) **[Figure 20-63-31]** from the five check valve ports.

Figure 20-63-32



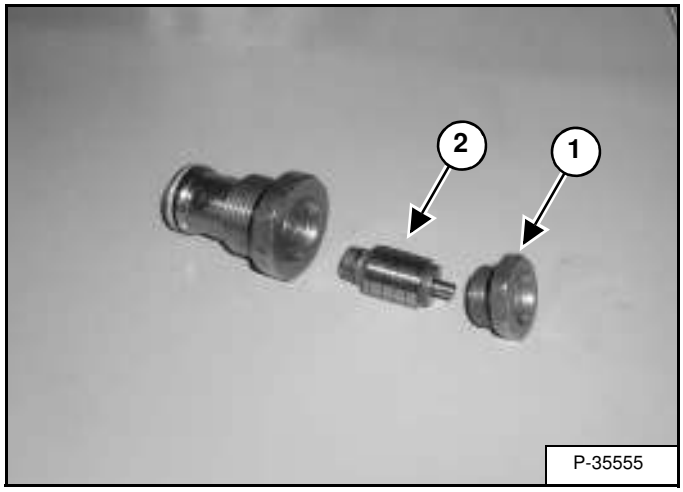
Remove the port adapter (Item 1) **[Figure 20-63-32]**.

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MANIFOLD ASSEMBLY (S/N 232311951 & ABOVE AND 232411764 & ABOVE) (CONT'D)

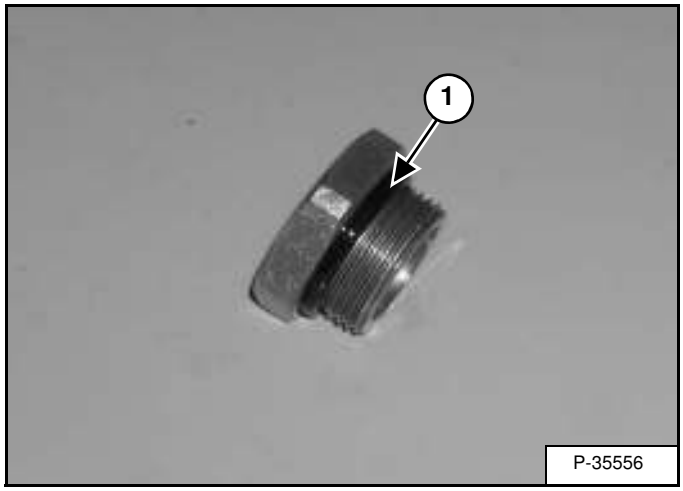
Disassembly (Cont'd)

Figure 20-63-33



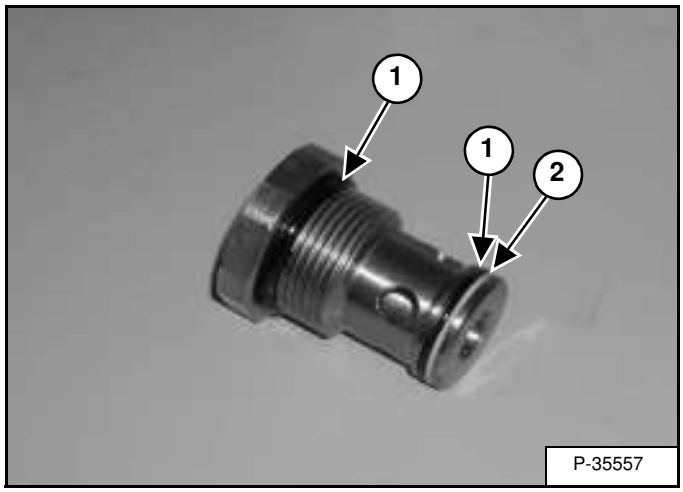
Remove the fitting (Item 1) and spool (Item 2) **[Figure 20-63-33]** from the port adapter.

Figure 20-63-34



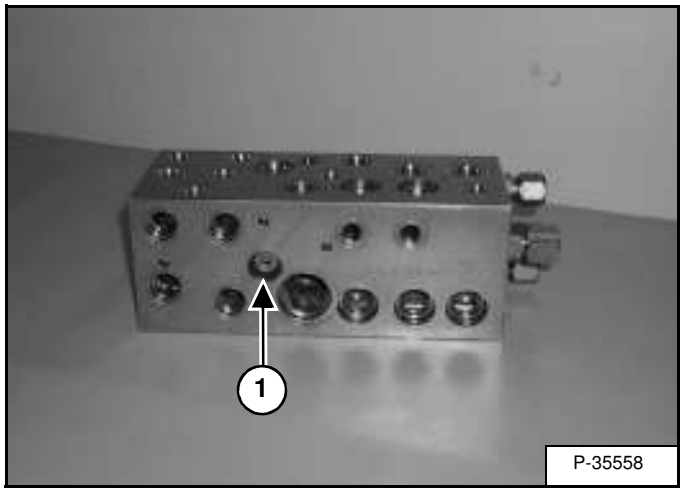
Remove the O-ring (Item 1) **[Figure 20-63-34]** from the fitting.

Figure 20-63-35



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-63-35]** from the port adapter.

Figure 20-63-36



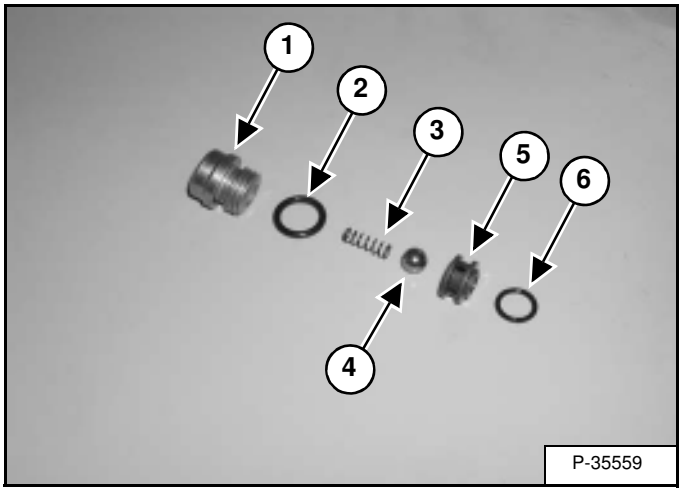
Loosen the cap (Item 1) **[Figure 20-63-36]**.

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MANIFOLD ASSEMBLY (S/N 232311951 & ABOVE AND 232411764 & ABOVE) (CONT'D)

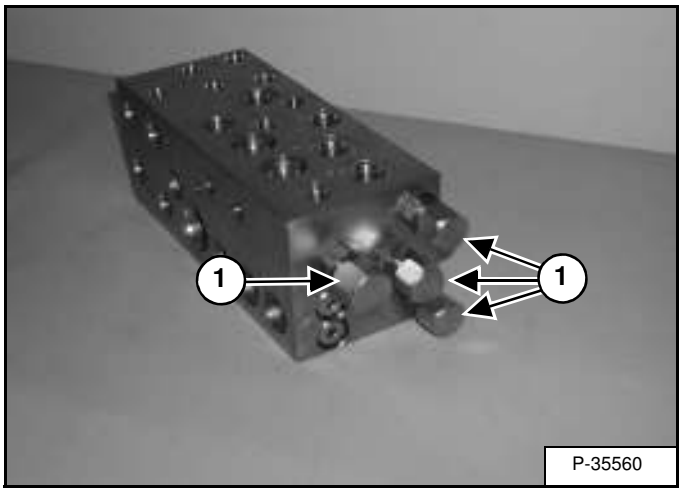
Disassembly (Cont'd)

Figure 20-63-37



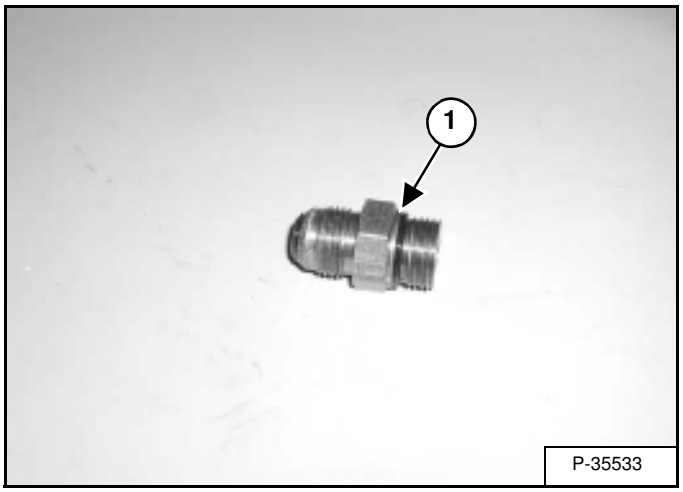
Remove the cap (Item 1) **[Figure 20-63-37]**, O-ring (Item 2) **[Figure 20-63-37]**, spring (Item 3) **[Figure 20-63-37]**, check ball (Item 4) **[Figure 20-63-37]**, seat (Item 5) **[Figure 20-63-37]** and O-ring (Item 6) **[Figure 20-63-37]** from the port (Item 1) **[Figure 20-63-36 on Page 10]**.

Figure 20-63-38



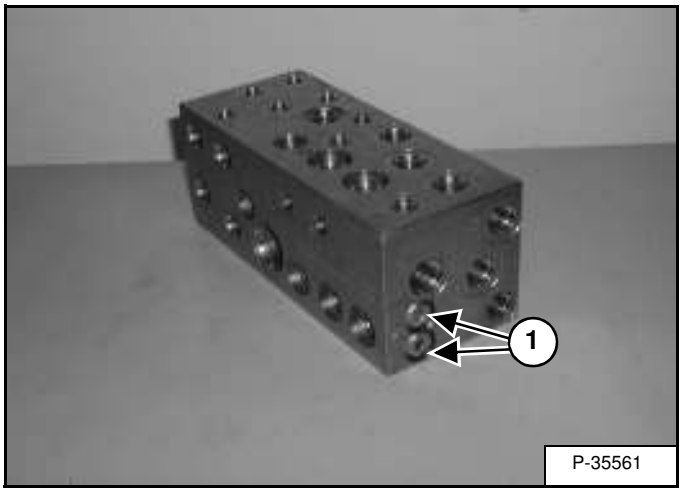
Remove the four fittings (Item 1) **[Figure 20-63-38]**.

Figure 20-63-39



Remove the O-ring (Item 1) **[Figure 20-63-39]** from the fittings.

Figure 20-63-40

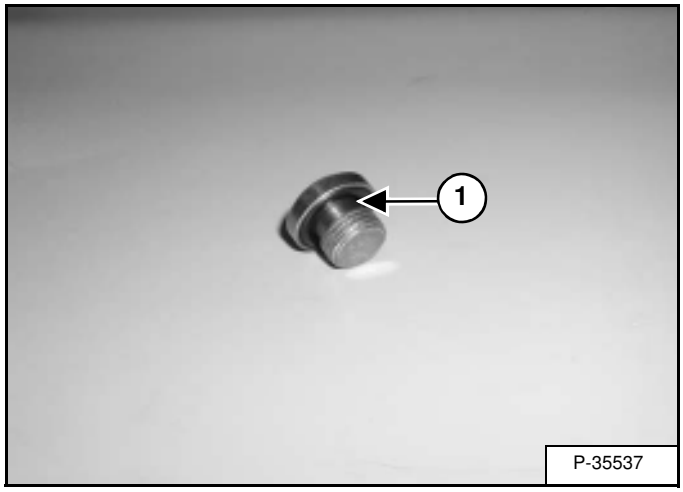


Remove the two plugs (Item 1) **[Figure 20-63-40]**.

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Disassembly (Cont'd)

Figure 20-63-41

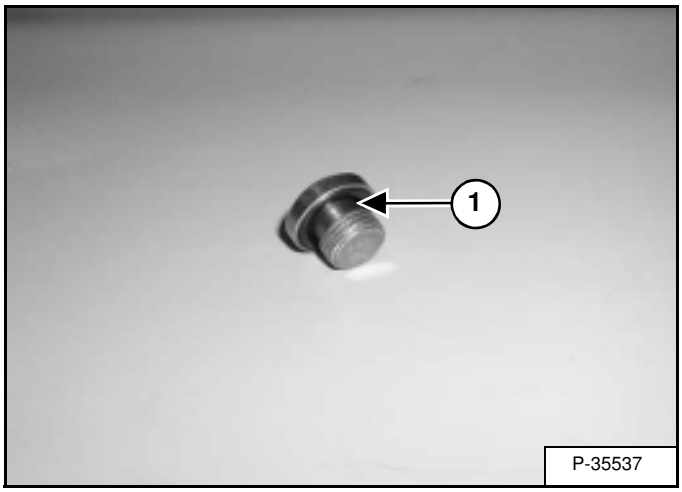


Remove the O-ring (Item 1) **[Figure 20-63-41]** from the plugs.

Assembly

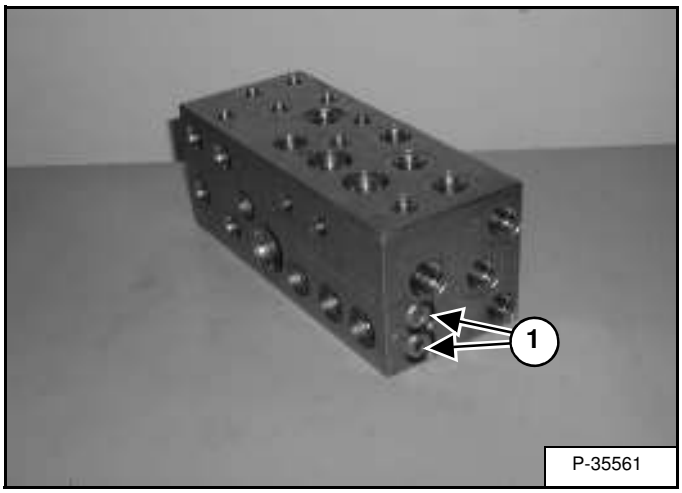
Clean all parts in solvent and dry with compressed air. Inspect all parts and replace any that are damaged. Discard all old O-rings and back-up rings. Apply clean hydraulic oil to the new O-rings and back-up rings before installation.

Figure 20-63-42



Install the O-ring (Item 1) **[Figure 20-63-42]** on the plugs.

Figure 20-63-43

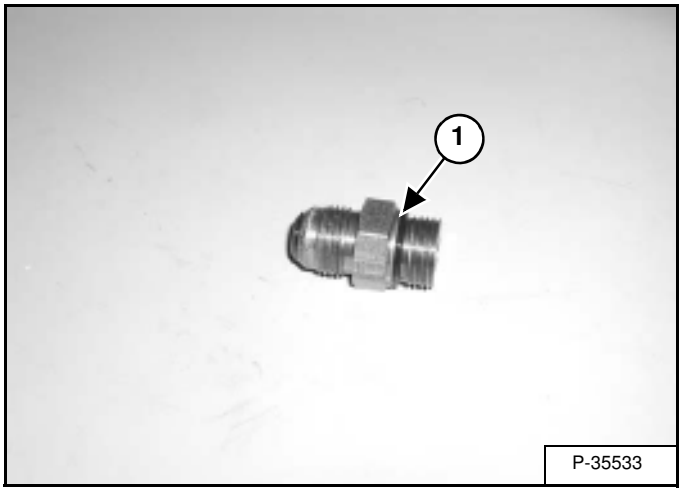


Install the two plugs (Item 1) **[Figure 20-63-43]**. Tighten the plugs to 18-20 ft.-lbs. (24,4-27,1 Nm) torque.

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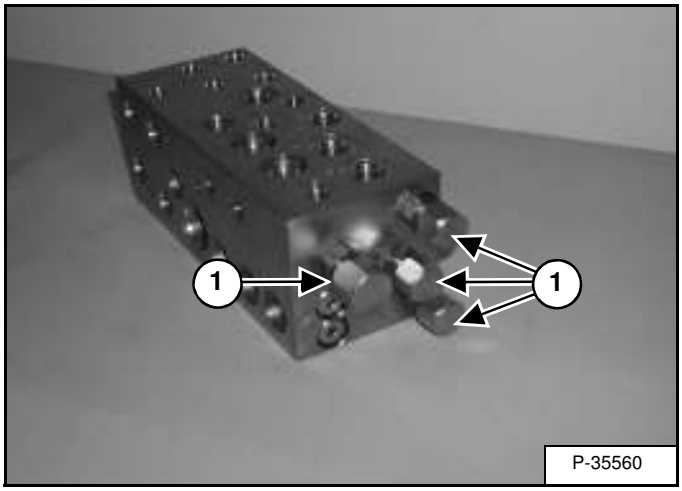
Assembly (Cont'd)

Figure 20-63-44



Install the O-ring (Item 1) **[Figure 20-63-44]** on the four fittings.

Figure 20-63-45



Install the four fittings (Item 1) **[Figure 20-63-45]**.

Figure 20-63-46

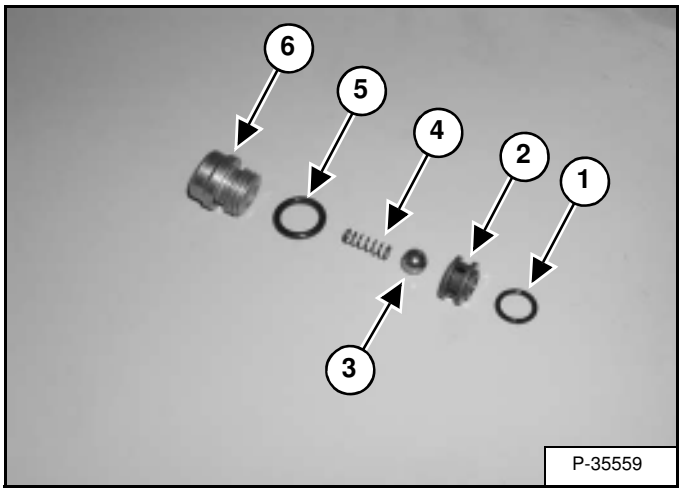
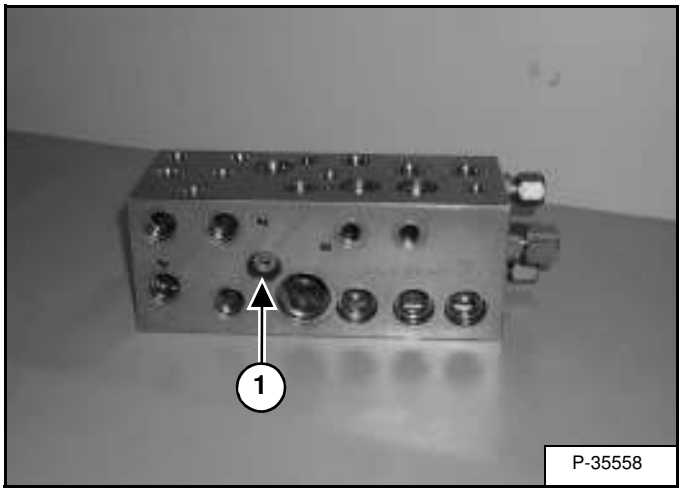


Figure 20-63-47

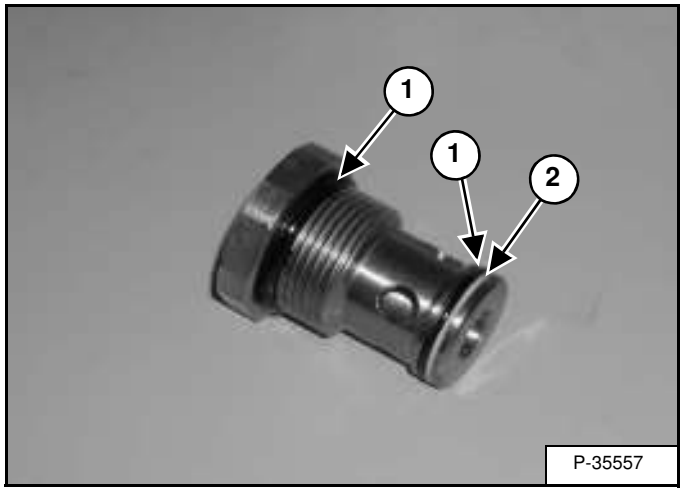


Install the O-ring (Item 1) **[Figure 20-63-46]**, seat (Item 2) **[Figure 20-63-46]**, check ball (Item 3) **[Figure 20-63-46]**, spring (Item 4) **[Figure 20-63-46]**, O-ring (Item 5) **[Figure 20-63-46]** and cap (Item 6) **[Figure 20-63-46]** in the port (Item 1) **[Figure 20-63-47]** in the manifold housing.

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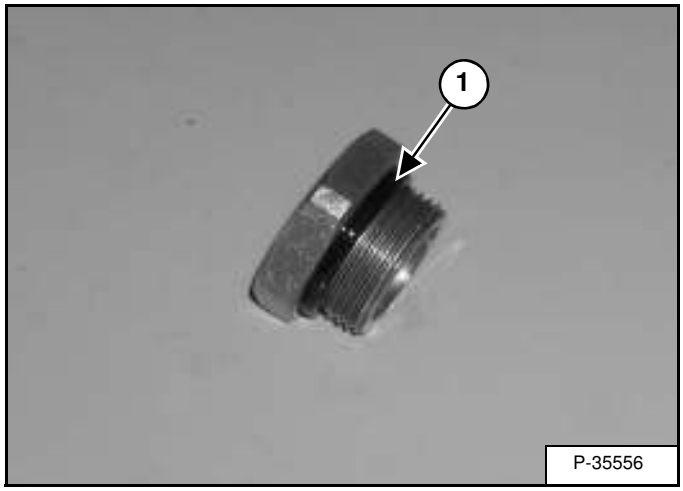
Assembly (Cont'd)

Figure 20-63-48



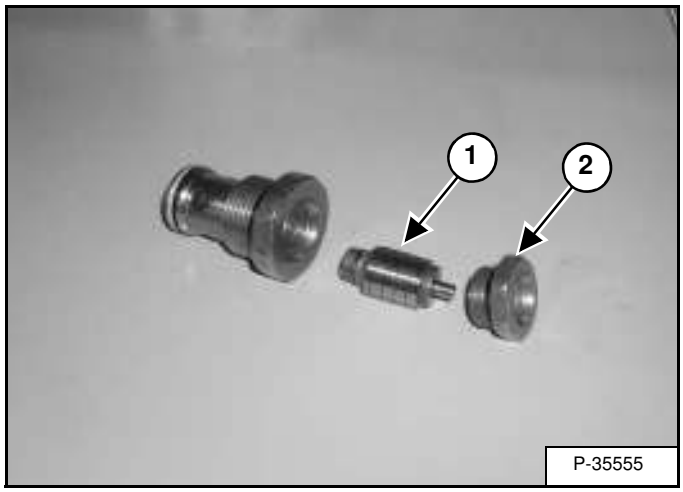
Install the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-63-48]** on the port adapter.

Figure 20-63-49



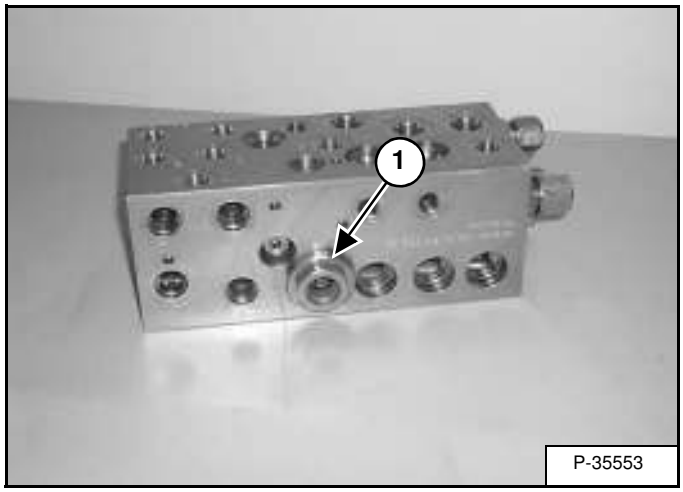
Install the O-ring (Item 1) **[Figure 20-63-49]** on the fitting.

Figure 20-63-50



Install the spool (Item 1) and fitting (Item 2) **[Figure 20-63-50]** in the port adapter.

Figure 20-63-51



Install the port adapter (Item 1) **[Figure 20-63-51]**.

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MANIFOLD ASSEMBLY (S/N 232311951 & ABOVE AND 232411764 & ABOVE) (CONT'D)

Assembly (Cont'd)

Figure 20-63-52

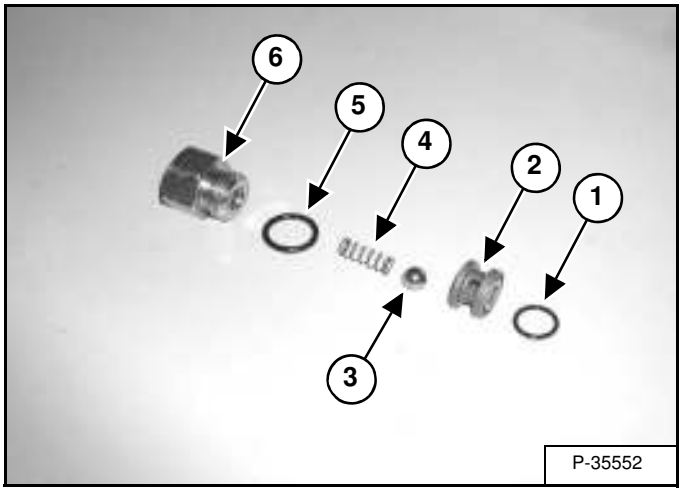
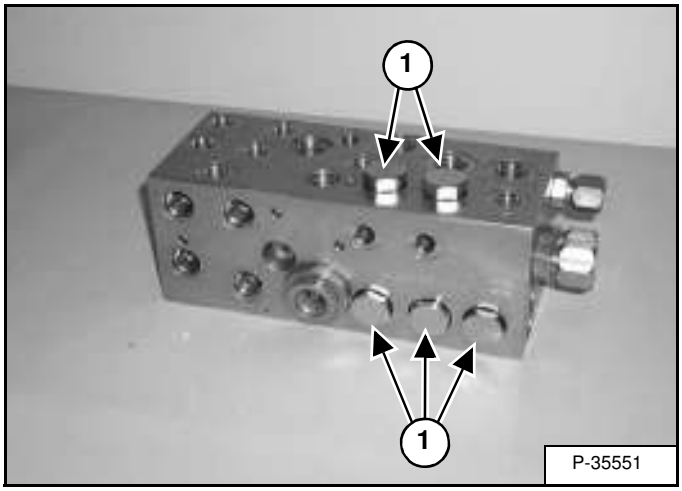


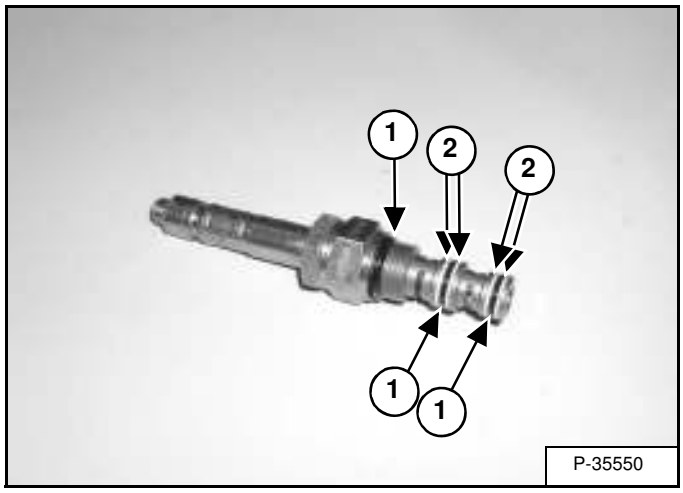
Figure 20-63-53



Install the O-ring (Item 1) **[Figure 20-63-52]**, seat (Item 2) **[Figure 20-63-52]**, check ball (Item 3) **[Figure 20-63-52]**, spring (Item 4) **[Figure 20-63-52]**, O-ring (Item 5) **[Figure 20-63-52]** and cap (Item 6) **[Figure 20-63-52]** in the five check valve ports (Item 1) **[Figure 20-63-53]**.

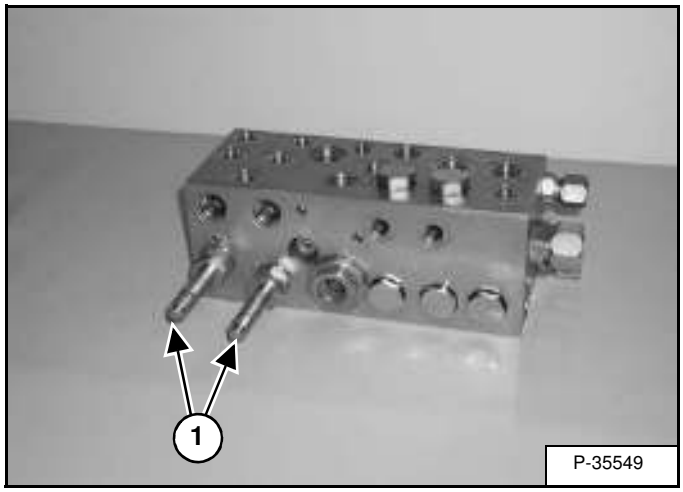
Tighten the caps to 19-22 ft.-lbs. (25,1-29,8 Nm) torque.

Figure 20-63-54



Install the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-63-54]** on the solenoids.

Figure 20-63-55

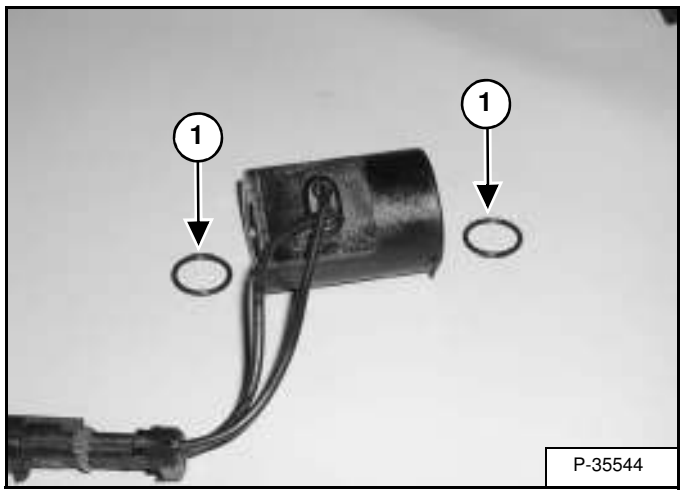


Install the solenoids (Item 1) **[Figure 20-63-55]**.

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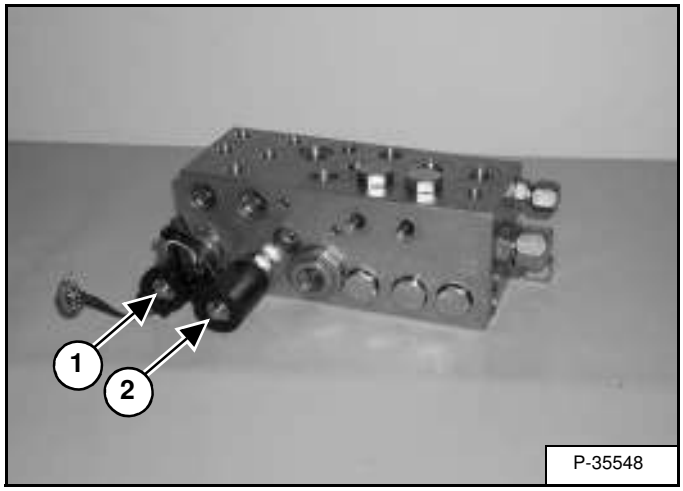
Assembly (Cont'd)

Figure 20-63-56



Install the two O-rings (Item 1) **[Figure 20-63-56]** on the coils.

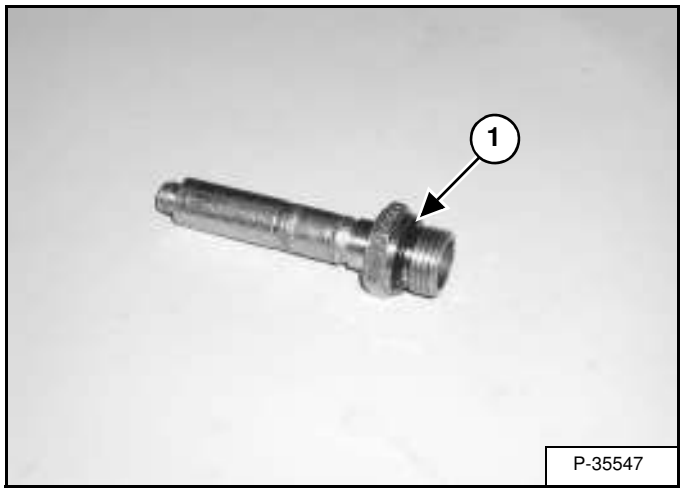
Figure 20-63-57



Install the coil with the green tie strap (Item 1) **[Figure 20-63-57]** on the left solenoid.

Install the coil with the yellow tie strap (Item 2) **[Figure 20-63-57]** on the right solenoid.

Figure 20-63-58



Install the O-ring (Item 1) **[Figure 20-63-58]** on the solenoid.

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Assembly (Cont'd)

Figure 20-63-59

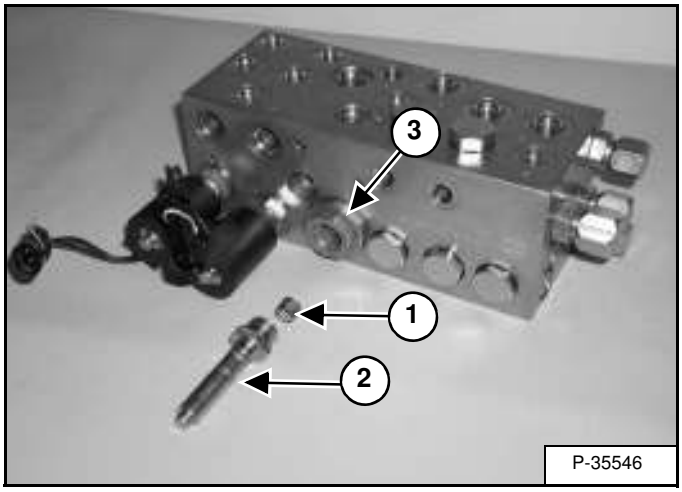
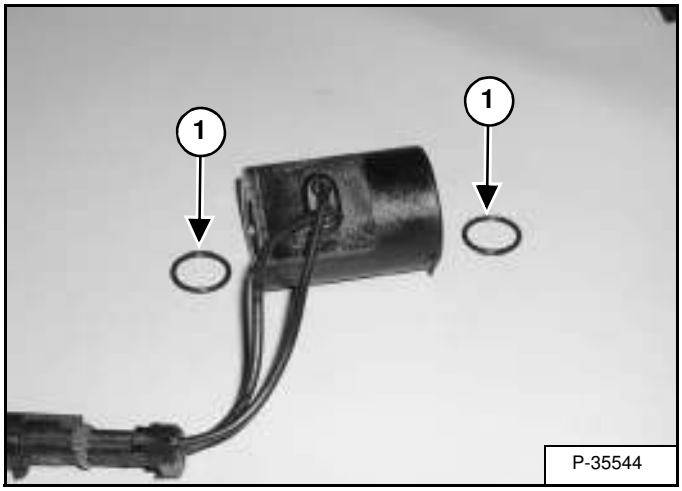


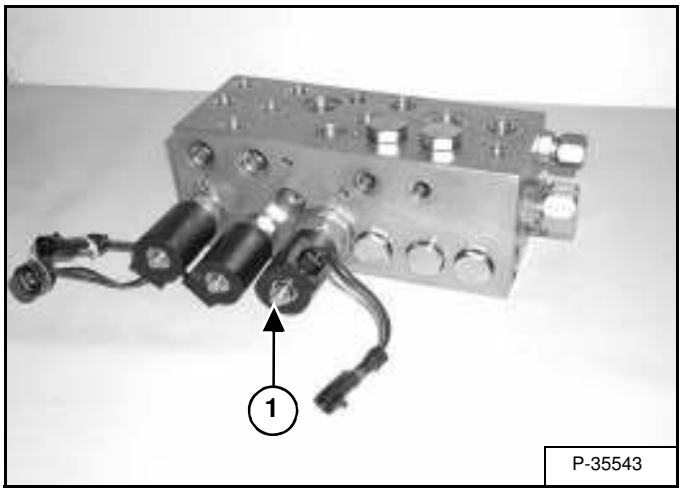
Figure 20-63-60



Install the spring (Item 1) **[Figure 20-63-59]** and solenoid (Item 2) **[Figure 20-63-59]** in the port (Item 3) **[Figure 20-63-60]**. Tighten the solenoid to 19-22 ft.-lbs. (25,1-29,8 Nm) torque.

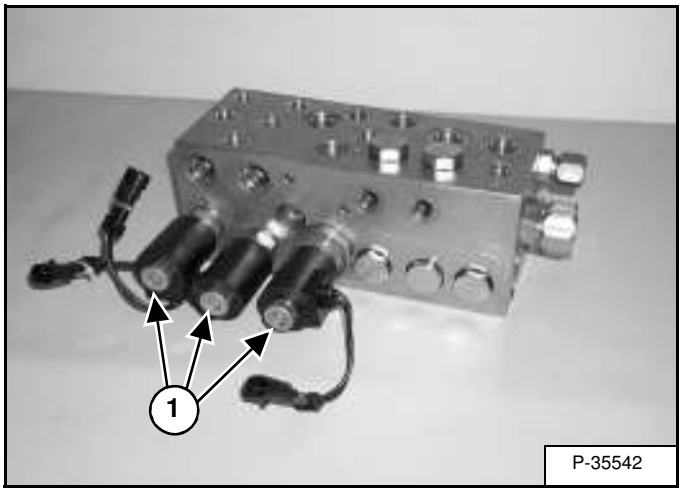
Install the O-rings (Item 1) **[Figure 20-63-60]** on the coil.

Figure 20-63-61



Install the coil with the brown tie strap (Item 1) **[Figure 20-63-61]** on the solenoid.

Figure 20-63-62



Install the nut (Item 1) **[Figure 20-63-62]** on the three solenoids.

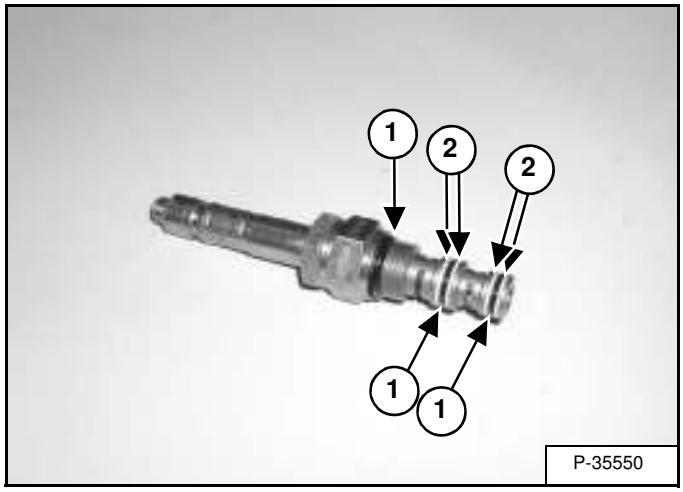
Hand tighten the nuts.

NOTE: Overtightening the coil nuts (Item 1) [Figure 20-63-62] may cause spool or coil failure.

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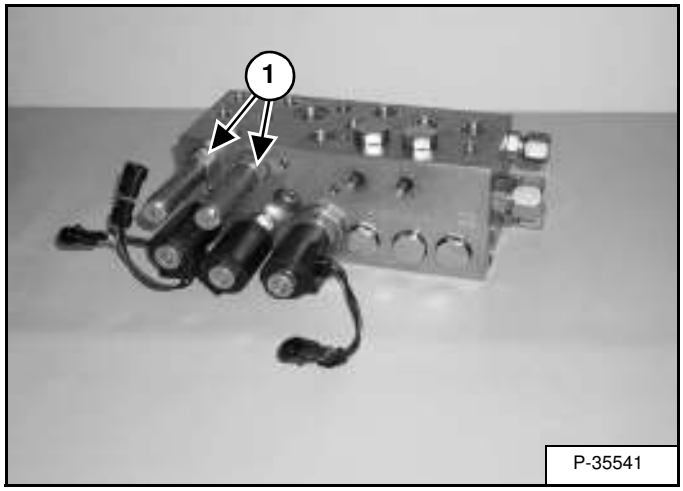
Assembly (Cont'd)

Figure 20-63-63



Install the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-63-63]** on the solenoids.

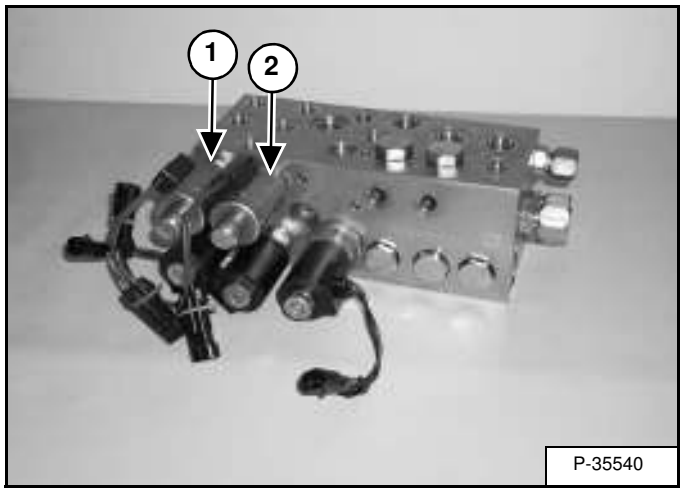
Figure 20-63-64



Install the two solenoids (Item 1) **[Figure 20-63-64]**.

Tighten the solenoids to 19-22 ft.-lbs. (25,1-29,8 Nm) torque.

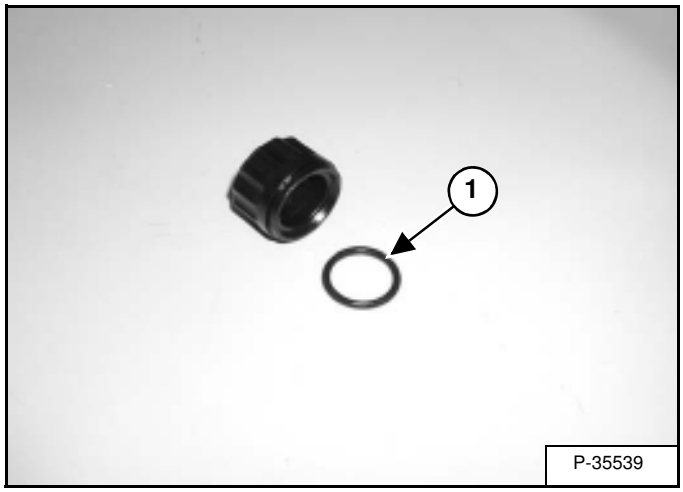
Figure 20-63-65



Install the coil with the red tie strap (Item 1) **[Figure 20-63-65]** on the left solenoid.

Install the coil with the blue tie strap (Item 2) **[Figure 20-63-65]** on the right solenoid.

Figure 20-63-66



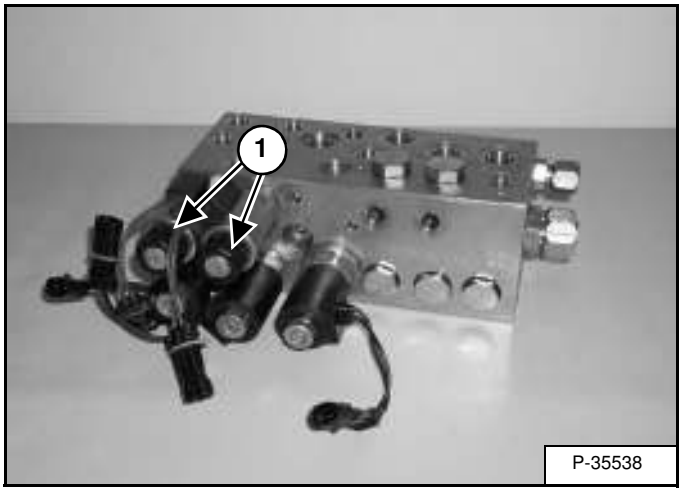
Install the O-ring (Item 1) **[Figure 20-63-66]** on the two nuts.

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MANIFOLD ASSEMBLY (S/N 232311951 & ABOVE AND 232411764 & ABOVE) (CONT'D)

Assembly (Cont'd)

Figure 20-63-67

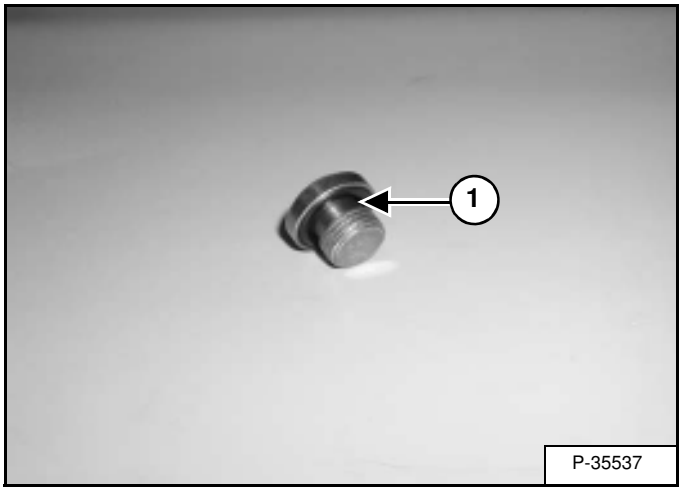


Install the nuts (Item 1) **[Figure 20-63-67]** on the solenoid.

Tighten the nuts to 3-5 ft.-lbs. (4,1-6,1 Nm) torque.

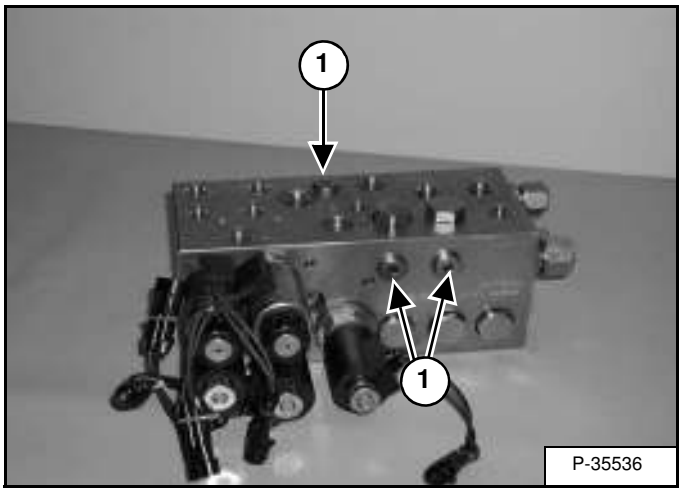
NOTE: Overtightening the coil nuts (Item 1) [Figure 20-63-67] may cause spool or coil failure.

Figure 20-63-68



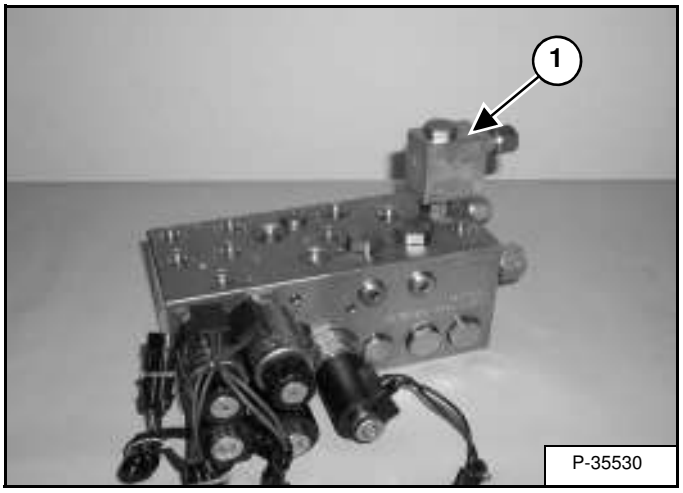
Install the O-ring (Item 1) **[Figure 20-63-68]** on the plugs.

Figure 20-63-69



Install the three plugs (Item 1) **[Figure 20-63-69]**.

Figure 20-63-70



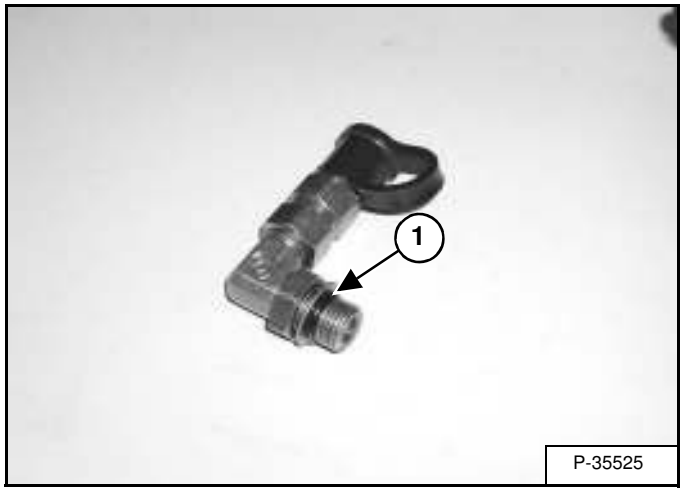
Install the build up valve (Item 1) **[Figure 20-63-70]**.

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MANIFOLD ASSEMBLY (S/N 232311951 & ABOVE AND 232411764 & ABOVE) (CONT'D)

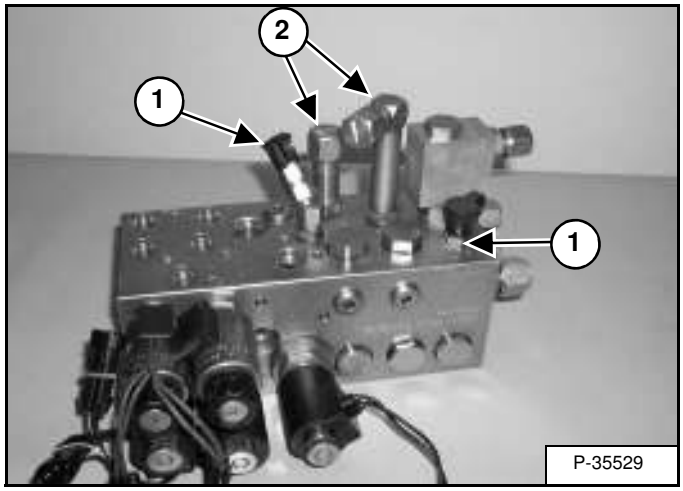
Assembly (Cont'd)

Figure 20-63-71



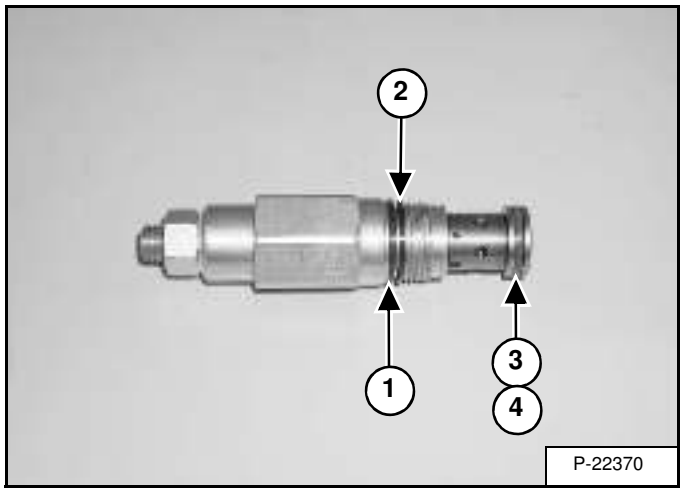
Install the O-ring (Item 1) **[Figure 20-63-71]** on the two diagnostic ports and two fittings.

Figure 20-63-72



Install the two diagnostic ports (Item 1) and two fittings (Item 2) **[Figure 20-63-72]**.

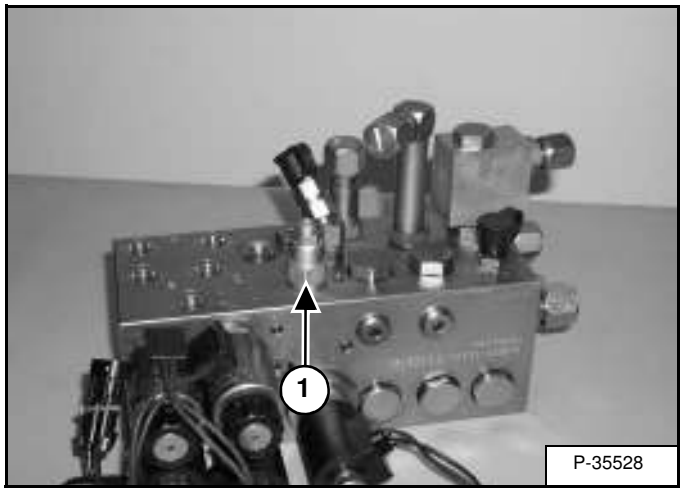
Figure 20-63-73



Install the O-ring (Item 1) and back-up rings (Item 2) **[Figure 20-63-73]** on the main relief valve.

Install the O-ring (Item 3) and glid ring (Item 4) **[Figure 20-63-73]** on the main relief valve.

Figure 20-63-74



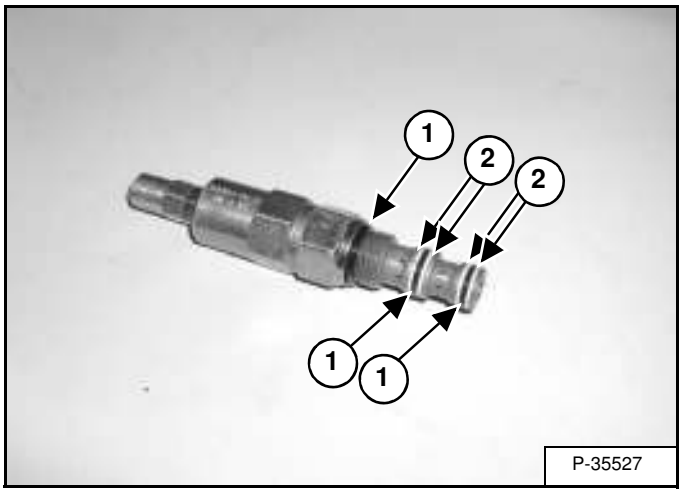
Install the main relief valve (Item 1) **[Figure 20-63-74]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

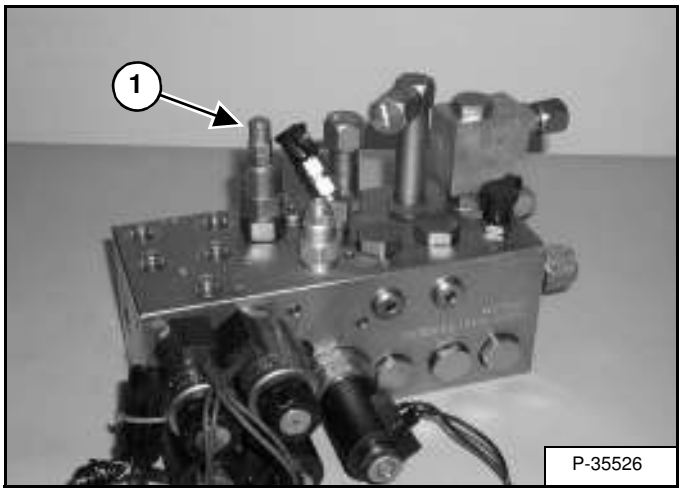
Tighten the main relief valve to 30-35 ft.-lbs. (40,7-47,5 Nm) torque.

Figure 20-63-75



Install the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-63-75]** on the pressure reducing valve.

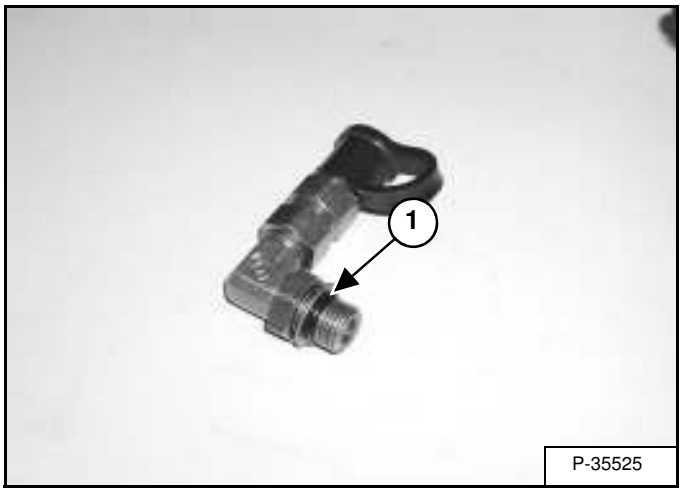
Figure 20-63-76



Install the pressure reducing valve (Item 1) **[Figure 20-63-76]**.

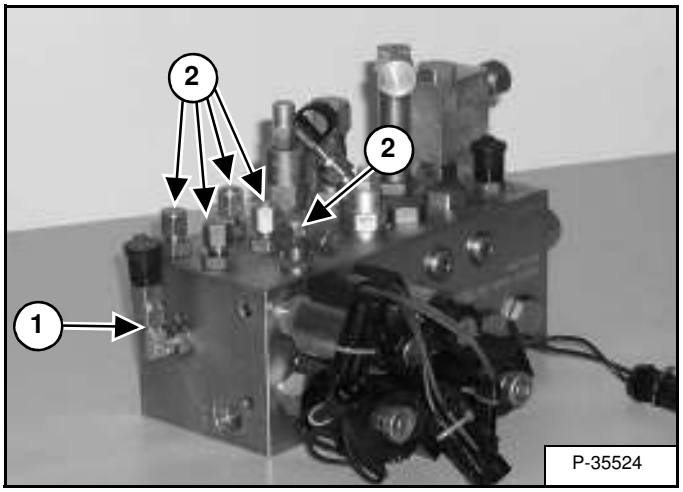
Tighten the pressure reducing valve to 19-22 ft.-lbs. (25,1-29,8 Nm) torque.

Figure 20-63-77



Install the O-ring (Item 1) **[Figure 20-63-77]** on the diagnostic port and five fittings.

Figure 20-63-78



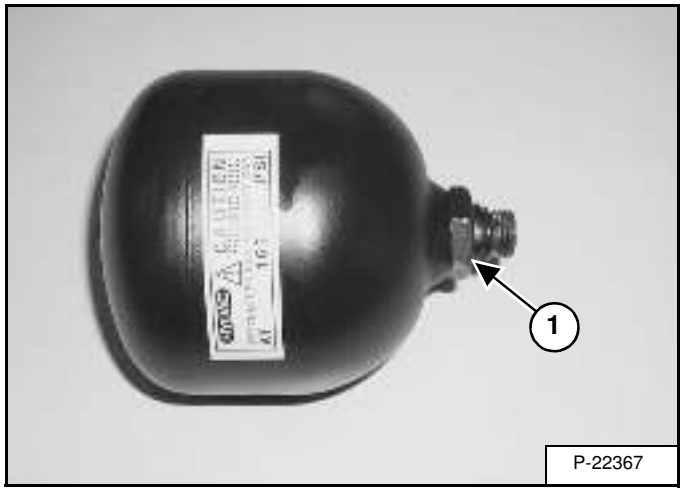
Install the diagnostic port (Item 1) and five fittings (Item 2) **[Figure 20-63-78]**.

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MANIFOLD ASSEMBLY (S/N 232311951 & ABOVE AND 232411764 & ABOVE) (CONT'D)

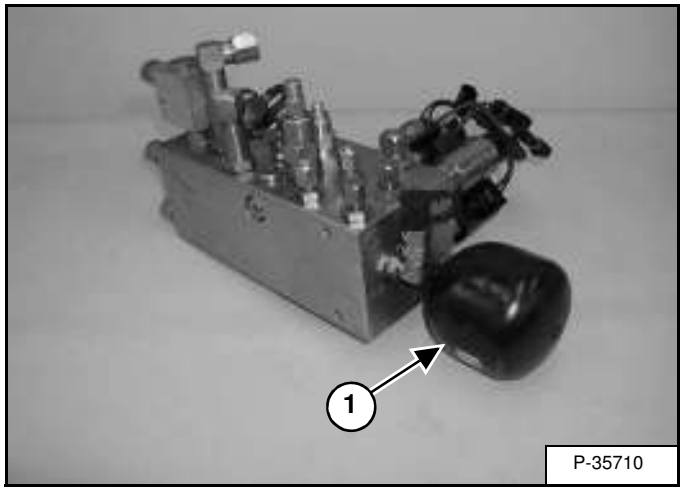
Assembly (Cont'd)

Figure 20-63-79



Install the O-ring (Item 1) **[Figure 20-63-79]** on the accumulator.

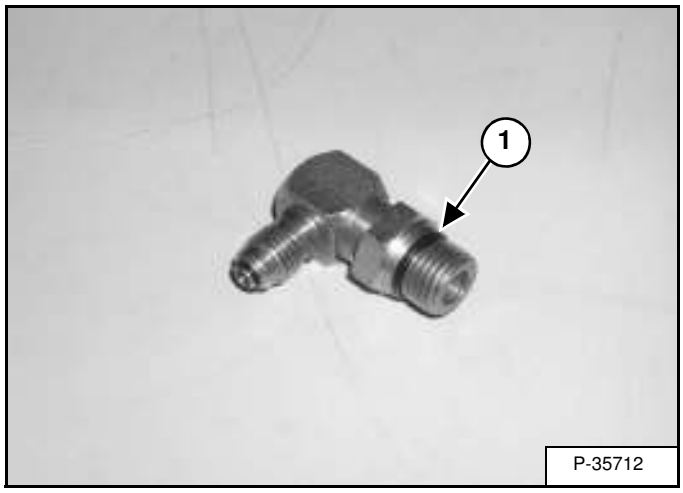
Figure 20-63-80



Install the accumulator (Item 1) **[Figure 20-63-80]**.

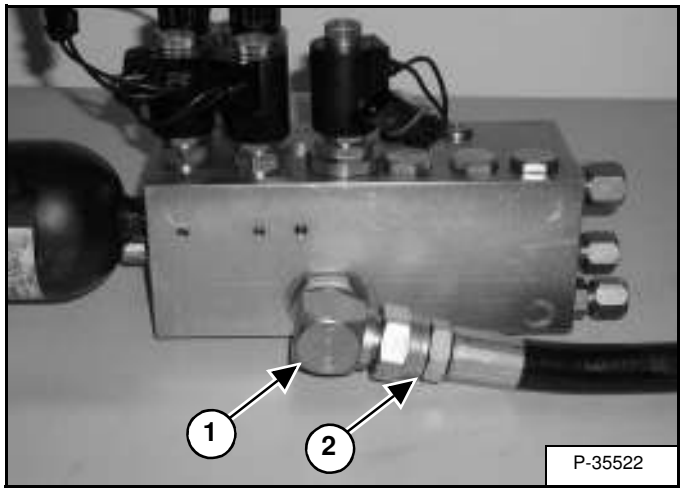
Tighten the accumulator to 22-24 ft.-lbs. (29-33 Nm) torque.

Figure 20-63-81



Install the O-ring (Item 1) **[Figure 20-63-81]** on the fitting.

Figure 20-63-82

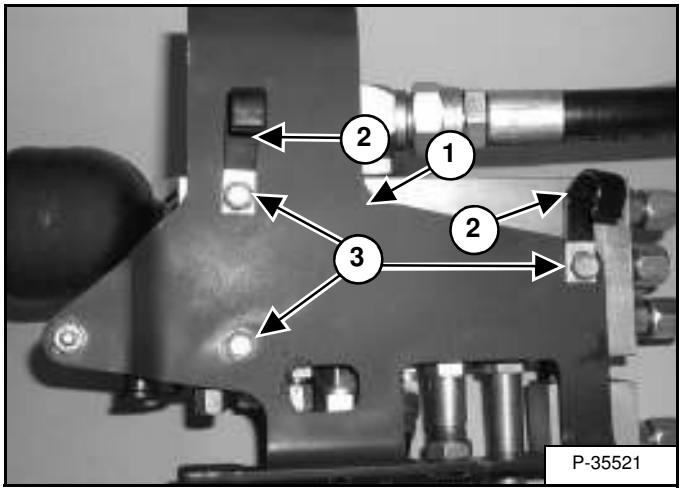


Install the fitting (Item 1) and hose (Item 2) **[Figure 20-63-82]** on the manifold block.

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Assembly (Cont'd)

Figure 20-63-83



Install the mount plate (Item 1), two clamps (Item 2) and three bolts (Item 3) **[Figure 20-63-83]** on the manifold block.

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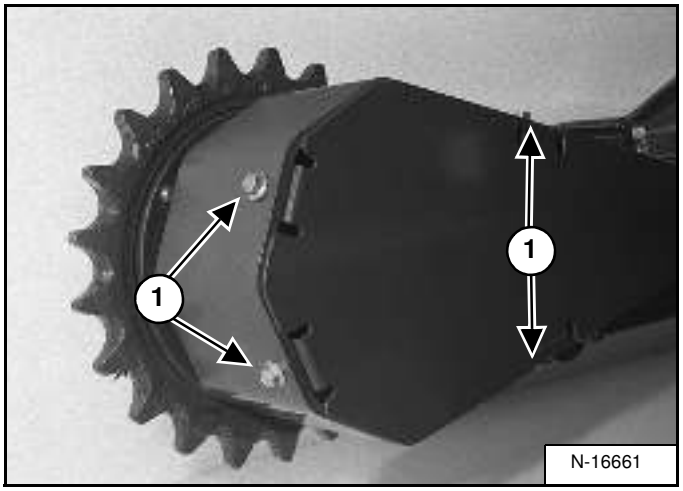
TRAVEL MOTOR

Removal And Installation

Lift and block the side of the track frame where the final drive will be removed.

Release the track tension and remove the track. (See Rubber Track Removal And Installation on Page 30-20-4 or Steel Track Removal And Installation on Page 30-20-6.)

Figure 20-70-1



emove 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.

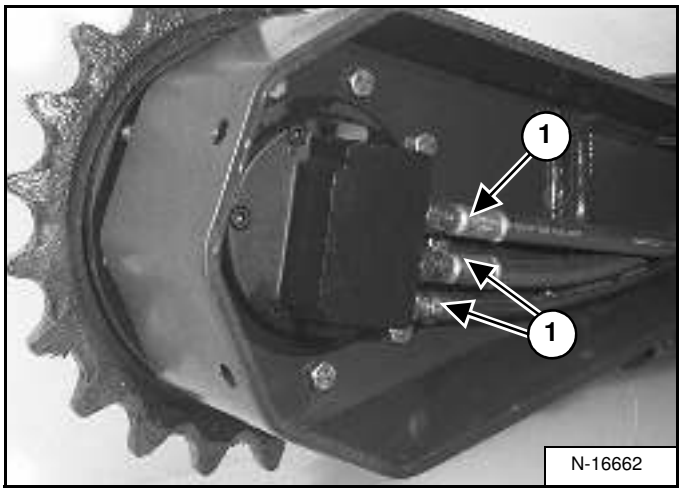
IMPORTANT

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

I-2003-0888

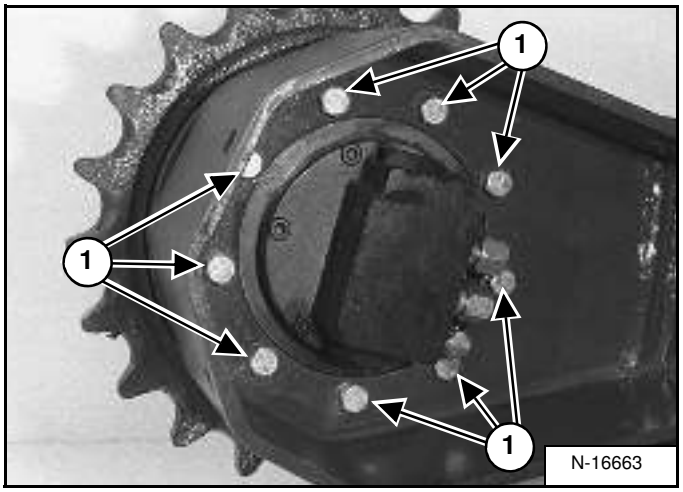
Mark the hoses for correct installation.

Figure 20-70-2



Disconnect the three hoses (Item 1) **[Figure 20-70-2]** from the drive motor.

Figure 20-70-3



Loosen and remove the final drive mounting bolts (Item 1) **[Figure 20-70-3]**.

NOTE: Later models have twelve final drive mounting bolts. Early models have nine final drive mounting bolts.

Installation: Apply thread adhesive (LOCTITE 242) on the bolts and tighten to 80 ft.-lbs. (108 Nm) torque.

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Removal And Installation (Cont'd)

Figure 20-70-4

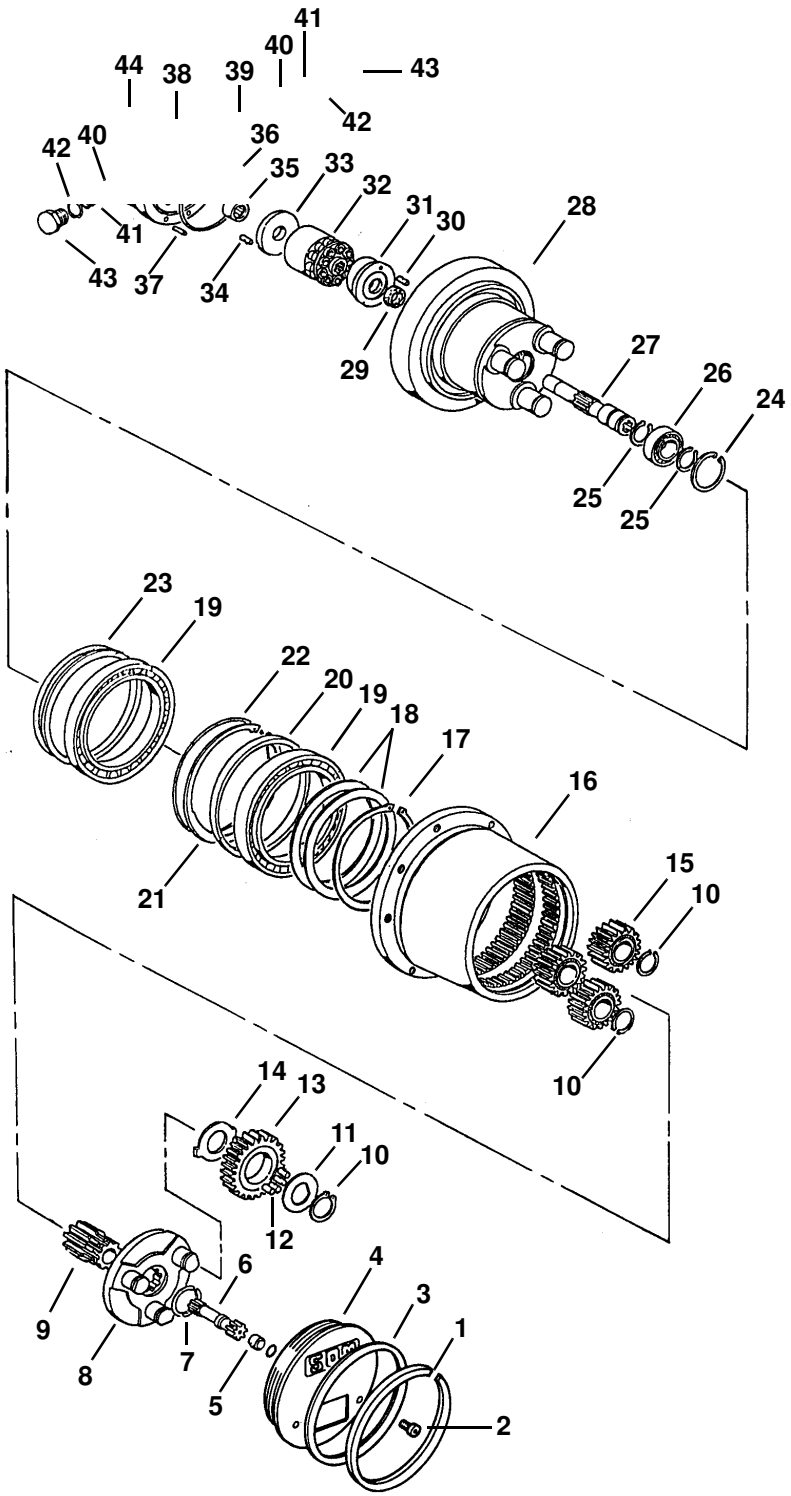


Remove the motor assembly from the track frame **[Figure 20-70-4]**.

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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. Shims
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. Alignment Pin
31. Swash Plate
32. Rotating Block
33. Motor Plate
34. Alignment Pin
35. Bearing
36. O-Ring
37. Alignment Pin
38. Motor Cover
39. Spool
40. Washer
41. Spring
42. O-Ring
43. Plug
44. Bolt



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Disassembly

IMPORTANT

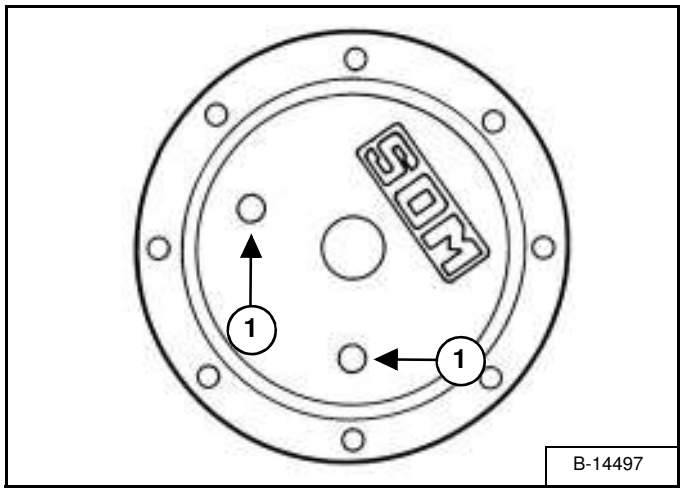
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tube lines and ports to keep dirt out. Dirt can quickly damage the system.

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.

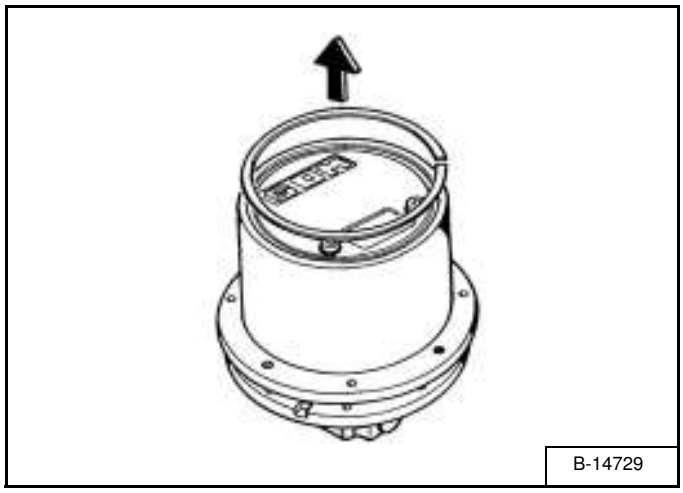
Figure 20-70-5



Remove the drain plugs (Item 1) **[Figure 20-70-5]** from the end cover.

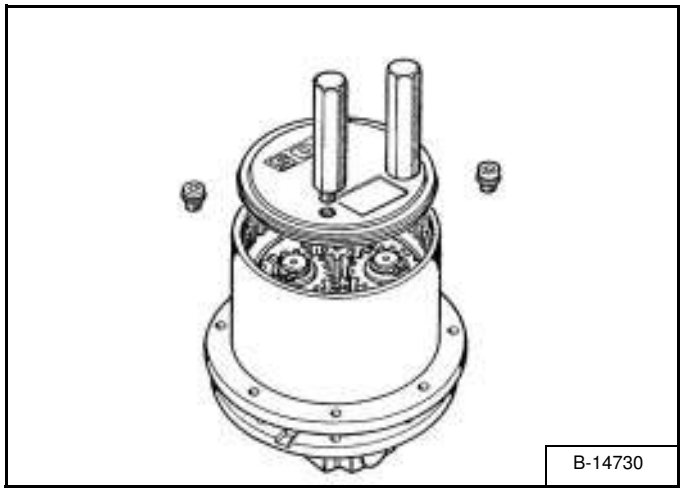
Drain the oil into a container.

Figure 20-70-6



Remove the internal snap ring from the travel motor case **[Figure 20-70-6]**.

Figure 20-70-7



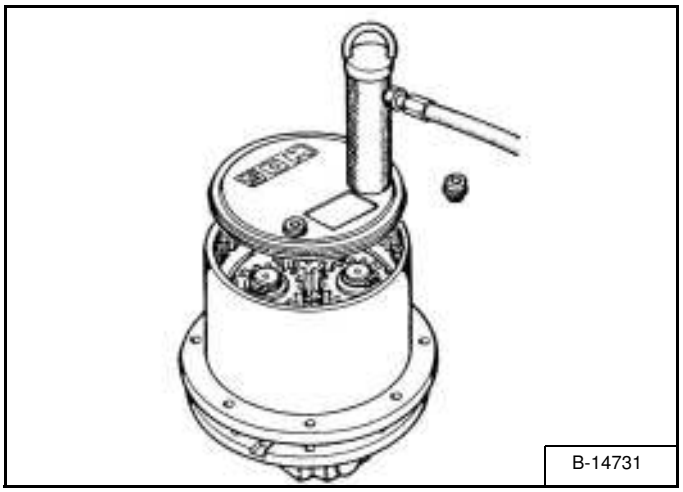
To remove the cover, install two threaded pins in the drain holes and lift the cover off **[Figure 20-70-7]**.

Air pressure may also be used to remove the cover.

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Disassembly (Cont'd)

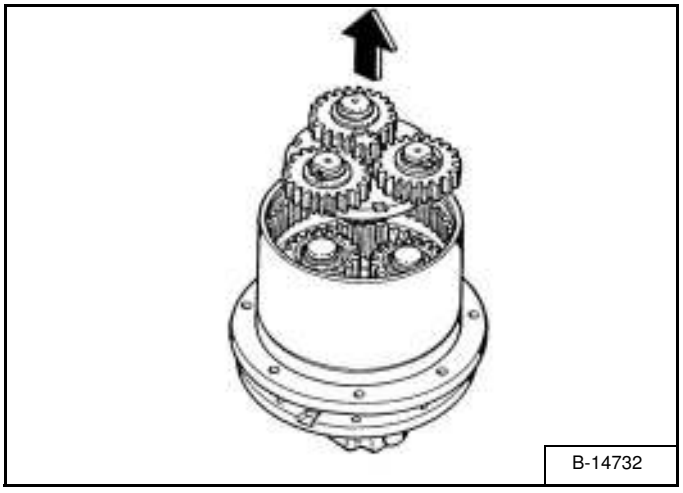
Figure 20-70-8



Screw the adapter in a drain hole and apply 8-11 psi **[Figure 20-70-8]**.

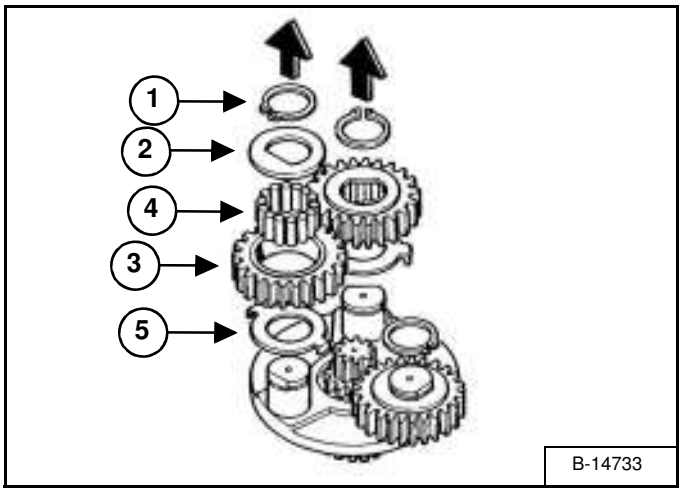
NOTE: Do not use excess pressure or seal damage may result.

Figure 20-70-9



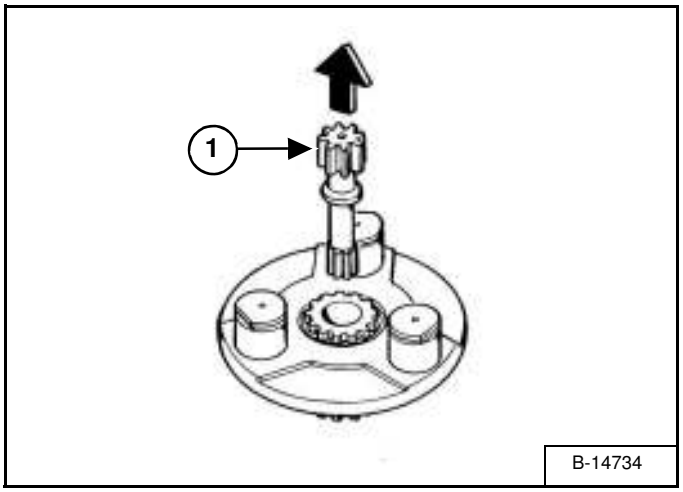
Remove the planetary carrier **[Figure 20-70-9]**.

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.

Figure 20-70-11

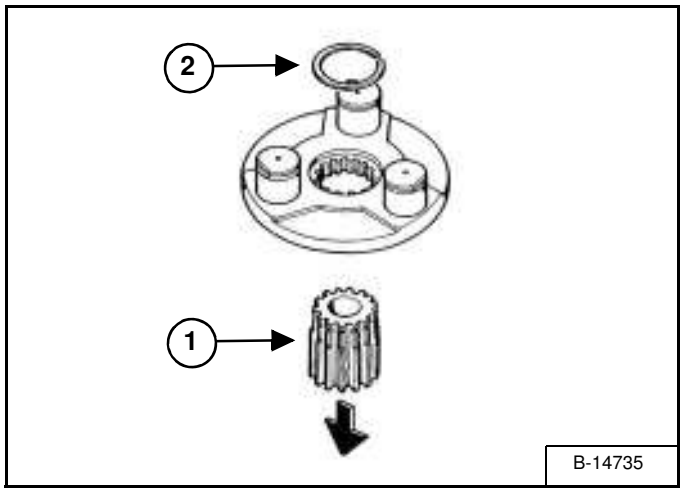


Remove the sun gear (Item 1) **[Figure 20-70-11]** from the carrier.

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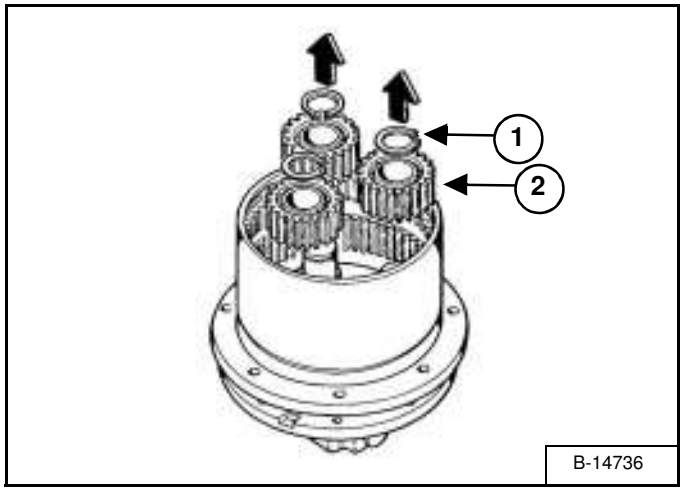
Disassembly (Cont'd)

Figure 20-70-12



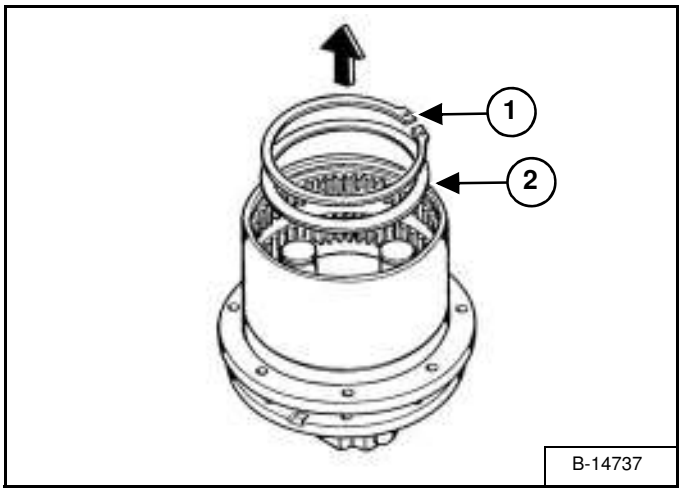
Remove the sun gear (Item 1) from the planetary carrier, by removing the snap ring (Item 2) and pushing the sun gear (Item 1) **[Figure 20-70-12]** out of the carrier.

Figure 20-70-13



Remove the snap rings (Item 1) and the gears/bearings (Item 2) **[Figure 20-70-13]**.

Figure 20-70-14

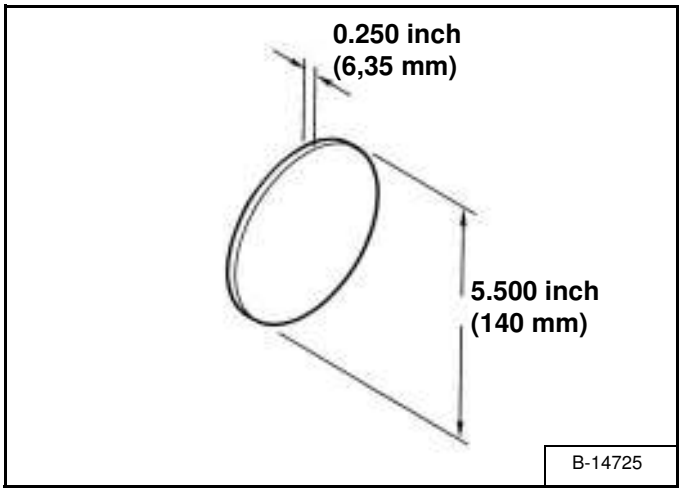


Remove the external snap ring (Item 1) and the shim(s) (Item 2) **[Figure 20-70-14]**.

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.

Figure 20-70-15



Obtain the plate **[Figure 20-70-15]** locally.

The dimensions of the plate are as follows:

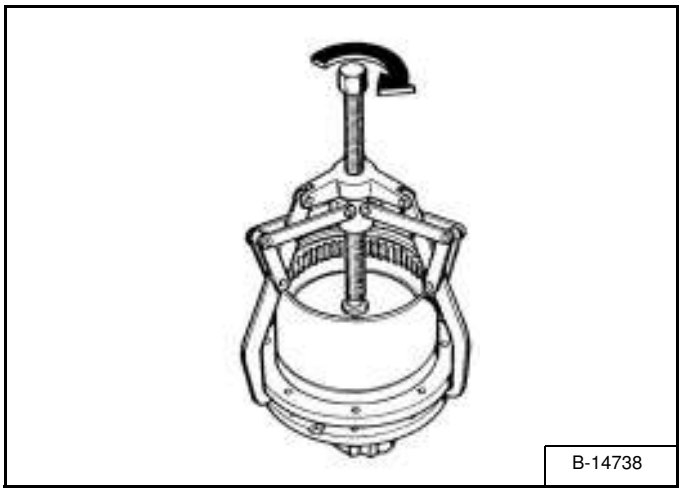
Diameter 5.500 inches (140 mm)

Thickness 0.250 inch (6.35 mm)

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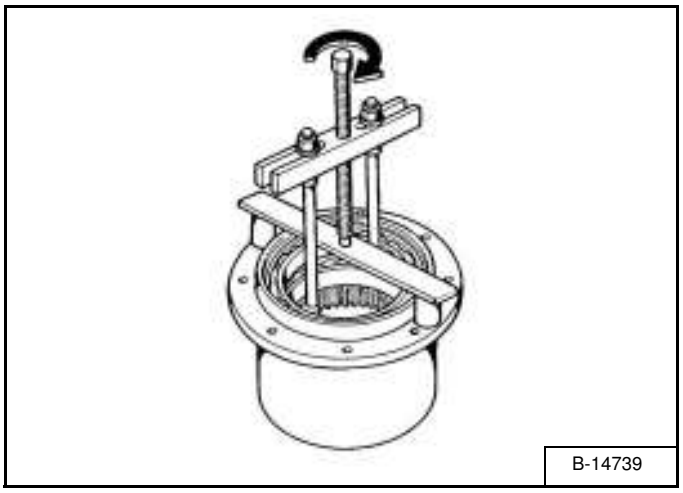
Disassembly (Cont'd)

Figure 20-70-16



Using a three jaw puller, separate the hub and the ring gear assembly **[Figure 20-70-16]**.

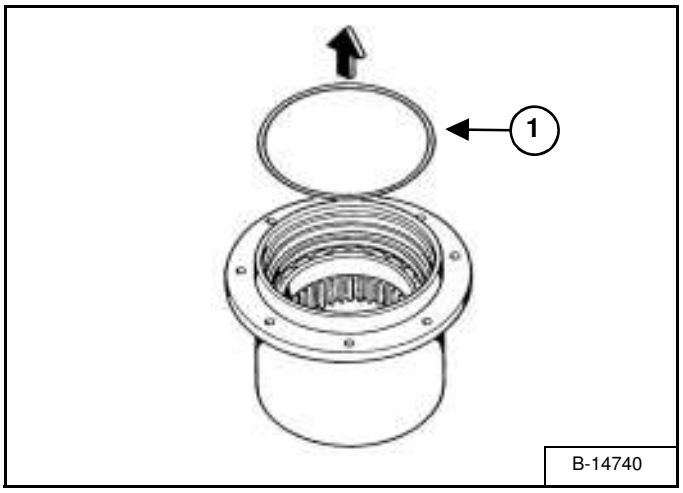
Figure 20-70-17



Remove the ball bearing from the ring gear as shown **[Figure 20-70-17]**.

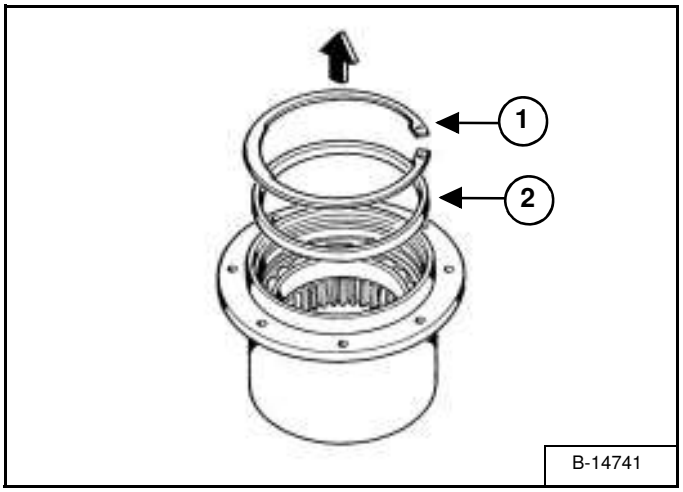
NOTE: Do not damage the top surface of the bearing as it is lapped (polished) to mate with the front seal ring.

Figure 20-70-18



Remove the O-ring (Item 1) **[Figure 20-70-18]** from the ring gear.

Figure 20-70-19

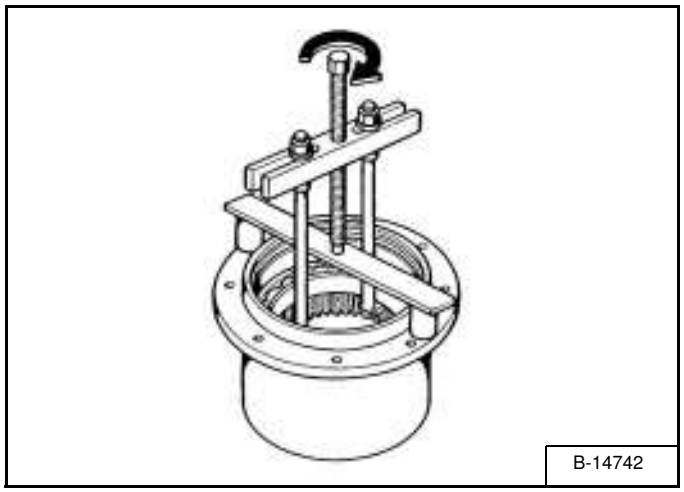


Remove the internal snap ring (Item 1) and spacer (Item 2) **[Figure 20-70-19]**.

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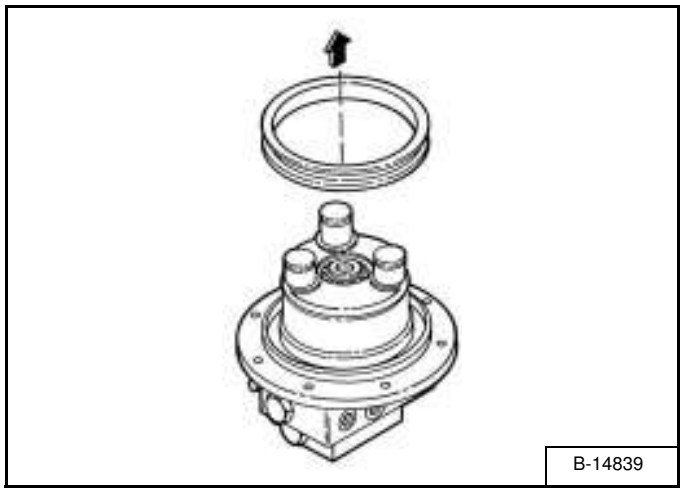
Disassembly (Cont'd)

Figure 20-70-20



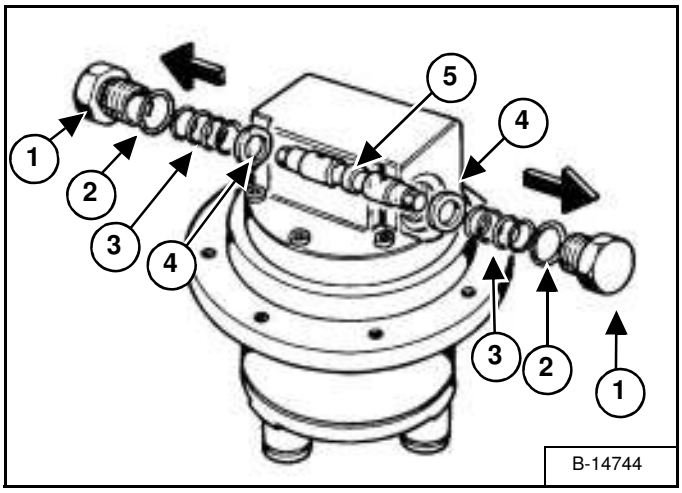
Remove the second bearing from the ring gear **[Figure 20-70-20]**.

Figure 20-70-21



Remove the front seal ring from the motor hub **[Figure 20-70-21]**.

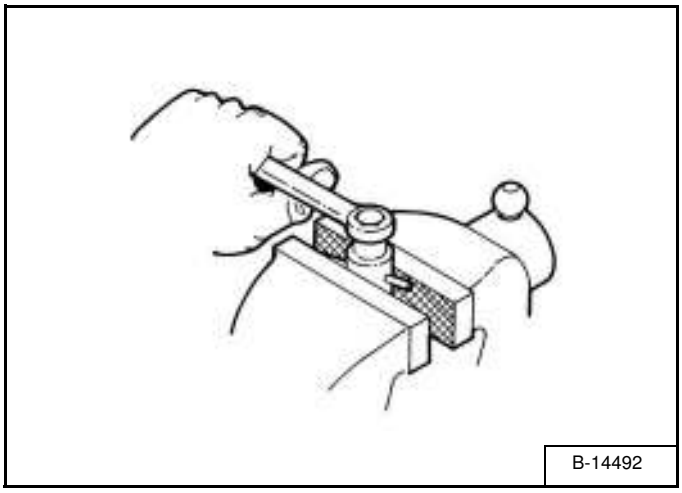
Figure 20-70-22



Remove the two plugs (Item 1), the O-rings (Item 2), the springs (Item 3) and the washers (Item 4) **[Figure 20-70-22]** from both ends of the spool.

Remove the spool (Item 5) **[Figure 20-70-22]**.

Figure 20-70-23



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 20-70-23]**.

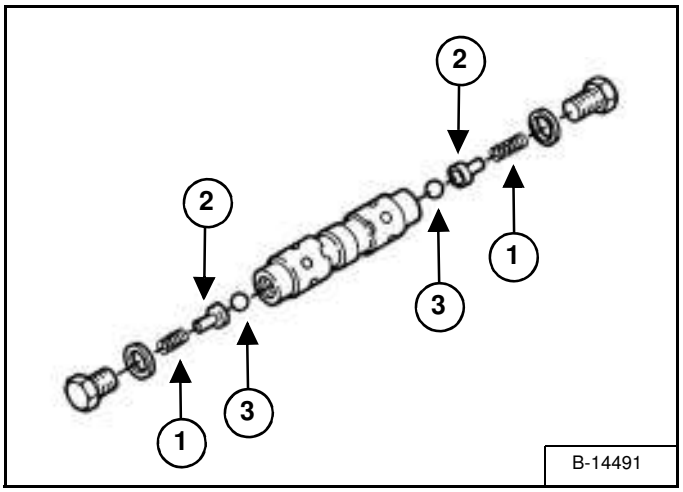
NOTE: Do not use any type of tool to grip the spool or damage to the spool will result.

Remove the two end plugs from both ends of the spool **[Figure 20-70-23]**.

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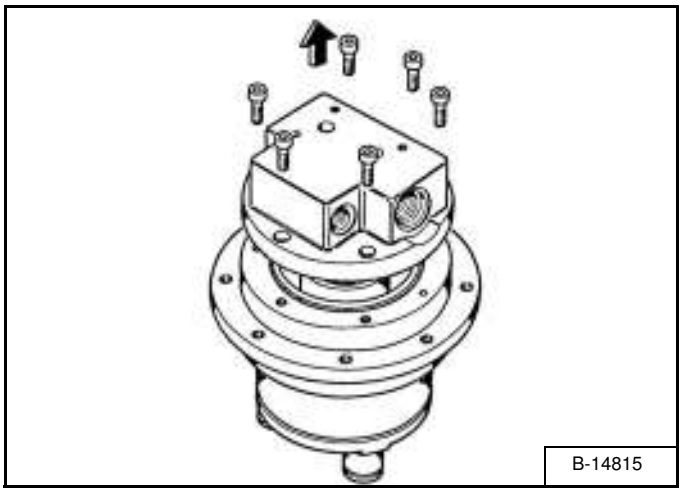
Disassembly (Cont'd)

Figure 20-70-24



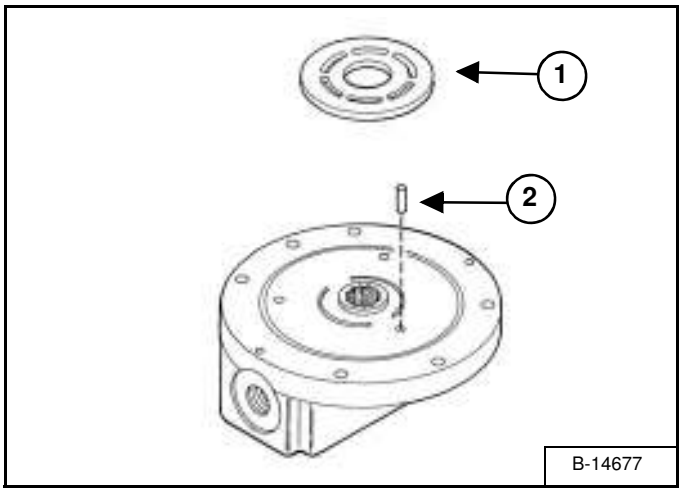
Remove the spring (Item 1), the poppet (Item 2) and the check ball (Item 3) **[Figure 20-70-24]** from both ends of the spool.

Figure 20-70-25



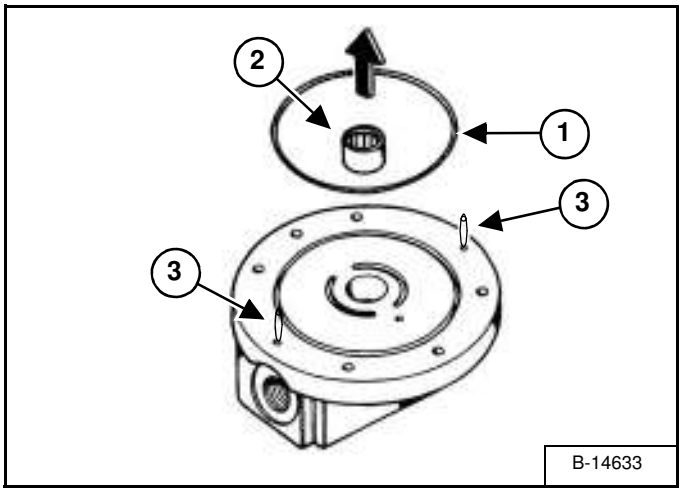
Remove the six bolts and motor cover **[Figure 20-70-25]**.

Figure 20-70-26



Remove the bronze motor plate (Item 1) and dowel pin (Item 2) **[Figure 20-70-26]**

Figure 20-70-27

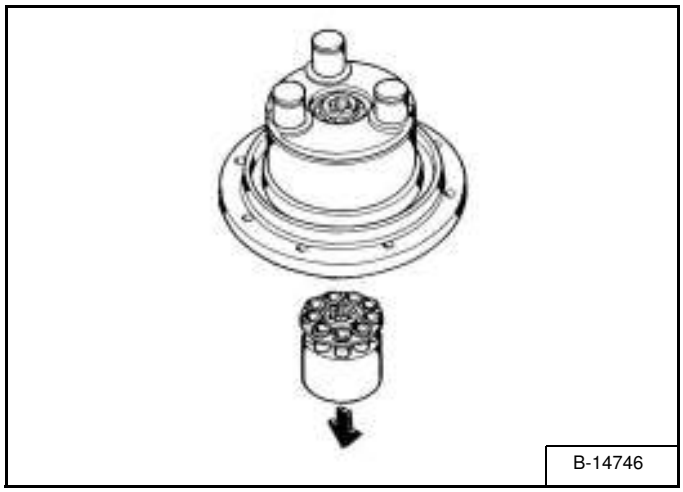


Remove the O-Ring (Item 1), bearing (Item 2) and the two alignment pins (Item 3). Remove the bearing (Item 2) **[Figure 20-70-27]** with a bearing puller.

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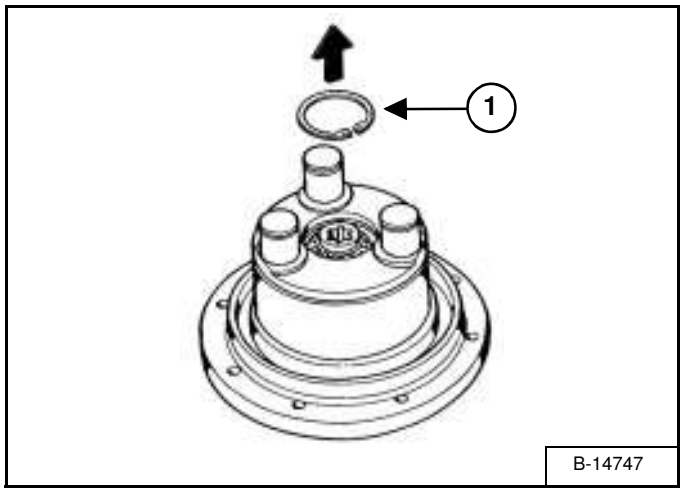
Disassembly (Cont'd)

Figure 20-70-28



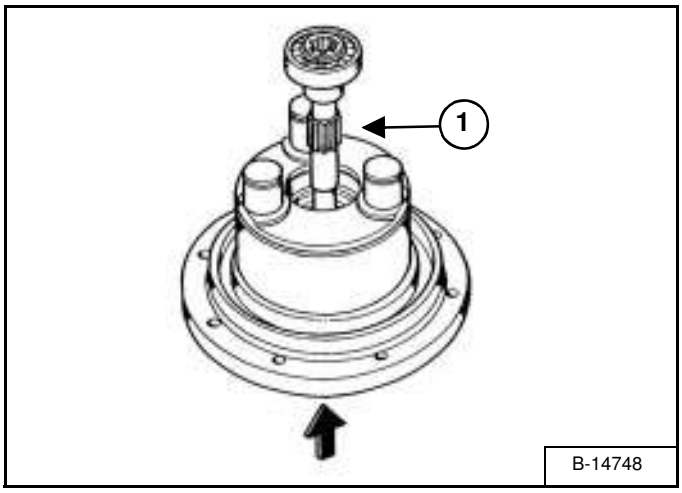
Invert the hub, and the rotating block will slide out **[Figure 20-70-28]**

Figure 20-70-29



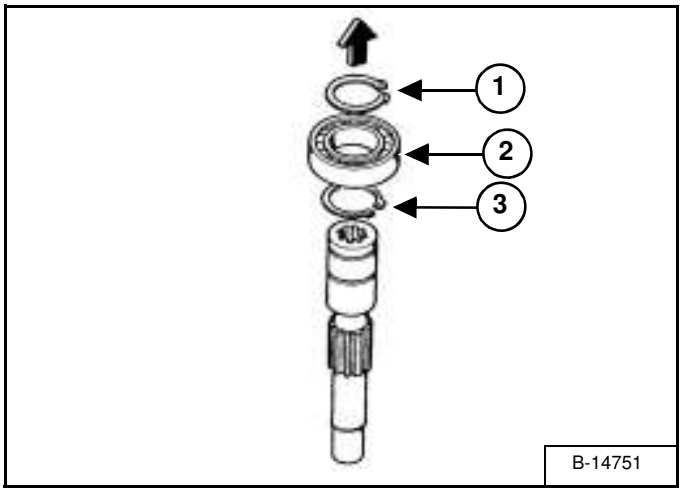
Remove the internal snap ring (Item 1) **[Figure 20-70-29]** retaining the bearing/drive shaft to the hub.

Figure 20-70-30



Push the drive shaft (Item 1) **[Figure 20-70-30]** from the bottom to remove the shaft from the hub.

Figure 20-70-31

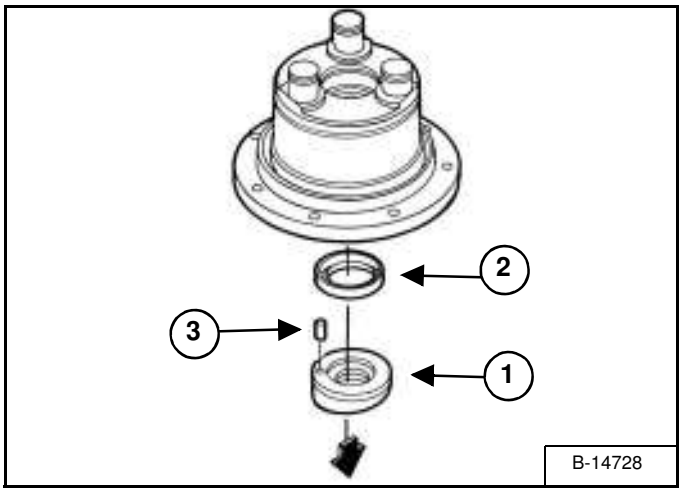


Remove the snap ring (Item 1), the bearing (Item 2) and the second snap ring (Item 3) **[Figure 20-70-31]** from the drive shaft.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

Figure 20-70-32

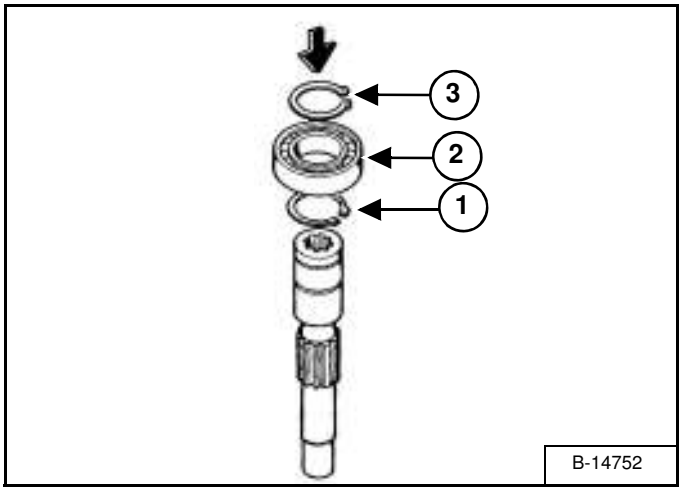


Remove the swash plate (Item 1), seal (Item 2) and alignment pin (Item 3) **[Figure 20-70-32]**.

Assembly

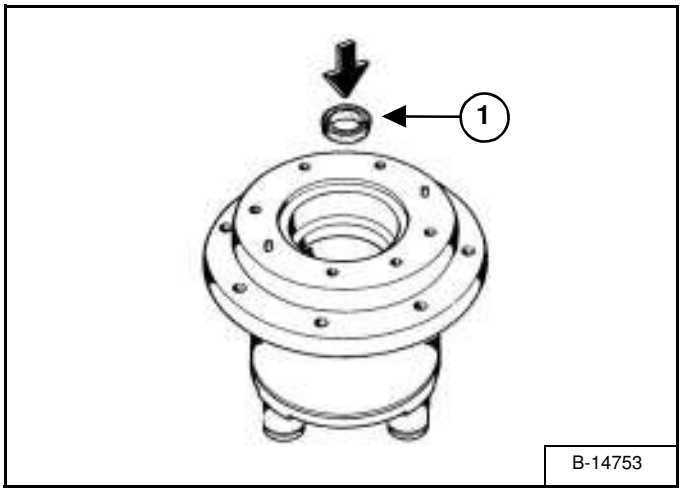
Clean all parts in solvent and dry with compressed air. Inspect all parts and replace any that are damaged. If any of the planetary gears are damaged, replace all the planetary gears and the sun gear from the planetary assembly that is damaged. One damaged gear can cause a microscopic fatigue crack in 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.

Figure 20-70-33



Install the lower snap ring (Item 1), the bearing (Item 2) and the top snap ring (Item 3) **[Figure 20-70-33]** on the drive shaft.

Figure 20-70-34

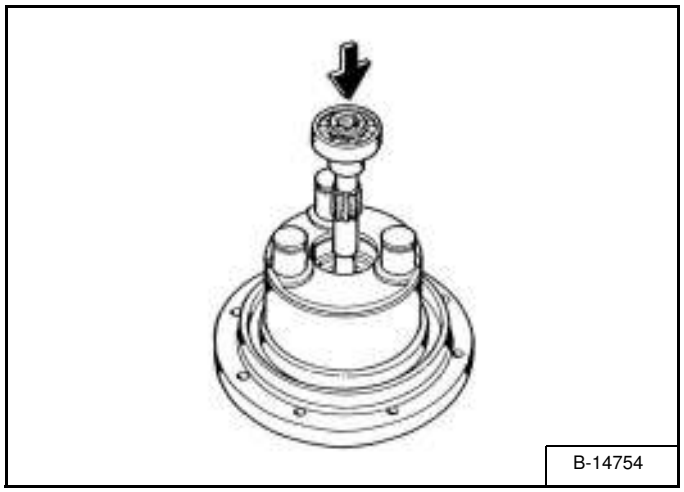


Apply oil to the inside diameter of the oil seal and install the oil seal (Item 1) **[Figure 20-70-34]** in the hub.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

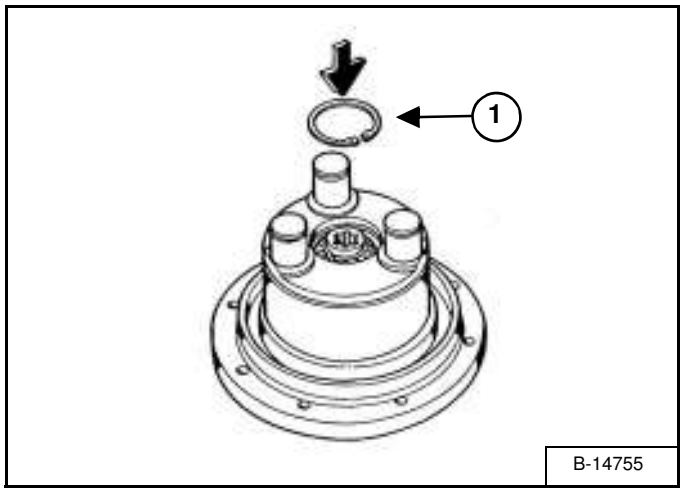
Figure 20-70-35



Install the drive shaft in the hub **[Figure 20-70-35]**.

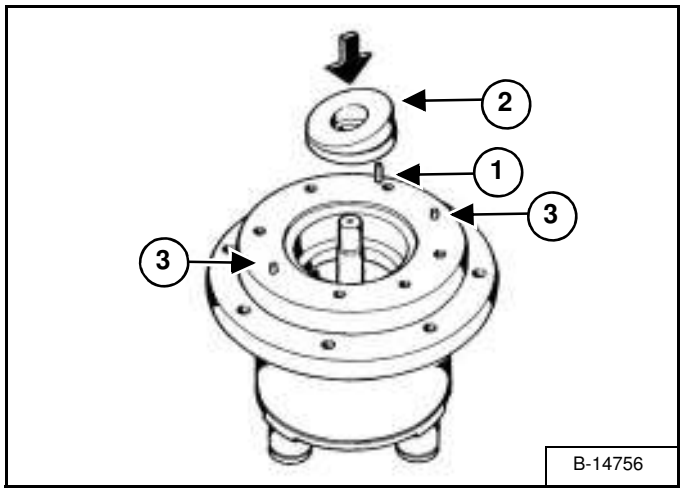
NOTE: Make sure the bearing is seated in the hub.

Figure 20-70-36



Install the internal snap ring (Item 1) **[Figure 20-70-36]**.

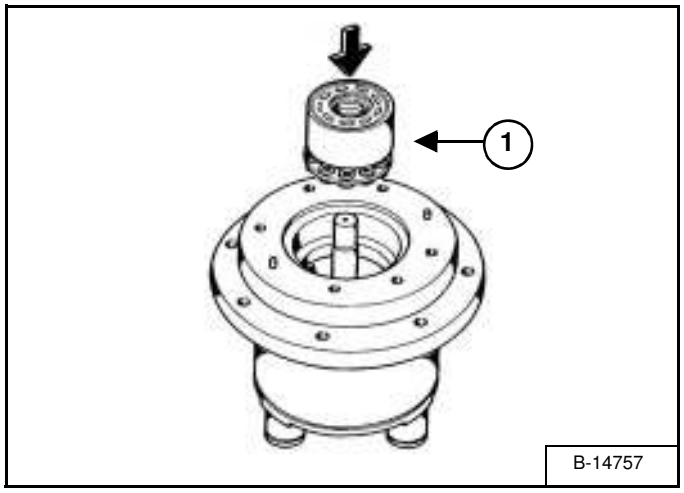
Figure 20-70-37



Invert the hub and install the alignment pin (Item 1) and swash plate (Item 2) **[Figure 20-70-37]**.

Install the two alignment pins (Item 3) **[Figure 20-70-37]** in the motor hub.

Figure 20-70-38



Apply oil to the piston faces and install the rotating block (Item 1) **[Figure 20-70-38]** in the motor hub.

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Assembly (Cont'd)

Figure 20-70-39

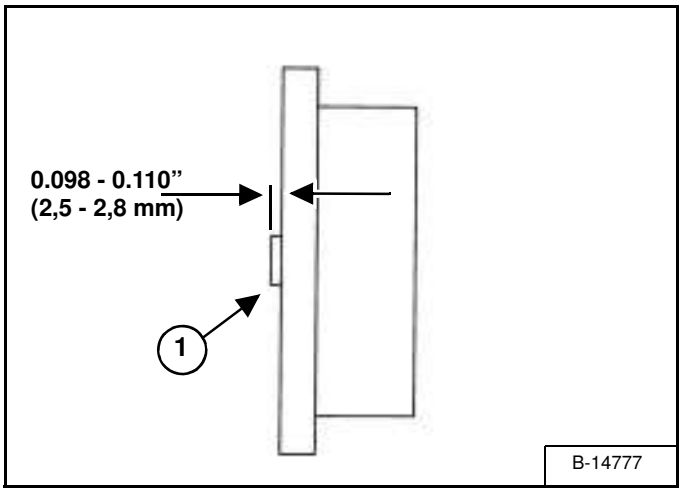
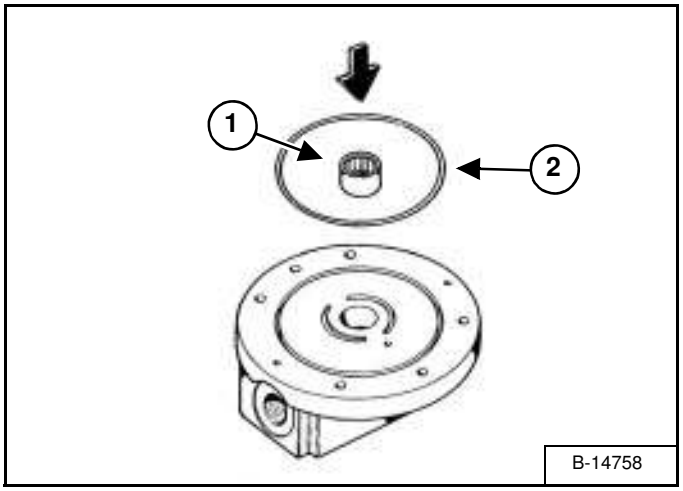


Figure 20-70-40

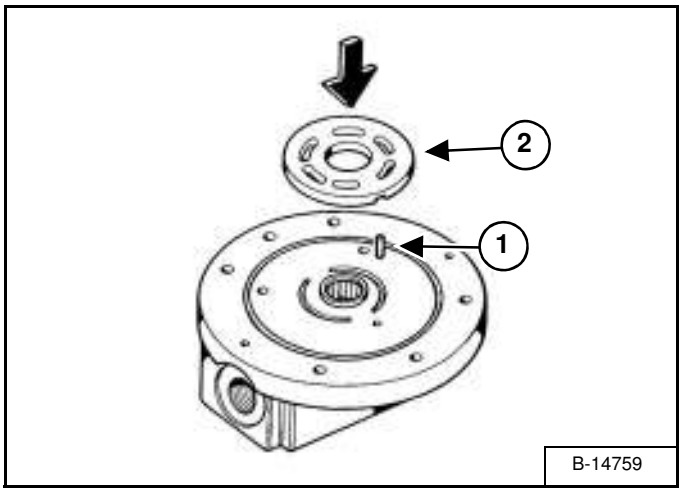


Press the bearing (Item 1) **[Figure 20-70-39]** & **[Figure 20-70-40]** in the motor cover.

The bearing (Item 1) **[Figure 20-70-39]** must extend from the face of the motor cover 0.098 - 0.110 inch (2,5-2,8 mm).

Apply oil to and install the O-ring (Item 2) **[Figure 20-70-40]** on the motor cover.

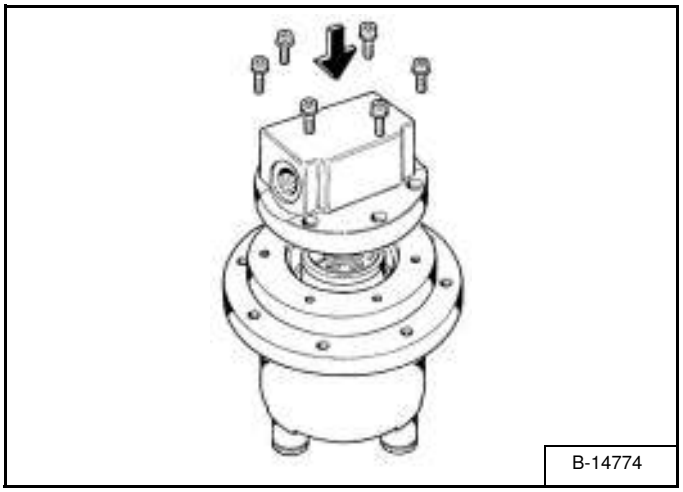
Figure 20-70-41



Install the alignment pin (Item 1) **[Figure 20-70-41]** on the motor cover.

Install the valve plate (Item 2) on the motor cover, with the alignment notch in the valve plate, sliding over the alignment pin (Item 1) **[Figure 20-70-41]**.

Figure 20-70-42



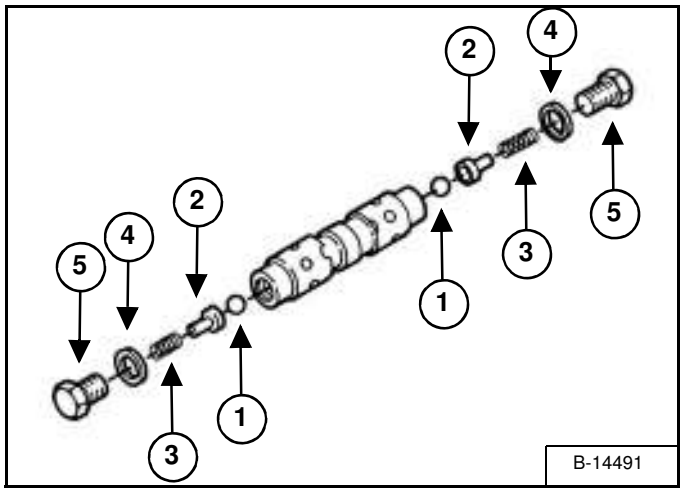
Lubricate the bearing with oil and install the motor cover on the hub with the six screws **[Figure 20-70-42]**.

Tighten the bolts in a crisscross manner to 18-22 ft.-lbs. (25-30 Nm) torque.

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Assembly (Cont'd)

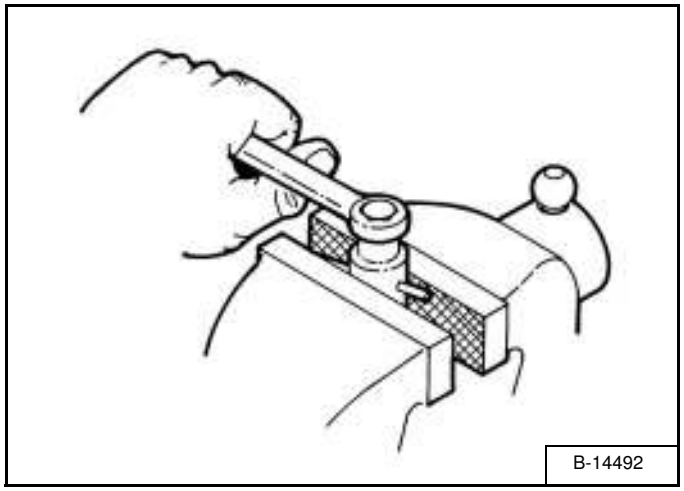
Figure 20-70-43



Install the check ball (Item 1), the poppet (Item 2) and the spring (Item 3) **[Figure 20-70-43]** in both ends of the spool.

Apply oil and install the new O-rings (Item 4) on the plugs (Item 5) **[Figure 20-70-43]**.

Figure 20-70-44



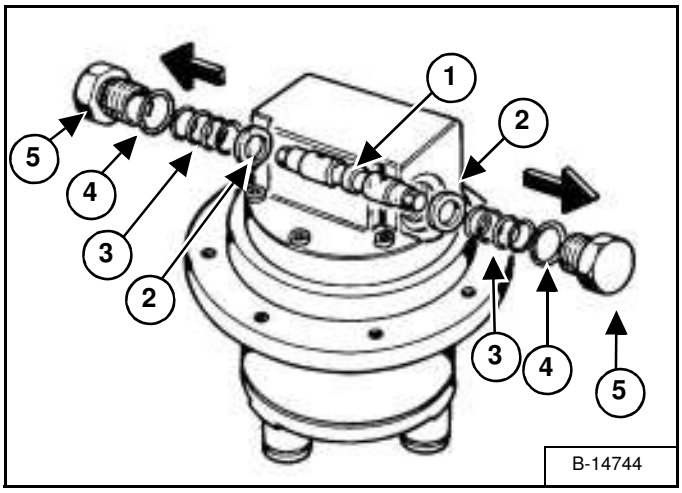
To assemble the spool, insert a hardened pin through the hole in the spool and use a vise with protective jaws to hold the spool **[Figure 20-70-44]**.

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

Install the two plugs in both ends of the spool **[Figure 20-70-44]**.

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

Figure 20-70-45



Apply oil to and install the spool (Item 1) **[Figure 20-70-45]** in the motor cover.

Install the washers (Item 2) and the springs (Item 3) on both ends of the spool (Item 1) **[Figure 20-70-45]**.

Apply oil to and install the new O-rings (Item 4) on the plugs (Item 5) **[Figure 20-70-45]**.

Install the plugs (Item 5) **[Figure 20-70-45]** on the motor cover.

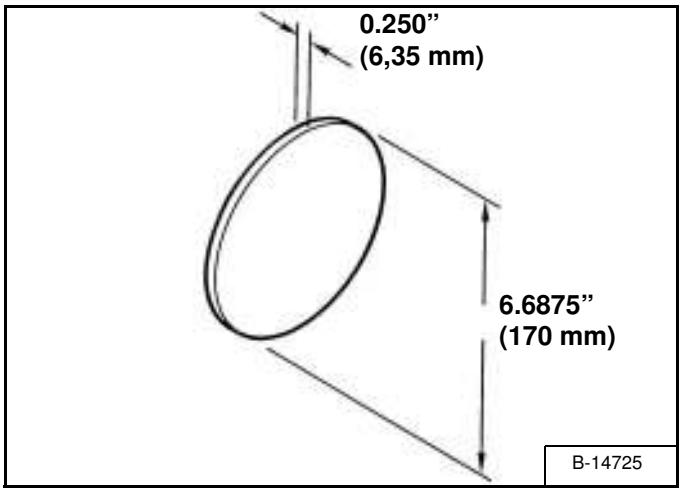
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Assembly (Cont'd)

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 20-70-46

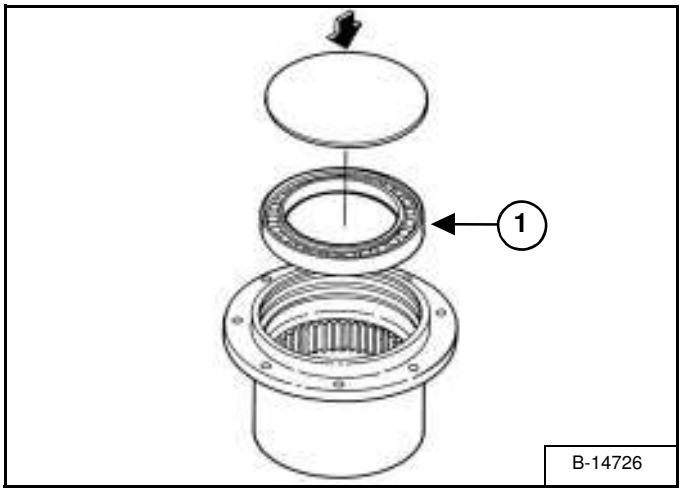


Obtain the tool locally **[Figure 20-70-46]**.

The dimensions are as follows:

Diameter	6.6875 inches (170 mm)
Thickness	0.250 inch (6,35 mm)

Figure 20-70-47



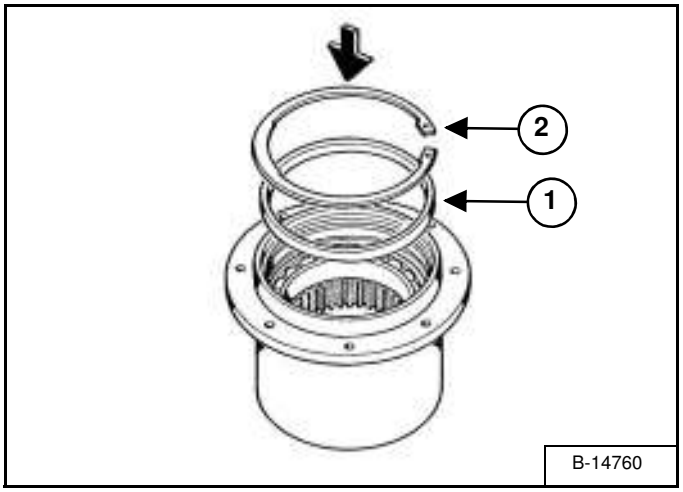
Lubricate the outer edge of the bearing and press the bearing (Item 1) **[Figure 20-70-47]** in the housing, using the bearing installation tool.

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 Melroe Parts:

P/N 6669119	0.0079 inch (0,2 mm)
P/N 6669120	0.0118 inch (0,3 mm)
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 20-70-48

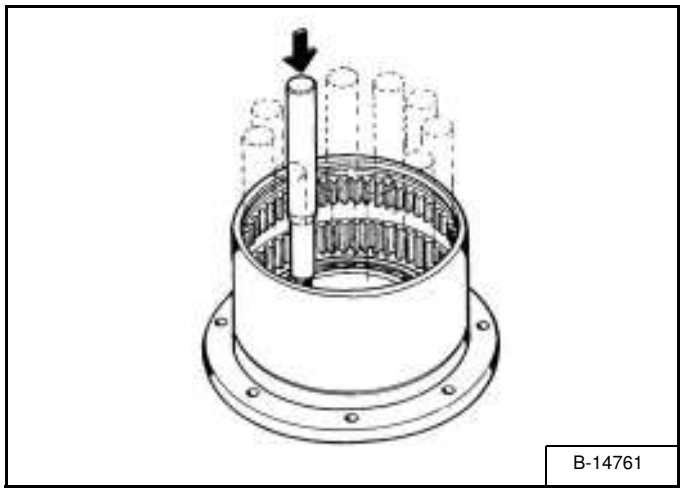


Install the spacer (Item 1) and internal snap ring (Item 2) **[Figure 20-70-48]**.

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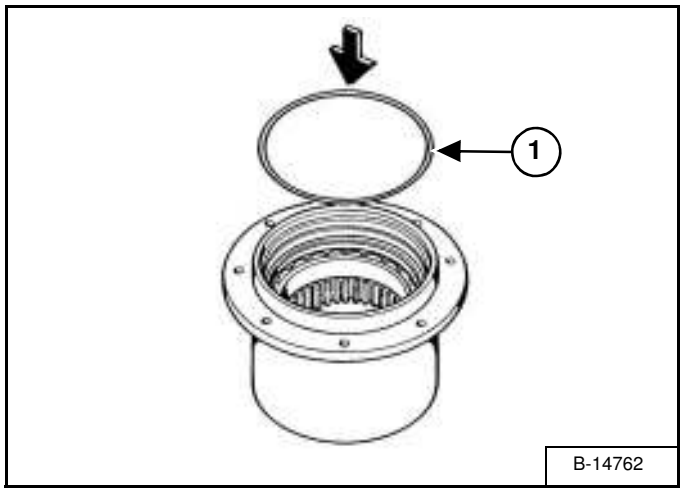
Assembly (Cont'd)

Figure 20-70-49



Invert the ring gear, and using a brass drift, seat the bearing against the spacer **[Figure 20-70-49]**.

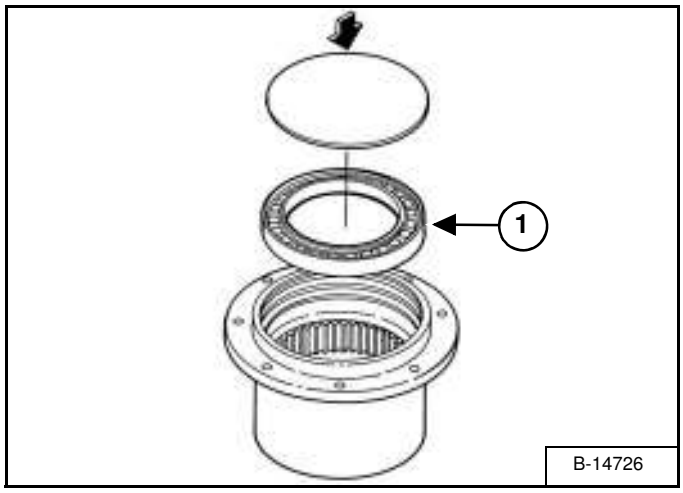
Figure 20-70-50



Apply oil to and install the O-ring (Item 1) **[Figure 20-70-50]**.

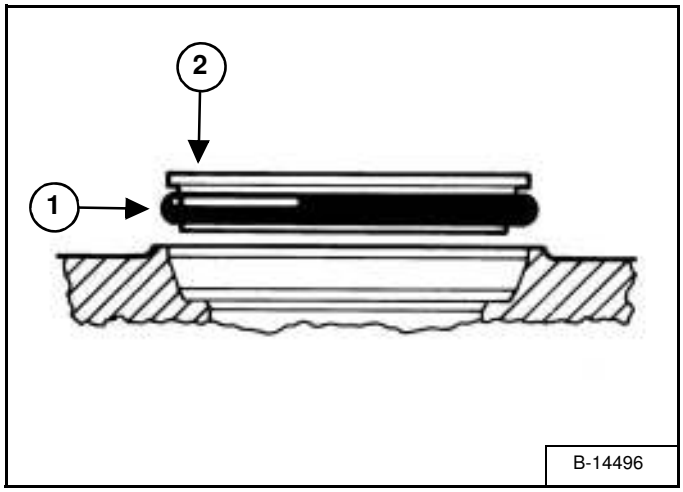
NOTE: Make sure the O-ring (Item 1) [Figure 20-70-50] is correctly installed in the housing groove so it is not damaged when the second bearing is installed.

Figure 20-70-51



Lubricate the outer edge of the second bearing and press the bearing in the housing (Item 1) **[Figure 20-70-51]**.

Figure 20-70-52



Install the O-ring (Item 1) on the seal ring (Item 2) **[Figure 20-70-52]**.

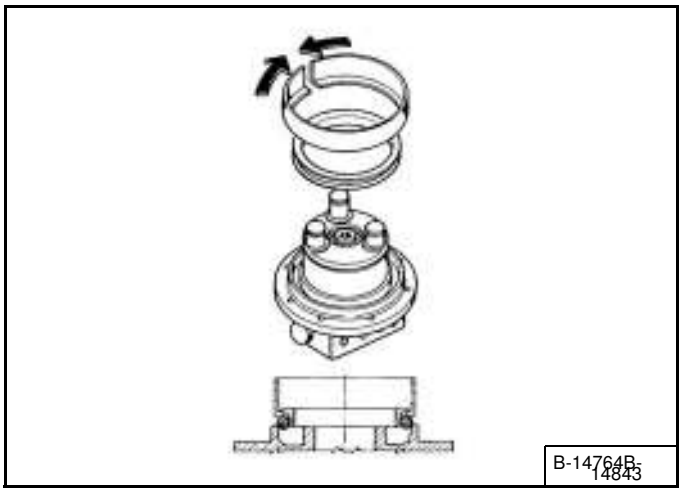
NOTE: Inspect the seal ring for burrs before installing the O-ring. Install the O-ring making sure it is not twisted. To remove any twists, gently pull a section of the O-ring and let it snap back.

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

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Assembly (Cont'd)

Figure 20-70-53

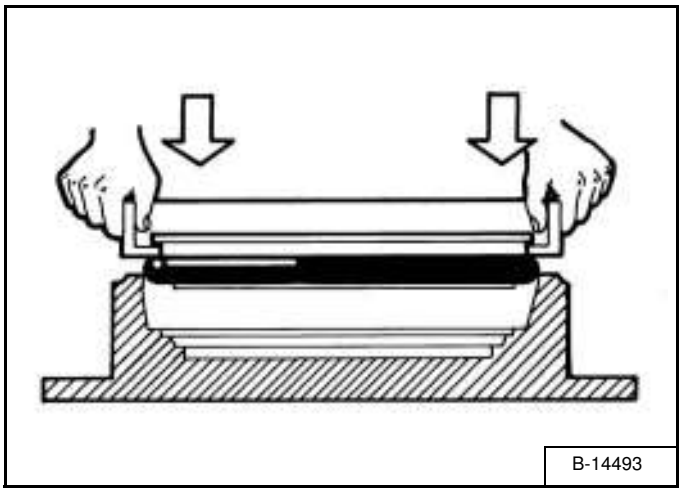


Install the seal seating tool (MEL1519) on the seal ring and O-ring assembly **[Figure 20-70-53]**.

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 20-70-53]**.

Dip the O-ring and seal ring assembly in a pan of alcohol.

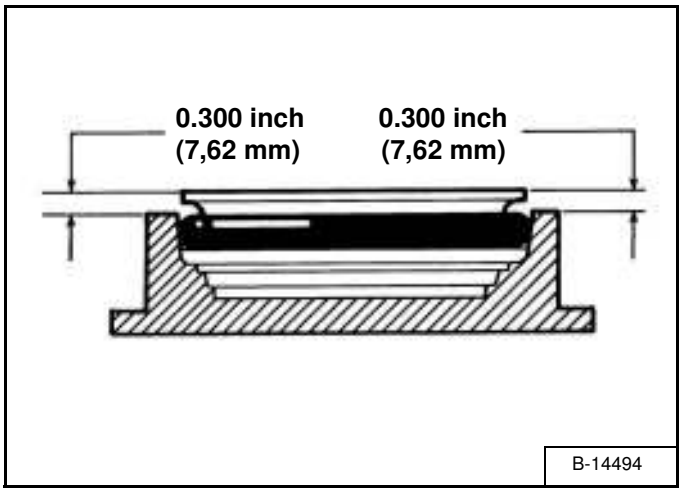
Figure 20-70-54



Shake off the excess alcohol and install the seal ring assembly on the motor **[Figure 20-70-54]**.

Use firm even pressure on the installation tool (MEL1519) to *pop* the O-ring into the motor housing.

Figure 20-70-55



After the seal ring is installed, check the stand out height **[Figure 20-70-55]** in four places, 90° apart.

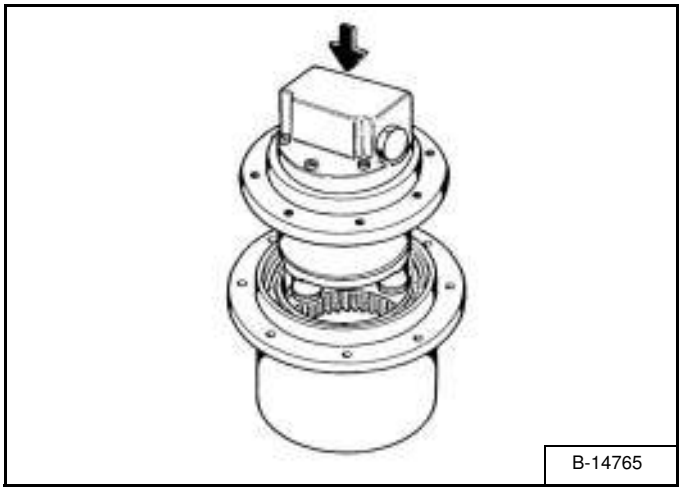
The stand out height is 0.300 ± 0.020 inches (7,62 ± 0,5 mm).

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 20-70-56

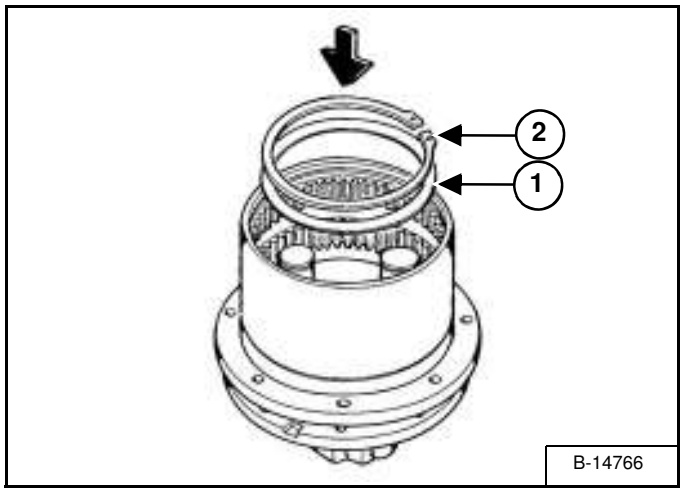


Press the reduction unit and motor assembly in the bearings **[Figure 20-70-56]**. The inner bearing may move deeper into the housing as the motor assembly is pressed in the housing. If this happens, tap the inner bearing down to its original position using a brass drift.

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Assembly (Cont'd)

Figure 20-70-57

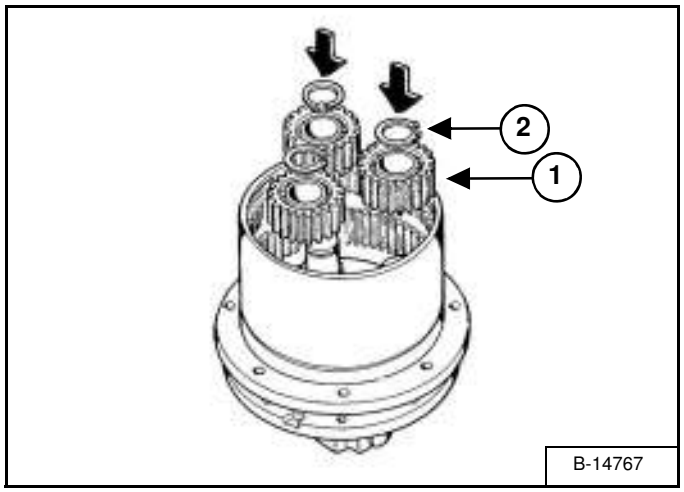


Install the shim(s) (Item 1) and external snap ring (Item 2) **[Figure 20-70-57]** in the motor reduction unit.

The shim(s) (Item 1) **[Figure 20-70-57]** 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 20-70-57]** and fully seated in the snap ring groove.

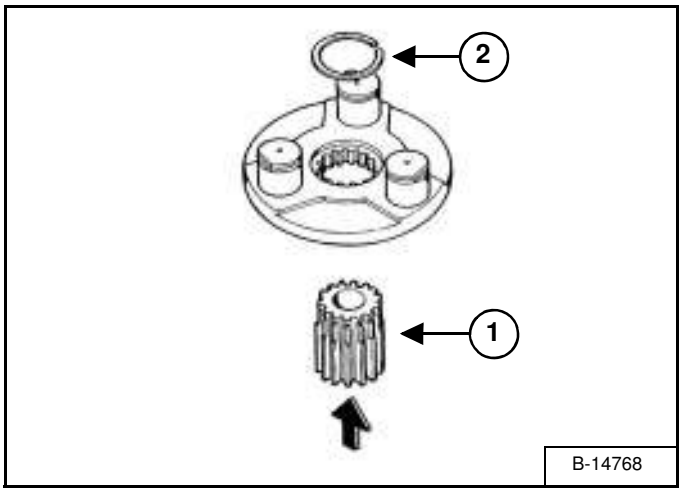
Figure 20-70-58



Install the planetary gears/bearings (Item 1) and the snap rings (Item 2) **[Figure 20-70-58]**.

NOTE: The second stage planetary gears/bearings must be installed with the bearing race flare facing down to match the shoulder on the pins.

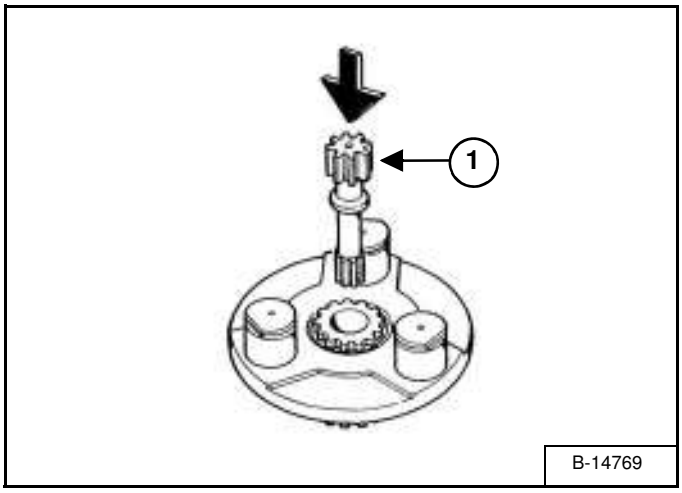
Figure 20-70-59



Install the sun gear (Item 1) **[Figure 20-70-59]** into the outer planetary carrier.

Install the snap ring (Item 2) on the sun gear (Item 1) **[Figure 20-70-59]**.

Figure 20-70-60

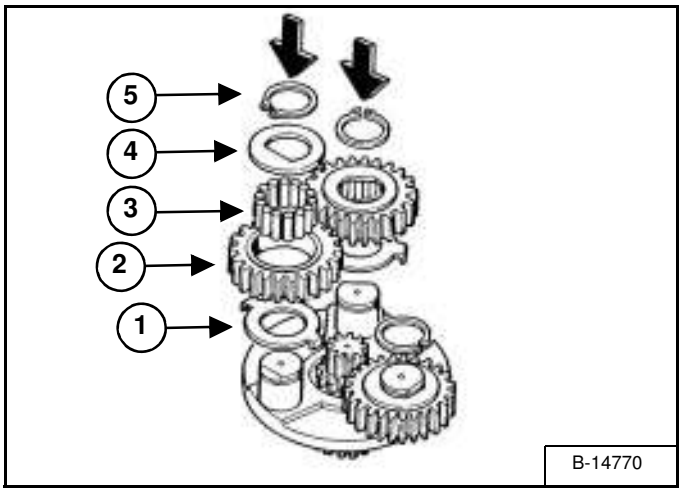


Install the sun gear (Item 1) **[Figure 20-70-60]**.

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Assembly (Cont'd)

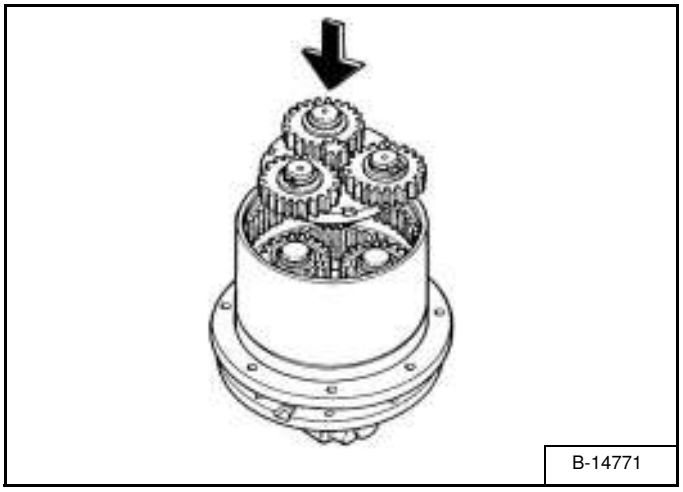
Figure 20-70-61



Install the thrust washers (Item 1), the planetary gears (Item 2), the bearings (Item 3), the anti-rotation washers (Item 4) and the external snap rings (Item 5) **[Figure 20-70-61]**.

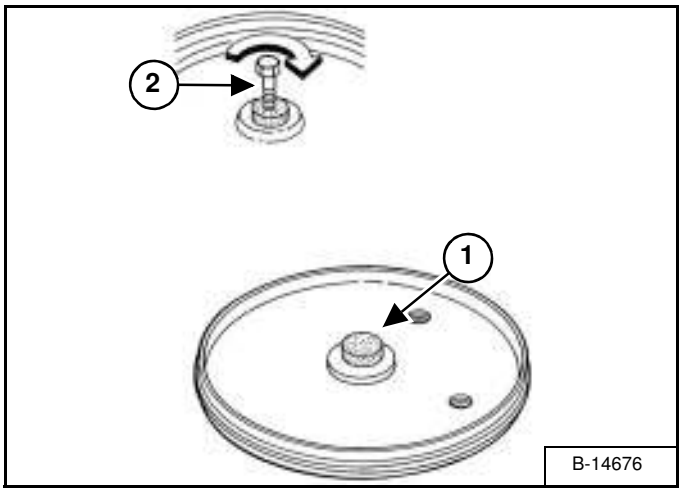
Install the snap rings (Item 5) **[Figure 20-70-61]** so the opening of the snap ring is towards the outside.

Figure 20-70-62



Install the planetary assembly in the hub **[Figure 20-70-62]**.

Figure 20-70-63



Inspect the cover bushing (Item 1) **[Figure 20-70-63]** for wear.

If the bushing (Item 1) **[Figure 20-70-63]** needs to be replaced, drill a hole in the center of the bushing.

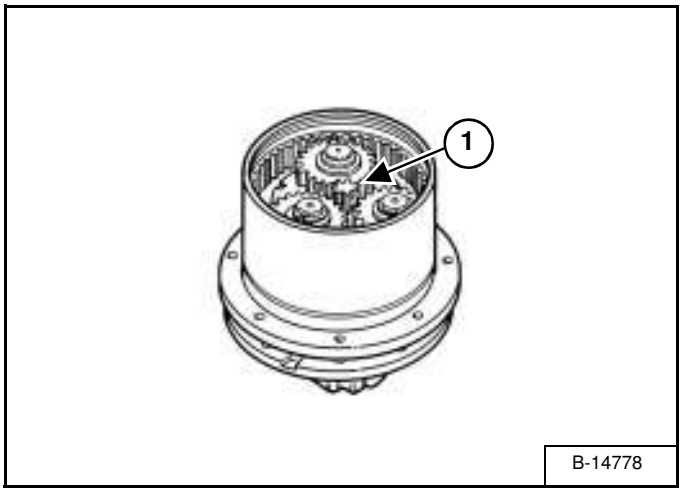
Using a number 3 drill bit, thread the hole with a 0.250 x 28.0 inches NF tap.

Install a 0.250 x 28.0 inch bolt (Item 2) **[Figure 20-70-63]** in the bushing and pull the bushing out of the cover.

Install the new bushing in the cover with the bevel down.

The clearance between the cover bushing and the sun gear must be 0.008-0.031 inches (0,2-0,8 mm).

Figure 20-70-64



Place a 0.500 inch (13 mm) long piece of 0.0625 inch (1,5 mm) solder (Item 1) **[Figure 20-70-64]** on the end of the sun gear.

Seat the cover in the hub.

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Assembly (Cont'd)

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.

Slim Thickness	MEL Part Number
0.020 inch (0,5 mm)	6669597
0.030 inch (0,76 mm)	6669598
0.050 inch (1,27 mm)	6669699

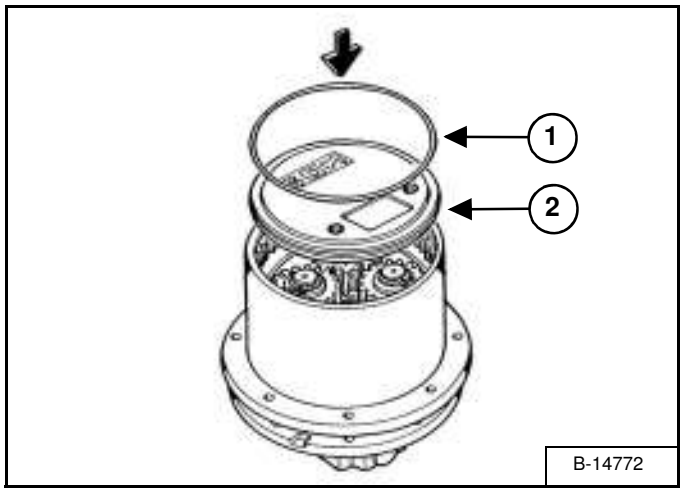
Remove the bushing.

Install the correct shim under the bushing and install the bushing.

NOTE: Make sure there are no burrs on the bushing face from bushing removal.

Repeat the procedure for checking clearance between the sun gear and cover bushing.

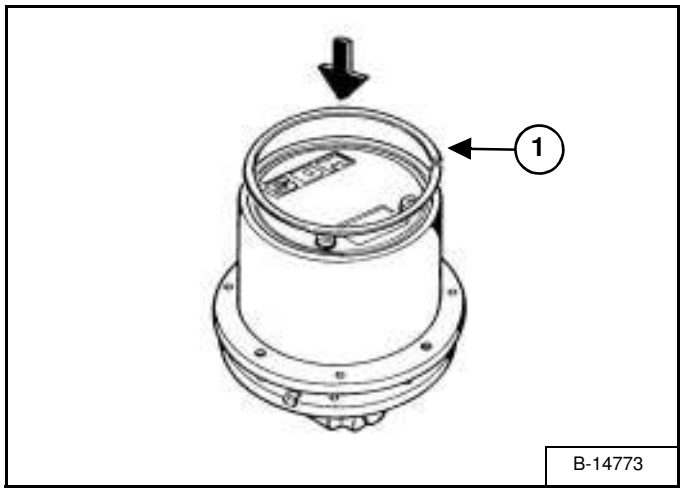
Figure 20-70-65



Apply oil to and install the O-ring (Item 1) **[Figure 20-70-65]** on the cover.

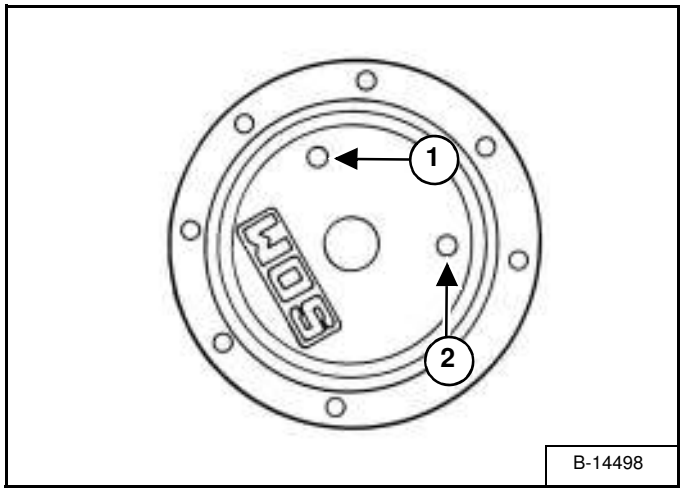
Install the cover (Item 2) **[Figure 20-70-65]** on the hub.

Figure 20-70-66



Install the snap ring (Item 1) **[Figure 20-70-66]** to securing the cover to the drive motor.

Figure 20-70-67



Add .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 20-70-67]**.

Install and tighten the two plugs.

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SWIVEL JOINT

Removal And Installation (With The Upperstructure Removed)

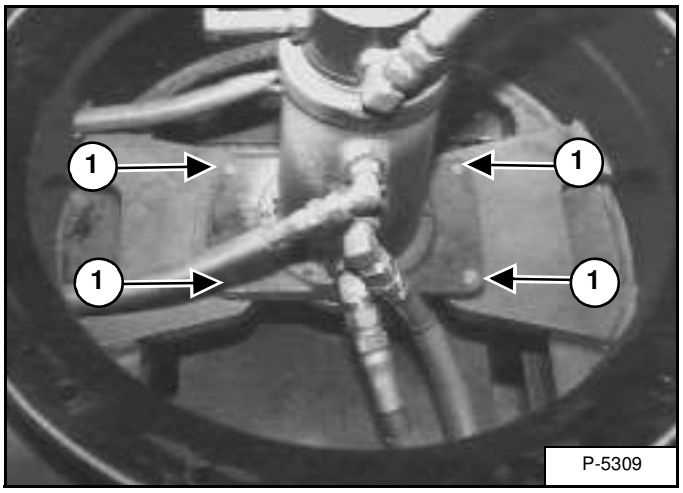
IMPORTANT

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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Mark all the hoses for correct installation.

Figure 20-80-1



Disconnect the hoses from the swivel joint **[Figure 20-80-1]**.

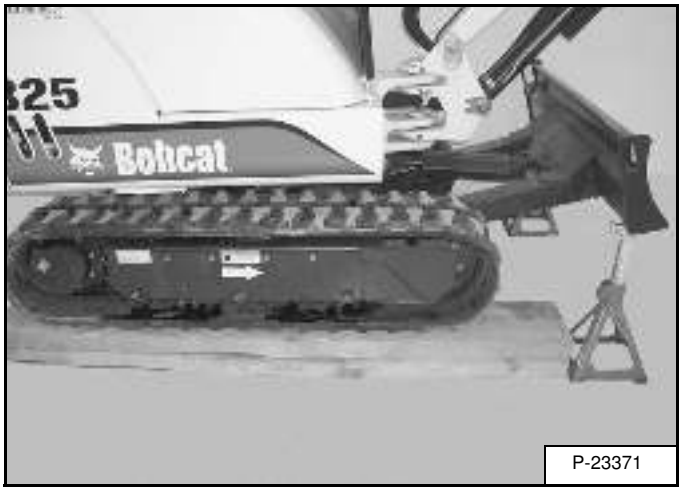
Remove the bolts (Item 1) **[Figure 20-80-1]** from the plate below the center swivel joint.

Installation: Apply LOCTITE 242 to the bolt threads and tighten the bolts to 48-55 ft.-lbs. (65-75 Nm) torque.

Remove the center swivel joint from the track frame.

Removal And Installation (Through Bottom Access Cover)

Figure 20-80-2



Raise the excavator approximately 7 inches (178 mm) and place blocks under the tracks**[Figure 20-80-2]**.

Lower the boom and bucket to the ground.

Remove the floor mat and floor plate. (See Removal And Installation on Page 40-110-1.)

Remove the right pedal. (See Pedal Removal And Installation on Page 40-90-1.)

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

IMPORTANT

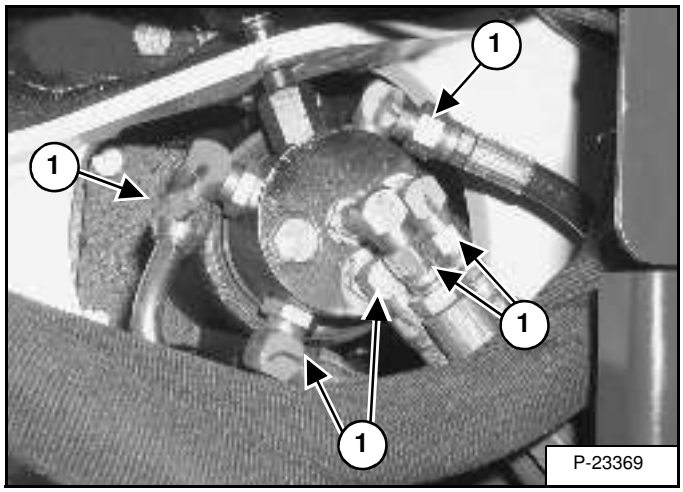
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tube lines and ports to keep dirt out. Dirt can quickly damage the system.

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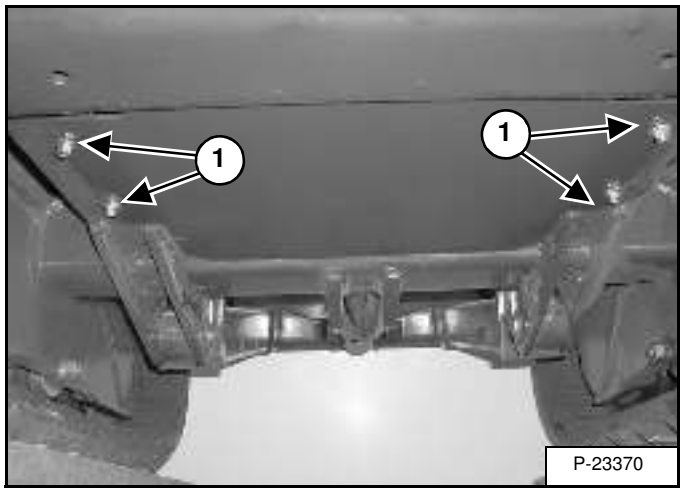
Removal And Installation (Through Bottom Access Cover) (Cont'd)

Figure 20-80-3



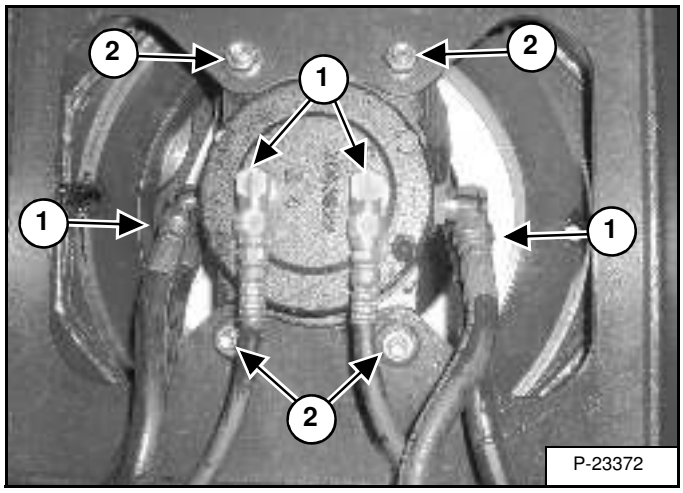
Mark and remove the seven hoses (Item 1) **[Figure 20-80-3]** from the top of the swivel joint.

Figure 20-80-4



Remove the four bolts (Item 1) **[Figure 20-80-4]** and access panel from the underside of the excavator.

Figure 20-80-5



Remove the eight hoses (Item 1) **[Figure 20-80-5]** from the swivel joint.

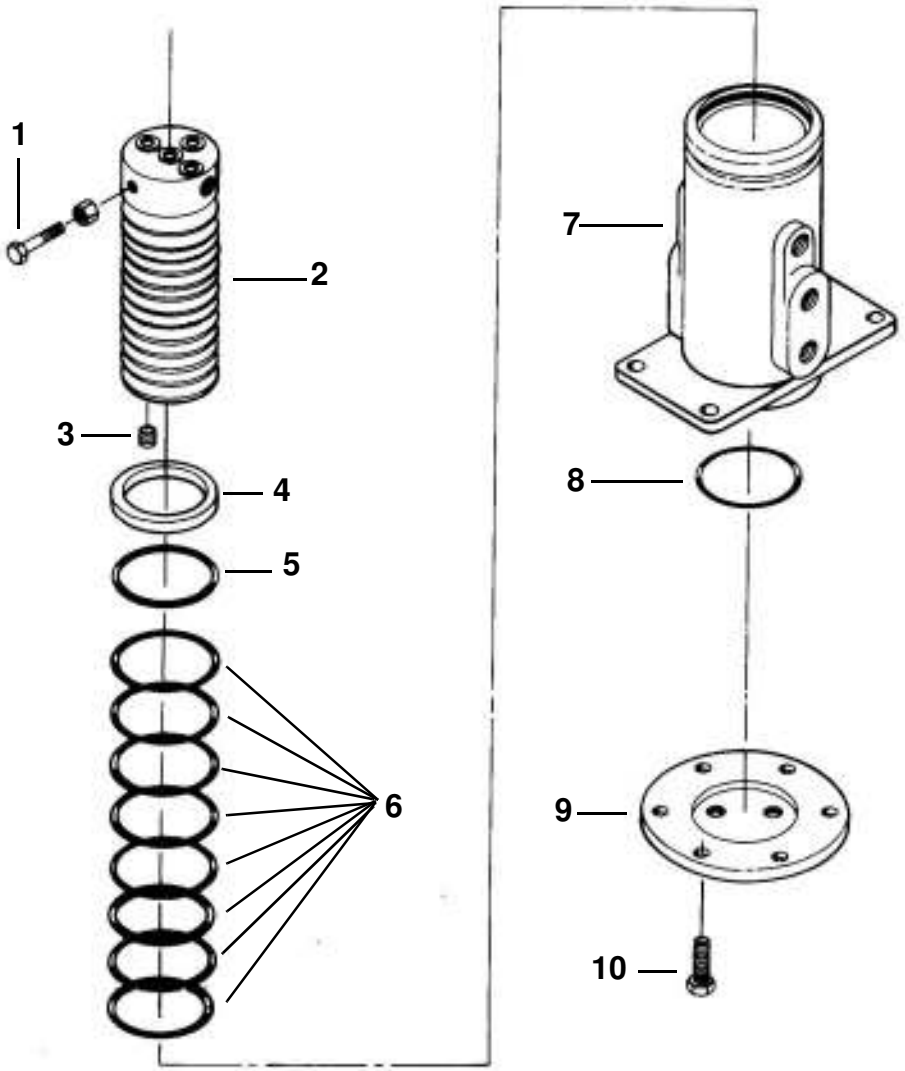
Remove the four bolts and nuts (Item 2) **[Figure 20-80-5]** and lower the swivel joint out the bottom of the excavator.

Installation: Apply LOCTITE 242 to the bolt threads and tighten the bolts to 48-55 ft.-lbs. (65-75 Nm) of torque.

Dealer Copy -- Not for Resale

Parts Identification

1. Bolt
2. Rotor
3. Plug
4. Seal
5. Seal
6. Seal
7. Body
8. O-ring
9. Cover
10. Bolt



D-2250

Dealer Copy -- Not for Resale

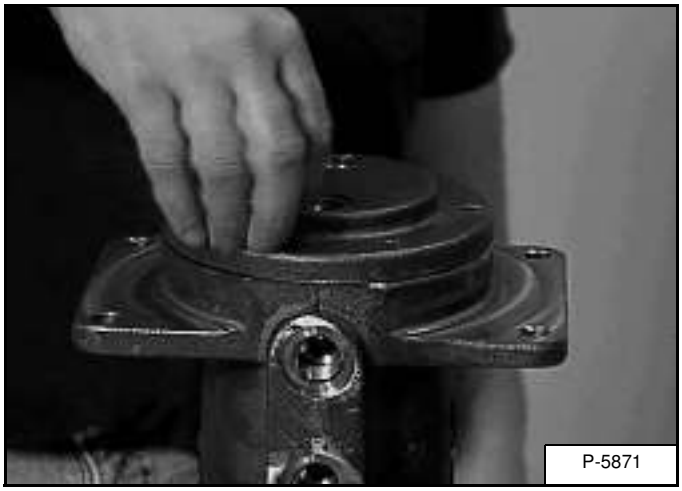
Description

The swivel joint is a rotary hydraulic swivel which diverts hydraulic oil, under pressure, to the travel motors and the blade cylinder.

Disassembly

Mark the cover and body for ease of assembly.

Figure 20-80-6



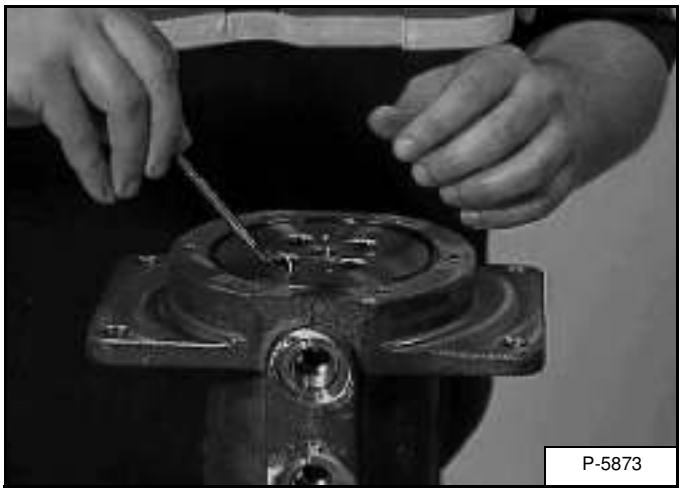
Remove the six bolts from the cover **[Figure 20-80-6]**.

Figure 20-80-7



Remove the cover **[Figure 20-80-7]**.

Figure 20-80-8



Remove the O-ring from the O-ring groove **[Figure 20-80-8]**.

Figure 20-80-9



Clamp the swivel joint, base end down in a vise, and drive the rotor out of the body with a soft faced hammer **[Figure 20-80-9]**.

Remove all the O-rings and glide rings from the rotor.

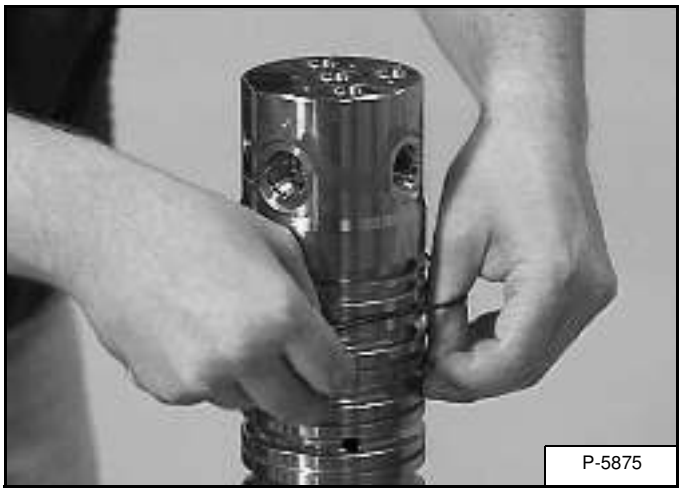
Clean the rotor with solvent and dry with compressed air.

NOTE: Use care not to scratch the rotor surface as damage to the finished surface could cause internal leakage.

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Assembly

Figure 20-80-10



Install new O-rings on the rotor **[Figure 20-80-10]**.

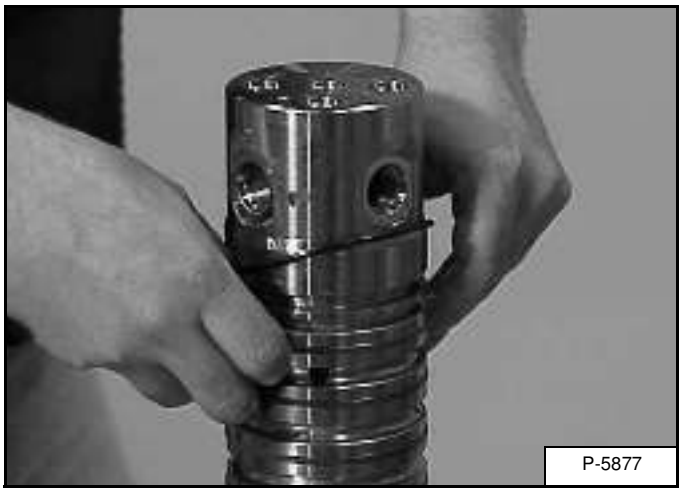
Heat the glide rings and crown seal in hydraulic oil for three minutes at 130° F (54° C).

Figure 20-80-11



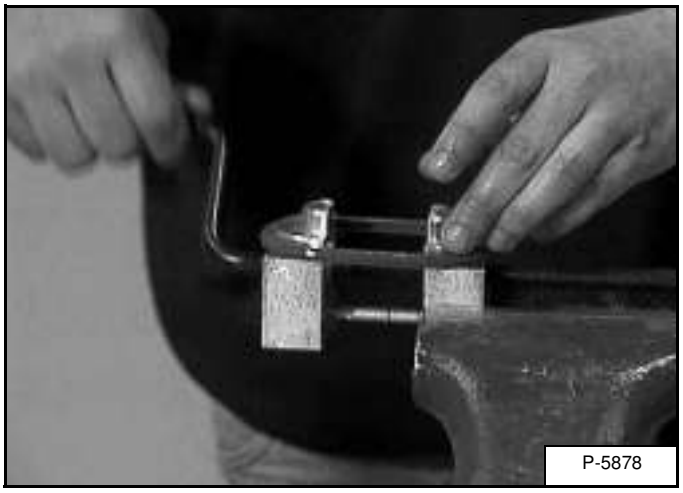
Stretch the heated glide rings to 4.0 inch (101,6 mm) and install on the rotor **[Figure 20-80-11]**.

Figure 20-80-12



Install the crown seal O-ring **[Figure 20-80-12]**.

Figure 20-80-13



Stretch the heated crown seal to 4.500 inches (114,3 mm) **[Figure 20-80-13]**.

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Assembly (Cont'd)

Figure 20-80-14



Work the crown seal on the rotor and down to the top groove **[Figure 20-80-14]**.

Figure 20-80-15

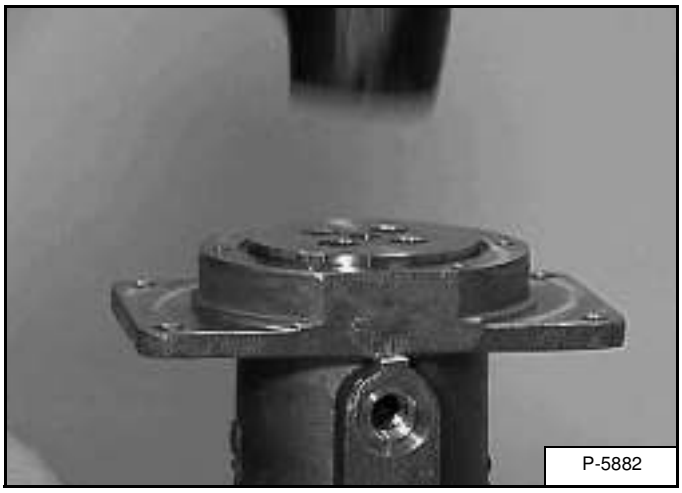


Press the wiper seal in the body **[Figure 20-80-15]**

Lubricate the inside of the body and the rotor with hydraulic oil or light grease.

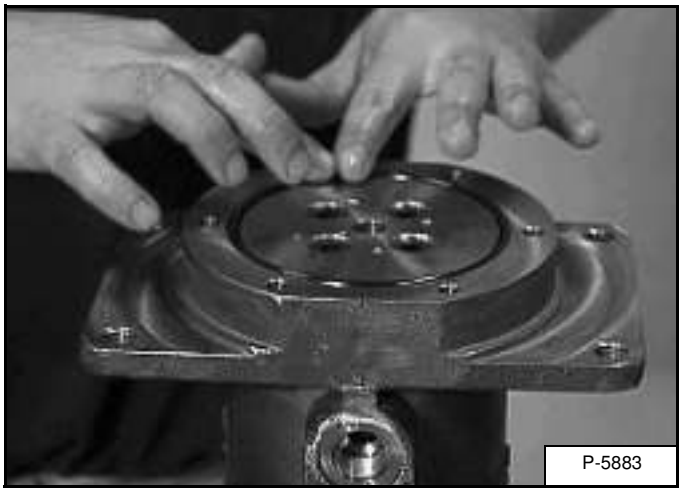
Slide the rotor in the body.

Figure 20-80-16



Seat the rotor using a soft faced hammer **[Figure 20-80-16]**.

Figure 20-80-17

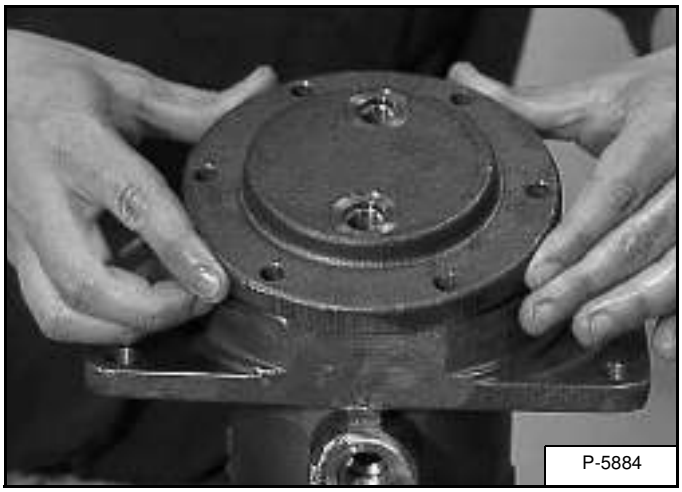


Install a new O-ring in the groove on the bottom of the body **[Figure 20-80-17]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-80-18



Install the cover on the body **[Figure 20-80-18]**.

Figure 20-80-19



Apply thread lock (LOCTITE 242) to the bolt threads, and install the cover bolts. Tighten to 18 ft.-lbs. (24 Nm) of torque **[Figure 20-80-19]**.

Figure 20-80-20



Check the breakaway torque of the swivel joint **[Figure 20-80-20]**.

The breakaway torque of the swivel joint is 50-90 ft.-lbs. (68-122 Nm).

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SWING MOTOR

Removal And Installation

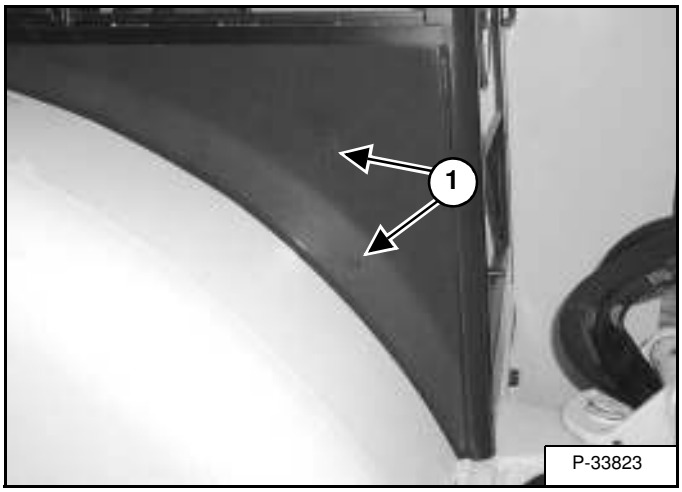
Remove the floor mat and floor plate. (See Removal And Installation on Page 40-110-1.)

Remove the right pedal and floor panel. (See Pedal Removal And Installation on Page 40-90-1 and Removal And Installation on Page 40-110-1.)

NOTE: Steps [Figure 20-90-1], [Figure 20-90-2] & [Figure 20-90-3] are for cab and heater equipped machines.

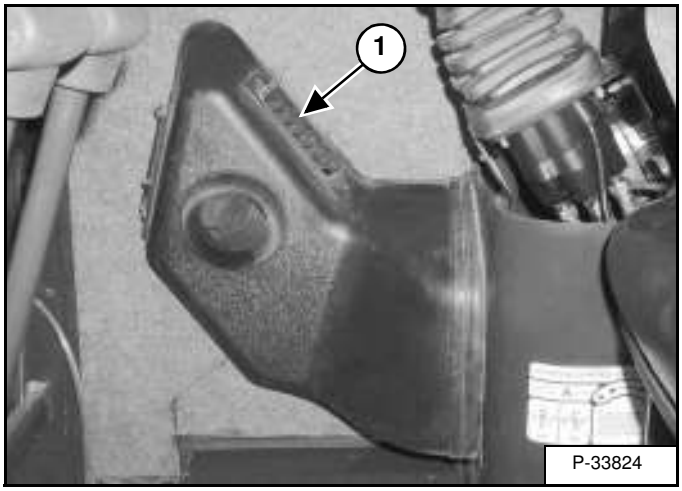
NOTE: On early models the duct is attached to the cab side wall with Velcro tabs.

Figure 20-90-1



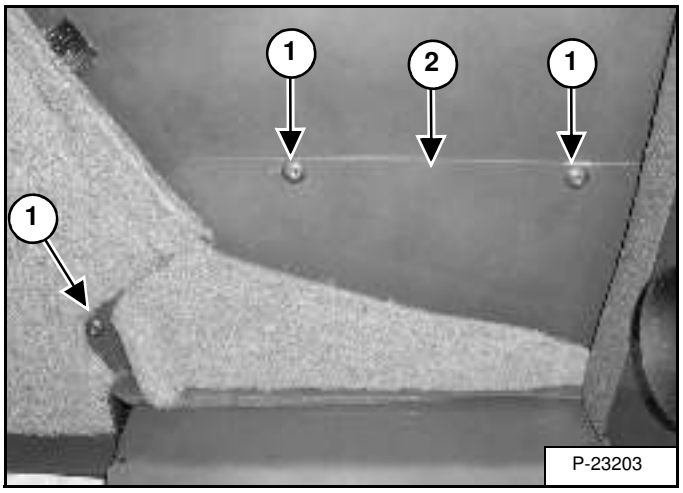
Later models without velcro mount tabs; remove the two bolts (Item 1) **[Figure 20-90-1]** from the right side of the operators cab.

Figure 20-90-2



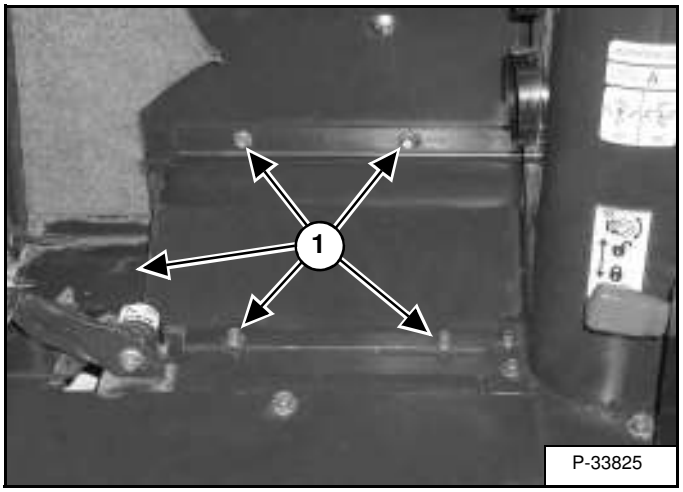
Remove the heater duct (Item 1) **[Figure 20-90-2]**.

Figure 20-90-3



Remove the three screws (Item 1) and remove the cover (Item 2) **[Figure 20-90-3]**.

Figure 20-90-4



Remove the five bolts (Item 1) and remove the swing motor cover (Item 2) **[Figure 20-90-4]**.

Dealer Copy -- Not for Resale

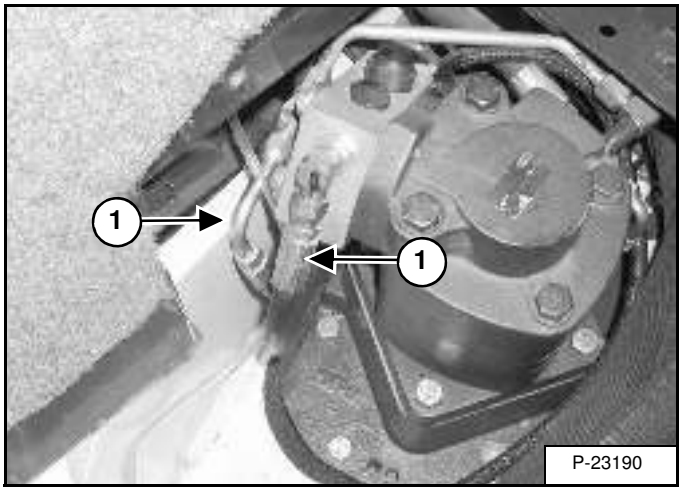
Removal And Installation (Cont'd)

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, tube lines and ports to keep dirt out. Dirt can quickly damage the system.

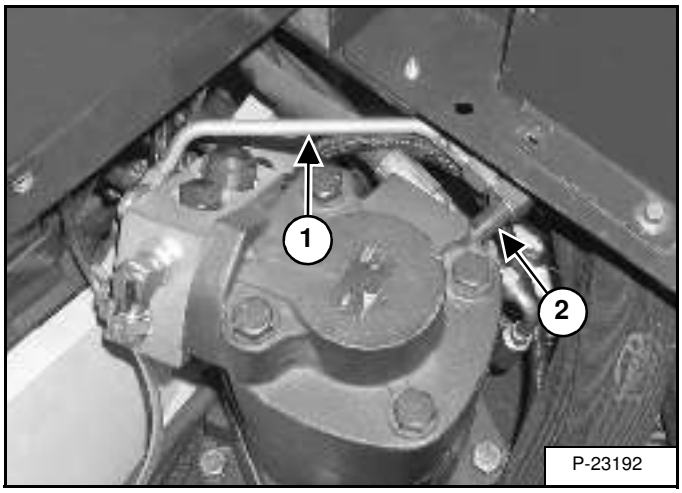
I-2003-0888

Figure 20-90-5



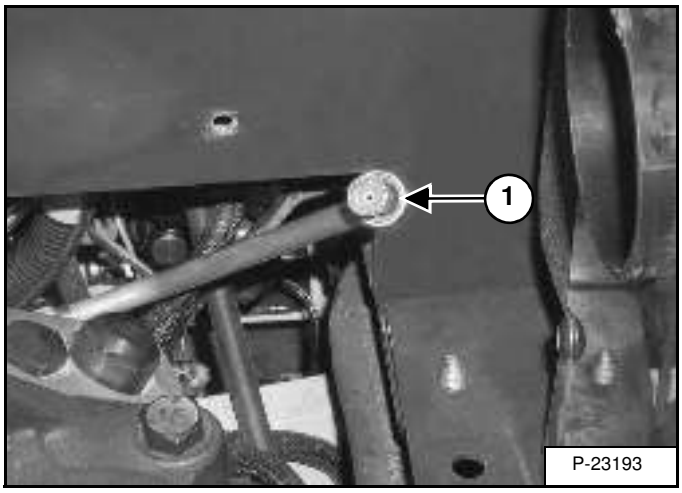
Mark and remove the hoses (Item 1) **[Figure 20-90-5]**.

Figure 20-90-6



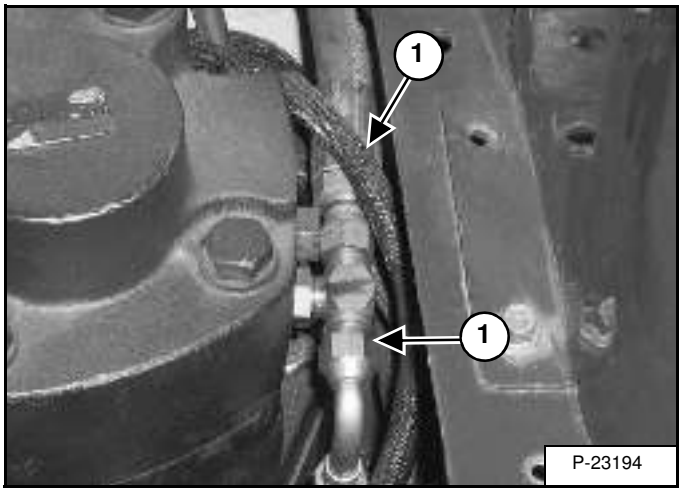
Remove the tubeline (Item 1) and fitting (Item 2) **[Figure 20-90-6]**.

Figure 20-90-7



Remove the orifice (Item 1) **[Figure 20-90-7]** from the tubeline.

Figure 20-90-8

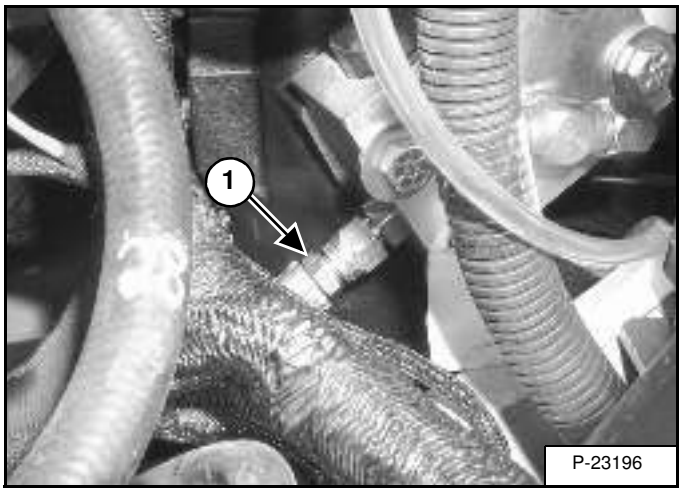


Remove the hoses (Item 1) **[Figure 20-90-8]** from the rear of the swing motor.

Dealer Copy -- Not for Resale

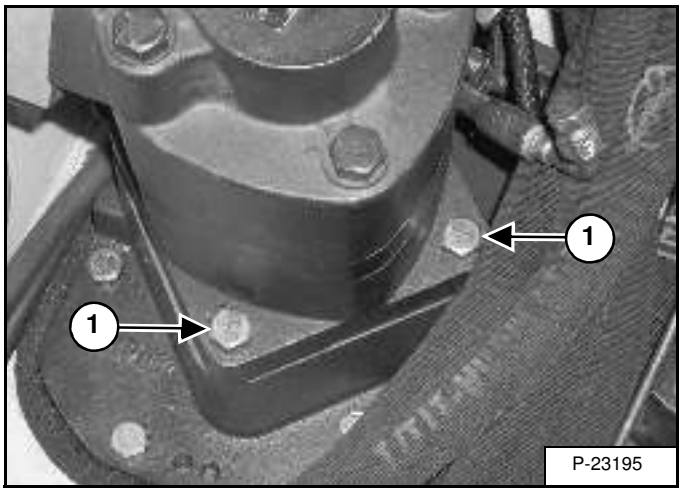
Removal And Installation (Cont'd)

Figure 20-90-9



Open the right side cover and remove the hose (Item 1) **[Figure 20-90-9]**.

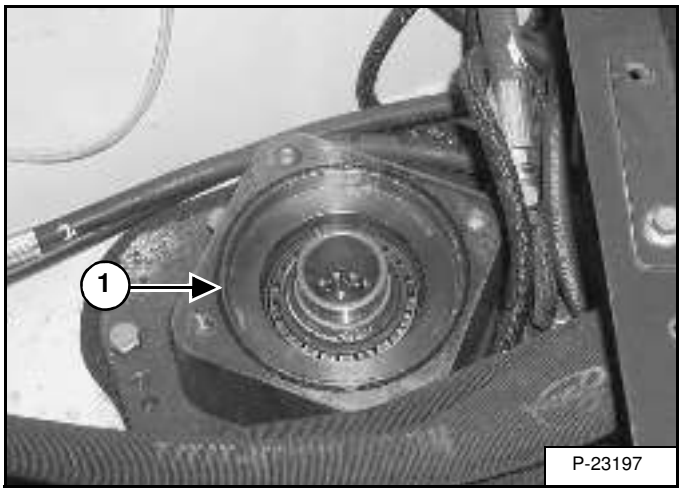
Figure 20-90-10



Remove the four bolts (Item 1) **[Figure 20-90-10]**.

Installation: Tighten the bolts to 78-85 ft.-lbs. (105-115 Nm) torque.

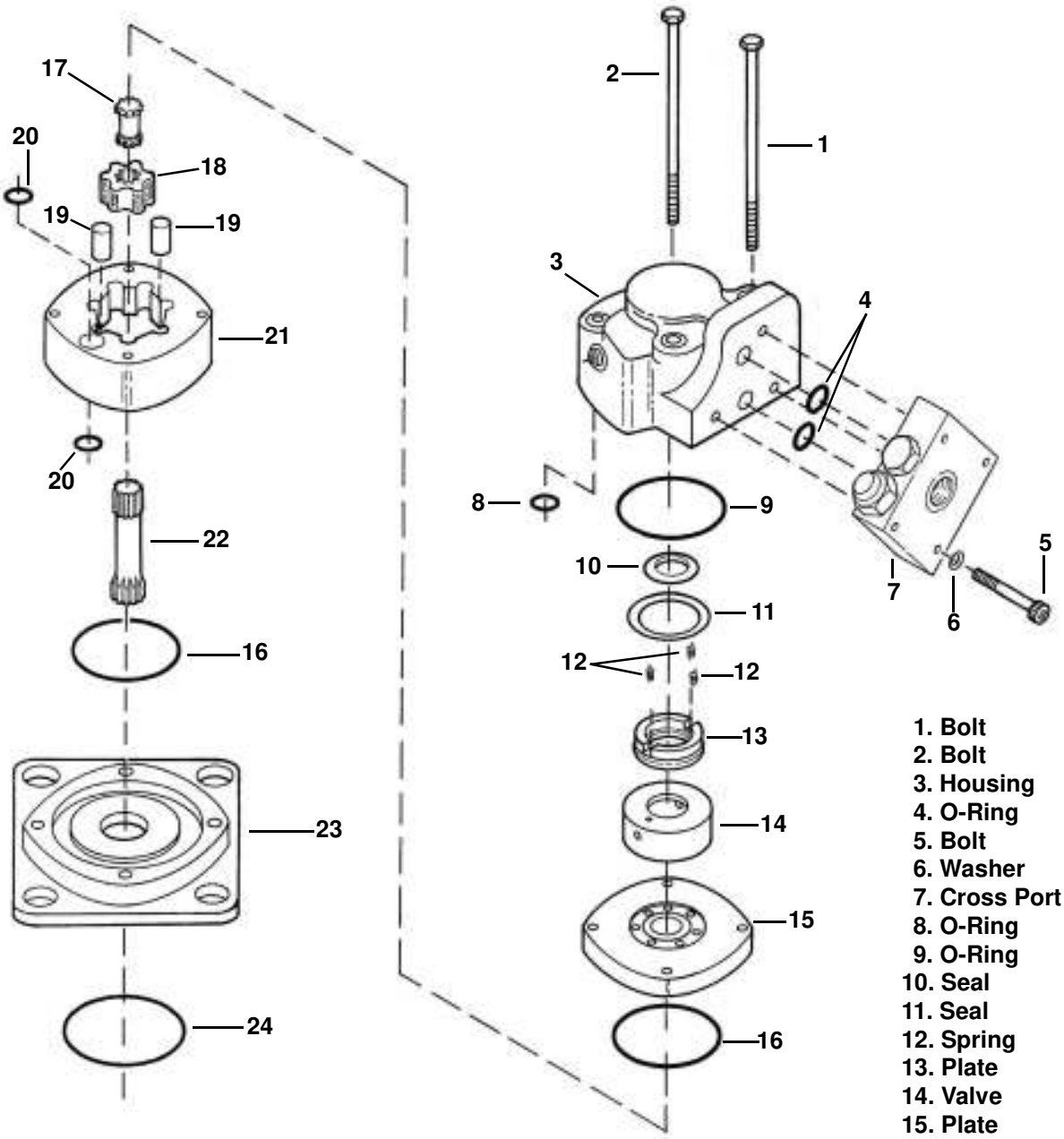
Figure 20-90-11



Remove the O-ring (Item 1) **[Figure 20-90-11]** from the swing motor drive carrier.

Dealer Copy -- Not for Resale

Parts Identification



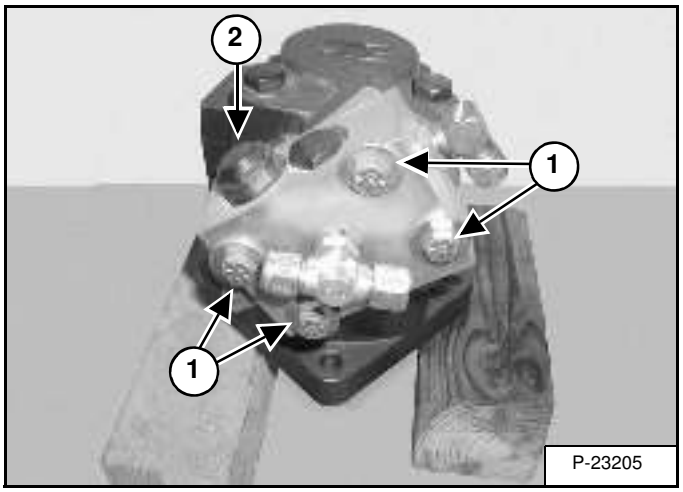
1. Bolt
2. Bolt
3. Housing
4. O-Ring
5. Bolt
6. Washer
7. Cross Port Relief Valve
8. O-Ring
9. O-Ring
10. Seal
11. Seal
12. Spring
13. Plate
14. Valve
15. Plate
16. O-Ring
17. Drive
18. Star
19. Roller
20. O-Ring
21. Plate
22. Drive
23. Housing
24. O-Ring

C-3421

Dealer Copy -- Not for Resale

Disassembly

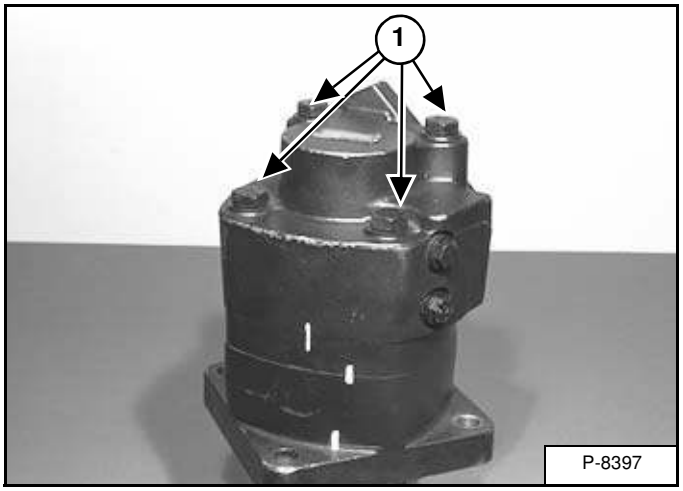
Figure 20-90-12



Remove the four bolts (Item 1) and remove the cross port relief valve (Item 2) **[Figure 20-90-12]** from the swing motor.

NOTE: See "Cross Port Relief Valve Disassembly" on Page 20-90-13.

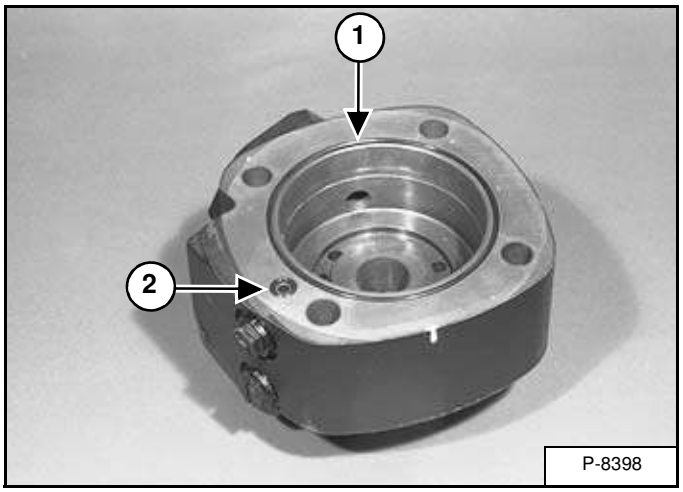
Figure 20-90-13



Mark the housing for ease of assembly **[Figure 20-90-13]**.

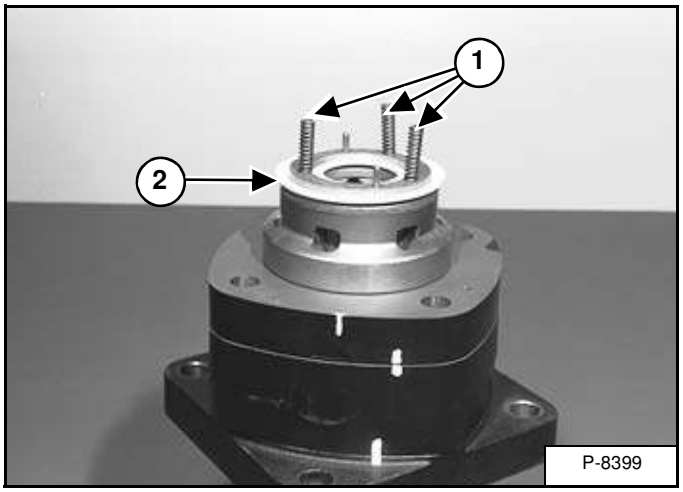
Remove the four bolts (Item 1) **[Figure 20-90-13]** from the motor.

Figure 20-90-14



Remove the large O-ring (Item 1) and small O-ring (Item 2) **[Figure 20-90-14]** from the housing.

Figure 20-90-15

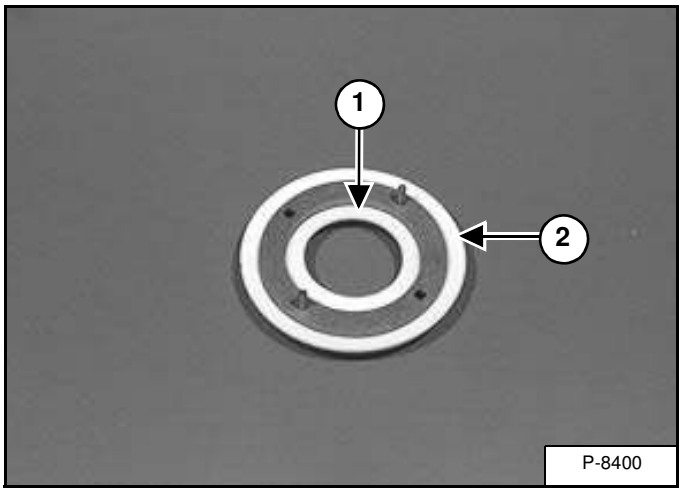


Lift the valve housing straight up. If done carefully the springs (Item 1) **[Figure 20-90-14]** and balance ring sub-assembly (Item 2) **[Figure 20-90-14]** will remain on the valve for easy removal. Remove the springs (Item 1) **[Figure 20-90-15]** and balance ring (Item 2) **[Figure 20-90-15]**.

Dealer Copy -- Not for Resale

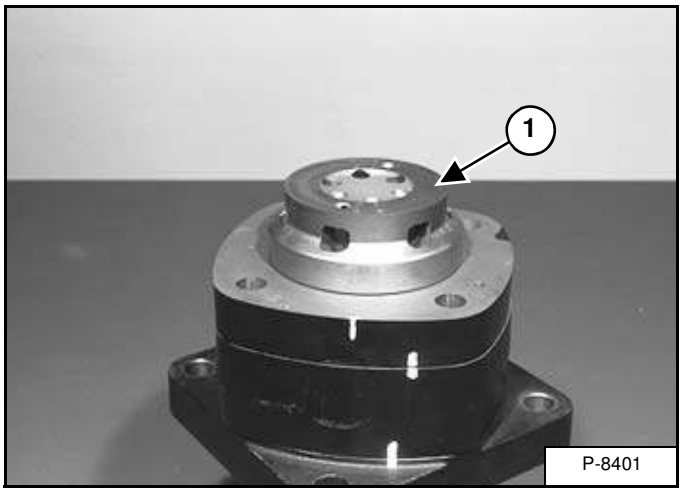
Disassembly (Cont'd)

Figure 20-90-16



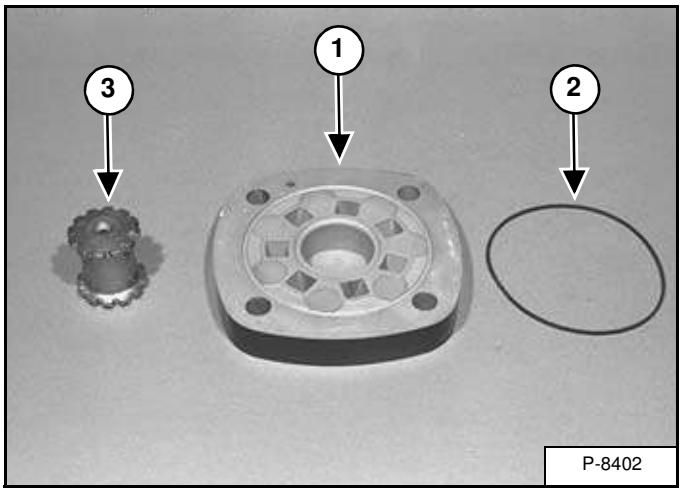
Remove the inner seal (Item 1) and outer seal (Item 2) **[Figure 20-90-16]** from the balance ring.

Figure 20-90-17



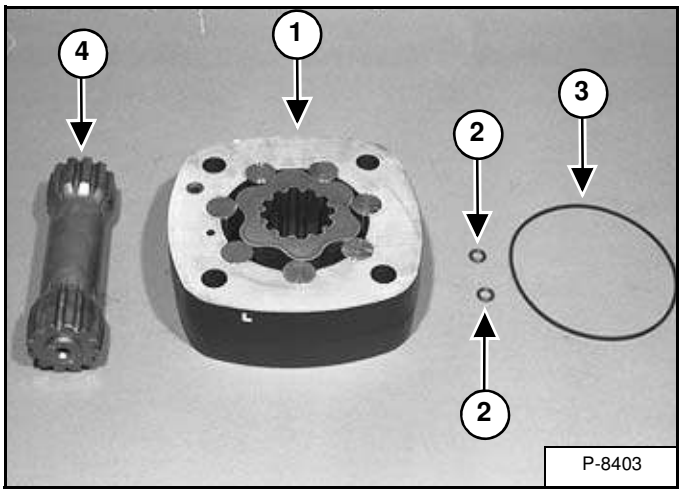
Remove the valve (Item 1) **[Figure 20-90-17]** from the assembly.

Figure 20-90-18



Remove the valve plate (Item 1) the O-ring (Item 2) and the valve drive (Item 3) **[Figure 20-90-18]** from the assembly.

Figure 20-90-19

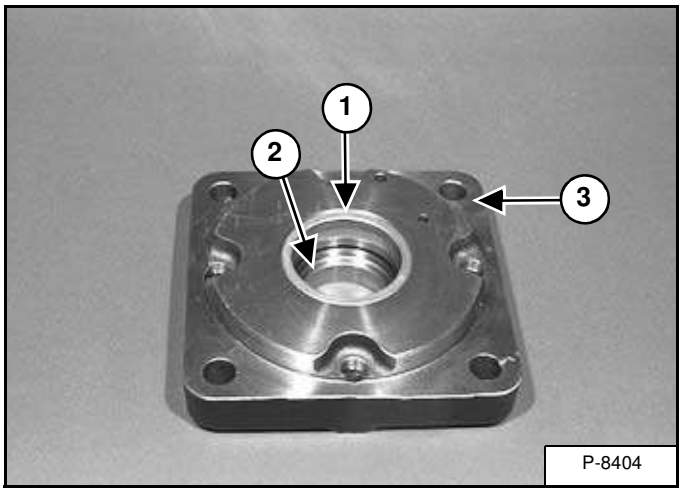


Remove the geroler (Item 1), the two small O-rings (Item 2), the large O-ring (Item 3), and the drive (Item 4) **[Figure 20-90-19]** from the bearing housing.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

Figure 20-90-20

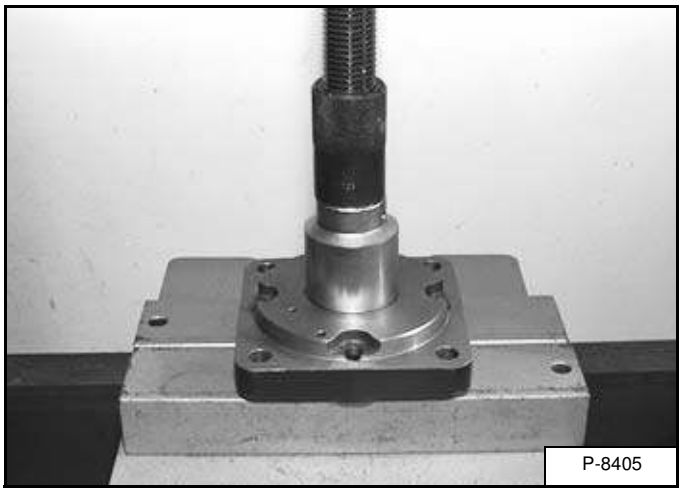


Remove the brass bearing (Item 1) and O-ring (Item 2) from the housing (Item 3) **[Figure 20-90-20]**.

NOTE: Only remove the brass bearing if needed.

Assembly

Figure 20-90-21

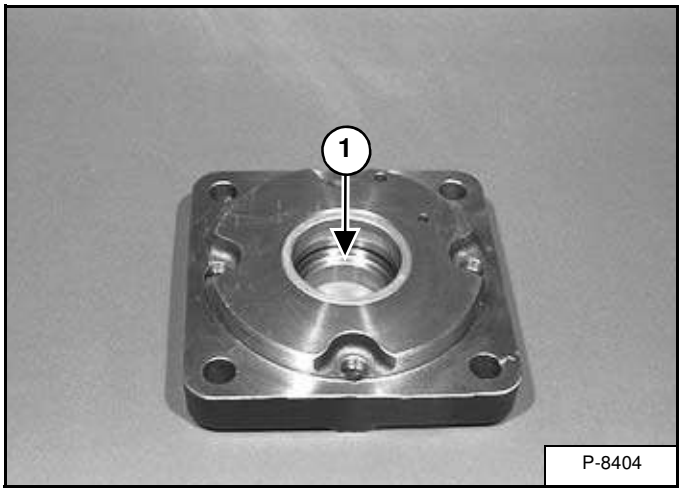


Clean all parts with solvent and dry with compressed air.

Apply oil to the O-rings.

Press the brass bearing (Item 1) **[Figure 20-90-21]** in the housing.

Figure 20-90-22

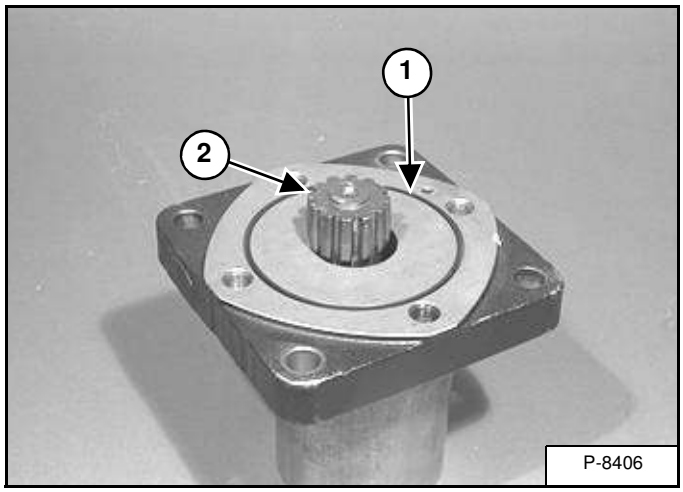


Install the new O-ring (Item 1) **[Figure 20-90-22]** in the housing.

