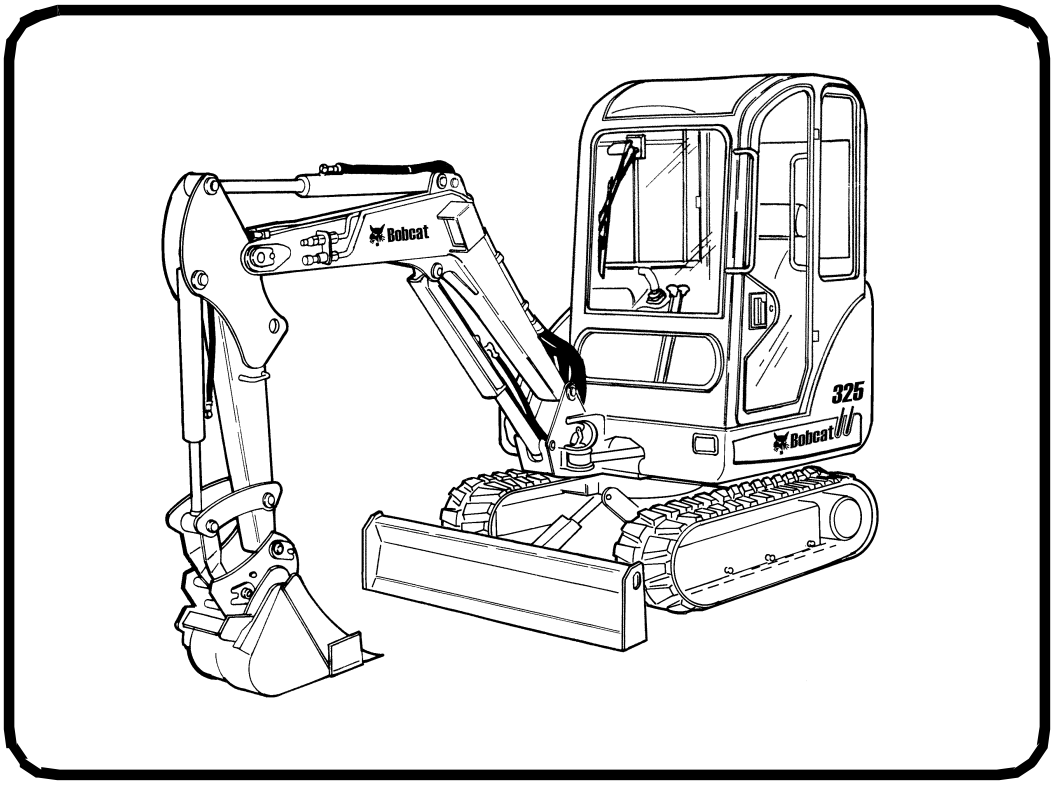
Bobcat®

Service Manual
325/328 Compact Excavator

325 S/N AAC511001 & Above
325 S/N A9K011001 & Above
328 S/N A9K111001 & Above



6986940 (10-09)

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-2003-0807

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

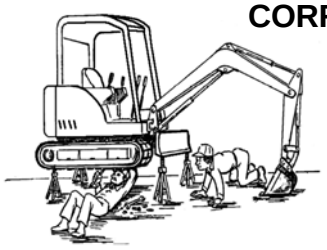
CORRECT



P-90216

Never service the Bobcat Excavator without instructions.

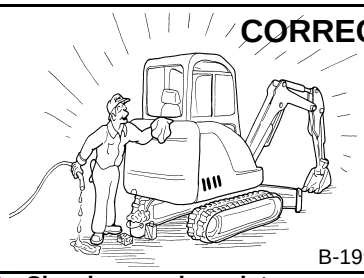
CORRECT



B-19964

Use the correct procedure to lift and support the excavator.

CORRECT



B-19959

Cleaning and maintenance are required daily.

WRONG



B-19965

Have good ventilation when welding or grinding painted parts.

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

WRONG

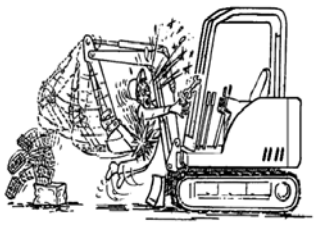


B-19960

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

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

WRONG

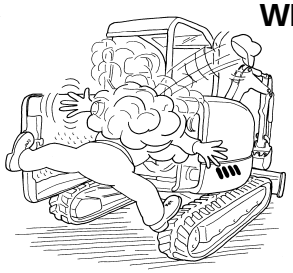


B-19966

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

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

WRONG



B-19962

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

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

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

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

WRONG



B-19958

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

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

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

WRONG



B-19798

Lead-acid batteries produce flammable and explosive gases.

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

Batteries contain acid which burns eyes or skin on contact.

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

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

MSW28-0409


Bobcat®

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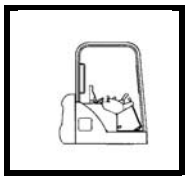
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FOREWORD

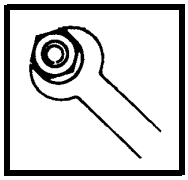
This manual is for the Bobcat excavator mechanic. It provides necessary servicing and adjustment procedures for the Bobcat excavator and its component parts and systems. Refer to the Operation & Maintenance Manual for operating instructions, starting procedure, daily checks, etc.

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

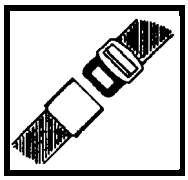
1. Check that the ROPS/TOPS/ FOPS is in good condition and is not modified.



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



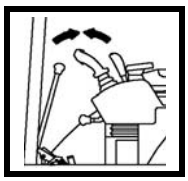
3. The seat belt must be correctly installed, functional and in good condition.



4. Machine signs (decals) must be legible and in the correct location.



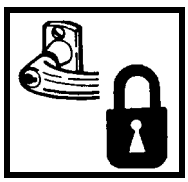
5. Travel levers, control levers and foot pedals must return to neutral. Check that the pedal locks are in working order.



6. Check for correct function of the work lights.



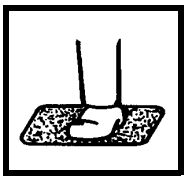
7. Enclosure door latches must open and close freely.



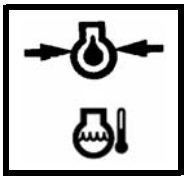
8. Attachment locking pins must function correctly and be in good condition.



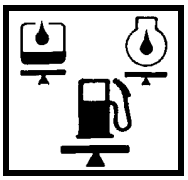
9. Safety treads must be in good condition.



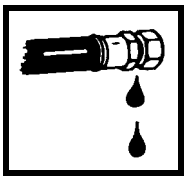
10. Check for correct function of indicator lamps.



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



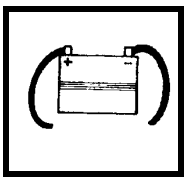
12. Inspect for fuel, oil or hydraulic fluid leaks.



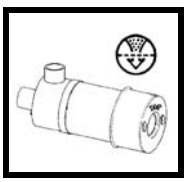
13. Lubricate the excavator.



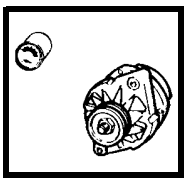
14. Check the condition of the battery and cables.



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

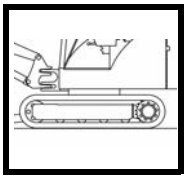


16. Check the electrical charging system.

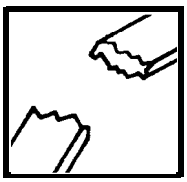


FW EXC-0509 SM

17. Check tracks for wear and tension. Use only approved tracks.



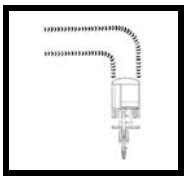
18. Inspect for loose or broken parts or connections.



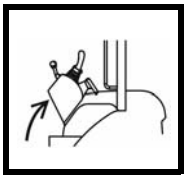
19. Check for any field modification not completed.



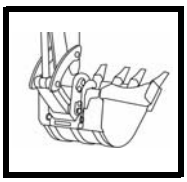
20. Operate the machine and check all functions.



21. Check the control console interlocks for correct function.



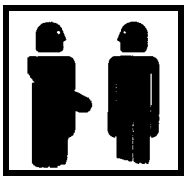
22. Inspect the X-Change™ for wear or damage. Repair or replace damaged parts.



23. Check function or condition of all equipped options and accessories (examples: special applications kit, motion alarm, etc.).



24. 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.

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

IMPORTANT

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

I-2019-0284

DANGER

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

D-1002-1107

WARNING

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

W-2044-1107

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

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

SI EXC-0308 SM

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



Call Before You Dig
Dial 811 (USA Only)
1-888-258-0808 (USA & Canada)

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



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

FIRE PREVENTION



Maintenance

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

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

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

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

Operation

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

Electrical



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

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

Hydraulic System

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

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

Fueling



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

Starting

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

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

Spark Arrestor Exhaust System

The spark arrestor exhaust system 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.

Check the spark arrestor exhaust system regularly to make sure it is maintained and working properly. Use the procedure in the Operation & Maintenance Manual for cleaning the spark arrestor muffler (if equipped).

SI EXC-0308 SM

FIRE PREVENTION (CONT'D)

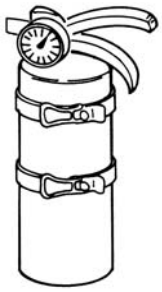
Welding And Grinding

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

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

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

Fire Extinguishers



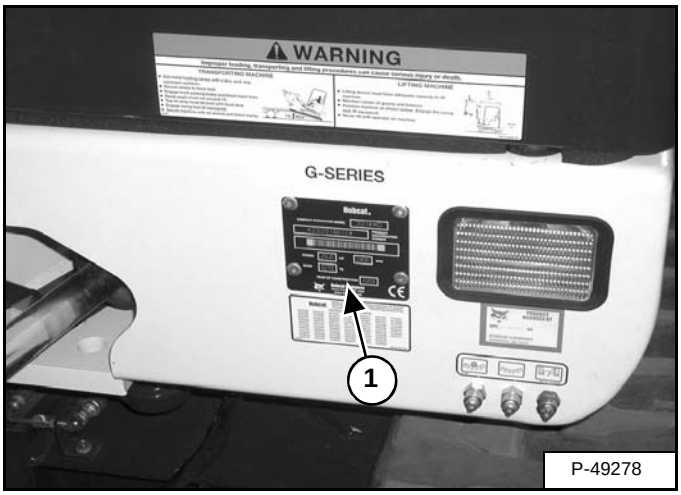
Know where fire extinguishers and first aid kits are located and how to use them. Inspect the fire extinguisher and service the fire extinguisher regularly. Obey the recommendations on the instructions plate.

SERIAL NUMBER LOCATIONS

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

Excavator Serial Number

Figure 1



The excavator serial number plate (Item 1) is located on the frame of the machine in the location shown **[Figure 1]**.

Explanation of Excavator Serial Number:

XXXX XXXXX

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

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

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

Engine Serial Number

Figure 2

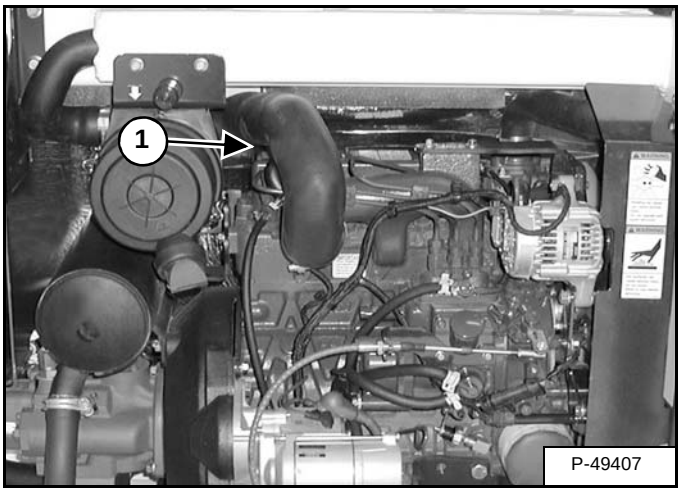
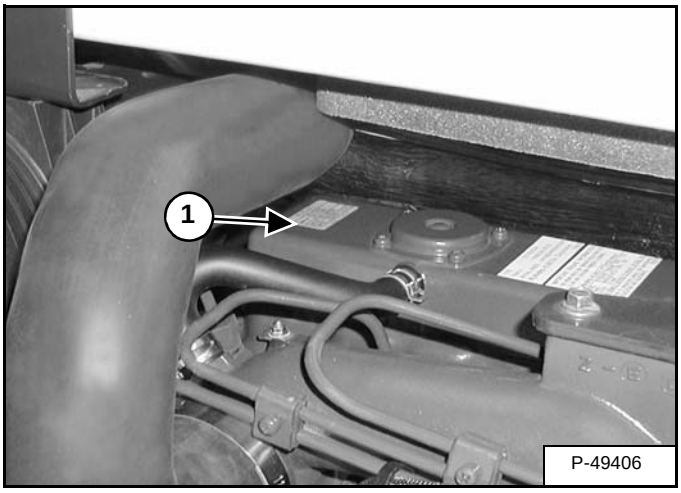


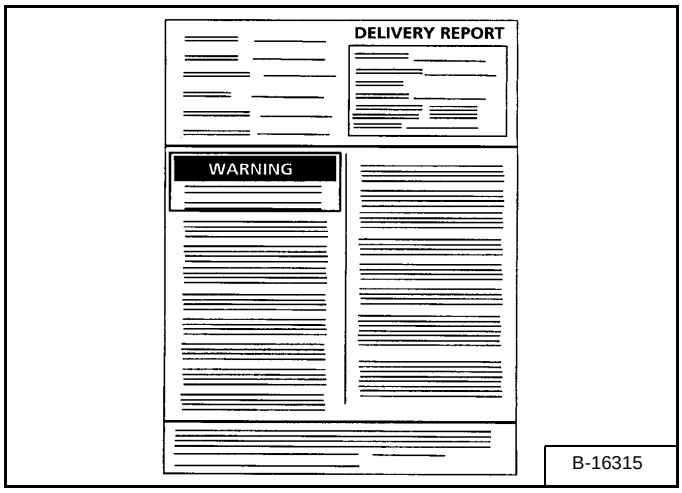
Figure 3



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

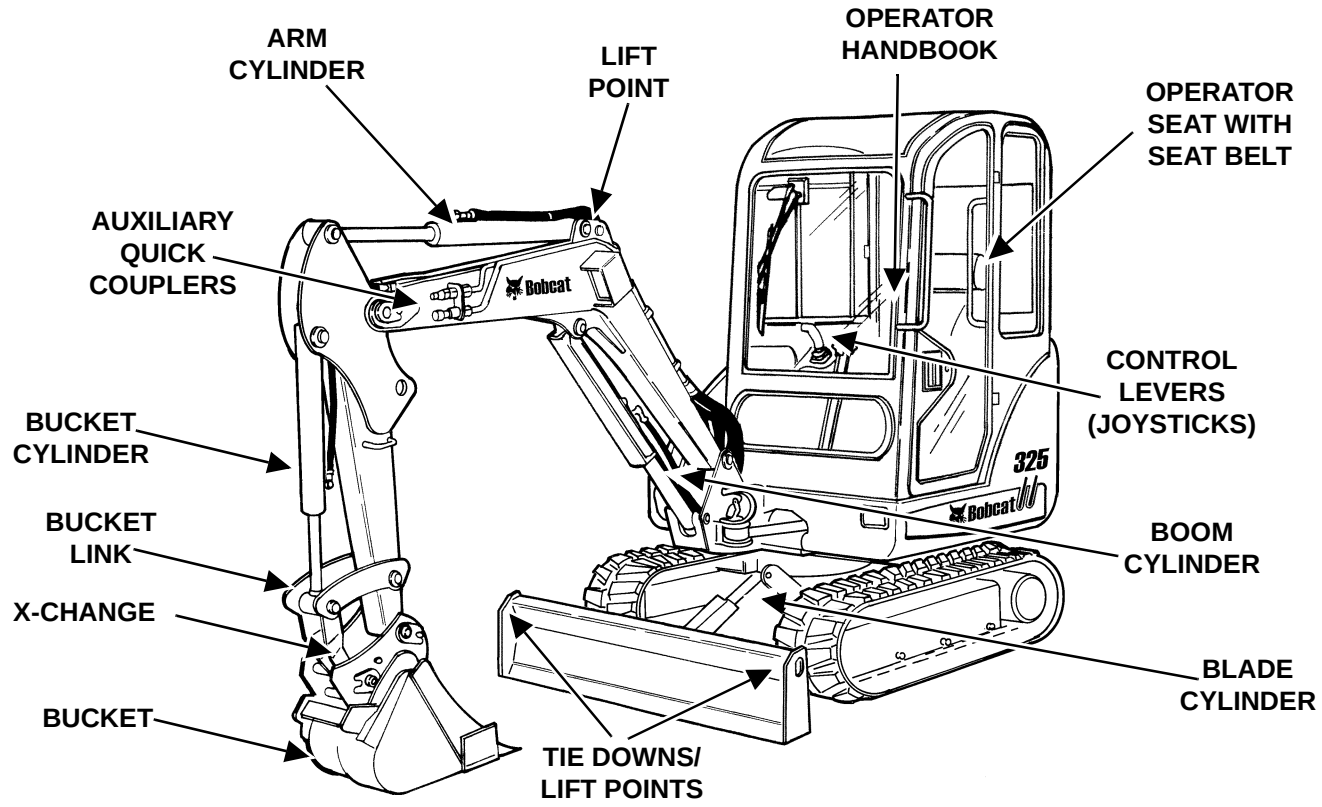
DELIVERY REPORT

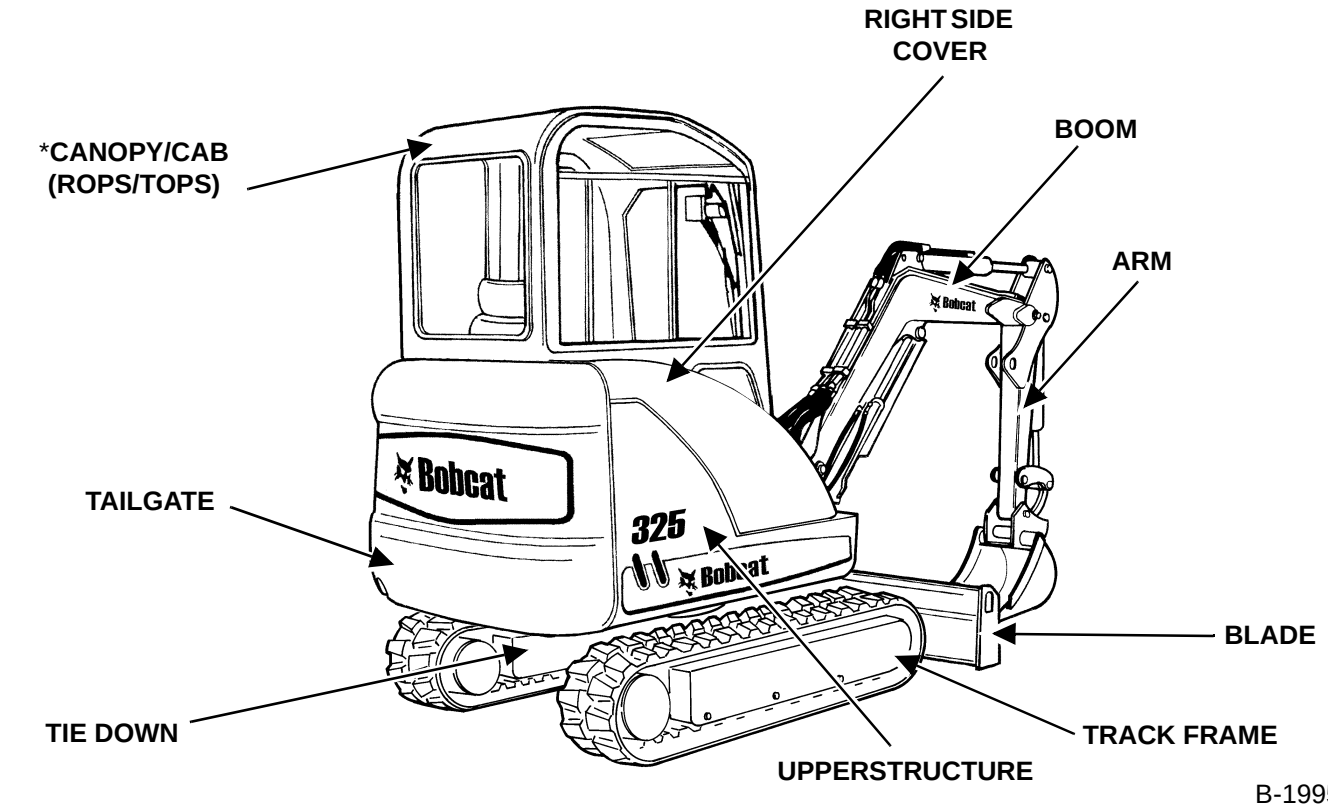
Figure 4



The delivery report must be filled out by the dealer and signed by the owner or operator when the Bobcat Excavator is delivered. An explanation of the form must be given to the owner. Make sure it is filled out completely **[Figure 4]**.

BOBCAT EXCAVATOR IDENTIFICATION





B-19951
B-19950

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

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TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION SPEC-01) UNLESS OTHERWISE SPECIFIED.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE AND STANDARD ITEMS MAY VARY.

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

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

W-2142-0903

Figure 10-10-1



Raise one side of the machine approximately 4 in. (102 mm) using the boom and arm as shown in **[Figure 10-10-1]**.

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

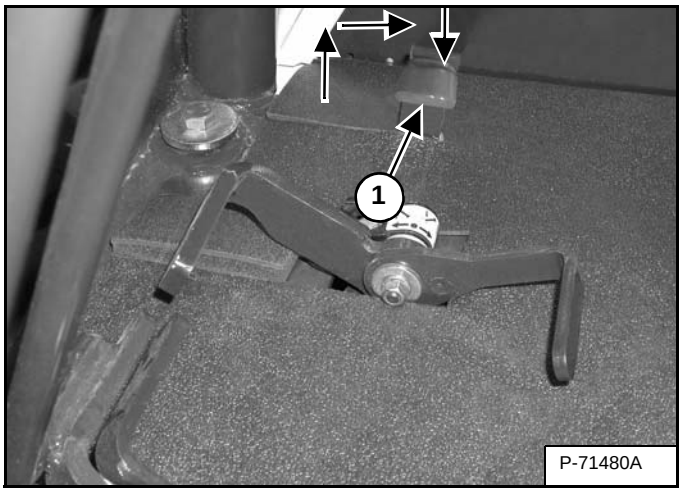
Stop the engine.


Bobcat®

UPPERSTRUCTURE SLEW LOCK

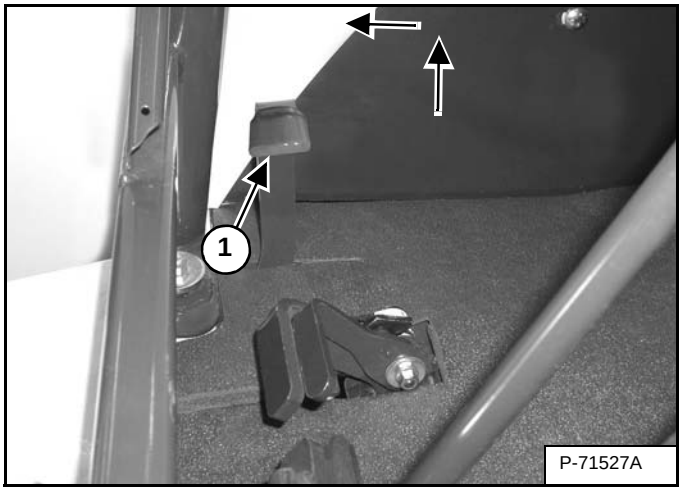
Operation

Figure 10-11-1



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

Figure 10-11-2



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

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

WARNING

AVOID INJURY

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

W-2197-0904

WARNING

AVOID INJURY OR DEATH

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

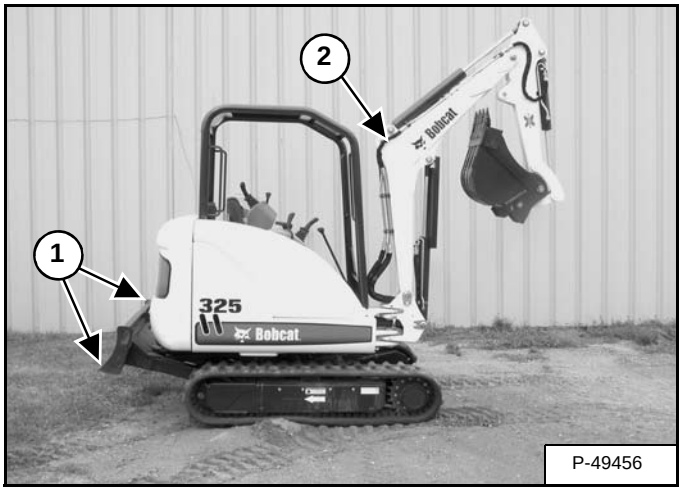
W-2052-0907


Bobcat®

LIFTING THE EXCAVATOR

Procedure

Figure 10-12-1



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

Raise the blade all the way.

Put all the control levers in neutral.

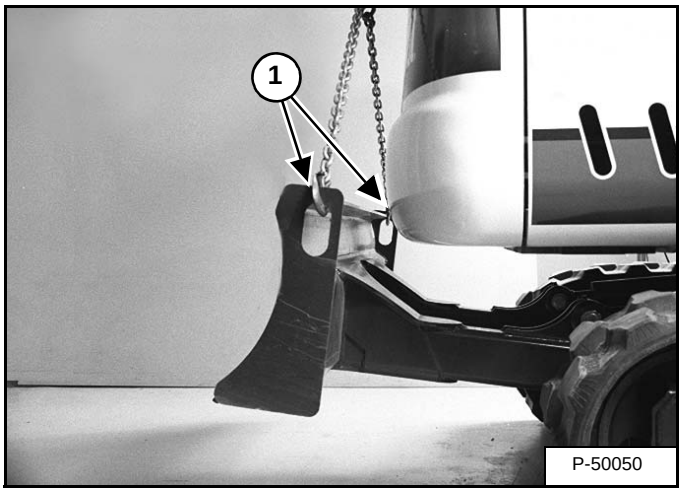
⚠ WARNING

AVOID INJURY OR DEATH

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

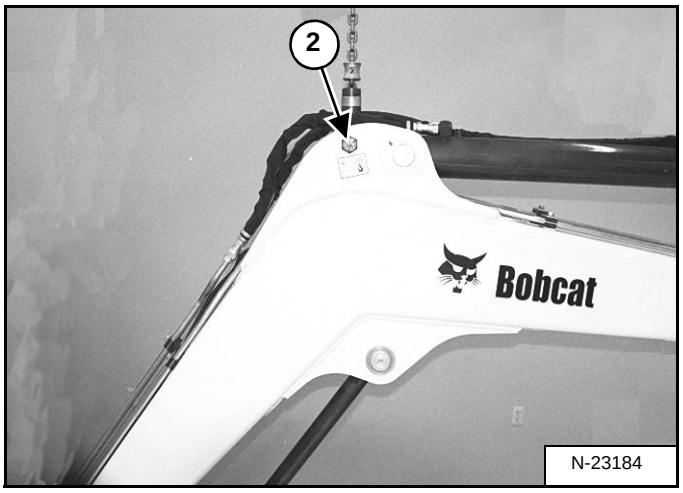
W-2202-0607

Figure 10-12-2



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

Figure 10-12-3



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

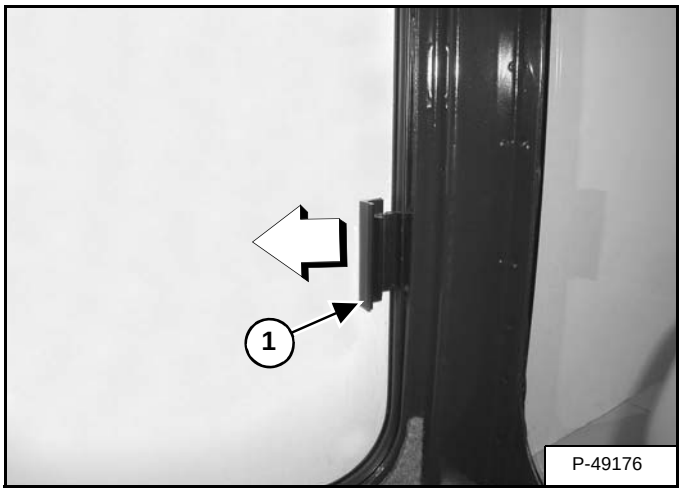

Bobcat®

OPERATOR CAB (ROPS/TOPS)

Emergency Exit

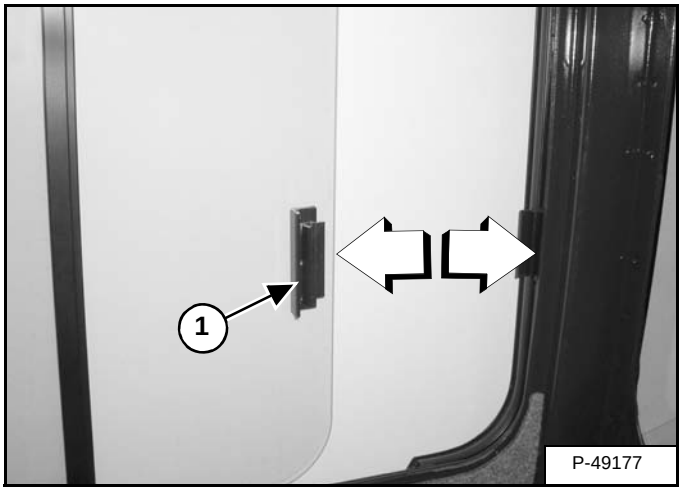
The left door, front window and right rear window provide exits.

Figure 10-20-1



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

Figure 10-20-2



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

Push the handle back to close the window.

Figure 10-20-3



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

Figure 10-20-4



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

Front Window

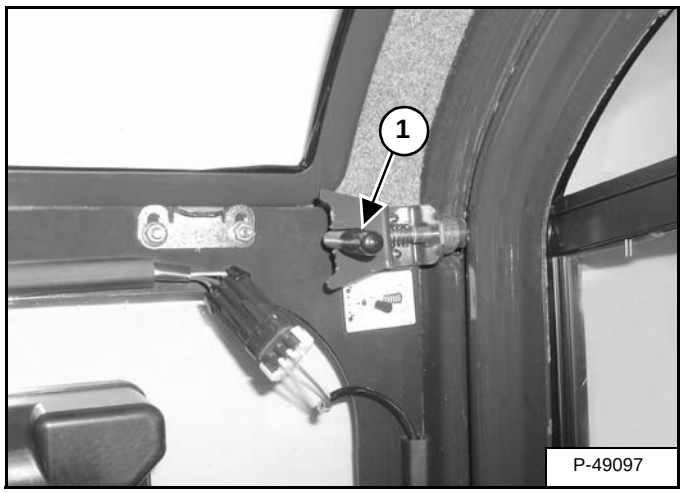
Figure 10-20-5



The front window is equipped with a wiper (Item 1) **[Figure 10-20-5]** and washer.

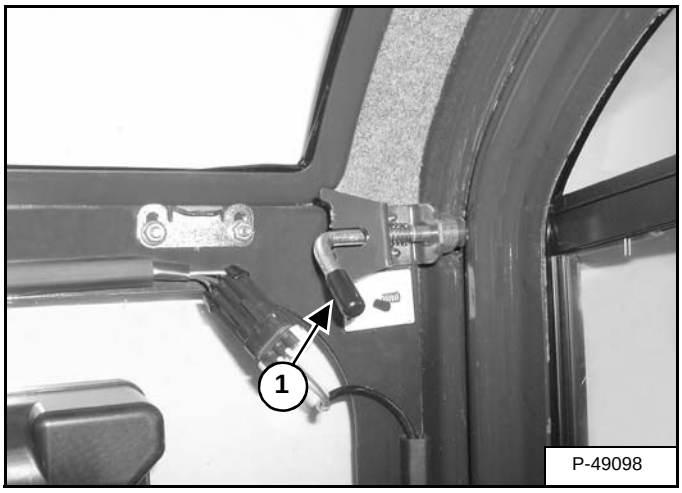
Opening The Front Window

Figure 10-20-6



Retract the two top window latch pins (Item 1) **[Figure 10-20-6]**.

Figure 10-20-7



Turn the two top latches (Item 1) **[Figure 10-20-7]** to the unlocked position.

Figure 10-20-8

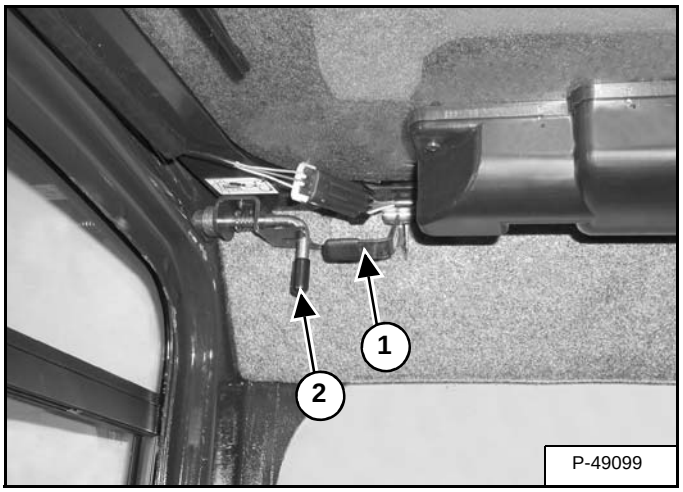


Use both window grab handles to pull the top of the window in **[Figure 10-20-8]**.

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

Front Window (Cont'd)

Figure 10-20-9



When the window is fully raised, the latch (Item 1) will close on the bracket. Turn the two top latches (Item 2) **[Figure 10-20-9]** to the locked position.

Closing The Front Window

Support the window while releasing both window latch pins and placing the pins in the unlocked position.

Support the window using the left grab handle and pull down on the latch (Item 1) **[Figure 10-20-9]** to release the window.

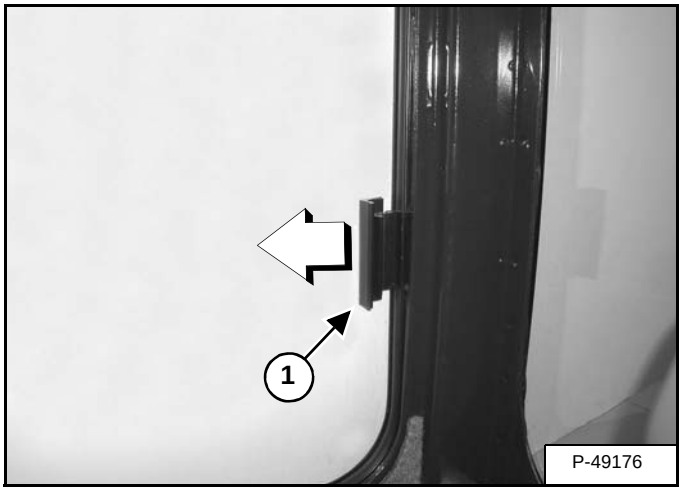
Use both window grab handles to pull the window down **[Figure 10-20-8 on Page 10-20-2]**.

Rotate the top latches (Item 1) **[Figure 10-20-7 on Page 10-20-2]** to the locked position (Item 1) **[Figure 10-20-6 on Page 10-20-2]**.

Right Side Windows

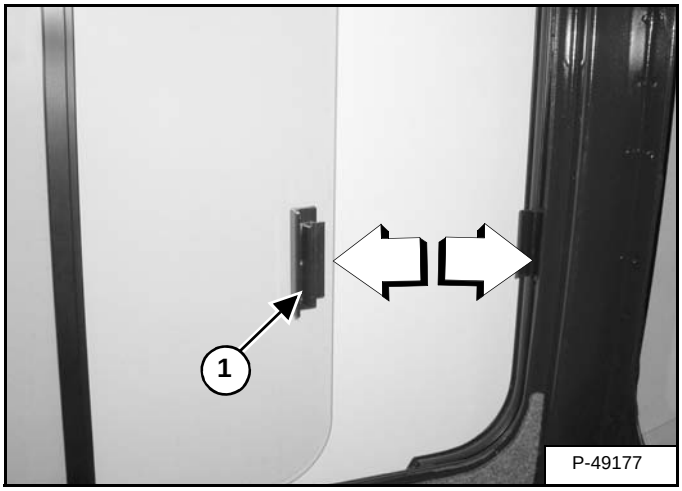
Opening the right rear window

Figure 10-20-10



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

Figure 10-20-11

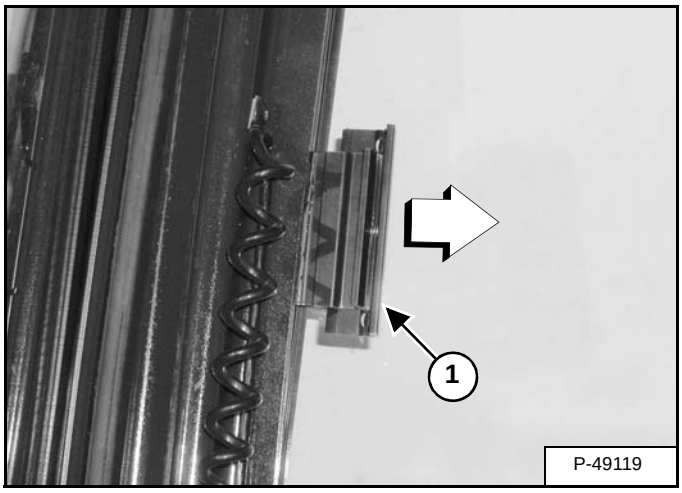


Pull the latch/handle (Item 1) **[Figure 10-20-11]** forward to open the window.

Push the handle back to close the window.

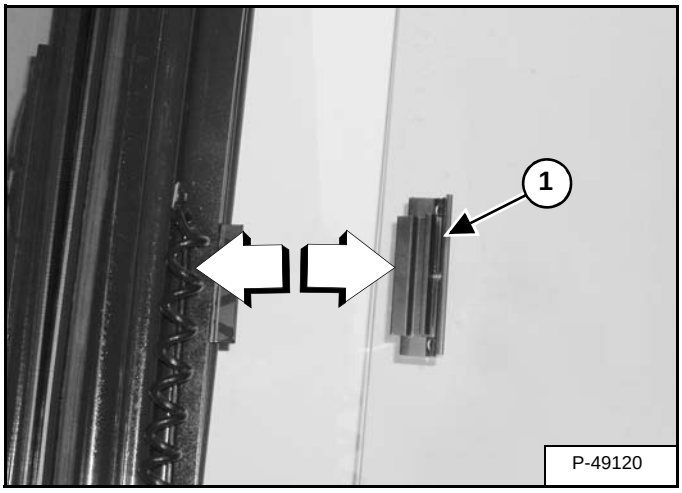
Opening the right front window

Figure 10-20-12



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

Figure 10-20-13

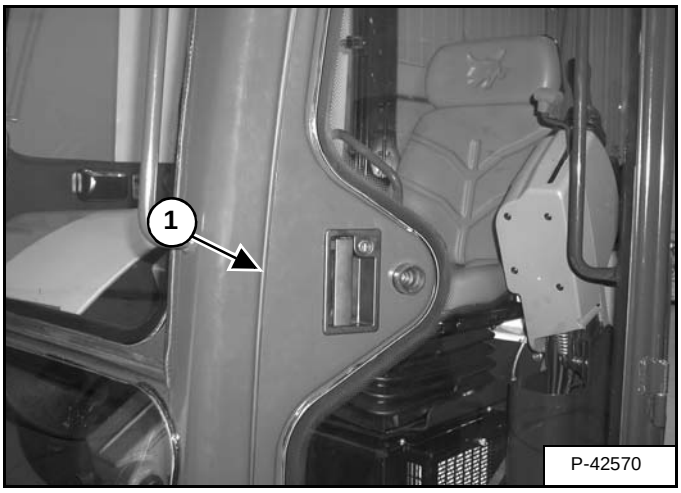


Pull the latch/handle (Item 1) **[Figure 10-20-13]** back to open the window.

Push the handle forward to close the window.

Cab Door

Figure 10-20-14



The cab door (Item 1) **[Figure 10-20-14]** can be locked with the same key as the starter switch (if equipped).

Figure 10-20-15



Push the door all the way open until the latch engages to hold the door in the open position **[Figure 10-20-15]**.

Firmly pull the door away from the cab to disengage the latch and close the door **[Figure 10-20-15]**.


Bobcat®

TRANSPORTING THE EXCAVATOR

Procedure

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°.

Use metal loading ramps with a slip resistant surface.

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

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

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

Engage the slew lock.

Figure 10-30-1



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

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

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

Stop the engine and remove the key (if equipped).

Put blocks at the front and rear of the tracks.

Figure 10-30-2

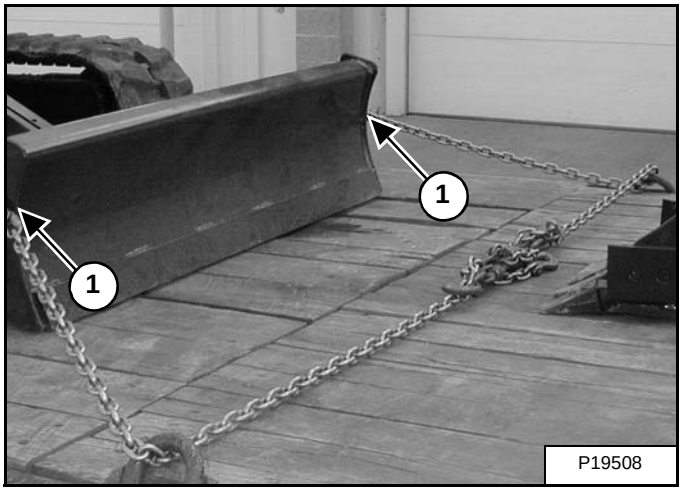
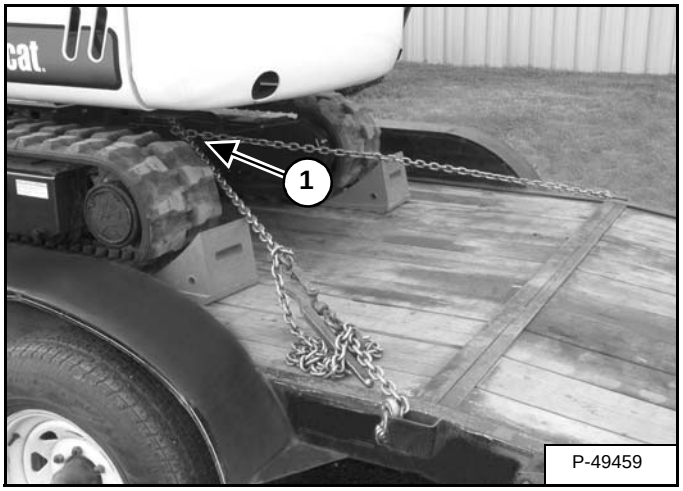


Figure 10-30-3



Fasten chains to the front corners of the blade (Item 1) **[Figure 10-30-2]** and to the tie down loop at the rear of the track frame (Item 1) **[Figure 10-30-3]** to prevent it from moving when going up or down slopes or during sudden stops.

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

⚠ WARNING

AVOID SERIOUS INJURY OR DEATH

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

W-2058-0807


Bobcat®

TAILGATE

Opening And Closing The Tailgate

WARNING

AVOID INJURY OR DEATH

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

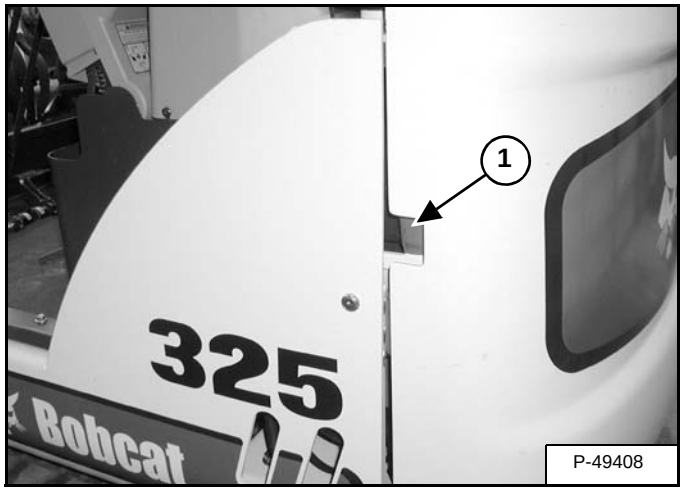
W-2012-0497

WARNING

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

W-2020-1285

Figure PM-1



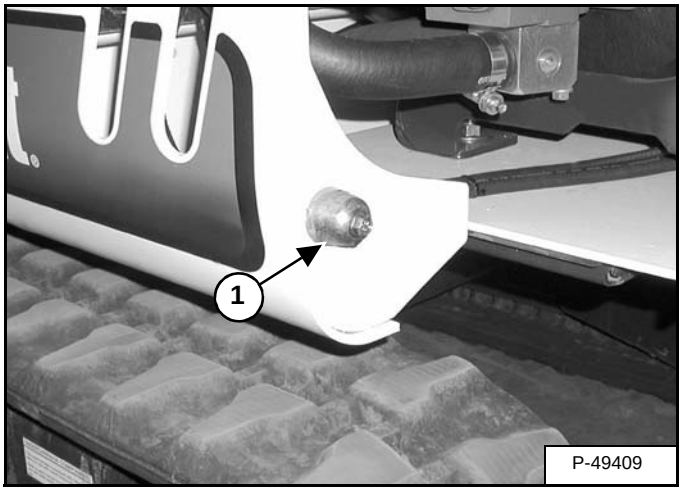
Pull the latch (Item 1) **[Figure PM-1]** and pull the tailgate open.

Push firmly to close the tailgate.

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

Adjusting The Bumper

Figure 10-40-2

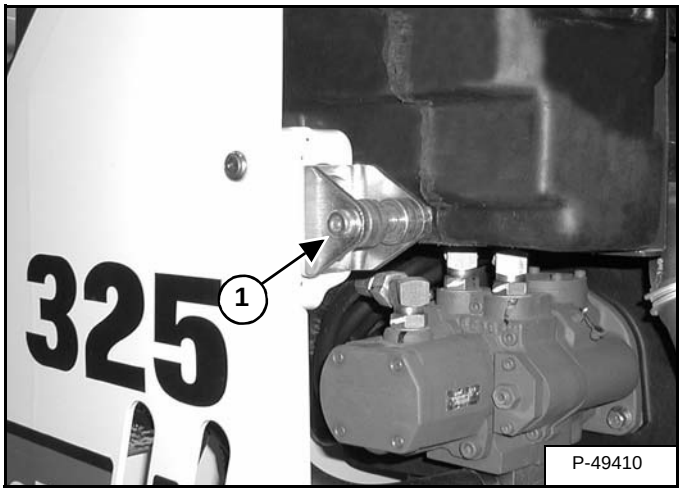


The door bumper (Item 1) **[Figure 10-40-2]** can be adjusted for alignment with the tailgate.

Close the tailgate before operating the excavator.

Adjusting The Latch

Figure 10-40-3



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

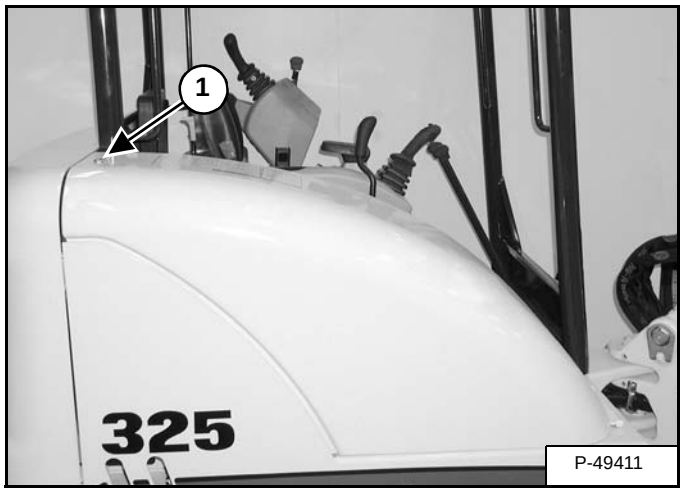
Close the tailgate before operating the excavator.


Bobcat®

RIGHT SIDE COVER

Opening And Closing The Right Side Cover

Figure 10-41-1



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

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


Bobcat®

SERVICE SCHEDULE

Chart

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

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2003-0807

SERVICE SCHEDULE		HOURS					
ITEM	SERVICE REQUIRED	8-10	50	100	250	500	■ 1000
Engine Coolant	Check coolant level. Add premixed coolant as needed.						
Engine Oil	Check the engine oil level and add as needed.						
Hydraulic Fluid, Hoses and Tubelines, Reservoir Breather Cap	Check the hydraulic fluid level and add as needed. Check for damage and leaks. Repair or replace as needed.						
Engine Air Filter and Air System	Check condition indicator and empty dust cup as needed. Check air system for leaks.						
Tracks	Check and adjust track tension as needed.						
Indicators and Lights	Check for correct operation of all indicators and lights.						
Operator Canopy / Cab	Check condition. Check mounting hardware.						
Seat Belt	Check condition. Check mounting hardware.						
Safety Signs and Safety Treads	Check for damaged signs (decals) and safety treads. Replace any signs or safety treads that are damaged or worn.						
Pivot Points	Grease all machinery pivot points.						
* Cab Heater Air Filter	Clean the filter as needed.						
Console Lockout	Check console lockout for proper operation.						
X-Change	Lubricate and inspect for damage or loose parts.						
Swing Circle and Pinion	Grease two fittings						
Fuel Tank & Filter	Drain water and sediment from fuel tank and fuel filter.						
Battery	Check battery, cables, connections and electrolyte level. Add distilled water as needed.						
Accessory Drive Belt	Check condition of belt and adjust as needed.		●				
Spark Arrestor Muffler	Clean the spark chamber.						
Travel Motor	Check the oil level in both travel motors.						
Fuel Filter	Replace fuel filter.		●				
Engine Oil and Filter	Replace oil and filter. Use CD or better grade oil and Bobcat filter.		▼				
Radiator, Oil Cooler	Clean debris from the radiator fins.						
Primary Hydraulic Filter and reservoir breather	Replace the primary hydraulic filter and reservoir breather.			^			
Case Drain Filter	Replace the case drain filter.			^			
Alternator & Starter	Check the alternator and starter connections.			^			
Engine Valves	Check and adjust the engine valve clearance.						
Hydraulic System	Replace the hydraulic fluid and filters. Clean the reservoir.						
Travel Motor	Replace the lubricant in both travel motors.			^			
Engine Coolant	Drain and flush the cooling system. Replace the coolant.	Every 2 years					

* **If equipped.**
● **Check after the first 50 hours, then as scheduled.**
▼ **First oil and filter change must occur at 50 hours; then as scheduled.**
^ **Check after the first 100 hours, then as scheduled.**
■ **Or every 12 months.**

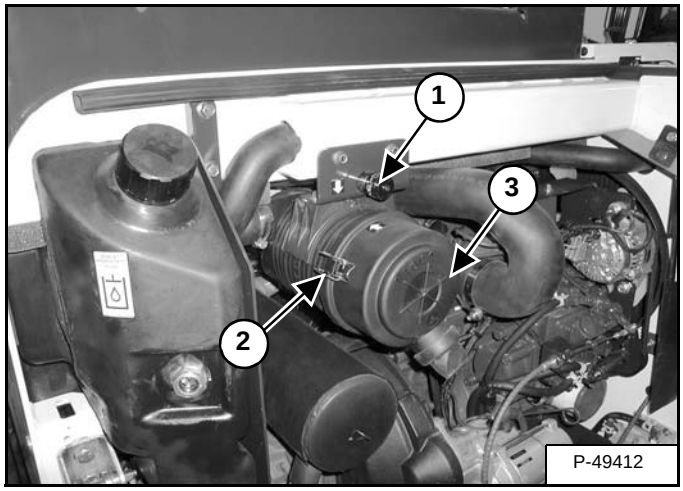

Bobcat®

AIR CLEANER

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

Daily Check

Figure 10-60-1



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

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

Replacing The Filters

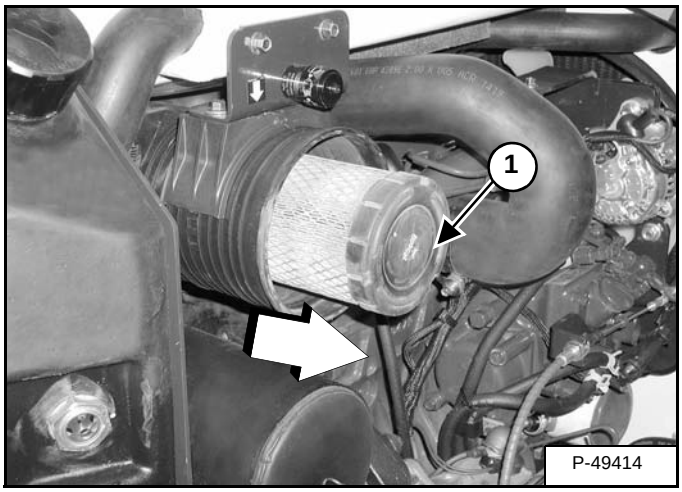
Outer Filter

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

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

Replacing The Filters (Cont'd)

Figure 10-60-2



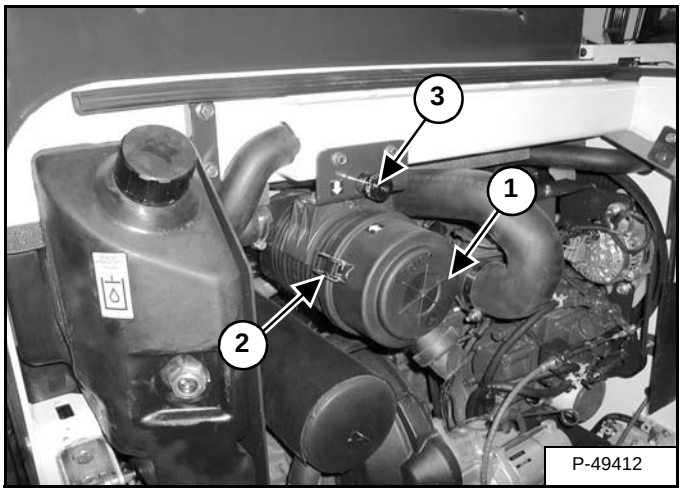
Pull the outer filter (Item 1) **[Figure 10-60-2]** from the air cleaner housing.

Check the housing for damage.

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

Install a new filter.

Figure 10-60-3



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

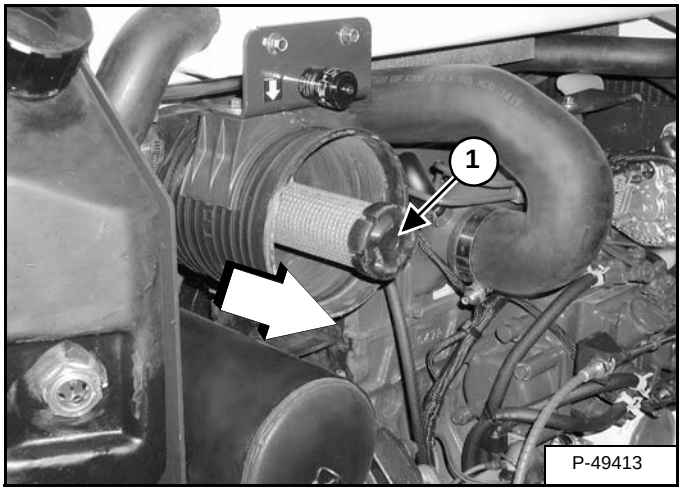
Check the air intake hose and the air cleaner housing for damage. Make sure all connections are tight.

Inner Filter

Only replace the inner filter under the following conditions:

- Replace the inner filter every *third* time the outer filter is replaced.
- After the outer filter has been replaced, press the button (Item 3) **[Figure 10-60-3]** on the top of the condition indicator and start the engine. Run at full RPM, then reduce engine speed and stop the engine. If the red ring shows in the condition indicator, replace the inner filter.

Figure 10-60-4



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

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

Install the new inner filter.

Install the outer filter and the dust cup.

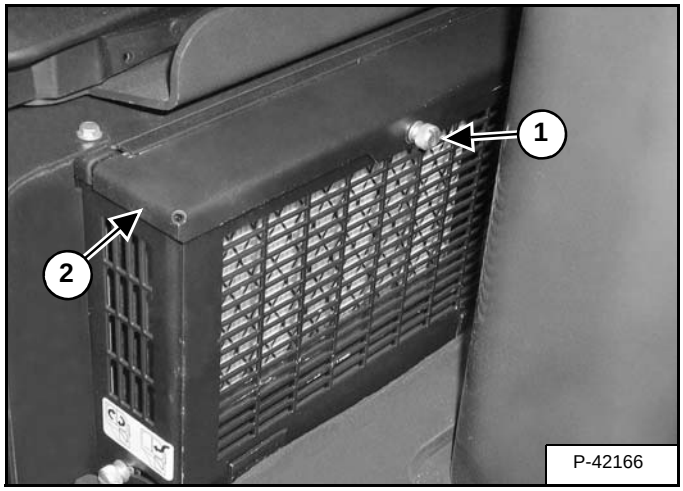
Press the button on the condition indicator to remove the red ring.

HEATER AIR FILTER (WITH CAB OPTION ONLY)

Removal And Installation

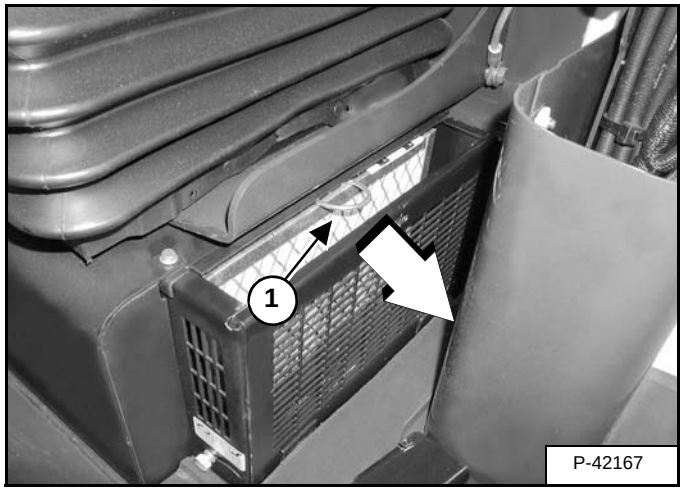
The heater filter must be cleaned regularly. The filter is located at the left of the operator seat.

Figure 10-61-1



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

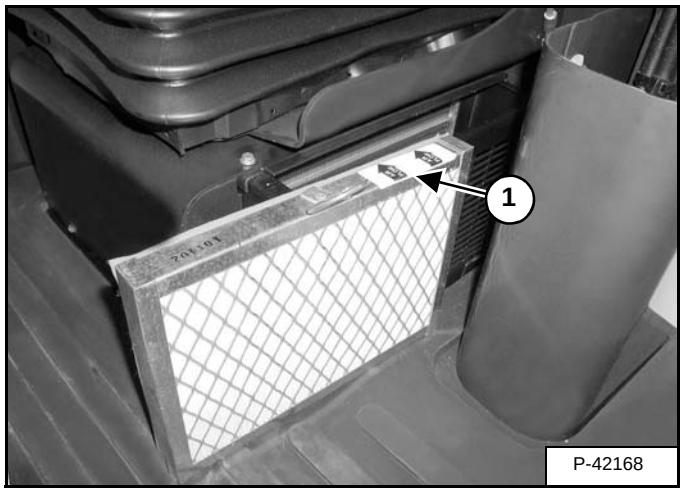
Figure 10-61-2



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

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

Figure 10-61-3



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


Bobcat®

COOLING SYSTEM

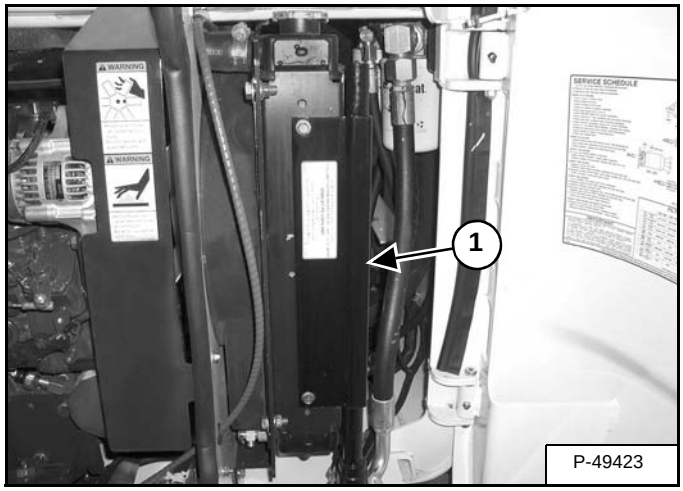
Check the cooling system every day to prevent overheating, loss of performance or engine damage.

Cleaning The Cooling System

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

Open the tailgate.

Figure 10-70-1



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

Checking Coolant Level

⚠ WARNING

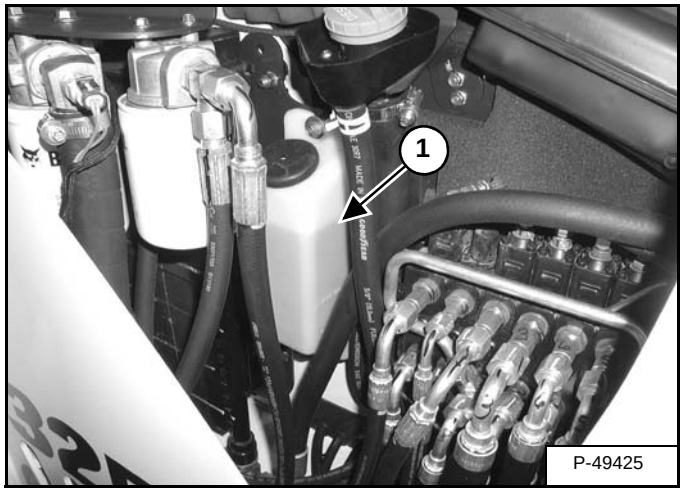
AVOID BURNS

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

W-2070-1203

Open the right side cover.

Figure 10-70-2



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.

IMPORTANT

AVOID ENGINE DAMAGE

Always use the correct ratio of water to antifreeze.

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

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

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

I-2124-0497

⚠ WARNING

AVOID INJURY OR DEATH

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-2019-0907

Replacing The Coolant

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

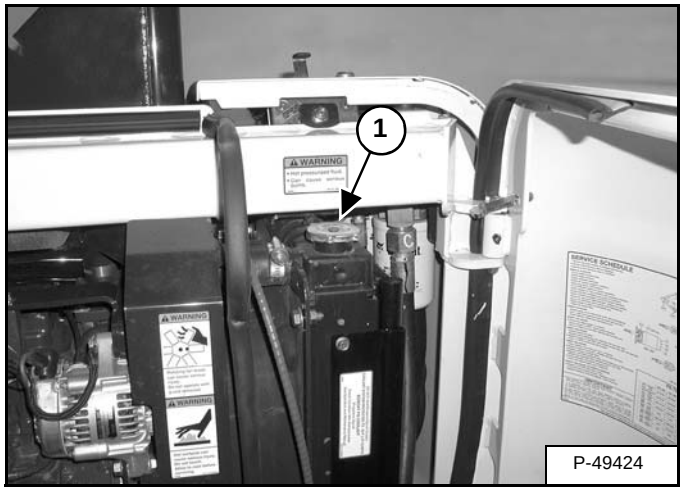
⚠ WARNING

AVOID BURNS

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

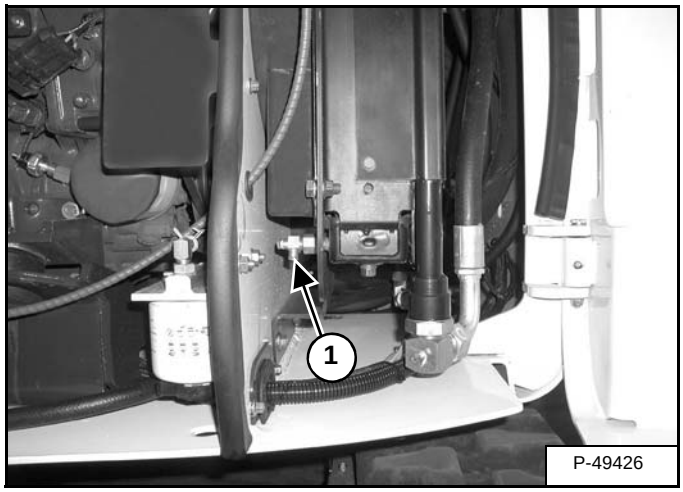
W-2070-1203

Figure 10-70-3



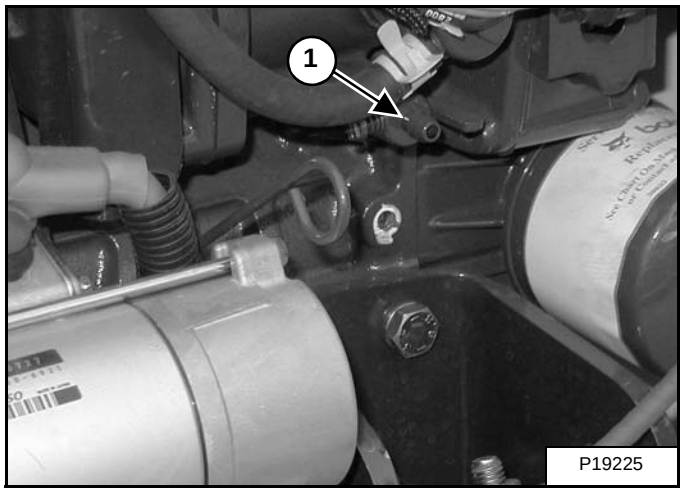
When the engine is cool, loosen and remove the radiator cap (Item 1) **[Figure 10-70-3]**.

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.

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 the drain valve.

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

Mix the coolant in a separate container. See chart for correct capacity. (See Chart on Page SPEC-60-1.)

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

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

One gallon and one pint of propylene glycol mixed with one gallon of water is the correct mixture of coolant to provide a -34×F (-37×C) freeze protection. (See Checking Coolant Level on Page 10-70-2.)

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 right side cover.


Bobcat®

FUEL SYSTEM

Fuel Specifications

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

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

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

At a minimum, Low Sulfur (500 ppm sulfur) Diesel Fuel must be used in this machine.



The following fuels may also be used in this machine:

- Ultra Low Sulfur (15 ppm sulfur) Diesel Fuel.
- Biodiesel Blend Fuel - Must contain no more than five percent biodiesel mixed with low sulfur or ultra low sulfur petroleum based diesel. This is commonly marketed as B5 blended diesel fuel.

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2063-0807

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2103-0508

Biodiesel Blend Fuel

Biodiesel blend fuel has unique qualities that should be considered before using in this machine:

- Cold weather conditions can lead to plugged fuel system components and hard starting.
- Biodiesel blend fuel is an excellent medium for microbial growth and contamination which can cause corrosion and plugging of fuel system components.
- Use of biodiesel blend fuel may result in premature failure of fuel system components, such as plugged fuel filters and deteriorated fuel lines.
- Shorter maintenance intervals may be required, such as cleaning the fuel system and replacing fuel filters and fuel lines.
- Using biodiesel blended fuels containing more than five percent biodiesel can affect engine life and cause deterioration of hoses, tubelines, injectors, injector pump and seals.

Apply the following guidelines if biodiesel blend fuel is used:

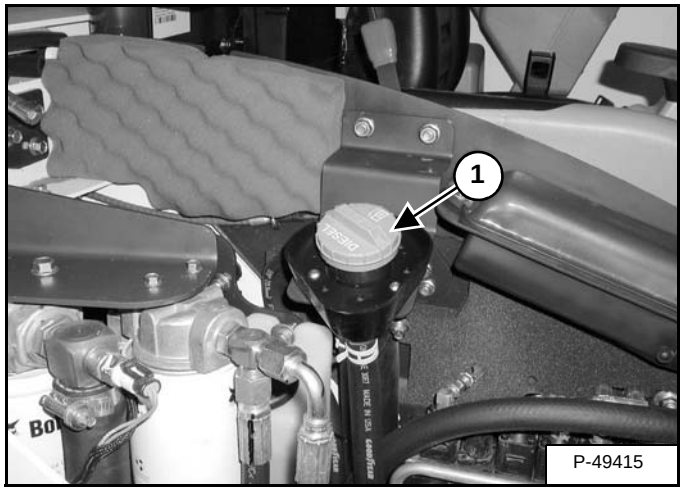
- Ensure the fuel tank is as full as possible at all times to prevent moisture from collecting in the fuel tank.
- Ensure that the fuel tank cap is securely tightened.
- Biodiesel blend fuel can damage painted surfaces, remove all spilled fuel from painted surfaces immediately.
- Drain all water from the fuel filter daily before operating the machine.
- Do not exceed engine oil change interval. Extended oil change intervals can cause engine damage.
- Before vehicle storage; drain the fuel tank, refill with 100% petroleum diesel fuel, add fuel stabilizer and run the engine for at least 30 minutes.

NOTE: Biodiesel blend fuel does not have long term stability and should not be stored for more than three months.

Filling The Fuel Tank

Open the right side cover.

Figure 10-80-1



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

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

Install and tighten the fuel fill cap.

Clean up any spilled fuel.

⚠ WARNING

AVOID INJURY OR DEATH

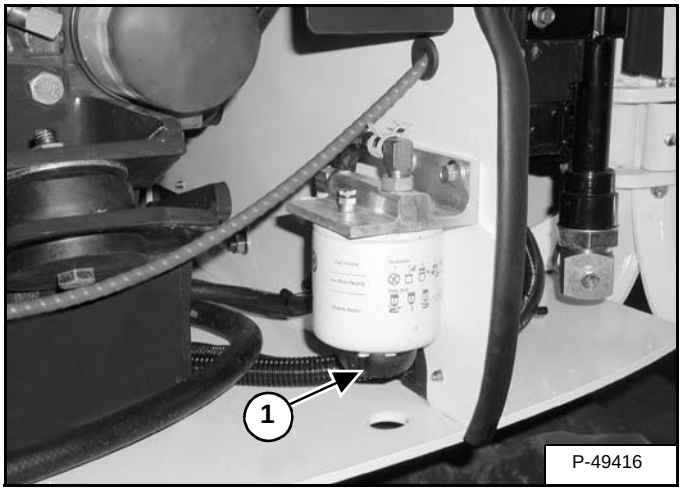
Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

Removing Water From The Fuel Filter

Open the tailgate.

Figure 10-80-2



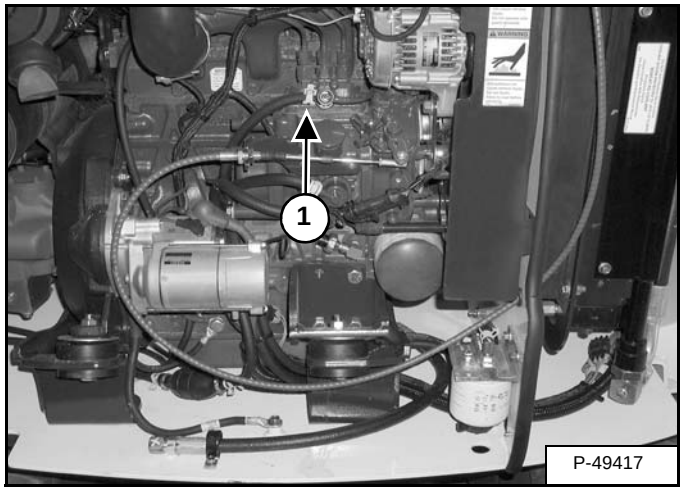
Loosen the drain (Item 1) **[Figure 10-80-2]** at the bottom of the filter to drain water from the filter.

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

Draining The Fuel Tank

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

Figure 10-80-3



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

Drain the fuel into a container.

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

⚠ WARNING

AVOID INJURY OR DEATH

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

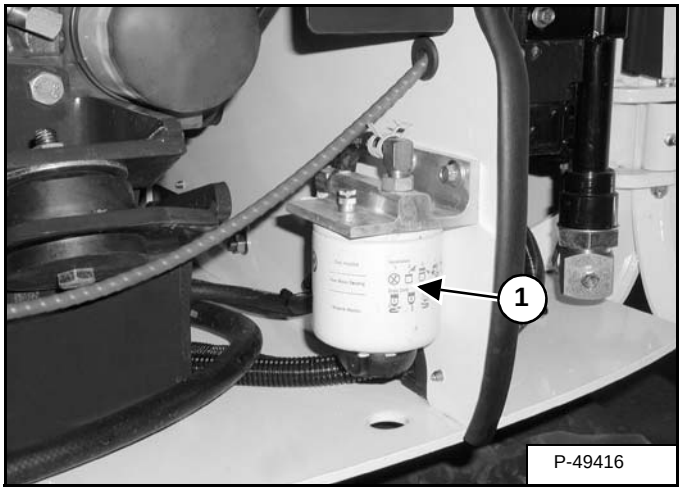
W-2072-0807

FUEL SYSTEM (CONT'D)

Fuel Filter

See the Service Schedule for the service interval when to replace the fuel filter. (See Chart on Page 10-50-1.)

Figure 10-80-4



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

Clean the area around the filter housing.

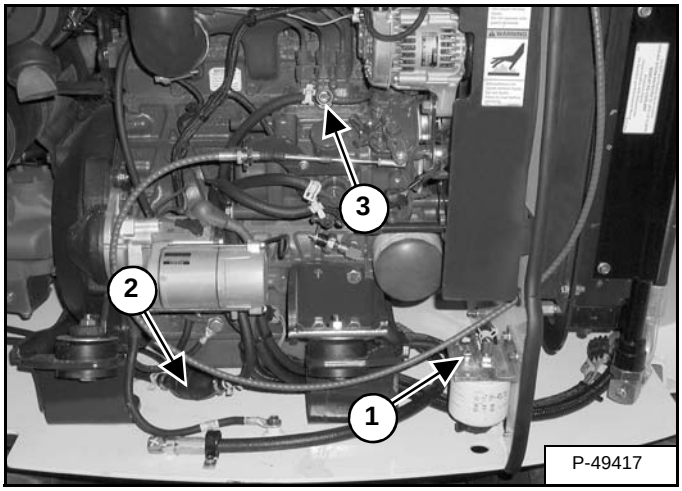
Put oil on the seal of the new filter.

Install the fuel filter, and hand tighten.

Removing Air From The Fuel System

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

Figure 10-80-5



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

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

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

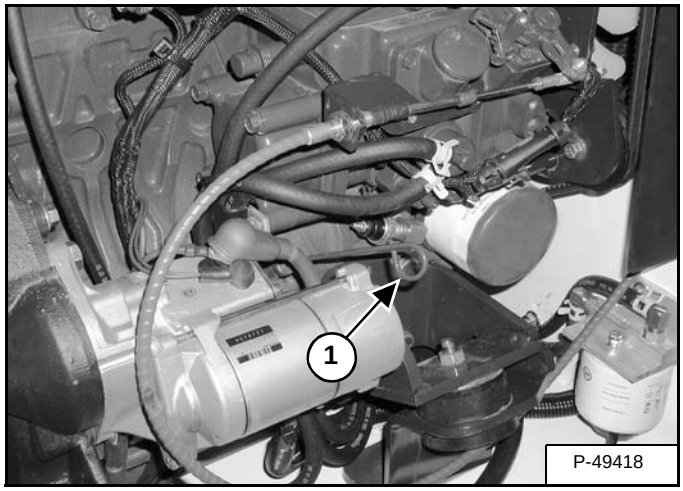
Start the engine. It may be necessary to open the vent (Item 3) **[Figure 10-80-5]** (at the fuel injection pump) briefly until the engine runs smoothly.

ENGINE LUBRICATION SYSTEM

Checking Engine Oil

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

Figure 10-90-1

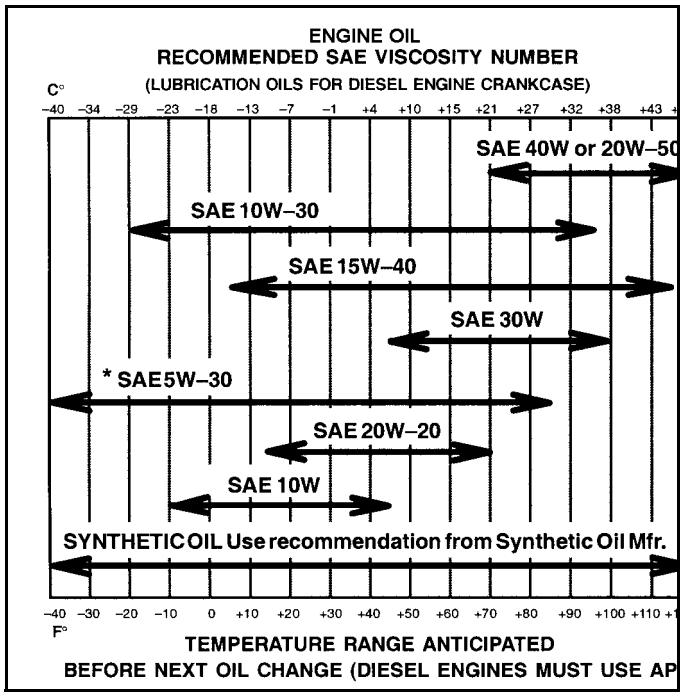


Open the tailgate and remove the dipstick (Item 1) **[Figure 10-90-1]**.

Keep the oil level between the marks on the dipstick.

Oil Chart

Figure 10-90-2



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

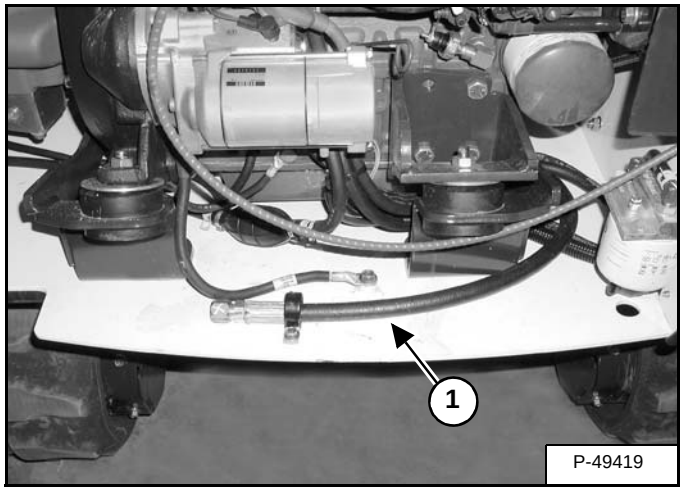
Replacing Oil And Filter

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

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

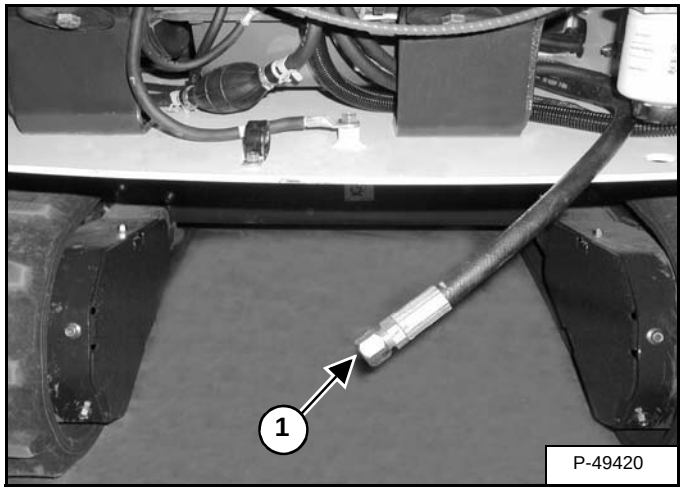
Open the tailgate.

Figure 10-90-3



Route the drain hose (Item 1) **[Figure 10-90-3]** out the tailgate.

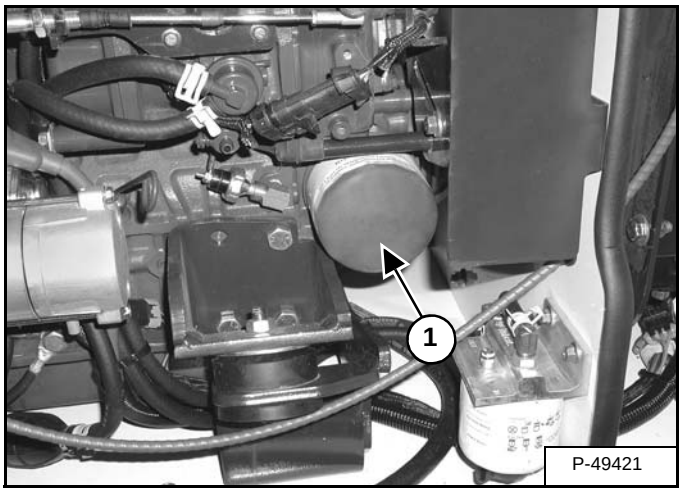
Figure 10-90-4



Remove the cap (Item 1) **[Figure 10-90-4]**. Drain the oil into a container.

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

Figure 10-90-5

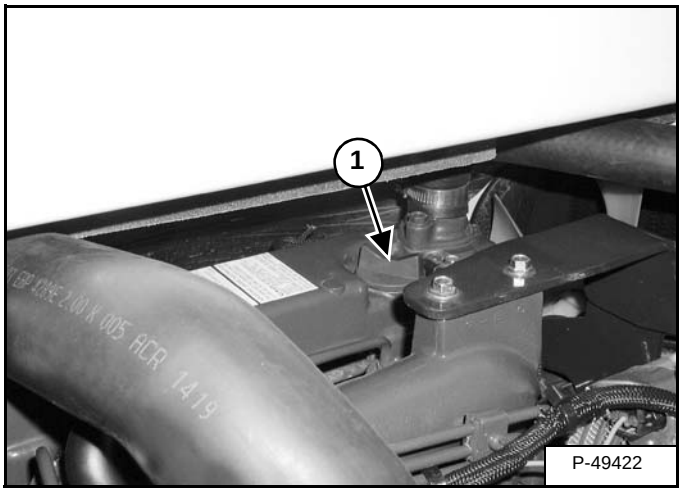


Remove the oil filter (Item 1) **[Figure 10-90-5]** and clean the filter housing surface.

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

Install and tighten the oil cap.

Figure 10-90-6



Remove the fill cap (Item 1) **[Figure 10-90-6]**.

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.

HYDRAULIC SYSTEM

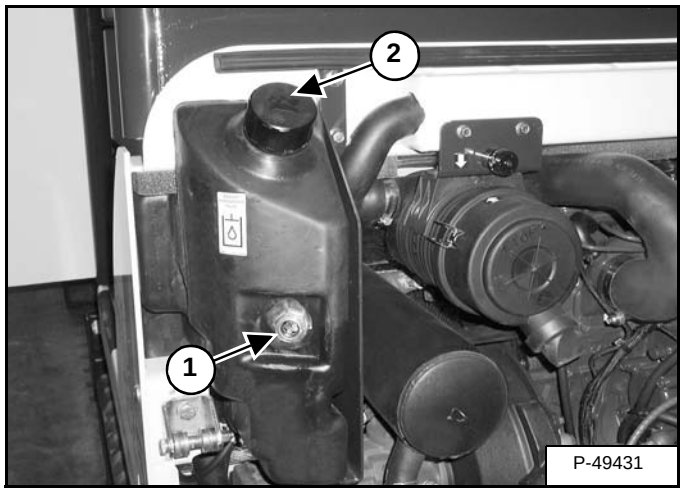
Checking And Adding Hydraulic Oil

Put the machine on a flat level surface.

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

Open the tailgate.

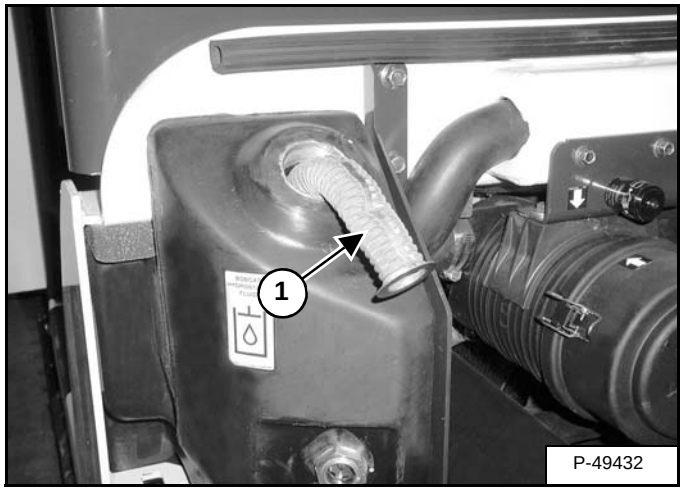
Figure 10-100-1



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

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

Figure 10-100-2



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

Be sure the screen is installed before adding fluid.

Add the correct fluid to the reservoir until it is visible in the sight gauge. (See Chart on Page SPEC-60-1)

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

Install the cap.

Close the tailgate.

Replacing The Hydraulic Oil

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

⚠ WARNING

AVOID INJURY OR DEATH

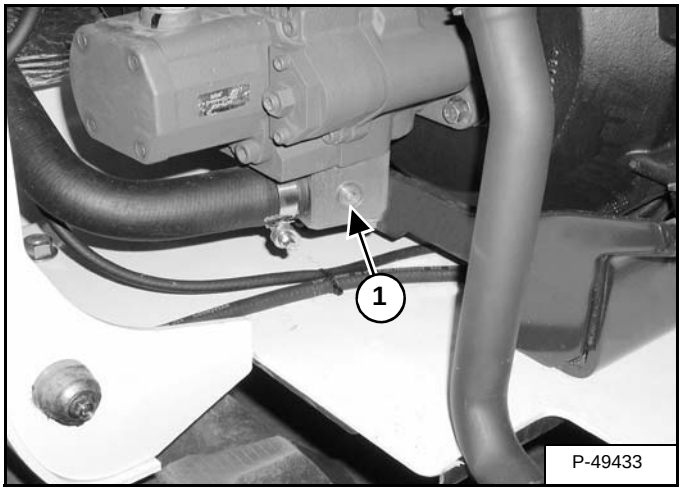
Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical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

W-2072-0807

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

Open the tailgate.

Figure 10-100-3



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

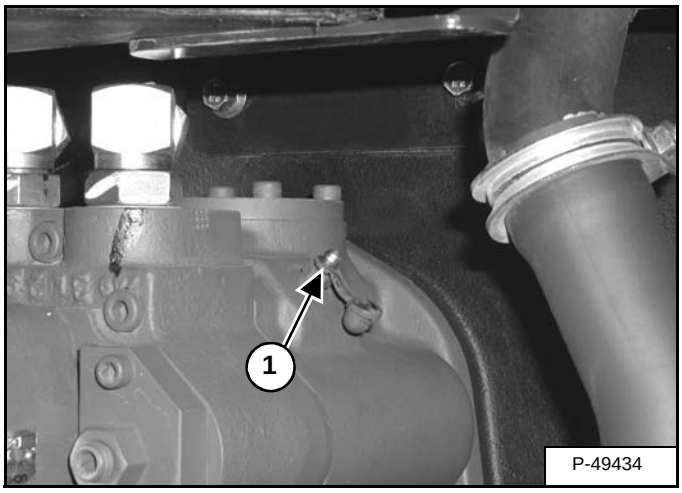
Drain the fluid into a container.

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

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

Add the correct fluid to the reservoir until it is visible in the sight gauge. (See Chart on Page SPEC-60-1)

Figure 10-100-4



Open the bleed valve (Item 1) **[Figure 10-100-4]** on the hydraulic pump. Close the valve after a steady stream of hydraulic fluid free of any air bubbles drains from the valve. Tighten the bleed valve.

DO NOT RUN THE MACHINE WITH THE BLEED VALVE OPEN.

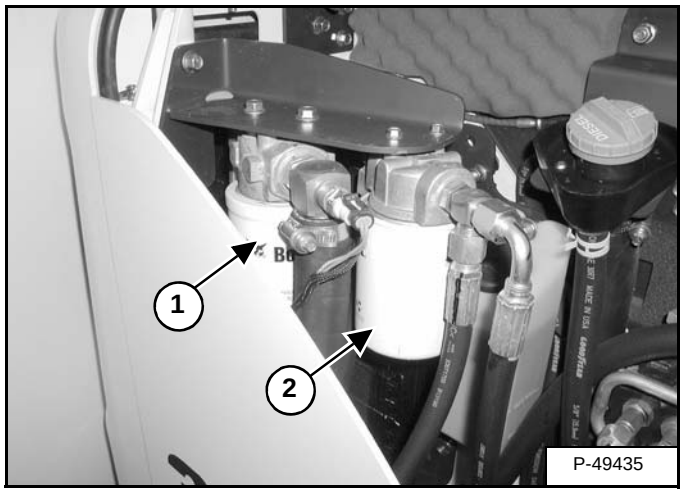
Run the machine through the hydraulic functions. Stop the engine. Check the fluid level and add as needed.

Replacing The Hydraulic Filter

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

Open the right side cover.

Figure 10-100-5



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

Clean the housing where the filter gasket makes contact.

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

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2103-0508

Replacing The Case Drain Filter

Open the tailgate.

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

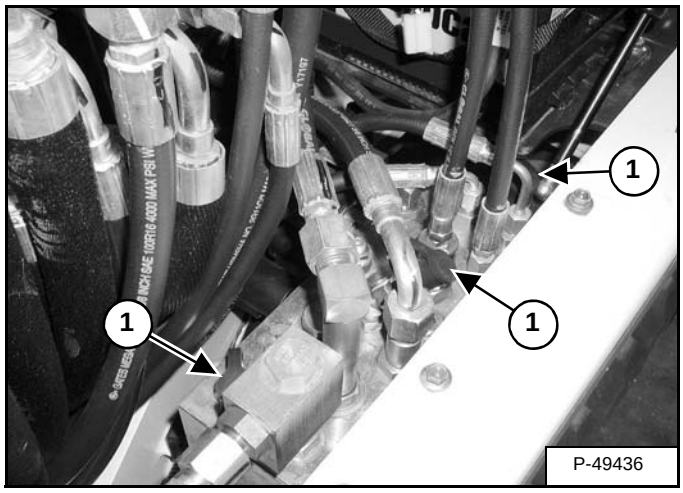
Clean the housing where the filter gasket makes contact.

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

Diagnostic Couplers

Open the right side cover and tailgate.

Figure 10-100-6



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

The couplers can be used to check circuit pressures.


Bobcat®

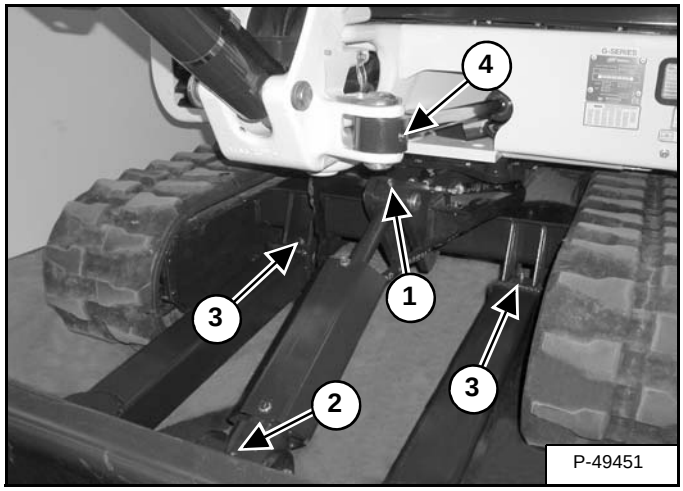
LUBRICATION OF THE HYDRAULIC EXCAVATOR

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

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

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

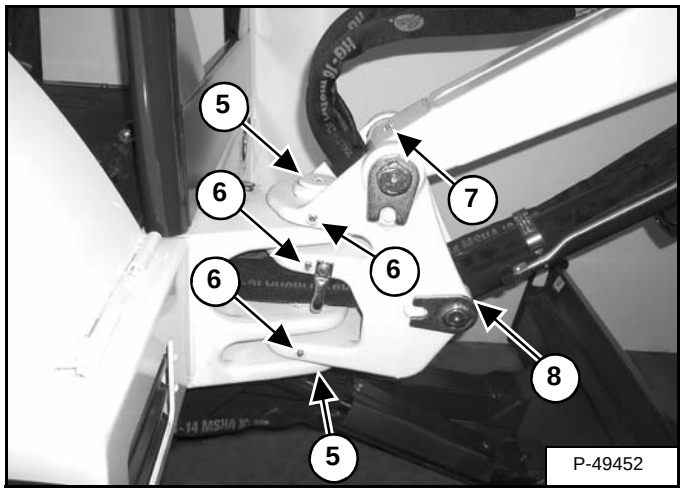
Figure 10-110-1



Ref Description (# of Fittings)

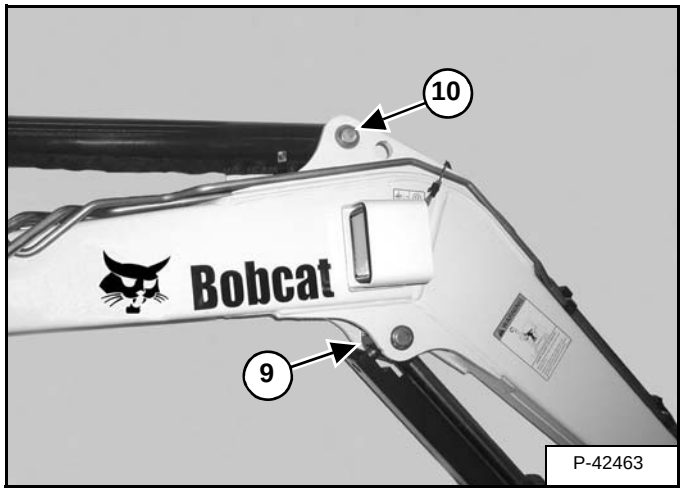
1. Blade Cylinder Rod End (1) **[Figure 10-110-1]**
2. Blade Cylinder Base End (1) **[Figure 10-110-1]**
3. Blade Pivots (2) **[Figure 10-110-1]**
4. Boom Swing Cylinder Rod End (1) **[Figure 10-110-1]**

Figure 10-110-2



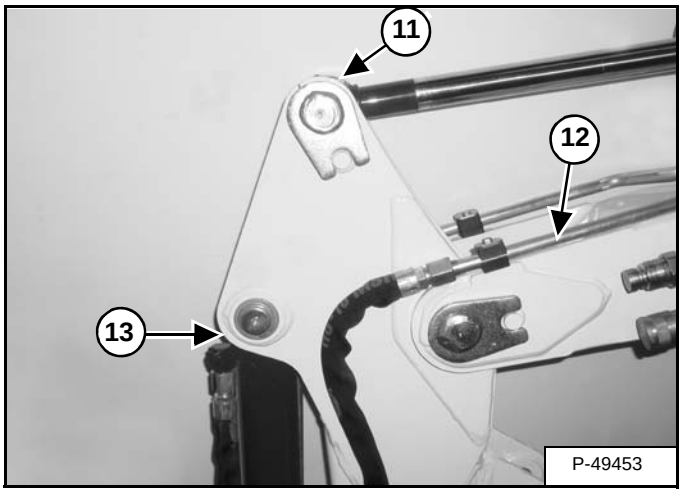
5. Boom Swing Pin (2) **[Figure 10-110-2]**
6. Boom Swing Pivot (3) **[Figure 10-110-2]**
7. Boom Pivot (1) **[Figure 10-110-2]**
8. Boom Cylinder Base End (1) **[Figure 10-110-2]**

Figure 10-110-3



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

Figure 10-110-4

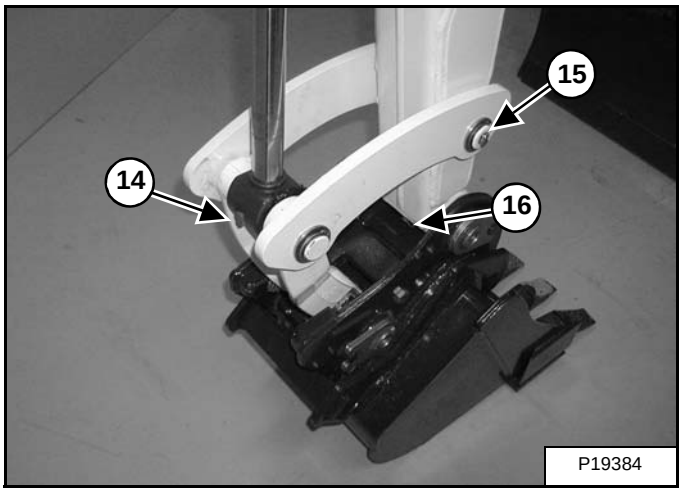


11. Arm Cylinder Rod End (1) **[Figure 10-110-4]**

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

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

Figure 10-110-5

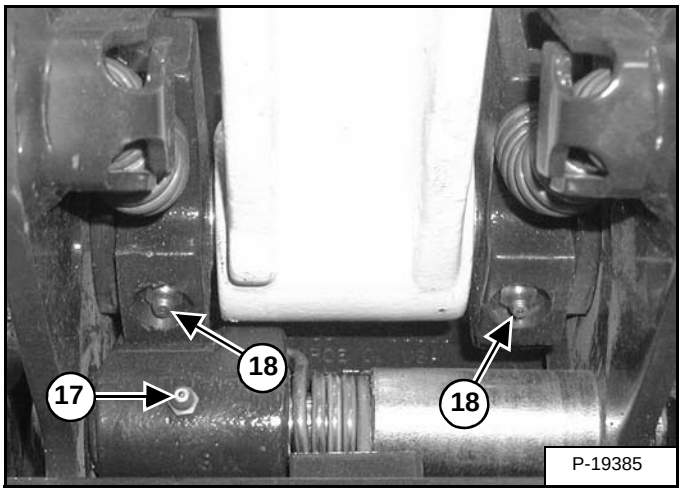


14. Bucket Cylinder Rod End (1) **[Figure 10-110-5]**

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

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

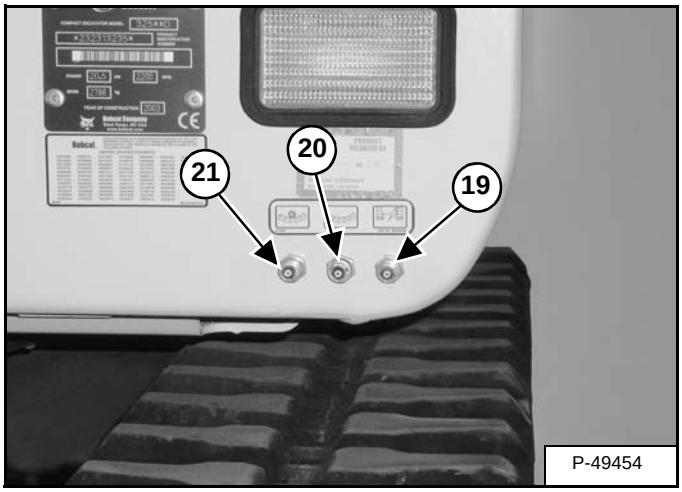
Figure 10-110-6



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

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

Figure 10-110-7



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

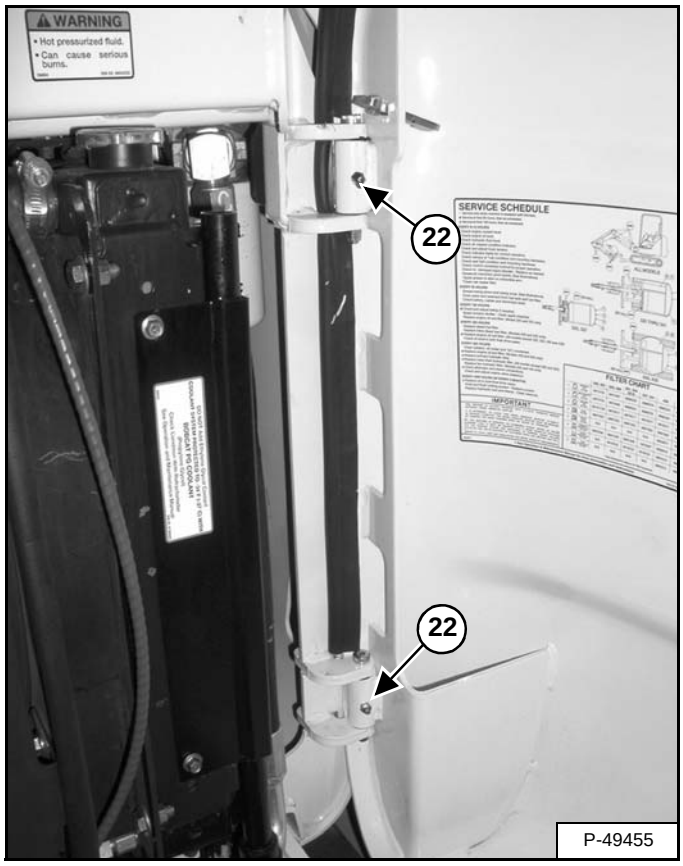
Lubricate the following locations on the hydraulic excavator **EVERY 50 HOURS**:

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

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

(Install 3 - 4 pumps of grease then rotate the upperstructure 90°. Install 3 - 4 pumps of grease and again rotate the upperstructure 90°. Repeat this until the swing pinion has been greased at four positions.)

Figure 10-110-8



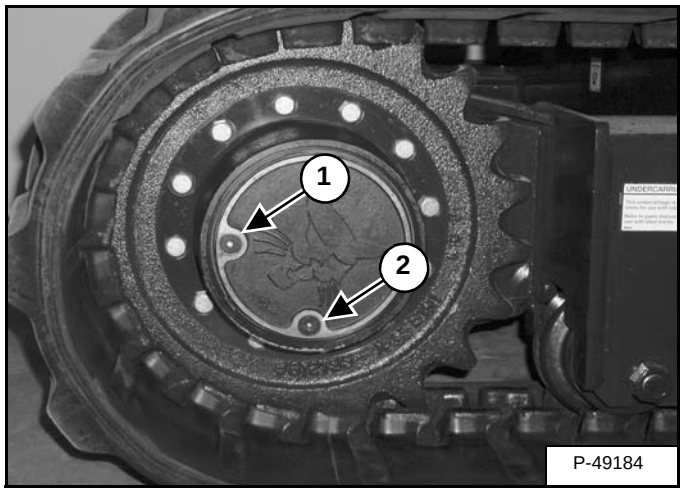
22. Tailgate Hinge (2) **[Figure 10-110-8]**


Bobcat®

TRAVEL MOTOR

Checking Oil Level

Figure 10-120-1



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

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

Add lubricant through the hole if the lube level is low. (See Chart on Page SPEC-60-1.)

Draining The Travel Motor

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

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

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2103-0508

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

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


Bobcat®

SPARK ARRESTOR MUFFLER

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

Do not operate the excavator with a defective exhaust system.

IMPORTANT

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

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

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

I-2061-0195

⚠ WARNING

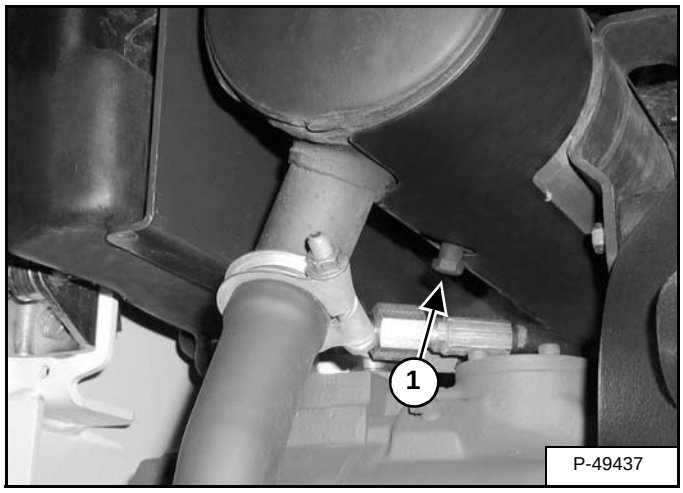
When the engine is running during service, the steering levers must be in neutral.

Failure to do so can cause injury or death.

W-2203-0595

Stop the engine. Open the tailgate.

Figure 10-130-1



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

Start the engine and run for about ten seconds while a second person, wearing safety glasses, holds a piece of wood over the outlet of the muffler. The carbon deposits will be forced out of the muffler plug hole (Item 1) **[Figure 10-130-1]**.

Stop the engine. Install and tighten the plug.

Close the tailgate.

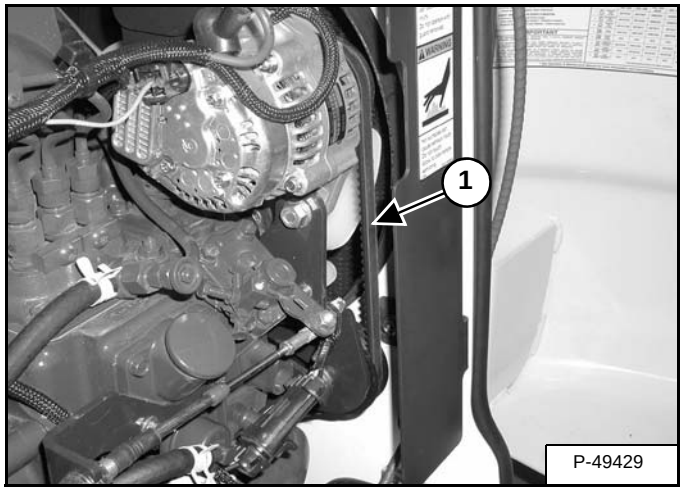

Bobcat®

ENGINE ACCESSORY DRIVE BELT

Belt Tension

Open the tailgate.

Figure 10-140-1



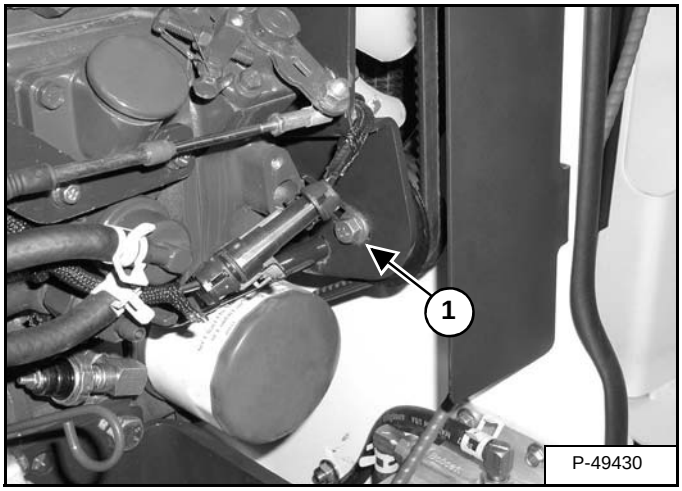
Using a belt tension gauge, measure the belt tension midway between the crankshaft pulley and alternator pulley (Item 1) **[Figure 10-140-1]**.

The tension is as follows:

New belt 56 - 60 (76 - 81 N•m)
Used belt 48 - 52 (65 - 71 N•m)

Belt Adjustment

Figure 10-140-2



Loosen the belt tensioner bolt (Item 1) **[Figure 10-140-2]** and move the tensioner away from the engine until the belt tension is correct.

Tighten the bolt to 15 - 18 ft.-lb. (20 - 25 N•m) torque.


Bobcat®

SEAT BELT

Inspection And Maintenance

⚠ WARNING

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

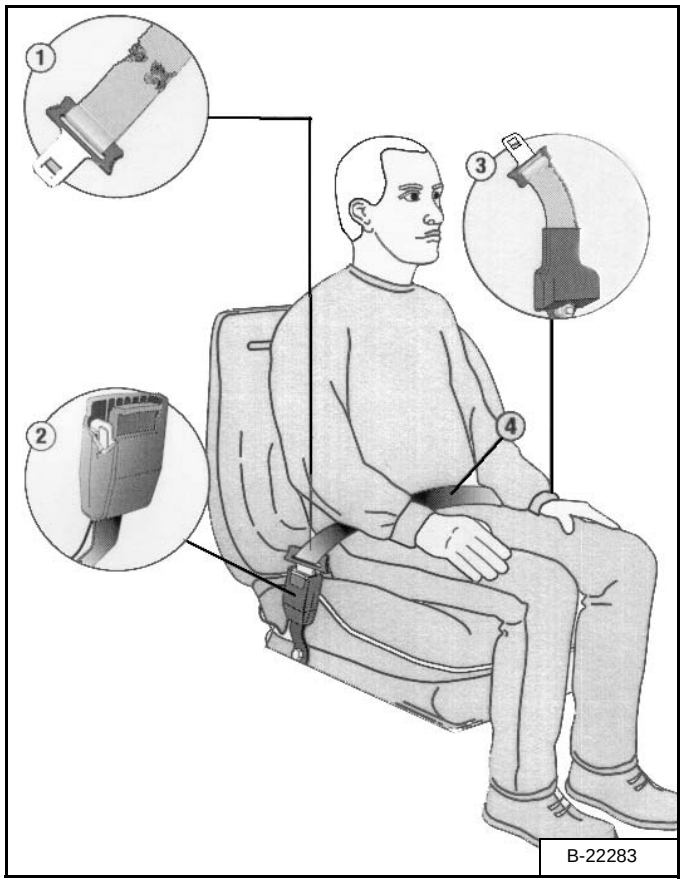
W-2466-0703

Check the seat belt daily for correct function.

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

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

Figure 10-150-1



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

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

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

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

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

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


Bobcat®

MOTION ALARM SYSTEM (IF EQUIPPED)

Description

This excavator may be equipped with a motion alarm system. The motion alarm will sound when the operator moves the travel control levers in the either the forward or reverse direction

Figure 10-160-1

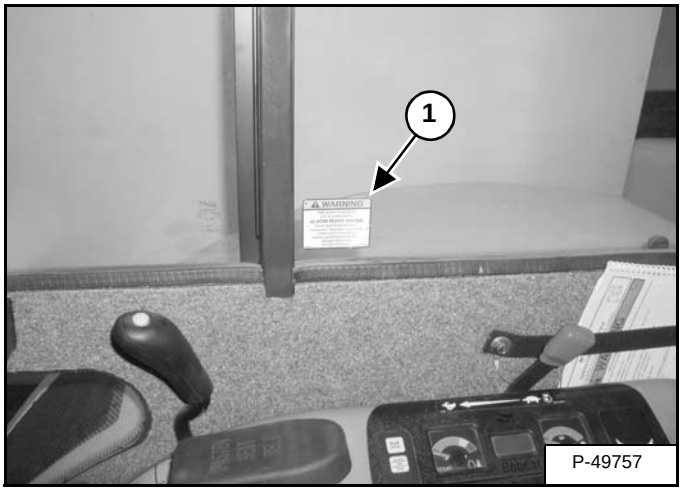
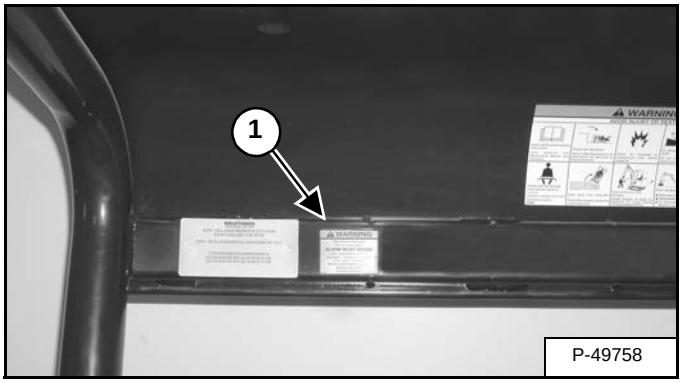


Figure 10-160-2



Inspect for damaged or missing motion alarm decal (Item 1) **[Figure 10-160-1]** (cab machine) or (Item 1) **[Figure 10-160-2]** (canopy machine). Replace if required.

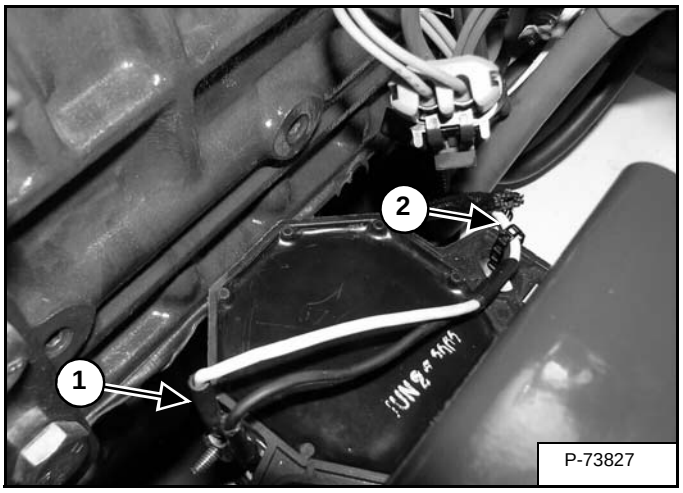
Sit in the operator's seat. Turn excavator key to ON position but do not start the engine.

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

Turn excavator key to OFF position.

The motion alarm is mounted to the bottom rear of the excavator at the louver opening. (The louver must be removed to access the back-up alarm. See the Service Manual for the correct procedure.)

Figure 10-160-3



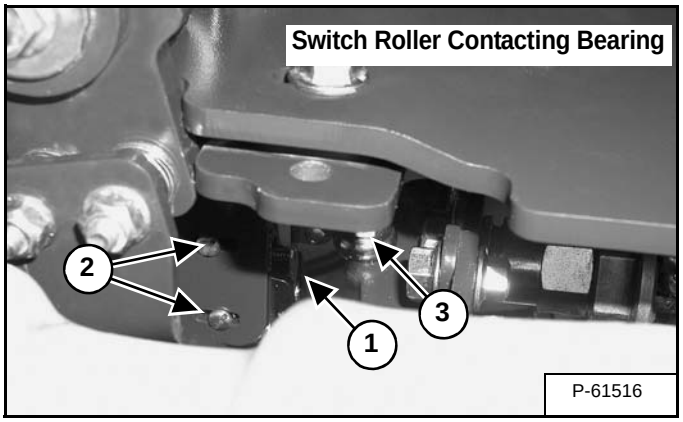
Inspect the motion alarm electrical connections (Item 1) **[Figure 10-160-3]**, wire harness (Item 2) **[Figure 10-160-3]** and motion alarm switches (Item 1) **[Figure 10-160-4]** for tightness and damage. Repair or replace any damaged components.

If the motion alarm switch requires adjustment, see information below.

Adjusting Switch Position

Stop the engine. Remove the floormat and floor plate. (See Service Manual for procedure for floormat and floor plate removal.)

Figure 10-160-4



Loosen the screws (Item 2) **[Figure 10-160-4]** securing the motion alarm switch.

Position the motion alarm switch roller (Item 1) so that it makes contact with bearing (Item 3) until it opens the switch circuit. (Listen for the click of the switch.) Torque the screws (Item 2) **[Figure 10-160-4]** securing the switch to the bracket to 14 - 19 in.-lb. (1,6 - 2,1 N•m).


Bobcat®

HYDRAULIC SYSTEM

ARM CYLINDER 20-21-1
- Assembly 20-21-8
- Disassembly. 20-21-6
- Parts Identification 20-21-5
- Removal And Installation 20-21-3
- Testing 20-21-1

BLADE CYLINDER 20-24-1
- Assembly 20-24-7
- Disassembly. 20-24-5
- Parts Identification 20-24-4
- Removal And Installation 20-24-3
- Testing 20-24-1

BOOM CYLINDER 20-20-1
- Assembly 20-20-10
- Disassembly. 20-20-8
- Parts Identification 20-20-7
- Removal And Installation 20-20-4
- Testing 20-20-1

BOOM SWING CYLINDER 20-22-1
- Assembly 20-22-8
- Disassembly. 20-22-6
- Parts Identification 20-22-5
- Removal And Installation 20-22-3
- Testing 20-22-1

BUCKET CYLINDER. 20-23-1
- Assembly 20-23-7
- Disassembly. 20-23-5
- Parts Identification 20-23-4
- Removal And Installation 20-23-3
- Testing 20-23-1

BUILD UP VALVE 20-160-1
- Description 20-160-1
- Disassembly And Assembly. 20-160-3
- Parts Identification 20-160-2
- Removal And Installation 20-160-1

CASE DRAIN FILTER 20-170-1
- Removal And Installation 20-170-1

Continued On Next Page

HYDRAULIC SYSTEM (CONT'D)

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- Disassembly 20-25-4
- Parts Identification 20-25-3
- Removal And Installation 20-25-2
- Testing 20-25-1

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- Assembly 20-100-4
- Disassembly 20-100-3
- Parts Identification 20-100-2
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- Testing And Adjusting The Port Relief Valves 20-32-1

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- Disassembly And Assembly 20-150-2
- Removal And Installation 20-150-1

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- Arm Valve Section Disassembly And Assembly 20-40-34
- Assembly 20-40-59
- Auxiliary Valve Section Disassembly And Assembly 20-40-42
- Blade Valve Section Disassembly And Assembly 20-40-50
- Boom Swing Valve Section Disassembly And Assembly 20-40-18
- Boom Valve Section Disassembly And Assembly 20-40-25
- Boost Valve Section Disassembly And Assembly 20-40-46
- Bucket Valve Section Disassembly And Assembly 20-40-38
- Control Valve Identification 20-40-9
- Description 20-40-1
- Disassembly 20-40-10
- Left Travel Valve Section Disassembly And Assembly 20-40-29
- Removal And Installation 20-40-1
- Right Travel Valve Section Disassembly And Assembly 20-40-12
- Slew Valve Section Disassembly And Assembly 20-40-55

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

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HYDRAULIC SYSTEM (CONT'D)

HYDRAULIC PUMP 20-50-1
- Coupler Removal And Installation 20-50-9
- Description 20-50-1
- Disassembly 20-50-13
- Gear Pump Assembly 20-50-17
- Gear Pump Disassembly 20-50-14
- Gear Pump Parts Identification 20-50-11
- Hydraulic Pump Start Up 20-50-10
- Piston Pump Assembly 20-50-26
- Piston Pump Disassembly 20-50-20
- Piston Pump Parts Identification 20-50-12
- Removal And Installation 20-50-8
- Testing Auxiliary Hydraulic Flow 20-50-7
- Testing The Gear Pump 20-50-5
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- Torque Adjustment 20-50-2

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- Troubleshooting The Cylinder Circuit 20-10-5
- Troubleshooting The Hydraulic Circuit 20-10-4
- Troubleshooting The Swing (Upperstructure Slew) Circuit 20-10-6
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- Assembly 20-111-13
- Disassembly 20-111-8
- Handle Removal And Installation 20-111-2
- Joystick Assembly Removal And Installation 20-111-5
- Parts Identification 20-111-7
- Testing 20-111-1

MAIN RELIEF VALVES 20-30-1
- Testing And Adjusting The Main Relief Valves 20-30-1

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- Assembly 20-60-17
- Description 20-60-1
- Disassembly 20-60-6
- Parts Identification 20-60-5
- Removal And Installation 20-60-1

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Removal And Installation 20-140-1

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Testing And Adjusting The Port Relief Valves 20-31-1

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

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Assembly 20-110-15
Disassembly 20-110-10
Handle Removal And Installation 20-110-2
Joystick Assembly, Removal And Installation 20-110-6
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SLEW LOCK VALVE 20-220-1
Description 20-220-1
Disassembly And Assembly 20-220-3
Parts Identification 20-220-2
Removal And Installation 20-220-1

SWING MOTOR DRIVE CARRIER 20-220-1
Assembly 20-220-5
Disassembly 20-220-3
Parts Identification 20-220-2
Removal And Installation 20-220-1

SWIVEL JOINT 20-80-1
Assembly 20-80-5
Description 20-80-1
Disassembly 20-80-4
Parts Identification 20-80-3
Removal And Installation 20-80-1

TRAVEL MOTOR 20-70-1
Assembly 20-70-11
Disassembly 20-70-3
Parts Identification 20-70-2
Removal And Installation 20-70-1

TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION SPEC-01) UNLESS OTHERWISE SPECIFIED.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE AND STANDARD ITEMS MAY VARY.

HYDRAULIC/HYDROSTATIC SCHEMATIC
325 (S/N AAC511001 AND ABOVE)
(S/N A9K011001 AND ABOVE)
328 (S/N A9K111001 AND ABOVE)

(PRINTED MAY 2009
V-0978legend

LEGEND

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

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

(3) SOLENOID VALVE - SYSTEM BY-PASS

(4) MAIN RELIEF VALVE
3800 PSI (262 Bar)

(5) AUXILIARY SELECTOR VALVE (Option)

(6) HYDRAULIC FILTER ELEMENT
15 Micron

(7) FILTER BY-PASS 50 PSI (3,5 Bar)

(8) SWING MOTOR CROSS PORT RELIEF
VALVE . . . . . 1700 PSI (117 Bar)
When Tested 2450 PSI (169 Bar)

(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)
3335 PSI (230 Bar)

(14) PORT RELIEF VALVE
Boom Cylinder (Base End)
3335 PSI (230 Bar)

(15) PORT RELIEF VALVE
Bucket Cylinder (Rod End)
3335 PSI (230 Bar)

(16) PORT RELIEF VALVE
Bucket Cylinder (Base End)
2900 PSI (200 Bar)

(17) PORT RELIEF VALVE
Arm Cylinder (Base End)
2900 PSI (200 Bar)

(18) PORT RELIEF VALVE
Arm Cylinder (Rod End)
2900 PSI (200 Bar)

(19) LOAD CHECK VALVE
Boom Swing Cylinder

(20) PRESSURE REDUCING VALVE
435 PSI (30 Bar)

(21) ACCUMULATOR
165 PSI (11,4 Bar)

(22) PORT RELIEF VALVE
Blade Cylinder (Base End)
3335 PSI (230 Bar)

(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 (1,38 Bar)

(29) MAIN RELIEF VALVE 2650 PSI (183 Bar)

(30) MAIN RELIEF VALVE 2900 PSI (200 Bar)

(31) BUILD-UP VALVE 150 PSI (10,34 Bar)

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

(33) RELIEF VALVE - Boost 2540 PSI (175 Bar)

(34) PORT RELIEF VALVE (OPTIONAL)
Auxiliary (Male Coupler)
2900 PSI (200 Bar)

(35) PORT RELIEF VALVE (OPTIONAL)
Auxiliary (Female Coupler)
2900 PSI (200 Bar)

(36) PILOT ACTIVATED DIRECTIONAL
CONTROL VALVE – Slew Lock Valve
(Used on S/N A9K011121 & Above ONLY
S/N A9K111122 & Above ONLY)

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

Printed in U.S.A.

HYDRAULIC/HYDROSTATIC SCHEMATIC
325 (S/N AAC511001 AND ABOVE)
(S/N A9K011001 AND ABOVE)
328 (S/N A9K111001 AND ABOVE)

(PRINTED MAY 2009)
V-0978

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) 5

MALE (RETURN)

FEMALE (PRESSURE)

RH TRAVEL 29

BOOM SWING 19

BOOM 14 13

LH TRAVEL

ARM 18 17

BUCKET 15 16

AUX 34 35 30 33

BOOST

BLADE 22

SLEW

P1 P2 P3 T1 T2

US OPTION
ISO/STD CONVERTER
(ISO SHOWN)

L3 ISO L1 ISO L2 ISO R1 ISO R4 ISO R2 ISO R3 ISO FRONT BACK

RH JOYSTICK

LH JOYSTICK

RIGHT FRONT REAR LEFT P T

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

A1 A2 A3 S1 HYDRAULIC PUMP 9

2 PRESSURIZED BREATHER 1

OIL COOLER

MAIN FILTER WITH BY-PASS 7 6

J2 J1 36 A A1 B B1 SLEW LOCK VALVE
(S/N A9K011121 & Above
& S/N A9K111122 & Above ONLY)

SLEW MOTOR 8 TOP BOTTOM 8 24

CASE DRAIN FILTER WITH BY-PASS 28 25

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

V-0978 (5/6/09)

Glossary Of Hydraulic/Hydrostatic Symbols For Excavators

GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

SYMBOL DESCRIPTION

FLOW LINES and CONNECTIONS

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

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

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

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

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

CONNECTED JUNCTION OF OIL LINES (Flow Line Connection)

OIL LINES CROSSING (NOT Connected)

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

SYMBOL DESCRIPTION

BASIC and MISCELLANEOUS SYMBOLS

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

VARIABLE ADJUSTMENT RESTRICTION – Regulated or Variable Restriction

TEMPERATURE CONTROL – (indication of temperature)

TEMPERATURE INDICATOR – (temperature measurement – thermometer)

FILTER (strainer or screen) – For fluid conditioning

VENTED AND FILTERED RESERVOIR (reservoir open to atmosphere)

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

PRESSURE SENSOR – Varies electric signal with pressure

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

PRESSURE SWITCH – Switch activates when pressure reaches specified level

MUFFLER (silencer) – Reduces noise

MS-1892-1

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

GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

SYMBOL DESCRIPTION

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



DOUBLE ACTING HYDRAULIC CYLINDER, UNEQUAL DISPLACEMENT – With single piston rod



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

PUMP: To convert mechanical energy into hydraulic energy



FIXED CAPACITY DISPLACEMENT HYDRAULIC PUMP – With one direction of flow



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

MOTOR: To convert hydraulic energy into rotary mechanical energy



FIXED CAPACITY DISPLACEMENT BIDIRECTIONAL HYDRAULIC MOTOR – With two directions of flow (bidirectional)

SYMBOL DESCRIPTION

CONTROL MECHANISMS



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



CONTROL VALVE ACTIVATED BY A PULL BUTTON (manual)



CONTROL VALVE ACTIVATED BY A PUSH–PULL BUTTON (manual)



CONTROL VALVE ACTIVATED BY A LEVER (manual)



CONTROL VALVE ACTIVATED BY A PEDAL (manual)



CONTROL VALVE WITH SPRING RETURN (mechanical)



CONTROL VALVE ACTIVATED BY AN ELECTRIC SOLENOID (electrical)



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

MC-1892-2

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

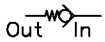
GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

SYMBOL DESCRIPTION

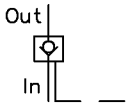
NON–RETURN VALVE, SHUTTLE VALVE: Valve which allows free flow in one direction only



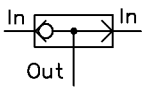
NON–RETURN VALVE (Check Valve) – Used as Replenishing Valve, Load Check Valve or Anticavitation Valve – Opens if the Inlet pressure is higher than the Outlet pressure. Often contains internal spring which has NO significant pressure value



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

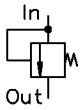


PILOT CONTROLLED NON–RETURN VALVE – It is possible to open the valve by pilot pressure

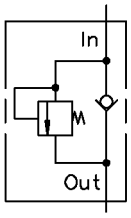


SHUTTLE VALVE – The Inlet port connected to the higher pressure is automatically connected to the Outlet port while the other Inlet port is closed

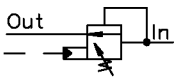
PRESSURE CONTROL VALVE: Valve ensuring the control of pressure



RELIEF VALVE – When the Inlet pressure overcomes the opposing force of the spring, the valve opens permitting flow from the Outlet port.



RELIEF/REPLENISHING VALVE or RELIEF/ANTICAVITATION VALVE – When the Inlet pressure overcomes the opposing force of the spring, the valve opens permitting flow from the Outlet port – Allows free flow in the opposite direction

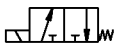


DUAL PRESSURE RELIEF VALVE – When the inlet pressure overcomes the opposing force of the spring, the valve opens permitting flow from the Outlet port. Pilot pressure provides a second pressure value.

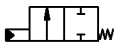
DIRECTIONAL CONTROL VALVE: Valve providing for the opening (fully or restricted) or the closing of one or more flow paths (represented by several squares)



TWO PORTS and CLOSED FLOW PATHS

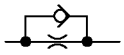


SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (Two Position) – controlled by an electric solenoid (with return spring)

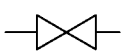


PILOT ACTIVATED DIRECTIONAL CONTROL VALVE (Two Position) – controlled by pressure (with return spring)

FLOW CONTROL VALVE: Valve controlling the flow in one or both directions



ONE WAY RESTRICTOR VALVE (Non–Return Valve with Restriction) – Unit allowing free flow in one direction but restricted flow in the other direction



TOW VALVE – Normally in closed position

MS-1892-3

Troubleshooting The Hydraulic Circuit

TROUBLESHOOTING THE HYDRAULIC CIRCUIT		
PROBLEM	**CAUSE**	**CORRECTION**
No hydraulic operation at one or more circuits	Hydraulic oil level low.	Refill with correct oil.
	Hydraulic pump drive coupling damaged.	Replace
	Hydraulic pump defective.	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).	

Troubleshooting The Cylinder Circuit

TROUBLESHOOTING THE CYLINDER CIRCUIT		
PROBLEM	**CAUSE**	**CORRECTION**
Cylinder inoperable.	Control console(s) raised.	Lower control console.
	Loose fittings or broken hoses.	Repair or replace.
	Lever linkage misadjusted.	Readjust
	Control console lockout switch.	Readjust or replace.
	Cylinder internal leakage excessive.	Repair or replace.
	Control lever (joystick) manifold solenoid coil defective.	Test, repair or replace.
	Control lever (joystick) manifold solenoid valve defective	Test, repair or replace.
	Control lever (joystick) manifold pressure reducing valve defective.	Test, repair or replace.
	Control lever (joystick) internal leakage excessive.	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.

Troubleshooting The Swing (Upperstructure Slew) Circuit

TROUBLESHOOTING THE SWING (UPPERSTRUCTURE SLEW) CIRCUIT		
PROBLEM	**CAUSE**	**CORRECTION**
Slew not operating.	Control console(s) raised.	Lower control console.
	Control console lockout switch defective.	Readjust or replace.
	Slew 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.
	Slew motor gear defective.	Repair or replace.
	Control lever (joystick) internal leakage	Repair or replace
	Slew motor defective.	Repair or replace.
Slew force.	Main relief valve set too low.	Readjust or replace.
	Slew motor relief valve pressure too low.	Readjust or replace.
Slew speed too 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.
	Slew motor internal leakage excessive.	Repair or replace.
Slew over run excessive.	Control valve spool sticking.	Repair or replace.
	Control lever (joystick) spool sticking.	Repair or replace.
	Slew motor relief valve set too low.	Repair or replace.
	Slew motor internal leakage excessive.	Repair or replace.

Troubleshooting The Travel Circuit

TROUBLESHOOTING THE TRAVEL CIRCUIT		
PROBLEM	**CAUSE**	**CORRECTION**
Travel system inoperable.	Lever linkage incorrectly adjusted.	Readjust.
	Track tension too tight.	Readjust.
	Defective pump.	Check, repair or replace.
	Travel motor 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.	Travel motor counterbalance valve leakage excessive.	Repair or replace.
	Hose damage.	Replace.
Blade drops while machine is moving.	Lever linkage misadjusted.	Readjust.
	Cylinder internal leakage excessive.	Repair or replace.
	Control valve internal leakage excessive.	Repair or replace.
	Swivel joint internal leakage from travel motor pressure circuit into blade cylinder circuit.	Repair or replace.


Bobcat®

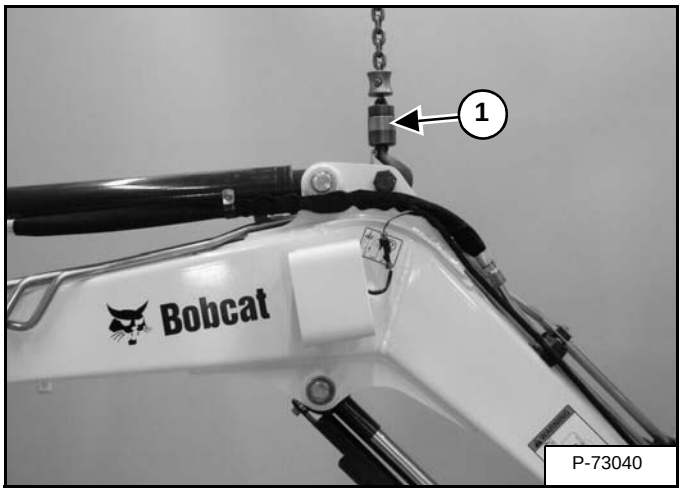
BOOM CYLINDER

Testing

Lower the boom/bucket and blade to the ground.

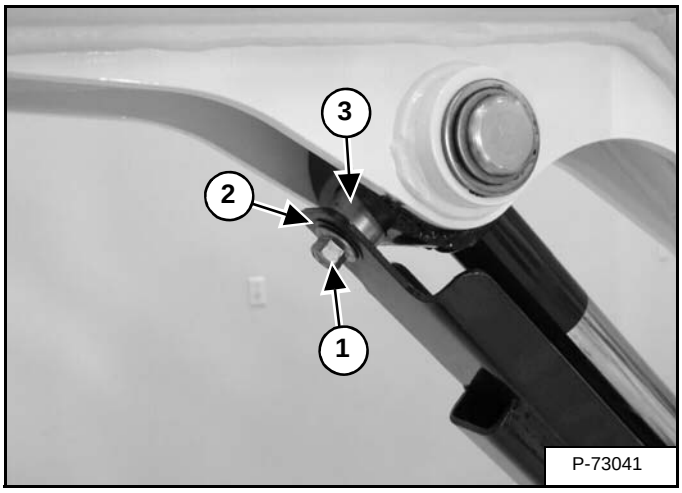
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-20-1



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

Figure 20-20-2



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

Figure 20-20-3

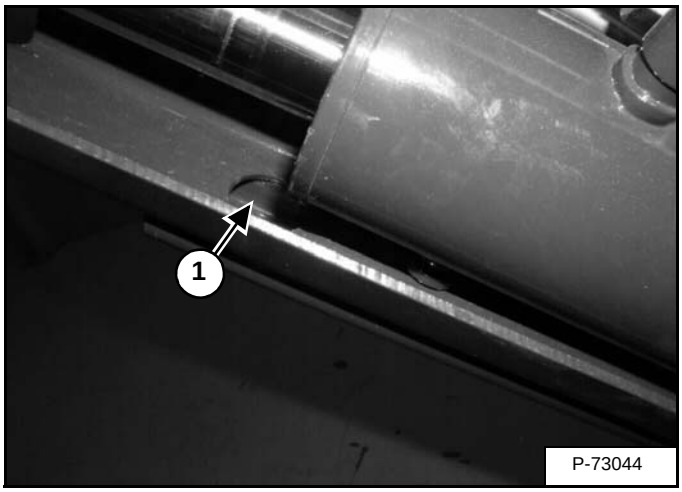
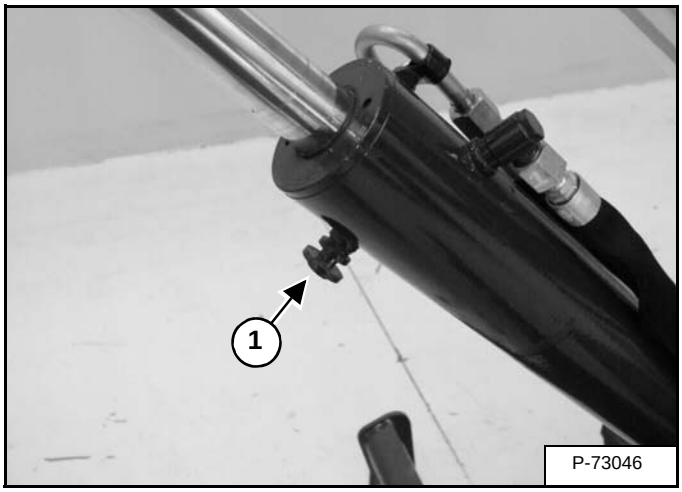


Figure 20-20-4



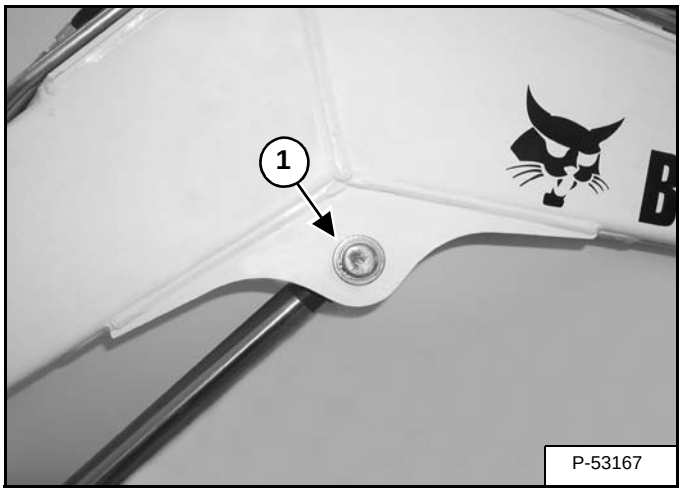
Slide the shield down until the keyhole (Item 1) **[Figure 20-20-3]** in the shield lines up with the mounting stud (Item 1) **[Figure 20-20-4]** on the cylinder.

Remove the shield.

BOOM CYLINDER (CONT'D)

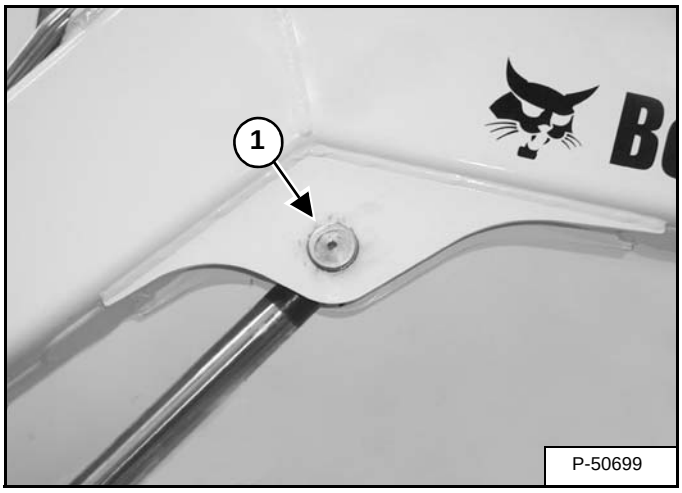
Testing (Cont'd)

Figure 20-20-5



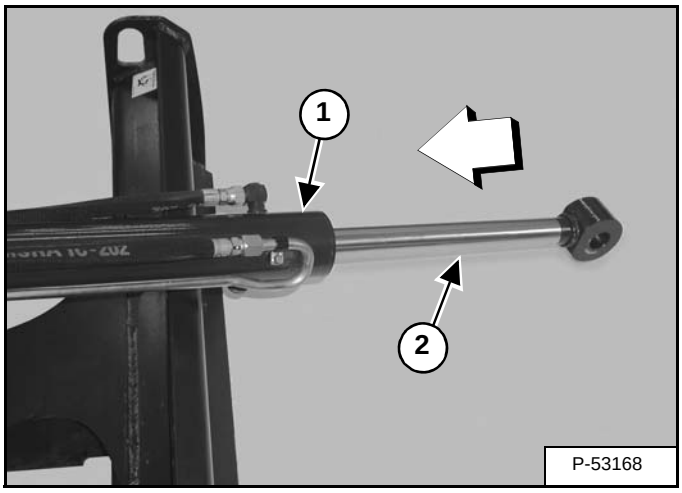
Remove the snap ring (Item 1) **[Figure 20-20-5]** and washer.

Figure 20-20-6



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

Figure 20-20-7



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

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

Stop the engine. Relieve hydraulic pressure.

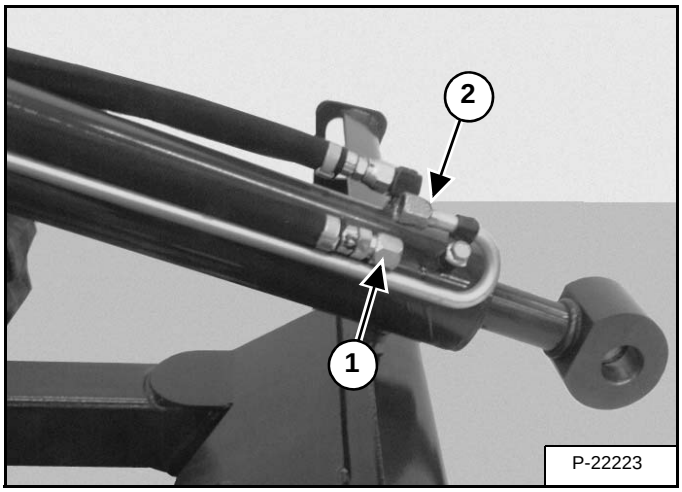
WARNING

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

W-2145-0290

Testing (Cont'd)

Figure 20-20-8



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

Start the engine and retract the boom cylinder.

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

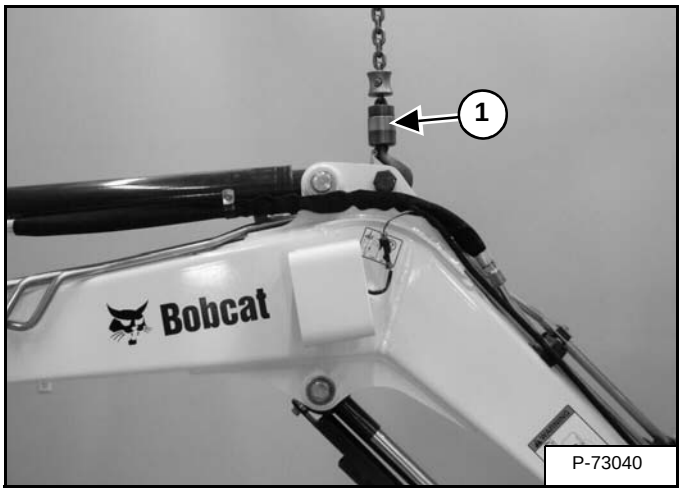
BOOM CYLINDER (CONT'D)

Removal And Installation

Lower the boom/bucket and blade to the ground.

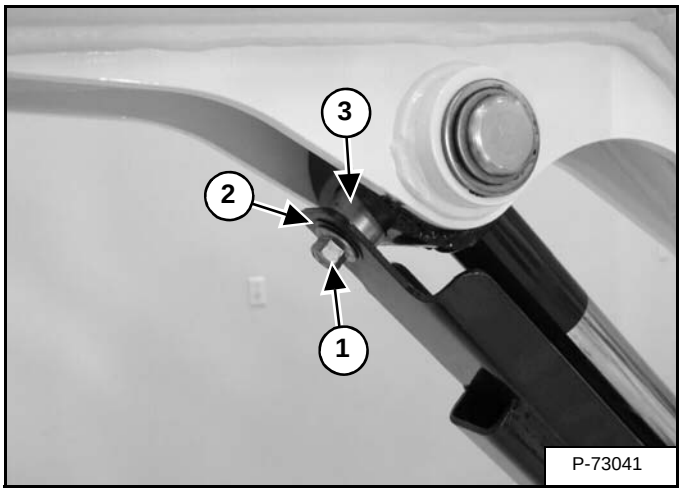
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-20-9



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

Figure 20-20-10



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

Figure 20-20-11

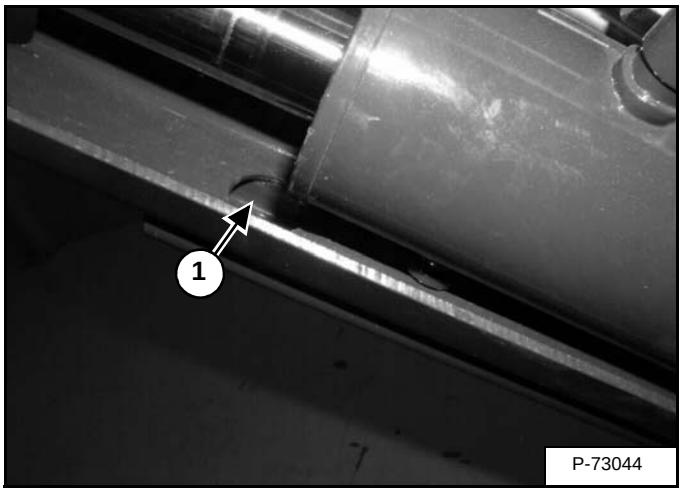
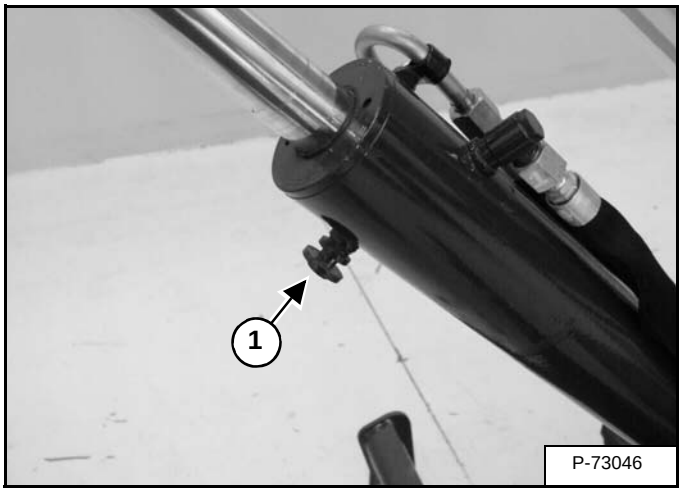


Figure 20-20-12

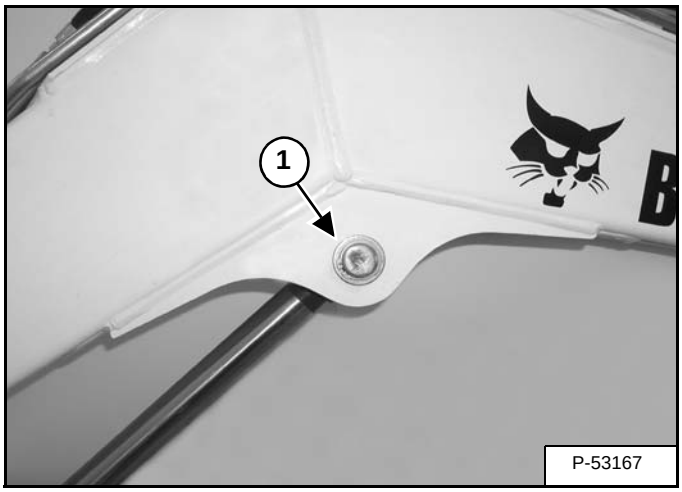


Slide the shield down until the keyhole (Item 1) **[Figure 20-20-11]** in the shield lines up with the mounting stud (Item 1) **[Figure 20-20-12]** on the cylinder.

Remove the shield.

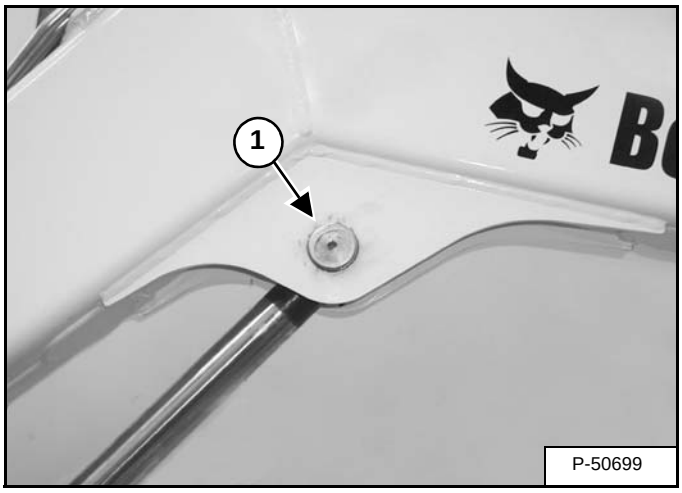
Removal And Installation (Cont'd)

Figure 20-20-13



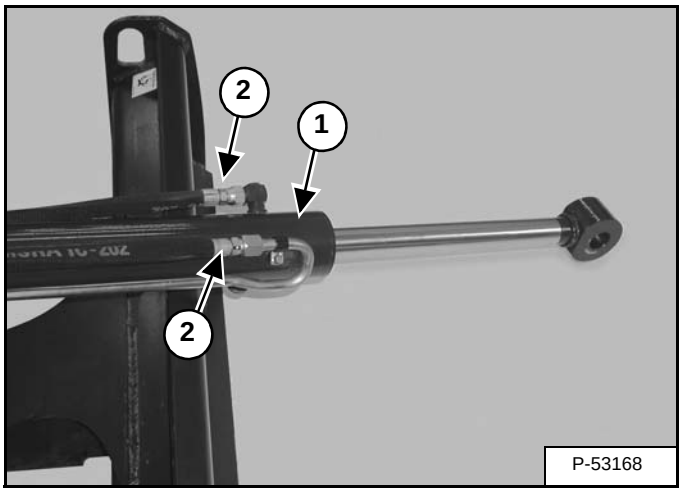
Remove the snap ring (Item 1) **[Figure 20-20-13]** and washer.

Figure 20-20-14



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

Figure 20-20-15



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

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

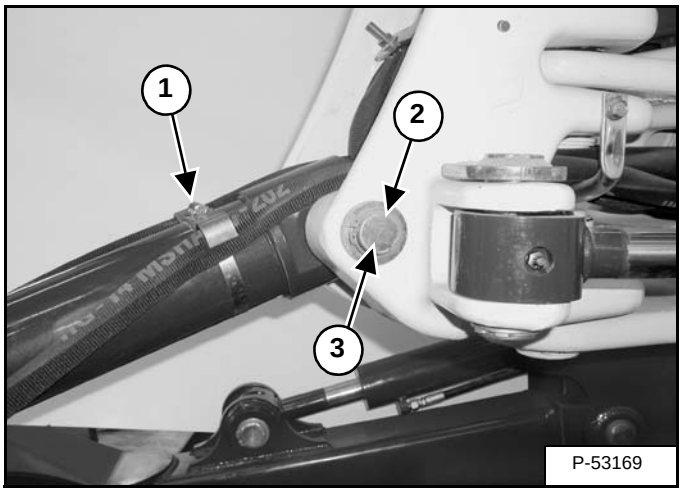
IMPORTANT

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

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Removal And Installation (Cont'd)

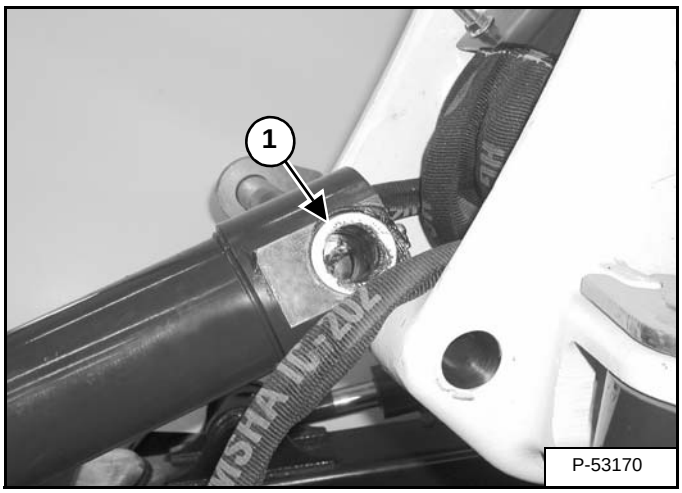
Figure 20-20-16



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

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

Figure 20-20-17

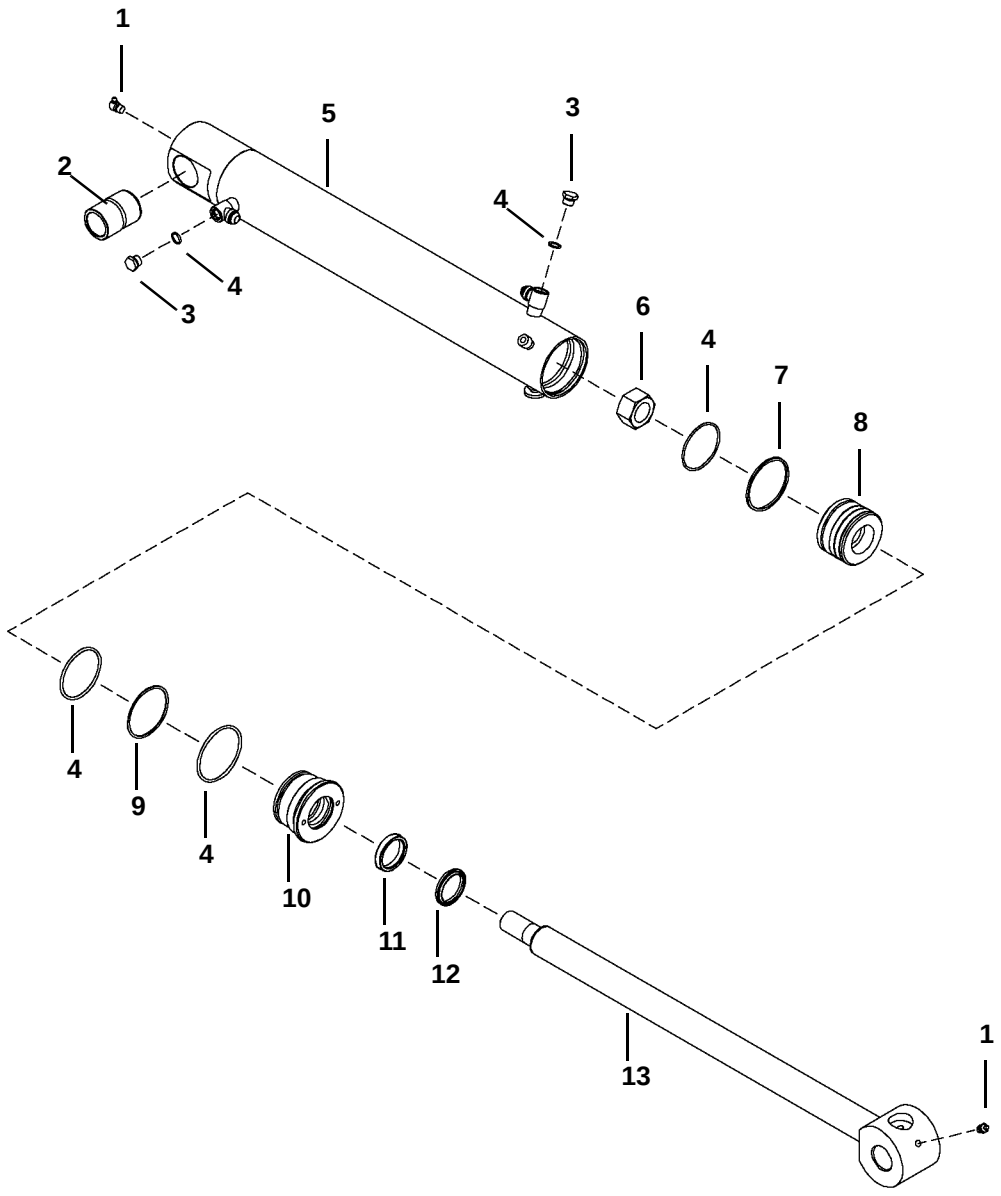


Remove the shims (Item 1) **[Figure 20-20-17]** from both sides of the cylinder.

Remove the cylinder.

Parts Identification

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



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Disassembly

Clean the outside of the boom cylinder before disassembly.

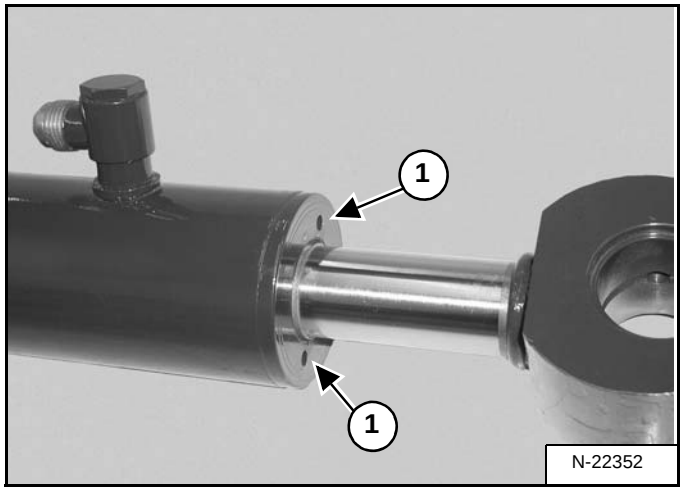
Use the following tools to disassemble the cylinder:

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

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

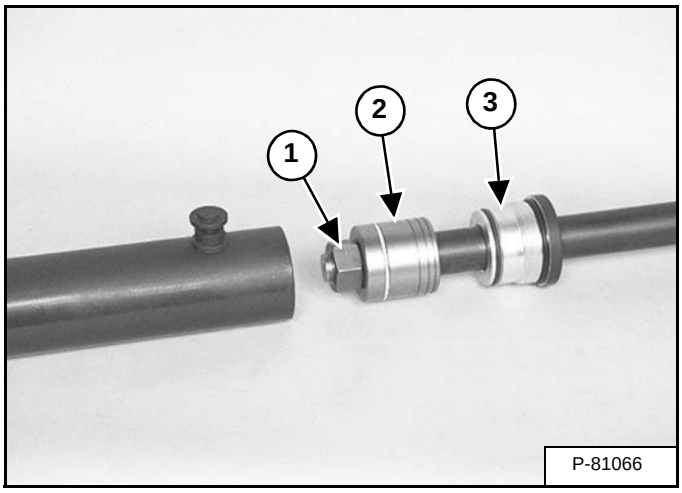
Put the base end of the cylinder in a vise.

Figure 20-20-18



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

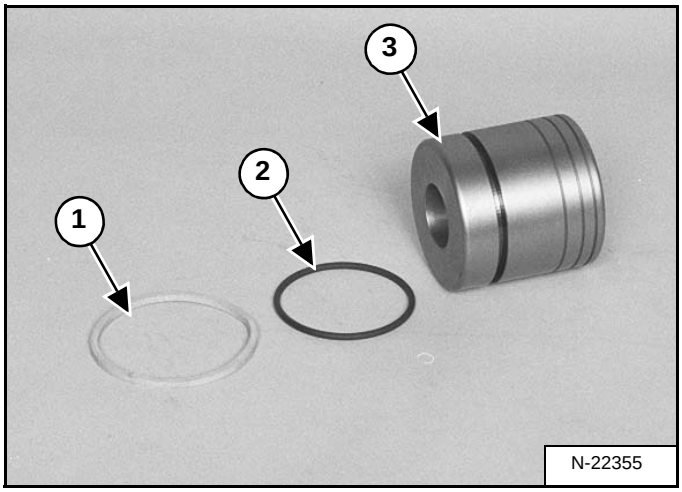
Figure 20-20-19



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

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

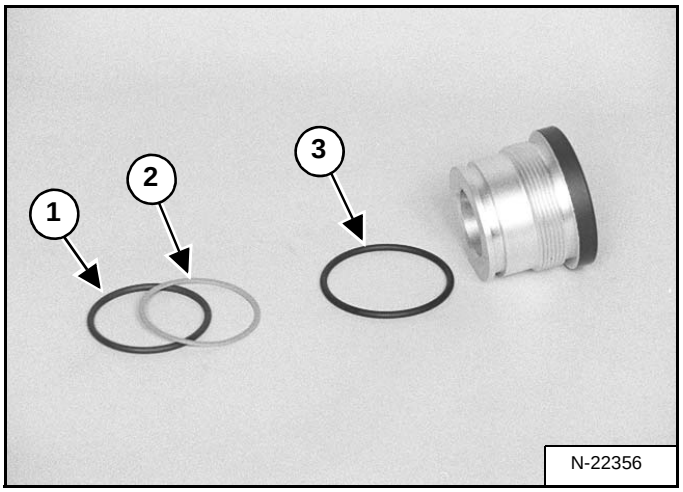
Figure 20-20-20



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

Disassembly (Cont'd)

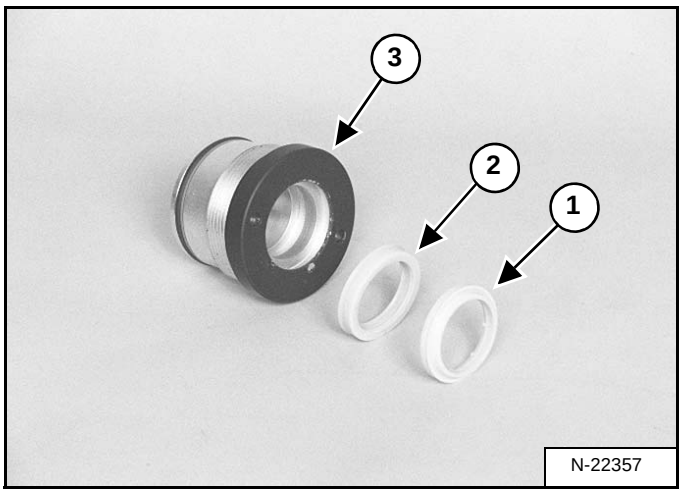
Figure 20-20-21



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

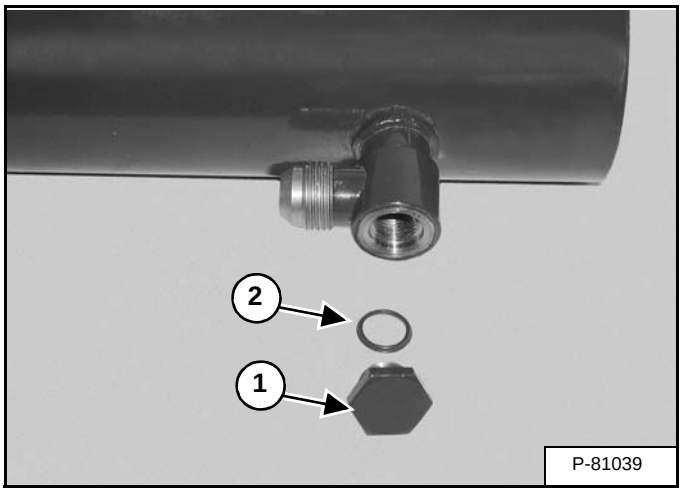
Remove the O-ring (Item 3) **[Figure 20-20-21]**.

Figure 20-20-22



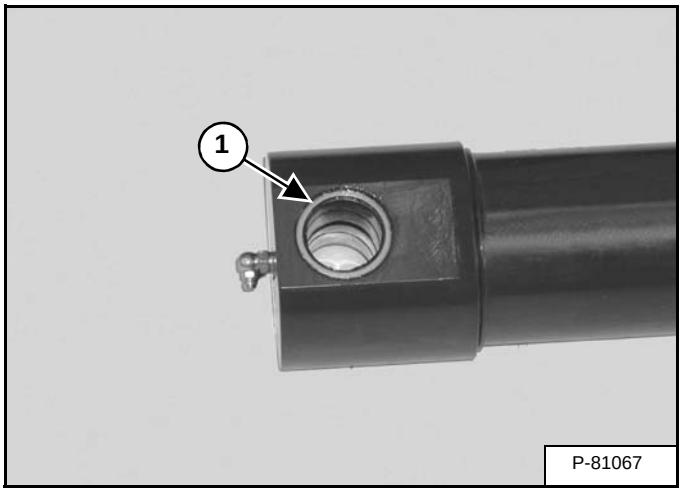
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-20-22]**.

Figure 20-20-23



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

Figure 20-20-24



Remove the bushing (Item 1) **[Figure 20-20-24]** from the cylinder base end.

Assembly

Clean all parts in solvent and dry with compressed air.

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

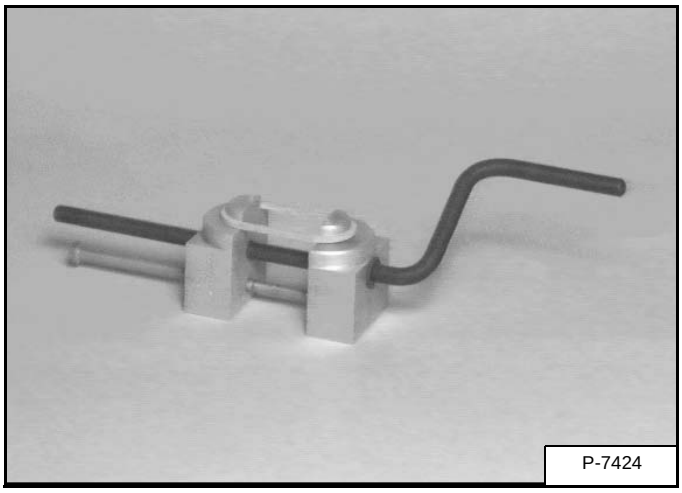
Always install new O-rings and seals.

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

Use the following tools to assemble the cylinder:

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

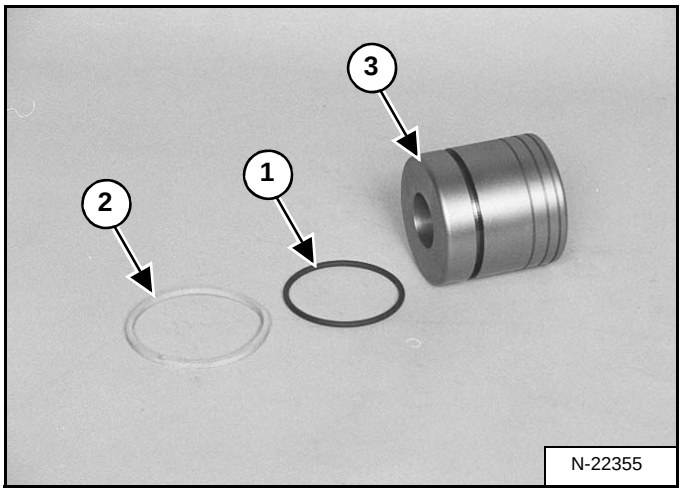
Figure 20-20-25



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

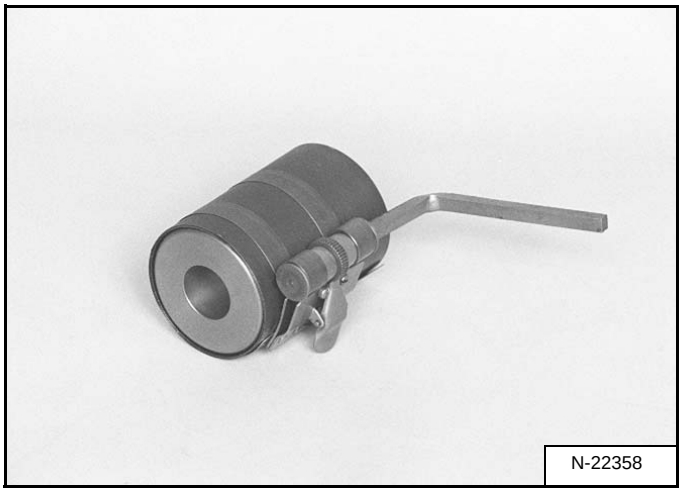
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-20-26



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

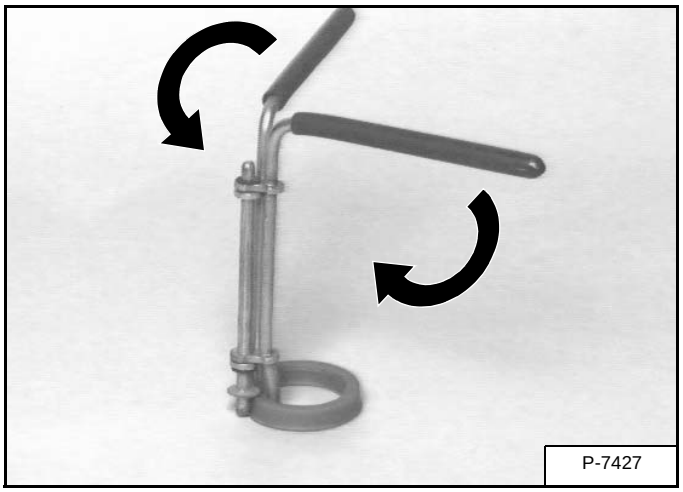
Figure 20-20-27



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

Assembly (Cont'd)

Figure 20-20-28

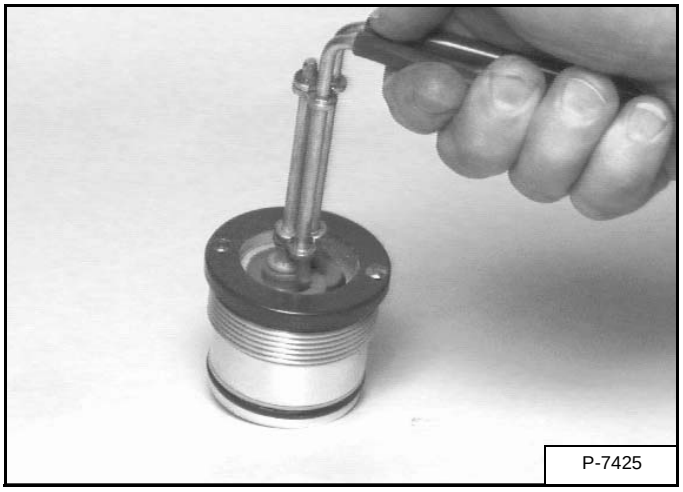


Install the rod seal on the rod seal tool **[Figure 20-20-28]**.

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

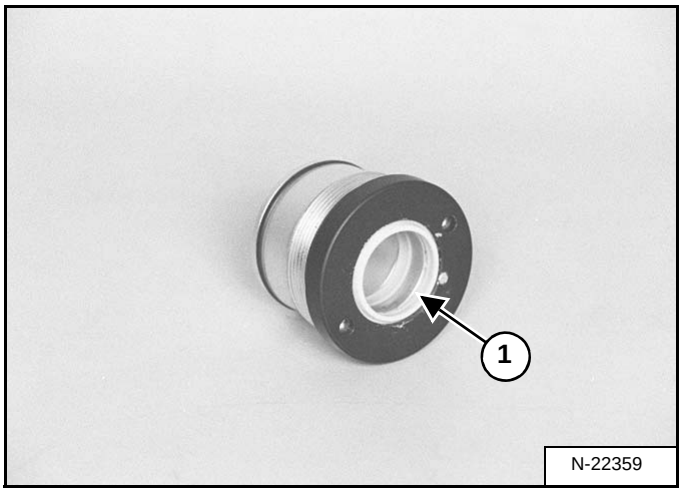
Rotate the handles to collapse the rod seal **[Figure 20-20-28]**.

Figure 20-20-29



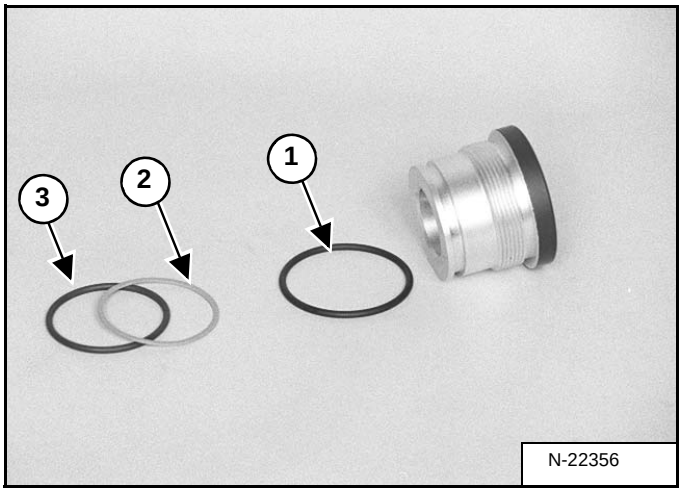
Install the rod seal in the head **[Figure 20-20-29]**.

Figure 20-20-30



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

Figure 20-20-31



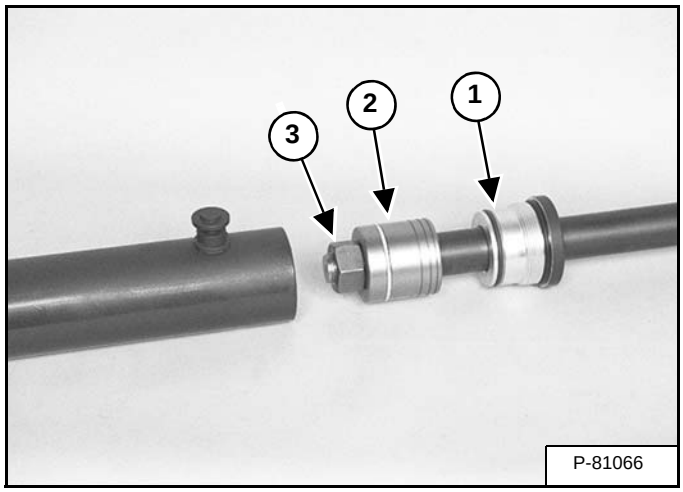
Install the O-ring (Item 1) **[Figure 20-20-31]**.

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

BOOM CYLINDER (CONT'D)

Assembly (Cont'd)

Figure 20-20-32



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

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

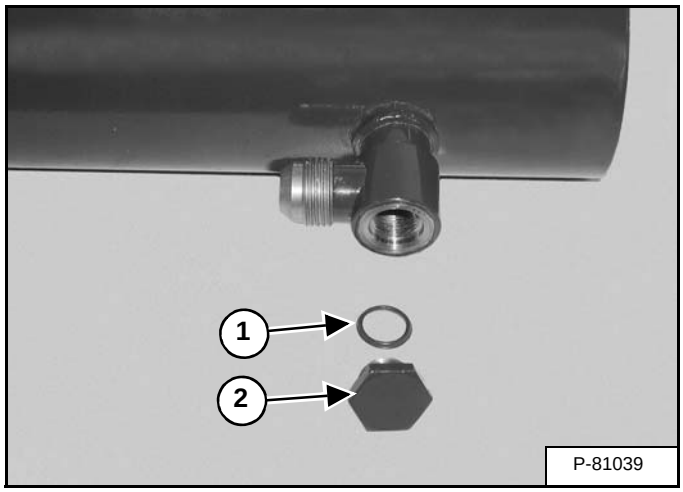
Provide an adequate support for the cylinder before tightening.

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

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

Tighten the nut to 850 ft.-lb. (1153 N•m) torque.

Figure 20-20-33

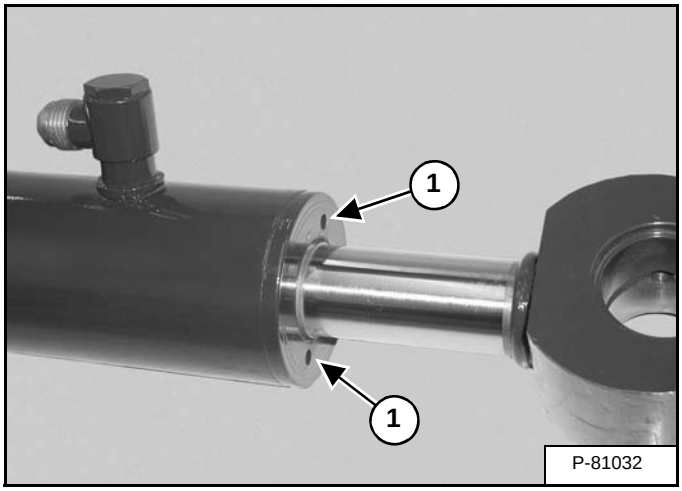


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-20-33]**.

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

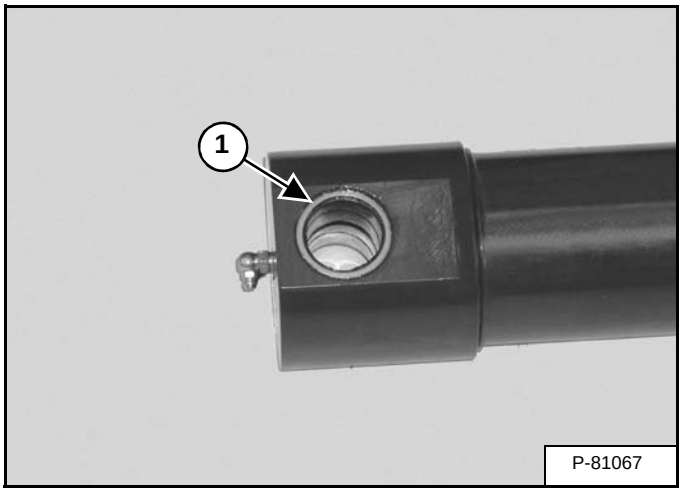
Put the base end of the cylinder in a vise.

Figure 20-20-34



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

Figure 20-20-35



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

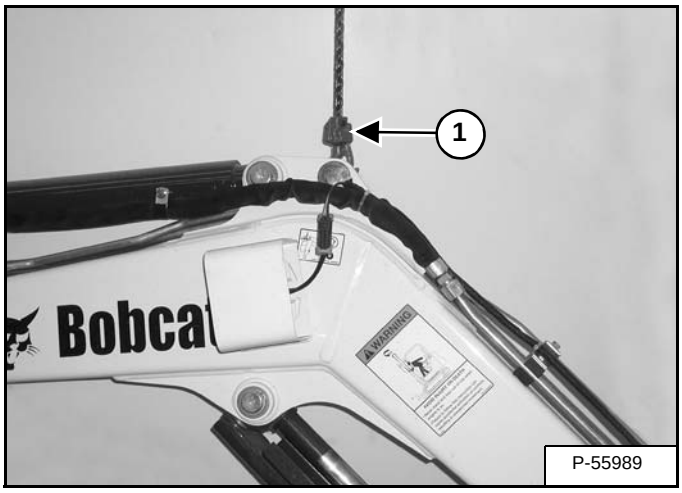
ARM CYLINDER

Testing

Lower the boom/bucket and blade to the ground.

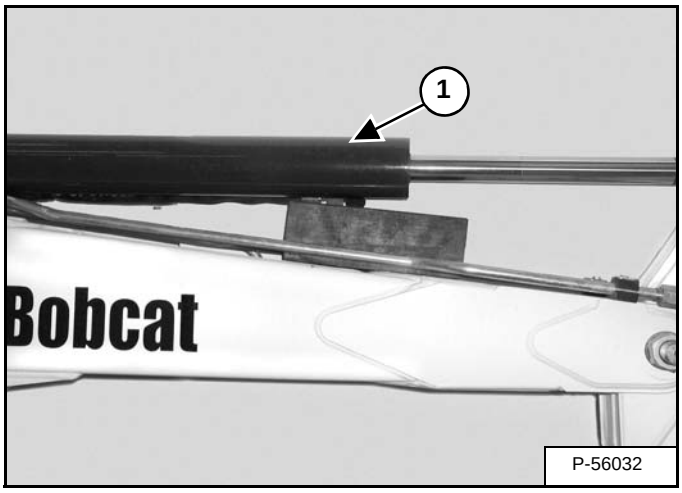
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-21-1



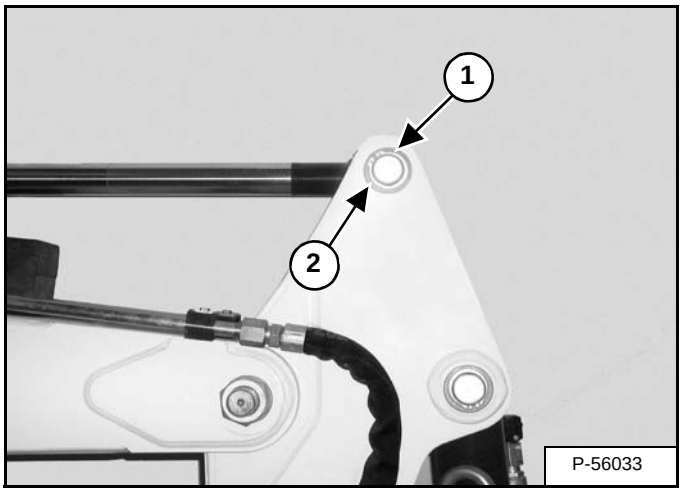
Support the boom with a chain hoist (Item 1) **[Figure 20-21-1]**.

Figure 20-21-2



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

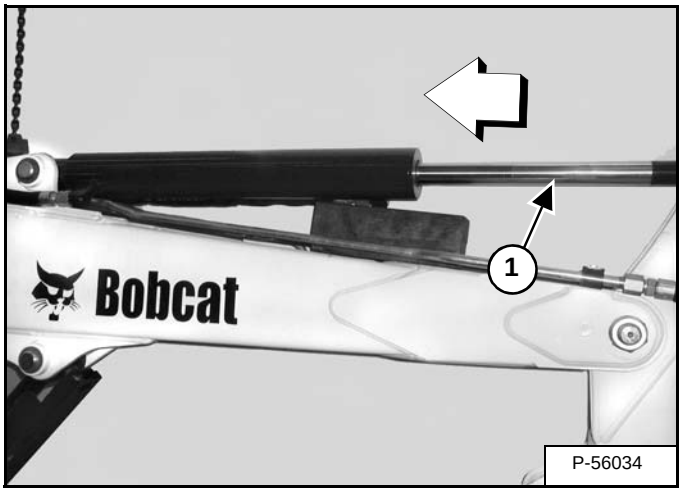
Figure 20-21-3



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

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

Figure 20-21-4



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

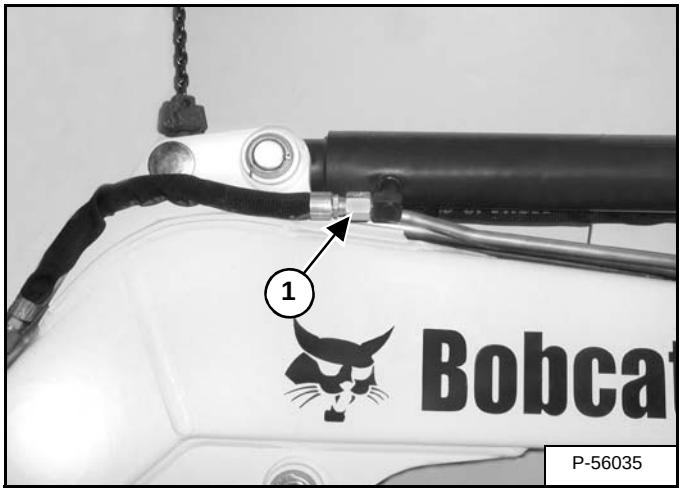
Testing (Cont'd)

WARNING

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

W-2145-0290

Figure 20-21-5



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

Figure 20-21-6



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

Start the engine and retract the cylinder.

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

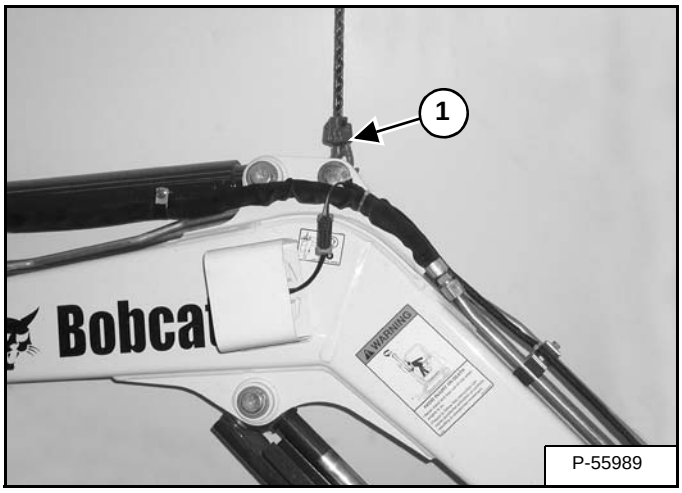
ARM CYLINDER (CONT'D)

Removal And Installation

Lower the boom/bucket and blade to the ground.

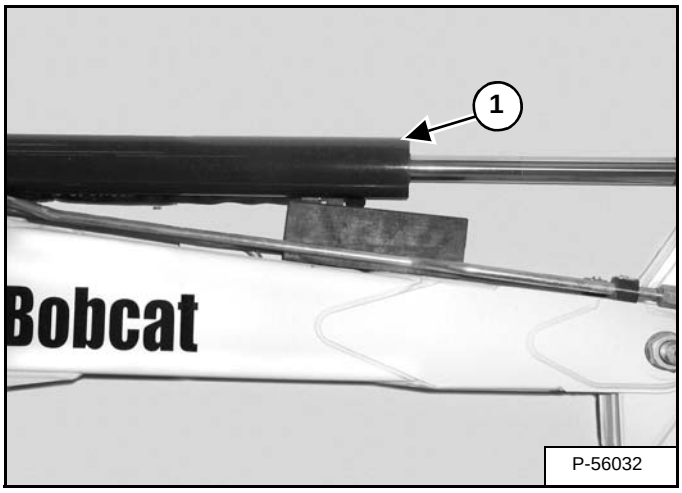
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-21-7



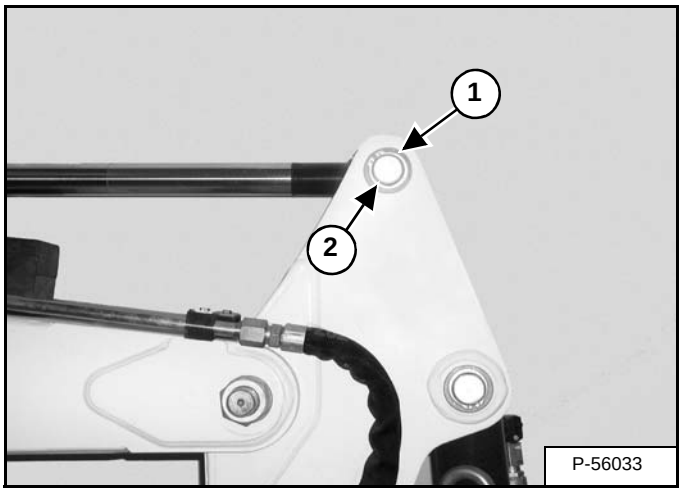
Support the boom with a chain hoist (Item 1) **[Figure 20-21-7]**.

Figure 20-21-8



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

Figure 20-21-9



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

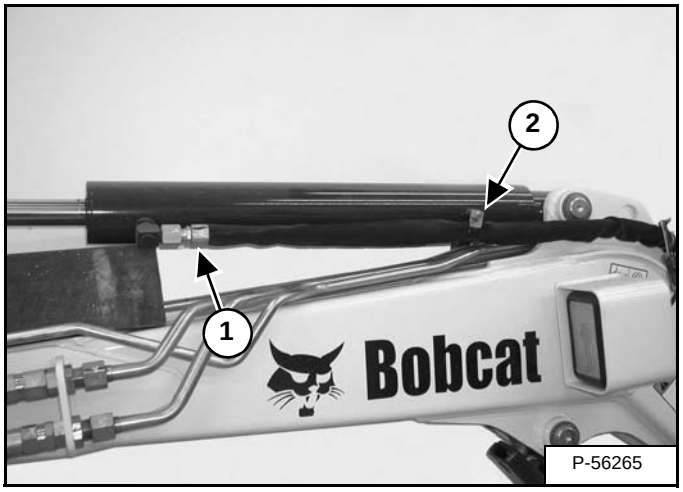
Remove the rod end pin (Item 2) **[Figure 20-21-9]**.

IMPORTANT

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

I-2003-0888

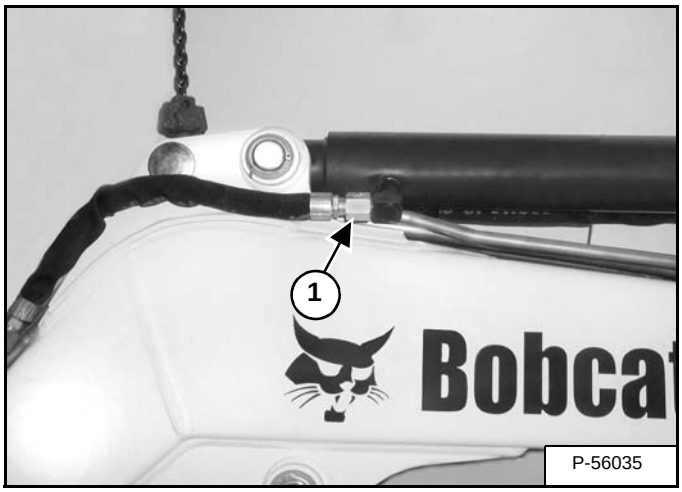
Figure 20-21-10



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

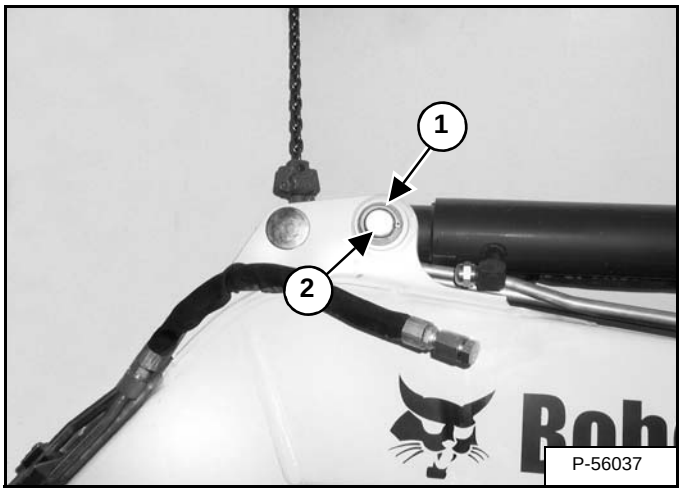
Removal And Installation (Cont'd)

Figure 20-21-11



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

Figure 20-21-12

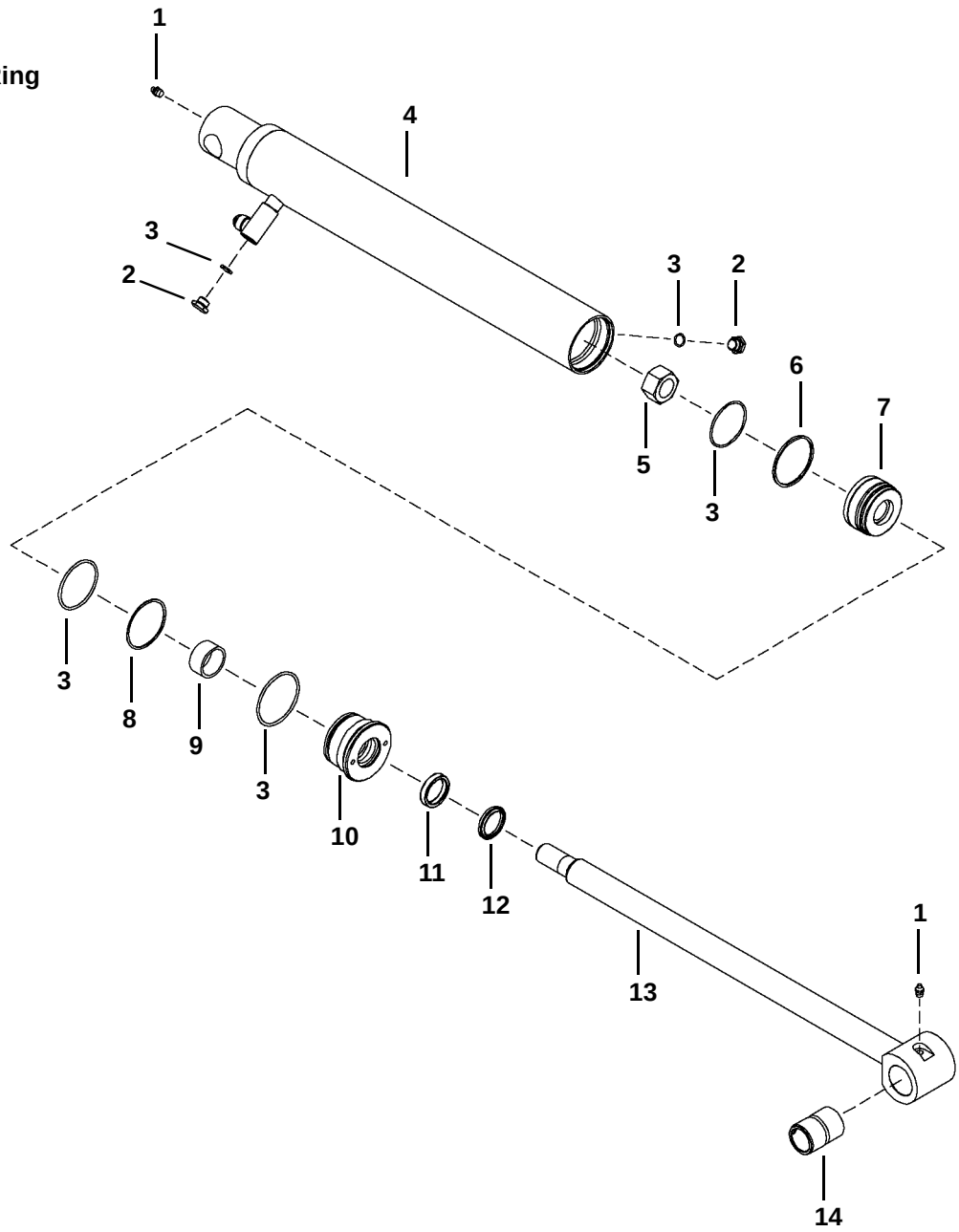


Remove the snap ring (Item 1), washer and base end pin (Item 2) **[Figure 20-21-12]**.

Remove the cylinder.

Parts Identification

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



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Disassembly

Clean the outside of the arm cylinder before disassembly.

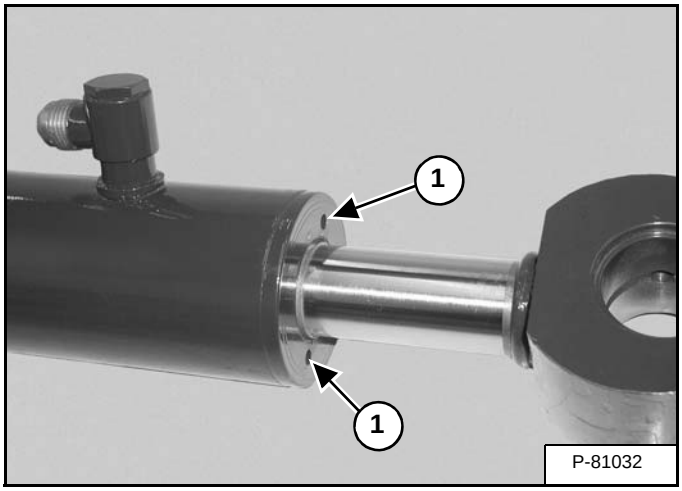
Use the following tools to disassemble the cylinder:

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

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

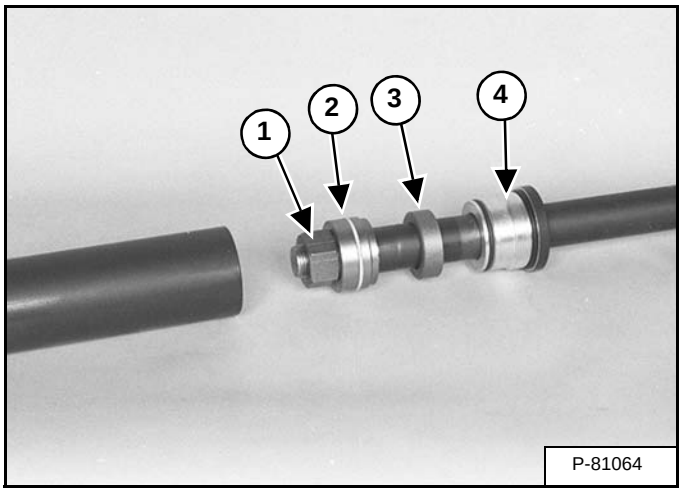
Put the base end of the cylinder in a vise.

Figure 20-21-13



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-21-13]** to loosen the head.

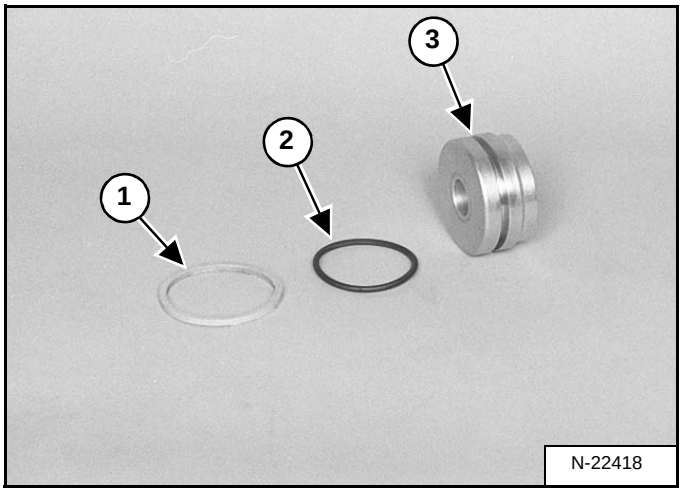
Figure 20-21-14



Remove the head and the rod assembly from the cylinder **[Figure 20-21-14]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2), spacer (Item 3) and head (Item 4) **[Figure 20-21-14]**.

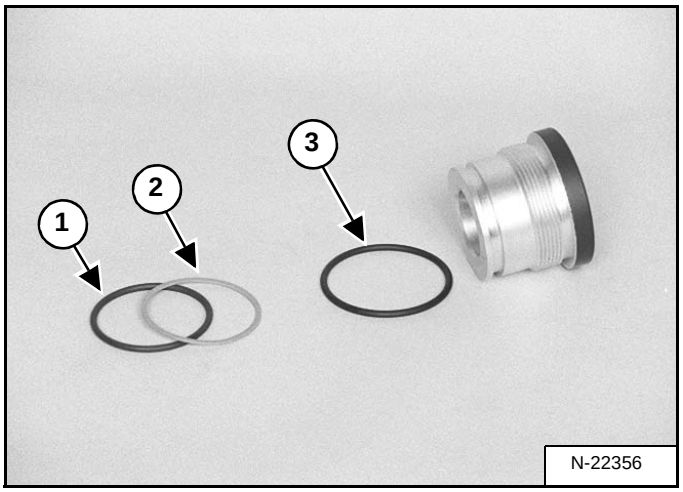
Figure 20-21-15



Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-21-15]**.

Disassembly (Cont'd)

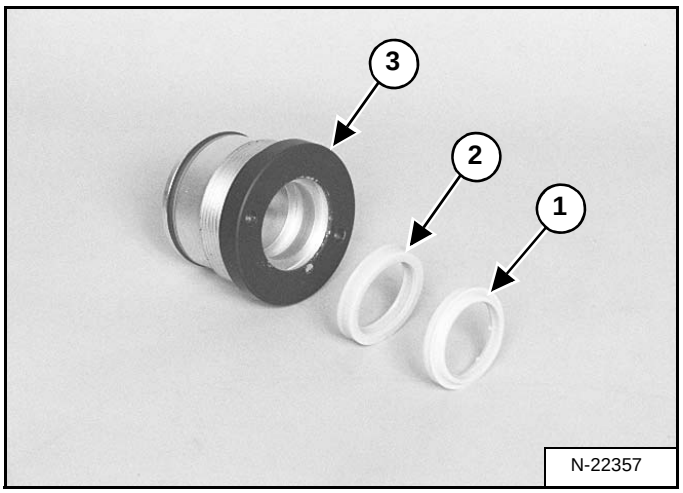
Figure 20-21-16



Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-21-16]**.

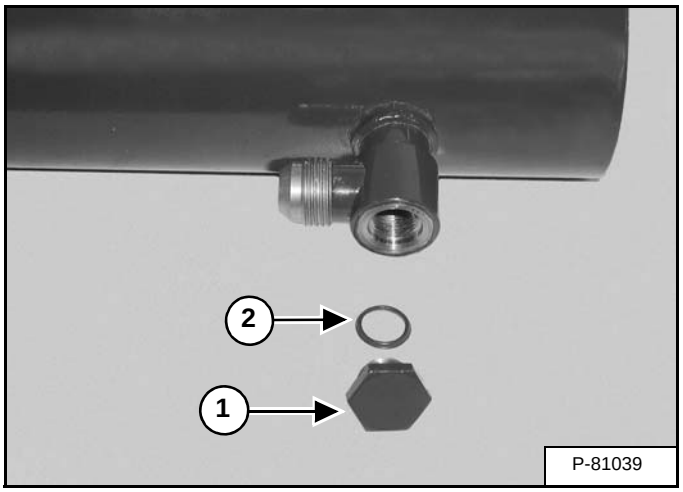
Remove the O-ring (Item 3) **[Figure 20-21-16]**.

Figure 20-21-17



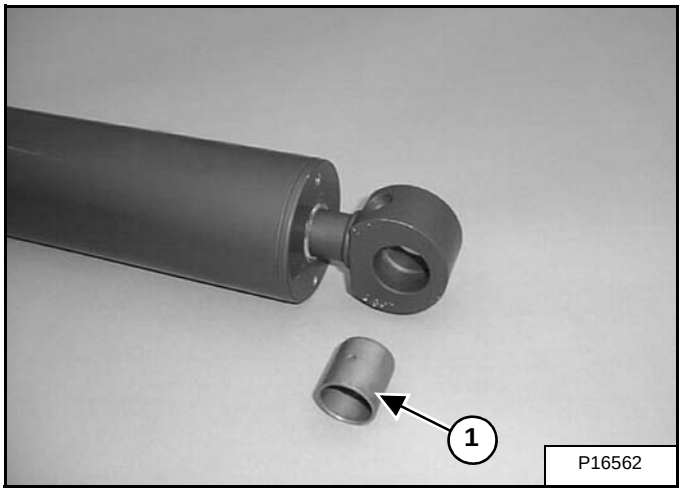
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-21-17]**.

Figure 20-21-18



Remove the plug (Item 1) and O-ring (Item 2) **[Figure 20-21-18]**.

Figure 20-21-19



Remove the bushing (Item 1) **[Figure 20-21-19]**.

Assembly

Clean all parts in solvent and dry with compressed air.

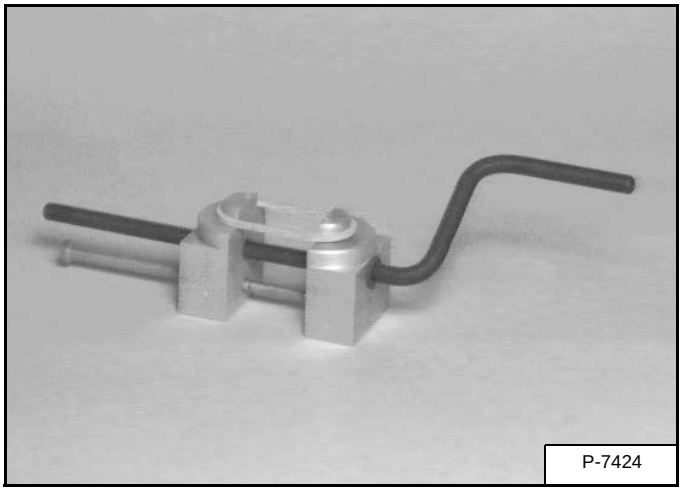
Inspect all parts for wear or damage. Replace any worn or damaged parts.

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

Use the following tools to assemble the cylinder:

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

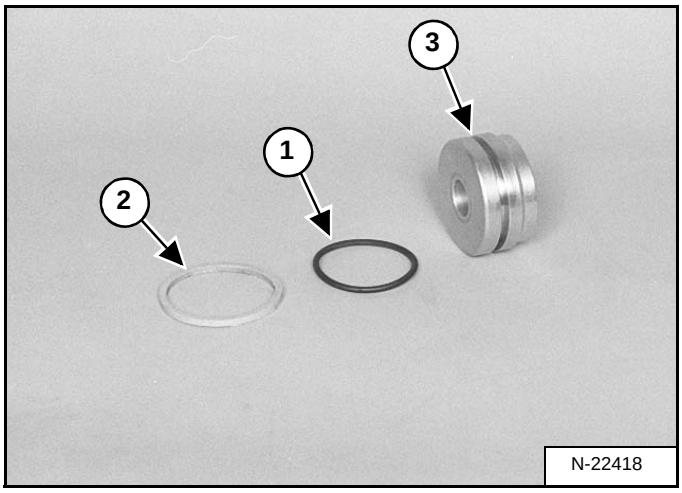
Figure 20-21-20



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

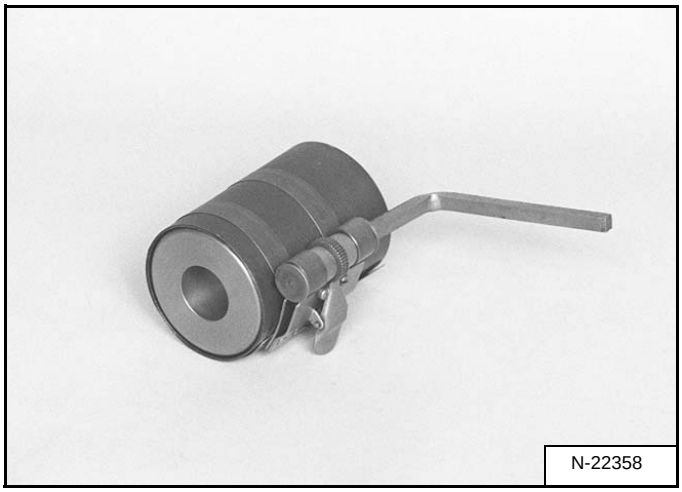
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-21-21



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

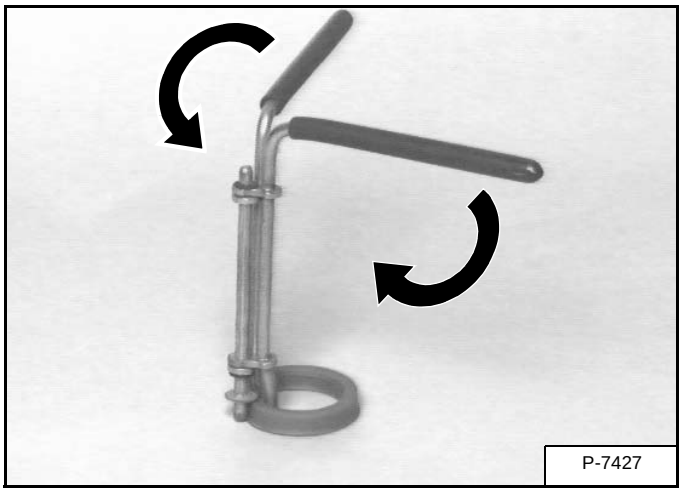
Figure 20-21-22



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-21-22]**.

Assembly (Cont'd)

Figure 20-21-23

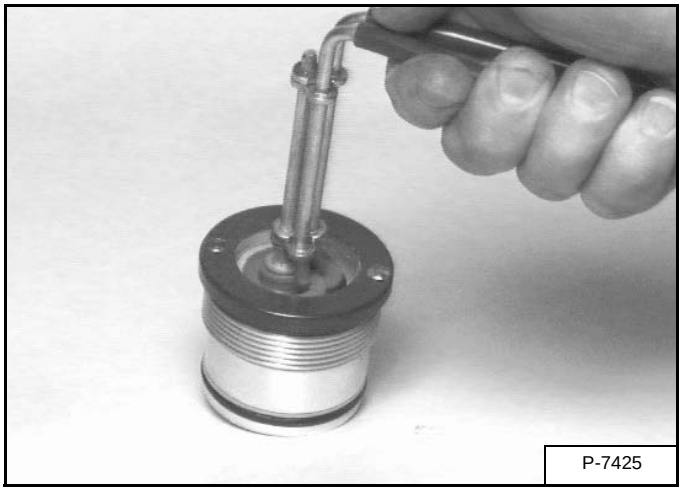


Install the rod seal on the rod seal tool **[Figure 20-21-23]**.

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

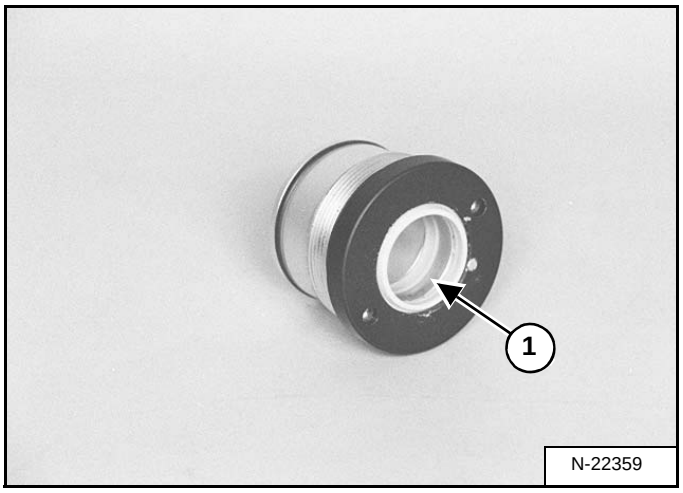
Rotate the handles to collapse the rod seal **[Figure 20-21-23]**.

Figure 20-21-24



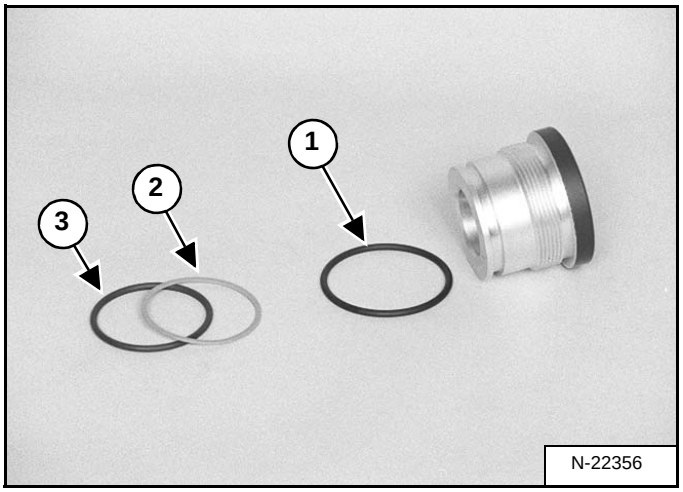
Install the rod seal in the head **[Figure 20-21-24]**.

Figure 20-21-25



Install the wiper seal with the wiper (Item 1) **[Figure 20-21-25]** toward the outside of the head.

Figure 20-21-26



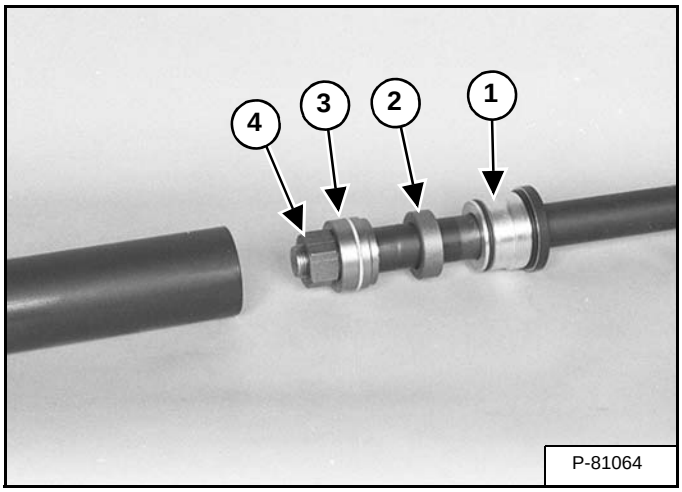
Install the O-ring (Item 1) **[Figure 20-21-26]**.

Install the back-up ring (Item 2) and O-ring (Item 3) **[Figure 20-21-26]**.

ARM CYLINDER (CONT'D)

Assembly (Cont'd)

Figure 20-21-27



Install the head (Item 1), spacer (Item 2) and the piston (Item 3) **[Figure 20-21-27]** on the rod as shown.

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

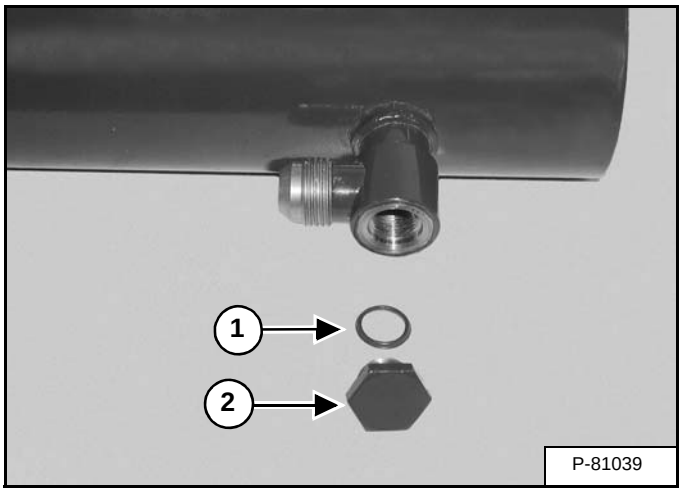
Provide an adequate support for the cylinder before tightening.

Install the nut (Item 4) **[Figure 20-21-27]**.

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

Tighten the nut to 850 ft.-lb. (1152 N•m) torque.

Figure 20-21-28

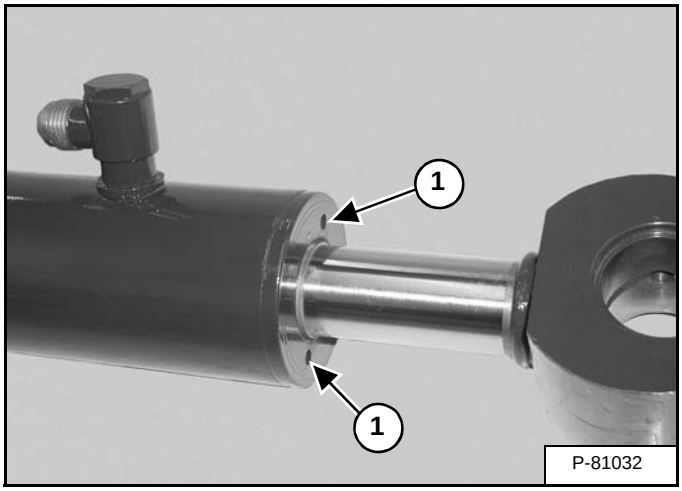


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-21-28]**.

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

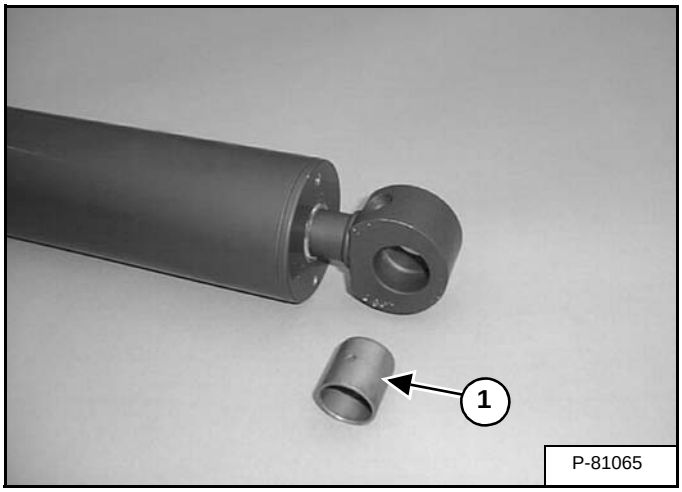
Put the base end of the hydraulic cylinder in a vise.

Figure 20-21-29



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-21-29]** to tighten the head. Head to be torqued until flush with the end of the housing.

Figure 20-21-30



Install the bushing (Item 1) **[Figure 20-21-30]**. The bushing must be aligned with the grease channel in the rod end of the cylinder.

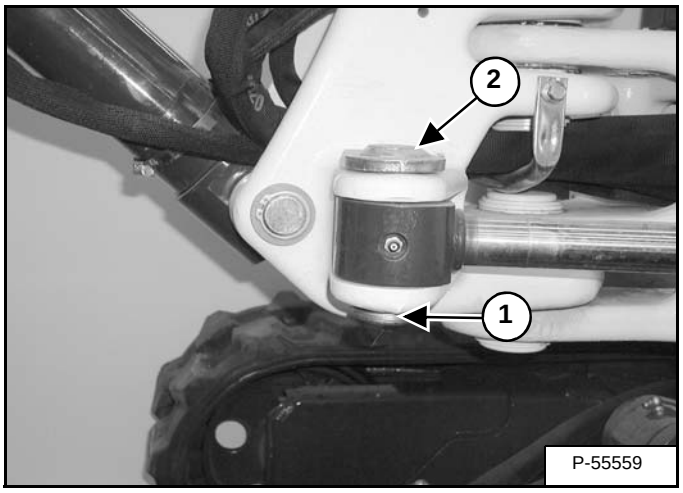
BOOM SWING CYLINDER

Testing

Lower the boom/bucket and blade to the ground.

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

Figure 20-22-1



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

Remove the pivot pin (Item 2) **[Figure 20-22-1]**.

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

Stop the engine. Relieve hydraulic pressure.

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

Figure 20-22-2



Support the rod end of cylinder **[Figure 20-22-2]**.

Testing (Cont'd)

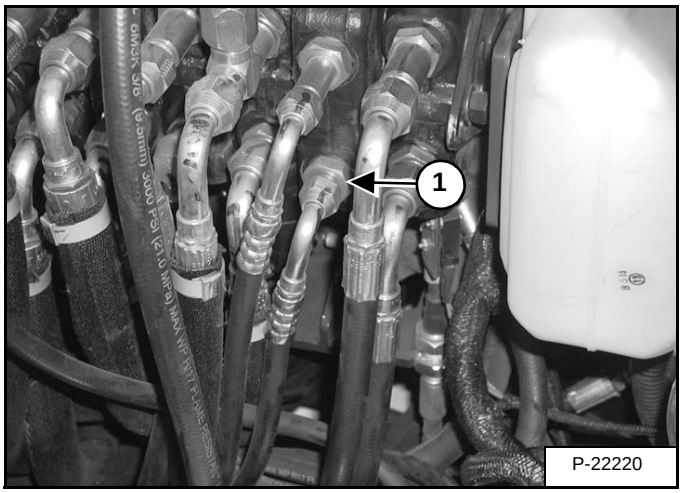
Open the right side cover.

⚠ 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.

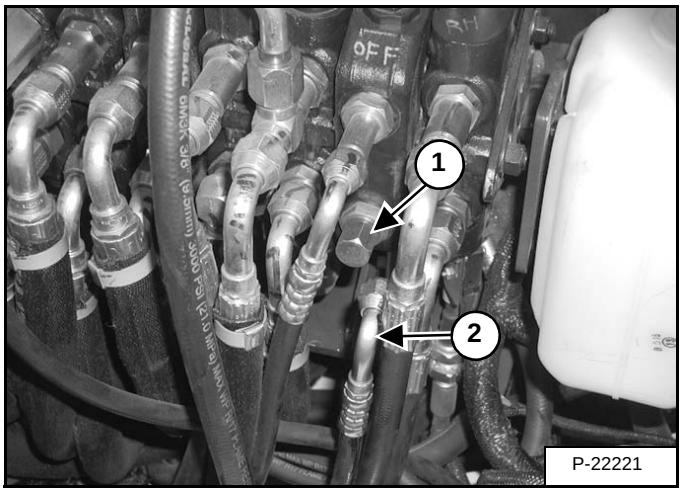
W-2145-0290

Figure 20-22-3



Remove the boom swing cylinder base end hose (Item 1) **[Figure 20-22-3]** at the hydraulic control valve.

Figure 20-22-4



Install a cap (Item 1) **[Figure 20-22-4]** on the fitting and tighten.

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

If there is any leakage from the base end hose (Item 2) **[Figure 20-22-4]** on the cylinder, remove the cylinder for repair or replacement.

BOOM SWING CYLINDER (CONT'D)

Removal And Installation

Lower the boom/bucket and blade to the ground.

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

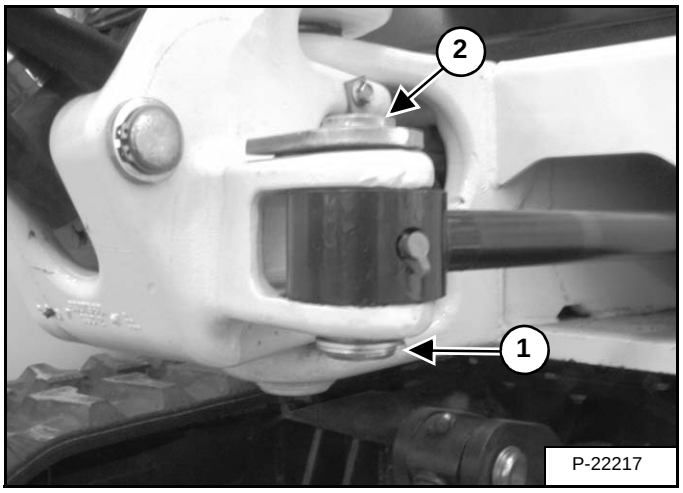
IMPORTANT

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 plate. (See Removal And Installation (Canopy Equipped Excavators) on Page 40-110-1.) or (See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

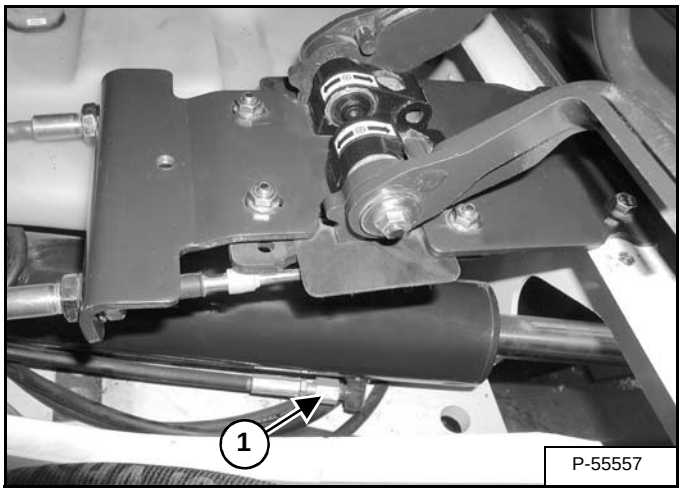
Figure 20-22-5



Remove the snap ring (Item 1) **[Figure 20-22-5]** and washer.

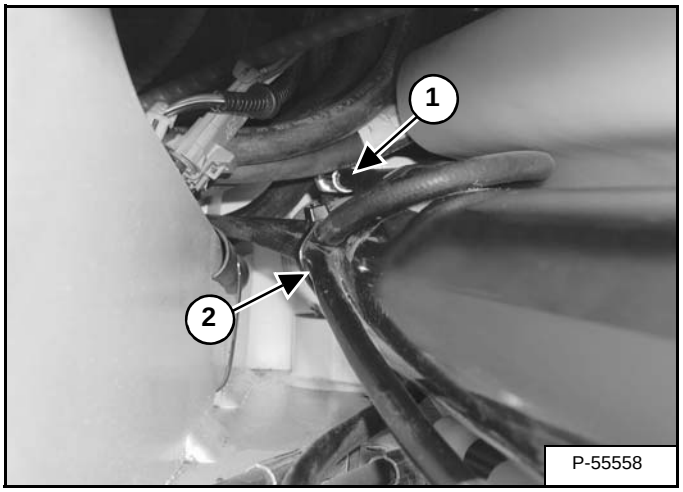
Remove the pivot pin (Item 2) **[Figure 20-22-5]**.

Figure 20-22-6



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

Figure 20-22-7

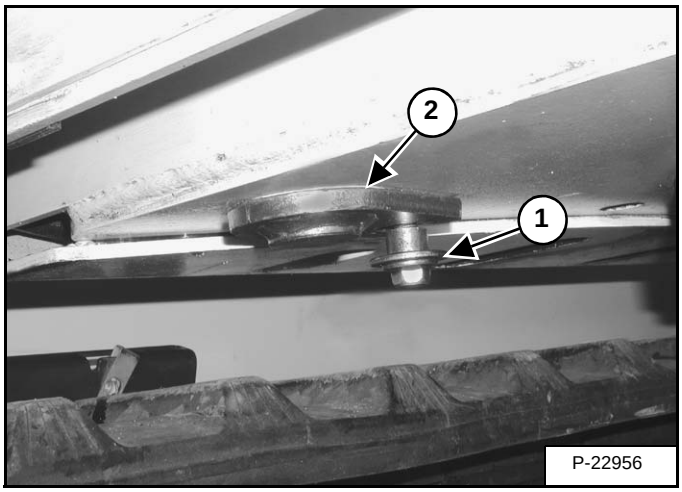


Remove the base end hose (Item 1). Cut and remove the tie strap (Item 2) **[Figure 20-22-7]**.

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 20-22-7].

Removal And Installation (Cont'd)

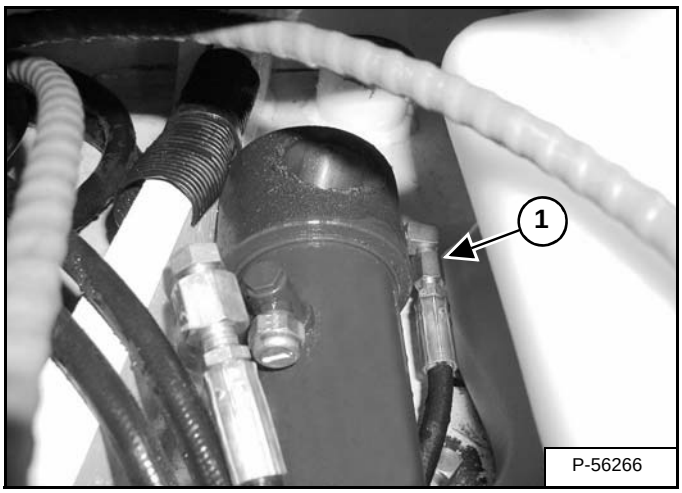
Figure 20-22-8



Remove the bolt, washer and spacer (Item 1) **[Figure 20-22-8]**.