Dealer Copy -- Not for Resale

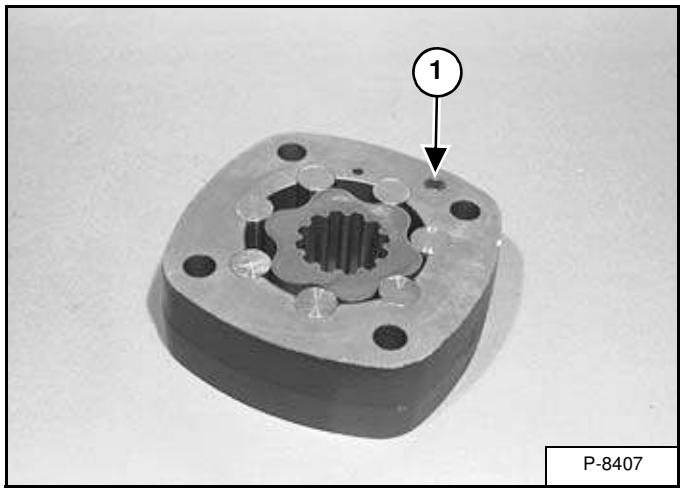
Assembly (Cont'd)

Figure 20-90-23



Install the new O-ring (Item 1) and the drive shaft (Item 2) **[Figure 20-90-23]**.

Figure 20-90-24



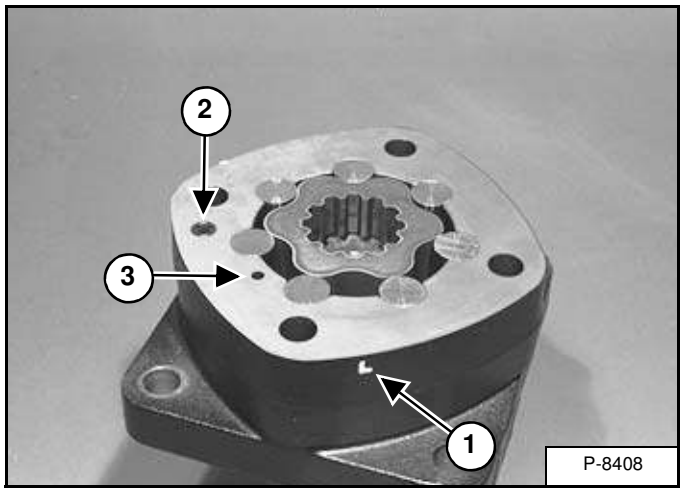
Install the two new small O-rings (Item 1) **[Figure 20-90-24]** on the geroler (both sides).

Timing the hydraulic motor.

The timing parts include:

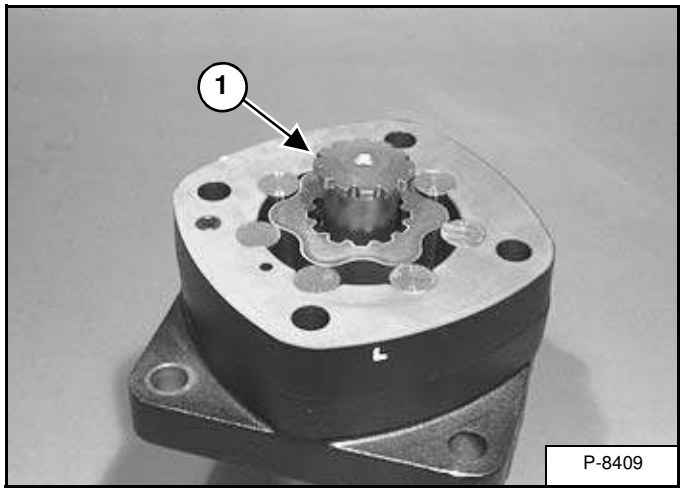
1. Geroler
2. Valve drive
3. Valve plate
4. Valve

Figure 20-90-25



Locate the largest opening in the geroler, and mark the location on the outside edge of the geroler (Item 1). Align the case drain hole (Item 2) and the pressure relief hole (Item 3) **[Figure 20-90-25]** in the geroler with the case drain hole and pressure relief hole in the bearing housing. Install the geroler on the bearing housing.

Figure 20-90-26

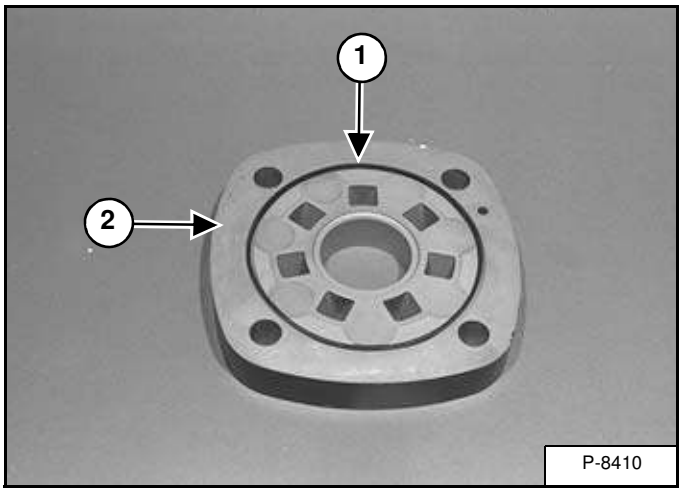


Install the valve drive (Item 1) **[Figure 20-90-26]** in the geroler.

Dealer Copy -- Not for Resale

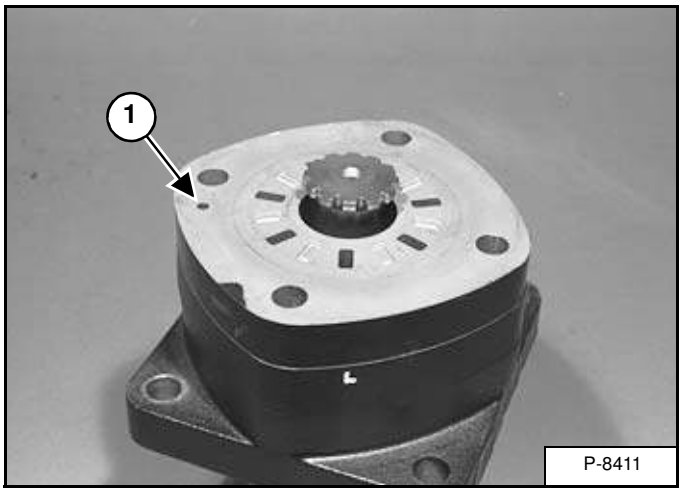
Assembly (Cont'd)

Figure 20-90-27



Install the large O-ring (Item 1) on the valve plate (Item 2) **[Figure 20-90-27]**.

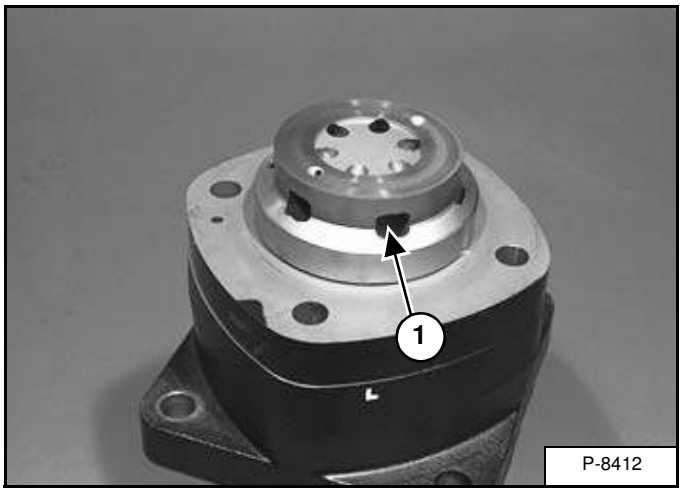
Figure 20-90-28



Align the case drain hole (Item 1) **[Figure 20-90-28]** in the valve plate with the case drain hole in geroler. Install the valve plate (seal side toward geroler) on the geroler.

NOTE: Locate the slot opening in the valve plate which is in line with the largest opening (marked earlier) in the geroler.

Figure 20-90-29

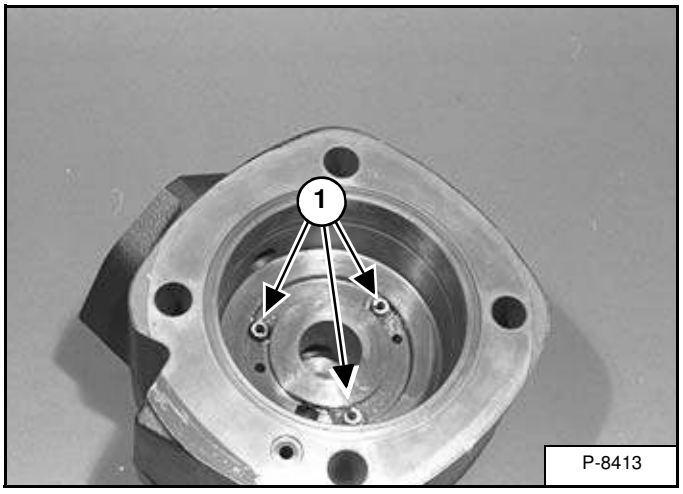


Locate any one of the side openings of the valve (Item 1) **[Figure 20-90-29]** that goes through to the face of the valve.

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 20-90-30

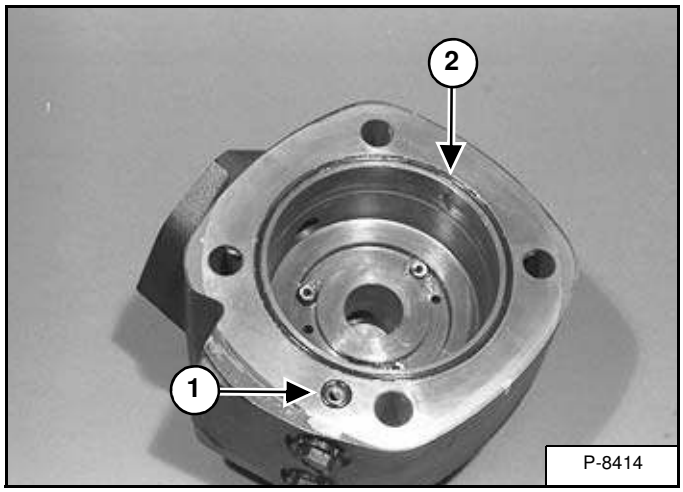


Apply clean grease on the three balance ring assembly springs (Item 1) **[Figure 20-90-30]** and install them in the holes located inside of the valve housing.

Dealer Copy -- Not for Resale

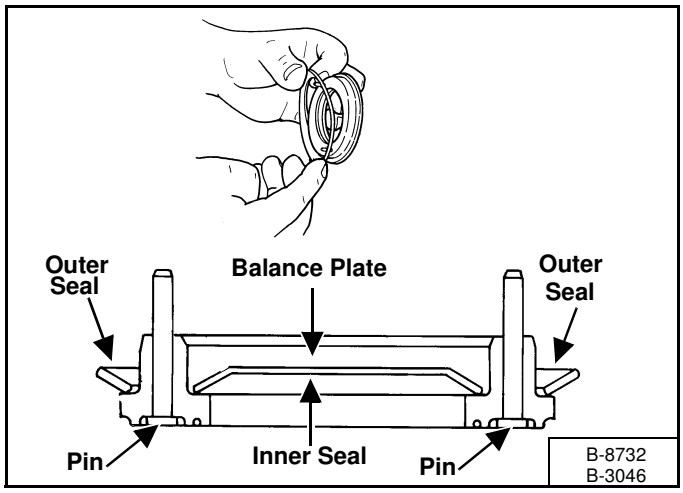
Assembly (Cont'd)

Figure 20-90-31



Install the small O-ring (Item 1) and the large O-ring (Item 2) **[Figure 20-90-31]** on the valve housing.

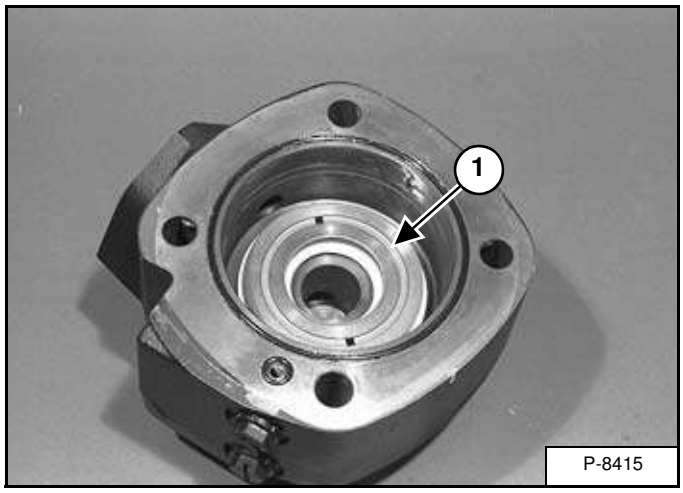
Figure 20-90-32



Install the inner and outer face seals on the balance ring **[Figure 20-90-32]**.

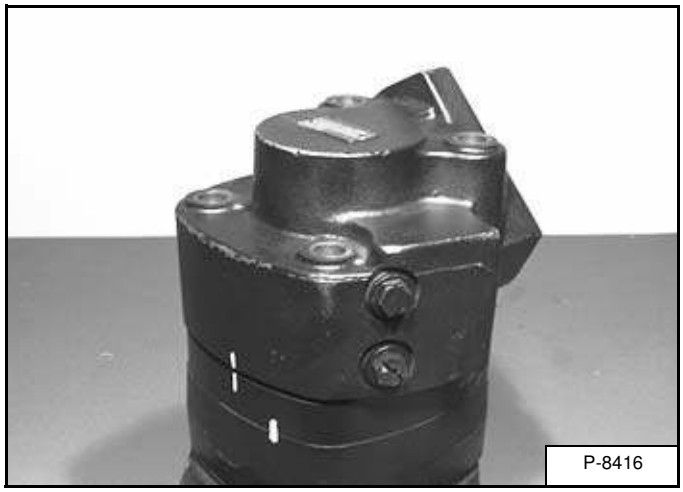
NOTE: Install the face seals as shown in [Figure 20-90-32], or the motor will not operate properly. Any damage to these seals will affect the operation of the motor.

Figure 20-90-33



Align the balance ring assembly pins with the two holes in the valve housing, and install the balance ring sub-assembly (Item 1) **[Figure 20-90-33]** in the valve housing.

Figure 20-90-34



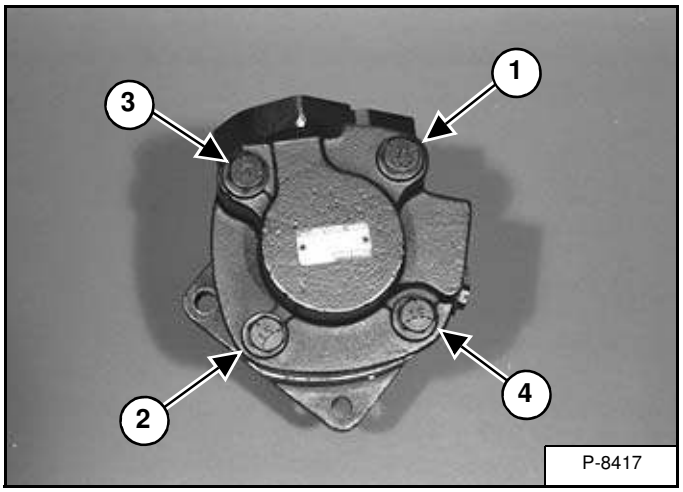
Insert a small screw driver through the port in the housing. Apply pressure to side of the balance ring assembly until the valve housing is in place. Align the case drain hole in the housing with the case drain hole in the valve plate. Install the valve housing against the valve plate and remove screwdriver **[Figure 20-90-34]**.

NOTE: Check that the O-rings on the motor sections are in place before the through 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 20-90-35

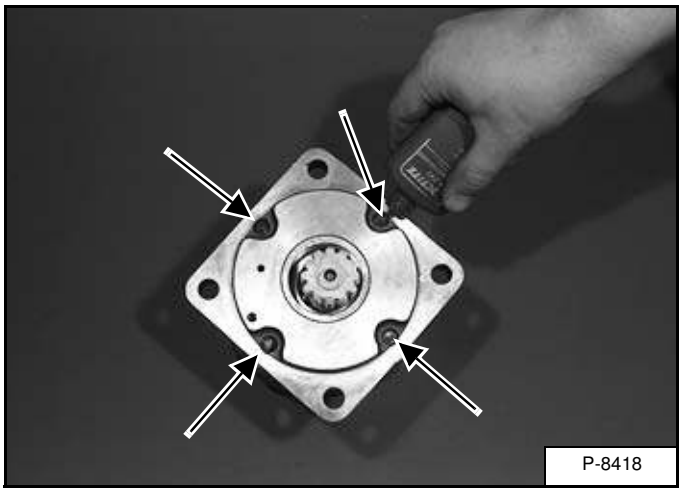


Install and finger tighten the four bolts. Tighten the bolts in sequence **[Figure 20-90-35]** to 63 ft.-lbs. (86 Nm) of torque.

Follow these procedures:

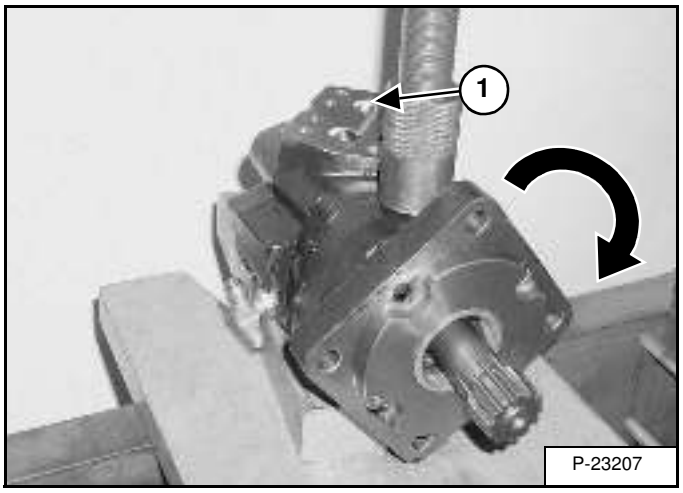
Important: This motor requires LOCTITE in threaded holes of the mounting flange.

Figure 20-90-36



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. You may need to use a tap to clean threads of excess old LOCTITE. Then after you have fully reassembled the motor, apply two to three drops of LOCTITE 290 at the top of the threaded holes **[Figure 20-90-36]**.

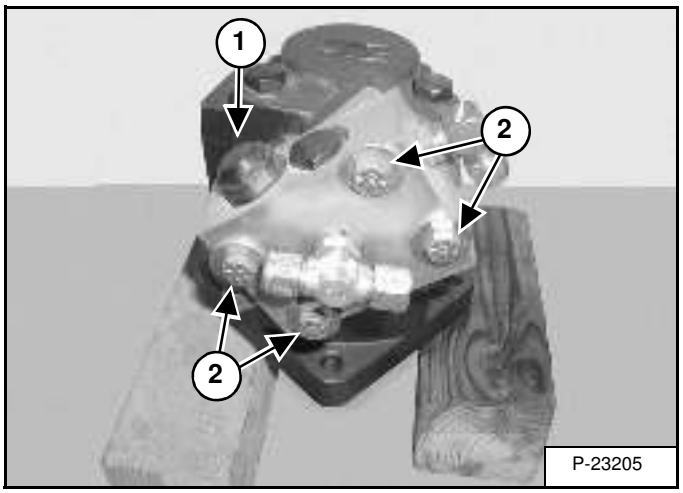
Figure 20-90-37



NOTE: Allow LOCTITE five minutes for thread penetration before installing the motor on the gear case.

To ensure that the timing of the swing motor is correct, put the swing motor in a press and use a pipe wrench to turn the shaft clockwise. There should be suction in the port hole (Item 1) [Figure 20-90-37].

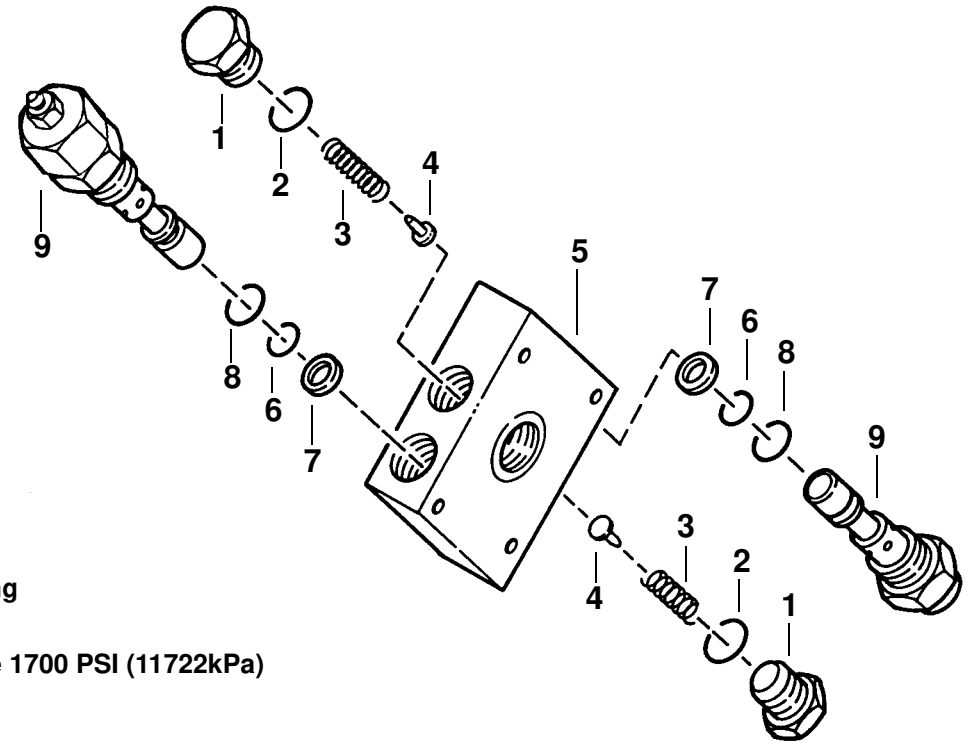
Figure 20-90-38



Install the cross port relief valve (Item 1) and four bolts (Item 2) **[Figure 20-90-38]** on the motor. Tighten the bolts to 45-54 ft.-lbs. (61-73 Nm) torque.

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Cross Port Relief Valve Parts Identification

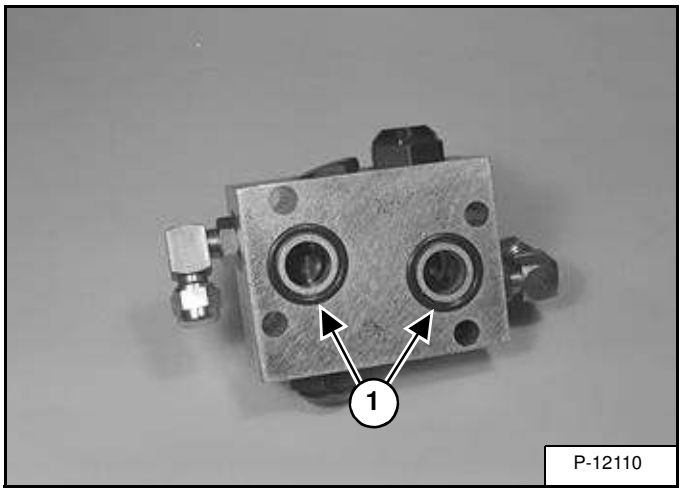


1. Plug
2. O-Ring
3. Spring
4. Poppet
5. Housing
6. O-Ring
7. Back-up Ring
8. O-Ring
9. Relief Valve 1700 PSI (11722kPa)

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Cross Port Relief Valve Disassembly

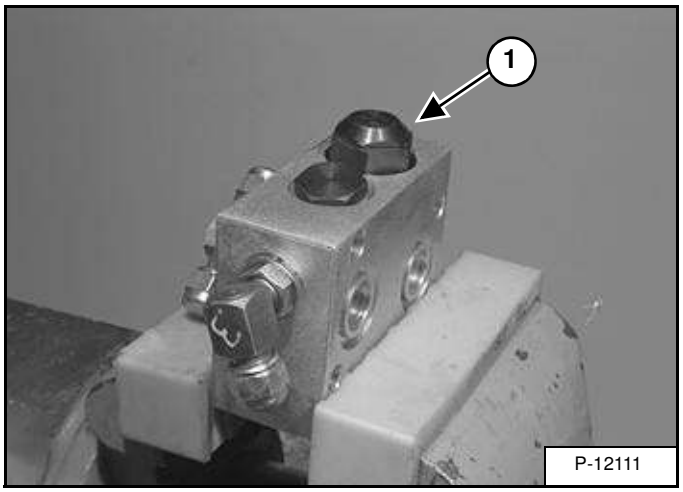
Figure 20-90-39



Remove the O-rings (Item 1) **[Figure 20-90-39]**.

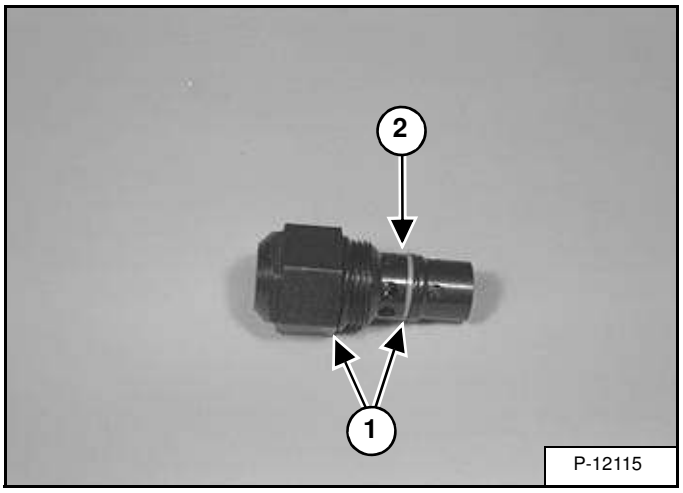
Place the valve in a vise equipped with padded jaws.

Figure 20-90-40



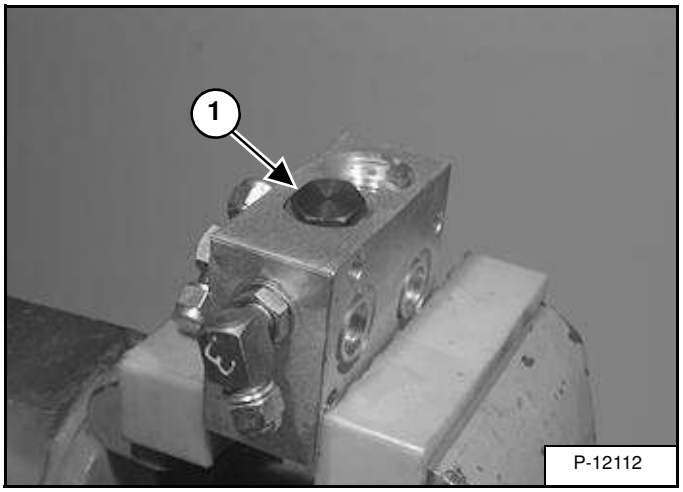
Remove the relief valve (Item 1) **[Figure 20-90-40]** from both sides of the valve body.

Figure 20-90-41



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-90-41]**.

Figure 20-90-42

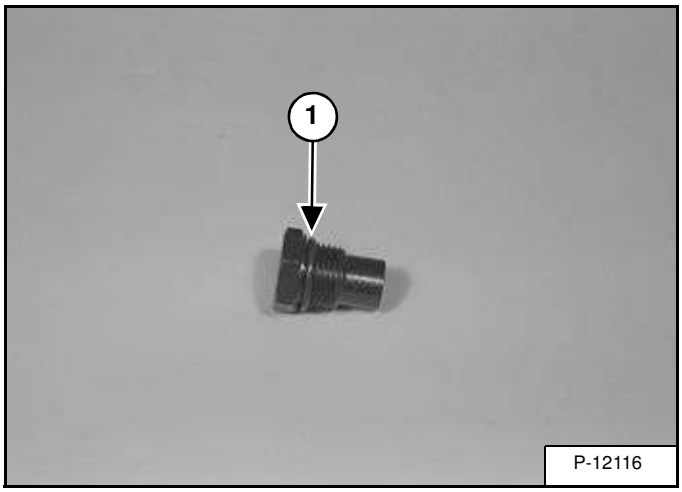


Remove the plug (Item 1) **[Figure 20-90-42]**.

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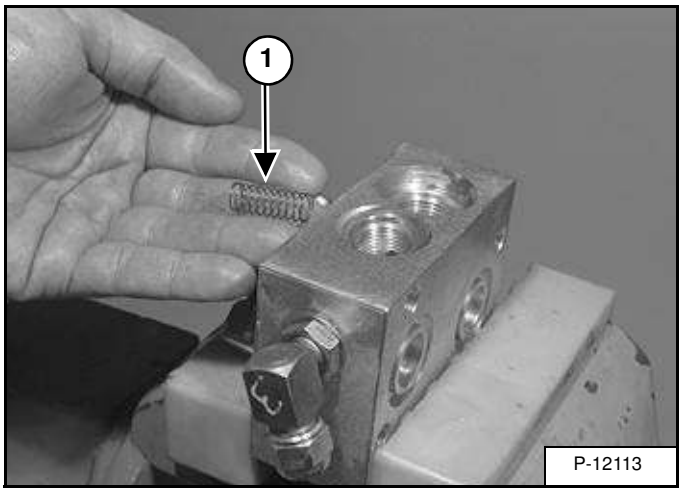
Cross Port Relief Valve Disassembly (Cont'd)

Figure 20-90-43



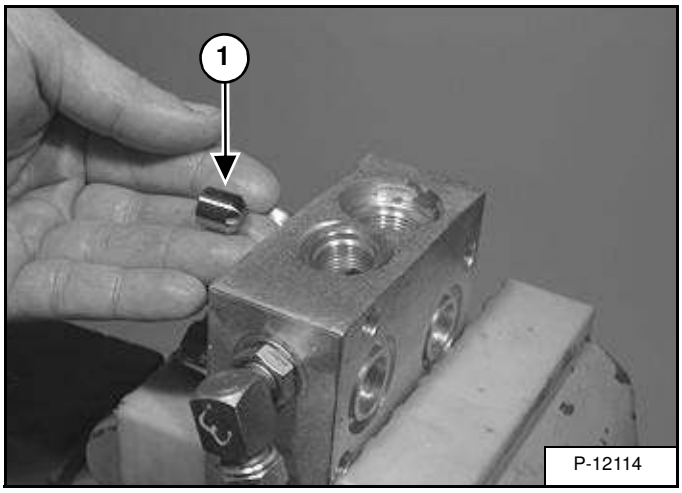
Remove the O-ring (Item 1) **[Figure 20-90-43]** from the plug.

Figure 20-90-44



Remove the spring (Item 1) **[Figure 20-90-44]**.

Figure 20-90-45



Remove the poppet (Item 1) **[Figure 20-90-45]**.

Repeat step **[Figure 20-90-42 on Page 13]** through step **[Figure 20-90-45 on Page 14]** for the opposite side of the valve.

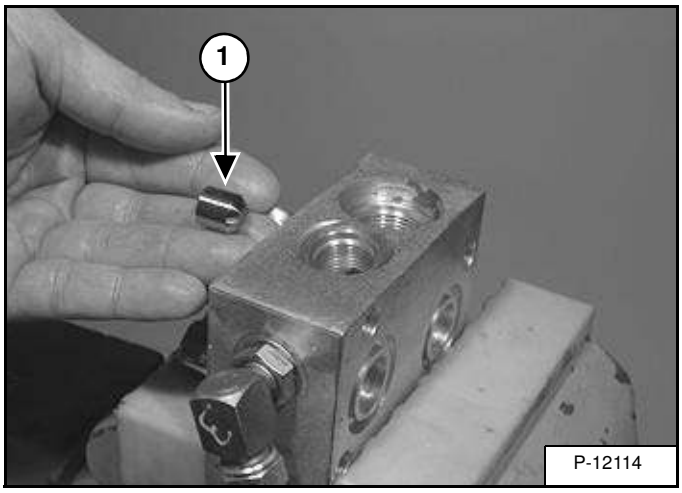
Dealer Copy -- Not for Resale

Cross Port Relief Valve Assembly

Clean all parts in solvent and dry with compressed air.

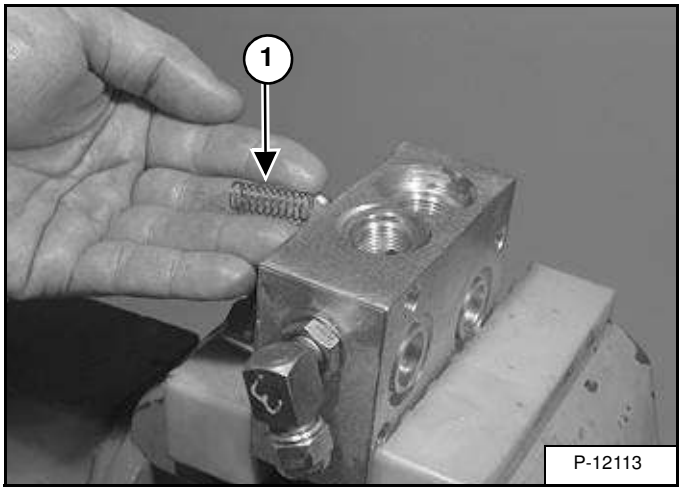
Replace all O-rings, back-up rings and any parts showing wear.

Figure 20-90-46



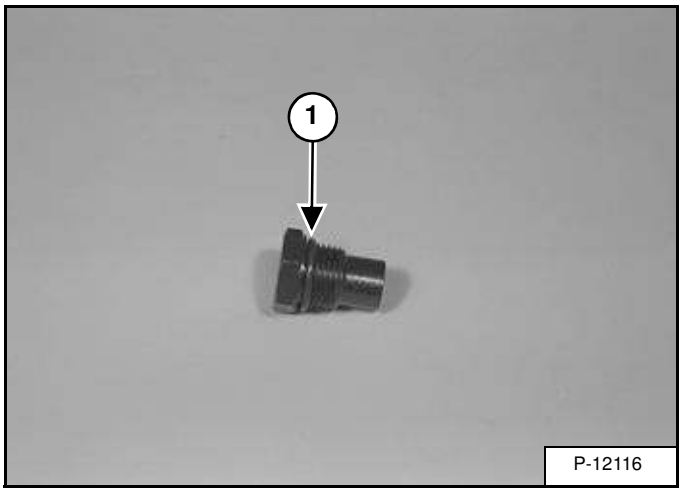
Apply oil to and install the poppet (Item 1) **[Figure 20-90-46]** in the valve body.

Figure 20-90-47



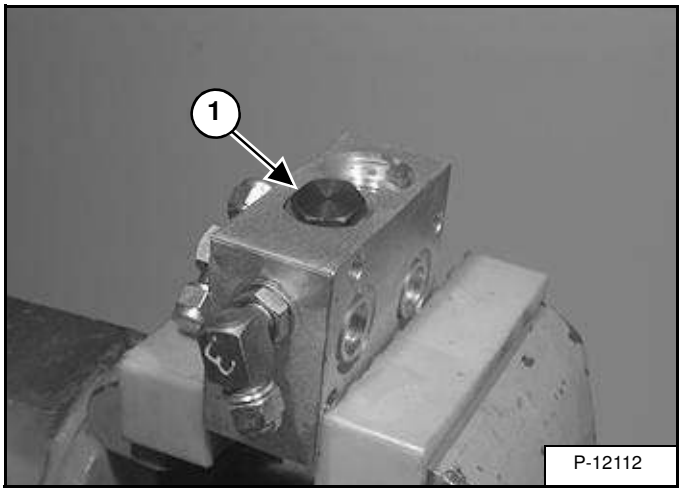
Install the spring (Item 1) **[Figure 20-90-47]**.

Figure 20-90-48



Apply oil to and install a new O-ring (Item 1) **[Figure 20-90-48]** on the plug.

Figure 20-90-49



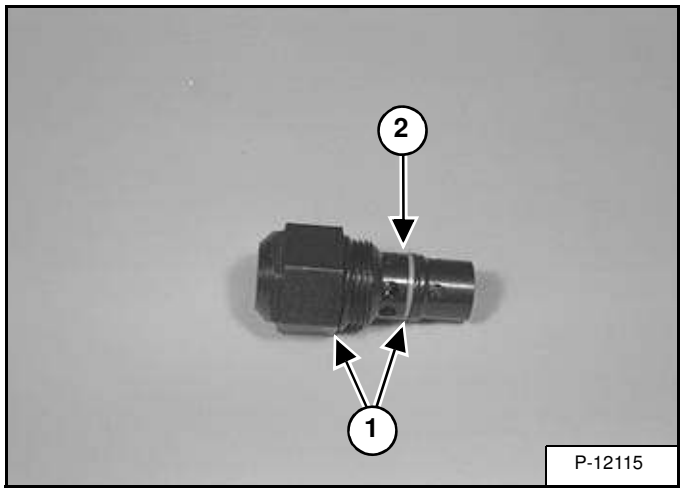
Install the plug (Item 1) **[Figure 20-90-49]** in the valve body.

Repeat step **[Figure 20-90-47]** through step **[Figure 20-90-49]** for the poppet, spring and plug on the opposite side of the valve body.

Dealer Copy -- Not for Resale

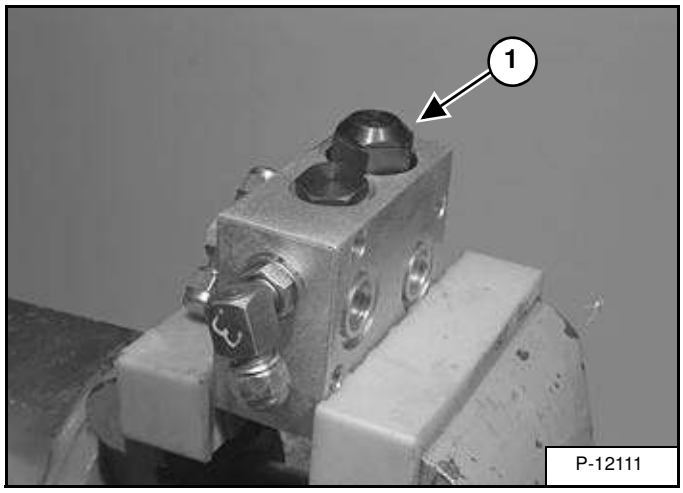
Cross Port Relief Valve Assembly (Cont'd)

Figure 20-90-50



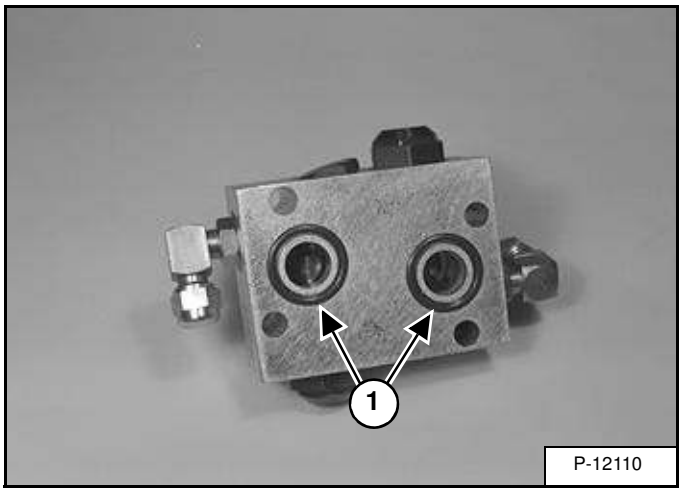
Apply oil to and install new O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-90-50]**.

Figure 20-90-51



Install the relief valves (Item 1) **[Figure 20-90-51]** on both sides of the valve body.

Figure 20-90-52



Apply oil to and install new O-rings (Item 1) **[Figure 20-90-52]** on the face of the valve body.

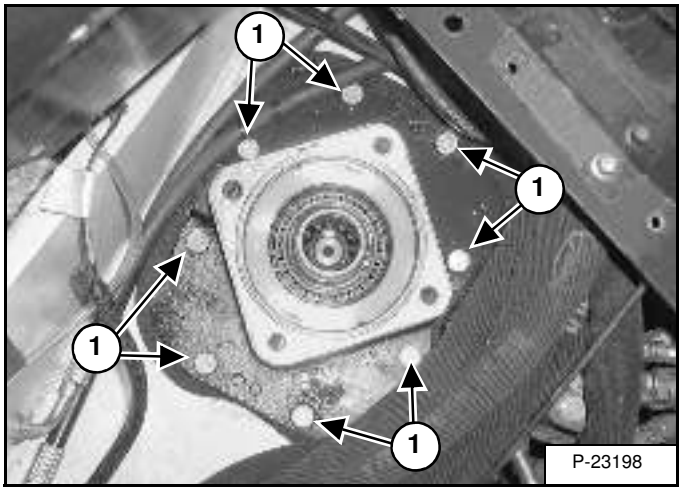
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SWING MOTOR DRIVE CARRIER

Removal And Installation

Remove the swing motor. (See Removal And Installation on Page 20-90-1.)

Figure 20-91-1

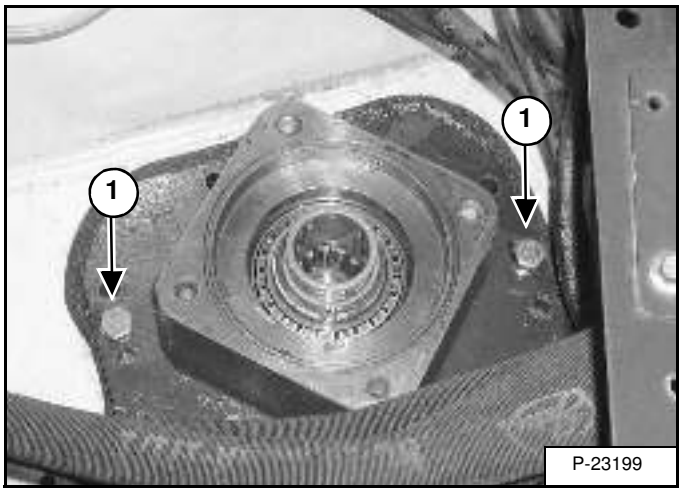


Mark and remove the eight bolts (Item 1) **[Figure 20-91-1]**.

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

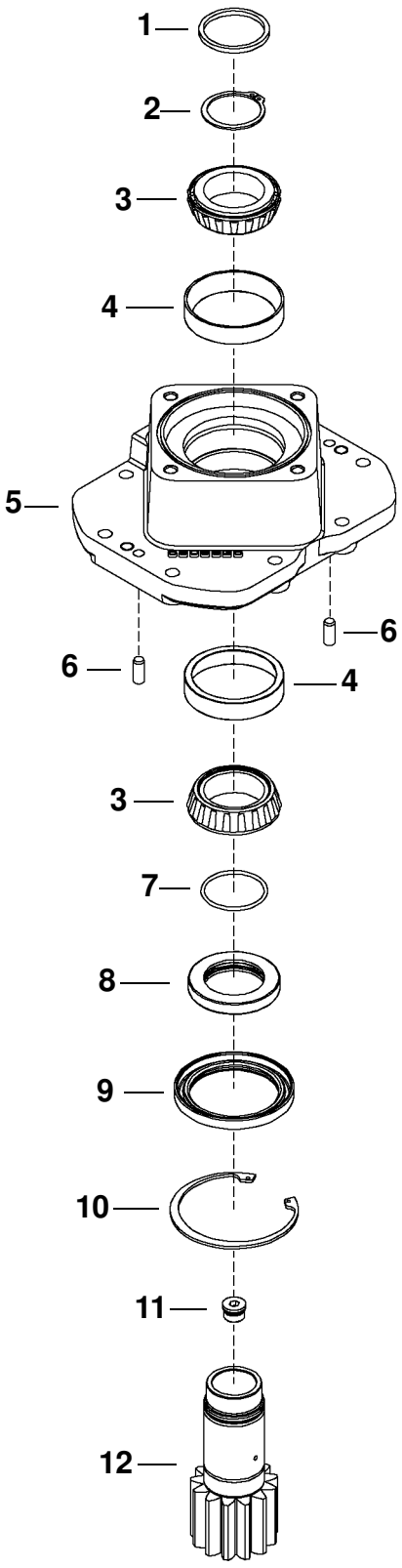


Install two of the short mount bolts (Item 1) **[Figure 20-91-2]** in the threaded holes in the carrier. Tighten the bolts to push the carrier off of the two alignment pins. The pins may stay in either the carrier or the upperstructure.

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Parts Identification

1. Snap Ring
2. Spacer
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

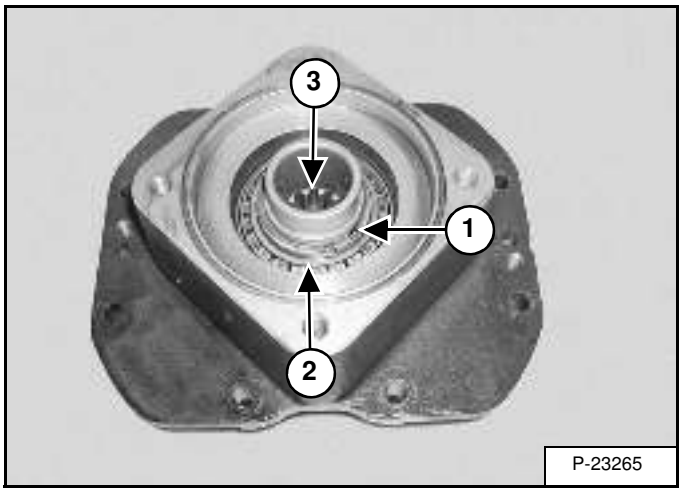
IMPORTANT

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.

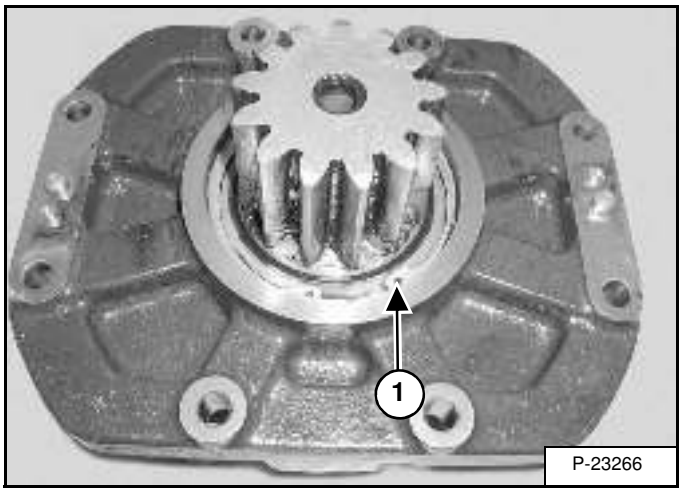
Figure 20-91-3



Remove the snap ring (Item 1) and the spacer (Item 2) **[Figure 20-91-3]** from the top of the drive shaft.

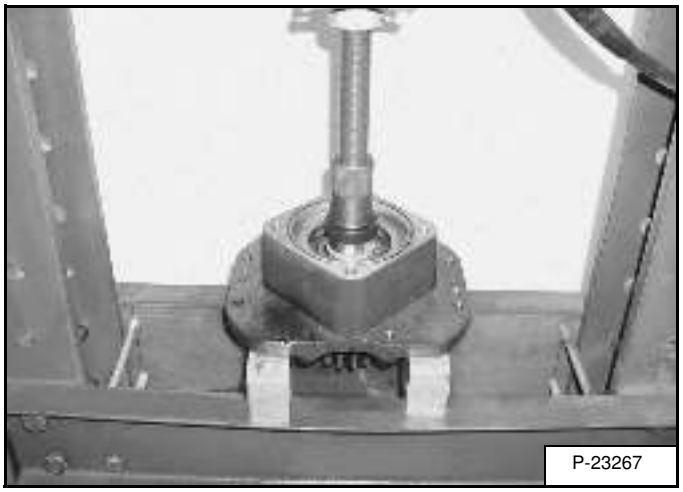
Remove the drain plug (Item 3) **[Figure 20-91-3]** from the bottom of the drive shaft.

Figure 20-91-4



Remove the snap ring (Item 1) **[Figure 20-91-4]** from the bottom of the carrier.

Figure 20-91-5

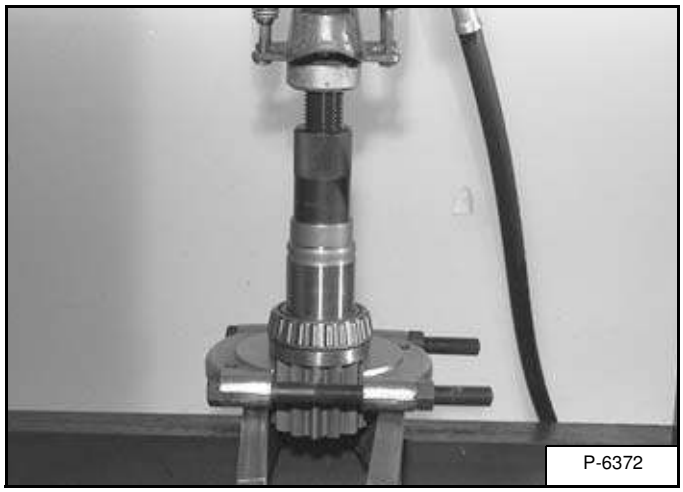


Support the motor carrier on two support blocks and press the drive shaft out the bottom of the carrier to remove the top bearing and bottom seal **[Figure 20-91-5]**.

Dealer Copy -- Not for Resale

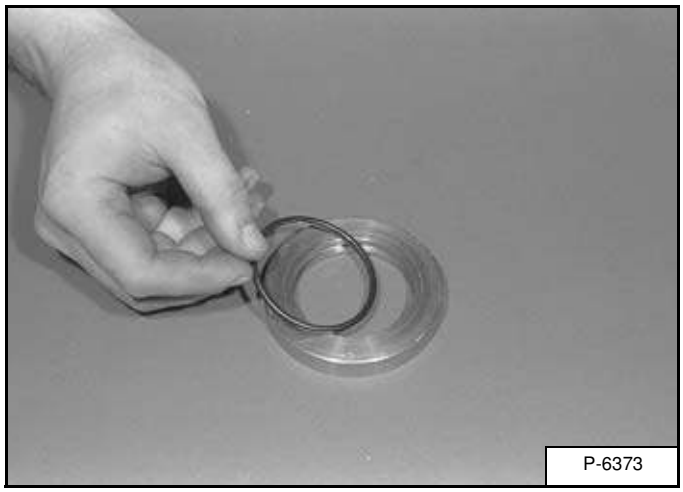
Disassembly (Cont'd)

Figure 20-91-6



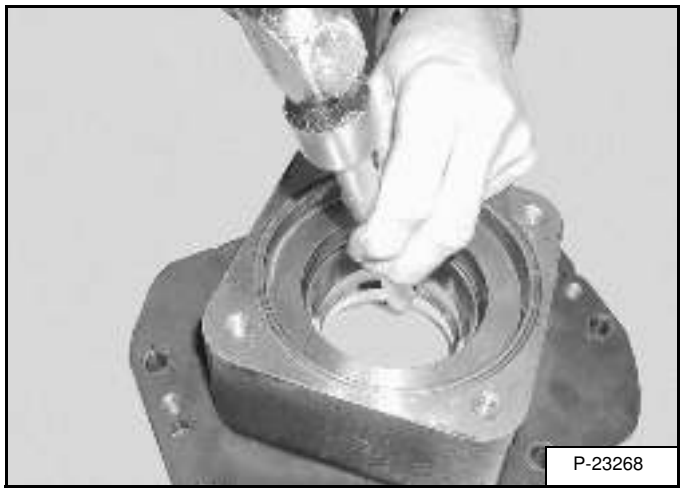
Remove the bottom bearing and spacer by supporting the spacer and pressing the shaft through it **[Figure 20-91-6]**.

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.

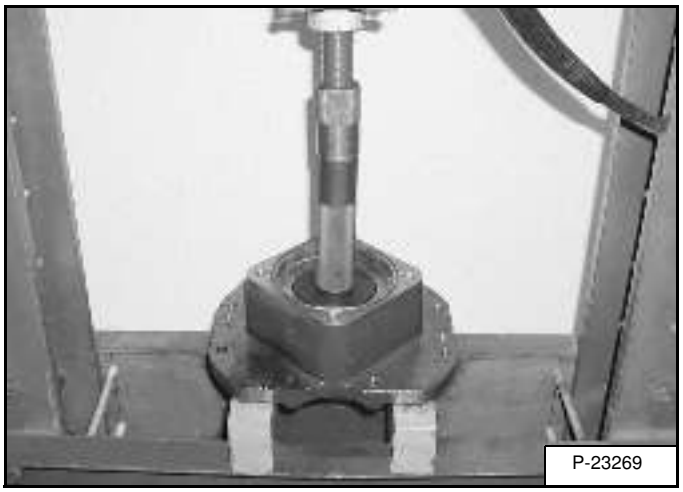
After cleaning, inspect the following components for damage and wear:

Bearings and Bearing Cups
Drive Shaft
Housing
Washer
Spacer
Snap Rings

Dealer Copy -- Not for Resale

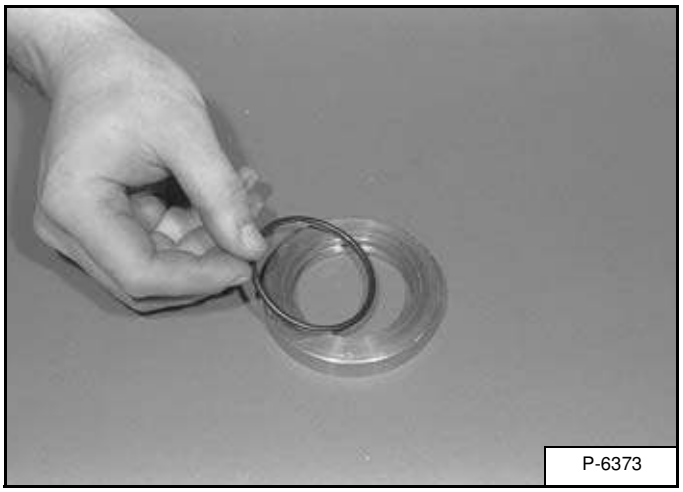
Assembly

Figure 20-91-9



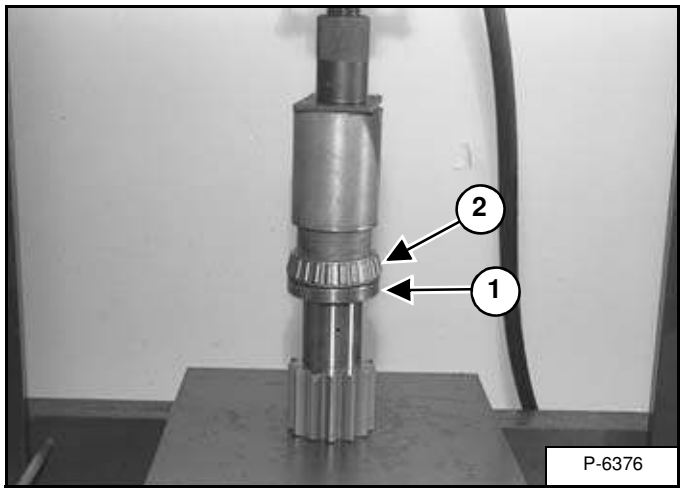
Apply a light film of grease to the outside of the new bearing cups, and press the top and bottom cups into the carrier **[Figure 20-91-9]**.

Figure 20-91-10



Oil and install a new O-ring inside the spacer **[Figure 20-91-10]**.

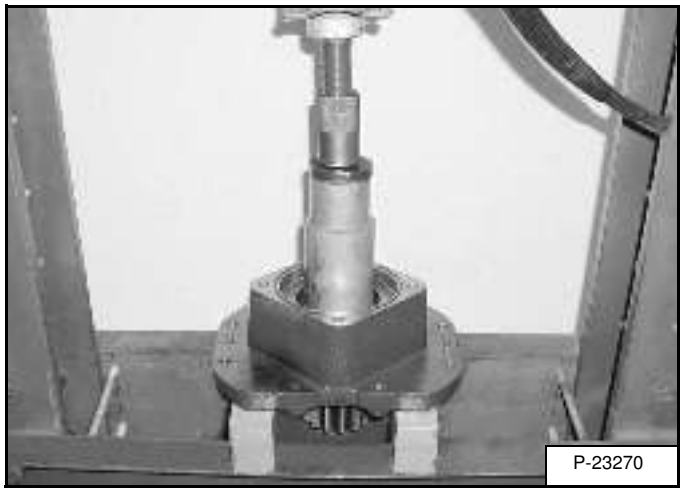
Figure 20-91-11



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

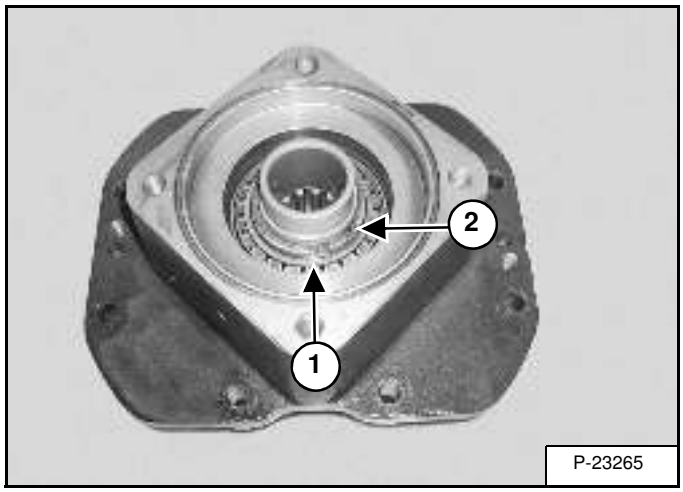


Press a new bearing on the top of the drive shaft **[Figure 20-91-12]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

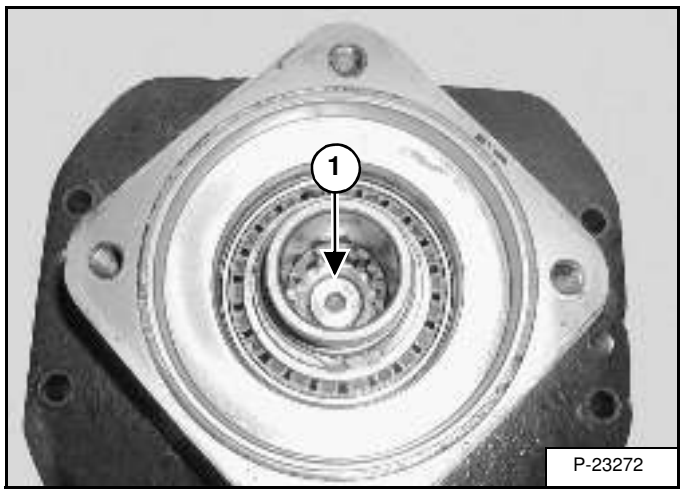
Figure 20-91-13



Install the washer (Item 1) and the snap ring (Item 2) **[Figure 20-91-13]** on the drive shaft.

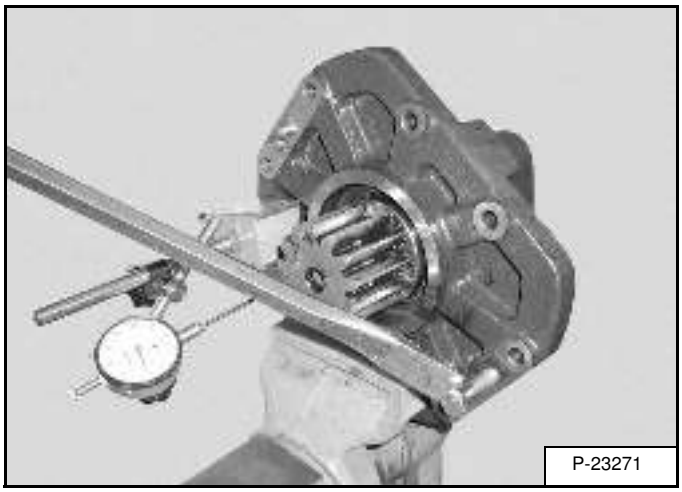
Oil and install a new O-ring on the drain plug.

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



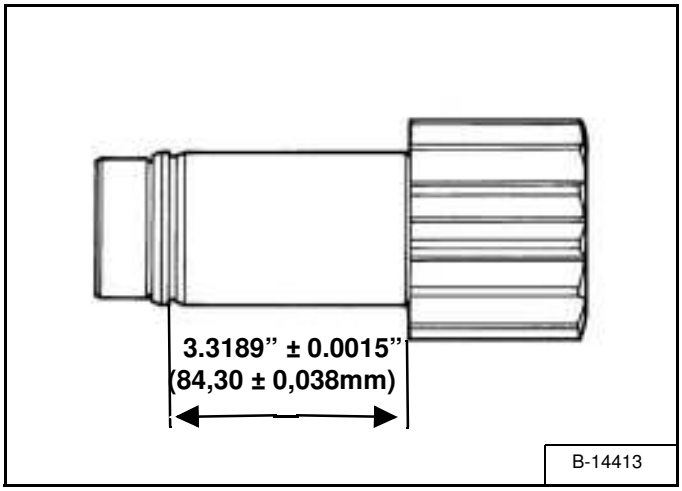
Clamp the carrier in a vise that has padded jaws. Thread a bolt in the threaded hole in the carrier flange. Setup a dial indicator so the end play of the drive shaft can be checked, by placing a pry bar under the head of the installed bolt and across the end of the drive shaft **[Figure 20-91-15]**.

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	0.78 ± 0.001 inch (4.52 ± 0.03 mm)
Spacer	0.042 ± 0.002 inch (12.0 ± 0.05 mm)

Figure 20-91-16

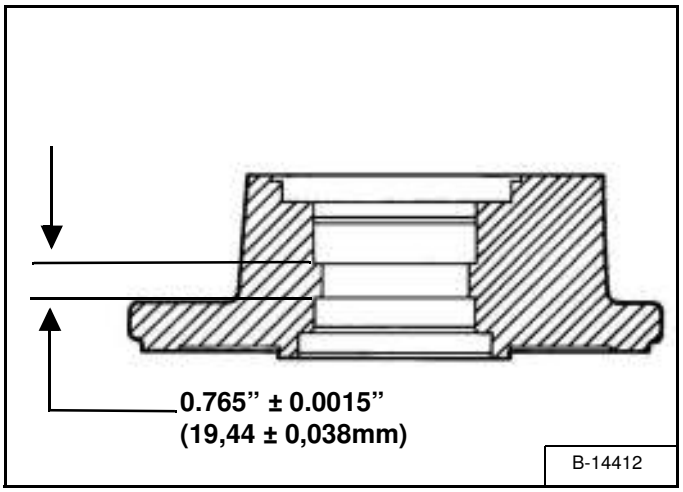


Length of drive shaft from top of snap ring groove to top of splined section 3.3189 inches ± 0.0015 inch (84.3 ± .038 mm) **[Figure 20-91-16]**.

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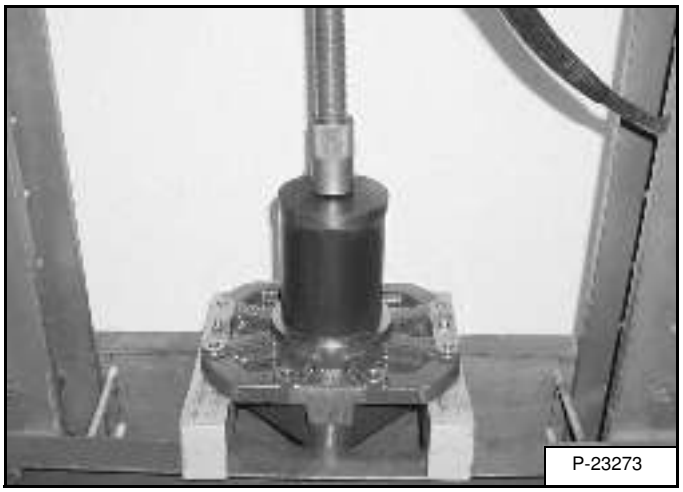
Assembly (Cont'd)

Figure 20-91-17



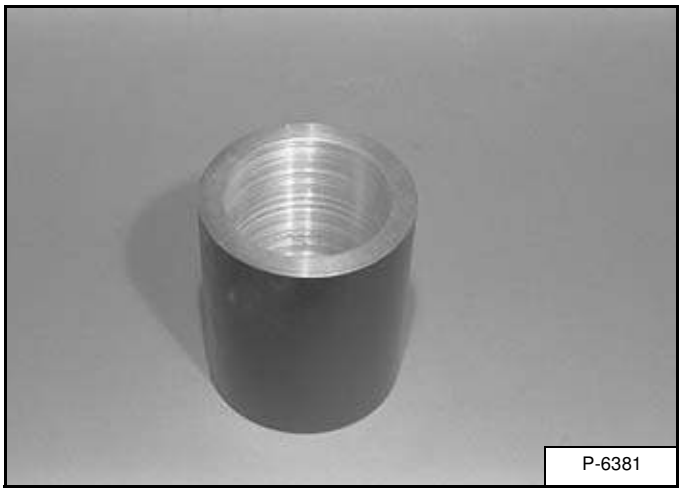
Housing top bearing cup seat to bottom bearing cup seat 0.765 inches ± 0.0015 inch (19.44 ± .038 mm) **[Figure 20-91-16]**.

Figure 20-91-18



Install the seal in the bottom of the carrier **[Figure 20-91-18]**.

Figure 20-91-19

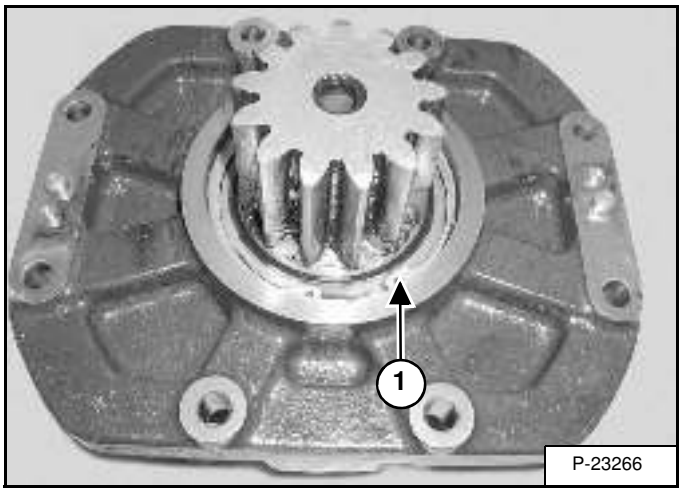


A seal installation tool can be made locally **[Figure 20-91-19]**.

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

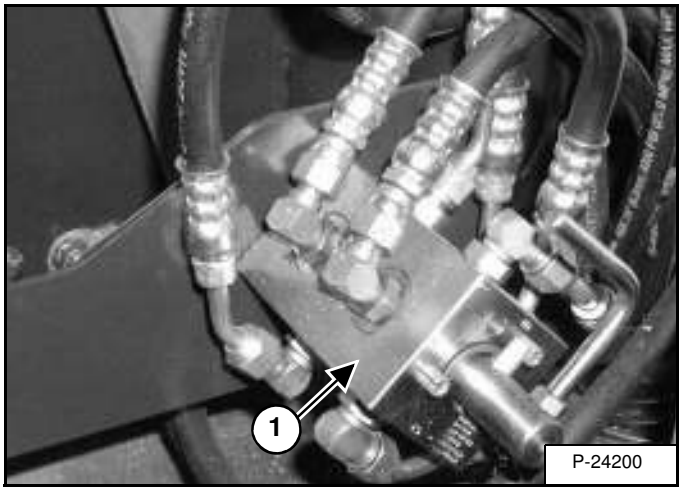
Removal And Installation

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.

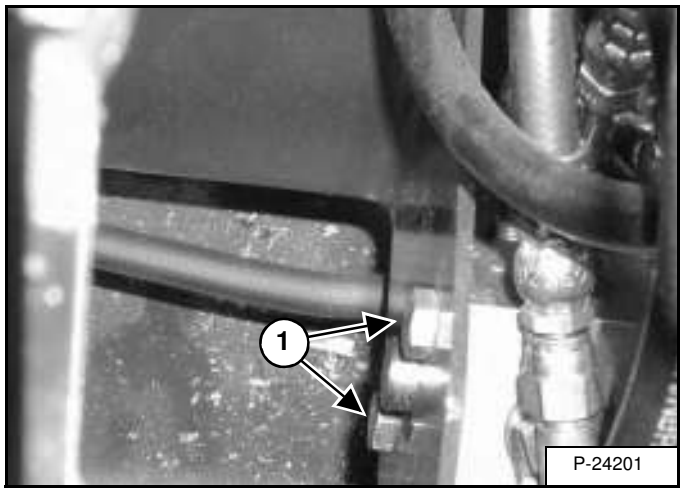
Figure 20-100-1



Remove the eight hydraulic hose from the control pattern selector valve (Item 1) **[Figure 20-100-1]**.

Cap and plug the hoses and fittings.

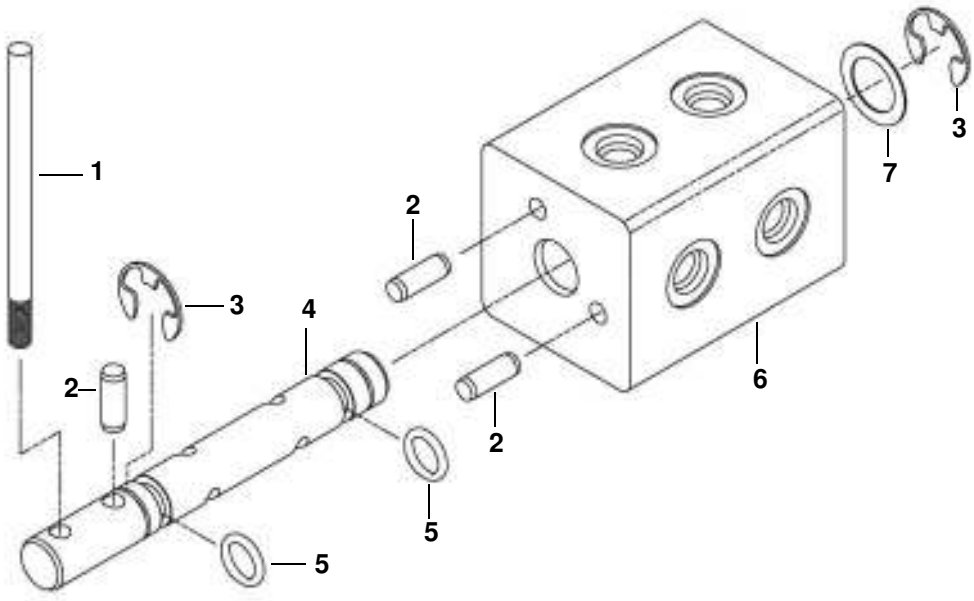
Figure 20-100-2



Remove the two selector valve mount bolts (Item 1) **[Figure 20-100-2]**.

Parts Identification

1. Handle
2. Roll Pin
3. Snap Ring
4. Spool
5. O-Ring
6. Valve Block
7. Washer

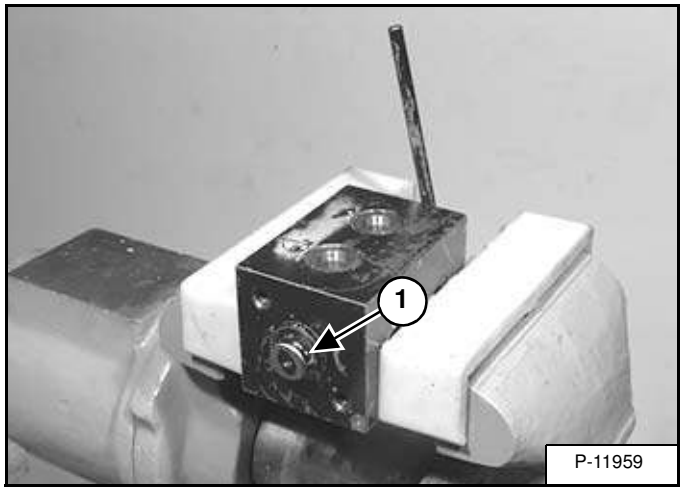


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Disassembly

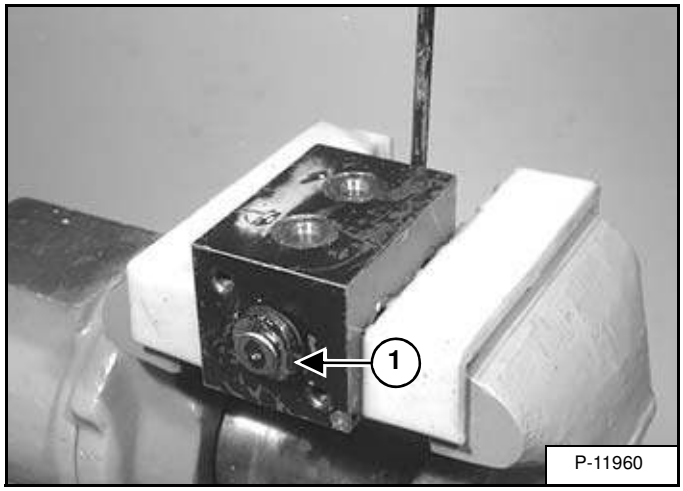
Clamp the valve in a vise equipped with padded jaws.

Figure 20-100-3



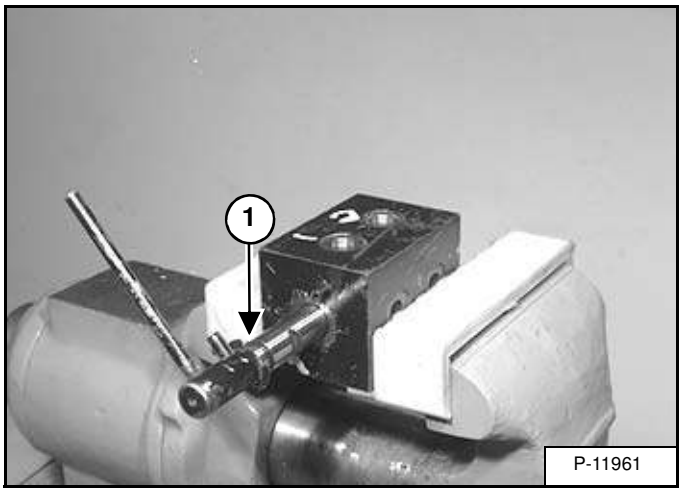
Remove the snap ring (Item 1) **[Figure 20-100-3]**.

Figure 20-100-4



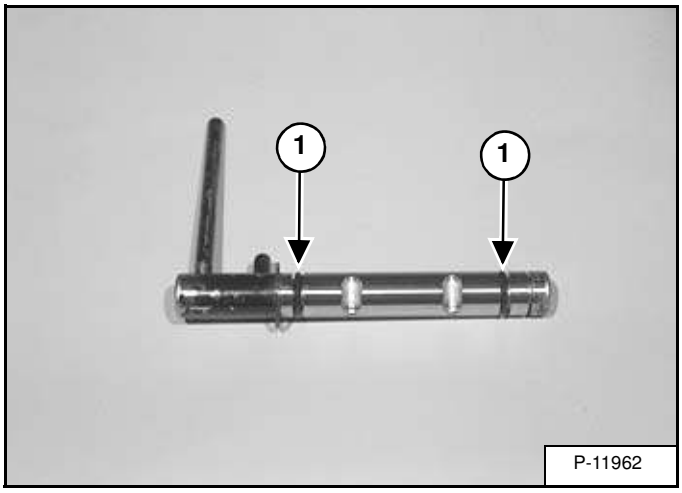
Remove the wave washer (Item 1) **[Figure 20-100-4]**.

Figure 20-100-5



Pull the spool (Item 1) **[Figure 20-100-5]** out of the valve.

Figure 20-100-6



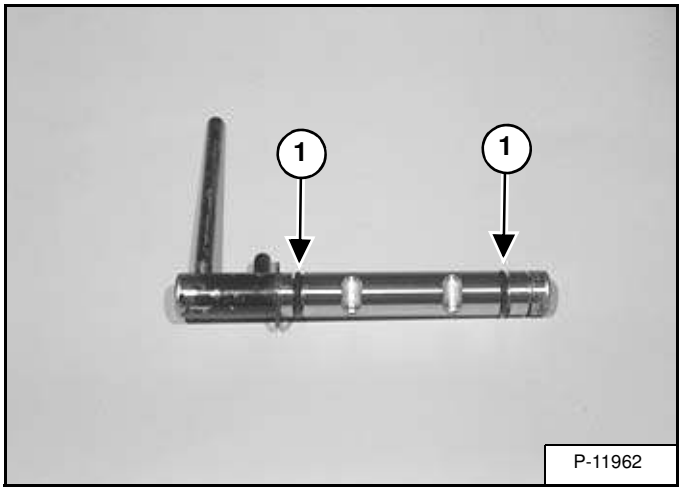
Remove the O-rings (Item 1) **[Figure 20-100-6]** from the spool.

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Assembly

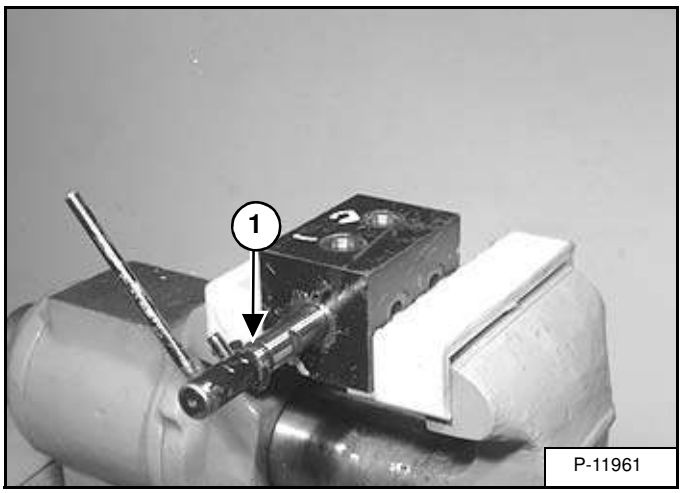
Clean all parts in solvent and dry with compressed air.

Figure 20-100-7



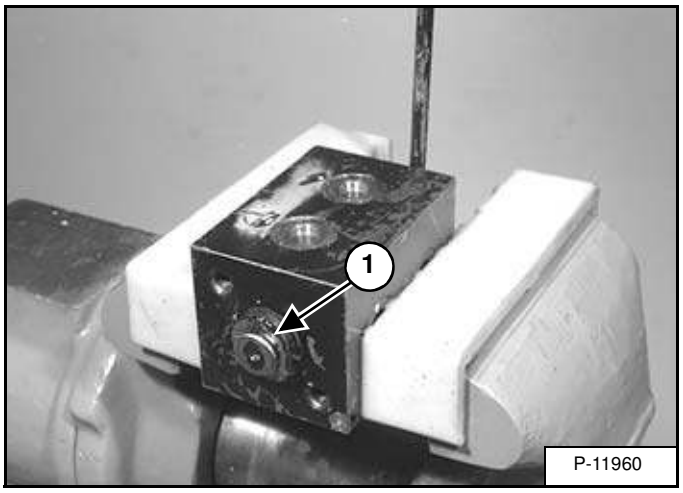
Apply oil to and install new O-rings (Item 1) **[Figure 20-100-7]** on the spool.

Figure 20-100-8



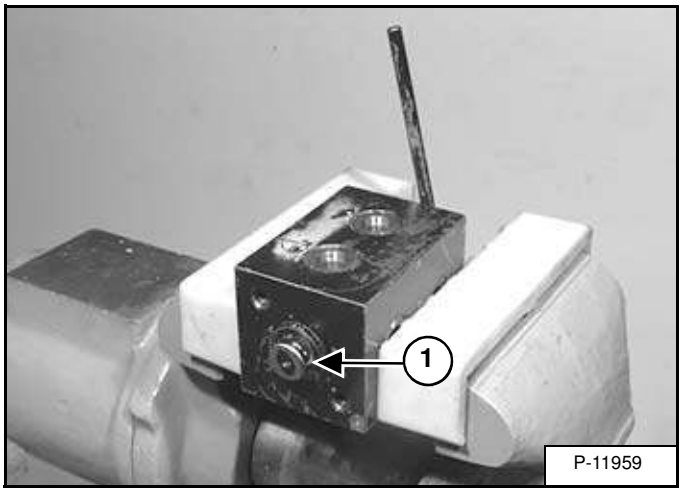
Apply oil to and install the spool (Item 1) **[Figure 20-100-8]** in the valve body.

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) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129)

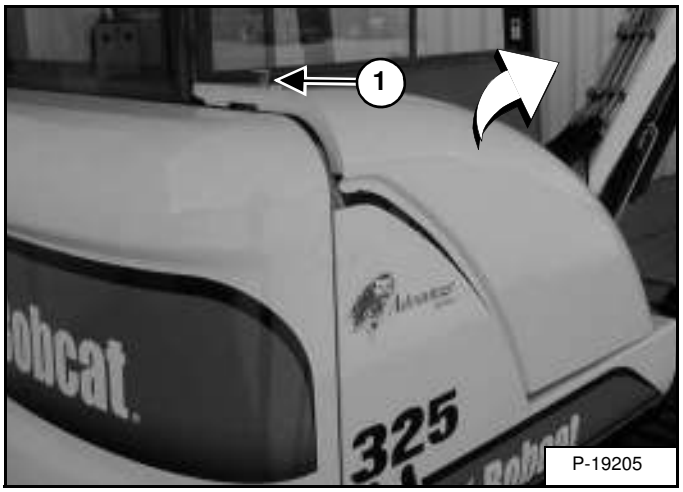
Testing

The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

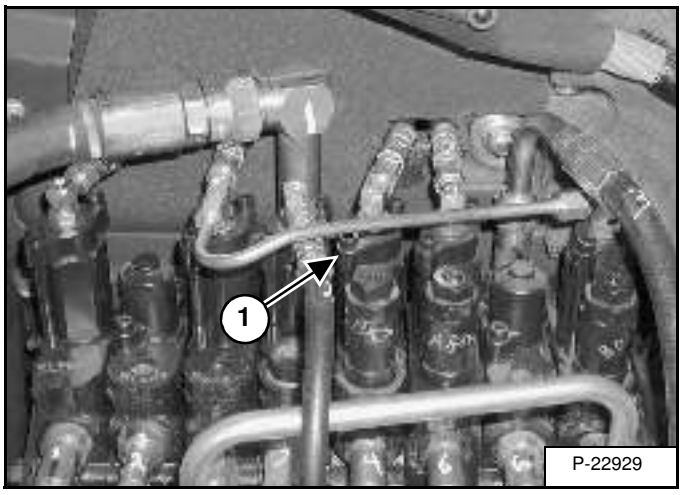
Stop the engine.

Figure 20-110-1



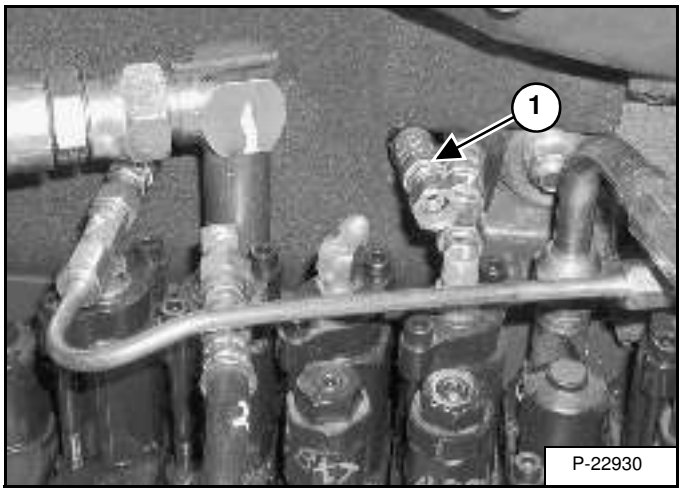
Open the right side access cover (Item 1) **[Figure 20-110-1]**.

Figure 20-110-2



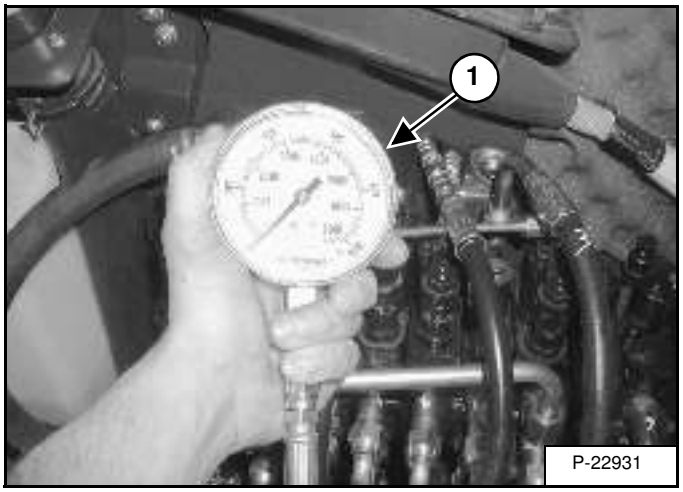
At the control valve assembly (Item 1) **[Figure 20-110-2]**, find the pilot line of the control lever (joystick) that is to be checked. (Boom, Arm, Boom Swing, Bucket.)

Figure 20-110-3



Disconnect the hydraulic hose (Item 1) **[Figure 20-110-3]** from the control valve.

Figure 20-110-4



From the test kit Install a 1000 PSI (6896 kPa) gauge (Item 1) **[Figure 20-110-4]** on the pilot line.

Start the excavator, and warm the hydraulic oil to operating temperature.

Engage the blade raise circuit until the blade is fully raised. Continue to engage the blade circuit and engage the circuit to be tested. Record the operating pressure.

The operating target pressure is 428 PSI (2951 kPa) with an acceptable range of 406-450 PSI (2799-3103 kPa).

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RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

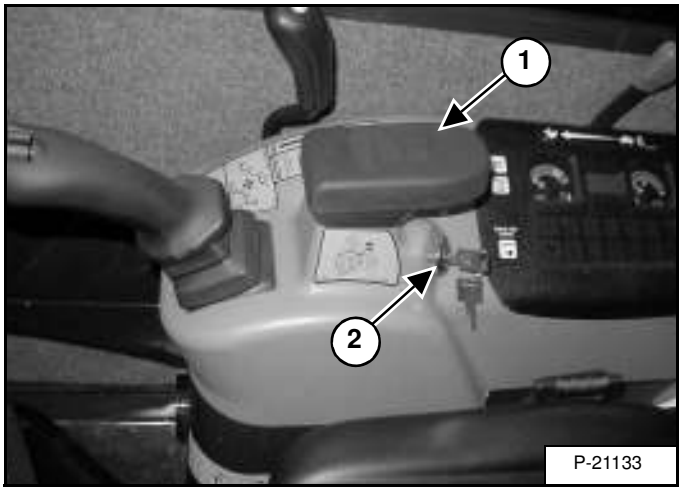
Testing (Cont'd)

If the operating pressure is correct, check the valve section spool for proper operation. If the operating pressure is incorrect, remove the pressure reducing valve, clean, install and retest. (See Testing And Adjusting The Pressure Reducing Valve on Page 20-33-1.)

If the pressure is still incorrect replace the pressure reducing valve. (See Testing And Adjusting The Pressure Reducing Valve on Page 20-33-1.)

Handle Removal And Installation

Figure 20-110-5



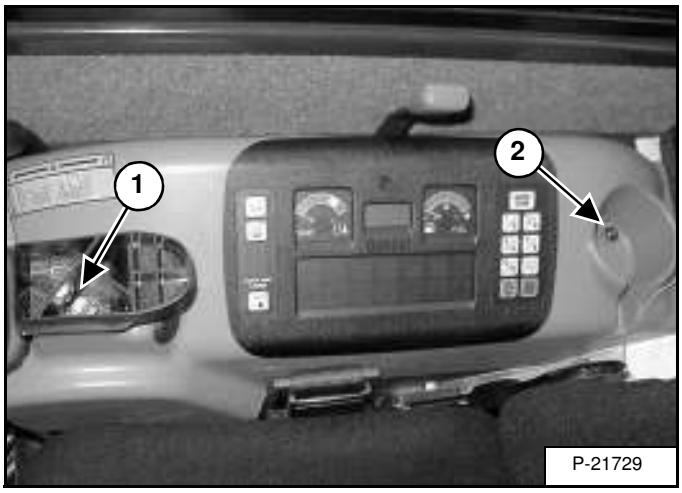
In the operator cab, at the right side operator console, remove the cover (Item 1) **[Figure 20-110-5]** from the arm rest.

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 20-110-5]** (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 20-110-6



Remove the two mount bolts (Item 1) **[Figure 20-110-6]** from the arm rest.

Remove the arm rest.

Remove the screw (Item 2) **[Figure 20-110-6]** from the cup holder.

Lift the console cover up and over the joystick lever.

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RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

Handle Removal And Installation (Cont'd)

Figure 20-110-7

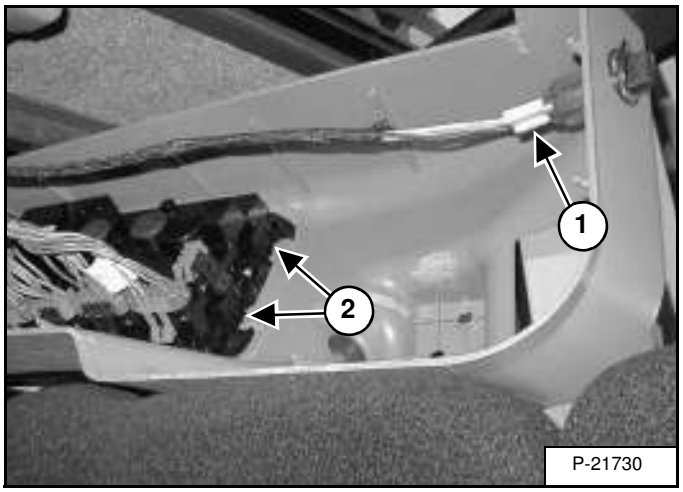


Figure 20-110-8



Key switch equipped machines perform [Figure 20-110-7] & [Figure 20-110-8] also.

Disconnect the accessory outlet electrical connector (Item 1) **[Figure 20-110-7]**.

Remove the controller from the console cover by pressing the mounting tabs (Item 2) **[Figure 20-110-7]**.

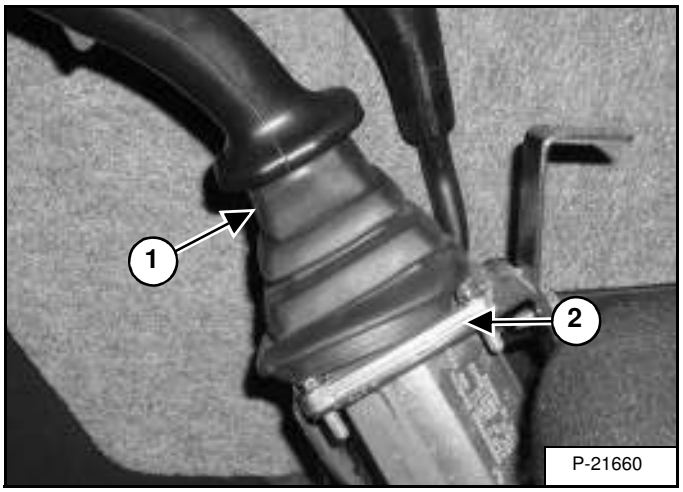
NOTE: The controller must be removed from the console only to allow access to re-install the key switch (if so equipped). Controller removal is not necessary on keyless machines, disconnect the instrument panel wires.

It is NOT necessary to disconnect the instrument panel wires on key switch equipped machines.

Turn the instrument panel to allow it to pass through the console cover **[Figure 20-110-8]**.

The console cover can now be removed from the work area for convenience.

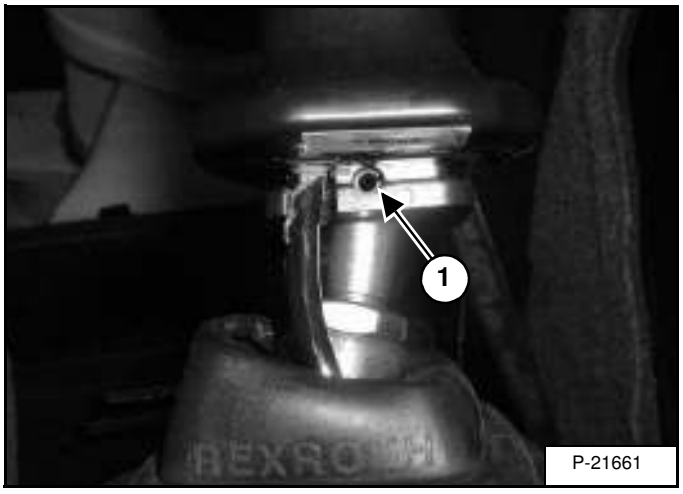
Figure 20-110-9



Pull the joystick boot (Item 1) **[Figure 20-110-9]** down, away from the joystick handle.

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 20-110-9]** and the mounting plate. Position the boot properly before re-installing the console cover.

Figure 20-110-10



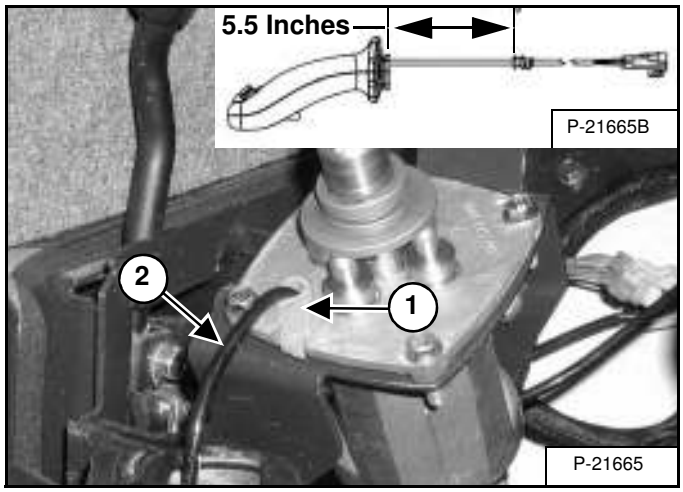
Remove the roll pin (Item 1) **[Figure 20-110-10]** from the joystick handle.

Remove the joystick handle from the joystick controller.

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Handle Removal And Installation (Cont'd)

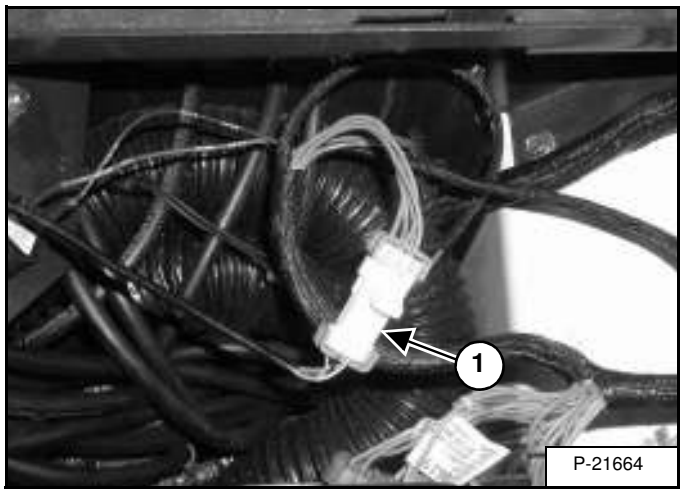
Figure 20-110-11



Lift the grommet (Item 1) **[Figure 20-110-11]** from the joystick mount plate.

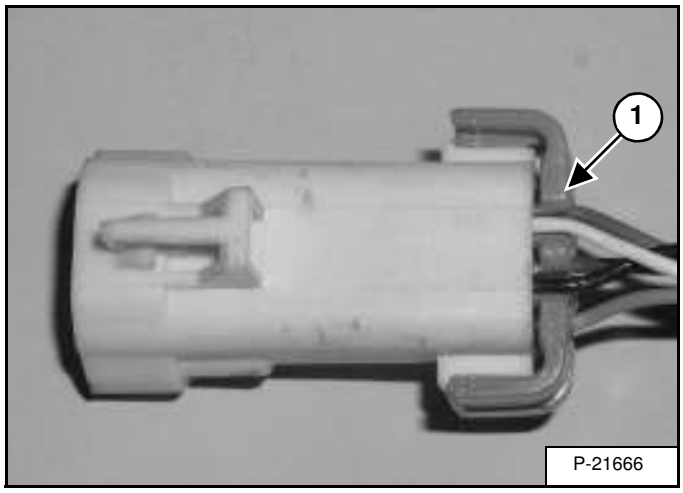
NOTE: The grommet (Item 1) [Figure 20-110-11] is attached to the handle wiring (Item 2) [Figure 20-110-11] with a tie-strap at 5.5 inches (140 mm) to avoid pulling or pinching wires during joystick operation.

Figure 20-110-12



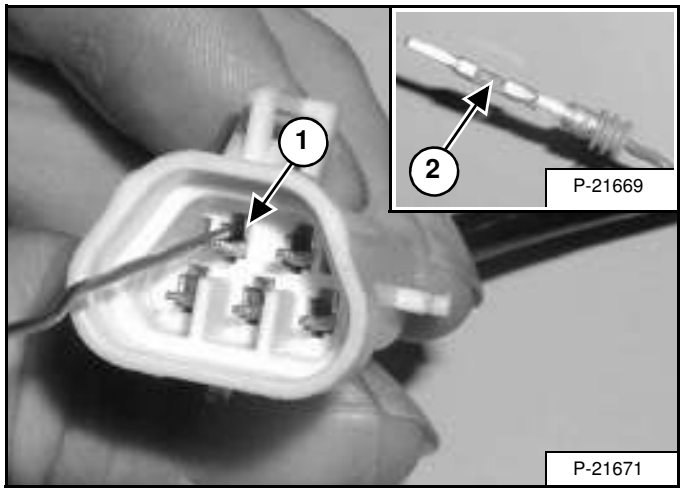
Disconnect the handle electrical connector (Item 1) **[Figure 20-110-12]**, from the excavator wiring harness.

Figure 20-110-13



Remove the lock (Item 1) **[Figure 20-110-13]** from the joystick electrical connector.

Figure 20-110-14



With a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 20-110-14]**.

Carefully remove the individual wires from the back of the electrical connector.

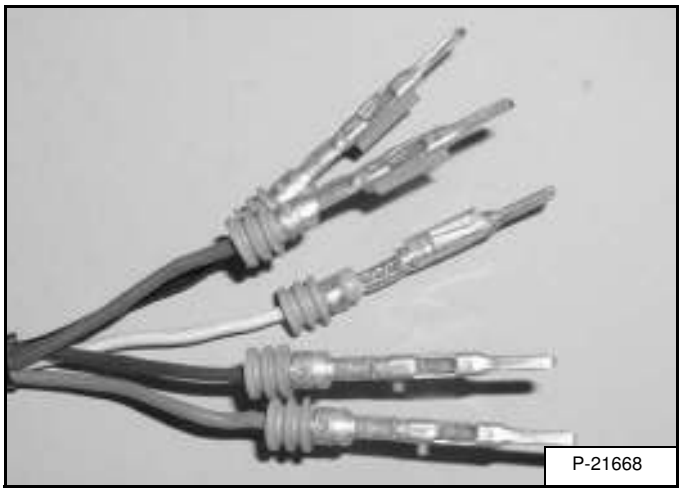
Remove the joystick handle assembly from the excavator.

Installation: Use a small piece of wire and re-bend the tab (Inset Item 2) **[Figure 20-110-14]** on each wire before installing in the electrical connector.

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Handle Removal And Installation (Cont'd)

Figure 20-110-15



Installation: The wires **[Figure 20-110-15]** 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.

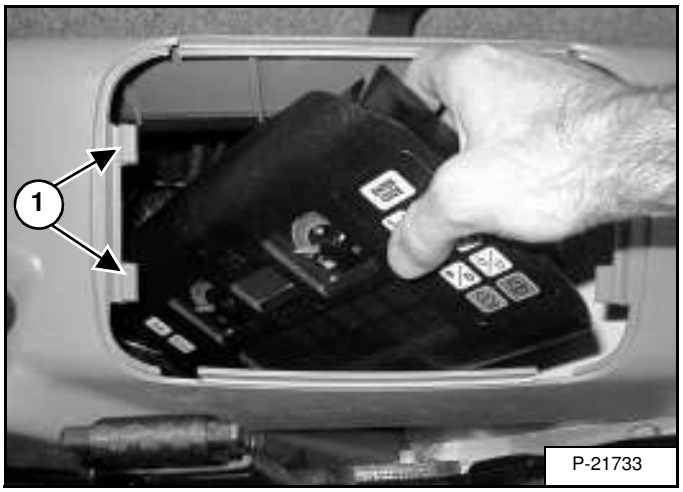
Re-install the console cover, cup holder screw, armrest bolts and armrest. Do not pinch the joystick boot.

Key switch equipped models:

Reach through the console and re-connect the accessory outlet electrical connector.

Reach through the console and install the key switch, nut and key.

Figure 20-110-16



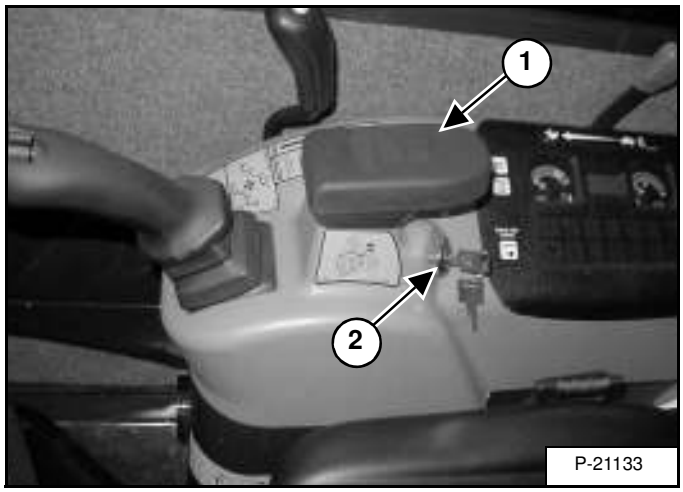
Lift the instrument panel through the console, position it in the opening and push down on the ends of the panel to lock the tabs (Item 1) **[Figure 20-110-16]**.

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RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

Joystick Assembly, Removal And Installation

Figure 20-110-17



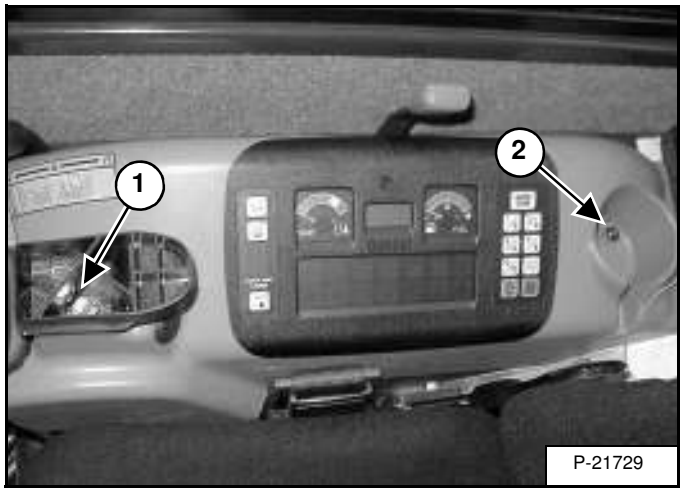
In the operator cab, at the right side operator console, remove the cover (Item 1) **[Figure 20-110-17]** from the arm rest.

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 20-110-17]** (if equipped). Allow the switch to drop inside the console.

NOTE: The key switch must be removed to remove and install the console cover.

Figure 20-110-18



Remove the two mount bolts (Item 1) **[Figure 20-110-18]** from the arm rest.

Remove the arm rest.

Remove the screw (Item 2) **[Figure 20-110-18]** from the console cover.

Lift the console cover up and over the joystick lever.

Figure 20-110-19

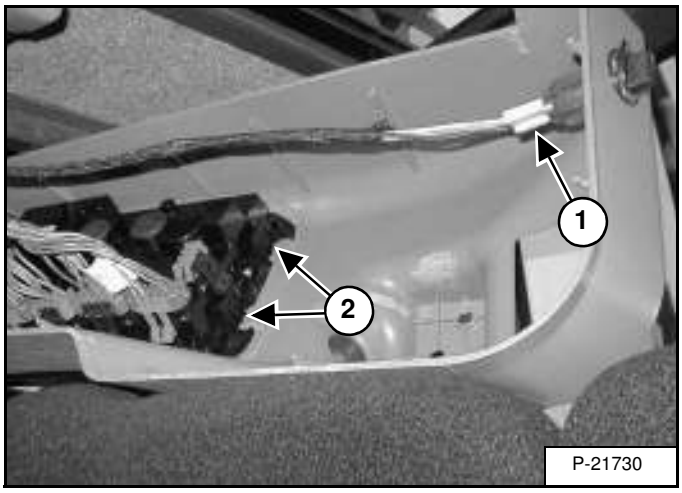


Figure 20-110-20



Key switch equipped machines perform **[Figure 20-110-19]** ***&*** **[Figure 20-110-20]** ***also***.

Disconnect the accessory outlet electrical connector (Item 1) **[Figure 20-110-19]**.

Remove the controller from the console cover by pressing the mounting tabs (Item 2) **[Figure 20-110-19]**.

NOTE: The instrument panel must be removed from the console only to allow access to re-install the key switch (if so equipped). Panel removal is not necessary on keyless machines, disconnect the instrument panel wires.

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RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

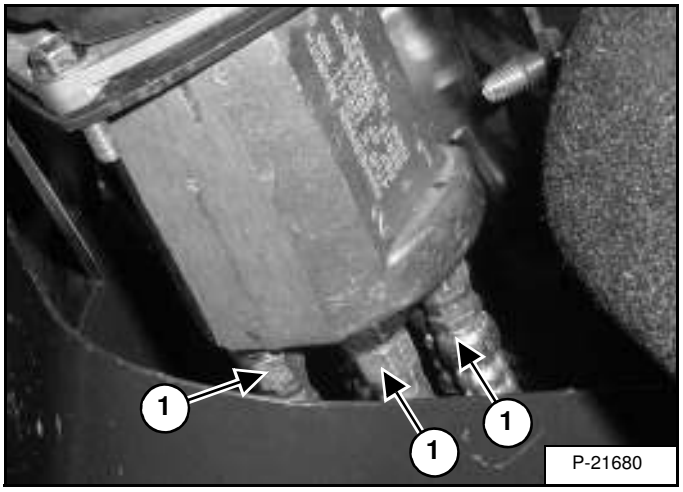
Joystick Assembly, Removal And Installation (Cont'd)

It is NOT necessary to disconnect the instrument panel wires on key switch equipped machines.

Turn the instrument panel to allow it to pass through the console cover **[Figure 20-110-20 on Page 6]**.

The console cover can now be removed from the work area for convenience.

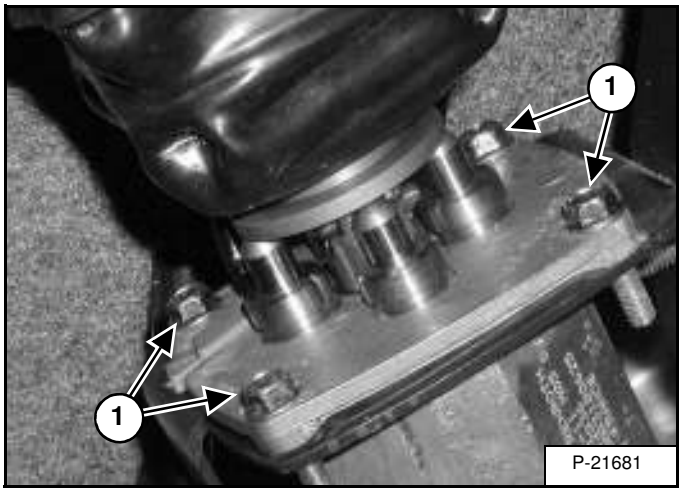
Figure 20-110-21



Mark the hydraulic hoses for proper installation. Remove the six hydraulic hoses (Item 1) **[Figure 20-110-21]** from the joystick housing.

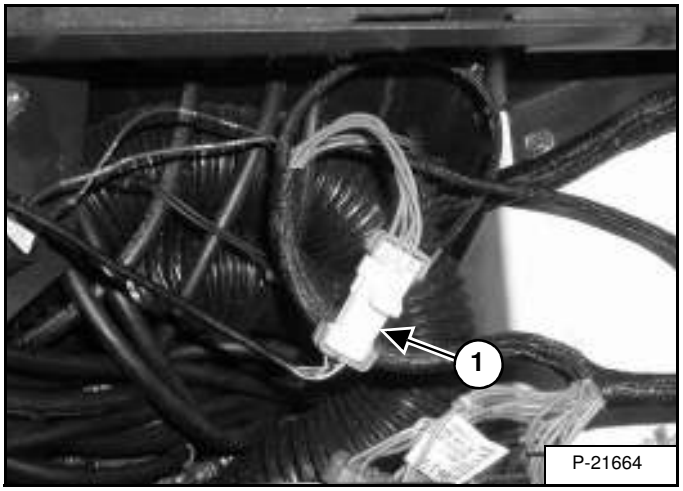
Cap and plug the hoses and fittings.

Figure 20-110-22



Remove the four mount bolts (Item 1) **[Figure 20-110-22]** from the joystick housing.

Figure 20-110-23



Disconnect the joystick electrical connector (Item 1) **[Figure 20-110-23]**, from the excavator wiring harness.

Remove the joystick assembly from the excavator.

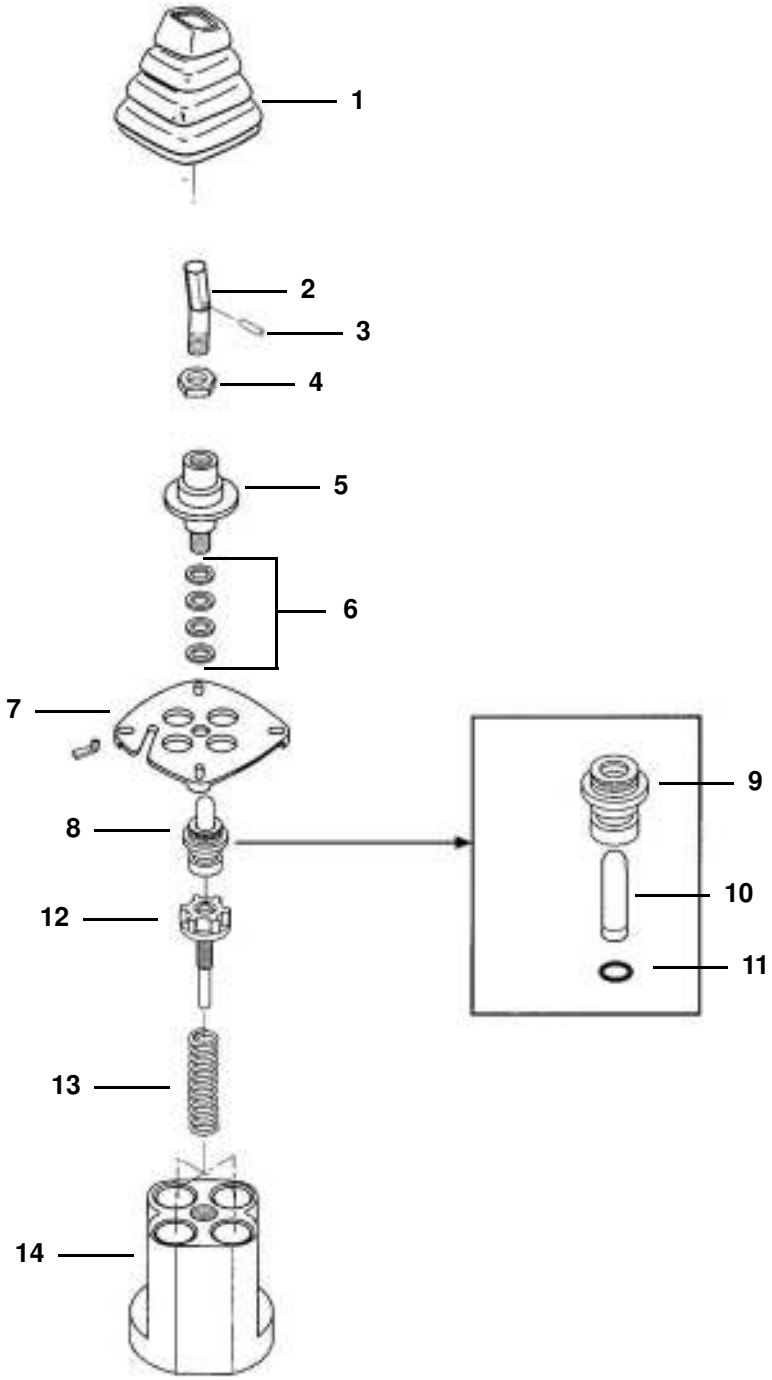
Remove the joystick handle from the housing. (See Handle Removal And Installation on Page 20-110-2.)

Remove the dust boot from the housing.

Dealer Copy -- Not for Resale

Parts Identification

1. Boot
2. Lever Kit
3. Roll Pin
4. Nut
5. Swivel Joint
6. Washers
7. Plate
8. Plunger Assembly
9. Plunger Body
10. Rod
11. O-Ring
12. Spool Assembly
13. Spring
14. Valve Body



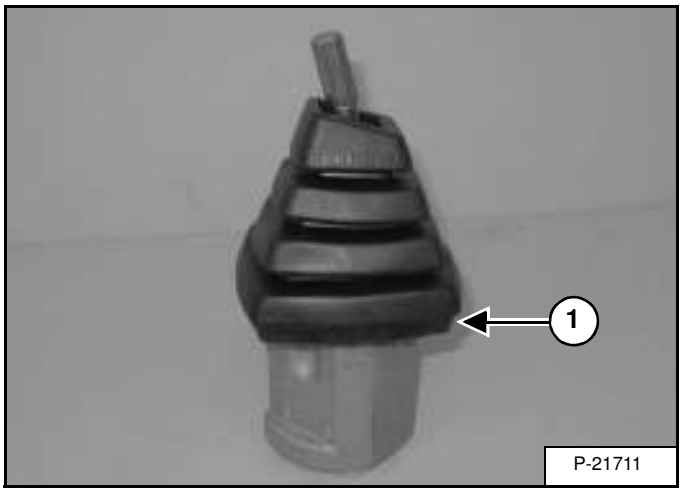
B-16679A

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RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

Disassembly

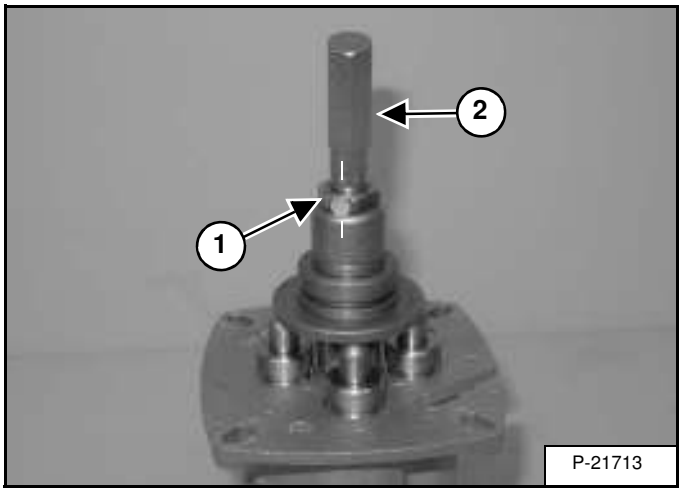
Figure 20-110-24



Remove the rubber boot (Item 1) **[Figure 20-110-24]** from the joystick valve.

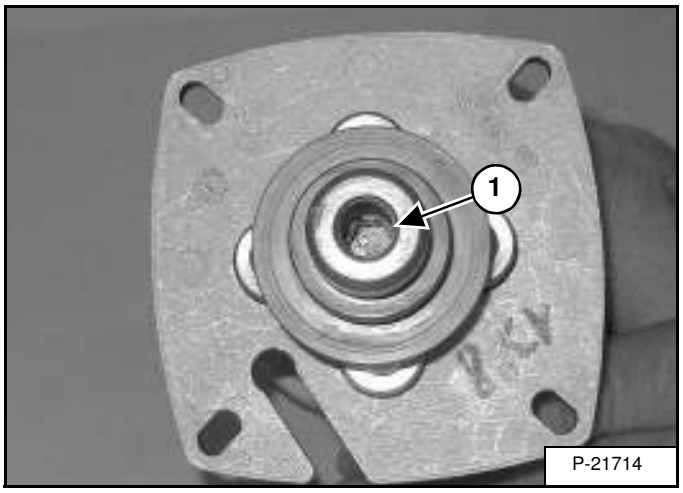
For ease of assembly make a white mark on the lever and the collar for re-alignment.

Figure 20-110-25



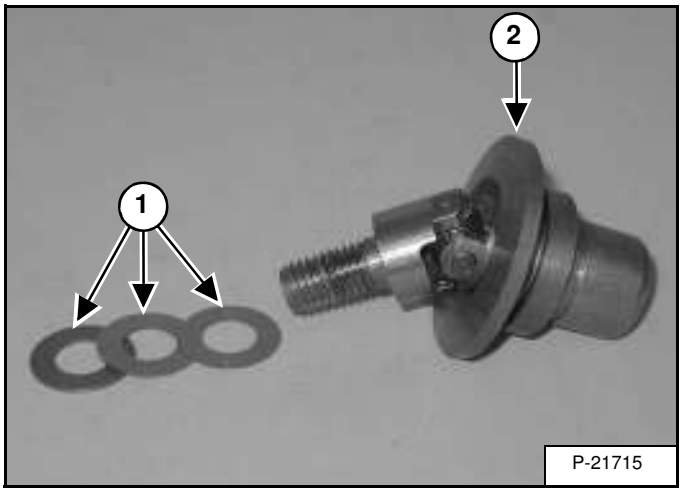
Loosen the jam nut (Item 1) and loosen and remove the controller lever (Item 2) **[Figure 20-110-25]**.

Figure 20-110-26



Insert an Allen wrench in the center of the collar (Item 1) **[Figure 20-110-26]** loosen and remove the swivel joint.

Figure 20-110-27



Remove the washers (Item 1) **[Figure 20-110-27]** from the swivel joint.

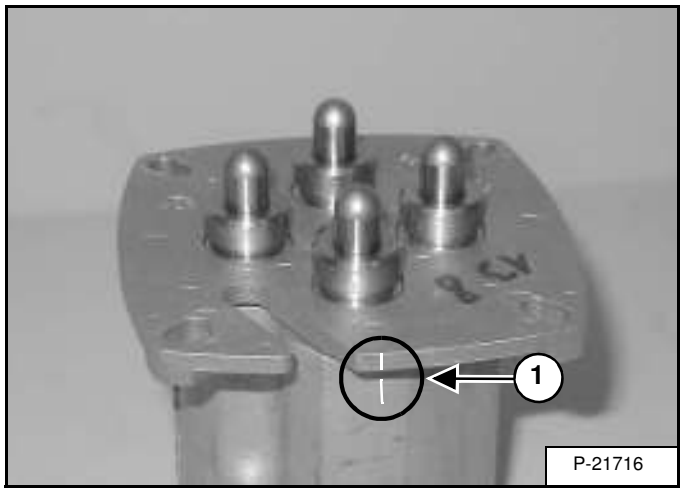
Check the swivel joint (Item 2) **[Figure 20-110-27]** for wear and replace as needed.

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RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

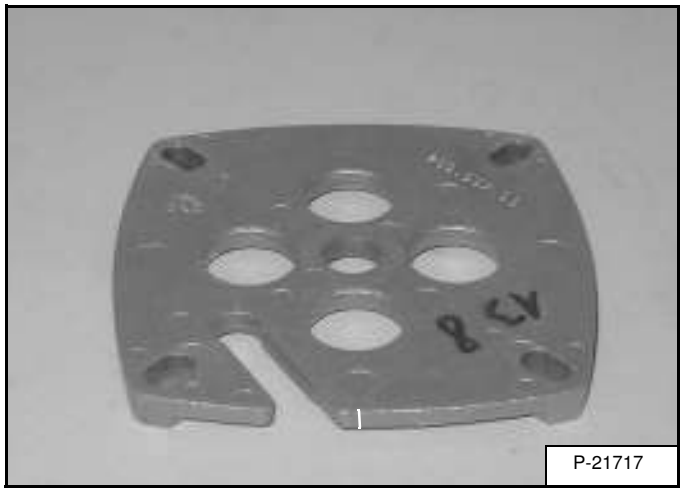
Disassembly (Cont'd)

Figure 20-110-28



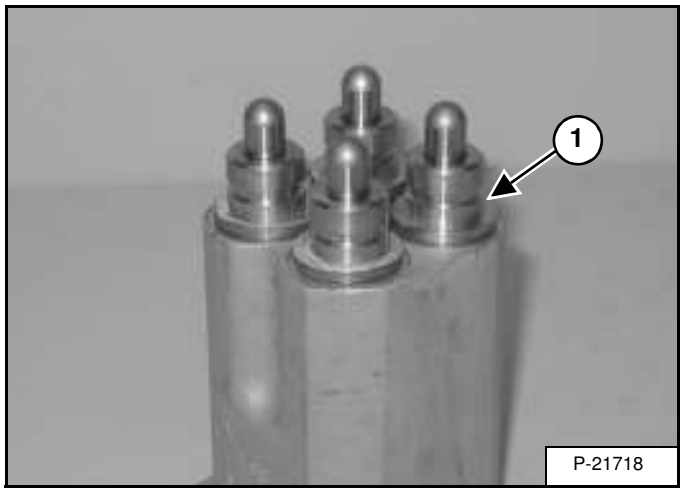
For ease of assembly make a white mark on the plate and the valve body for re-alignment (Item 1) **[Figure 20-110-28]**.

Figure 20-110-29



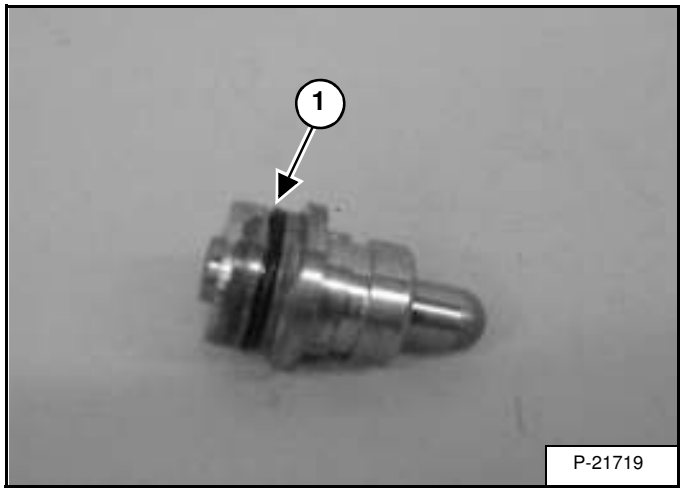
Remove the plate **[Figure 20-110-29]**.

Figure 20-110-30



Remove the plunger assemblies (Item 1) **[Figure 20-110-30]** from the valve body.

Figure 20-110-31



Check the O-ring (Item 1) **[Figure 20-110-31]** and replace as needed for wear.

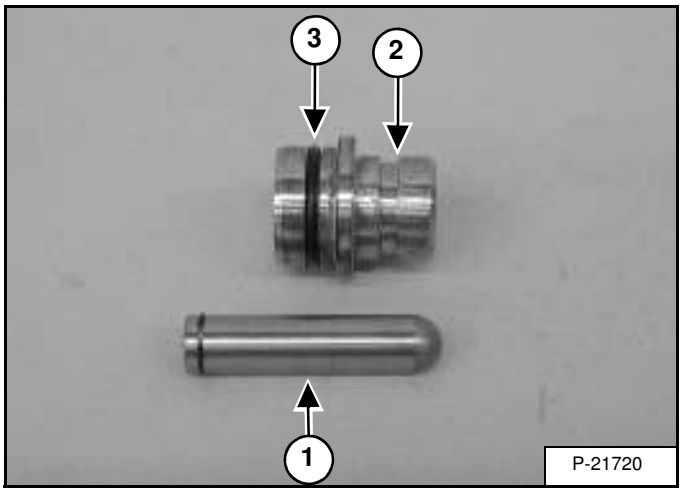
NOTE: Install the plunger assemblies in the same bore from which they are removed.

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RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

Disassembly (Cont'd)

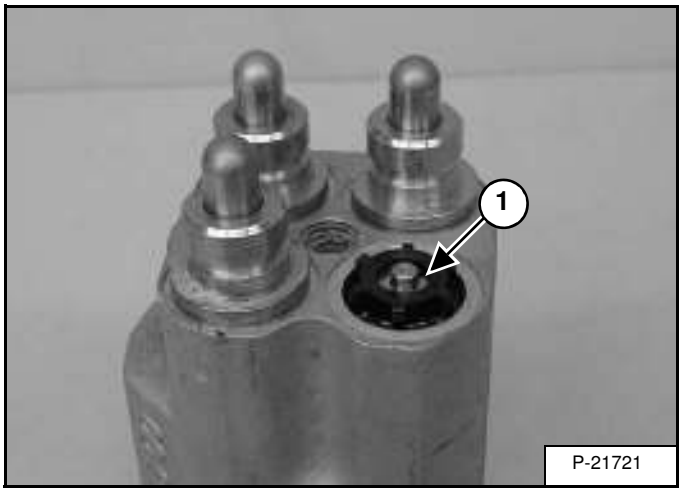
Figure 20-110-32



Remove the push rod (Item 1) from the plunger body (Item 2) **[Figure 20-110-32]**.

Remove the O-ring (Item 3) from the outside of the plug if damaged. Check the O-ring (Item 3) **[Figure 20-110-32]** for wear and replace as needed.

Figure 20-110-33



Remove the spool assembly (Item 1) **[Figure 20-110-33]**.

NOTE: Install the spool assembly in the same bore from which they are removed.

Figure 20-110-34

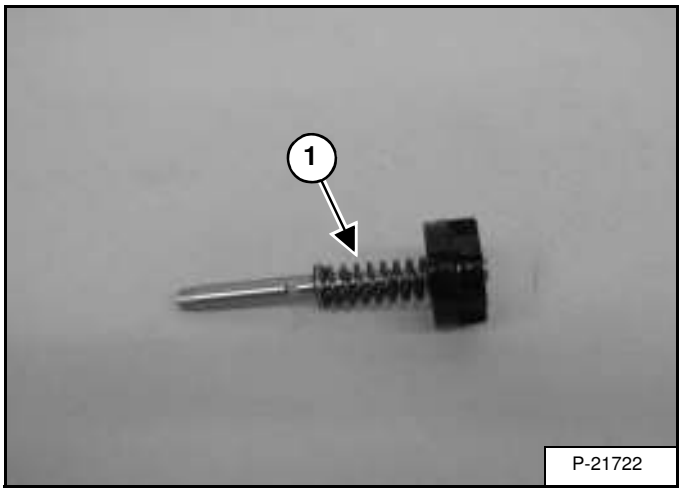
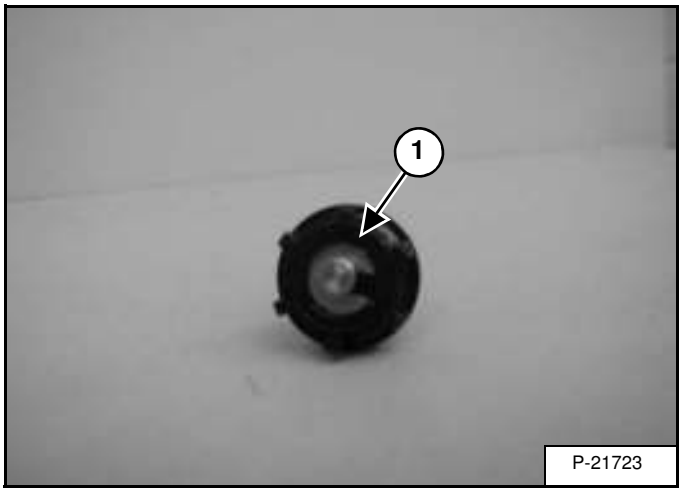


Figure 20-110-35



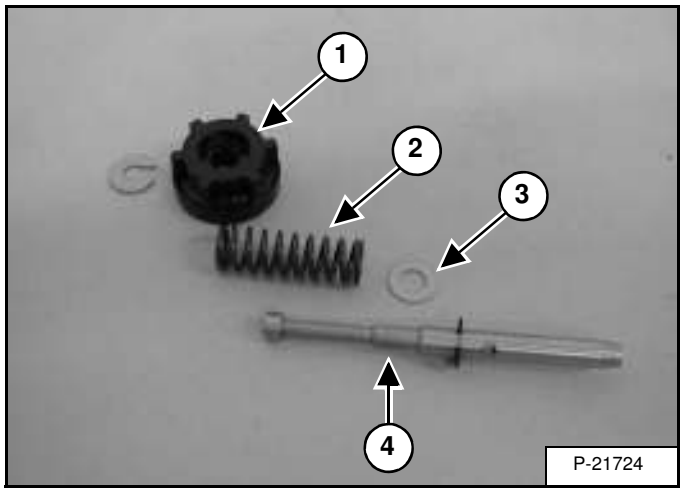
Compress the spring (Item 1) **[Figure 20-110-34]** and remove the C-clip (Item 1) **[Figure 20-110-35]** from the end of the spool.

Dealer Copy -- Not for Resale

RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

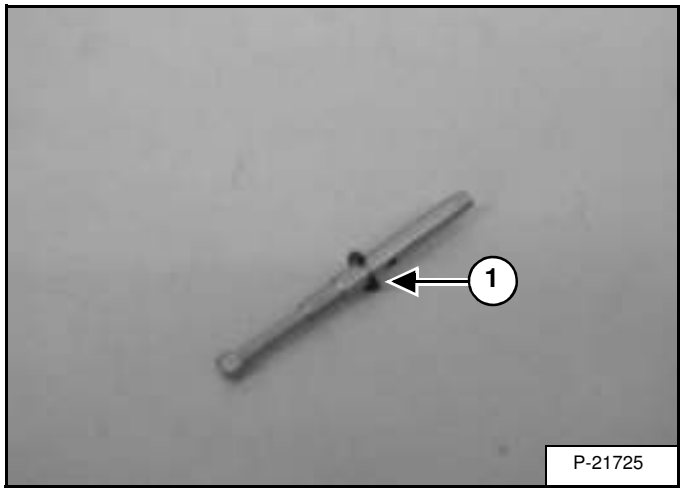
Disassembly (Cont'd)

Figure 20-110-36



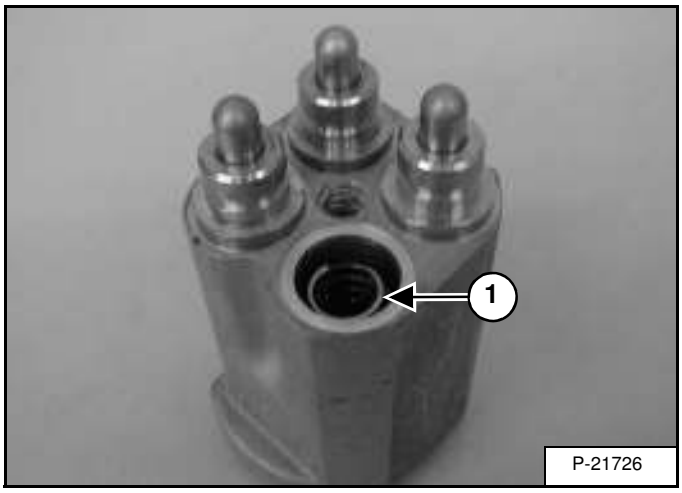
Remove the spring seat (Item 1), the spring (Item 2) and washer (Item 3) from the spool (Item 4) **[Figure 20-110-36]**.

Figure 20-110-37



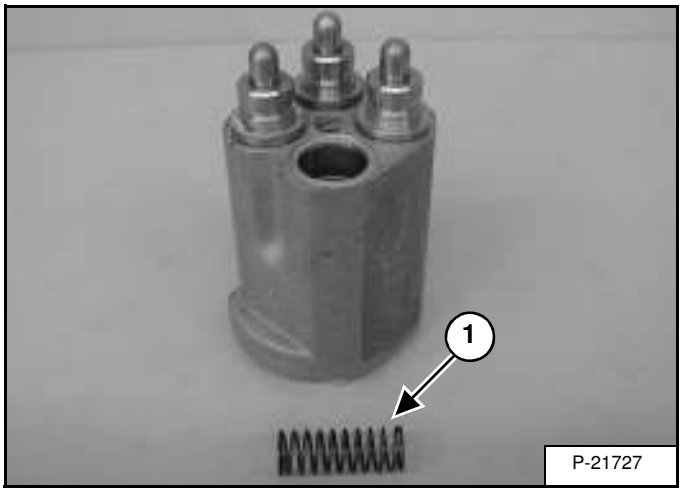
Check the clip (Item 1) **[Figure 20-110-37]** for wear and replace as needed.

Figure 20-110-38



Remove the centering spring (Item 1) **[Figure 20-110-38]** from the joystick body.

Figure 20-110-39



Check the centering spring (Item 1) **[Figure 20-110-39]** for wear and replace as needed.

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LEFT CONTROL LEVER (JOYSTICK) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129)

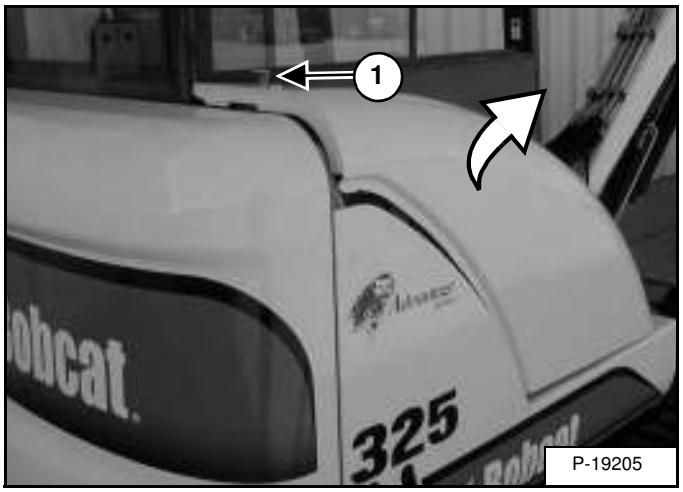
Testing

The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

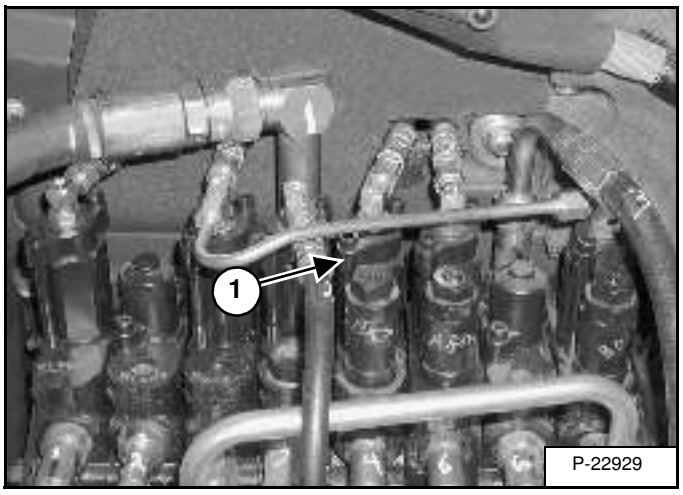
Stop the engine.

Figure 20-111-1



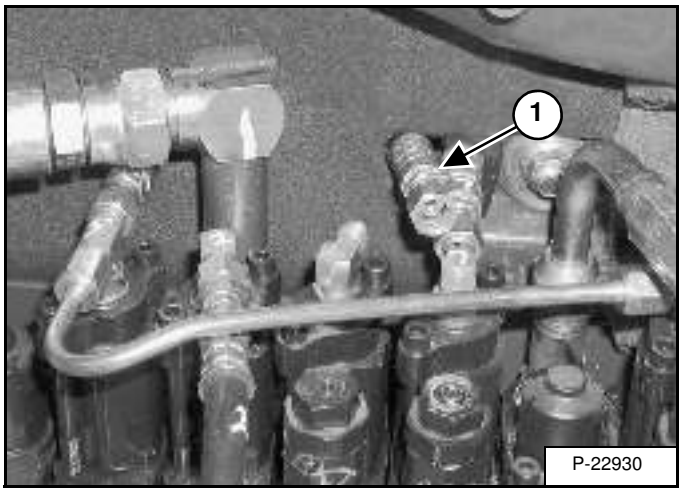
Open the right side access cover (Item 1) **[Figure 20-111-1]**.

Figure 20-111-2



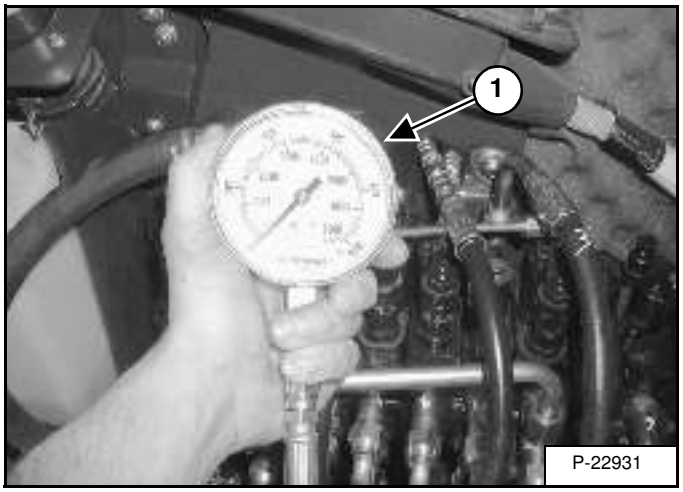
At the control valve assembly (Item 1) **[Figure 20-111-2]**, find the pilot line of the control lever (joystick) that is to be checked. (Boom, Arm, Boom Swing, Bucket.)

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 1000 PSI (6896 kPa) gauge (Item 1) **[Figure 20-111-4]** on the pilot line.

Start the excavator, and warm the hydraulic oil to operating temperature.

Engage the blade raise circuit until the blade is fully raised. Continue to engage the blade circuit and engage the circuit to be tested. Record the operating pressure.

The operating target pressure is 428 PSI (2951 kPa) with an acceptable range of 406-450 PSI (2799-3103 kPa).

Dealer Copy -- Not for Resale

LEFT CONTROL LEVER (JOYSTICK) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

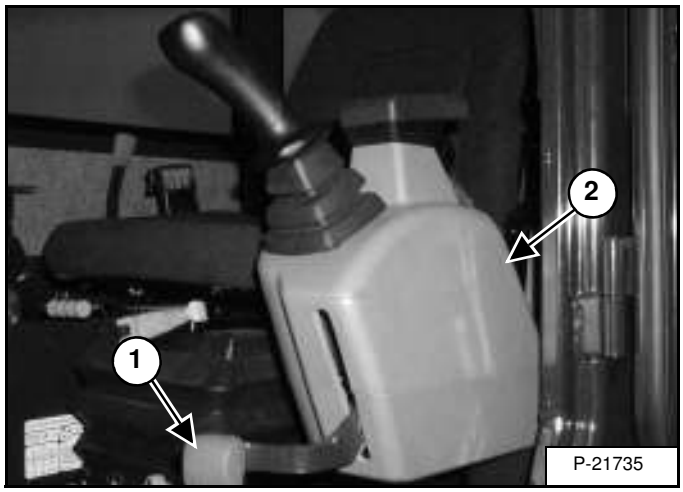
Testing (Cont'd)

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 20-33-3.)

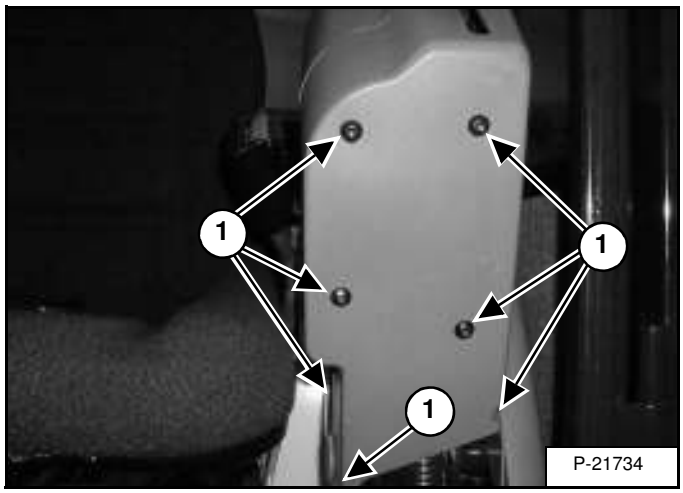
Handle Removal And Installation

Figure 20-111-5



In the operator cab, at the left side operator console, lift the lever (Item 1) and raise the console (Item 2) **[Figure 20-111-5]**.

Figure 20-111-6

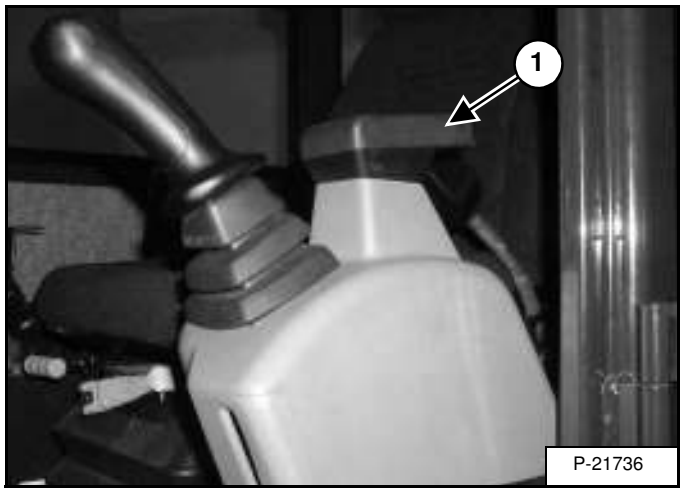


Remove the seven mounting bolts (Item 1) **[Figure 20-111-6]** from the lower half of the operator console.

Remove the lower half of the console.

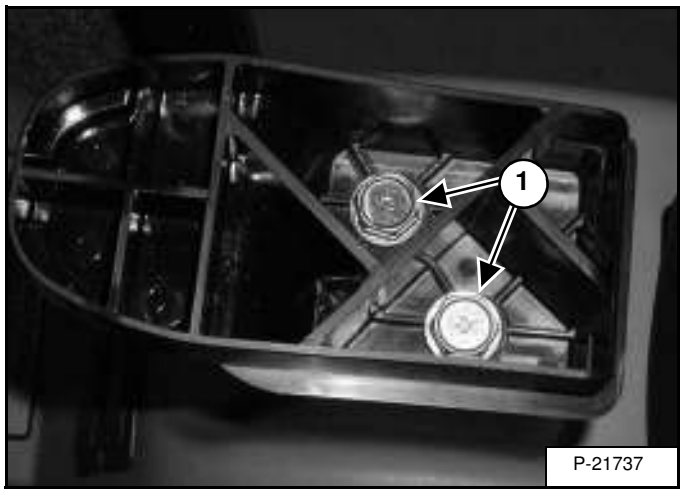
Lower the console.

Figure 20-111-7



Remove the cover (Item 1) **[Figure 20-111-7]** from the arm rest.

Figure 20-111-8



Remove the two mount bolts (Item 1) **[Figure 20-111-8]** from the arm rest.

Remove the arm rest.

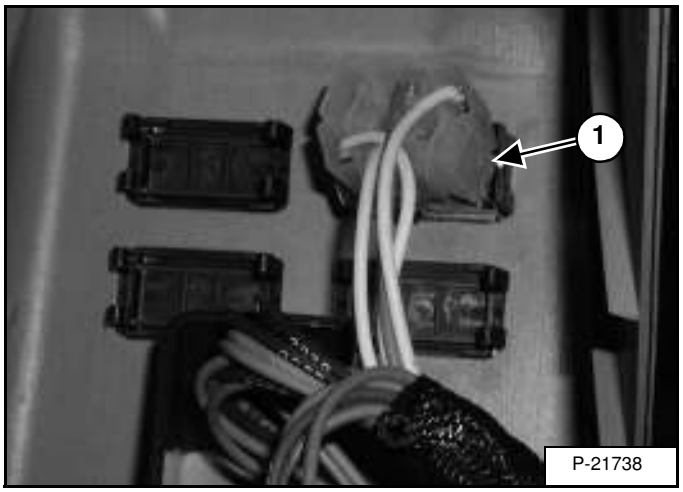
Raise the upper half of the console cover.

Dealer Copy -- Not for Resale

LEFT CONTROL LEVER (JOYSTICK) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

Handle Removal And Installation (Cont'd)

Figure 20-111-9

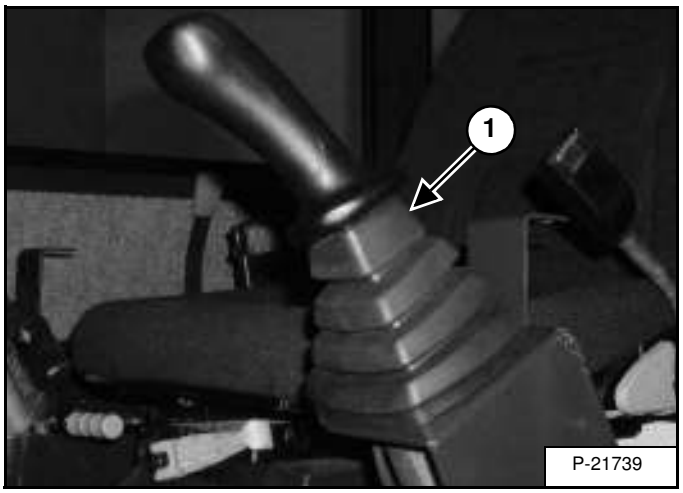


Unplug the electrical connector (Item 1) **[Figure 20-111-9]**.

NOTE: These connectors are keyed so they can be plugged in only one way.

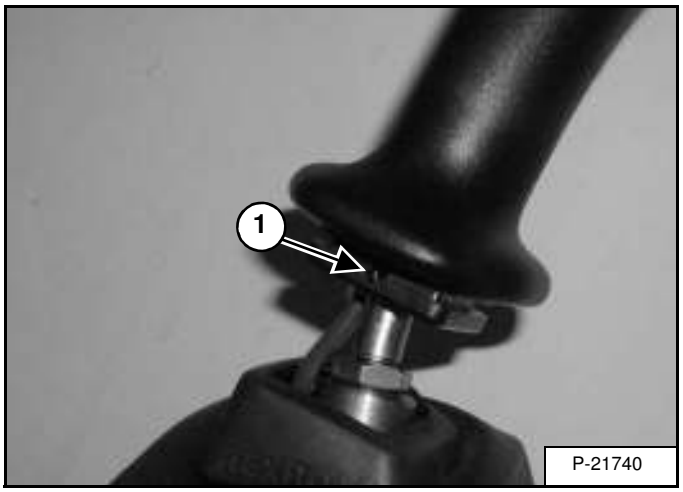
Remove the console cover.

Figure 20-111-10



Remove the joystick boot (Item 1) **[Figure 20-111-10]** from the joystick handle.

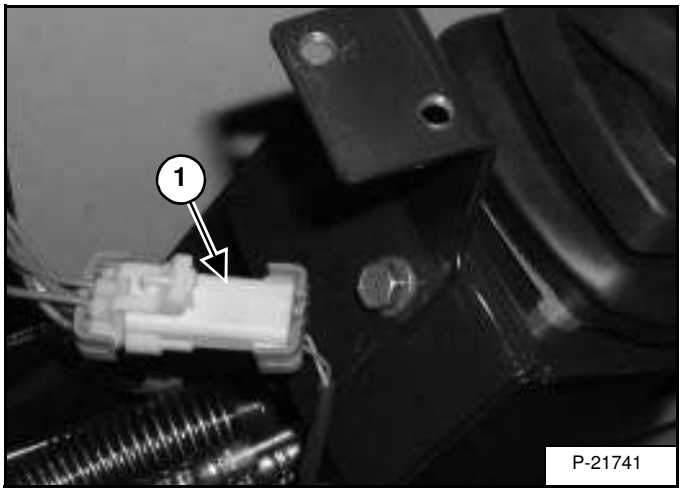
Figure 20-111-11



Remove the roll pin (Item 1) **[Figure 20-111-11]** from the joystick handle.

Remove the joystick handle from the joystick controller.

Figure 20-111-12



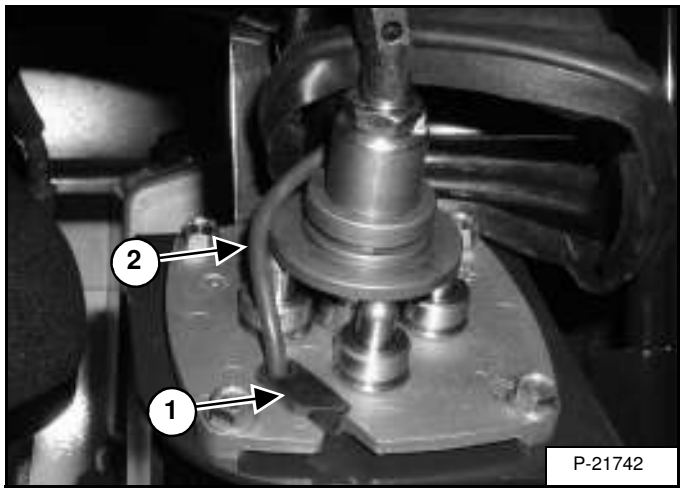
Disconnect the handle electrical connector (Item 1) **[Figure 20-111-12]**, from the excavator wiring harness.

Dealer Copy -- Not for Resale

LEFT CONTROL LEVER (JOYSTICK) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

Handle Removal And Installation (Cont'd)

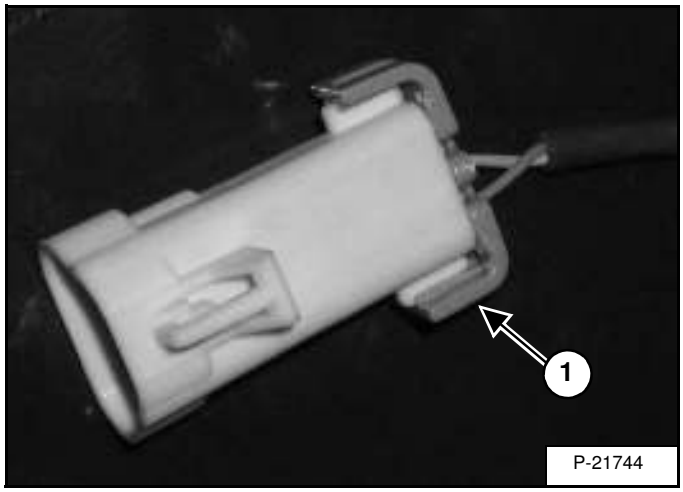
Figure 20-111-13



Remove the grommet (Item 1) **[Figure 20-111-13]** from the joystick mount plate.

NOTE: The grommet (Item 1) is attached to the joystick electrical cable (Item 2) [Figure 20-111-13] with a tie-strap.

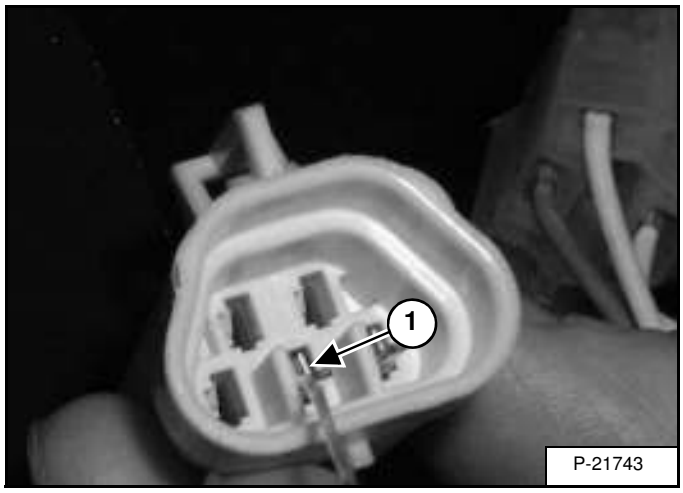
Figure 20-111-14



Remove the end piece (Item 1) **[Figure 20-111-14]** from the joystick electrical connector.

Remove the joystick handle assembly from the excavator.

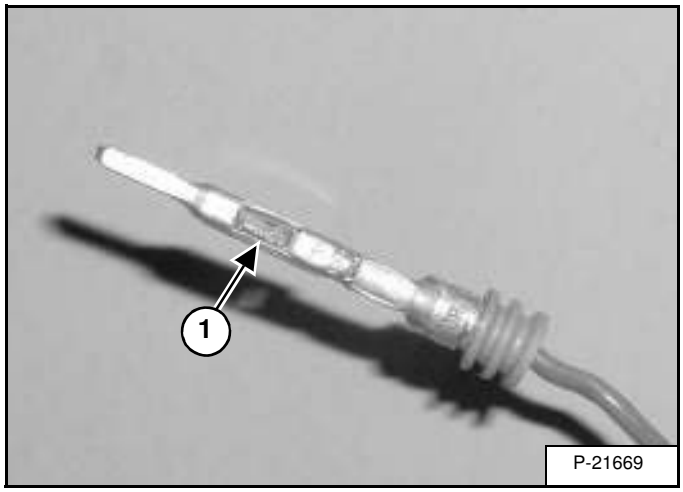
Figure 20-111-15



With a small piece of wire, depress the electrical connectors, (Item 1) **[Figure 20-111-15]**.

Lightly pull the individual wires from the back of the electrical connector.

Figure 20-111-16



Installation: Use a small piece of wire and lightly depress the tab (Item 1) **[Figure 20-111-16]** on each individual wire before installing in the electrical connector.

Installation: The wires must be installed in the proper locations in the wire connector, listed below.

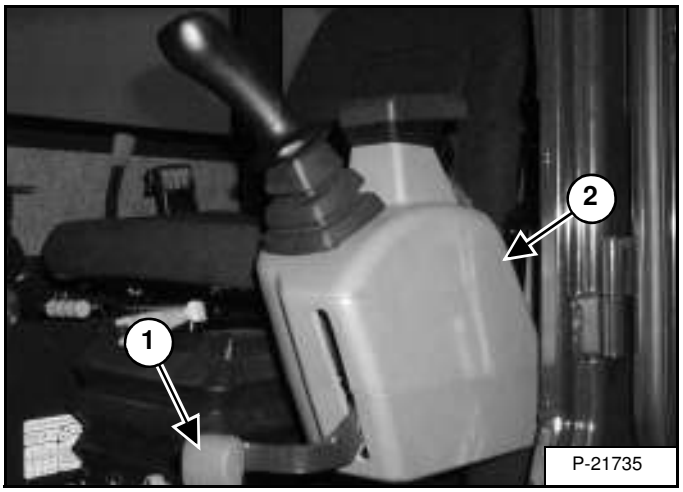
A Open
B Yellow
C Green
D Open
E Open

Dealer Copy -- Not for Resale

LEFT CONTROL LEVER (JOYSTICK) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

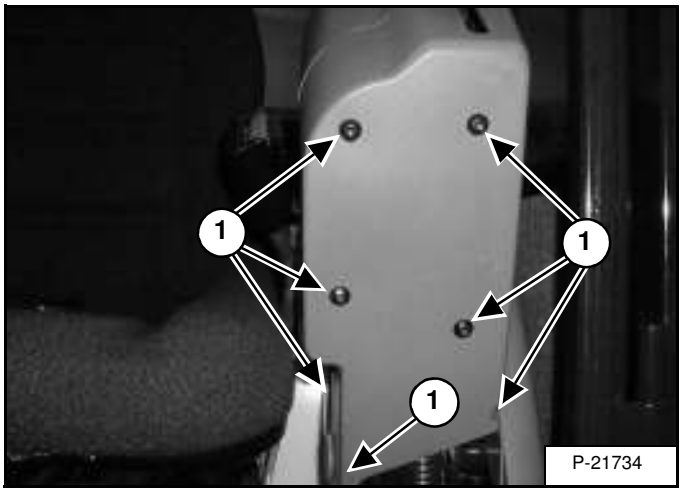
Joystick Assembly Removal And Installation

Figure 20-111-17



In the operator cab, at the left side operator console, lift the lever (Item 1) and raise the console (Item 2) **[Figure 20-111-17]**.

Figure 20-111-18

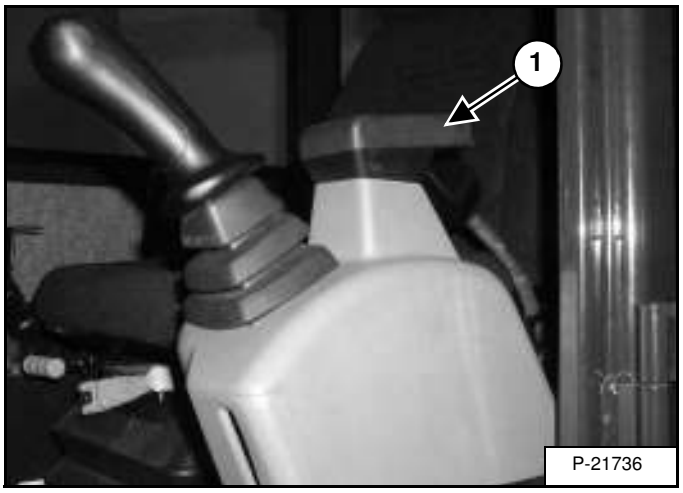


Remove the seven mounting bolts (Item 1) **[Figure 20-111-18]** from the lower half of the operator console.

Remove the lower half of the console.

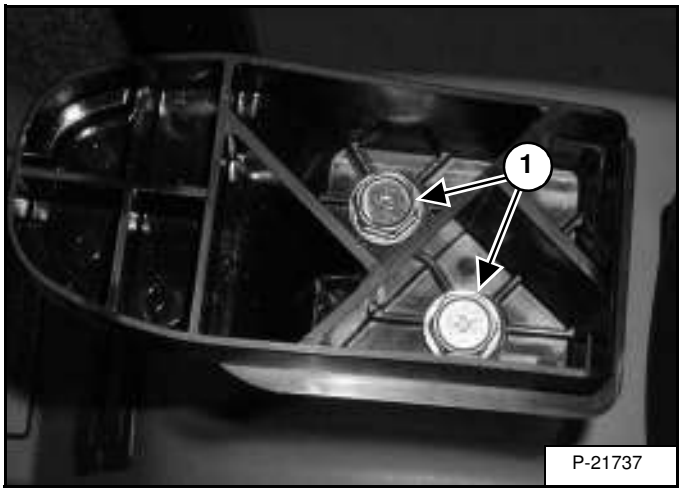
Lower the console.

Figure 20-111-19



Remove the cover (Item 1) **[Figure 20-111-19]** from the arm rest.

Figure 20-111-20



Remove the two mount bolts (Item 1) **[Figure 20-111-20]** from the arm rest.

Remove the arm rest.

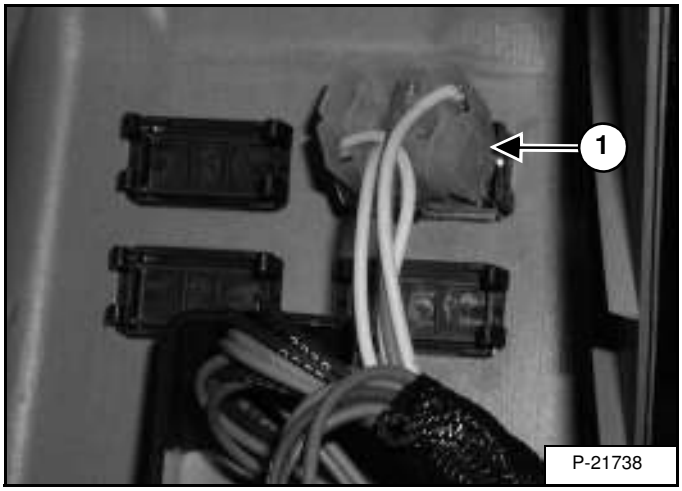
Raise the upper half of the console cover.

Dealer Copy -- Not for Resale

LEFT CONTROL LEVER (JOYSTICK) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

Joystick Assembly, Removal And Installation (Cont'd)

Figure 20-111-21

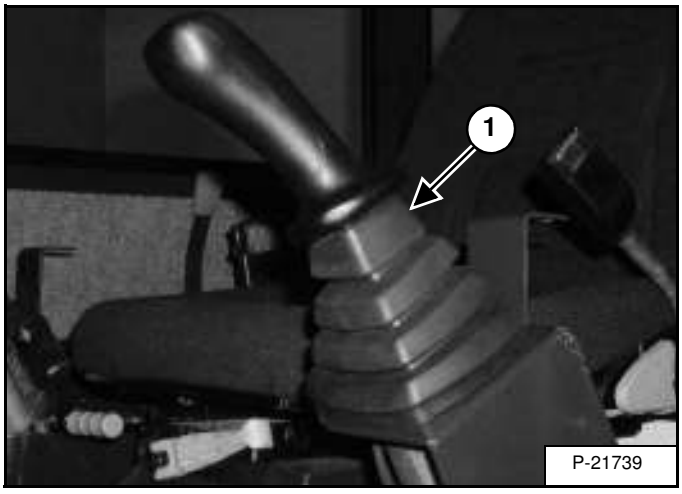


Unplug the electrical connector (Item 1) **[Figure 20-111-21]**.

NOTE: These connectors are keyed so they can be plugged in only one way.

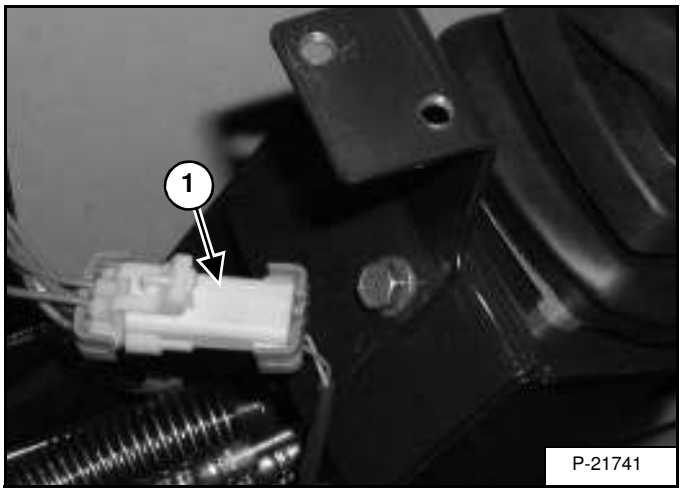
Remove the console cover.

Figure 20-111-22



Remove the joystick boot (Item 1) **[Figure 20-111-22]** from the joystick handle.

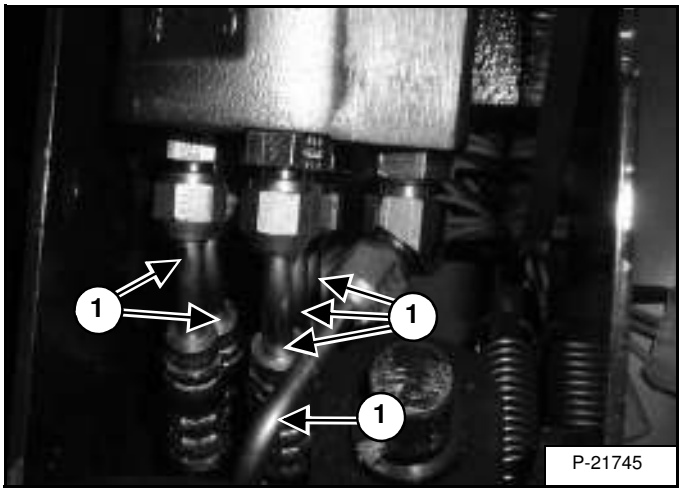
Figure 20-111-23



Disconnect the handle electrical connector (Item 1) **[Figure 20-111-23]**, from the excavator wiring harness.

Mark the hydraulic hoses for proper installation.

Figure 20-111-24



Remove the six hydraulic hoses (Item 1) **[Figure 20-111-24]** from the joystick housing.

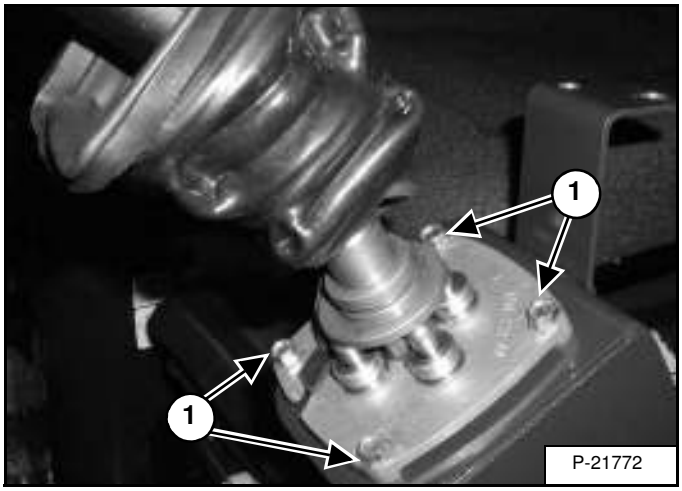
Cap and plug the hoses and fittings.

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LEFT CONTROL LEVER (JOYSTICK) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

Joystick Assembly, Removal And Installation (Cont'd)

Figure 20-111-25



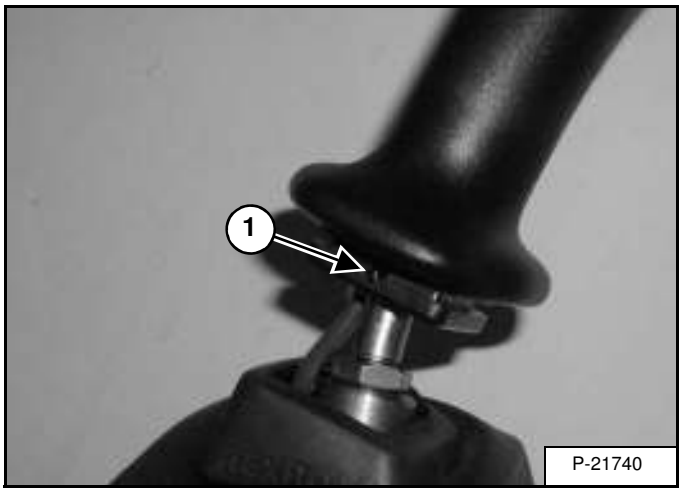
Remove the four mount bolts (Item 1) **[Figure 20-111-25]** from the joystick housing.

Figure 20-111-26



Remove the joystick assembly from the excavator **[Figure 20-111-26]**.

Figure 20-111-27



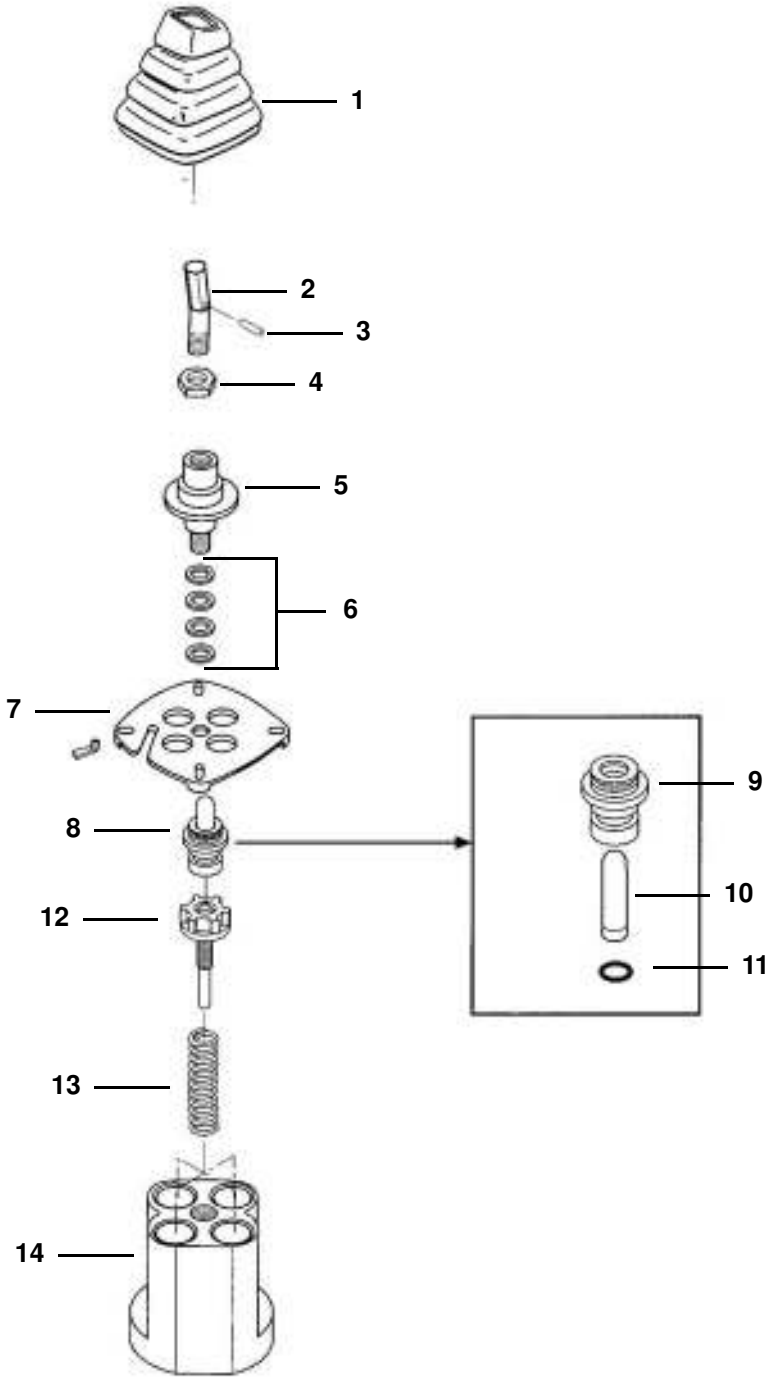
Remove the roll pin (Item 1) **[Figure 20-111-27]** from the joystick handle.

Remove the joystick handle from the joystick controller.

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Parts Identification

1. Boot
2. Lever Kit
3. Roll Pin
4. Nut
5. Swivel Joint
6. Washers
7. Plate
8. Plunger Assembly
9. Plunger Body
10. Rod
11. O-Ring
12. Spool Assembly
13. Spring
14. Valve Body



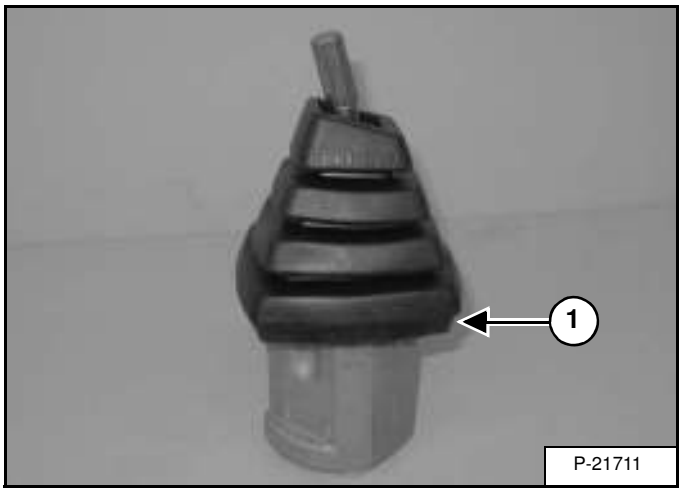
B-16679A

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LEFT CONTROL LEVER (JOYSTICK) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

Disassembly

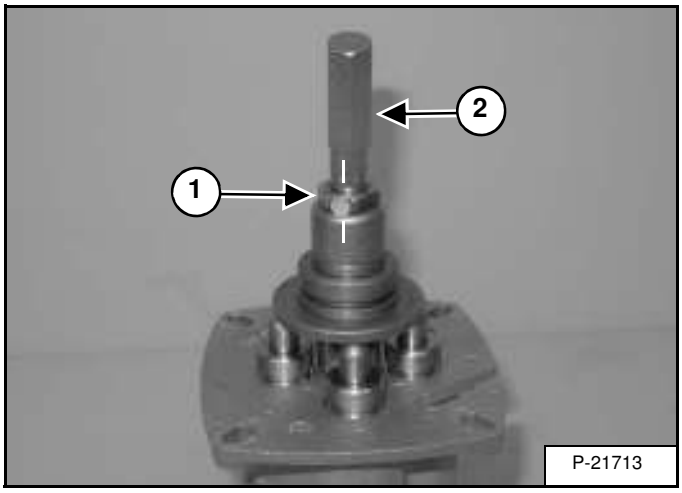
Figure 20-111-28



Remove the rubber boot (Item 1) **[Figure 20-111-28]** from the joystick valve.

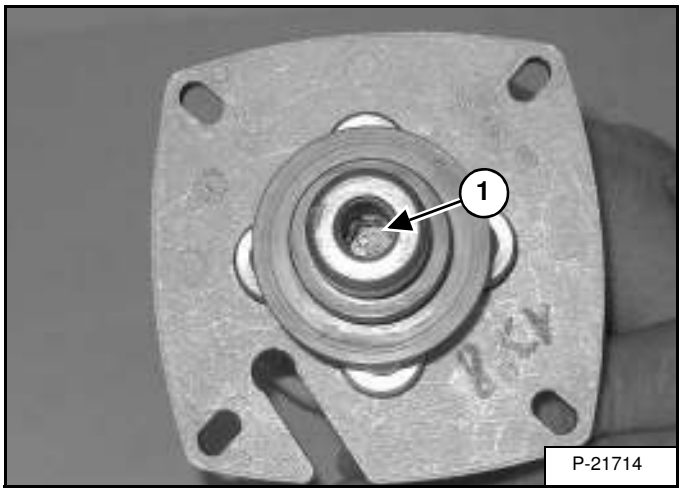
For ease of assembly make a white mark on the lever and the collar for re-alignment.

Figure 20-111-29



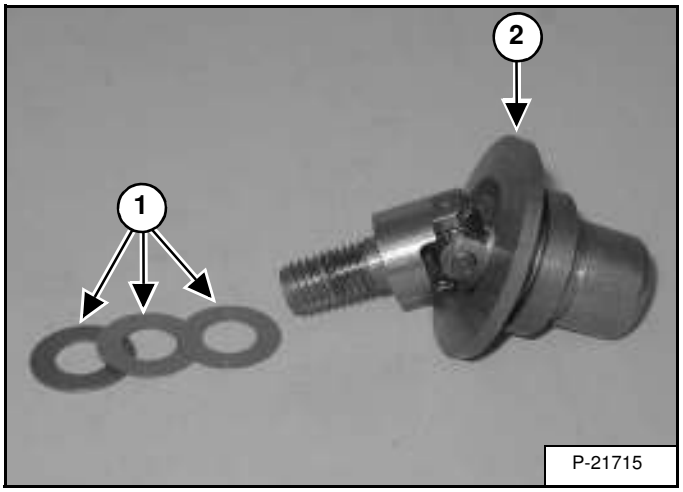
Loosen the jam nut (Item 1) and loosen and remove the controller lever (Item 2) **[Figure 20-111-29]**.

Figure 20-111-30



Insert an Allen wrench in the center of the collar (Item 1) **[Figure 20-111-30]** loosen and remove the swivel joint.

Figure 20-111-31



Remove the washers (Item 1) **[Figure 20-111-31]** from the swivel joint.

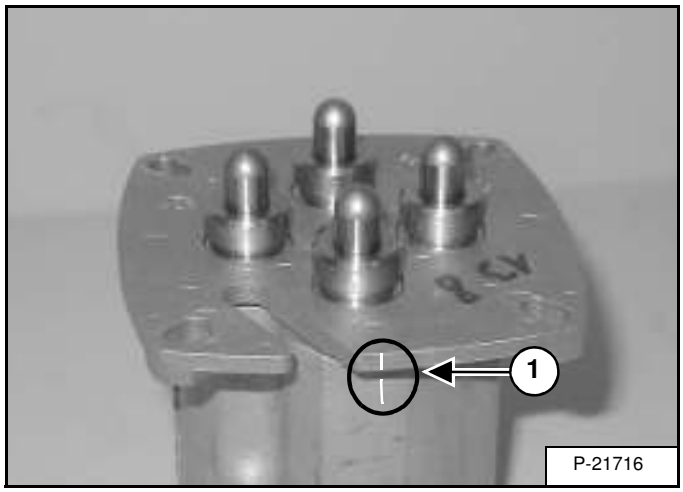
Check the swivel joint (Item 2) **[Figure 20-111-31]** for wear and replace as needed.

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LEFT CONTROL LEVER (JOYSTICK) (S/N 232312386 & BELOW, 232412117 & BELOW, 232412128 AND 232412129) (CONT'D)

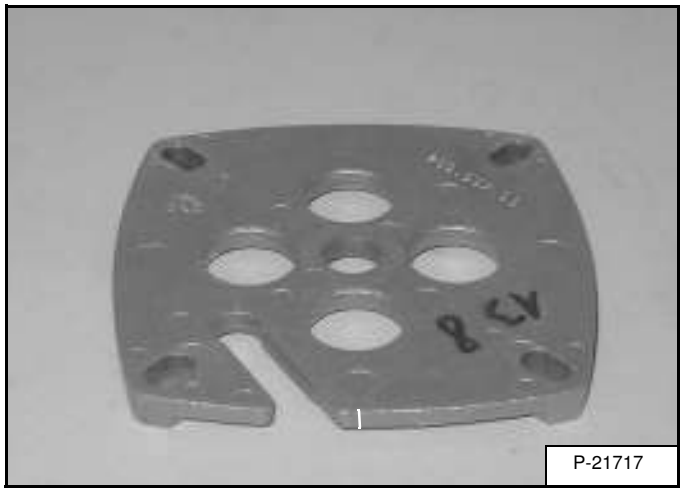
Disassembly (Cont'd)

Figure 20-111-32



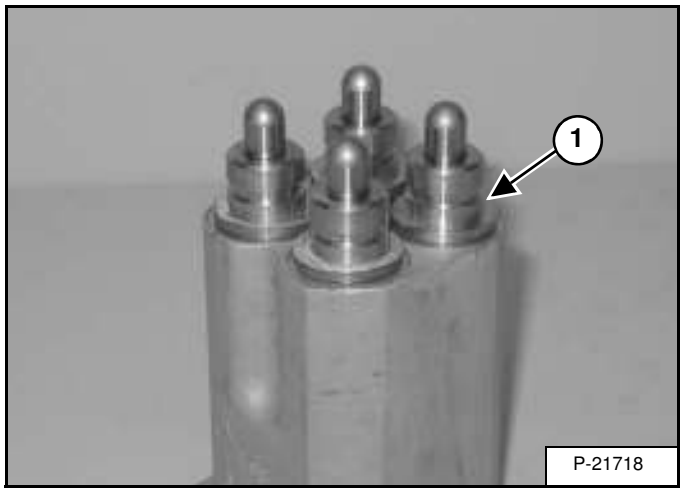
For ease of assembly make a white mark on the plate and the valve body for re-alignment (Item 1) **[Figure 20-111-32]**.

Figure 20-111-33



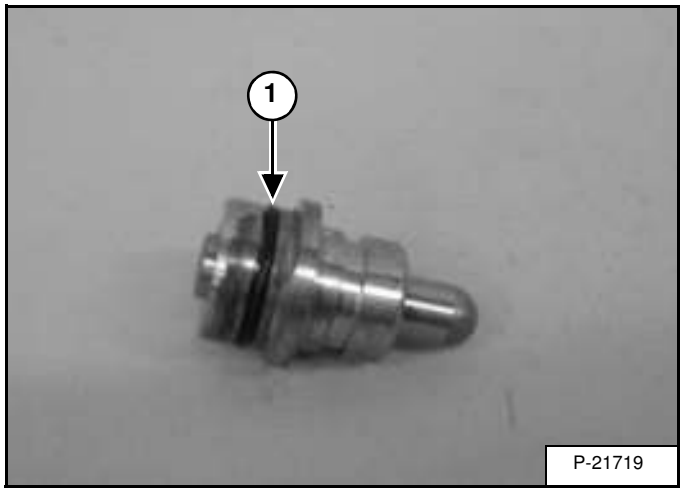
Remove the plate **[Figure 20-111-33]**.

Figure 20-111-34



Remove the plunger assemblies (Item 1) **[Figure 20-111-34]** from the valve body.

Figure 20-111-35



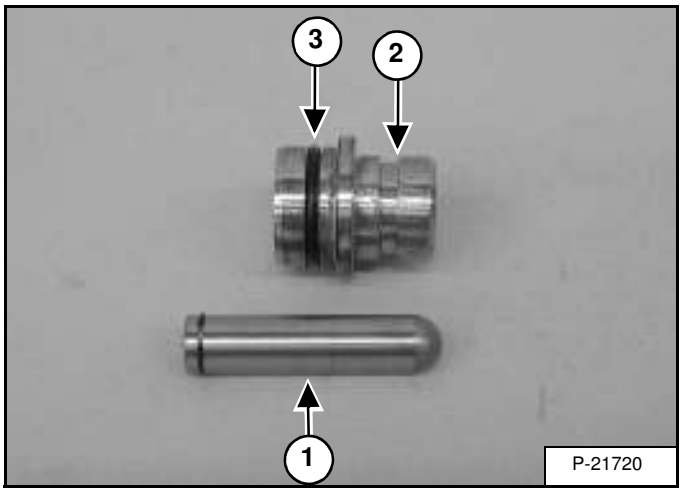
Check the O-ring (Item 1) **[Figure 20-111-35]** and replace as needed for wear.

NOTE: Install the plunger assemblies in the same bore from which they are removed.

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Disassembly (Cont'd)

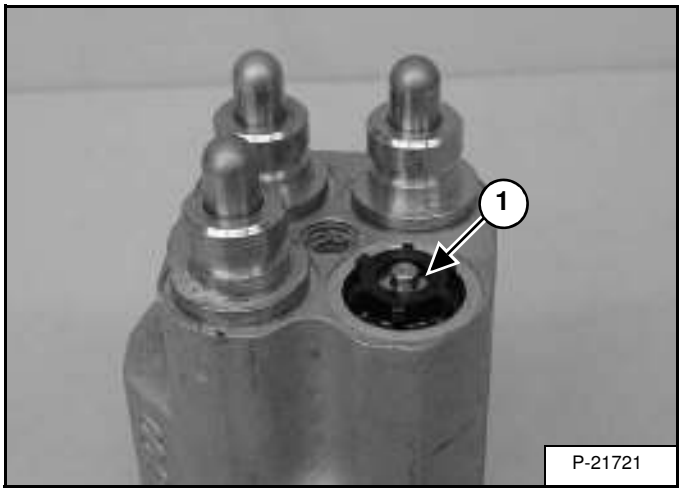
Figure 20-111-36



Remove the push rod (Item 1) from the plunger body (Item 2) **[Figure 20-111-36]**.

Remove the O-ring (Item 3) from the outside of the plug if damaged. Check the O-ring (Item 3) **[Figure 20-111-36]** for wear and replace as needed.

Figure 20-111-37



Remove the spool assembly (Item 1) **[Figure 20-111-37]**.

NOTE: Install the spool assembly in the same bore from which they are removed.

Figure 20-111-38

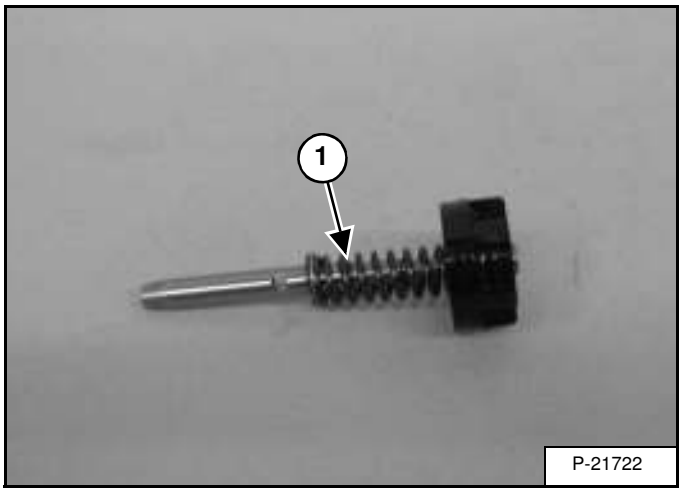
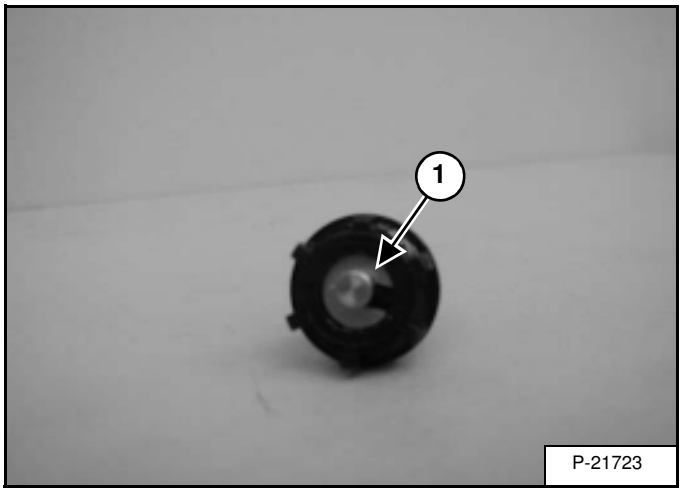


Figure 20-111-39

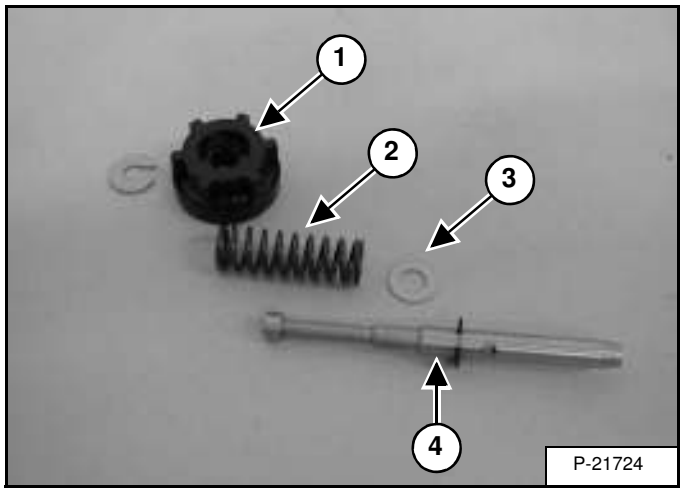


Compress the spring (Item 1) **[Figure 20-111-38]** and remove the C-clip (Item 1) **[Figure 20-111-39]** from the end of the spool.

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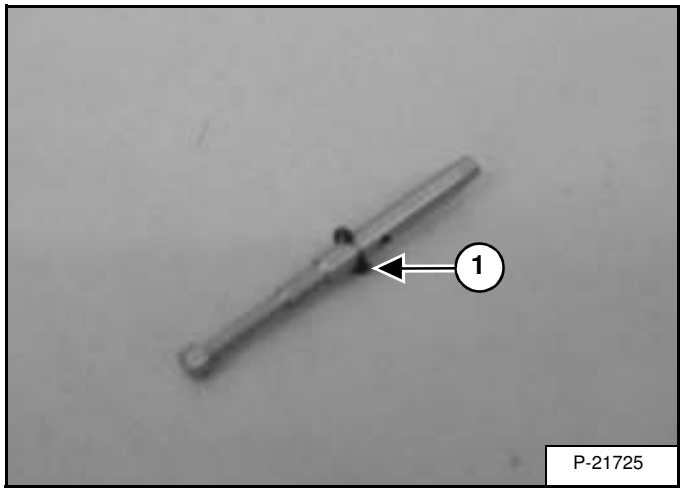
Disassembly (Cont'd)

Figure 20-111-40



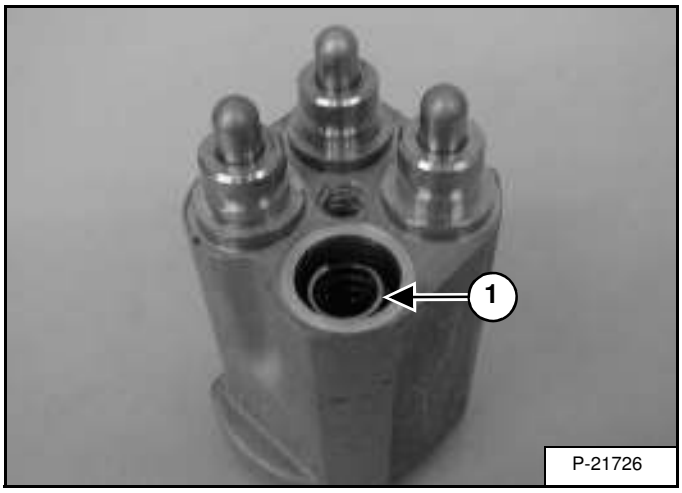
Remove the spring seat (Item 1), the spring (Item 2) and washer (Item 3) from the spool (Item 4) **[Figure 20-111-40]**.

Figure 20-111-41



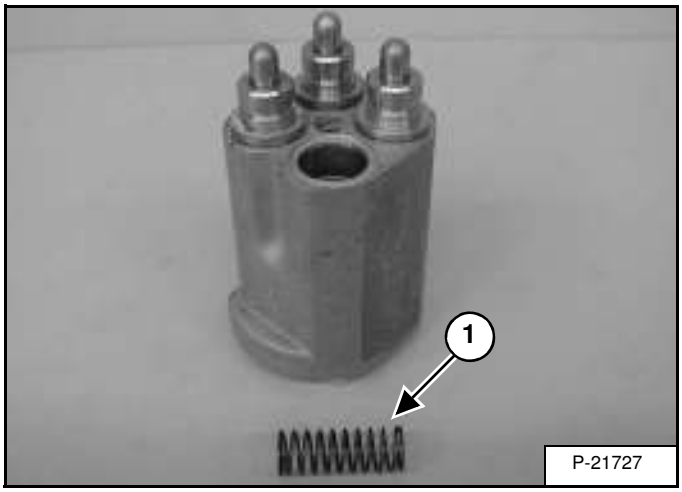
Check the clip (Item 1) **[Figure 20-111-41]** for wear and replace as needed.

Figure 20-111-42



Remove the centering spring (Item 1) **[Figure 20-111-42]** from the joystick body.

Figure 20-111-43



Check the centering spring (Item 1) **[Figure 20-111-43]** for wear and replace as needed.

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LEFT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE)

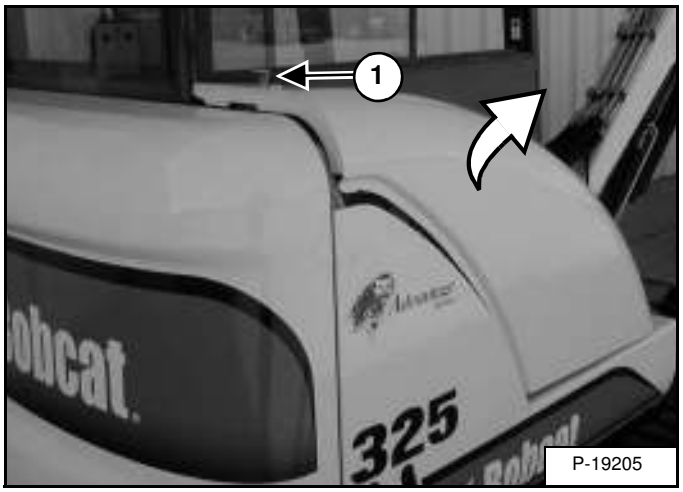
Testing

The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

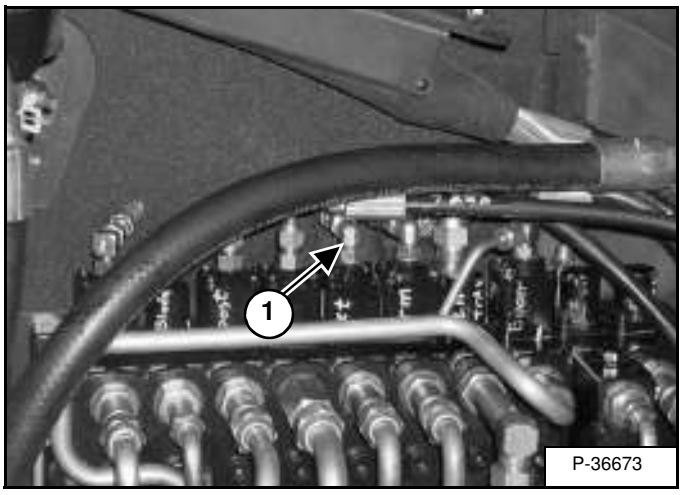
Stop the engine.

Figure 20-112-1



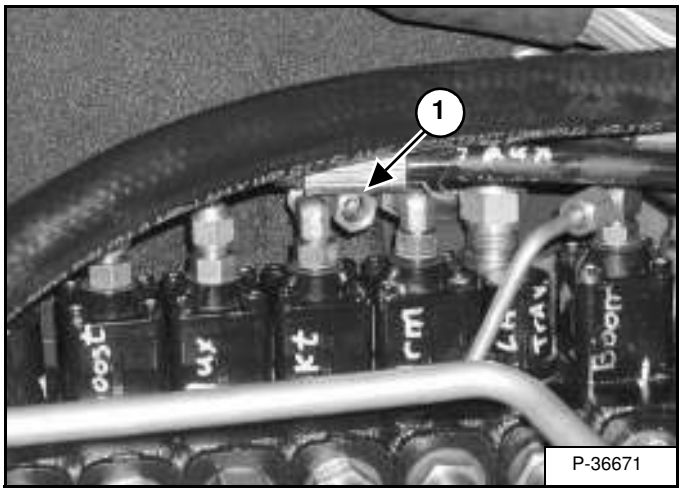
Open the right side access cover (Item 1) **[Figure 20-112-1]**.

Figure 20-112-2



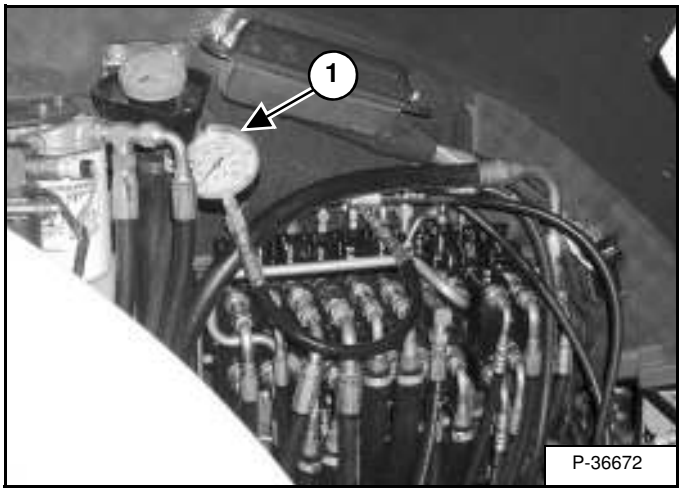
At the control valve assembly (Item 1) **[Figure 20-112-2]**, find the pilot line of the control lever (joystick) that is to be checked. (Boom, Arm, Boom Offset, Bucket.)

Figure 20-112-3



Disconnect the hydraulic hose (Item 1) **[Figure 20-112-3]** from the control valve.

Figure 20-112-4



From the test kit install a 1000 PSI (6896 kPa) gauge (Item 1) **[Figure 20-112-4]** on the pilot line.

Start the excavator, and warm the hydraulic oil to operating temperature.

Engage the blade raise circuit until the blade is fully raised. Continue to engage the blade circuit and engage the circuit to be tested. Record the operating pressure.

The operating target pressure is 428 PSI (2951 kPa) with an acceptable range of 406-450 PSI (2799-3103 kPa).

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LEFT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

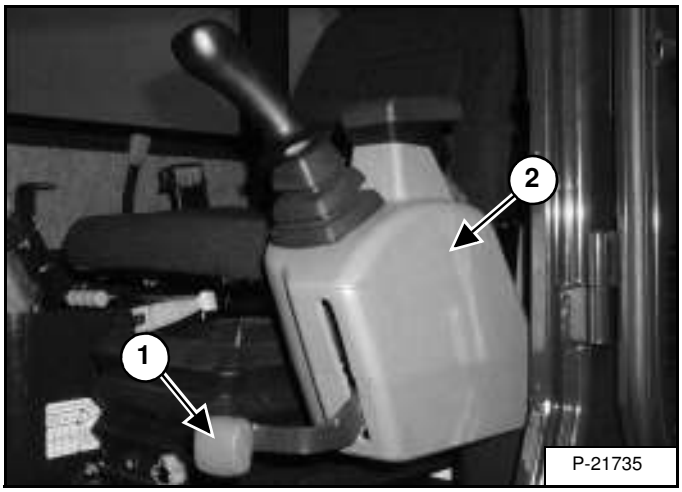
Testing (Cont'd)

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 20-33-3.)

If the pressure is still incorrect replace the pressure reducing valve. (See Testing And Adjusting The Pressure Reducing Valve on Page 20-33-3.)

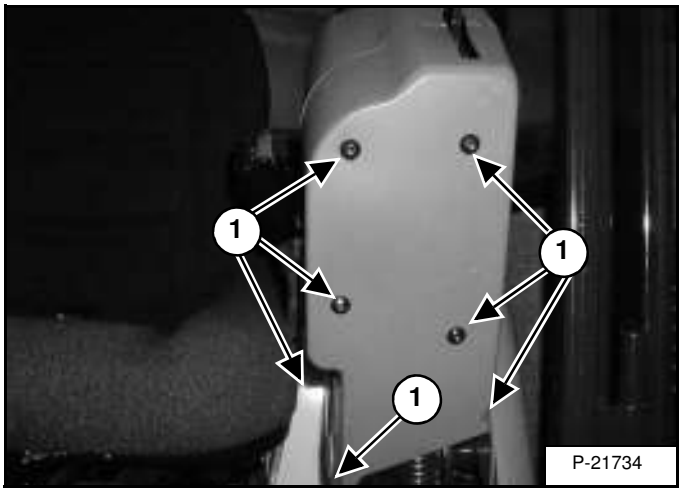
Handle Removal And Installation

Figure 20-112-5



In the operator cab, at the left side operator console, lift the lever (Item 1) and raise the console (Item 2) **[Figure 20-112-5]**.

Figure 20-112-6

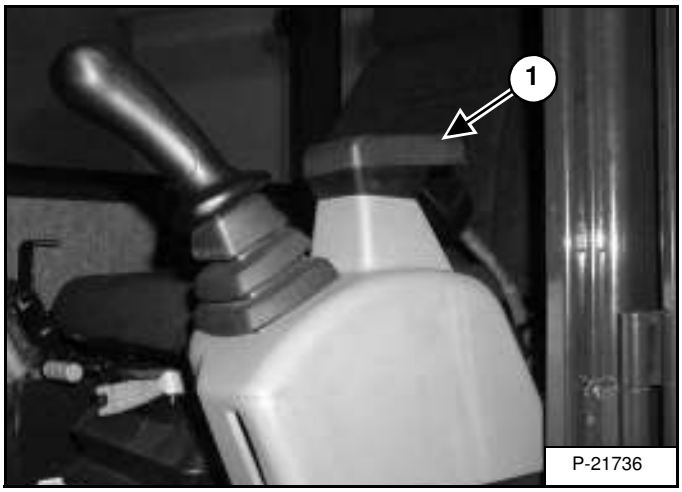


Remove the seven mounting bolts (Item 1) **[Figure 20-112-6]** from the lower half of the operator console.

Remove the lower half of the console.

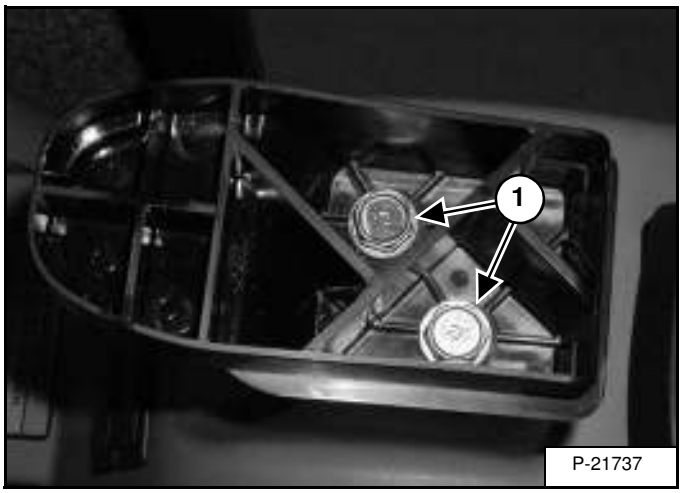
Lower the console.

Figure 20-112-7



Remove the cover (Item 1) **[Figure 20-112-7]** from the arm rest.

Figure 20-112-8



Remove the two mount bolts (Item 1) **[Figure 20-112-8]** from the arm rest.

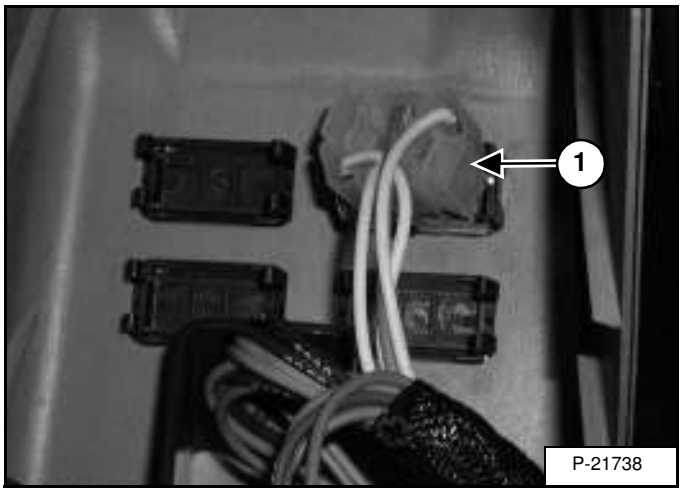
Remove the arm rest.

Raise the upper half of the console cover.

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Handle Removal And Installation (Cont'd)

Figure 20-112-9

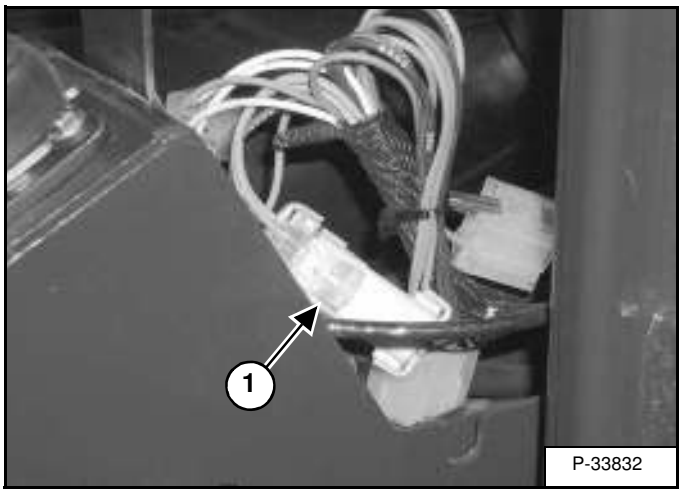


Disconnect the electrical connector (Item 1) **[Figure 20-112-9]**.

NOTE: These connectors are keyed so they can be plugged in only one way.

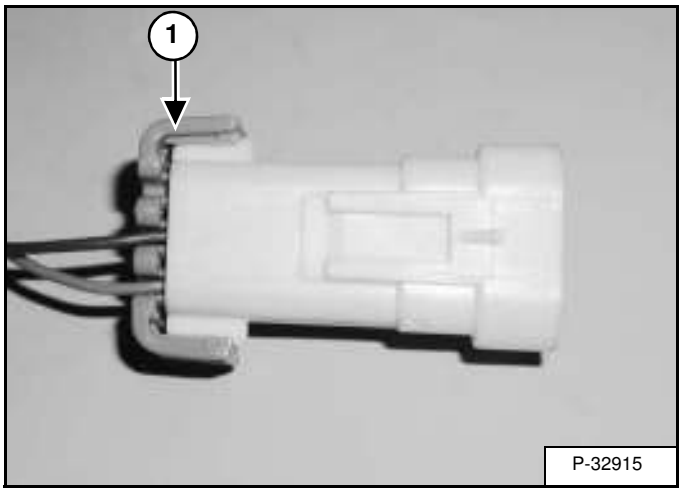
Remove the console cover.

Figure 20-112-10



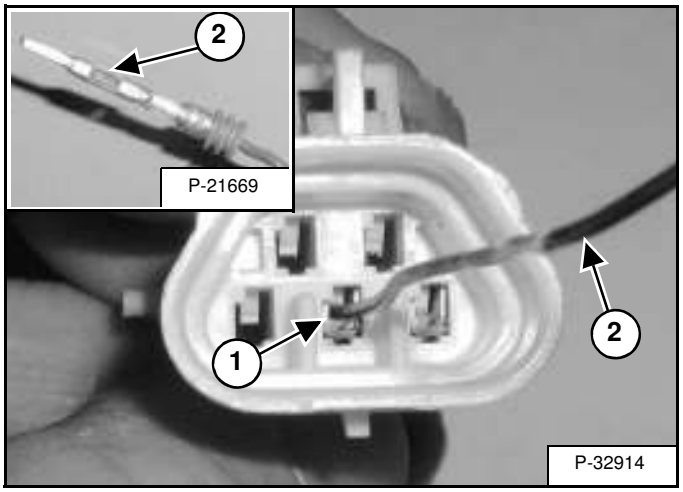
Disconnect the joystick wire connector (Item 1) **[Figure 20-112-10]** from the wire harness.

Figure 20-112-11



Remove the lock (Item 1) **[Figure 20-112-11]** from the joystick electrical connector.

Figure 20-112-12



Using a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 20-112-12]**.

Carefully remove the individual wires from the back of the electrical connector.

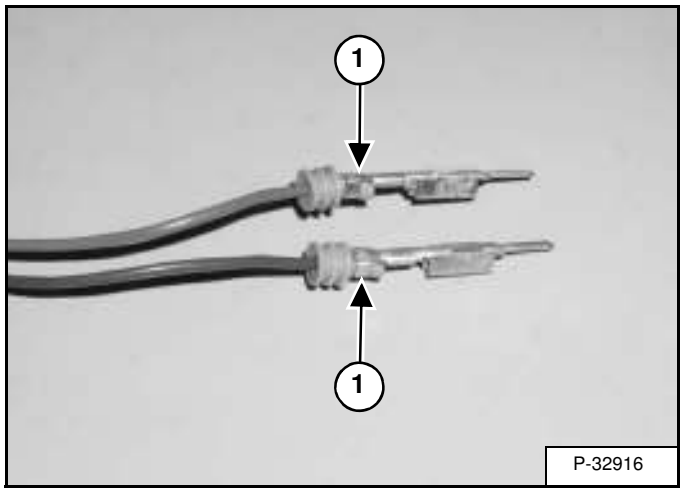
Remove the control handle (joystick) assembly from the excavator.

Installation: Use a small piece of wire and rebend the tab (inset Item 2) **[Figure 20-112-12]** on each wire before installing in the electrical connector.

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Handle Removal And Installation (Cont'd)

Figure 20-112-13

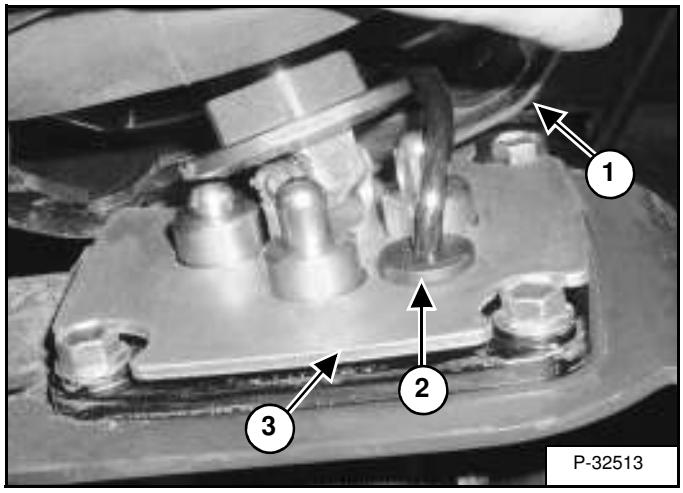


Installation: The wires **[Figure 20-112-13]** must be installed in the proper locations in the wire connector, listed below.