Remove the pivot pin (Item 2) **[Figure 20-22-8]**.

Figure 20-22-9

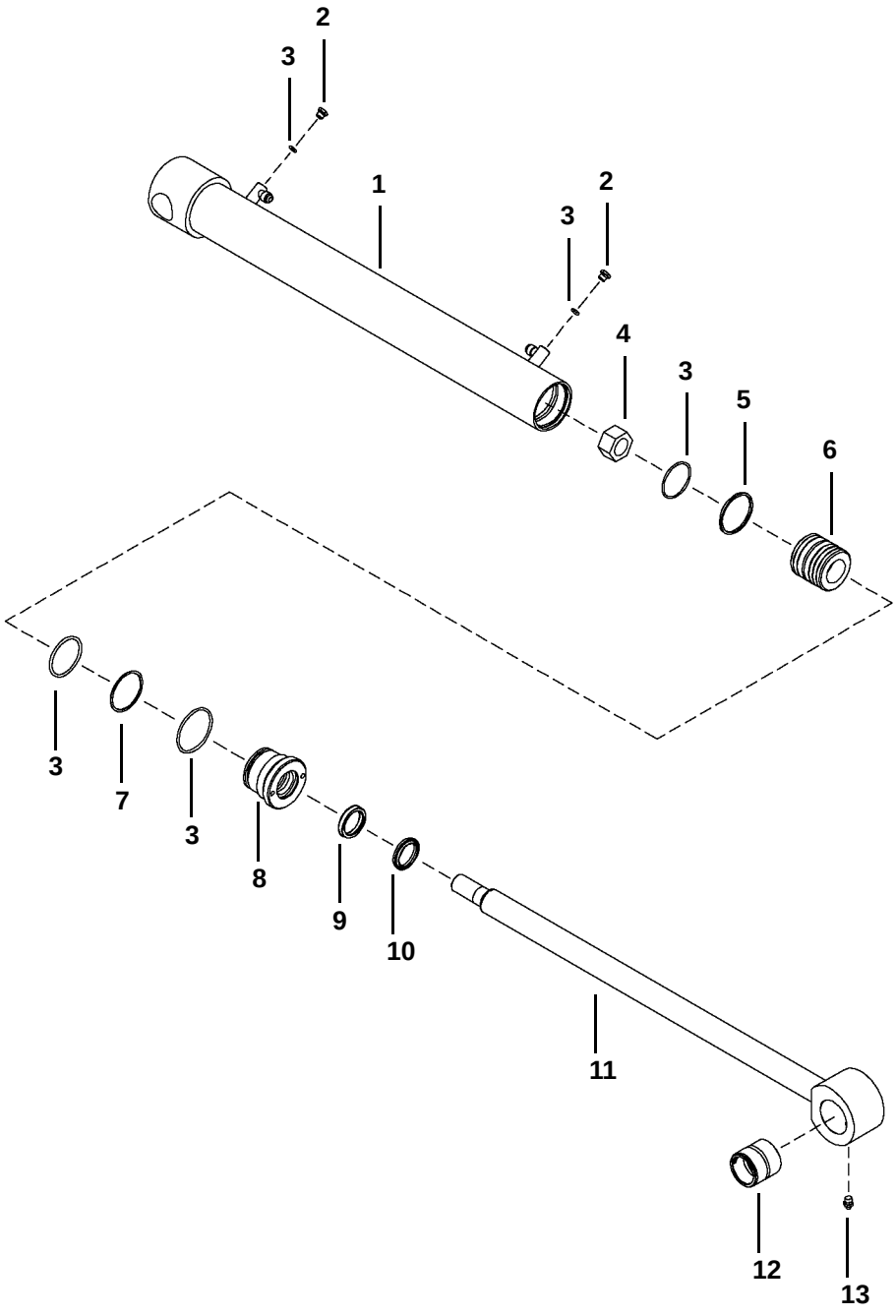


Move the cylinder forward. Remove the hose (Item 1) **[Figure 20-22-9]**.

Remove the cylinder.

Parts Identification

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



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Disassembly

Clean the outside of the boom swing cylinder before disassembly.

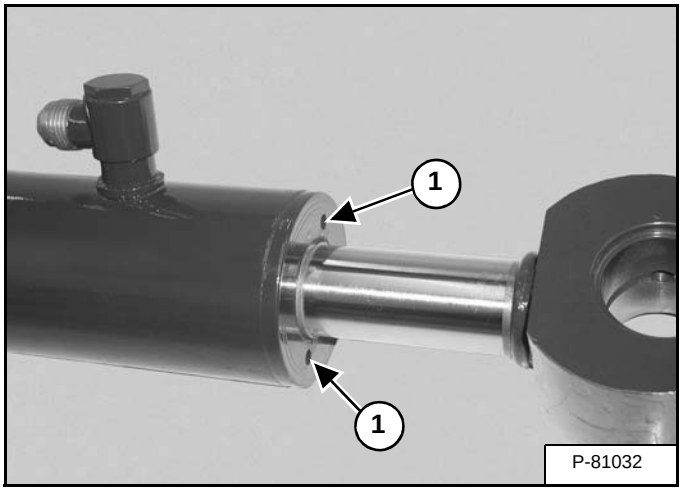
Use the following tools to disassemble the cylinder:

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

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

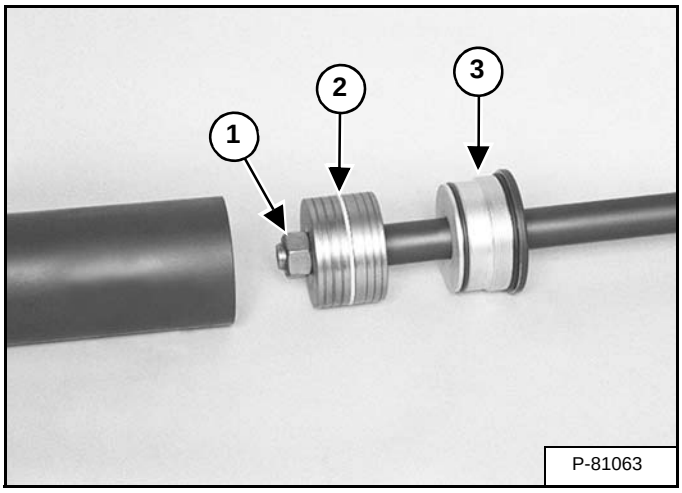
Put the base end of the cylinder in a vise.

Figure 20-22-10



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-22-10]** to loosen the head.

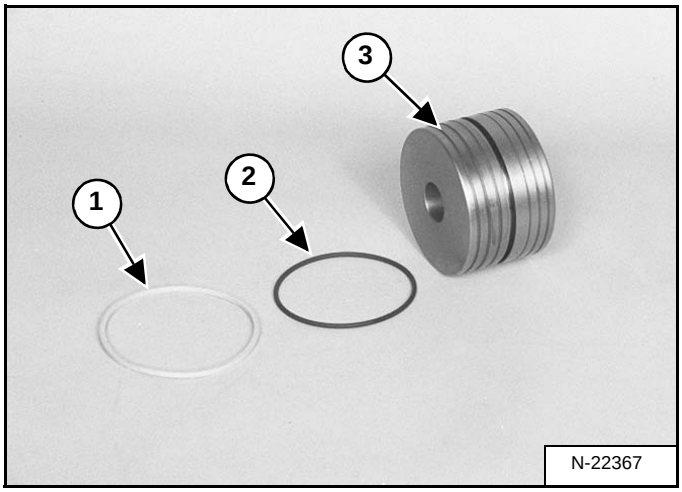
Figure 20-22-11



Remove the head and rod assembly from the cylinder **[Figure 20-22-11]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-22-11]**.

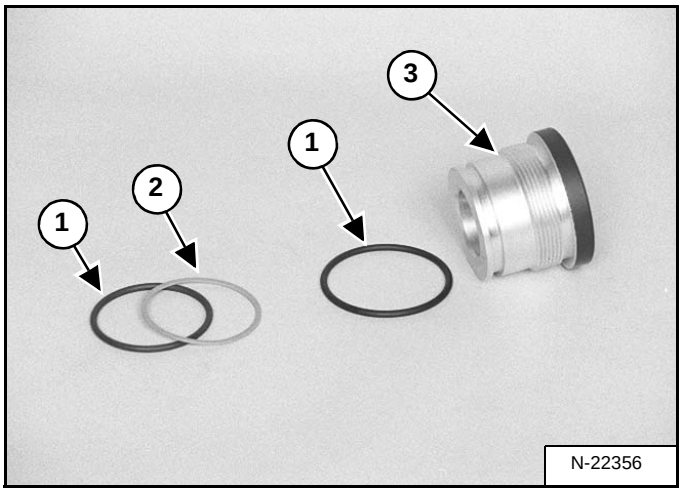
Figure 20-22-12



Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-22-12]**.

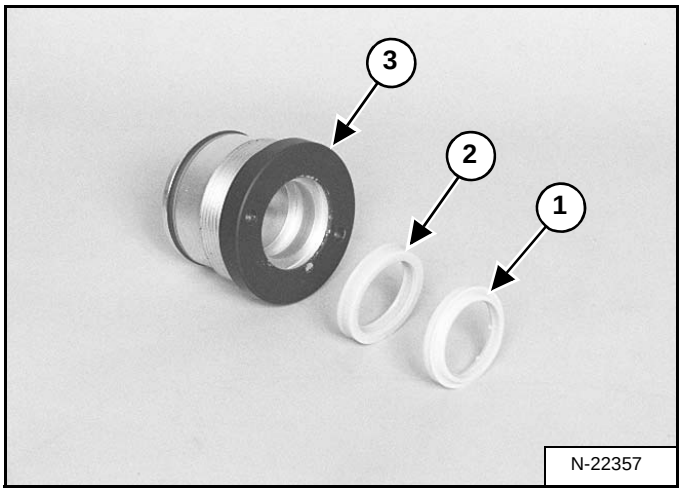
Disassembly (Cont'd)

Figure 20-22-13



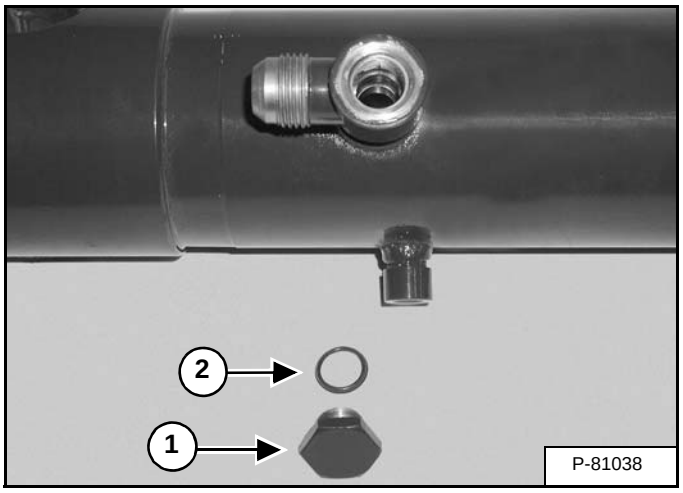
Remove the O-rings (Item 1) and the back-up ring (Item 2) from the head (Item 3) **[Figure 20-22-13]**.

Figure 20-22-14



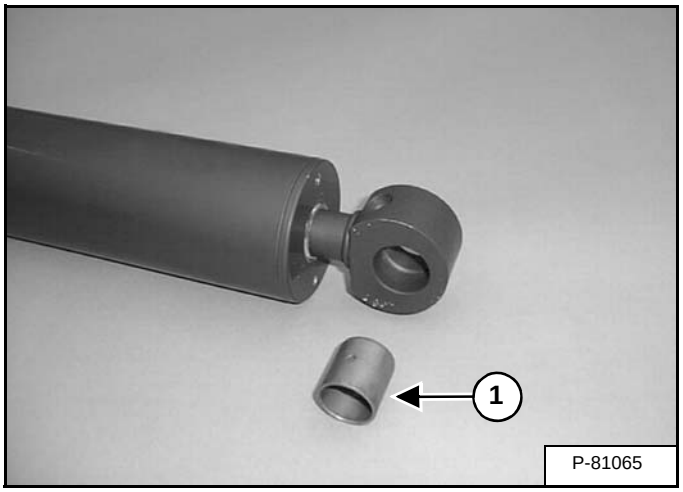
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-22-14]**.

Figure 20-22-15



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-22-15]**.

Figure 20-22-16



Remove the bushing (Item 1) **[Figure 20-22-16]**.

Assembly

Clean all parts in solvent and dry with compressed air.

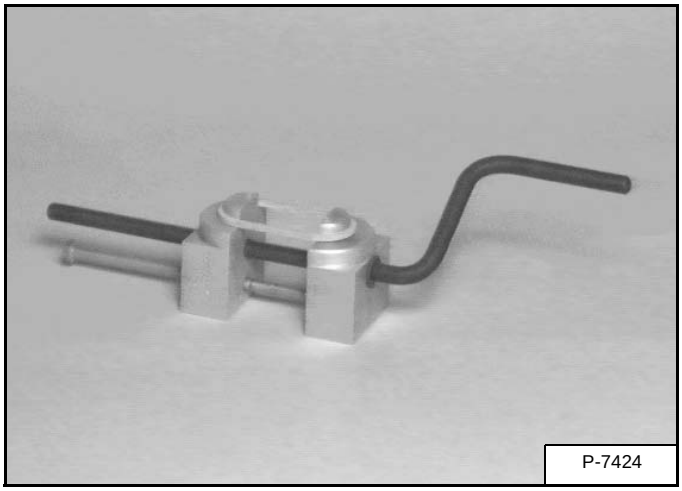
Inspect all parts for wear or damage. Replace any worn or damaged parts.

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

Use the following tools to assemble the cylinder:

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

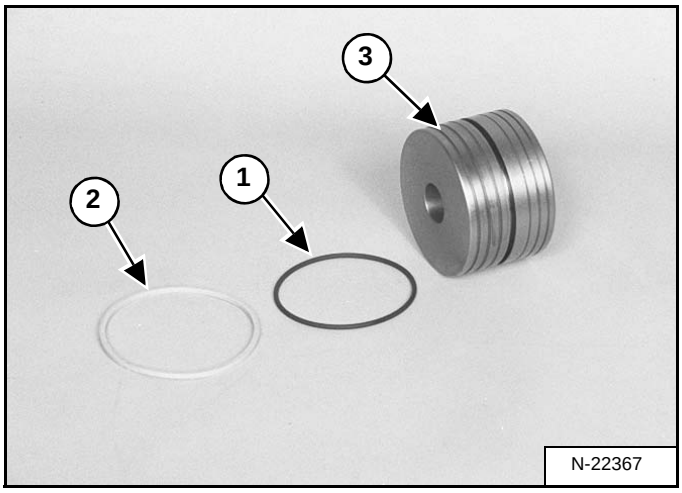
Figure 20-22-17



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-22-17]**.

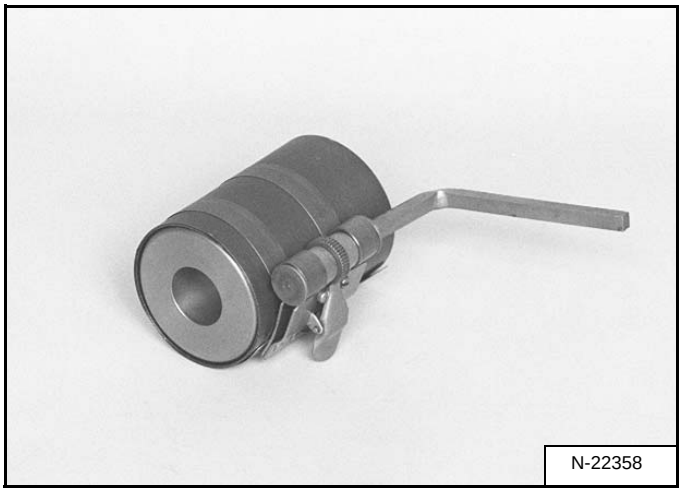
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-22-18



Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-22-18]**.

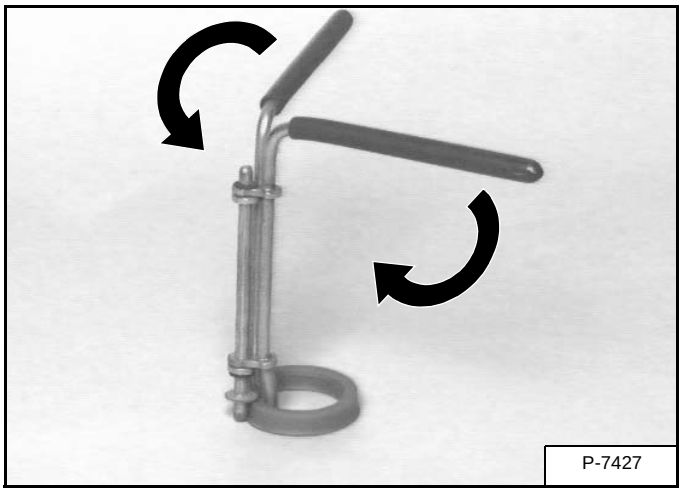
Figure 20-22-19



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-22-19]**.

Assembly (Cont'd)

Figure 20-22-20

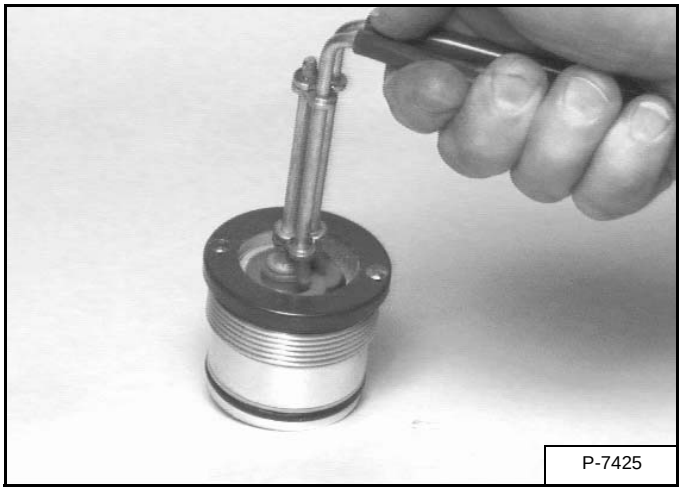


Install the rod seal on the rod seal tool **[Figure 20-22-20]**.

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

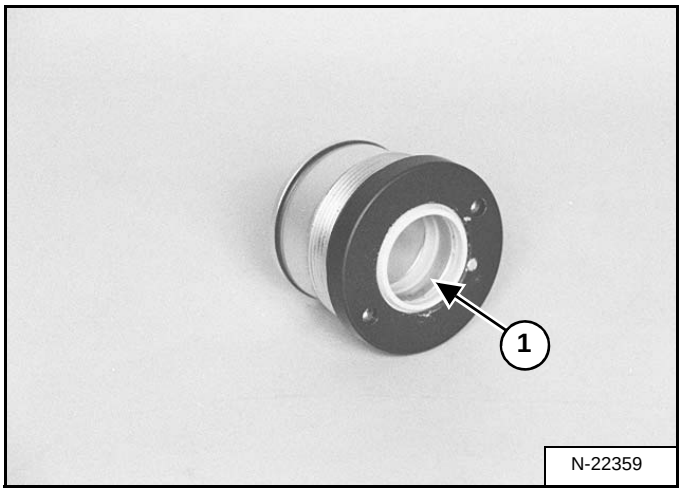
Rotate the handles to collapse the rod seal **[Figure 20-22-20]**.

Figure 20-22-21



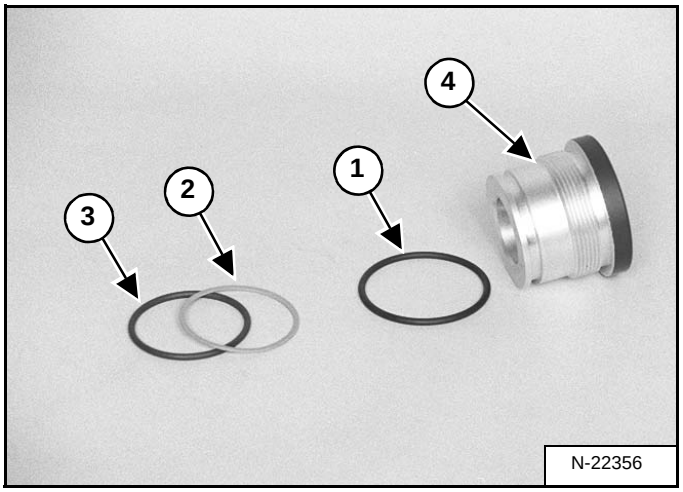
Install the rod seal in the head **[Figure 20-22-21]**.

Figure 20-22-22



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

Figure 20-22-23



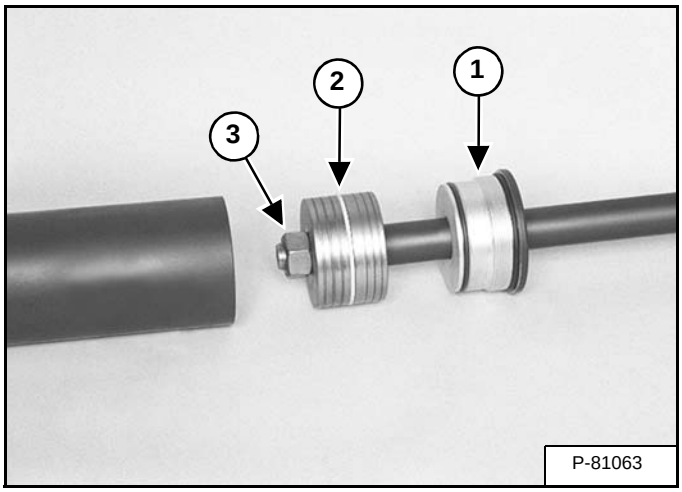
Install the O-ring (Item 1) **[Figure 20-22-23]**.

Install the back-up ring (Item 2) and O-ring (Item 3) on the head (Item 4) **[Figure 20-22-23]**.

BOOM SWING CYLINDER (CONT'D)

Assembly (Cont'd)

Figure 20-22-24



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

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

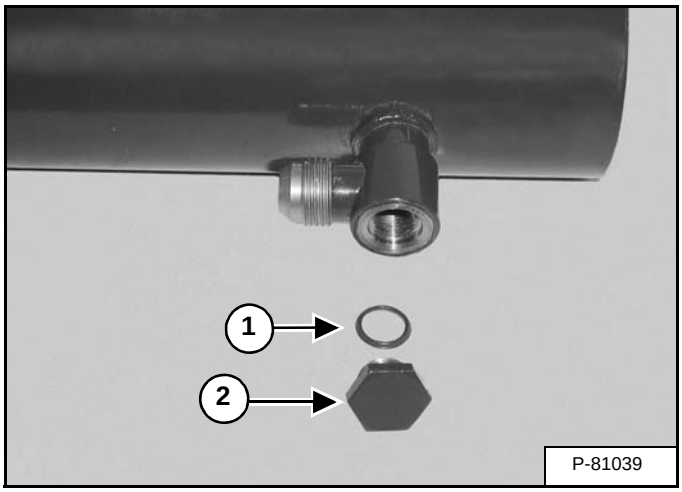
Provide an adequate support for the cylinder before tightening.

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

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

Tighten the nut to 600 ft.-lb. (814 N•m) torque.

Figure 20-22-25

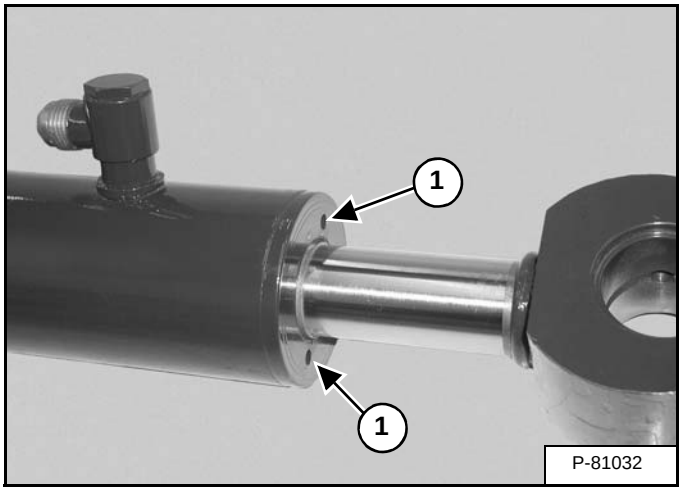


Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-22-25]**.

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

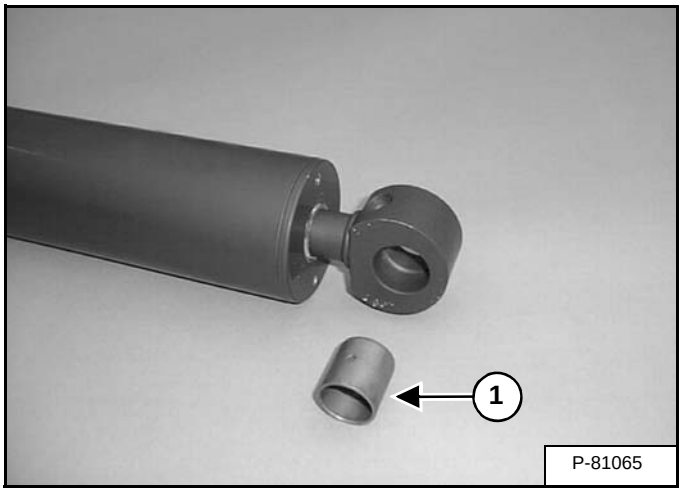
Put the base end of the cylinder in a vise.

Figure 20-22-26



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-22-26]** to tighten the head. Head to be torqued until flush with the end of the housing.

Figure 20-22-27



Install the bushing (Item 1) **[Figure 20-22-27]**. The bushing must be aligned with the grease channel in the rod end of the cylinder.

BUCKET CYLINDER

Testing

Lower the boom/bucket and blade to the ground.

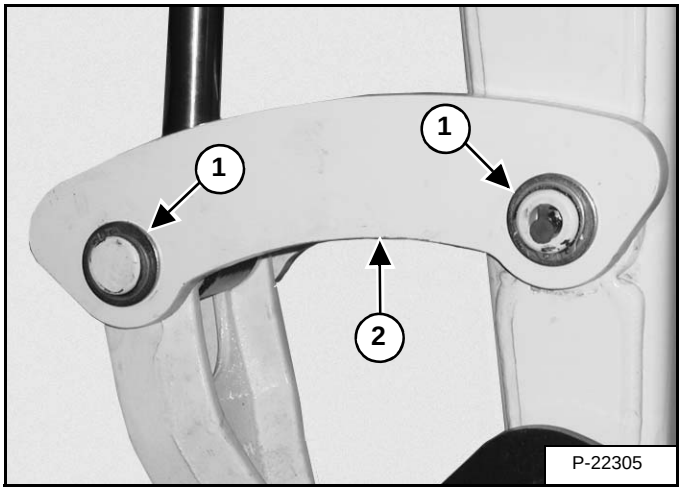
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-23-1



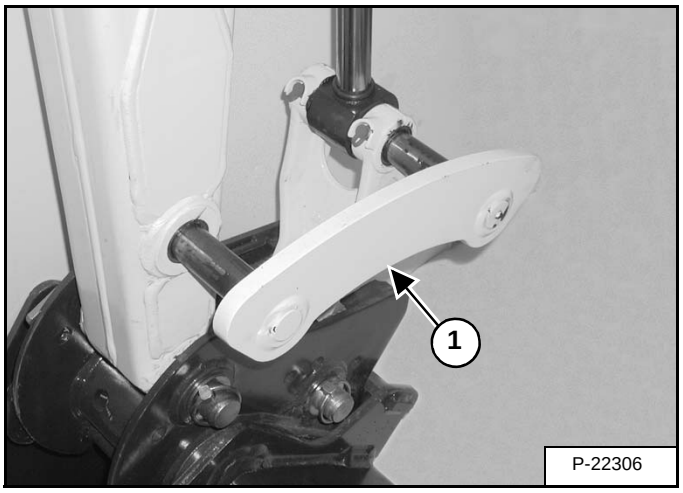
Support the boom using a chain hoist **[Figure 20-23-1]**.

Figure 20-23-2



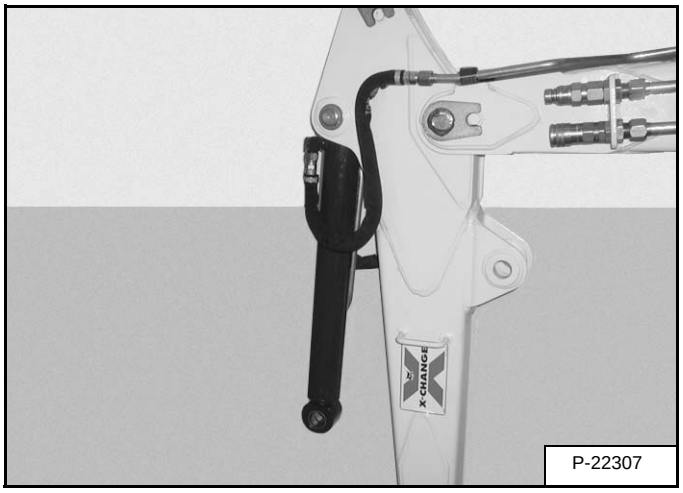
Remove the retaining rings (Item 1), washers and plate (Item 2) **[Figure 20-23-2]**.

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. Relieve hydraulic pressure.

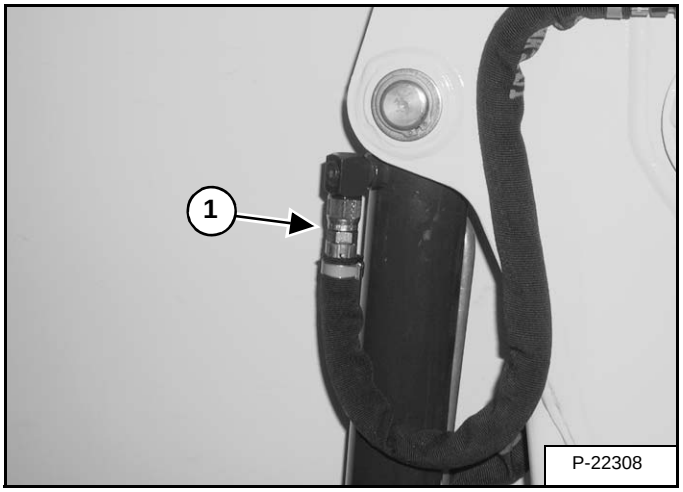
Testing (Cont'd)

WARNING

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

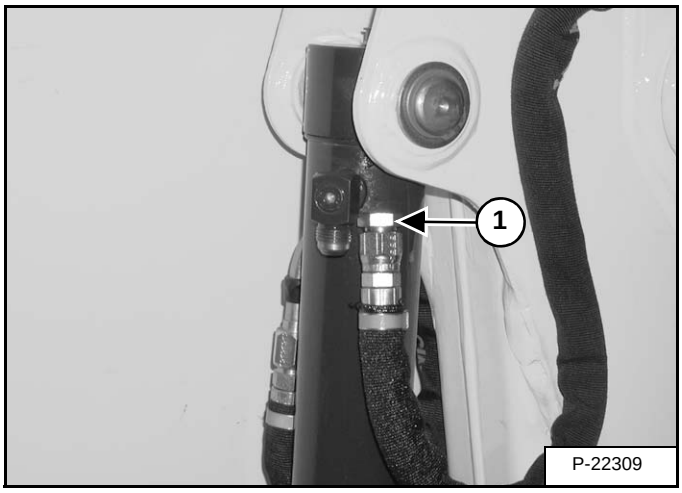
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Figure 20-23-5



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 bucket cylinder.

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

BUCKET CYLINDER (CONT'D)

Removal And Installation

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

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

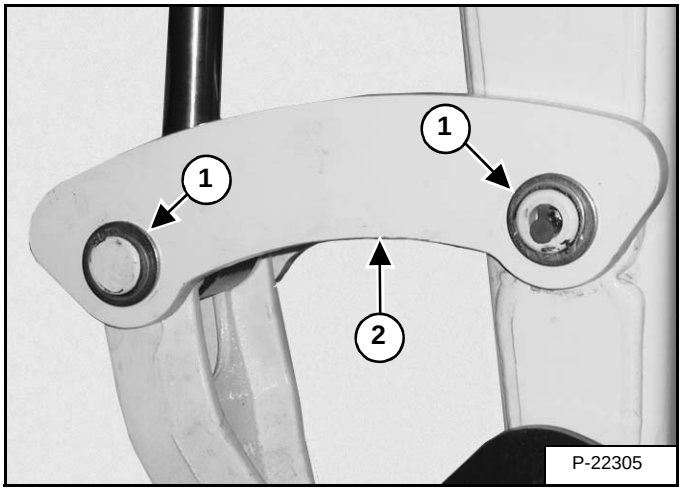
IMPORTANT

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

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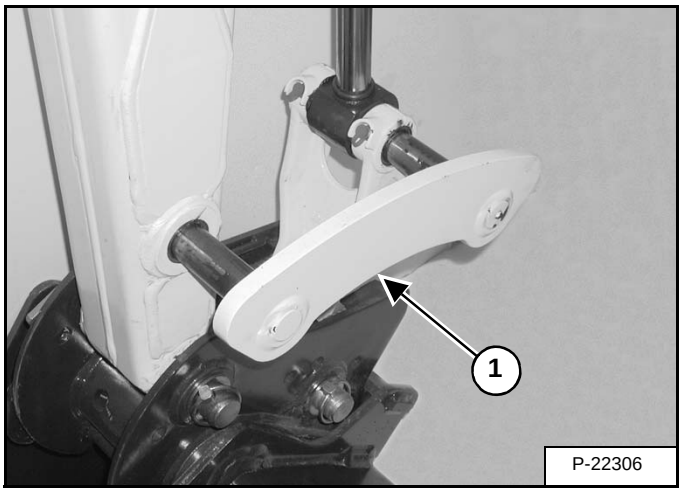
Install a chain hoist to the boom lift point.

Figure 20-23-7



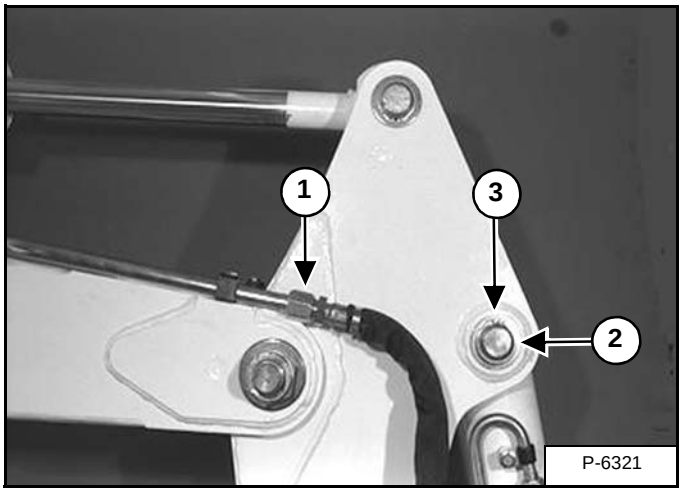
Remove the snap rings (Item 1), washers and plate (Item 2) **[Figure 20-23-7]**.

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.

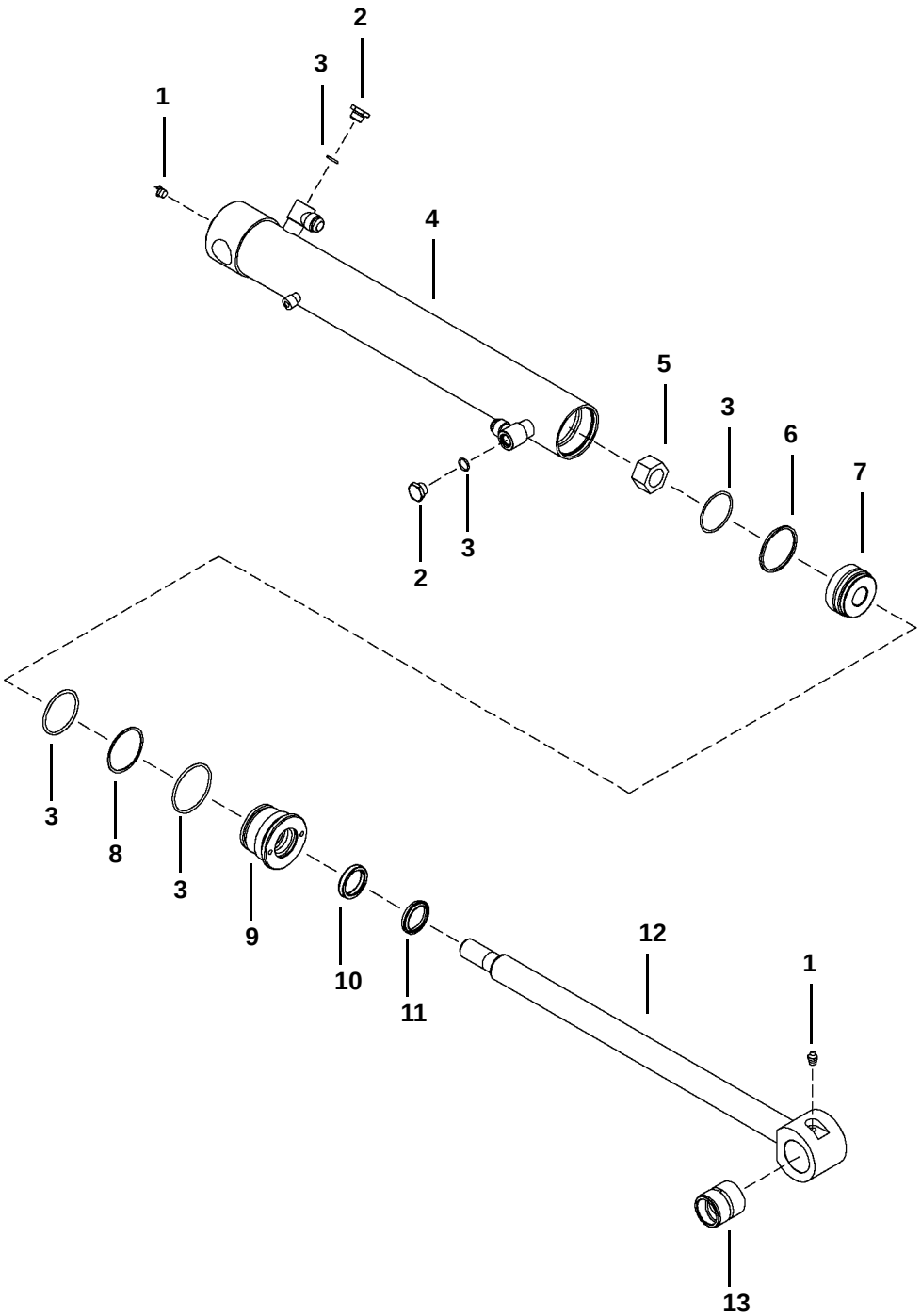
Remove the cylinder base end pin.

Remove the cylinder.

BUCKET CYLINDER (CONT'D)

Parts Identification

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



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Disassembly

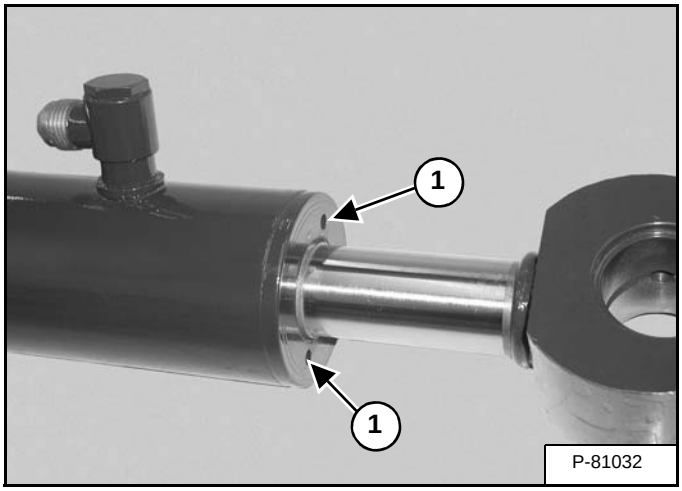
Clean the outside of the bucket cylinder before disassembly.

Use the following tools to disassemble the cylinder:

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

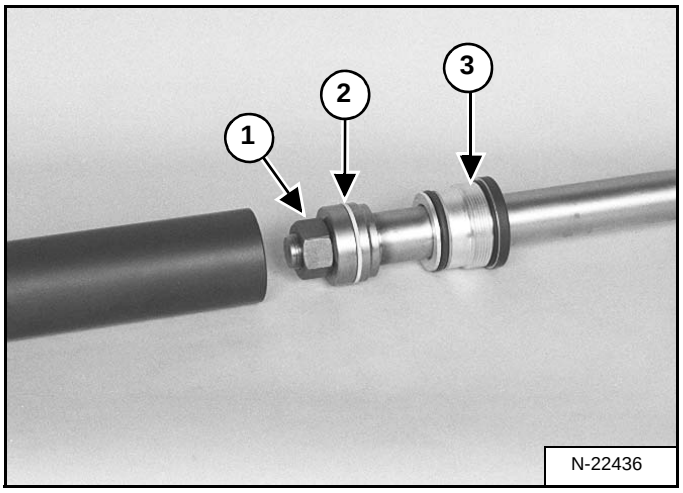
Hold the hydraulic cylinder over a drain pan and move the rod in and out slowly to remove the fluid from the cylinder.

Figure 20-23-10



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

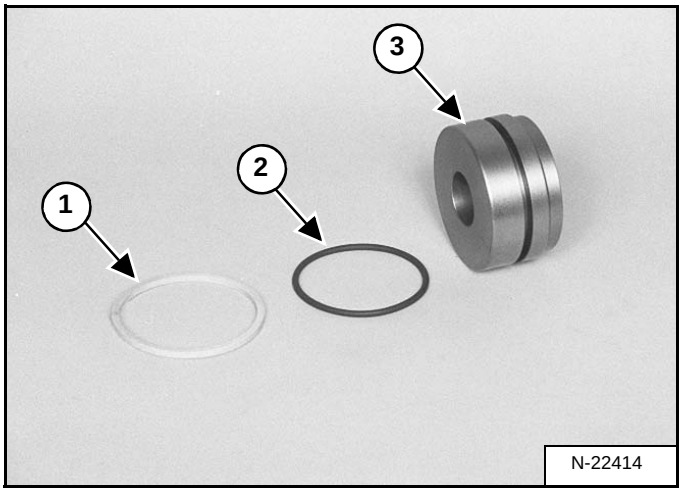
Figure 20-23-11



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]**.

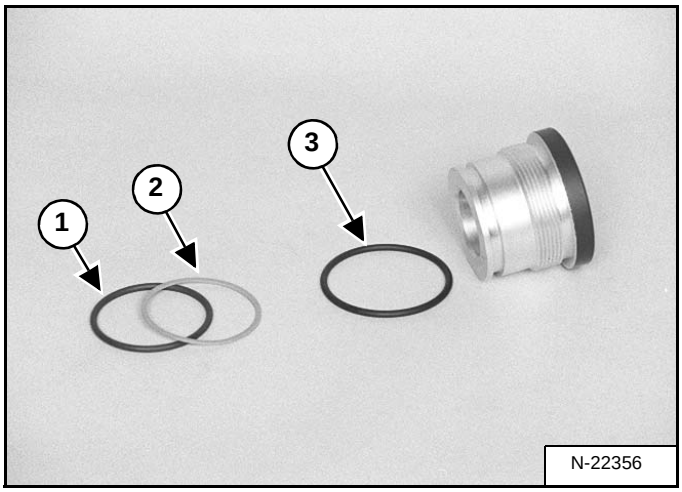
Figure 20-23-12



Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-23-12]**.

Disassembly (Cont'd)

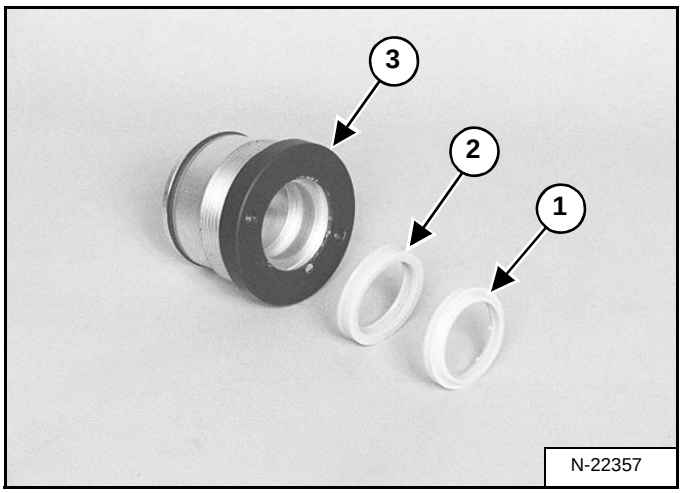
Figure 20-23-13



Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-23-13]**.

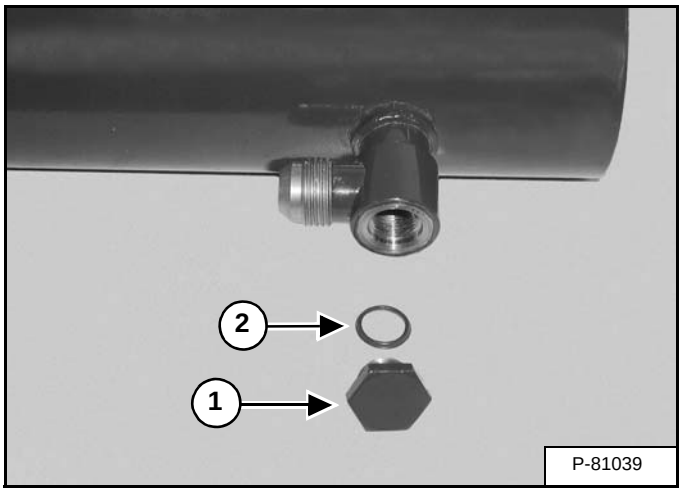
Remove the O-ring (Item 3) **[Figure 20-23-13]**.

Figure 20-23-14



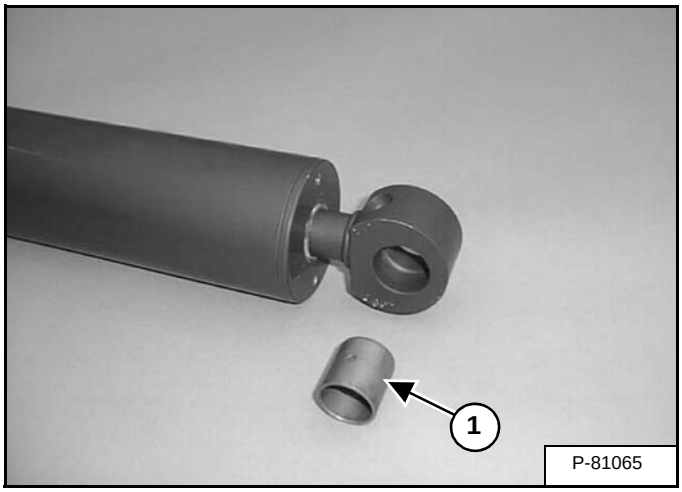
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-23-14]**.

Figure 20-23-15



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

Figure 20-23-16



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

Assembly

Clean all parts in solvent and dry with compressed air.

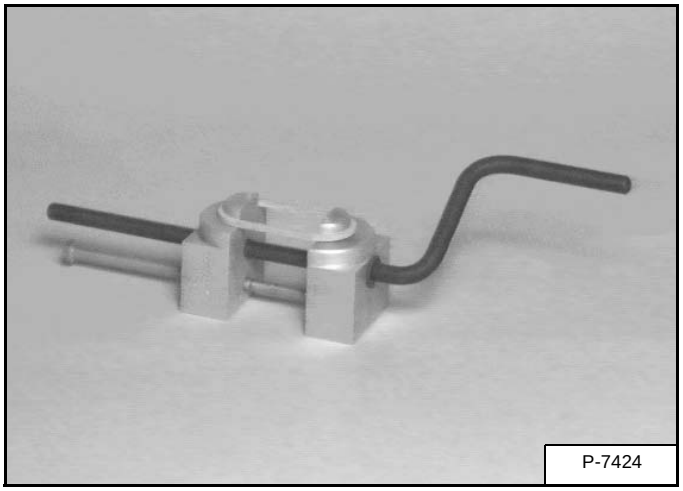
Inspect all parts for wear or damage. Replace any worn or damaged parts.

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

Use the following tools to assemble the cylinder:

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

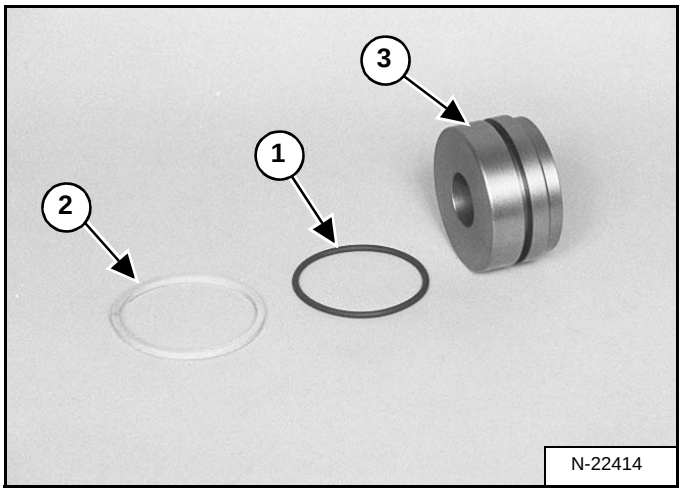
Figure 20-23-17



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

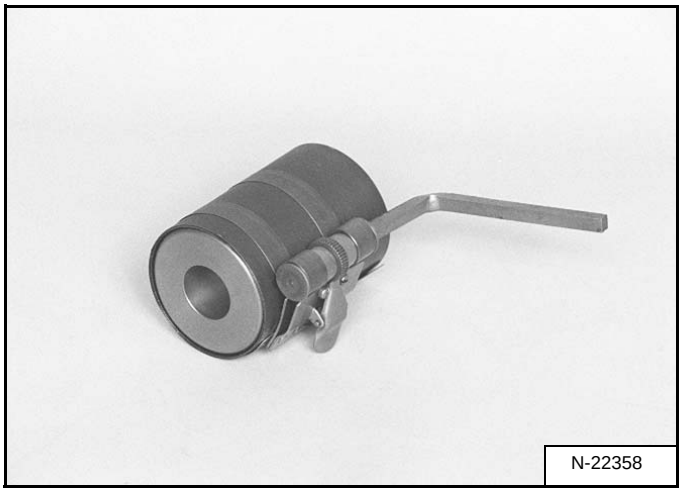
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-23-18



Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-23-18]**.

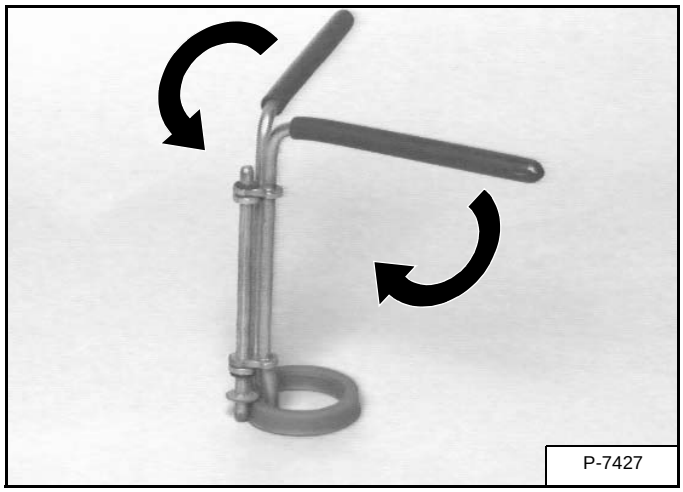
Figure 20-23-19



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]**.

Assembly (Cont'd)

Figure 20-23-20

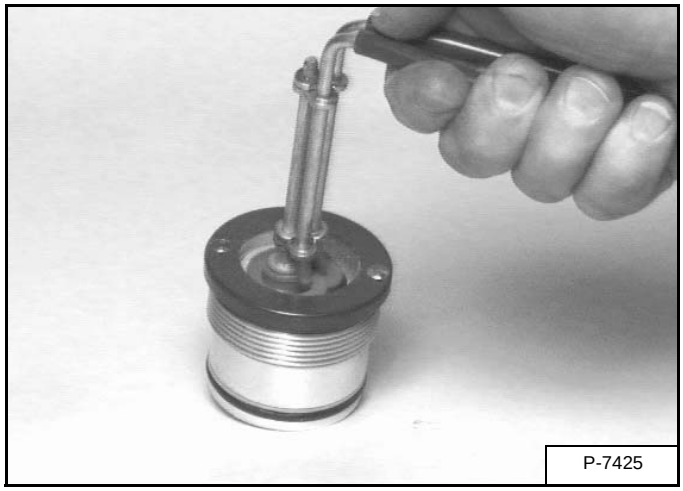


Install the rod seal on the rod seal tool **[Figure 20-23-20]**.

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

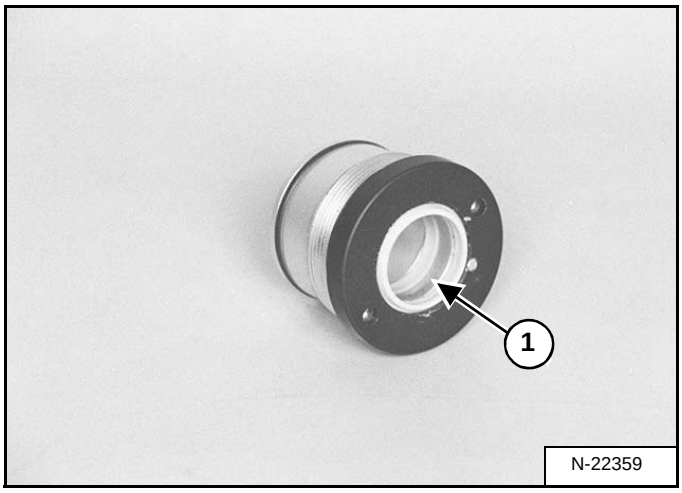
Rotate the handles to collapse the rod seal **[Figure 20-23-20]**.

Figure 20-23-21



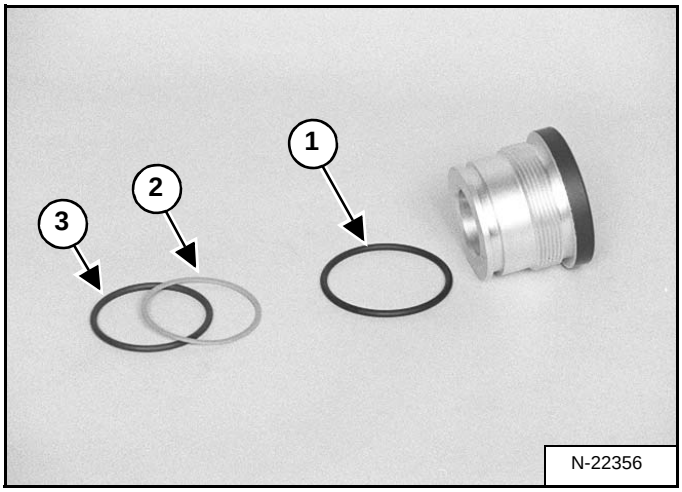
Install the rod seal in the head **[Figure 20-23-21]**.

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

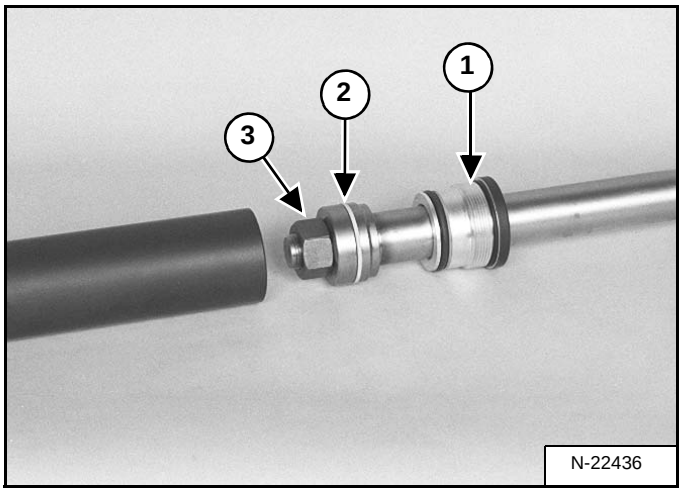


Install the O-ring (Item 1) **[Figure 20-23-23]**.

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

Assembly (Cont'd)

Figure 20-23-24



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

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

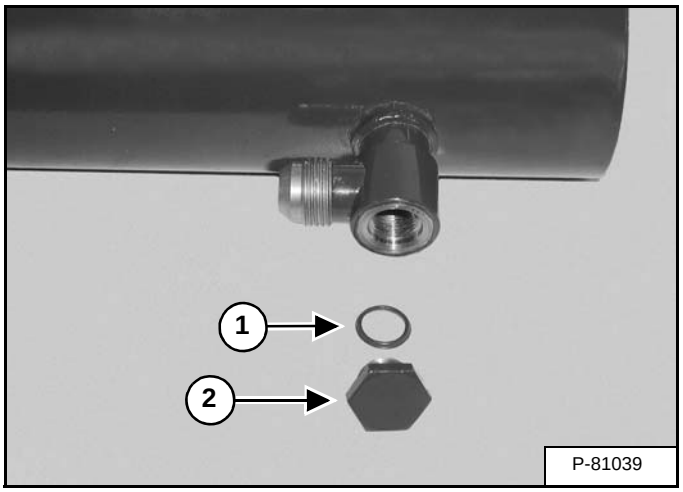
Provide an adequate support for the cylinder before tightening.

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

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

Tighten the nut to 600 ft.-lb. (814 N•m) torque.

Figure 20-23-25

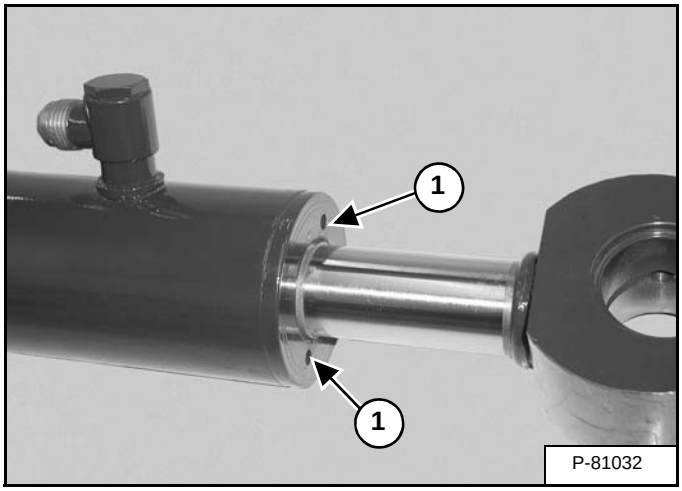


Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-23-25]**.

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

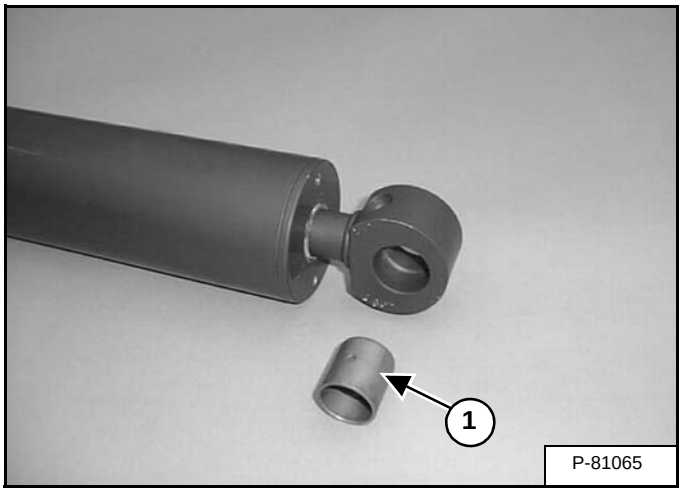
Put the base end of the cylinder in a vise.

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 the end of the housing.

Figure 20-23-27



Install the bushing (Item 1) **[Figure 20-23-27]**. The bushing must be aligned with the grease channel in the rod end of the cylinder.


Bobcat®

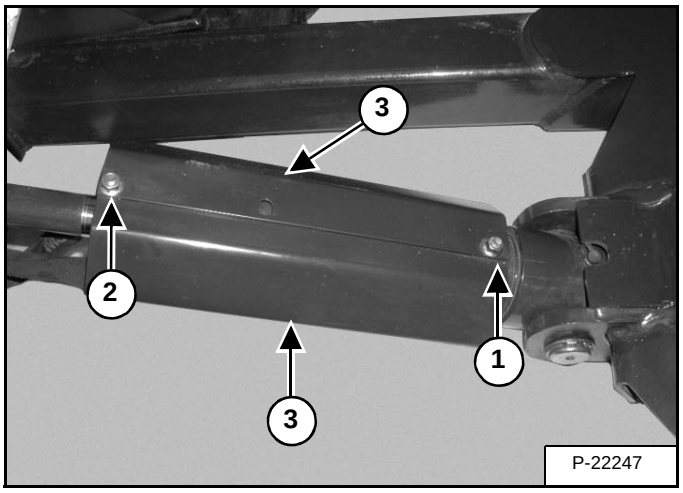
BLADE CYLINDER

Testing

Lower the boom/bucket and blade to the ground.

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

Figure 20-24-1

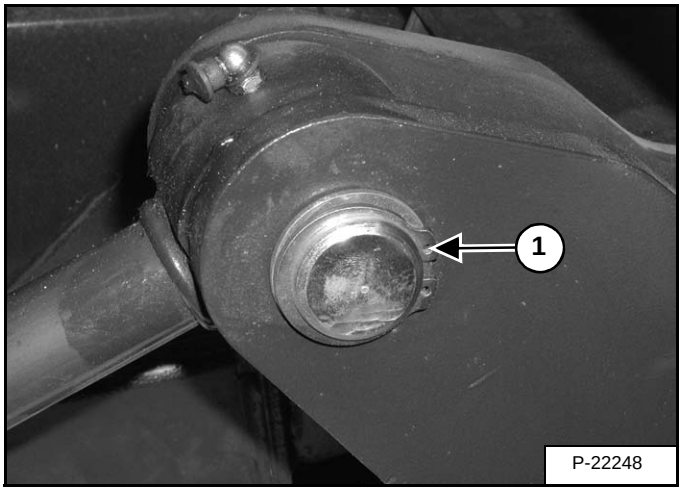


Remove the two nuts (Item 1) **[Figure 20-24-1]** from the studs.

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

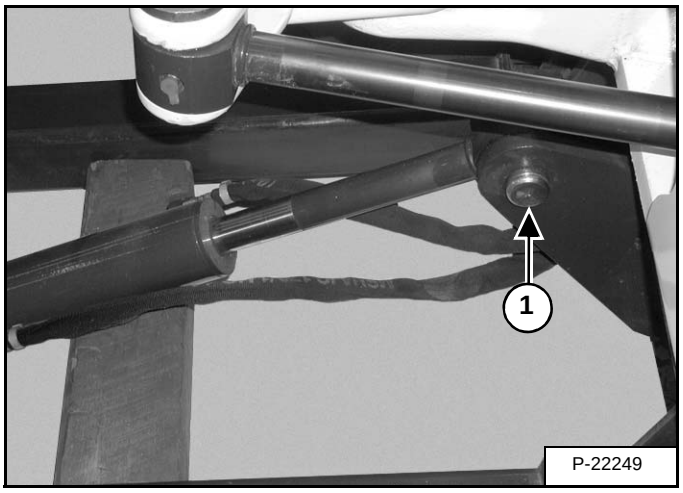
Remove the shields (Item 3) **[Figure 20-24-1]**.

Figure 20-24-2



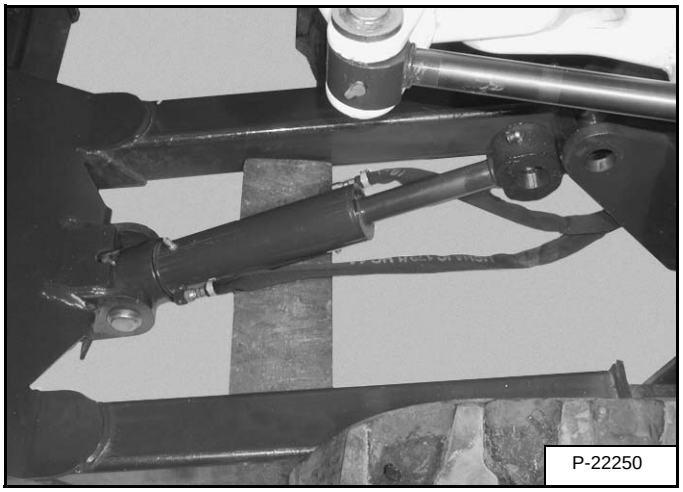
Remove the snap ring (Item 1) **[Figure 20-24-2]** and washer from the cylinder rod end.

Figure 20-24-3



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

Figure 20-24-4



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

Stop the engine. Relieve hydraulic pressure.

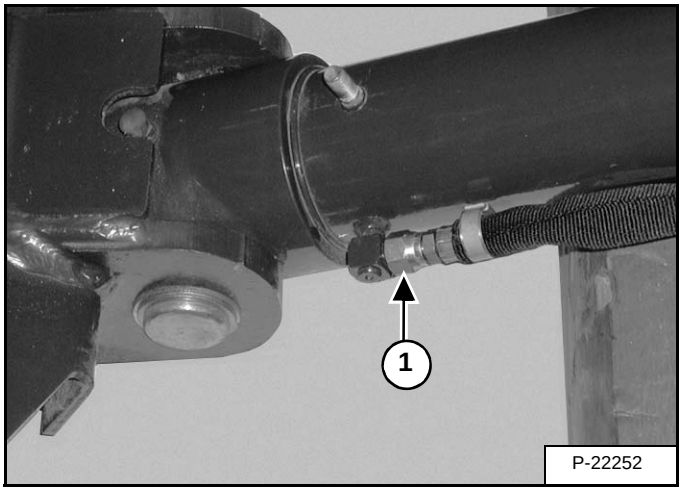
Testing (Cont'd)

WARNING

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

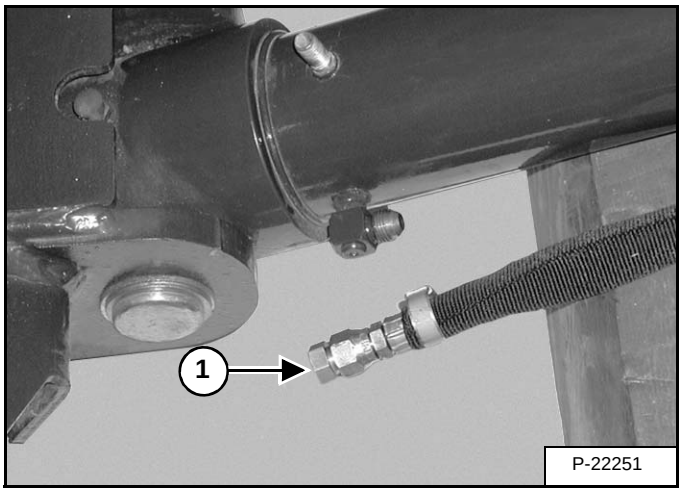
W-2145-0290

Figure 20-24-5



Remove the base 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 blade cylinder.

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

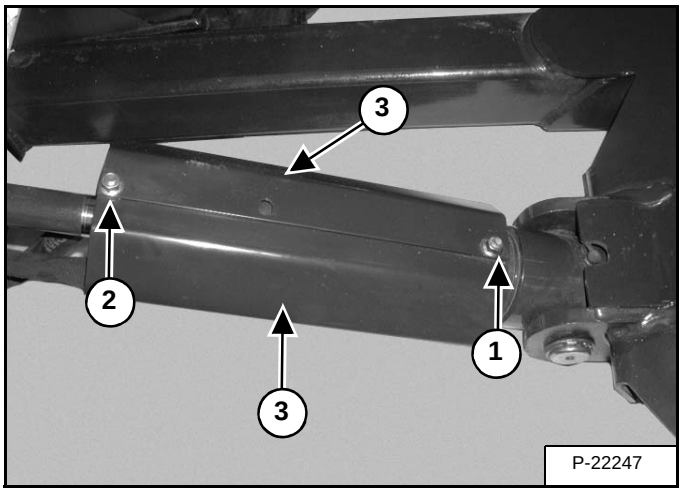
BLADE CYLINDER (CONT'D)

Removal And Installation

Lower the boom/bucket and blade to the ground.

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

Figure 20-24-7

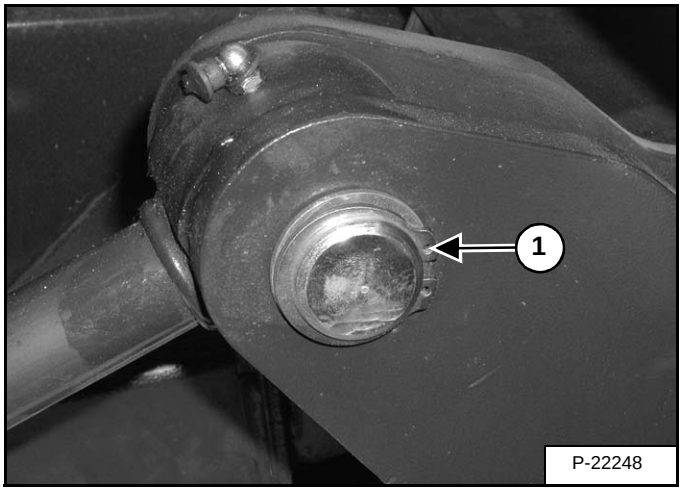


Remove the nuts (Item 1) **[Figure 20-24-7]** from the studs.

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

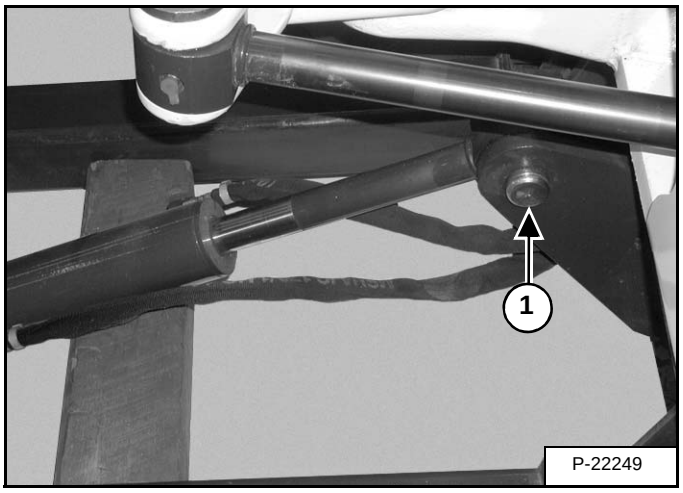
Remove the shields (Item 3) **[Figure 20-24-7]**.

Figure 20-24-8



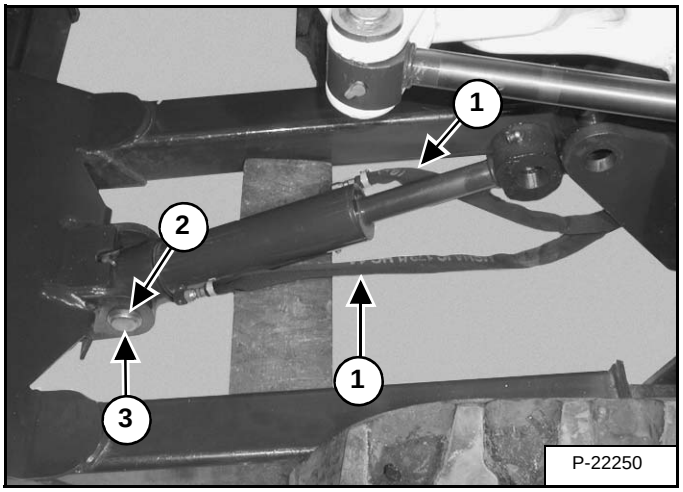
Remove the snap ring (Item 1) **[Figure 20-24-8]** and washer from the cylinder rod end.

Figure 20-24-9



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

Figure 20-24-10



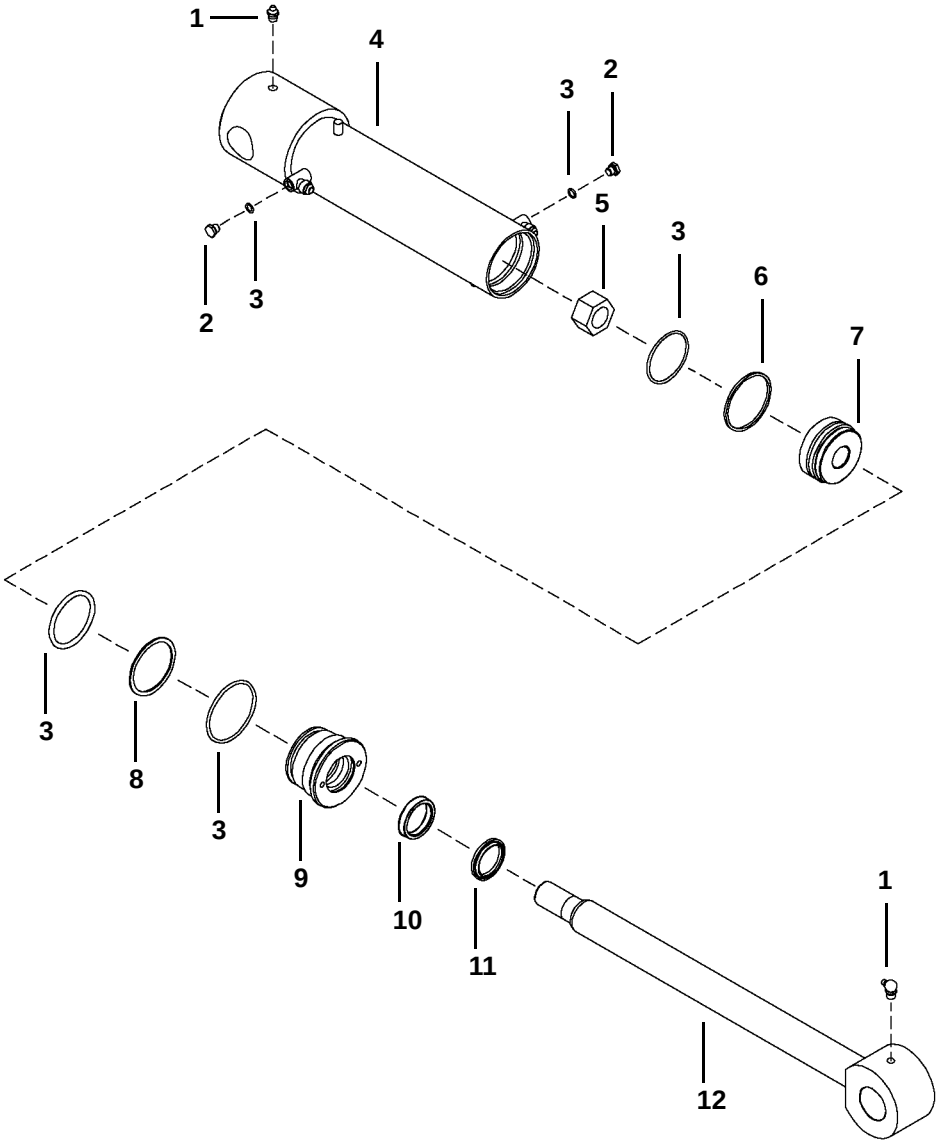
Remove the hoses (Item 1) **[Figure 20-24-10]**.

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

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

Parts Identification

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



PE3420S

Disassembly

Clean the outside of the blade cylinder before disassembly.

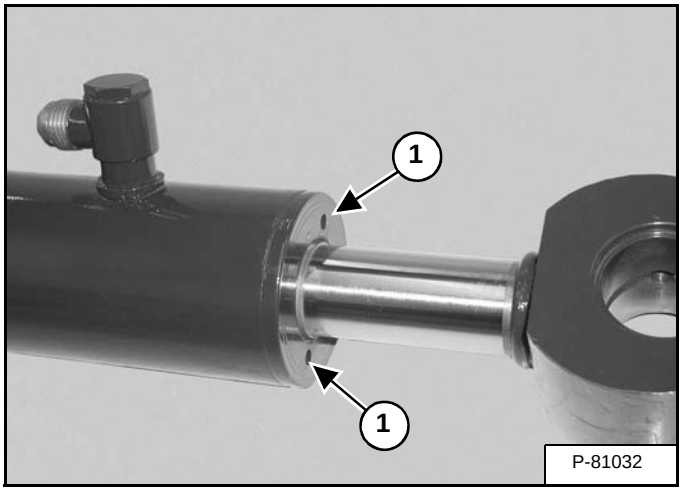
Use the following tools to disassemble the cylinder:

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

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

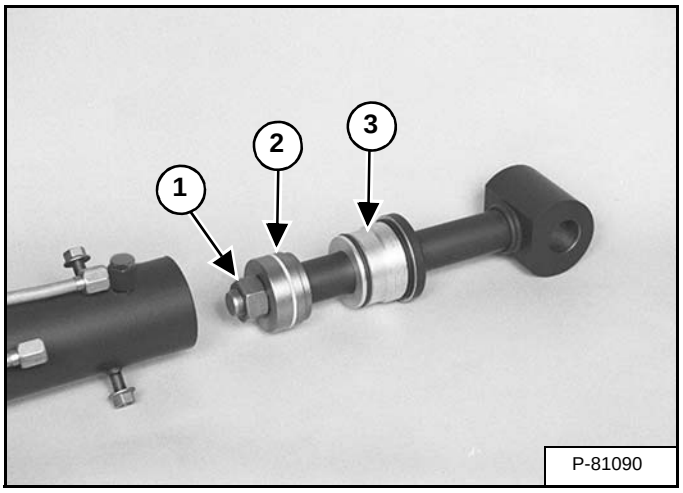
Put the base end of the cylinder in a vise.

Figure 20-24-11



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

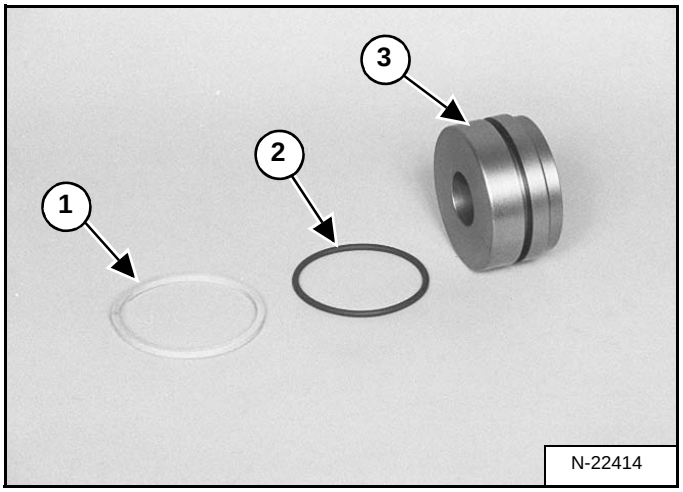
Figure 20-24-12



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

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

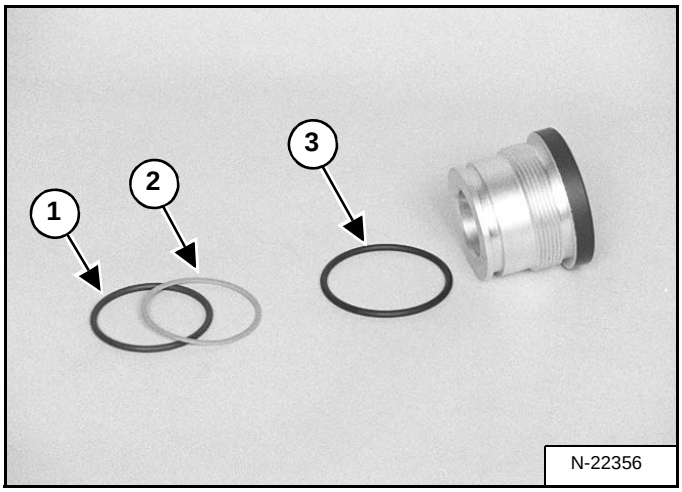
Figure 20-24-13



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

Disassembly (Cont'd)

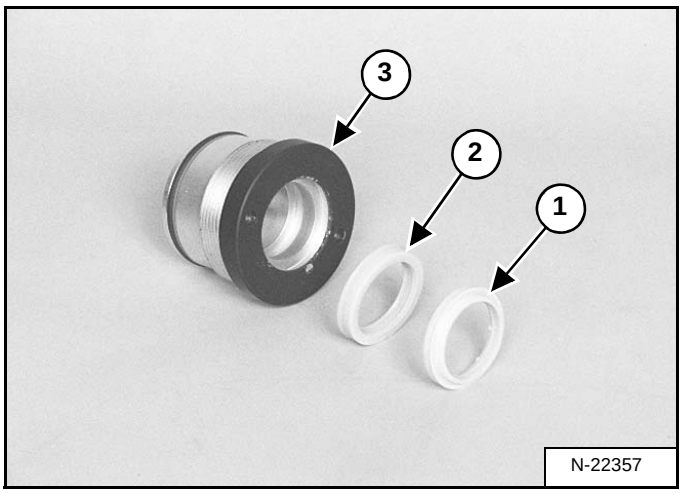
Figure 20-24-14



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

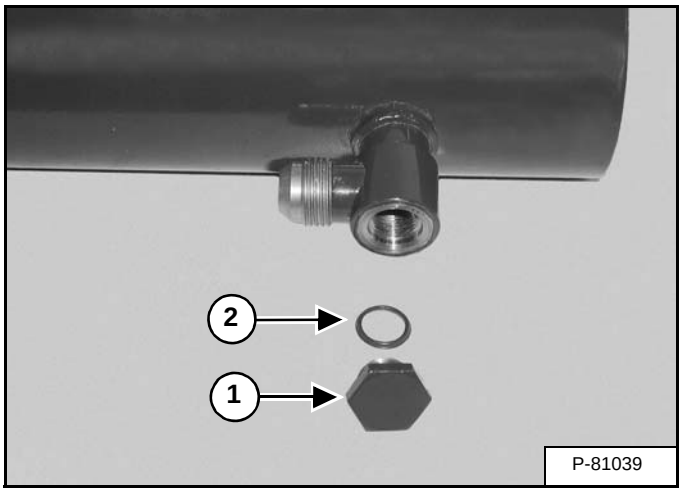
Remove the O-ring (Item 3) **[Figure 20-24-14]**.

Figure 20-24-15



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

Figure 20-24-16



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

Assembly

Clean all parts in solvent and dry with compressed air.

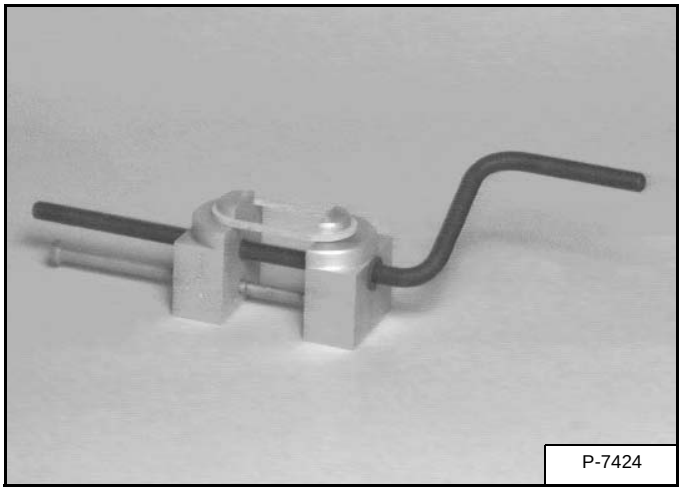
Inspect all parts for wear or damage. Replace any worn or damaged parts.

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

Use the following tools to assemble the cylinder:

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

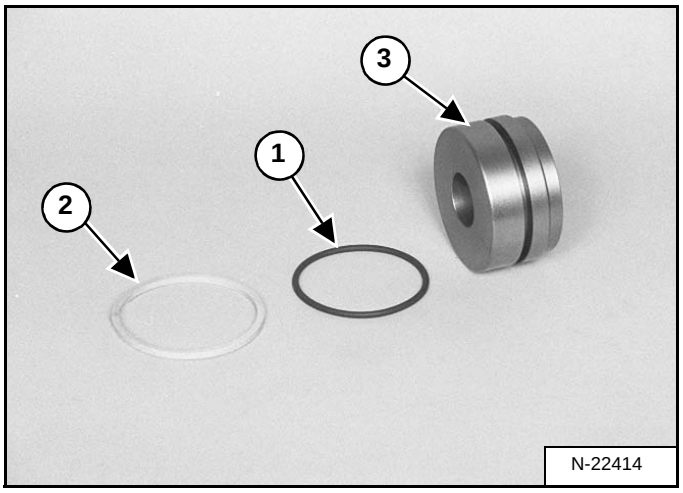
Figure 20-24-17



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

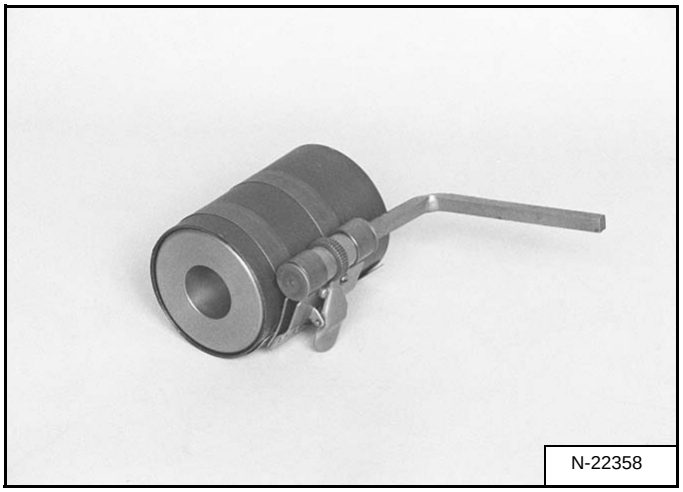
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-24-18



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

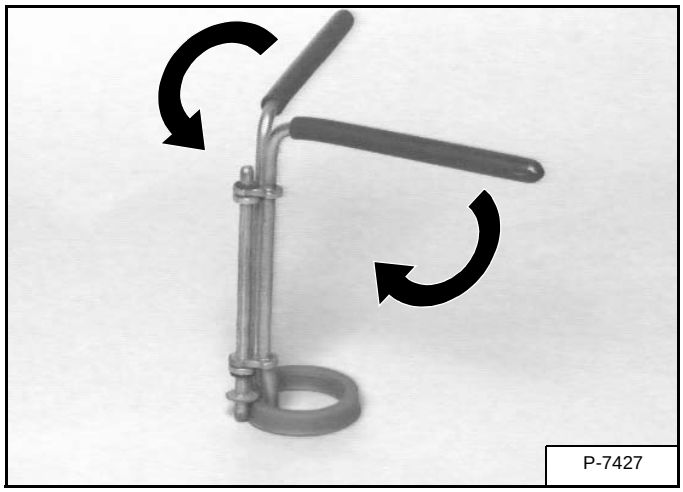
Figure 20-24-19



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

Assembly (Cont'd)

Figure 20-24-20

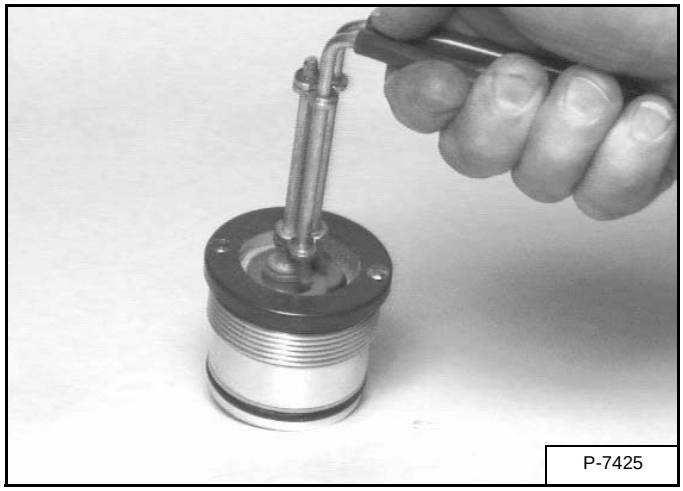


Install the rod seal on the rod seal tool **[Figure 20-24-20]**.

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

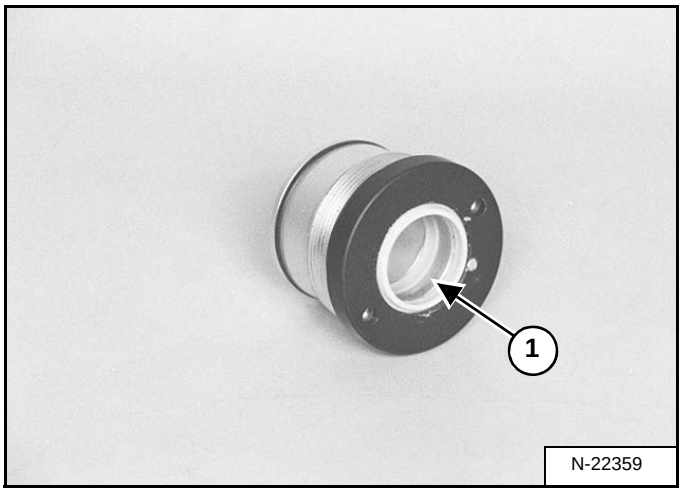
Rotate the handles to collapse the rod seal **[Figure 20-24-20]**.

Figure 20-24-21



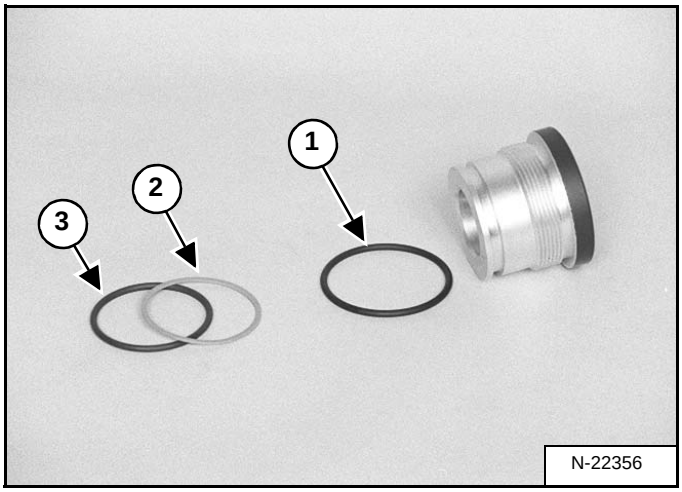
Install the rod seal in the head **[Figure 20-24-21]**.

Figure 20-24-22



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

Figure 20-24-23



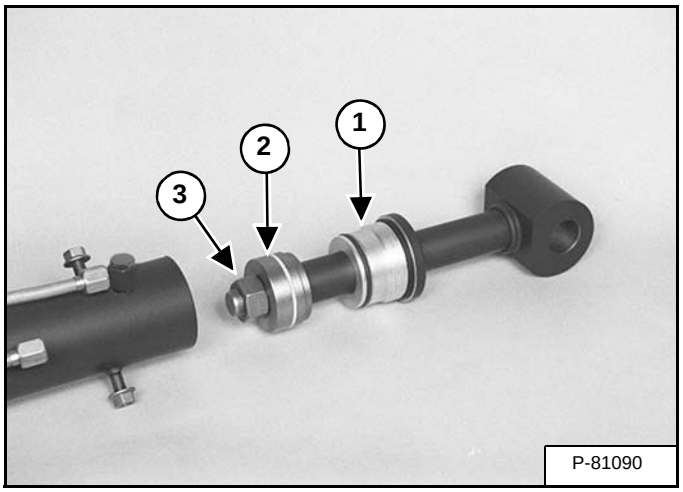
Install the O-ring (Item 1) **[Figure 20-24-23]**.

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

BLADE CYLINDER (CONT'D)

Assembly (Cont'd)

Figure 20-24-24



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

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

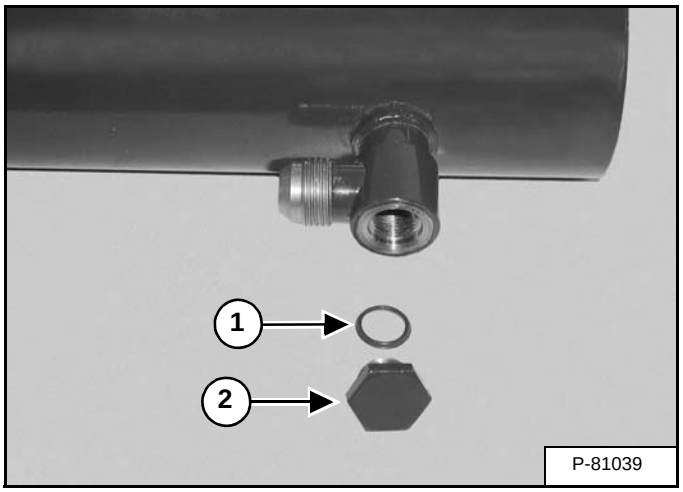
Provide an adequate support for the cylinder before tightening.

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

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

Tighten the nut to 600 ft.-lb. (814 N•m) torque.

Figure 20-24-25

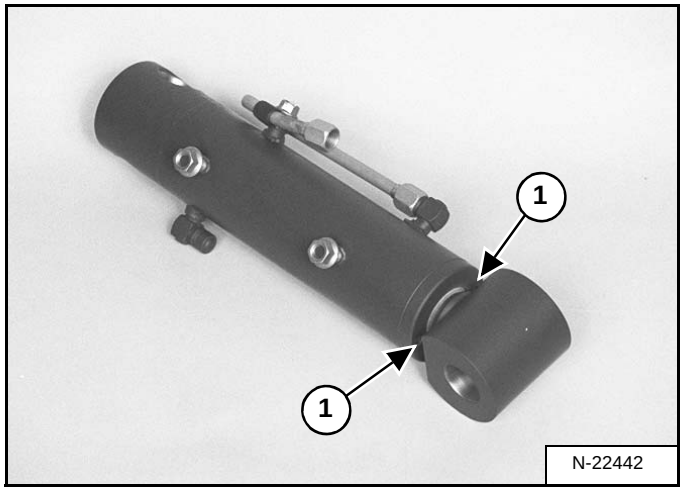


Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-24-25]**.

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

Put the base end of the cylinder in a vise.

Figure 20-24-26



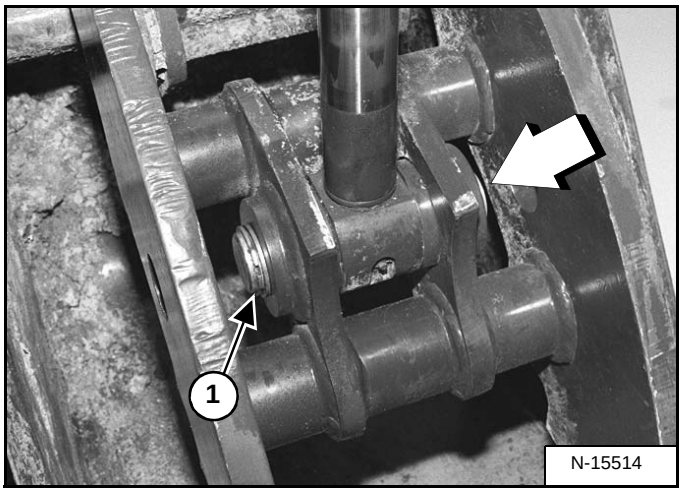
Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-24-26]** to tighten the head. Head to be torqued until flush with the end of the housing.


Bobcat®

CLAMP CYLINDER

Testing

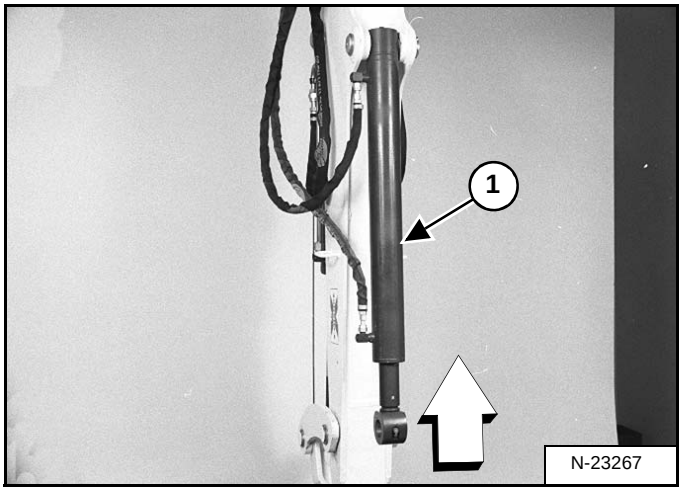
Figure 20-25-1



Remove the snap ring and washer (Item 1) **[Figure 20-25-1]** from the clamp cylinder pin.

Remove the pin from the rod end of the clamp cylinder **[Figure 20-25-1]**.

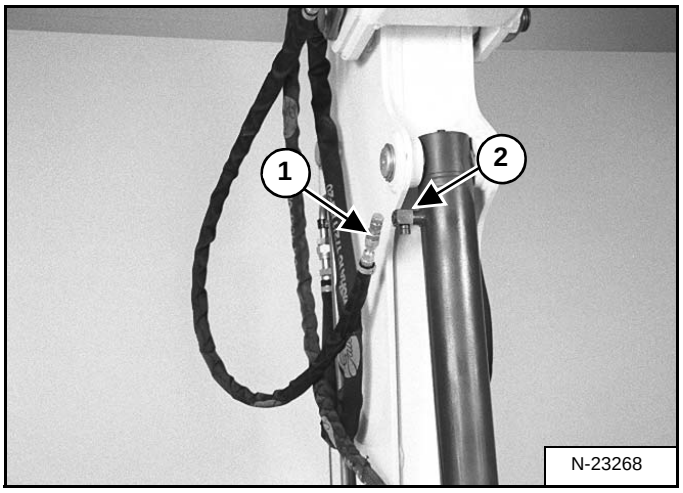
Figure 20-25-2



Start the engine and retract the clamp cylinder (Item 1) **[Figure 20-25-2]**.

Stop the engine.

Figure 20-25-3



Disconnect the hydraulic hose (Item 1) **[Figure 20-25-3]** from the base end of the cylinder.

Cap the hose (Item 1) **[Figure 20-25-3]**.

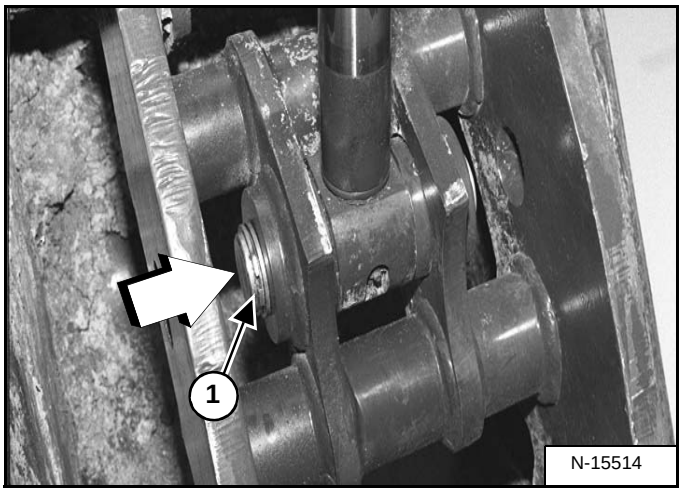
Start the and retract the cylinder.

If there is any oil leakage from the base end fitting (Item 2) **[Figure 20-25-3]** on the cylinder, remove the cylinder for repair or replacement.

CLAMP CYLINDER (CONT'D)

Removal And Installation

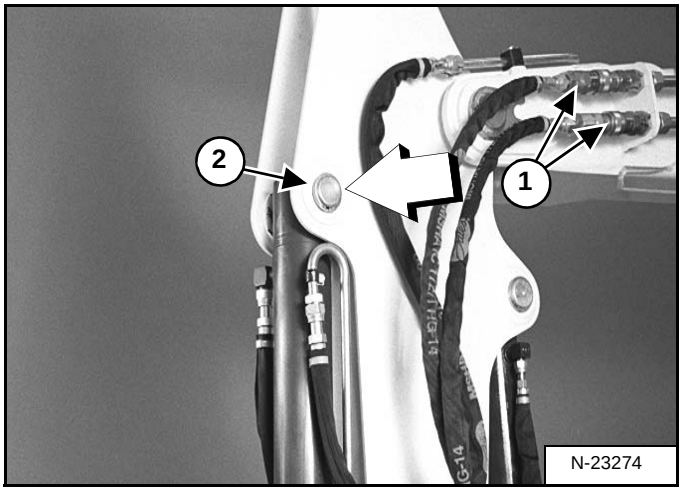
Figure 20-25-4



Remove the snap ring and washer (Item 1) **[Figure 20-25-4]** from the cylinder pin.

Remove the pin from the rod end of the cylinder **[Figure 20-25-4]**.

Figure 20-25-5



Disconnect the quick couplers (Item 1) **[Figure 20-25-5]**.

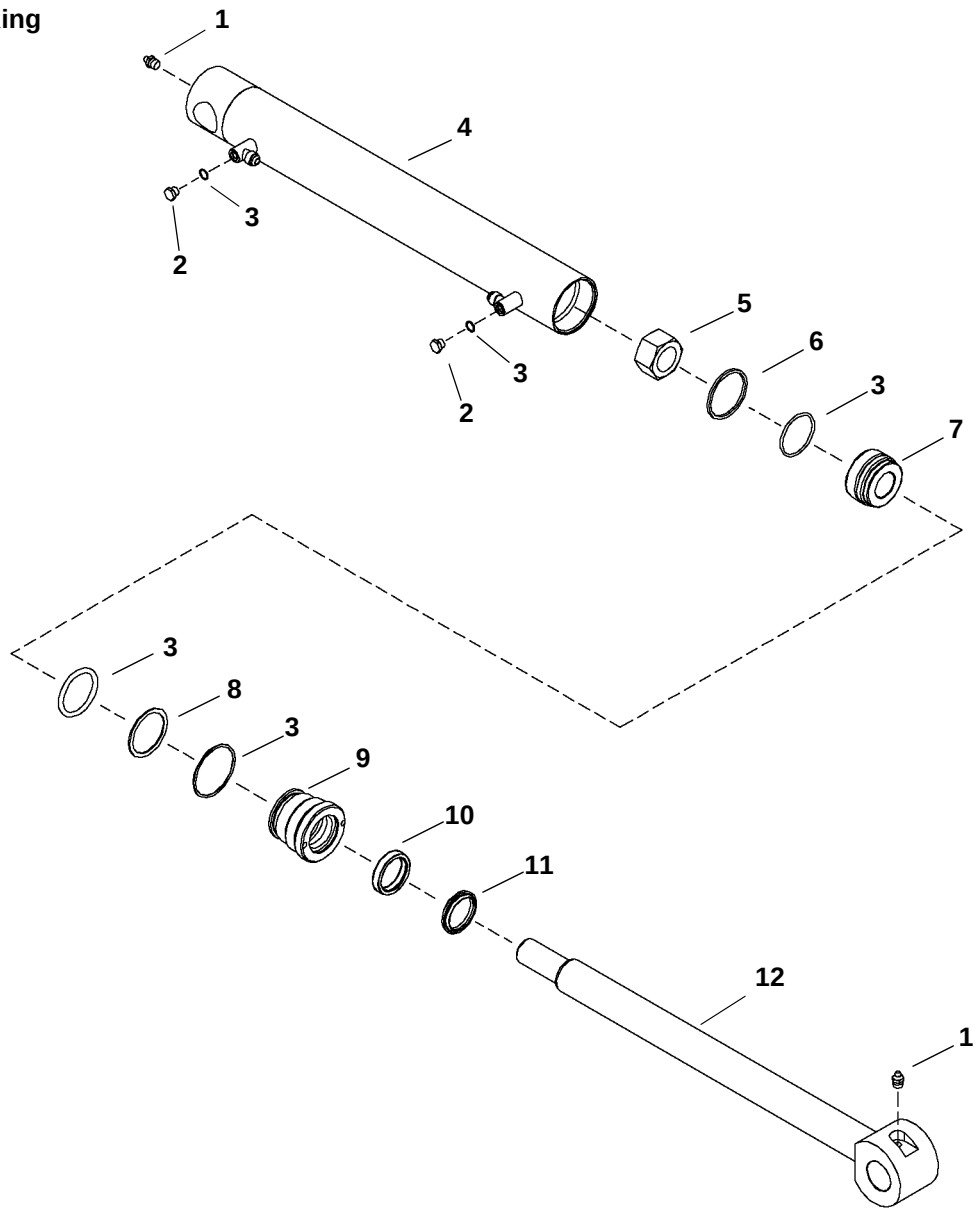
Remove the snap ring and washer (Item 2) **[Figure 20-25-5]**.

Remove the base end cylinder pin **[Figure 20-25-5]**.

Remove the cylinder.

Parts Identification

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



PE3415S

CLAMP CYLINDER (CONT'D)

Disassembly

NOTE: The drawings may appear different. The procedure is the same.

Clean the outside of the clamp cylinder before disassembly.

The following tools will be needed to disassemble and assemble the cylinders:

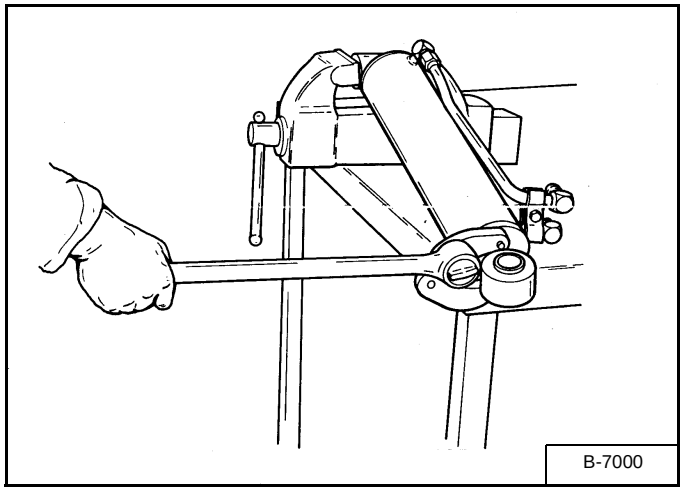
1. MEL1075 - Adjustable Gland Nut Wrench
2. MEL1074 - O-Ring Seal Hook
3. MEL1396 - Seal Installation Tool
4. MEL1033 - Rod Seal Installation Tool

Put the base end of the hydraulic cylinder in a drain pan.

Move the rod in and out to remove the fluid from the cylinder. Move the rod slowly so the fluid will go directly into the drain pan.

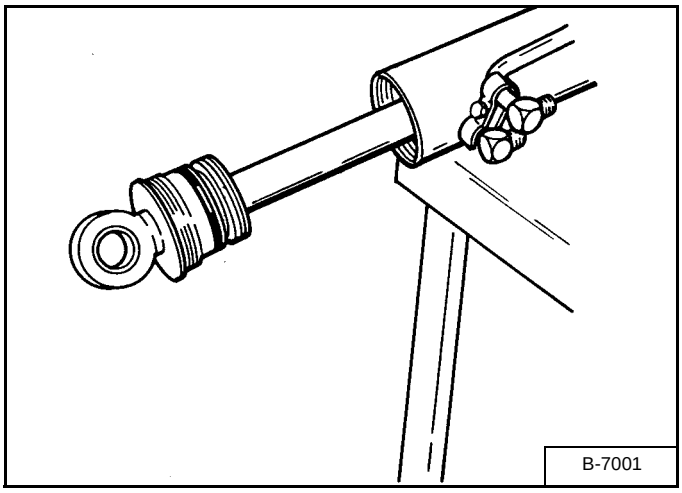
Put the base end of the cylinder in a vise.

Figure 20-25-6



Use the adjustable gland nut wrench to loosen the head **[Figure 20-25-6]**.

Figure 20-25-7

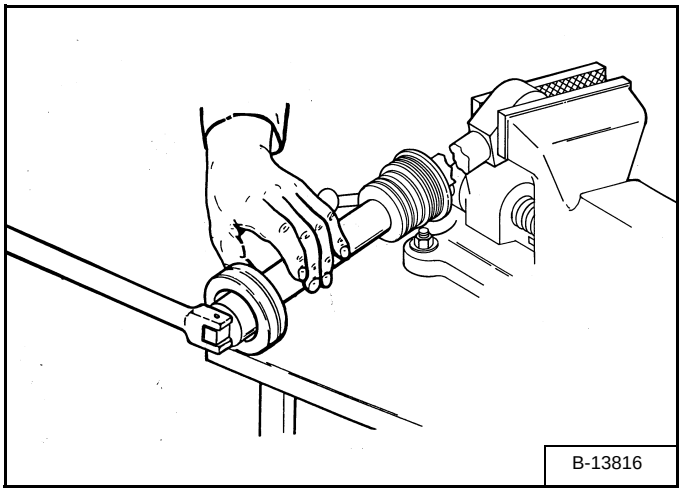


Remove the rod assembly from the cylinder housing **[Figure 20-25-7]**.

Remove the cylinder housing from the vise.

Put the rod end in the vise.

Figure 20-25-8

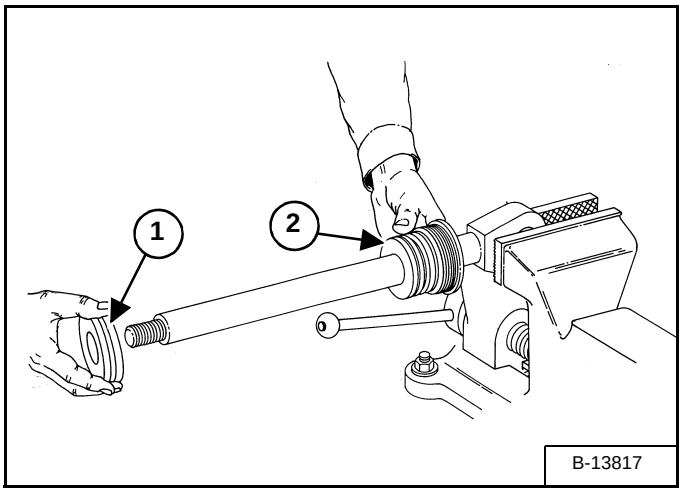


Loosen the nut from the piston end of the rod **[Figure 20-25-8]**.

CLAMP CYLINDER (CONT'D)

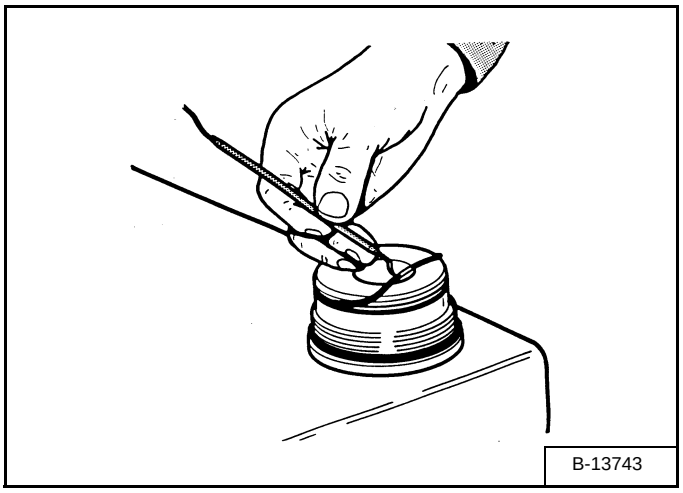
Disassembly (Cont'd)

Figure 20-25-9



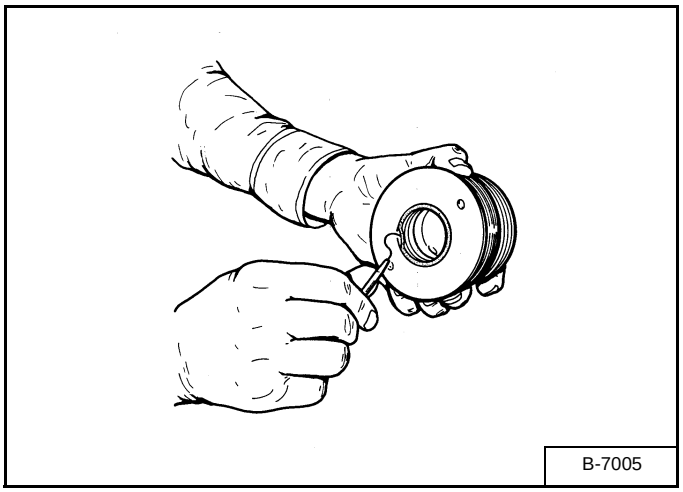
Remove the piston (Item 1) and head (Item 2) **[Figure 20-25-9]**.

Figure 20-25-10



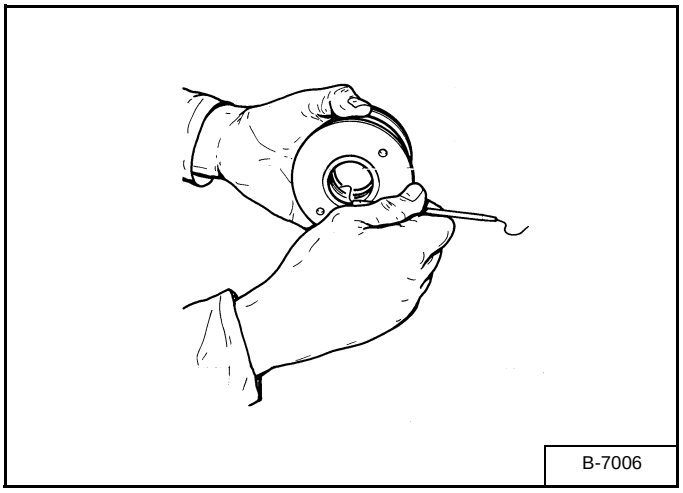
Remove the O-ring and back-up ring from the head with seal hook **[Figure 20-25-10]**.

Figure 20-25-11



Remove the wiper seal **[Figure 20-25-11]**.

Figure 20-25-12

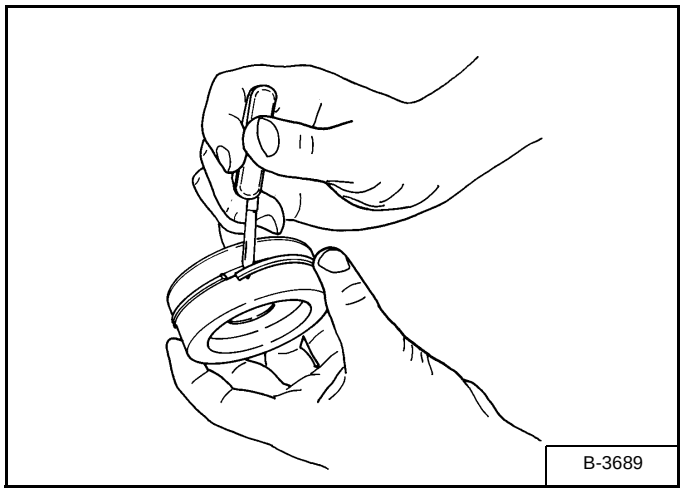


Remove the oil seal from the head **[Figure 20-25-12]**.

CLAMP CYLINDER (CONT'D)

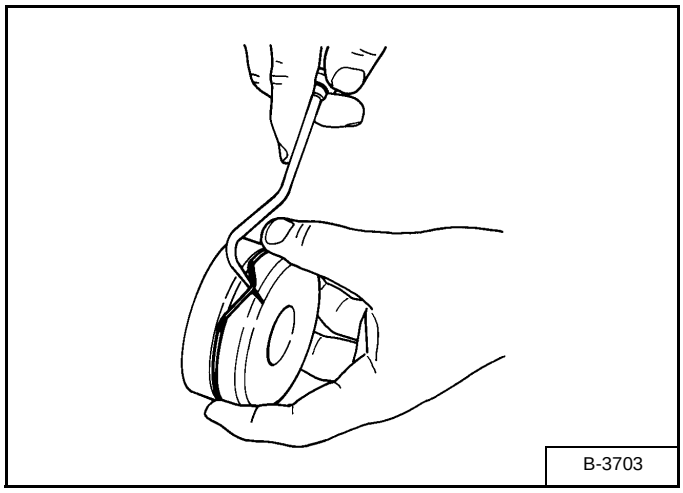
Disassembly (Cont'd)

Figure 20-25-13



Cut the old teflon seal and remove the seal from the piston **[Figure 20-25-13]**.

Figure 20-25-14



Remove the O-ring from the piston **[Figure 20-25-14]**.

CLAMP CYLINDER (CONT'D)

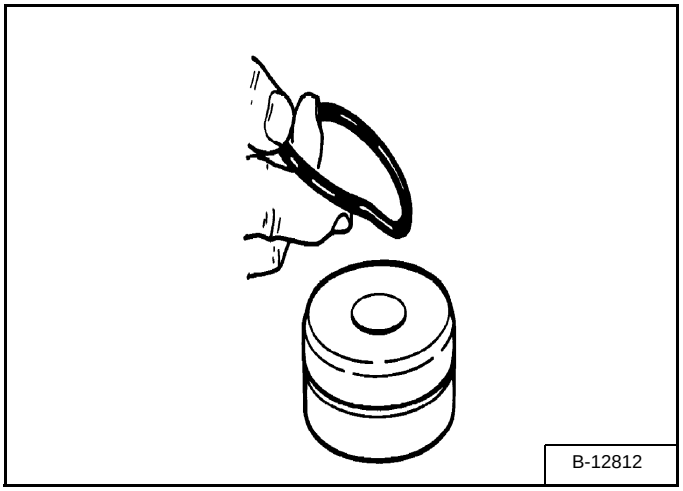
Assembly

Clean all parts in solvent and dry with compressed air.

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

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

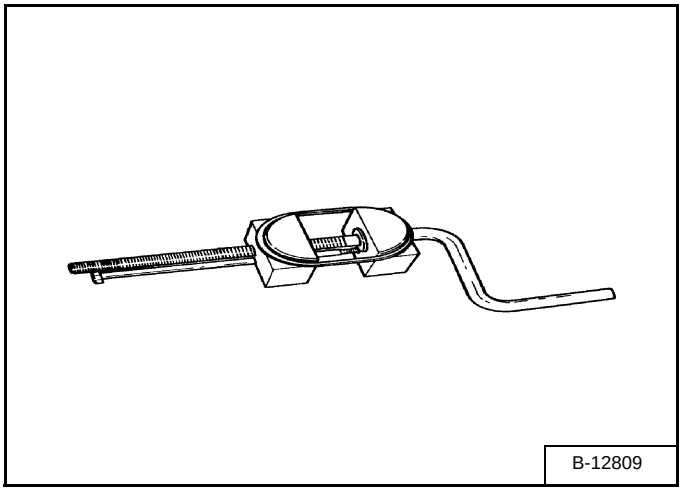
Figure 20-25-15



Install the O-ring on the piston **[Figure 20-25-15]**.

NOTE: Do not overstretch the seal.

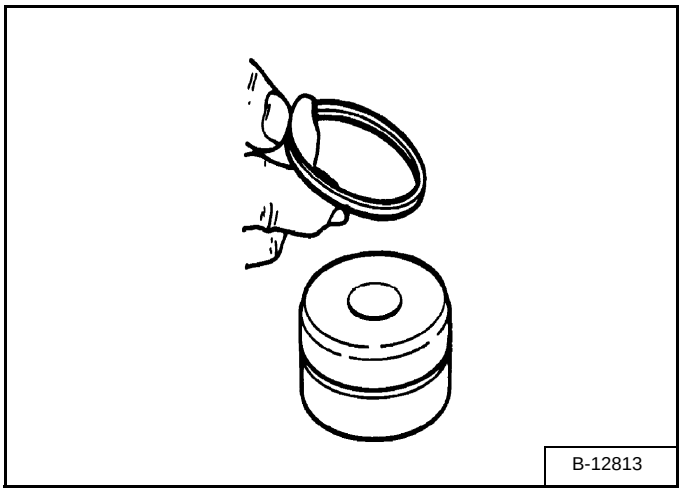
Figure 20-25-16



Install the seal on the tool and stretch it until it fits the piston **[Figure 20-25-16]**.

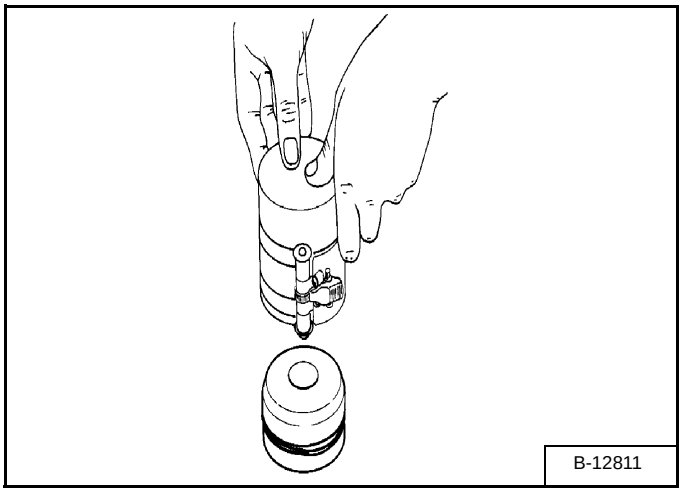
Allow the seal to stretch for 30 seconds before removing it from the tool.

Figure 20-25-17



Install the seal on the piston **[Figure 20-25-17]**.

Figure 20-25-18

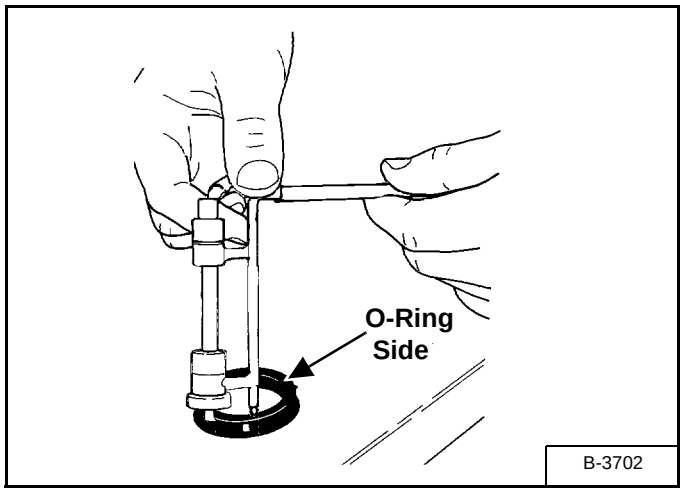


Use a ring compressor to compress the seal to the correct size **[Figure 20-25-18]**.

Leave the piston in the ring compressor for three minutes.

Assembly (Cont'd)

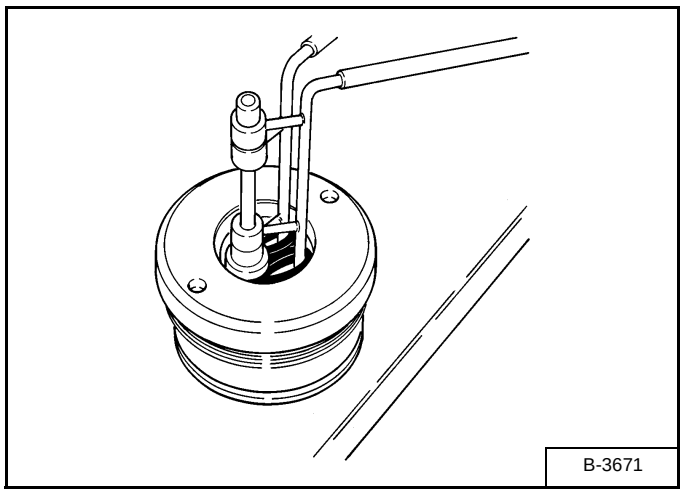
Figure 20-25-19



Install the oil seal on the rod seal tool **[Figure 20-25-19]**.

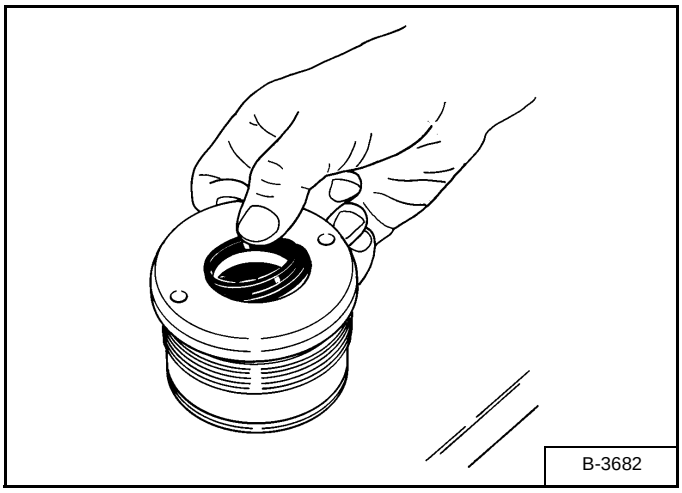
NOTE: The O-ring side of the oil seal goes toward the inside of the cylinder.

Figure 20-25-20



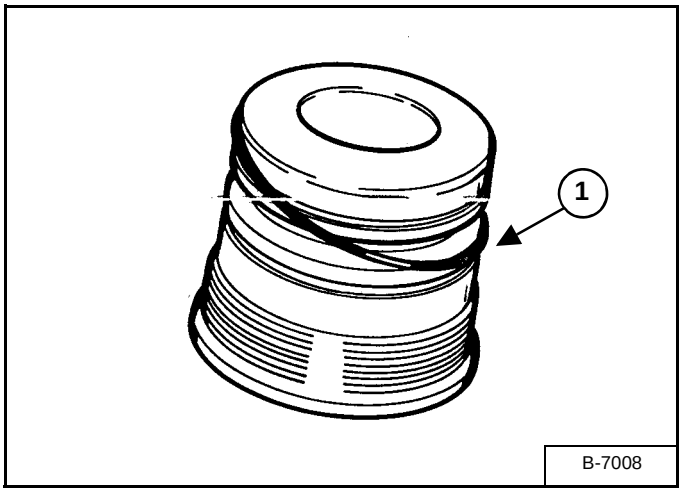
Install the oil seal in the head **[Figure 20-25-20]**.

Figure 20-25-21



Install the wiper seal with the lip toward the outside of the head **[Figure 20-25-21]**.

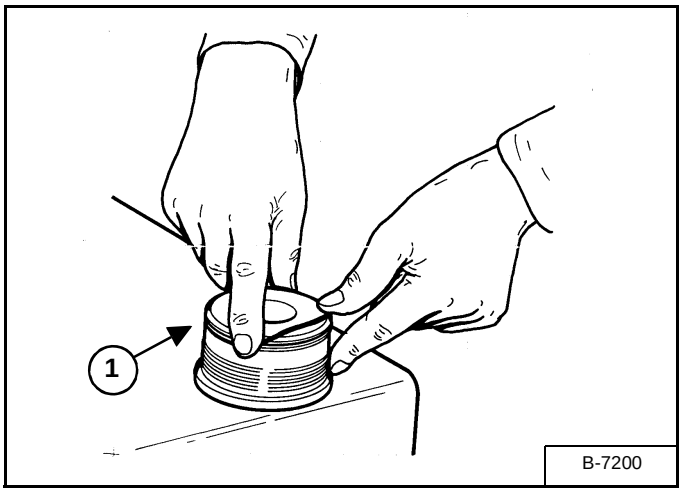
Figure 20-25-22



Install the O-ring (Item 1) **[Figure 20-25-22]** on the head.

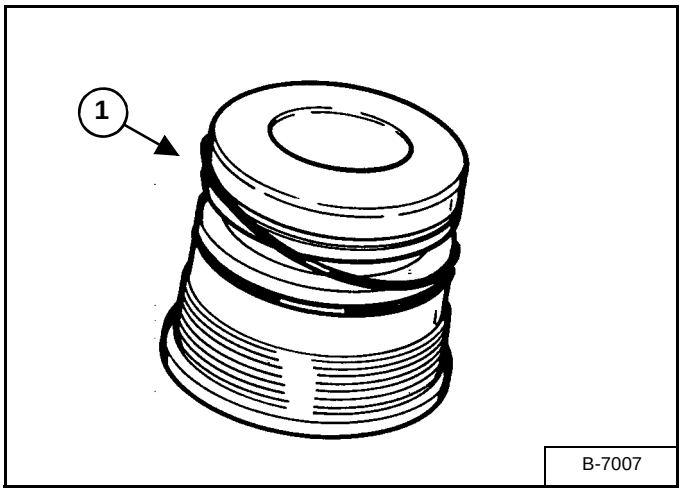
Assembly (Cont'd)

Figure 20-25-23



Install the back-up ring (Item 1) **[Figure 20-25-23]** on the head.

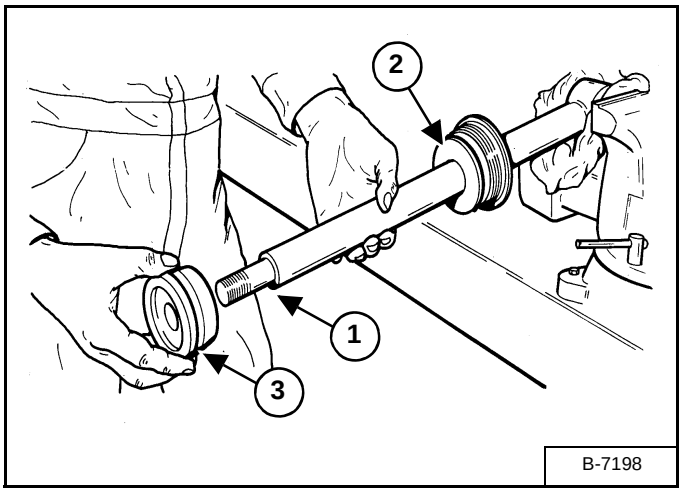
Figure 20-25-24



Install the O-ring (Item 1) **[Figure 20-25-24]** on the head.

Apply grease to the inside of the head and to the lips of the seals.

Figure 20-25-25



Inspect the beveled edge of the rod for nicks or sharp edges (Item 1) **[Figure 20-25-25]**. Remove these with a file prior to installing the head on the rod or damage to the seals may occur.

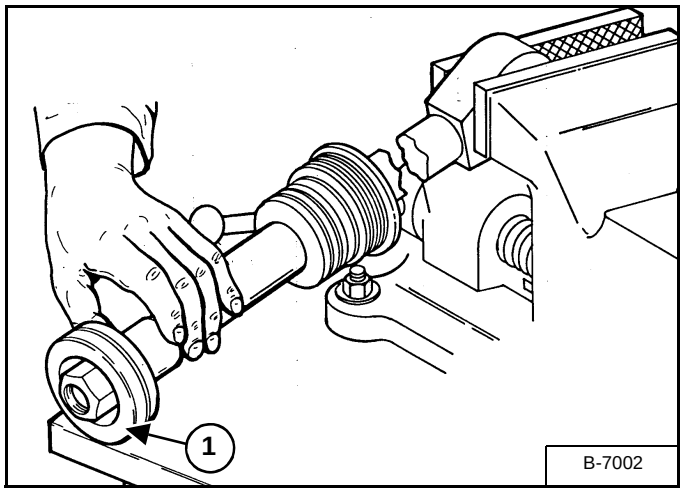
Install the head (Item 2) **[Figure 20-25-25]** on the rod.

Install the piston (Item 3) **[Figure 20-25-25]** on the rod.

Clean and dry the cylinder rod threads. Grease the shoulder of the cylinder rod.

Assembly (Cont'd)

Figure 20-25-26



Tighten the nut (Item 1) **[Figure 20-25-26]** to 850 ft.-lb. (1153 N•m) torque.

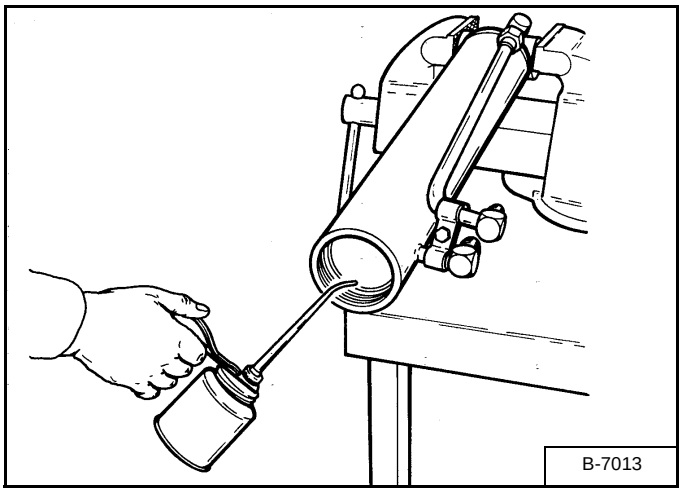
Inspect the inside of the cylinder housing for nicks and scratches. If the cylinder housing has minor scuffing the cylinder housing can be honed. Use a flexible hone and lubricate with oil during the honing process.

The following hones can be ordered from OTC Service Tools:

MEL1418 - 2 in.
OEM6275 - 2 3/4 in. - 3 in.
OEM6270 - 3 in. - 3 1/2 in.
OEM6271 - 3 1/2 in. - 4 in.

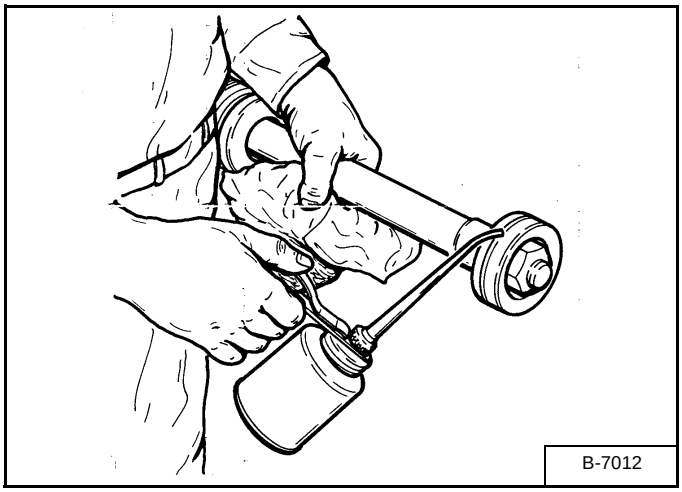
Thoroughly wash the inside of the housing after the honing process.

Figure 20-25-27



Apply oil to the seal surface of the housing **[Figure 20-25-27]**.

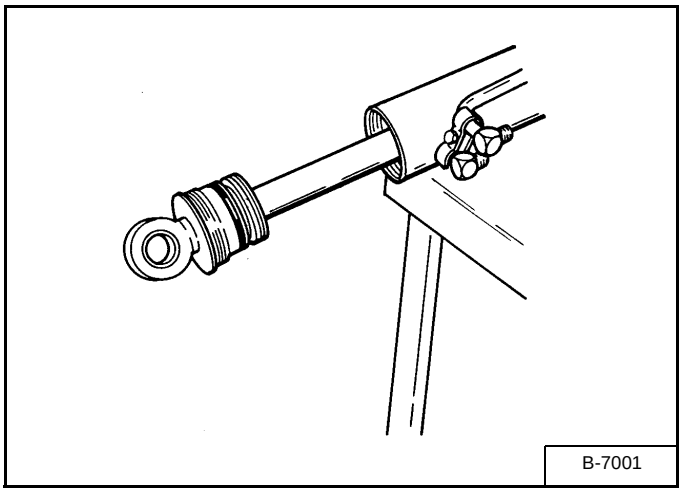
Figure 20-25-28



Apply oil to the Teflon seal on the piston **[Figure 20-25-28]**.

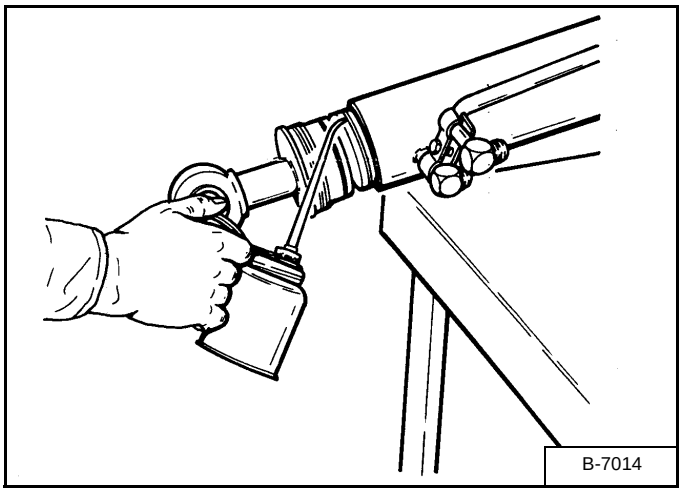
Assembly (Cont'd)

Figure 20-25-29



Install the rod assembly in the housing **[Figure 20-25-29]**.

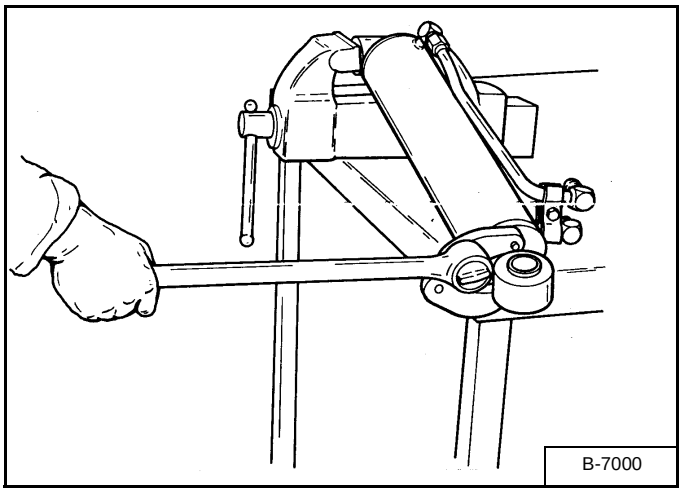
Figure 20-25-30



Apply oil to the seals on the head **[Figure 20-25-30]**.

Apply oil to the threads of the head.

Figure 20-25-31



Use the adjustable gland nut wrench to tighten the head **[Figure 20-25-31]**.

NOTE: Tighten gland until it is flush with the end of the housing.

Move rod in and out of cylinder housing and make sure that it moves freely.

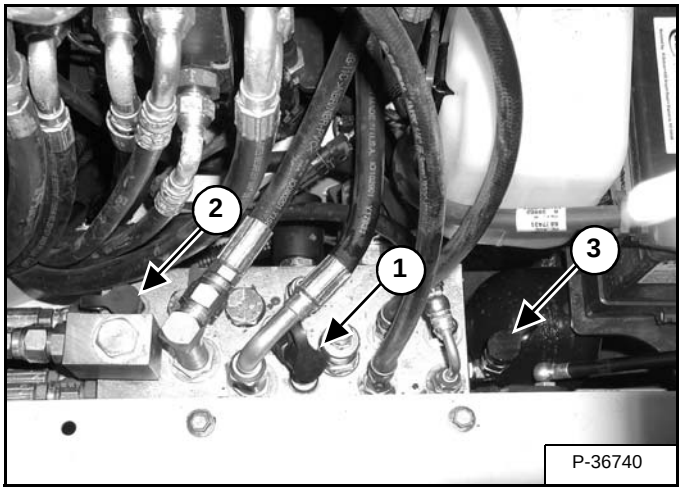

Bobcat®

MAIN RELIEF VALVES

Testing And Adjusting The Main Relief Valves

All testing is done with the hydraulic oil at operating temperature and the at high idle speed. (See Engine on Page SPEC-10-4.)

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) is used in assembly of the excavator. The third coupler (Item 3) **[Figure 20-30-1]** is used to check the pressure reducing valve.

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

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

System Pressures At Gauge Port Specifications

TEST CONDITIONS

1. Engine High Idle Speed

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

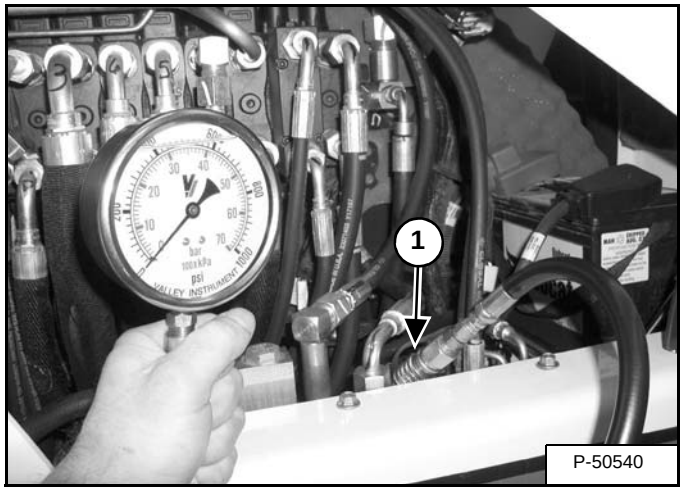
3. Activate function until cylinder movement stops. Hold over relief for 5 - 10 seconds.
   Record pressure.

SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET (PSI)	ACCEPTABLE RANGE (PSI)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	GI	428	406 - 450
PRESSURE BUILD - UP VALVE	NONE - CONSOLE DOWN	P3	G	450	308 - 520
SYSTEM BY - PASS	NONE - CONSOLE UP	DUMP TO TANK	G	60	MAX ALLOWABLE 100
MAIN RELIEF ON MANIFOLD BLOCK	SLEW AND ARM	P3 & P2	G	3800	3700 - 3850
MAIN RELIEF ON CONTROL VALVE - FRONT	BOOM SWING	P1	G	2650	2550 - 2700
MAIN RELIEF ON CONTROL VALVE - REAR	ARM	P3 & P2	G	2900	2800 - 2950
SWING MOTOR - CROSS PORT RELIEF	SLEW RIGHT	P3	G	2450	2300 - 2600
SWING MOTOR - CROSS PORT RELIEF	SLEW LEFT	P3	G	2450	2300 - 2600

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

Open the right side cover.

Figure 20-30-2



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

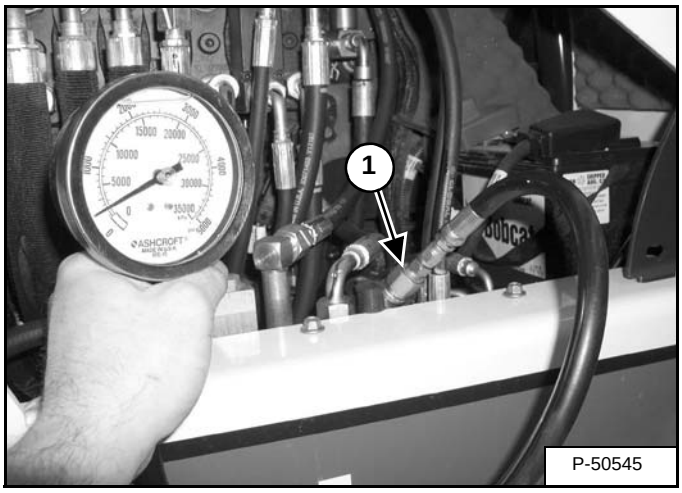
Lower the control console and fasten the seat belt.

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

With the console lowered, and the engine at full RPM there is pressure buildup valve pressure of 600 PSI (41 bar).

Remove the gauge.

Figure 20-30-3

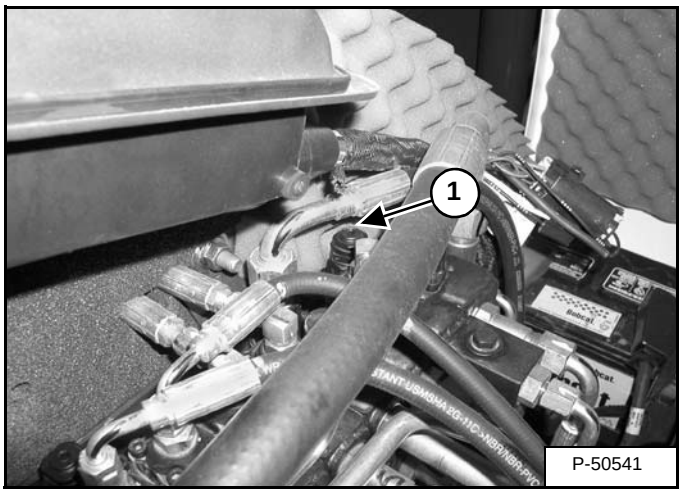


Connect the test gauge coupler and 5000 PSI (345 bar) gauge to the diagnostic coupler (Item 1) **[Figure 20-30-3]**.

Front Relief Valve (Right Hand Travel, Boom Swing and Boom Valve Sections)

Engage the boom swing circuit over relief and record the pressure.

Figure 20-30-4



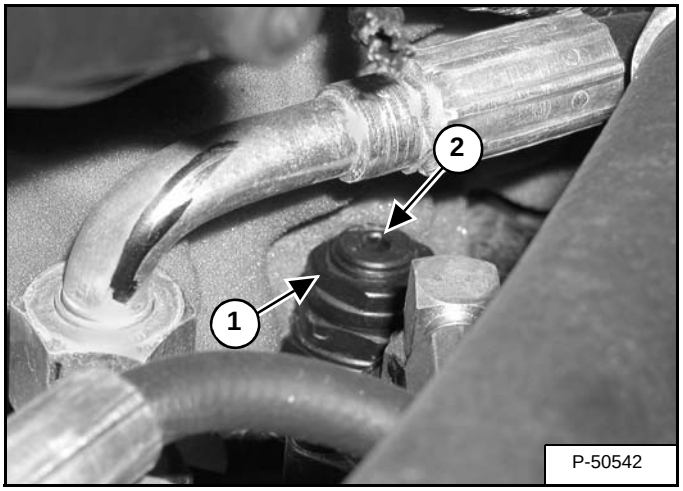
The main relief valve (Item 1) **[Figure 20-30-4]** pressure should be as follows:

A target pressure of 2650 PSI (183 bar) with an acceptable range of 2550 - 2700 PSI (176 - 186 bar).

Stop the engine.

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

Figure 20-30-5



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

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

NOTE: 1/4 turn is approximately 100 PSI (6,9 bar).

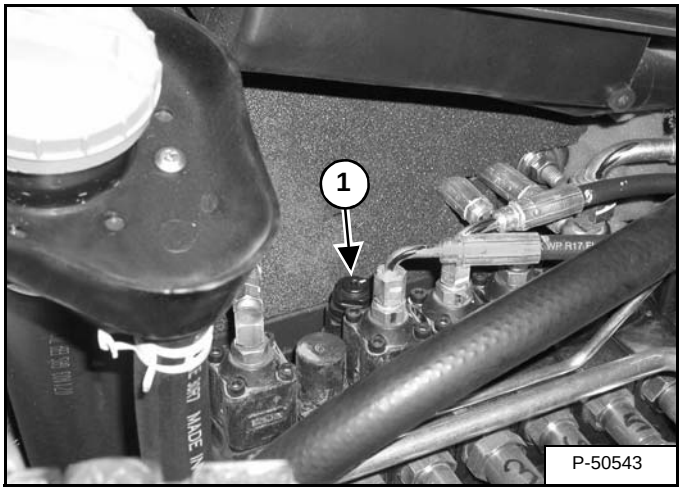
Tighten the nut (Item 1) **[Figure 20-30-5]**.

Retest the main relief valve after adjustment.

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

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

Figure 20-30-6



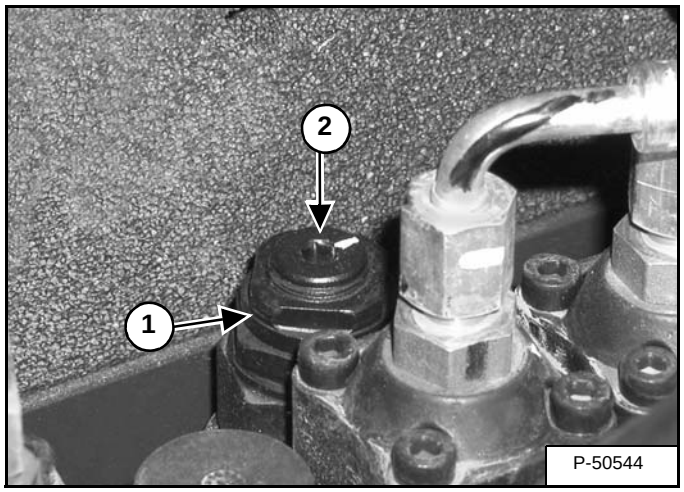
The main relief valve (Item 1) **[Figure 20-30-6]** pressure should be as follows:

A target pressure of 2900 PSI (200 bar) with an acceptable range of 2800 - 2950 PSI (193 - 203 bar).

Stop the engine.

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

Figure 20-30-7



If adjustment is needed, loosen the nut (Item 1) **[Figure 20-30-7]**.

Turn the adjustment screw (Item 2) **[Figure 20-30-7]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

NOTE: 1/4 turn is approximately 100 PSI (6,9 Bar).

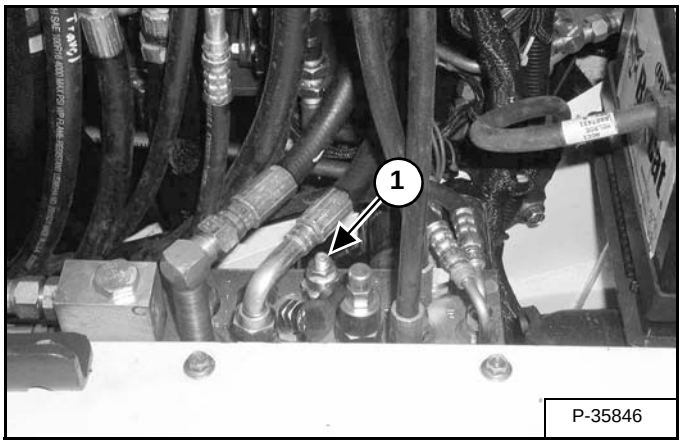
Tighten the nut (Item 1) **[Figure 20-30-7]**.

Retest the main relief valve after adjustment.

Manifold Relief Valve (Boost, Blade And Upperstructure Slew Valve Sections)

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

Figure 20-30-8

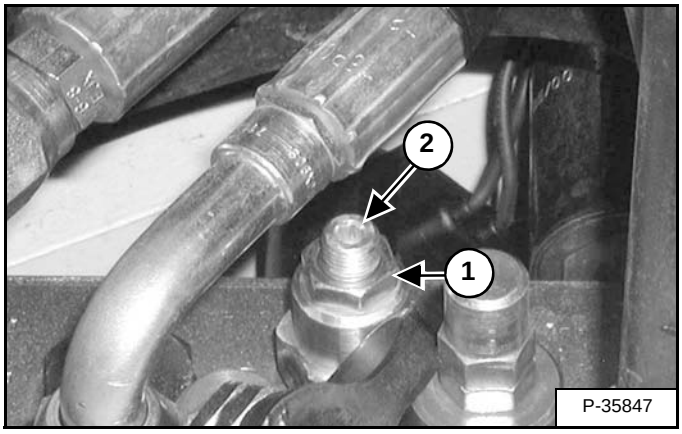


The main relief valve (Item 1) **[Figure 20-30-8]** pressure should be as follows:

A target pressure of 3800 PSI (262 bar) with an acceptable range of 3700 - 3850 PSI (255 - 266 bar).

Stop the engine.

Figure 20-30-9



If adjustment is needed, loosen the nut (Item 1) **[Figure 20-30-9]**.

Turn the adjustment screw (Item 2) **[Figure 20-30-9]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

NOTE: 1/4 turn is approximately 100 PSI (6,9 Bar).

Tighten the nut (Item 1) **[Figure 20-30-9]**.

Retest the main relief valve after adjustment.

PORT RELIEF VALVES

Testing And Adjusting The Port Relief Valves

Figure 20-31-1

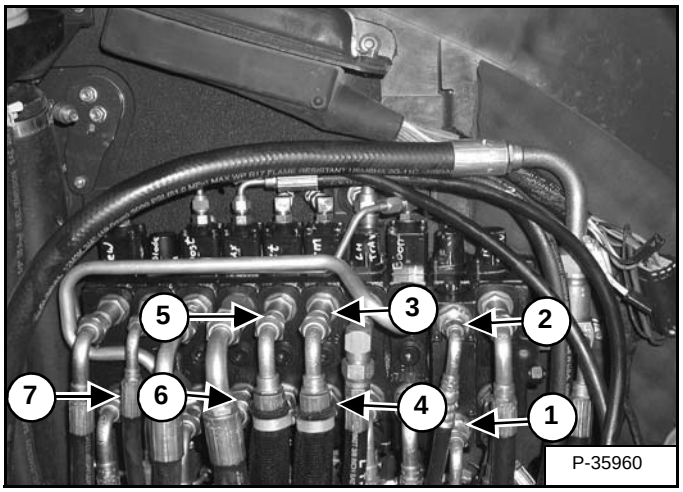
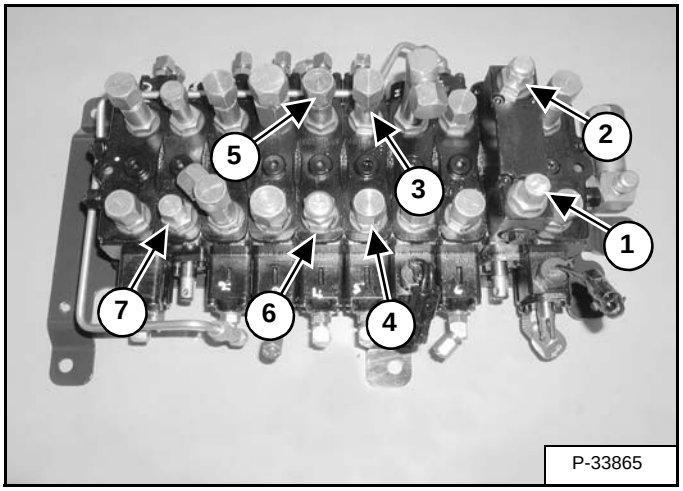


Figure 20-31-2



Boom Port Relief set at:

Rod End (Item 1) **[Figure 20-31-1]** & **[Figure 20-31-2]** 3335 PSI (230 bar)

Base End (Item 2) **[Figure 20-31-1]** & **[Figure 20-31-2]** 3335 PSI (230 bar)

Arm Port Relief set at:

Rod End (Item 3) **[Figure 20-31-1]** & **[Figure 20-31-2]** 2900 PSI (200 bar)

Base End (Item 4) **[Figure 20-31-1]** & **[Figure 20-31-2]** 2900 PSI (200 bar)

Bucket Port Relief set at:

Rod End (Item 5) **[Figure 20-31-1]** & **[Figure 20-31-2]** 3335 PSI (230 bar)

Base End (Item 6) **[Figure 20-31-1]** & **[Figure 20-31-2]** 2900 PSI (200 bar)

Blade Port Relief set at:

Base End (Item 7) **[Figure 20-31-1]** & **[Figure 20-31-2]** 3335 PSI (230 bar)

When testing the port relief valves with a hydraulic hand pump, slowly pressurize the valve. If the hand pump is pumped fast, the pressure will be altered by as much as 50 PSI (3,5 bar).

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

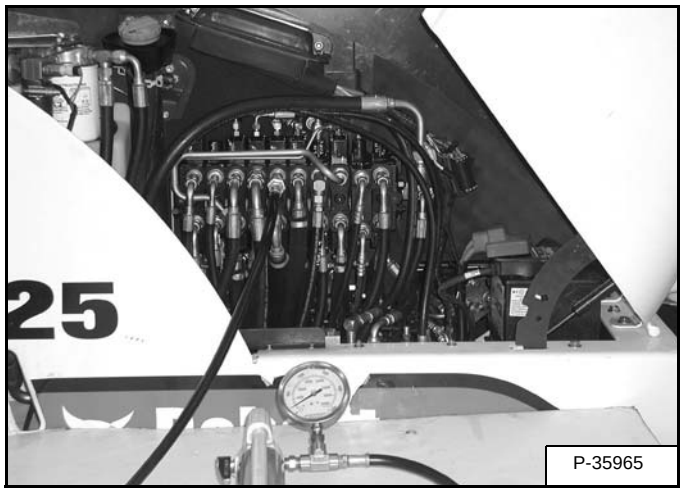
For 2900 PSI (200 bar) relief valves, crack pressure is 2765 ± 50 PSI (191 ± 3,5 bar).

For 3335 PSI (230 bar) relief valves, crack pressure is 3220 ± PSI (222 ± 3,5 bar).

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.

Testing And Adjusting Port Relief Valves (Cont'd)

Figure 20-31-3



Install the hand pump hose and a pressure gauge (minimum of 5000 PSI [345 bar]) into the valve section work port in which the port relief valve is located **[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.

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

⚠ WARNING

AVOID INJURY OR DEATH

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.**

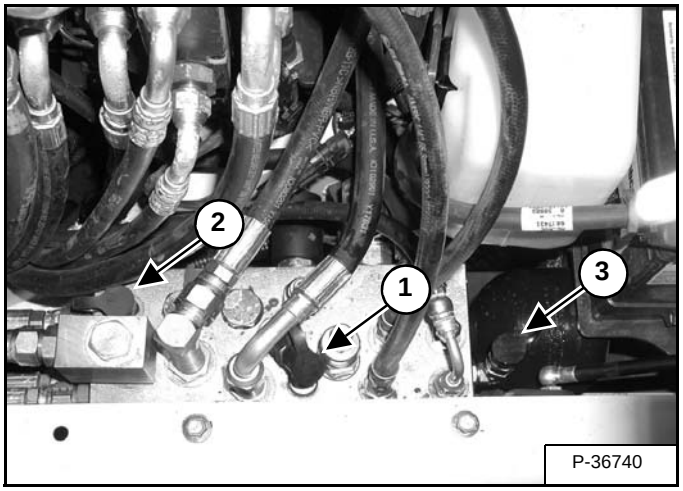
W-2019-0907

CROSSPORT RELIEF VALVES

Testing And Adjusting The Crossport Relief Valves

All testing is done with the hydraulic oil at operating temperature and the at high idle speed. See Engine on Page SPEC-10-4

Figure 20-32-1



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

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

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

System Pressures At Gauge Port Specifications

TEST CONDITIONS

1. Engine High Idle Speed

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

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

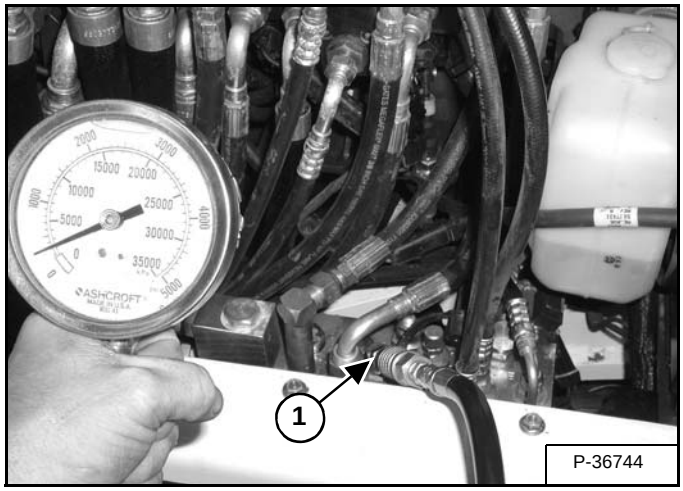
SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET (PSI)	ACCEPTABLE RANGE (PSI)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	GI	428	406 - 450
PRESSURE BUILD - UP VALVE	NONE - CONSOLE DOWN	P3	G	450	308 - 520
SYSTEM BY - PASS	NONE - CONSOLE UP	DUMP TO TANK	G	60	MAX ALLOWABLE 100
MAIN RELIEF ON MANIFOLD BLOCK	SLEW AND ARM	P3 & P2	G	3800	3700 - 3850
MAIN RELIEF ON CONTROL VALVE - FRONT	BOOM SWING	P1	G	2650	2550 - 2700
MAIN RELIEF ON CONTROL VALVE - REAR	ARM	P3 & P2	G	2900	2800 - 2950
SWING MOTOR - CROSS PORT RELIEF	SLEW RIGHT	P3	G	2450	2300 - 2600
SWING MOTOR - CROSS PORT RELIEF	SLEW 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 and 5000 PSI (345 bar) gauge from the test kit to the diagnostic coupler (Item 1) **[Figure 20-32-2]**.

Lower control console and fasten the seat belt.

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

With the console lowered, and the engine at full RPM there is pressure buildup valve pressure of 600 PSI (42 bar).

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

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

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

Repeat the procedure to the left and record the pressure.

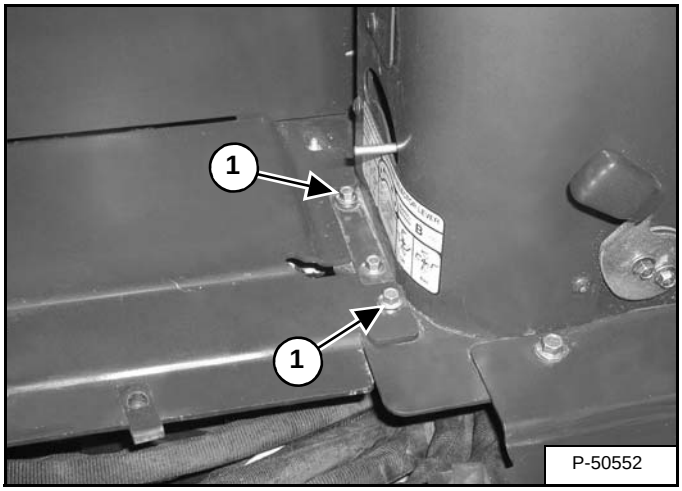
The crossport relief valve pressure should be as follows:

A target pressure of 2450 PSI (169 bar) with an acceptable range of 2300 - 2600 PSI (159 - 179 bar).

Stop the engine.

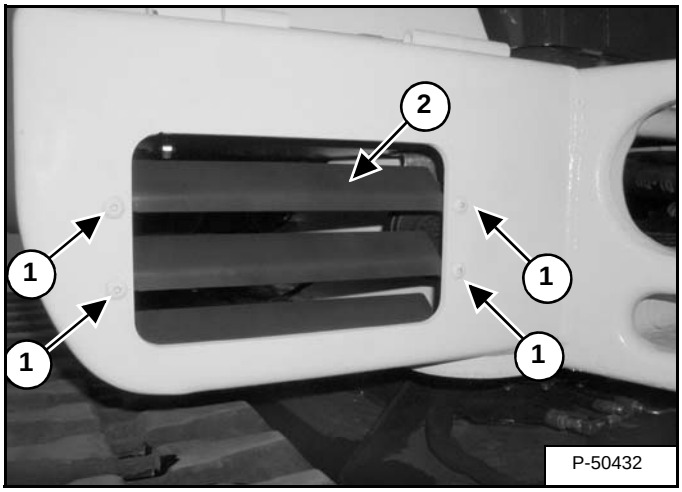
If the relief valves need adjustment, remove the floor mat and floor panel.(See FLOOR MAT AND FLOOR PLATE on Page 40-110-1.)

Figure 20-32-3



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

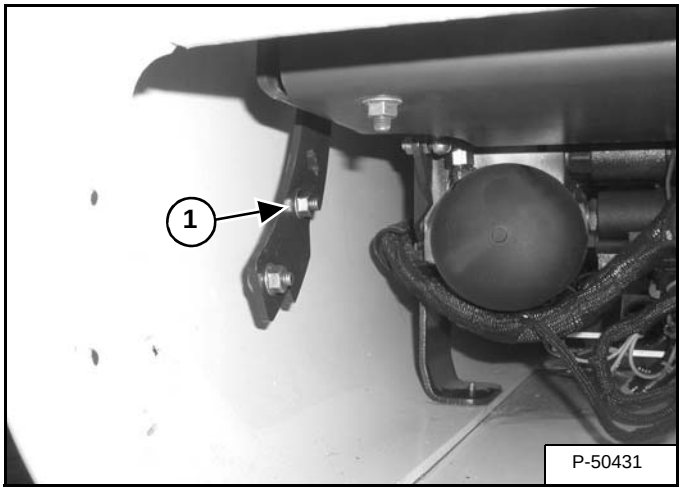
Figure 20-32-4



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

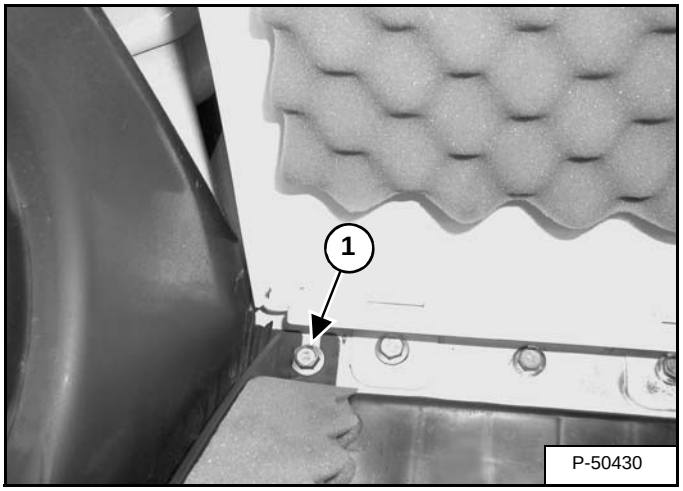
Testing And Adjusting The Crossport Relief Valves (Cont'd)

Figure 20-32-5



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

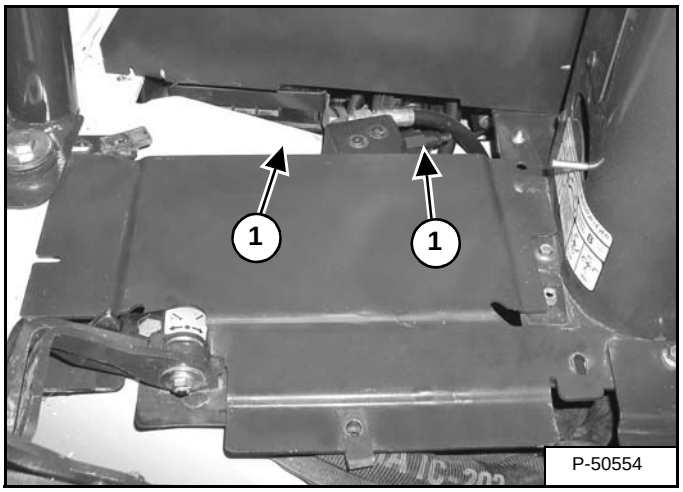
Figure 20-32-6



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

NOTE: Canopy equipped excavators have two bolts installed.

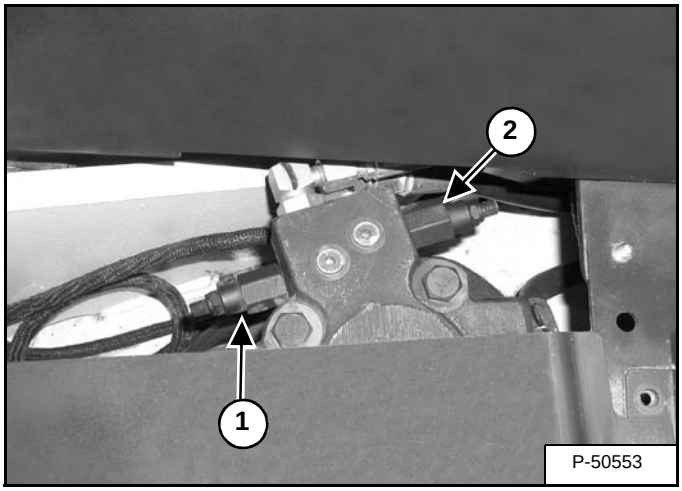
Figure 20-32-7



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

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

Figure 20-32-8

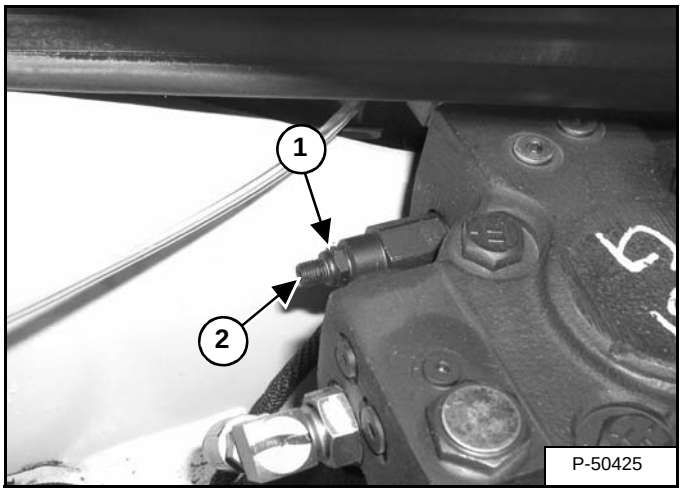


The front relief valve (Item 1) **[Figure 20-32-8]**. is slew left.

The rear relief valve (Item 2) **[Figure 20-32-8]**. is slew right.

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

Figure 20-32-9



Loosen the nut (Item 1) **[Figure 20-32-9]**.

Turn the adjustment screw (Item 2) **[Figure 20-32-9]** clockwise to increase the pressure or counterclockwise to decrease pressure.

NOTE: 1/4 turn is 100 PSI (6,9 bar)

Tighten the nut (Item 1) **[Figure 20-32-9]**, reinstall the right floor panel and retest the crossport relief valves.

PRESSURE REDUCING VALVE

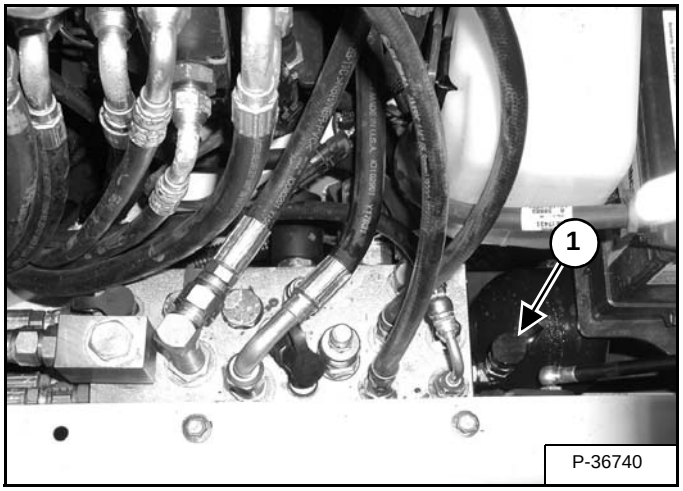
Testing And Adjusting The Pressure Reducing Valve

The pressure reducing valve supplies lower hydraulic pressure to joysticks.

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

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

Figure 20-33-1

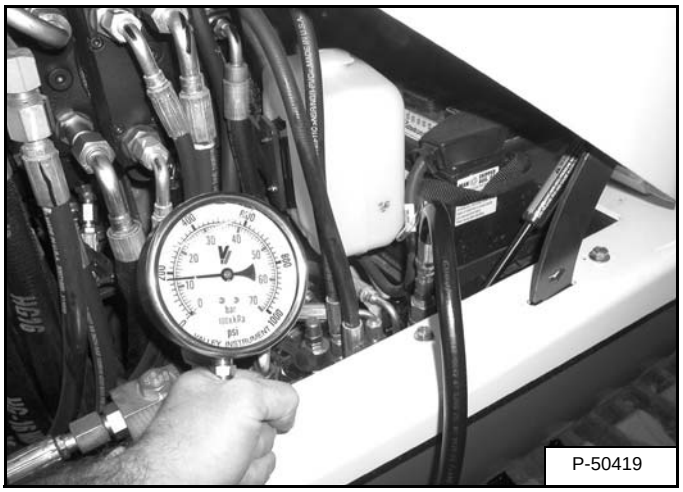


The diagnostic port (Item 1) **[Figure 20-33-1]** located on the end of the manifold block will be used to check the pressure reducing valve.

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

Open the right side cover.

Figure 20-33-2



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

Lower the control console and fasten the seat belt.

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

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

Engage the bucket curl circuit and fully curl the bucket.

The pressure reducing valve pressure should be as follows:

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

Move the engine speed control to low idle speed.

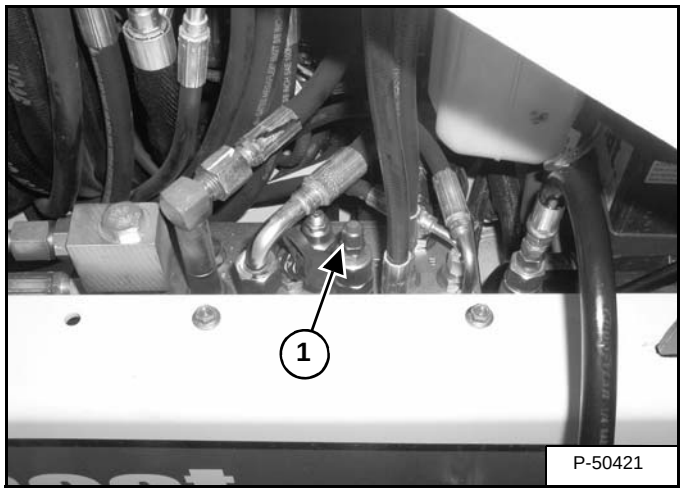
Stop the engine.

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

PRESSURE REDUCING VALVE (CONT'D)

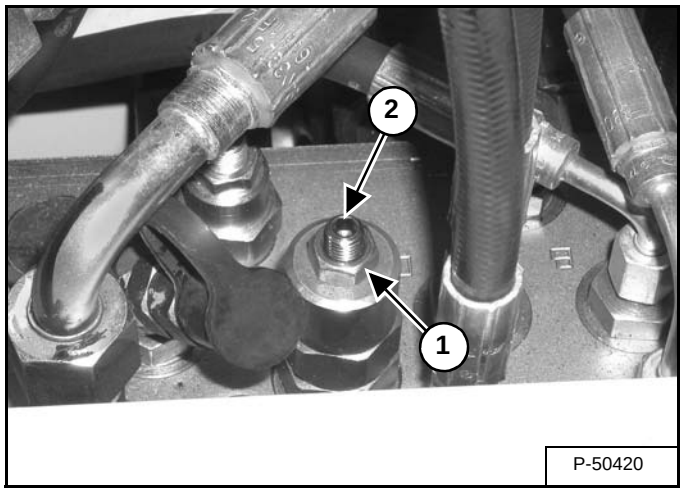
Testing And Adjusting The Pressure Reducing Valve (Cont'd)

Figure 20-33-3



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

Figure 20-33-4



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

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

NOTE: 1/2 turn is approximately 30 PSI (2.1 Bar).

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

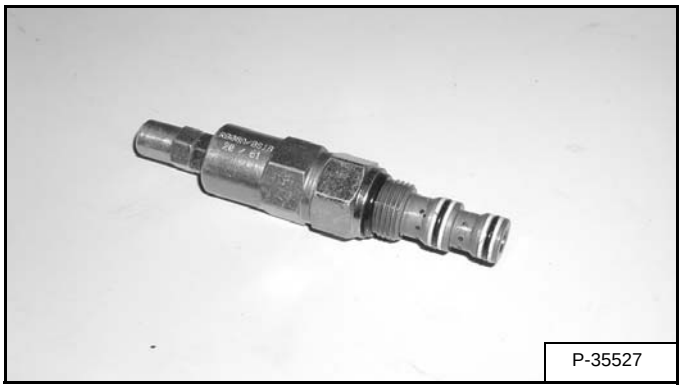
Retest the pressure reducing valve after adjustment.

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

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

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

Figure 20-33-5



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

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

Repeat the pressure reducing valve test.

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

HYDRAULIC CONTROL VALVE

Description

The hydraulic control valve has two main relief valves. The front main relief valve operates at 2650 PSI (183 Bar), the rear main relief valve operates at 2900 PSI (200 Bar). The boom, arm, bucket and blade sections have 2900 PSI (200 Bar) and/or 3335 PSI (230 Bar) work port reliefs.

Removal And Installation

Lower the boom/bucket and blade to the ground.

Stop the engine.

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

IMPORTANT

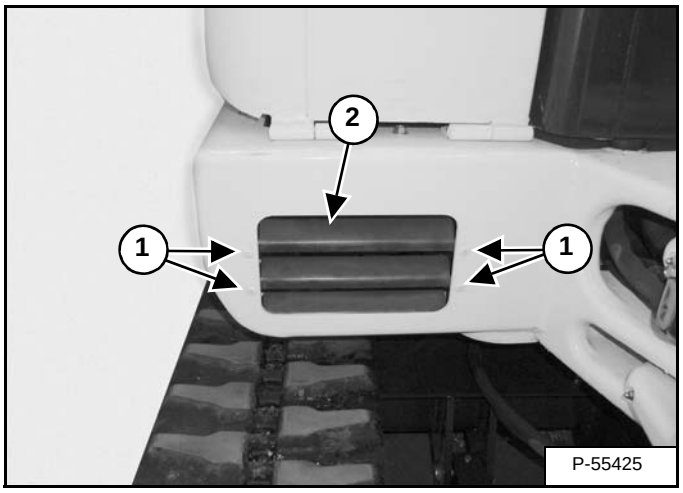
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

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

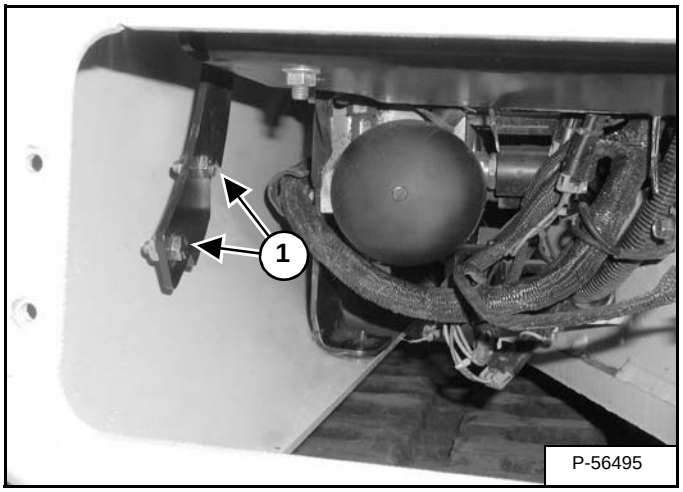
Remove the right console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 20-40-1



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

Figure 20-40-2



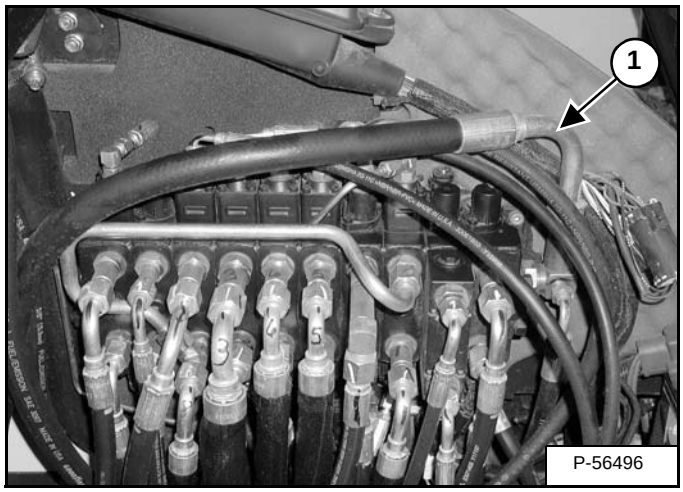
Remove the bolts (Item 1) **[Figure 20-40-2]** and nuts from the stop.

Open the right side cover.

Mark all tubelines and hoses for proper installation.

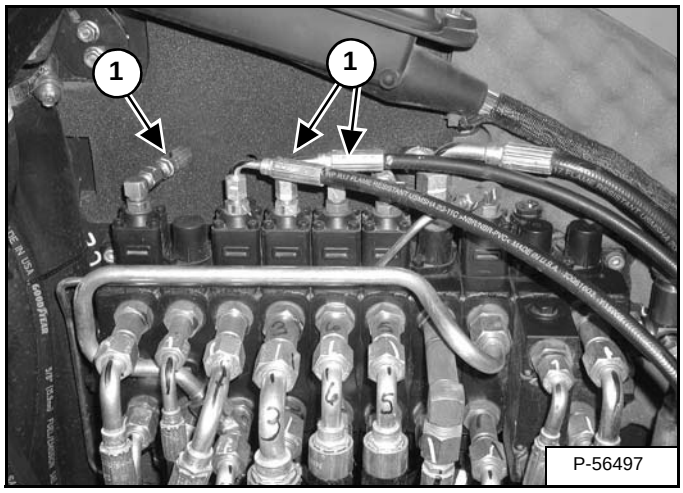
Removal And Installation (Cont'd)

Figure 20-40-3



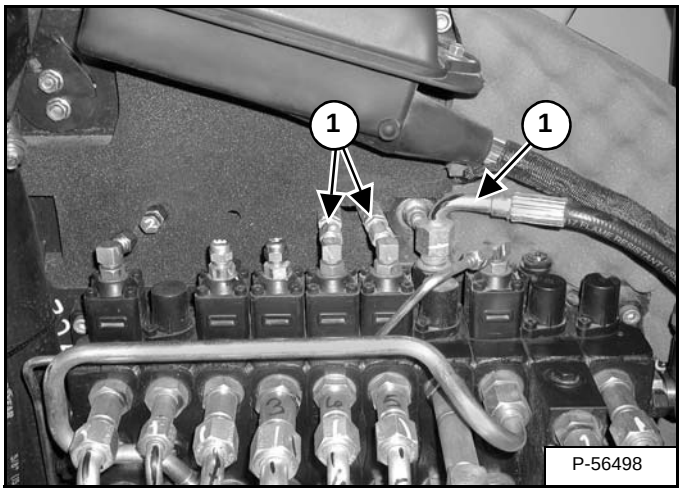
Remove the hose (Item 1) **[Figure 20-40-3]**.

Figure 20-40-4



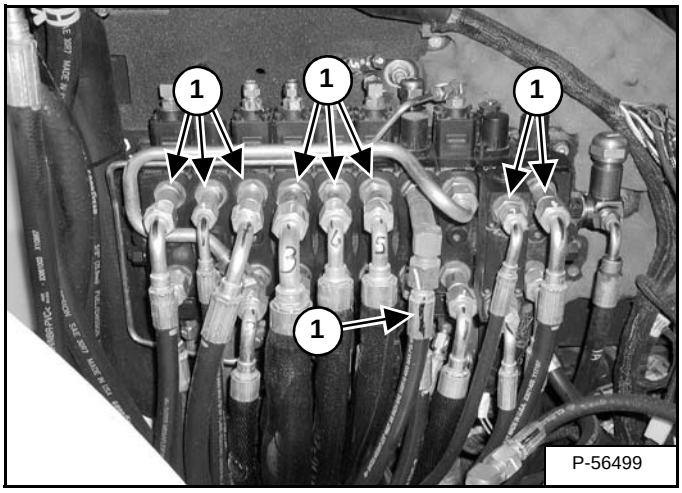
Remove the hoses (Item 1) **[Figure 20-40-4]**.

Figure 20-40-5



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

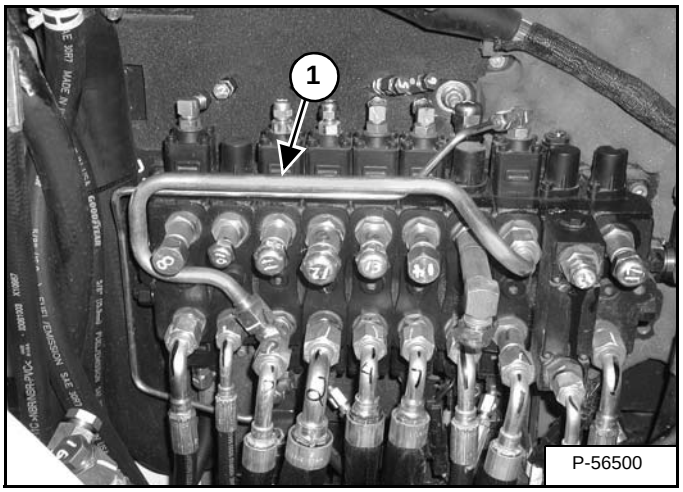
Figure 20-40-6



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

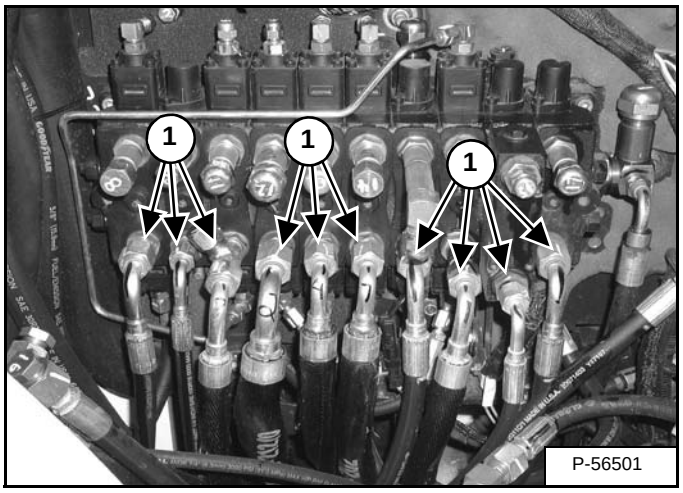
Removal And Installation (Cont'd)

Figure 20-40-7



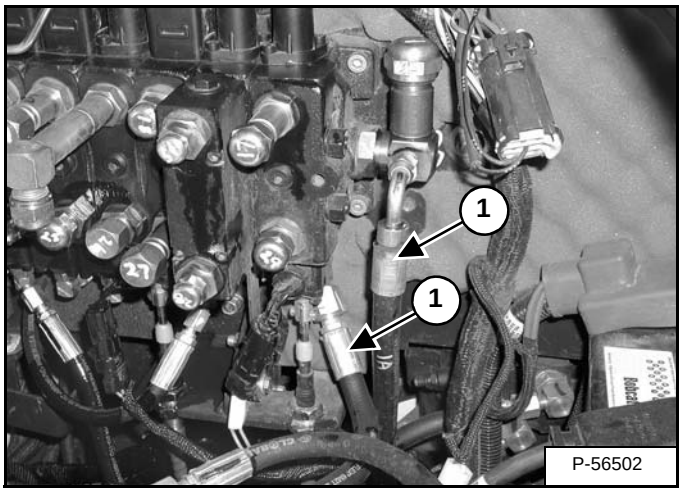
Remove the tubeline (Item 1) **[Figure 20-40-7]**.

Figure 20-40-8



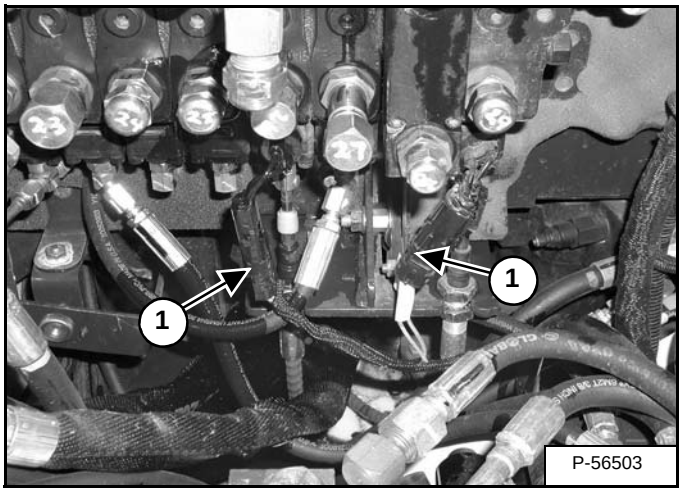
Remove the hoses (Item 1) **[Figure 20-40-8]**.

Figure 20-40-9



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

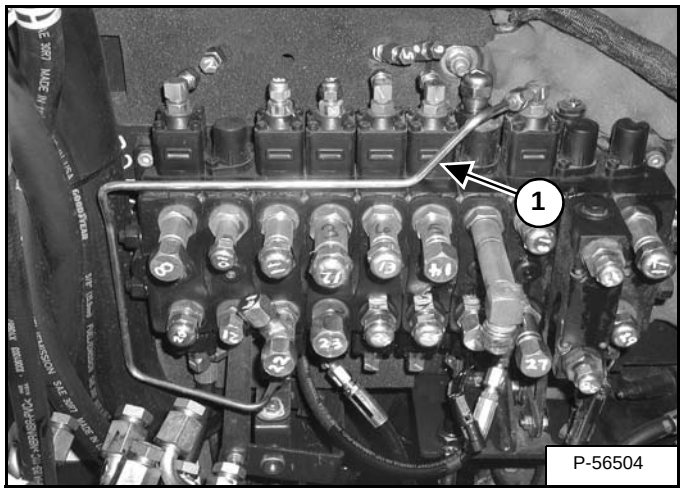
Figure 20-40-10



Disconnect the wire harness (Item 1) **[Figure 20-40-10]** from the left and right travel switches.

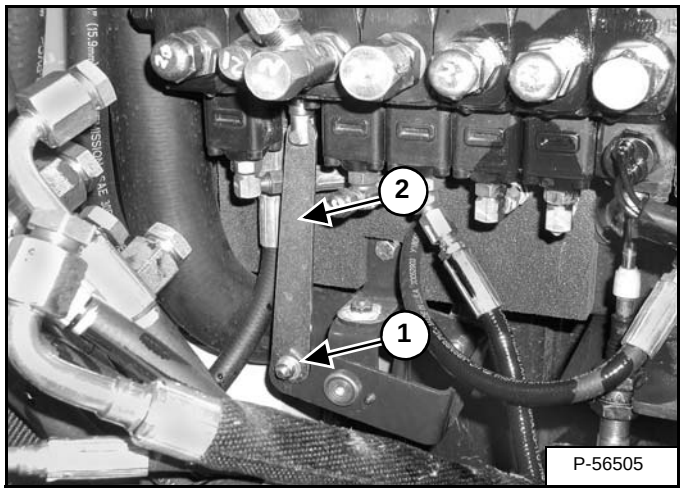
Removal And Installation (Cont'd)

Figure 20-40-11



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

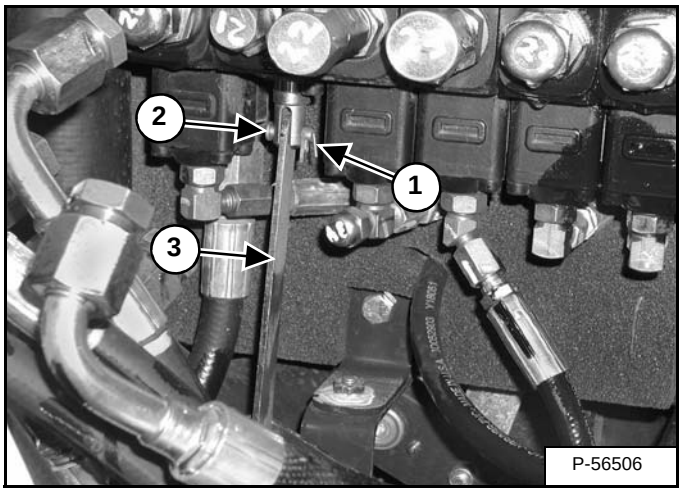
Figure 20-40-12



Remove the nut (Item 1) and bolt from the blade control linkage (Item 2) **[Figure 20-40-12]**.

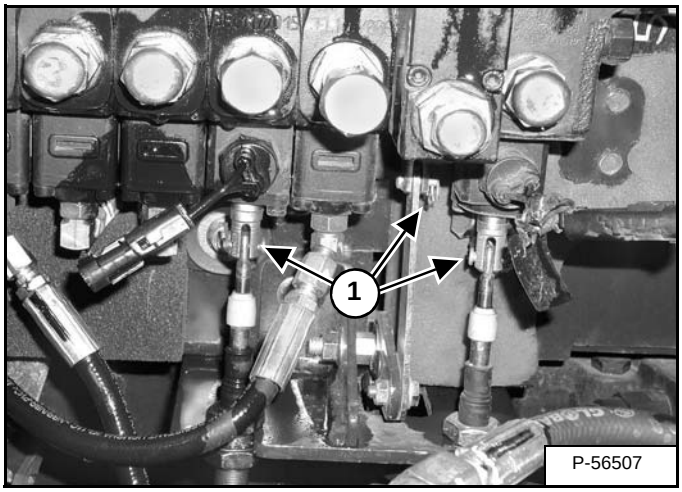
Turn the blade control linkage 90°.

Figure 20-40-13



Remove the cotter pin (Item 1), clevis pin (Item 2) and linkage (Item 3) **[Figure 20-40-13]**.

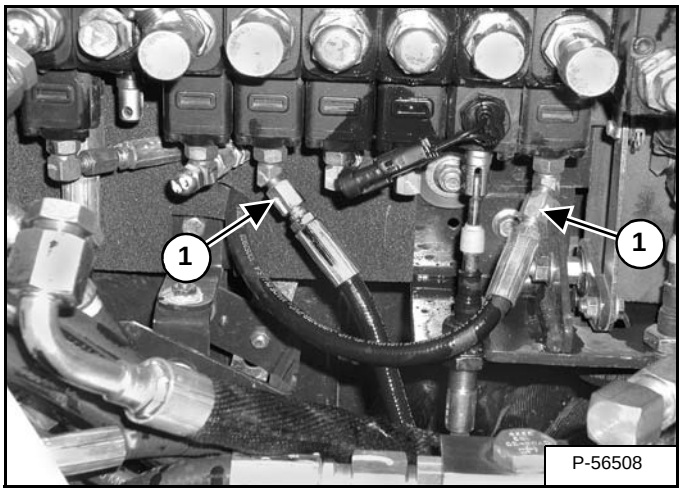
Figure 20-40-14



Remove the cotter pins and clevis pins (Item 1) **[Figure 20-40-14]**.

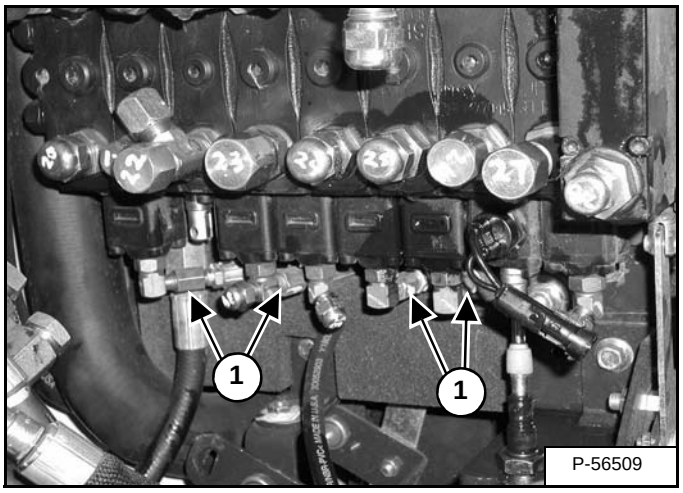
Removal And Installation (Cont'd)

Figure 20-40-15



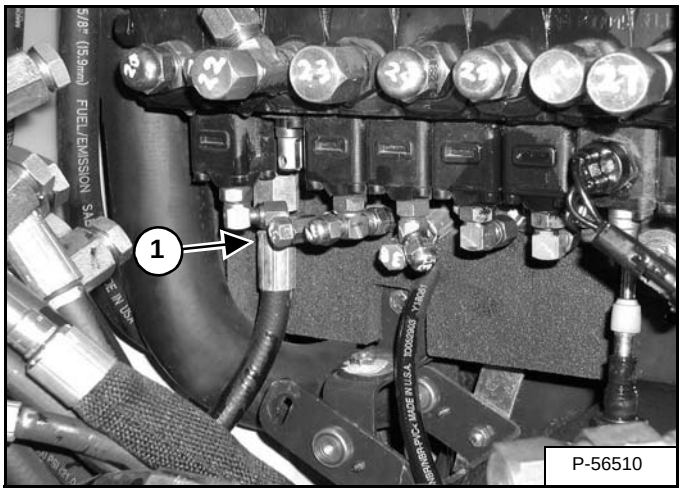
Remove the hoses (Item 1) **[Figure 20-40-15]**.

Figure 20-40-16



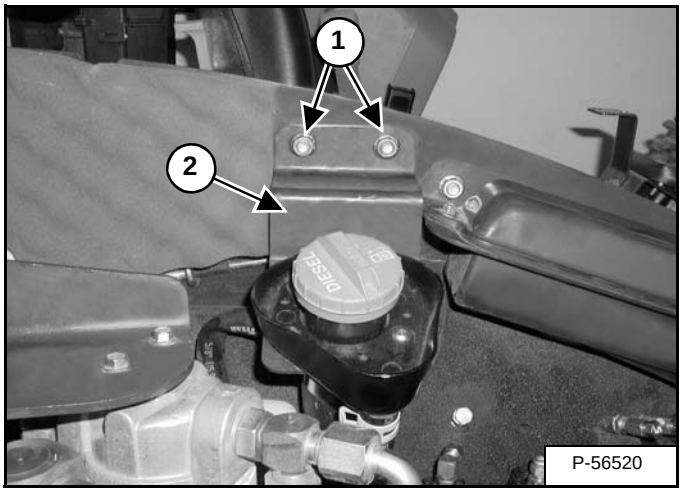
Remove the hoses (Item 1) **[Figure 20-40-16]**.

Figure 20-40-17



Remove the hose (Item 1) **[Figure 20-40-17]**.

Figure 20-40-18

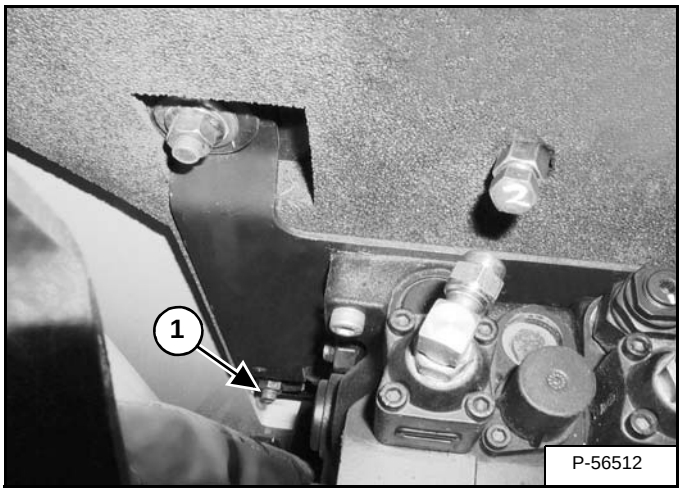


Remove the nuts (Item 1) from the fuel fill (Item 2) **[Figure 20-40-18]**.

Relocate the fuel fill.

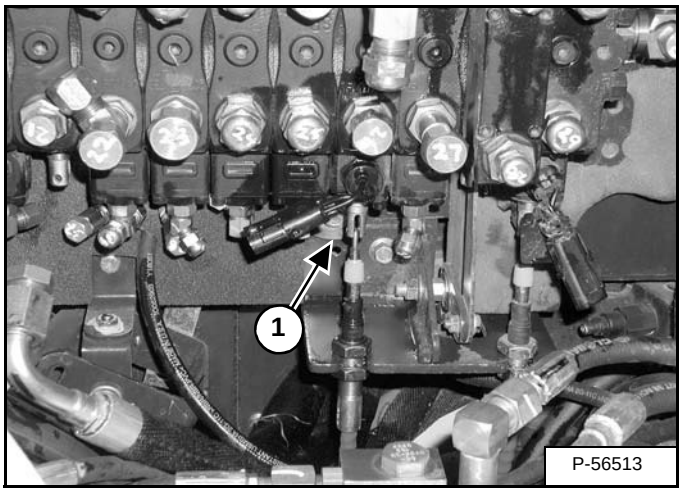
Removal And Installation (Cont'd)

Figure 20-40-19



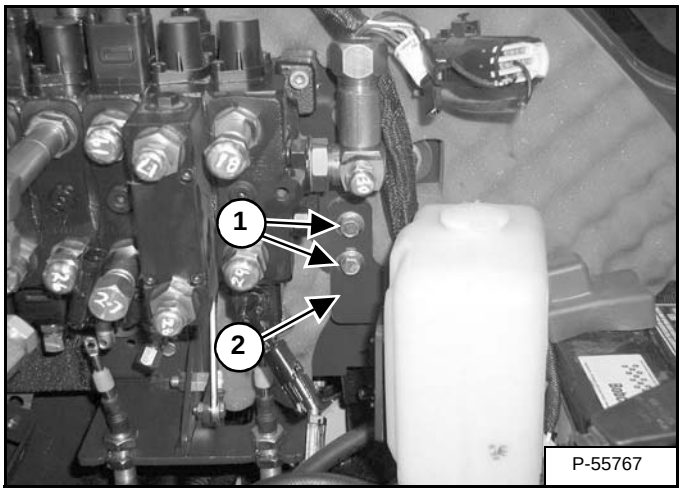
Remove the nut (Item 1) **[Figure 20-40-19]**, washer and rubber washer from the control valve.

Figure 20-40-20



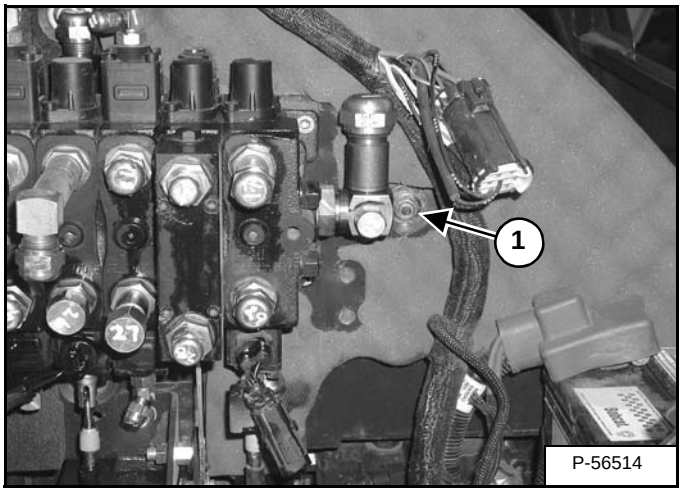
Remove the nut (Item 1) **[Figure 20-40-20]**, washer and rubber washer.

Figure 20-40-21



Remove the bolts (Item 1) from the windshield washer fluid reservoir mount bracket (Item 2) **[Figure 20-40-21]** (if equipped). Relocate the reservoir and mount.

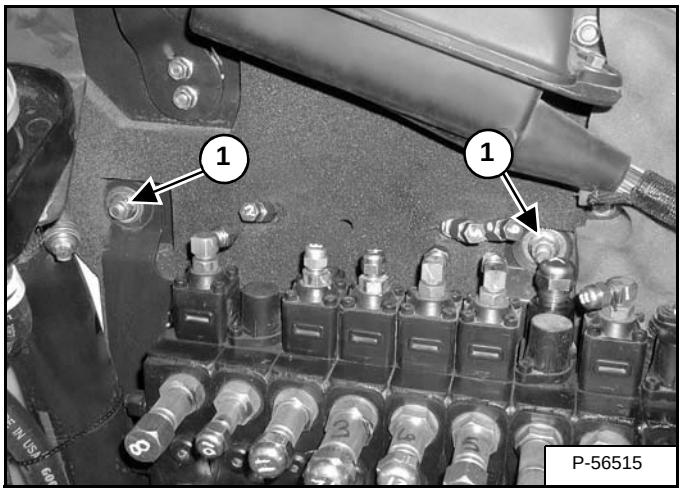
Figure 20-40-22



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

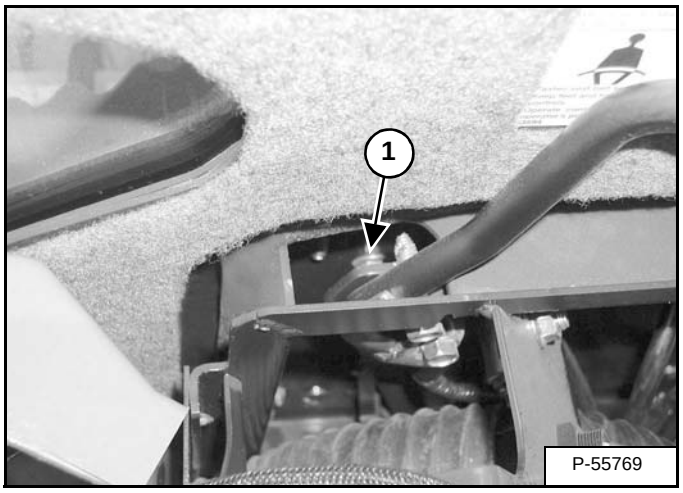
Removal And Installation (Cont'd)

Figure 20-40-23



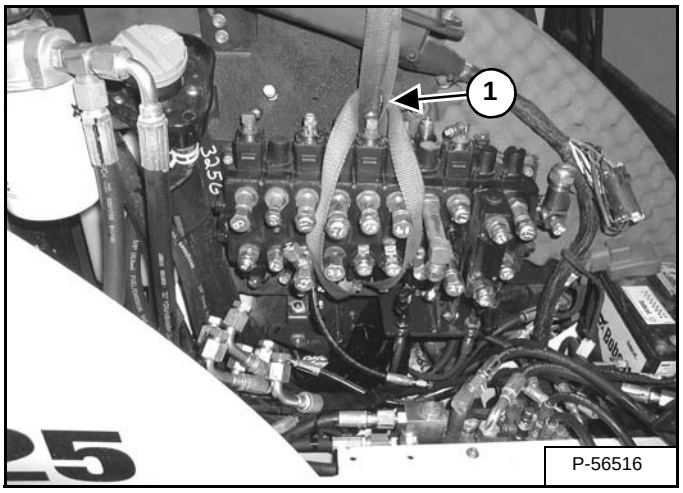
Loosen the nuts (Item 1) **[Figure 20-40-23]**.

Figure 20-40-24



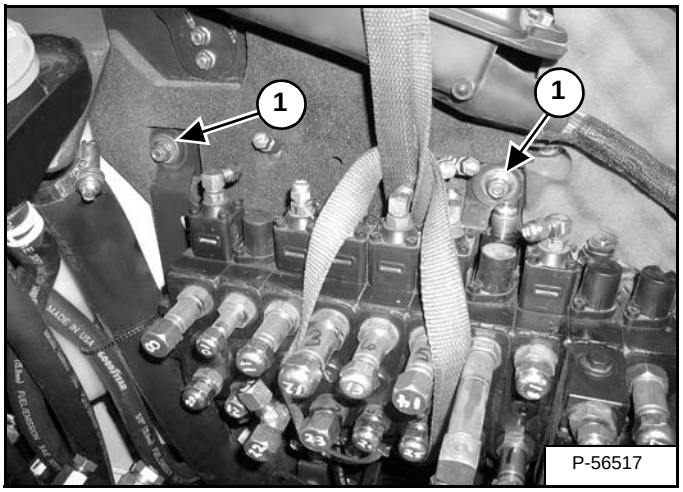
NOTE: Access the head of the bolt (Item 1) [Figure 20-40-24] through the right console in the cab to loosen the nut (Item 2) [Figure 20-40-23].

Figure 20-40-25



Install a sling (Item 1) **[Figure 20-40-25]** around the control valve and connect to a chain hoist.

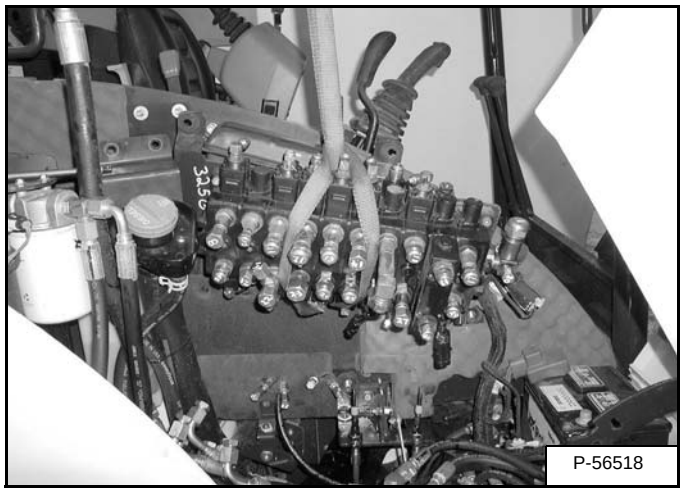
Figure 20-40-26



Remove the nuts (Item 1) **[Figure 20-40-26]**, washers, and rubber washers.

Removal And Installation (Cont'd)

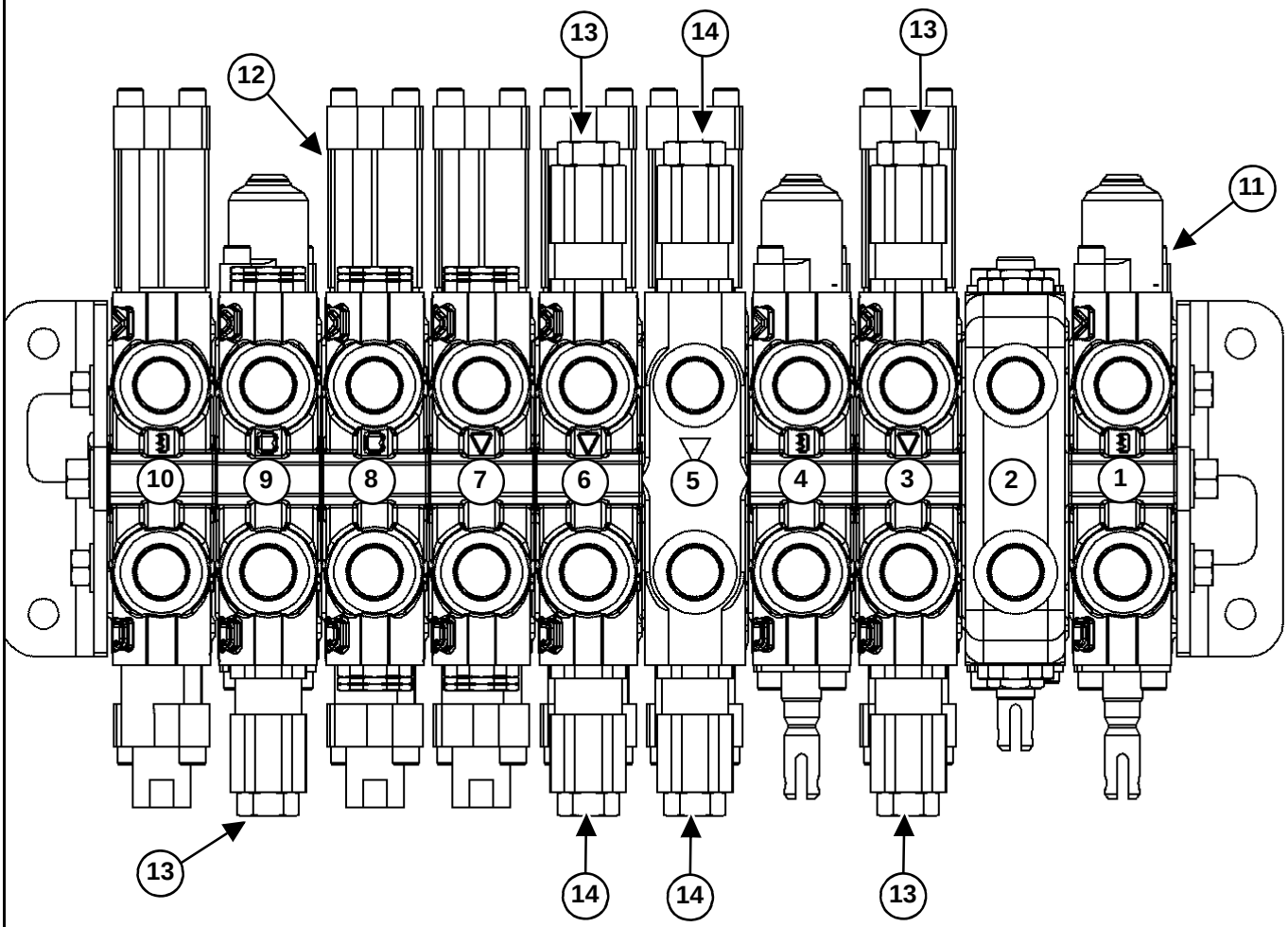
Figure 20-40-27



Raise the hoist and remove the control valve from the excavator **[Figure 20-40-27]**.

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.	Slew Section
11.	Main Relief Valve 2650 PSI (183 Bar)
12.	Main Relief Valve 2900 PSI (183 Bar)
13.	Port Relief Valve 3335 PSI (230 Bar)
14.	Port Relief Valve 2900 PSI (200 Bar)



MS-1118

Disassembly

Clean the outside of the control valve before disassembly.

Mark the outside of the control valve for ease of assembly.

IMPORTANT

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

I-2003-0888

Figure 20-40-28

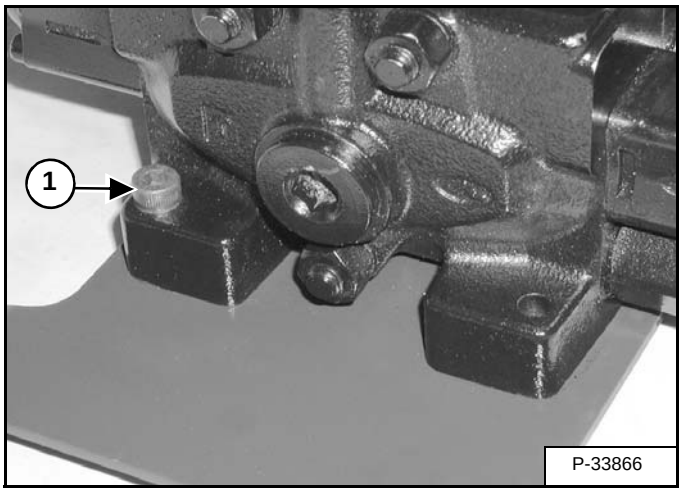
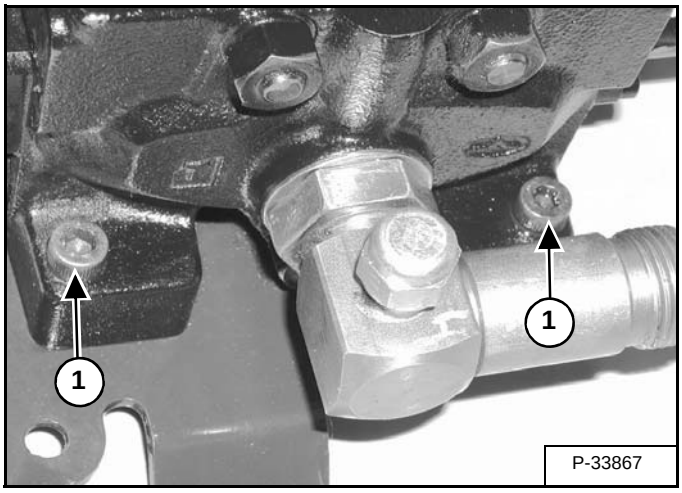


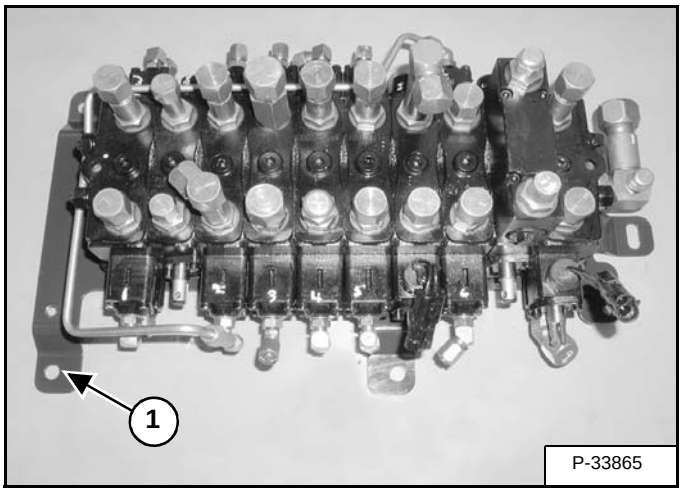
Figure 20-40-29



Remove the three bolts and nuts (Item 1) **[Figure 20-40-28]** & **[Figure 20-40-29]** from the mount.

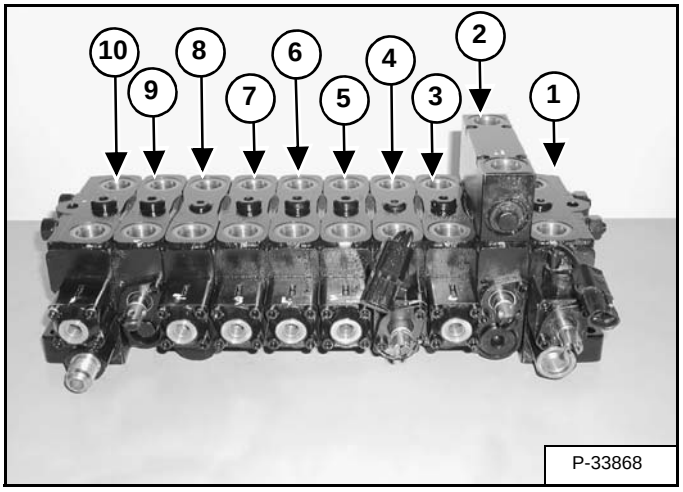
Disassembly (Cont'd)

Figure 20-40-30



Remove the mount (Item 1) **[Figure 20-40-30]** and fittings.

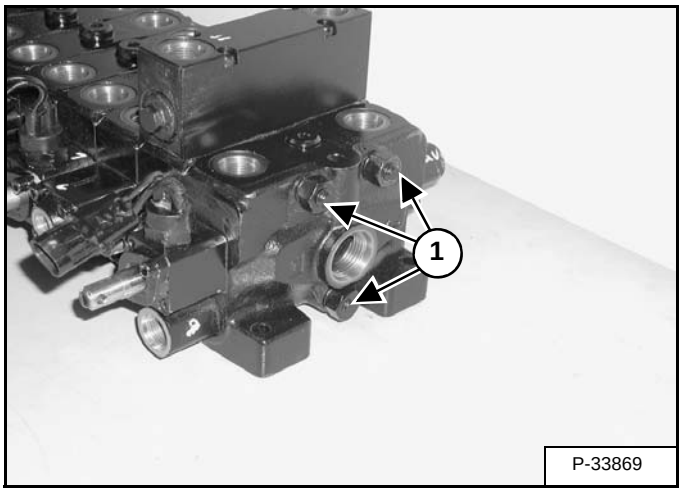
Figure 20-40-31



Mark the valve sections for ease of assembly **[Figure 20-40-31]**.

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

Figure 20-40-32



Remove the tie rod nuts (Item 1) **[Figure 20-40-32]** and lock washers.

Right Travel Valve Section Disassembly And Assembly

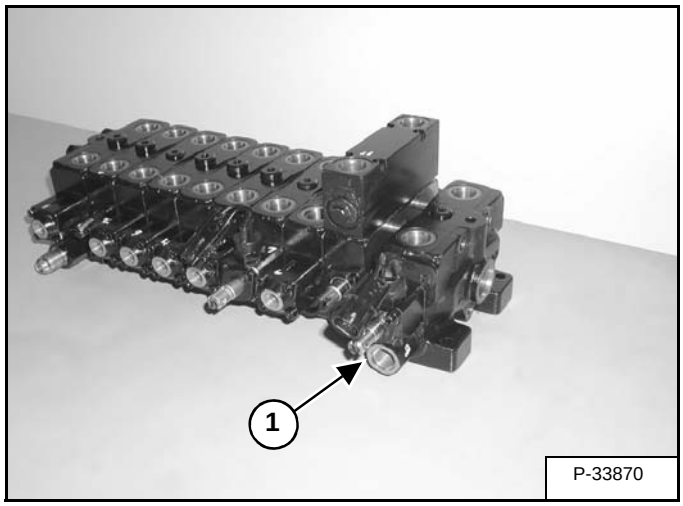
IMPORTANT

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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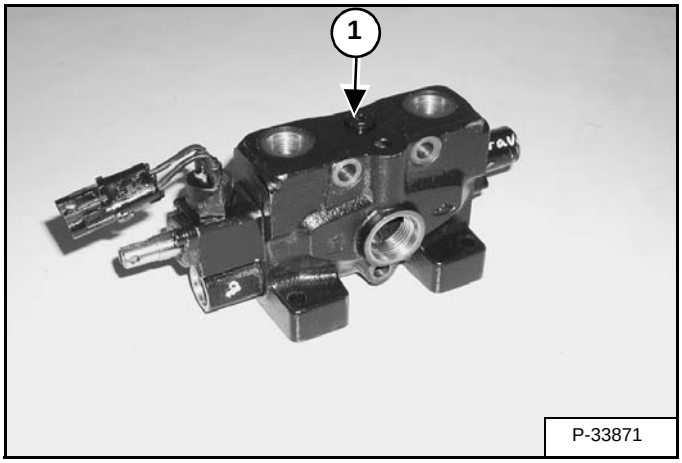
Clean the outside of the right travel valve before disassembly.

Figure 20-40-33



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

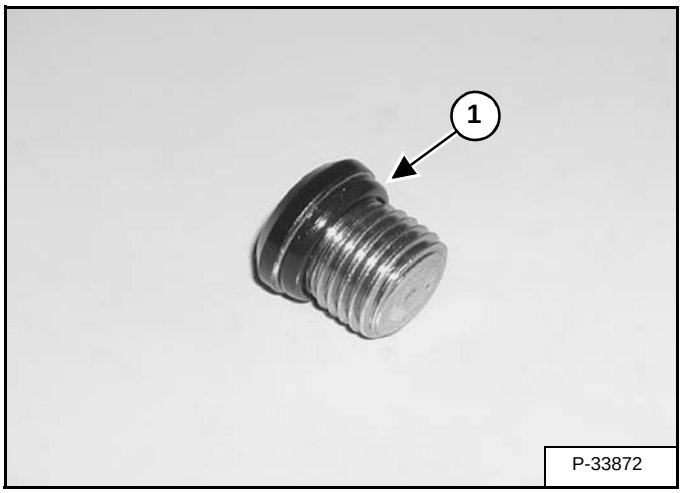
Figure 20-40-34



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

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

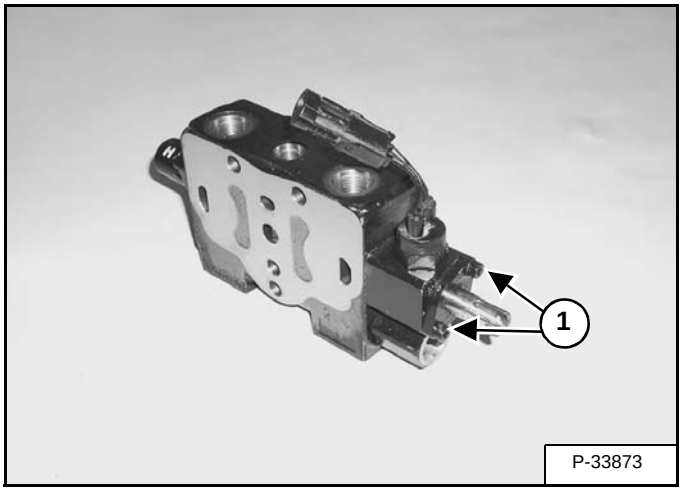
Figure 20-40-35



Remove the O-ring (Item 1) **[Figure 20-40-35]** from the plug.

Right Travel Section Disassembly And Assembly (Cont'd)

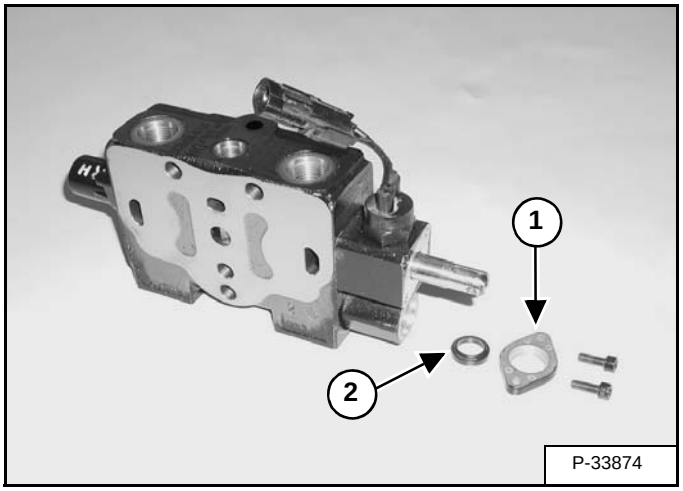
Figure 20-40-36



Remove the bolts (Item 1) **[Figure 20-40-36]**.

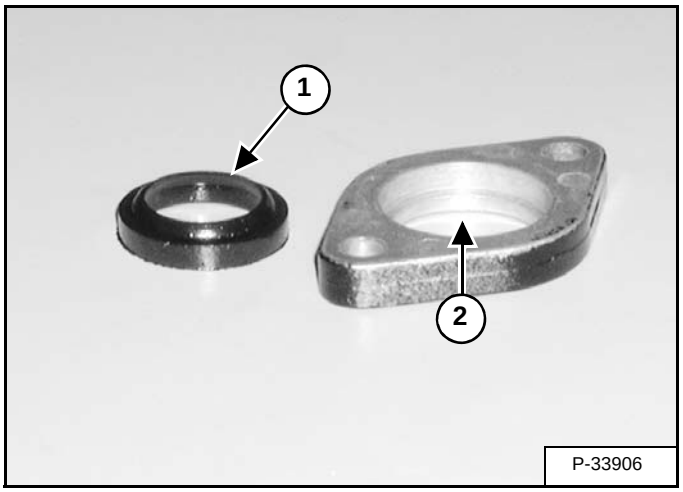
Installation: Tighten the bolts to 5 ft.-lb. (6,6 N•m) torque.

Figure 20-40-37



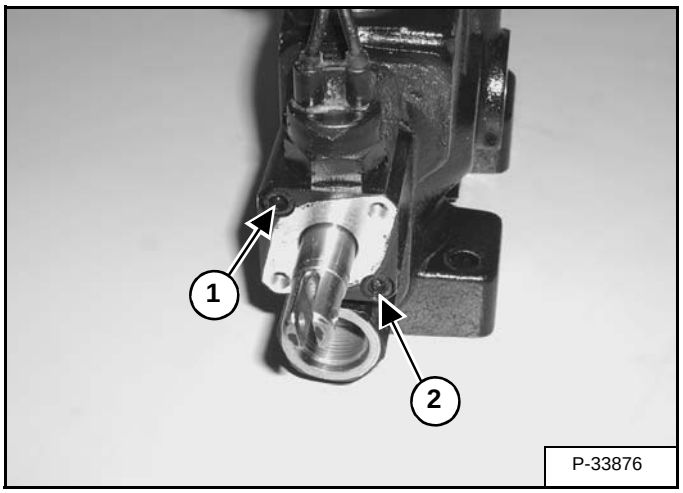
Remove the retaining plate (Item 1) and seal (Item 2) **[Figure 20-40-37]**.

Figure 20-40-38



Installation: Make sure the lip (Item 1) of the seal fits inside the lip on the retaining plate (Item 2) **[Figure 20-40-38]**.

Figure 20-40-39

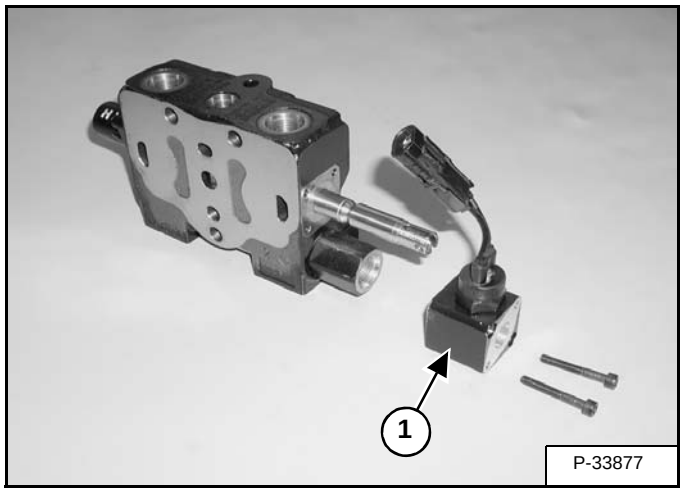


Remove the bolts (Item 1) **[Figure 20-40-39]** on the two speed switch.

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

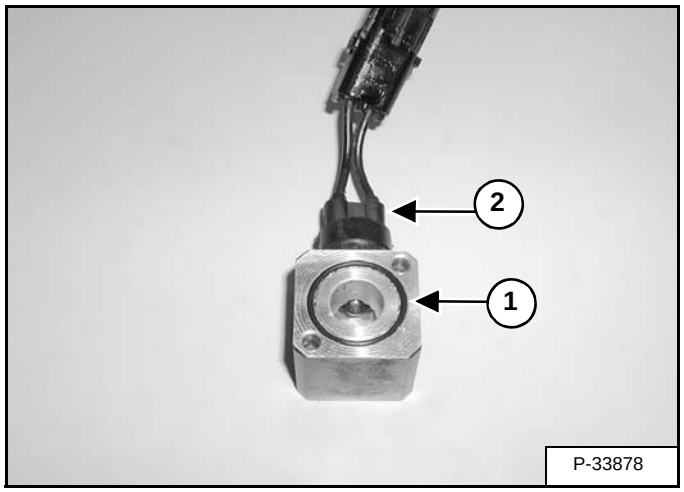
Right Travel Section Disassembly And Assembly (Cont'd)

Figure 20-40-40



Remove the two speed switch (Item 1) **[Figure 20-40-40]**.

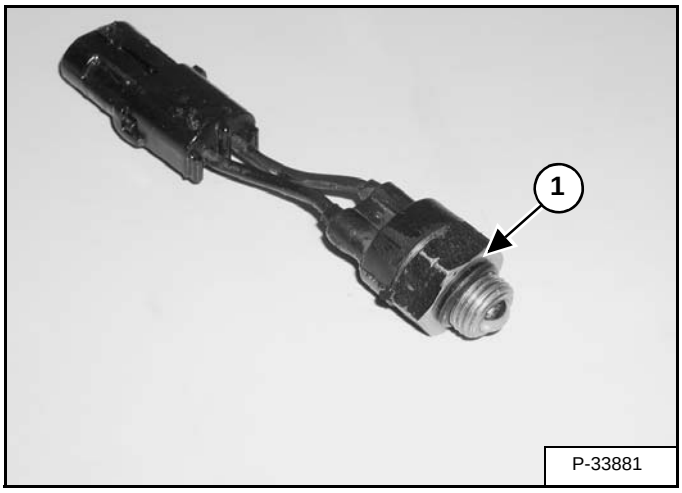
Figure 20-40-41



Remove the O-ring (Item 1) and electrical switch (Item 2) **[Figure 20-40-41]**.

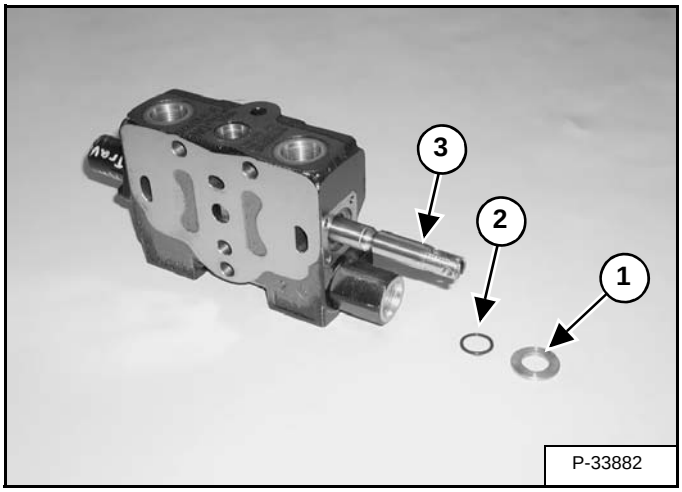
Installation: Tighten the switch to 31 ft.-lb. (42 N•m) torque.

Figure 20-40-42



Remove the O-ring (Item 1) **[Figure 20-40-42]** from the switch.

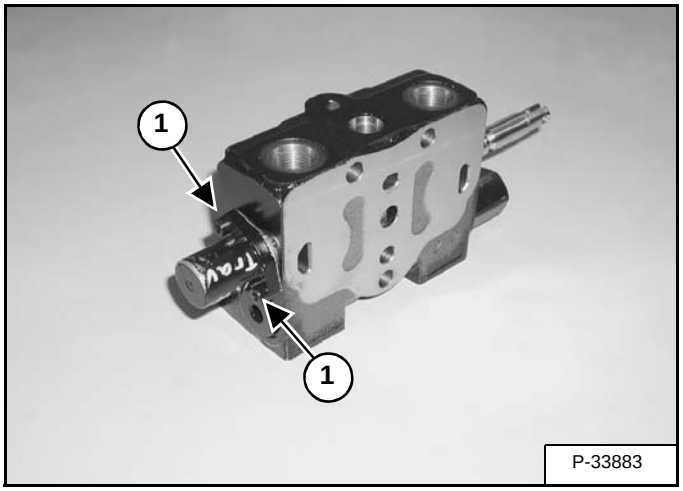
Figure 20-40-43



Remove the washer (Item 1) and O-ring (Item 2) from the spool (Item 3) **[Figure 20-40-43]**.

Right Travel Section Disassembly And Assembly (Cont'd)

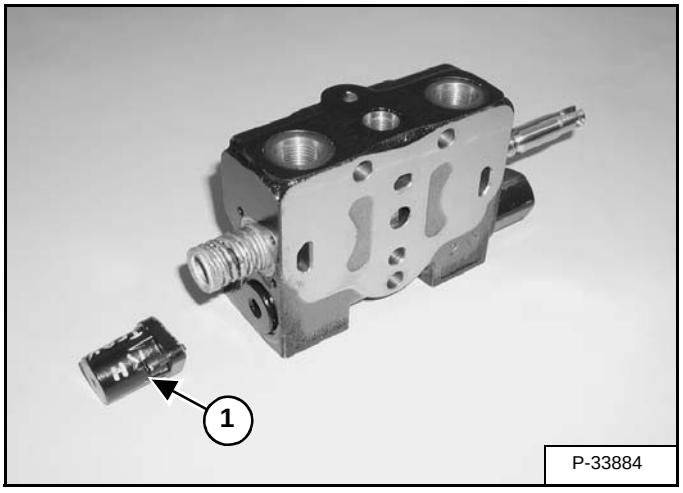
Figure 20-40-44



Remove the bolts (Item 1) **[Figure 20-40-44]** on the cap.

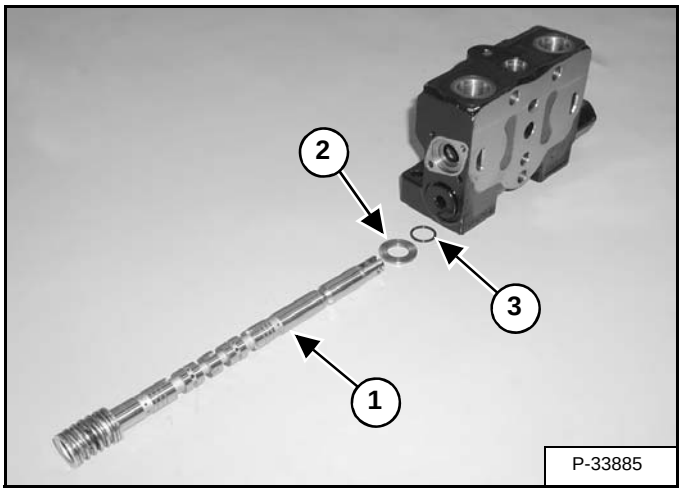
Installation: Tighten the bolts to 5 ft.-lb. (6,6 N•m) torque.

Figure 20-40-45



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

Figure 20-40-46



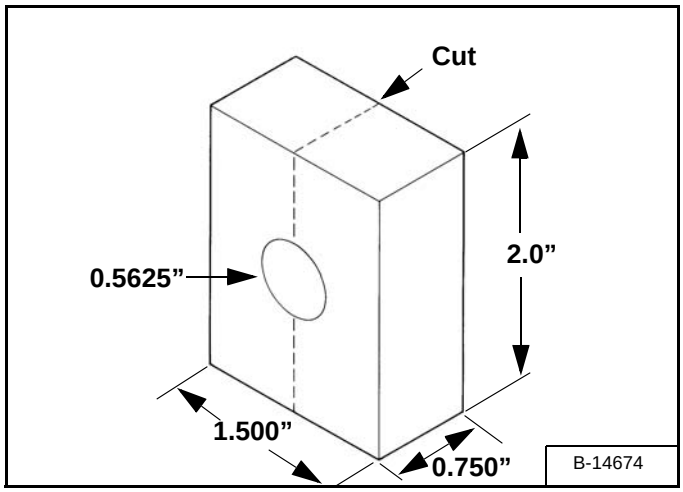
Remove the spool assembly (Item 1), washer (Item 2) and O-ring (Item 3) **[Figure 20-40-46]**.

The spool and valve block are not serviced separately.

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

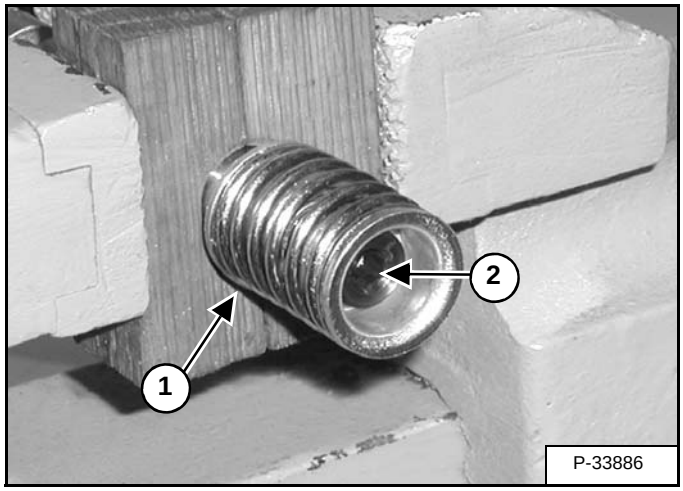
Right Travel Section Disassembly And Assembly (Cont'd)

Figure 20-40-47



To remove the spring assembly from the spool a holding fixture will have to be made from a 0.750 in. thick x 1.500 in. wide x 2.0 in. long (19 mm thick x 38 mm wide x 51 mm long) piece of hardwood. Drill a 0.5625 in. (14 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-47]**.

Figure 20-40-48



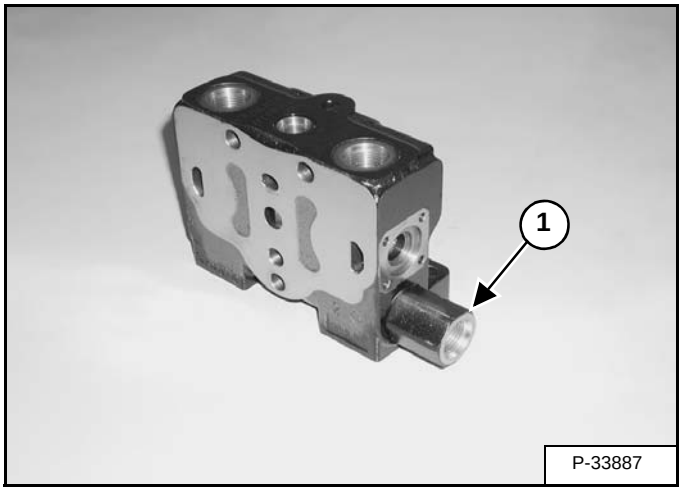
Using the wood blocks clamp the spool (Item 1) **[Figure 20-40-48]** in a vise.

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 20-40-48]** from the spool.

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

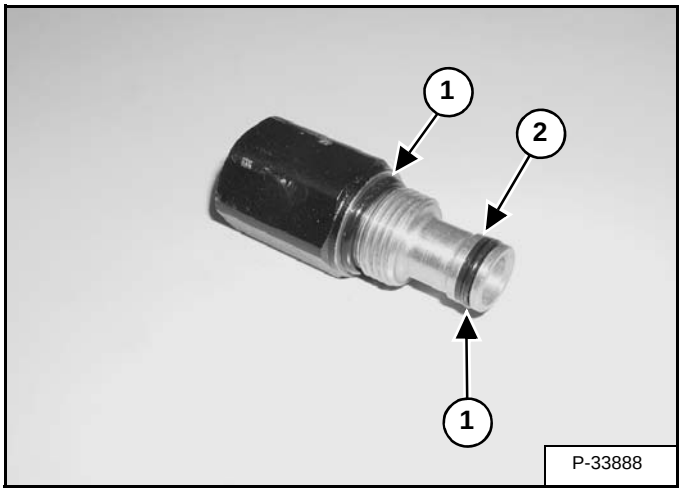
Figure 20-40-49



Remove the fitting (Item 1) **[Figure 20-40-49]**.

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

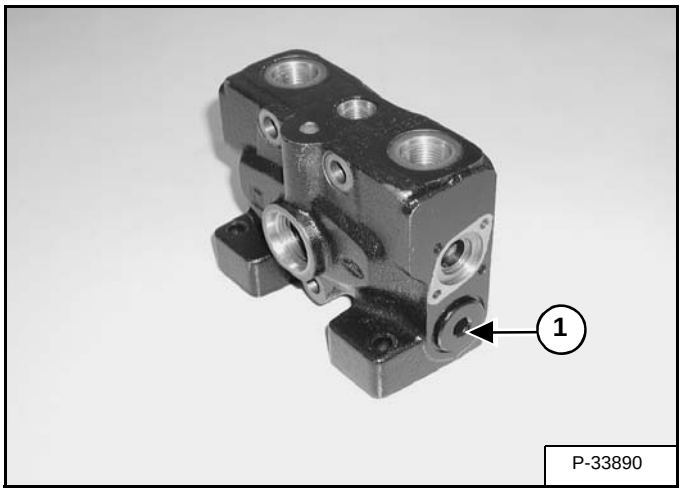
Figure 20-40-50



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-50]** from the fitting.

Right Travel Section Disassembly And Assembly (Cont'd)

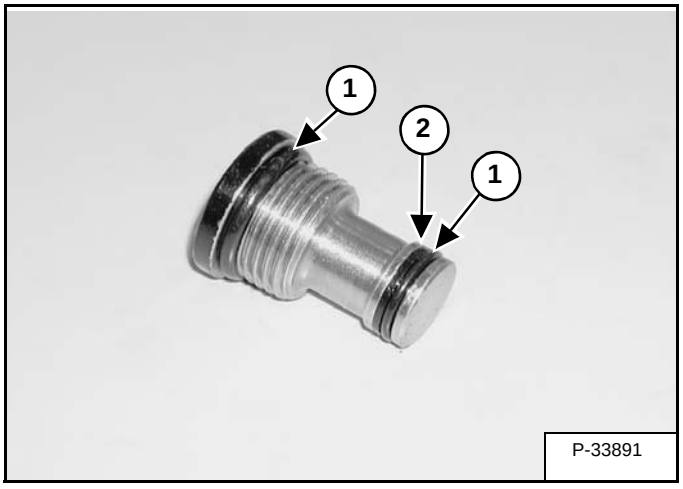
Figure 20-40-51



Remove the plug (Item 1) **[Figure 20-40-51]**.

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

Figure 20-40-52



Remove the O-rings (Item 1) and back up ring (Item 2) **[Figure 20-40-52]** from the plug.

Clean all parts in solvent and dry with compressed air.

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

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

Boom Swing Valve Section Disassembly And Assembly

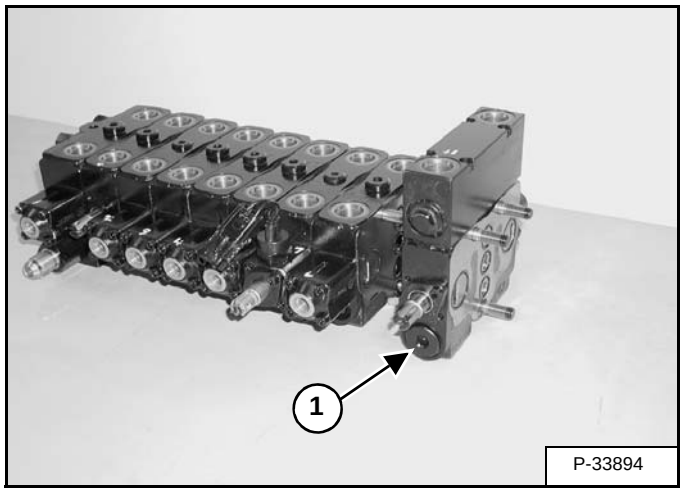
Clean the outside of the boom swing valve before disassembly.

IMPORTANT

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

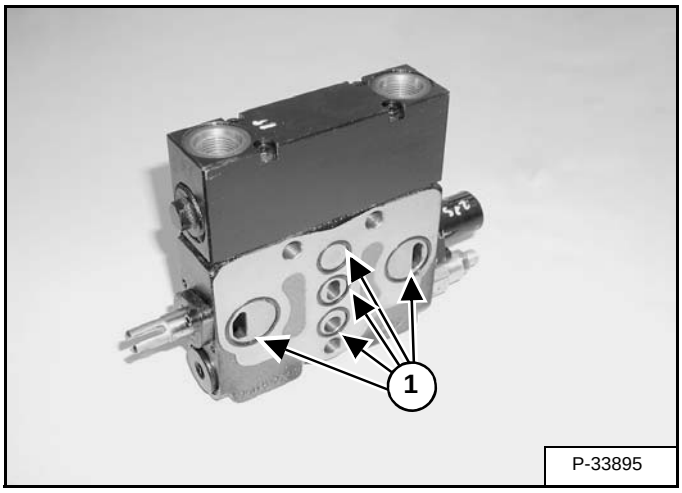
I-2003-0888

Figure 20-40-53



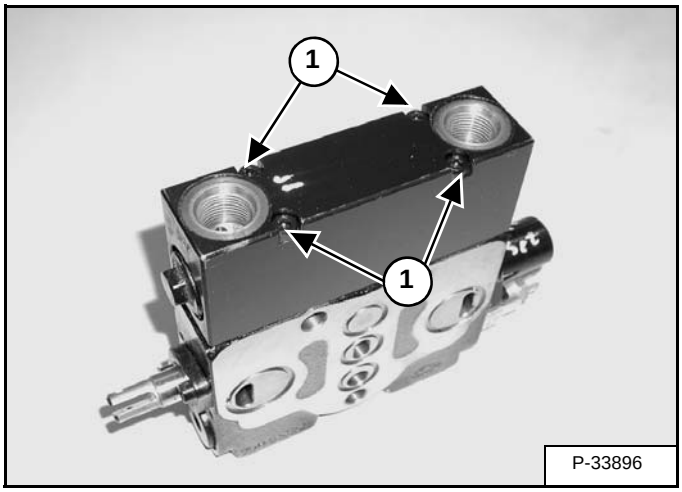
Remove the boom swing valve section (Item 1) **[Figure 20-40-53]** from the valve assembly.

Figure 20-40-54



Remove the O-rings (Item 1) **[Figure 20-40-54]** from the boom swing valve section.

Figure 20-40-55

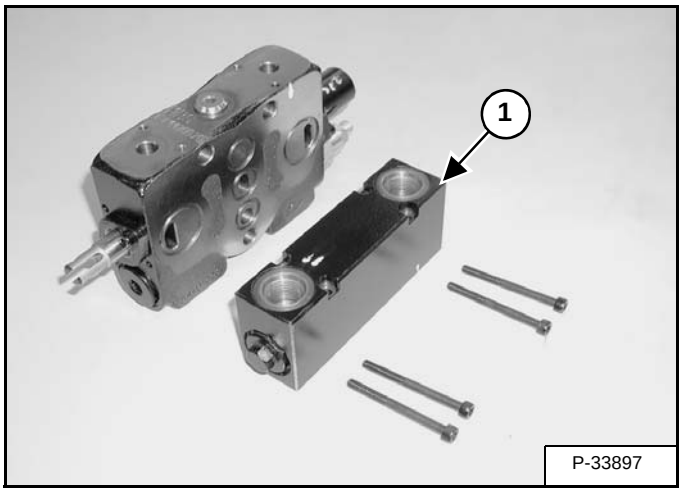


Remove the bolts (Item 1) **[Figure 20-40-55]** on the spool control block.

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

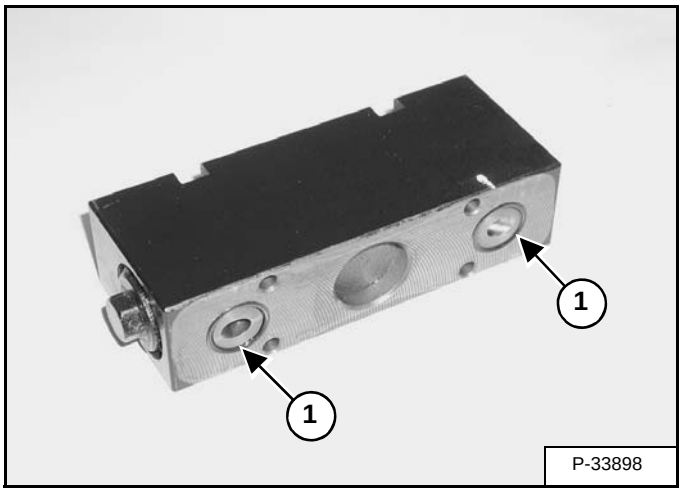
Boom Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-56



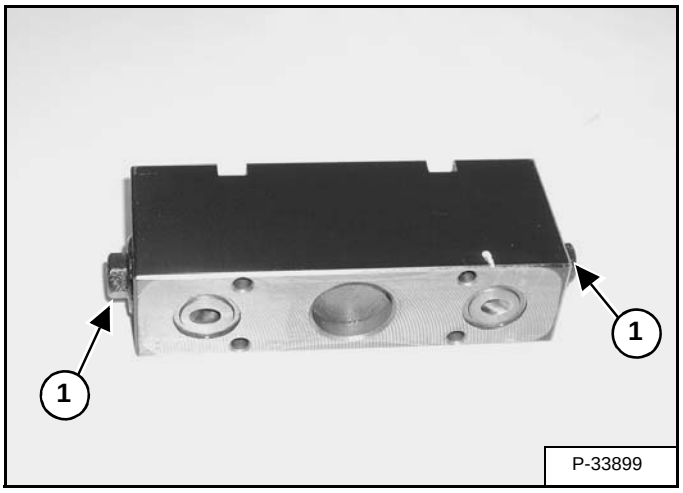
Mark the control block for correct installation. Remove the control block (Item 1) **[Figure 20-40-56]**.

Figure 20-40-57



Remove the O-rings (Item 1) **[Figure 20-40-57]**.

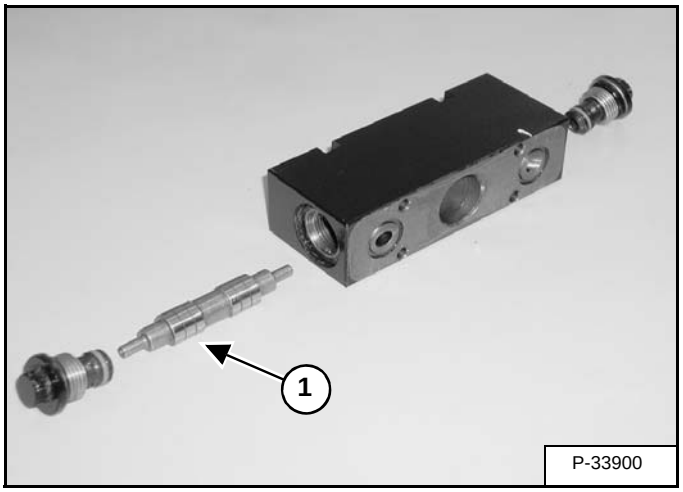
Figure 20-40-58



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

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

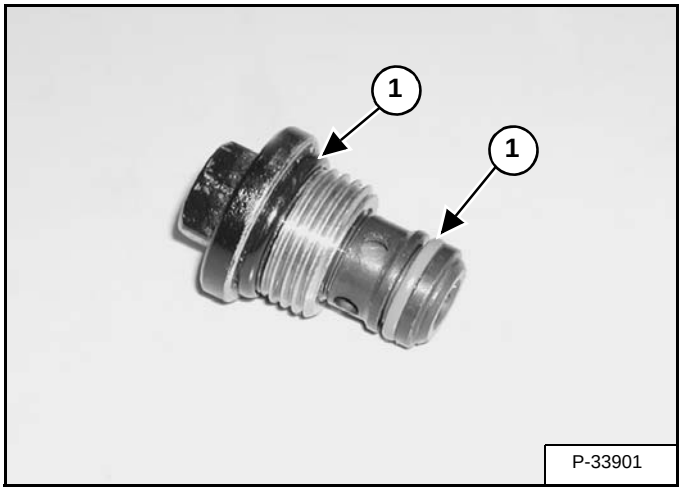
Figure 20-40-59



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

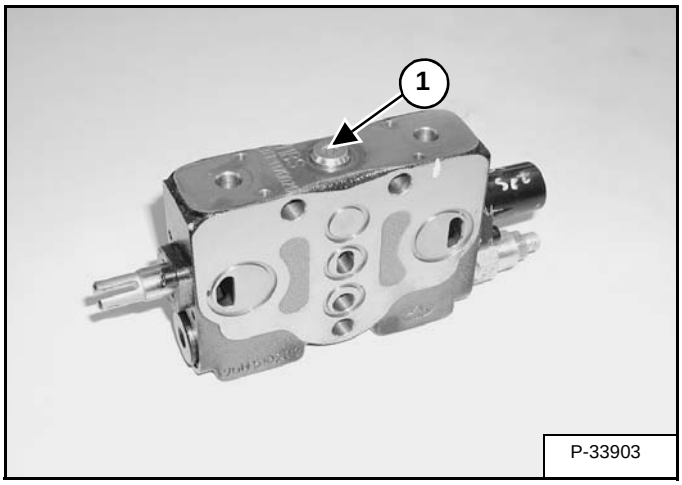
Boom Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-60



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

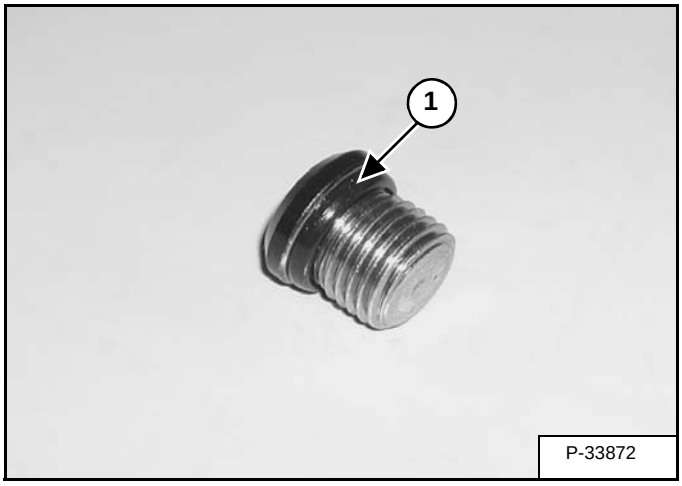
Figure 20-40-61



Remove the plug (Item 1) **[Figure 20-40-61]**.

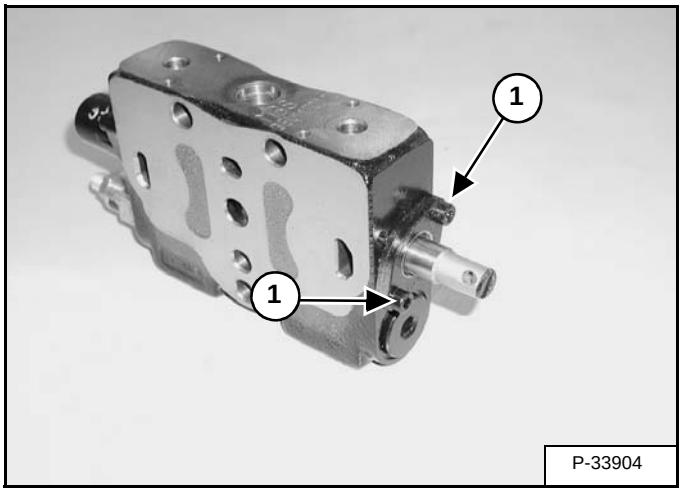
Installation: Tighten the plug to 18 ft.-lb. (24 N•m) torque.

Figure 20-40-62



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

Figure 20-40-63

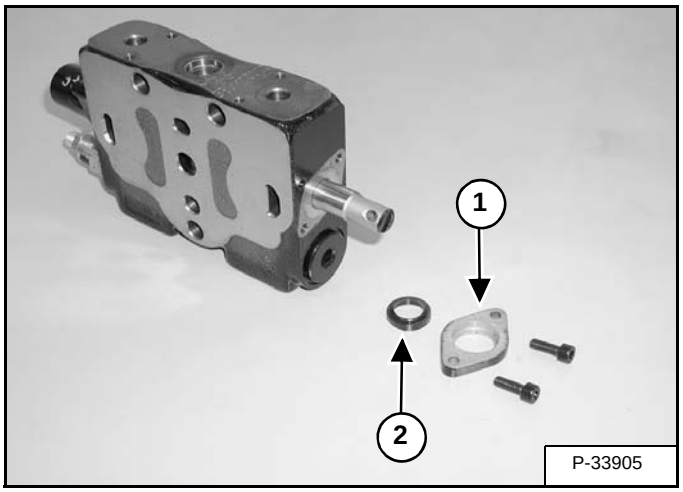


Remove the bolts (Item 1) **[Figure 20-40-63]**.

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

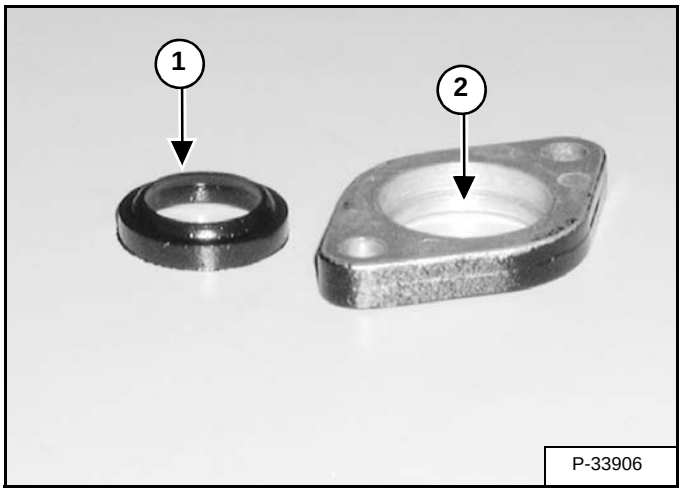
Boom Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-64



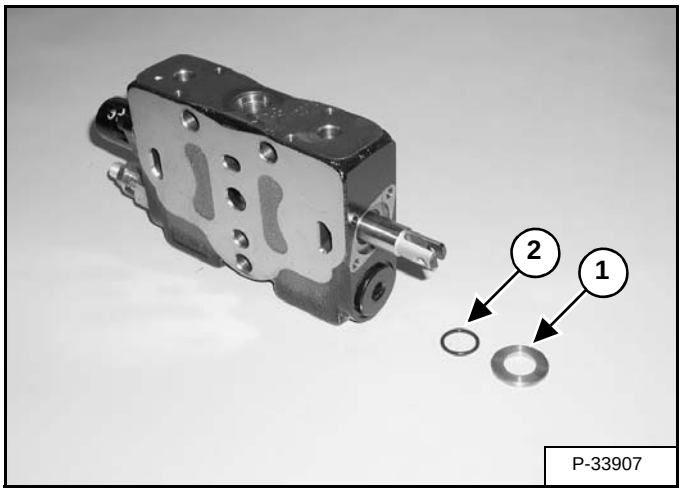
Remove the retainer (Item 1) and seal (Item 2) **[Figure 20-40-64]**.

Figure 20-40-65



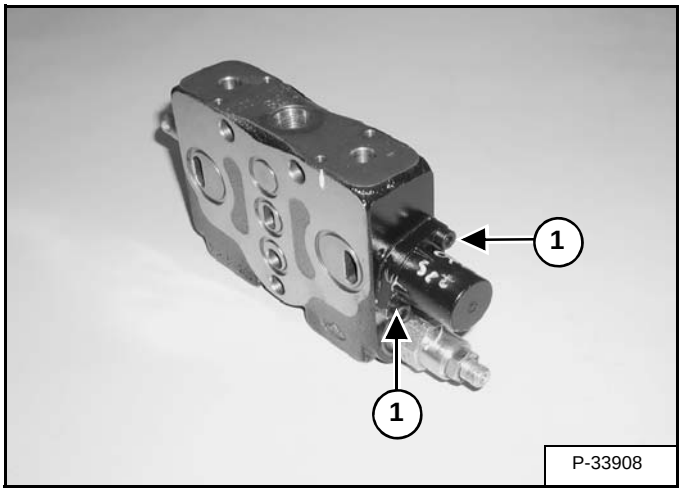
Installation: Make sure the lip (Item 1) on the seal fits into the lip on the retainer (Item 2) **[Figure 20-40-65]**.

Figure 20-40-66



Remove the washer (Item 1) and O-ring (Item 2) **[Figure 20-40-66]** from the actuating end of the spool.

Figure 20-40-67

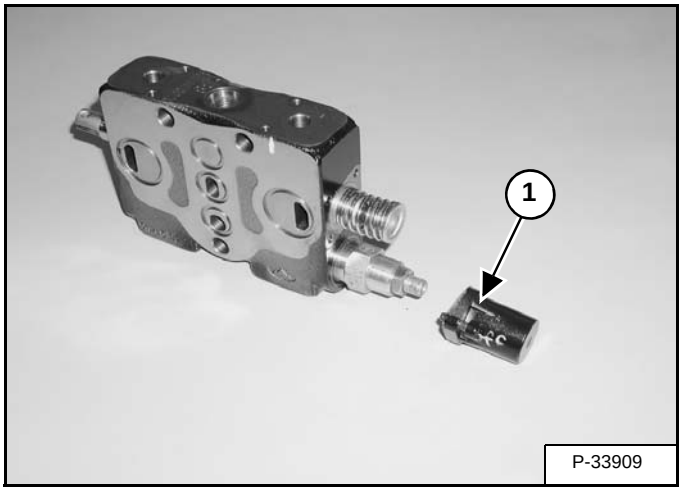


Remove the bolts (Item 1) **[Figure 20-40-67]**.

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

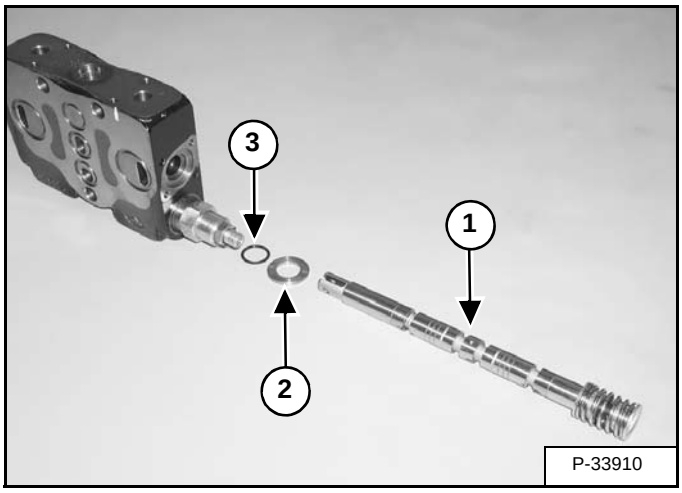
Boom Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-68



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

Figure 20-40-69

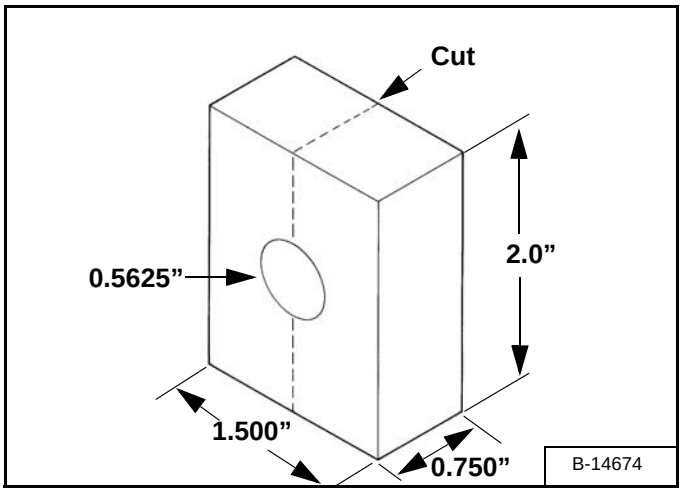


Remove the spool assembly (Item 1), washer (Item 2) and O-ring (Item 3) **[Figure 20-40-69]**.

The spool and valve block are not serviced separately.

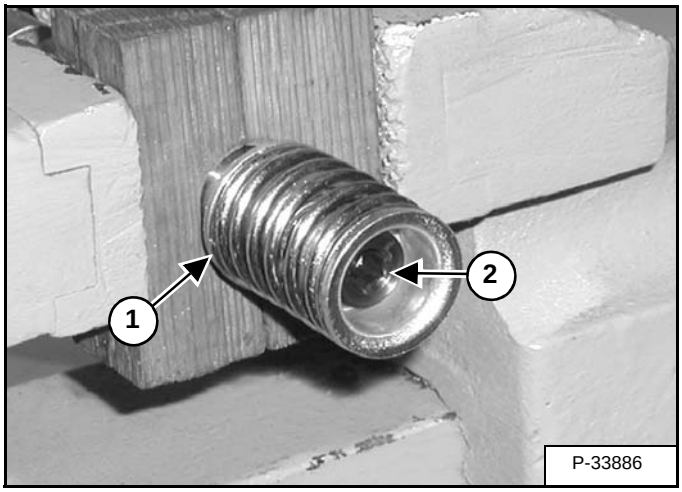
NOTE: When the spool is removed, use care not to scratch the spool surface. Do not interchange spools and valve blocks.

Figure 20-40-70



To remove the spring assembly form the spool a holding fixture will have to be made from a 0.750 in. thick x 1.500 in. wide x 2.0 in. long (19 mm thick x 38 mm wide x 51 mm long) piece of hardwood. Drill a 0.5625 in. (14 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-70]**.

Figure 20-40-71



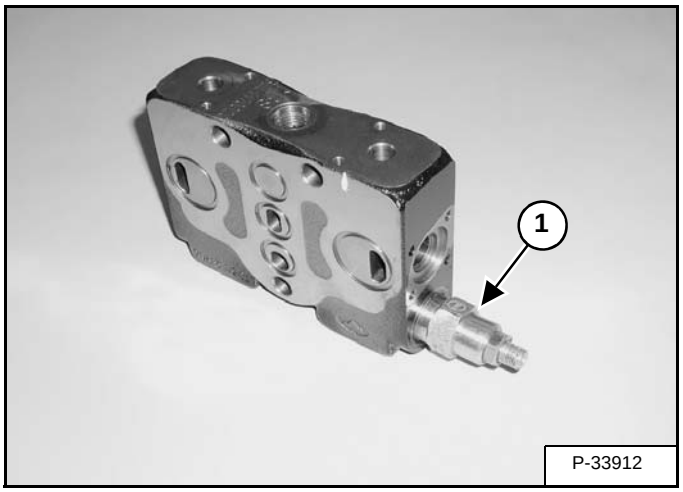
Using the wood block, clamp the spool (Item 1) in a vise and remove the spring assembly (Item 2) **[Figure 20-40-71]**.

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.-lb. (9,8 N•m) torque.

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

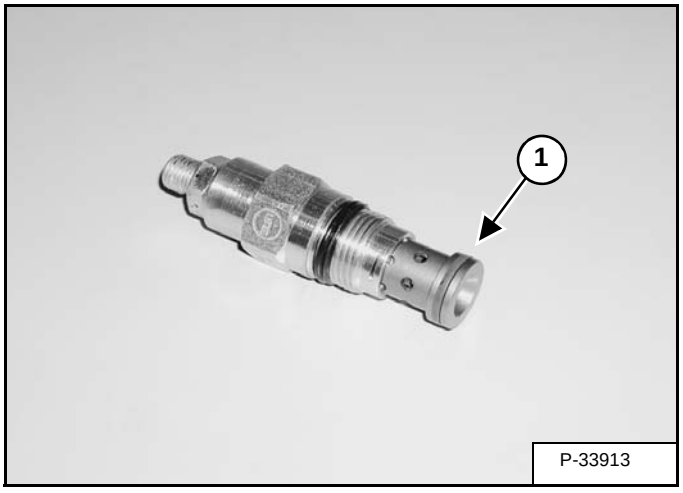
Figure 20-40-72



Remove the main relief valve (Item 1) **[Figure 20-40-72]**.

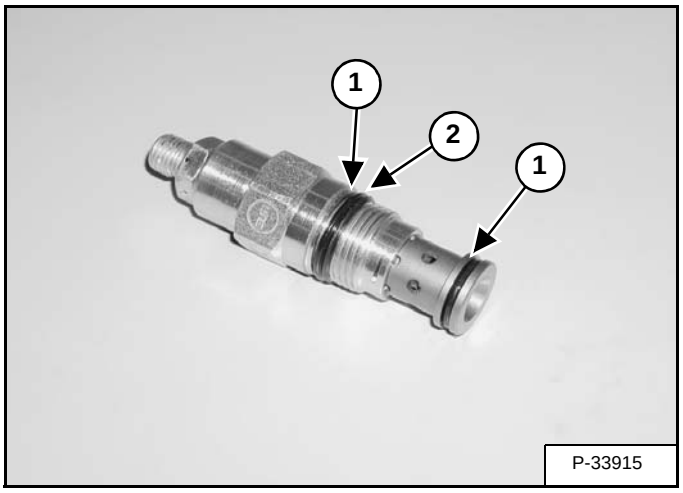
Installation: Tighten the main relief valve to 31 ft.-lb. (42 N•m) torque.

Figure 20-40-73



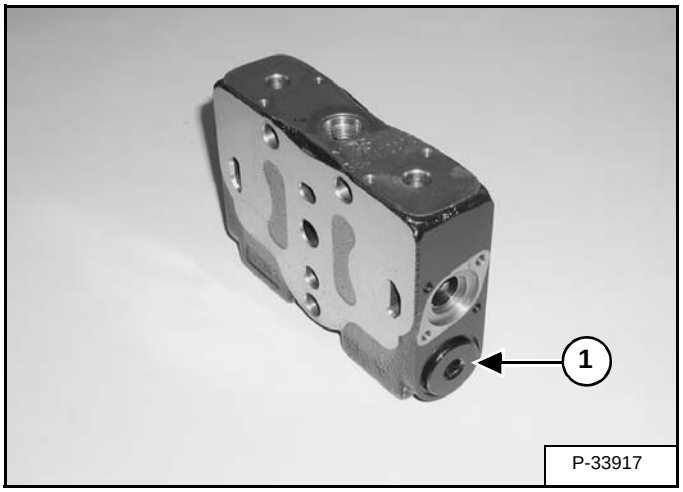
Remove the seal (Item 1) **[Figure 20-40-73]** from the main relief valve.

Figure 20-40-74



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-74]**.

Figure 20-40-75

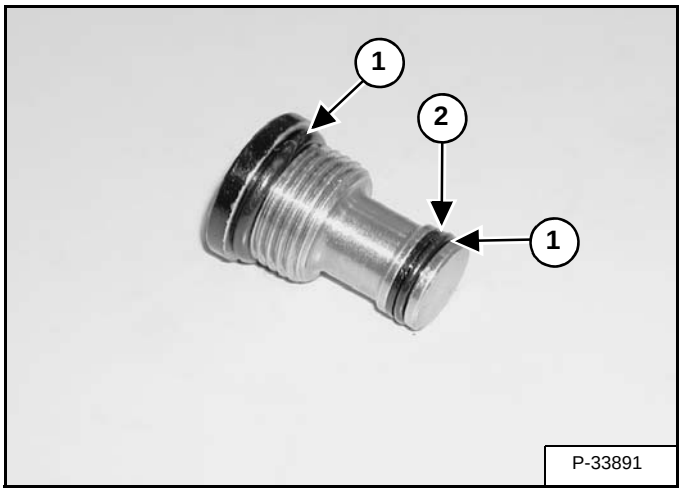


Remove the plug (Item 1) **[Figure 20-40-75]**.

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

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

Figure 20-40-76



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-76]** from the plug.

Clean all parts in solvent and dry with compressed air.

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

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

Boom Valve Section Disassembly And Assembly

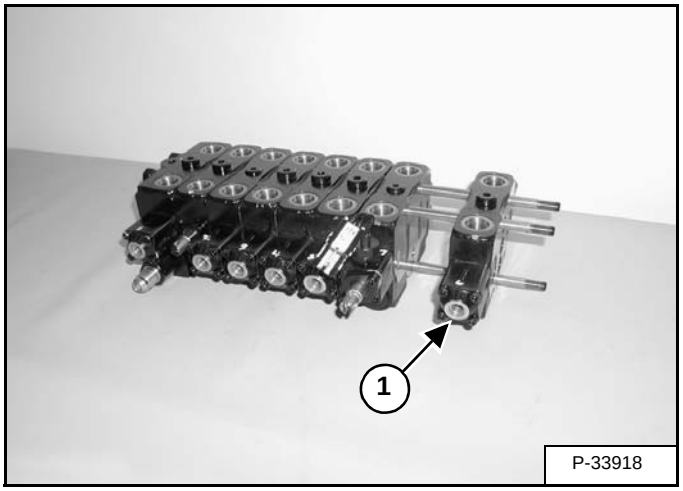
Clean the outside of the boom valve before disassembly.

IMPORTANT

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

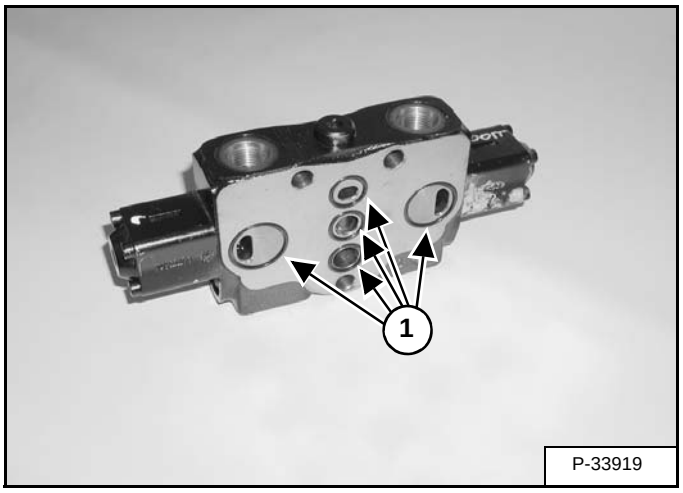
I-2003-0888

Figure 20-40-77



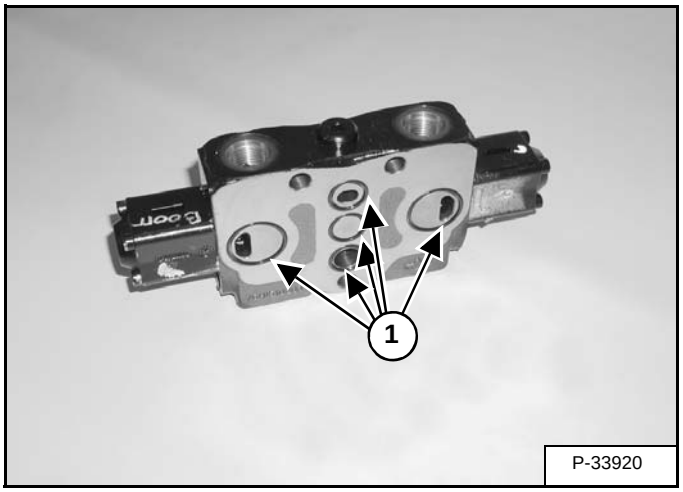
Remove the boom valve section (Item 1) **[Figure 20-40-77]** from the control valve assembly.

Figure 20-40-78



Remove the O-rings (Item 1) **[Figure 20-40-78]** from the right side of the boom valve section.

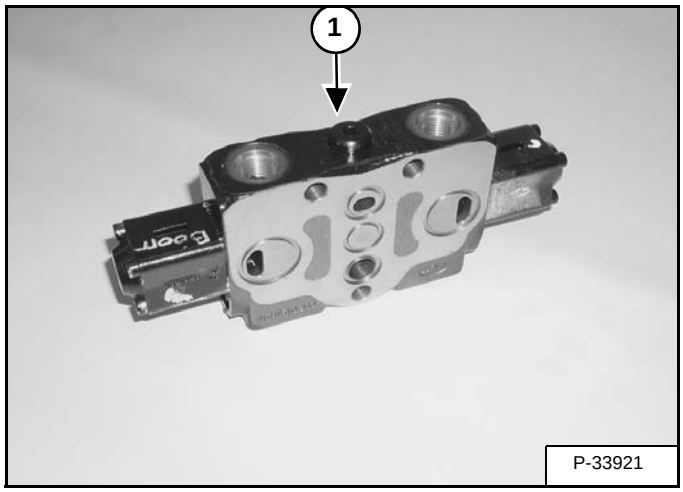
Figure 20-40-79



Remove the O-rings (Item 1) **[Figure 20-40-79]** from the left side of the boom valve section.

Boom Valve Section Disassembly And Assembly (Cont'd)

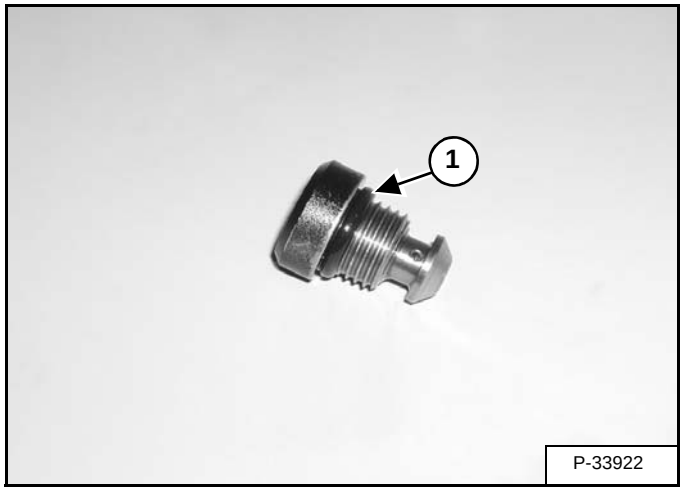
Figure 20-40-80



Remove the load check valve (Item 1) **[Figure 20-40-80]**.

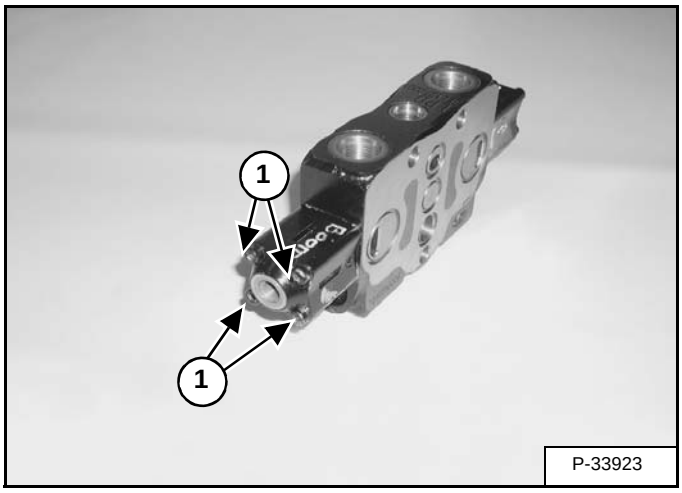
Installation: Tighten the load check valve to 18 ft.-lb. (24 N•m) torque.

Figure 20-40-81



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

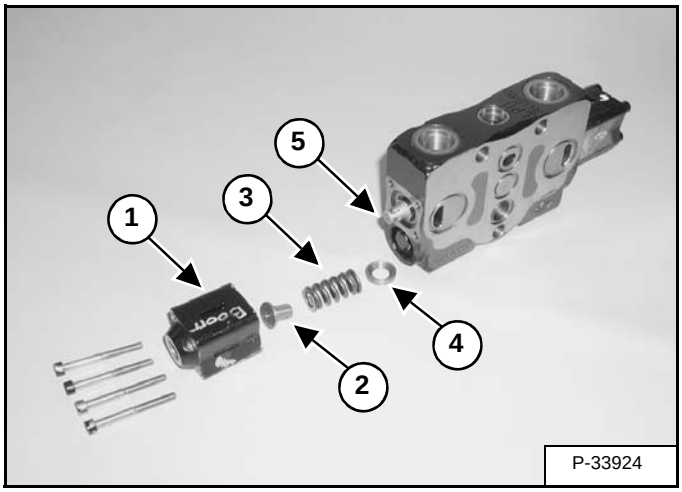
Figure 20-40-82



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

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

Figure 20-40-83

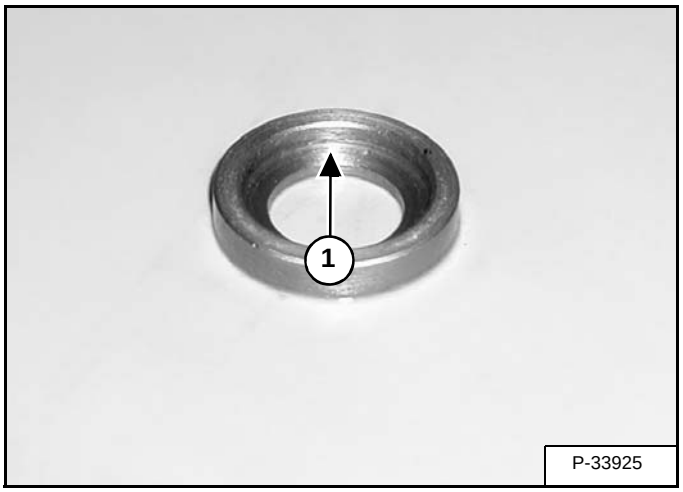


Remove the spool cover (Item 1), spring retainer (Item 2), spring (Item 3) and spring seat (Item 4) **[Figure 20-40-83]**.

Remove the O-ring (Item 5) **[Figure 20-40-83]**.

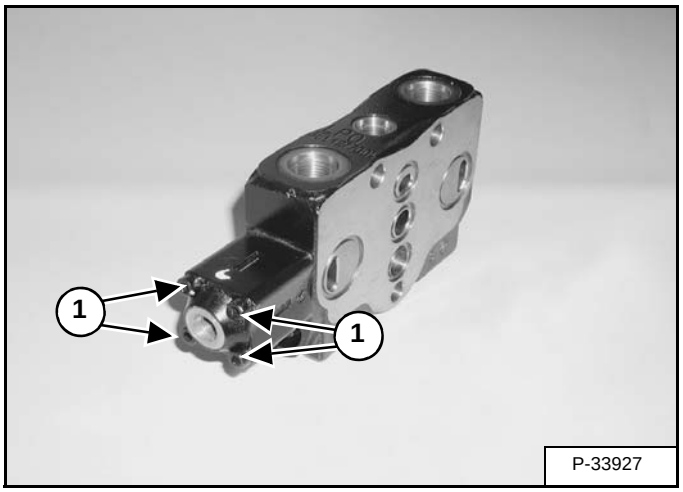
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-84



Installation: Make sure the lip (Item 1) **[Figure 20-40-84]** on the spring seat fits over the spool.

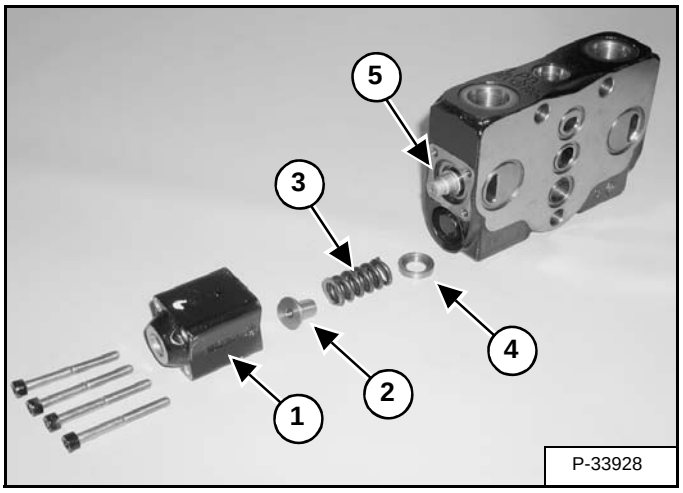
Figure 20-40-85



Remove the bolts (Item 1) **[Figure 20-40-85]**.

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

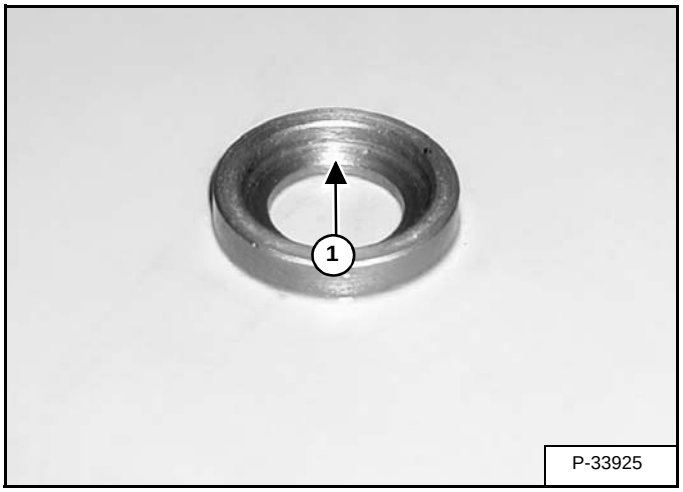
Figure 20-40-86



Remove the spool cover (Item 1), spring retainer (Item 2), spring (Item 3) and spring seat (Item 4) **[Figure 20-40-86]**.

Remove the O-ring (Item 5) **[Figure 20-40-86]**.

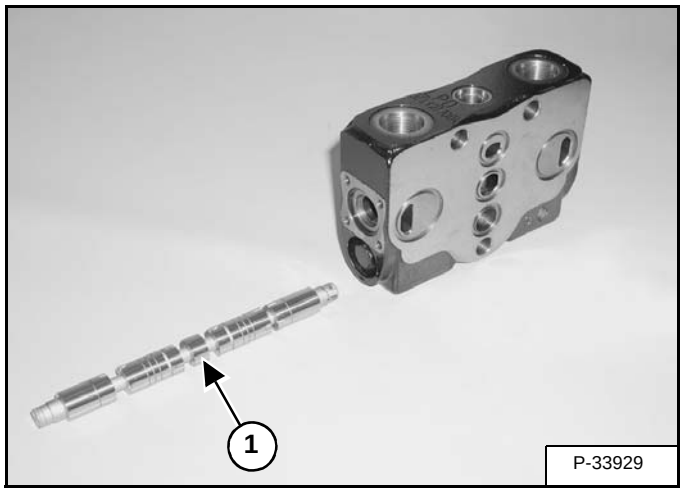
Figure 20-40-87



Installation: Make sure the lip (Item 1) **[Figure 20-40-86]** on the spring seat fits over the spool.

Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-88

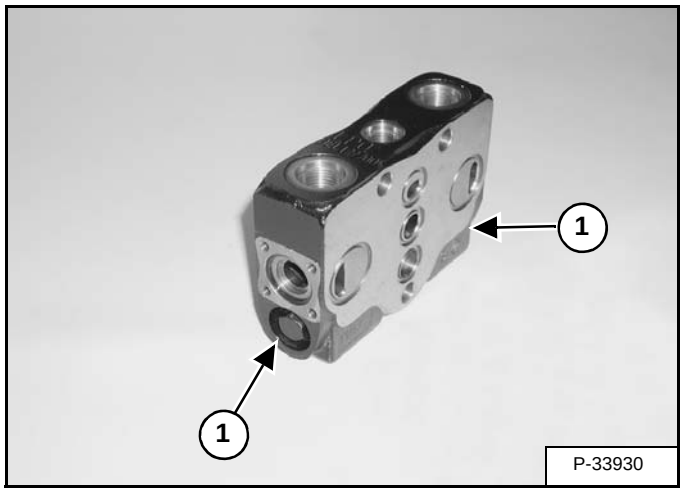


Remove the spool (Item 1) **[Figure 20-40-88]**.

The spool and valve block are not serviced separately.

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

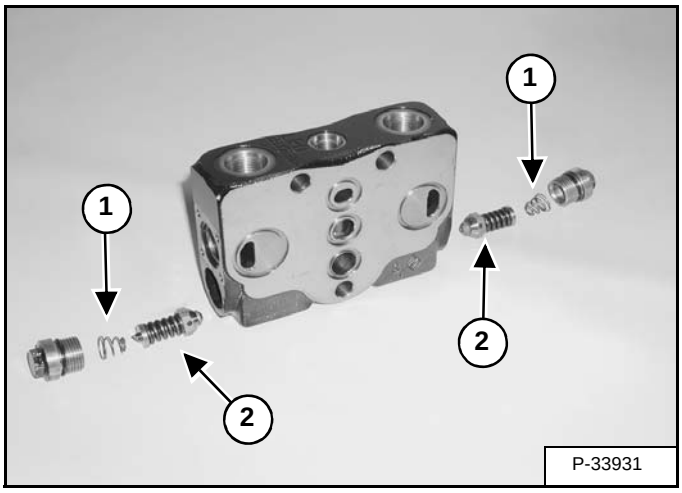
Figure 20-40-89



Remove the relief valve plug (Item 1) **[Figure 20-40-89]** (both sides).

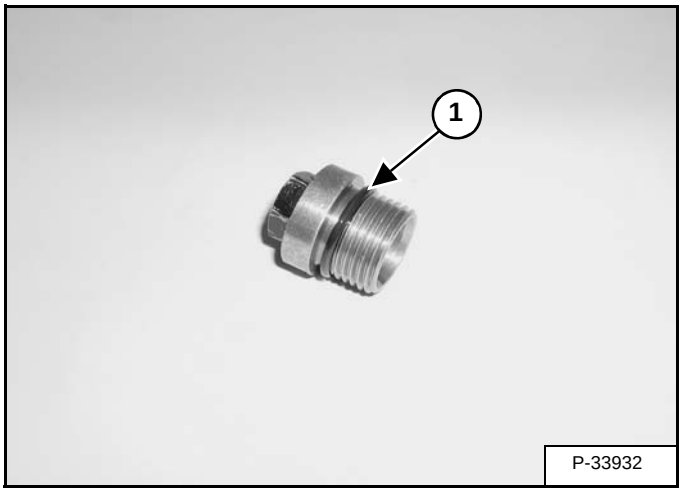
Installation: Tighten the relief valve to 18 ft.-lb. (24 N•m) torque.

Figure 20-40-90



Remove the spring (Item 1) and spring assembly (Item 2) **[Figure 20-40-90]** from both relief valve ports.

Figure 20-40-91



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

Clean all parts in solvent and dry with compressed air. Inspect all parts for wear or damage. Replace any worn or damaged parts. Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

IMPORTANT

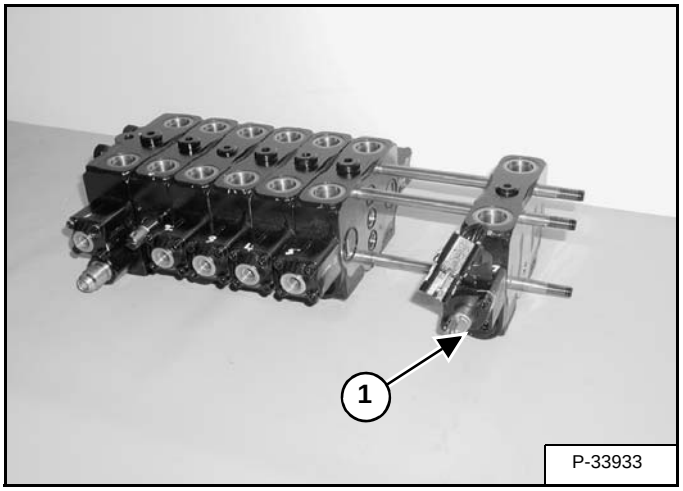
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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Left Travel Valve Section Disassembly And Assembly

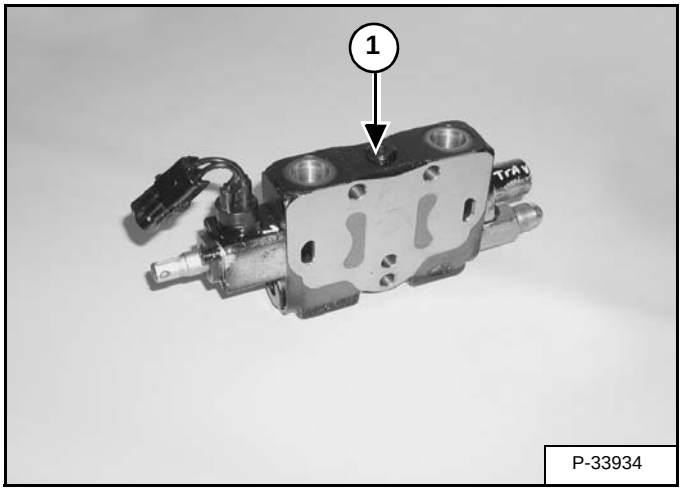
Clean the outside of the left travel valve before disassembly.

Figure 20-40-92



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

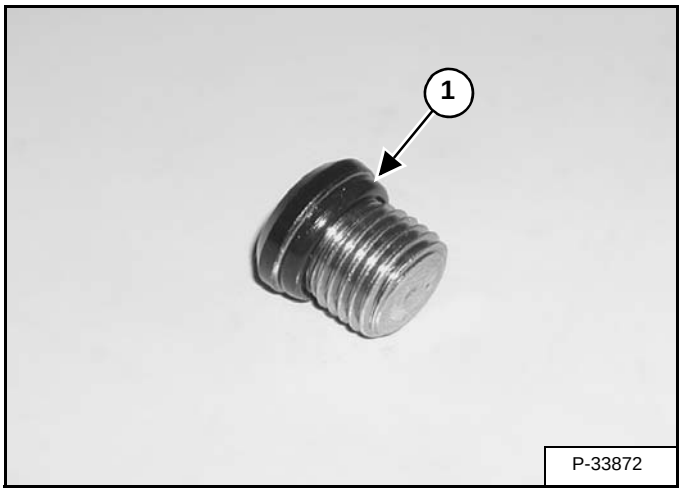
Figure 20-40-93



Remove the plug (Item 1) **[Figure 20-40-93]** from the left travel valve section.

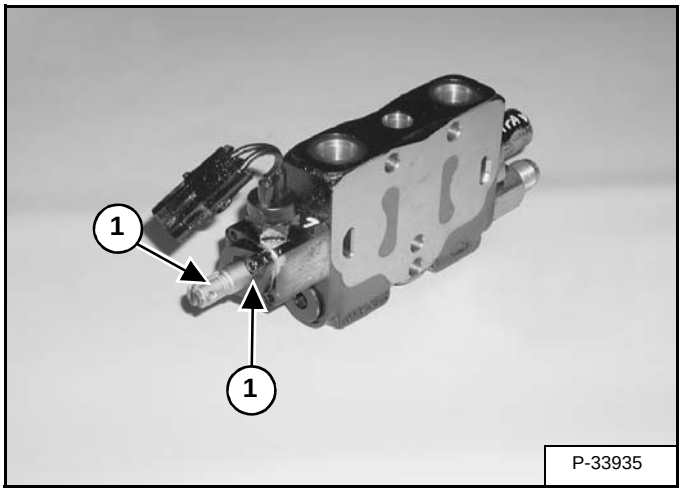
Installation: Tighten the plug to 18 ft.-lb. (24 N•m) torque.

Figure 20-40-94



Remove the O-ring (Item 1) **[Figure 20-40-94]** from the plug.

Figure 20-40-95

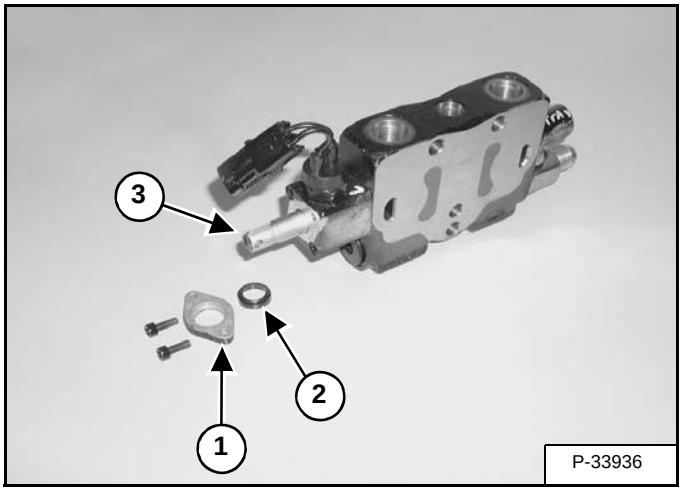


Remove the bolts (Item 1) **[Figure 20-40-95]**.

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

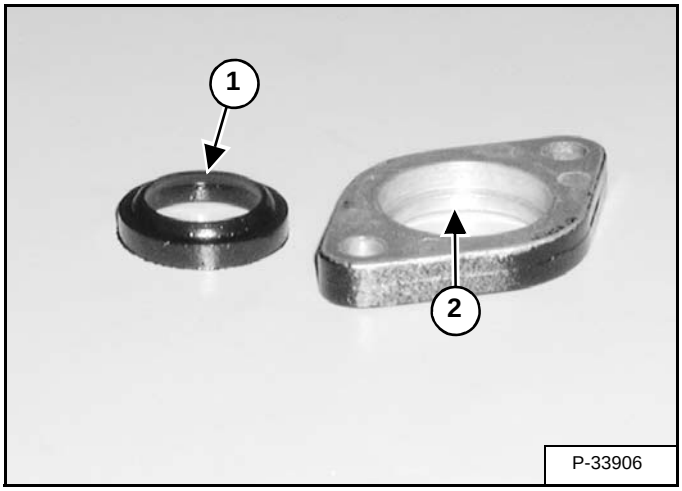
Left Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-96



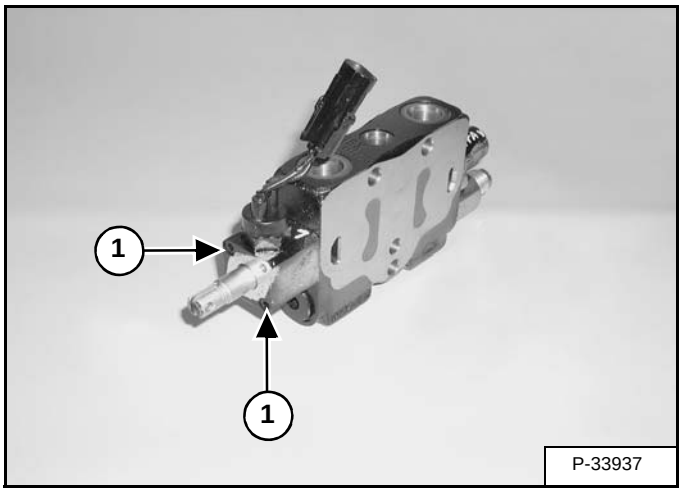
Remove the retainer (Item 1) and seal (Item 2) from the spool (Item 3) **[Figure 20-40-96]**.

Figure 20-40-97



Installation: Make sure the lip (Item 1) of the seal fits inside the retainer (Item 2) **[Figure 20-40-97]**.

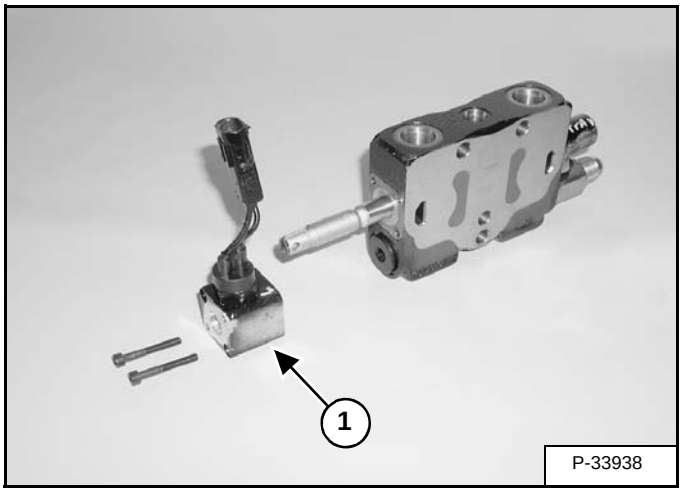
Figure 20-40-98



Remove the bolts (Item 1) **[Figure 20-40-98]** on the two speed switch.

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

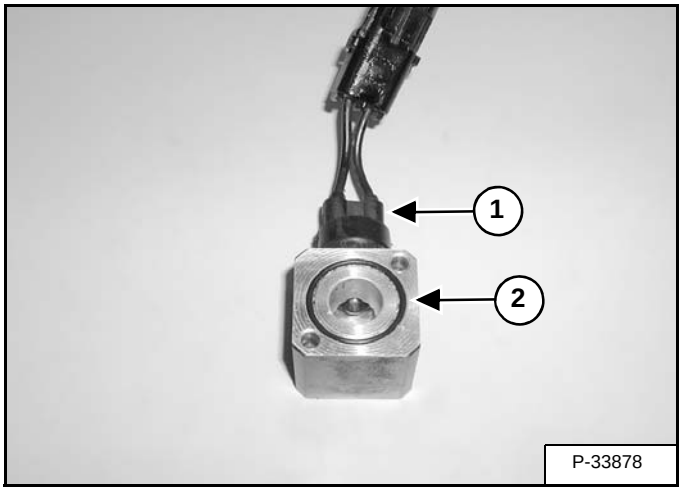
Figure 20-40-99



Remove the switch assembly (Item 1) **[Figure 20-40-99]**.

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

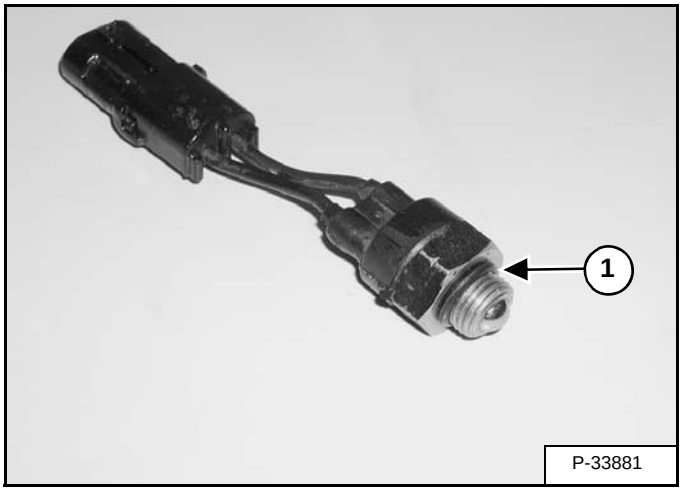
Figure 20-40-100



Remove the electrical connector (Item 1) and O-ring (Item 2) **[Figure 20-40-100]**.

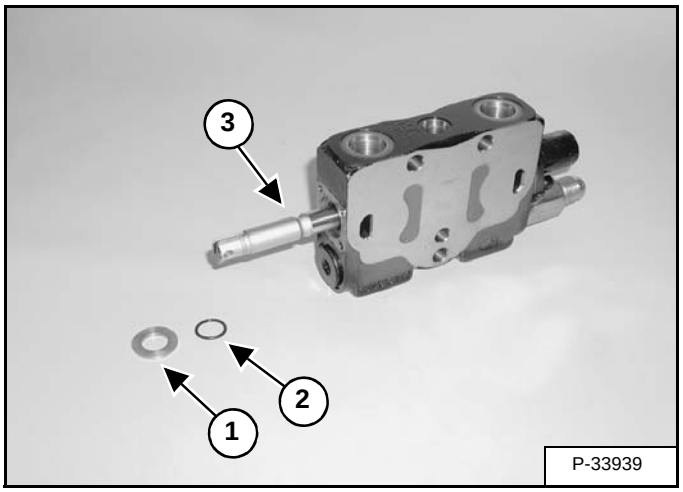
Installation: Tighten the electrical connector to 31 ft.-lb. (42 N•m) torque.

Figure 20-40-101



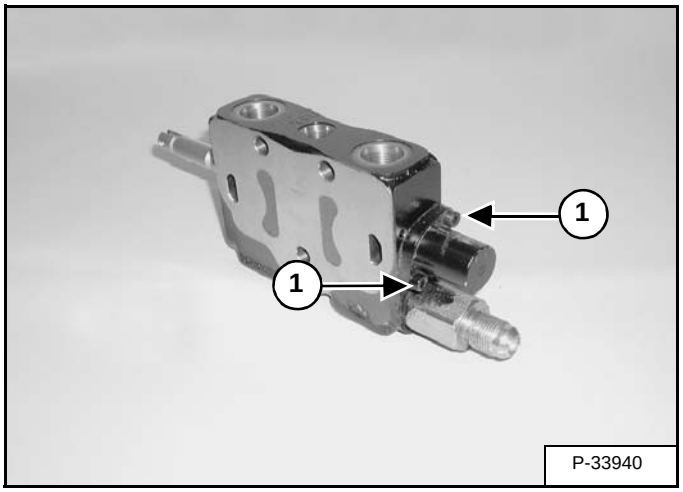
Remove the O-ring (Item 1) **[Figure 20-40-101]** from the electrical connector.

Figure 20-40-102



Remove the washer (Item 1) and O-ring (Item 2) from the actuating end of the spool (Item 3) **[Figure 20-40-102]**.

Figure 20-40-103

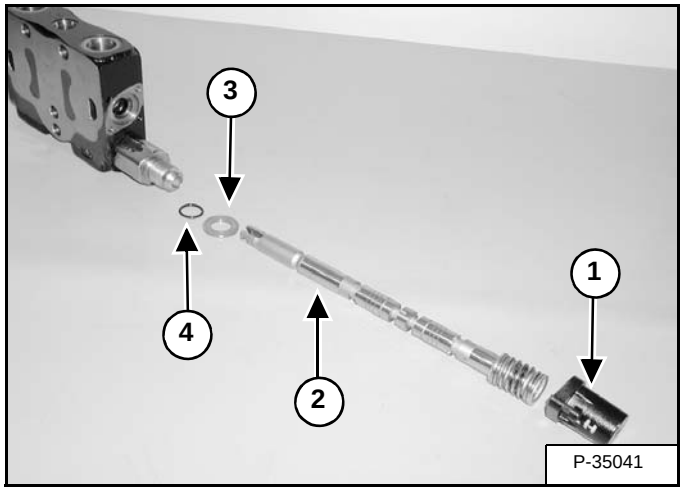


Remove the bolts (Item 1) **[Figure 20-40-103]** on the cover.

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

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

Figure 20-40-104

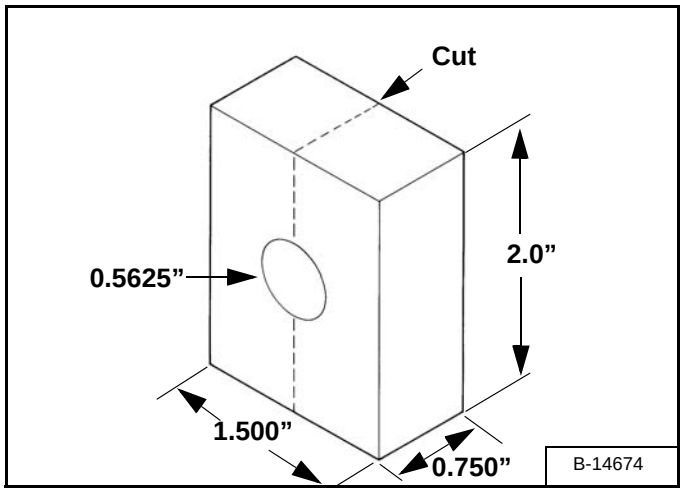


Remove the cover (Item 1), spool assembly (Item 2), washer (Item 3) and O-ring (Item 4) **[Figure 20-40-104]**.

The spool and valve block are not serviced separately.

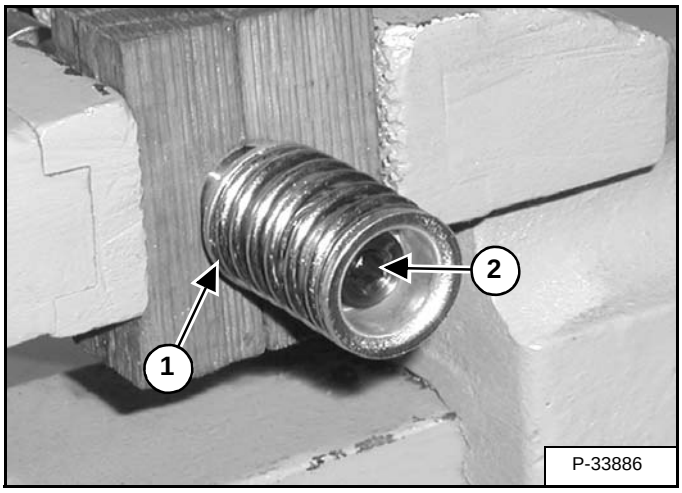
NOTE: When the spool is removed, use care not to scratch the spool surface. Do not interchange spools and valve blocks.

Figure 20-40-105



To remove the spring assembly from the spool a holding fixture will have to be made from a 0.750 in. thick x 1.500 in. wide x 2.0 in. long (19 mm thick x 38 mm wide x 51 mm long) piece of hardwood block. Drill a 0.5625 in. (14 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-105]**.

Figure 20-40-106



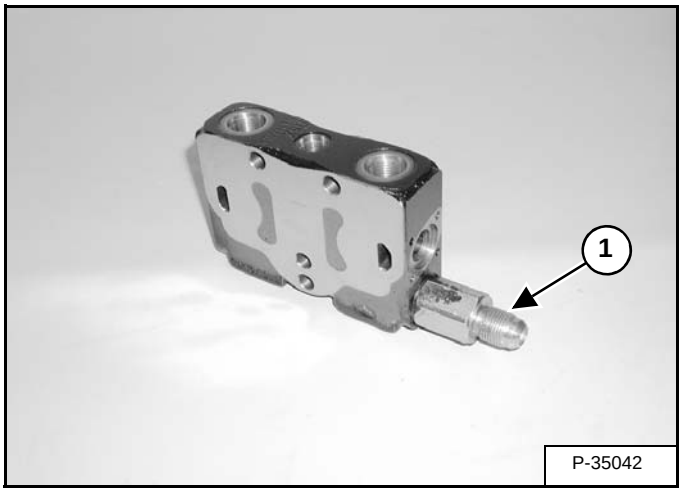
Using the wood blocks clamp the spool (Item 1) **[Figure 20-40-106]** in a vise.

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 20-40-106]**.

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

Figure 20-40-107

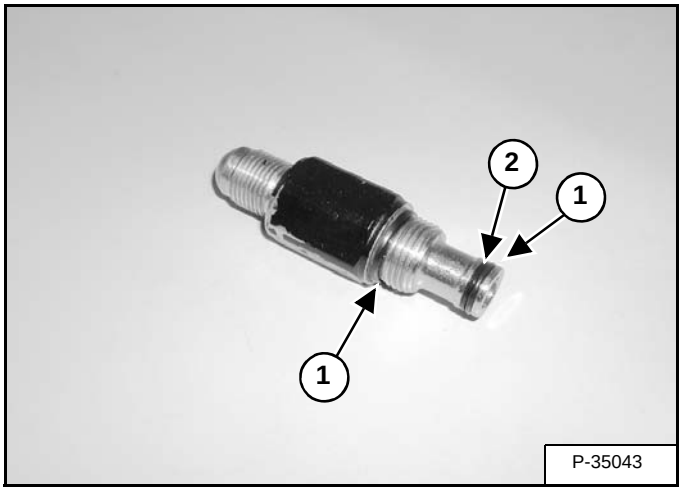


Remove the fitting (Item 1) **[Figure 20-40-107]**.

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

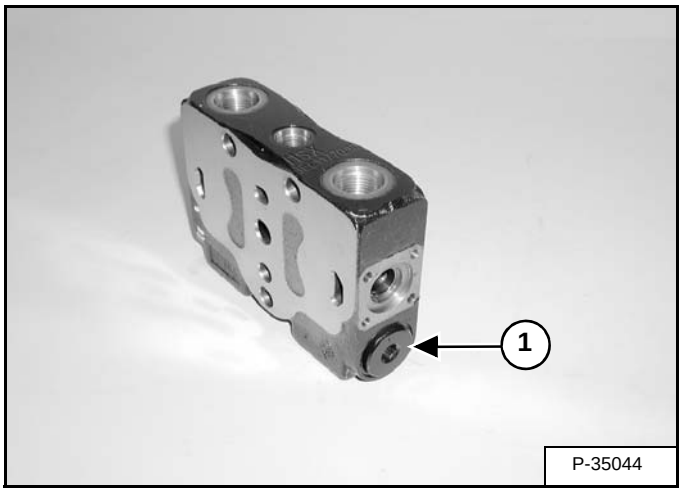
Left Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-108



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-108]** from the fitting.

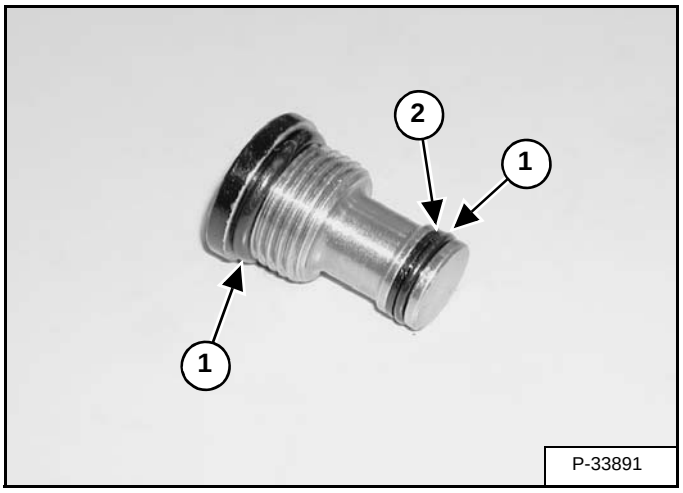
Figure 20-40-109



Remove the plug (Item 1) **[Figure 20-40-109]**.

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

Figure 20-40-110



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-110]** from the plug.

Clean all parts in solvent and dry with compressed air.

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

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

Arm Valve Section Disassembly And Assembly

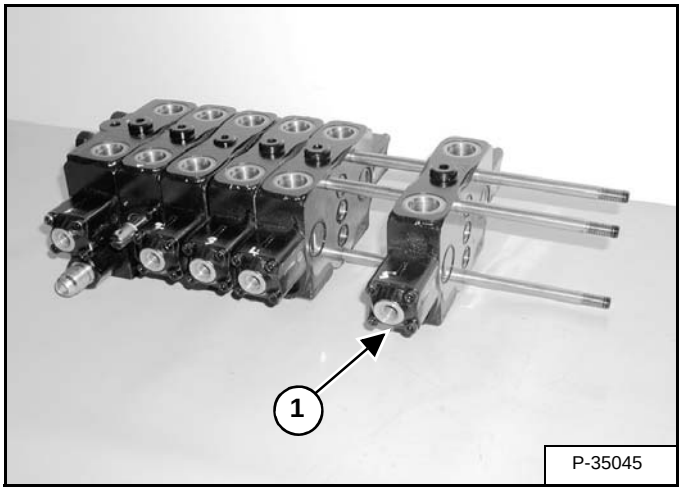
Clean the outside of the am valve before disassembly.

IMPORTANT

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

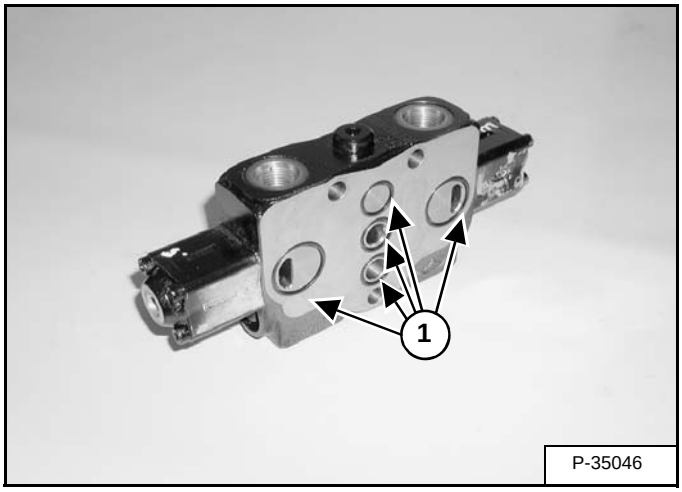
I-2003-0888

Figure 20-40-111



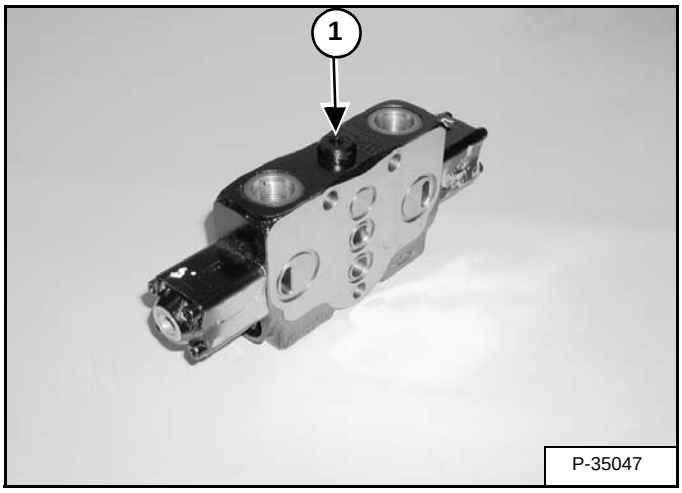
Remove the arm valve section (Item 1) **[Figure 20-40-111]** from the valve assembly.

Figure 20-40-112



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

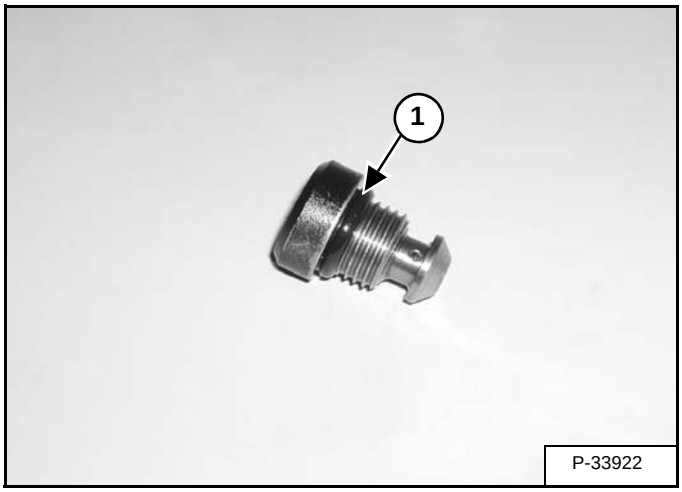
Figure 20-40-113



Remove the load check valve (Item 1) **[Figure 20-40-113]**.

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

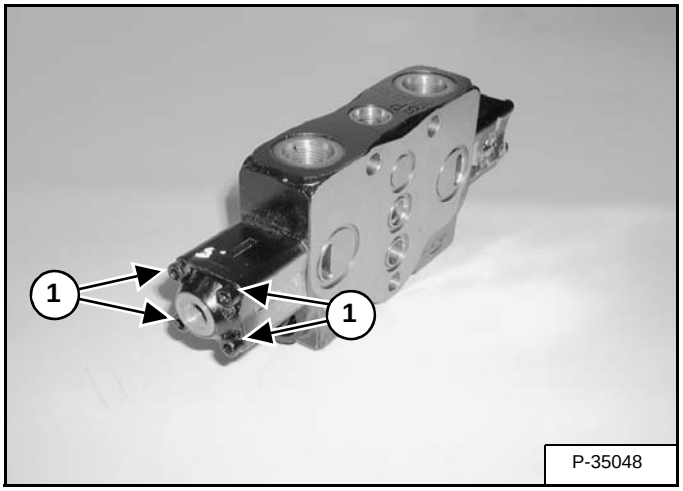
Figure 20-40-114



Remove the O-ring (Item 1) **[Figure 20-40-114]** from the load check valve.

Arm Valve Section Disassembly And Assembly (Cont'd)

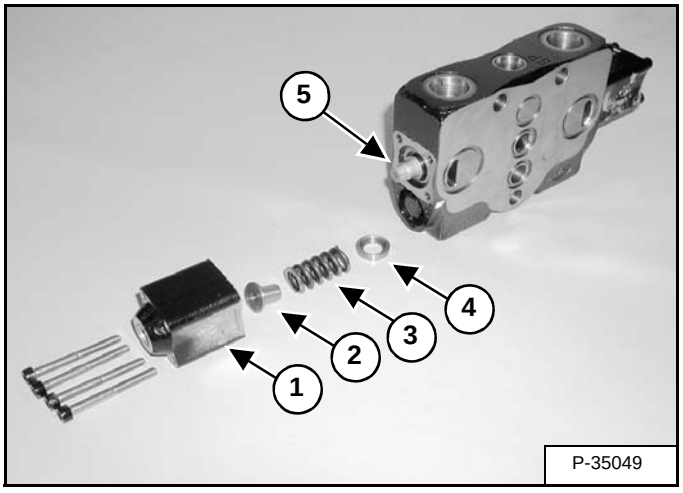
Figure 20-40-115



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

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

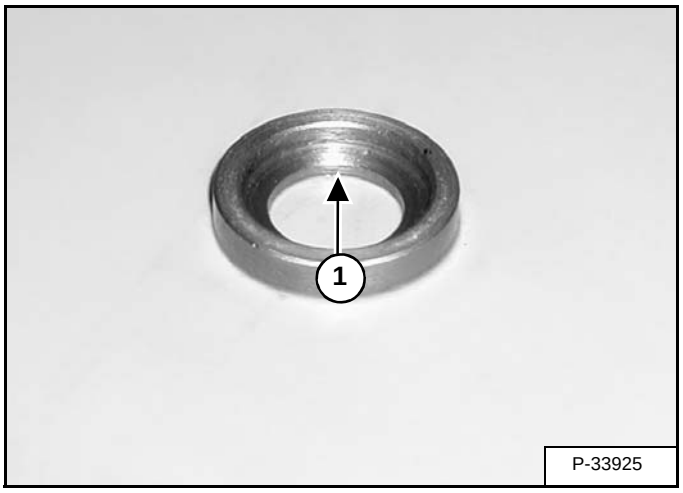
Figure 20-40-116



Remove the spool cover (Item 1), spring retainer (Item 2), spring (Item 3) and spring seat (Item 4) **[Figure 20-40-116]**.

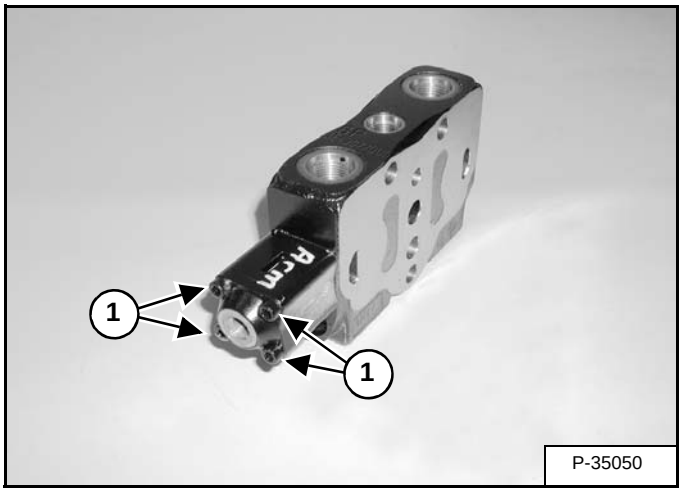
Remove the O-ring (Item 5) **[Figure 20-40-116]**.

Figure 20-40-117



Installation: Make sure the lip (Item 1) **[Figure 20-40-117]** on the spring seat fits over the spool.

Figure 20-40-118

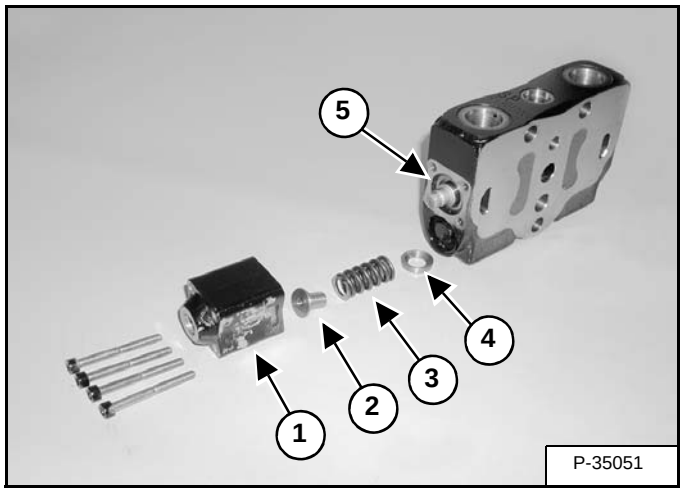


Remove the bolts (Item 1) **[Figure 20-40-118]**.

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

Arm Valve Section Disassembly And Assembly (Cont'd)

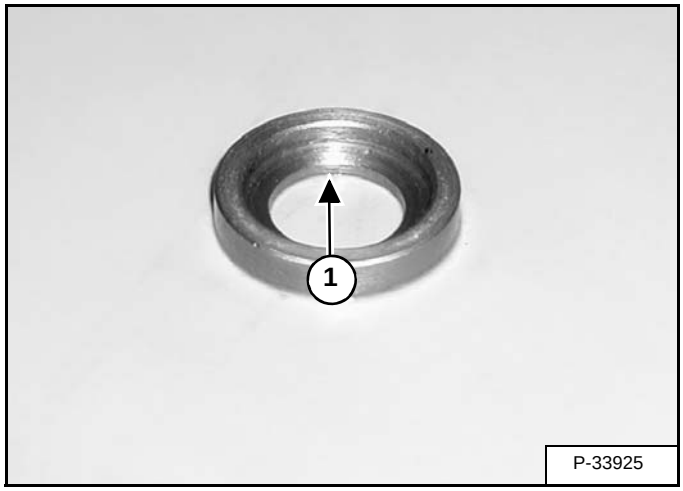
Figure 20-40-119



Remove the spool cover (Item 1), spring retainer (Item 2), spring (Item 3) and spring seat (Item 4) **[Figure 20-40-119]**.

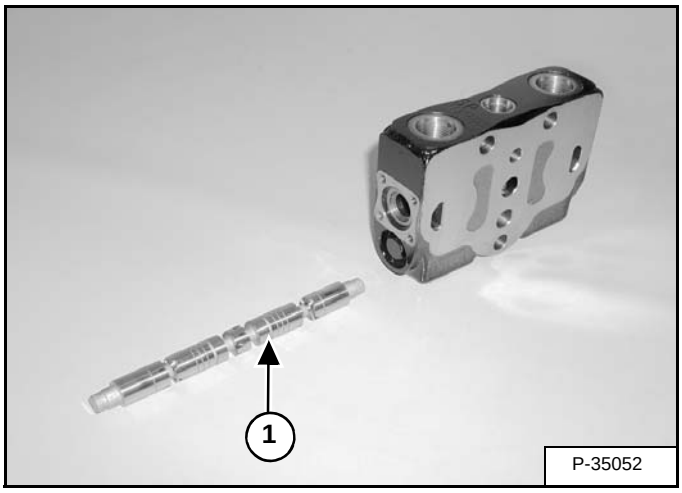
Remove the O-ring (Item 5) **[Figure 20-40-119]**.

Figure 20-40-120



Installation: Make sure the lip (Item 1) **[Figure 20-40-120]** on the spring seat fits over the spool.

Figure 20-40-121

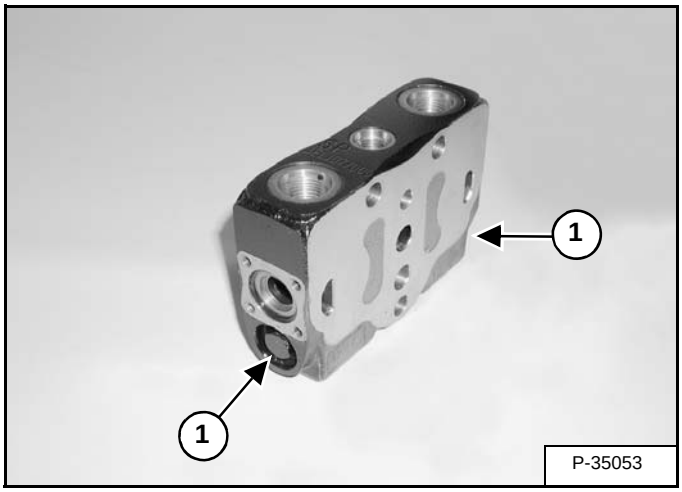


Remove the spool (Item 1) **[Figure 20-40-121]**.

The spool and valve block are not serviced separately.

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

Figure 20-40-122

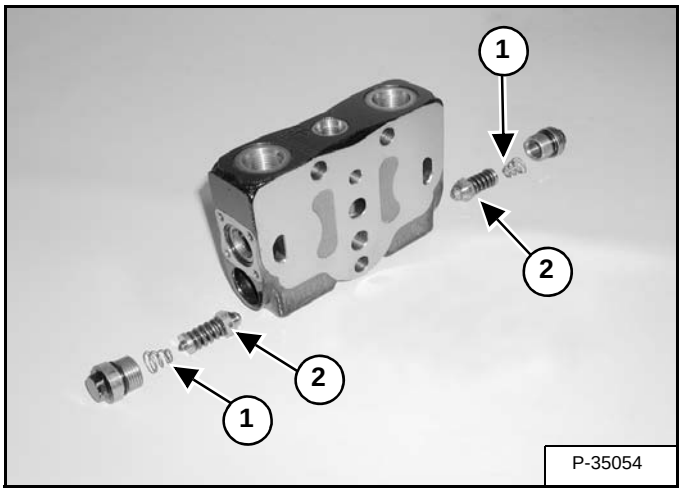


Remove the relief valve plug (Item 1) **[Figure 20-40-122]**. (Both ends)

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

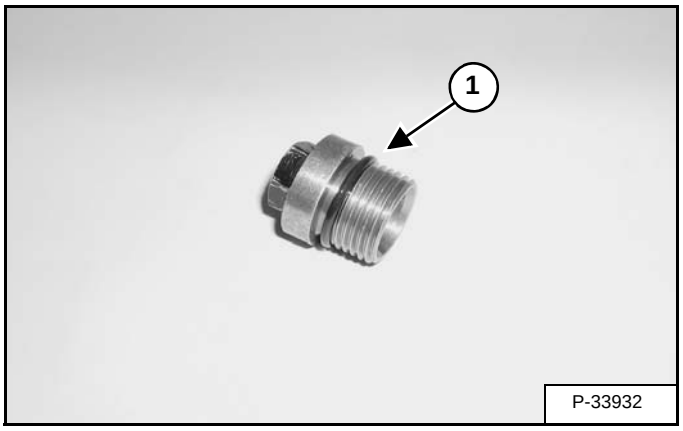
Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-123



Remove the springs (Item 1) and spring assemblies (Item 2) **[Figure 20-40-123]**.

Figure 20-40-124



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

Clean all parts in solvent and dry with compressed air.

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

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

Bucket Valve Section Disassembly And Assembly

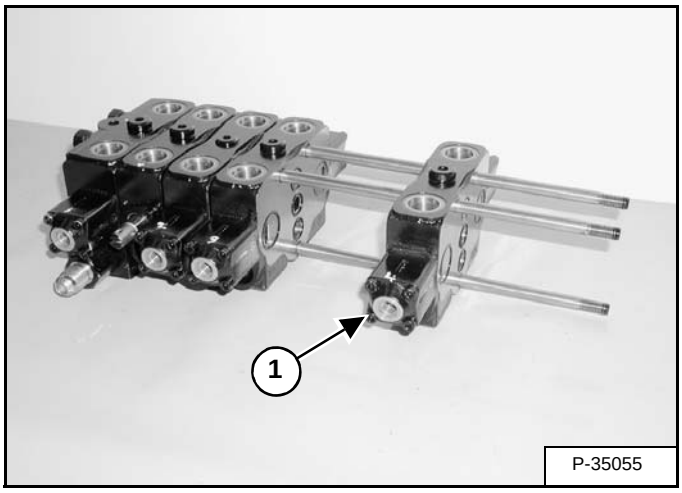
Clean the outside of the bucket valve before disassembly.

IMPORTANT

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

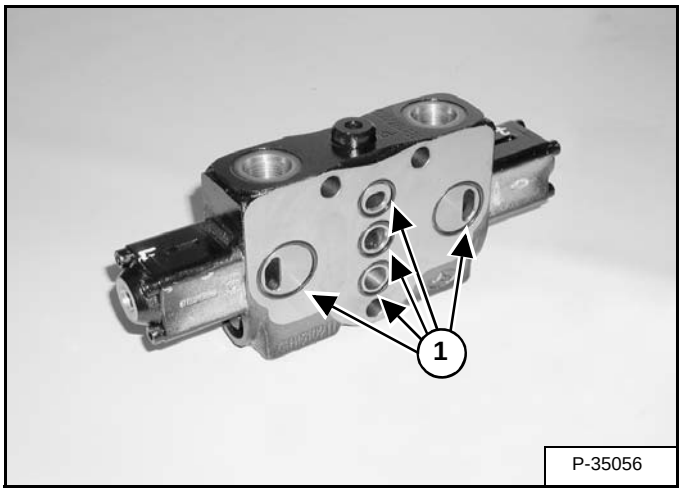
I-2003-0888

Figure 20-40-125



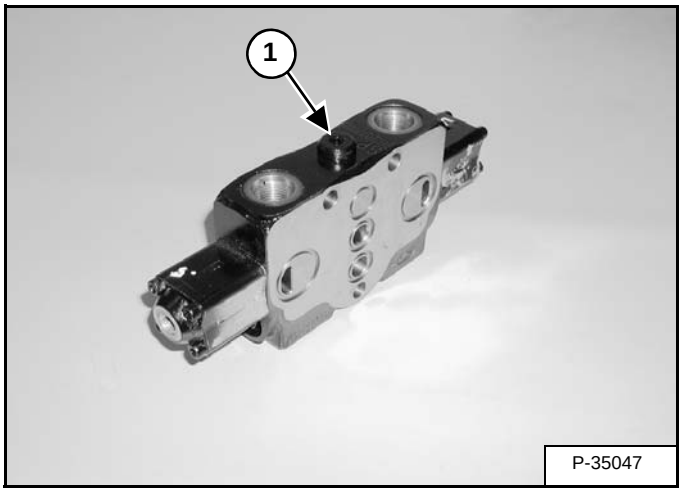
Remove the bucket valve section (Item 1) **[Figure 20-40-125]** from the valve assembly.

Figure 20-40-126



Remove the O-rings (Item 1) **[Figure 20-40-126]** from the bucket valve section.

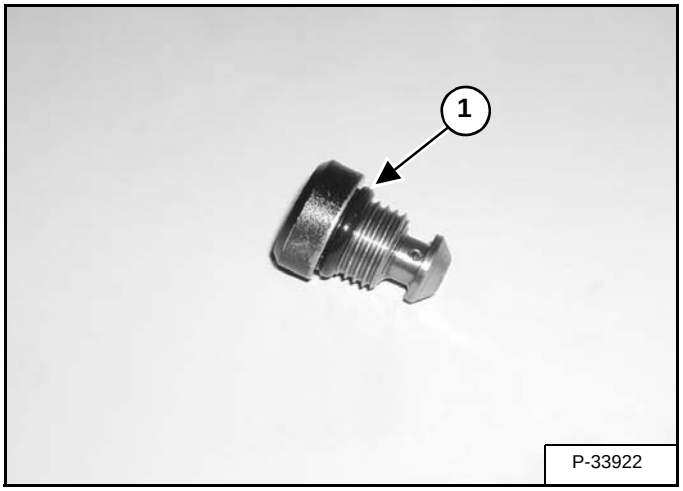
Figure 20-40-127



Remove the load check valve (Item 1) **[Figure 20-40-127]**.

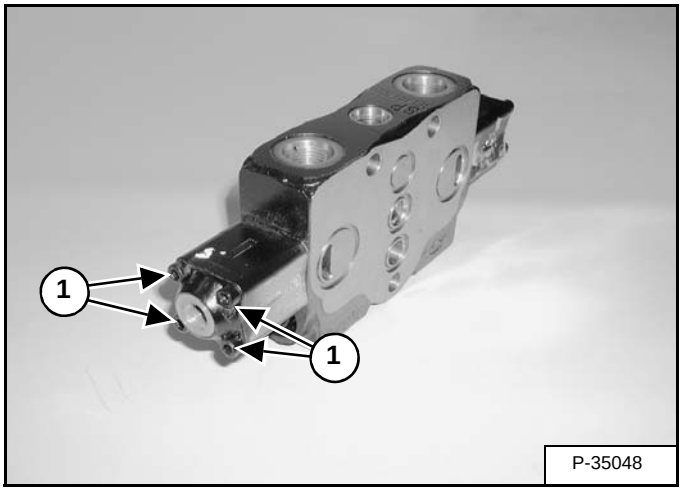
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-128



Remove the O-ring (Item 1) **[Figure 20-40-128]** from the load check valve.

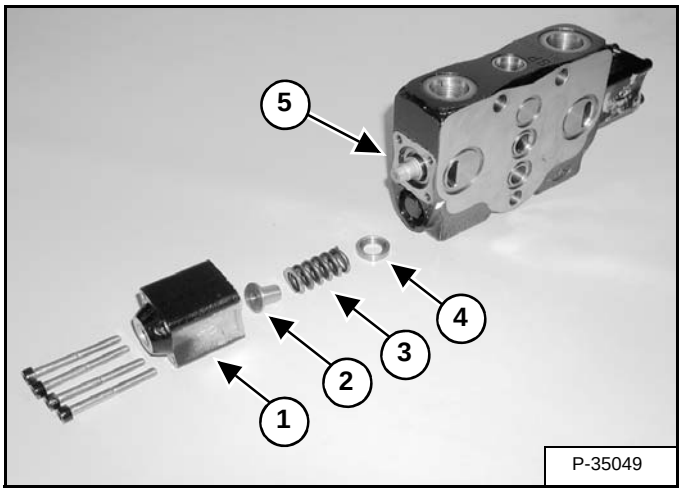
Figure 20-40-129



Remove the bolts (Item 1) **[Figure 20-40-129]**.

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

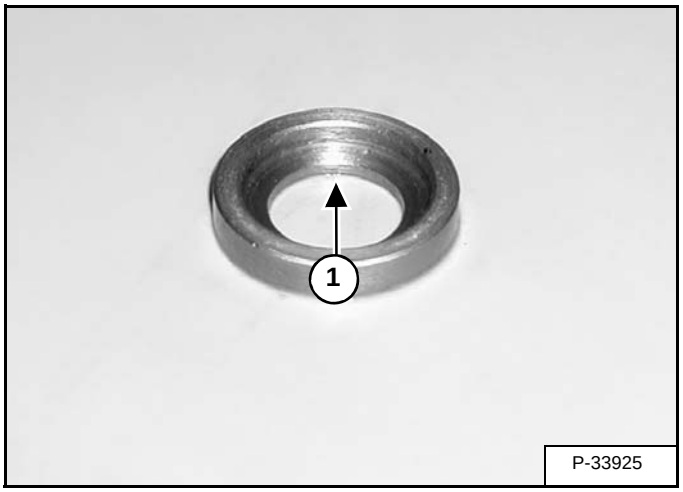
Figure 20-40-130



Remove the spool cover (Item 1), spring retainer (Item 2), spring (Item 3) and spring seat (Item 4) **[Figure 20-40-130]**.

Remove the O-ring (Item 5) **[Figure 20-40-130]**.

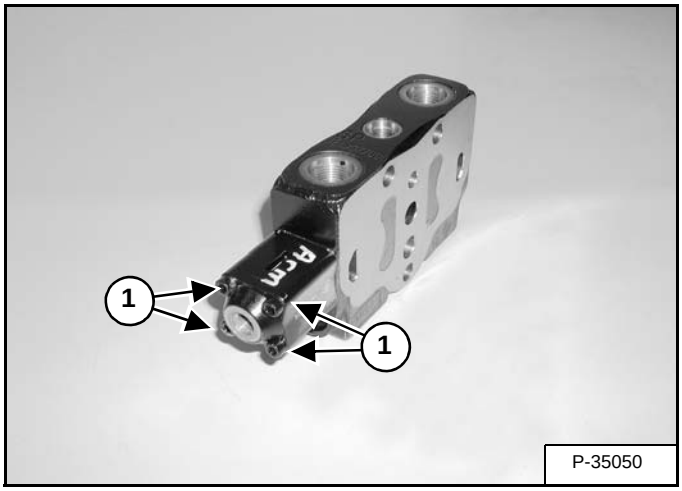
Figure 20-40-131



Installation: Make sure the lip (Item 1) **[Figure 20-40-131]** on the spring seat fits over the spool.

Bucket Valve Section Disassembly And Assembly (Cont'd)

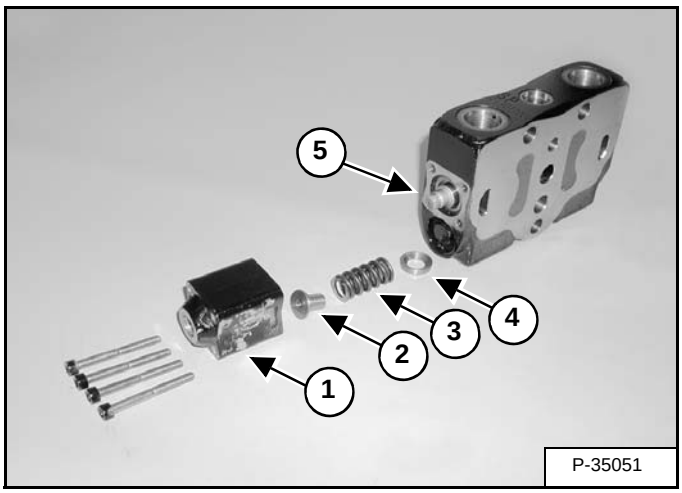
Figure 20-40-132



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

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

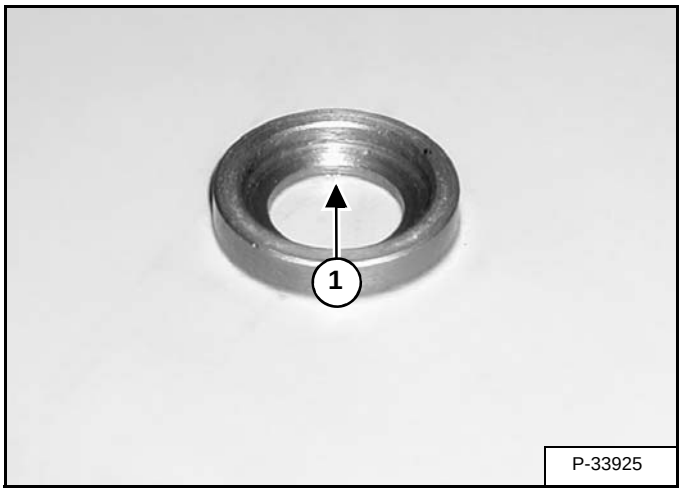
Figure 20-40-133



Remove the spool cover (Item 1), spring retainer (Item 2), spring (Item 3) and spring seat (Item 4) **[Figure 20-40-133]**.

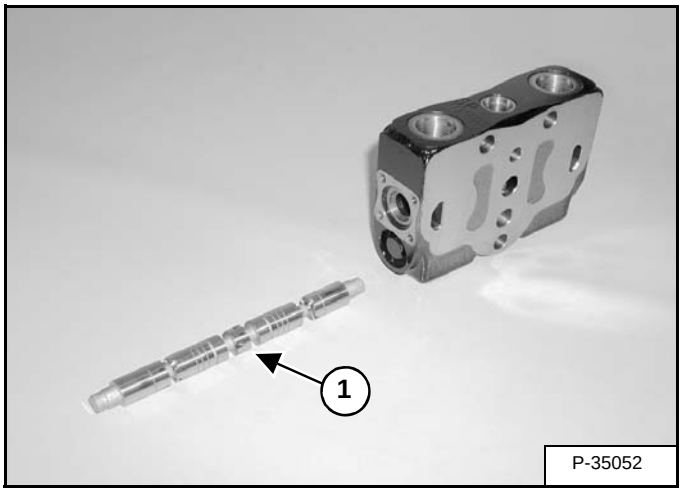
Remove the O-ring (Item 5) **[Figure 20-40-133]**.

Figure 20-40-134



Installation: Make sure the lip (Item 1) **[Figure 20-40-134]** on the spring seat fits over the spool.

Figure 20-40-135



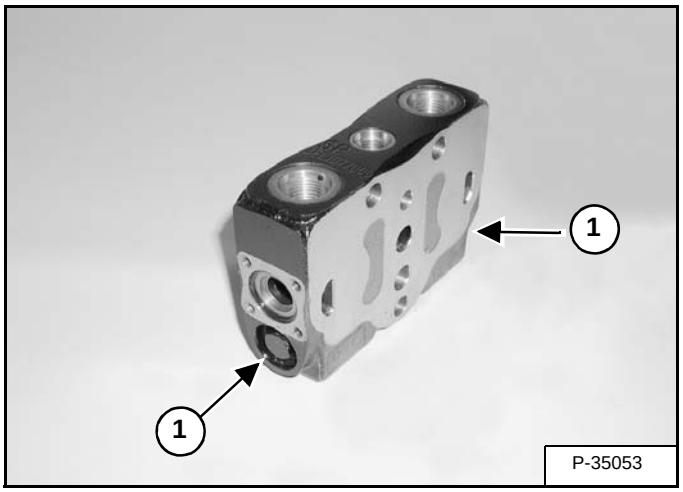
Remove the spool (Item 1) **[Figure 20-40-135]**.

The spool and valve are not serviced separately.

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

Bucket Valve Section Disassembly And Assembly (Cont'd)

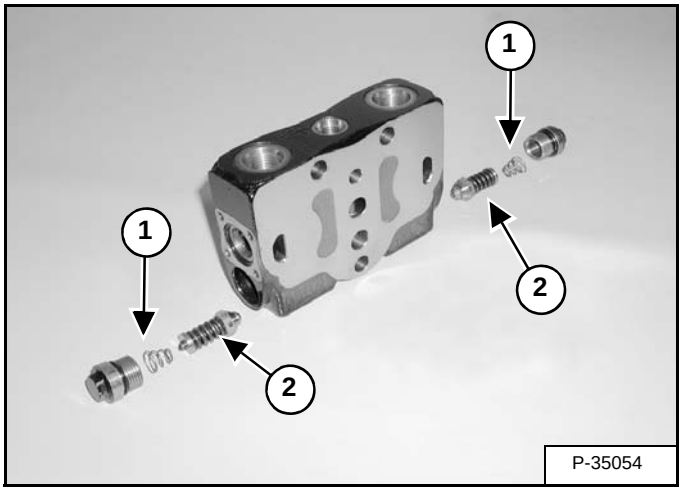
Figure 20-40-136



Remove the relief valve plug (Item 1) **[Figure 20-40-136]** (both ends.)

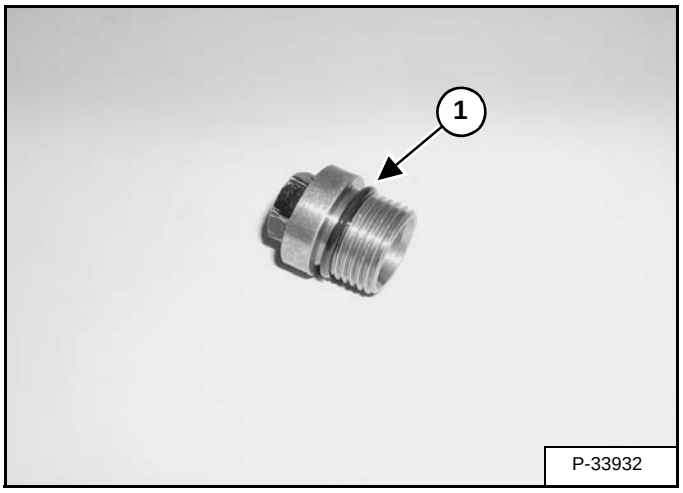
Installation: Tighten the relief valve to 18 ft.-lb. (24 N•m) torque.

Figure 20-40-137



Remove springs (Item 1) and spring assemblies (Item 2) **[Figure 20-40-137]**.

Figure 20-40-138



Remove the O-ring (Item 1) **[Figure 20-40-138]**.

Clean all parts in solvent and dry with compressed air.

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

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

Auxiliary Valve Section Disassembly And Assembly

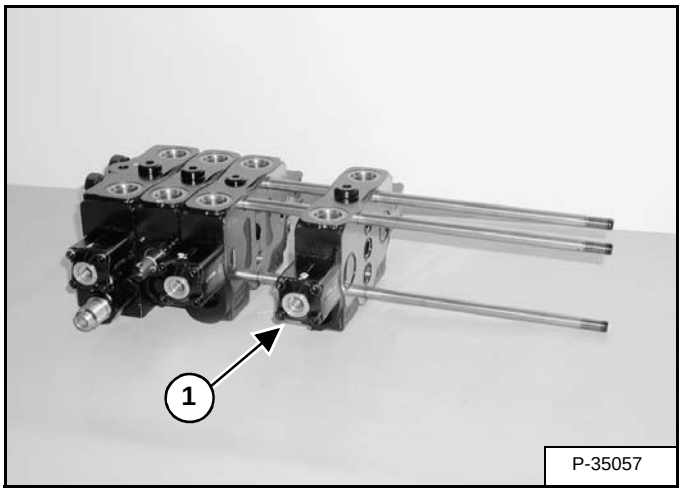
Clean the outside of the auxiliary valve before disassembly.

IMPORTANT

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

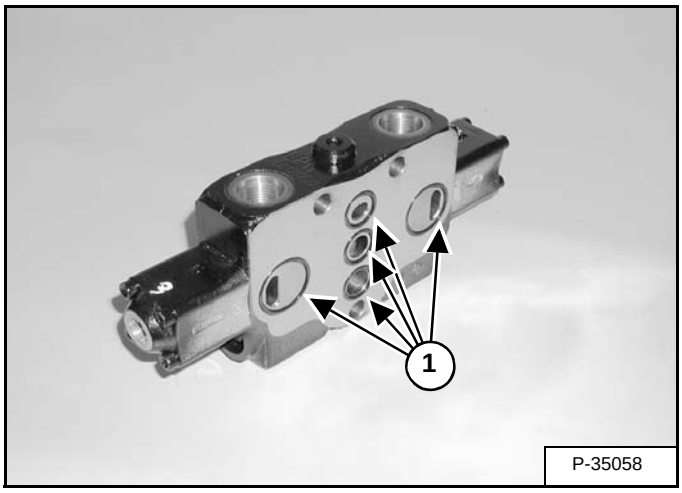
I-2003-0888

Figure 20-40-139



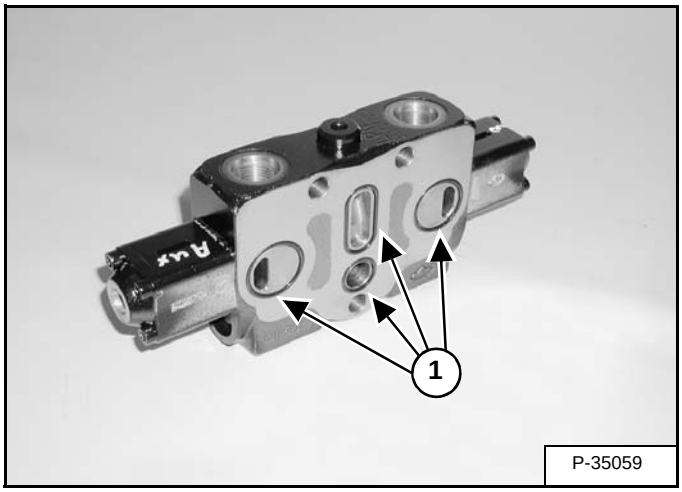
Remove the auxiliary valve section (Item 1) **[Figure 20-40-139]** from the valve assembly.

Figure 20-40-140



Remove the O-rings (Item 1) **[Figure 20-40-140]** from the right side of the auxiliary valve section.

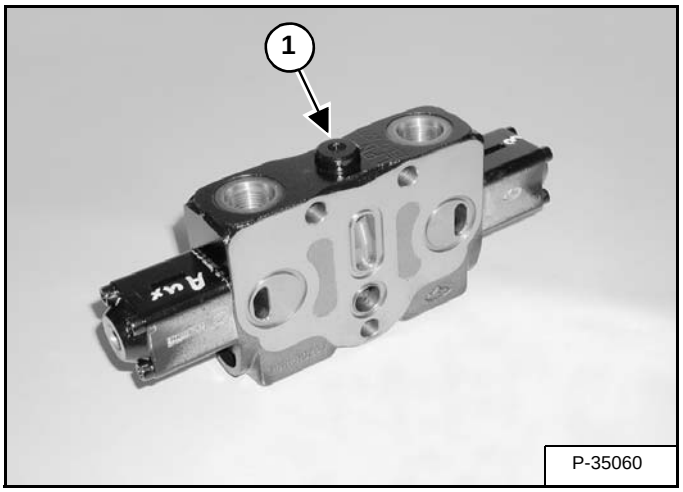
Figure 20-40-141



Remove the O-rings (Item 1) **[Figure 20-40-141]** from the left side of the auxiliary valve section.

Auxiliary Valve Section Disassembly And Assembly (Cont'd)

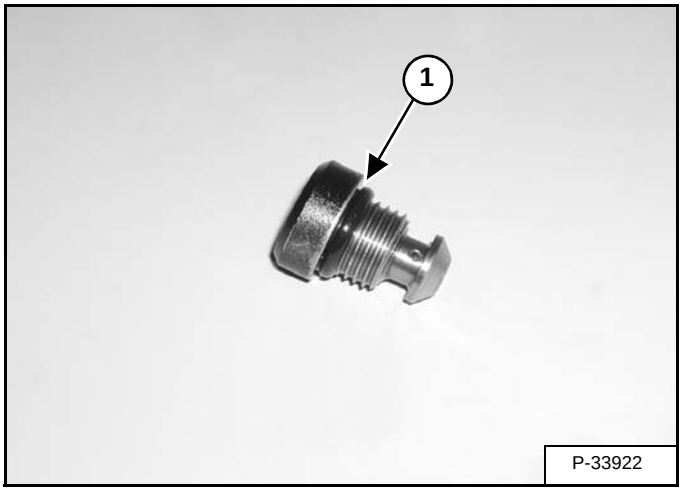
Figure 20-40-142



Remove the load check valve assembly (Item 1) **[Figure 20-40-142]**.

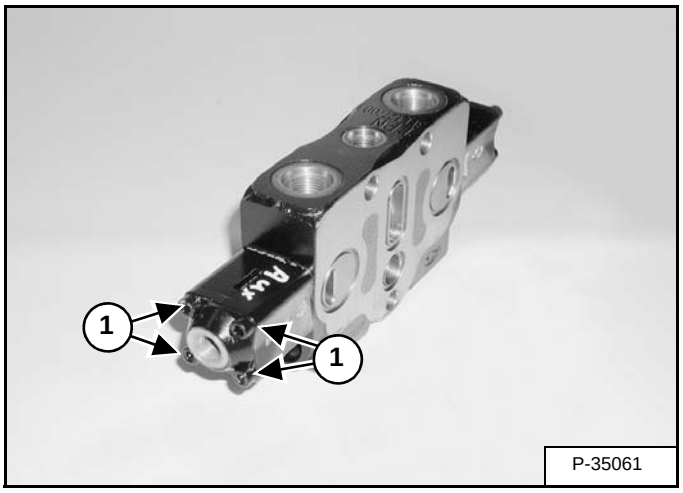
Installation: Tighten the load check valve to 18 ft.-lb. (24 N•m) torque.

Figure 20-40-143



Remove the O-ring (Item 1) **[Figure 20-40-143]** from the load check valve.

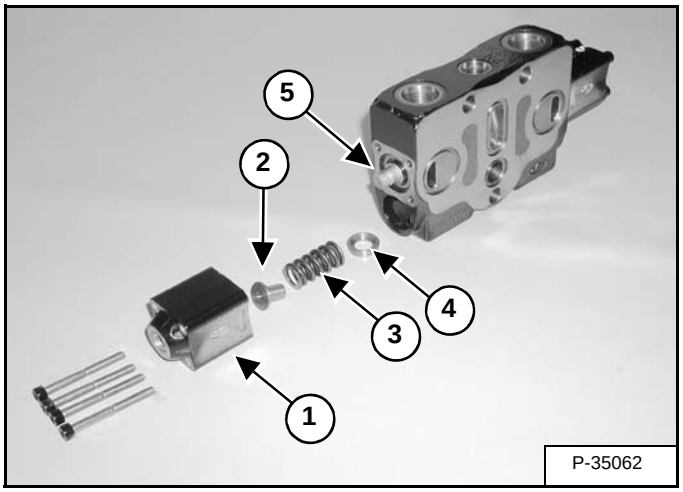
Figure 20-40-144



Remove the bolts (Item 1) **[Figure 20-40-144]**.

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

Figure 20-40-145

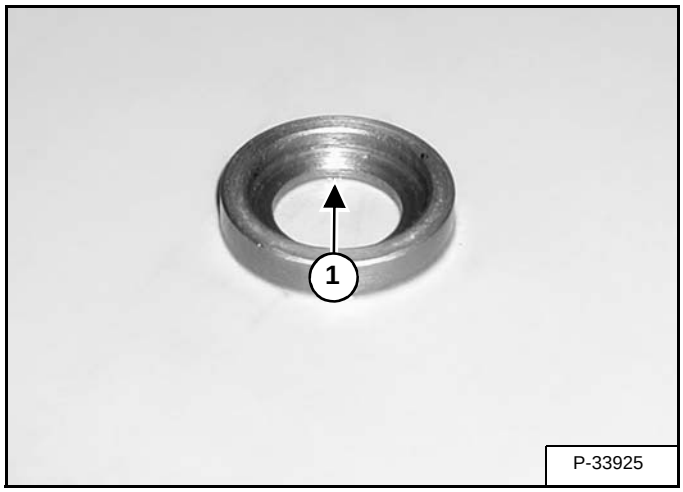


Remove the spool cover (Item 1), spring retainer (Item 2), spring (Item 3) and spring seat (Item 4) **[Figure 20-40-145]**.

Remove the O-ring (Item 5) **[Figure 20-40-145]**.

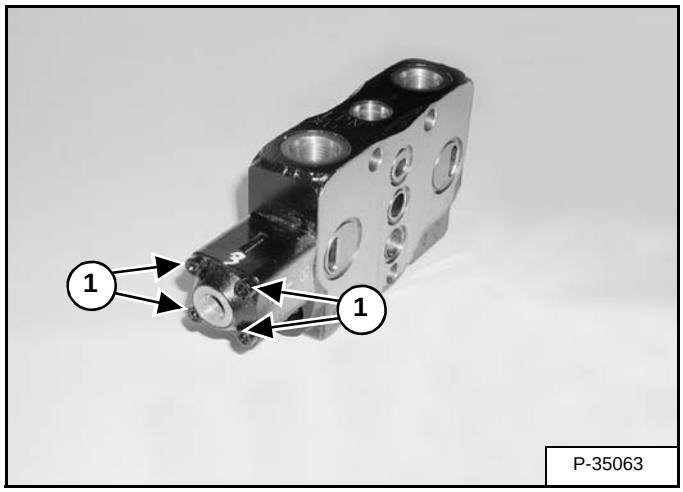
Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-146



Installation: Make sure the lip (Item 1) **[Figure 20-40-146]** on the spring seat fits over the spool.

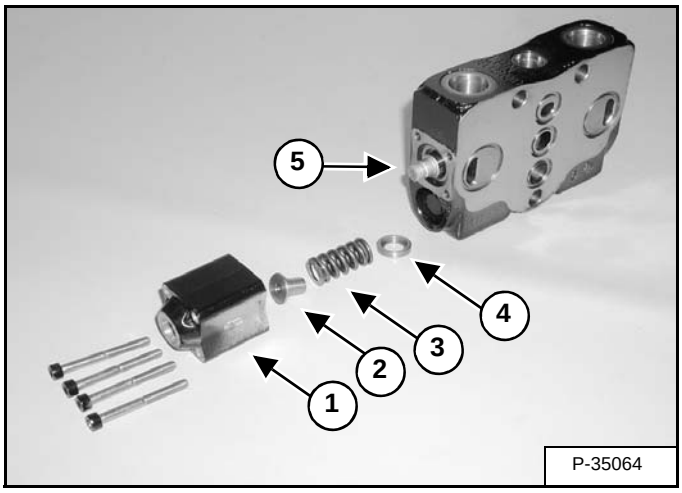
Figure 20-40-147



Remove the bolts (Item 1) **[Figure 20-40-147]**.

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

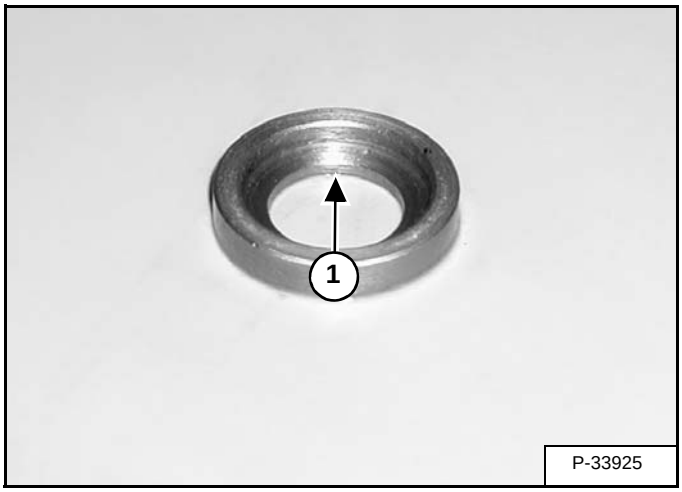
Figure 20-40-148



Remove the spool cover (Item 1), spring retainer (Item 2), spring (Item 3) and spring seat (Item 4) **[Figure 20-40-148]**.

Remove the O-ring (Item 5) **[Figure 20-40-148]**.

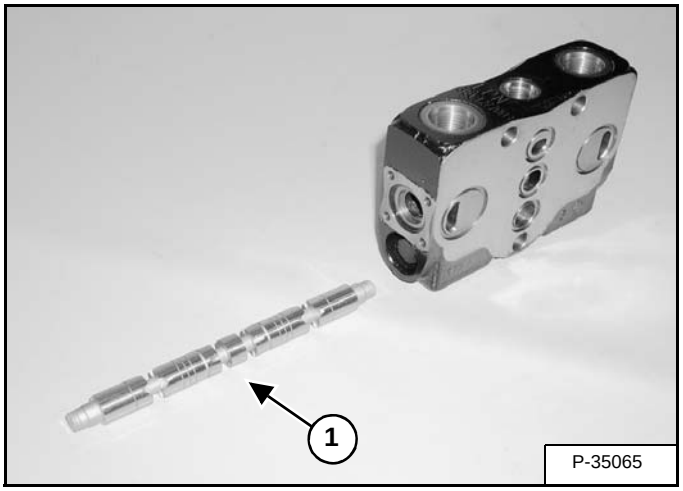
Figure 20-40-149



Installation: Make sure the lip (Item 1) **[Figure 20-40-149]** on the spring seat fits over the spool.

Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-150

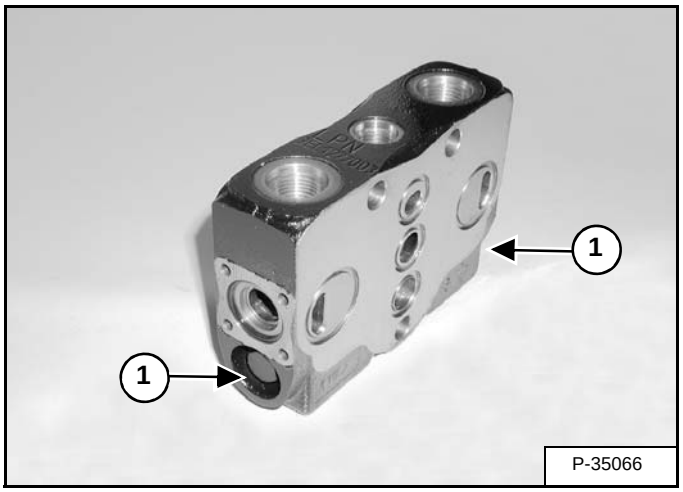


Remove the spool (Item 1) **[Figure 20-40-150]**.

The spool and valve block are not serviced separately.

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

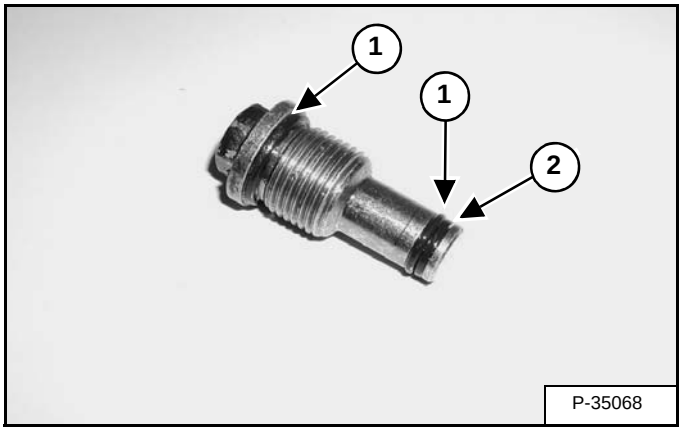
Figure 20-40-151



Remove the plugs (Item 1) **[Figure 20-40-151]** (both ends.)

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

Figure 20-40-152



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-152]** from the plugs.

Clean all parts in solvent and dry with compressed air.

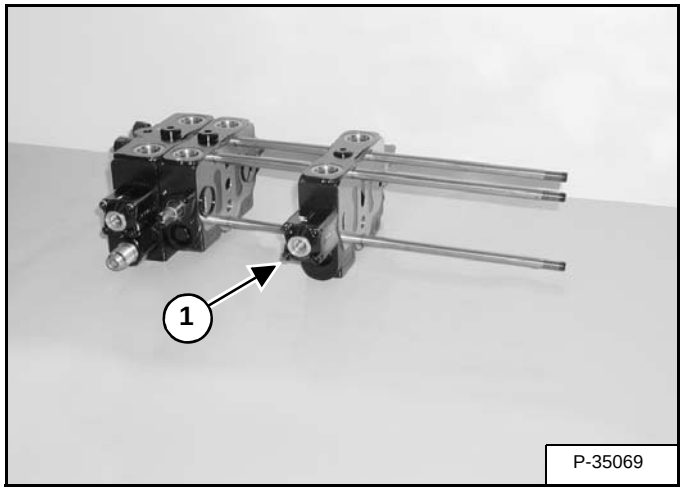
Inspect all parts for wear or damage. Replace any worn or damaged parts.

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

Boost Valve Section Disassembly And Assembly

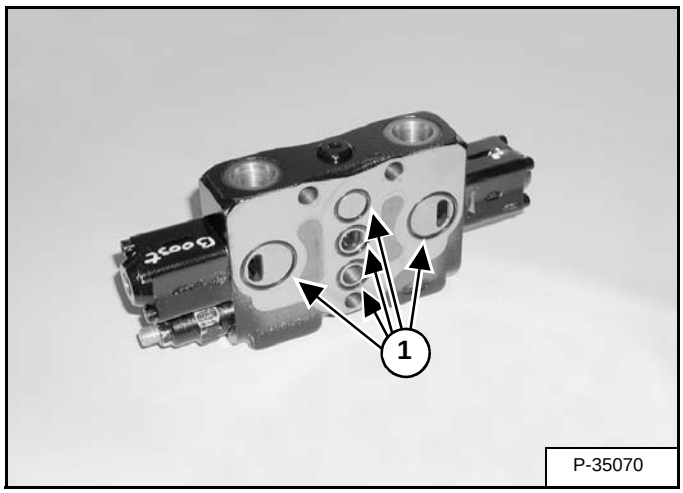
Clean the outside of the boost valve before disassembly.

Figure 20-40-153



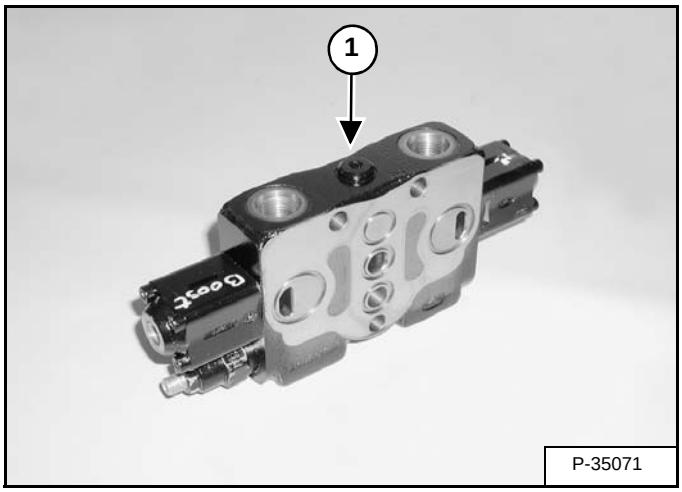
Remove the boost valve section (Item 1) **[Figure 20-40-153]**.

Figure 20-40-154



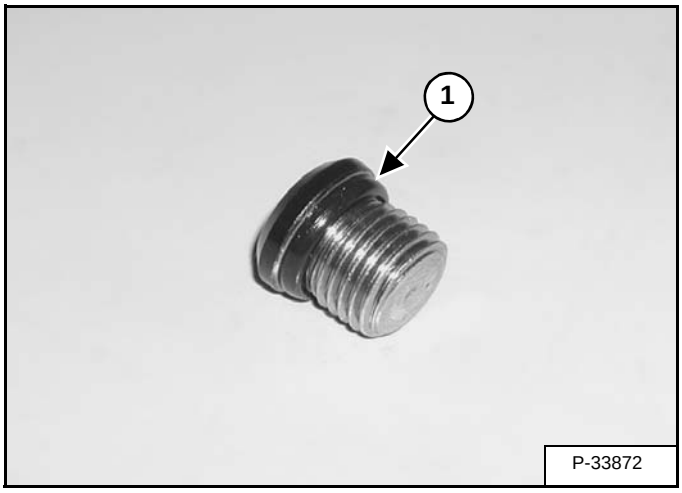
Remove the O-rings (Item 1) **[Figure 20-40-154]** from the boost valve section.

Figure 20-40-155



Remove the plug (Item 1) **[Figure 20-40-155]**.

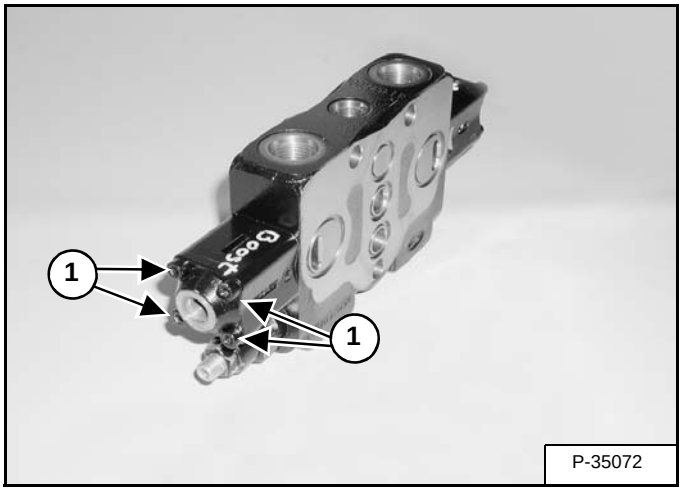
Figure 20-40-156



Remove the O-ring (Item 1) **[Figure 20-40-156]** from the plug.

Boost Valve Section Disassembly And Assembly (Cont'd)

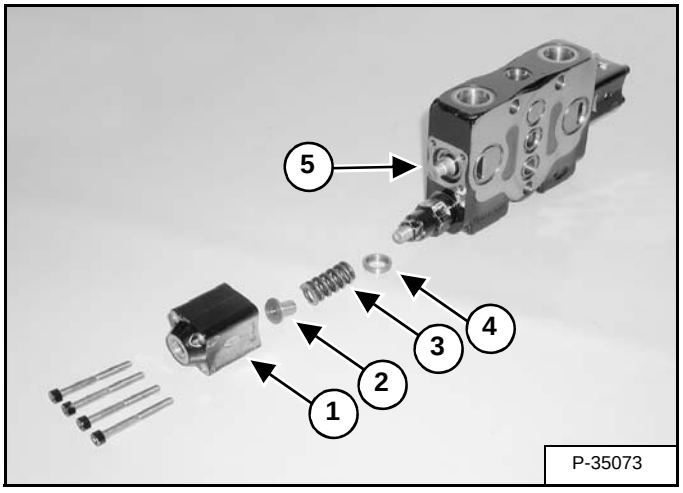
Figure 20-40-157



Remove the bolts (Item 1) **[Figure 20-40-157]**.

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

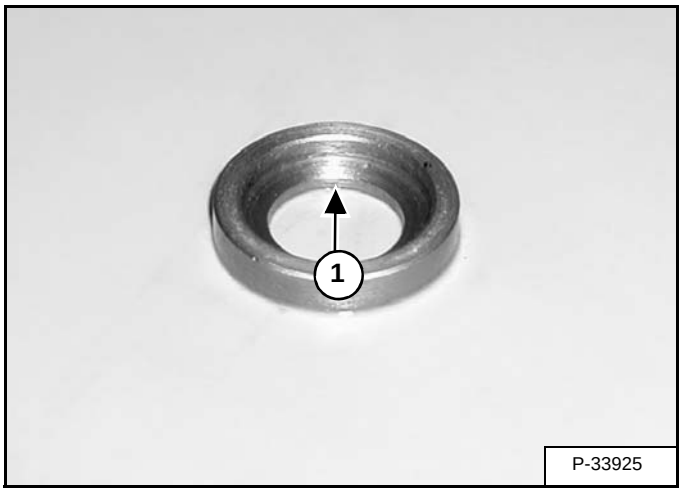
Figure 20-40-158



Remove the spool cover (Item 1), spring retainer (Item 2), spring (Item 3) and spring seat (Item 4) **[Figure 20-40-158]**.

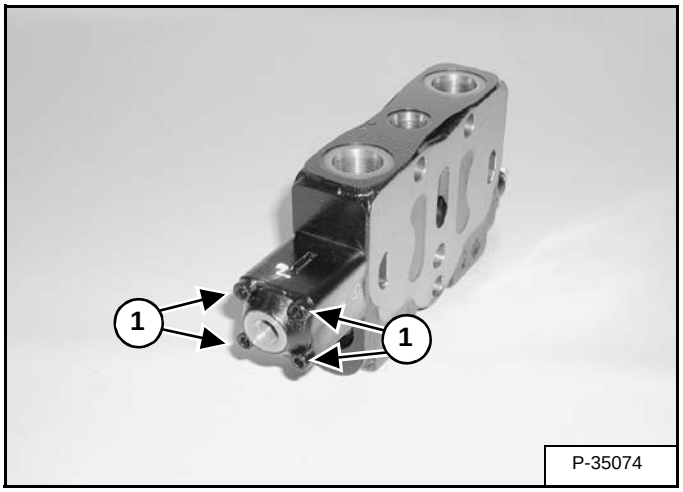
Remove the O-ring (Item 5) **[Figure 20-40-158]**.

Figure 20-40-159



Installation: Make sure the lip (Item 1) **[Figure 20-40-159]** on the spring seat fits over the spool.

Figure 20-40-160

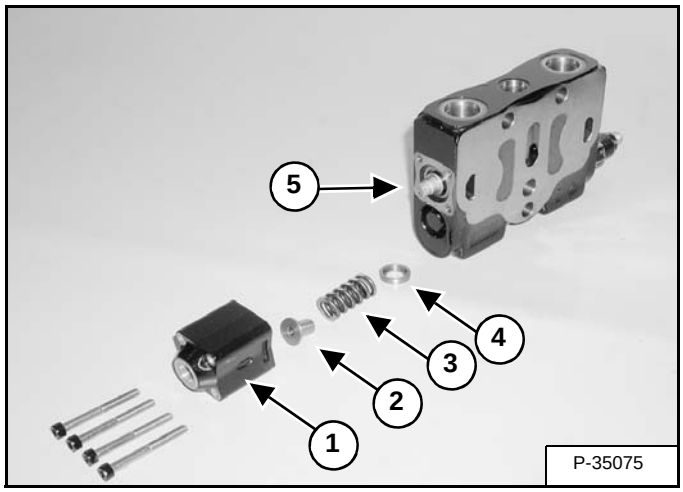


Remove the bolts (Item 1) **[Figure 20-40-160]**.

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

Boost Valve Section Disassembly And Assembly (Cont'd)

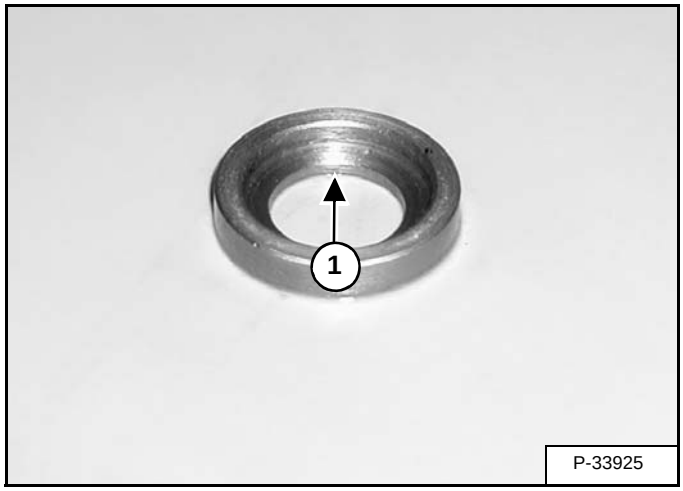
Figure 20-40-161



Remove the spool cover (Item 1), spring retainer (Item 2), spring (Item 3) and spring seat (Item 4) **[Figure 20-40-161]**.

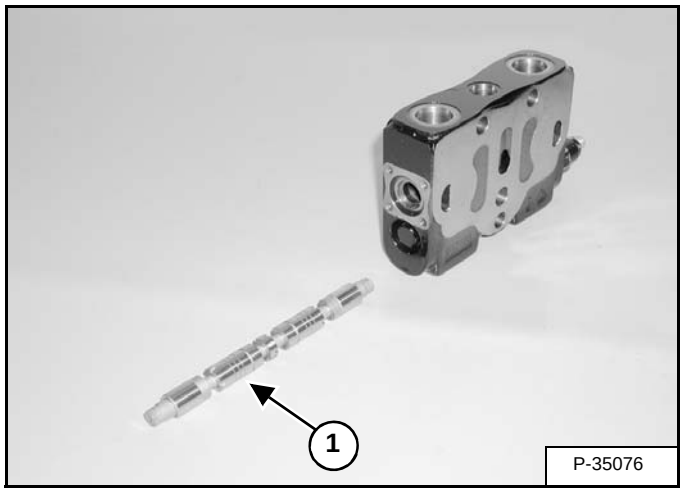
Remove the O-ring (Item 5) **[Figure 20-40-161]**.

Figure 20-40-162



Installation: Make sure the lip (Item 1) **[Figure 20-40-162]** on the spring seat fits over the spool.

Figure 20-40-163

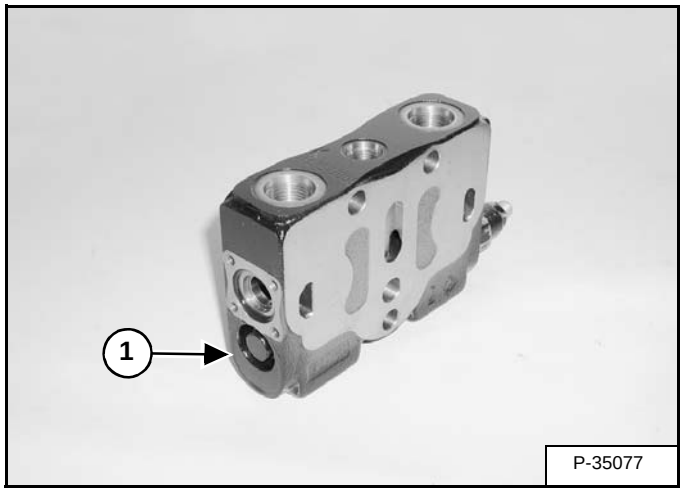


Remove the spool (Item 1) **[Figure 20-40-163]**.

The spool and valve block are not serviced separately.

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

Figure 20-40-164

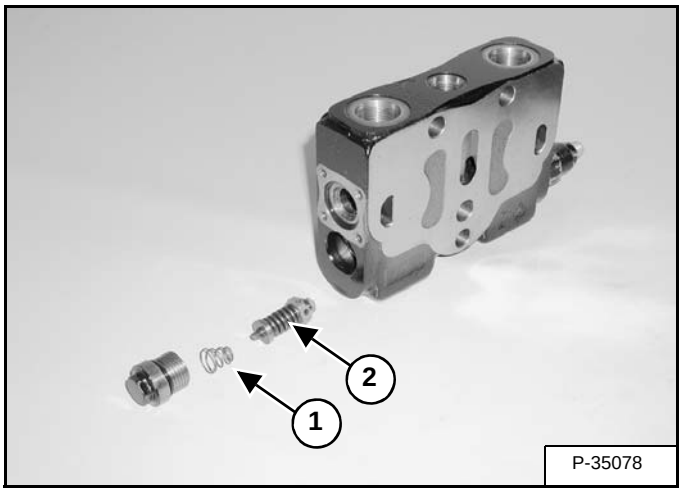


Remove the relief valve plug (Item 1) **[Figure 20-40-164]**.

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

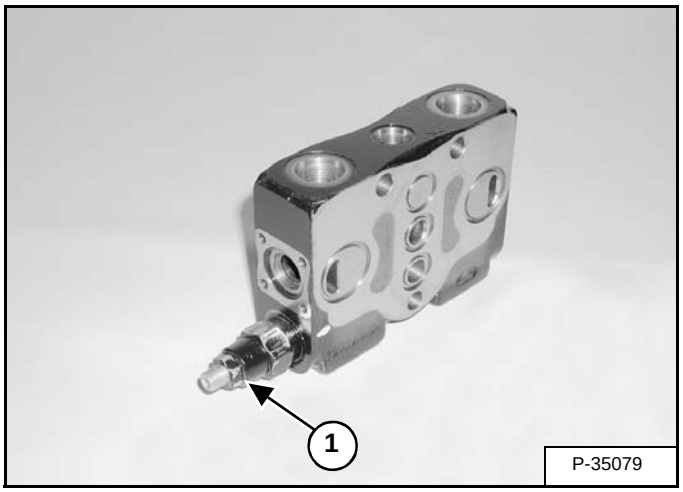
Boost Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-165



Remove the spring (Item 1) and spring assembly (Item 2) **[Figure 20-40-165]**.

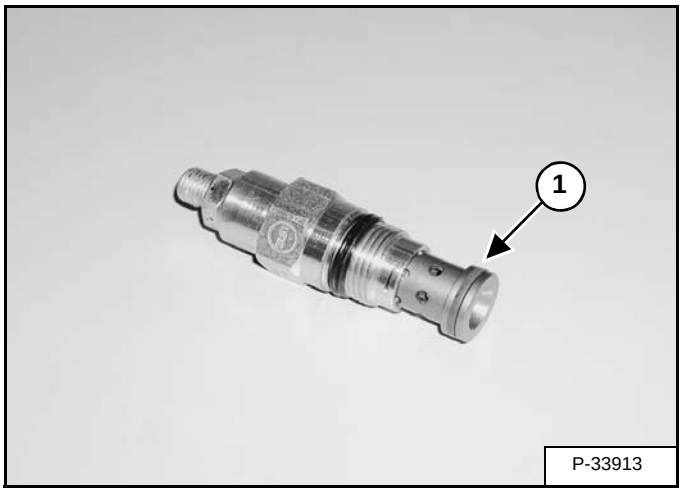
Figure 20-40-166



Remove the main relief valve (Item 1) **[Figure 20-40-166]**.

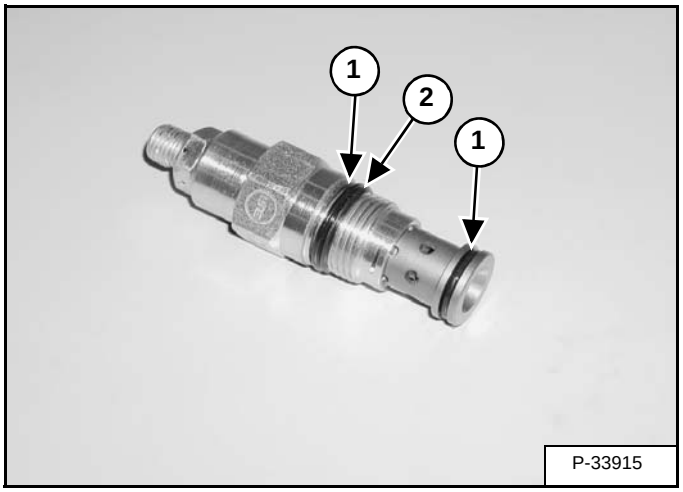
Installation: Tighten the valve to 31 ft.-lb. (42 N•m) torque.

Figure 20-40-167



Remove the seal (Item 1) **[Figure 20-40-167]** from the main relief valve.

Figure 20-40-168



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-168]**.

Clean all parts in solvent and dry with compressed air.

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

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

Blade Valve Section Disassembly And Assembly

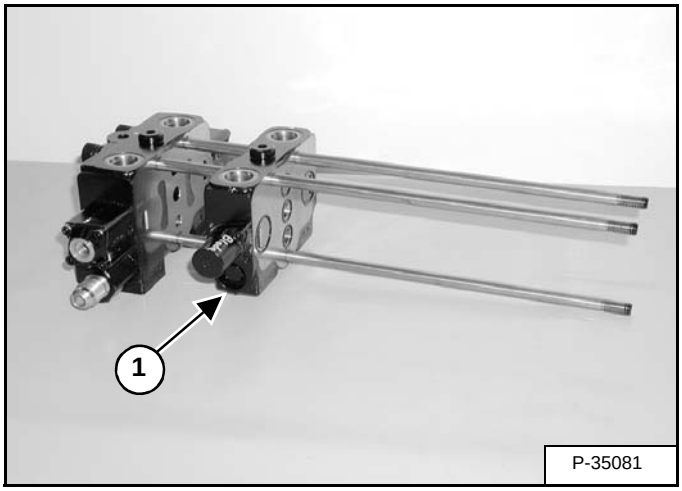
Clean the outside of the blade valve before disassembly.

IMPORTANT

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

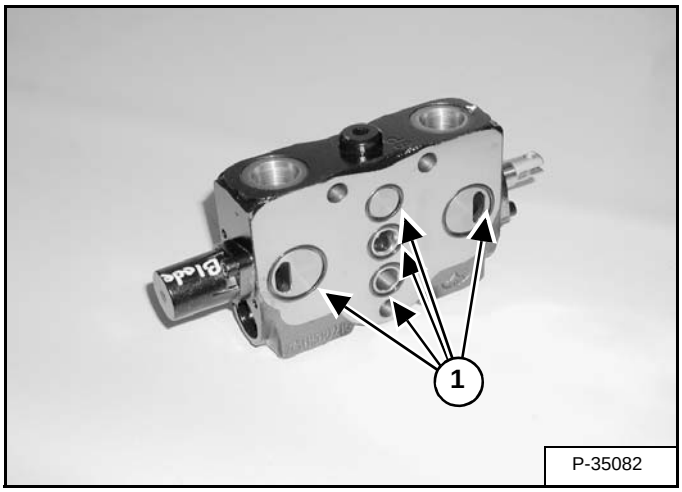
I-2003-0888

Figure 20-40-169



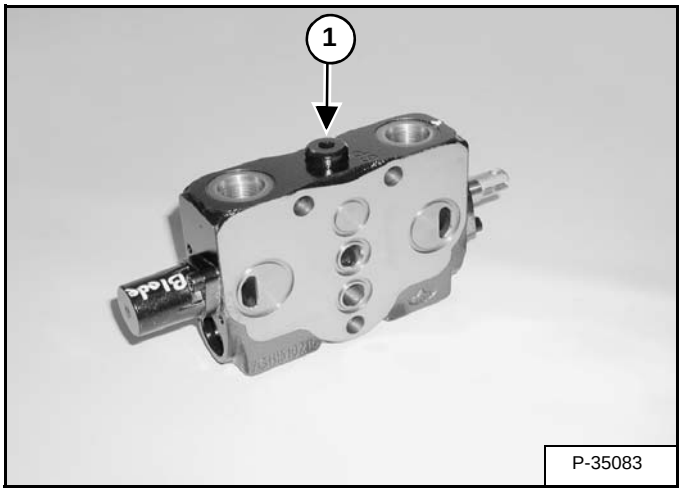
Remove the blade valve section (Item 1) **[Figure 20-40-169]** from the valve assembly.

Figure 20-40-170



Remove the O-rings (Item 1) **[Figure 20-40-170]** from the blade valve section.

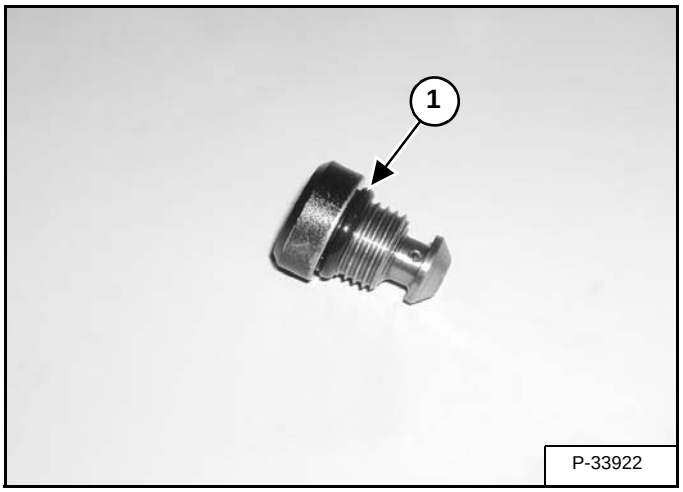
Figure 20-40-171



Remove the load check valve (Item 1) **[Figure 20-40-171]**.

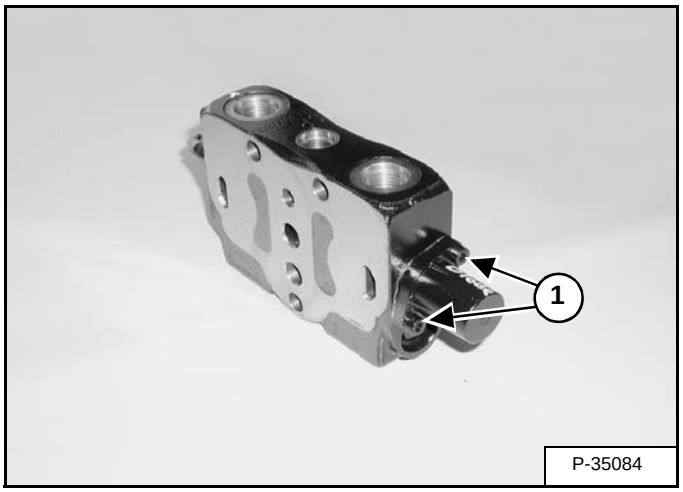
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-172



Remove the O-ring (Item 1) **[Figure 20-40-172]** from the load check valve.

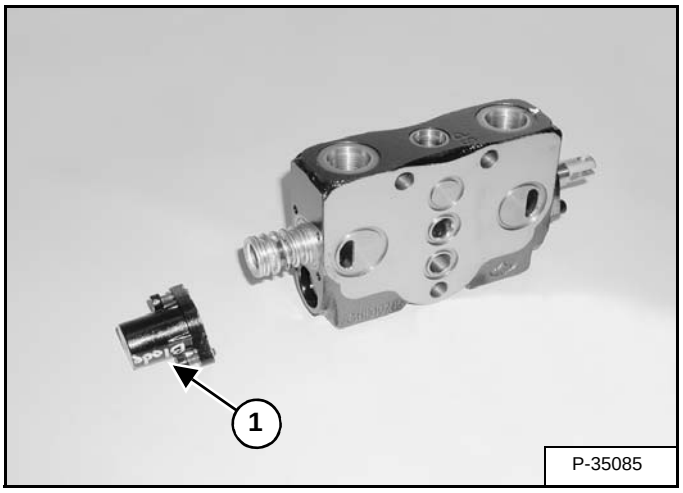
Figure 20-40-173



Remove the bolts (Item 1) **[Figure 20-40-173]**.

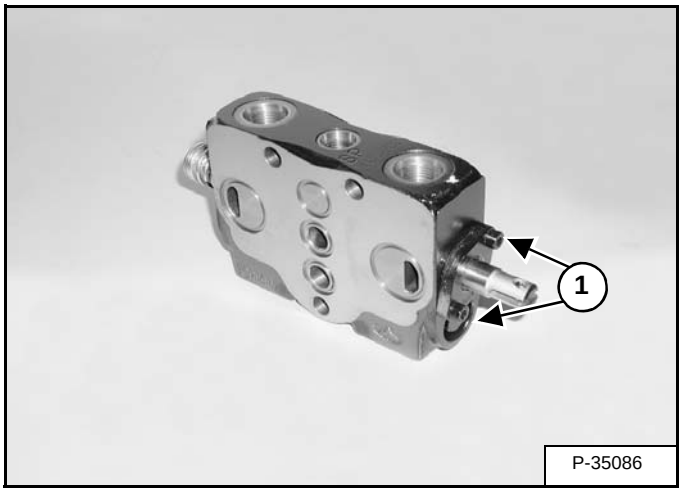
Installation: Tighten the bolts to 5 ft.-lb. (6,6 N•m) torque.

Figure 20-40-174



Remove the cover (Item 1) **[Figure 20-40-174]**.

Figure 20-40-175

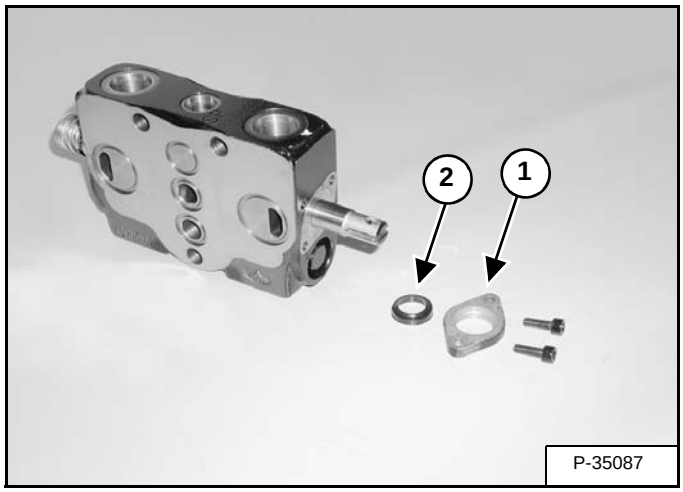


Remove the bolts (Item 1) **[Figure 20-40-175]**.

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

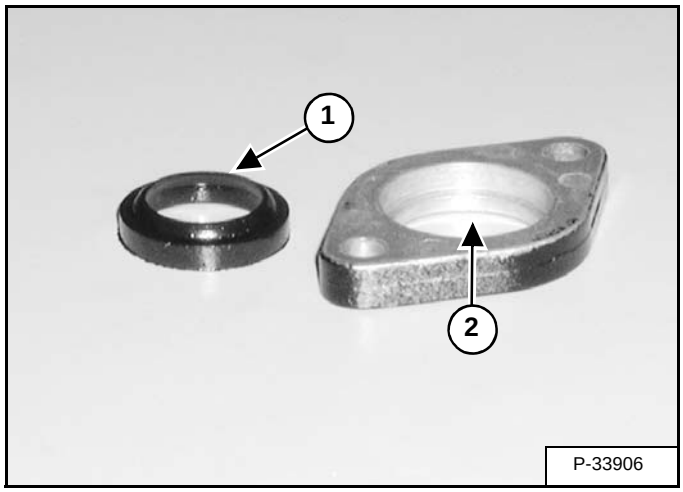
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-176



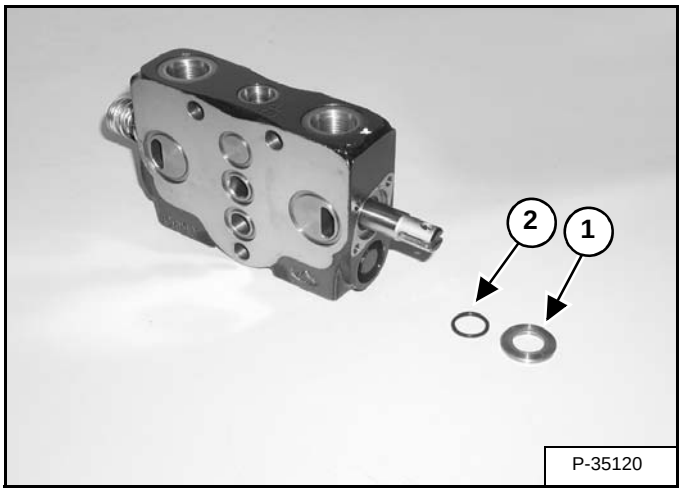
Remove the spool retainer (Item 1) and seal (Item 2) **[Figure 20-40-176]**.

Figure 20-40-177



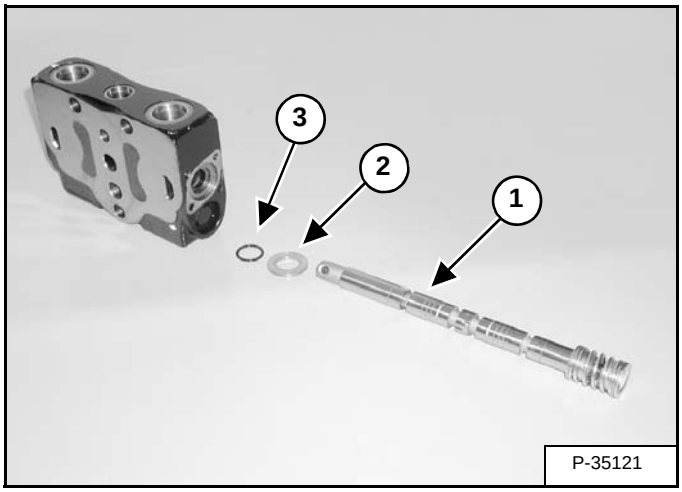
Installation: Make sure the lip (Item 1) on the seal fits inside the lip (Item 2) **[Figure 20-40-177]** on the retainer.

Figure 20-40-178



Remove the washer (Item 1) and O-ring (Item 2) **[Figure 20-40-178]** from the spool.

Figure 20-40-179



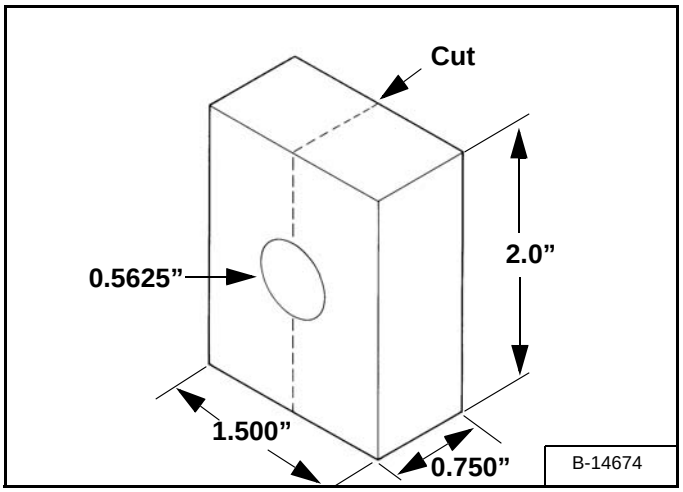
Remove the spool assembly (Item 1), washer (Item 2) and O-ring (Item 3) **[Figure 20-40-179]**.

The spool and valve block are not serviced separately.

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

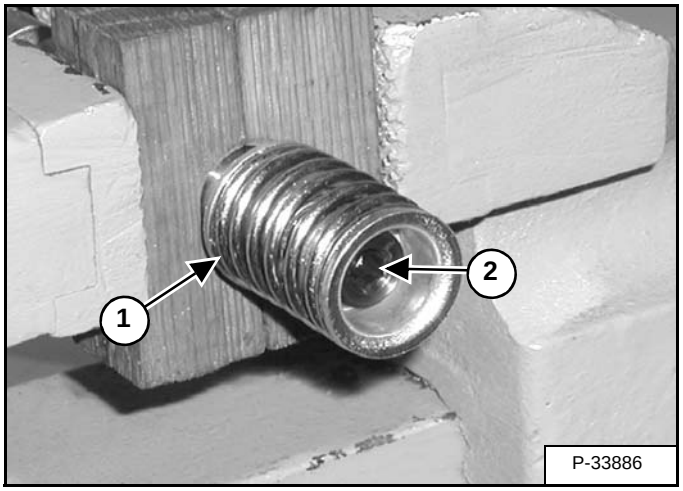
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-180



To remove the spring assembly from the spool a holding fixture will have to be made from a 0.750 in. thick x 1.500 in. wide x 2.0 in. long (19 mm thick x 38 mm wide x 51 mm long) piece of hardwood. Drill a 0.5625 in. (14 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-180]**.

Figure 20-40-181

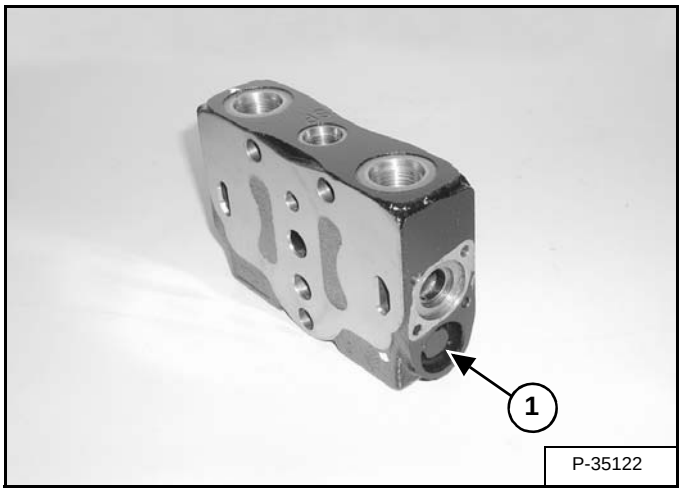


Using the wood blocks clamp the spool (Item 1) in a vise and remove the spring assembly (Item 2) **[Figure 20-40-181]**.

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.-lb. (9,8 N•m) torque.

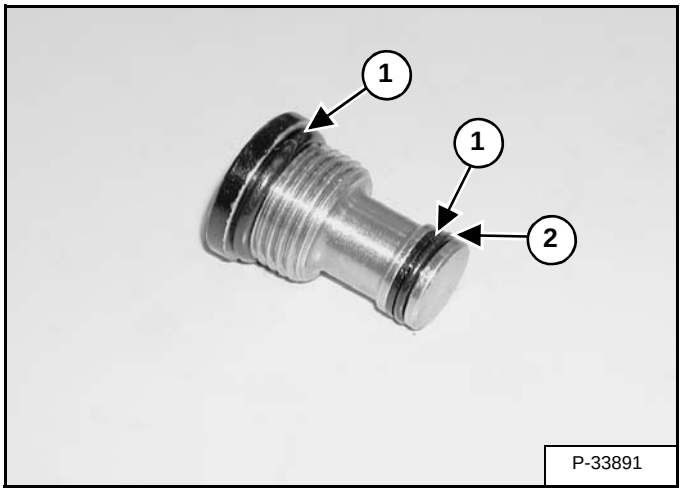
Figure 20-40-182



Remove the plug (Item 1) **[Figure 20-40-182]**.

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

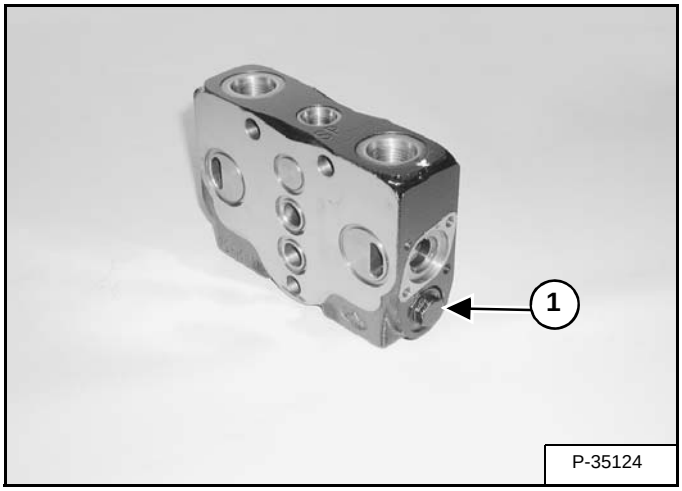
Figure 20-40-183



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-183]** from the plug.

Blade Valve Section Disassembly And Assembly (Cont'd)

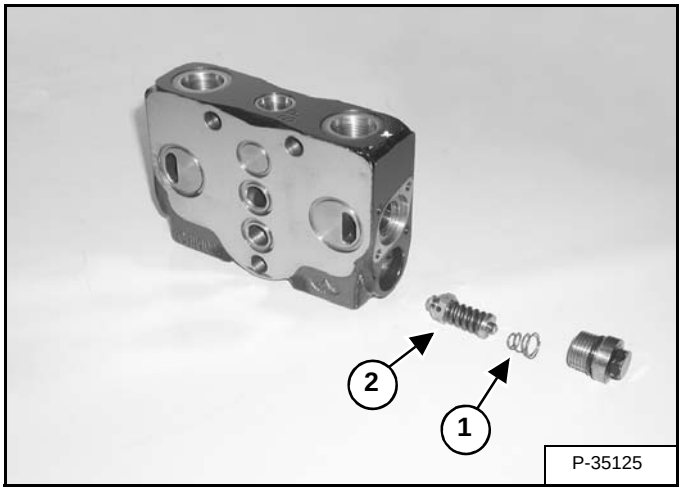
Figure 20-40-184



Remove the relief valve plug (Item 1) **[Figure 20-40-184]**.

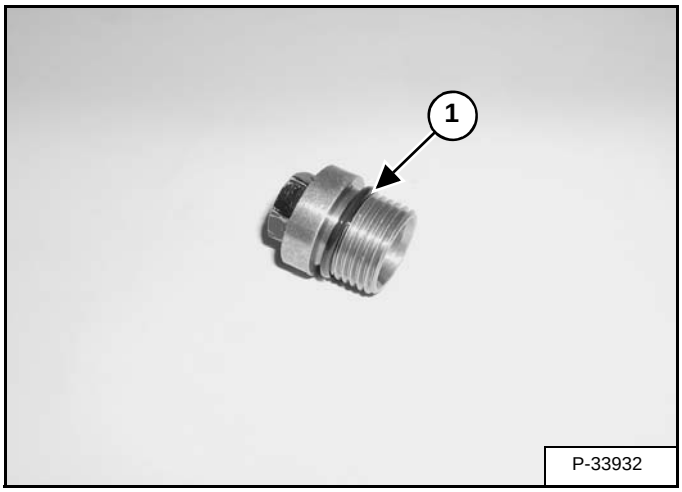
Installation: Tighten the plug to 18 ft.-lb. (24 N•m) torque.

Figure 20-40-185



Remove the spring (Item 1) and spring assembly (Item 2) **[Figure 20-40-185]**.

Figure 20-40-186



Remove the O-ring (Item 1) **[Figure 20-40-186]** from the plug.

Clean all parts in solvent and dry with compressed air.

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

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

Slew Valve Section Disassembly And Assembly

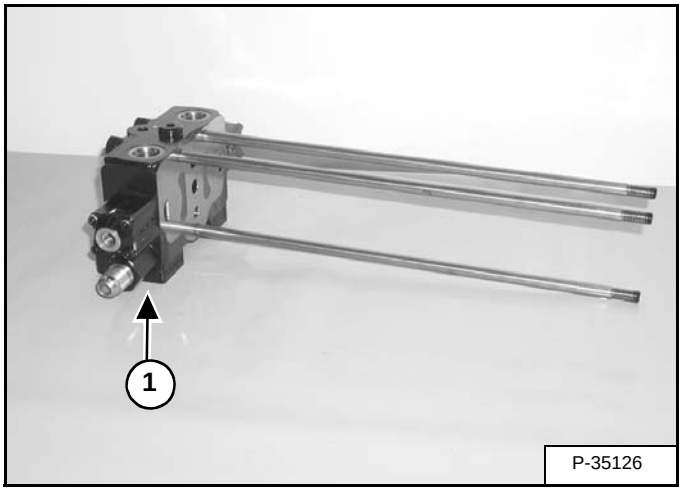
Clean the outside of the slew valve before disassembly.

IMPORTANT

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

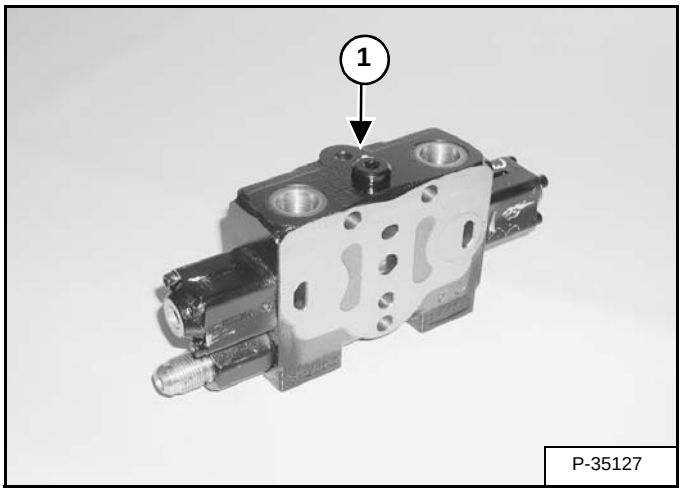
I-2003-0888

Figure 20-40-187



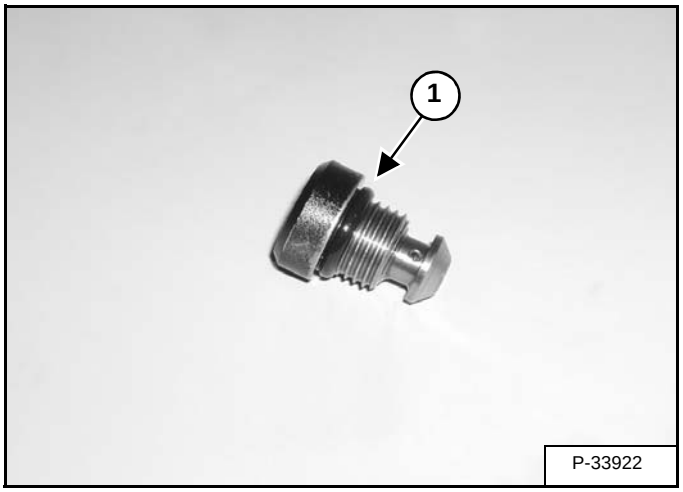
Remove the slew valve section (Item 1) **[Figure 20-40-187]** from the valve assembly.

Figure 20-40-188



Remove the load check valve (Item 1) **[Figure 20-40-188]**.

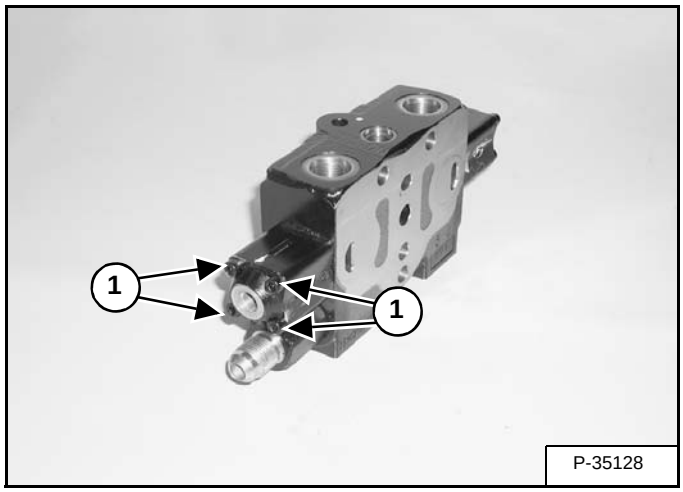
Figure 20-40-189



Remove the O-ring (Item 1) **[Figure 20-40-189]** from the load check valve.

Slew Valve Section Disassembly And Assembly (Cont'd)

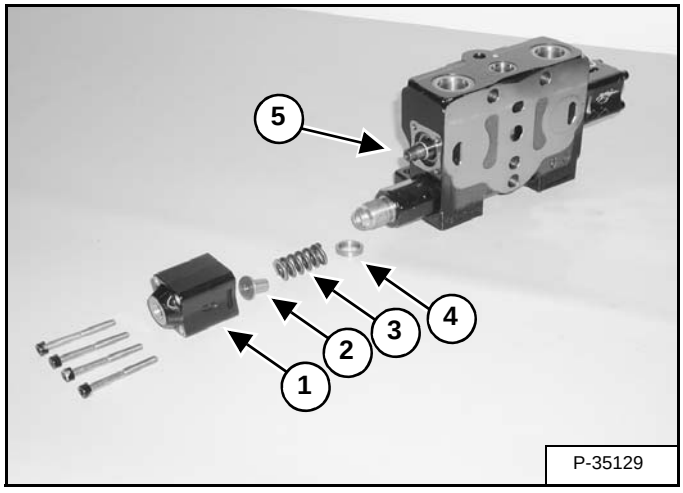
Figure 20-40-190



Remove the bolts (Item 1) **[Figure 20-40-190]**.

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

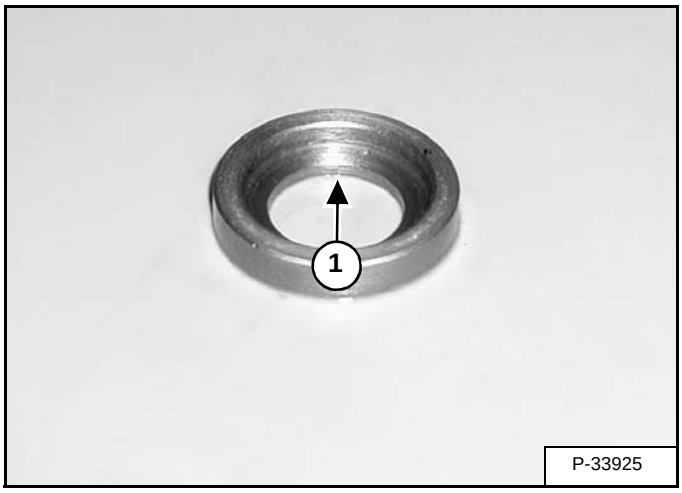
Figure 20-40-191



Remove the spool cover (Item 1), spring retainer (Item 2), spring (Item 3) and spring retainer (Item 4) **[Figure 20-40-191]**.

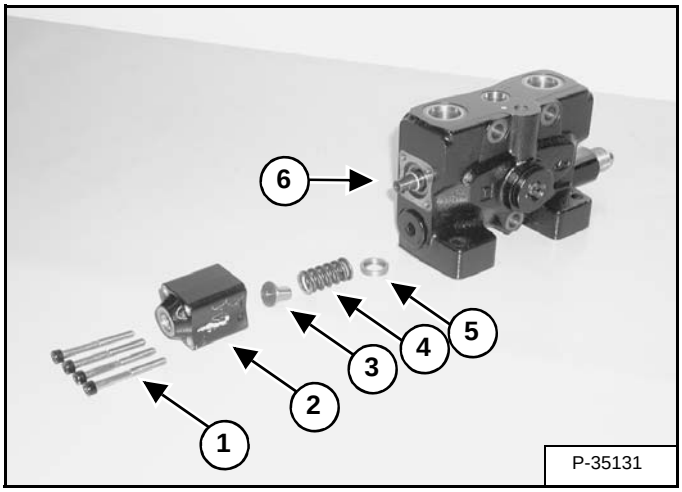
Remove the O-ring (Item 5) **[Figure 20-40-191]**.

Figure 20-40-192



Installation: Make sure the lip (Item 1) **[Figure 20-40-192]** on the spring seat fits over the spool.

Figure 20-40-193

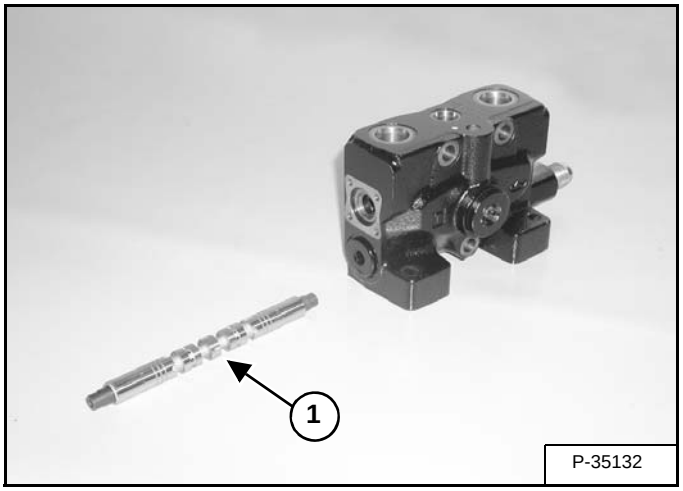


Remove the bolts (Item 1), spool cover (Item 2), spring retainer (Item 3), spring (Item 4) and spring seat (Item 5) **[Figure 20-40-193]**.

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

Slew Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-194

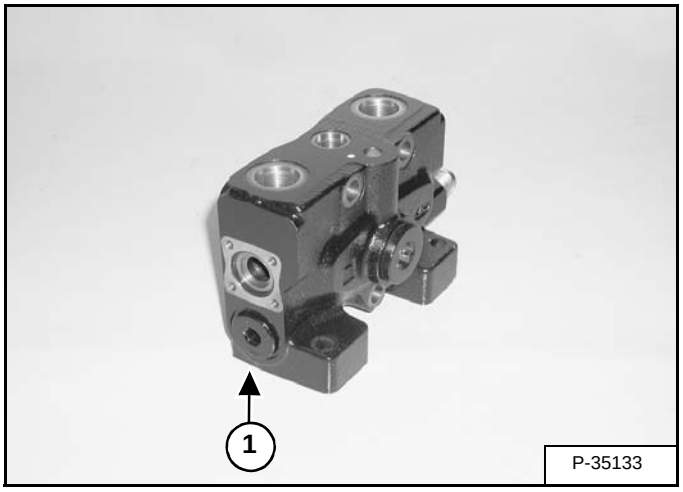


Remove the spool (Item 1) **[Figure 20-40-194]**.

The spool and valve block are not serviced separately.

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

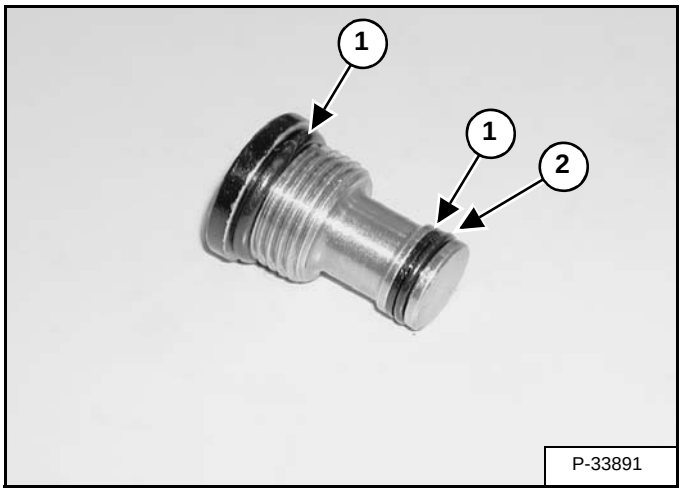
Figure 20-40-195



Remove the plug (Item 1) **[Figure 20-40-195]**.

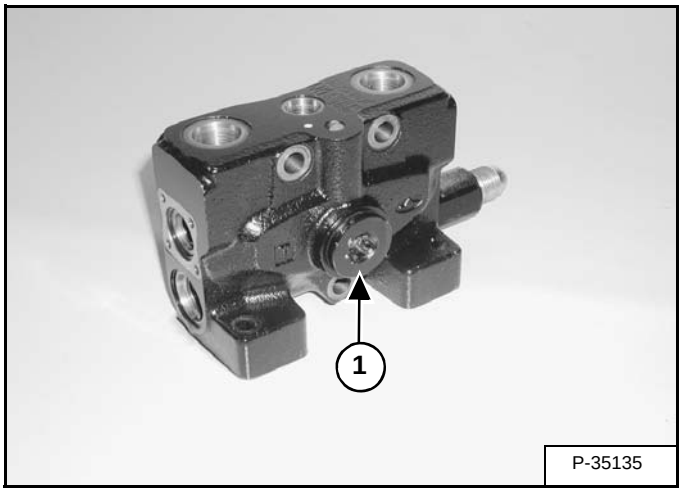
Installation: Tighten the plug to 31 ft.-lb. (42 N•m) torque.

Figure 20-40-196



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-196]** from the plug.

Figure 20-40-197

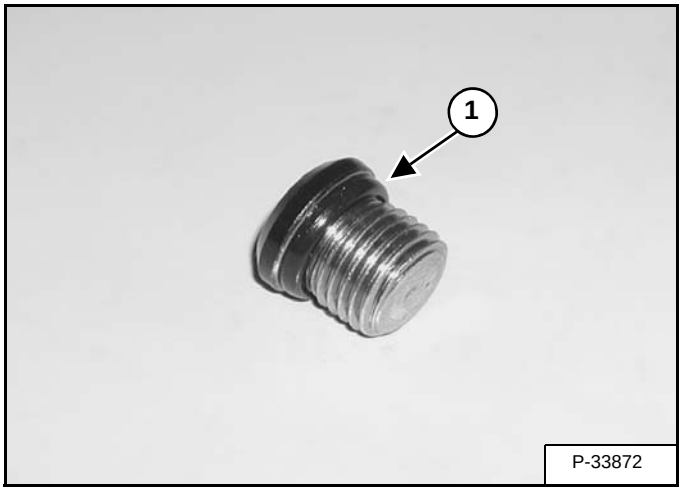


Remove the plug (Item 1) **[Figure 20-40-197]**.

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

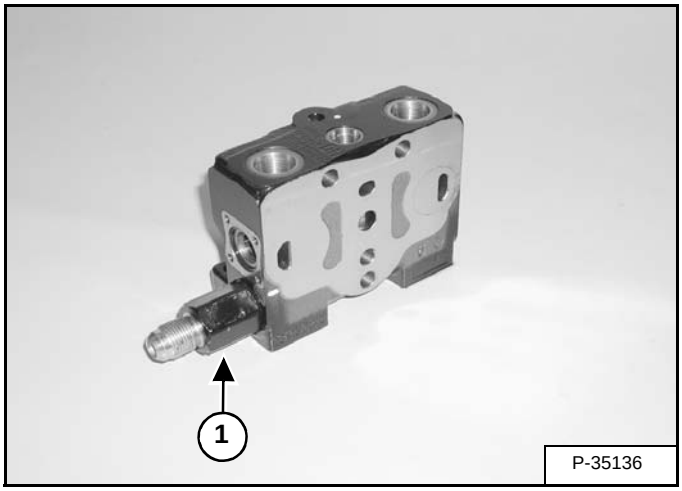
Slew Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-198



Remove the O-ring (Item 1) **[Figure 20-40-198]** from the plug.

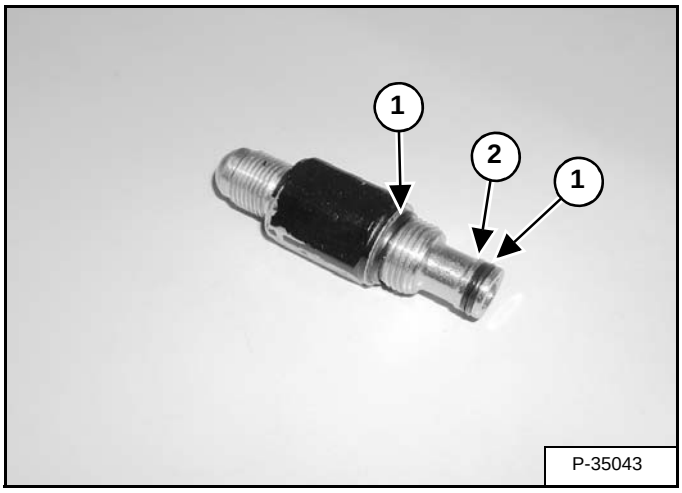
Figure 20-40-199



Remove the fitting (Item 1) **[Figure 20-40-199]**.

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

Figure 20-40-200



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-200]** from the fitting.

Assembly

Clean all parts in solvent and dry with compressed air.

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

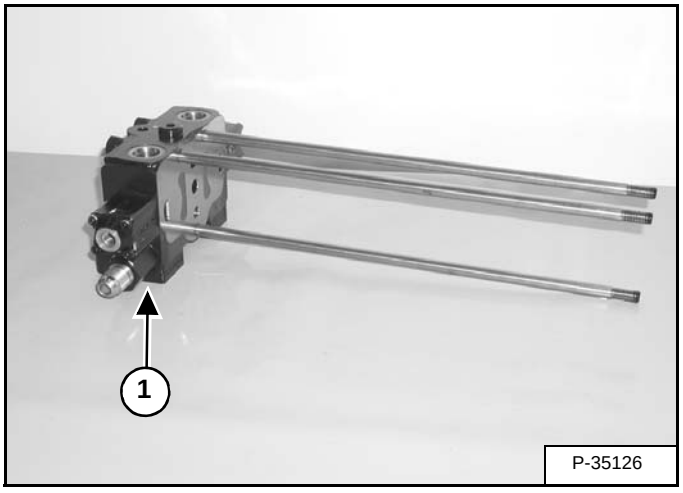
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

IMPORTANT

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

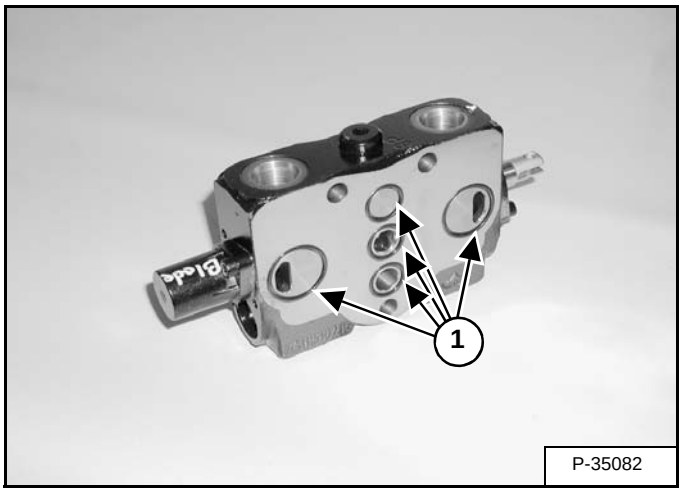
I-2003-0888

Figure 20-40-201



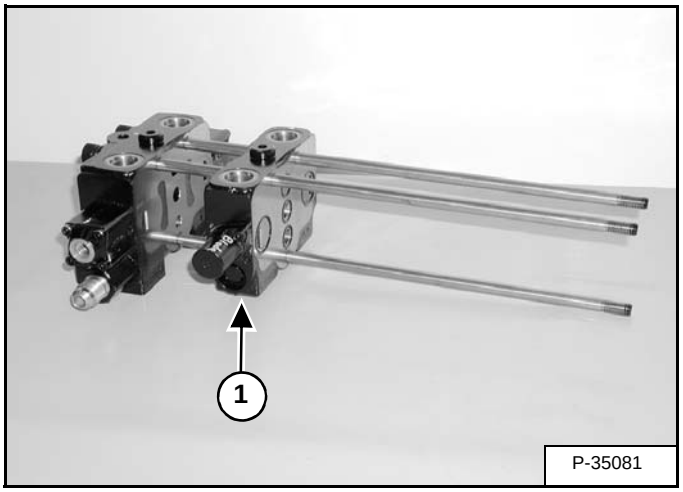
Install the slew valve section (Item 1) **[Figure 20-40-201]** on the tie rods.

Figure 20-40-202



Install the O-rings (Item 1) **[Figure 20-40-202]** on the blade valve section.

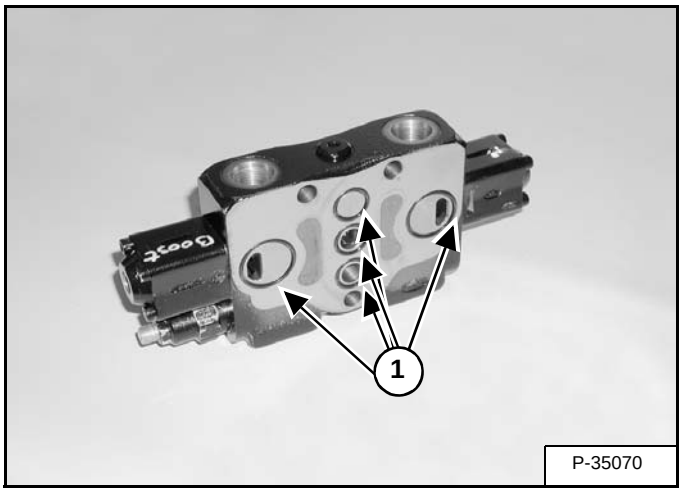
Figure 20-40-203



Install the blade valve section (Item 1) **[Figure 20-40-203]** on the tie rods.

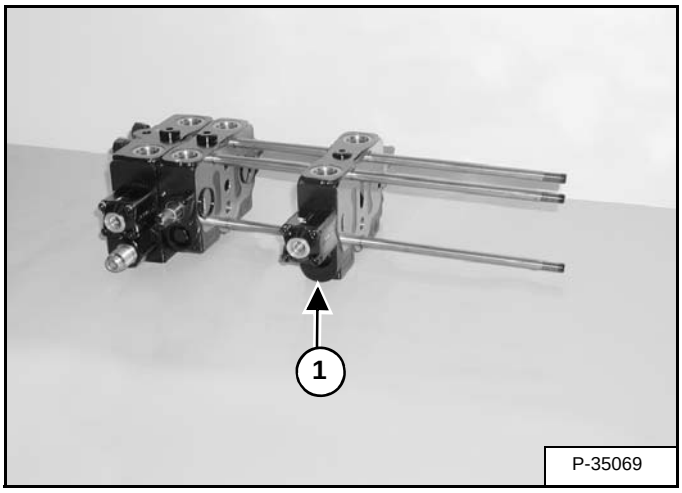
Assembly (Cont'd)

Figure 20-40-204



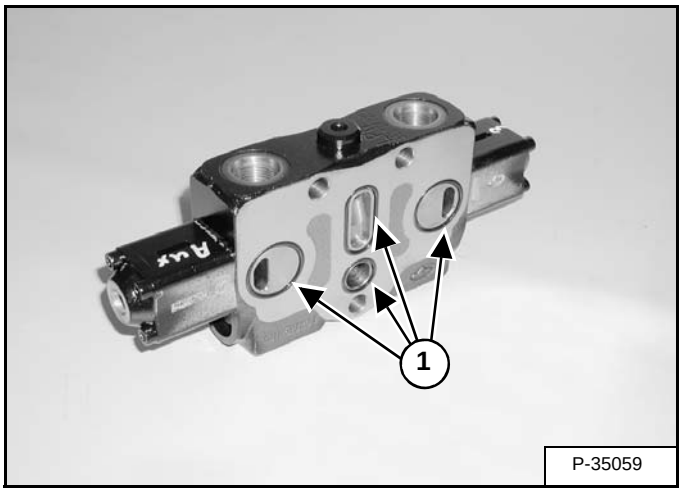
Install the O-rings (Item 1) **[Figure 20-40-204]** on the boost valve section.

Figure 20-40-205



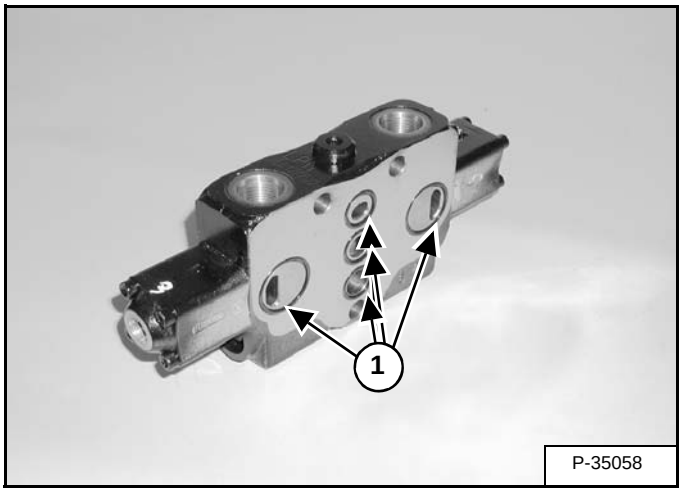
Install the boost valve section (Item 1) **[Figure 20-40-205]** on the tie rods.

Figure 20-40-206



Install the O-rings (Item 1) **[Figure 20-40-206]** on the left side of the auxiliary valve section.

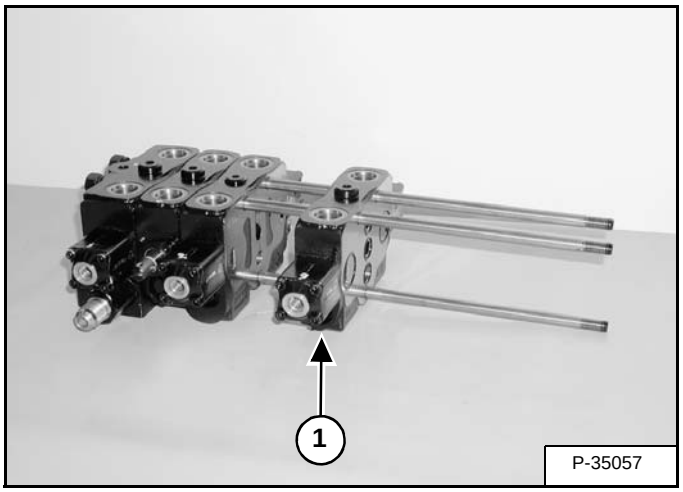
Figure 20-40-207



Install the O-rings (Item 1) **[Figure 20-40-207]** on the right side of the auxiliary valve section.

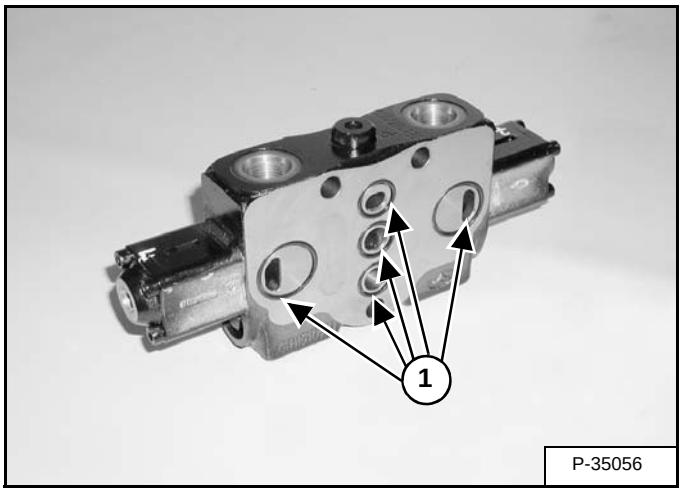
Assembly (Cont'd)

Figure 20-40-208



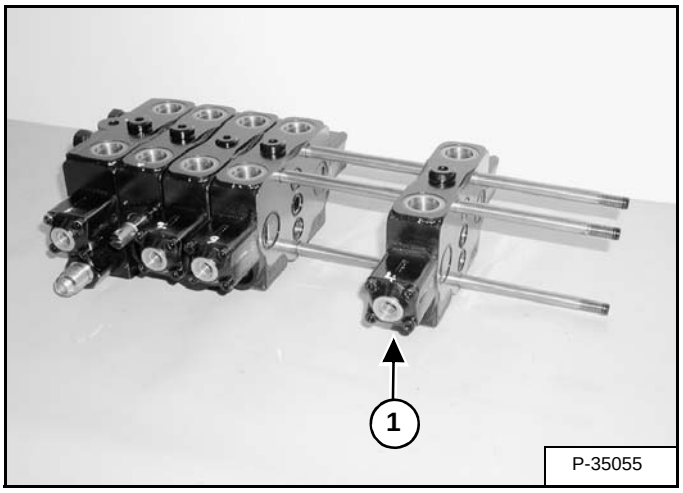
Install the auxiliary valve section (Item 1) **[Figure 20-40-208]** on the tie rods.

Figure 20-40-209



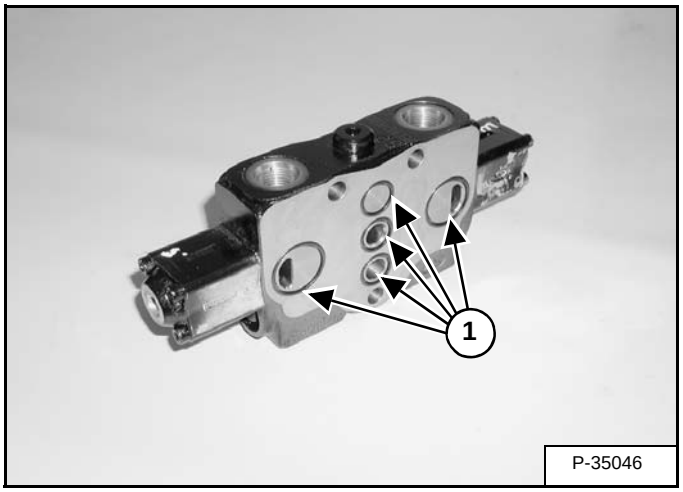
Install the O-rings (Item 1) **[Figure 20-40-209]** on the bucket valve section.

Figure 20-40-210



Install the bucket valve section (Item 1) **[Figure 20-40-210]** on the tie rods.

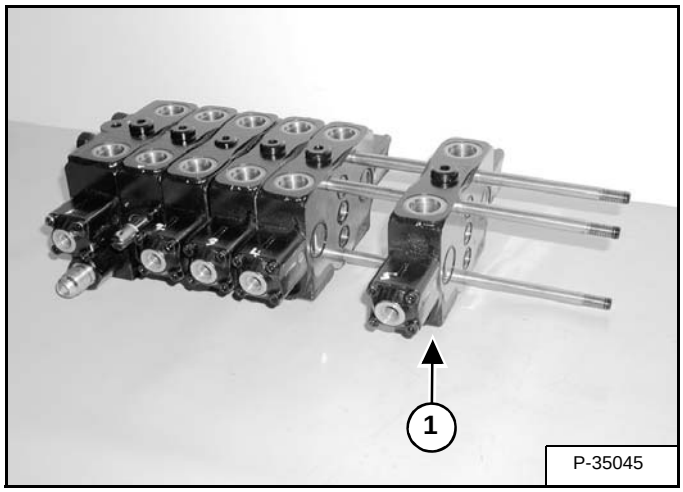
Figure 20-40-211



Install the O-rings (Item 1) **[Figure 20-40-211]** on the arm valve section.

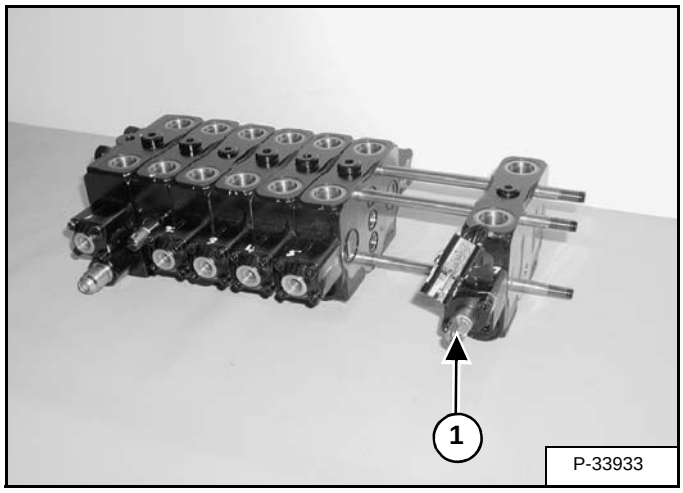
Assembly (Cont'd)

Figure 20-40-212



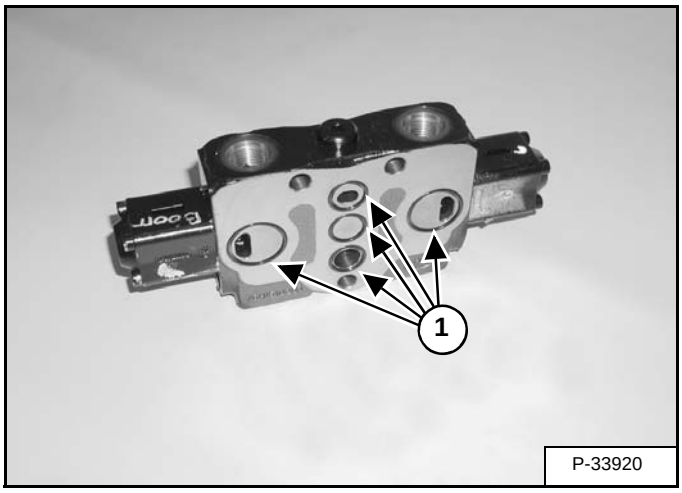
Install the arm valve section (Item 1) **[Figure 20-40-212]** on the tie rods.

Figure 20-40-213



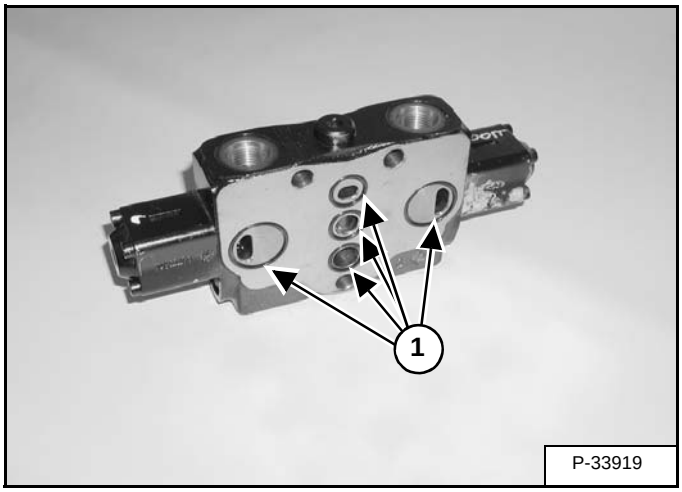
Install the left travel section (Item 1) **[Figure 20-40-213]** on the tie rods.

Figure 20-40-214



Install the O-rings (Item 1) **[Figure 20-40-214]** on the left side if the boom valve section.

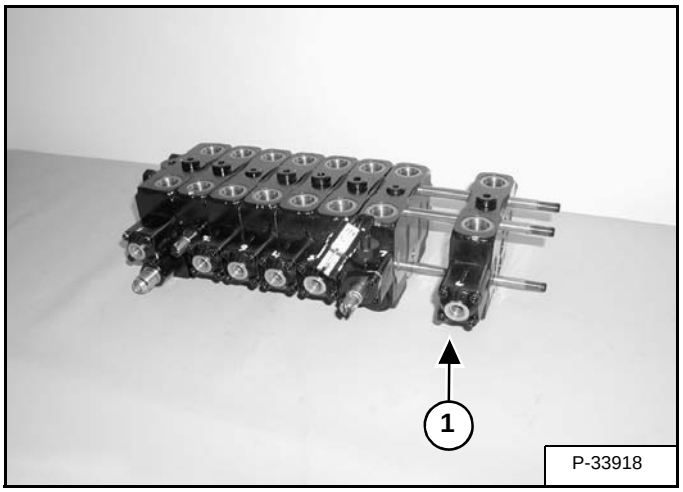
Figure 20-40-215



Install the O-rings (Item 1) **[Figure 20-40-215]** on the right side of the boom valve section.

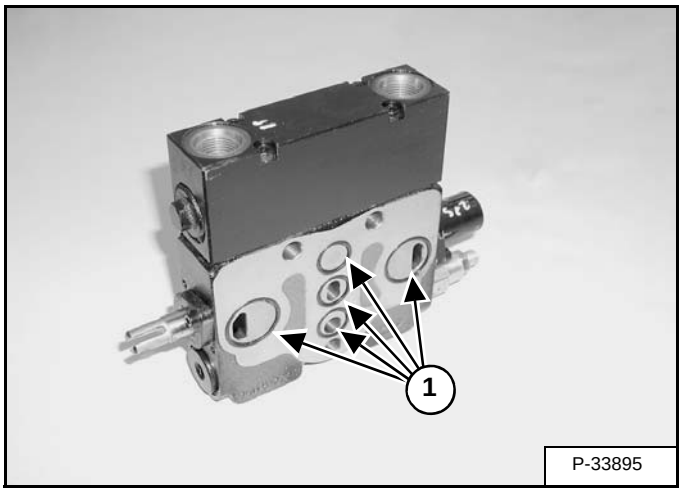
Assembly (Cont'd)

Figure 20-40-216



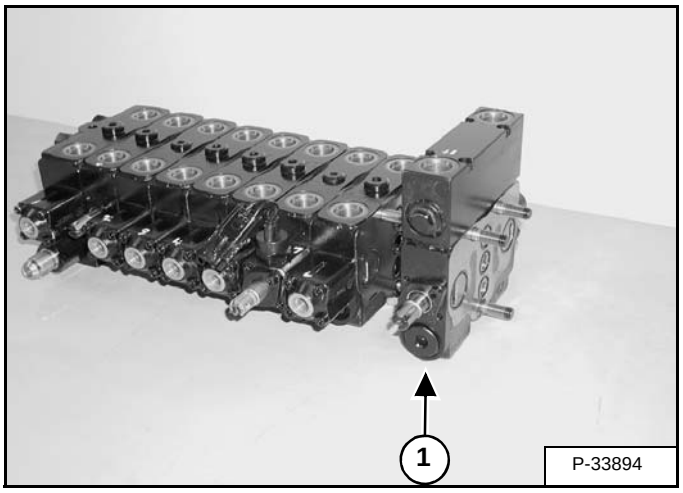
Install the boom valve section (Item 1) **[Figure 20-40-216]** on the tie rods.

Figure 20-40-217



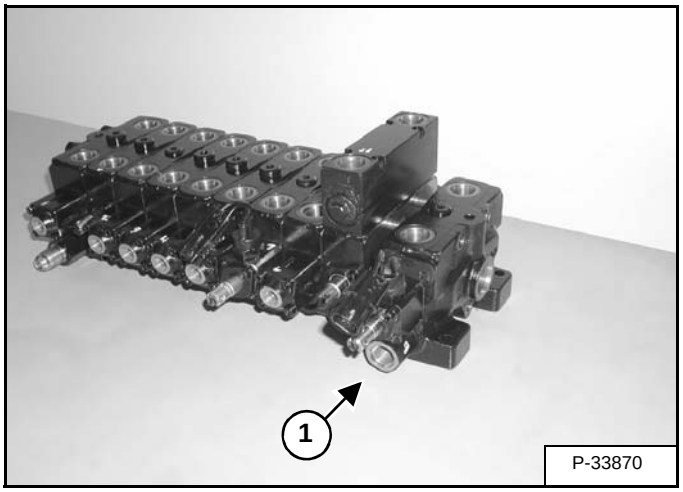
Install the O-rings (Item 1) **[Figure 20-40-217]** on the boom swing valve section.

Figure 20-40-218



Install the boom swing valve section (Item 1) **[Figure 20-40-218]** on the tie rods.

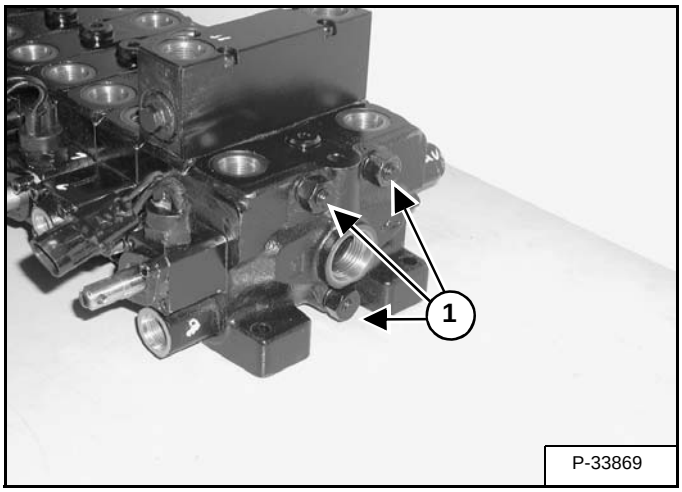
Figure 20-40-219



Install the right travel section (Item 1) **[Figure 20-40-219]** on the tie rods.

Assembly (Cont'd)

Figure 20-40-220



Install the washers and nuts (Item 1) **[Figure 20-40-220]** on the ends of the tie rods, finger tight.

Be sure the valve assembly does not rock on a flat surface.

Tighten the tie rod nuts (Item 1) **[Figure 20-40-220]** to 10 ft.-lb. (13 N•m) torque.

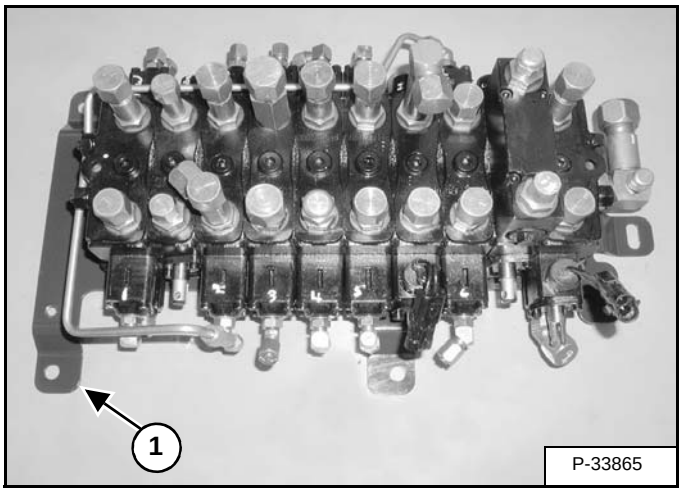
The valve assembly must not have any spacing between the valve section and the spools must be free when pushed in and released.