C Red
D Black

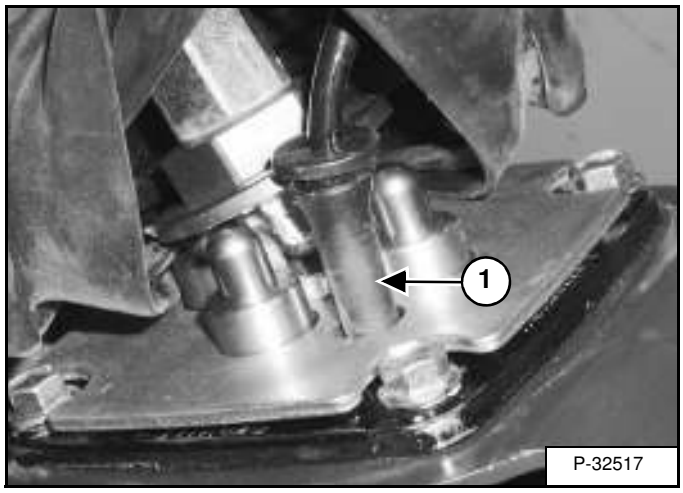
Check each wire to be certain the tab locks (Item 1) **[Figure 20-112-13]** into position.

Figure 20-112-14



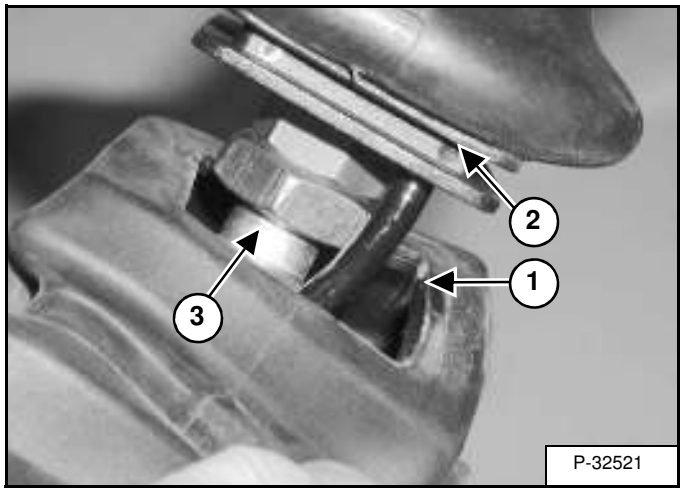
Raise the dust boot (Item 1) and pull the grommet (Item 2) up thru the mount plate (Item 3) **[Figure 20-112-14]**.

Figure 20-112-15



Remove the grommet and wire (Item 1) **[Figure 20-112-15]** from the mount plate.

Figure 20-112-16



Remove the joystick boot (Item 1) **[Figure 20-112-16]** from the joystick handle.

Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-112-16]**.

Hold the dust boot down and loosen the jam nut (Item 3) **[Figure 20-112-16]**.

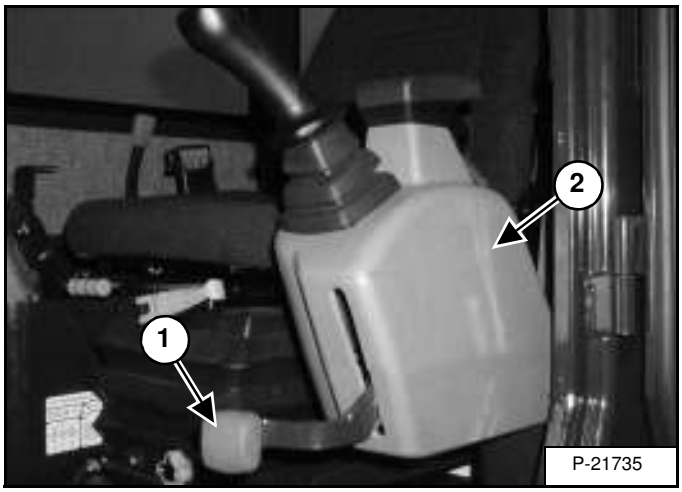
Remove the handle.

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LEFT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

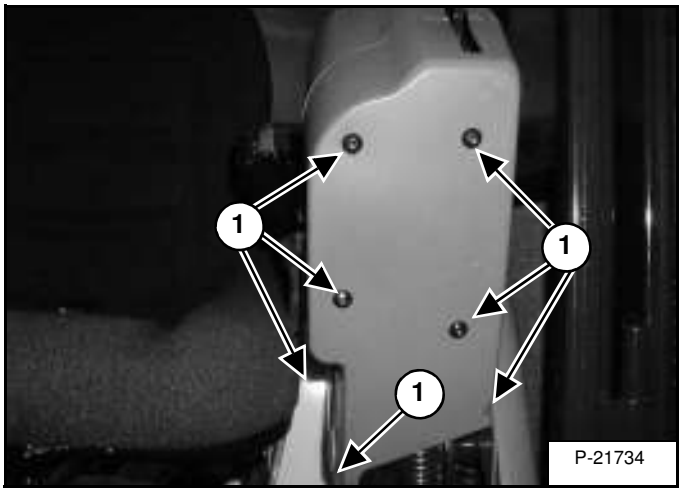
Joystick Assembly Removal And Installation

Figure 20-112-17



In the operator cab, at the left side operator console, lift the lever (Item 1) and raise the console (Item 2) **[Figure 20-112-17]**.

Figure 20-112-18

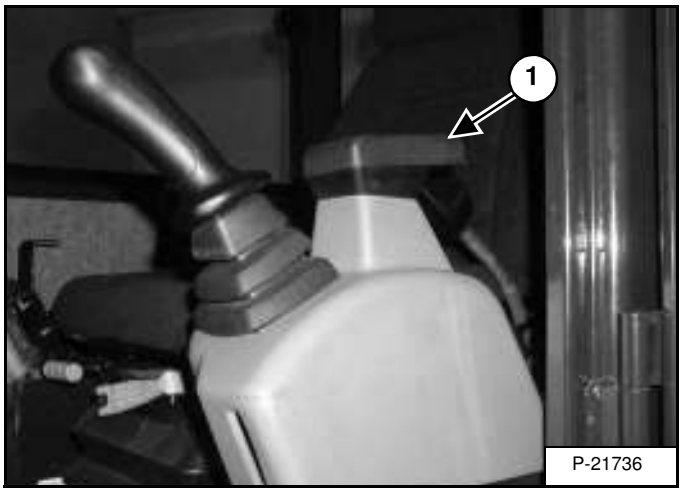


Remove the seven mounting bolts (Item 1) **[Figure 20-112-18]** from the lower half of the operator console.

Remove the lower half of the console.

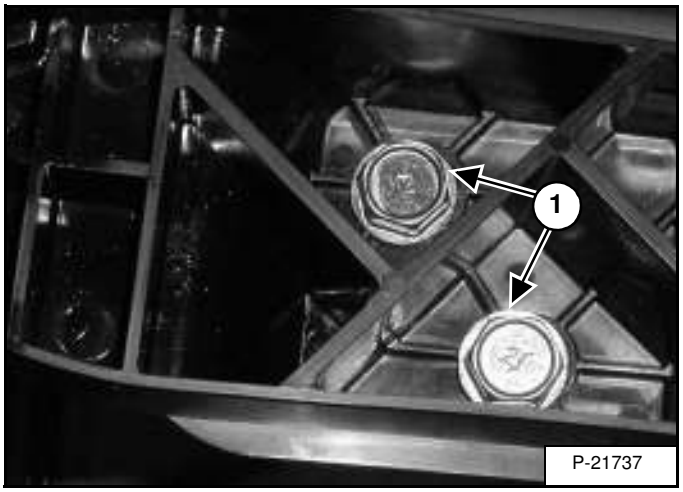
Lower the console.

Figure 20-112-19



Remove the cover (Item 1) **[Figure 20-112-19]** from the arm rest.

Figure 20-112-20



Remove the two mount bolts (Item 1) **[Figure 20-112-20]** from the arm rest.

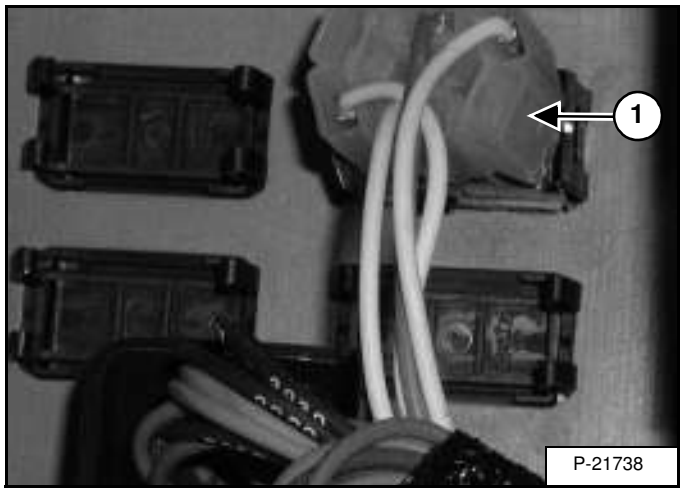
Remove the arm rest.

Raise the upper half of the console cover.

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Joystick Assembly Removal And Installation (Cont'd)

Figure 20-112-21

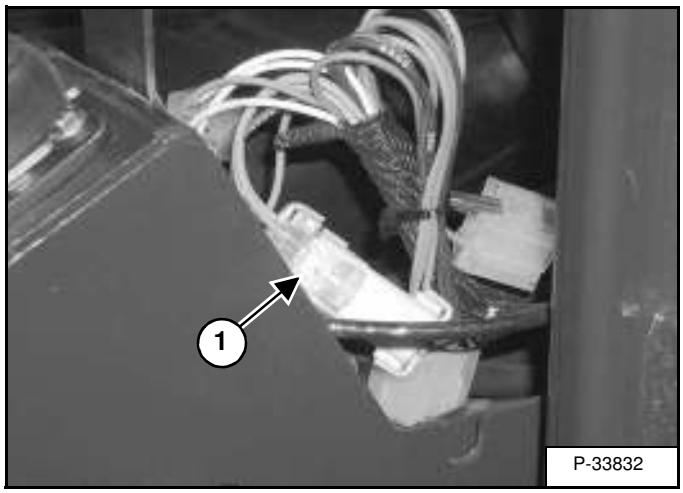


Disconnect the electrical connector (Item 1) **[Figure 20-112-21]**.

NOTE: These connectors are keyed so they can be plugged in only one way.

Remove the console cover.

Figure 20-112-22



Disconnect the electrical connector (Item 1) **[Figure 20-112-22]**.

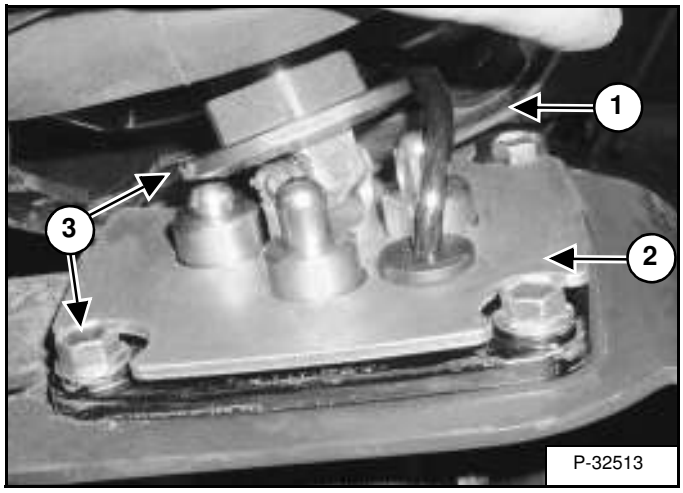
Figure 20-112-23



Mark the hoses for correct installation **[Figure 20-112-23]**.

Remove and cap the hose connections while the control lever (joystick) is bolted to the console **[Figure 20-112-23]**.

Figure 20-112-24



Raise the dust boot (Item 1) up from the mounting plate (Item 2) **[Figure 20-112-24]**.

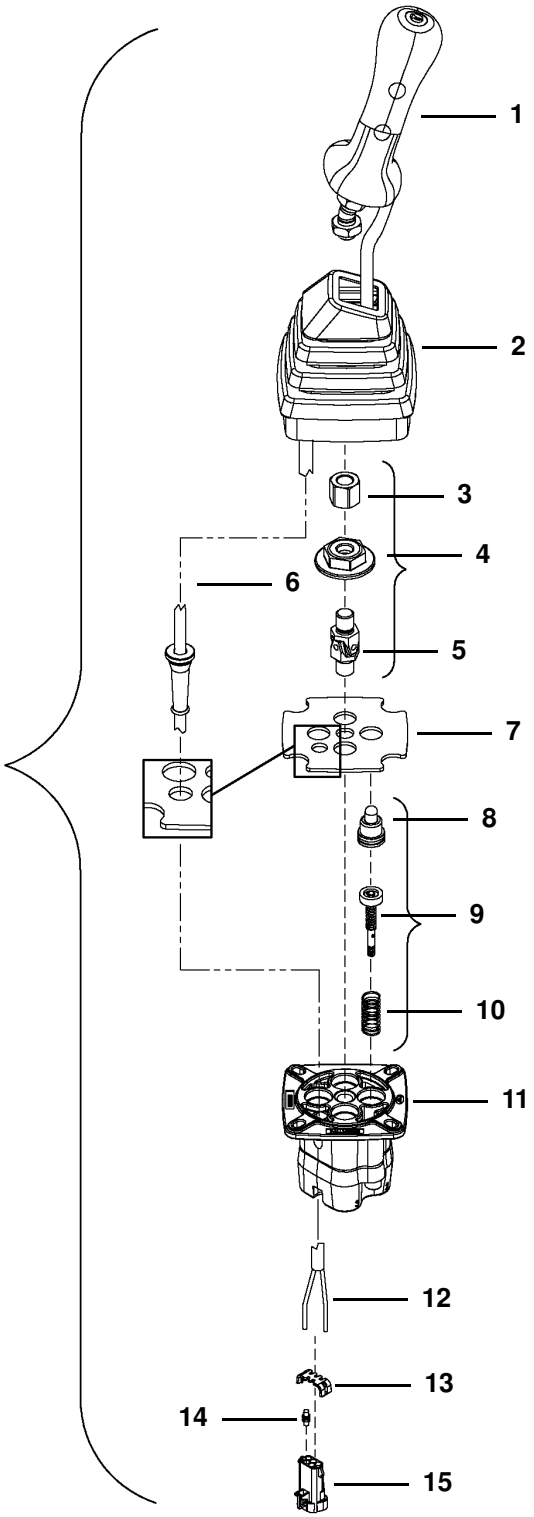
Remove the four bolts (Item 3) **[Figure 20-112-24]** from the control lever (joystick) mounting plate.

Remove the control lever (joystick).

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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. Pin
15. Connector



MS1354

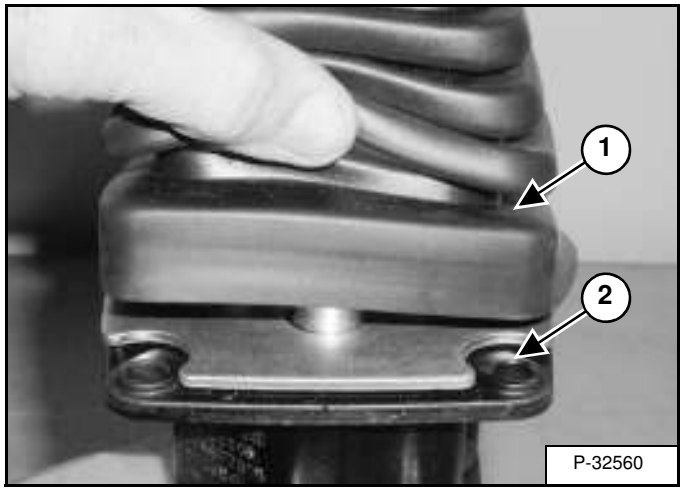
Dealer Copy -- Not for Resale

LEFT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

Disassembly

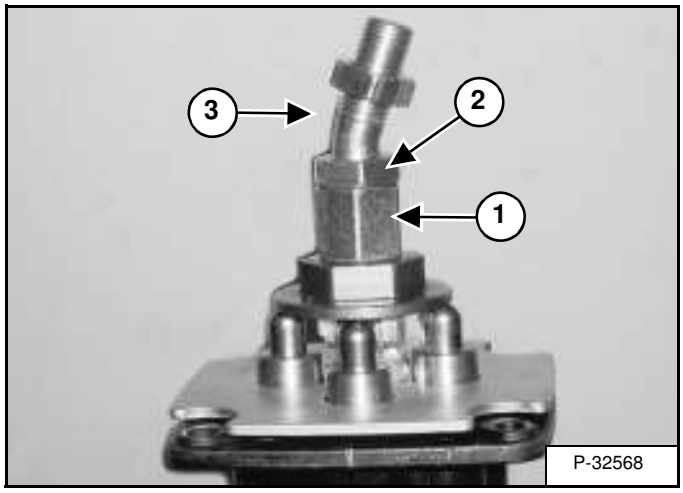
Remove the left handle. (See Handle Removal And Installation on Page 20-111-2.)

Figure 20-112-25



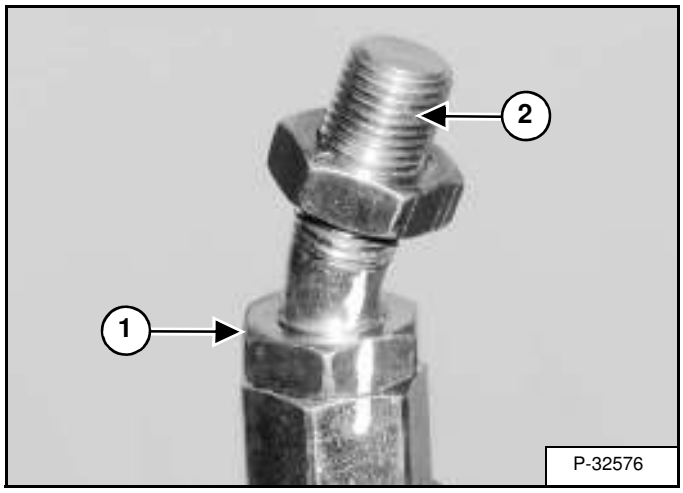
Remove the dust boot (Item 1) from the control lever (joystick) (Item 2) **[Figure 20-112-25]**.

Figure 20-112-26



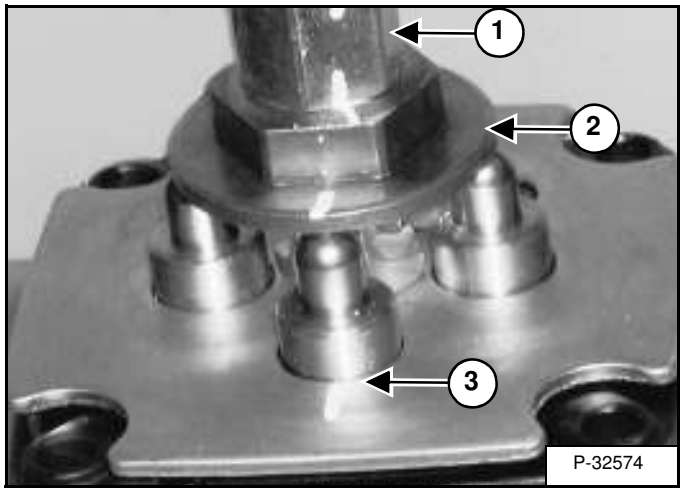
Mark the coupler (Item 1), jam nut (Item 2) and connector (Item 3) **[Figure 20-112-26]** for correct realignment.

Figure 20-112-27



Loosen the jam nut (Item 1) and remove the connector (Item 2) **[Figure 20-112-27]**.

Figure 20-112-28

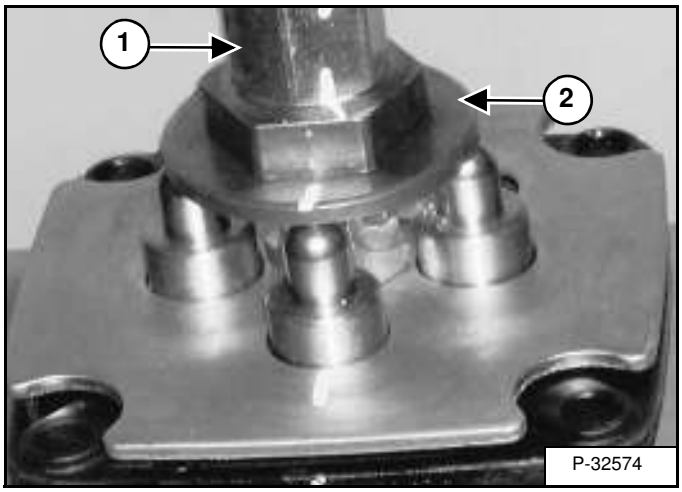


Mark the coupler (Item 1), control plate (Item 2) and plunger (Item 3) **[Figure 20-112-28]** for correct realignment.

Dealer Copy -- Not for Resale

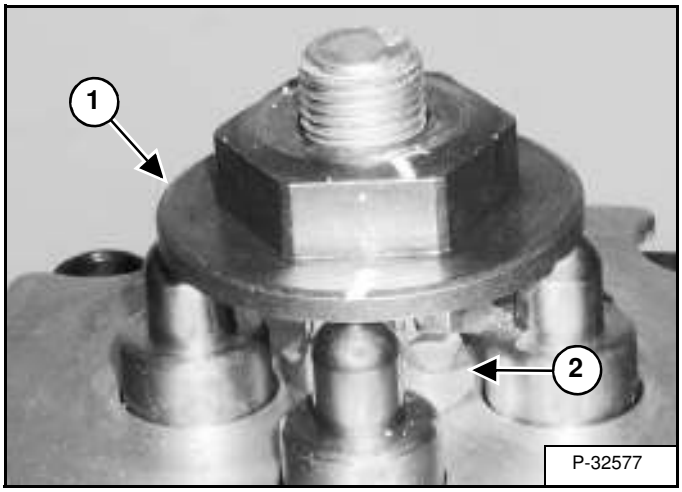
Disassembly (Cont'd)

Figure 20-112-29



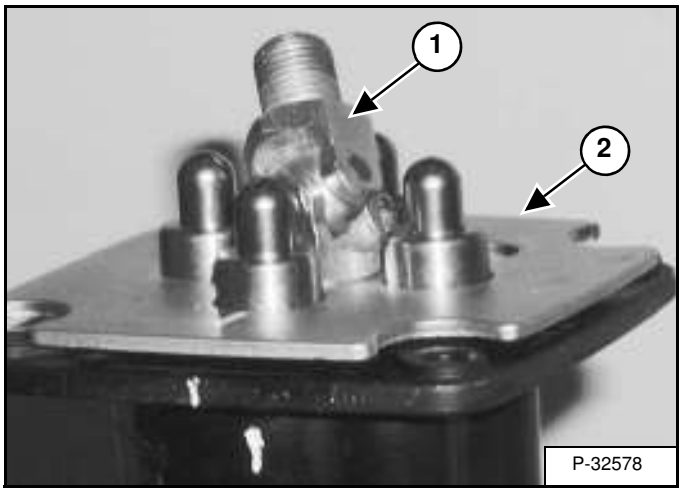
Loosen and remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-112-29]**.

Figure 20-112-30



Loosen and remove the control plate (Item 1) from the U-joint (Item 2) **[Figure 20-112-30]**.

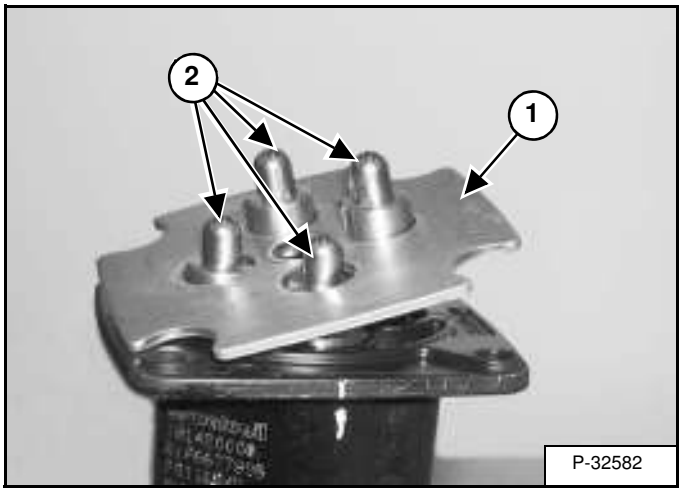
Figure 20-112-31



Mark the plate and housing for correct installation. Loosen and remove the U-joint (Item 1) **[Figure 20-112-31]**.

NOTE: The plate (Item 2) [Figure 20-112-31] is spring loaded and will come up as the U-joint is removed.

Figure 20-112-32



Remove the plate (Item 1) **[Figure 20-112-32]**.

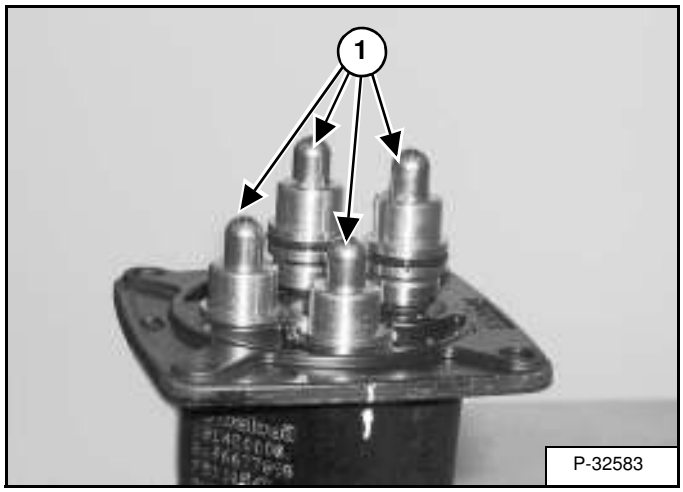
NOTE: Use care while removing the plate. The plungers (Item 2) [Figure 20-112-32] are spring loaded.

Dealer Copy -- Not for Resale

LEFT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

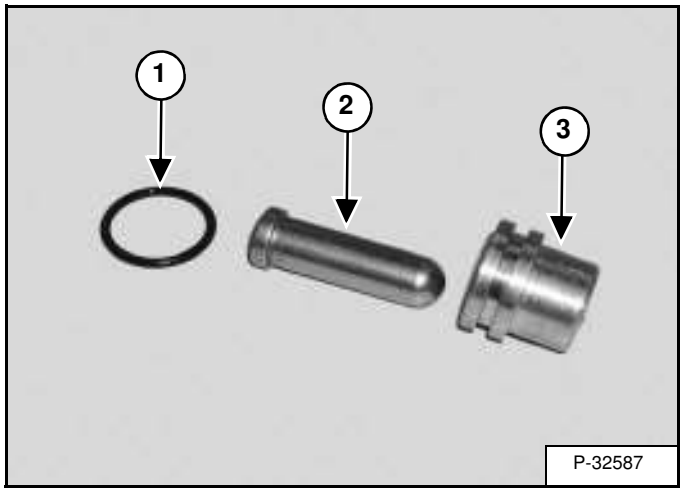
Disassembly (Cont'd)

Figure 20-112-33



Remove the four plunger assemblies (Item 1) **[Figure 20-112-33]**.

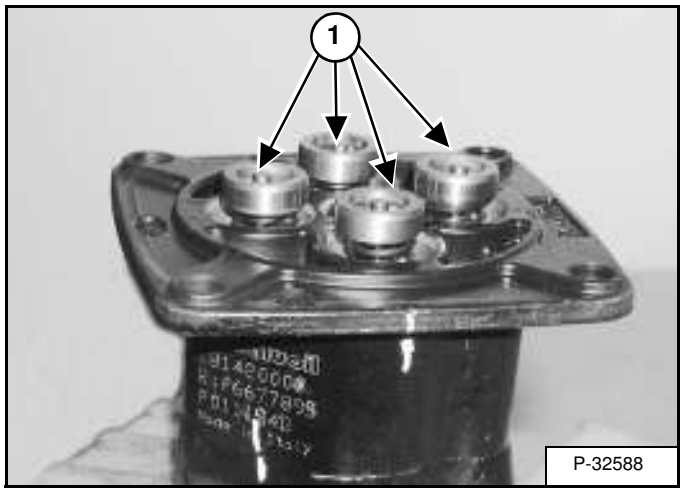
Figure 20-112-34



Remove the O-ring (Item 1) and rod (Item 2) from the bushing (Item 3) **[Figure 20-112-34]**.

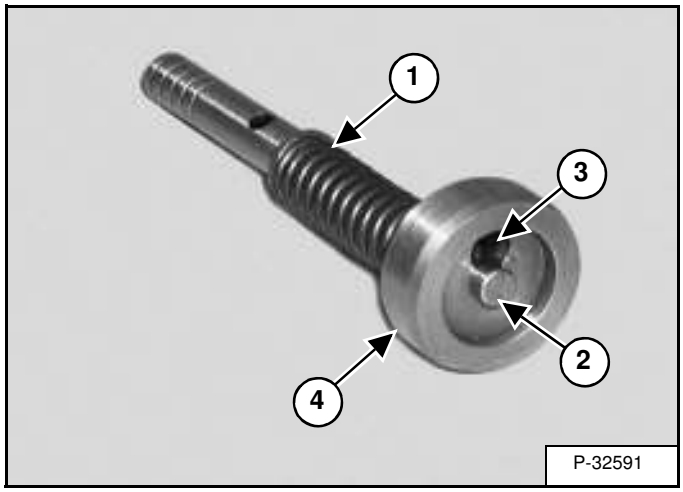
NOTE: Mark the spool assemblies for installation in their original location.

Figure 20-112-35



Remove the four spool assemblies (Item 1) **[Figure 20-112-35]**.

Figure 20-112-36



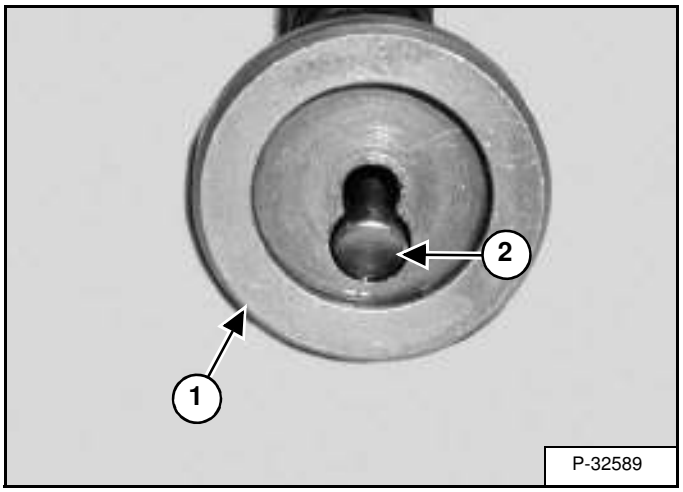
Compress the spring (Item 1) until the end of the spool (Item 2) can be aligned with the offset hole (Item 3) in the washer (Item 4) **[Figure 20-112-36]**.

Dealer Copy -- Not for Resale

LEFT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

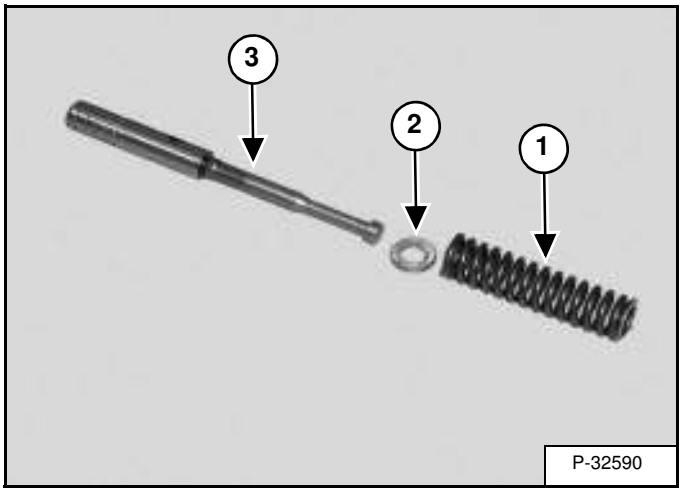
Disassembly (Cont'd)

Figure 20-112-37



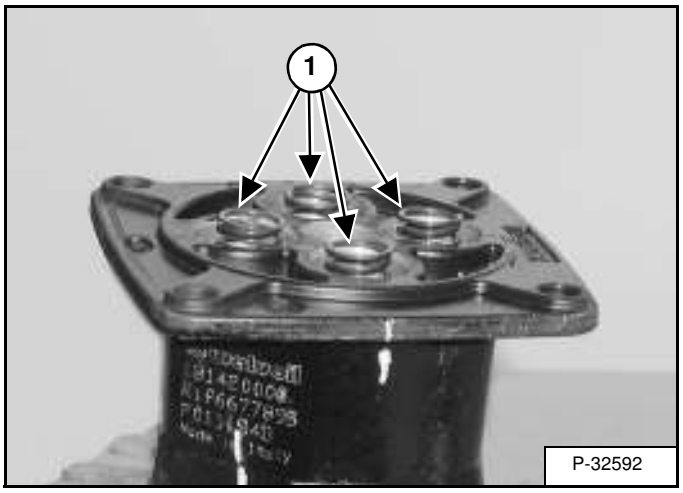
Remove the washer (Item 1) from the spool (Item 2) **[Figure 20-112-37]**.

Figure 20-112-38



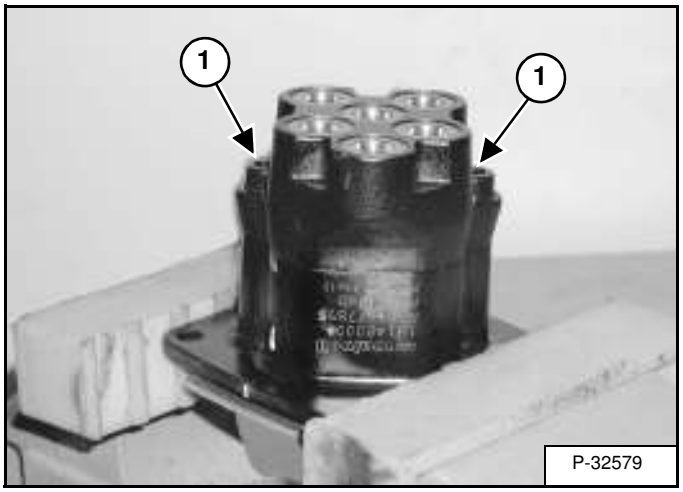
Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-112-38]**.

Figure 20-112-39



Remove the four springs (Item 1) **[Figure 20-112-39]** from the housing.

Figure 20-112-40



Clamp the housing in a vise **[Figure 20-112-40]**. Use care not to damage the housing.

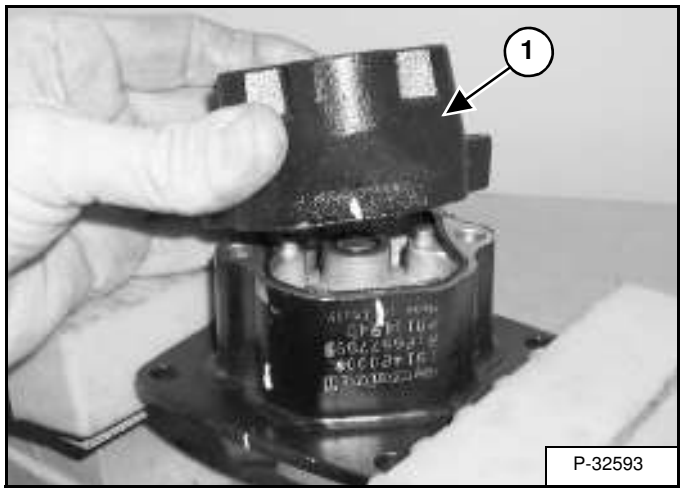
Remove the two bolts (Item 1) **[Figure 20-112-40]**.

Dealer Copy -- Not for Resale

LEFT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

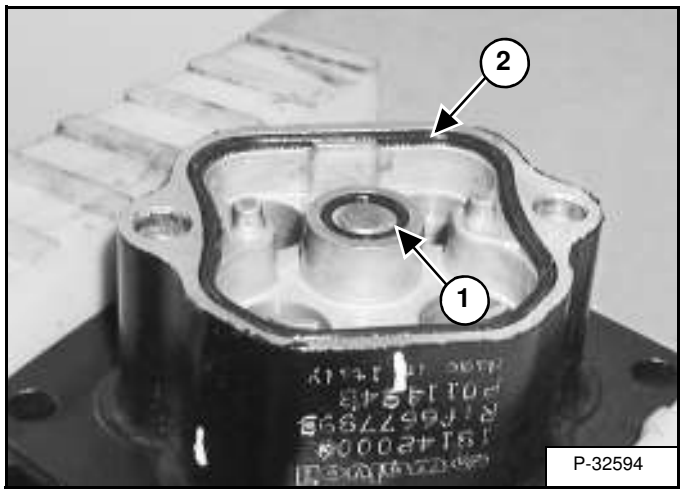
Disassembly (Cont'd)

Figure 20-112-41



Remove the end cap (Item 1) **[Figure 20-112-41]**.

Figure 20-112-42



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-112-42]**.

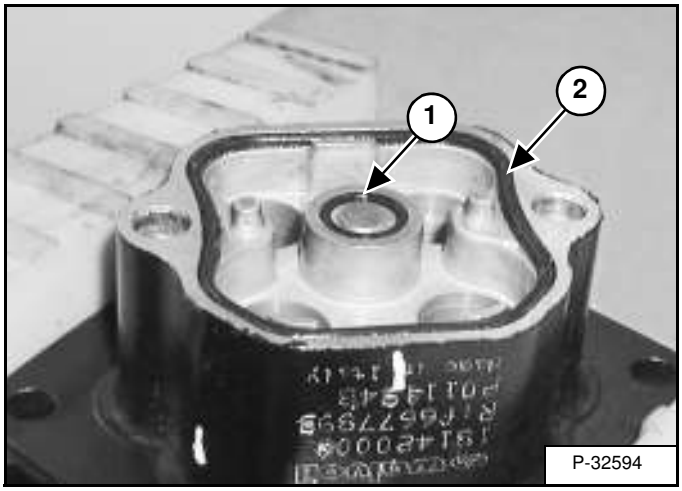
Assembly

Clean all parts in solvent and dry with compressed air. Inspect the push rod crown for wear. Replace all components showing excessive wear.

Always install new seals and O-rings.

Lubricate the components with clean hydraulic oil during installation.

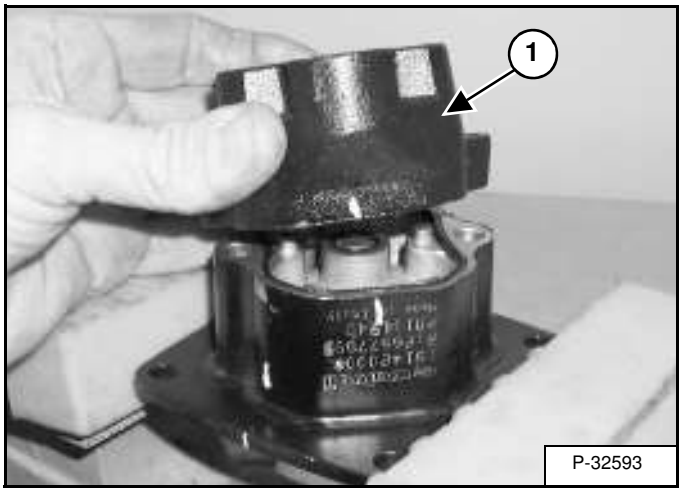
Figure 20-112-43



Clamp the housing in a vise. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-112-43]**.

NOTE: Use care not to damage the housing.

Figure 20-112-44

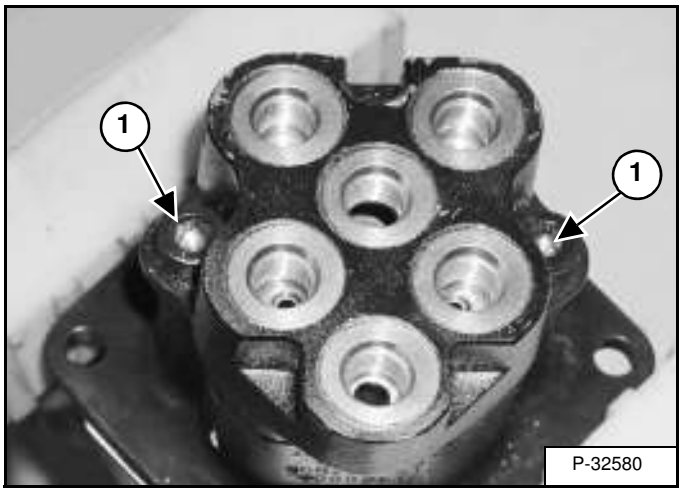


Install the end cap (Item 1) **[Figure 20-112-44]**.

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Assembly (Cont'd)

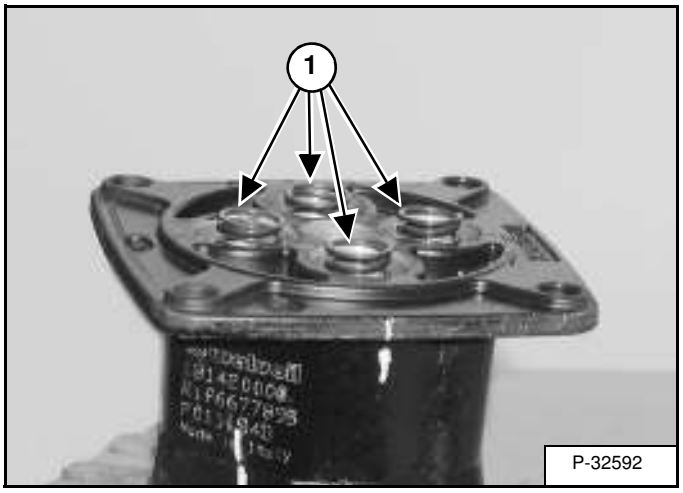
Figure 20-112-45



Install the two bolts (Item 1) **[Figure 20-112-45]**.

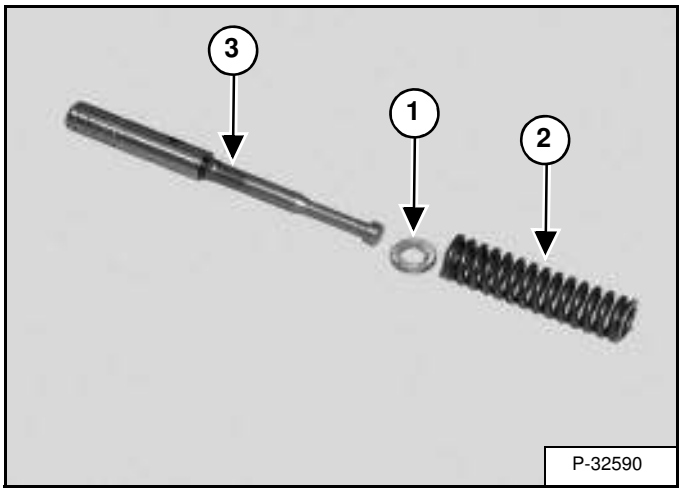
Turn the housing over.

Figure 20-112-46



Install the four springs (Item 1) **[Figure 20-112-46]**.

Figure 20-112-47



Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-112-47]**.

Dealer Copy -- Not for Resale

LEFT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

Assembly (Cont'd)

Figure 20-112-48

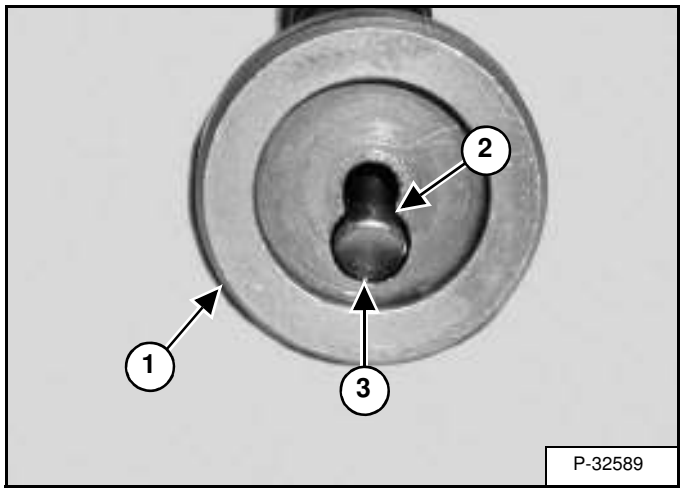
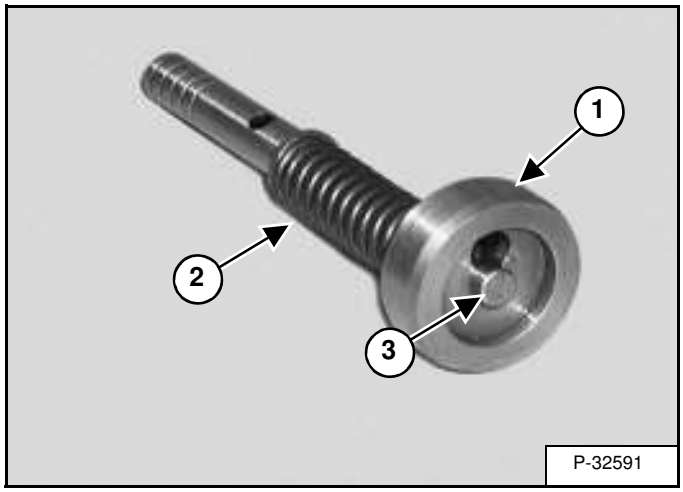


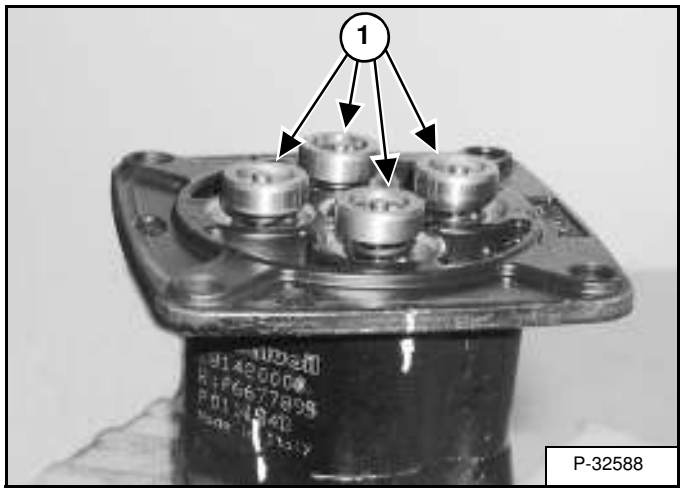
Figure 20-112-49



Install the washer (Item 1) **[Figure 20-112-48]** & **[Figure 20-112-49]** by compressing the spring (Item 2) **[Figure 20-112-49]** and pushing the end of the spool into the offset hole (Item 3) **[Figure 20-112-48]**.

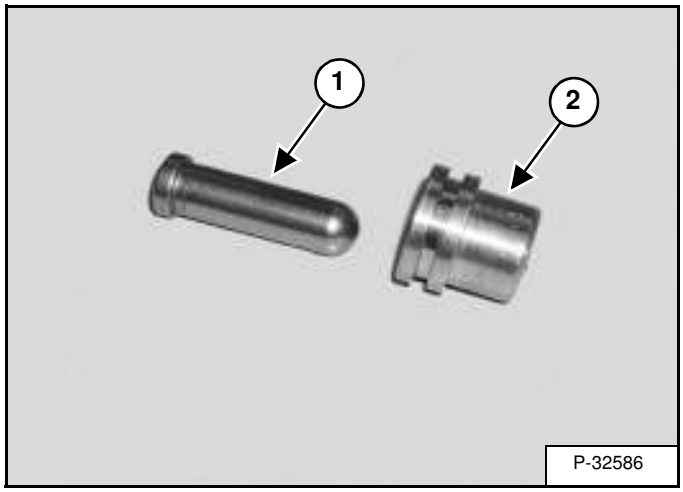
Center the end of the spool (Item 2) **[Figure 20-112-48]** in the washer (Item 3) **[Figure 20-112-49]**.

Figure 20-112-50



Install the four spool assemblies (Item 1) **[Figure 20-112-50]** into the housing.

Figure 20-112-51

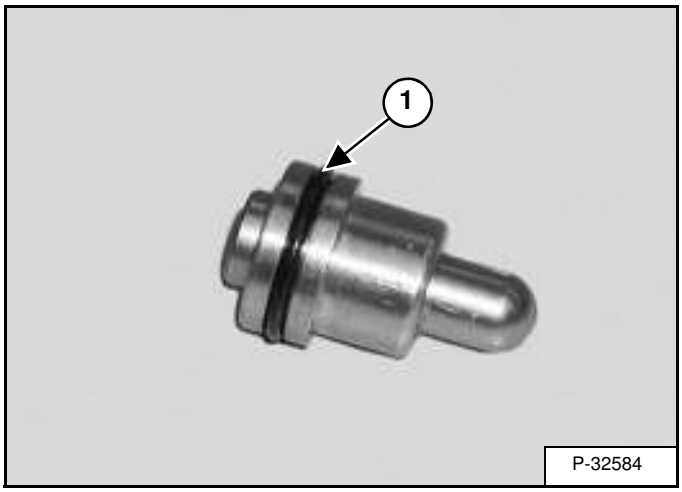


Install the rod (Item 1) into the bushing (Item 2) **[Figure 20-112-51]**.

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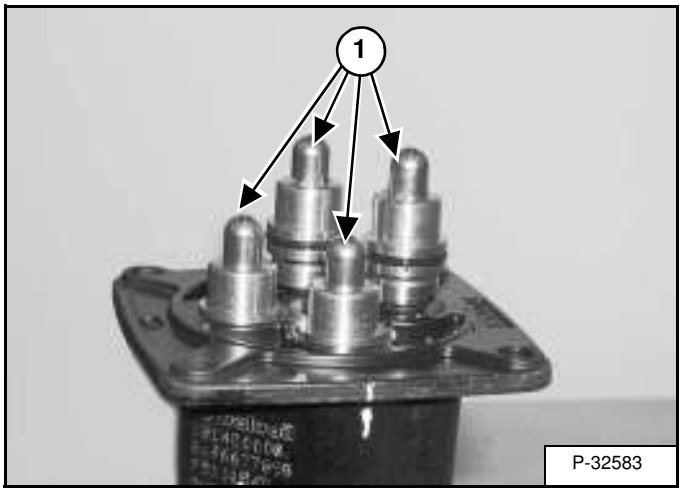
Assembly (Cont'd)

Figure 20-112-52



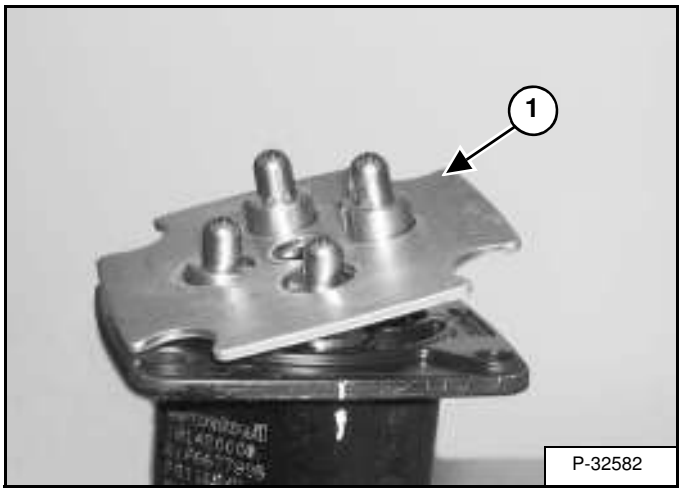
Install the O-ring (Item 1) **[Figure 20-112-52]** on the bushing.

Figure 20-112-53



Install the four rod assemblies (Item 1) **[Figure 20-112-53]** into the housing.

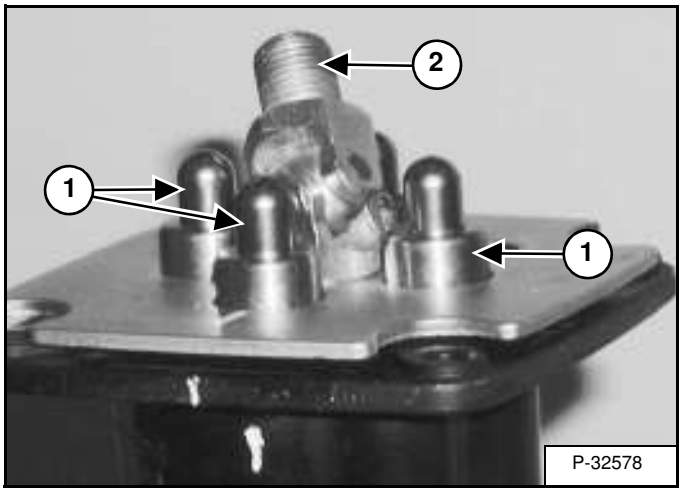
Figure 20-112-54



NOTE: Spring pressure can dislodge the rod assemblies until the plate (Item 1) [Figure 20-112-54] is secured in place.

Install the plate (Item 1) **[Figure 20-112-54]**.

Figure 20-112-55



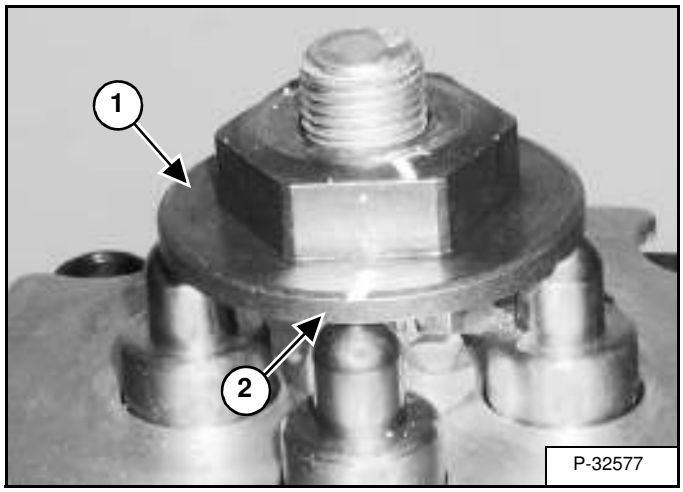
Ensure the plunger assemblies (Item 1) are fully seated and install the U-joint (Item 2) **[Figure 20-112-55]**.

Dealer Copy -- Not for Resale

LEFT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

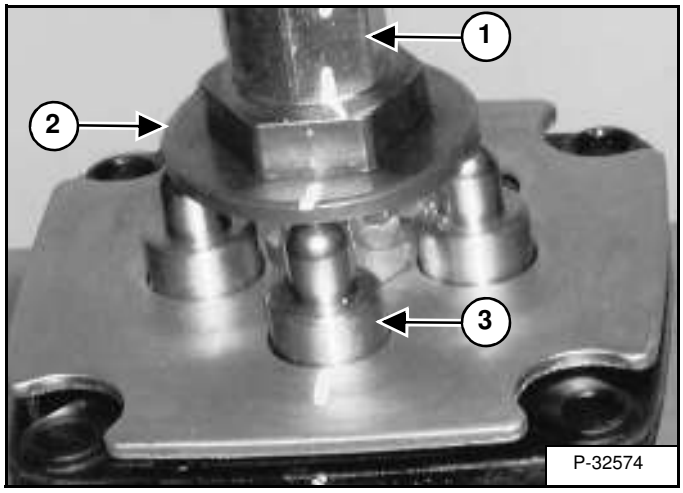
Assembly (Cont'd)

Figure 20-112-56



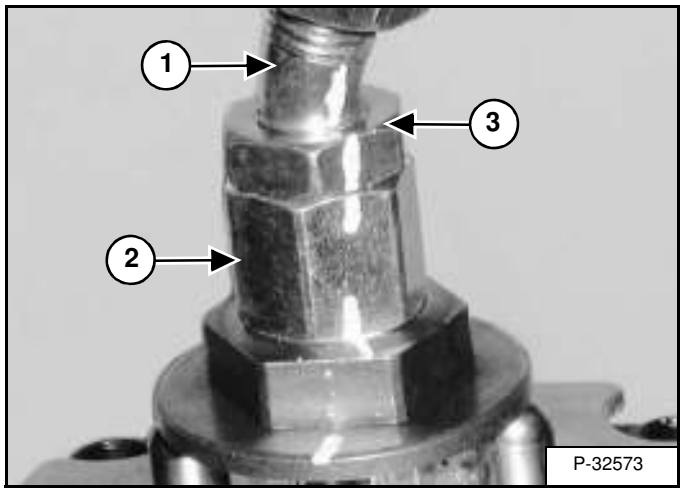
Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-112-56]**.

Figure 20-112-57



Align the coupler (Item 1) with the control plate (Item 2) and plunger (Item 3) **[Figure 20-112-57]** and tighten.

Figure 20-112-58



Install the connector (Item 1) **[Figure 20-112-58]**.

Align the connector with the coupler (Item 2) and tighten the jam nut (Item 3) **[Figure 20-112-58]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-112-59

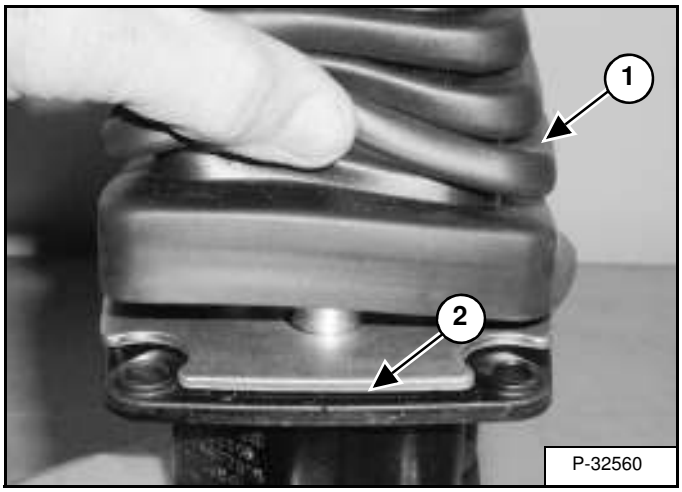
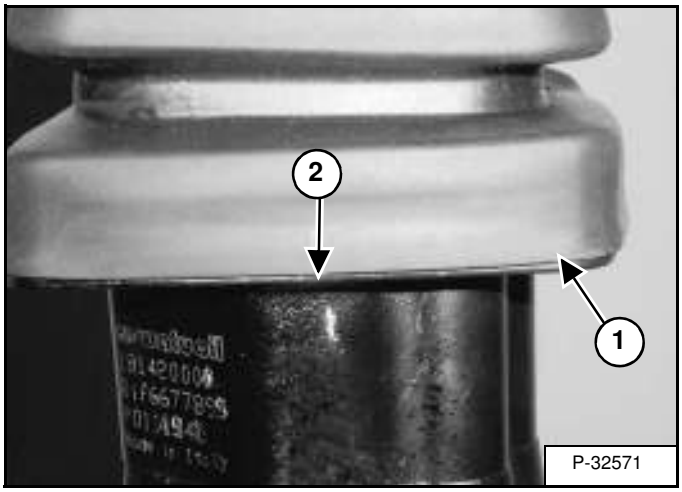


Figure 20-112-60



Install the dust boot (Item 1) **[Figure 20-112-59]** & **[Figure 20-112-60]** in the groove (Item 2) **[Figure 20-112-59]** & **[Figure 20-112-60]**.

Install the left handle. (See Handle Removal And Installation on Page 20-111-2.)

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RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE)

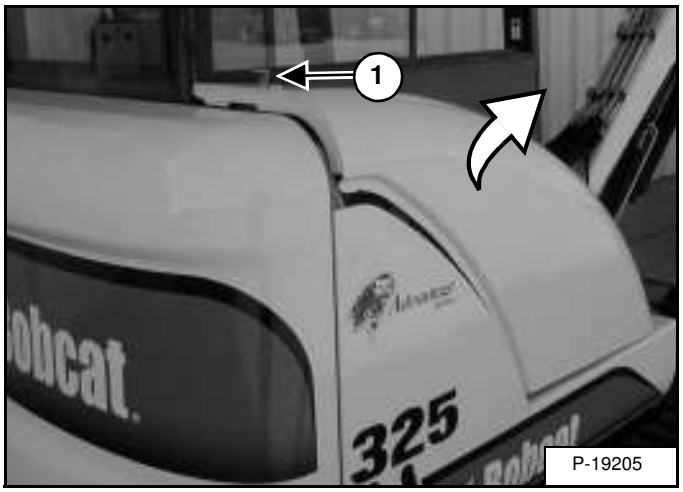
Testing

The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

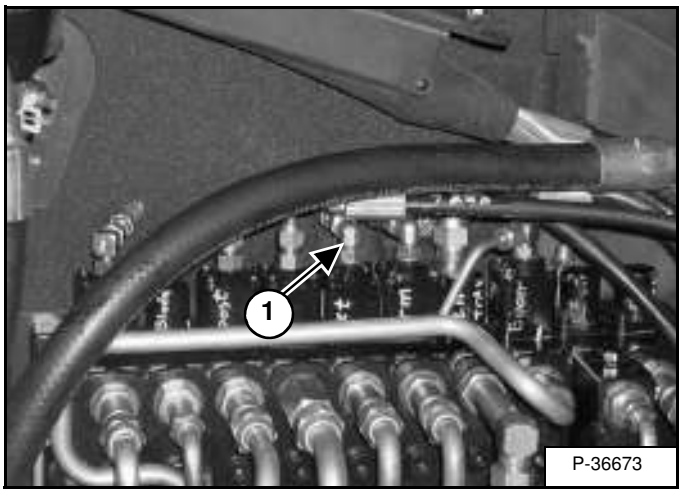
Stop the engine.

Figure 20-113-1



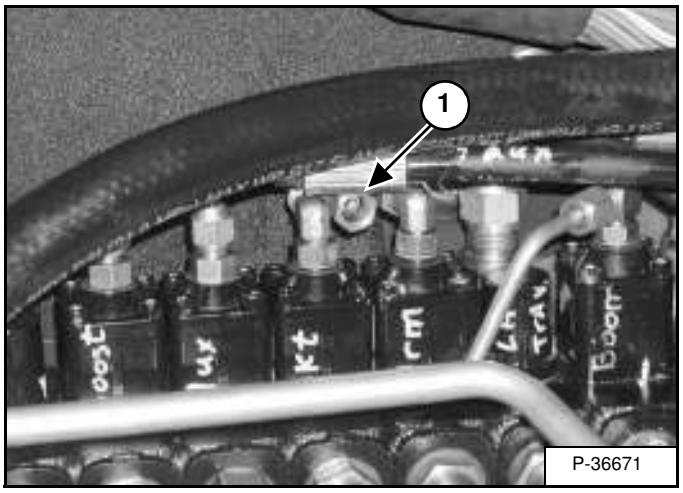
Open the right side access cover (Item 1) **[Figure 20-113-1]**.

Figure 20-113-2



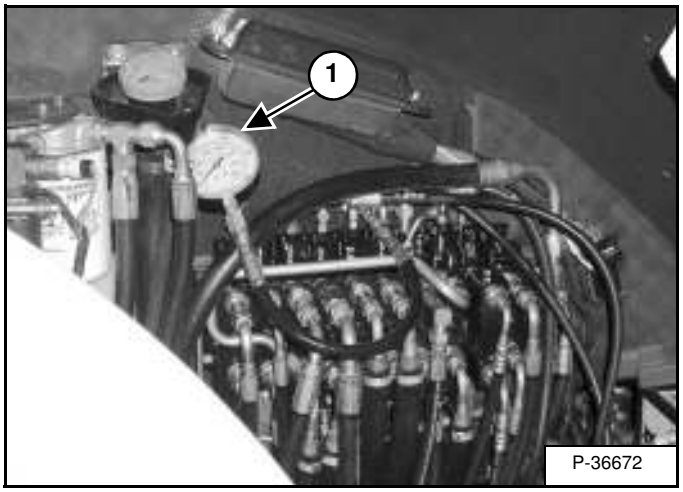
At the control valve assembly (Item 1) **[Figure 20-113-2]**, find the pilot line of the control lever (joystick) that is to be checked. (Boom, Arm, Boom Offset, Bucket.)

Figure 20-113-3



Disconnect the hydraulic hose (Item 1) **[Figure 20-113-3]** from the control valve.

Figure 20-113-4



From the test kit Install a 1000 PSI (6896 kPa) gauge (Item 1) **[Figure 20-113-4]** on the pilot line.

Start the excavator, and warm the hydraulic oil to operating temperature.

Engage the blade raise circuit until the blade is fully raised. Continue to engage the blade circuit and engage the circuit to be tested. Record the operating pressure.

The operating target pressure is 428 PSI (2951 kPa) with an acceptable range of 406-450 PSI (2799-3103 kPa).

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RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

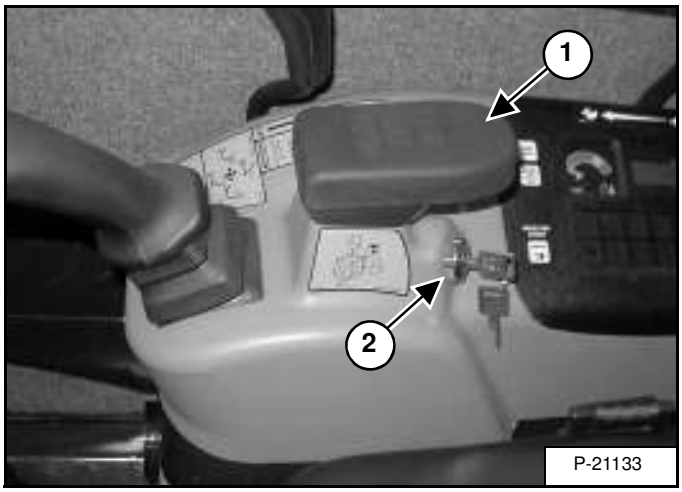
Testing (Cont'd)

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 20-33-3.)

If the pressure is still incorrect replace the pressure reducing valve. (See Testing And Adjusting The Pressure Reducing Valve on Page 20-33-3.)

Handle Removal And Installation

Figure 20-113-5

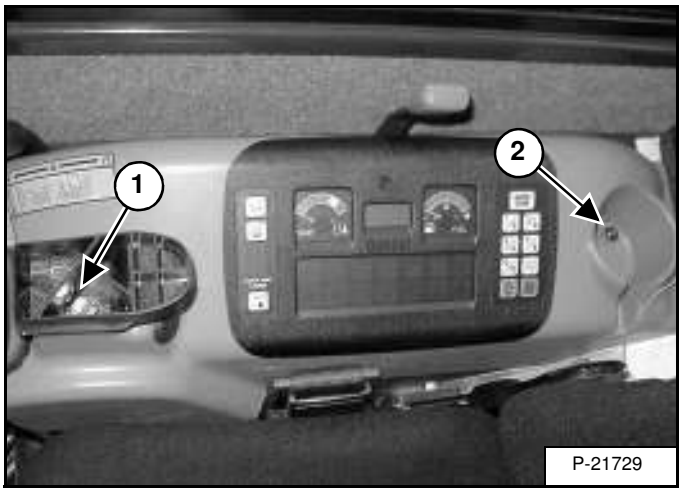


In the operator cab, at the right side operator console, remove the cover (Item 1) **[Figure 20-113-5]** from the arm rest by lifting up on the rear of the cover and sliding the cover ahead.

Remove the key and nut from the key switch (Item 2) **[Figure 20-113-5]** (if equipped). Allow the switch to drop inside the console.

NOTE: The key switch must be removed to remove and install the console cover.

Figure 20-113-6



Remove the two mount bolts (Item 1) **[Figure 20-113-6]** from the arm rest.

Remove the arm rest.

Remove the screw (Item 2) **[Figure 20-113-6]** from the cup holder.

Lift the console cover up and over the joystick lever.

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RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

Handle Removal And Installation (Cont'd)

Figure 20-113-7

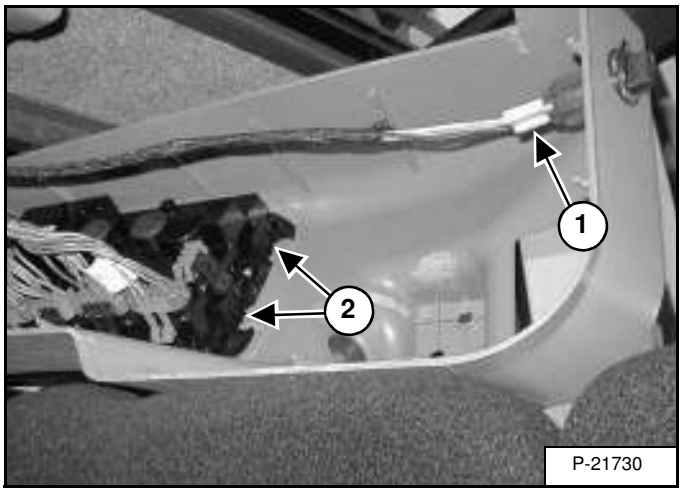


Figure 20-113-8



Key switch equipped machines perform **[Figure 20-113-7]** ***&*** **[Figure 20-113-8]** ***also.***

Disconnect the accessory outlet electrical connector (Item 1) **[Figure 20-113-7]**.

Remove the controller from the console cover by pressing the mounting tabs (Item 2) **[Figure 20-113-7]**.

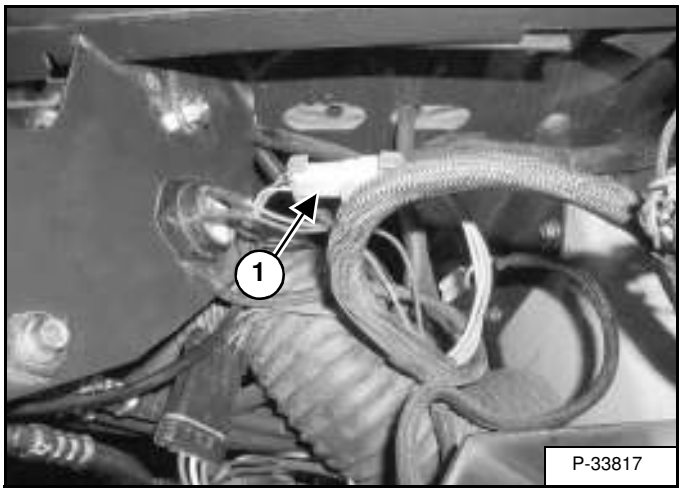
NOTE: The controller must be removed from the console only to allow access to re-install the key switch (if so equipped). Controller removal is not necessary on keyless machines, disconnect the instrument panel wires.

It is NOT necessary to disconnect the instrument panel wires on key switch equipped machines.

Turn the instrument panel to allow it to pass through the console cover **[Figure 20-113-8]**.

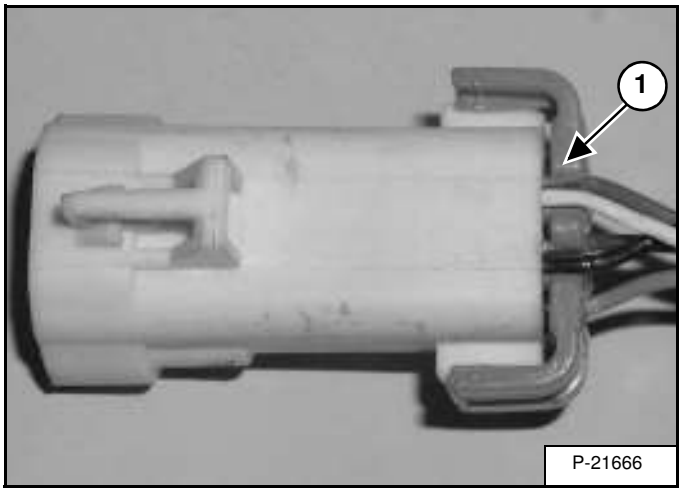
The console cover can now be removed from the work area for convenience.

Figure 20-113-9



Disconnect the handle electrical connector (Item 1) **[Figure 20-113-9]** from the excavator wiring harness.

Figure 20-113-10

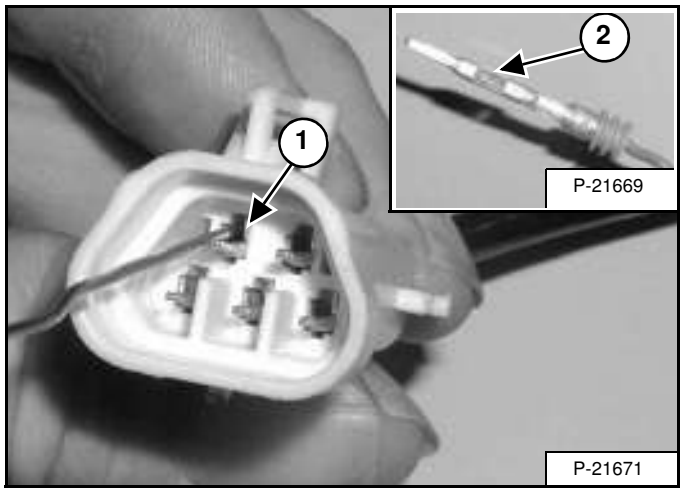


Remove the lock (Item 1) **[Figure 20-113-10]** from the joystick electrical connector.

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Handle Removal And Installation (Cont'd)

Figure 20-113-11



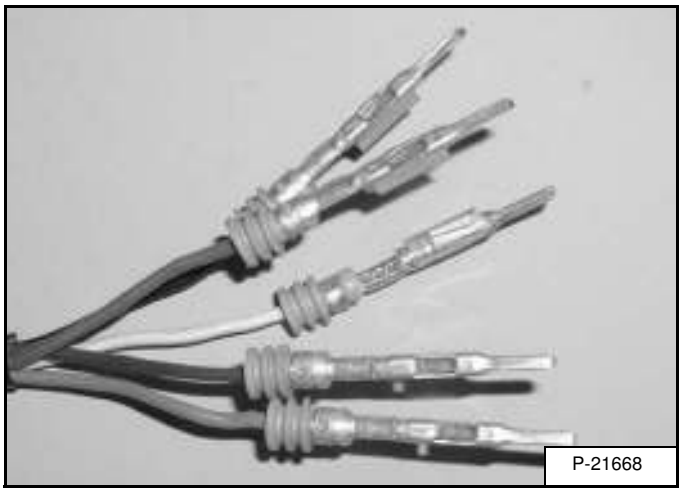
With a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 20-113-11]**.

Carefully remove the individual wires from the back of the electrical connector.

Remove the joystick handle assembly from the excavator.

Installation: Use a small piece of wire and re-bend the tab (Inset Item 2) **[Figure 20-113-11]** on each wire before installing in the electrical connector.

Figure 20-113-12

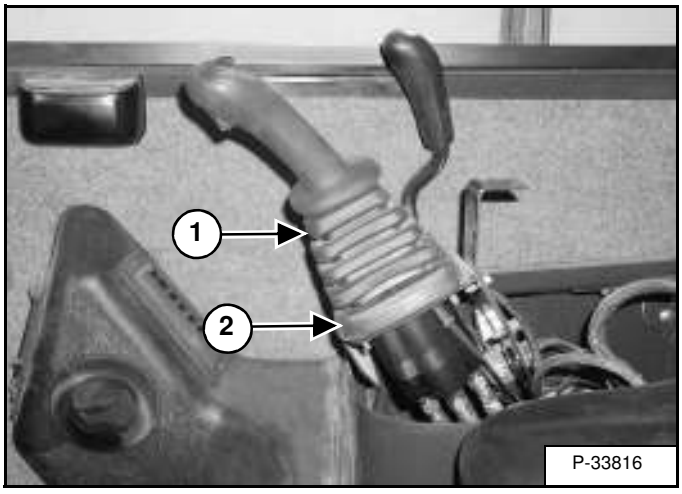


Installation: The wires **[Figure 20-113-12]** must be installed in the proper locations in the wire connector, listed below.

A Green
B Brown
C Pink
D Black
E White

Check each wire to be certain the tab locks into position.

Figure 20-113-13



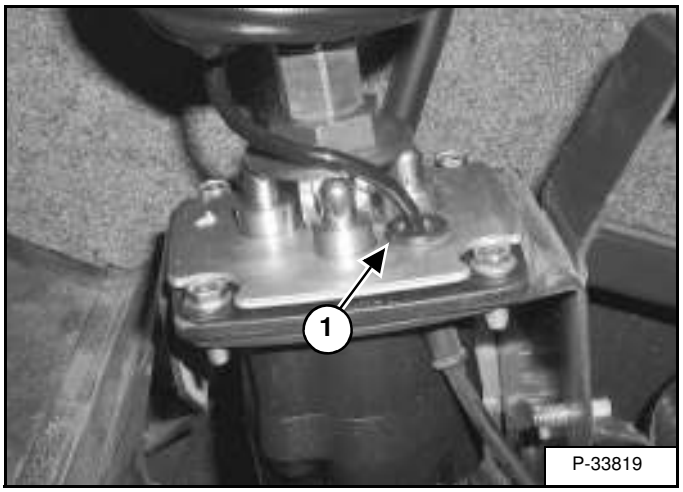
Pull the joystick boot (Item 1) **[Figure 20-113-13]** up away from the mounting plate.

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 20-113-13]** and the mounting plate. Position the boot properly before installing the console cover.

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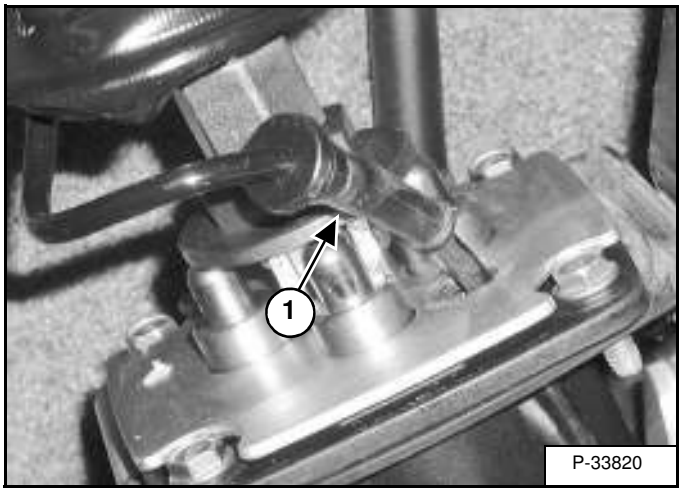
Handle Removal And Installation (Cont'd)

Figure 20-113-14



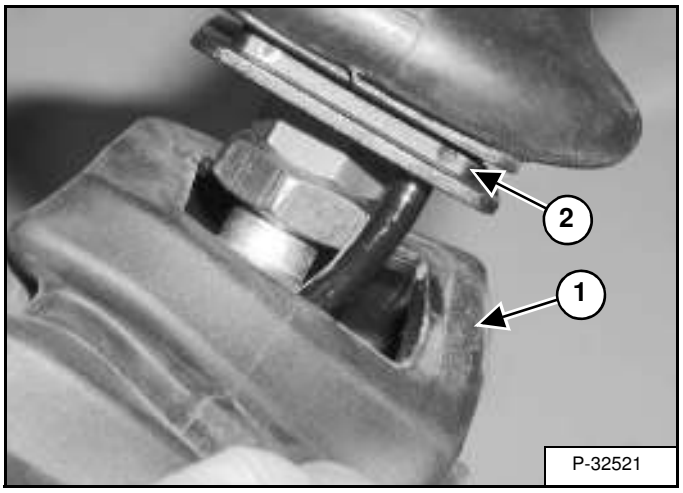
Lift the grommet (Item 1) **[Figure 20-113-14]** from the joystick mount plate.

Figure 20-113-15



Remove the wire and grommet (Item 1) **[Figure 20-113-15]**.

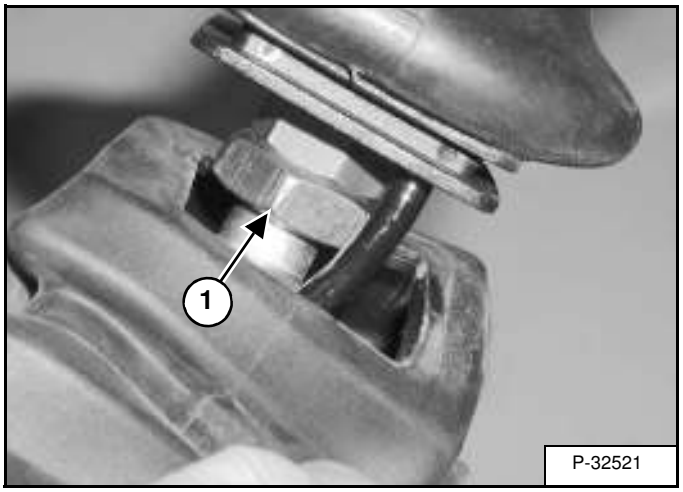
Figure 20-113-16



Pull the joystick boot (Item 1) **[Figure 20-113-16]** down away from the joystick handle.

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 20-113-16]**. Position the boot properly before reinstalling the console cover.

Figure 20-113-17



Loosen the jam nut (Item 1) **[Figure 20-113-17]** on the joystick handle.

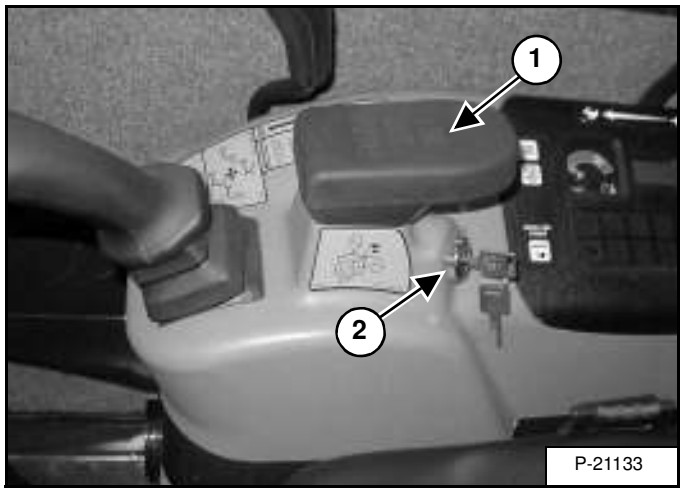
Remove the joystick handle from the joystick controller.

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RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

Joystick Assembly Removal And Installation

Figure 20-113-18



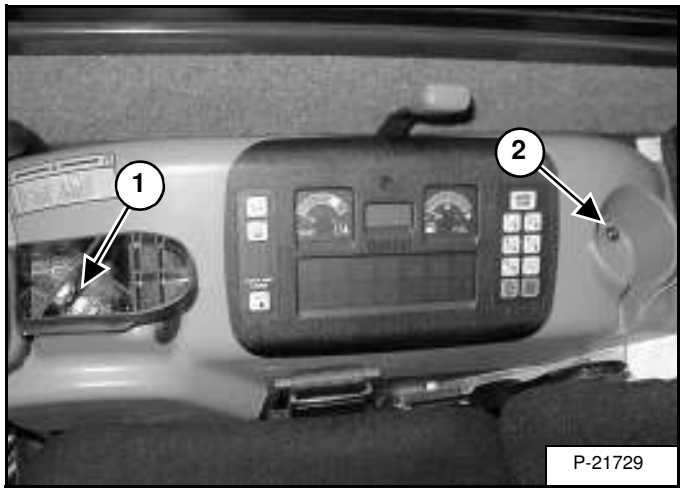
In the operator cab, at the right side operator console, remove the cover (Item 1) **[Figure 20-113-18]** from the arm rest.

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 20-113-18]** (if equipped). Allow the switch to drop inside the console.

NOTE: The key switch must be removed to remove and install the console cover.

Figure 20-113-19



Remove the two mount bolts (Item 1) **[Figure 20-113-19]** from the arm rest.

Remove the arm rest.

Remove the screw (Item 2) **[Figure 20-113-19]** from the console cover.

Lift the console cover up and over the joystick lever.

Figure 20-113-20

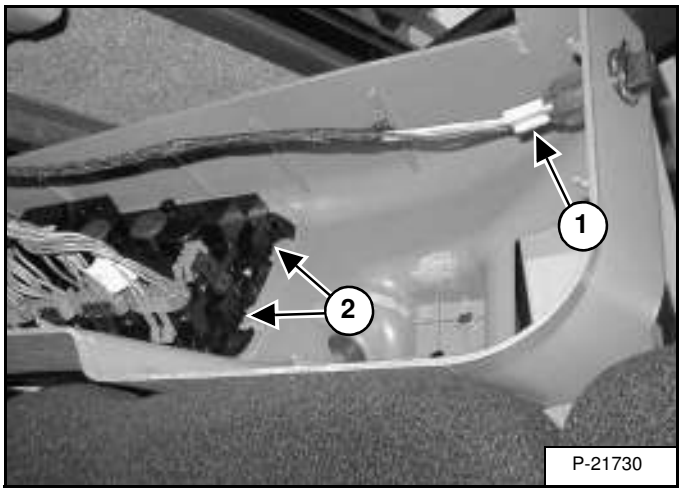


Figure 20-113-21



Key switch equipped machines perform **[Figure 20-113-20]** ***&*** **[Figure 20-113-21]** ***also.***

Disconnect the accessory outlet electrical connector (Item 1) **[Figure 20-113-20]**.

Remove the controller from the console cover by pressing the mounting tabs (Item 2) **[Figure 20-113-20]**.

NOTE: The instrument panel must be removed from the console only to allow access to re-install the key switch (if so equipped). Panel removal is not necessary on keyless machines, disconnect the instrument panel wires on keyless machines.

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RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

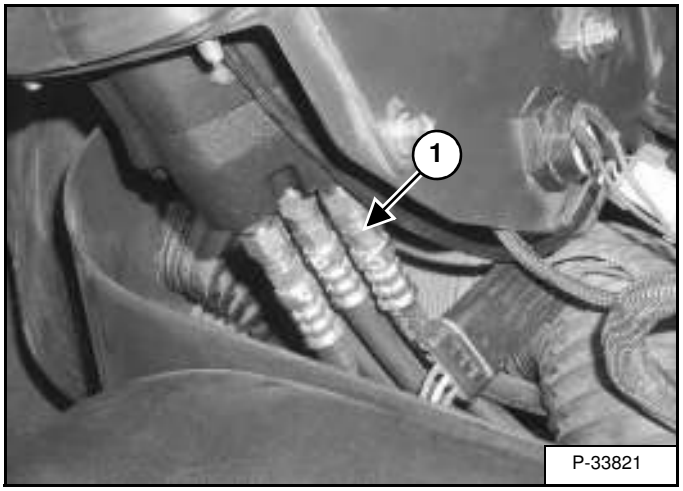
Joystick Assembly Removal And Installation (Cont'd)

It is NOT necessary to disconnect the instrument panel wires on key switch equipped machines.

Turn the instrument panel to allow it to pass through the console cover **[Figure 20-113-21 on Page 6]**.

The console cover can now be removed from the work area for convenience.

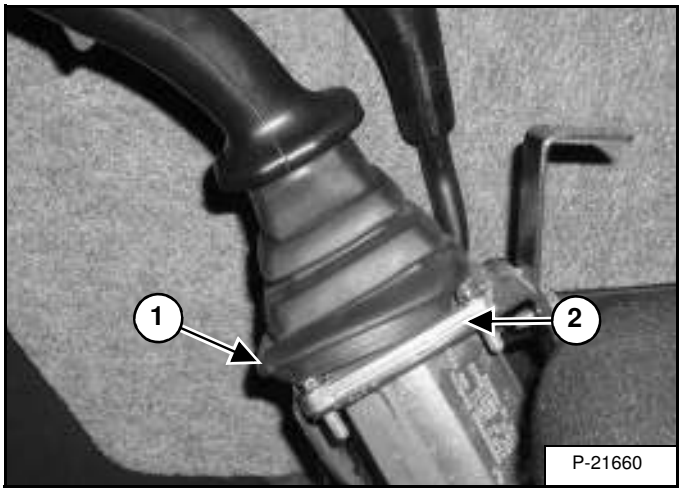
Figure 20-113-22



Mark the hydraulic hoses for proper installation. Remove the six hydraulic hoses (Item 1) **[Figure 20-113-22]** from the joystick housing.

Cap and plug the hoses and fittings.

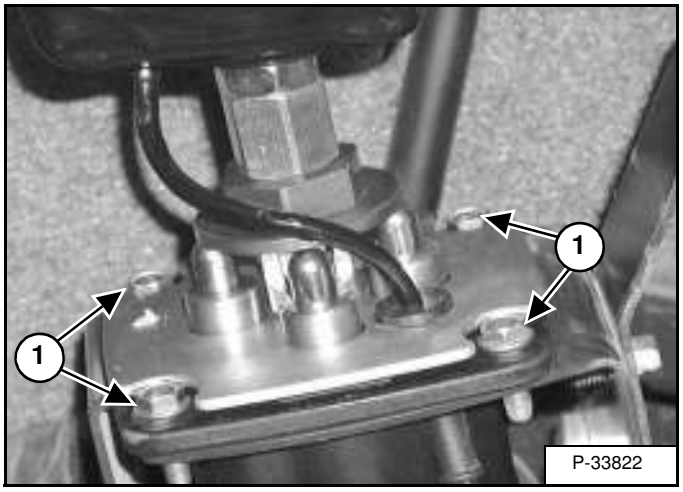
Figure 20-113-23



Pull the joystick boot (Item 1) **[Figure 20-113-23]** up away from the mounting plate.

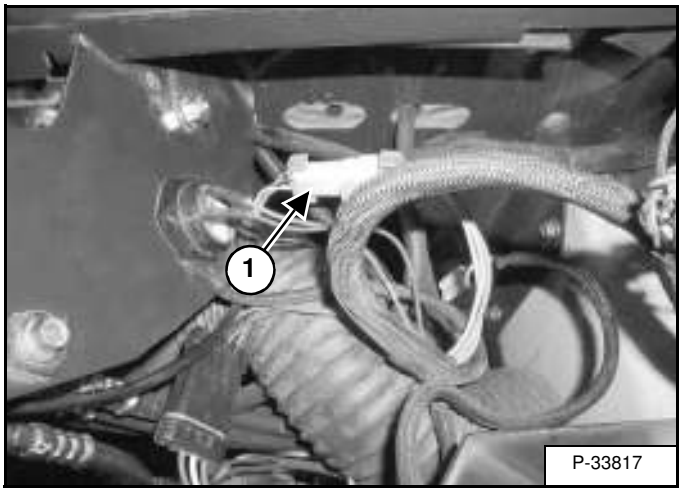
Installation: The bottom of the boot is molded to fit over the flange of the joystick. It has tabs that fit between the joystick flange (Item 2) **[Figure 20-113-23]** and the mounting plate. Position the boot properly before installing the console cover.

Figure 20-113-24



Remove the four mount bolts (Item 1) **[Figure 20-113-24]** from the joystick housing.

Figure 20-113-25



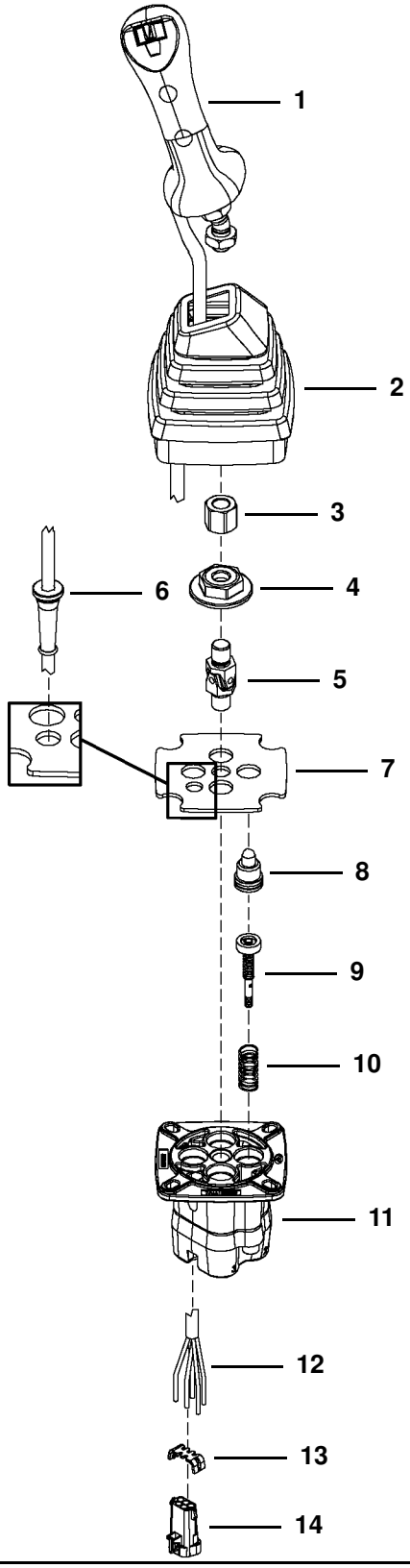
Disconnect the handle electrical connector (Item 1) **[Figure 20-113-25]**, from the excavator wiring harness.

Remove the joystick assembly from the excavator.

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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



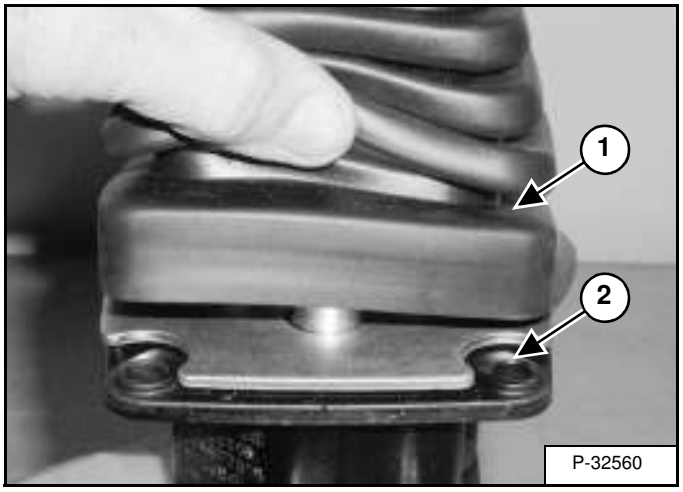
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RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

Disassembly

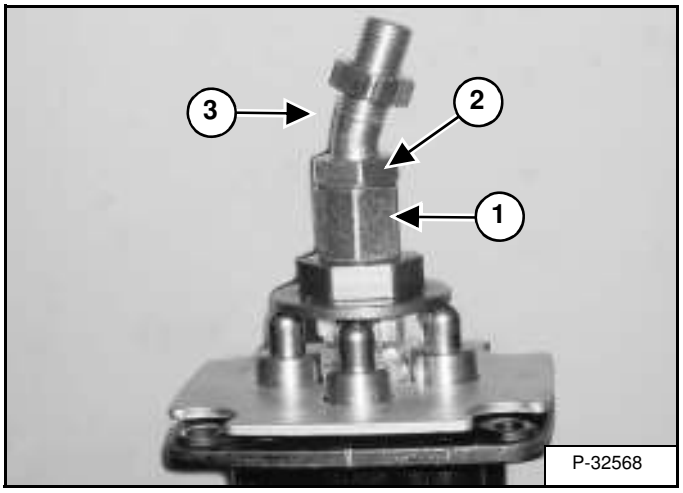
Remove the right handle. (See Handle Removal And Installation on Page 20-110-2.)

Figure 20-113-26



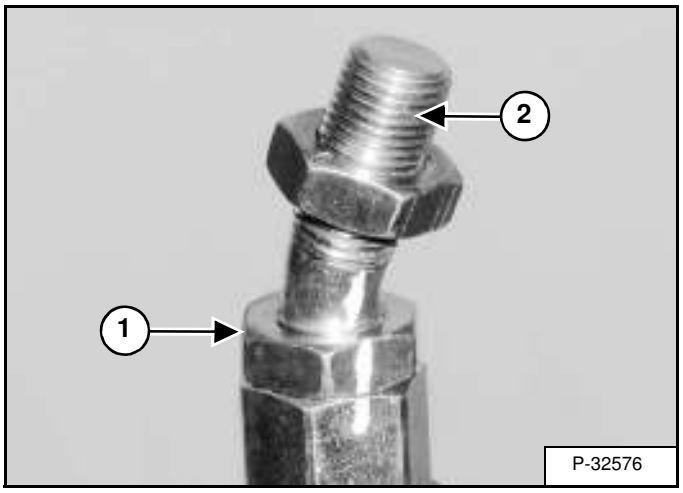
Remove the dust boot (Item 1) from the control lever (joystick) (Item 2) **[Figure 20-113-26]**.

Figure 20-113-27



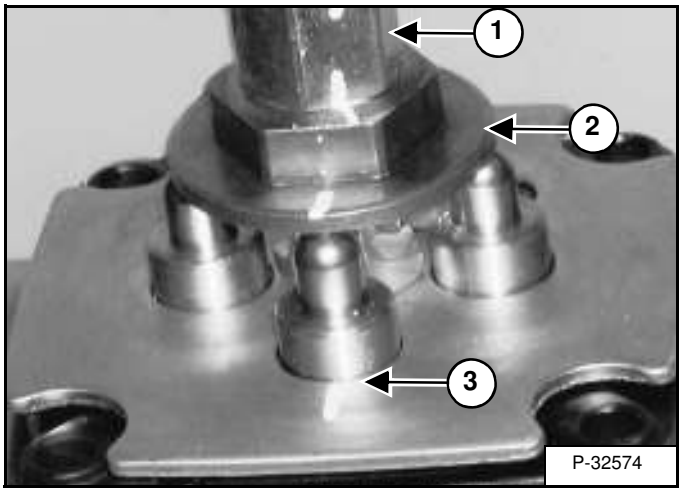
Mark the coupler (Item 1), jam nut (Item 2) and connector (Item 3) **[Figure 20-113-27]** for correct realignment.

Figure 20-113-28



Loosen the jam nut (Item 1) and remove the connector (Item 2) **[Figure 20-113-28]**.

Figure 20-113-29



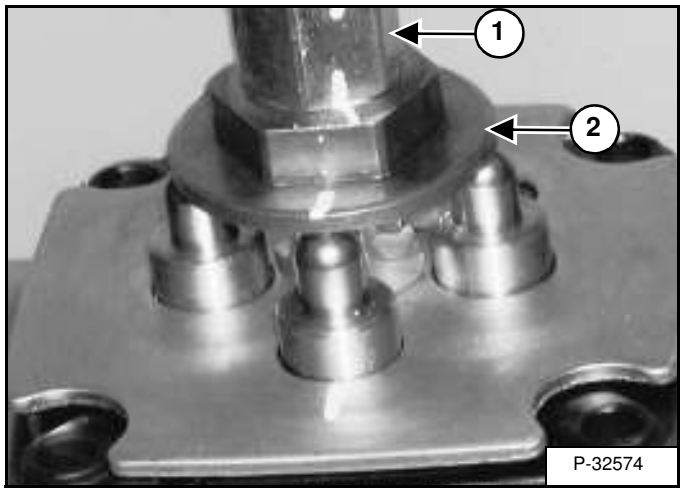
Mark the coupler (Item 1), control plate (Item 2) and plunger (Item 3) **[Figure 20-113-29]** for correct realignment.

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RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

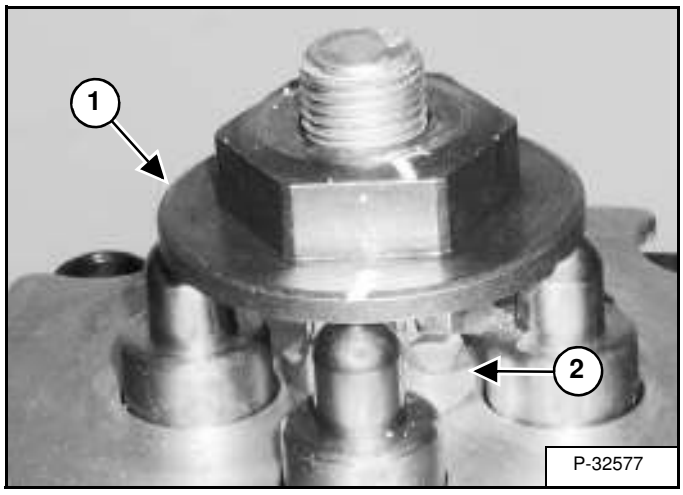
Disassembly (Cont'd)

Figure 20-113-30



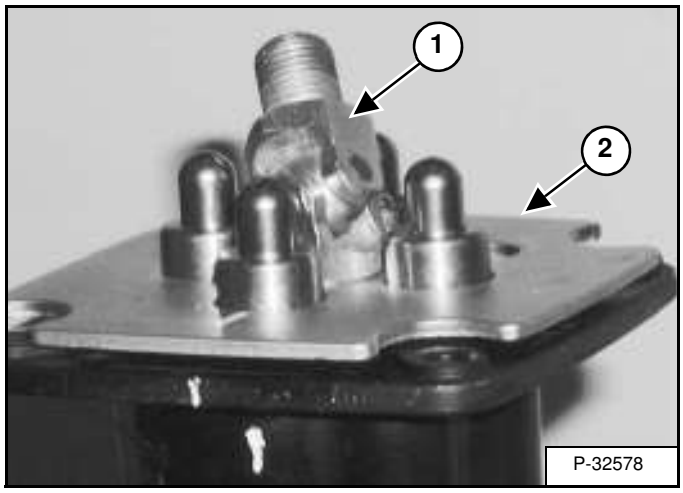
Loosen and remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-113-30]**.

Figure 20-113-31



Loosen and remove the control plate (Item 1) from the U-joint (Item 2) **[Figure 20-113-31]**.

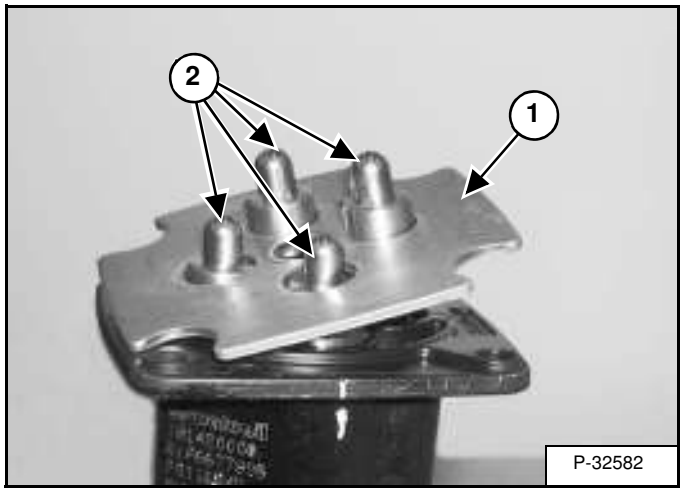
Figure 20-113-32



Mark the plate and housing for correct installation. Loosen and remove the U-joint (Item 1) **[Figure 20-113-32]**.

NOTE: The plate (Item 2) [Figure 20-113-32] is spring loaded and will come up as the U-joint is removed.

Figure 20-113-33



Remove the plate (item 1) **[Figure 20-113-33]**.

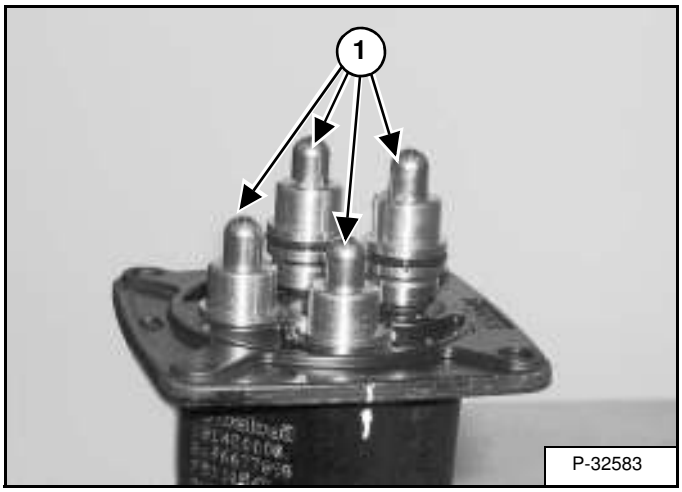
NOTE: Use care while removing the plate. The plungers (Item 2) [Figure 20-113-33] are spring loaded.

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RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

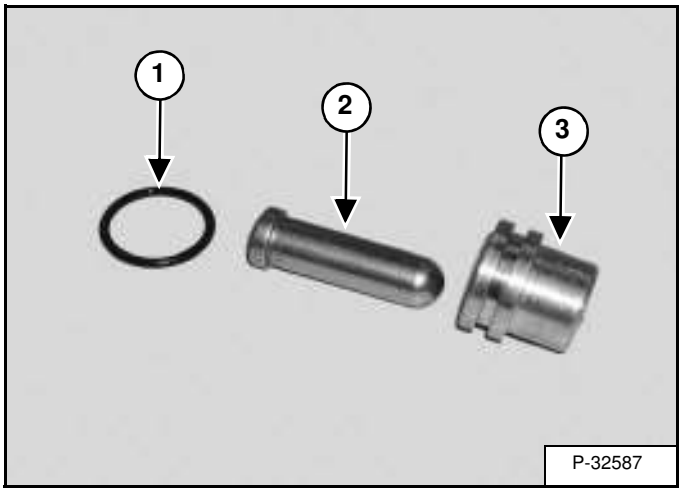
Disassembly (Cont'd)

Figure 20-113-34



Remove the four plunger assemblies (Item 1) **[Figure 20-113-34]**.

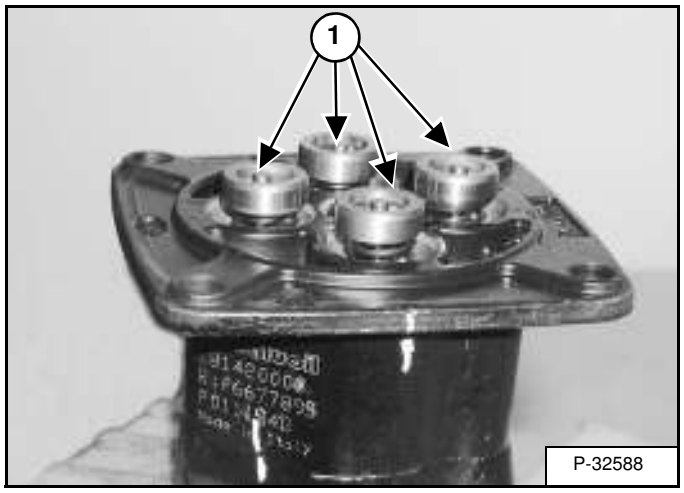
Figure 20-113-35



Remove the O-ring (Item 1) and rod (Item 2) from the bushing (Item 3) **[Figure 20-113-35]**.

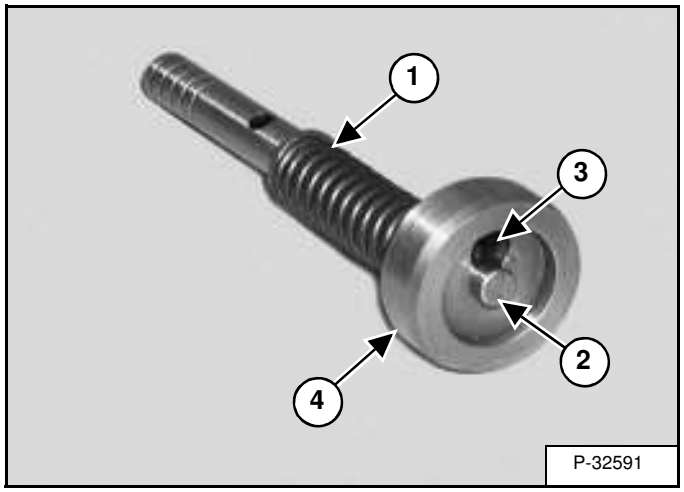
NOTE: Mark the spool assemblies for installation in their original location.

Figure 20-113-36



Remove the four spool assemblies (Item 1) **[Figure 20-113-36]**.

Figure 20-113-37

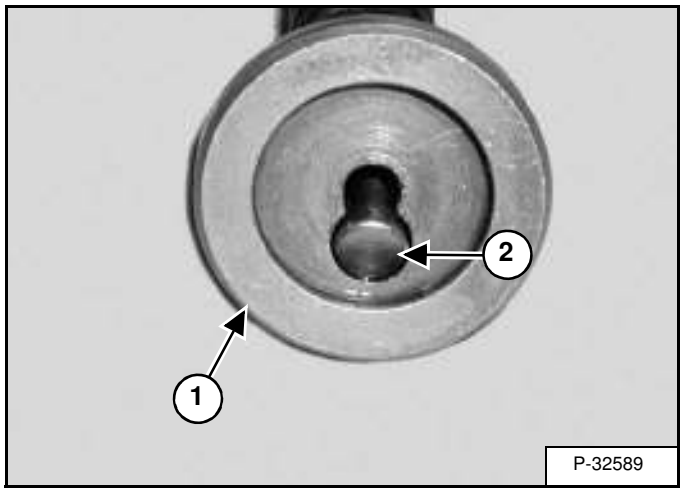


Compress the spring (item 1) until the end of the spool (Item 2) can be aligned with the offset hole (Item 3) in the washer (Item 4) **[Figure 20-113-37]**.

Dealer Copy -- Not for Resale

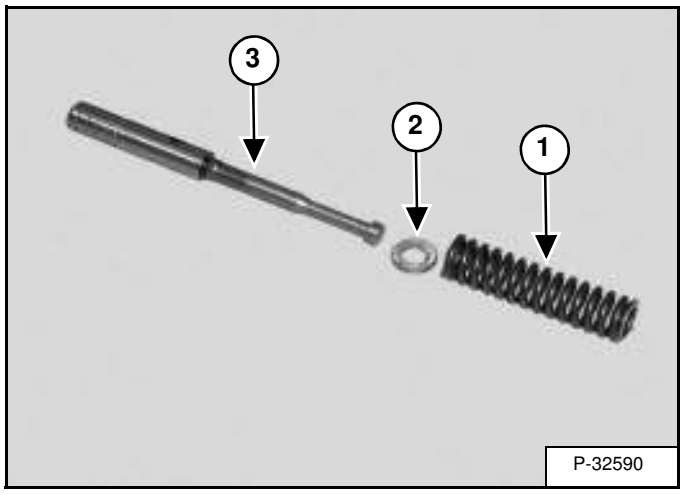
Disassembly (Cont'd)

Figure 20-113-38



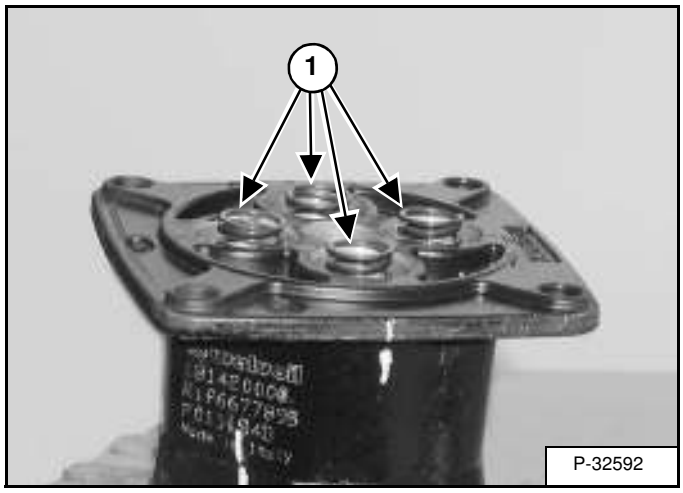
Remove the washer (Item 1) from the spool (Item 2) **[Figure 20-113-38]**.

Figure 20-113-39



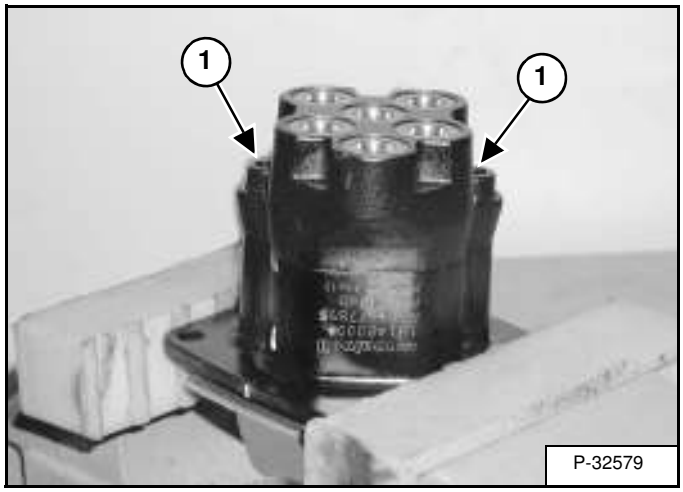
Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-113-39]**.

Figure 20-113-40



Remove the four springs (Item 1) **[Figure 20-113-40]** from the housing.

Figure 20-113-41



Clamp the housing in a vise **[Figure 20-113-41]**. Use care not to damage the housing.

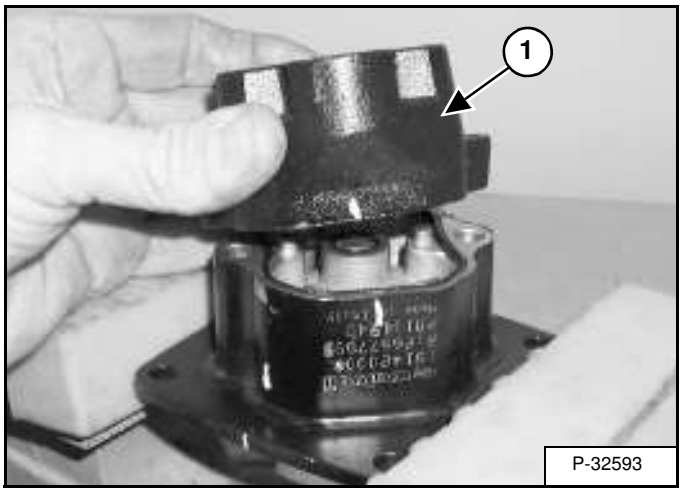
Remove the two bolts (Item 1) **[Figure 20-113-41]**.

Dealer Copy -- Not for Resale

RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

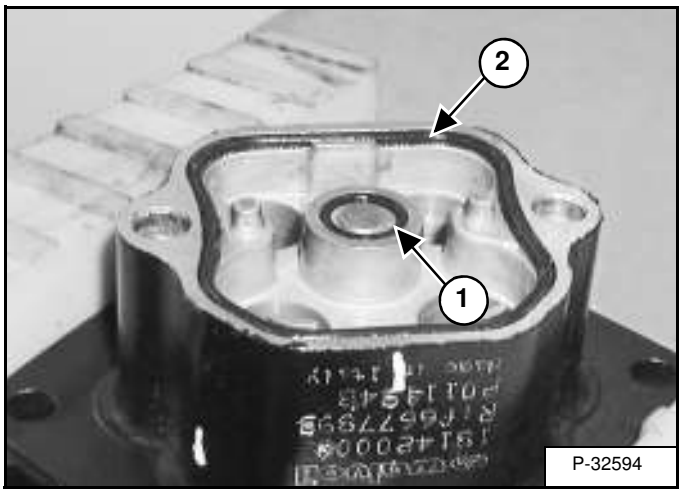
Disassembly (Cont'd)

Figure 20-113-42



Remove the end cap (Item 1) **[Figure 20-113-42]**.

Figure 20-113-43



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-113-43]**.

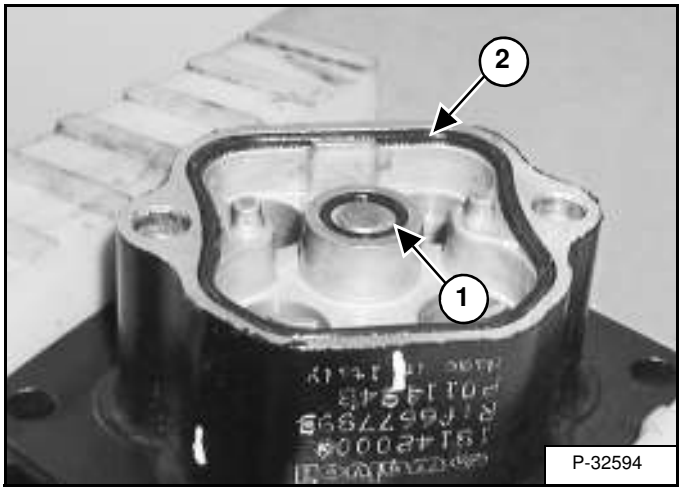
Assembly

Clean all parts in solvent and dry with compressed air. Inspect the push rod crown for wear. Replace all components showing excessive wear.

Always install new seals and O-rings.

Lubricate the components with clean hydraulic oil during installation.

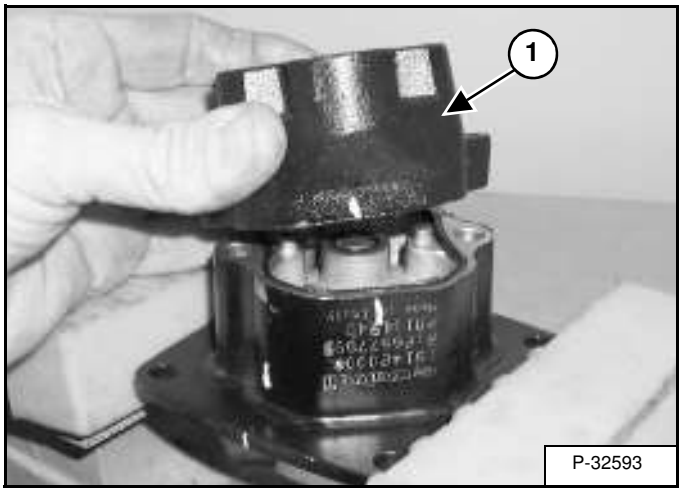
Figure 20-113-44



Clamp the housing in a vise. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-113-44]**.

NOTE: Use care not to damage the housing.

Figure 20-113-45



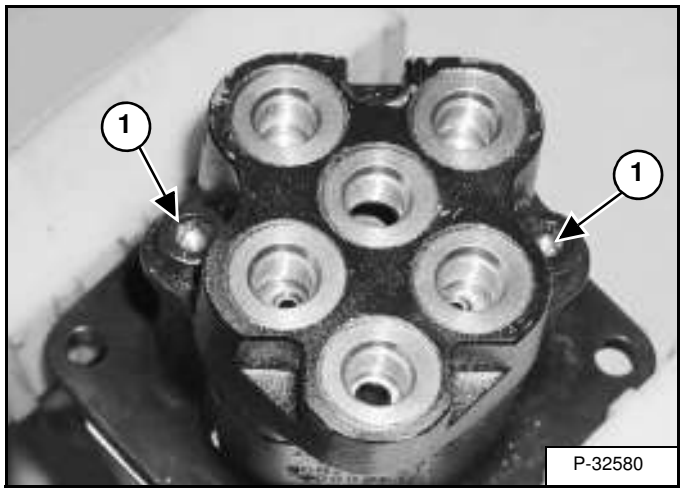
Install the end cap (Item 1) **[Figure 20-113-45]**.

Dealer Copy -- Not for Resale

RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

Assembly (Cont'd)

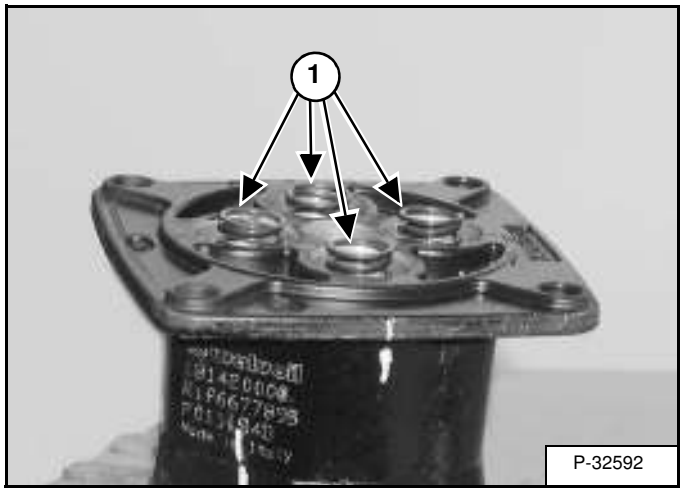
Figure 20-113-46



Install the two bolts (Item 1) **[Figure 20-113-46]**.

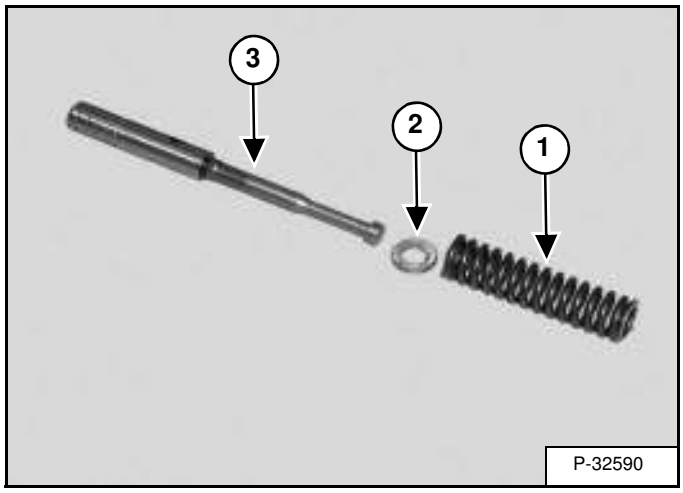
Turn the housing over.

Figure 20-113-47



Install the four springs (Item 1) **[Figure 20-113-47]**.

Figure 20-113-48



Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-113-48]**.

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Assembly (Cont'd)

Figure 20-113-49

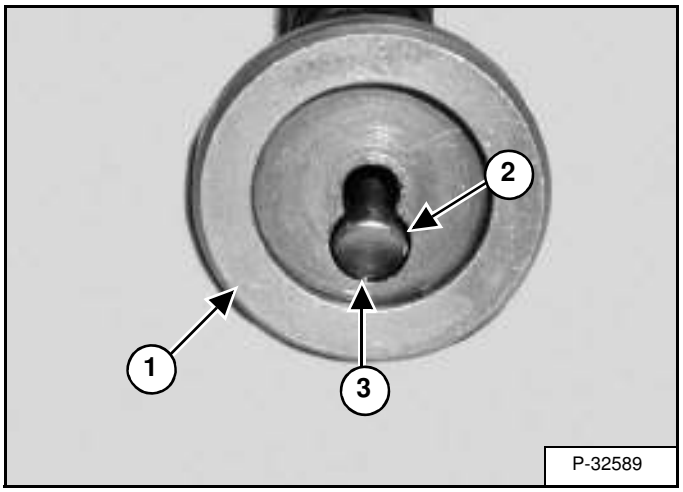
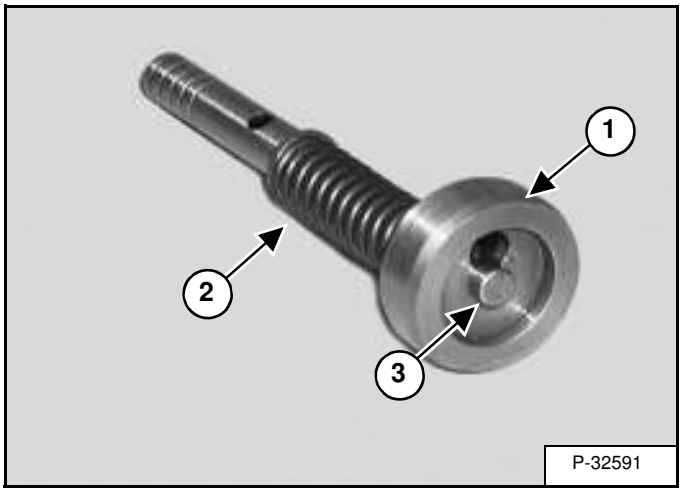


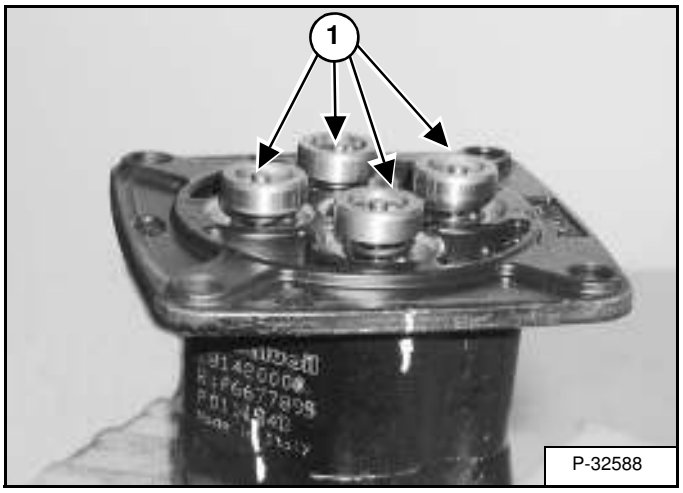
Figure 20-113-50



Install the washer (Item 1) **[Figure 20-113-49]** & **[Figure 20-113-50]** by compressing the spring (Item 2) **[Figure 20-113-50]** and pushing the end of the spool into the offset hole (Item 3) **[Figure 20-113-49]**.

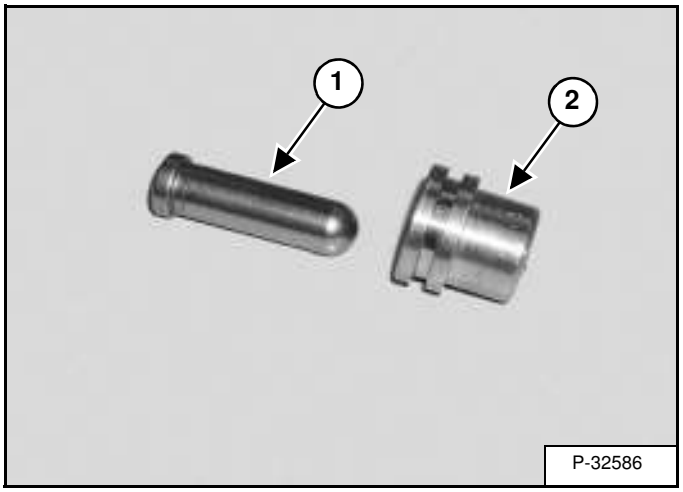
Center the end of the spool (Item 2) **[Figure 20-113-49]** in the washer (Item 3) **[Figure 20-113-50]**.

Figure 20-113-51



Install the four spool assemblies (Item 1) **[Figure 20-113-51]** into the housing.

Figure 20-113-52

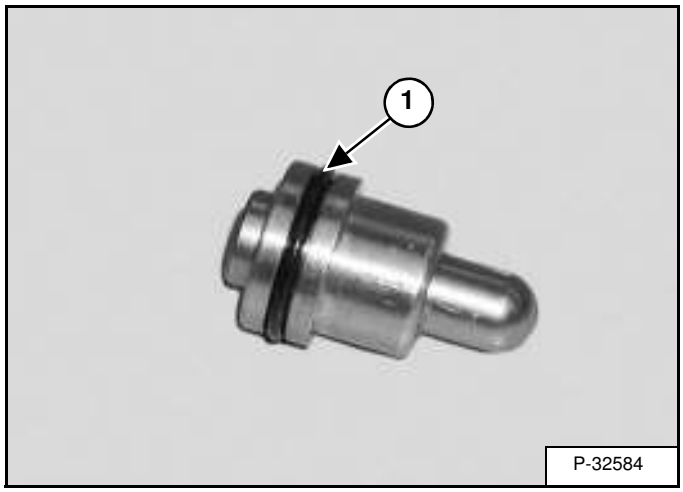


Install the rod (Item 1) into the bushing (Item 2) **[Figure 20-113-52]**.

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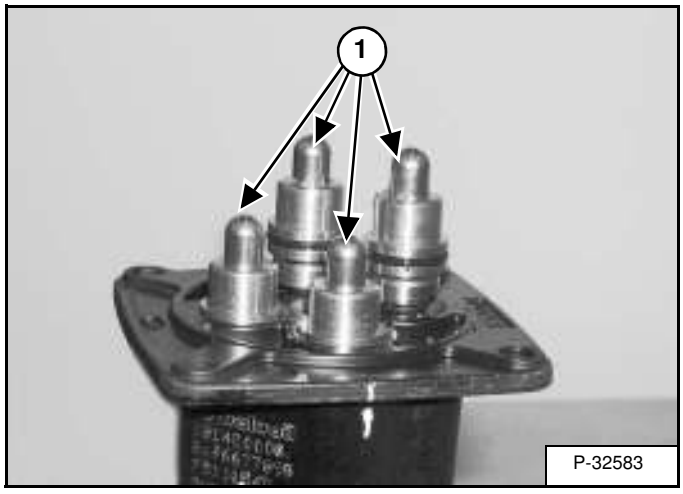
Assembly (Cont'd)

Figure 20-113-53



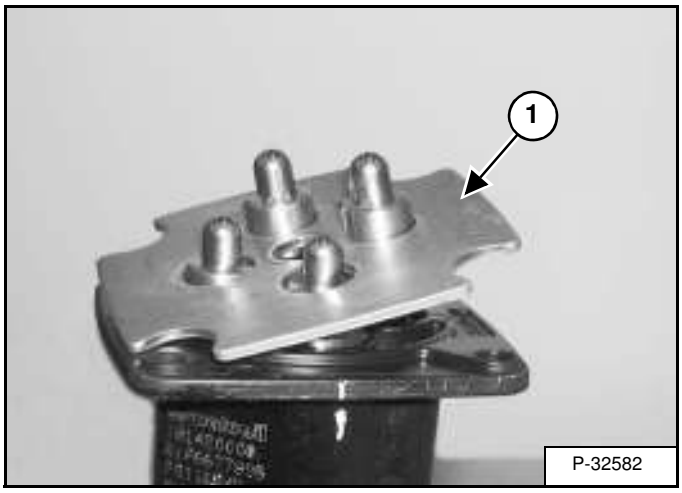
Install the O-ring (Item 1) **[Figure 20-113-53]** on the bushing.

Figure 20-113-54



Install the four rod assemblies (Item 1) **[Figure 20-113-54]** into the housing.

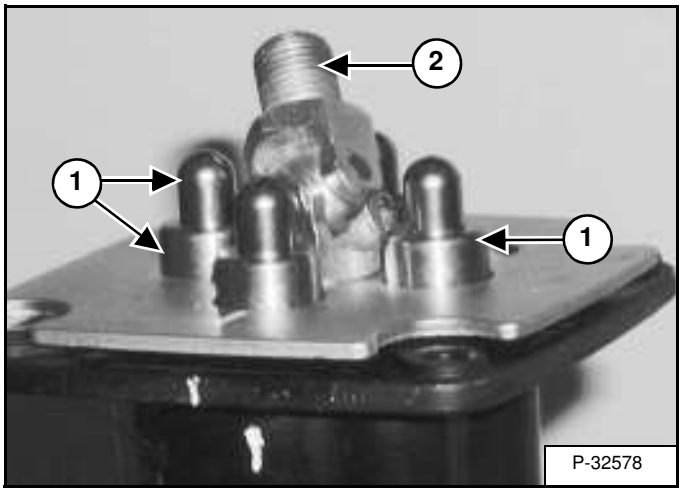
Figure 20-113-55



NOTE: Spring pressure can dislodge the rod assemblies until the plate (Item 1) [Figure 20-113-55] is secured in place.

Install the plate (Item 1) **[Figure 20-113-55]**.

Figure 20-113-56



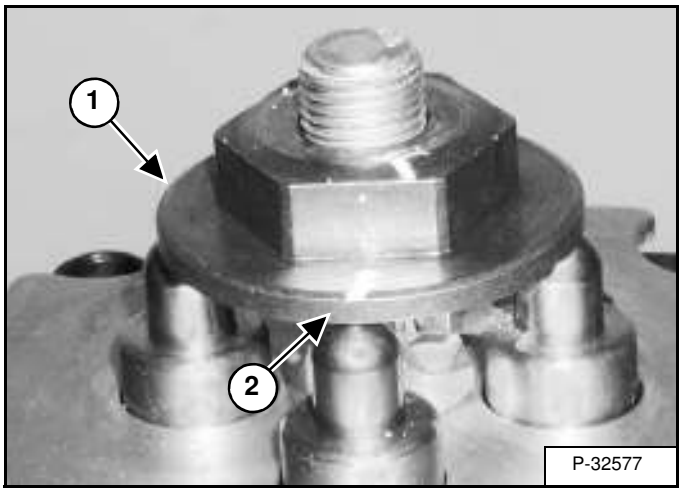
Ensure the plunger assemblies (Item 1) are fully seated and install the U-joint (Item 2) **[Figure 20-113-56]**.

Dealer Copy -- Not for Resale

RIGHT CONTROL LEVER (JOYSTICK) (S/N 232312387 & ABOVE, 232412118-232412127 AND 232412130 & ABOVE) (CONT'D)

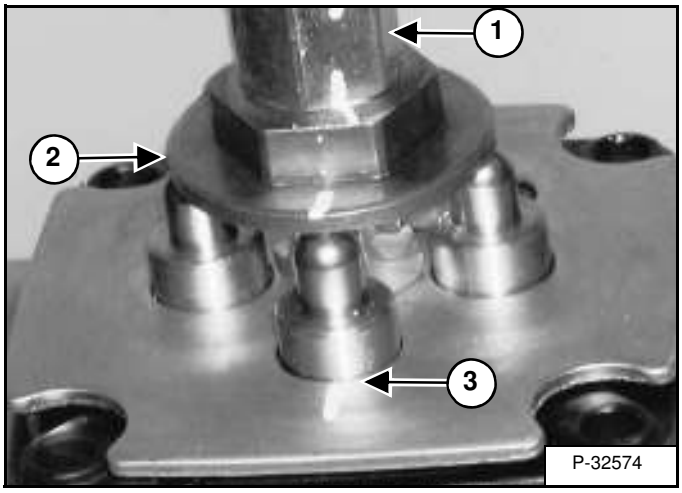
Assembly (Cont'd)

Figure 20-113-57



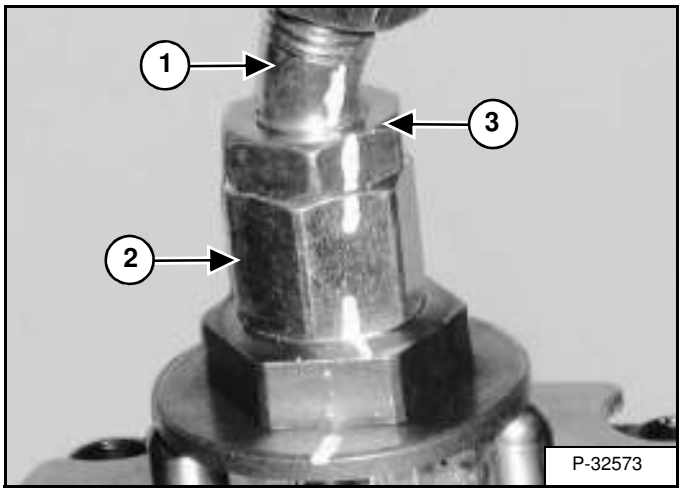
Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-113-57]**.

Figure 20-113-58



Align the coupler (Item 1) with the control plate (Item 2) and plunger (Item 3) **[Figure 20-113-58]** and tighten.

Figure 20-113-59



Install the connector (Item 1) **[Figure 20-113-59]**.

Align the connector with the coupler (Item 2) and tighten the jam nut (Item 3) **[Figure 20-113-59]**.

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Assembly (Cont'd)

Figure 20-113-60

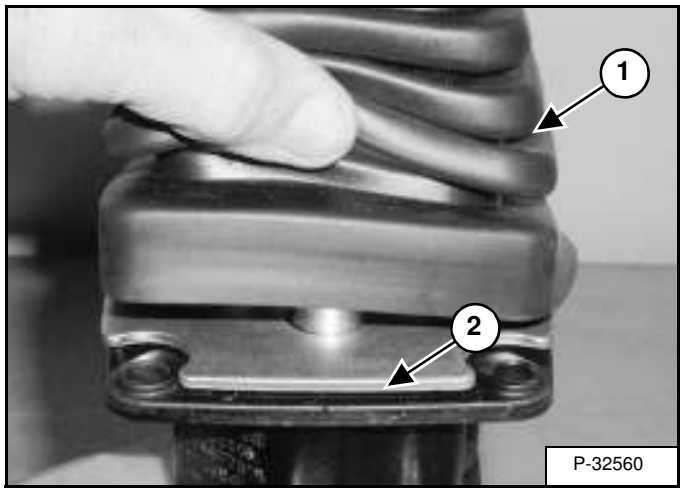
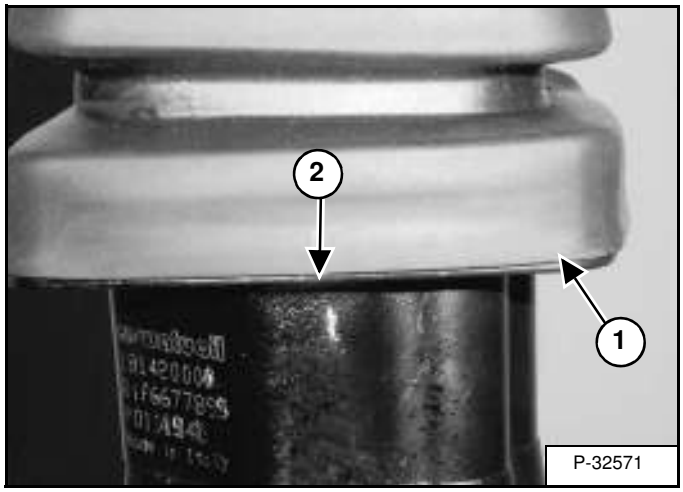


Figure 20-113-61



Install the dust boot (Item 1) **[Figure 20-113-60]** & **[Figure 20-113-61]** in the groove (Item 2) **[Figure 20-113-60]** & **[Figure 20-113-61]**.

Install the right or left handle. (See Handle Removal And Installation on Page 20-111-2.)

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HYDRAULIC FILTER

Removal And Installation

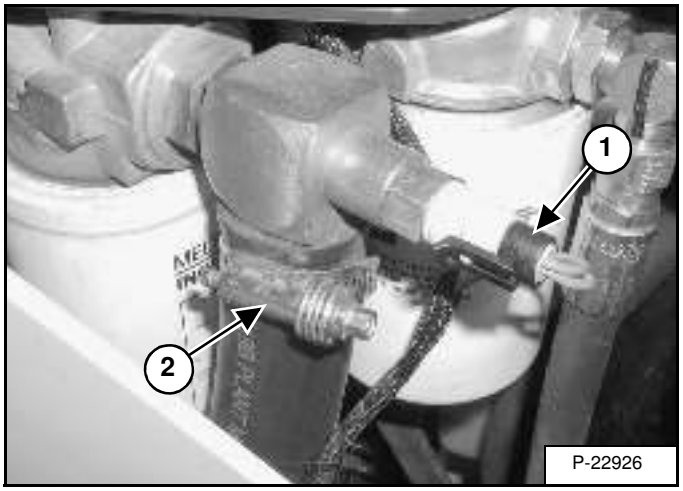
IMPORTANT

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.

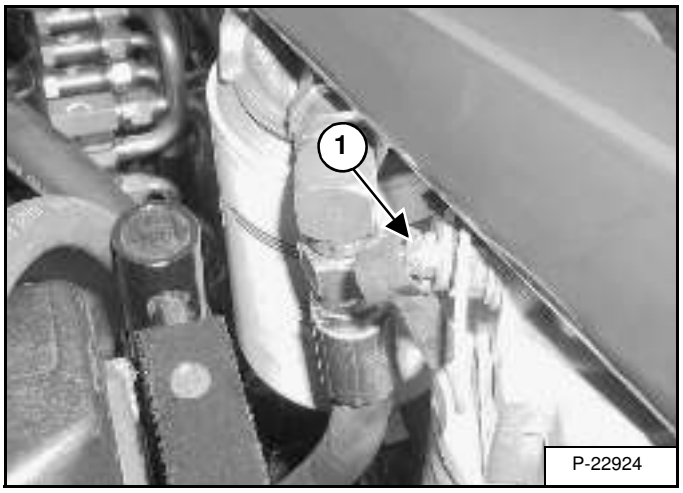
Figure 20-120-1



Disconnect the wire harness (Item 1) **[Figure 20-120-1]**.

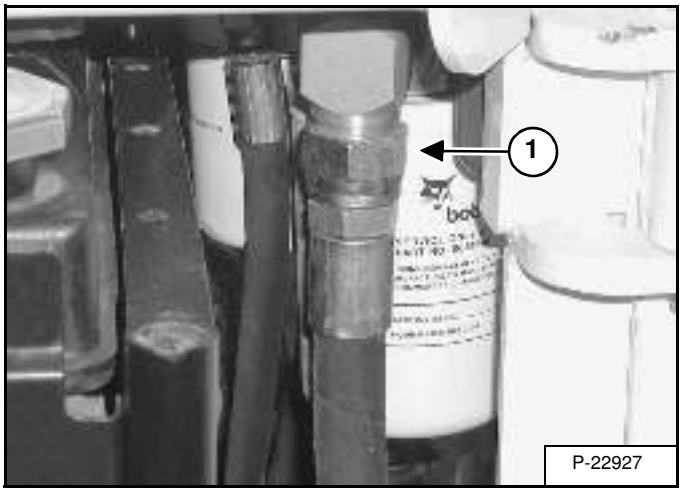
Loosen the hose clamp (Item 2) **[Figure 20-120-1]** and remove the hose.

Figure 20-120-2



Remove the wire (Item 2) **[Figure 20-120-2]** from the sending unit.

Figure 20-120-3

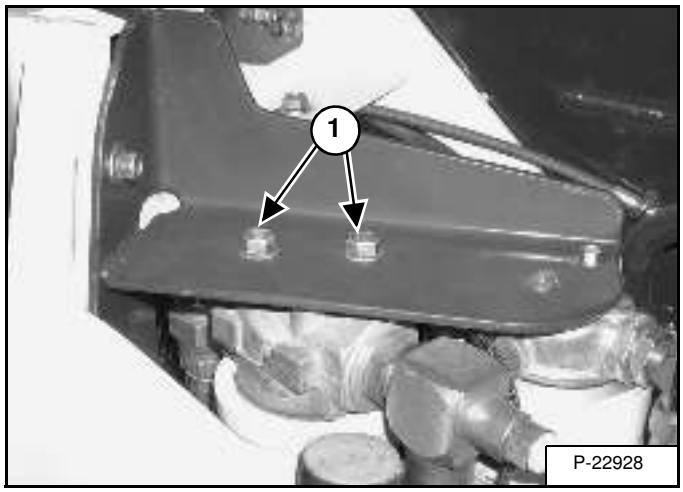


Remove the oil cooler to filler hose (Item 1) **[Figure 20-120-3]**.

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Removal And Installation

Figure 20-120-4



Remove the two bolts (Item 1) **[Figure 20-120-4]**.

Remove the filter.

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HYDRAULIC RESERVOIR

Removal And Installation

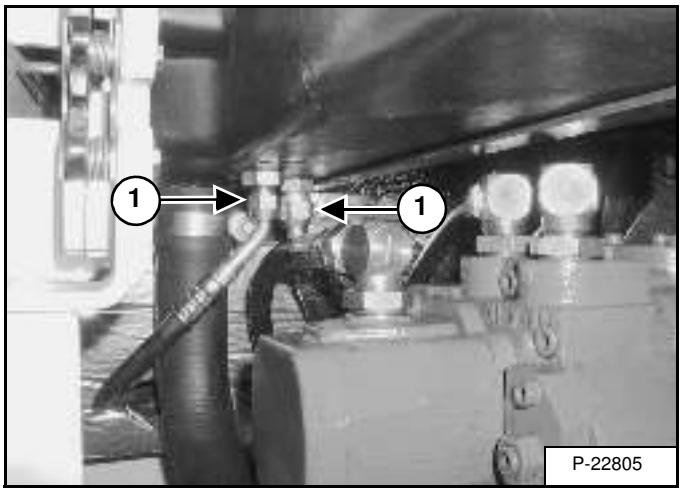
IMPORTANT

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

I-2003-0888

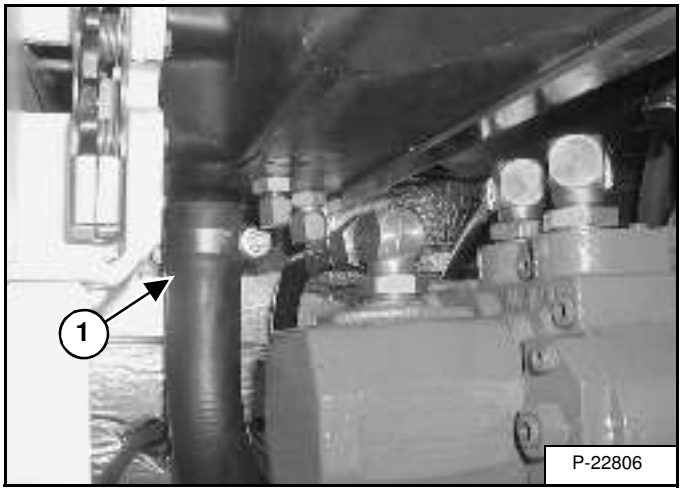
Drain the hydraulic reservoir. (See Replacing the Hydraulic Fluid on Page 10-100-2.)

Figure 20-130-1



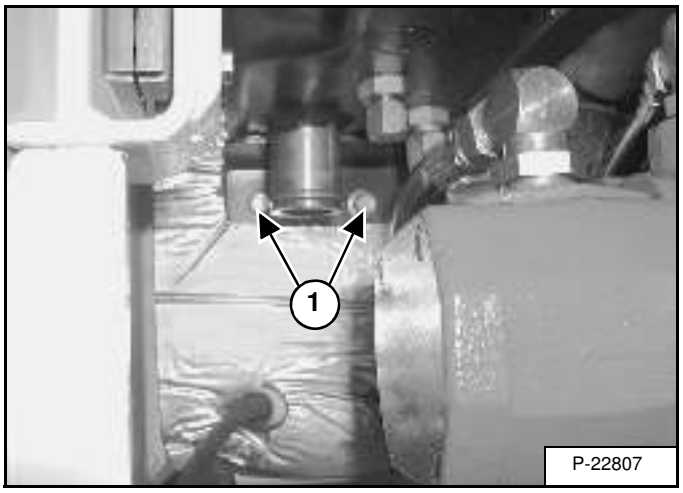
Remove the two hoses (Item 1) **[Figure 20-130-1]**.

Figure 20-130-2



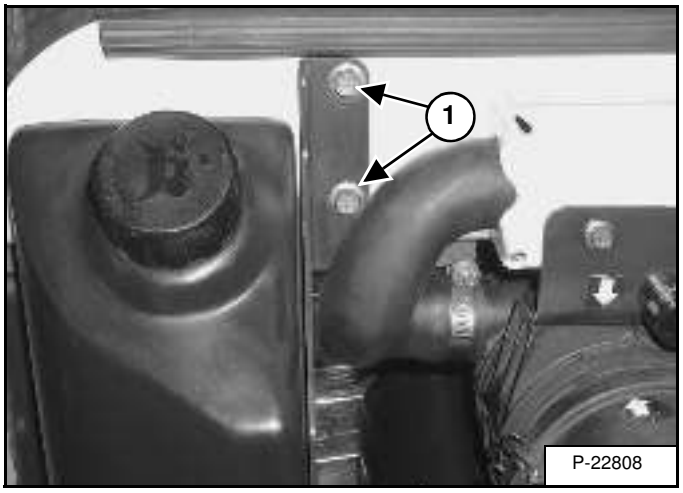
Remove the pump supply line (Item 1) **[Figure 20-130-2]**.

Figure 20-130-3



Remove the two bottom bolts (Item 1) **[Figure 20-130-3]**.

Figure 20-130-4

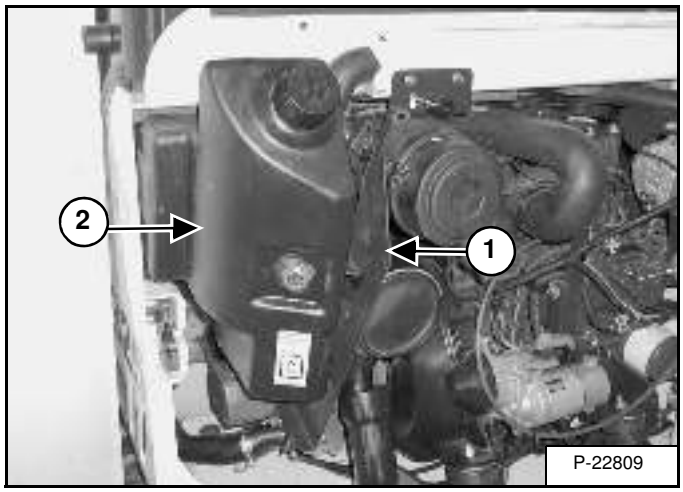


Remove the top bolts (Item 1) **[Figure 20-130-4]**.

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Removal And Installation (Cont'd)

Figure 20-130-5



Lower the mount (Item 1) **[Figure 20-130-5]** and position it to the right.

Remove the reservoir (Item 2) **[Figure 20-130-5]**.

Remove the mount.

Dealer Copy -- Not for Resale

OIL COOLER

Removal And Installation

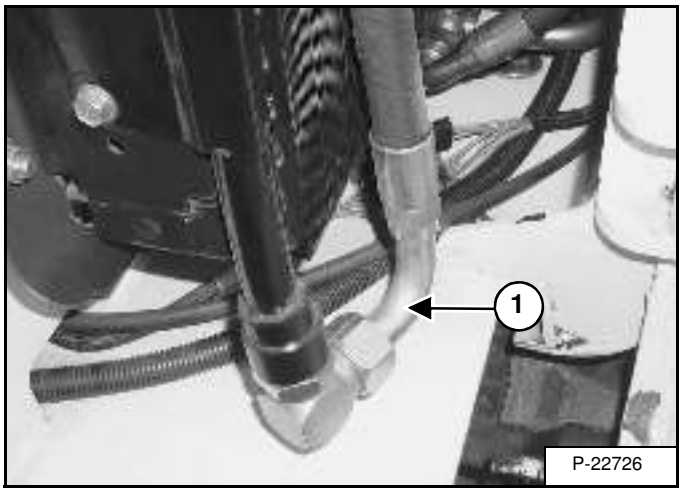
IMPORTANT

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

I-2003-0888

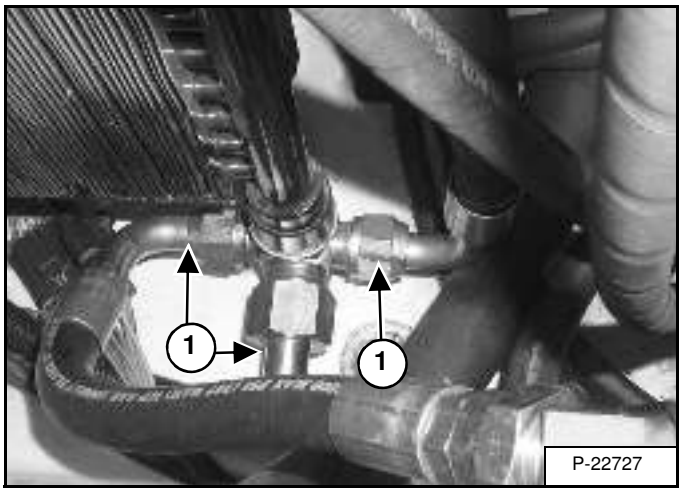
Drain the hydraulic reservoir. (See Replacing the Hydraulic Fluid on Page 10-100-2.)

Figure 20-140-1



Remove the hose (Item 1) **[Figure 20-140-1]** from the rear of the cooler.

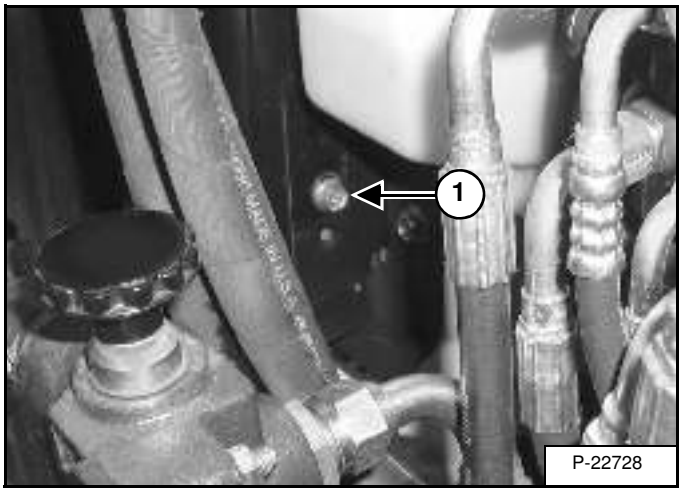
Figure 20-140-2



Remove the three hoses (Item 1) **[Figure 20-140-2]** from the front of the cooler.

NOTE: If the excavator is not equipped with the direct to tank valve there will be two hoses on the front of the cooler.

Figure 20-140-3

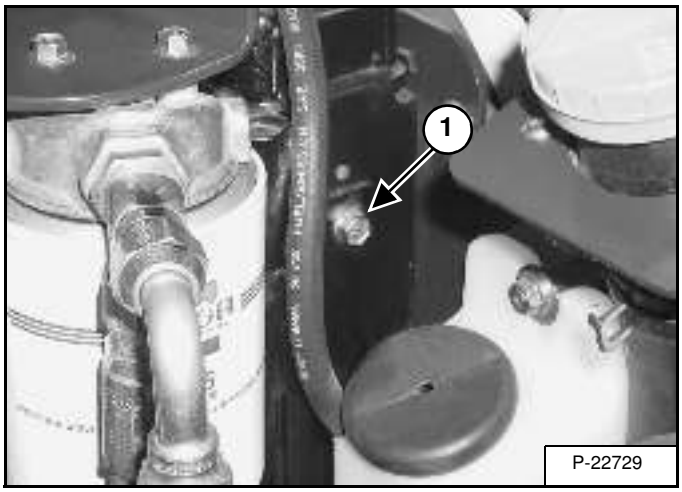


Remove the front bottom bolt (Item 1) **[Figure 20-140-3]**.

Dealer Copy -- Not for Resale

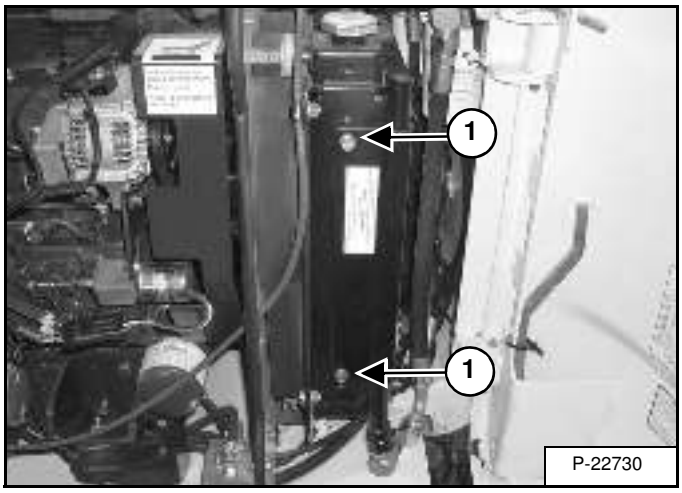
Removal And Installation (Cont'd)

Figure 20-140-4



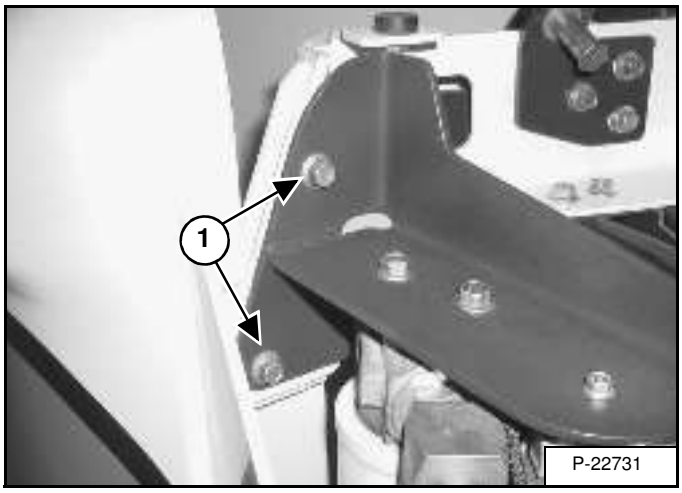
Remove the front top bolt (Item 1) **[Figure 20-140-4]** .

Figure 20-140-5



Remove the rear top and bottom bolts (Item 1) **[Figure 20-140-5]**, and lower the cooler to the excavator frame.

Figure 20-140-6



Remove the two bolts (Item 1) **[Figure 20-140-6]** and reposition the filter mount to provide clearance to remove the cooler.

Remove the cooler.

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DIRECT TO TANK VALVE

Removal And Installation

IMPORTANT

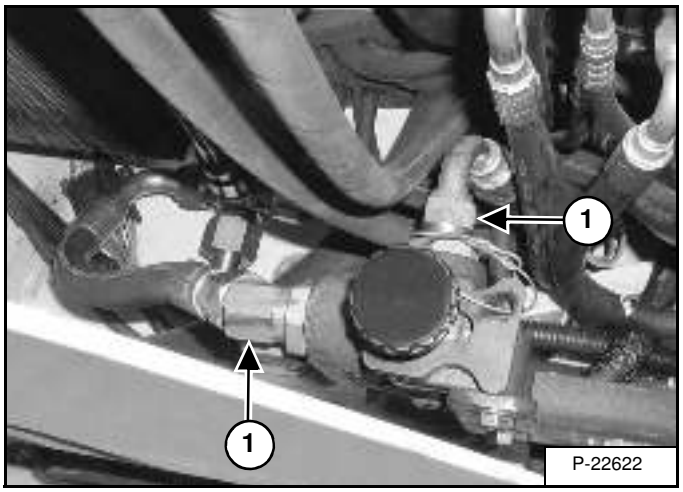
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tube lines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

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

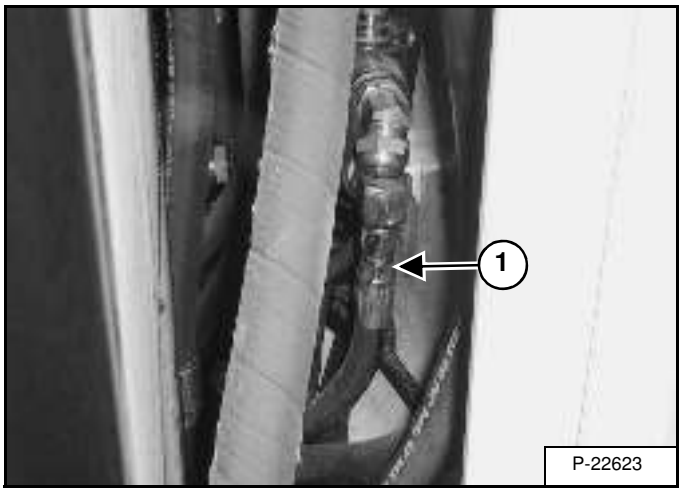
Open the right side cover.

Figure 20-150-1



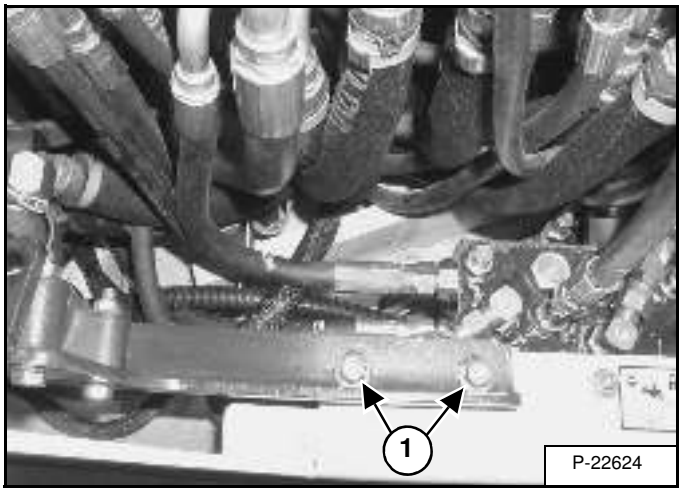
Remove the two hoses (Item 1) **[Figure 20-150-1]**.

Figure 20-150-2



Remove the lower hose (Item 1) **[Figure 20-150-2]**.

Figure 20-150-3



Remove the two mount bolts (Item 1) **[Figure 20-150-3]**.

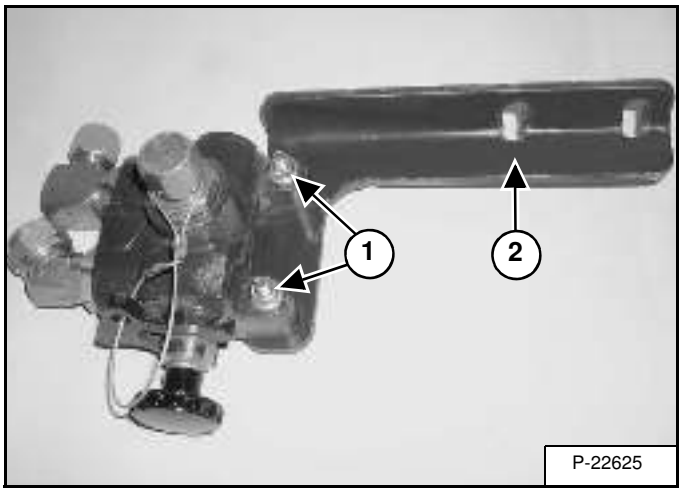
Remove the valve.

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DIRECT TO TANK VALVE (CONT'D)

Disassembly And Assembly

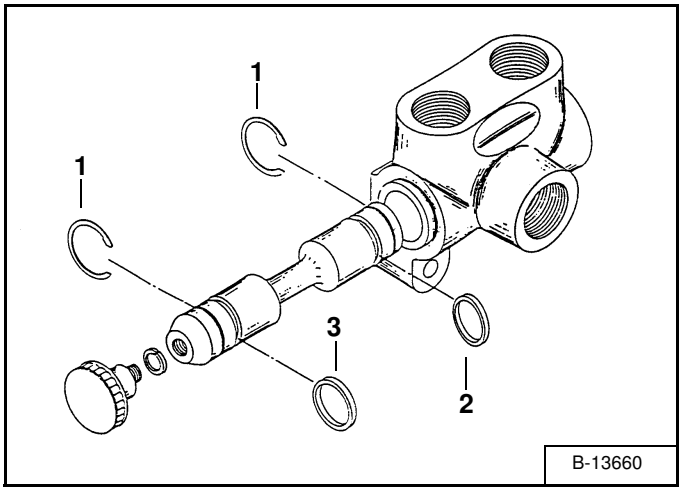
Figure 20-150-4



Remove the two nuts and bolts (Item 1). Remove the mount (Item 2) **[Figure 20-150-4]** from the valve.

NOTE: Access the tubelines from under the excavator.

Figure 20-150-5



Remove the snap rings (Item 1) **[Figure 20-150-5]**.

Push the spool in until the rear seal (Item 2) **[Figure 20-150-5]** is exposed. Remove the rear seal.

Remove the spool from the valve body. Remove the front seal (Item 3) **[Figure 20-150-5]** from the spool.

To prevent cutting the new seal on the sharp edges, wrap the spool in three or four layers of glossy paper. Leave the front seal groove exposed.

Install the new seal over the paper and into the front seal groove.

Put clean grease on the new seal. Remove the paper and install the spool in the body.

With a rotating action, push the spool until the front seal is in the body and the rear seal groove is exposed.

Install the rear seal in the groove.

Put clean grease on the rear seal.

Install the rear snap ring and pull the spool toward the front until it stops.

Install the front snap ring.

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BUILD UP VALVE

Description

The build up valve provides hydraulic pressure to charge the accumulator when the engine is at low idle.

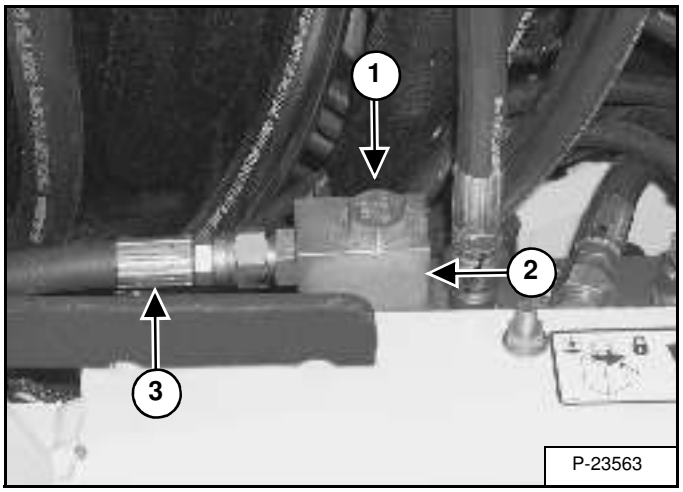
Removal And Installation

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

Figure 20-160-1



The build up valve (Item 1) **[Figure 20-160-1]** is located on the manifold assembly.

Either the valve (Item 1) or valve body (Item 2) **[Figure 20-160-1]** may be removed for O-ring and back-up ring replacement.

Valve Removal: Remove the valve (Item 1) **[Figure 20-160-1]**.

Valve Body Removal: Remove the hose (Item 3) **[Figure 20-160-1]** from the valve.

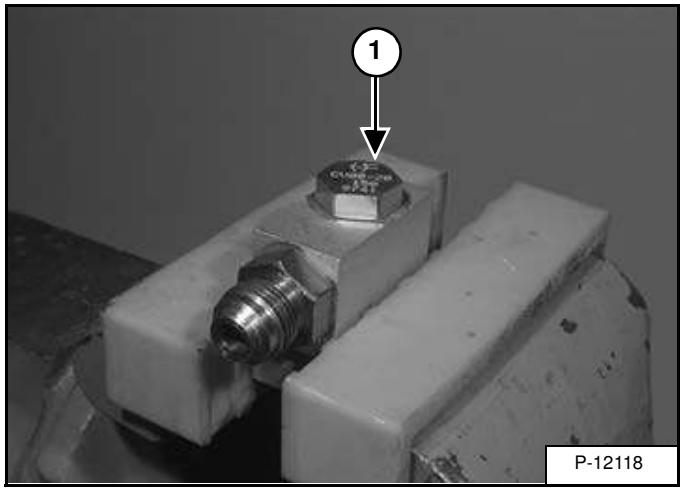
Loosen the manifold mount bolts and reposition the manifold for clearance.

Remove the valve body (Item 2) **[Figure 20-160-1]**.

Disassembly And Assembly

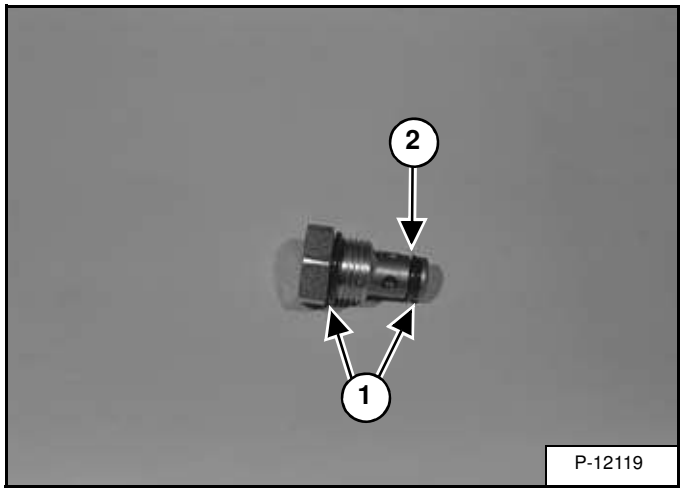
Clamp the valve in a vise with padded jaws.

Figure 20-160-2



Remove the valve (Item 1) **[Figure 20-160-2]**.

Figure 20-160-3



Remove the O-rings (Item 1) and back up ring (Item 2) **[Figure 20-160-3]**.

Clean all parts in solvent and dry with compressed air.

Apply oil to and install new O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-160-3]**.

Install the valve (Item 1) **[Figure 20-160-2]** in the valve body.

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CASE DRAIN FILTER

Removal And Installation

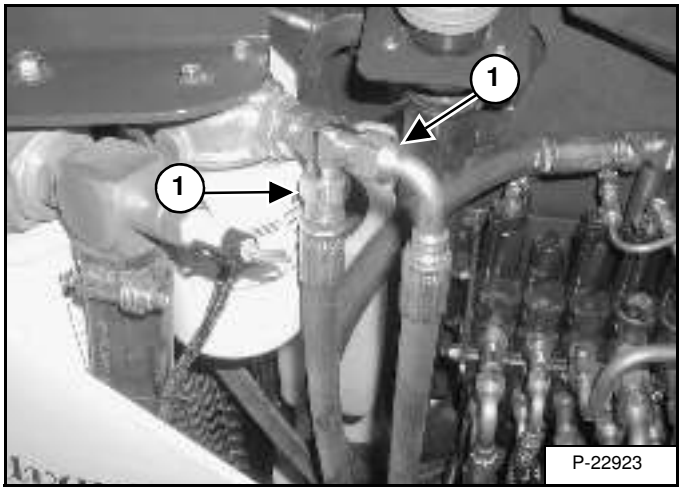
IMPORTANT

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

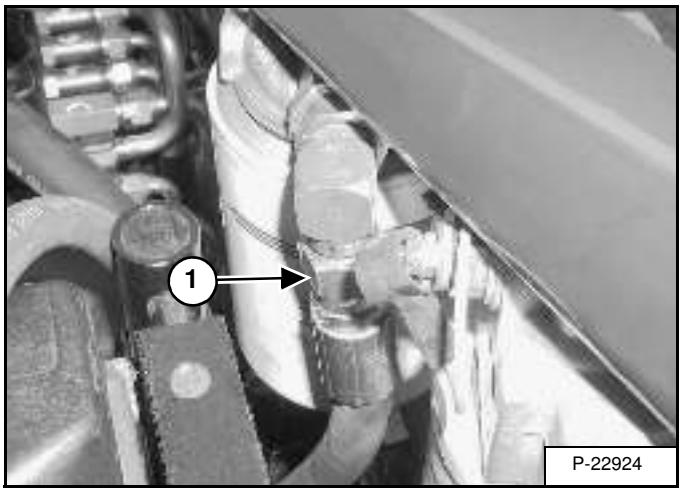
Open the right side cover.

Figure 20-170-1



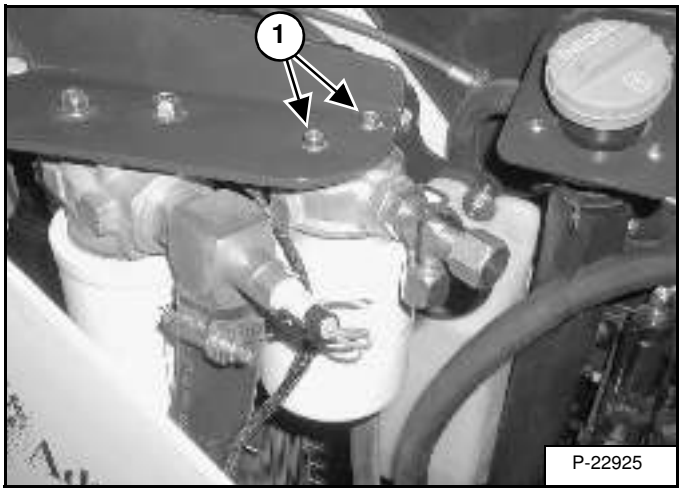
Remove the two hoses (Item 1) **[Figure 20-170-1]**.

Figure 20-170-2



Remove the hose (Item 1) **[Figure 20-170-2]** from the rear of the case drain filter.

Figure 20-170-3



Remove the two bolts (Item 1) **[Figure 20-170-3]**.

Remove the filter.

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UNDERCARRIAGE

BLADE. 30-10-1
Removal And Installation 30-10-1

TRACKS 30-20-1
Adjustment. 30-20-1
Rubber Track Removal And Installation. 30-20-4
Steel Track Removal And Installation 30-20-6
Track Lug Height 30-20-1

TRACK FRAME. 30-30-1
Disassembly And Assembly. 30-30-1
Recoil Spring Disassembly And Assembly 30-30-3

TRACK DAMAGE IDENTIFICATIONS 30-40-1
Abrasion Of Embedded Metals 30-40-2
Abrasion Of The Track Roller Side 30-40-9
Cracks And Cuts On The Lug Side Rubber. 30-40-8
Cracks On The Lug Side Rubber Due To Fatigue 30-40-6
Cuts On The Edges Of Track Roller Side 30-40-10
Cuts On The Lug Side Rubber. 30-40-5
Cutting Of Steel Cords. 30-40-1
Lug Abrasion 30-40-7
Separation Of Embedded Metals. 30-40-3
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TRACK IDLER. 30-50-1
Assembly (S/N 232311036 & Below And 232411019 & Below). . .30-50-4
Assembly (S/N 232311037 & Above And 232411020 & Above) .30-50-11
Disassembly (S/N 232311036 & Below And 232411019 & Below) 30-50-2
Disassembly (S/N 232311037 & Above And 232411020 & Above)30-50-9

TRACK ROLLER. 30-60-1
Assembly (S/N 232311036 & Below And 232411019 & Below). . .30-60-4
Assembly (S/N 232311037 & Above And 232411020 & Above) .30-60-10
Disassembly (S/N 232311036 & Below And 232411019 & Below) 30-60-2
Disassembly (S/N 232311037 & Above And 232411020 & Above)30-60-9

SWING CIRCLE GEAR. 30-70-1
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Removal And Installation 30-70-1
Swing Bearing Installation 30-70-4
Swing Bearing Removal. 30-70-3

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BLADE

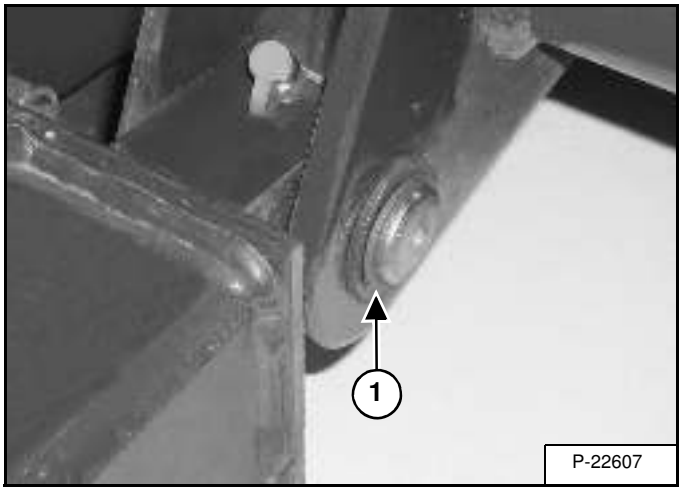
Removal And Installation

Lower the blade to the ground.

Remove the blade cylinder hoses. (See Removal And Installation on Page 20-24-3.)

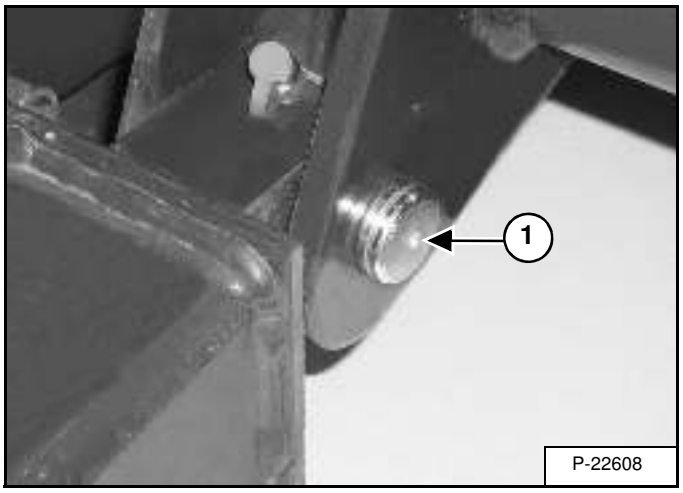
Remove the cylinder. (See Removal And Installation on Page 20-24-3.)

Figure 30-10-1



Remove the snap ring (Item 1) **[Figure 30-10-1]** and washer from the blade arm pivot pins (both sides).

Figure 30-10-2



Remove the blade arm pivot pins (Item 1) **[Figure 30-10-2]** (both sides).

Remove the blade.

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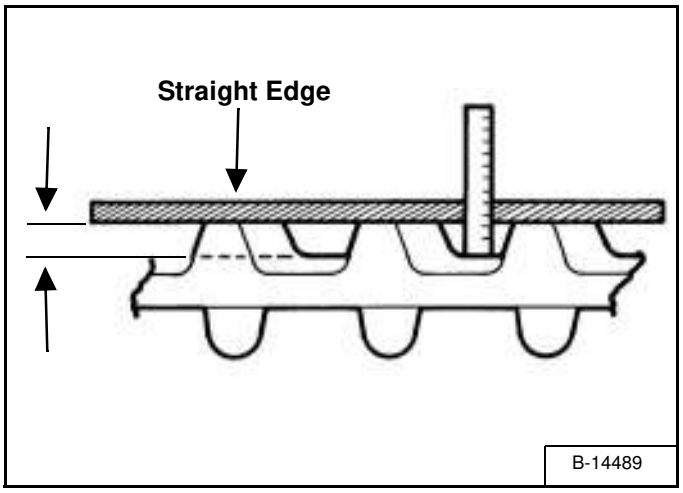
TRACKS

Track Lug Height

Rubber Track

The lug height of a new rubber track (Bridgestone or Spencer) 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)

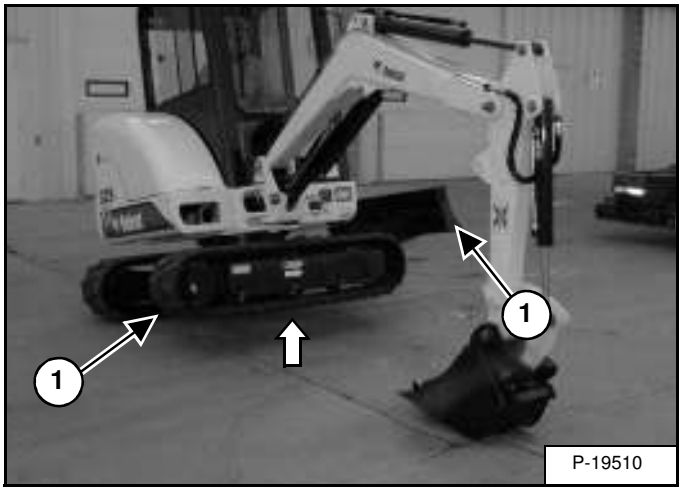
$$\frac{0.787}{0.984} \times 100 = 80$$

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 on Page 10-50-1 for the correct service interval.

Figure 30-20-2



Raise the side of the machine (approximately four inches) using the boom and arm **[Figure 30-20-2]**.

Raise the blade fully and install jackstands under the blade and track frame (Item 1) **[Figure 30-20-2]**. Lower the boom until all machine weight is on the jackstands.

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

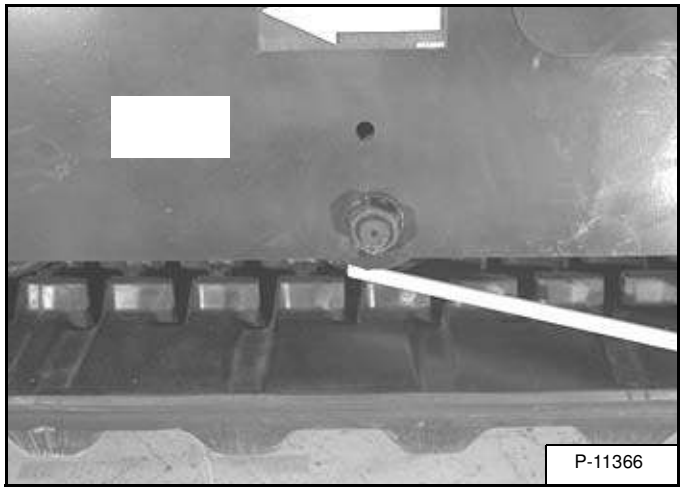
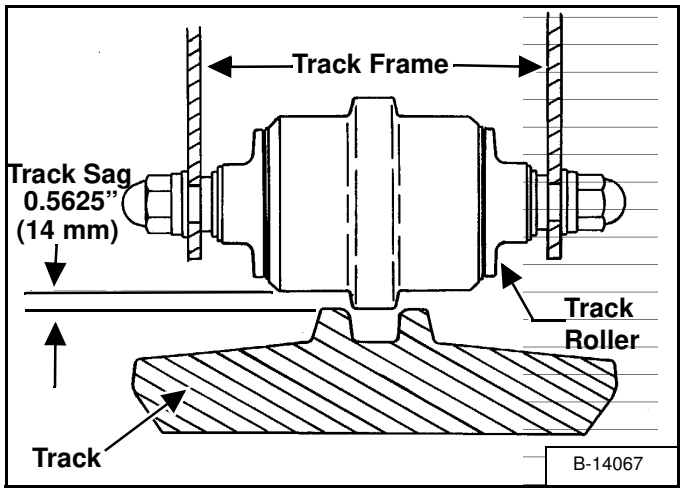


Figure 30-20-4



Measure the sag at the middle track roller **[Figure 30-20-3]**. 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 lug **[Figure 30-20-3]** & **[Figure 30-20-4]**.

Rubber Track Clearance	0.984-1.181 inches (14mm) (25,0-30,0 mm)

Steel Track Clearance

Figure 30-20-5

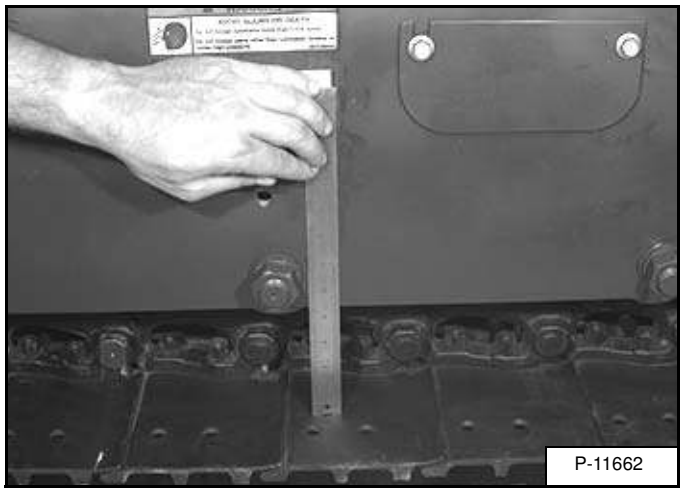
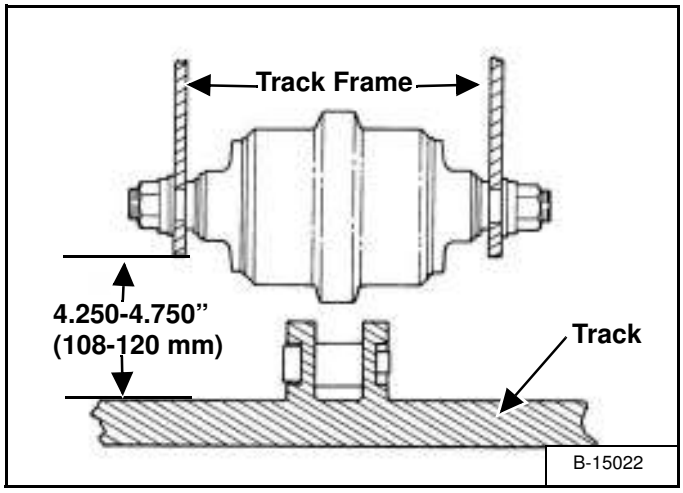


Figure 30-20-6



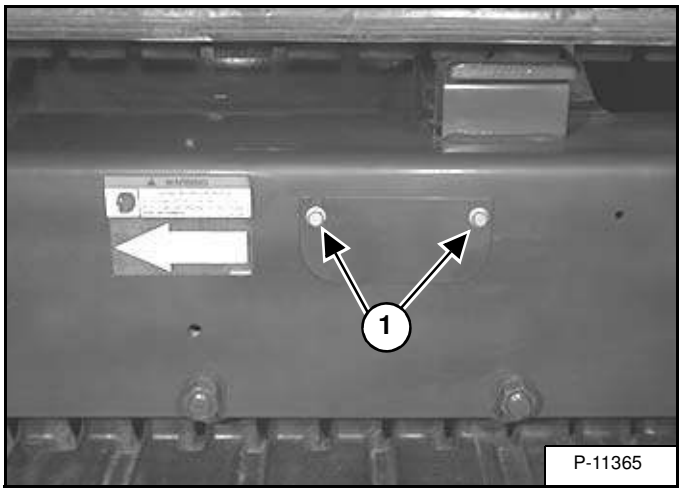
Measure the steel track sag at the center of the track, between the contact surface of the roller and the contact surface of the track **[Figure 30-20-5]** & **[Figure 30-20-6]**. Do Not get fingers into pinch points between the track and the track roller.

Steel Track Sag	4.250-4.750 inches (108-120 mm)

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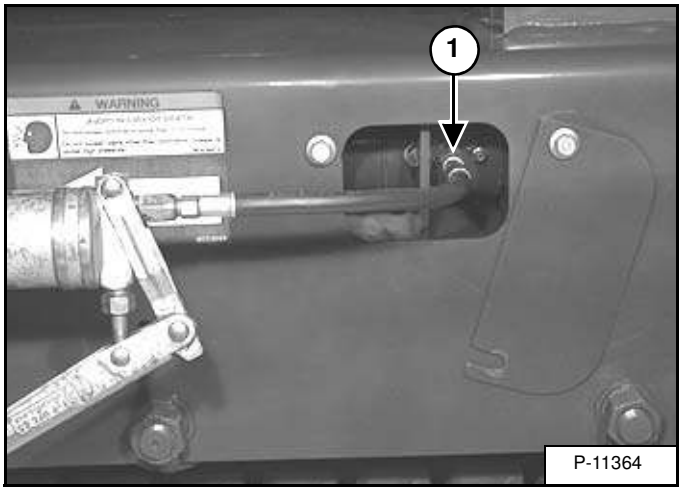
Adjustment (Cont'd)

Figure 30-20-7



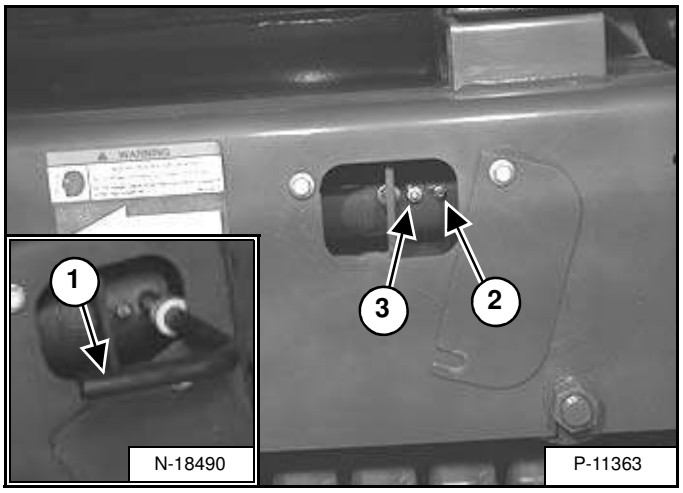
If the track tension is not correct loosen the two bolts from the cover (Item 1) **[Figure 30-20-7]**. Pivot the cover downward.

Figure 30-20-8



Add grease to the fitting (Item 1) **[Figure 30-20-8]** until the track tension is correct.

Figure 30-20-9



If the track tension is too tight use tool MEL1560 (Item 1) to loosen the bleed fitting (Item 2) **[Figure 30-20-9]** (maximum one turn) to release tension from the track.

NOTE: Do not loosen the grease fitting (Item 3) [Figure 30-20-9].

Repeat the procedure for the other side.

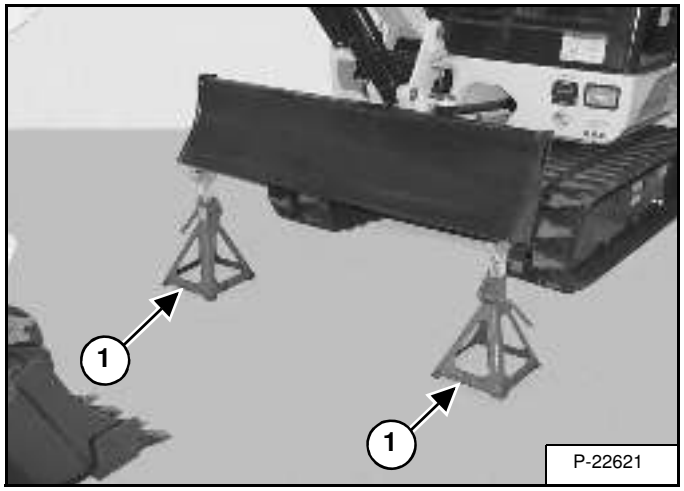
Dealer Copy -- Not for Resale

Rubber Track Removal And Installation

Lift and block both sides of the machine as follows:

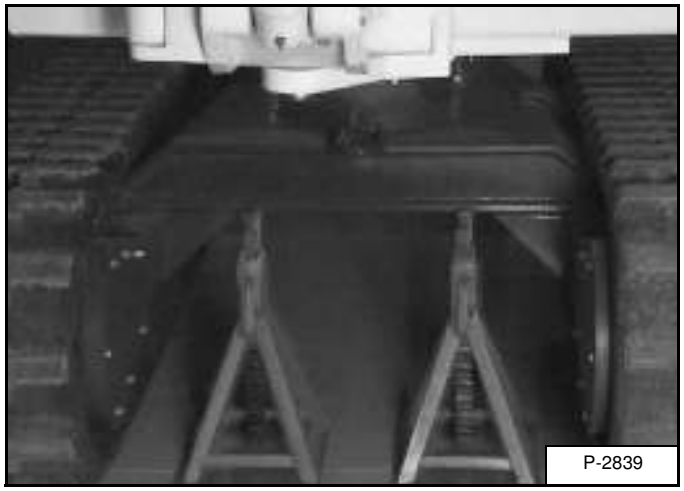
Raise the blade fully.

Figure 30-20-10



Use the boom and arm to lift the blade end of the machine up about 3.0 inches (75 mm) and install jackstands (Item 1) **[Figure 30-20-10]** under the blade.

Figure 30-20-11



Swing the upperstructure 180° and use the boom and arm to slowly lift the opposite end of the undercarriage and install jackstands under the undercarriage **[Figure 30-20-11]**.

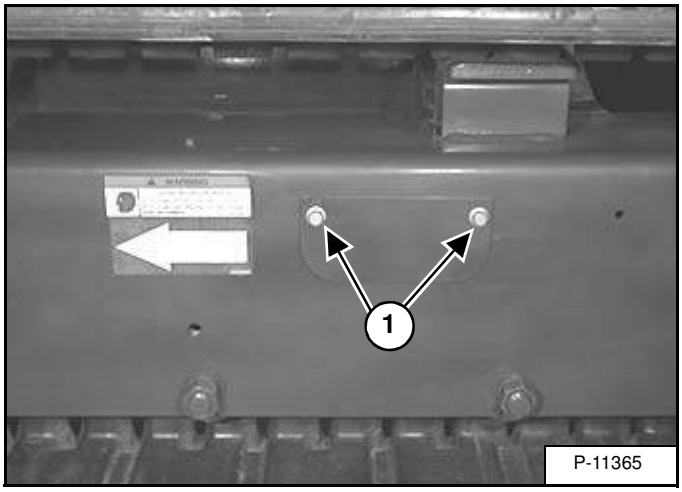
⚠ WARNING

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.

W-2218-1097

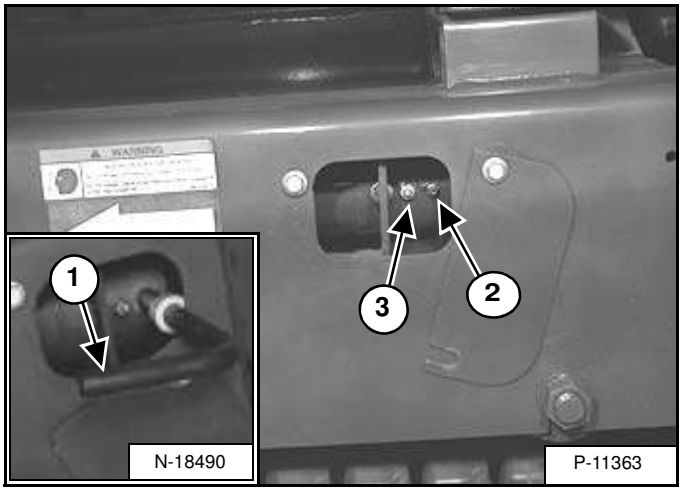
Stop the engine.

Figure 30-20-12



Loosen the two bolts (Item 1) **[Figure 30-20-12]** from the cover. Pivot the cover downwards.

Figure 30-20-13



Loosen the bleed fitting (Item 1) **[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 30-20-13].

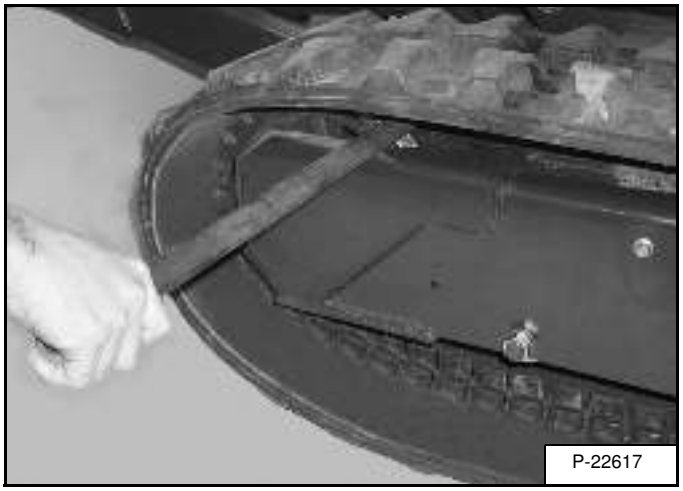
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Rubber Track Removal And Installation (Cont'd)

Start the engine.

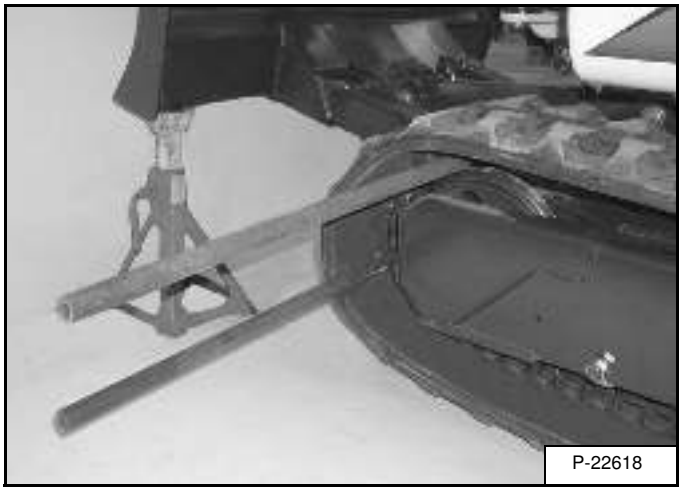
Slowly turn the track in the forward direction.

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.

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 on Page 30-20-1) for adding grease to the grease spring and for checking track tension.

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Steel Track Removal And Installation

With the excavator raised and the bleed fitting loosened (See Adjustment on Page 30-20-1), start the excavator. Slowly turn the track. This will force more grease out of the grease spring.

Stop the engine.

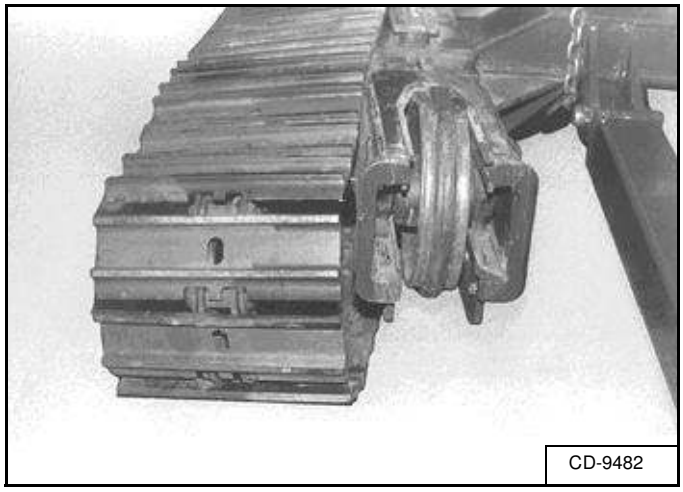
⚠ WARNING

AVOID INJURY OR DEATH
Keep fingers and hands out of pinch points when removing the track.

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The track can be removed either as a complete assembly or by removing a connecting pin and separating the track.

Figure 30-20-17



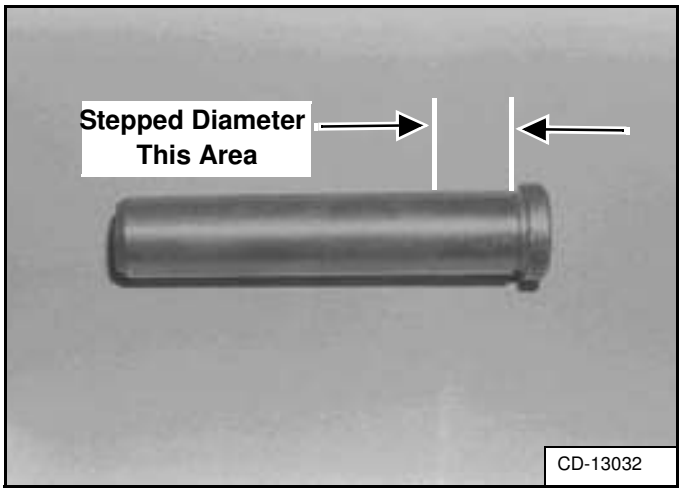
To remove the track as a compete assembly, install a pry bar between the track and the front idler wheel and pry out on the track **[Figure 30-20-17]**.

Installation: Put the track over the drive sprocket lugs. Then position the front of the track over the front idler wheel.

(See Adjustment on Page 30-20-1) for adding grease to the grease spring and for checking track clearance.

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

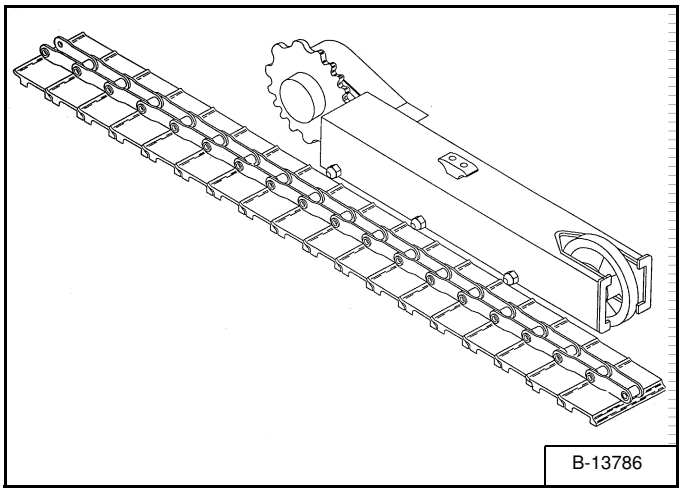
Wear safety glasses to prevent eye injury when any of the following conditions exist:
- **When fluids are under pressure.**
- **Flying debris or loose material is present.**
- **Engine is running.**
- **Tools are being used.**

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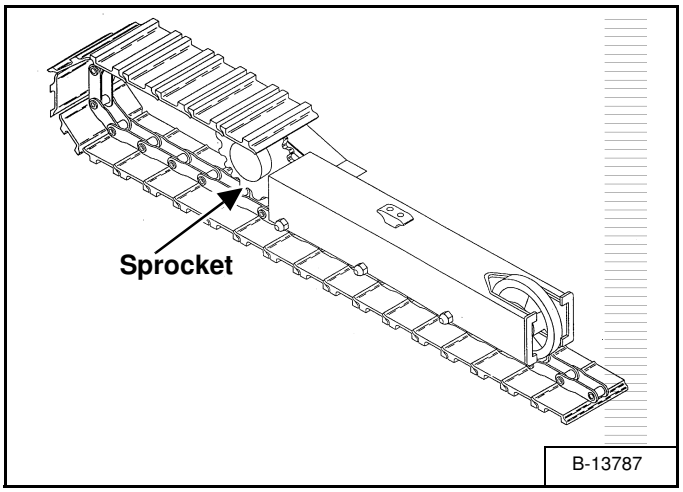
Steel Track Removal And Installation (Cont'd)

Figure 30-20-19



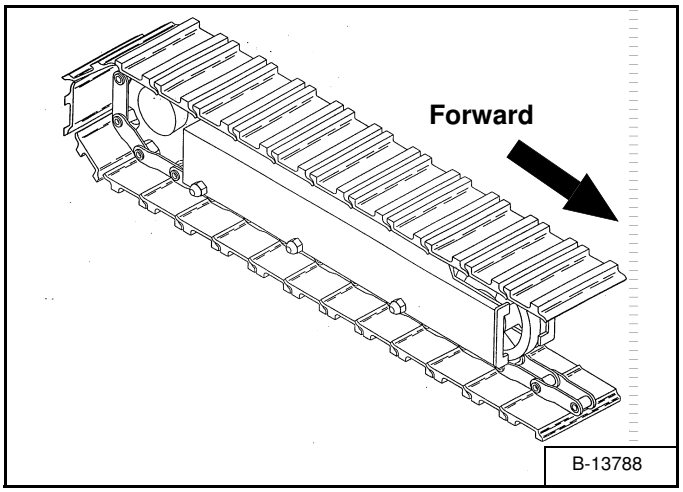
Installation: Put the steel track under the track frame so the front end of the track extends approximately three links in front of idler wheel **[Figure 30-20-19]**.

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 swing 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.

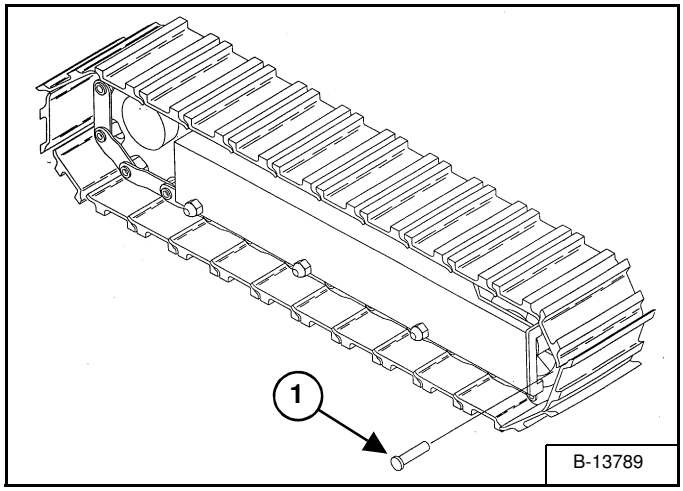
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Steel Track Removal And Installation (Cont'd)

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 heavy 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 on Page 30-20-1) for adding grease to the grease spring and for checking track sag.

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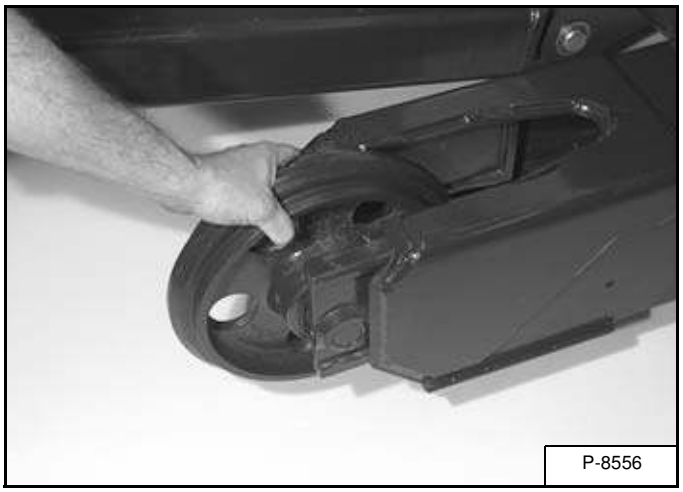
TRACK FRAME

Disassembly And Assembly

Use the following procedure to remove the different parts from the track frame.

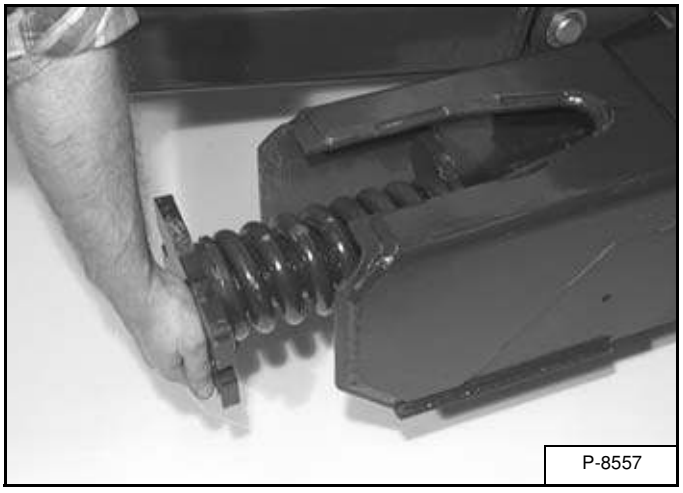
Remove the track. ((See Rubber Track Removal And Installation on Page 30-20-4 or Steel Track Removal And Installation on Page 30-20-6.)

Figure 30-30-1



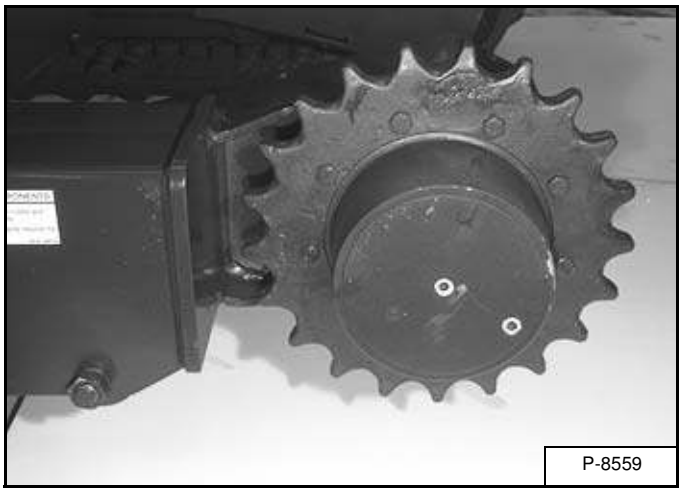
Slide the front track idler out of the track frame **[Figure 30-30-1]**. ((See Disassembly (S/N 232311036 & Below And 232411019 & Below) on Page 30-50-2 or Disassembly (S/N 232311037 & Above And 232411020 & Above) on Page 30-50-9.)

Figure 30-30-2



Remove the recoil spring **[Figure 30-30-2]**. (See Recoil Spring Disassembly And Assembly on Page 30-30-3.)

Figure 30-30-3

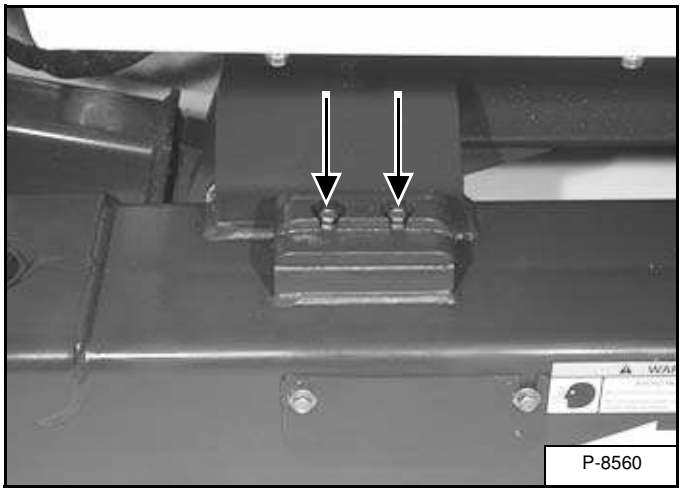


Remove the drive sprocket bolts **[Figure 30-30-3]**.

Installation: Put liquid adhesive (LOCTITE 242) on the bolts and tighten to 80 ft.-lbs. (108 Nm) torque.

Remove the drive sprocket from the travel motor.

Figure 30-30-4



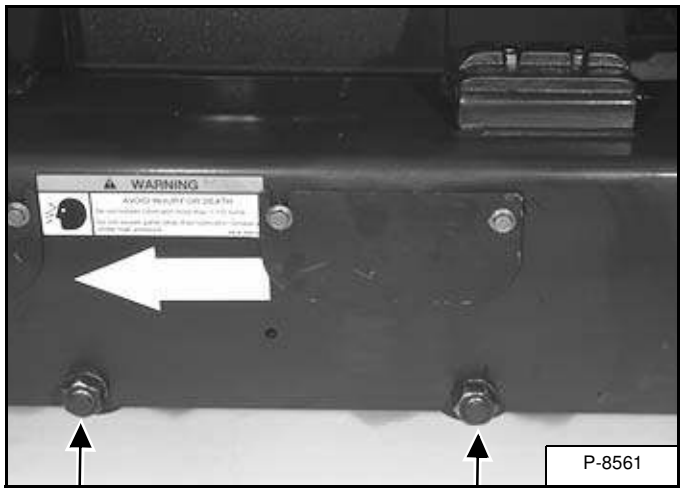
Remove the guide block bolts **[Figure 30-30-4]**.

Remove the guide block.