Tighten the tie rod nuts to 25 ft.-lb. (36 N•m) torque.

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.

Figure 20-40-221



Install the fittings **[Figure 20-40-221]**.

Install the control valve assembly on the mount (Item 1) **[Figure 20-40-221]**.

Assembly (Cont'd)

Figure 20-40-222

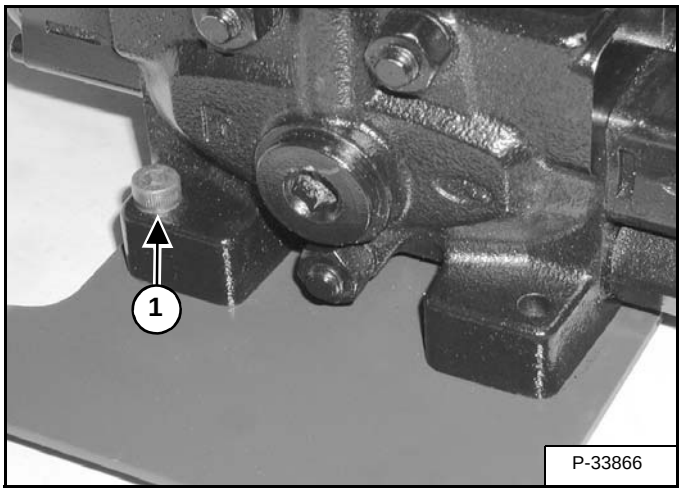
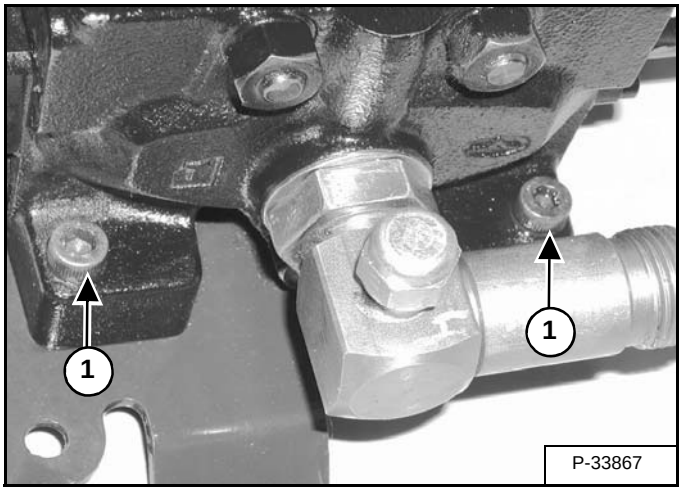


Figure 20-40-223



Install the bolts (Item 1) **[Figure 20-40-222]** & **[Figure 20-40-223]** on the control valve assembly. Tighten the bolts to 18 - 19 ft.-lb. (24 - 26 N•m) torque.


Bobcat®

HYDRAULIC PUMP

Description

IMPORTANT

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

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Figure 20-50-1

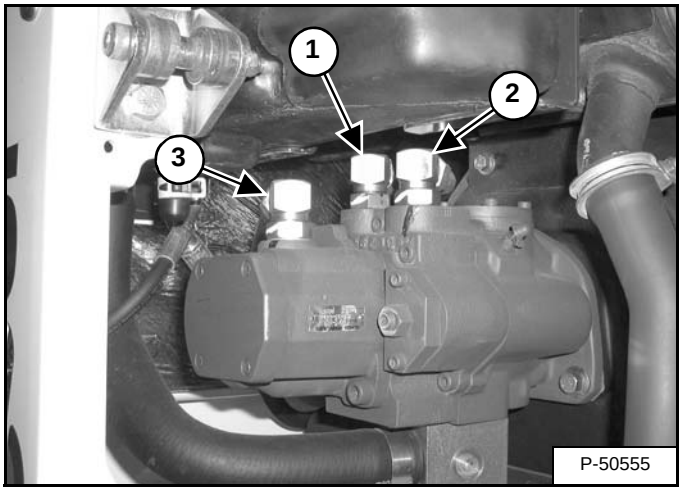
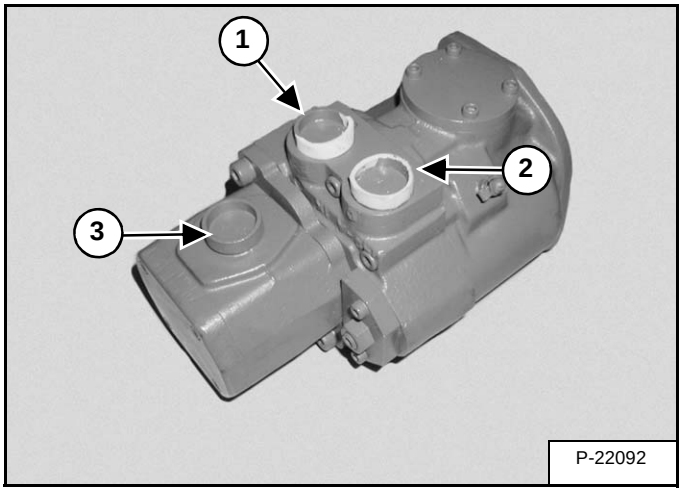


Figure 20-50-2



Pump outlet 1 (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 2 (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 3 (gear pump) (Item 3) **[Figure 20-50-1]** & **[Figure 20-50-2]** provides hydraulic fluid flow to the upperstructure slew, blade and boost valve sections.

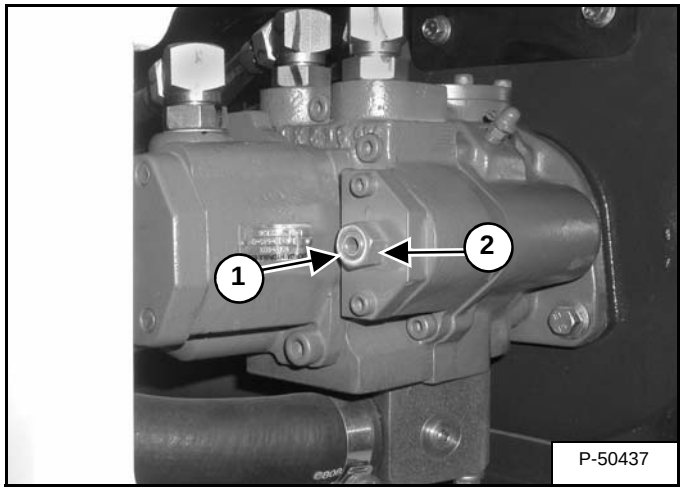
Hydraulic flow from pump outlet 2 (Item 2) **[Figure 20-50-1]** & **[Figure 20-50-2]** and 3 (Item 3) **[Figure 20-50-1]** & **[Figure 20-50-2]** are combined for the auxiliary hydraulic flow.

Torque Adjustment

Prior to making any torque adjustment, all piston and gear pump tests must be completed and are to rated specifications. (See the following pages for pump tests.)

Prior to making any torque adjustment, make sure the no load engine RPM is correct. (See Engine on Page SPEC-10-4.)

Figure 20-50-3



The adjustment screw (Item 1) **[Figure 20-50-3]** is used to match the maximum hydraulic horsepower of the pump to the maximum rated engine horsepower.

Remove any auxiliary hydraulic attachments from the excavator.

Engage the slew lock.

Start the engine and move the speed control to the high idle position.

Engage the following hydraulic functions, and continue to engage the functions.

Engage the auxiliary hydraulics.
Extend the bucket cylinder.
Extend the arm cylinder.
Extend the boom cylinder.
Extend the boom swing cylinder.
Engage the upperstructure slew.

With all the above hydraulic functions engaged, the engine speed must maintain 2400 RPM.

Loosen the nut (Item 2) **[Figure 20-50-3]** and turn the adjustment screw clockwise to increase pump torque. counterclockwise to decrease pump torque.

Tighten the nut and retest the pump.

Increase or decrease pump torque until correct engine RPM is maintained.

Testing The Piston Pump

All pump testing is done with the hydraulic oil at operating temperature and with the engine high idle speed. (See Engine on Page SPEC-10-4.)

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

MEL10003 - Hydraulic Tester

Stop the engine.

Open the tailgate.

Figure 20-50-4

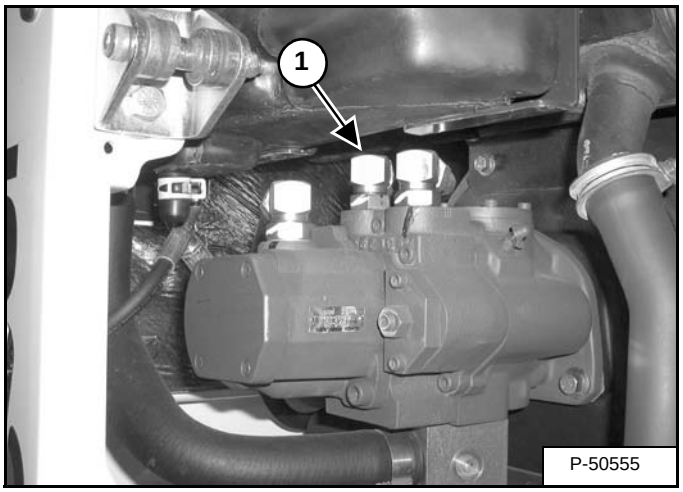
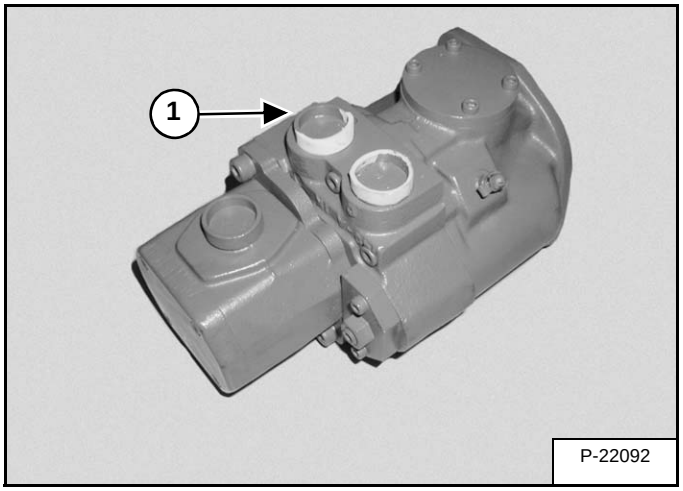
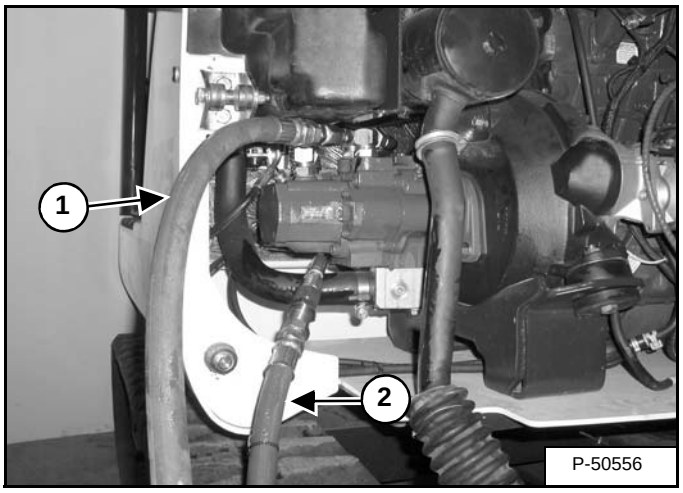


Figure 20-50-5



Remove the outlet hose (Item 1) **[Figure 20-50-4]** & **[Figure 20-50-5]** from the hydraulic pump being tested.

Figure 20-50-6

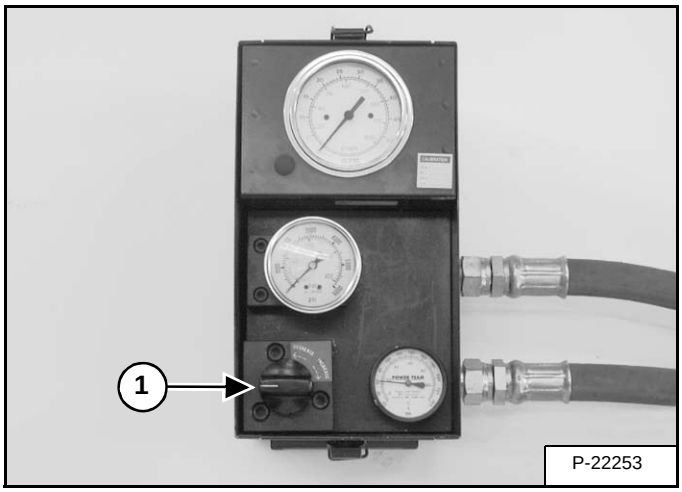


Connect the inlet side (Item 1) **[Figure 20-50-6]** of the tester to the pump.

Connect the outlet side of the tester to the hose (Item 2) **[Figure 20-50-6]** that was removed from the pump.

Testing The Piston Pump (Cont'd)

Figure 20-50-7



NOTE: Open the flow control knob (Item 1) [Figure 20-50-7] fully to prevent pump damage. This is a direct pump test. There is no relief valve in the system.

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

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

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

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

Pump flow on a new piston pump is 10.1 gpm (38.2 L/min.).

Close the flow control knob (Item 1) **[Figure 20-50-7]** slowly to 100 PSI below the relief valve setting (2650 PSI [180 bar]).

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

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

$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \text{ x100}$$

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

Testing The Gear Pump

All pump testing is done with the hydraulic oil at operating temperature and with the engine at high idle speed. (See Engine on Page SPEC-10-4.)

Figure 20-50-8

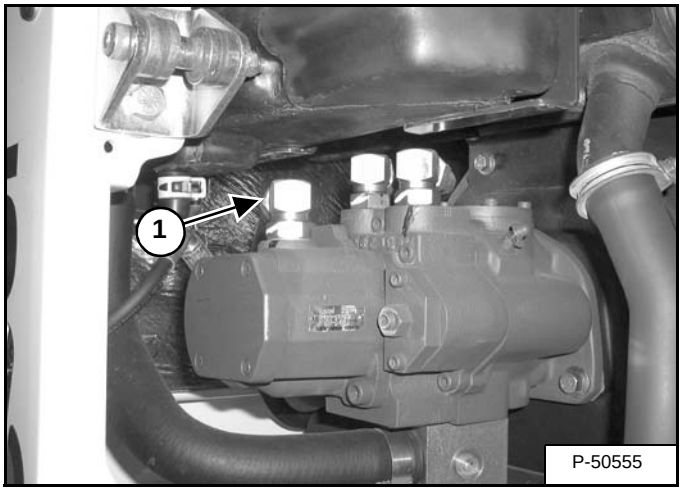
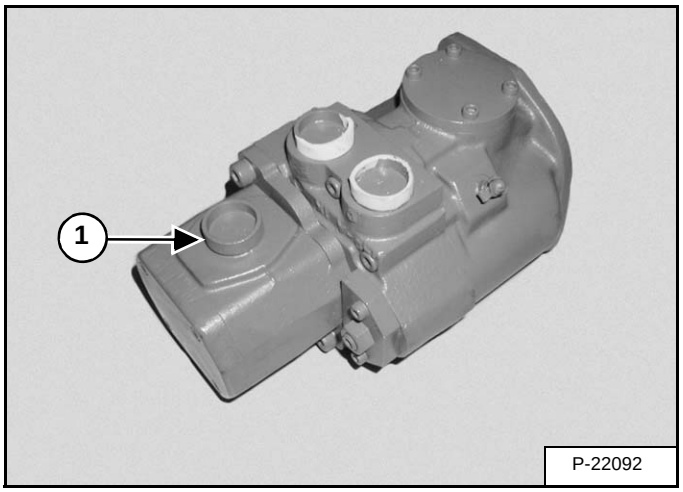
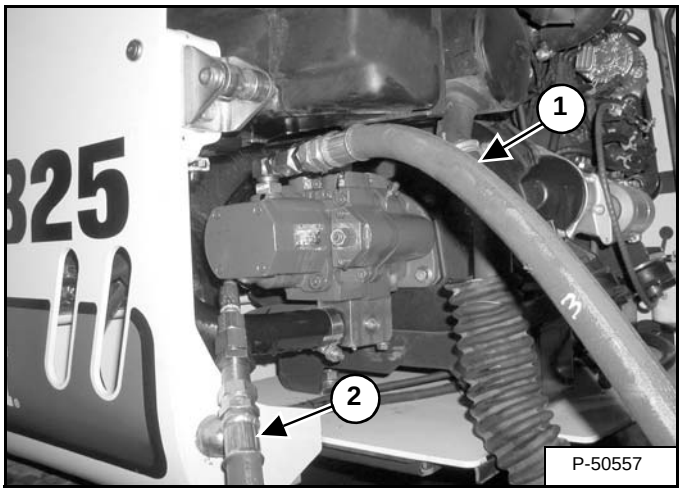


Figure 20-50-9



Remove the outlet hose (Item 1) **[Figure 20-50-8]** & **[Figure 20-50-9]** from the gear pump.

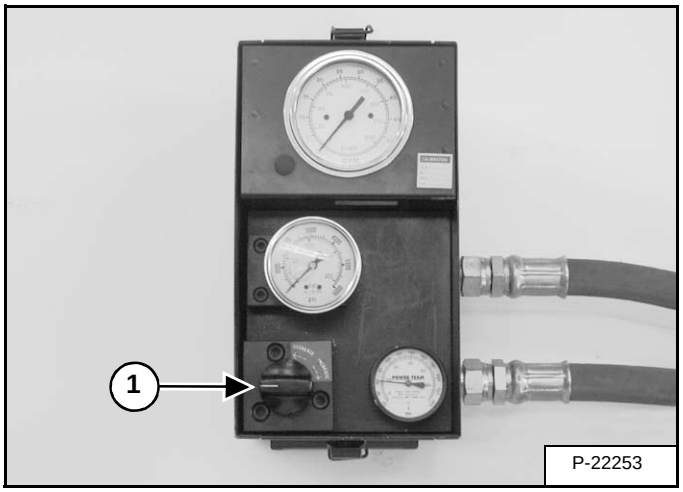
Figure 20-50-10



Connect the inlet side (Item 1) **[Figure 20-50-10]** of the tester to the pump.

Connect the outlet side of the tester to the hose (Item 2) **[Figure 20-50-10]** that was removed from the pump.

Figure 20-50-11



NOTE: Open the flow control knob (Item 1) [Figure 20-50-11] fully to prevent pump damage. This is a direct pump test. There is no relief valve in the system.

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

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

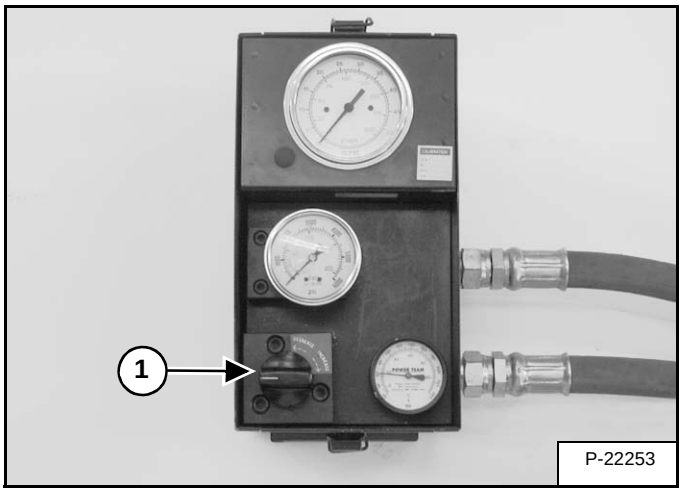
After the temperature is correct, open the restrictor valve fully.

Testing The Gear Pump (Cont'd)

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

Pump flow on a new gear pump is 7.03 GPM (26,6 L/min.).

Figure 20-50-12



Close the flow control knob (Item 1) **[Figure 20-50-12]** slowly to 100 PSI (6,9 bar) below the relief valve setting (2500 PSI [172 bar]).

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

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

$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \text{ x100}$$

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

Testing Auxiliary Hydraulic Flow

The auxiliary hydraulic flow is the combined flow of pump outlet 2 and pump outlet 3.

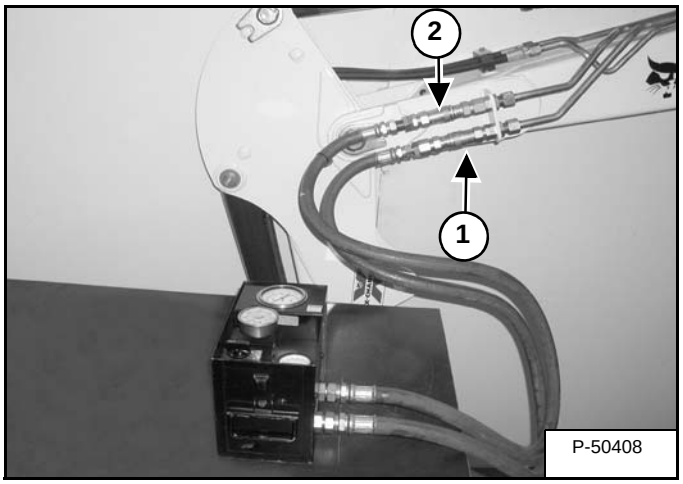
All testing is done with the hydraulic oil at operating temperature and the engine at high idle speed setting. (See Engine on Page SPEC-10-4.)

The following tool will be needed for the auxiliary hydraulic flow test:

MEL10003-Hydraulic Tester.

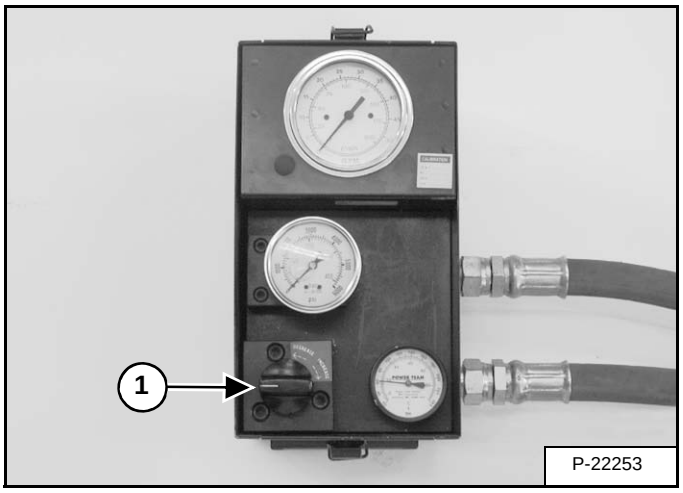
Stop the engine.

Figure 20-50-13



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 20-50-13]**.

Figure 20-50-14



NOTE: Open the flow control knob (Item 1) [Figure 20-50-14] fully.

Start the engine, and run at low RPM. Engage the auxiliary hydraulic circuit.

NOTE: When engaging the auxiliary hydraulic circuit, make sure the female coupler is pressure and the male coupler is return.

Make sure the tester is connected correctly. If no flow is indicated at the tester, the hoses are connected wrong.

Increase the engine speed to full RPM. Warm the hydraulic fluid to 150° F (66° C) by turning the restrictor valve until the gauge reads about 1000 PSI (193 bar). Do not exceed system pressure.

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

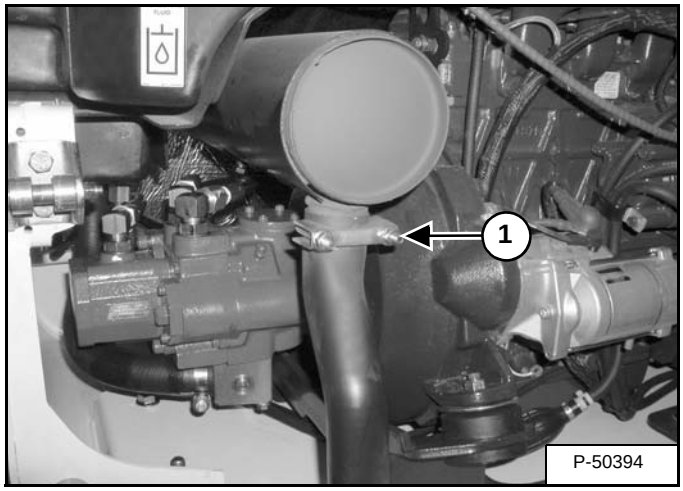
Record the auxiliary hydraulic free flow GPM (L/min.).

HYDRAULIC PUMP (CONT'D)

Removal And Installation

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

Figure 20-50-15



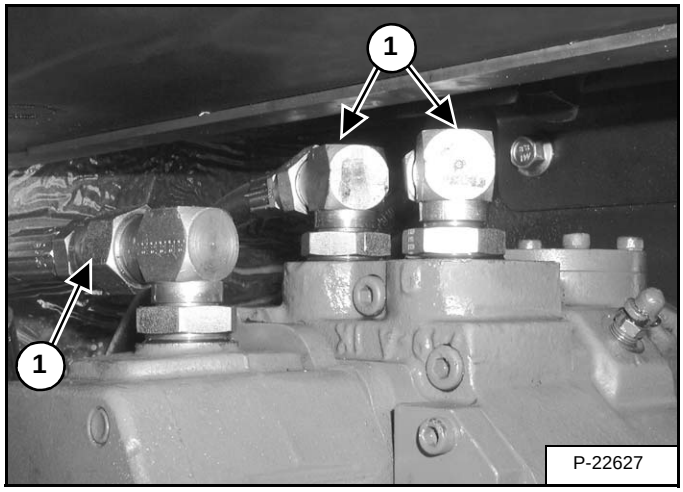
Remove the clamp (Item 1) **[Figure 20-50-15]** and tailpipe.

IMPORTANT

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

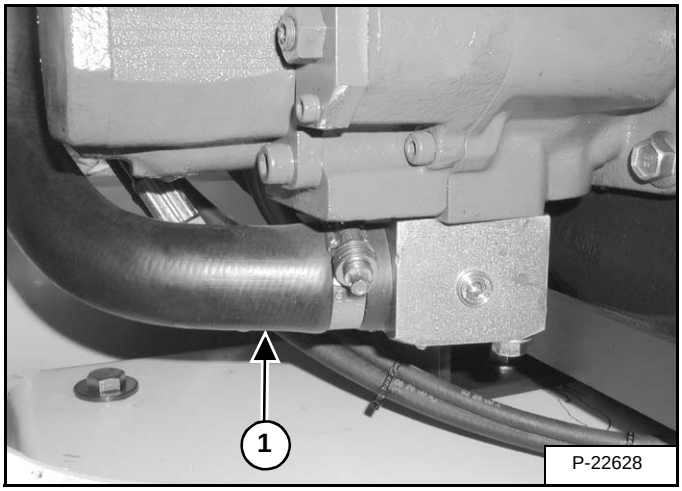
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Figure 20-50-16



Mark and remove the three hoses (Item 1) **[Figure 20-50-16]**.

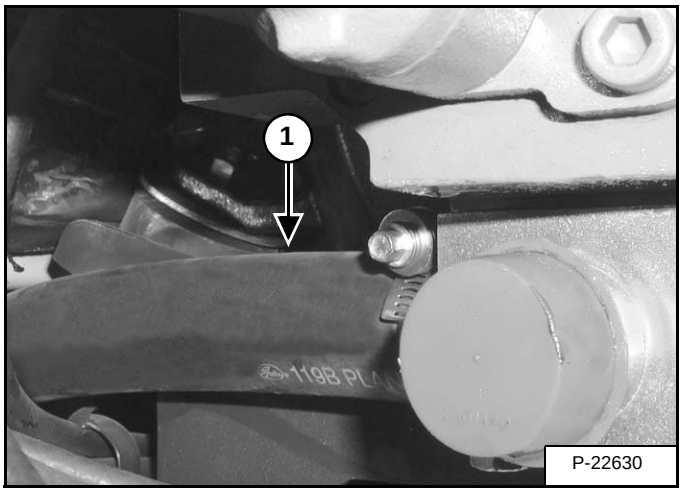
Figure 20-50-17



Remove the hydraulic reservoir to pump hose (Item 1) **[Figure 20-50-17]**.

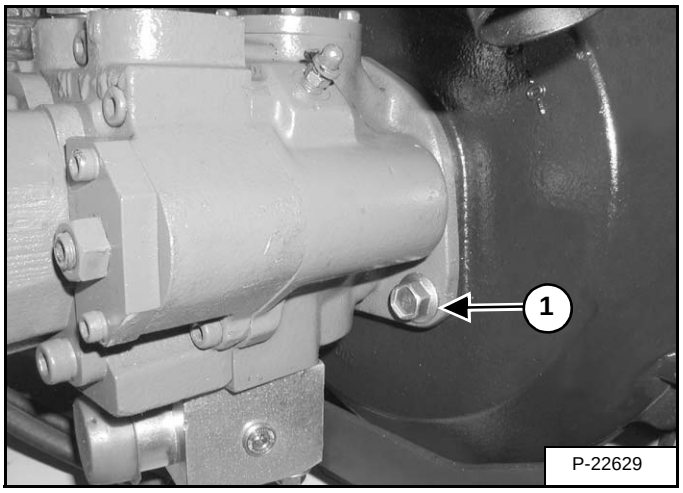
Removal And Installation (Cont'd)

Figure 20-50-18



Remove the hydraulic filter to pump hose (Item 1) **[Figure 20-50-18]**.

Figure 20-50-19

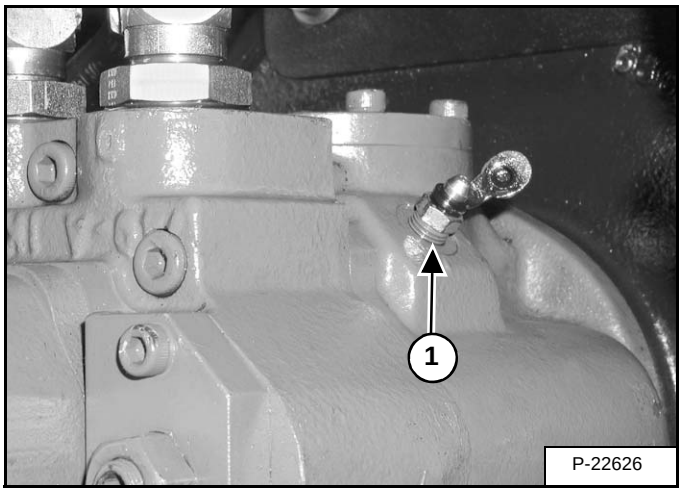


Remove the two bolts (Item 1) **[Figure 20-50-19]**.

Installation: Tighten the bolts to 55 - 60 ft.-lb. (75 - 85 N•m) torque.

Pump Installation: Whenever the hydraulic system has been drained and refilled, the hydraulic pump must be purged of air.

Figure 20-50-20

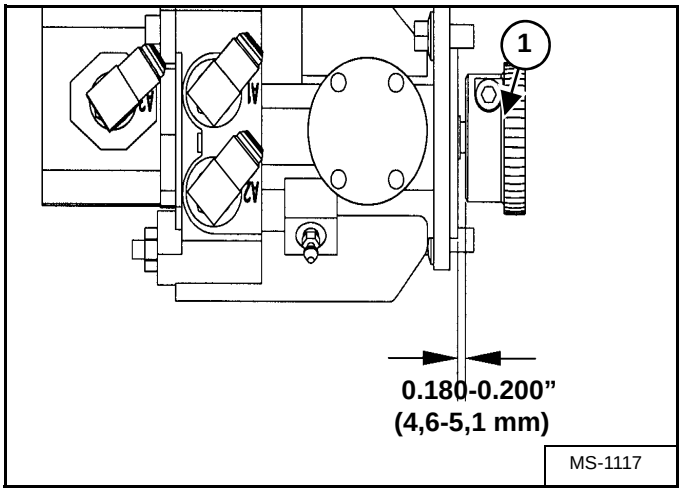


Open the bleed valve (Item 1) **[Figure 20-50-20]** on the hydraulic pump. Close the valve after a steady stream of hydraulic fluid free of any air drains from the valve.

Tighten the bleed valve.

Coupler Removal And Installation

Figure 20-50-21



Remove the bolt (Item 1) **[Figure 20-50-21]** from the coupler.

Slide the coupler off of the pump shaft.

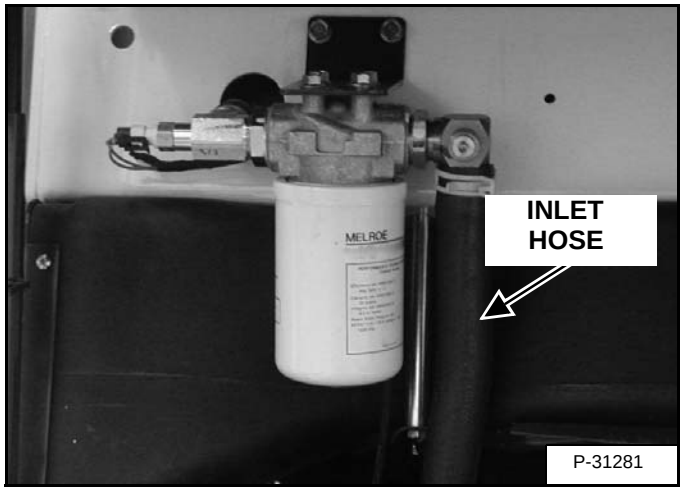
When installing the coupler, maintain 0.19 in. (4,8 mm) gap from the pump mount flange to the coupler.

Tighten the bolt (Item 1) **[Figure 20-50-21]** to 36 - 44 ft.-lb. (49 - 60 N•m) torque.

Hydraulic Pump Start Up

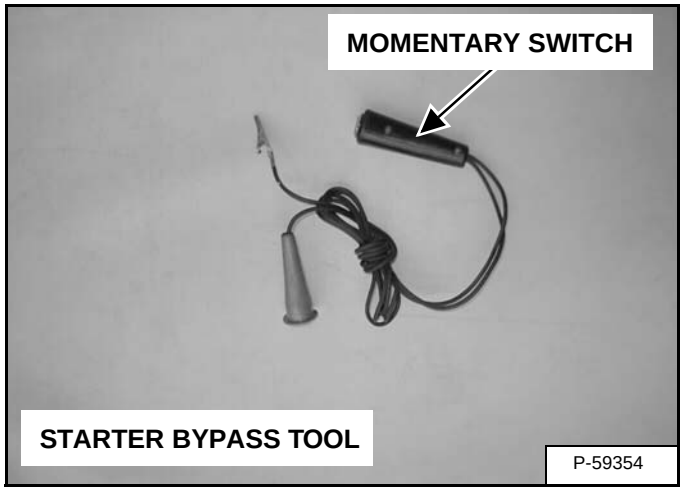
NOTE: This procedure is to prevent a dry start up of the hydraulic pump.

Figure 20-50-22



Disconnect the pump inlet hose connection at the filter head. Fill the pump inlet and hose completely with hydraulic fluid. Reconnect the hose **[Figure 20-50-22]**.

Figure 20-50-23



To crank the engine without starting, the machine key switch can be bypassed. Obtain a starter bypass tool from a local source which can be used as a universal connection to remotely crank the engine without starting **[Figure 20-50-23]**.

The starter bypass tool consists of two wires, each with a clamp. The momentary switch, when depressed, will allow current to pass through the circuit.

Figure 20-50-24

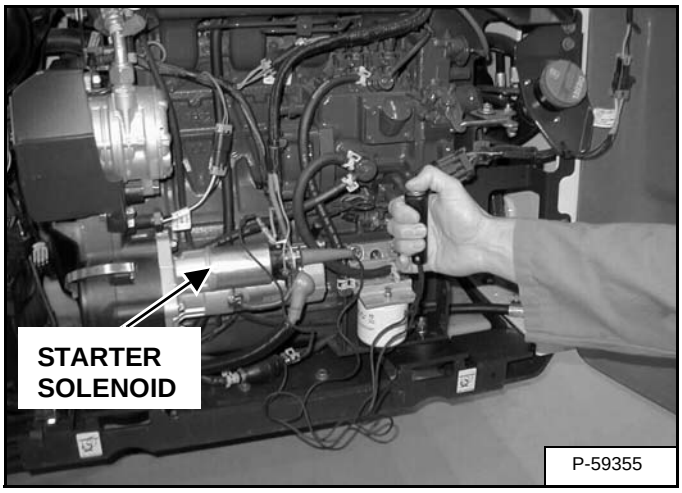
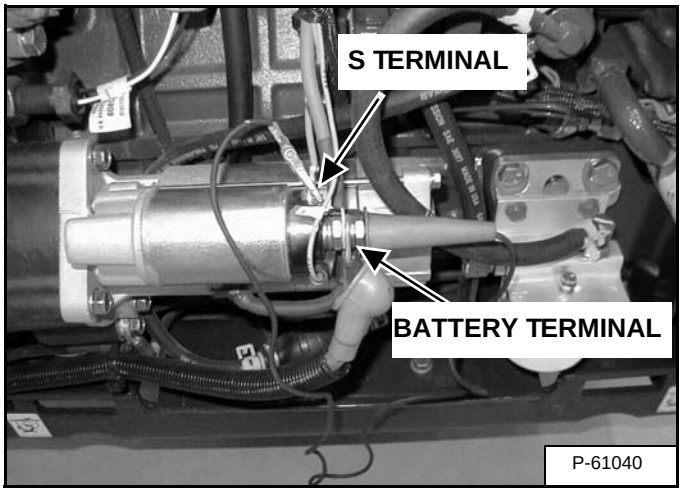


Figure 20-50-25



Connect the starter bypass tool to the starter solenoid battery terminal and S terminal. Crank the engine for 15 seconds, then stop for at least 30 seconds. Again, crank the engine for 15 seconds. Remove the starter bypass tool **[Figure 20-50-24]** & **[Figure 20-50-25]**.

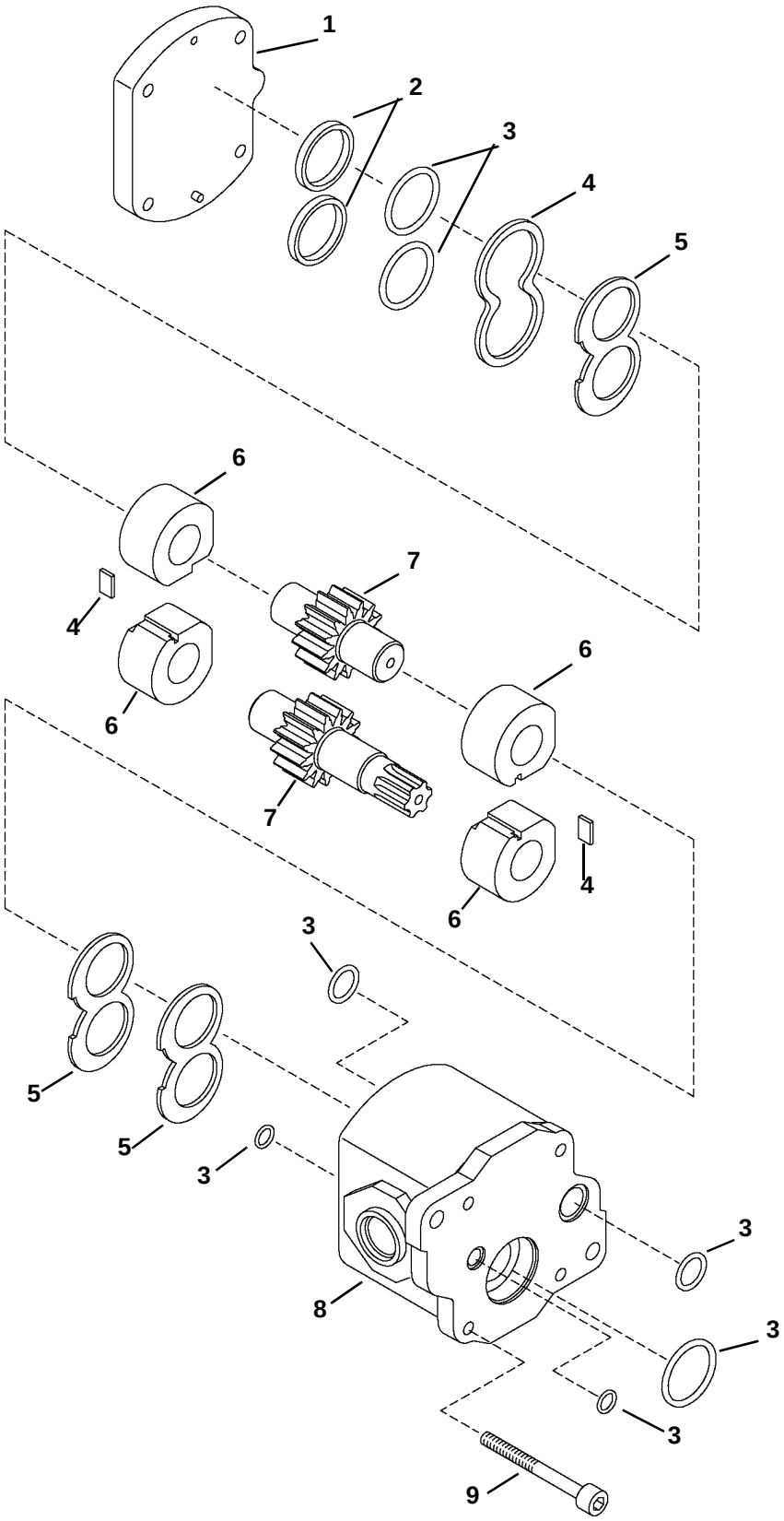
Start the excavator from the operators cab and run the engine at low idle for 1 - 2 minutes without operating the hydraulics.

After operating the engine at low idle, operate the hydraulic systems several times or until air is purged from the system. **Avoid running over the relief valve setting at the end of cylinder stroke.**

With the excavator parked on a level surface and lift arms down, check and fill the hydraulic reservoir as required. Check for hydraulic leaks.

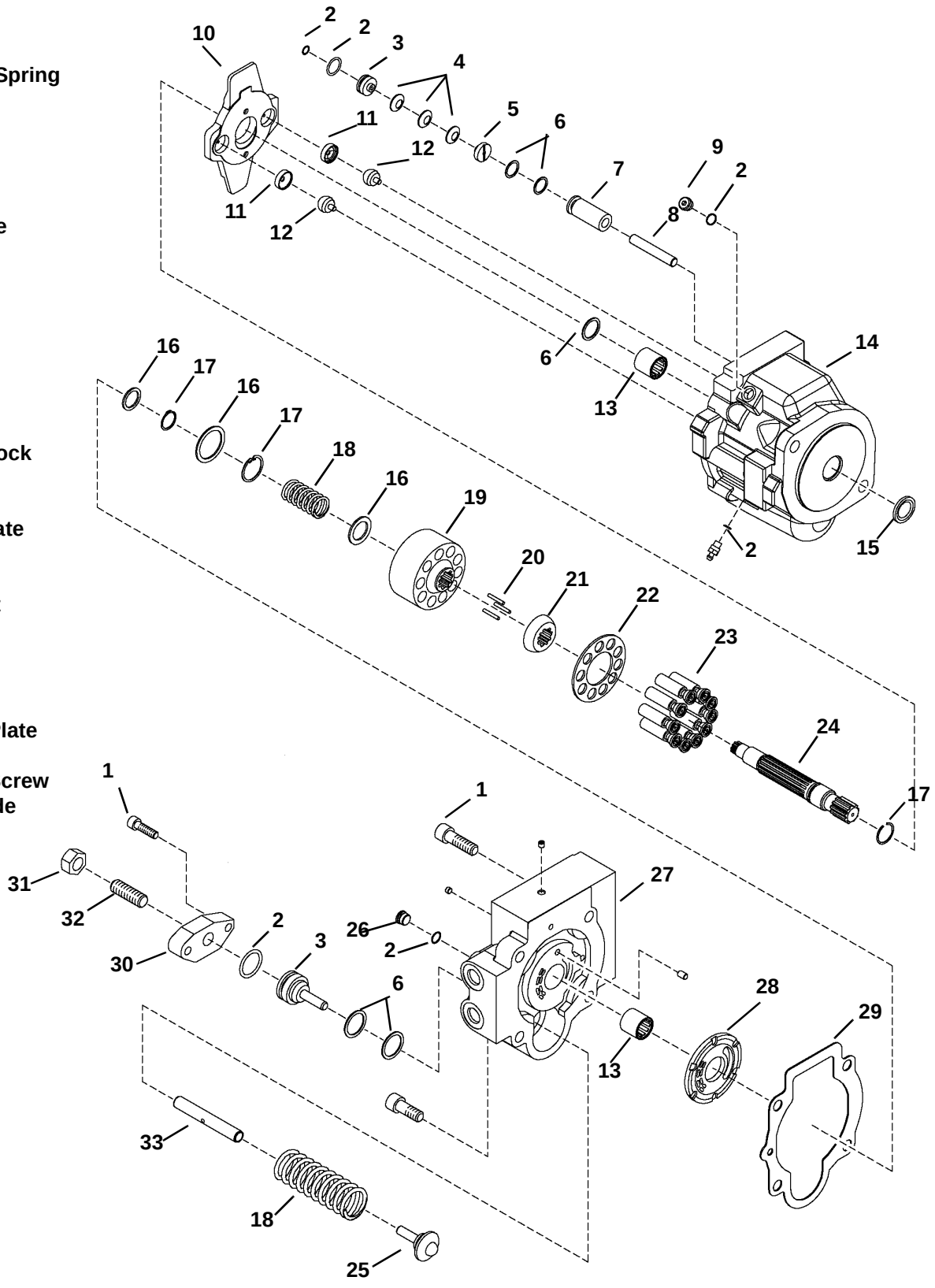
Gear Pump Parts Identification

1. End Plate
2. Guide
3. O-Ring
4. Seal
5. Spacer
6. Bearing
7. Gear
8. Housing
9. Bolt



Piston Pump Parts Identification

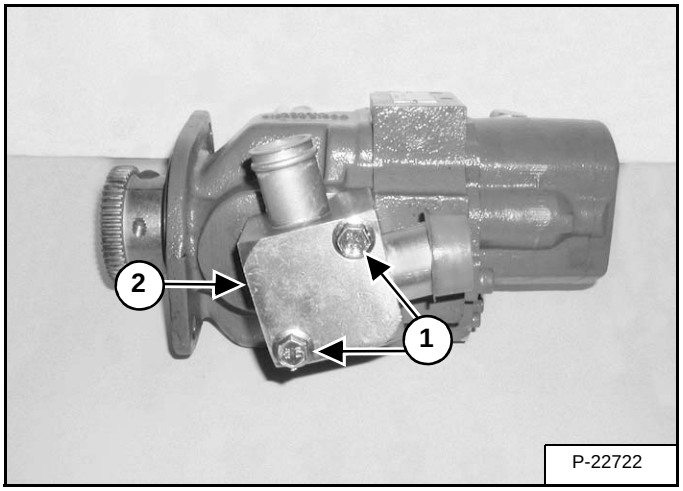
1. Bolt
2. O-Ring
3. Piston
4. Coned Disc Spring
5. Spacer
6. Shim
7. Sleeve
8. Parallel Pin
9. Fitting
10. Swash Plate
11. Guide Seat
12. Guides
13. Bearing
14. Housing
15. Seal
16. Washer
17. Snap Ring
18. Spring
19. Cylinder Block
20. Pins
21. Retainer
22. Retainer Plate
23. Pistons
24. Shaft
25. Spring Seat
26. Plug
27. Face Plate
28. Port Plate
29. Gasket
30. Adjusting Plate
31. Nut
32. Adjusting Screw
33. Spring Guide



Disassembly

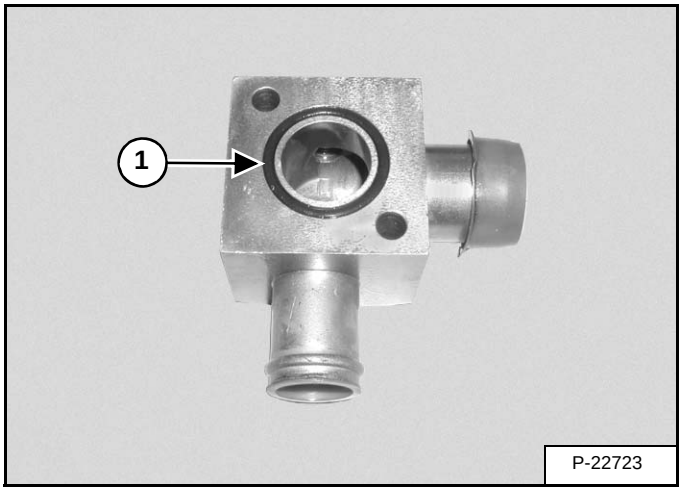
Clean the outside of the hydraulic pump before disassembly.

Figure 20-50-26



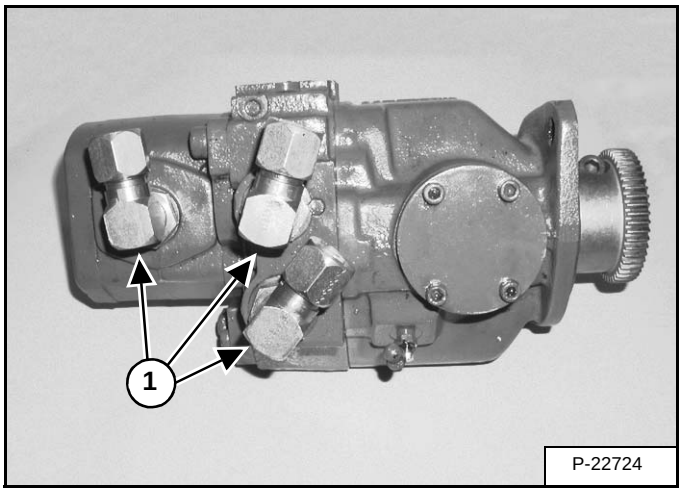
Remove the two bolts (Item 1) and the fitting (Item 2) **[Figure 20-50-26]**.

Figure 20-50-27



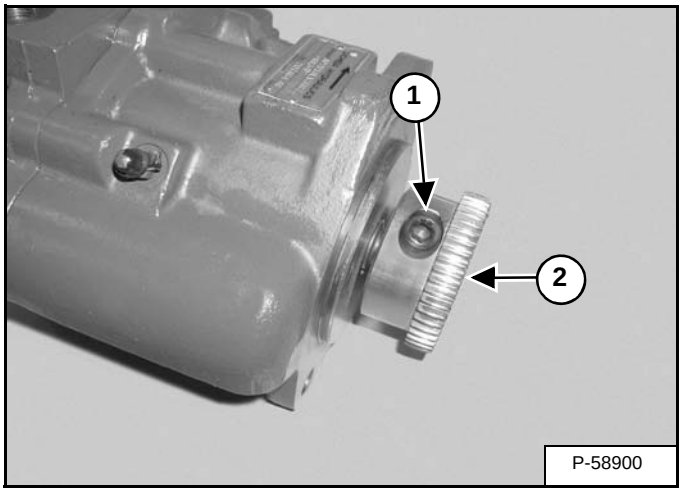
Remove the O-ring (Item 1) **[Figure 20-50-27]** from the fitting.

Figure 20-50-28



Remove the three fittings (Item 1) **[Figure 20-50-28]**.

Figure 20-50-29



Remove the bolt (Item 1) and coupler (Item 2) **[Figure 20-50-29]**.

Gear Pump Disassembly

IMPORTANT

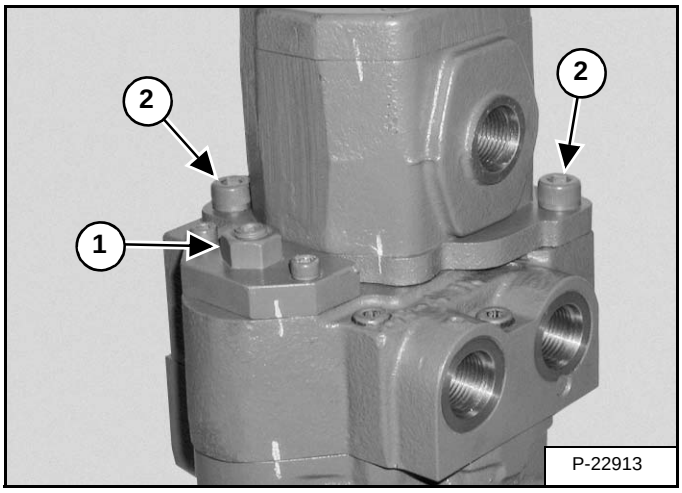
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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Clean the outside of the pump before disassembly.

Mark the outside of the pump for ease of assembly.

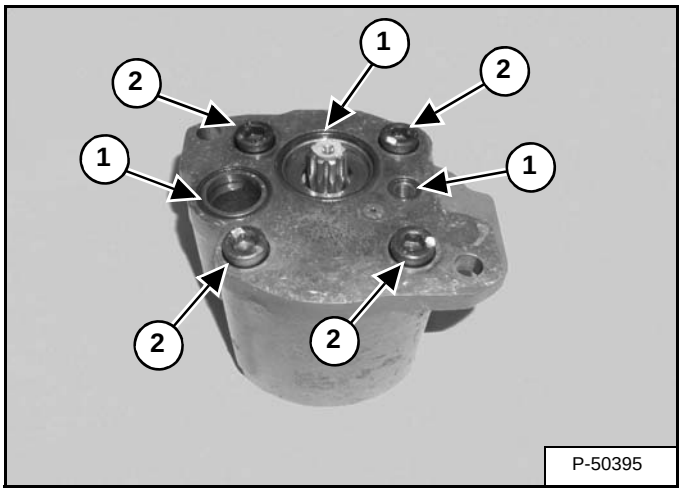
Figure 20-50-30



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.

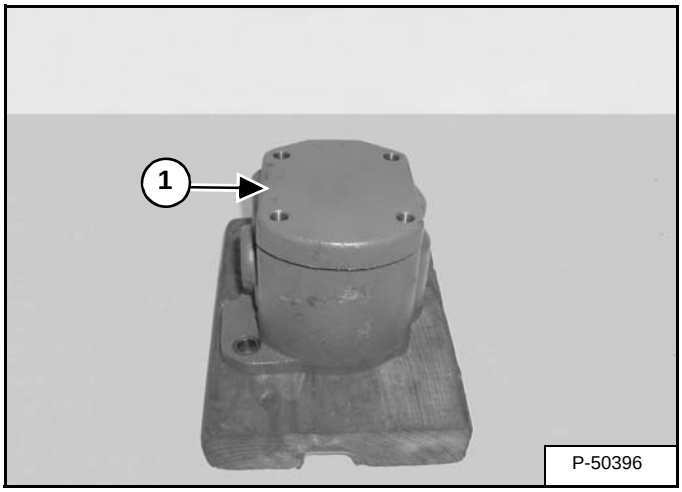
Remove the bolts (Item 2) **[Figure 20-50-30]** and remove the gear pump.

Figure 20-50-31



Remove the O-rings (Item 1) and four bolts (Item 2) **[Figure 20-50-31]**.

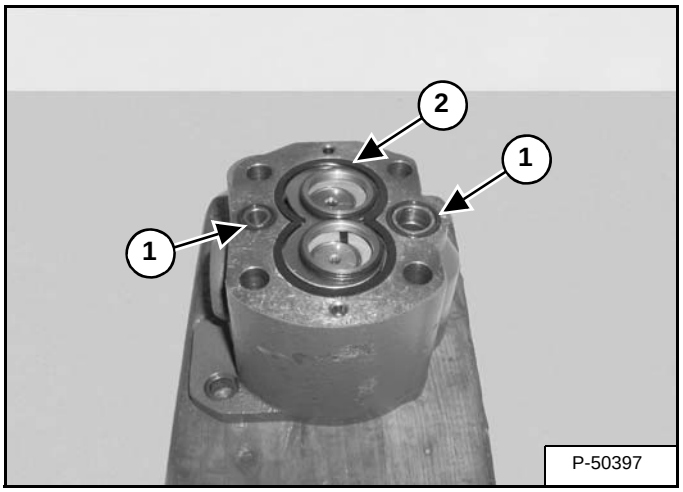
Figure 20-50-32



Turn the pump over and remove the end plate (Item 1) **[Figure 20-50-32]**.

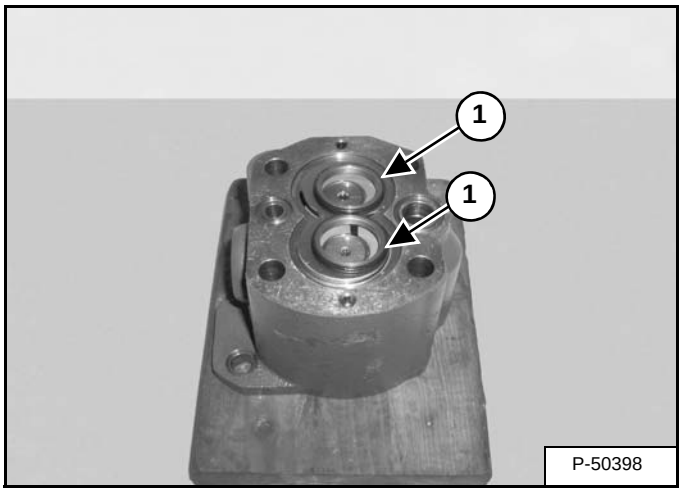
Gear Pump Disassembly (Cont'd)

Figure 20-50-33



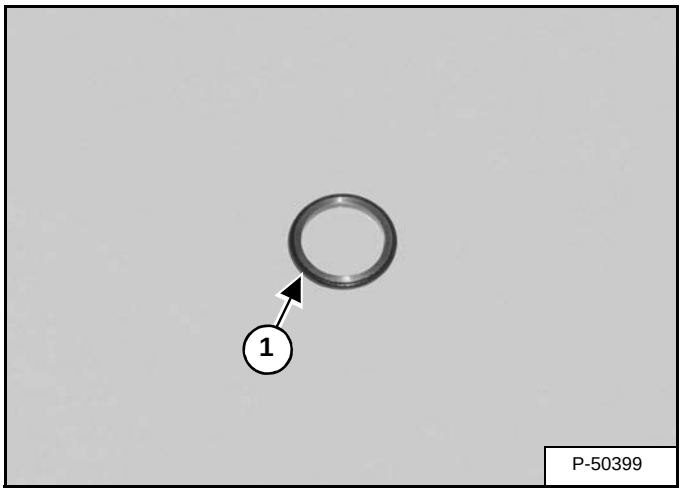
Remove the O-rings (Item 1) and seal (Item 2) **[Figure 20-50-33]** from the pump housing.

Figure 20-50-34



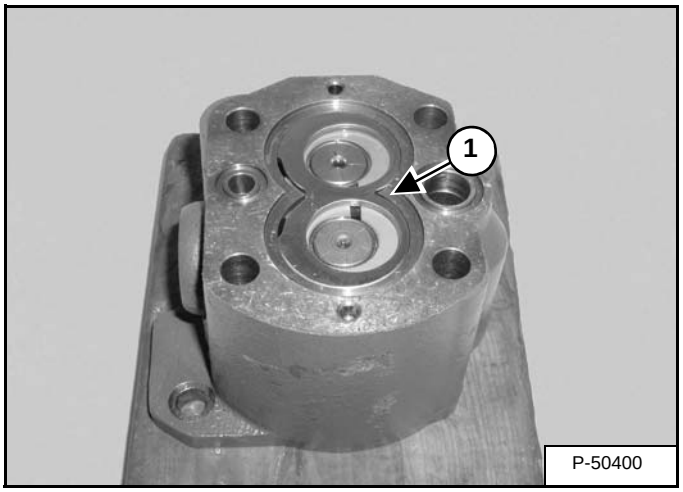
Remove the guides (Item 1) and O-rings from the spacers **[Figure 20-50-34]**.

Figure 20-50-35



Remove the O-ring (Item 1) **[Figure 20-50-35]** from the guide.

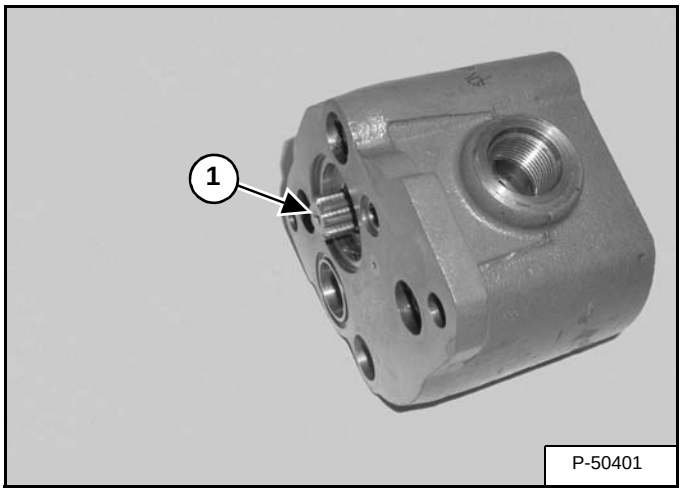
Figure 20-50-36



Remove the spacer (Item 1) **[Figure 20-50-36]**.

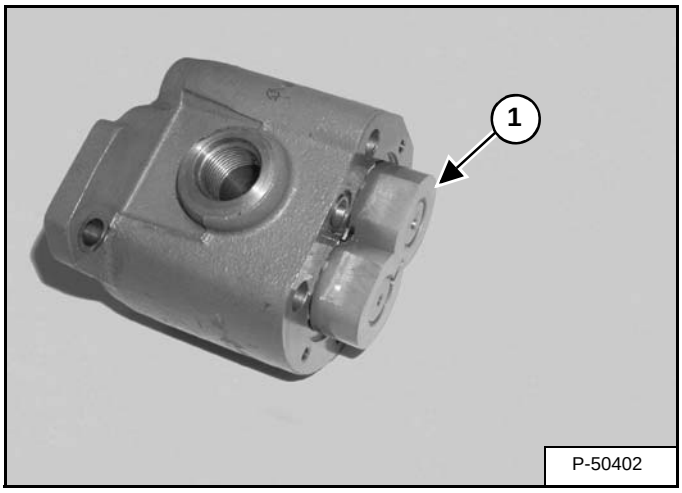
Gear Pump Disassembly (Cont'd)

Figure 20-50-37



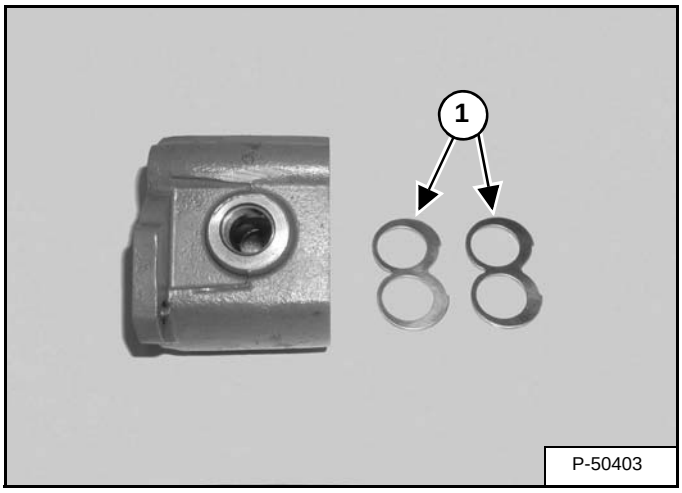
Turn the pump and push in on the shaft (Item 1) **[Figure 20-50-37]**.

Figure 20-50-38



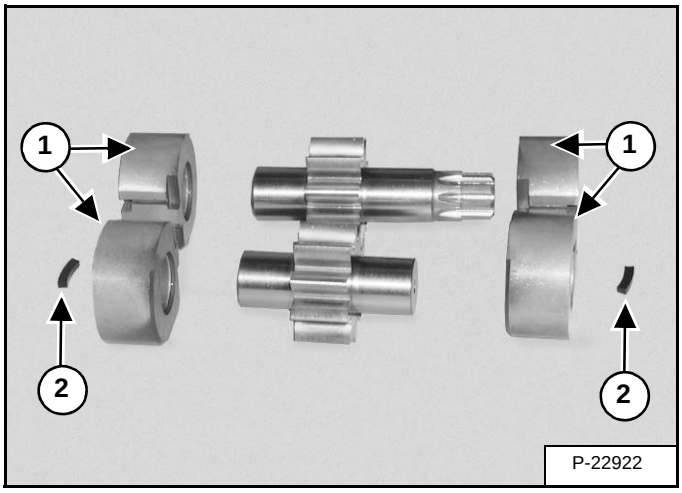
Remove the bearing/gear assembly (Item 1) **[Figure 20-50-38]**.

Figure 20-50-39



Remove the spacers (Item 1) **[Figure 20-50-39]**.

Figure 20-50-40



Remove the bearings (Item 1) and seals (Item 2) **[Figure 20-50-40]** from the gears.

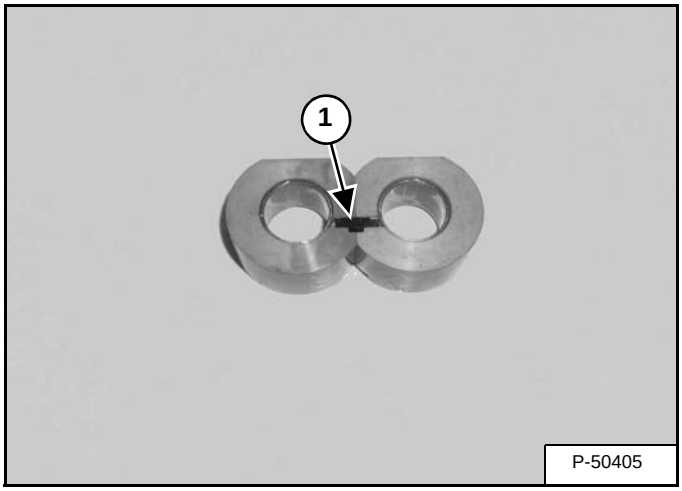
Gear Pump Assembly

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

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

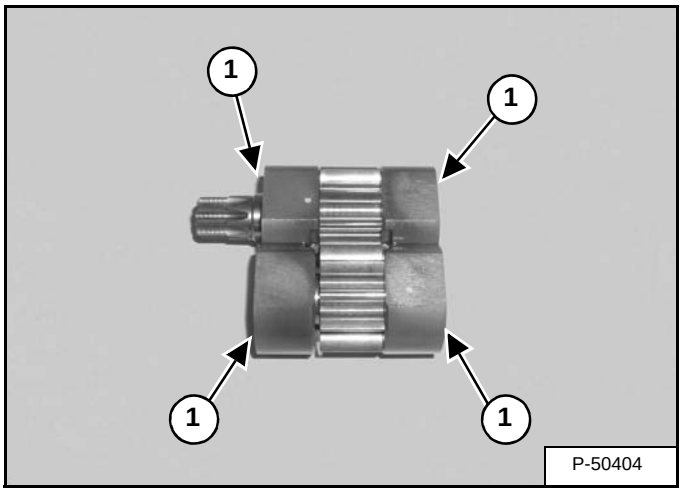
Clean all parts in solvent and dry with compressed air.

Figure 20-50-41



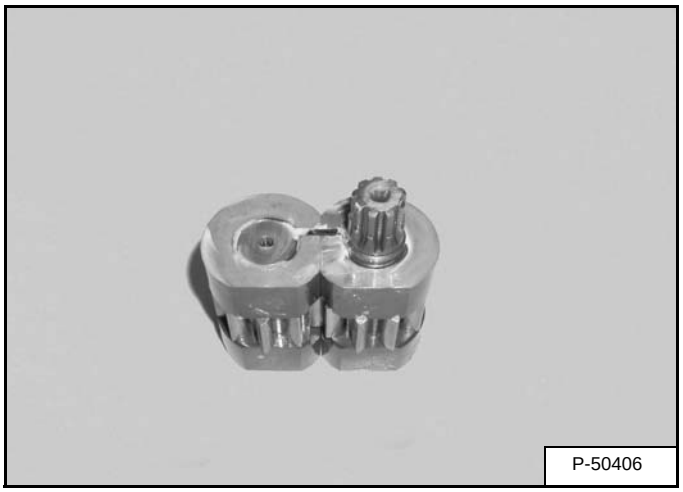
Install the seal (Item 1) **[Figure 20-50-41]** (both sets.)

Figure 20-50-42



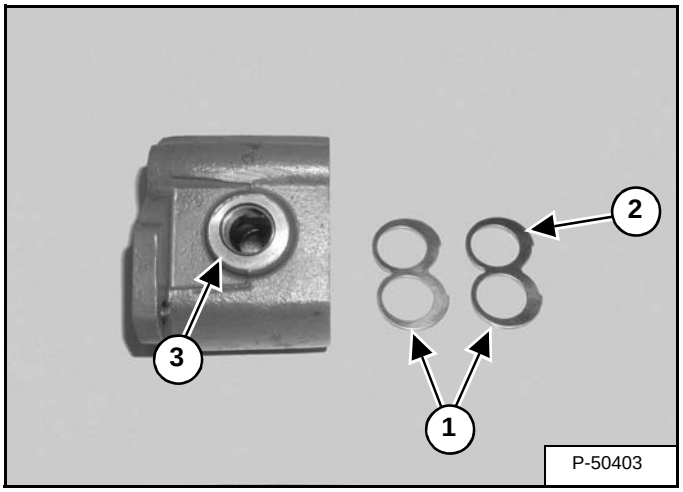
Install the bearings (Item 1) **[Figure 20-50-42]** on the gears.

Figure 20-50-43



Stand the bearing/gear assembly up **[Figure 20-50-43]**.

Figure 20-50-44

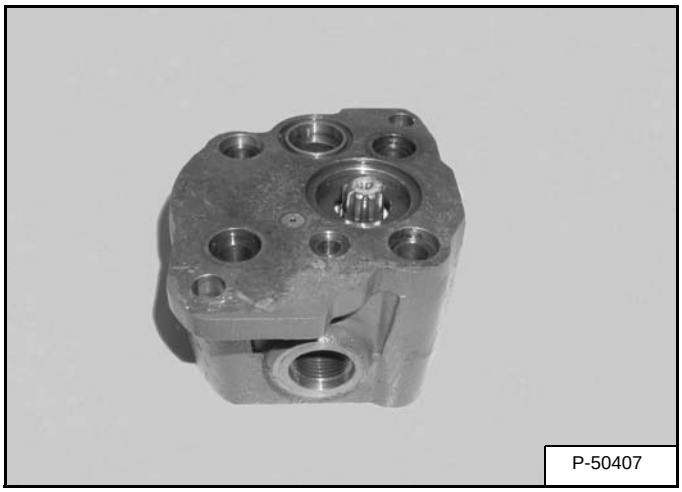


Apply assembly lube to the spacers and install the spacers (Item 1) **[Figure 20-50-44]** into the pump.

NOTE: The cut out area (Item 2) on the spacer is installed toward the outlet port (Item 3) [Figure 20-50-44].

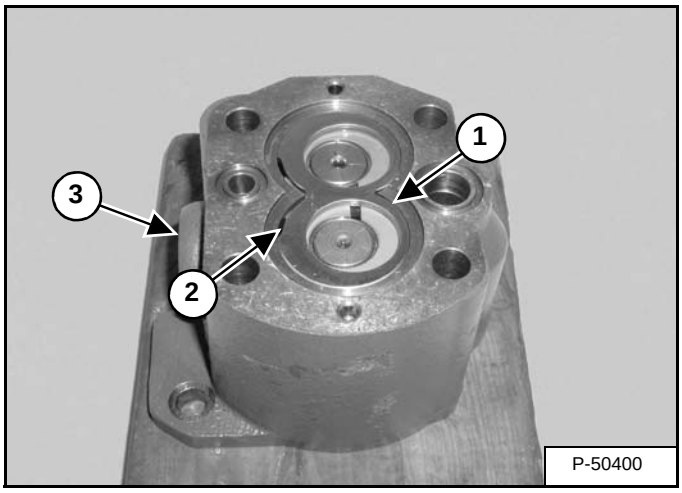
Gear Pump Assembly (Cont'd)

Figure 20-50-45



Install the housing over the bearing/gear assembly **[Figure 20-50-45]**.

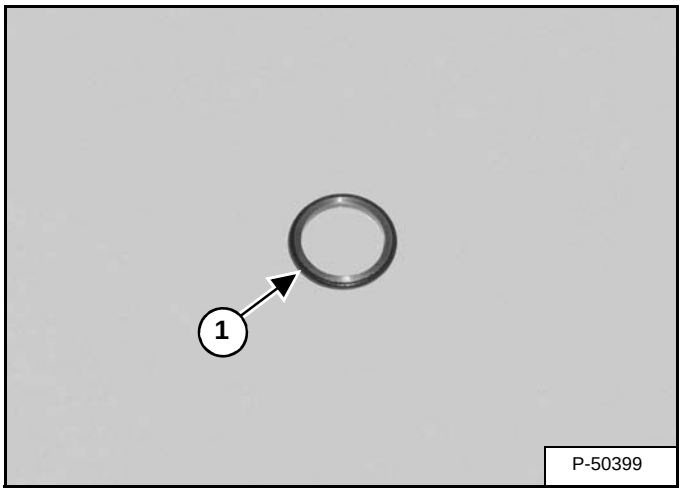
Figure 20-50-46



Turn the pump over and install the spacer (Item 1) **[Figure 20-50-46]**.

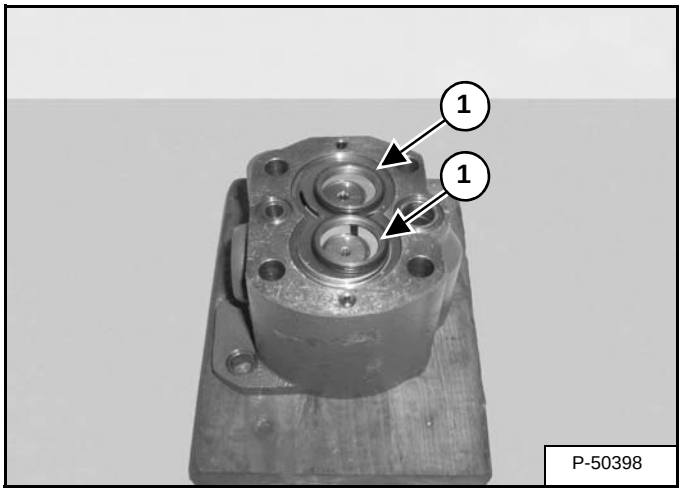
NOTE: The cut out area (Item 2) on the spacer is installed toward the outlet port (Item 3) [Figure 20-50-46].

Figure 20-50-47



Install the O-rings (Item 1) **[Figure 20-50-47]** on the guides.

Figure 20-50-48

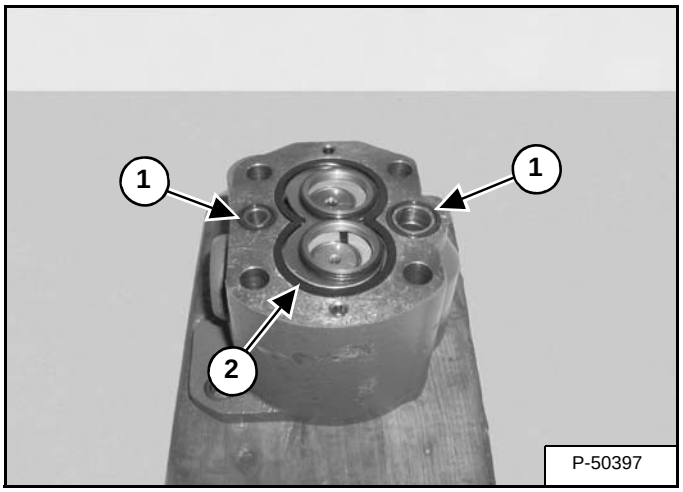


Install the guide/O-ring assembly (Item 1) **[Figure 20-50-48]** into the spacers.

NOTE: The flanges on the guides must face out.

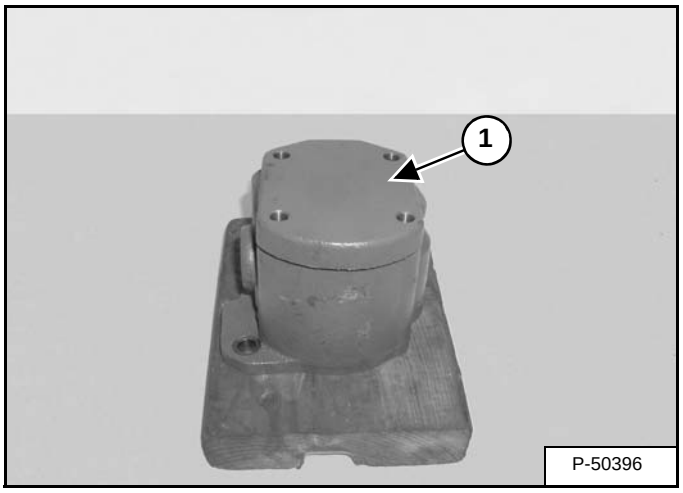
Gear Pump Assembly (Cont'd)

Figure 20-50-49



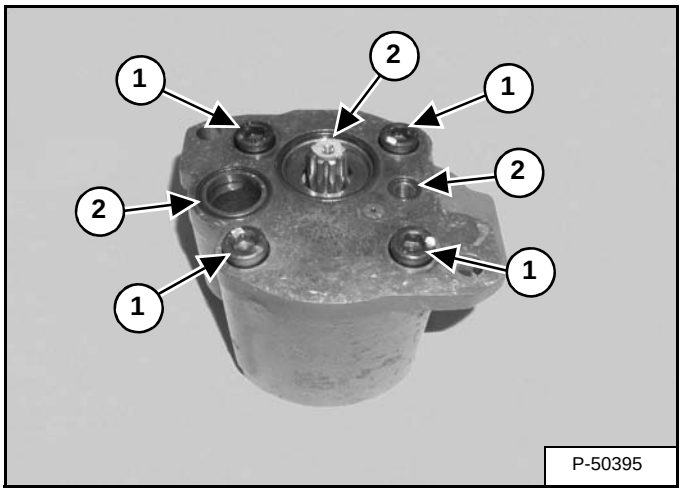
Install the O-rings (Item 1) and the seal (Item 2) **[Figure 20-50-49]** in the pump housing.

Figure 20-50-50



Install the end plate (Item 1) **[Figure 20-50-50]**.

Figure 20-50-51



Turn the pump over and install the four bolts (Item 1) **[Figure 20-50-51]**.

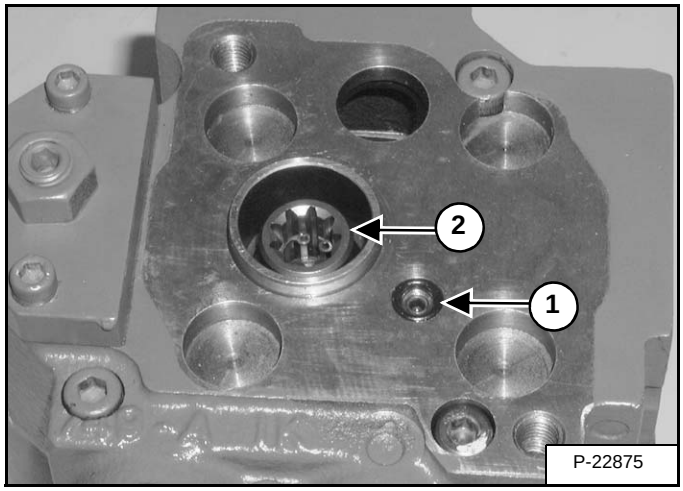
Tighten the bolts to 41 - 47 ft.-lb. (57 - 63 N•m) torque.

Install the O-rings (Item 2) **[Figure 20-50-51]**.

Piston Pump Disassembly

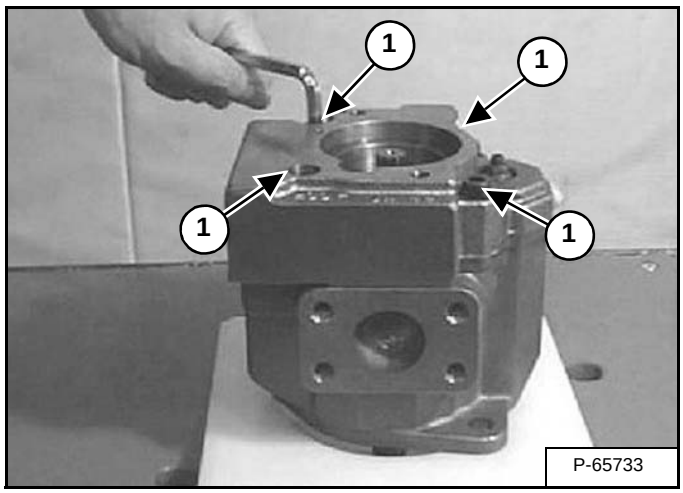
Clean the outside of the pump before disassembly.

Figure 20-50-52



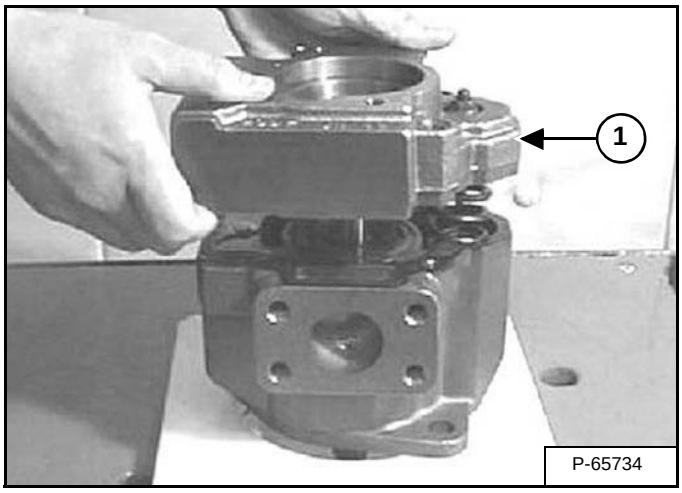
Remove the O-ring (Item 1) and coupler (Item 2) **[Figure 20-50-52]** from the face plate.

Figure 20-50-53



Mark and remove the four bolts (Item 1) **[Figure 20-50-53]**. Note the length and location of each bolt for correct assembly.

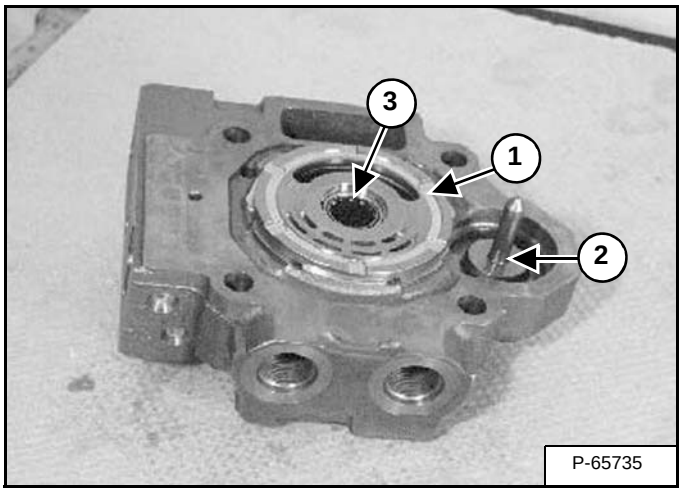
Figure 20-50-54



Remove the face plate (Item 1) **[Figure 20-50-54]** from the pump housing.

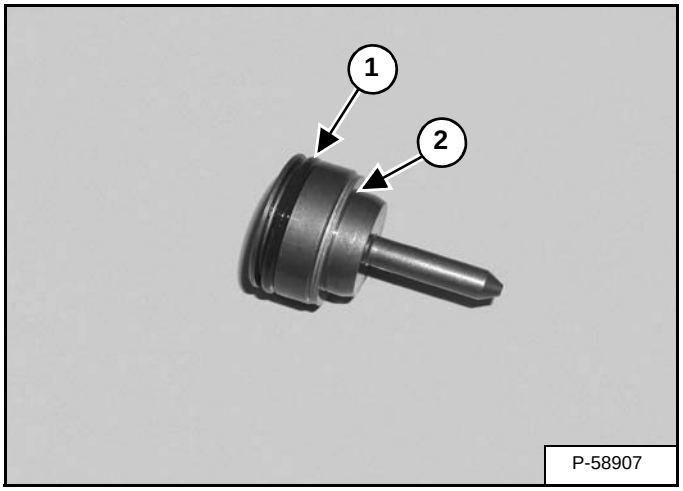
Piston Pump Disassembly (Cont'd)

Figure 20-50-55



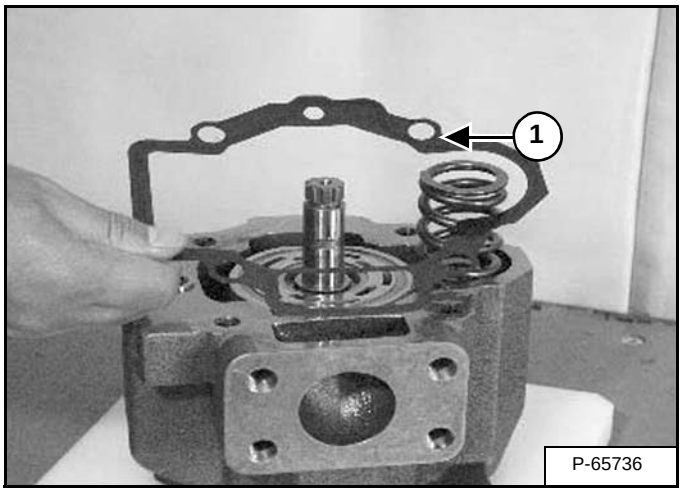
Remove the port plate (Item 1), piston (Item 2) and needle bearing (Item 3) **[Figure 20-50-55]** from the face plate.

Figure 20-50-56



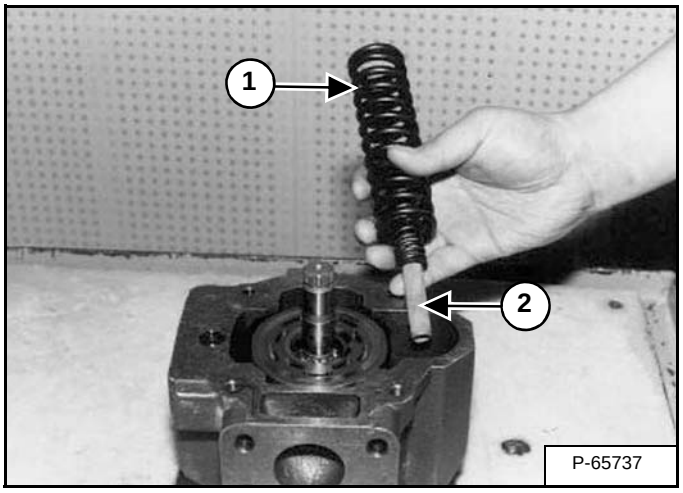
Remove the O-ring (Item 1) and two shims (Item 2) **[Figure 20-50-56]** from the piston.

Figure 20-50-57



Remove the gasket (Item 1) **[Figure 20-50-57]**.

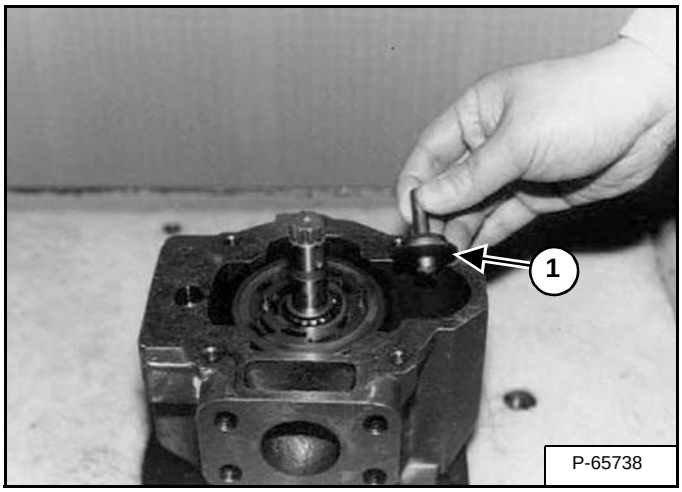
Figure 20-50-58



Remove the springs (Item 1) and spring guide (Item 2) **[Figure 20-50-58]**.

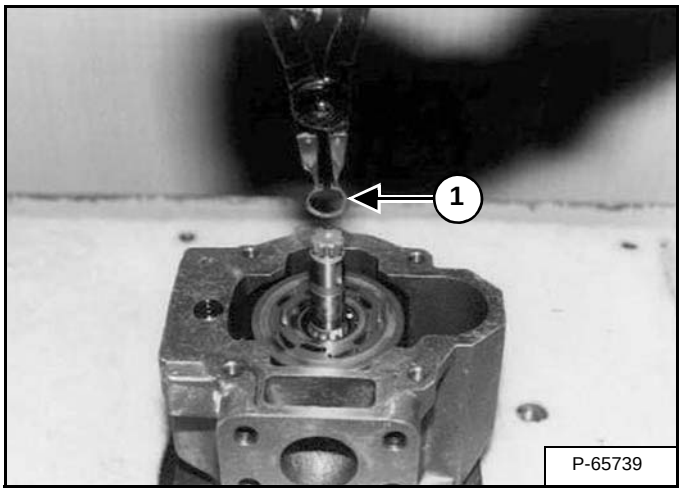
Piston Pump Disassembly (Cont'd)

Figure 20-50-59



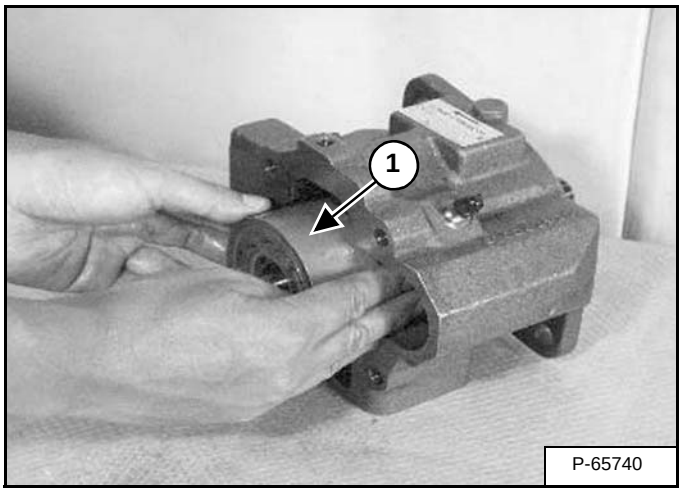
Remove the spring seat (Item 1) **[Figure 20-50-59]**.

Figure 20-50-60



Remove the snap ring (Item 1) **[Figure 20-50-60]**.

Figure 20-50-61

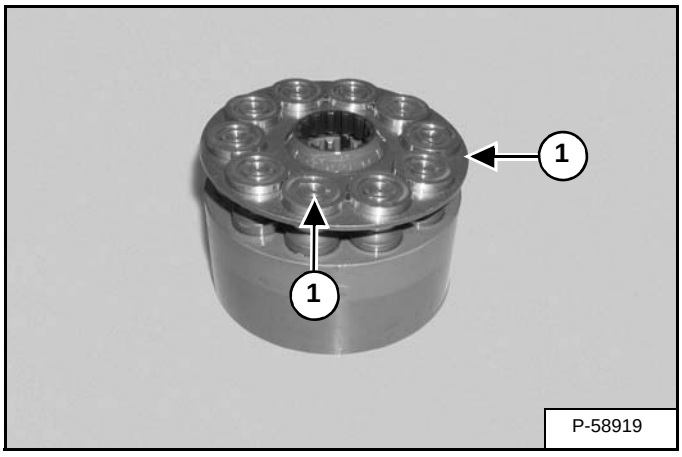


Remove the rotating group (Item 1) **[Figure 20-50-61]**.

NOTE: The following procedure shown is to disassemble the rotating group for inspection only. The rotating group parts cannot be ordered separately and must be ordered as an assembly.

NOTE: Check for scratches or damage on the sliding surfaces.

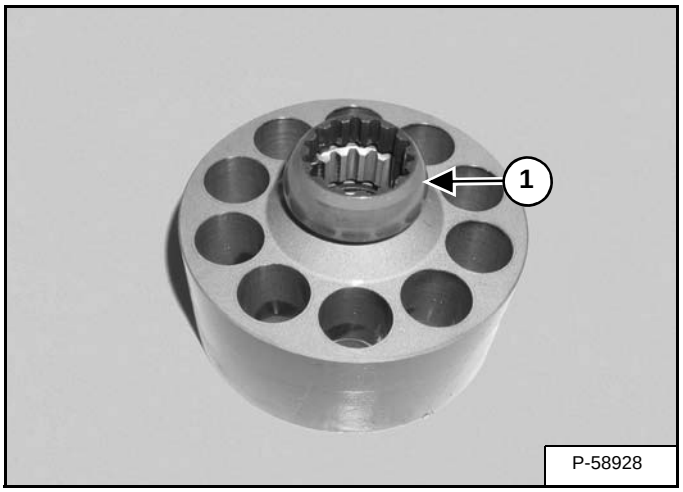
Figure 20-50-62



Remove the retainer plate (Item 1) and pistons (Item 2) **[Figure 20-50-62]** from the cylinder block.

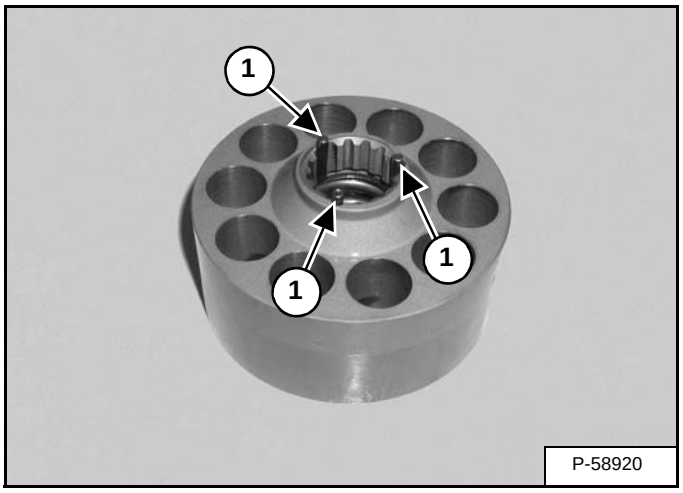
Piston Pump Disassembly (Cont'd)

Figure 20-50-63



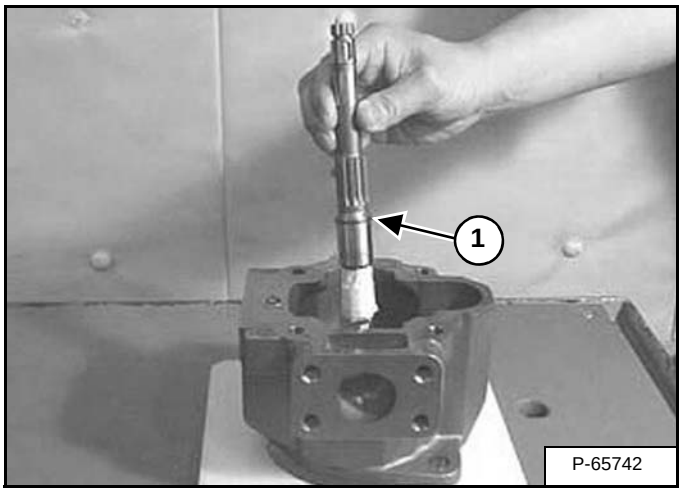
Remove the retainer (Item 1) **[Figure 20-50-63]**.

Figure 20-50-64



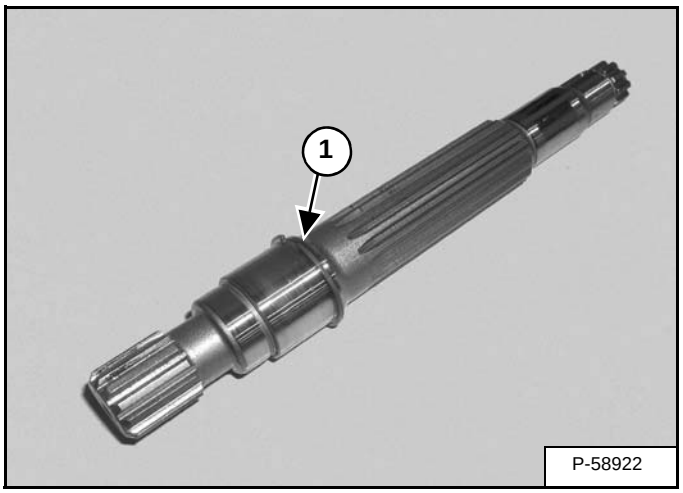
Remove and inspect the pins (Item 1) **[Figure 20-50-64]** for wear or damage.

Figure 20-50-65



Place tape around the shaft splines as shown to protect the seal and remove the shaft (Item 1) **[Figure 20-50-65]** from the pump housing.

Figure 20-50-66

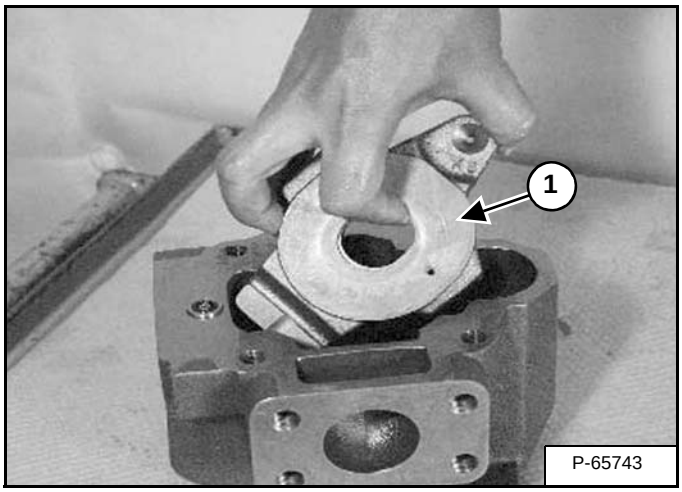


Remove the snap ring (Item 1) **[Figure 20-50-66]** from the shaft.

NOTE: Inspect the shaft for damage or wear. Replace shaft if damaged or worn.

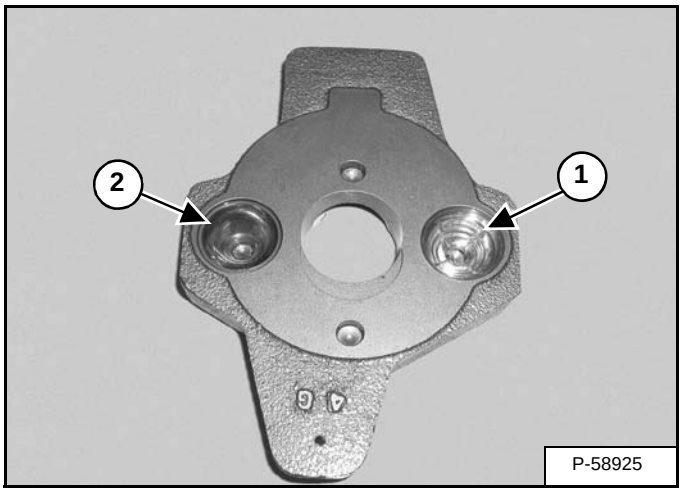
Piston Pump Disassembly (Cont'd)

Figure 20-50-67



Remove the swash plate (Item 1) **[Figure 20-50-67]**.

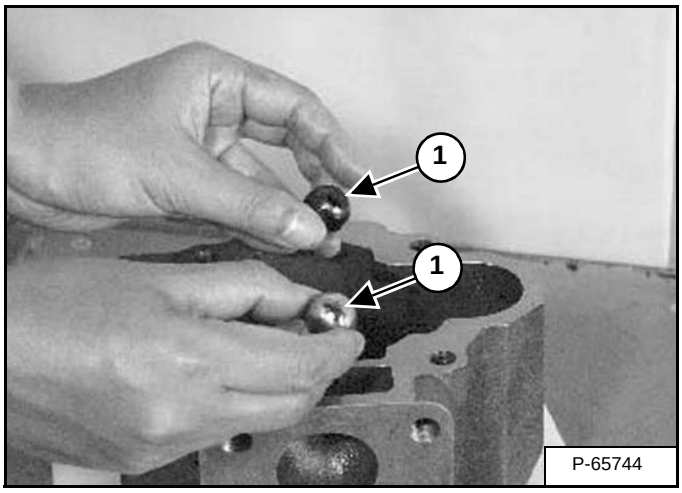
Figure 20-50-68



Remove the brass guide seat (Item 1) and steel guide seat (Item 2) **[Figure 20-50-68]** from the swash plate.

NOTE: Mark the location of each guide for correct assembly.

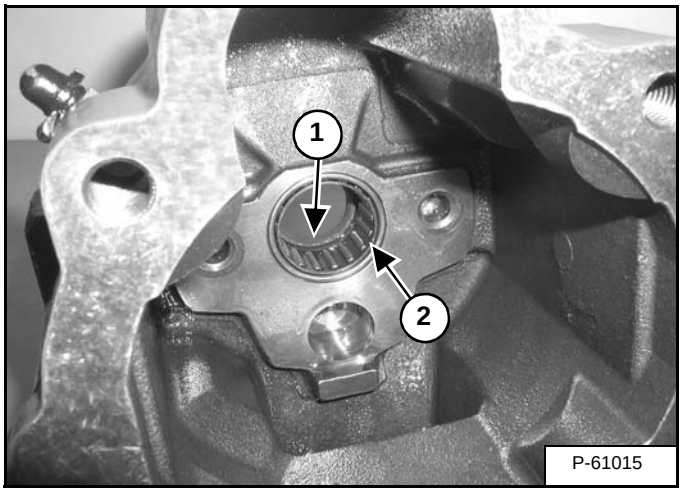
Figure 20-50-69



Remove the guides (Item 1) **[Figure 20-50-69]** from the pump housing.

NOTE: Mark the location of each guide for correct assembly.

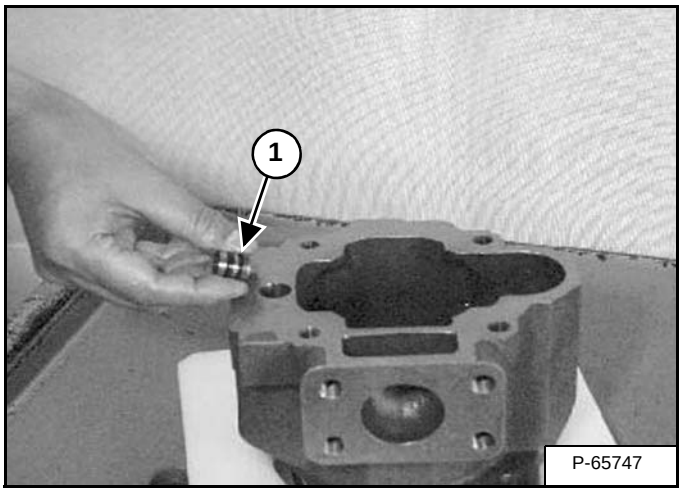
Figure 20-50-70



Remove the seal (Item 1) and bearing (Item 2) **[Figure 20-50-70]**.

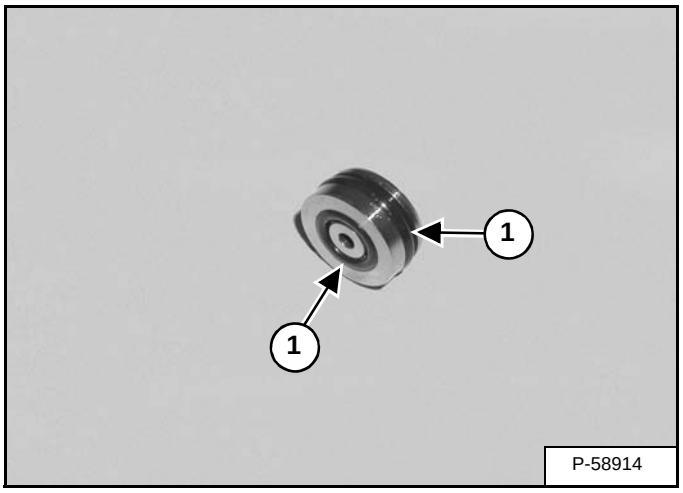
Piston Pump Disassembly (Cont'd)

Figure 20-50-71



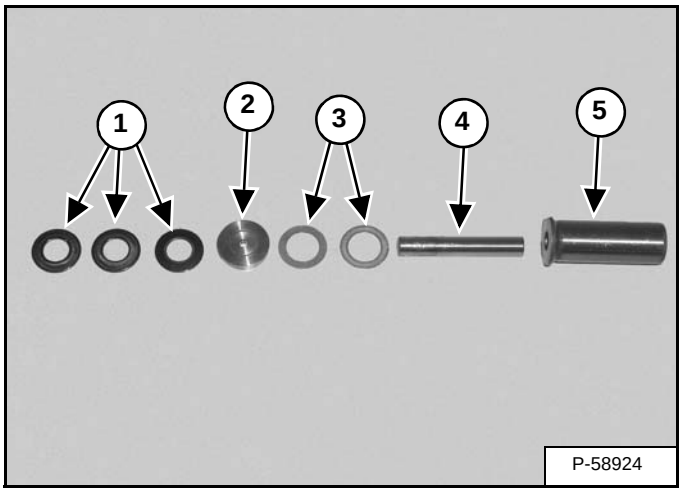
Remove the piston (Item 1) **[Figure 20-50-72]**.

Figure 20-50-72



Remove the two O-rings (Item 1) **[Figure 20-50-72]**.

Figure 20-50-73



Remove the three coned disc springs (Item 1), spacer (Item 2), shims (Item 3), parallel pin (Item 4) and sleeve (Item 5) **[Figure 20-50-73]**.

Piston Pump Assembly

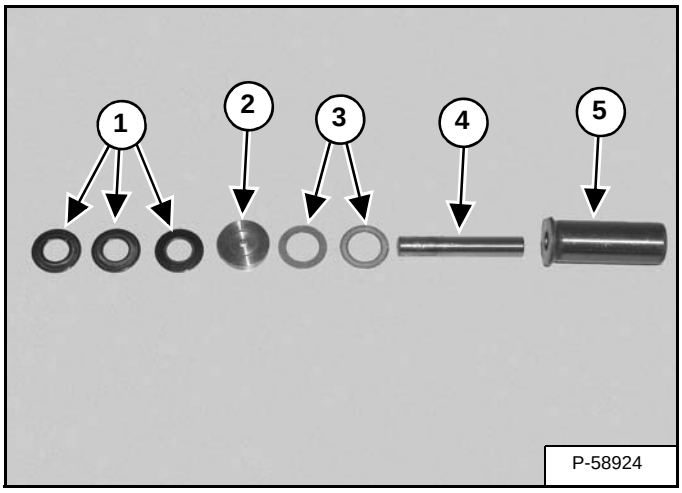
Clean all parts in solvent and dry with compressed air. Do not use compressed air to dry the bearings.

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

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

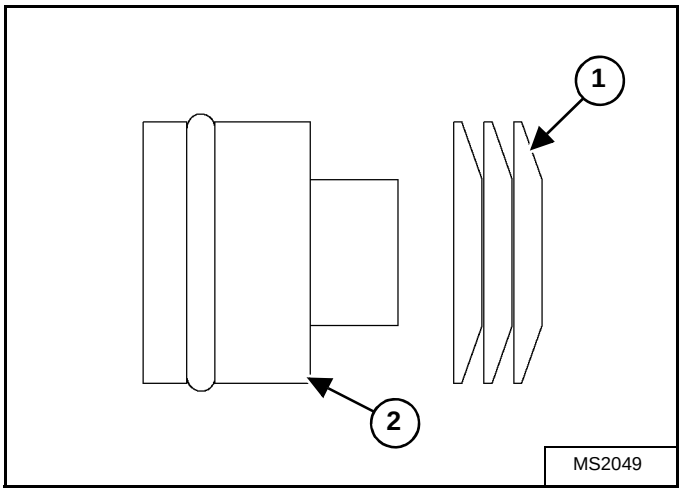
Apply a thin coat of hydraulic fluid to all components before assembly.

Figure 20-50-74



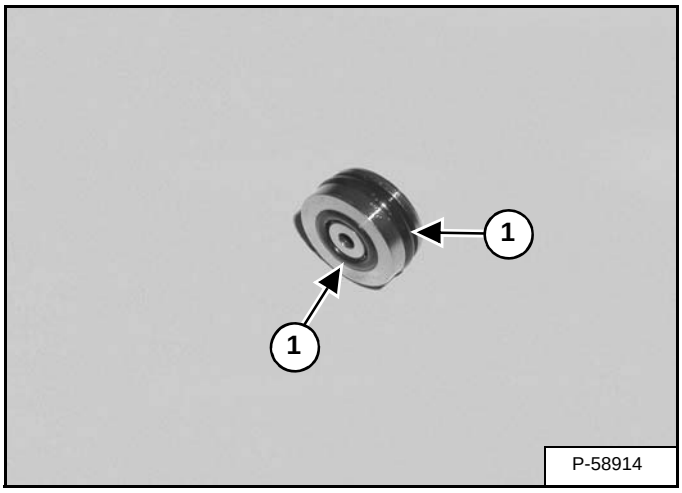
Assemble the three coned disc springs (Item 1), spacer (Item 2), shims (Item 3), parallel pin (Item 4) and sleeve (Item 5) **[Figure 20-50-74]** and install in the housing.

Figure 20-50-75



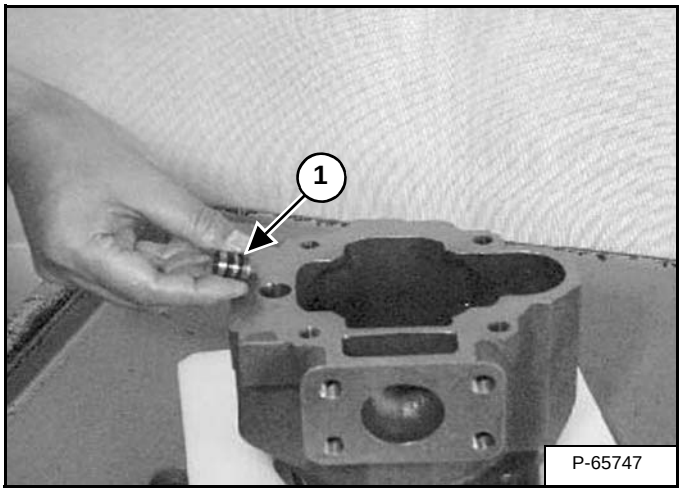
The three coned disc springs (Item 1) must face the piston (Item 2) **[Figure 20-50-75]** as shown.

Figure 20-50-76



Install the two O-rings (Item 1) **[Figure 20-50-76]**.

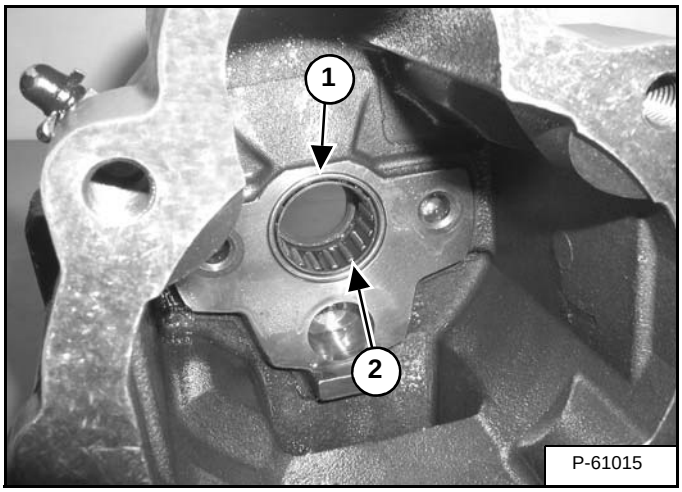
Figure 20-50-77



Install the piston (Item 1) **[Figure 20-50-77]**.

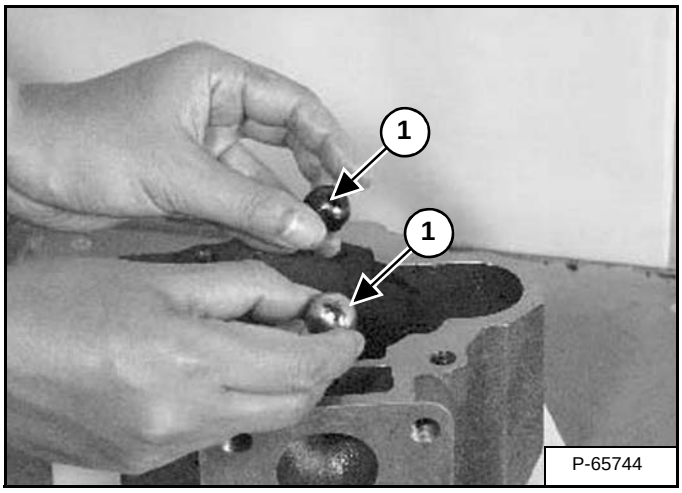
Piston Pump Assembly (Cont'd)

Figure 20-50-78



Install the bearing (Item 1) and seal (Item 2) **[Figure 20-50-78]** in the pump housing.

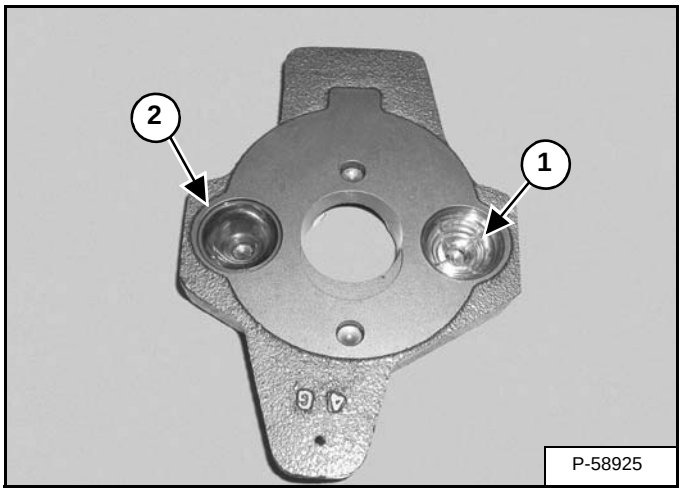
Figure 20-50-79



Install the guides (Item 1) **[Figure 20-50-79]** in the locations noted during disassembly.

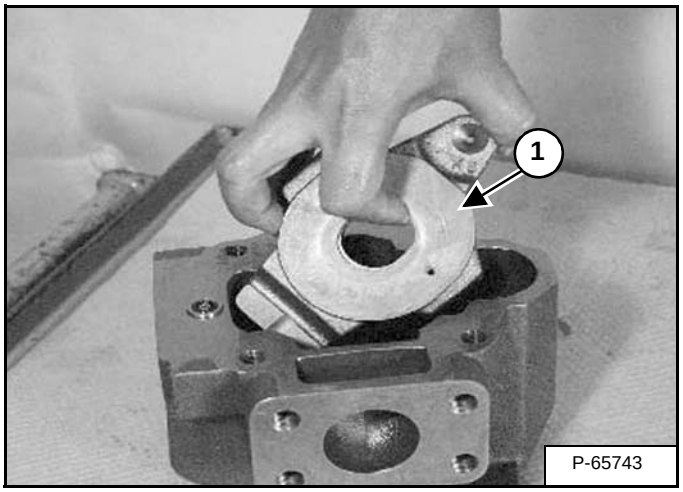
NOTE: Apply assembly lube to the shim for ease of assembly.

Figure 20-50-80



Install the brass guide seat (Item 1) and steel guide seat (Item 2) **[Figure 20-50-80]** in the pump housing.

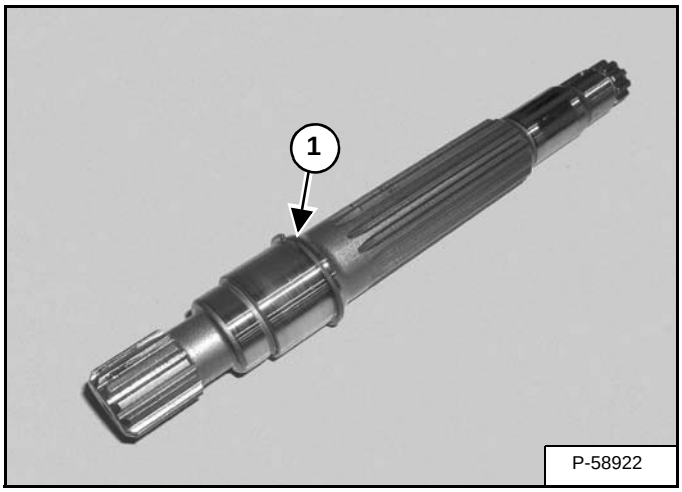
Figure 20-50-81



Install the swash plate (Item 1) **[Figure 20-50-81]** in the pump housing.

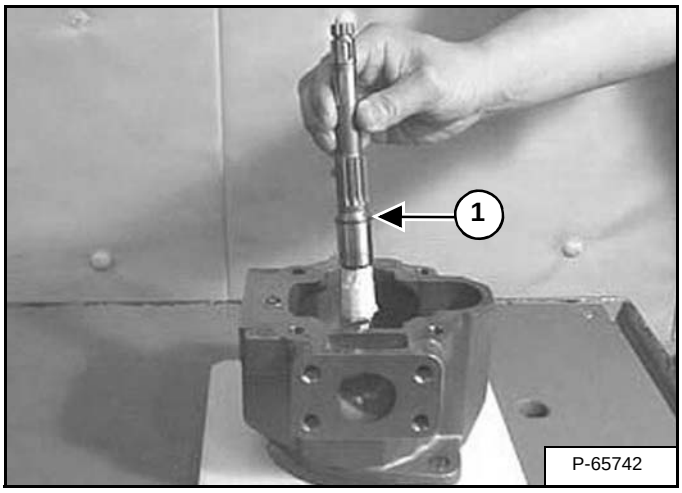
Piston Pump Assembly (Cont'd)

Figure 20-50-82



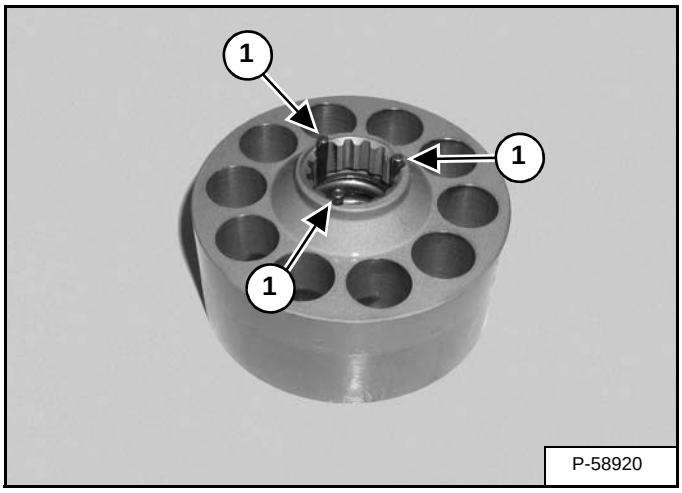
Install the snapring (Item 1) **[Figure 20-50-82]** on the shaft.

Figure 20-50-83



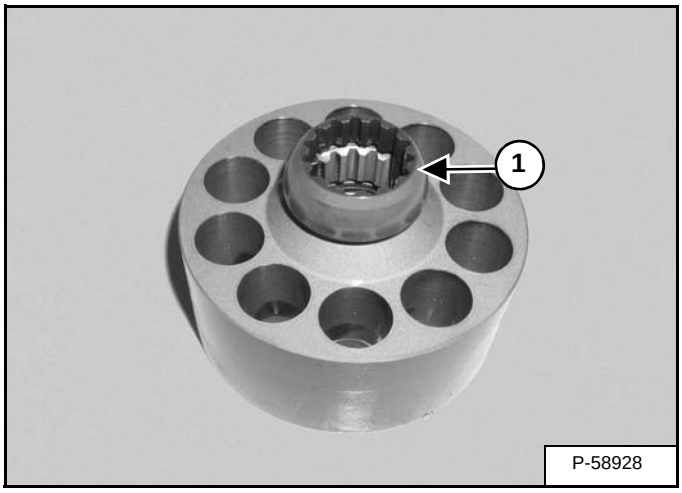
Place tape around the shaft splines as shown to protect the seal and install the shaft (Item 1) **[Figure 20-50-83]** in the pump housing.

Figure 20-50-84



Install the pins (Item 1) **[Figure 20-50-84]**.

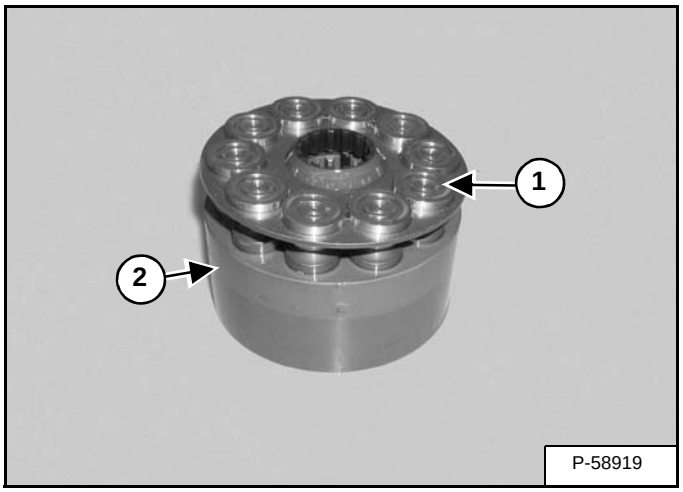
Figure 20-50-85



Install the retainer (Item 1) **[Figure 20-50-85]** on the pins.

Piston Pump Assembly (Cont'd)

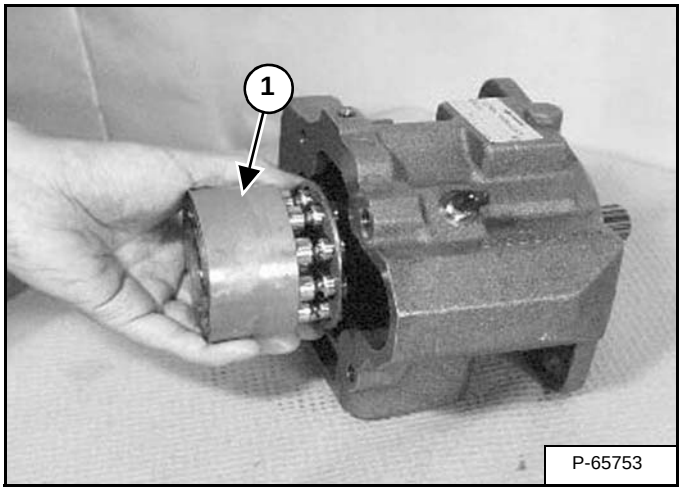
Figure 20-50-86



Install the retainer and piston assembly (Item 1) in the cylinder block (Item 2) **[Figure 20-50-86]**.

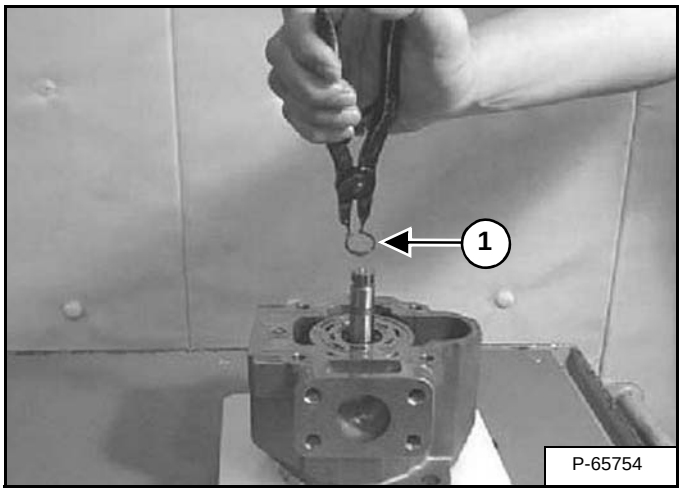
NOTE: It is NOT important that the pistons are installed in their original positions.

Figure 20-50-87



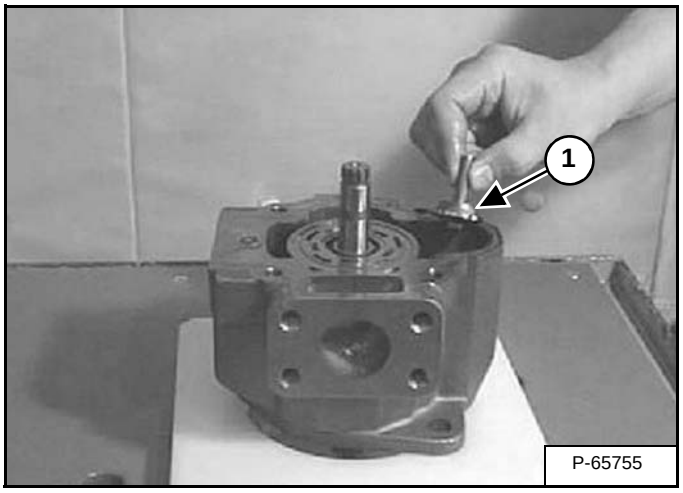
Lay the pump housing on its side and install the rotary group (Item 1) **[Figure 20-50-87]**.

Figure 20-50-88



Install the snap ring (Item 1) **[Figure 20-50-88]**.

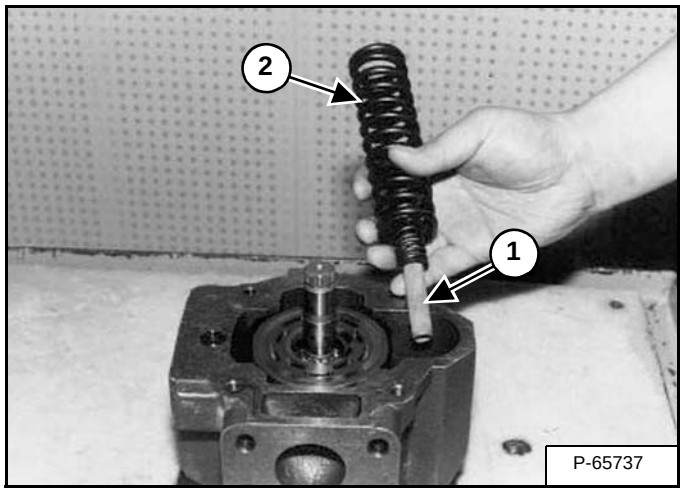
Figure 20-50-89



Install the spring seat (Item 1) **[Figure 20-50-89]**.

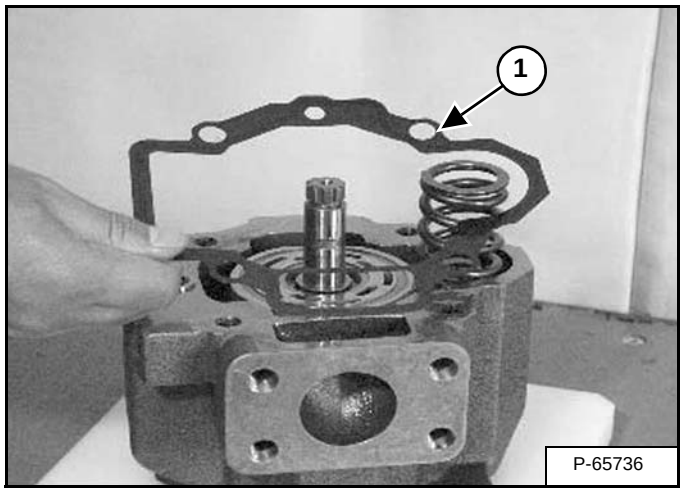
Piston Pump Assembly (Cont'd)

Figure 20-50-90



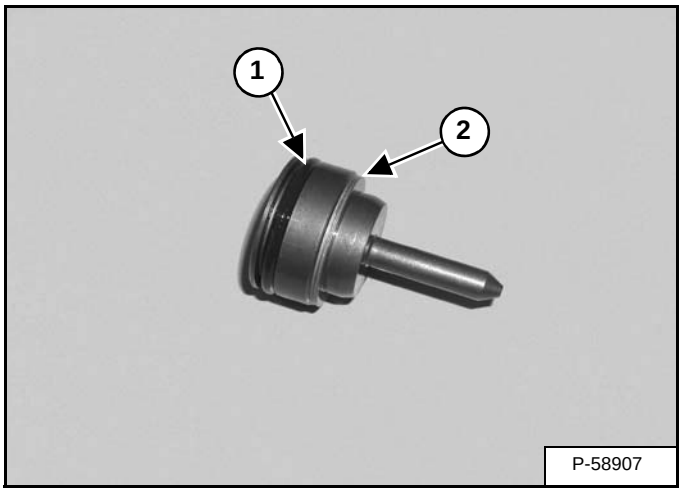
Install the spring guide (Item 1) and spring (Item 2) **[Figure 20-50-90]**.

Figure 20-50-91



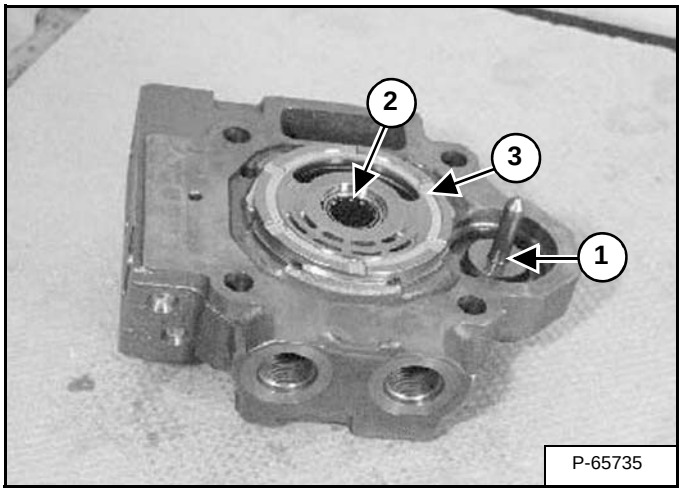
Install the gasket (Item 1) **[Figure 20-50-91]**.

Figure 20-50-92



Install the O-ring (Item 1) and two shims (Item 2) **[Figure 20-50-92]** on the piston.

Figure 20-50-93

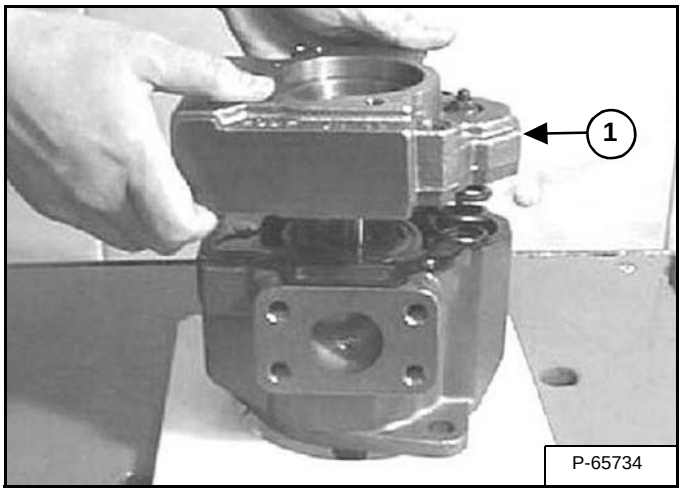


Install the piston (Item 1) and needle bearing (Item 2) **[Figure 20-50-93]**.

Apply assembly grease on the port plate (Item 3) **[Figure 20-50-93]** and install.

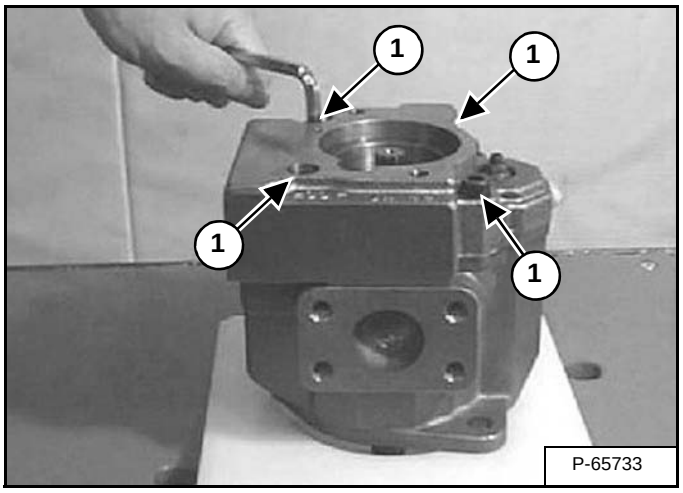
Piston Pump Assembly (Cont'd)

Figure 20-50-94



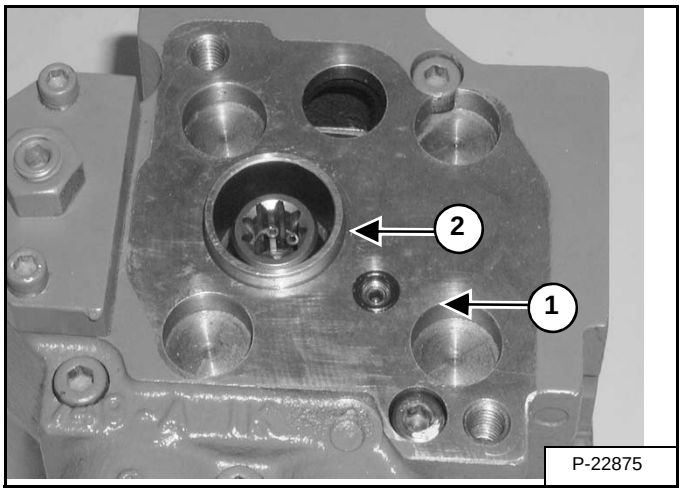
Install the face plate (Item 1) **[Figure 20-50-94]** on the pump housing.

Figure 20-50-95



Install the four bolts (Item 1) **[Figure 20-50-95]** in the location noted during disassembly and tighten the bolts to 41 - 51 ft.-lb. (55 - 69 N•m) torque.

Figure 20-50-96



Install the O-ring (Item 1) and coupler (Item 2) **[Figure 20-50-96]** on the face plate.

Piston Pump Assembly (Cont'd)

Figure 20-50-97

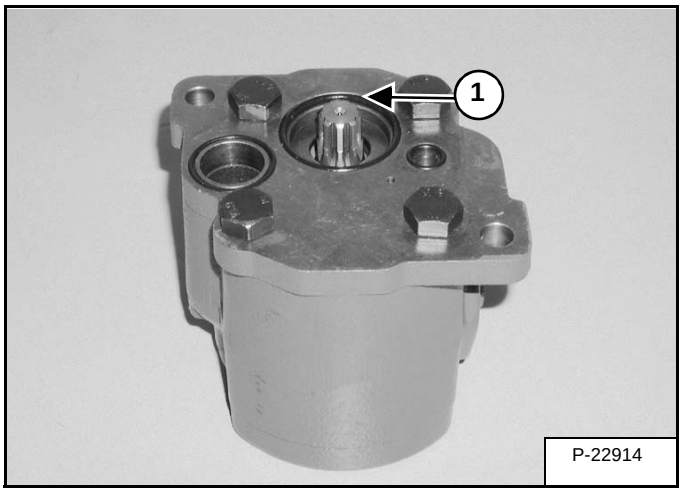
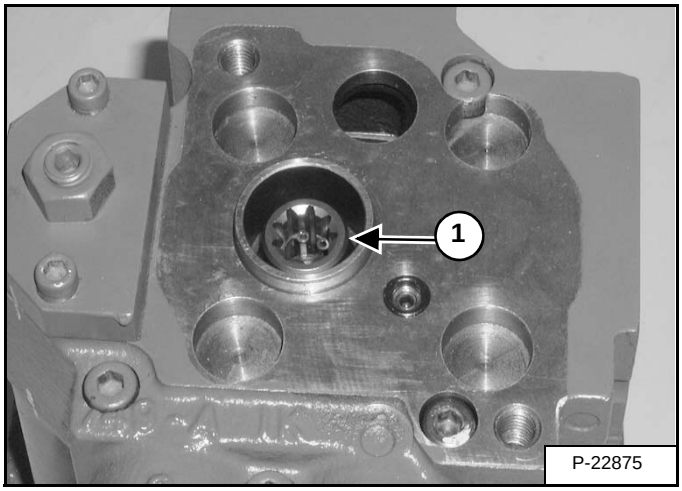
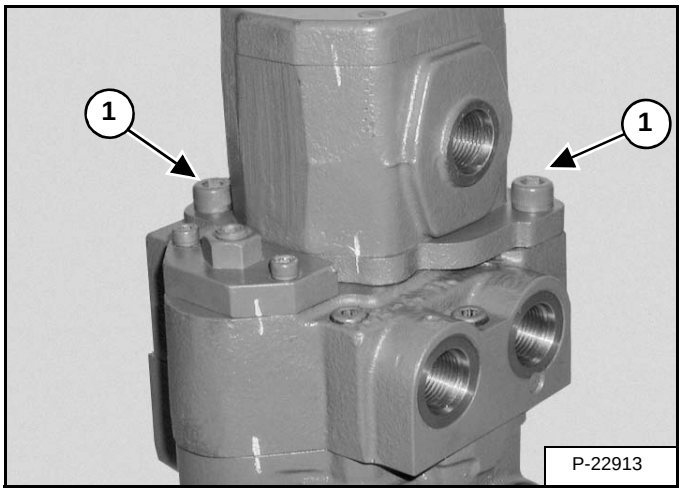


Figure 20-50-98



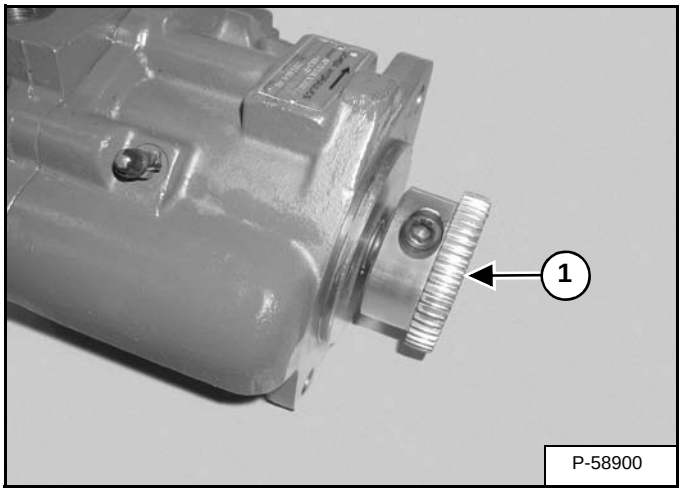
Align the splines on the gear pump shaft (Item 1) **[Figure 20-50-97]** with the splines in the coupler (Item 1) **[Figure 20-50-98]** and install the gear pump on the piston pump.

Figure 20-50-99



Install the two bolts (Item 1) **[Figure 20-50-99]**. Tighten the bolts to 41 - 51 ft.-lb. (55 - 69 N•m) torque.

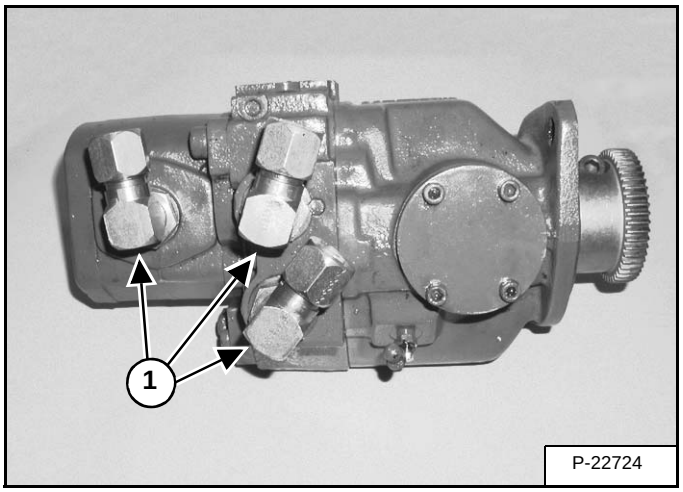
Figure 20-50-100



Install the coupler (Item 1) **[Figure 20-50-100]** on the pump. (See Coupler Removal And Installation on Page 20-50-9.)

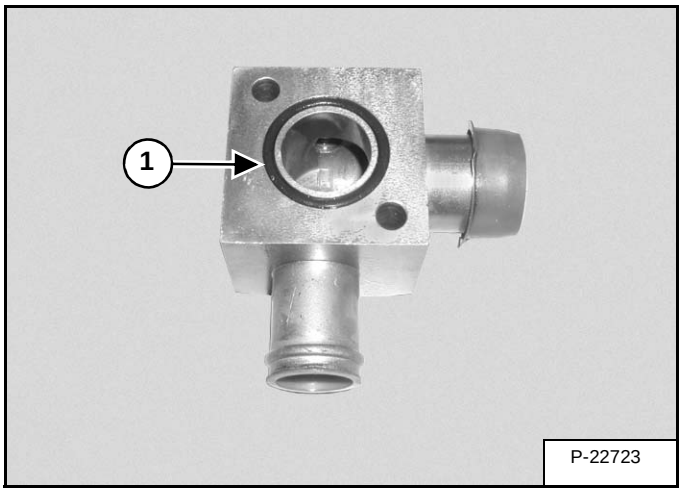
Piston Pump Assembly (Cont'd)

Figure 20-50-101



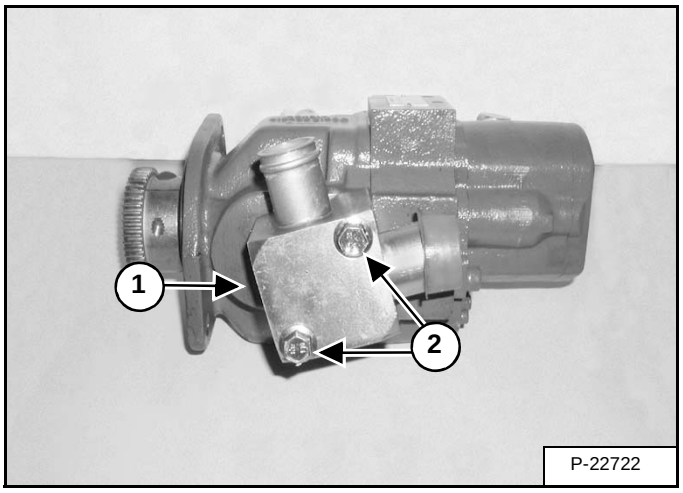
Install the fittings (Item 1) **[Figure 20-50-101]**.

Figure 20-50-102



Install the O-ring (Item 1) **[Figure 20-50-102]** in the fitting.

Figure 20-50-103



Install the fitting (Item 1) and bolts (Item 2) **[Figure 20-50-103]**.

Tighten the bolts to 55 - 60 ft.-lb. (75 - 85 N•m) torque.


Bobcat®

MANIFOLD ASSEMBLY/ ACCUMULATOR

Description

The manifold body contains three valves, the pressure reducing valve, main relief valve and build up valve.

The manifold supplies 428 PSI (29,5 bar) 406 - 450 PSI (28 - 31 bar) 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.

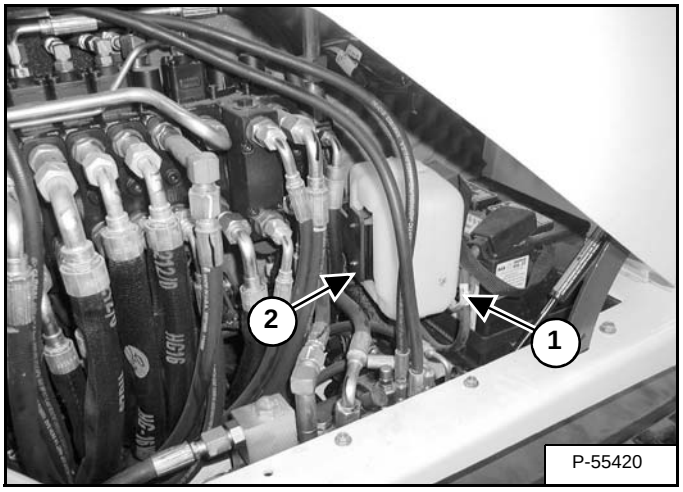
Removal And Installation

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

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

Remove the right side cover. (See Removal And Installation on Page 40-200-1.)

Figure 20-60-1



For models equipped with a windshield washer, lift up on the windshield washer fluid reservoir (Item 1) and remove the reservoir from the bracket (Item 2) **[Figure 20-60-1]**. Reposition the reservoir away from the manifold assembly.

Remove the battery. (See Removing And Installing The Battery on Page 50-20-2.)

IMPORTANT

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

I-2003-0888

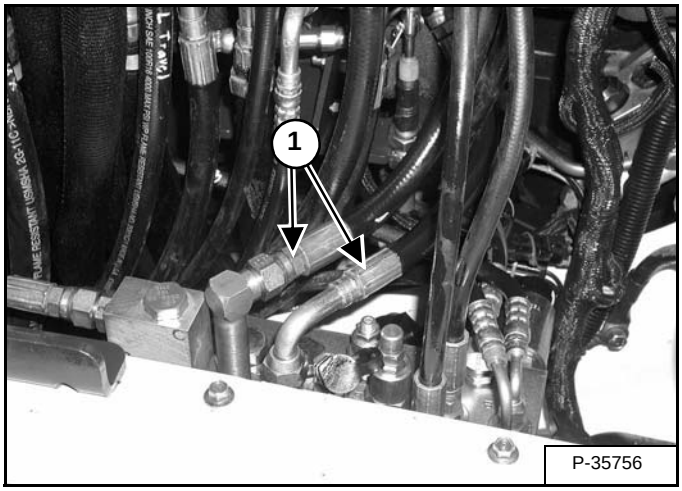
Mark the hoses for correct installation.

⚠ WARNING

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

W-2145-0290

Figure 20-60-2

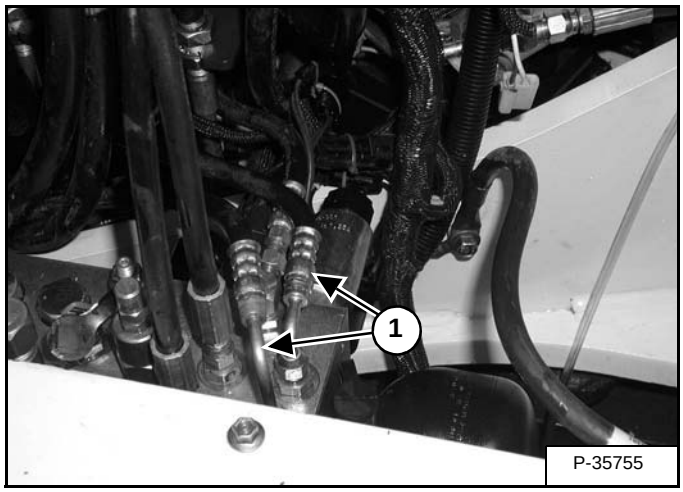


Remove the hoses (Item 1) **[Figure 20-60-2]**.

MANIFOLD ASSEMBLY/ ACCUMULATOR (CONT'D)

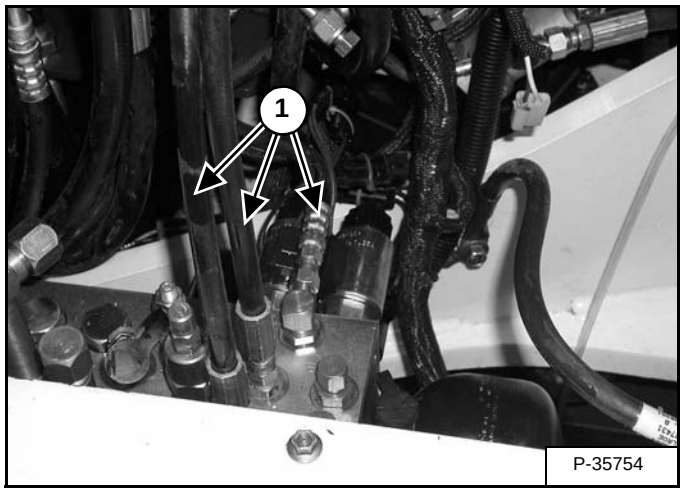
Removal And Installation (Cont'd)

Figure 20-60-3



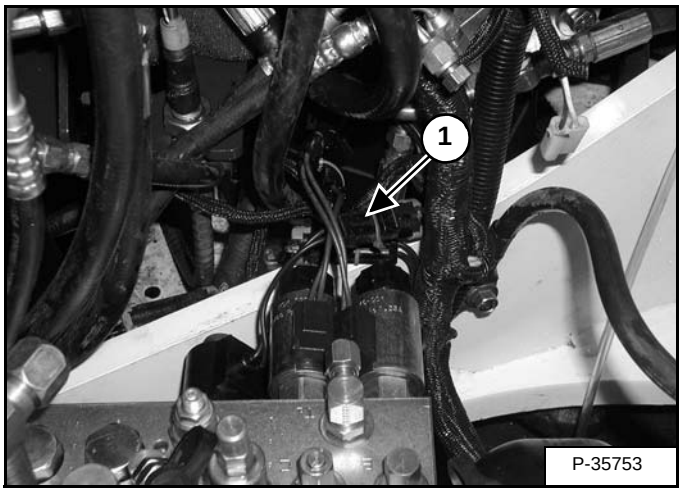
Remove the hoses (Item 1) **[Figure 20-60-3]**.

Figure 20-60-4



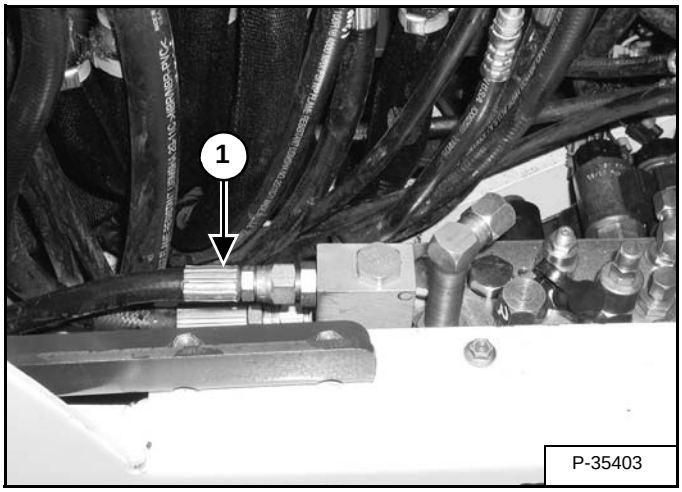
Remove the hoses (Item 1) **[Figure 20-60-4]**.

Figure 20-60-5



Disconnect the five electrical connectors (Item 1) **[Figure 20-60-5]**.

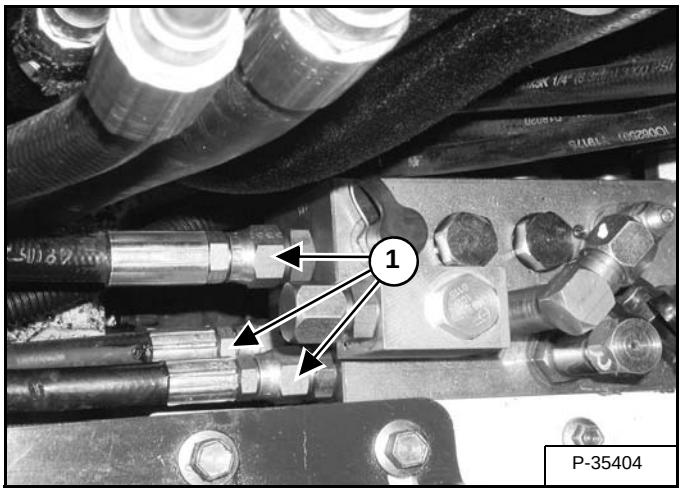
Figure 20-60-6



Remove the hose (Item 1) **[Figure 20-60-6]**.

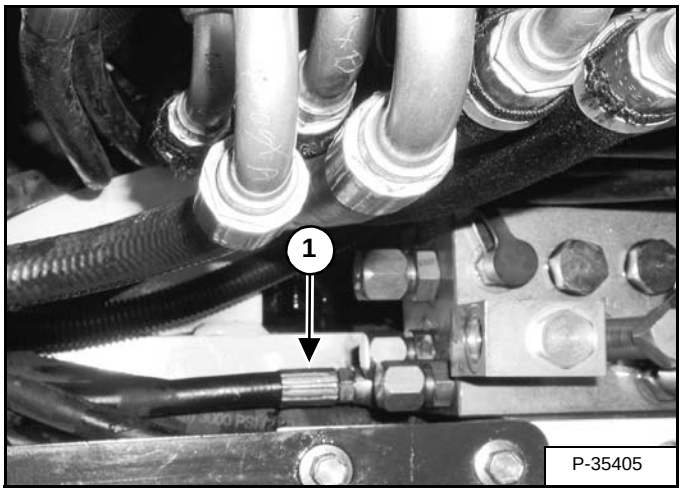
Removal And Installation (Cont'd)

Figure 20-60-7



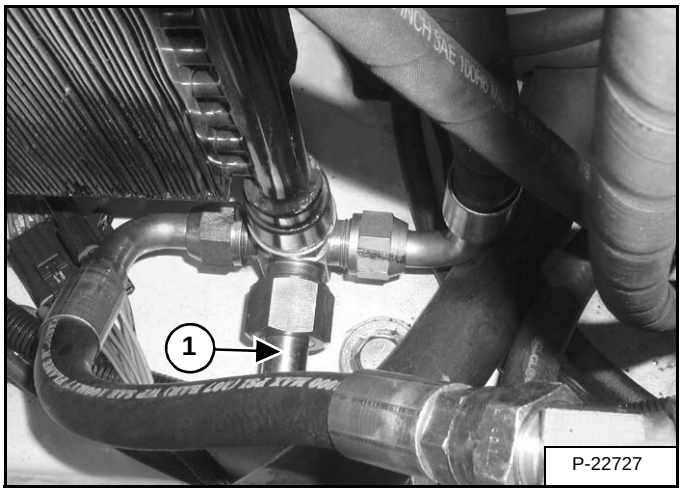
Remove the hoses (Item 1) **[Figure 20-60-7]**.

Figure 20-60-8



Remove the hose (Item 1) **[Figure 20-60-8]**.

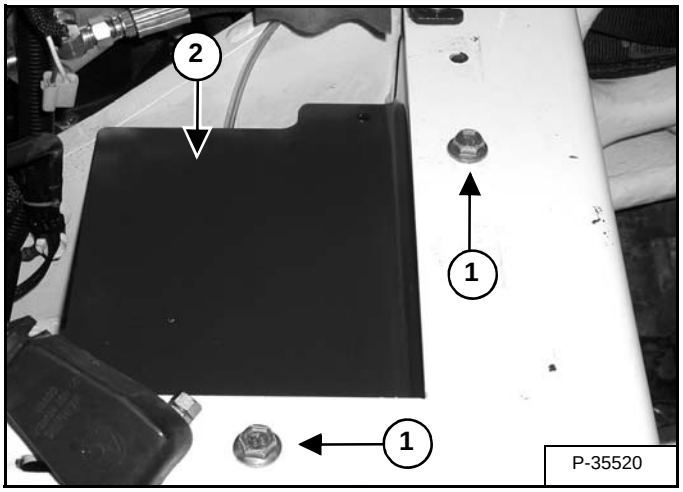
Figure 20-60-9



Remove the hose (Item 1) **[Figure 20-60-9]** from the oil cooler.

NOTE: The hose will be removed with the manifold.

Figure 20-60-10

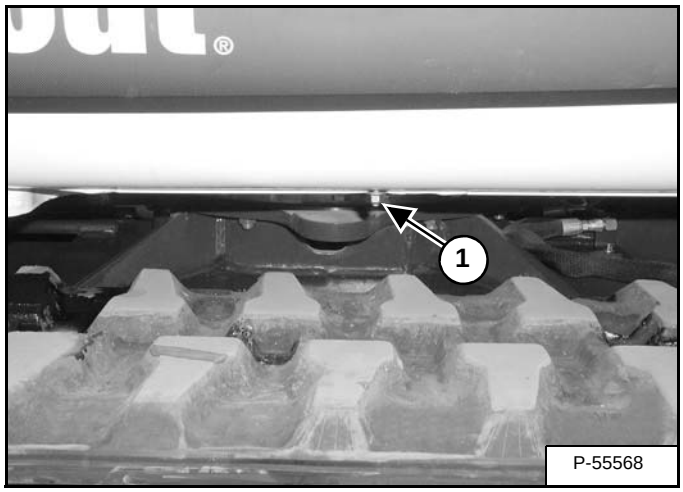


Remove the bolts (Item 1) from the battery tray (Item 2) **[Figure 20-60-10]**.

Remove the battery tray.

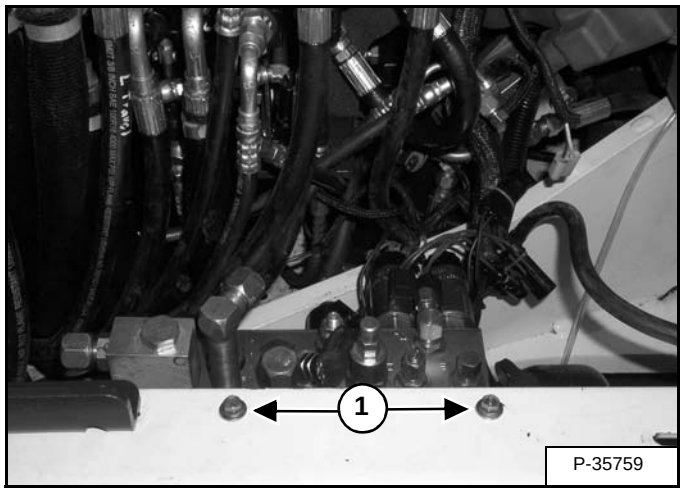
Removal And Installation (Cont'd)

Figure 20-60-11



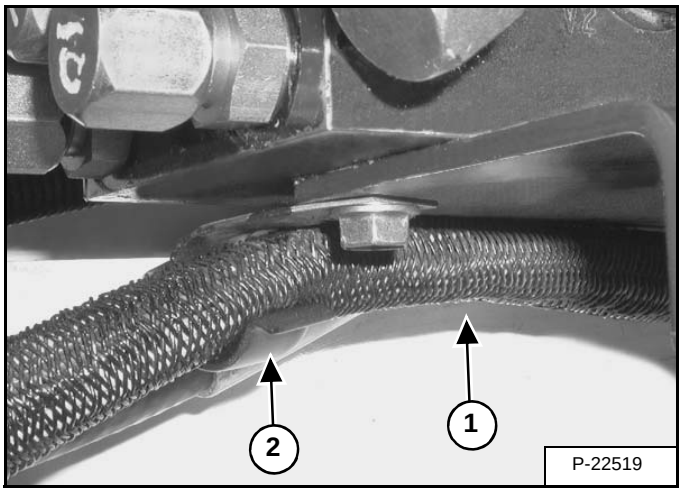
Remove the bolt (Item 1) **[Figure 20-60-11]**.

Figure 20-60-12



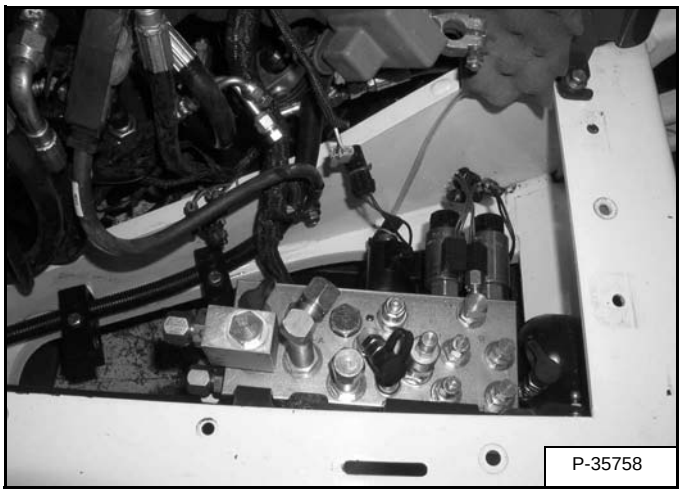
Remove the bolts (Item 1) **[Figure 20-60-12]**.

Figure 20-60-13



Push the manifold toward the excavator and remove the wire harness (Item 1) from the two clamps (Item 2) **[Figure 20-60-13]**.

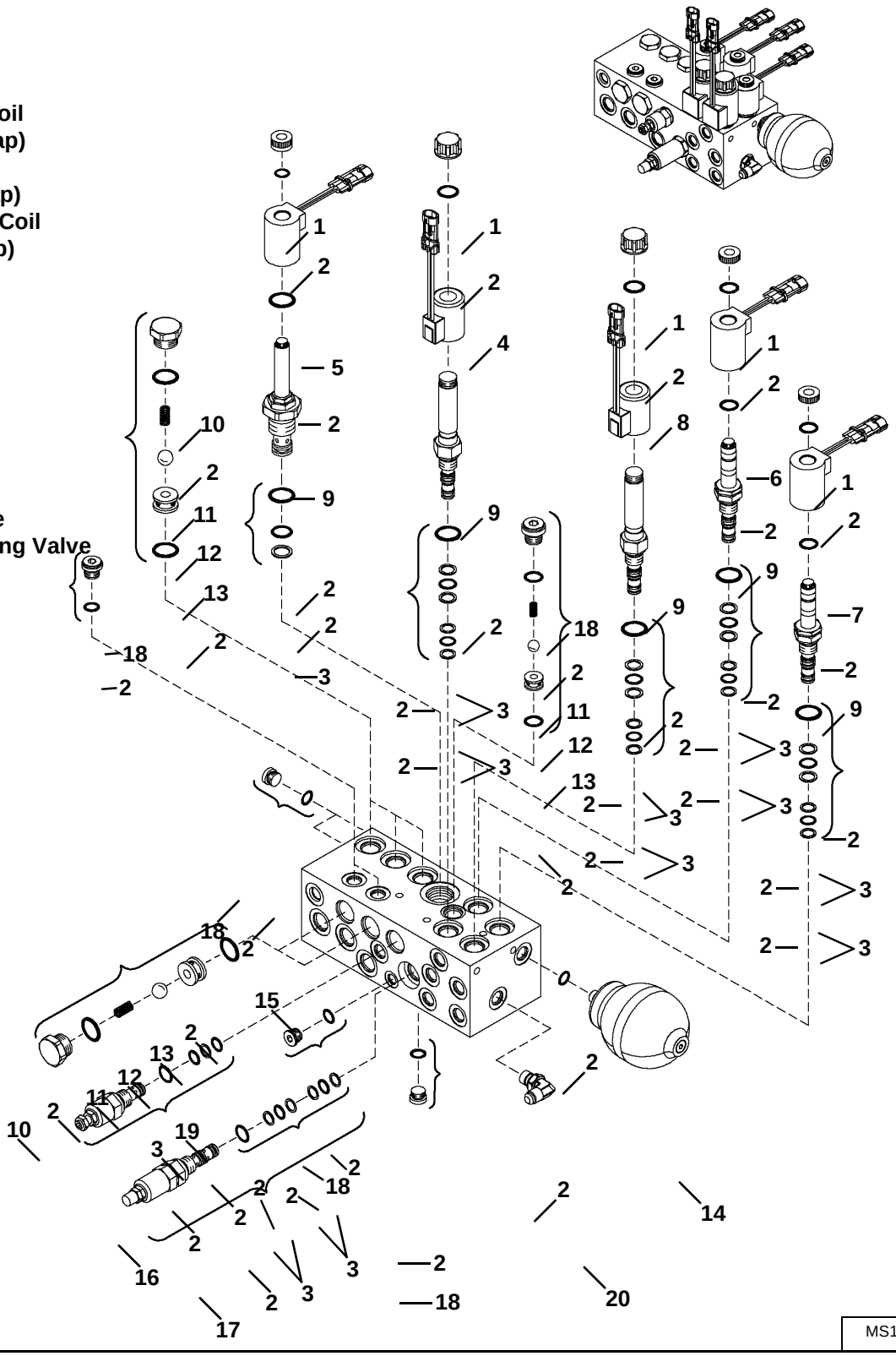
Figure 20-60-14



Move the manifold forward and remove the manifold from the excavator **[Figure 20-60-14]**.

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

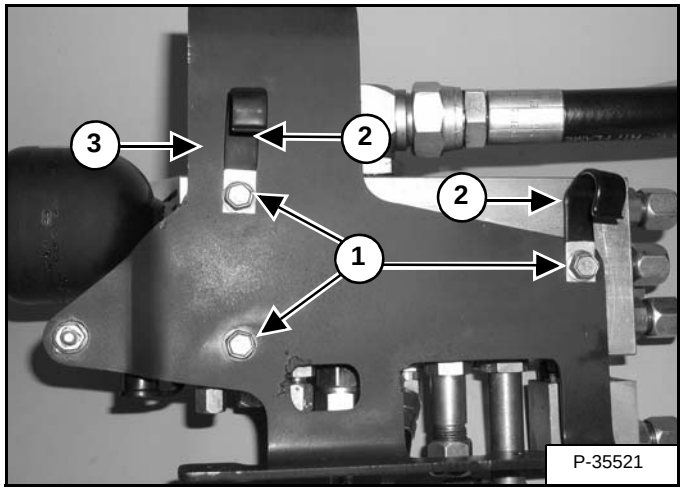


MS1402

Disassembly

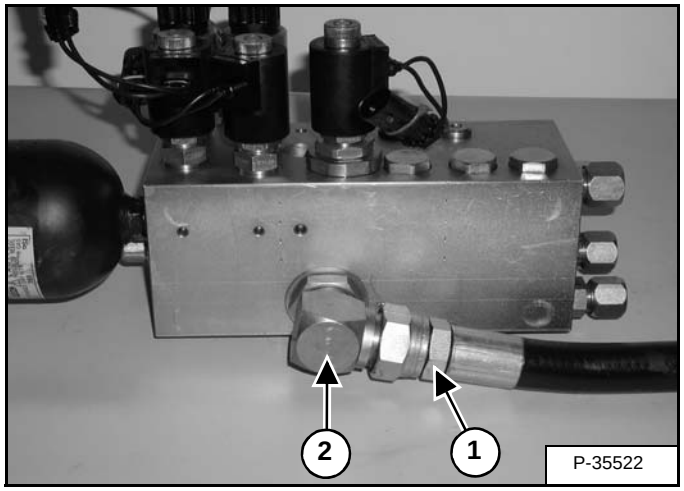
Clean the outside of the manifold assembly before disassembly.

Figure 20-60-15



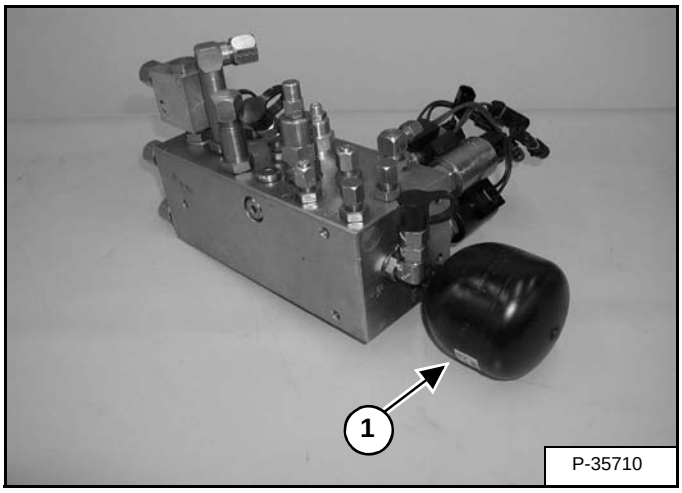
Remove the bolts (Item 1), clamps (Item 2) and mount (Item 3) **[Figure 20-60-15]** from the manifold.

Figure 20-60-16



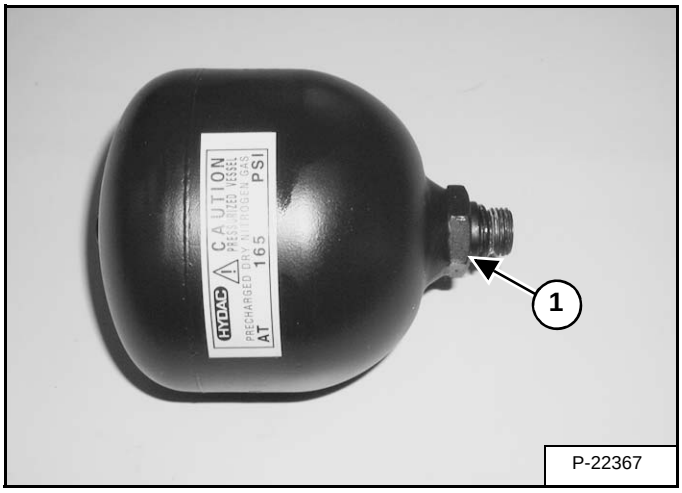
Remove the hose (Item 1) and fitting (Item 2) **[Figure 20-60-16]**.

Figure 20-60-17



Remove the accumulator (Item 1) **[Figure 20-60-17]**.

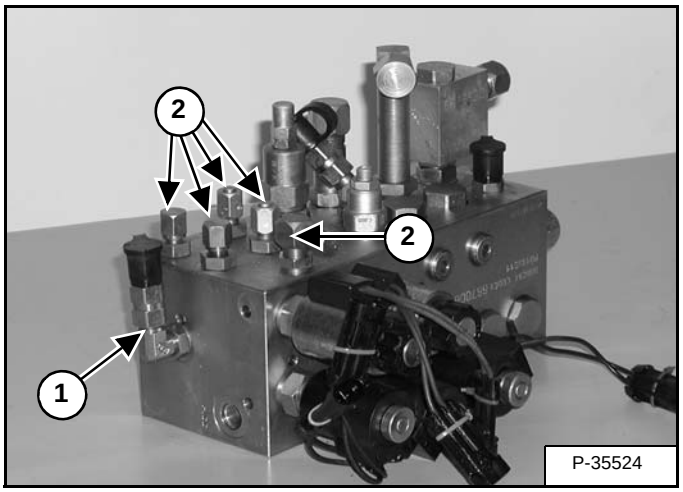
Figure 20-60-18



Remove the O-ring (Item 1) **[Figure 20-60-18]** from the accumulator.

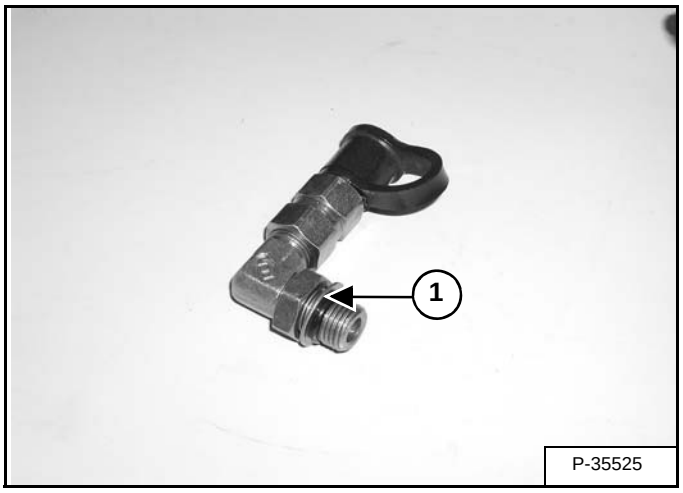
Disassembly (Cont'd)

Figure 20-60-19



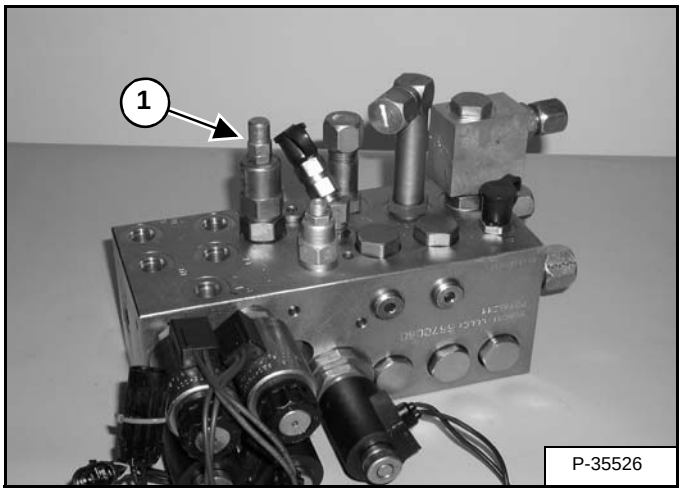
Remove the diagnostic coupler (Item 1) and five fittings (Item 2) **[Figure 20-60-19]**.

Figure 20-60-20



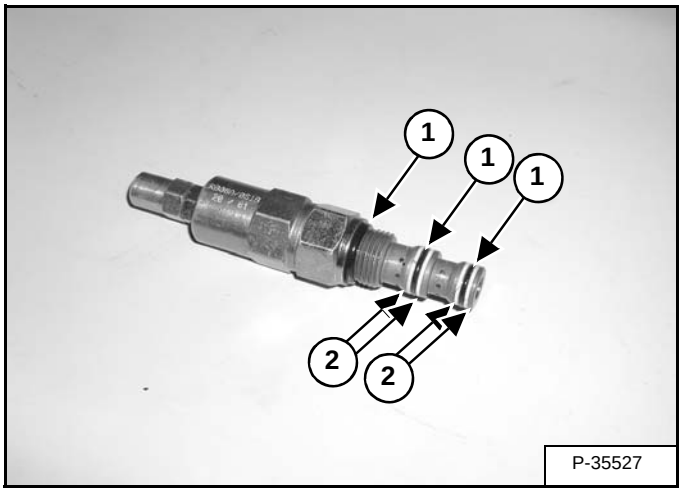
Remove the O-ring (Item 1) **[Figure 20-60-20]** from the diagnostic coupler and fittings.

Figure 20-60-21



Remove the pressure reducing valve (Item 1) **[Figure 20-60-21]**.

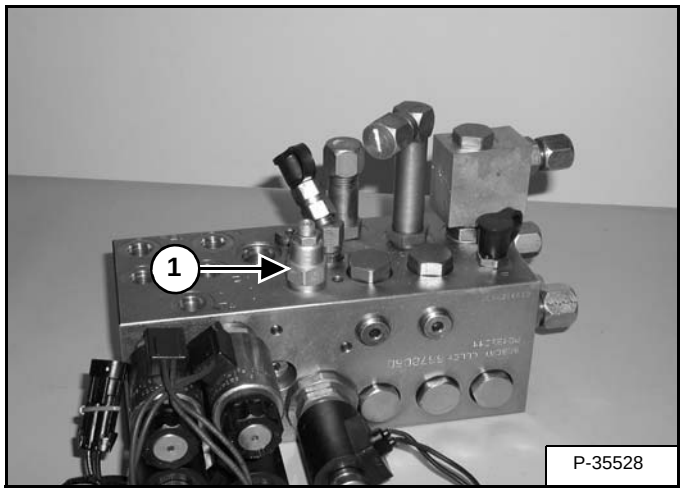
Figure 20-60-22



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-60-22]** from the pressure reducing valve.

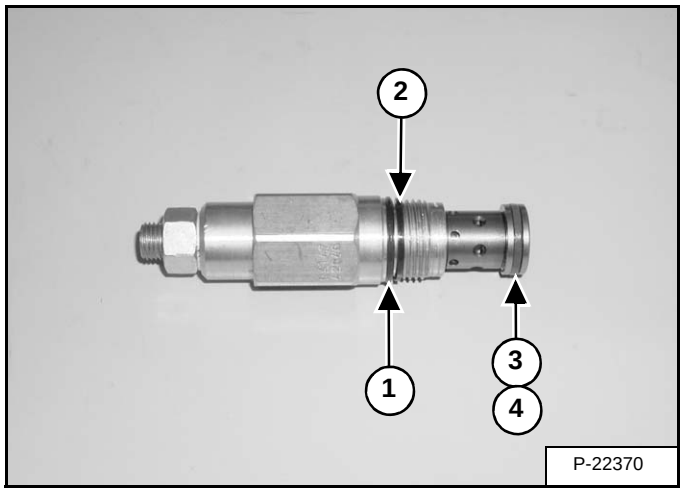
Disassembly (Cont'd)

Figure 20-60-23



Remove the main relief valve (Item 1) **[Figure 20-60-23]**.

Figure 20-60-24

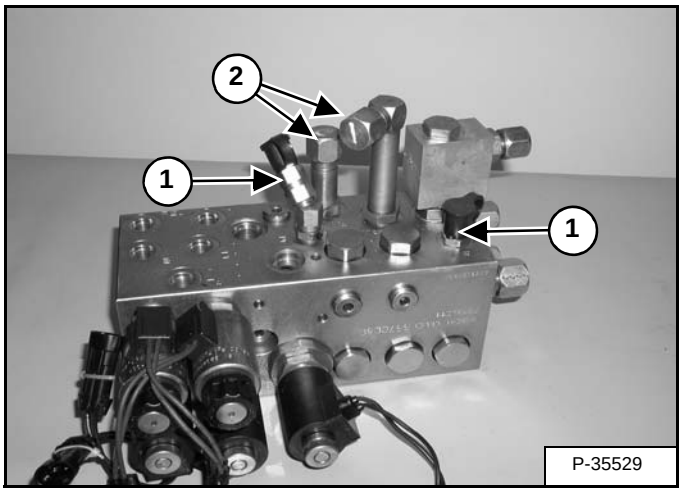


Remove the O-ring (Item 1) and back-up rings (Item 2) **[Figure 20-60-24]** from the main relief valve.

Remove the ring (Item 3) and O-ring (Item 4) **[Figure 20-60-24]** from the main relief valve.

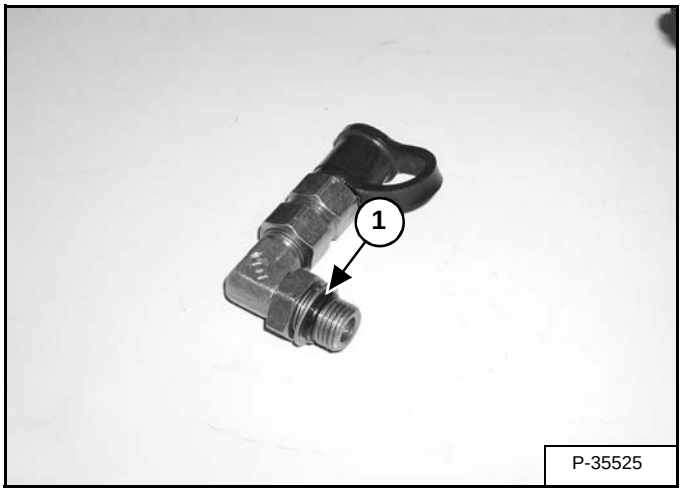
NOTE: Later model excavators may be equipped with a different main relief valve. Record the location of O-rings, back-up rings, seals or glid rings during disassembly for proper assembly.

Figure 20-60-25



Remove the two diagnostic ports (Item 1) and two fittings (Item 2) **[Figure 20-60-25]**.

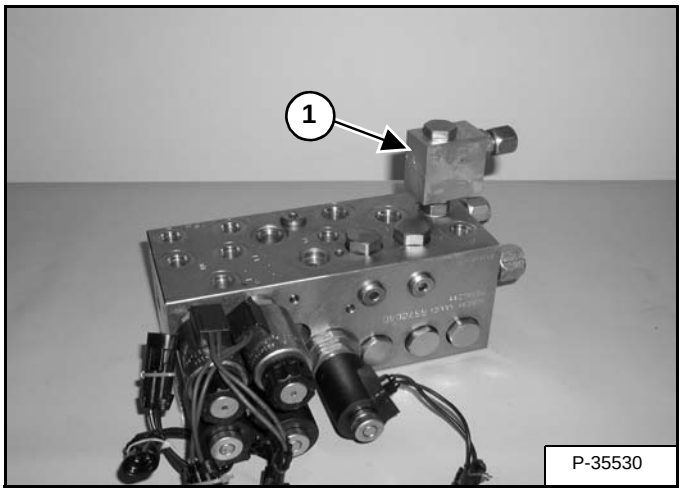
Figure 20-60-26



Remove the O-ring (Item 1) **[Figure 20-60-26]** from the diagnostic ports and fittings.

Disassembly (Cont'd)

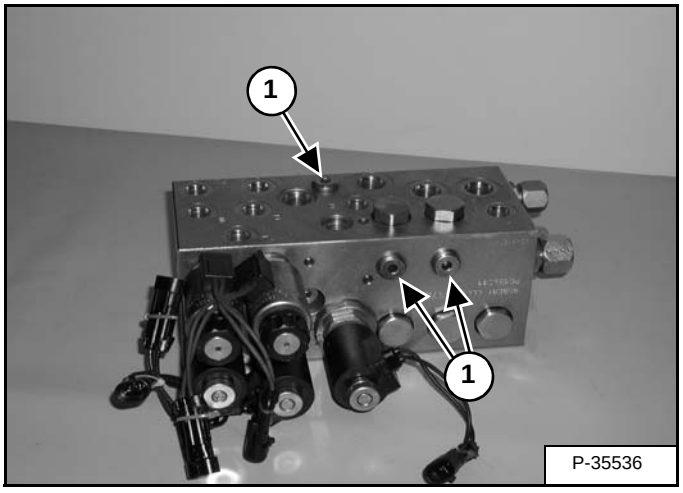
Figure 20-60-27



Remove the build up valve (Item 1) **[Figure 20-60-27]**.

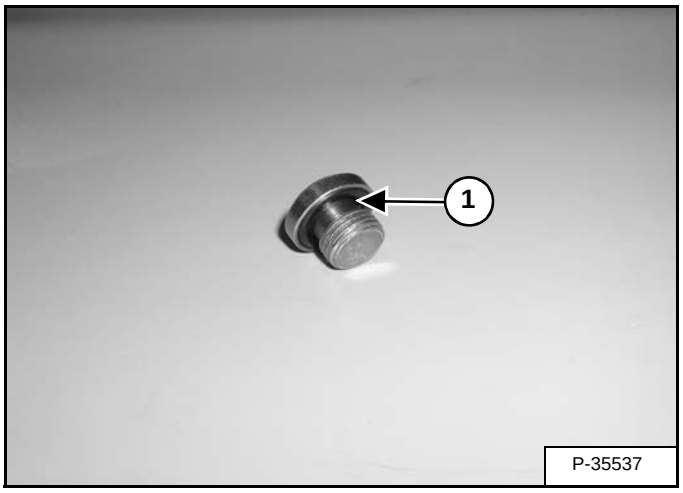
NOTE: See Build Up Valve Disassembly. (See Disassembly And Assembly on Page 20-160-3.)

Figure 20-60-28



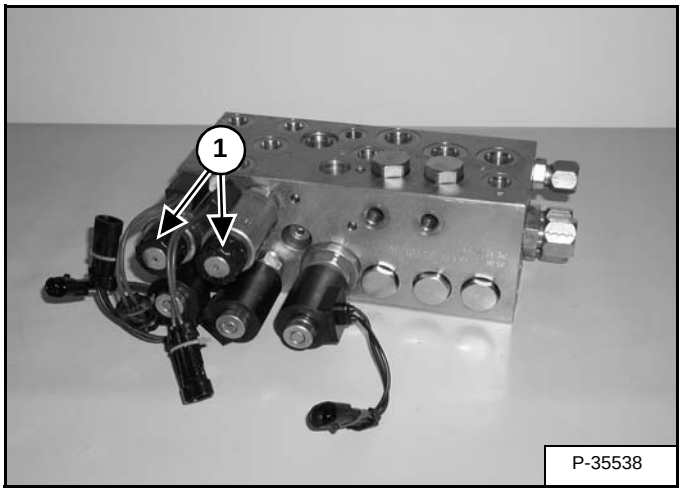
Remove the plugs (Item 1) **[Figure 20-60-28]**.

Figure 20-60-29



Remove the O-ring (Item 1) **[Figure 20-60-29]** from the plugs.

Figure 20-60-30

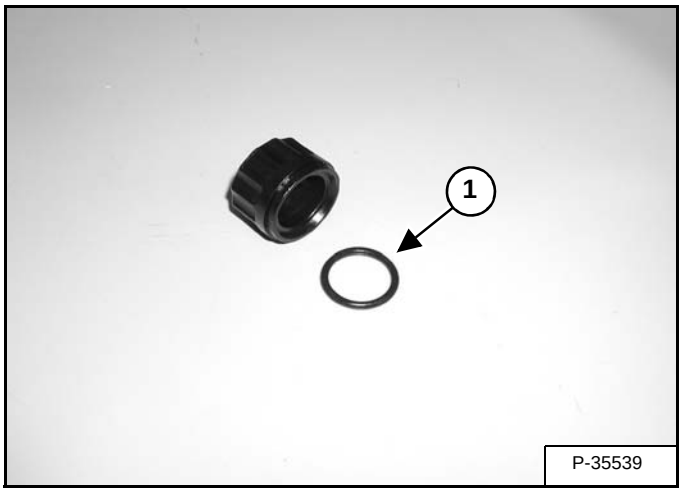


Remove the nuts (Item 1) **[Figure 20-60-30]** from the solenoids.

MANIFOLD ASSEMBLY/ACCUMULATOR (CONT'D)

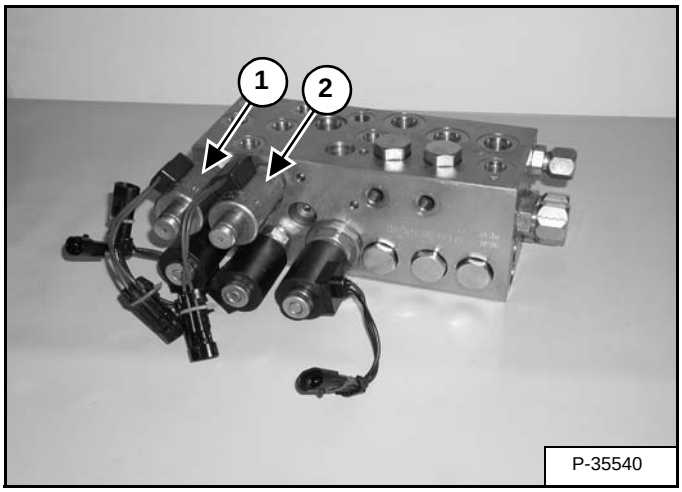
Disassembly (Cont'd)

Figure 20-60-31



Remove the O-ring (Item 1) **[Figure 20-60-31]** from both nuts.

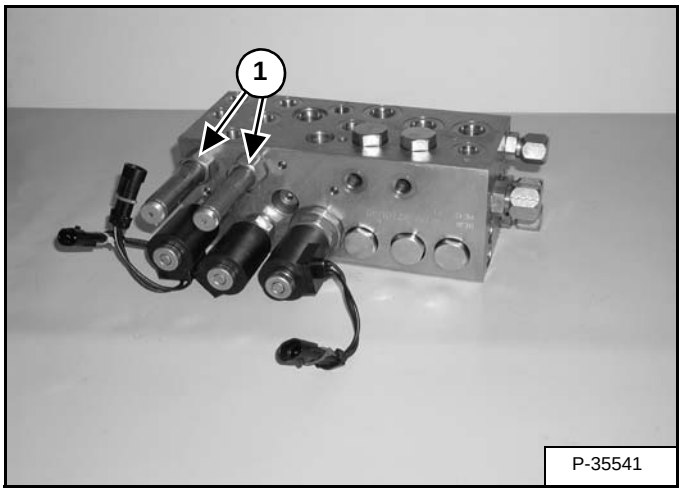
Figure 20-60-32



Remove the coil with the red tie strap (Item 1) **[Figure 20-60-32]** from the solenoid.

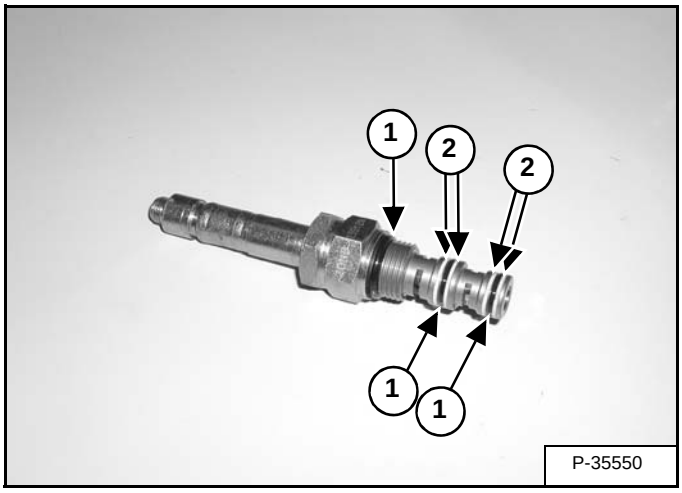
Remove the coil with the blue tie strap (Item 2) **[Figure 20-60-32]** from the solenoid.

Figure 20-60-33



Remove the solenoids (Item 1) **[Figure 20-60-33]**.

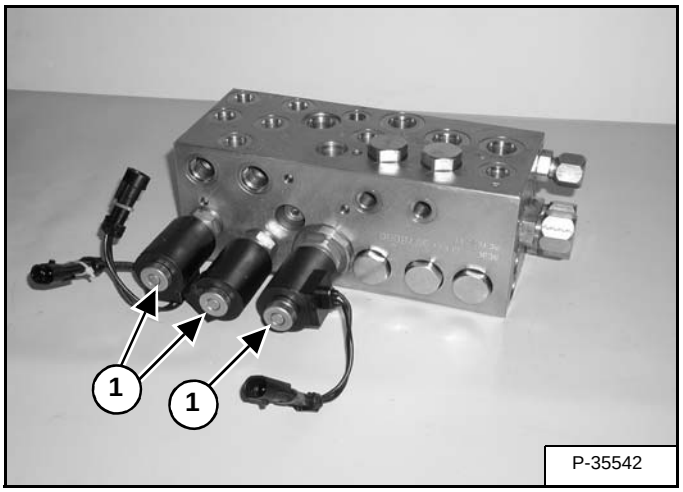
Figure 20-60-34



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-60-34]** from both solenoids.

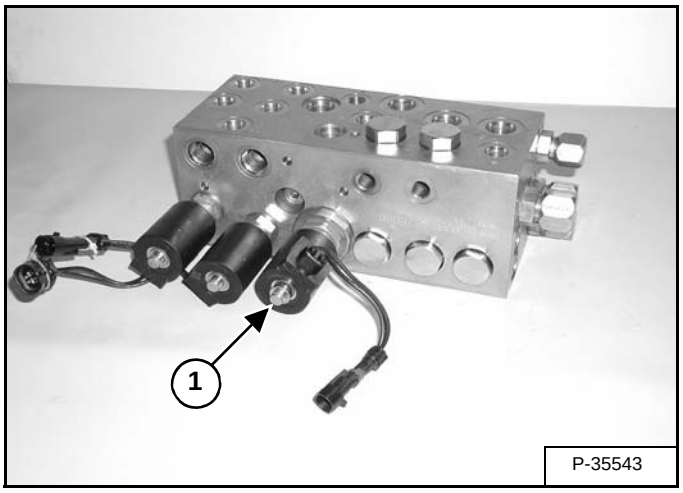
Disassembly (Cont'd)

Figure 20-60-35



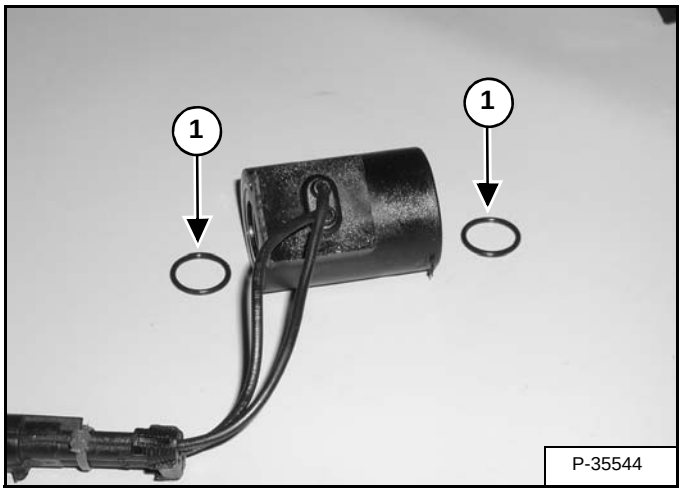
Remove the nut (Item 1) **[Figure 20-60-35]** from the solenoids.

Figure 20-60-36



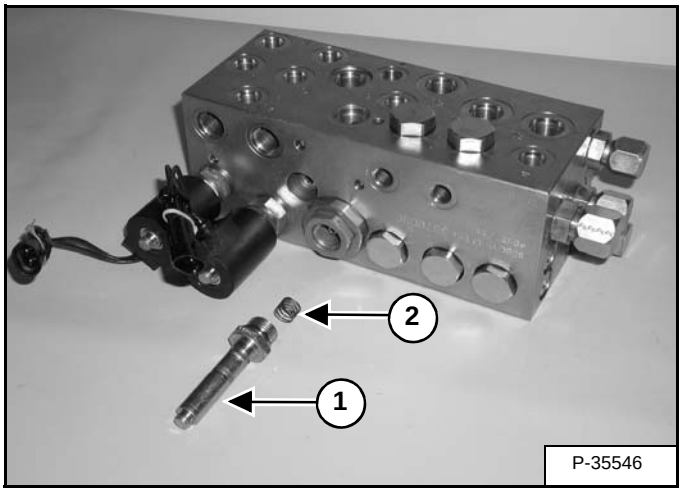
Remove the coil with the brown tie strap (Item 1) **[Figure 20-60-36]** from the solenoid.

Figure 20-60-37



Remove the O-rings (Item 1) **[Figure 20-60-37]** from the coil.

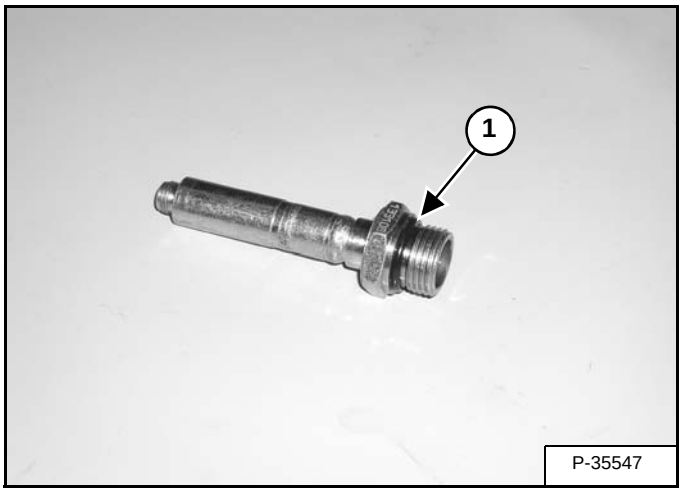
Figure 20-60-38



Remove the solenoid (Item 1) and spring (Item 2) **[Figure 20-60-38]**.

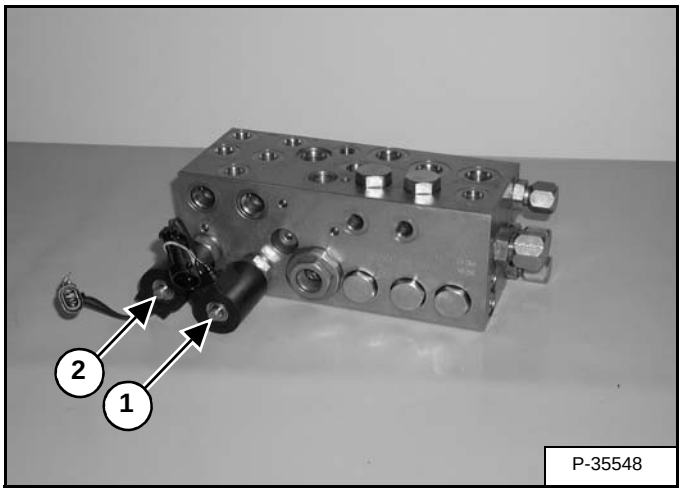
Disassembly (Cont'd)

Figure 20-60-39



Remove the O-ring (Item 1) **[Figure 20-60-39]** from the solenoid.

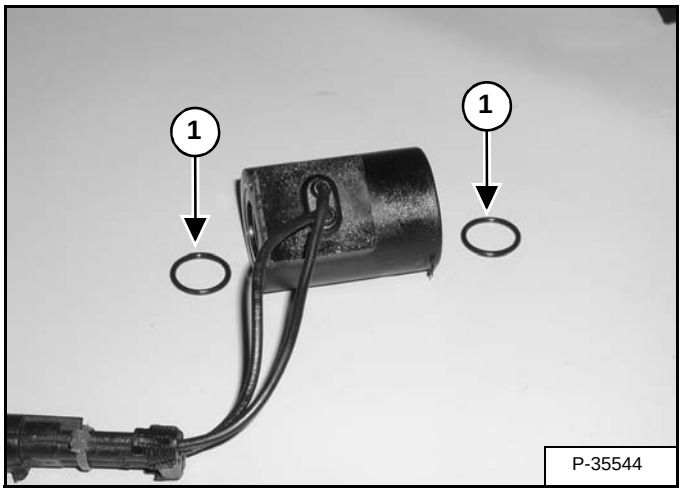
Figure 20-60-40



Remove the coil with the yellow tie strap (Item 1) **[Figure 20-60-40]** from the solenoid.

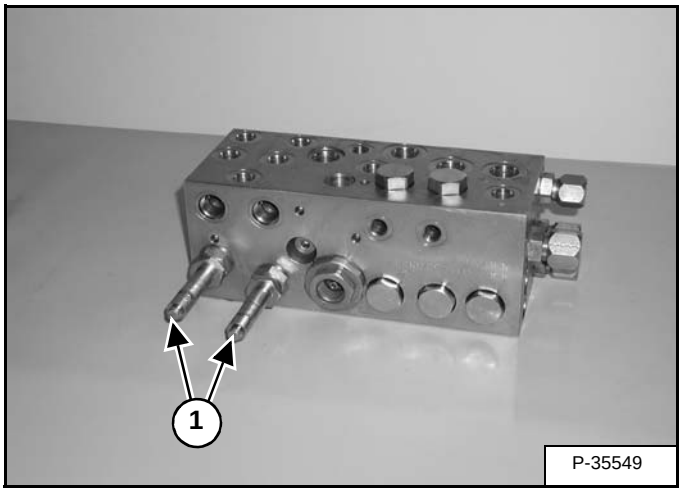
Remove the coil with the green tie strap (Item 2) **[Figure 20-60-40]** from the solenoid.

Figure 20-60-41



Remove the two O-rings (Item 1) **[Figure 20-60-41]** from the coils.

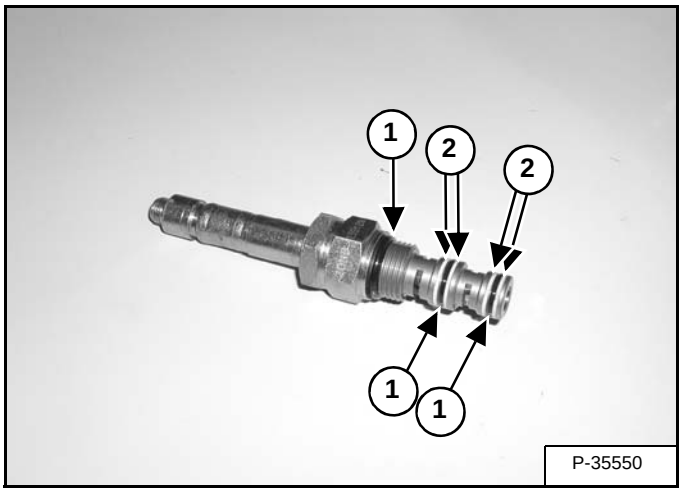
Figure 20-60-42



Remove the solenoids (Item 1) **[Figure 20-60-42]**.

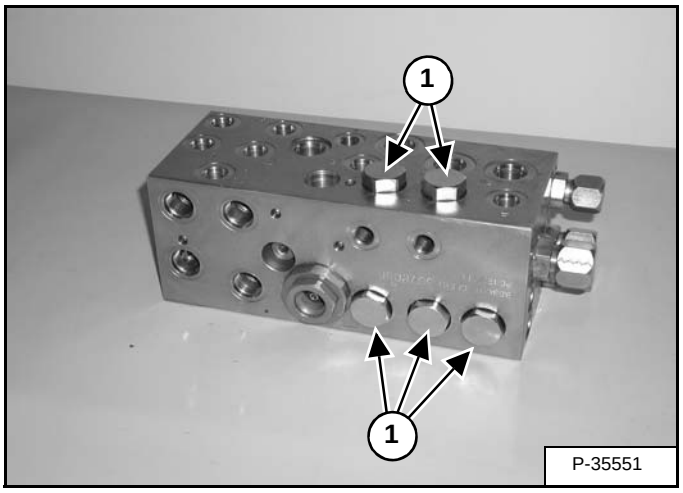
Disassembly (Cont'd)

Figure 20-60-43



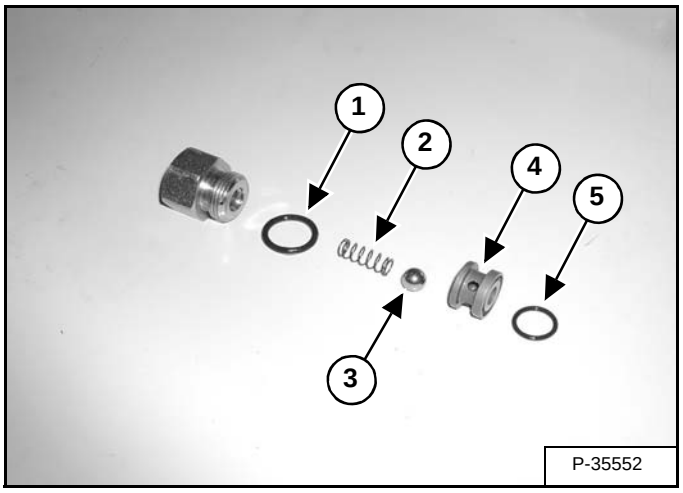
Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-60-43]** from both solenoids.

Figure 20-60-44



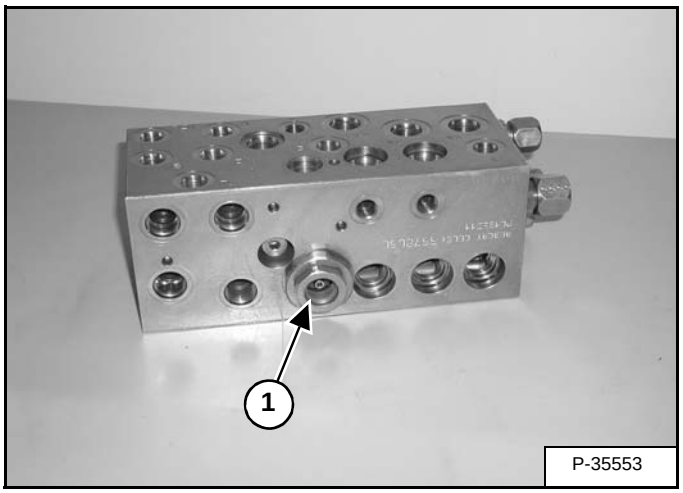
Remove the check valves (Item 1) **[Figure 20-60-44]**.

Figure 20-60-45



Remove the O-ring (Item 1), spring (Item 2), check ball (Item 3), seat (Item 4) and O-ring (Item 5) **[Figure 20-60-45]** from the five check valve ports.

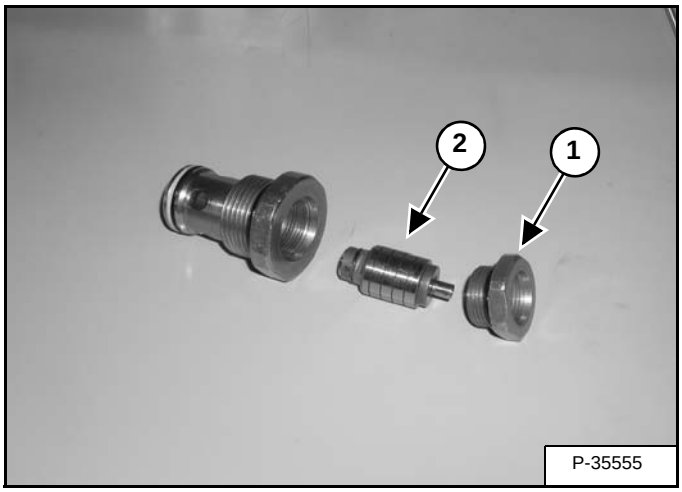
Figure 20-60-46



Remove the port adapter (Item 1) **[Figure 20-60-46]**.

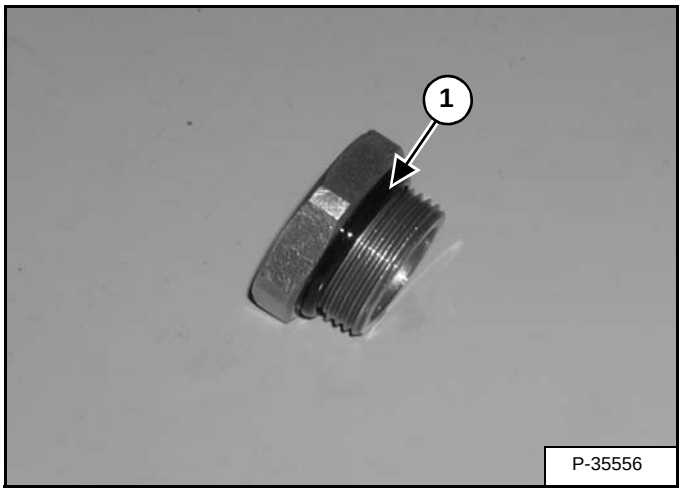
Disassembly (Cont'd)

Figure 20-60-47



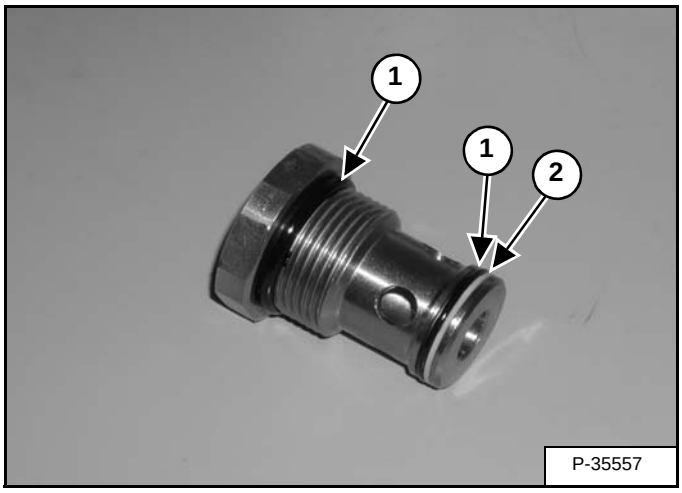
Remove the fitting (Item 1) and spool (Item 2) **[Figure 20-60-47]** from the port adapter.

Figure 20-60-48



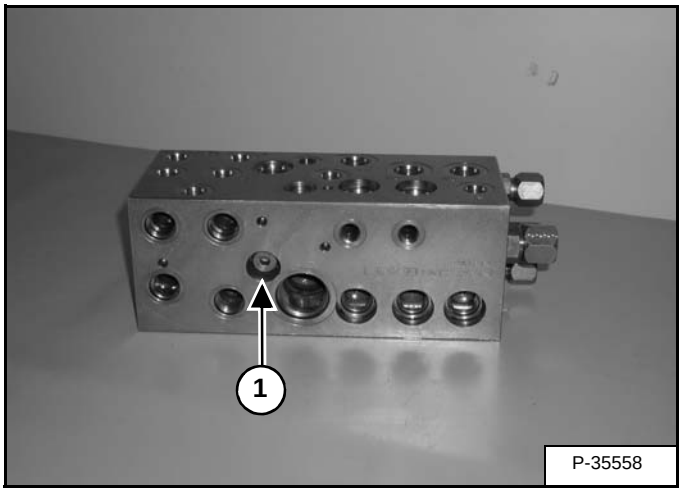
Remove the O-ring (Item 1) **[Figure 20-60-48]** from the fitting.

Figure 20-60-49



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-60-49]** from the port adapter.

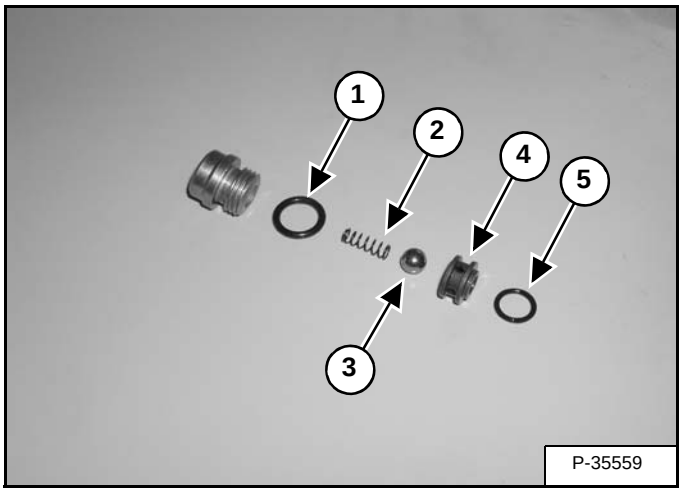
Figure 20-60-50



Remove the plug (Item 1) **[Figure 20-60-50]**.

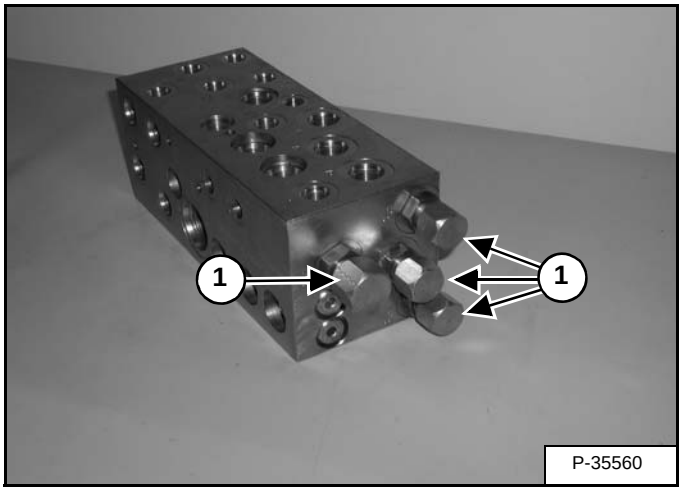
Disassembly (Cont'd)

Figure 20-60-51



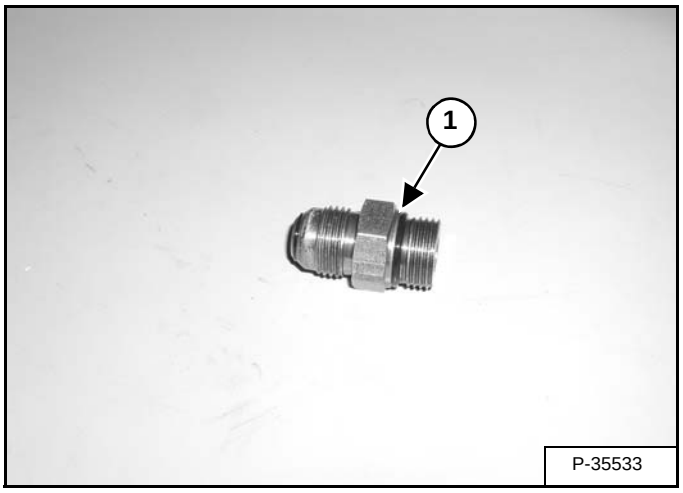
Remove the O-ring (Item 1), spring (Item 2), check ball (Item 3), seat (Item 4) and O-ring (Item 5) **[Figure 20-60-51]** from the port.

Figure 20-60-52



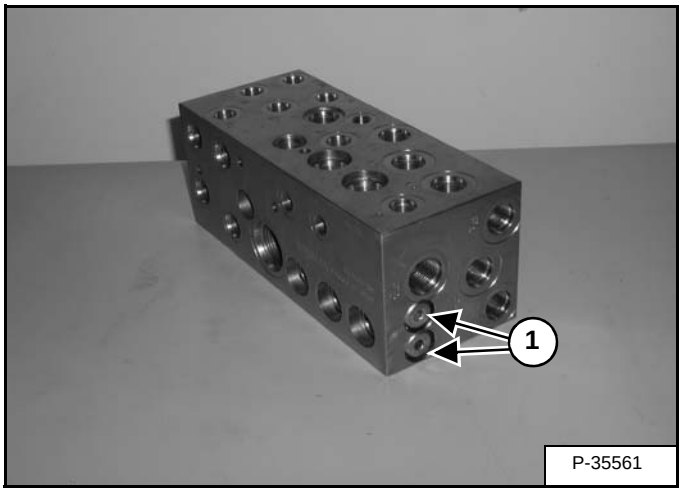
Remove the fittings (Item 1) **[Figure 20-60-52]**.

Figure 20-60-53



Remove the O-ring (Item 1) **[Figure 20-60-53]** from the fittings.

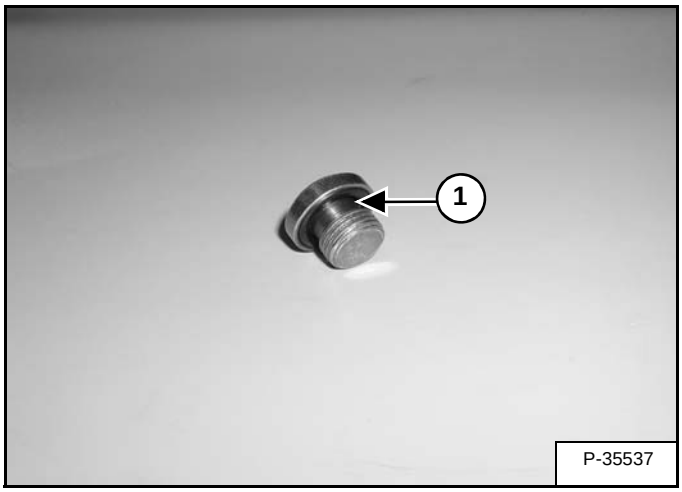
Figure 20-60-54



Remove the plugs (Item 1) **[Figure 20-60-54]**.

Disassembly (Cont'd)

Figure 20-60-55



Remove the O-ring (Item 1) **[Figure 20-60-55]** from the plugs.

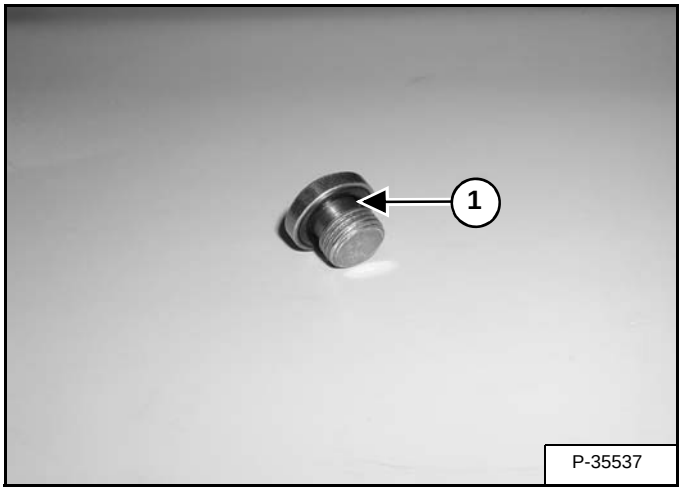
Assembly

Clean all parts in solvent and dry with compressed air.

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

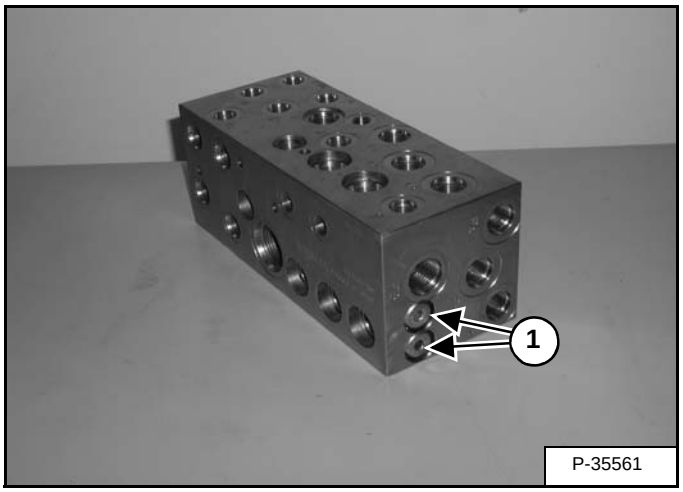
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-60-56



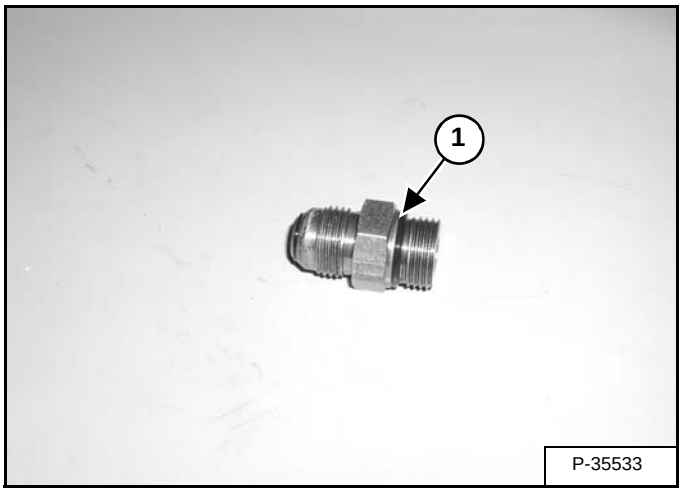
Install the O-ring (Item 1) **[Figure 20-60-56]** on the plugs.

Figure 20-60-57



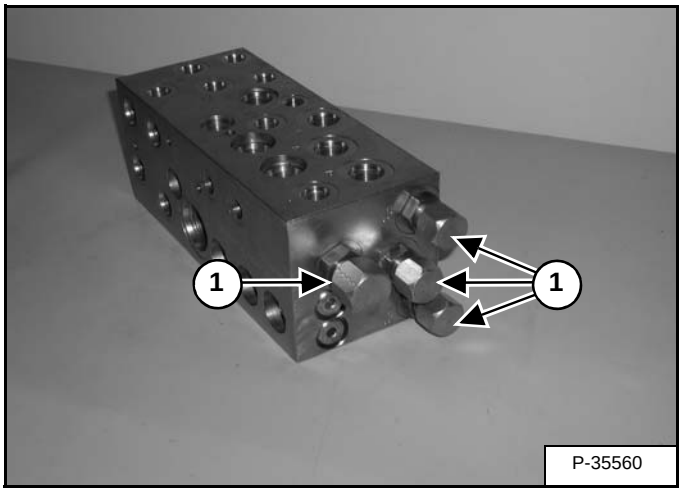
Install the plugs (Item 1) **[Figure 20-60-57]**. Tighten the plugs to 18 - 20 ft.-lb. (24,4 - 27,1 N•m) torque.

Figure 20-60-58



Install the O-ring (Item 1) **[Figure 20-60-58]** on the four fittings.

Figure 20-60-59



Install the fittings (Item 1) **[Figure 20-60-59]**.

Assembly (Cont'd)

Figure 20-60-60

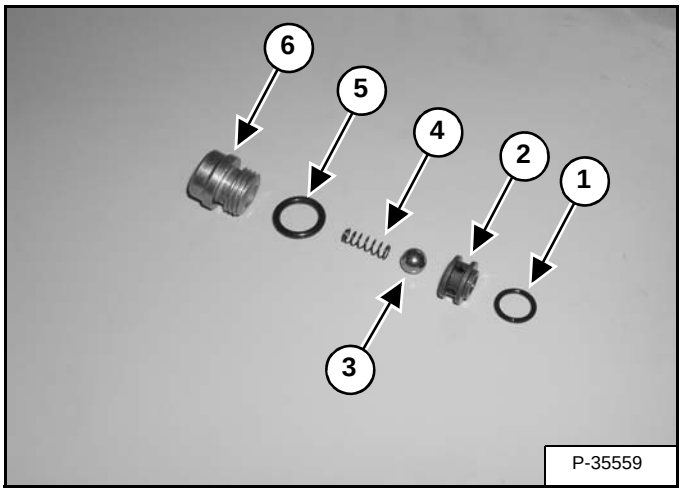
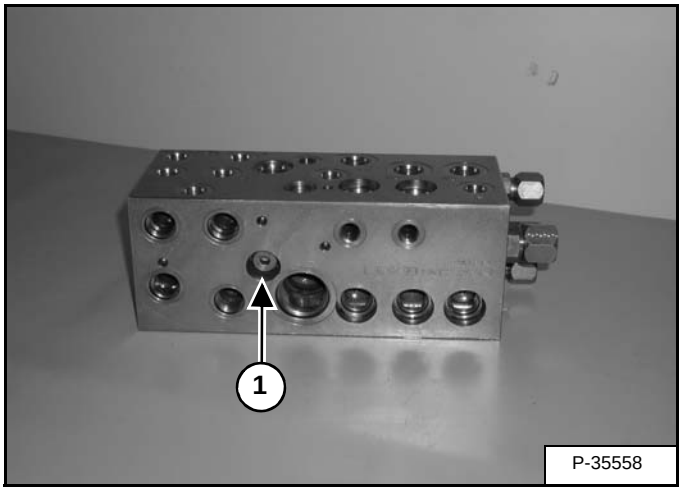
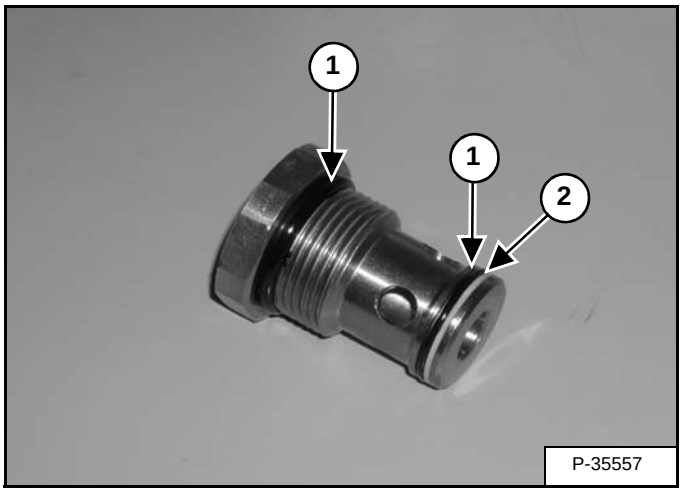


Figure 20-60-61



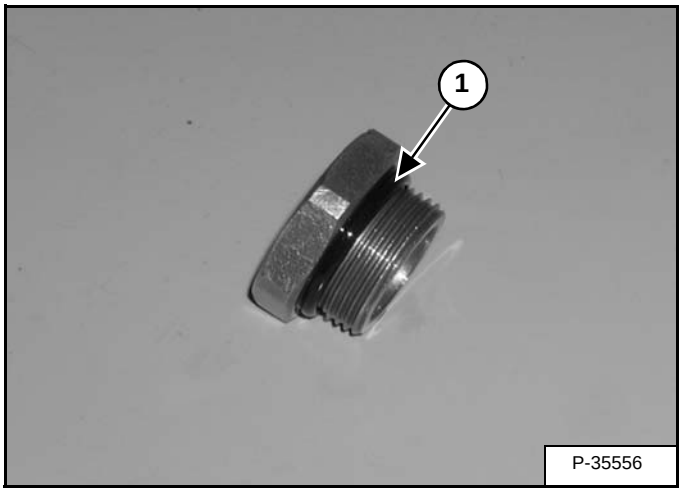
Install the O-ring (Item 1), seat (Item 2), check ball (Item 3), spring (Item 4), O-ring (Item 5) and plug (Item 6) **[Figure 20-60-60]** in the port (Item 1) **[Figure 20-60-61]** in the manifold housing.

Figure 20-60-62



Install the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-60-62]** on the port adapter.

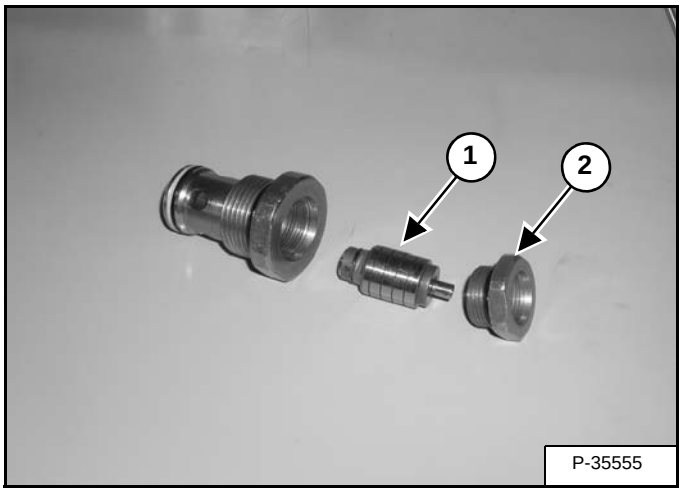
Figure 20-60-63



Install the O-ring (Item 1) **[Figure 20-60-63]** on the fitting.

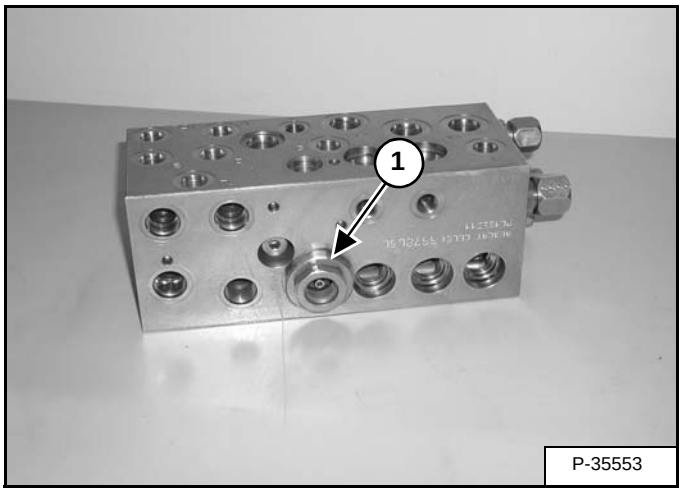
Assembly (Cont'd)

Figure 20-60-64



Install the spool (Item 1) and fitting (Item 2) **[Figure 20-60-64]** in the port adapter.

Figure 20-60-65



Install the port adapter (Item 1) **[Figure 20-60-65]**.

Figure 20-60-66

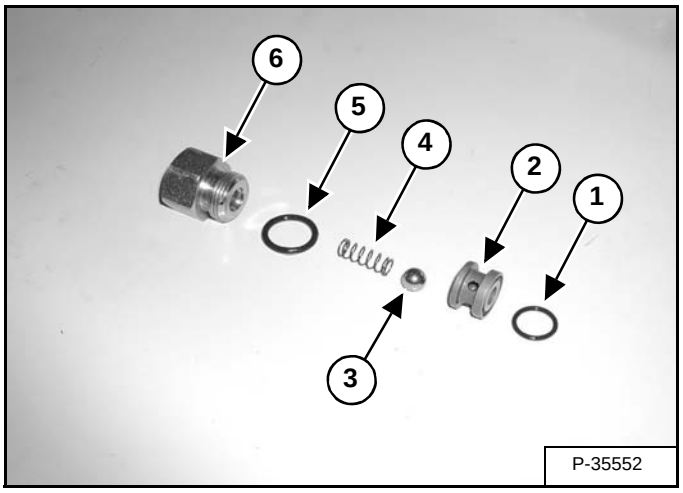
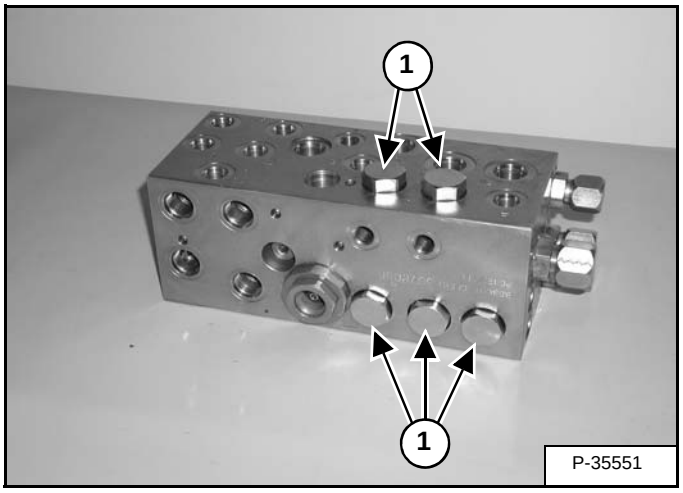


Figure 20-60-67

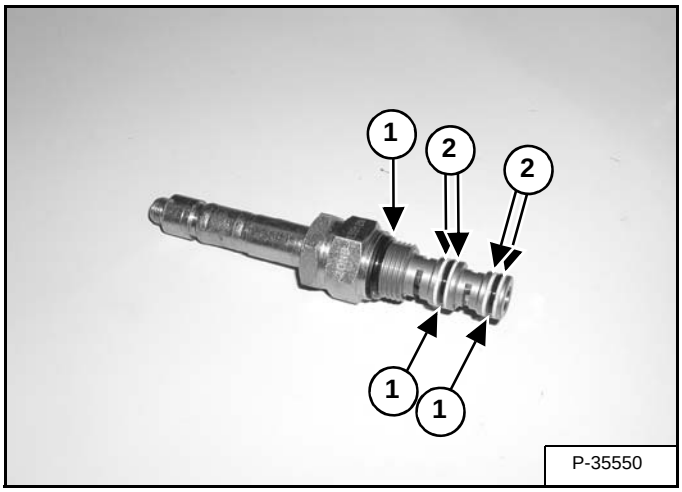


Install the O-ring (Item 1), seat (Item 2), check ball (Item 3), spring (Item 4), O-ring (Item 5) and plug (Item 6) **[Figure 20-60-66]** in the check valve ports (Item 1) **[Figure 20-60-67]**.

Tighten the plugs to 19 - 22 ft.-lb. (25,1 - 29,8 N•m) torque.

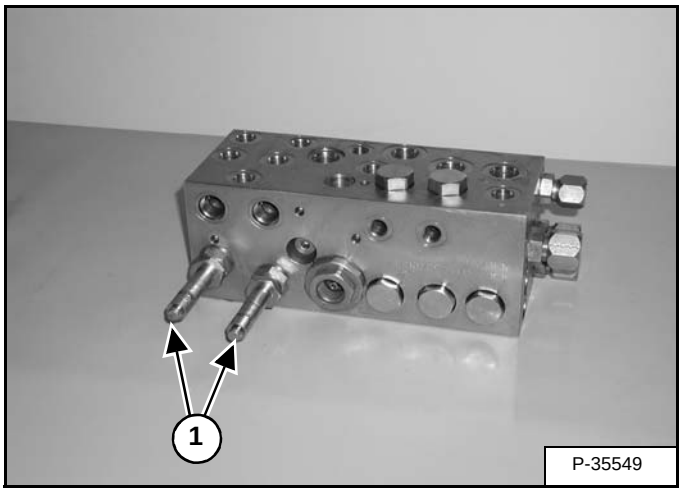
Assembly (Cont'd)

Figure 20-60-68



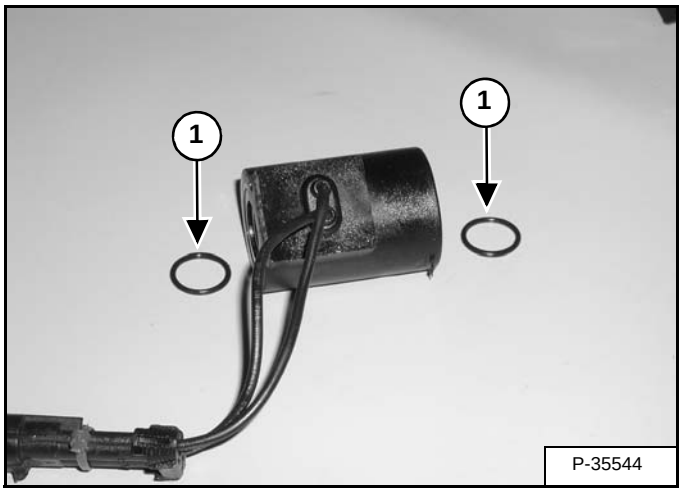
Install the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-60-68]** on the solenoids.

Figure 20-60-69



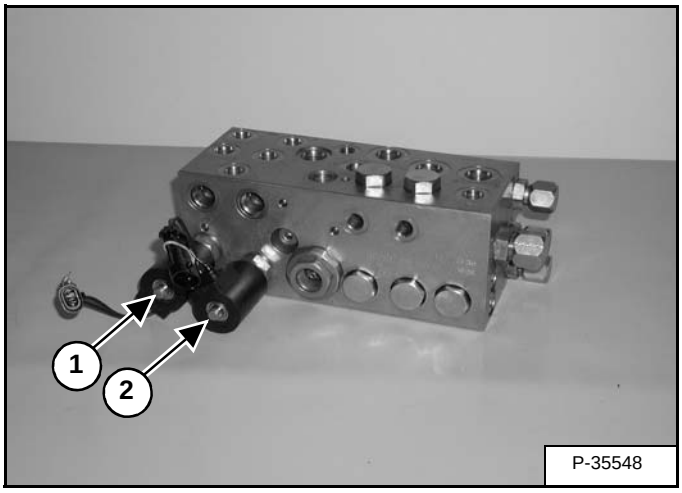
Install the solenoids (Item 1) **[Figure 20-60-69]**.

Figure 20-60-70



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

Figure 20-60-71

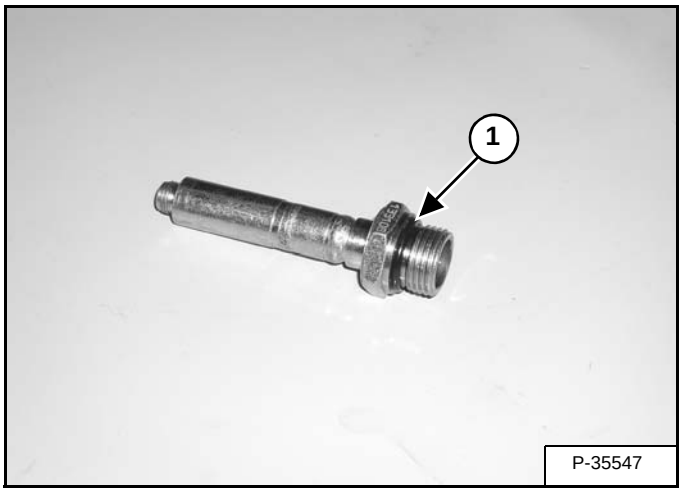


Install the coil with the green tie strap (Item 1) **[Figure 20-60-71]** on the solenoid.

Install the coil with the yellow tie strap (Item 2) **[Figure 20-60-71]** on the solenoid.

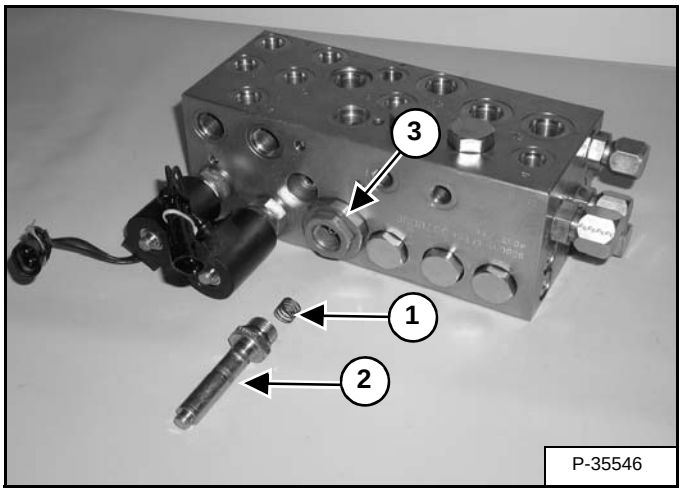
Assembly (Cont'd)

Figure 20-60-72



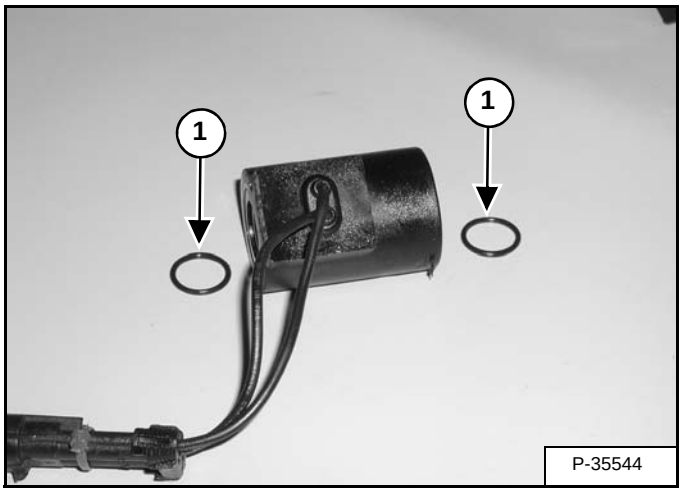
Install the O-ring (Item 1) **[Figure 20-60-72]** on the solenoid.

Figure 20-60-73



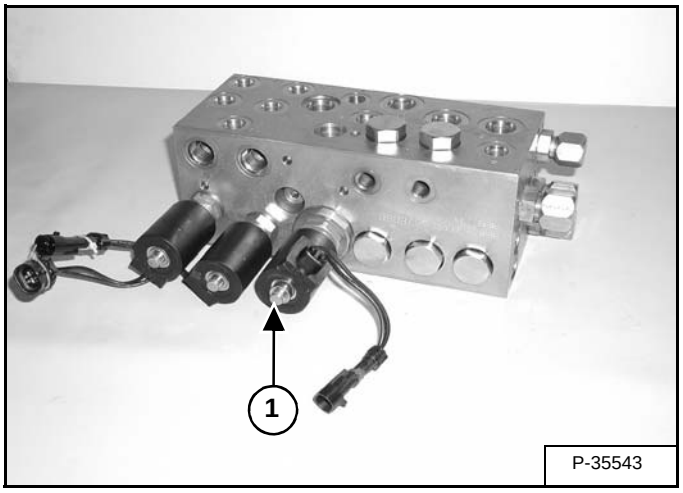
Install the spring (Item 1) and solenoid (Item 2) in the port (Item 3) **[Figure 20-60-73]**. Tighten the solenoid to 19 - 22 ft.-lb. (25,1 - 29,8 N•m) torque.

Figure 20-60-74



Install the O-rings (Item 1) **[Figure 20-60-74]** on the coil.

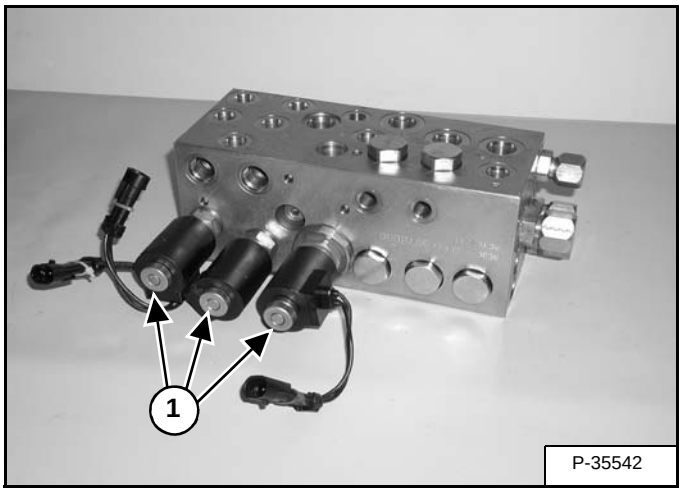
Figure 20-60-75



Install the coil with the brown tie strap (Item 1) **[Figure 20-60-75]** on the solenoid.

Assembly (Cont'd)

Figure 20-60-76

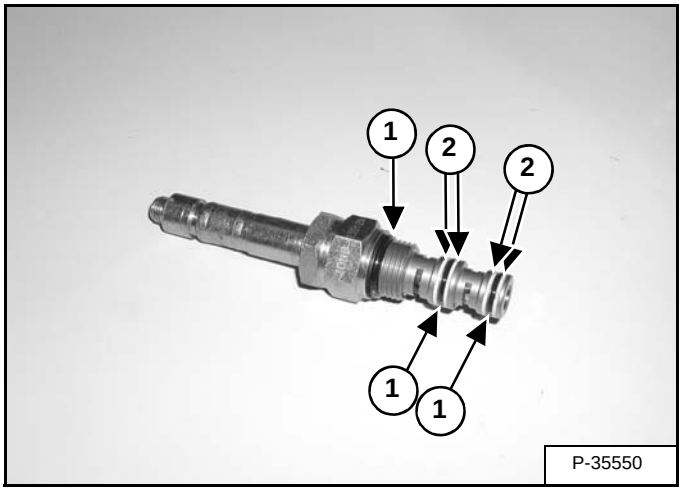


Install the nut (Item 1) **[Figure 20-60-76]** on the solenoids.

Tighten the nuts to 3 - 5 ft.-lb. (4,1 - 6,1 N•m) torque.

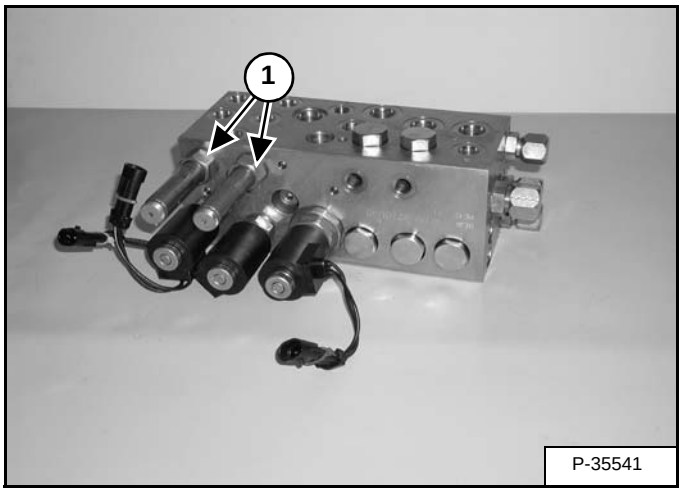
NOTE: Overtightening the coil nuts (Item 1) [Figure 20-60-76] may cause spool or coil failure.

Figure 20-60-77



Install the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-60-77]** on the solenoids.

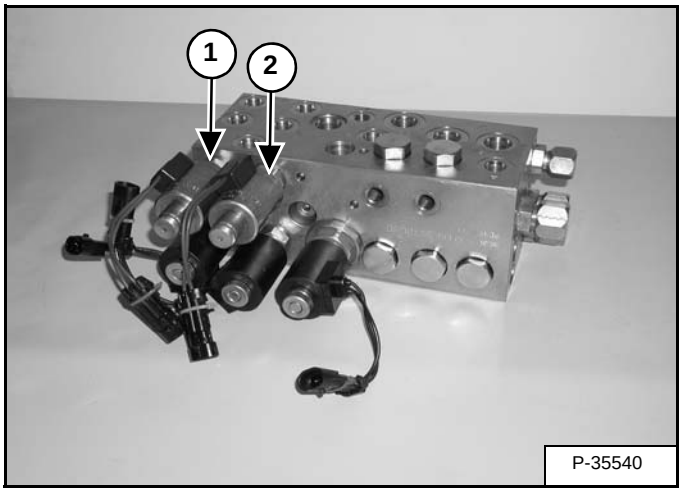
Figure 20-60-78



Install the solenoids (Item 1) **[Figure 20-60-78]**.

Tighten the solenoids to 19 - 22 ft.-lb. (25,1 - 29,8 N•m) torque.

Figure 20-60-79

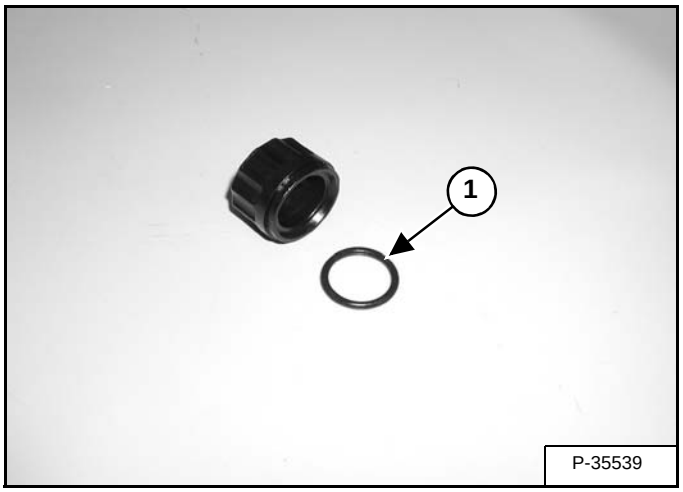


Install the coil with the red tie strap (Item 1) **[Figure 20-60-79]** on the solenoid.

Install the coil with the blue tie strap (Item 2) **[Figure 20-60-79]** on the solenoid.

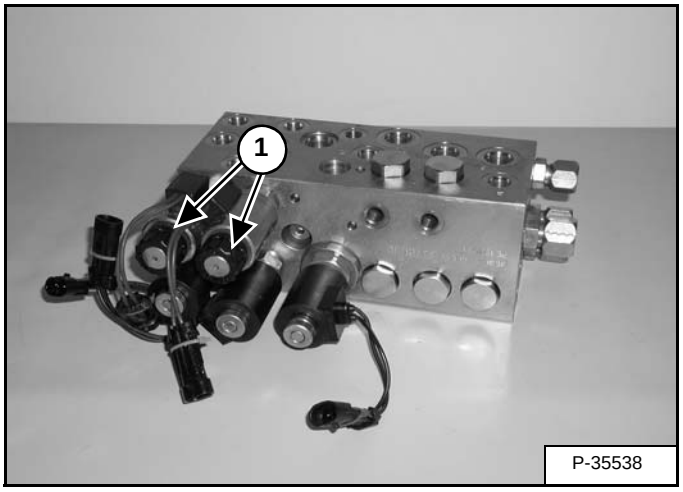
Assembly (Cont'd)

Figure 20-60-80



Install the O-ring (Item 1) **[Figure 20-60-80]** on the two nuts.

Figure 20-60-81

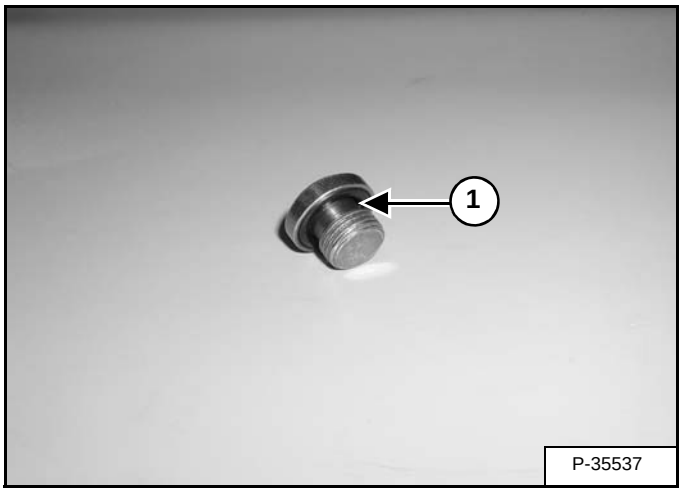


Install the nut (Item 1) **[Figure 20-60-81]** on the solenoid.

Tighten the nuts to 3 - 5 ft.-lb. (4,1 - 6,1 N•m) torque.

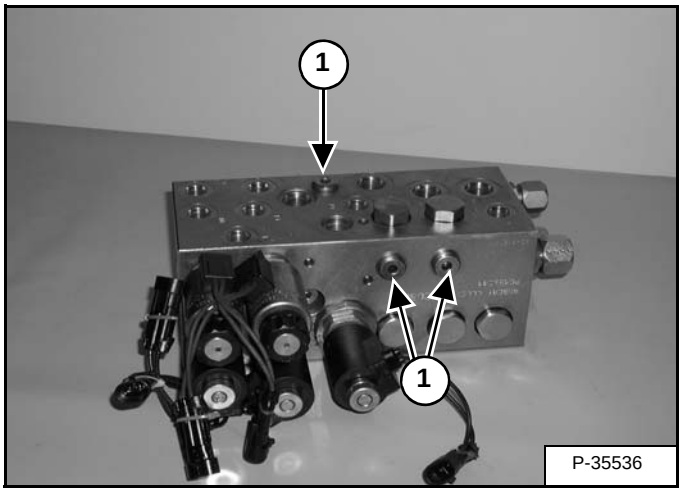
NOTE: Overtightening the coil nuts may cause spool or coil failure.

Figure 20-60-82



Install the O-ring (Item 1) **[Figure 20-60-82]** on the plugs.

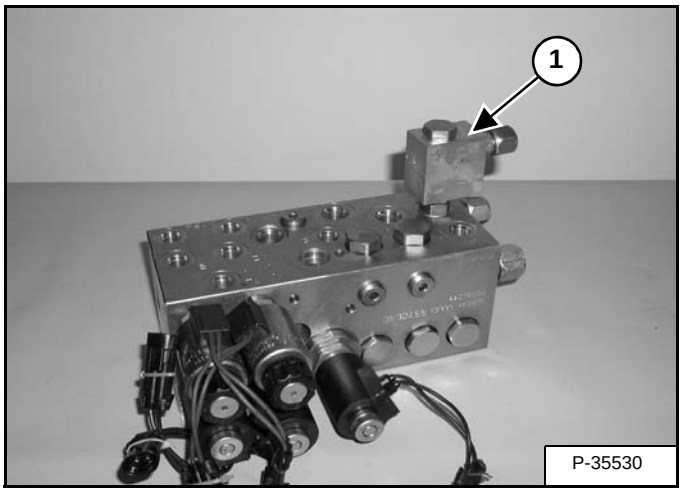
Figure 20-60-83



Install the plugs (Item 1) **[Figure 20-60-83]**.

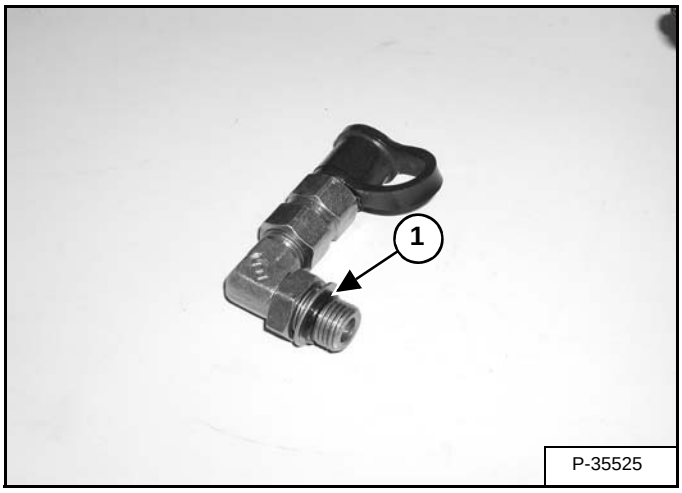
Assembly (Cont'd)

Figure 20-60-84



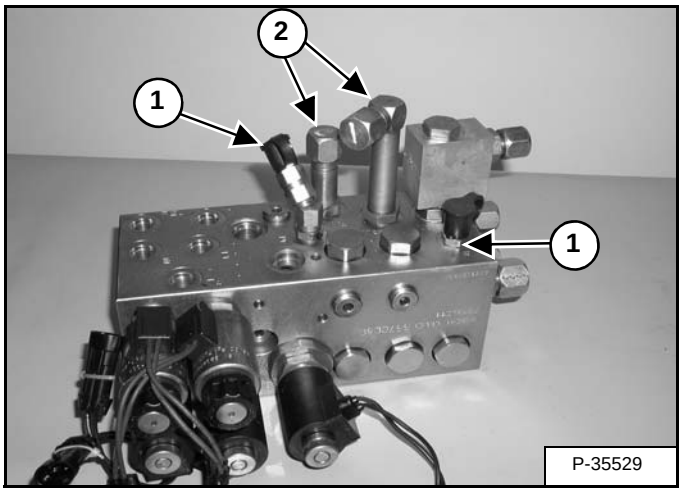
Install the build up valve (Item 1) **[Figure 20-60-84]**.

Figure 20-60-85



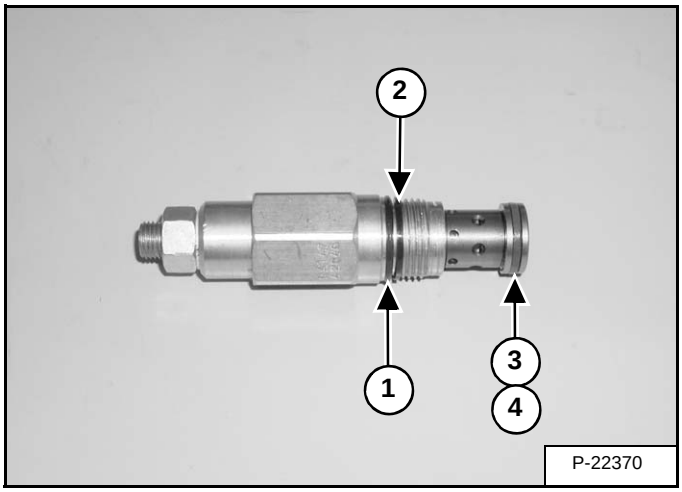
Install the O-ring (Item 1) **[Figure 20-60-85]** on the two diagnostic couplers and two fittings.

Figure 20-60-86



Install the diagnostic couplers (Item 1) and fittings (Item 2) **[Figure 20-60-86]**.

Figure 20-60-87



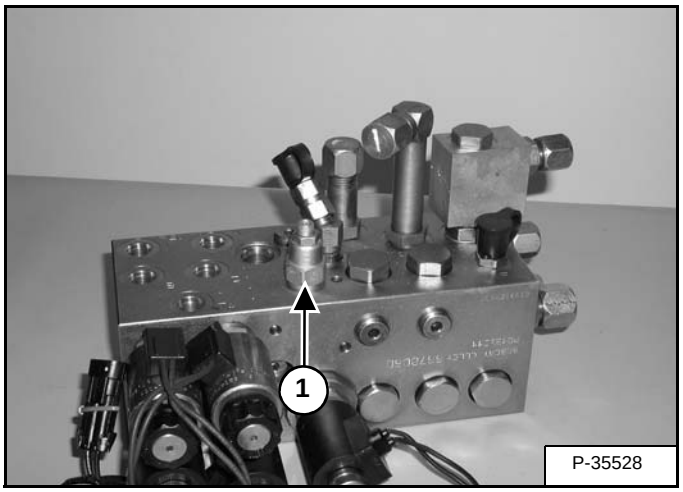
Install the O-ring (Item 1) and back-up ring (Item 2) **[Figure 20-60-87]** on the main relief valve.

Install the O-ring (Item 3) and ring (Item 4) **[Figure 20-60-87]** on the main relief valve.

NOTE: Later model excavators may have a different main relief valve. Check the proper location of O-rings, back-up rings, glid rings and seals recorded earlier.

Assembly (Cont'd)

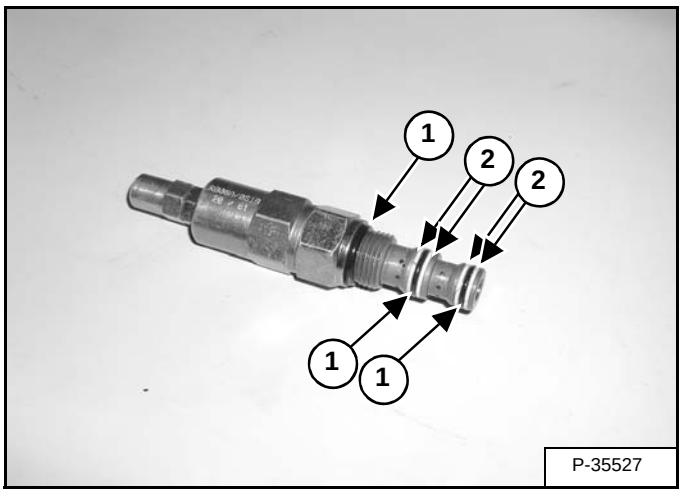
Figure 20-60-88



Install the main relief valve (Item 1) **[Figure 20-60-88]**.

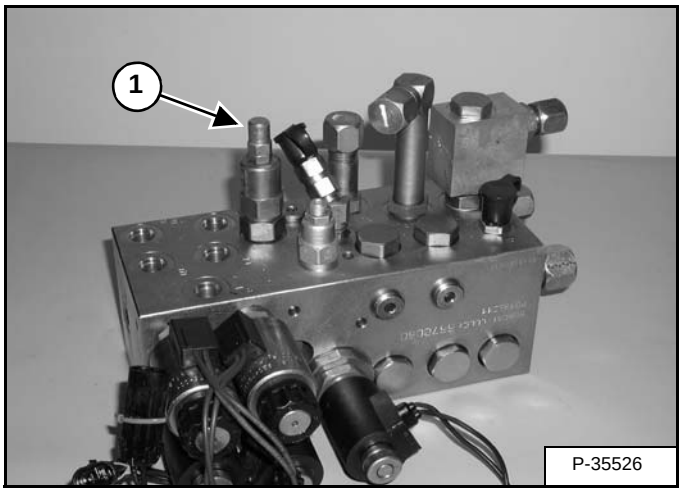
Tighten the main relief valve to 30 - 35 ft.-lb. (40,7 - 47,5 N•m) torque.

Figure 20-60-89



Install the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-60-89]** on the pressure reducing valve.

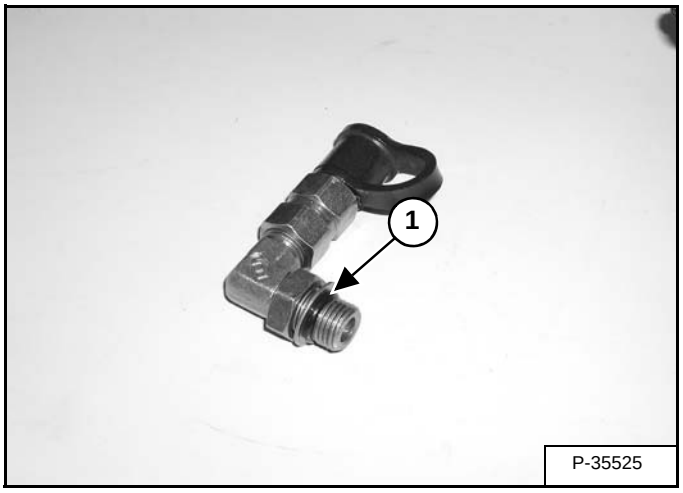
Figure 20-60-90



Install the pressure reducing valve (Item 1) **[Figure 20-60-90]**.

Tighten the pressure reducing valve to 19 - 22 ft.-lb. (25,1 - 29,8 N•m) torque.

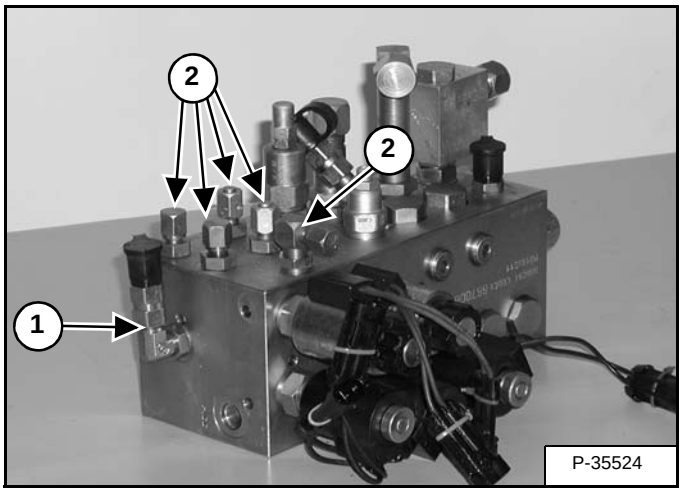
Figure 20-60-91



Install the O-ring (Item 1) **[Figure 20-60-91]** on the diagnostic coupler and five fittings.

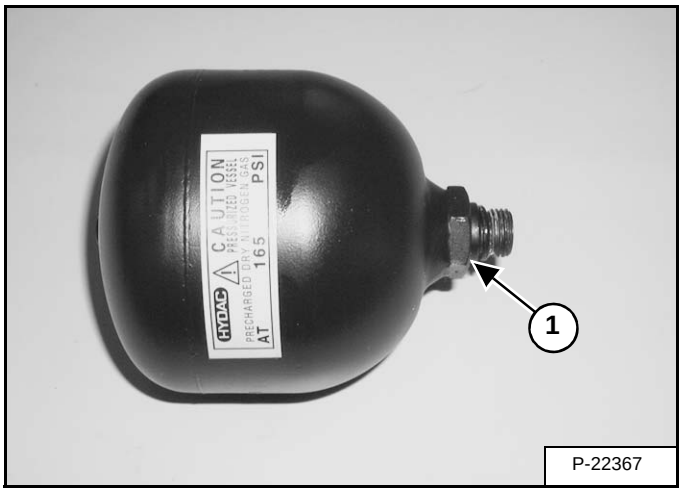
Assembly (Cont'd)

Figure 20-60-92



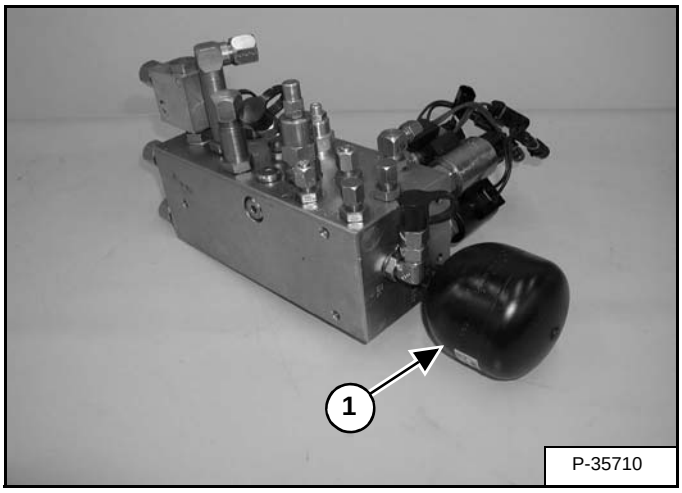
Install the diagnostic coupler (Item 1) and fittings (Item 2) **[Figure 20-60-92]**.

Figure 20-60-93



Install the O-ring (Item 1) **[Figure 20-60-93]** on the accumulator.

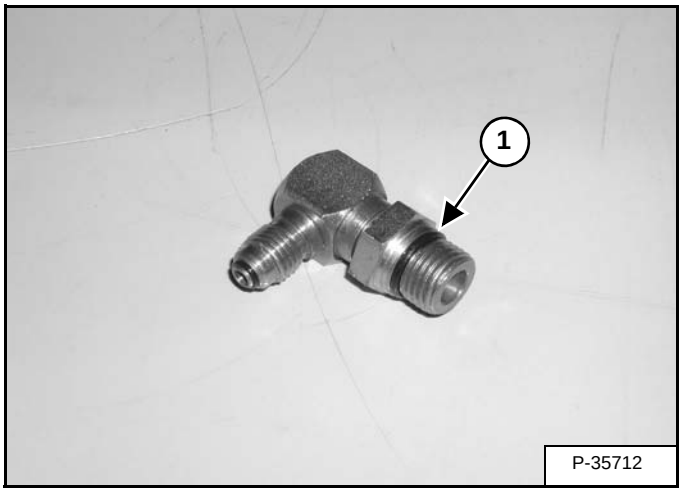
Figure 20-60-94



Install the accumulator (Item 1) **[Figure 20-60-94]**.

Tighten the accumulator to 22 - 24 ft.-lb. (29 - 33 N•m) torque.

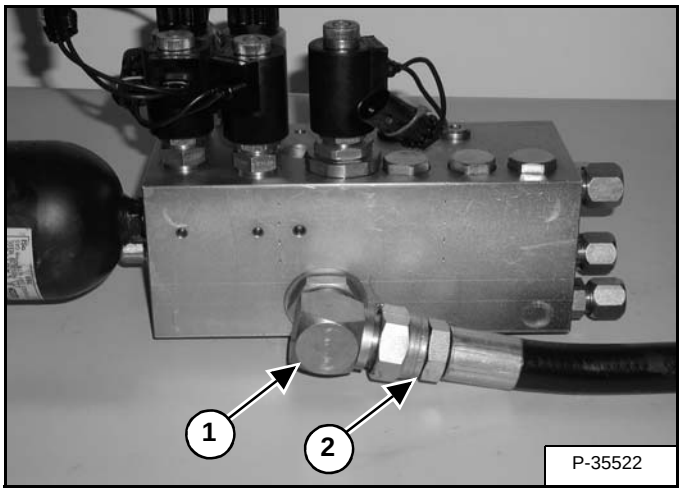
Figure 20-60-95



Install the O-ring (Item 1) **[Figure 20-60-95]** on the fitting.

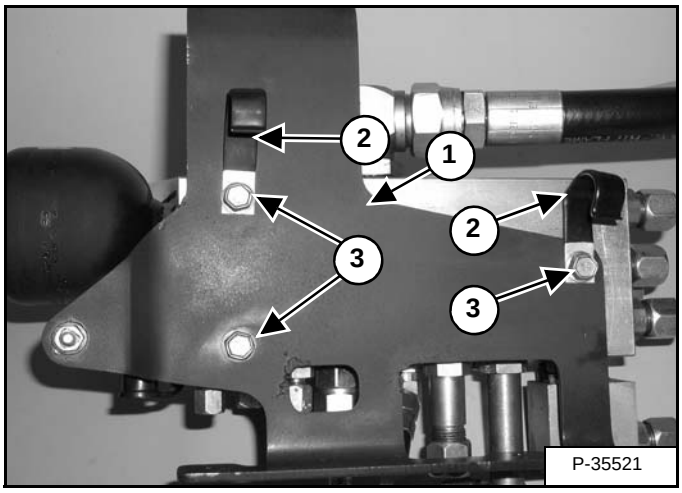
Assembly (Cont'd)

Figure 20-60-96



Install the fitting (Item 1) and hose (Item 2) **[Figure 20-60-96]** on the manifold block.

Figure 20-60-97



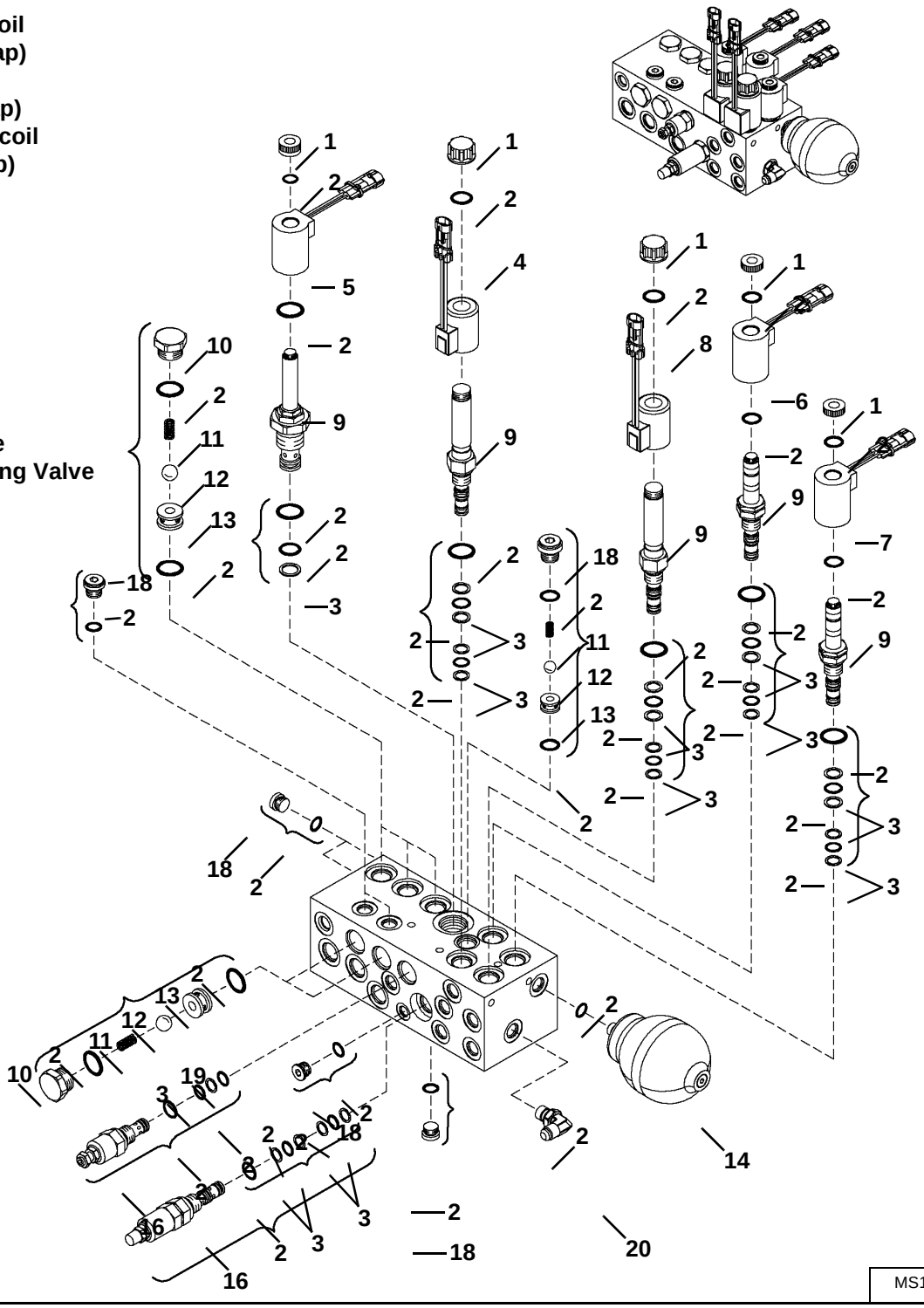
Install the mount (Item 1), clamps (Item 2) and bolts (Item 3) **[Figure 20-60-97]** on the manifold block.


Bobcat®

MANIFOLD ASSEMBLY

Parts Identification

1. Nut
2. O-Ring
3. Backup 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. Glide Ring
20. Fitting

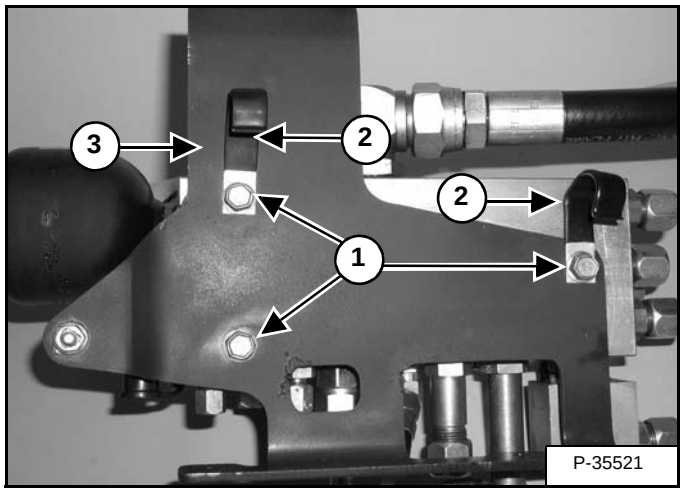


Disassembly

Clean the outside of the manifold assembly before disassembly.

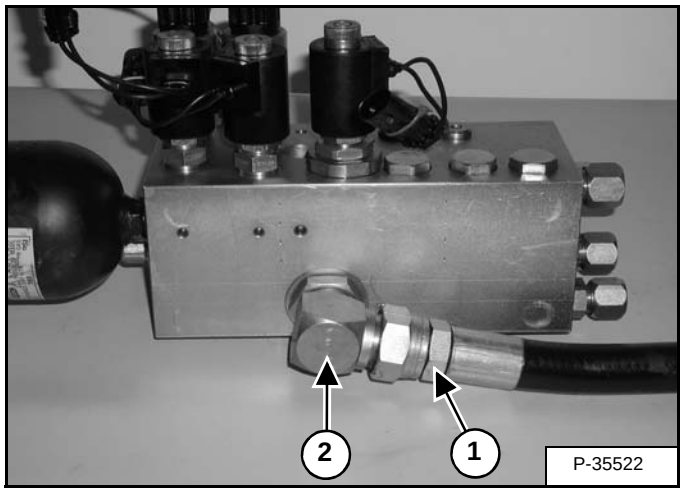
Mark the outside of the manifold assembly for ease of assembly.

Figure 20-61-1



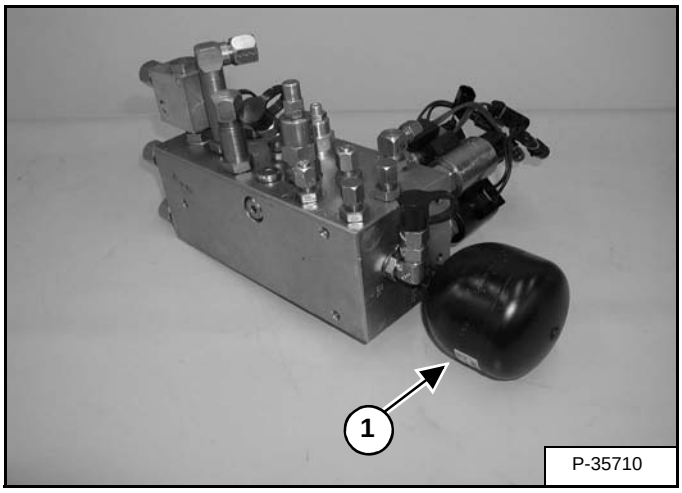
Remove the three bolts (Item 1), clamps (Item 2) and mount plate (Item 3) **[Figure 20-61-1]** from the manifold.

Figure 20-61-2



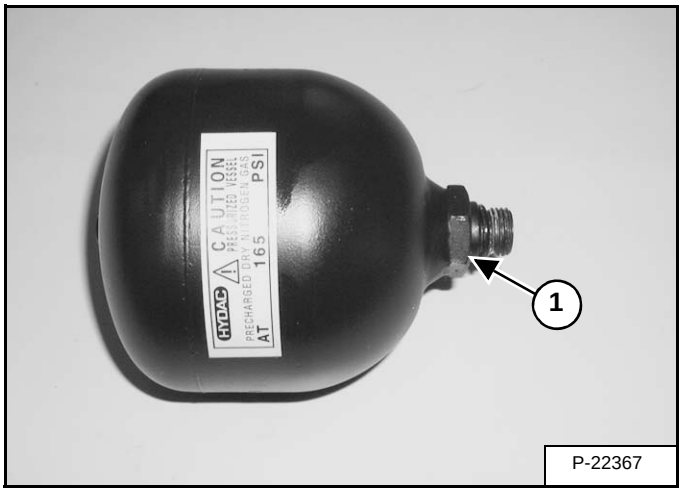
Remove the hose (Item 1) and fitting (Item 2) **[Figure 20-61-2]**.

Figure 20-61-3



Remove the accumulator (Item 1) **[Figure 20-61-3]**.

Figure 20-61-4

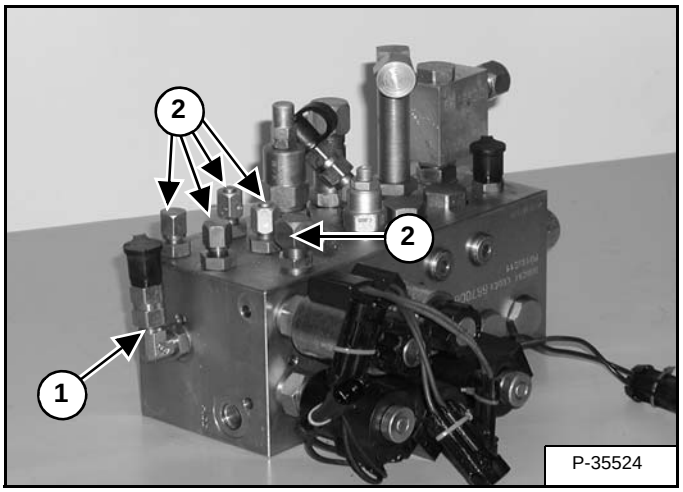


Remove the O-ring (Item 1) **[Figure 20-61-4]** from the accumulator.

MANIFOLD ASSEMBLY (CONT'D)

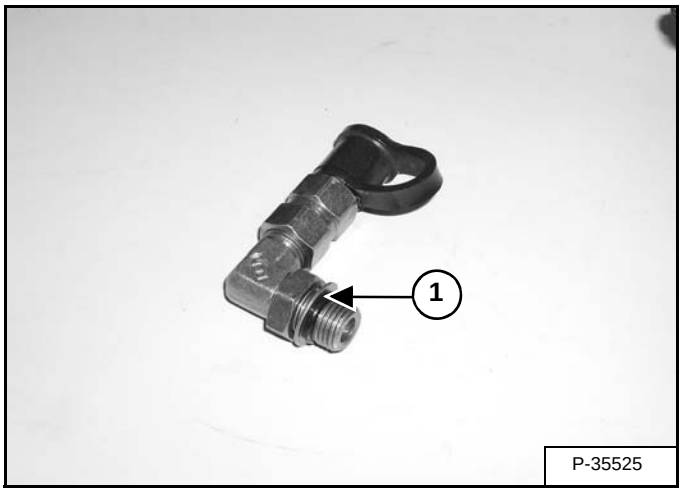
Disassembly (Cont'd)

Figure 20-61-5



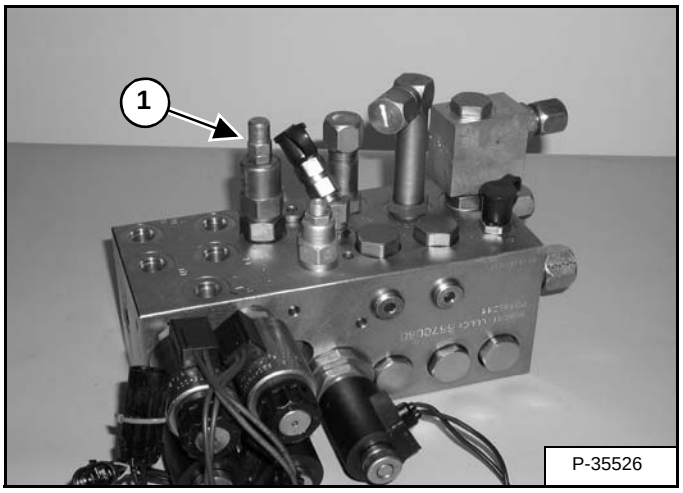
Remove the diagnostic port (Item 1) and five fittings (Item 2) **[Figure 20-61-5]**.

Figure 20-61-6



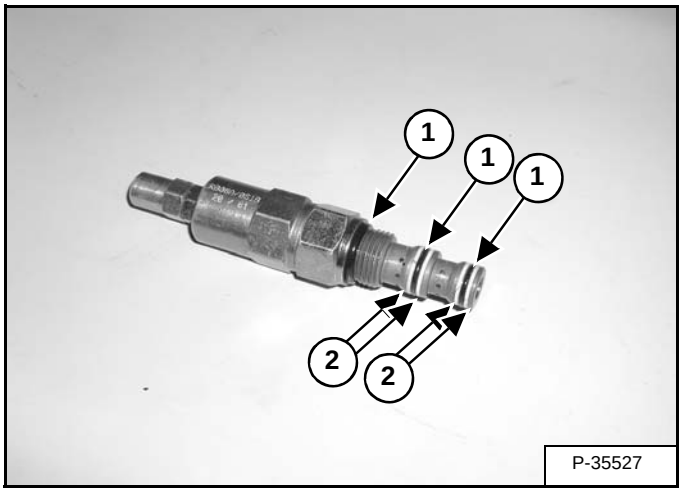
Remove the O-ring (Item 1) **[Figure 20-61-6]** from the diagnostic port and fittings.

Figure 20-61-7



Remove the pressure reducing valve (Item 1) **[Figure 20-61-7]**.

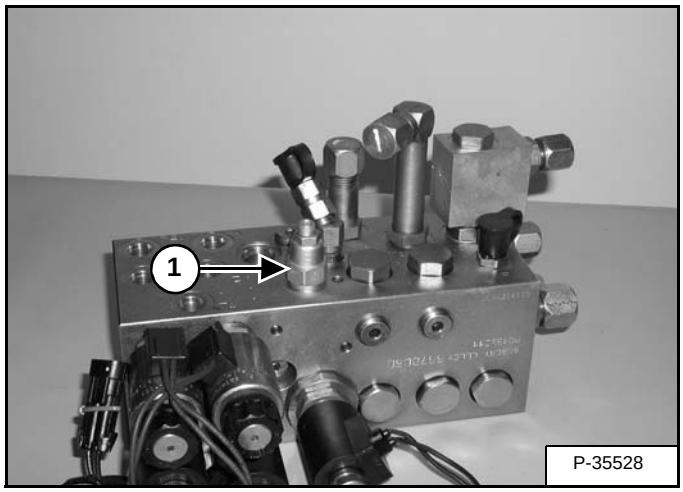
Figure 20-61-8



Remove the O-rings (Item 1) and backup rings (Item 2) **[Figure 20-61-8]** from the pressure reducing valve.

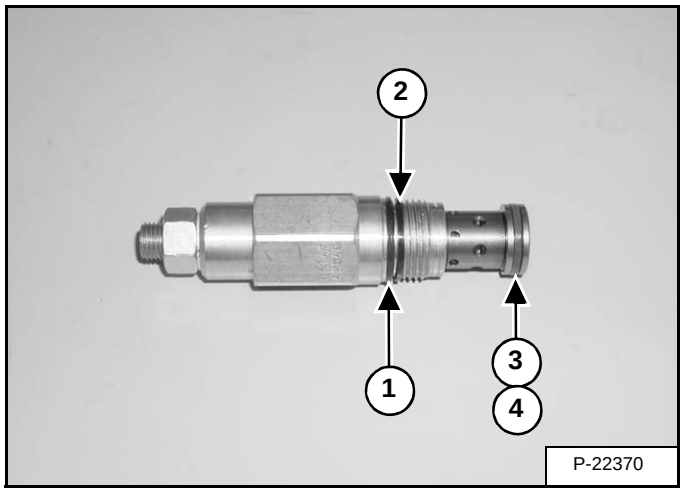
Disassembly (Cont'd)

Figure 20-61-9



Remove the main relief valve (Item 1) **[Figure 20-61-9]**.

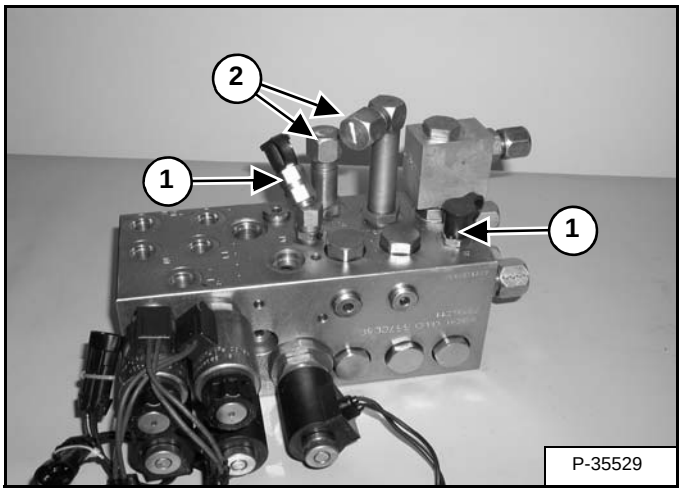
Figure 20-61-10



Remove the O-ring (Item 1) and backup rings (Item 2) **[Figure 20-61-10]** from the main relief valve.

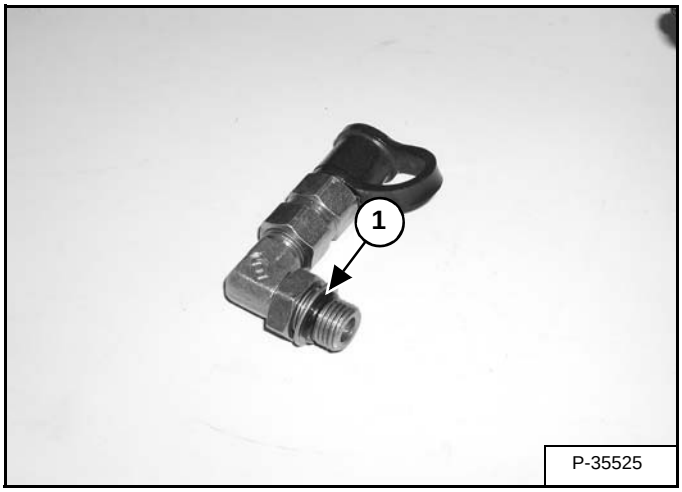
Remove the glid ring (Item 3) and O-ring (Item 4) **[Figure 20-61-10]** from the main relief valve.

Figure 20-61-11



Remove the two diagnostic ports (Item 1) and two fittings (Item 2) **[Figure 20-61-11]**.

Figure 20-61-12

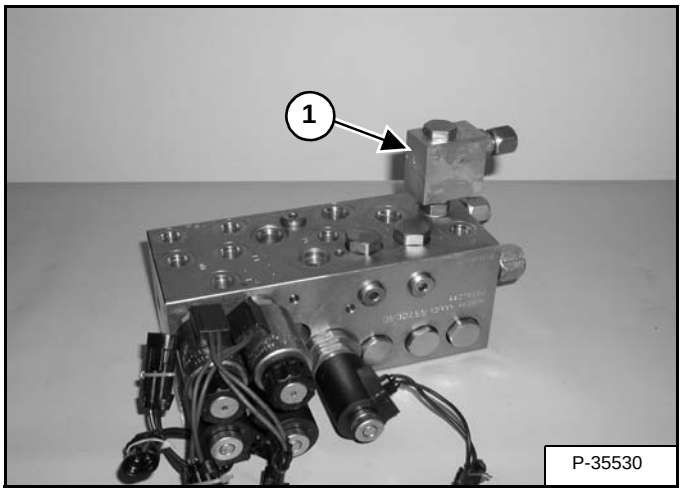


Remove the O-ring (Item 1) **[Figure 20-61-12]** from the diagnostic ports and fittings.

MANIFOLD ASSEMBLY (CONT'D)

Disassembly (Cont'd)

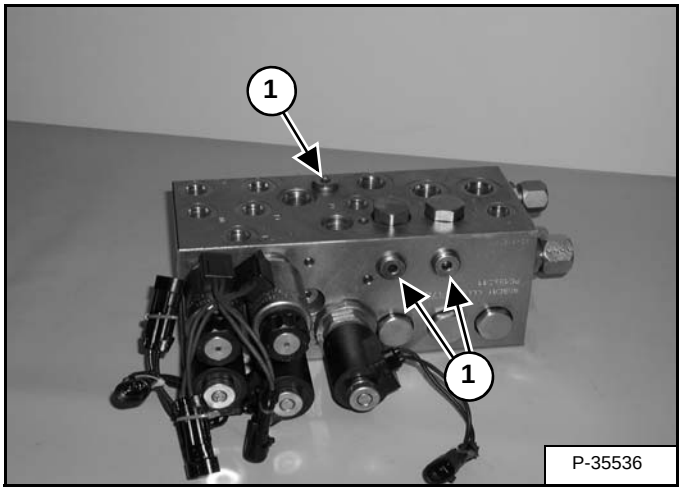
Figure 20-61-13



Remove the build up valve (Item 1) **[Figure 20-61-13]**.

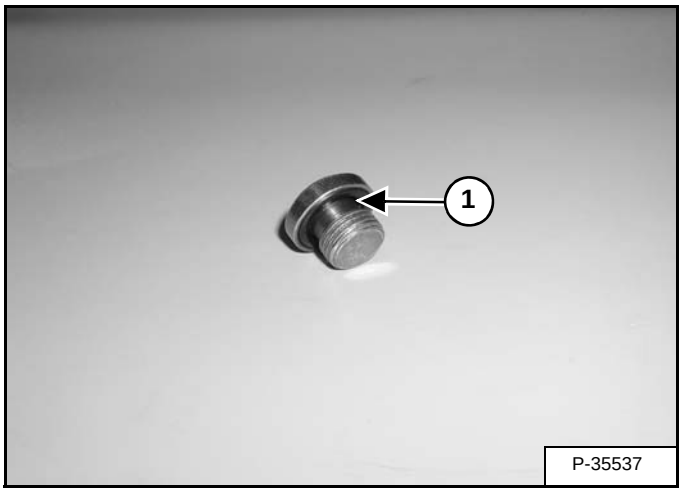
NOTE: See Buildup Valve Disassembly. (See Disassembly And Assembly on Page 20-160-3.)

Figure 20-61-14



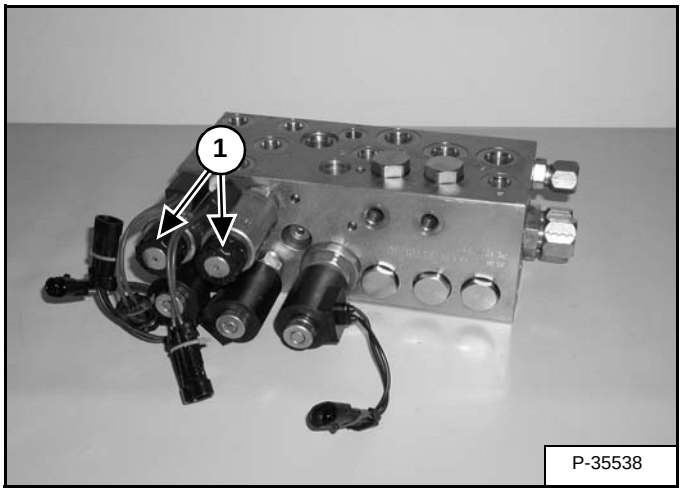
Remove the three plugs (Item 1) **[Figure 20-61-14]**.

Figure 20-61-15



Remove the O-ring (Item 1) **[Figure 20-61-15]** from the plugs.

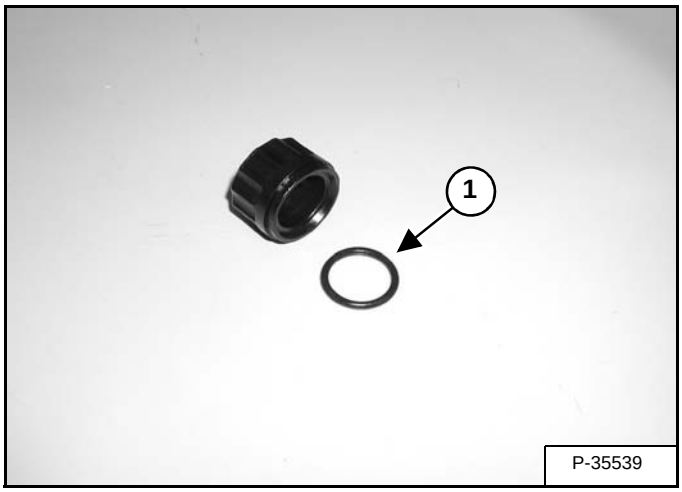
Figure 20-61-16



Remove the nuts (Item 1) **[Figure 20-61-16]** from the two solenoids.

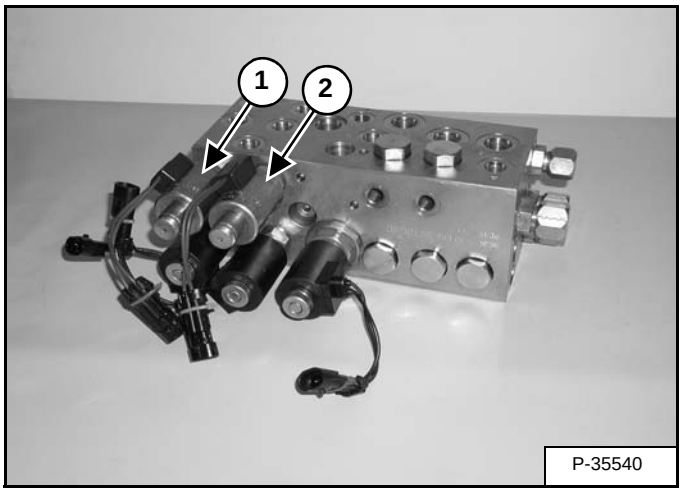
Disassembly (Cont'd)

Figure 20-61-17



Remove the O-ring (Item 1) **[Figure 20-61-17]** from both nuts.

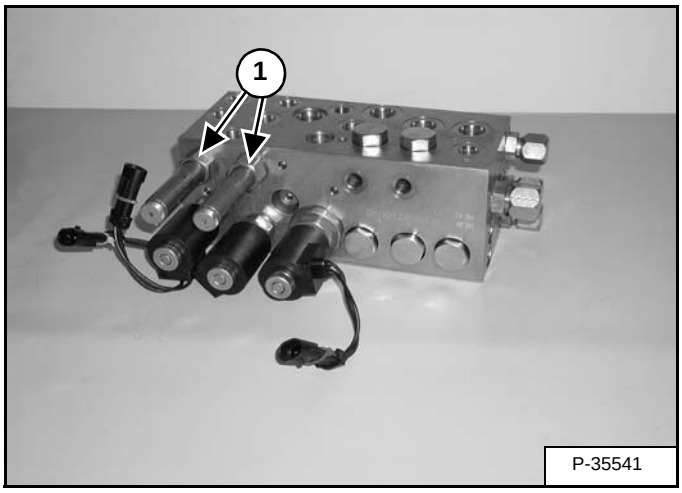
Figure 20-61-18



Remove the coil with the red tie strap (Item 1) **[Figure 20-61-18]** from the left solenoid.

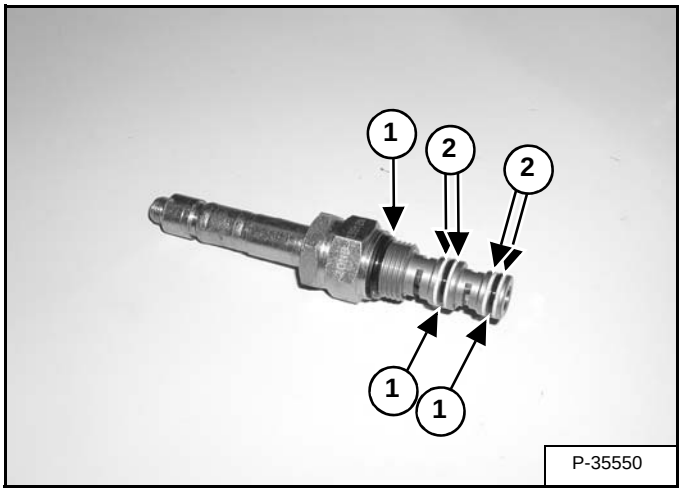
Remove the coil with the blue tie strap (Item 2) **[Figure 20-61-18]** from the right solenoid.

Figure 20-61-19



Remove the two solenoids (Item 1) **[Figure 20-61-19]**.

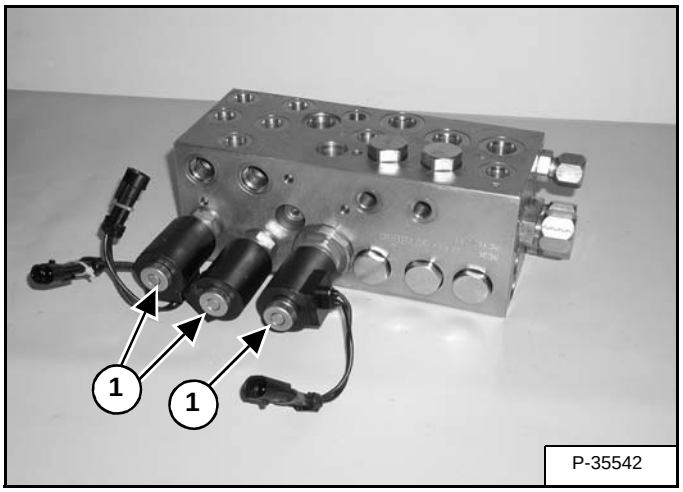
Figure 20-61-20



Remove the O-rings (Item 1) and backup rings (Item 2) **[Figure 20-61-20]** from both solenoids.

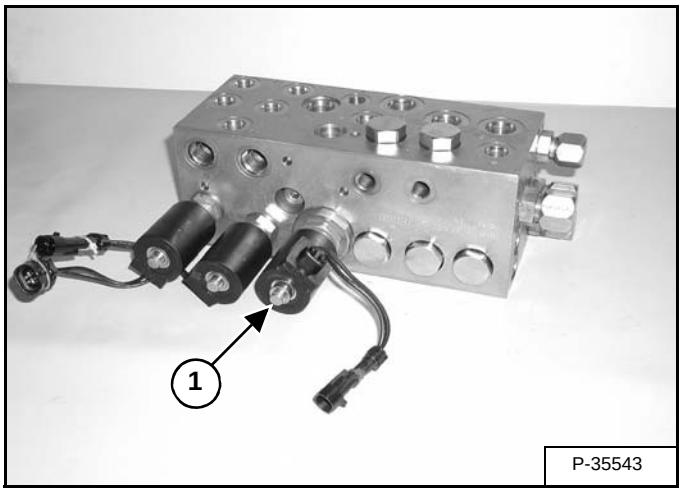
Disassembly (Cont'd)

Figure 20-61-21



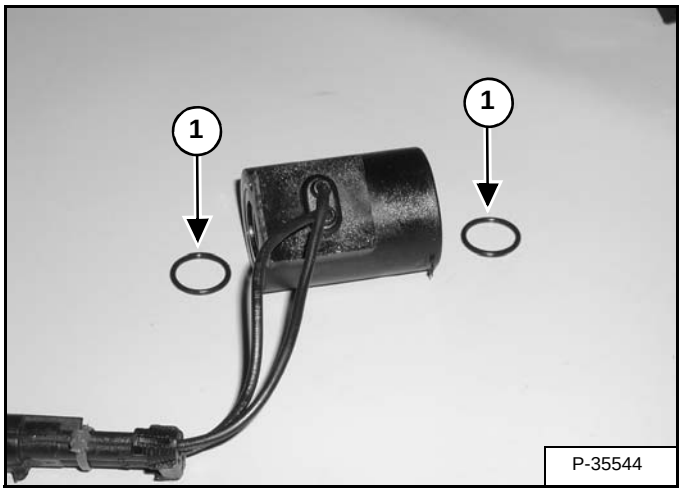
Remove the nut (Item 1) **[Figure 20-61-21]** from the three solenoids.

Figure 20-61-22



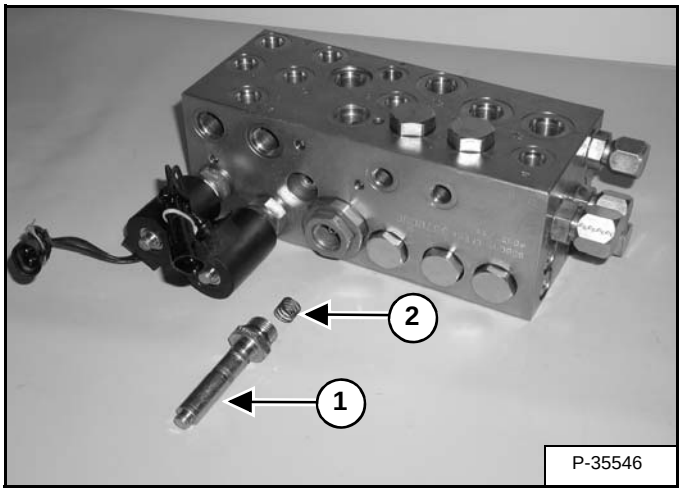
Remove the coil with the brown tie strap (Item 1) **[Figure 20-61-22]** from the solenoid.

Figure 20-61-23



Remove the O-rings (Item 1) **[Figure 20-61-23]** from the coil.

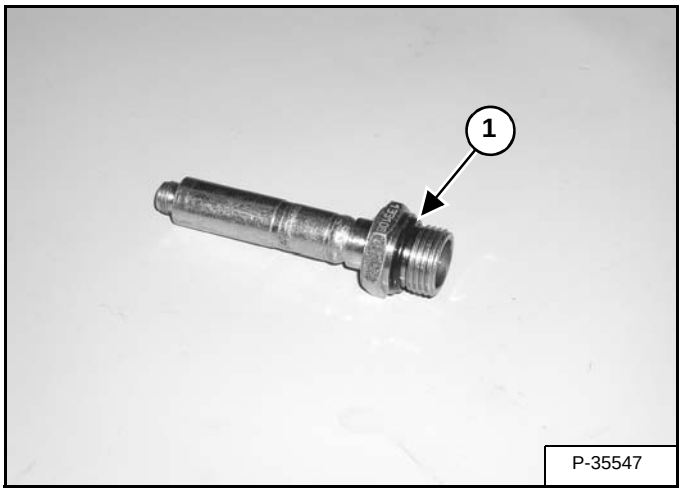
Figure 20-61-24



Remove the solenoid (Item 1) and spring (Item 2) **[Figure 20-61-24]**.

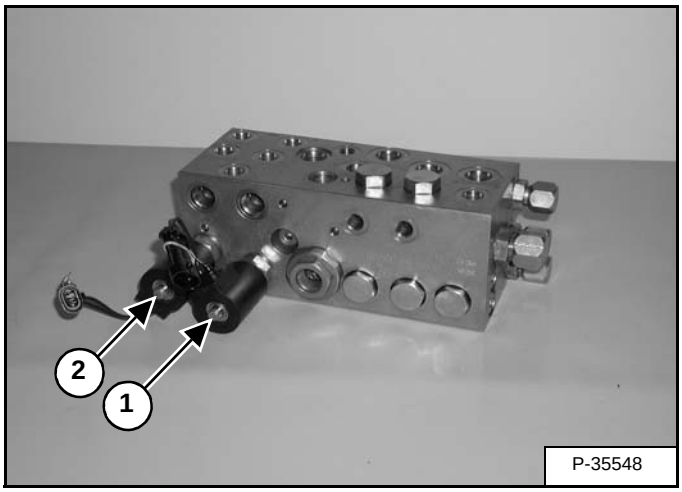
Disassembly (Cont'd)

Figure 20-61-25



Remove the O-ring (Item 1) **[Figure 20-61-25]** from the solenoid.

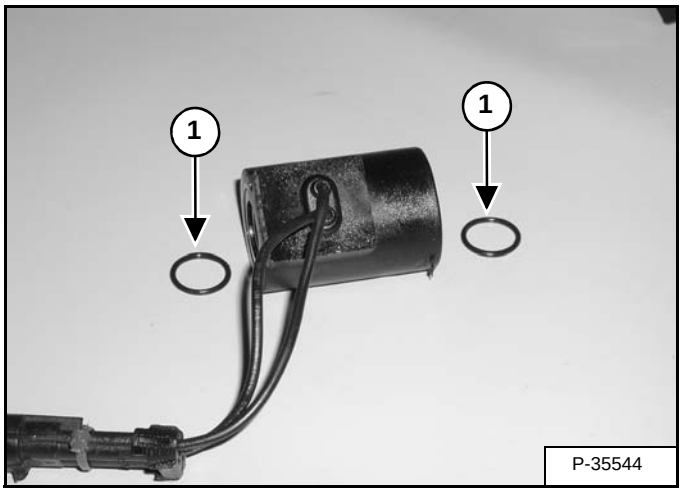
Figure 20-61-26



Remove the coil with the yellow tie strap (Item 1) **[Figure 20-61-26]** from the solenoid.

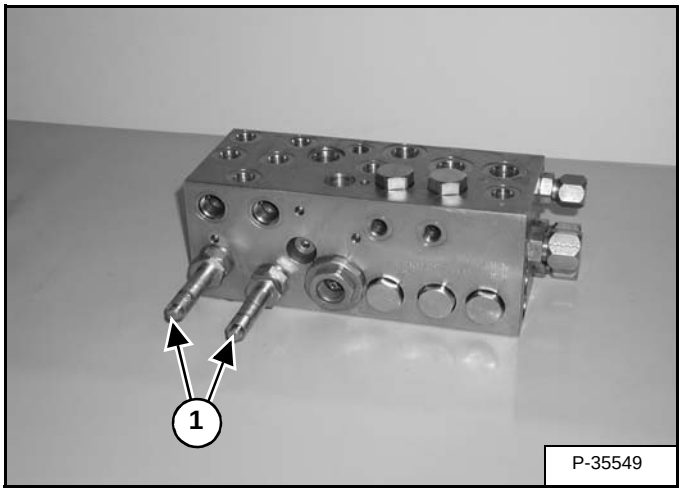
Remove the coil with the green tie strap (Item 2) **[Figure 20-61-26]** from the solenoid.

Figure 20-61-27



Remove the two O-rings (Item 1) **[Figure 20-61-27]** from the coils.

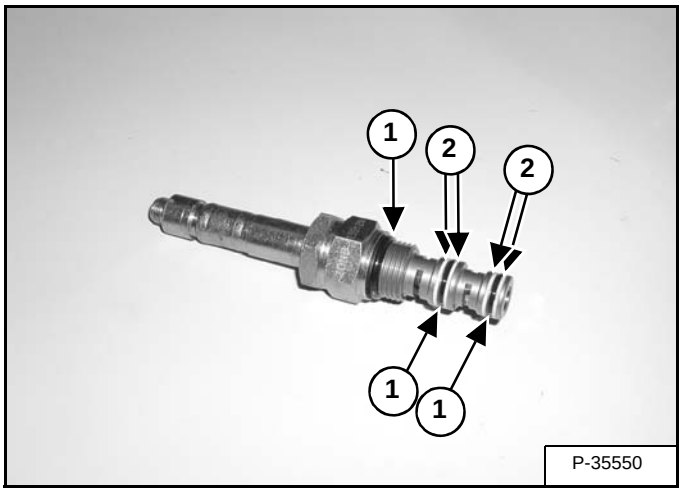
Figure 20-61-28



Remove the two solenoids (Item 1) **[Figure 20-61-28]**.

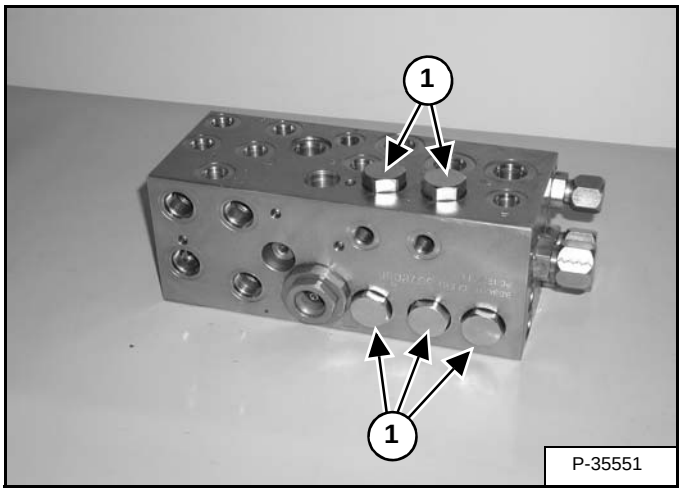
Disassembly (Cont'd)

Figure 20-61-29



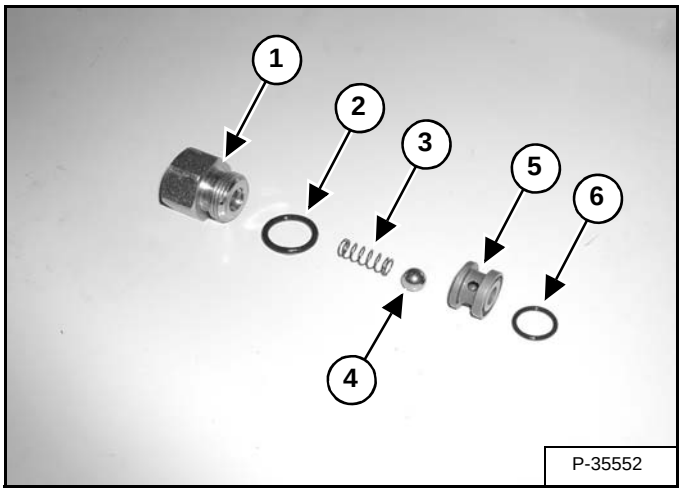
Remove the O-rings (Item 1) and backup rings (Item 2) **[Figure 20-61-29]** from both solenoids.

Figure 20-61-30



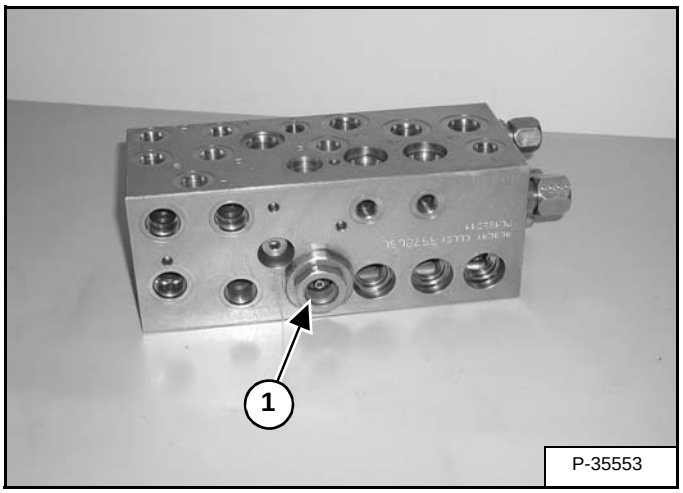
Loosen the five check valves (Item 1) **[Figure 20-61-30]**.

Figure 20-61-31



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 20-61-31]** from the five check valve ports.

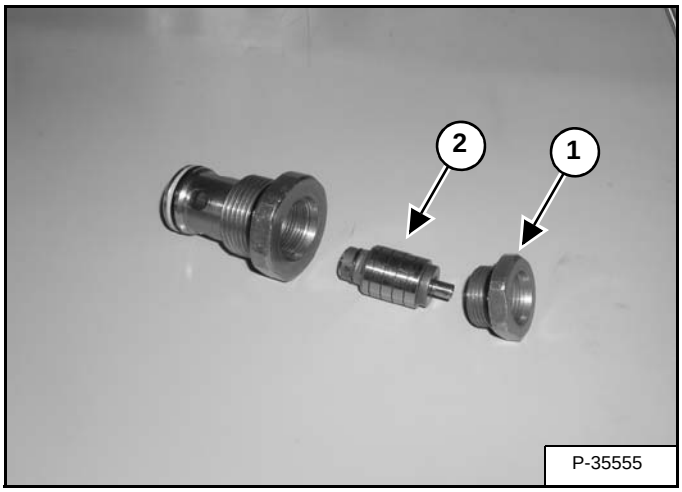
Figure 20-61-32



Remove the port adapter (Item 1) **[Figure 20-61-32]**.

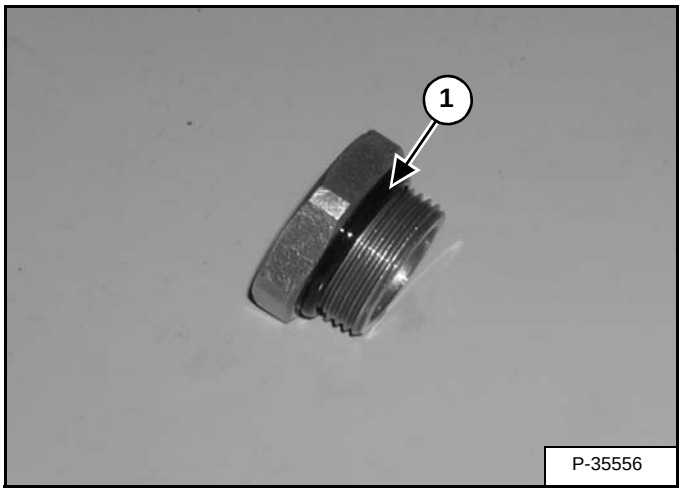
Disassembly (Cont'd)

Figure 20-61-33



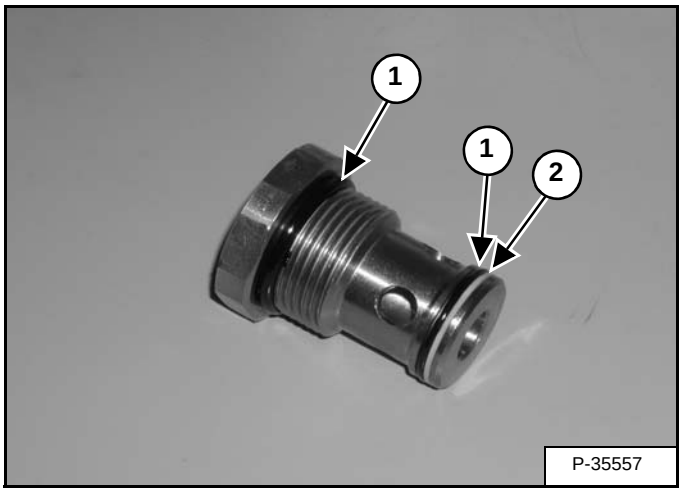
Remove the fitting (Item 1) and spool (Item 2) **[Figure 20-61-33]** from the port adapter.

Figure 20-61-34



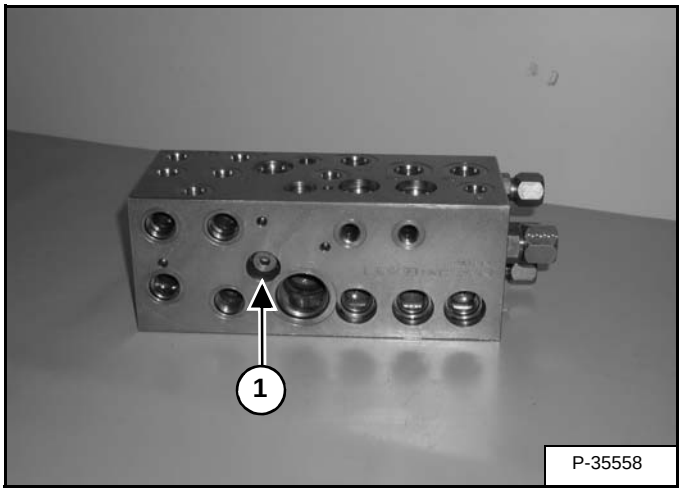
Remove the O-ring (Item 1) **[Figure 20-61-34]** from the fitting.

Figure 20-61-35



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-61-35]** from the port adapter.

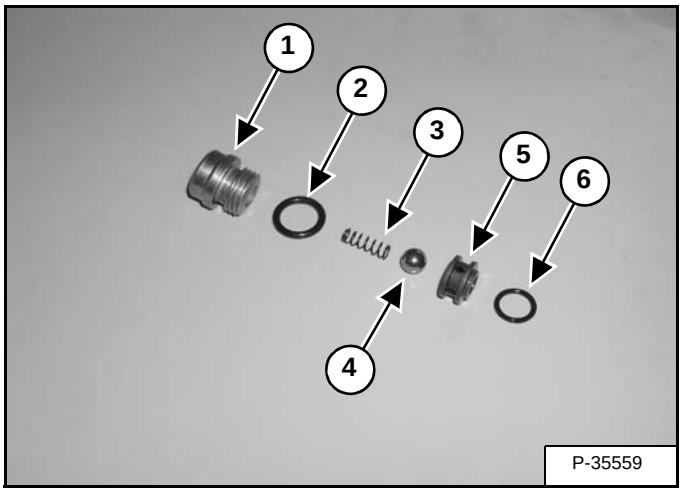
Figure 20-61-36



Loosen the cap (Item 1) **[Figure 20-61-36]**.

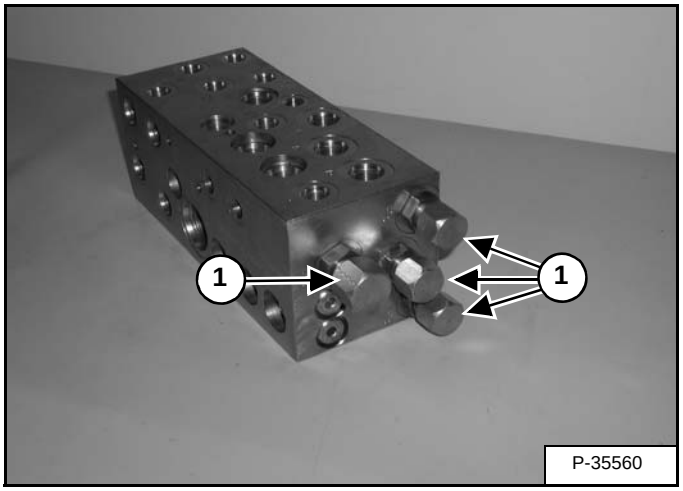
Disassembly (Cont'd)

Figure 20-61-37



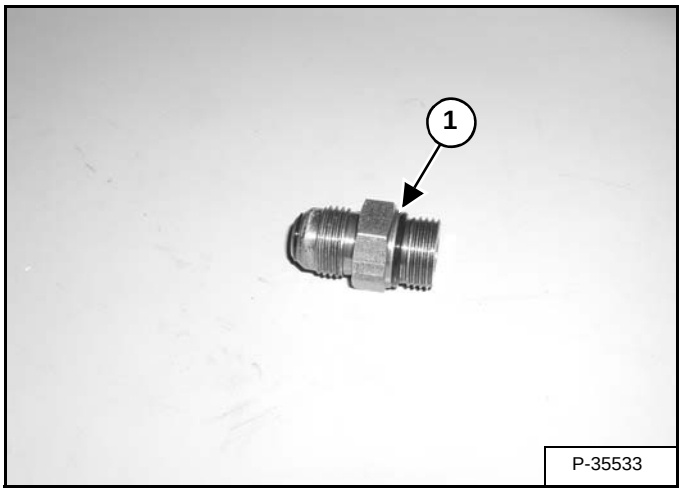
Remove the cap (Item 1), O-ring (Item 2), spring (Item 3), check ball (Item 4), seat (Item 5) and O-ring (Item 6) **[Figure 20-61-37]** from the port.

Figure 20-61-38



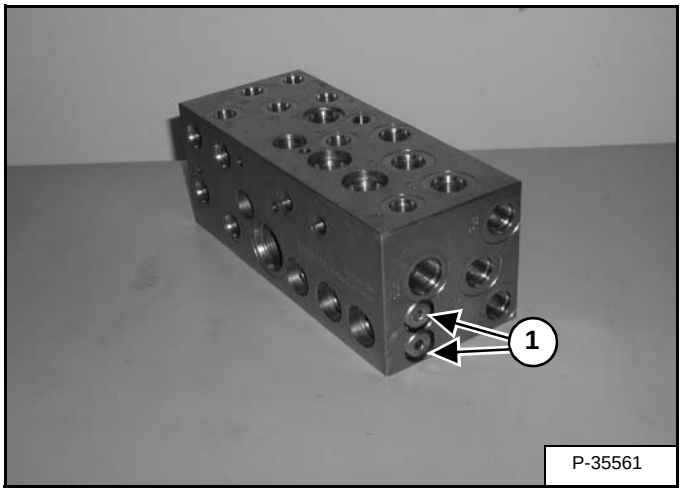
Remove the four fittings (Item 1) **[Figure 20-61-38]**.

Figure 20-61-39



Remove the O-ring (Item 1) **[Figure 20-61-39]** from the fittings.

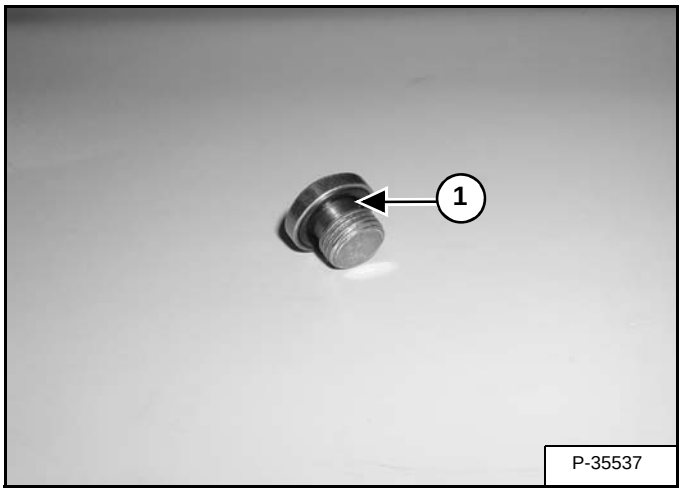
Figure 20-61-40



Remove the two plugs (Item 1) **[Figure 20-61-40]**.

Disassembly (Cont'd)

Figure 20-61-41



Remove the O-ring (Item 1) **[Figure 20-61-41]** from the plugs.

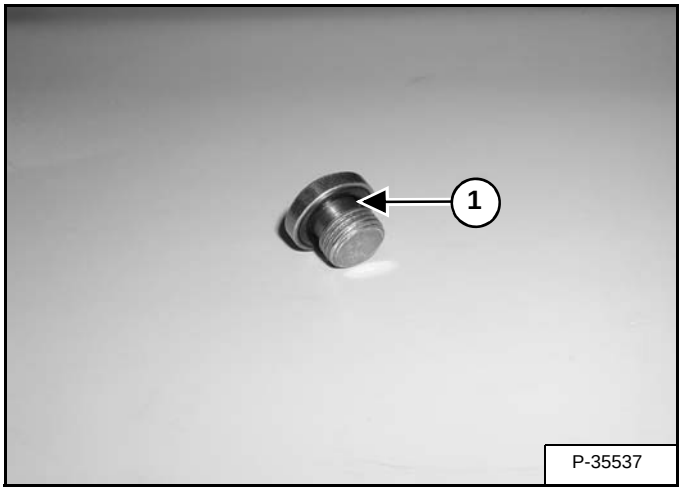
Assembly

Clean all parts in solvent and dry with compressed air.

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

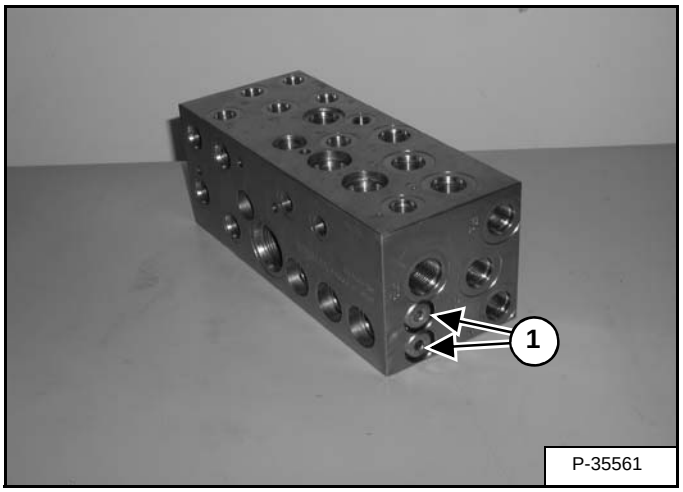
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-61-42



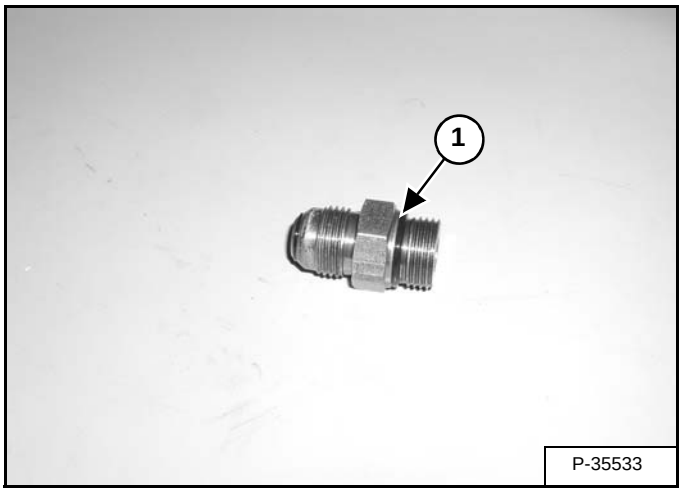
Install the O-ring (Item 1) **[Figure 20-61-42]** on the plugs.

Figure 20-61-43



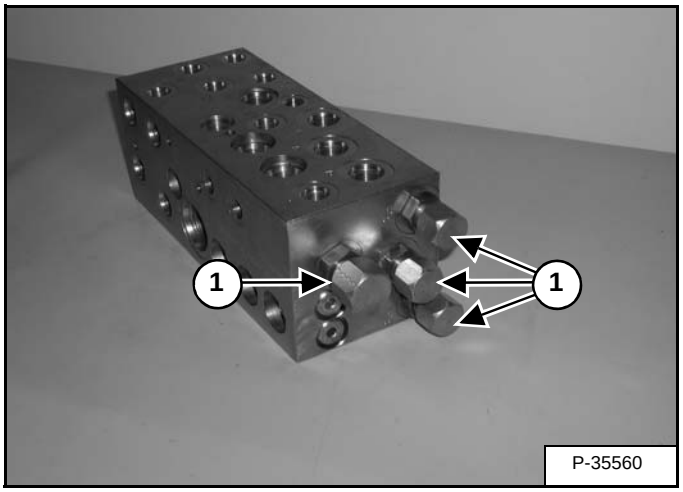
Install the two plugs (Item 1) **[Figure 20-61-43]**. Tighten the plugs to 18 - 20 ft.-lb. (24,4 - 27,1 N•m) torque.

Figure 20-61-44



Install the O-ring (Item 1) **[Figure 20-61-44]** on the four fittings.

Figure 20-61-45



Install the four fittings (Item 1) **[Figure 20-61-45]**.

Assembly (Cont'd)

Figure 20-61-46

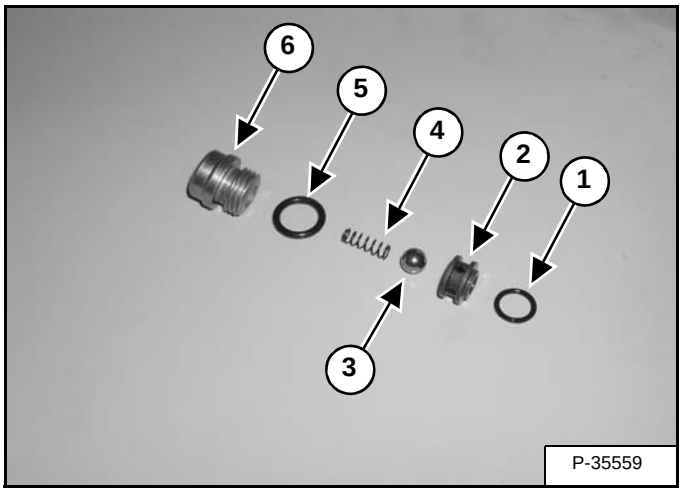
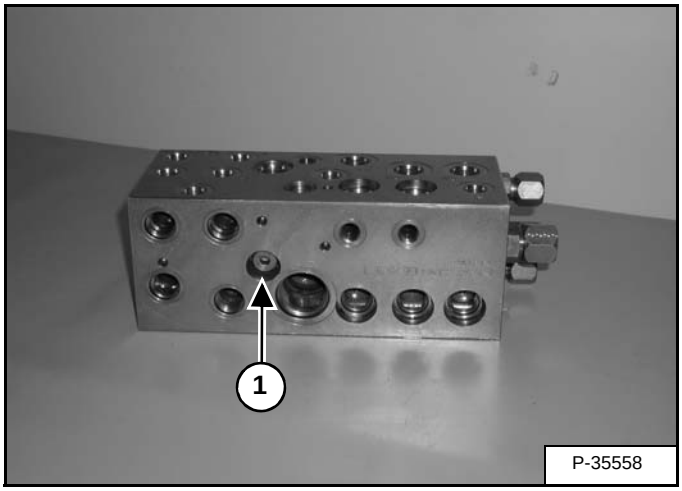
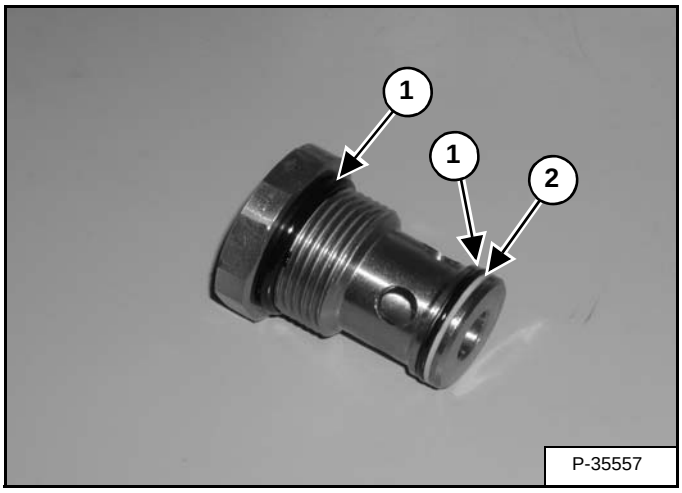


Figure 20-61-47



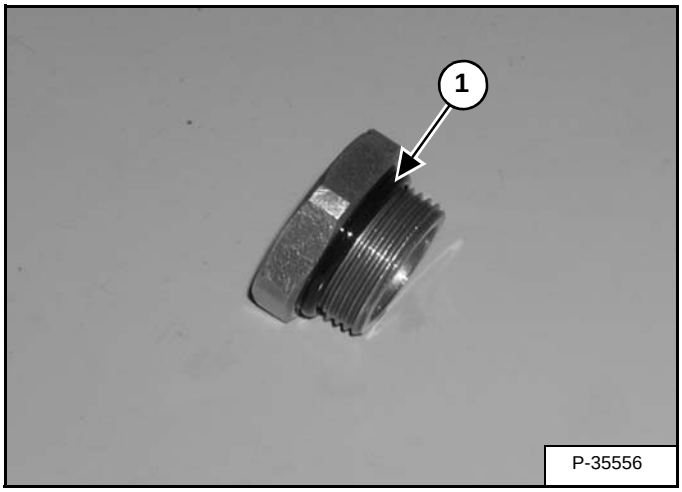
Install the O-ring (Item 1), seat (Item 2), check ball (Item 3), spring (Item 4), O-ring (Item 5) and cap (Item 6) **[Figure 20-61-46]** in the port (Item 1) **[Figure 20-61-47]** in the manifold housing.

Figure 20-61-48



Install the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-61-48]** on the port adapter.

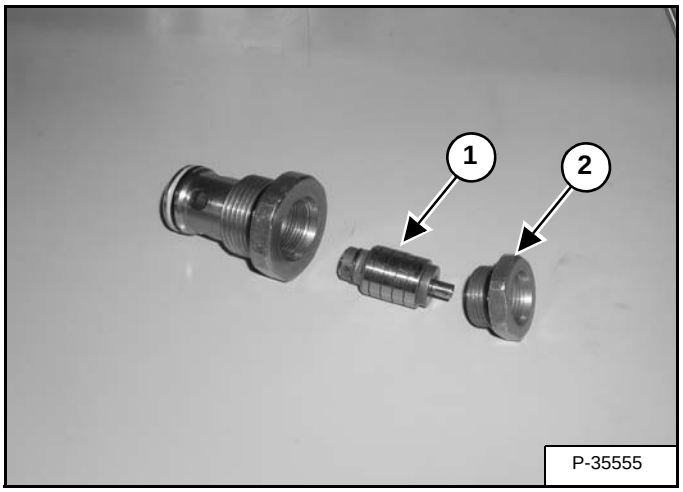
Figure 20-61-49



Install the O-ring (Item 1) **[Figure 20-61-49]** on the fitting.

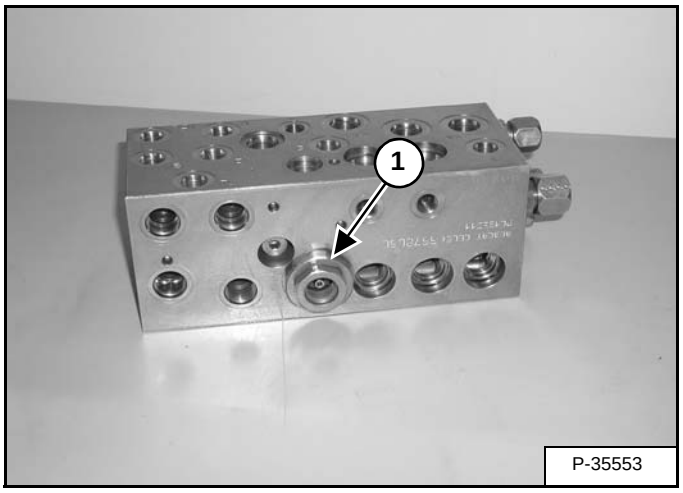
Assembly (Cont'd)

Figure 20-61-50



Install the spool (Item 1) and fitting (Item 2) **[Figure 20-61-50]** in the port adapter.

Figure 20-61-51



Install the port adapter (Item 1) **[Figure 20-61-51]**.

Figure 20-61-52

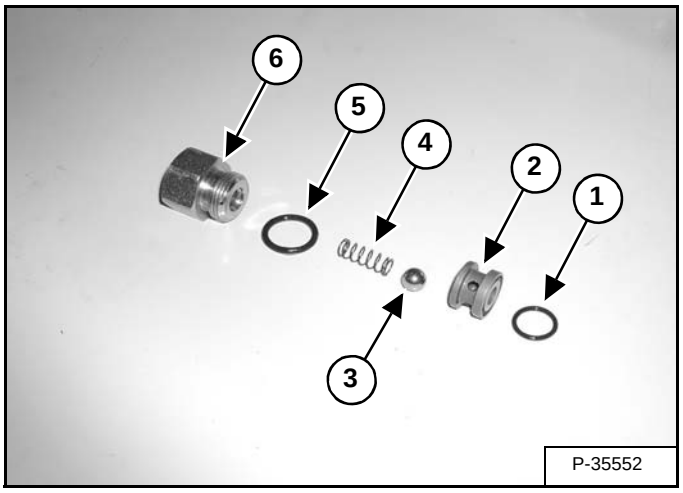
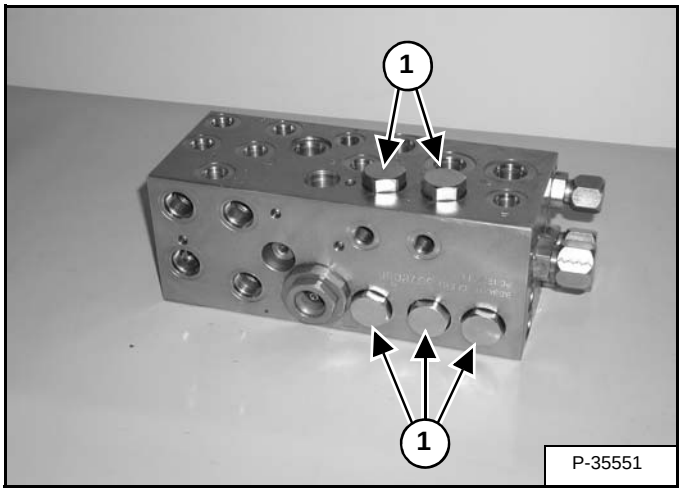


Figure 20-61-53

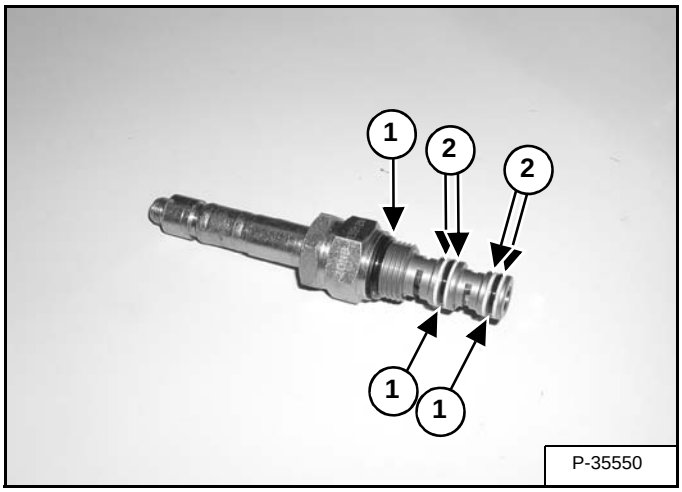


Install the O-ring (Item 1), seat (Item 2), check ball (Item 3), spring (Item 4), O-ring (Item 5) and cap (Item 6) **[Figure 20-61-52]** in the five check valve ports (Item 1) **[Figure 20-61-53]**.

Tighten the caps to 19 - 22 ft.-lb. (25,1- 29,8 N•m) torque.

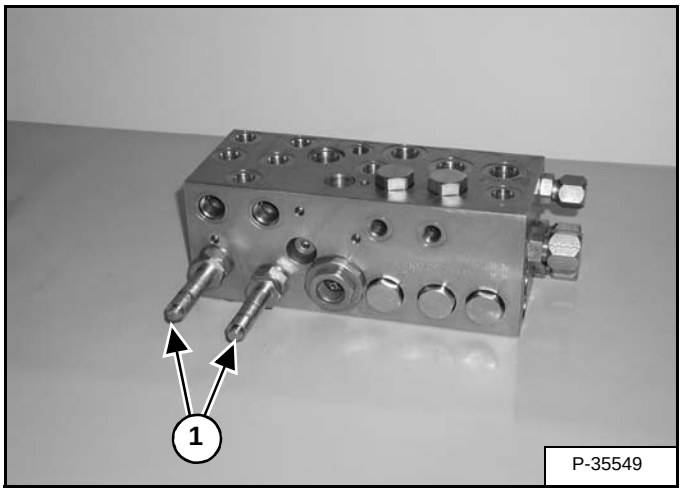
Assembly (Cont'd)

Figure 20-61-54



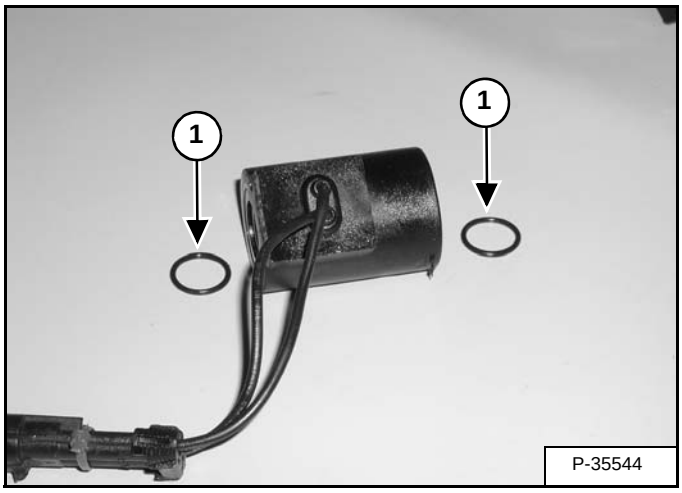
Install the O-rings (Item 1) and backup rings (Item 2) **[Figure 20-61-54]** on the solenoids.

Figure 20-61-55



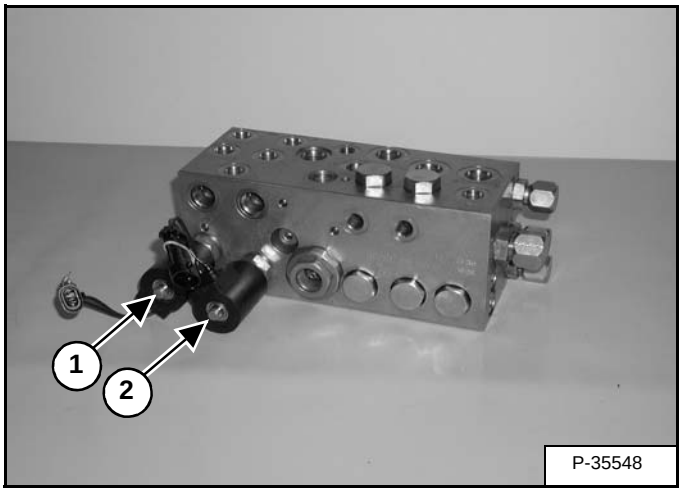
Install the solenoids (Item 1) **[Figure 20-61-55]**.

Figure 20-61-56



Install the two O-rings (Item 1) **[Figure 20-61-56]** on the coils.

Figure 20-61-57

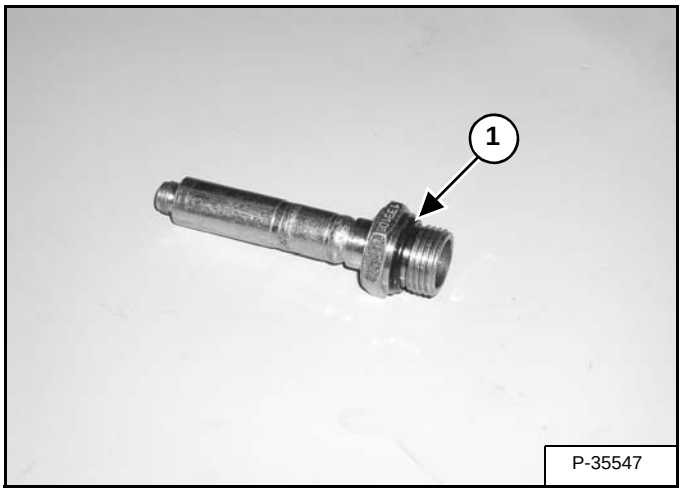


Install the coil with the green tie strap (Item 1) **[Figure 20-61-57]** on the left solenoid.

Install the coil with the yellow tie strap (Item 2) **[Figure 20-61-57]** on the right solenoid.

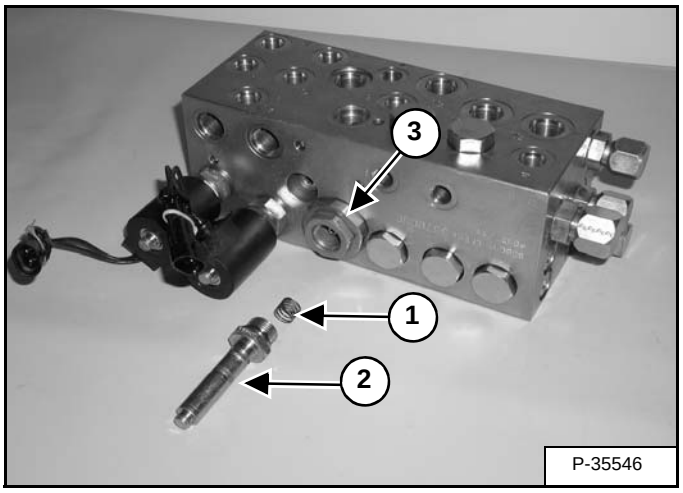
Assembly (Cont'd)

Figure 20-61-58



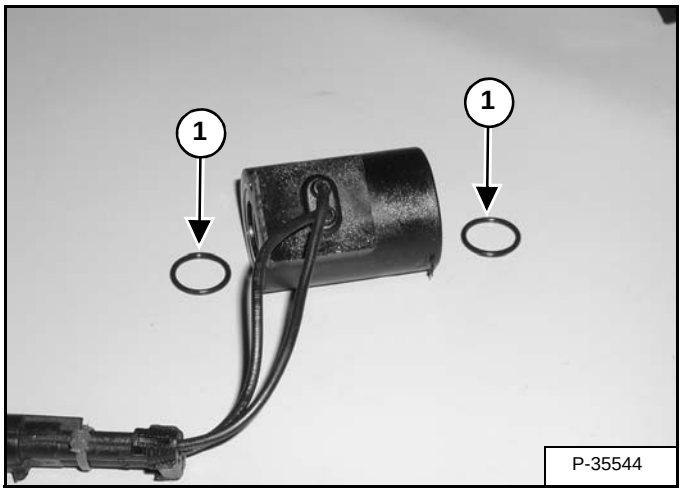
Install the O-ring (Item 1) **[Figure 20-61-58]** on the solenoid.

Figure 20-61-59



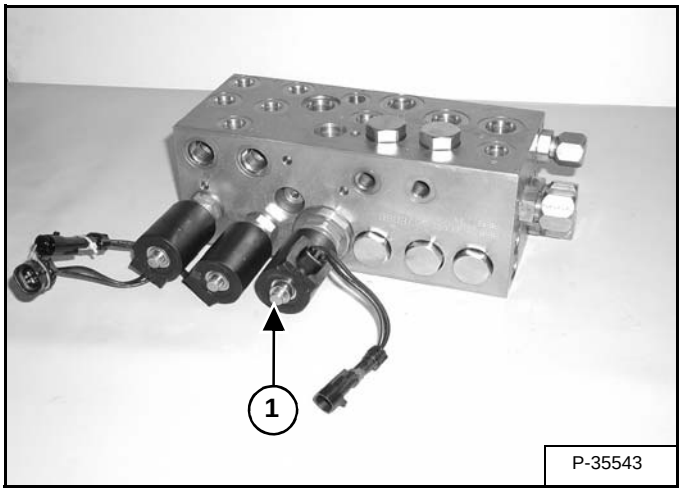
Install the spring (Item 1) and solenoid (Item 2) in the port (Item 3) **[Figure 20-61-59]**. Tighten the solenoid to 19 - 22 ft.-lb. (25,1- 29,8 N•m) torque.

Figure 20-61-60



Install the O-rings (Item 1) **[Figure 20-61-60]** on the coil.

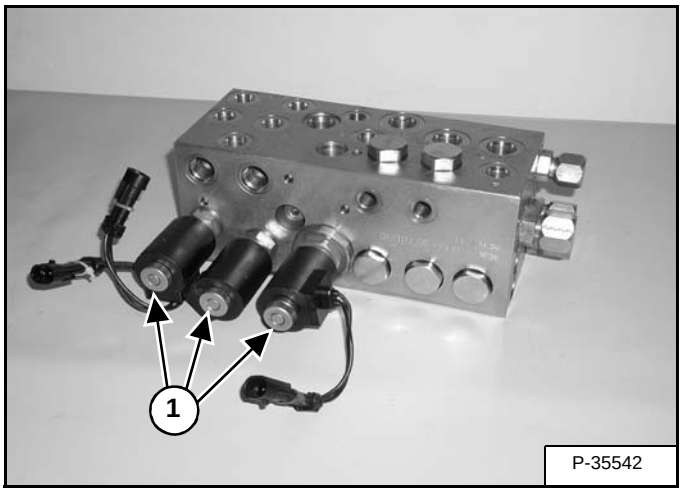
Figure 20-61-61



Install the coil with the brown tie strap (Item 1) **[Figure 20-61-61]** on the solenoid.

Assembly (Cont'd)

Figure 20-61-62

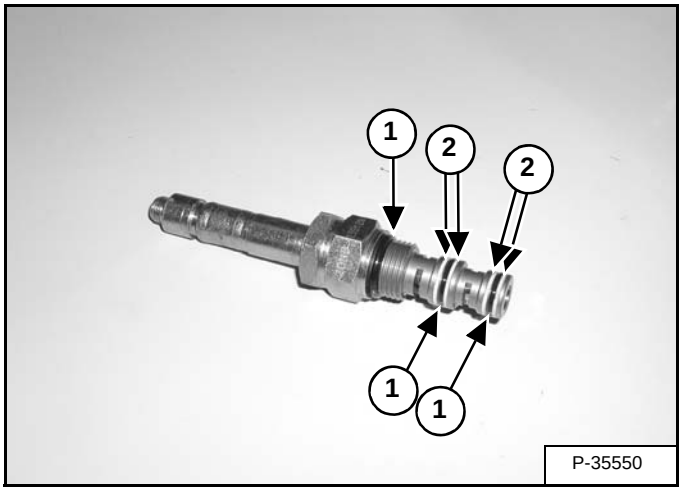


Install the nut (Item 1) **[Figure 20-61-62]** on the three solenoids.

Hand tighten the nuts.

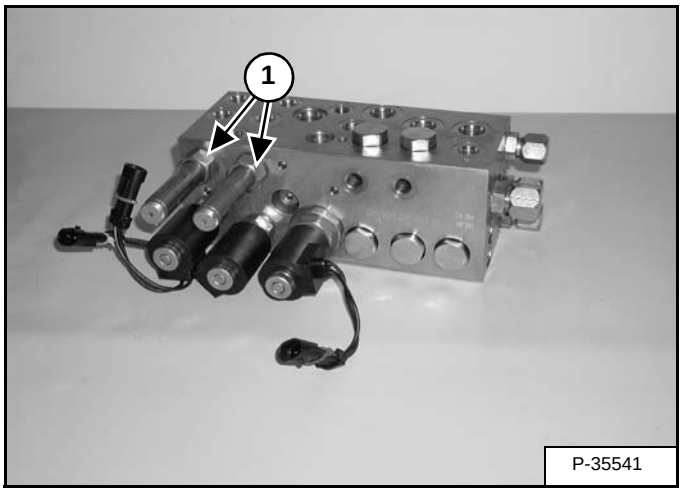
NOTE: Overtightening the coil nuts (Item 1) [Figure 20-61-62] may cause spool or coil failure.

Figure 20-61-63



Install the O-rings (Item 1) and backup rings (Item 2) **[Figure 20-61-63]** on the solenoids.

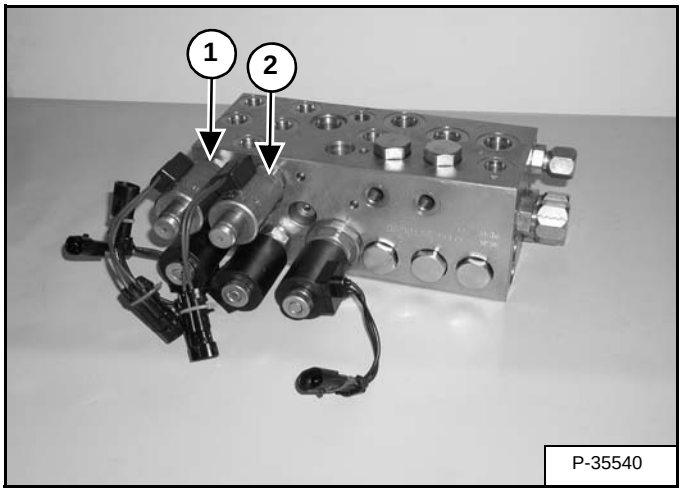
Figure 20-61-64



Install the two solenoids (Item 1) **[Figure 20-61-64]**.

Tighten the solenoids to 19 - 22 ft.-lb. (25,1- 29,8 N•m) torque.

Figure 20-61-65

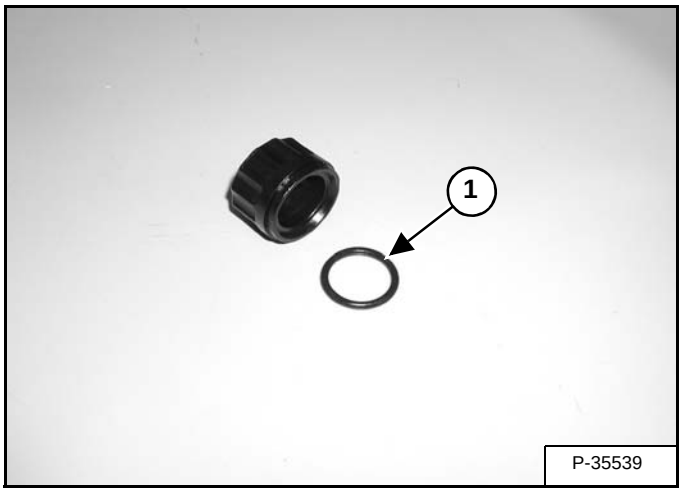


Install the coil with the red tie strap (Item 1) **[Figure 20-61-65]** on the left solenoid.

Install the coil with the blue tie strap (Item 2) **[Figure 20-61-65]** on the right solenoid.

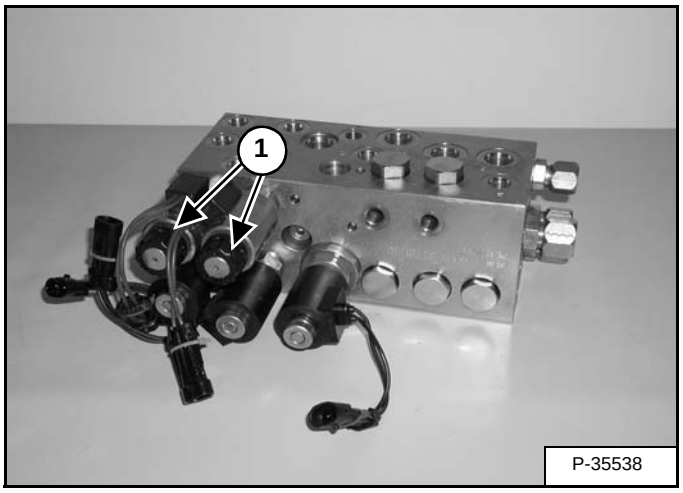
Assembly (Cont'd)

Figure 20-61-66



Install the O-ring (Item 1) **[Figure 20-61-66]** on the two nuts.

Figure 20-61-67

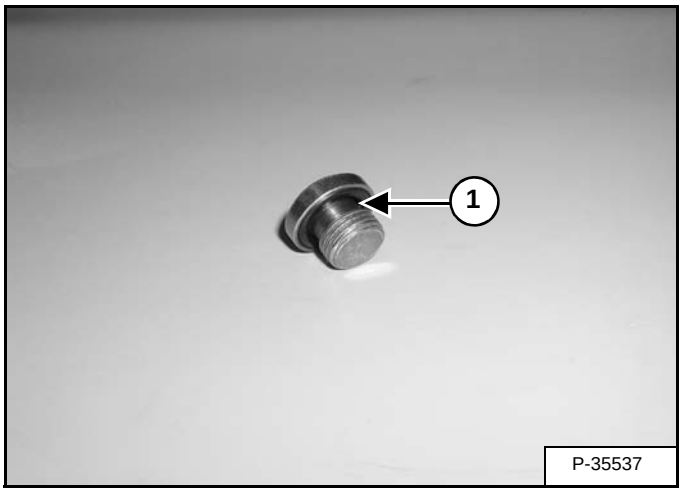


Install the nuts (Item 1) **[Figure 20-61-67]** on the solenoid.

Tighten the nuts to 3 - 5 ft.-lb. (4,1- 6,1 N•m) torque.

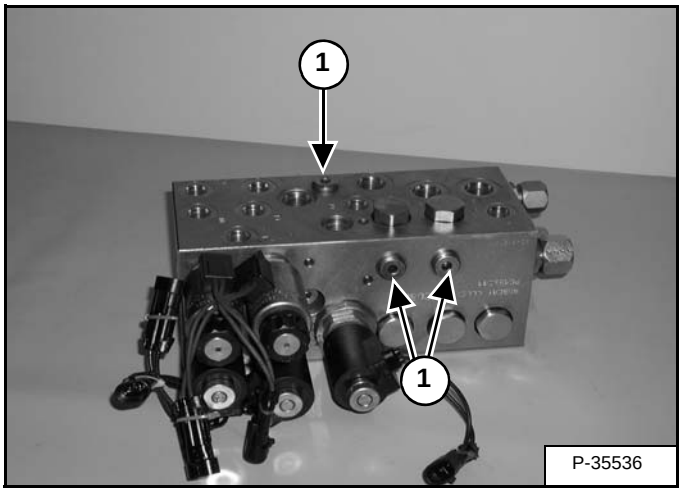
NOTE: Overtightening the coil nuts (Item 1) [Figure 20-61-67] may cause spool or coil failure.

Figure 20-61-68



Install the O-ring (Item 1) **[Figure 20-61-68]** on the plugs.

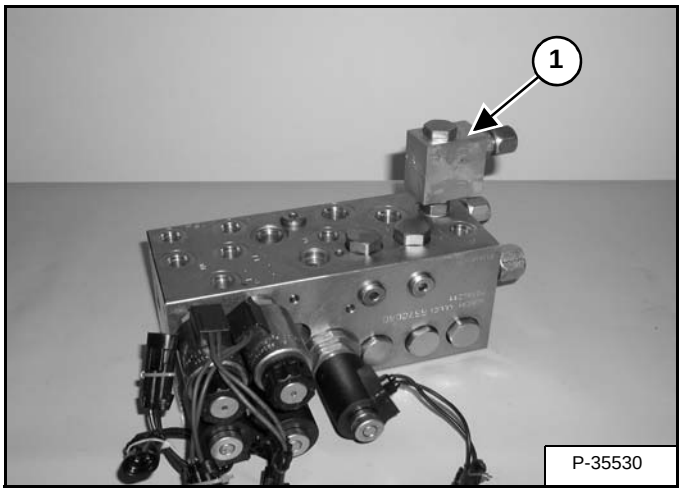
Figure 20-61-69



Install the three plugs (Item 1) **[Figure 20-61-69]**.

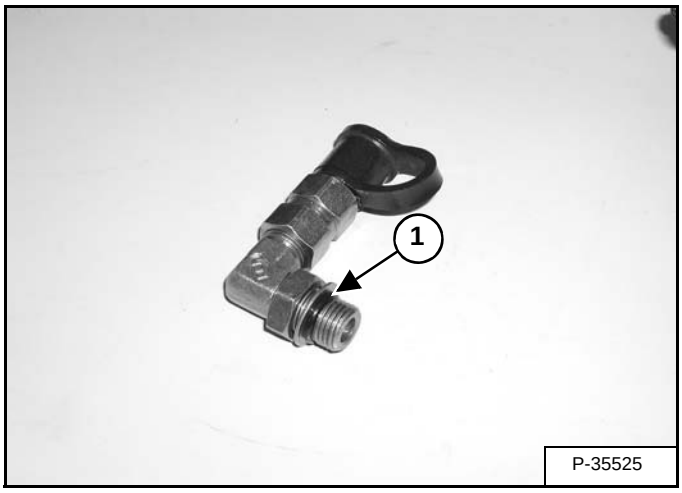
Assembly (Cont'd)

Figure 20-61-70



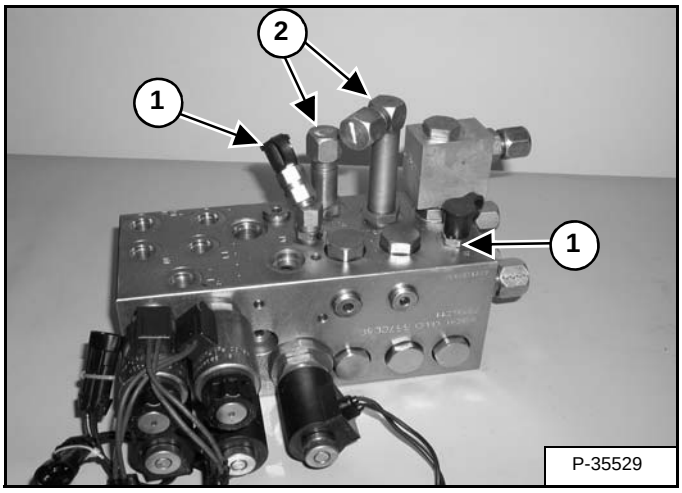
Install the build up valve (Item 1) **[Figure 20-61-70]**.

Figure 20-61-71



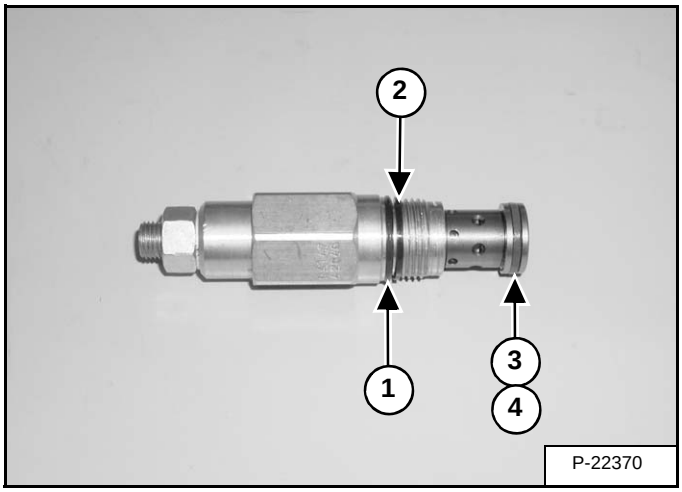
Install the O-ring (Item 1) **[Figure 20-61-71]** on the two diagnostic ports and two fittings.

Figure 20-61-72



Install the two diagnostic ports (Item 1) and two fittings (Item 2) **[Figure 20-61-72]**.

Figure 20-61-73

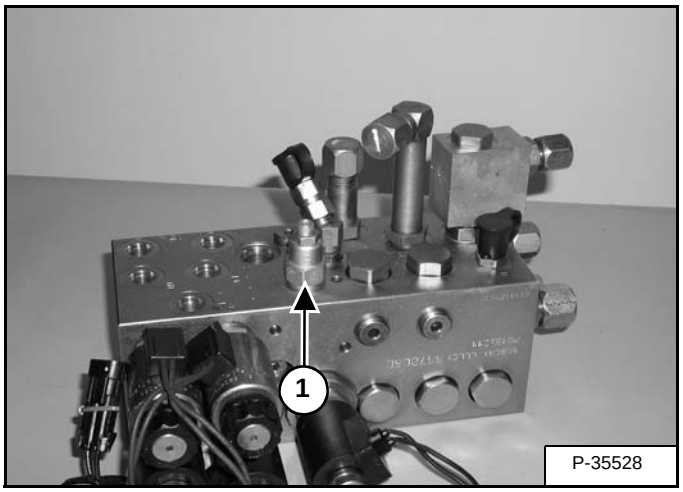


Install the O-ring (Item 1) and backup rings (Item 2) **[Figure 20-61-73]** on the main relief valve.

Install the O-ring (Item 3) and glid ring (Item 4) **[Figure 20-61-73]** on the main relief valve.

Assembly (Cont'd)

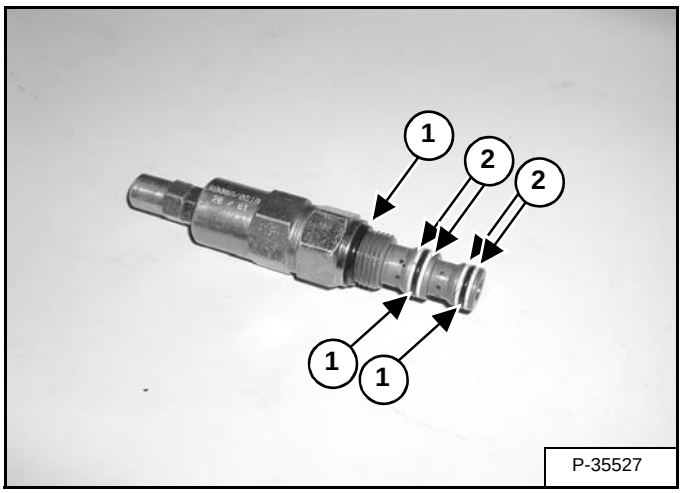
Figure 20-61-74



Install the main relief valve (Item 1) **[Figure 20-61-74]**.

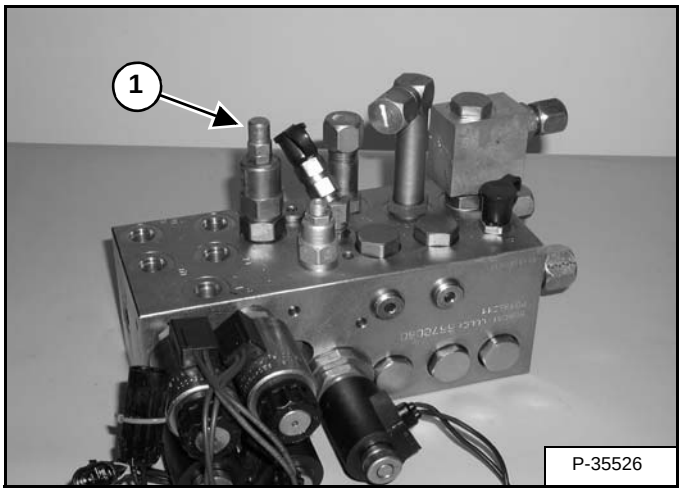
Tighten the main relief valve to 30 - 35 ft.-lb. (40,7 - 47,5 N•m) torque.

Figure 20-61-75



Install the O-rings (Item 1) and backup rings (Item 2) **[Figure 20-61-75]** on the pressure reducing valve.

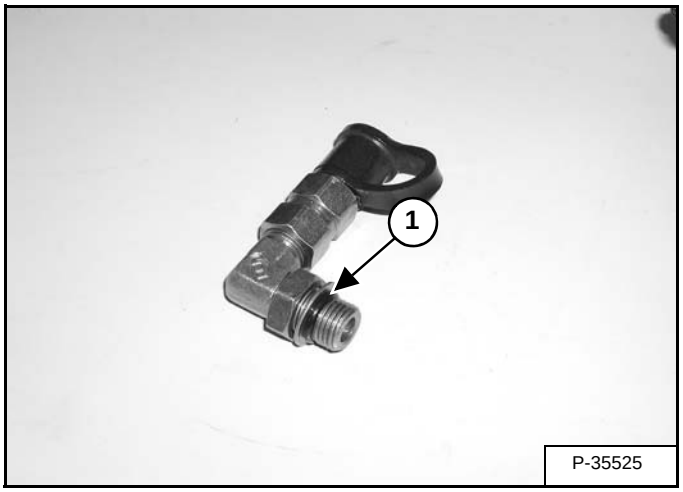
Figure 20-61-76



Install the pressure reducing valve (Item 1) **[Figure 20-61-76]**.

Tighten the pressure reducing valve to 19 - 22 ft.-lb. (25,1- 29,8 N•m) torque.

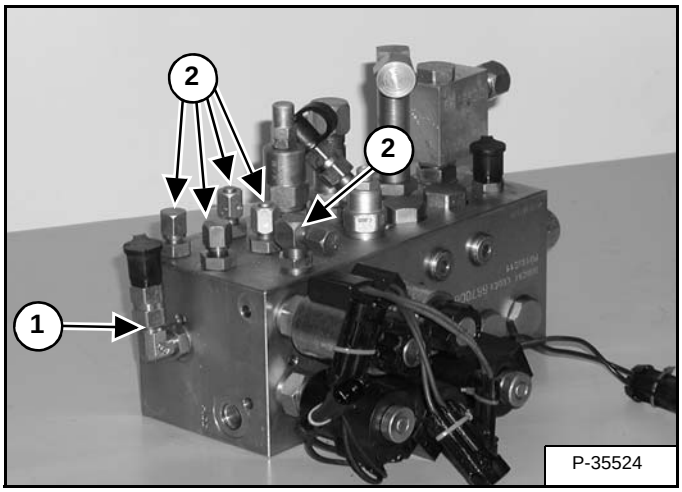
Figure 20-61-77



Install the O-ring (Item 1) **[Figure 20-61-77]** on the diagnostic port and five fittings.

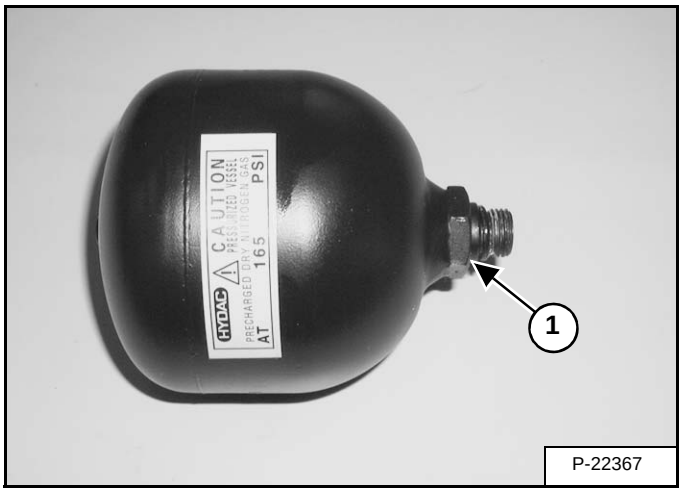
Assembly (Cont'd)

Figure 20-61-78



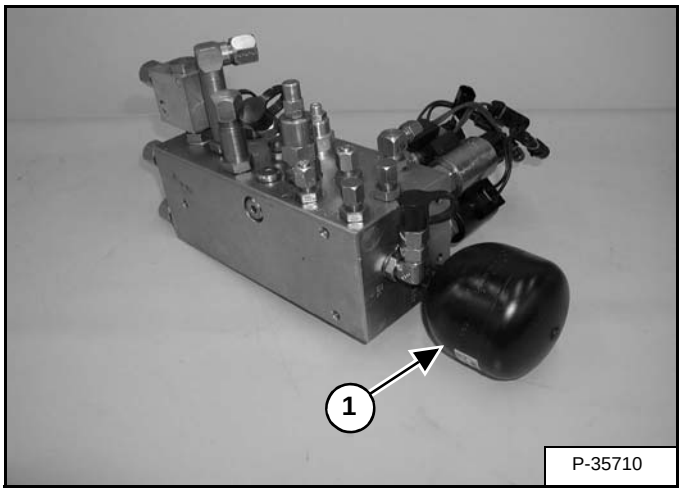
Install the diagnostic port (Item 1) and five fittings (Item 2) **[Figure 20-61-78]**.

Figure 20-61-79



Install the O-ring (Item 1) **[Figure 20-61-79]** on the accumulator.

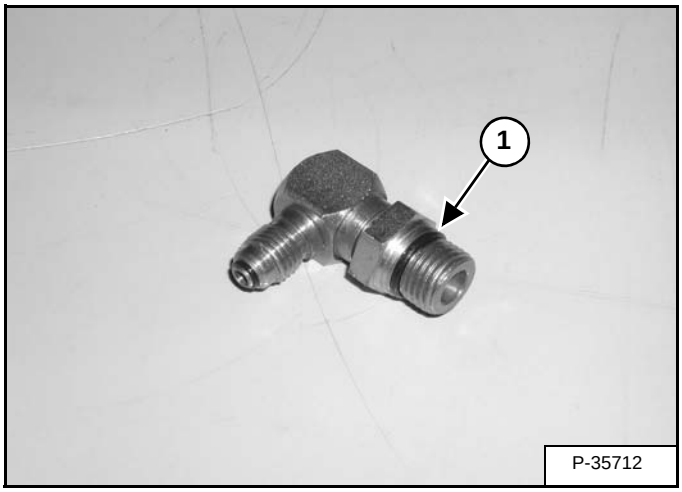
Figure 20-61-80



Install the accumulator (Item 1) **[Figure 20-61-80]**.

Tighten the accumulator to 22 - 24 ft.-lb. (29 - 33 N•m) torque.

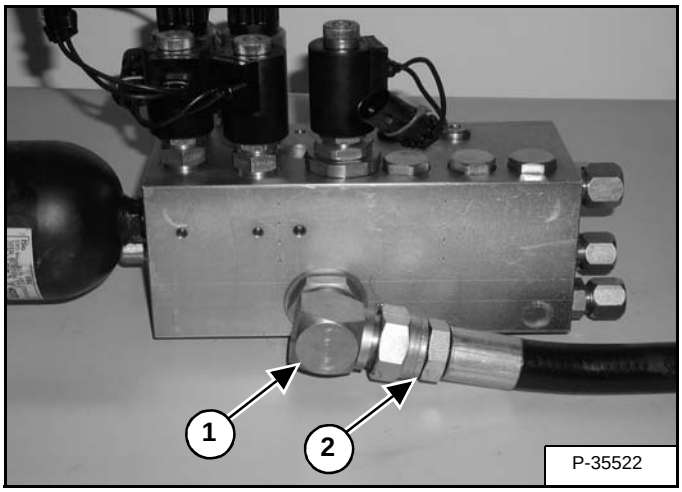
Figure 20-61-81



Install the O-ring (Item 1) **[Figure 20-61-81]** on the fitting.

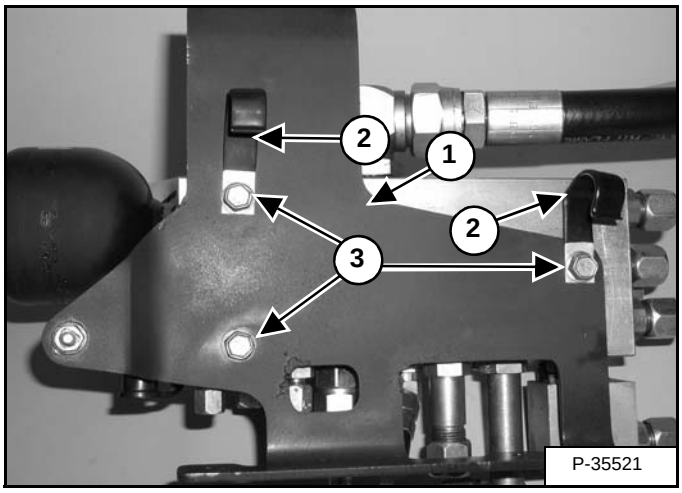
Assembly (Cont'd)

Figure 20-61-82



Install the fitting (Item 1) and hose (Item 2) **[Figure 20-61-82]** on the manifold block.

Figure 20-61-83



Install the mount plate (Item 1), two clamps (Item 2) and three bolts (Item 3) **[Figure 20-61-83]** on the manifold block.


Bobcat®

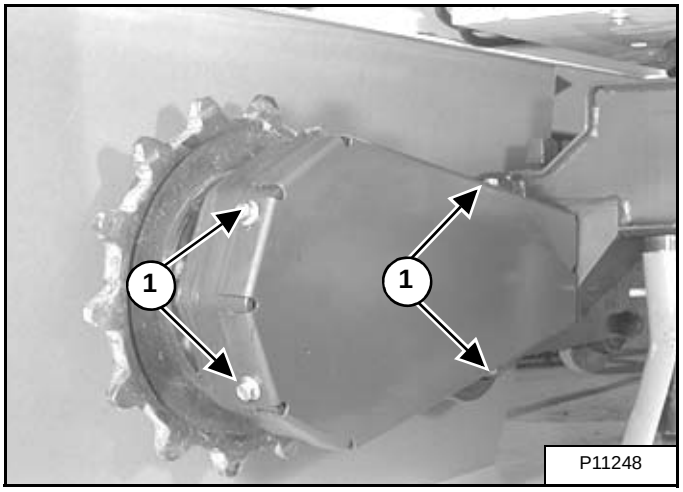
TRAVEL MOTOR

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 TRACKS on Page 30-20-1.)

Figure 20-70-1



Remove the bolts (Item 1) **[Figure 20-70-1]** from the track frame cover.

Installation: Tighten the bolts to 20 - 25 ft.-lb. (27 - 34 N•m) torque.

Remove the cover.

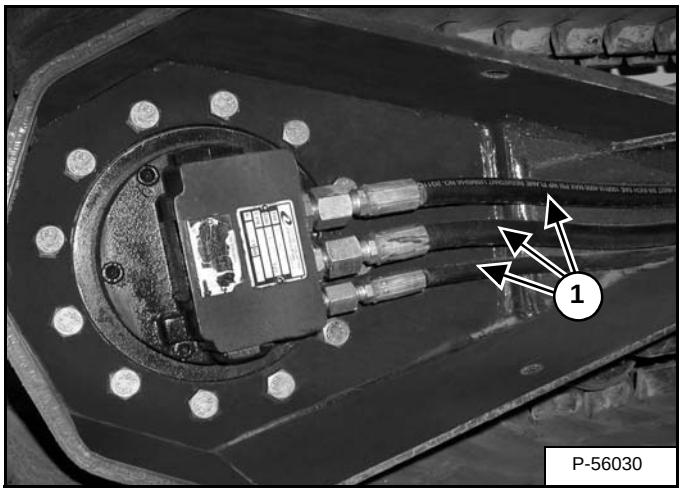
IMPORTANT

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

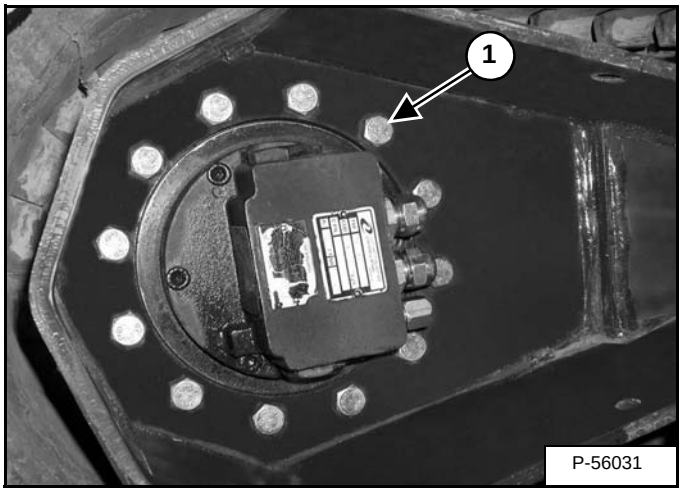
Mark the hoses for correct installation.

Figure 20-70-2



Remove the hoses (Item 1) **[Figure 20-70-2]** from the travel motor.

Figure 20-70-3



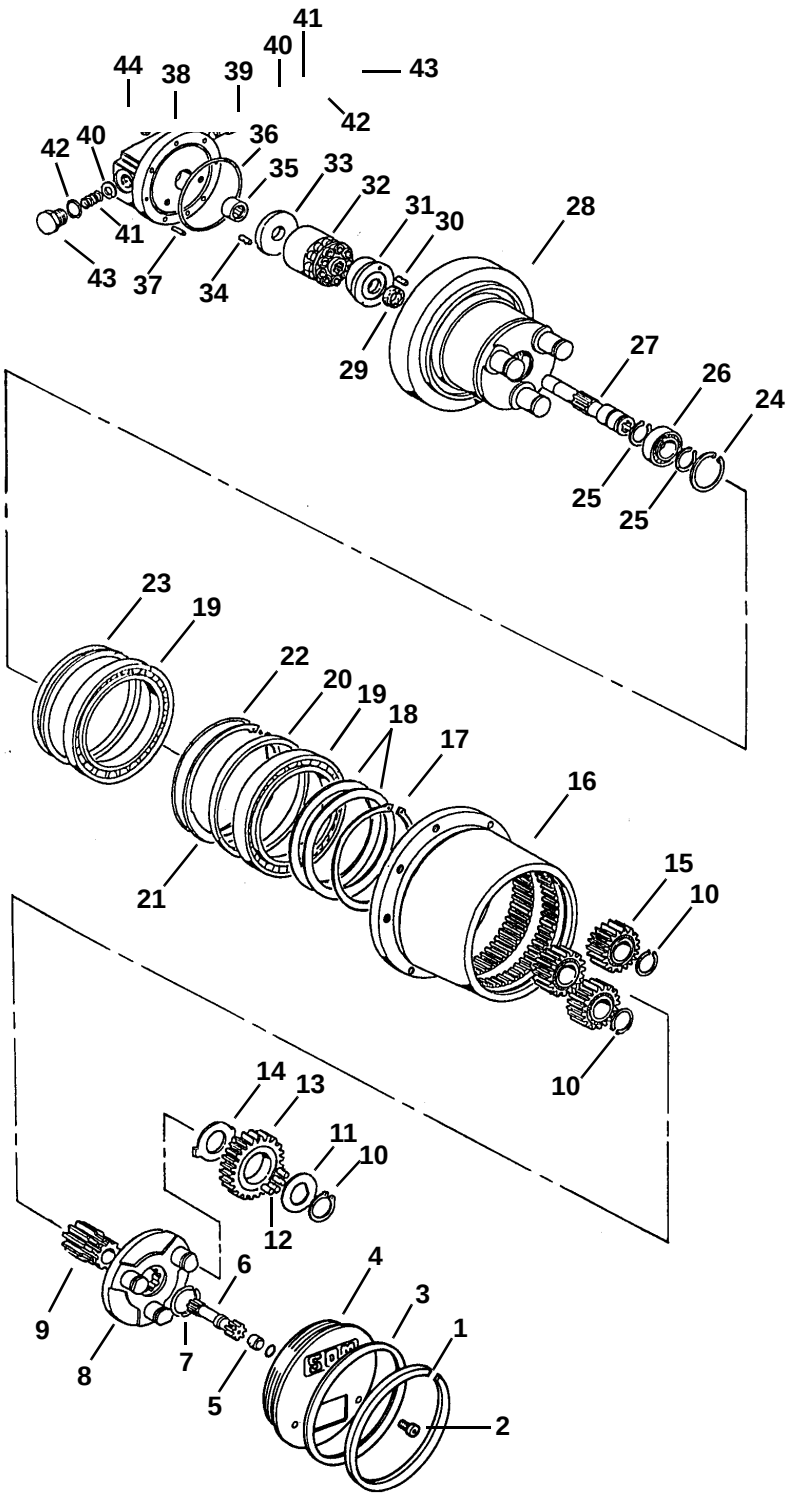
Remove the bolts (Item 1) **[Figure 20-70-3]** from the travel motor.

Installation: Apply thread lock (Loctite® 242) to the bolts and tighten to 74 - 81 ft.-lb. (100 - 110 N•m) torque.

Remove the travel motor from the track frame.

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



B-14711

Disassembly

IMPORTANT

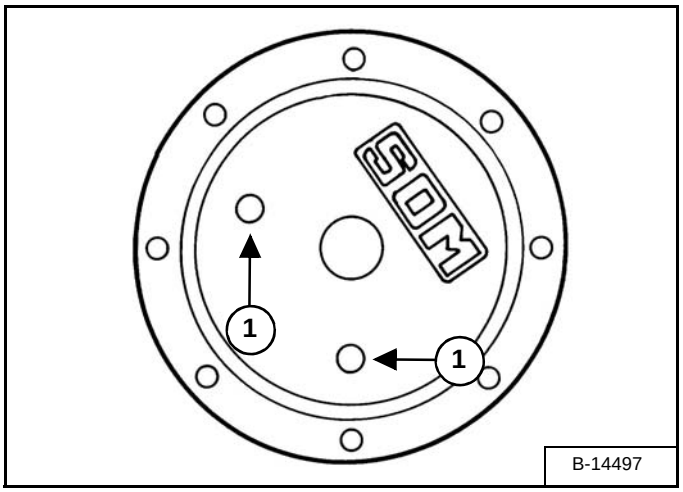
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

The following tool will need to be ordered from OTC Tool to reassemble the travel motor:

MEL1519 for torque ring and seal ring assembly.

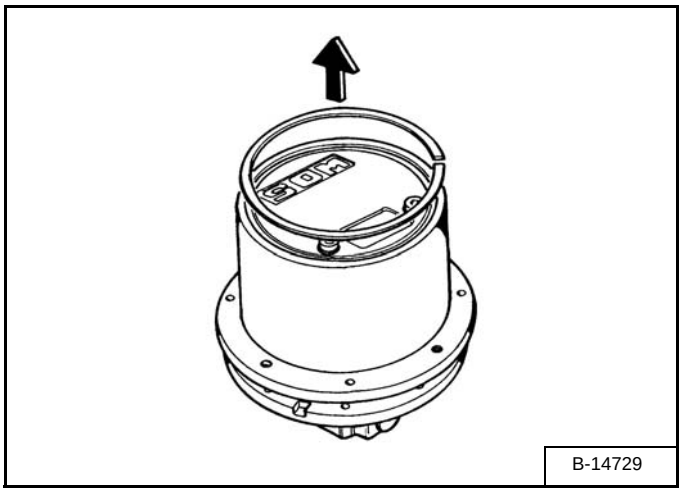
Figure 20-70-4



Remove the drain plugs (Item 1) **[Figure 20-70-4]** from the cover.

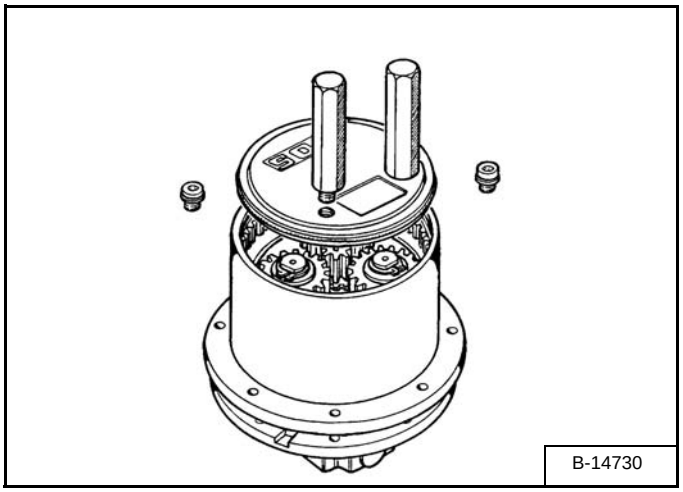
Drain the oil into a container.

Figure 20-70-5



Remove the internal snap ring from the travel motor case **[Figure 20-70-5]**.

Figure 20-70-6

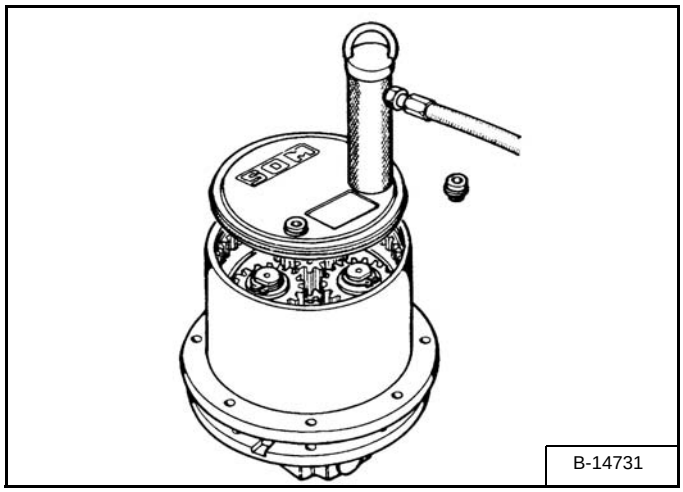


To remove the cover, install two threaded pins in the drain holes and lift the cover off **[Figure 20-70-6]**.

Air pressure may also be used to remove the cover.

Disassembly (Cont'd)

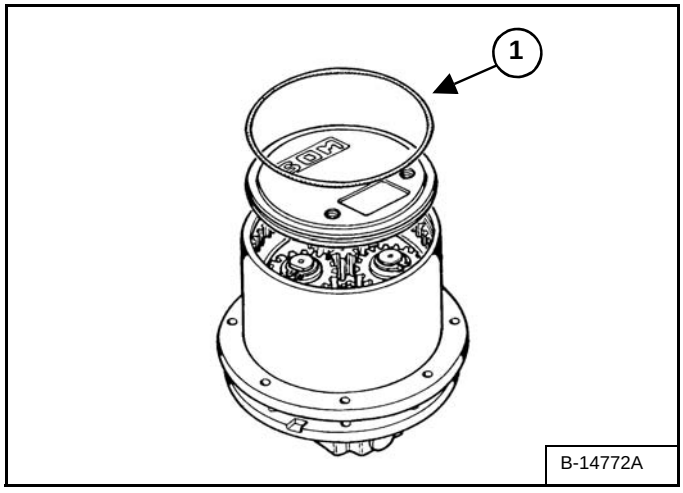
Figure 20-70-7



Screw the adapter in a drain hole and apply 8 - 11 psi **[Figure 20-70-7]**.

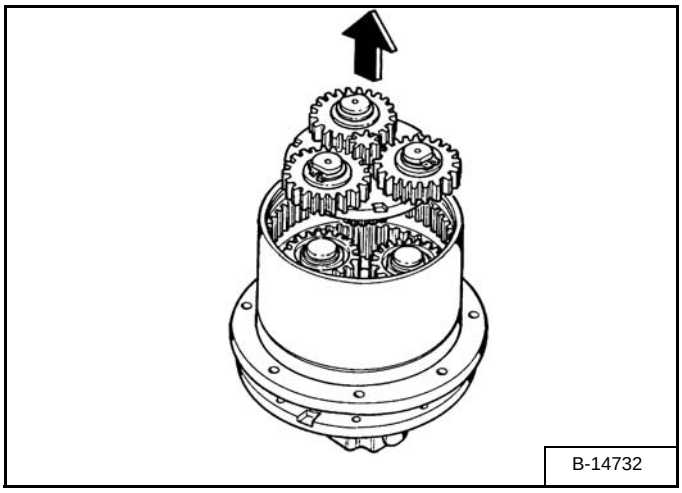
NOTE: Do not use excess pressure or seal damage may result.

Figure 20-70-8



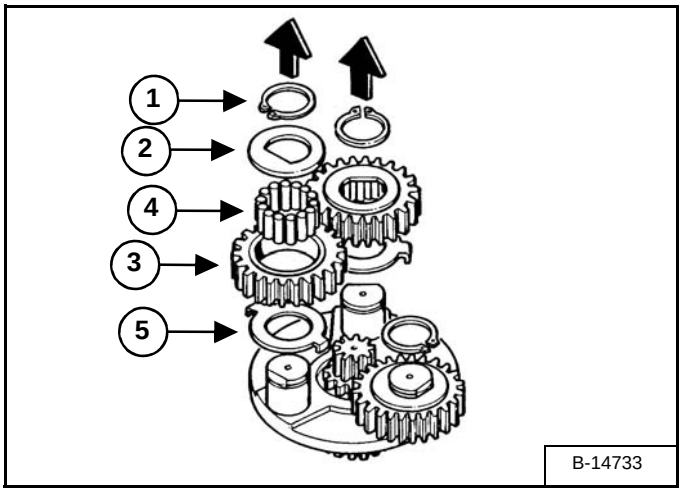
Remove the O-ring (Item 1) **[Figure 20-70-8]** from the cover.

Figure 20-70-9



Remove the planetary carrier **[Figure 20-70-9]**.

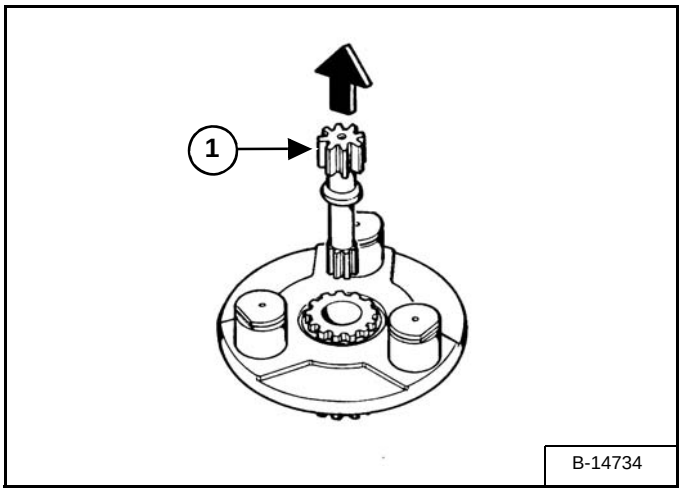
Figure 20-70-10



Remove the snap rings (Item 1), anti-rotation washers (Item 2), gears (Item 3), bearings (Item 4) and the bottom thrust washers (Item 5) **[Figure 20-70-10]** from the planetary carrier assembly.

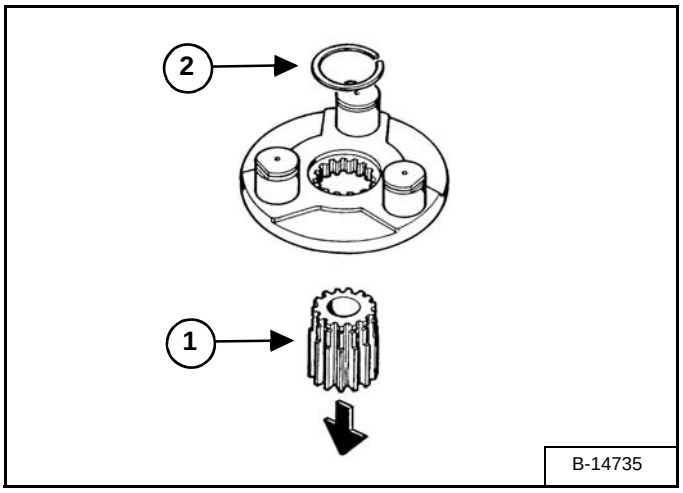
Disassembly (Cont'd)

Figure 20-70-11



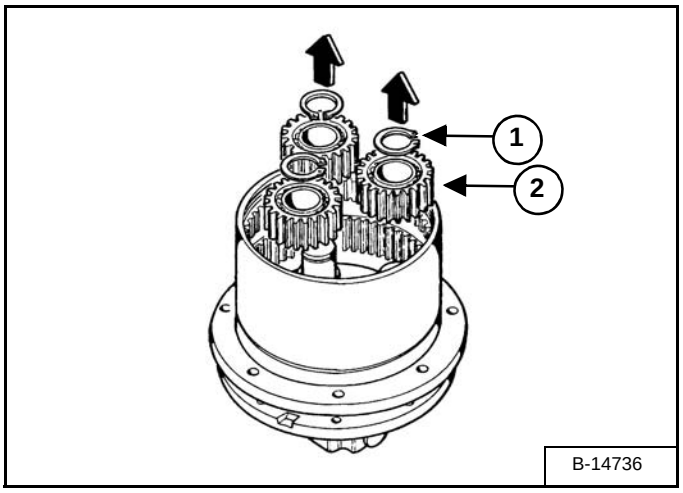
Remove the drive shaft (Item 1) **[Figure 20-70-11]** from the carrier.

Figure 20-70-12



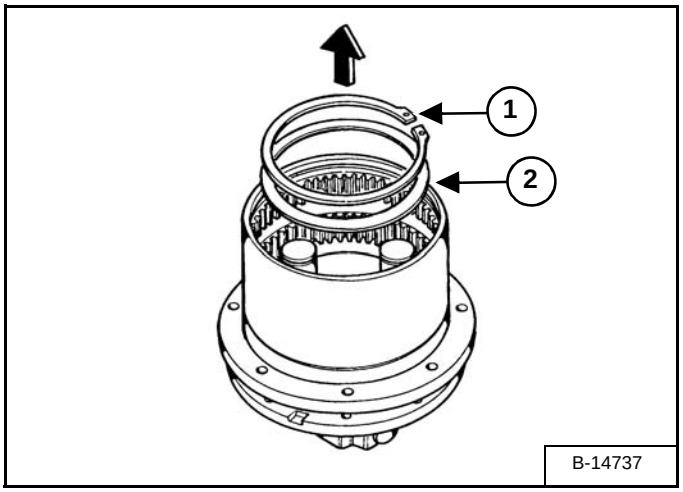
Remove the sun gear (Item 1) from the planetary carrier, by removing the snap ring (Item 2) and pushing the sun gear (Item 1) **[Figure 20-70-12]** out of the carrier.

Figure 20-70-13



Remove the snap rings (Item 1) and the gears/bearings (Item 2) **[Figure 20-70-13]**.

Figure 20-70-14



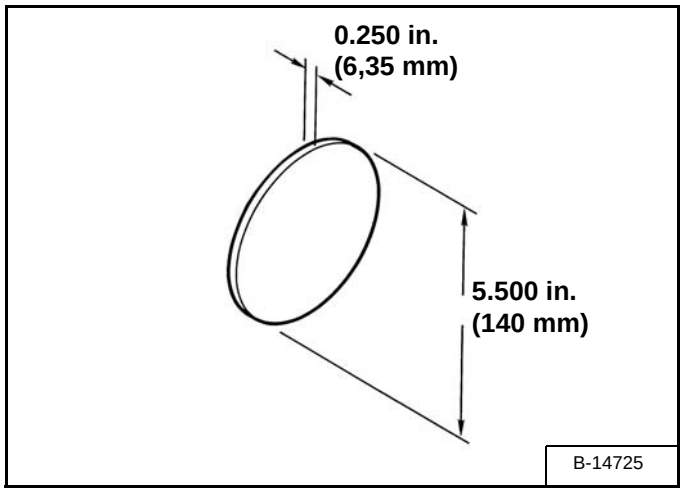
Remove the external snap ring (Item 1) and the shim(s) (Item 2) **[Figure 20-70-14]**.

Before the ring gear can be pulled from the hub, a plate must be placed on the three pins of the planetary carrier.

The plate will provide support for the three jaw puller.

Disassembly (Cont'd)

Figure 20-70-15



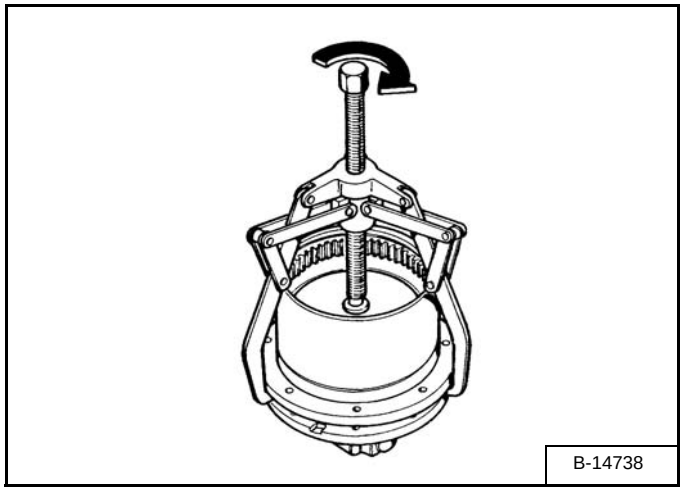
Obtain the plate **[Figure 20-70-15]** locally.

The dimensions of the plate are as follows:

Diameter 5.500 in. (140 mm)

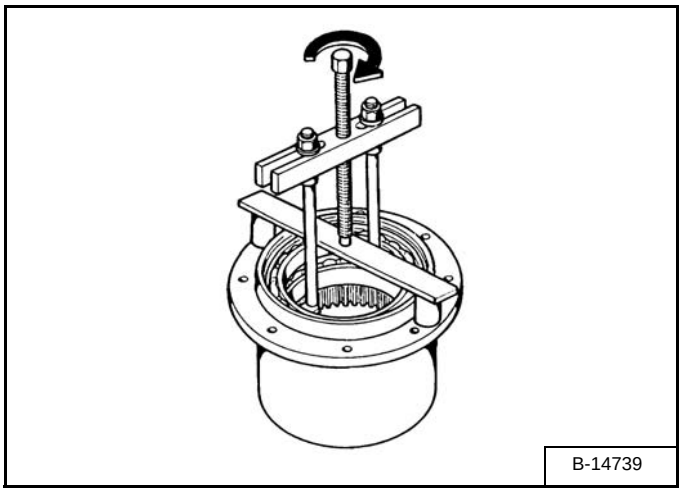
Thickness 0.250 in. (6.35 mm)

Figure 20-70-16



Using a three jaw puller, separate the hub and the ring gear assembly **[Figure 20-70-16]**.

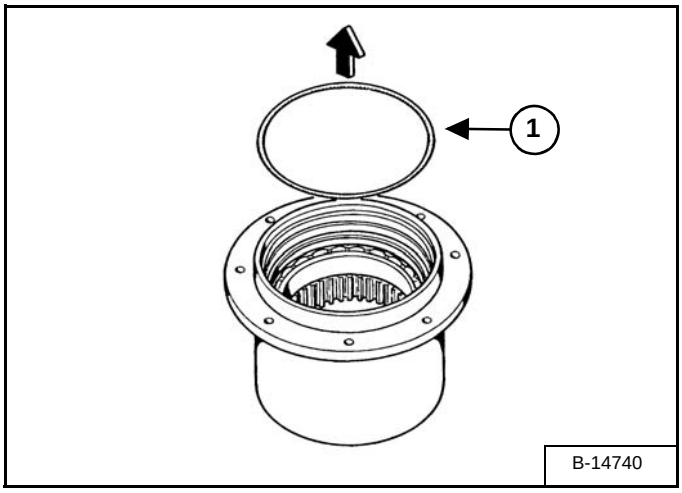
Figure 20-70-17



Remove the ball bearing from the ring gear 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

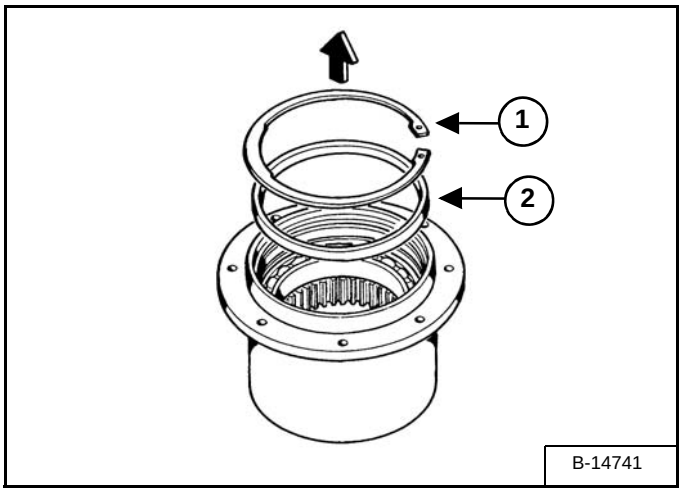


Remove the O-ring (Item 1) **[Figure 20-70-18]** from the ring gear.

TRAVEL MOTOR (CONT'D)

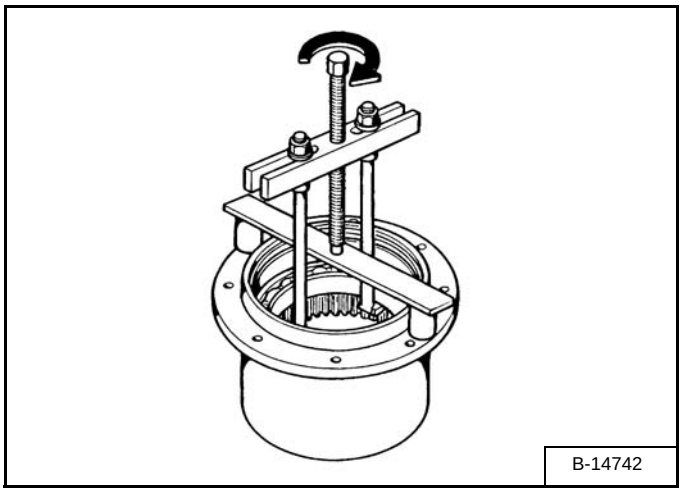
Disassembly (Cont'd)

Figure 20-70-19



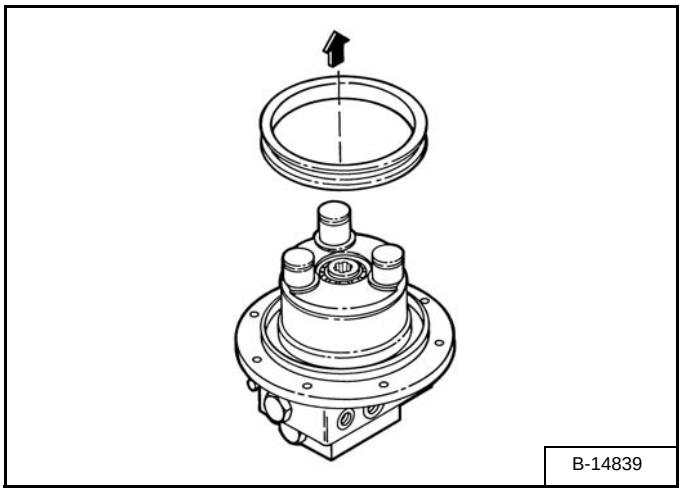
Remove the internal snap ring (Item 1) and spacer (Item 2) **[Figure 20-70-19]**.

Figure 20-70-20



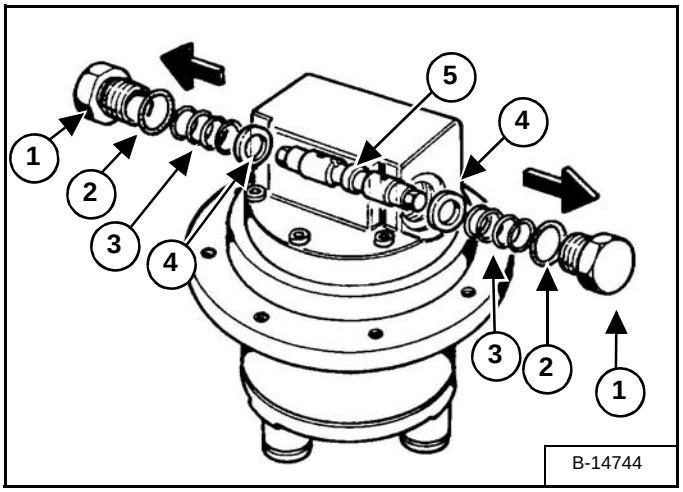
Remove the second bearing from the ring gear **[Figure 20-70-20]**.

Figure 20-70-21



Remove the front seal ring from the motor hub **[Figure 20-70-21]**.

Figure 20-70-22

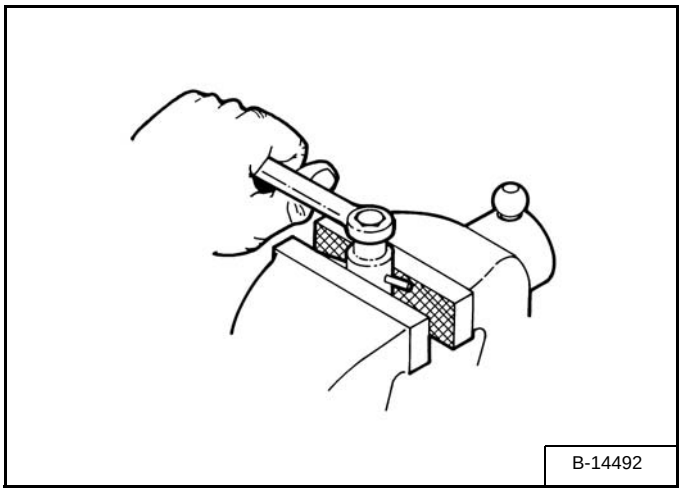


Remove the plugs (Item 1), O-rings (Item 2), springs (Item 3), and washers (Item 4) **[Figure 20-70-22]** from both ends of the spool.

Remove the spool (Item 5) **[Figure 20-70-22]**.

Disassembly (Cont'd)

Figure 20-70-23

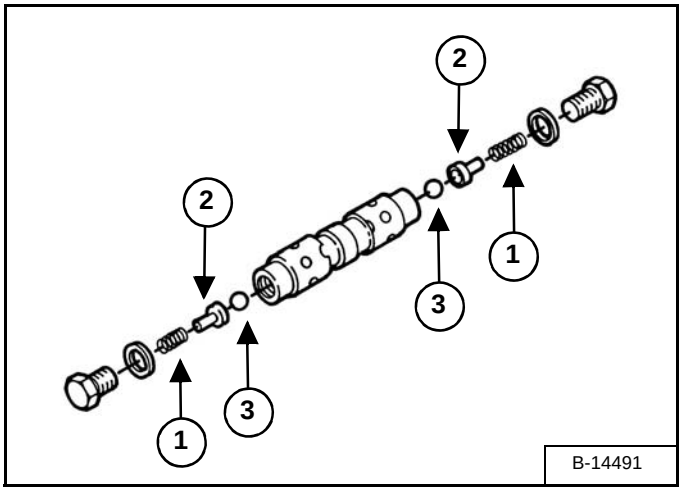


To disassemble the spool, insert a hardened pin through the hole in the spool and use a vise with protective jaws to hold the spool **[Figure 20-70-23]**.

NOTE: Do not use any type of tool to grip the spool or damage to the spool will result.

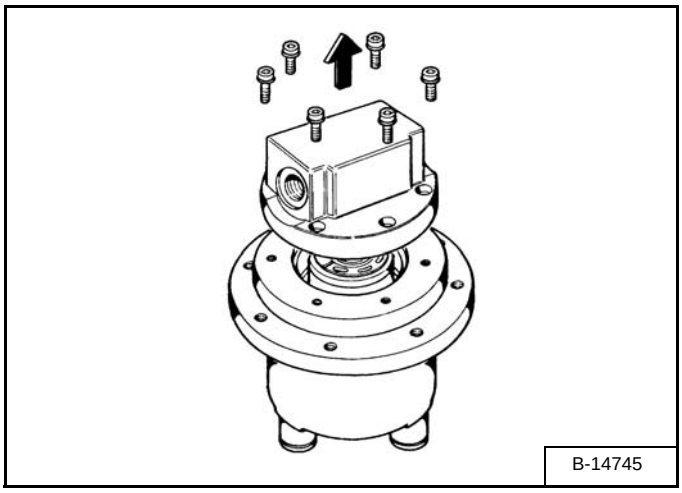
Remove the end plug from both ends of the spool **[Figure 20-70-23]**.

Figure 20-70-24



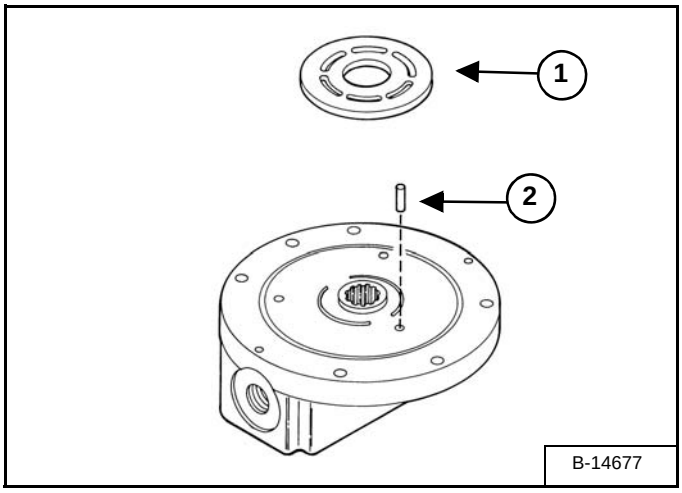
Remove the spring (Item 1), poppet (Item 2), and check ball (Item 3) **[Figure 20-70-24]** from both ends of the spool.

Figure 20-70-25



Remove the bolts and motor cover **[Figure 20-70-25]**.

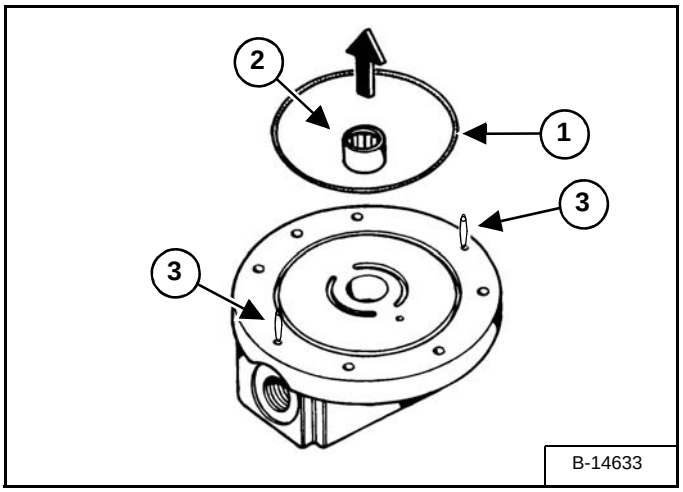
Figure 20-70-26



Remove the valve plate (Item 1) and dowel pin (Item 2) **[Figure 20-70-26]**

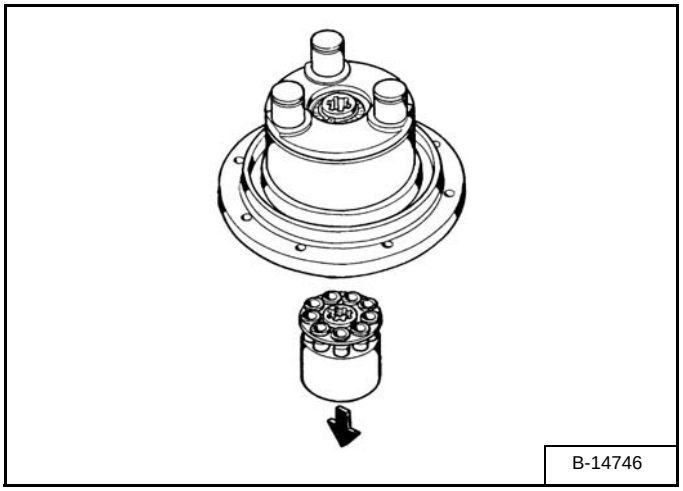
Disassembly (Cont'd)

Figure 20-70-27



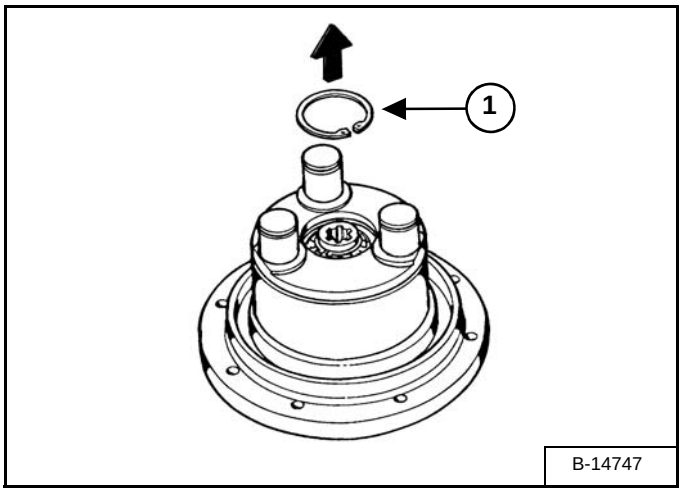
Remove the O-Ring (Item 1), bearing (Item 2) and the two alignment pins (Item 3). Remove the bearing (Item 2) **[Figure 20-70-27]** with a bearing puller.

Figure 20-70-28



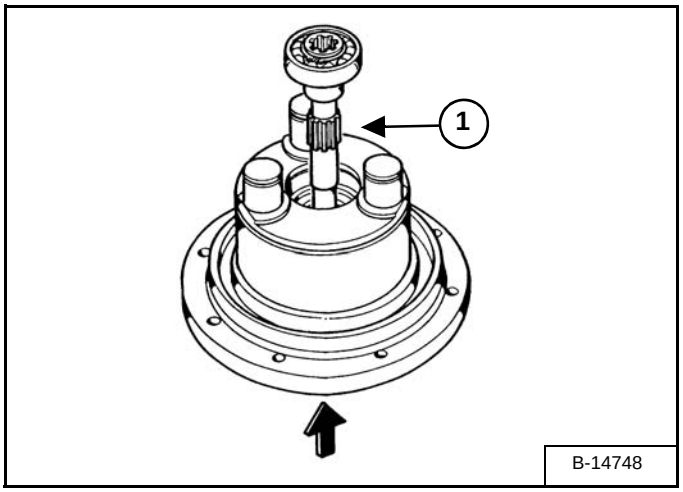
Invert the hub, and the rotating block will slide out **[Figure 20-70-28]**

Figure 20-70-29



Remove the internal snap ring (Item 1) **[Figure 20-70-29]** retaining the bearing/drive shaft to the hub.

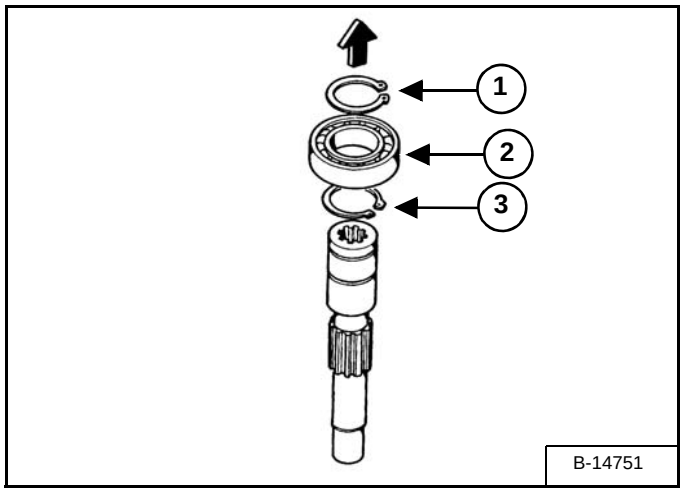
Figure 20-70-30



Push the drive shaft (Item 1) **[Figure 20-70-30]** from the bottom to remove the shaft from the hub.

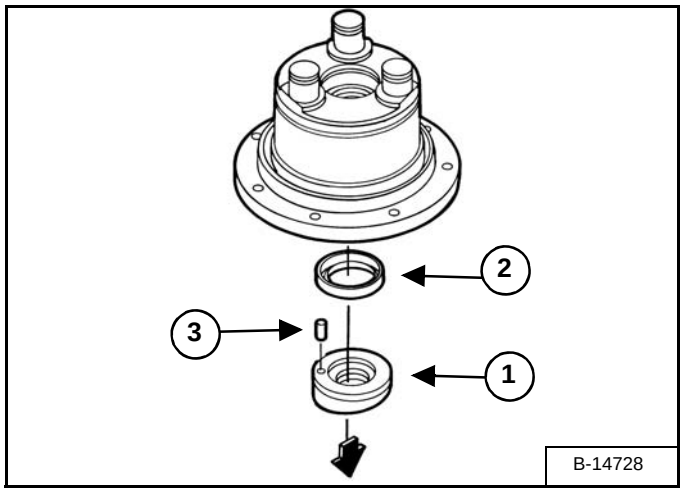
Disassembly (Cont'd)

Figure 20-70-31



Remove the snap ring (Item 1), bearing (Item 2) and the snap ring (Item 3) **[Figure 20-70-31]** from the drive shaft.

Figure 20-70-32



Remove the swash plate (Item 1), seal (Item 2) and alignment pin (Item 3) **[Figure 20-70-32]**.

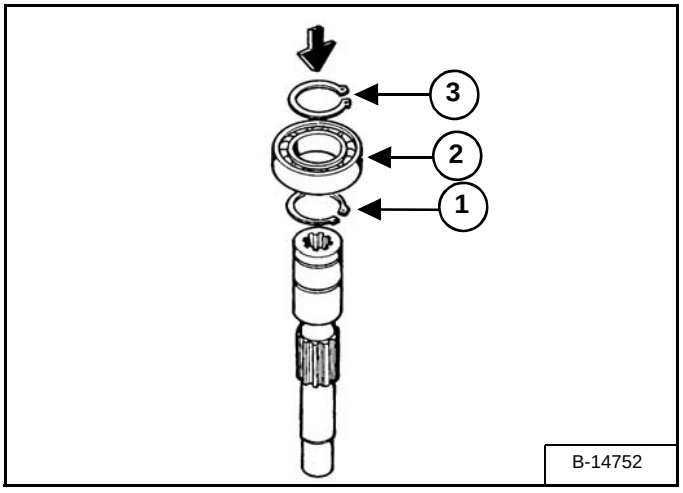
Assembly

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.

The following tools will be needed to assemble the travel motor:

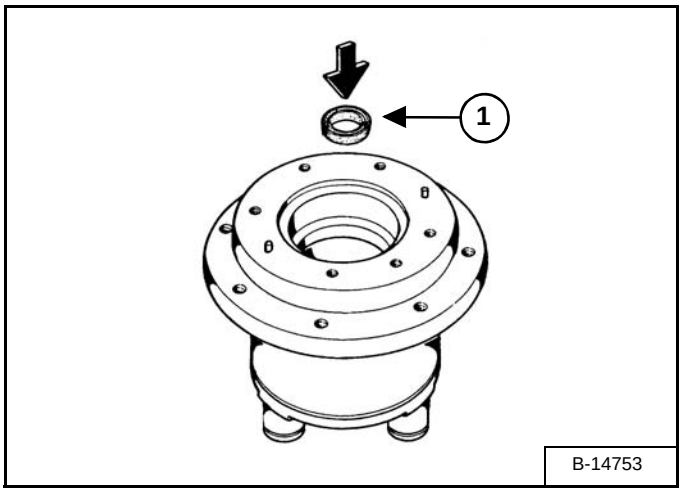
MEL 1519 - Seal Installation Tool

Figure 20-70-33



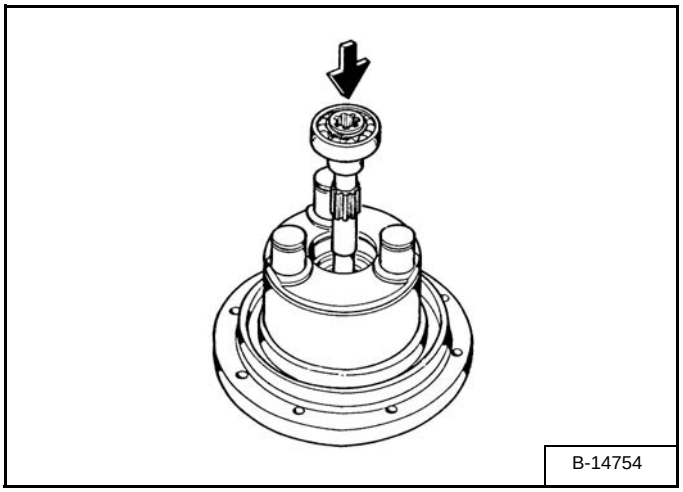
Install the snap ring (Item 1), bearing (Item 2) and snap ring (Item 3) **[Figure 20-70-33]** on the drive shaft.

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.

Figure 20-70-35

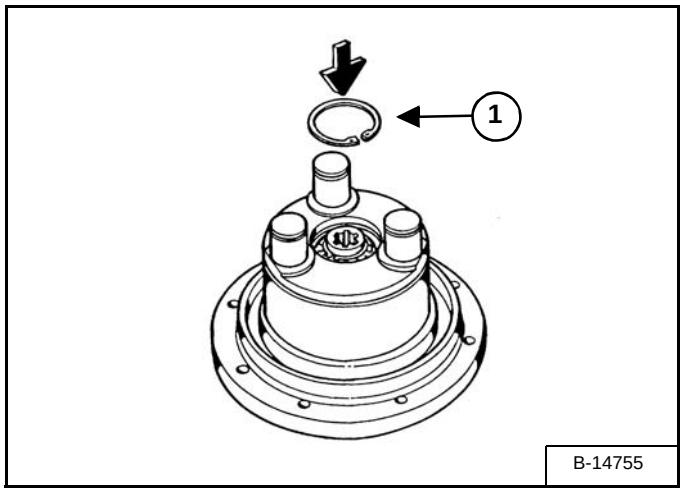


Install the drive shaft/bearing assembly (Item 1) **[Figure 20-70-35]** in the hub.

NOTE: Make sure the bearing is seated in the hub.

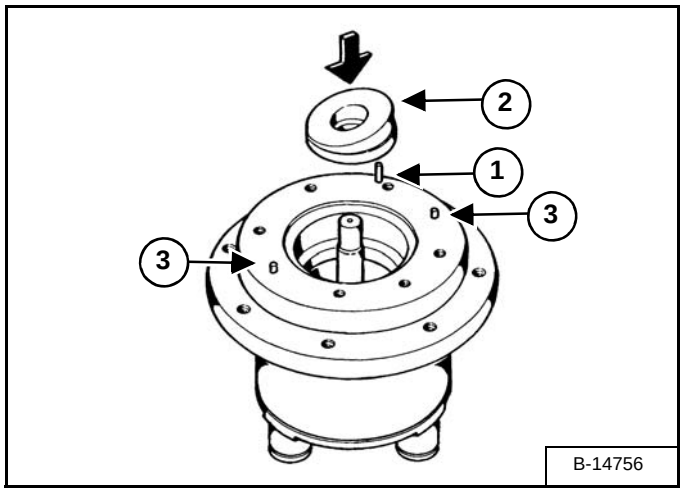
Assembly (Cont'd)

Figure 20-70-36



Install the snap ring (Item 1) **[Figure 20-70-36]**.

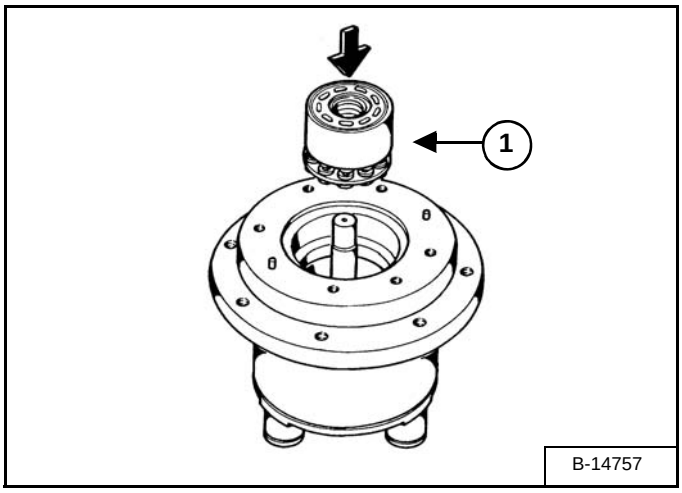
Figure 20-70-37



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.

Assembly (Cont'd)

Figure 20-70-39

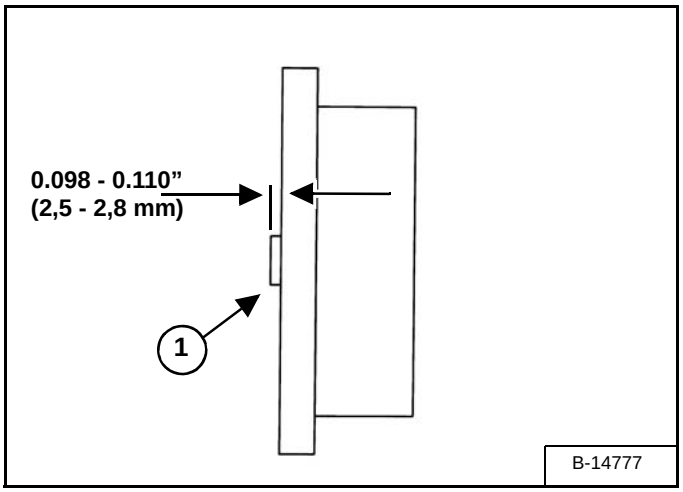
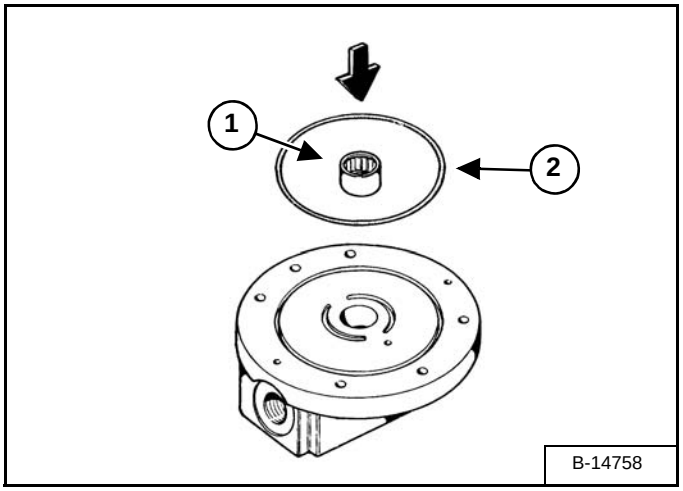


Figure 20-70-40

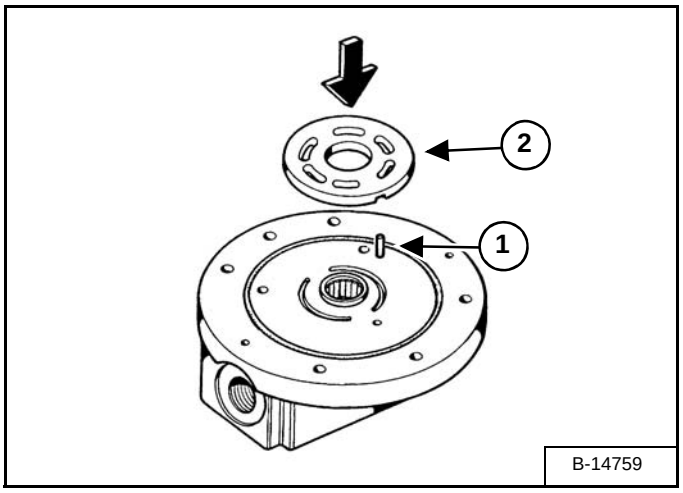


Press the bearing (Item 1) **[Figure 20-70-39]** & **[Figure 20-70-40]** in the motor cover.

The bearing (Item 1) **[Figure 20-70-39]** must extend from the face of the motor cover 0.098 - 0.110 in. (2,5 - 2,8 mm).

Install the O-ring (Item 2) **[Figure 20-70-40]** on the motor cover.

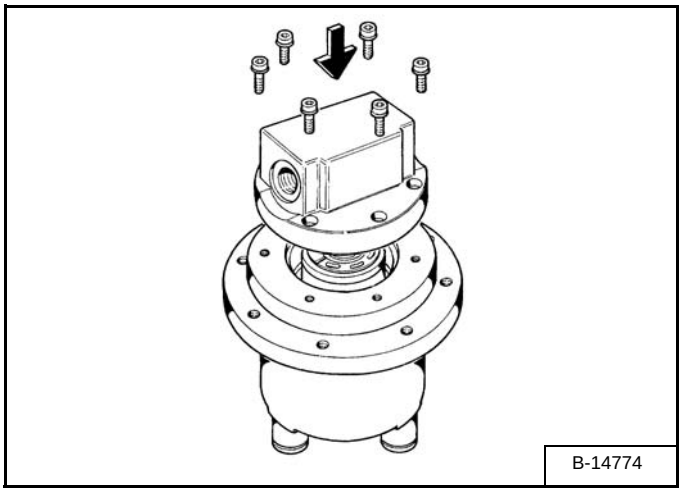
Figure 20-70-41



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

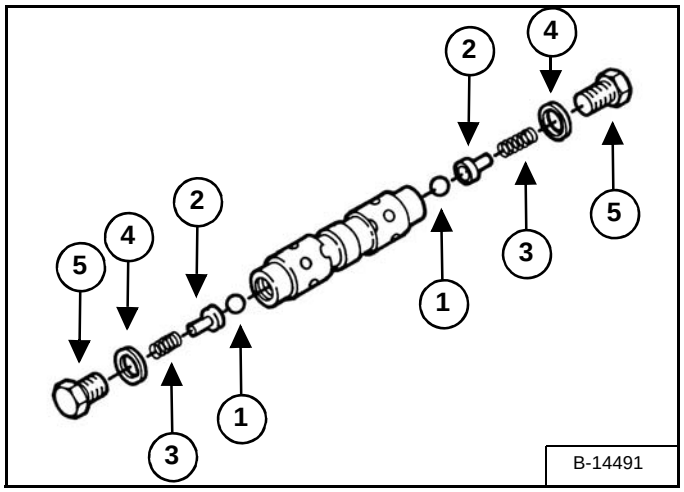


Lubricate the bearing with oil and install the motor cover on the hub with the screws **[Figure 20-70-42]**.

Tighten the bolts in a crisscross manner to 18 - 22 ft.-lb. (25 - 30 N•m) torque.

Assembly (Cont'd)

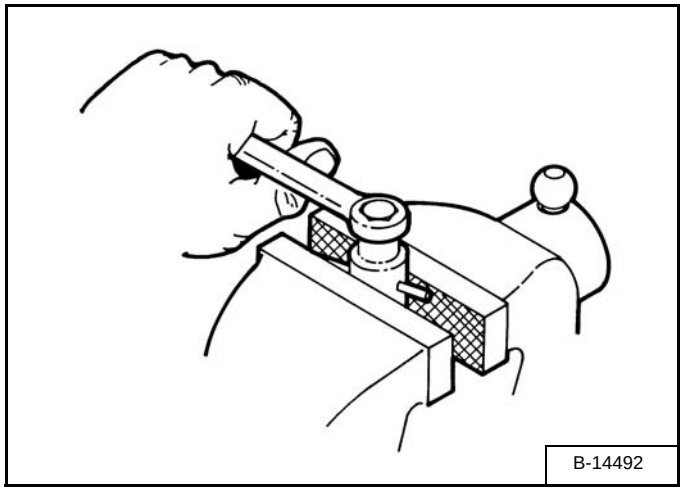
Figure 20-70-43



Install the check ball (Item 1), poppet (Item 2) and the spring (Item 3) **[Figure 20-70-43]** in both ends of the spool.

Install the new O-rings (Item 4) on the plugs (Item 5) **[Figure 20-70-43]**.

Figure 20-70-44



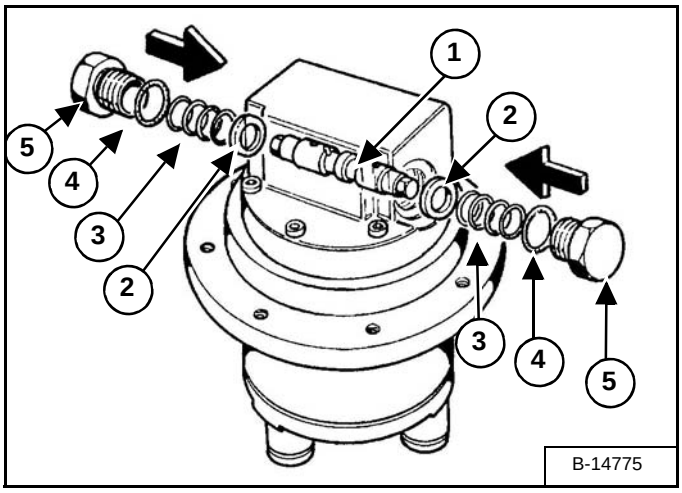
To assemble the spool, insert a hardened pin through the hole in the spool and use a vise with protective jaws to hold the spool **[Figure 20-70-44]**.

NOTE: Do not use any type of tool to grip the spool or damage to the spool will result.

Install the plug in both ends of the spool **[Figure 20-70-44]**.

Tighten the plugs to 18 - 22 ft.-lb. (25 - 30 N•m) 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]**.

Install the O-rings (Item 4) on the plugs (Item 5) **[Figure 20-70-45]**.

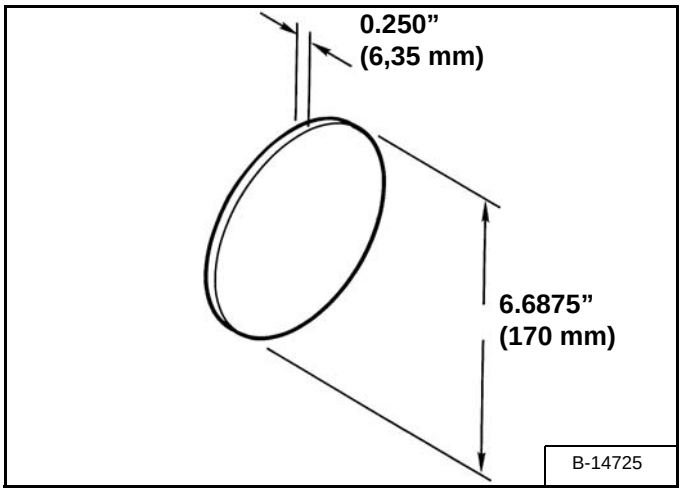
Install the plugs (Item 5) **[Figure 20-70-45]** on the motor cover.

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.

Assembly (Cont'd)

Figure 20-70-46

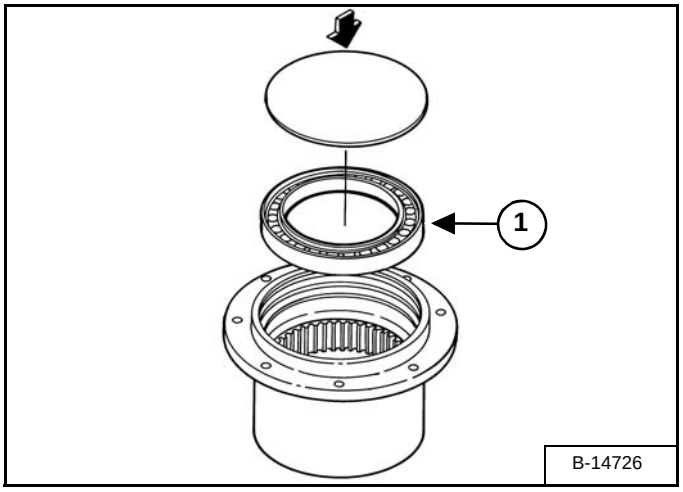


Obtain the tool locally **[Figure 20-70-46]**.

The dimensions are as follows:

Diameter	6.6875 in. (170 mm)
Thickness	0.250 in. (6,35 mm)

Figure 20-70-47



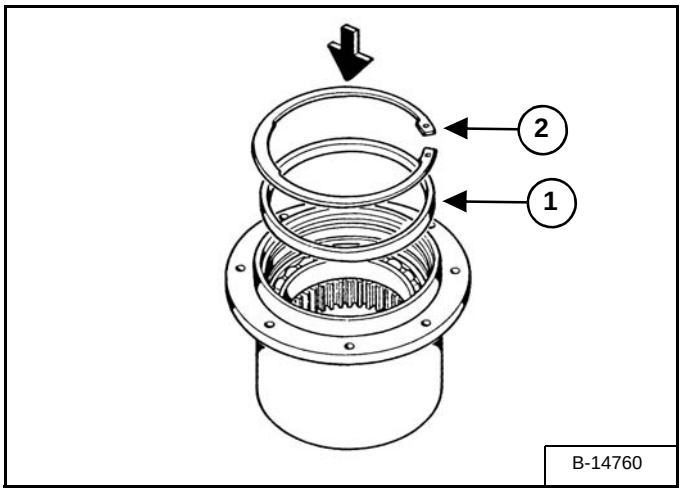
Lubricate the outer edge of the bearing and press the bearing (Item 1) **[Figure 20-70-47]** in the housing, using the bearing installation tool.

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 in. (0,05 mm) add or subtract shims to match the new bearing thickness to the old bearing thickness.

If shims are needed, order the appropriate shim(s) from Bobcat Parts:

P/N 6669119	0.0079 in. (0,2 mm)
P/N 6669120	0.0118 in. (0,3 mm)
P/N 6669121	0.0157 in. (0,4 mm)
P/N 6669122	0.0354 in. (0,9 mm)
P/N 6669123	0.0374 in. (0,95 mm)

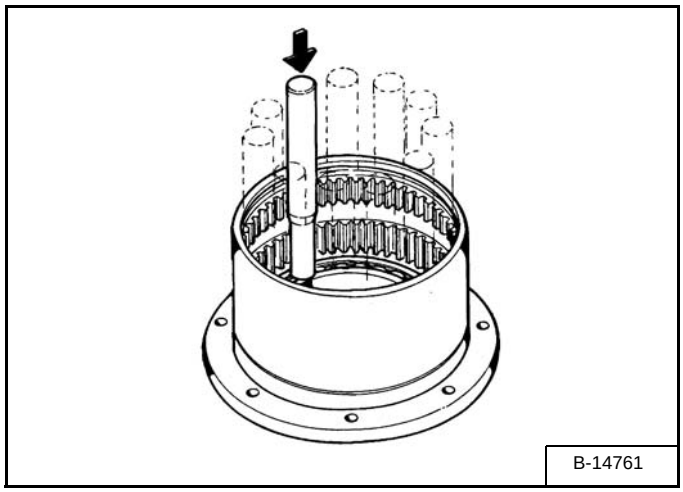
Figure 20-70-48



Install the spacer (Item 1) and internal snap ring (Item 2) **[Figure 20-70-48]**.

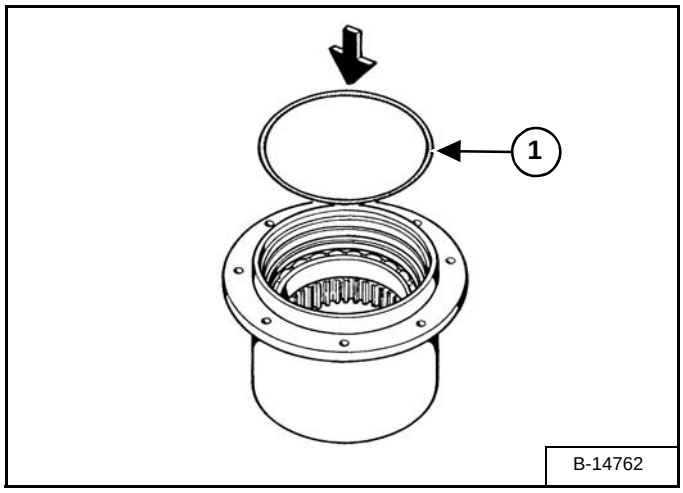
Assembly (Cont'd)

Figure 20-70-49



Invert the ring gear, and using a brass drift, seat the bearing against the spacer **[Figure 20-70-49]**.

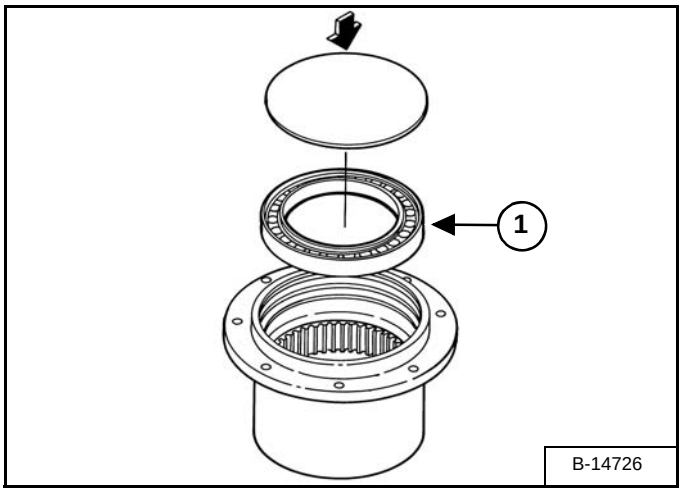
Figure 20-70-50



Install the O-ring (Item 1) **[Figure 20-70-50]**.

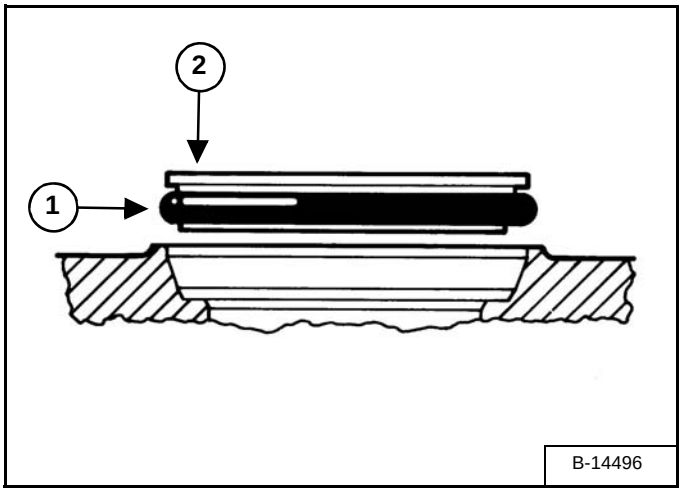
NOTE: Make sure the O-ring is correctly installed in the housing groove so it is not damaged when the second bearing is installed.

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



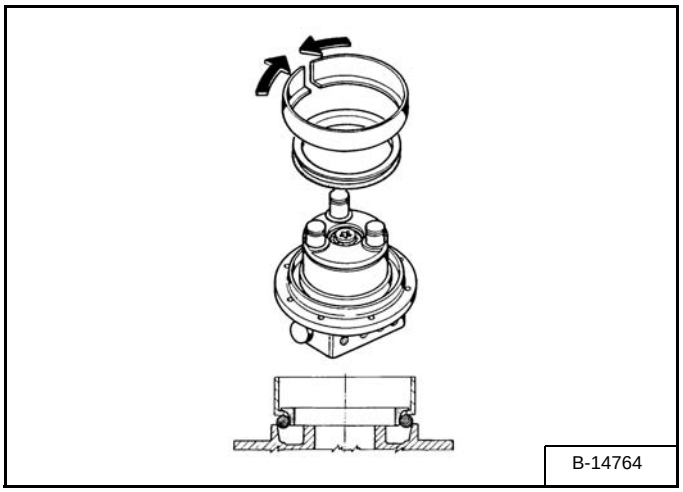
Install the O-ring (Item 1) on the seal ring (Item 2) **[Figure 20-70-52]**.

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.

Assembly (Cont'd)

Figure 20-70-53

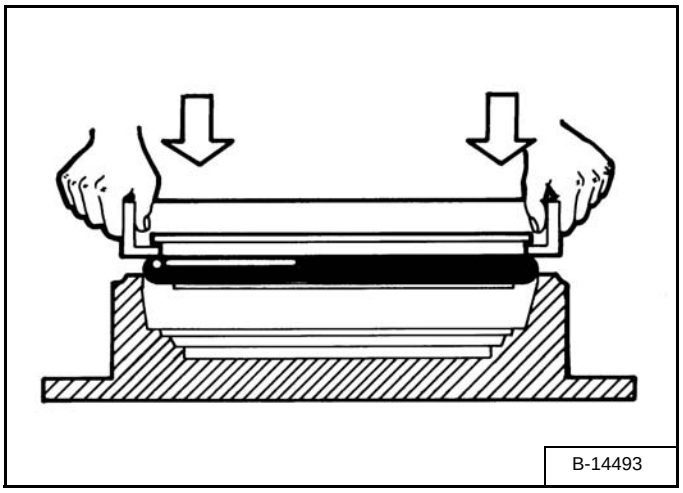


Install the seal seating tool (MEL1519) on the seal ring and O-ring assembly **[Figure 20-70-53]**.

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.

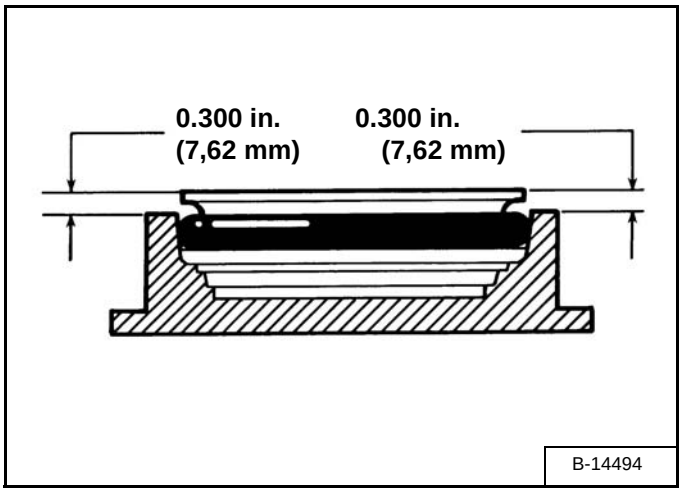
Figure 20-70-54



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.

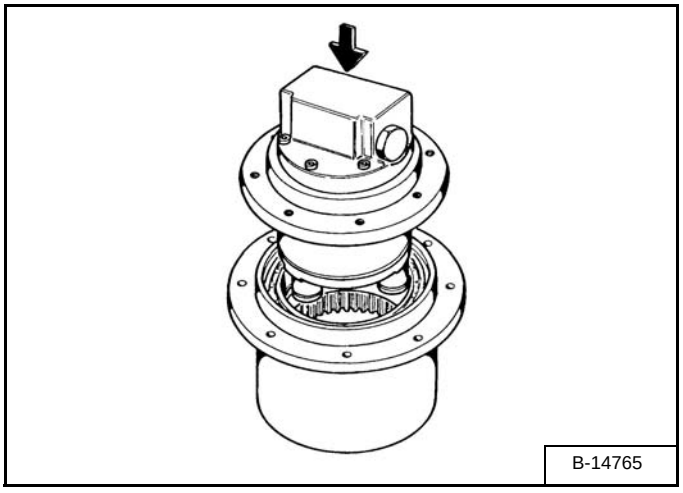
The stand out height is 0.300 ± 0.020 in. (7,62 ± 0,5 mm).

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.

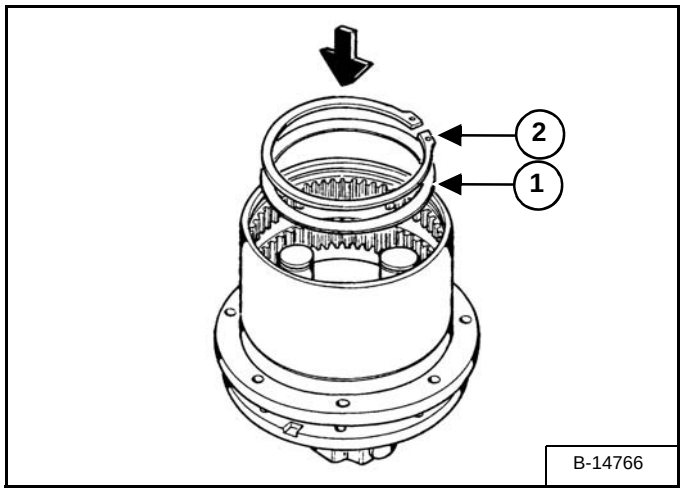
Figure 20-70-56



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.

Assembly (Cont'd)

Figure 20-70-57

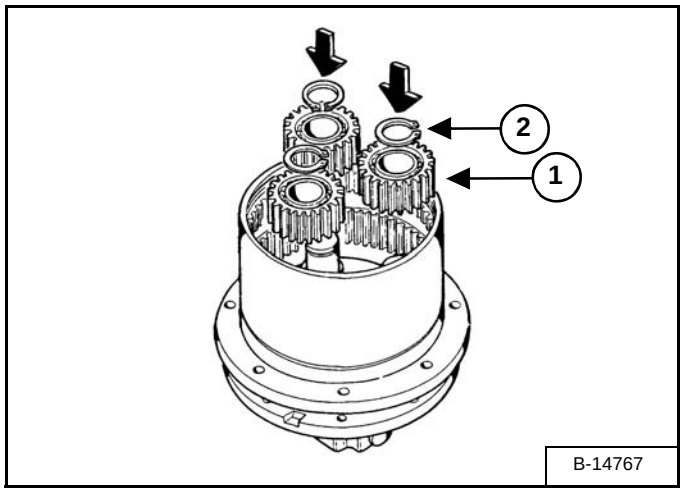


Install the shim(s) (Item 1) and snap ring (Item 2) **[Figure 20-70-57]** in the motor reduction unit.

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.

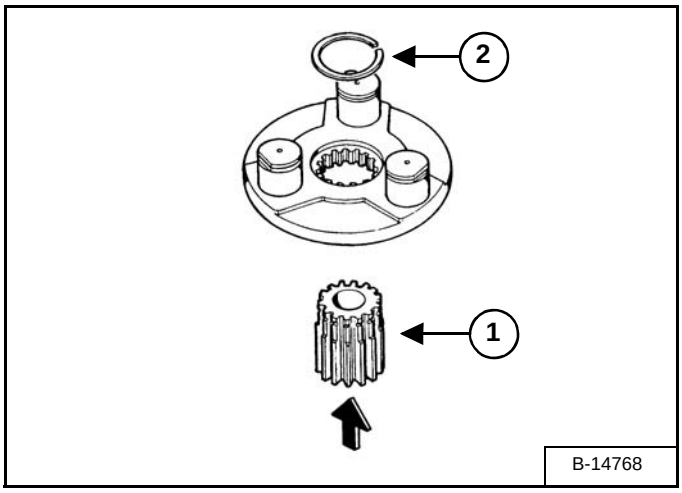
Figure 20-70-58



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.

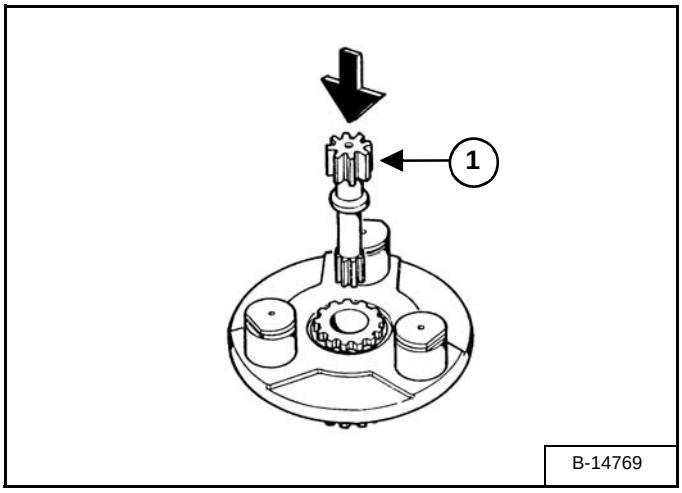
Figure 20-70-59



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]**.