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Disassembly And Assembly (Cont'd)

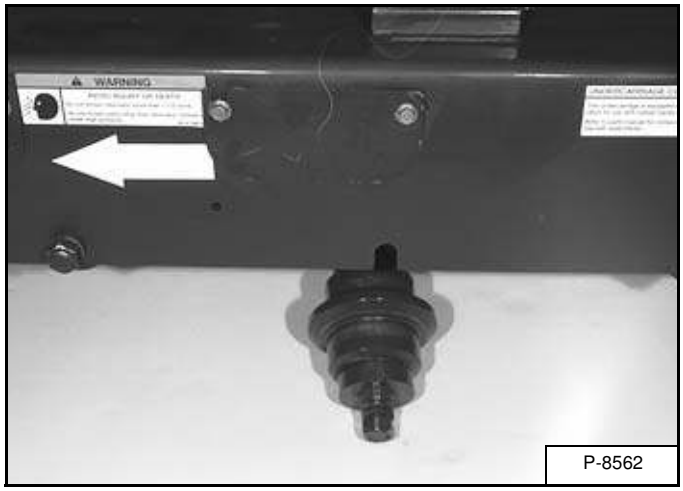
Figure 30-30-5



Loosen the nuts on the track roller on both sides of the track frame **[Figure 30-30-5]**.

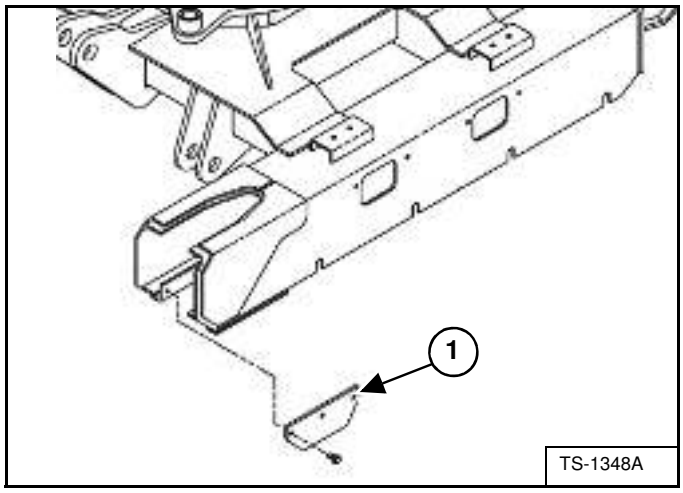
Installation: Tighten the nuts to 125-140 ft.-lbs. (170-190 Nm) torque.

Figure 30-30-6



Remove the track roller **[Figure 30-30-6]** ((See Disassembly (S/N 232311036 & Below And 232411019 & Below) on Page 30-60-2 or Disassembly (S/N 232311037 & Above And 232411020 & Above) on Page 30-60-9.)

Figure 30-30-7

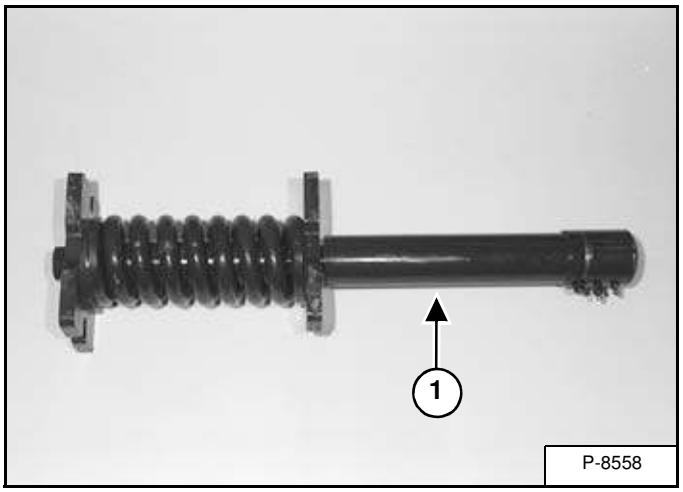


Remove the four guide plates (two per side) (Item 1) **[Figure 30-30-7]** from the track frame (steel tracks only).

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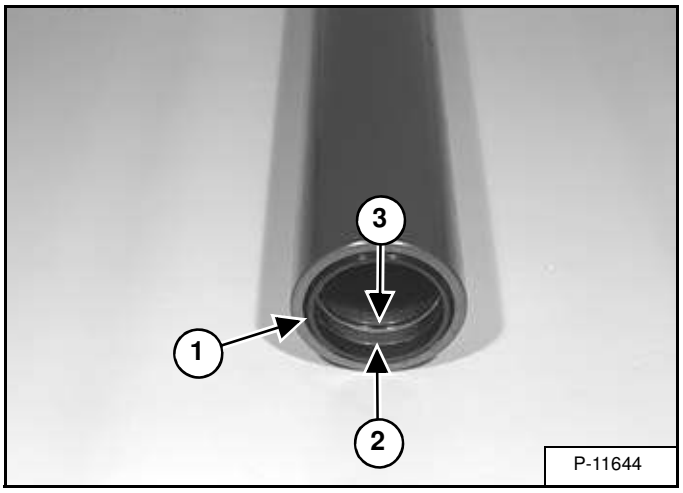
Recoil Spring Disassembly And Assembly

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.

Figure 30-30-10

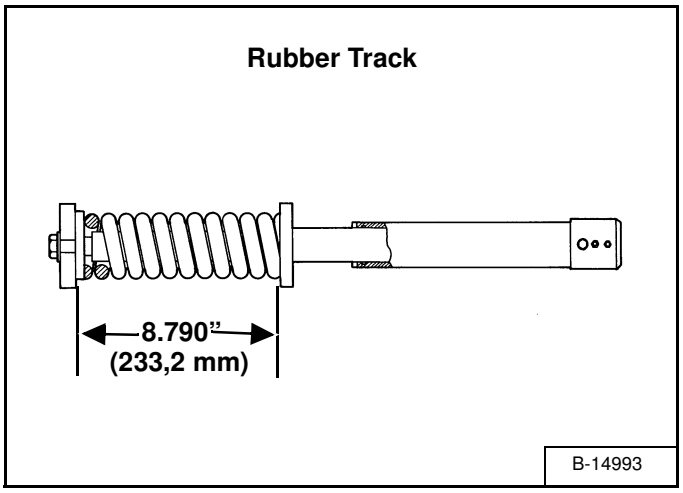
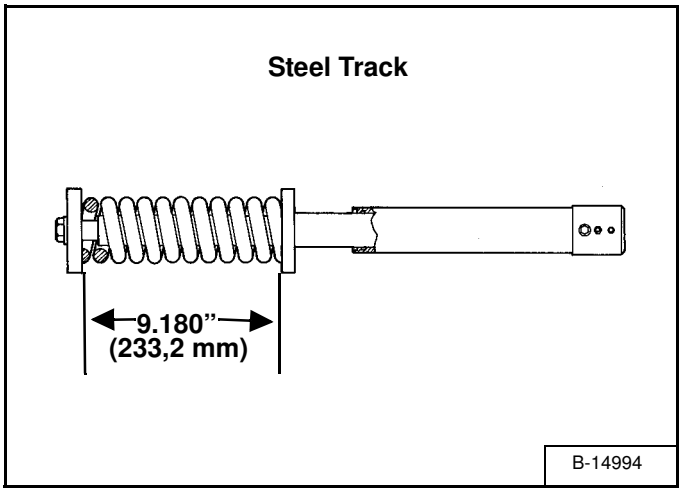


Figure 30-30-11



If the recoil spring is disassembled or whenever the recoil spring is removed from the track frame, check that the recoil spring is compressed to 8.790 inches (223,2 mm) for the rubber track **[Figure 30-30-10]** and 9.180 inches (233,2 mm) for the steel track **[Figure 30-30-11]**.

NOTE: The recoil spring is not adjustable. If it does not meet the required measurement, order a new recoil spring.

NOTE: If the grease cylinder is disassembled, it may be necessary to install the grease spring cylinder assembly in a press and compress the spring slightly to start the bolt.

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TRACK DAMAGE IDENTIFICATIONS

Cutting Of Steel Cords

The following pages show photos and illustrations of track damage and the probable cause of the damage. It is intended to be used for identifying the reason for track damage and how to avoid future track damage.

Figure 30-40-1

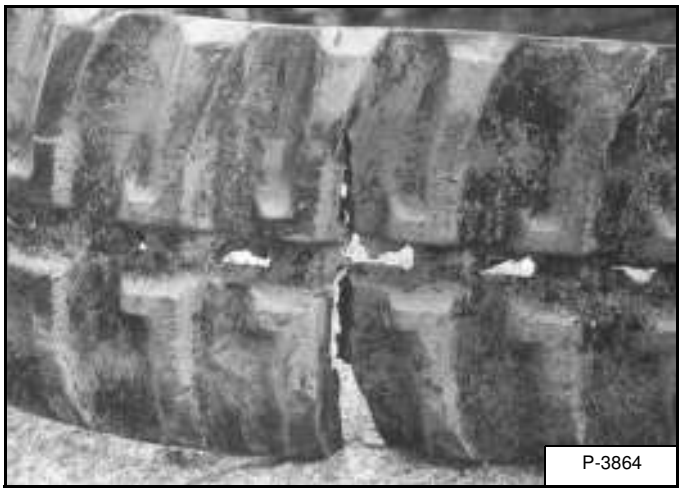
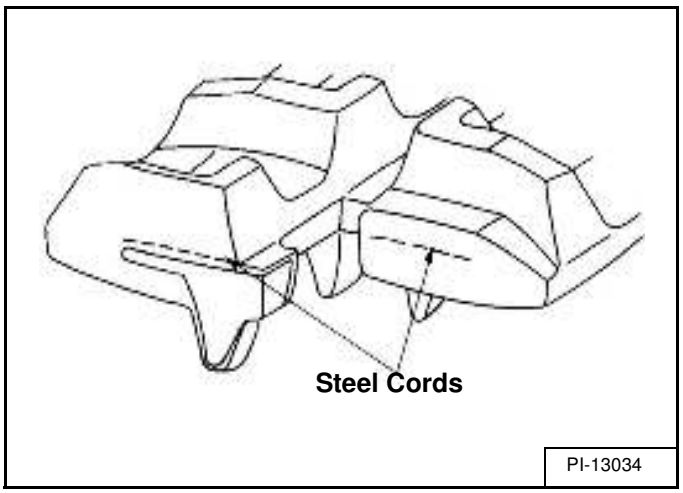


Figure 30-40-2



Damage:

Embedded steel cords are cut off **[Figure 30-40-1]** & **[Figure 30-40-2]**.

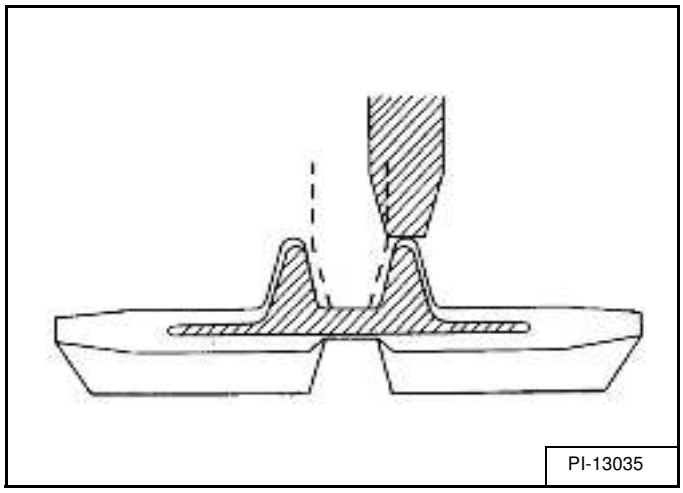
Replacement:

Replacement is required **[Figure 30-40-1]** & **[Figure 30-40-2]**.

Causes of the damage:

When applied to rubber tracks under the following circumstances, tension in excess of the breaking strength of the embedded steel cords causes steel cords to be cut:

Figure 30-40-3



When the rubber track is 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.

Furthermore, when moisture invades through a cut on the lug side rubber surface, the embedded steel cords will corrode. The deterioration of the design strength may lead to the breaking off of the steel cords.

Prevention:

The following preventions should be taken to minimize the risk of this damage:

Periodical checking on site of the recommended track tension. (See Adjustment on Page 30-20-1.)

Avoiding quick turns on bumpy and rocky fields.

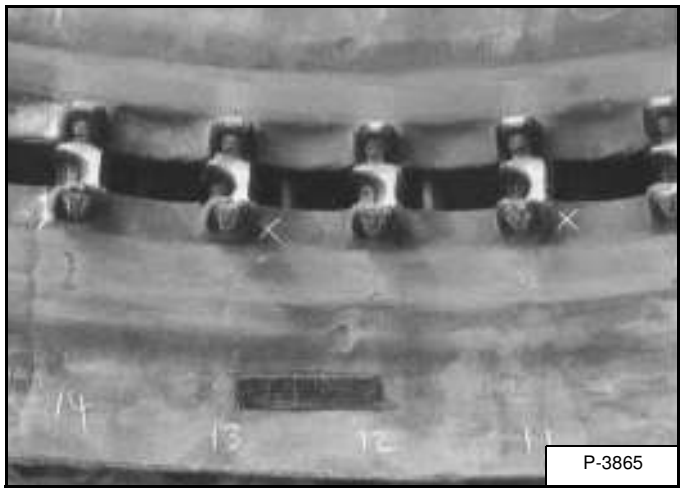
Drive carefully to avoid having stones and other articles clog the rubber tracks.

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

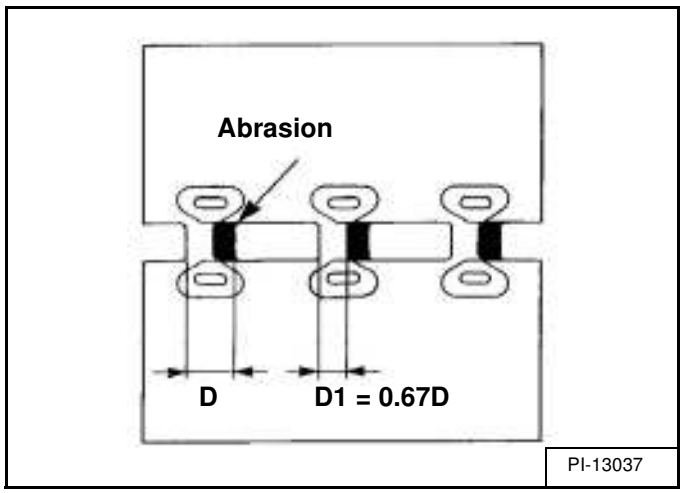
Figure 30-40-4



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.

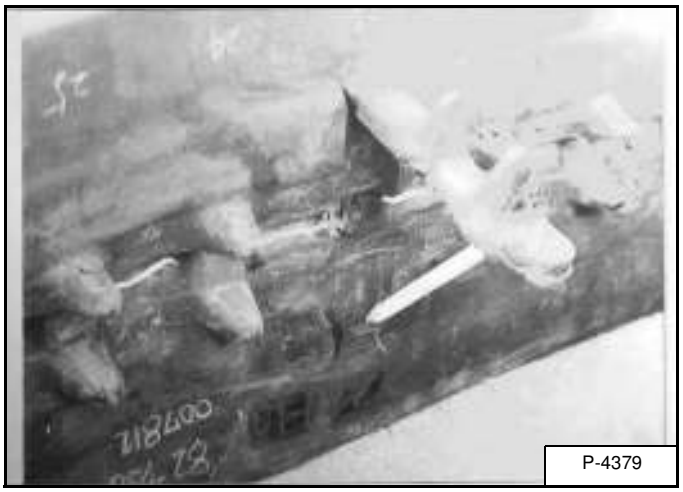
Prevention:

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]**.

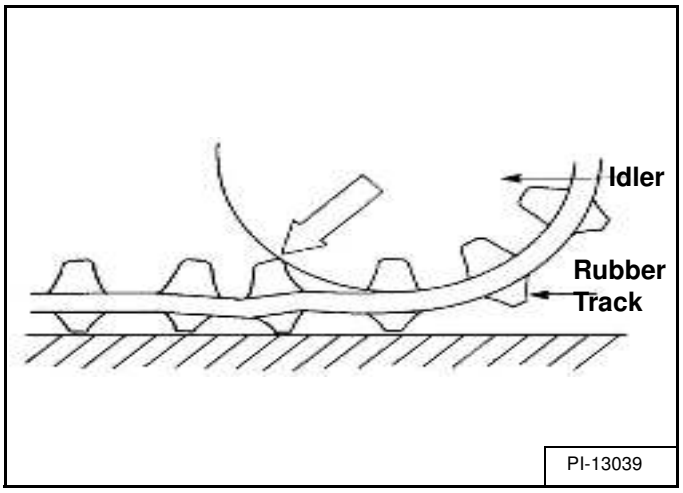
Replacement:

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

Causes of the damage:

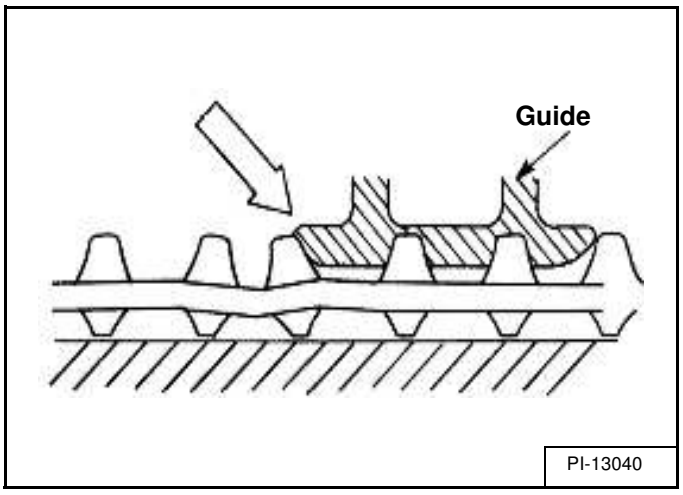
Embedded metals are adhered between the steel cords and the rubber body. The following cases generate external forces greater than the adhesion strength, causing separation of the embedded metals:

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

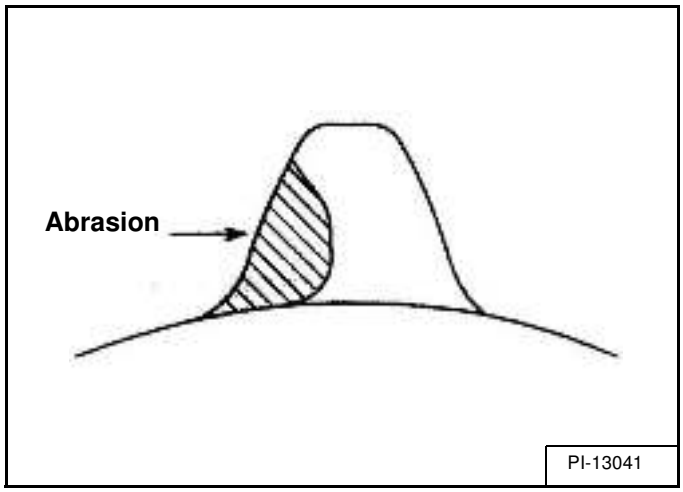


When a rubber track is detracted, it becomes stuck between the guide or the undercarriage frame, causing the separation of embedded metals **[Figure 30-40-8]**.

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Separation Of Embedded Metals (Cont'd)

Figure 30-40-9



Abnormally worn sprockets as shown will pull embedded metals out **[Figure 30-40-9]**.

Prevention:

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

Recommended track tension should be periodically checked. (See Adjustment on Page 30-20-1.)

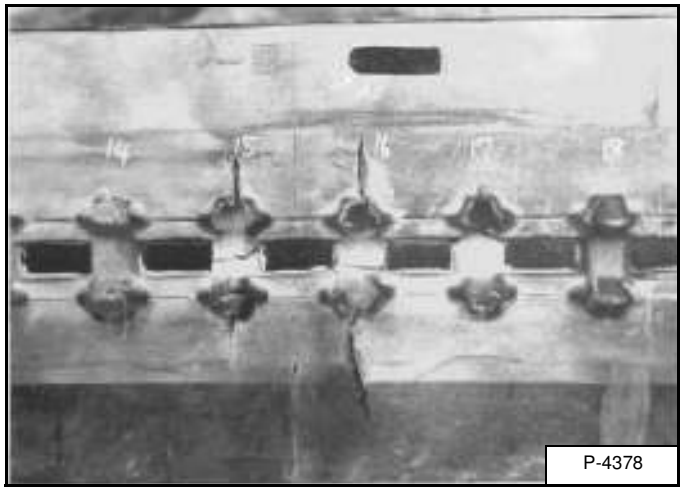
Quick turns on bumpy and rocky fields should be avoided.

If abnormal wear of sprockets is observed, they should be immediately replaced.

Separation Of Embedded Metals Due To Corrosion

Damage:

Figure 30-40-10



Due to corrosion of embedded metals, the adhesion to the rubber body deteriorates, resulting in complete separation **[Figure 30-40-10]**.

Replacement:

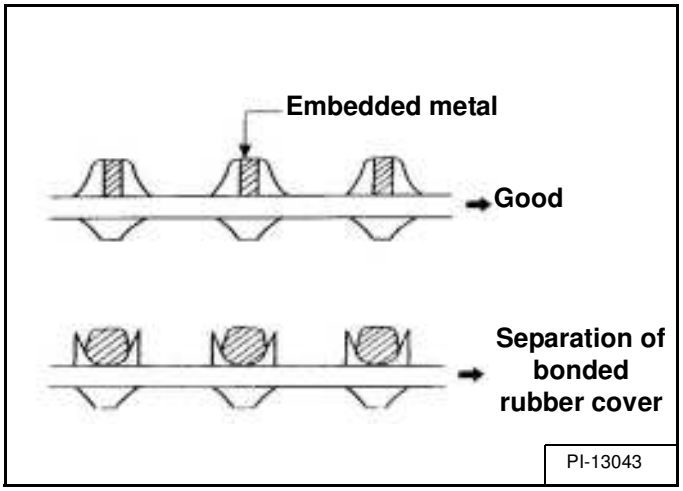
Even a partial separation of embedded metals requires a rubber track replacement.

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Separation Of Embedded Metals Due To Corrosion (Cont'd)

Causes of the damage:

Figure 30-40-11



Embedded metals are bonded to the rubber body. The following operating conditions cause embedded metals to corrode, causing deterioration of the bonding, and finally resulting in separation of the embedded metals from the rubber body **[Figure 30-40-11]**.

Excessively salty fields, like the sea shore.

Strong acidic or alkali soil conditions

Compost spread grounds

On tracks that are out of adjustment, the track rollers, idlers and sprockets will gradually wear the rubber surface at track roller side, causing exposure of the embedded metals. Consequently the embedded metals will corrode resulting in their separation from the rubber body.

Prevention:

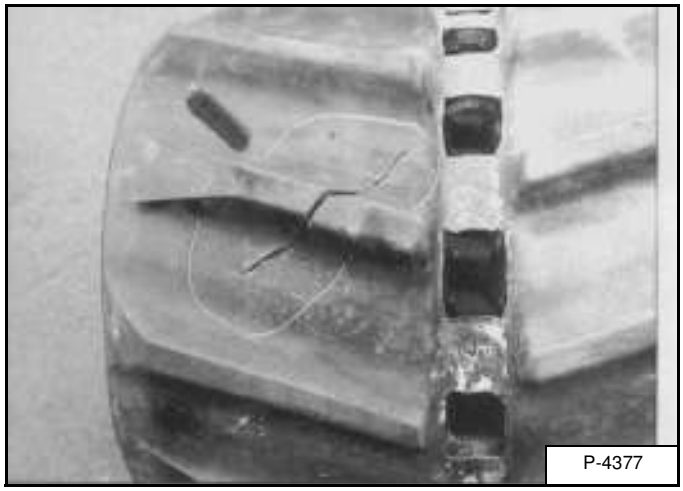
If rubber tracks are used under such field conditions as described under (Causes of the damage), they should be washed with plenty of water. After being completely dried, they should be stored correctly.

When the bonded rubber cover is separated from the embedded metal projections and the metals in the rubber body become loose, it is time to consider replacement of the rubber track.

Cuts On The Lug Side Rubber

Damage:

Figure 30-40-12



Cuts on the lug side rubber often occurs as one of the most typical failure modes **[Figure 30-40-12]**

Replacement:

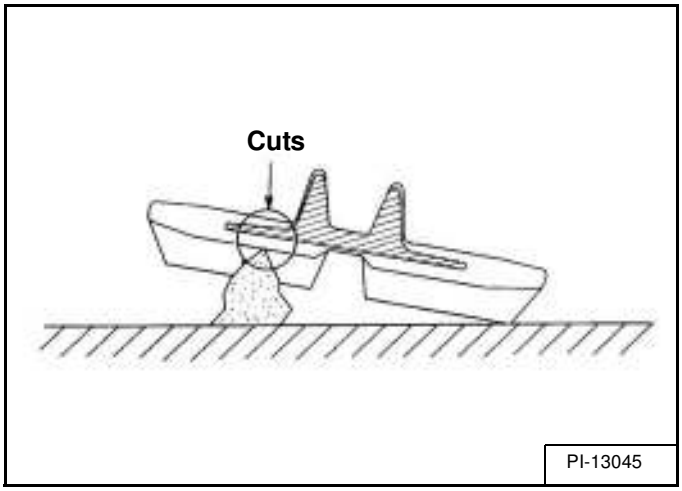
When a cut on the lug side rubber reaches the embedded steel cords, it should be immediately repaired with cold vulcanization rubber.

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Cuts On The Lug Side Rubber (Cont'd)

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.

Cracks On The Lug Side Rubber Due To Fatigue

Damage:

Figure 30-40-14

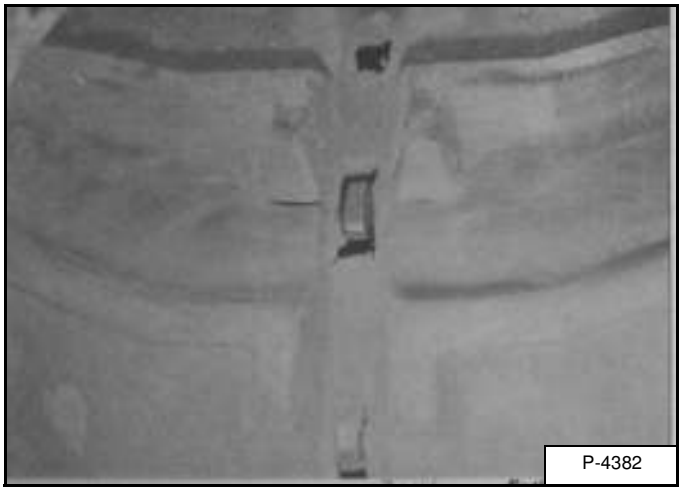
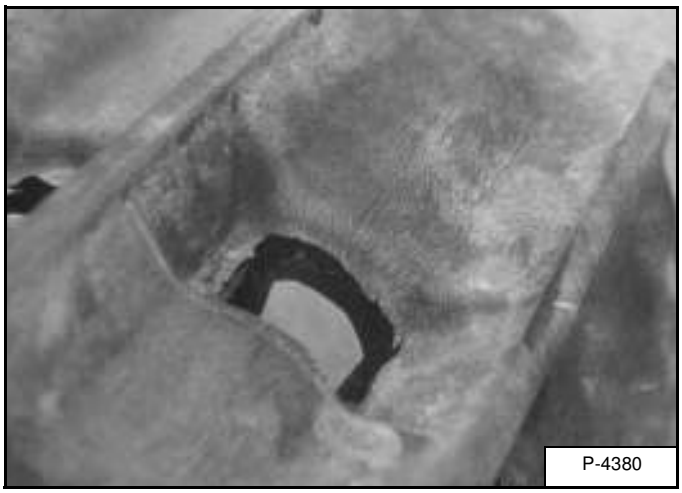


Figure 30-40-15



Small cracks around the root of the lug 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. Also when operating near seashores or under cold temperatures, rubber tracks are more likely to suffer from ozone cracks.

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Cracks On The Lug Side Rubber Due To Fatigue (Cont'd)

Prevention:

Rubber tracks are designed with special rubber compounds to prevent cracks due to fatigue. However, external injuries on the lug side rubber sometimes cause more chance of cracking. Machine operators should observe soil conditions when driving, so as not to cause external injuries to the lug side rubber. In order to minimize the occurrence of ozone cracks, attention should be paid to the following instructions for maintenance:

Avoid exposing stored tracks to direct sun light.

Avoid exposing stored tracks to direct rain and snow fall.

Store tracks in well ventilated warehouses.

Use the tracks at least once a month.

Lug Abrasion

Damage:

Figure 30-40-16

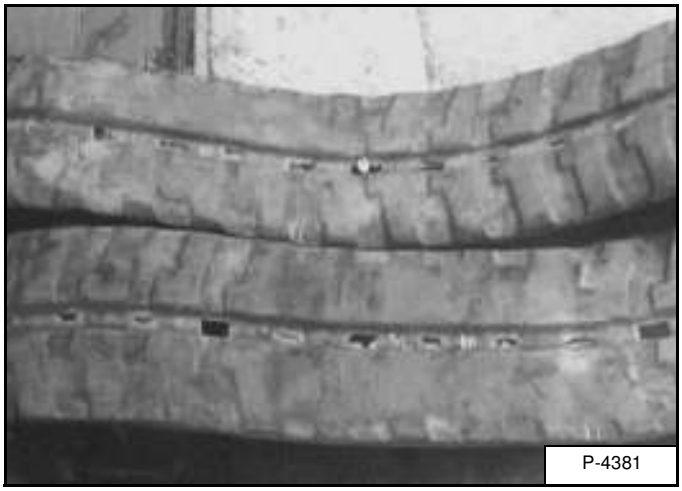
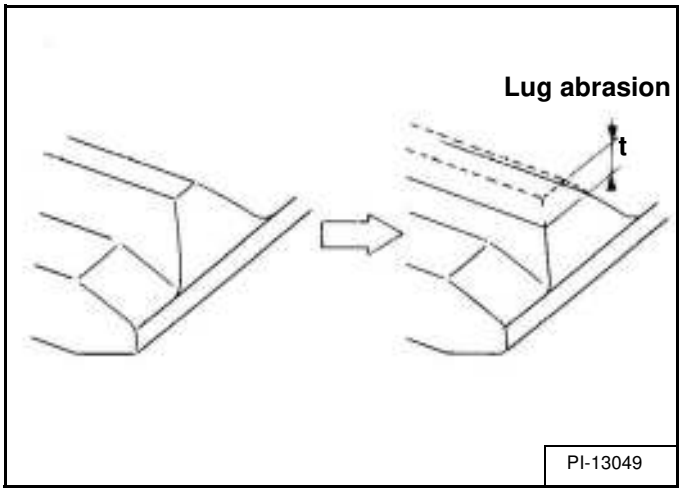


Figure 30-40-17



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 more or less inevitable. Even if lug abrasion is proceeding, the rubber track can be used. However, as the traction performance deteriorates accordingly, it is highly recommended to replace the abraded tracks with new ones when the lug height becomes less than 5 mm.

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Lug Abrasion (Cont'd)

Prevention:

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

Making quick and repeated turns on concrete and asphalt roads

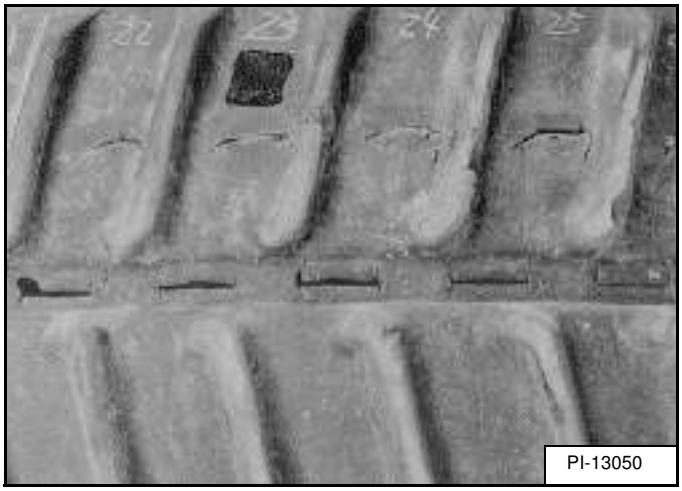
Driving up and down hilly paths with slippage

Making frequent turns on paths covered with rocks and wood

Cracks And Cuts On The Lug Side Rubber

Damage:

Figure 30-40-18



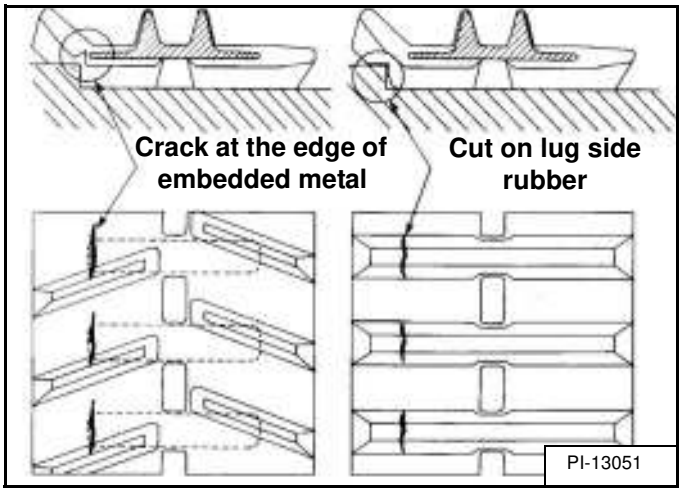
Sometimes cracks and cuts on the lug side rubber at the edges of the embedded metals can be observed **[Figure 30-40-18]**.

Replacement:

Basically, no replacement is required unless the cuts on the lug side rubber are discovered all around the edges of the embedded metals, as this will result in a complete cut off.

Causes of the damage:

Figure 30-40-19



When rubber tracks drive over sharp projections, intensive stress is applied to the lug side rubber surface, especially at the edges of embedded metals, causing cracks and cuts in the area around the embedded metals **[Figure 30-40-19]**.

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Cracks And Cuts On The Lug Side Rubber (Cont'd)

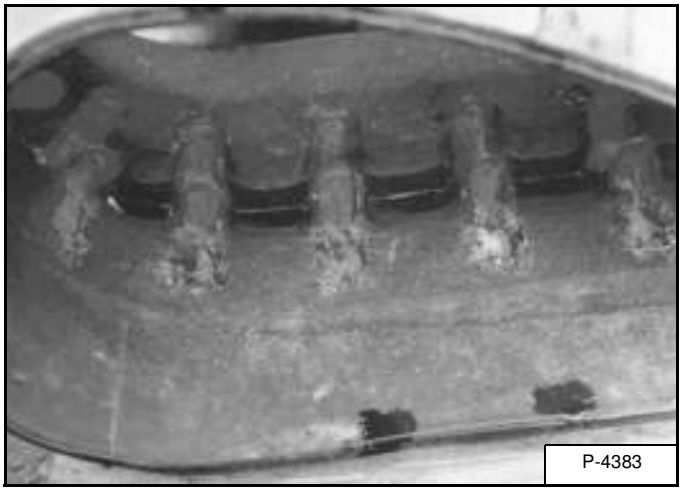
Prevention:

To avoid extensive stress applied to the lug root where metals are embedded, machine operators are requested to avoid driving over stumps and ridges.

Abrasion Of The Track Roller Side

Damage:

Figure 30-40-20



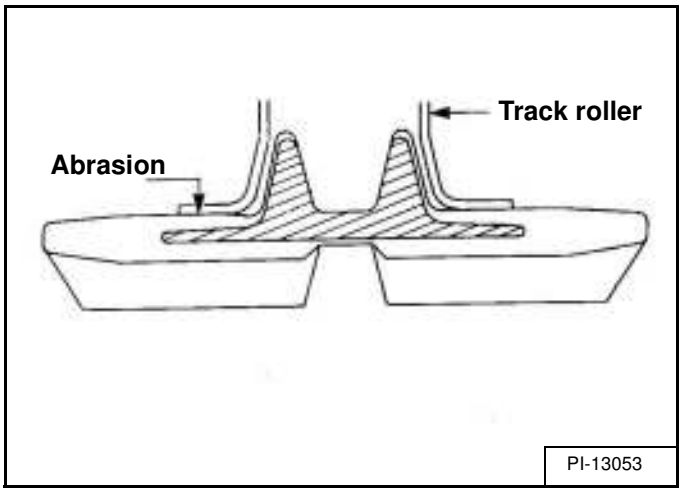
The rubber surface on which track rollers run is gradually abraded. It will end in the exposure of the embedded metals **[Figure 30-40-20]**.

Replacement:

It is recommended to replace the rubber track when more than half of the embedded metals are completely exposed.

Causes of the damage:

Figure 30-40-21



The abrasion of the track roller side rubber surface occurs because of sand and gravel being clogged between the rubber and the outside surface of the track rollers. The stress pushes the sand and gravel against the side of the rubber track to cause the abrasion **[Figure 30-40-21]**.

The level of abrasion is highly dependent on terrain conditions. A higher level of abrasion will occur when the rubber tracks are operated in fields covered with many stones and gravel. Small stones hardened with mud, stuck to the track rollers increase the abrasion level. After an extended period of abrasion, it will be more likely for exposed embedded metals to catch moisture through the inside steel cords, which can cause breakage of steel cords and separation of the metals from the rubber body.

Prevention:

After operation in wet fields containing many small stones, wash off the mud that is stuck to the track rollers completely. When operating on gravel paths and stony grounds, machines should be driven slowly and the turning radius should be big enough to prevent stones and gravel from getting stuck to the track roller side rubber.

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TRACK DAMAGE IDENTIFICATIONS (CONT'D)

Cuts On The Edges Of Track Roller Side

Damage:

Figure 30-40-22

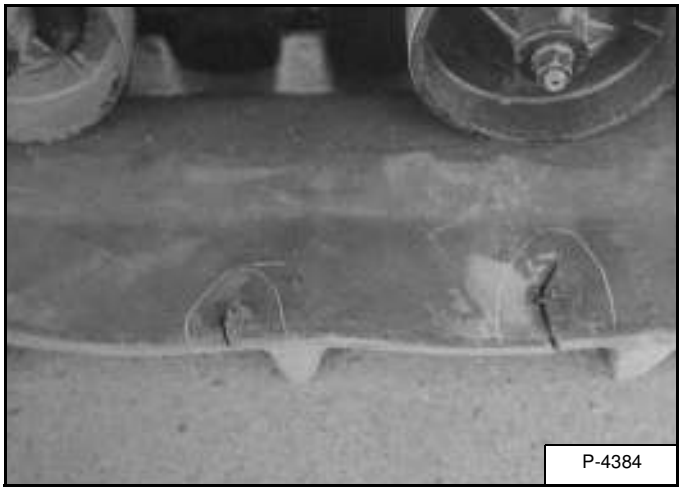
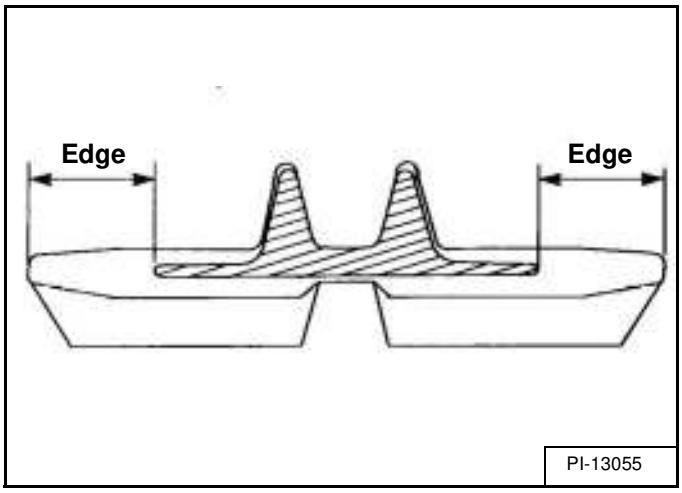


Figure 30-40-23



Both edges of a 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:

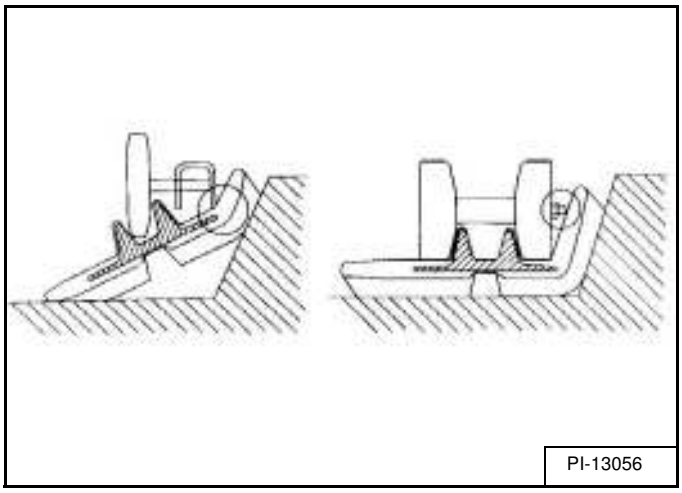
In such case, the rubber track does not have to be replaced.

Causes of the damage:

This damage is caused by objects on the field or by interference with the machine frame.

In case of damage by objects on the operating ground:

Figure 30-40-24



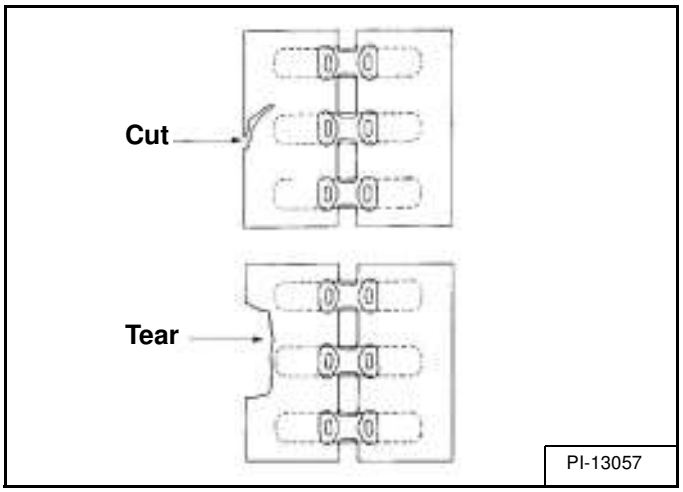
The edges of rubber track are often deformed largely due to a bumpy ground surface, stones and other objects, which cause extensive stress on the edges resulting in the damage. Especially, when a machine drives over concrete ridges, this type of damage easily occurs **[Figure 30-40-24]**.

In case of damage by interference with the machine frame

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Cuts On The Edges Of Track Roller Side (Cont'd)

Figure 30-40-25



If a machine continues operating with rubber tracks being detracted, the rubber tracks may get caught up in the machine frame or undercarriage parts resulting in damage. Furthermore, when a machine travels along side slopes, the rubber tracks are deformed so much that they come into contact with the machine frame and undercarriage parts, which causes cutting, gouging and rubbing of rubber tracks in the end **[Figure 30-40-25]**.

Prevention:

When traveling, a machine operator should be careful not to drive over any projections on the ground. He should also prevent rubber tracks from coming into contact with concrete walls, ditches and ridges. If rubber tracks are detracked, the machine should be stopped immediately for retracting.

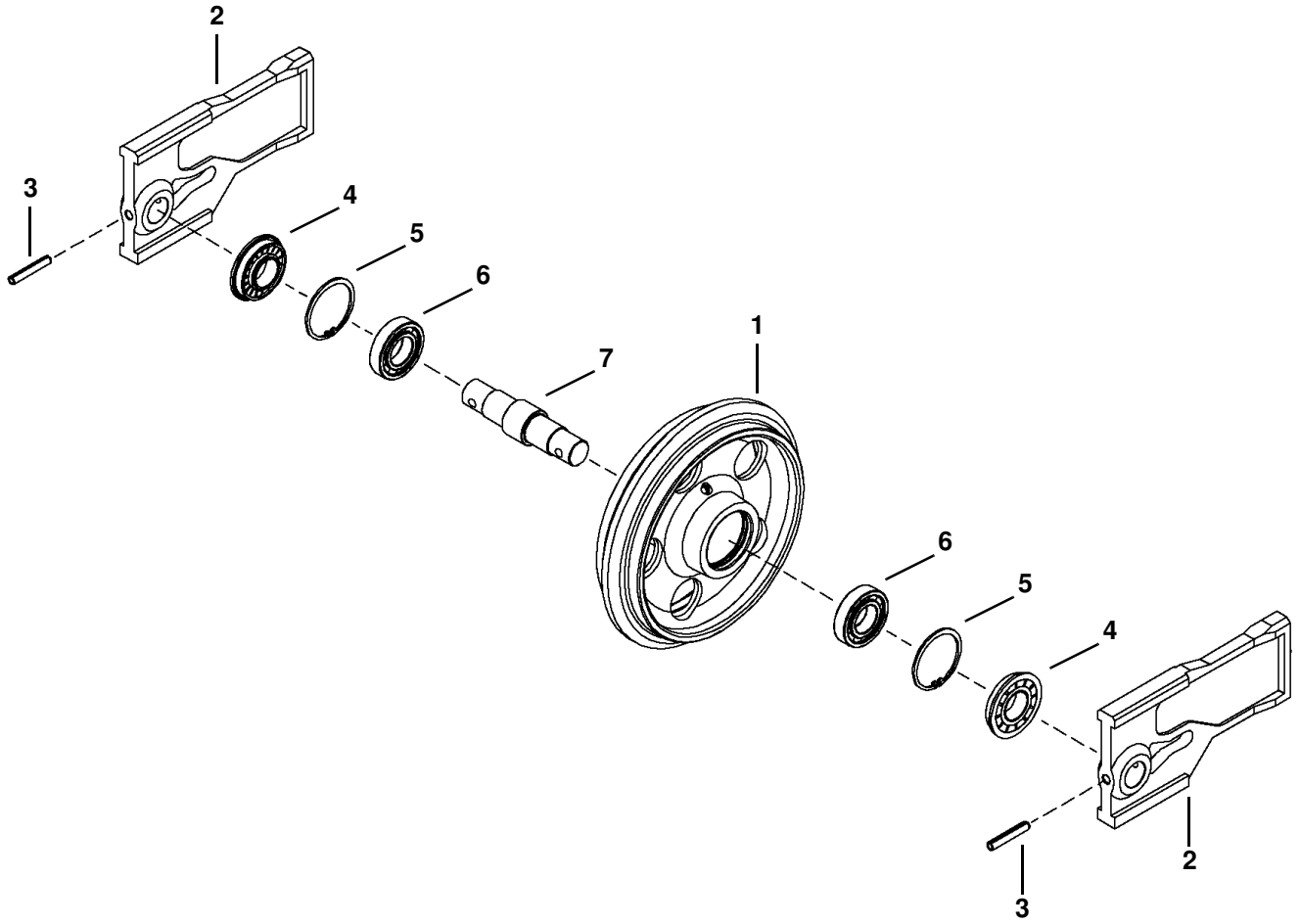
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Parts Identification (S/N 232311036 & Below And 232411019 & Below)

1. Idler
2. Block
3. Pin
4. Seal
5. Snap Ring
6. Bearing
7. Shaft



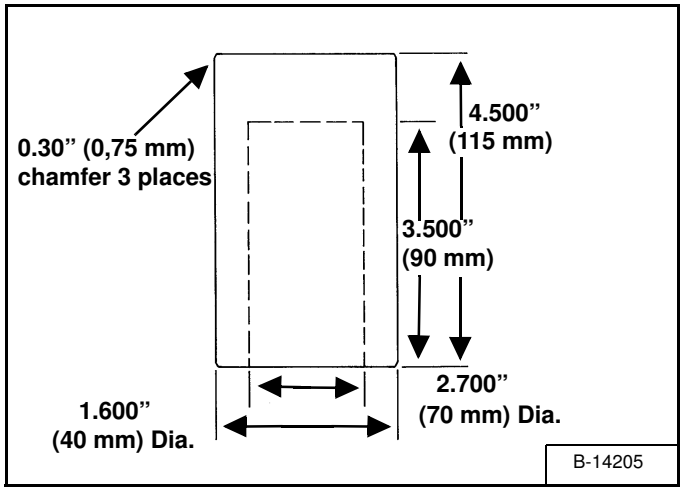
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Disassembly (S/N 232311036 & Below And 232411019 & Below)

The following tools must be fabricated for this procedure:

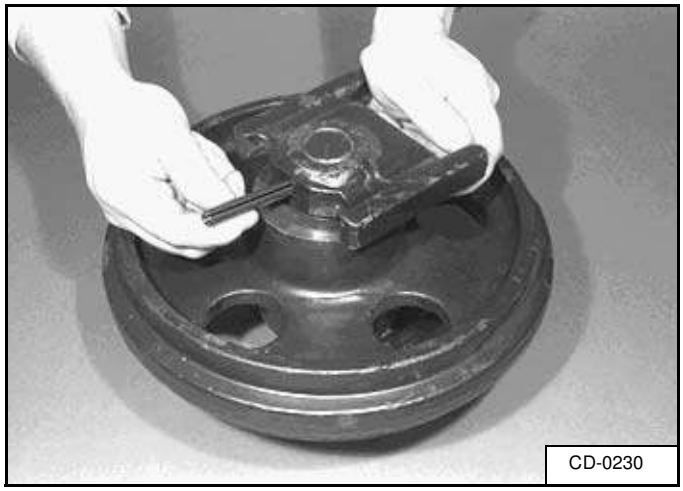
Figure 30-50-1



1. Driver Tool - See **[Figure 30-50-1]**.

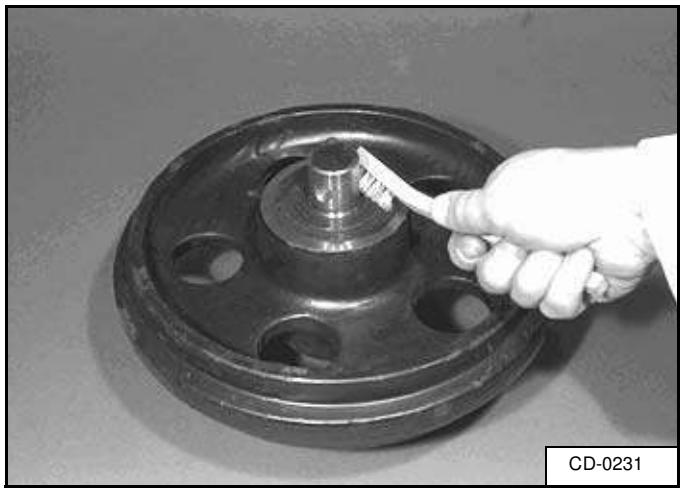
2. Support Fixture - Tube, 3.0 inches ID x 0.250 inch wall x 6.0 inches long.

Figure 30-50-2



Remove the roll pin and block from each end of the shaft **[Figure 30-50-2]**.

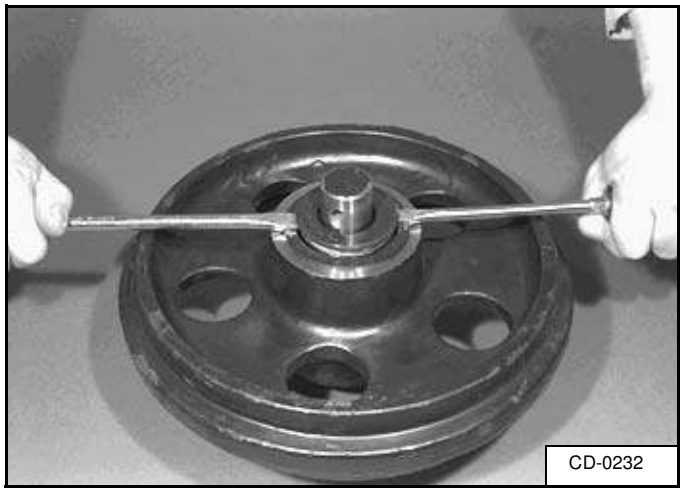
Figure 30-50-3



Use a wire brush to remove any corrosion or paint from both ends of the exposed shaft that could affect seal removal or damage the new seal during installation **[Figure 30-50-3]**.

Apply penetrating oil to both ends of the exposed shaft to ease removal of the inner part of the seal.

Figure 30-50-4

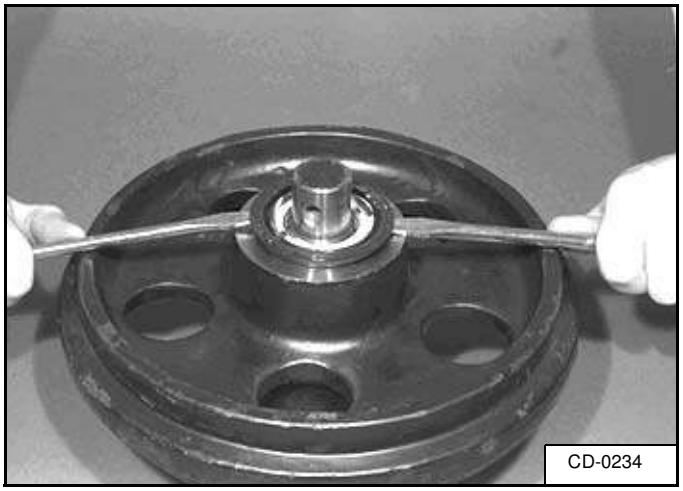


Remove the inner part of the seal using two screwdrivers **[Figure 30-50-4]**.

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Disassembly (S/N 232311036 & Below And 232411019 & Below) (Cont'd)

Figure 30-50-5



Remove the outer part of the seal from the idler using two screwdrivers **[Figure 30-50-5]**.

Pour the oil out of the idler. Discard the oil in an appropriate manner.

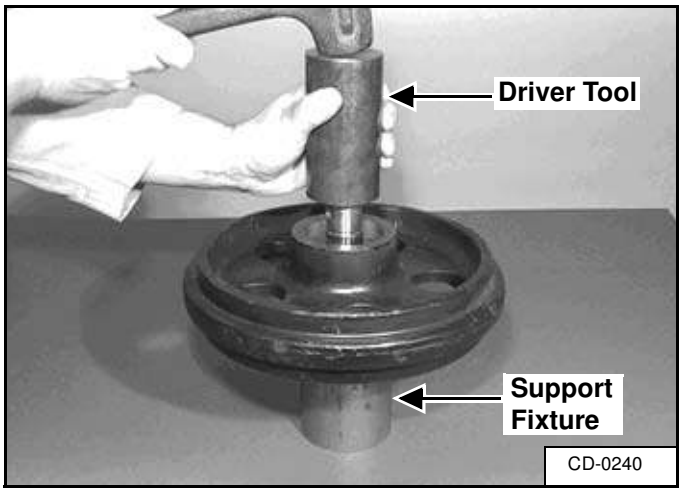
Turn the idler assembly over and remove the other seal.

Figure 30-50-6



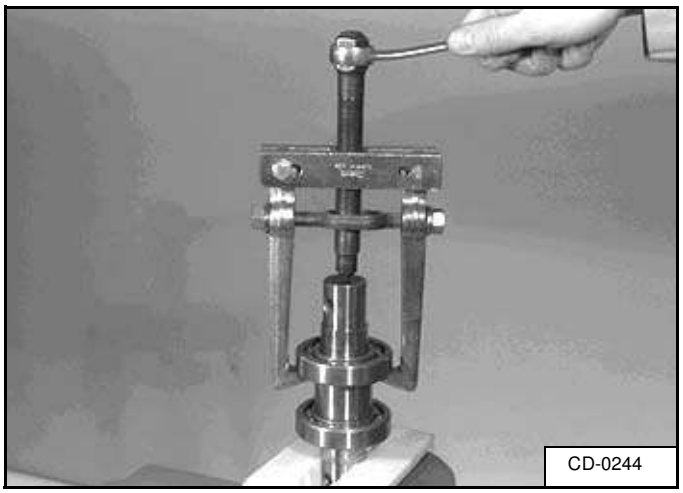
Remove the snap ring from each side of the idler **[Figure 30-50-6]**.

Figure 30-50-7



Using the fabricated driver tool and support fixture, press or drive the shaft and bearing assembly out of the idler **[Figure 30-50-7]**.

Figure 30-50-8



Inspect the bearings for rust or for rough spots. The bearings must turn freely. If any damage is found, replace the bearings. If replacement of the bearings is necessary, use a two or three jaw puller, remove the two bearings from the shaft **[Figure 30-50-8]**.

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Assembly (S/N 232311036 & Below And 232411019 & Below)

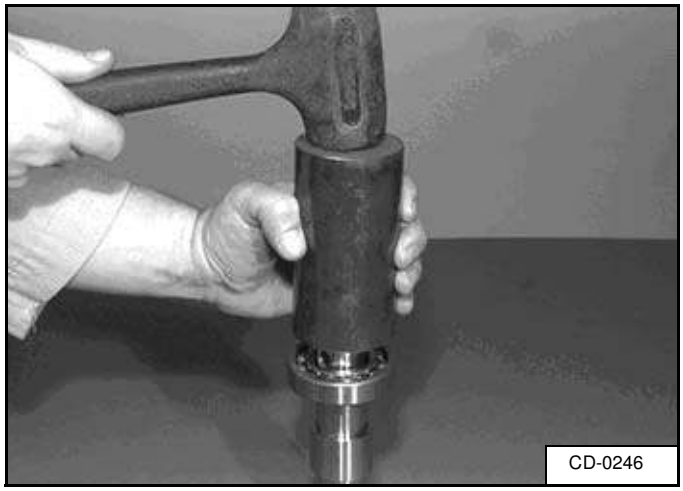
Figure 30-50-9



Remove all paint and corrosion from the seal surface on both sides of the idler **[Figure 30-50-9]**.

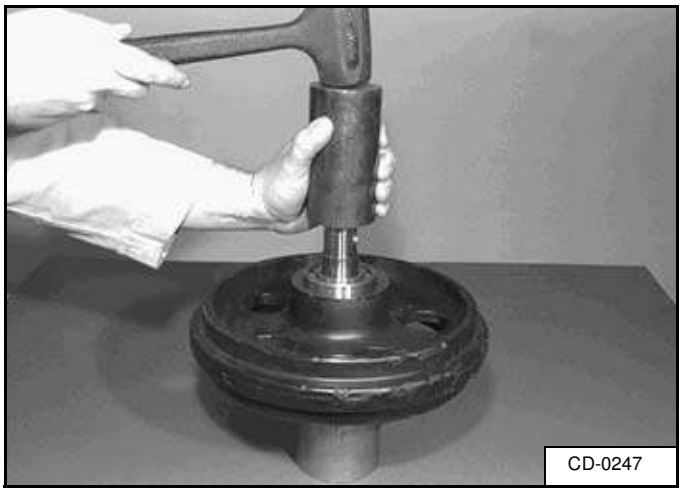
Be sure all parts are clean before assembly.

Figure 30-50-10



Using the driver tool, install new bearings, with the numbered side upward, onto the shaft **[Figure 30-50-10]**. Press only on the inner diameter of the bearing.

Figure 30-50-11



Using the driver tool, install the shaft and bearing assembly into the roller **[Figure 30-50-11]**.

Figure 30-50-12



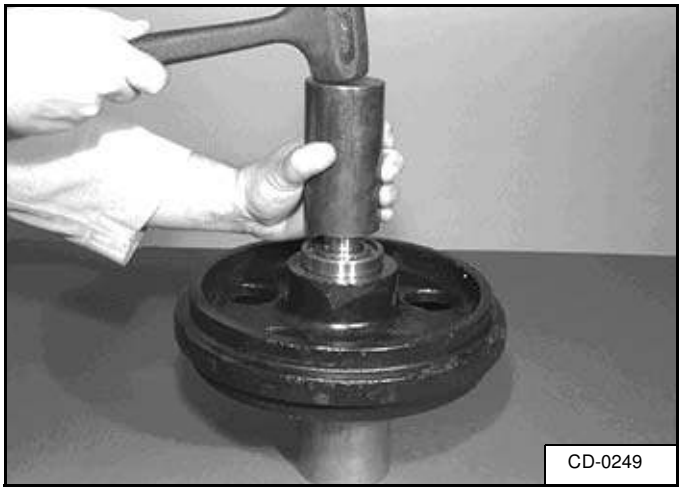
Install the snap ring **[Figure 30-50-12]**.

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Assembly (S/N 232311036 & Below And 232411019 & Below) (Cont'd)

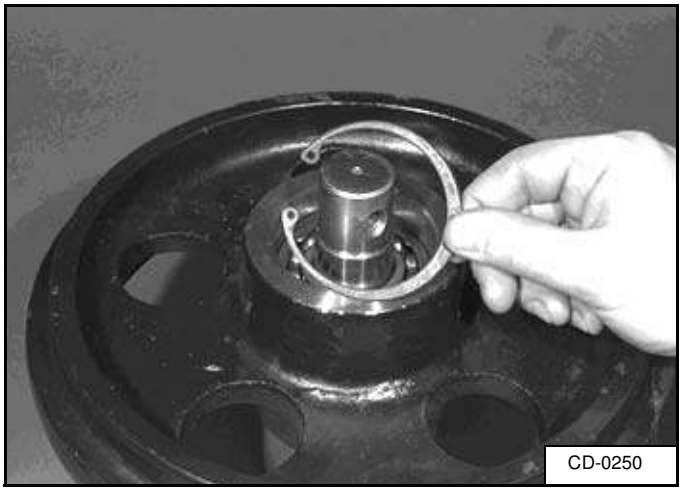
Turn the idler assembly over.

Figure 30-50-13



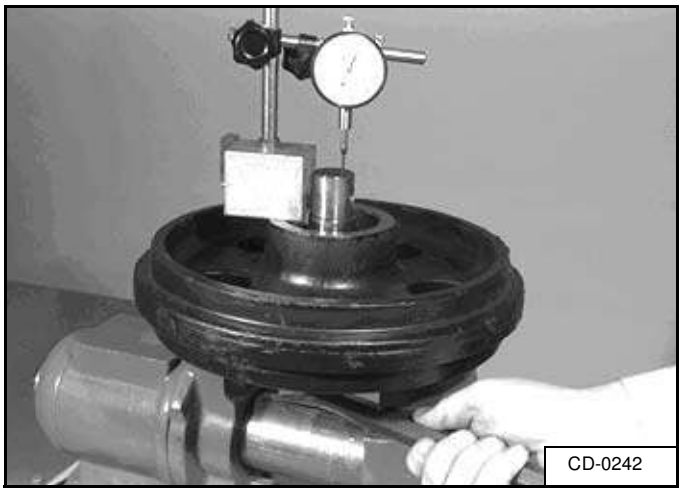
Using the driver tool, install the bearings, with the numbered side upward, into the idler **[Figure 30-50-13]**.

Figure 30-50-14



Install the snap ring **[Figure 30-50-14]**.

Figure 30-50-15



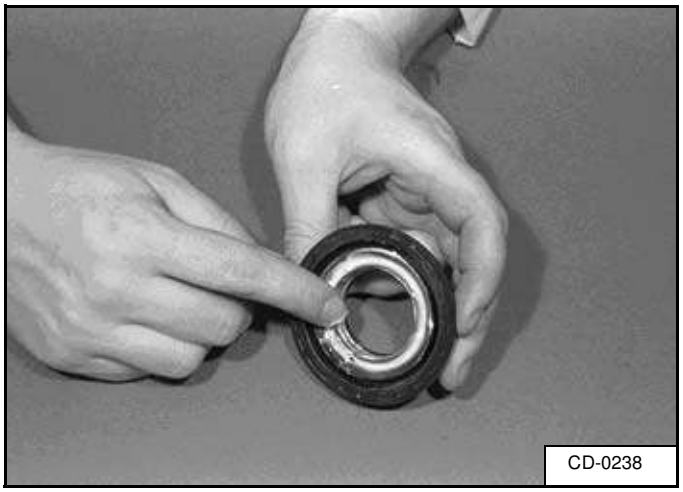
Using a dial indicator, check the endplay of the shaft **[Figure 30-50-15]**.

If the endplay is greater than 0.030 inch (0,76 mm) then the bearing must be shimmed.

Cut a shim from the necessary thickness shim stock and install the shim between the bearing and the shoulder on the shaft.

Separate the inner and outer halves of the seal.

Figure 30-50-16

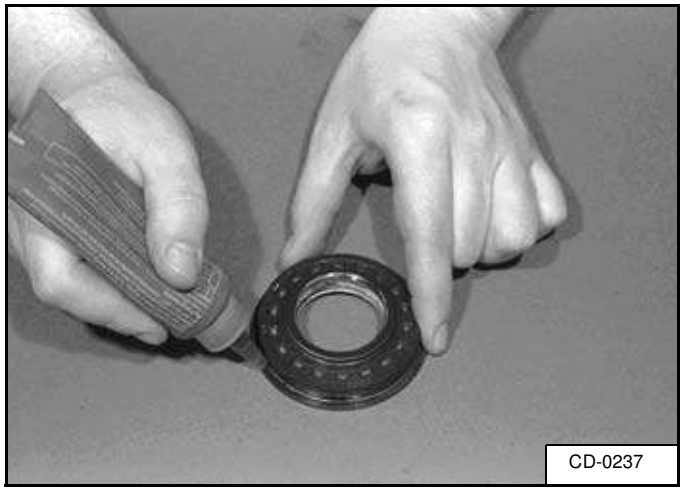


Apply grease to the grooves on the outer part of a new seal **[Figure 30-50-16]**.

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Assembly (S/N 232311036 & Below And 232411019 & Below) (Cont'd)

Figure 30-50-17



Apply a small bead of high temperature silicone sealant around the flange surface of the seal **[Figure 30-50-17]**.

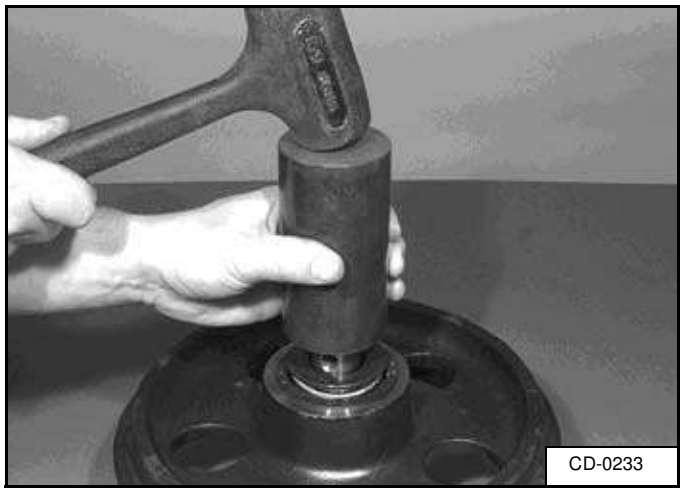
Figure 30-50-18



Using the driver tool, install the outer part of the new seal into the idler **[Figure 30-50-18]**.

NOTE: The inner and outer parts of the seal must be installed separately so the air will escape from under the seal.

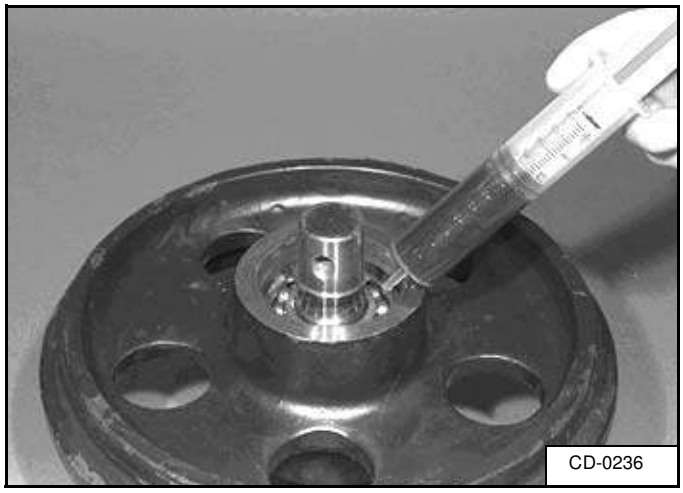
Figure 30-50-19



Using the driver tool, install the inner part of the new seal over the shaft **[Figure 30-50-19]**.

NOTE: The inner part of the seal must be pressed down level with the outer part of the seal to seal properly.

Figure 30-50-20



Turn the idler assembly over. Using a syringe add 100 cc of SAE 10W/30 oil to the assembly **[Figure 30-50-20]**.

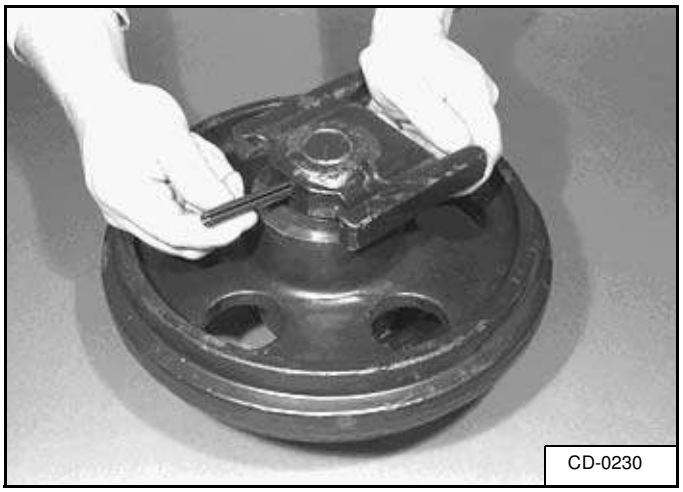
Repeat **[Figure 30-50-16 on Page 5]** through **[Figure 30-50-19]** to install the remaining seal.

Check for leaks.

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Assembly (S/N 232311036 & Below And 232411019 & Below) (Cont'd)

Figure 30-50-21

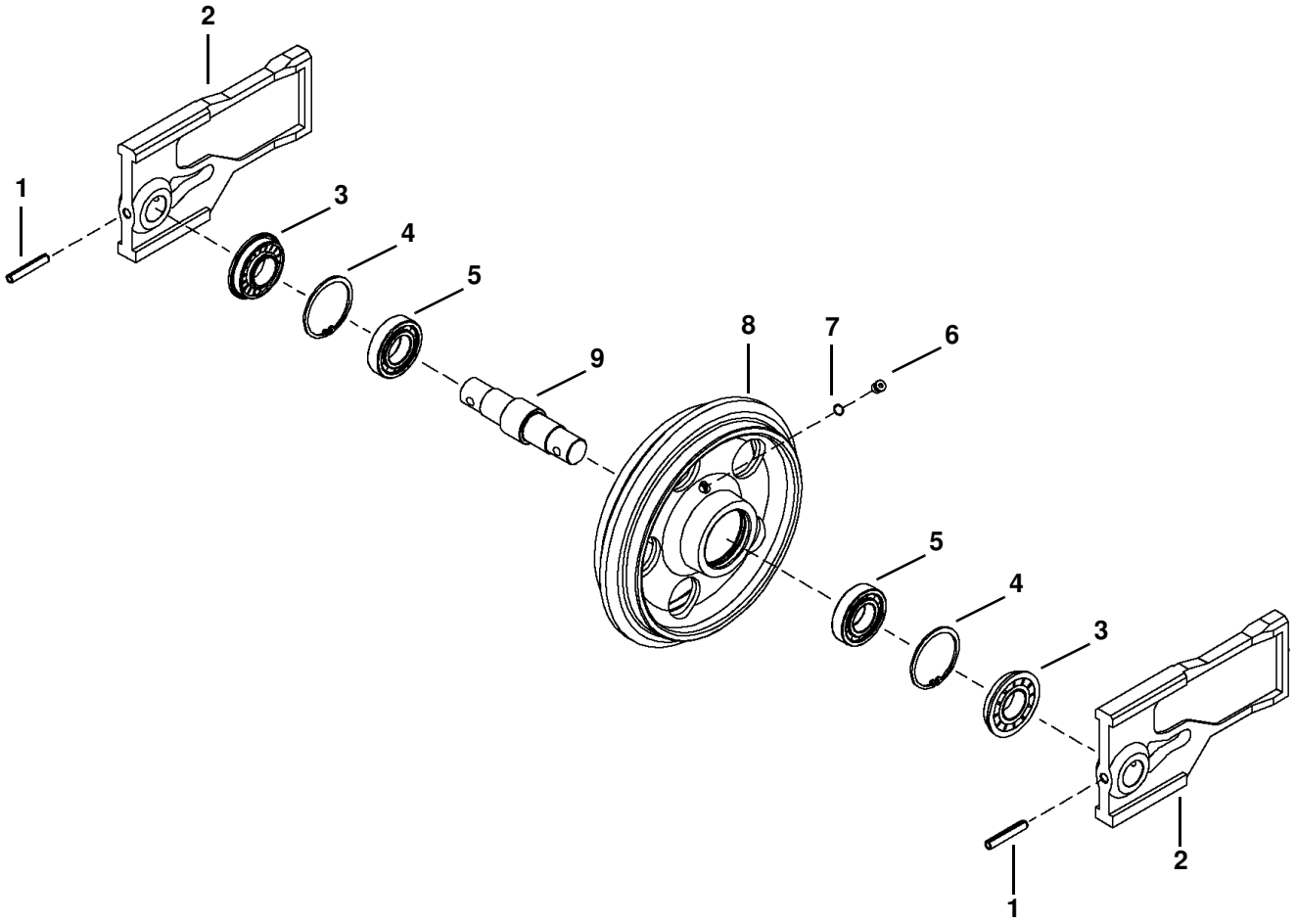


Install the roll pin and block on each end of the shaft **[Figure 30-50-21]**.

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Parts Identification (S/N 232311037 & Above And 232411020 & Above)

1. Roll Pin
2. Block
3. Seal
4. Snap Ring
5. Bearing
6. Plug
7. O-ring
8. Idler
9. Shaft



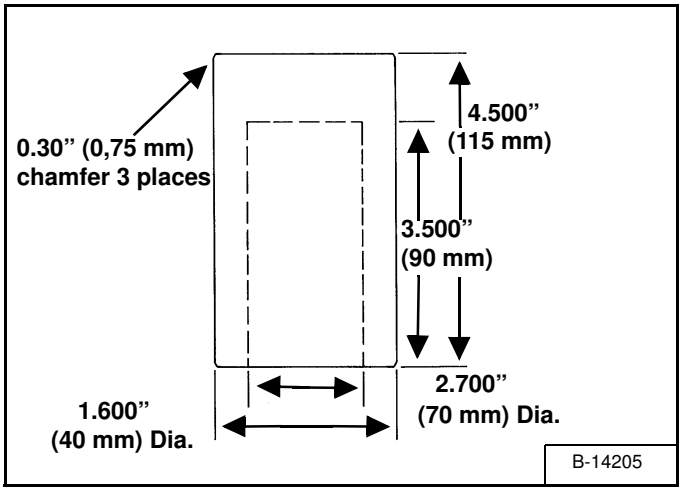
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Disassembly (S/N 232311037 & Above And 232411020 & Above)

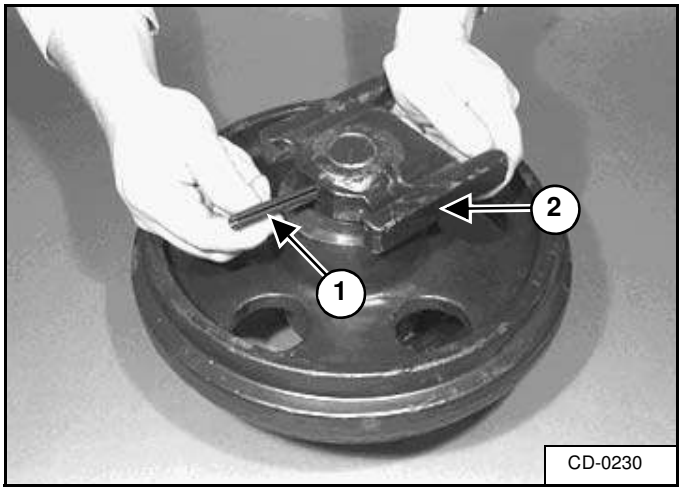
The following tools must be fabricated for this procedure:

Figure 30-50-22



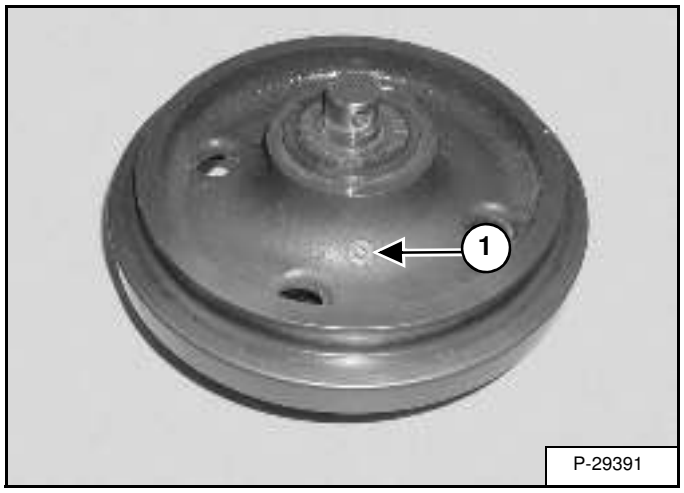
1. Driver Tool - See **[Figure 30-50-22]**.
2. Support Fixture - Tube, 3.0 inches ID x 0.250 inch wall x 6.0 inches long.

Figure 30-50-23



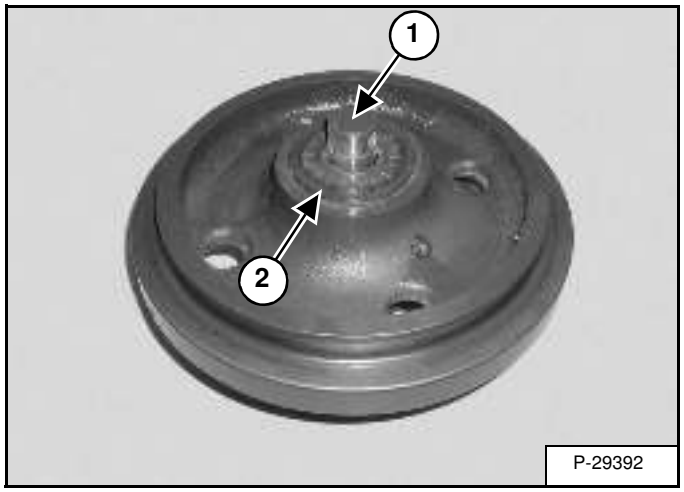
Remove the roll pin (Item 1) and block (Item 2) **[Figure 30-50-23]** from each end of the shaft.

Figure 30-50-24



Remove the plug (Item 1) **[Figure 30-50-24]** and drain the oil from the idler.

Figure 30-50-25



Remove any corrosion or paint from both ends of the exposed shaft (Item 1) **[Figure 30-50-25]** that could affect seal removal or damage the new seal during installation.

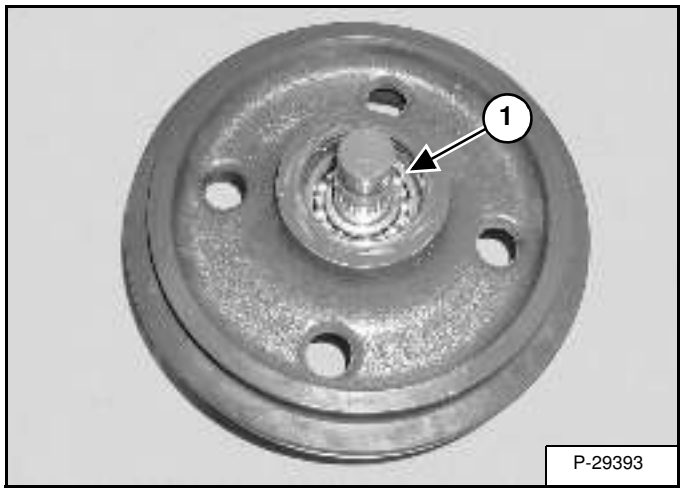
Apply penetrating oil to both ends of the exposed shaft to ease removal of the seal.

Remove the seal (Item 2) **[Figure 30-50-25]** from both sides of the idler.

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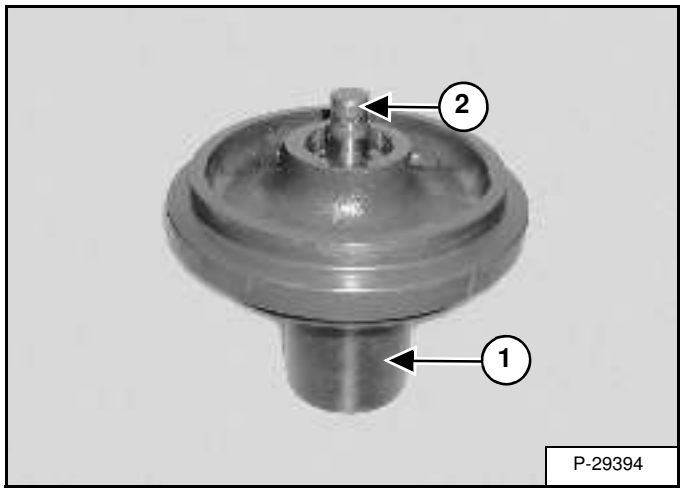
Disassembly (S/N 232311037 & Above And 232411020 & Above) (Cont'd)

Figure 30-50-26



Remove the snap ring (Item 1) **[Figure 30-50-26]** from both sides of the idler.

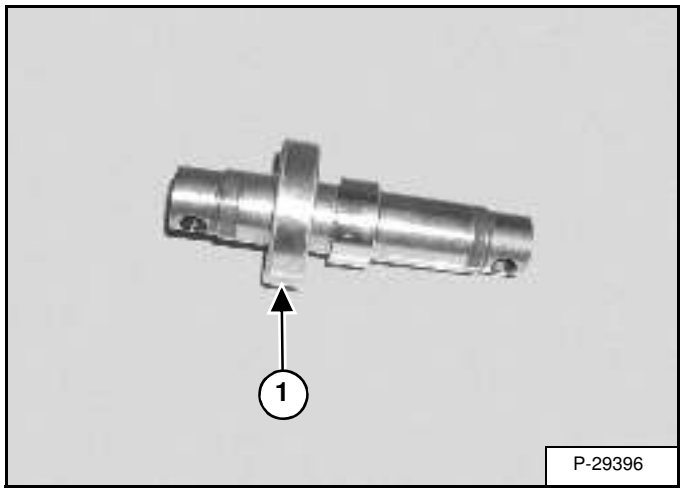
Figure 30-50-27



Place the idler on the support fixture (Item 1) **[Figure 30-50-27]**.

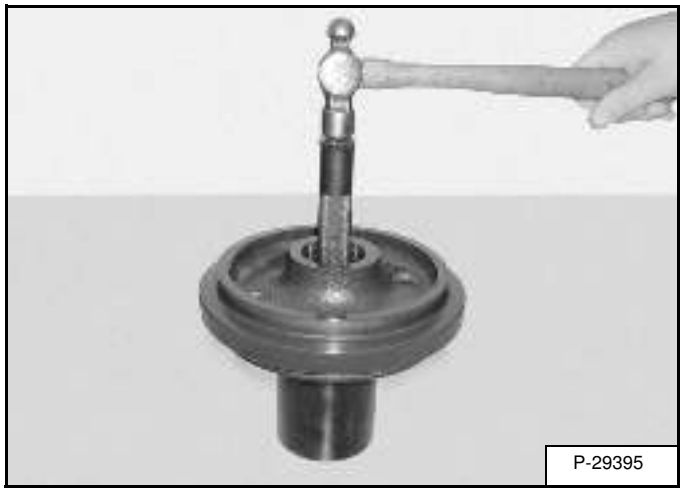
Using a soft faced hammer, tap the shaft (Item 2) **[Figure 30-50-27]** and bearing out the bottom of the idler.

Figure 30-50-28



Slide the bearing (Item 1) **[Figure 30-50-28]** off the shaft.

Figure 30-50-29



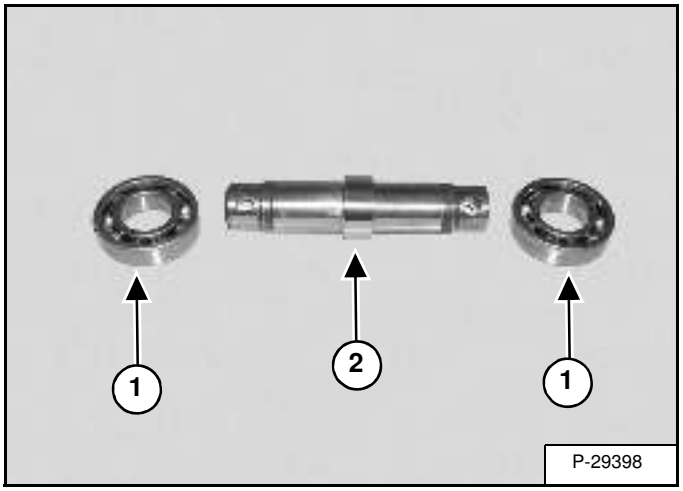
Turn the idler over, and using a bearing driver, remove the second bearing **[Figure 30-50-29]**.

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Assembly (S/N 232311037 & Above And 232411020 & Above)

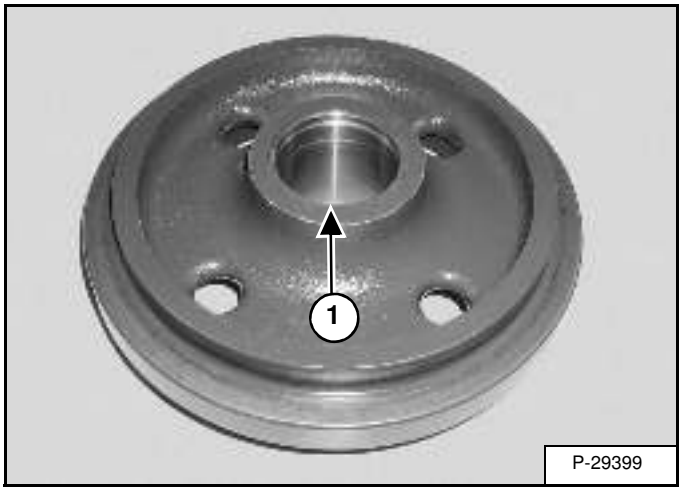
Clean all parts in solvent and dry with compressed air.

Figure 30-50-30



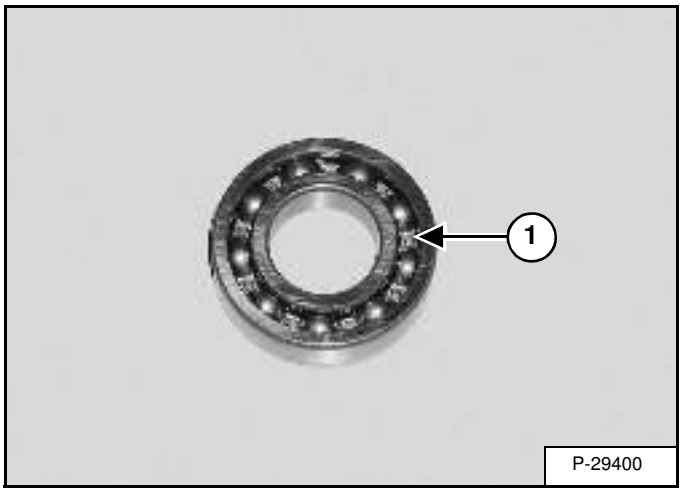
Inspect the bearings (Item 1) and shaft (Item 2) **[Figure 30-50-30]** for wear or damage. Replace any worn or damaged parts.

Figure 30-50-31



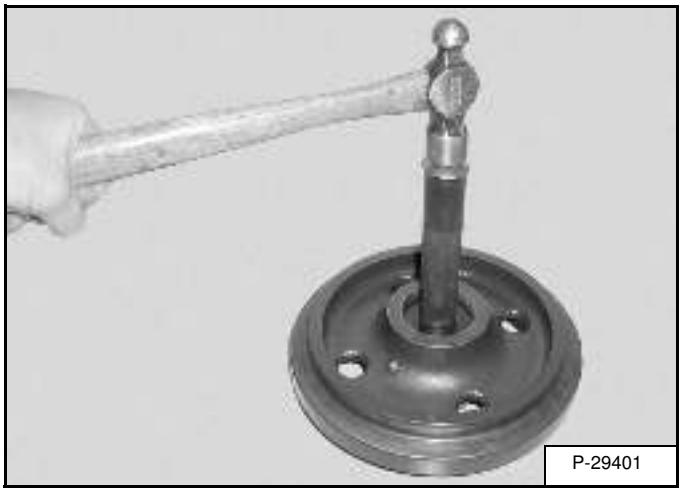
Remove all paint and corrosion from the seal surface (Item 1) **[Figure 30-50-31]** on both sides of the idler.

Figure 30-50-32



Apply assembly lube to both sides of the bearings (Item 1) **[Figure 30-50-32]**.

Figure 30-50-33

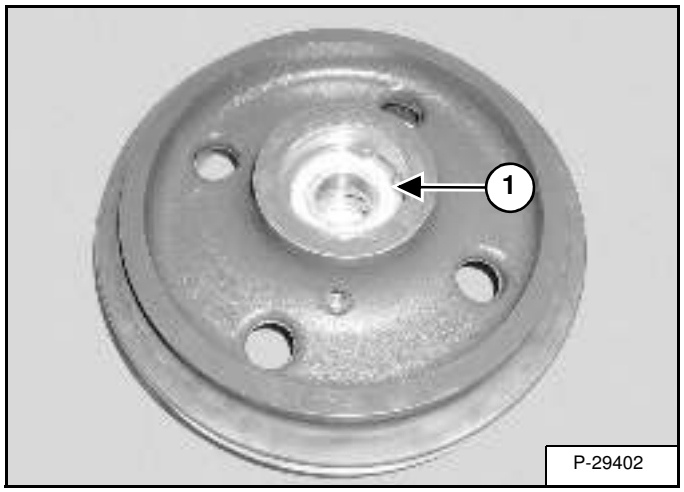


Using a bearing driver, install the bearing in the idler **[Figure 30-50-33]**.

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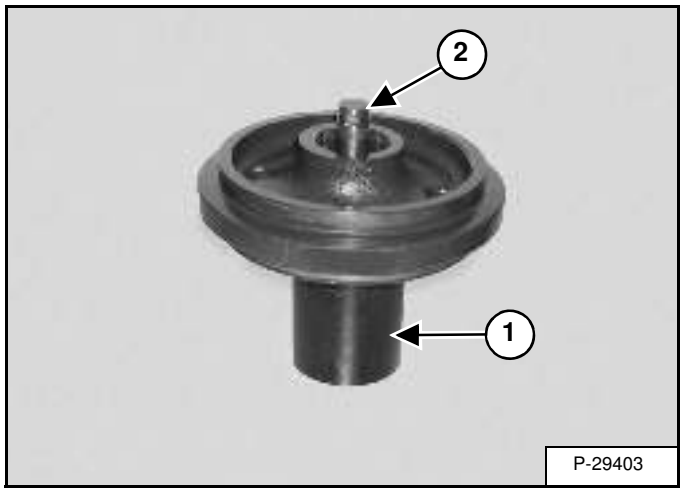
Assembly (S/N 232311037 & Above And 232411020 & Above) (Cont'd)

Figure 30-50-34



Install the snap ring (Item 1) **[Figure 30-50-34]**.

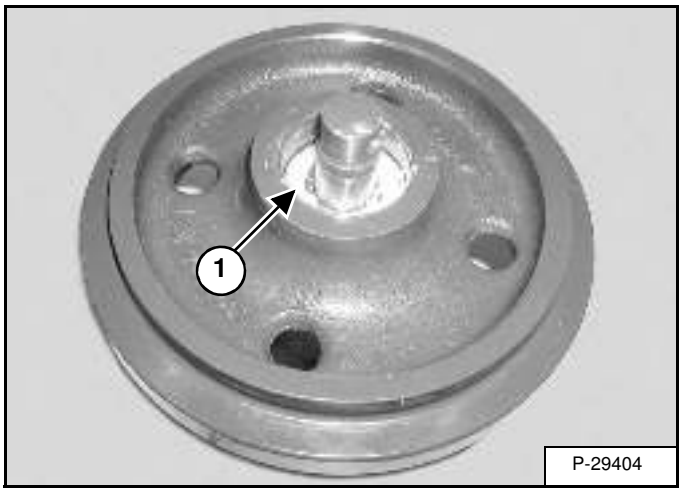
Figure 30-50-35



Turn the idler over and place the idler on the support fixture (Item 1) **[Figure 30-50-35]**.

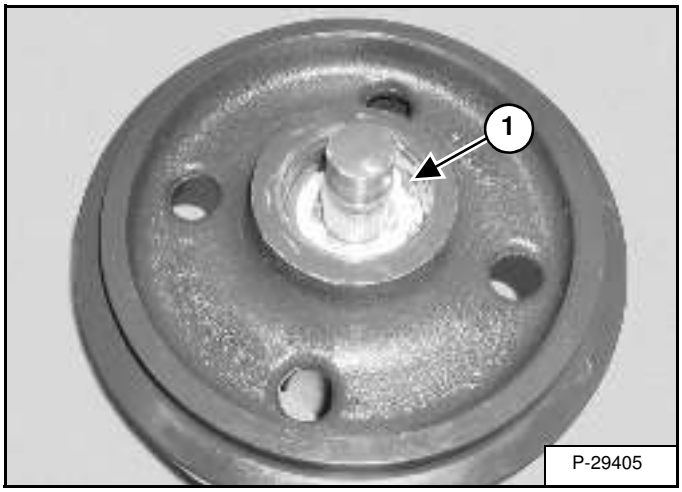
Install the shaft (Item 2) **[Figure 30-50-35]**.

Figure 30-50-36



Install the bearing (Item 1) **[Figure 30-50-36]**. Use a brass drift to seat the bearing.

Figure 30-50-37

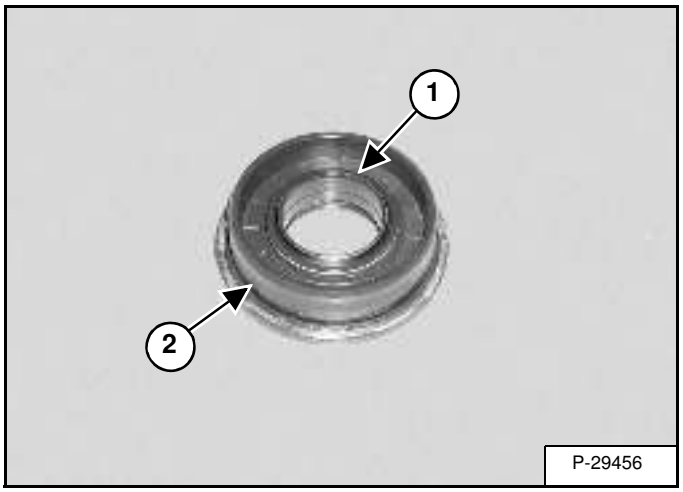


Install the snap ring (Item 1) **[Figure 30-50-37]**.

Dealer Copy -- Not for Resale

Assembly (S/N 232311037 & Above And 232411020 & Above) (Cont'd)

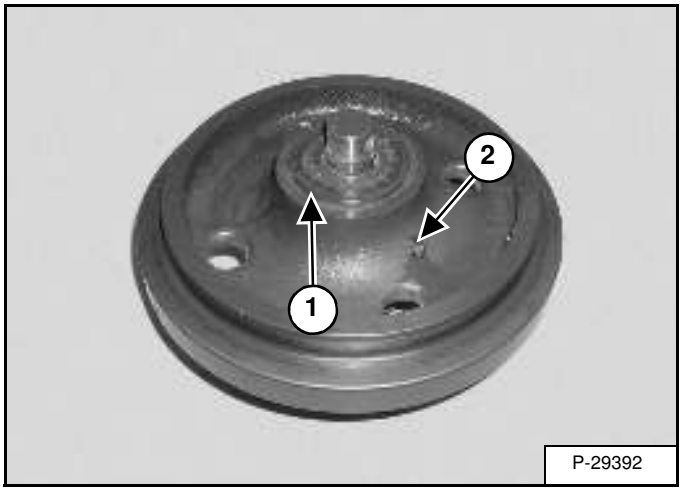
Figure 30-50-38



Apply assembly lube to the inside diameter (Item 1) **[Figure 30-50-38]** of the seal.

Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-50-38]** of the seal.

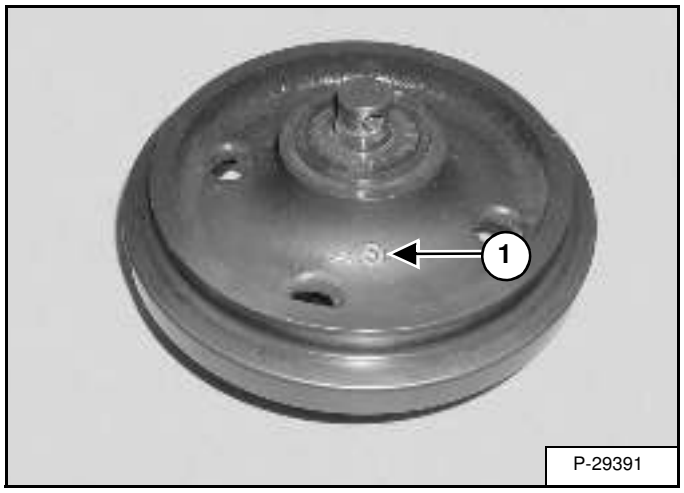
Figure 30-50-39



Using the driving tool, install the seal (Item 1) **[Figure 30-50-39]** on both sides of the idler.

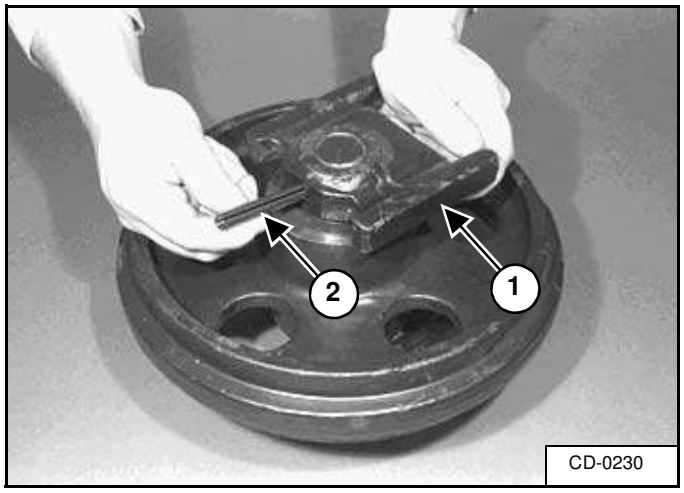
Using a syringe, add 38 cc of SAE 10W/30 oil to the assembly through the fill hole (Item 2) **[Figure 30-50-39]**.

Figure 30-50-40



Install the plug (Item 1) **[Figure 30-50-40]**.

Figure 30-50-41



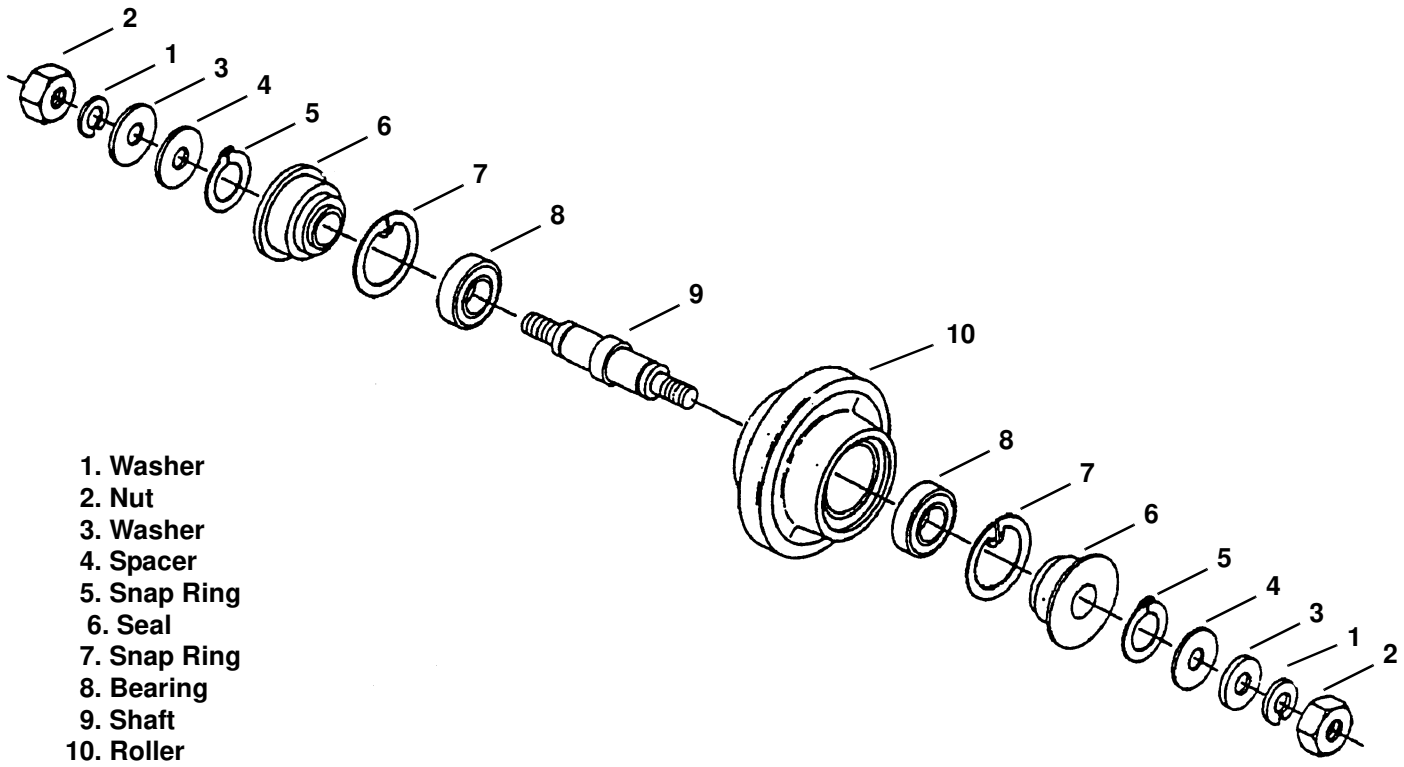
Install the block (Item 1) and roll pin (Item 2) **[Figure 30-50-41]** on both sides of the shaft.

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Parts Identification (S/N 232311036 & Below And 232411019 & Below)



1. Washer
2. Nut
3. Washer
4. Spacer
5. Snap Ring
6. Seal
7. Snap Ring
8. Bearing
9. Shaft
10. Roller

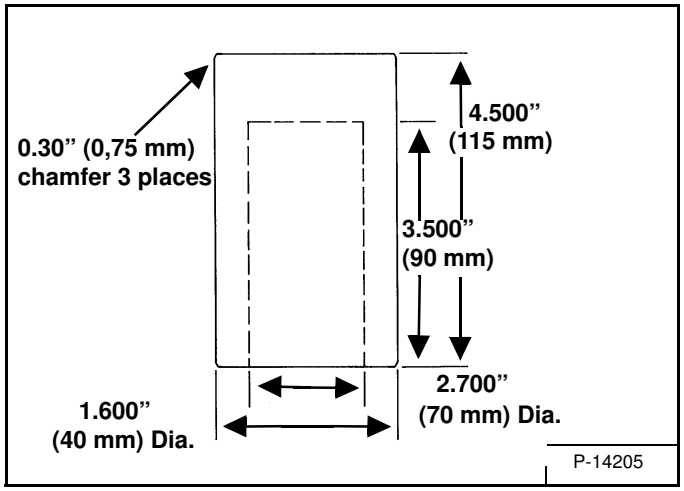
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Dealer Copy -- Not for Resale

Disassembly (S/N 232311036 & Below And 232411019 & Below)

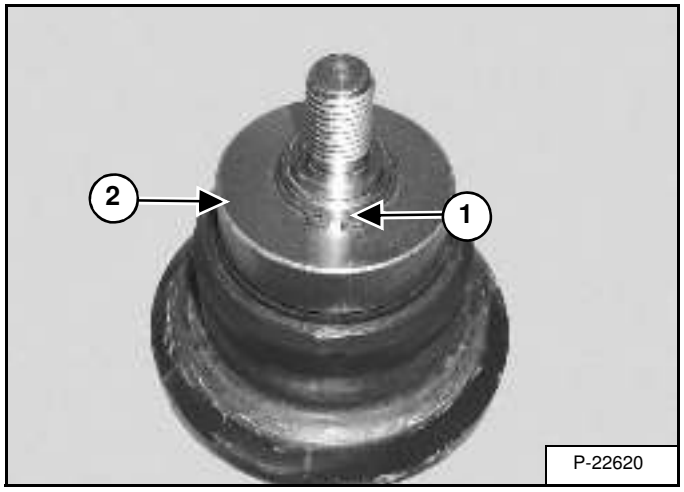
The following tools must be fabricated for this procedure:

Figure 30-60-1



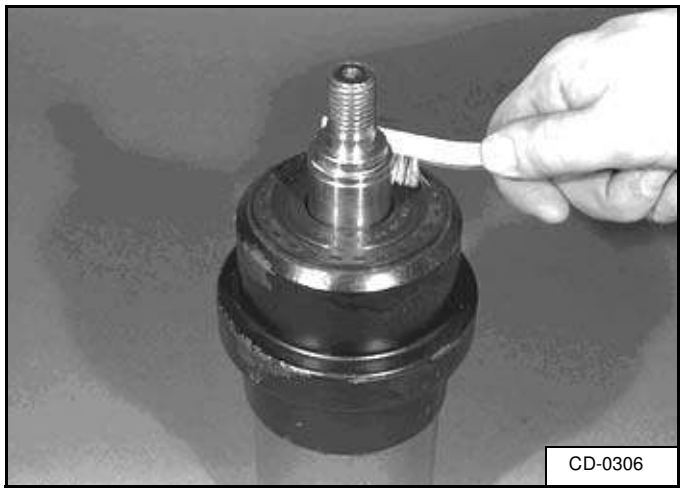
1. Driver Tool - See **[Figure 30-60-1]**.
2. Support Fixture - Tubing, 3.0 inches ID x 0.250 inches wall x 6.0 inches long.

Figure 30-60-2



Remove the snap ring (Item 1) and spacer (Item 2) **[Figure 30-60-2]** from each end of the shaft.

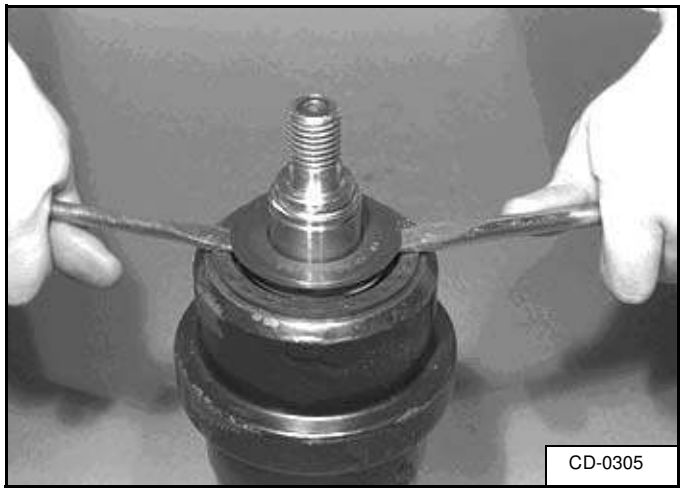
Figure 30-60-3



Use a wire brush to remove any corrosion or paint from both ends of the exposed shaft that could affect seal removal or damage the new seal during installation **[Figure 30-60-3]**.

Apply penetrating oil to both ends of the exposed shaft to ease removal of the inner part of the seal.

Figure 30-60-4

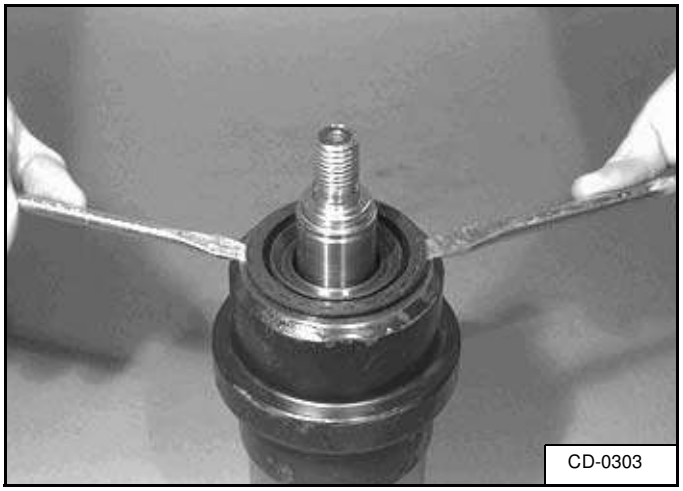


Remove the inner part of the seal using two screwdrivers **[Figure 30-60-4]**.

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Disassembly (S/N 232311036 & Below And 232411019 & Below) (Cont'd)

Figure 30-60-5



Remove the outer part of the seal from the roller using two screwdrivers **[Figure 30-60-5]**.

Pour the oil out of the roller. Discard the oil in an appropriate manner.

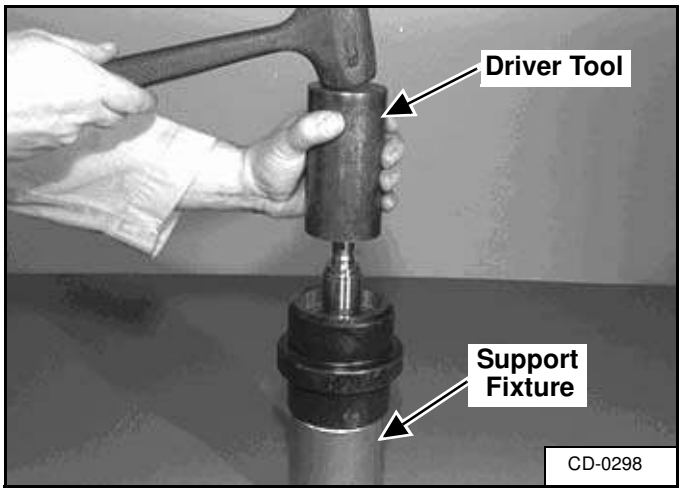
Turn the roller assembly over and remove the other seal.

Figure 30-60-6



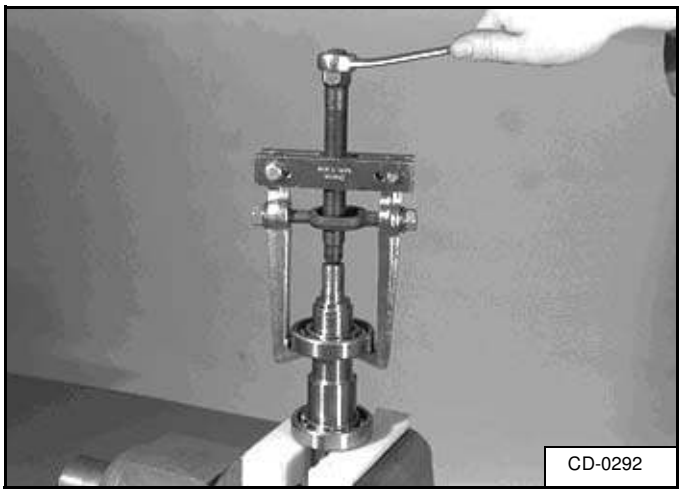
Remove the snap ring from each side of the roller **[Figure 30-60-6]**.

Figure 30-60-7



Using the fabricated driver tool and support fixture, press or drive the shaft and bearing assembly out of the roller **[Figure 30-60-7]**.

Figure 30-60-8

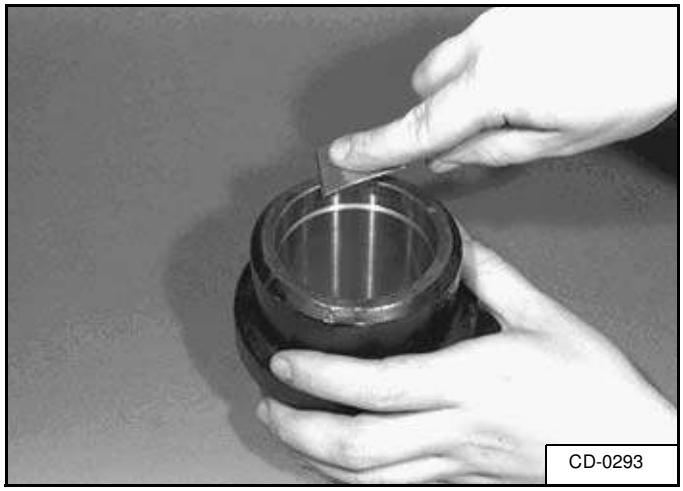


Inspect the bearings for rust or for rough spots. The bearings must turn freely. If any damage is found, replace the bearings. If replacement of the bearings is necessary, use a two or three jaw puller, remove the four bearings from the shaft **[Figure 30-60-8]**.

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Assembly (S/N 232311036 & Below And 232411019 & Below)

Figure 30-60-9



Remove all paint and corrosion from the seal surface on both sides of the idler **[Figure 30-60-9]**.

Be sure all parts are clean before assembly.

Figure 30-60-10



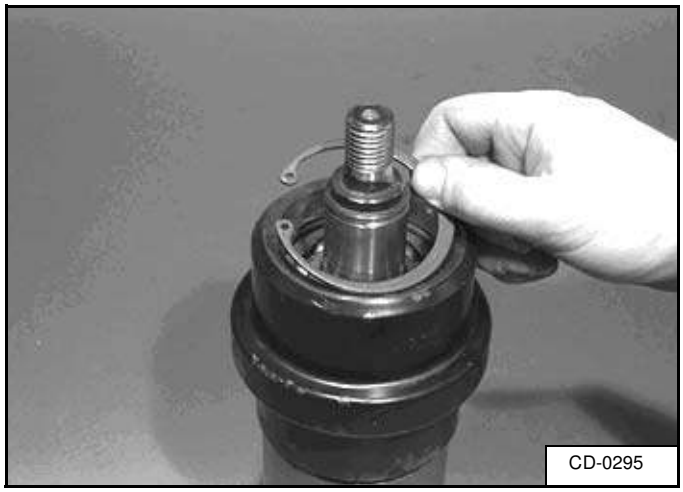
Using the driver tool, install new bearings, with the numbered side upward, onto the shaft **[Figure 30-60-10]**. Press only on the inner diameter of the bearing.

Figure 30-60-11



Using the driver tool, install the shaft and bearing assembly into the roller **[Figure 30-60-11]**.

Figure 30-60-12



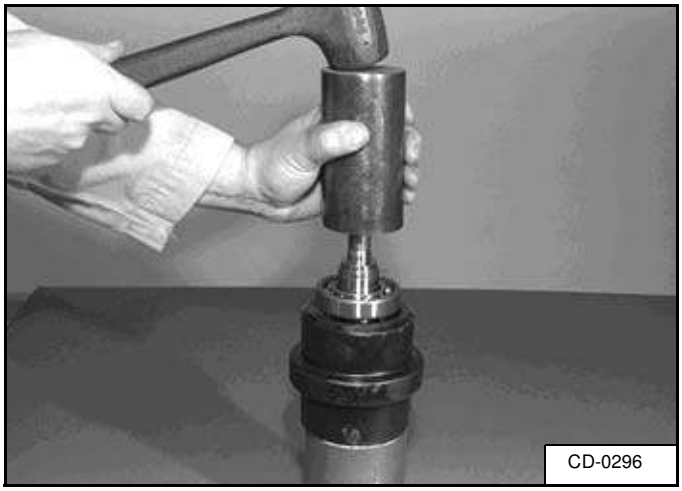
Install the snap ring **[Figure 30-60-12]**.

Turn the roller assembly over.

Dealer Copy -- Not for Resale

Assembly (S/N 232311036 & Below And 232411019 & Below) (Cont'd)

Figure 30-60-13



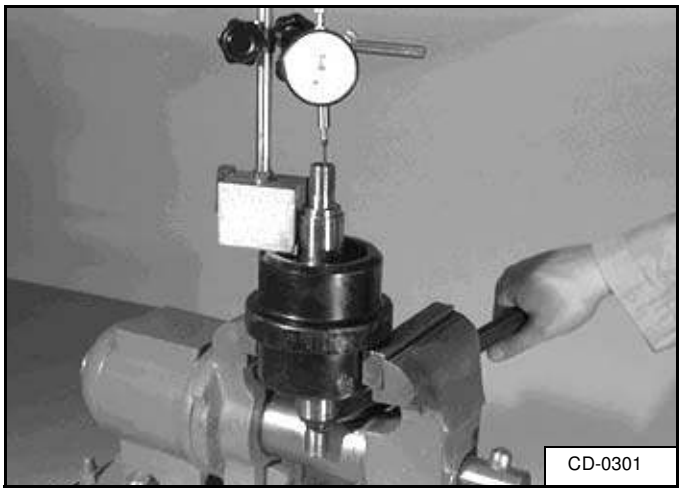
Using the driver tool, install the other bearings, with the numbered side upward, in the roller **[Figure 30-60-13]**.

Figure 30-60-14



Install the snap ring **[Figure 30-60-14]**.

Figure 30-60-15



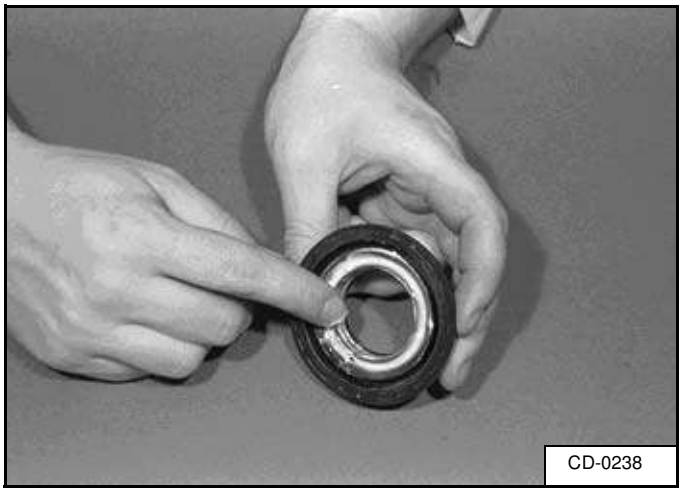
Using a dial indicator, check the endplay of the shaft **[Figure 30-60-15]**.

If the endplay is greater than 0.030 inch (0,76 mm) then the bearing must be shimmed.

Cut a shim from the necessary thickness shim stock and install the shim between the bearing and the shoulder on the shaft.

Separate the inner and outer halves of the seal.

Figure 30-60-16

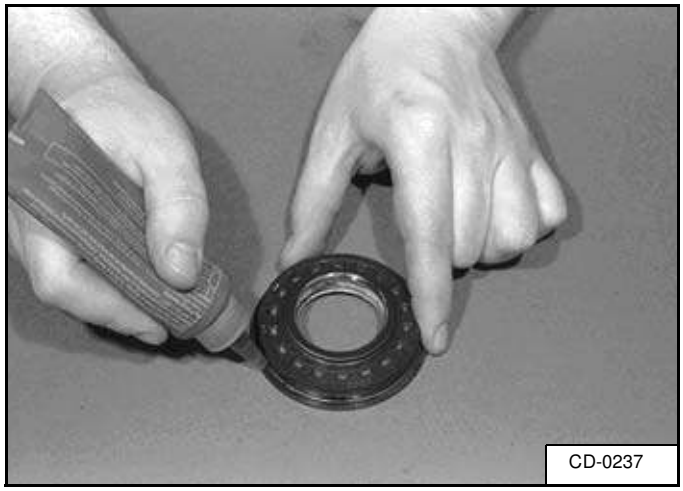


Apply grease to the grooves on the outer part of a new seal **[Figure 30-60-16]**.

Dealer Copy -- Not for Resale

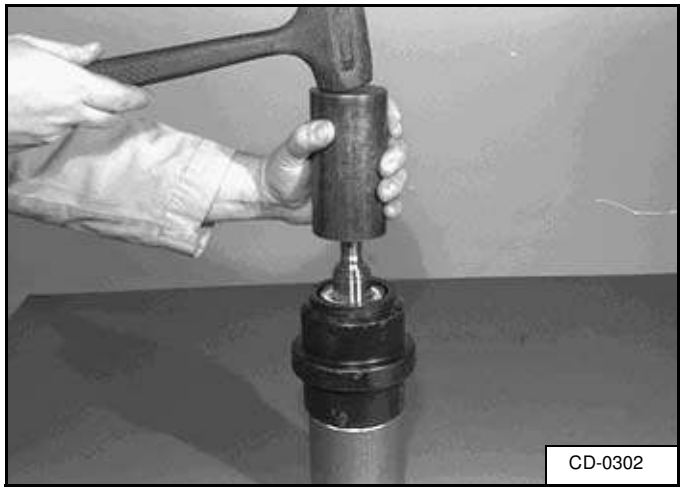
Assembly (S/N 232311036 & Below And 232411019 & Below) (Cont'd)

Figure 30-60-17



Apply a small bead of high temperature silicone sealant around the flange surface of the seal **[Figure 30-60-17]**.

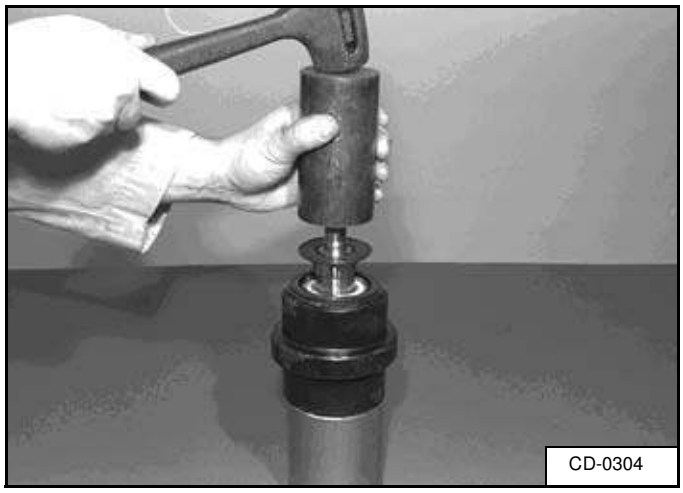
Figure 30-60-18



Using the driver tool, install the outer part of the new seal into the roller **[Figure 30-60-18]**.

NOTE: The inner and outer parts of the seal must be installed separately so the air will escape from under the seal.

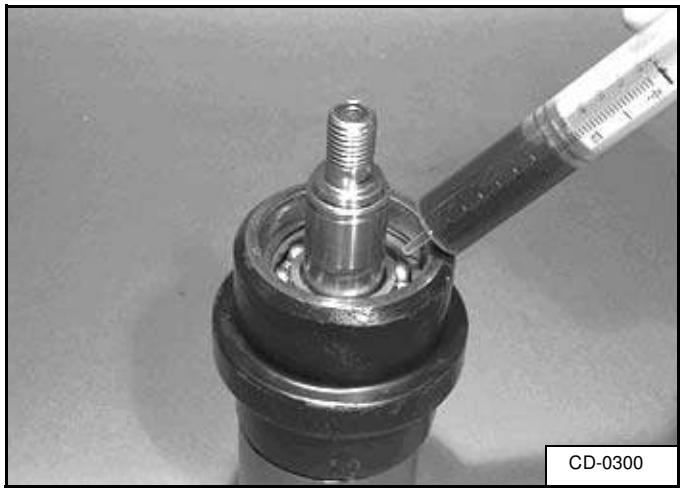
Figure 30-60-19



Using the driver tool, install the inner part of the new seal over the shaft **[Figure 30-60-19]**.

NOTE: The inner part of the seal must be pressed down level with the outer part of the seal to seal properly.

Figure 30-60-20



Turn the roller assembly over. Using a syringe add 100 cc of SAE 10W/30 oil to the assembly **[Figure 30-60-20]**.

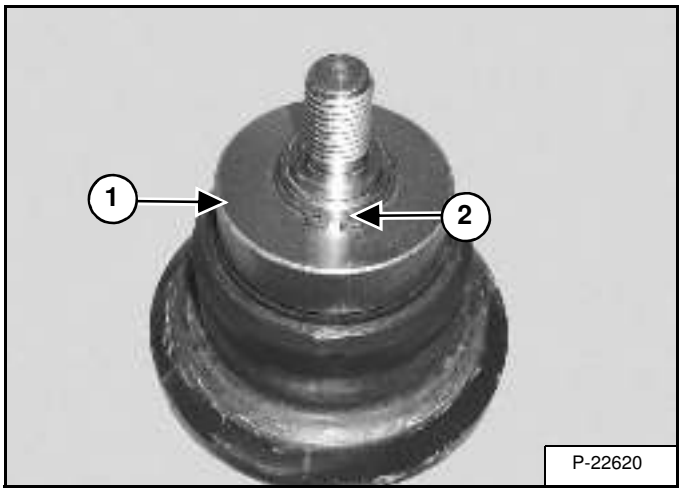
Repeat procedure to install the remaining seal.

Check for leaks.

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Assembly (S/N 232311036 & Below And 232411019 & Below) (Cont'd)

Figure 30-60-21

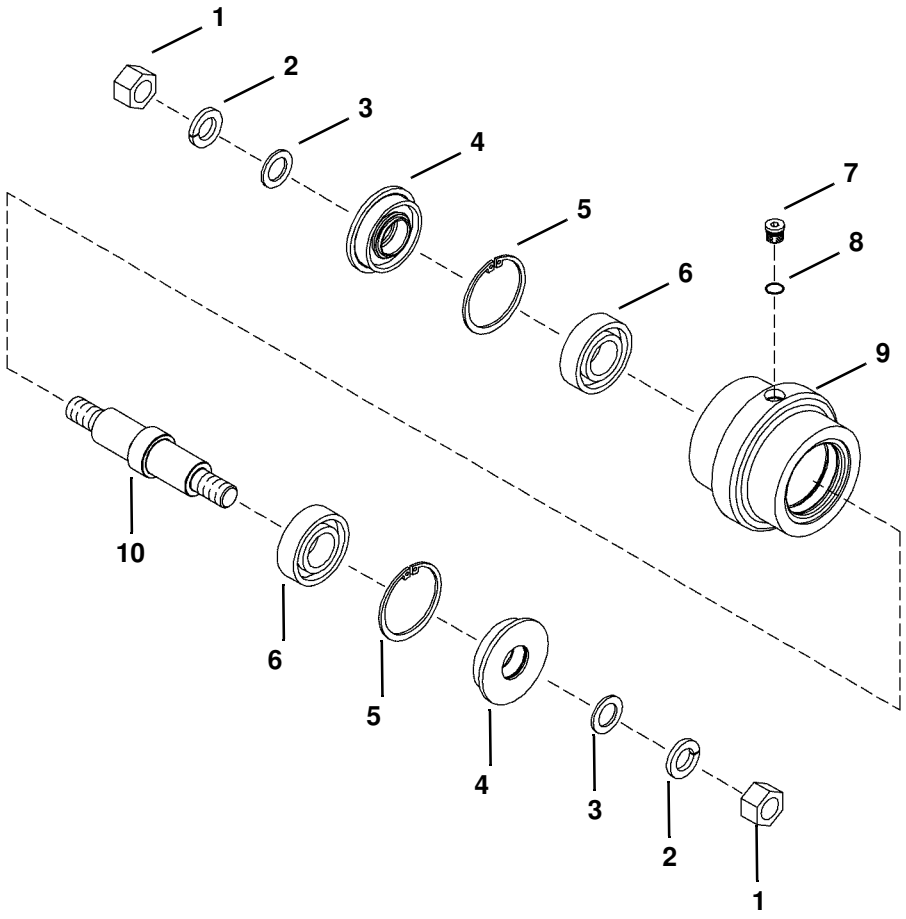


Install the spacer (Item 1) and the snap ring (Item 2) **[Figure 30-60-21]** on each end of the shaft.

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Parts Identification (S/N 232311037 & Above And 232411020 & Above)

1. Nut
2. Lock Washer
3. Washer
4. Seal
5. Snap Ring
6. Bearing
7. Plug
8. O-ring
9. Roller
10. Shaft



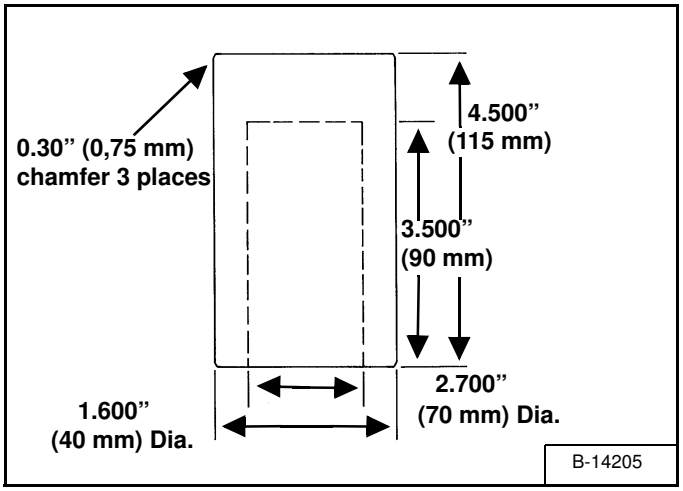
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Dealer Copy -- Not for Resale

Disassembly (S/N 232311037 & Above And 232411020 & Above)

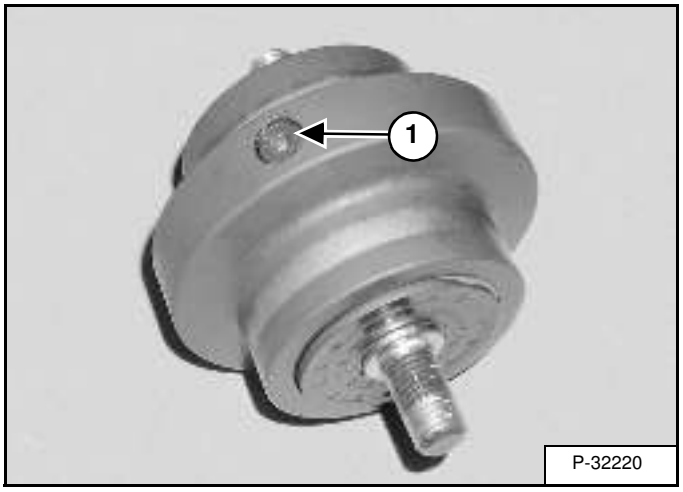
The following tools must be fabricated for this procedure:

Figure 30-60-22



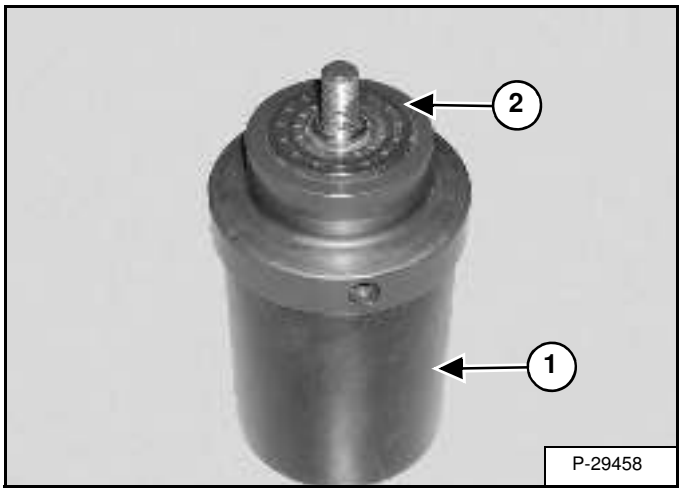
1. Driver Tool - See **[Figure 30-60-22]**.
2. Support Fixture - Tube, 3.0 inches ID x 0.250 inches wide x 6.0 inches long.

Figure 30-60-23



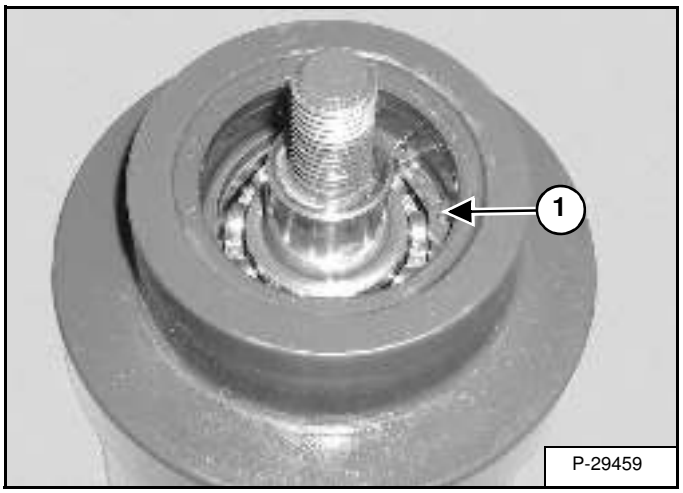
Remove the plug (Item 1) **[Figure 30-60-23]**, and drain the oil from the roller.

Figure 30-60-24



Support the roller in the support fixture (Item 1). Remove the seal (Item 2) **[Figure 30-60-24]** from both sides of the roller.

Figure 30-60-25

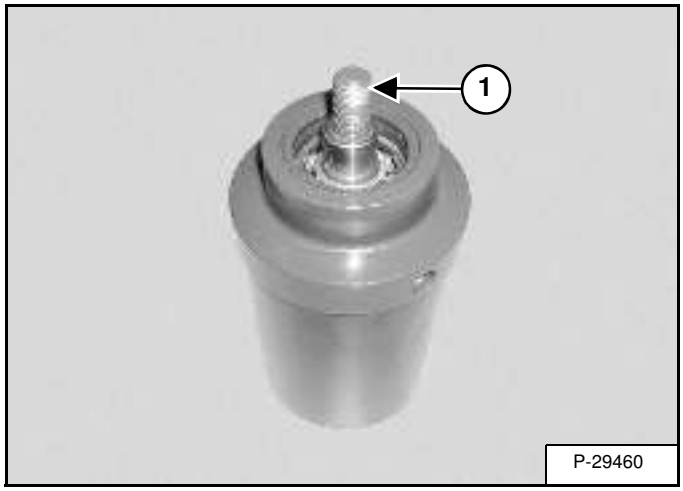


Remove the snap ring (Item 1) **[Figure 30-60-25]** from both sides of the roller.

Dealer Copy -- Not for Resale

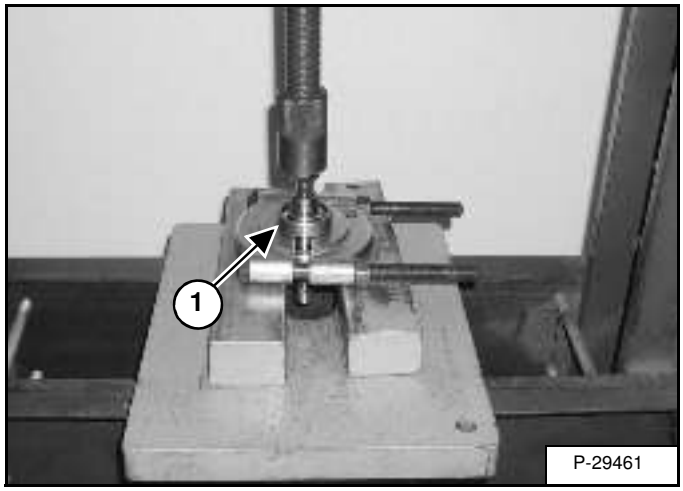
Disassembly (S/N 232311037 & Above And 232411020 & Above) (Cont'd)

Figure 30-60-26



Tap the shaft (Item 1) **[Figure 30-60-26]** and bearings out the bottom of the roller.

Figure 30-60-27

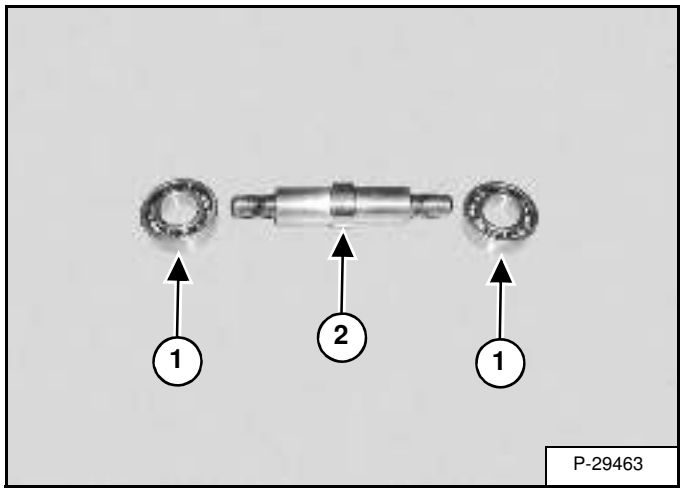


Press the bearings (Item 1) **[Figure 30-60-27]** off the shaft.

Assembly (S/N 232311037 & Above And 232411020 & Above)

Clean all parts in solvent and dry with compressed air.

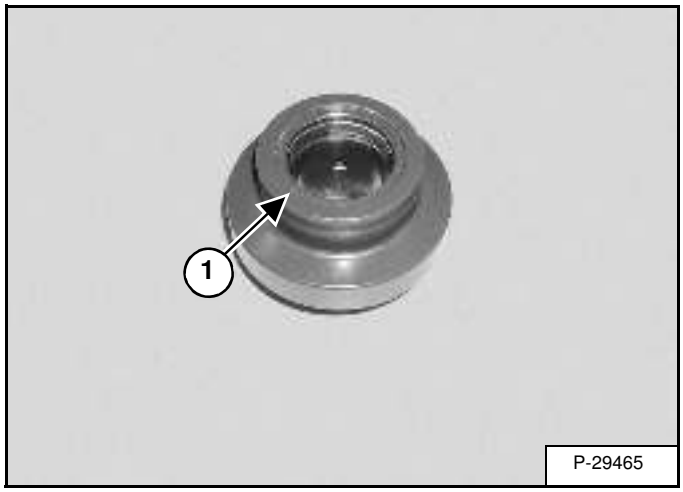
Figure 30-60-28



Inspect the bearings (Item 1) and shaft (Item 2) **[Figure 30-60-28]** for wear or damage.

Replace any worn or damaged parts.

Figure 30-60-29

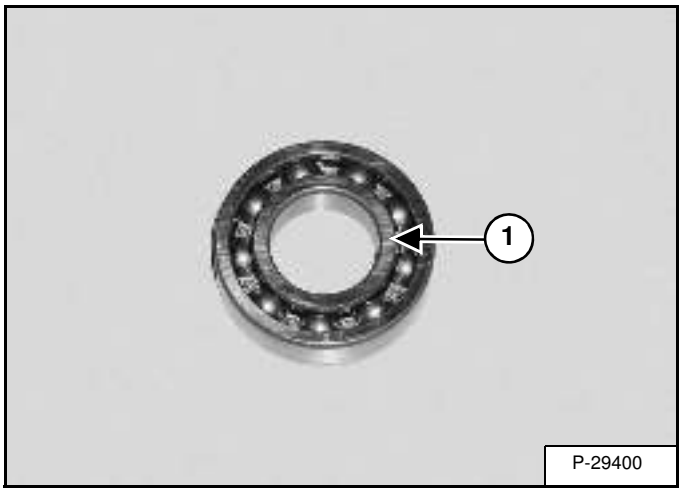


Remove all paint and corrosion from the seal surface (Item 1) **[Figure 30-60-29]** on both sides of the roller.

Dealer Copy -- Not for Resale

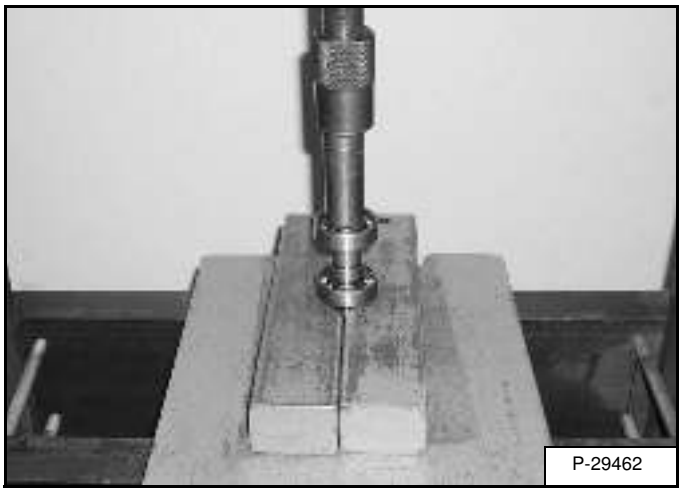
Assembly (S/N 232311037 & Above And 232411020 & Above) (Cont'd)

Figure 30-60-30



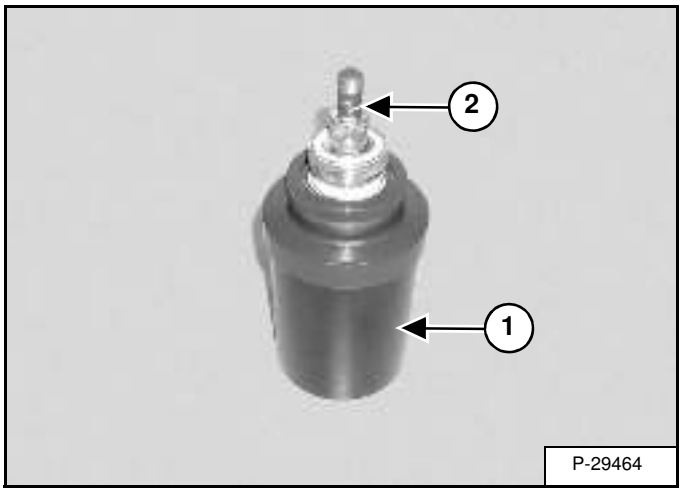
Apply assembly lube to both sides of the bearings (Item 1) **[Figure 30-60-30]**.

Figure 30-60-31



Press the bearings (Item 1) **[Figure 30-60-31]** on the shaft.

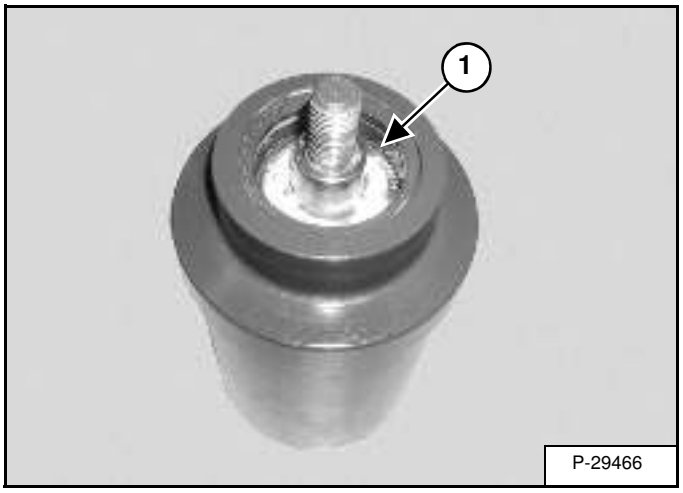
Figure 30-60-32



Place the roller on the support fixture (Item 1) **[Figure 30-60-32]**.

Tap the shaft and bearing assembly (Item 2) **[Figure 30-60-32]** into the roller.

Figure 30-60-33

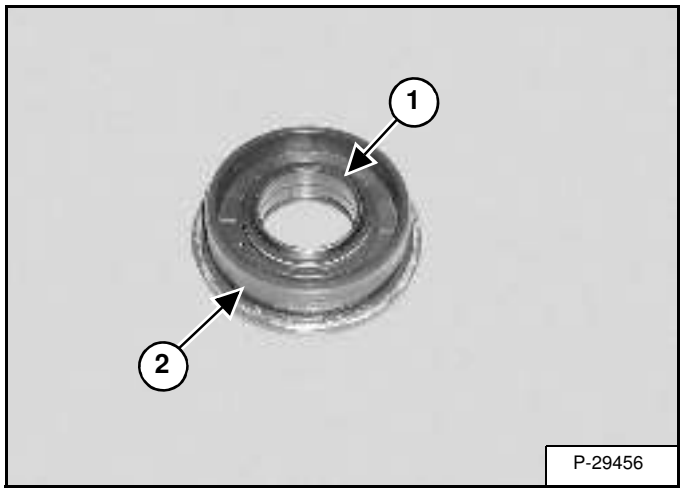


Install the snap ring (Item 1) **[Figure 30-60-33]** on both sides of the roller.

Dealer Copy -- Not for Resale

Assembly (S/N 232311037 & Above And 232411020 & Above) (Cont'd)

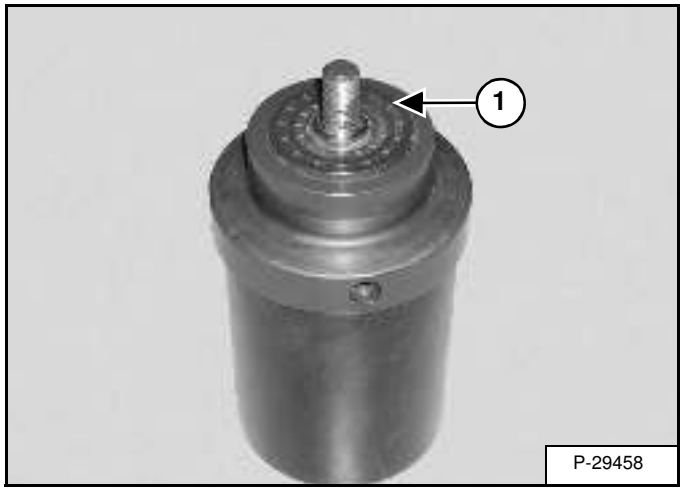
Figure 30-60-34



Apply assembly lube to the inside diameter (Item 1) **[Figure 30-60-34]** of the seal.

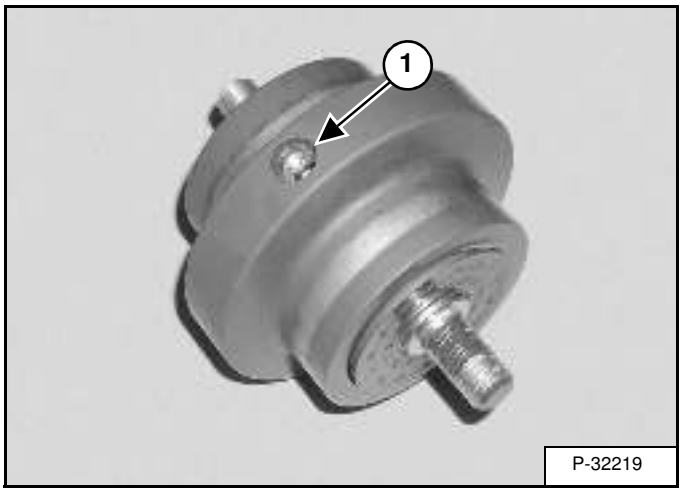
Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-60-34]** of the seal.

Figure 30-60-35



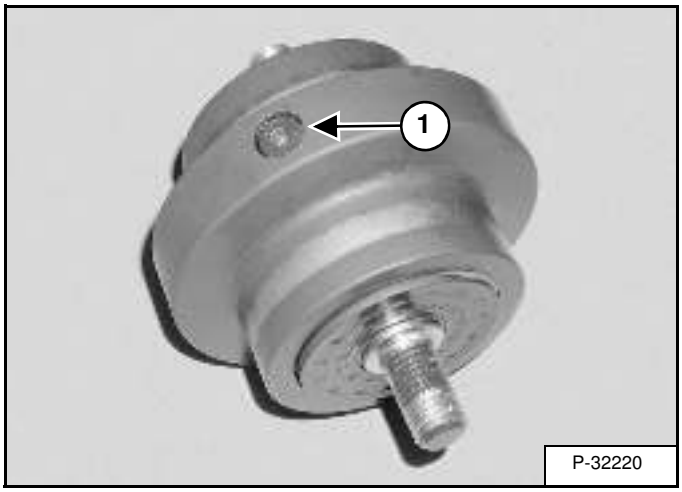
Using the driving tool, install the seal (Item 1) **[Figure 30-60-35]** on both sides of the roller.

Figure 30-60-36



Using a syringe, add 76 cc of SAE 10W/30 oil to the assembly, through the fill hole (Item 1) **[Figure 30-60-36]**.

Figure 30-60-37



Install the plug (Item 1) **[Figure 30-60-37]**.

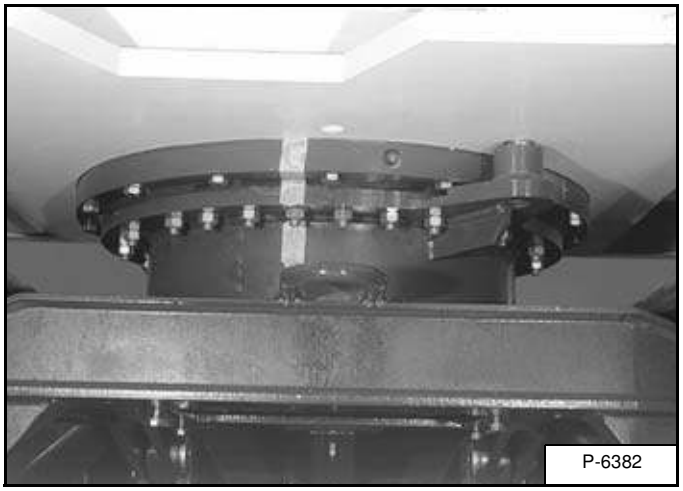
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SWING CIRCLE GEAR

Removal And Installation

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

Figure 30-70-1



Mark the upperstructure to the swing bearing and to the track frame for assembly (Item 1) **[Figure 30-70-1]**.

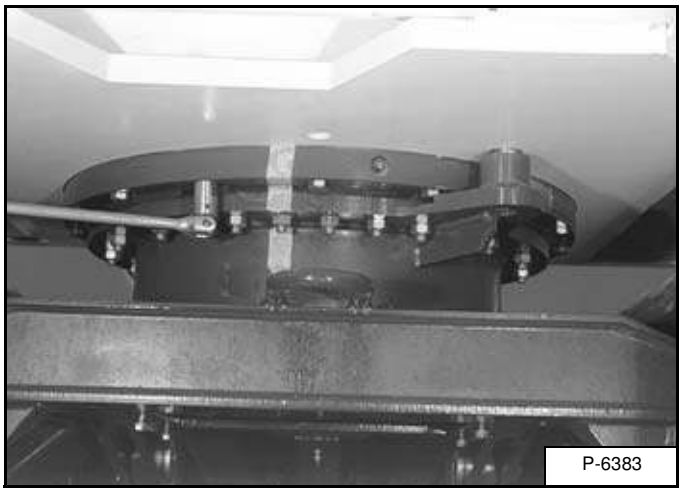
Mark the upperstructure to the swing bearing and to the track frame for assembly **[Figure 30-70-1]**.

IMPORTANT

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

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Figure 30-70-2



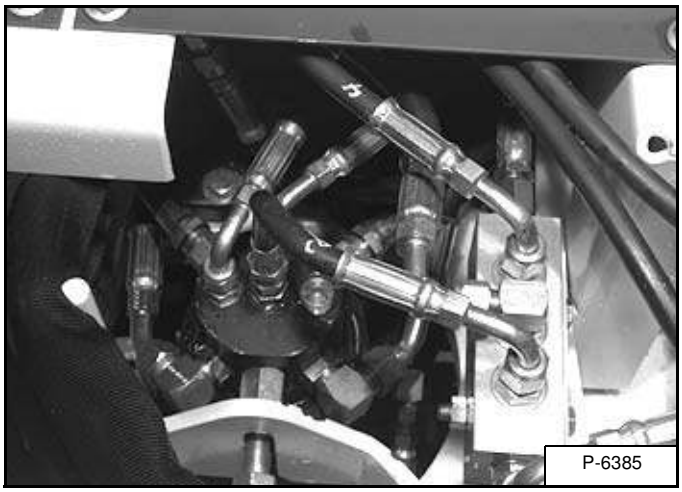
Partially disassemble the upperstructure from the swing bearing by removing all but four bolts which are spaced at 90° from each other **[Figure 30-70-2]**. The upperstructure must be rotated to gain access to the bolts for removal. Start the engine and run it at idle. Remove a bolt from the swing bearing, then move out of the way of upperstructure and slowly rotate the excavator until access to the next bolt is available. Remove this bolt and continue the above procedure.

NOTE: For disassembly safety a minimum of four evenly spaced bolts must remain installed, to be removed later.

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Removal And Installation (Cont'd)

Figure 30-70-3



Remove the tee fitting with the two hoses from the rear of the drain block **[Figure 30-70-3]**. Reposition these hoses out of the way.

Mark the seven hoses and fittings on the top portion of the swivel for correct installation **[Figure 30-70-3]**. Remove the hoses from the swivel joint.

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

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.

Figure 30-70-4

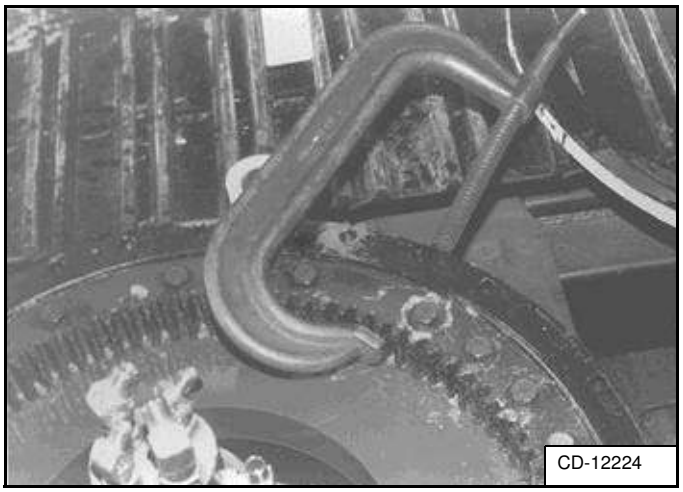


Lift the upperstructure off of the swing bearing. Position the upperstructure onto suitable supporting stands or blocks **[Figure 30-70-4]**.

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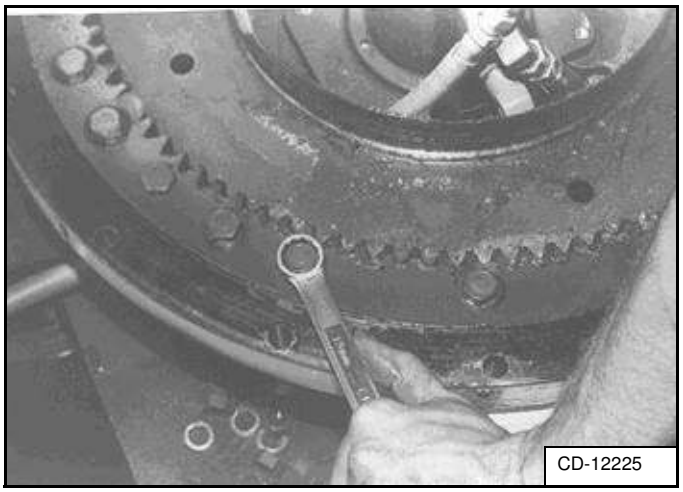
Swing Bearing Removal

Figure 30-70-5



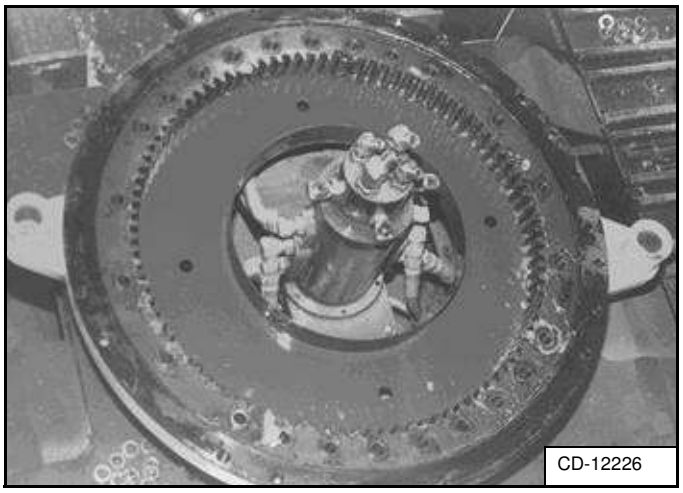
Install a c-clamp or other suitable retainer to prevent the swing bearing from turning while being removed **[Figure 30-70-5]**.

Figure 30-70-6



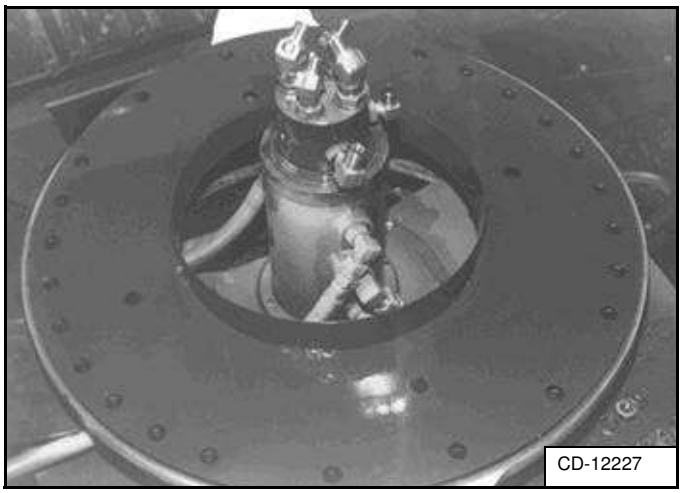
Remove the 24 bolts and nuts that hold the swing bearing to the track frame **[Figure 30-70-6]**.

Figure 30-70-7



Mark the top surface of the swing bearing for ease of assembly. Remove the swing bearing from the track frame **[Figure 30-70-7]**.

Figure 30-70-8

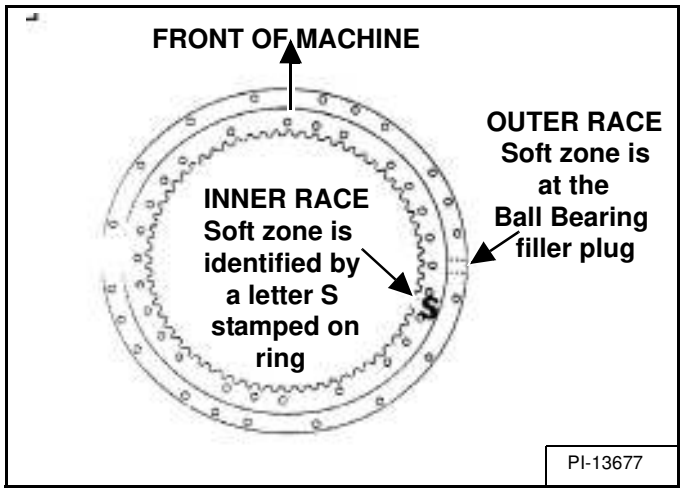


Remove the grease cover from the track frame. Clean and inspect the grease cover for damage **[Figure 30-70-8]**. Replace if necessary.

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Swing Bearing Installation

Figure 30-70-9



If reusing the existing swing bearing, use top side and edge aligning marks to correctly position the swing bearing. If a new swing bearing is being installed, locate the soft zone area **[Figure 30-70-9]**.

Install the swing bearing so that the soft zone is positioned to the right hand side of the excavator.

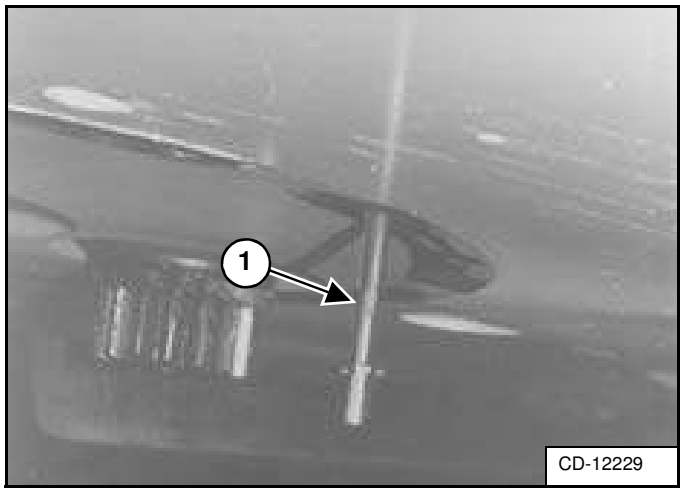
NOTE: DO NOT locate the soft zone to the front or rear of excavator.

Figure 30-70-10



Install the 24 bolts and lock nuts **[Figure 30-70-10]**.

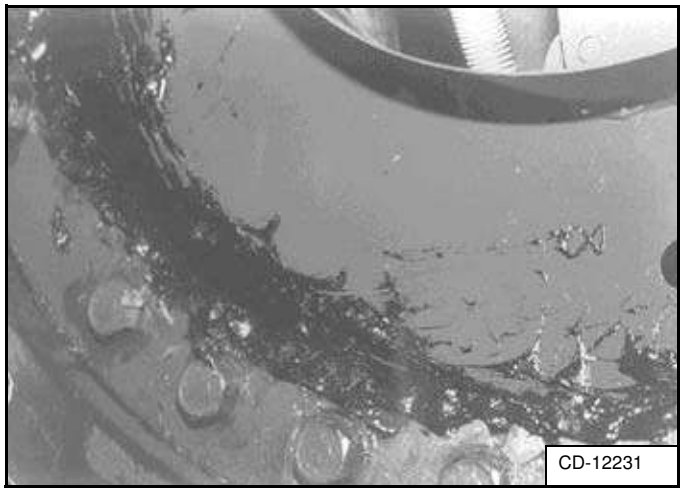
Figure 30-70-11



Install a tap (12 mm) (Item 1) **[Figure 30-70-11]** into the tapped holes in the upperstructure to remove any dried liquid adhesive (LOCTITE) or burrs.

Remove the tap (Item 1) **[Figure 30-70-11]**.

Figure 30-70-12

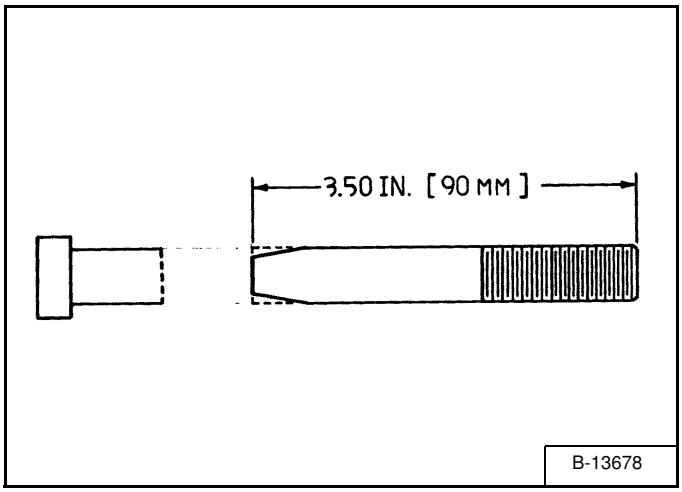


Grease the swing bearing with lubriplate grease or equivalent **[Figure 30-70-12]**.

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Swing Bearing Installation (Cont'd)

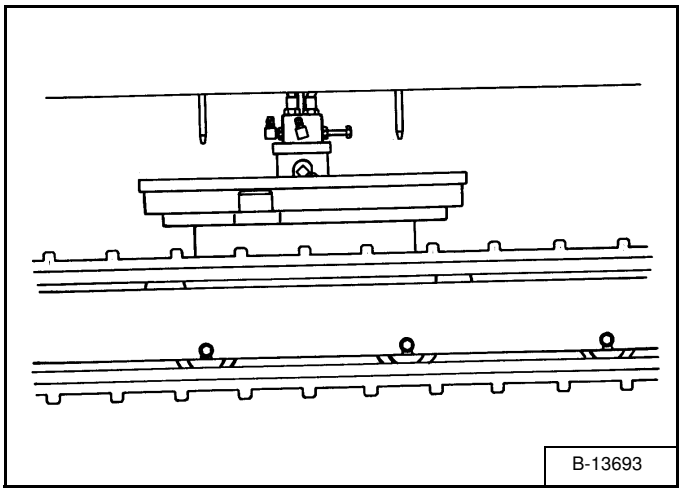
Figure 30-70-13



Make three alignment pins by using M12 x 110 mm (P/N 7GM-12110) long bolts. Cut the head off of these bolts at 3.500 inches (90 mm), then taper this end of the bolts **[Figure 30-70-13]**.

Install these three pins into the upperstructure at approximately 120° apart **[Figure 30-70-13]**. These will act as alignment pins while lowering the house frame onto the swing bearing.

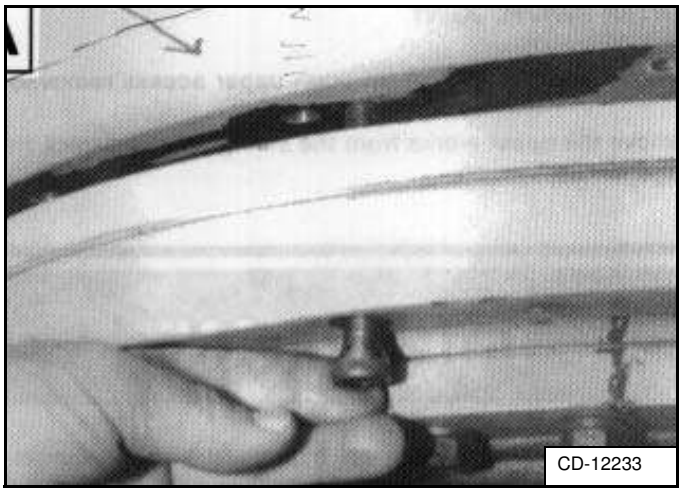
Figure 30-70-14



Install the upperstructure onto the swing bearing using the alignment marks and the alignment pins **[Figure 30-70-14]**.

Make sure the swing motor gear teeth mesh with the swing bearing teeth and that the swivel joint is centered into the upperstructure access hole.

Figure 30-70-15



Install the three tapered head alignment bolts (P/N 6535902) through the swing bearing and into the upperstructure **[Figure 30-70-15]**. 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.

Remove the three, 3.500 inches (90 mm) alignment pins from the upperstructure.

These headless pins can be removed from the bottom.

Apply thread adhesive (LOCTITE 242) to the swivel joint stop bolt.

Install the swivel joint stop bolt and nut into the swivel joint.

Install the nut completely onto the bolt threads then tighten the bolt to 110-125 ft.-lbs. (150-170 Nm) torque.

Install the hoses and fittings that were removed earlier. Start the engine and run at idle to rotate the upperstructure to install and tighten the bolts.

Apply liquid 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 73-81 ft.-lbs. (100-110 Nm) torque.

Remove the three alignment bolts (P/N 6535902). Install the three remaining bolts. Tighten these bolts to 73-81 ft.-lbs. (100-110 Nm) torque.

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Swing Bearing Installation (Cont'd)

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 floor plate and floor mat.

Check the hydraulic fluid level and add as necessary.

Alignment Pins (Not Threaded)

Figure 30-70-16

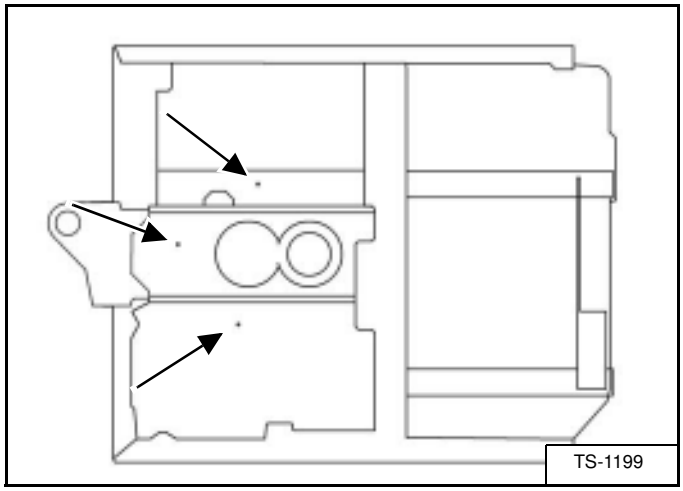
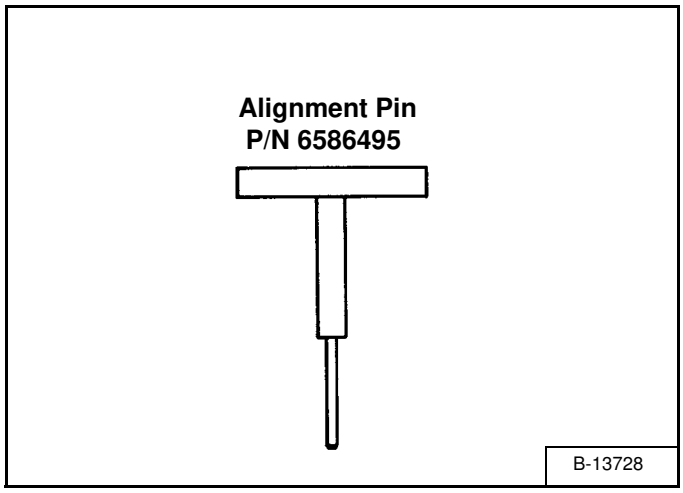


Figure 30-70-17



If the upperstructure is being replaced, use the special alignment pins (P/N 6586495) in the holes provided in the upperstructure **[Figure 30-70-16]** & **[Figure 30-70-17]**.

Remove any paint from the three alignment pin holes.

Use a chain hoist to lower the upperstructure onto the swing bearing.

Align the bolt holes in the upperstructure with the holes in the bearing.

Install an alignment pin into the upperstructure and put the upperstructure on the bearing to allow the pin to be put into the swing bearing gear teeth. Pull the upperstructure to set the pin firmly into the bearing teeth.

Install the next alignment pin into the upperstructure and into the bearing gear teeth. Pull the upperstructure to set the second pin into the bearing teeth.

Install the third alignment pin, this will align the bearing to the upperstructure for correct swing motor to bearing teeth engagement.

Apply liquid adhesive (LOCTITE 242) to the bolt threads. Rotate the upperstructure to install the bolts.

Tighten the bolts to 73-81 ft.-lbs. (100-110 Nm) torque.

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ARM 40-160-1
Arm To Boom Bushing Removal And Installation 40-160-1
Arm To Bucket And Bucket Link Bushing Removal And Installation 40-160-2
Removal And Installation 40-160-1

BLADE CONTROL 40-80-1
Lever Removal And Installation 40-80-1
Linkage Bar Removal And Installation 40-80-4
Linkage Removal And Installation 40-80-2
Lower Linkage Removal And Installation 40-80-5

BOOM 40-150-1
Boom Bushing Removal And Installation 40-150-2
Removal And Installation 40-150-1

BUCKET 40-170-1
Bucket Side Cutting Edge Removal And Installation 40-170-2
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CAB 40-30-1
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Front Window Removal And Installation 40-30-5
Lower Front Window Removal And Installation 40-30-7
Right Side Front Sliding Window Removal And Installation 40-30-9
Right Side Panel And Window Assembly Removal And Installation 40-30-10
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Removal And Installation 40-30-1

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Removal And Installation 40-70-1

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Removal And Installation 40-110-1

FUEL TANK 40-120-1
Removal And Installation 40-120-1

HORN 40-130-1
Removal And Installation 40-130-1

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Console Switch Removal And Installation 40-60-8
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Lock Lever Removal And Installation 40-60-5
Lower Console Cover Removal And Installation 40-60-1
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Upper Console Removal And Installation 40-60-6

RIGHT CONSOLE 40-50-1
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Linkage Removal And Installation 40-90-4
Pedal Removal And Installation 40-90-1
Right Pedal Disassembly And Assembly 40-90-2

RIGHT SIDE COVER 40-200-1
Removal And Installation 40-200-1

ROPS CANOPY 40-20-1
Removal And Installation 40-20-1

STANDARD SEAT AND SEAT MOUNT 40-40-1
Removal And Installation 40-40-1

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Release Rod Removal And Installation (Early Models) 40-180-3
Removal And Installation 40-180-1

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Adjustment 40-100-5
Disassembly And Assembly. 40-100-2
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UPPERSTRUCTURE

Removal And Installation

Figure 40-10-1

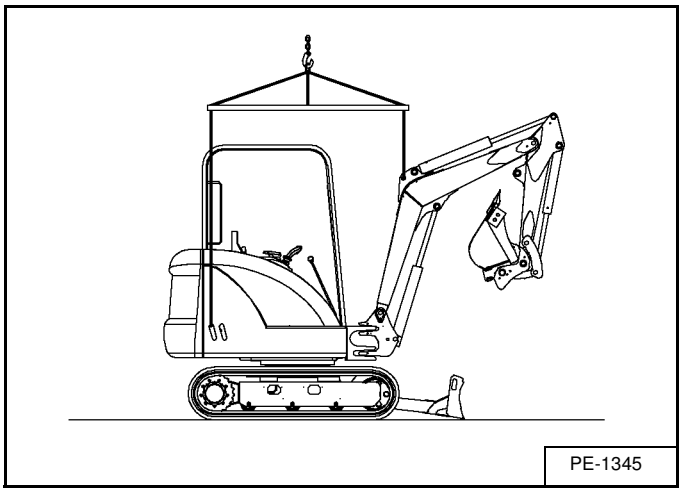


Connect a lifting sling to the excavator at the rear of the swing frame and to the lift hook holes in the boom **[Figure 40-10-1]**.

Remove the floor mat and floor plate. (See Removal And Installation on Page 40-110-1.)

Remove the right pedal and pedal mount. (See Pedal Removal And Installation on Page 40-90-1.)

Figure 40-10-2



The boom must be in full raised position and centered to the front of the excavator **[Figure 40-10-2]**.

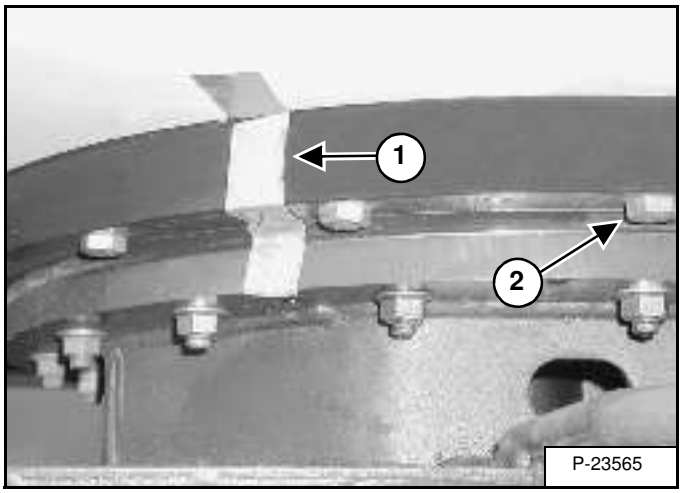
⚠ WARNING

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 40-10-3



Mark the upperstructure to the swing bearing and to the track frame for assembly (Item 1) **[Figure 40-10-3]**.

Partially disassemble the upperstructure from the swing bearing by removing all but four bolts which are spaced at 90° from each other (Item 2) **[Figure 40-10-3]**. The upperstructure must be rotated to gain access to the bolts for removal. Start the engine and run it at idle. Remove a bolt from the swing bearing, then move out of the way of upperstructure and slowly rotate the excavator until access to the next bolt is available. Remove this bolt and continue the above procedure.

NOTE: For disassembly safety a minimum of four evenly spaced bolts must remain installed, to be removed later.

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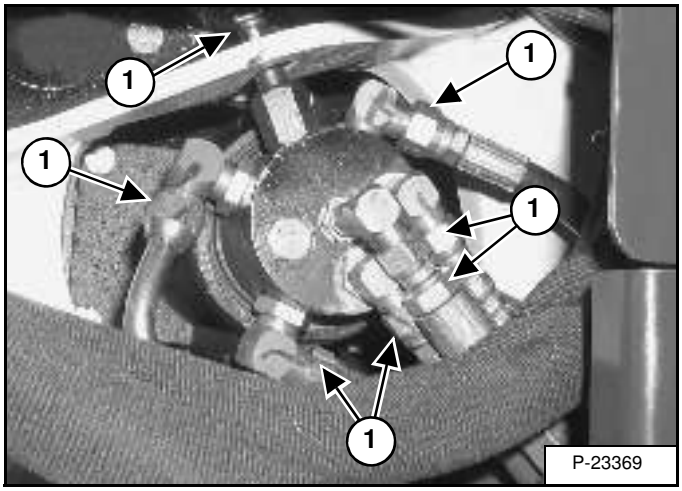
Removal And Installation (Cont'd)

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, tube lines and ports to keep dirt out. Dirt can quickly damage the system.

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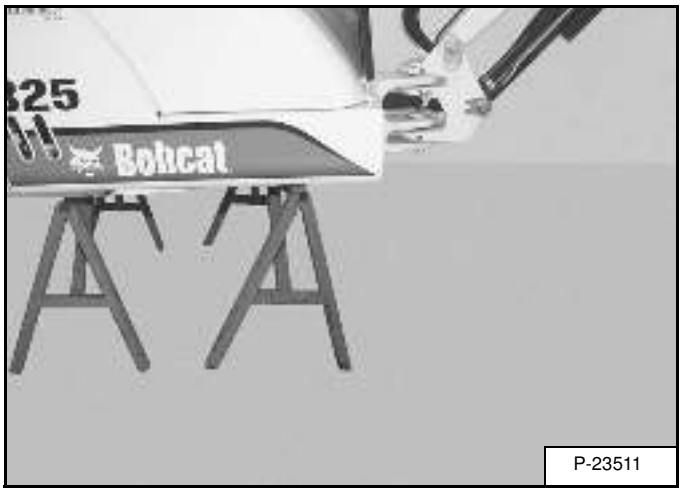
Figure 40-10-4



Mark the seven hoses (Item 1) **[Figure 40-10-4]** and fittings on the top portion of the swivel for correct installation. Remove the hoses from the swivel joint.

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.

Figure 40-10-5

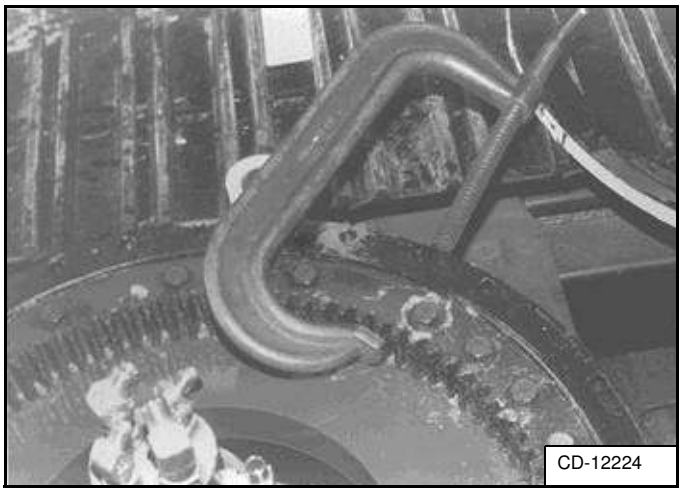


Lift the upperstructure off of the swing bearing. Position the upperstructure onto suitable supporting stands or blocks **[Figure 40-10-5]**.

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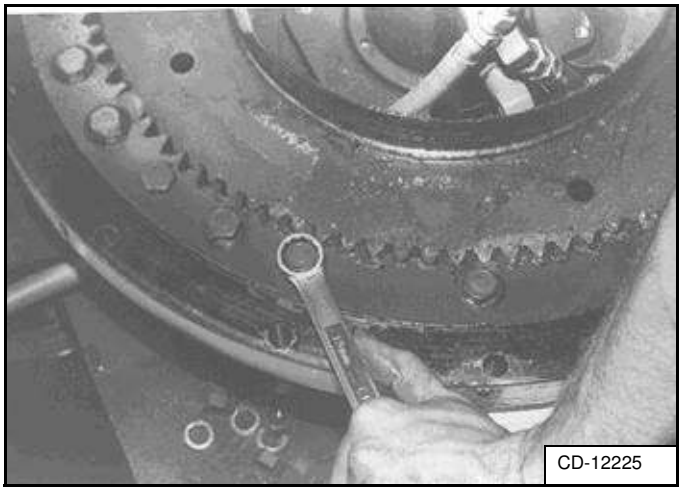
Swing Bearing Removal

Figure 40-10-6



Install a c-clamp or other suitable retainer to prevent the swing bearing from turning while being removed **[Figure 40-10-6]**.

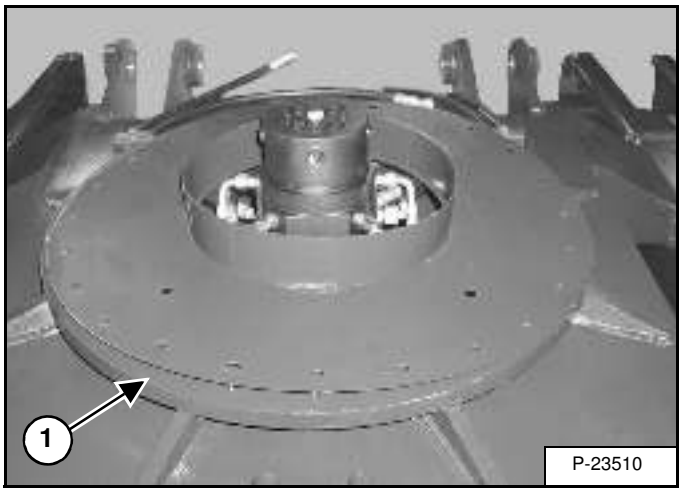
Figure 40-10-7



Remove the bolts and nuts that hold the swing bearing to the track frame **[Figure 40-10-7]**.

Mark the top surface of the swing bearing for ease of assembly. Remove the swing bearing from the track frame.

Figure 40-10-8



Remove the grease cover (Item 1) **[Figure 40-10-8]** from the track frame. Clean and inspect the grease cover for damage. Replace if necessary.

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Swing Bearing Installation

Figure 40-10-9

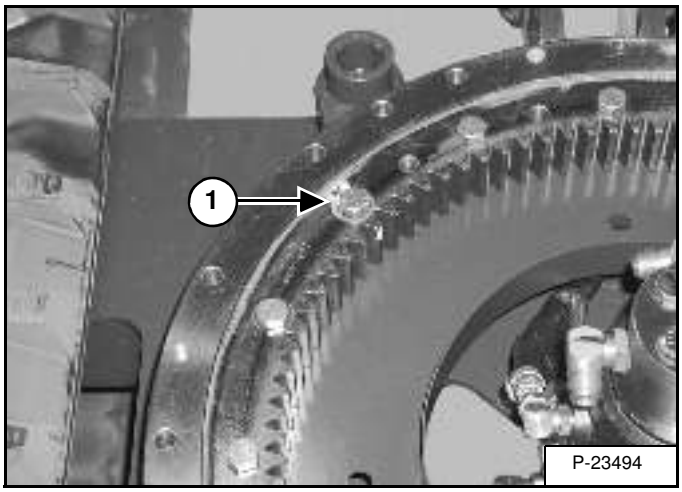
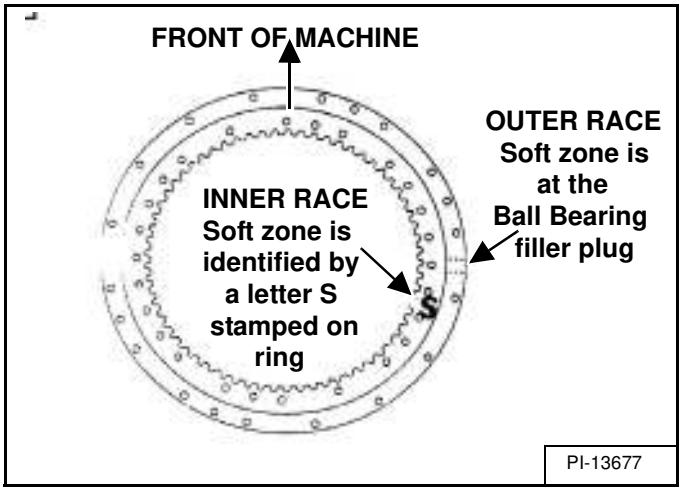


Figure 40-10-10

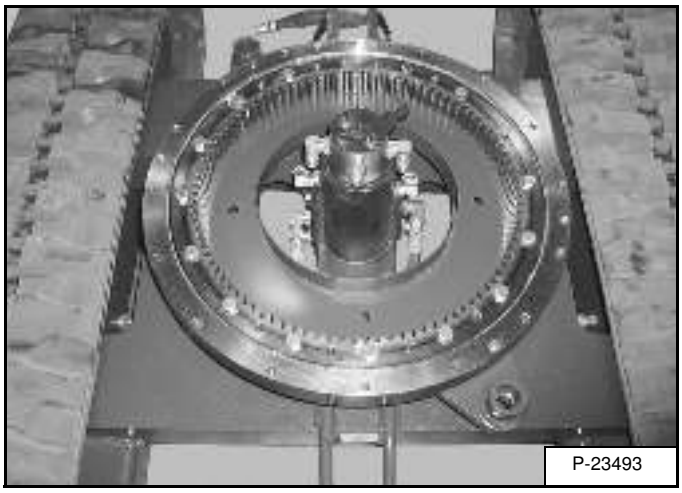


If reusing the existing swing bearing, use top side and edge aligning marks to correctly position the swing bearing. If a new swing bearing is being installed, locate the soft zone area (Item 1) **[Figure 40-10-9]** & **[Figure 40-10-10]**.

Install the swing bearing so that the soft zone is positioned to the left hand side of the excavator.

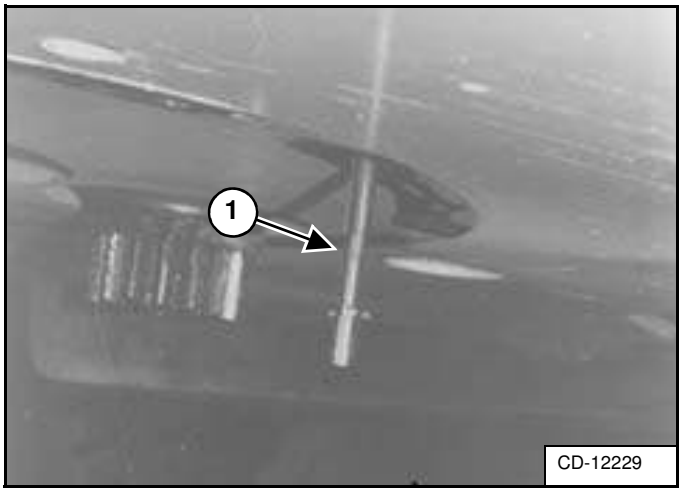
NOTE: DO NOT locate the soft zone to the front or rear of excavator.

Figure 40-10-11



Install the bolts and lock nuts **[Figure 40-10-10]**.

Figure 40-10-12



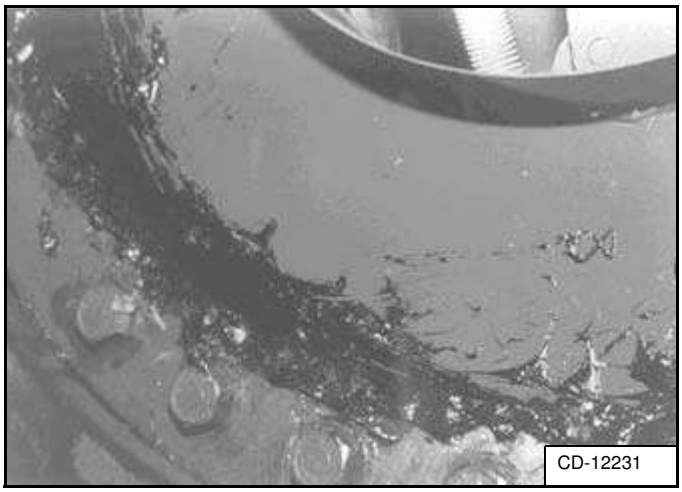
Install a tap (12 mm) (Item 1) **[Figure 40-10-12]** into the tapped holes in the upperstructure to remove any dried liquid adhesive (LOCTITE) or burrs.

Remove the tap (Item 1) **[Figure 40-10-12]**.

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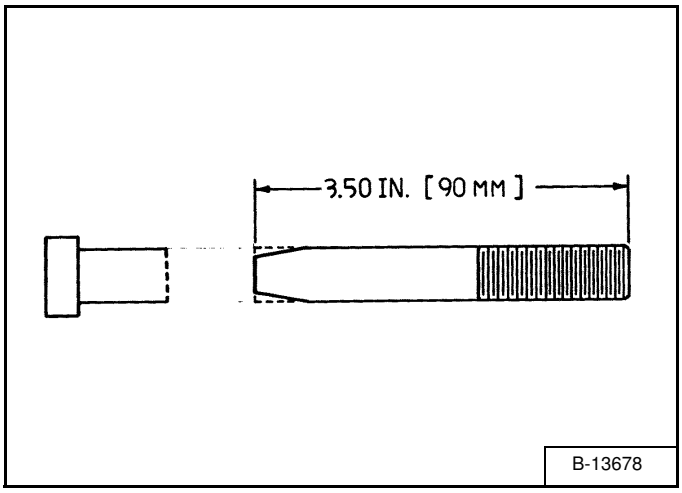
Swing Bearing Removal (Cont'd)

Figure 40-10-13



Grease the swing bearing with lubriplate grease or equivalent **[Figure 40-10-13]**.

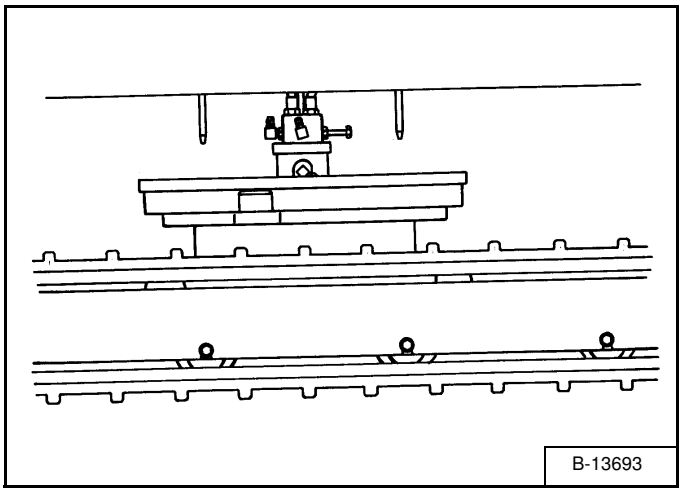
Figure 40-10-14



Make three alignment pins by using M12 x 110 mm (P/N 7GM-12110) long bolts. Cut the head off of these bolts at 3.500 inches (90 mm), then taper this end of the bolts **[Figure 40-10-14]**.

Install these three pins into the upperstructure at approximately 120° apart **[Figure 40-10-14]**. These will act as alignment pins while lowering the house frame onto the swing bearing.

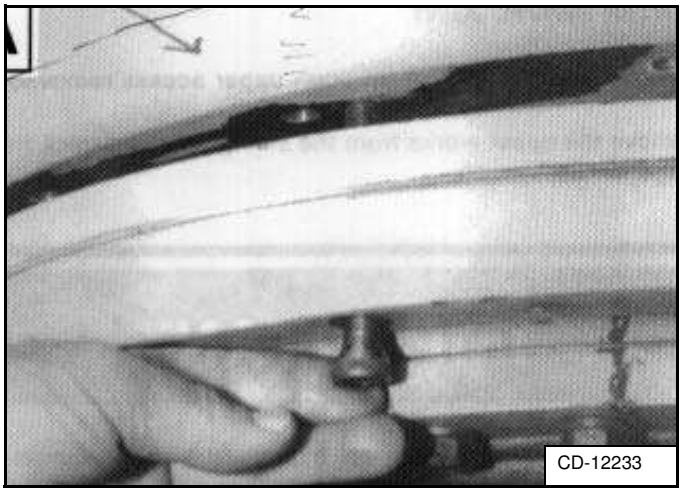
Figure 40-10-15



Install the upperstructure onto the swing bearing using the alignment marks and the alignment pins **[Figure 40-10-15]**.

Make sure the swing motor gear teeth mesh with the swing bearing teeth and that the swivel joint is centered into the upperstructure access hole.

Figure 40-10-16



Install the three tapered head alignment bolts (P/N 6535902) through the swing bearing and into the upperstructure **[Figure 40-10-16]**. 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.

Remove the three, 3.500 inches (90 mm) alignment pins from the upperstructure.

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Swing Bearing Removal (Cont'd)

These headless pins can be removed from the bottom.

Apply thread adhesive (LOCTITE 242) to the swivel joint stop bolt.

Install the hoses and fittings that were removed earlier. Start the engine and run at idle to rotate the upperstructure to install and tighten the bolts.

Apply liquid 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 73-81 ft.-lbs. (100-110 Nm) torque.

Remove the three alignment bolts (P/N 6535902). Install the three remaining bolts. Tighten these bolts to 73-81 ft.-lbs. (100-110 Nm) torque.

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 floor plate and floor mat.

Check the hydraulic fluid level and add as necessary.

Alignment Pins (Not Threaded)

Figure 40-10-17

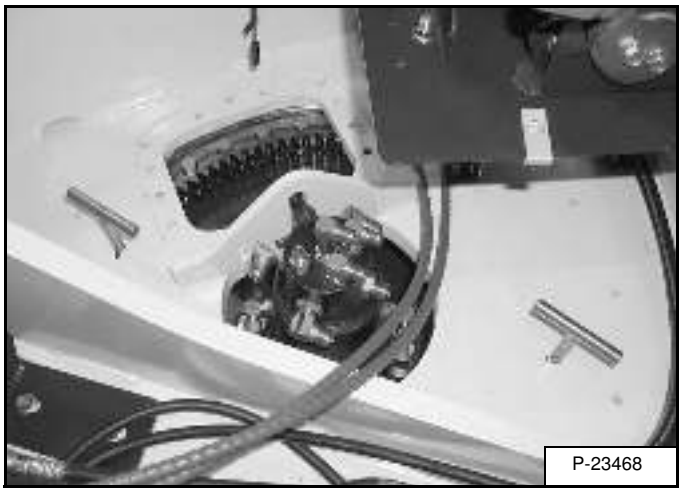
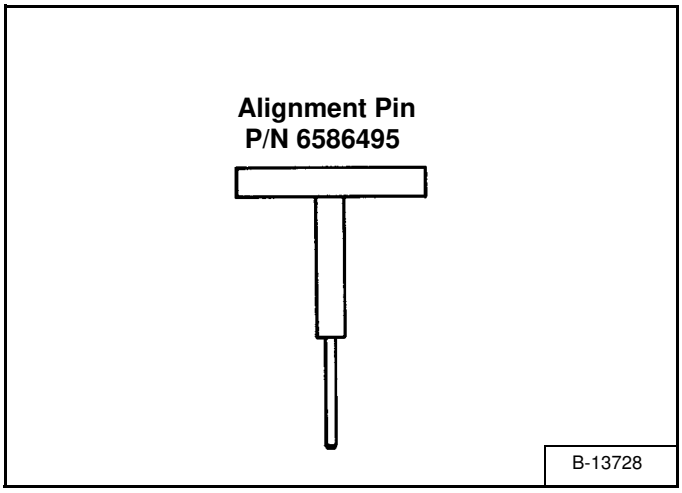


Figure 40-10-18



If the upperstructure is being replaced, use the special alignment pins (P/N 6586495) in the holes provided in the upperstructure **[Figure 40-10-17]** & **[Figure 40-10-18]**.

Remove any paint from the three alignment pin holes.

Use a chain hoist to lower the upperstructure onto the swing bearing.

Align the bolt holes in the upperstructure with the holes in the bearing.

Install an alignment pin into the upperstructure and put the upperstructure on the bearing to allow the pin to be put into the swing bearing gear teeth. Pull the upperstructure to set the pin firmly into the bearing teeth.

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Alignment Pins (Not Threaded) (Cont'd)

Install the next alignment pin into the upperstructure and into the bearing gear teeth. Pull the upperstructure to set the second pin into the bearing teeth.

Install the third alignment pin, this will align the bearing to the upperstructure for correct swing motor to bearing teeth engagement.

Apply liquid adhesive (LOCTITE 242) to the bolt threads. Rotate the upperstructure to install the bolts.

Tighten the bolts to 73-81 ft.-lbs. (100-110 Nm) torque.

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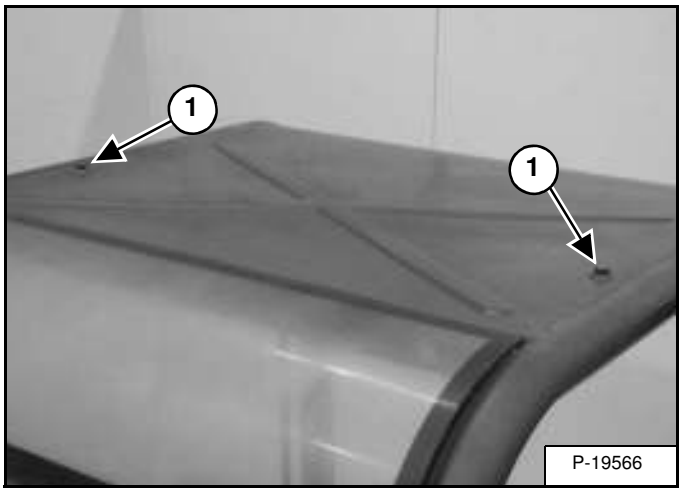


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ROPS CANOPY

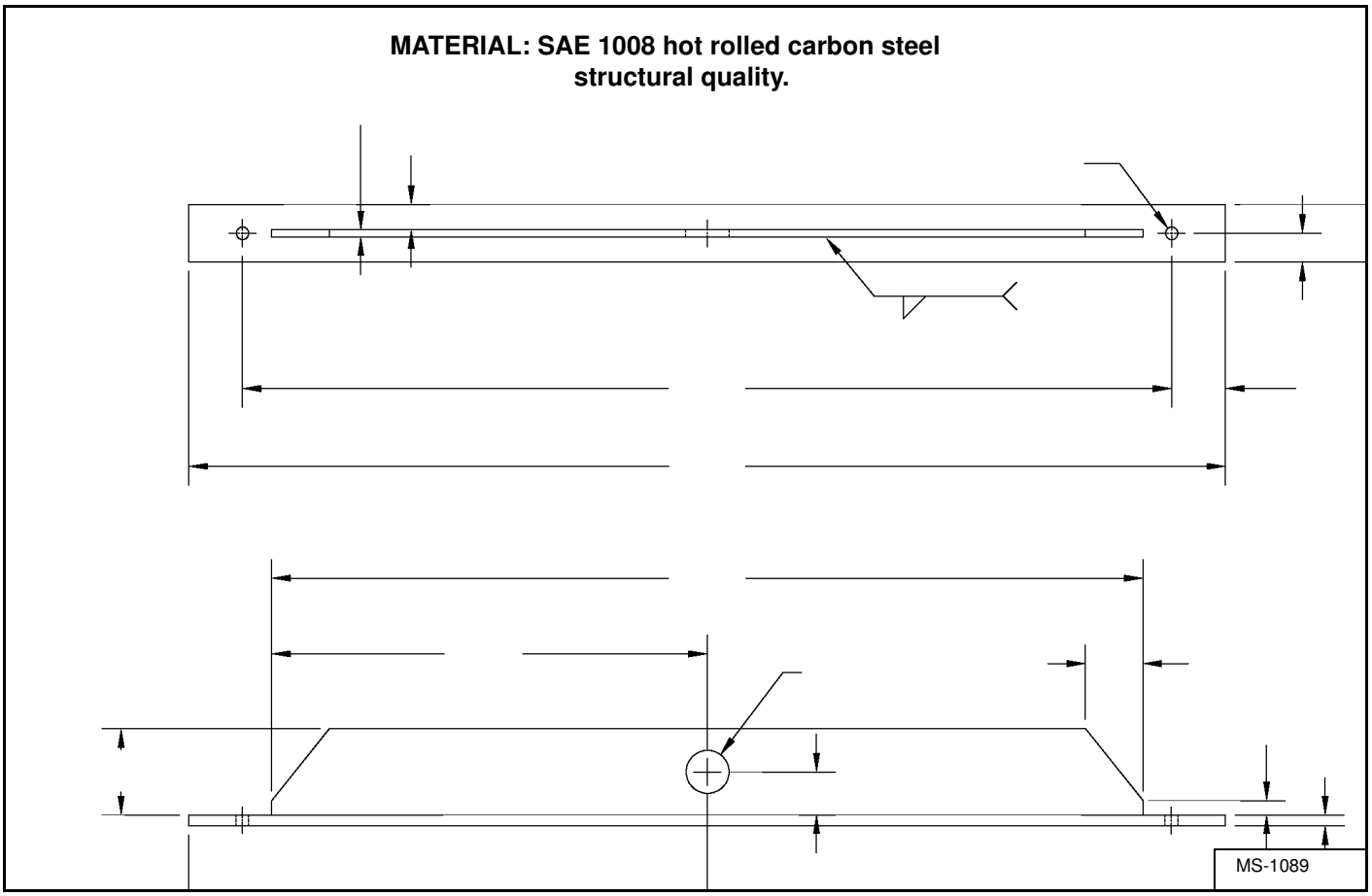
Removal And Installation

Figure 40-20-1



Remove the two bolts (Item 1) **[Figure 40-20-1]** from the top of the canopy.

Figure 40-20-2

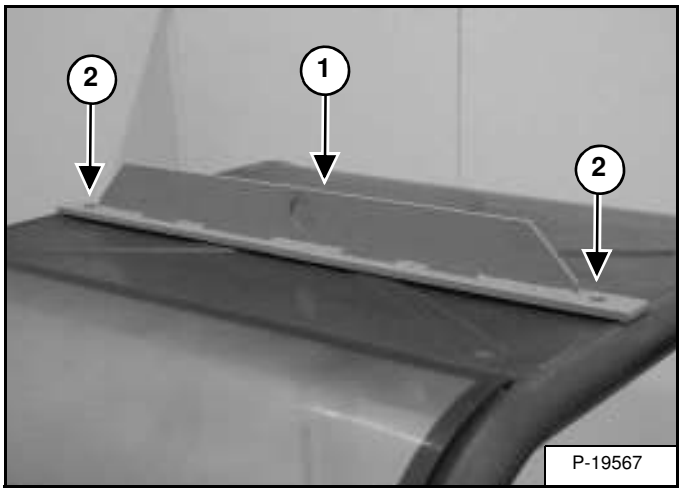


Build the service lifting bracket **[Figure 40-20-2]** used to remove and install the canopy.

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Removal And Installation (Cont'd)

Figure 40-20-3



Install the cab/canopy service lifting bracket (Item 1) **[Figure 40-20-3]** on the top of the canopy.

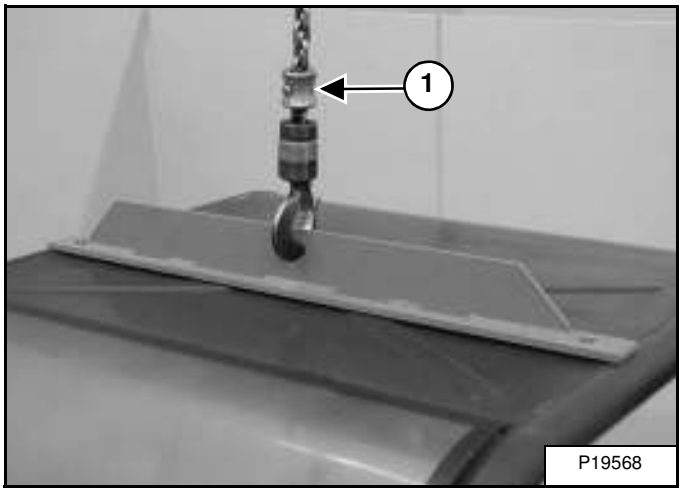
Use two bolts (Item 2) **[Figure 40-20-3]** 3/8-16 UNC x 1.25 lg. Grade 5 to fasten the lifting bracket to the canopy.

⚠ 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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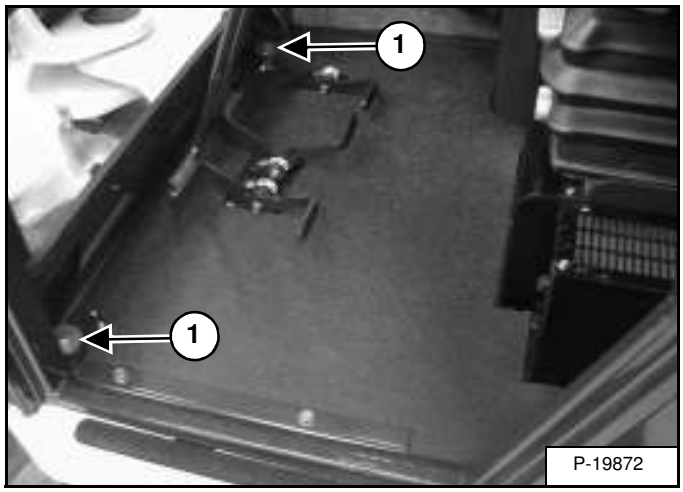
Figure 40-20-4



Install a chain hoist (Item 1) **[Figure 40-20-4]** to the cab/canopy service lifting bracket.

NOTE: Use a lifting device of sufficient capacity.

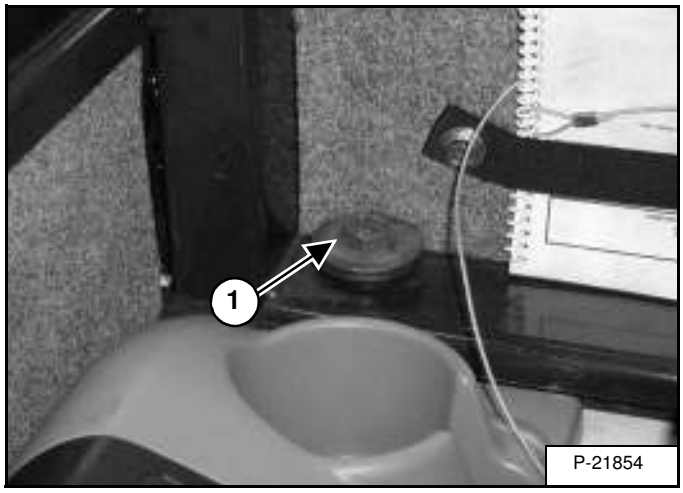
Figure 40-20-5



Remove the bolts and washers (Item 1) **[Figure 40-20-5]** from the inside front of the canopy.

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

Figure 40-20-6



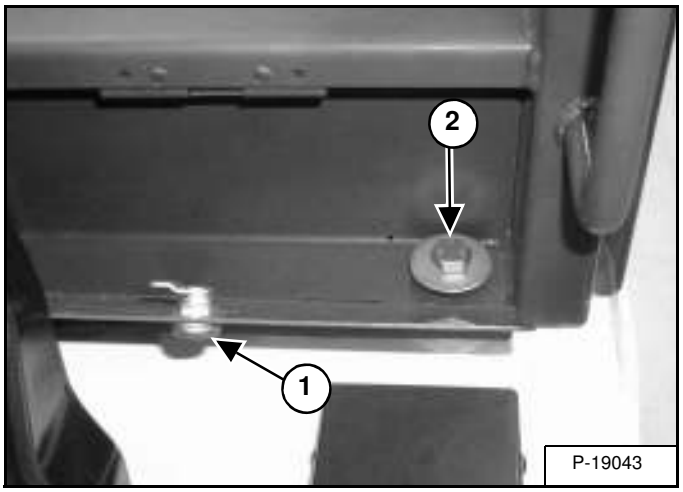
Remove the bolt and washer (Item 1) **[Figure 40-20-6]** from the right rear of the canopy.

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

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Removal And Installation (Cont'd)

Figure 40-20-7

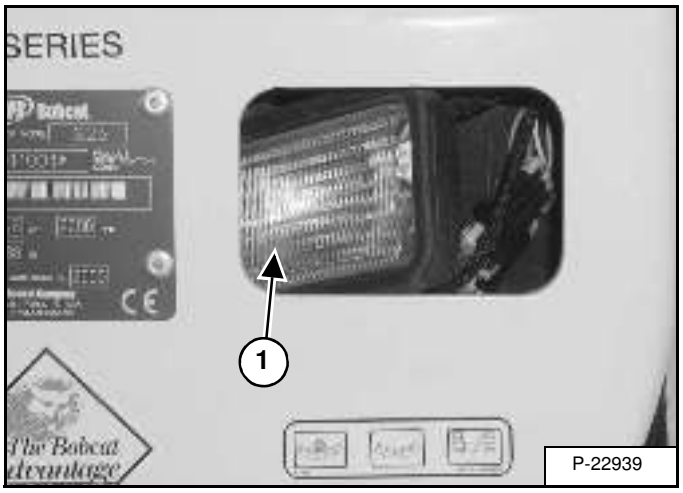


Open and remove the Operation & Maintenance Manual storage door (Item 1) **[Figure 40-20-7]** with the start key.

Remove the bolt and washer (Item 2) **[Figure 40-20-7]** from the left rear of the canopy.