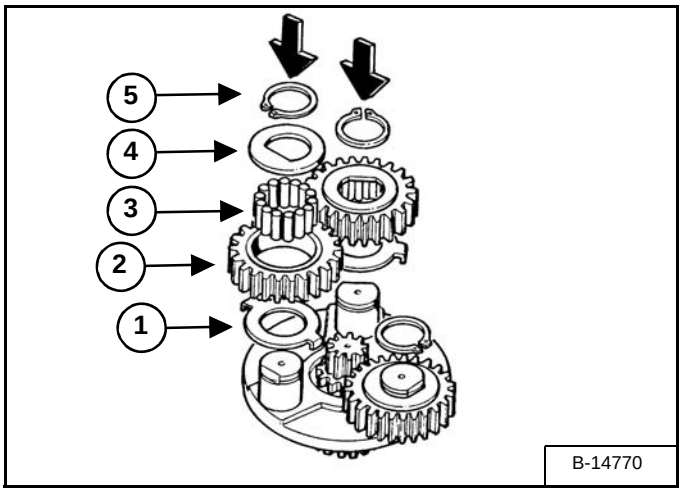
Figure 20-70-60



Install the drive shaft (Item 1) **[Figure 20-70-60]**.

Assembly (Cont'd)

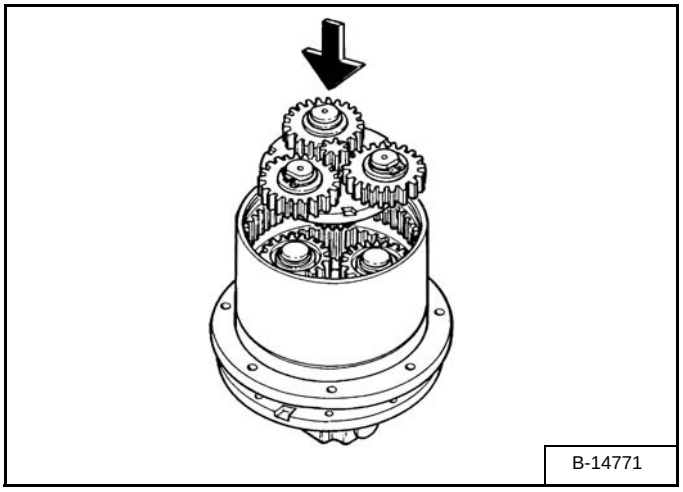
Figure 20-70-61



Install the thrust washers (Item 1), planetary gears (Item 2), bearings (Item 3), anti-rotation washers (Item 4) and the snap rings (Item 5) **[Figure 20-70-61]**.

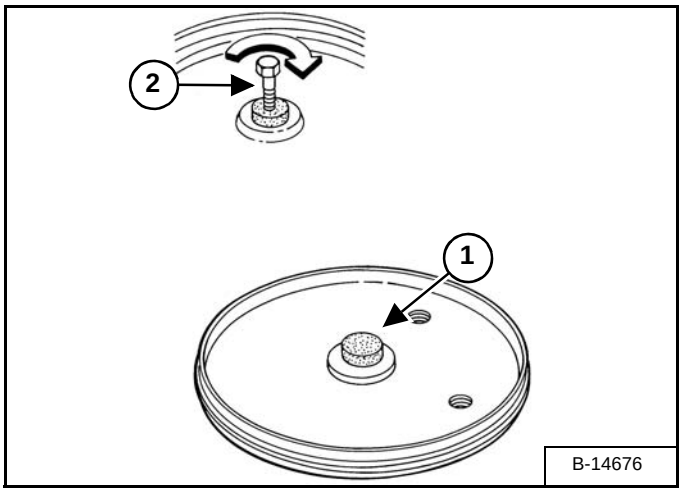
NOTE: Install the snap rings (Item 5) [Figure 20-70-61] so the opening of the snap ring is towards the outside.

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.

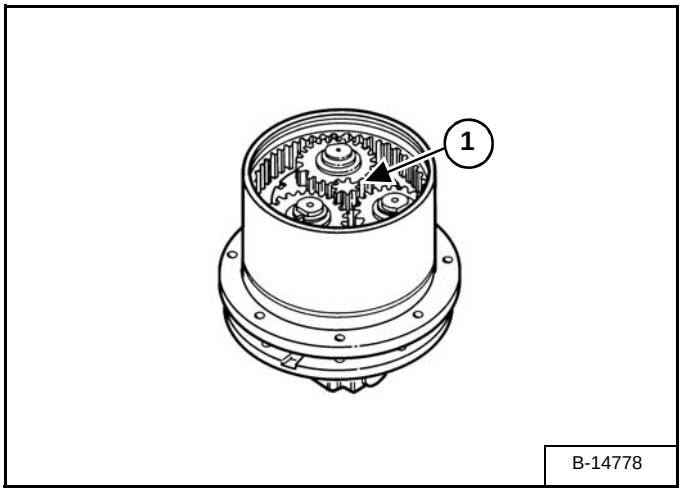
Thread the hole with a 0.250 x 28 in. NF tap.

Install a 0.250 x 28 in. 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 in. (0,2 - 0,8 mm).

Figure 20-70-64



Place a 0.500 in. (13 mm) long piece of 0.0625 in. (1,5 mm) solder (Item 1) **[Figure 20-70-64]** on the end of the drive shaft.

Seat the cover in the hub.

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.

Shim Thickness	MEL Part Number
0.020 in. (0,5 mm)	6669597
0.030 in. (0,76 mm)	6669598
0.050 in. (1,27 mm)	6669699

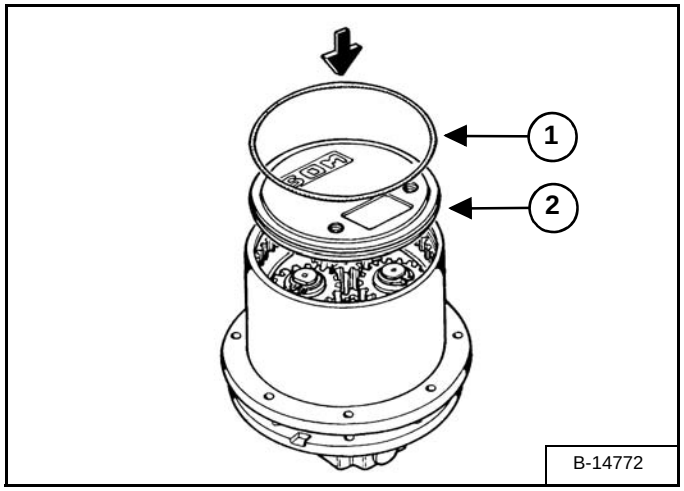
Remove the bushing.

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.

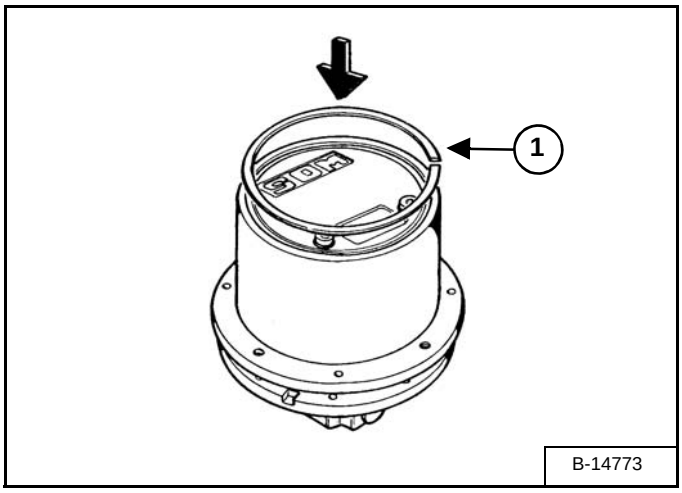
Figure 20-70-65



Install the O-ring (Item 1) **[Figure 20-70-65]** on the cover.

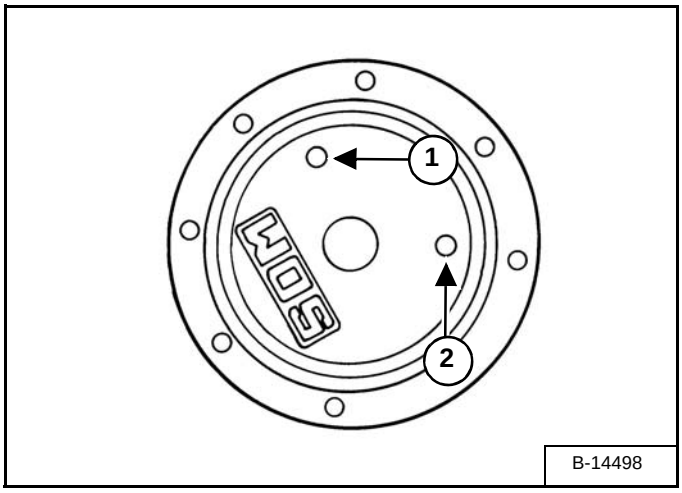
Install the cover (Item 2) **[Figure 20-70-65]** on the hub.

Figure 20-70-66



Install the snap ring (Item 1) **[Figure 20-70-66]**.

Figure 20-70-67



Add 0.55 quarts (0,5 L) of gear lube 80W90 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.

SWIVEL JOINT

Description

The swivel joint is a rotary hydraulic swivel which diverts hydraulic oil, under pressure, to the travel motors and the blade cylinder.

Removal And Installation

WARNING

AVOID INJURY OR DEATH

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

W-2003-0807

Remove the floor mat and floor plate. (See Removal And Installation (Canopy Equipped Excavators) on Page 40-110-1.) or (See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

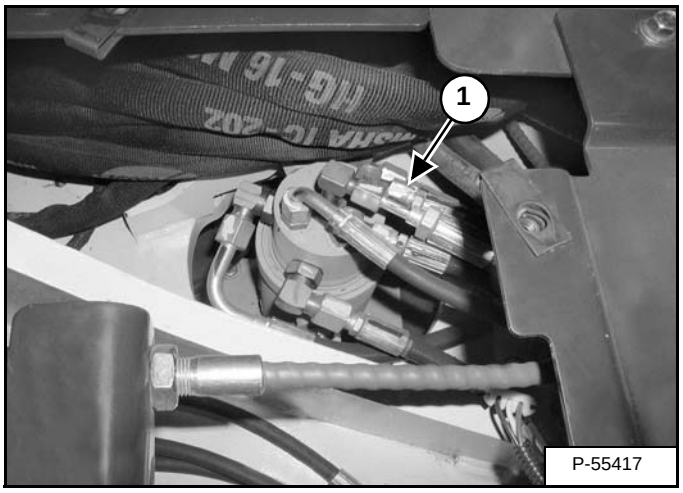
IMPORTANT

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

I-2003-0888

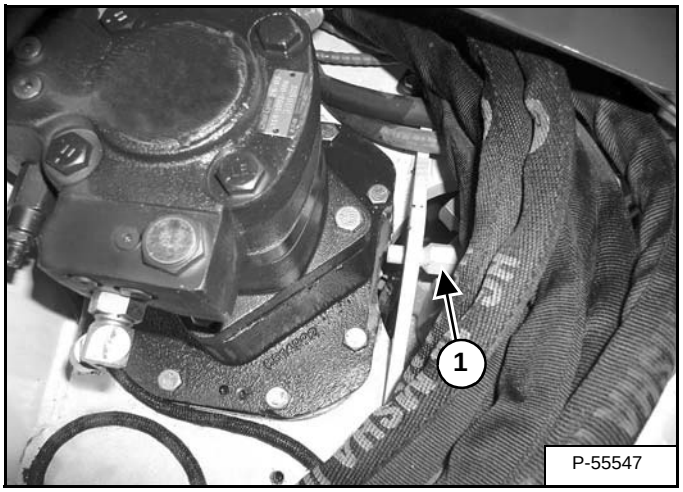
Mark the hoses for ease of installation.

Figure 20-80-1



Remove the hoses (Item 1) **[Figure 20-80-1]** from the top of the swivel joint.

Figure 20-80-2



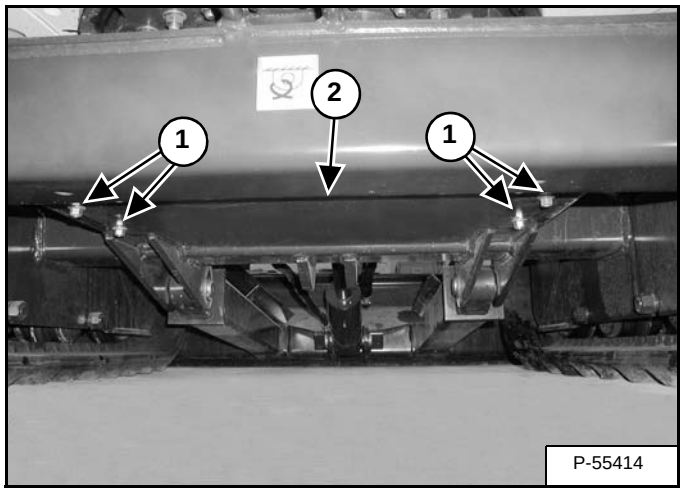
Remove the nut and swivel joint stop bolt (Item 1) **[Figure 20-80-2]**.

Installation: Apply thread lock adhesive (Loctite® 242) to the swivel joint stop bolt and install the nut and the bolt in the swivel joint. Tighten the nut completely on the bolt threads. Tighten the bolt to 110 - 125 ft.-lb. (150 - 175 N•m) torque.

SWIVEL JOINT (CONT'D)

Removal And Installation (Cont'd)

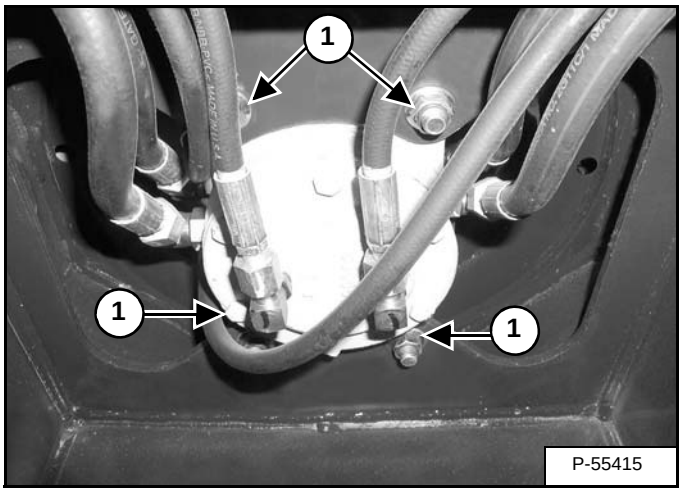
Figure 20-80-3



Remove the bolts (Item 1) **[Figure 20-80-3]**.

Remove the access plate (Item 2) **[Figure 20-80-3]** from the bottom of the undercarriage.

Figure 20-80-4



Remove the hoses from the lower end of the swivel joint **[Figure 20-80-4]**.

Remove the four bolts (Item 1) **[Figure 20-80-4]**.

Support the swivel joint with a jack.

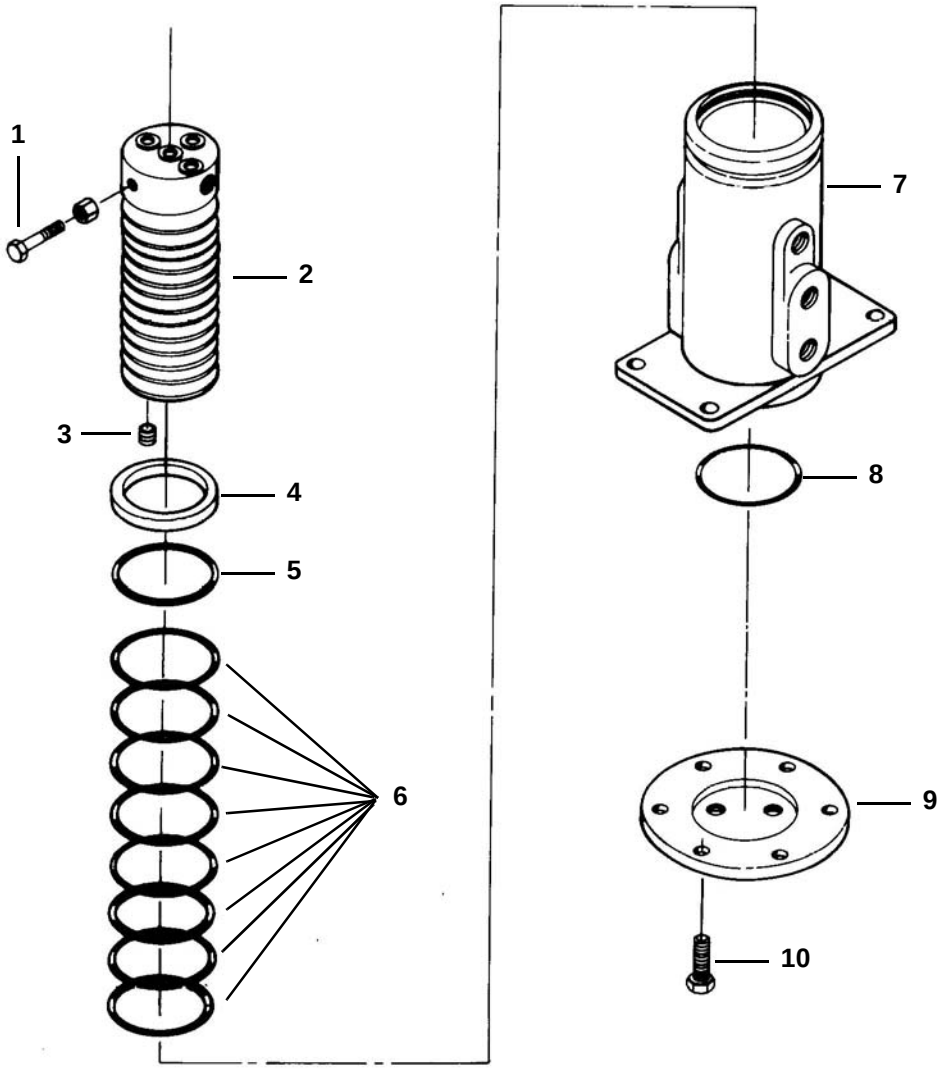
Rotate the swivel joint 90° to allow clearance between the swivel joint and the mount brackets.

Installation: Apply thread lock adhesive (Loctite® 242) to the bolts. Tighten the bolts to 48 - 55 ft.-lb. (65 - 75 N•m) torque.

Lower the swivel joint through the bottom of the undercarriage.

Parts Identification

1. Bolt
2. Rotor
3. Plug
4. Crown Seal
5. O-Ring
6. Glid Ring
7. Body
8. O-Ring
9. Cover
10. Bolt



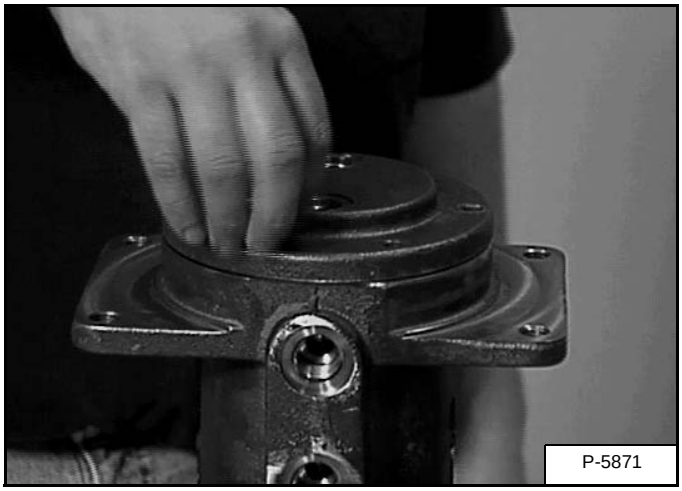
D-2250

SWIVEL JOINT (CONT'D)

Disassembly

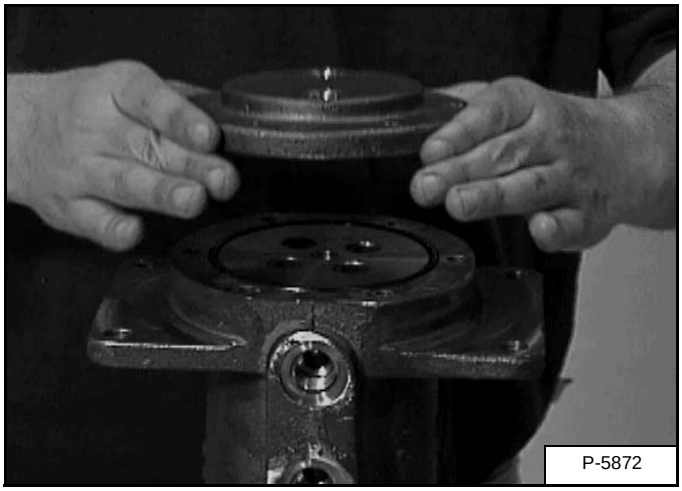
Clean the outside of the swivel joint before disassembly.

Figure 20-80-5



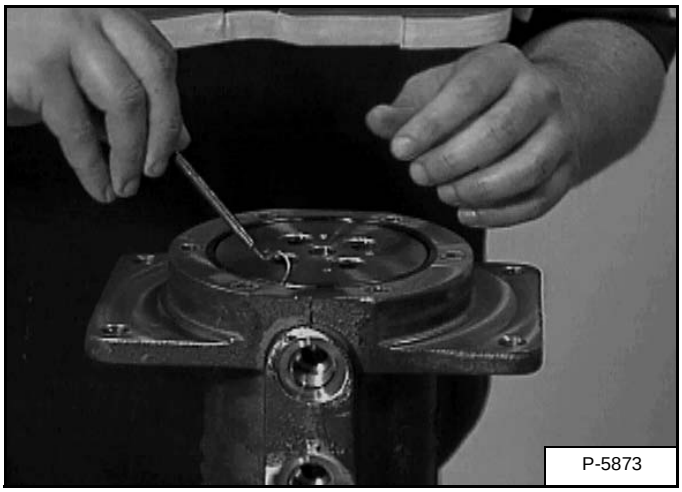
Remove the six bolts from the cover **[Figure 20-80-5]**.

Figure 20-80-6



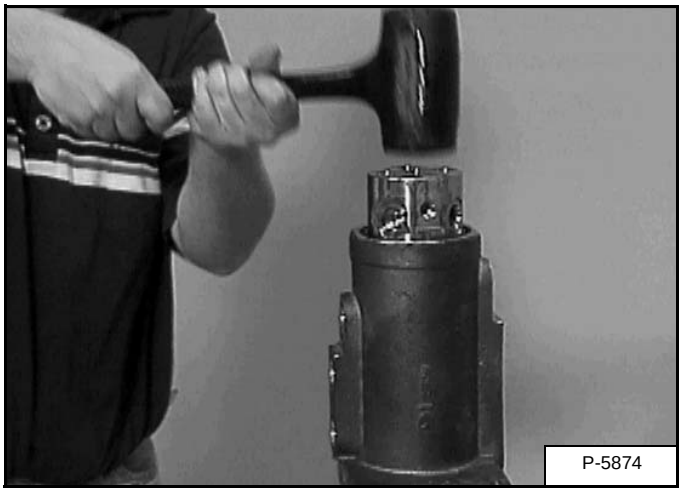
Remove the cover **[Figure 20-80-6]**.

Figure 20-80-7



Remove the O-ring from the O-ring groove **[Figure 20-80-7]**.

Figure 20-80-8



Clamp the swivel joint, base end down in a vise, and drive the rotor out of the body with a soft faced hammer **[Figure 20-80-8]**.

Remove all the O-rings and glid rings from the rotor.

NOTE: Use care not to scratch the rotor surface as damage to the finished surface could cause internal leakage.

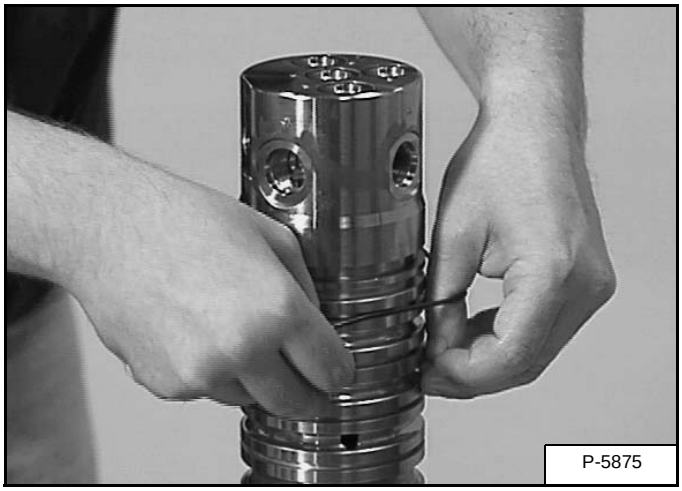
Assembly

Clean all parts in solvent and dry with compressed air.

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

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

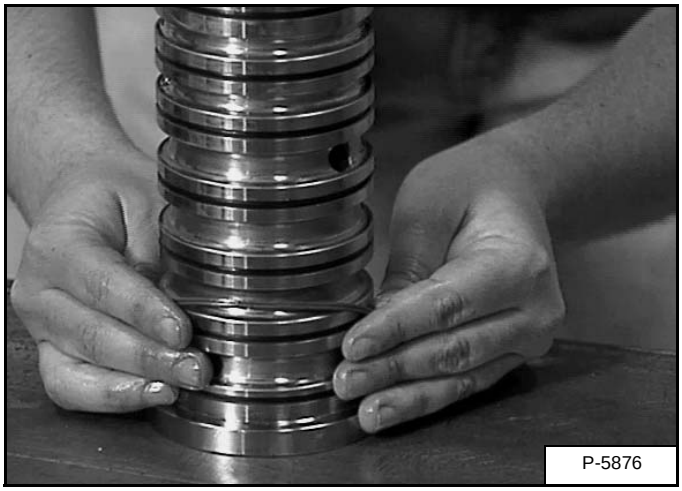
Figure 20-80-9



Install the O-rings on the rotor **[Figure 20-80-9]**.

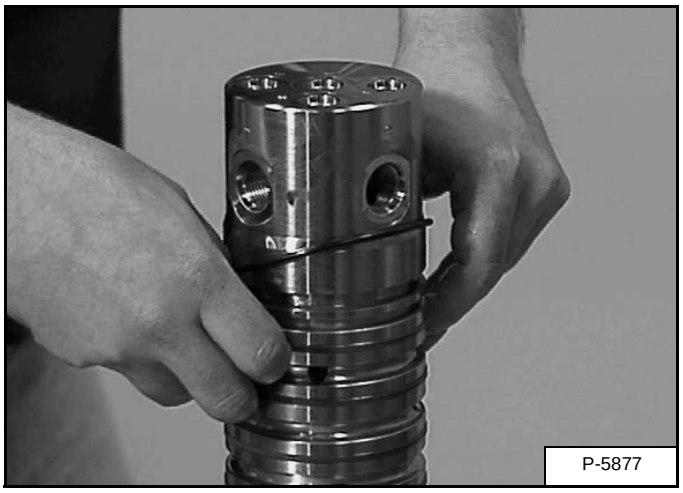
Heat the glid rings and crown seal in hydraulic oil for three minutes at 130° F (54° C).

Figure 20-80-10



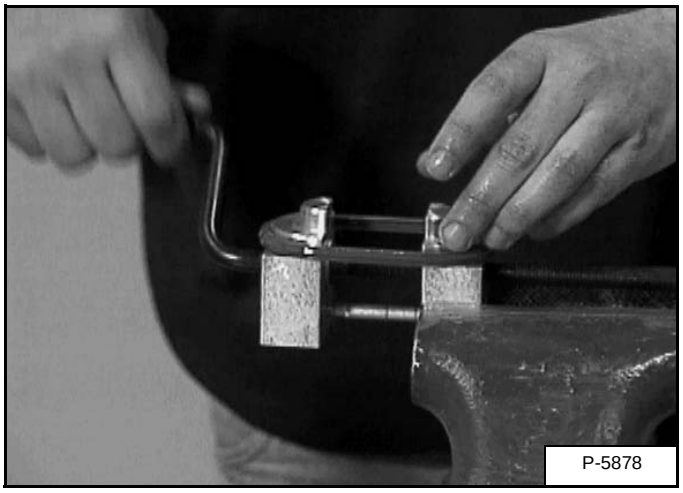
Stretch the heated rings to 4.0 in. (101,6 mm) and install on the rotor **[Figure 20-80-10]**.

Figure 20-80-11



Install the crown seal O-ring **[Figure 20-80-11]**.

Figure 20-80-12



Stretch the heated crown seal to 4.500 in. (114,3 mm) **[Figure 20-80-12]**.

SWIVEL JOINT (CONT'D)

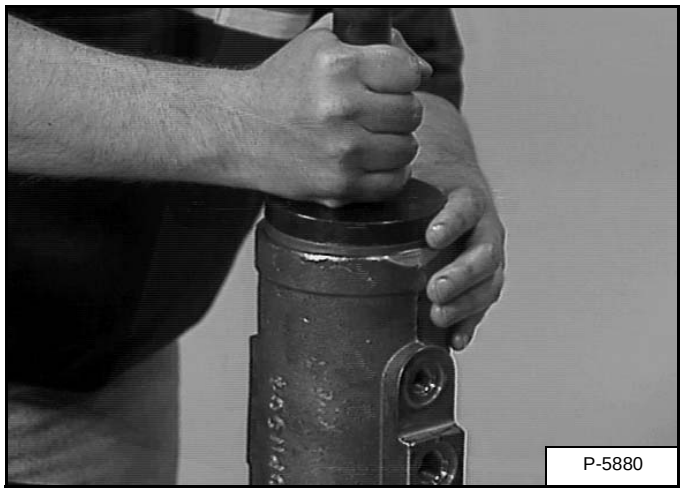
Assembly (Cont'd)

Figure 20-80-13



Work the crown seal on the rotor and down to the top groove **[Figure 20-80-13]**.

Figure 20-80-14

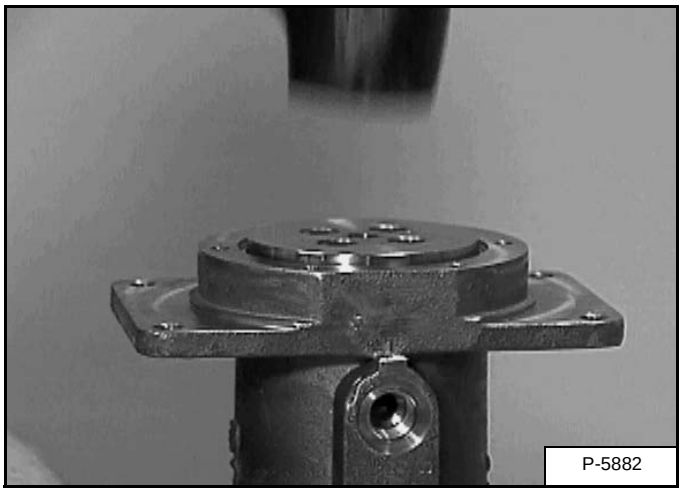


Press the wiper seal in the body **[Figure 20-80-14]**

Lubricate the inside of the body and the rotor with hydraulic oil or light grease.

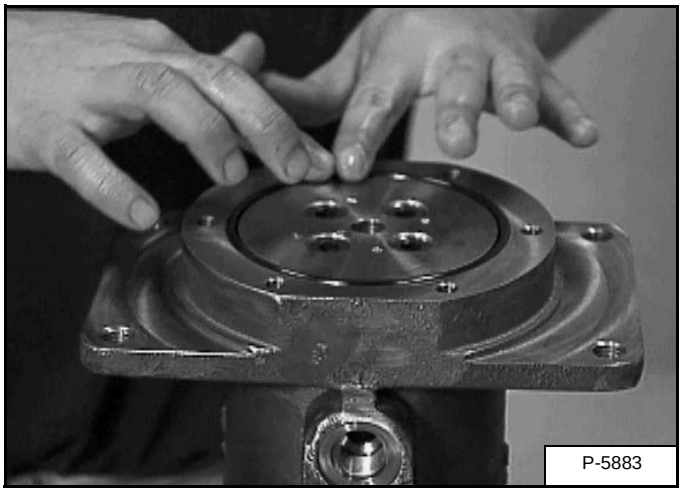
Slide the rotor in the body.

Figure 20-80-15



Seat the rotor using a soft faced hammer **[Figure 20-80-15]**.

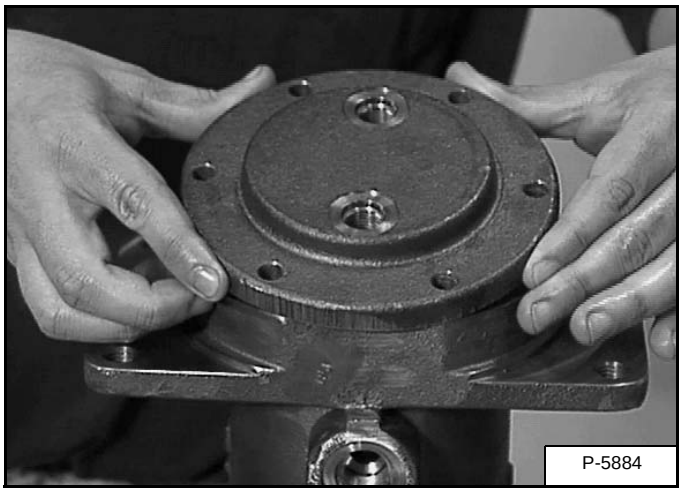
Figure 20-80-16



Install the O-ring in the groove on the bottom of the body **[Figure 20-80-16]**.

Assembly (Cont'd)

Figure 20-80-17



Install the cover on the body **[Figure 20-80-17]**.

Figure 20-80-18



Apply thread lock adhesive (Loctite® 242) to the bolt threads, and install the cover bolts. Tighten the bolts to 18 ft.-lb. (24 N•m) torque **[Figure 20-80-18]**.

Figure 20-80-19



Check the breakaway torque of the swivel joint **[Figure 20-80-19]**.

The breakaway torque of the swivel joint is 50 - 90 ft.-lb. (68 - 122 N•m).


Bobcat®

SWING MOTOR

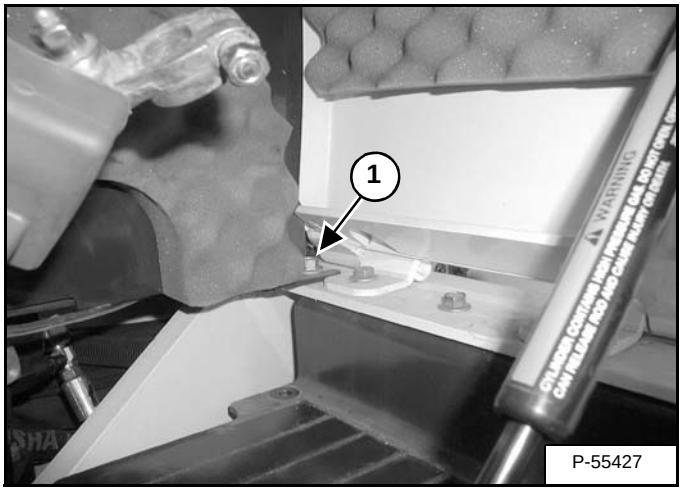
Removal And Installation

Remove the floormat and floor plate. (See Removal And Installation (Canopy Equipped Excavators) on Page 40-110-1 or See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

Remove the battery. (See Removing And Installing The Battery on Page 50-20-2.)

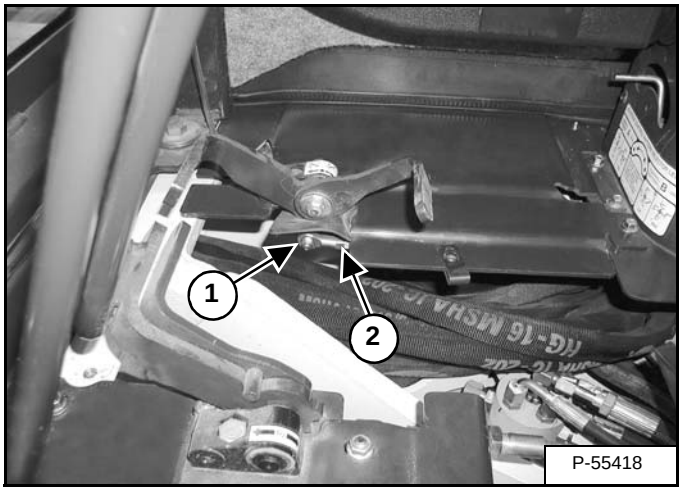
Open the right side cover.

Figure 20-90-1



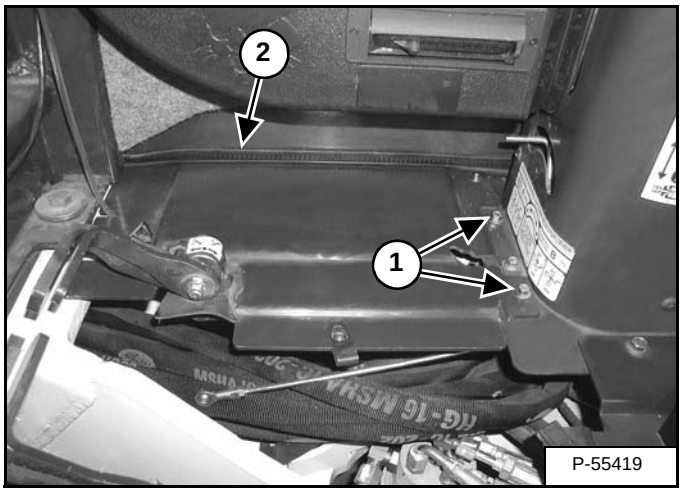
Remove the bolt (Item 1) **[Figure 20-90-1]**.

Figure 20-90-2



Remove the nut (Item 1) from the ball joint on the right pedal linkage (Item 2) **[Figure 20-90-2]**. Remove the linkage from the pedal.

Figure 20-90-3



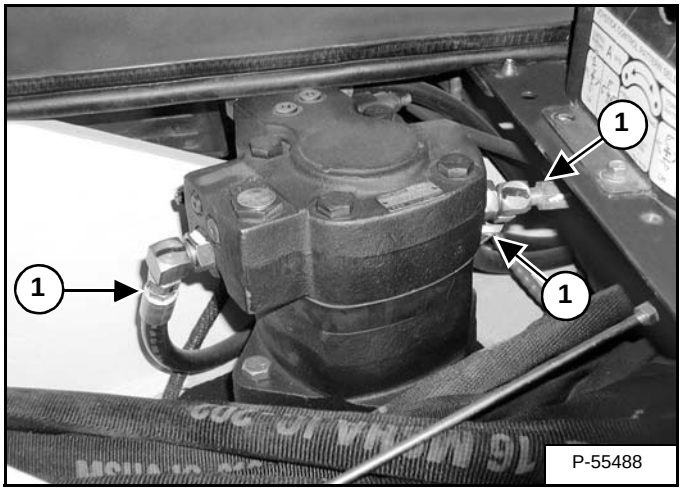
Remove the bolts (Item 1) from the right floor plate (Item 2) **[Figure 20-90-3]**. Remove the right floor plate.

IMPORTANT

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

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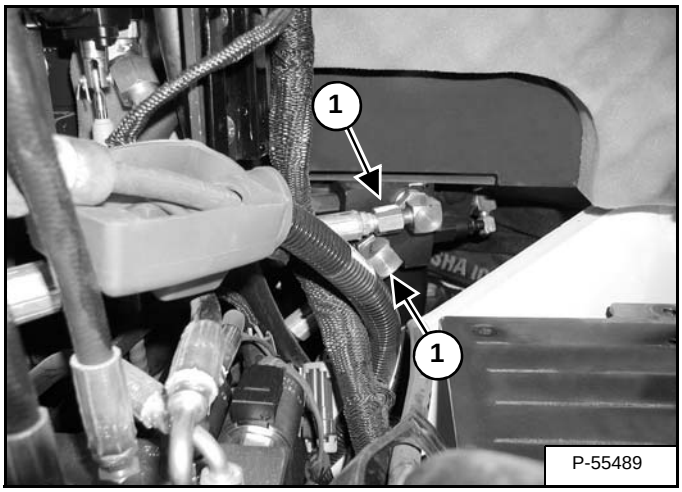
Figure 20-90-4



Remove the three hoses (Item 1) **[Figure 20-90-4]**.

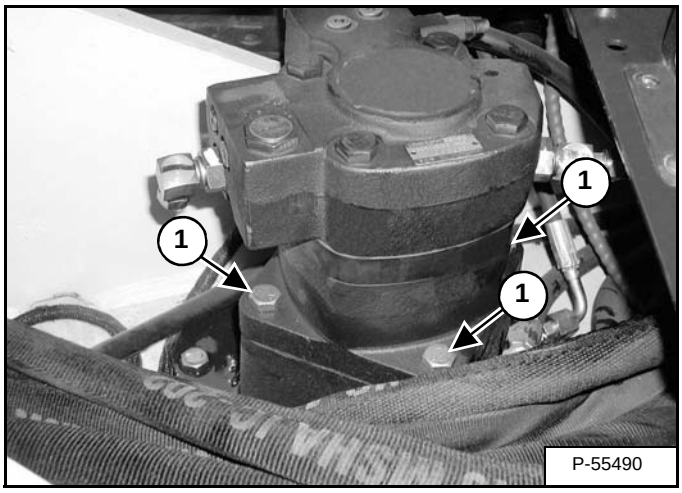
Removal And Installation (Cont'd)

Figure 20-90-5



Remove the hoses (Item 1) **[Figure 20-90-5]**.

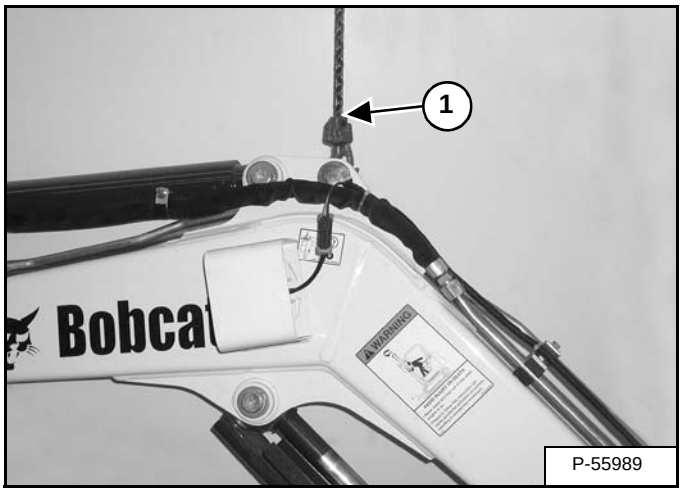
Figure 20-90-6



Remove the four bolts (Item 1) **[Figure 20-90-6]**.

Installation: Apply thread lock adhesive (Loctite® 242) to the bolt threads. Tighten the bolts to 90 - 100 ft.-lb. (125 - 135 N•m) torque.

Figure 20-90-7



Install a hoist (Item 1) **[Figure 20-90-7]** on the boom.

Raise the hoist until the boom/bucket is off the ground.

Figure 20-90-8

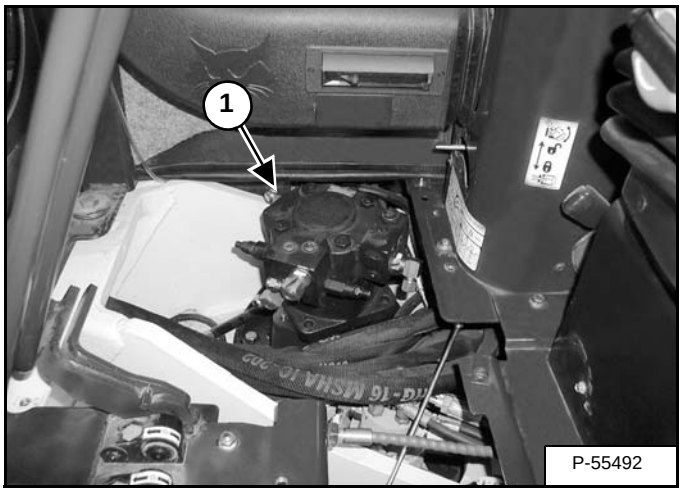


Rotate the upperstructure until the swing motor is in the position shown **[Figure 20-90-8]**.

Lower the boom/bucket to the ground.

Removal And Installation (Cont'd)

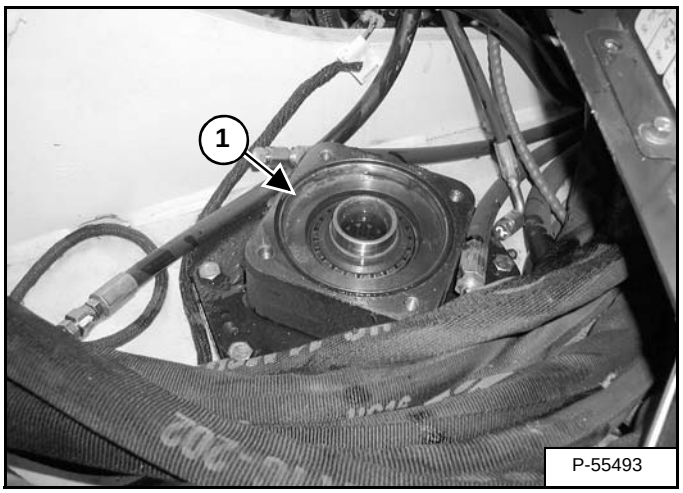
Figure 20-90-9



Raise and tilt the motor (Item 1) **[Figure 20-90-9]** toward the left side of the excavator.

Remove the swing motor.

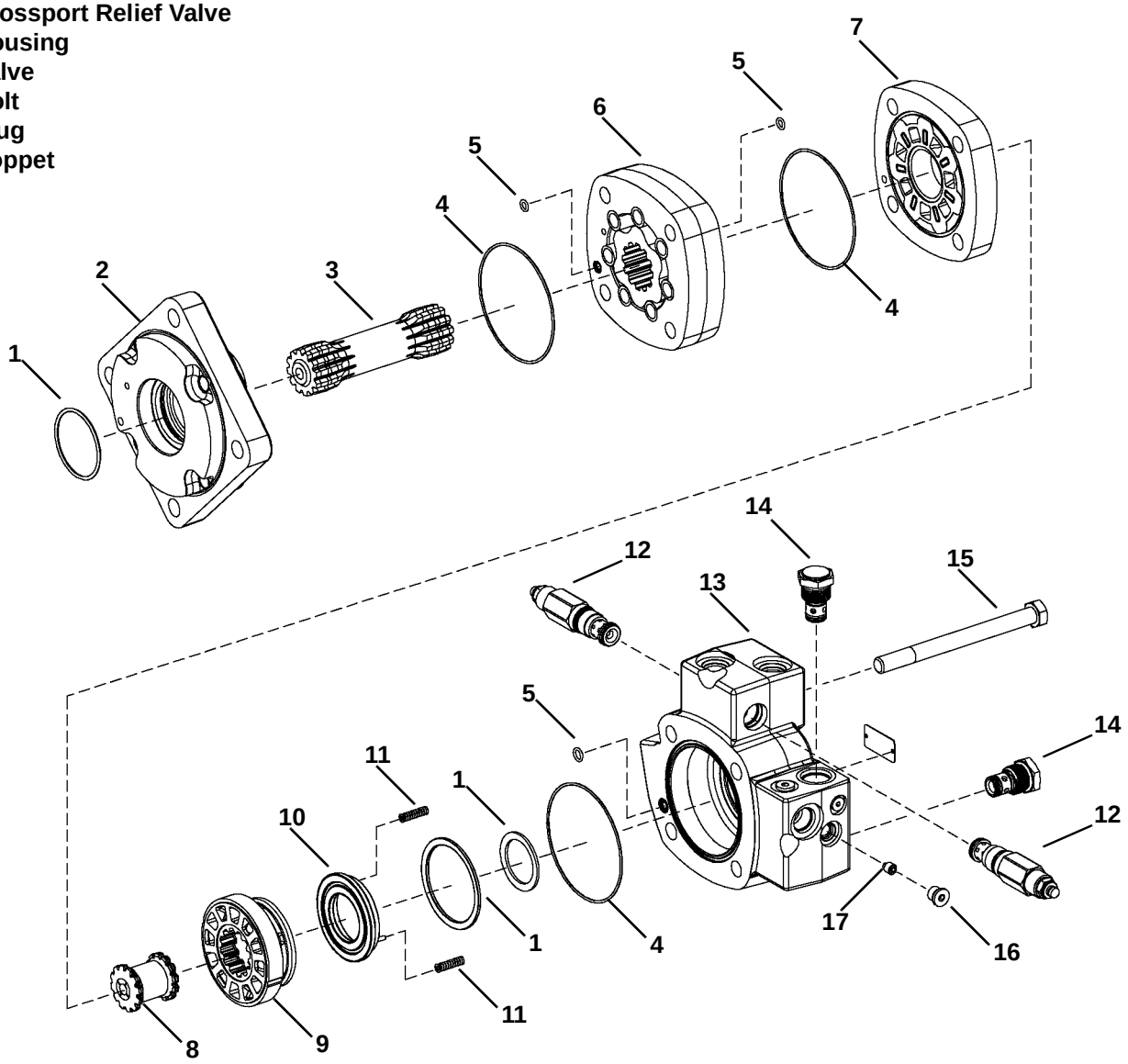
Figure 20-90-10



Remove the O-ring (Item 1) **[Figure 20-90-10]**.

Parts Identification

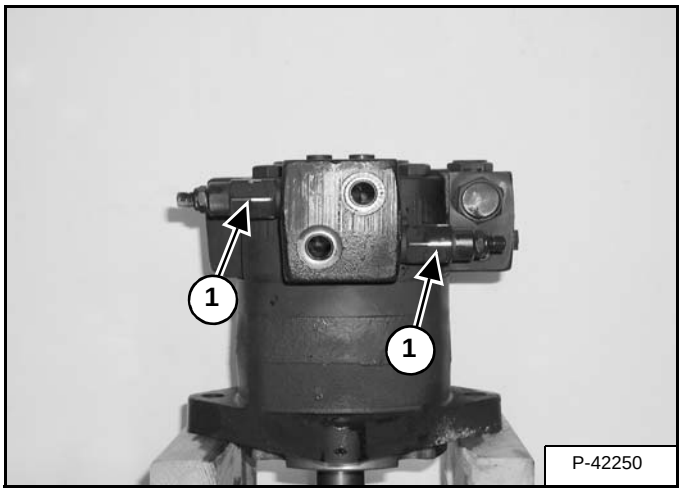
1. Seal
2. Housing
3. Drive Shaft
4. O-Ring
5. O-Ring
6. Geroler®
7. Plate
8. Drive
9. Valve
10. Valve Plate
11. Spring
12. Crossport Relief Valve
13. Housing
14. Valve
15. Bolt
16. Plug
17. Poppet



MS1847S

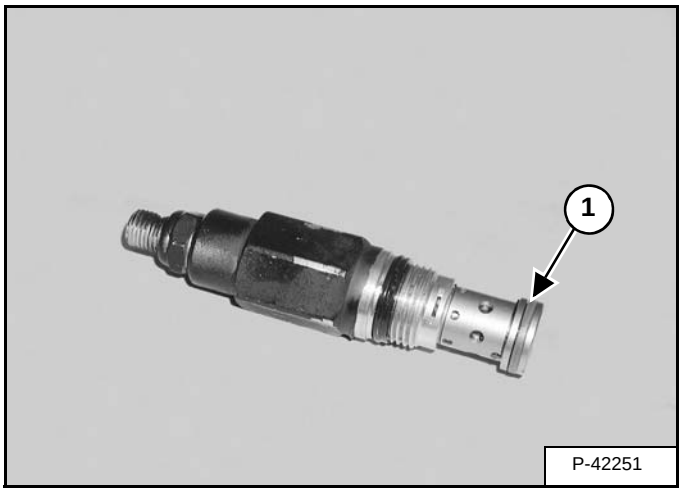
Disassembly

Figure 20-90-11



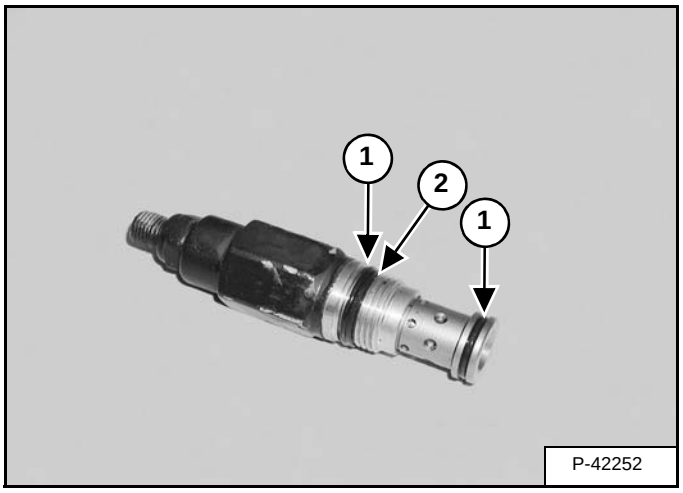
Remove the crossport relief valves (Item 1) **[Figure 20-90-11]**.

Figure 20-90-12



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

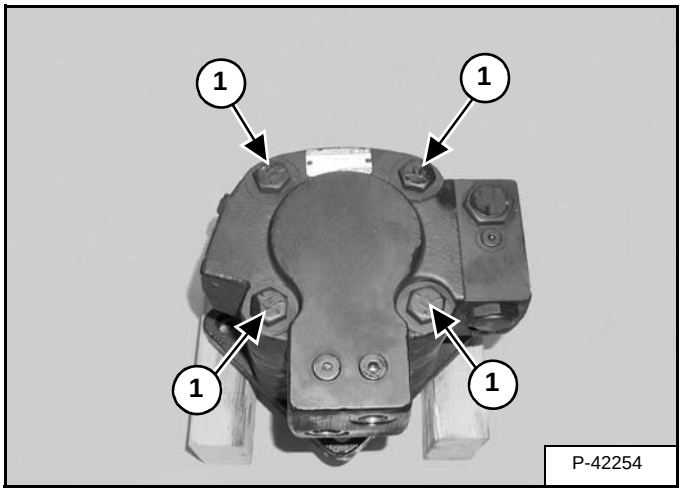
Figure 20-90-13



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-90-13]**.

Mark the housing for ease of assembly.

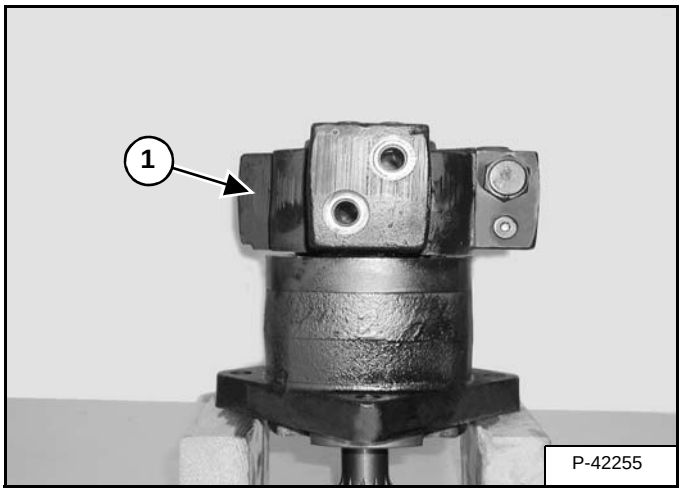
Figure 20-90-14



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

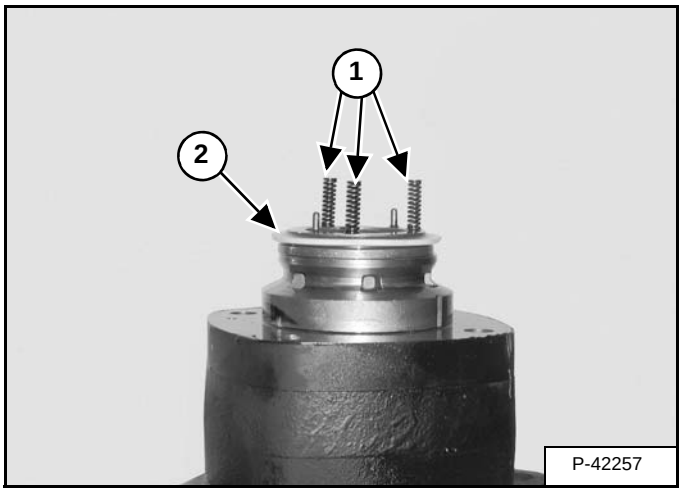
Disassembly (Cont'd)

Figure 20-90-15



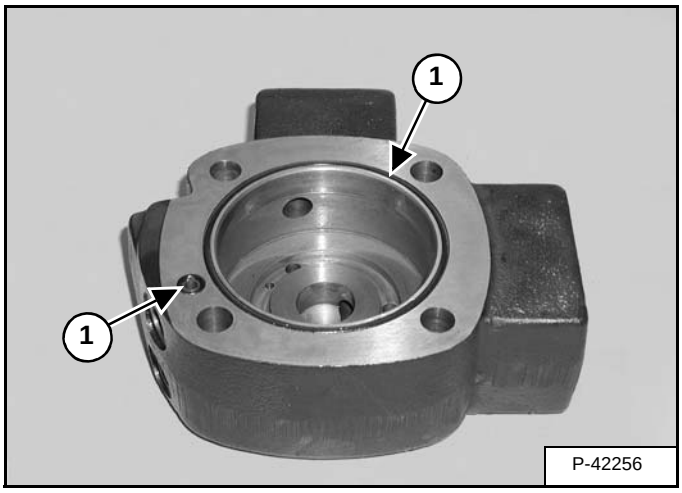
Remove the valve housing (Item 1) **[Figure 20-90-15]**.

Figure 20-90-16



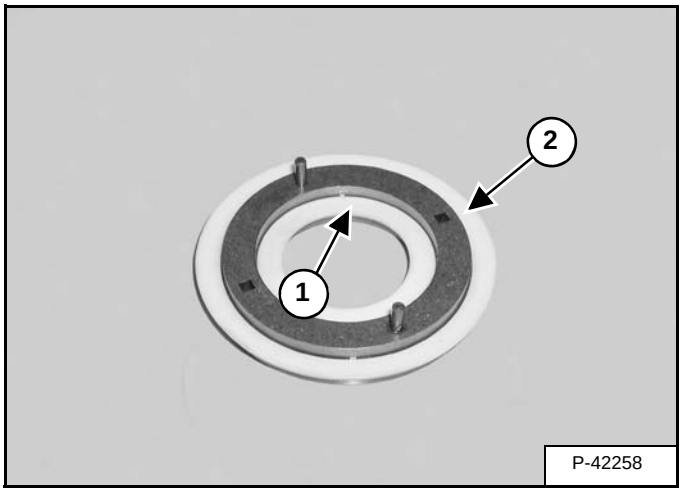
Lift the housing straight up. If done carefully the springs (Item 1) and balance ring sub-assembly (Item 2) **[Figure 20-90-16]** will remain on the valve for easy removal. Remove the springs and balance ring.

Figure 20-90-17



Remove the O-rings (Item 1) **[Figure 20-90-17]**.

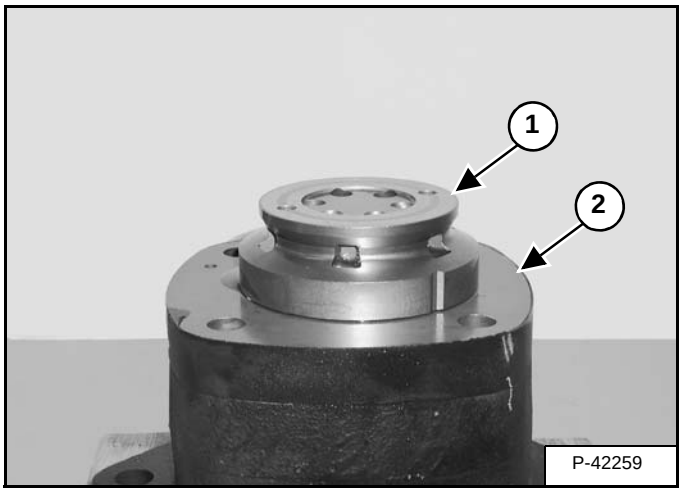
Figure 20-90-18



Remove the inner seal (Item 1) and outer seal (Item 2) **[Figure 20-90-18]**.

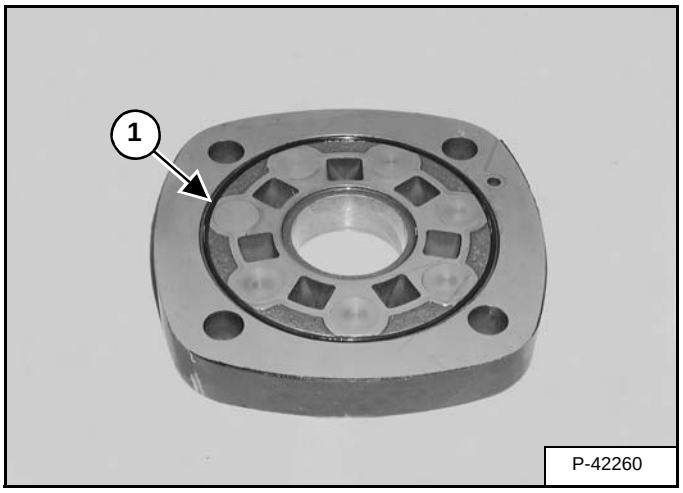
Disassembly (Cont'd)

Figure 20-90-19



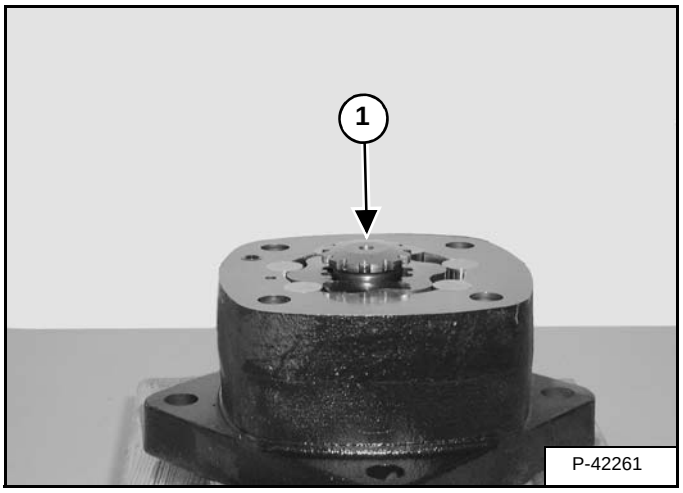
Remove the valve (Item 1) and valve plate (Item 2) **[Figure 20-90-19]**.

Figure 20-90-20



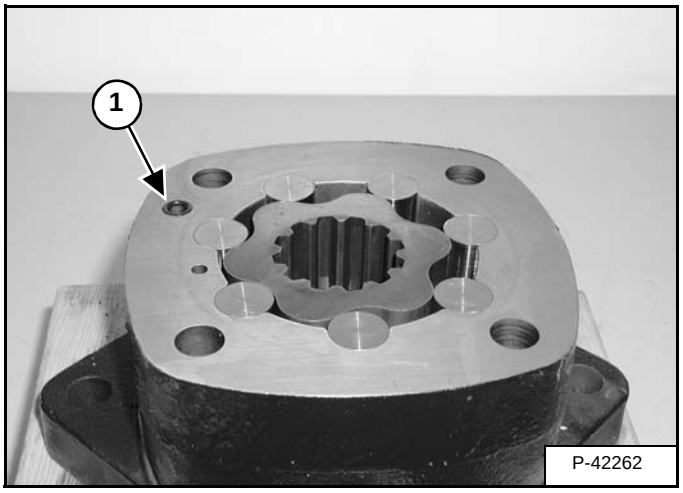
Turn the valve plate over and remove the O-ring (Item 1) **[Figure 20-90-20]**.

Figure 20-90-21



Remove the valve drive (Item 1) **[Figure 20-90-21]**.

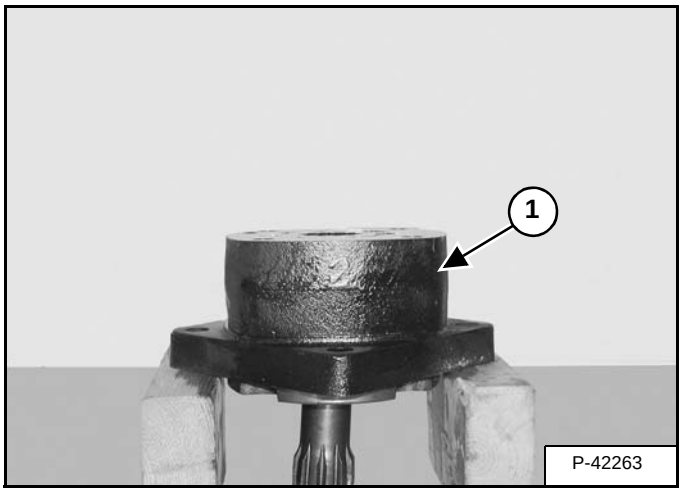
Figure 20-90-22



Remove the O-ring (Item 1) **[Figure 20-90-22]** from the Geroler®.

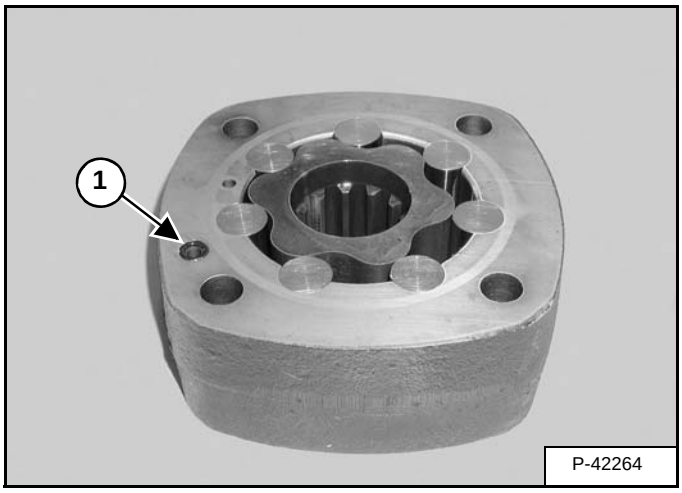
Disassembly (Cont'd)

Figure 20-90-23



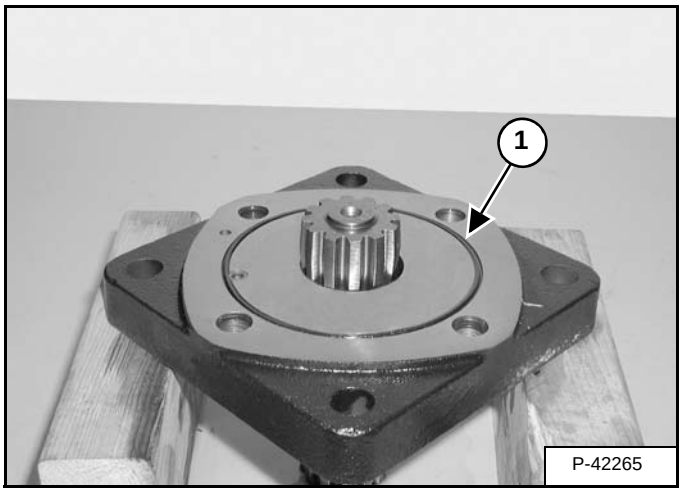
Remove the Geroler® (Item 1) **[Figure 20-90-23]**.

Figure 20-90-24



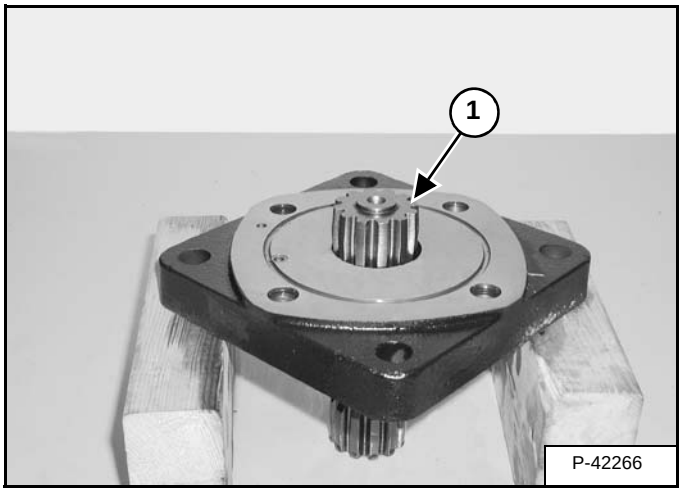
Turn the Geroler® over and remove the O-ring (Item 1) **[Figure 20-90-24]**.

Figure 20-90-25



Remove the O-ring (Item 1) **[Figure 20-90-25]** from the housing.

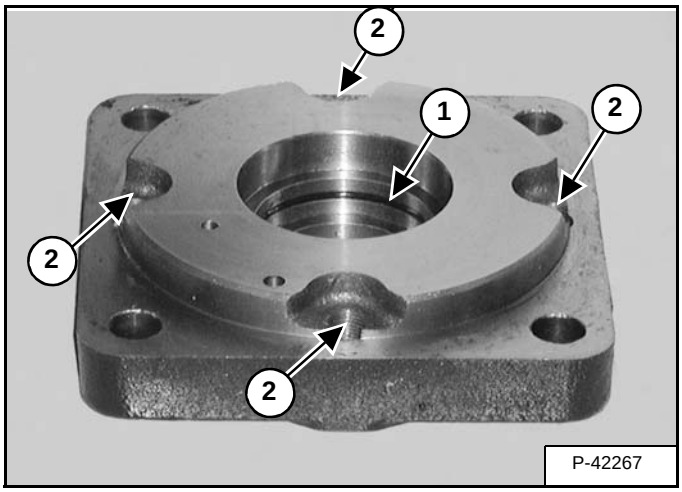
Figure 20-90-26



Remove the drive shaft (Item 1) **[Figure 20-90-26]**.

Disassembly (Cont'd)

Figure 20-90-27



Remove the O-ring (Item 1) **[Figure 20-90-27]**.

Use a tap to remove all the old thread adhesive from the bolt hole threads (Item 2) **[Figure 20-90-27]**.

SWING MOTOR (CONT'D)

Assembly

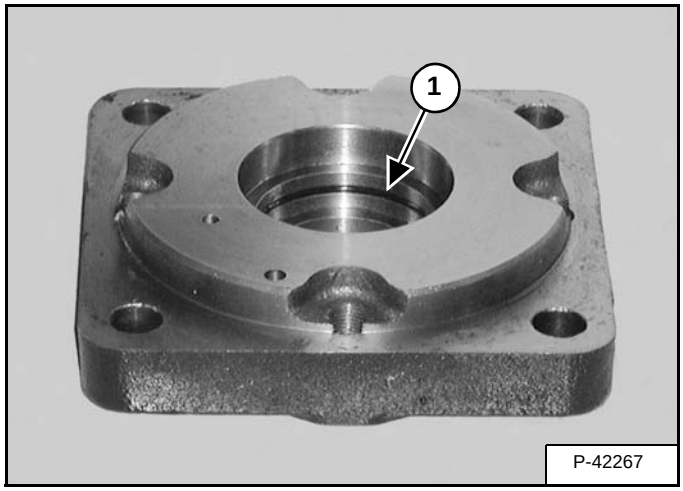
Clean all parts in solvent and dry with compressed air.

Check the components for damage or wear.

Always use new O-rings and seals.

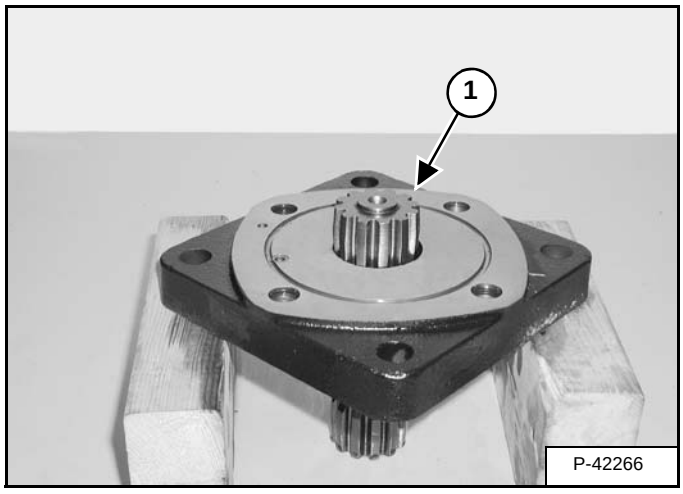
Apply clean hydraulic oil to the components during installation.

Figure 20-90-28



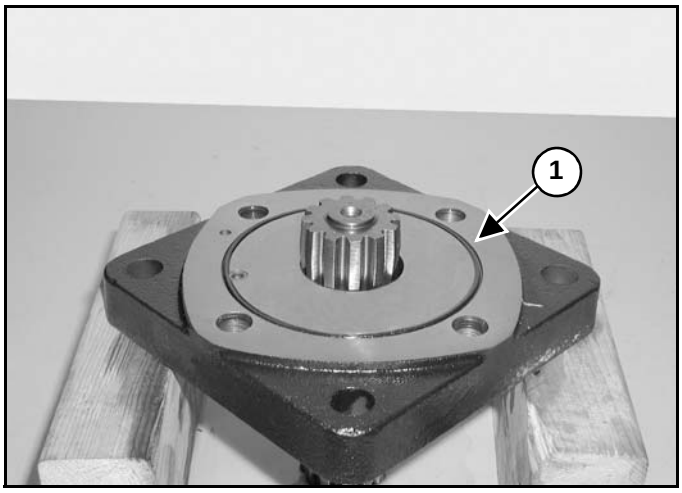
Install the O-ring (Item 1) **[Figure 20-90-28]**.

Figure 20-90-29



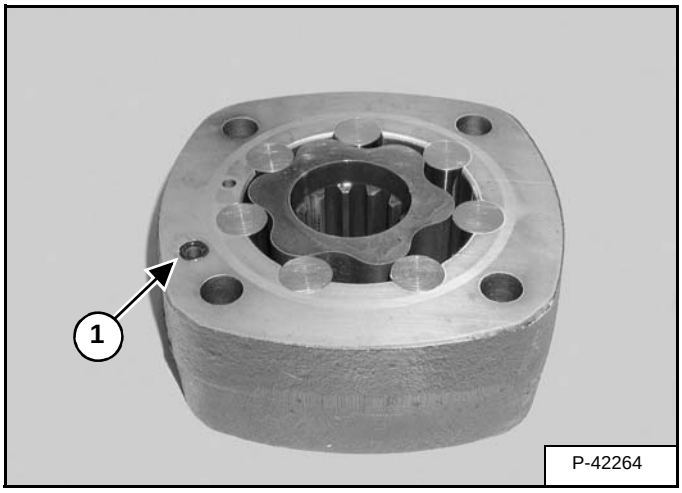
Install the drive shaft (Item 1) **[Figure 20-90-29]**.

Figure 20-90-30



Install the O-ring (Item 1) **[Figure 20-90-30]**.

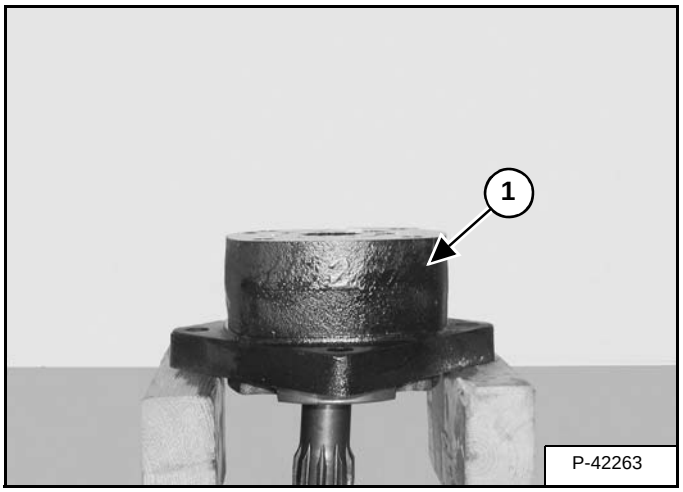
Figure 20-90-31



Install the O-ring (Item 1) **[Figure 20-90-31]** on the Geroler®.

Assembly (Cont'd)

Figure 20-90-32



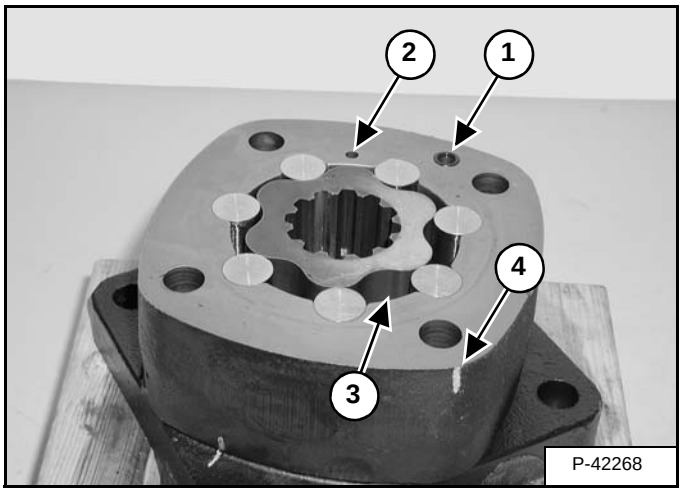
Turn the Geroler® over and install the Geroler® (Item 1) **[Figure 20-90-32]** on the housing.

Timing the hydraulic motor:

The timing parts include:

1. Geroler®
2. Valve drive
3. Valve plate
4. Valve

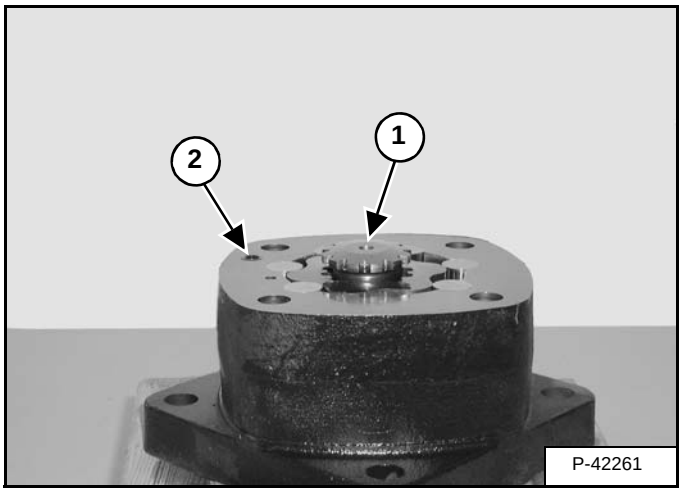
Figure 20-90-33



Align the case drain hole (Item 1) and the pressure relief hole (Item 2) **[Figure 20-90-33]** in the Geroler® with the case drain hole and pressure relief hole in the housing.

Locate the largest opening in the Geroler® (Item 3), and mark the location on the outside edge of the Geroler® (Item 4) **[Figure 20-90-33]**.

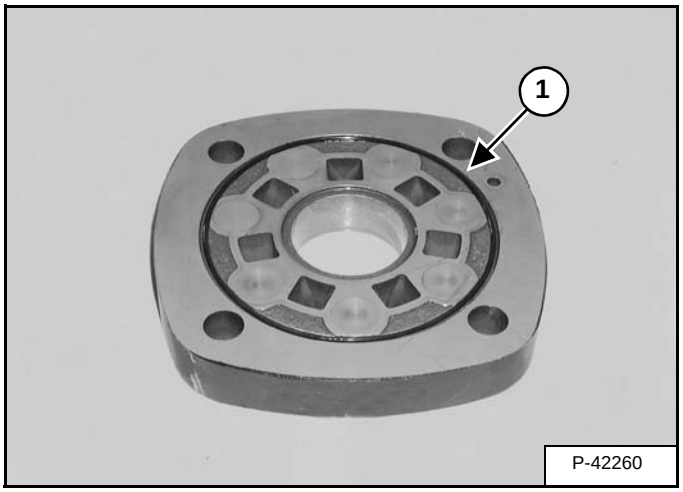
Figure 20-90-34



Install the valve drive (Item 1) **[Figure 20-90-34]** in the Geroler®.

Install the O-ring (Item 2) **[Figure 20-90-34]**.

Figure 20-90-35

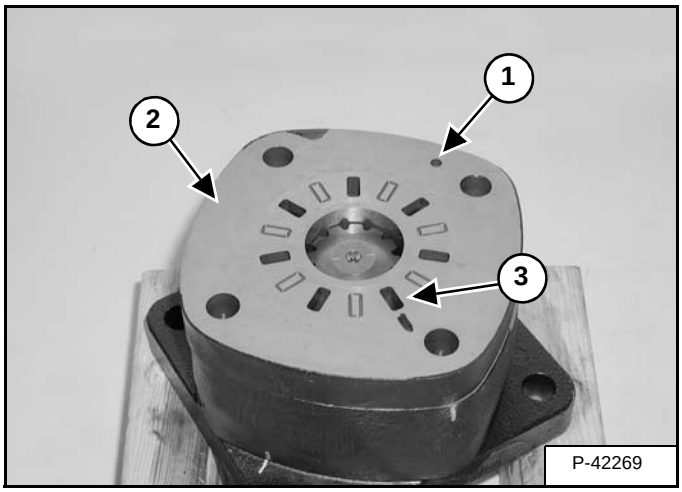


Install the O-ring (Item 1) **[Figure 20-90-35]** on the valve plate.

SWING MOTOR (CONT'D)

Assembly (Cont'd)

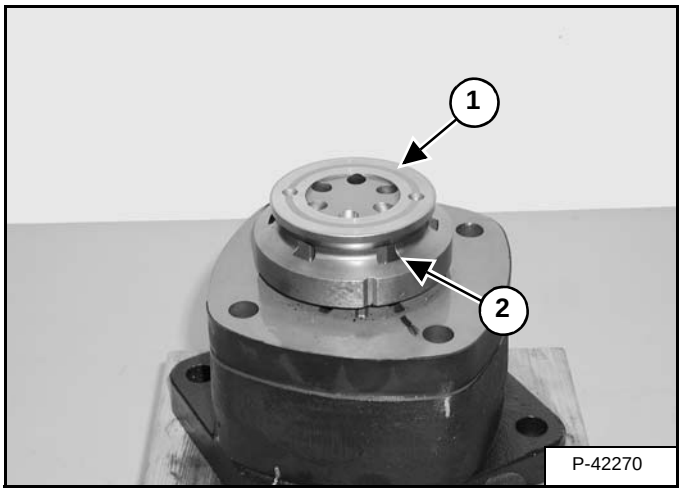
Figure 20-90-36



Align the case drain hole (Item 1) in the valve plate (Item 2) **[Figure 20-90-36]** with the case drain hole in the Geroler®. Install the valve plate (seal side toward Geroler®) on the Geroler®.

NOTE: Locate the slot opening (Item 3) [Figure 20-90-36] in the valve plate which is in line with the largest opening (marked earlier) in the Geroler®.

Figure 20-90-37



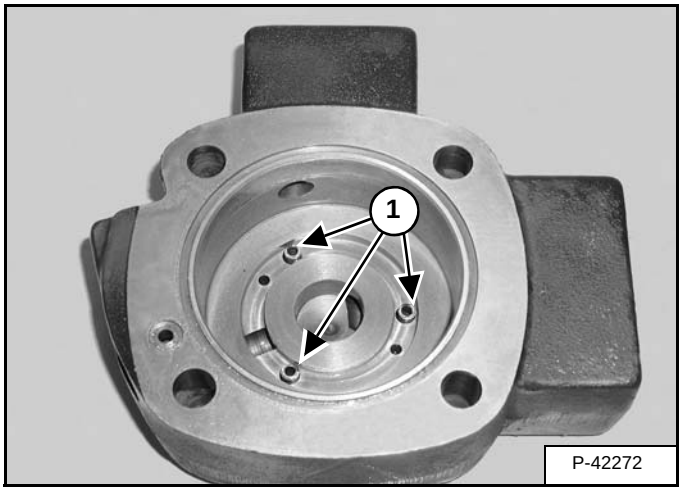
Install the valve (Item 1) **[Figure 20-90-37]**.

Locate any one of the side openings of the valve (Item 2) **[Figure 20-90-37]** that goes through to the face of the valve.

Line up this side opening with the open slot of the valve plate that is in line with the largest opening of the Geroler® (marked earlier).

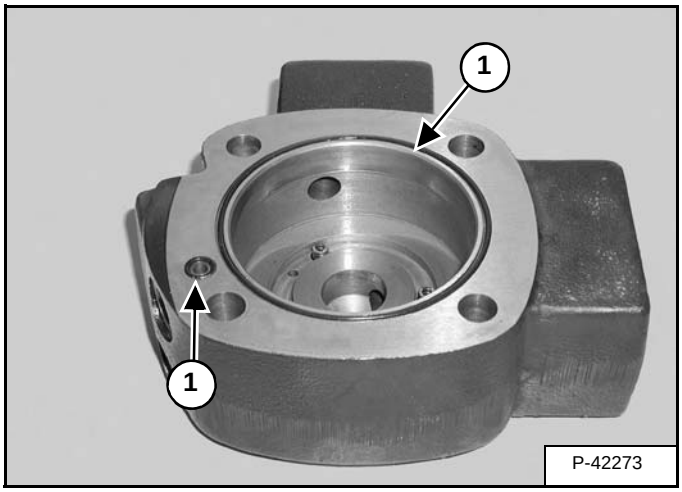
Rotate the valve clockwise until the spline teeth engage in the valve.

Figure 20-90-38



Apply clean grease on the three balance ring assembly springs (Item 1) **[Figure 20-90-38]** and install the springs in the holes located inside of the valve housing.

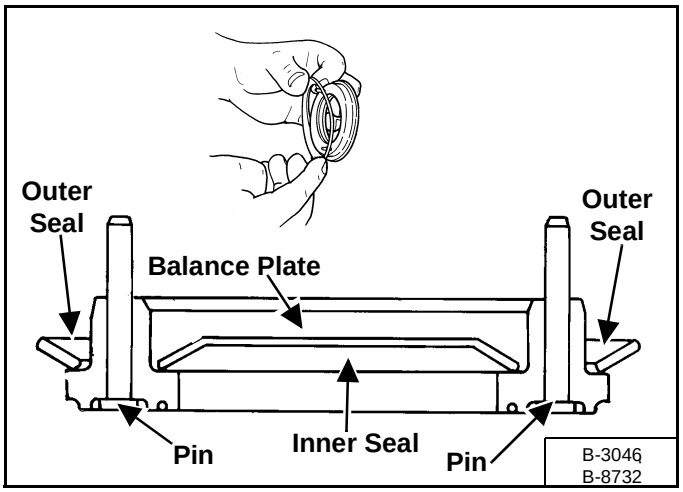
Figure 20-90-39



Install the O-rings (Item 1) **[Figure 20-90-39]** on the valve housing.

Assembly (Cont'd)

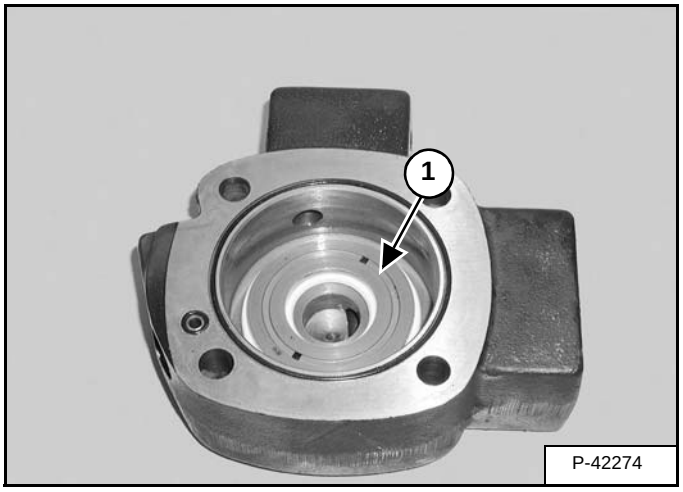
Figure 20-90-40



Install the inner and outer face seals on the balance ring **[Figure 20-90-40]**.

NOTE: Install the face seals as shown in [Figure 20-90-40], or the motor will not operate properly. Any damage to these seals will affect the operation of the motor.

Figure 20-90-41



Align the balance ring assembly pins with the two holes in the valve housing, and install the balance ring sub-assembly (Item 1) **[Figure 20-90-41]** in the valve housing.

Figure 20-90-42

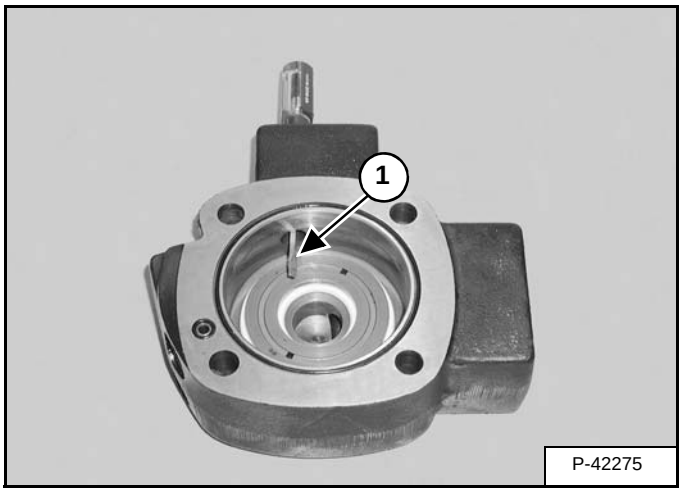
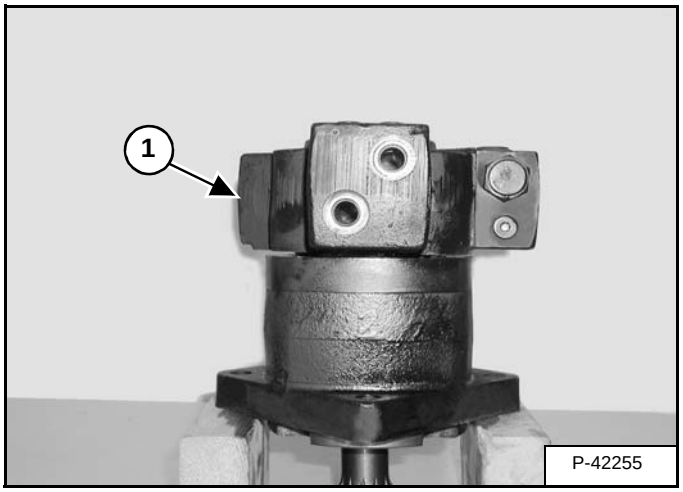


Figure 20-90-43

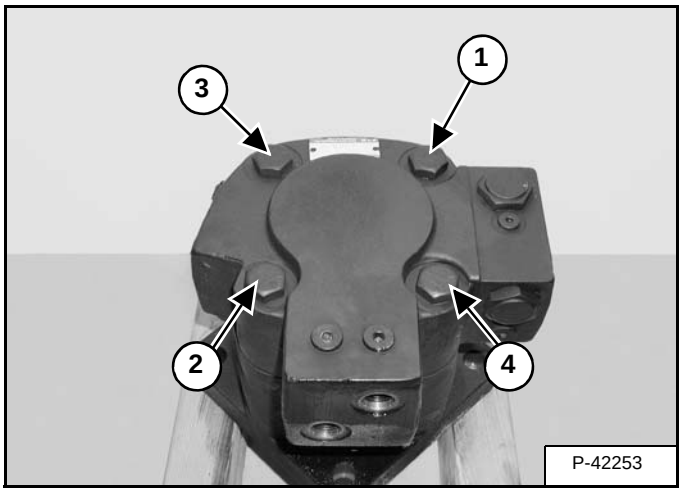


Insert a small screw driver (Item 1) **[Figure 20-90-42]** through the port in the housing. Apply pressure to side of the balance ring assembly until the valve housing is in place. Align the case drain hole in the housing with the case drain hole in the valve plate. Install the valve housing (Item 1) **[Figure 20-90-43]** against the valve plate and remove the screwdriver.

NOTE: Check that the O-rings on the motor sections are in place before the bolts are installed. If the O-rings are out of position the swing motor will leak between the sections.

Assembly (Cont'd)

Figure 20-90-44

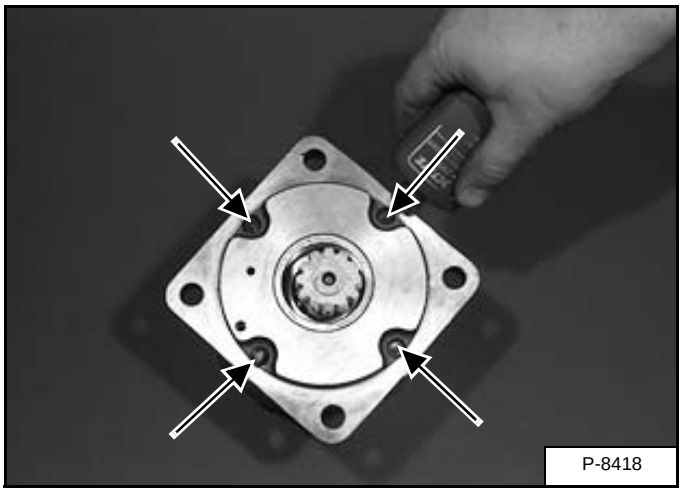


Install the four bolts. Tighten the bolts in sequence (Item 1 through Item 4) **[Figure 20-90-44]** to 63 ft.-lb. (86 N•m) of torque.

Follow these procedures:

NOTE: This motor requires Loctite® in threaded holes of the mounting flange.

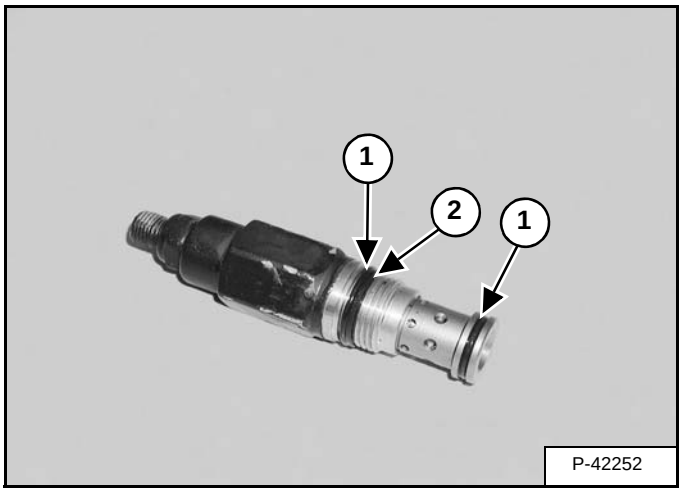
Figure 20-90-45



Adequate Loctite® penetration and sealing depends highly on cleanliness and dryness of the threads. Use a non-petroleum base solvent to clean excess oil from threads of the flange after disassembly. Apply two to three drops of Loctite® 290 at the top of the threaded holes **[Figure 20-90-45]**.

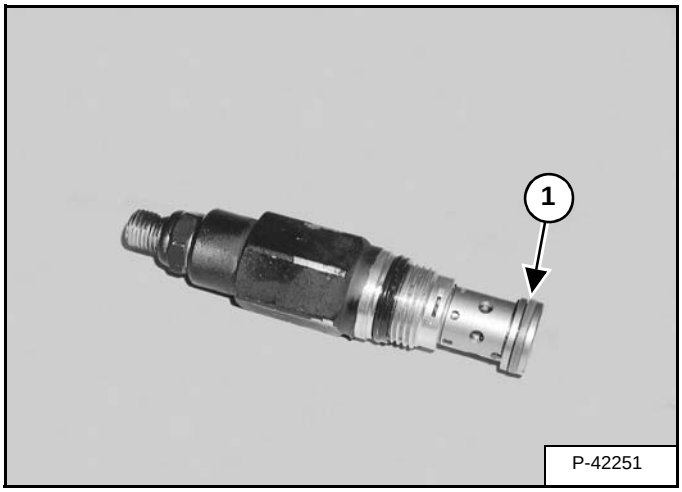
NOTE: Allow the Loctite® five minutes for thread penetration before installing the motor on the swing motor carrier.

Figure 20-90-46



Install the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-90-46]** on both crossport relief valves.

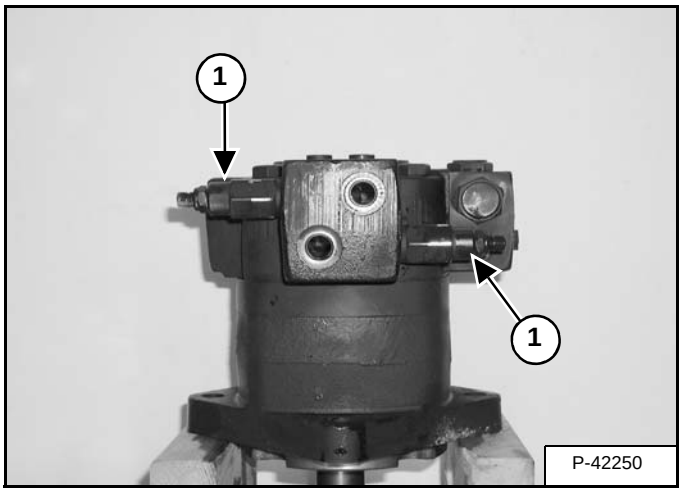
Figure 20-90-47



Install the ring (Item 1) **[Figure 20-90-47]**.

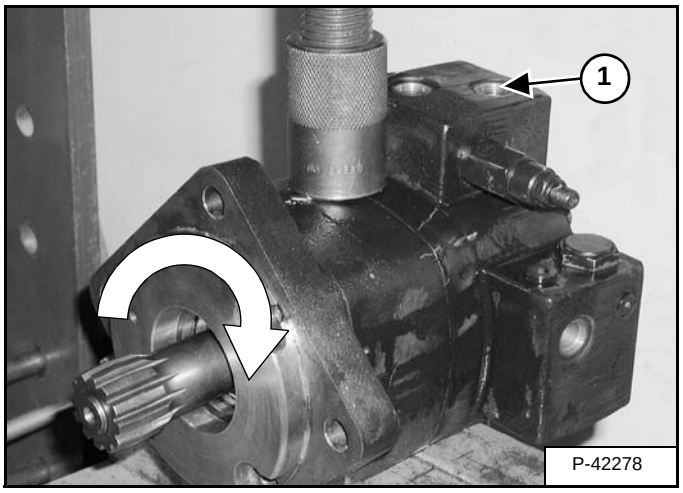
Assembly (Cont'd)

Figure 20-90-48



Install the relief valves (Item 1) **[Figure 20-90-48]**.

Figure 20-90-49



Clamp the motor in a press. Turn the shaft in a clockwise direction. If the motor is correctly timed, there will be suction at the top port (Item 1) **[Figure 20-90-49]**.

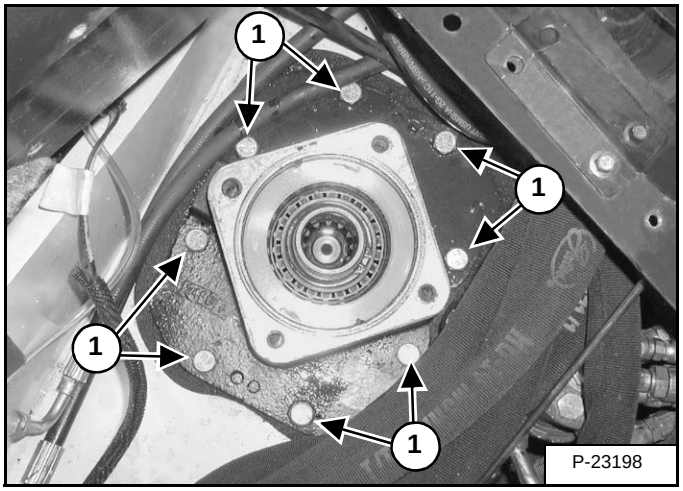

Bobcat®

SWING MOTOR DRIVE CARRIER

Removal And Installation

Remove the swing motor. (See Removal And Installation on Page 20-90-1.)

Figure 20-91-1

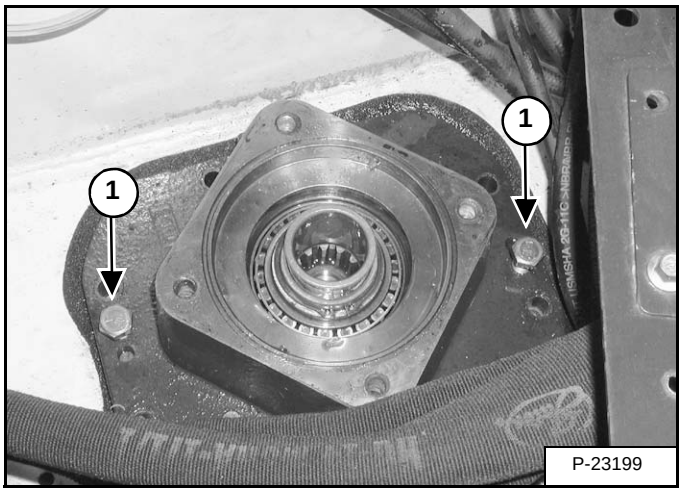


Mark and remove the eight bolts (Item 1) **[Figure 20-91-1]**.

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.-lb. (105 - 115 N•m) torque.

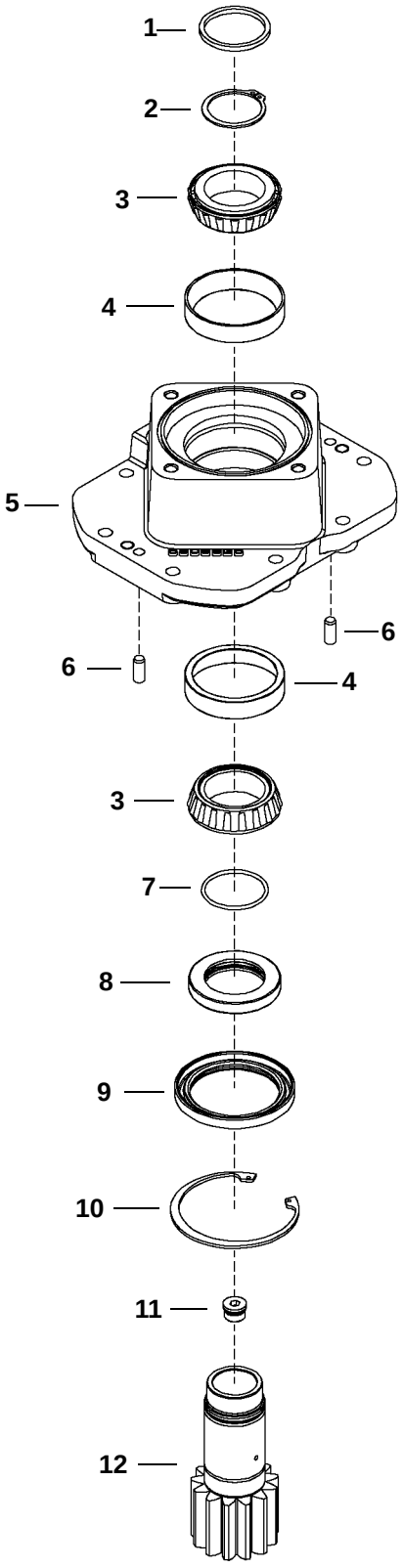
Figure 20-91-2



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.

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

Disassembly

Clean the outside of the carrier before disassembly.

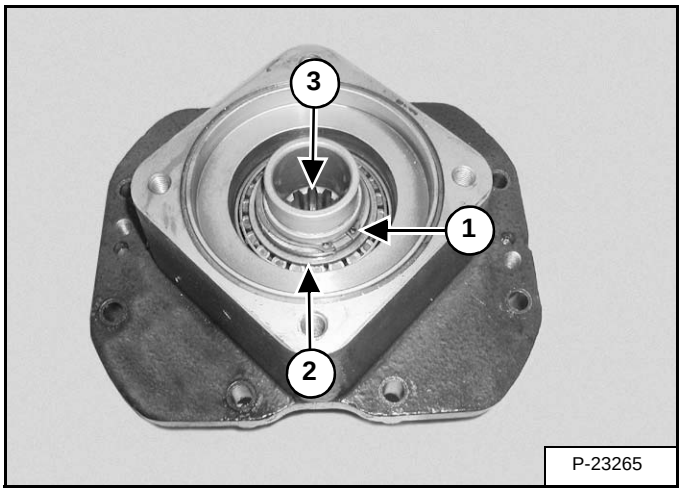
IMPORTANT

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

I-2003-0888

Drain the lubrication oil from the assembly. Tip the carrier over, allowing the oil to drain through the top bearing.

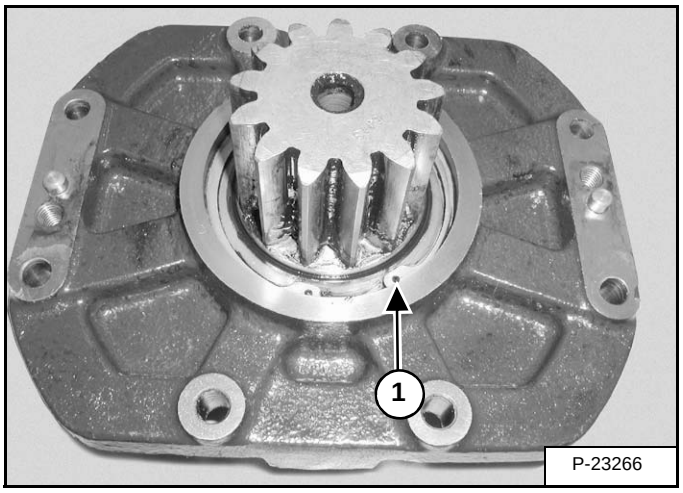
Figure 20-91-3



Remove the snap ring (Item 1) and the spacer (Item 2) **[Figure 20-91-3]** from the top of the drive shaft.

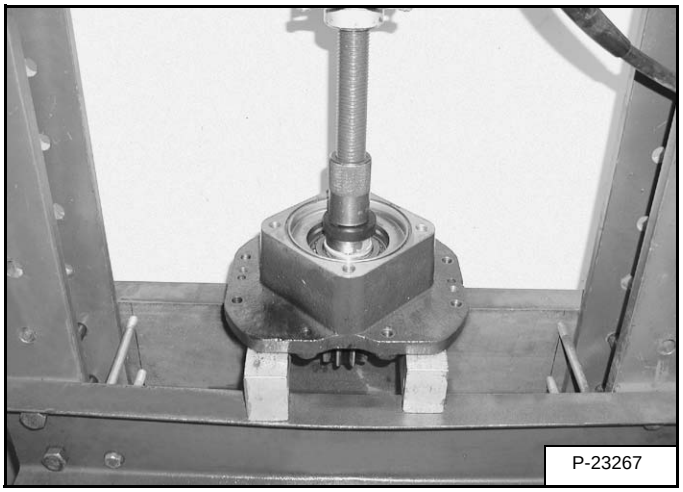
Remove the drain plug (Item 3) **[Figure 20-91-3]** from the bottom of the drive shaft.

Figure 20-91-4



Remove the snap ring (Item 1) **[Figure 20-91-4]** from the bottom of the carrier.

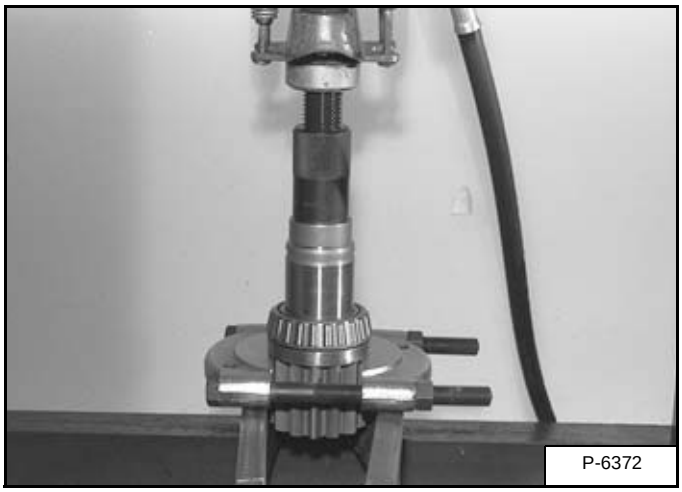
Figure 20-91-5



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]**.

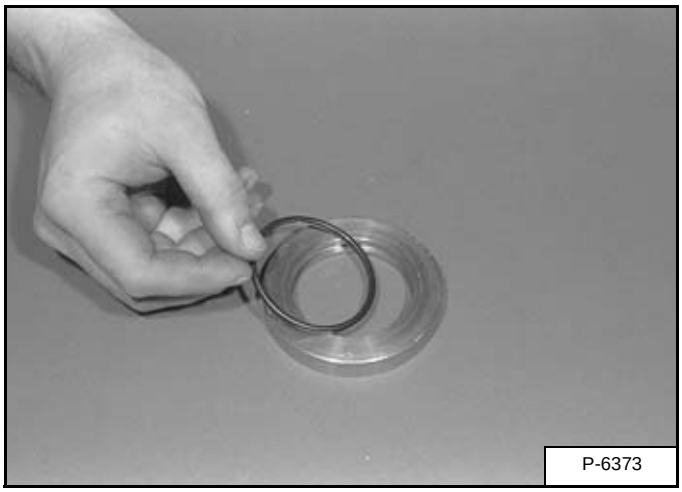
Disassembly (Cont'd)

Figure 20-91-6



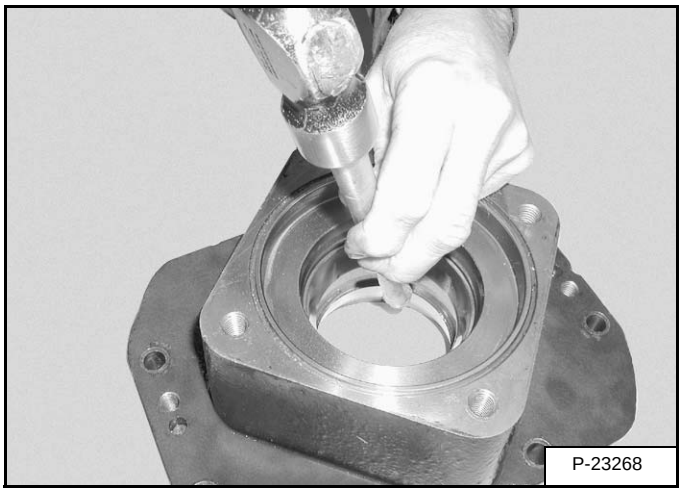
Remove the bottom bearing and spacer by supporting the spacer and pressing the shaft through it **[Figure 20-91-6]**.

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]**.

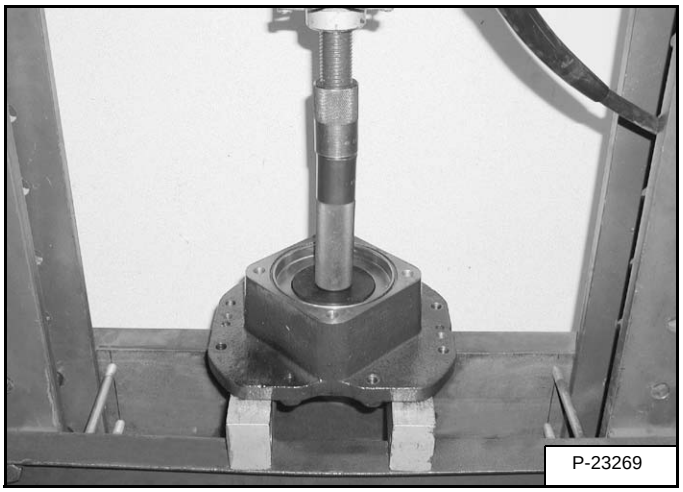
Clean all parts in solvent and dry with compressed air.

After cleaning, inspect the following components for damage and wear:

Bearings and Bearing Cups
Drive Shaft
Housing
Washer
Spacer
Snap Rings

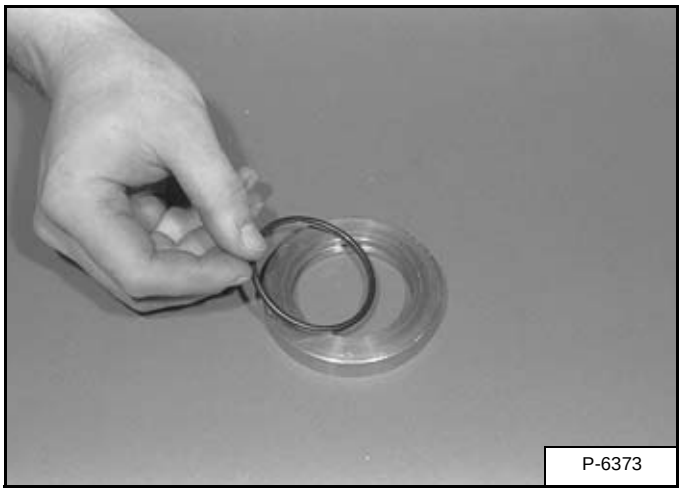
Assembly

Figure 20-91-9



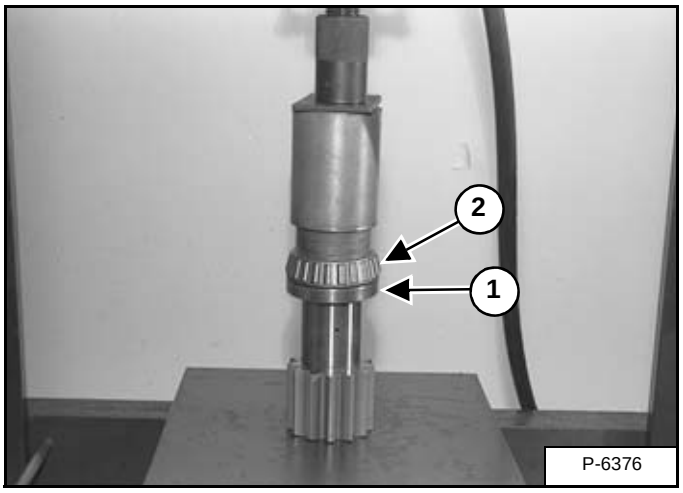
Apply a light film of grease to the outside of the new bearing cups, and press the top and bottom cups into the carrier **[Figure 20-91-9]**.

Figure 20-91-10



Oil and install a new O-ring inside the spacer **[Figure 20-91-10]**.

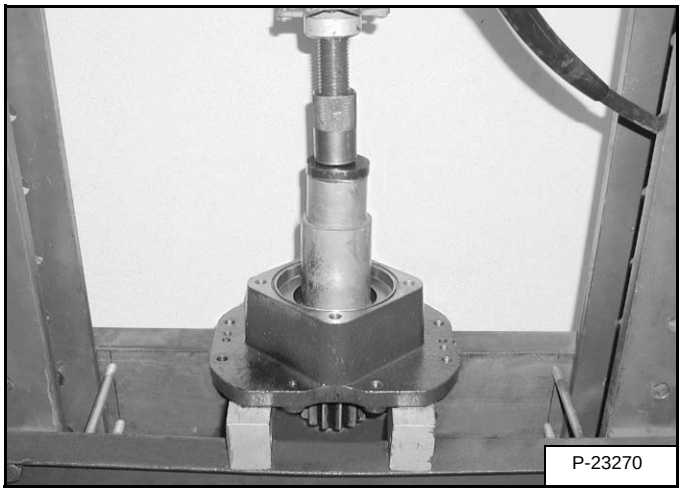
Figure 20-91-11



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.

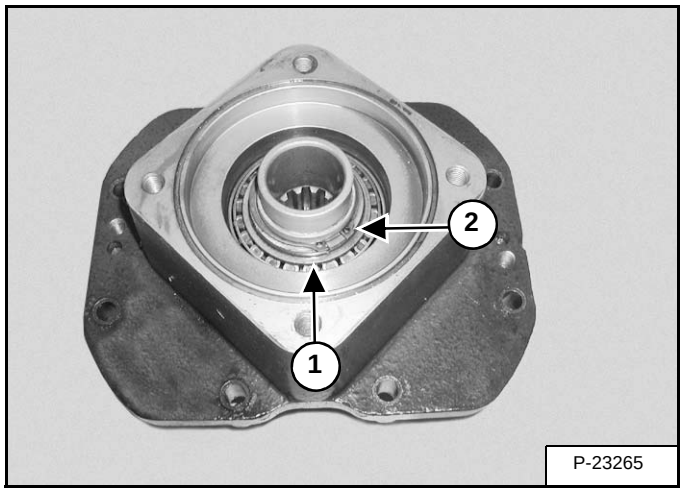
Figure 20-91-12



Press a new bearing on the top of the drive shaft **[Figure 20-91-12]**.

Assembly (Cont'd)

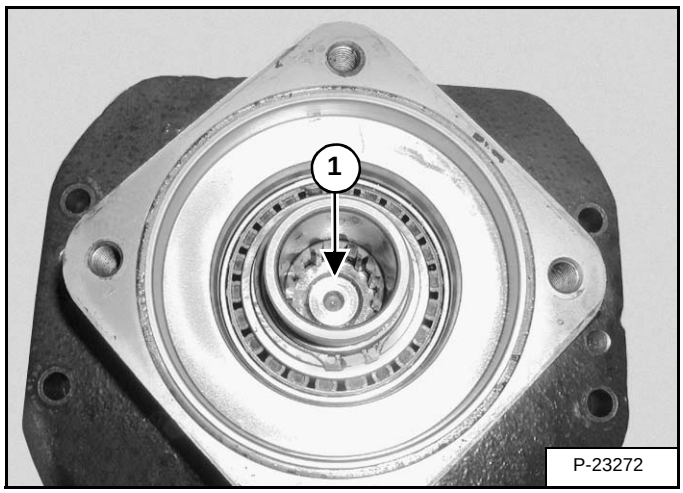
Figure 20-91-13



Install the washer (Item 1) and the snap ring (Item 2) **[Figure 20-91-13]** on the drive shaft.

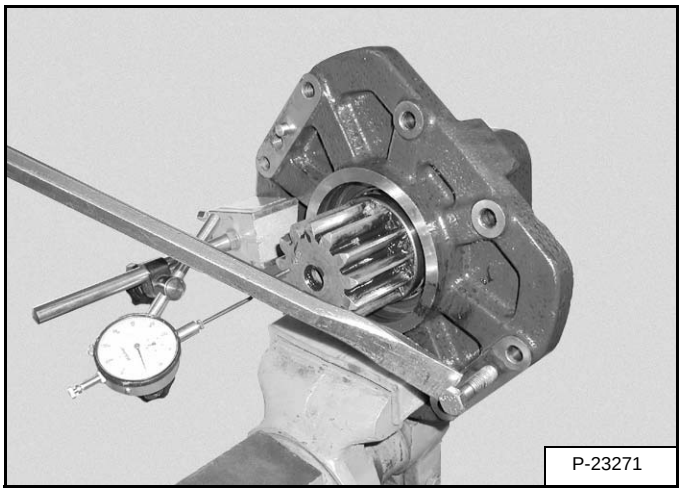
Oil and install a new O-ring on the drain plug.

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



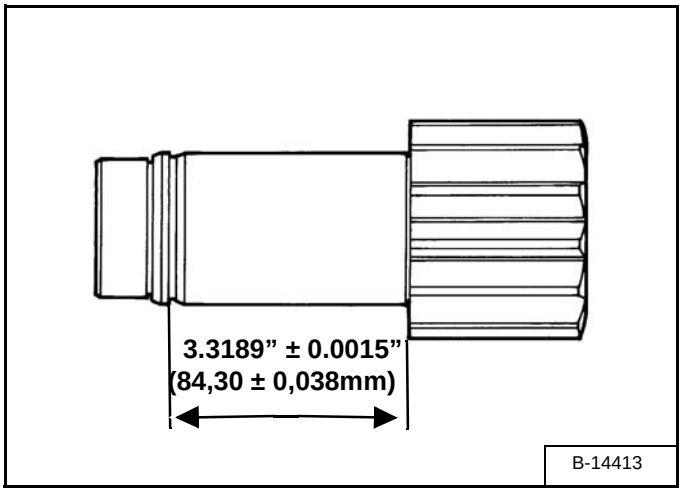
Clamp the carrier in a vise that has padded jaws. Thread a bolt in the threaded hole in the carrier flange. Setup a dial indicator so the end play of the drive shaft can be checked, by placing a pry bar under the head of the installed bolt and across the end of the drive shaft **[Figure 20-91-15]**.

End play should not be more than 0.009 in. (.229 mm) and the shaft should rotate smoothly.

If the end play is greater than 0.009 in. (.229 mm) the carrier assembly has to be disassembled and the following components checked;

Snap Ring	0.078 ± 0.002 in. (1.98 ± 0.05 mm)
Washer	0.78 ± 0.001 in. (4.52 ± 0.03 mm)
Spacer	0.042 ± 0.002 in. (12.0 ± 0.05 mm)

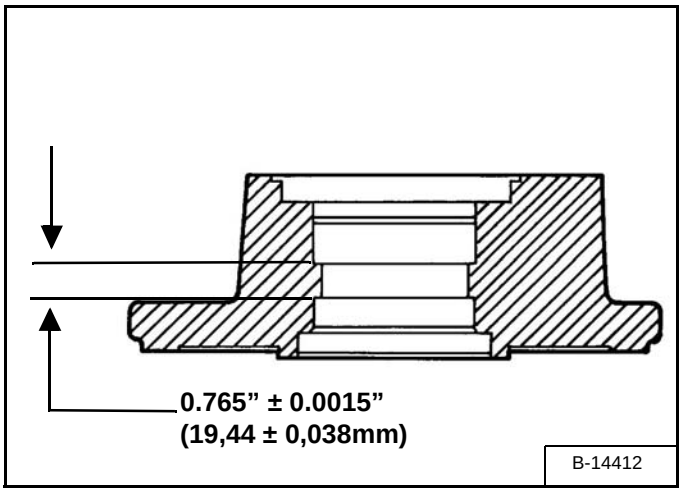
Figure 20-91-16



Length of drive shaft from top of snap ring groove to top of splined section 3.3189 in. ± 0.0015 in. (84.3 ± 0.038 mm) **[Figure 20-91-16]**.

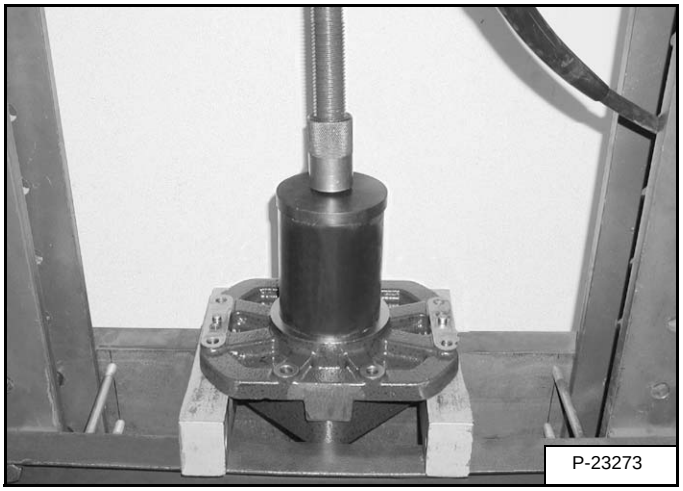
Assembly (Cont'd)

Figure 20-91-17



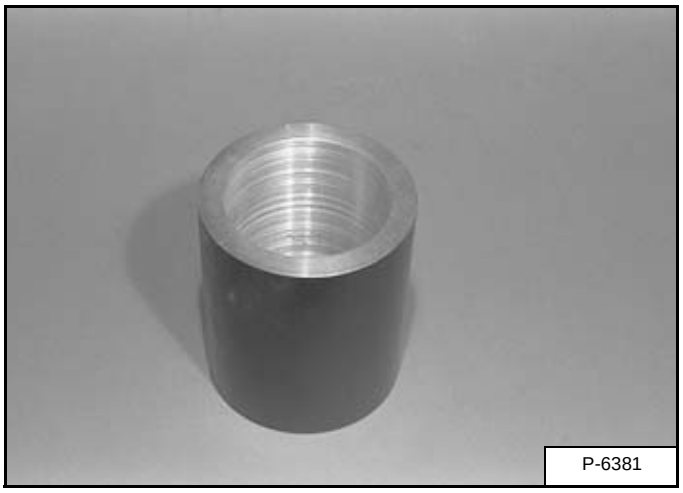
Housing top bearing cup seat to bottom bearing cup seat 0.765 in. ± 0.0015 in. (19,44 ± 0,038 mm) **[Figure 20-91-16]**.

Figure 20-91-18



Install the seal in the bottom of the carrier **[Figure 20-91-18]**.

Figure 20-91-19

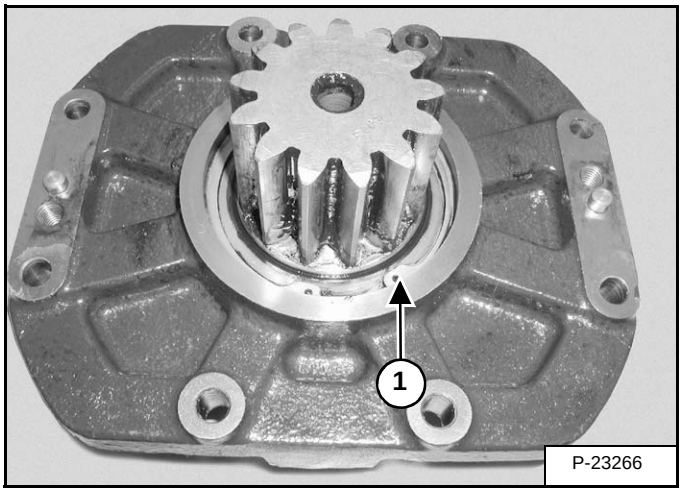


A seal installation tool can be made locally **[Figure 20-91-19]**.

Dimensions of the seal installation tool:

I.D.	3.250 in. (82,55 mm)
O.D.	4.0 in. (101,6 mm)
Height	5.0 in. (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.


Bobcat®

CONTROL PATTERN SELECTOR VALVE

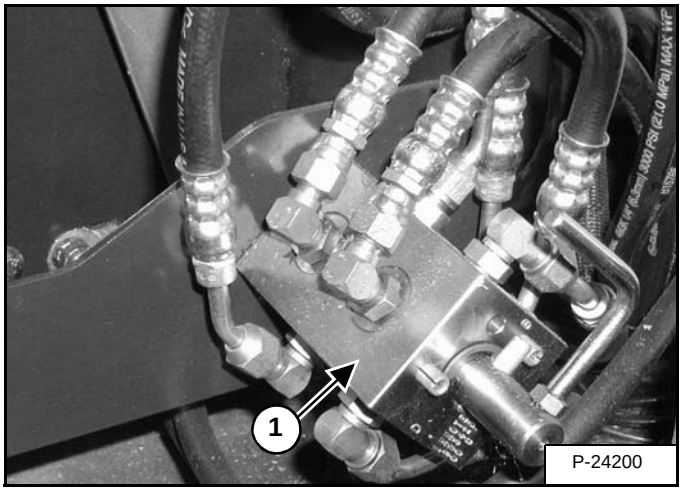
Removal And Installation

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.

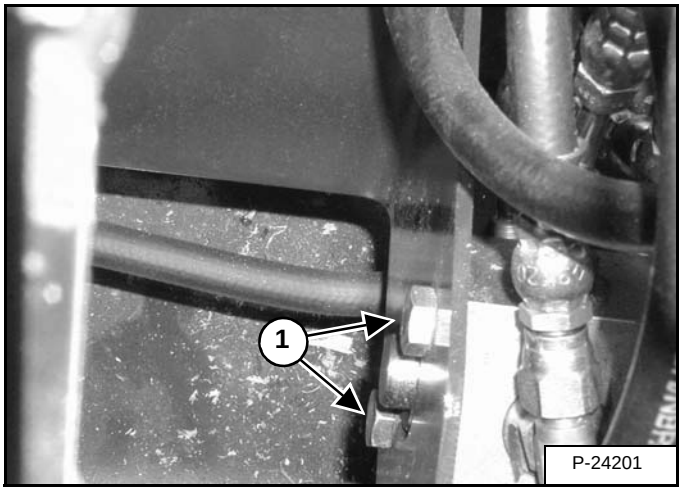
Figure 20-100-1



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

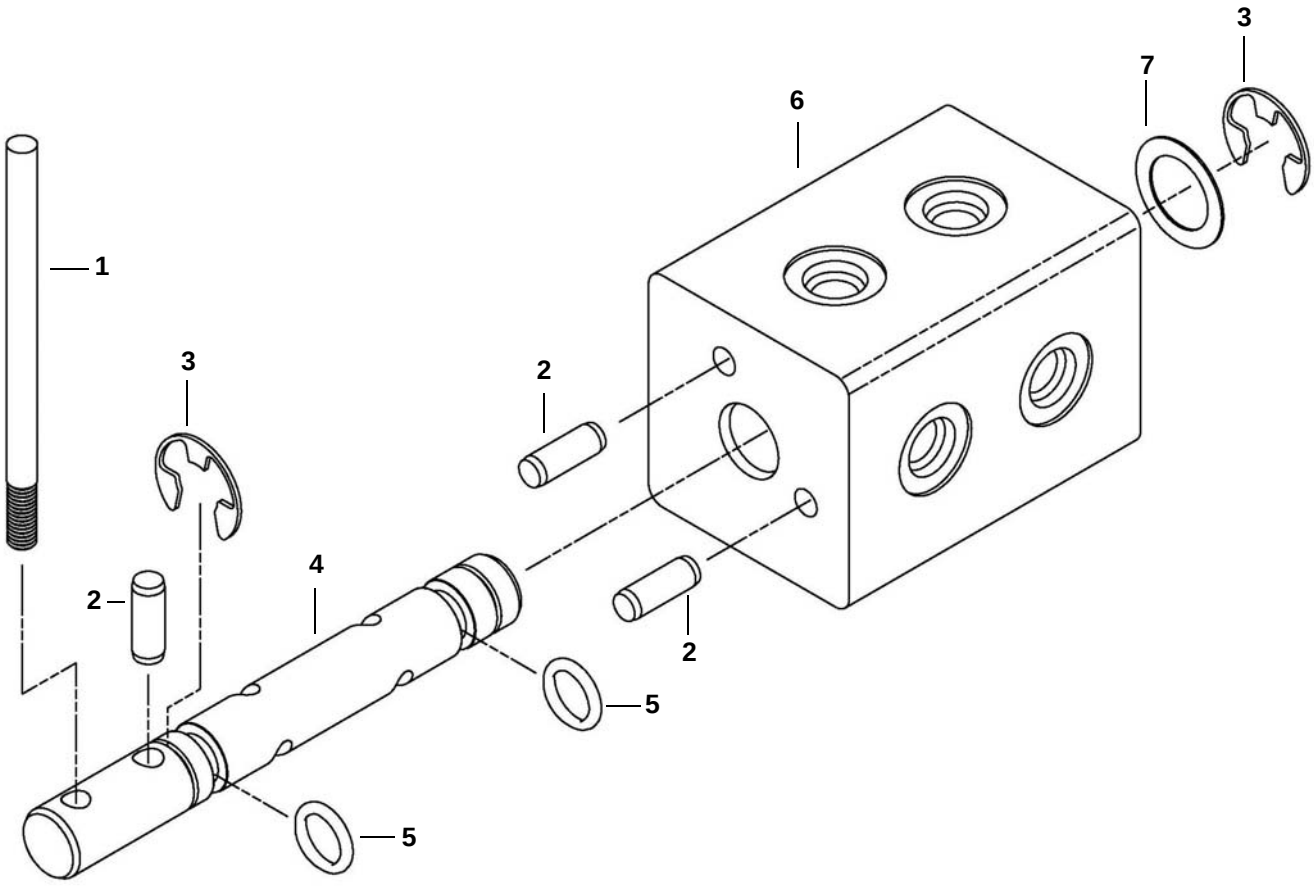


Remove the bolts (Item 1) **[Figure 20-100-2]**.

Remove the valve from the excavator.

Parts Identification

1. Handle
2. Roll Pin
3. Snap Ring
4. Spool
5. O-Ring
6. Valve Block
7. Washer



TS-1353

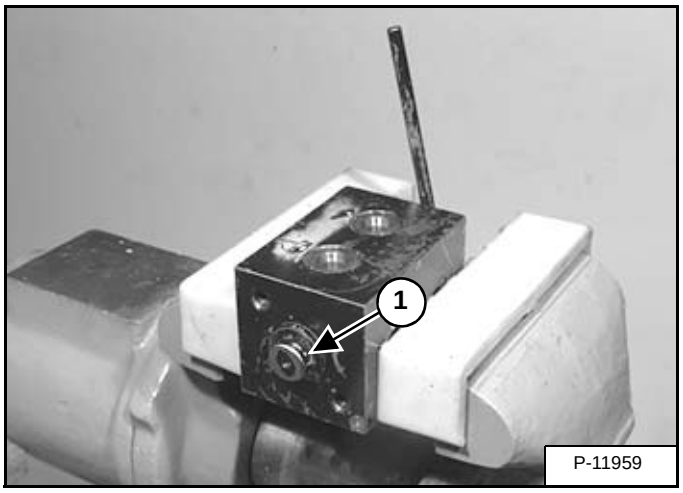
CONTROL PATTERN SELECTOR VALVE (CONT'D)

Disassembly

Clean the outside of the selector valve before disassembly.

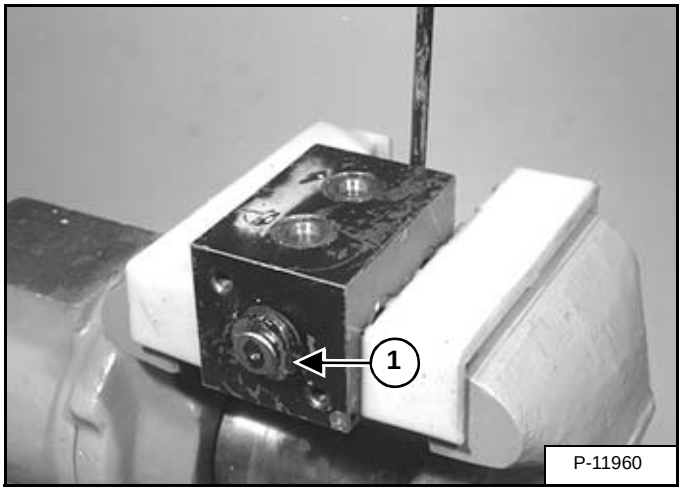
Clamp the valve in a vise equipped with padded jaws.

Figure 20-100-3



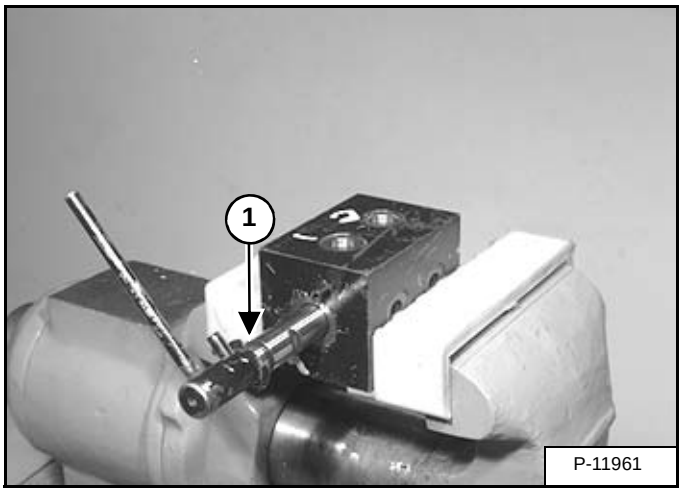
Remove the snap ring (Item 1) **[Figure 20-100-3]**.

Figure 20-100-4



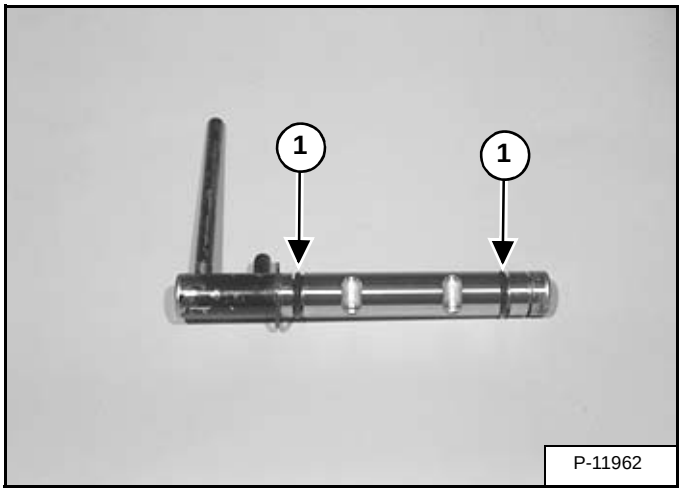
Remove the washer (Item 1) **[Figure 20-100-4]**.

Figure 20-100-5



Pull the spool (Item 1) **[Figure 20-100-5]** out of the valve.

Figure 20-100-6



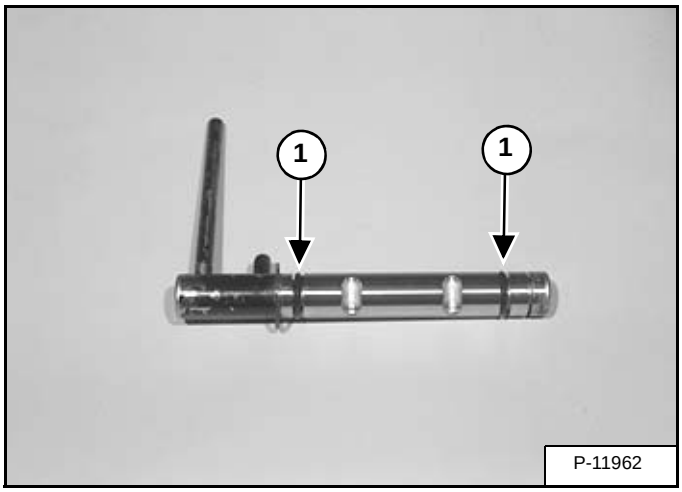
Remove the O-rings (Item 1) **[Figure 20-100-6]** from the spool.

Assembly

Clean all parts in solvent and dry with compressed air. Inspect all parts for wear or damage. Replace any worn or damaged parts.

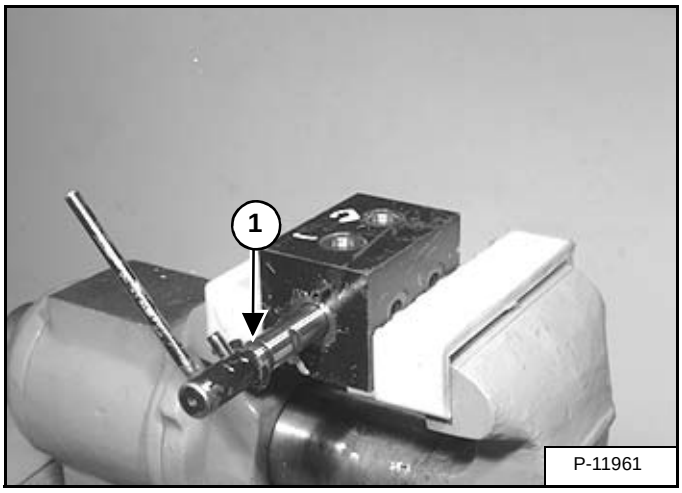
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-100-7



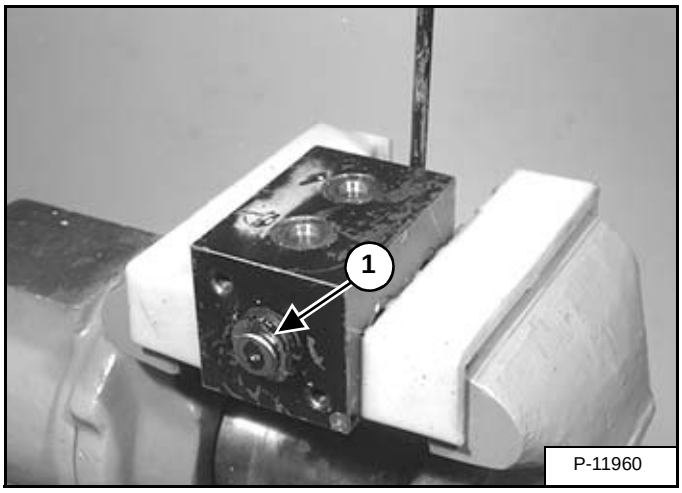
Install the O-rings (Item 1) **[Figure 20-100-7]** on the spool.

Figure 20-100-8



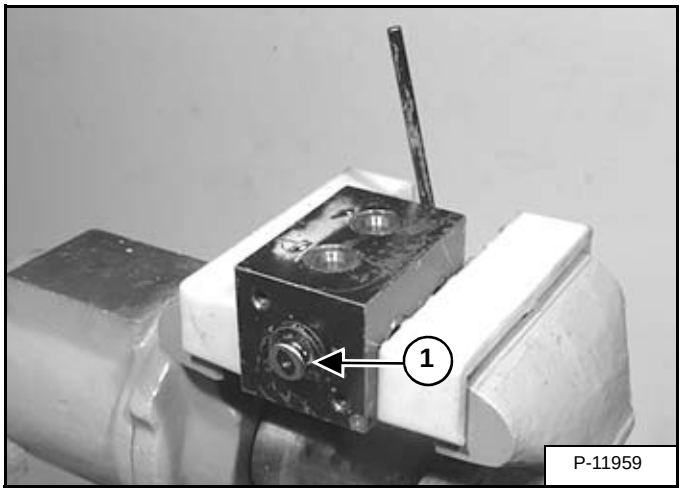
Apply oil to and install the spool (Item 1) **[Figure 20-100-8]** in the valve body.

Figure 20-100-9



Install the 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.

RIGHT CONTROL LEVER (JOYSTICK)

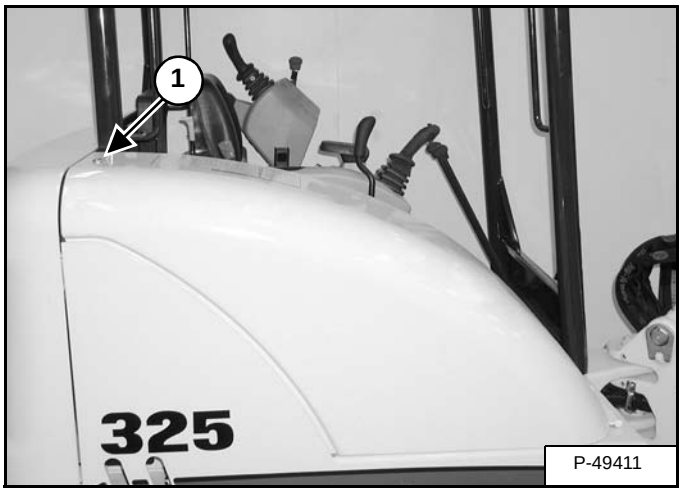
Testing

The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

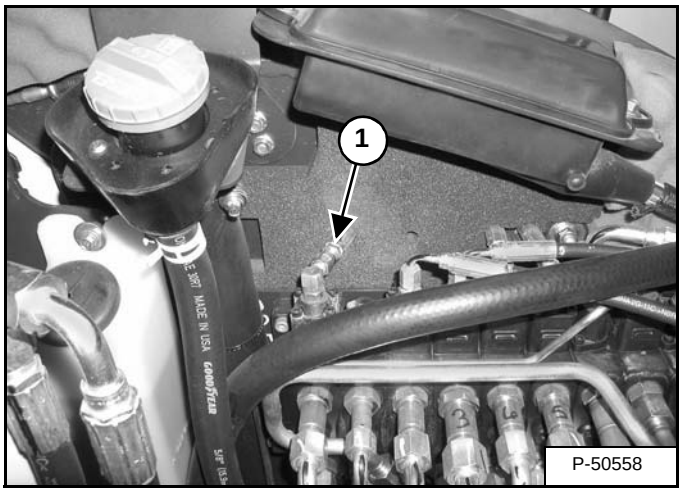
Stop the engine.

Figure 20-110-1



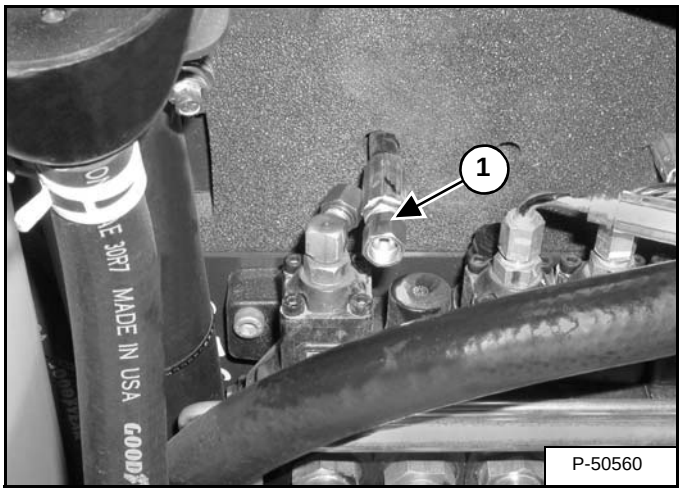
Open the right side access cover (Item 1) **[Figure 20-110-1]**.

Figure 20-110-2



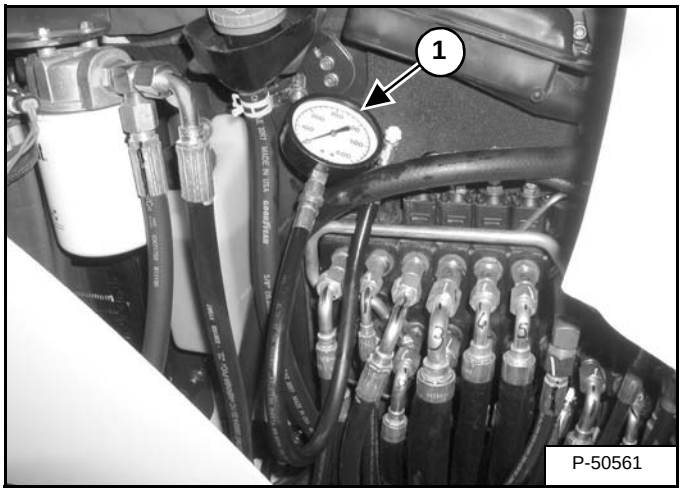
At the control valve assembly find the pilot line (Item 1) **[Figure 20-110-2]** of the control lever (joystick) that is to be checked (Boom, Arm, Boom Swing, Bucket.)

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 of 150° F (66° C).

Engage the circuit to be tested. Record the operating pressure.

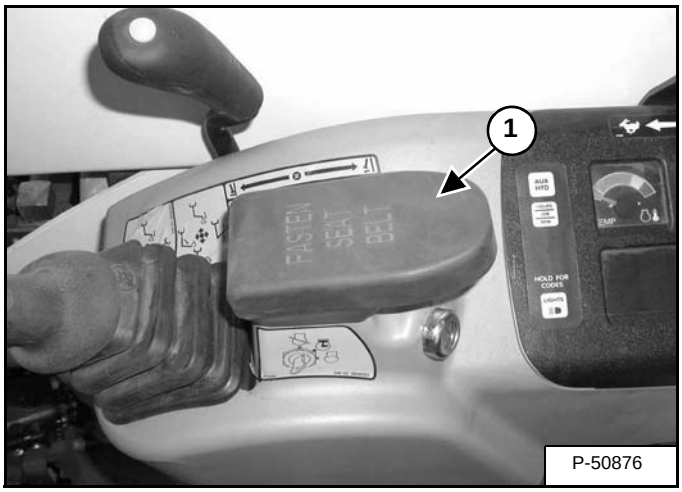
The operating pressure should be approximately 428 SPI (29.5 Bar) with an acceptable range of 406 - 450 PSI (28 - 31 Bar).

If the operating pressure is correct, check the valve section spool for proper operation. If the operating pressure is incorrect, remove the pressure reducing valve, clean, install and retest. (See Testing And Adjusting The Pressure Reducing Valve on Page 20-33-1.) If the pressure is still incorrect replace the pressure reducing valve.

RIGHT CONTROL LEVER (JOYSTICK) (CONT'D)

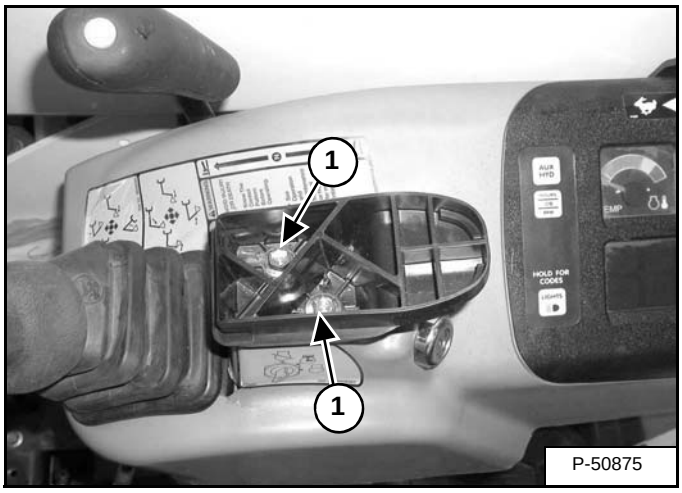
Handle Removal And Installation

Figure 20-110-5



Remove the cover (Item 1) **[Figure 20-110-5]** from the arm rest.

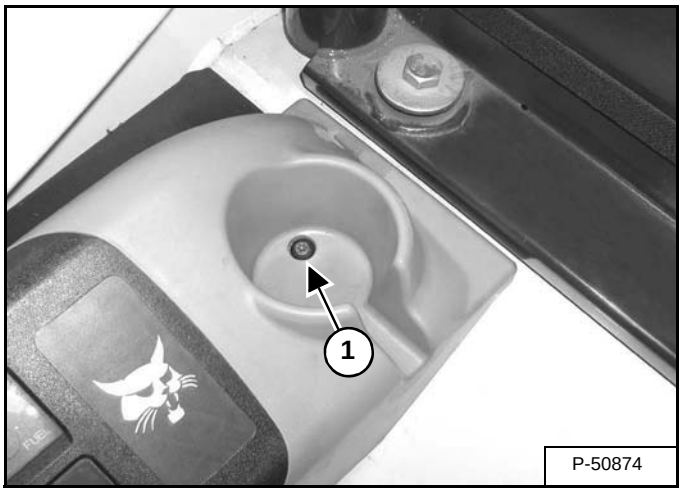
Figure 20-110-6



Remove the two bolts (Item 1) **[Figure 20-110-6]** from the arm rest.

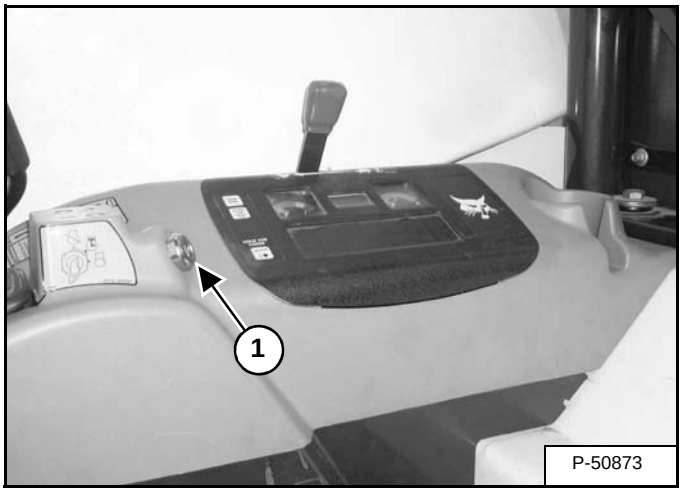
Remove the arm rest.

Figure 20-110-7



Remove the screw (Item 1) **[Figure 20-110-7]** from the cup holder.

Figure 20-110-8

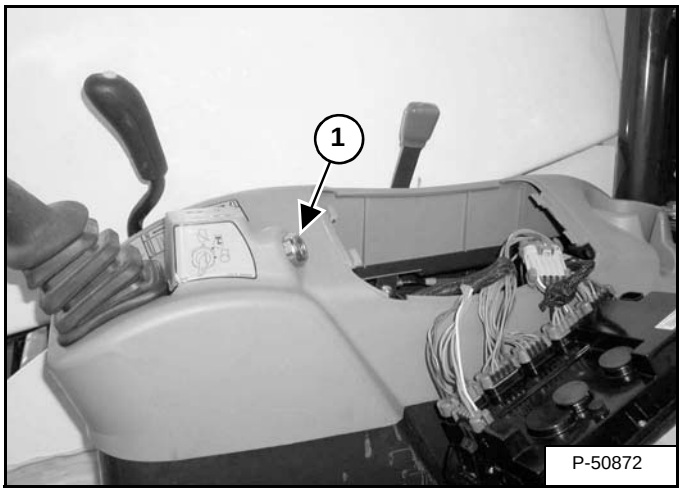


Remove the nut (Item 1) **[Figure 20-110-8]** from the key switch. Allow the keyswitch to drop inside the console.

Lift the console cover up and over the joystick.

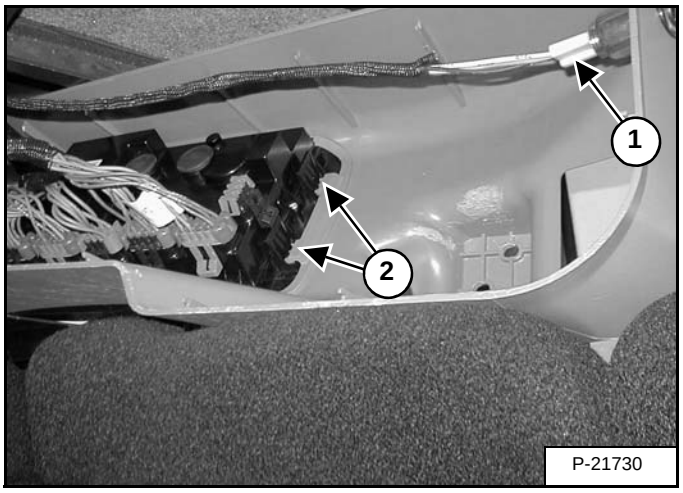
Handle Removal And Installation (Cont'd)

Figure 20-110-9



Installation: Install the keyswitch and nut (Item 1) **[Figure 20-110-9]** before installing the controller.

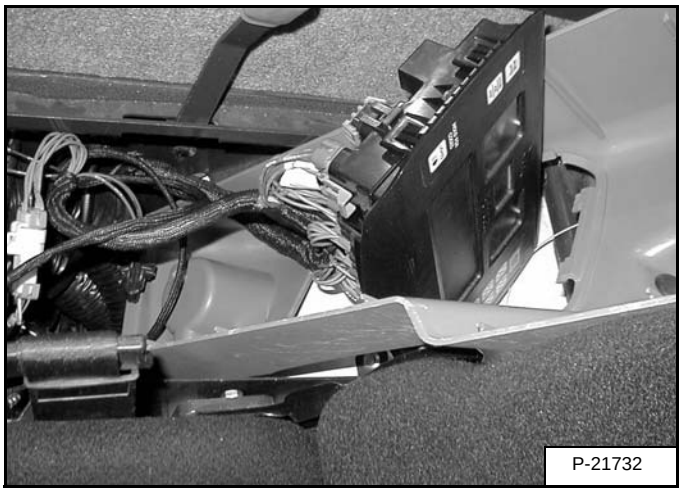
Figure 20-110-10



Disconnect the accessory outlet electrical connector (Item 1) **[Figure 20-110-10]**.

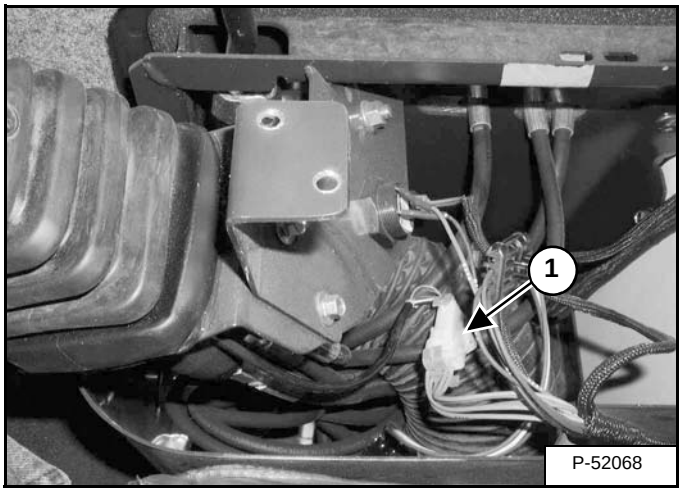
Depress the four tabs (Item 2) **[Figure 20-110-10]** and remove the controller.

Figure 20-110-11



Turn the controller to allow it to pass through the console cover **[Figure 20-110-11]**.

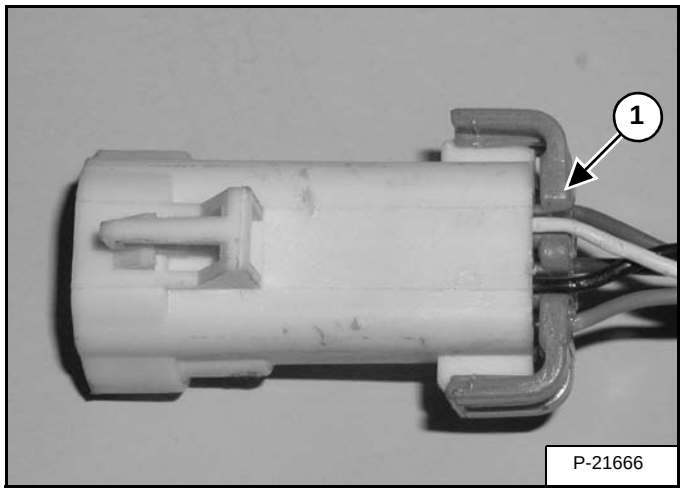
Figure 20-110-12



Disconnect the wire harness (Item 1) **[Figure 20-110-12]**.

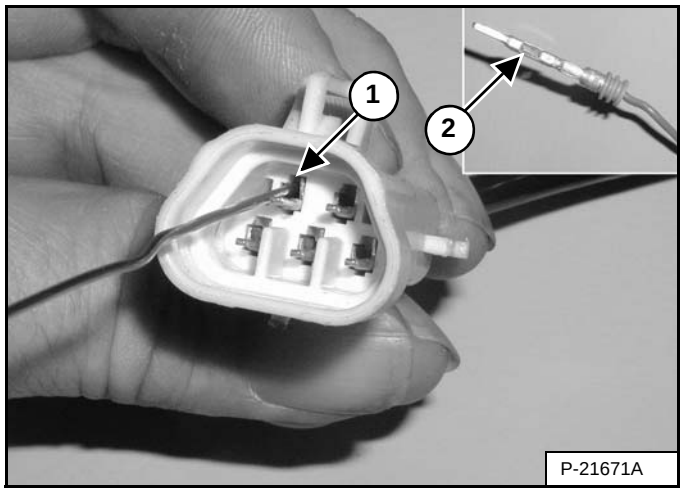
Handle Removal And Installation (Cont'd)

Figure 20-110-13



Remove the lock (Item 1) **[Figure 20-110-13]** from the joystick electrical connector.

Figure 20-110-14

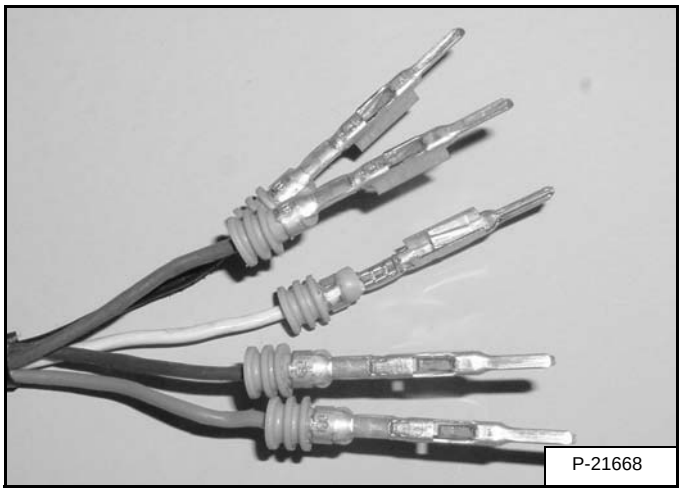


With a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 20-110-14]**.

Carefully remove the individual wires from the back of the electrical connector.

Installation: Use a small piece of wire and re-bend the tab (Item 2) **[Figure 20-110-14]** on each wire before installing in the electrical connector.

Figure 20-110-15

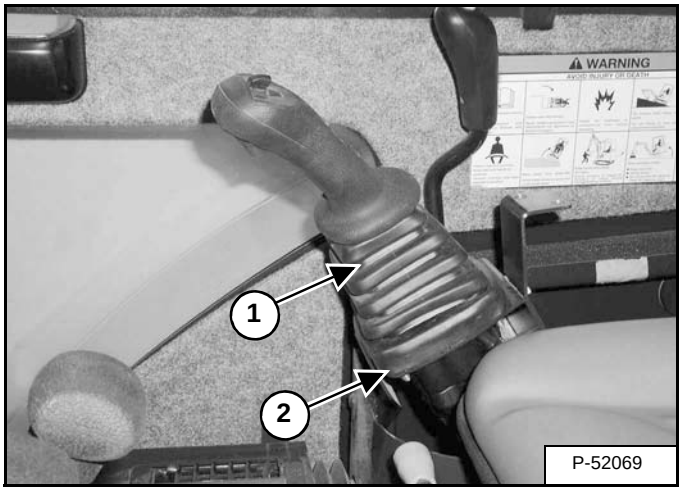


Installation: The wires **[Figure 20-110-15]** must be installed in the proper locations in the wire connector, listed below.

A	**Green**
B	**Brown**
C	**Pink**
D	**Black**
E	**White**

Check each wire to be certain the tab locks into position.

Figure 20-110-16

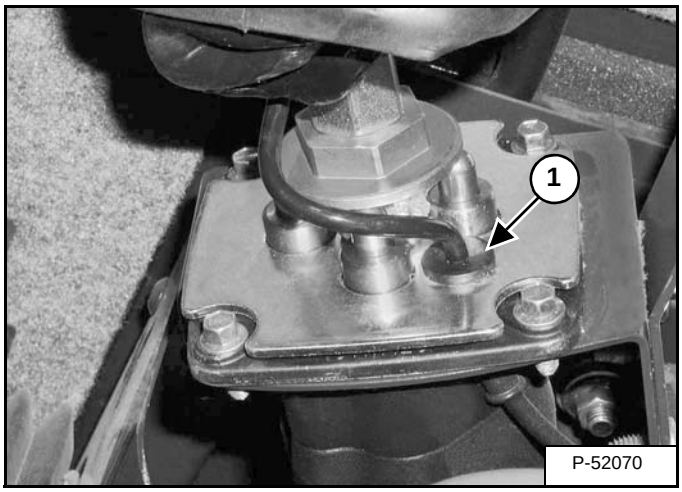


Pull the boot (Item 1) **[Figure 20-110-16]** up.

Installation: The top of the boot is molded to fit over the flange of the joystick. It has tabs that fit between the handle and joystick flange (Item 2) **[Figure 20-110-16]**. Install the boot properly before installing the console cover.

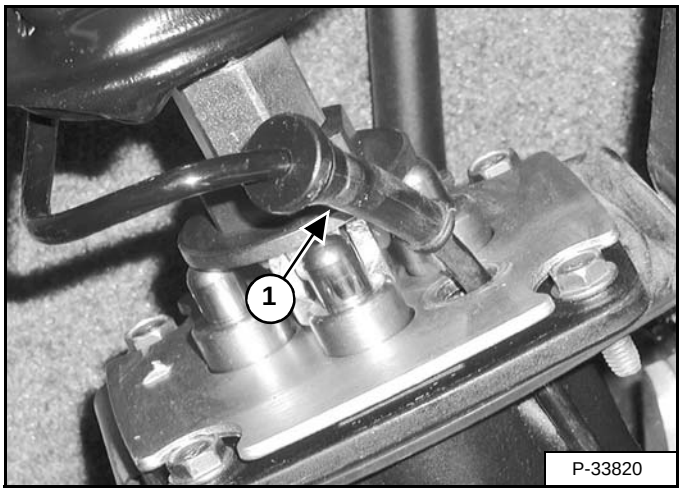
Handle Removal And Installation (Cont'd)

Figure 20-110-17



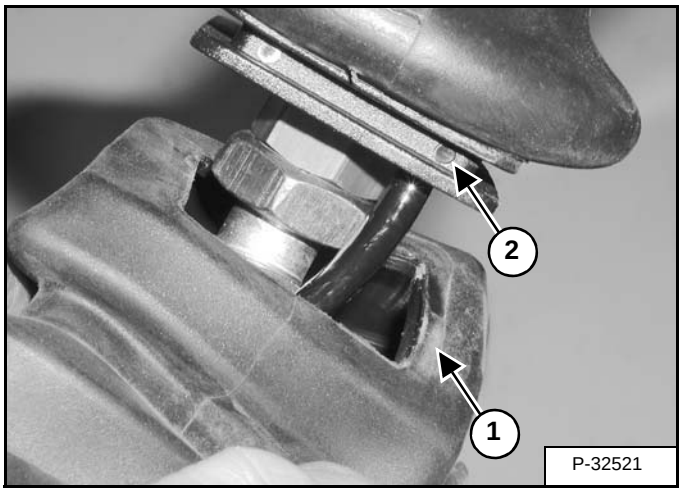
Lift the grommet (Item 1) **[Figure 20-110-17]** from the mount plate.

Figure 20-110-18



Remove the wire and grommet (Item 1) **[Figure 20-110-18]**.

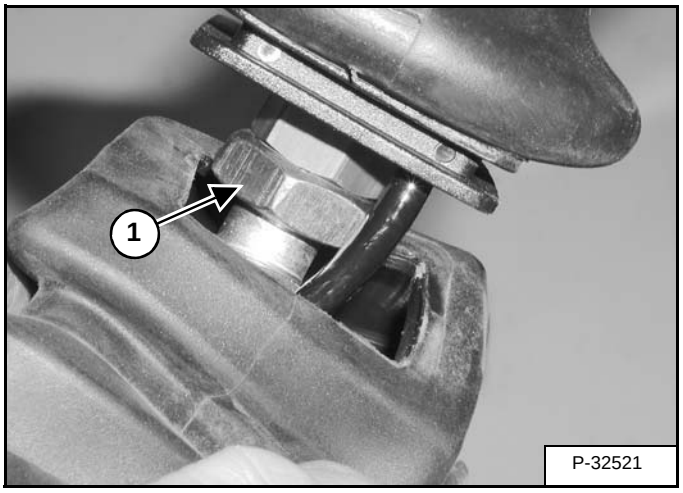
Figure 20-110-19



Pull the boot (Item 1) **[Figure 20-110-19]** down.

Installation: The top of the boot is molded to fit over the flange of the joystick. It has tabs that fit between the handle and joystick flange (Item 2) **[Figure 20-110-19]**. Install the boot properly before installing the console cover.

Figure 20-110-20

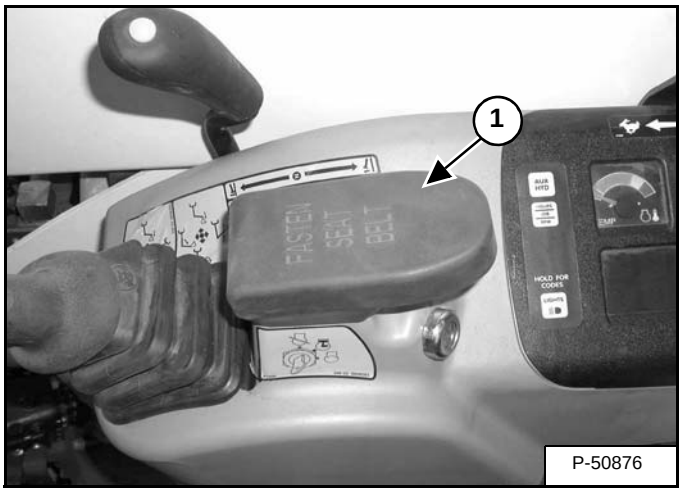


Loosen the nut (Item 1) **[Figure 20-110-20]**.

Remove the handle.

Joystick Assembly, Removal And Installation

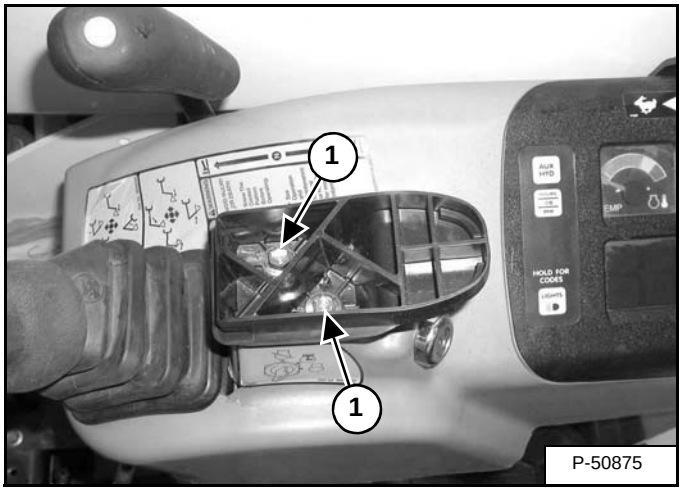
Figure 20-110-21



Remove the cover (Item 1) **[Figure 20-110-21]** from the arm rest.

Lift up on the rear of the cover and slide the cover ahead to remove it.

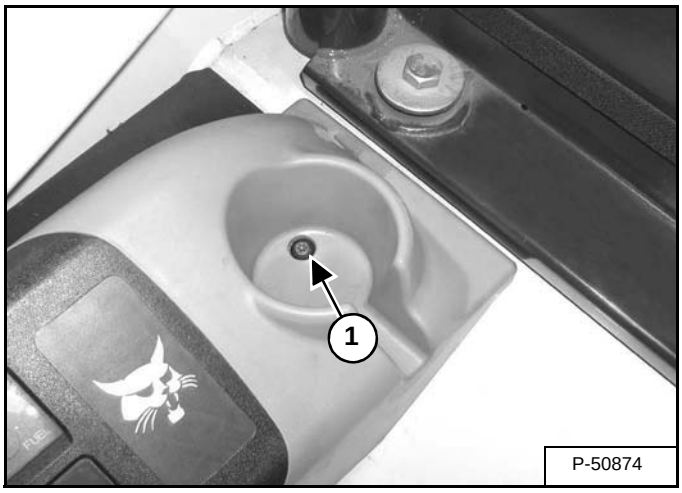
Figure 20-110-22



Remove the bolts (Item 1) **[Figure 20-110-22]** from the arm rest.

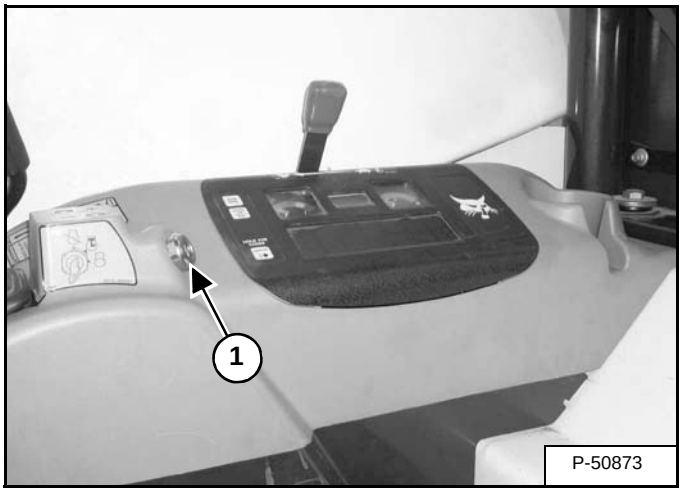
Remove the arm rest.

Figure 20-110-23



Remove the screw (Item 1) **[Figure 20-110-23]** from the cup holder.

Figure 20-110-24

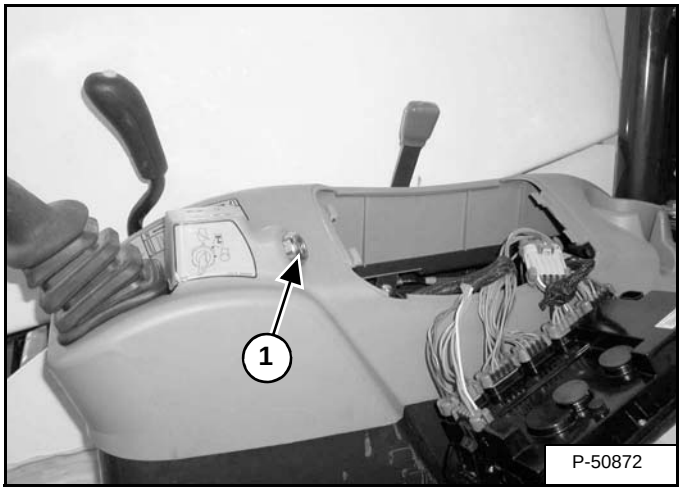


Remove the nut from the key switch (Item 1) **[Figure 20-110-24]** (if equipped). Allow the switch to drop inside the console.

Lift the console up and over the joystick.

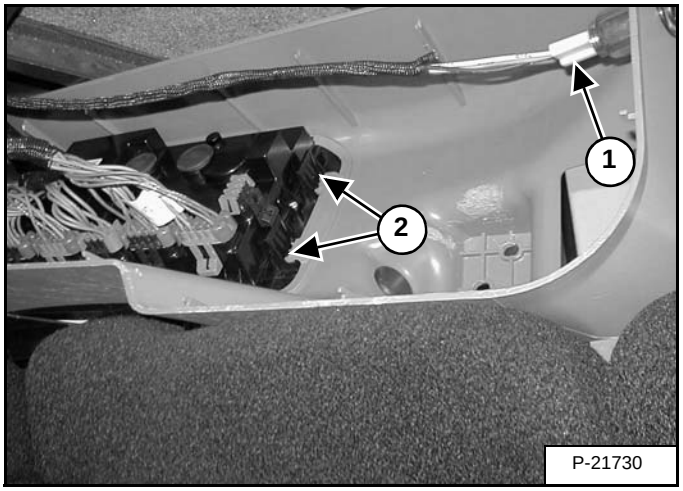
Joystick Assembly, Removal And Installation (Cont'd)

Figure 20-110-25



Installation: Install the keyswitch and nut (Item 1) **[Figure 20-110-25]** before installing the controller.

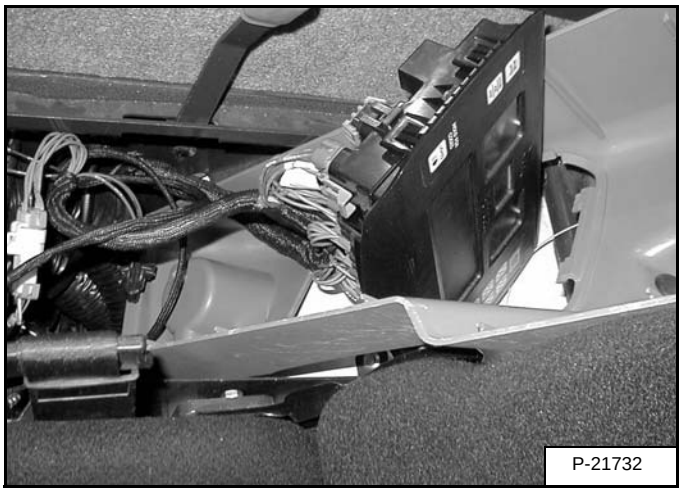
Figure 20-110-26



Disconnect the accessory outlet electrical connector (Item 1) **[Figure 20-110-26]**.

Remove the controller from the console cover by pressing the mounting tabs (Item 2) **[Figure 20-110-26]**.

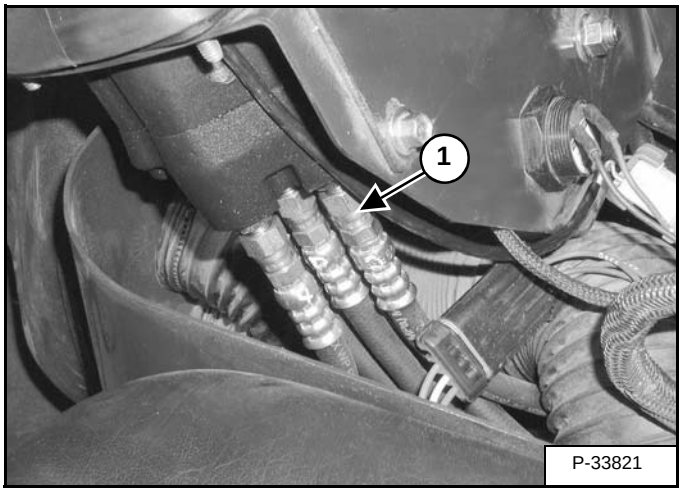
Figure 20-110-27



Turn the controller to allow it to pass through the console cover **[Figure 20-110-27]**.

Remove the console cover.

Figure 20-110-28



Mark the hoses for proper installation. Remove the six hoses (Item 1) **[Figure 20-110-28]** from the housing.

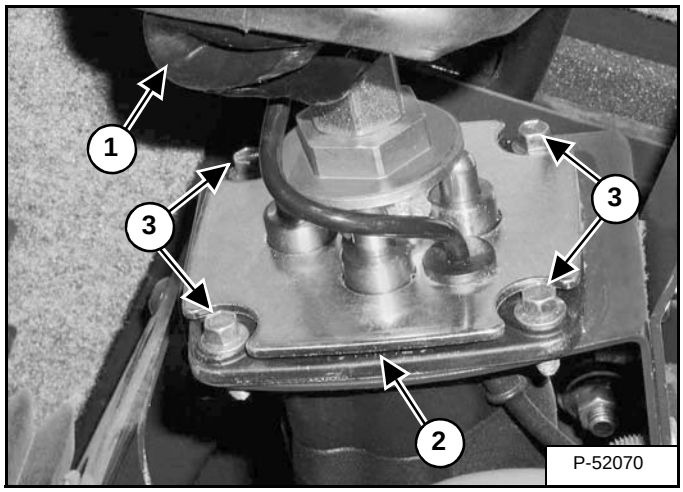
IMPORTANT

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

I-2003-0888

Joystick Assembly, Removal And Installation (Cont'd)

Figure 20-110-29

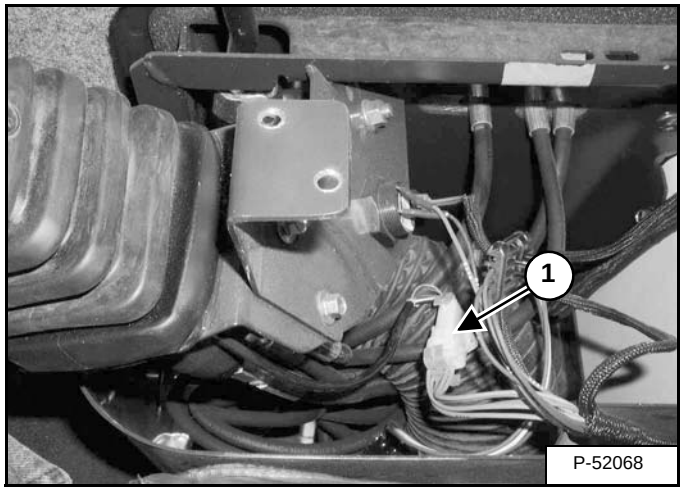


Pull the boot (Item 1) **[Figure 20-110-29]** up.

Installation: The bottom of the boot is molded to fit over the flange of the joystick. It has tabs that fit between the joystick flange (Item 2) **[Figure 20-110-29]** and the mounting plate. Position the boot properly before installing the console cover.

Remove the bolts (Item 3) **[Figure 20-110-29]** from the housing.

Figure 20-110-30

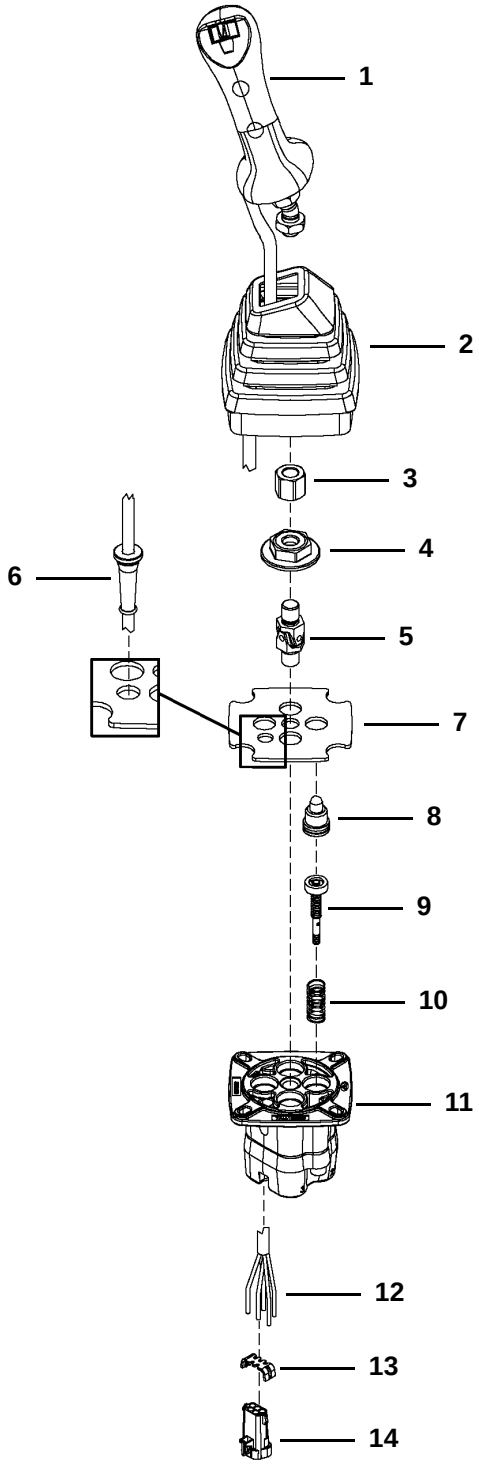


Disconnect wire harness (Item 1) **[Figure 20-110-30]**.

Remove the joystick assembly.

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



MS1352

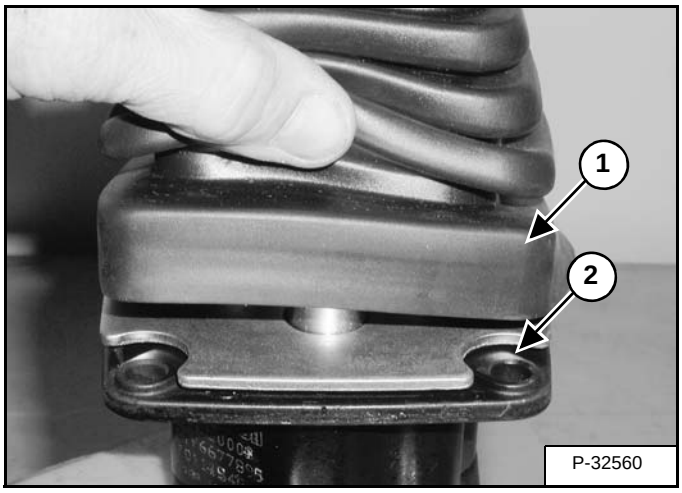
RIGHT CONTROL LEVER (JOYSTICK) (CONT'D)

Disassembly

Clean the outside of the control lever before disassembly.

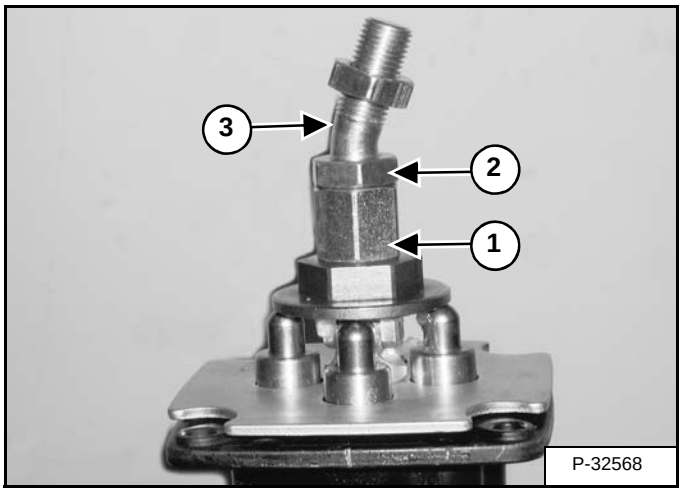
Remove the handle. (See Handle Removal And Installation on Page 20-110-2.)

Figure 20-110-31



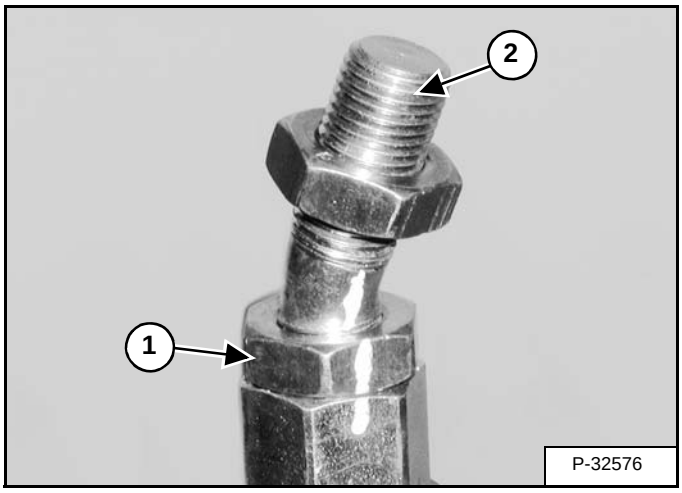
Remove the boot (Item 1) from the control lever (joystick) (Item 2) **[Figure 20-110-31]**.

Figure 20-110-32



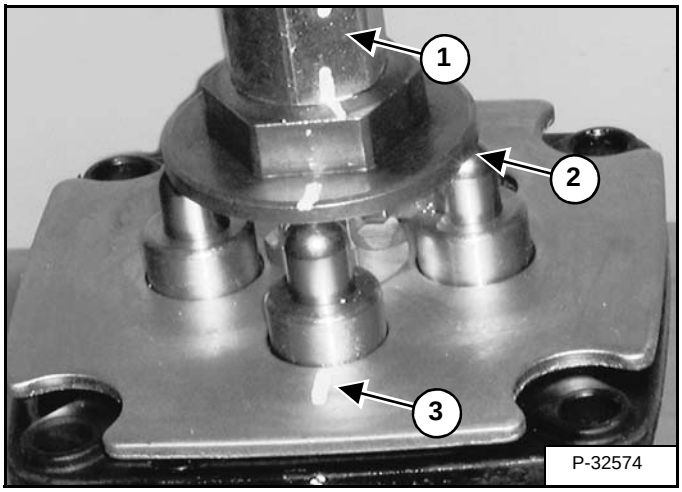
Mark the coupler (Item 1), nut (Item 2), and connector (Item 3) **[Figure 20-110-32]** for correct assembly.

Figure 20-110-33



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-110-33]**.

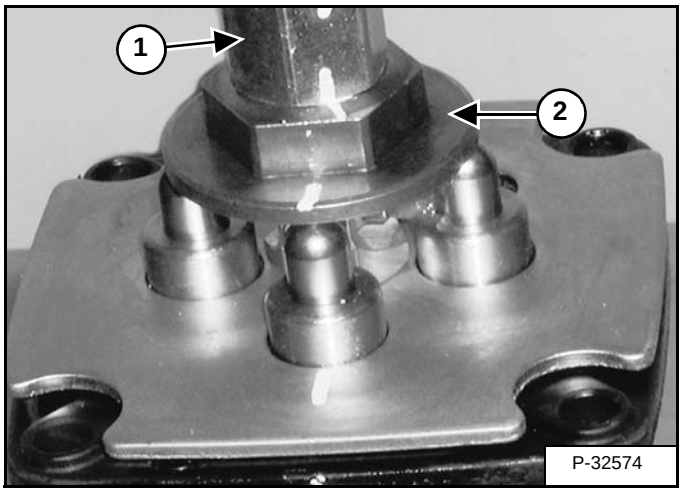
Figure 20-110-34



Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) (Item 1) **[Figure 20-110-34]** for correct installation.

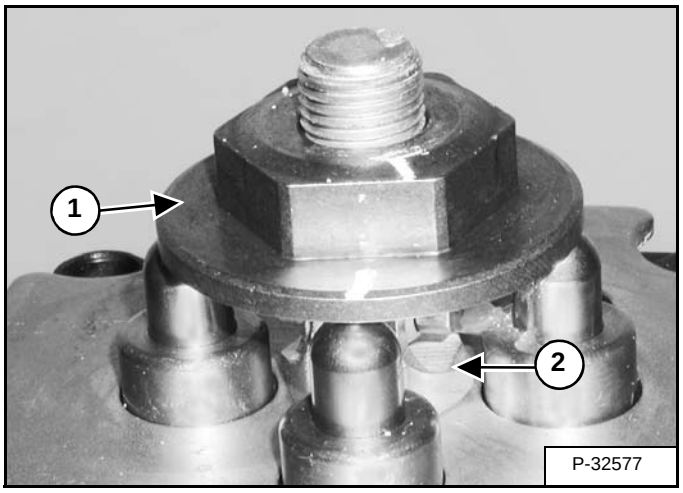
Disassembly (Cont'd)

Figure 20-110-35



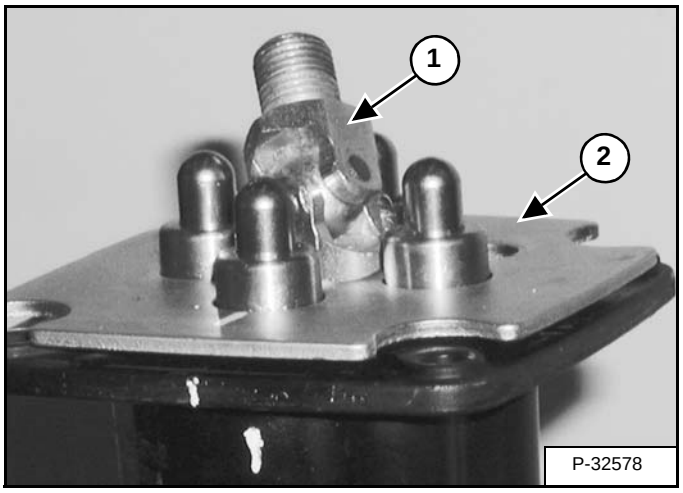
Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-110-35]**.

Figure 20-110-36



Remove the control plate (Item 1) from the U-Joint (Item 2) **[Figure 20-110-36]**.

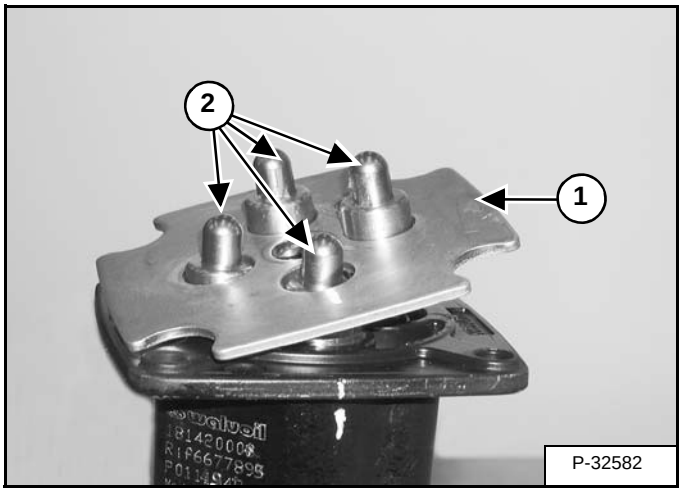
Figure 20-110-37



Mark the plate and housing for correct installation. Remove the U-Joint (Item 1) **[Figure 20-110-37]**.

NOTE: The plate (Item 2) [Figure 20-110-37] is spring loaded and will come up as the U-Joint is removed.

Figure 20-110-38



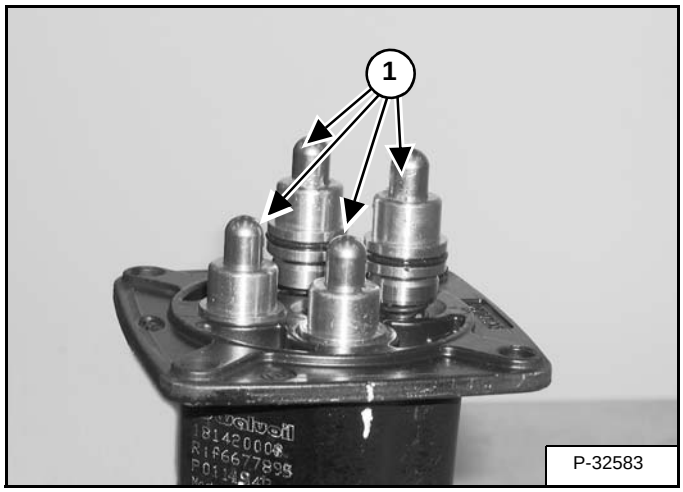
Remove the plate (Item 1) **[Figure 20-110-38]**.

NOTE: Use care while removing the plate. The plungers (Item 2) [Figure 20-110-38] are spring loaded.

RIGHT CONTROL LEVER (JOYSTICK) (CONT'D)

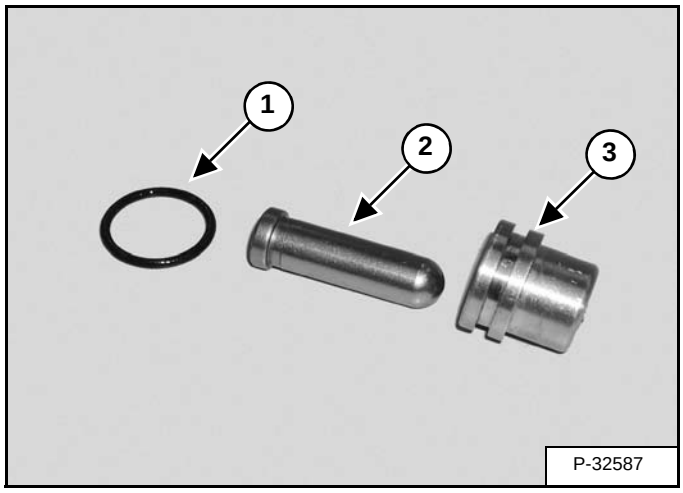
Disassembly (Cont'd)

Figure 20-110-39



Remove the plunger assemblies (Item 1) **[Figure 20-110-39]**.

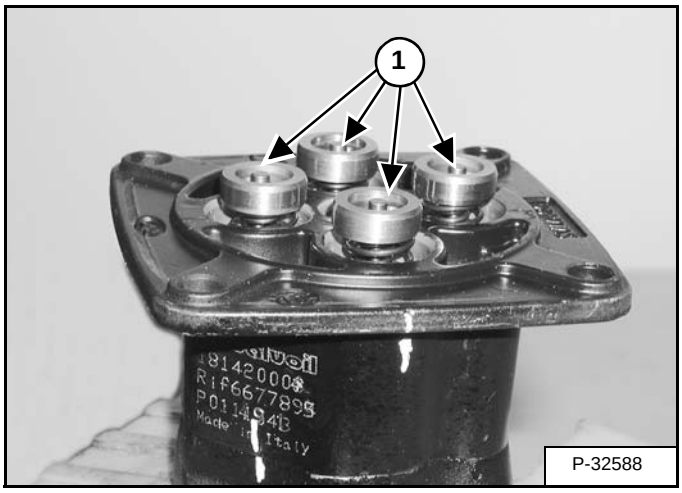
Figure 20-110-40



Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-110-40]**.

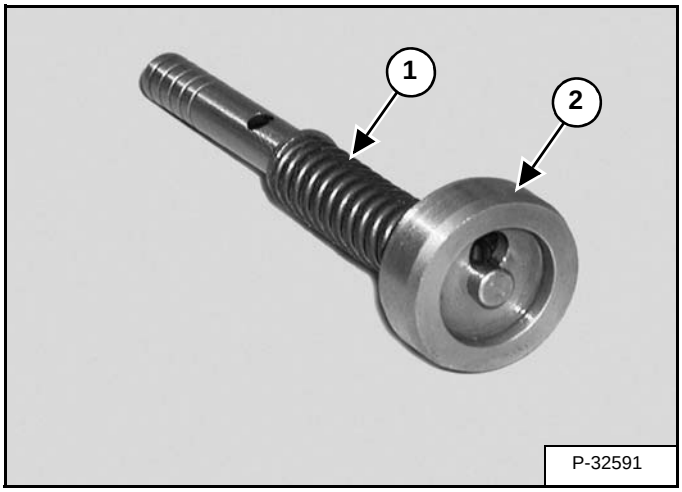
NOTE: Mark the spool assemblies for installation in their original location.

Figure 20-110-41



Remove the spool assemblies (Item 1) **[Figure 20-110-41]**.

Figure 20-110-42

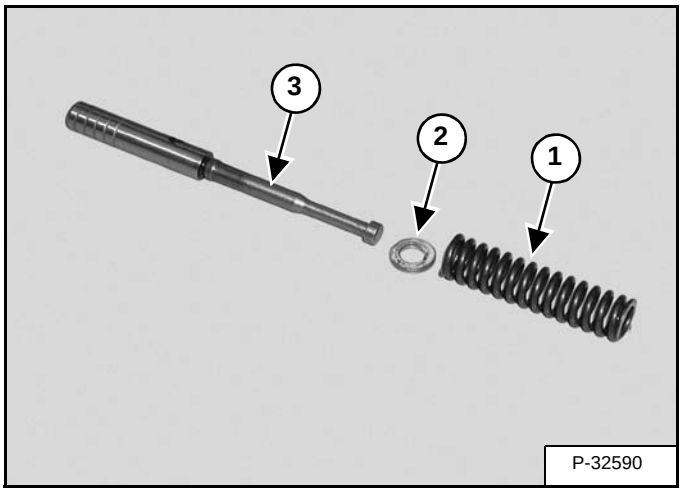


Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-110-42]**.

RIGHT CONTROL LEVER (JOYSTICK) (CONT'D)

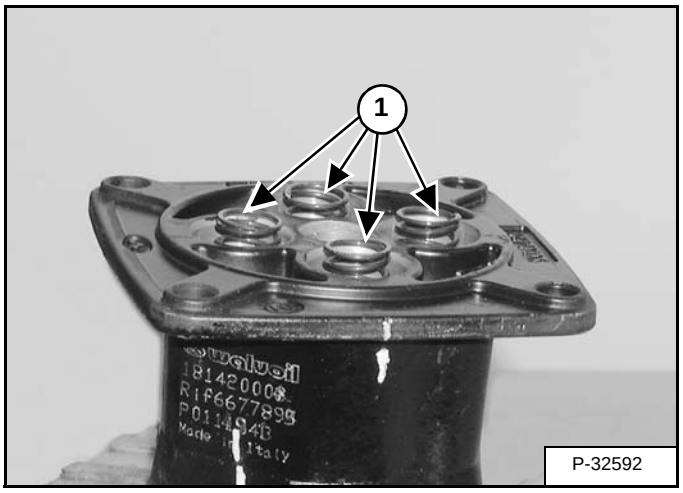
Disassembly (Cont'd)

Figure 20-110-43



Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-110-43]**.

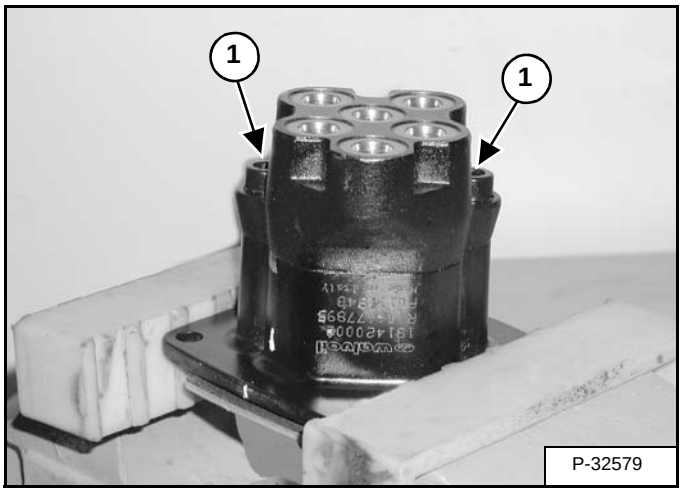
Figure 20-110-44



Remove the springs (Item 1) **[Figure 20-110-44]** from the housing.

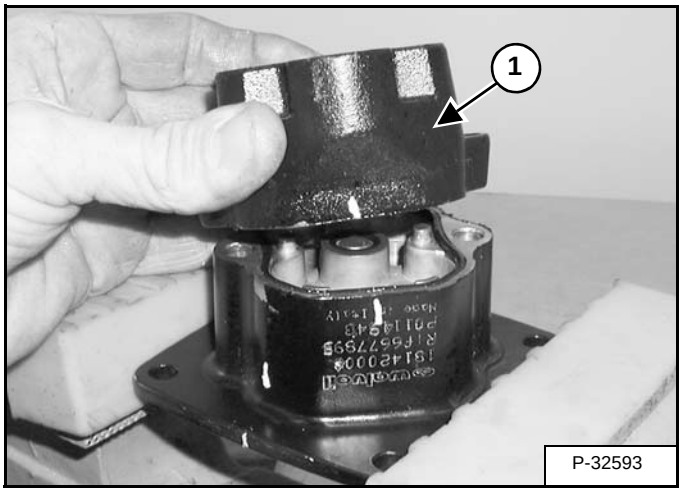
Clamp the housing in a vise. Use care not to damage the housing.

Figure 20-110-45



Remove the bolts (Item 1) **[Figure 20-110-45]**.

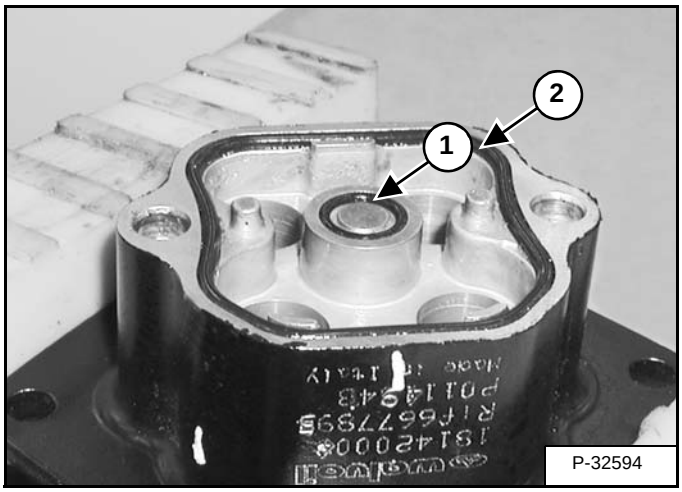
Figure 20-110-46



Remove the end cap (Item 1) **[Figure 20-110-46]**.

Disassembly (Cont'd)

Figure 20-110-47



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-110-47]**.

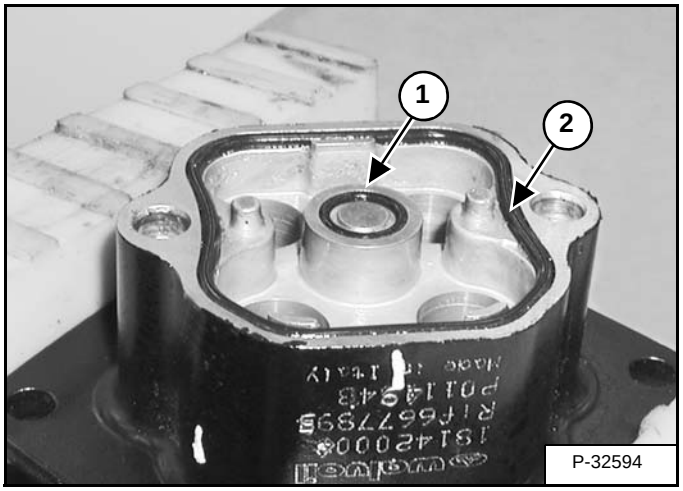
Assembly

Clean all parts in solvent and dry with compressed air.

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

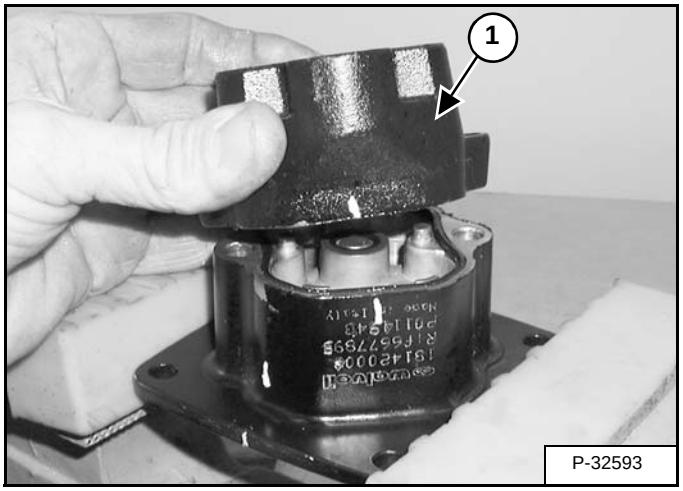
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-110-48



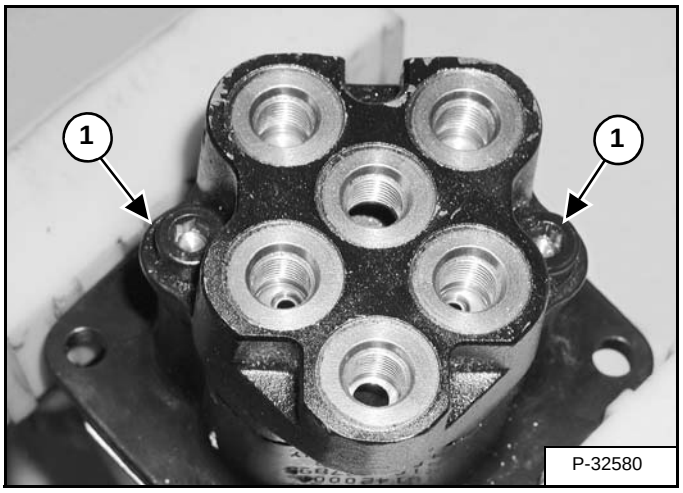
Clamp the housing in a vise equipped with padded jaws. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-110-48]**.

Figure 20-110-49



Install the end cap (Item 1) **[Figure 20-110-49]**.

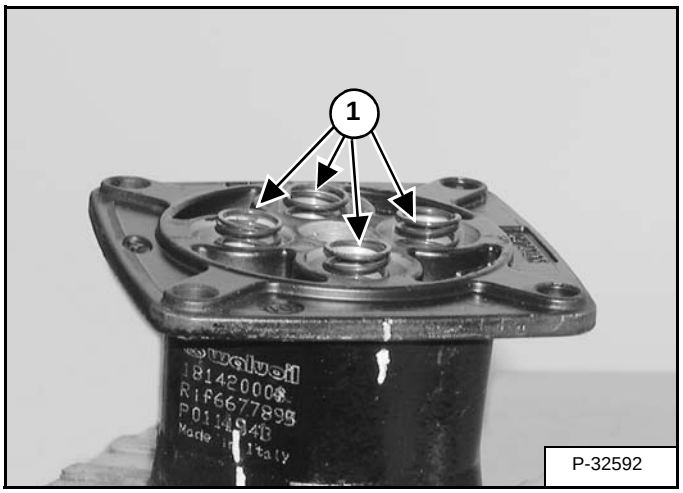
Figure 20-110-50



Install the bolts (Item 1) **[Figure 20-110-50]**.

Turn the housing over.

Figure 20-110-51

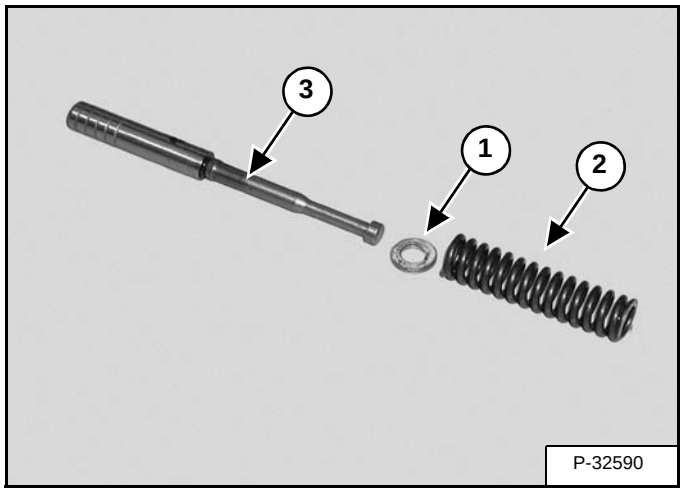


Install the springs (Item 1) **[Figure 20-110-51]**.

RIGHT CONTROL LEVER (JOYSTICK) (CONT'D)

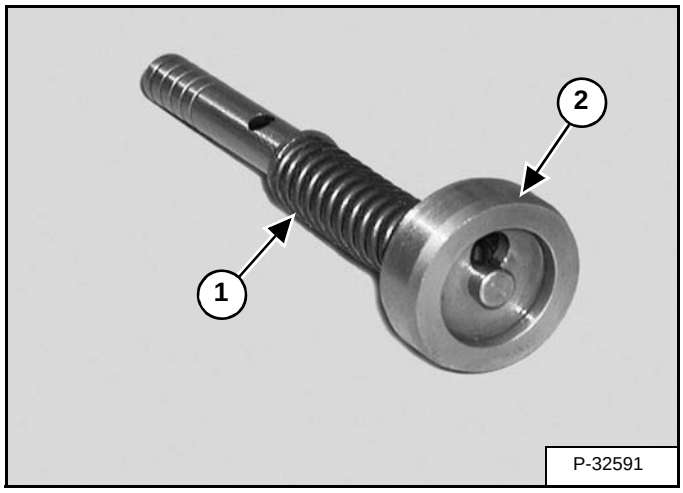
Assembly (Cont'd)

Figure 20-110-52



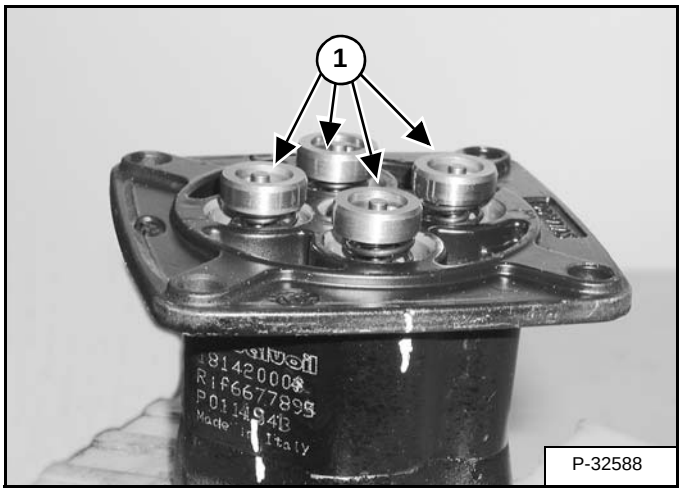
Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-110-52]**.

Figure 20-110-53



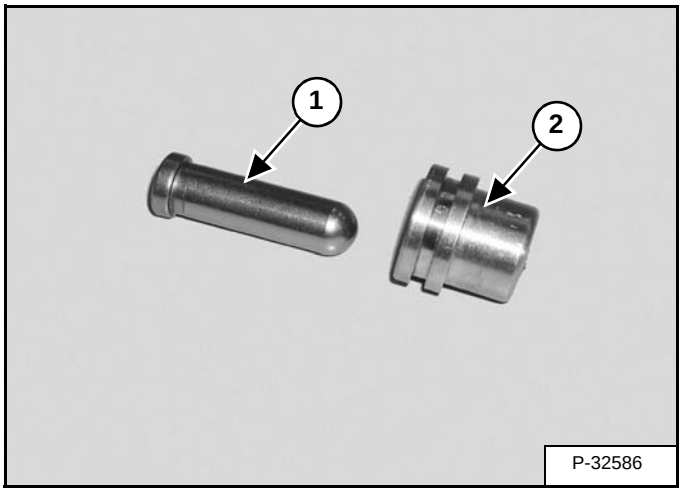
Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-110-53]**.

Figure 20-110-54



Install the spool assemblies (Item 1) **[Figure 20-110-54]** into the housing.

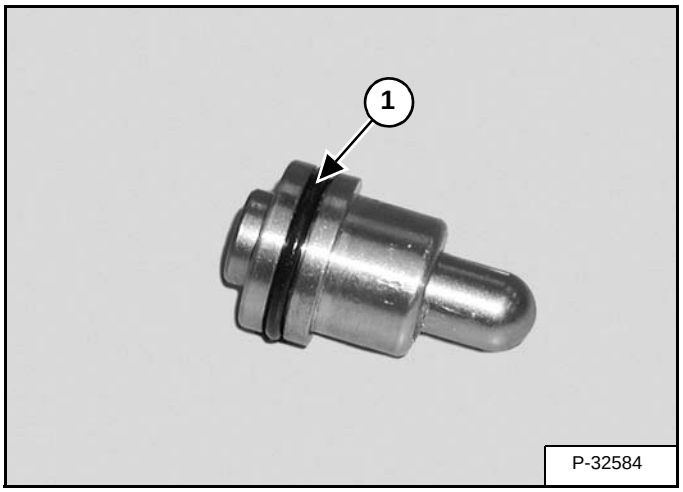
Figure 20-110-55



Install the plunger (Item 1) into the bushing (Item 2) **[Figure 20-110-55]**.

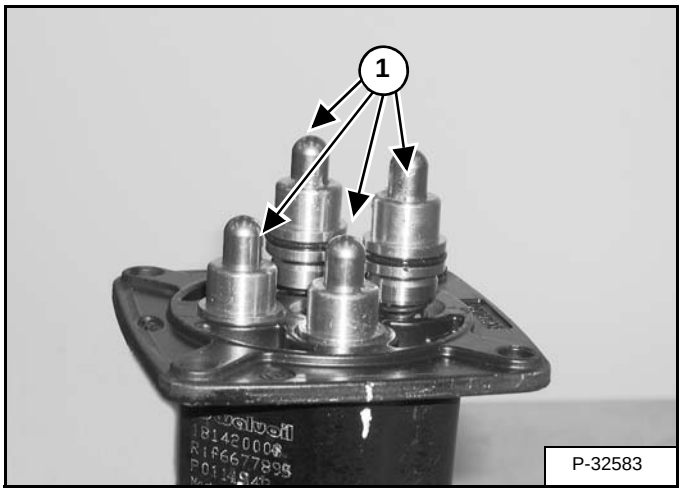
Assembly (Cont'd)

Figure 20-110-56



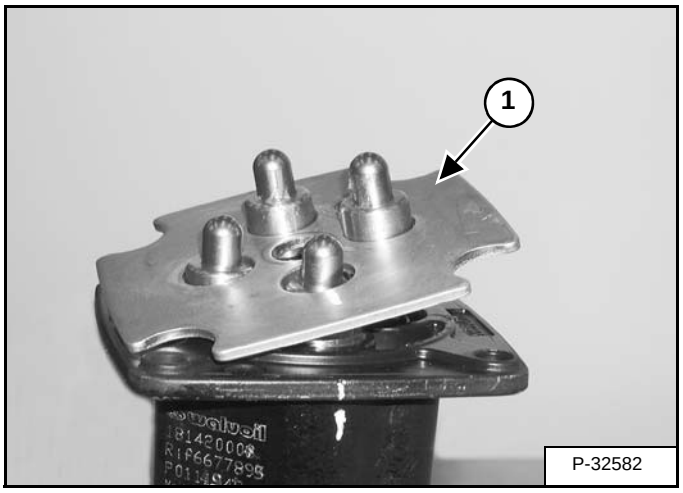
Install the O-ring (Item 1) **[Figure 20-110-56]** on the bushing.

Figure 20-110-57



Install the plunger assemblies (Item 1) **[Figure 20-110-57]** into the housing.

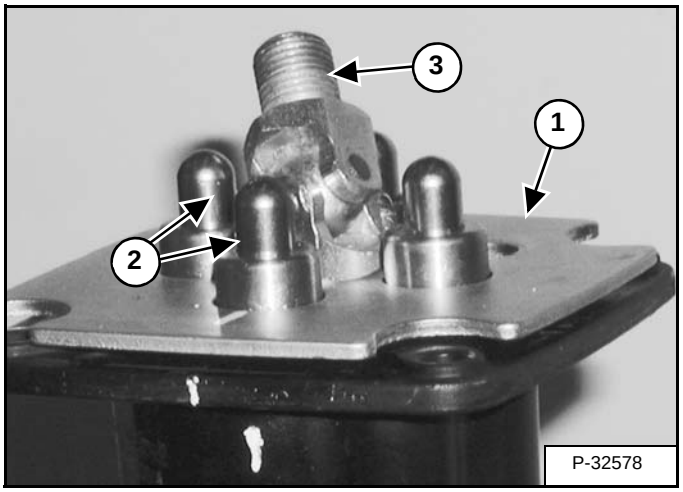
Figure 20-110-58



Install the plate (Item 1) **[Figure 20-110-58]**.

NOTE: Spring pressure can dislodge the plunger assemblies until the plate is secured in place.

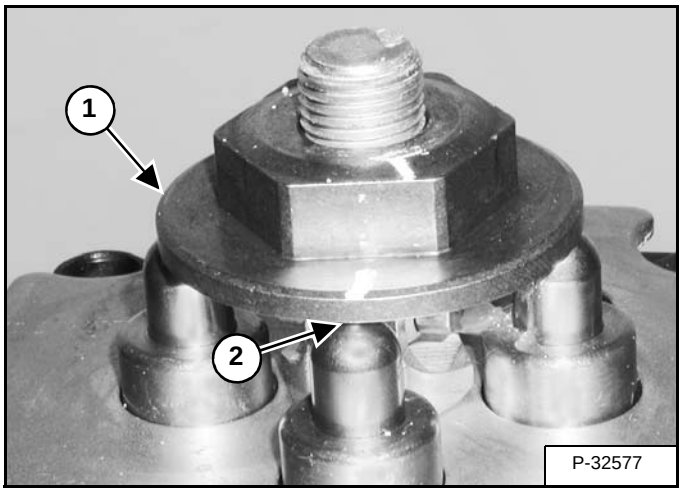
Figure 20-110-59



Press down on the plate (Item 1) keeping the plunger assemblies (Item 2) fully seated and install the U-joint (Item 3) **[Figure 20-110-59]**.

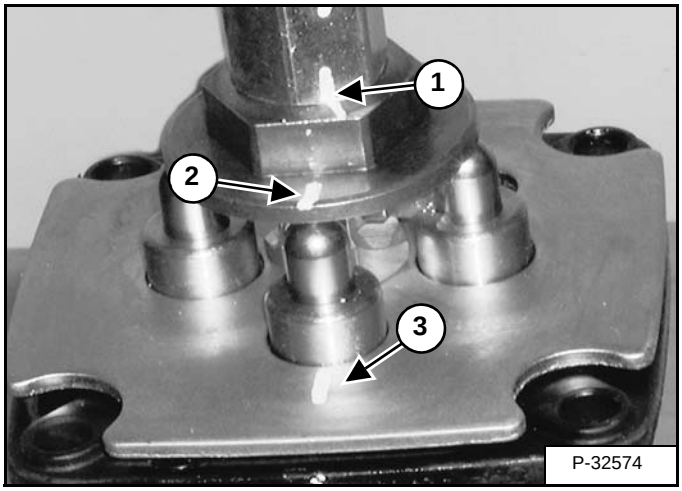
Assembly (Cont'd)

Figure 20-110-60



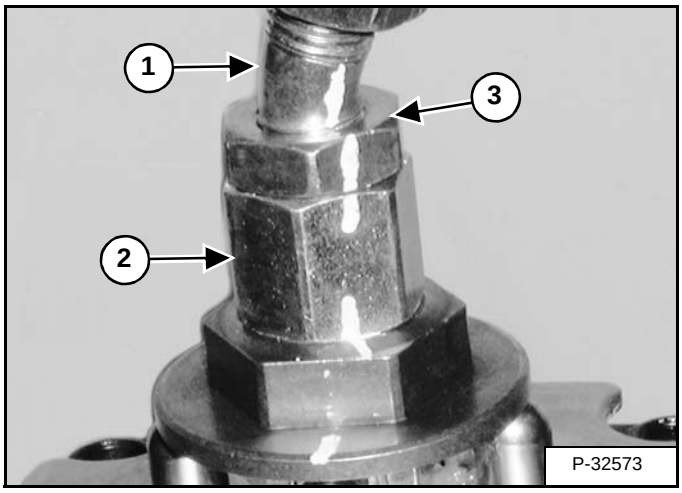
Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-110-60]**.

Figure 20-110-61



Align the coupler (Item 1) with the control plate (Item 2) and plate (Item 3) **[Figure 20-110-61]**. Tighten the coupler.

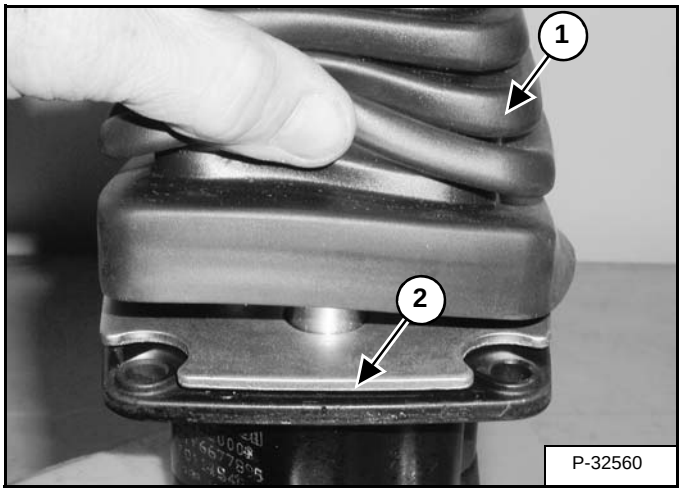
Figure 20-110-62



Install the connector (Item 1) **[Figure 20-110-62]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-110-62]**.

Figure 20-110-63



Install the tabs of the boot (Item 1) in between the joystick flange and mounting plate (Item 2) **[Figure 20-110-63]**.

Install the handle. (See Handle Removal And Installation on Page 20-110-2.)

LEFT CONTROL LEVER (JOYSTICK)

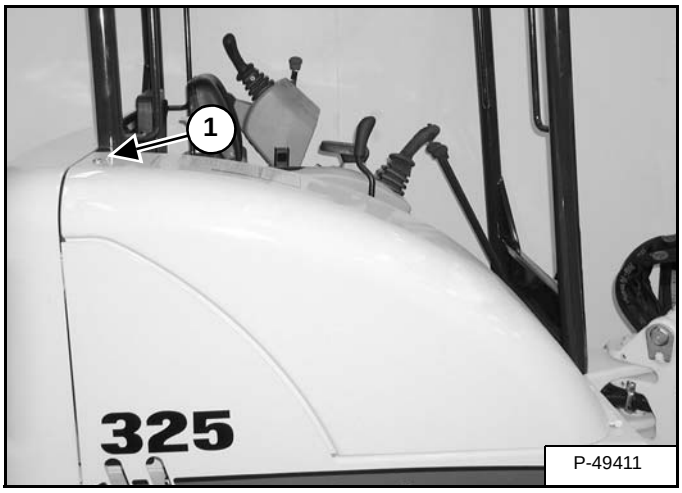
Testing

The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

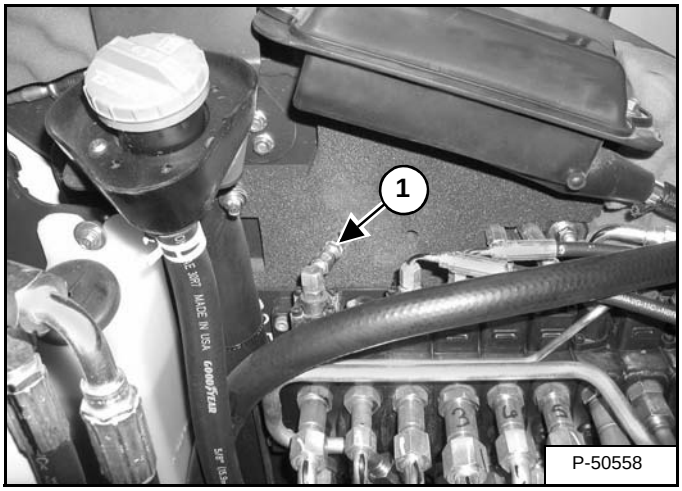
Stop the engine.