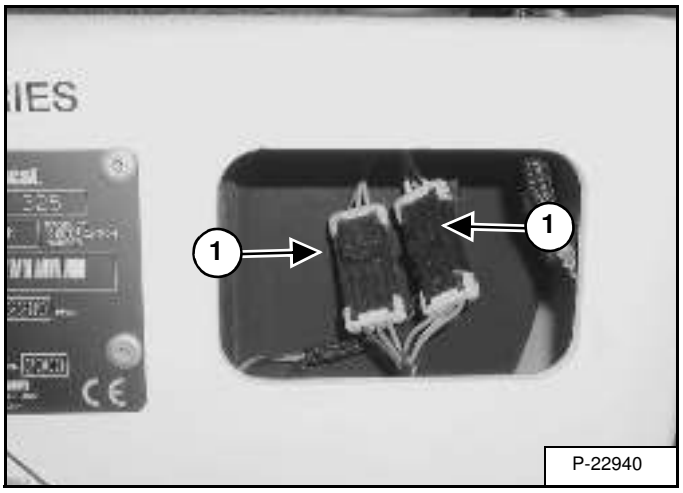
Installation: Tighten the bolt to 118-133 ft.-lbs. (160-180 Nm) torque.

Figure 40-20-8



If the canopy is equipped with a cab/canopy light kit, pivot the light (Item 1) **[Figure 40-20-8]** back inside the frame.

Figure 40-20-9



Disconnect the cab/canopy light wire harness (Item 1) **[Figure 40-20-9]**.

Guide the wiring harness through the excavator frame as the canopy is being removed off of the upperstructure.

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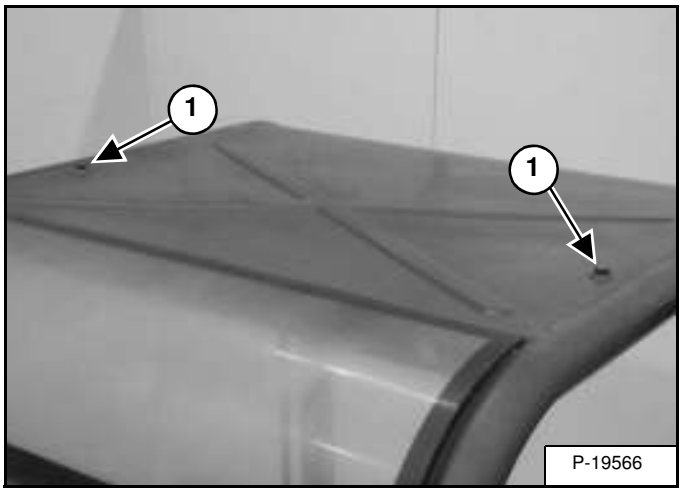


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CAB

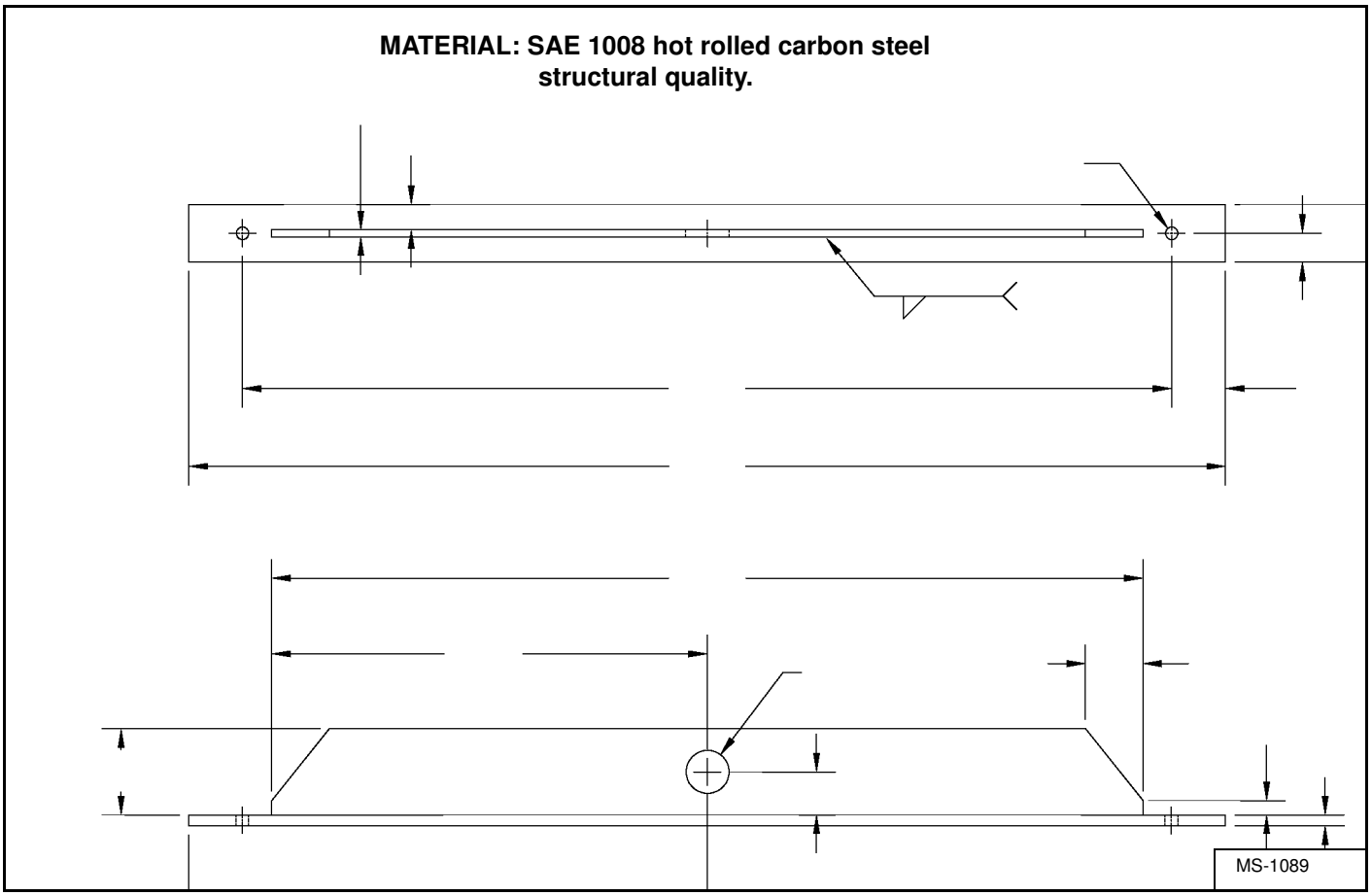
Removal And Installation

Figure 40-30-1



Remove the two bolts (Item 1) **[Figure 40-30-1]** from the top of the cab.

Figure 40-30-2

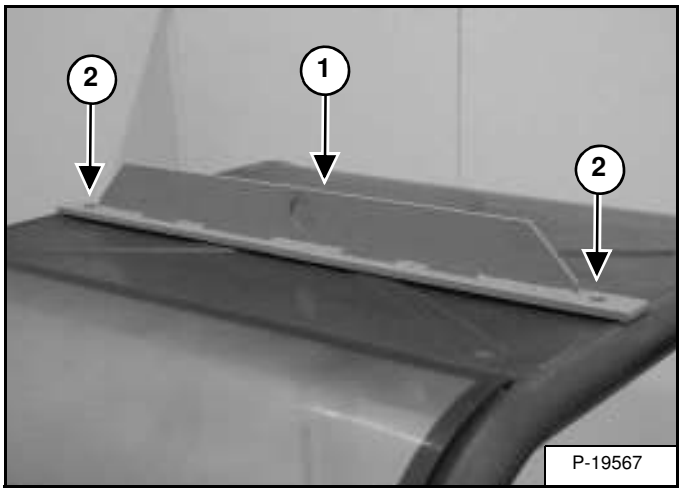


Build the service lifting bracket **[Figure 40-30-2]** used to remove and install the cab.

Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

Figure 40-30-3



Install the cab/canopy service lifting bracket (Item 1) **[Figure 40-30-3]** on the top of the canopy.

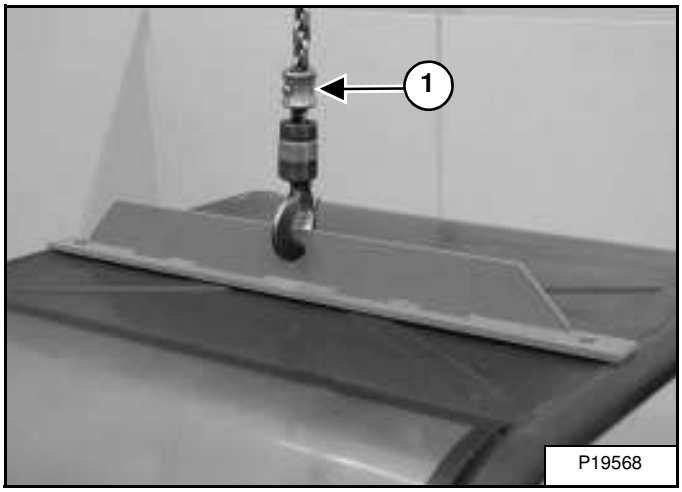
Use two bolts (Item 2) **[Figure 40-30-3]** 3/8-16 UNC x 1.25 lg. Grade 5 to fasten the lifting bracket to the canopy.

⚠ 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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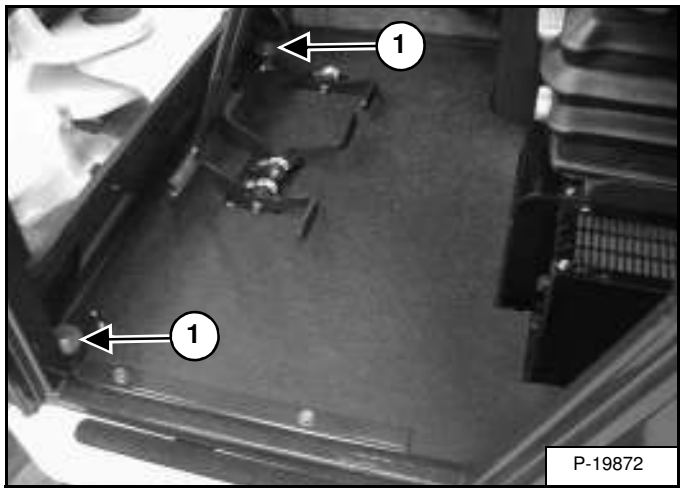
Figure 40-30-4



Install a chain hoist (Item 1) **[Figure 40-30-4]** to the cab/canopy service lifting bracket.

NOTE: Use a lifting device of sufficient capacity.

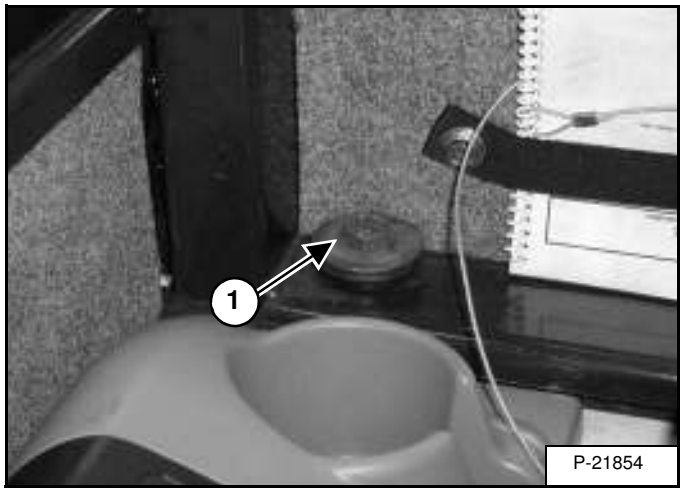
Figure 40-30-5



Remove the bolts and washers (Item 1) **[Figure 40-30-5]** from the inside front of the canopy.

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

Figure 40-30-6



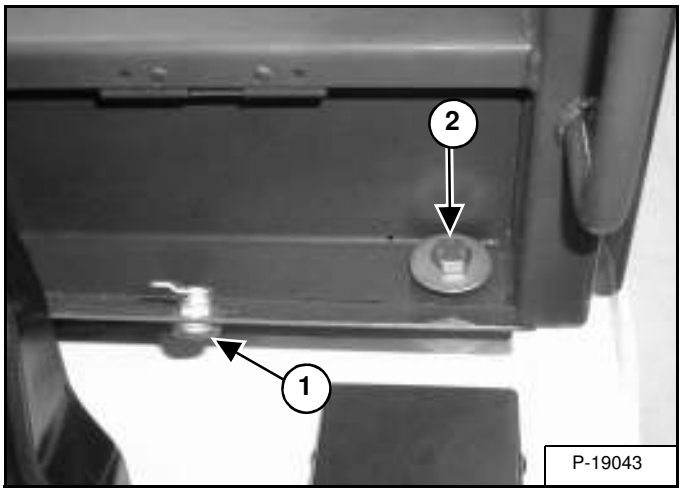
Remove the bolt and washer (Item 1) **[Figure 40-30-6]** from the right rear of the canopy.

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

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Removal And Installation (Cont'd)

Figure 40-30-7

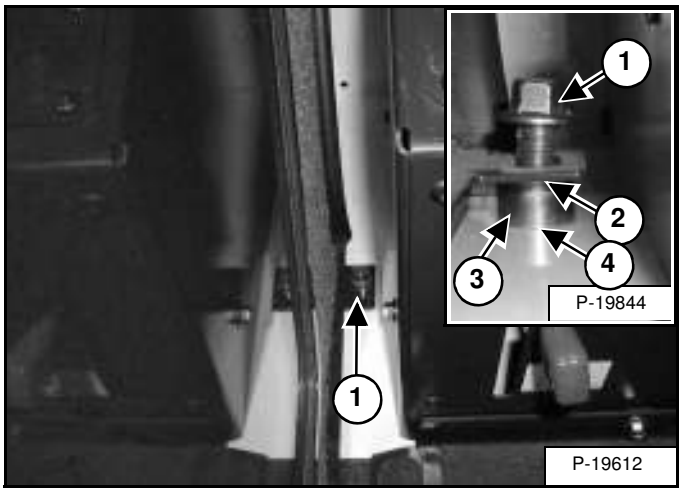


Open and remove the Operation & Maintenance Manual storage door (Item 1) **[Figure 40-30-7]** with the start key.

Remove the bolt and washer (Item 2) **[Figure 40-30-7]** from the left rear of the cab.

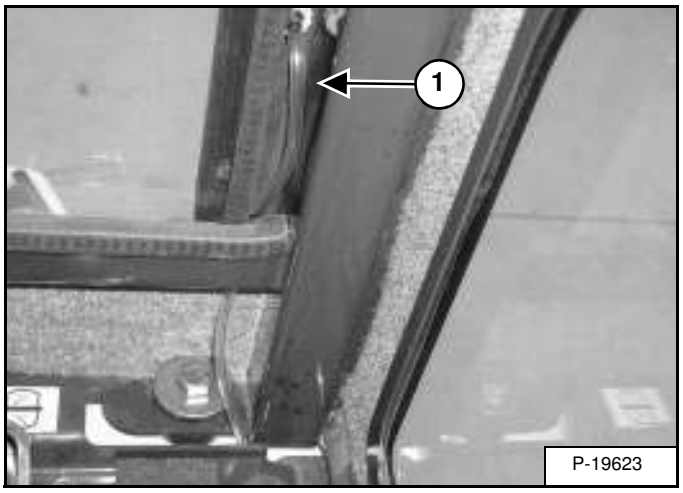
Installation: Tighten the bolt to 118-133 ft.-lbs. (160-180 Nm) torque.

Figure 40-30-8



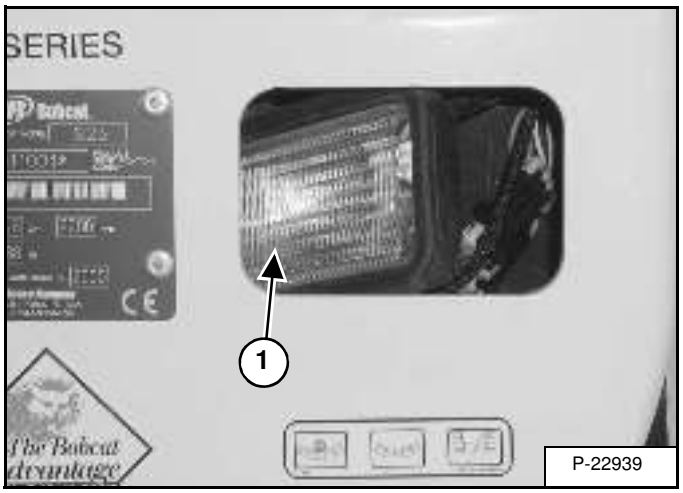
Remove the bolt (Item 1), washer (Item 2), spacer (Item 3) and capscrew retainer (Item 4) **[Figure 40-30-8]**.

Figure 40-30-9



Remove the hose (Item 1) **[Figure 40-30-9]** from the nozzle. Pull the hose from behind the crossbar on cab to prevent damage when cab is removed.

Figure 40-30-10

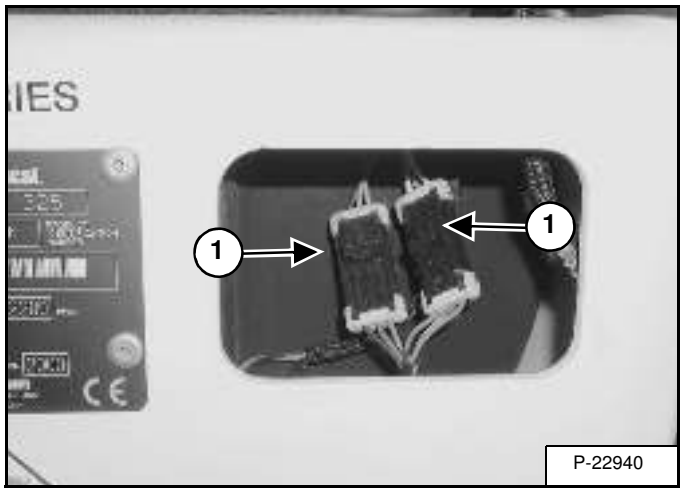


If the canopy is equipped with a cab/canopy light kit, pivot the light (Item 1) **[Figure 40-30-10]** back inside the frame.

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Removal And Installation (Cont'd)

Figure 40-30-11



Disconnect the cab/canopy light wire harness (Item 1) **[Figure 40-30-11]**.

Guide the wiring harness through the excavator frame as the canopy is being removed off of the upper structure.

Door Removal And Installation

Figure 40-30-12



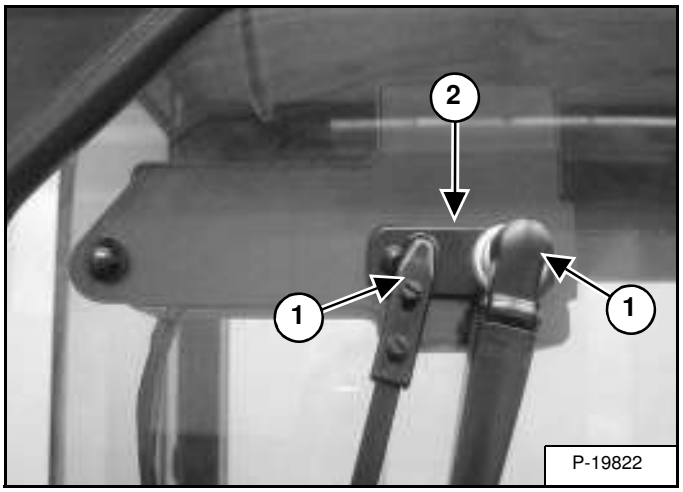
The door can be removed from the cab by slowly swinging the door back and forth while lifting up on the door **[Figure 40-30-12]**.

NOTE: When installing the door, align the hinges and rock the door back and forth until the door weight settles the door hinges to full engagement.

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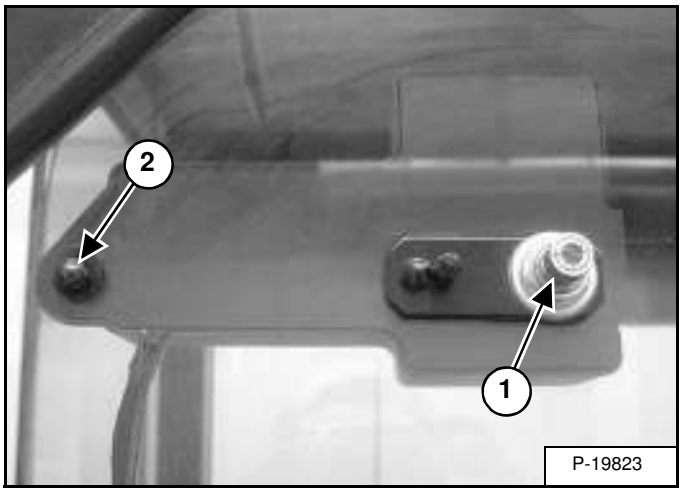
Front Window Removal And Installation

Figure 40-30-13



Remove the front wiper assembly (Item 1) from the pivot mount (Item 2)**[Figure 40-30-13]** on the front window.

Figure 40-30-14

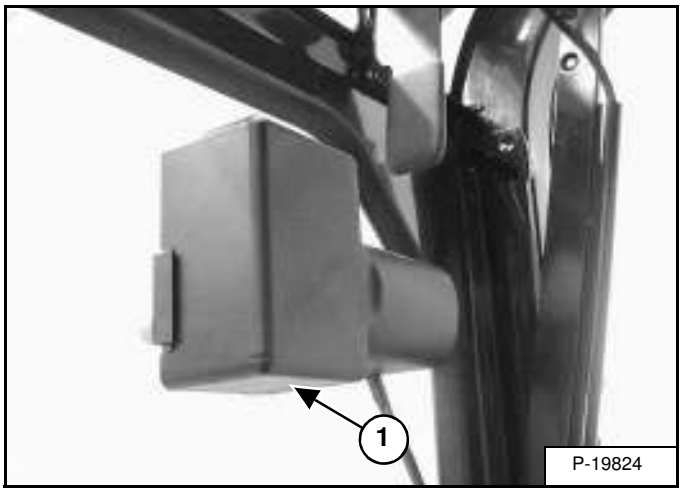


Remove the nut, cap and washer (Item 1) **[Figure 40-30-14]** from spline shaft.

Remove the nut, washer, spacer and bolt (Item 2) **[Figure 40-30-14]**.

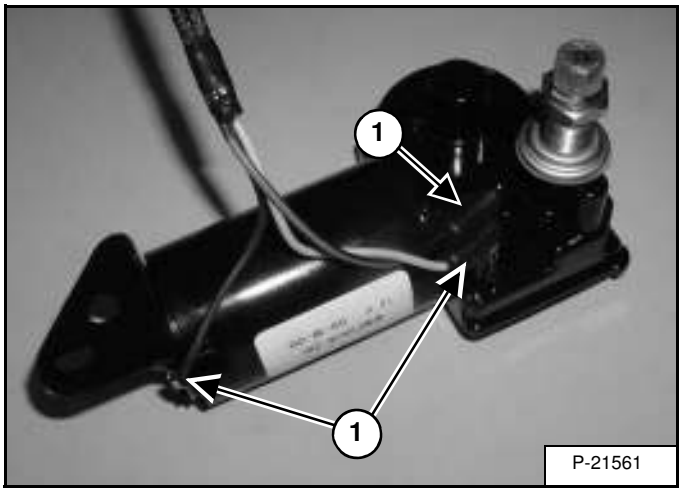
NOTE: Be careful to support the wiper motor before removing the mounting hardware. The spacer is a plastic tube that fits over the bolt in the front window.

Figure 40-30-15



Remove the wiper motor cover (Item 1) **[Figure 40-30-15]** from the wiper motor.

Figure 40-30-16



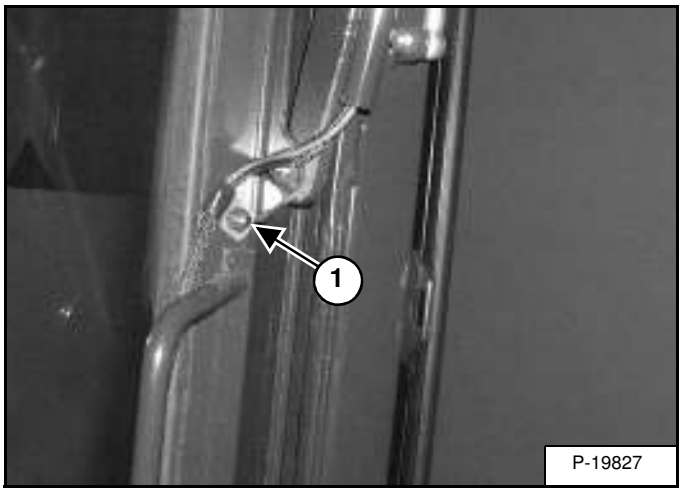
Mark the three wiper motor wires for ease of assembly (Item 1) **[Figure 40-30-16]**.

Remove the wires (Item 1) **[Figure 40-30-16]** from the wiper motor.

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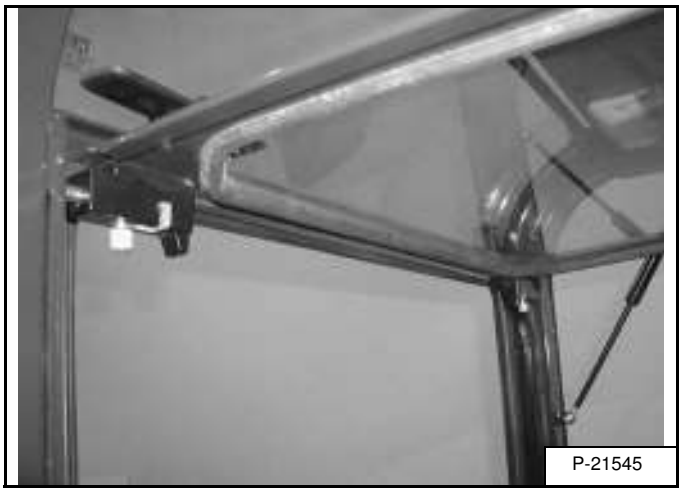
Front Window Removal And Installation (Cont'd)

Figure 40-30-17



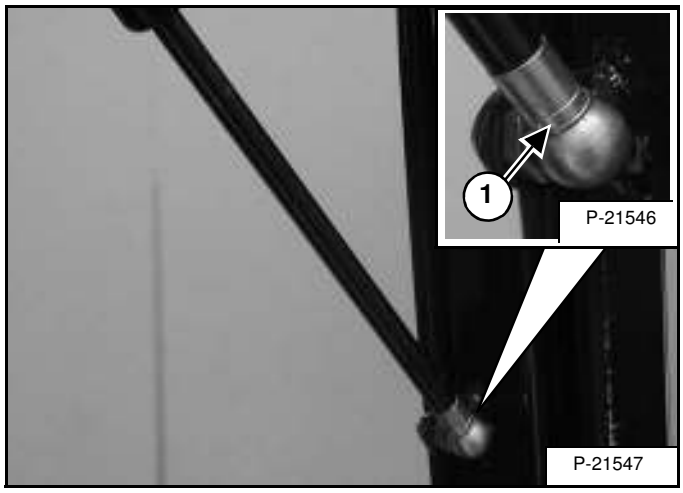
Remove the nut and bolt (Item 1) **[Figure 40-30-17]** holding the wire clamp to the front window.

Figure 40-30-18



Slide the front window up and lock into place **[Figure 40-30-18]**.

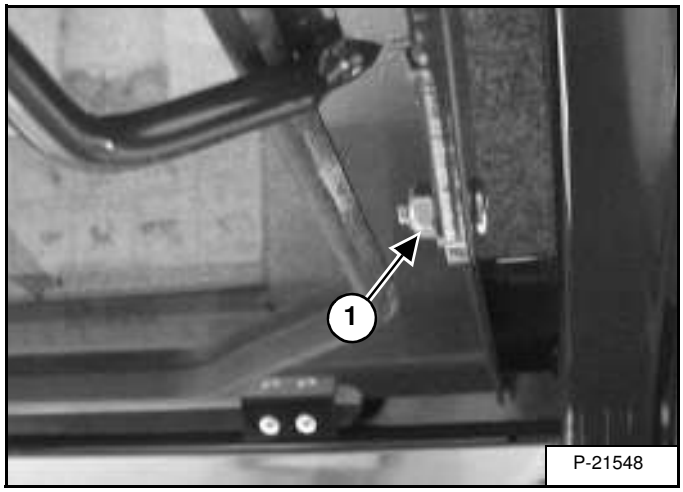
Figure 40-30-19



Remove the retaining clip (Item 1) **[Figure 40-30-19]** from the rod end of the gas spring.

Remove the gas spring from the pivot mount.

Figure 40-30-20

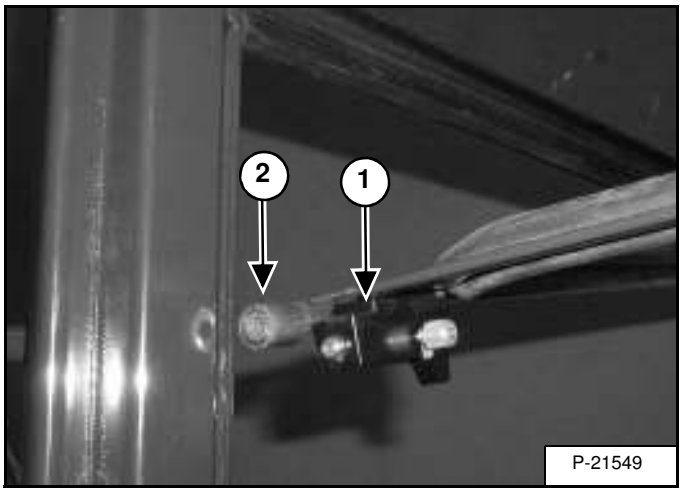


With the help of a second person holding the front window, remove the nuts and bolts (Item 1) **[Figure 40-30-20]** from both sides of the front window.

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Front Window Removal And Installation (Cont'd)

Figure 40-30-21

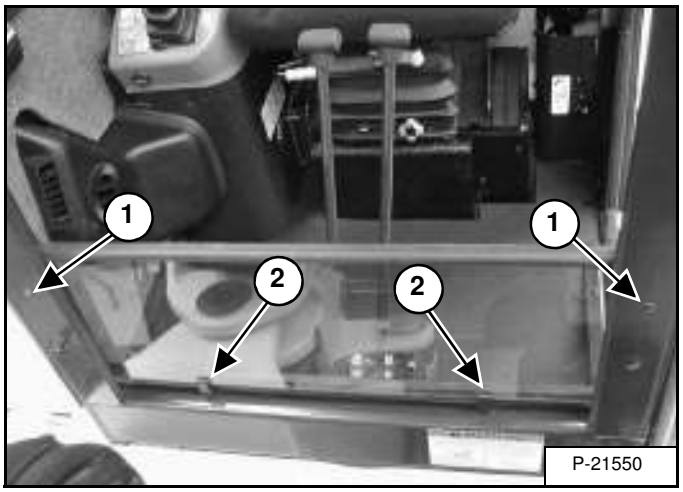


Unlock the two front window locks and tilt the front window (Item 1) **[Figure 40-30-21]**. Remove front window from the cab frame.

Remove the rollers (Item 2) **[Figure 40-30-21]** from both sides of the front window frame.

Lower Front Window Removal And Installation

Figure 40-30-22

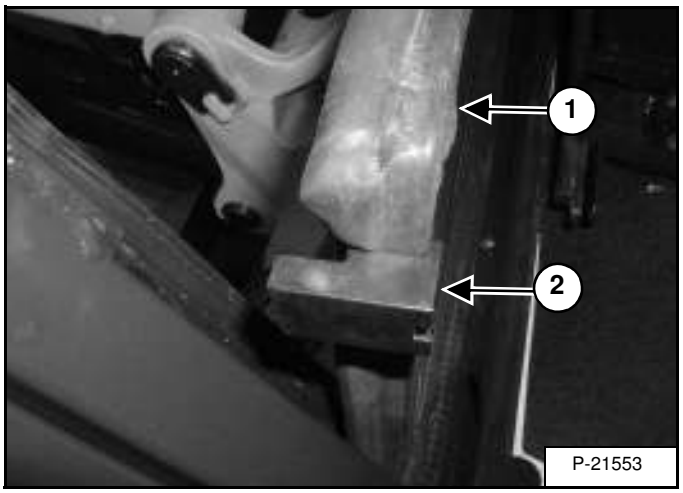


Lift and lock the front window in the up position.

Remove the two bolts and nuts (Item 1) **[Figure 40-30-22]** from the lower front window.

Loosen the two bolts (Item 2) **[Figure 40-30-22]** on the lower front window.

Figure 40-30-23



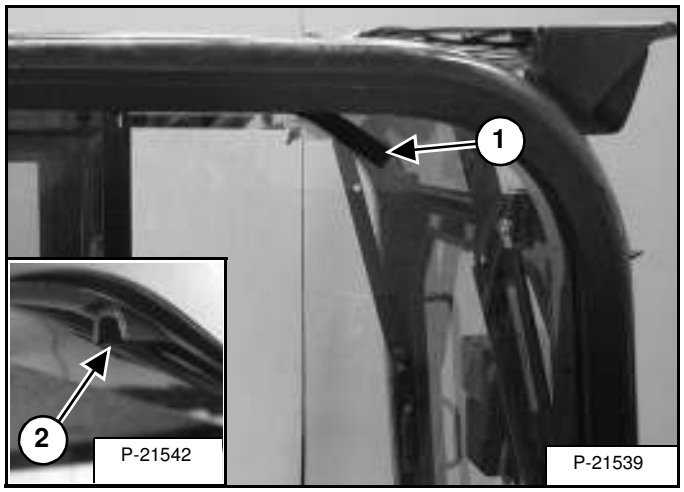
Tilt lower front window (Item 1) in the cab and remove the plastic blocks (Item 2) **[Figure 40-30-23]** on each side of the window.

Remove the lower front window from the cab frame.

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Right Side Rear Sliding Window Removal And Installation

Figure 40-30-24



Close and latch the front and rear sliding windows.

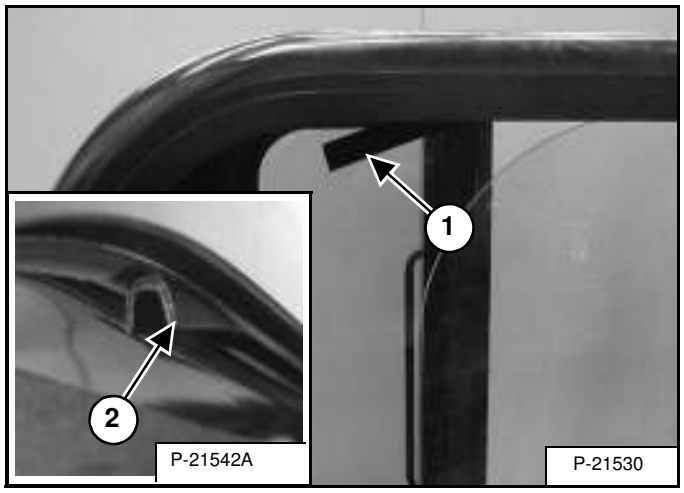
Use a pick to pull the 10 inch long felt (Item 1) **[Figure 40-30-24]** from the outside top window channel.

NOTE: On earlier cabs, the felt was one long piece. If this is on your cab, cut the felt off at 10 inches.

Installation: When installing the felt (Item 2) **[Figure 40-30-24]** back into the track frame use a window cleaner or equivalent lubricant.

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

Figure 40-30-25



Use a pick to pull the 17 inch long felt (Item 1) **[Figure 40-30-25]** from the outside top window channel.

NOTE: On earlier cabs, the felt was one long piece. If this is on your cab, cut the felt off at 17 inches.

Installation: When installing the felt (Item 2) **[Figure 40-30-25]** back into the track frame use a window cleaner or equivalent lubricant.

Figure 40-30-26



Figure 40-30-27



Lift rear sliding window up into the channel **[Figure 40-30-26]** and tilt the bottom edge out **[Figure 40-30-27]**. Remove rear sliding window from the excavator.

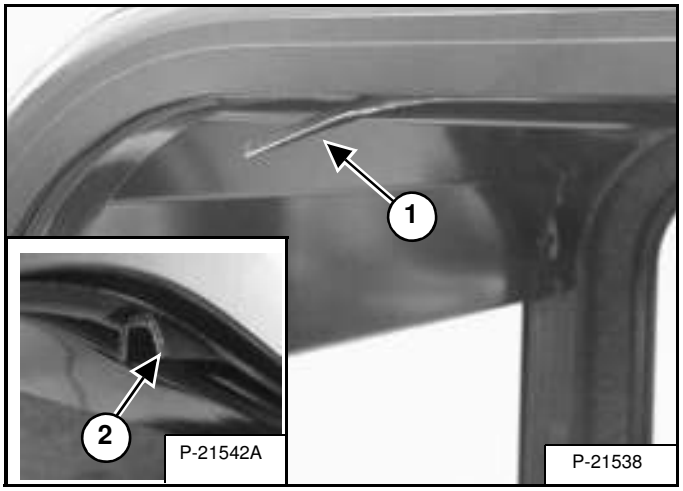
NOTE: The rear sliding window must be removed before front sliding window can be removed.

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Right Side Front Sliding Window Removal And Installation

Close the front sliding window.

Figure 40-30-28



Use a pick to pull the 16 inch long felt (Item 1) **[Figure 40-30-28]** from the inside top window channel.

NOTE: On earlier cabs, the felt was one long piece. If this is on your cab, cut the felt off at 16 inches.

Installation: When installing the felt (Item 2) **[Figure 40-30-28]** back into the track frame use a window cleaner or equivalent lubricant.

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

Figure 40-30-29

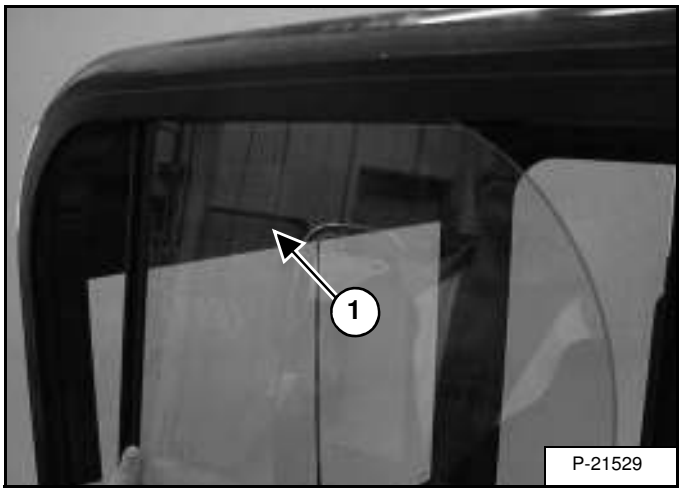


Figure 40-30-30



Lift front sliding window up into channel **[Figure 40-30-29]** and tilt the bottom edge out **[Figure 40-30-30]**. Remove front sliding window from the excavator.

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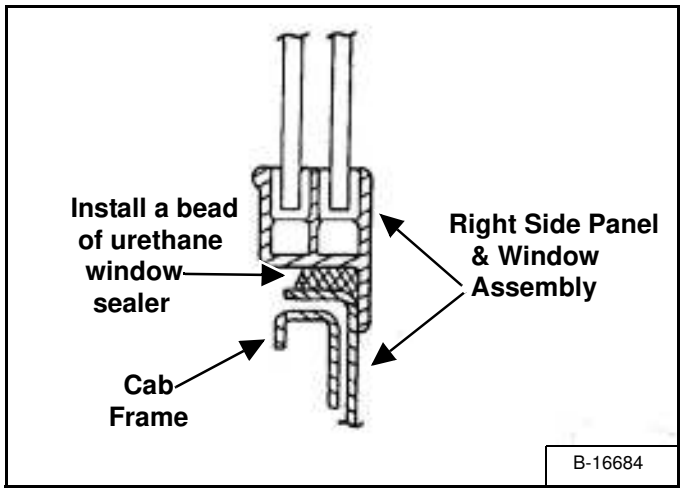
Right Side Panel And Window Assembly Removal And Installation

Remove the cab. (See Removal And Installation on Page 40-30-1.)

NOTE: To remove the right side panel, the right side sliding windows and frame need to be removed first.

Remove the right side sliding windows. (See Right Side Rear Sliding Window Removal And Installation on Page 40-30-8.)

Figure 40-30-31



Remove the sliding window frame by cutting, from the inside of the cab, the adhesive around the perimeter of the sliding window frame **[Figure 40-30-31]**. Carefully pry out the sliding window frame from the cab assembly.

NOTE: If the sliding window frame is to be re-used, use care when removing the frame. The window frame is aluminum and can easily be damaged.

Remove the right side panel by cutting, from the outside of the cab, the adhesive along the two vertical sides of the panel **[Figure 40-30-31]**. Carefully pry out the side panel from the cab assembly.

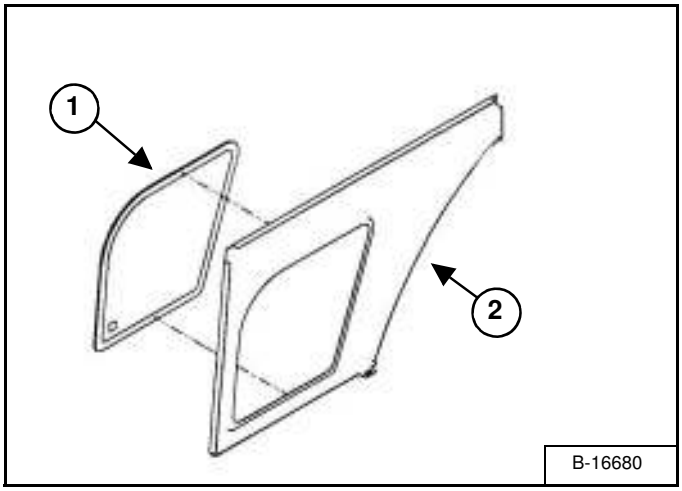
NOTE: Order window glass, urethane adhesive and primer/degreaser through Bobcat parts.

NOTE: To install the right side sliding windows and frame, the right side panel needs to be installed first.

The right side panel on a 320/322 (D Series) Excavator has a window in the panel. All other D Series excavators do not have a window in the panel.

Lay the side panel on a flat surface with the exterior of the panel facing up.

Figure 40-30-32



Dry fit the window (Item 1) in the right side panel (Item 2) **[Figure 40-30-32]**.

Clean perimeter of window and frame inset on panel.

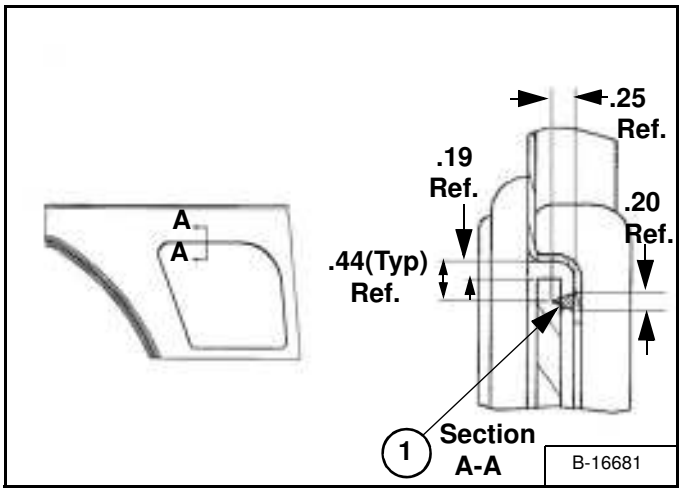
Apply the primer/degreaser (P/N 6808881) to perimeter of the window where the adhesive will contact. If the window and panel are new and do not have old urethane adhesive on them, apply the primer/degreaser (P/N 6808881) to both the panel and window surfaces. Allow to dry for 3 minutes.

Cut tip of the adhesive tube to desired shape and size to provide a bead height sufficient to give good contact with the window around the entire perimeter. A triangular shaped bead will provide the desired bead shape and height.

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Right Side Panel And Window Assembly Removal And Installation (Cont'd)

Figure 40-30-33

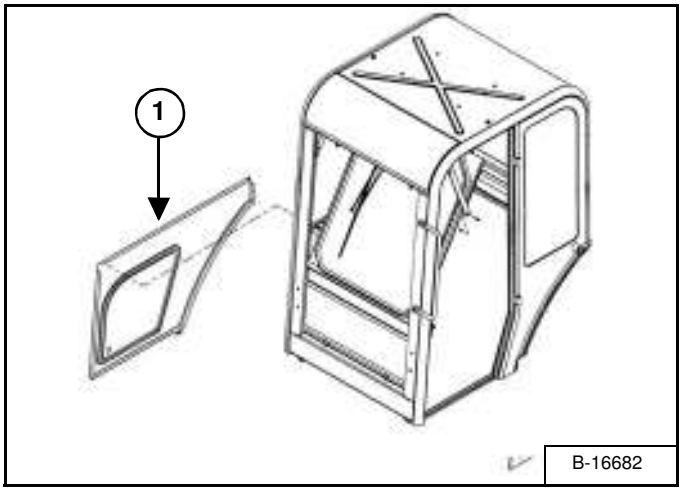


Apply urethane adhesive (P/N 6808882) (Item 1) **[Figure 40-30-33]** to the panel or window as shown.

Install the window and press window to assure complete contact with the urethane adhesive. Tape window in place. Allow 2 hours for curing at normal conditions (65° F, 75% relative humidity). With varying temperatures and relative humidity, curing will change accordingly.

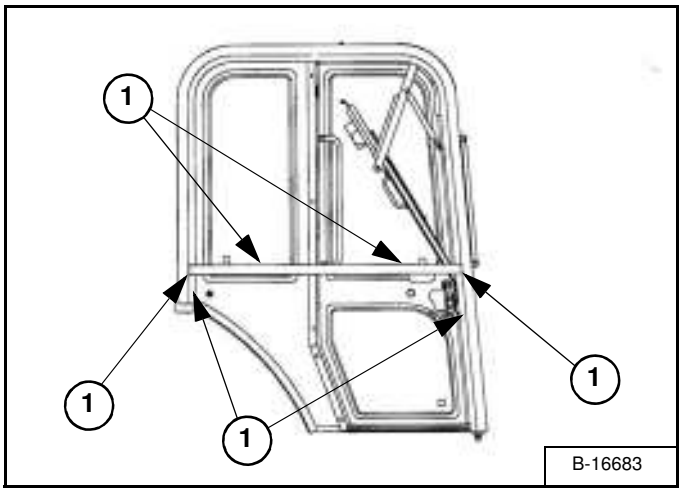
Remove tape once the urethane adhesive is cured.

Figure 40-30-34



Dry fit the right side panel (Item 1) **[Figure 40-30-34]**. The right side panel lip rests on top of the cab crossmember.

Figure 40-30-35



Remove the majority of the old urethane adhesive (Item 1) **[Figure 40-30-35]** from the two vertical sides and cross member of the cab frame. Try to prevent scraping paint off of the cab frame.

NOTE: Leave a thin film of the old urethane on the cab frame and fresh urethane is bonded to the remaining film.

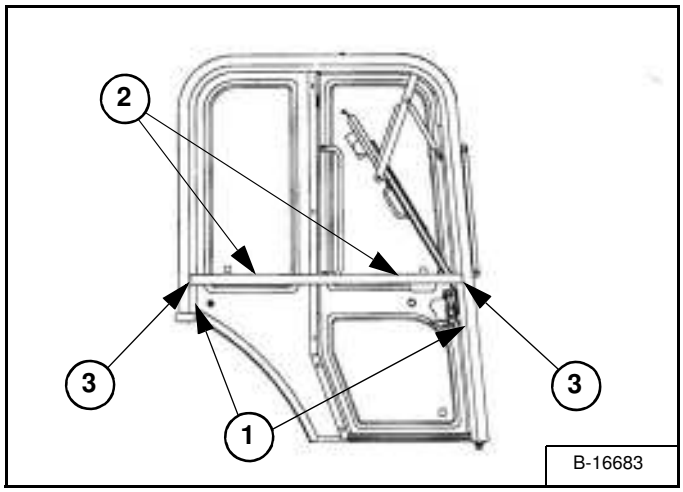
Prime any bare metal scratches.

Clean the edges of the right side panel where the urethane adhesive will contact.

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Right Side Panel And Window Assembly Removal And Installation (Cont'd)

Figure 40-30-36



Apply the primer/degreaser (P/N 6808881) to the two vertical sides (Item 1) **[Figure 40-30-36]** of the right side panel. Allow to dry for three minutes.

Cut tip of the adhesive tube to desired shape and size to provide a bead height sufficient to give good contact with the window around the entire perimeter.

Apply a .25 bead of urethane adhesive (P/N 6808882) in the corner of the cab rube along the full length of the tube (Item 1) **[Figure 40-30-36]**.

Apply a .3 x .25 triangular bead of urethane adhesive (P/N 6808882), 6 inches long, at two places on the cross member (Item 2) **[Figure 40-30-36]**.

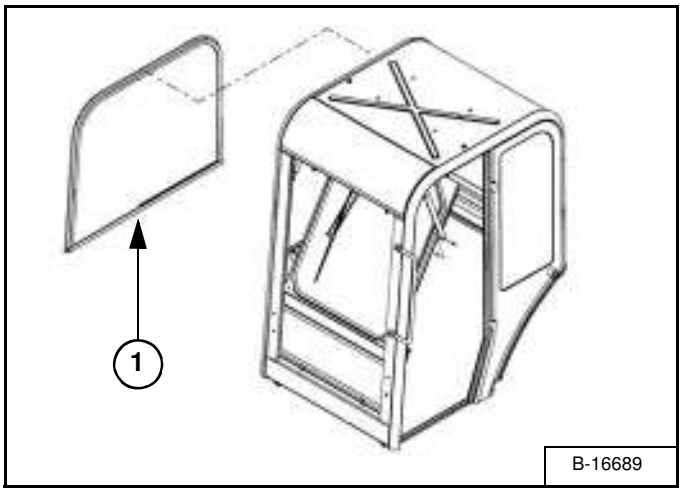
Install the right side panel on the cross member and press panel to assure complete contact with the urethane adhesive. Clamp the panel vertically in place.

Seal the two openings between the right side panel and cross member, from the inside of the cab (Item 3) **[Figure 40-30-36]**.

Allow two hours for curing at normal conditions (65° F, 75% relative humidity). With varying temperatures and relative humidity, curing time will change accordingly.

Remove clamps once the urethane adhesive is cured.

Figure 40-30-37

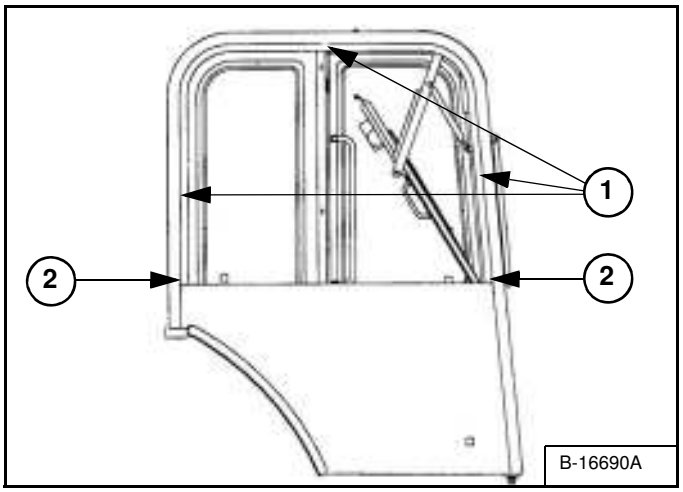


Dry fit the right side sliding window frame (Item 1) **[Figure 40-30-37]**. The frame sits on top of the right side panel and cab crossmember.

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Right Side Panel And Window Assembly Removal And Installation (Cont'd)

Figure 40-30-38



Remove a majority of the old urethane adhesive (Item 1 & 2) **[Figure 40-30-38]** from the perimeter of the sliding window frame and crossmember of the cab frame. Try to prevent scraping paint off of the cab frame.

NOTE: Leave a thin film of the old urethane on the cab frame and fresh urethane is bonded to the remaining film.

Prime any bare metal scratches.

Clean the edges of the right sliding window frame where the urethane adhesive will contact.

Apply the primer/degreaser (P/N 6808881) to the perimeter of the sliding window frame (Item 1) **[Figure 40-30-38]**. Allow to dry for 3 minutes.

Cut tip of the adhesive tube to desired shape and size to provide a bead height sufficient to give good contact with the frame around the entire perimeter.

Apply a .3 x .25 triangular bead of urethane adhesive (P/N 6808882) on the surface of the cab tube along the length of the opening and at the two corners where the crossmember welds to the cab tube (Item 1) **[Figure 40-30-38]**.

Install the right side sliding window frame over the crossmember and press frame to assure complete contact with the urethane adhesive. Tape the frame vertically in place.

Allow 2 hours for curing at normal conditions (65° F, 75% relative humidity). With varying temperatures and relative humidity, curing time will change accordingly.

Remove tape once the urethane adhesive is cured.

Re-install the cab on excavator. (See Removal And Installation on Page 40-30-1.)

Door, Left Side, Rear And Upper Front Window Removal And Installation

NOTE: Order window glass, urethane adhesive and primer/degreaser through Bobcat parts.

Fasten the window in position while cutting the adhesive to prevent the window from falling out.

Cut the adhesive around the perimeter of the window. Carefully remove window from cab frame.

Dry fit the replacement window.

Remove a majority of the old urethane adhesive from the perimeter of the cab frame. Try to prevent scraping paint off of the cab frame.

NOTE: Leave a thin film of the old urethane on the cab frame and fresh urethane is bonded to the remaining film.

Prime any bare metal scratches.

Clean the edges of the window where the urethane adhesive will contact.

Apply the primer/degreaser (P/N 6808881) to the perimeter of the window. Allow to dry for 3 minutes.

Cut tip of the adhesive tube to desired shape and size to provide a bead height sufficient to give good contact with the frame around the entire perimeter.

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Door, Left Side, Rear And Upper Front Window Removal And Installation (Cont'd)

Figure 40-30-39

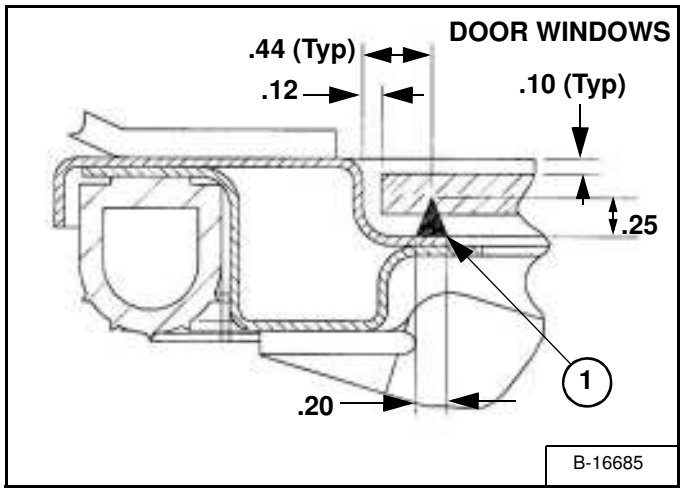


Figure 40-30-40

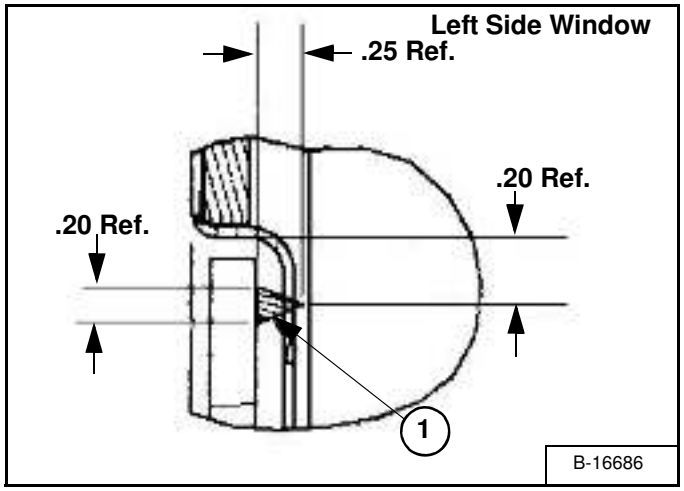
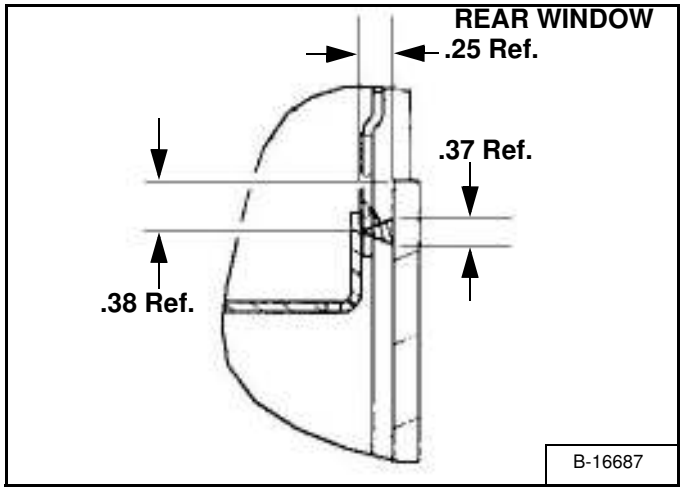
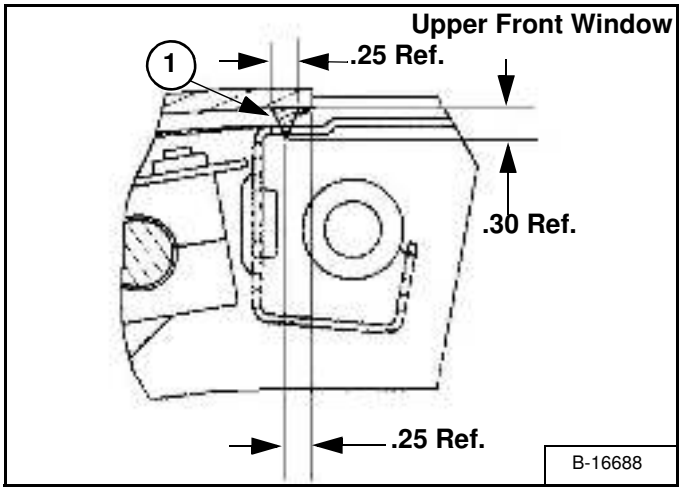


Figure 40-30-41



Apply a .2 x .25 triangular bead of urethane adhesive (P/N 6808882) (Item 1) **[Figure 40-30-39]**, **[Figure 40-30-40]** & **[Figure 40-30-41]** along the perimeter of the cab frame or window for the door windows, left side window and rear window.

Figure 40-30-42



Apply a .3 x .25 triangular bead of urethane adhesive (P/N 6808882) (Item 1) **[Figure 40-30-42]** along the perimeter of the cab frame or window for the upper window.

NOTE: Order window glass, urethane adhesive and primer/degreaser through Bobcat parts.

Install the window in the cab frame opening and press window to assure complete contact with the urethane adhesive. Tape the window vertically in place.

Allow 2 hours for curing at normal conditions (65° F, 75% relative humidity). With varying temperatures and relative humidity, curing time will change accordingly.

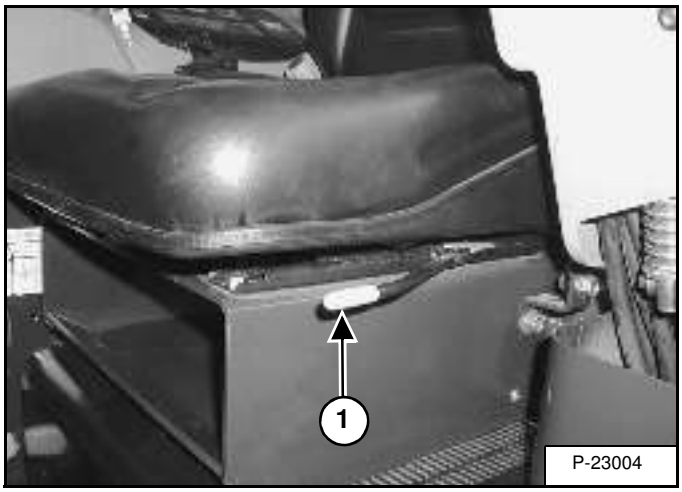
Remove tape once the urethane adhesive is cured.

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STANDARD SEAT AND SEAT MOUNT

Removal And Installation

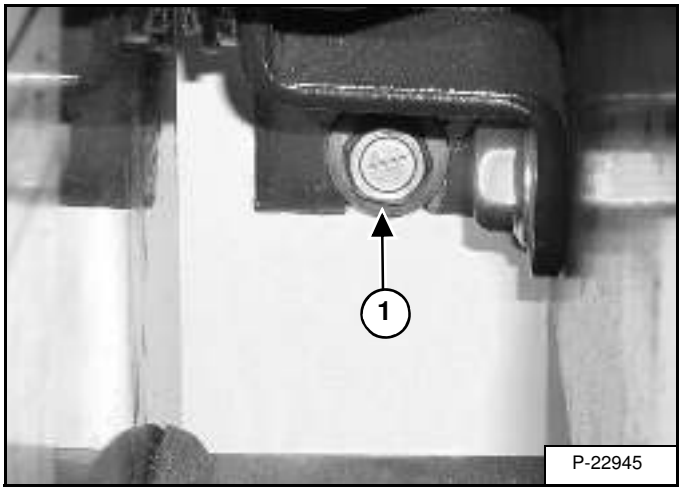
Figure 40-40-1



Pull the lever (Item 1) **[Figure 40-40-1]** away from the seat to release the seat lock. Pull the seat toward the front of the machine until it is free of the seat tracks.

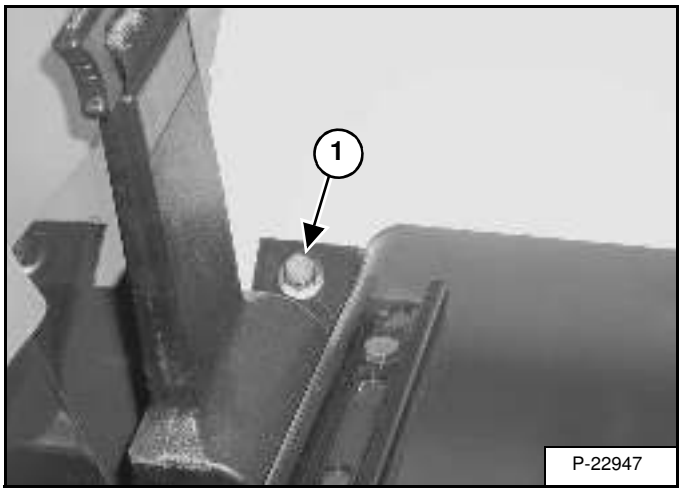
Remove the seat.

Figure 40-40-2



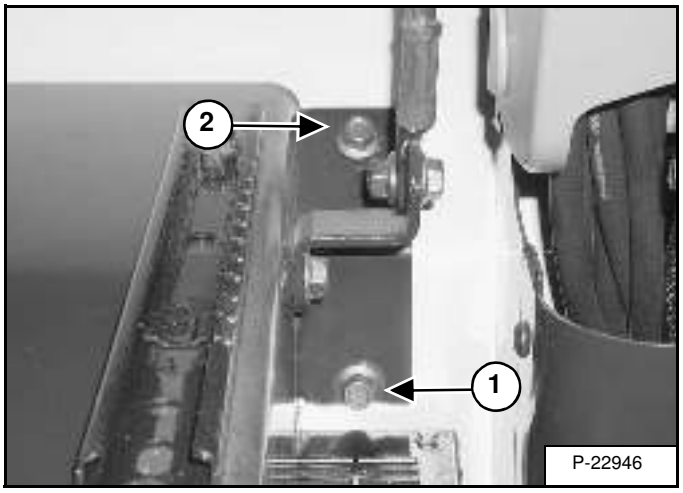
Loosen the bottom right bolt (Item 1) **[Figure 40-40-2]**.

Figure 40-40-3



Remove the top right bolt (Item 1) **[Figure 40-40-3]**.

Figure 40-40-4



Loosen the bottom left bolt (Item 1) and remove the top left bolt (Item 2) **[Figure 40-40-4]**.

Remove seat mount.

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SUSPENSION SEAT AND SEAT MOUNT

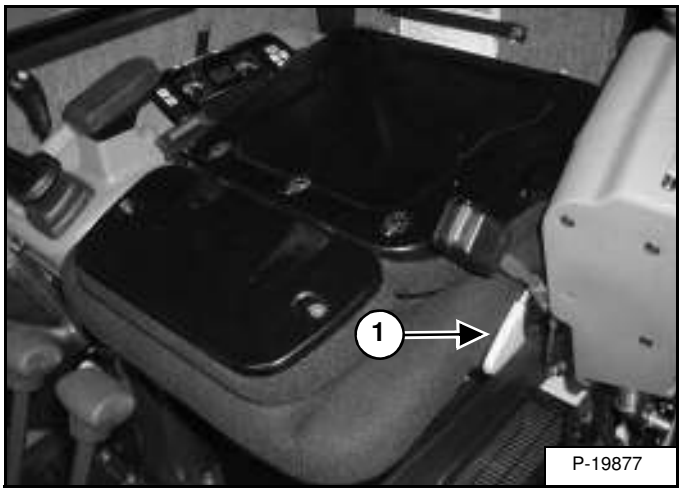
Removal And Installation

Figure 40-41-1



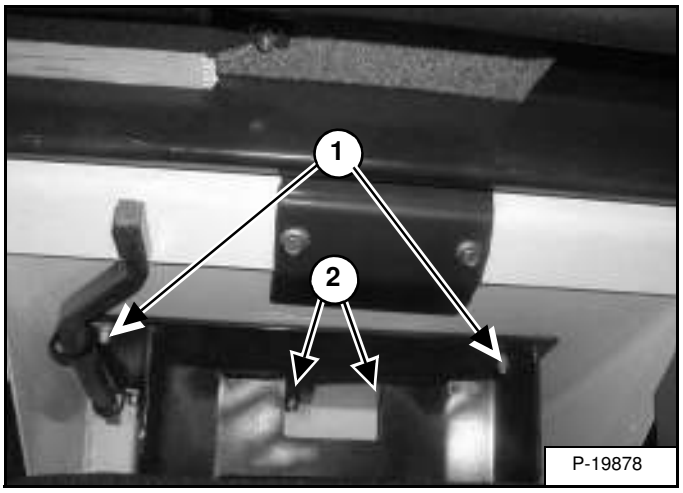
Pull the slide handle (Item 1) **[Figure 40-41-1]** out and slide the seat forward.

Figure 40-41-2



Pull seat release lever (Item 1) **[Figure 40-41-2]** to tip the seat back forward.

Figure 40-41-3

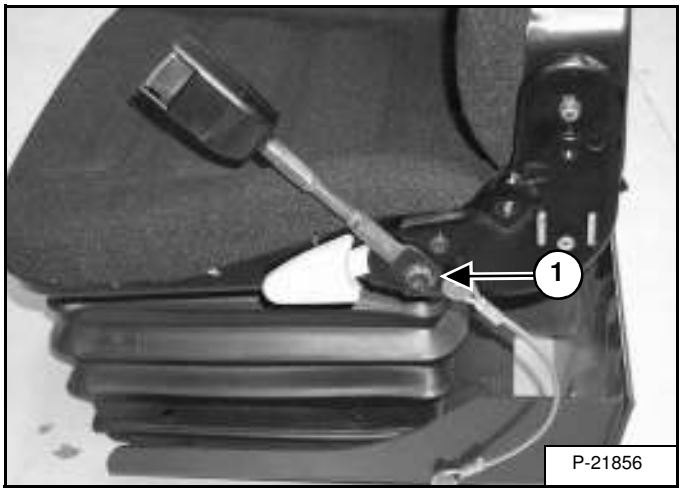


Remove the top two bolts (Item 1) **[Figure 40-41-3]**.

Loosen the 2 bottom bolts (Item 2) **[Figure 40-41-3]**.

Remove the seat and seat mount from the excavator.

Figure 40-41-4



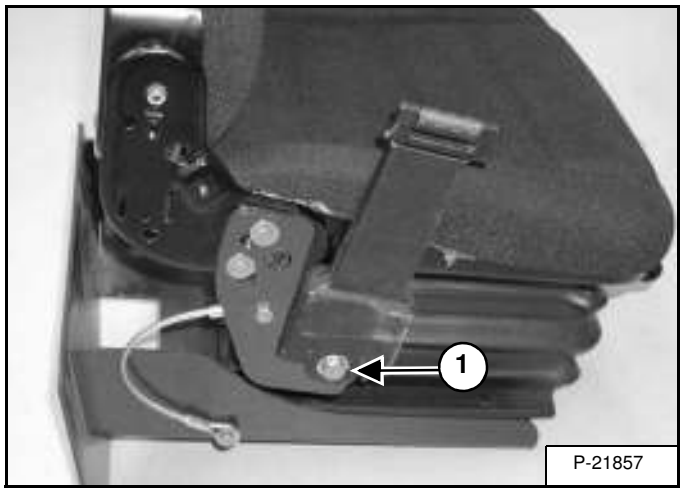
Remove the seat belt mounting bolt (Item 1) **[Figure 40-41-4]**.

Remove the seat belt.

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Removal and Installation (Cont'd)

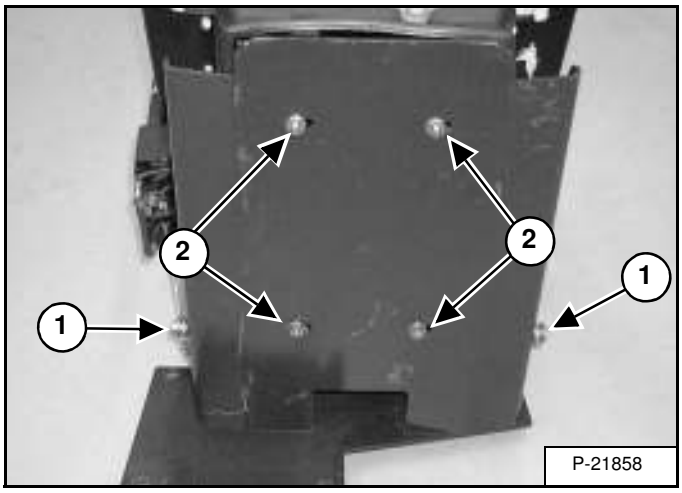
Figure 40-41-5



Remove the seat belt mounting bolt (Item 1) **[Figure 40-41-5]**.

Remove the seat belt.

Figure 40-41-6



Remove the two bolts (Item 1) **[Figure 40-41-6]** from the seat cables.

Remove the four seat mount bolts (Item 2) **[Figure 40-41-6]**.

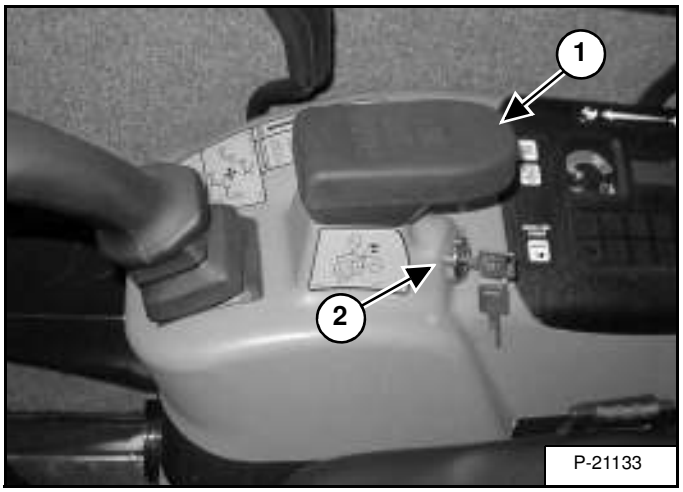
Remove the mount bracket from the seat.

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RIGHT CONSOLE

Console Cover Removal And Installation

Figure 40-50-1



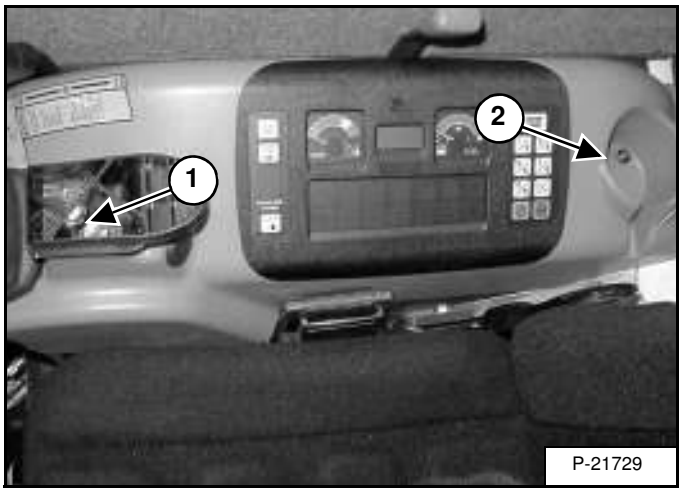
In the operator cab, at the right side operator console, remove the cover (Item 1) **[Figure 40-50-1]** from the arm rest.

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



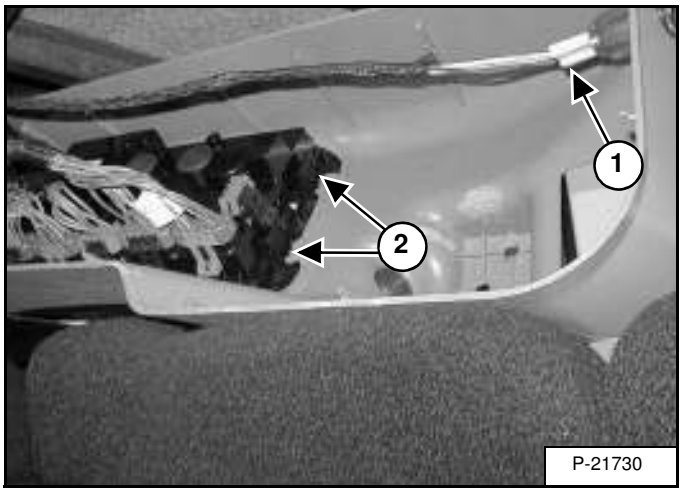
Remove the two mount bolts (Item 1) **[Figure 40-50-2]** from the arm rest.

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



Key switch equipped machines perform **[Figure 40-50-3]** ***&*** **[Figure 40-50-4]** ***also.***

Disconnect the accessory outlet electrical connector (Item 1) **[Figure 40-50-3]**.

Remove the controller from the console cover by pressing the mounting tabs (Item 2) **[Figure 40-50-3]**.

NOTE: The controller must be removed from the console only to allow access to re-install the key switch (if so equipped). Controller removal is not necessary on keyless machines, disconnect the instrument panel wires.

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Console Cover Removal And Installation (Cont'd)

Figure 40-50-4



It is NOT necessary to disconnect the instrument panel wires on key switch equipped machines.

Turn the instrument panel to allow it to pass through the console cover **[Figure 40-50-4]**.

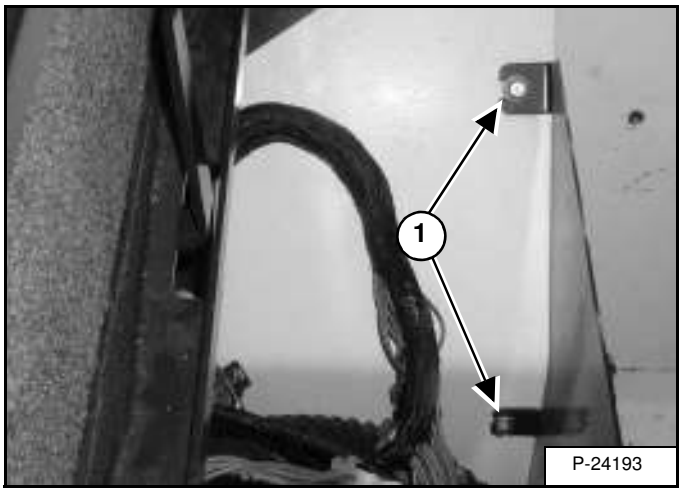
The console cover can now be removed from the work area for convenience.

Console Base Removal And Installation

Remove the right console cover. (See Console Cover Removal And Installation on Page40-50-1)

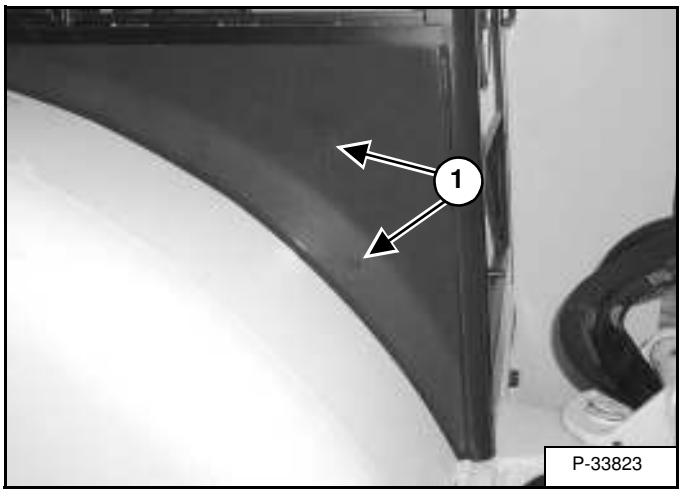
Remove the floor mat. (See Removal And Installation on Page 40-110-1.)

Figure 40-50-5



Remove the two mount bolts (Item 1) **[Figure 40-50-5]**.

Figure 40-50-6

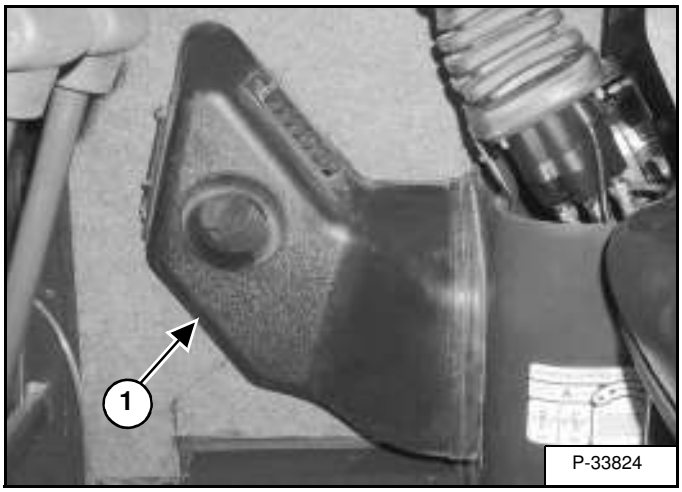


Remove the two bolts (Item 1) **[Figure 40-50-6]** from the right side of the cab (Later Models without Velcro mount tabs).

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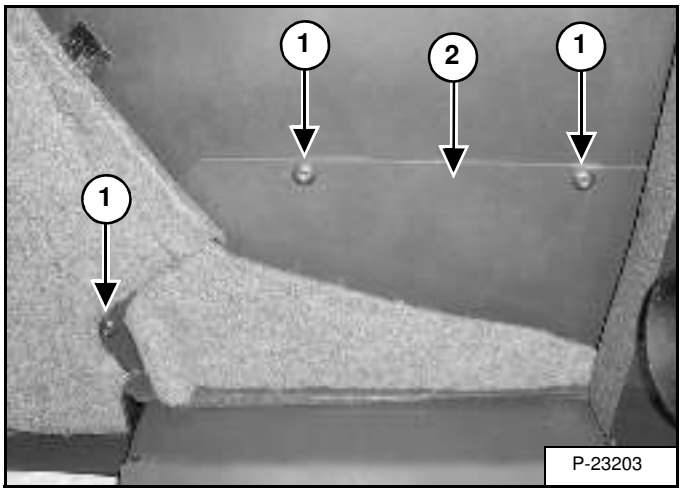
Console Base Removal And Installation (Cont'd)

Figure 40-50-7



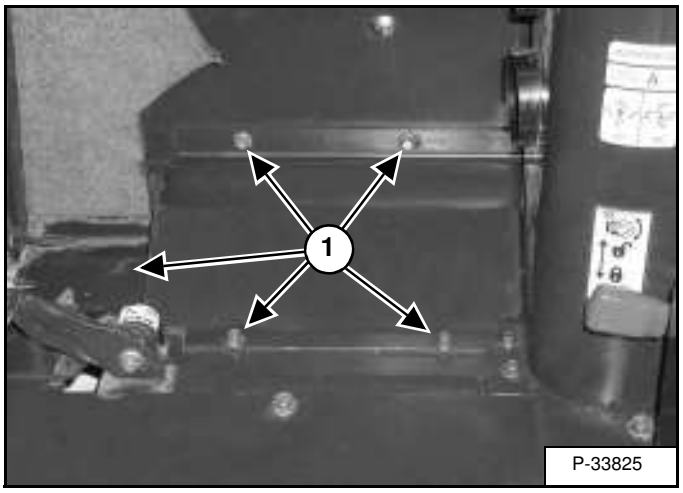
Remove the heater duct (Item 1) **[Figure 40-50-7]**.

Figure 40-50-8



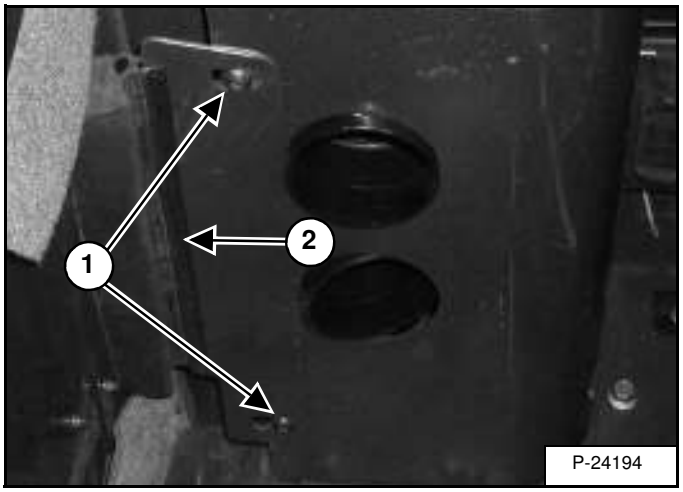
Remove the three bolts (Item 1) and remove the cover (Item 2) **[Figure 40-50-8]**.

Figure 40-50-9



Remove the five bolts (Item 1) and remove the swing motor cover (Item 2) **[Figure 40-50-9]**.

Figure 40-50-10

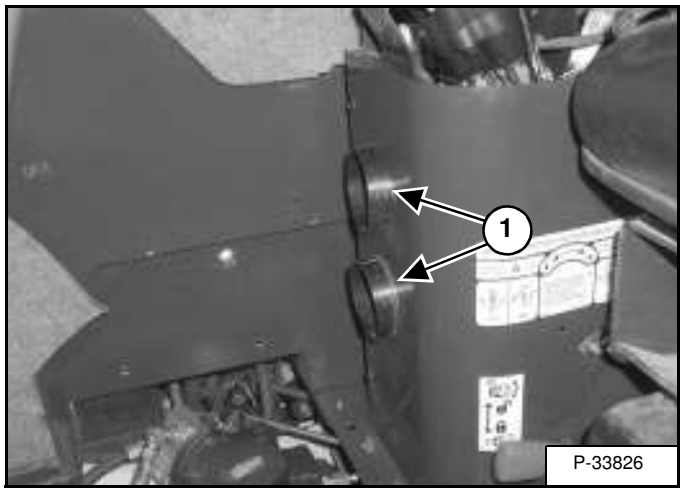


On early models remove the two bolts (Item 1) and remove the plate (Item 2) **[Figure 40-50-10]**.

Dealer Copy -- Not for Resale

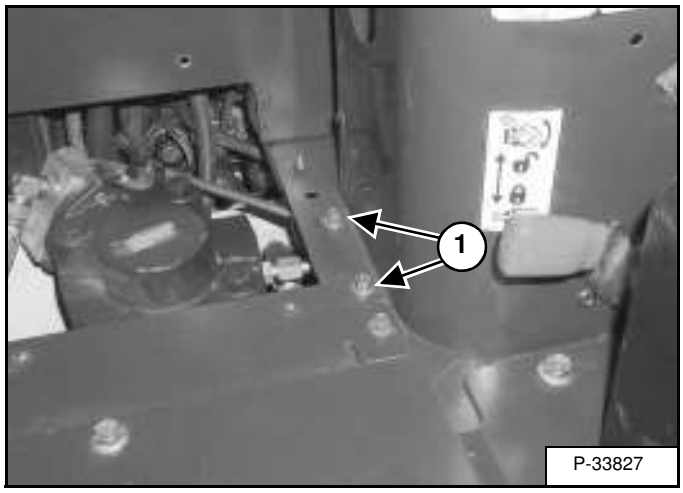
Console Base Removal And Installation (Cont'd)

Figure 40-50-11



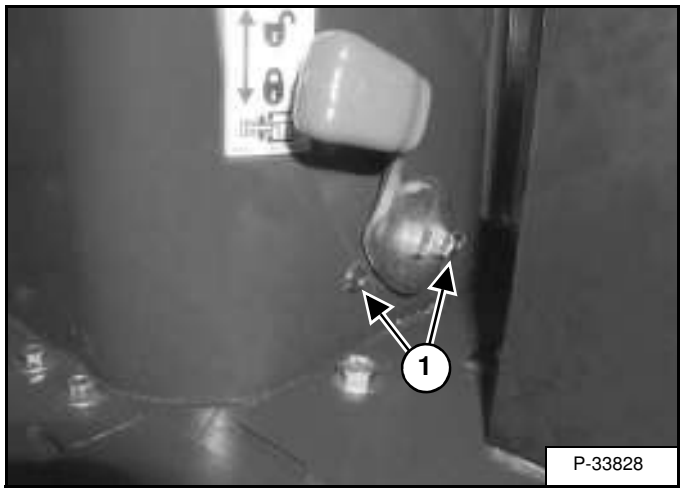
Push in the two ducts (Item 1) **[Figure 40-50-11]**.

Figure 40-50-12



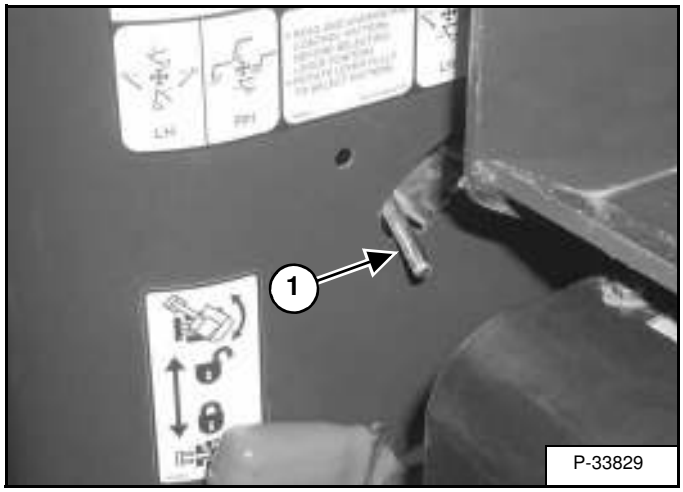
Remove the two bolts (Item 1) **[Figure 40-50-12]** from the front of the console base.

Figure 40-50-13



Remove the two bolts (Item 1) **[Figure 40-50-13]** from the left side of the console base.

Figure 40-50-14

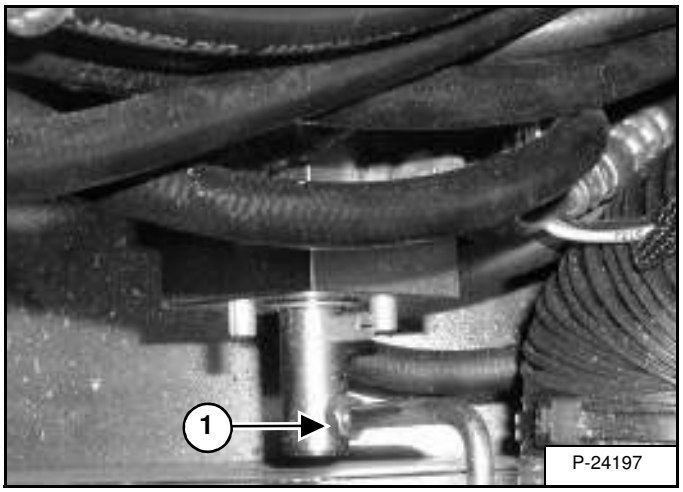


The joystick control pattern selector (Item 1) **[Figure 40-50-14]** must be turned to allow the console base to be removed.

Dealer Copy -- Not for Resale

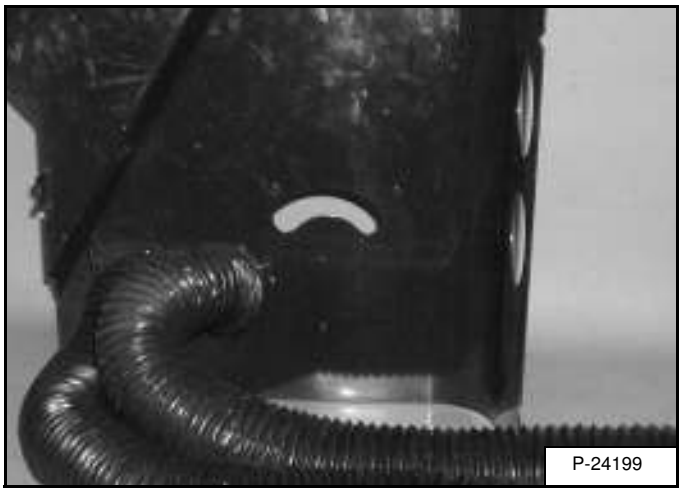
Console Base Removal And Installation (Cont'd)

Figure 40-50-15



Loosen the jam nut (Item 1) **[Figure 40-50-15]** on the pattern selector and rotate the selector.

Figure 40-50-16



Remove the complete console base assembly, with hoses, from the excavator cab **[Figure 40-50-16]**.

Dealer Copy -- Not for Resale

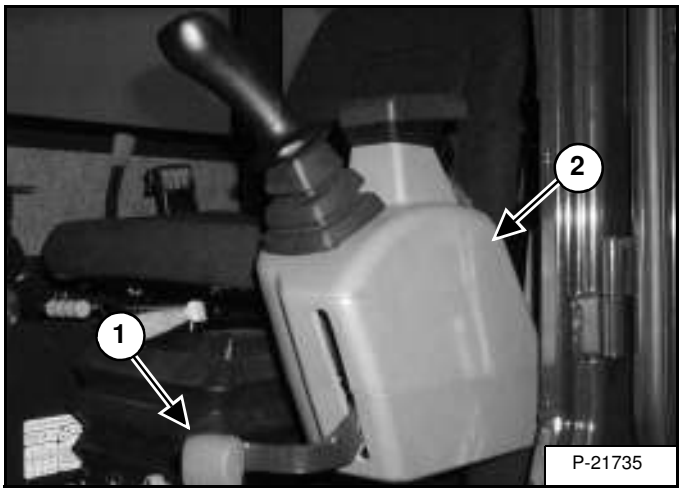


Dealer Copy -- Not for Resale

LEFT CONSOLE

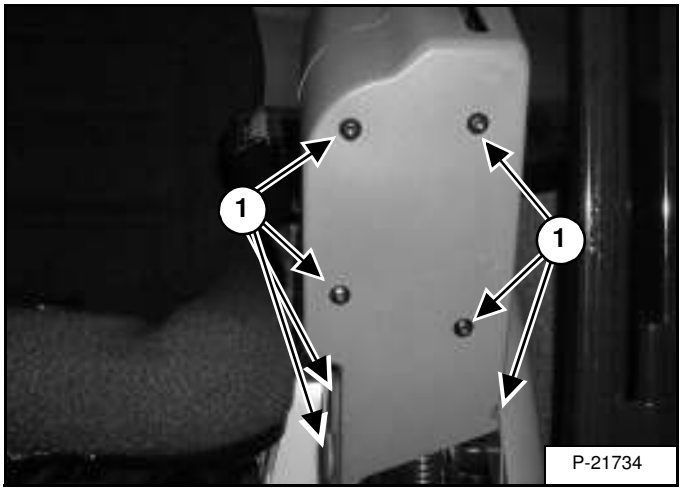
Lower Console Cover Removal And Installation

Figure 40-60-1



In the operator cab, at the left side operator console, lift the lever (Item 1) and raise the console (Item 2) **[Figure 40-60-1]**.

Figure 40-60-2

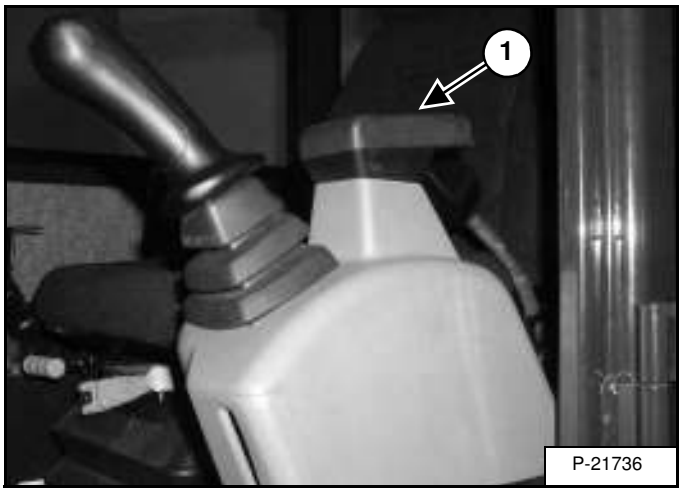


Remove the seven mounting bolts (Item 1) **[Figure 40-60-2]** from the lower half of the operator console.

Remove the lower half of the console.

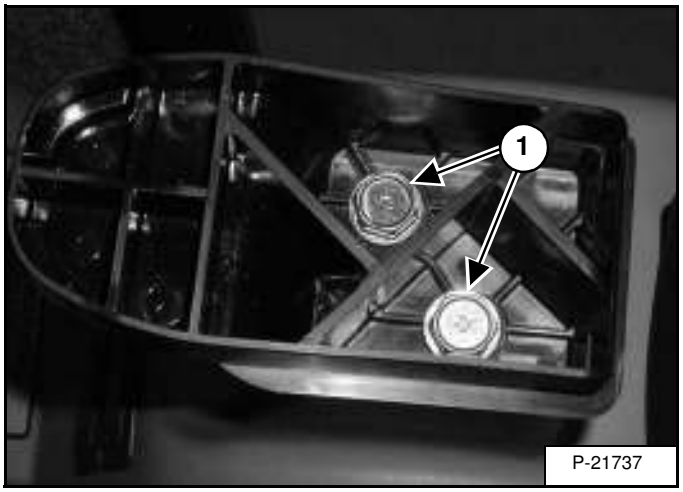
Lower the console.

Figure 40-60-3



Remove the cover (Item 1) **[Figure 40-60-3]** from the arm rest.

Figure 40-60-4



Remove the two mount bolts (Item 1) **[Figure 40-60-4]** from the arm rest.

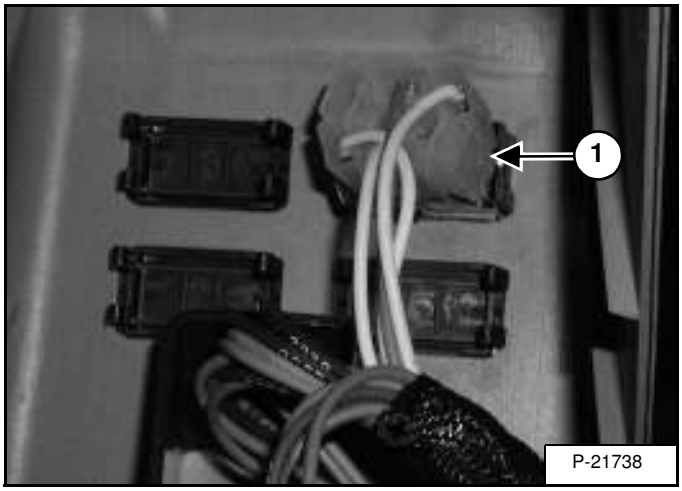
Remove the arm rest.

Dealer Copy -- Not for Resale

Lower Console Removal And Installation (Cont'd)

Raise the upper half of the console cover.

Figure 40-60-5



Unplug the electrical connector (Item 1) **[Figure 40-60-5]**.

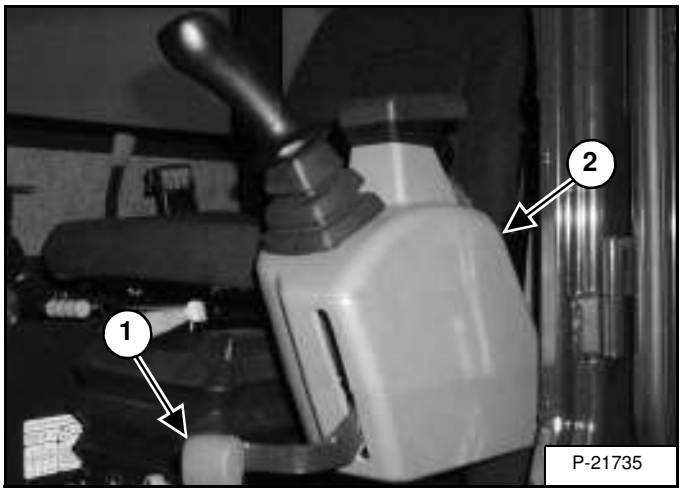
NOTE: These connectors are keyed so they can be plugged in only one way.

Remove the console cover.

Dealer Copy -- Not for Resale

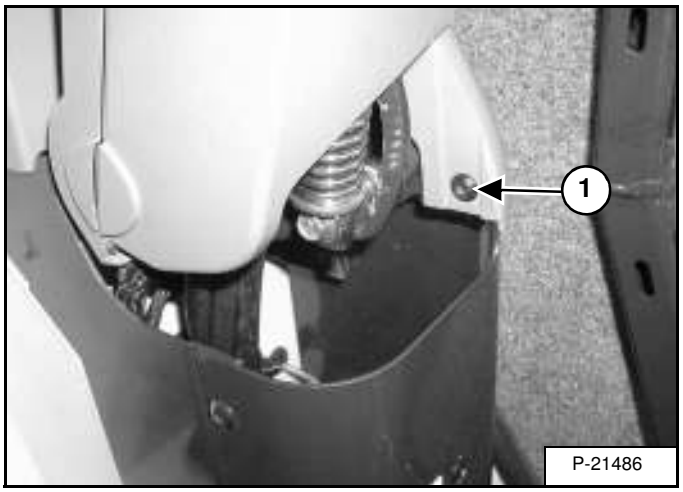
Upper Console Cover Removal And Installation

Figure 40-60-6



In the operator cab, at the left side operator console, lift the lever (Item 1) and raise the console (Item 2) **[Figure 40-60-6]**.

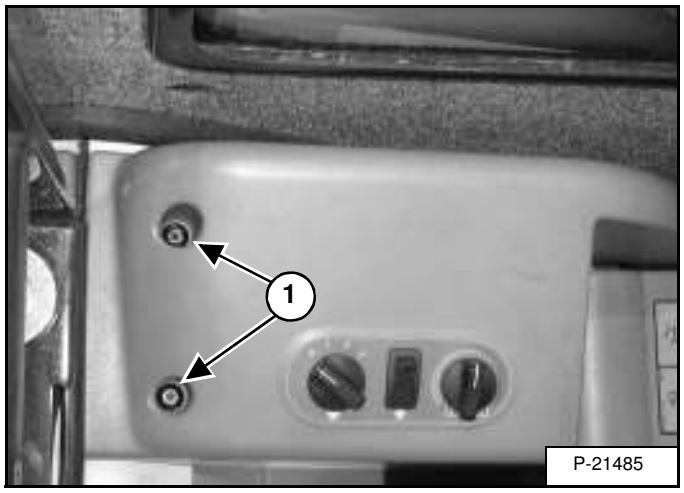
Figure 40-60-7



Remove the console cover mount bolt (Item 1) **[Figure 40-60-7]**.

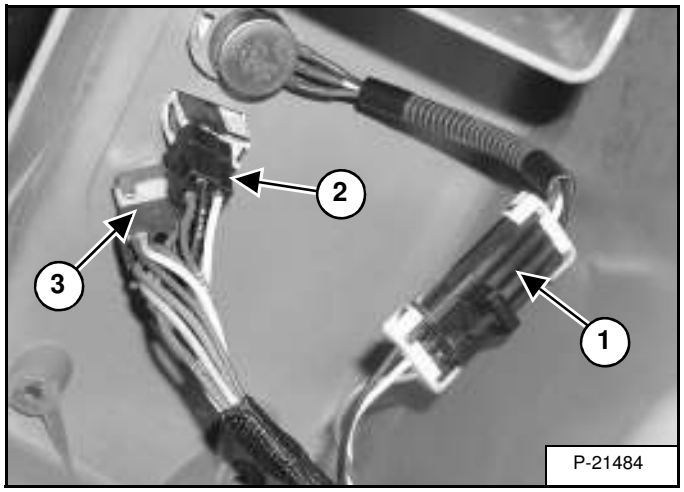
Lower the console assembly.

Figure 40-60-8



Remove the two console cover mount bolts (Item 1) **[Figure 40-60-8]**.

Figure 40-60-9



Lift the console cover and disconnect the harness (Item 1) **[Figure 40-60-9]** from the potentiometer harness. (If equipped with Heater/AC.)

Disconnect the harness (Item 2) **[Figure 40-60-9]** from the A/C switch. (If equipped with Heater/AC.)

Disconnect the harness (Item 3) **[Figure 40-60-9]** from the blower switch. (If equipped with Heater/AC.)

Remove the console from the excavator.

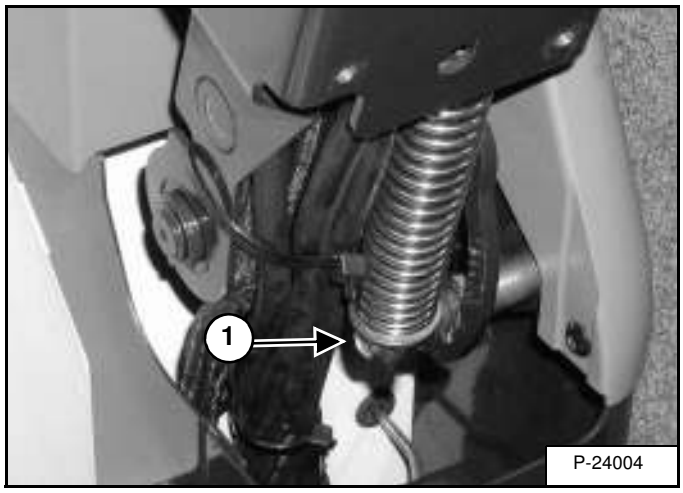
Dealer Copy -- Not for Resale

Compression Spring Removal And Installation

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

Place the left console in the raised position.

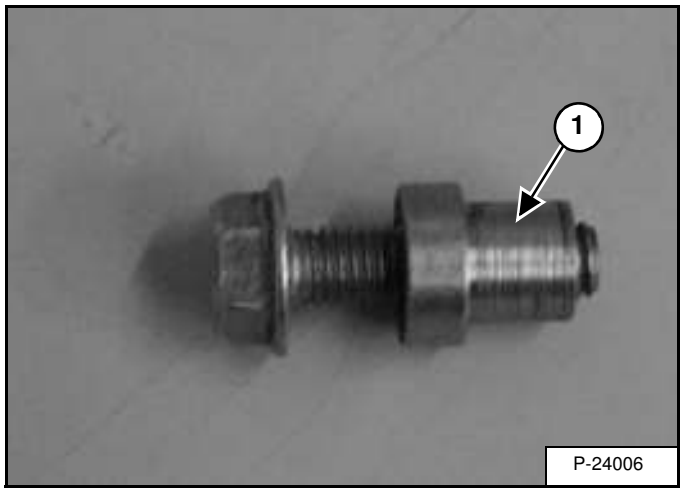
Figure 40-60-10



Remove the compression spring mount bolt (Item 1) **[Figure 40-60-10]**.

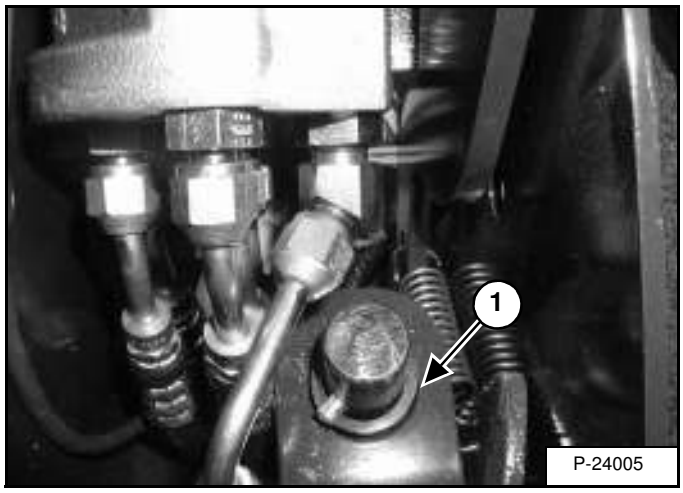
Support the console in the up position.

Figure 40-60-11



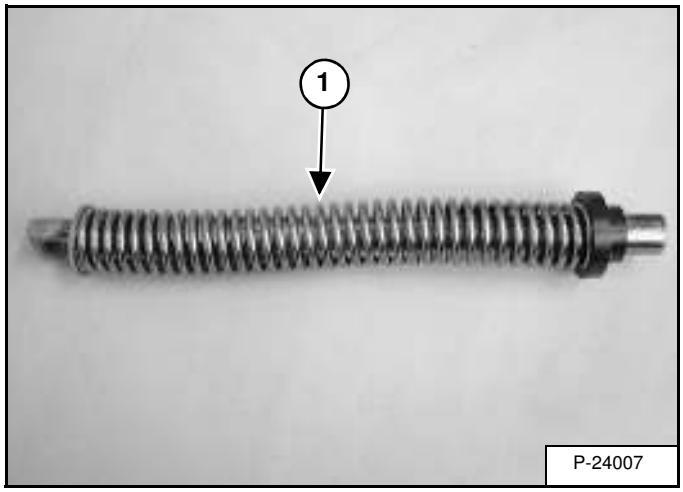
Remove the bushing (Item 1) **[Figure 40-60-11]** from the mount bolt.

Figure 40-60-12



Remove the upper end of the shaft and rubber bushing (Item 1) **[Figure 40-60-12]** from the mount bracket.

Figure 40-60-13

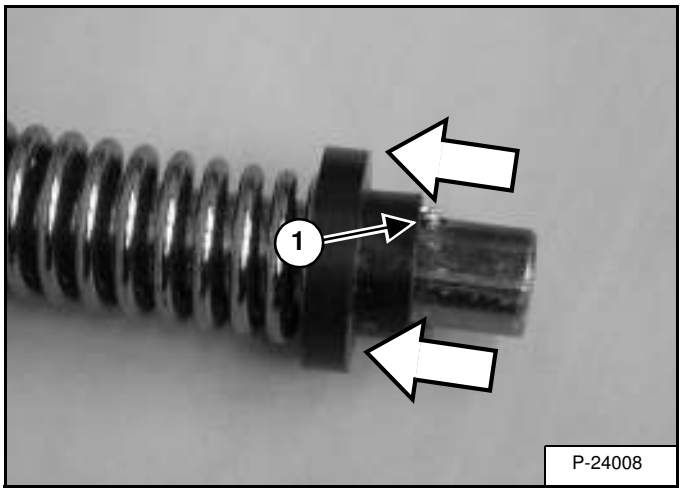


Remove the spring assembly (Item 1) **[Figure 40-60-13]** from the console.

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Compression Spring Removal And Installation (Cont'd)

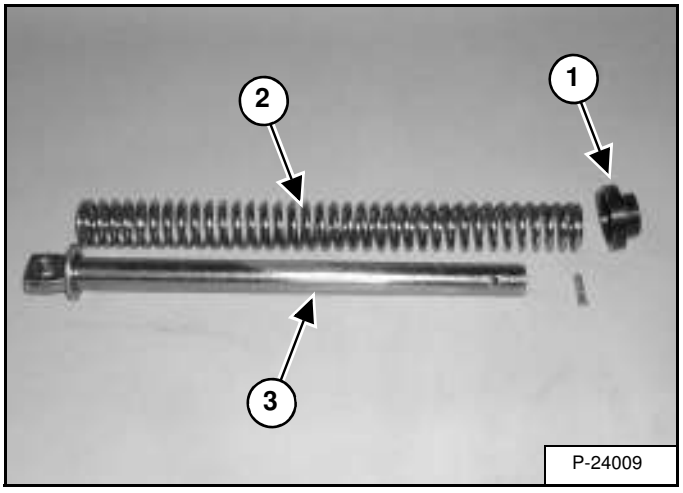
Figure 40-60-14



Apply pressure against the spring, and remove the roll pin (Item 1) **[Figure 40-60-14]** from the shaft.

Release the pressure from the spring.

Figure 40-60-15



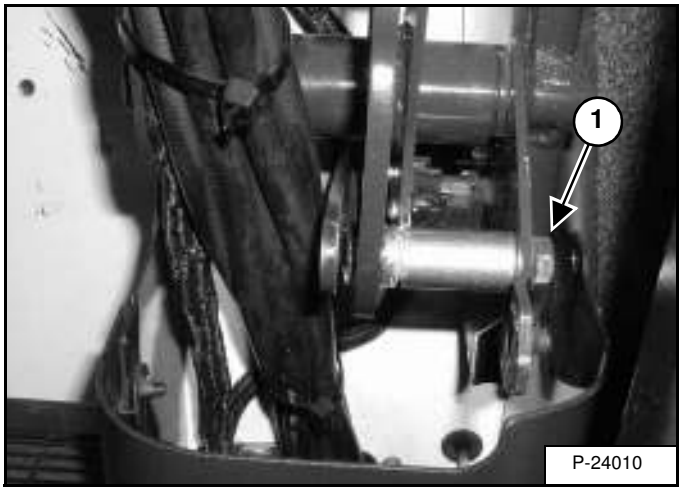
Remove the bushing (Item 1), spring (Item 2) from the shaft (Item 3) **[Figure 40-60-15]**.

Inspect the parts and replace as needed.

Lock Lever Removal And Installation

Remove the compression spring assembly from the console. (See Compression Spring Removal And Installation on Page 40-60-4..)

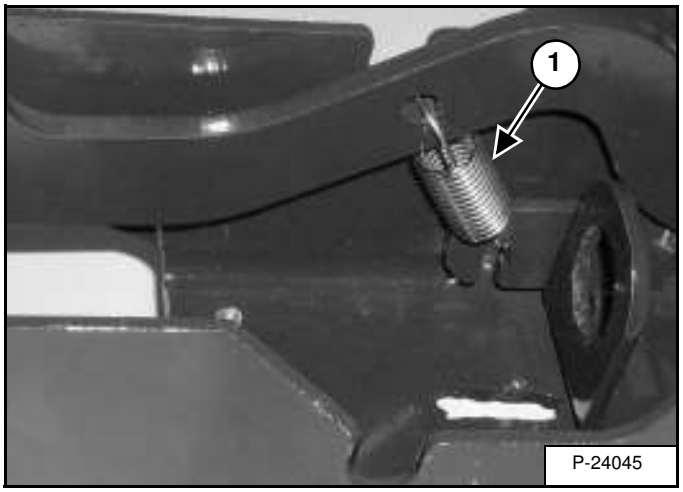
Figure 40-60-16



Remove the bolt (Item 1) **[Figure 40-60-16]** from the lock lever roller bearing assembly.

Remove the roller bearing assembly.

Figure 40-60-17

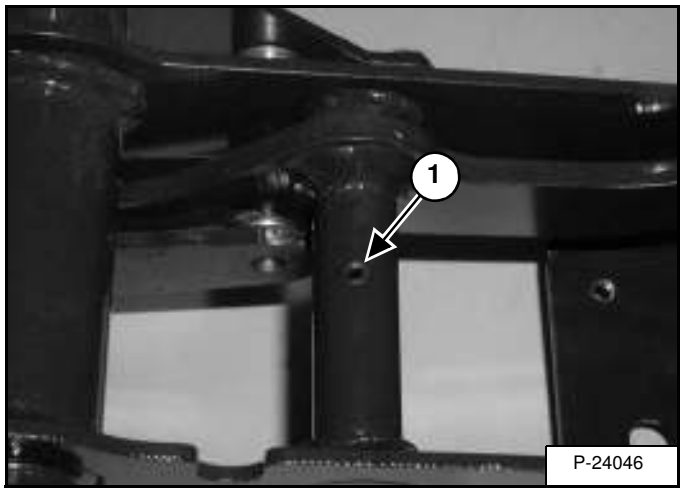


Remove the lock lever spring (Item 1) **[Figure 40-60-17]** from the lock lever.

Dealer Copy -- Not for Resale

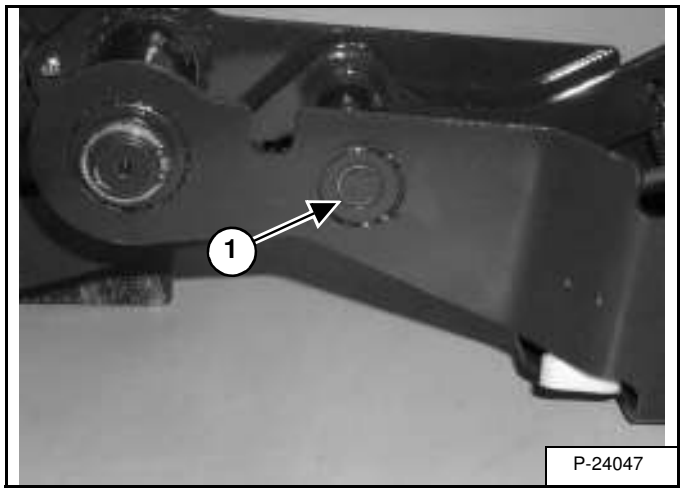
Lock Lever Removal And Installation (Cont'd)

Figure 40-60-18



Remove the roll pin (Item 1) **[Figure 40-60-18]** from the lock lever pivot pin.

Figure 40-60-19



Remove the lock lever pivot pin (Item 1) **[Figure 40-60-19]** from the lever assembly.

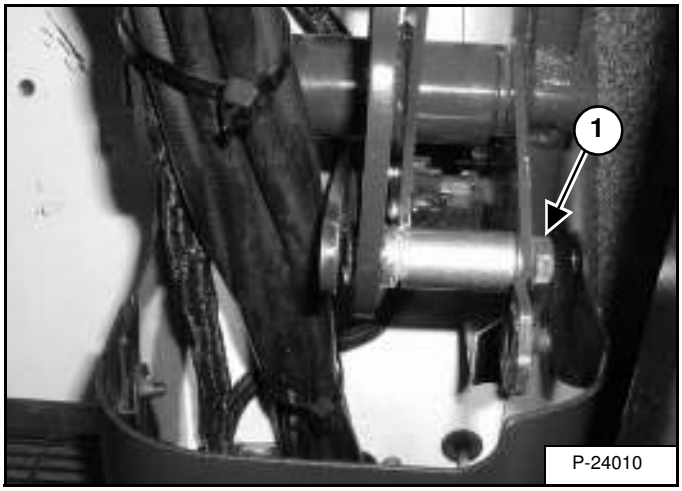
Remove the lock lever.

Upper Console Removal And Installation

Remove the lower and upper console covers. (See Upper Console Cover Removal And Installation on Page 40-60-3.) (See Lower Console Cover Removal And Installation on Page 40-60-1.)

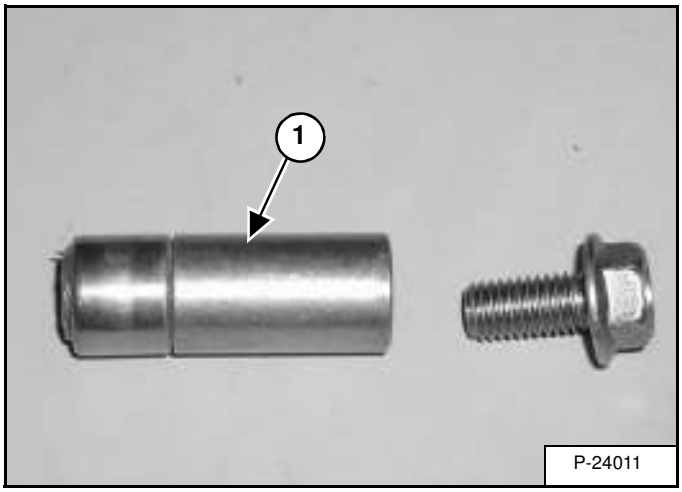
Remove the compression spring assembly from the console. (See Compression Spring Removal And Installation on Page 40-60-4.)

Figure 40-60-20



Remove the bolt (Item 1) **[Figure 40-60-20]** from the lock lever roller bearing assembly.

Figure 40-60-21

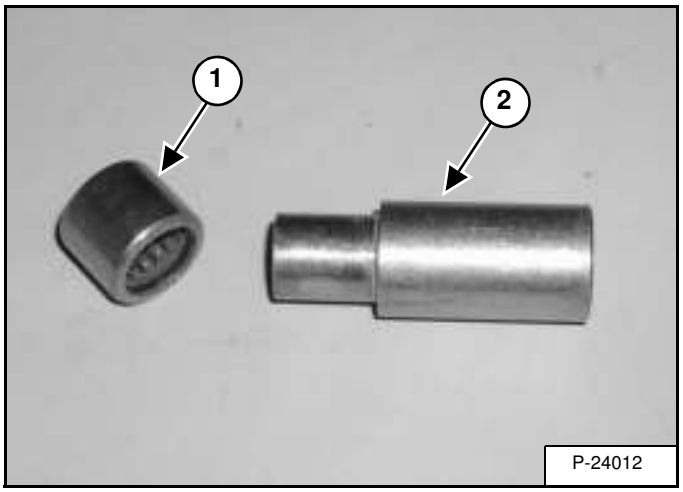


Remove the bearing assembly (Item 1) **[Figure 40-60-21]** from the console.

Dealer Copy -- Not for Resale

Upper Console Removal And Installation (Cont'd)

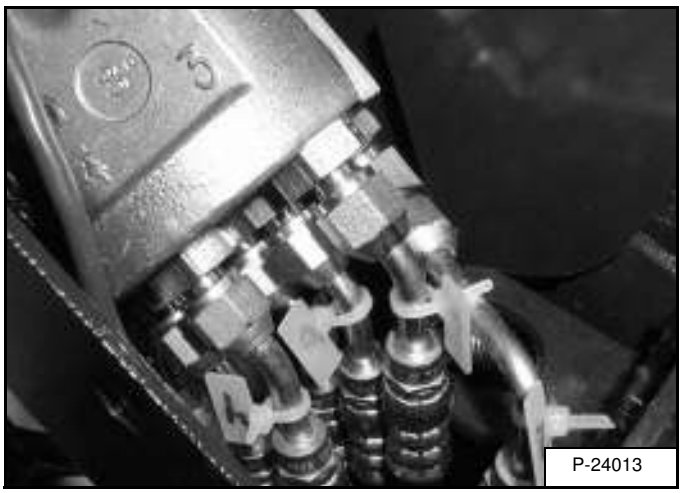
Figure 40-60-22



Remove the bearing (Item 1) from the end of the bearing mount (Item 2) **[Figure 40-60-22]**.

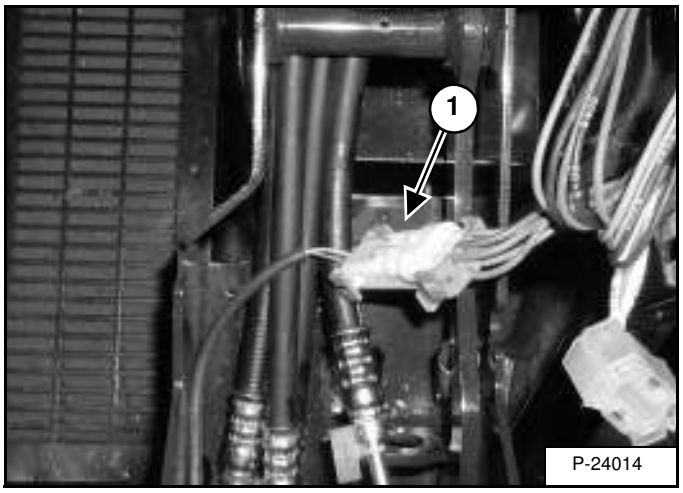
Inspect the parts and replace as needed.

Figure 40-60-23



Mark and disconnect the six hydraulic hoses **[Figure 40-60-23]** from the joystick.

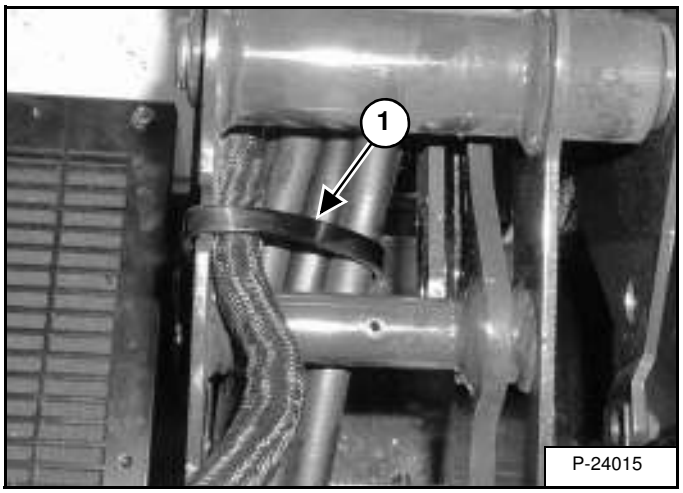
Figure 40-60-24



Disconnect the electrical connector (Item 1) **[Figure 40-60-24]** for the joystick controls.

Lower the console.

Figure 40-60-25

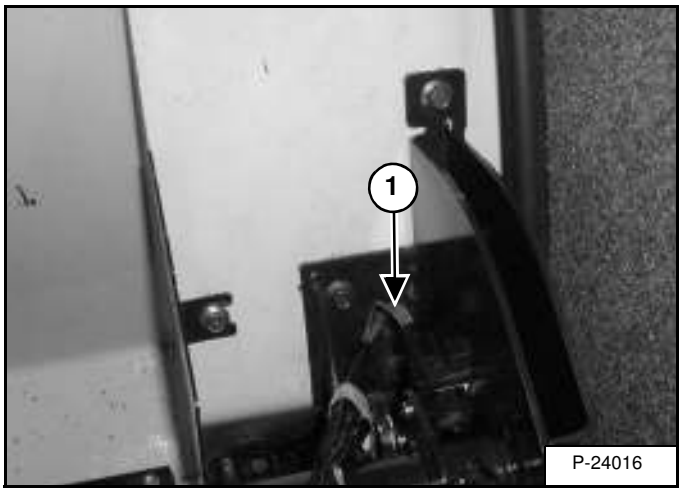


Remove the tie strap (Item 1) **[Figure 40-60-25]**.

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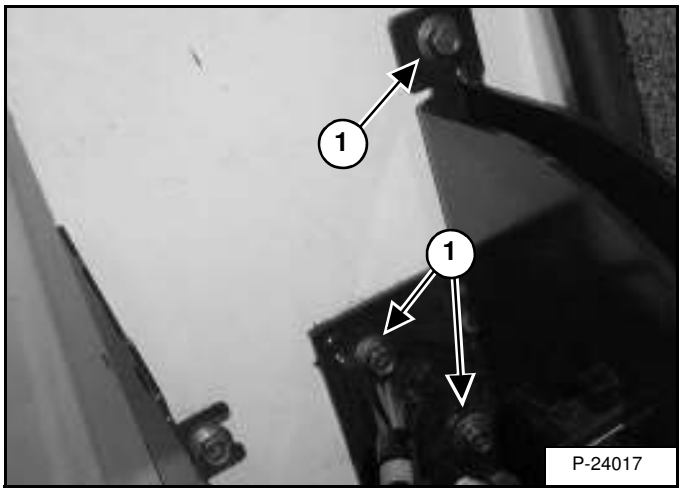
Upper Console Removal And Installation (Cont'd)

Figure 40-60-26



Disconnect the console sensor wire (Item 1) **[Figure 40-60-26]**.

Figure 40-60-27

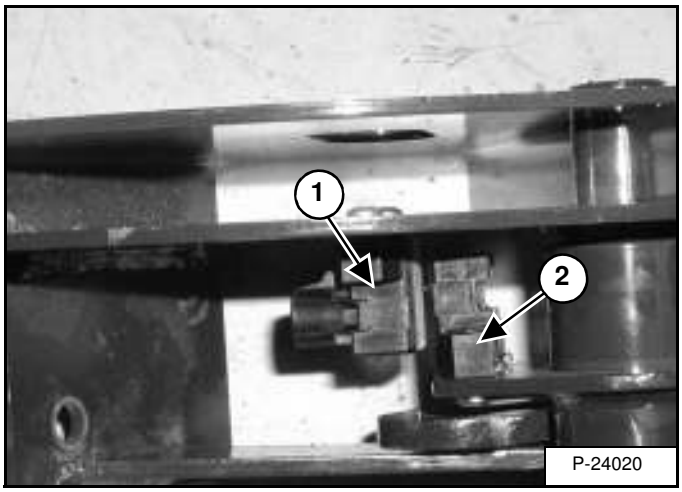


Remove the three console mount bolts (Item 1) **[Figure 40-60-27]**.

Remove the left console assembly from the cab.

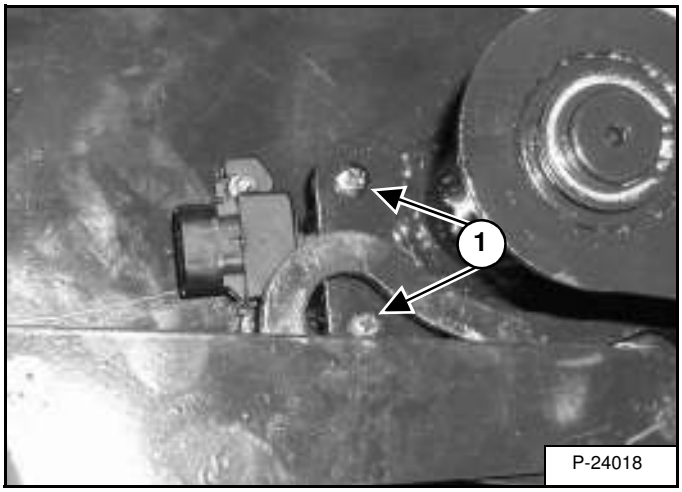
Console Switch Removal And Installation

Figure 40-60-28



Locate the console switch (Item 1), and magnet (Item 2) **[Figure 40-60-28]**.

Figure 40-60-29

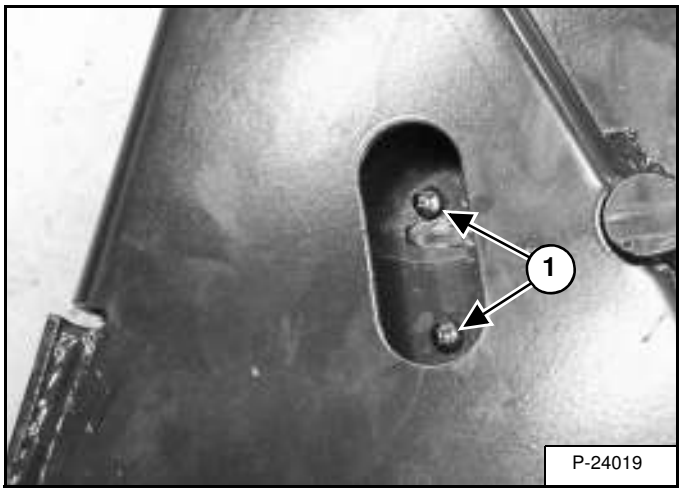


Remove the two screws (Item 1) **[Figure 40-60-29]** from the magnet side of the sensor.

Dealer Copy -- Not for Resale

Console Switch Removal And Installation

Figure 40-60-30



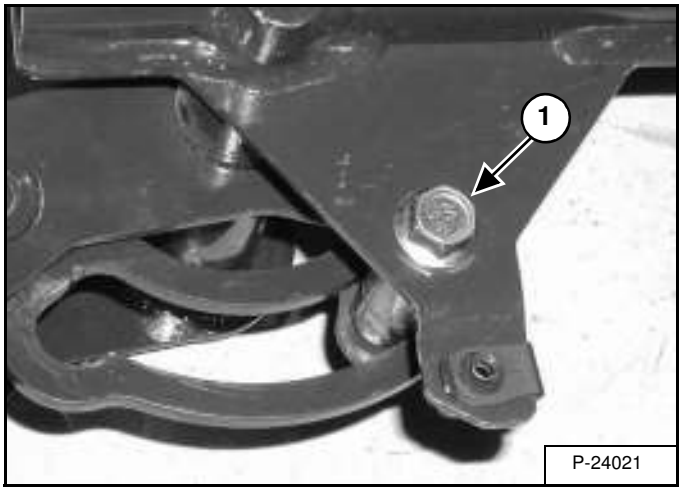
Remove the two screws (Item 1) **[Figure 40-60-30]** from the switch console.

Disassembly And Assembly

Remove the lower and upper console covers. (See Upper Console Cover Removal And Installation on Page 40-60-3.) (See Lower Console Cover Removal And Installation on Page 40-60-1.)

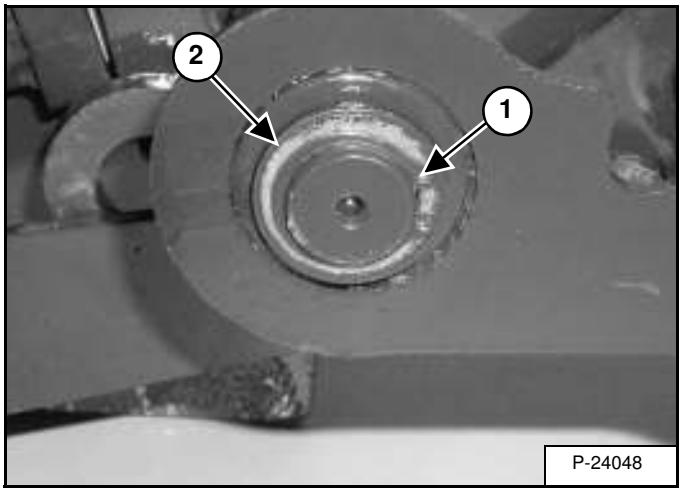
Remove the complete assembly from the excavator. (See Upper Console Removal And Installation on Page 40-60-6.)

Figure 40-60-31



Remove the lever swivel bolt (Item 1) **[Figure 40-60-31]**.

Figure 40-60-32

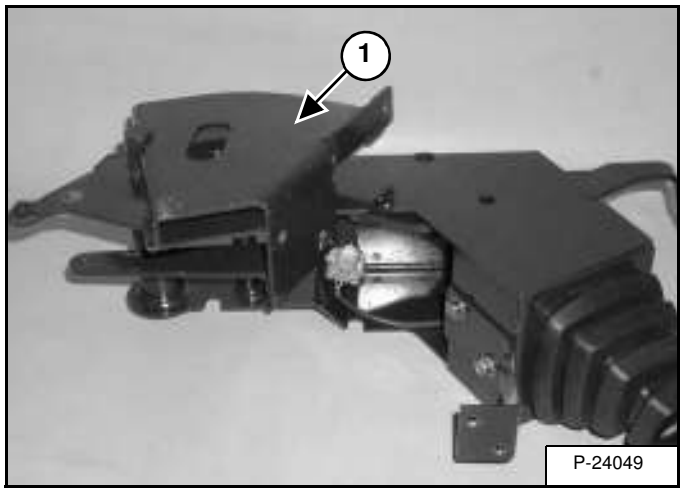


Remove the snap ring (Item 1) and the washer (Item 2) **[Figure 40-60-32]**.

Dealer Copy -- Not for Resale

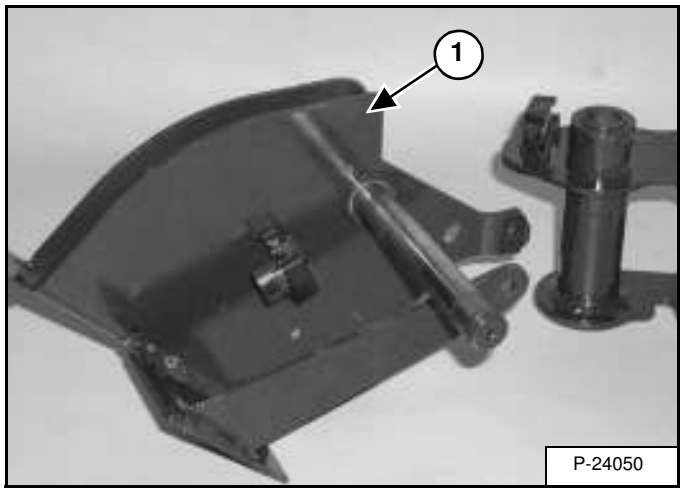
Disassembly And Assembly (Cont'd)

Figure 40-60-33



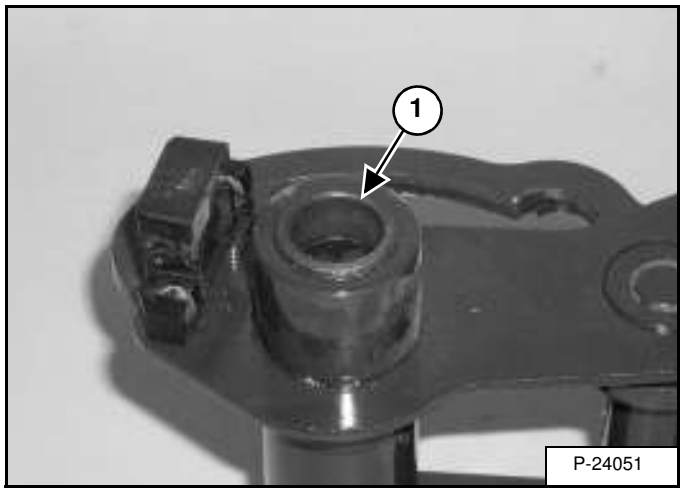
Rotate the mounting plate (Item 1) **[Figure 40-60-33]** against the front assembly.

Figure 40-60-34



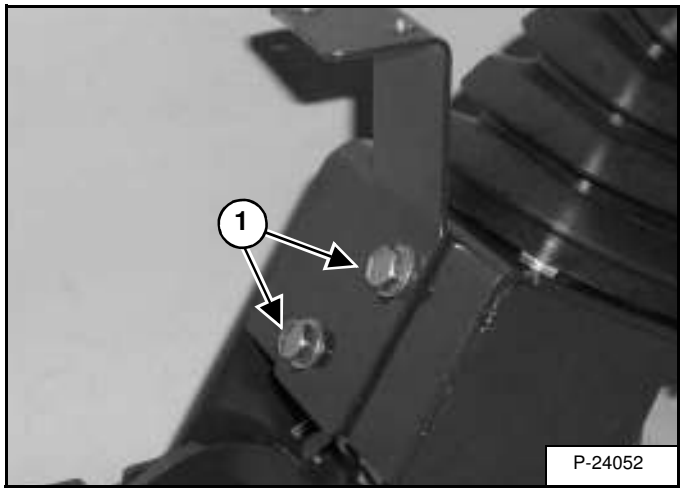
Remove the rear mounting plate (Item 1) **[Figure 40-60-34]**.

Figure 40-60-35



Check the bearings (Item 1) **[Figure 40-60-35]** for damage and wear. Replace as needed (Both sides).

Figure 40-60-36



Remove the two console cover mount bracket bolts (Item 1) **[Figure 40-60-36]**.

Remove the console cover mount bracket.

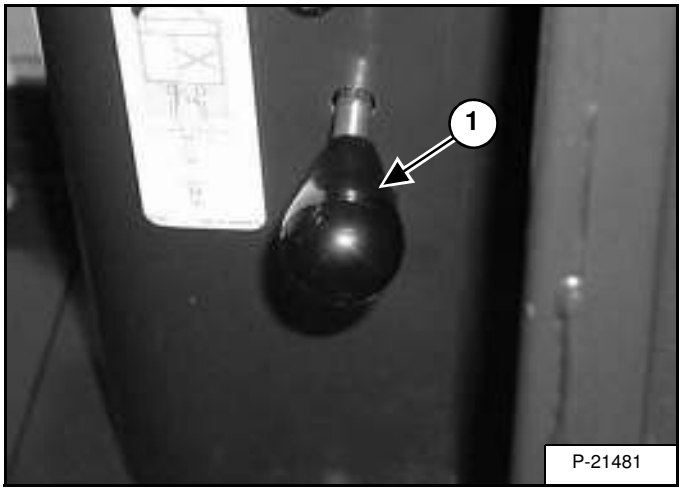
Dealer Copy -- Not for Resale

Console Base Removal And Installation

Remove the lower and upper console covers. (See Upper Console Cover Removal And Installation on Page 40-60-3.) (See Lower Console Cover Removal And Installation on Page 40-60-1.)

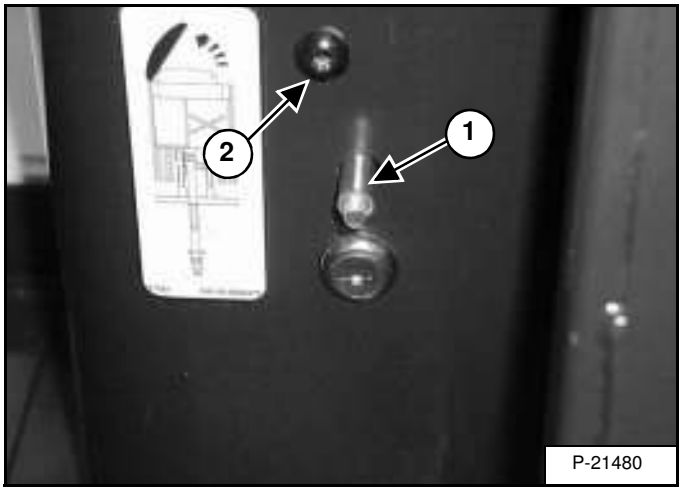
Remove the upper console assembly from the excavator. (See Upper Console Removal And Installation on Page 40-60-6.)

Figure 40-60-37



Remove the tailgate release knob (Item 1) **[Figure 40-60-37]**.

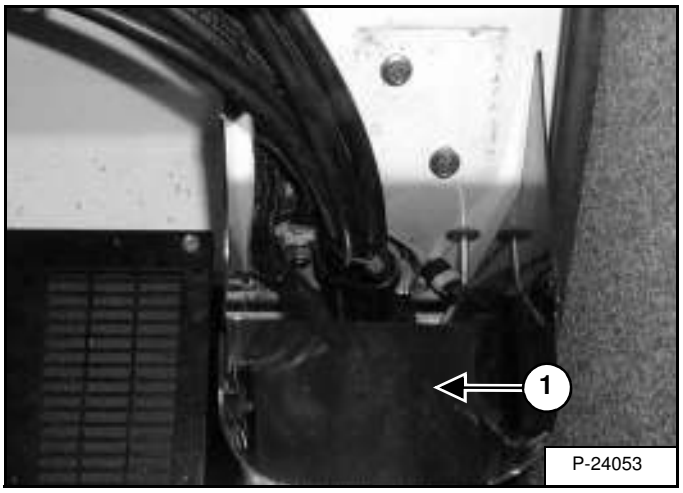
Figure 40-60-38



Remove the spacer (Item 1) **[Figure 40-60-38]** from the tailgate release rod.

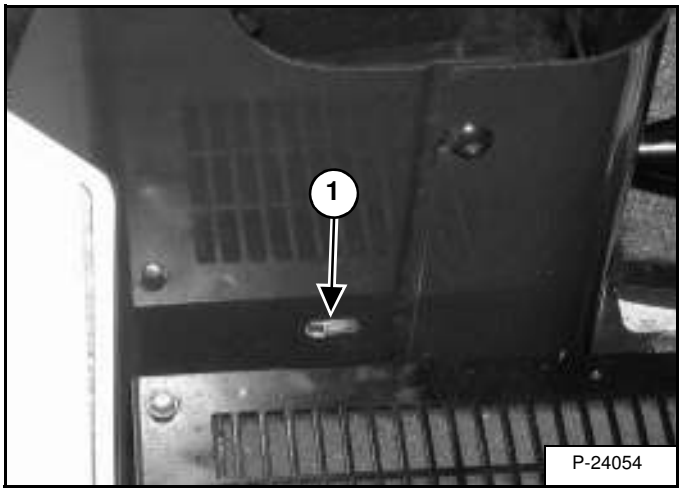
Remove the mount bolt (Item 2) **[Figure 40-60-38]** from the angle shield.

Figure 40-60-39



Remove the angle shield (Item 1) **[Figure 40-60-39]** from the console base.

Figure 40-60-40

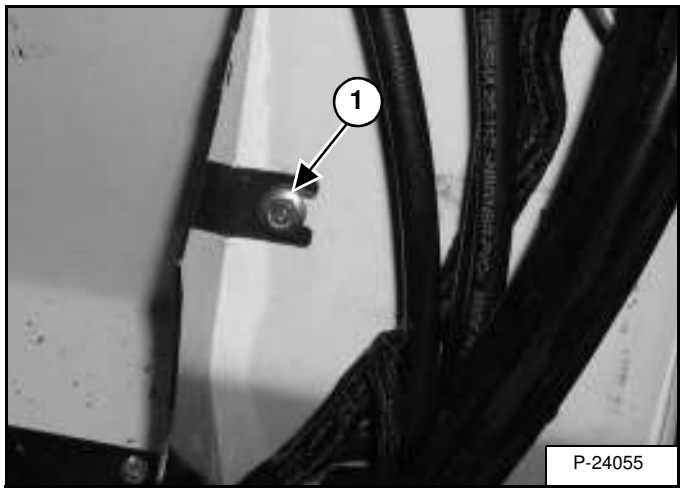


Installation: When installing the angle shield in the console base, be sure the tab on the shield is installed in the slot (Item 1) **[Figure 40-60-40]** on the console base.

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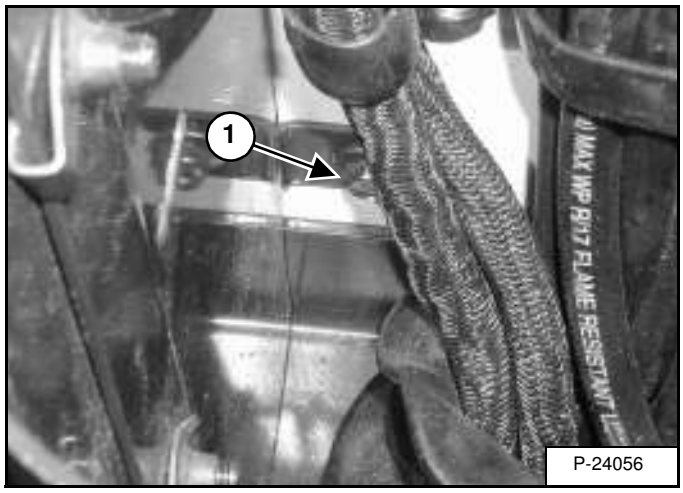
Console Base Removal And Installation (Cont'd)

Figure 40-60-41



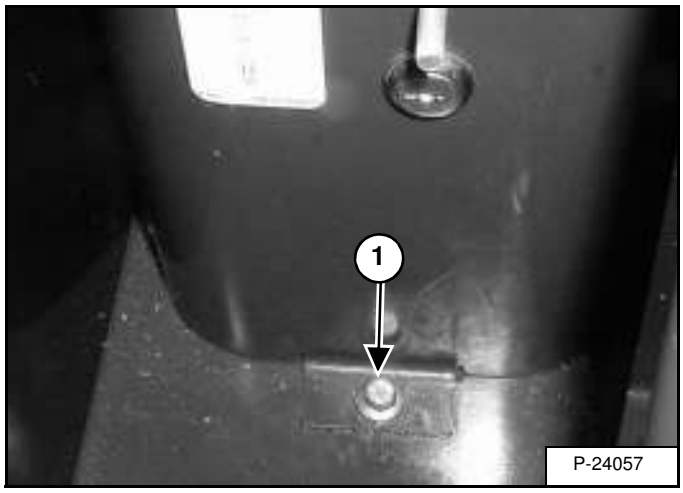
Remove the upper mount bolt (Item 1) **[Figure 40-60-41]** from the console cover.

Figure 40-60-42



Remove the lower mount bolt (Item 1) **[Figure 40-60-42]**.

Figure 40-60-43



Remove the mounting bolt (Item 1) **[Figure 40-60-43]** from the console base.

Remove the console base cover from the excavator cab.

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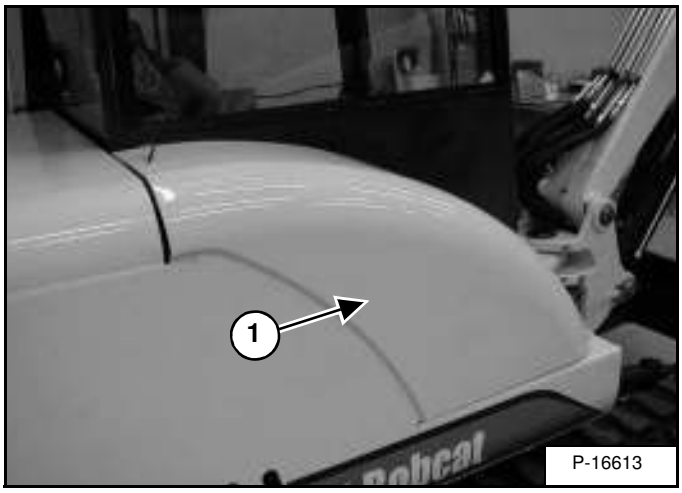
ENGINE SPEED CONTROL

Removal And Installation

Remove the right upper console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

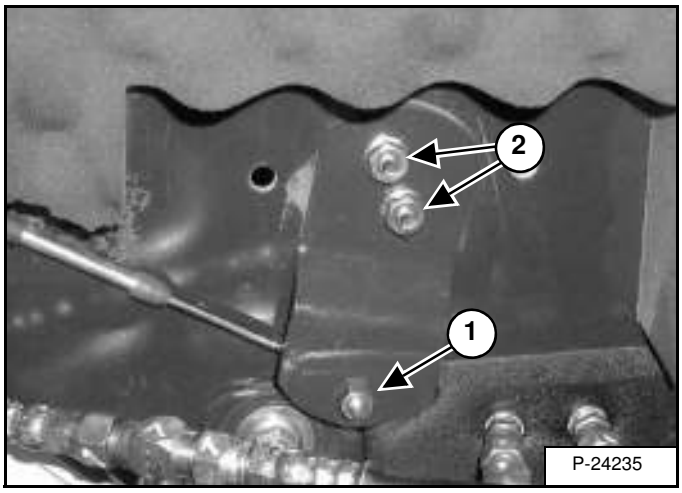
Remove the right lower console base. (See Console Base Removal And Installation on Page 40-50-2.)

Figure 40-70-1



Open the right side cover on the excavator (Item 1) **[Figure 40-70-1]**.

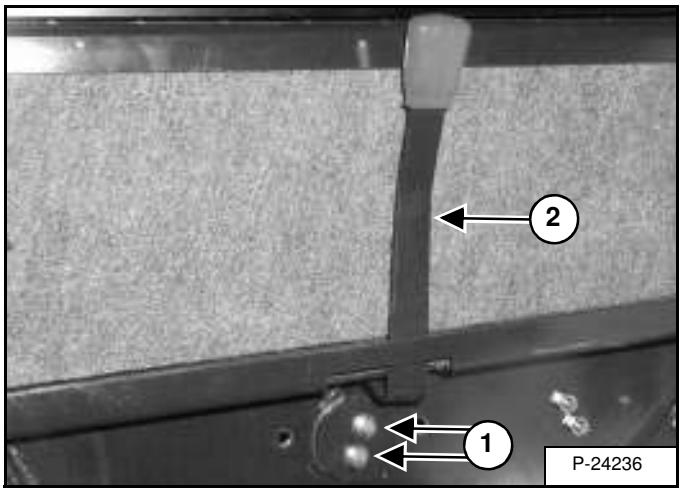
Figure 40-70-2



Remove the linkage cable nut (Item 1) **[Figure 40-70-2]**.

Remove the two speed control lever mount nuts (Item 2) **[Figure 40-70-2]**.

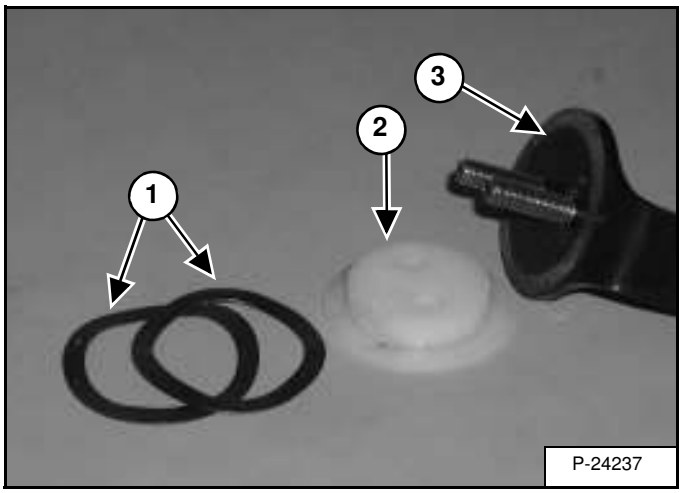
Figure 40-70-3



Remove the two speed control bolts (Item 1) **[Figure 40-70-3]**.

Remove the speed control lever (Item 2) **[Figure 40-70-3]**

Figure 40-70-4



Remove the two wave washers (Item 1), spacer (Item 2) from the lever (Item 3) **[Figure 40-70-4]**.

Dealer Copy -- Not for Resale



Dealer Copy -- Not for Resale

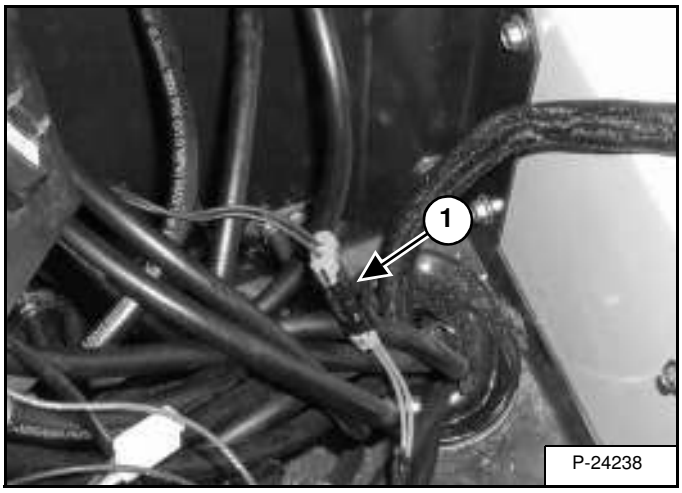
BLADE CONTROL

Lever Removal And Installation

Remove the right upper console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

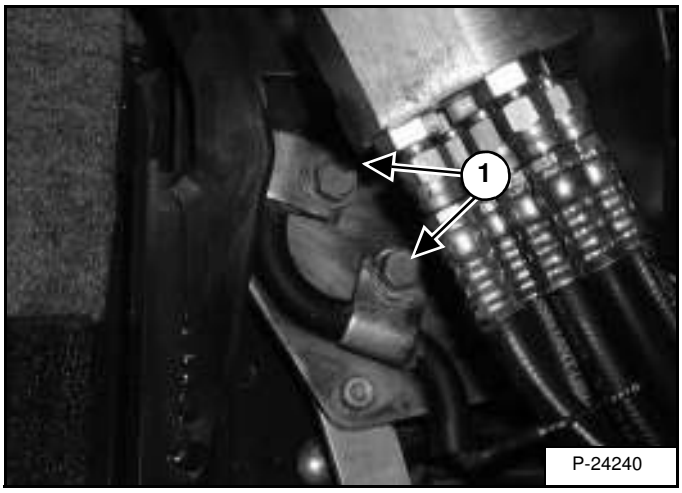
Remove the right lower console base. (See Console Base Removal And Installation on Page 40-50-2.)

Figure 40-80-1



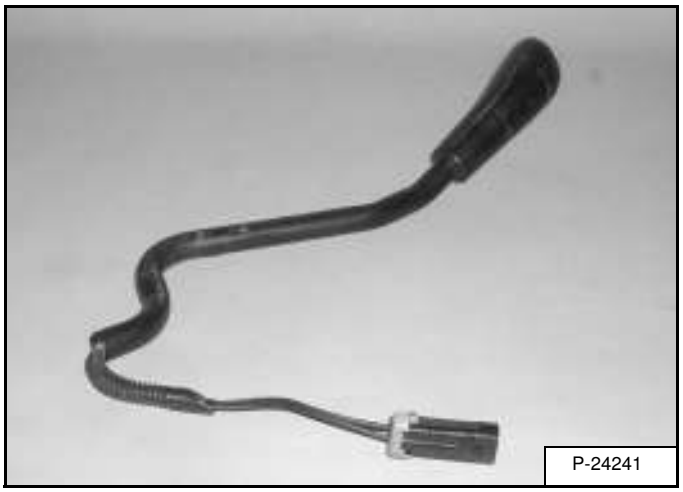
Unplug the two speed wire connector (Item 1) **[Figure 40-80-1]**.

Figure 40-80-2



Remove the two blade control lever mounting bolts (Item 1) **[Figure 40-80-2]**.

Figure 40-80-3



Remove the blade control lever from the excavator **[Figure 40-80-3]**.

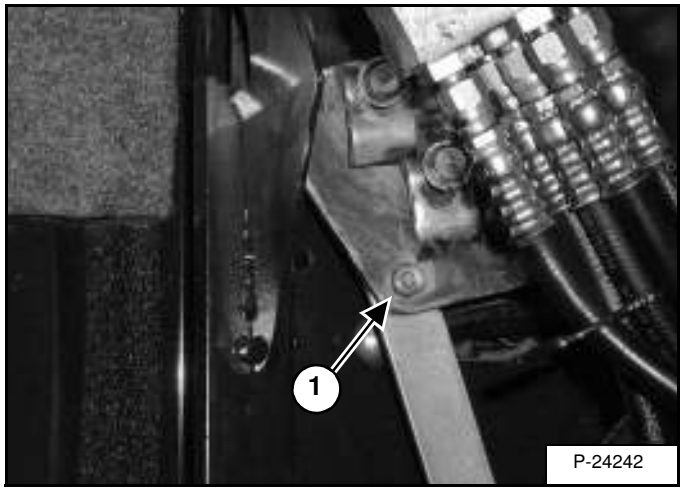
NOTE: If the two-speed switch needs to be replaced, the complete blade control lever must be replaced.

Dealer Copy -- Not for Resale

Linkage Removal And Installation

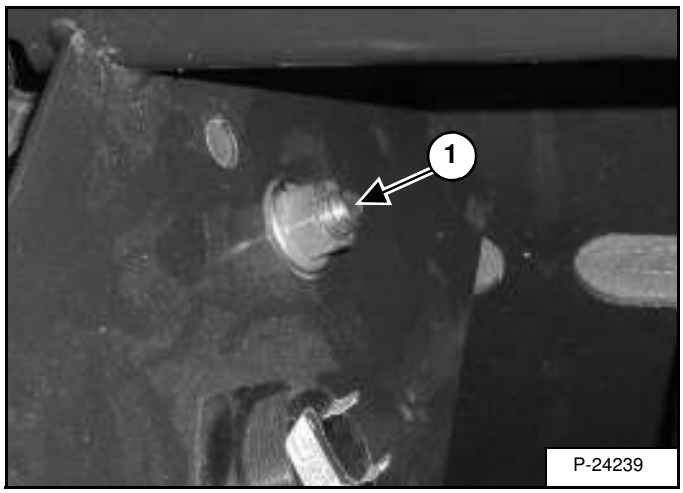
Remove the blade control lever. (See Lever Removal And Installation on Page 40-80-1.)

Figure 40-80-4



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

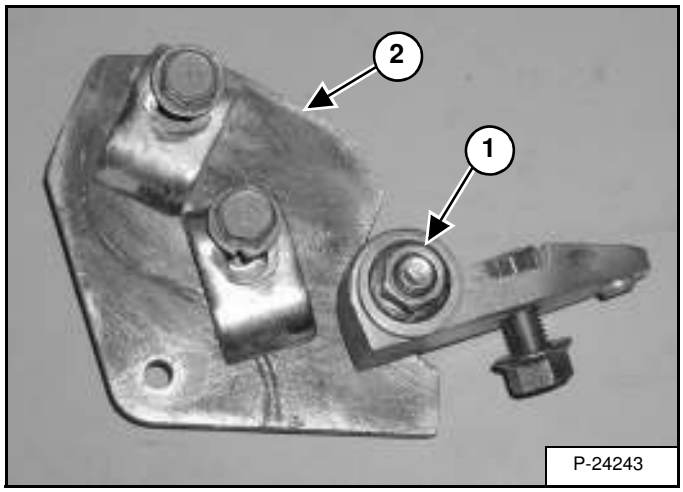
Figure 40-80-5



Remove the mount bolt (Item 1) **[Figure 40-80-5]** from the blade control pivot mount.

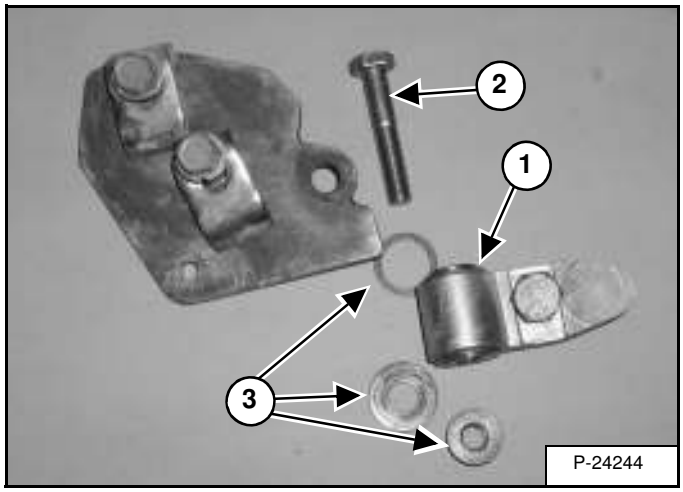
Remove the blade control pivot mount.

Figure 40-80-6



Remove the nut (Item 1) from the mount plate (Item 2) **[Figure 40-80-6]**.

Figure 40-80-7

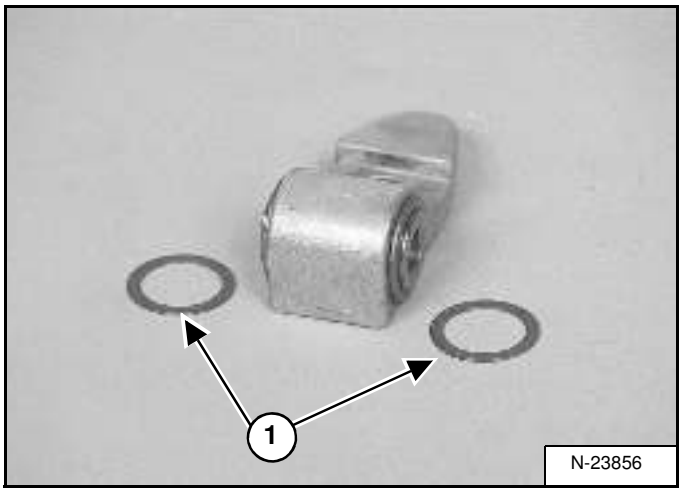


Remove the pivot mount (Item 1) bolt (Item 2) and washers (Item 3) **[Figure 40-80-7]**.

Dealer Copy -- Not for Resale

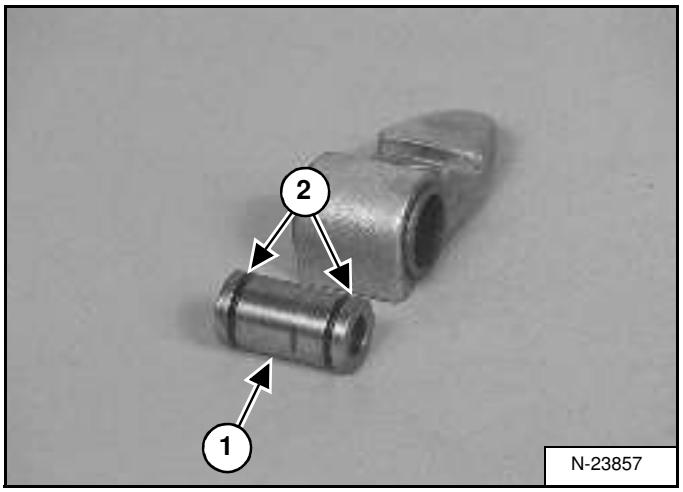
Linkage Removal And Installation (Cont'd)

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.

Dealer Copy -- Not for Resale

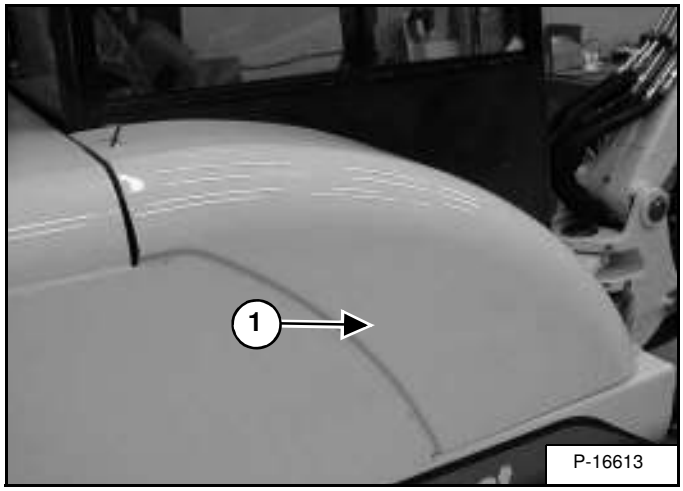
Linkage Bar Removal And Installation

Remove the right upper console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Remove the right lower console base. (See Console Base Removal And Installation on Page 40-50-2.)

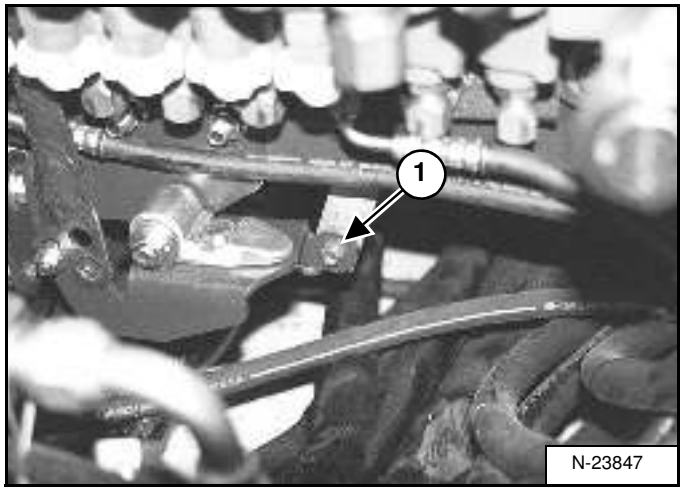
Remove the blade control lever. (See Lever Removal And Installation on Page 40-80-1.)

Figure 40-80-10



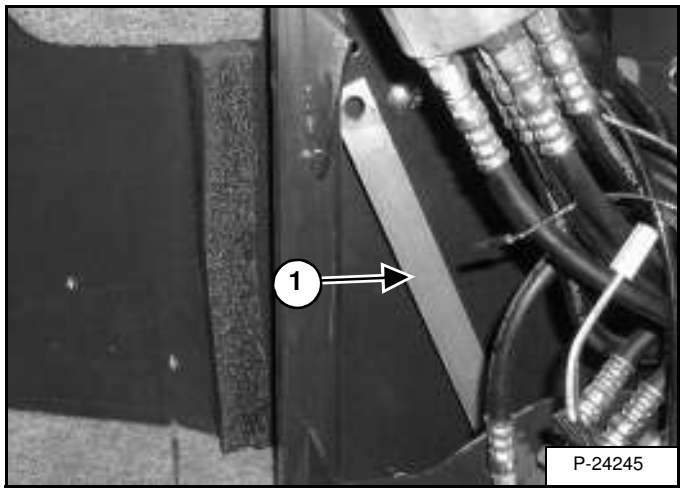
Open the right side cover on the excavator (Item 1) **[Figure 40-80-10]**.

Figure 40-80-11



Remove the linkage nut (Item 1) **[Figure 40-80-11]** from the lower pivot.

Figure 40-80-12

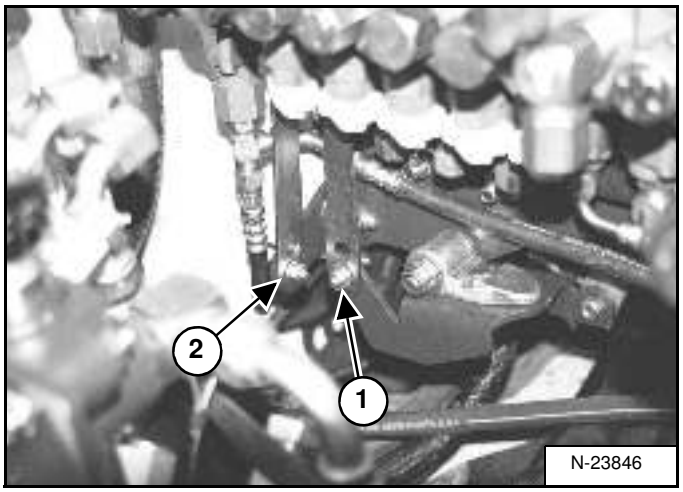


Remove the linkage bar (Item 1) **[Figure 40-80-12]** from the top.

Dealer Copy -- Not for Resale

Lower Linkage Removal And Installation

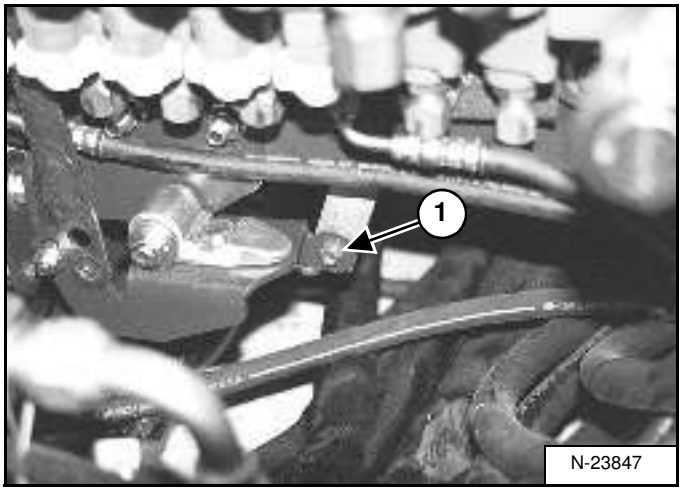
Figure 40-80-13



At the control valve, remove the bolt (Item 1) **[Figure 40-80-13]** from the blade linkage.

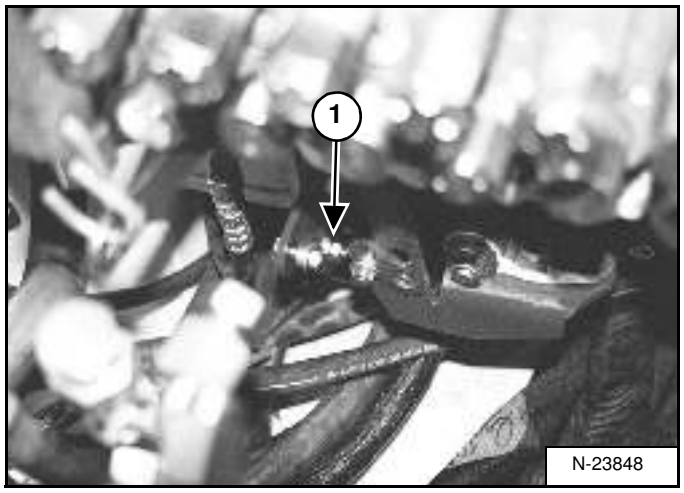
Remove the bolt (Item 2) **[Figure 40-80-13]** from the offset linkage.

Figure 40-80-14



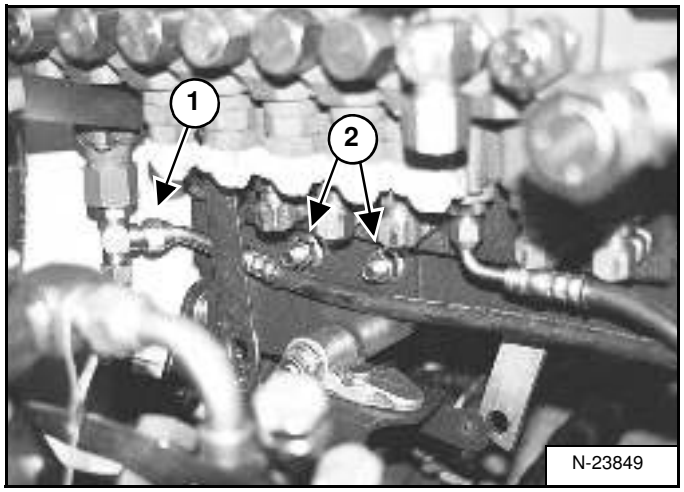
Remove the bolt (Item 1) **[Figure 40-80-14]** from the blade control linkage bar.

Figure 40-80-15



Remove the bolt (Item 1) **[Figure 40-80-15]** from the offset control linkage.

Figure 40-80-16



Remove the hydraulic hose (Item 1) **[Figure 40-80-16]**.

Cap and plug the hose and fitting.

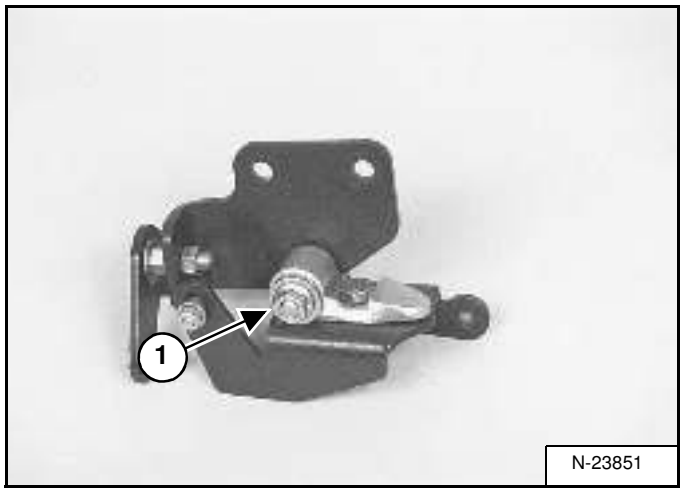
Remove the linkage mount bolts (Item 2) **[Figure 40-80-16]**.

Remove the linkage assembly.

Dealer Copy -- Not for Resale

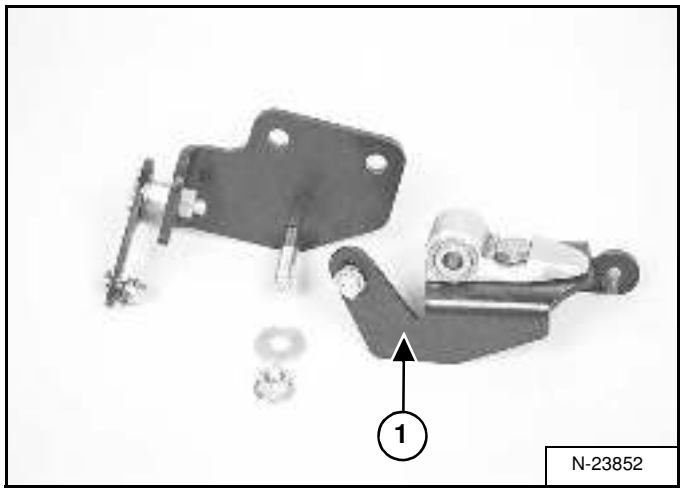
Lower Linkage Disassembly And Assembly (Cont'd)

Figure 40-80-17



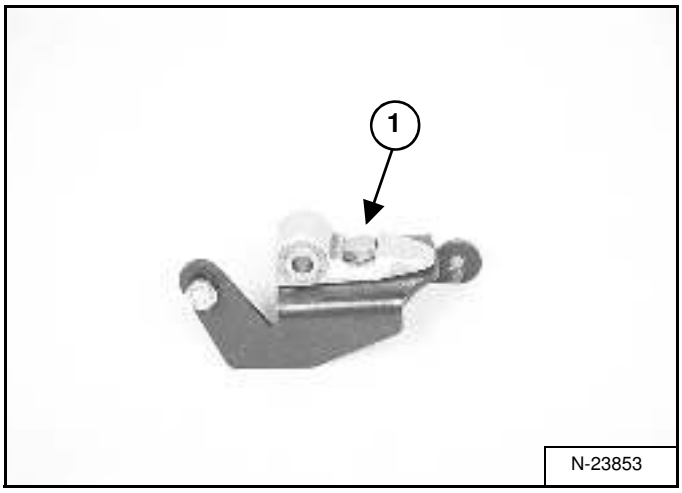
Remove the nut (Item 1) **[Figure 40-80-17]** from the pivot mount bolt.

Figure 40-80-18



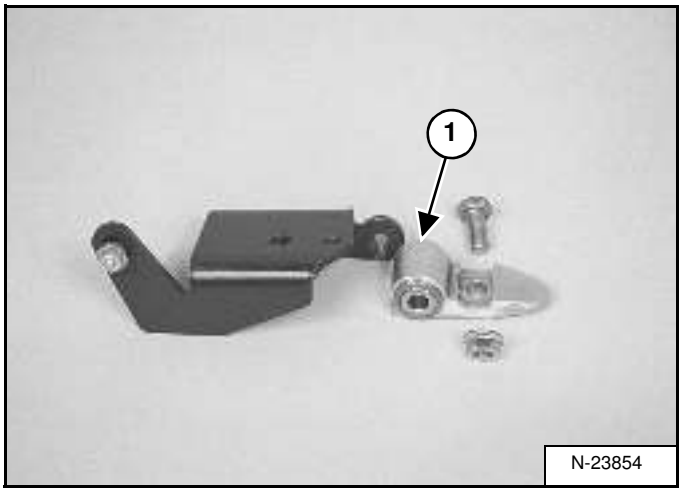
Remove the crank bracket assembly (Item 1) **[Figure 40-80-18]** from the pivot mount bolt.

Figure 40-80-19



Remove the mount bolt (Item 1) **[Figure 40-80-19]** from the pivot mount.

Figure 40-80-20

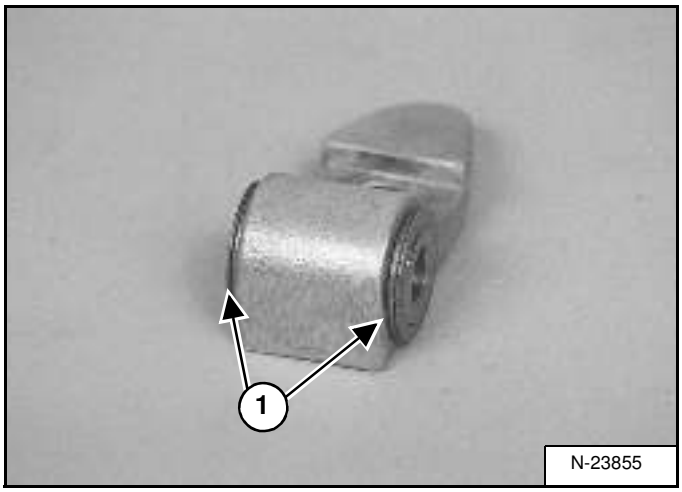


Remove the pivot mount (Item 1) **[Figure 40-80-20]** from the crank bracket.

Dealer Copy -- Not for Resale

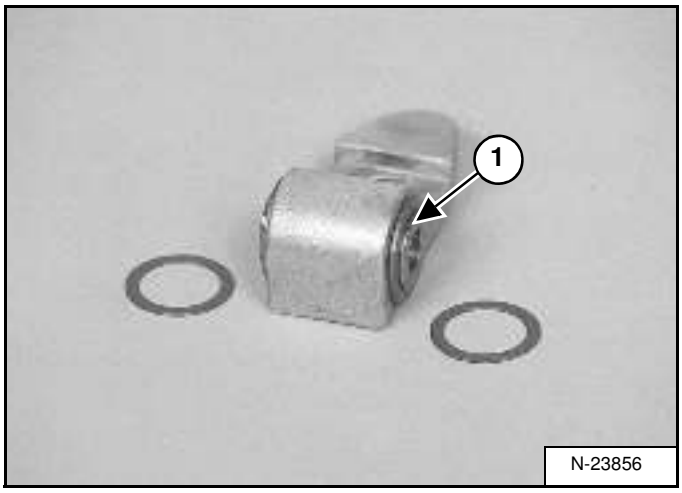
Lower Linkage Disassembly And Assembly (Cont'd)

Figure 40-80-21



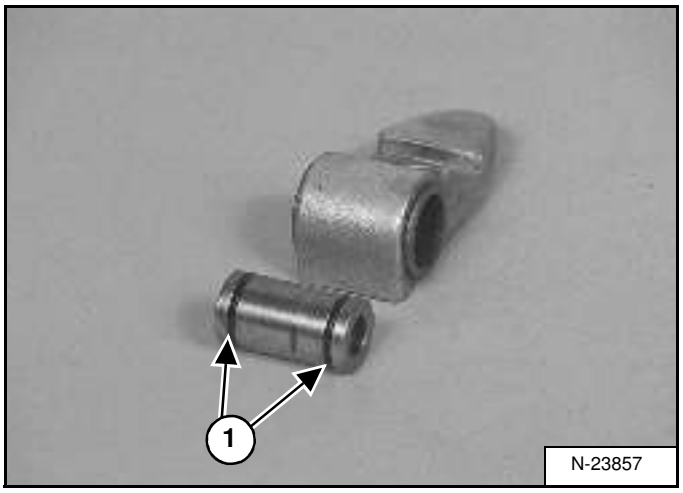
Remove the washers (Item 1) **[Figure 40-80-21]** from the sleeve.

Figure 40-80-22



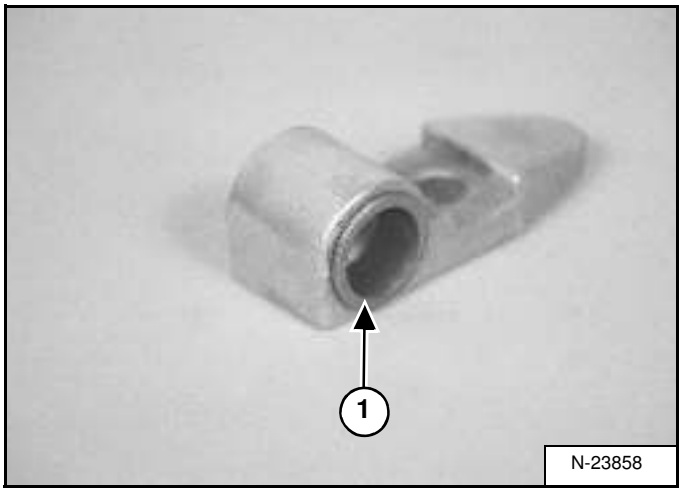
Remove the sleeve (Item 1) **[Figure 40-80-22]** from the pivot mount.

Figure 40-80-23



Check the O-rings (Item 1) **[Figure 40-80-23]** on the sleeve, and replace as needed.

Figure 40-80-24

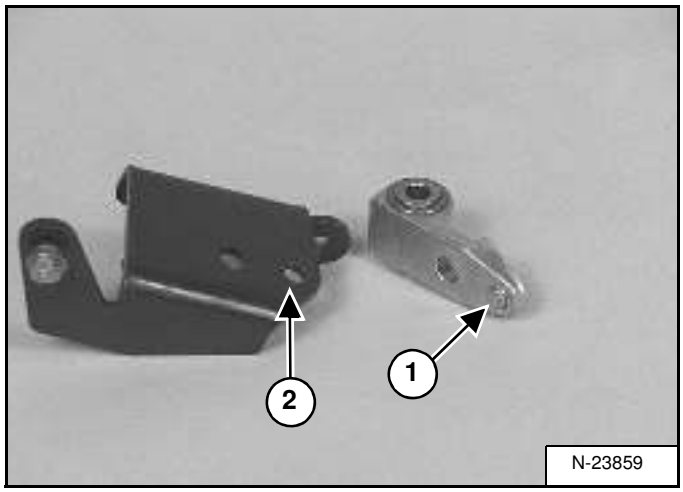


Remove the bushing (Item 1) **[Figure 40-80-24]** and replace as needed. (Both sides.)

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Lower Linkage Disassembly And Assembly (Cont'd)

Figure 40-80-25



Installation: Align the tab (Item 1) on the mount with the hole (Item 2) **[Figure 40-80-25]** in the crank bracket, before installing the bolt and tightening.

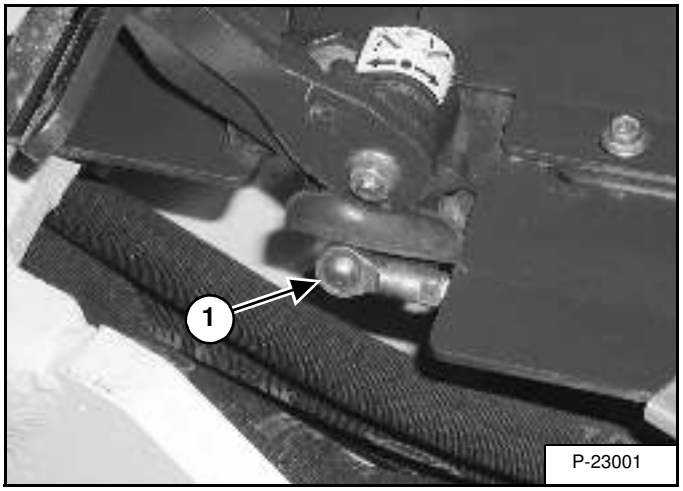
Dealer Copy -- Not for Resale

RIGHT PEDAL AND LINKAGE

Pedal Removal And Installation

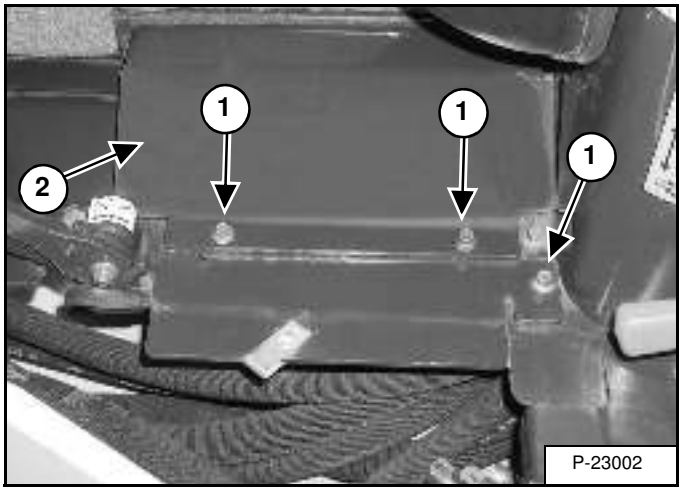
Remove the floor mat and floor plate. (See Removal And Installation on Page 40-110-1.)

Figure 40-90-1



Remove the linkage (Item 1) **[Figure 40-90-1]** from the pedal.

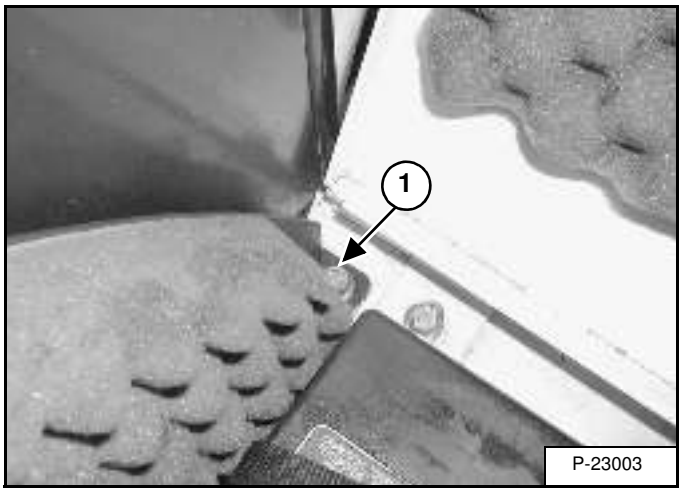
Figure 40-90-2



Remove the three bolts (Item 1) **[Figure 40-90-2]**.

NOTE: If the excavator is equipped with a canopy remove the swing motor cover (Item 2) [Figure 40-90-2].

Figure 40-90-3



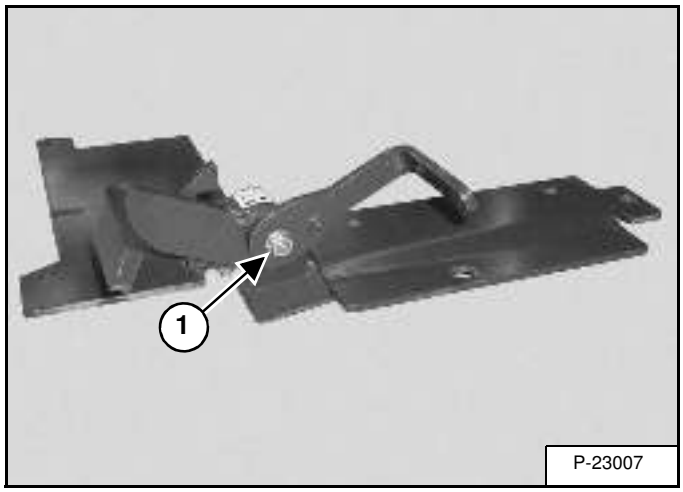
Remove the bolt (Item 1) **[Figure 40-90-3]** from the right front corner of the frame.

Remove the pedal and floor plate.

Dealer Copy -- Not for Resale

Right Pedal Disassembly And Assembly

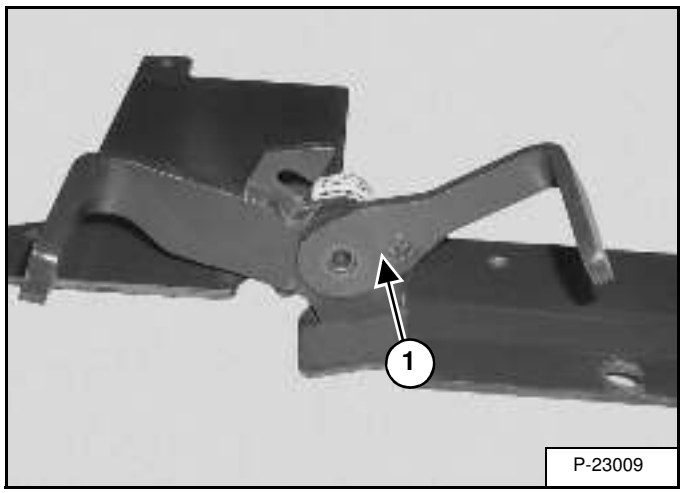
Figure 40-90-4



Remove the nut and bolt (Item 1) **[Figure 40-90-4]**.

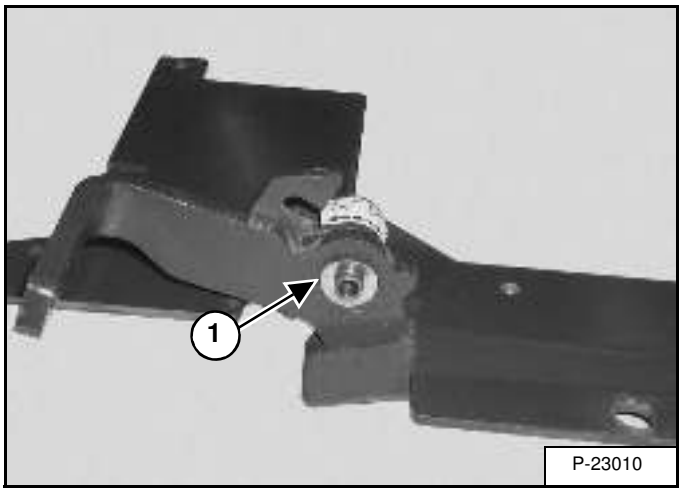
Installation: tighten the nut and bolt to eliminate any side play while allowing for free pedal movement.

Figure 40-90-5



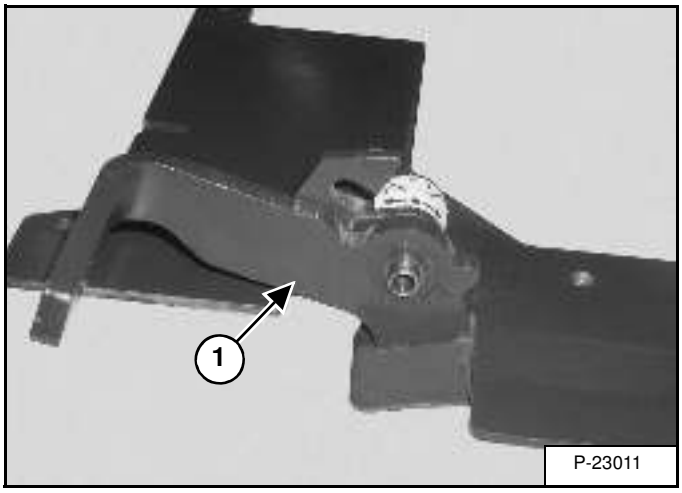
Remove the rear pedal (Item 1) **[Figure 40-90-5]**.

Figure 40-90-6



Remove the wave washer (Item 1) **[Figure 40-90-6]**.

Figure 40-90-7

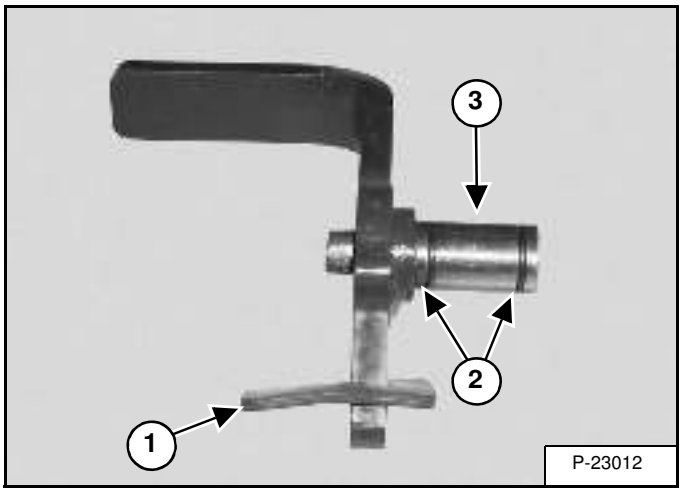


Remove the front pedal (Item 1) **[Figure 40-90-7]**.

Dealer Copy -- Not for Resale

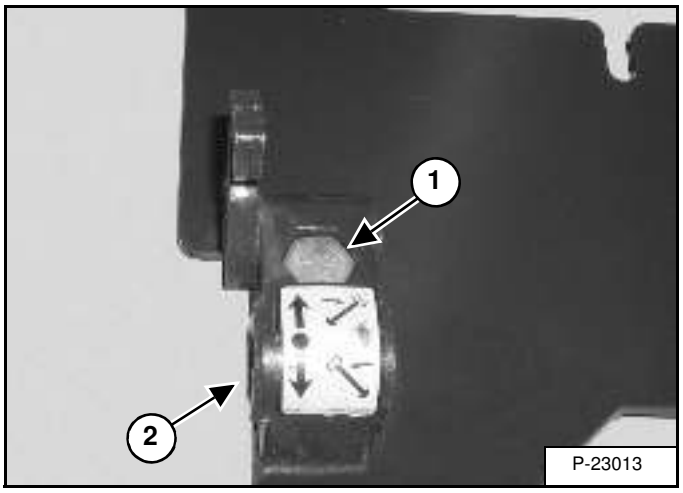
Right Pedal Disassembly And Assembly (Cont'd)

Figure 40-90-8



Remove the seal (Item 1), O-rings (Item 2) and bushing (Item 3) **[Figure 40-90-8]** from the front pedal.

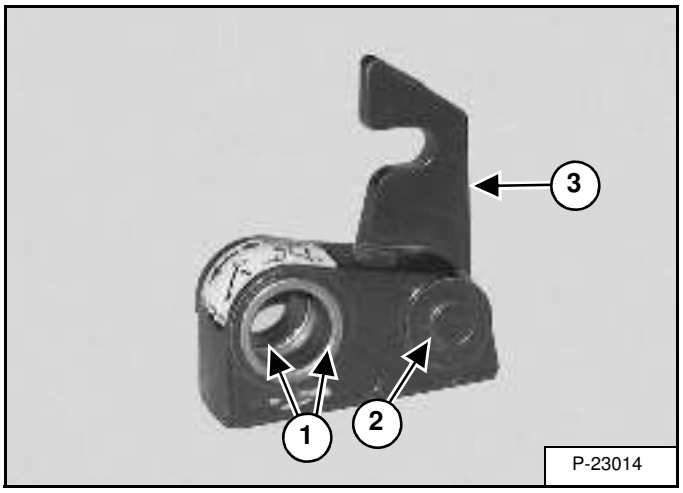
Figure 40-90-9



Remove the bolt (Item 1) from the pedal mount bracket (Item 2) **[Figure 40-90-9]**.

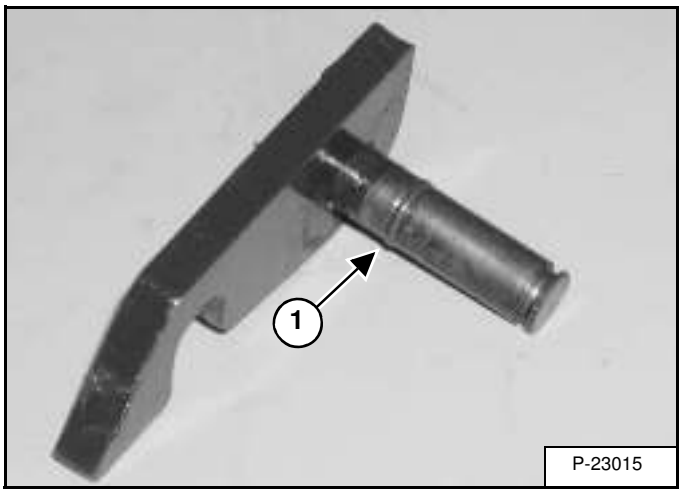
Installation: Clean the threads of the bolt and apply thread lock adhesive (LOCTITE 242) to the bolt threads and tighten to 32-35 ft.-lbs. (43-47 Nm) torque.

Figure 40-90-10



Remove the bushings (Item 1) and O-ring (Item 2) from the pedal mount bracket and remove the pedal lock (Item 3) **[Figure 40-90-10]**.

Figure 40-90-11



Remove the O-ring (Item 1) **[Figure 40-90-11]** from the pedal lock.

NOTE: Do not lubricate the O-ring (Item 1) [Figure 40-90-11] during installation. The O-ring works as a friction lock to prevent the lock (Item 3) [Figure 40-90-10] from pivoting freely.

Dealer Copy -- Not for Resale

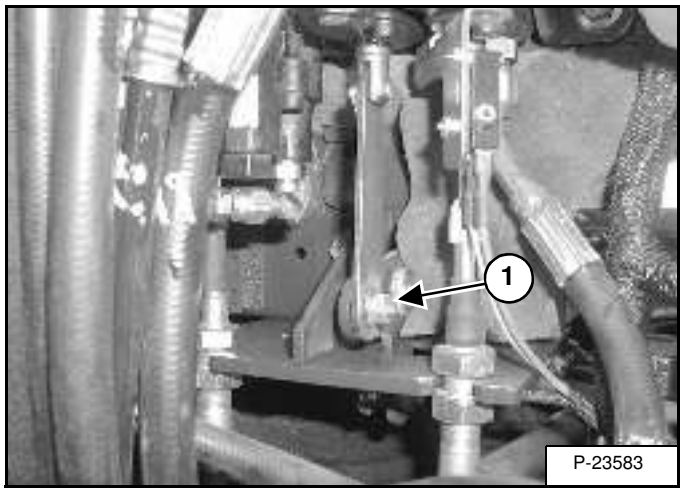
RIGHT PEDAL LINKAGE (CONT'D)

Linkage Removal And Installation

Remove right console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Open the right side cover.

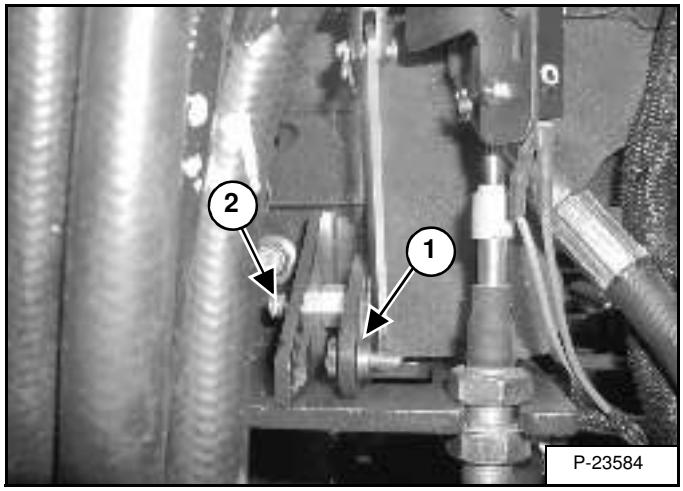
Figure 40-90-12



Remove the nut (Item 1) **[Figure 40-90-12]** and washer from the bellcrank.

NOTE: The control valve hoses may need to be loosened and repositioned to gain access to the bellcrank.

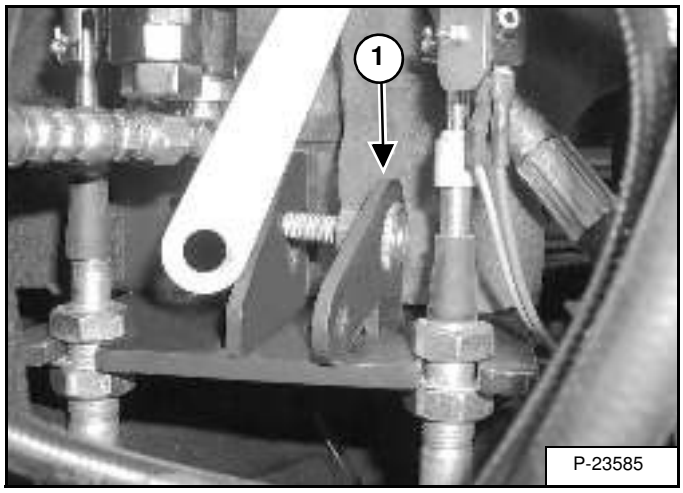
Figure 40-90-13



Remove the spacer (Item 1) **[Figure 40-90-13]**.

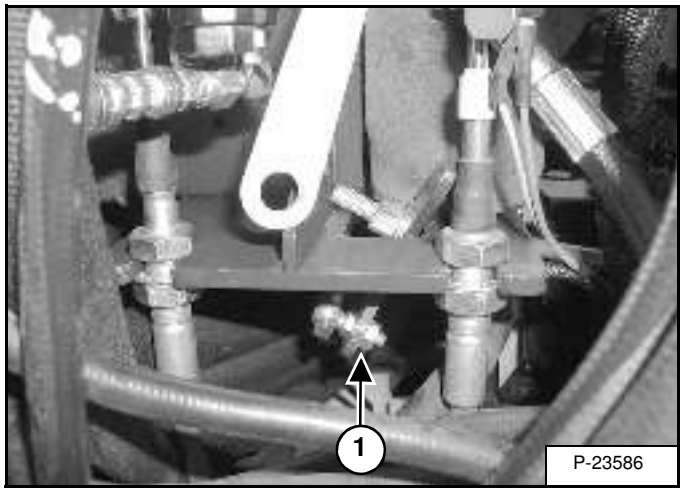
Remove the bellcrank mount nut (Item 2) **[Figure 40-90-13]**.

Figure 40-90-14



Push the bellcrank (Item 1) **[Figure 40-90-14]** through the mount to gain access to the linkage.

Figure 40-90-15

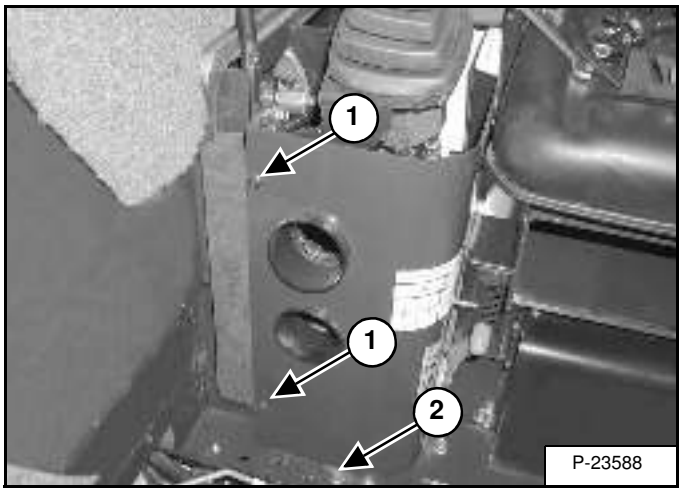


Remove the nut (Item 1) **[Figure 40-90-15]** and separate the linkage from the bellcrank. Remove the bellcrank.

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Linkage Removal And Installation (Cont'd)

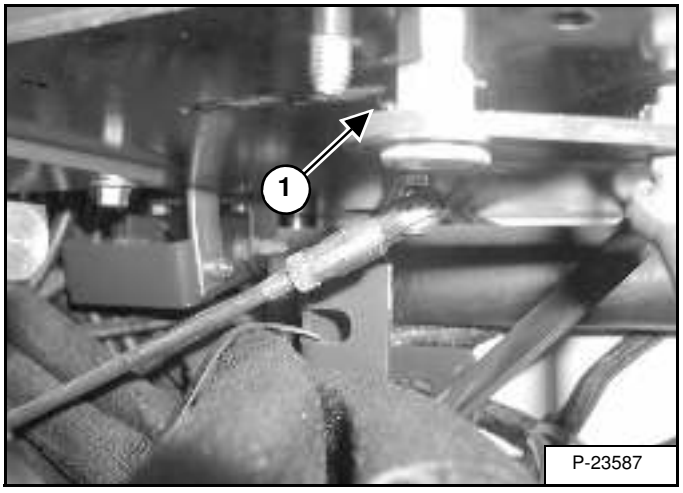
Figure 40-90-16



Remove the screws (item 1) and bolt (Item 2) **[Figure 40-90-16]** from the right console.

NOTE: This allows the right console side cover to move forward and access to the bellcrank mount nut.

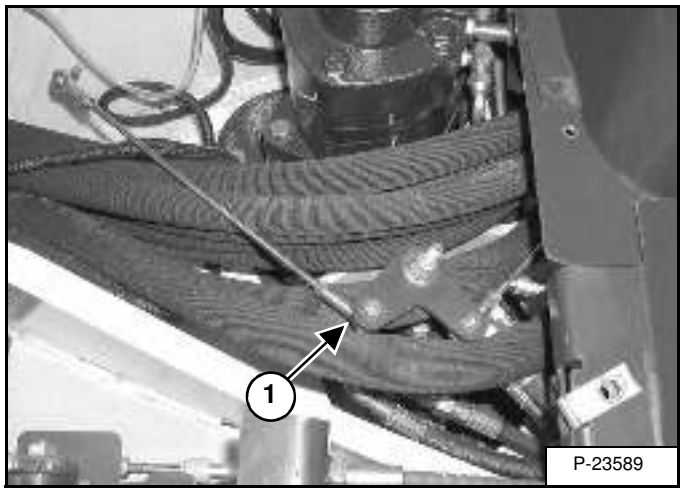
Figure 40-90-17



Remove the bellcrank mount bolt (Item 1) **[Figure 40-90-17]** from under the rear floor pan.

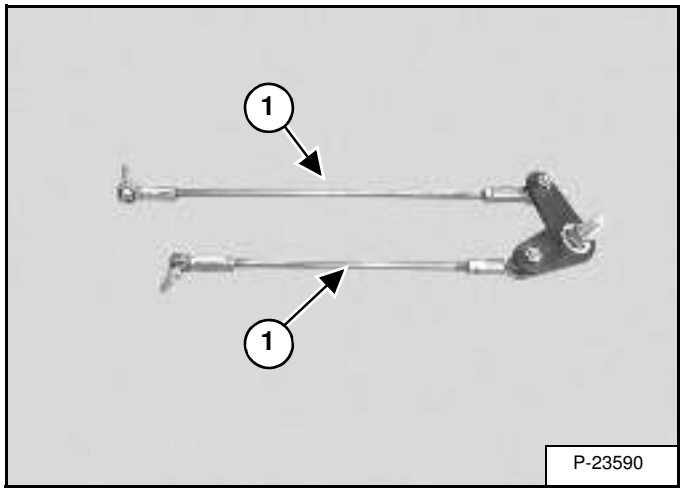
NOTE: Access the nut from inside the right console.

Figure 40-90-18



Remove the linkage and bellcrank assembly (Item 1) **[Figure 40-90-18]**.

Figure 40-90-19

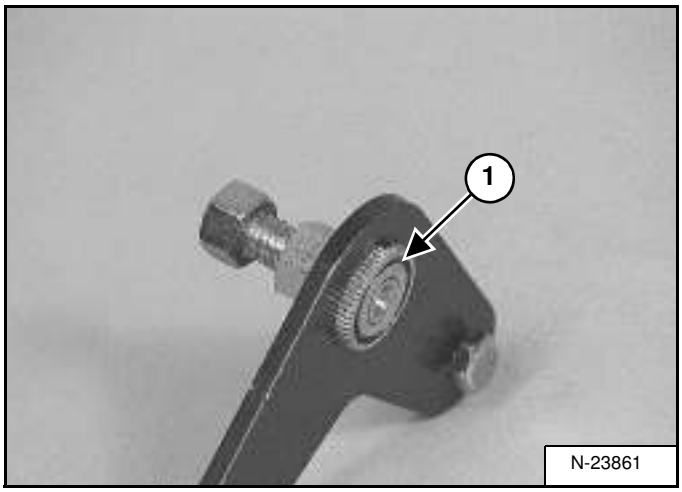


Mark the linkage rods for ease of assembly and remove the rods (Item 1) **[Figure 40-90-19]** from the bellcrank.

Dealer Copy -- Not for Resale

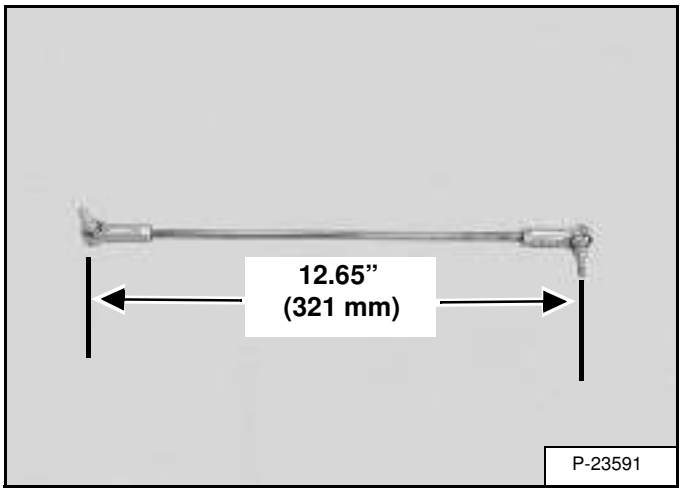
Linkage Removal And Installation (Cont'd)

Figure 40-90-20



Press and remove the bearing (Item 1) **[Figure 40-90-20]** from both bellcranks.

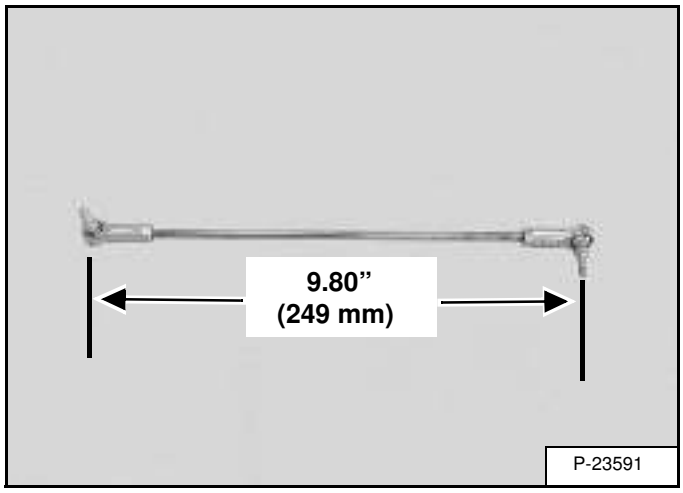
Figure 40-90-21



Before installation adjust the pedal to bellcrank linkage to 12.65 inches (321 mm) **[Figure 40-90-21]**.

NOTE: Linkage rod ball dimensions [Figure 40-90-21] may need final adjustment, with the pedal (valve) in neutral, to ensure the lock engages the pedal lock pin after the right pedal is installed. (See Adjustment on Page 40-90-7.)

Figure 40-90-22



Before installation, adjust the bellcrank to bellcrank linkage to 9.80 inches (249 mm) **[Figure 40-90-22]**.