Figure 20-111-1



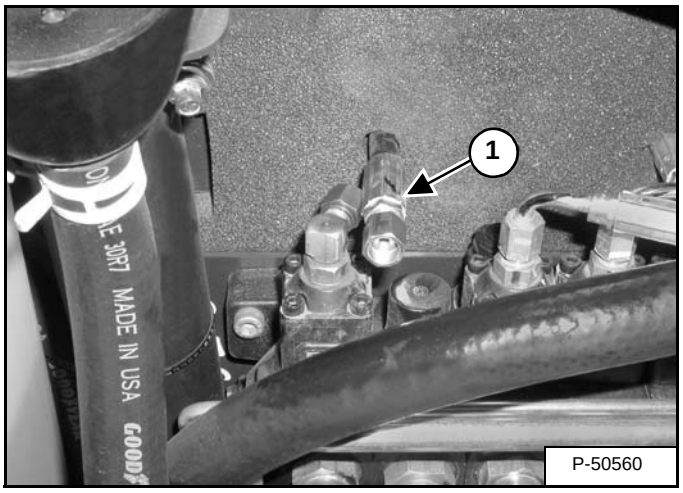
Open the right side cover (Item 1) **[Figure 20-111-1]**.

Figure 20-111-2



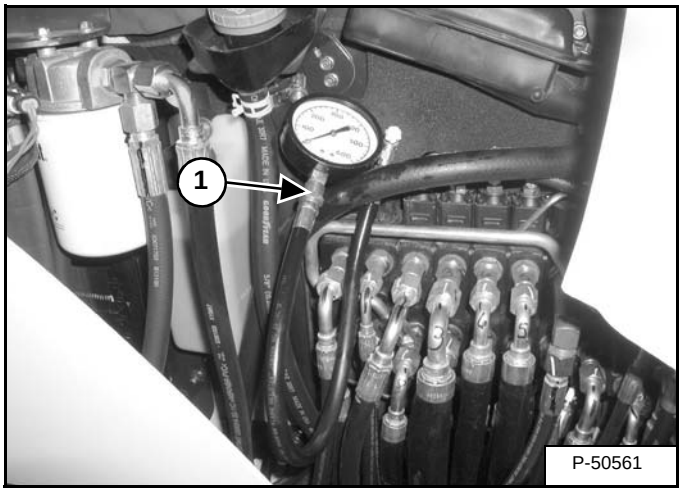
At the control valve assembly (Item 1) **[Figure 20-111-2]**, find the pilot line of the control lever (joystick) that is to be checked (Boom, Arm, Slew, Bucket.)

Figure 20-111-3



Disconnect the hydraulic hose (Item 1) **[Figure 20-111-3]** from the control valve.

Figure 20-111-4



From the test kit install a 1000 PSI (6896 kPa) gauge (Item 1) **[Figure 20-111-4]** on the pilot line. Start the excavator, and warm the hydraulic oil to a minimum temperature of 150° F (66° C).

Engage the circuit to be tested. Record the operating pressure.

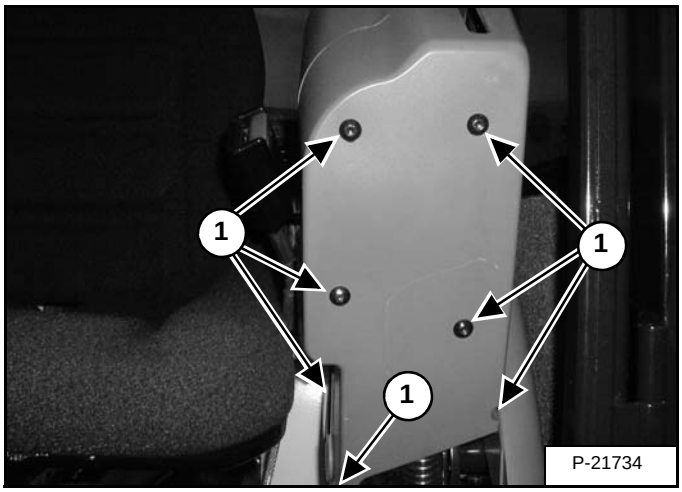
The operating pressure should be approximately 428 PSI (2951 kPa) with an acceptable range of 406 - 450 psi (2799 - 3103 kPa).

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.

LEFT CONTROL LEVER (JOYSTICK) (CONT'D)

Handle Removal And Installation

Figure 20-111-5

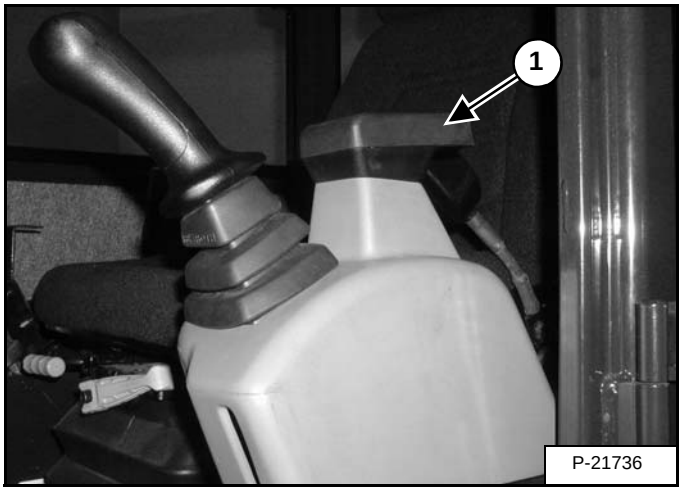


Remove the seven mounting bolts (Item 1) **[Figure 20-111-5]** from the lower half of the operator console.

Remove the lower half of the console.

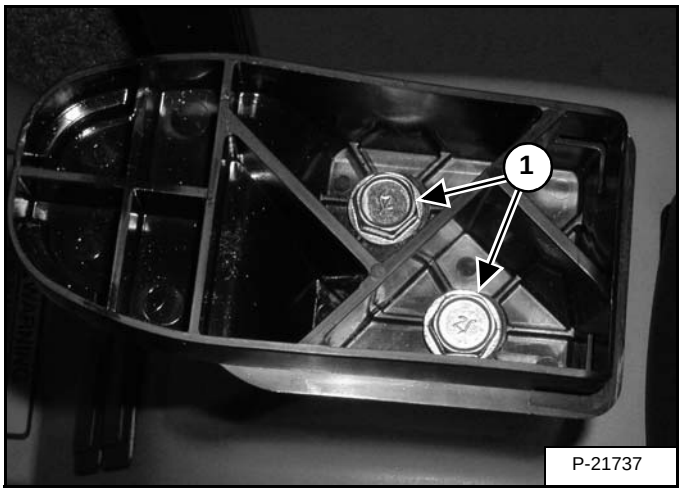
Lower the console.

Figure 20-111-6



Remove the cover (Item 1) **[Figure 20-111-6]** from the arm rest.

Figure 20-111-7

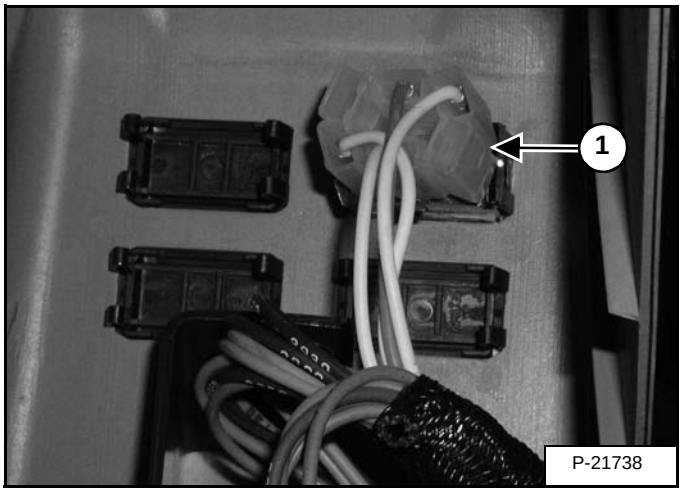


Remove the two mount bolts (Item 1) **[Figure 20-111-7]** from the arm rest.

Remove the arm rest.

Raise the upper half of the console cover.

Figure 20-111-8



Disconnect the electrical connector (Item 1) **[Figure 20-111-8]**.

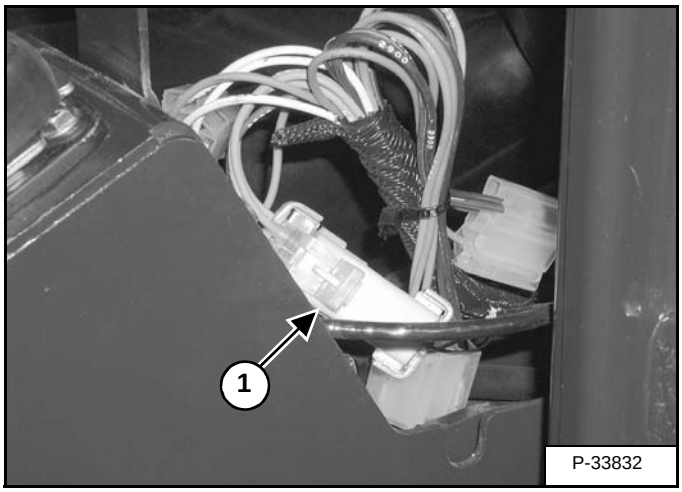
NOTE: These connectors are keyed so they can be plugged in only one way.

Remove the console cover.

LEFT CONTROL LEVER (JOYSTICK) (CONT'D)

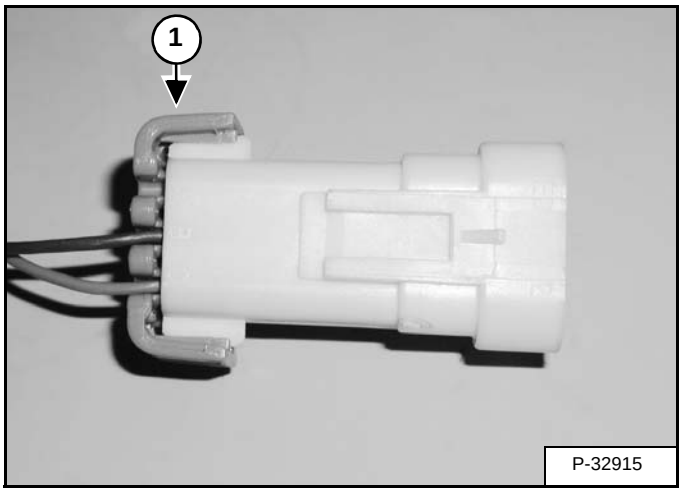
Handle Removal And Installation (Cont'd)

Figure 20-111-9



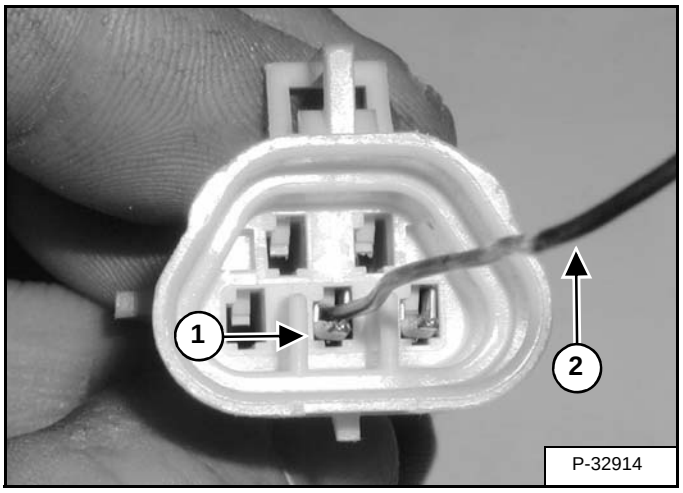
Disconnect the joystick wire connector (Item 1) **[Figure 20-111-9]** from the wire harness.

Figure 20-111-10



Remove the lock (Item 1) **[Figure 20-111-10]** from the joystick electrical connector.

Figure 20-111-11



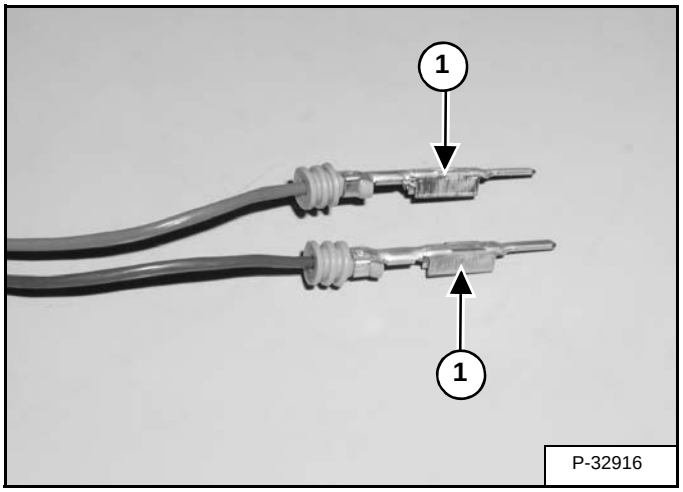
Using a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 20-111-11]**.

Carefully remove the individual wires from the back of the electrical connector.

Remove the control handle (joystick) assembly from the excavator.

Installation: Use a small piece of wire and rebend the tab on each wire before installing it in the electrical connector.

Figure 20-111-12



Installation: The wires **[Figure 20-111-12]** must be installed in the proper locations in the wire connector, listed below.

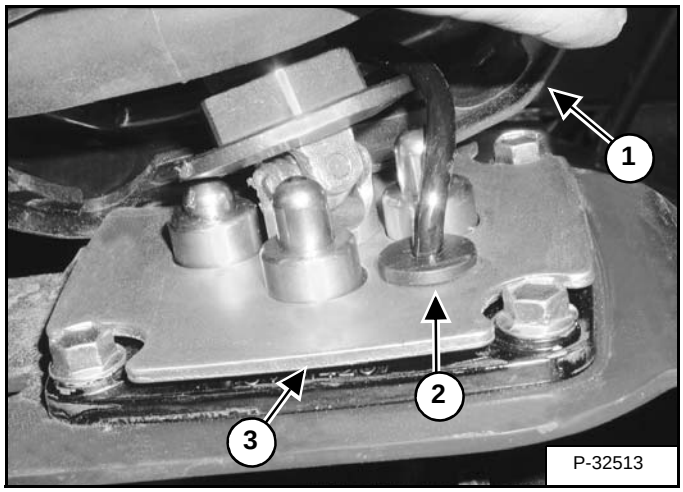
C Red
D Black

Check each wire to be certain the tab (Item 1) **[Figure 20-111-12]** locks into position.

LEFT CONTROL LEVER (JOYSTICK) (CONT'D)

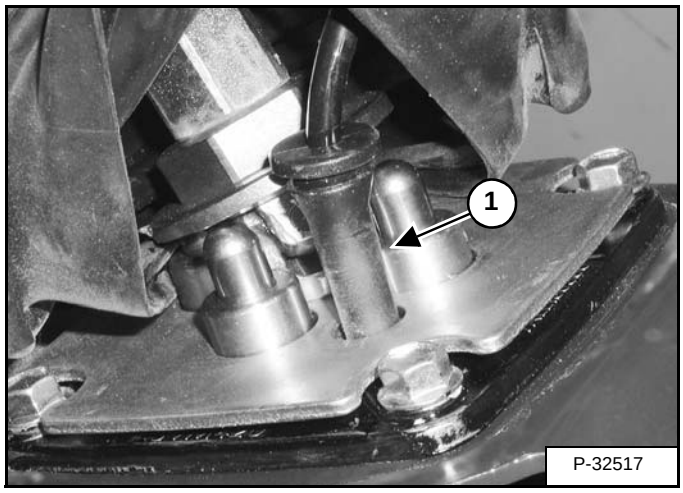
Handle Removal And Installation (Cont'd)

Figure 20-111-13



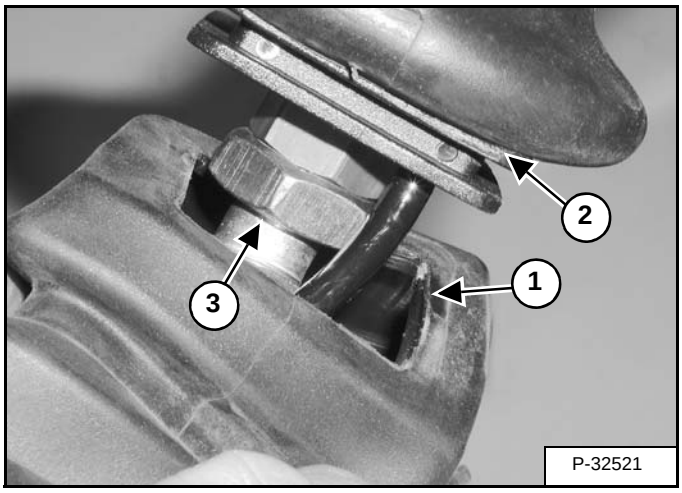
Raise the boot (Item 1) and pull the grommet (Item 2) up through the mount plate (Item 3) **[Figure 20-111-13]**.

Figure 20-111-14



Remove the grommet and wire (Item 1) **[Figure 20-111-14]** from the mount plate.

Figure 20-111-15



Remove the boot (Item 1) **[Figure 20-111-15]** from the joystick handle.

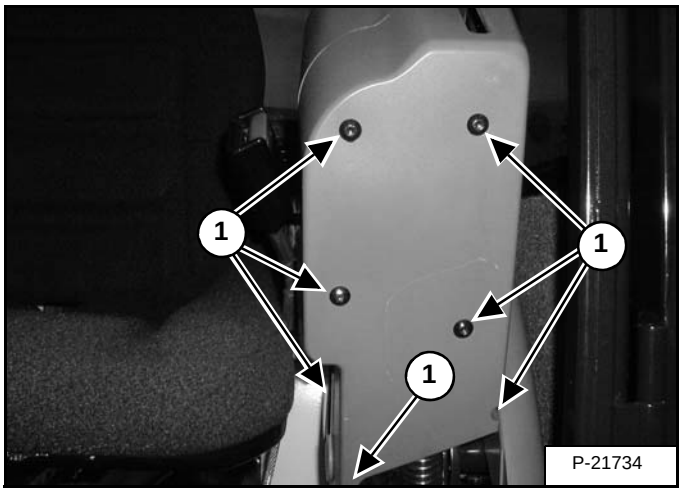
Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-111-15]**.

Hold the boot down and loosen the nut (Item 3) **[Figure 20-111-15]**.

Remove the handle.

Joystick Assembly Removal And Installation

Figure 20-111-16

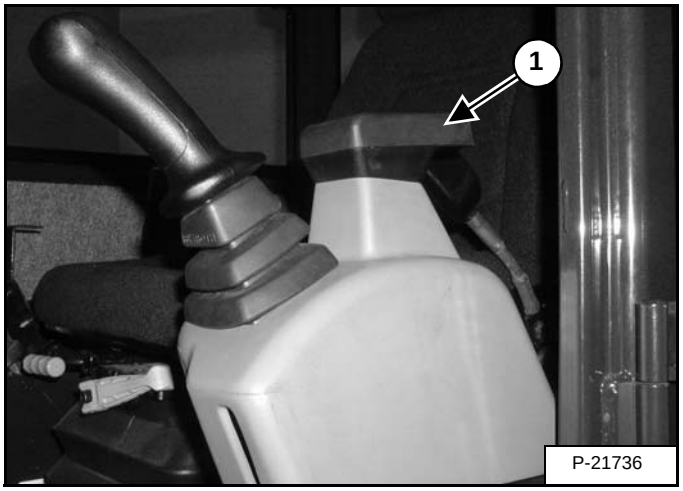


Remove the seven mounting bolts (Item 1) **[Figure 20-111-16]** from the lower half of the operator console.

Remove the lower half of the console.

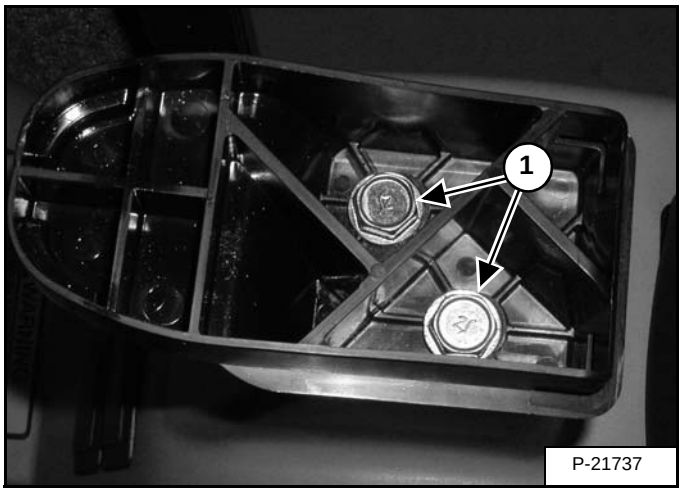
Lower the console.

Figure 20-111-17



Remove the cover (Item 1) **[Figure 20-111-17]** from the arm rest.

Figure 20-111-18

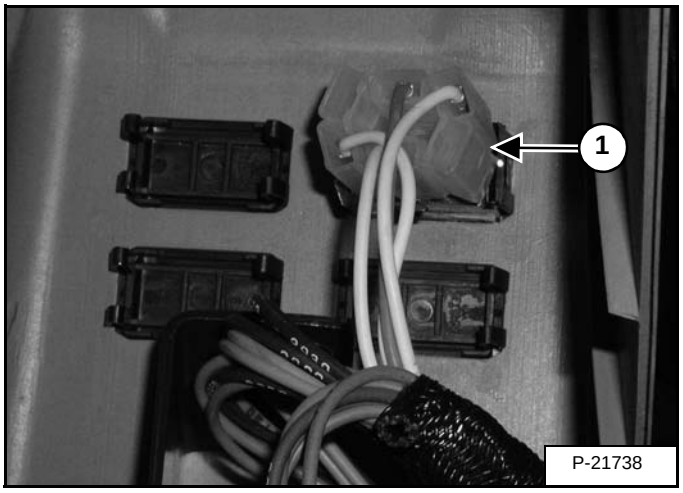


Remove the two mount bolts (Item 1) **[Figure 20-111-18]** from the arm rest.

Remove the arm rest.

Raise the upper half of the console cover.

Figure 20-111-19



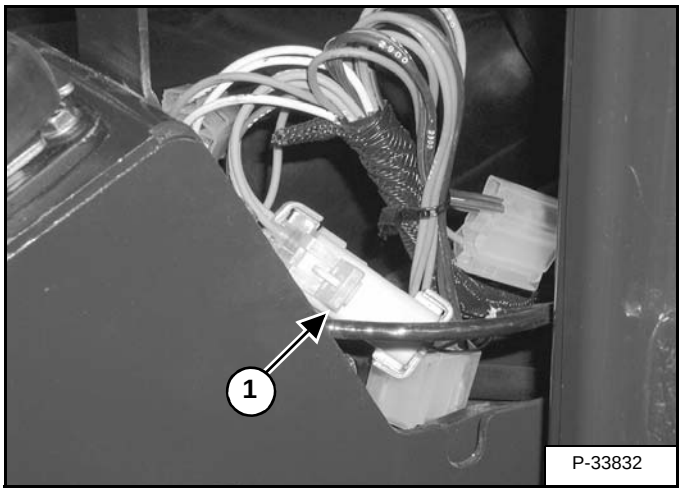
Disconnect the electrical connector (Item 1) **[Figure 20-111-19]**.

NOTE: These connectors are keyed so they can be plugged in only one way.

Remove the console cover.

Joystick Assembly Removal And Installation (Cont'd)

Figure 20-111-20



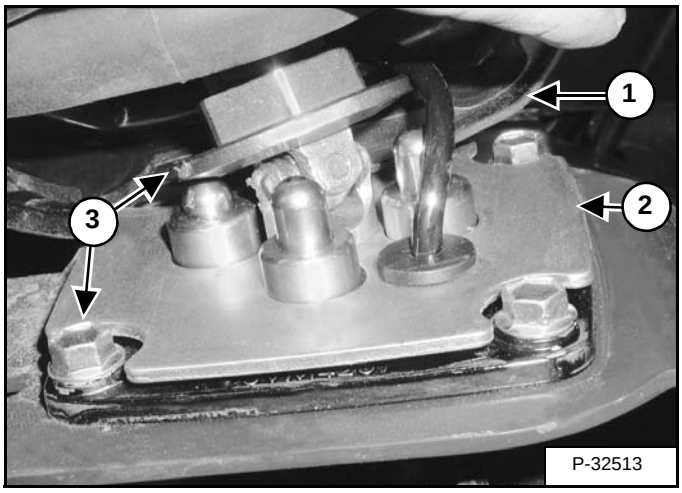
Disconnect the electrical connector (Item 1) **[Figure 20-111-20]**.

Figure 20-111-21



Mark and remove the hoses **[Figure 20-111-21]**.

Figure 20-111-22



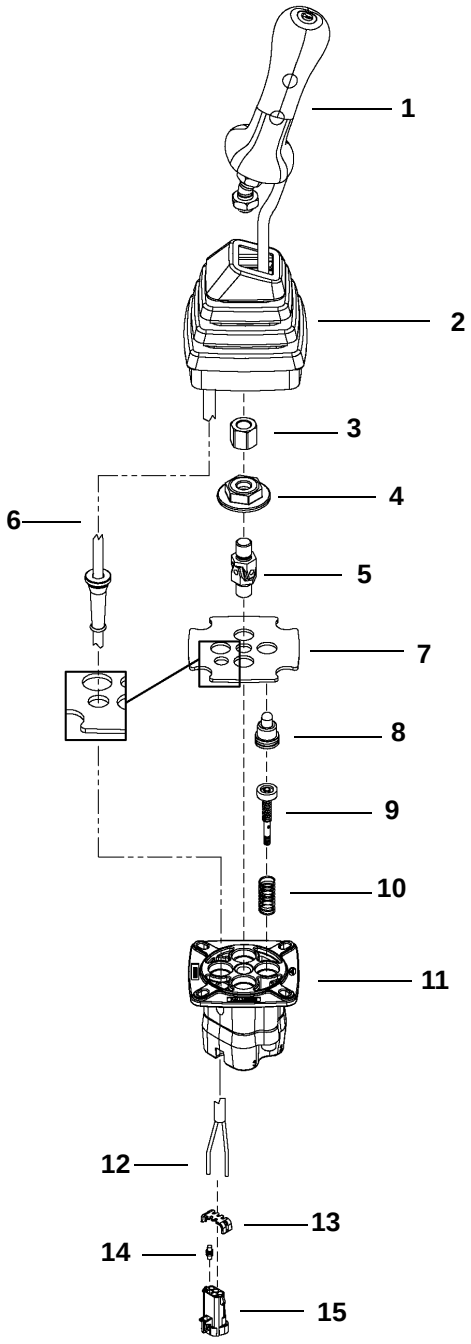
Raise the boot (Item 1) up from the mounting plate (Item 2) **[Figure 20-111-22]**.

Remove the four bolts (Item 3) **[Figure 20-111-22]** from the control lever (joystick) mounting bolt.

Remove the control lever (joystick).

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

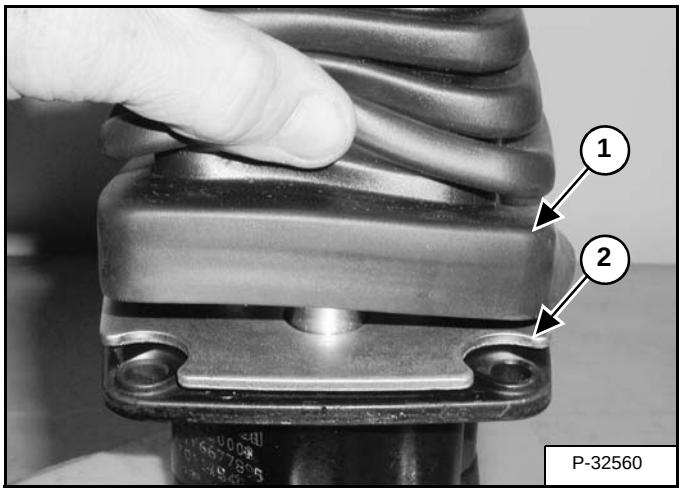
LEFT CONTROL LEVER (JOYSTICK) (CONT'D)

Disassembly

Remove the left handle. (See Handle Removal And Installation on Page 20-111-2.)

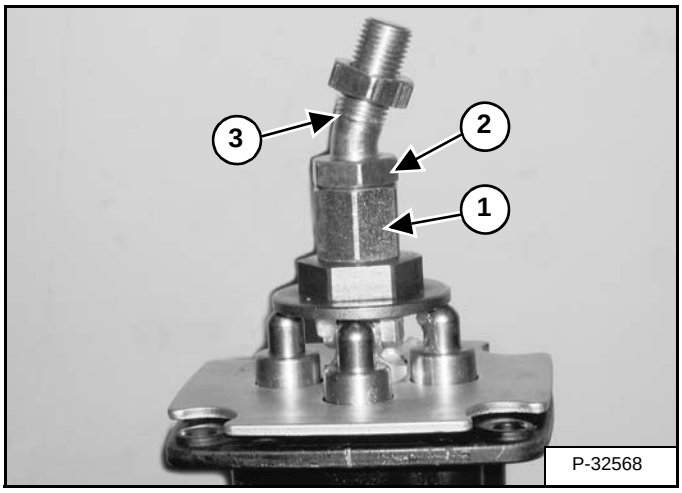
Clean the outside of the control lever before disassembly.

Figure 20-111-23



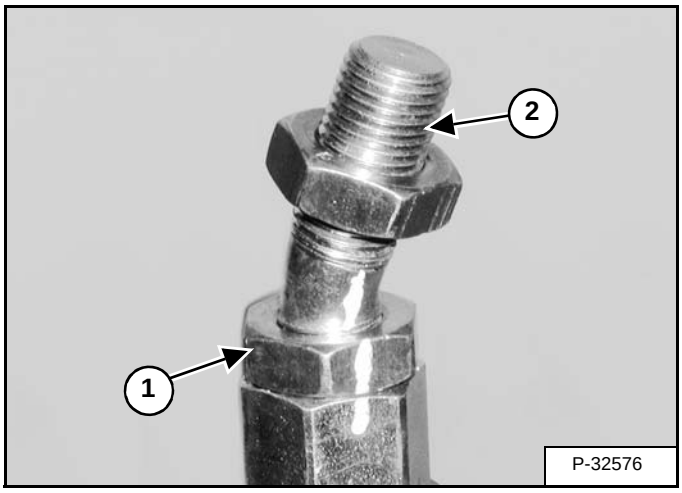
Remove the boot (Item 1) from the control lever (joystick) (Item 2) **[Figure 20-111-23]**.

Figure 20-111-24



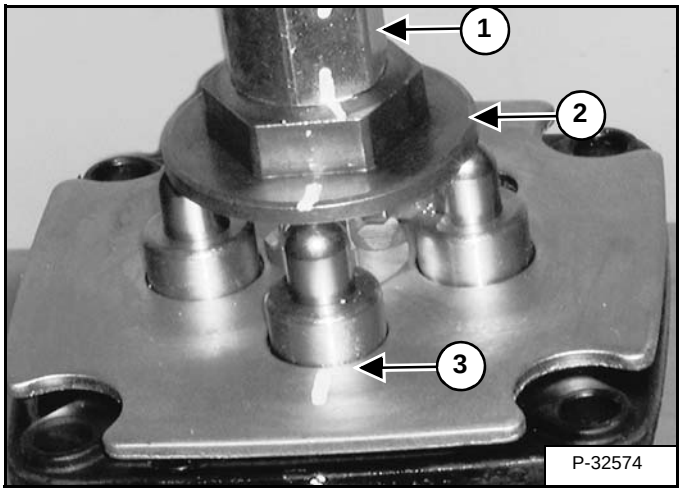
Mark the coupler (Item 1), nut (Item 2), and connector (Item 3) **[Figure 20-111-24]** for correct assembly.

Figure 20-111-25



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-111-25]**.

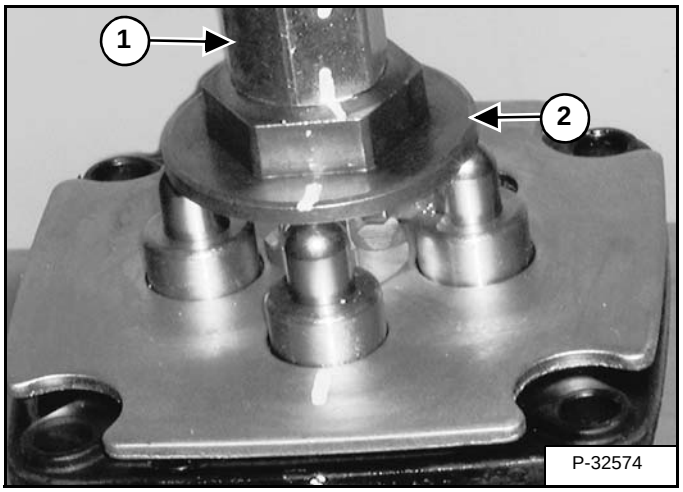
Figure 20-111-26



Mark the coupler (Item 1), control plate (Item 2), and plunger (Item 3) **[Figure 20-111-26]** for correct installation.

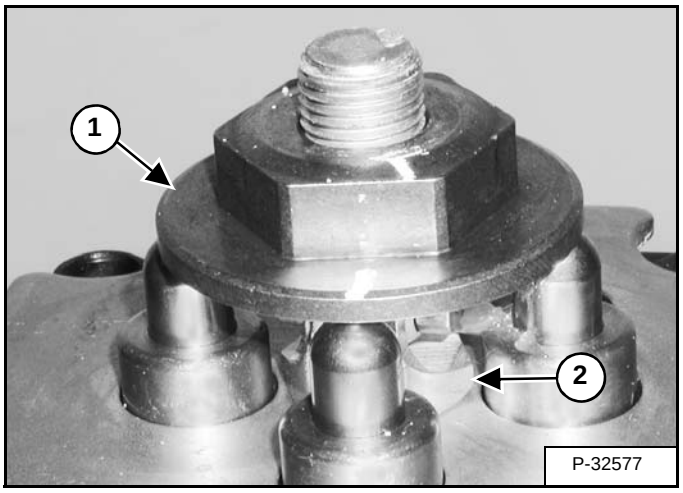
Disassembly (Cont'd)

Figure 20-111-27



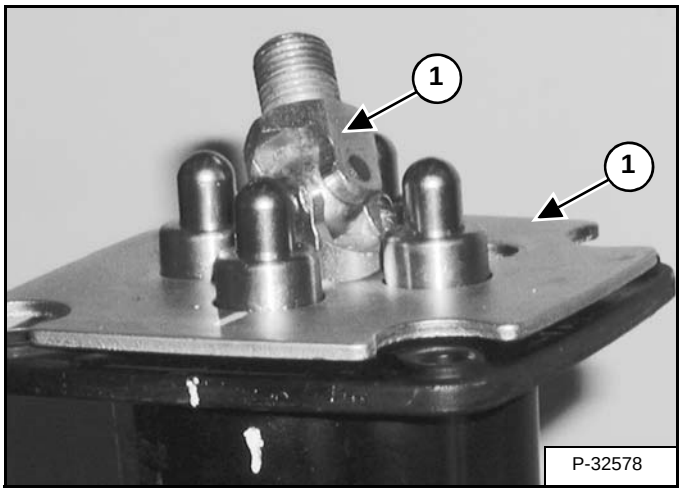
Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-111-27]**.

Figure 20-111-28



Remove the control plate (Item 1) from the U-joint (Item 2) **[Figure 20-111-28]**.

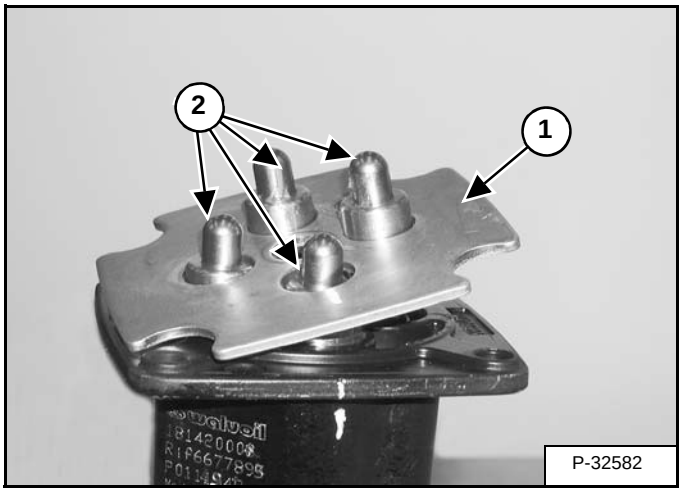
Figure 20-111-29



Mark the plate and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-111-29]**.

NOTE: The plate (Item 2) [Figure 20-111-29] is spring loaded and will come up as the U-joint is removed.

Figure 20-111-30



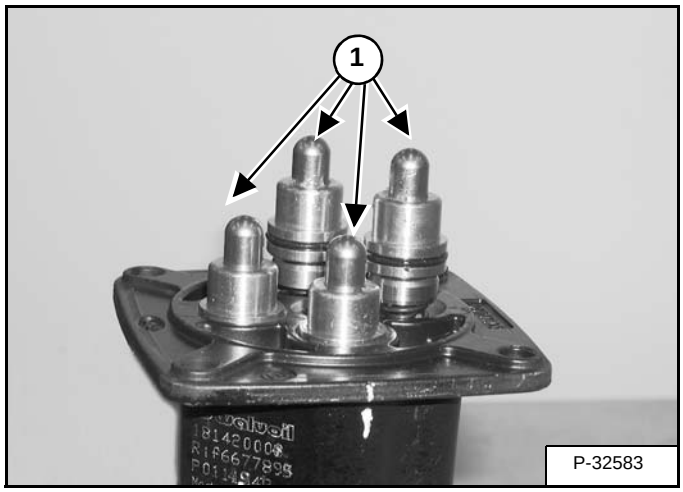
Remove the plate (Item 1) **[Figure 20-111-30]**.

NOTE: Use care while removing the plate. The plungers (Item 2) [Figure 20-111-30] are spring loaded.

LEFT CONTROL LEVER (JOYSTICK) (CONT'D)

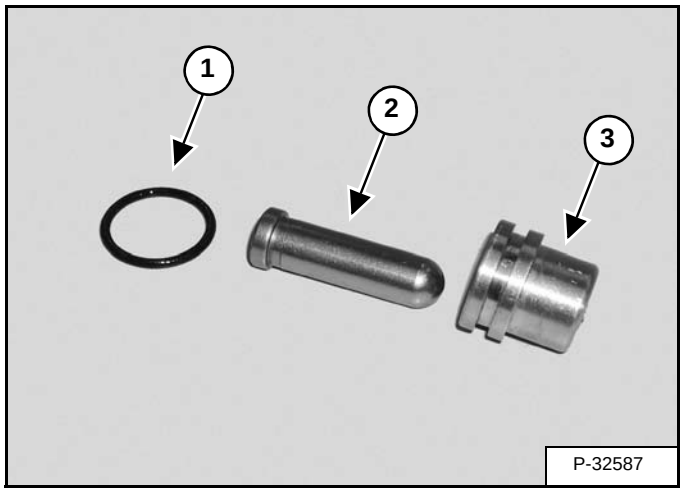
Disassembly (Cont'd)

Figure 20-111-31



Remove the four plunger assemblies (Item 1) **[Figure 20-111-31]**.

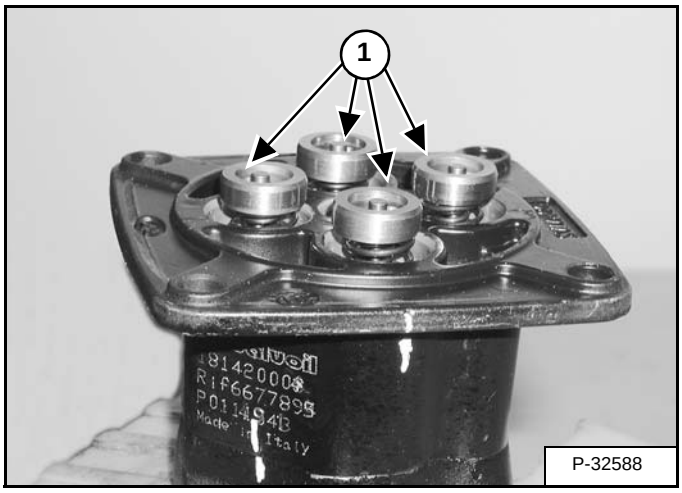
Figure 20-111-32



Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-111-32]**.

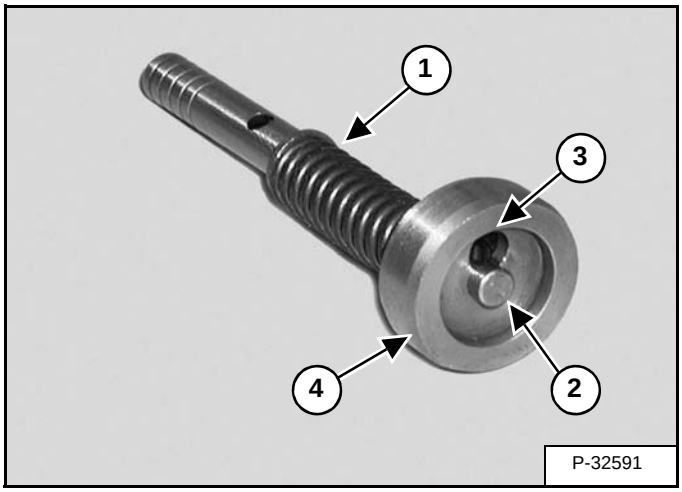
NOTE: Mark the spool assemblies for installation in their original location.

Figure 20-111-33



Remove the four spool assemblies (Item 1) **[Figure 20-111-33]**.

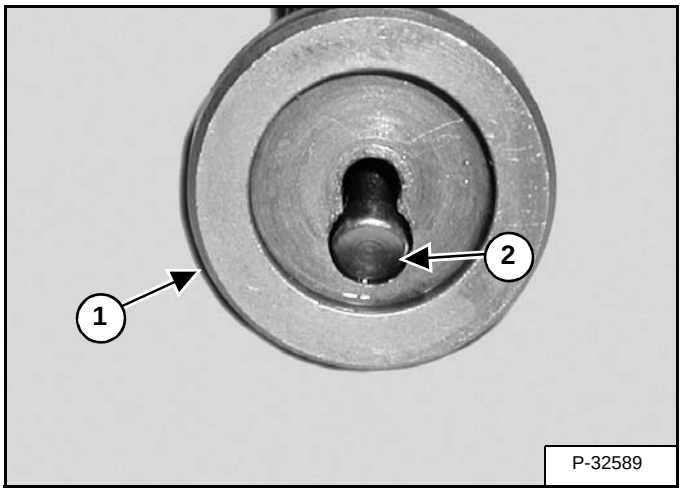
Figure 20-111-34



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 20-111-34]**.

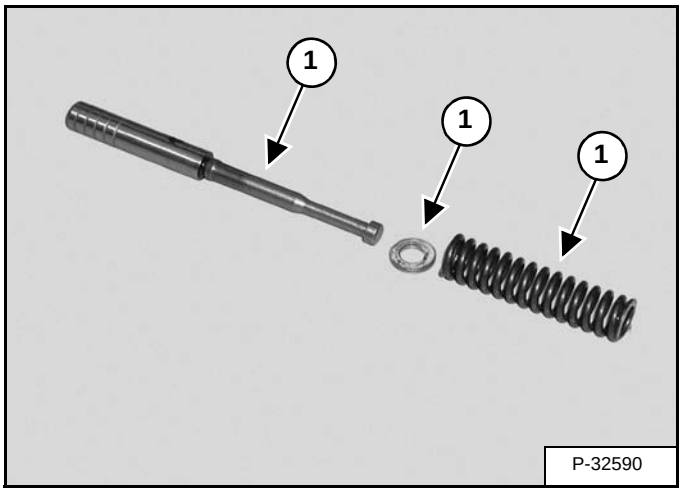
Disassembly (Cont'd)

Figure 20-111-35



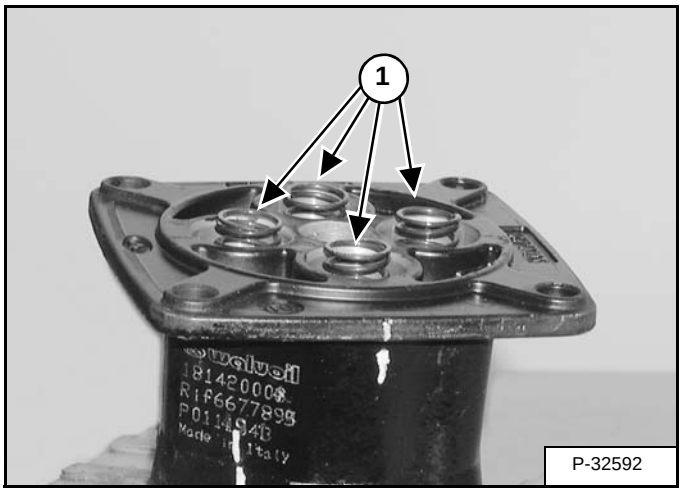
Remove the washer (Item 1) from the spool (Item 2) **[Figure 20-111-35]**.

Figure 20-111-36



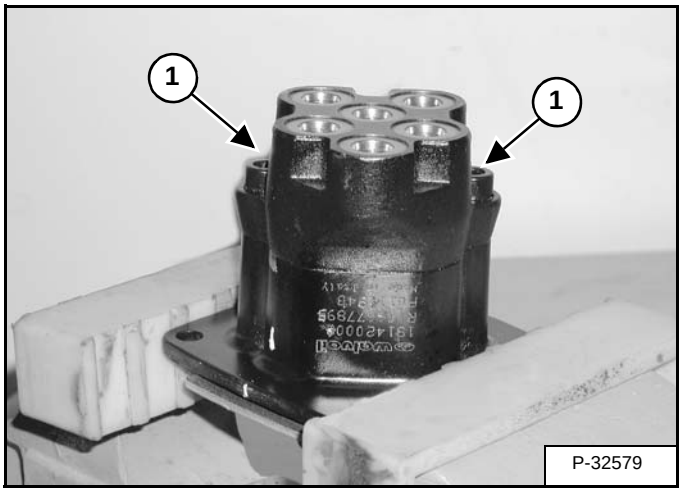
Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-111-36]**.

Figure 20-111-37



Remove the four springs (Item 1) **[Figure 20-111-37]** from the housing.

Figure 20-111-38

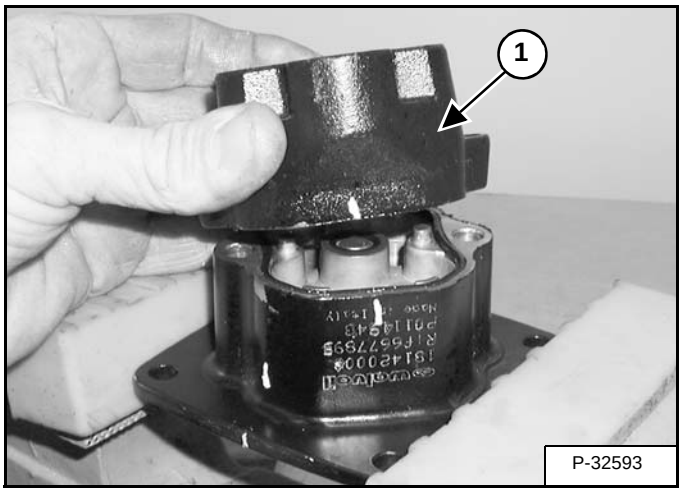


Clamp the housing in a vise **[Figure 20-111-38]**. Use care not to damage the housing.

Remove the two bolts (Item 1) **[Figure 20-111-38]**.

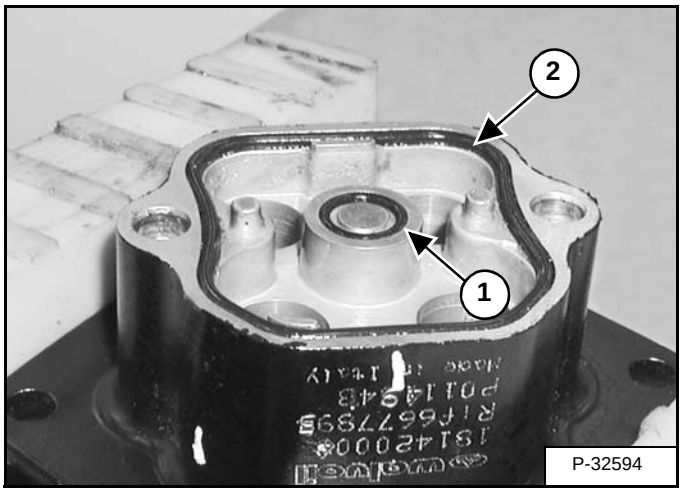
Disassembly (Cont'd)

Figure 20-111-39



Remove the end cap (Item 1) **[Figure 20-111-39]**

Figure 20-111-40



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-111-40]**.

LEFT CONTROL LEVER (JOYSTICK) (CONT'D)

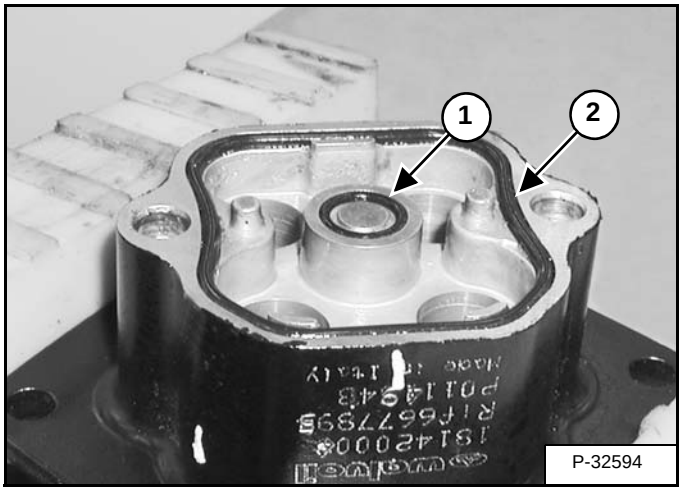
Assembly

Clean all parts in solvent and dry with compressed air.

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

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

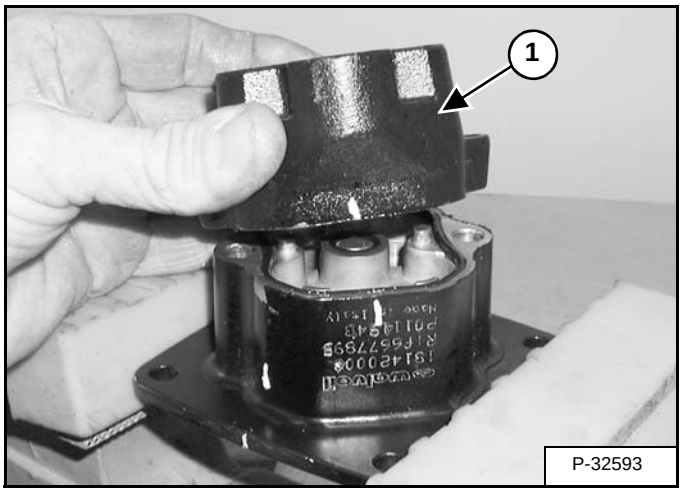
Figure 20-111-41



Clamp the housing in a vise. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-111-41]**.

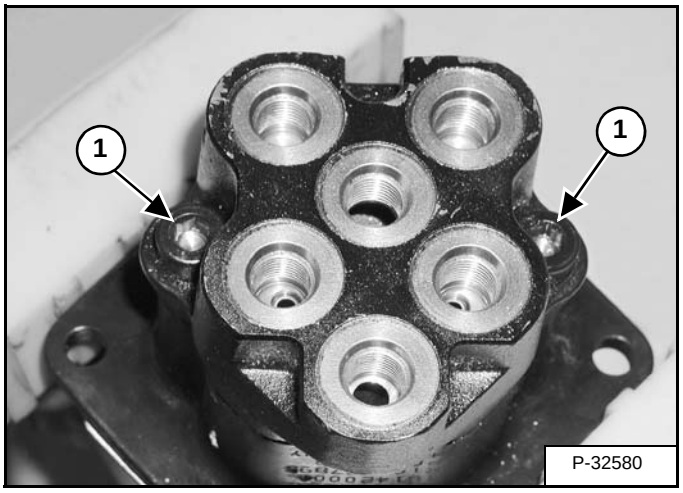
NOTE: Use care not to damage the housing.

Figure 20-111-42



Install the end cap (Item 1) **[Figure 20-111-42]**.

Figure 20-111-43

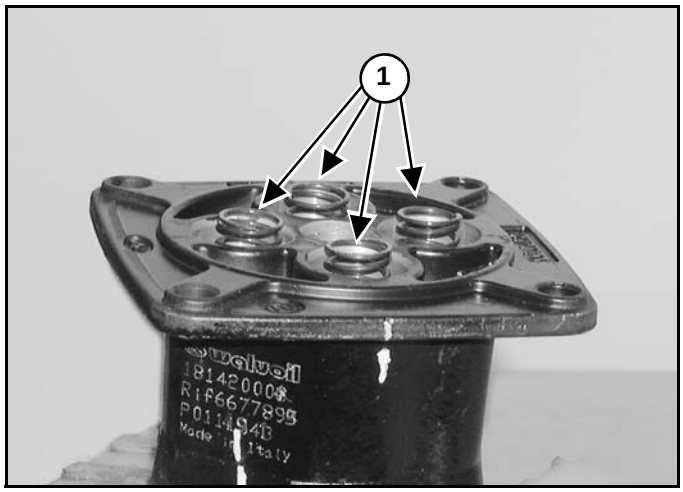


Install the two bolts (Item 1) **[Figure 20-111-43]**.

Turn the housing over.

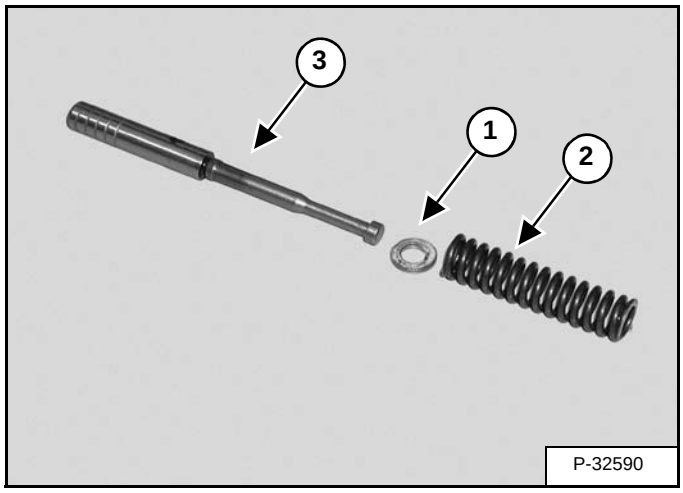
Assembly (Cont'd)

Figure 20-111-44



Install the four springs (Item 1) **[Figure 20-111-44]**.

Figure 20-111-45



Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-111-45]**.

Figure 20-111-46

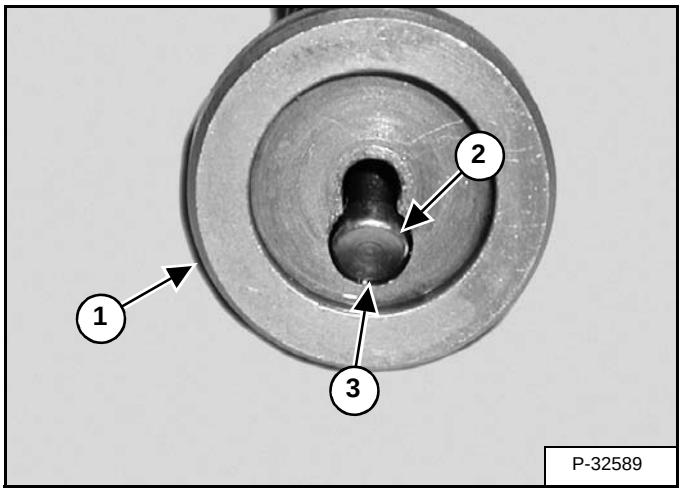
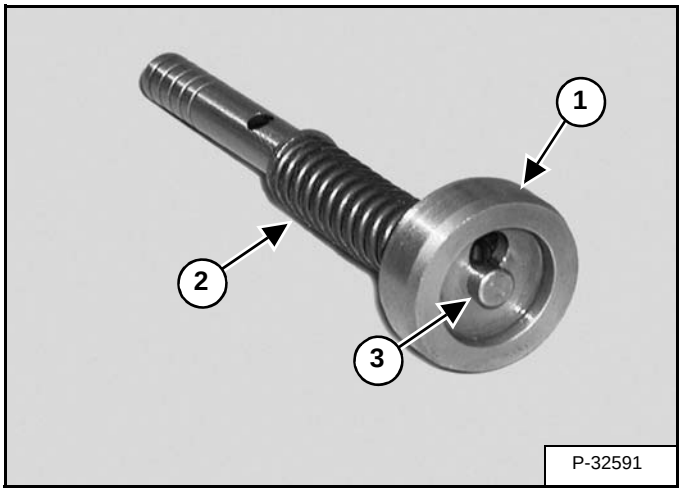


Figure 20-111-47



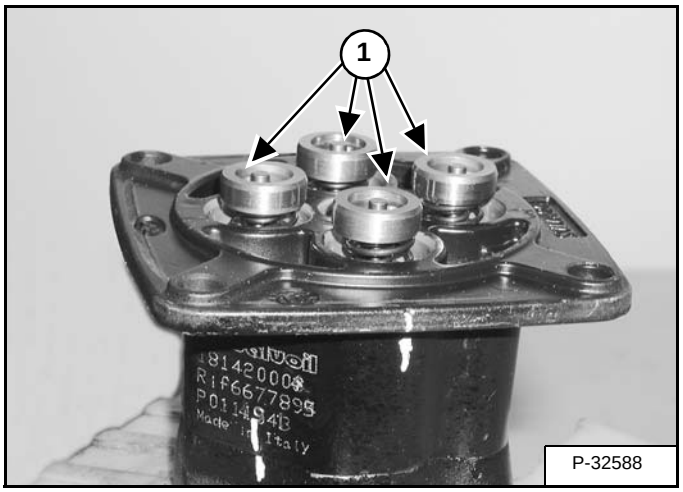
Install the washer (Item 1) **[Figure 20-111-46]** & **[Figure 20-111-47]** by compressing the spring (Item 2) **[Figure 20-111-47]** and pushing the end of the spool into the offset hole (Item 3) **[Figure 20-111-46]**.

Center the end of the spool (Item 2) **[Figure 20-111-46]** in the washer (Item 3) **[Figure 20-111-47]**.

LEFT CONTROL LEVER (JOYSTICK) (CONT'D)

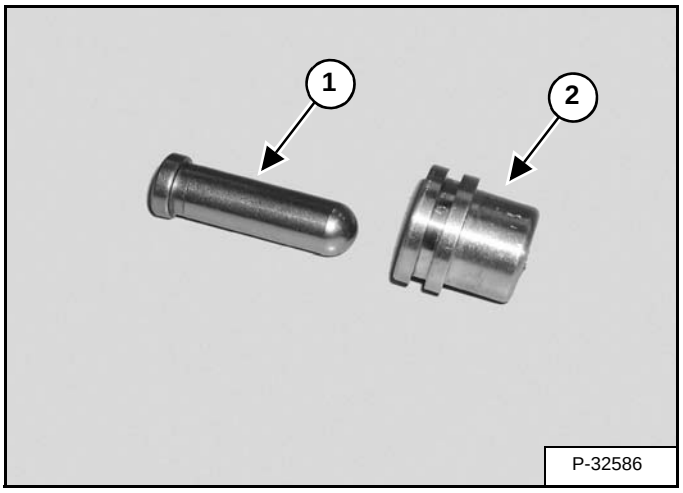
Assembly (Cont'd)

Figure 20-111-48



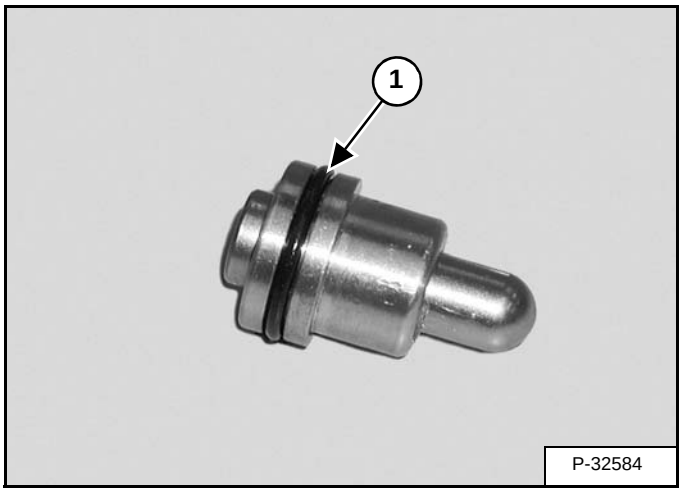
Install the four spool assemblies (Item 1) **[Figure 20-111-48]** into the housing.

Figure 20-111-49



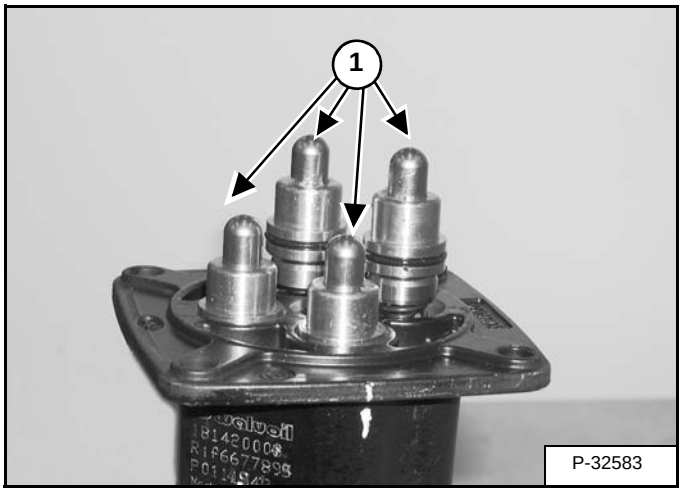
Install the plunger (Item 1) into the bushing (Item 2) **[Figure 20-111-49]**.

Figure 20-111-50



Install the O-ring (Item 1) **[Figure 20-111-50]** on the bushing.

Figure 20-111-51

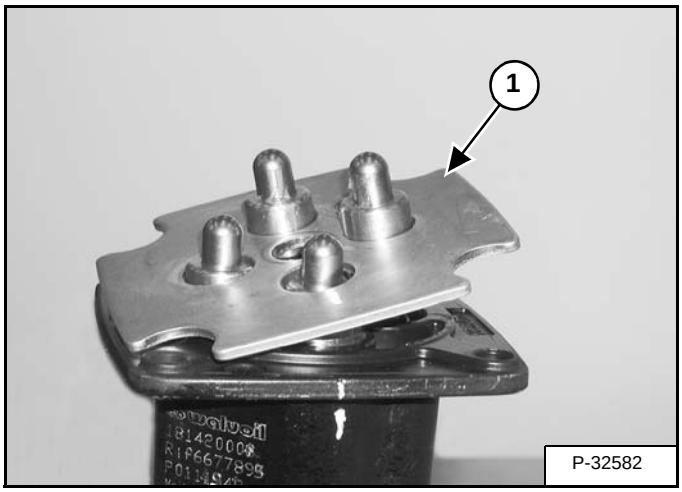


Install the four plunger assemblies (Item 1) **[Figure 20-111-51]** into the housing.

LEFT CONTROL LEVER (JOYSTICK) (CONT'D)

Assembly (Cont'd)

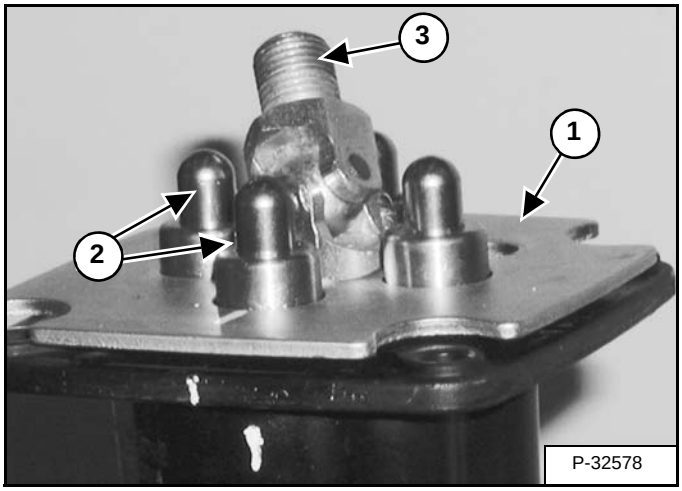
Figure 20-111-52



NOTE: Spring pressure can dislodge the plunger assemblies until the plate (Item 1) [Figure 20-111-52] is secured in place.

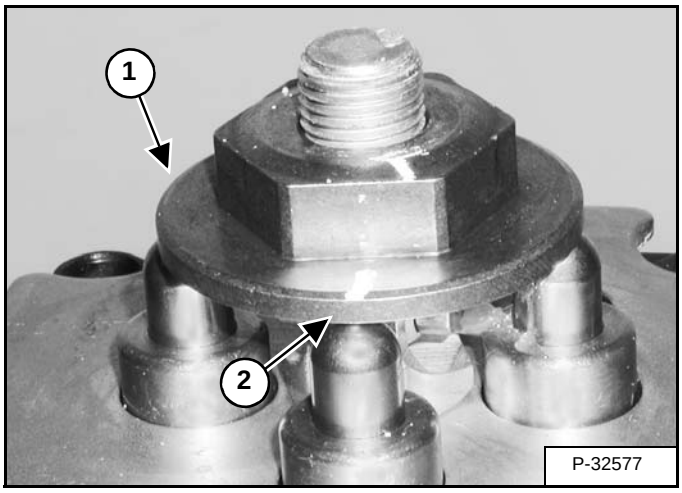
Install the plate (Item 1) **[Figure 20-111-52]**.

Figure 20-111-53



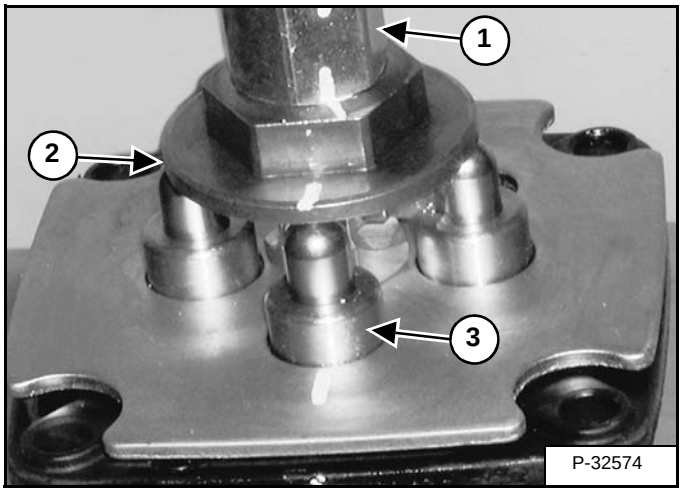
Press down on the plate (Item 1) to seat the four plunger assemblies (Item 2). Install the U-joint (Item 3) **[Figure 20-111-53]**.

Figure 20-111-54



Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-111-54]**.

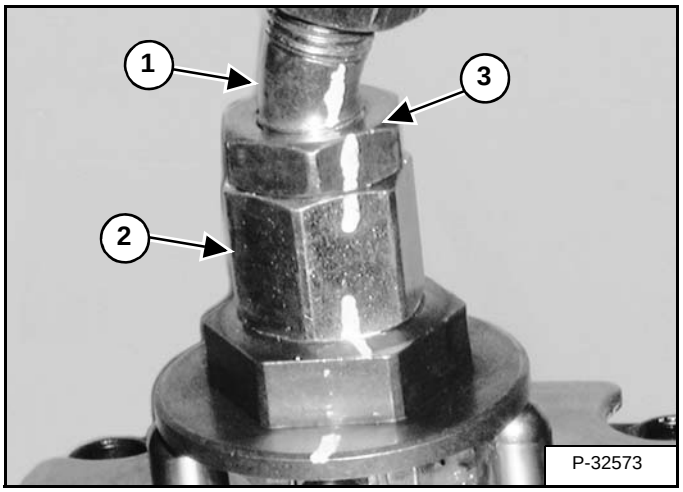
Figure 20-111-55



Align the coupler (Item 1) with the control plate (Item 2) and plunger (Item 3) **[Figure 20-111-55]**. Tighten the coupler.

Assembly (Cont'd)

Figure 20-111-56



Install the connector **[Figure 20-111-56]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-111-56]**.

Figure 20-111-57

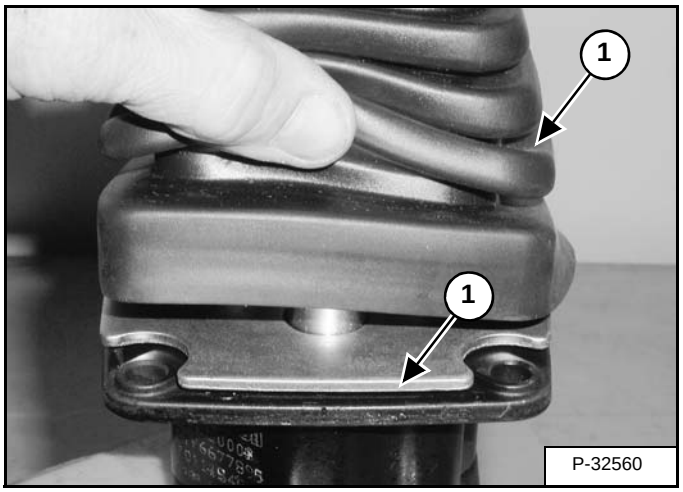
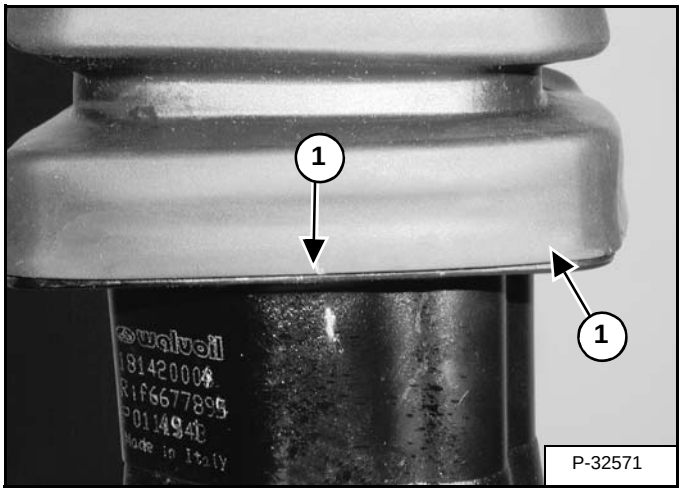


Figure 20-111-58



Install the boot (Item 1) **[Figure 20-111-57]** & **[Figure 20-111-58]** in the groove (Item 2) **[Figure 20-111-57]** & **[Figure 20-111-58]**.

Install the left handle. (See Handle Removal And Installation on Page 20-111-2.)


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HYDRAULIC FILTER MOUNT

Removal And Installation

IMPORTANT

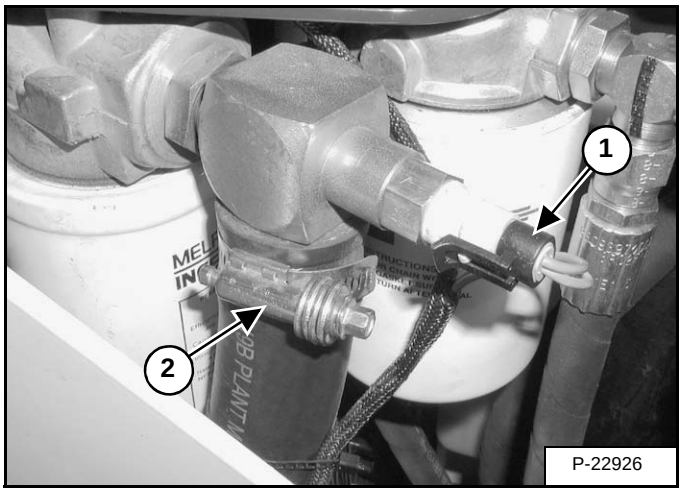
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

Open the right side cover.

Open the tailgate.

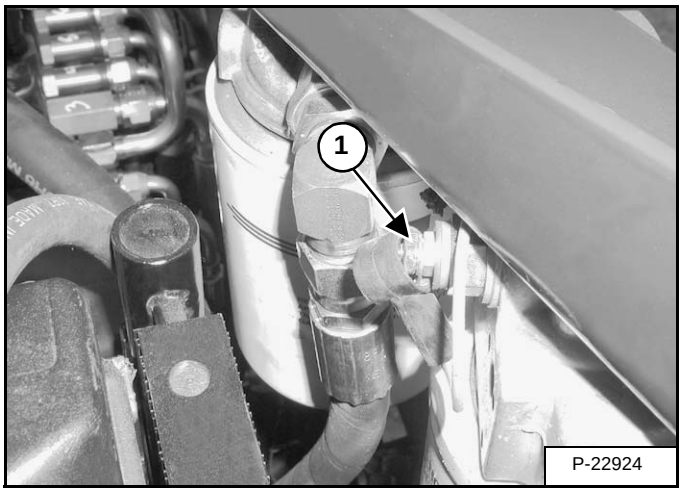
Figure 20-120-1



Disconnect the wire harness (Item 1) **[Figure 20-120-1]**.

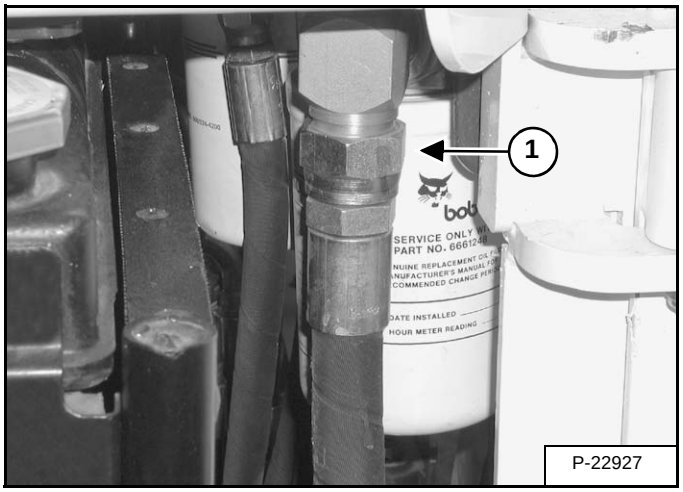
Loosen the hose clamp (Item 2) **[Figure 20-120-1]** and remove the hose.

Figure 20-120-2



Remove the wire (Item 2) **[Figure 20-120-2]** from the sending unit.

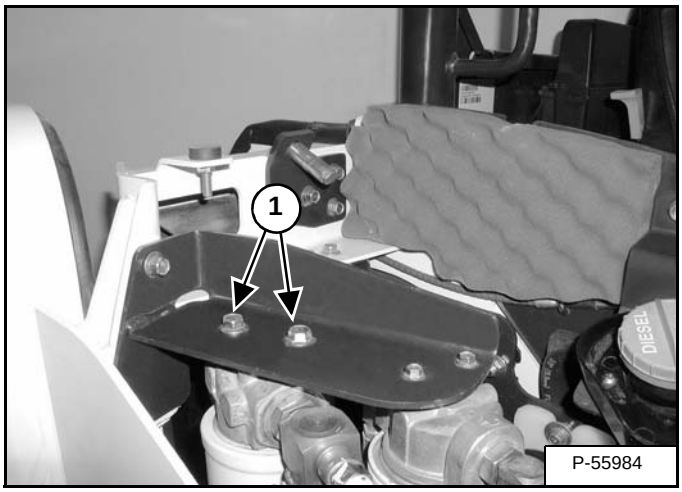
Figure 20-120-3



Remove the oil cooler to filter hose (Item 1) **[Figure 20-120-3]**.

Removal And Installation

Figure 20-120-4



Remove the bolts (Item 1) **[Figure 20-120-4]**.

Remove the filter and filter mount.

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.

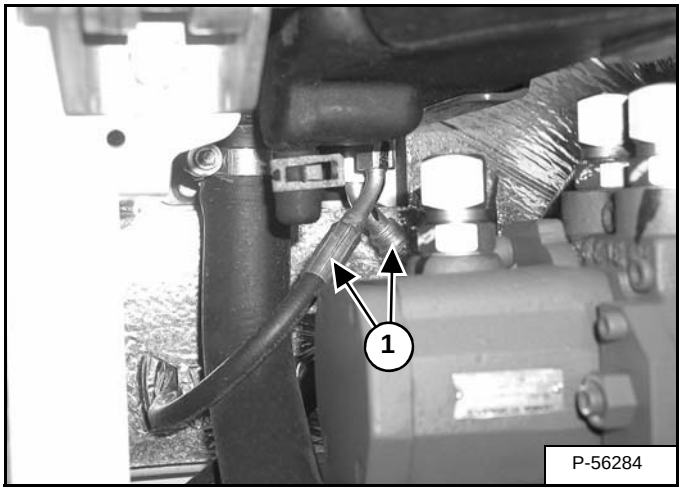
I-2003-0888

Open the tailgate.

Drain the reservoir. (See Replacing The Hydraulic Oil on Page 10-100-2.)

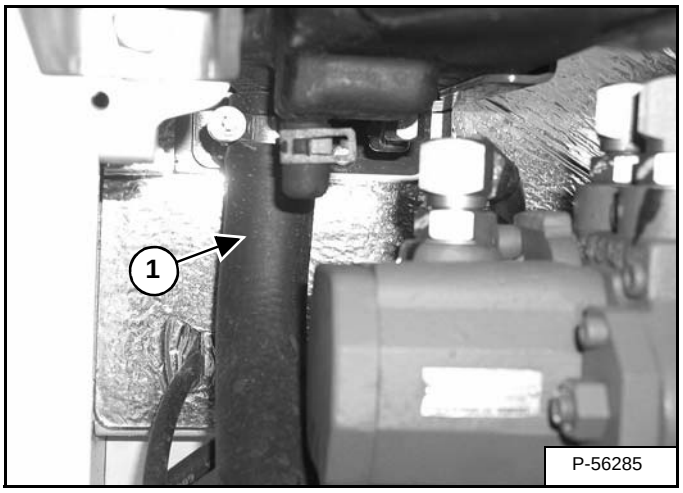
Remove the muffler. (See Removal And Installation on Page 60-20-1.)

Figure 20-130-1



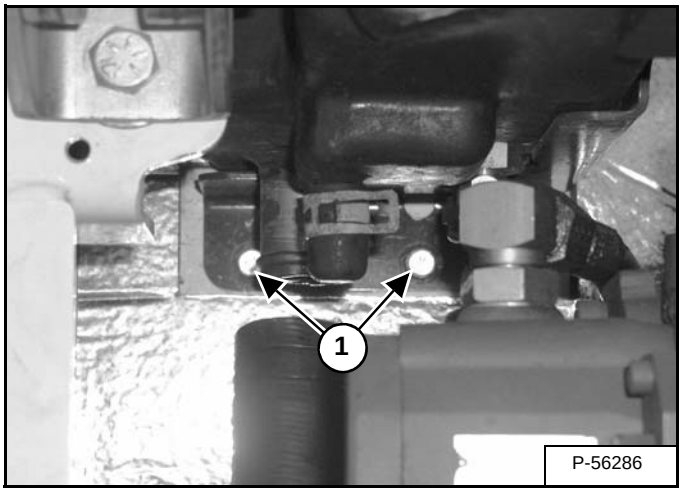
Remove the hoses (Item 1) **[Figure 20-130-1]**.

Figure 20-130-2



Remove the pump supply line (Item 1) **[Figure 20-130-2]**.

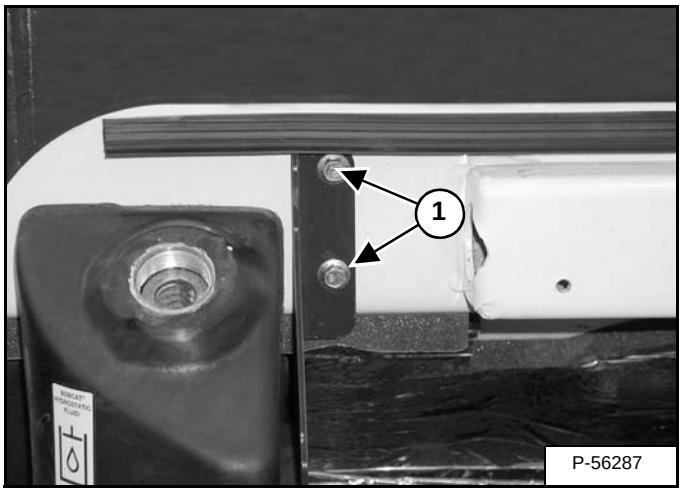
Figure 20-130-3



Remove the bolts (Item 1) **[Figure 20-130-3]**.

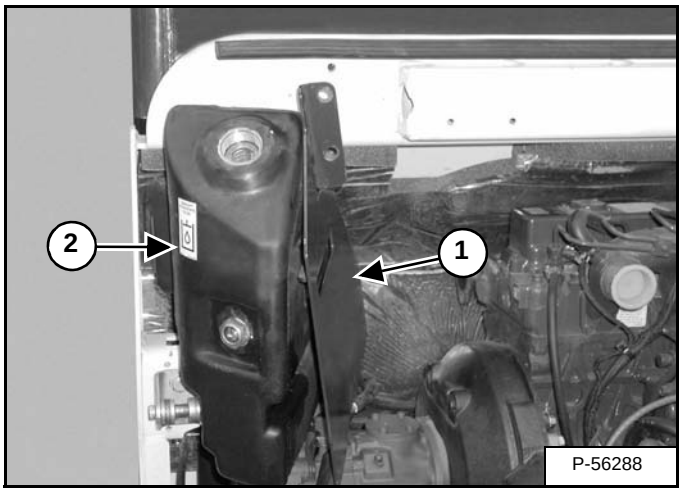
Removal And Installation (Cont'd)

Figure 20-130-4



Remove the bolts (Item 1) **[Figure 20-130-4]**.

Figure 20-130-5



Remove the mount (Item 1) **[Figure 20-130-5]**.

Remove reservoir (Item 2) **[Figure 20-130-5]**.

OIL COOLER

Removal And Installation

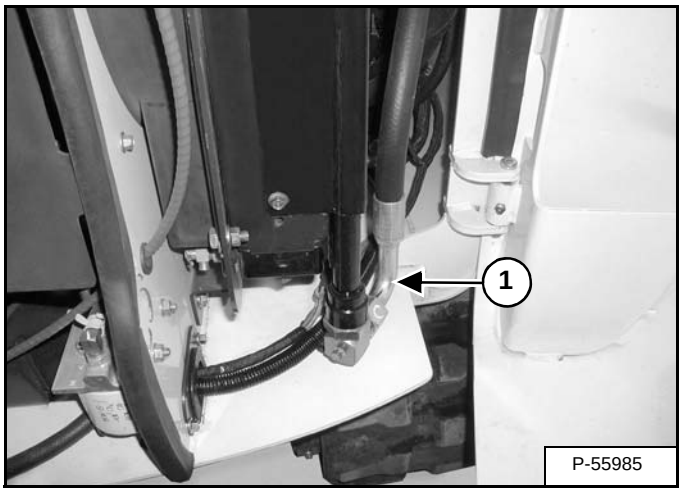
IMPORTANT

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

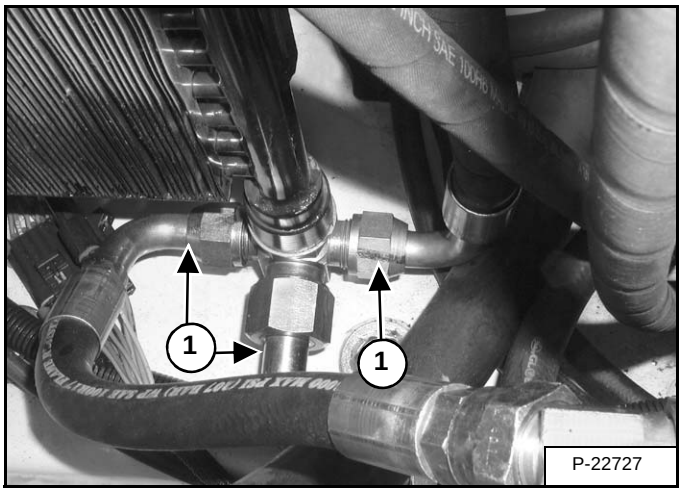
Drain the hydraulic reservoir. (See Replacing The Hydraulic Oil on Page 10-100-2.)

Figure 20-140-1



Remove the hose (Item 1) **[Figure 20-140-1]** from the rear of the cooler.

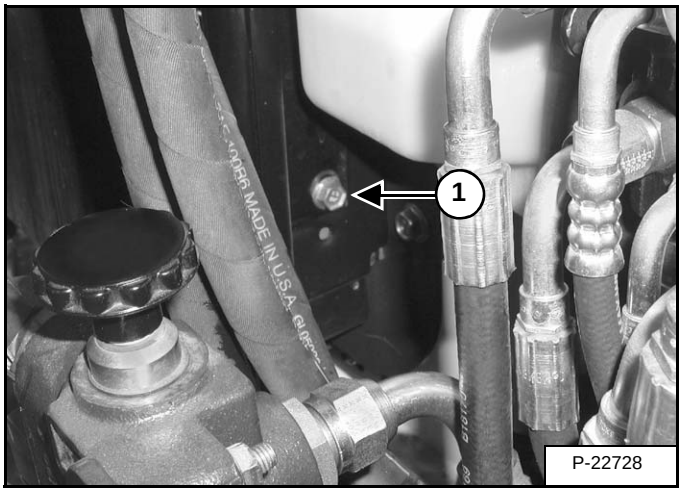
Figure 20-140-2



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.

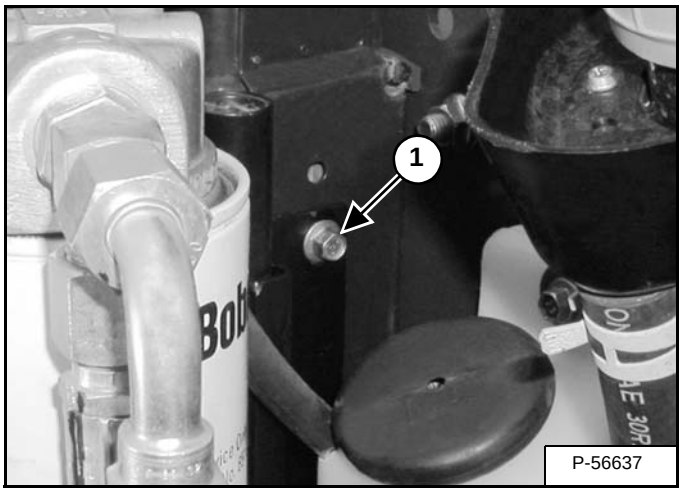
Figure 20-140-3



Remove the front bottom bolt (Item 1) **[Figure 20-140-3]**.

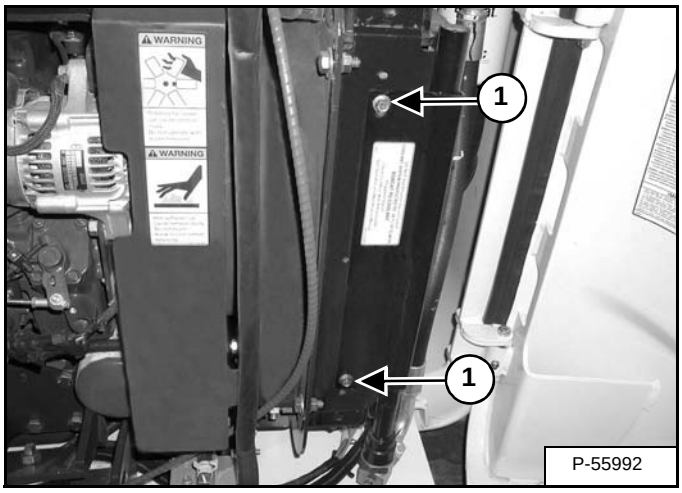
Removal And Installation (Cont'd)

Figure 20-140-4



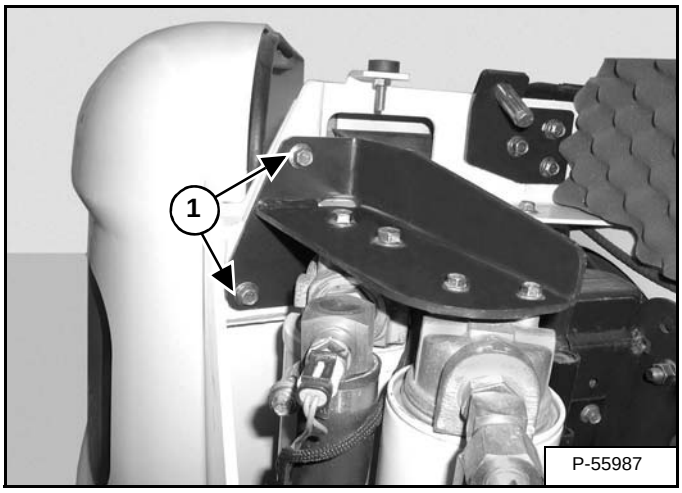
Remove the front top bolt (Item 1) **[Figure 20-140-4]**.

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.

DIRECT TO TANK VALVE

Removal And Installation

IMPORTANT

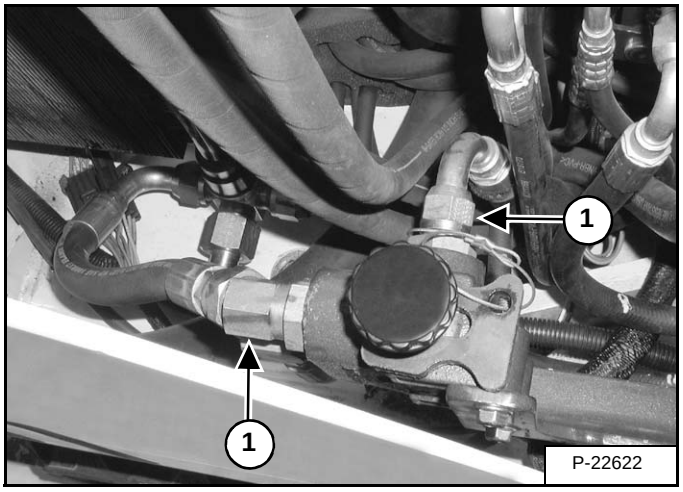
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

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

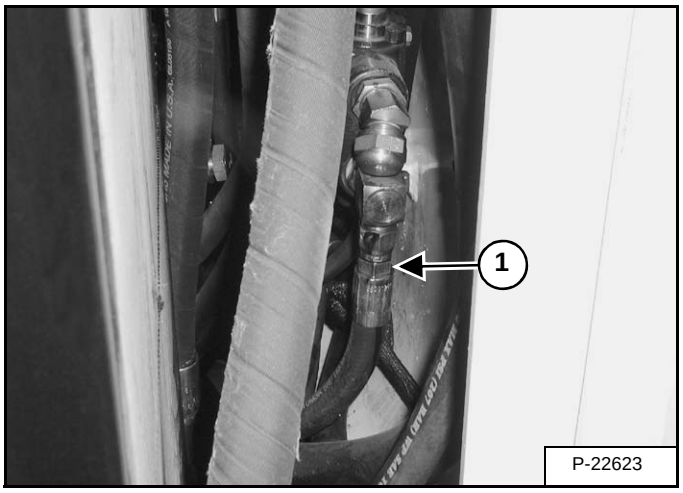
Open the right side cover.

Figure 20-150-1



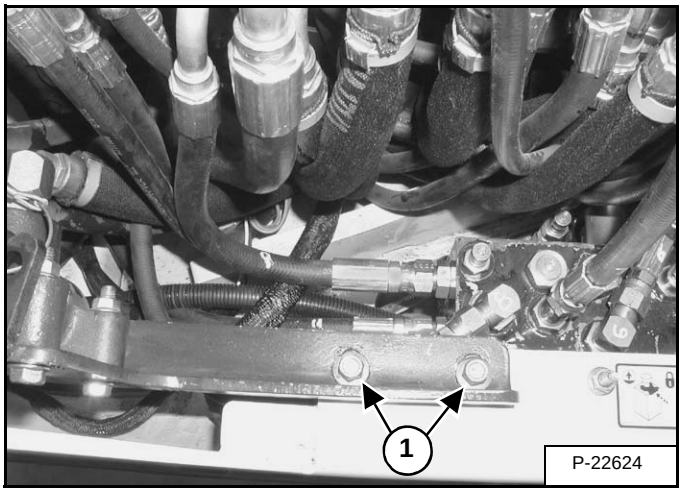
Remove the two hoses (Item 1) **[Figure 20-150-1]**.

Figure 20-150-2



Remove the lower hose (Item 1) **[Figure 20-150-2]**.

Figure 20-150-3



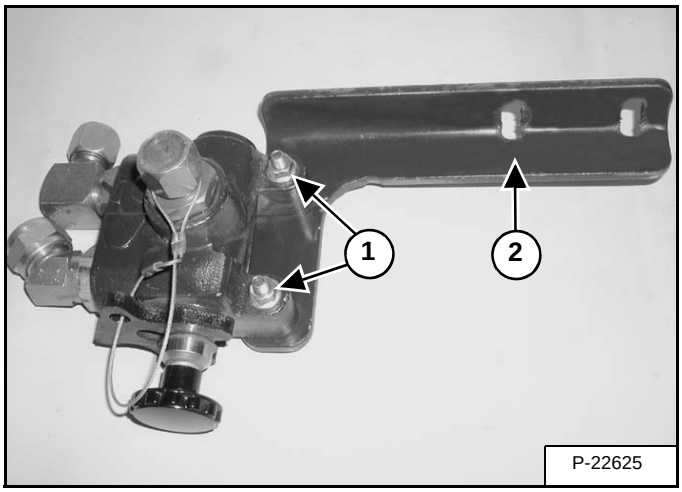
Remove the two mount bolts (Item 1) **[Figure 20-150-3]**.

Remove the valve.

DIRECT TO TANK VALVE (CONT'D)

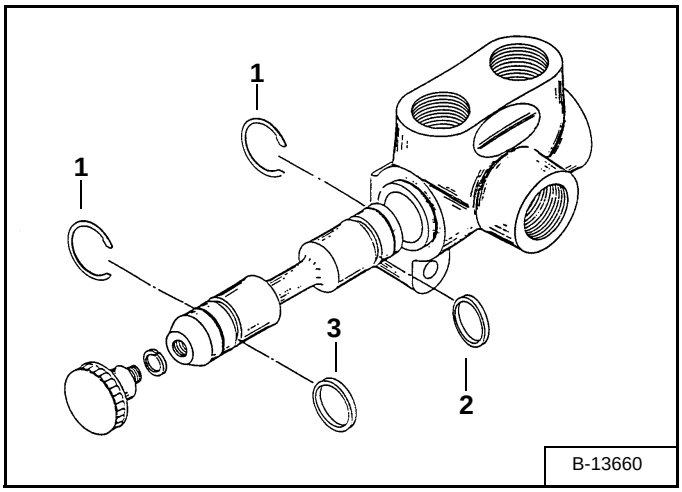
Disassembly And Assembly

Figure 20-150-4



Remove the two nuts and bolts (Item 1). Remove the mount (Item 2) **[Figure 20-150-4]** from the valve.

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.

BUILD UP VALVE

Description

The build up valve provides hydraulic pressure to charge the accumulator when the engine is at low idle.

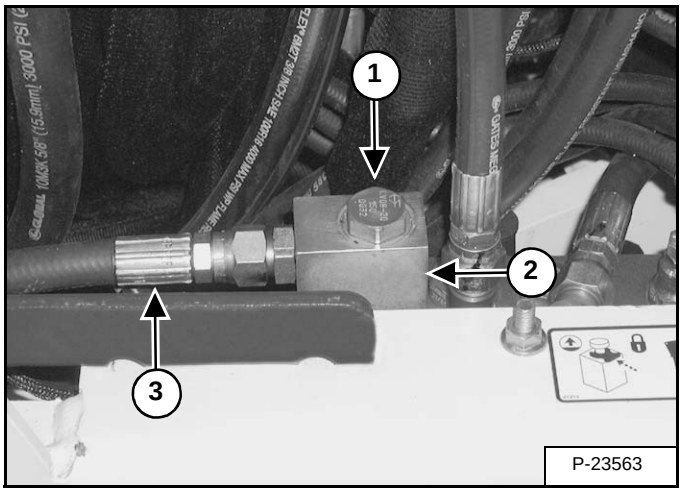
Removal And Installation

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, tubelines 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.

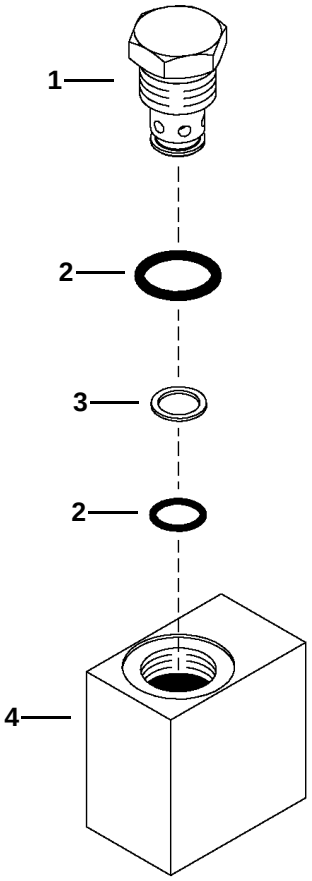
Loosen the manifold mount bolts and reposition the manifold for clearance.

Remove the valve body (Item 2) **[Figure 20-160-1]**.

BUILD UP VALVE (CONT'D)

Parts Identification

1. Valve
2. O-Ring
3. Back-Up Ring
4. Valve Body



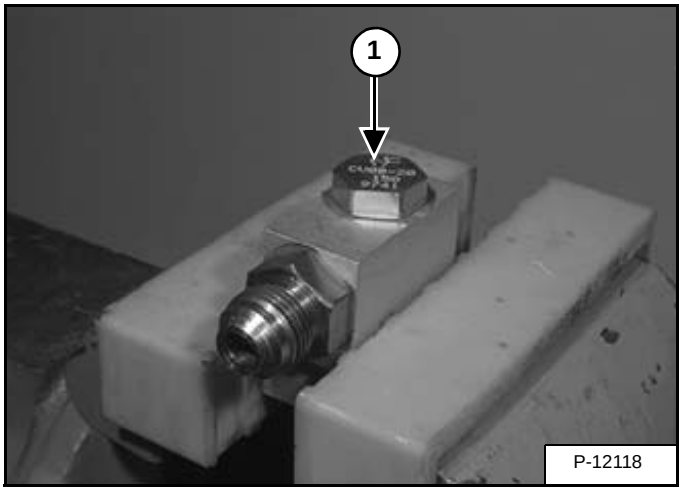
MS2135

BUILD UP VALVE (CONT'D)

Disassembly And Assembly

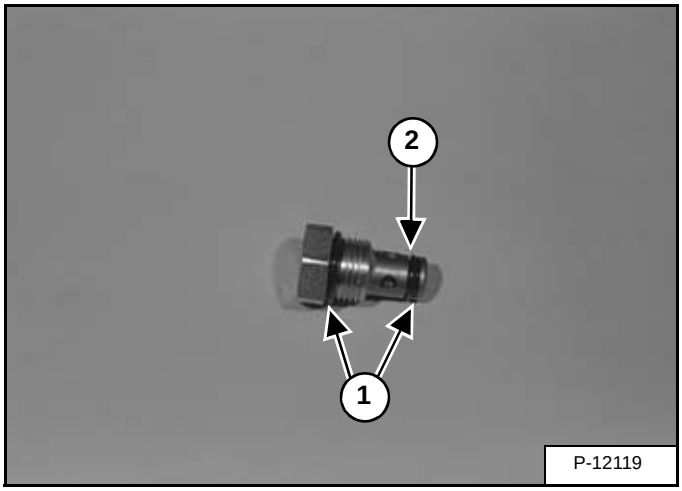
Clamp the valve in a vise with padded jaws.

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.


Bobcat®

CASE DRAIN FILTER

Removal And Installation

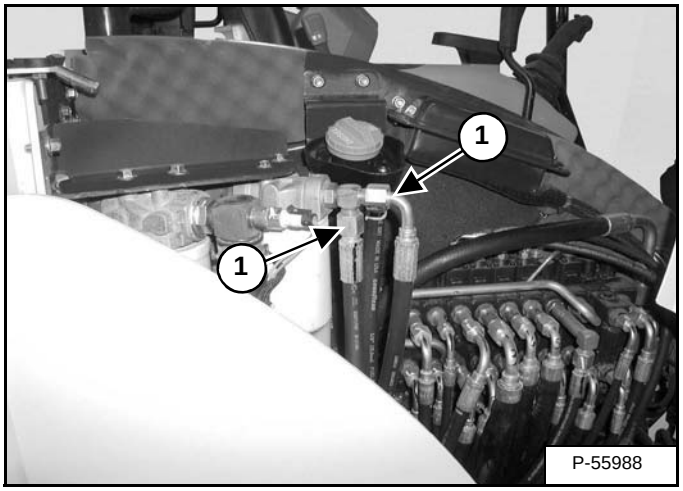
IMPORTANT

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

I-2003-0888

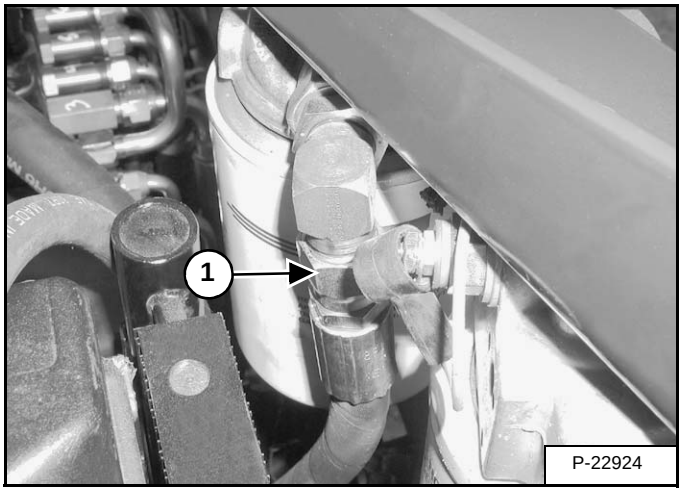
Open the right side cover.

Figure 20-170-1



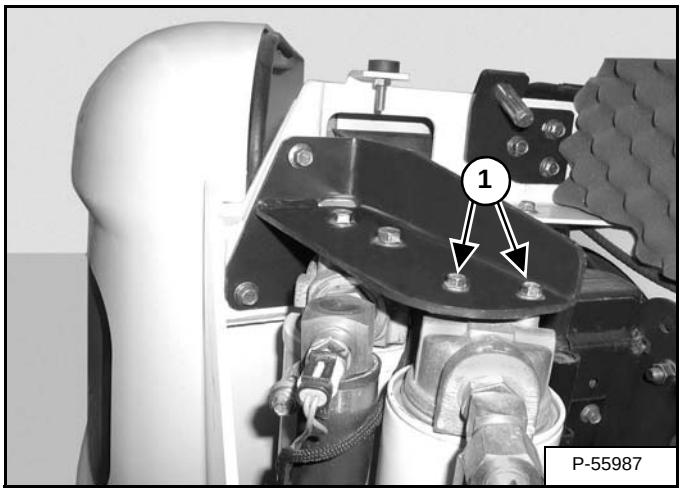
Remove the hoses (Item 1) **[Figure 20-170-1]**.

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 bolts (Item 1) **[Figure 20-170-3]**.

Remove the filter.


Bobcat®

SLEW LOCK VALVE

Description

The slew lock valve uses two pilot operated check valves to restrict hydraulic flow between the control valve and the slew motor.

When the joystick is moved to swing the upperstructure, hydraulic pressure opens the slew lock check valves and allows hydraulic flow to the swing motor to rotate the upperstructure. When the joystick is in neutral, the check valves close, restricting hydraulic flow to the swing motor.

Removal And Installation

Lower the boom / bucket and blade to the ground.

With the engine OFF, turn the key to the ON position and move the joysticks to relieve hydraulic pressure.

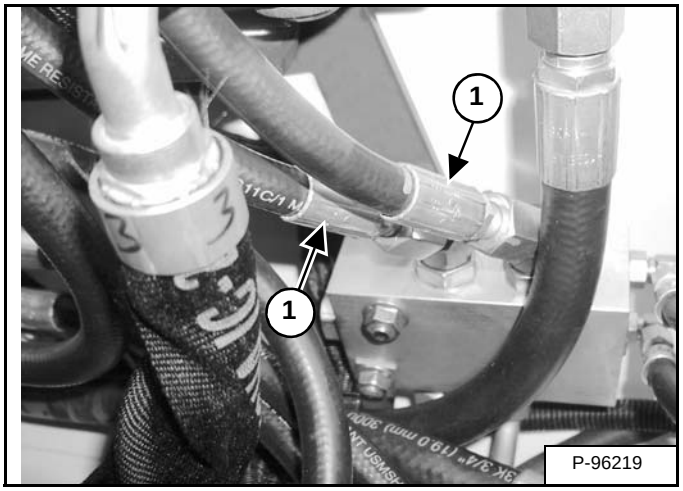
IMPORTANT

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

I-2003-0888

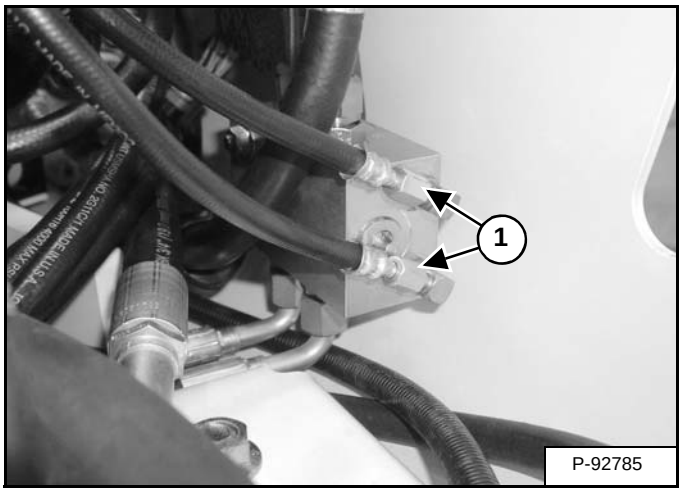
Mark all hoses for ease of assembly.

Figure 20-220-1



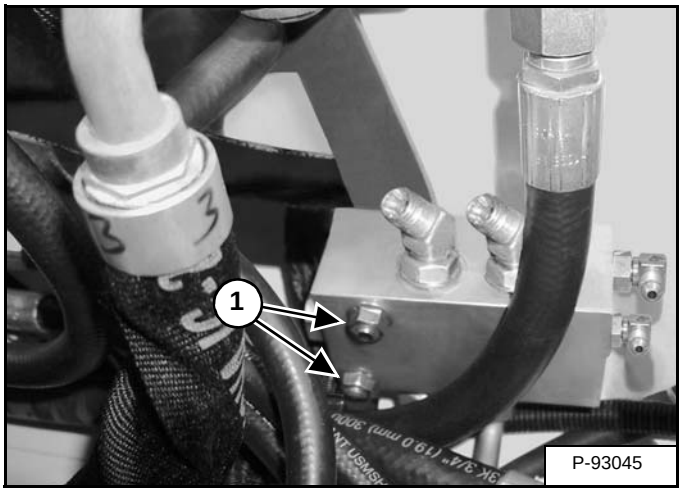
Remove the hoses (Item 1) **[Figure 20-220-1]**.

Figure 20-220-2



Remove the hoses (Item 1) **[Figure 20-220-2]**.

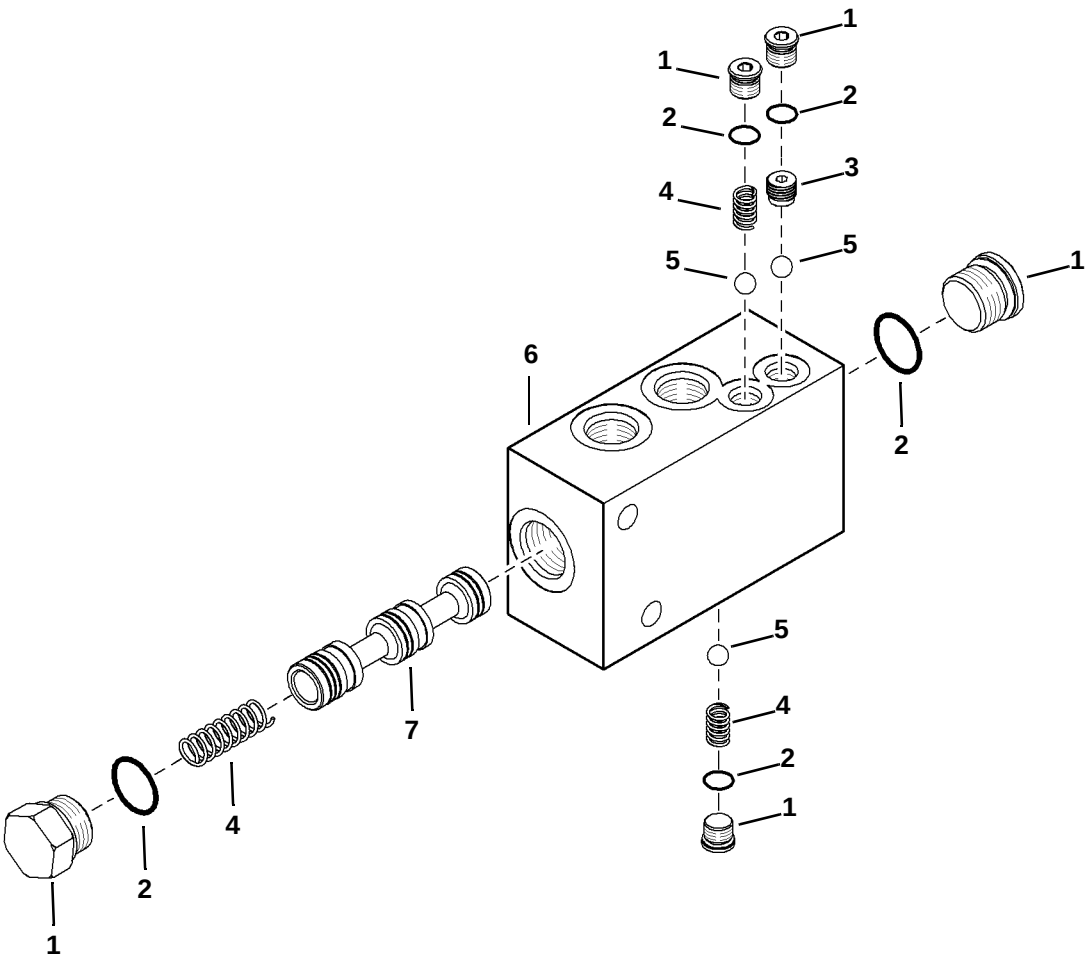
Figure 20-220-3



Remove the nuts (Item 1) **[Figure 20-220-3]**. Remove the valve.

Parts Identification

1. Plug
2. O-Ring
3. Seat
4. Spring
5. Ball
6. Valve
7. Spool



NA-1334S

Disassembly And Assembly

Clean all parts in solvent and dry with compressed air.

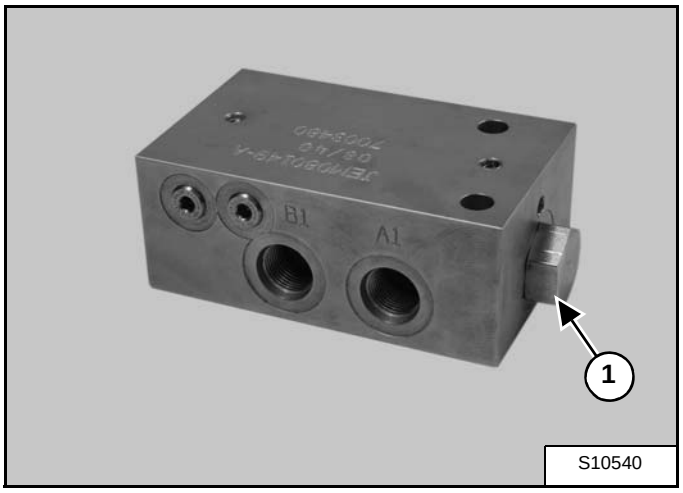
Inspect all parts for wear or damage. Replace any worn or damaged parts.

Always install new back-up rings and O-rings with clean hydraulic fluid before installation.

Mark the locations and orientation of the six fittings.

Remove the six fittings from the manifold.

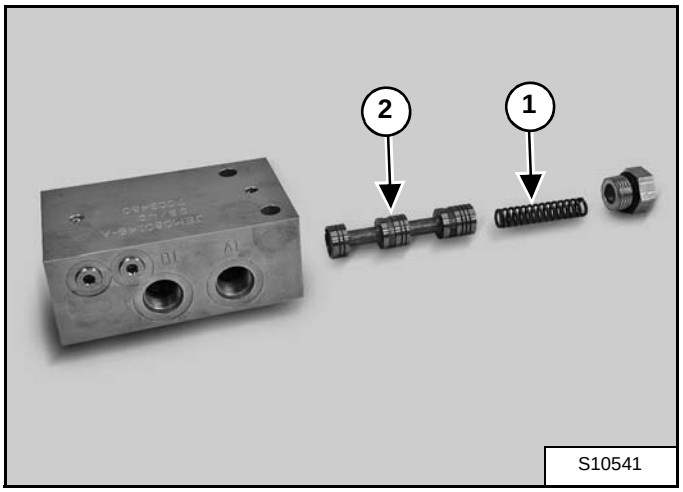
Figure 20-220-4



Remove the plug (Item 1) **[Figure 20-220-4]**.

Installation: Tighten the plug to 50 ft.-lb. (68 N•m) torque.

Figure 20-220-5



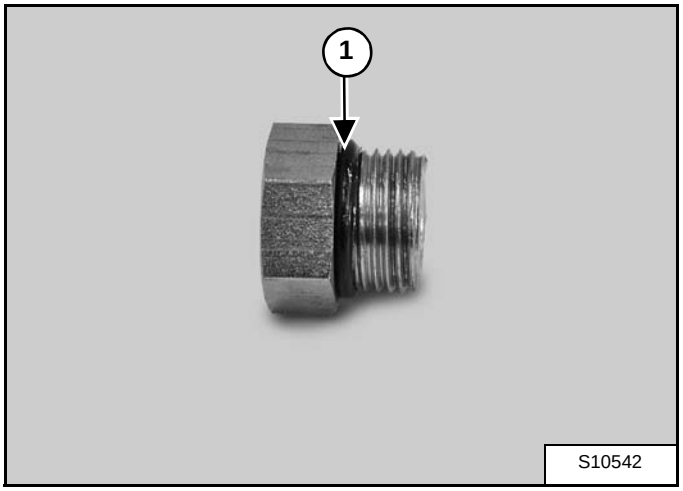
Remove the spring (Item 1) and spool (Item 2) **[Figure 20-220-5]**

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.

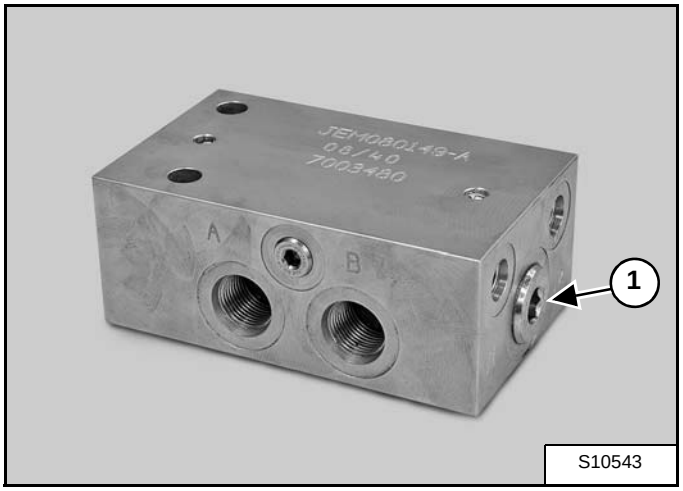
I-2003-0888

Figure 20-220-6



Remove the O-ring (Item 1) **[Figure 20-220-6]** from the plug.

Figure 20-220-7



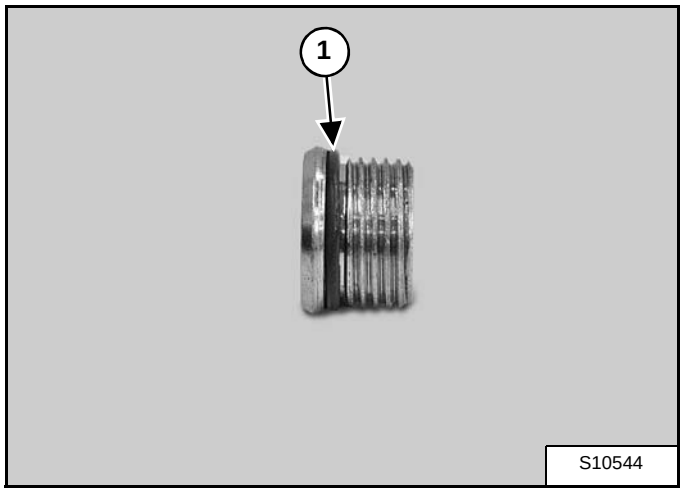
Remove the plug (Item 1) **[Figure 20-220-7]**.

Installation: Tighten the plug to 75 ft.-lb. (102 N•m) torque.

SLEW LOCK VALVE (CONT'D)

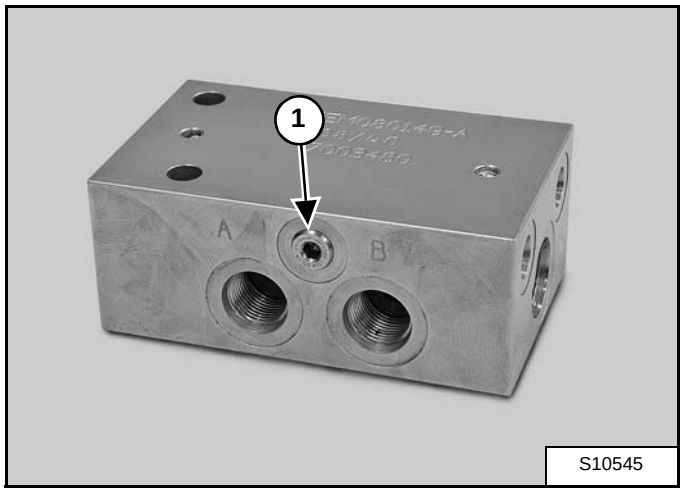
Disassembly And Assembly (Cont'd)

Figure 20-220-8



Remove the O-ring (Item 1) **[Figure 20-220-8]** from the plug.

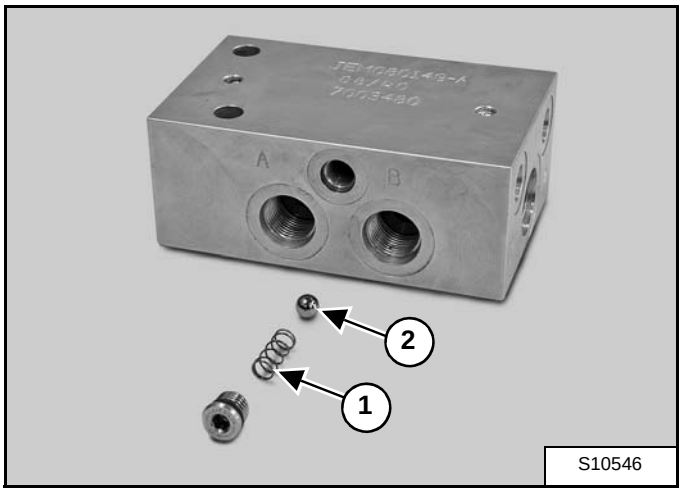
Figure 20-220-9



Remove the plug (Item 1) **[Figure 20-220-9]**.

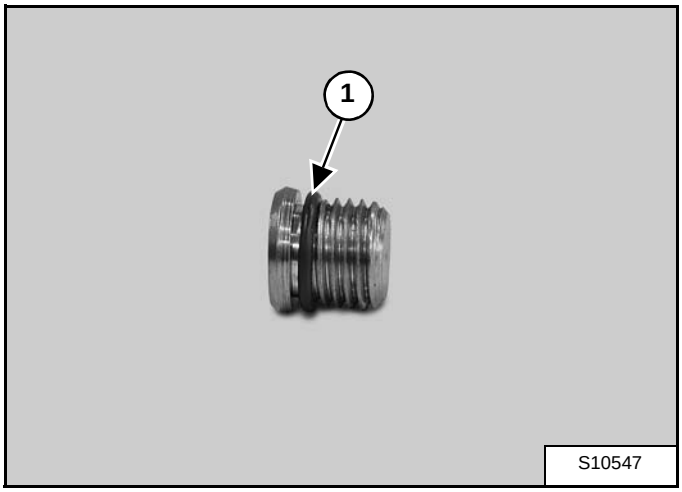
Installation: Tighten the plug to 20 ft.-lb. (27 N•m) torque.

Figure 20-220-10



Remove the spring (Item 1) and ball (Item 2) **[Figure 20-220-10]**.

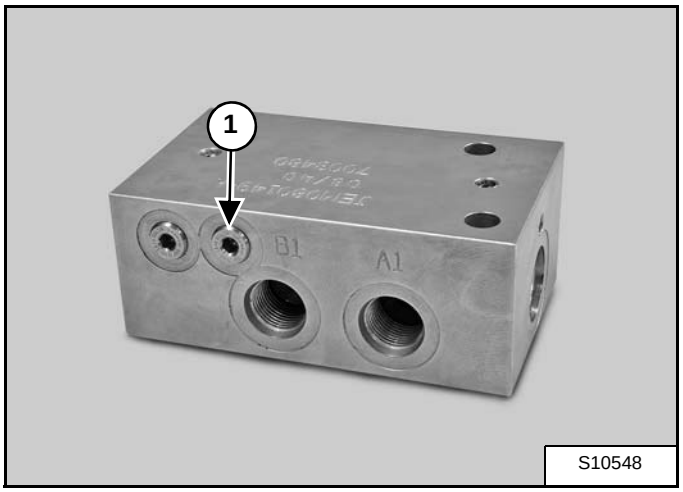
Figure 20-220-11



Remove the O-ring (Item 1) **[Figure 20-220-11]** from the plug.

Disassembly And Assembly (Cont'd)

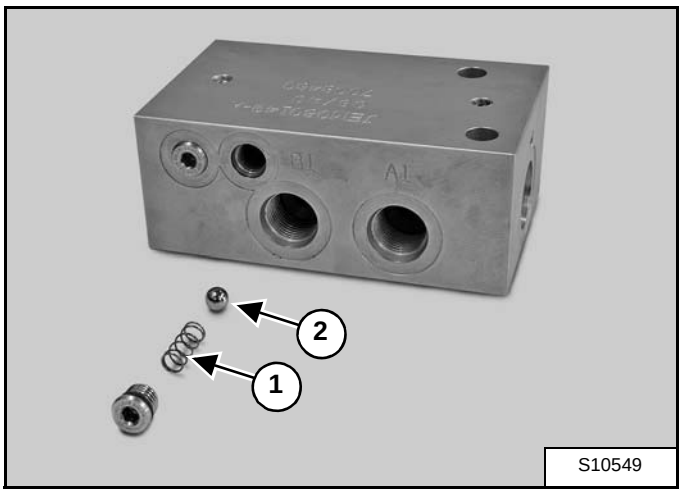
Figure 20-220-12



Remove the plug (Item 1) **[Figure 20-220-12]**.

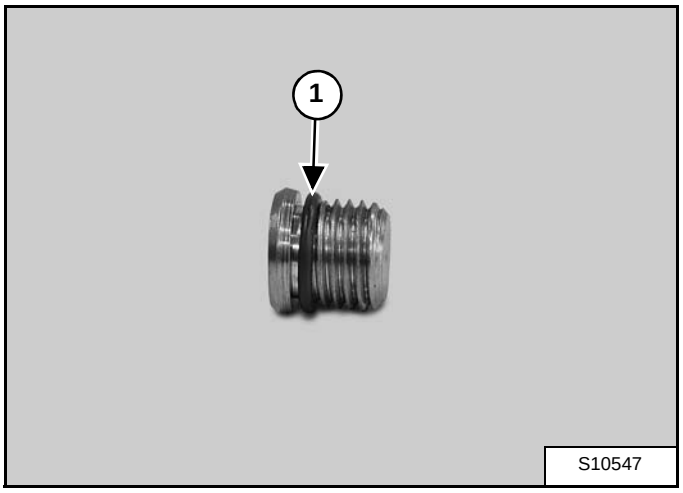
Installation: Tighten the plug to 20 ft.-lb. (27 N•m) torque.

Figure 20-220-13



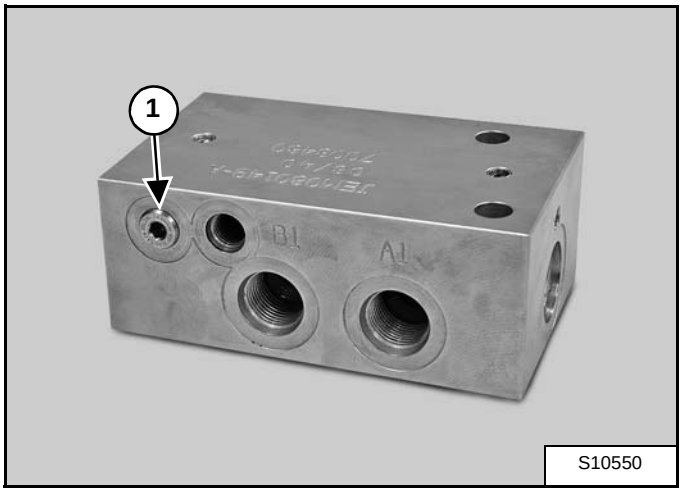
Remove the spring (Item 1) and ball (Item 2) **[Figure 20-220-13]**.

Figure 20-220-14



Remove the O-ring (Item 1) **[Figure 20-220-14]** from the plug.

Figure 20-220-15

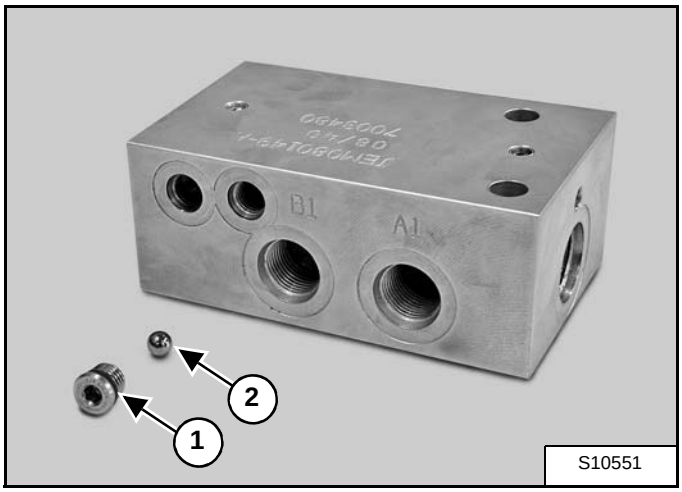


Remove the plug (Item 1) **[Figure 20-220-15]**.

Installation: Tighten the plug to 20 ft.-lb. (27 N•m) torque.

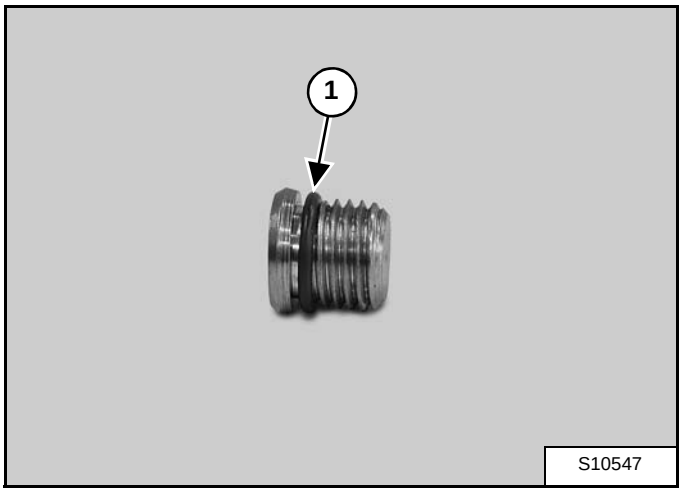
Disassembly And Assembly (Cont'd)

Figure 20-220-16



Remove the shuttle seat (Item 1) and ball (Item 2) **[Figure 20-220-16]**.

Figure 20-220-17



Remove the O-ring (Item 1) **[Figure 20-220-17]** from the plug.

UNDERCARRIAGE

BLADE. 30-10-1
Removal And Installation 30-10-1

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Swing Bearing Installation 30-70-2
Swing Bearing Removal. 30-70-1

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Abrasion Of The Track Roller Side 30-40-9
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TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION SPEC-01) UNLESS OTHERWISE SPECIFIED.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE AND STANDARD ITEMS MAY VARY.


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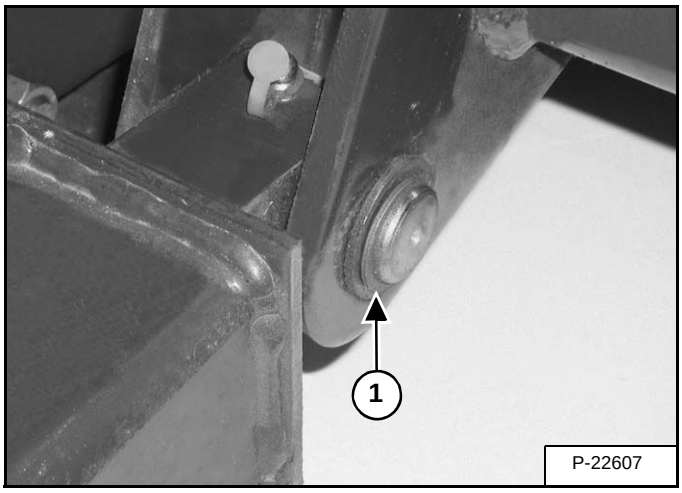
BLADE

Removal And Installation

Lower the blade and bucket to the ground.

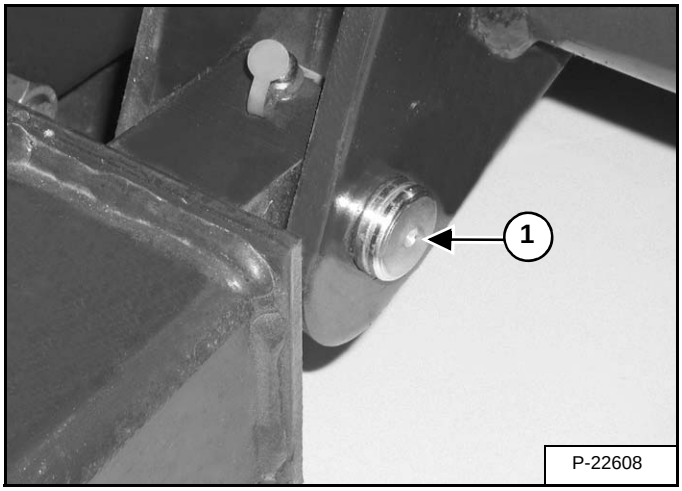
Remove the blade cylinder. (See Removal And Installation on Page 20-24-3.)

Figure 30-10-1



Remove the snap ring (Item 1) **[Figure 30-10-1]** and washer from the blade arm pivot 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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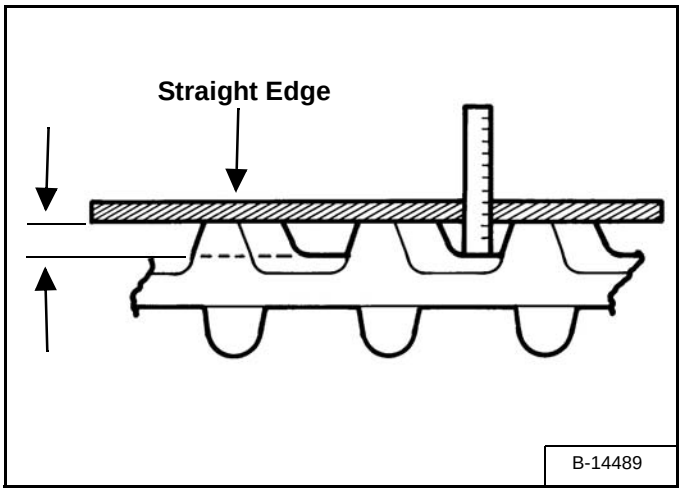
TRACKS

Track Lug Height

Rubber Track

The lug height of a new rubber track (Bridgestone or Spencer) is 0.984 in. (25,0 mm).

Figure 30-20-1



To find the percentage of wear on an excavator track, measure the height of the lug by placing a straight edge across the top of three lugs and measure the distance from the base of the track to the bottom of the straight edge **[Figure 30-20-1]**.

Divide this measurement by the new track height and multiply by 100. This will give the percentage of track lug left.

Example: lug height 0.787 in. (20,0 mm)

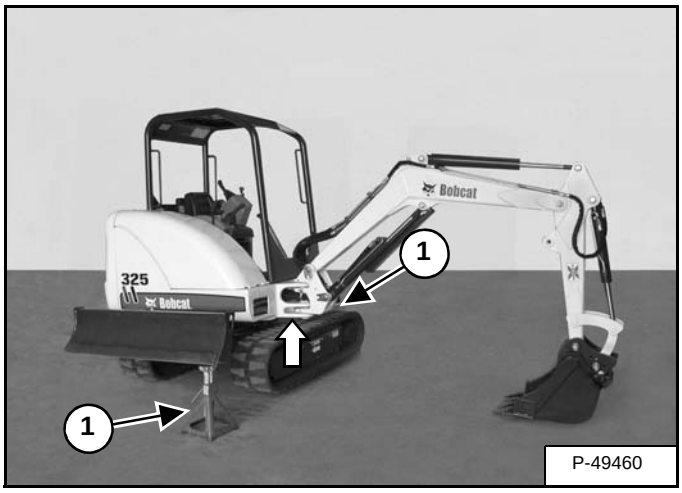
$$\frac{0.787}{0.984} \times 100 = 80$$

80% of the track lug is remaining with 20% wear on the track lugs.

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 4 in. [102 mm]) 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]**. Raise the boom until all machine weight is on the jackstands.

Stop the engine.

⚠ WARNING

AVOID INJURY

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

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TRACKS (CONT'D)

Adjustment (Cont'd)

Rubber Track Clearance

Figure 30-20-3

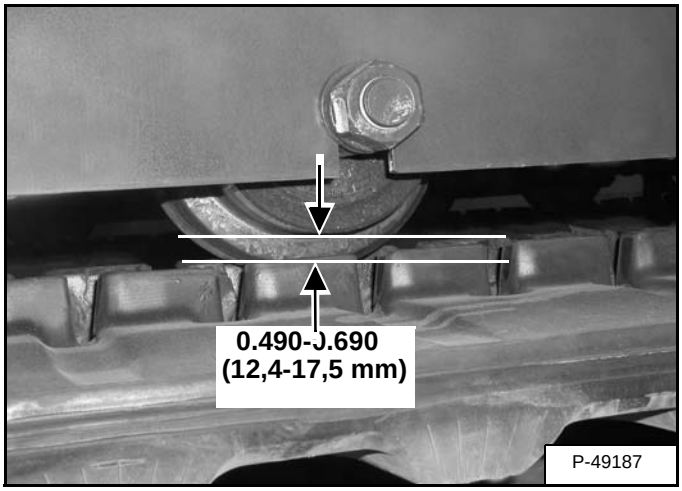
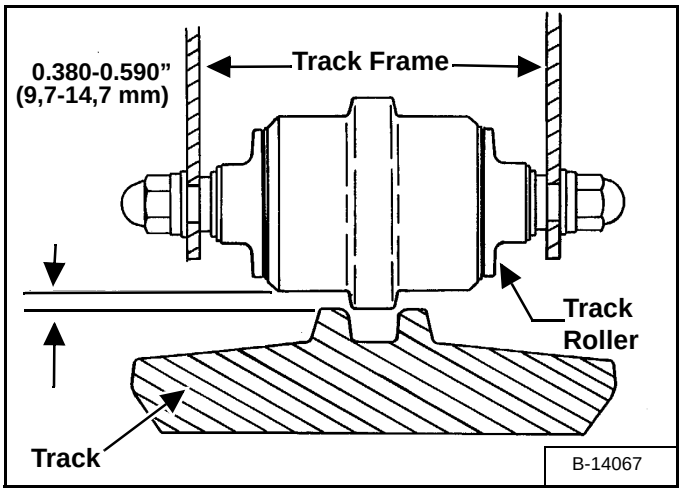


Figure 30-20-4



Measure the clearance 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	0.380 - 0.590 in. (9,7 - 14,7 mm)

Steel Track Clearance

Figure 30-20-5

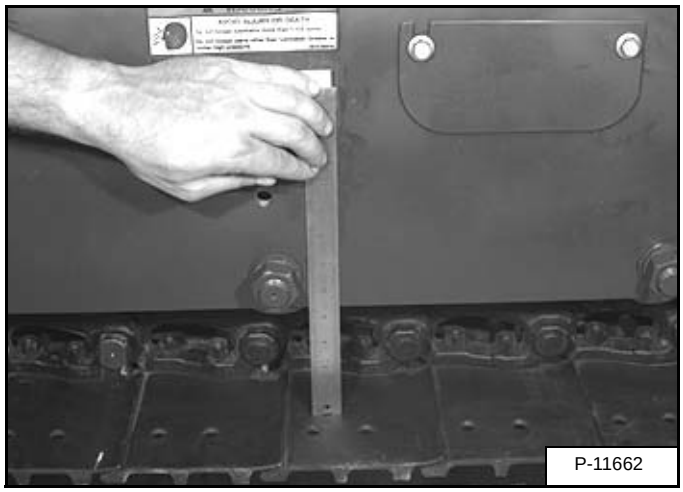
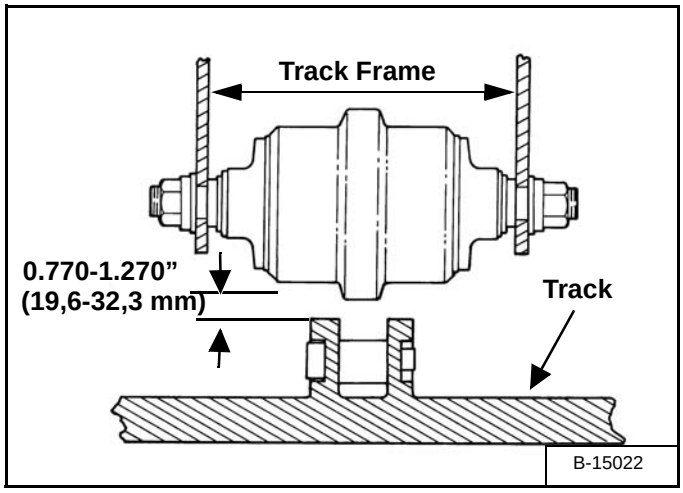


Figure 30-20-6

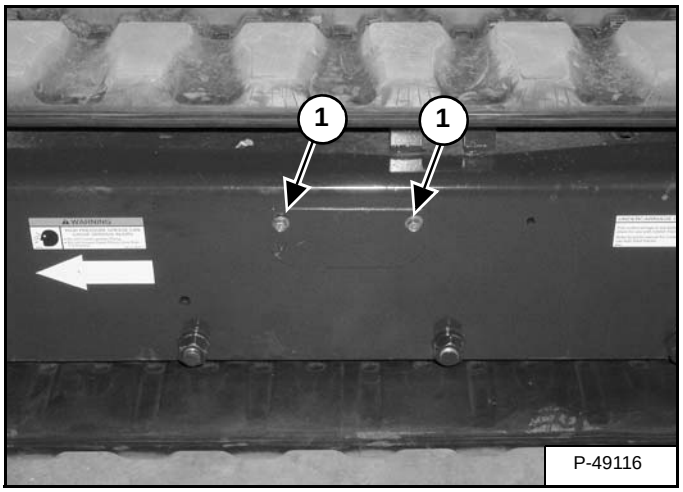


Measure the steel track clearance at the center of the track, between the contact surface of the roller and the contact surface of the track **[Figure 30-20-5]** & **[Figure 30-20-6]**. Do Not get fingers into pinch points between the track and the track roller.

Steel Track Clearance	0.770 - 1.270 in. (19,6 - 32,3 mm)

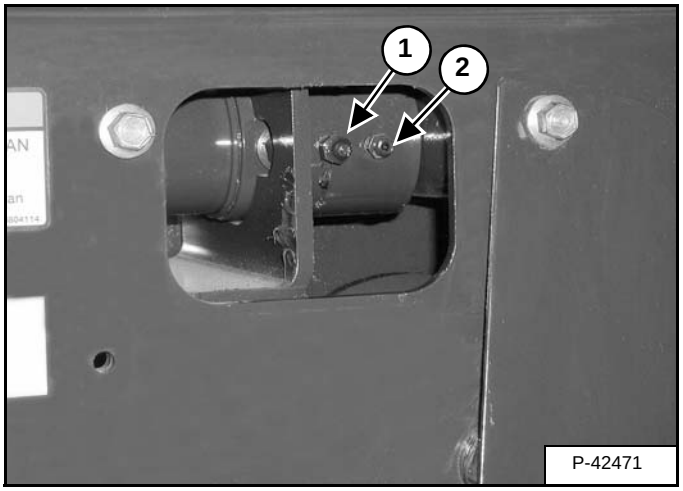
Adjustment (Cont'd)

Figure 30-20-7



If the track tension is not correct loosen the two bolts on the cover (Item 1) **[Figure 30-20-7]**. Pivot the cover downward.

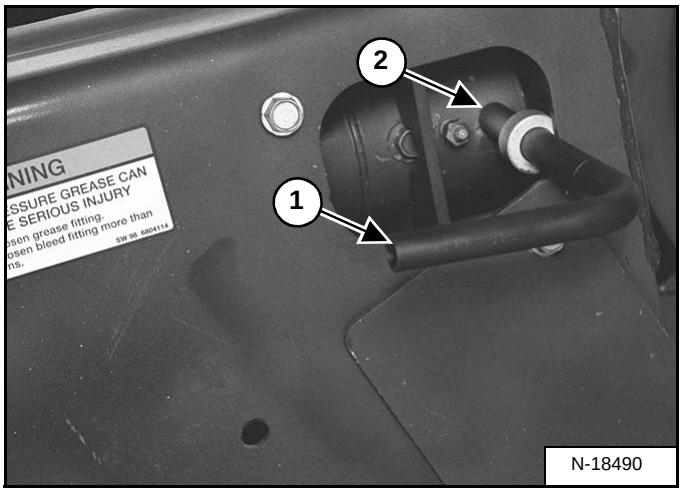
Figure 30-20-8



Add grease to the fitting (Item 1) **[Figure 30-20-8]** until the track tension is correct.



Figure 30-20-9



Use tool MEl1560 (Item 1) to loosen the bleed fitting (Item 2) **[Figure 30-20-9]** to release tension from the track.

NOTE: Do not loosen the grease fitting (Item 1) [Figure 30-20-8].

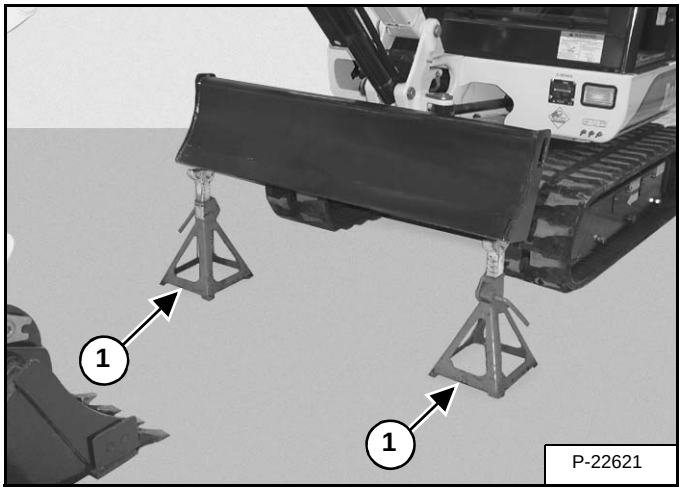
Repeat the procedure for the other side.

Rubber Track Removal And Installation

Lift and block both sides of the machine as follows:

Raise the blade fully.

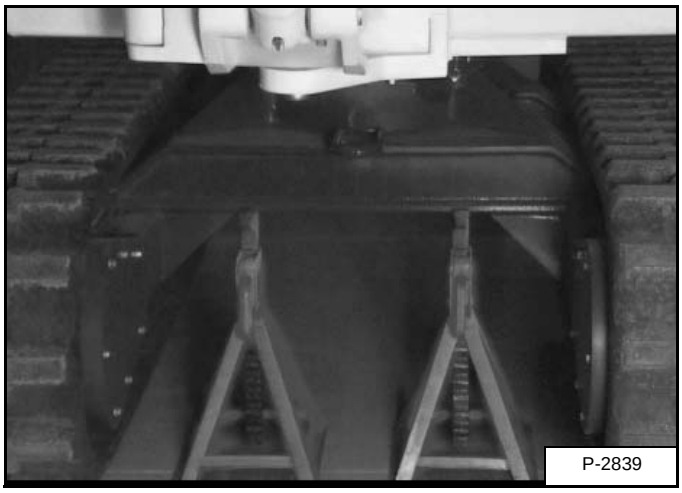
Figure 30-20-10



Use the boom and arm to lift the blade end of the machine up about 3.0 in. (75 mm) and install jackstands (Item 1) **[Figure 30-20-10]** under the blade.

Raise the boom.

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]**.

Raise the boom until the weight of the machine is supported by the jackstands.

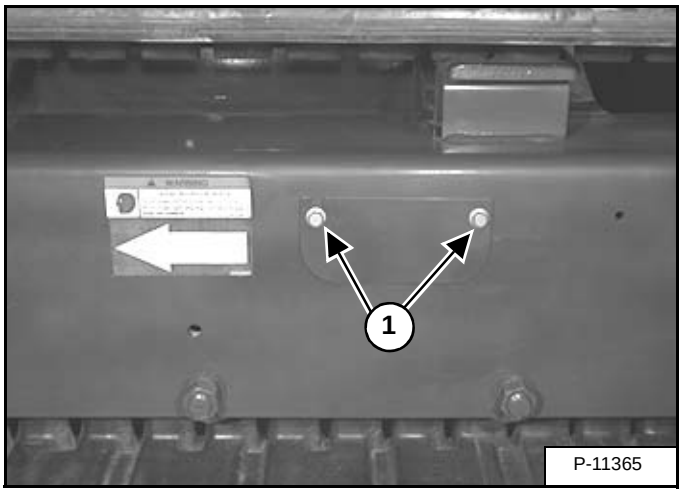
⚠ WARNING

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

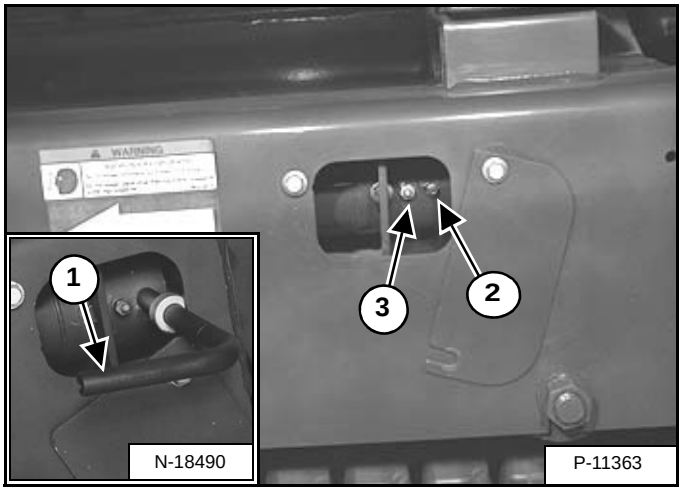
Stop the engine.

Figure 30-20-12



Loosen the two bolts (Item 1) **[Figure 30-20-12]** on the cover. Pivot the cover downwards.

Figure 30-20-13



Use tool MEL1560 (Item 1) to loosen the bleed fitting (Item 2) **[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 3) [Figure 30-20-13].

Rubber Track Removal And Installation (Cont'd)

Start the engine.

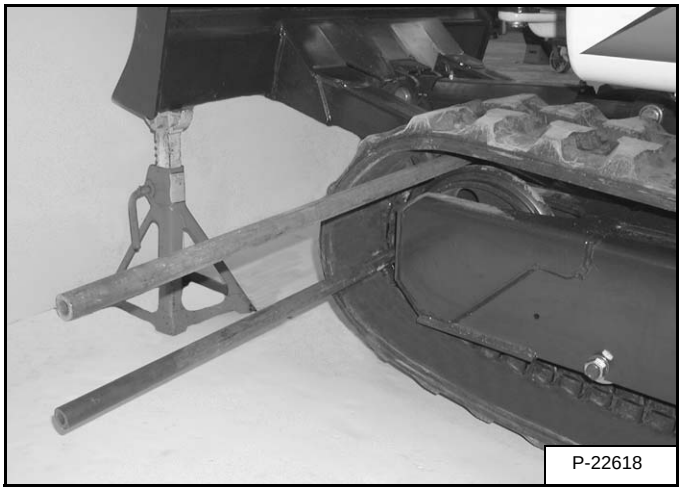
Slowly turn the track in the forward direction.

Figure 30-20-14



Insert a steel rod or pipe (Approximately 1.250 in. [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 for adding grease to the grease spring and for checking track tension (See Adjustment on Page 30-20-1.)

Steel Track Removal And Installation

With the excavator raised and the bleed fitting loosened, start the excavator (See Adjustment on Page 30-20-1.). Slowly turn the track. This will force more grease out of the grease spring.

Stop the engine.

⚠ WARNING

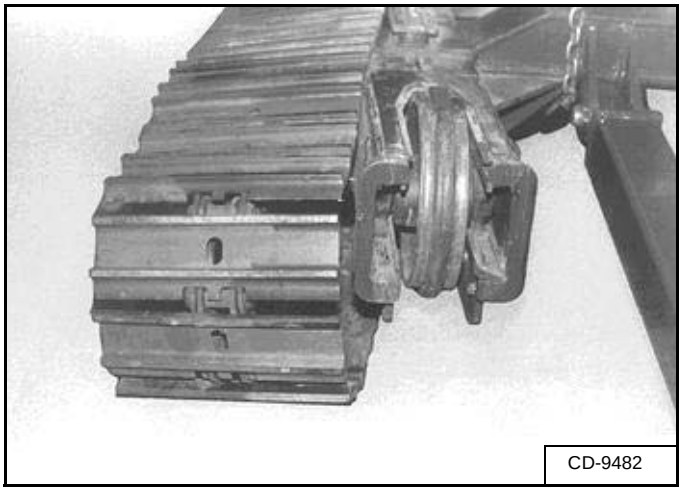
AVOID INJURY OR DEATH

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

W-2173-0195

The track can be removed either as a complete assembly or by removing a connecting pin and separating the track.

Figure 30-20-17



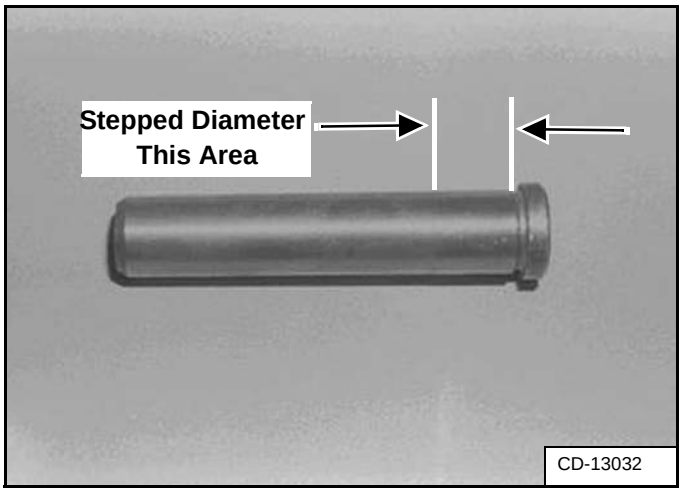
To remove the track as a compete assembly, install a pry bar between the track and the front idler wheel and pry out on the track **[Figure 30-20-17]**.

Installation: Put the track over the drive sprocket lugs. Then position the front of the track over the front idler wheel.

See Adjustment for adding grease to the grease spring and for checking track tension (See Adjustment on Page 30-20-1.)

To remove the track by removing a connecting pin:

Figure 30-20-18



There is no master link or master connecting pin with this track. The connecting pins have a stepped diameter **[Figure 30-20-18]**. The smaller diameter is a slip fit into the track connecting links and the larger diameter is a press fit.

To remove a connecting pin, hold a heavy steel block on the connecting link near the pin being removed. Use a hammer and a punch to drive out the connecting pin.

⚠ WARNING

AVOID INJURY OR DEATH

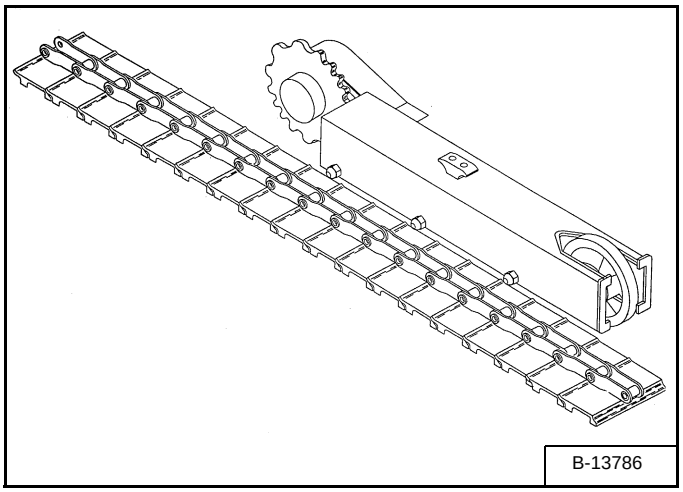
Wear safety glasses to prevent eye injury when any of the following conditions exist:

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

W-2019-0907

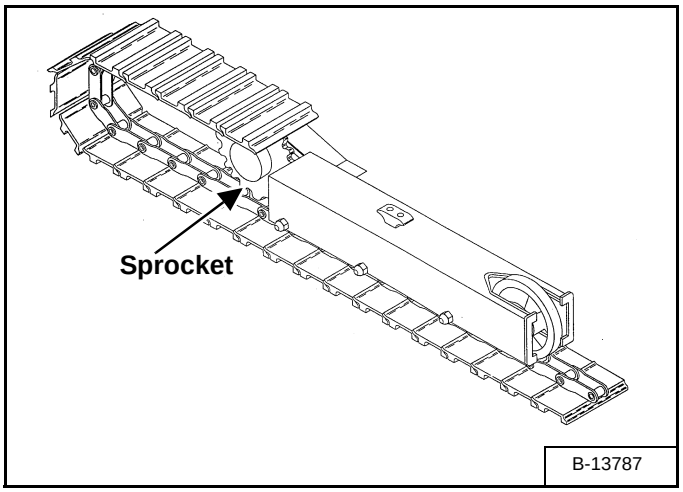
Steel Track Removal And Installation (Cont'd)

Figure 30-20-19



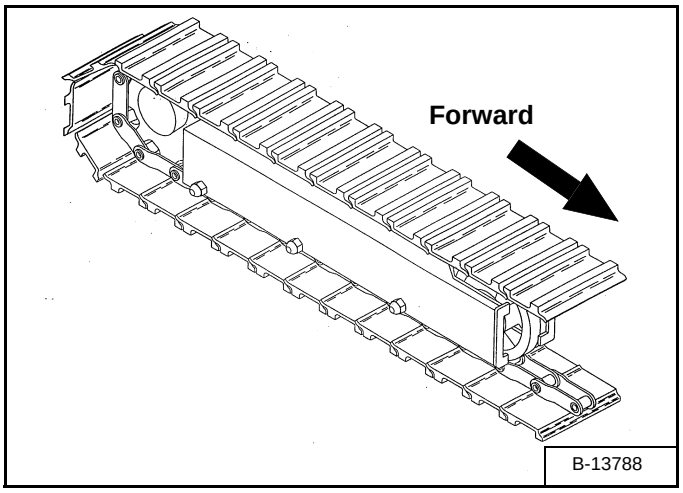
Installation: Put the steel track under the track frame so the front end of the track extends approximately three links in front of the idler wheel **[Figure 30-20-19]**.

Figure 30-20-20



Pull the opposite end of the track up and forward and position the end links of the steel track onto the sprocket **[Figure 30-20-20]**.

Figure 30-20-21



With the help of a second person, start the excavator. Make sure that the slew lock 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

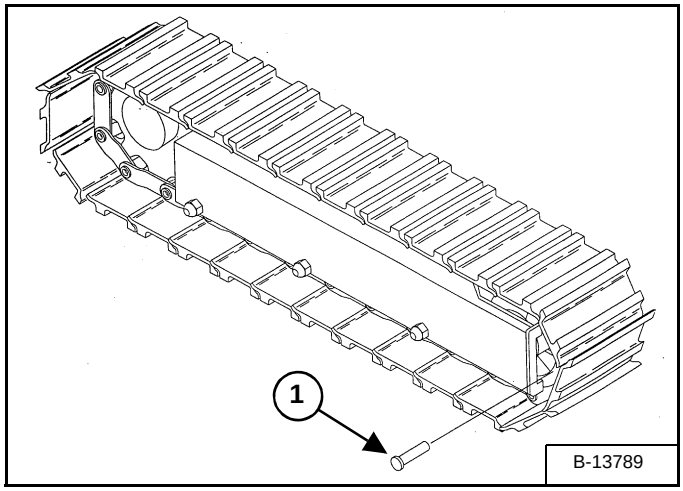
Drive motor must be operated slowly to avoid any sudden movements that could cause injury or death.

W-2174-0195

Steel Track Removal And Installation (Cont'd)

Position the two ends of the track together and use a drift pin to hold the links together.

Figure 30-20-22



Insert the connecting link pin (Item 1) **[Figure 30-20-22]** into the track link hole. Tap the end of the pin until the press fit diameter contacts the connecting link hole.

Hold a heavy steel block on the back side of the track connecting link and use a hammer to drive the connecting link pin into the track link until the head of the pin is flush with the track link.

See Adjustment for adding grease to the grease spring and for checking track tension (See Adjustment on Page 30-20-1.)

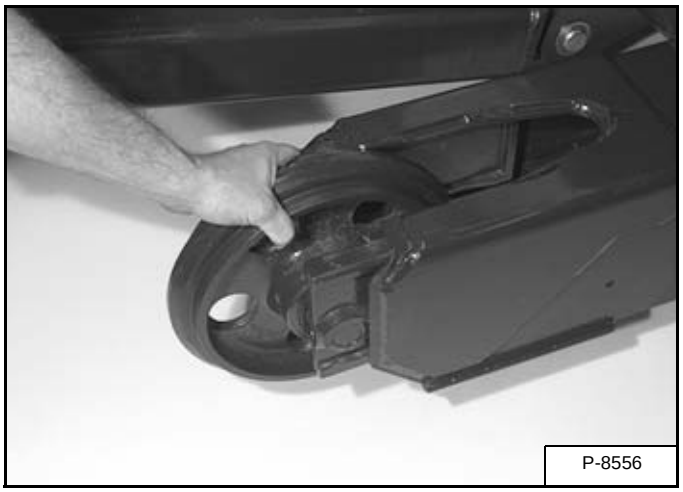
TRACK FRAME

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 See 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]**.

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY (Item 1) **[Figure 30-30-2]**.

⚠ WARNING



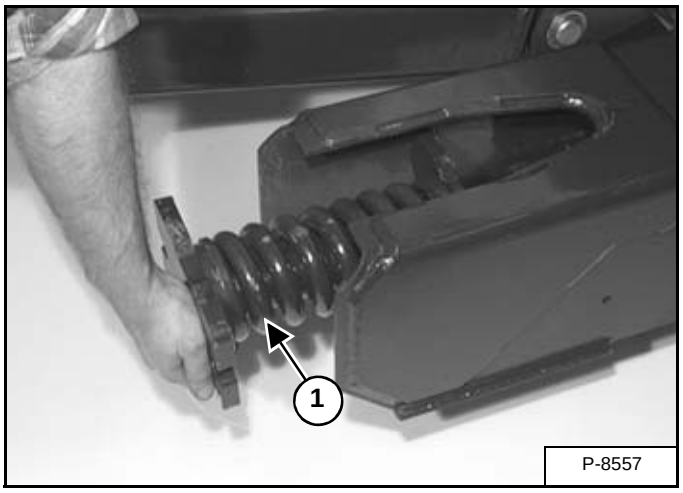
P-62574

AVOID INJURY OR DEATH

- **Spring loaded components under pressure can cause serious injury or death.**
- **Do not disassemble the coil spring assembly.**

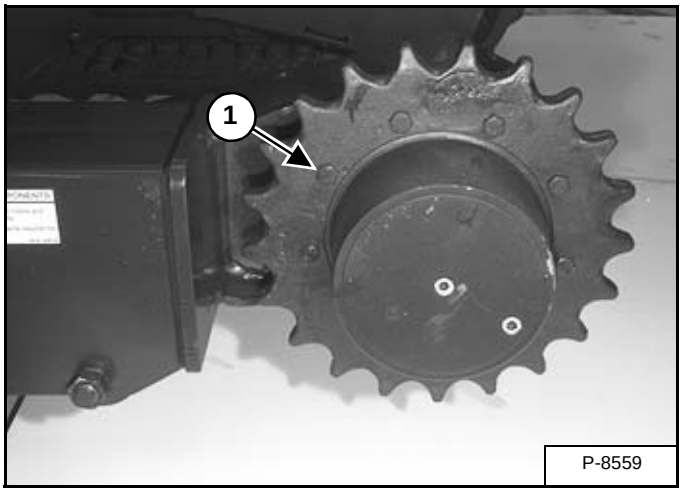
W-2617-1004

Figure 30-30-2



Remove the recoil spring (Item 1) **[Figure 30-30-2]**.

Figure 30-30-3



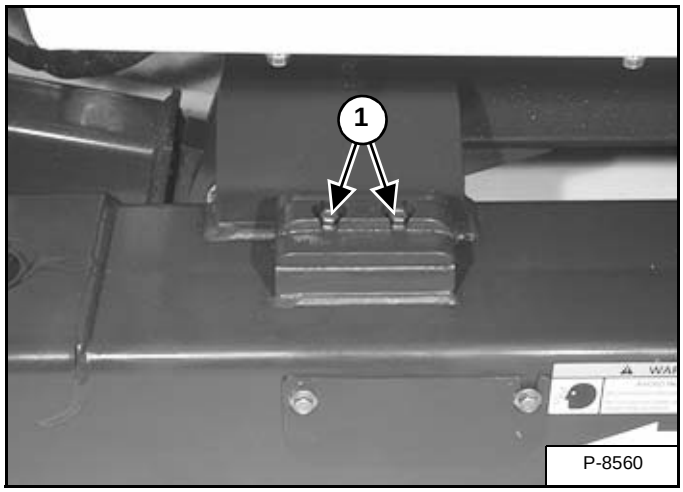
Remove the drive sprocket bolts (Item 1) **[Figure 30-30-3]**.

Installation: Put thread lock adhesive (Loctite® 242) on the bolts. Tighten the bolts to 80 ft.-lb. (108 N•m) torque.

Remove the drive sprocket from the travel motor.

Disassembly And Assembly (Cont'd)

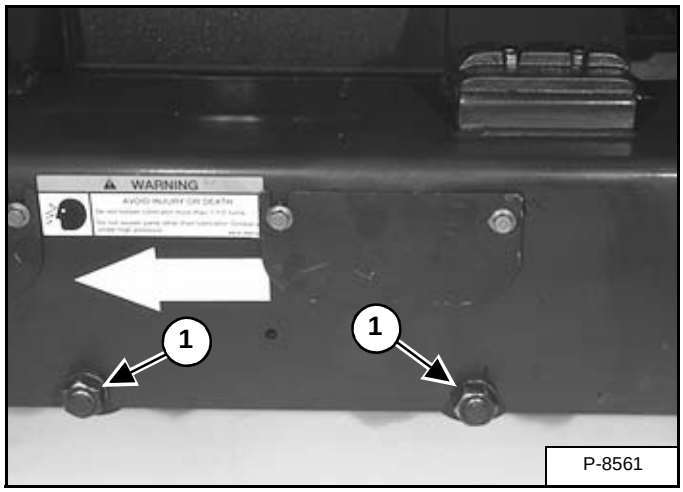
Figure 30-30-4



Remove the guide block bolts (Item 1) **[Figure 30-30-4]**.

Remove the guide block.

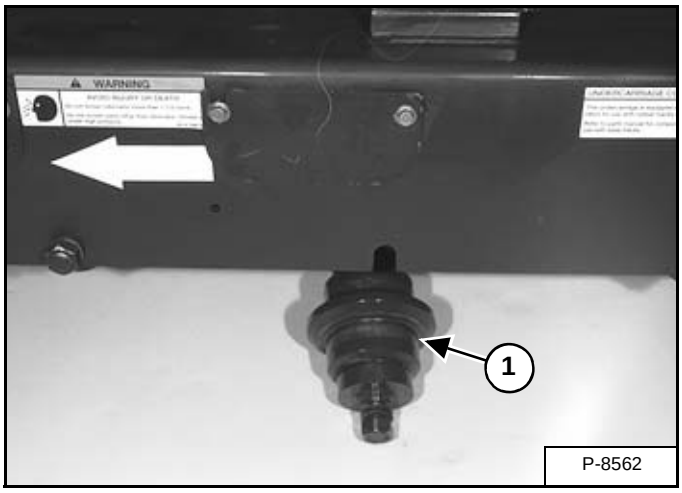
Figure 30-30-5



Loosen the nuts (Item 1) **[Figure 30-30-5]** on the track roller on both sides of the track frame.

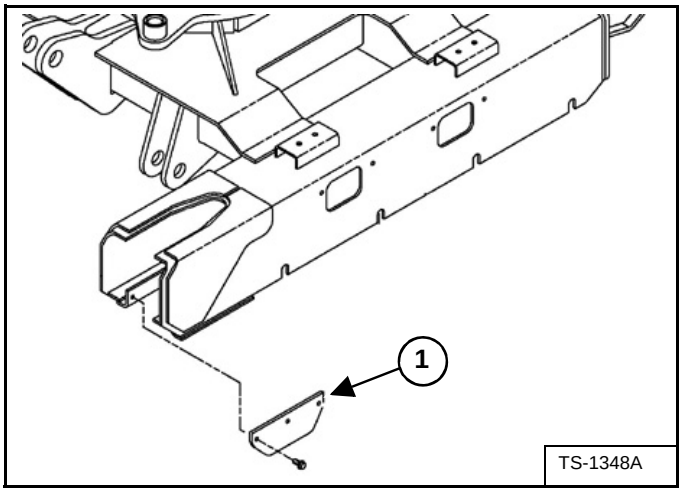
Installation: Tighten the nuts to 125 - 140 ft.-lb. (170 - 190 N•m) torque.

Figure 30-30-6



Remove the track roller (Item 1) **[Figure 30-30-6]**.

Figure 30-30-7



Remove the four guide plates (two per side) (Item 1) **[Figure 30-30-7]** from the track frame (steel tracks only).

Recoil Spring Cylinder Disassembly And Assembly (S/N AAC511315 & Below, A9KO11108 & Below And A9K111109 & Below)

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY (Item 2) **[Figure 30-30-8]**.

⚠ WARNING



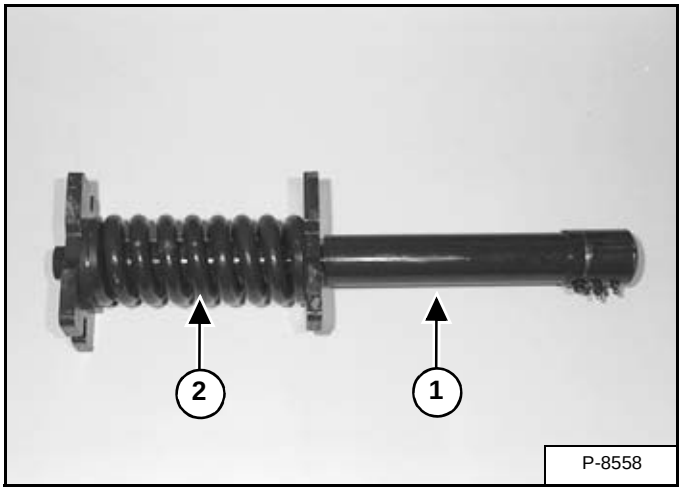
P-62574

AVOID INJURY OR DEATH

- **Spring loaded components under pressure can cause serious injury or death.**
- **Do not disassemble the coil spring assembly.**

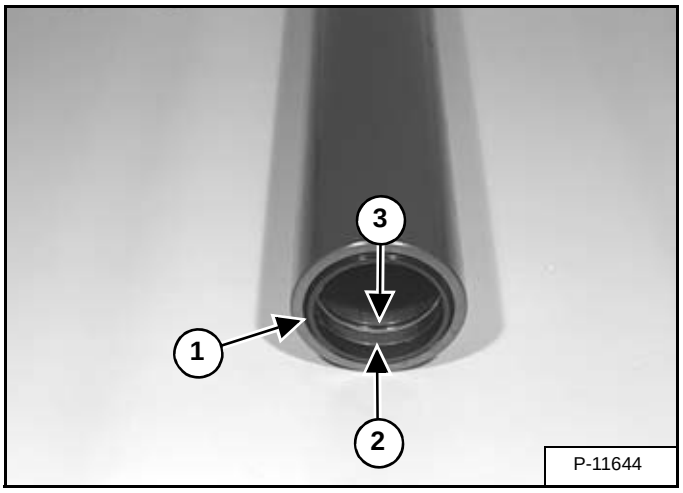
W-2617-1004

Figure 30-30-8



Remove the cylinder (Item 1) **[Figure 30-30-8]** from the shaft.

Figure 30-30-9

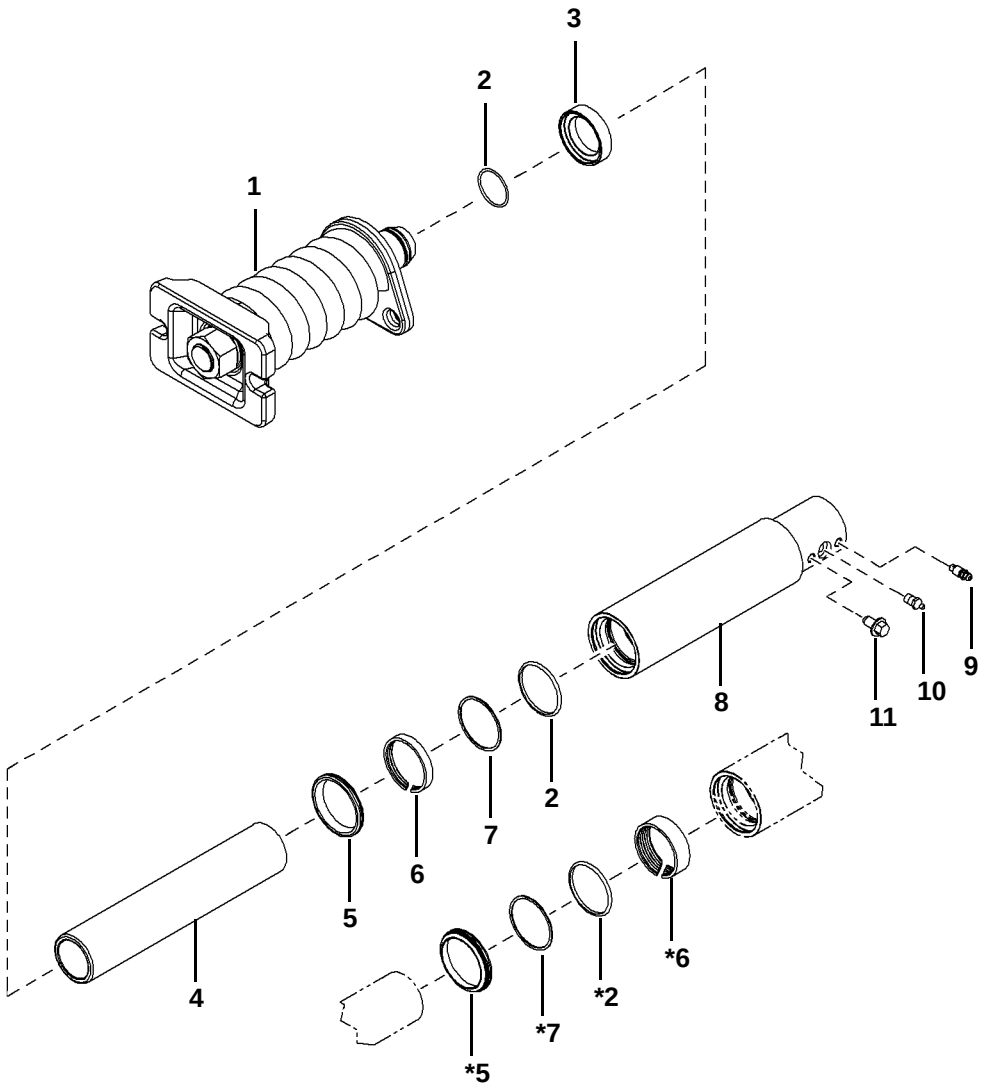


Remove the seal (Item 1) back-up ring (Item 2) and O-ring (Item 3) **[Figure 30-30-9]** from the cylinder.

Installation: Apply oil to the O-ring, back-up ring and seal before installation.

Recoil Spring Cylinder Parts Identification (S/N AAC511316 & Above, A9K011109 & Above And A9K111110 & Above)

1. Coil Spring Assembly
2. O-Ring
3. Spacer (Steel Track Only)
4. Shaft
5. Wiper Seal
6. Wear Ring
7. Back-up Ring
8. Tube
9. Bleed Fitting
10. Grease Fitting
11. Bolt



*** Early Models**

PE-3895S

Recoil Spring Cylinder Disassembly And Assembly (S/N AAC511316 & Above, A9K011109 & Above And A9K111110 & Above)

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY (Item 2) **[Figure 30-30-10]**.

⚠ WARNING



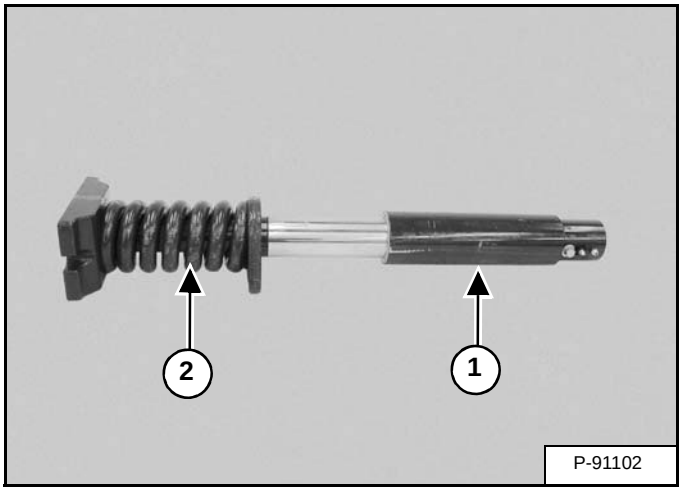
P-62574

AVOID INJURY OR DEATH

- **Spring loaded components under pressure can cause serious injury or death.**
- **Do not disassemble the coil spring assembly.**

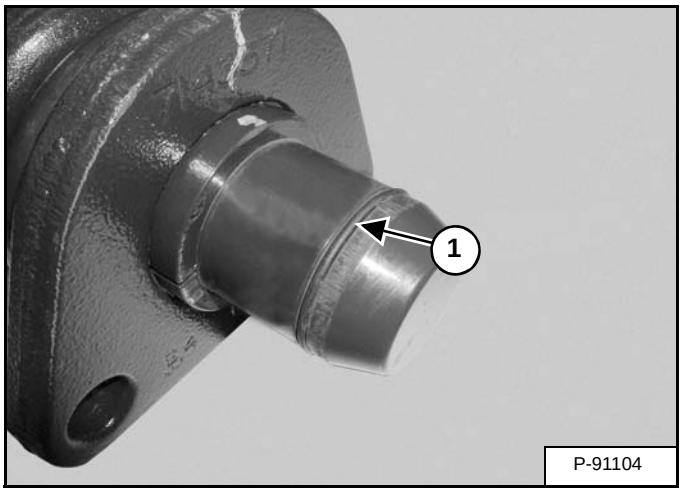
W-2617-1004

Figure 30-30-10



Remove the cylinder (Item 1) from the coil spring assembly (Item 2) **[Figure 30-30-10]**.

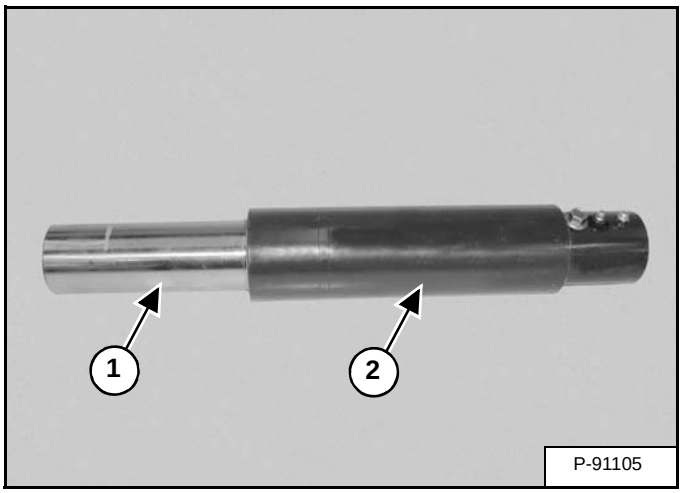
Figure 30-30-11



Remove the O-ring (Item 1) **[Figure 30-30-11]**.

Installation: Apply oil to the O-ring before installation.

Figure 30-30-12

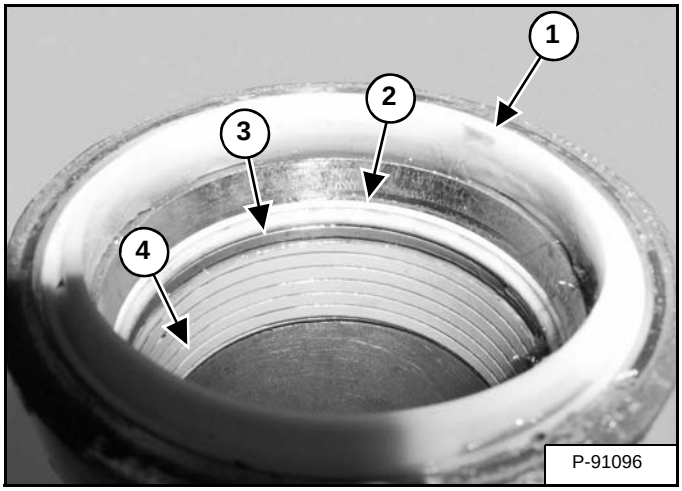


Remove the shaft (Item 1) from the tube (Item 2) **[Figure 30-30-12]**.

Recoil Spring Cylinder Disassembly And Assembly (S/N AAC511316 & Above, A9K011109 & Above And A9K111110 & Above) (Cont'd)

Early Models

Figure 30-30-13

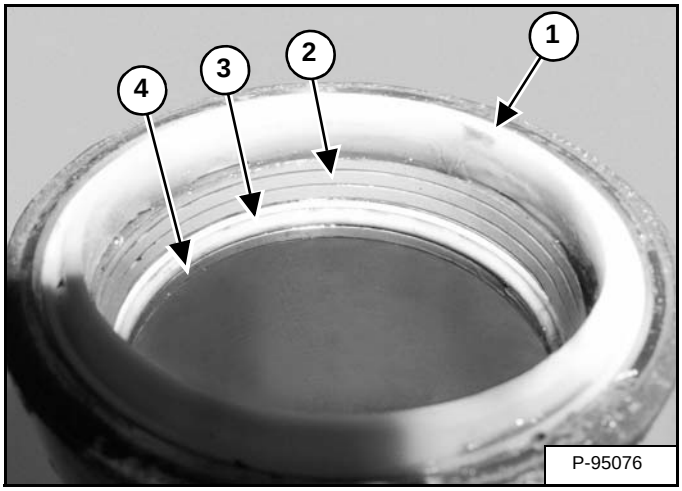


Remove the wiper seal (Item 1), back-up ring (Item 2) and O-ring (Item 3) and wear ring (Item 4) **[Figure 30-30-13]**.

Installation: Apply oil to the O-ring, back-up ring, and seal before installation.

Later Models

Figure 30-30-14



Remove the wiper seal (Item 1), wear ring (Item 2), back-up ring (Item 3) and O- ring (Item 4) **[Figure 30-30-14]**.

Installation: Apply oil to the O-ring, back-up ring, and seal before installation.

TRACK DAMAGE IDENTIFICATION

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

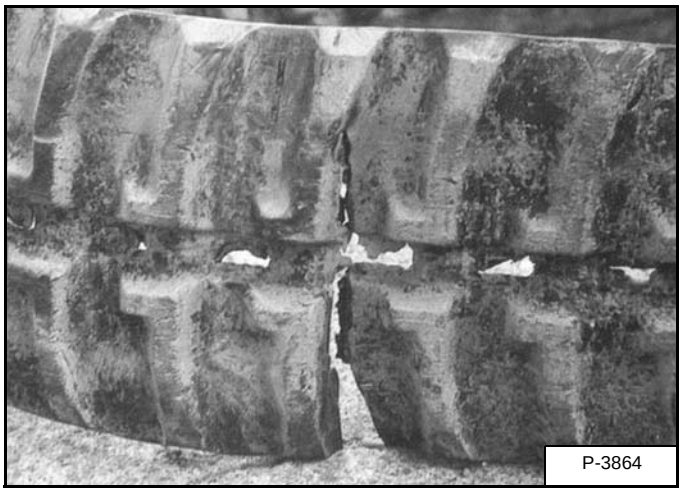
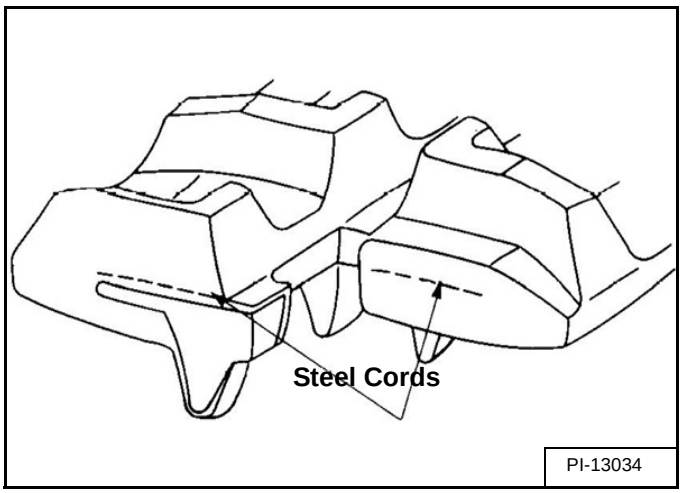


Figure 30-40-2



Damage:

Embedded steel cords are cut off **[Figure 30-40-1]** & **[Figure 30-40-2]**.

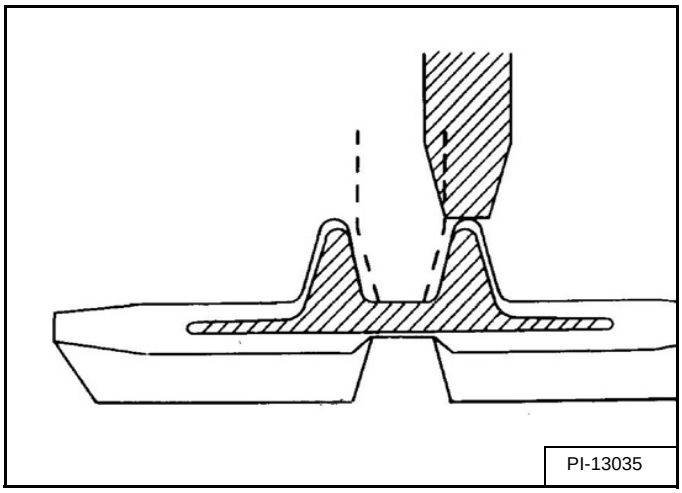
Replacement:

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.

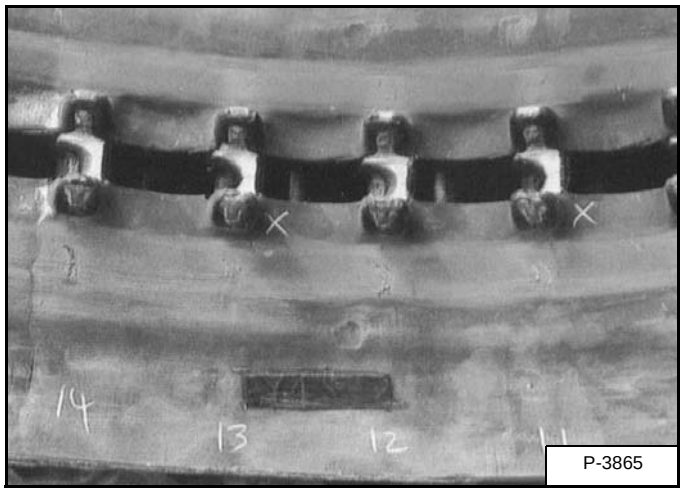
Drive carefully to avoid having stones and other articles clog the rubber tracks.

Driving over sharp objects should be avoided. If this is impossible, do not make turns while driving over sharp objects.

TRACK DAMAGE IDENTIFICATION (CONT'D)

Abrasion Of Embedded Metals

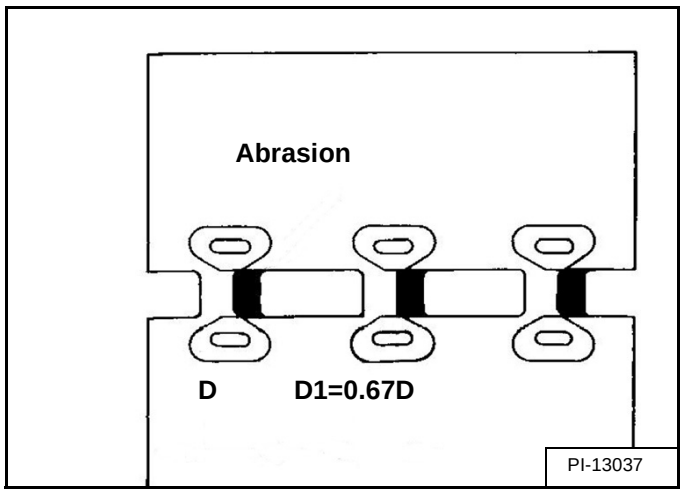
Figure 30-40-4



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.

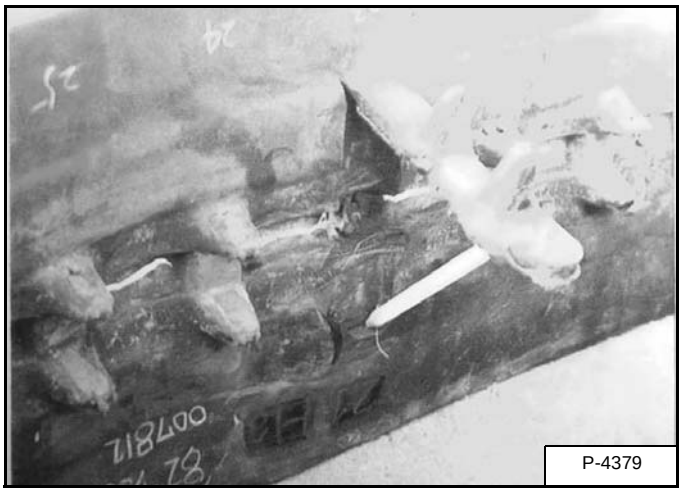
Rubber tracks are used on sandy fields.

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.

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]**.

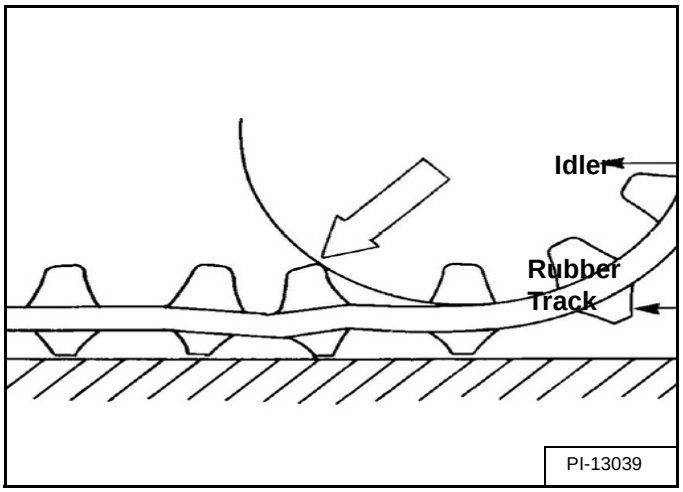
Replacement:

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

Causes Of The Damage:

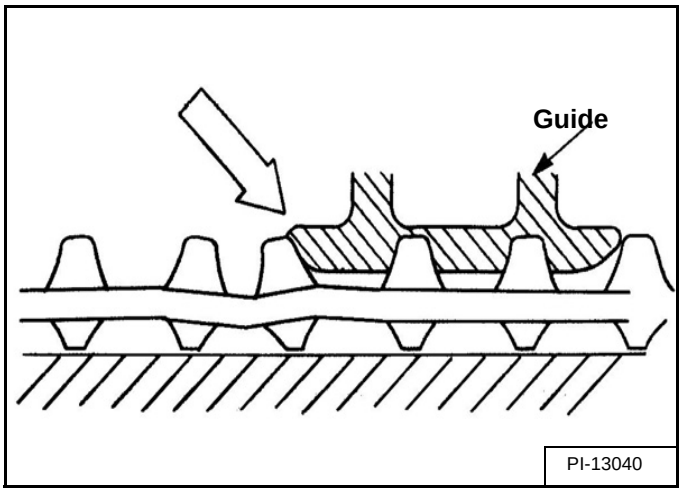
Embedded metals are adhered between the steel cords and the rubber body. The following cases generate external forces greater than the adhesion strength, causing separation of the embedded metals:

Figure 30-40-7



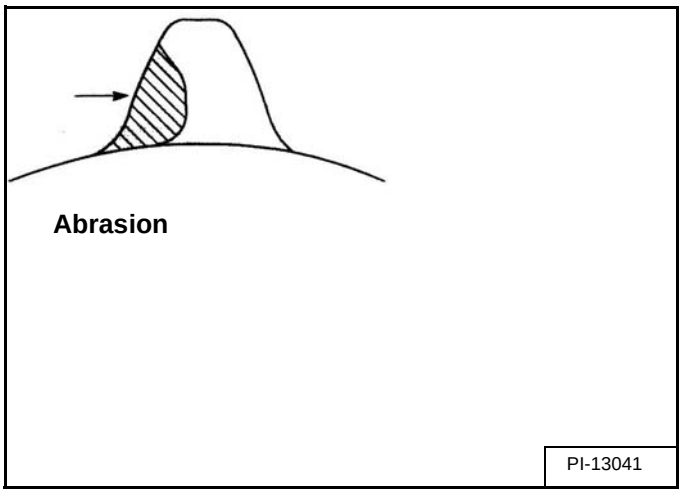
When the idler continually rides on the projections of embedded metals, the embedded metals will eventually peel off **[Figure 30-40-7]**.

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]**.

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.)

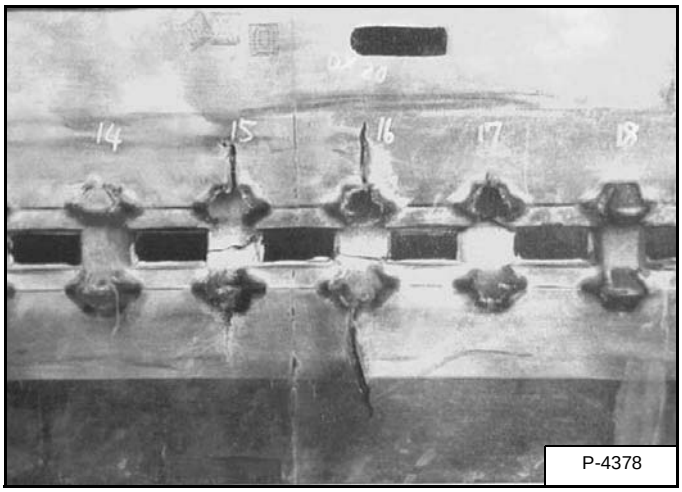
Quick turns on bumpy and rocky fields should be avoided.

If abnormal wear of sprockets is observed, they should be immediately replaced.

TRACK DAMAGE IDENTIFICATION (CONT'D)

Separation Of Embedded Metals Due To Corrosion

Figure 30-40-10



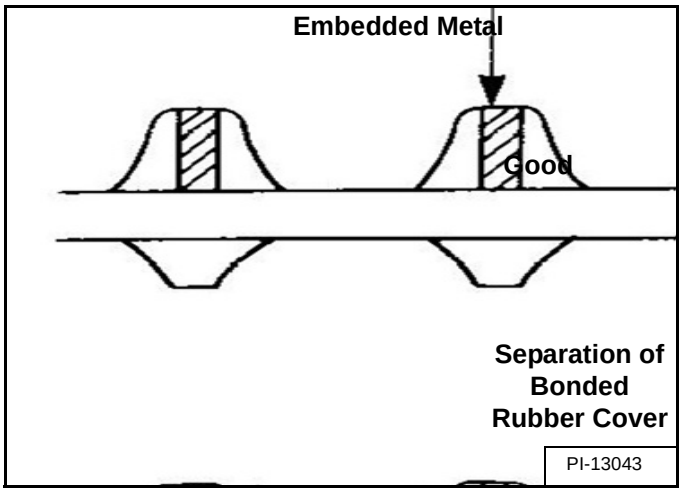
Damage:

Due to corrosion of embedded metals, the adhesion to the rubber body deteriorates, resulting in complete separation **[Figure 30-40-10]**.

Replacement:

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

Figure 30-40-11



Causes Of The Damage:

Embedded metals are bonded to the rubber body. The following operating conditions cause embedded metals to corrode, causing deterioration of the bonding, and finally resulting in separation of the embedded metals from the rubber body **[Figure 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.

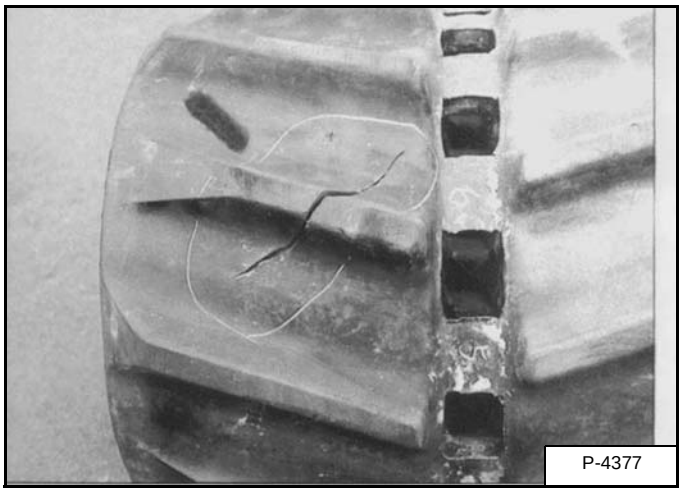
Prevention:

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

Figure 30-40-12



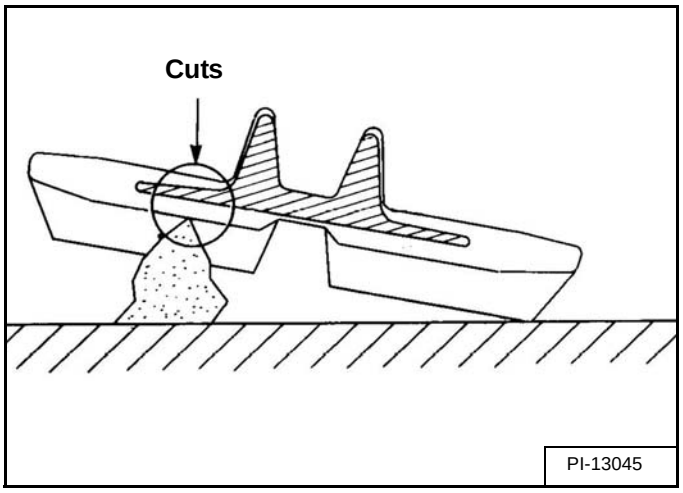
Damage:

Cuts on the lug side rubber often occurs as one of the most typical failure modes **[Figure 30-40-12]**

Replacement:

When a cut on the lug side rubber reaches the embedded steel cords, it should be immediately repaired with cold vulcanization rubber.

Figure 30-40-13



Causes Of The Damage:

When rubber tracks drive over projections or sharp stones in the fields, the concentrated forces applied cause cuts on the lug side rubber surface. In case of making turns on projections, the lug side rubber surface will have an even higher chance to be cut. If the cuts run through the embedded steel cords, it might result in the steel cords' breakage due to their corrosion. It is highly recommended to repair the cuts with cold vulcanization rubber as soon as they are observed **[Figure 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.

TRACK DAMAGE IDENTIFICATION (CONT'D)

Cracks On The Lug Side Rubber Due To Fatigue

Figure 30-40-14

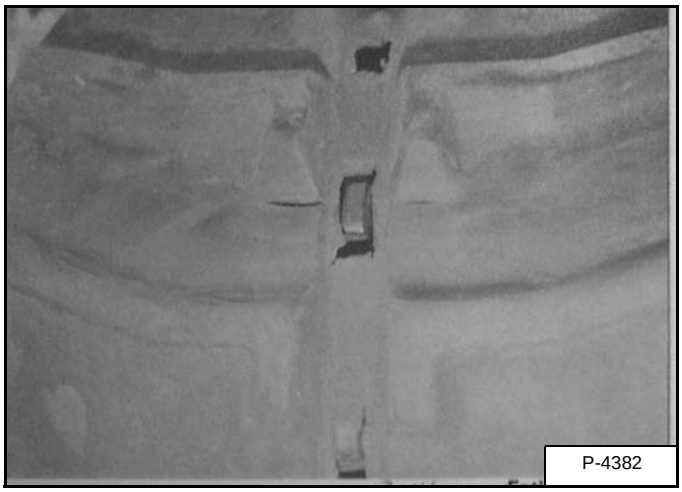
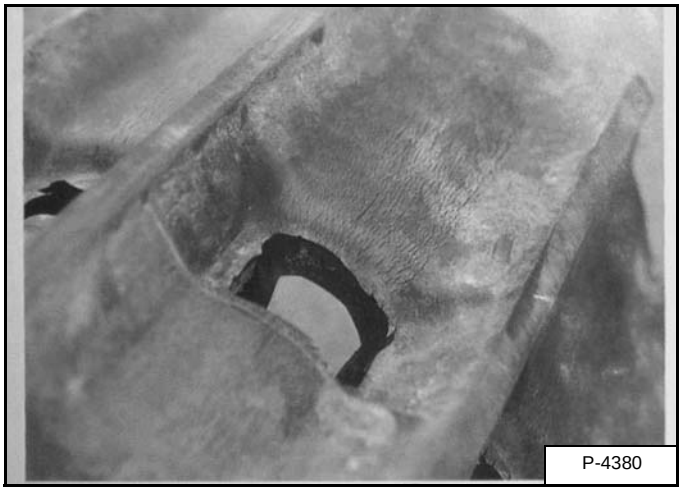


Figure 30-40-15



Damage:

Small cracks around the root of the lug as a result from operation fatigue **[Figure 30-40-14]** & **[Figure 30-40-15]**.

Replacement:

When the cracks reach so deep that they expose the steel cords, track replacement is required.

Causes Of The Damage:

Because of wound stress applied to rubber tracks around the undercarriage parts during operation, the fatigue especially causes cracks on the lug side rubber surface. Once the cracks occur, they gradually deteriorate with even small external cracks. Also when operating near seashores or under cold temperatures, rubber tracks are more likely to suffer from ozone cracks.

Prevention:

Rubber tracks are designed with special rubber compounds to prevent cracks due to fatigue. However, external injuries on the lug side rubber sometimes cause more chance of cracking. Machine operators should observe soil conditions when driving, so as not to cause external injuries to the lug side rubber. In order to minimize the occurrence of ozone cracks, attention should be paid to the following instructions for maintenance:

Avoid exposing stored tracks to direct sun light.

Avoid exposing stored tracks to direct rain and snow fall.

Store tracks in well ventilated warehouses.

Use the tracks at least once a month.

Lug Abrasion

Figure 30-40-16

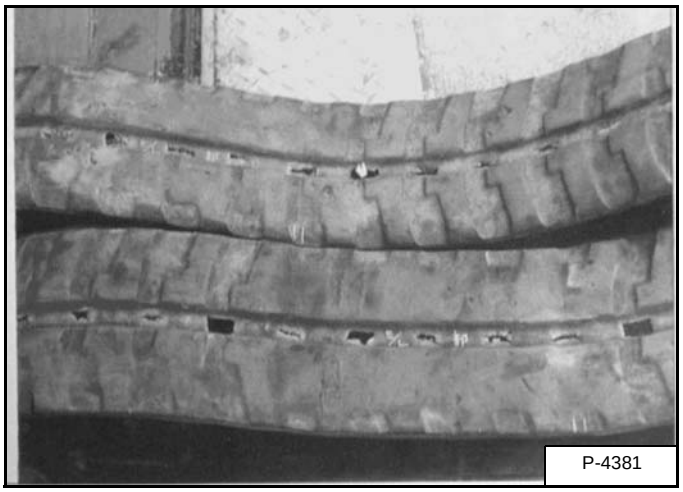
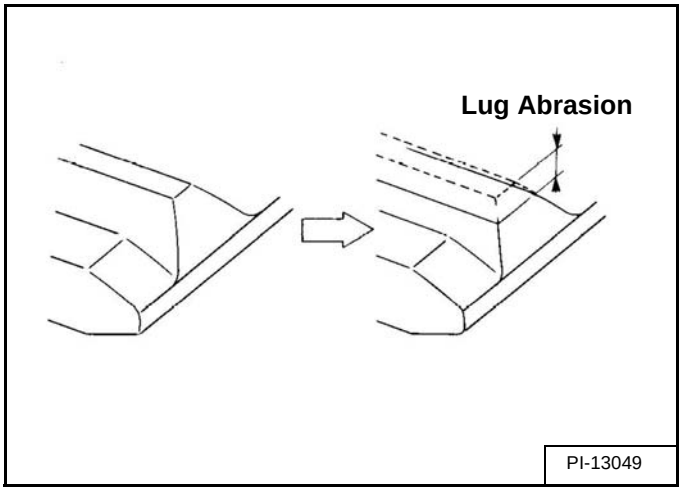


Figure 30-40-17



Damage:

As its service time proceeds, the lug side inevitably undergoes abrasion **[Figure 30-40-16]** & **[Figure 30-40-17]**.

Replacement:

No replacement is required.

Causes Of The Damage:

Lug abrasion is 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 0.197 in. (5 mm).

Prevention:

In order to prevent the rubber track from abnormal or premature abrasion, following operating conditions should be avoided:

Making quick and repeated turns on concrete and asphalt roads

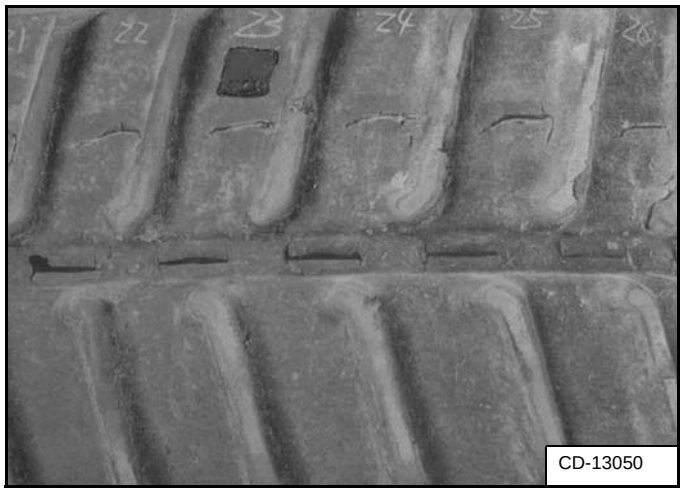
Driving up and down hilly paths with slippage

Making frequent turns on paths covered with rocks and wood

TRACK DAMAGE IDENTIFICATION (CONT'D)

Cracks And Cuts On The Lug Side Rubber

Figure 30-40-18



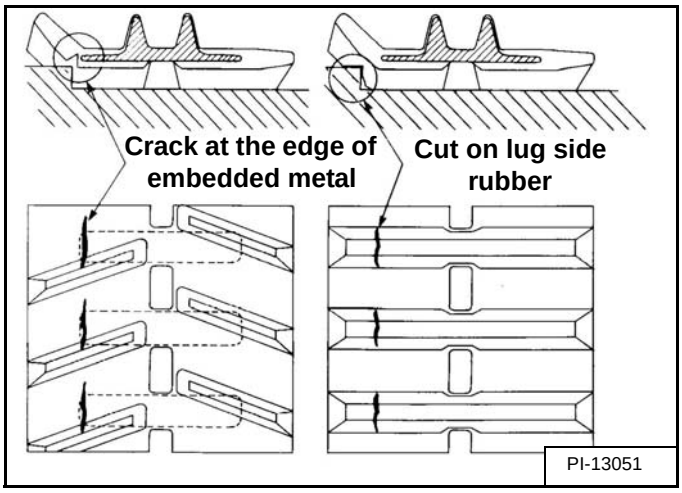
Damage:

Sometimes cracks and cuts on the lug side rubber at the edges of the embedded metals can be observed **[Figure 30-40-18]**.

Replacement:

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.

Figure 30-40-19



Causes Of The Damage:

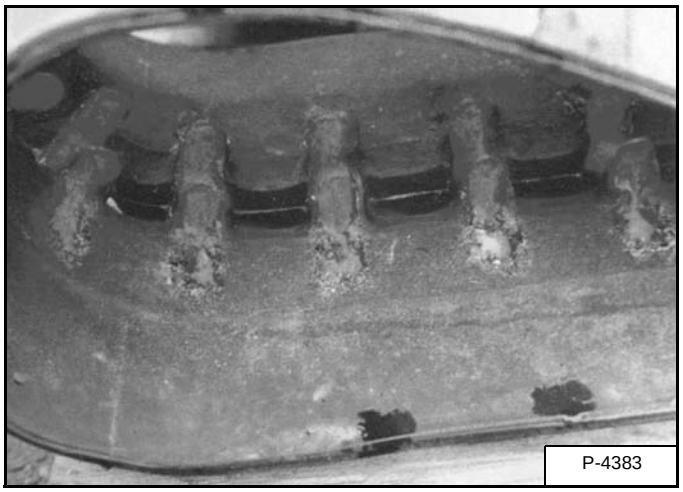
When rubber tracks drive over sharp projections, intensive stress is applied to the lug side rubber surface, especially at the edges of embedded metals, causing cracks and cuts in the area around the embedded metals **[Figure 30-40-19]**.

Prevention:

To avoid extensive stress applied to the lug root where metals are embedded, machine operators are requested to avoid driving over stumps and ridges.

Abrasion Of The Track Roller Side

Figure 30-40-20



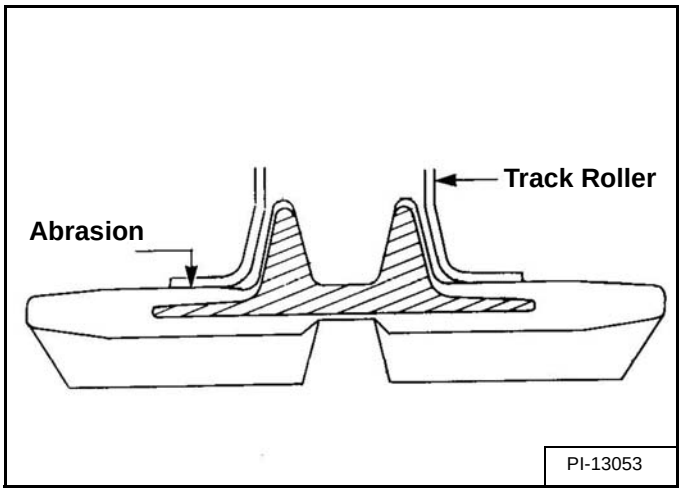
Damage:

The rubber surface on which track rollers run is gradually abraded. It will end in the exposure of the embedded metals **[Figure 30-40-20]**.

Replacement:

It is recommended to replace the rubber track when more than half of the embedded metals are completely exposed.

Figure 30-40-21



Causes Of The Damage:

The abrasion of the track roller side rubber surface occurs because of sand and gravel being clogged between the rubber and the outside surface of the track rollers. The stress pushes the sand and gravel against the side of the rubber track to cause the abrasion **[Figure 30-40-21]**.

The level of abrasion is highly dependent on terrain conditions. A higher level of abrasion will occur when the rubber tracks are operated in fields covered with many stones and gravel. Small stones hardened with mud, stuck to the track rollers increase the abrasion level. After an extended period of abrasion, it will be more likely for exposed embedded metals to catch moisture through the inside steel cords, which can cause breakage of steel cords and separation of the metals from the rubber body.

Prevention:

After operation in wet fields containing many small stones, wash off the mud that is stuck to the track rollers completely. When operating on gravel paths and stony grounds, machines should be driven slowly and the turning radius should be big enough to prevent stones and gravel from getting stuck to the track roller side rubber.

Cuts On The Edges Of Track Roller Side

Figure 30-40-22

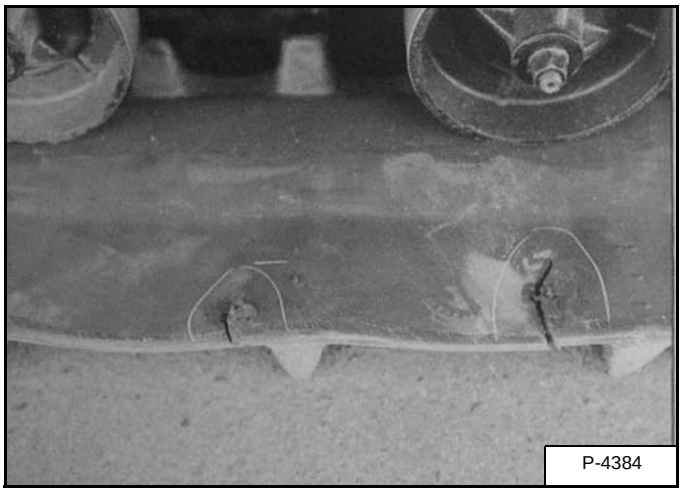
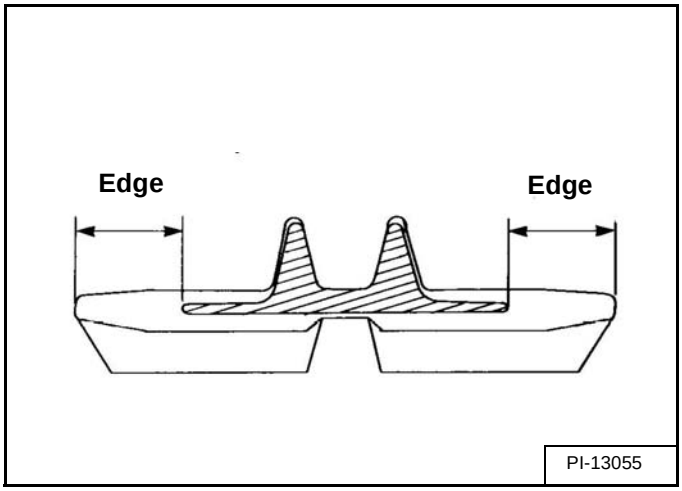


Figure 30-40-23



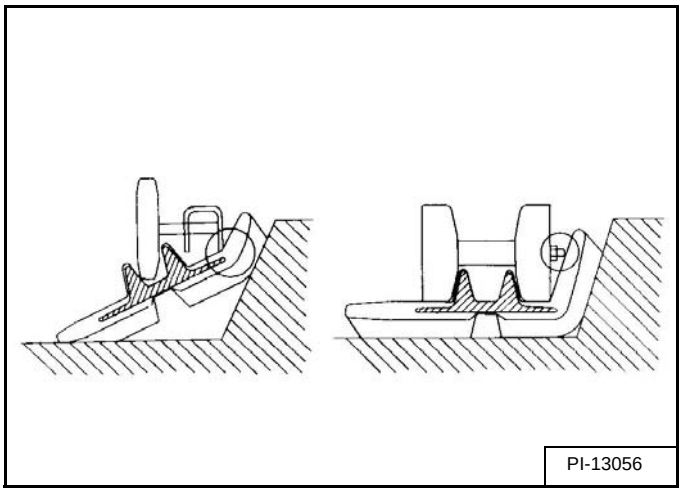
Damage:

Both edges of a rubber track have no special reinforcements. It sometimes occurs during operation that they are cut or torn off **[Figure 30-40-22]** & **[Figure 30-40-23]**.

Replacement:

In such case, the rubber track does not have to be replaced.

Figure 30-40-24



Causes Of The Damage:

This damage is caused by objects on the field or by interference with the machine frame.

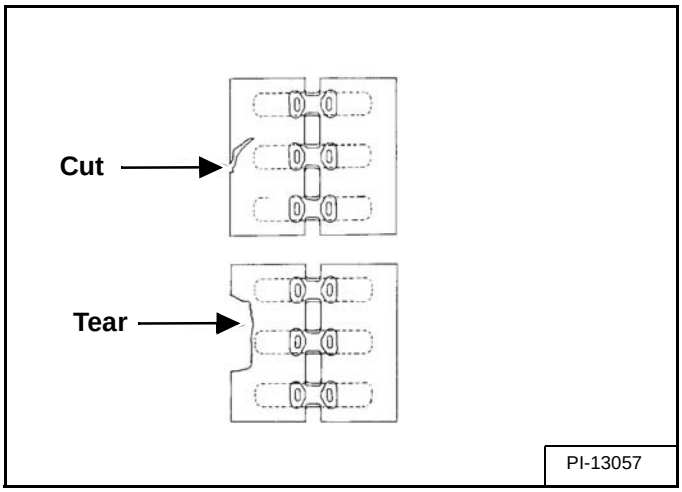
In case of damage by objects on the field:

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]**.

TRACK DAMAGE IDENTIFICATION (CONT'D)

Cuts On The Edges Of Track Roller Side (Cont'd)

Figure 30-40-25



In case of damage by interference with the machine frame:

If a machine continues operating with rubber tracks being detracted, the rubber tracks may get caught up in the machine frame or undercarriage parts resulting in damage. 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:

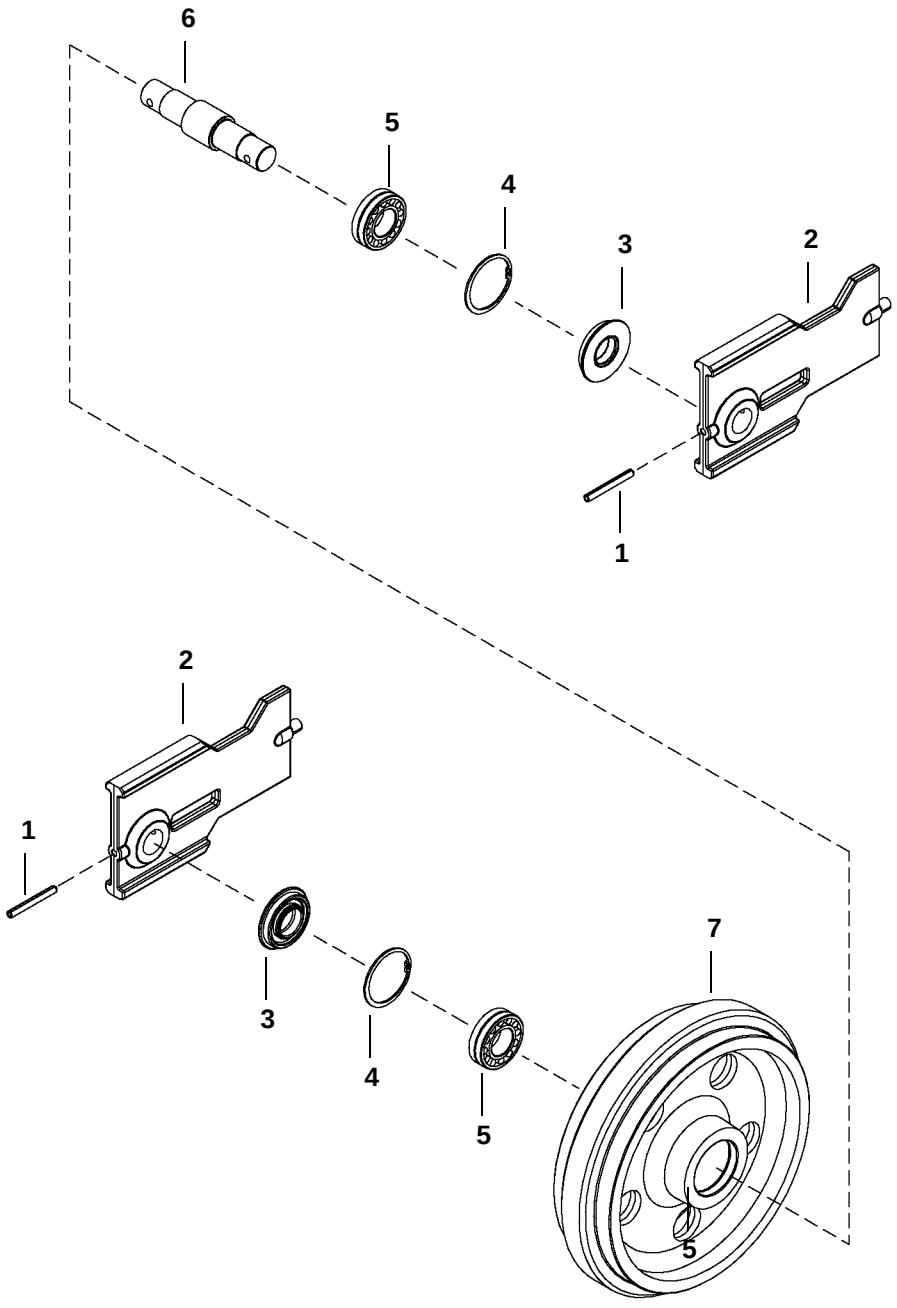
When traveling, a machine operator should be careful not to drive over any projections on the ground. He should also prevent rubber tracks from coming into contact with concrete walls, ditches and ridges. If rubber tracks are detracked, the machine should be stopped immediately for re-tracking.


Bobcat®

TRACK IDLER

Parts Identification

1. Roll Pin
2. Block
3. Seal
4. Snap Ring
5. Bearing
6. Shaft
7. Idler

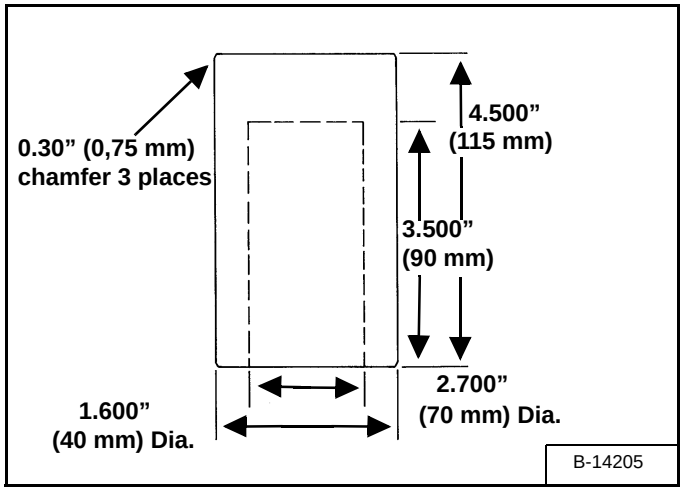


PE1911S

Disassembly

The following tools must be fabricated for this procedure:

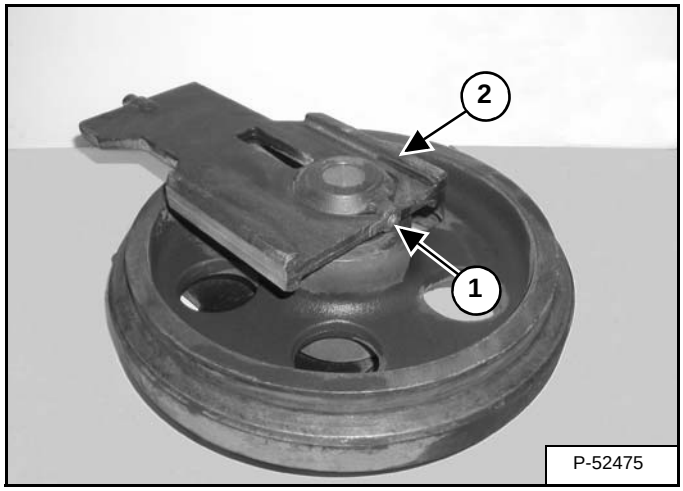
Figure 30-50-1



1. Driver Tool - **[Figure 30-50-1]**.

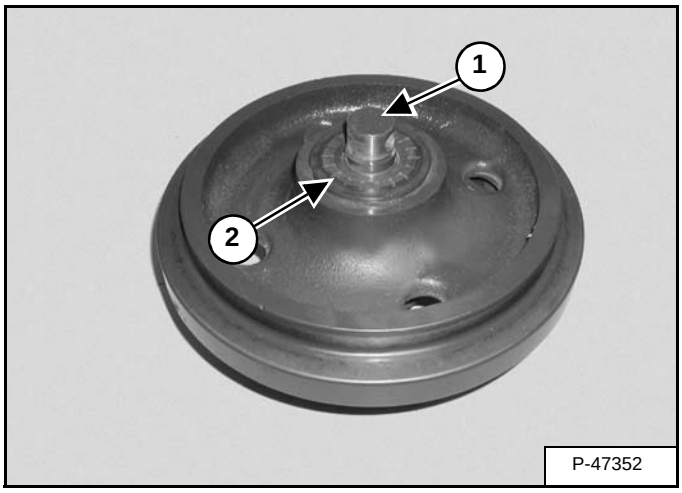
2. Support Fixture - Tube, 3.0 in. ID x 0.250 in. wall x 6.0 in. long (76,2 mm ID x 6,35 mm wall x 152,4 mm long).

Figure 30-50-2



Remove the roll pin (Item 1) and block (Item 2) **[Figure 30-50-2]** from the shaft (both ends.)

Figure 30-50-3



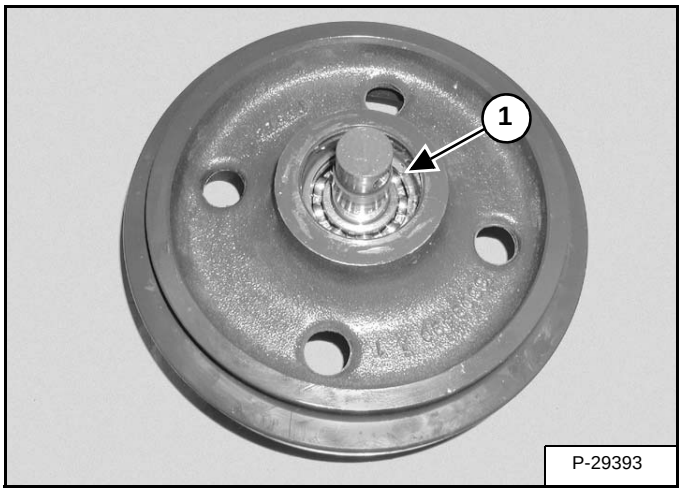
Remove any corrosion or paint from both ends of the exposed shaft (Item 1) **[Figure 30-50-3]** that could affect seal removal or damage the new seal during installation.

Apply penetrating oil to both ends of the exposed shaft to ease removal of the seal.

Remove the seal (Item 2) **[Figure 30-50-3]** from both sides of the idler.

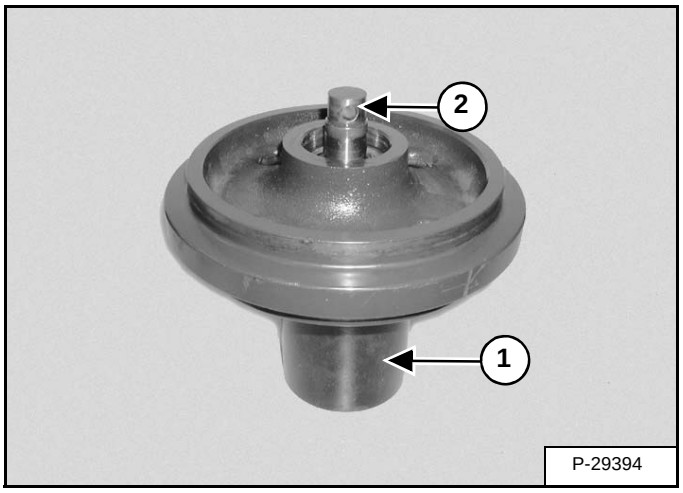
Disassembly (Cont'd)

Figure 30-50-4



Remove the snap ring (Item 1) **[Figure 30-50-4]** from both sides of the idler.