Dealer Copy -- Not for Resale

Adjustment

Figure 40-90-23

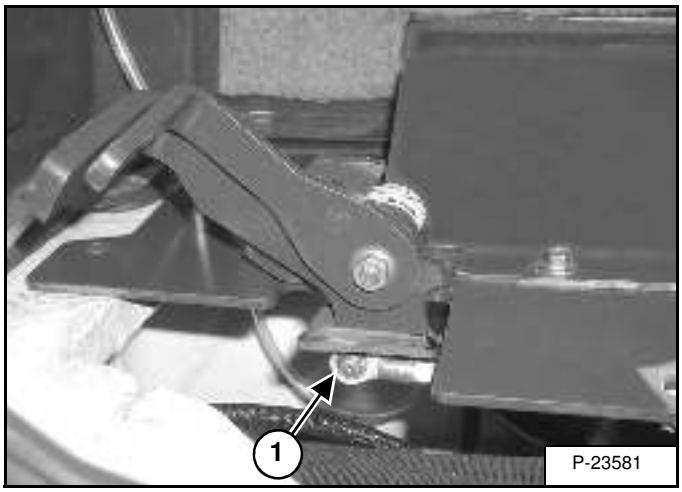
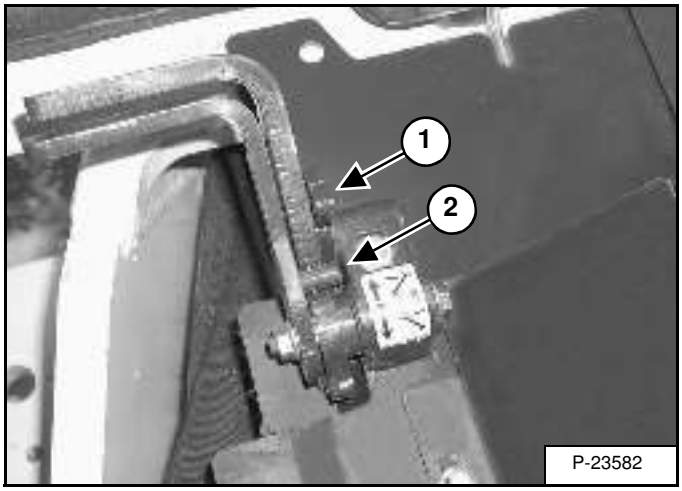


Figure 40-90-24



Disconnect and adjust the ball joint (Item 1) **[Figure 40-90-23]** until the lock (Item 1) **[Figure 40-90-24]** engages the pedal lock pin (Item 2) **[Figure 40-90-24]** while the pedal (valve) is in neutral.

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Dealer Copy -- Not for Resale

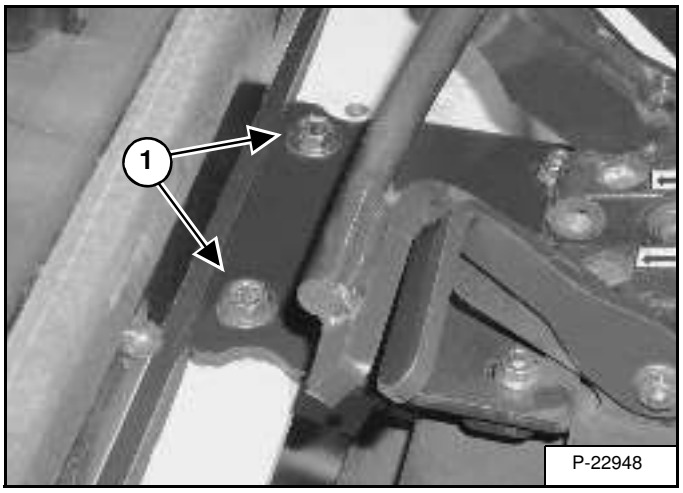
TRAVEL CONTROLS

Removal And Installation

Remove the floor mat. (See Removal And Installation on Page 40-110-1.)

Remove the floor plate. (See Removal And Installation on Page 40-110-1.)

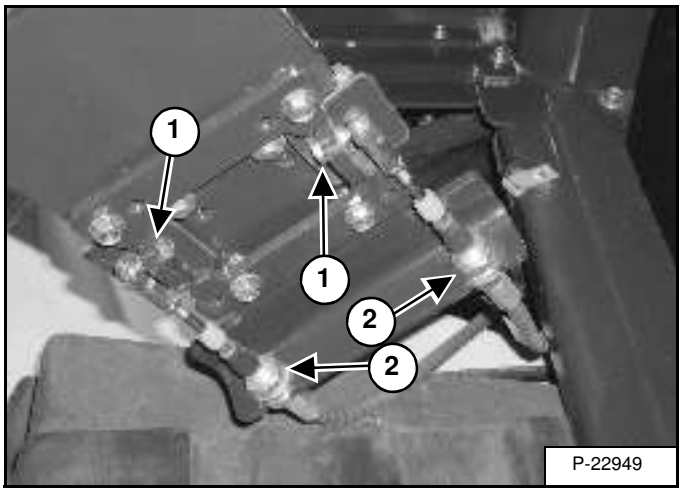
Figure 40-100-1



Remove the two bolts and nuts (Item 1) **[Figure 40-100-1]** from the front floor panel.

Turn the travel lever mount over.

Figure 40-100-2



Mark and remove the cables (Item 1) **[Figure 40-100-2]** from the travel levers.

Loosen the jam nuts (Item 2) **[Figure 40-100-2]** and remove the cables from the travel lever mount.

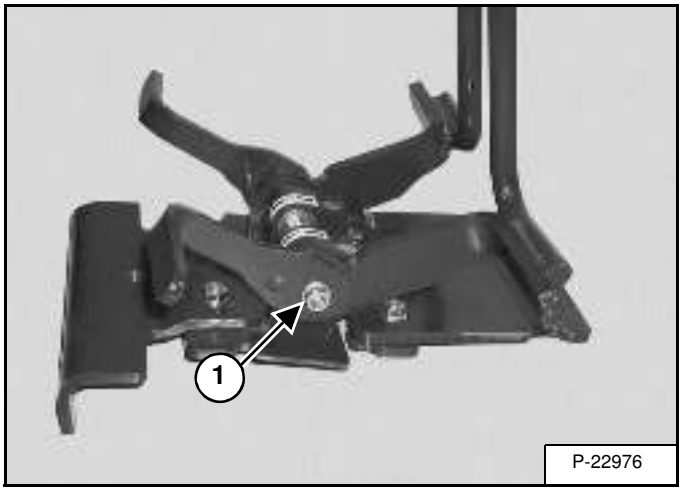
Lift the steering levers and mount plate from the machine.

Dealer Copy -- Not for Resale

Disassembly And Assembly

Disassembly of the right travel control is shown. The procedure is the same for both the left and right travel control.

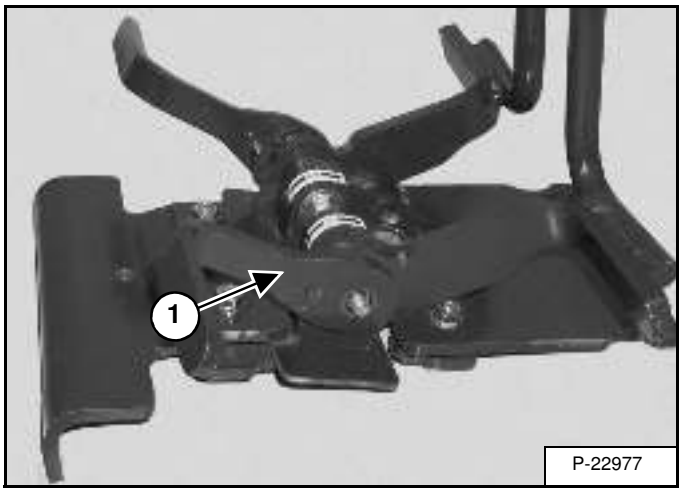
Figure 40-100-3



Remove the nut (Item 1) **[Figure 40-100-3]** from the rear pedal.

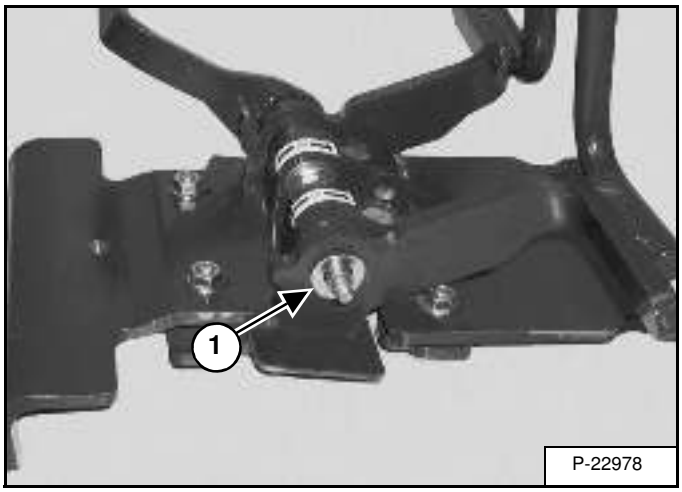
Installation: Tighten the nut to eliminate side play while allowing free travel of the pedals.

Figure 40-100-4



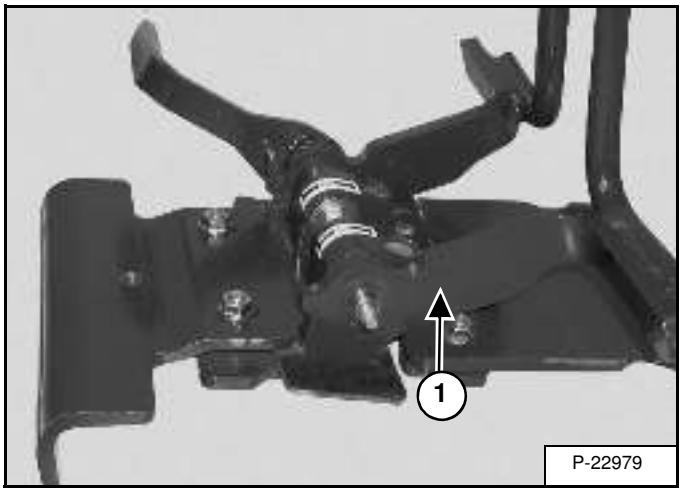
Remove the rear pedal (Item 1) **[Figure 40-100-4]**.

Figure 40-100-5



Remove the wave washer (Item 1) **[Figure 40-100-5]**.

Figure 40-100-6

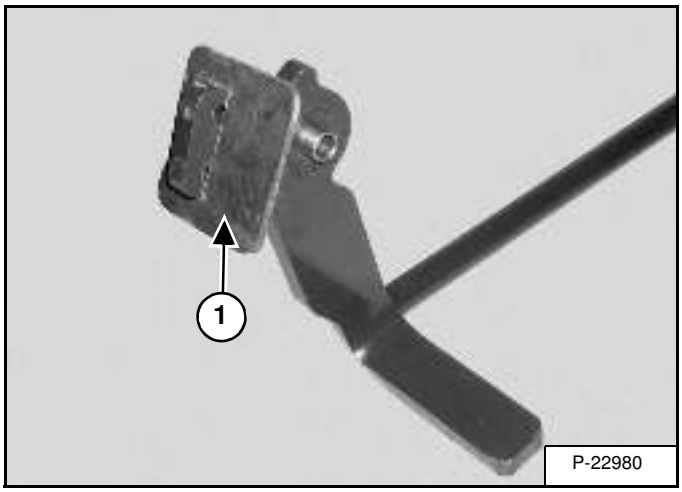


Remove the front pedal (Item 1) **[Figure 40-100-6]**.

Dealer Copy -- Not for Resale

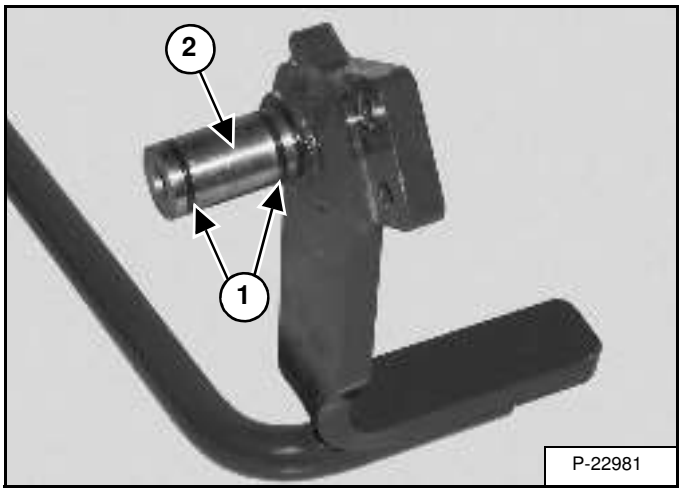
Disassembly And Assembly (Cont'd)

Figure 40-100-7



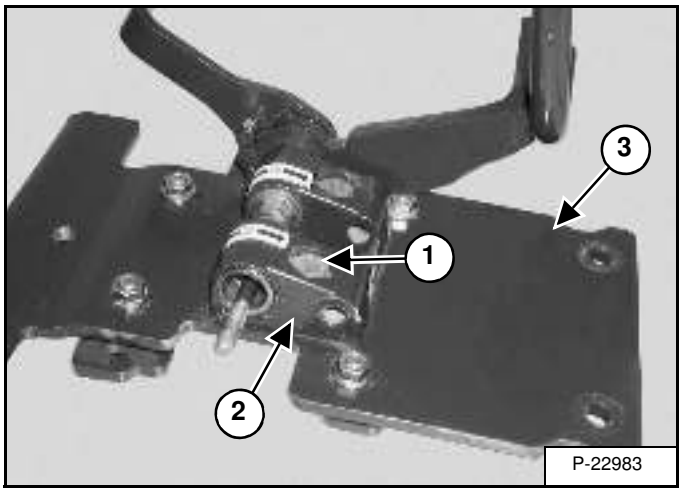
Remove the seal (Item 1) **[Figure 40-100-7]** from the front pedal.

Figure 40-100-8



Remove the O-rings (Item 1) from the bushing (Item 2) **[Figure 40-100-8]** and remove the bushing from the front pedal.

Figure 40-100-9

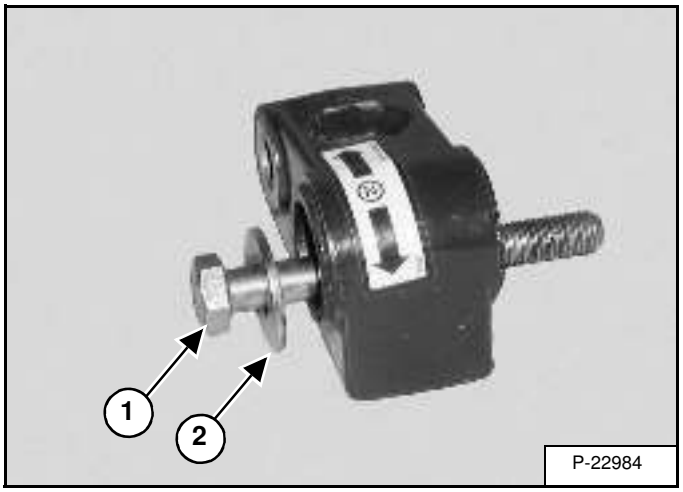


Remove the bolt (Item 1) that attaches the pedal mount (Item 2) to the mount plate (Item 3) **[Figure 40-100-9]**.

Installation: Clean the bolt threads and apply thread lock adhesive (LOCTITE 242). Tighten the bolts to 32-35 ft.-lbs. (43-47 Nm) torque.

Remove the pedal mount.

Figure 40-100-10

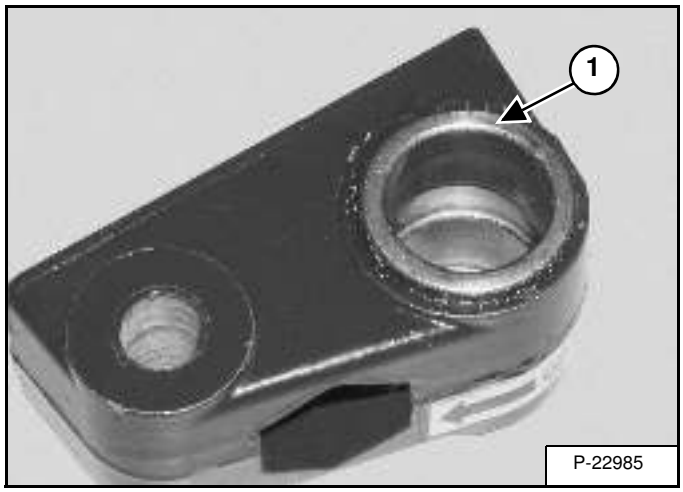


Remove the bolt (Item 1) and washer (Item 2) **[Figure 40-100-10]** from the pedal mount.

Dealer Copy -- Not for Resale

Disassembly And Assembly (Cont'd)

Figure 40-100-11



Remove the bushings (Item 1) **[Figure 40-100-11]** from the pedal mount.

Figure 40-100-12

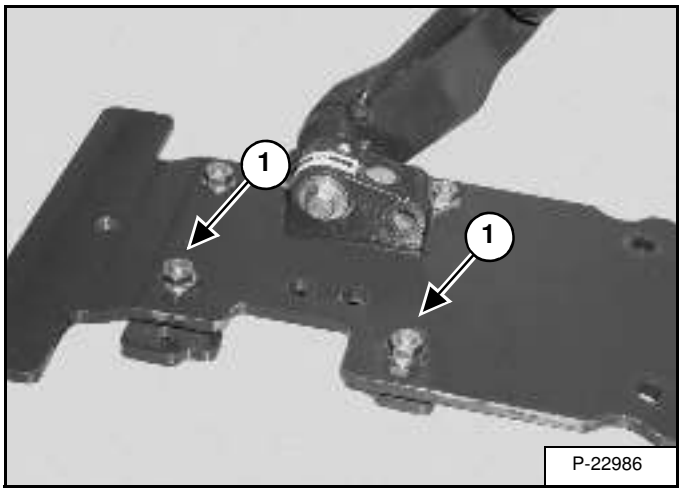
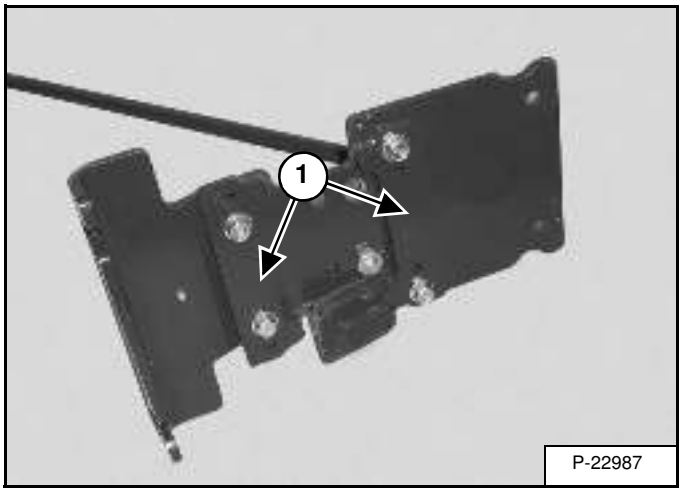


Figure 40-100-13



Remove the four nuts (Item 1) **[Figure 40-100-12]** that attach the pedal stops (Item 1) **[Figure 40-100-13]** to the mount plate.

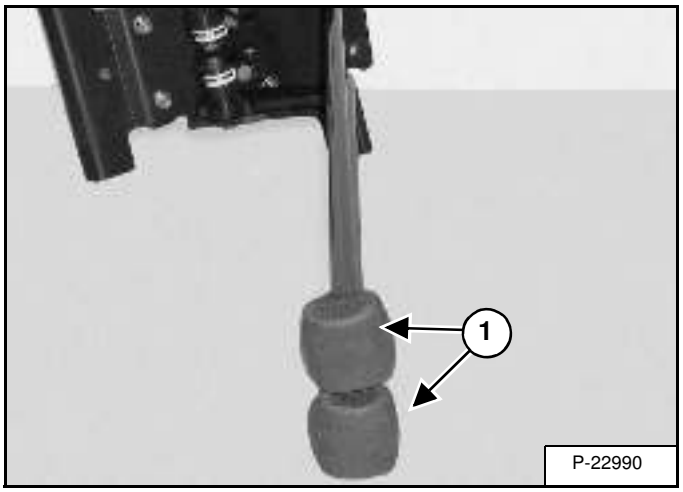
Installation: Tighten the four nuts to 18-19 ft.-lbs. (24-26 Nm) torque.

Remove the pedal stops.

Dealer Copy -- Not for Resale

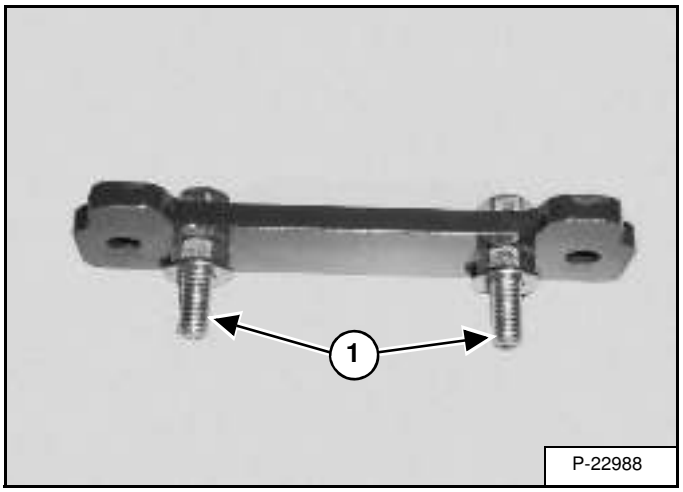
Disassembly And Assembly (Cont'd)

Figure 40-100-14



Installation: Adjust the pedal stops to align the hand levers (Item 1) **[Figure 40-100-14]** in both forward and reverse positions.

Figure 40-100-15



Remove the two bolts (Item 1) **[Figure 40-100-15]** from each of the pedal stops.

Installation: Tighten the bolts to 18-19 ft.-lbs. (24-26 Nm) torque.

NOTE: After installing the travel controls, the controls must be adjusted for correct operation.

Adjustment

Remove the floor mat and floor plate. (See Removal And Installation on Page 40-110-1.)

Figure 40-100-16

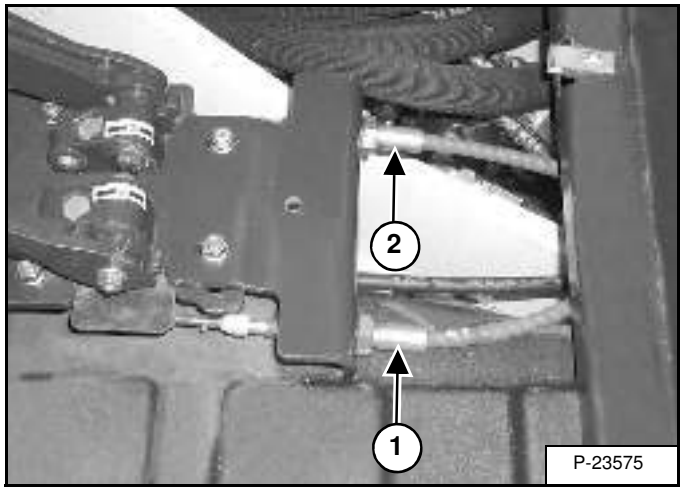
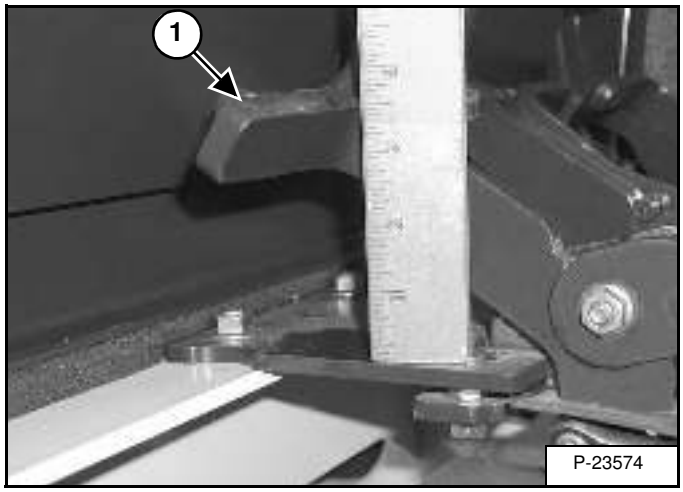


Figure 40-100-17



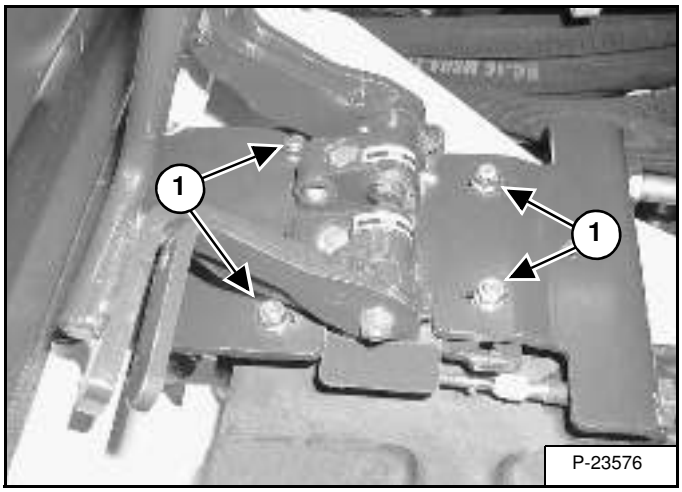
Adjust the left hand cable (Item 1) **[Figure 40-100-16]** (with the travel lever in the neutral position) until the top of the pedal (Item 1) **[Figure 40-100-17]** is 3.50 inches from the pedal mount plate.

Adjust the right side travel lever (Item 2) **[Figure 40-100-17]** until it is parallel with the left travel lever.

Dealer Copy -- Not for Resale

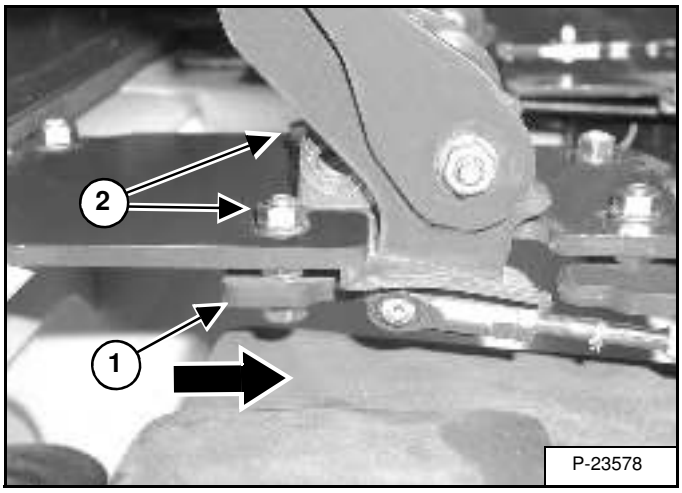
Adjustment (Cont'd)

Figure 40-100-18



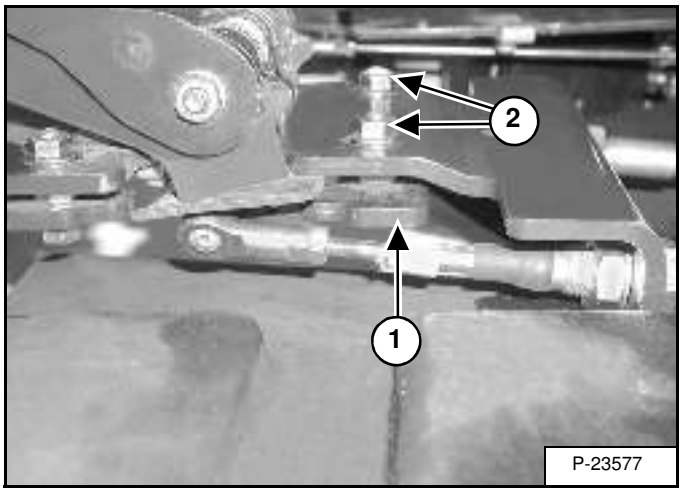
Loosen the front and rear pedal stop bolts (Item 1) **[Figure 40-100-18]**.

Figure 40-100-19



Move both travel levers toward the operator seat. When the travel spools are fully engaged, slide the stop (Item 1) back until the stop is in contact with the travel lever. Tighten the forward stop bolts (Item 2) **[Figure 40-100-19]**.

Figure 40-100-20



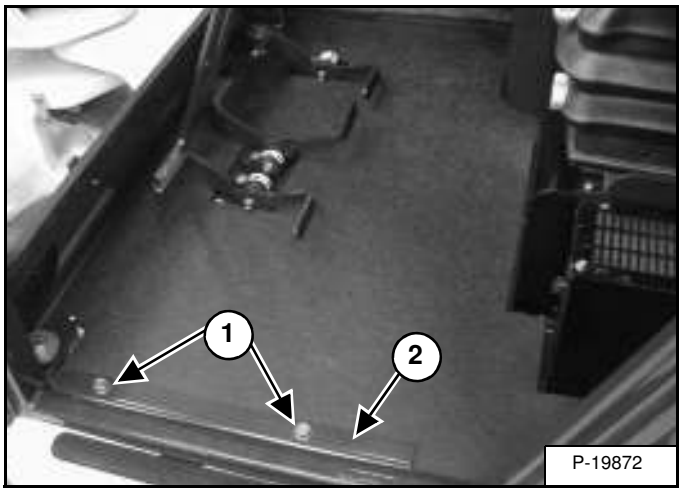
Move both travel levers away from the operators seat. When the travel spools are fully engaged, slide the stop (Item 1) forward until the stop is in contact with the travel lever. Tighten the rear stop bolts (Item 2) **[Figure 40-100-20]**.

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FLOOR MAT AND FLOOR PANELS

Removal And Installation

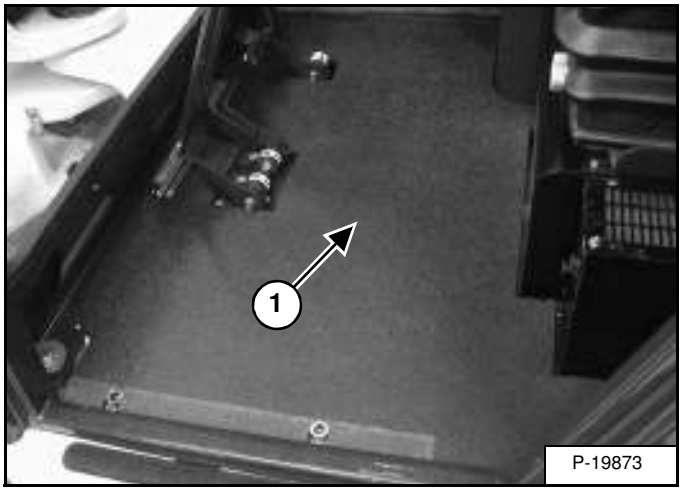
Figure 40-110-1



Remove the two bolts (Item 1) **[Figure 40-110-1]** from the floor mat retaining plate.

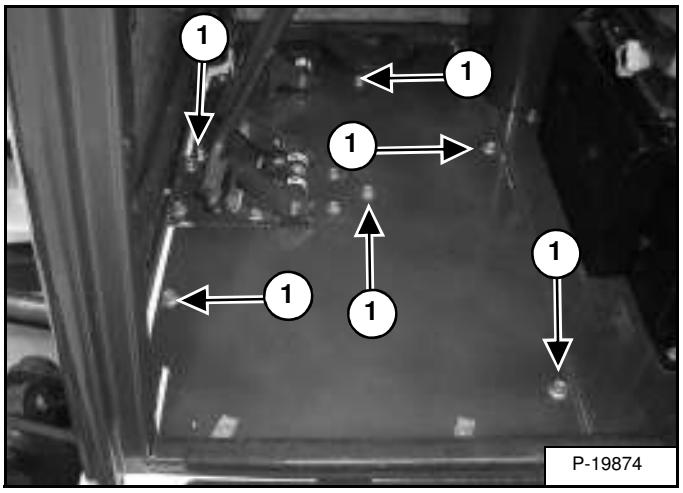
Remove the retaining plate (Item 2) **[Figure 40-110-1]** from the cab.

Figure 40-110-2



Remove the floor mat (Item 1) **[Figure 40-110-2]** from the cab.

Figure 40-110-3



Remove the six mount bolts (Item 1) **[Figure 40-110-3]** from the floor panel.

Remove the floor panel from the cab.

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Dealer Copy -- Not for Resale

FUEL TANK

Removal And Installation

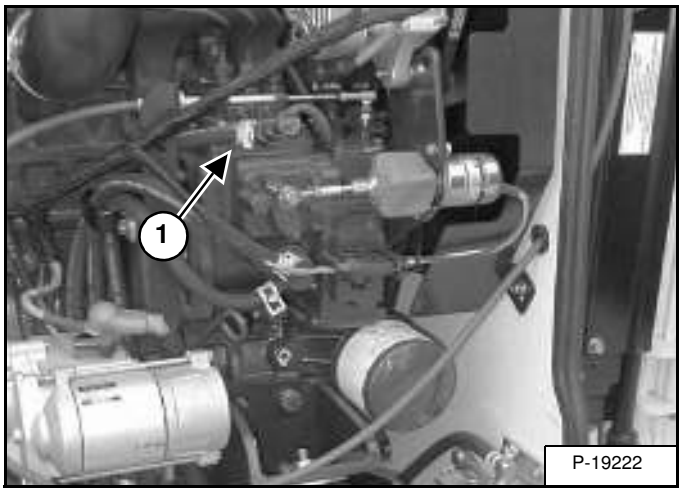
Remove the floor mat and floor plate. (See Removal And Installation on Page 40-110-1.)

Remove the travel controls. (See Removal And Installation on Page 40-100-1.)

Remove the seat and seat mount. (See STANDARD SEAT AND SEAT MOUNT on Page 40-40-1 or SUSPENSION SEAT AND SEAT MOUNT on Page 40-41-1.)

Remove the left console upper and lower console covers. (See LEFT CONSOLE on Page 40-60-1.)

Figure 40-120-1



Remove the hose (Item 1) **[Figure 40-120-1]**.

Drain the fuel into a suitable container.

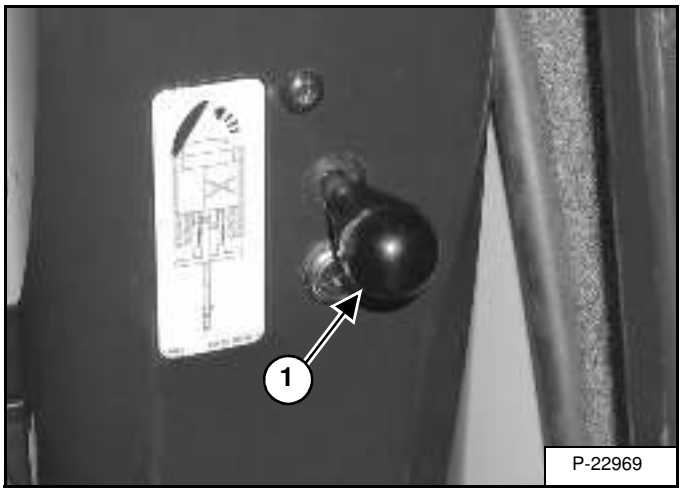
⚠ WARNING

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

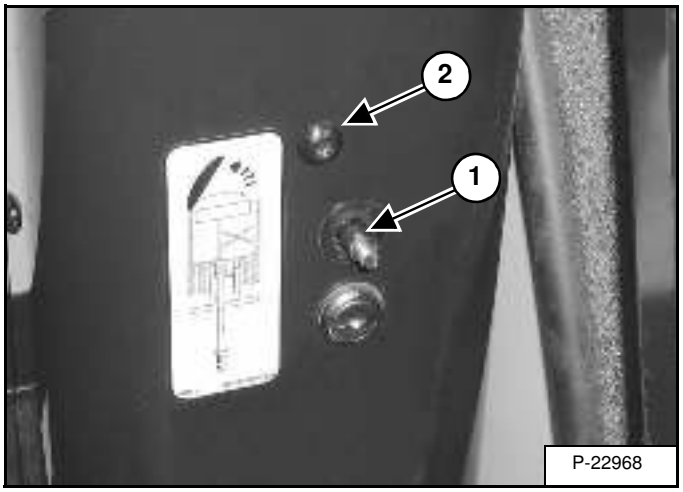
NOTE: Early model excavators are equipped with a one piece rear floor pan. Later models have a two piece rear floor pan. The photos may appear different, the procedure is the same.

Figure 40-120-2



Remove the tailgate latch knob (Item 1) **[Figure 40-120-2]**.

Figure 40-120-3

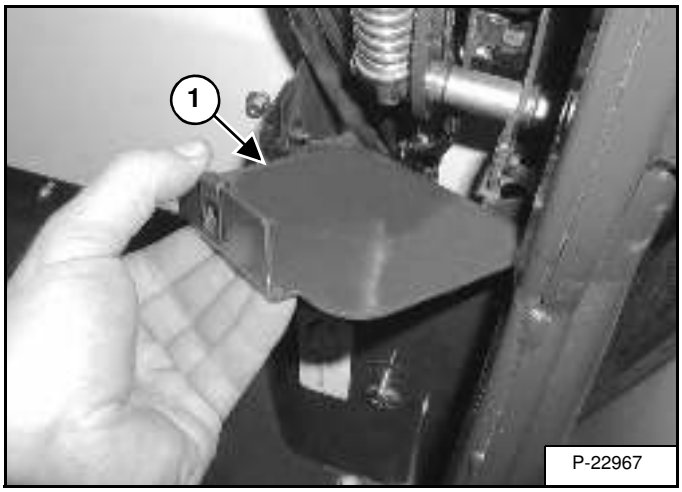


Remove the spacer (Item 1) and screw (Item 2) **[Figure 40-120-3]**.

Dealer Copy -- Not for Resale

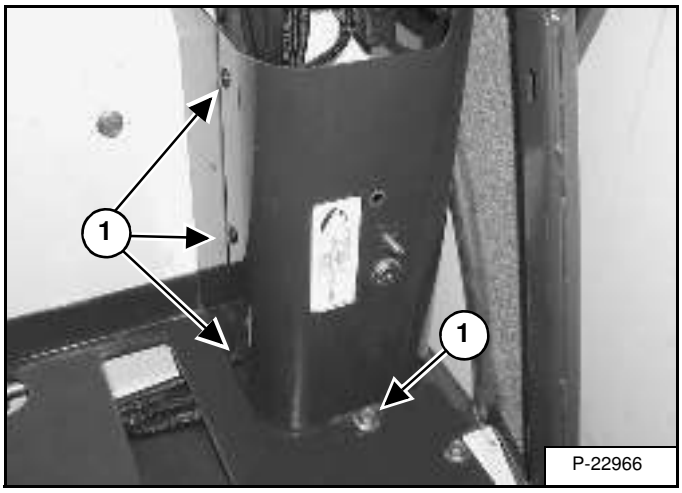
Removal And Installation (Cont'd)

Figure 40-120-4



Remove the inside panel (Item 1) **[Figure 40-120-4]**.

Figure 40-120-5



Remove the four bolts (Item 1) **[Figure 40-120-5]** and remove the console front frame.

Figure 40-120-6

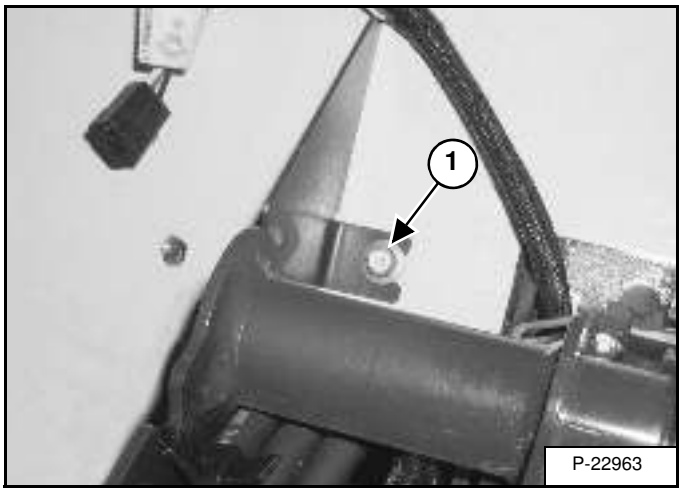
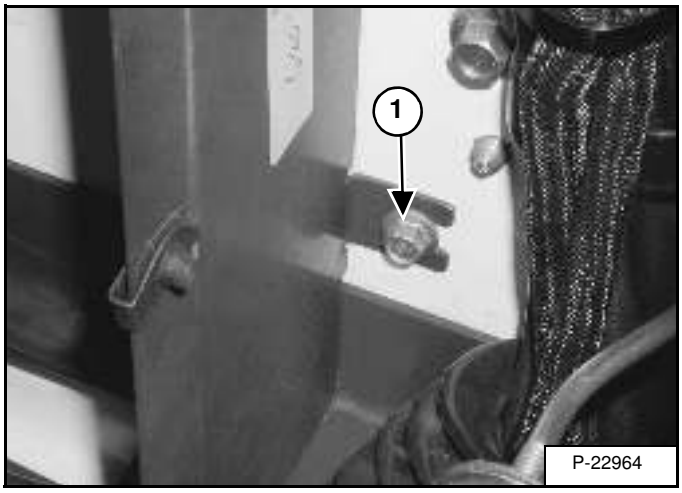


Figure 40-120-7

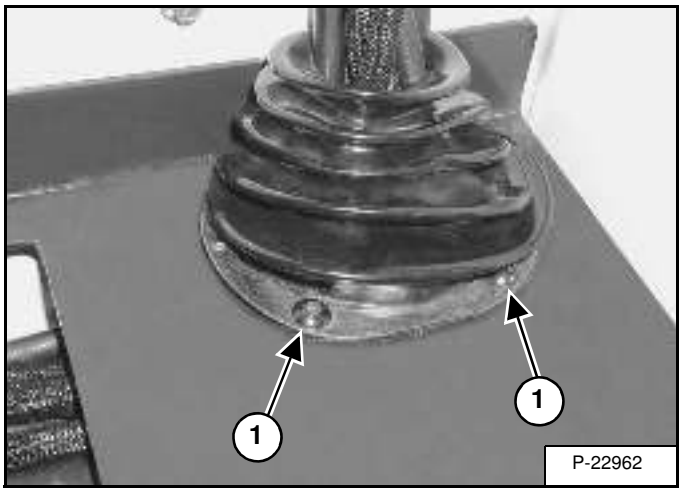


Loosen the top bolt (Item 1) and bottom bolt (Item 1) **[Figure 40-120-7]** and remove the console side frame.

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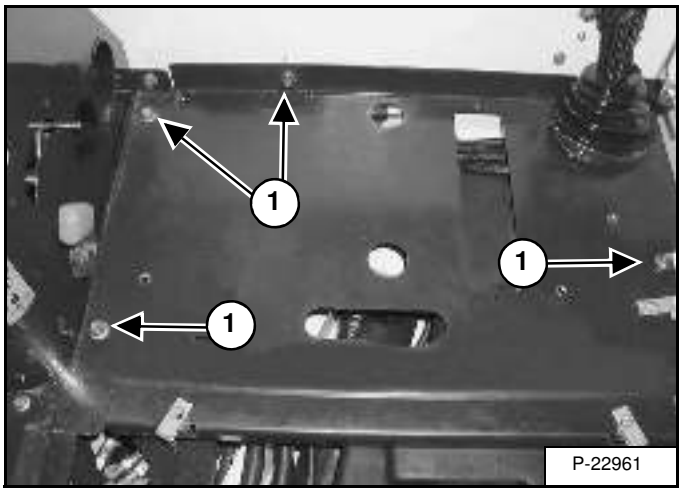
Removal And Installation (Cont'd)

Figure 40-120-8



Remove the four screws (Item 1) **[Figure 40-120-8]** and slide the dust boot up.

Figure 40-120-9



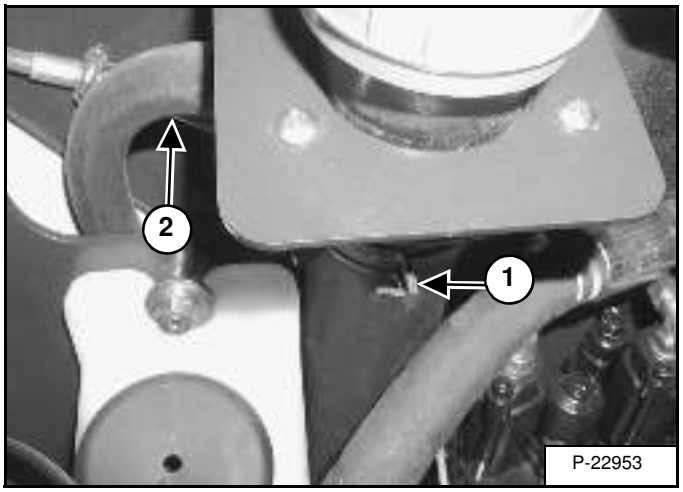
Remove the four bolts (Item 1) **[Figure 40-120-9]** from the floor pan.

Figure 40-120-10



Pull out on the cab frame (if equipped) and remove the rear floor pan **[Figure 40-120-10]**.

Figure 40-120-11

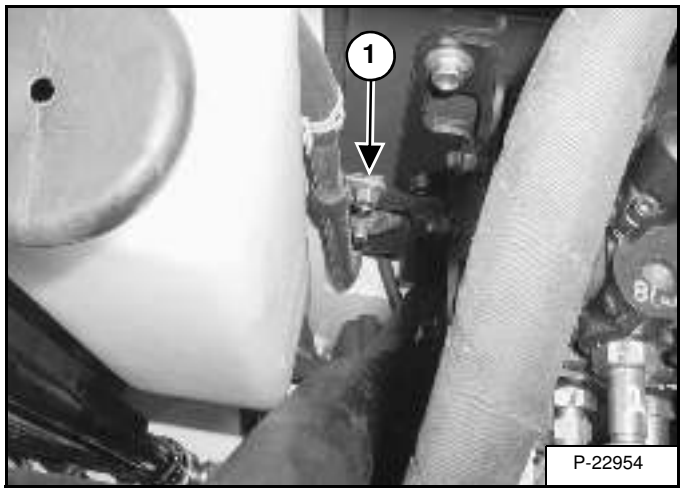


Disconnect the fuel fill hose (Item 1) and vent tube (Item 2) **[Figure 40-120-11]** from the fuel fill.

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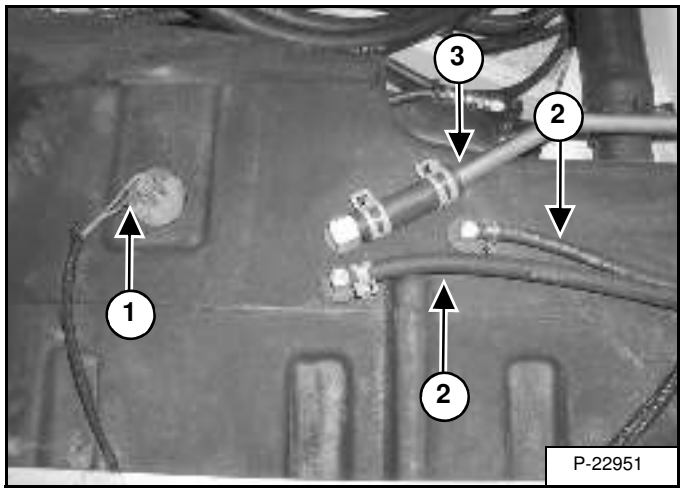
Removal And Installation (Cont'd)

Figure 40-120-12



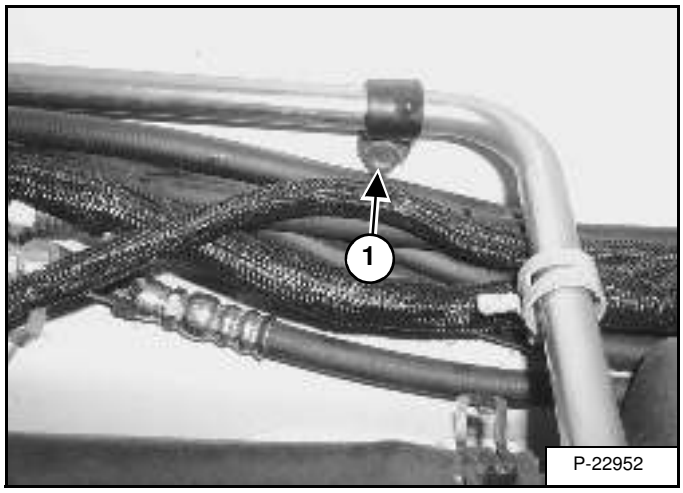
Remove the bolt and clamp (Item 1) **[Figure 40-120-12]** from the vent tube.

Figure 40-120-13



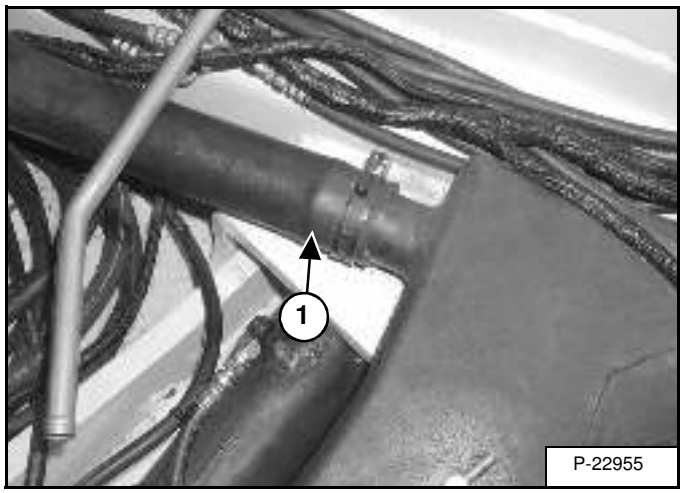
Remove the fuel sending unit wire harness (Item 1), two hoses (Item 2) and vent tube (Item 3) **[Figure 40-120-13]**.

Figure 40-120-14



Remove the bolt and clamp (Item 1) **[Figure 40-120-14]** from the vent tube line. Reposition the vent tubeline to provide clearance when removing the fuel tank.

Figure 40-120-15

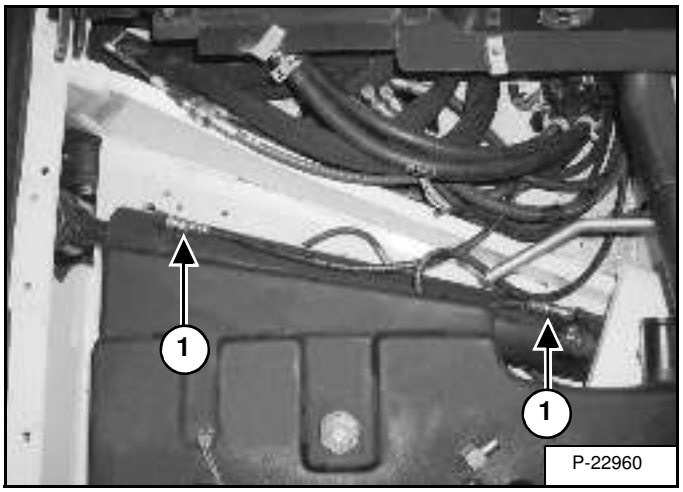


Remove the fuel fill hose (Item 1) **[Figure 40-120-15]**.

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Removal And Installation (Cont'd)

Figure 40-120-16



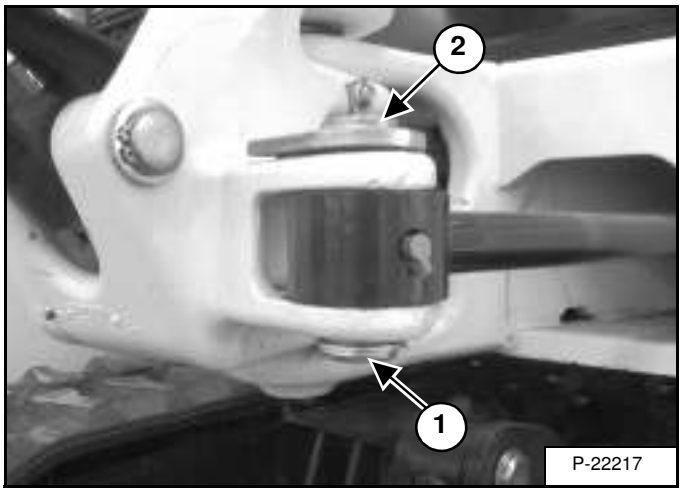
Mark and remove the boom swing cylinder base and rod end hoses (Item 1) **[Figure 40-120-16]**.

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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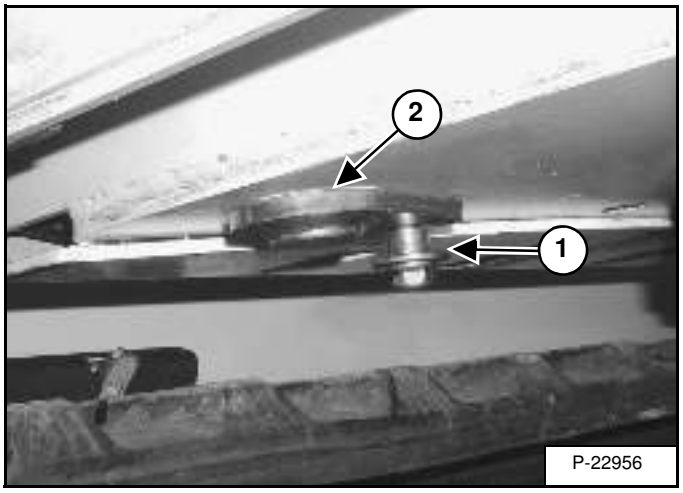
Figure 40-120-17



Remove the retaining ring (Item 1) **[Figure 40-120-17]** and washer.

Remove the rod end pivot pin (Item 2) **[Figure 40-120-17]**.

Figure 40-120-18



Remove the bolt, washer and spacer (Item 1) **[Figure 40-120-18]**.

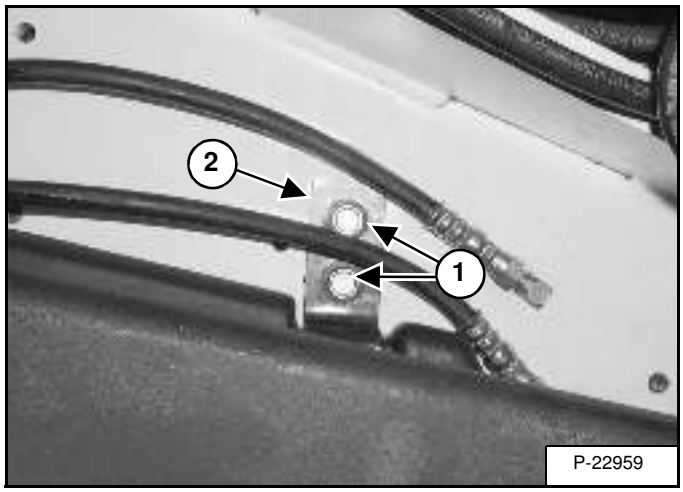
Remove the base end pivot pin (Item 2) **[Figure 40-120-18]**.

Remove the cylinder.

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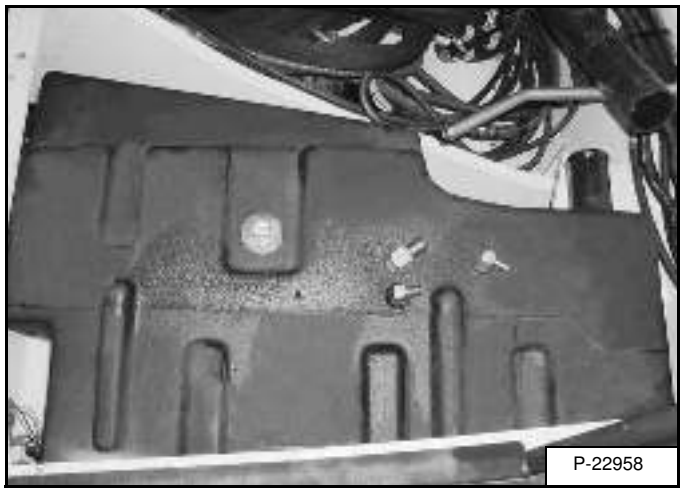
Removal And Installation (Cont'd)

Figure 40-120-19



Remove the two bolts (Item 1) and fuel tank mount (Item 2) **[Figure 40-120-19]**.

Figure 40-120-20



Remove the fuel tank (Item 1) **[Figure 40-120-20]**.

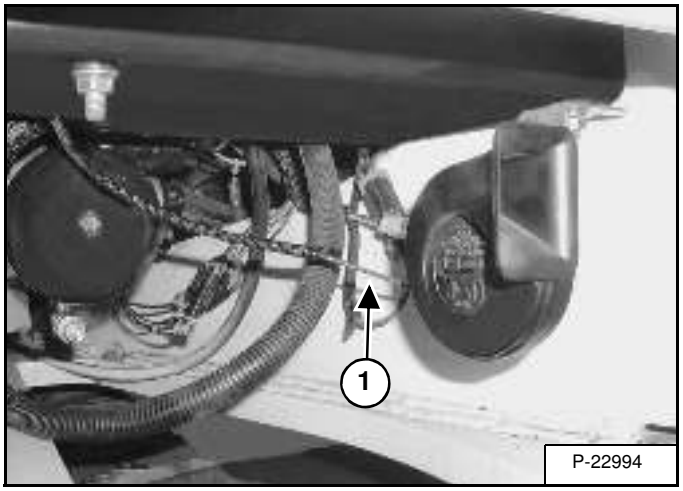
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HORN

Removal And Installation

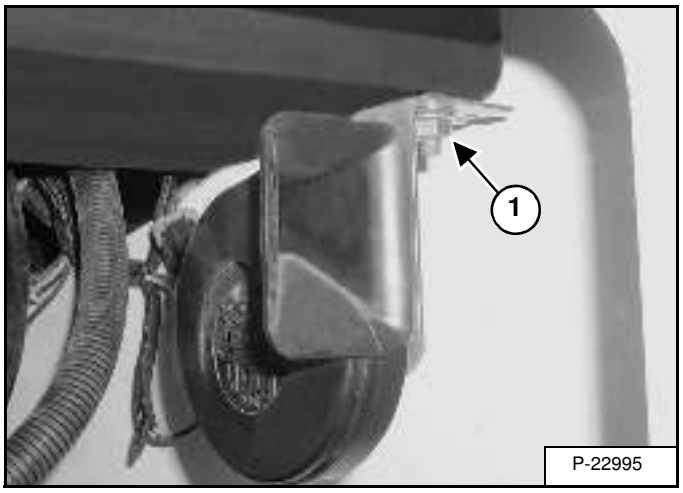
Access the horn through the right front side of the upperstructure.

Figure 40-130-21



Disconnect the horn from the wire harness (Item 1) **[Figure 40-130-21]**.

Figure 40-130-22



Remove the mount bolt (Item 1) **[Figure 40-130-22]** and remove the horn.

NOTE: The horn mount bolt is also the left battery clamp mount bolt.

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SWING FRAME

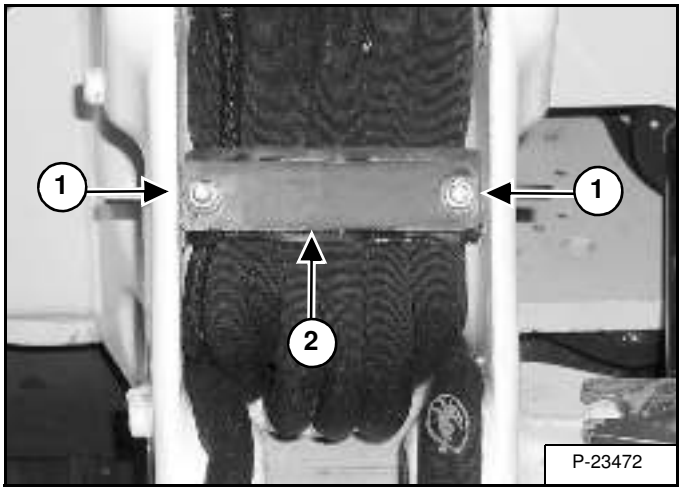
Boom Swing Bracket Removal And Installation

Rotate the upperstructure so the blade is to the rear of the excavator.

Remove the arm. (See Removal And Installation on Page 40-160-1.)

Remove the boom. (See Removal And Installation on Page 40-150-1.)

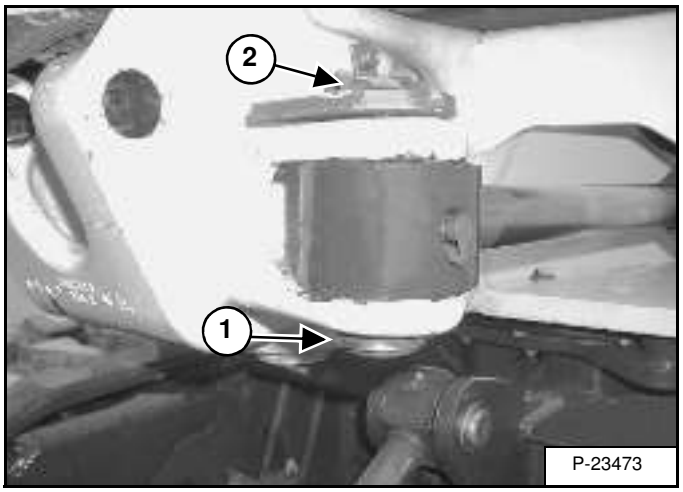
Figure 40-140-1



Remove the two bolts (Item 1) and the clamp (Item 2) **[Figure 40-140-1]**.

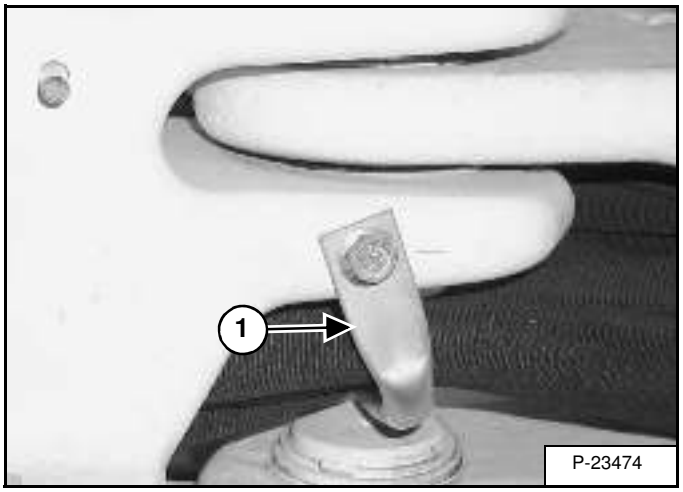
NOTE: When the hoses have been removed from the clamped position, the hoses must be measured for correct clamped length and position. (See Boom Swing Bracket Hose Installation on Page 40-140-5.)

Figure 40-140-2



Remove the snap ring (Item 1), washer, and pin (Item 2) **[Figure 40-140-2]** from the boom swing bracket.

Figure 40-140-3



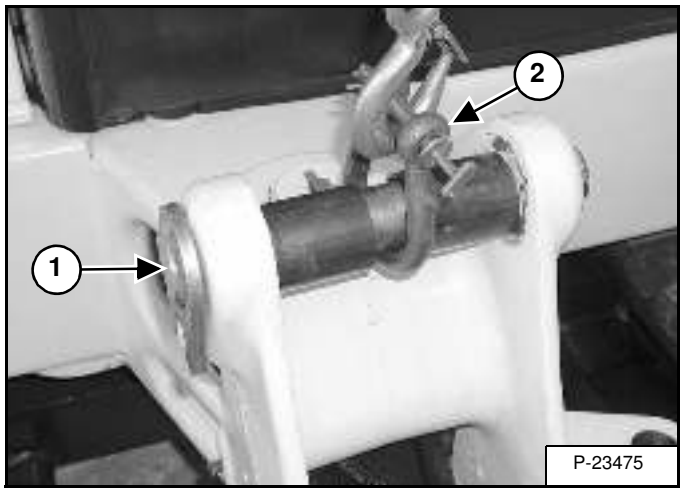
Remove the hose bracket (Item 1) **[Figure 40-140-3]**.

Reposition the hoses to gain clearance.

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Boom Swing Bracket Removal And Installation (Cont'd)

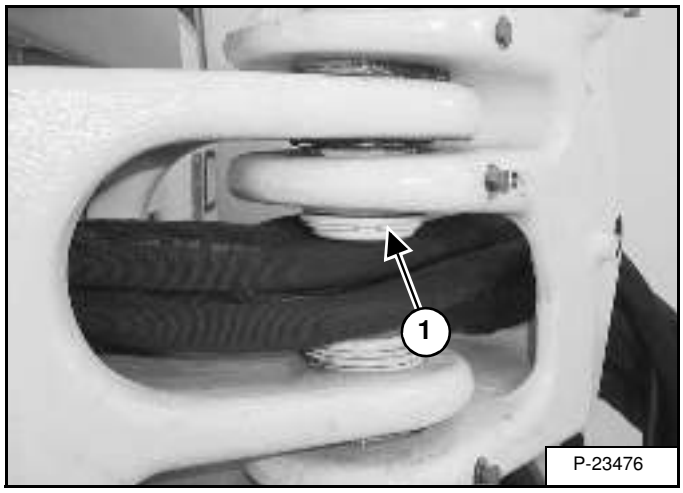
Figure 40-140-4



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 boom swing bracket to tip from side to side.

Figure 40-140-5



Remove the snap ring (Item 1) **[Figure 40-140-5]** and washer from the top pin.

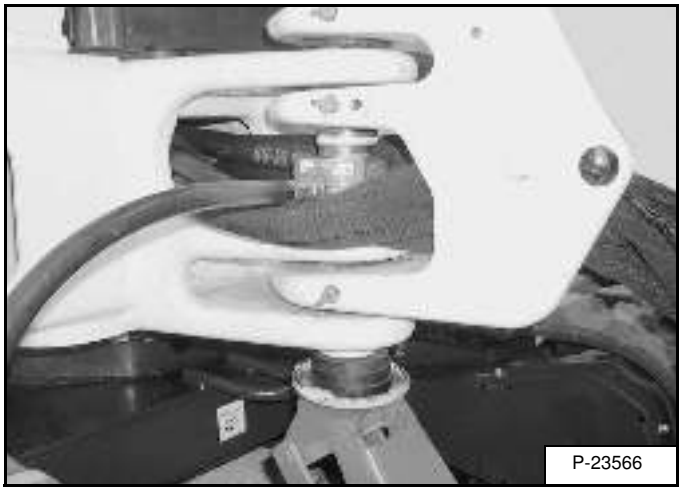
IMPORTANT

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.

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Support the bottom pin with a jack.

Figure 40-140-6

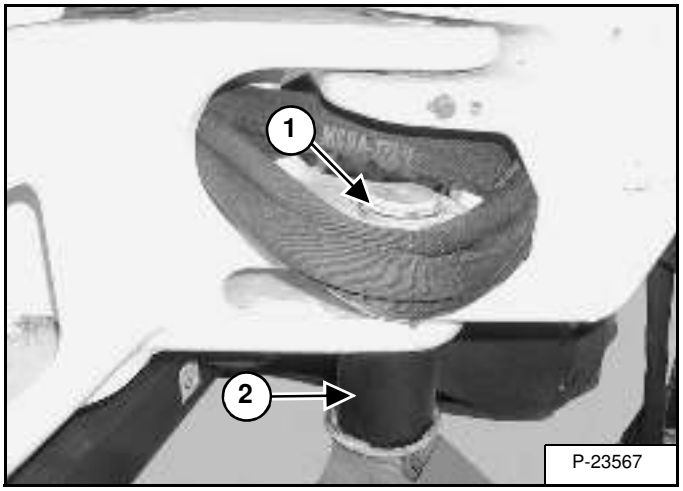


Install a porta-power between the top and bottom pins and press the top pin out **[Figure 40-140-6]**.

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Boom Swing Bracket Removal And Installation (Cont'd)

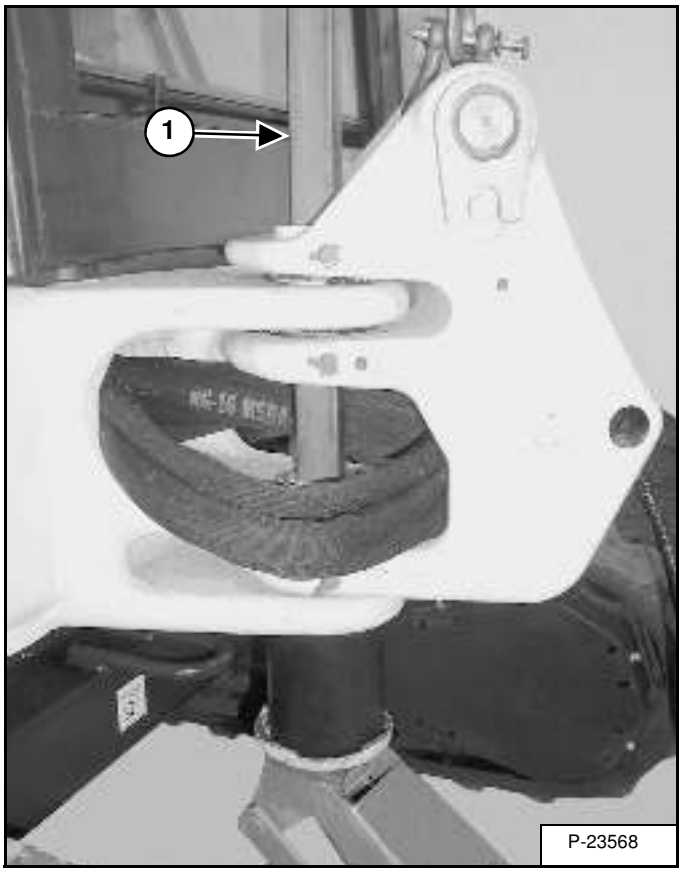
Figure 40-140-7



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 bracket 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.

Figure 40-140-8



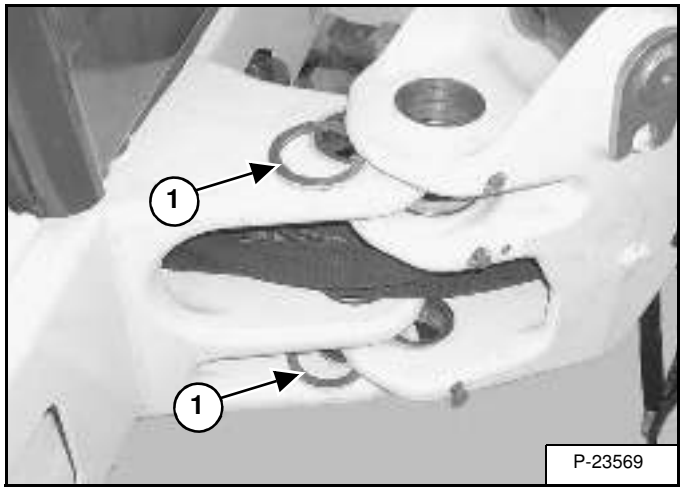
Use a large punch (Item 1) **[Figure 40-140-8]** and drive the bottom swing bracket pin out.

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.

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Boom Swing Bracket Removal And Installation (Cont'd)

Figure 40-140-9

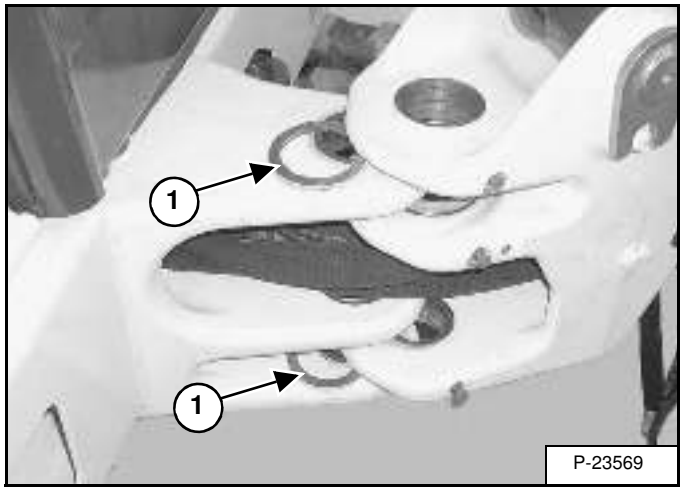


Remove the top and bottom spacer (Item 1) **[Figure 40-140-9]** from the swing bracket.

Remove the swing bracket.

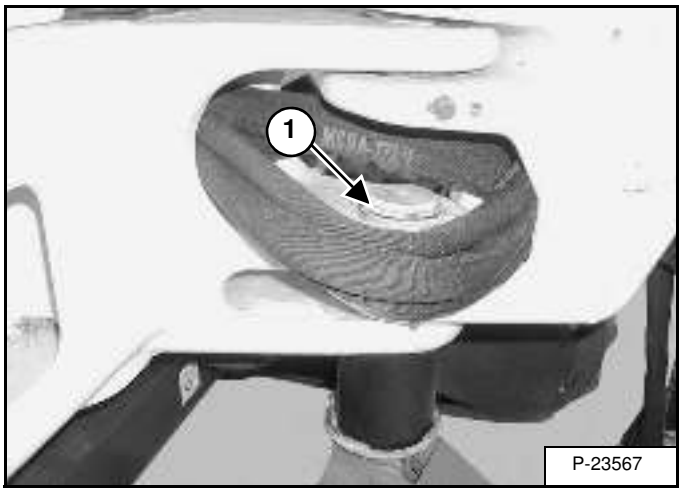
Inspect the bushings for damage. Replace damaged bushings as necessary. (See Boom Bushing Removal And Installation on Page 40-150-2.)

Figure 40-140-10



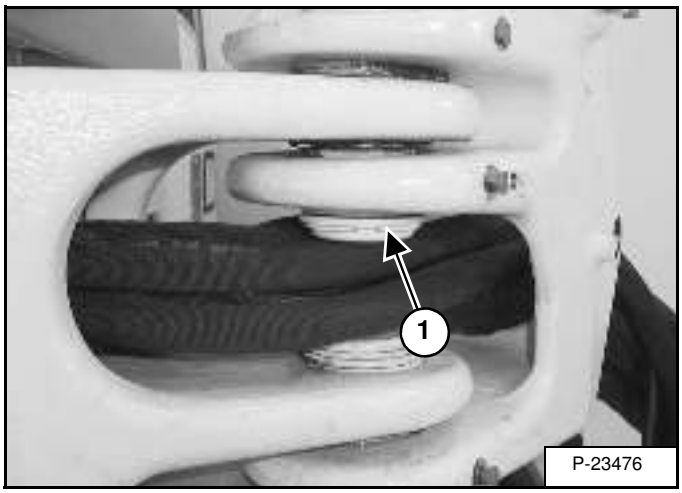
Installation: Install the top and bottom spacer (Item 1) **[Figure 40-140-10]** on the swing bracket. Install the swing bracket.

Figure 40-140-11



Installation: Align the boom swing bracket and install the lower pin. Install the washer and snap ring (Item 1) **[Figure 40-140-11]**. Lift up on the boom swing bracket.

Figure 40-140-12



Installation: Install the top pin, washer and snap ring (Item 1) **[Figure 40-140-12]**.

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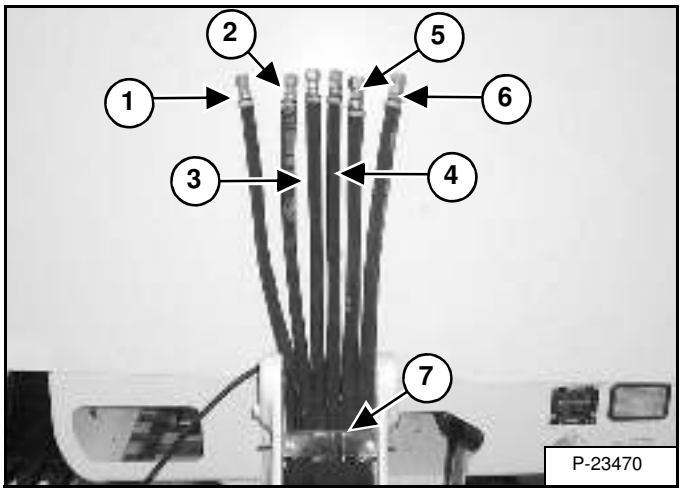
Boom Swing Bracket Hose Installation

IMPORTANT

Hoses must not be forced to align with the control valve fittings or damage may result during Stump Grinder operation.

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Figure 40-140-13



Route the hoses through the boom swing bracket as follows **[Figure 40-140-13]**:

1. Bucket Rod End Hose
2. Bucket Base End Hose
3. Arm Base End Hose
4. Arm Rod End Hose
5. Male Quick Coupler Hose
6. Female Quick Coupler 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 30 inches (762 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

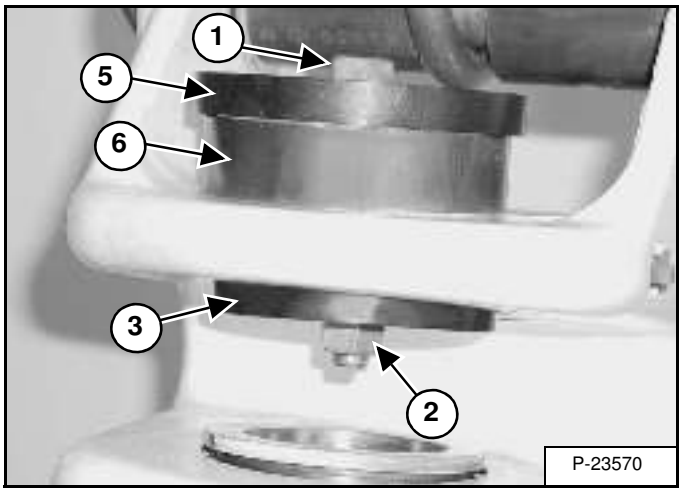
Do Not point (hammer) on the boom swing bracket. Excess pressure can cause the casting to crack.

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The following parts will be needed for removal and installation of the boom swing bracket bushings:

1. Bolt - 5/8 x 4.0 inches or (15 x 101 mm) long.
2. Nut - 5/8 inch or (15 mm).
3. Washer -3/4 I.D. x 3 O.D. x 3/8 inch thick or (19 mm I.D. x 79 mm O.D. x 10 mm thick.
4. Washer - 3/4 I.D. x 3-1/2 O.D. x 3/8 inch thick or (19 mm I.D. x 79 mm O.D. x 10 mm thick).
5. Washer - 3/4 I.D. x 4-1/2 O.D. x 1.0 inch thick or (19 mm I.D. 114 mm O.D. x 25 mm thick).
6. Spacer - 3-9/16 I.D. x 4-5/16 O.D. x 1-1/2 inch thick or (90 mm I.D. x 110 mm O.D. x 25 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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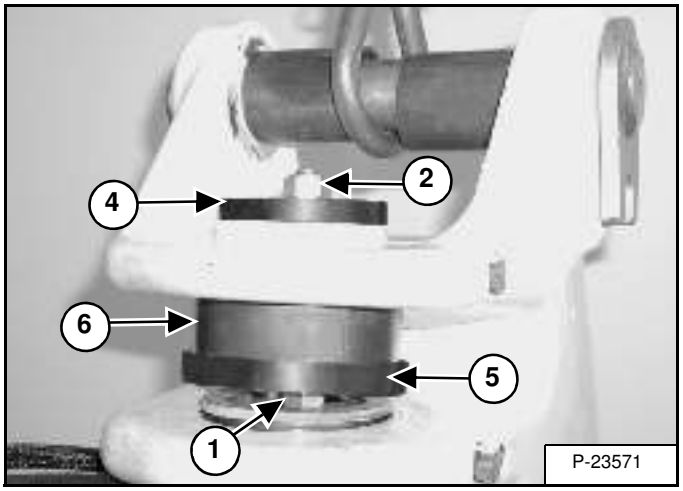
Bushing Installation

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

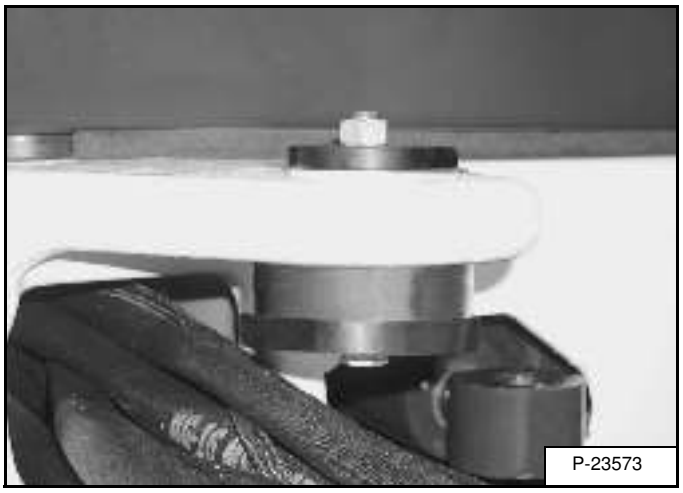
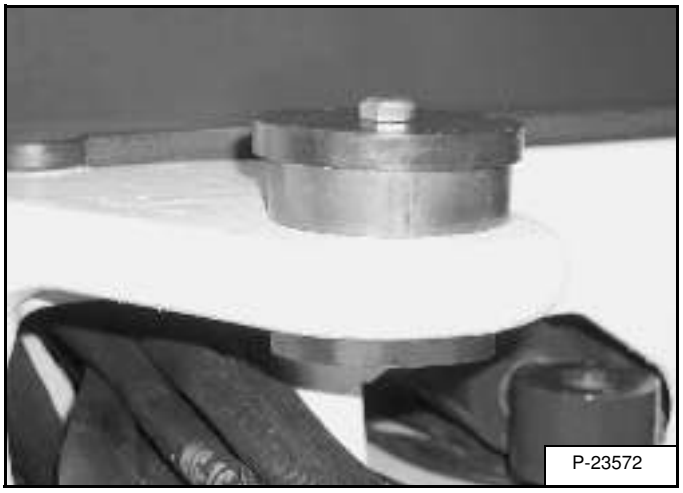


Figure 40-140-18



The same procedure is used to remove and install the bushings into the frame castings **[Figure 40-140-17]** & **[Figure 40-140-18]**.

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Dealer Copy -- Not for Resale

BOOM

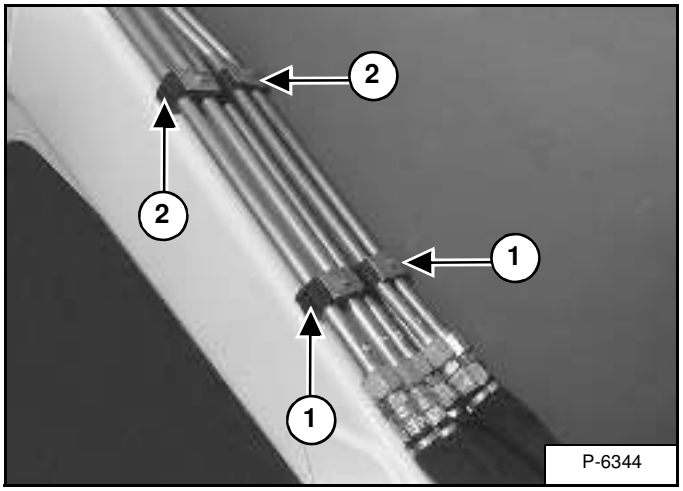
Removal And Installation

Remove the arm. (See Removal And Installation on Page 40-160-1.)

Remove the boom cylinder. (See Removal And Installation on Page 20-22-3.)

Mark all hoses for ease of assembly.

Figure 40-150-1



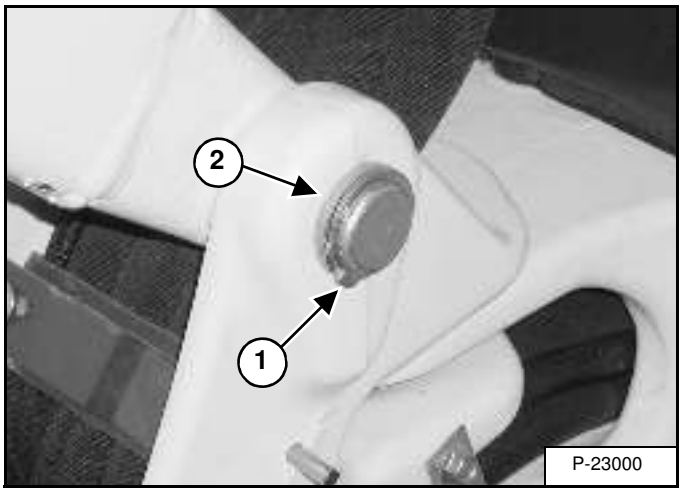
Remove the tubeline clamps (Item 1) **[Figure 40-150-1]**.

Loosen the upper tubeline clamps (Item 2) **[Figure 40-150-1]**.

Mark the hoses & tubes for ease of installation.

Remove all the cylinder hoses from the tubes on the boom **[Figure 40-150-1]**.

Figure 40-150-2



Remove the snap ring (Item 1) and washers (Item 2) **[Figure 40-150-2]** from the pivot pin.

Remove the pivot pin.

Figure 40-150-3



Remove the boom **[Figure 40-150-3]**.

Dealer Copy -- Not for Resale

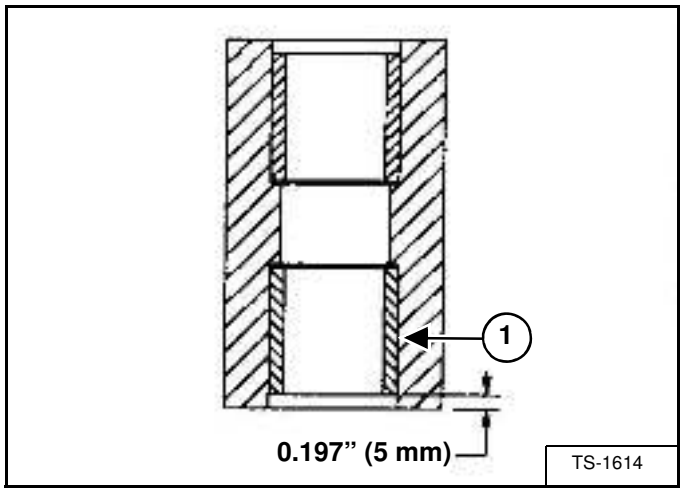
Boom Bushing Removal And Installation

Remove the boom. (See Removal And Installation on Page 40-150-1.)

Remove the dust seals from both sides of the boom.

Remove the bushings from both sides of the boom.

Figure 40-150-4



Install the bushings (Item 1) **[Figure 40-150-4]** until they are seated 0.197 inch (5 mm) in the pin boss (Both sides).

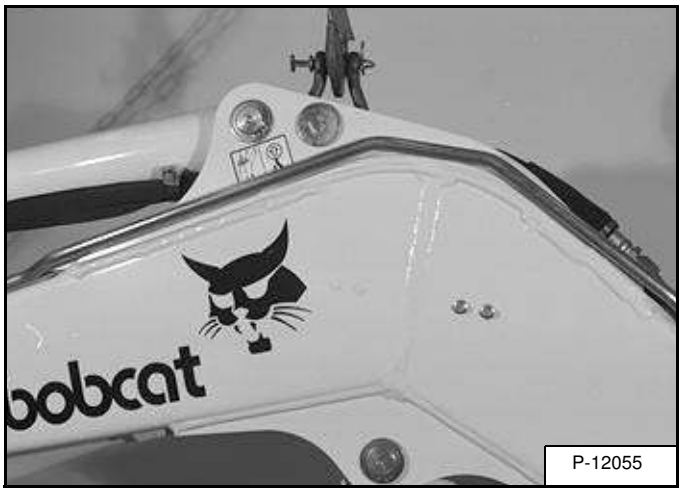
Install new dust seals.

Dealer Copy -- Not for Resale

ARM

Removal And Installation

Figure 40-160-1

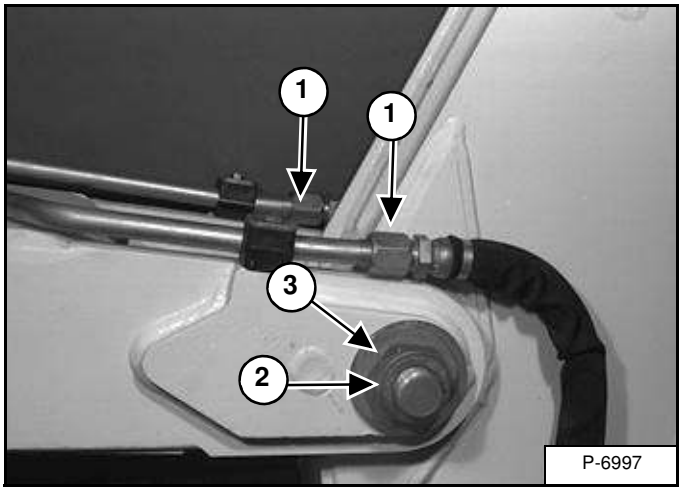


Support the boom **[Figure 40-160-1]**.

Remove the arm cylinder. (See Removal And Installation on Page 20-21-3.)

Support the arm with a chain hoist.

Figure 40-160-2



Disconnect the bucket cylinder hoses (Item 1) **[Figure 40-160-2]**.

Remove the nut (Item 2) and the washer (Item 3) **[Figure 40-160-2]** from the boom mounting pin.

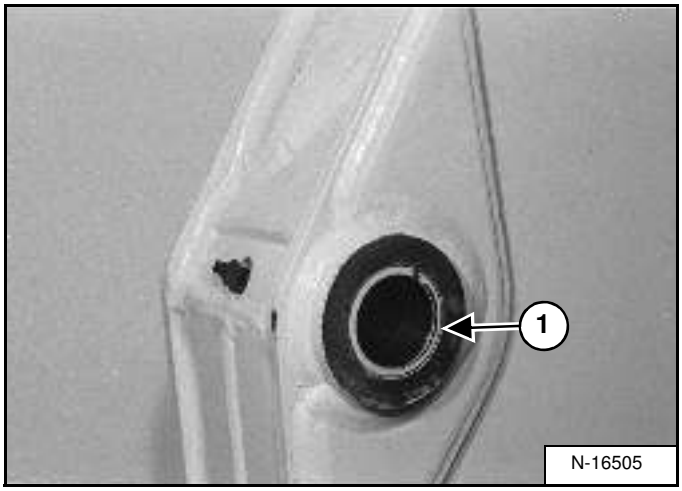
Installation: Tighten the lock nut until it is seated firmly against the boom. Do not over tighten and deflect the boom mounting plates. The arm must pivot freely.

Remove the arm.

Arm To Boom Bushing Removal And Installation

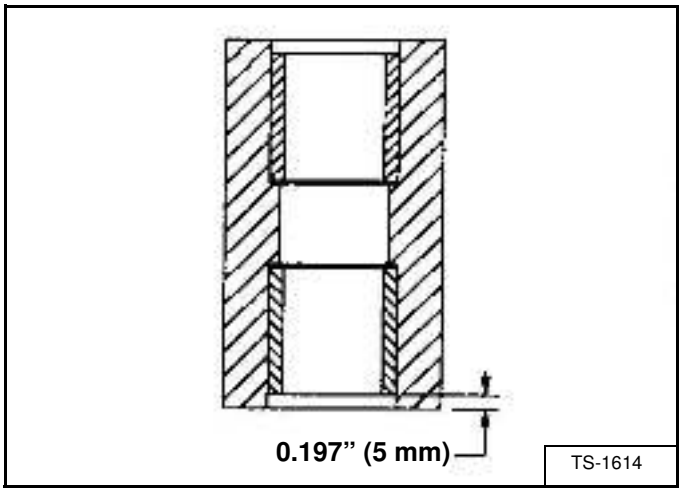
Remove the dust seal (if equipped) from both sides of the arm.

Figure 40-160-3



Remove the bushings (Item 1) **[Figure 40-160-3]** from both sides of the arm.

Figure 40-160-4



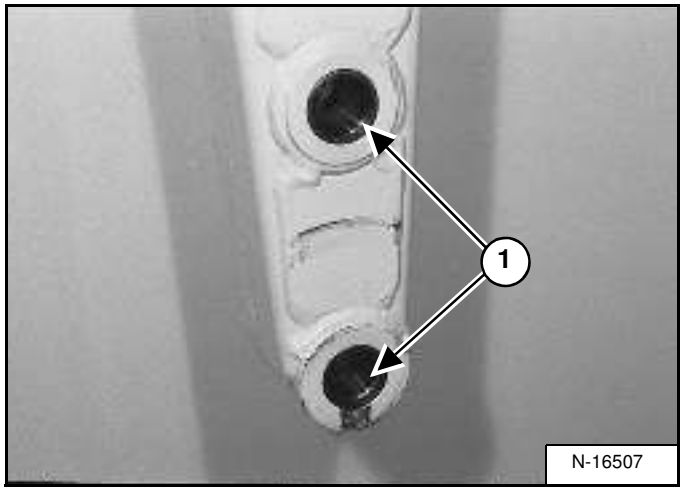
Install the bushings until they are seated 0.197 inches (5 mm) in the pin boss **[Figure 40-160-4]** (both sides).

Install new dust seals (if equipped).

Dealer Copy -- Not for Resale

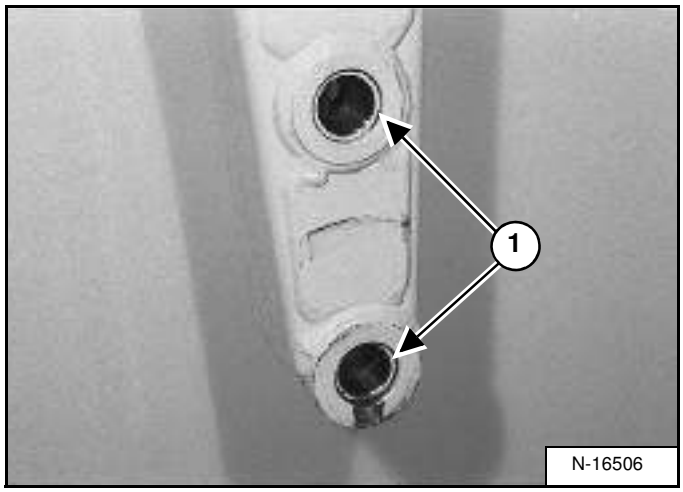
Arm To Bucket And Bucket Link Bushing Removal And Installation

Figure 40-160-5



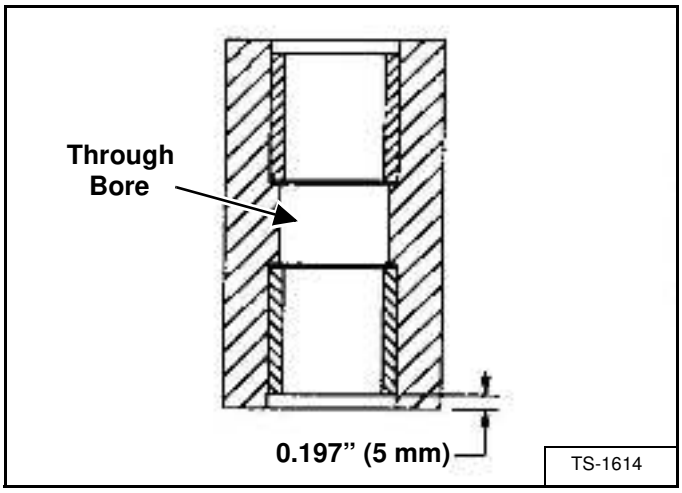
Remove the dust seals (Item 1) **[Figure 40-160-5]** from both sides of the arm.

Figure 40-160-6



Remove the bushings (Item 1) **[Figure 40-160-6]** from both sides of the arm.

Figure 40-160-7



Install the bushings until they are seated 0.197 inches (5 mm) in the pin boss **[Figure 40-160-7]** (both sides).

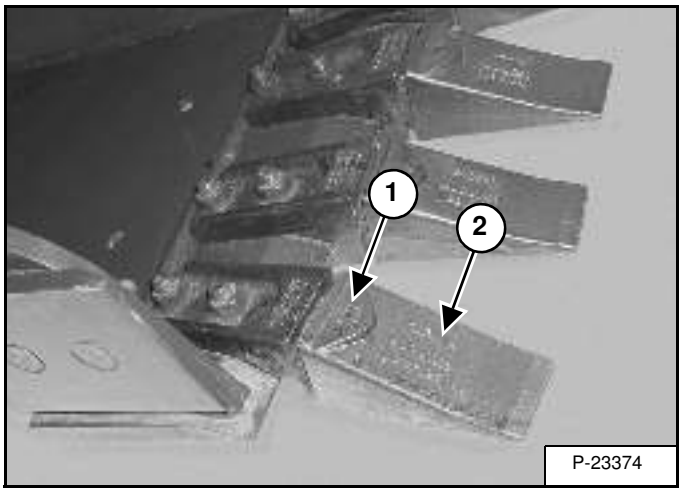
Install the dust seals (Item 1) **[Figure 40-160-5]** on both sides of the arm.

Dealer Copy -- Not for Resale

BUCKET

Bucket Teeth Removal And Installation

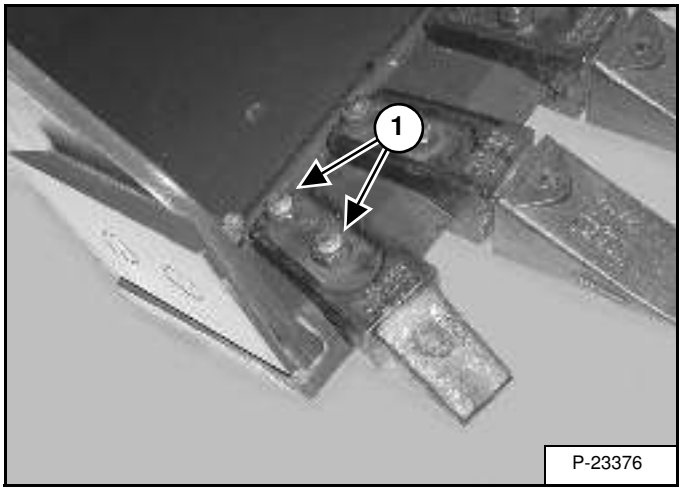
Figure 40-170-1



Remove the roll pin (Item 1) **[Figure 40-170-1]**.

Remove the bucket tooth (Item 2) **[Figure 40-170-1]**.

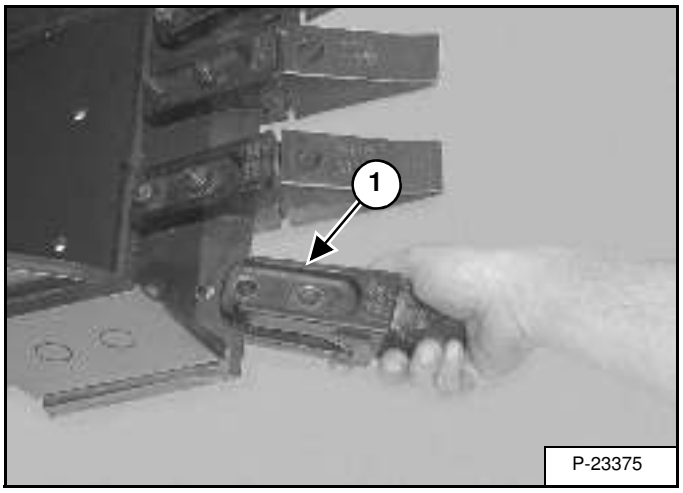
Figure 40-170-2



Remove the two nuts (Item 1) **[Figure 40-170-2]** and bolts.

Installation: Tighten the nuts to 65-70 ft.-lbs. (88-95 Nm) torque.

Figure 40-170-3

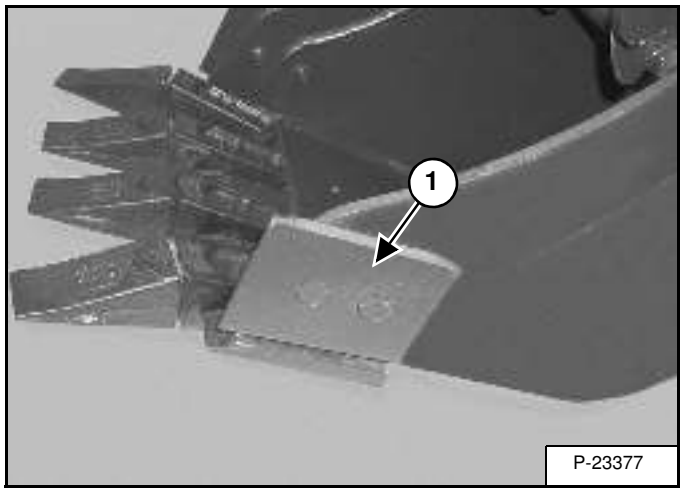


Remove the bucket tooth mount (Item 1) **[Figure 40-170-3]**.

Dealer Copy -- Not for Resale

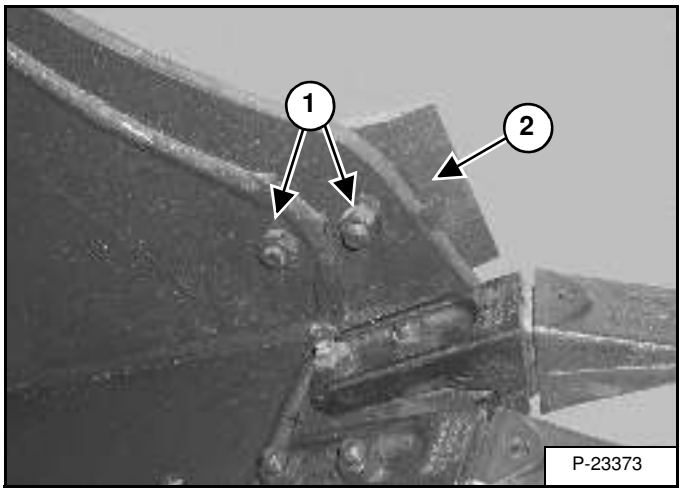
Bucket Side Cutting Edge Removal And Installation

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.-lbs. (125-135 Nm) torque.

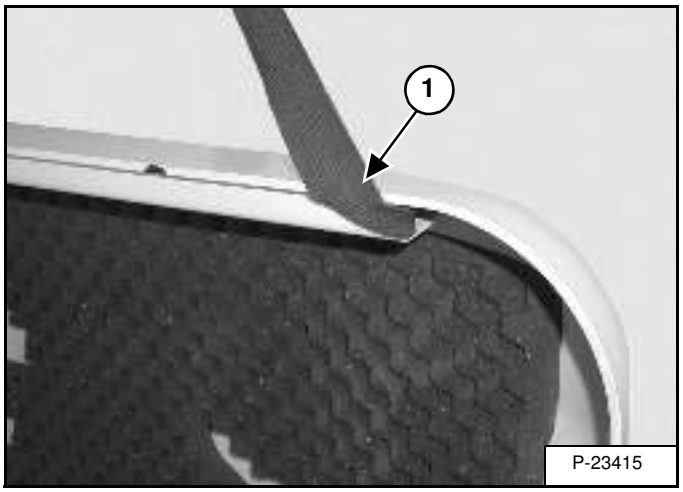
Remove the cutting edge (Item 2) **[Figure 40-170-5]**.

Dealer Copy -- Not for Resale

TAILGATE

Removal And Installation

Figure 40-180-1



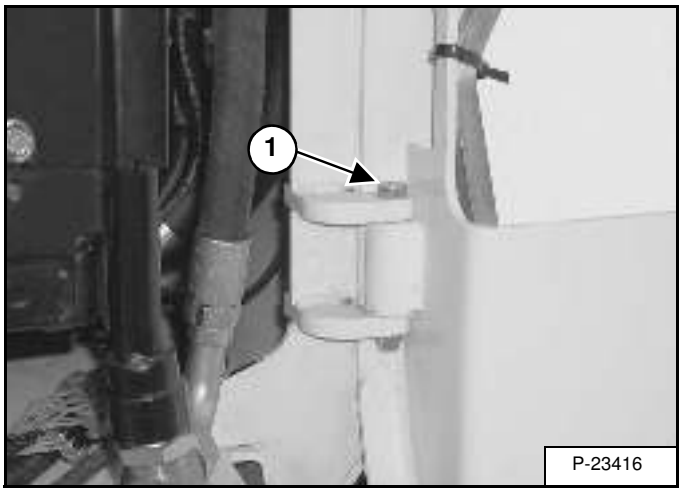
Install a sling (Item 1) **[Figure 40-180-1]** through the top tailgate brace.

Figure 40-180-2



Install an overhead hoist on the sling **[Figure 40-180-2]**.

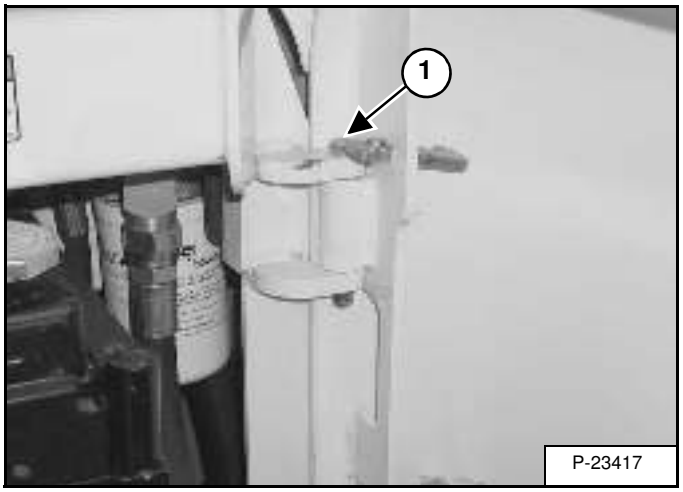
Figure 40-180-3



Remove the bottom bolt (Item 1) **[Figure 40-180-3]** and nut.

Installation: Tighten the bolts 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.

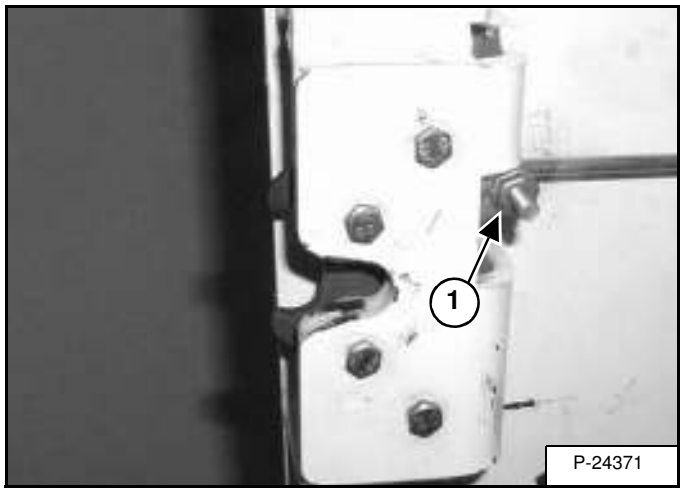
Remove the tailgate.

Dealer Copy -- Not for Resale

TAILGATE (CONT'D)

Release Rod Removal And Installation

Figure 40-180-5



Remove the nut (Item 1) **[Figure 40-180-5]** from the tailgate release rod.

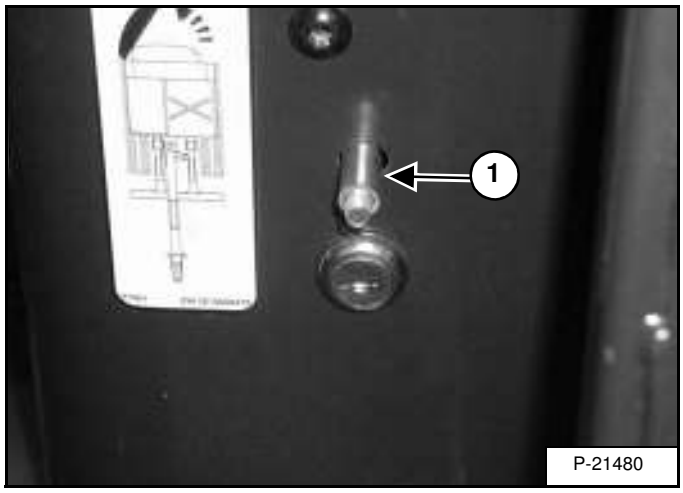
Remove the rod from the door latch.

Figure 40-180-6



At the cab, remove the knob from the release rod **[Figure 40-180-6]**.

Figure 40-180-7



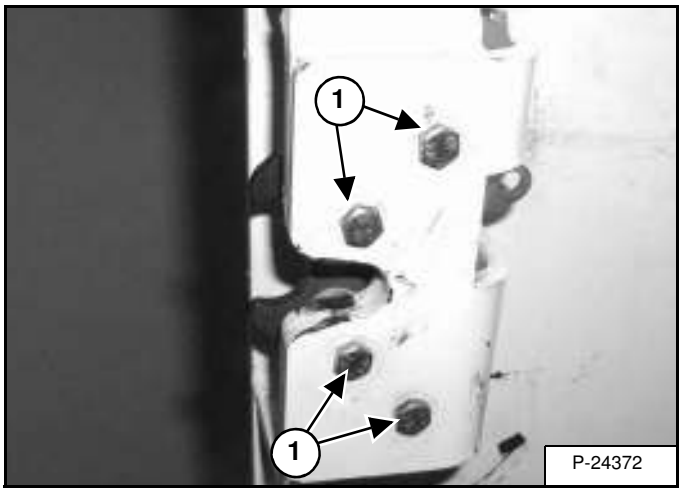
Remove the spacer from the release rod (Item 1) **[Figure 40-180-7]**.

Remove the release rod from the excavator at the engine compartment.

Dealer Copy -- Not for Resale

Latch Removal And Installation

Figure 40-180-8

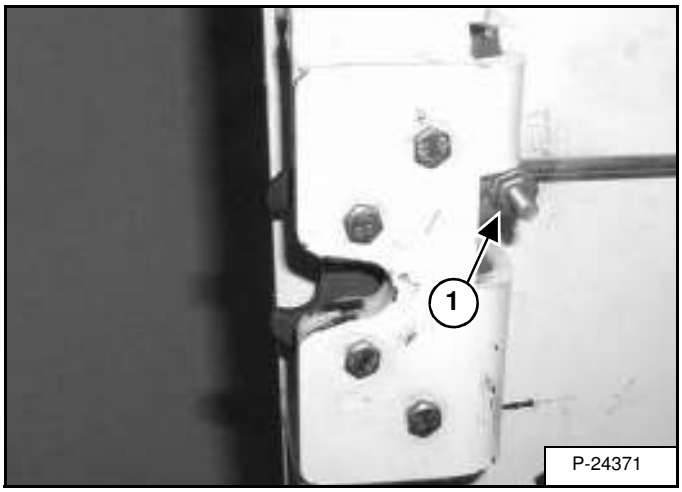


Remove the four bolts (Item 1) **[Figure 40-180-8]** from the tailgate latch.

Remove the latch from the excavator.

Release Rod Removal And Installation (Early Models)

Figure 40-180-9



Remove the nut (Item 1) **[Figure 40-180-9]** from the tailgate release rod.

Remove the rod from the door latch.

Figure 40-180-10

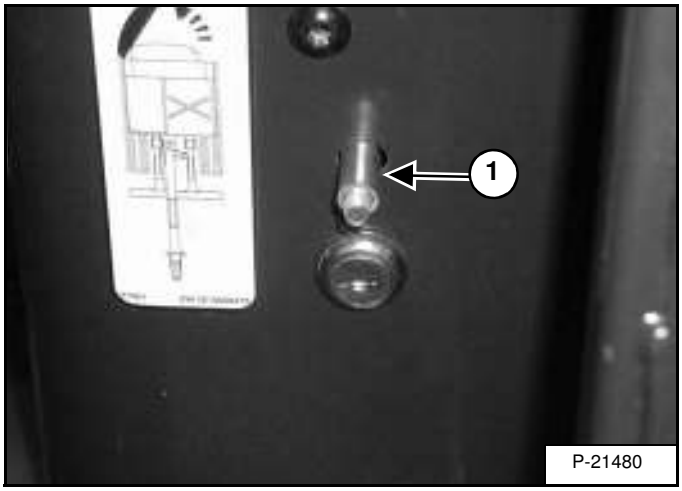


At the cab, remove the knob (Item 1) **[Figure 40-180-10]** from the release rod.

Dealer Copy -- Not for Resale

Release Rod Removal And Installation (Early Models) (Cont'd)

Figure 40-180-11

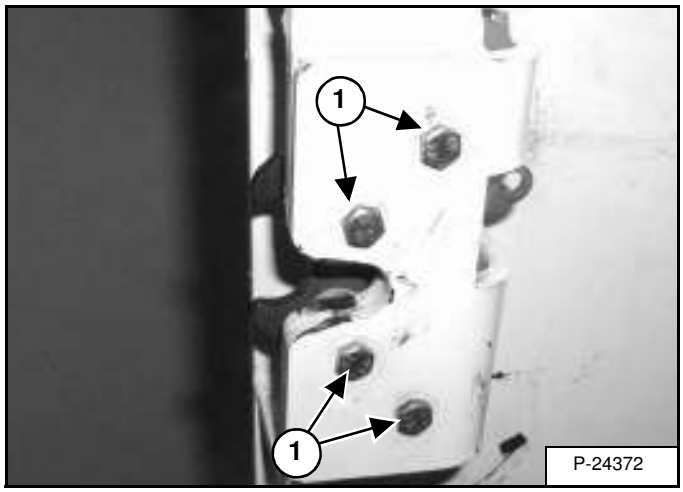


Remove the spacer (Item 1) **[Figure 40-180-11]**from the release rod.

Remove the release rod from the excavator at the engine compartment.

Latch Removal And Installation (Early Models)

Figure 40-180-12



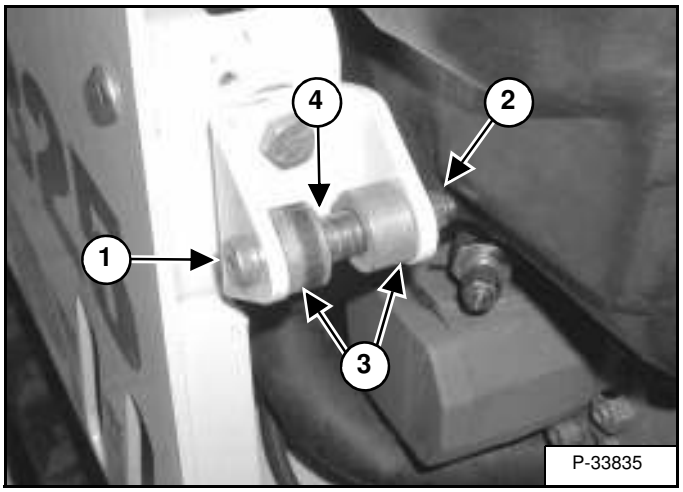
Remove the four bolts (Item 1) **[Figure 40-180-12]** from the tailgate latch.

Remove the latch from the excavator.

Dealer Copy -- Not for Resale

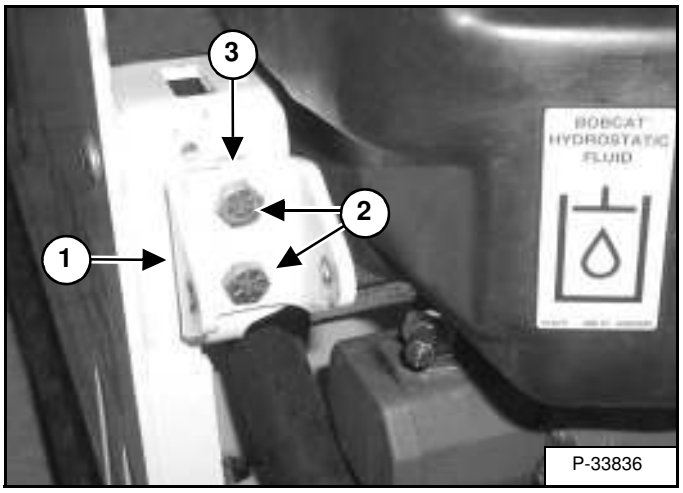
Latch Removal And Installation (Later Models)

Figure 40-180-13



Remove the bolt (Item 1), locknut (Item 2), outer rollers (Item 3) and inner roller (Item 4) **[Figure 40-180-13]**.

Figure 40-180-14

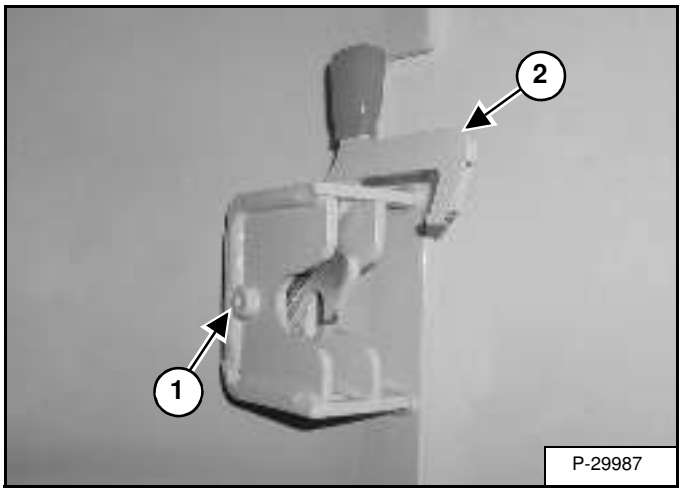


For ease of assembly, mark around the outside edge (Item 1) **[Figure 40-180-14]** of the latch bracket.

Remove the two bolts (Item 2), latch bracket and washers (Item 3) **[Figure 40-180-14]**.

See Adjusting The Tailgate Latch (Early Models) on Page 10-40-2 or Adjusting The Tailgate Latch (Later Models) on Page 10-40-3 for latch adjustment.

Figure 40-180-15



Remove the bolt (Item 1). Remove the latch assembly (Item 2) **[Figure 40-180-15]** from the tailgate.

Dealer Copy -- Not for Resale

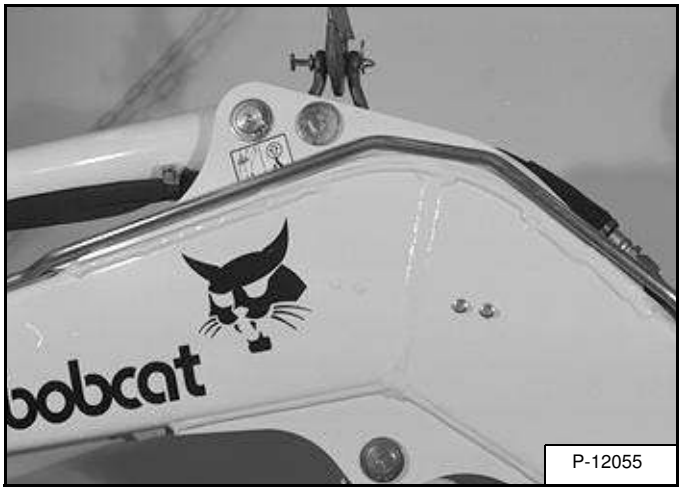


Dealer Copy -- Not for Resale

Removal And Installation

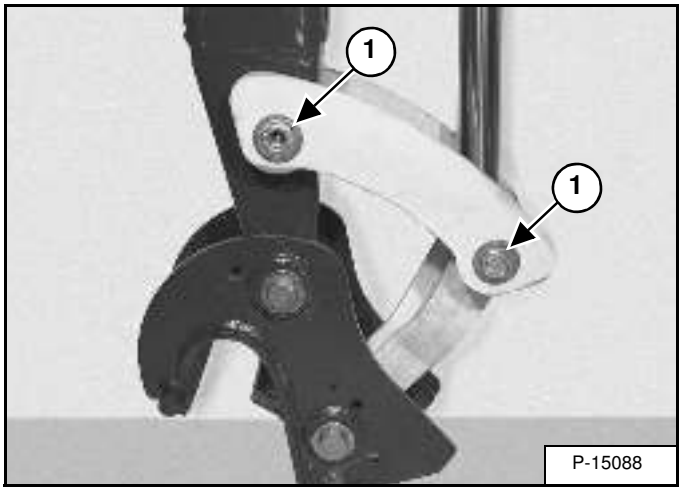
Remove the bucket. (See the *OPERATION AND MAINTENANCE MANUAL* for the correct removal procedure.)

Figure 40-190-1



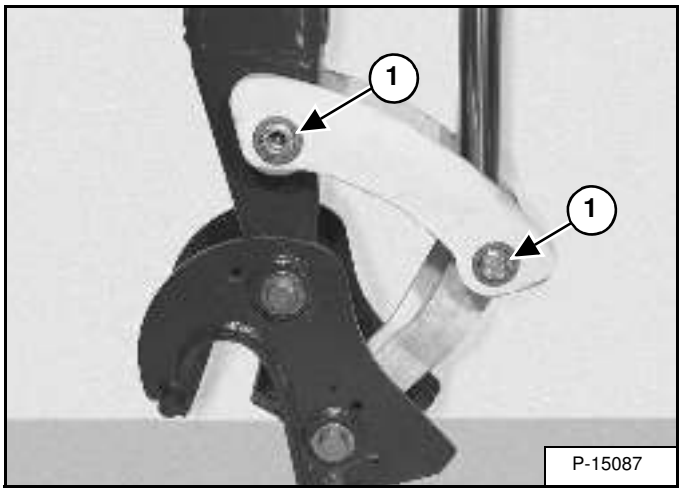
Support the boom with a hoist **[Figure 40-190-1]**.

Figure 40-190-2



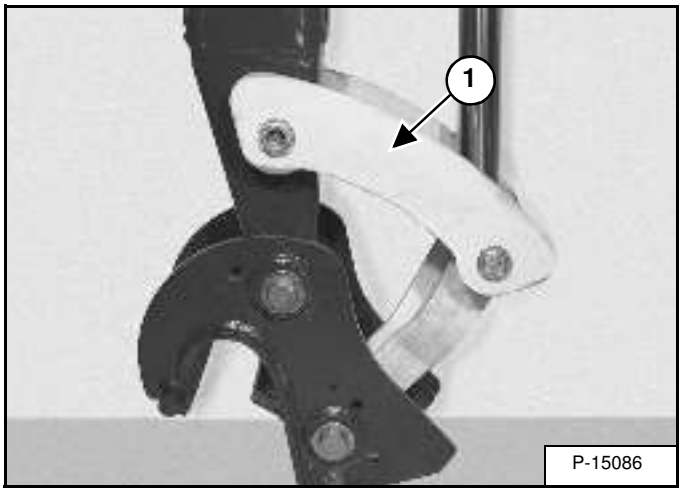
Remove the snap rings (Item 1) **[Figure 40-190-2]**.

Figure 40-190-3



Remove the washers (Item 1) **[Figure 40-190-3]**.

Figure 40-190-4

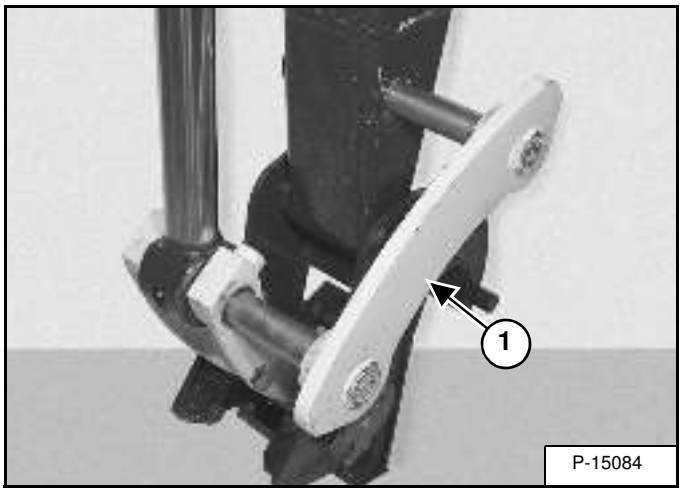


Remove the plate (Item 1) **[Figure 40-190-4]**.

Dealer Copy -- Not for Resale

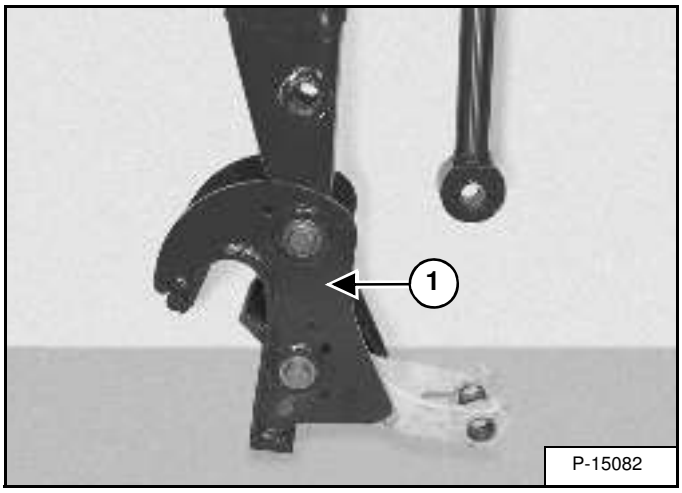
Removal And Installation (Cont'd)

Figure 40-190-5



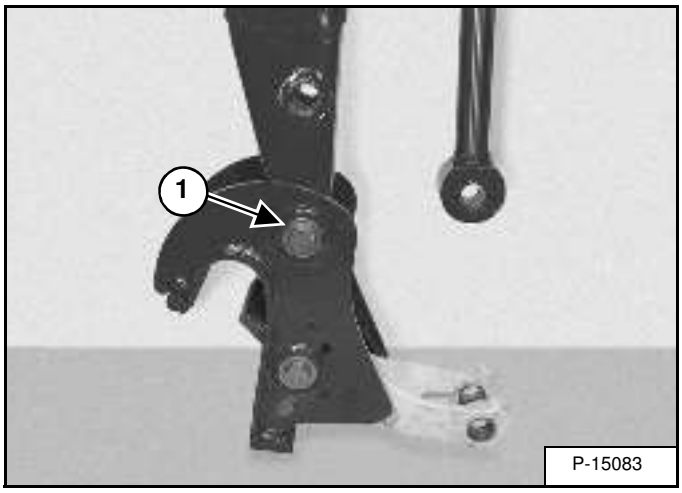
Remove the link (Item 1) **[Figure 40-190-5]**.

Figure 40-190-6



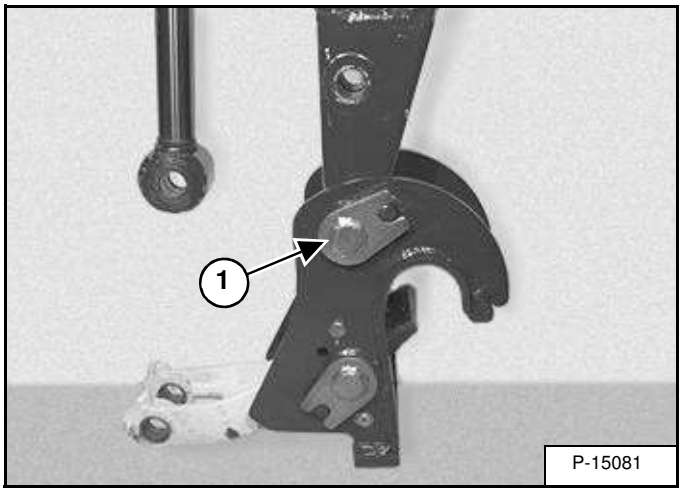
Remove the snap ring (Item 1) **[Figure 40-190-6]**.

Figure 40-190-7



Remove the washer (Item 1) **[Figure 40-190-7]**.

Figure 40-190-8

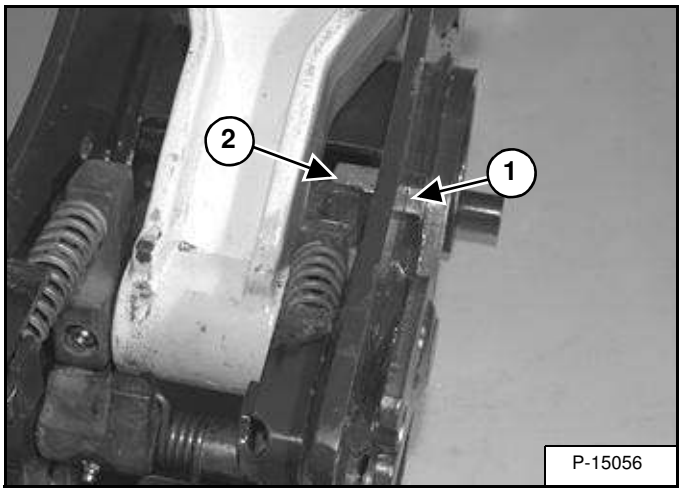


Remove the pin (Item 1) **[Figure 40-190-8]** and remove the X-Change™ from the arm.

Dealer Copy -- Not for Resale

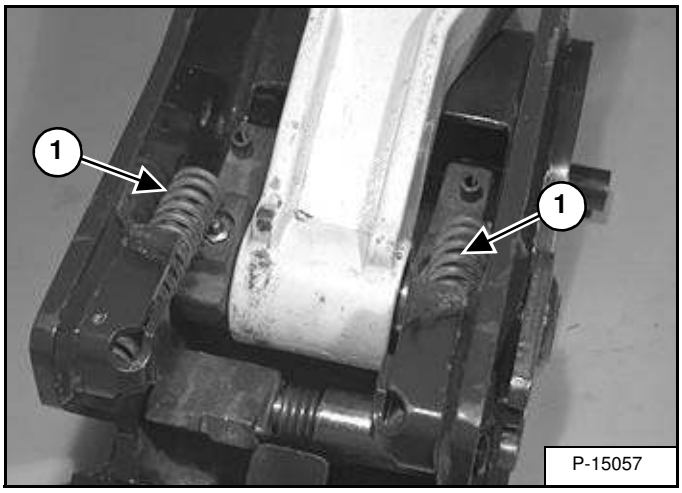
Disassembly

Figure 40-190-9



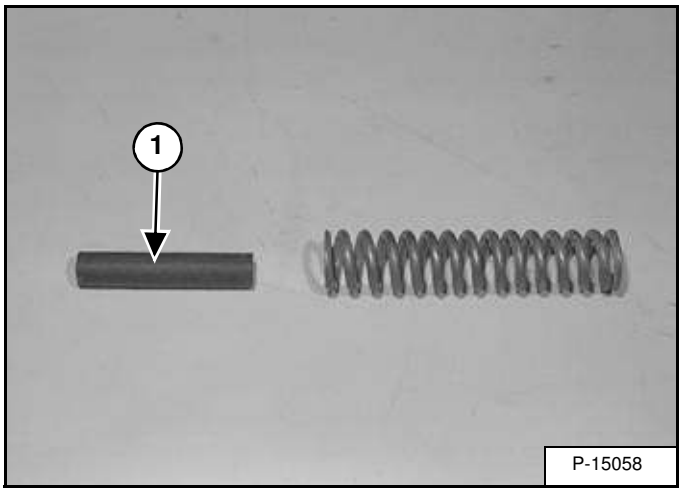
Remove the bolt (Item 1) and nut (Item 2) **[Figure 40-190-9]**.

Figure 40-190-10



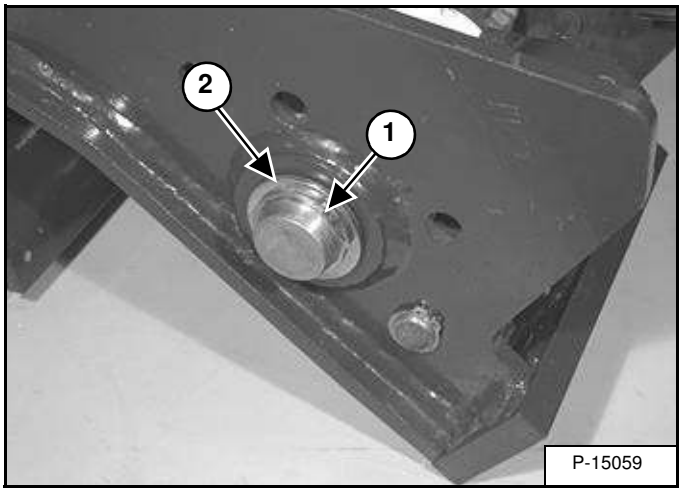
Remove the springs (Item 1) **[Figure 40-190-10]**.

Figure 40-190-11



Remove the rubber hose (Item 1) **[Figure 40-190-11]**.

Figure 40-190-12

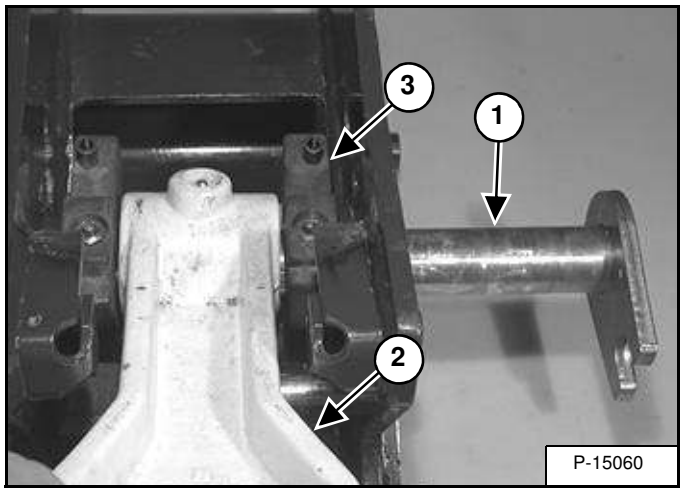


Remove the snap ring (Item 1) and washer (Item 2) **[Figure 40-190-12]**.

Dealer Copy -- Not for Resale

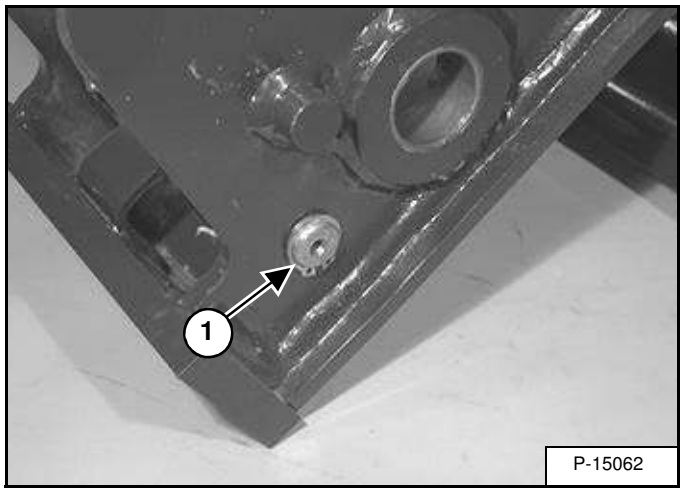
Disassembly (Cont'd)

Figure 40-190-13



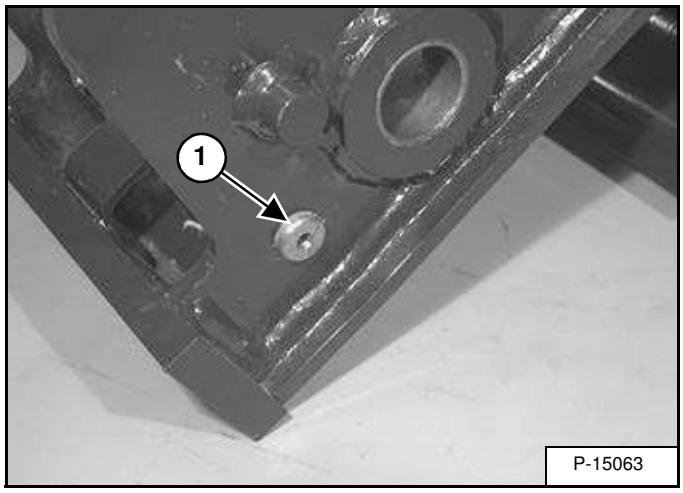
Remove the pin (Item 1), link (Item 2) and latch (Item 3) **[Figure 40-190-13]**.

Figure 40-190-14



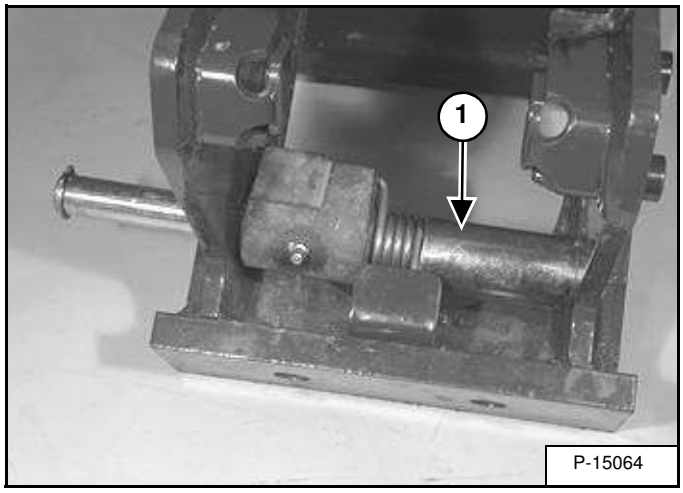
Remove the snap ring (Item 1) **[Figure 40-190-14]**.

Figure 40-190-15



Partially remove the pin (Item 1) **[Figure 40-190-15]**.

Figure 40-190-16

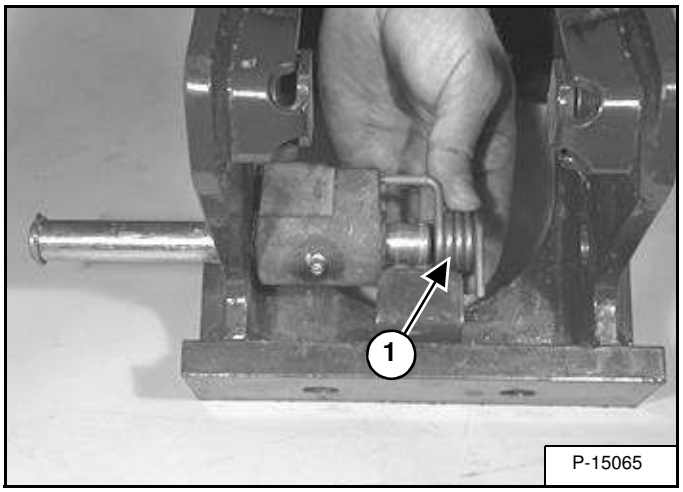


Remove the pin far enough to remove the spacer (Item 1) **[Figure 40-190-16]**.

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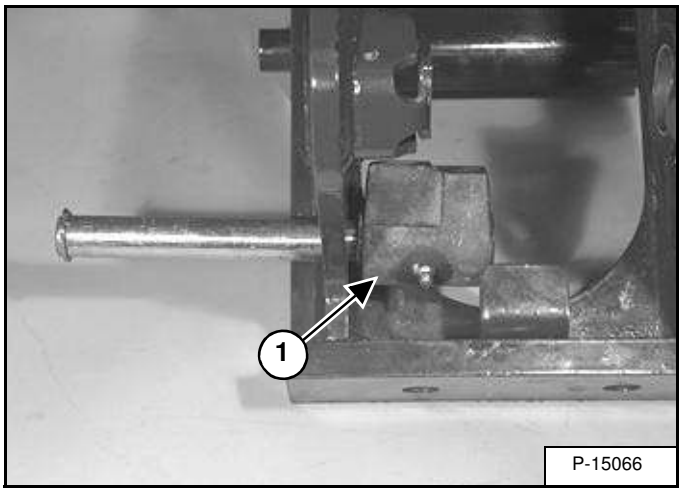
Disassembly (Cont'd)

Figure 40-190-17



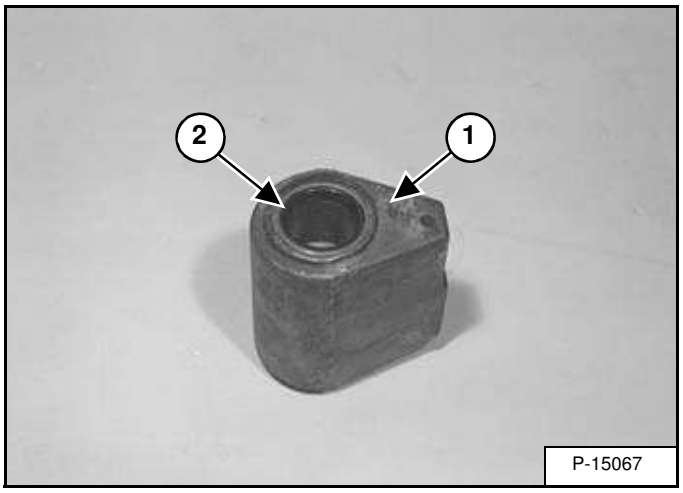
Remove the spring (Item 1) **[Figure 40-190-17]**.

Figure 40-190-18



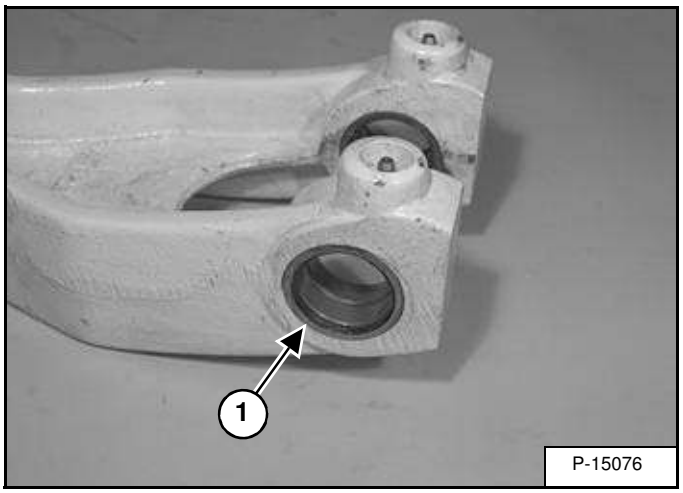
Completely remove the pin and remove the catch (Item 1) **[Figure 40-190-18]**.

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

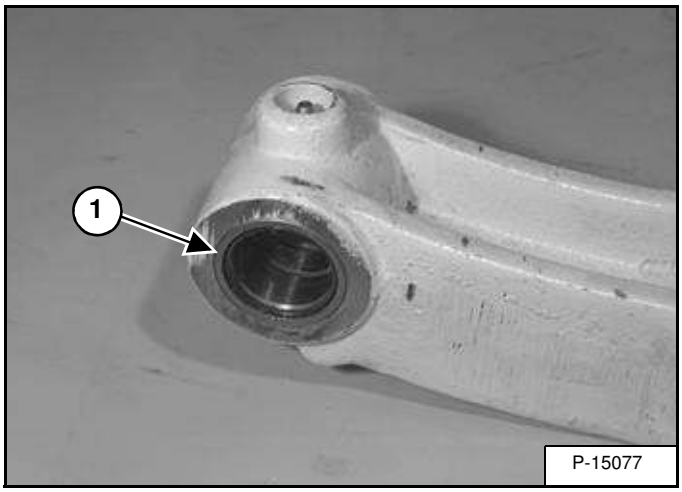


Remove the four seals (two per side) (Item 1) **[Figure 40-190-20]** from the top pivot point of the link.

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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

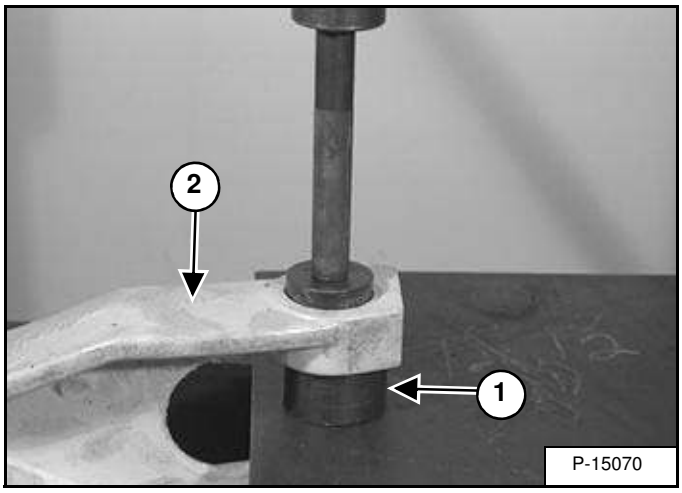
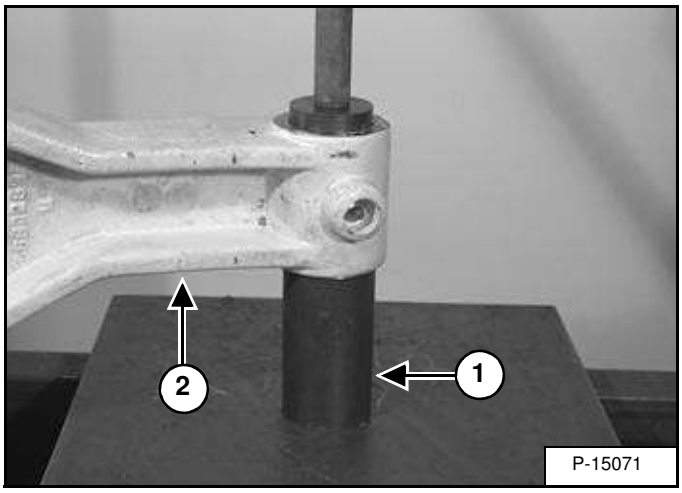


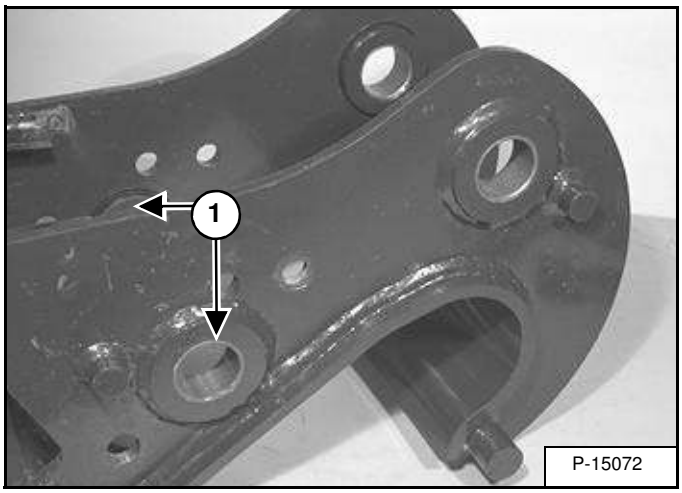
Figure 40-190-23



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

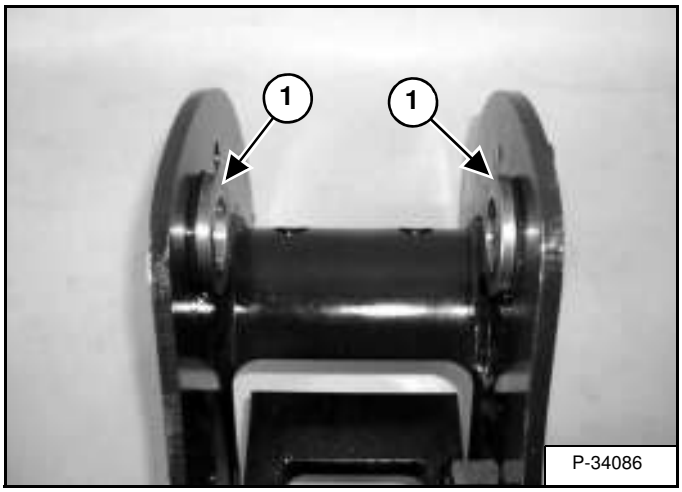


Remove the two bushings (Item 1) **[Figure 40-190-24]** from the X-Change] frame.

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Disassembly (Cont'd)

Figure 40-190-25



NOTE: On excavators S/N 232312222 & Below and 232412014 & Below use step [Figure 40-190-25].

Remove the bushings (Item 1) **[Figure 40-190-25]**.

Figure 40-190-26

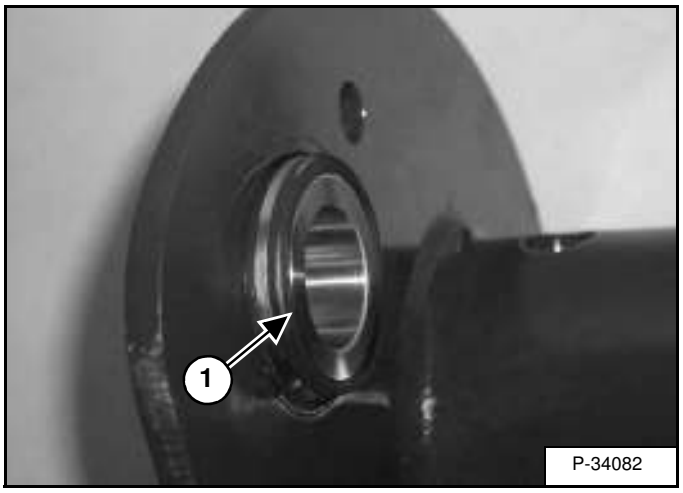
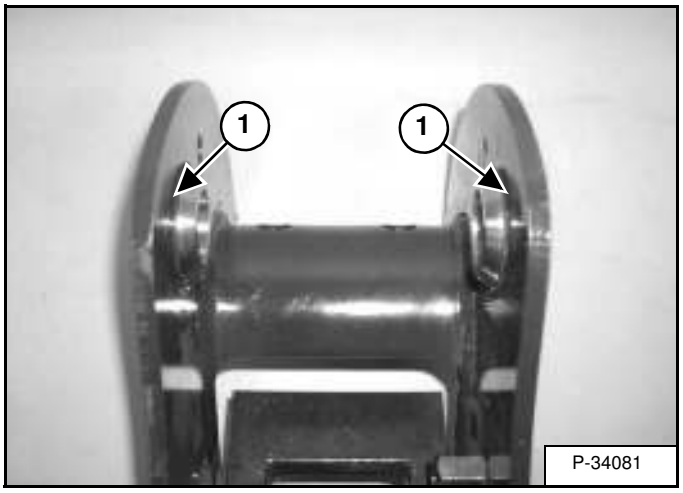


Figure 40-190-27



NOTE: On excavators S/N 232312223 & Above and 232412015 & Above use Steps [Figure 40-190-26] & [Figure 40-190-27].

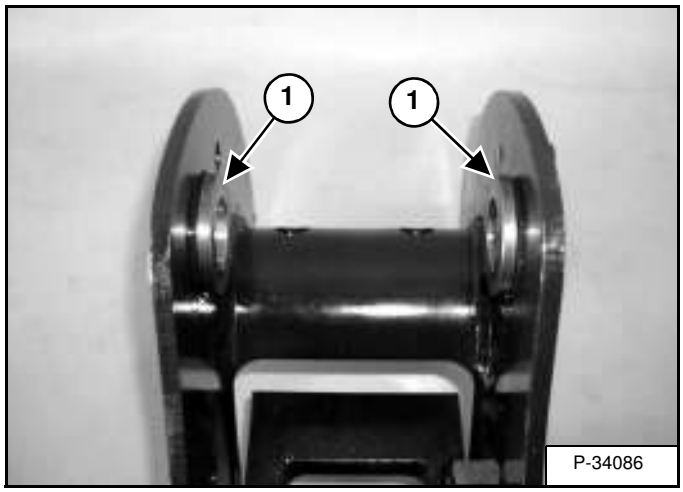
Remove the O-ring (Item 1) **[Figure 40-190-26]** (both sides).

Remove the bushings (Item 1) **[Figure 40-190-27]**.

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Assembly

Figure 40-190-28



NOTE: On excavators S/N 232312222 & Below and 232412014 & Below use Step [Figure 40-190-28].

Install the bushings (Item 1) **[Figure 40-190-28]**.

Figure 40-190-29

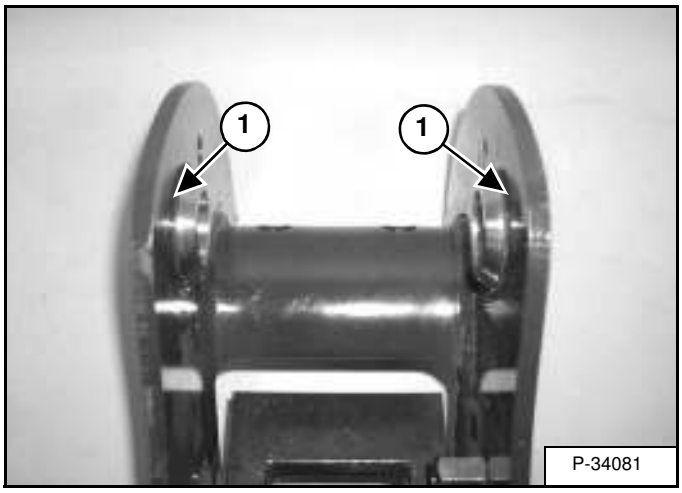
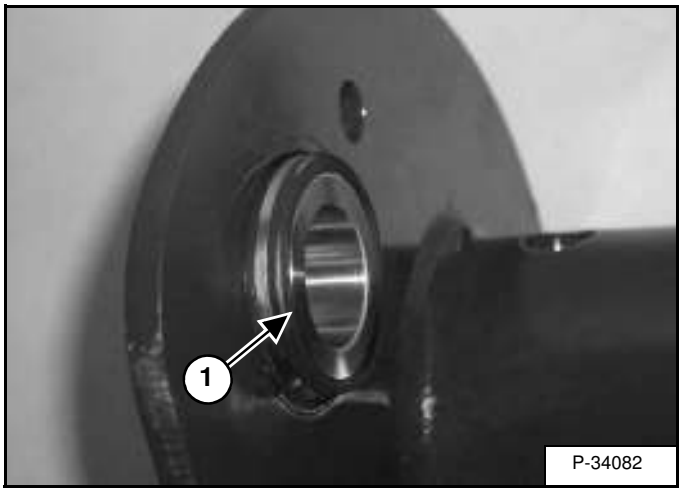


Figure 40-190-30



NOTE: On excavators S/N 232312223 & Above and 232412015 & Above use Steps [Figure 40-190-29] & [Figure 40-190-30].

Install the bushings (Item 1) **[Figure 40-190-29]**.

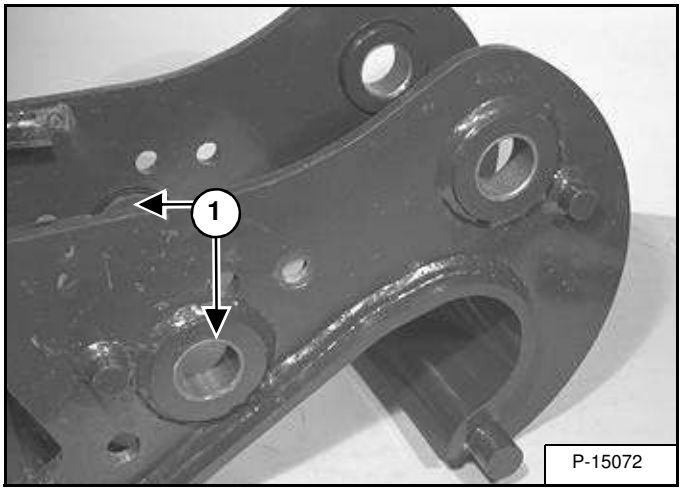
Install the O-ring (Item 1) **[Figure 40-190-30]** (both sides). Use grease to hold the bushings in place.

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Assembly (Cont'd)

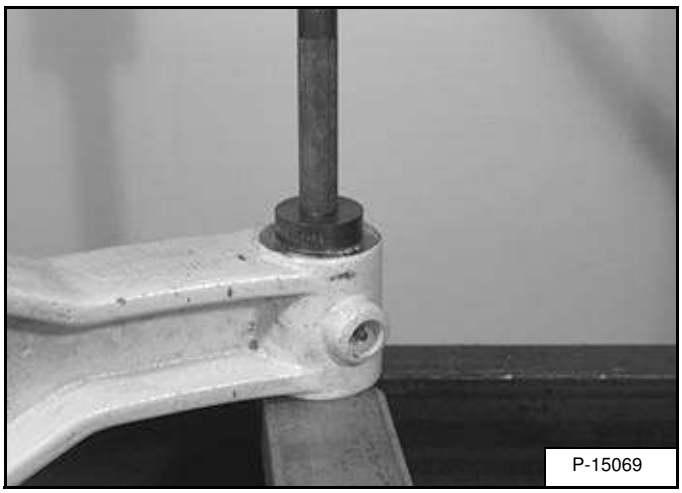
(All Models)

Figure 40-190-31



Install the two bushings (Item 1) **[Figure 40-190-31]** and apply grease to all four bushings.

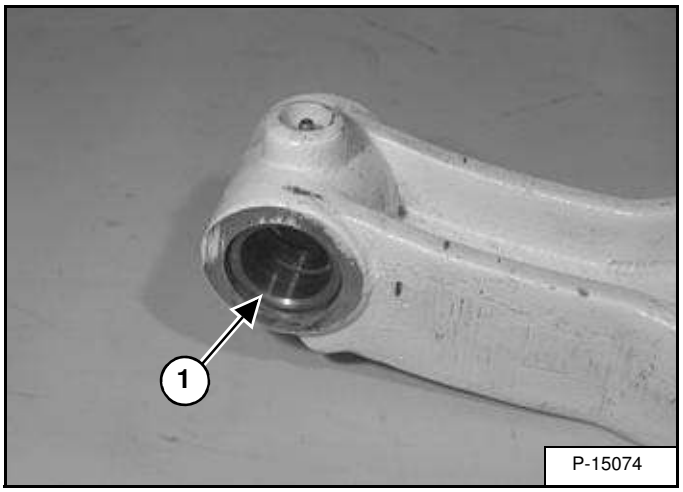
Figure 40-190-32



Install the bushings in both sides of the link **[Figure 40-190-32]**.

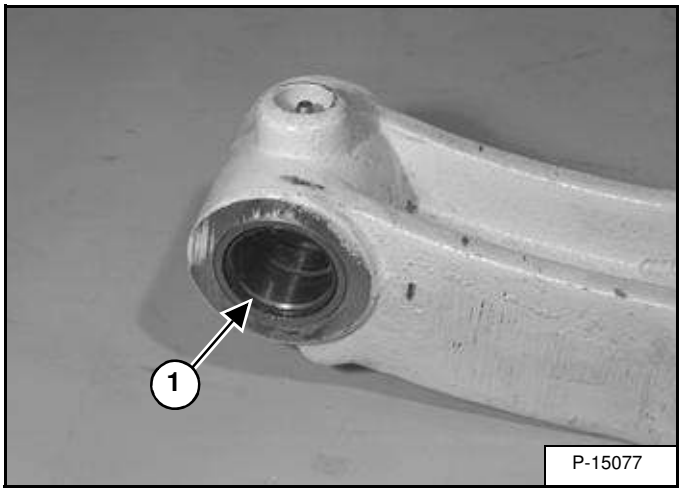
NOTE: Properly support the cast link to prevent damage when installing or removing the bushings.

Figure 40-190-33



Press the bushings (Item 1) **[Figure 40-190-33]** in until the seal will fit flush in the link.

Figure 40-190-34

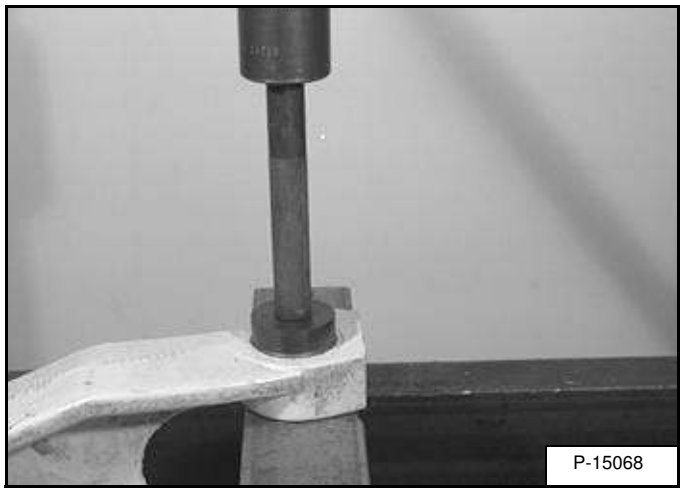


Install the two seals (Item 1) **[Figure 40-190-34]** (one per side).

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Assembly (Cont'd)

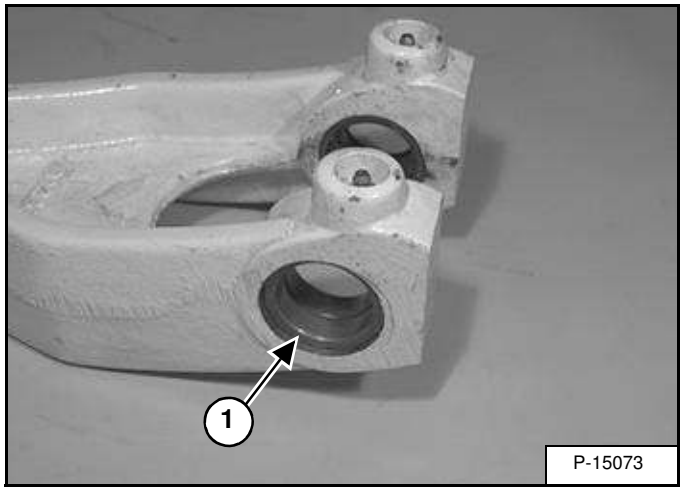
Figure 40-190-35



Install the bushings in both sides of the link **[Figure 40-190-35]**.

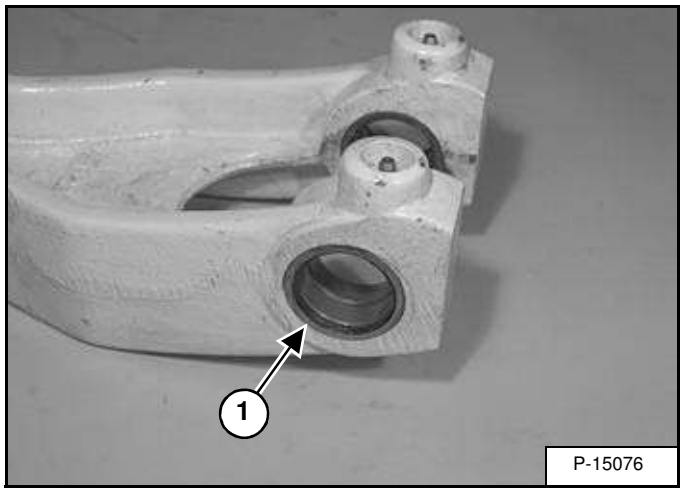
NOTE: Properly support the cast link to prevent damage when installing or removing the bushings.

Figure 40-190-36



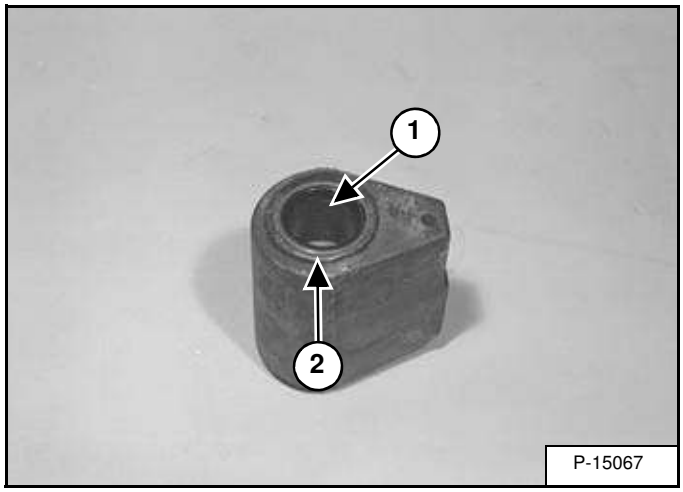
Press the bushings (Item 1) **[Figure 40-190-36]** in until the seal will fit flush.

Figure 40-190-37



Install the four seals (Item 1) **[Figure 40-190-37]** (one per side).

Figure 40-190-38



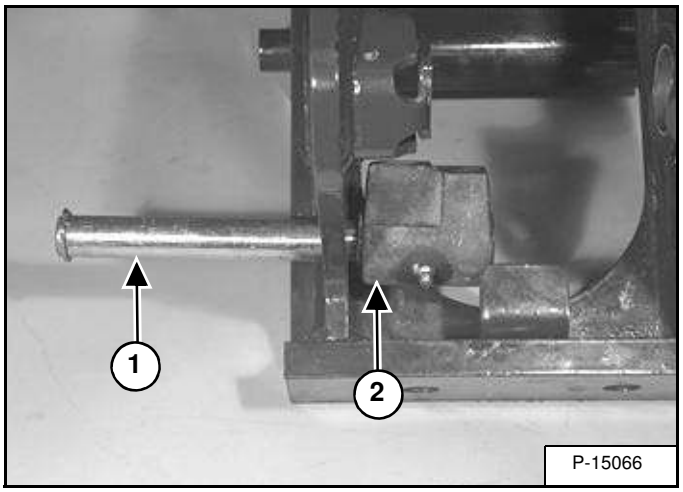
Install the bushings (Item 1) **[Figure 40-190-38]** in the catch.

Install the seal (Item 2) **[Figure 40-190-38]** on both sides of the catch.

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Assembly (Cont'd)

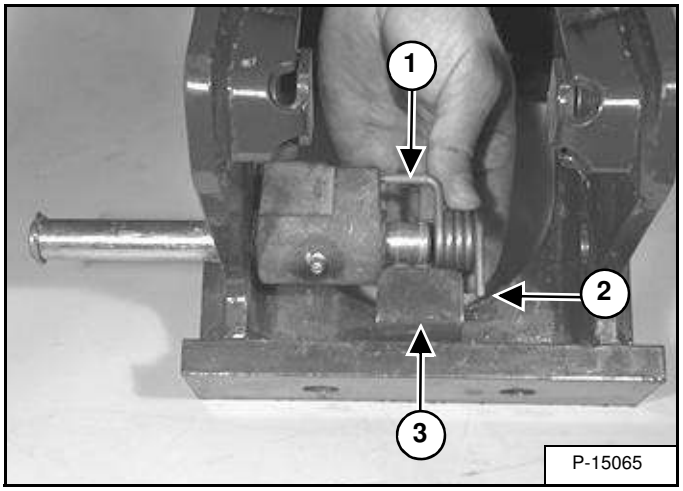
Figure 40-190-39



Partially install the pin (Item 1) **[Figure 40-190-39]**.

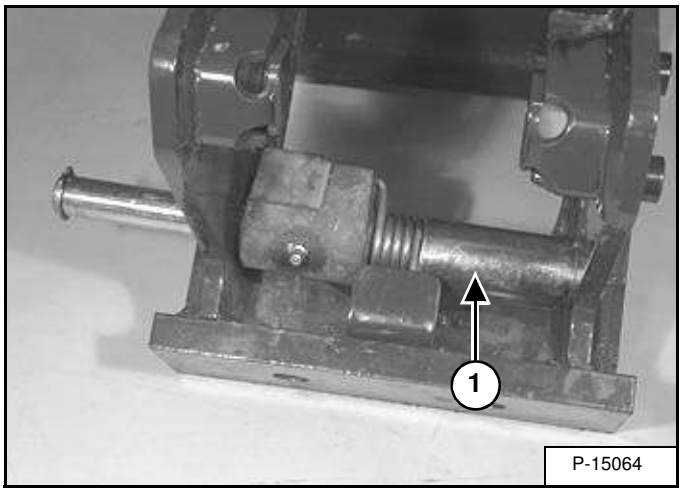
Install the catch (Item 2) **[Figure 40-190-39]** on the pin.

Figure 40-190-40



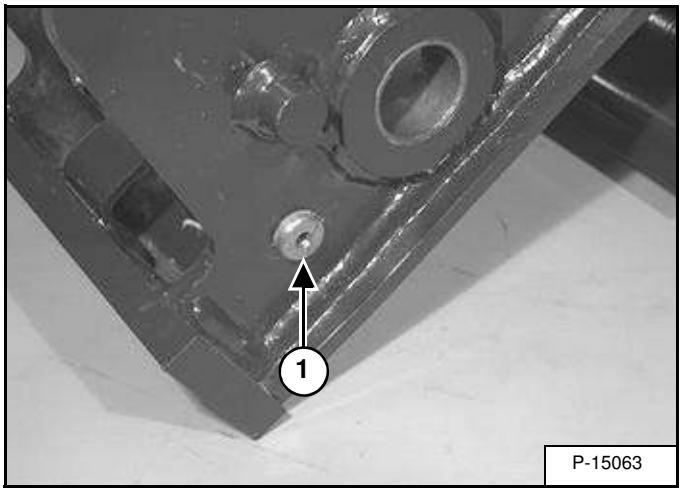
Install the spring on the pin, with the angled end of the spring (Item 1) engaging the hole in the catch. Put the straight end of the spring (Item 2) under the spring retainer (Item 3) **[Figure 40-190-40]**.

Figure 40-190-41



Install the spacer (Item 1) **[Figure 40-190-41]**.

Figure 40-190-42

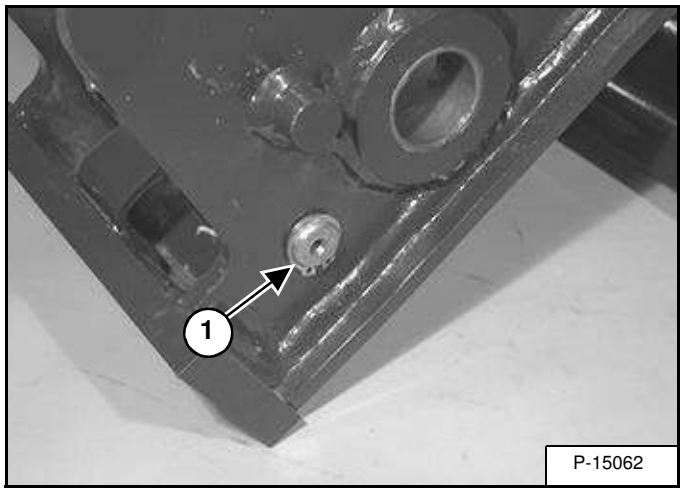


Completely install the pin (Item 1) **[Figure 40-190-42]**.

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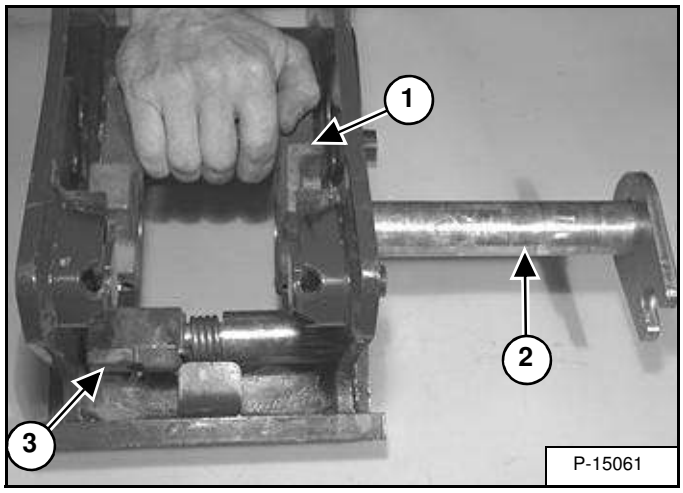
Assembly (Cont'd)

Figure 40-190-43



Install the snap ring (Item 1) **[Figure 40-190-43]**.

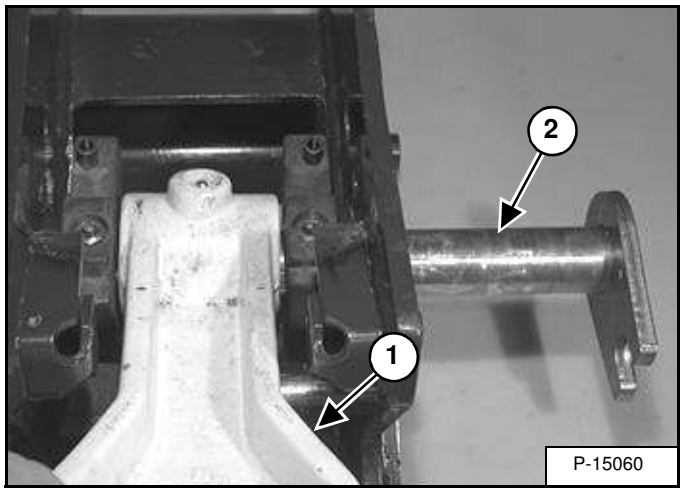
Figure 40-190-44



Align the latch (Item 1) and partially install the pin (Item 2) **[Figure 40-190-44]**.

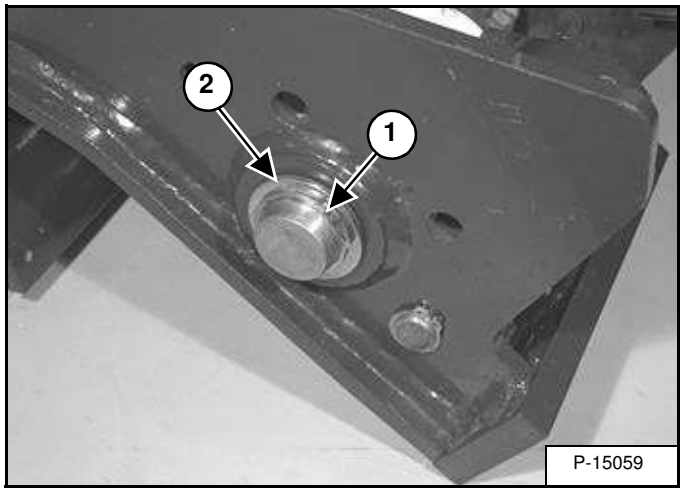
Rotate the catch toward the latch so the end of the catch (Item 3) **[Figure 40-190-44]** is under the latch.

Figure 40-190-45



Install the link (Item 1) and completely install the pin (Item 2) **[Figure 40-190-45]**.

Figure 40-190-46

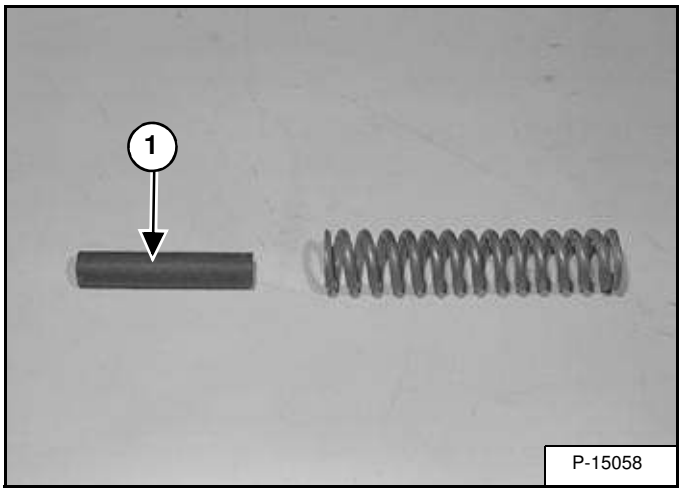


Install the washer (Item 1) and snap ring (Item 2) **[Figure 40-190-46]**.

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Assembly (Cont'd)

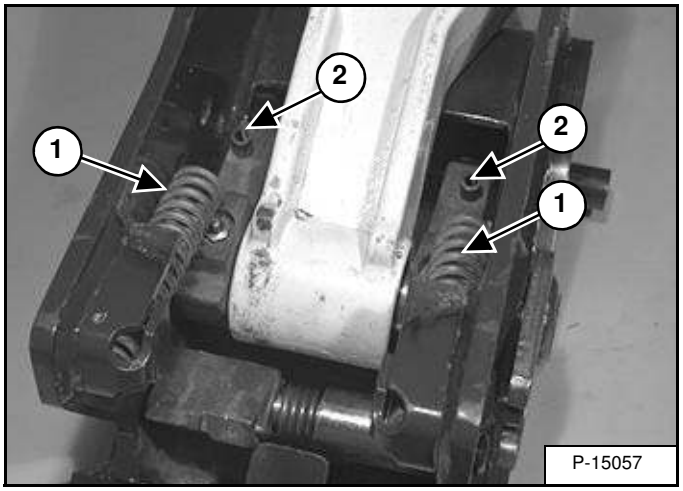
Figure 40-190-47



Install the hose (Item 1) **[Figure 40-190-47]** 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).

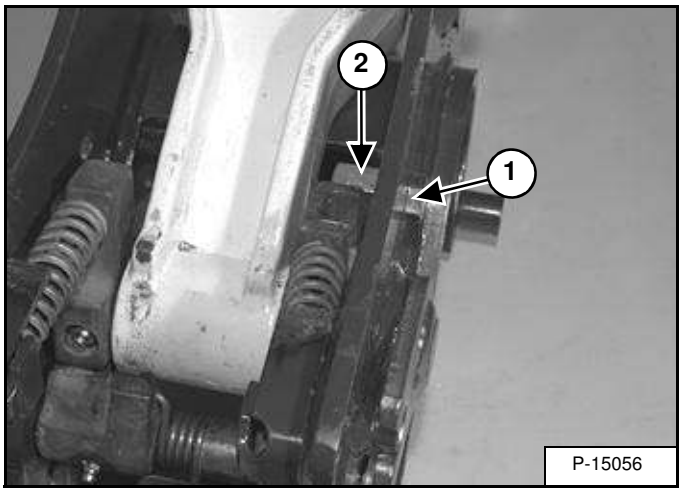
Figure 40-190-48



Install the springs (Item 1) **[Figure 40-190-48]** in the X-Change].

Pull the latch up until the springs (Item 1) seat over the roll pins (Item 2) **[Figure 40-190-48]**.

Figure 40-190-49



Apply thread lock adhesive (LOCTITE 242) to the bolt threads and install the bolt (Item 1) and nut (Item 2) **[Figure 40-190-49]**.

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

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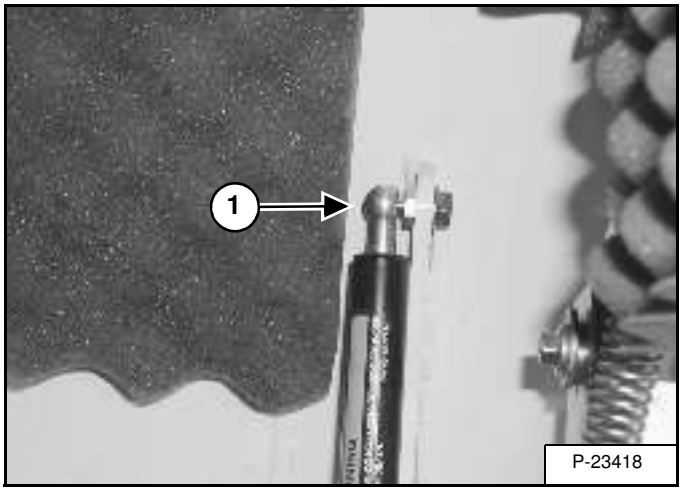
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RIGHT SIDE COVER

Removal And Installation

Open the cover.

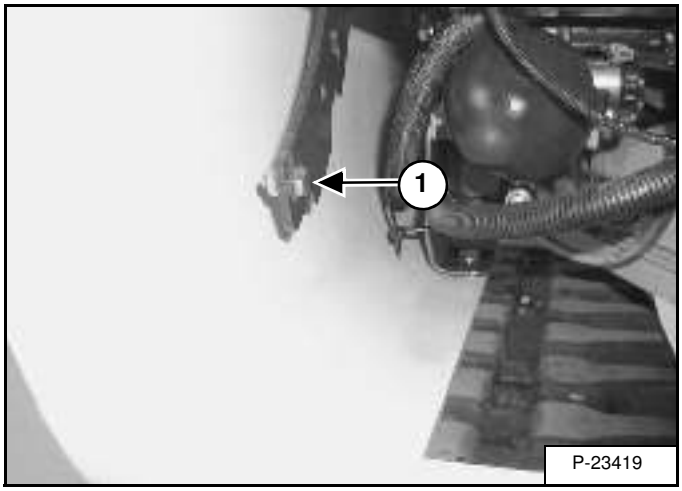
Figure 40-200-1



Remove the gas spring retaining clip (Item 1) **[Figure 40-200-1]** and disconnect the gas spring.

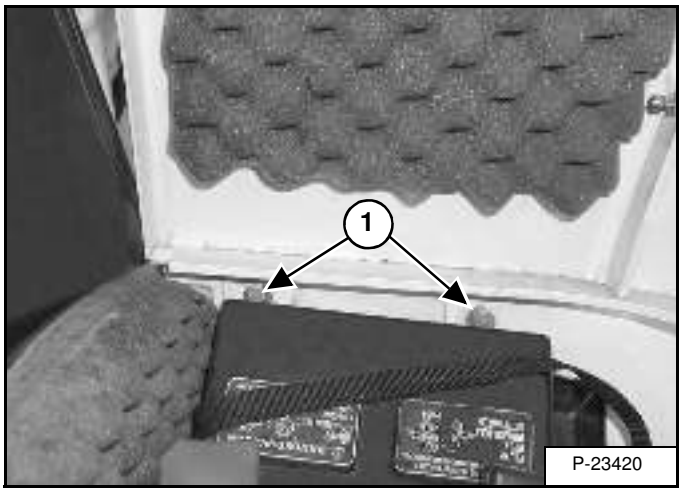
Rotate the gas spring towards the rear of the excavator.

Figure 40-200-2



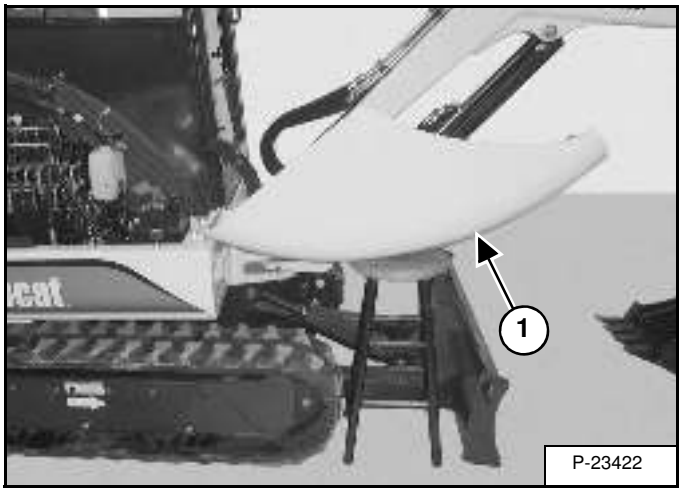
Close the cover. Remove the stop bolt and nut (Item 1) **[Figure 40-200-2]**.

Figure 40-200-3



Open the cover. Loosen the two bolts (Item 1) **[Figure 40-200-3]** and nuts.

Figure 40-200-4

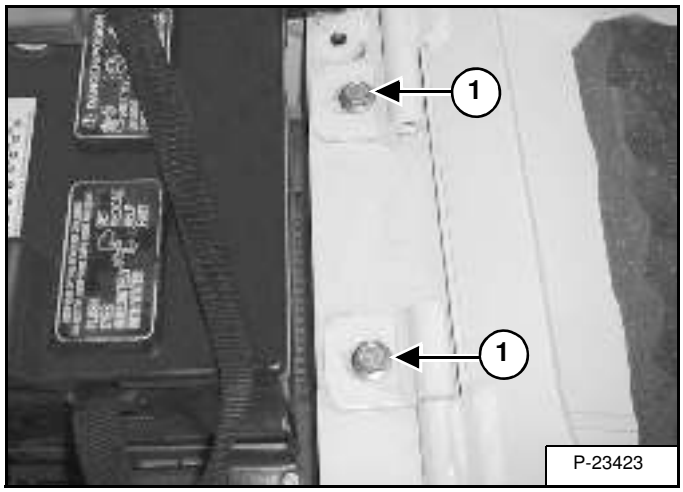


Fully open and support the cover (Item 1) **[Figure 40-200-4]**.

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Removal And Installation (Cont'd)

Figure 40-200-5



Remove the two nuts and bolts (Item 1) **[Figure 40-200-5]**.

Remove the cover.

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ELECTRICAL SYSTEM AND ANALYSIS

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- Alternator Regulator Test 50-30-3
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- Full Field Test 50-30-3
- Removal And Installation 50-30-4
- Tests 50-30-2

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TWO SPEED SWITCH
NOT AVAILABLE AT TIME OF PRINTING

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WIRING SCHEMATIC

325 (S/N 232311001 AND ABOVE)
328 (S/N 232411001 AND ABOVE)
(PRINTED FEBRUARY 2001)
V-0052

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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: A FUEL SENDER, B L HOT SIGNAL, C SENSOR POWER (+8V), D CONSOLE, E HYD TEMP, F SENSOR GROUND, G SPARE ANG #1, H ENGINE TEMP
J4: A HYD OIL FILTER, B GLOW PLUG STATUS, C ENGINE SPEED VR, K ENGINE SPEED VR, G ENGINE SPEED HALL, A STARTER STATUS, D CRANK, J FUEL PULL STATUS, C KEY, E TRAVEL PEDAL SWITCH, H
J1: B FUEL HOLD, K FUEL HOLD POWER RELAY, J FUEL PULL, C LIGHT, D GROUND, A STARTER, G GROUND, E BATTERY, F BATTERY, H GLOW PLUG
J5: A L SKI UP, J L SKI DOWN, D R SKI DOWN, C R SKI UP, K CAN SHIELD, A CAN LOW, B CAN HIGH, F R POT SIGNAL, E 2 SPEED, G DETENT
J6: F UNUSED #2, E UNUSED #2, D SPARE DIG #2, C SPARE DIG #1, B SPARE ANG #2, A
J2: K LOAD MOMENT, J PIEZO OUT, G DIVERTER OUT, E TWO SPEED, C PWM WORKGROUP P37, H WORKGROUP P25 AND D31, D SPARE RELAY OUT, A FRONT ROD, B FRONT BASE, F SPARE RETURNS 9 SOL.

RIGHT HAND CONSOLE HARNESS 6809046

RIGHT HANDLE: DETENT, PWM
TWO SPEED (BLADE LEVER)
TRAVEL PEDAL SWITCH
BUZZER
DIVERTER FOR 2ND AUX (OPTIONAL) — C413
TWO-SPEED — C414 — YELLOW TIE STRAP
WORK GROUP LOCKOUT — C415 — ORANGE TIE STRAP
WORK GROUP LOCKOUT — C416 — GREEN TIE STRAP
FRONT ROD — C419 — BLUE TIE STRAP
FRONT BASE — C420 — RED TIE STRAP
8 ohm nominal at 12 VDC (325/328)
6 ohm nominal at 12 VDC

LH CONSOLE HARNESS 6809045

LEFT HANDLE: DETENT
FUEL SENDER 20-270 ohm — C158
CONSOLE SENSOR — C467
HORN
LOAD MOMENT (OPTIONAL)
TRAVEL ALARM (OPTIONAL) — C458
FRAME LIGHT
BEACON SWITCH (OPTIONAL)
WIPER SWITCH (OPTIONAL)
HYD FILTER SWITCH
HYD TEMP SENDER 538-1824 ±30 ohm
WASHER BOTTLE — C462
AUXILIARY SOCKET — C465
C457, C461, C463, C464

CAB AND WIPER WIRING (IF SO EQUIPPED) HARNESS 6802664 AND 6802665

BEACON
LEFT WORK LIGHT (OPT)
RIGHT WORK LIGHT (OPT)
MOTOR WIPER — GROUND, PARK, HIGH
ALL GROUNDS ARE CONNECTED IN SERIES
DOME LIGHT

BOOM LIGHT HARNESS 6808415

BOOM LIGHT — C468, C460

ENGINE HARNESS 6809047

FUEL SHUT OFF — WHT TO BLK = 0.26 ohm, RED TO BLK = 10.9 ohm — HOLD 2800, PULL
GLOW PLUGS 0.4 ohm — HR
SPEED SENSOR (VR) — C160
ENGINE OIL PRESSURE SWITCH
ENGINE COOLANT SENDER 500-3000 ± 30 ohm — C159
GROUNDS 2060, 2800
STARTER — B, S
ALTERNATOR — BAT, G, EXC
BATTERY 2300, 2310
C161 HEATER
RADIO CONNECTOR
C101, C162

ACD POWER — FUSE 4 25A — 1320
WIPER POWER — FUSE 1 5A — 1460
ALT HEATER — FUSE 3 25A — 1480, 1740
SWITCHED POWER — 1050
SWITCH POWER — FUSE 2 20A — 1470
RADIO MEMORY — 7220, 7210
STARTER — 87A 87 86 30 85 — 9380, 9390, 1070, 2050
FUEL SHUTOFF — 8100, 8120, 8110, 1300, 2030
LIGHT RELAY — 6210, 6200, 1370, 2030
GLOW PLUG — 8500, 8510, 2040, 2060
FUSE 5 25A — 1310
FUSE 6 25A — 1310
FUSE 11 20A — 1300
FUSE 9 25A — 1150
FUSE 12 15A — 1300
FUSE 7 5A — 1310
FUSE 10 25A — 1150
RELAY GROUNDS 2000-2050 ARE CONNECTED IN SERIES

IGNITION SWITCH

C455 — WHT, DGN, RED — START, RUN, OFF

ACD AND REMOTE START CONNECTOR

120 ohm — 2080, 2090
C453 — A B C D G E F — 9500, 9600, 9700, 2710, 1320, 1140

FUSE BLOCK

15A AUX FUSE 12 — 20A LIGHTS FUSE 11 — 25A ACD FUSE 10 — 25A CONTROLLER FUSE 9
STARTER — GLOW PLUGS — LIGHTS — FUEL PULL — SWITCH POWER
25A ACD FUSE 4 — 25A FUEL FUSE 8 — 25A ALT HEATER FUSE 3 — 5A IGN FUSE 7 — 20A SW POWER FUSE 2 — 25A HEATER FUSE 6 — 5A WIPER FUSE 1 — FUSE 5

GROUNDS

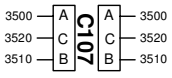
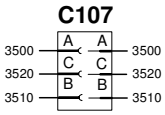
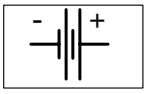
2310 — 2000, 2330, 2340, 2450, 2480, 2510, 2520,2650, 2710, 2820, 2830, 2940
2300 — 2100, 2110, 2610, 2740, 2790, 2840, 2930

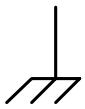
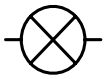
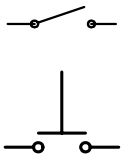
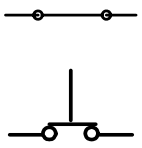
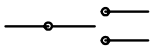
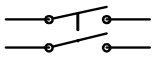
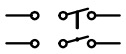
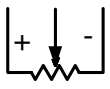
POWER LEADS

1150, 1070, 1330, 1310, 1060, 1360 — 1040, 1030

V-0052 (2-8-01)

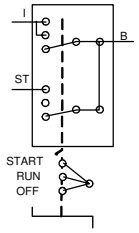
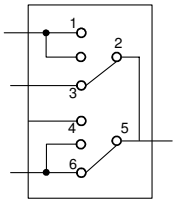
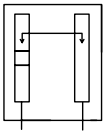
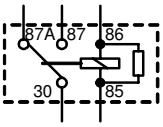
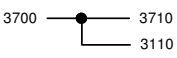
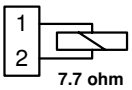
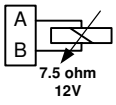
Glossary Of Electrical Symbols

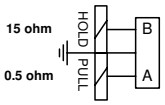
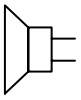
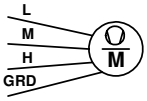
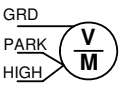
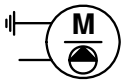
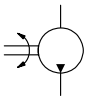
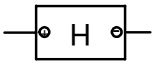
SYMBOL	DESCRIPTION
	CONNECTIONS
	CONNECTOR - Harness - Used for connecting 2 harnesses together or a harness to a component. The connector can vary from a single pin to any number of pins (Example: 3 pin connectors shown). The connector pins can be numbered alphabetical (shown) or numerical (1, 2, 3 etc.). The harness wires numbers are called out next to the connector (Example: 3500).
	The connector number is called out next to the connector (Example: C107). These connector numbers are used for schematic identification only and do not appear on the harness or connector.
	COMPONENTS
	BATTERY - Used for supplying and storing electrical power for the machine.
+	POSITIVE ELECTRICAL CIRCUIT - Indicates positive battery circuit.
-	NEGATIVE ELECTRICAL CIRCUIT - Indicates battery ground circuit.
	ALTERNATOR - Used to create the electrical current to supply voltage to the battery and components.
	STARTER - Uses battery current to start the machine engine.
	GROUND - Used to represent an external ground connection.

SYMBOL	DESCRIPTION
	COMPONENTS
	GROUND - Frame - Used to represent an component that is internally grounded.
	LIGHT -
	SWITCH - Single Pole - Single Throw (ON-OFF) Normally Open
	SWITCH - Single Pole - Single Throw (ON-OFF) Normally Closed.
	SWITCH - Single Pole - Double Throw (ON-OFF-ON) - This switch can be in any of three positions. (Some switches are spring activated to return them to a certain position when released.)
	SWITCH - Double Pole - Single Throw (ON-OFF) Open and Closed positions will be specified depending on switch application.)
	SWITCH - Double Pole - Double Throw (ON-OFF) Open and Closed positions will be specified depending on switch application.
	POTENTIOMETER - Variable resistance - Provides variable resistance.

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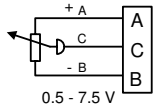
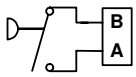
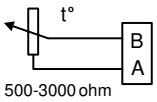
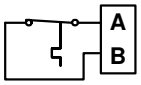
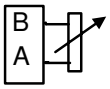
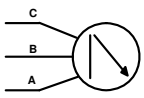
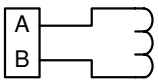
Glossary Of Electrical Symbols (Cont'd)

SYMBOL	DESCRIPTION
	COMPONENTS
	SWITCH - Ignition - Multi position switch to activate various start functions at different positions.
	SWITCH - Light - Multi position switch to activate various lights at different positions.
	ROTARY CONTROL - Provides variable voltage proportional to position.
	RELAY - Uses a low amp switch to control a high amp component.
	FUSE - Used to protect the wire harness from an overloaded circuit. (The fuse rating is listed next to the fuse.)
	SPLICE (•) - Used to show when multiple wires are connected together on the schematic.
	SOLENOID - ON / OFF - Electrically activated coil that controls movement magnetically. (The ohm rating of the solenoid coil is listed next to the component [if available]).
	SOLENOID - VARIABLE - Electrically activated coil that controls movement magnetically. (The ohm rating and voltage of the solenoid coil is listed next to the component [if available]).

SYMBOL	DESCRIPTION
	SOLENOID - Fuel and Traction Lock - Dual solenoids. (The ohm rating of the solenoid coils are listed next to the component [if available]). The pull solenoid is energized for a short time.
	HORN - Audible alarm. Sound is activated manually by a switch to warn personnel.
	BUZZER - Audible alarm. Sounds at a predetermined setting to warn the operator of a component condition.
	RESISTOR - Limits current flow.
	DIODE - Allows electrical current to flow in 1 direction only.
	MOTOR - HVAC - Multi speed motor.
	MOTOR - Wiper - Single or multi speed motor.
	MOTOR - Washer - Single speed.
	PUMP - FUEL
	HOURMETER - Records the time the engine is running.
	POWER PLUG - Supplies 12 volt power for customer supplied accessories.
	GAUGE - Instrument - Indicates certain engine or other component conditions. (The different types of gauge are marked with a icon that represents what function the gauge is monitoring. Example: the gauge shown is for fuel.)

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Glossary Of Electrical Symbols (Cont'd)

SYMBOL	DESCRIPTION
	SENDERS AND SENSORS
	PRESSURE SENDER - Provides a variable voltage proportional to pressure. (Sender voltage rating is listed to show volts at high and low setting.)
	PRESSURE SWITCH - Switch opens or closes at a predetermined pressure to active a function or to turn on a warning light. (Switch is shown in the open position.)
	TEMPERATURE SENDER - Provides a variable resistance (ohm) signal proportional to temperature. (Sender ohm rating is listed to show ohms at high and low setting.)
	TEMPERATURE SWITCH - The switch opens or closes at a predetermined temperature to active a function or to turn on a warning light. (Switch is shown in the closed position.)
	FUEL SENDER - Provides a variable resistance, based on the fuel level in the tank. (Sender ohm rating is listed to show ohms at full and empty setting.)
	HALL EFFECT SENSOR - Detects linear or rotary position and provides a proportional variable voltage.
	SPEED SENSOR - magnetic pickup - detects RPM.

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Troubleshooting 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

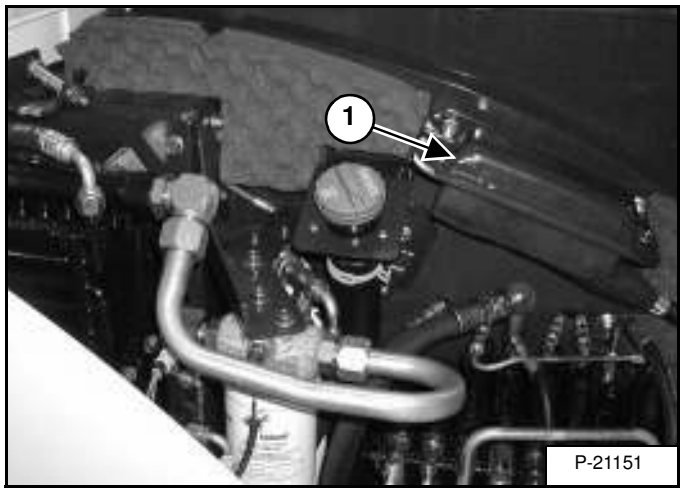
PROBLEM	CAUSE
Battery will not take charge.	1, 2, 3, 4, 5
Alternator will not charge.	1, 2, 5
Starter will not turn engine.	2, 3, 4, 6, 7, 8, 9

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



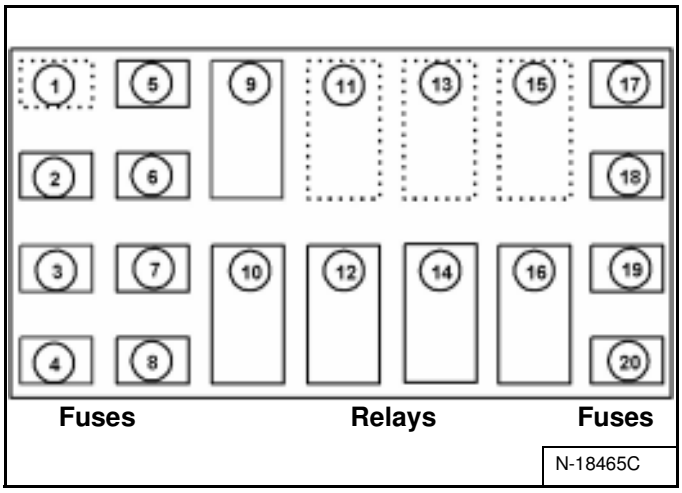
The excavator has a 12 volt, negative ground electrical system. The electrical system is protected by fuses located under the cover at the right side of the excavator (Item 1) **[Figure 50-10-1]**. The fuses will protect the electrical system when there is an electrical overload. The reason for the overload must be found before starting the engine again.

Fuse Location

A decal is inside the cover to show location and amp ratings.

Remove the cover to check or replace the fuses.

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**	*Not Used*	-
2	Heater	25	**12**	Lights	R
3	Ignition	5	**13**	Not Used	-
4	Fuel	25	**14**	Glow Plug	R
5	Wiper	5	**15**	*Not Used*	-
6	Switch Power	20	**16**	Starter	R
7	Alternator/ Heater	25	**17**	Bobcat Controller	25
8	ACD	25	**18**	ACD	25
9	Switch Power	R	**19**	Lights	20
10	Fuel	R	**20**	Accessory Plug	15

R - Relay

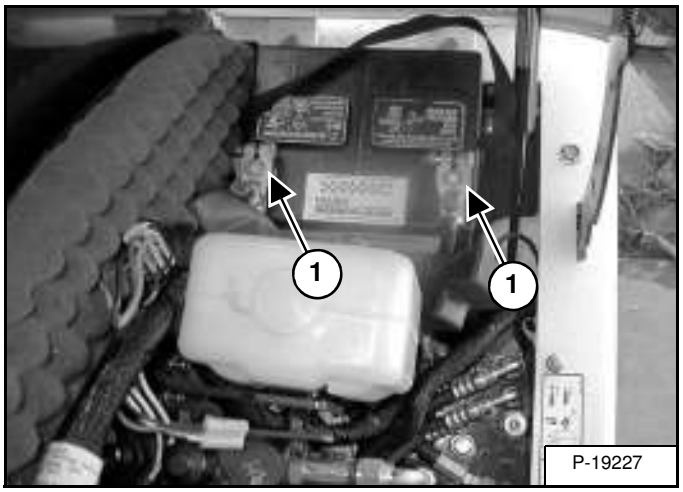
Always replace fuses using the same type and capacity.

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BATTERY

Servicing

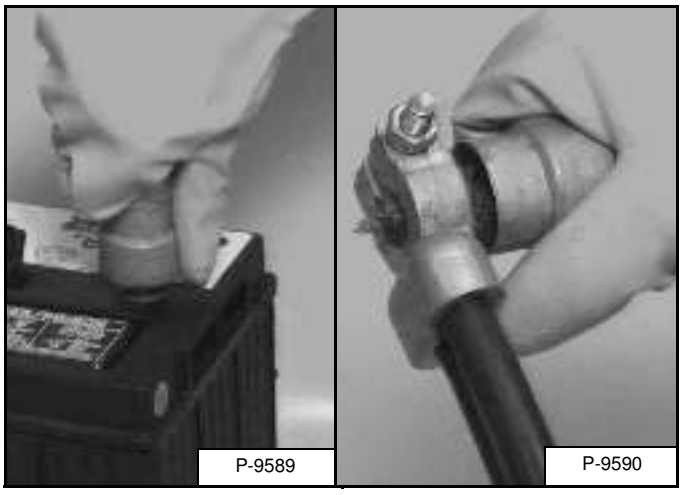
Figure 50-20-1



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.

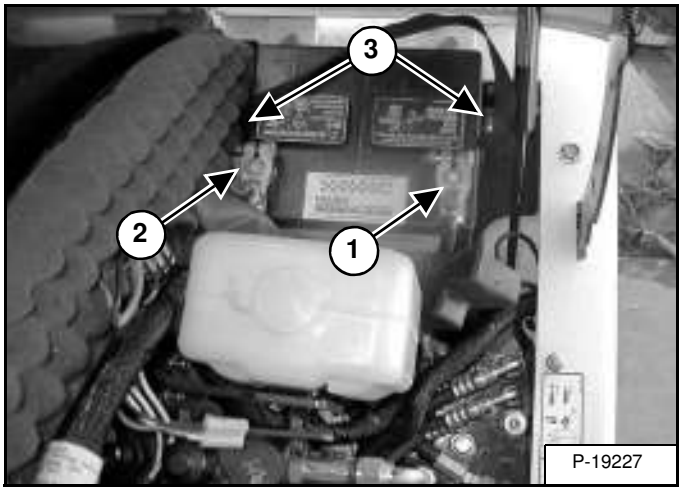
W-2065-1296

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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]**.

Remove the bolts (Item 3) **[Figure 50-20-3]** and remove the hold down clamp.

Remove the battery.

Always clean the terminals and the cable ends, even when installing a new battery.

Install the battery. Install the hold down clamp and tighten the bolts.

Connect the battery cables. Connect the negative (-) cable (Item 1) **[Figure 50-20-3]** last to prevent sparks.

⚠ WARNING

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

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BATTERY (CONT'D)

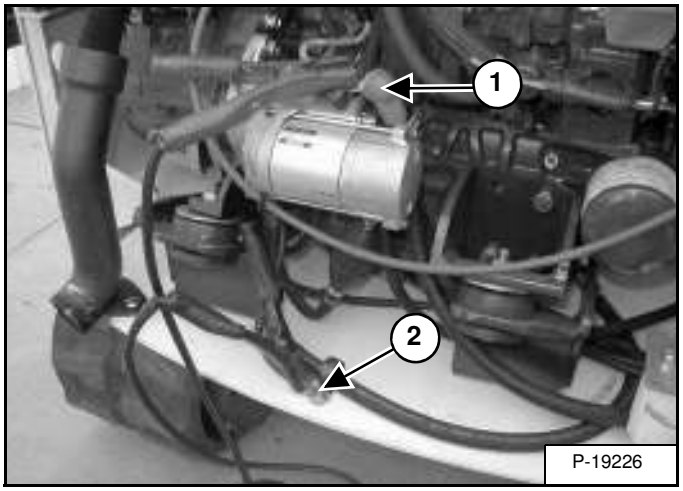
Using A Booster Battery (Jump Starting)

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 50-20-4



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 50-20-4]** of the excavator starter.

Connect the 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 50-20-4]** where it is fastened to the frame.

NOTE: See *Cold Temperature Starting Procedure*, in the correct Operation & Maintenance Manual.

Start the engine. After the engine has started, remove the ground (-) cable first (Item 2) **[Figure 50-20-4]**.

Disconnect the cable from the excavator starter (Item 1) **[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.

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

If jump starting the excavator from a second machine:

When jump starting the excavator from a battery installed in a second machine. Make sure that 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

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Using A Booster Battery (Jump Starting) (Cont'd)

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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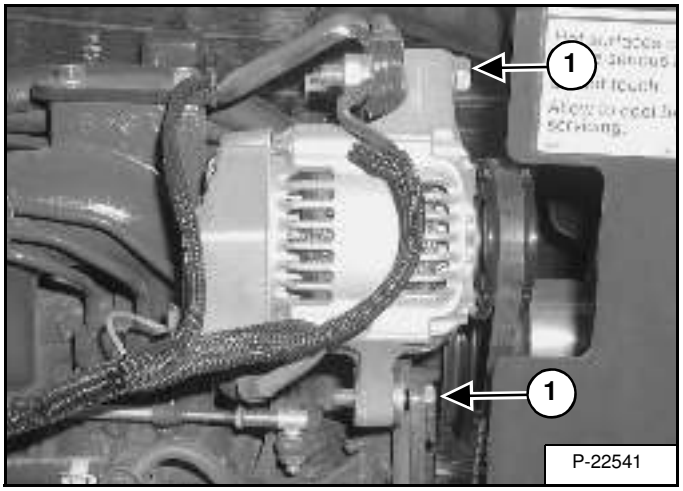
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ALTERNATOR

Adjusting The Alternator Belt

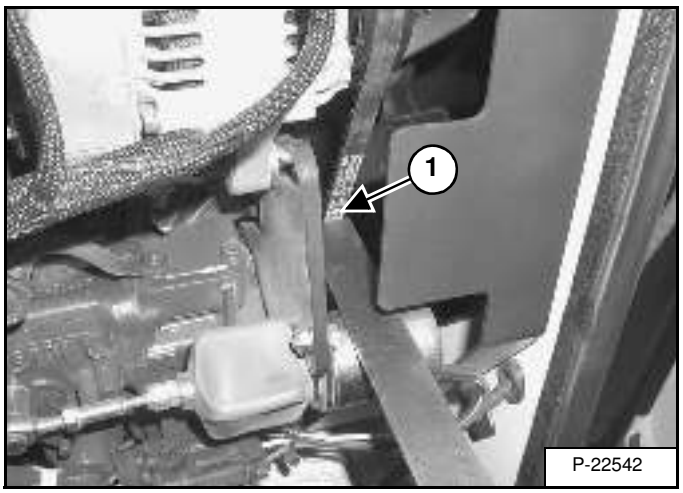
Stop the engine. Open the engine cover.

Figure 50-30-1



Loosen the alternator mounting bolts (Item 1) **[Figure 50-30-1]**.

Figure 50-30-2



Move the alternator until the belt has 1/2 inch (13 mm) movement at the middle of the belt span (Item 1) **[Figure 50-30-2]** with 13 lbs. (58 N) of force.

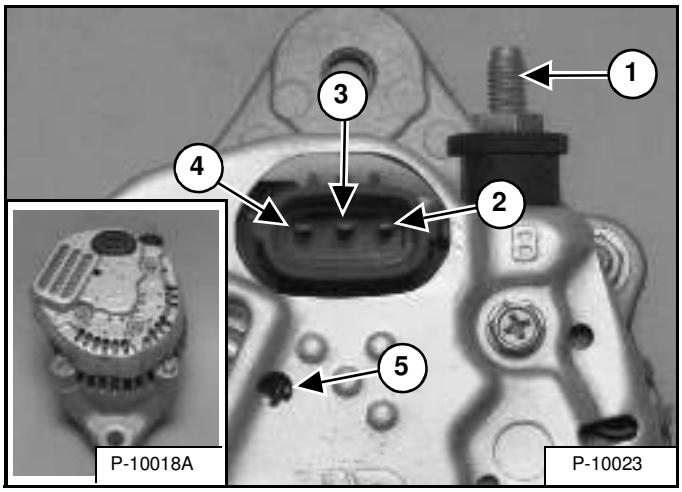
Tighten the mounting bolts.

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

Close the rear door.

Description

Figure 50-30-3



The output terminal (Item 1) **[Figure 50-30-3]**.

The battery or power sensing terminal (Item 2) **[Figure 50-30-3]**.

The ignition terminal (Item 3) **[Figure 50-30-3]**.

Open terminal not used in the excavator harness (Item 4) **[Figure 50-30-3]**.

Access hole for full field test (Item 5) **[Figure 50-30-3]**.

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Tests

Perform the following alternator tests in this order:

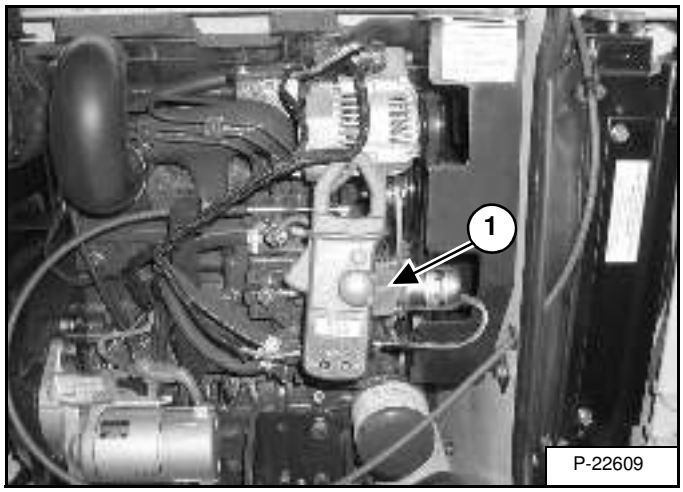
Alternator Output Test: Tests the alternator and regulator output.

Full Field Test: Tests the maximum amperage output of the alternator.

Alternator Regulator Test: Tests the regulator voltage output.

Alternator Output Test

Figure 50-30-4



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

Use the induction meter and loop around positive (+) wire (Item 1) **[Figure 50-30-4]** at the alternator.

Start the engine and run at full RPM.

The ammeter reading should be between 35 and 40 amps.

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

⚠ WARNING

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

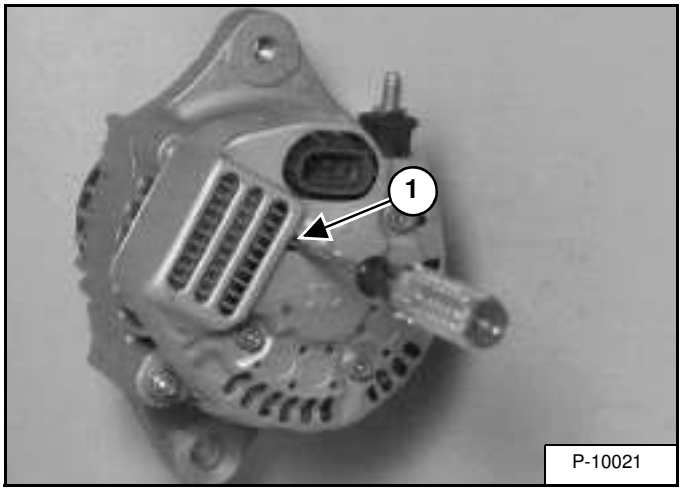
W-2050-1285

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Full Field Test

Start the engine and run at full RPM.

Figure 50-30-5



Place a small screwdriver in the test port (Item 1) **[Figure 50-30-5]** to provide a ground to the alternator case. This will give maximum amperage output from the alternator.

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

The ammeter reading should be above 35 amps.

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

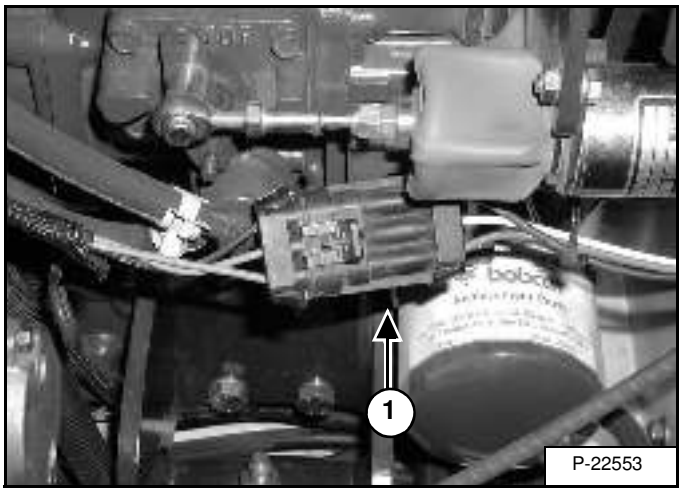
⚠ WARNING

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

W-2050-1285

Alternator Regulator Test

Figure 50-30-6



Disconnect the fuel stop solenoid connector (Item 1) **[Figure 50-30-6]**.

Turn the lights on (if equipped) and crank the engine for 30 seconds to discharge the battery.

Connect the fuel stop solenoid connector.

Start the engine and run at full RPM.

The ammeter reading should be around 35 amps and slowly decrease with alternator output.

If ammeter reading is low or does not decrease with time, replace the alternator's regulator.

Disconnect the negative (-) cable from the battery.

Reconnect the alternator wires.

Reconnect the negative (-) cable from the battery.

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Alternator Regulator Test (Cont'd)

IMPORTANT

Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the excavator. (Remove both cables from the battery.)**
- **Extra battery cables (booster cables) are connected wrong.**

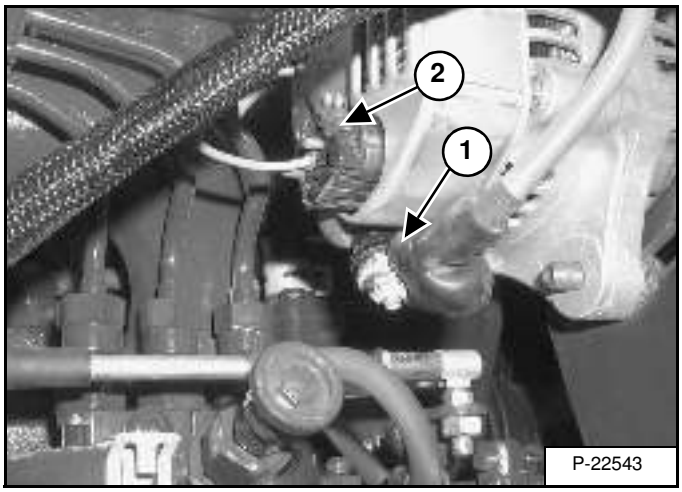
I-2222-0903

Removal And Installation

Open tailgate.

Disconnect the negative (-) battery cable. (See Removal And Installation on Page 50-20-2.)

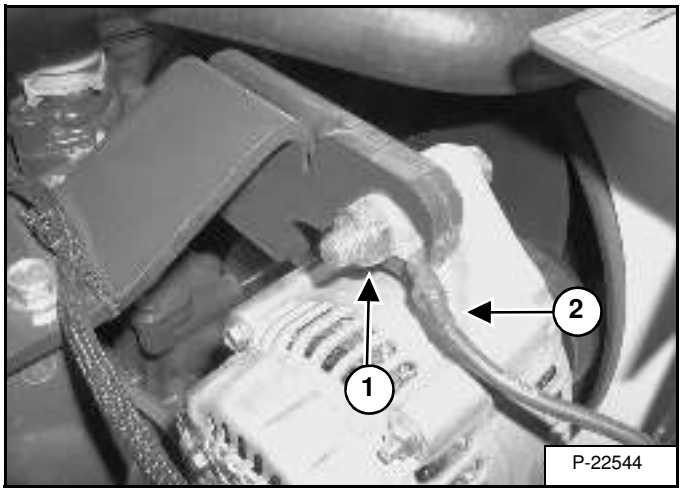
Figure 50-30-7



Disconnect the red wire (Item 1) **[Figure 50-30-7]** from the alternator.

Disconnect the wire harness connector (Item 2) **[Figure 50-30-7]** from the alternator.

Figure 50-30-8

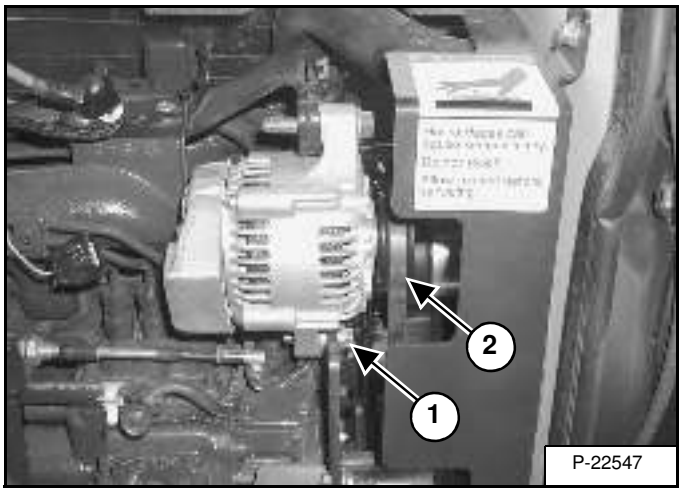


Remove the nut (Item 1) washers and ground wire (Item 2) **[Figure 50-30-8]**.

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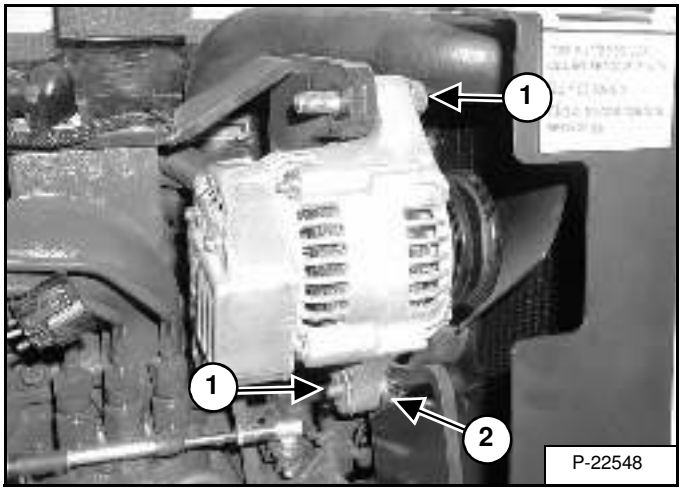
Removal And Installation (Cont'd)

Figure 50-30-9



Loosen the bottom bolt (Item 1) and push the alternator toward the engine. Remove the alternator belt (Item 2) **[Figure 50-30-9]**.

Figure 50-30-10



Remove the top and bottom bolts (Item 1). Remove the washer (Item 2) **[Figure 50-30-10]** from in between the alternator and alternator mount.

Remove the alternator.

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Disassembly And Assembly

Disassemble the alternator (See Parts Identification)

Remove the regulator cover and regulator.

Remove the three bolts holding halves together.

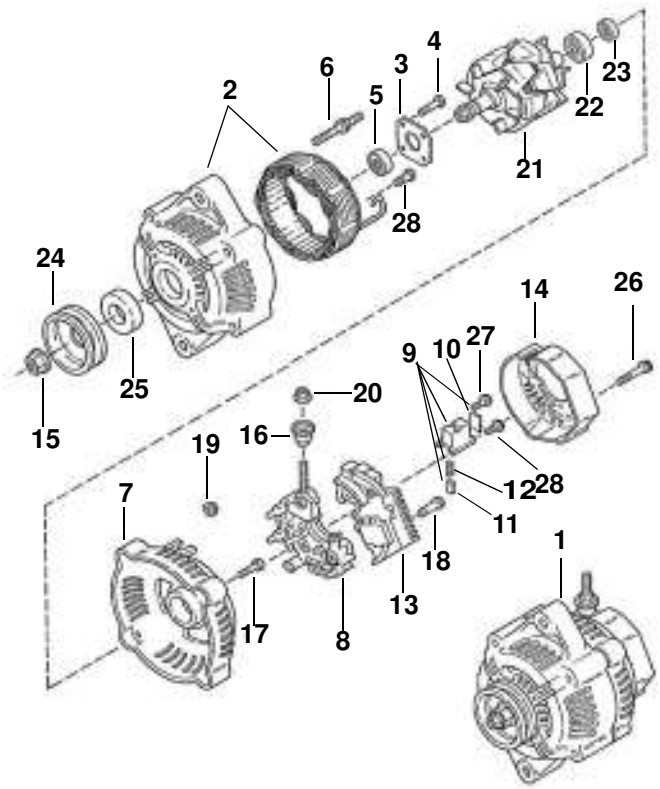
Pry the halves apart.

Use a soft jaw vise to hold rotor while removing pulley nut.

Remove the front case half from the rotor using a plastic hammer.

Unsolder the stator leads from the rectifier. Remove the stator.

1. **Alternator**
2. **Frame Assembly**
3. **Plate**
4. **Screw**
5. **Bearing**
6. **Stud**
7. **Frame End**
8. **Holder**
9. **Holder**
10. **Seal**
11. **Brush**
12. **Spring**
13. **Regulator**
14. **Cover**
15. **Nut**
16. **Insulator**
17. **Bolt**
18. **Screw**
19. **Nut**
20. **Nut**
21. **Rotor Assembly**
22. **Bearing**
23. **Cover**
24. **Pulley**
25. **Spacer**
26. **Bolt**
27. **Screw**
28. **Screw**



C-3456

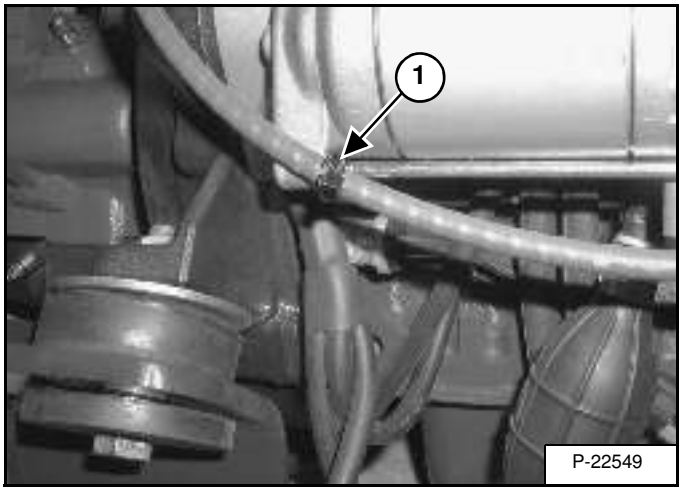
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STARTER

Removal And Installation

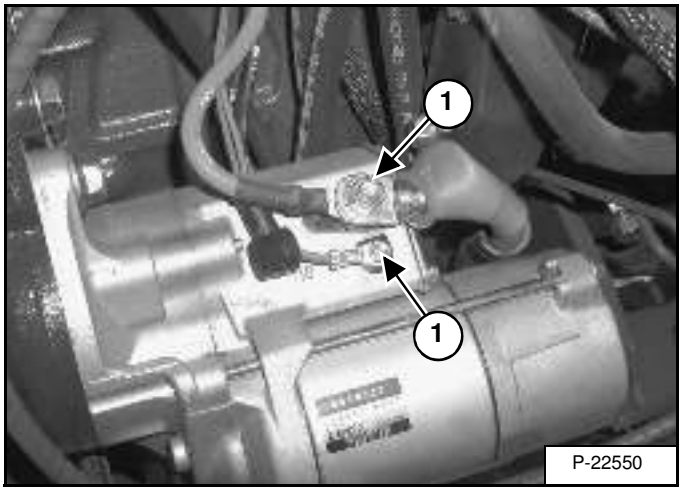
Disconnect the negative (-) cable from the battery. (See Removal And Installation on Page 50-20-2.)

Figure 50-40-1



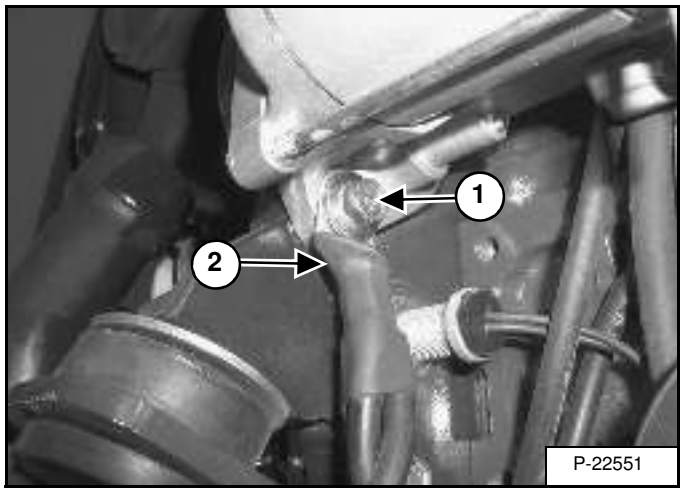
Cut and remove the cable tie (Item 1) **[Figure 50-40-1]** from the starter frame bolt.

Figure 50-40-2



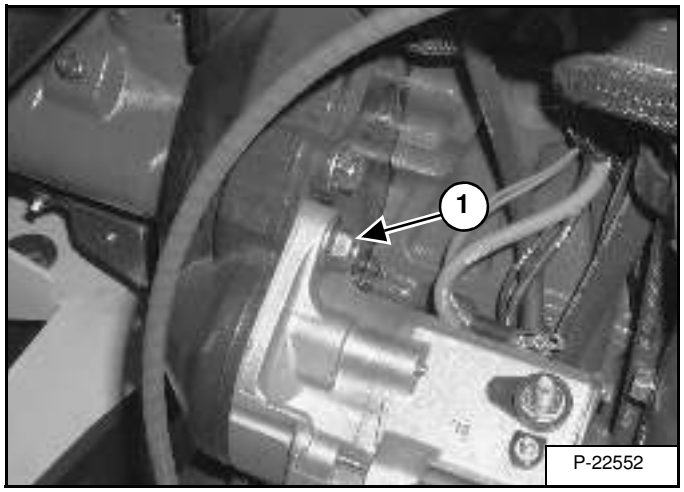
Disconnect the wires (Item 1) **[Figure 50-40-2]** from the starter.

Figure 50-40-3



Remove the bottom mounting bolt (Item 1) and ground cable (Item 2) **[Figure 50-40-3]**.

Figure 50-40-4

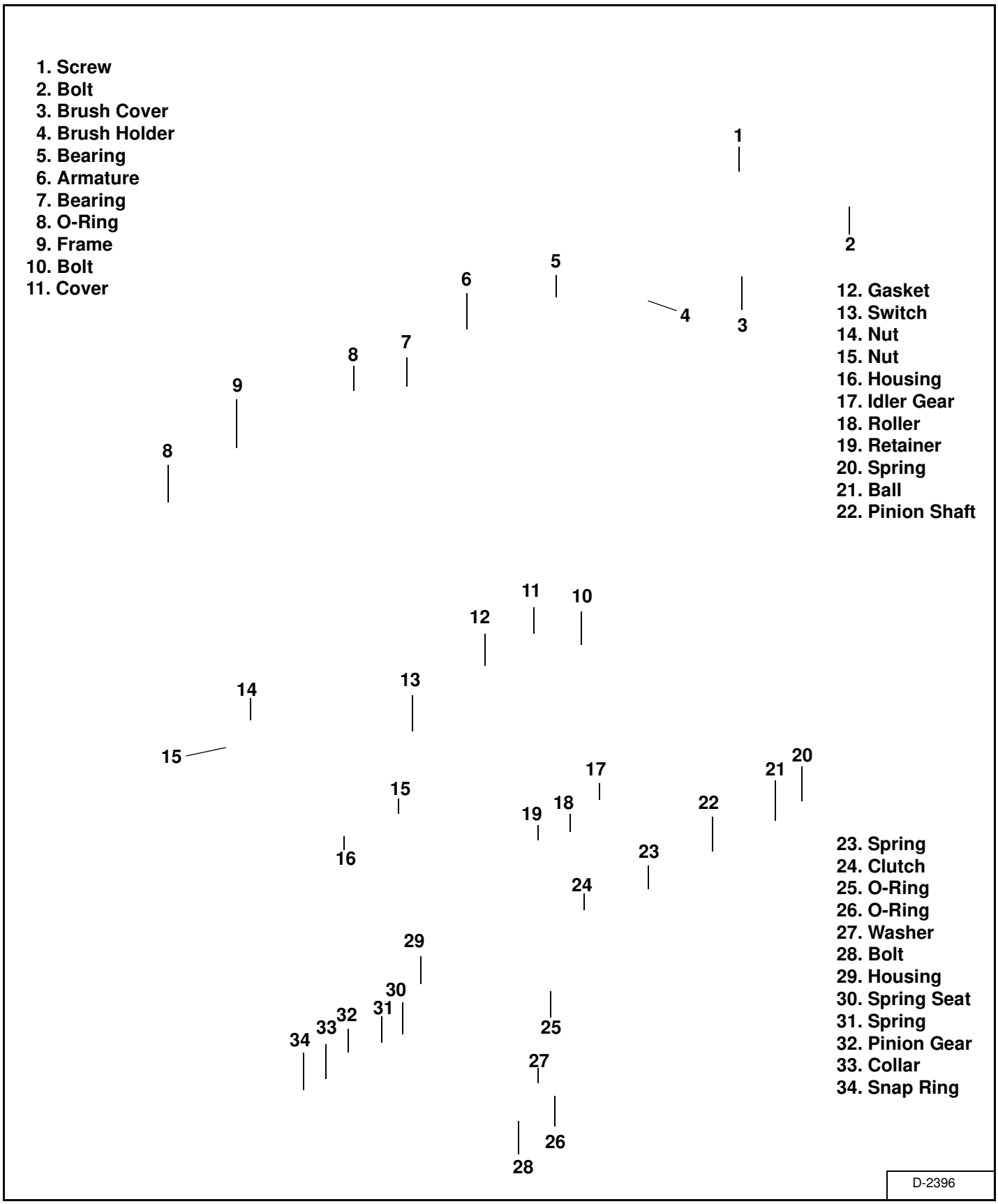


Remove the top mounting bolt (Item 1) **[Figure 50-40-4]**.

Remove the starter.

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Parts Identification



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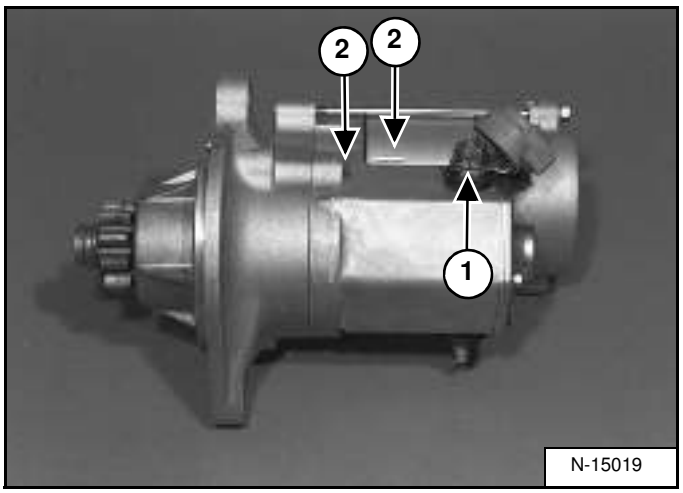
Disassembly

⚠ WARNING

AVOID INJURY OR DEATH
DO NOT operate the utility work machine with the tow bolts installed. By-passing the parking brake can cause machine roll away.

W-2460-0403

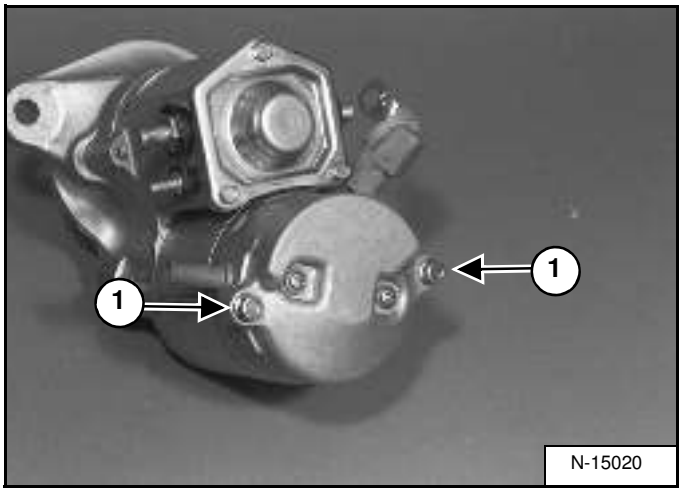
Figure 50-40-5



Remove the cable (Item 1) **[Figure 50-40-5]** from the magnetic switch.

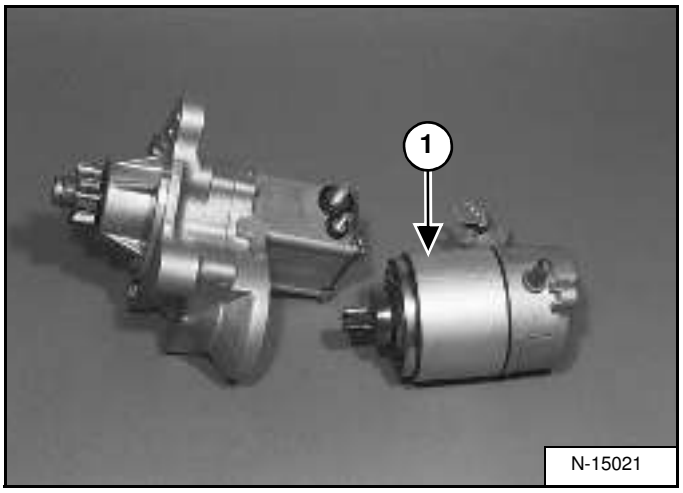
Mark the frame and magnetic switch (Item 2) **[Figure 50-40-5]** for ease of assembly.

Figure 50-40-6



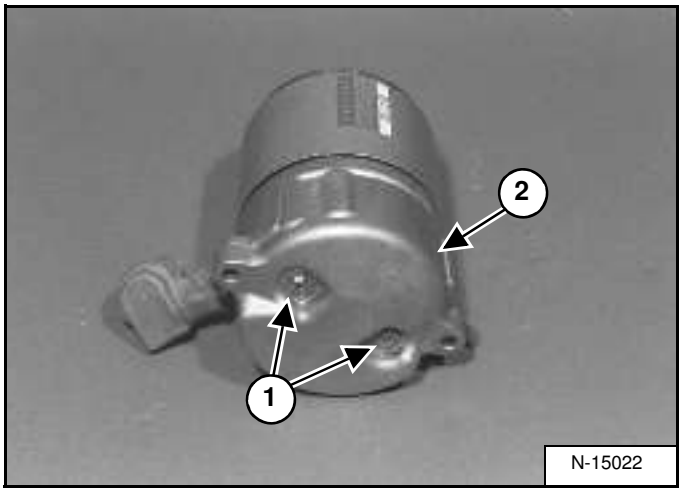
Remove the bolts (Item 1) **[Figure 50-40-6]**.

Figure 50-40-7



Remove the frame (Item 1) **[Figure 50-40-7]** from the magnetic switch.

Figure 50-40-8



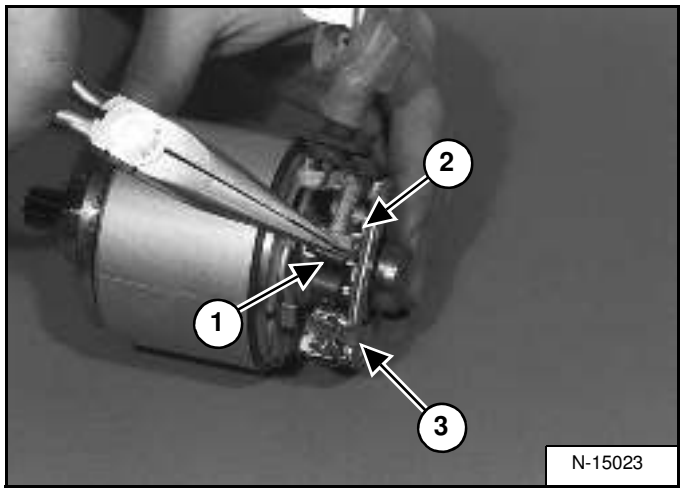
Remove the screws (Item 1) from the brush cover (Item 2) **[Figure 50-40-8]**.

Remove the cover (Item 2) **[Figure 50-40-8]**.

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Disassembly (Cont'd)

Figure 50-40-9

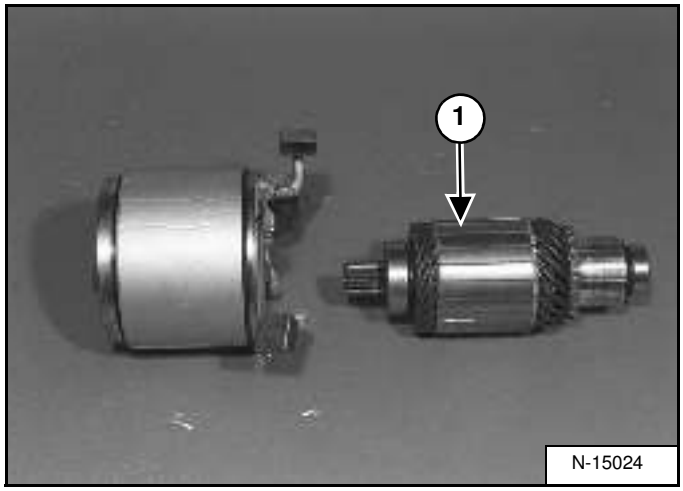


Using a needle nose pliers, pull the brush springs (Item 1) back and remove the brushes (Item 2) **[Figure 50-40-9]**.

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).

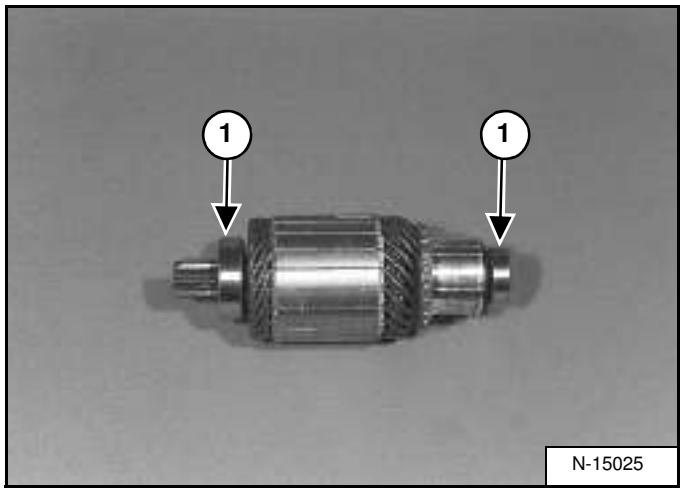
Remove the brush holder (Item 3) **[Figure 50-40-9]** from the end of the armature.

Figure 50-40-10



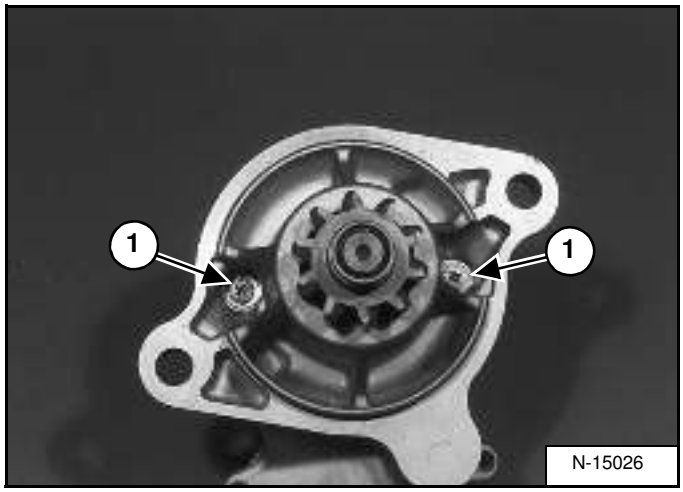
Remove the armature (Item 1) **[Figure 50-40-10]** from the frame.

Figure 50-40-11



Remove the bearings (Item 1) **[Figure 50-40-11]** from both ends of the armature.

Figure 50-40-12

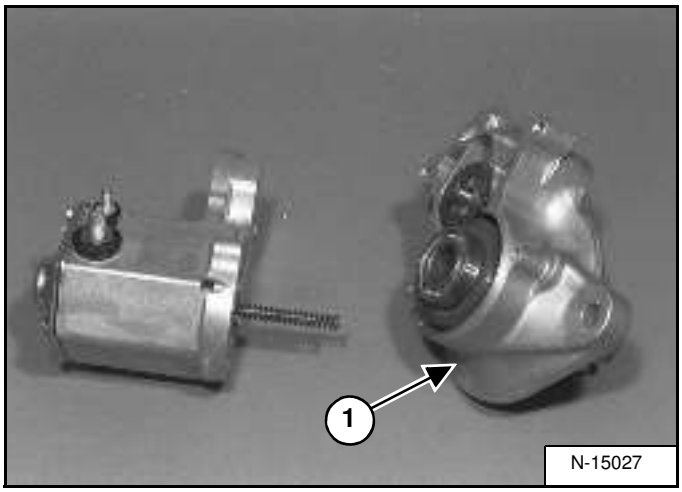


Remove the bolts (Item 1) **[Figure 50-40-12]** from the starter housing.

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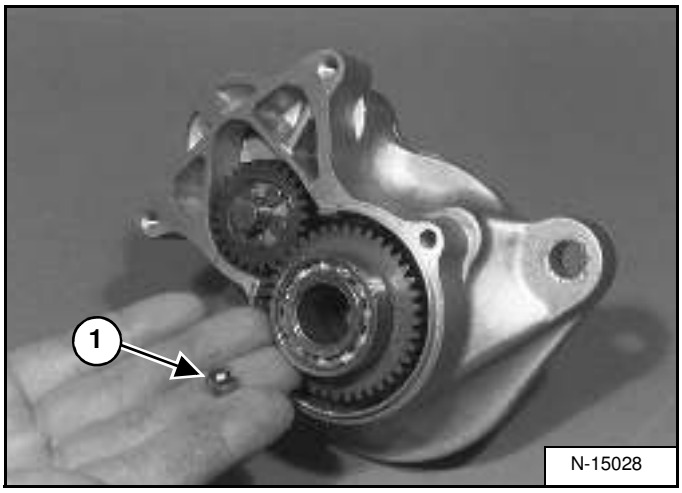
Disassembly (Cont'd)

Figure 50-40-13



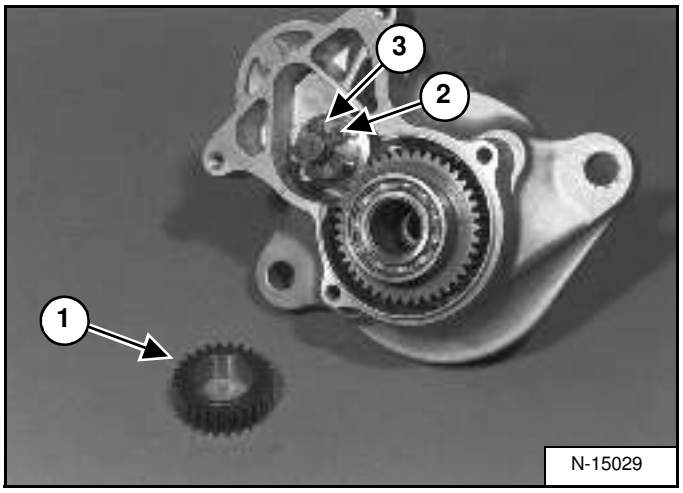
Remove the starter housing (Item 1) **[Figure 50-40-13]** from the magnetic switch housing.

Figure 50-40-14



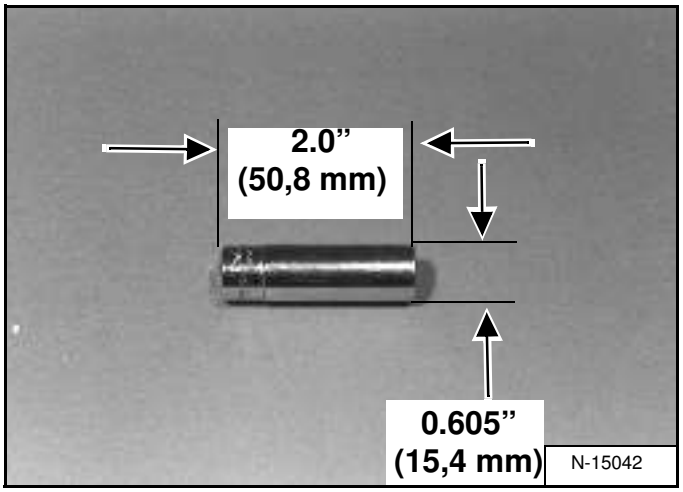
Remove the ball (Item 1) **[Figure 50-40-14]** from the pinion shaft.

Figure 50-40-15



Remove the idler gear (Item 1), rollers (Item 2) and retainer (Item 3) **[Figure 50-40-15]**.

Figure 50-40-16

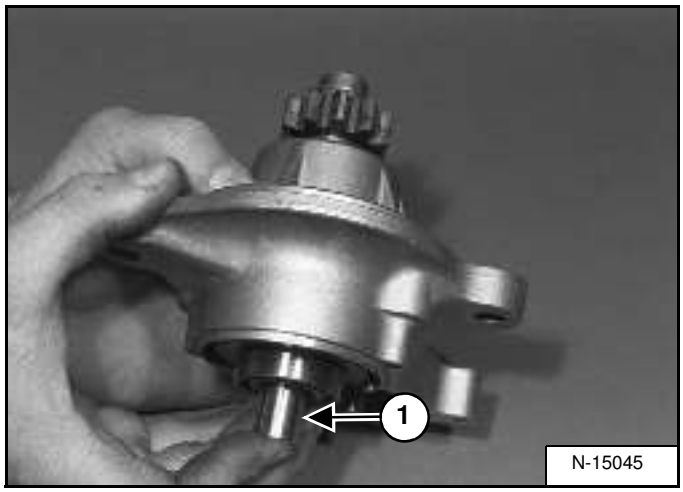


In order to remove the snap ring from the pinion shaft, a tube 0.605 inches (15,4 mm) in diameter by 2.0 inches (50,8 mm) in length is needed **[Figure 50-40-16]**.

Dealer Copy -- Not for Resale

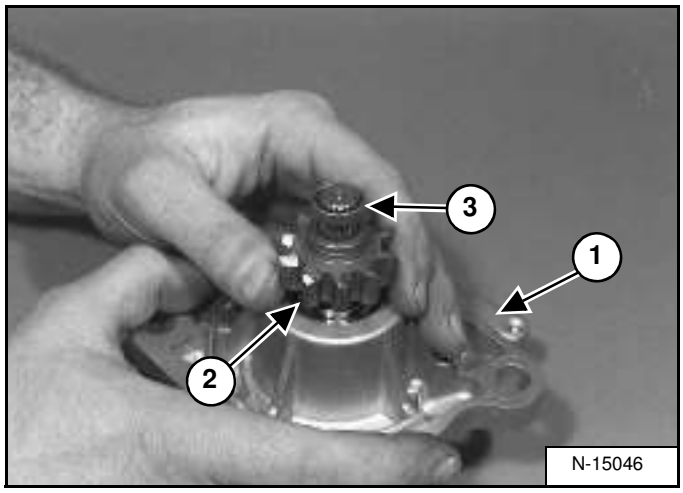
Disassembly (Cont'd)

Figure 50-40-17



Install the tube (Item 1) **[Figure 50-40-17]** in the over running clutch.

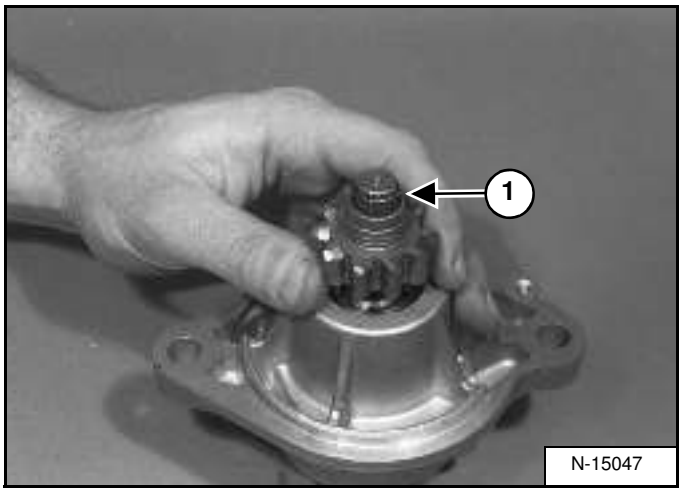
Figure 50-40-18



Press down on the starter carrier (Item 1) to extend the pinion shaft. Press down on the pinion (Item 2) **[Figure 50-40-18]**.

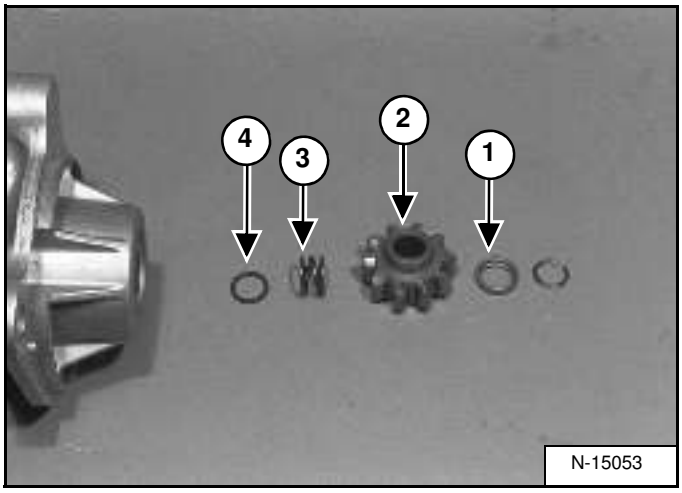
Press the collar (Item 3) **[Figure 50-40-18]** down to gain access to the snap ring.

Figure 50-40-19



Remove the snap ring (Item 1) **[Figure 50-40-19]**.

Figure 50-40-20

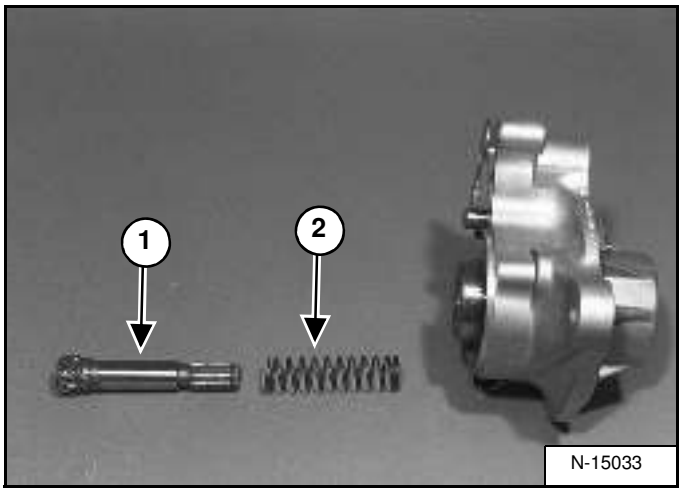


Remove the collar (Item 1), pinion (Item 2), spring (Item 3), and spring seat (Item 4) **[Figure 50-40-20]**.

Dealer Copy -- Not for Resale

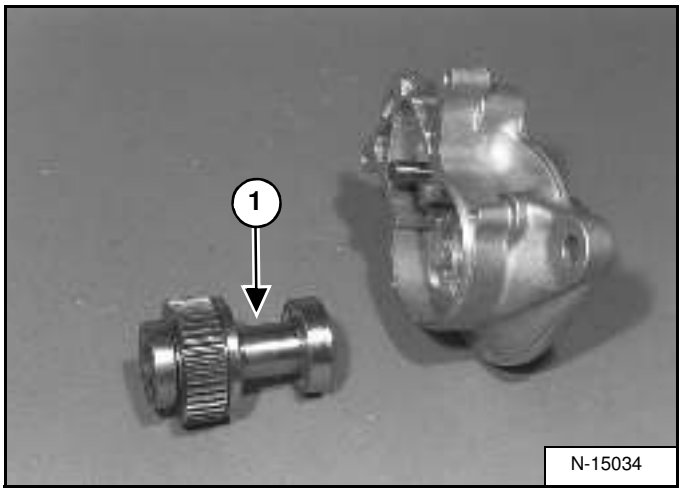
Disassembly (Cont'd)

Figure 50-40-21



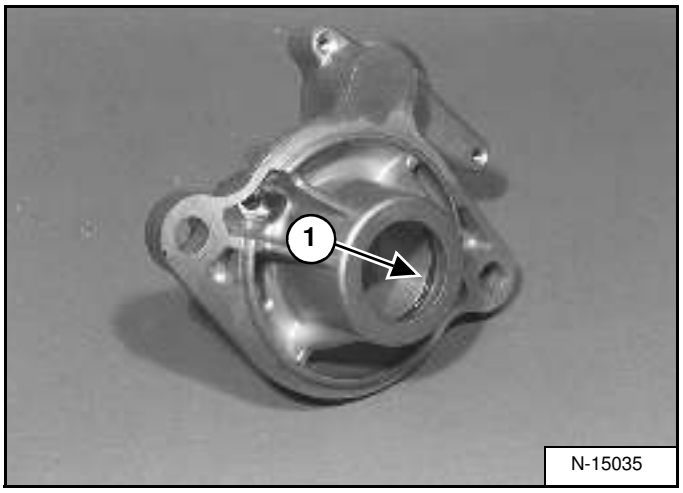
Remove the pinion shaft (Item 1) and spring (Item 2) **[Figure 50-40-21]** from the starter drive.

Figure 50-40-22



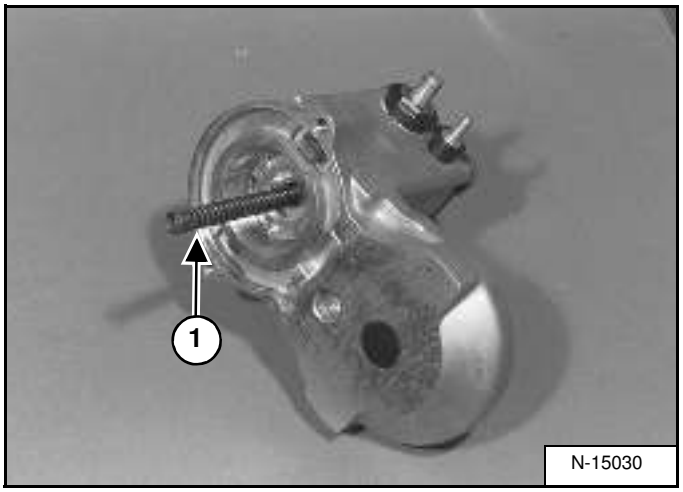
Remove the over running clutch (Item 1) **[Figure 50-40-22]**.

Figure 50-40-23



Remove the O-ring (Item 1) **[Figure 50-40-23]** from the starter housing.

Figure 50-40-24

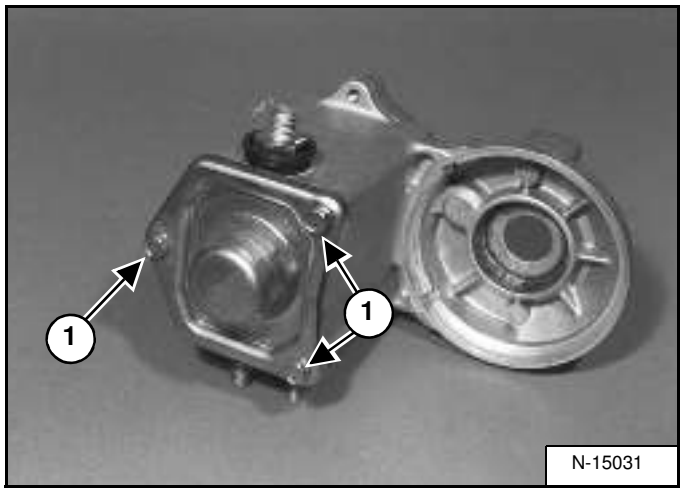


Remove the spring (Item 1) **[Figure 50-40-24]** from the magnetic switch.

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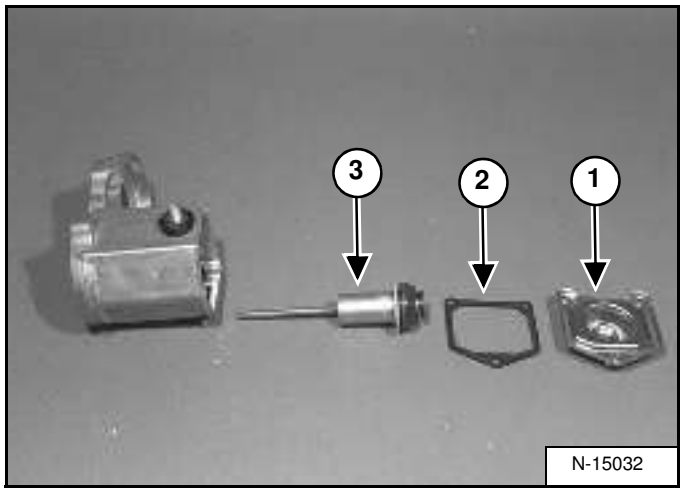
Disassembly (Cont'd)

Figure 50-40-25



Remove the bolts (Item 1) **[Figure 50-40-25]** from the magnetic switch cover.

Figure 50-40-26



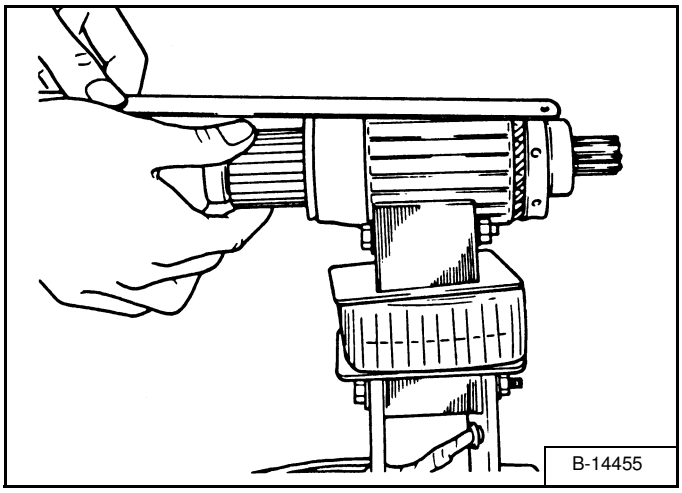
Remove the cover (Item 1), gasket (Item 2) and switch (Item 3) **[Figure 50-40-26]**.

Inspection And Repair

Inspect the brush cover for discoloration, indicating the starter has been overheated.

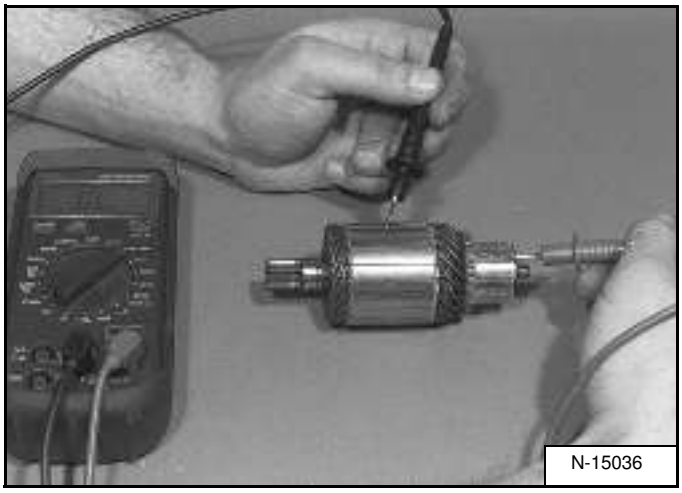
Inspect the pinion teeth for wear and damage.

Figure 50-40-27



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 50-40-27]**. 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 50-40-28

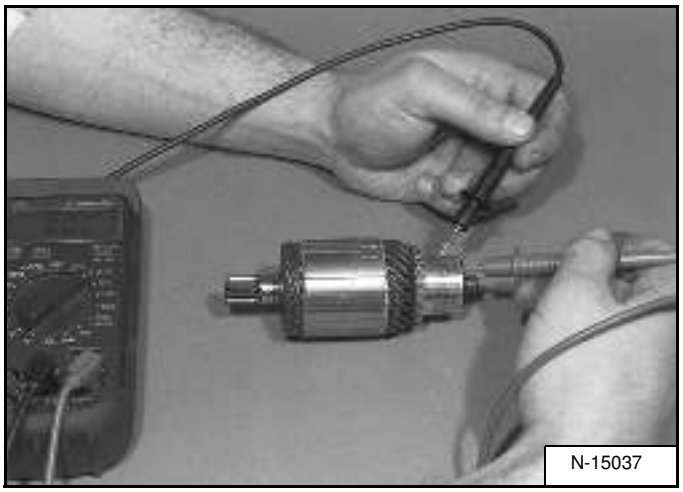


Armature Winding Ground Test: Use a circuit tester, touch one probe to a commutator segment and the other probe to the armature core **[Figure 50-40-28]**. There should be no continuity. If there is continuity, the armature is grounded and must be replaced.

Dealer Copy -- Not for Resale

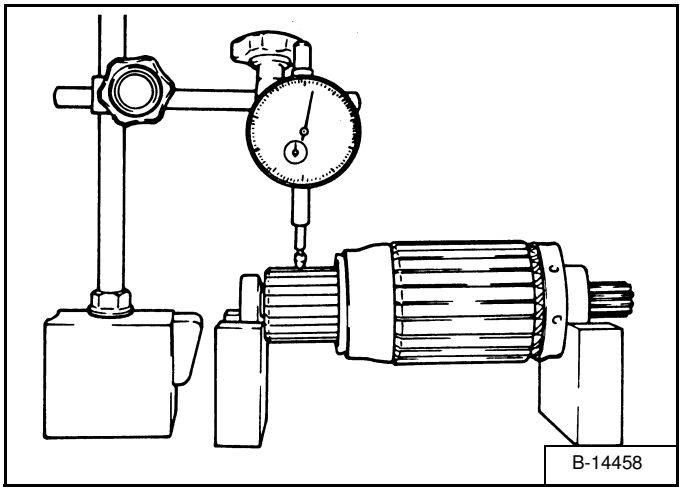
Inspection And Repair (Cont'd)

Figure 50-40-29



Armature Winding Continuity Test: Use a circuit tester, touch the probes to two commutator segments **[Figure 50-40-29]**. There must be continuity at any point. If there is no continuity, the winding is open-circuited, replace the armature.

Figure 50-40-30

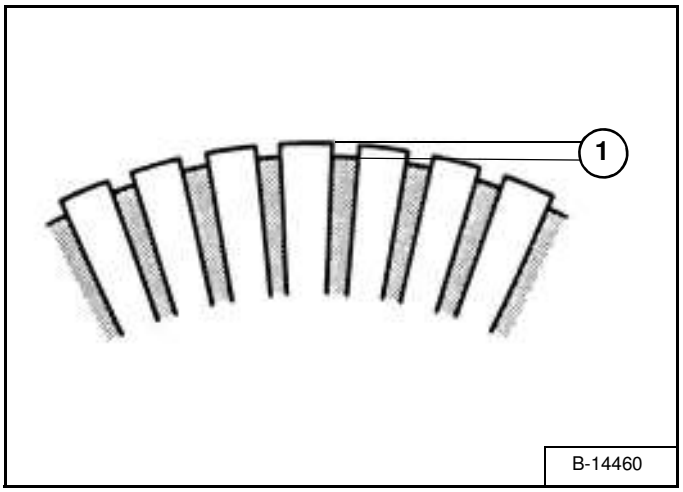


Commutator Run-Out Test: Check the commutator run-out as shown in **[Figure 50-40-30]**.

Service Limit - 0.020 inch (0,4 mm)

If the commutator exceeds the service limit, repair as needed.

Figure 50-40-31



Measure the segment mica depth (Item 1) **[Figure 50-40-31]**.

Service Limit - 0.008 inch (0,2 mm)

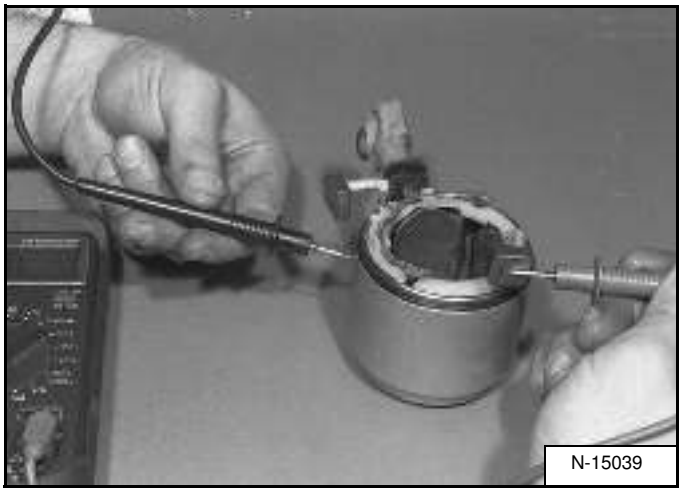
If it is worn, replace the armature.

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 50-40-32



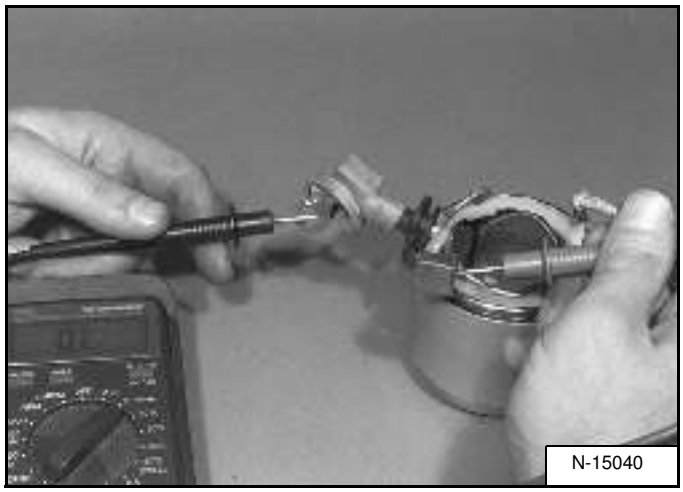
Field Winding Ground Test: Use a circuit tester, touch one probe to the field winding end of the brush and the other probe to the surface of the frame **[Figure 50-40-32]**. There should be no continuity. If there is continuity, the field windings are grounded.

Replace the field windings.

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Inspection And Repair (Cont'd)

Figure 50-40-33



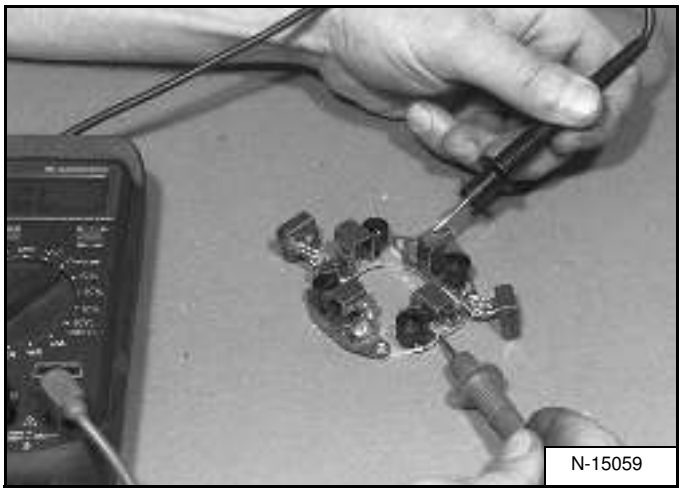
Field Windings Continuity Test: Use a circuit tester, touch one probe to the wire and the other probe to the brush **[Figure 50-40-33]**. There must be continuity. If there is no continuity, the field windings are open-circuited. Replace the yoke if the field windings have an open circuit.

Inspect the brushes for wear and damage.

Replace the brush holder or yoke assembly if the brushes are worn or damaged.

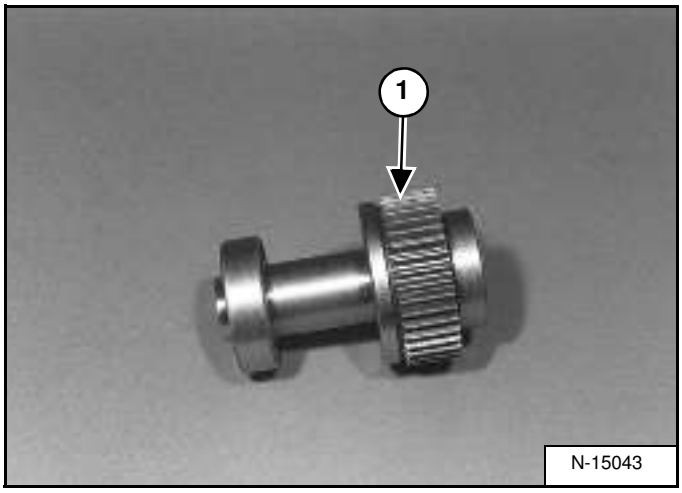
Check brush springs, for damage or rust. Replace as needed.

Figure 50-40-34



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 50-40-34]**. There should be no continuity. If there is continuity, replace or repair.

Figure 50-40-35



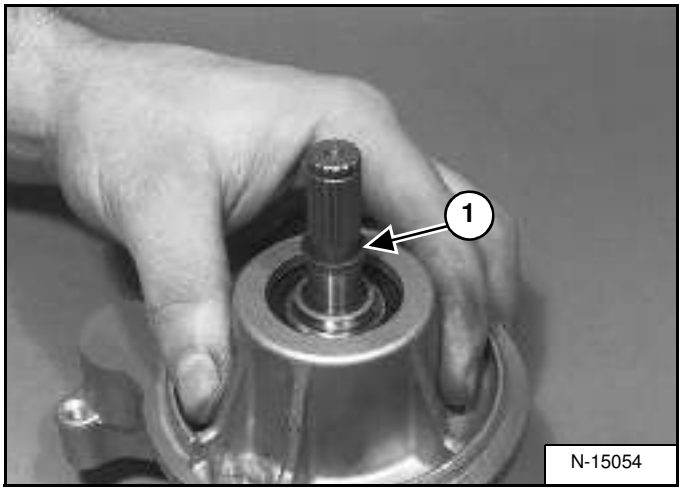
Inspect the over running clutch (Item 1) **[Figure 50-40-35]**, it must rotate freely in the direction of the starter rotation and locked in the opposite rotation.

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Assembly

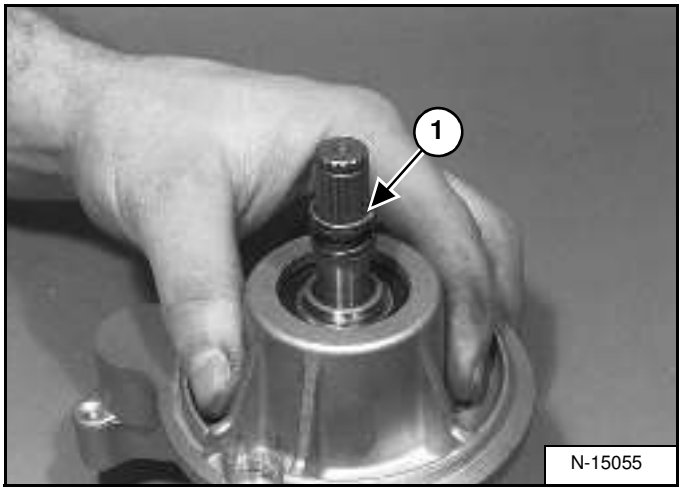
Place the starter drive on the bench, and press down on the starter drive housing.

Figure 50-40-36



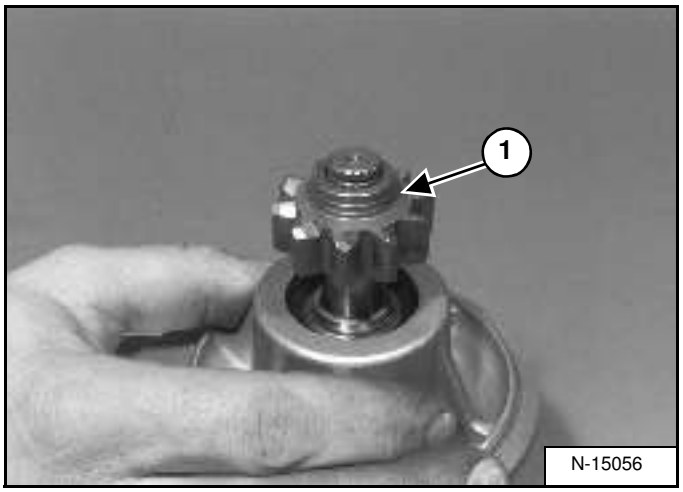
Install the spring seat (Item 1) **[Figure 50-40-36]** on the pinion shaft.

Figure 50-40-37



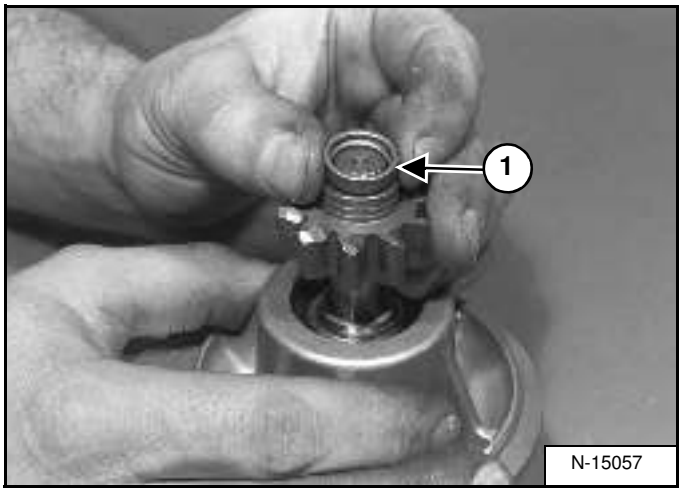
Install the spring (Item 1) **[Figure 50-40-37]**.

Figure 50-40-38



Install the pinion (Item 1) **[Figure 50-40-38]**.

Figure 50-40-39

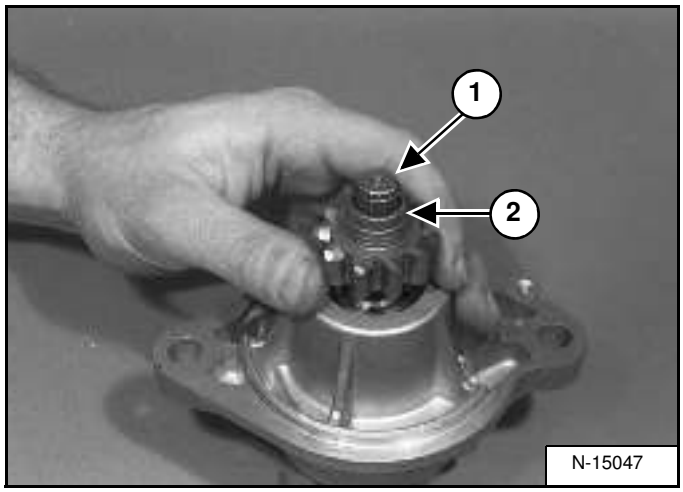


Install the collar (Item 1) **[Figure 50-40-39]**.

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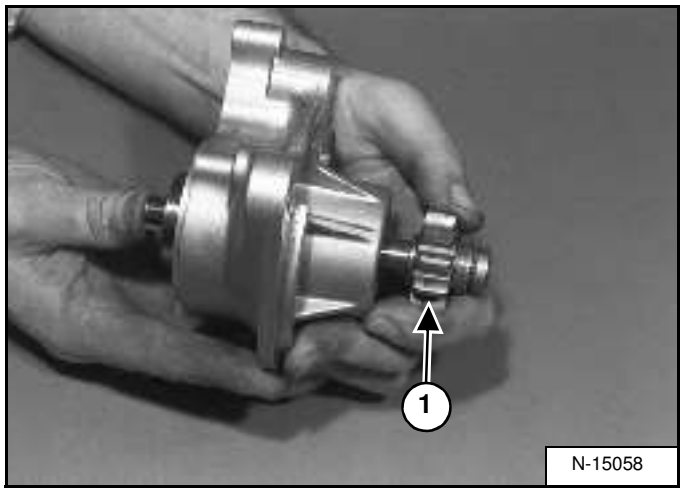
Assembly (Cont'd)

Figure 50-40-40



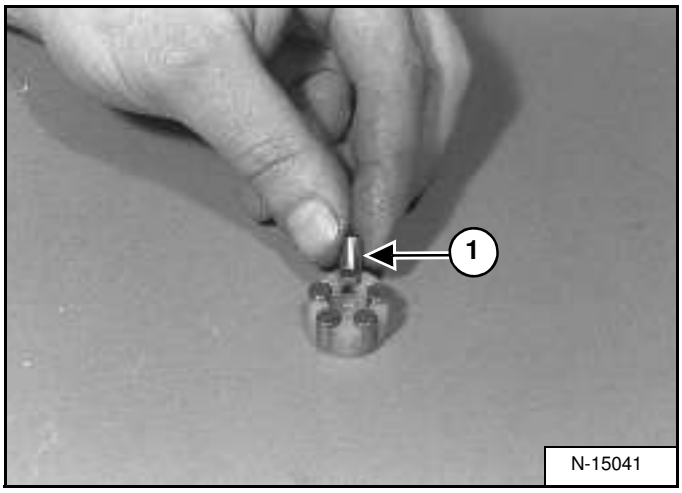
Install the snap ring (Item 1). Pull the collar (Item 2) **[Figure 50-40-40]** over the snap ring.

Figure 50-40-41



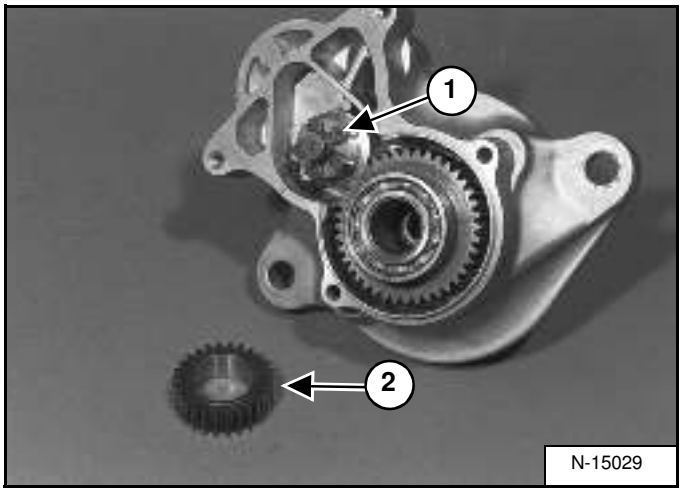
With the pinion shaft extended, extend and release the pinion (Item 1) **[Figure 50-40-41]**. The pinion must return to the fully retracted position.

Figure 50-40-42



Install the rollers (Item 1) **[Figure 50-40-42]** in the retainer.

Figure 50-40-43



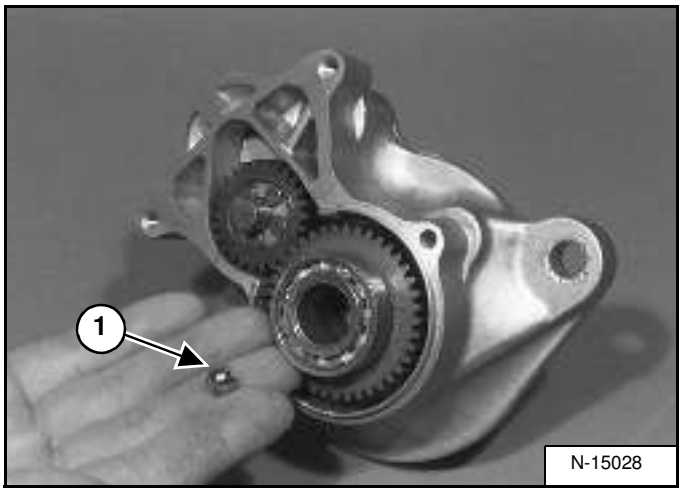
Install the roller/retainer assembly (Item 1) **[Figure 50-40-43]** on the starter housing.

Install the idler gear (Item 2) **[Figure 50-40-43]** over the roller/retainer assembly.

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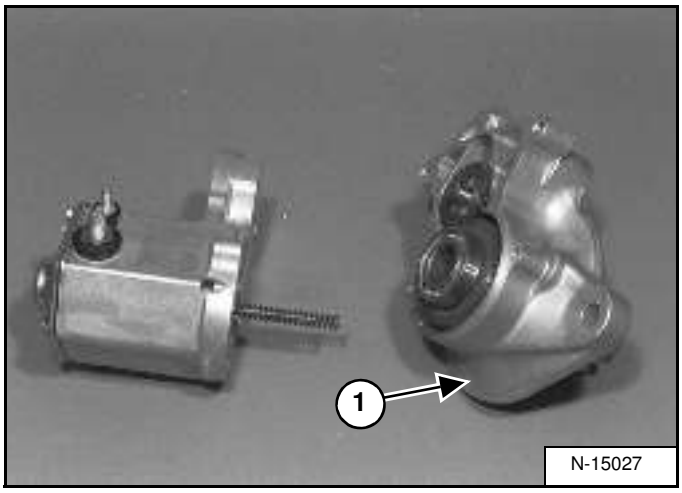
Assembly (Cont'd)

Figure 50-40-44



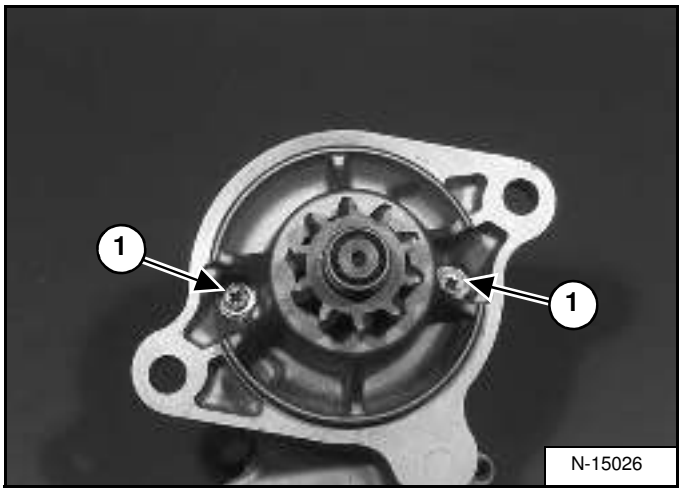
Install the ball (Item 1) **[Figure 50-40-44]** in the pinion shaft.

Figure 50-40-45



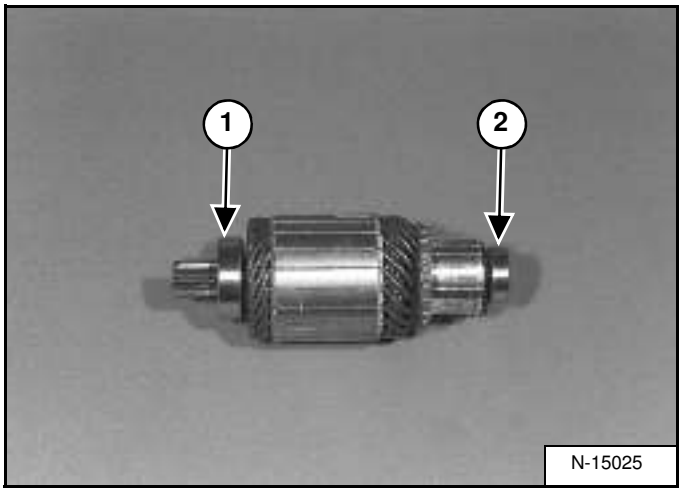
Install the starter drive (Item 1) **[Figure 50-40-45]** on the magnetic switch.

Figure 50-40-46



Install the two bolts (Item 1) **[Figure 50-40-46]**. Tighten the bolts to 60-104 in.-lbs. (7-12 Nm) torque.

Figure 50-40-47

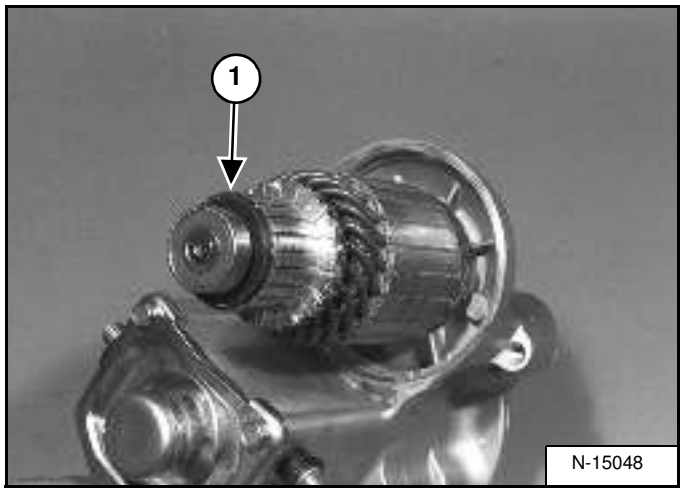


Install the bearings (Items 1 & 2) **[Figure 50-40-47]** on both ends of the armature.

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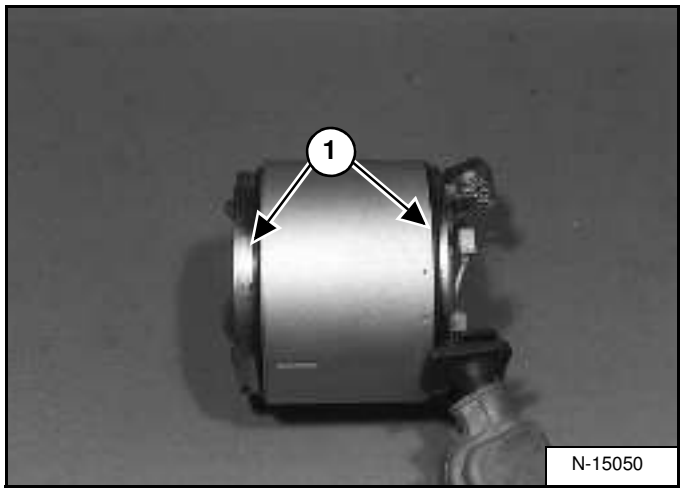
Assembly (Cont'd)

Figure 50-40-48



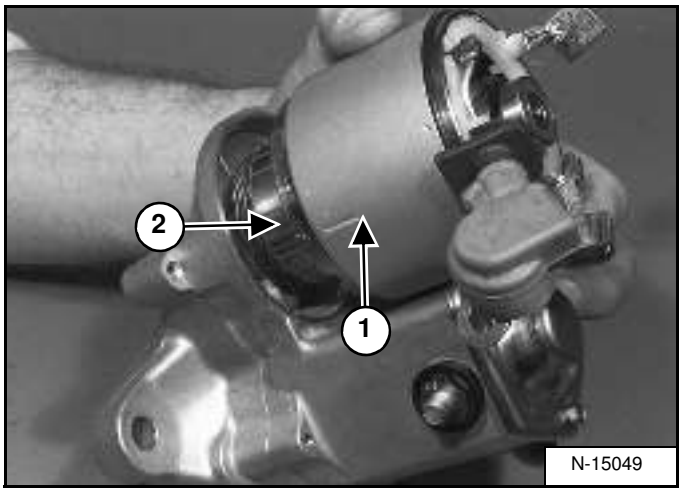
Install the armature (Item 1) **[Figure 50-40-48]** in the magnetic switch housing.

Figure 50-40-49



Install the new O-rings (Item 1) **[Figure 50-40-49]** on both ends of the frame.

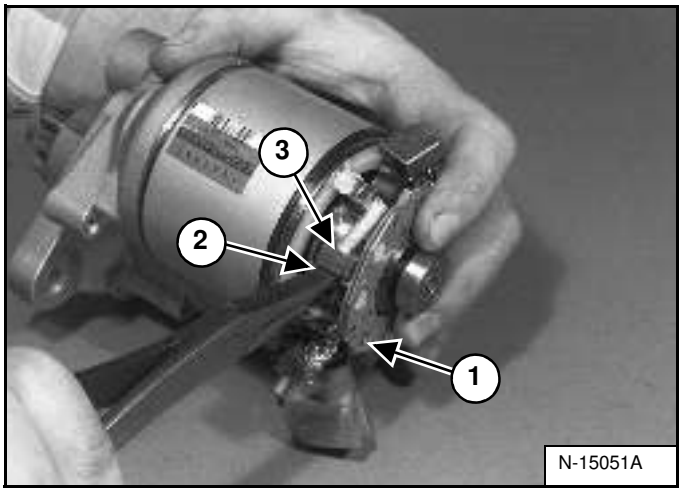
Figure 50-40-50



Install the frame (Item 1) **[Figure 50-40-50]** over the armature.

NOTE: Make sure the tab (Item 2) [Figure 50-40-50] on the frame is aligned with the slot in the magnetic switch housing.

Figure 50-40-51



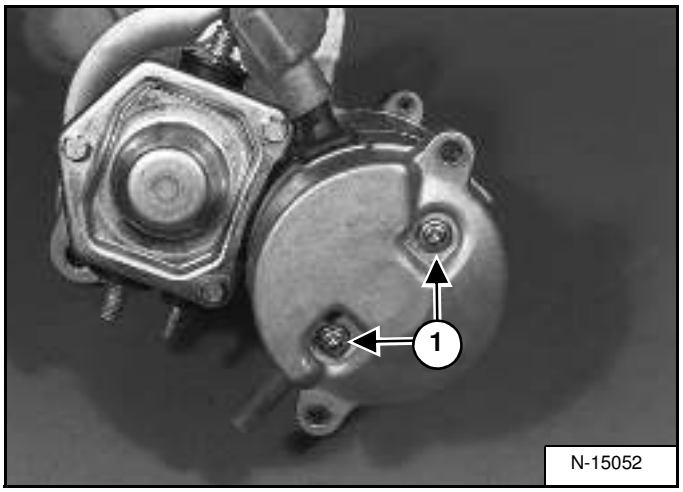
Install the brush holder (Item 1) **[Figure 50-40-51]** on the armature.

Using a needle nose pliers, pull the spring (Item 2) back and install the brushes (Item 3) **[Figure 50-40-51]**.

Dealer Copy -- Not for Resale

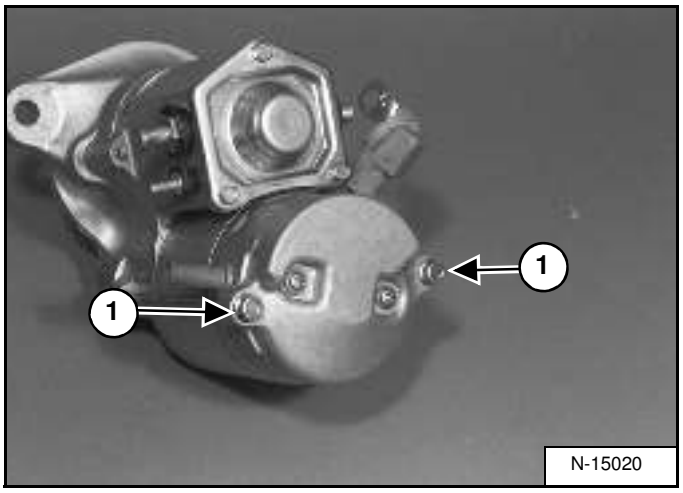
Assembly (Cont'd)

Figure 50-40-52



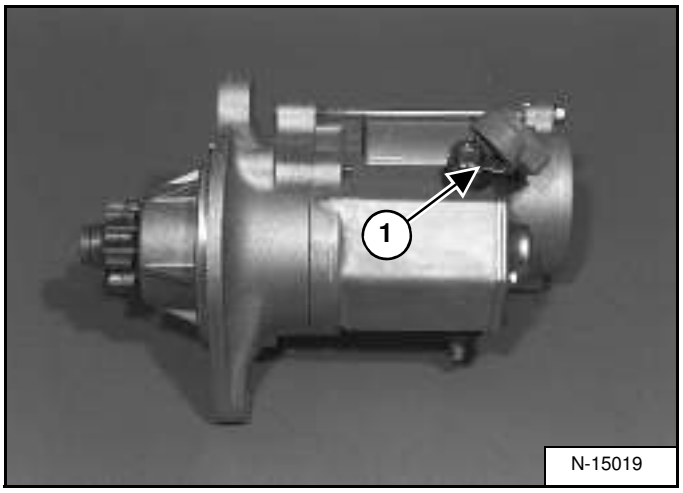
Install the brush cover and screws (Item 1) **[Figure 50-40-52]**.

Figure 50-40-53



Install the bolts (Item 1) **[Figure 50-40-53]**. Tighten the bolts to 60-104 in.-lbs. (7-12 Nm) torque.

Figure 50-40-54



Install the cable (Item 1) **[Figure 50-40-54]** on the terminal. Tighten the terminal nut to 4-7 ft.-lbs. (5-9 Nm) torque.

Dealer Copy -- Not for Resale

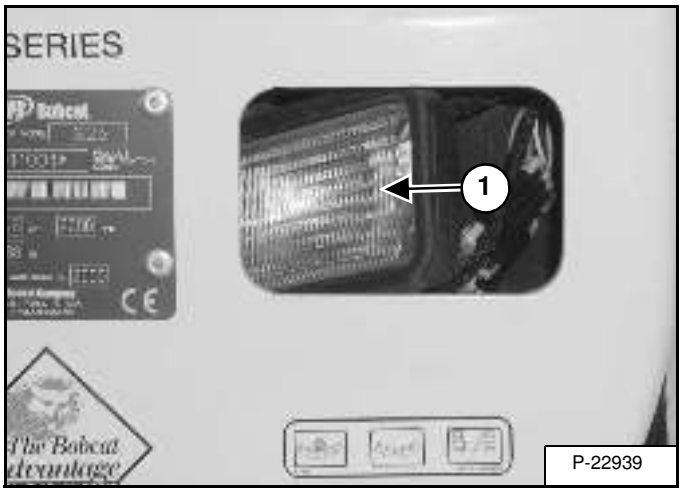


Dealer Copy -- Not for Resale

LIGHTS

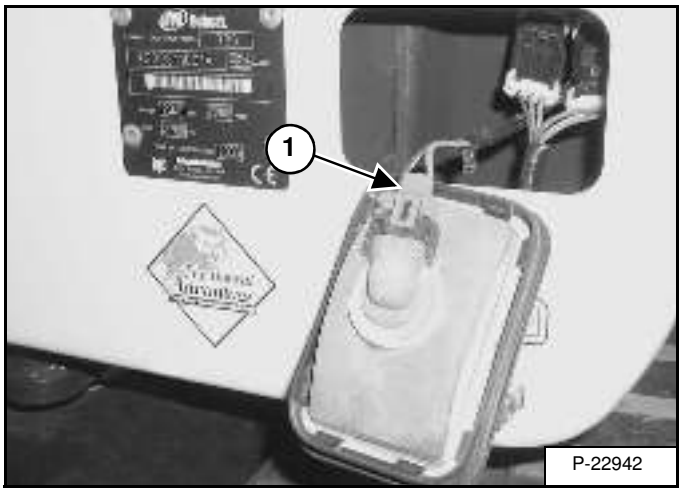
Removal And Installation

Figure 50-50-1



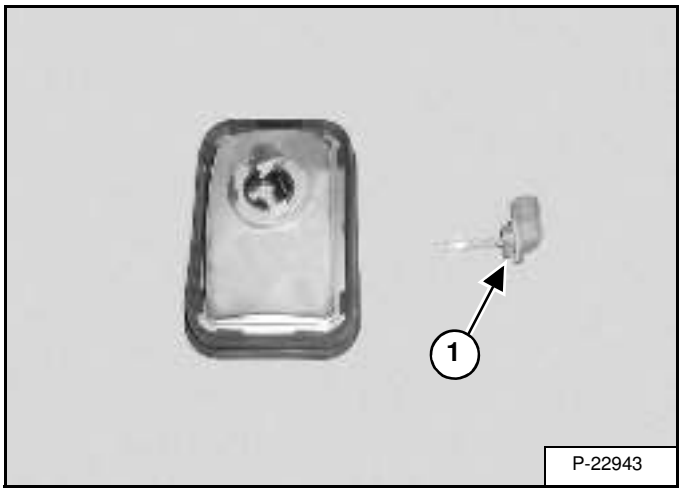
To remove the upperstructure light, pivot the light (Item 1) **[Figure 50-50-1]** back inside the frame.

Figure 50-50-2



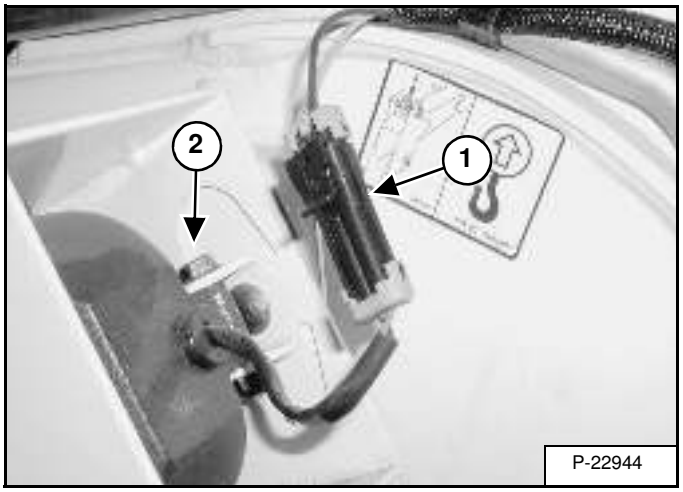
Disconnect the wire harness (Item 1) **[Figure 50-50-2]**.

Figure 50-50-3



Remove the light bulb assembly (Item 1) **[Figure 50-50-3]** from the lens.

Figure 50-50-4

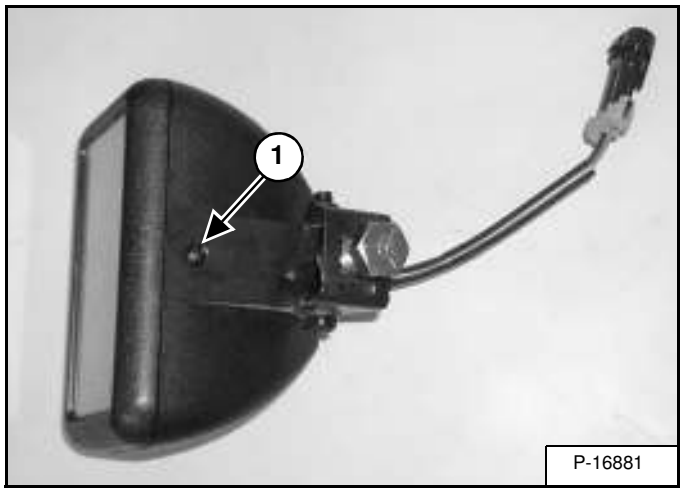


To remove the boom light, disconnect the wire harness (Item 1) and remove the nut and bolt (Item 2) **[Figure 50-50-4]**.

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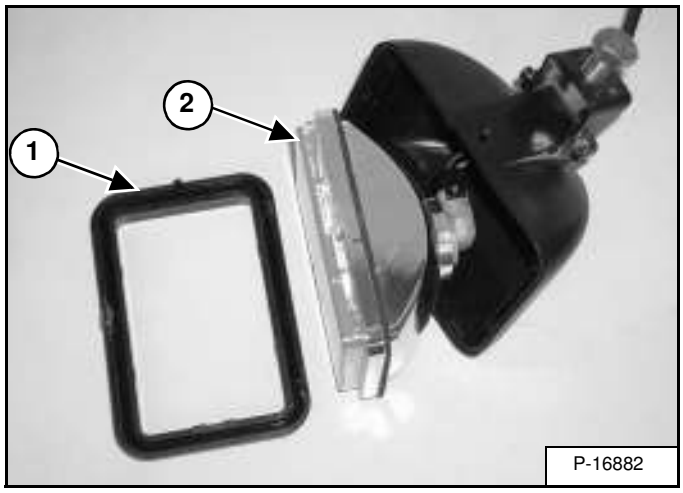
Disassembly And Assembly

Figure 50-50-5



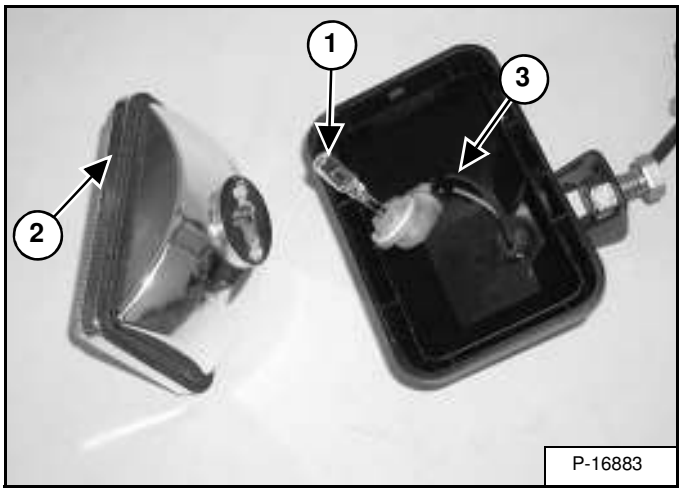
Remove screw (Item 1) **[Figure 50-50-5]** from side of light.

Figure 50-50-6



Remove cover (Item 1) and lens assembly (Item 2) **[Figure 50-50-6]**.

Figure 50-50-7



Remove light bulb assembly (Item 1) from lens assembly (Item 2) **[Figure 50-50-7]**.

Disconnect the wire connector (Item 3) **[Figure 50-50-7]** from the light bulb assembly.

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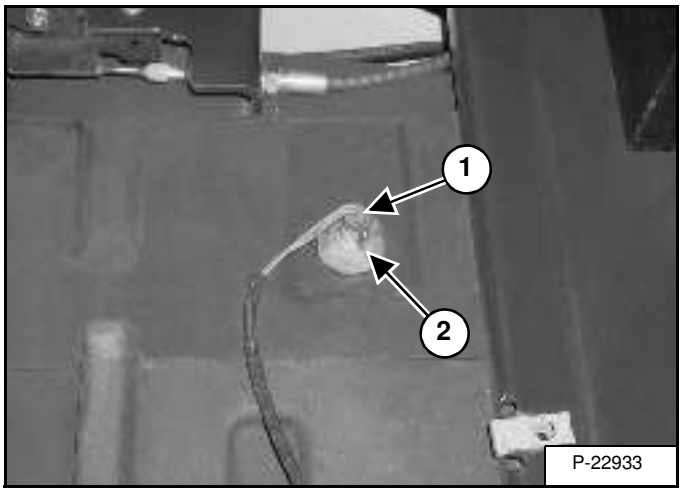
FUEL LEVEL SENDER

Removal And Installation

Remove the negative battery cable. (See Removal And Installation on Page 50-20-2.)

Remove the floor mat and floor plate. (See Removal And Installation on Page 40-110-1.)

Figure 50-80-1



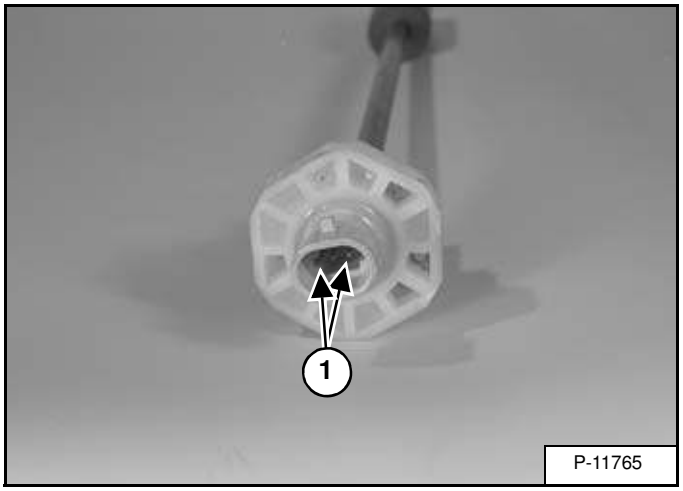
Disconnect the harness connector (Item 1) **[Figure 50-80-1]** from the fuel sender.

Remove the fuel sender (Item 2) **[Figure 50-80-1]**. The sender threads into the tank, use a wrench to remove the sender.

Testing

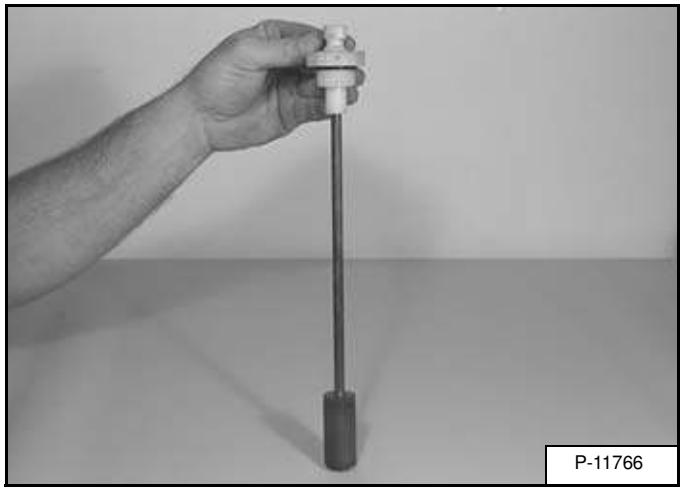
Use an ohmmeter to check the resistance of the fuel sender.

Figure 50-80-2



Insert one of the ohm tester leads into each of the fuel sender electrical connectors (Item 1) **[Figure 50-80-2]** in the end of the fuel sender.

Figure 50-80-3

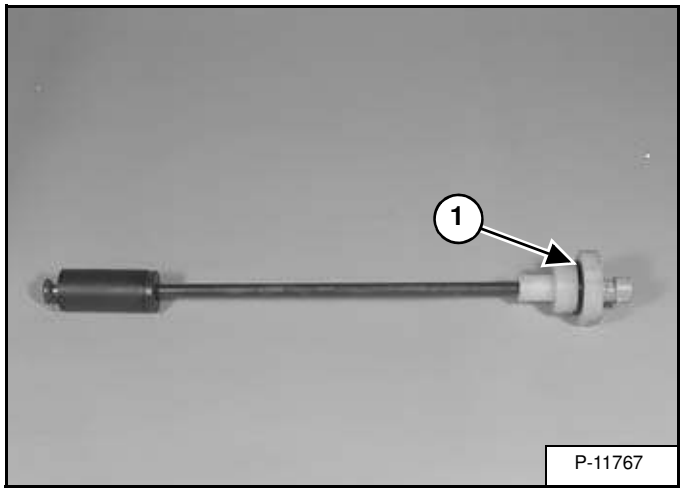


With the fuel sender in the position shown **[Figure 50-80-3]**, read the ohms in the empty position. Slide the float upwards and the ohm reading will decrease. See resistance chart below.

The resistance should read as follows:

FULL: 15-35 Ohms.
HALF: 82-97 Ohms.
EMPTY: 230-250 Ohms.

Figure 50-80-4



Inspect the O-ring (Item 1) **[Figure 50-80-4]** and replace as needed.

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DIAGNOSTICS SERVICE CODE

Number Codes List

CODE		CODE	
02-16	Hydraulic charge filter not connected	22-02	Starter relay output error ON
02-17	Hydraulic charge filter plugged	22-03	Starter relay output error OFF
03-09	Battery voltage low	26-02	Front base output error ON
03-10	Battery voltage high	26-03	Front base output error OFF
03-11	Battery voltage extremely high		
03-14	Battery voltage extremely low	27-02	Front rod output error ON
03-22	Battery voltage out of range low	27-03	Front rod output error OFF
04-14	Oil pressure extremely low	28-02	Diverter output error ON
04-15	Oil pressure shutdown level	28-03	Diverter output error OFF
6-10	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		
		60-21	Sec. aux. thumbswitch out of range high
07-10	Hydraulic oil temperature high	60-22	Sec. aux. thumbswitch out of range low
07-11	Hydraulic oil temperature extremely high	60-23	Sec. aux. thumbswitch not calibrated
07-15	Hydraulic oil temperature shutdown level		
07-21	Hydraulic oil temperature out of range high	62-04	Load moment monitoring in error
07-22	Hydraulic oil temperature out of range low		
		63-05	Work group/travel console sensor
08-10	Engine coolant temperature high	63-06	Work group/travel console senor
08-11	Engine coolant temperature extremely high		
08-15	Engine coolant temperature shutdown level	64-05	Switched power/acc. relay short to battery
08-21	Engine coolant temperature out of range high	64-06	Switched power/acc.relay short to ground
08-22	Engine coolant temperature out of range low	64-07	Switched power/acc. relay open circuit
09-09	Fuel level low	65-02	Work group/travel lockout solenoid error ON
09-21	Fuel level out of range high	65-03	Work group/travel lockout solenoid error OFF
09-22	Fuel level out of range low	65-05	Work group/travel lockout solenoid short to battery
		65-06	Work group/travel lockout solenoid short to ground
12-21	Primary auxiliary PWM switch out of range high	65-07	Work group/travel lockout solenoid open circuit
12-22	Primary auxiliary PWM switch out of range low		
12-23	Primary auxiliary PWM switch not calibrated		
13-05	Fuel shut-off hold solenoid short to battery		
13-06	Fuel shut-off hold solenoid short to ground		
14-02	Fuel shut-off pull solenoid error ON		
14-03	Fuel shut-off pull solenoid error OFF		
20-02	Two speed output error ON		
20-03	Two speed output error OFF		
21-02	Glow plug output error ON		
21-03	Glow plug output error OFF		

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ENGINE SERVICE

AIR CLEANER 60-30-1
Removal And Installation 60-30-1

ENGINE. 60-60-1
Removal And Installation 60-60-1

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Fuel Injection Pump Check 60-50-4
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Removal And Installation 60-20-1

RADIATOR 60-40-1
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Continued On Next Page

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TROUBLESHOOTING 60-10-1
Chart 60-10-1

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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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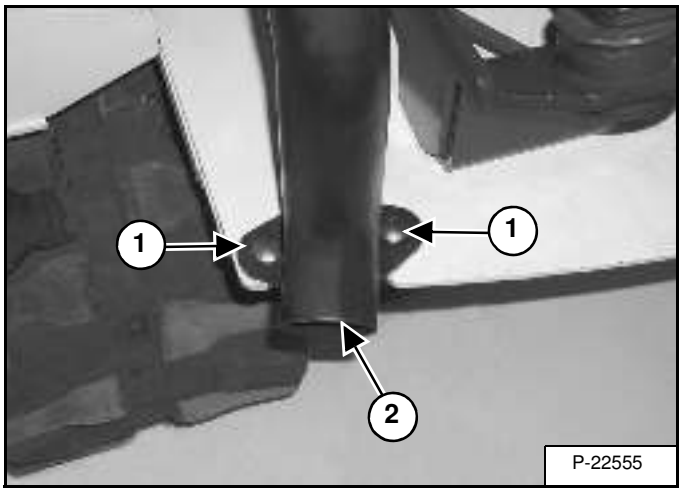
MUFFLER

Removal And Installation

Remove the air cleaner. (See Removal And Installation on Page 60-30-1.)

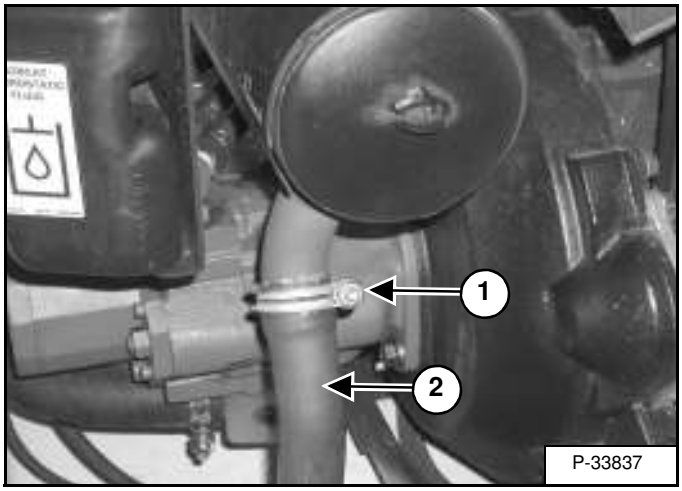
Open the tail gate.

Figure 60-20-1



Remove the two bolts (Item 1) **[Figure 60-20-1]** and nuts (Early Models).

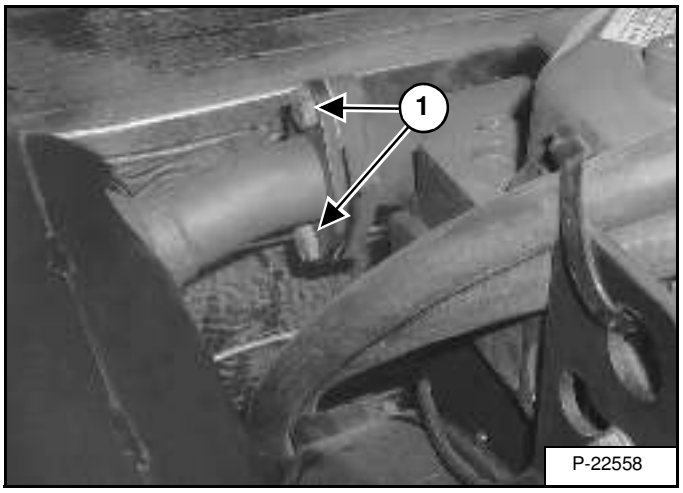
Figure 60-20-2



Remove the clamp (Item 1) **[Figure 60-20-2]** (Later Models).

Remove the tail pipe (Item 2) **[Figure 60-20-1]** & **[Figure 60-20-2]**.

Figure 60-20-3



Remove the two flange bolts (Item 1) **[Figure 60-20-3]**.

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Removal And Installation (Cont'd)

Figure 60-20-4

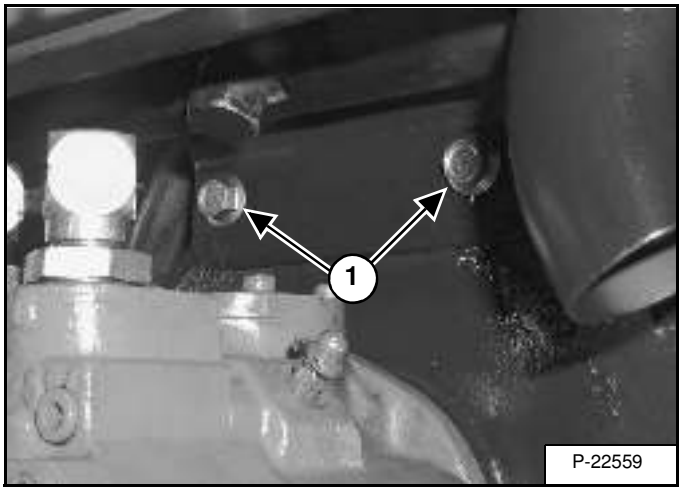
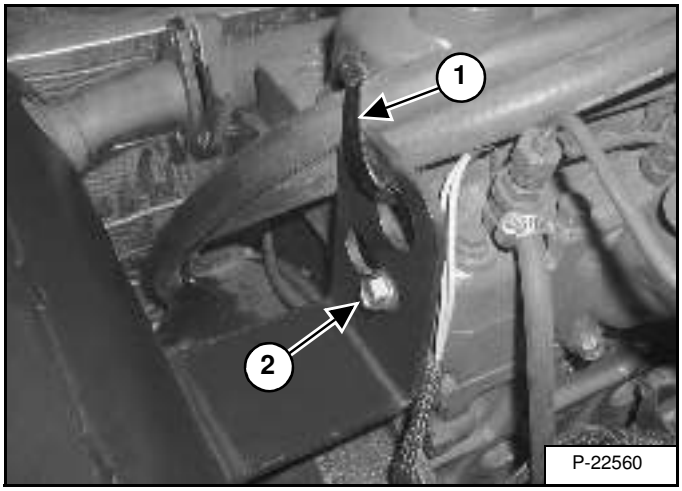


Figure 60-20-5



NOTE: It may be necessary to loosen all three mount bolts [Figure 60-20-4] & [Figure 60-20-5] to remove the flange bolts.

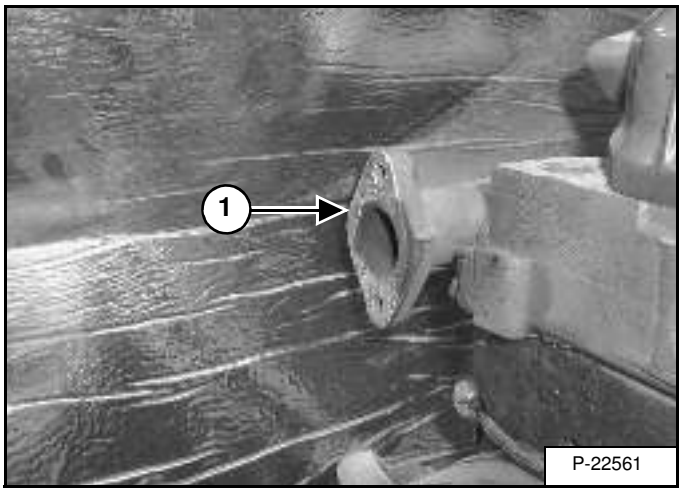
Remove the two bottom mount bolts (Item 1) **[Figure 60-20-4]**.

Cut and remove the cable tie (Item 1) **[Figure 60-20-5]** from the heater hoses (if equipped).

Remove the top mount bolt (Item 2) **[Figure 60-20-5]**.

Remove the muffler.

Figure 60-20-6



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

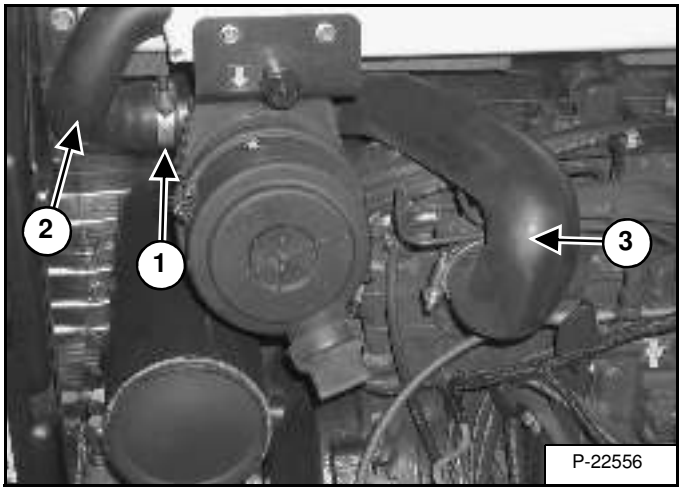
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AIR CLEANER

Removal And Installation

Open the tailgate.

Figure 60-30-1



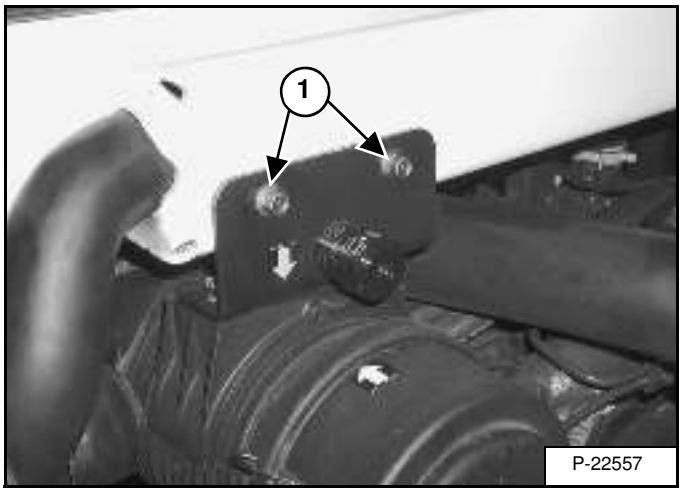
Loosen the hose clamp (Item 1) **[Figure 60-30-1]** on the air intake hoses.

Remove the hose (Item 2) **[Figure 60-30-1]** from the air cleaner.

Remove the hose (Item 3) **[Figure 60-30-1]** from the intake manifold.

NOTE: Plug the intake manifold hole to prevent any contamination from getting into the engine.

Figure 60-30-2



Remove the two bolts (Item 1) **[Figure 60-30-2]** from the air cleaner mount.

Remove the air cleaner.

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RADIATOR

Removal And Installation

Remove the hydraulic oil cooler. (See Removal And Installation on Page 20-140-1.)

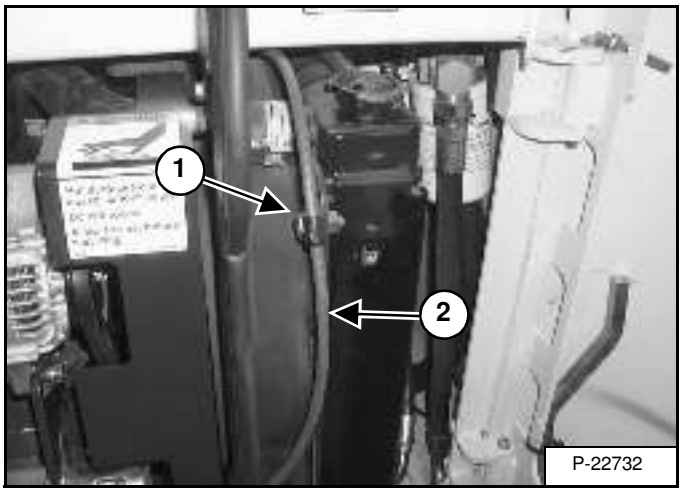
Drain the radiator. (See Replacing The Coolant on Page 10-70-2.)

⚠ WARNING

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

W-2070-1285

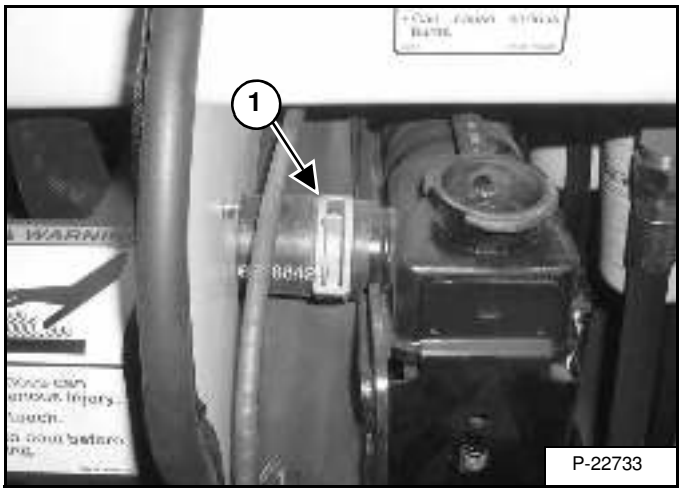
Figure 60-40-1



Remove the bolt (Item 1) **[Figure 60-40-1]** washer and nut.

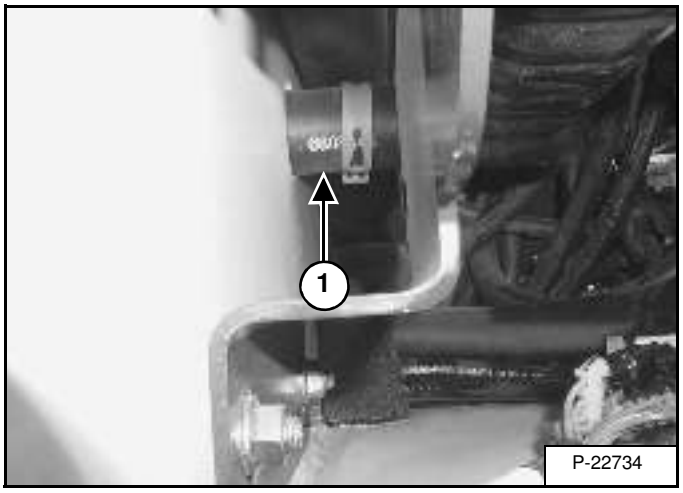
Reposition the throttle cable (Item 2) **[Figure 60-40-1]**.

Figure 60-40-2



Remove the top hose (Item 1) **[Figure 60-40-2]**.

Figure 60-40-3

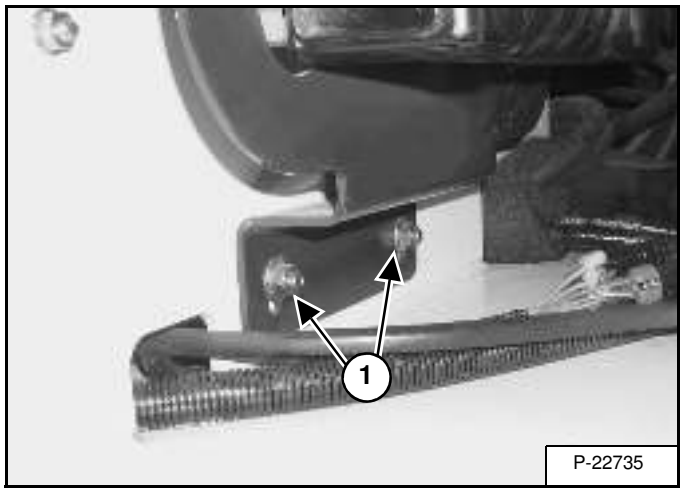


Remove the bottom hose (Item 1) **[Figure 60-40-3]**.

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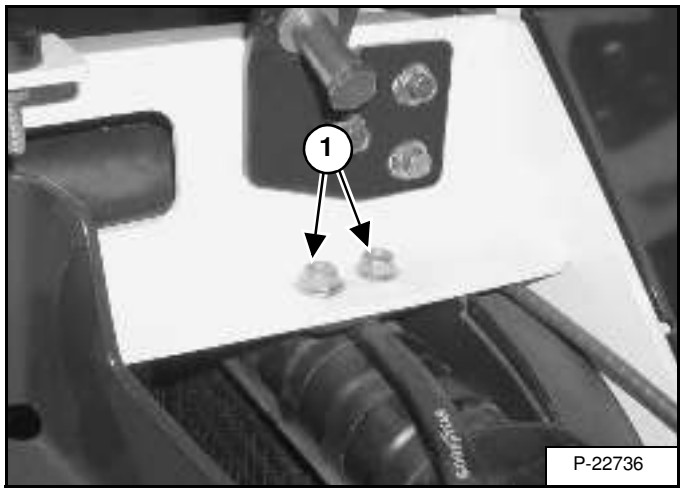
Removal And Installation (Cont'd)

Figure 60-40-4



Remove the bottom bolts and nuts (Item 1) **[Figure 60-40-4]**.

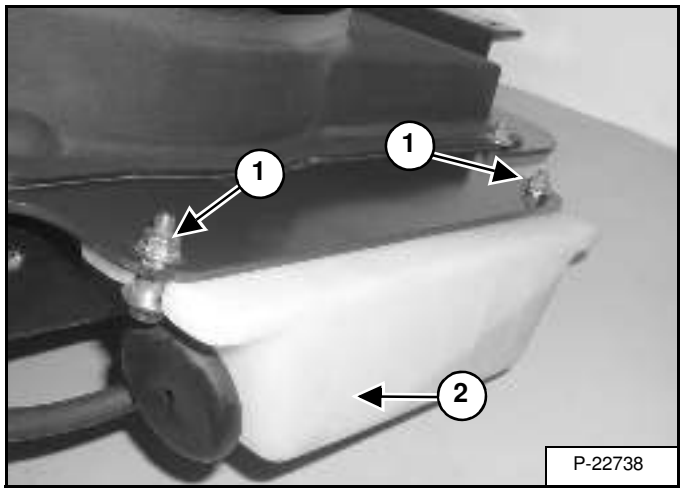
Figure 60-40-5



Remove the front top bolts and nuts (Item 1) **[Figure 60-40-5]**.

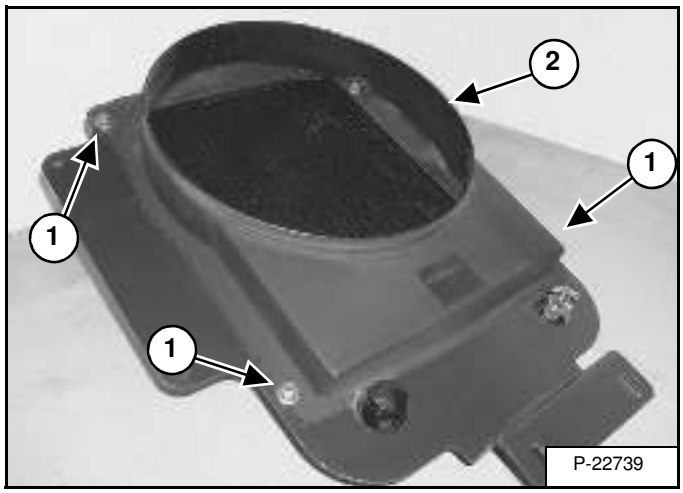
Remove the radiator, mount and shroud assembly from the excavator.

Figure 60-40-6



Remove the two bolts, washers and spacers (Item 1) from the overflow tank (Item 2) **[Figure 60-40-6]**. Remove the tank.

Figure 60-40-7

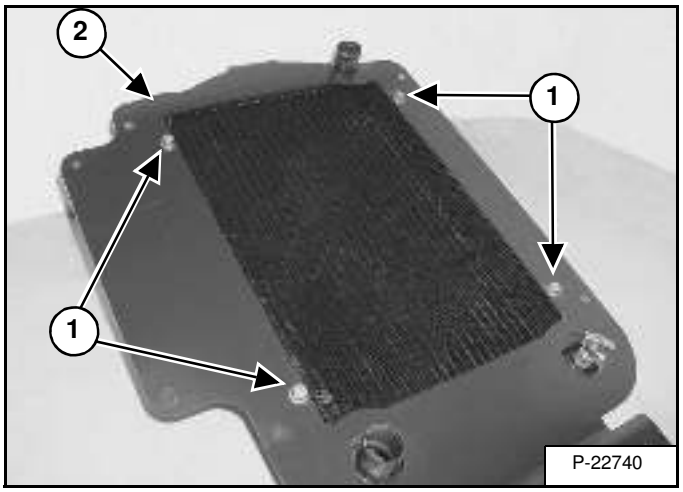


Remove the three bolts and nuts (Item 1). Remove the fan shroud (Item 2) **[Figure 60-40-7]**.

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Removal And Installation (Cont'd)

Figure 60-40-8



Remove the four bolts (Item 1) **[Figure 60-40-8]**.

Remove the radiator from the mount (Item 2) **[Figure 60-40-8]**.

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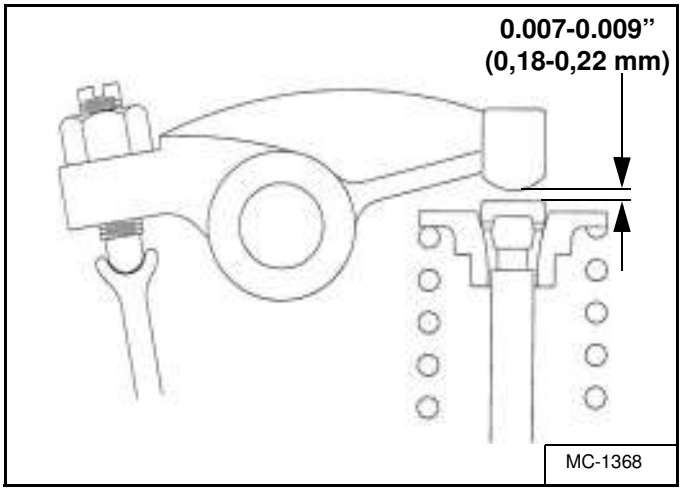
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ENGINE COMPONENTS AND TESTING

Valve Clearance Adjustment

Adjust the valve clearance with the engine stopped and cold.

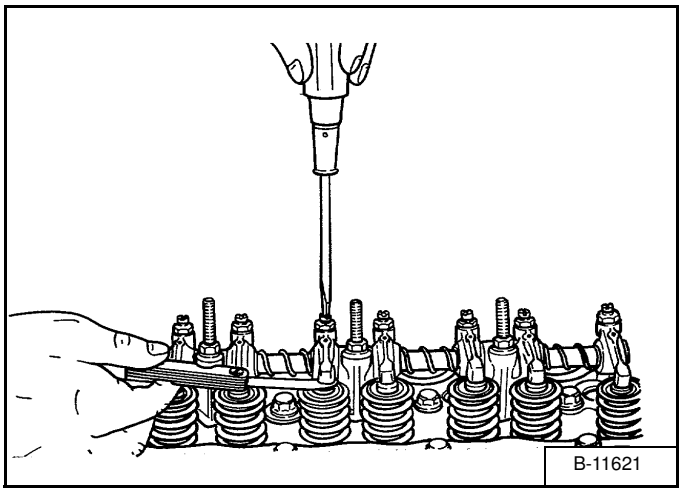
Figure 60-50-1



The correct valve clearance (Intake & Exhaust) is 0.007-0.008 inch (0,18-0,22 mm) **[Figure 60-50-1]**.

Make sure the piston is at T.D.C. when making the adjustment for the valves of the particular cylinder.

Figure 60-50-2



Put the correct size feeler gauge between the rocker arm and valve stem. Turn the adjustment bolt until the clearance is correct **[Figure 60-50-2]**.

Engine Compression Checking

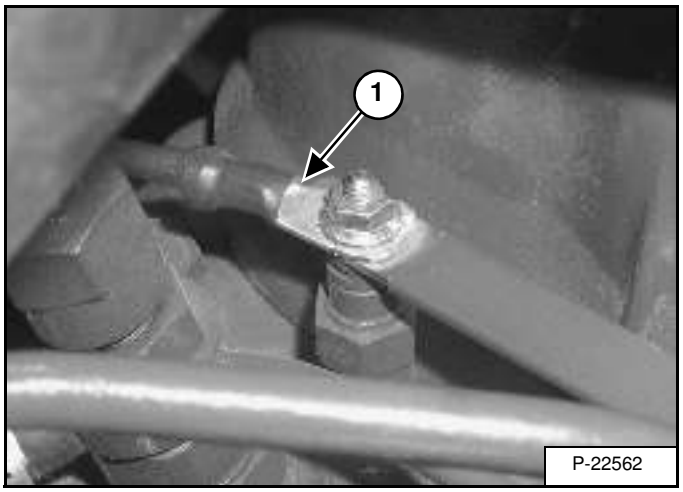
The tools listed will be needed to do the following procedure:

MEL10630 - Engine Compression Kit
MEL1352 - Compression Adapter

The engine must be at operating temperature.

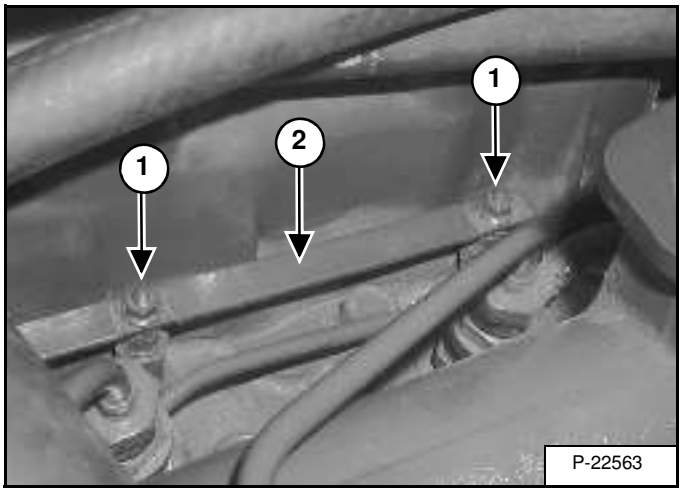
The compression of the Kubota 1703 is 512-540 PSI (3530-3723 kPa), with the allowable limit of 355 PSI (2448 kPa) and no more than 10% difference between cylinders.

Figure 60-50-3



Remove the nut and the glow plug wire (Item 1) **[Figure 60-50-3]**.

Figure 60-50-4

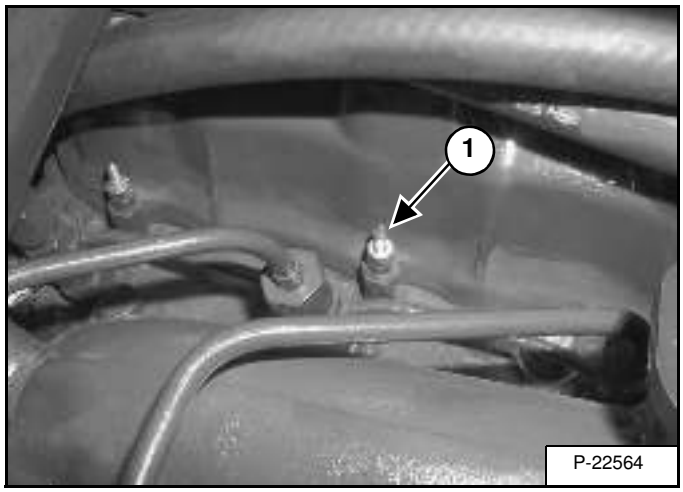


Remove two nuts (Item 1) and glow plug strip (Item 2) **[Figure 60-50-4]**.

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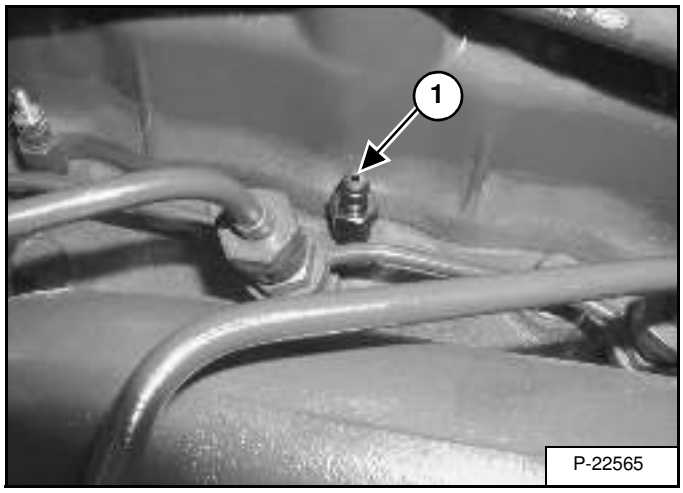
Engine Compression Checking (Cont'd)

Figure 60-50-5



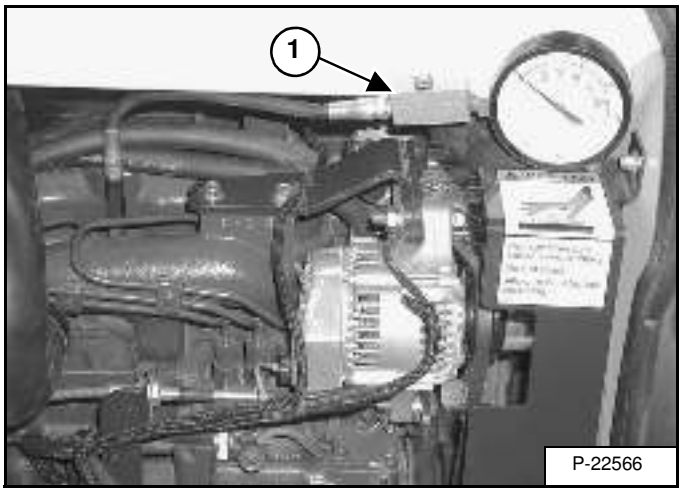
Remove the glow plug (Item 1) **[Figure 60-50-5]** from the cylinder that is to be tested.

Figure 60-50-6



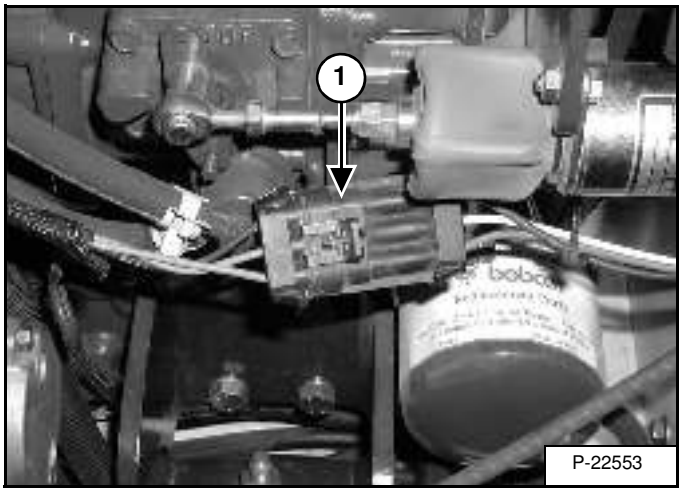
Install the compression tester (Item 1) **[Figure 60-50-6]** in the glow plug hole.

Figure 60-50-7



Connect the compression gauge (Item 1) **[Figure 60-50-7]** to the tester.

Figure 60-50-8



Disconnect the fuel stop solenoid (Item 1) **[Figure 60-50-8]**.

Turn the engine with the starter and check the gauge pressure.

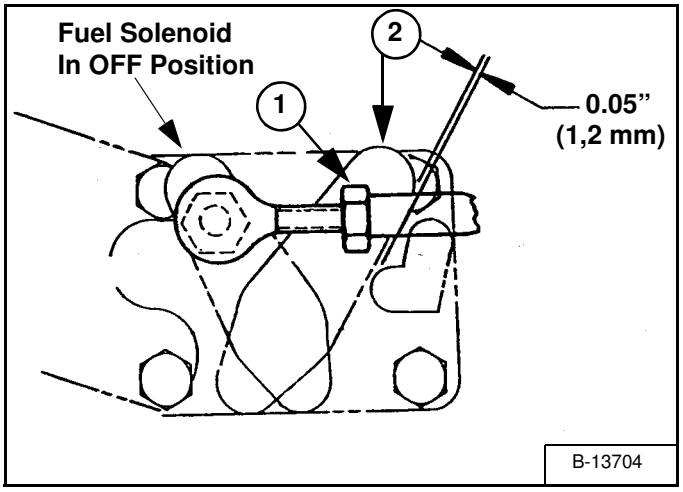
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Fuel Shutoff Solenoid Adjustment

Stop the engine.

Raise the engine cover.

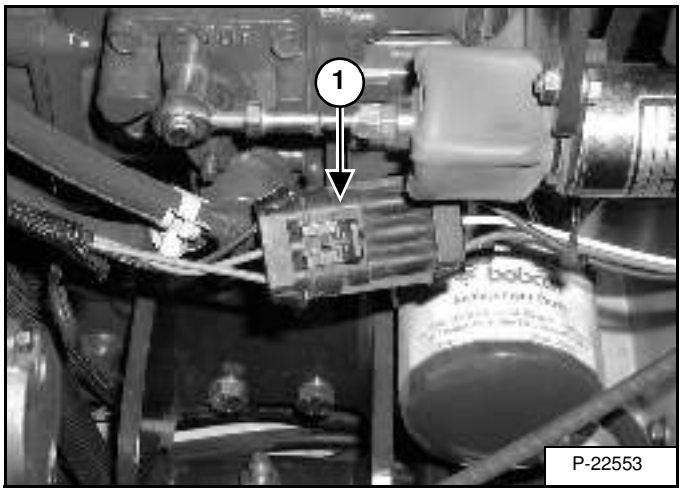
Figure 60-50-9



Loosen the jam nut (Item 1) and rotate the solenoid shaft to adjust the linkage for a maximum distance of 0.050 inch (1,2 mm) between the lever (Item 2) **[Figure 60-50-9]** and the stop when the solenoid plunger is seated.

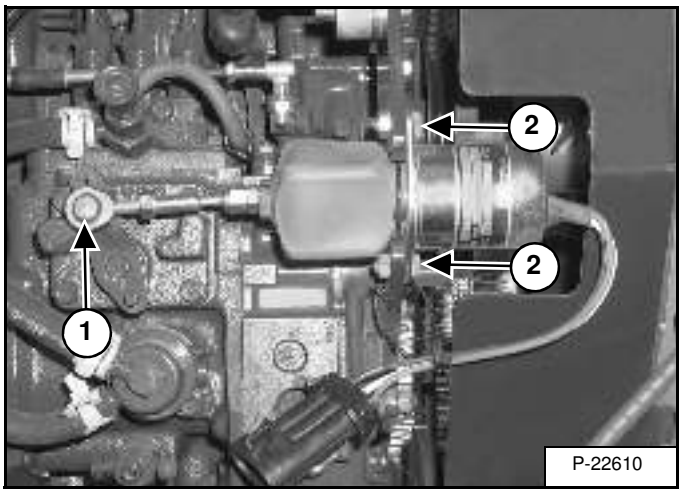
Fuel Shutoff Solenoid Removal And Installation

Figure 60-50-10



Disconnect the wire (Item 1) **[Figure 60-50-10]** from the solenoid.

Figure 60-50-11



Remove the bolt (Item 1) **[Figure 60-50-11]** and nut from the ball joint.

Remove the bolts and nuts (Item 2) **[Figure 60-50-11]** from the solenoid.

Remove the solenoid.

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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.

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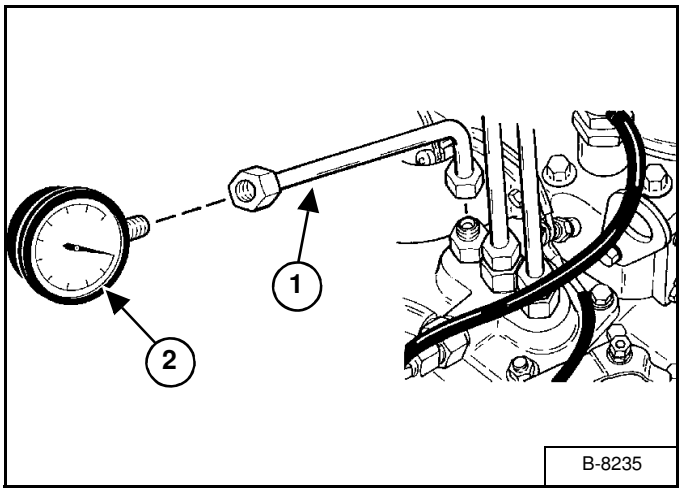
The tools listed will be needed to do the following procedure:

MEL1237 - Adapter Fuel Line
MEL1173-1 - 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 60-50-12



Connect the adapter fuel line (Item 1) to the fitting and connect the pressure gauge (Item 2) **[Figure 60-50-12]**.

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 . . . . . 2133 PSI (14707 kPa)

Measure the time needed to decrease the pressure from 2133-1990 PSI (14707-13721 kPa). If the measurement is less than the allowable limit, replace the delivery valve.

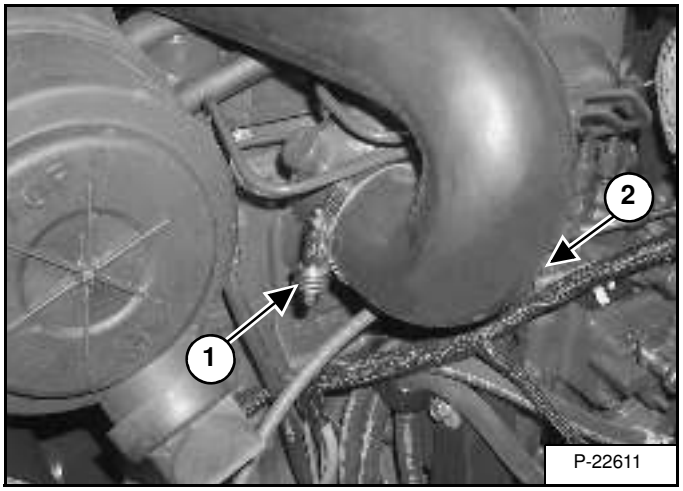
Fuel Tightness of Delivery Valve
Allowable Limit . . . . . .5 Seconds

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Fuel Injection Pump Removal And Installation

Clean around the injection pump.

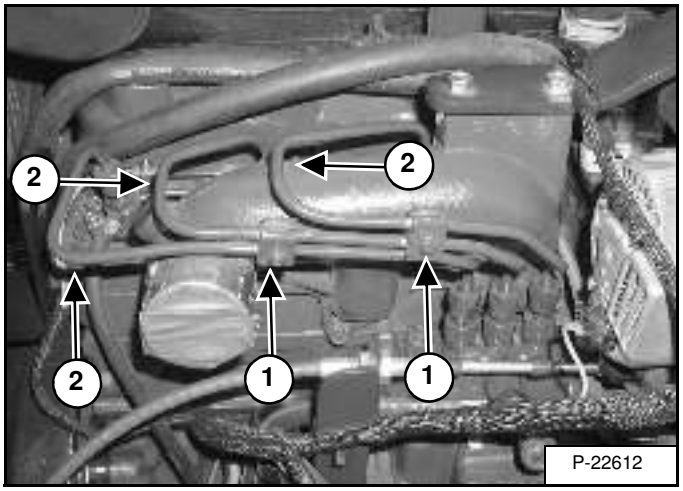
Figure 60-50-13



Loosen the clamp (Item 1) and remove the hose (Item 2) **[Figure 60-50-13]** from the intake manifold.

NOTE: Plug the intake manifold to prevent any contamination from getting in the engine.

Figure 60-50-14



Loosen the fuel line clamps (Item 1) **[Figure 60-50-14]**.

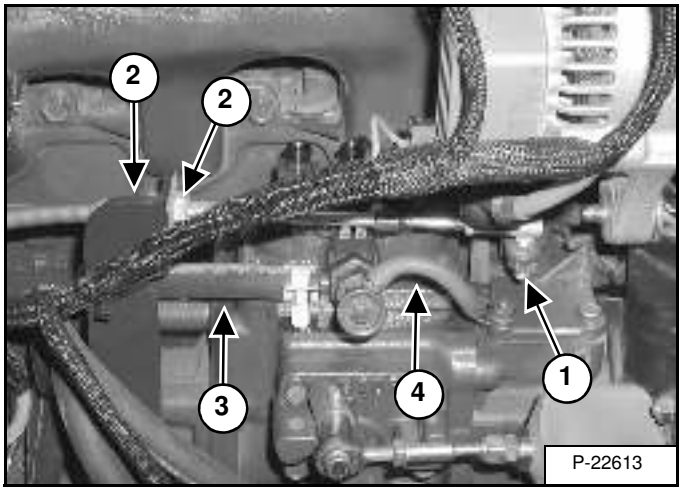
Disconnect the high pressure lines (Item 2) **[Figure 60-50-14]** from the fuel injectors and fuel injection pump.

IMPORTANT

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

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Figure 60-50-15

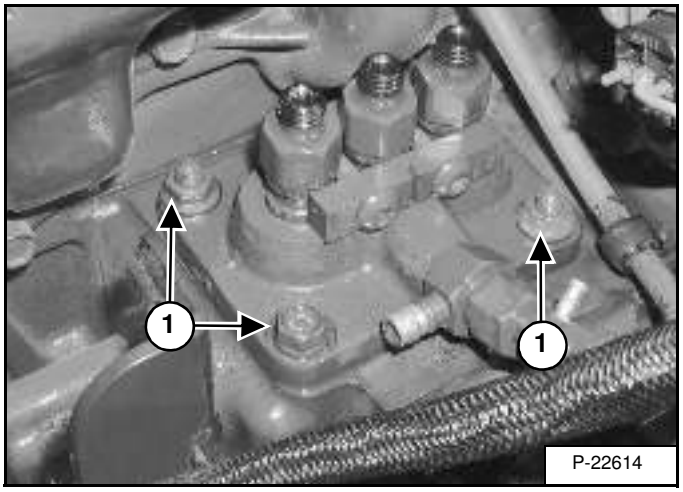


Disconnect the throttle control linkage cable ball joint (Item 1) **[Figure 60-50-15]** from the injection pump.

Loosen the jam nuts (Item 2) **[Figure 60-50-15]** from the bracket to remove the throttle cable.

Disconnect the fuel inlet hose (Item 3) and return hose (Item 4) **[Figure 60-50-15]**.

Figure 60-50-16



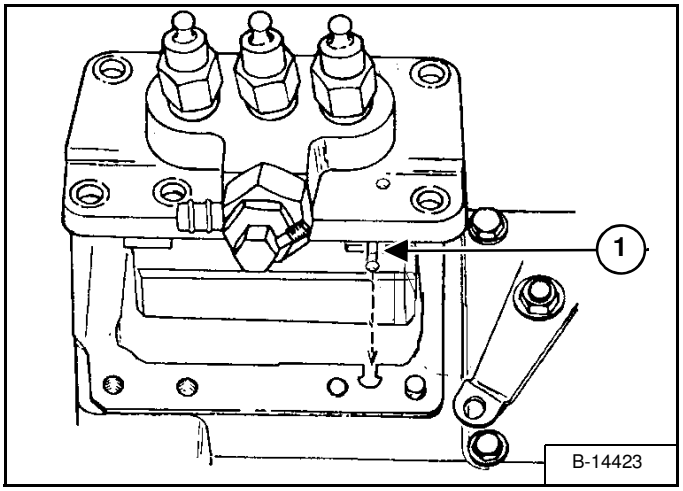
Remove the four injection pump mounting nuts (Item 1) **[Figure 60-50-16]**.

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Fuel Injection Pump Removal And Installation (Cont'd)

Installation: Tighten the nuts to 17-20 ft.-lbs. (23-27 Nm) torque.

Figure 60-50-17



Align the pin (Item 1) **[Figure 60-50-17]** in the control rack with the slot in the engine block.

Remove the injection pump.

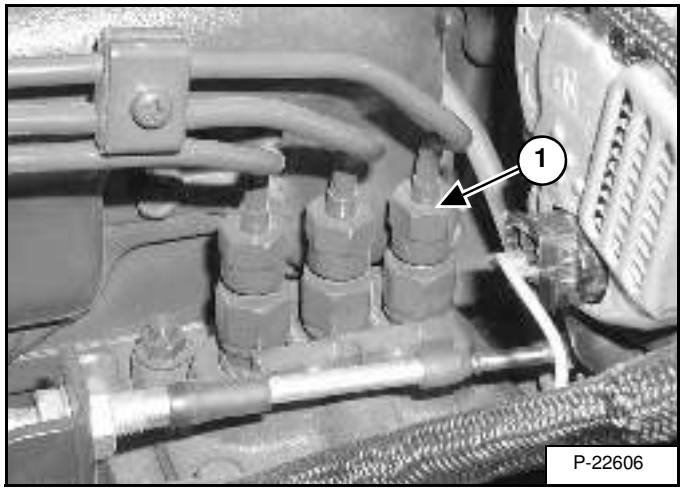
Installation: When the injection pump is installed, make sure the pin (Item 1) **[Figure 60-50-17]** on the control rack is correctly installed on the fork lever. If the slot is not installed correctly, the engine will run over maximum speed and serious damage can result.

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

Fuel Injection Pump Timing

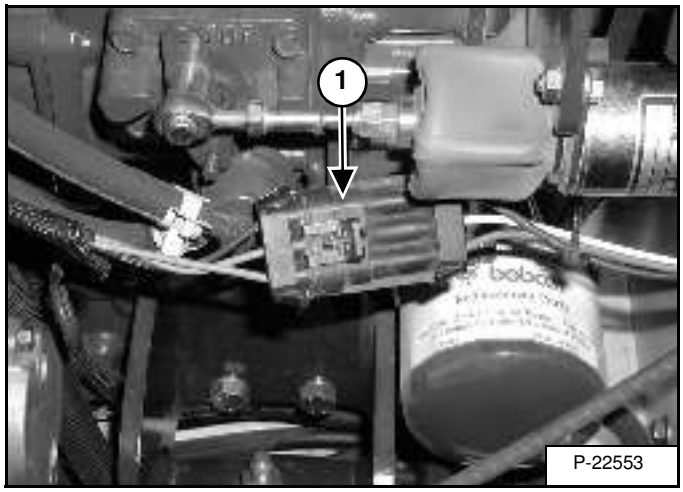
Timing the injection pump is done by changing the number of shims between the injection pump and engine block.

Figure 60-50-18



Remove the number one cylinder high pressure line (Item 1) **[Figure 60-50-18]** from the injection pump.

Figure 60-50-19



Disconnect the fuel shut-off linkage (Item 1) **[Figure 60-50-19]** from the injection pump.

Turn the fuel supply lever to the ON position. Install a short plastic tube in the fitting of the number one cylinder port. Point the tube vertical.

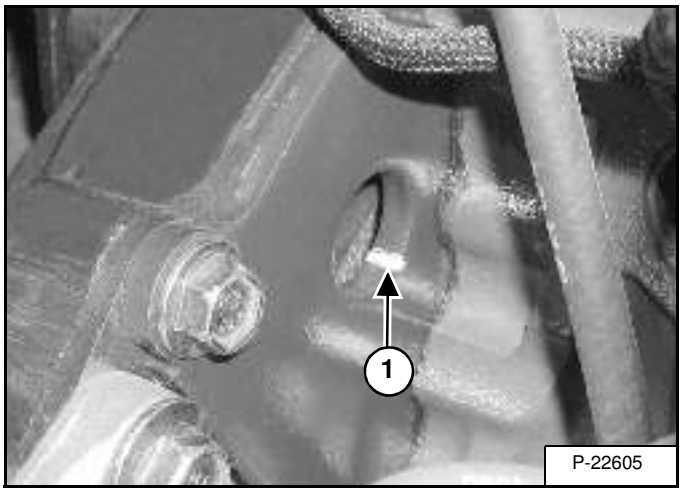
Turn the engine counterclockwise until fuel flows out of the injection pumps number 1 cylinder nozzle. (Install a tool on the crankshaft at the front of the engine to turn the engine).

NOTE: The fuel must flow out of the nozzle for one firing cycle before timing can be attempted.

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Fuel Injection Pump Timing (Cont'd)

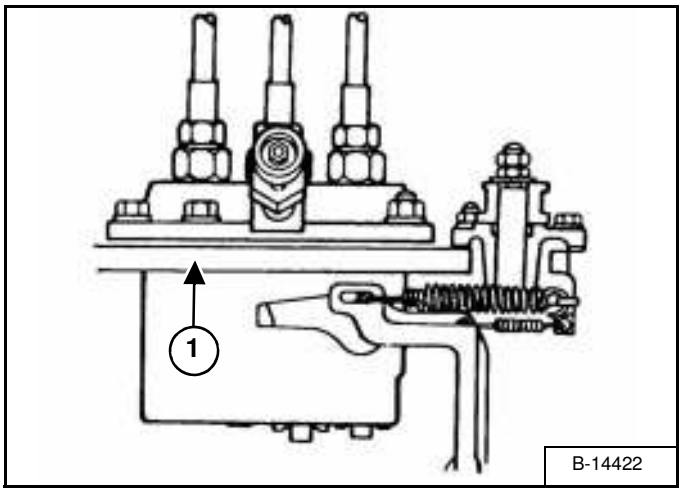
Figure 60-50-20



Continue to turn the engine slowly (for approximately 1-3/4 turns after fuel stops flowing from the injection pump nozzle), until the 17° B.T.D.C. mark on the side of the flywheel is at the bottom edge of the timing hole (Item 1) **[Figure 60-50-20]** 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.

Figure 60-50-21



The correct engine timing for all Kubota D1703 engines is 17° B.T.D.C.. Add or subtract shims (Item 1) **[Figure 60-50-21]** to time the engine to 17° B.T.D.C. The engine is correctly timed when the 17° B.T.D.C. mark on the flywheel is aligned with the notch in the timing hole **[Figure 60-50-20]**.

NOTE: Adding or reducing the shim thickness by 0,05 mm retards or advances the injection timing by 0.5°.

Fuel Injector Nozzles Removal And Installation

Some problems caused by faulty injector nozzles:

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

IMPORTANT

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

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⚠ WARNING

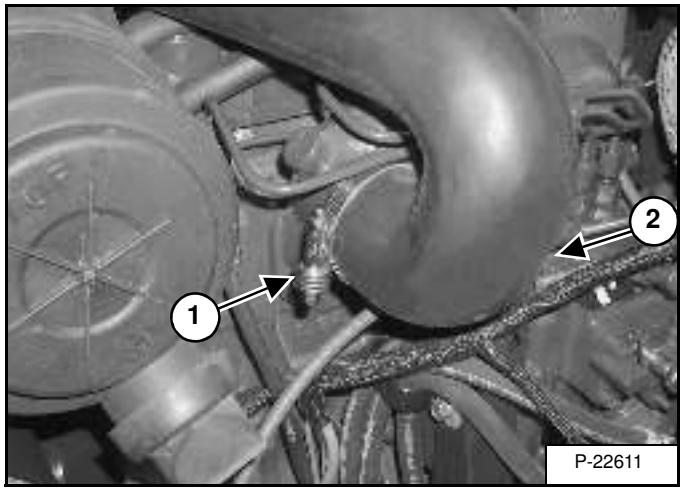
Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical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

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Fuel Injector Nozzles Removal And Installation (Cont'd)

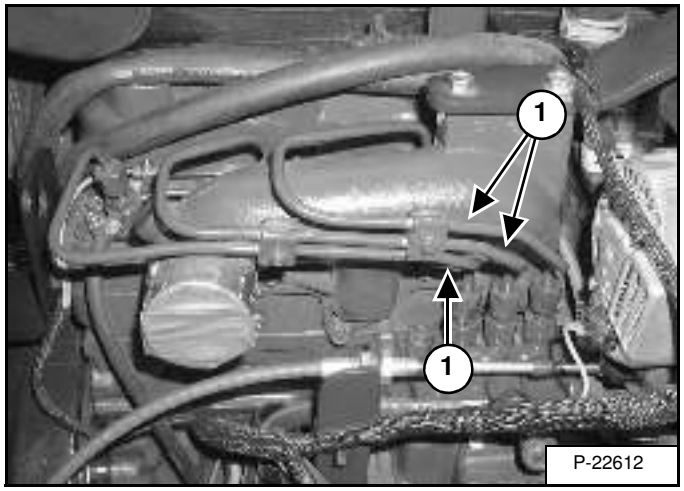
Figure 60-50-22



Loosen the clamp (Item 1) and remove the hose (Item 2) **[Figure 60-50-22]**, from the intake manifold.

NOTE: Plug the intake manifold to prevent any contamination from getting in the engine.

Figure 60-50-23

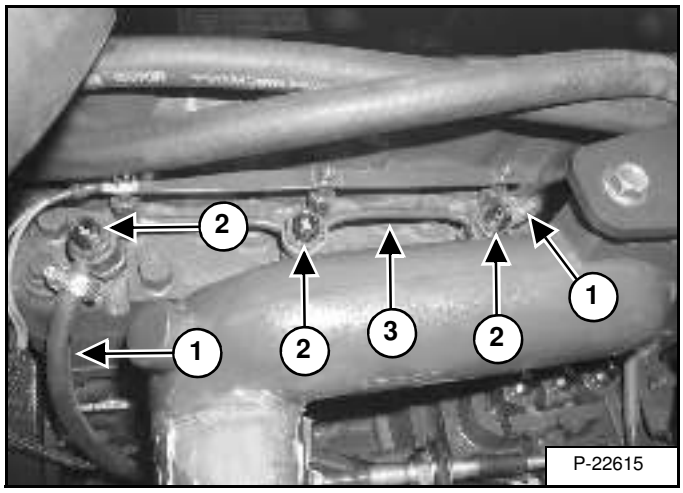


Disconnect the fuel lines (Item 1) **[Figure 60-50-23]** from the injection pump.

Disconnect the high pressure fuel lines from the fuel injectors.

Remove the high pressure fuel lines.

Figure 60-50-24



Disconnect the fuel hoses (Item 1) **[Figure 60-50-24]**.

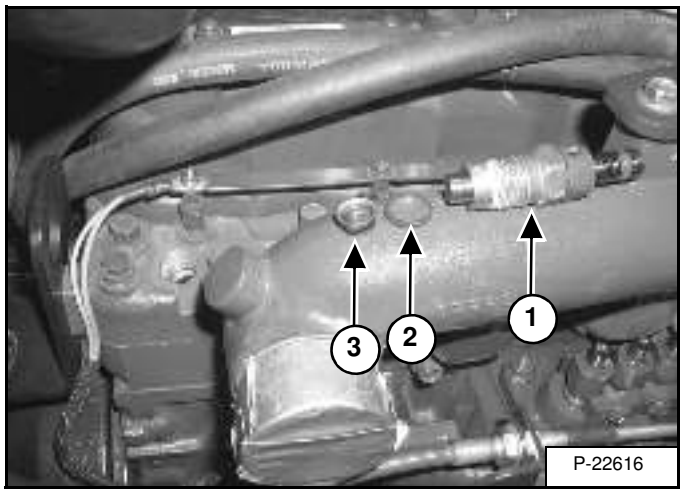
Remove the retainer nut from the top of the fuel injectors.

Remove the fuel return pipe (Item 3) **[Figure 60-50-24]**.

Loosen the injector nozzle.

Installation: Tighten the injector nozzle to 36-51 ft.-lbs. (40-69 Nm) torque.

Figure 60-50-25



Remove the injector nozzle (Item 1) **[Figure 60-50-25]** from the cylinder head.

NOTE: Be sure to replace the copper washer (Item 2) and nozzle cap (Item 3) [Figure 60-50-25] anytime new or used fuel injectors are installed.

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Checking The Injector Nozzle

IMPORTANT

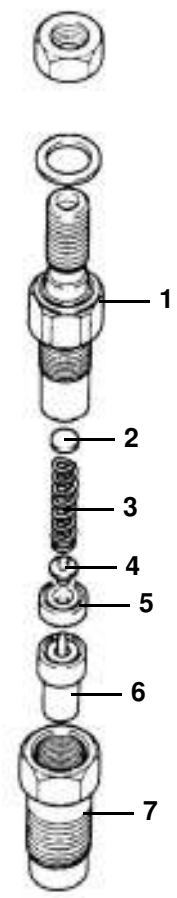
Do not disassemble or test the fuel injector nozzles unless you have the correct service and testing tools.

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

MEL10018 - Injector Nozzle Tester

Figure 60-50-26



(1) Nozzle Holder
(2) Adjusting Washer
(3) Nozzle Spring
(4) Push Rod
(5) Distance Piece
(6) Nozzle Piece
(7) Nozzle Retaining Nut

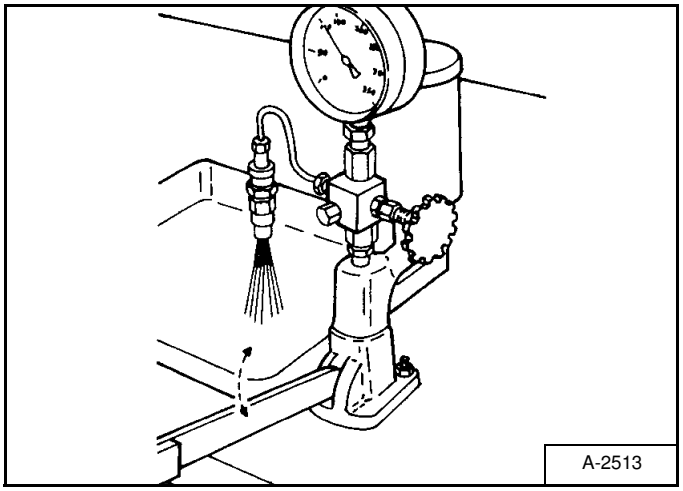
PI-9981

The nozzle release pressure can be adjusted by adding or removing spacer(s) (Item 2) **[Figure 60-50-26]** from the top of the nozzle spring (Item 3) **[Figure 60-50-26]**.

Each spacer will change the release pressure by about 142 PSI (980 kPa).

Fuel Injection Pressure . . . . . 1991-2133 PSI (13721-14707 kPa)

Figure 60-50-27



A-2513

Assemble the injector nozzle. Connect the nozzle to the tester with the nozzle down **[Figure 60-50-27]**.

Operate the hand lever slow rate and record the opening pressure. If the pressure is not correct, disassemble the nozzle and add or remove spacer(s) (Item 2) **[Figure 60-50-26]** as needed.

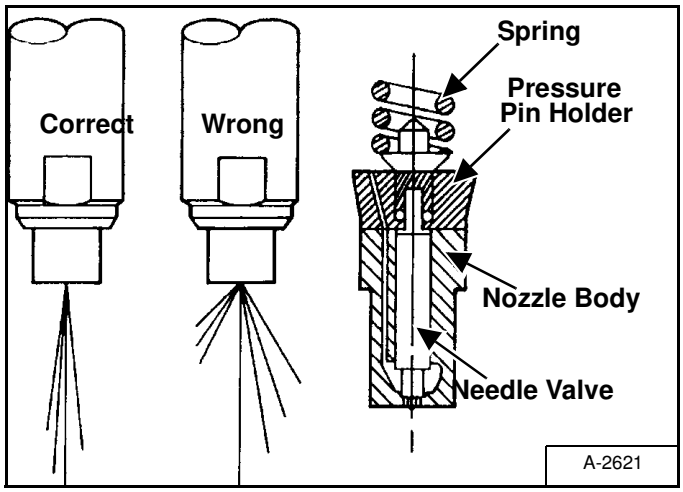
When the injector nozzle is assembled, tighten the nozzle body to 43-58 ft.-lbs. (59-79 Nm) torque.

Check for inside leakage. Operate the hand lever until the pressure 1850 PSI (12755 kPa). Keep the nozzle under this pressure for 10 seconds, check to see if fuel leaks from the nozzle. If fuel leaks, replace the nozzle.

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Checking The Injector Nozzle (Cont'd)

Figure 60-50-28



Check that the spray pattern is correct **[Figure 60-50-28]**:

1. Fuel does not come out the side of the nozzle.
2. Drops of fuel are not present at the nozzle.
3. The injector has an even flow coming from the nozzle.

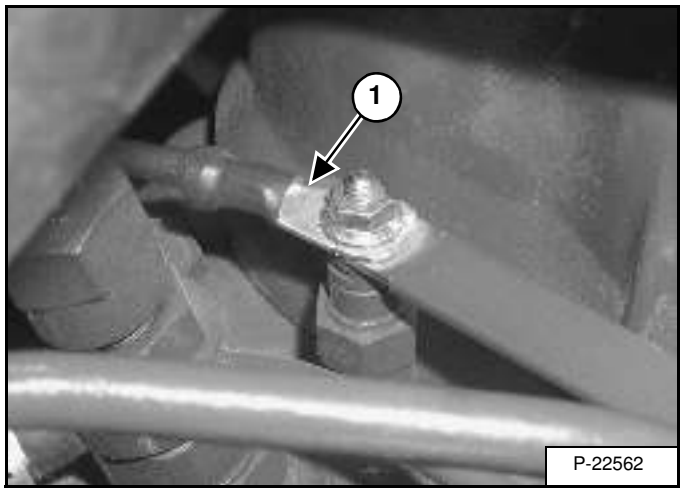
Glow Plug Removal And Installation

IMPORTANT

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

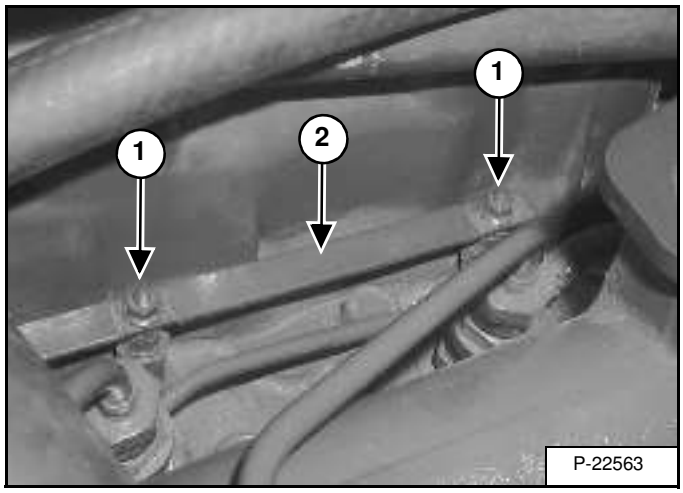
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Figure 60-50-29



Remove the nut and glow plug wire (Item 1) **[Figure 60-50-29]**.

Figure 60-50-30

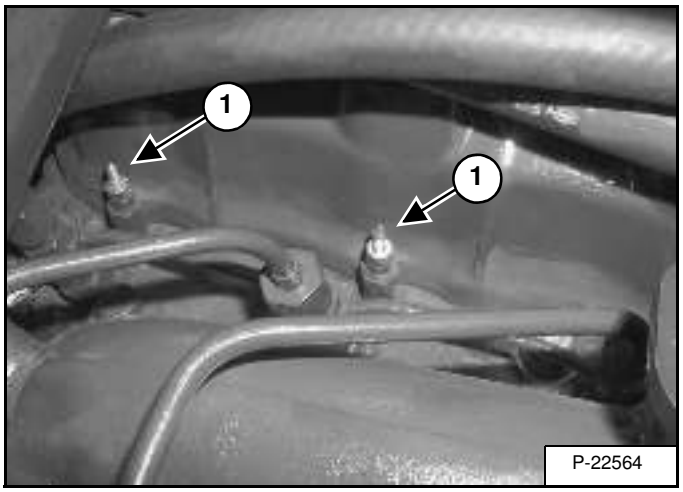


Remove the two nuts (Item 1) and the glow plug strip (Item 2) **[Figure 60-50-30]**.

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Glow Plug Removal And Installation (Cont'd)

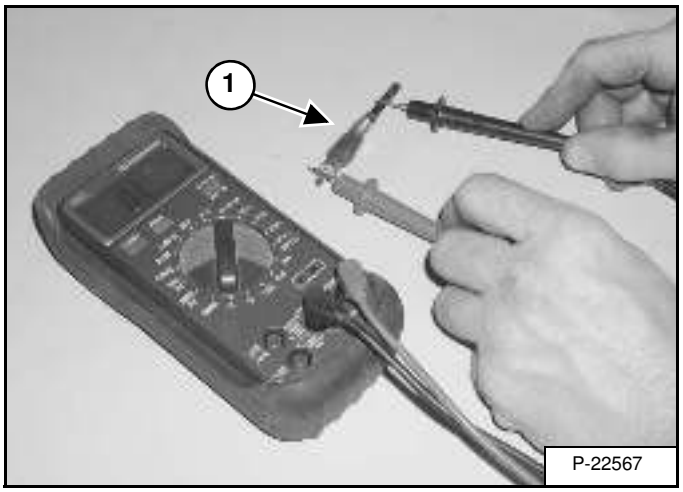
Figure 60-50-31



Remove the glow plugs (Item 1) **[Figure 60-50-31]**.

Glow Plug Checking

Figure 60-50-32



Connect an ohmmeter to the terminal end of the glow plug, touch the other lead from the ohmmeter to the heating end of the glow plug (Item 1) **[Figure 60-50-32]**.

The reading will be approximately .8 OHMS. If the resistance is zero OHMS, the glow plug has a short circuit. If the resistance is infinite, the coil of the glow plug is broken.

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ENGINE

Removal And Installation

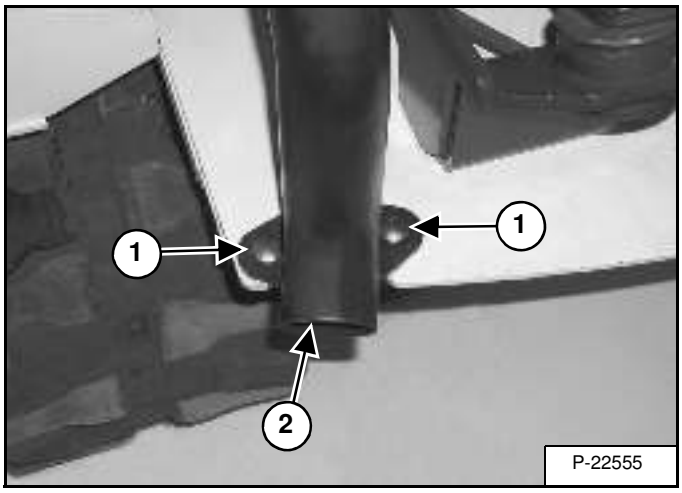
Disconnect the battery. (See Removal And Installation on Page 50-20-2.)

Remove the air cleaner. (See Removal And Installation on Page 60-30-1.)

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

Drain the radiator. (See Replacing The Coolant on Page 10-70-2.)

Figure 60-60-1



Remove the two nuts (Item 1) **[Figure 60-60-1]**.

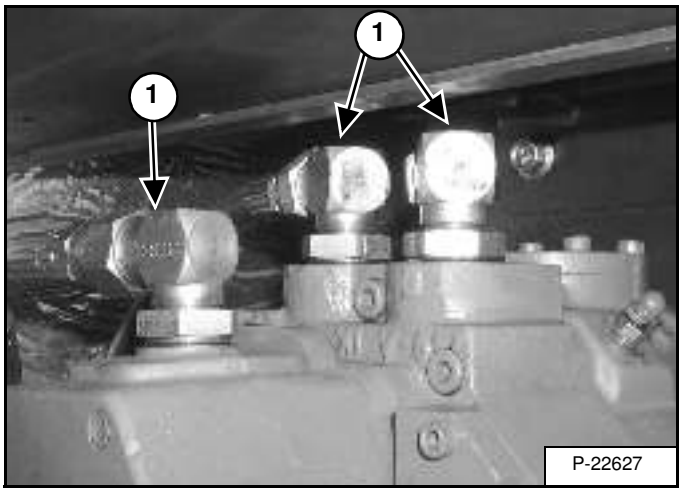
Remove the tailpipe (Item 2) **[Figure 60-60-1]**.

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, tube lines and ports to keep dirt out. Dirt can quickly damage the system.

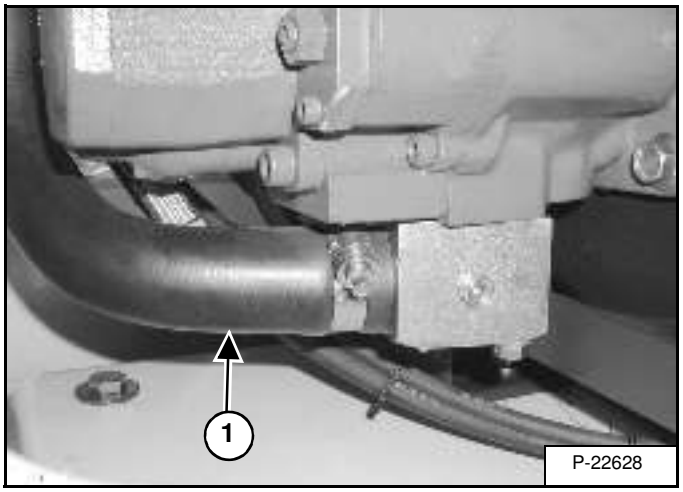
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Figure 60-60-2



Remove the three hoses (Item 1) **[Figure 60-60-2]** from the hydraulic pump.

Figure 60-60-3

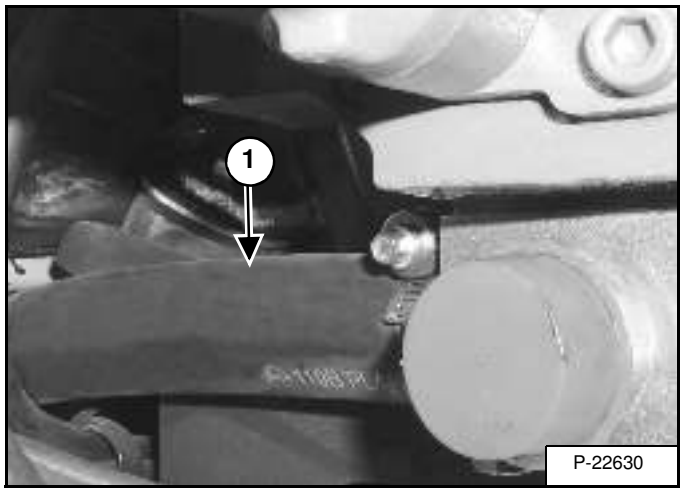


Remove the supply hose (Item 1) **[Figure 60-60-3]**.

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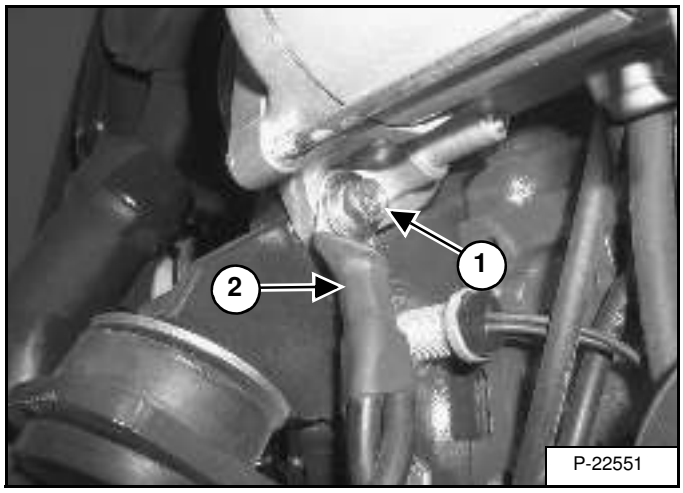
Removal And Installation (Cont'd)

Figure 60-60-4



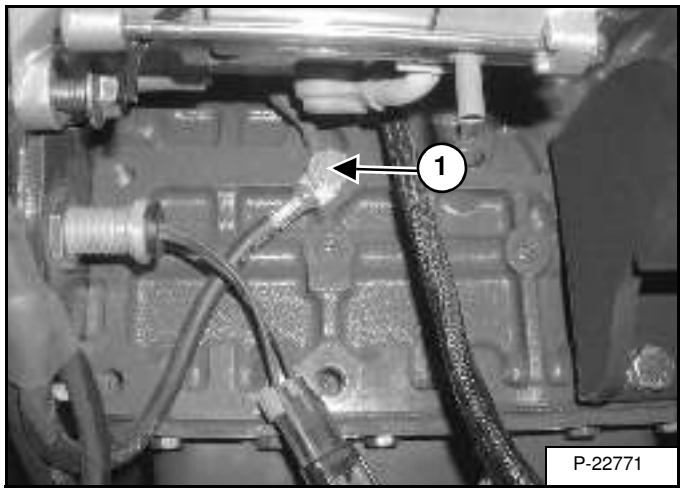
Remove the oil cooler to hydraulic pump hose (Item 1) **[Figure 60-60-4]**.

Figure 60-60-5



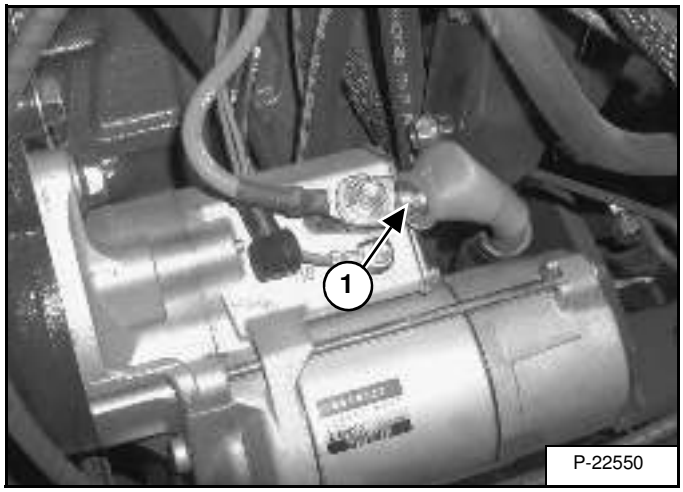
Remove the bottom starter bolt (Item 1) and remove the wire harness grounds (Item 2) **[Figure 60-60-5]**.

Figure 60-60-6



Remove the engine ground cable (Item 1) **[Figure 60-60-6]**.

Figure 60-60-7

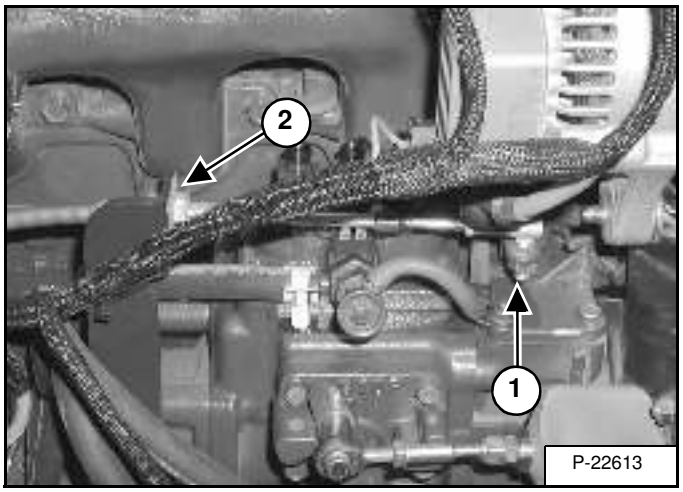


Remove the positive battery cable (Item 1) **[Figure 60-60-7]** from the starter.

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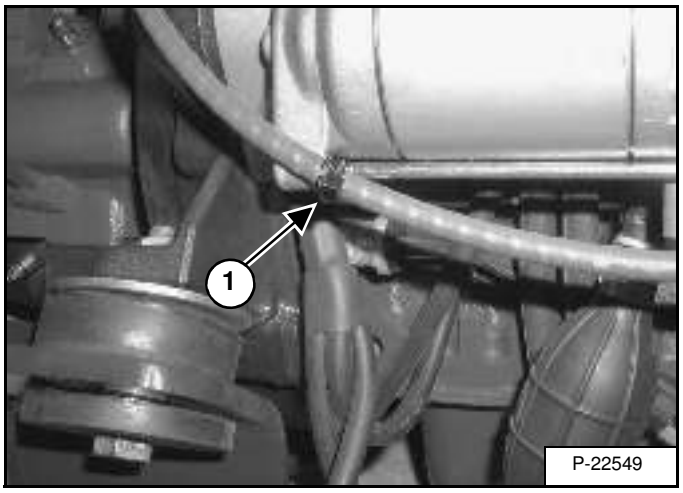
Removal And Installation (Cont'd)

Figure 60-60-8



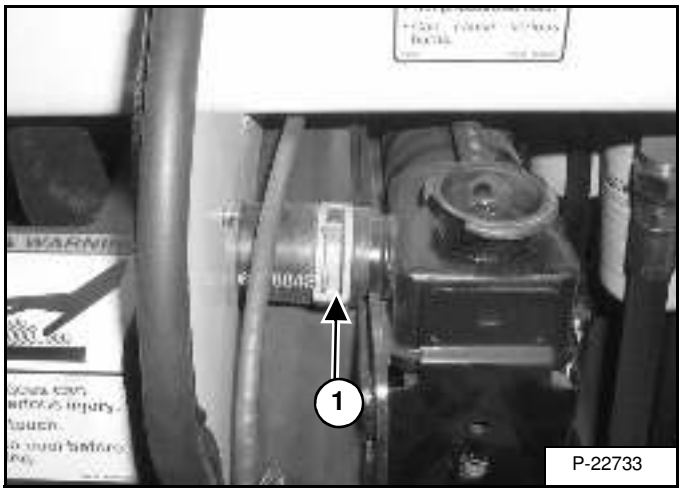
Remove the throttle cable from the ball stud (Item 1) and cable mount (Item 2) **[Figure 60-60-8]**.

Figure 60-60-9



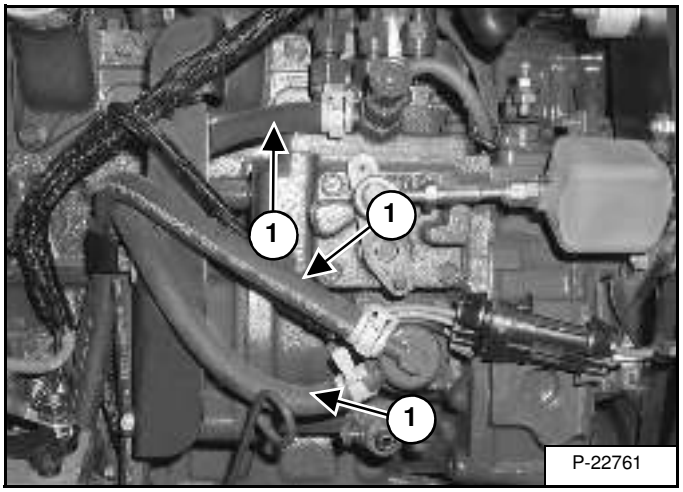
Cut and remove the tie strap (Item 1) **[Figure 60-60-9]** from the throttle cable.

Figure 60-60-10



Remove the top radiator hose (Item 1) **[Figure 60-60-10]**.

Figure 60-60-11

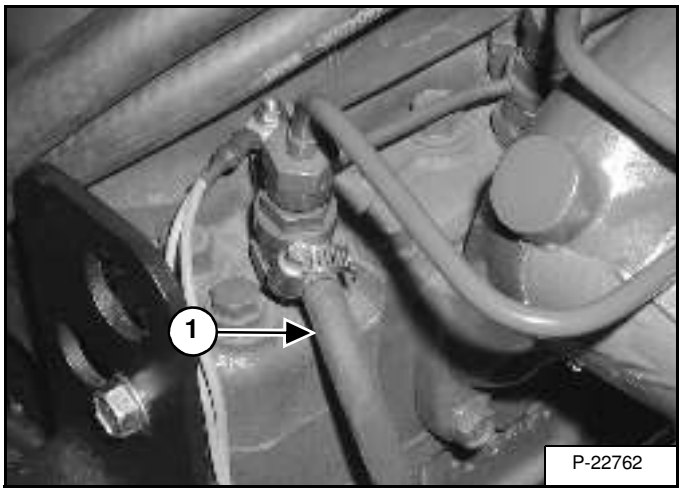


Mark for ease of assembly and remove the three fuel lines (Item 1) **[Figure 60-60-11]**.

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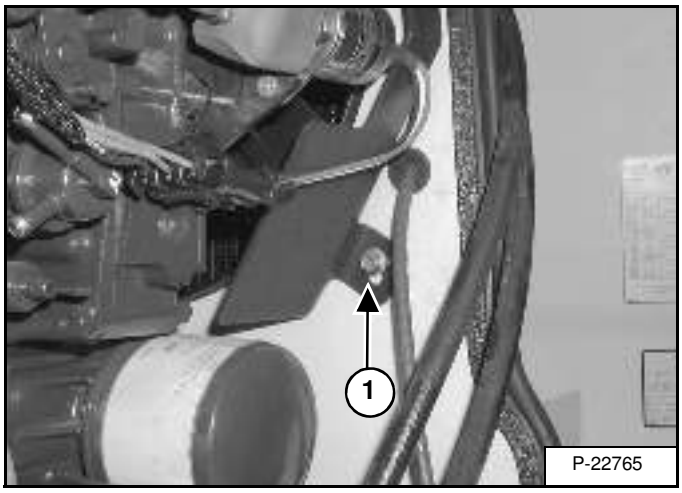
Removal And Installation (Cont'd)

Figure 60-60-12



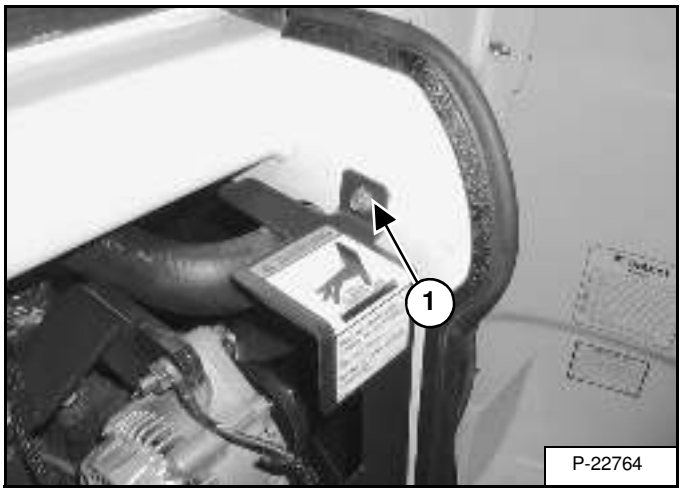
Remove the return fuel line (Item 1) **[Figure 60-60-12]**.

Figure 60-60-13



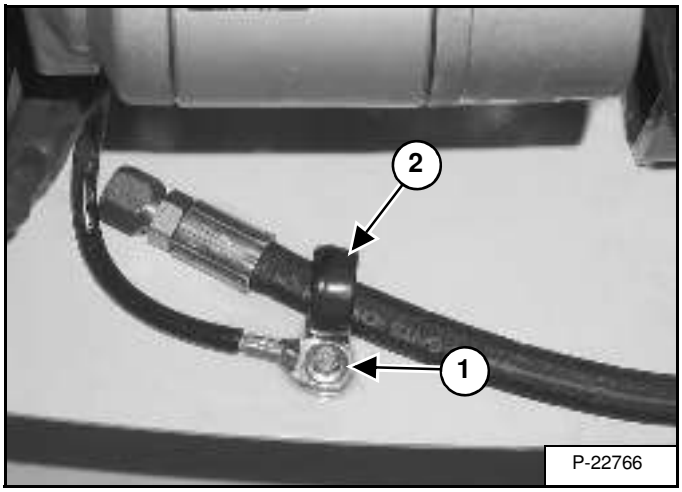
Remove the bottom bolt (Item 1) **[Figure 60-60-13]** from the belt guard.

Figure 60-60-14



Remove the top bolt (Item 1) **[Figure 60-60-14]** and belt guard.

Figure 60-60-15



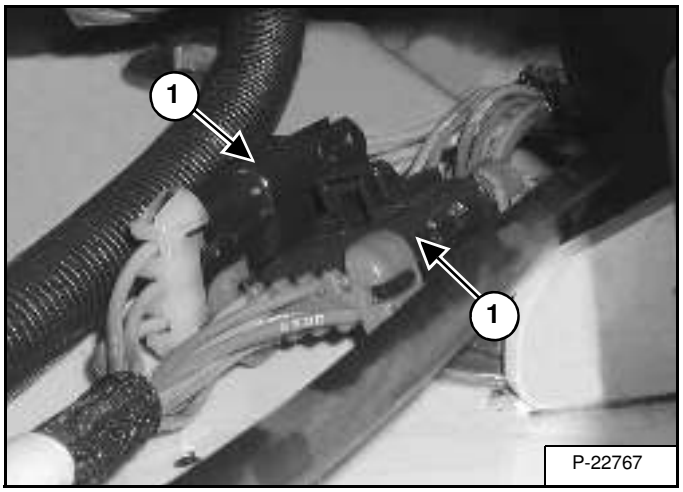
Remove the bolt (Item 1) from the clamp (Item 2) **[Figure 60-60-15]**.

Remove the clamp.

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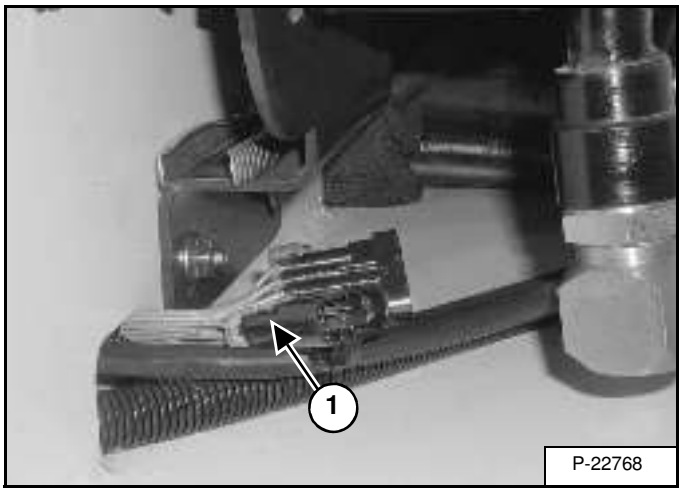
Removal And Installation (Cont'd)

Figure 60-60-16



Disconnect the two electrical harness connectors (Item 1) **[Figure 60-60-16]**.

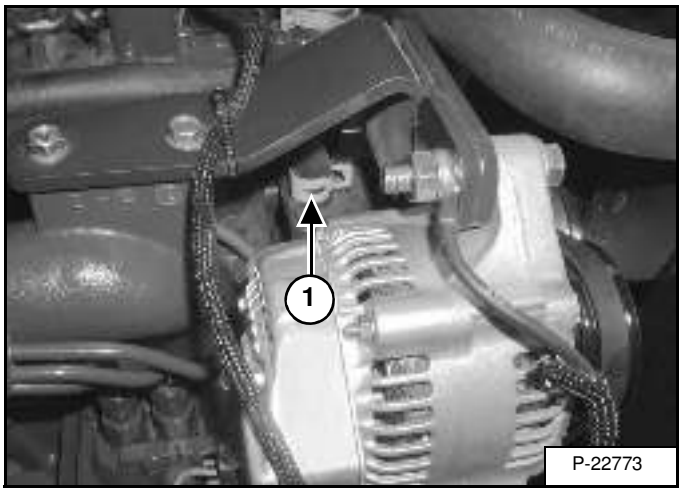
Figure 60-60-17



Pull the harness (Item 1) **[Figure 60-60-17]** through the frame.

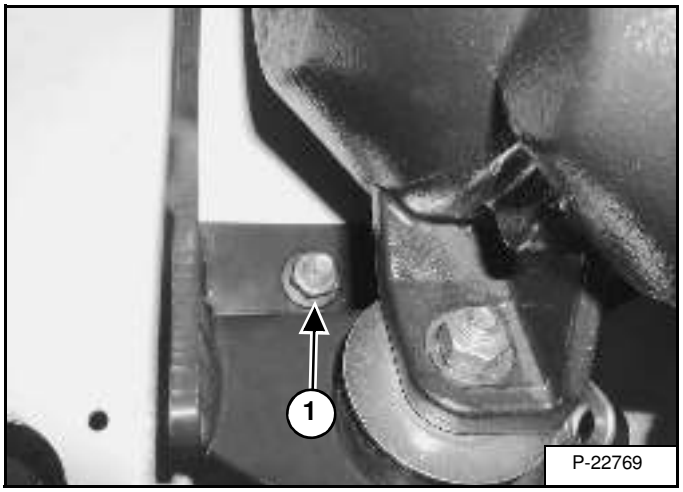
NOTE: The harness will be removed with the engine.

Figure 60-60-18



Mark for ease of assembly and remove the heater hoses (Item 1) **[Figure 60-60-18]**. (If equipped.)

Figure 60-60-19

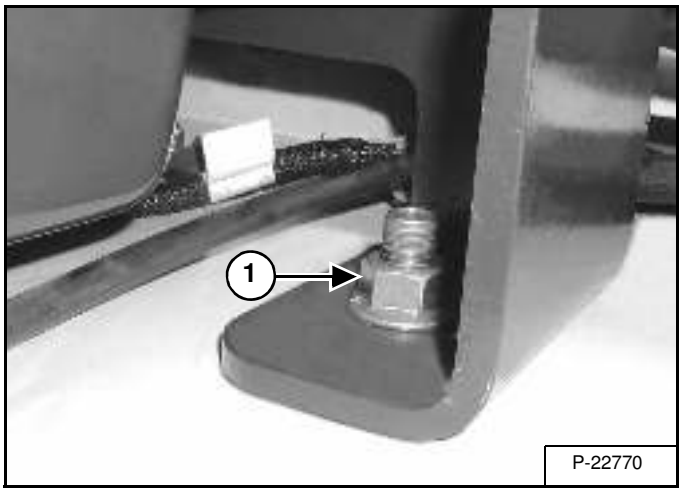


Remove the two left engine mount bolts (Item 1) **[Figure 60-60-19]**.

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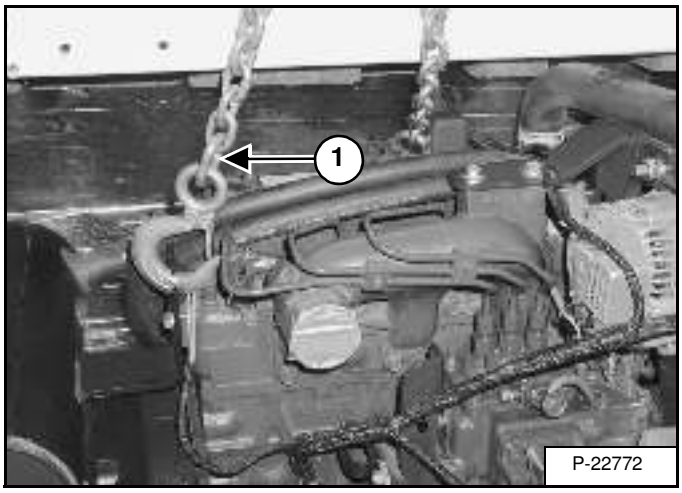
Removal And Installation (Cont'd)

Figure 60-60-20



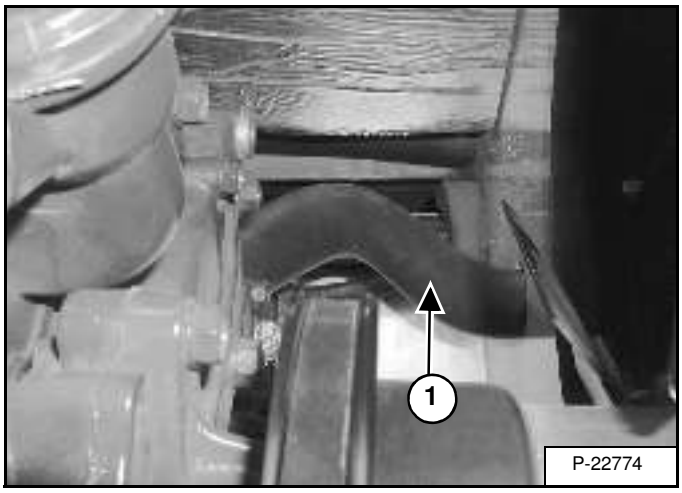
Remove the two right engine mount bolts (Item 1) **[Figure 60-60-20]**.

Figure 60-60-21



Install a chain (Item 1) **[Figure 60-60-21]** on the two engine lift eyes.

Figure 60-60-22



Slide the engine to the right and rear of the excavator.

Remove the lower radiator hose (Item 1) **[Figure 60-60-22]** from the water pump.

Remove the engine.

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ENGINE FLYWHEEL

Removal And Installation

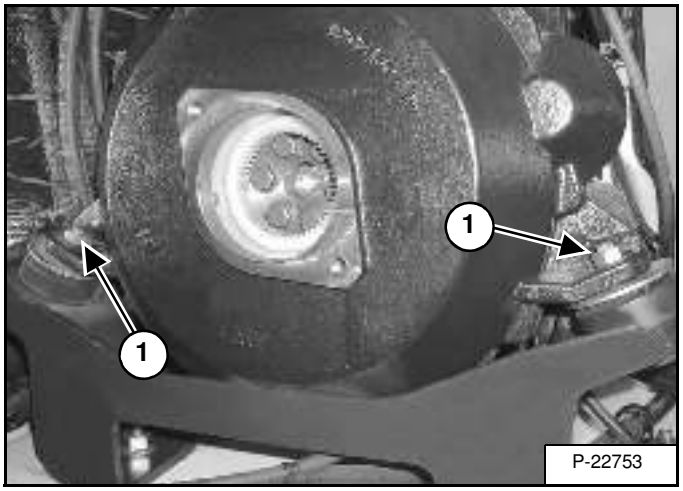
Open the tailgate.

Remove the starter. (See Removal And Installation on Page 50-40-1.)

Remove the hydraulic pump. (See Removal And Installation on Page 20-50-7.)

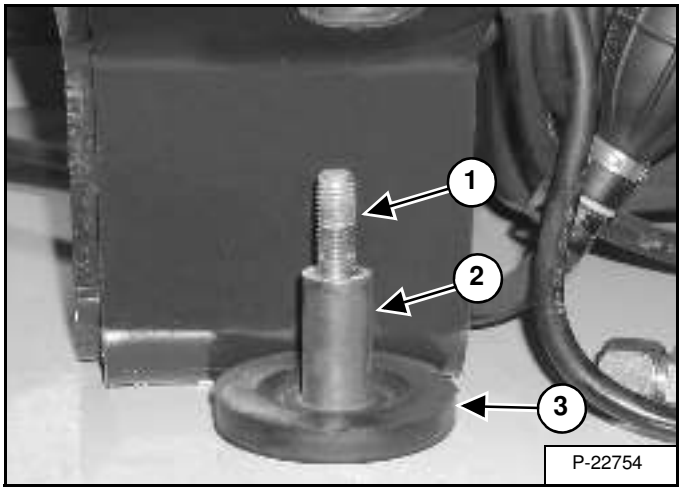
Remove the muffler. (See Removal And Installation on Page 60-20-1.)

Figure 60-70-1



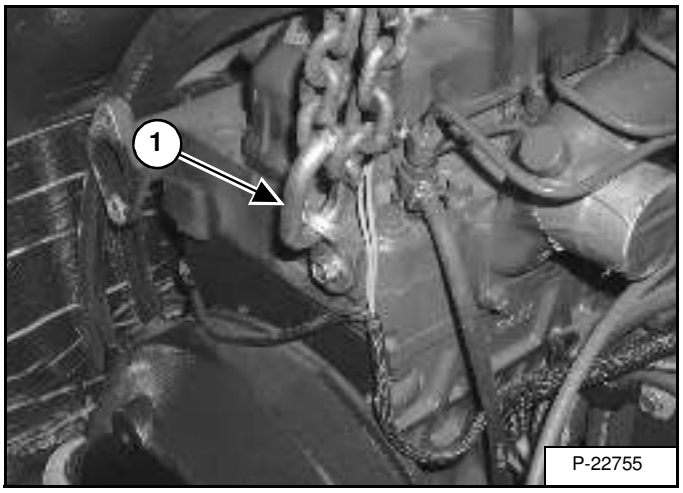
Remove the front and rear engine mount bolts (Item 1) **[Figure 60-70-1]**.

Figure 60-70-2



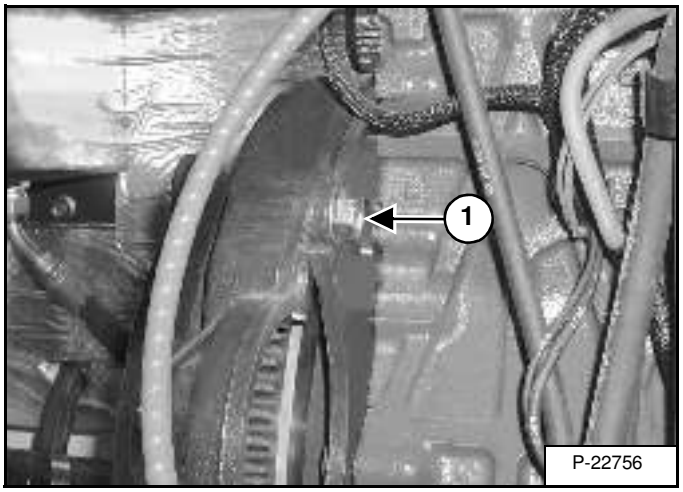
Remove the bolts (Item 1), spacers (Item 2) and washer (Item 3) **[Figure 60-70-2]** from the engine mounts.

Figure 60-70-3



Install a lifting eye (Item 1) **[Figure 60-70-3]** and hoist on the end of the engine.

Figure 60-70-4

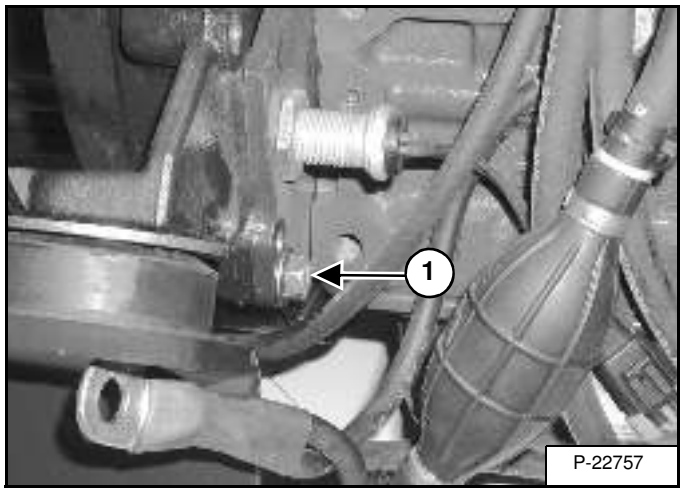


Remove the top housing bolts (Item 1) **[Figure 60-70-4]** from both sides of the engine.

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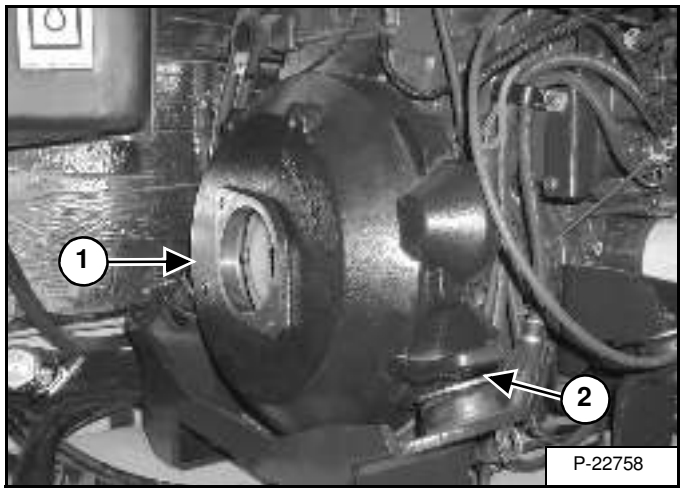
Removal And Installation (Cont'd)

Figure 60-70-5



Remove the bottom housing bolts (Item 1) **[Figure 60-70-5]** from both sides of the engine.

Figure 60-70-6

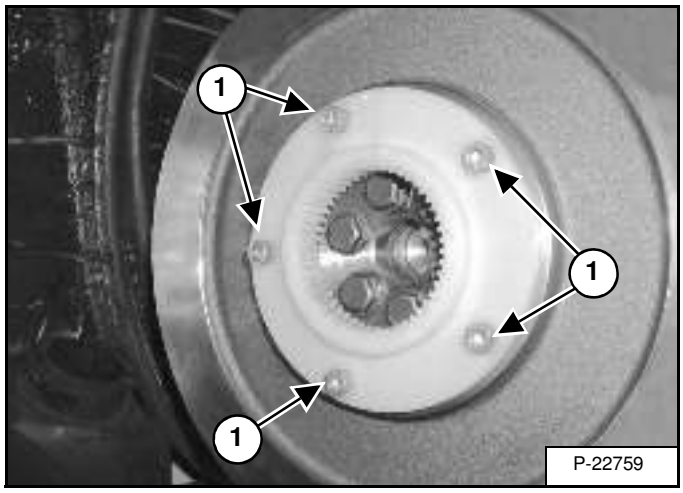


Raise the left side of the engine and remove the housing (Item 1) **[Figure 60-70-6]**.

NOTE: Make sure the washers (Item 2) [Figure 60-70-6] are in proper position when the housing is installed.

Installation: Position the housing over the alignment pins and tighten the bolts to 30-37 ft.-lbs. (40-50 Nm) torque.

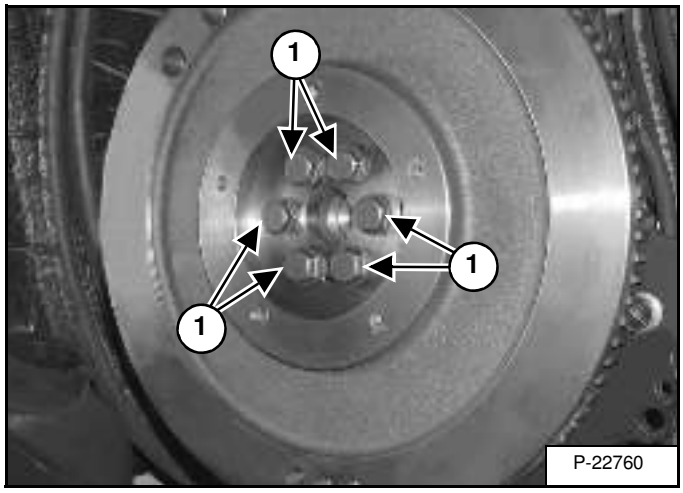
Figure 60-70-7



Remove the five bolts (Item 1) **[Figure 60-70-7]** from the hydraulic pump coupler.

Installation: Tighten the bolts to 27-32 ft.-lbs. (37-43 Nm) torque.

Figure 60-70-8



Remove the six bolts (Item 1) **[Figure 60-70-8]** from the flywheel.

Remove the flywheel.

Installation: Tighten the bolts to 40-43 ft.-lbs. (54-59 Nm) torque.

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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.**

W-2019-1285

The ring gear is installed on the flywheel with an interference fit. Heat the ring gear enough to expand it and hit it with a hammer (evenly) to remove it.

Clean the ring gear mounting 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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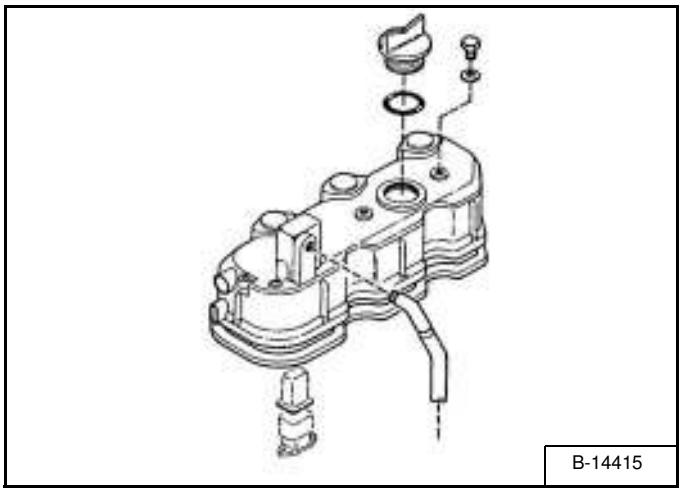


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RECONDITIONING THE ENGINE

Cylinder Head Removal And Installation

Figure 60-80-1



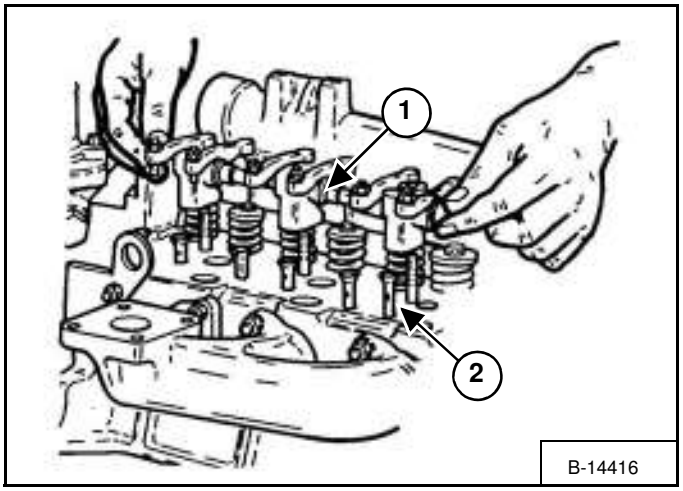
Remove the nuts from the valve cover and remove the valve cover and gasket **[Figure 60-80-1]**.

Remove the fuel injector nozzles. (See Fuel Injector Nozzles Removal And Installation on Page 60-50-7.)

Remove the glow plugs. (See Glow Plug Removal And Installation on Page 60-50-10.)

Remove the alternator. (See Removal And Installation on Page 50-30-4.)

Figure 60-80-2



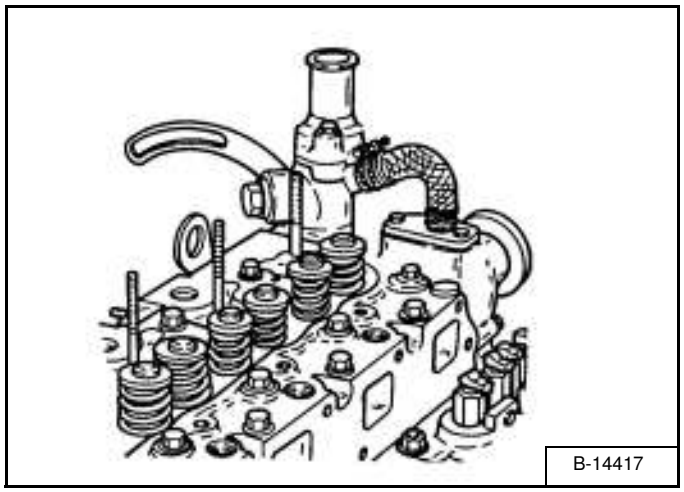
Remove the rocker arm and shaft assembly (Item 1) **[Figure 60-80-2]**.

Mark the push rods so they will be returned to their original position.

Remove the push rods (Item 2) **[Figure 60-80-2]**.

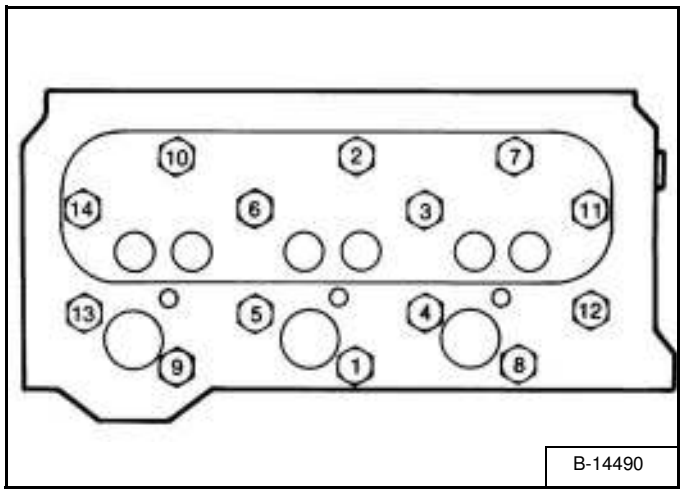
Remove the intake and exhaust manifolds.

Figure 60-80-3



Remove the water return hose **[Figure 60-80-3]**.

Figure 60-80-4



Remove the cylinder head bolts in order of #14 to #1 **[Figure 60-80-4]**.

Installation: Put oil on the bolt threads. Tighten the bolts in the correct sequence to 68-72 ft.-lbs. (93-98 Nm) torque.

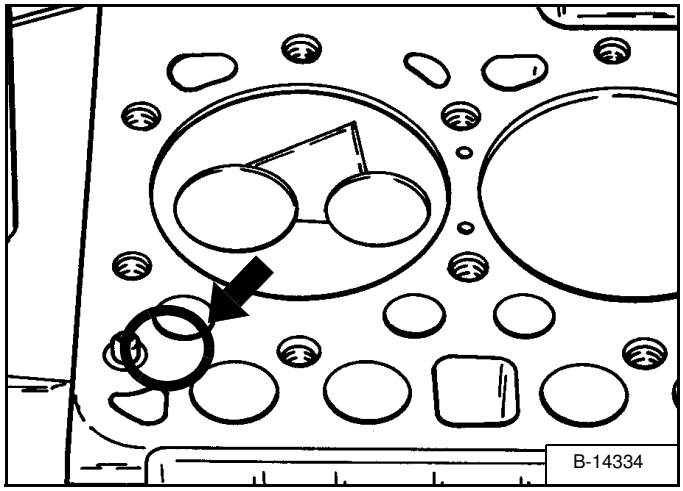
NOTE: Re-tighten the cylinder head bolts in the correct sequence after the engine has been run for 30 minutes.

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Cylinder Head Removal And Installation (Cont'd)

Remove the cylinder head from the engine block.

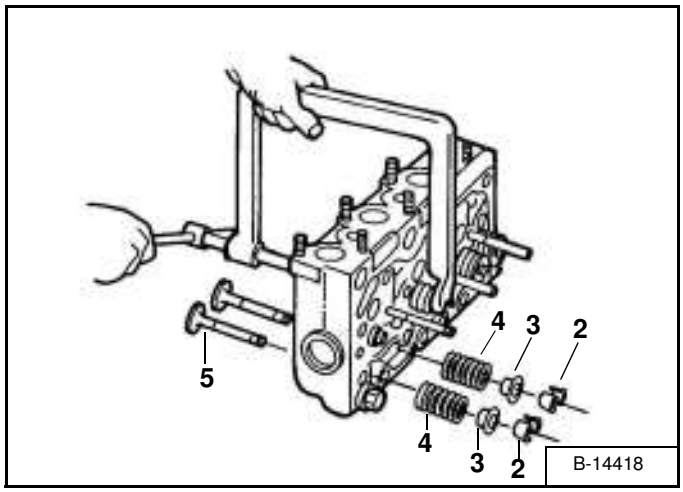
Figure 60-80-5



Installation: Always use new head gasket and new O-ring. Make sure the O-ring is seated over the dowel **[Figure 60-80-5]**.

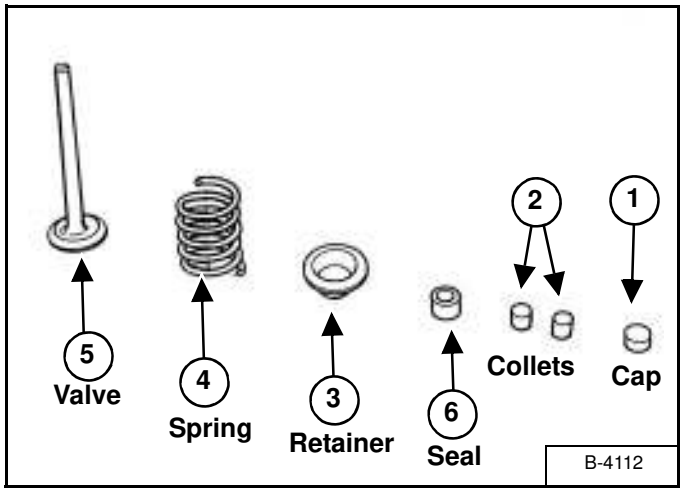
Cylinder Head Disassembly And Assembly

Figure 60-80-6



Use a valve spring compressor to compress the valve spring **[Figure 60-80-6]**.

Figure 60-80-7



Remove the valve cap (Item 1) **[Figure 60-80-6]** & **[Figure 60-80-7]** and valve spring collet (Item 2) **[Figure 60-80-6]** & **[Figure 60-80-7]**.

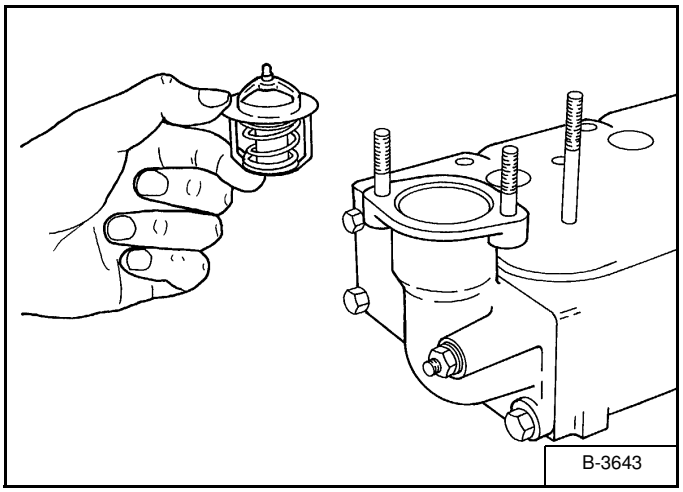
Remove the valve spring retainer (Item 3) **[Figure 60-80-6]** & **[Figure 60-80-7]** and the spring (Item 4) **[Figure 60-80-6]** & **[Figure 60-80-7]**.

Remove the seal (Item 6) **[Figure 60-80-6]** & **[Figure 60-80-7]** and the valve (Item 5) **[Figure 60-80-6]** & **[Figure 60-80-7]**.

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Cylinder Head Disassembly And Assembly (Cont'd)

Figure 60-80-8

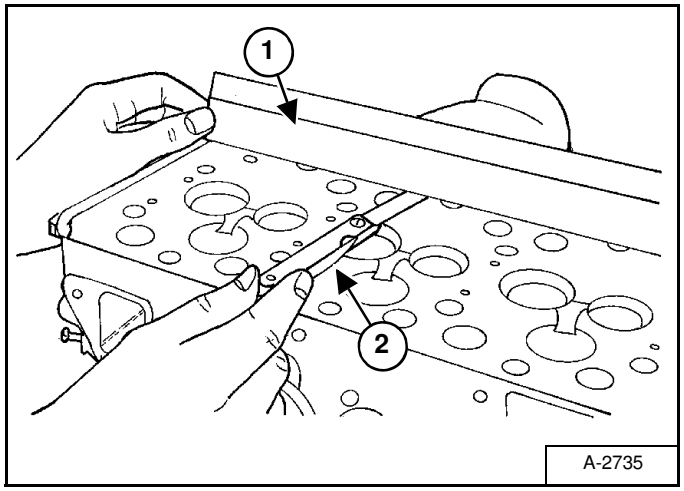


Remove the thermostat housing. Remove the thermostat from the cylinder head **[Figure 60-80-8]**.

Cylinder Head Servicing

Clean the surface of the cylinder head.

Figure 60-80-9

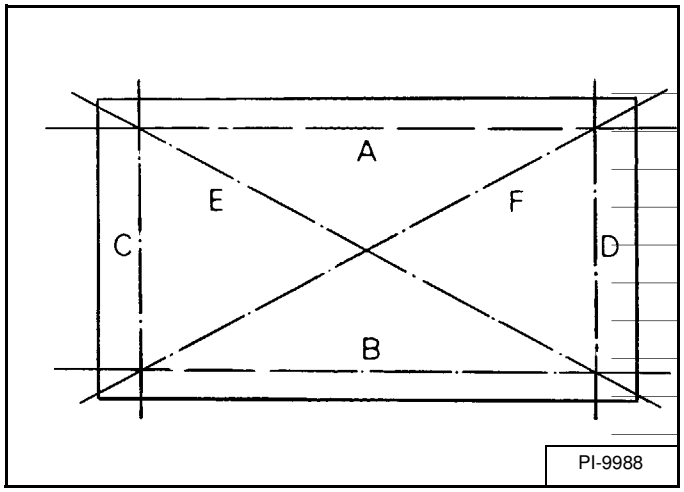


Put a straight edge (Item 1) **[Figure 60-80-9]** on the cylinder head.

NOTE: Do not put the straight edge across combustion chambers.

Put a feeler gauge (Item 2) **[Figure 60-80-9]** between the straight edge and the surface of the cylinder head.

Figure 60-80-10



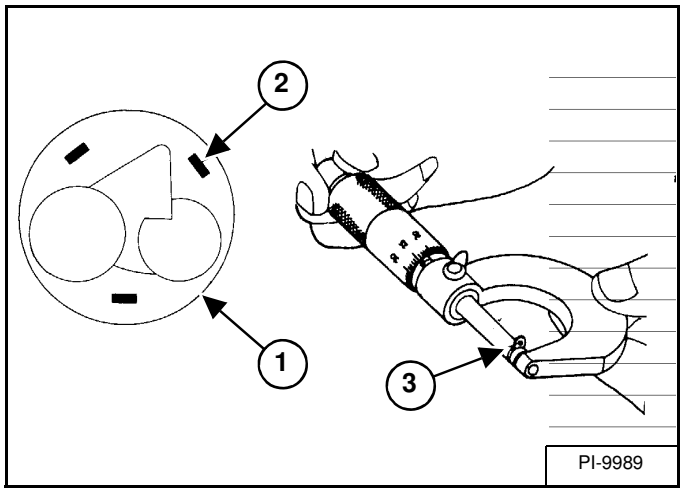
Put the straight edge on the cylinder head's four sides and two diagonal as shown in figure **[Figure 60-80-10]**.

The maximum distortion of the head surface is ± 0.002 inch (± 0,05 mm). If the measurement exceeds the specification, replace the cylinder head.

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Cylinder Head Top Clearance

Figure 60-80-11



Install the cylinder head gasket. Put the piston (Item 1) **[Figure 60-80-11]** being checked at T.D.C.

Put 3 pieces of 0.060 inch (1,5 mm) diameter solder (Item 2) **[Figure 60-80-11]** 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.

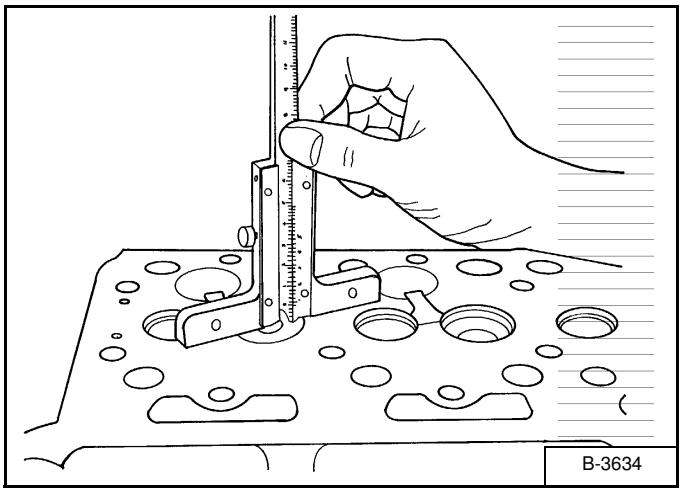
Remove the solder wire (Item 3) **[Figure 60-80-11]** and measure it.

If the measurement exceeds the specifications, check the oil clearance of the crank pin journal or the piston pin.

Top Clearance. . . . . 0.0217-0.0276 inch (0,55-0,70 mm)

Valve Guide, Checking

Figure 60-80-12

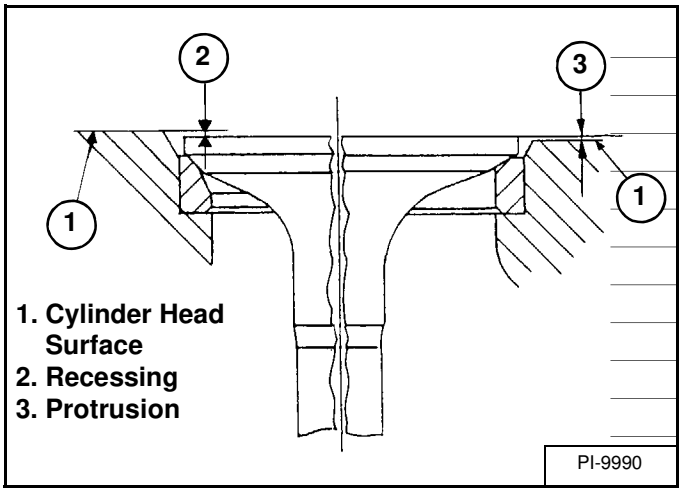


Remove the valve and spring from the cylinder head. (See Cylinder Head Disassembly And Assembly on Page 60-80-2)

Clean the valve seat and combustion chamber.

Install the valve into the guide. Measure the valve recessing or protrusion with a depth gauge **[Figure 60-80-12]**.

Figure 60-80-13



If the measurement exceeds the allowable limit, replace the valve or cylinder head **[Figure 60-80-13]**.

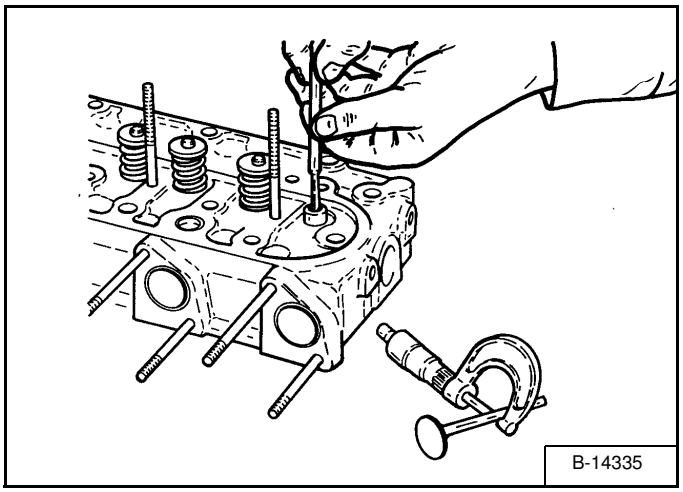
Protrusion	0.0022 inch (0,5 mm)
Recessing	0.006 inch (0,15 mm)
Allowable Limit (Recessing)	0.016 inch (0,4 mm)

Remove the carbon from the valve guide.

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Valve Guide, Checking (Cont'd)

Figure 60-80-14



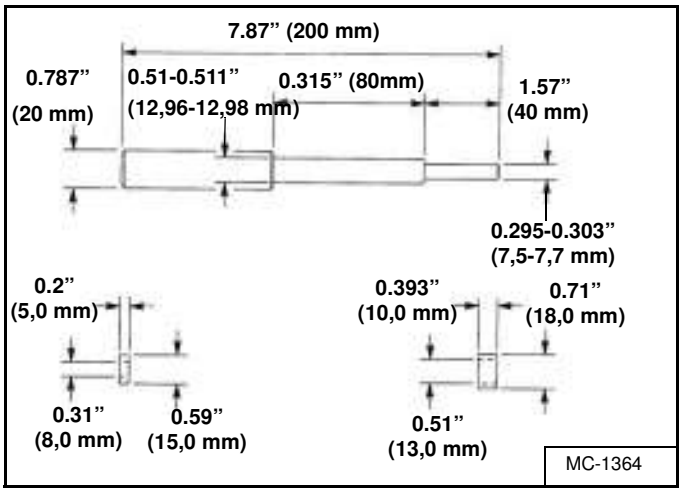
Measure the valve stem O.D. **[Figure 60-80-14]**.

Measure the valve guide I.D. **[Figure 60-80-14]**.

Calculate the clearance. If the clearance exceeds the allowable limit, replace the valve and/or valve guide.

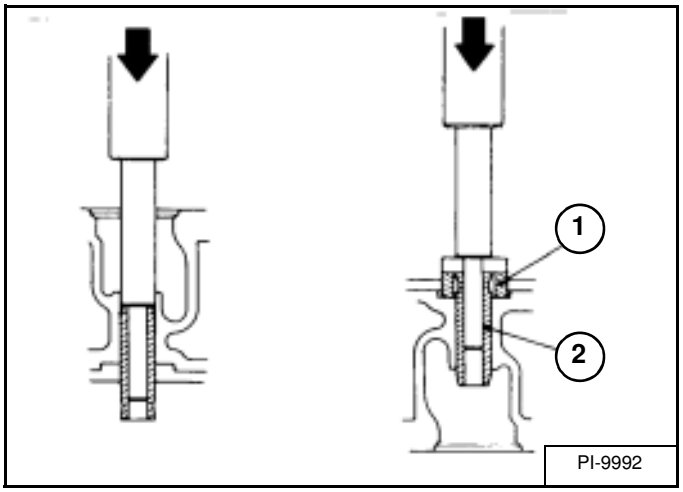
Valve Guide I.D.	0.3156-0.3161 inch (8,015-8,03 mm)
Valve Guide O.D.	0.3134-0.3140 inch (7,96-7,957 mm)
Clearance Between Valve Stem and Guide	0.0016-0.0026 inch (0,04-0,07 mm)
Allowable Limit	0.0039 inch (0,1)mm

Figure 60-80-15



To remove and replace the valve guide, make the driver tool as shown in figure **[Figure 60-80-15]**.

Figure 60-80-16



Press the used valve guide out of the cylinder head using the special driver tool **[Figure 60-80-16]**. (See Valve Guide, Checking on Page 60-80-4.)

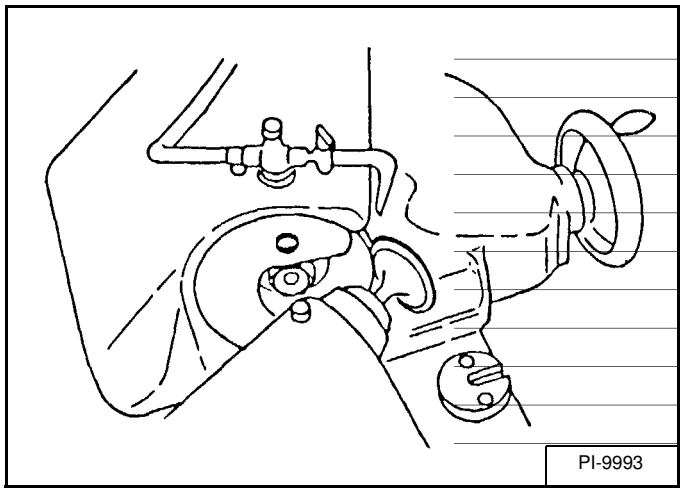
Put oil on the outside diameter of the new valve guide. Press the new valve guide into the cylinder head from the top side. Use the special driver tools (Items 1 & 2) **[Figure 60-80-16]**, press the new guide until the tool contacts the cylinder head.

Ream the valve guide to the correct specifications.

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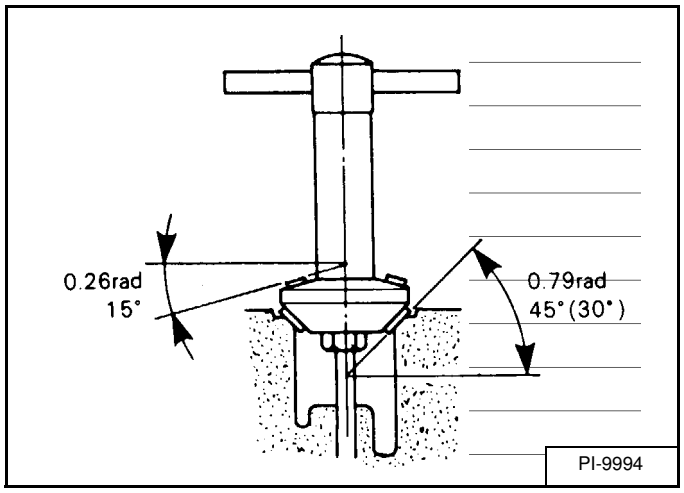
Reconditioning The Valve And Valve Seat

Figure 60-80-17



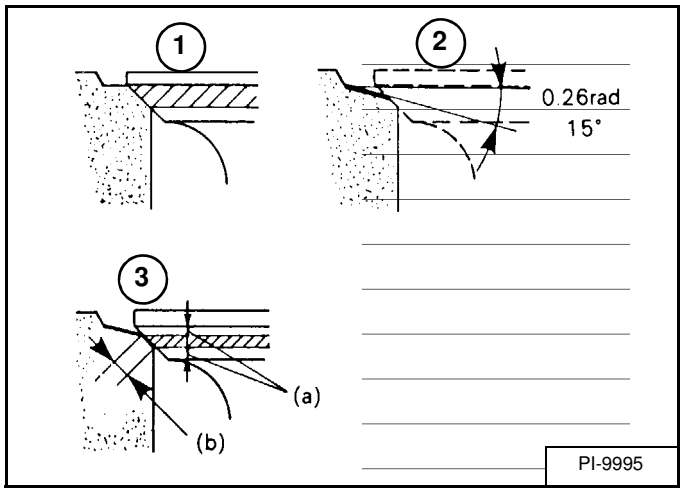
Grind the valve face to the correct angle using a valve refacer **[Figure 60-80-17]**.

Figure 60-80-18



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

Figure 60-80-19



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

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

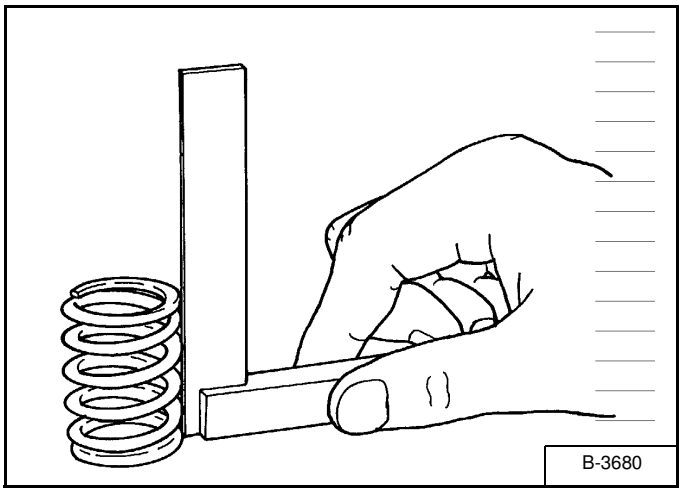
	Valve Seat Width
Intake	0.0835 inch(2,12 mm)
Exhaust	0.0835 inch(2,12 mm)

	Valve Seat & Face Angle
Intake	60°
Exhaust	45°

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Valve Spring

Figure 60-80-20



Measure the length of the valve spring. If the measurement is less than the allowable limit, replace the spring **[Figure 60-80-20]**.

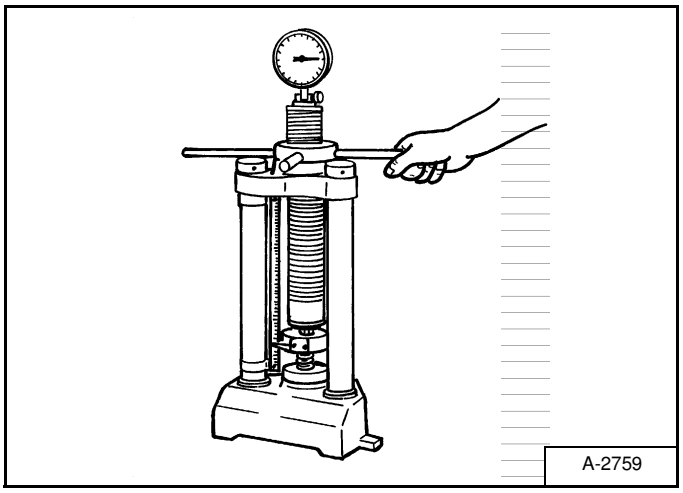
Free Length	1.642-1.661 inch (41,7-41,2 mm)
Allowable Limit	1.622 inch (41,2 mm)

Put the spring on a flat surface, place a square on the side of the spring **[Figure 60-80-20]**.

Rotate the spring and measure the maximum tilt. If the measurement excess the allowable limit, replace the spring.

Tilt	0.040 inch (1,0 mm)

Figure 60-80-21



Put the spring on a tester and compress to specified length **[Figure 60-80-21]**.

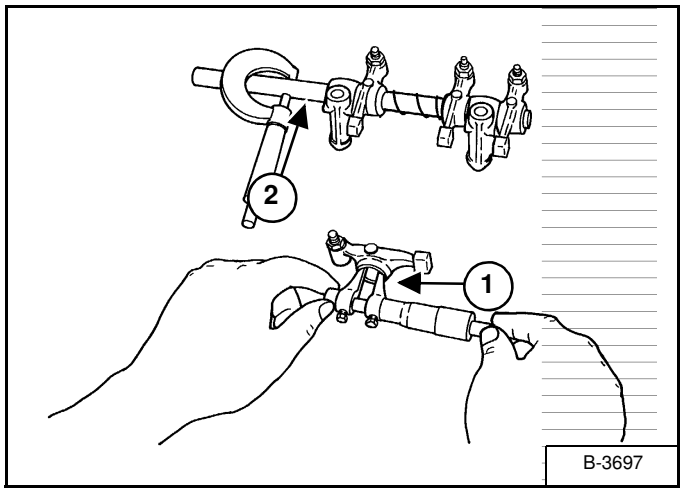
Read the compressed load on the gauge. If the measurement exceeds allowable limit, replace the spring.

Setting Length	1.378 inch (35,0 mm)
Setting Load	26.4 lbs (117,6 N)
Allowable Limit	22.5 lbs. (100,0 N)

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Rocker Arm And Shaft Checking

Figure 60-80-22



Measure the rocker arm I.D. (Item 1) **[Figure 60-80-22]** with an inside micrometer.

Measure the rocker arm shaft O.D. (Item 2) **[Figure 60-80-22]** 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 inch (0,016-0,045 mm)
Allowable Limit	0.0059 inch (0,15 mm)

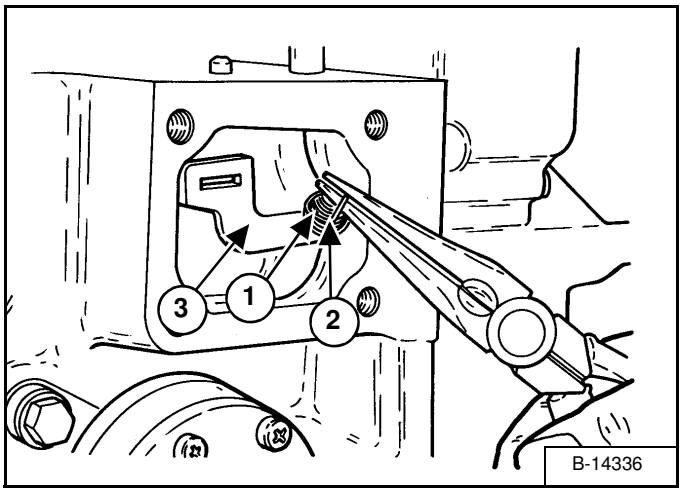
Rocker arm shaft O.D.	0.5501-0.5506 inch (13,97-13,98 mm)
Rocker arm I.D. for shaft	0.5512-0.5519 inch (14,0-14,02 mm)

Timing Gearcase Cover Removal And Installation

Remove the Fuel Injection Pump. (See Fuel Injection Pump Removal And Installation on Page 60-50-5.)

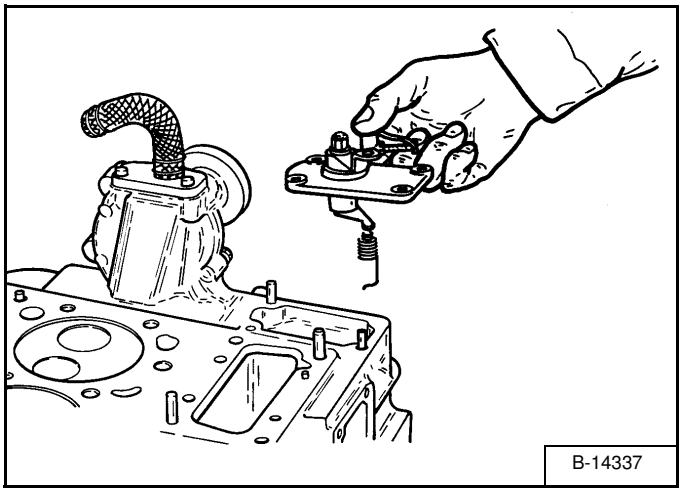
Remove the Cylinder Head, Rocker Arms and Push Rods. (See Cylinder Head Removal And Installation on Page 60-80-1

Figure 60-80-23



Disconnect the two governor springs (Items 1 & 2) **[Figure 60-80-23]** from the fork lever (Item 3) **[Figure 60-80-23]**.

Figure 60-80-24

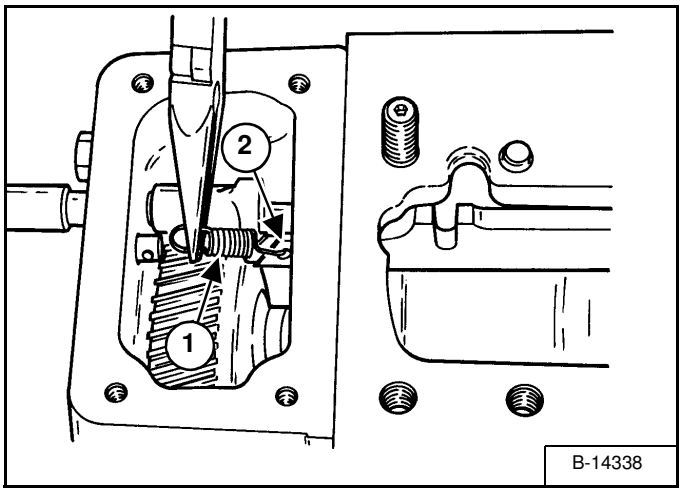


Remove the speed control plate with the governor springs **[Figure 60-80-24]**.

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Timing Gearcase Cover Removal And Installation (Cont'd)

Figure 60-80-25



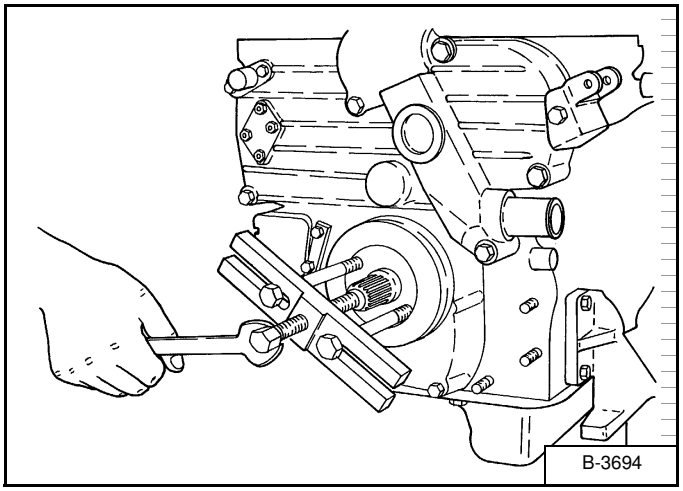
Remove the start spring (Item 1) from the fork lever (Item 2) **[Figure 60-80-25]**.

Installation: Be careful; do not drop the spring into the gearcase.

Remove the crankshaft pulley nut.

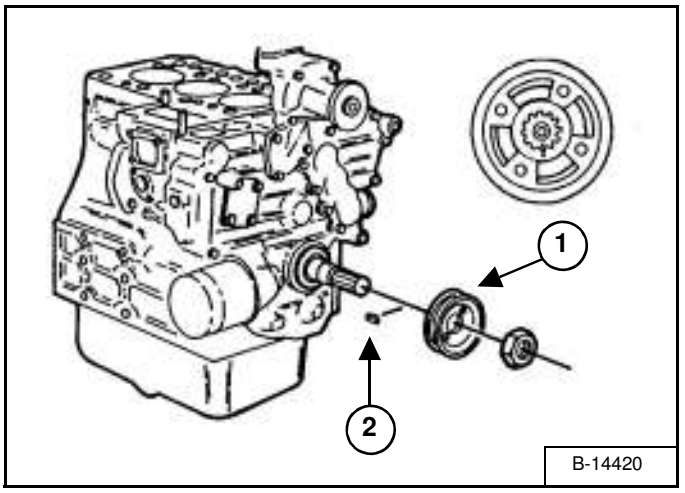
Installation: Tighten the nut to 101-116 ft.-lbs. (137-157 Nm) torque.

Figure 60-80-26



Use a puller and remove the crankshaft pulley **[Figure 60-80-26]**.

Figure 60-80-27

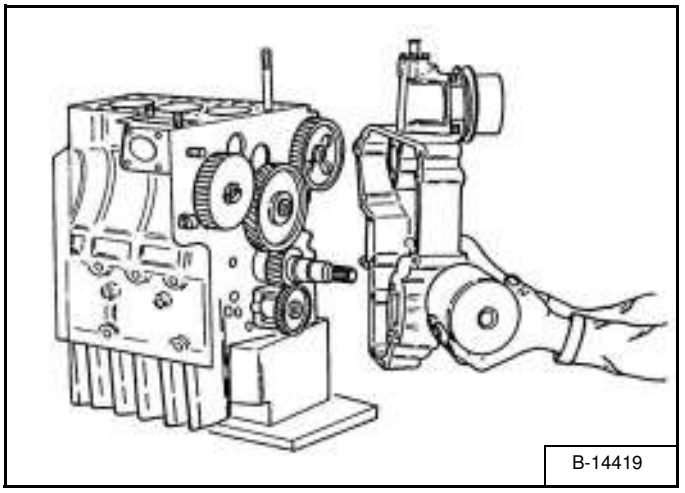


Remove the crankshaft pulley (Item 1) and key (Item 2) **[Figure 60-80-27]**.

Remove the bolts from the timing gearcase cover.

Installation: Tighten the bolts to 13-15 ft.-lbs. (18-21 Nm) torque.

Figure 60-80-28

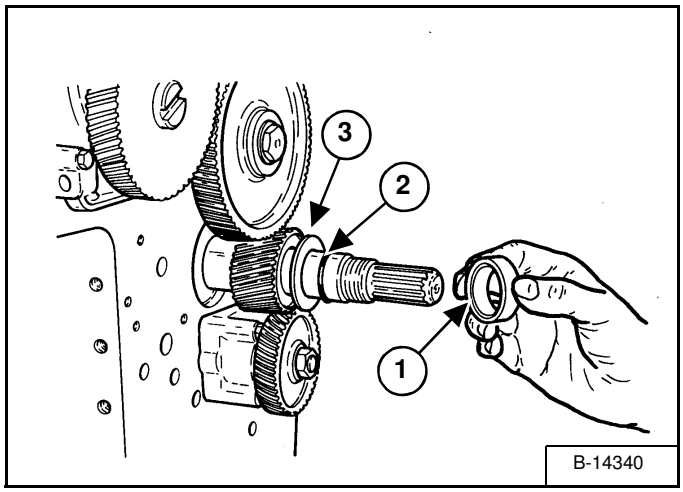


Remove the timing gearcase cover **[Figure 60-80-28]**.

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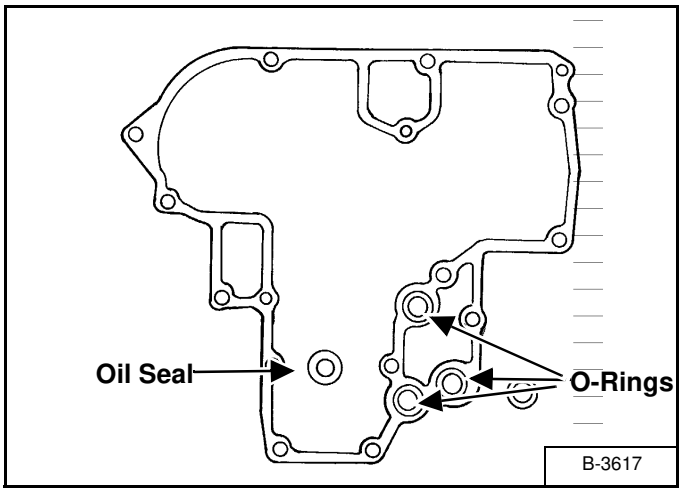
Timing Gearcase Cover Removal And Installation (Cont'd)

Figure 60-80-29



Remove the crankshaft oil slinger (Item 1), O-ring (Item 2) and collar (Item 3) **[Figure 60-80-29]**.

Figure 60-80-30



Installation: Install new O-rings and oil seal into the timing gearcase cover **[Figure 60-80-30]**.

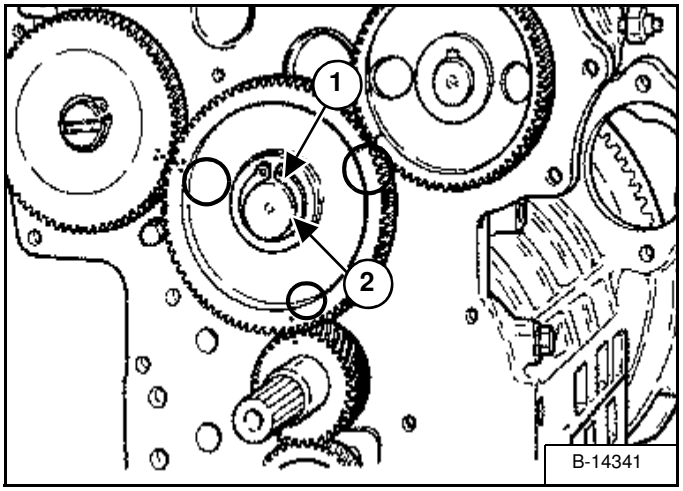
NOTE: When a new timing gearcase cover is installed, to establish the *correct position* of the injection pump fuel rack stop before removing it from the old timing gearcase cover, the distance from the machined surface of the gearcase (gasket surface) to the end of the stop should be measured. The stop should then be installed in the new gearcase and set to the same distance that was previously measured. Do not try to test operate the engine to establish if it has enough power. The adjustment must be set by a qualified service personnel for the injection pump.

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Idler Gear And Camshaft Removal And Installation

Remove the cylinder head cover. (See Cylinder Head Removal And Installation on Page 60-80-1

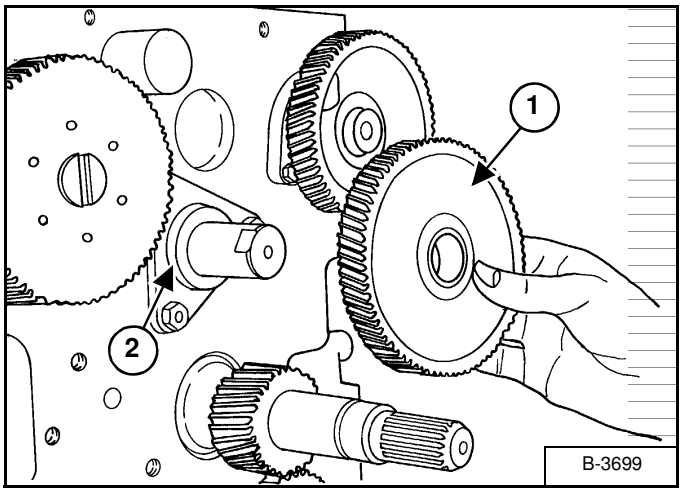
Figure 60-80-31



Remove the snap ring (Item 1) from the idler gear shaft (Item 2) **[Figure 60-80-31]**.

Installation: Make sure the timing marks are in correct alignment when installing the timing gears **[Figure 60-80-31]**.

Figure 60-80-32



Remove the idler gear (Item 1) **[Figure 60-80-32]**.

Remove the idler gear collar (Item 2) **[Figure 60-80-32]**.

Remove the idler gear shaft mounting bolts.

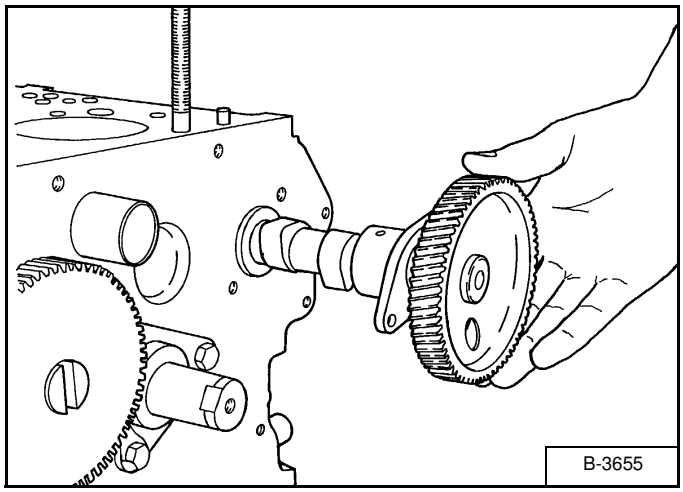
Installation: Tighten the mounting bolts to 17-20 ft.-lbs. (23-27 Nm) torque.

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

Remove the bolts.

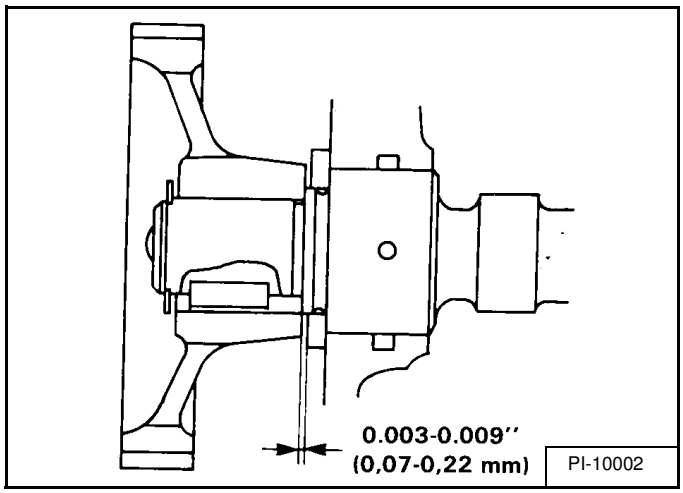
Installation: Tighten the camshaft retainer bolts to 17-20 ft.-lbs. (23-27 Nm) torque.

Figure 60-80-33



Remove the camshaft from the engine block **[Figure 60-80-33]**.

Figure 60-80-34



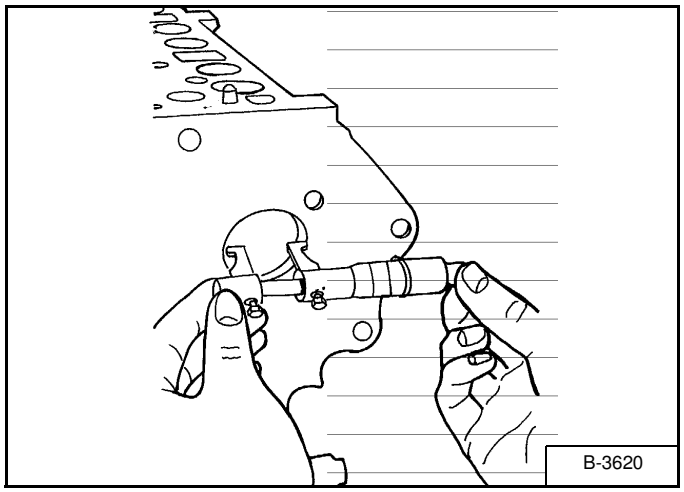
Installation: Check the camshaft end play, if the clearance exceeds the allowable limit, replace the camshaft retainer plate **[Figure 60-80-34]**.

Camshaft End Play	0.003-0.009 inch (0,07-0,22 mm)
Allowable Limit	0.012 inch (0,3 mm)

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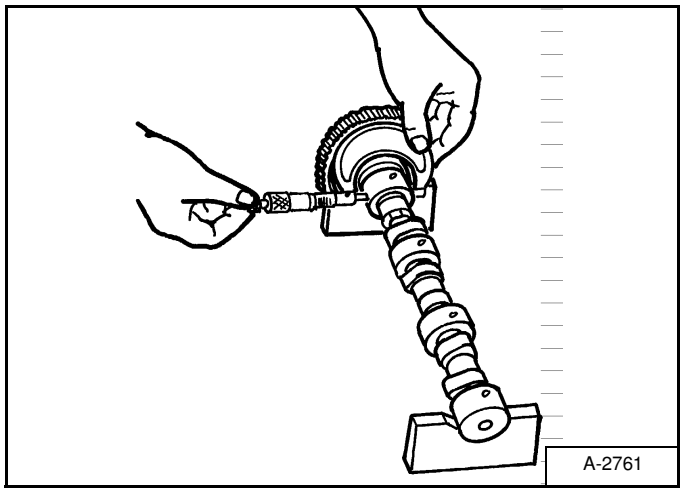
Idler Gear And Camshaft Removal And Installation (Cont'd)

Figure 60-80-35



Measure the camshaft bearing in the engine block **[Figure 60-80-35]**.

Figure 60-80-36

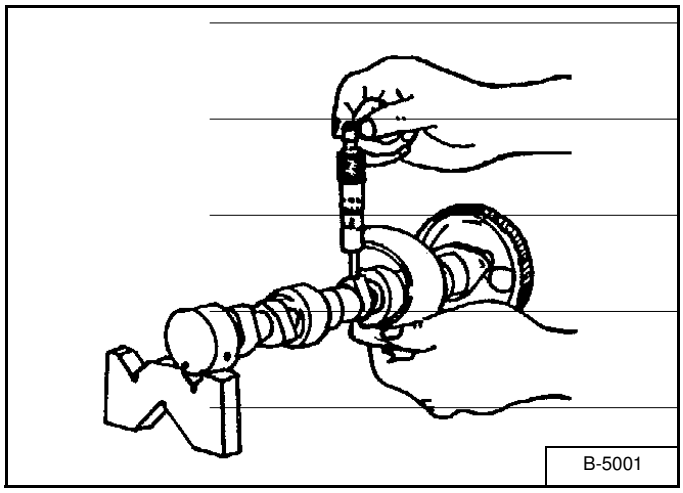


Measure the camshaft journal **[Figure 60-80-36]**.

Calculate the oil clearance. If the clearance exceeds the allowable limit, replace the camshaft.

Bearing I.D.	1.575-1.576 inch (40,0-40,03 mm)
Journal O.D.	1.572-1.573 inch (39,93-39,95 mm)
Oil Clearance of Camshaft Journal	0.002-0.004 inch (0,05-0,09 mm)
Allowable Limit	0.006 inch (0,15 mm)

Figure 60-80-37

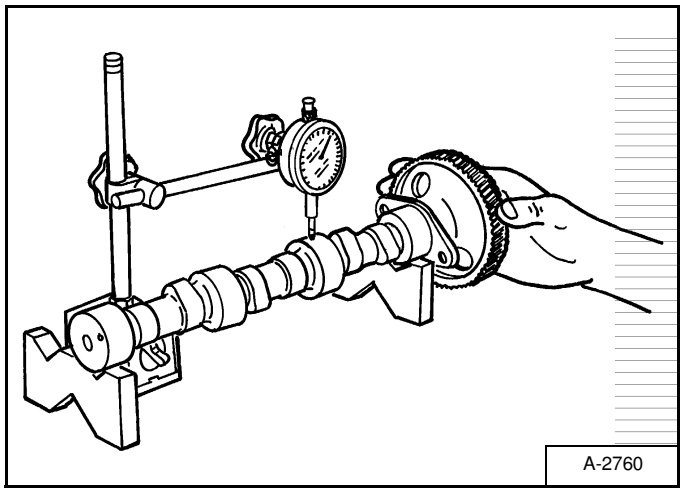


Measure the cam lobes at their highest point **[Figure 60-80-37]**.

If the measurement is less than the allowable limit, replace the camshaft.

Cam Lobe Height	1.318 inch (33,47 mm)
Allowable Limit	1.36 inch (33,42 mm)

Figure 60-80-38



Put the camshaft in V-blocks. Install a dial indicator **[Figure 60-80-38]**.

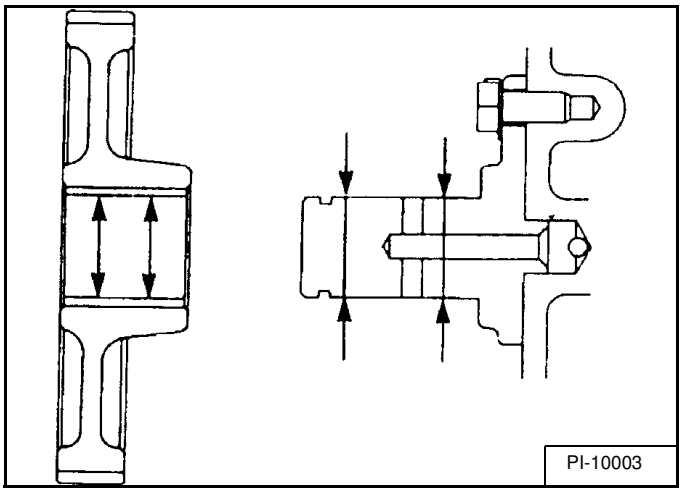
Turn the camshaft at a slow rate. If the misalignment exceeds the allowable limit, replace the camshaft.

Camshaft Alignment Allowable Limit	0.0004 inch (0,01 mm)

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Idler Gear And Shaft Servicing

Figure 60-80-39



Measure the O.D. of the idler gear shaft **[Figure 60-80-39]**.

Measure the I.D. of the idler gear bushing **[Figure 60-80-39]**.

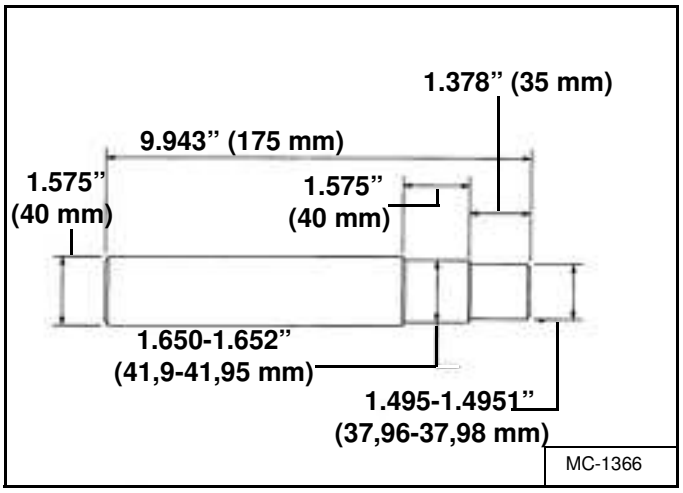
If the clearance exceeds the allowable limit, replace the bushing.

Idler Gear Shaft O.D.	1.494-1.495 inch (37,959-37,975 mm)
Idler Gear Bushing I.D.	1.496-1.495 inch (38,00-38,025 mm)

Clearance between Idler Shaft &

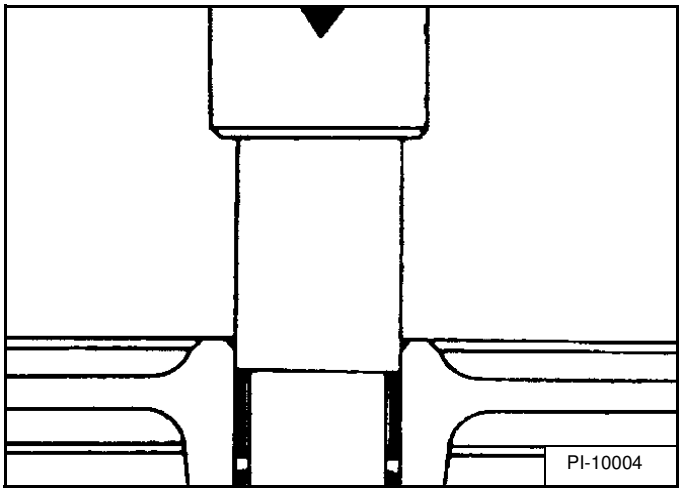
Gear Bushing	0.001-0.003 inch (0,025-0,07 mm)
Allowable Limit	0.004 inch (0,1 mm)

Figure 60-80-40



To replace the idler gear bushing, make a driver tool as shown in **[Figure 60-80-40]**.

Figure 60-80-41



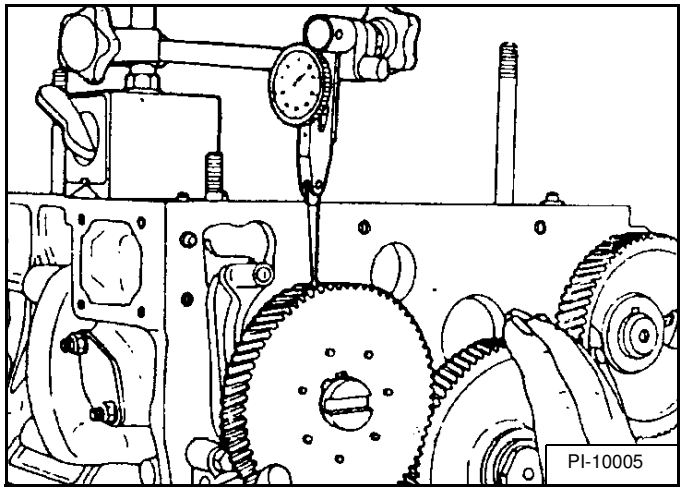
Use a press and special driver tool, to remove the old bushing and install the new bushing **[Figure 60-80-41]**.

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Timing Gears Checking Backlash

When the gears are installed, check the backlash of the gears.

Figure 60-80-42



Install a dial indicator **[Figure 60-80-42]**.

Hold one gear while turning the other gear **[Figure 60-80-42]**.

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.

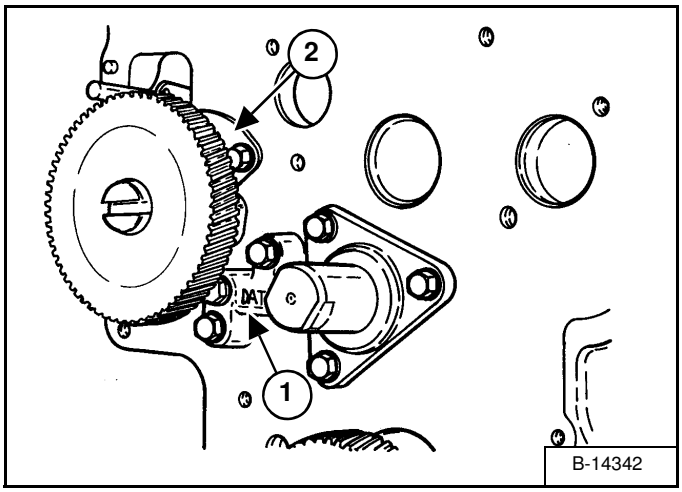
Crank Gear & Idler Gear	0.002-0.004 inch (0,042-0,11)
Allowable Limit	0.006 inch (0,15 mm)
Cam Gear & Idler Gear	0.002-0.005 inch (0,042-0,12 mm)
Allowable Limit	0.006 inch (0,15 mm)
Injection Pump Gear & Idler Gear	0.002-0.005 inch (0,042-,0115 mm)
Allowable Limit	0.006 inch (0,15 mm)
Oil Pump Gear & Crankshaft	0.002-0.004 inch (0,042-0,109 mm)
Allowable Limit	0.006 inch (0,15 mm)

Fuel Camshaft Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-80-8.)

Remove the idler gear. (See Idler Gear And Camshaft Removal And Installation on Page 60-80-11.)

Figure 60-80-43

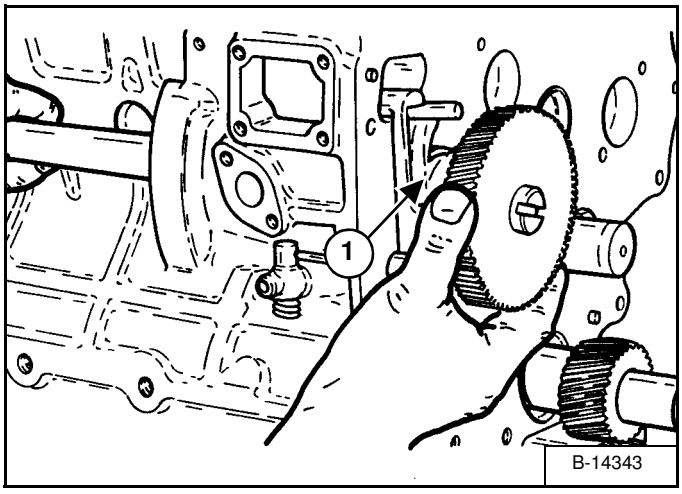


Remove the bolt (Item 1) from the retainer plate (Item 2) **[Figure 60-80-43]**.

Installation: Tighten the bolt to 60-72 in.-lbs. (6,8-8,1 Nm) torque.

Remove the fuel camshaft retainer plate (Item 2) **[Figure 60-80-43]**.

Figure 60-80-44



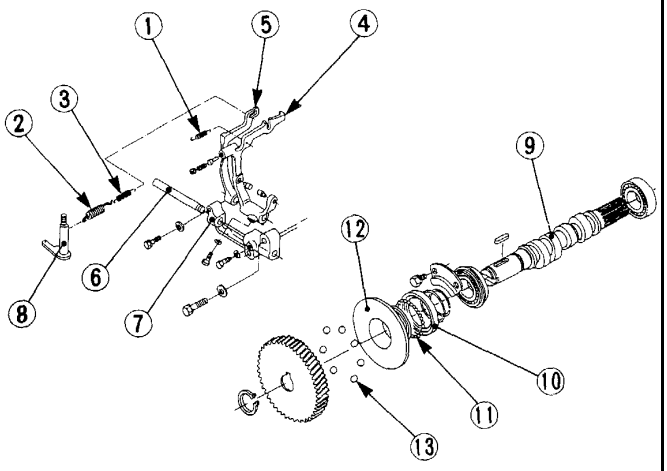
Remove the fuel camshaft and fork lever assembly (Item 1) **[Figure 60-80-44]** at the same time.

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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 60-80-45



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 60-80-45]**.

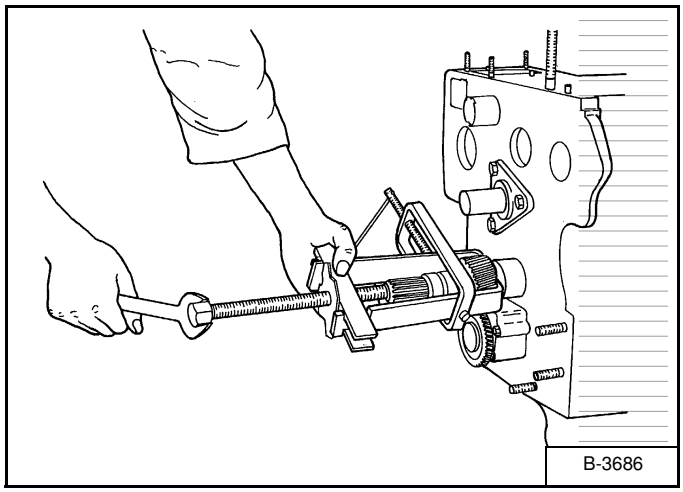
Check all the parts for wear or damage and replace as needed.

Crankshaft Gear Removal And Installation

Remove the timing gearcase cover. (See Timing Gears Checking Backlash on Page 60-80-14.)

Remove the idler gear. (See Idler Gear And Camshaft Removal And Installation on Page 60-80-11.)

Figure 60-80-46



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Remove the crankshaft gear with a puller **[Figure 60-80-46]**.

Remove the crankshaft key.

Installation: Install the crankshaft key. Heat the crankshaft gear to 176° F (80° C) and fit it on the crankshaft.

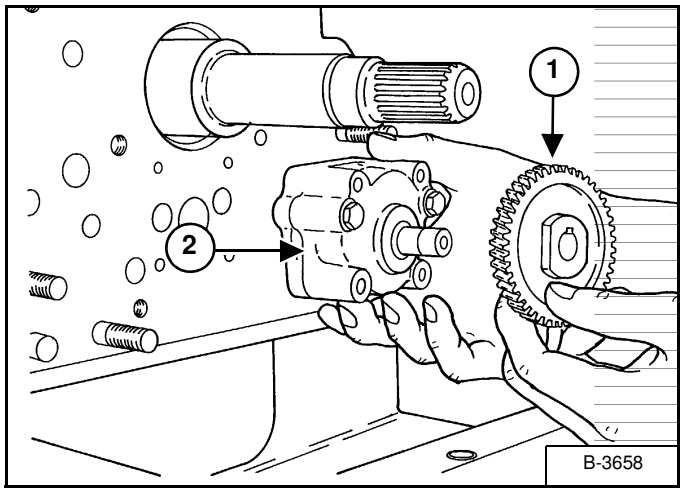
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Oil Pump Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-80-8.)

Remove the crankshaft gear.

Figure 60-80-47



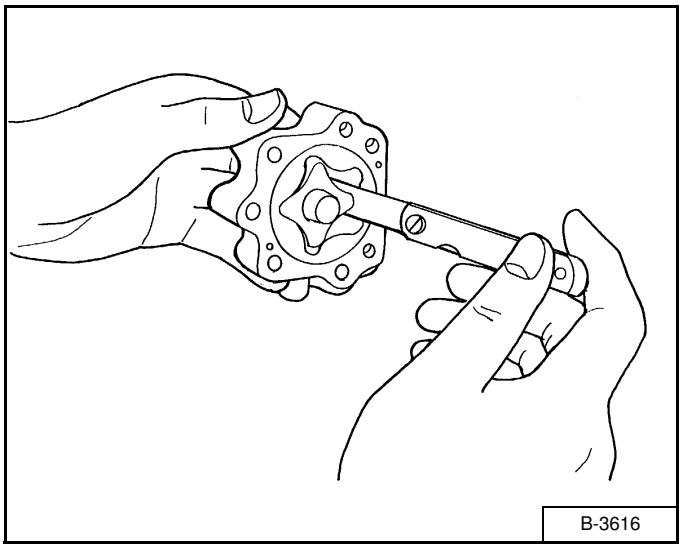
Remove the nut from the oil pump shaft. Use a puller to remove the oil pump gear (Item 1) **[Figure 60-80-47]**.

Remove the oil pump mounting bolts. Remove the oil pump (Item 2) **[Figure 60-80-47]**.

Installation: Tighten the oil pump mounting bolts to 60-72 in.-lbs. (6,9-8,1 Nm) torque.

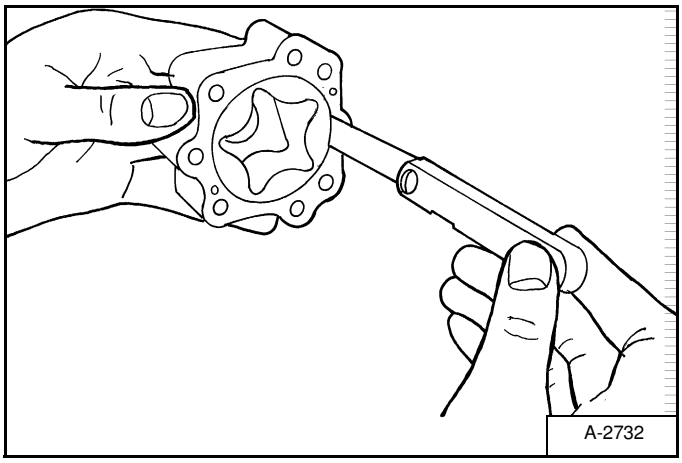
Oil Pump Service

Figure 60-80-48



Measure the clearance between the lobes of the inner rotor and outer rotor **[Figure 60-80-48]**.

Figure 60-80-49



Measure the clearance between the outer rotor and pump body **[Figure 60-80-49]**.

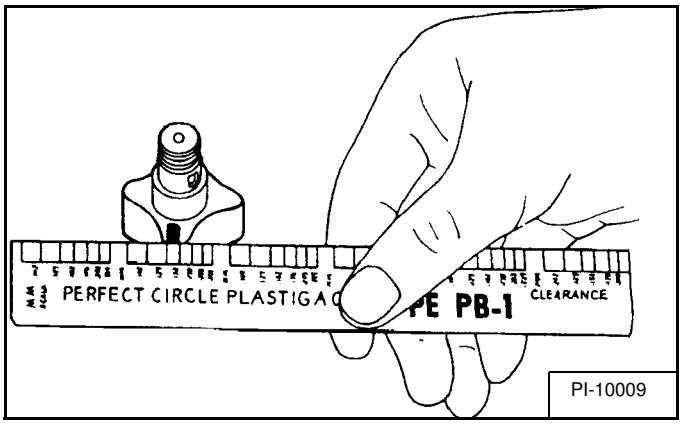
If the clearance exceeds the allowable limit, replace the oil pump.

Clearance Between Inner & Outer Rotor	0.003-0.006 inch (0,10-0,16 mm)
Clearance Between Outer Rotor & Body	0.004-0.008 inch (0,11-0,19 mm)

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Oil Pump Service (Cont'd)

Figure 60-80-50



Put a piece of press gauge on the rotor face **[Figure 60-80-50]**.

Install the cover and tighten the bolts.

Remove the cover carefully. Measure the width of the press gauge **[Figure 60-80-50]**.

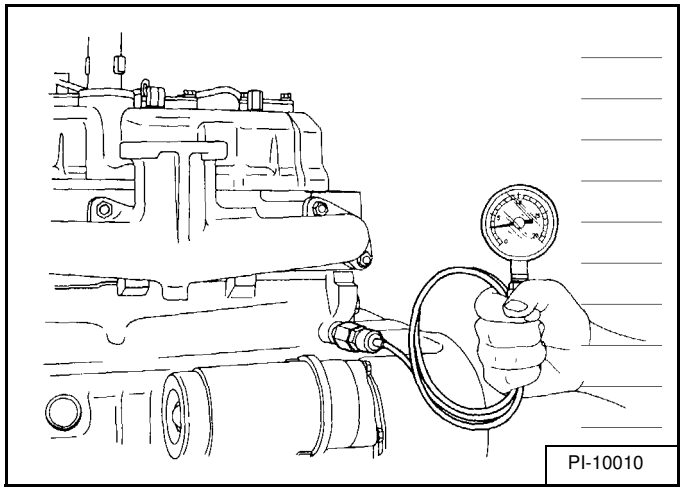
If the clearance exceeds the allowable limit replace the oil pump.

End Clearance	0.004-0.006 inch (0,11-0,15 mm)

Engine Oil Pressure, Checking

Remove the oil pressure sensor.

Figure 60-80-51



Install a pressure gauge **[Figure 60-80-51]**.

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
* Relief Valve Stuck

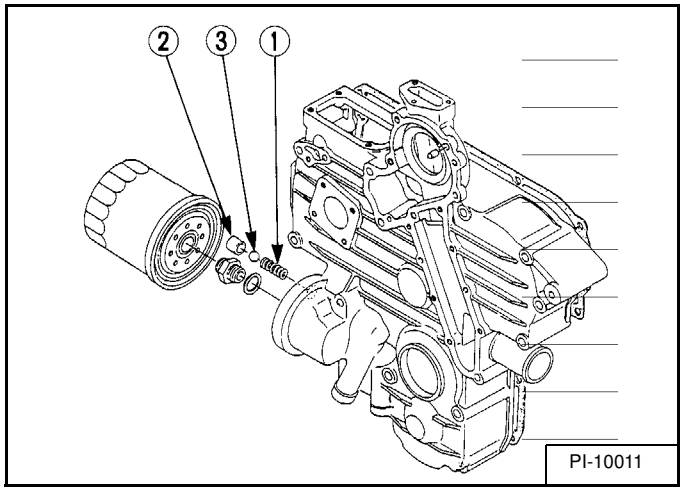
At Idle Speed Allowable Limit	7 PSI (49 kPa)
At Rated Speed	43-65 PSI (294-441 kPa)
Allowable Limit	36 PSI (245 kPa)

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Relief Valve

The relief valve prevents damage of the lubricating system due to high pressure. This relief valve is a ball type.

Figure 60-80-52



Remove the valve seat (Item 2), ball (Item 3) and spring (Item 1) **[Figure 60-80-52]**.

Check the parts for wear or damage and replace as needed.

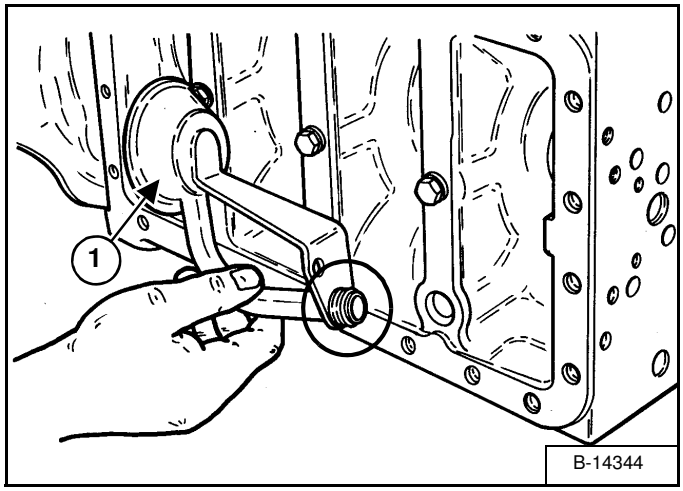
Piston And Connecting Rod Removal And Installation

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 60-80-53



Remove the oil pump strainer (Item 1) **[Figure 60-80-53]**.

Turn the flywheel and put a pair of connecting rods at bottom dead center.

Remove the connecting rod bolts.

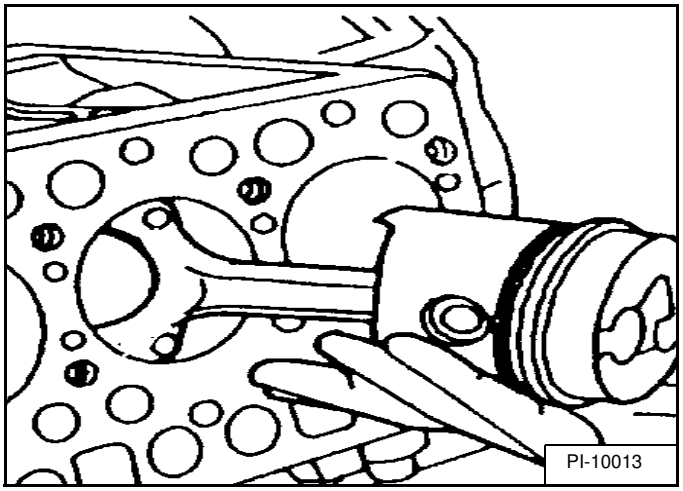
Installation:Tighten the connecting rod bolts to the following torque:

W/O Flange Bolt	27-30 ft.-lbs. (37-41 Nm)
W/Flange Bolt	33-36 ft.-lbs (44-49 Nm)

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

Figure 60-80-54

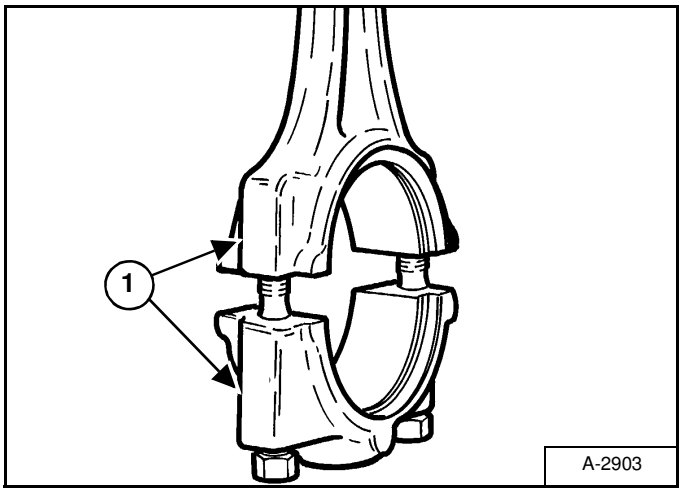


Remove the rod cap and bearing **[Figure 60-80-54]**.

Use a hammer handle and push the piston/connecting rod assembly out of the cylinder bore **[Figure 60-80-54]**.

NOTE: Make sure the pistons are marked so they will be returned to the same cylinder bore.

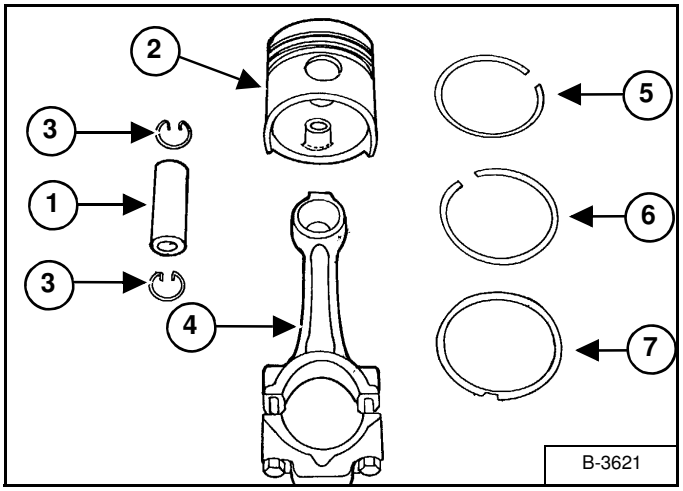
Figure 60-80-55



Installation: Make sure the marks on the connecting rod and bearing are aligned when installing the bearing cap **[Figure 60-80-55]**.

Repeat the procedure to remove the other piston/ connecting rod assemblies from the engine block.

Figure 60-80-56



Remove the first compression ring (Item 5) **[Figure 60-80-56]**.

Remove the second compression ring (Item 6) **[Figure 60-80-56]**.

Remove the oil ring (Item 7) **[Figure 60-80-56]**.

Remove the snap ring (Item 3) and piston pin (Item 1) **[Figure 60-80-56]**.

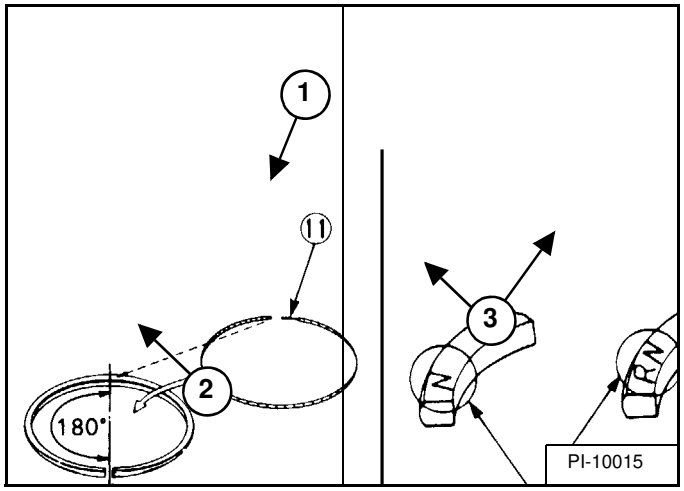
Separate the piston (Item 2) from the connecting rod (Item 4) **[Figure 60-80-56]**.

NOTE: Make sure the piston and rod assembly is marked so as not to change the piston rod assembly with another piston or connecting rod.

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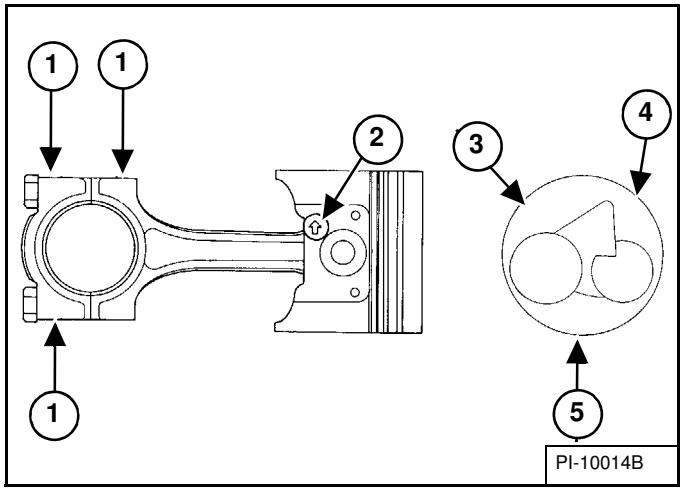
Piston And Connecting Rod Removal And Installation (Cont'd)

Figure 60-80-57



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 60-80-57]**.

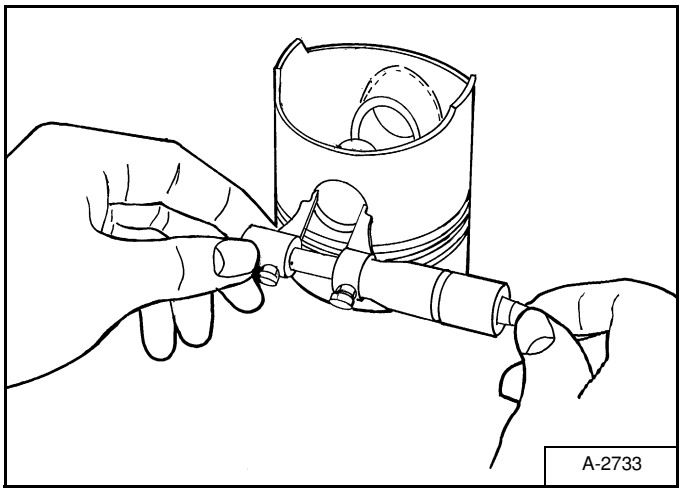
Figure 60-80-58



Installation: When reassembling, align the marks (Item 1) on the connecting rod and piston (Item 2). Heat the piston to 176-212° F. (80-100° C.) and tap the piston pin into position. Place the piston rings so that there are gaps every 120° (Items 3, 4 & 5) **[Figure 60-80-58]** with no gap facing the piston pin in the cylinder.

Piston And Connecting Rod Servicing

Figure 60-80-59

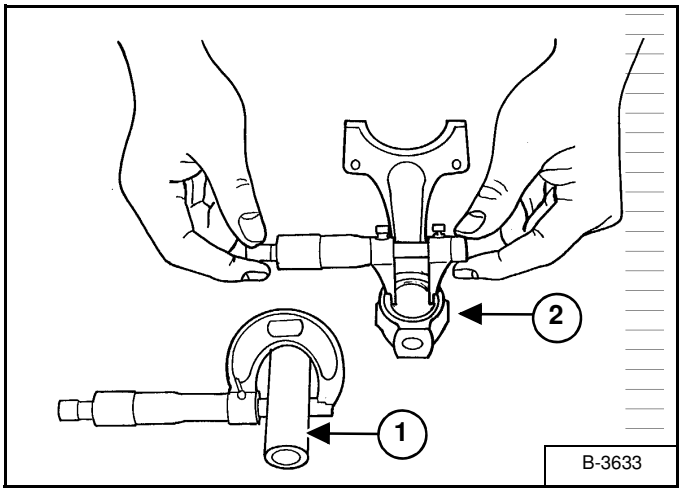


Measure the I.D. of the piston pin bore in both horizontal and vertical directions **[Figure 60-80-59]**.

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

Piston Bore I.D.	0.984-0.985 inch (25,0-25,013 mm)
Allowable Limit	0.986 inch (25,05 mm)

Figure 60-80-60



Measure the O.D. of the piston pin (Item 1) **[Figure 60-80-60]**.

Measure the I.D. of the connecting rod small end (Item 2) **[Figure 60-80-60]**.

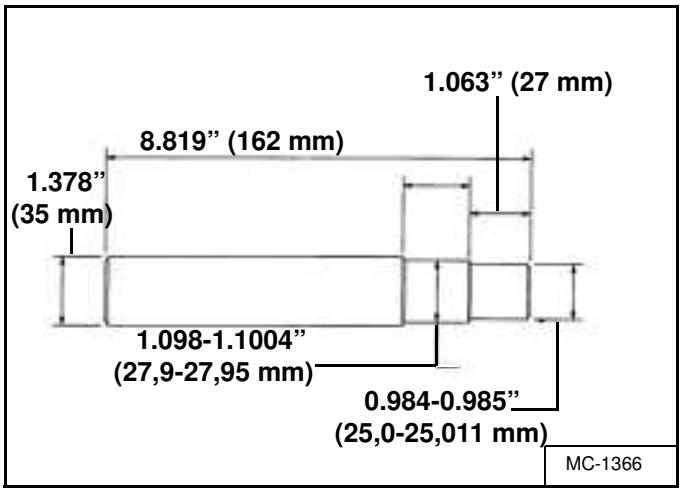
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Piston And Connecting Rod Servicing (Cont'd)

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

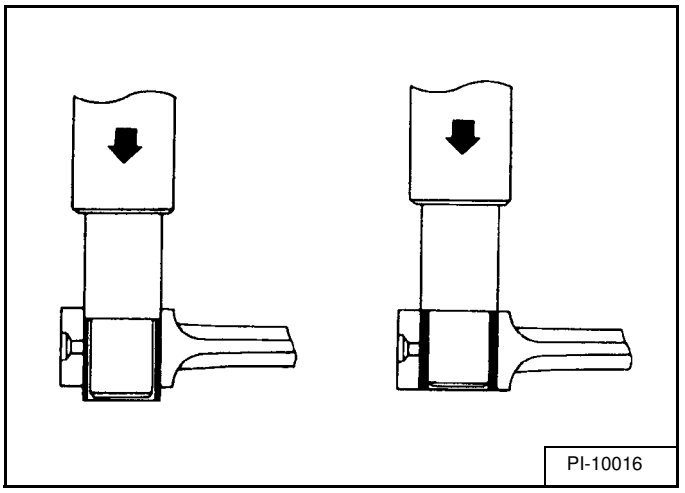
Piston Pin O.D.	0.984-0.985 inch (25,0-25,11 mm)
Bushing I.D.	0.985-0.986 inch (25,03-25,04 mm)
Oil Clearance Between Piston Pin & Bushing	0.0006-0.0015 inch (0,014-0,038 mm)
Allowable Limit	0.006 inch (0,15 mm)
Service Replacement Part	0.0006-0.003 inch (0,015-0,07 mm)

Figure 60-80-61



To replace the connecting rod small end bushing, make a driver tool as shown in figure **[Figure 60-80-61]**.

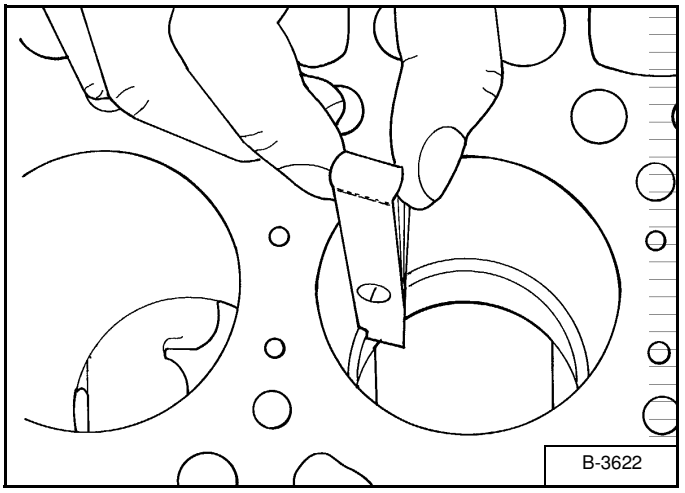
Figure 60-80-62



Use a press and special driver tool to remove the small end bushing **[Figure 60-80-62]**.

Installation: Clean the small end bushing and bore. Put oil on the bushing and press into the connecting rod until it is flush **[Figure 60-80-62]**.

Figure 60-80-63



Install a new piston ring into the lower part of the cylinder bore. Measure the ring gap with a feeler gauge **[Figure 60-80-63]**.

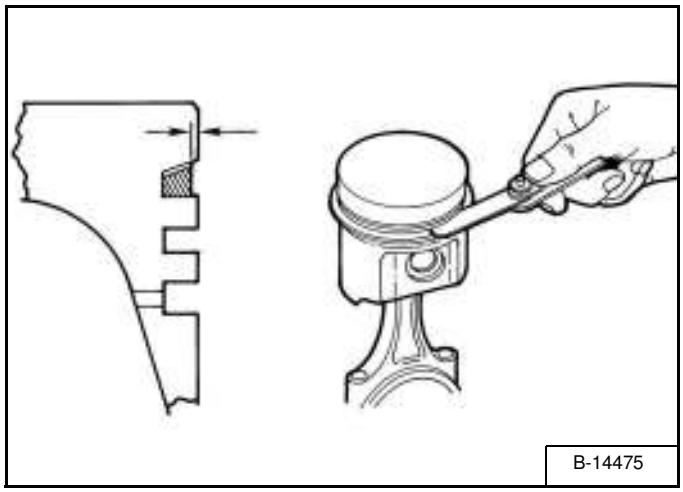
If the gap exceeds the allowable limit, replace the cylinder liner.

Compression Ring Gap	0.012-0.018 inch (0,3-0,5 mm)
Oil Ring Gap	0.010-0.016 inch (0,25-0,45 mm)
Allowable Limit	0.05 inch (1,25 mm)

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Piston And Connecting Rod Servicing (Cont'd)

Figure 60-80-64



Remove the carbon from the ring grooves. Measure the clearance between the ring and groove with a feeler gauge **[Figure 60-80-64]**.

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

Factory Spec.	**2nd Ring**	0.093 to 0.12 mm 0.0037 to 0.0047 in.
	Oil Ring	0.020 to 0.052 mm 0.0079 to 0.0020 in.

Allowable Limit [Figure60-80-62]	**2nd Ring**	0.02 mm 0.0079 in.
	Oil Ring	0.015 mm 0.0059 in.

Factory specifications: A	More than 0.2 mm 0.079 in.

Connecting Rod Alignment

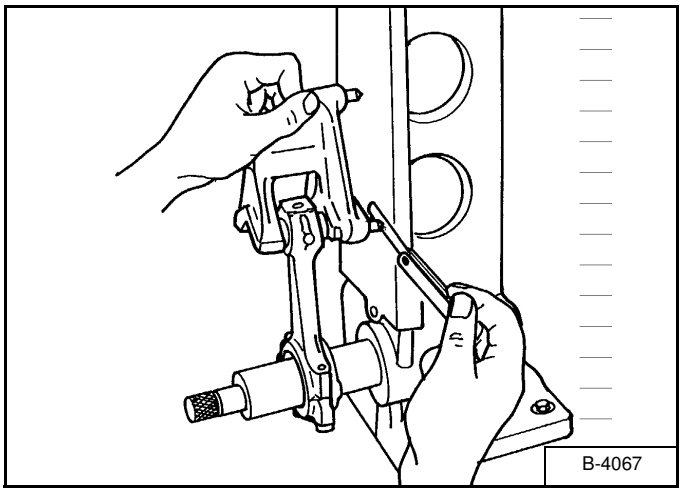
NOTE: The small end bushing is the basis of this check, check the bushing for wear before doing this check.

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 60-80-65



If the gauge does not fit squarely against the face plate, measure the space between the gauge and face plate **[Figure 60-80-65]**.

If the measurement exceeds the allowable limit, replace the connecting rod.

Rod Alignment	0.002 inch (0,05 mm)

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Crankshaft And Bearings Removal And Installation

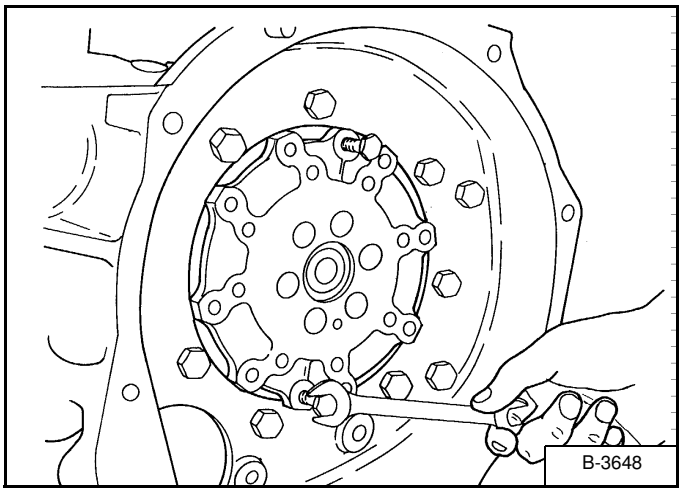
Remove the piston and connecting rod assemblies. (See Piston And Connecting Rod Removal And Installation on Page 60-80-18.)

Remove the engine flywheel. (See Removal And Installation on Page 60-70-1.)

Remove the bolts which fasten the bearing case cover to the block.

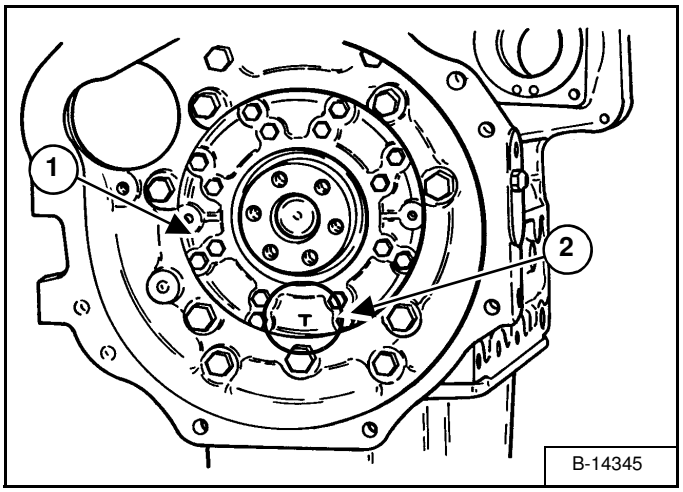
Installation: Tighten the bearing case cover bolts to 13-15 ft.-lbs. (18-21 Nm) torque.

Figure 60-80-66



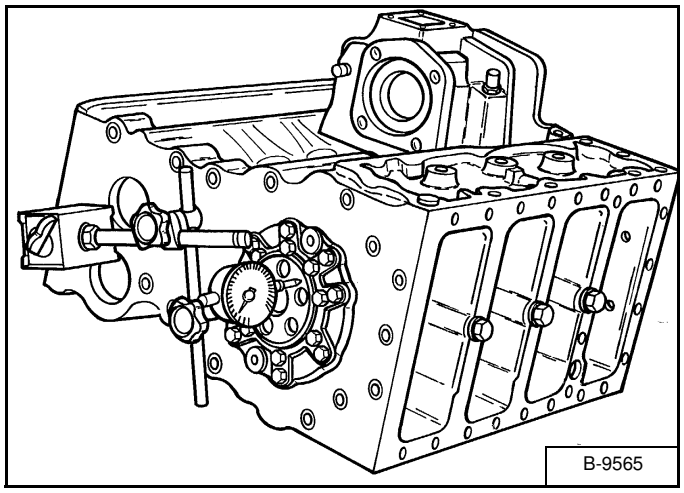
Install two bolts into the bearing case cover and pull the cover out **[Figure 60-80-66]**.

Figure 60-80-67



Installation: When installing the cover (Item 1), make sure the casting mark (Item 2) **[Figure 60-80-67]** is in the down position.

Figure 60-80-68

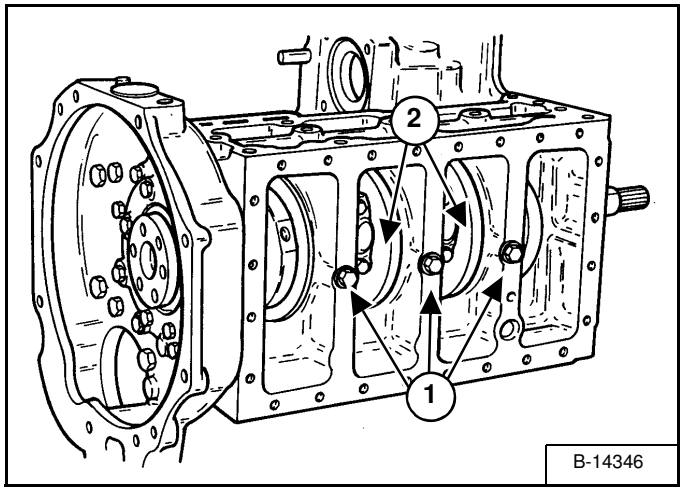


Before removing the crankshaft/main bearings, check the end play. Install a dial indicator. Measure the end play by moving the crankshaft back and forth **[Figure 60-80-68]**.

If the measurement exceeds the allowable limit, replace the thrust washers.

End Play	0.006-0.012 inch (0,15-0,31 mm)
Allowable Limit	0.020 inch (0,5 mm)

Figure 60-80-69



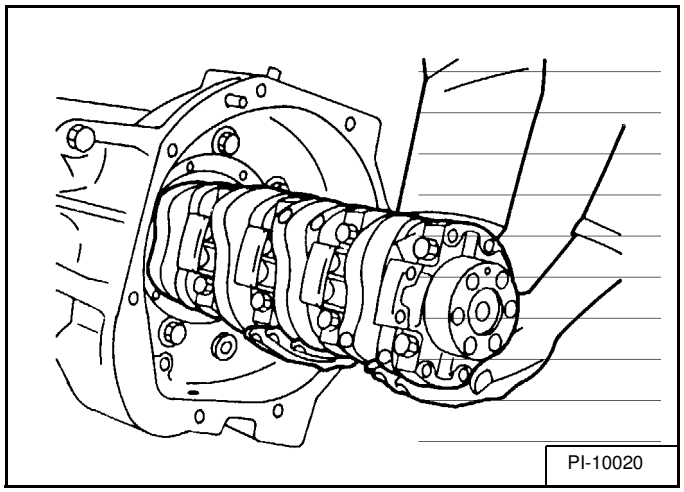
Remove the main bearing case bolt (Item 1) **[Figure 60-80-69]**.

Installation: Align the bearing case hole (Item 2) **[Figure 60-80-69]** with the hole in the block. Put oil on the bolt threads and tighten to 51-54 ft.-lbs. (69-73 Nm) torque.

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Crankshaft And Bearings Removal And Installation (Cont'd)

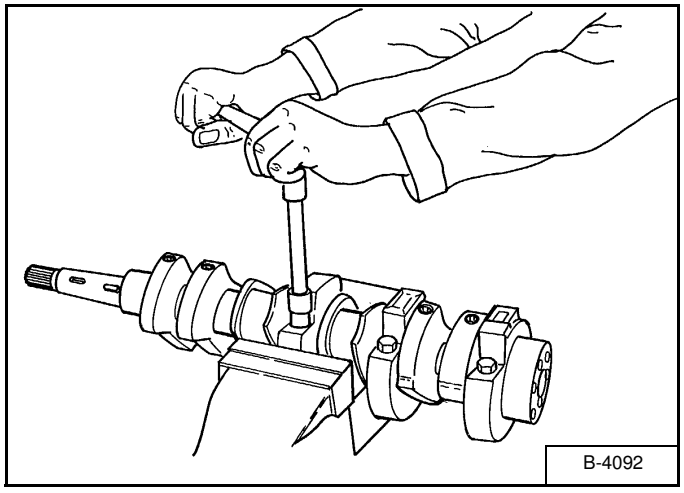
Figure 60-80-70



Remove the crankshaft/main bearing assembly from the engine block **[Figure 60-80-70]**.

Mark the bearing case halves for correct installation.

Figure 60-80-71

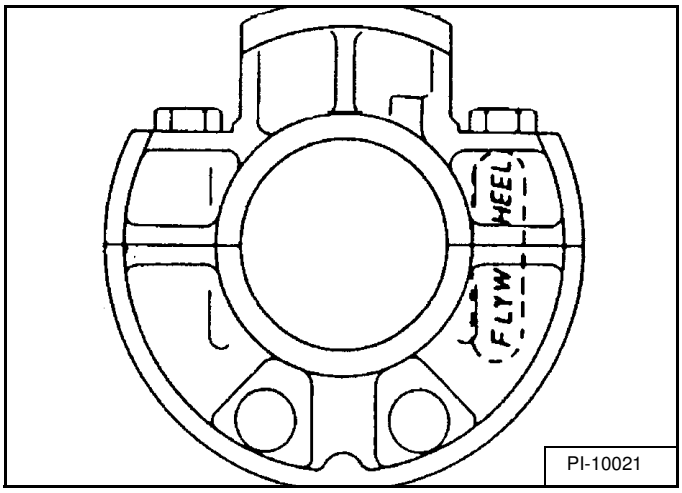


Remove the two bearing case bolts **[Figure 60-80-71]**.

Remove the bearing case and bearing.

Installation: Tighten the bearing case bolts to 34-38 ft.-lbs. (46-52 Nm) torque.

Figure 60-80-72

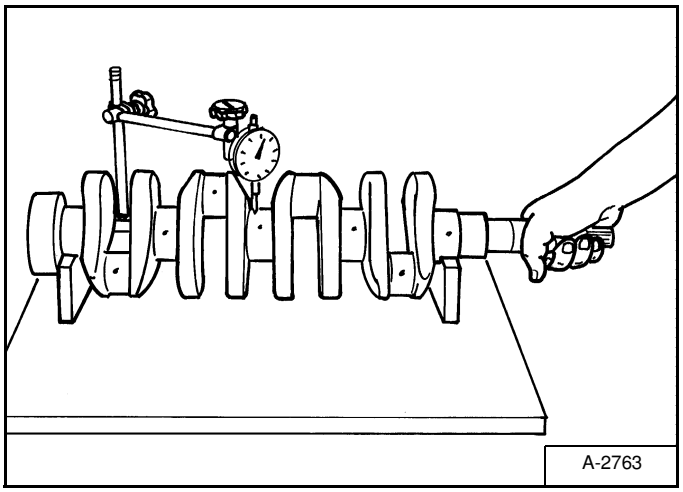


Installation: When installing the main bearing case assemblies, face the mark FLYWHEEL to the flywheel side of the engine block **[Figure 60-80-72]**. Be sure the thrust washers with its oil grooves face outward.

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Crankshaft And Bearings, Servicing

Figure 60-80-73



Put the crankshaft on V-blocks. Install a dial indicator on the center journal **[Figure 60-80-73]**.

Turn the crankshaft at a slow rate.

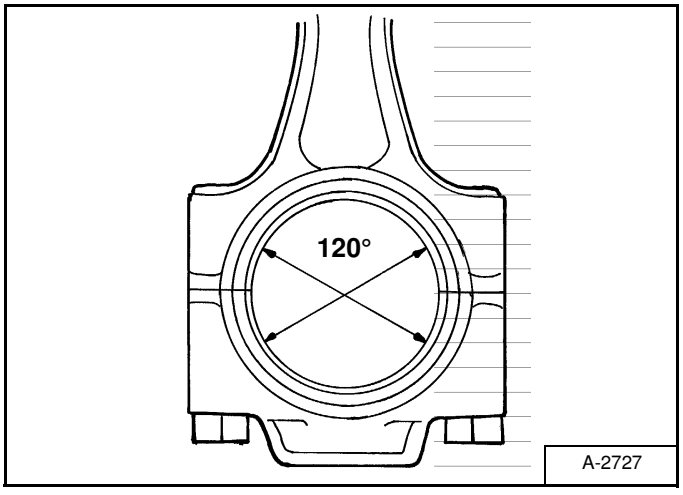
If the misalignment exceeds the allowable limit, replace the crankshaft.

Alignment	0.0008 inch (0,02 mm)

Tighten the connecting rod cap bolts as follows:

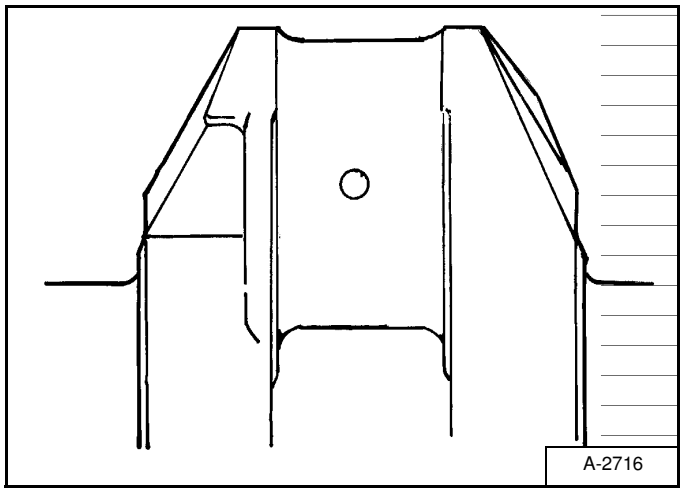
W/O Flange Bolt	27-30 ft.-lbs. (37-41 Nm)
W/Flange Bolt	33-36 ft.-lbs (45-49 Nm)

Figure 60-80-74



Measure the crankpin bearing I.D. **[Figure 60-80-74]**.

Figure 60-80-75

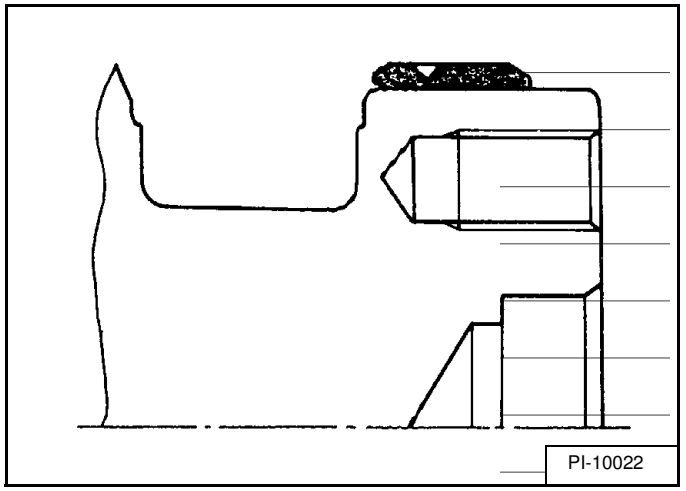


Measure the crankpin O.D. **[Figure 60-80-75]**.

Calculate the oil clearance.

Crankpin Bearing I.D.	1.850-1.852 inch (47,0-47,05 mm)
Crankpin O.D.	1.849-1.850 inch (46,96-46,98 mm)
Oil Clearance	0.0009-0.003 inch (0,025-0,87 mm)

Figure 60-80-76



Check the wear on the crankshaft sleeve **[Figure 60-80-76]**.

If the wear exceeds the allowable limit or the seal leaks oil, replace the sleeve.

Wear of Sleeve	0.004 inch (0,1 mm)

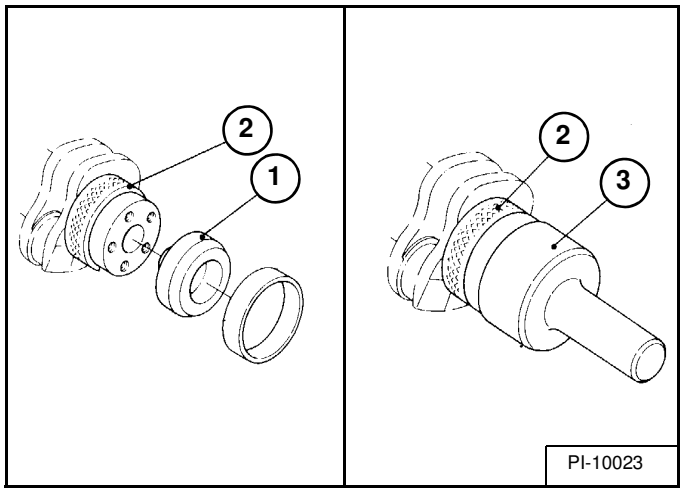
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Crankshaft And Bearings, Servicing (Cont'd)

The special tool set will be needed to replace the crankshaft sleeve.

Remove the sleeve.

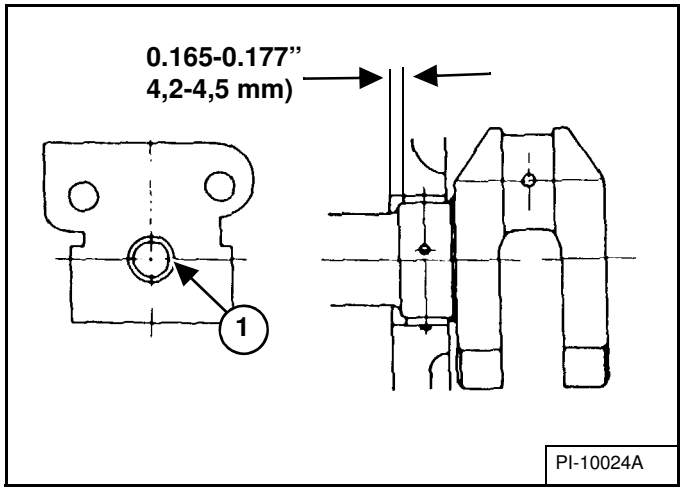
Figure 60-80-77



Install the sleeve guide (Item 1) and stop (Item 2) **[Figure 60-80-77]**.

Heat the sleeve to about 300° F (150° C). Install the sleeve on the crankshaft using the special driver tool (Item 3) **[Figure 60-80-77]**.

Figure 60-80-78



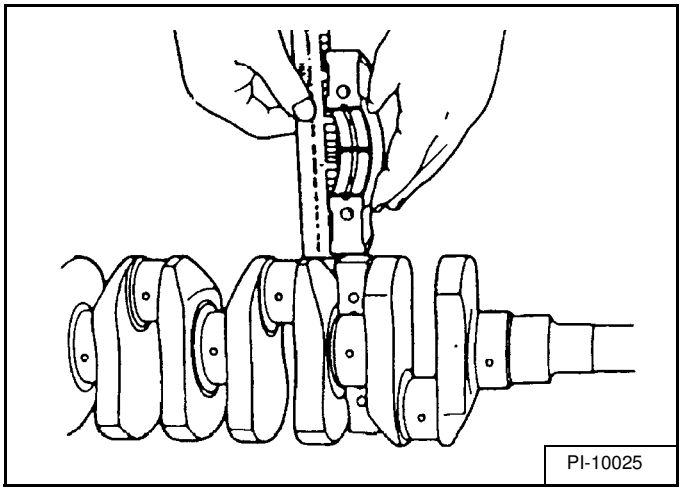
Remove the front bearing (Item 1) **[Figure 60-80-78]** with the special removal tool.

Installation: Clean the new bearing and bore, put oil on them. Install the new bearing with the installation driver tool **[Figure 60-80-78]**.

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.

Figure 60-80-79



Measure the flattened press gauge **[Figure 60-80-79]**.

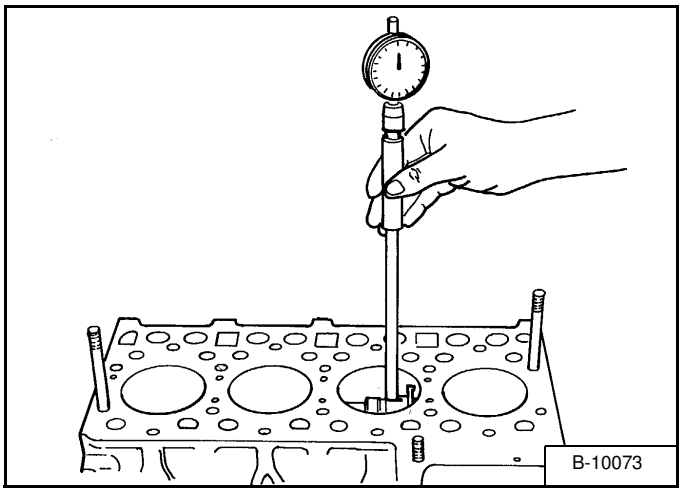
If the clearance exceeds the allowable limit, replace the crankshaft bearing.

Crankshaft Journal O.D.	2.044-2.045 inch (51,92-51,94 mm)
Bearing I.D.	2.046-2.048 inch (51,98-52,03 mm)
Oil Clearance	0.002-0.004 inch (0,04-0,10 mm)
Allowable Limit	0.008- inch (0,2 mm)

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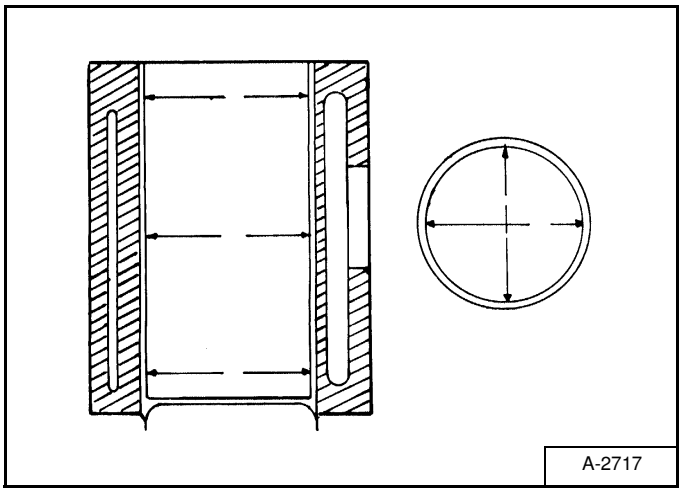
Cylinder Bore, Checking

Figure 60-80-80



Use a gauge to check the inside measurement of the cylinder bore **[Figure 60-80-80]**.

Figure 60-80-81



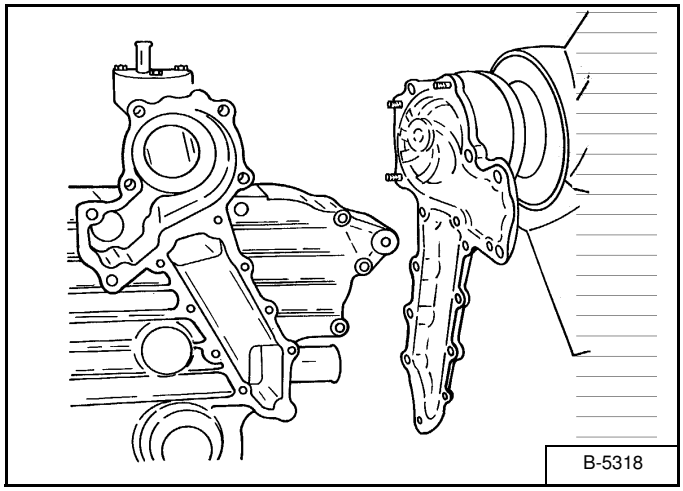
Measure the six points as shown in figure **[Figure 60-80-81]** to find the maximum wear. The specifications is 3.425-3.426 inch (87,0-87,02 mm). The wear limit is +0.006 inch (+0,15 mm).

If the cylinder bore is not within specifications, re-bore the cylinder for oversize piston.

Water Pump Removal And Installation

Remove the fan and fan pulley.

Figure 60-80-82

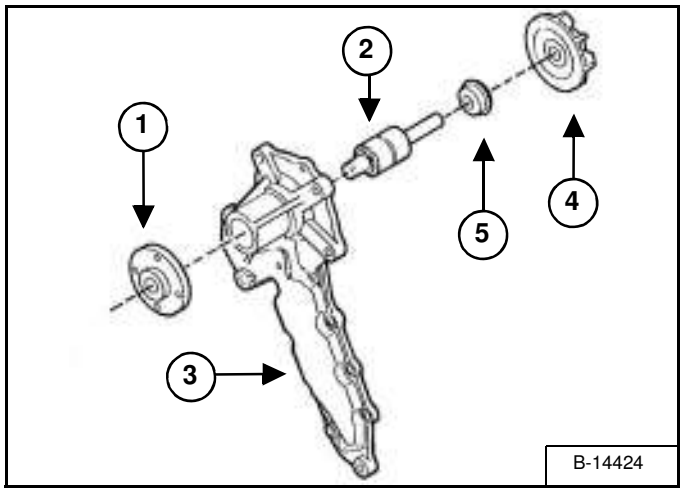


Remove the water pump from the timing gearcase cover **[Figure 60-80-82]**.

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Water Pump Disassembly And Assembly

Figure 60-80-83



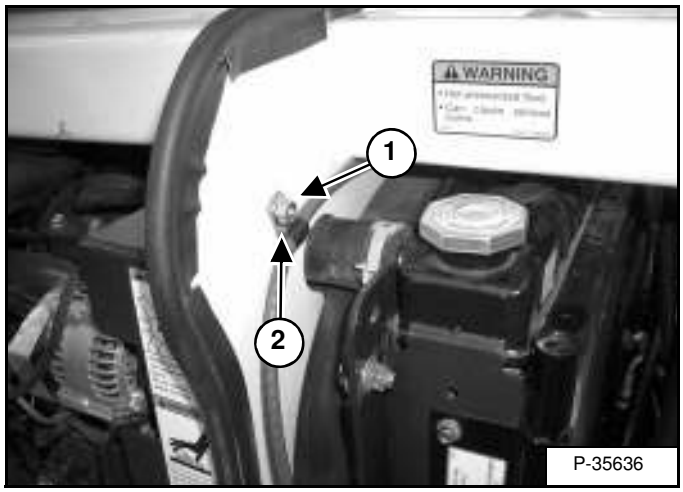
Remove the water pump flange (Item 1). Press the water pump shaft (Item 2) out of the pump body (Item 3)**[Figure 60-80-83]**.

Remove the impeller (Item 4) from the water pump shaft (Item 2) **[Figure 60-80-83]**.

Remove the seal (Item 5) from the water pump shaft (Item 2) **[Figure 60-80-83]**.

Fan Removal And Installation

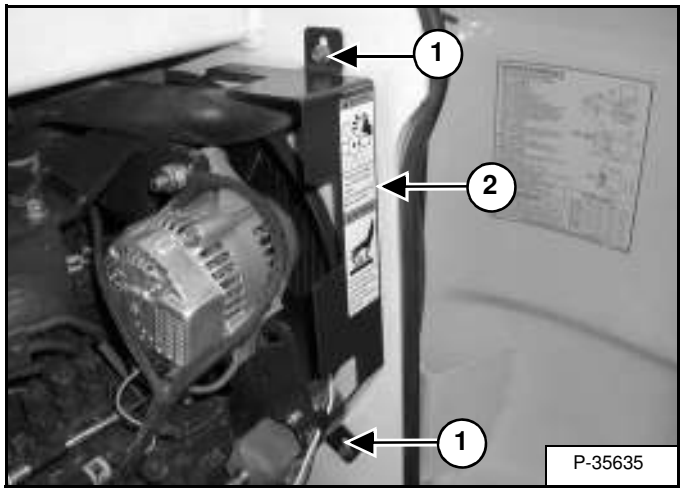
Figure 60-80-84



Remove the nut (Item 1) from the throttle cable clamp (Item 2) **[Figure 60-80-84]**.

Remove the clamp.

Figure 60-80-85

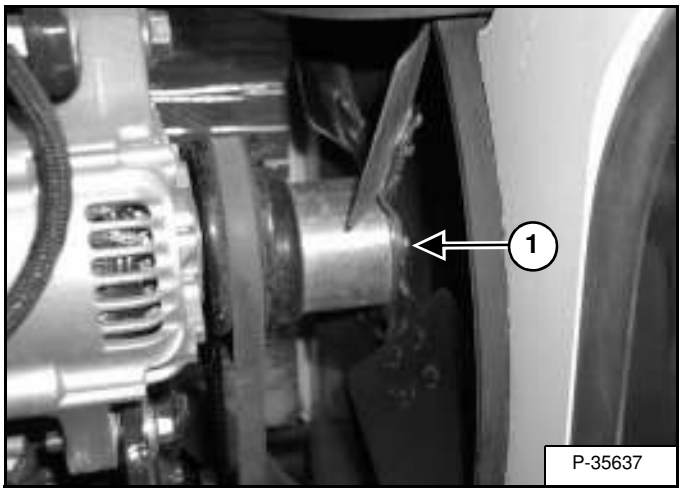


Remove the two bolts (Item 1) from the fan shroud (Item 2) **[Figure 60-80-85]**.

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Fan Removal And Installation (Cont'd)

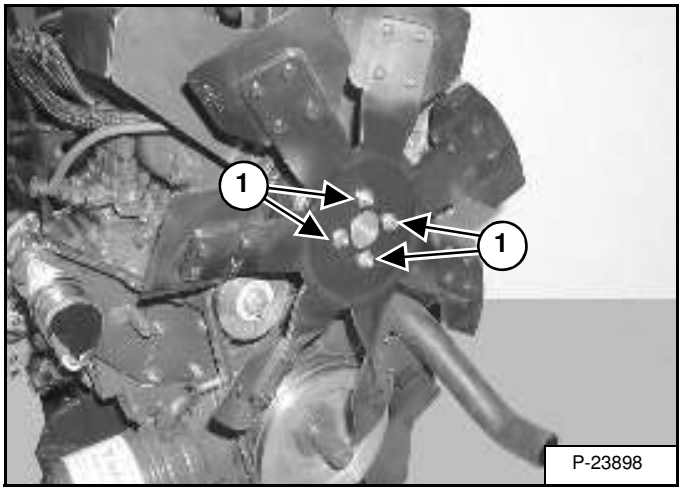
Figure 60-80-86



Remove the shroud (Item 2) **[Figure 60-80-85 on Page 28]** to gain access to the fan mount bolts (Item 1) **[Figure 60-80-86]**.

NOTE: The engine is shown removed for photo clarity.

Figure 60-80-87



Remove the four mount bolts (Item 1) **[Figure 60-80-87]**. Remove the fan.

Installation: Install new bolts with pre-applied thread lock adhesive. Tighten the bolts to 12-15 ft.-lbs. (16,3-20,3 Nm) torque.

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HEATER

HEATER UNIT. 70-10-1
Disassembly And Assembly. 70-10-2
Removal And Installation 70-10-1

HEATER COIL. 70-20-1
Removal And Installation 70-20-1

HEATER FAN 70-30-1
Disassembly And Assembly. 70-30-2
Removal And Installation 70-30-1
Resistor Removal And Installation 70-30-3
Wire Connector Removal And Installation 70-30-4

REMOVAL AND INSTALLATION 70-40-1
Removal And Installation 70-40-1

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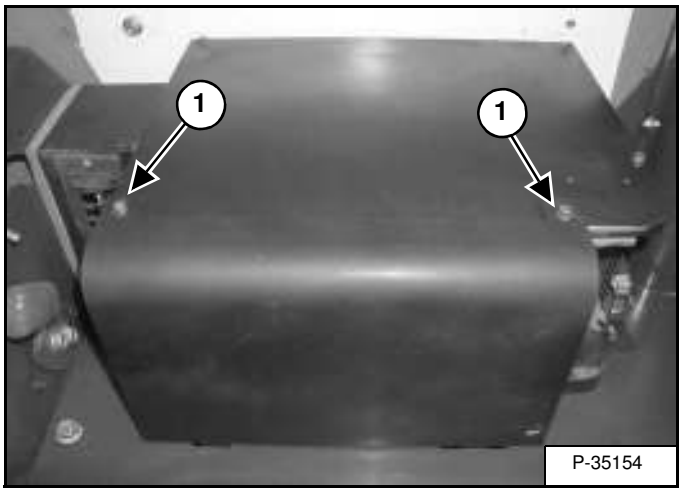
HEATER UNIT

Removal And Installation

Remove the operator seat. (See STANDARD SEAT AND SEAT MOUNT on Page 40-40-1 or SUSPENSION SEAT AND SEAT MOUNT on Page 40-41-1.)

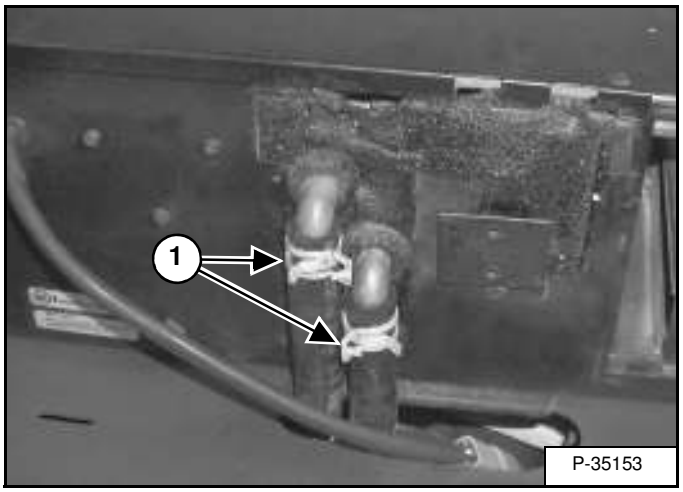
Remove the filter. (See Replacing The Filters on Page 10-60-1.)

Figure 70-10-1



Remove the two mount bolts (Item 1) **[Figure 70-10-1]** from the heater unit front cover.

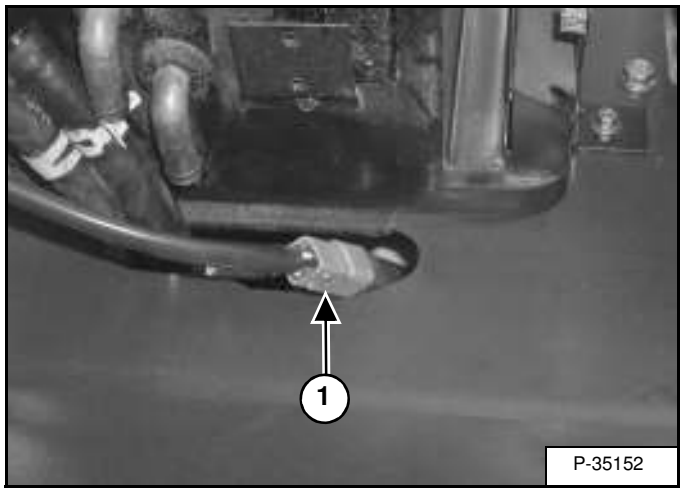
Figure 70-10-2



Remove the two clamps (Item 2) **[Figure 70-10-2]** from the heater hoses.

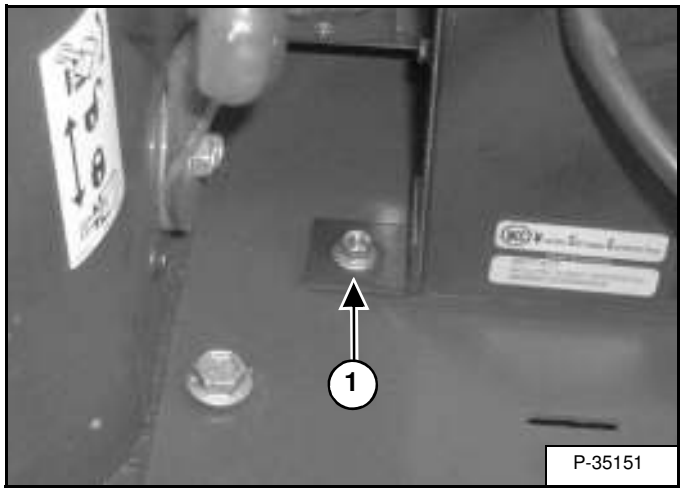
Remove the two heater hoses from the heater coil.

Figure 70-10-3



Disconnect the wire harness (Item 1) **[Figure 70-10-3]**.

Figure 70-10-4

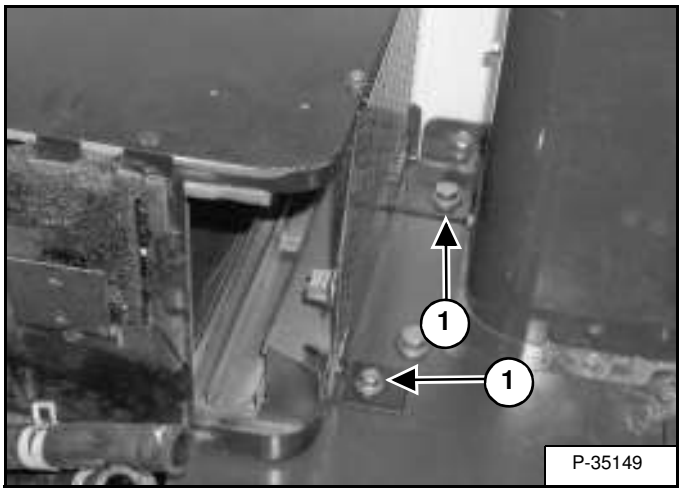


Remove the right side mount bolt (Item 1) **[Figure 70-10-4]** from the heater unit.

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Removal And Installation (Cont'd)

Figure 70-10-5

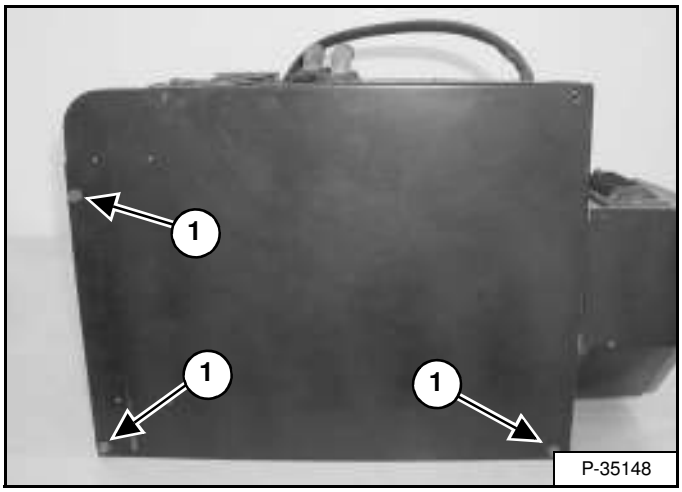


Remove the two left side mount bolts (Item 1) **[Figure 70-10-5]** from the heater unit.

Remove the heater unit from the excavator.

Disassembly And Assembly

Figure 70-10-6



Remove the three mount bolts (Item 1) **[Figure 70-10-6]** from the heater unit access cover.

Remove the cover from the unit.

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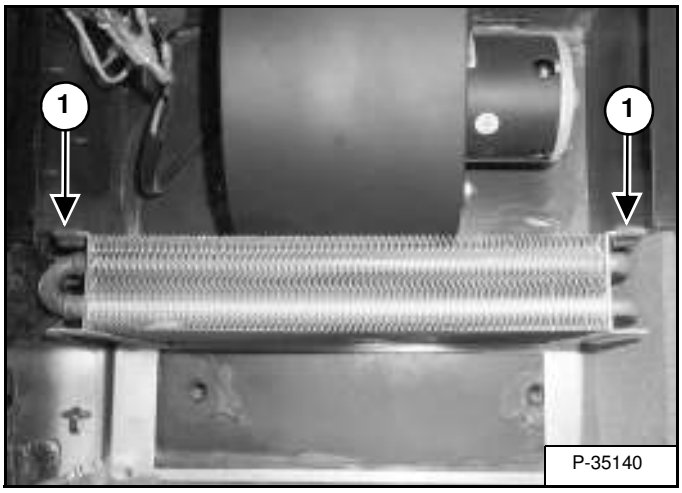
HEATER COIL

Removal And Installation

Remove the heater unit from the excavator. (See Removal And Installation on Page 70-10-1.)

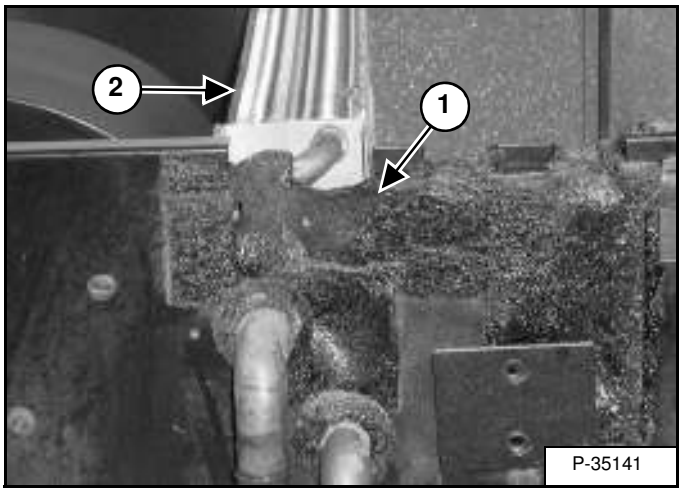
Remove the top cover from the heater unit. (See Disassembly And Assembly on Page 70-10-2.)

Figure 70-20-1



Remove the two retaining clips (Item 1) **[Figure 70-20-1]** from the heater coil.

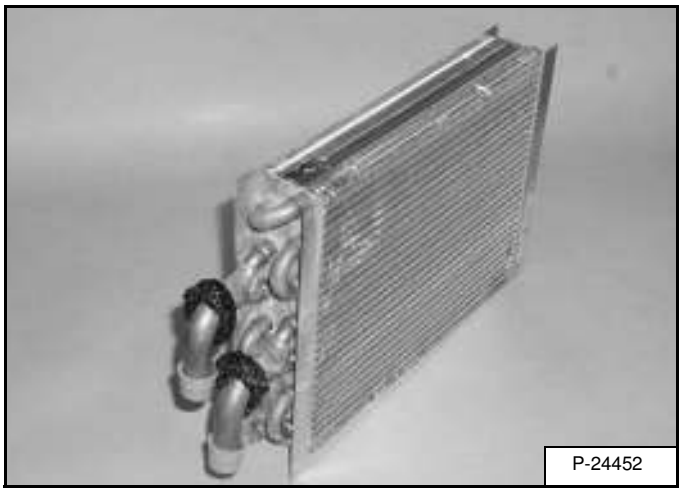
Figure 70-20-2



Remove the refrigerator tape (Item 1) **[Figure 70-20-2]** from the heater coil.

Lift the heater coil (Item 2) **[Figure 70-20-2]** straight up and remove it from the heater unit.

Figure 70-20-3



The heater coil **[Figure 70-20-3]** can be cleaned with low air or water pressure.

If the heater coil needs replacement it must be replaced as a complete unit.

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HEATER FAN

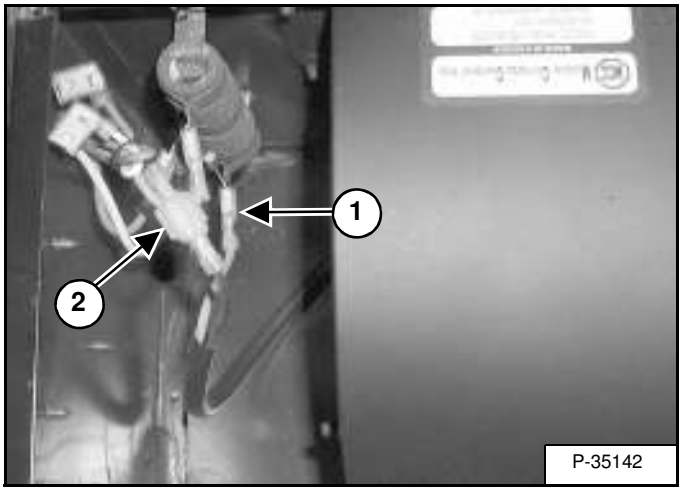
Removal And Installation

Remove the heater unit from the excavator. (See Removal And Installation on Page 70-10-1.)

Remove the top cover from the heater unit. (See Disassembly And Assembly on Page 70-10-2.)

Remove the heater coil from the heater unit. (See Removal And Installation on Page 70-20-1.)

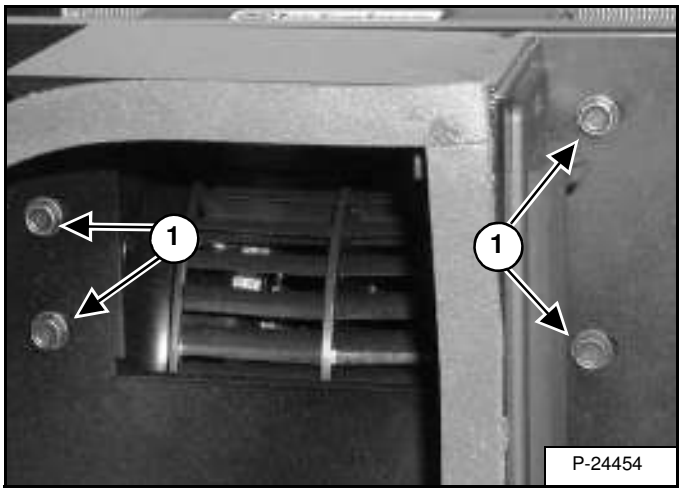
Figure 70-30-1



Disconnect the orange fan motor wire (Item 1) **[Figure 70-30-1]** from the resistor.

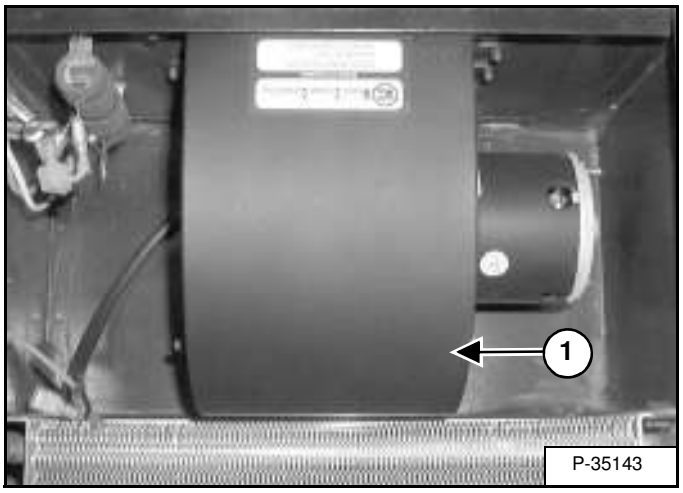
Disconnect the black fan motor wire (Item 2) **[Figure 70-30-1]** from the black wire on the wire harness.

Figure 70-30-2



Remove the four blower fan assembly mount bolts (Item 1) **[Figure 70-30-2]**.

Figure 70-30-3



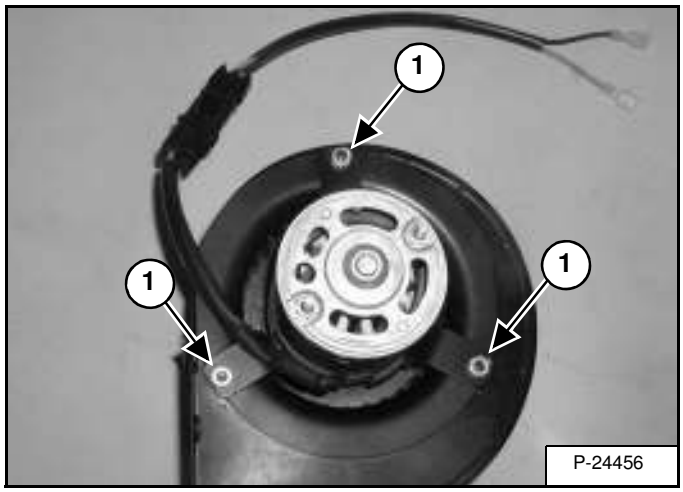
Remove the blower fan assembly (Item 1) **[Figure 70-30-3]** from the heater unit.

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HEATER FAN (CONT'D)

Disassembly And Assembly

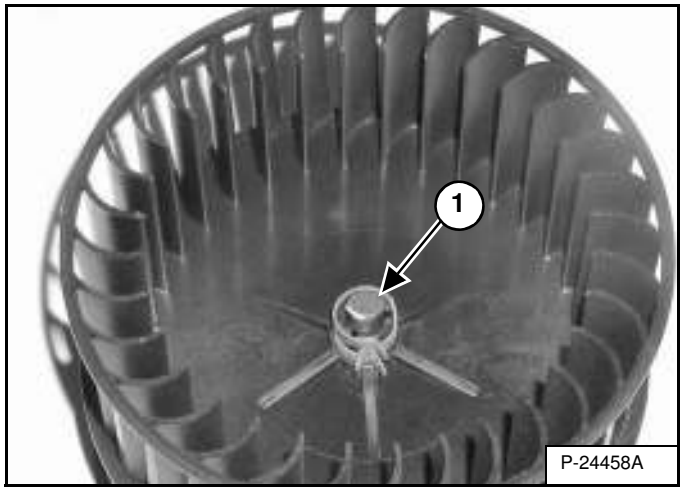
Figure 70-30-4



Remove the three mounting nuts (Item 1) **[Figure 70-30-4]** from the blower fan housing.

Remove the blower motor and fan from the blower housing unit.

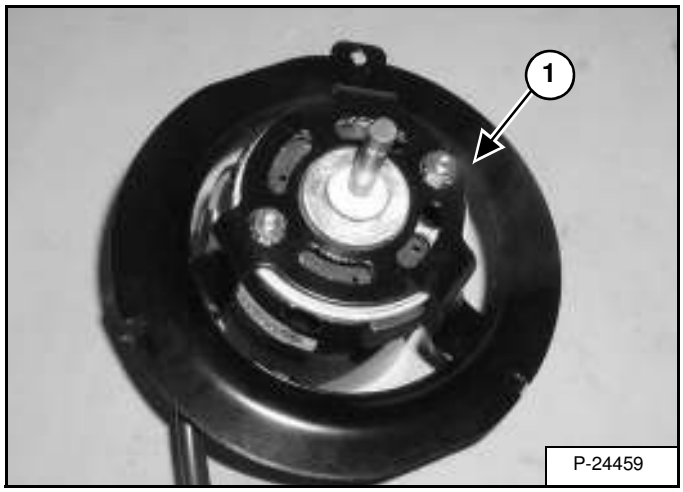
Figure 70-30-5



Mark the fan shaft and blower wheel (Item 1) **[Figure 70-30-5]**, for the proper installation of the blower wheel.

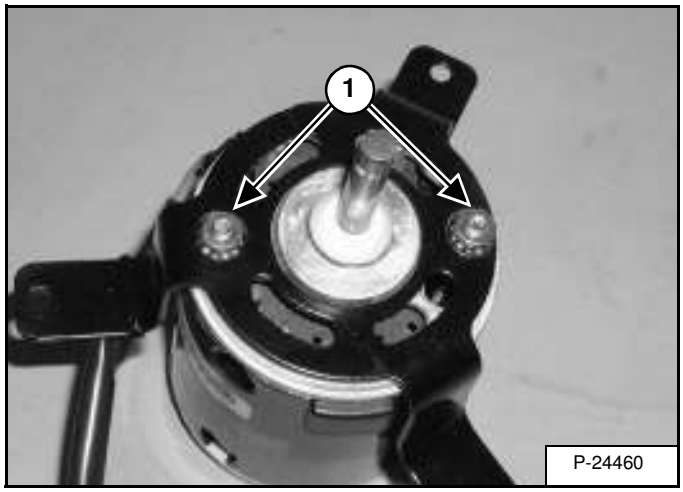
Remove the clamp (Item 1) **[Figure 70-30-5]** and remove the blower wheel from the fan shaft.

Figure 70-30-6



Remove the outside ring (Item 1) **[Figure 70-30-6]** from the fan motor.

Figure 70-30-7

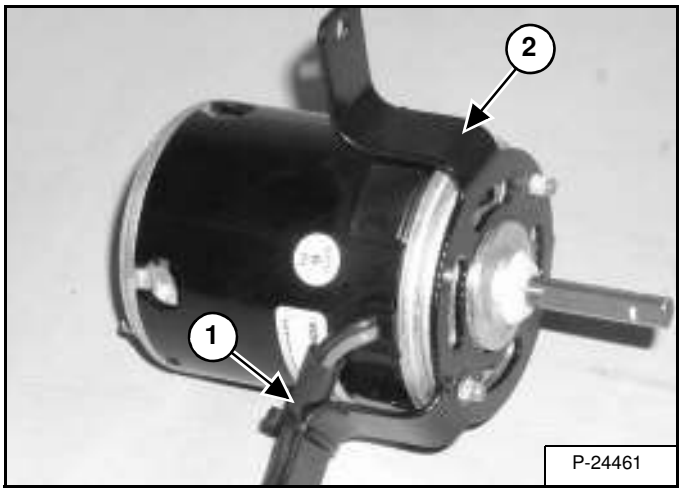


Remove the two mounting nuts (Item 1) **[Figure 70-30-7]** from the fan motor mount bracket.

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Disassembly And Assembly (Cont'd)

Figure 70-30-8



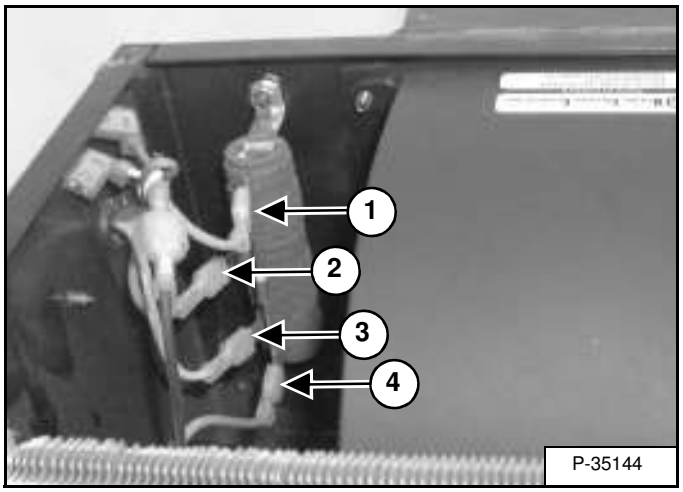
Remove the tie-strap (Item 1) **[Figure 70-30-8]**.

Remove the fan motor mount bracket (Item 2) **[Figure 70-30-8]** 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 70-30-9



Remove the four electrical wires from the resistor **[Figure 70-30-9]**.

Wire Installation

Install the Orange wire from the wire harness (Item 1) **[Figure 70-30-9]** on the top terminal of the resistor.

Install the Red wire from the wire harness (Item 2) **[Figure 70-30-9]** on the 2nd terminal of the resistor.

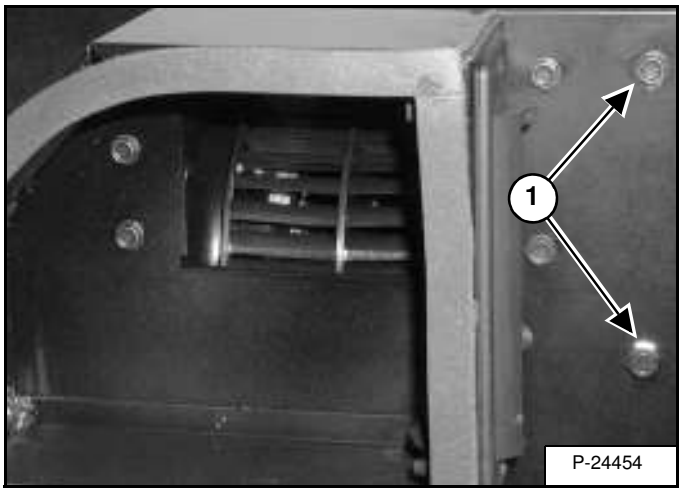
Install the Yellow wire from the wire harness (Item 3) **[Figure 70-30-9]** on the 3rd terminal of the resistor.

Install the Orange wire from the heater fan motor (Item 4) **[Figure 70-30-9]** on the bottom terminal of the resistor.

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Resistor Removal And Installation (Cont'd)

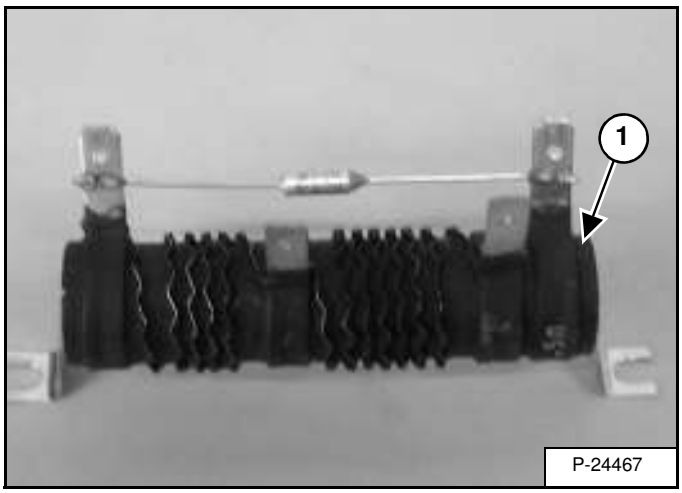
Figure 70-30-10



Loosen the two resistor mount bolts (Item 1) **[Figure 70-30-10]**.

Remove the resistor from the unit.

Figure 70-30-11



Inspect the resistor (Item 1) **[Figure 70-30-11]** and replace as needed.

Wire Connector Removal And Installation

Figure 70-30-12

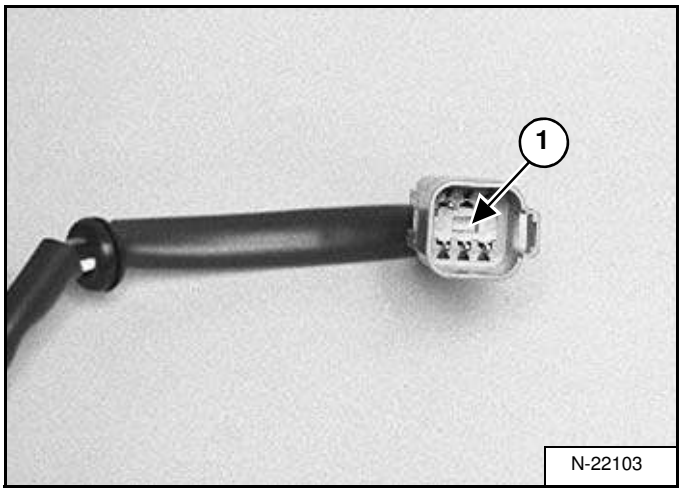
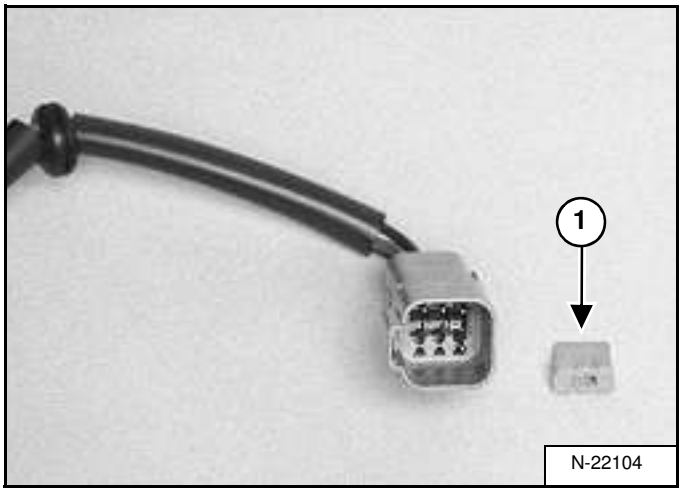


Figure 70-30-13

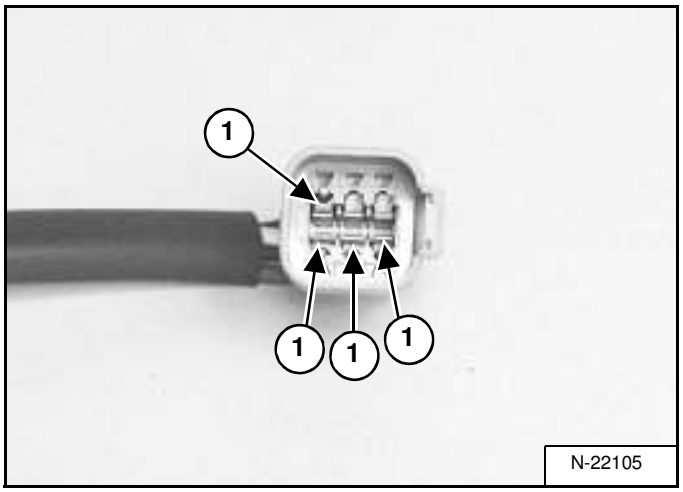


Remove the plastic wedge (Item 1) **[Figure 70-30-12]** & **[Figure 70-30-13]** from the center of the blower fan motor wiring connector.

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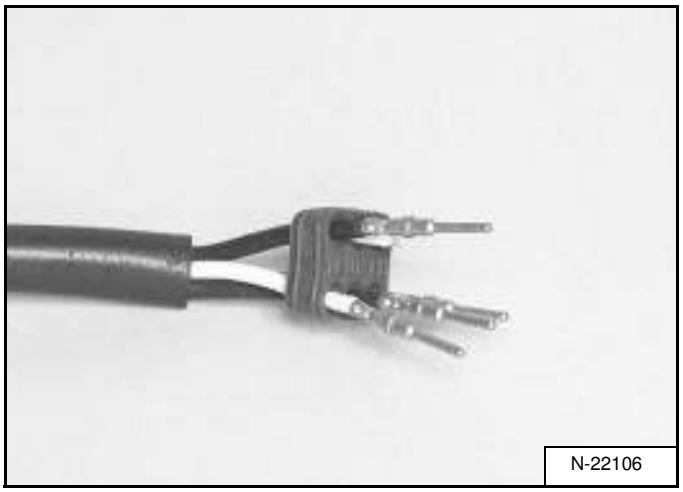
Wire Connector Removal And Installation (Cont'd)

Figure 70-30-14



With a pointed screwdriver lightly press in on the tabs (Item 1) **[Figure 70-30-14]** and remove the individual wires from the connector.

Figure 70-30-15



The wiring code for the blower fan connector **[Figure 70-30-15]** is:

Number on Connector	Wire Color
1	Orange
2	Red
3	Yellow
4	Black
5	White
6	Blue

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HEATER VALVE

Removal And Installation

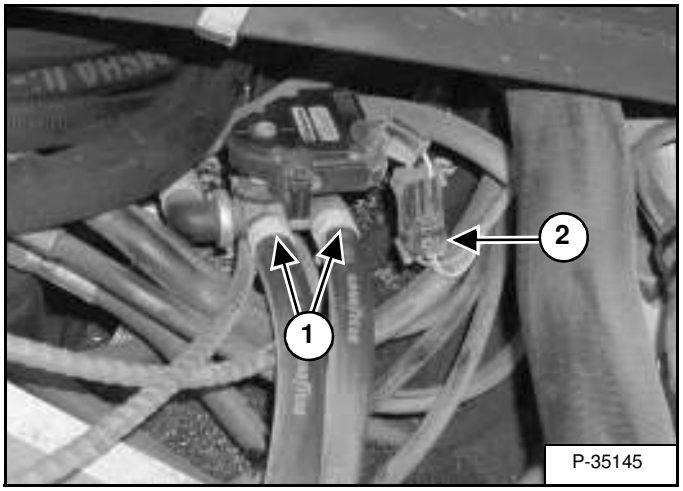
Remove the operator seat from the excavator. (See Removal And Installation on Page 40-40-1.)

Remove the heater unit from the excavator. (See Removal And Installation on Page 70-10-1.)

Remove the front and rear floor panels. (See Removal And Installation on Page 40-110-1.)

Mark all heater hoses for proper installation.

Figure 70-40-1

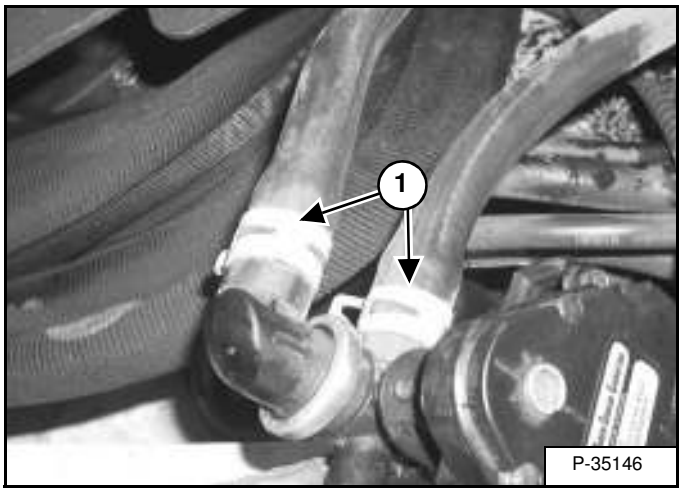


Remove the two hose clamps (Item 1) **[Figure 70-40-1]** from the heater hoses.

Remove the heater hoses from the valve.

Disconnect the excavator wiring harness (Item 2) **[Figure 70-40-1]** from the heater valve.

Figure 70-40-2



Remove the two hose clamps (Item 1) **[Figure 70-40-2]** from the heater hoses.

Remove the heater hoses from the valve.

Remove the heater valve from the excavator.

The heater valve must be replaced as a complete unit.

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SPECIFICATIONS

CONVERSIONS SPEC-70-1
Decimal And Millimeter Equivalents. SPEC-70-1
U.S. To Metric Conversion SPEC-70-2

ENGINE SPECIFICATIONS SPEC-20-1
Camshaft SPEC-20-2
Connecting Rods SPEC-20-3
Crankshaft SPEC-20-4
Crankshaft Re-Grind Data SPEC-20-6
Cylinders SPEC-20-3
Cylinder Head SPEC-20-1
Engine Bolt Torque. SPEC-20-5
Fuel Injection Nozzles SPEC-20-1
Fuel Injection Pump SPEC-20-1
Oil Pump SPEC-20-3
Pistons SPEC-20-3
Piston Rings. SPEC-20-3
Rocker Arms SPEC-20-2
Tappet SPEC-20-2
Thermostat. SPEC-20-4
Timing Gear SPEC-20-5
Valves SPEC-20-1
Valve Springs SPEC-20-2
Valve Timing. SPEC-20-2

FUEL, COOLANT AND LUBRICANTS SPEC-60-1
Chart SPEC-60-1

HYDRAULIC CONNECTION SPECIFICATIONS SPEC-40-1
Flare Fitting SPEC-40-1
O-Ring Face Seal Connection SPEC-40-1
O-Ring Flare Fitting SPEC-40-2
Port Seal Fitting SPEC-40-4
Straight Thread O-Ring Fitting SPEC-40-1
Tubelines And Hoses. SPEC-40-1

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SPECIFICATIONS (CONT'D)

HYDRAULIC EXCAVATOR SPECIFICATIONS (325) SPEC-10-1
- Brakes SPEC-10-4
- Capacities SPEC-10-5
- Controls SPEC-10-2
- Digging Force SPEC-10-5
- Drive System SPEC-10-4
- Electrical SPEC-10-3
- Engine SPEC-10-3
- Hydraulic Cylinders SPEC-10-4
- Hydraulic System SPEC-10-3
- Lifting Capacity SPEC-10-2
- Machine Dimensions SPEC-10-1
- STD Track SPEC-10-5
- Swing System SPEC-10-4
- Undercarriage SPEC-10-4
- Weights SPEC-10-2

HYDRAULIC EXCAVATOR SPECIFICATIONS (325 W/LONG ARM KIT & 328) SPEC-10-6
- Brakes SPEC-10-9
- Capacities SPEC-10-10
- Controls SPEC-10-7
- Digging Force SPEC-10-10
- Drive System SPEC-10-9
- Electrical SPEC-10-8
- Engine SPEC-10-8
- Hydraulic Cylinders SPEC-10-9
- Hydraulic System SPEC-10-8
- Lifting Capacities SPEC-10-7
- Machine Dimensions SPEC-10-6
- STD Track SPEC-10-10
- Swing System SPEC-10-9
- Undercarriage SPEC-10-9
- Weights SPEC-10-7

HYDRAULIC FLUID SPECIFICATIONS SPEC-50-1
- Specifications SPEC-50-1

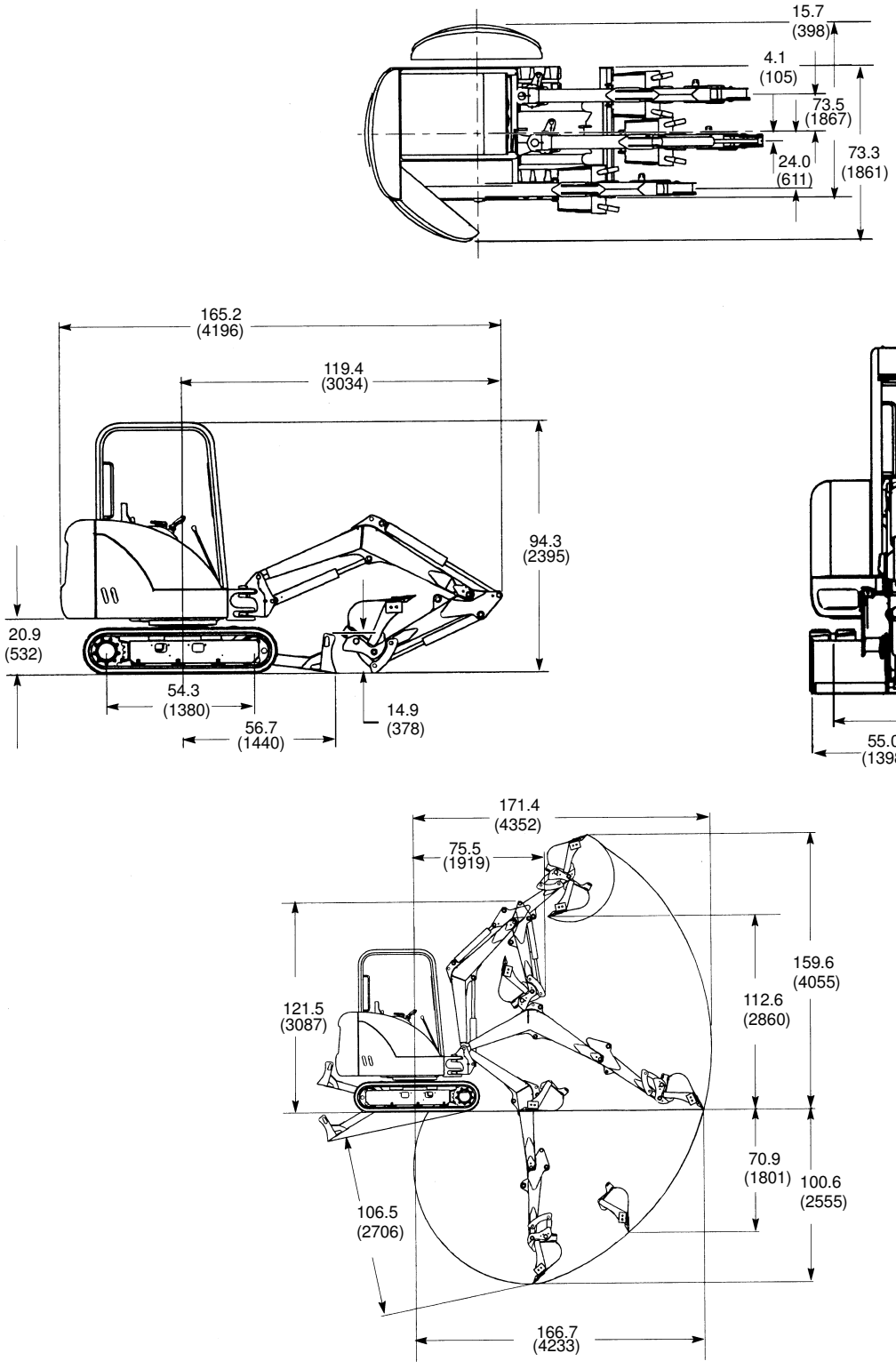
TORQUE SPECIFICATIONS SPEC-30-1
- Torque For General Metric Bolts SPEC-30-2
- Torque For General SAE Bolts SPEC-30-1

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HYDRAULIC EXCAVATOR SPECIFICATIONS (325)

Machine Dimensions

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



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Lifting Capacity

WARNING

OVERLOAD CAN TIP THE EXCAVATOR AND CAUSE INJURY OR DEATH

- Do not lift or hold any load that exceeds these ratings at their specified load radii and height.
- Total rated load is shown. The weight of all lifting devices must be deducted to determine the net load that can be lifted.

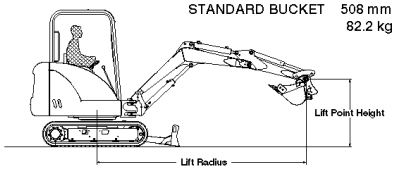


Where applicable, specifications conform to ISO Standards.
Specifications are subject to change without notice.
Lift Point is bucket hinge point with standard bucket attached and bucket cylinder fully extended.

EXCAVATOR MODEL 325

CIRCUIT PRESSURES
WORKING 172 bar (2500 psi)
HOLDING 203 bar (2950 psi)

BOOM LENGTH	2000 mm	(78.7 in)
ARM LENGTH	1050 mm	(41.3 in)
COUNTERWEIGHT	24.9 kg	(55.0 lb)
STANDARD BUCKET	508 mm	(20.0 in)
	82.2 kg	(181.3 lb)



LIFT POINT HEIGHT	RATED LIFT CAPACITY OVER BLADE, BLADE DOWN - kg (lb)			RATED LIFT CAPACITY OVER BLADE, BLADE UP - kg (lb)			RATED LIFT CAPACITY OVER SIDE, BLADE UP - kg (lb)		
	LIFT RADIUS - mm (in)		LIFT @ MAXIMUM RADIUS, kg (lb) @ mm (in)	LIFT RADIUS - mm (in)		LIFT @ MAXIMUM RADIUS, kg (lb) @ mm (in)	LIFT RADIUS - mm (in)		LIFT @ MAXIMUM RADIUS, kg (lb) @ mm (in)
mm (in)	2000 (78.7)	3000 (118.1)		2000 (78.7)	3000 (118.1)		2000 (78.7)	3000 (118.1)	
3000 (118.1)			*326 (719) @ 2870 (113)			*311 (686) @ 2870 (113)			*326 (719) @ 2870 (113)
2000 (78.7)		*365 (806)	*350 (772) @ 3510 (138)		*355 (782)	*335 (738) @ 3510 (138)		*361 (796)	*343 (766) @ 3510 (138)
1000 (39.4)	*909 (2004)	*494 (1088)	*374 (826) @ 3710 (146)	*886 (1955)	*474 (1044)	280 (618) @ 3710 (146)	705 (1553)	*470 (1036)	267 (589) @ 3710 (146)
Ground	*1111 (2449)	*567 (1249)	*414 (913) @ 3560 (140)	777 (1714)	405 (893)	305 (672) @ 3560 (140)	660 (1455)	367 (808)	274 (603) @ 3560 (140)
-1000 (-39.4)	*936 (2063)	*446 (983)	*437 (964) @ 3010 (118)	*936 (2063)	*446 (983)	*433 (954) @ 3010 (118)	748 (1648)		*431 (951) @ 3010 (118)

41644 * Rated Hydraulic Lift Capacity SW 00 6809677

Weights

	325
Operating Weight (Includes Canopy and 24" Bucket)	
W/Rubber Track	6145 lbs. (2788 kg)
W/Steel Track	6291 lbs. (2854 kg)
(Includes Cab and 24" Bucket)	
W/Rubber Track	6408 lbs. (2907 kg)
W/Steel Track	6554 lbs (2973 kg)
Travel Speed	
(Low)	1.2 MPH (1,9 km/hr.)
(High)	1.9 MPH (3,1 km/hr.)

Controls

Vehicle	Two Hand Levers or Optional Foot Levers control speed & direction.
Excavator Functions	Two hydraulic joysticks control boom, arm, bucket and cab swing. A foot pedal controls boom offset and the blade is controlled by a separate lever.

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Engine

	325
Make	Kubota
Model	D1703-B
Fuel	Diesel
Horsepower	27.5 HP (20,5 Kw) @ 2200 Rpm
Low idle RPM (no load)	1225 - 1275 RPM
High idle RPM (no load)	2315 - 2385 RPM
Maximum Torque	74.8 ft.-lbs. (101.9 Nm) @ 1600 RPM
Number of Cylinders	Three
Displacement	100.5 cu.-in. (1,7 L)
Bore x Stroke	3.43" x 3.64" (87 mm x 92,4 mm)
Lubrication	Forced
Filter	Duel Element
Air Cleaner	Dry Replaceable Paper Cartridge

Electrical

Alternator	12 Volt, 40 Amps.
Battery	12 Volt, 500 Cold Crank Amps. @ 0° F. (-18° C); 75 Minute Reserve Capacity
Starter	12 Volt (1,4 Kw), Reduction Drive

Hydraulic System

Variable Displacement Piston Pump	2 x 0.0 to 10.46 GPM (39.6 L/min.)	
Gear Pump	1 x 7.03 GPM (26.6 L/min.)	
System Relief Settings		
Blade And Travel Circuits	3750 PSI (25856 kPa)	
Bucket, Arm, Boom and Auxiliary Circuits	2500 PSI (17237 kPa)	
Boom Swing Circuits	2500 PSI (17237 kPa)	
Swing Circuits	1700 PSI (11721 kPa)	
Auxiliary Flow	12.26 Gpm (46,4 L/min.)	
Control Valves	10 Spool Parallel & Series Type	
Drive Motors	Two Axial Piston	
Swing Motor	Orbit Motor	
Hydraulic Function Time		
Bucket	Curl 2.0 sec.	Dump 1.5 Sec.
Arm	Retract 3.0 sec.	Extend 2.25 Sec.
Boom	Raise 3.4 sec.	Lower 4.5 Sec.
Boom Swing	Left 2.4 sec.	Right 2.4 Sec.
Blade	Raise 2.4 sec.	Lower 2.4 Sec.

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Swing System

	325
Swing Drive	Orbit Motor, Direct Drive
Swing Circle	Single Row Shear Type Ball Bearings with Internal Gears Built Into Swing Circle
Swing Speed	9.18 RPM

Hydraulic Cylinders

	Bore Dia. in. (mm)	Rod Dia. in. (mm)	Stroke in. (mm)
Boom	3.0 (76,2)	1.62 (44,1)	18.68 (474)
Arm	3.0 (76,2)	1.50 (38)	19.11 (485)
Bucket	2.50 (63,5)	1.50 (38)	18.34 (465,8)
Boom Offset	2.38 (60)	1.38 (35)	15.75 (400)
Blade	2.75 (70)	1.50 (38)	7.68 (195)

Drive System

Final Drive	Each Track is Independently Driven by a Hydrostatic Axial Piston Motor
Type of Reduction	Two Stage Planetary Gear Reduction - 44:1
Max. Drawbar Pull	5480 lbs. (2485 kg)
Gradability	30 Degrees

Brakes

Travel	
Service	Hydraulic Lock on Motor
Parking	Hydraulic Lock on Motor
Swing	
Service	Hydraulic Lock on Motor
Holding	Pin Lock

Undercarriage

Type	Crawler - Tractor Design Undercarriage. Sealed Track Rollers with Reinforced Box - Section Track Roller Frame. Grease Type Track Adjusters with Shock Absorbing Recoil Springs.

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STD Track

	325
Type	Rubber
Width	12.6" (320 mm)
No. of Shoes	Single Assembly
No. of Track Rollers	3 Each Side
Ground Pressure	4.12 PSI (28,4 kPa)

Capacities

Fuel Tank	14.1 gal. (53,3 L)
Cooling System	5.5 qts. (5,2 L)
Engine & Oil Filter	5.0 qts. (4,7 L)
Hydraulic Reservoir	4.8 gal. (18,2 L)

Digging Force

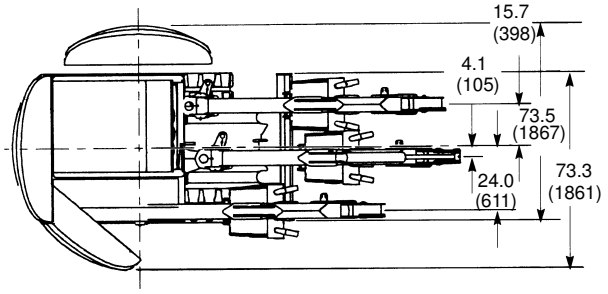
Arm	2820 lbf. (12544 N)
Bucket	4766 lbf. (21200 N)

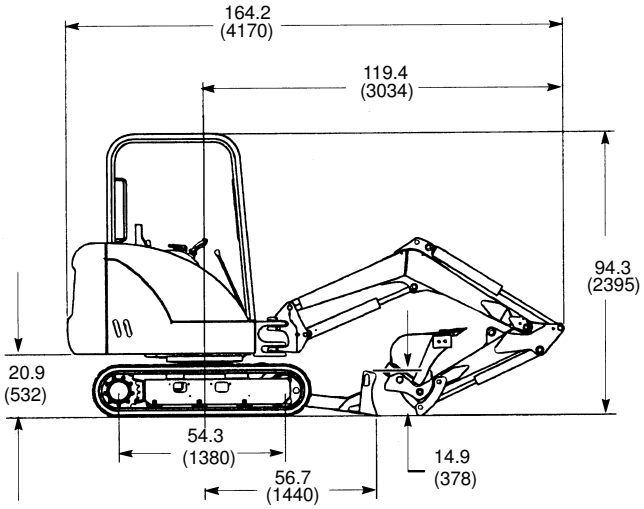
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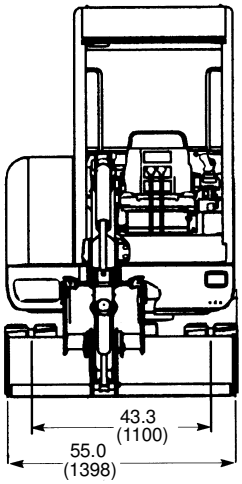
HYDRAULIC EXCAVATOR SPECIFICATIONS (325 W/LONG ARM KIT & 328)

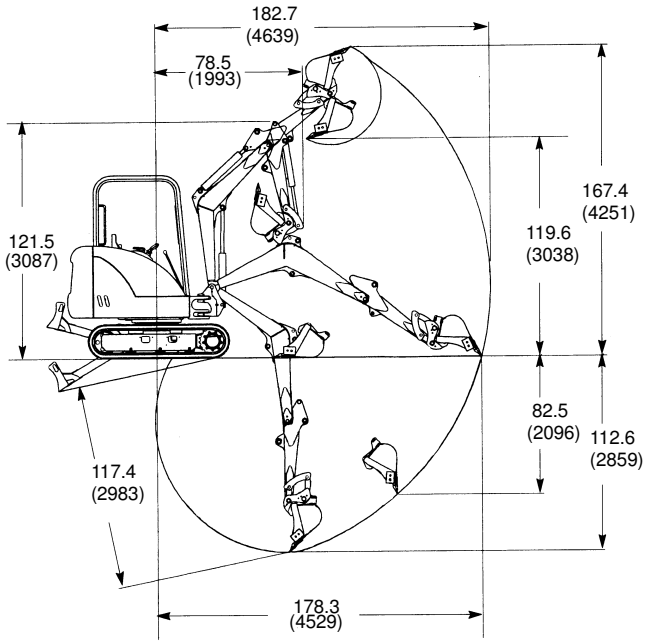
Machine Dimensions

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









B-16806

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Lifting Capacities

WARNING

OVERLOAD CAN TIP THE EXCAVATOR AND CAUSE INJURY OR DEATH

- Do not lift or hold any load that exceeds these ratings at their specified load radii and height.
- Total rated load is shown. The weight of all lifting devices must be deducted to determine the net load that can be lifted.

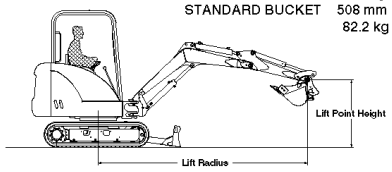


Where applicable, specifications conform to ISO Standards. Specifications are subject to change without notice. Lift Point is bucket hinge point with standard bucket attached and bucket cylinder fully extended.

EXCAVATOR MODEL 328
(AND MODEL 325 EQUIPPED WITH LONG ARM)

CIRCUIT PRESSURES
WORKING 172 bar (2500 psi)
HOLDING 203 bar (2950 psi)

BOOM LENGTH	2000 mm	(78.7 in)
ARM LENGTH	1350 mm	(53.1 in)
COUNTERWEIGHT	166 kg	(366 lb)
STANDARD BUCKET	508 mm	(20.0 in)
	82.2 kg	(181.3 lb)



LIFT POINT HEIGHT	RATED LIFT CAPACITY OVER BLADE, BLADE DOWN - kg (lb)			RATED LIFT CAPACITY OVER BLADE, BLADE UP - kg (lb)			RATED LIFT CAPACITY OVER SIDE, BLADE UP - kg (lb)		
	LIFT RADIUS - mm (in)		LIFT @ MAXIMUM RADIUS, kg (lb) @ mm (in)	LIFT RADIUS - mm (in)		LIFT @ MAXIMUM RADIUS, kg (lb) @ mm (in)	LIFT RADIUS - mm (in)		LIFT @ MAXIMUM RADIUS, kg (lb) @ mm (in)
mm (in)	2000 (78.7)	3000 (118.1)		2000 (78.7)	3000 (118.1)		2000 (78.7)	3000 (118.1)	
3000 (118.1)			*270 (594) @ 3240 (128)			*266 (586) @ 3240 (128)			*270 (594) @ 3240 (128)
2000 (78.7)		*295 (651)	*296 (652) @ 3800 (150)		*287 (632)	*285 (629) @ 3800 (150)		*290 (639)	*294 (649) @ 3800 (150)
1000 (39.4)	*785 (1731)	*425 (938)	*322 (709) @ 3990 (157)	*756 (1666)	*412 (908)	*313 (689) @ 3990 (157)	*768 (1693)	*422 (931)	*320 (706) @ 3990 (157)
Ground	*1049 (2313)	*532 (1174)	*346 (763) @ 3850 (152)	827 (1822)	*516 (1137)	*345 (761) @ 3850 (152)	781 (1721)	399 (880)	279 (615) @ 3850 (152)
-1000 (-39.4)	*975 (2149)	*479 (1057)	*379 (835) @ 3360 (132)	*964 (2125)	*481 (1061)	*378 (833) @ 3360 (132)	783 (1727)	*484 (1067)	*374 (825) @ 3360 (132)

42354 * Rated Hydraulic Lift Capacity SW 01 6809678

Weights

	328
Operating Weight (Includes Canopy and 20" Bucket)	
W/Rubber Tracks	6477 lbs. (2939 kg)
W/Steel Tracks	6623 lbs. (3005 kg)
(Includes Cab and 20" Bucket)	
W/Rubber Tracks	6740 lbs. (3058 kg)
W/Steel Tracks	6886 lbs (3124 kg)
Travel Speed	
(Low)	1.2 MPH (1,9 km/hr.)
(High)	1.9 MPH (3,1 km/hr.)

Controls

Vehicle	Two Hand Levers or Optional Foot Levers control speed & direction
Excavator Functions	Two hydraulic joysticks control boom, arm, bucket and cab swing. Foot pedals controls boom offset and Aux. Hyds. The blade is controlled by a separate lever.

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Engine

	328
Make	Kubota
Model	D1703-B
Fuel	Diesel
Horsepower	27.5 HP (20,5 Kw) @ 2200 Rpm
Low Idle RPM (no load)	1225 - 1275 RPM RPM
High Idle RPM (no load)	2315 - 2385 RPM
Maximum Torque	74.4 ft.-lbs. (100,8 Nm) @ 1600 RPM
Number of Cylinders	Three
Displacement	100.5 cu.-in. (1,7 L)
Bore x Stroke	3.43" (87 mm) x 3.64" (87 mm x 92,4 mm)
Lubrication	Forced
Filter	Cartridge Type - Full Flow
Air Cleaner	Dry Replaceable Paper Cartridge

Electrical

Alternator	12 Volt, 40 Amps
Battery	12 Volt, 500 Cold Crank Amps @ 0° F (-18° C); 75 Minute Reserve Capacity
Starter	12 Volt (1,4 Kw), Reduction Drive

Hydraulic System

Variable Displacement Piston Pump	2 x 0.0 to 10.46 GPM (39.6 L/min.)	
Gear Pump	1 x 7.03 GPM (26.6 L/min.)	
System Relief Settings		
Blade Circuit	2650 PSI (18272 kPa)	
Bucket & Arm Circuits	2550 PSI (17582 kPa)	
Boom Circuits	2700 PSI (18617 kPa)	
Travel Circuits	3700 PSI (25512 kPa)	
Swing Circuits	1700 PSI (11721 kPa)	
Auxiliary Flow	12.26 GPM (46,4 L/min.)	
Control Valve(s)	10 Spool Parallel & Series Type	
Drive Motors	Two Axial Piston	
Swing Motor	Orbit Motor	
Hydraulic Function Time		
Bucket	Curl 2.0 sec.	Dump 1.5 Sec.
Arm	Retract 3.0 sec.	Extend 2.25 Sec.
Boom	Raise 3.4 sec.	Lower 4.5 Sec.
Boom Offset	Left 2.4 sec.	Right 2.4 Sec.
Blade	Raise 2.4 sec.	Lower 2.4 Sec.

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Swing System

	328
Swing Drive	Orbit Motor, Direct Drive
Swing Circle	Single Row Shear Type Ball Bearings with Internal Gears Built Into Swing Circle
Swing Speed	9,18 RPM

Hydraulic Cylinders

	Bore Dia. in. (mm)	Rod Dia. in. (mm)	Stroke in. (mm)
Boom	3.0 (76,2)	1.62 (44,1)	18.68 (474)
Arm	3.0 (76,2)	1.50 (38)	19.11 (485)
Bucket	2.50 (63,5)	1.50 (38)	18.34 (465,8)
Boom Swing	2.38 (60)	1.38 (35)	15.75 (400)
Blade	2.75 (70)	1.50 (38)	7.68 (195)

Drive System

Final Drive	Each Track is Independently Driven by a Hydrostatic Axial Piston Motor
Type of Reduction	Two Stage Planetary Gear Reduction - 44:1
Max. Drawbar Pull	5480 lbs. (2485 kg)
Gradability	30 Degrees

Brakes

Travel	
Service	Hydraulic Lock on Motor
Parking	Hydraulic Lock on Motor
Swing	
Service	Hydraulic Lock on Motor
Holding	Pin Lock

Undercarriage

Type	Crawler - Tractor Design Undercarriage. Sealed Track Rollers with Reinforced Box - Section Track Roller Frame. Grease Type Track Adjusters with shock Absorbing Recoil Springs.

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STD Track

	328
Type	Rubber
Width	12.6" (320 mm)
No. of Shoes	Single Assembly
No. of Track Rollers	3 Each Side
Ground Pressure	4.12 PSI (28,4 kPa)

Capacities

Fuel Tank	14.1 gal. (53,3 L)
Cooling System	5.5 qts. (5,2 L)
Engine & Oil Filter	5.0 qts. (4,7 L)
Hydraulic Reservoir	4.8 gal. (18,2 L)

Digging Force

Arm	2820 lbf. (12544 N)
Bucket	4766 lbf. (21200 N)

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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	1991-2130 PSI (1372,1-1468,63 kPa)
Fuel Tightness Nozzle Seat	Dry Nozzle at 1848-1990 PSI (12741,9-1372,1 kPa)

Fuel Injection Pump

Fuel Tightness Plunger	8 sec.: initial pressure 8532-7110 PSI (58828,1-49023,4 kPa)
Limit Permitted	5 seconds or less
Injection Timing	16 - 18 degrees B.T.D.C.
High Idle	2400-2550 RPM
Low Idle	1225-1275 RPM

Cylinder Head

Cylinder Head Surface Flatness	0.002 (0,05)
Thickness of Gasket (Used)	0.0453-0.0492 (1,15-1,25 mm)
(New)	0.0512-0.0512 (1,3-1,4)
Top Clearance (Piston to Head)	0.0217-0.0276 (0,55-0,70 mm)
Compression	512-540 PSI (kPa)
Allowable Limit	355 PSI (kPa)
Allowable Difference Between Cylinders	10%

Valves

Valve Seat Width	0.0835 in. (2,12 mm)
O.D. of Valve Stems	0.3134-0.3140 in. (7,960-7,975 mm)
I.D. of Valve Guides	0.3156-0.3161 in. (8,015-8,030 mm)
Clearance Between Valve Stem & Guide	0.0016-0.0026 in. (0,04-0,07 mm)
Allowable Limit	0.0039 in. (0,1 mm)
Valve Clearance (Cold)	0.007-0.0087 in. (0,18-0,22 mm)
Valve Recessing (Protrusion)	0.002 in. (0,05 mm)
(Recess)	0.006 in. (0,15 mm)
Valve Seat Angle (Int.)	60°
Valve Seat Angle (Exh.)	45°

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

Valve Springs

Free Length	1.64-1.66 in. (41,7-42,2 mm)
Allowable Limit	1.62 in. (41,2 mm)
Fitted Length	1.378 in. (35,0 mm)
Compress to Fitted Length	26.4 lbs. (117,6 N))
Allowable Limit	22.5 lbs. (100,0 N)
Inclination Allowable Limit	0.039 (1,0)

Valve Timing

Intake Valve (Open)	12° B.T.D.C.
(Close)	36° A.B.D.C.
Exhaust Valve (Open)	60° A.B.D.C.
(Close)	12° A.T.D.C.

Rocker Arms

O.D. of Rocker Arm Shaft	0.5501-0.5506 in. (13,973-13,984 mm)
I.D. of Rocker Arm Bushings	0.5512-0.5519 in. (14,0-14,02 mm)
Clearance Between Rocker Arm & Bushing	0.0006-0.0018 (0,016-0,045 mm)
Allowable Limit	0.0059 (0,15 mm)

Camshaft

Journal O.D.	1.5722-1.5728 in. (39,934-39,950 mm)
Bearing I.D.	1.5748-1.5758 in. (40,0-40,025 mm)
Oil Clearance	0.002-0.0036 in. (0,50-0,091 mm)
Allowable Limit	0.006 in. (0,15 mm)
Alignment Allowable Limit	0.00039 in. (0,01 mm)
Cam Lobe Height	.318 in. (33,47 mm)
Allowable Limit	1.316 in. (33,42 mm)
End Clearance	0.0028-0.0087 in. (0,07-0,22 mm)
Allowable Limit	0.012 in. (0,3 mm)

Tappet

Clearance Between Tappet & Guide	0.0008-0.0024 in. (0,02-0,61 mm)
Tappet O.D.	0.9433-0.9441 in. (23,959-23,98 mm)
Tappet Guide I.D.	0.0449-0.9457 in. (24,0-24,021 mm)

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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.	3.425-3.426 in (87,00-87,022 mm)
Allowable Limit	+0.006 (+0,15 mm)

Piston Rings

Ring Gap (Top & 2nd Ring)	0.012-0.18 in. (0,3-0,45 mm)
Limit Permitted	0.05 in. (1,25 mm)
Ring Gap (Oil Ring)	0.010-0.018 in. (0,25-0,45 mm)
Limit Permitted	0.05 in. (1,25 mm)
Side Clearance of Ring Groove:	
Top Ring	Zero Clearance
Second Ring	0.0037-0.0047 in. (0,093-0,120 mm)
Oil Ring	0.0008-0.0020 in. (0,020-0,052 mm)

Pistons

Piston Pin Bore	0.9843-0.9848 in. (25,0-25,013 mm)
Limit Permitted	0.9862 in. (25,05 mm)

Connecting Rods

Piston Pin O.D.	0.9843-0.9847 in. (25,002-25,011 mm)
Small End Bushing I.D.	0.9852-0.9858 in. (25,025-25,04 mm)
Clearance Between Piston Pin & Small End Bushing	0.0006-0.0015 in. (0,014-0,038 mm)
Service Replacement Part	0.0006-0.003 in. (0,015-0,07 mm)
Connecting Rod Alignment Limit Permitted	0.002 in. (0,05 mm)

Oil Pump

Oil Pressure @ Rated RPM	43-64 PSI (294-441 kPa)
Limit Permitted	36 PSi (245 kPa)
Idle Speed	14 PSI (98 kPa)
Limit Permitted	7 PSI (49 kPa)
Clearance Between Inner Rotor & Outer Rotor	0.0043-0.0075 in. (0,11-0,16 mm)
Outer Rotor & Pump Body	0.0043-0.0075 in. (0,11-0,19 mm)
End Clearance Between Inner Rotor & Cover	0.0041-0.0059 in. (0,105-0,15 mm)

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Crankshaft

I.D. of Crankshaft Main Bearing (No. 1)	2.0465-2.0488 in. (51,98-52,039 mm)
I.D. of Crankshaft Main Bearing	2.0465-2.0482 in. (51,98-52,025 mm)
Clearance Between Crankshaft and Journal Bearing	0.0016-0.0046 in. (0,04-0,118 mm)
Limit Permitted	0.0079 in. (0,2 mm)
O.D. of Connecting Rod Journals	1.849-1.8850 in. (46,959-46,975 mm)
I.D. of Connecting Rod Bearings (Std.)	1.850-1.852 in. (47,00-47,046 mm)
I.D. of Connecting Rod (Undersize)	1.841-1.842 in. (46,759-46,775 mm)
	1.833-1.834 in. (46,559-46,575 mm)
Clearance Between Connecting Rod Journal and Bearing	0.0014-0.0037 in. (0,035-0.093 mm)
Limit Permitted	0.0079 in. (0,02 mm)
End Play of Crankshaft	0.0059-0.0122 in. (0,15-0,21 mm)
Crankshaft Alignment Limit Permitted	0.0008 in. (0,02 mm)
Oil Clearance Between Journal & Bearing #1	0.0016-0.0046 in. (0,04-0,118 mm)
Limit Permitted	0.008 in. (0,2 mm)
Journal O.D. #1	2.0441-2.0449 in. (51,921-51,94 mm)
Bearing I.D. #1	2.0465-2.0488 in. (51,98-52,04 mm)
Oil Clearance Between Journal & Bearing #2	0.016-0.0041 in. (0,04-0,104 mm)
Limit Permitted	0.008 in. (0,2 mm)
Journal O.D. #2	2.0441-2.0449 in. (51,921-51,94 mm)
Bearing I.D. #2	2.0465-2.0482 in. (51,98-52,02 mm)
Oil Clearance Between Crank Pin & Bearing	0.0009-0.0034 in. (0,025-0,087 mm)
Limit Permitted	0.008 in. (0,12 mm)
Crank Pin O.D.	1.8488-1.8494 in. (46,96-46,98 mm)
Crank Pin Bearing I.D.	1.8504-1.8522 in. (47,0-47,05 mm)
Crankshaft Clearance	0.0059-0.0122 in. (0,15-0,31 mm)
Limit Permitted	0.020 in. (0,5 mm)

Thermostat

Valve Opening Temperature	157-163° F (70-73° C)
Valve Fully Open	185° F (85° C)

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

Timing Gear

Timing Gear Backlash	
Crank Gear - Idle Gear	0.0016-0.0044 in. (0,042-0,122 mm)
Idle Gear - Cam Gear	0.0016-0.0045 in. (0,042-0,115 mm)
Idle Gear - Injection Pump Gear	0.0016-0.0045 in. (0,042-0,115 mm)
Idle Gear - Oil Pump Gear	0.0016-0.0043 in. (0,042-0,109 mm)
Limit Permitted	0.006 in. (0,15 mm)
Clearance Between Idle Gear Shaft & Idle Gear Bushing	0.001-0.0026 in. (0,025-0,066 mm)
Limit Permitted	0.004 in. (0,10 mm)
Idler Gear Side Clearance Idler Gear	0.008-0.020 in. (0,2-0,51 mm)

Engine Bolt Torque

	Ft.-Lbs.	**Nm**
Camshaft Retainer Plate Bolts	17-20	23-27
*Connecting Rod Bolts W/O Flange	27-30	37-41
W/Flange	33-36	45-49
Crankshaft Nut	101-116	137-157
*Cylinder Head Bolts	67-72	91-98
Drain Plug	30-36	39-49
*Flywheel Bolts	83-90	113-122
Fuel Camshaft Retainer Bolts	5-6	6,8-8,1
Fuel Injection Tubeline Fittings	11-19	13-26
Glow Plugs	15-18	20-25
*Idler Gear Shaft Bolt	17-20	23-27
Injection Nozzles	36-51	49-69
Injection Pump Mounting Bolts	17-20	23-27
Injector Nozzle Body	43-58	59-79
*Main Bearing Bolts	51-54	69-73
*Main Bearing Case Bolts	34-38	46-52
Oil Switch	11-15	15-20
Rear Bearing Case Cover Bolts	13-15	18-20
Timing Gear Case Cover Bolts	13-15	18-20
Valve Cover Nut	5-6	7-9

*Lightly Oiled Threads

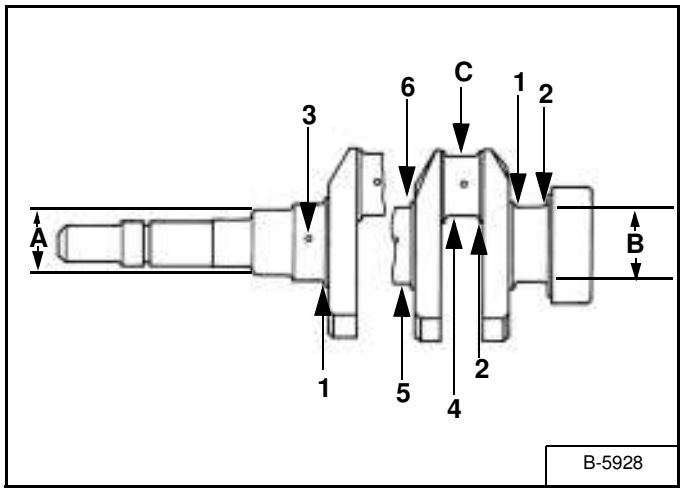
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Crankshaft Re-Grind Data

If the standard size bearing cannot be used due to excessive wear of the crank pin 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 crank pin 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. Be sure to chamfer the oil hole circumference to 0.04-0.06" (1,0-1,5 mm) radius with and oil stone.
4. The crank pin must be fine finished to higher than (0,4-S).
5. The crank journal must be fine-finished to higher than (0,4-S).
6. The crank journal side surface must be fine-finished to higher than (1,6-S).

SIZE	CODE NO.	NAME OF BEARING	BEARING MARK	CRANKSHAFT PROCESSING DIM.	
-0.008" (0,2 mm)	17331-2391-1	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)	17331-2392-1	Crankshaft Bearing 2 0.008" minus (0,2 minus)	020 US		
-0.016" (0,4 mm)	17331-2393-1	Crankshaft Bearing 1 0.016" minus (0,4 minus)	040 US		2.0284-2.0291" (51,521-51,54 mm)
-0.016" (0,4 mm)	17331-2394-1	Crankshaft Bearing 2 0.016" minus (0,4 minus)	040 US		
-0.008" (0,2 mm)	17331-2297-1	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)	17331-2298-1	Crank Pin Bearing 0.016" minus (0,4 minus)	040 US		1.8330-1.8337" (46,559-46,575 mm)
+0.008" (+0,2 mm)	15221-2395-1	Thrust Bearing 1 - 0.008" plus (0,2 mm plus)	020 OS	C	1.0315-1.03357" (46,559-46,575 mm)
	19202-2397-1	Thrust Bearing 2 - 0.008" plus (0,2 mm plus)			
+0.016" (+0,4 mm)	15221-2396-1	Thrust Bearing 1 - 0.016" plus (0,4 mm plus)	040 OS		1.0394-1.0413" (26,4-26,45 mm)
	19202-2398	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 Melroe 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)

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TORQUE SPECIFICATIONS (CONT”D)

Torque For General Metric Bolts

Nominal Diameter / Grade / Unit	Standard Screw and Bolt			Special Screw and Bolt		
	⬡	⑷		⑺		
	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

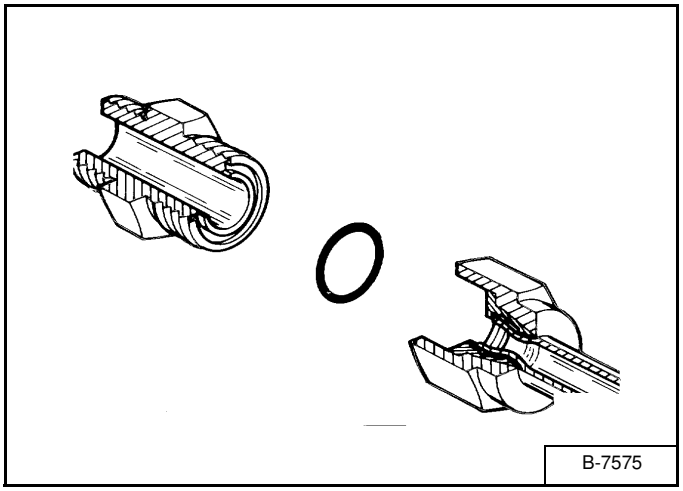
O-Ring Face Seal Connection

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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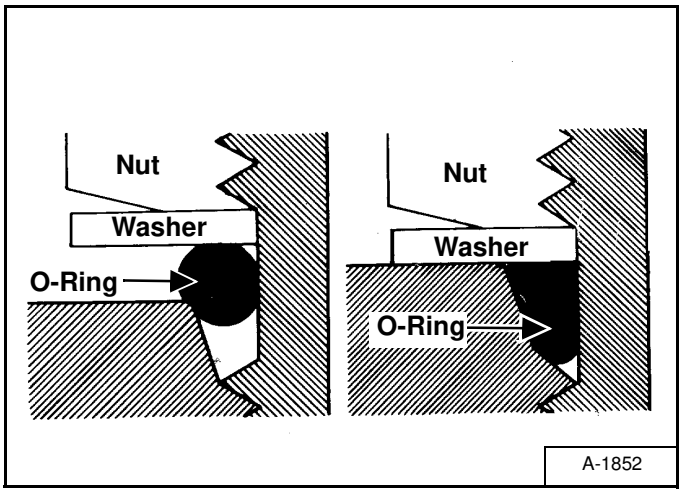
Figure SPEC-40-1



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 jam nut and install the fitting. Tighten the jam nut until the washer is tight against the surface **[Figure SPEC-40-2]**.

Tubelines And Hoses

Replace any tubelines that are bent or flattened. They will restrict flow, which will slow hydraulic action and cause heat.

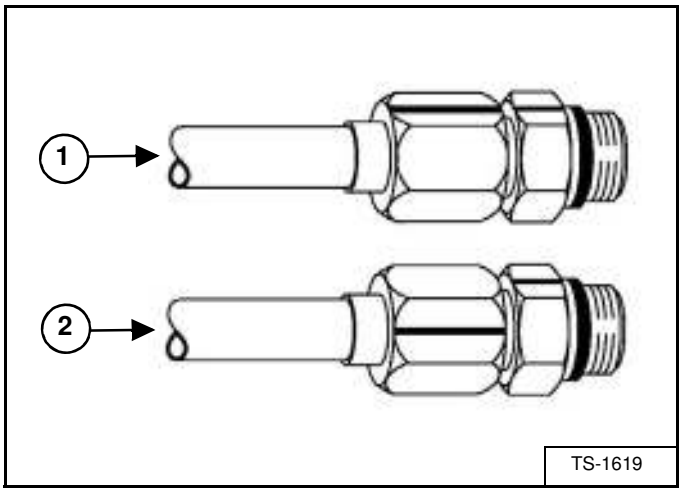
Replace hoses which show signs of wear, damage or weather cracked rubber.

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.

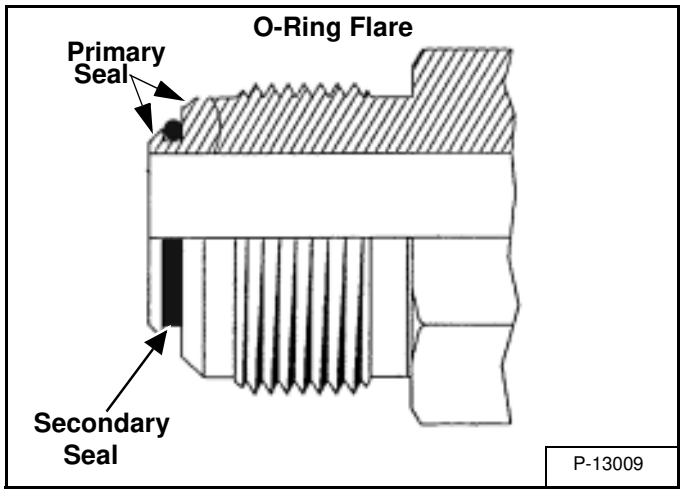
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Flare Fitting (Cont'd)

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

O-Ring Flare Fitting

Figure SPEC-40-4

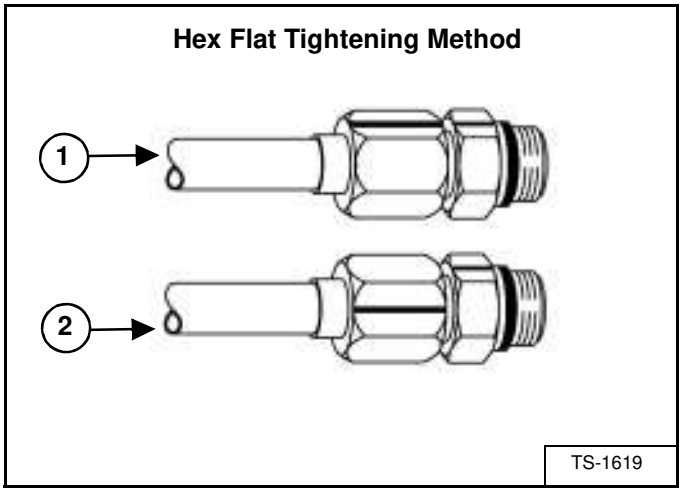


The flare is the primary seal, the O-ring is the secondary seal and helps absorb vibration and pressure pulses at the connection **[Figure SPEC-40-4]**.

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.

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O-ring Flare Fitting (Cont'd)

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

* If a torque wrench is used to tighten a new fitting to a used hose/tubeline.

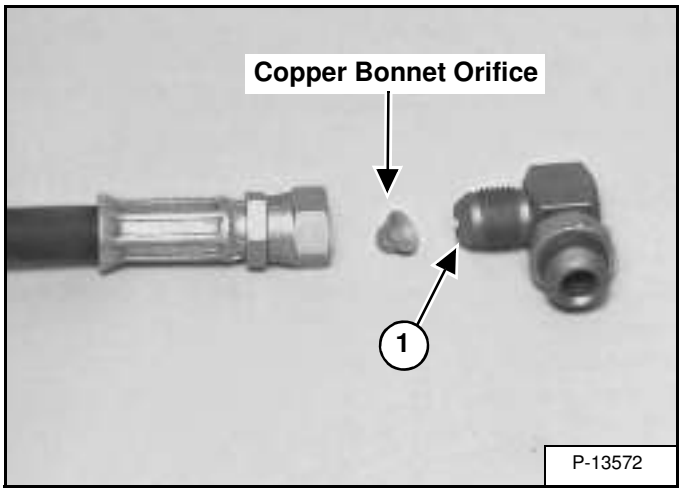
* If a torque wrench is used to tighten a used fitting to a new hose/tubeline.

* 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 an 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.

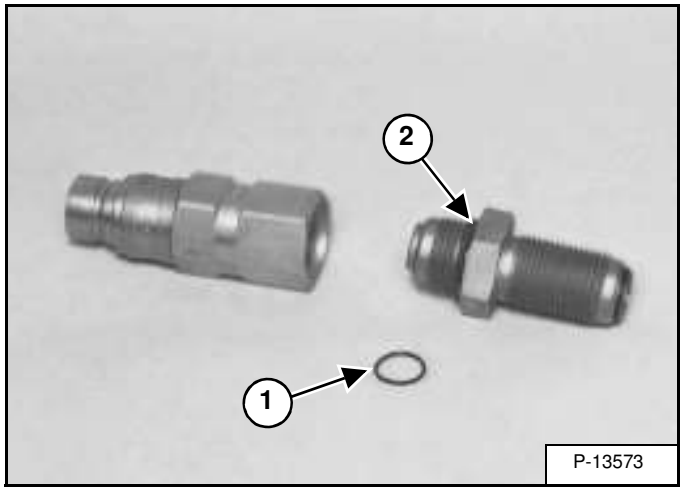
** If using the hex flat tightening method to tighten a new fitting to a new hose/tubleline.

** If using the hex flat tightening method to tighten a new fitting to a used hose/tubline.

*** If using the hex flat tightening method to tighten a used fitting to a new hose/tubline.

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

Figure SPEC-40-7



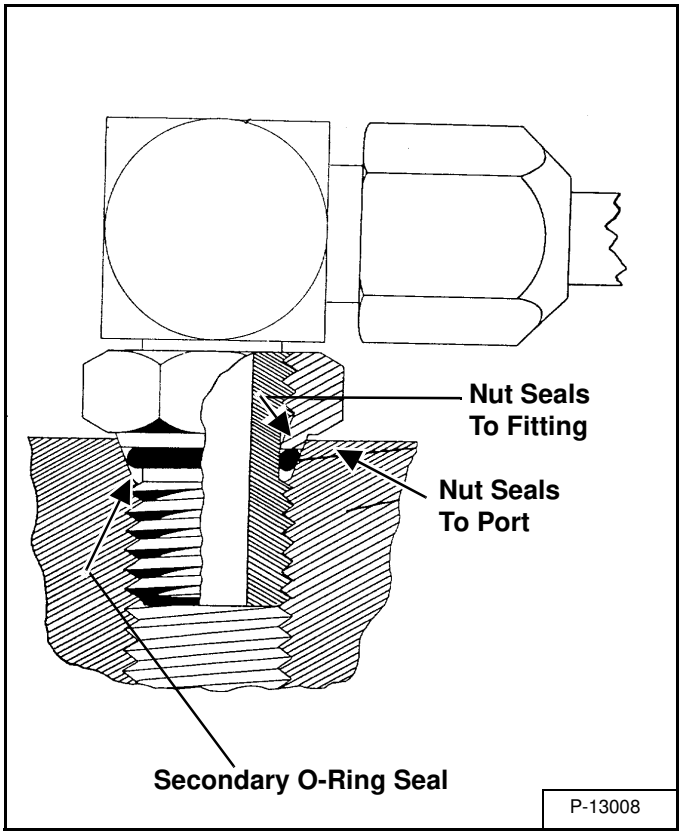
Always remove the O-ring (Item 1) **[Figure SPEC-40-7]** from the flare face as shown.

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

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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.

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 (54)
1-1/8”	7/8”-14	60 (81)
1-1/4”	1-1/16”-12	84 (114)
1-1/2”	1-5/16”-12	118 (160)

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HYDRAULIC FLUID SPECIFICATIONS

Specifications

Use Bobcat hydraulic transmission fluid (P/N 6563328). If this fluid is not available, use 10W-30 or 10W-40 SAE Motor Oil (5W-30 for 0° F [-18° C] and Below).

DO NOT use automatic transmission fluids in the loader or permanent damage to the transmission will result.

⚠ WARNING

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

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When temperatures below zero° 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 hydrostatic transmission pump (indicated by TRANS light ON) can cause transmission 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 (5) 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 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.

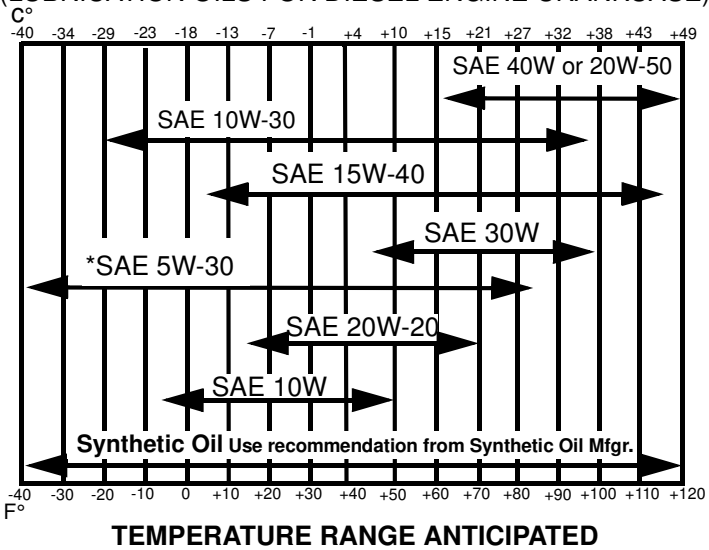
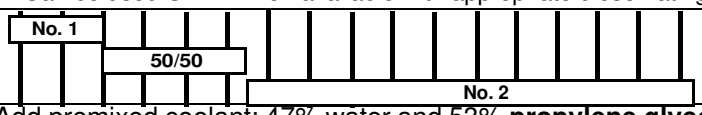
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Chart

RESERVOIR	TYPE OF FLUID	RECOMMENDED FLUIDS	CAPACITY
Engine Oil	*Use SAE Viscosity Number as Listed With API Classification CD or Better	**RECOMMENDED SAE VISCOSITY NUMBER** (LUBRICATION OILS FOR DIESEL ENGINE CRANKCASE)  **TEMPERATURE RANGE ANTICIPATED BEFORE NEXT OIL CHANGE (DIESEL ENGINES MUST USE API CLASSIFICATION CD, CF4, CG4)** *Can be used **ONLY** when available with appropriate diesel rating	5.5 qts. (4,7 L)
Fuel	*Diesel Fuel		14 gal. (53,3 L)
Coolant	Propylene 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. Check condition with a refractometer.	5.5 qts. (5,7 L)
Hydraulic	Bobcat Fluid 6563328*	If Bobcat fluid is not available, use engine oil SAE 10W-30 or 10W-40, Class SE or better.	Tank Cap. 4.8 qts. (18,2 L) System Capacity 9.5 gals. (36,0 L)
Drive Motors (each side)	Gear Lube	SAE - 90W	0.55 qts. (0,5 L)

*** Engine Oil Change Interval Relating To Diesel Fuel Sulfur Content**

Sulfur Content	Change Interval
0.5% or Less	Change engine oil and filter as shown on the *SERVICE SCHEDULE*, Page 10-01
0.5% - 1.0%	Use 1/2 of *SERVICE SCHEDULE* interval.
Above 1.0%	Use 1/4 of *SERVICE SCHEDULE* interval.

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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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Bobcat

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: 325/328-1
Date: 15 March 2001
Product: Bobcat Excavator
Model: 325, 328
Manual No: 6901138 (2-01)

The following pages are a revision to the above Service Manual. The intent of this revision is to add and correct miscellaneous text and update photos to current loader status.

Take out existing pages and put in the new pages as listed below:

TAKE OUT	PUT IN	REVISION DECRIPTION
Alphabetical Index	Alphabetical Index	Text change
20-01, 20-04	20-01, 20-04	Text change
Hydraulic/Hydrostatic Schematic 325 (S/N 232311001 & Above) 328 (S/N 232411001 & Above) (Printed February 2001) V-0055	Hydraulic/Hydrostatic Schematic 325 (S/N 232311001 & Above) 328 (232411001 & Above) Printed March 2001) V-0055	Control Valve Schematic Connection Points
20-80-1 thru 20-80-2	20-80-1 thru 20-80-2	Text change
	20-90-1 thru 20-90-16	Added Swing Motor
	20-91-1 thru 20-91-16	Added Swing Motor Drive Carrier
	20-150-1 thru 20-150-2	Moved from Section 160 to 150
20-160-1 thru 20-160-2	20-160-1 thru 20-160-2	Moved from Section 170 to 160
20-170-1 thru 20-170-2	20-170-1 thru 20-170-2	Moved from section 180 to 170
20-180-1 thru 20-180-2		Moved to Section 170
40-01 thru 40-02	40-01 thru 40-02	Text change
	40-10-1 thru 40-10-6	Added Upperstructure
40-90-1 thru 40-90-4	40-90-1 thru 40-90-8	Added Linkage Removal & Installation-Adjustment
40-100-1 thru 40-100-6	40-100-1 thru 40-100-6	Added Adjustment
	40-140-1 thru 40-140-6	Added Swing Frame
40-150-1 thru 40-150-2	40-150-1 thru 40-150-2	Revised text and photo
40-160-1 thru 40-160-2	40-160-1 thru 40-160-2	Revised text and photo
40-170-1 thru 40-170-2	40-170-1 thru 40-170-2	Text and photo changes
	40-180-1 thru 40-180-2	Added Tailgate
	40-200-1 thru 40-200-2	Added Right Side Cover

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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: 325/328-2
Date: 17 July 2002
Product: Bobcat Excavator
Model: 325, 328
Manual No: 6901138 (2-01)

The following pages are a revision to the above Service Manual.

Take out existing pages and put in the new pages as listed below:

TAKE OUT	PUT IN	REVISION DECRIPTION
Alphabetical Index	Alphabetical Index	Text change
i,ii	I, II	Text change
10-01, 10-02	10-01, 10-02	Text change
10-20-1, 10-20-2	10-20-1, 10-20-2	Text change
10-40-1, 10-40-2	10-40-1, 10-40-2	Picture change
10-50-1, 10-50-2	10-50-1, 10-50-2	Text change
10-130-1, 10-130-2	10-130-1, 10-130-2	Text change
Hydraulic/Hydrostatic Schematic 325 (S/N 232311001 & Above) 328 (S/N 232411001 & Above) (Printed February 2001) V-0055	Hydraulic/Hydrostatic Schematic 325 (S/N 2323111001-12386) 328 (232411001-12129) Printed July 2002) V-0055	
	Hydraulic/Hydrostatic Schematic 325 (S/N 232312387 & Above, 232412118-232412127 and 232412130 & Above) (Printed July 2002) V-0194	
20-01 thru 20-04	20-01 thru 20-04	Text change
20-22-1 thru 20-22-10	20-22-1 thru 20-22-10	Text change
20-30-1 thru 20-30-4	20-30-1 thru 20-30-8	Text change & add new valve
20-31-1 thru 20-31-2	20-31-1 thru 20-31-2	Text and picture change
	20-32-1, 20-32-2	Add new valve
20-33-1, 20-33-2	20-33-1, 20-3242	Text change, new valve
20-40-1 thru 20-40-42	20-40-1 thru 20-40-42	Text change
	20-41-1 thru 20-41-42	Add new valve
20-50-1 thru 20-50-34	20-50-1 thru 20-50-36	Text and picture change
20-60-1 thru 20-60-4	20-60-1 thru 20-60-4	Tect change
20-61-1 thru 20-61-18	20-61-1 thru 20-61-18	Text change
	20-62-1 thru 20-62-4	Add new manifold
	20-63-1 thru 20-63-24	Add new manifold
20-70-1 thru 20-70-2	20-70-1 thru 20-70-2	Text change

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SERVICE MANUAL REVISION

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SERVICE MANAGER	☒
SALES MANAGER	☐

NOTICE **Insert This Sheet With The Below Listed Manual For Future Reference.**

Revision No: 325/328-3
Date: 24 March 2006
Product: Bobcat Excavator
Model: 325/328
Manual No: 6901189 (2-01)

325/328 Service Manual (P/N 6901138) Dated (2-06) contains updated service information which replaces the previous 325/328 Service Manual (P/N 6901138) Dated (2-01)

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