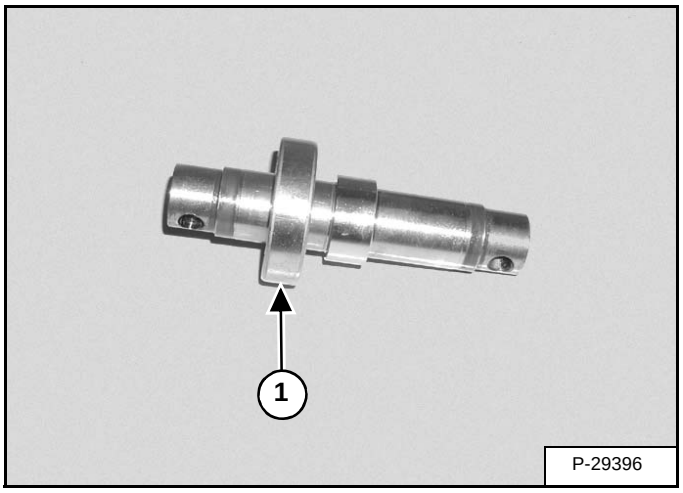
Figure 30-50-5



Place the idler on the support fixture (Item 1) **[Figure 30-50-5]**.

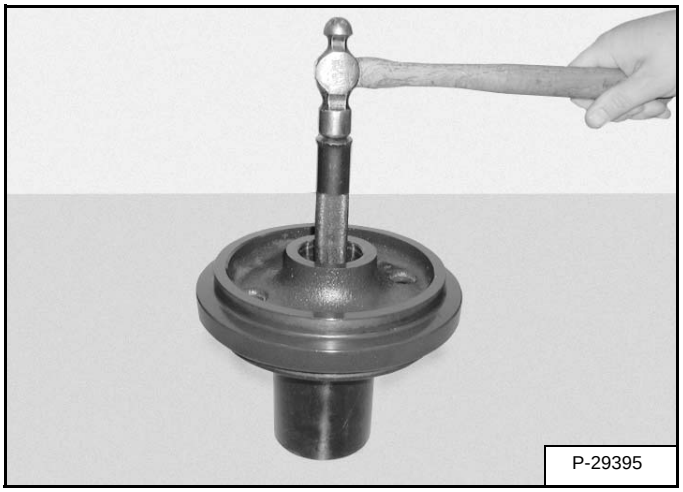
Using a soft faced hammer, tap the shaft (Item 2) **[Figure 30-50-5]** and bearing out the bottom of the idler.

Figure 30-50-6



Remove the bearing (Item 1) **[Figure 30-50-6]** from the shaft.

Figure 30-50-7

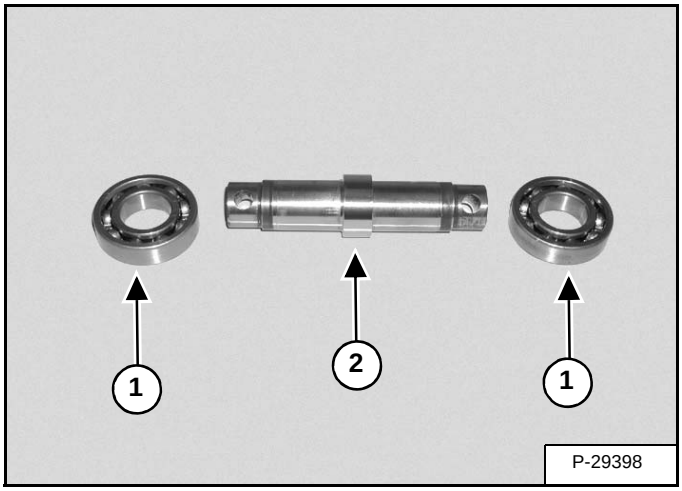


Turn the idler over, and using a bearing driver, remove the second bearing **[Figure 30-50-7]**.

Assembly

Clean all parts in solvent and dry with compressed air.

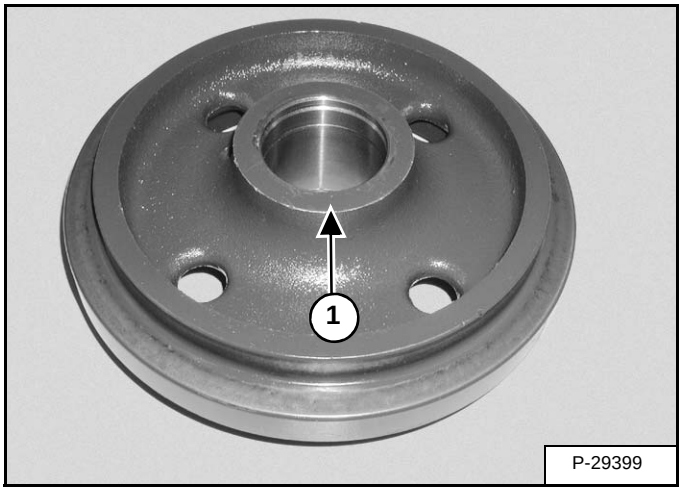
Figure 30-50-8



Inspect the bearings (Item 1) and shaft (Item 2) **[Figure 30-50-8]** for wear or damage. Replace any worn or damaged parts.

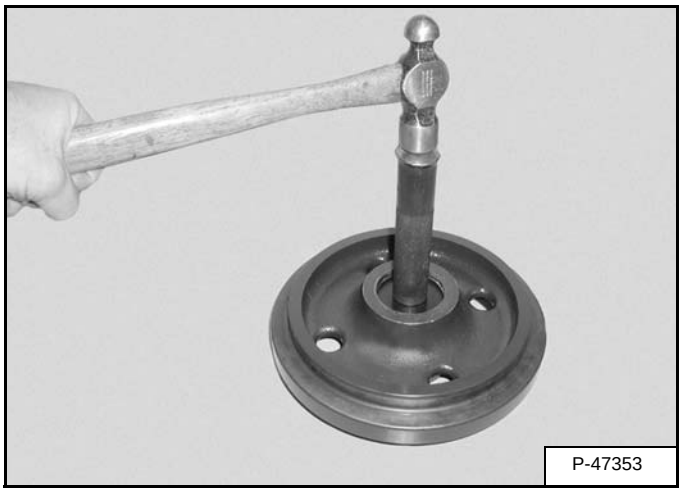
The bearings are sealed. If the bearings do not roll smoothly, or if the seals are damaged, replace the bearings.

Figure 30-50-9



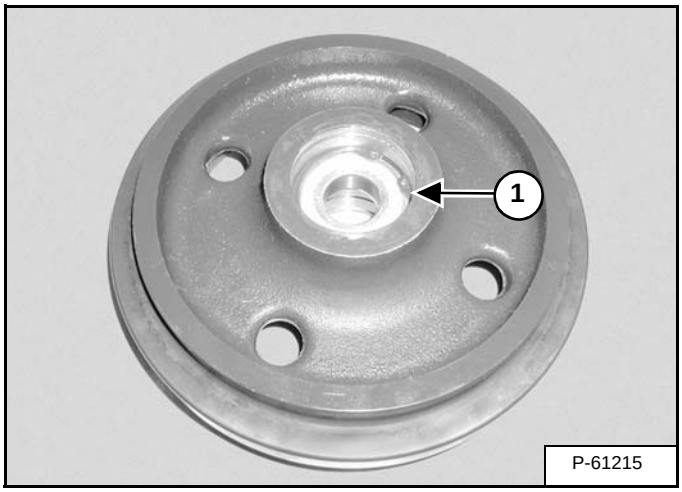
Remove all paint and corrosion from the seal surface (Item 1) **[Figure 30-50-9]** on both sides of the idler.

Figure 30-50-10



Using a bearing driver, install the bearing in the idler **[Figure 30-50-10]**.

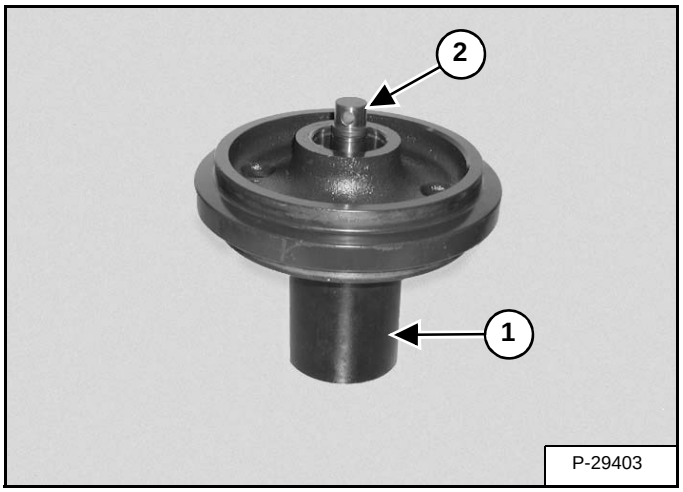
Figure 30-50-11



Install the snap ring (Item 1) **[Figure 30-50-11]**.

Assembly (Cont'd)

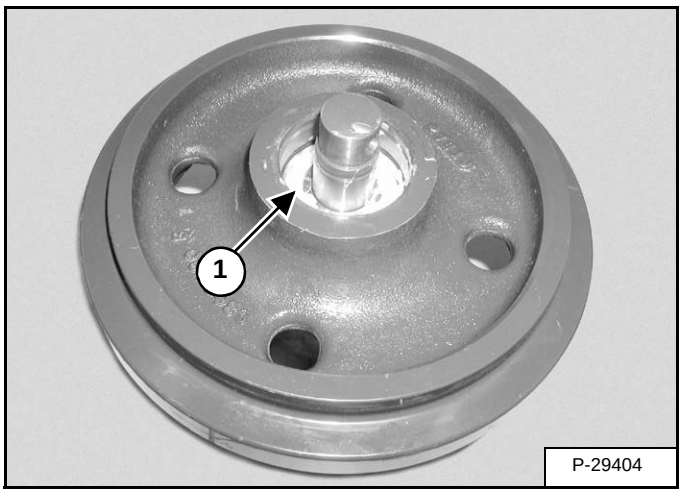
Figure 30-50-12



Turn the idler over and place the idler on the support fixture (Item 1) **[Figure 30-50-12]**.

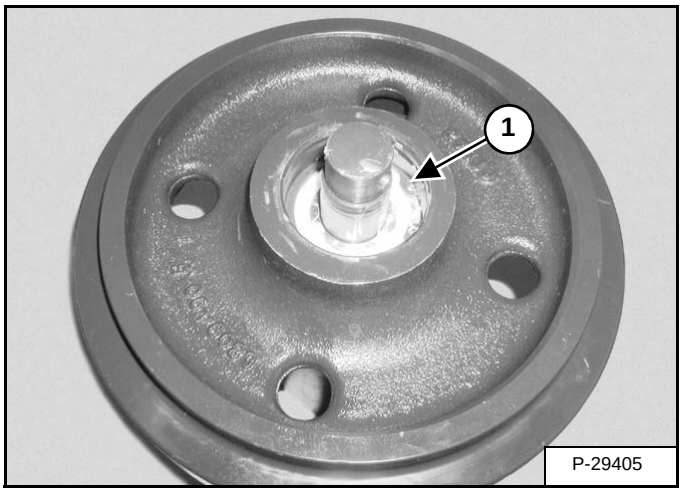
Install the shaft (Item 2) **[Figure 30-50-12]**.

Figure 30-50-13



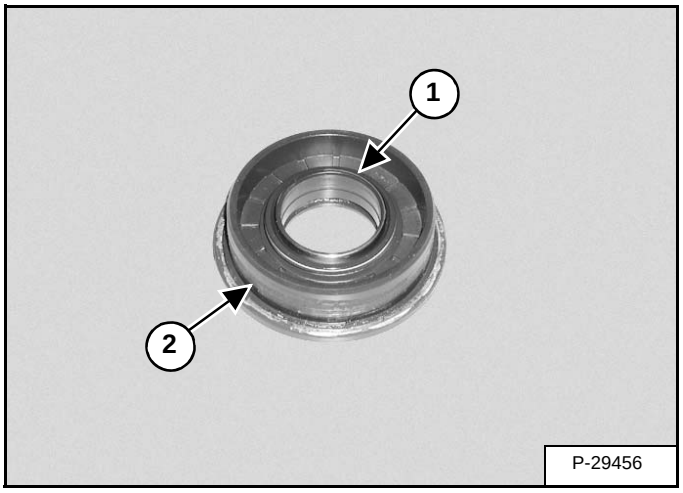
Install the bearing (Item 1) **[Figure 30-50-13]**. Use a brass drift to seat the bearing.

Figure 30-50-14



Install the snap ring (Item 1) **[Figure 30-50-14]**.

Figure 30-50-15

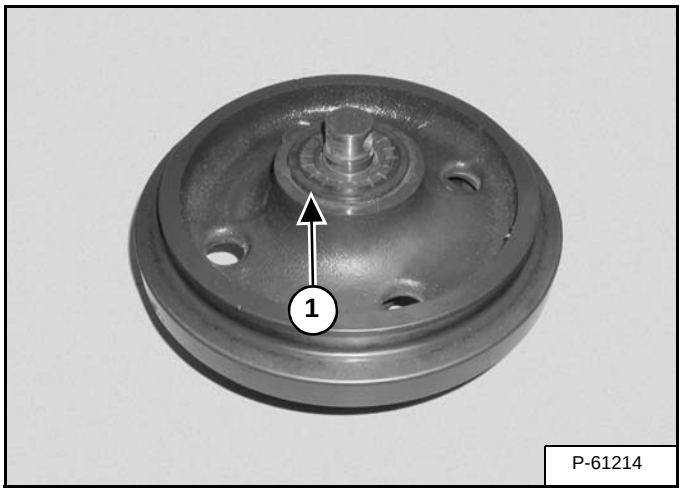


Apply assembly lube to the inside diameter (Item 1) **[Figure 30-50-15]** of the seal.

Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-50-15]** of the seal.

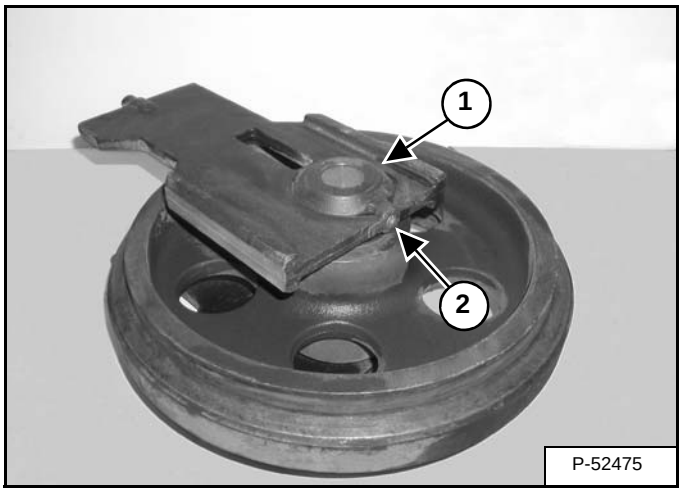
Assembly (Cont'd)

Figure 30-50-16



Using the driving tool, install the seal (Item 1) **[Figure 30-50-16]** on the idler (both ends.)

Figure 30-50-17

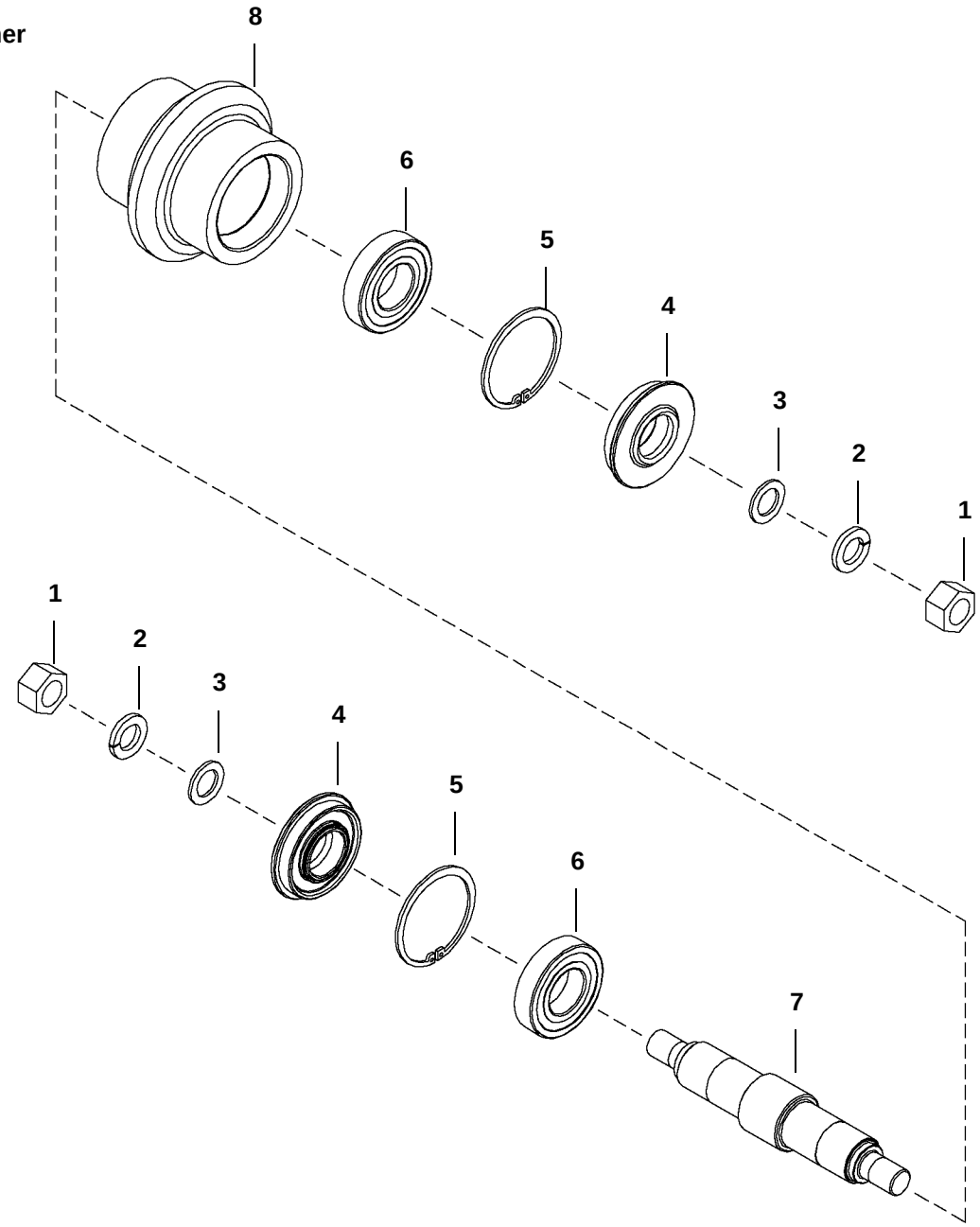


Install the block (Item 1) and roll pin (Item 2) **[Figure 30-50-17]** on the shaft (both ends.)

TRACK ROLLER

Parts Identification

1. Nut
2. Lock Washer
3. Washer
4. Seal
5. Snap Ring
6. Bearing
7. Shaft
8. Roller

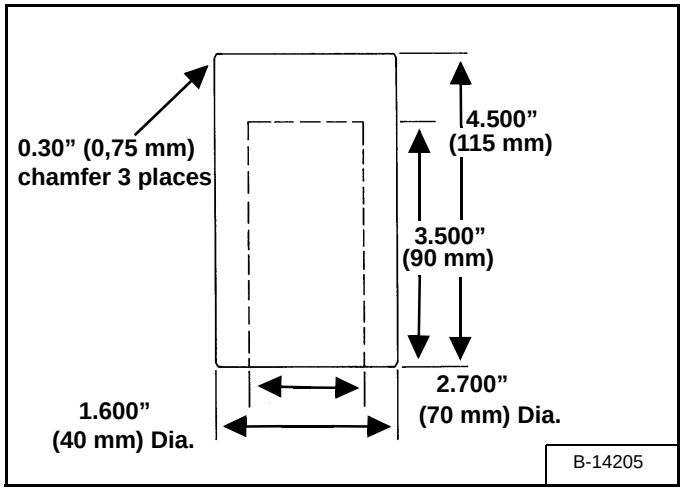


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Disassembly

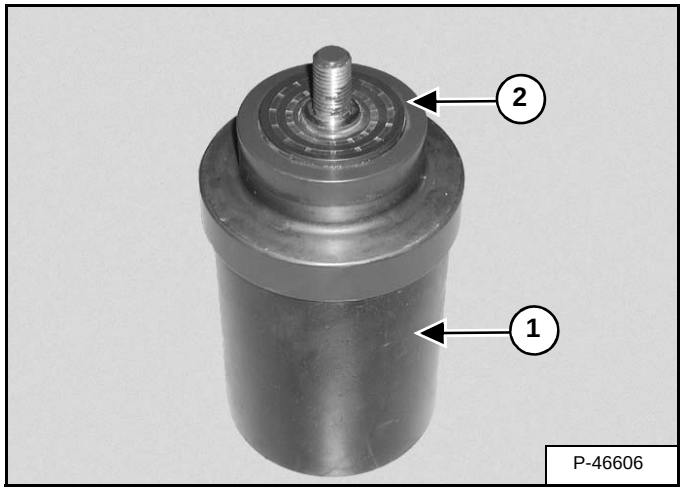
The following tools must be fabricated for this procedure:

Figure 30-60-1



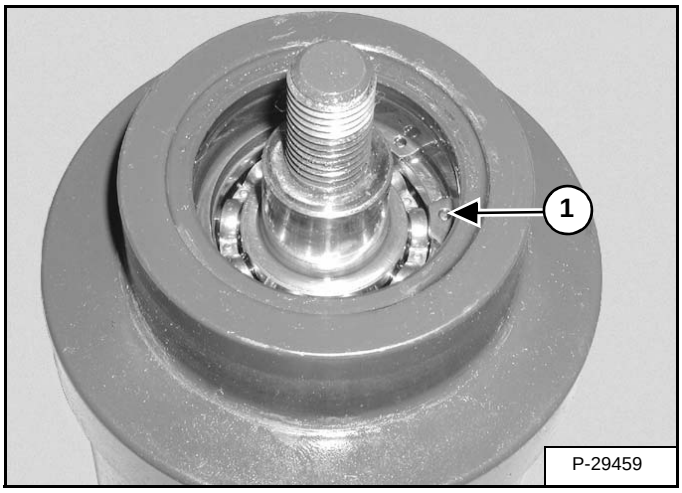
1. Driver Tool - See **[Figure 30-60-1]**.
2. Support Fixture - Tubing, 3.0 in. ID x 0.250 in. wide x 6.0 in. long.

Figure 30-60-2



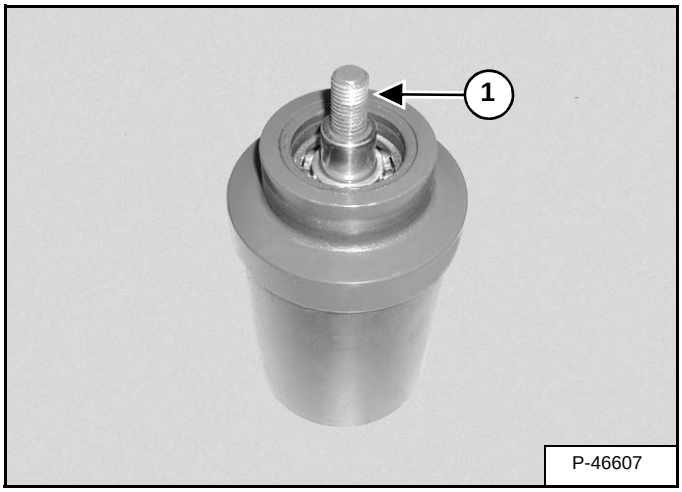
Support the roller in the support fixture (Item 1). Remove the seal (Item 2) **[Figure 30-60-2]** from both sides of the roller.

Figure 30-60-3



Remove the snap ring (Item 1) **[Figure 30-60-3]** from both sides of the roller.

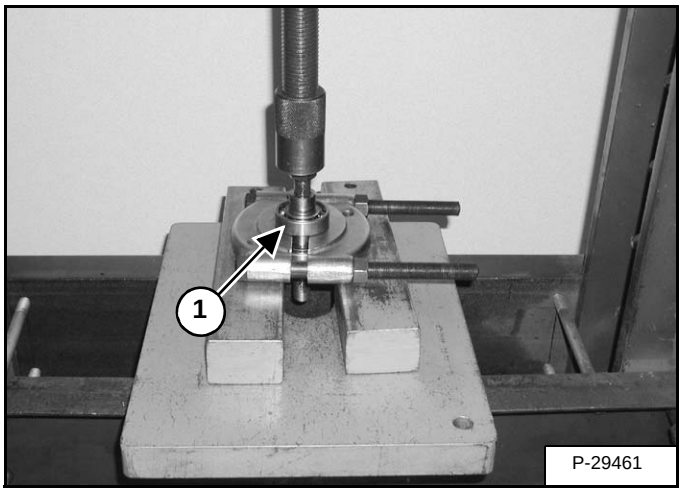
Figure 30-60-4



Tap the shaft (Item 1) **[Figure 30-60-4]** and bearings out of the roller.

Disassembly (Cont'd)

Figure 30-60-5

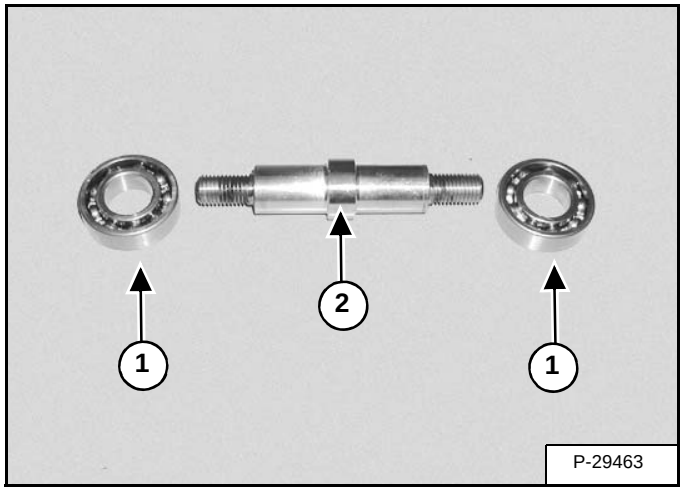


Press the bearings (Item 1) **[Figure 30-60-5]** off the shaft.

Assembly

Clean all parts in solvent and dry with compressed air.

Figure 30-60-6

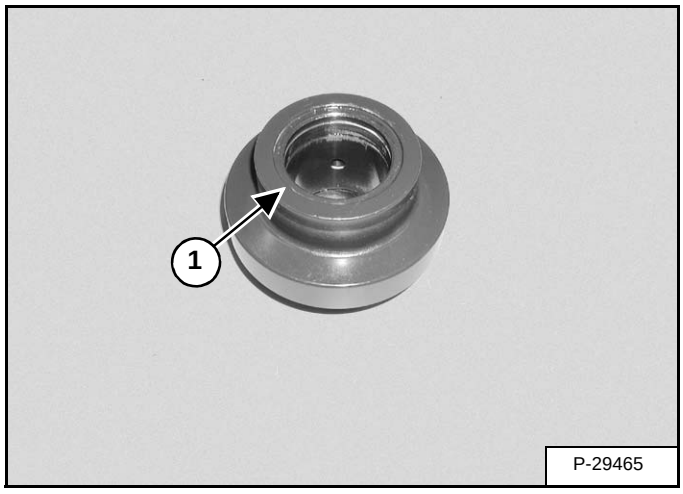


Inspect the bearings (Item 1) and shaft (Item 2) **[Figure 30-60-6]** for wear or damage.

The bearings are sealed. If the bearings do not roll smoothly or if the seals are damaged, replace the bearings.

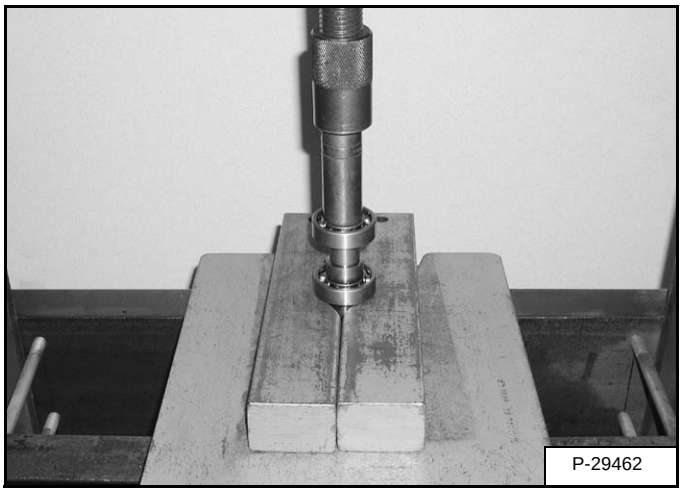
Replace any worn or damaged parts.

Figure 30-60-7



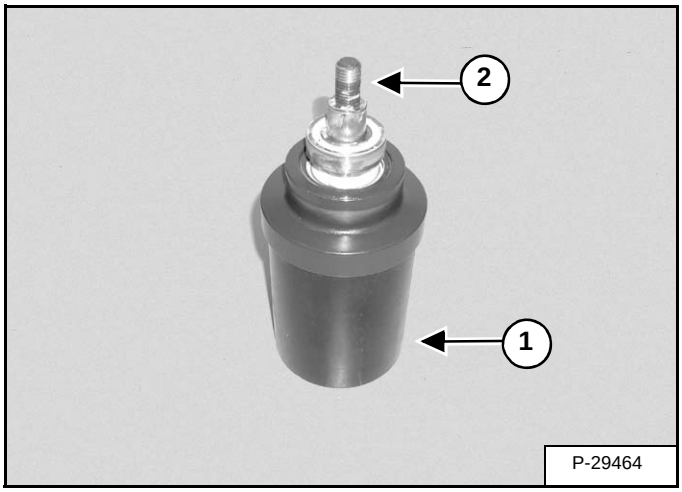
Remove all paint and corrosion from the seal surface (Item 1) **[Figure 30-60-7]** on both sides of the roller.

Figure 30-60-8



Press the bearings (Item 1) **[Figure 30-60-8]** on the shaft.

Figure 30-60-9

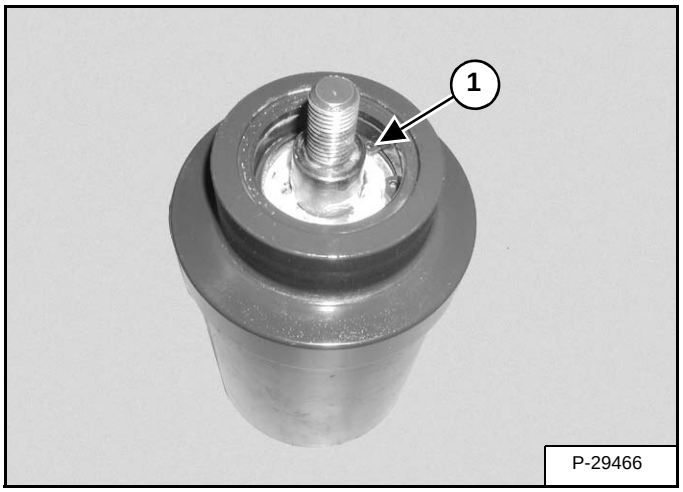


Place the roller on the support fixture (Item 1) **[Figure 30-60-9]**.

Tap the shaft and bearing assembly (Item 2) **[Figure 30-60-9]** into the roller.

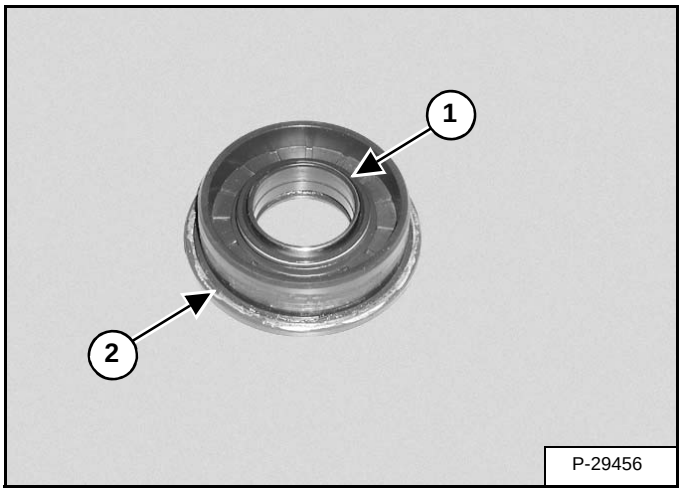
Assembly (Cont'd)

Figure 30-60-10



Install the snap ring (Item 1) **[Figure 30-60-10]** on both sides of the roller.

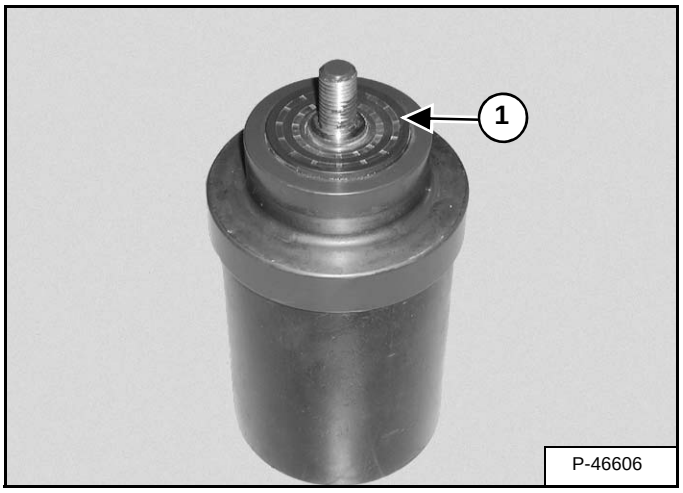
Figure 30-60-11



Apply assembly lube to the inside diameter (Item 1) **[Figure 30-60-11]** of the seal.

Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-60-11]** of the seal.

Figure 30-60-12



Using the driving tool, install the seal (Item 1) **[Figure 30-60-12]** on both sides of the roller.

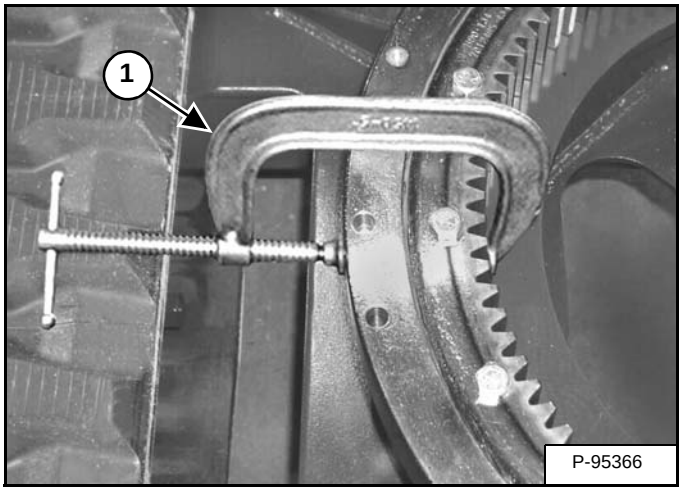

Bobcat®

SWING CIRCLE GEAR

Swing Bearing Removal

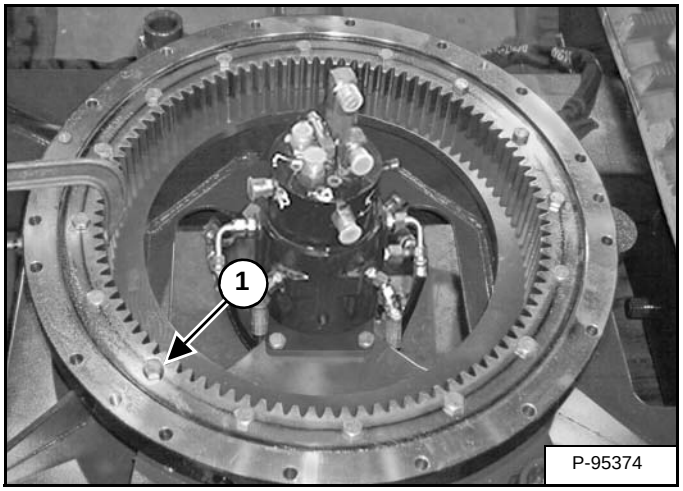
Remove the upperstructure. (See Removal on Page 40-10-1.)

Figure 30-70-1



Install a C-clamp (Item 1) **[Figure 30-70-1]** to prevent the swing bearing from turning while being removed.

Figure 30-70-2



Remove the 16 bolts (Item 1) **[Figure 30-70-2]** and nuts that hold the swing bearing to the track frame.

Remove the swing bearing.

SWING CIRCLE GEAR (CONT'D)

Swing Bearing Installation

Figure 30-70-3

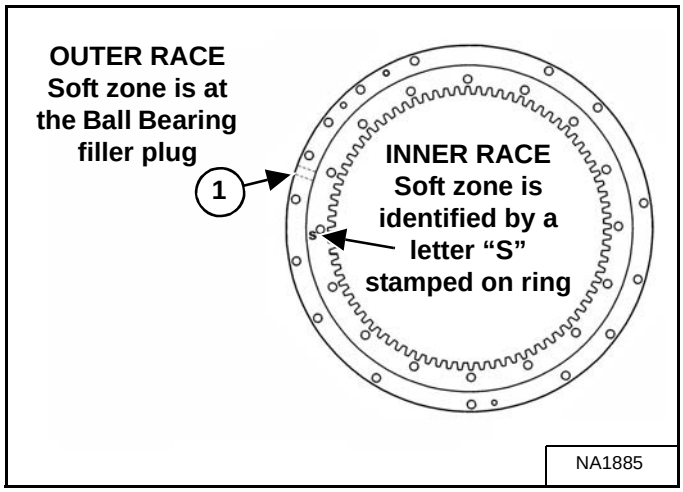
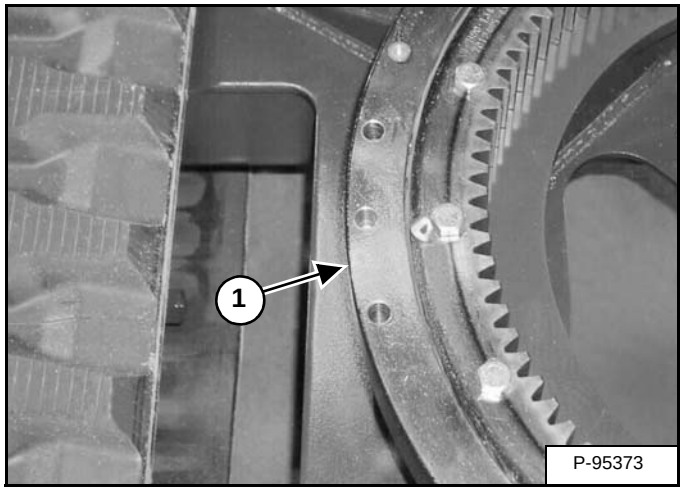


Figure 30-70-4

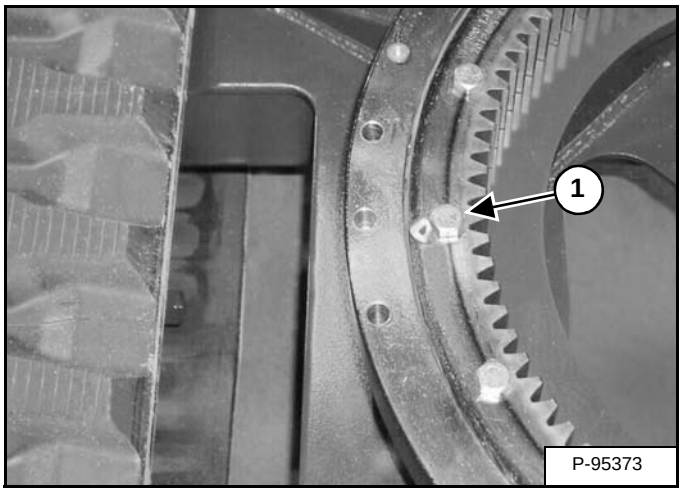


If reusing the existing swing bearing, use top, side and edge aligning marks to put the swing bearing in the correct location. If installing a new swing bearing find the soft zone area (Item 1) **[Figure 30-70-3]** & **[Figure 30-70-4]**.

Install the swing bearing so the inside soft zone is at the left side of the excavator **[Figure 30-70-3]** & **[Figure 30-70-4]**.

NOTE: Do not put the soft zone to the front or rear of the excavator.

Figure 30-70-5



Install the swing bearing mount bolts (Item 1) **[Figure 30-70-5]** and lock nuts.

Put lubriplate grease or equivalent on the swing bearing gear.

UPPERSTRUCTURE & SWING SECTION

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 40-80-6

BOOM 40-150-1
Removal And Installation 40-150-1

BUCKET 40-170-1
Bucket Side Cutting Edge Removal And Installation 40-170-2
Bucket Teeth Removal And Installation 40-170-1

CAB 40-30-1
Door Removal And Installation 40-30-6
Front Window Removal And Installation 40-30-7
Glass Installation 40-30-13
Glass Removal 40-30-12
Removal And Installation 40-30-1
Right Side Front And Rear Sliding Window Weather Strip Removal And Installation 40-30-11
Right Side Front And Rear Sliding Window Wiper Strip Removal And Installation 40-30-11
Right Side Front Sliding Window Removal And Installation 40-30-10
Right Side Rear Sliding Window Removal And Installation 40-30-10

CLAMP 40-171-1
Removal And Installation 40-171-1

ENGINE SPEED CONTROL 40-70-1
Adjustment 40-70-2
Removal And Installation 40-70-1

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Removal And Installation (Canopy Equipped Excavators) 40-110-1

FUEL TANK 40-120-1
Removal And Installation 40-120-1

Continued On Next Page

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Removal And Installation 40-130-1

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Compression Spring Disassembly And Assembly 40-60-5
Compression Spring Removal And Installation 40-60-4
Console Base Removal And Installation 40-60-16
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Console Switch Removal And Installation 40-60-15
Disassembly And Assembly 40-60-12
Lock Lever Removal And Installation 40-60-7
Lower Console Cover Removal And Installation 40-60-1
Upper Console Cover Removal And Installation 40-60-3

RIGHT CONSOLE 40-50-1
Console Base Removal And Installation 40-50-2
Console Cover Removal And Installation 40-50-1

RIGHT PEDAL AND LINKAGE 40-90-1
Linkage Removal And Installation 40-90-4
Pedal Disassembly And Assembly 40-90-2
Pedal Removal And Installation 40-90-1

RIGHT SIDE COVER 40-210-1
Removal And Installation 40-210-1

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

SUSPENSION SEAT AND SEAT MOUNT 40-41-1
Removal And Installation 40-41-1

SWING FRAME 40-140-1
Boom Swing Bracket Hose Installation 40-140-5
Boom Swing Bracket Removal And Installation 40-140-1
Bushing Installation 40-140-7
Bushing Removal 40-140-6

Continued On Next Page

UPPERSTRUCTURE & SWING SECTION (CONT'D)

TAILGATE 40-180-1
Latch Removal And Installation 40-180-2
Removal And Installation 40-180-1

TRAVEL CONTROLS 40-100-1
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Disassembly And Assembly. 40-100-2
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UPPERSTRUCTURE 40-10-1
Installation 40-10-4
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UPPERSTRUCTURE SLEW LOCK 40-200-1
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X-CHANGE 40-190-1
Assembly 40-190-7
Check Proper Latch Engagement 40-190-13
Disassembly. 40-190-3
Removal And Installation 40-190-1

TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION SPEC-01) UNLESS OTHERWISE SPECIFIED.

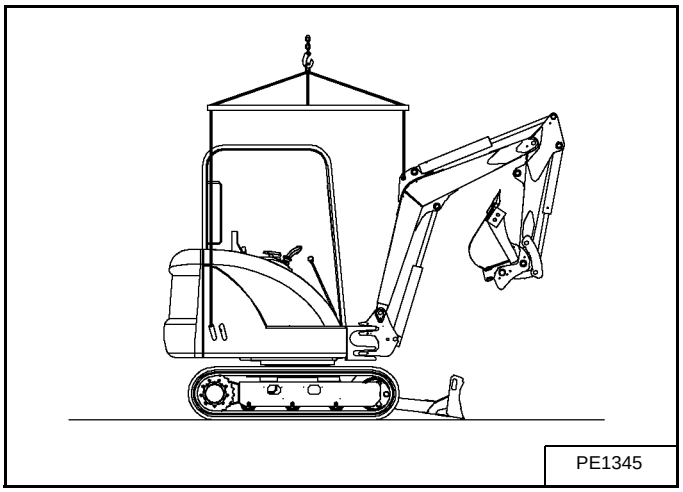
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE AND STANDARD ITEMS MAY VARY.


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UPPERSTRUCTURE

Removal

Figure 40-10-1



Fully extend the cylinders of the bucket, arm, and boom so that the excavator is in the position as shown **[Figure 40-10-1]**.

Lower the blade all the way.

Put all the control levers in neutral.

The boom must be in full raised position and centered to the front of the excavator **[Figure 40-10-1]**.

⚠ WARNING

AVOID INJURY OR DEATH

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

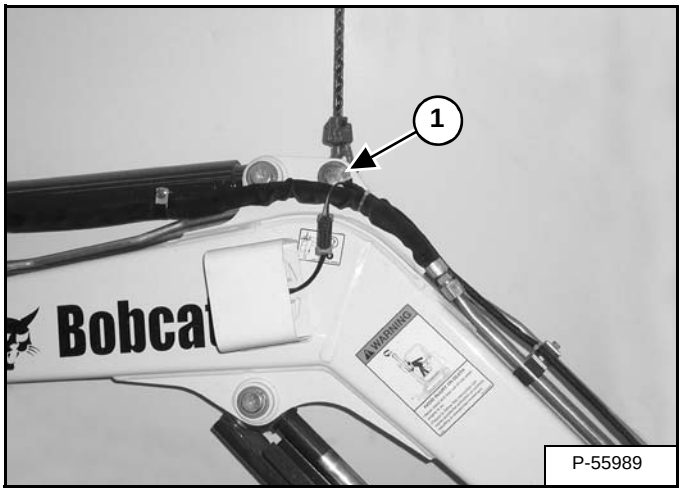
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Figure 40-10-2



Fasten chains to the rear of the upperstructure on both sides (Item 1) **[Figure 40-10-2]** and up to a lifting fixture above the canopy/cab **[Figure 40-10-1]**. The lifting fixture must extend over the sides of the canopy/cab to prevent the chains from hitting the ROPS/TOPS.

Figure 40-10-3



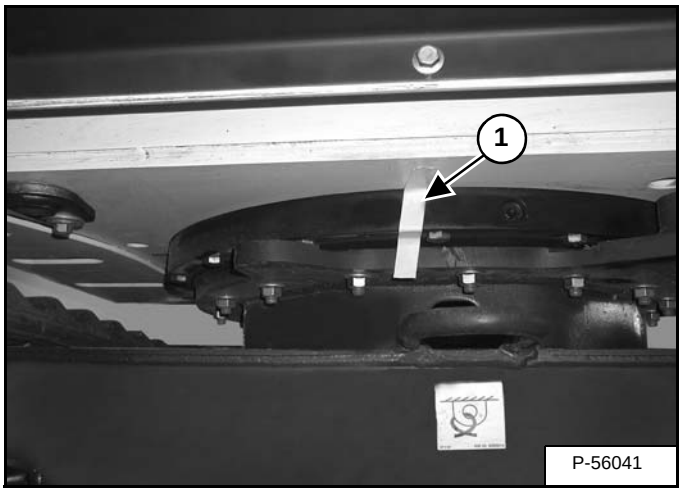
Install a 1 in. (25 mm) bolt and nut (Grade 5 or 8) through the holes at the boom (Item 1) **[Figure 40-10-3]**. Fasten a chain from the bolt to the lift fixture **[Figure 40-10-1]**.

Removal (Cont'd)

Remove the swing motor. (See Removal And Installation on Page 20-90-1.)

Remove the swing motor drive carrier. (See Removal And Installation on Page 20-91-1.)

Figure 40-10-4



Mark the upperstructure to the swing bearing and to the track frame for assembly (Item 1) **[Figure 40-10-4]**.

IMPORTANT

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

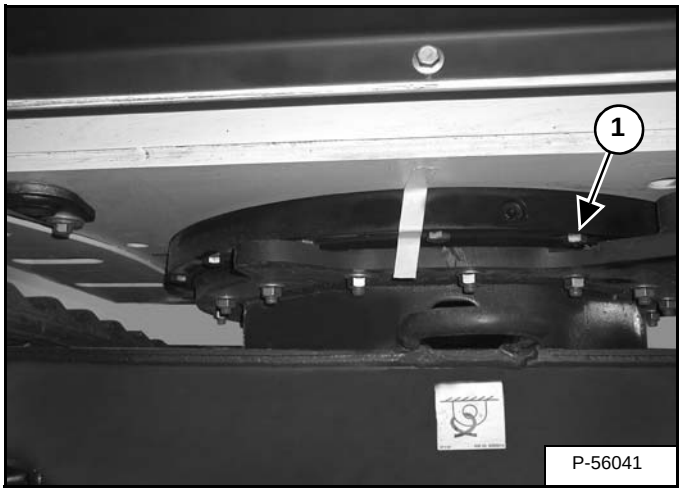
I-2003-0888

Figure 40-10-5



Mark and remove the hoses **[Figure 40-10-5]** from the swivel joint.

Figure 40-10-6



Partially disassemble the upperstructure from the swing bearing by removing all but four bolts which are spaced at 90° from each other (Item 1) **[Figure 40-10-6]**.

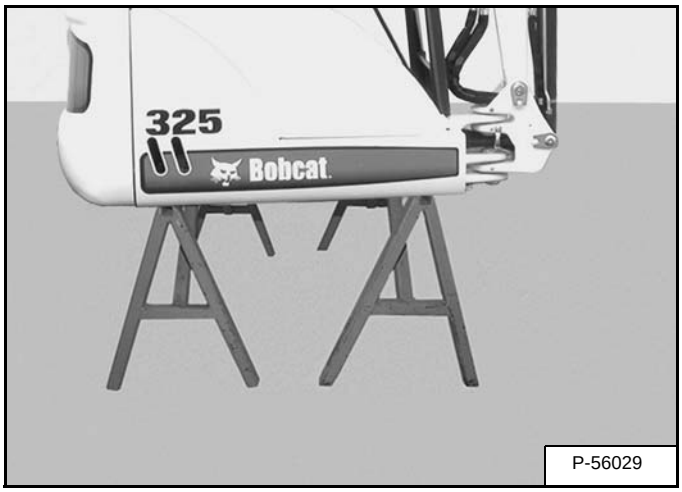
The upperstructure must be rotated to gain access to the bolts for removal. With the help of a second person, manually turn the upperstructure to provide clearance for bolt removal.

NOTE: For disassembly safety a minimum of four evenly spaced bolts must remain installed, to be removed later.

Apply a small amount of lifting pressure to the upperstructure with the lift sling. Remove the four remaining bolts holding the upperstructure to the swing bearing.

Removal (Cont'd)

Figure 40-10-7



Lift the upperstructure off of the swing bearing. Put the upperstructure on suitable supporting stands or blocks **[Figure 40-10-7]**.

Installation

Figure 40-10-8

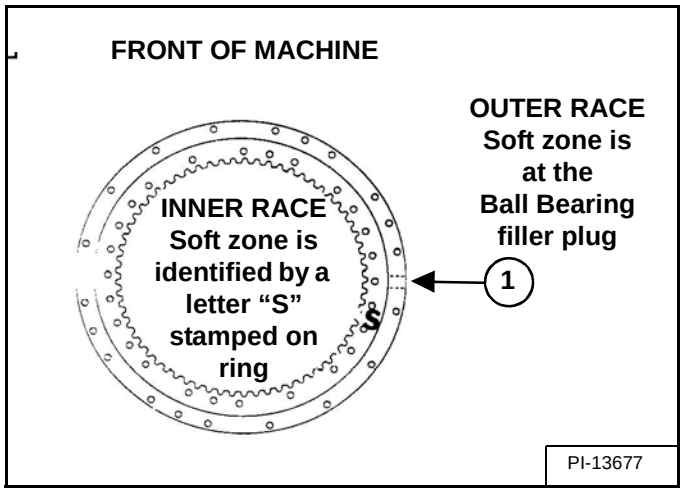
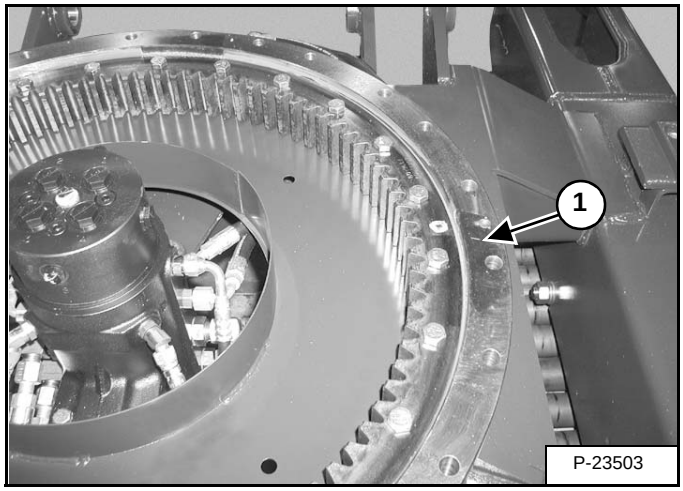


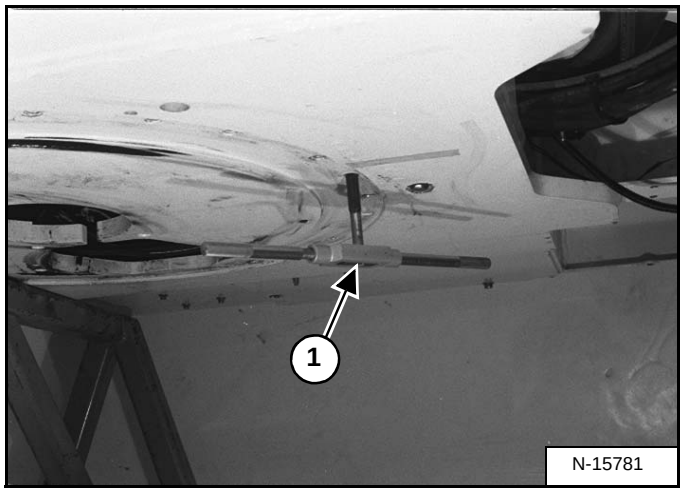
Figure 40-10-9



Rotate the swing bearing so the outside soft zone (Item 1) **[Figure 40-10-8]** & **[Figure 40-10-9]** is to the right hand side of the excavator.

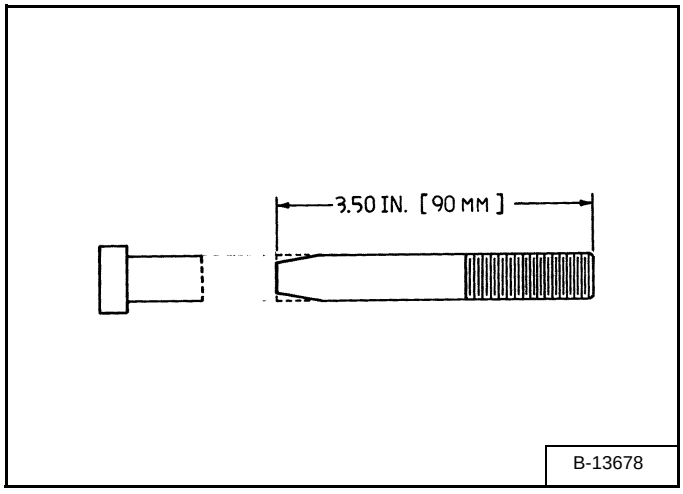
NOTE: The upperstructure can only be installed on the swing bearing in one position. Match the mount holes in the swing bearing to the mount holes in the upperstructure.

Figure 40-10-10



Use a tap (12 mm) in the holes (Item 1) **[Figure 40-10-10]** in the upperstructure to remove any dried thread lock adhesive or burrs.

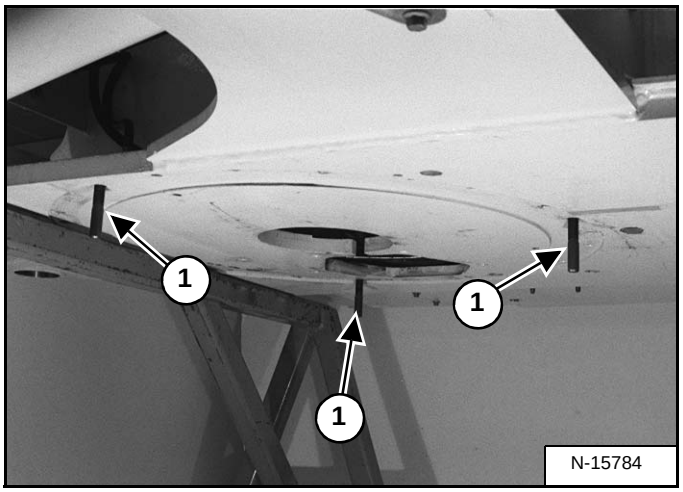
Figure 40-10-11



Make three alignment pins by using M12 X 110 mm (P/N 7GM-12110) long bolts. Cut the head off of these bolts at 3.50 in. (90 mm). Taper this end of the bolts **[Figure 40-10-11]**.

Installation (Cont'd)

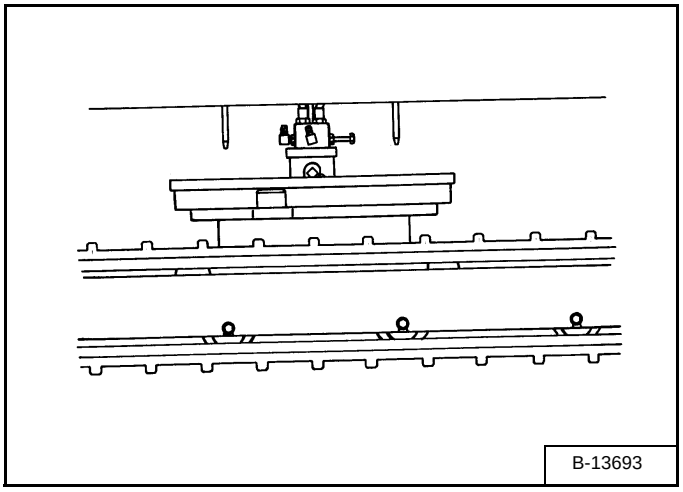
Figure 40-10-12



Install the pins (Item 1) **[Figure 40-10-12]** into the upperstructure at approximately 120° apart. These will act as alignment pins while lowering the upperstructure onto the swing bearing.

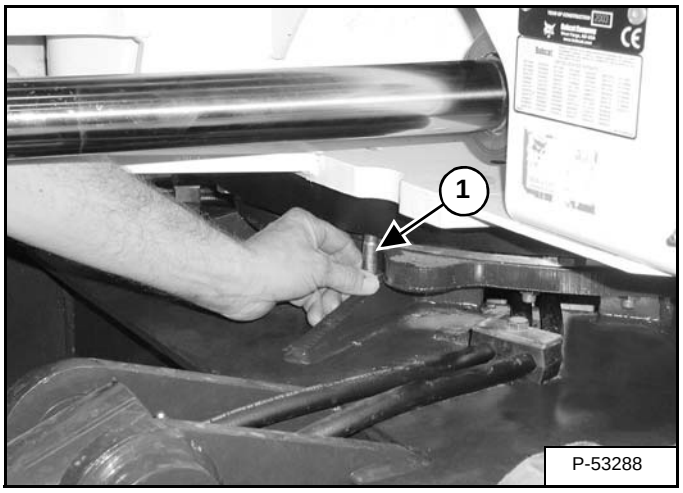
Install the upperstructure onto the swing bearing using the alignment marks and the alignment pins.

Figure 40-10-13



Make sure the swivel joint is centered into the upperstructure access hole **[Figure 40-10-13]**.

Figure 40-10-14



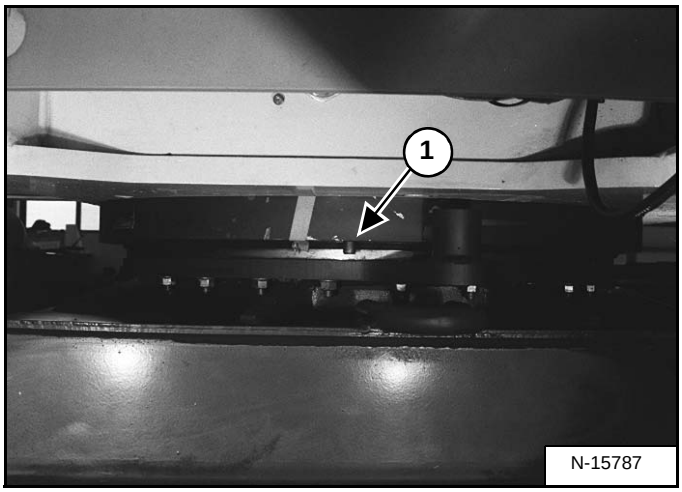
Install the three tapered head alignment bolts (Item 1) **[Figure 40-10-14]** through the swing bearing and into the upperstructure. These bolts should be spaced 120° apart.

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.-lb. (81 N•m) torque.

Installation (Cont'd)

Figure 40-10-15



Remove the three, 3.50 in. (90 mm) alignment pins (Item 1) **[Figure 40-10-15]** from the upperstructure.

These headless pins can be removed from the bottom.

Apply thread lock adhesive (Loctite® 242) to the threads of the bolts. Install the bolts into all holes (except the three with the alignment bolts installed). Tighten these bolts to 78 - 85 ft.-lb. (106 - 115 N•m) torque.

Remove the three alignment bolts. Install the three remaining bolts. Tight these bolts to 78 - 85 ft.-lb. (106 - 115 N•m) torque.

Figure 40-10-16



Install the hoses **[Figure 40-10-16]** on the swivel joint.

Remove the chains and lifting fixture.

Install the swing motor drive carrier. (See Removal And Installation on Page 20-91-1.)

Check the backlash between the gears by moving the frame back and forth at several points throughout 360° of frame rotation. There must be some backlash present.

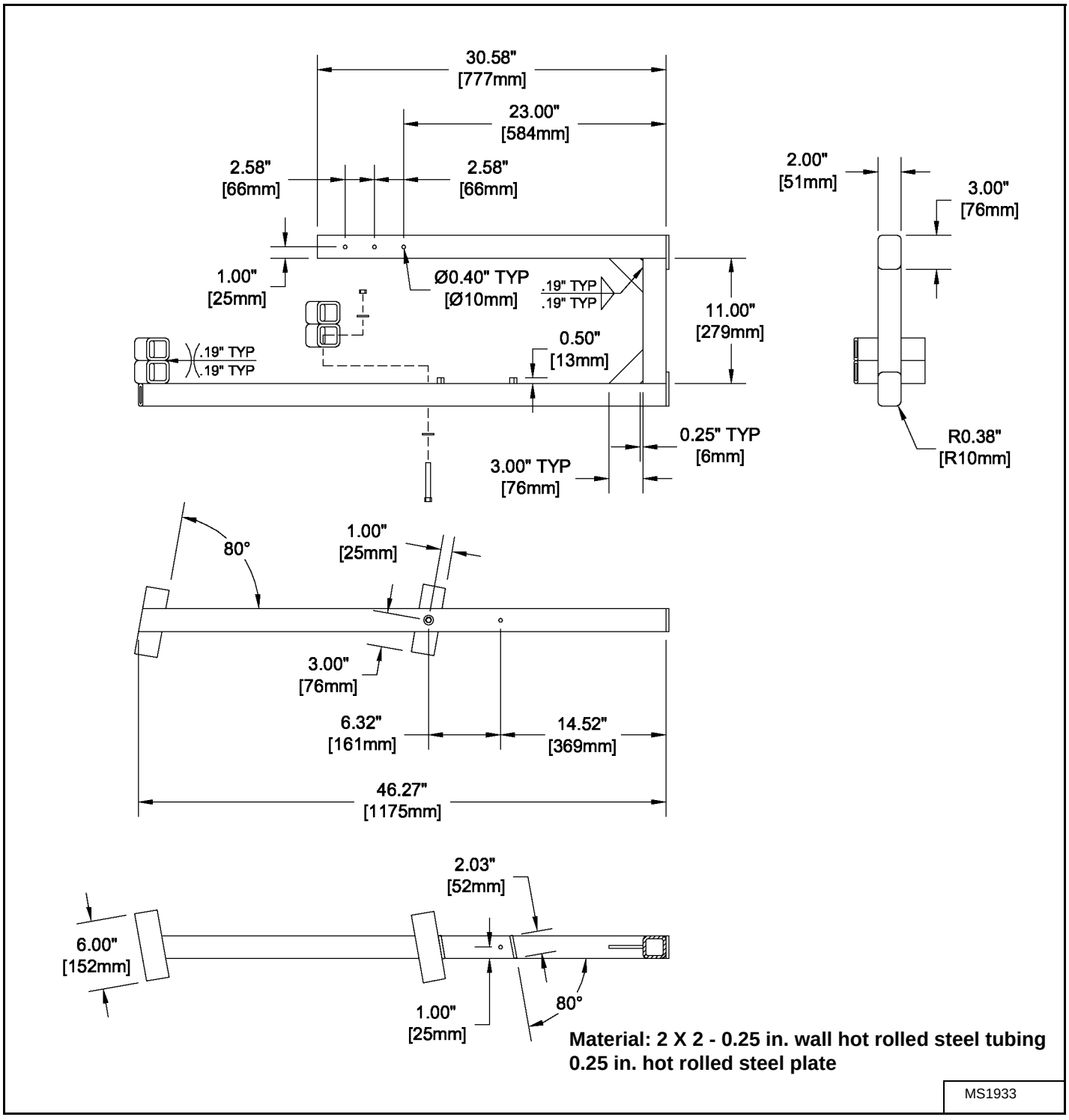
Install the swing motor. (See Removal And Installation on Page 20-90-1.)

ROPS CANOPY

Removal And Installation

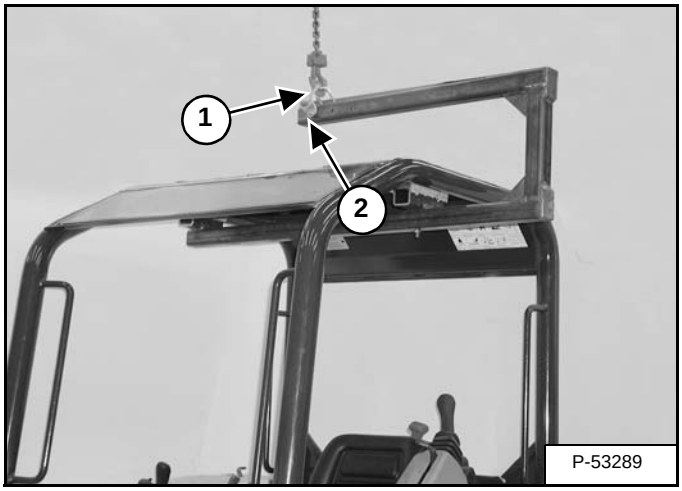
Build the service lifting bracket used to remove and install the ROPS canopy. Use the dimensions shown **[Figure 40-20-1]** to build the service lifting bracket.

Figure 40-20-1



Removal And Installation (Cont'd)

Figure 40-20-2



Install the chain hoist (Item 1) in the end hole of the lifting bracket (Item 2) **[Figure 40-20-2]**.

Install the cab/canopy service lifting bracket on the canopy **[Figure 40-20-2]**.

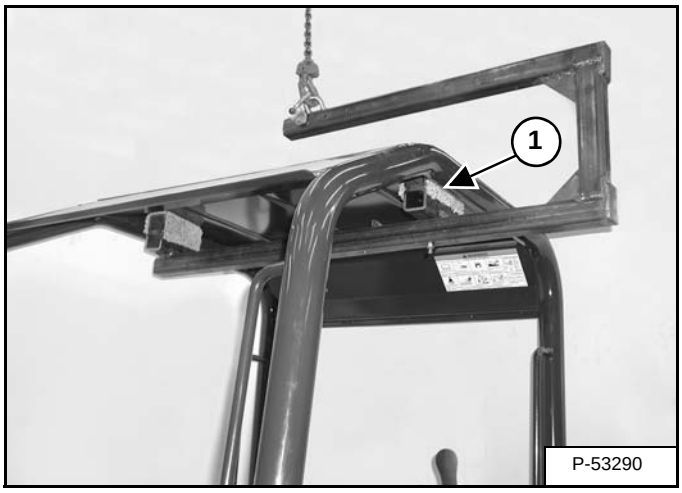
NOTE: Use a chain hoist of sufficient capacity.

⚠ WARNING

Never use the cab/canopy service lifting bracket to lift the excavator. The bracket is not strong enough and can fail causing serious injury or death.

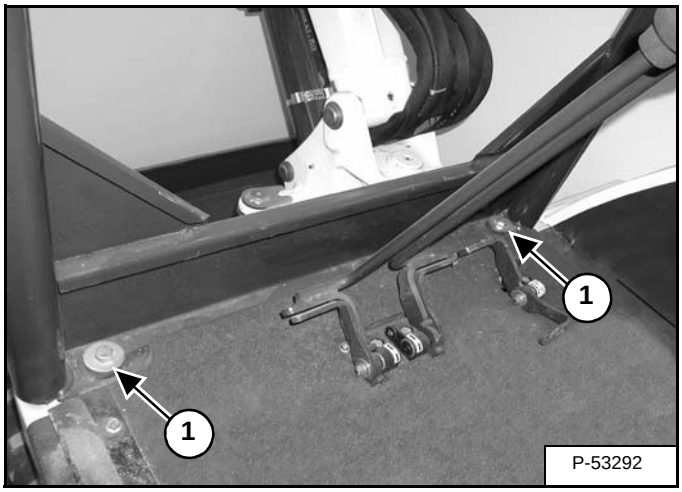
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Figure 40-20-3



Adjust the lifting bracket to the proper width by moving the bracket (Item 1) **[Figure 40-20-3]**.

Figure 40-20-4



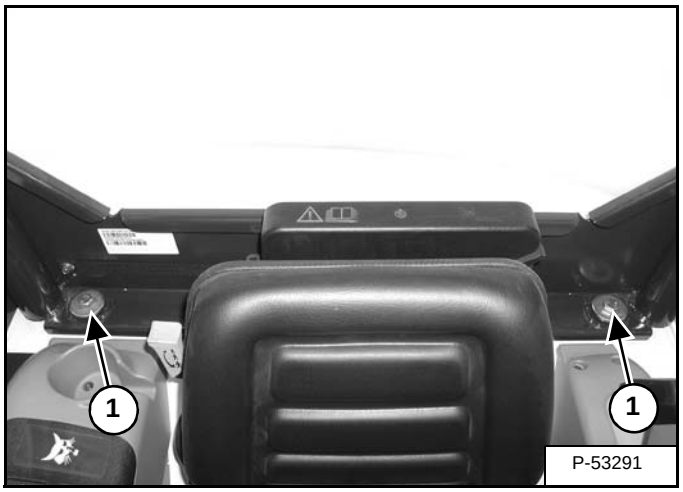
Remove the bolts and washers (Item 1) **[Figure 40-20-4]** from the inside front of the canopy.

Installation: Tighten the bolts to 118 - 133 ft.-lb. (160-180 N•m) torque.

Remove the canopy.

Removal And Installation (Cont'd)

Figure 40-20-5



Remove the bolts and washers (Item 1) **[Figure 40-20-5]** from the rear of the canopy.

Installation: Tighten the bolts to 118 - 133 ft.-lb. (160-180 N•m) torque.

Raise the hoist.

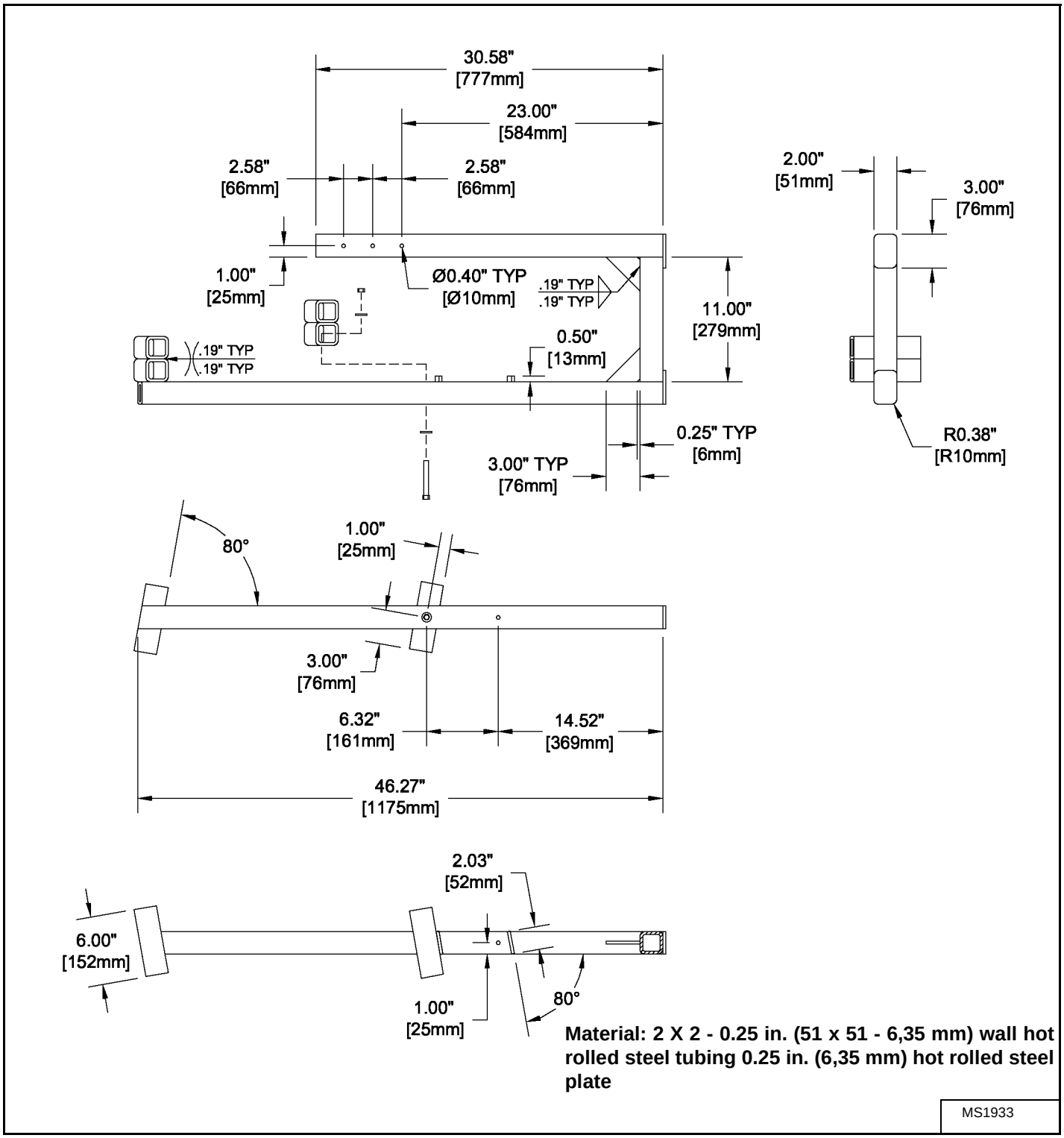
Remove the canopy.


Bobcat®

Removal And Installation

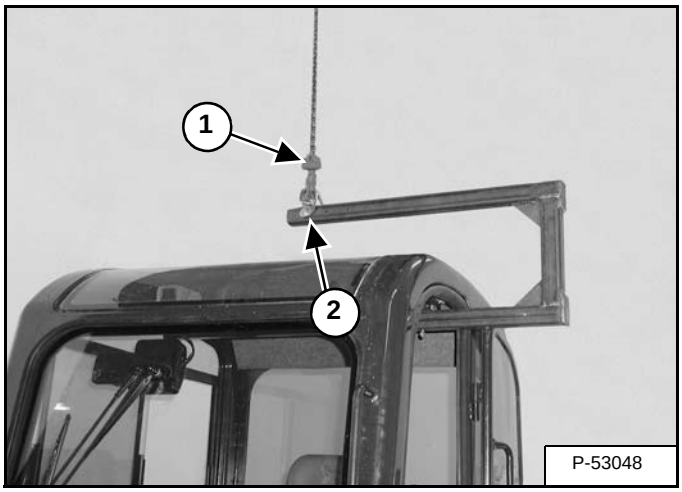
Build the service lifting bracket used to remove and install the cab. Use the dimensions shown **[Figure 40-30-1]** to build the service lifting bracket.

Figure 40-30-1



Removal And Installation (Cont'd)

Figure 40-30-2



Install the chain hoist (Item 1) in the end hole of the lifting bracket (Item 2) **[Figure 40-30-2]**.

Install the cab/canopy service lifting bracket on the cab **[Figure 40-30-2]**.

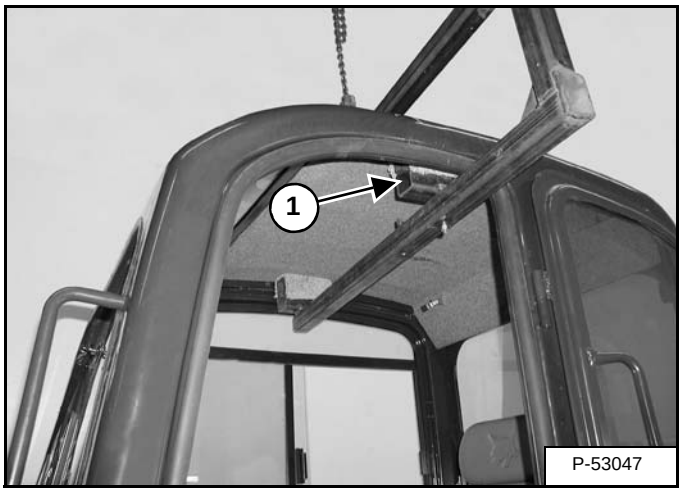
NOTE: Use a chain hoist of sufficient capacity.

⚠ WARNING

Never use the cab/canopy service lifting bracket to lift the excavator. The bracket is not strong enough and can fail causing serious injury or death.

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Figure 40-30-3

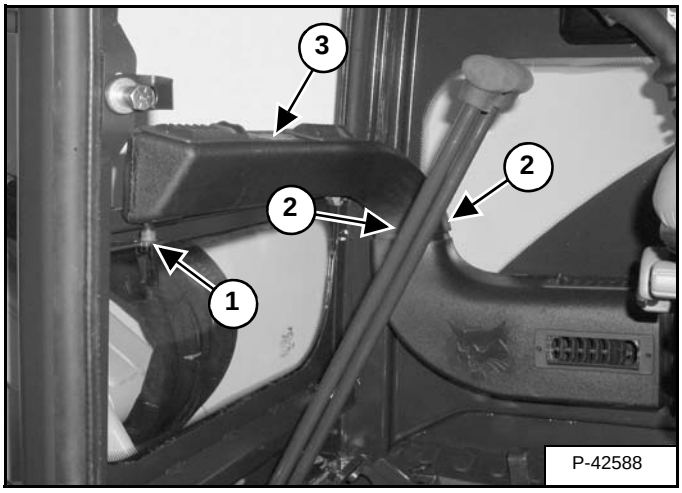


Adjust the lifting bracket to the proper width by moving the bracket (Item 1) **[Figure 40-30-3]**.

The cab may be equipped with either the A/C or heater duct.

A/C Duct

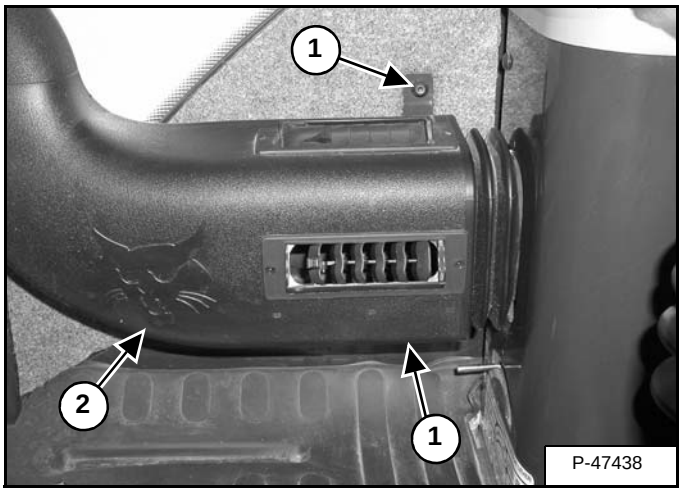
Figure 40-30-4



Pull down on the lock (Item 1), remove the screws (Item 2), and remove the A/C duct (Item 3) **[Figure 40-30-4]**.

Removal And Installation (Cont'd)

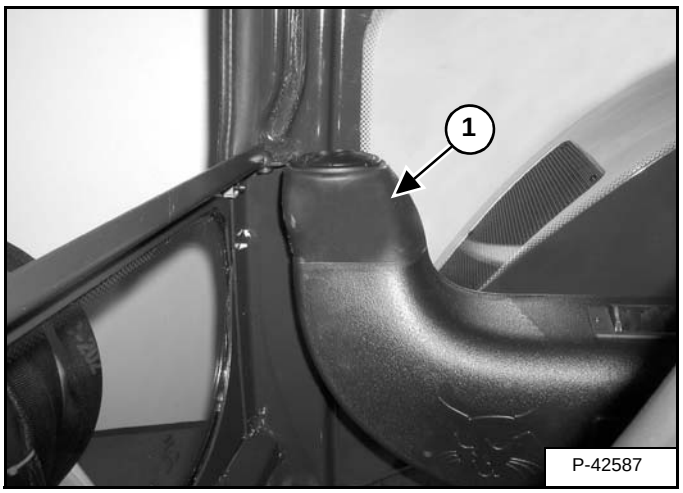
Figure 40-30-5



Remove the screws (Item 1). Remove the air manifold (Item 2) **[Figure 40-30-5]**.

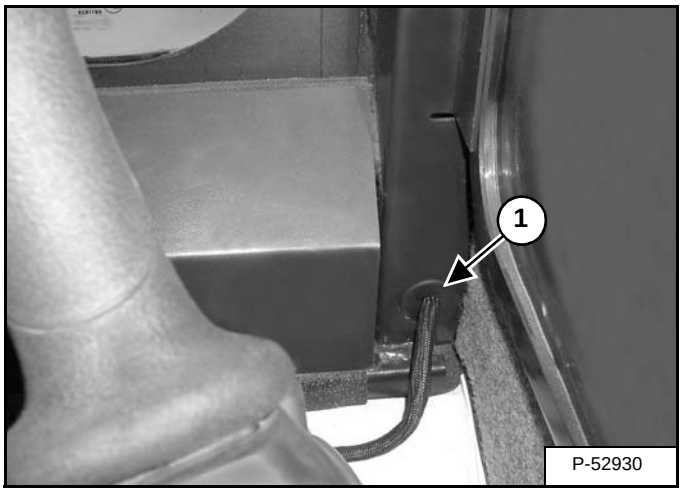
Heater Duct

Figure 40-30-6



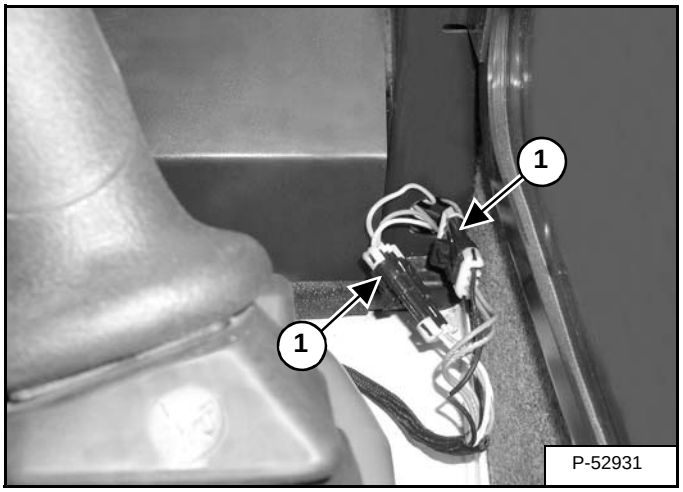
Remove the screws and pull straight up to remove the heater duct (Item 1) **[Figure 40-30-6]**.

Figure 40-30-7



Remove the grommet (Item 1) **[Figure 40-30-7]** located in the left rear corner of the cab.

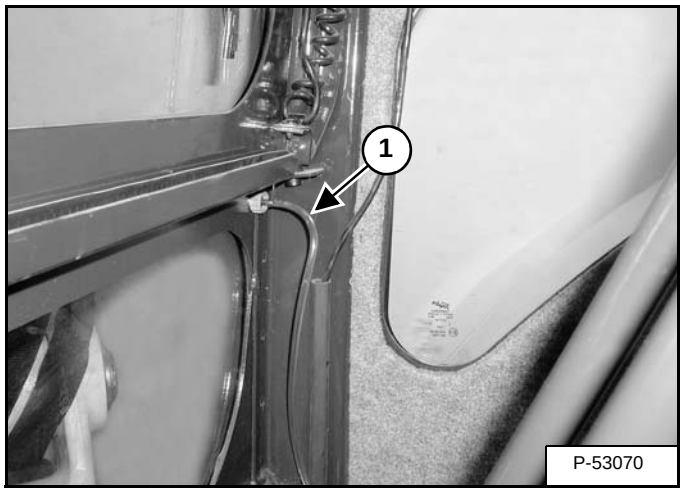
Figure 40-30-8



Remove the wire harness from the cab frame and disconnect the wire connectors (Item 1) **[Figure 40-30-8]**.

Removal And Installation (Cont'd)

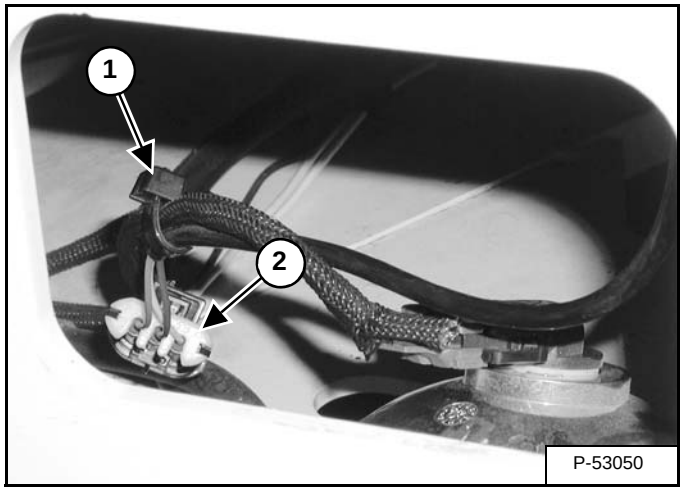
Figure 40-30-9



Remove the windshield washer hose (Item 1) **[Figure 40-30-9]** from the nozzle.

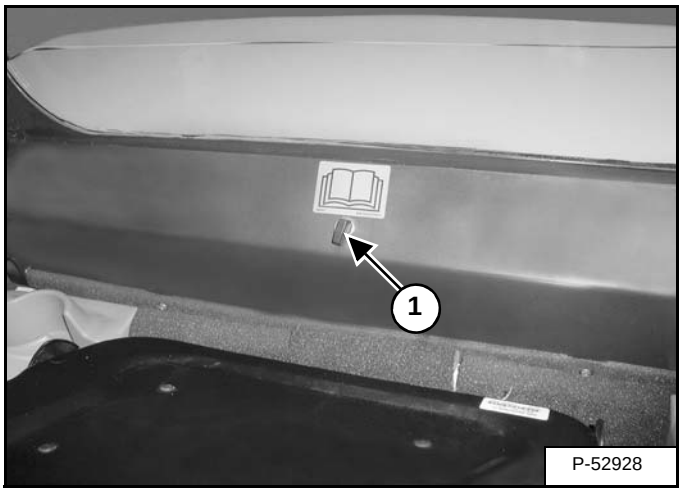
Remove the upperstructure light. (See Removal And Installation on Page 50-50-1.)

Figure 40-30-10



Remove the tie strap (Item 1) and disconnect the wire harness (Item 2) **[Figure 40-30-10]**.

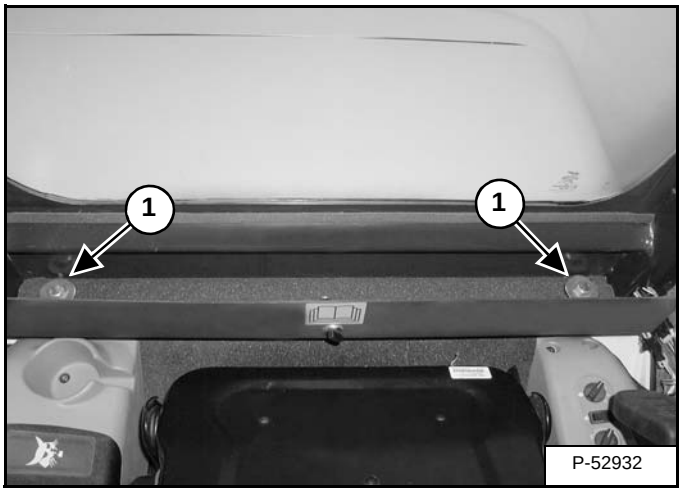
Figure 40-30-11



Open the Operation & Maintenance Manual storage door (Item 1) **[Figure 40-30-11]**.

NOTE: Later models are not equipped with the storage door.

Figure 40-30-12

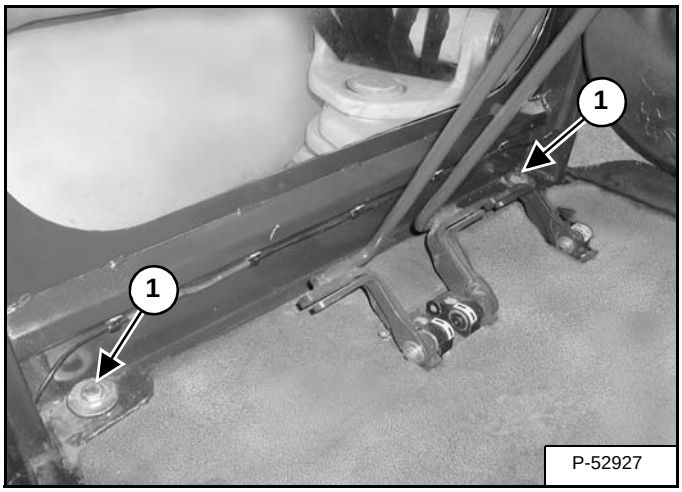


Remove the bolts and washers (Item 1) **[Figure 40-30-12]** from the rear of the cab.

Installation: Tighten the bolts to 118 - 133 ft.-lb. (160 - 180 N•m) torque.

Removal And Installation (Cont'd)

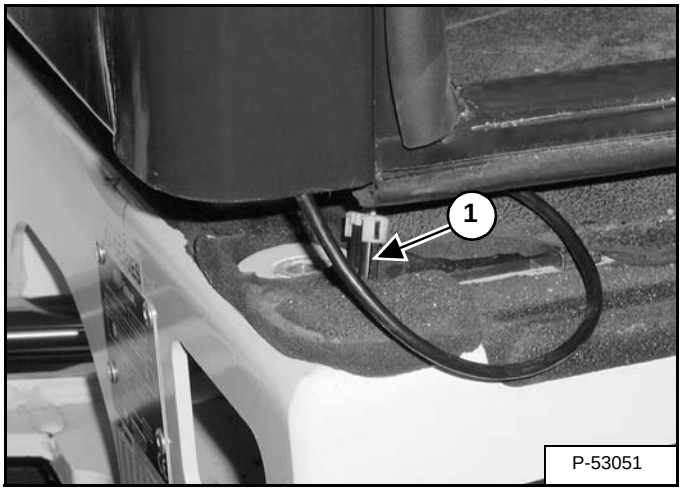
Figure 40-30-13



Remove the bolts and washers (Item 1) **[Figure 40-30-13]** from the front of the cab.

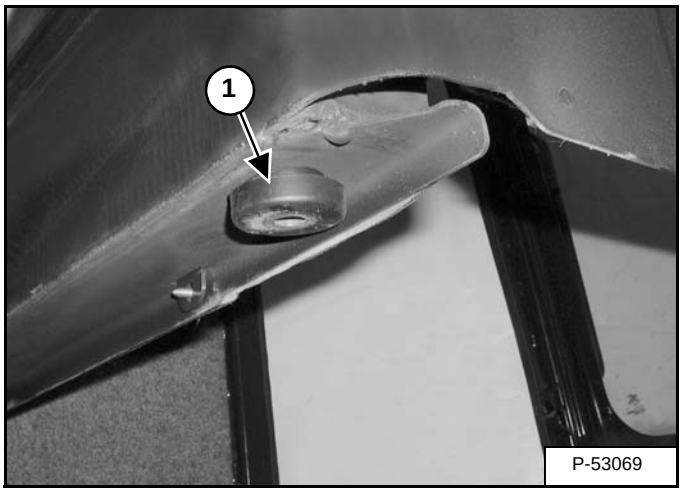
Installation: Tighten the bolts to 118 - 133 ft.-lb. (160 - 180 N•m) torque.

Figure 40-30-14



Guide the wiring harness (Item 1) **[Figure 40-30-14]** through the upperstructure as the cab is being removed.

Figure 40-30-15



Installation: Install the cab mounts (Item 1) **[Figure 40-30-15]** on the four corners of the cab.

Door Removal And Installation

Figure 40-30-16

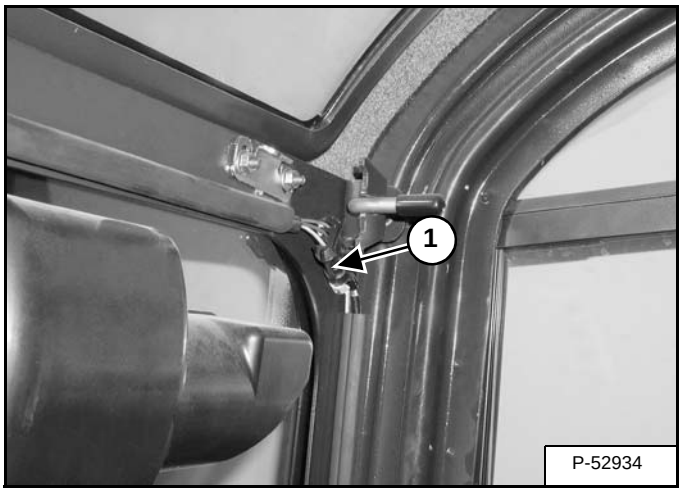


The door can be removed from the cab by slowly swinging the door back and forth while lifting up on the door **[Figure 40-30-16]**.

Installation: Align the hinges and swing the door back and forth until the door weight settles the hinges to full engagement.

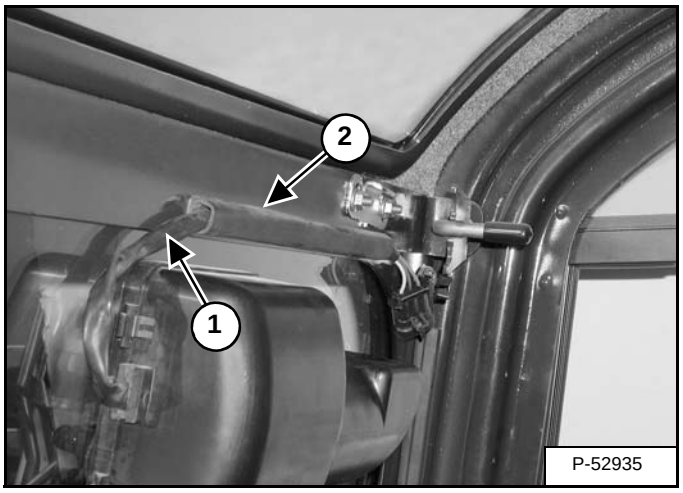
Front Window Removal And Installation

Figure 40-30-17



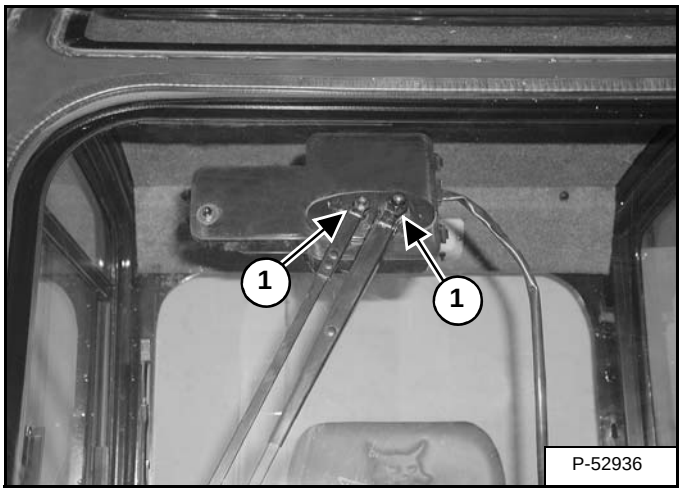
Disconnect the wire harness (Item 1) **[Figure 40-30-17]**.

Figure 40-30-18



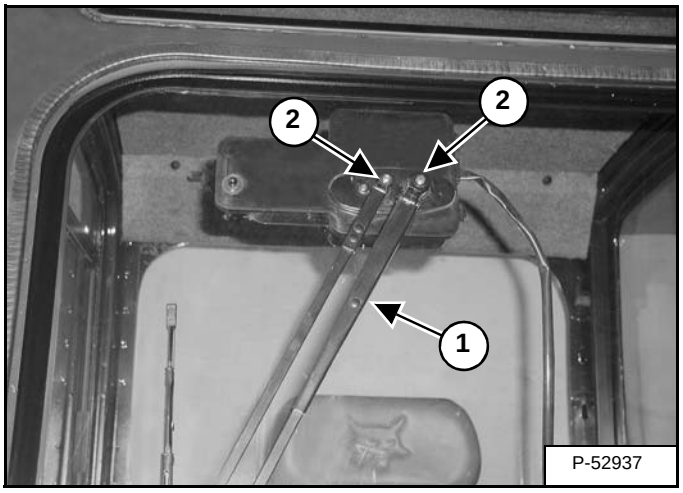
Remove the wire harness (Item 1) from the channel (Item 2) **[Figure 40-30-18]**.

Figure 40-30-19



Remove the nuts (Item 1) **[Figure 40-30-19]**.

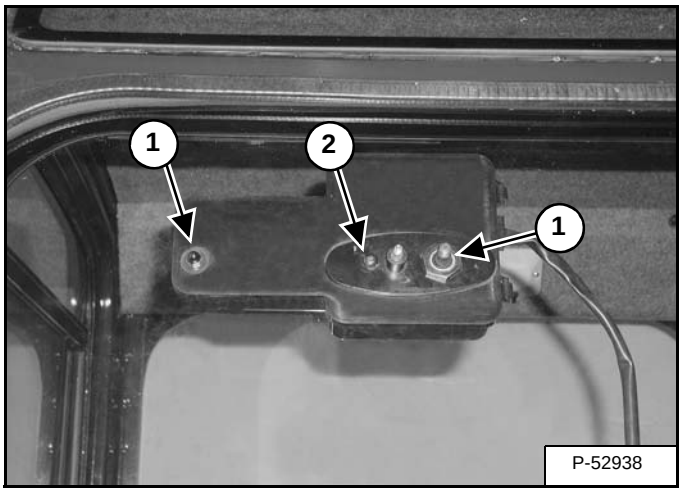
Figure 40-30-20



Remove the wiper assembly (Item 1) from the pivot mounts (Item 2) **[Figure 40-30-20]**.

Front Window Removal And Installation (Cont'd)

Figure 40-30-21

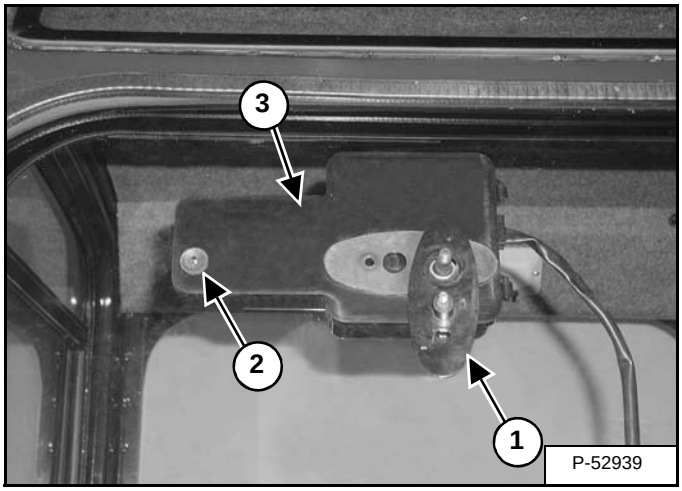


Remove the nuts and washers (Item 1) **[Figure 40-30-21]**.

Remove the bolt (Item 2) **[Figure 40-30-21]**.

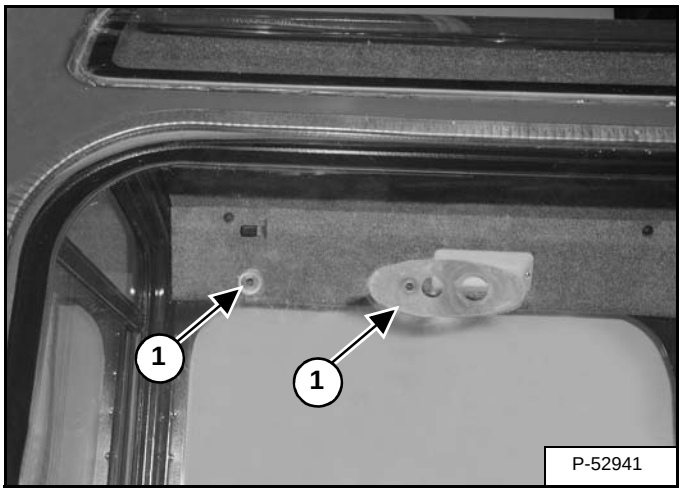
NOTE: Support the wiper motor before removing the mounting hardware.

Figure 40-30-22



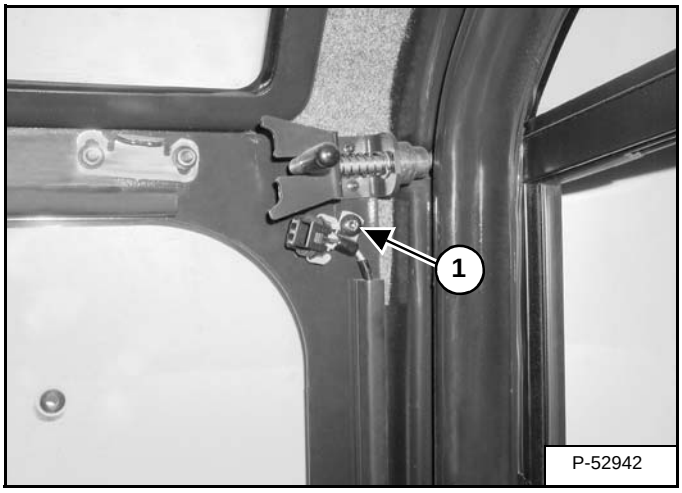
Remove the plate (Item 1), washer (Item 2), and wiper motor (Item 3) **[Figure 40-30-22]**.

Figure 40-30-23



Remove the seals (Item 1) **[Figure 40-30-23]**.

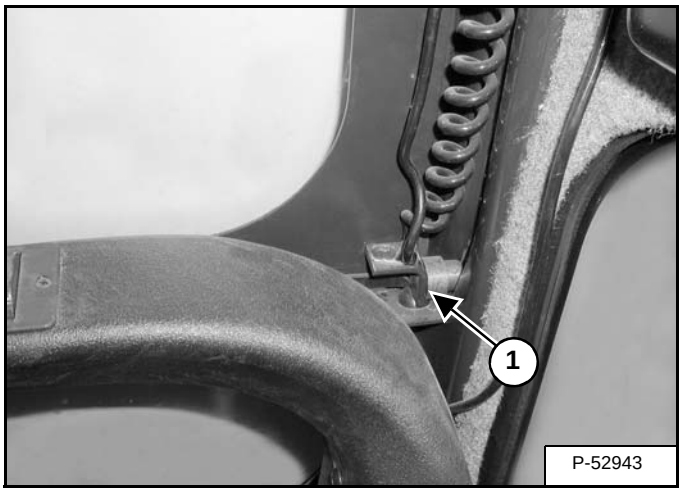
Figure 40-30-24



Remove the screw (Item 1) **[Figure 40-30-24]** holding the wire harness clamp to the top of the front window.

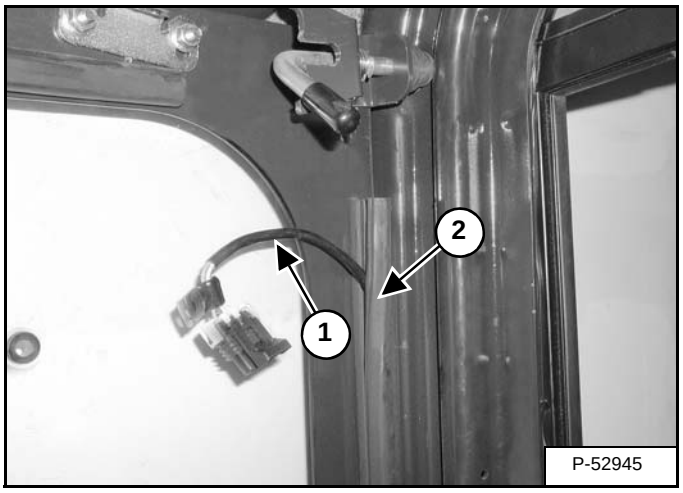
Front Window Removal And Installation (Cont'd)

Figure 40-30-25



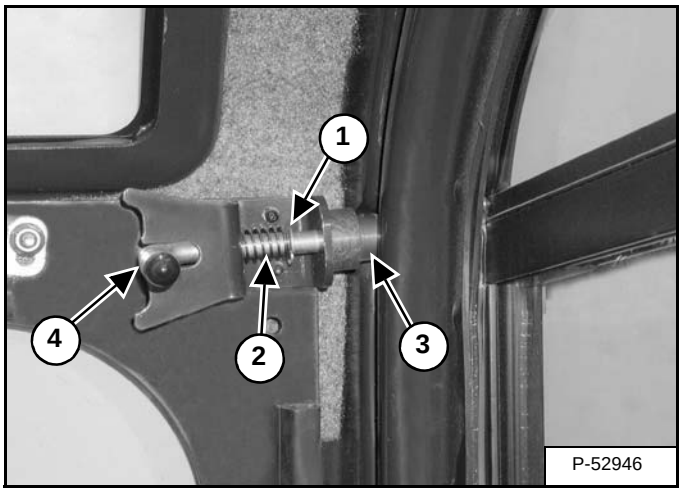
Remove the bolt (Item 1) **[Figure 40-30-25]** holding the wire harness clamp to the bottom of the front window.

Figure 40-30-26



Remove the wire harness (Item 1) from the channel (Item 2) **[Figure 40-30-26]**.

Figure 40-30-27



With the help of a second person holding the front window, remove the retainer (Item 1), spring (Item 2), roller (Item 3), and handle (Item 4) **[Figure 40-30-27]** from both sides of the front window.

Figure 40-30-28

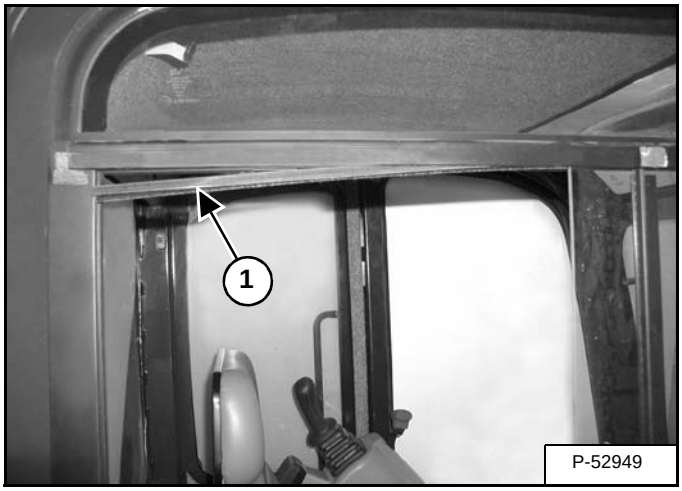


Tilt the front window (Item 1) **[Figure 40-30-28]**. Remove the front window from the cab frame.

Right Side Rear Sliding Window Removal And Installation

Close and latch the front and rear sliding windows.

Figure 40-30-29



Use a pick to pull the felt (Item 1) **[Figure 40-30-29]** from the top window channel.

Unlatch the rear sliding window and slide the window open until it stops.

Figure 40-30-30



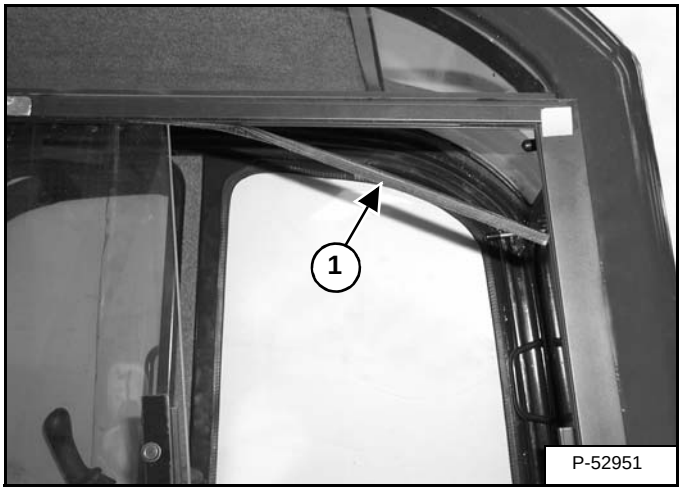
Lift the window up into the top channel and tilt the bottom edge out **[Figure 40-30-30]**. Remove the window from the excavator.

Right Side Front Sliding Window Removal And Installation

NOTE: The rear sliding window must be removed before the front sliding window can be removed.

Unlatch the front sliding window and slide the window open until it stops.

Figure 40-30-31



Use a pick to pull the felt (Item 1) **[Figure 40-30-31]** from the inside top window channel.

Figure 40-30-32

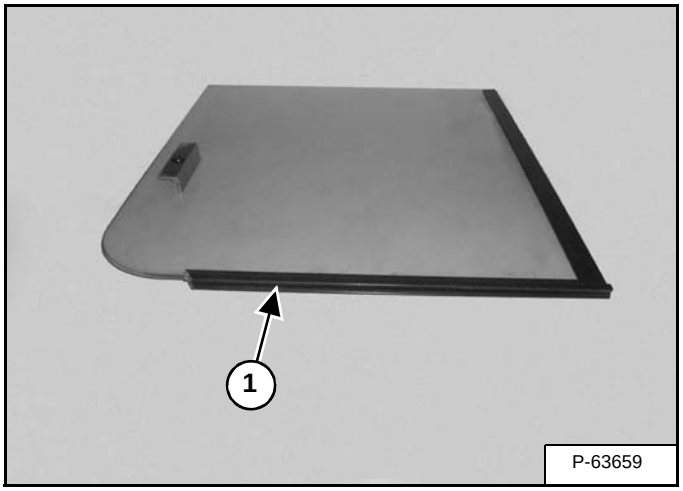


Lift the window up into the channel and tilt the bottom edge out **[Figure 40-30-32]**. Remove the window from the excavator.

Right Side Front And Rear Sliding Window Weather Strip Removal And Installation

Remove the window.

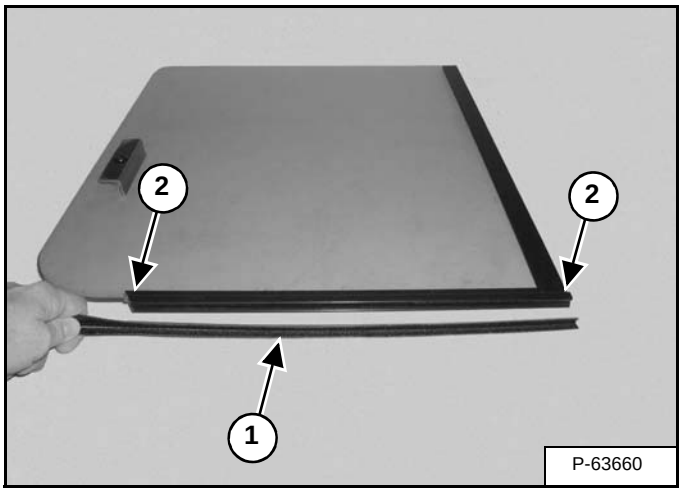
Figure 40-30-33



Remove the weather strip (Item 1) **[Figure 40-30-33]** from the bottom channel of the window.

Installation: Clean the bottom channel. Apply a bead of adhesive in the channel.

Figure 40-30-34

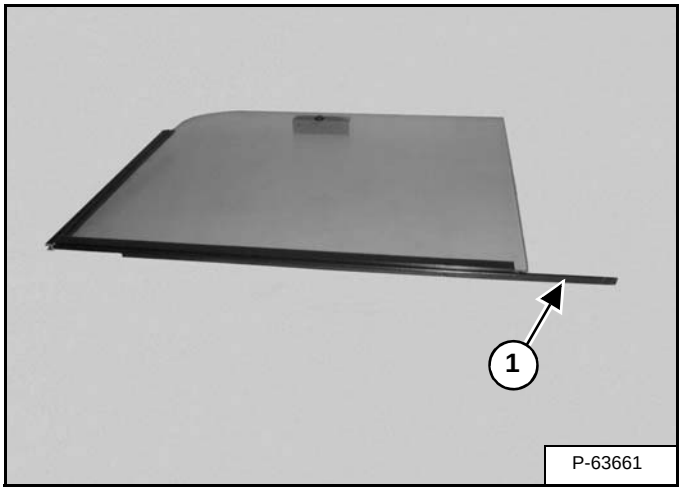


Install the new weather strip (Item 1). Cut the weather strip flush with the ends of the window channel (Item 2) **[Figure 40-30-34]**.

Right Side Front And Rear Sliding Window Wiper Strip Removal And Installation

Remove the window.

Figure 40-30-35

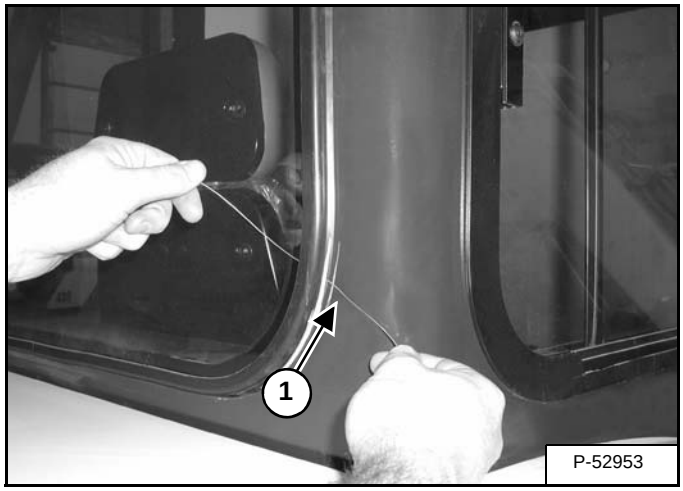


Remove the wiper strip (Item 1) **[Figure 40-30-35]** from the window channel.

Glass Removal

Use the following procedure to remove the glass from the cab and right side window assembly.

Figure 40-30-36



Push a small diameter wire (Item 1) **[Figure 40-30-36]** through the adhesive. Pull the wire around the perimeter of the glass to cut the adhesive.

Remove the glass.

NOTE: The right side window frame is aluminum and will be destroyed when removed.

CAB (CONT'D)

Glass Installation

Rear and front lower glass.

Remove the majority of the old urethane adhesive from the perimeter of the cab.

NOTE: Leave a thin film of the old urethane on the cab frame, fresh urethane will bond to the remaining film.

Prime and paint any bare metal or scratches.

Clean the metal surfaces with general purposes adhesive cleaner. Clean the glass surface with glass cleaner.

Figure 40-30-37

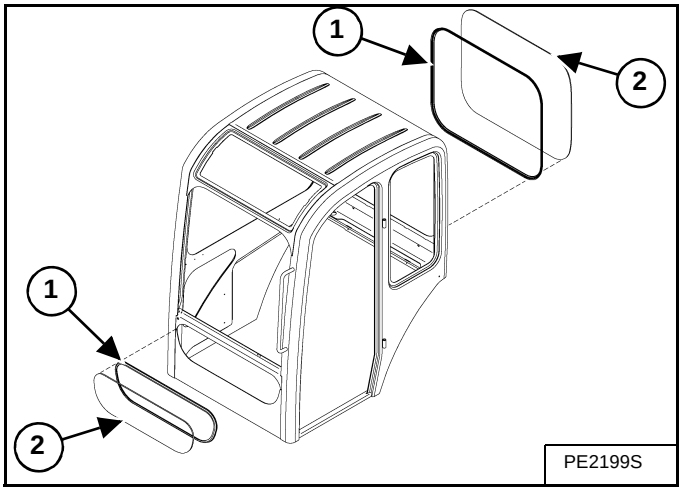
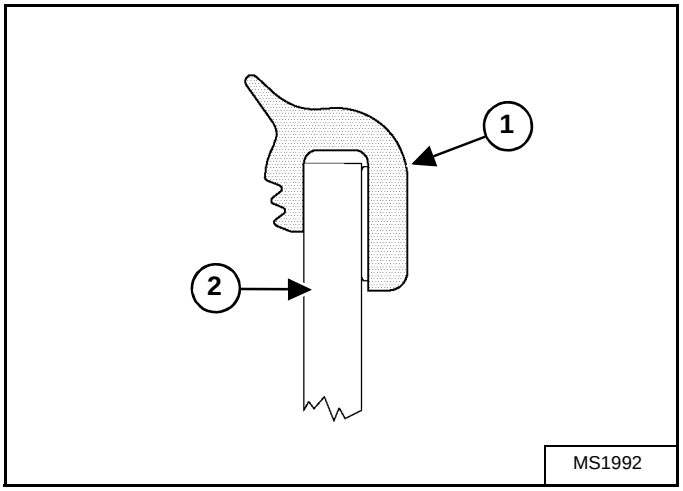


Figure 40-30-38



Install the seal (Item 1) on the glass (Item 2) **[Figure 40-30-37]** & **[Figure 40-30-38]**.

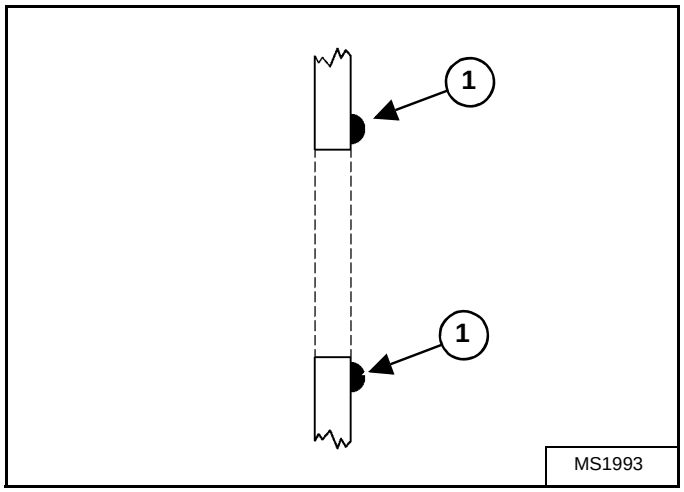
Shake the combo primer for one minute.

Apply the combo primer to the perimeter of the cab and glass (Item 2) **[Figure 40-30-38]**. Apply the primer in one direction only, using a dauber. Do not dip the dauber in the primer more than once. Use multiple daubers if needed.

Allow the combo primer to dry for five minutes. Dry time doubles if the primer is applied in two coats.

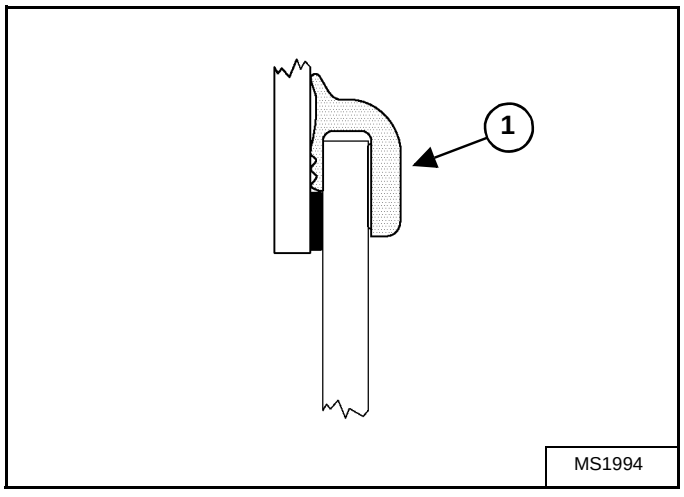
Cut the tip of the adhesive tube to the desired shape and size to provide a bead height sufficient to give good contact with the glass around the entire perimeter.

Figure 40-30-39



Apply a 0.3 x 0.25 in. (7,62 x 6,35 mm) bead of urethane adhesive (Item 1) **[Figure 40-30-39]** to the perimeter of the cab.

Figure 40-30-40



Install the glass and seal assembly (Item 1) **[Figure 40-30-40]**. Press the glass into the cab to make complete contact with the adhesive. Tape the glass in place.

Glass Installation (Cont'd)

Allow two hours for curing at normal conditions (65° F (18° C), 75% relative humidity).

Remove the tape after the adhesive is cured.

Top, right side and left side glass

Remove the majority of the old urethane adhesive from the perimeter of the cab.

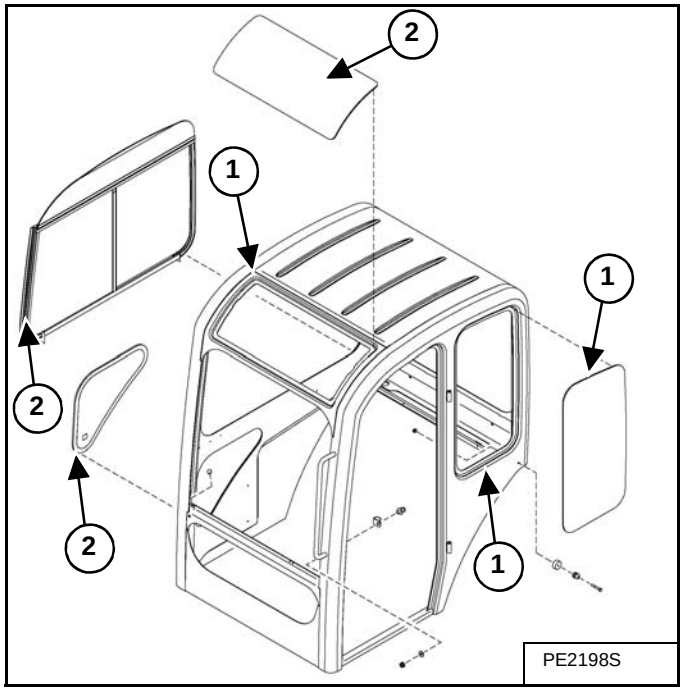
NOTE: Leave a thin film of the old urethane on the cab frame, fresh urethane will bond to the remaining film.

Prime and paint any bare metal or scratches.

Clean the metal surfaces with general purposes adhesive cleaner. Clean the glass surface with glass cleaner.

Shake the combo primer for one minute.

Figure 40-30-41

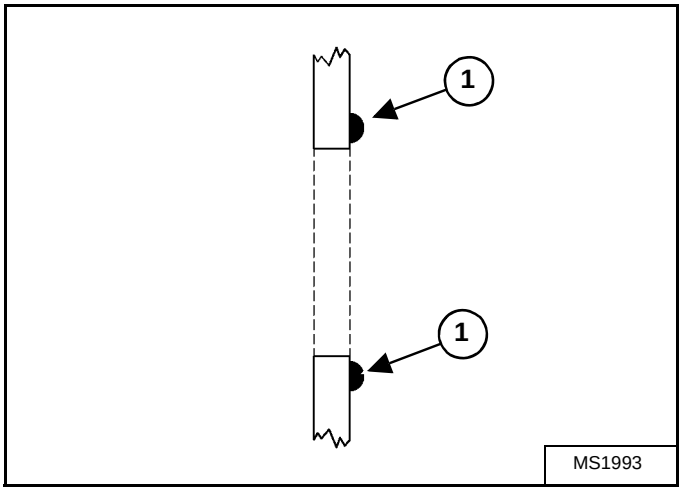


Apply combo primer to the perimeter of the cab (Item 1) and glass (Item 2) **[Figure 40-30-41]**. Apply the primer in one direction only, using a dauber. Do not dip the dauber in the primer more than once. Use multiple daubers if needed.

Allow the combo primer to dry for five minutes. Dry time doubles if the primer is applied in two coats.

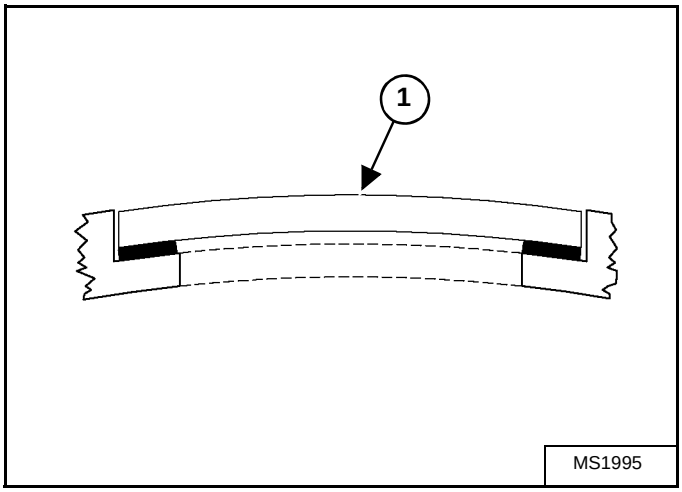
Cut the tip of the adhesive tube to the desired shape and size to provide a bead height sufficient to give good contact with the glass around the entire perimeter.

Figure 40-30-42



Apply a 0.3 x 0.25 in. (7,62 x 6,35 mm) bead of urethane adhesive (Item 1) **[Figure 40-30-42]** to the perimeter of the cab.

Figure 40-30-43



Install the glass (Item 1) **[Figure 40-30-43]**. Press the glass into the cab to make complete contact with the adhesive. Tape the glass in place.

Allow two hours for curing at normal conditions (65° F (18° C), 75% relative humidity).

Remove the tape after the adhesive is cured.

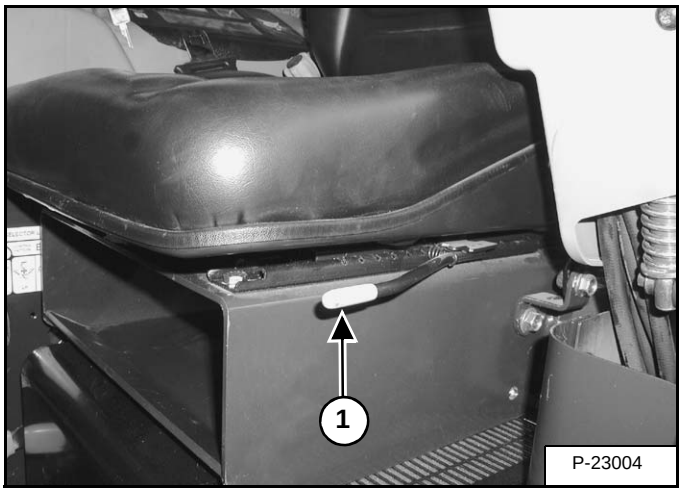
Door and front window glass

The door and front window glass are not available separately. Order and install the door or front window frame and glass assembly.

STANDARD SEAT AND SEAT MOUNT

Removal And Installation

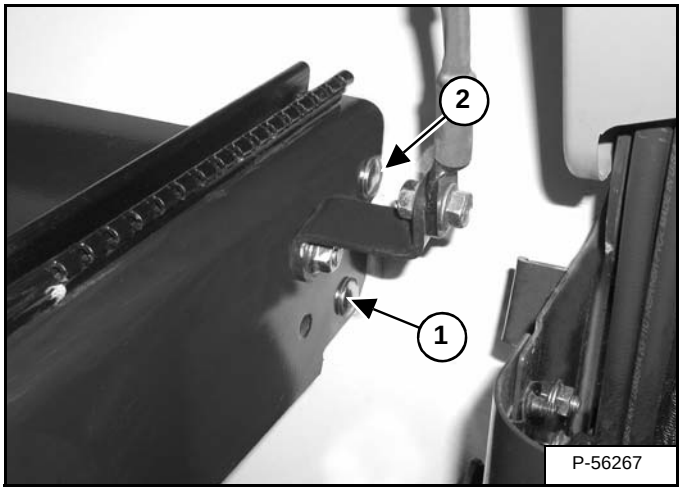
Figure 40-40-1



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 bolt (Item 1) **[Figure 40-40-2]** (both sides.)

Remove the top bolt (Item 2) **[Figure 40-40-2]** (both sides.)

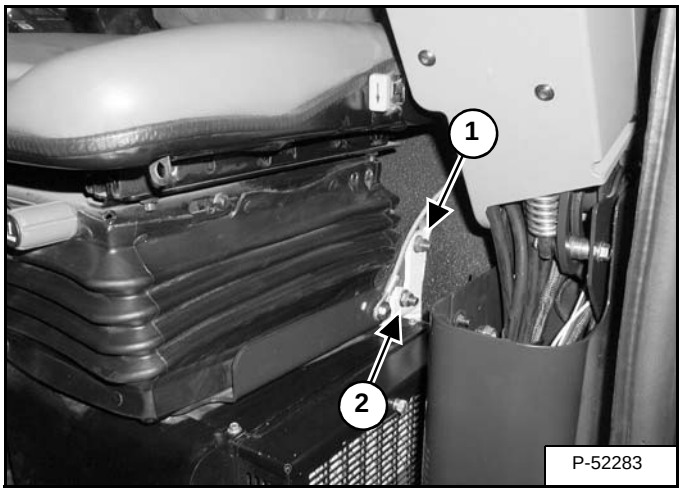
Remove the seat mount.


Bobcat®

SUSPENSION SEAT AND SEAT MOUNT

Removal And Installation

Figure 40-41-1

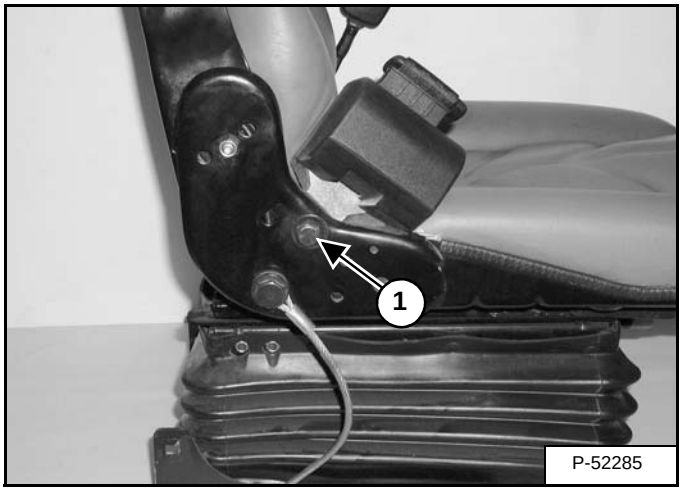


Remove the top bolt (Item 1) **[Figure 40-41-1]** (both sides.)

Loosen the bottom bolt (Item 2) **[Figure 40-41-1]** (both sides.)

Remove the seat and seat mount from the excavator.

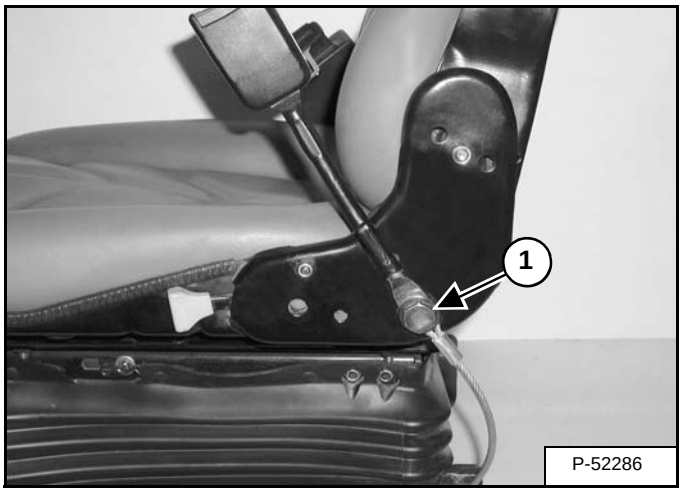
Figure 40-41-2



Remove the seat belt mounting bolt (Item 1) **[Figure 40-41-2]**.

Remove the seat belt.

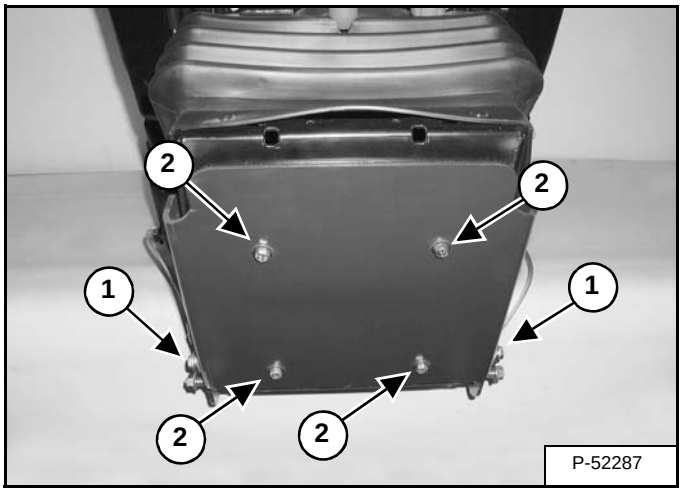
Figure 40-41-3



Remove the seat belt mounting bolt (Item 1) **[Figure 40-41-3]**.

Remove the seat belt.

Figure 40-41-4



Remove the bolts (Item 1) **[Figure 40-41-4]** from the seat cables.

Remove the seat mount bolts (Item 2) **[Figure 40-41-4]**.

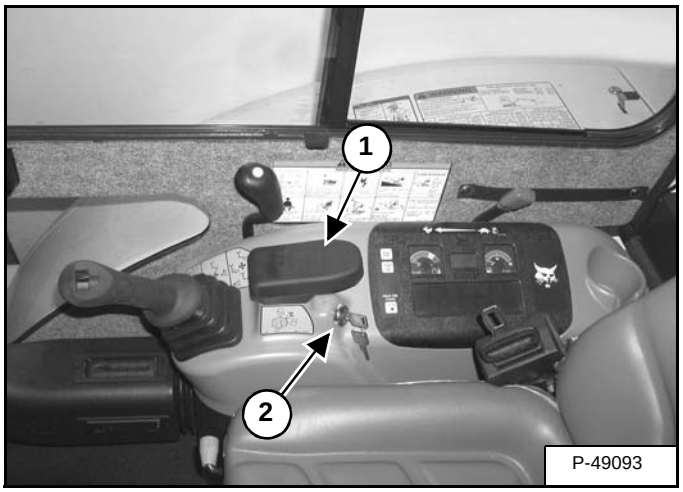
Remove the seat mount from the seat.


Bobcat®

RIGHT CONSOLE

Console Cover Removal And Installation

Figure 40-50-1



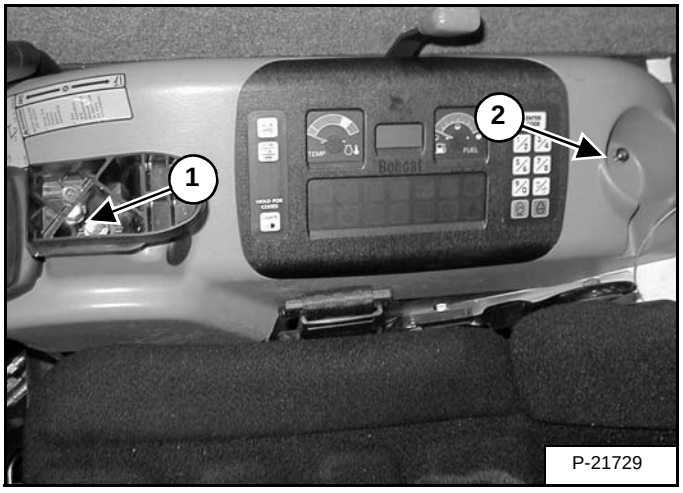
Remove the cover (Item 1) **[Figure 40-50-1]** from the arm rest.

Lift up on the rear of the cover and slide the cover ahead to remove it.

Remove the key and nut from the key switch (Item 2) **[Figure 40-50-1]** (if equipped). Allow the switch to drop inside the console.

NOTE: The key switch must be removed to remove and install the console cover.

Figure 40-50-2



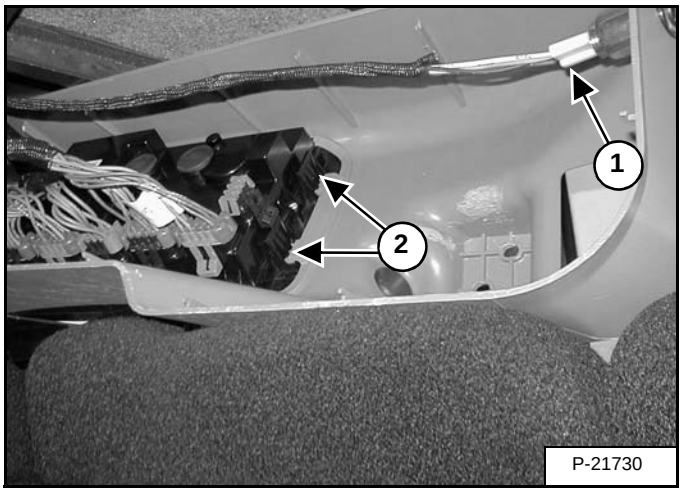
Remove the two bolts (Item 1) **[Figure 40-50-2]** from the arm rest.

Remove the arm rest.

Remove the screw (Item 2) **[Figure 40-50-2]** from the cup holder.

Lift the console cover up and over the joystick lever.

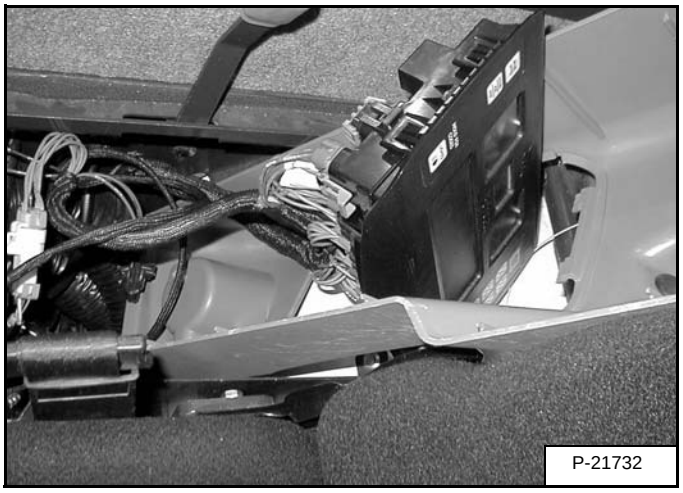
Figure 40-50-3



Disconnect the accessory outlet electrical connector (Item 1) **[Figure 40-50-3]**.

Remove the controller from the console cover by pressing the mounting tabs (Item 2) **[Figure 40-50-3]**.

Figure 40-50-4



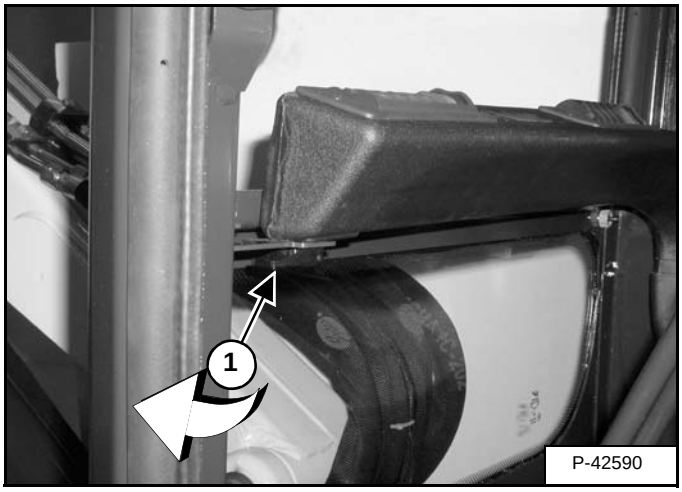
Turn the instrument panel to allow it to pass through the console cover **[Figure 40-50-4]**.

Remove the console cover.

Console Base Removal And Installation

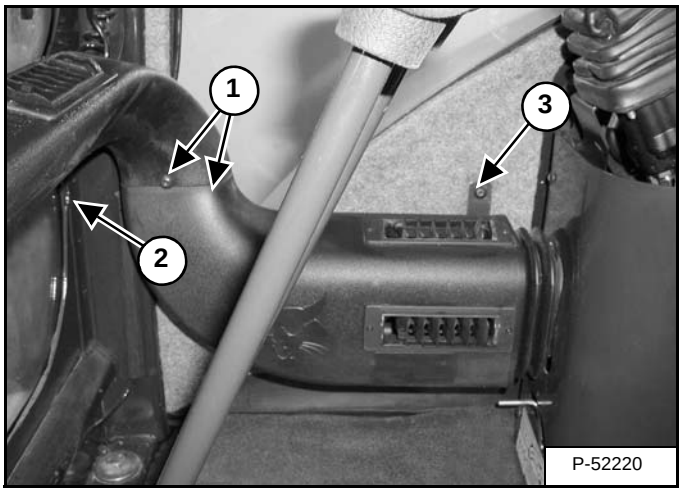
Remove the console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 40-50-5



Rotate the lock (Item 1) **[Figure 40-50-5]**.

Figure 40-50-6

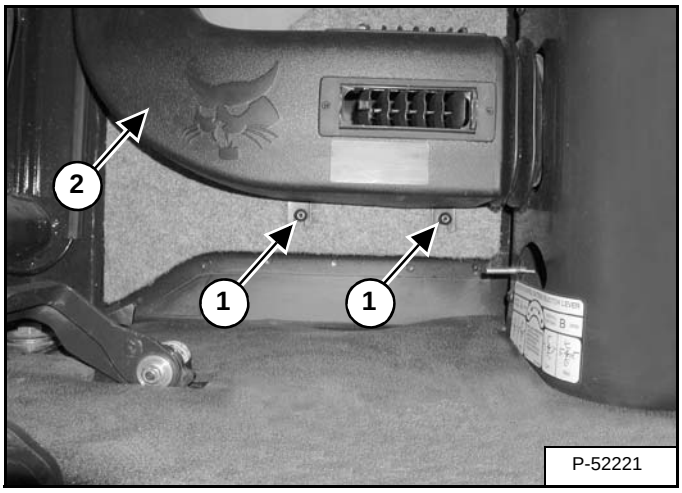


Remove the screws (Item 1) **[Figure 40-50-6]**.

Remove the air conditioning duct (Item 2) **[Figure 40-50-6]**.

Remove the screw (Item 3) **[Figure 40-50-6]**.

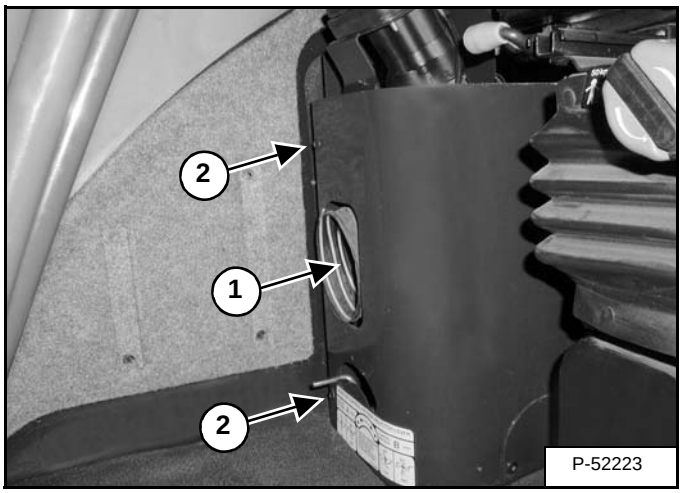
Figure 40-50-7



Remove the screws (Item 1) **[Figure 40-50-7]**.

Remove the duct (Item 2) **[Figure 40-50-7]**.

Figure 40-50-8

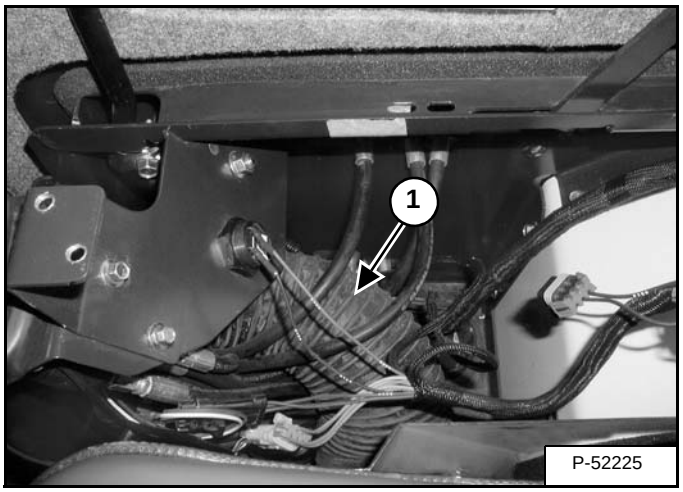


Push the hose (Item 1) **[Figure 40-50-8]** inside the console base.

Remove the bolts (Item 2) **[Figure 40-50-8]**.

Console Base Removal And Installation (Cont'd)

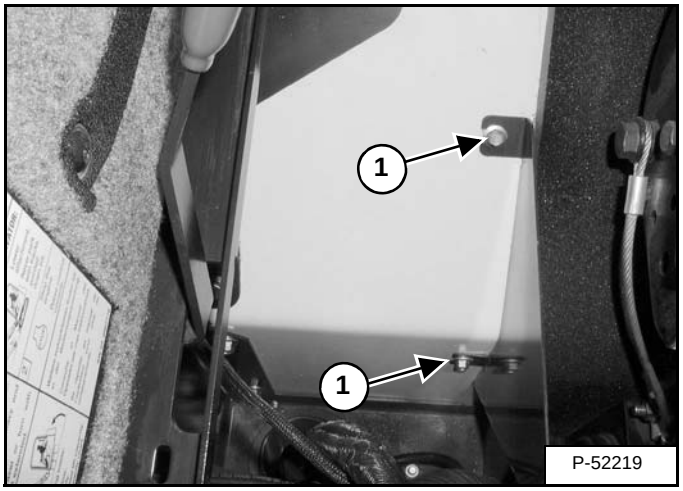
Figure 40-50-9



Remove the hose (Item 1) **[Figure 40-50-9]**.

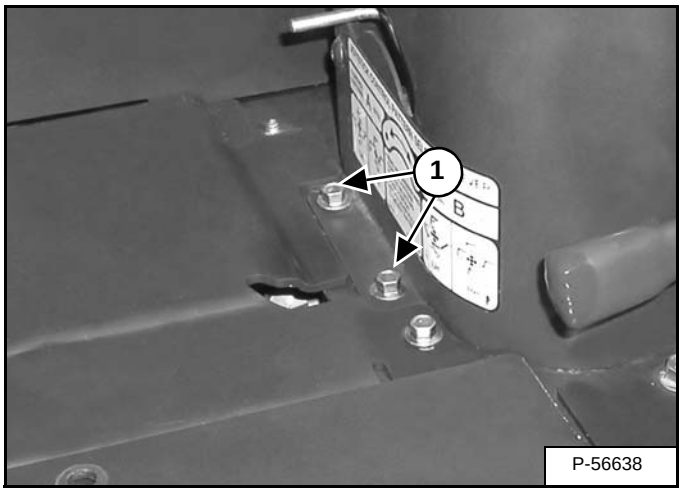
Remove the floor mat.

Figure 40-50-10



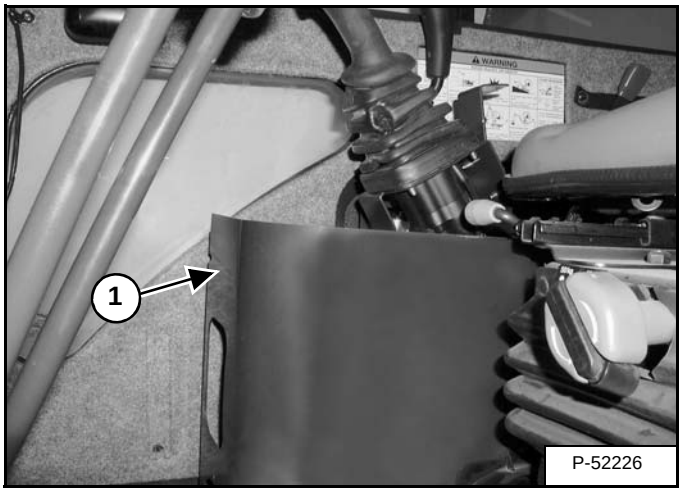
Remove the bolts (Item 1) **[Figure 40-50-10]**.

Figure 40-50-11



Remove the bolts (Item 1) **[Figure 40-50-11]**.

Figure 40-50-12



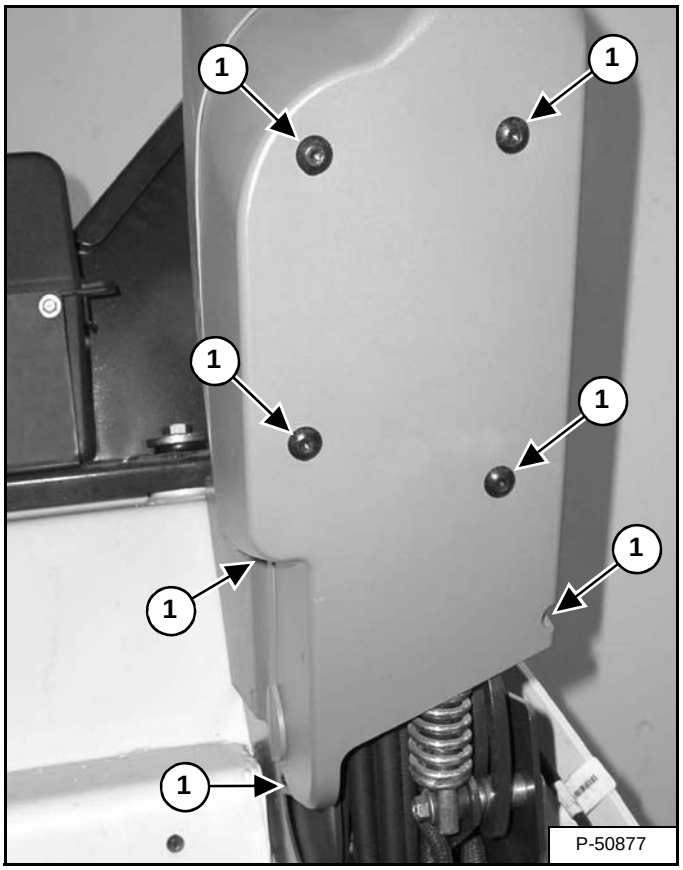
Slide the console base (Item 1) **[Figure 40-50-12]** forward and remove the base from the excavator.


Bobcat®

LEFT CONSOLE

Lower Console Cover Removal And Installation

Figure 40-60-13

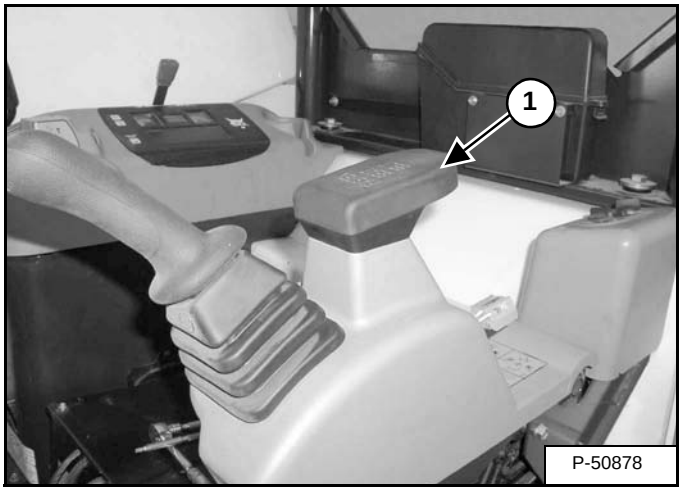


Remove the seven screws (Item 1) **[Figure 40-60-13]** from the lower half of the console cover.

Remove the lower half of the console cover.

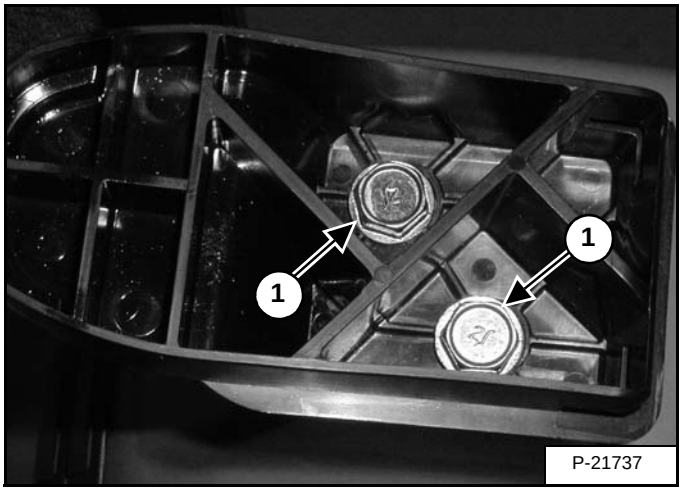
Lower the console.

Figure 40-60-14



Remove the cover (Item 1) **[Figure 40-60-14]** from the arm rest.

Figure 40-60-15



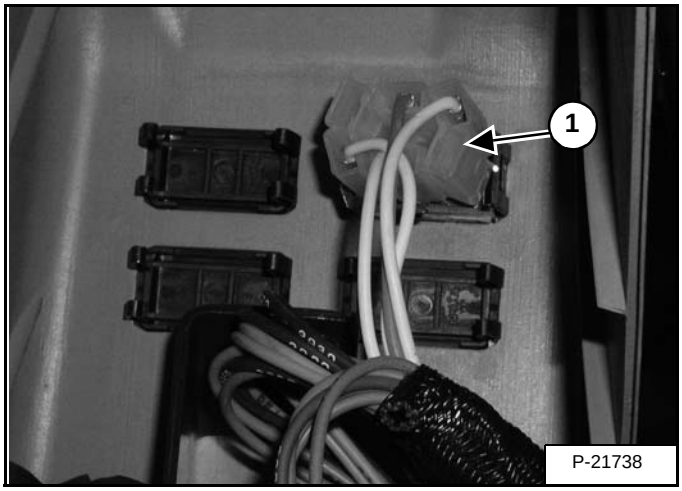
Remove the bolts (Item 1) **[Figure 40-60-15]** from the arm rest.

Remove the arm rest.

Raise the upper half of the console cover.

Lower Console Cover Removal And Installation (Cont'd)

Figure 40-60-16



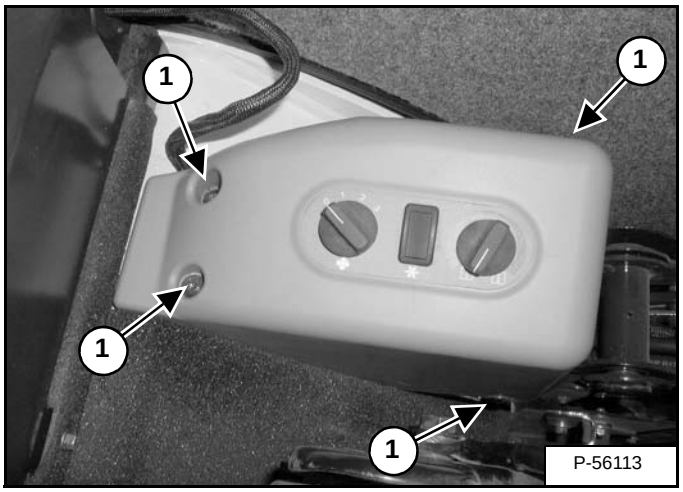
Disconnect the electrical connector (Item 1) **[Figure 40-60-16]**.

NOTE: These connectors are keyed so they can be plugged in only one way.

Remove the console cover.

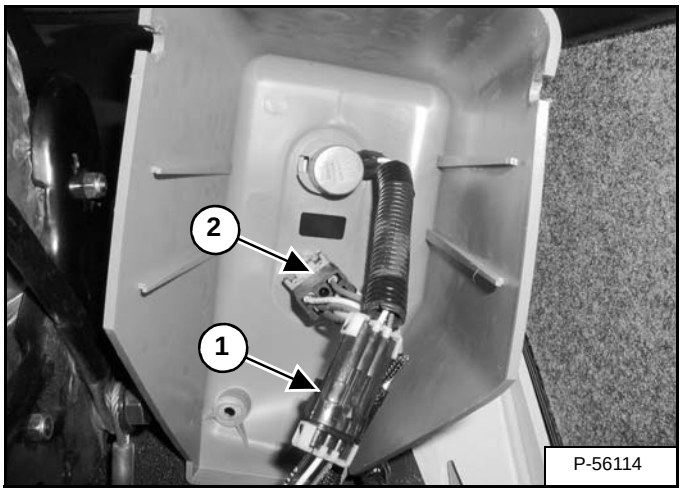
Upper Console Cover Removal And Installation

Figure 40-60-17



Remove the four console cover screws (Item 1) **[Figure 40-60-17]**.

Figure 40-60-18



Lift the console cover and disconnect the harness (Item 1) **[Figure 40-60-18]** from the potentiometer harness. (If equipped with heater)

Disconnect the harness (Item 2) **[Figure 40-60-18]** from the blower switch. (If equipped with heater)

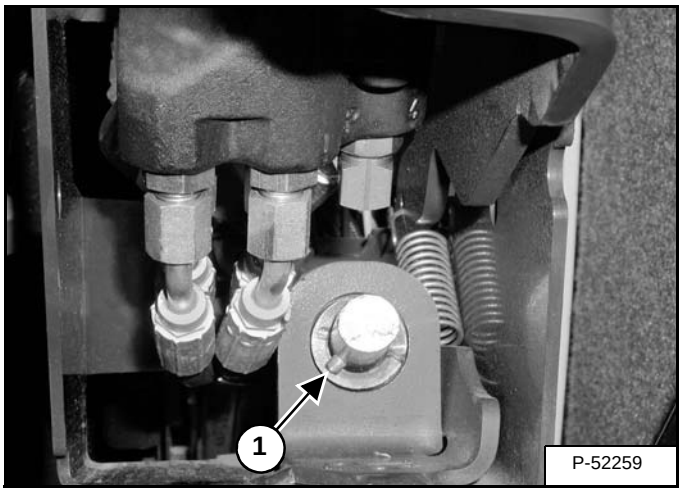
Remove the console from the excavator.

Compression Spring Removal And Installation

Remove the lower console cover. See Lower Console Cover Removal And Installation on Page 40-60-1.)

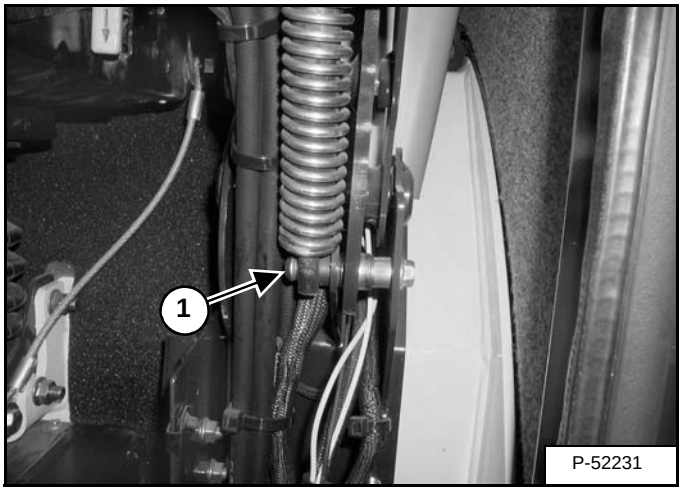
Lower the console.

Figure 40-60-19



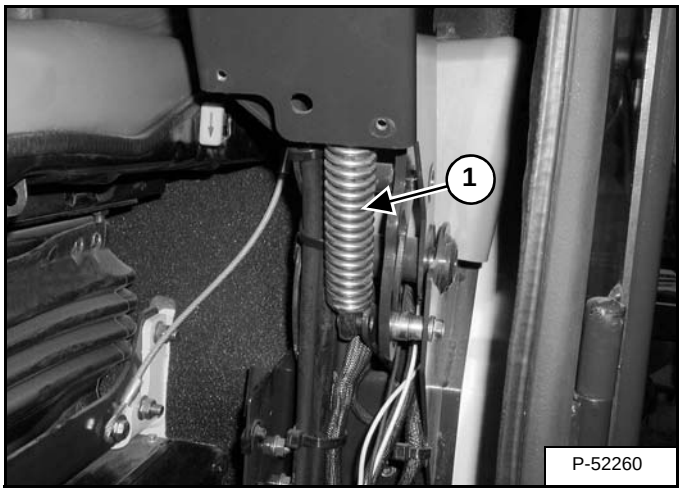
Install a pin (Item 1) **[Figure 40-60-19]** in the top of the compression spring rod.

Figure 40-60-20



Support the console in the raised position. Remove the bolt (Item 1) **[Figure 40-60-20]**.

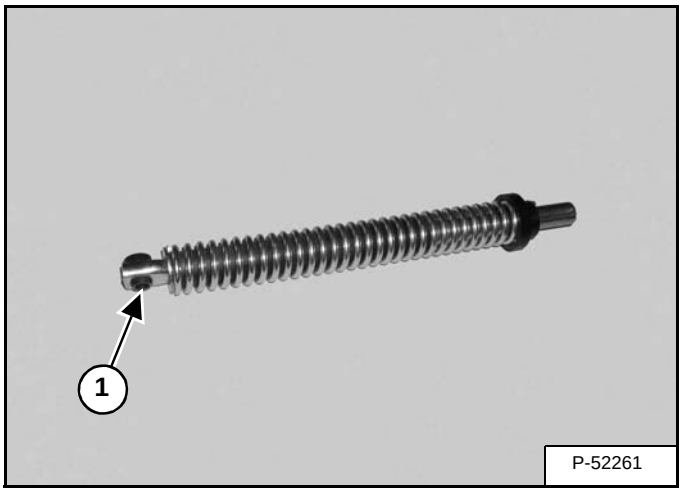
Figure 40-60-21



Remove the spring assembly (Item 1) **[Figure 40-60-21]** from the console.

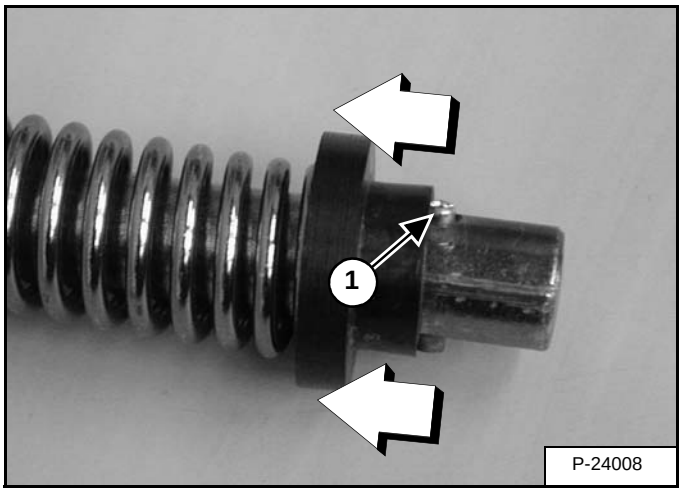
Compression Spring Disassembly And Assembly

Figure 40-60-22



Remove the bushing (Item 1) **[Figure 40-60-22]**.

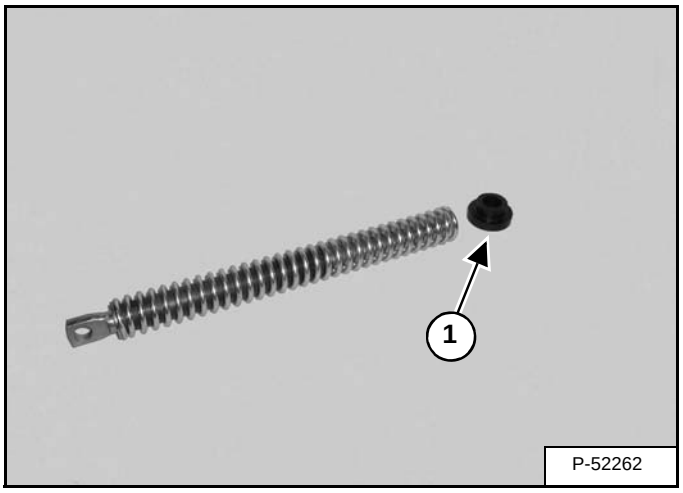
Figure 40-60-23



Apply pressure against the spring, and remove the pin (Item 1) **[Figure 40-60-23]** from the shaft.

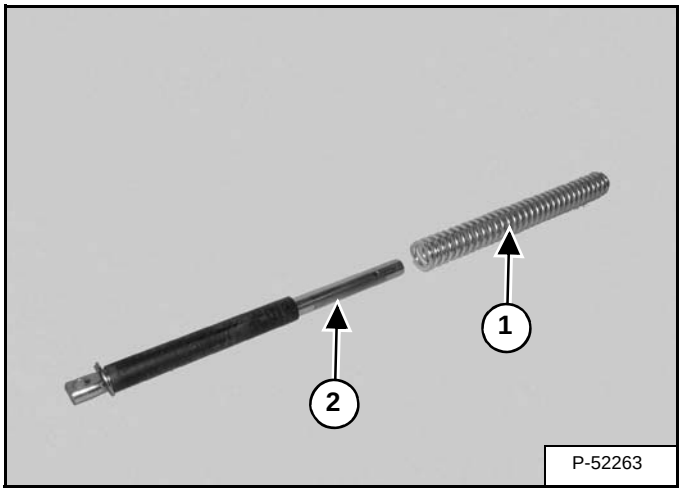
Release the pressure from the spring.

Figure 40-60-24



Remove the bushing (Item 1) **[Figure 40-60-24]**.

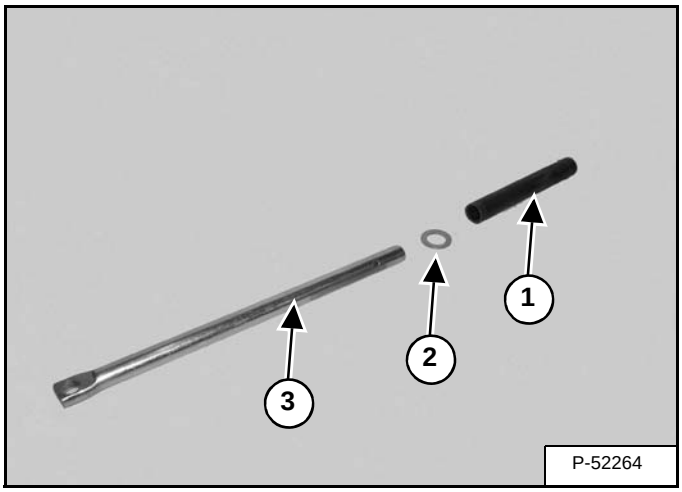
Figure 40-60-25



Remove the spring (Item 1) from the shaft (Item 2) **[Figure 40-60-25]**.

Compression Spring Disassembly And Assembly (Cont'd)

Figure 40-60-26



Remove the sleeve (Item 1) and washer (Item 2) from the shaft (Item 3) **[Figure 40-60-26]**.

LEFT CONSOLE (CONT'D)

Lock Lever Removal And Installation

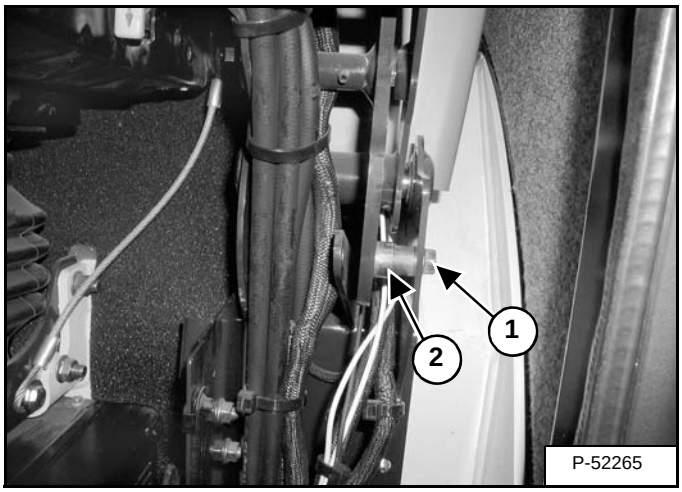
Remove the upper console cover. See Console Removal And Installation on Page 40-60-8

Remove the lower console cover. See Lower Console Cover Removal And Installation on Page 40-60-1

Remove the console base. See Console Base Removal And Installation on Page 40-60-16

Remove the compression spring assembly from the console. See Compression Spring Disassembly And Assembly on Page 40-60-5

Figure 40-60-27

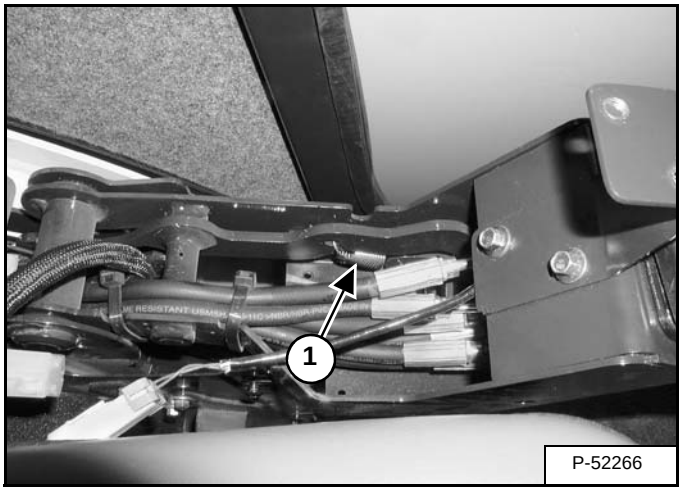


Remove the bolt (Item 1) from the lock lever bearing (Item 2) **[Figure 40-60-27]**.

Remove the bearing.

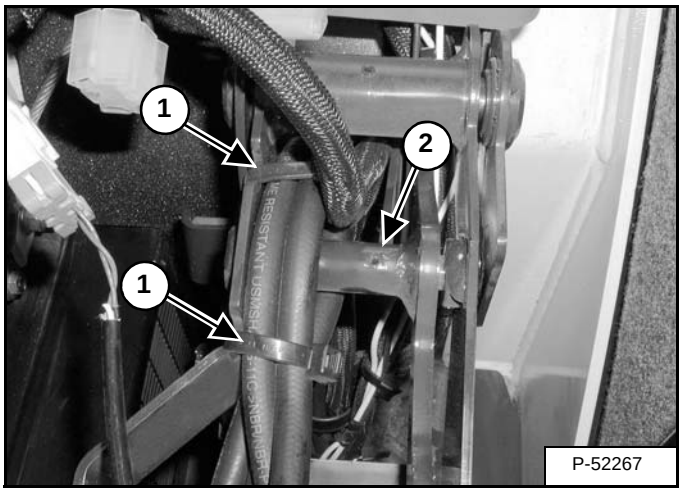
Lower the console.

Figure 40-60-28



Remove the spring (Item 1) **[Figure 40-60-28]**.

Figure 40-60-29

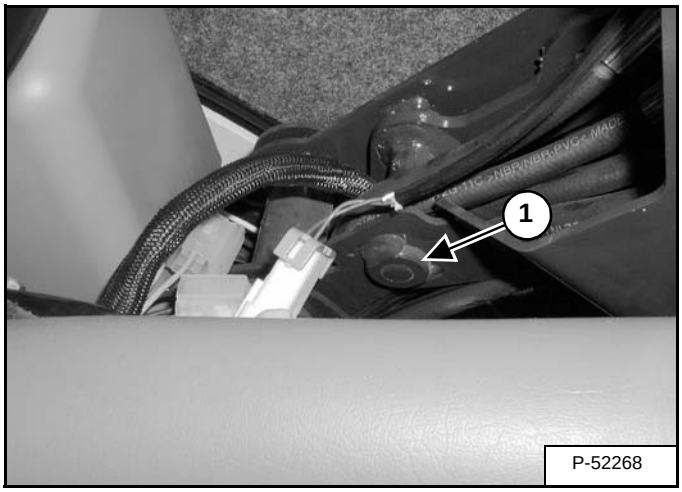


Remove the tie straps (Item 1) **[Figure 40-60-29]**.

Remove the roll pin (Item 2) **[Figure 40-60-29]** from the lock lever pivot pin.

Raise and support the console.

Figure 40-60-30



Remove the pivot pin (Item 1) **[Figure 40-60-30]** from the lever assembly.

Remove the lock lever.

LEFT CONSOLE (CONT'D)

Console Removal And Installation

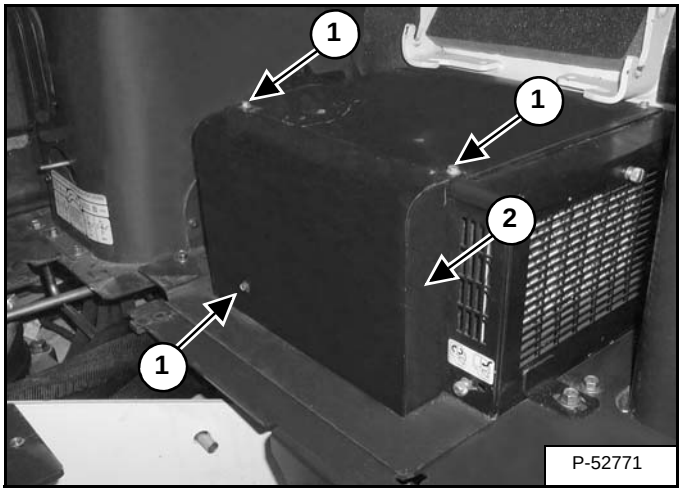
Remove the seat and seat mount. (See Removal And Installation on Page 40-40-1 or See Removal And Installation on Page 40-41-1)

Remove the floormat and floor plate. (See Removal And Installation (Canopy Equipped Excavators) on Page 40-110-1 or See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

Remove the upper console cover. (See Upper Console Cover Removal And Installation on Page 40-60-3.)

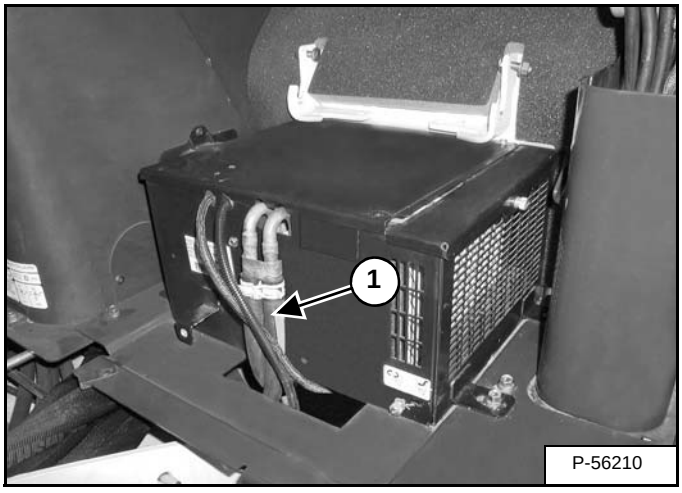
Remove the lower console cover. (See Lower Console Cover Removal And Installation on Page 40-60-1.)

Figure 40-60-31



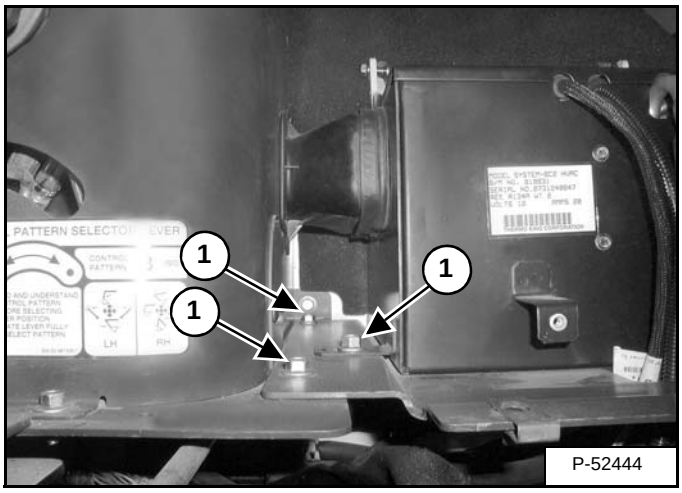
Remove the bolts (Item 1) and remove the cover (Item 2) **[Figure 40-60-31]** from the heater unit.

Figure 40-60-32



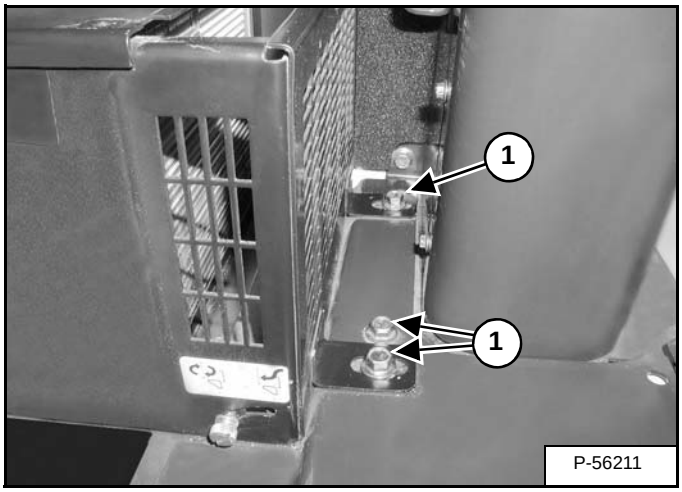
Mark and remove the heater hoses (Item 1) **[Figure 40-60-32]**.

Figure 40-60-33



Remove the bolts (Item 1) **[Figure 40-60-33]** from the right side of the heater unit.

Figure 40-60-34



Remove the bolts (Item 1) **[Figure 40-60-34]** from the left side of the heater unit.

Console Removal And Installation (Cont'd)

Figure 40-60-35



Relocate the heater unit as shown **[Figure 40-60-35]**.

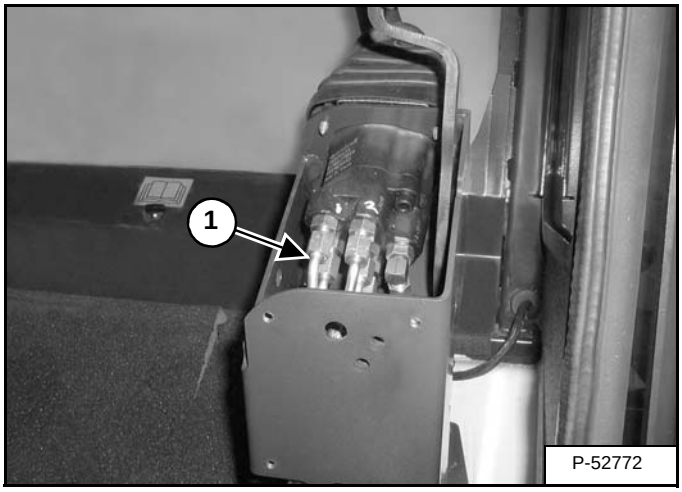
Remove the console base. (See Console Base Removal And Installation on Page 40-60-16)

IMPORTANT

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

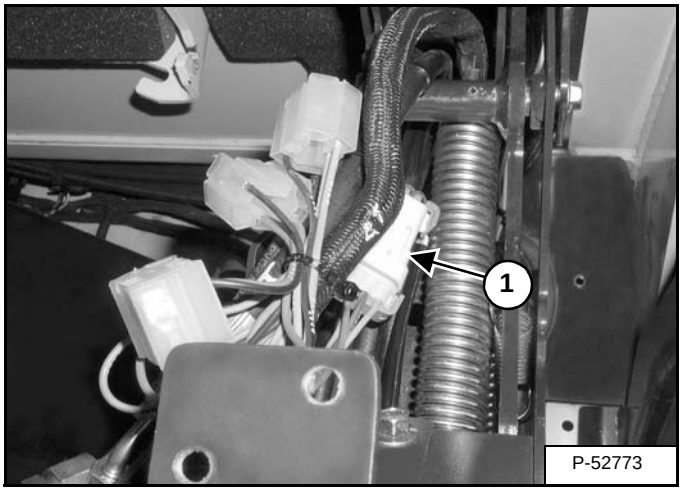
I-2003-0888

Figure 40-60-36



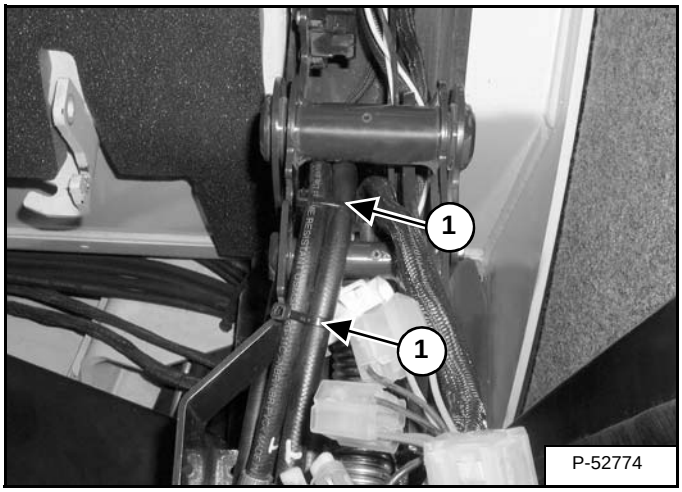
Remove the six hoses (Item 1) **[Figure 40-60-36]** from the joystick.

Figure 40-60-37



Lower the console. Disconnect the joystick wire harness (Item 1) **[Figure 40-60-37]**.

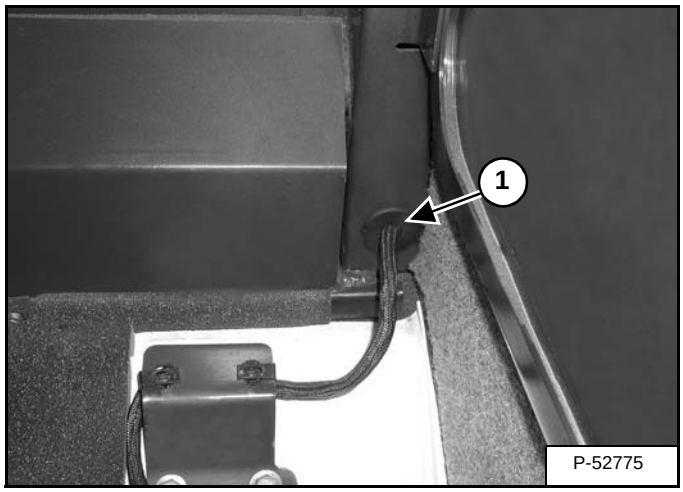
Figure 40-60-38



Remove the tie straps (Item 1) **[Figure 40-60-38]**.

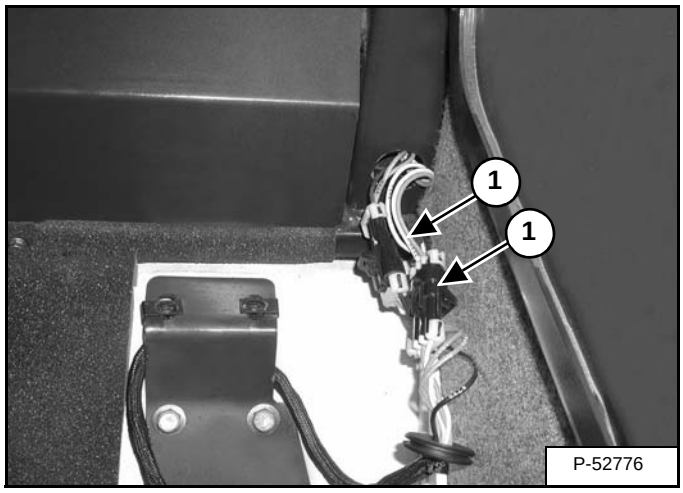
Console Removal And Installation (Cont'd)

Figure 40-60-39



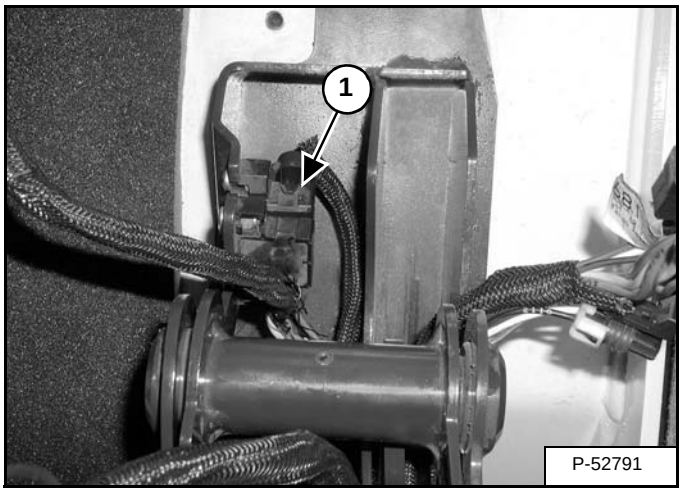
Remove the grommet (Item 1) **[Figure 40-60-39]**.

Figure 40-60-40



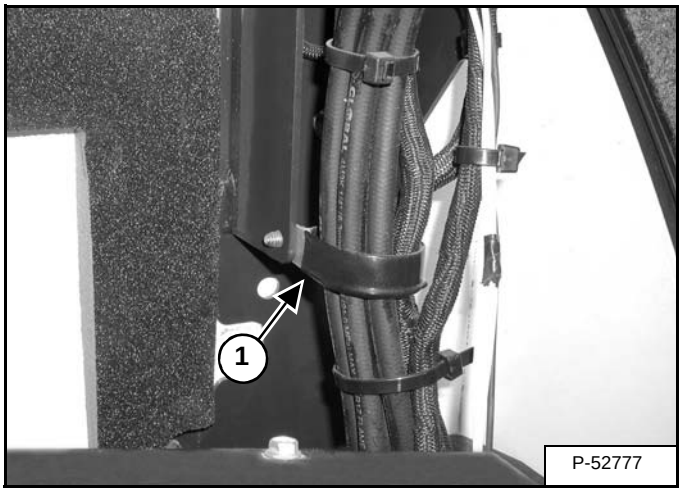
Pull the wire harness out and disconnect the connectors (Item 1) **[Figure 40-60-40]**.

Figure 40-60-41



Disconnect the wire harness (Item 1) **[Figure 40-60-41]** from the console lockout switch.

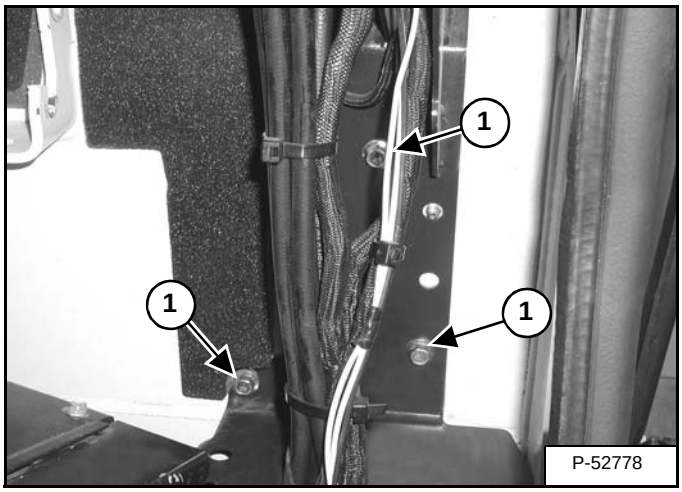
Figure 40-60-42



Remove the hose clamp (Item 1) **[Figure 40-60-42]**.

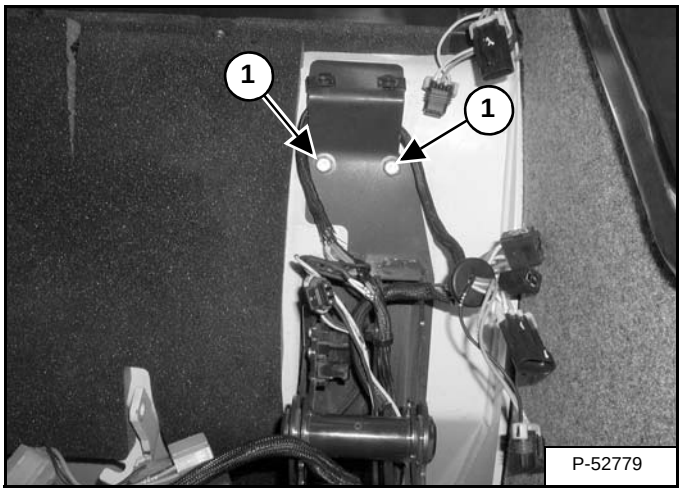
Console Removal And Installation (Cont'd)

Figure 40-60-43



Remove the bolts (Item 1) **[Figure 40-60-43]**.

Figure 40-60-44



Remove the bolts (Item 1) **[Figure 40-60-44]**.

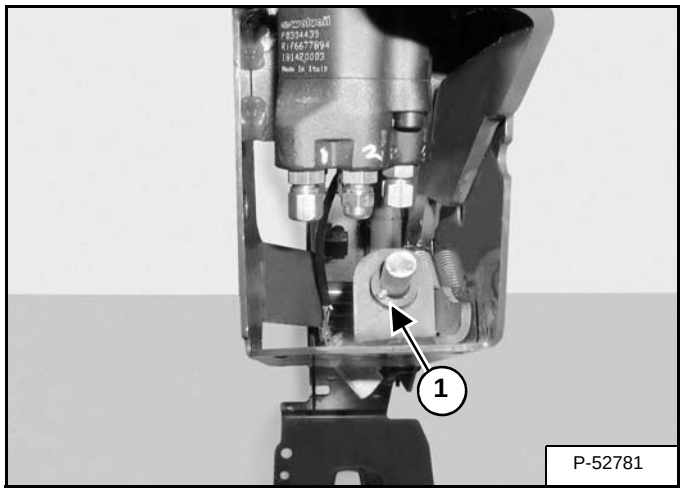
Figure 40-60-45



Remove the console (Item 1) **[Figure 40-60-45]**.

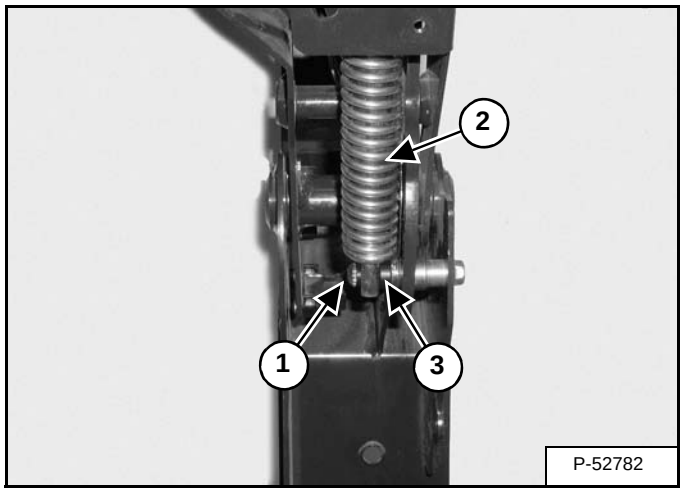
Disassembly And Assembly

Figure 40-60-46



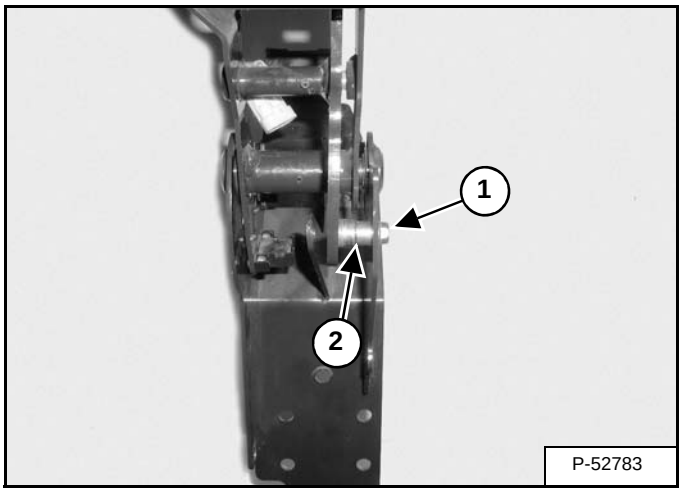
Install a pin (Item 1) **[Figure 40-60-46]** in the shaft.

Figure 40-60-47



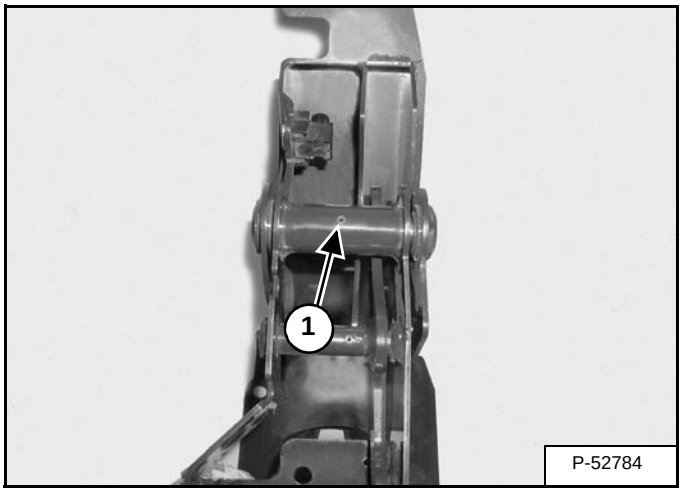
Remove the bolt (Item 1), spring assembly (Item 2), and bushing (Item 3) **[Figure 40-60-47]**.

Figure 40-60-48



Remove the bolt (Item 1) and bearing (Item 2) **[Figure 40-60-48]**.

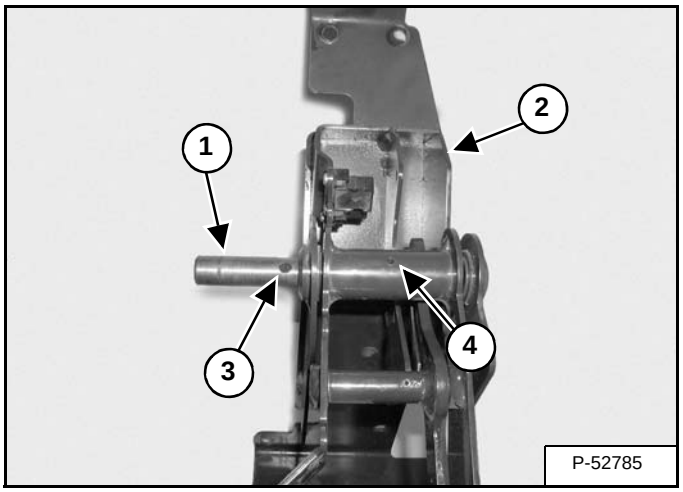
Figure 40-60-49



Remove the roll pin (Item 1) **[Figure 40-60-49]**.

Disassembly And Assembly (Cont'd)

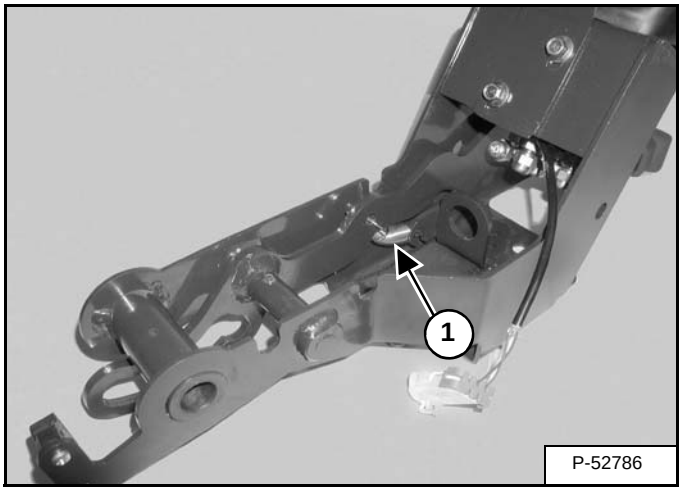
Figure 40-60-50



Remove the pin (Item 1). Remove the bracket (Item 2) **[Figure 40-60-50]**.

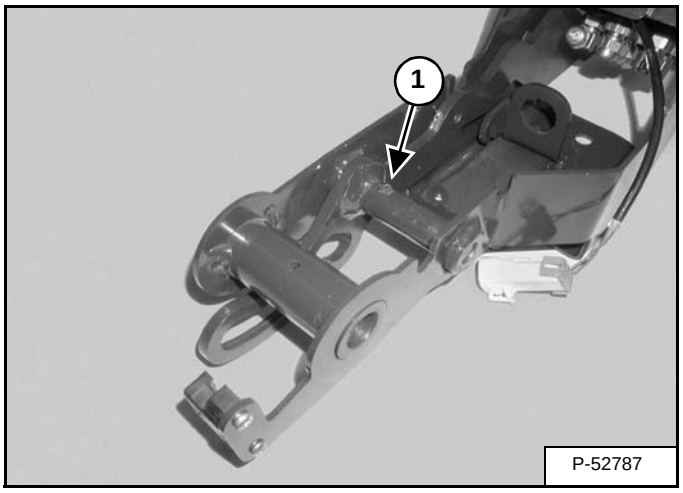
Installation: Align the hole (Item 3) in the pin with the hole (Item 4) **[Figure 40-60-50]** in the bracket.

Figure 40-60-51



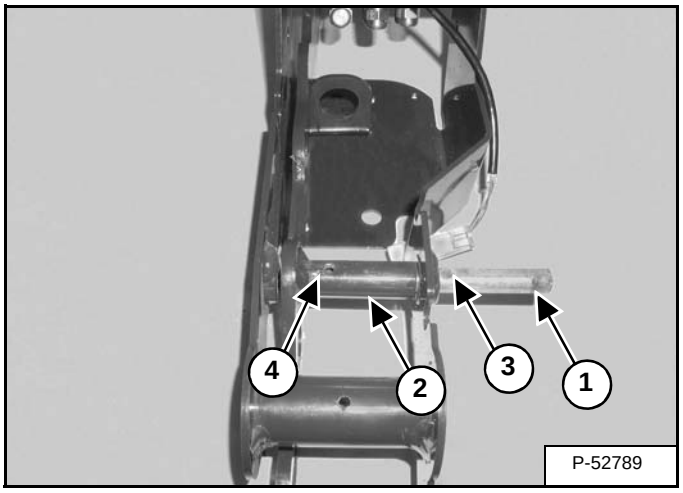
Remove the spring (Item 1) **[Figure 40-60-51]**.

Figure 40-60-52



Remove the rollpin (Item 1) **[Figure 40-60-52]**.

Figure 40-60-53

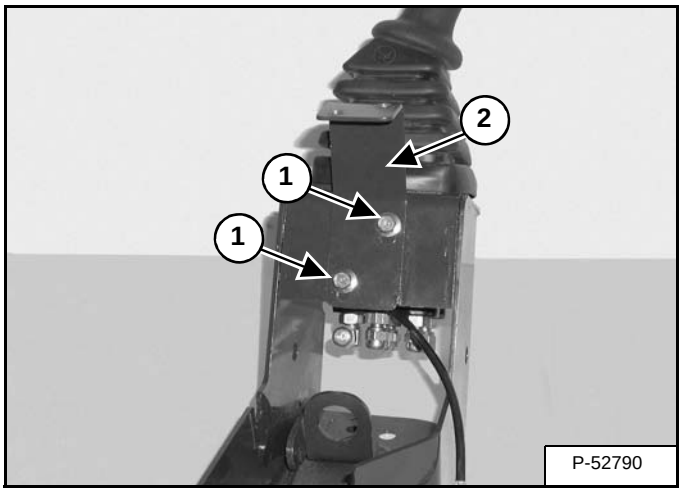


Remove the pin (Item 1) from the bracket (Item 2) **[Figure 40-60-53]**.

Installation: Align the hole (Item 3) in the pin with the hole (Item 4) **[Figure 40-60-53]** in the bracket.

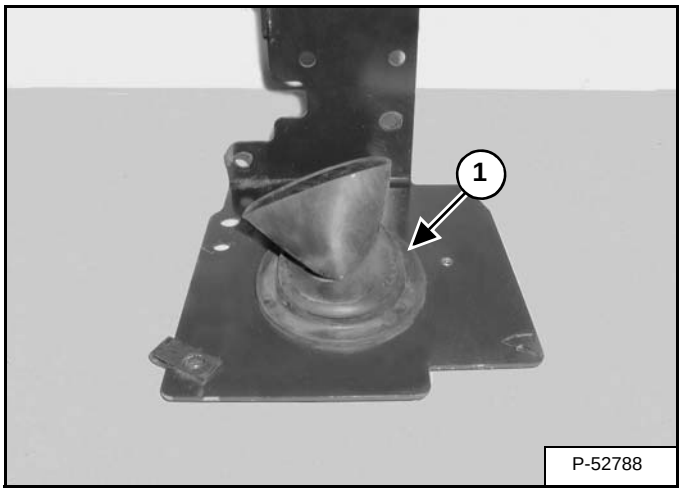
Disassembly And Assembly (Cont'd)

Figure 40-60-54



Remove the bolts (Item 1). Remove the bracket (Item 2) **[Figure 40-60-54]**.

Figure 40-60-55



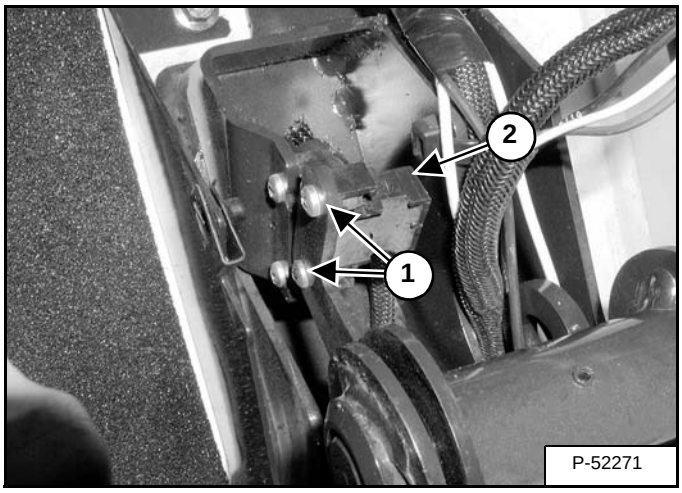
Remove the dust boot (Item 1) **[Figure 40-60-55]**.

Console Switch Removal And Installation

Remove the upper console cover. (See Upper Console Cover Removal And Installation on Page 40-60-3)

Remove the lower console cover. (See Lower Console Cover Removal And Installation on Page 40-60-1)

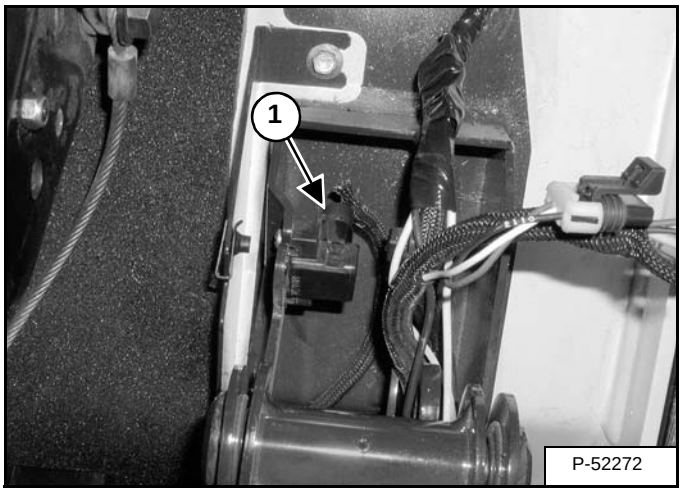
Figure 40-60-56



Remove the screws (Item 1) **[Figure 40-60-56]** from the magnet side of the console lockout switch.

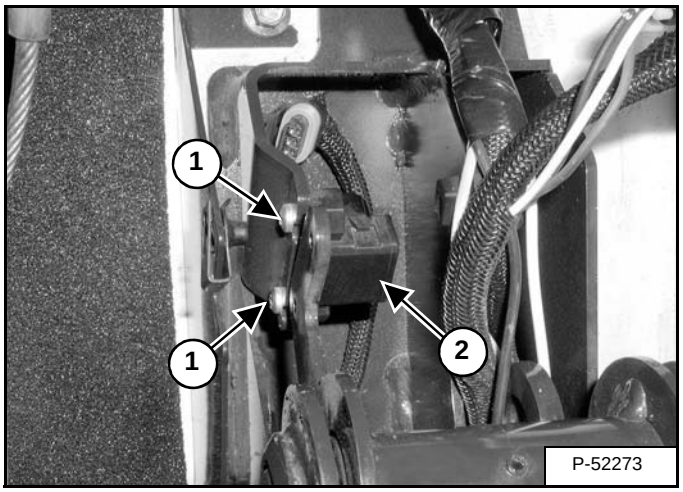
Remove the magnet (Item 2) **[Figure 40-60-56]**.

Figure 40-60-57



Remove the wire harness (Item 1) **[Figure 40-60-57]** from the switch.

Figure 40-60-58



Remove the screws (Item 1) from the switch (Item 2) **[Figure 40-60-58]**.

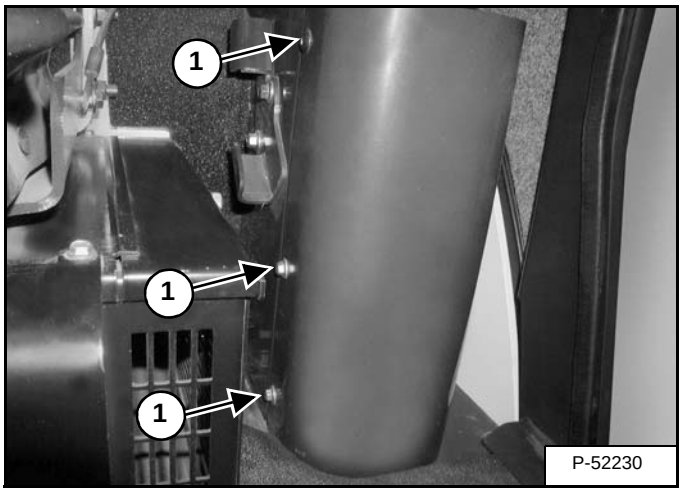
Remove the console lockout switch.

Console Base Removal And Installation

Remove the upper console cover. (See Upper Console Cover Removal And Installation on Page 40-60-3.)

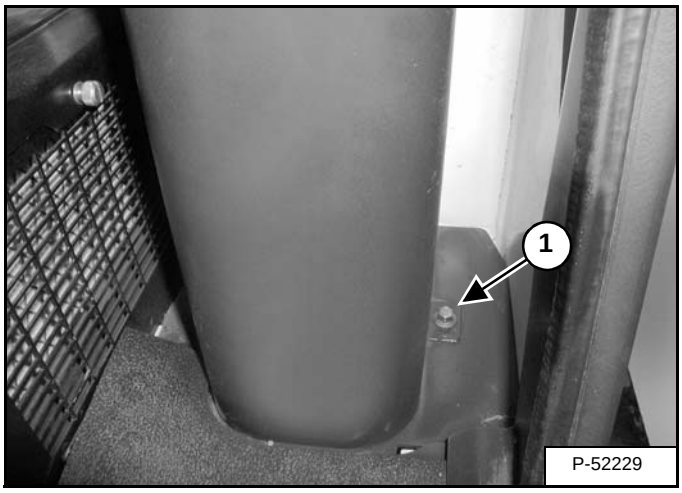
Remove the lower console cover. (See Lower Console Cover Removal And Installation on Page 40-60-1.)

Figure 40-60-59



Remove the bolts (Item 1) **[Figure 40-60-59]** from the console base cover.

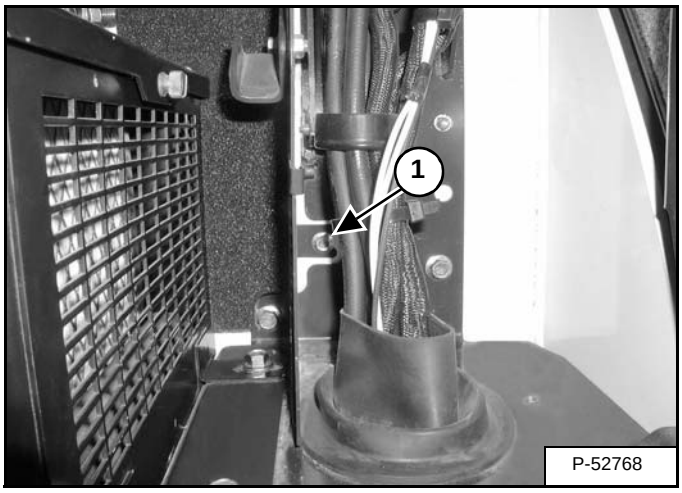
Figure 40-60-60



Remove the bolt (Item 1) **[Figure 40-60-60]** from the console base cover.

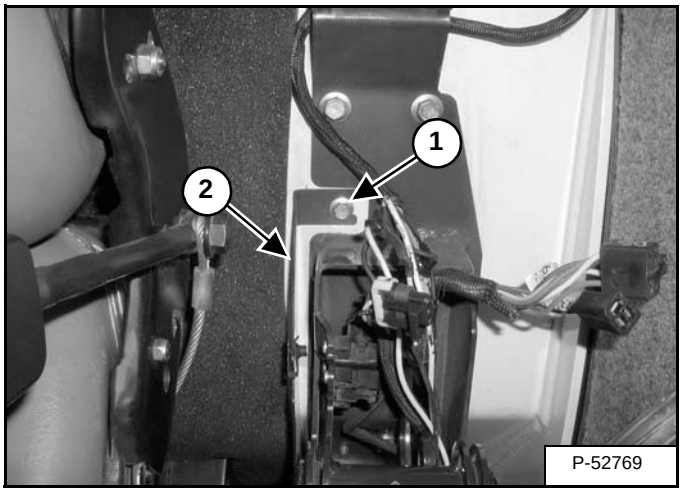
Remove the console base cover.

Figure 40-60-61



Remove the bolt (Item 1) **[Figure 40-60-61]**.

Figure 40-60-62



Remove the bolt (Item 1) from the bracket (Item 2) **[Figure 40-60-62]**.

Remove the console base mount bracket.

ENGINE SPEED CONTROL

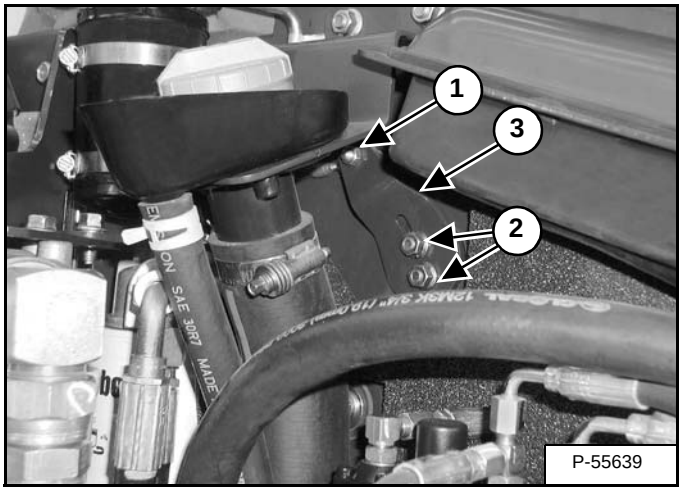
Removal And Installation

NOTE: The removal and installation procedure for the engine speed control is the same for both early and later models. Early model is shown.

Remove the right upper console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Open the right side cover.

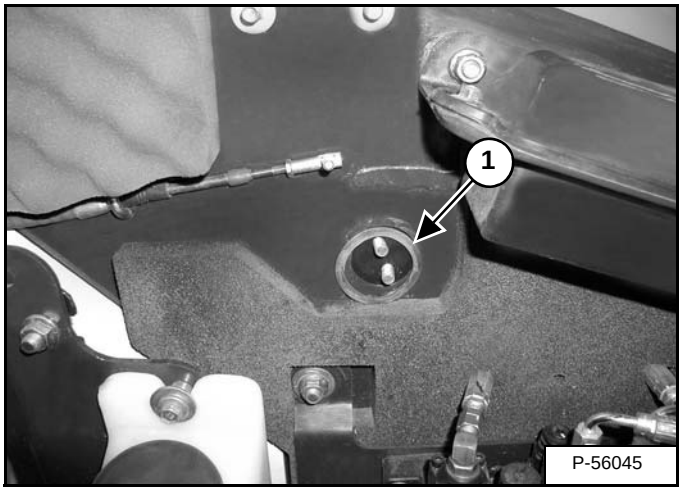
Figure 40-70-1



Remove the linkage cable nut (Item 1) **[Figure 40-70-1]**.

Remove the nuts (Item 2) and bracket (Item 3) **[Figure 40-70-1]**.

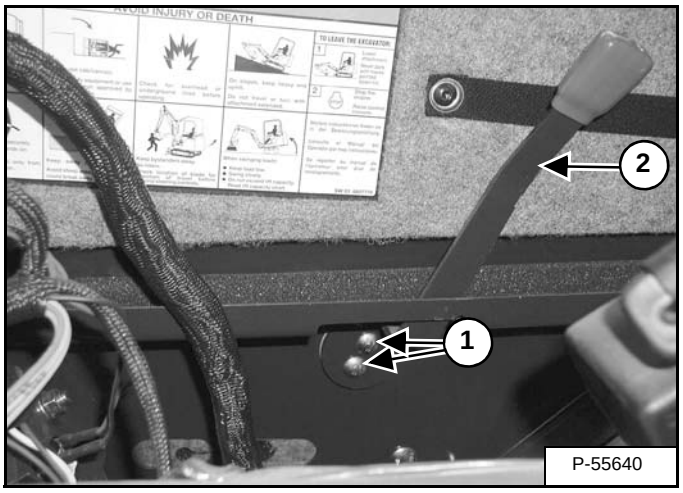
Figure 40-70-2



Remove the wave washers (Item 1) **[Figure 40-70-2]**.

NOTE: The fuel fill is shown removed for photo clarity.

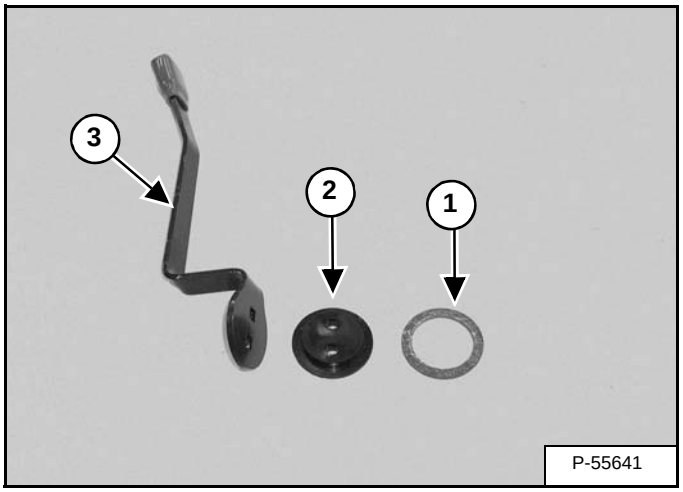
Figure 40-70-3



Remove the bolts (Item 1) **[Figure 40-70-3]**.

Remove the speed control lever (Item 2) **[Figure 40-70-3]**

Figure 40-70-4

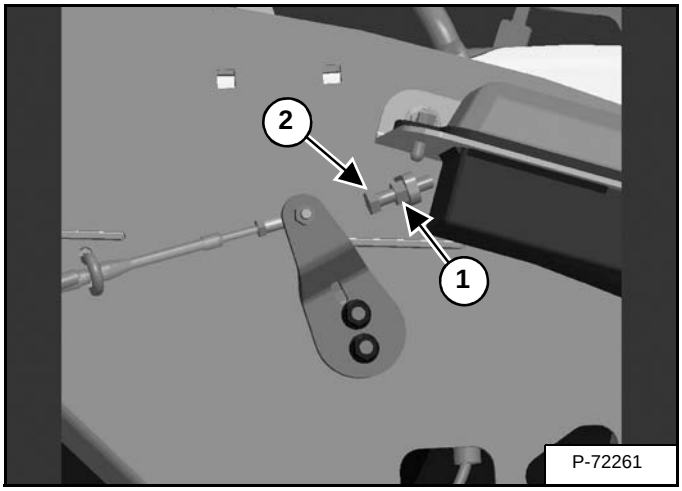


Remove the washer (Item 1) and spacer (Item 2) from the lever (Item 3) **[Figure 40-70-4]**.

Adjustment

Open the engine cover.

Figure 40-70-5



Loosen the jam nut (Item 1) and adjust the bolt (Item 2) **[Figure 40-70-5]** until the engine runs at 2615 RPM.

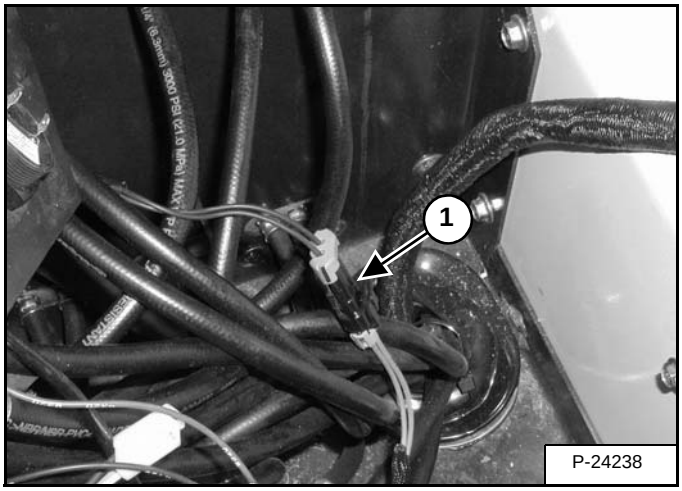
Tighten the jam nut (Item 1) **[Figure 40-70-5]**.

BLADE CONTROL

Lever Removal And Installation

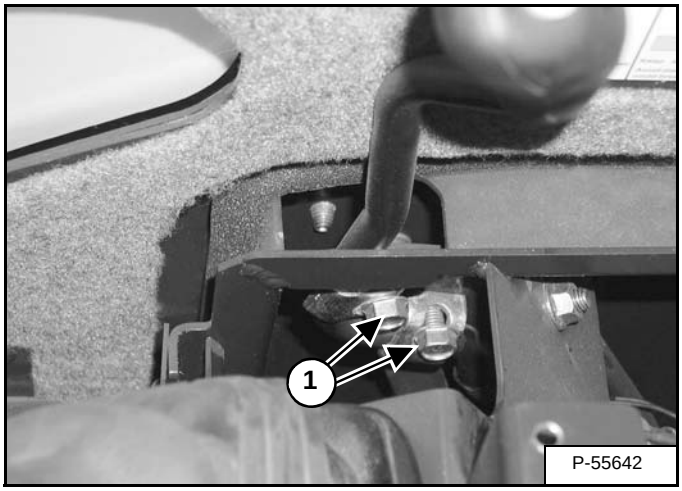
Remove the right upper console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 40-80-1



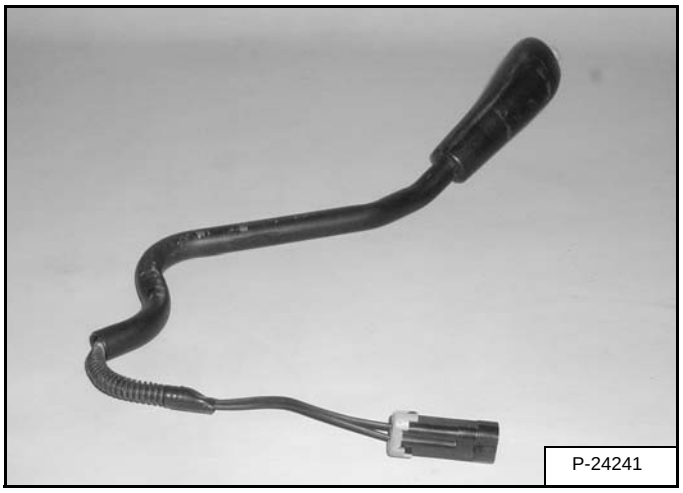
Disconnect the two speed wire harness (Item 1) **[Figure 40-80-1]**.

Figure 40-80-2



Loosen the bolts (Item 1) **[Figure 40-80-2]**.

Figure 40-80-3



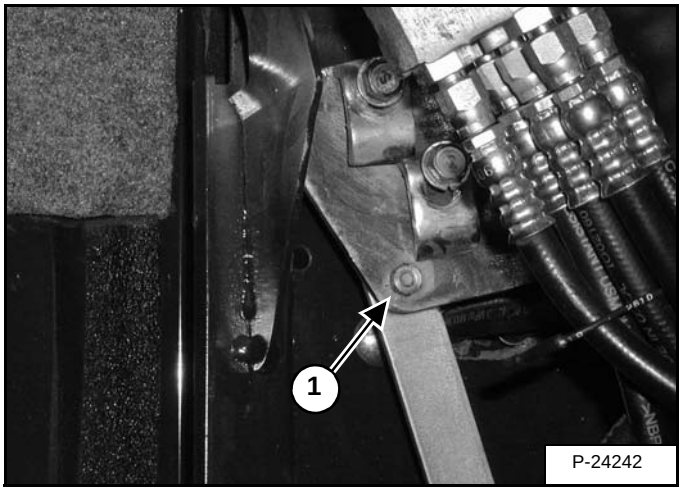
Remove the blade control lever from the excavator **[Figure 40-80-3]**.

NOTE: If the two-speed switch needs to be replaced, the complete blade control lever must be replaced.

Linkage Removal And Installation

Remove the blade control lever. (See Lever Removal And Installation on Page 40-80-1.)

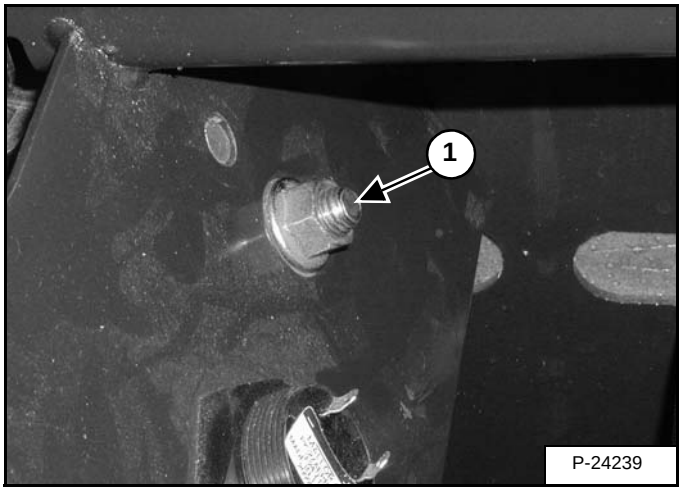
Figure 40-80-4



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

NOTE: The console base has been removed for photo clarity.

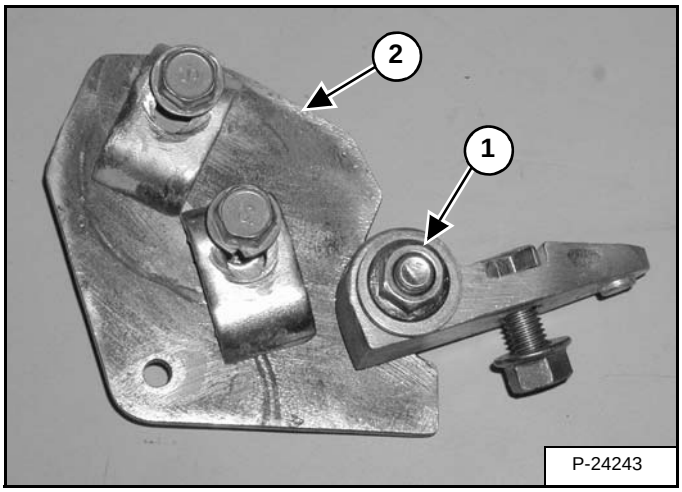
Figure 40-80-5



Remove the bolt (Item 1) **[Figure 40-80-5]** from the blade control pivot mount.

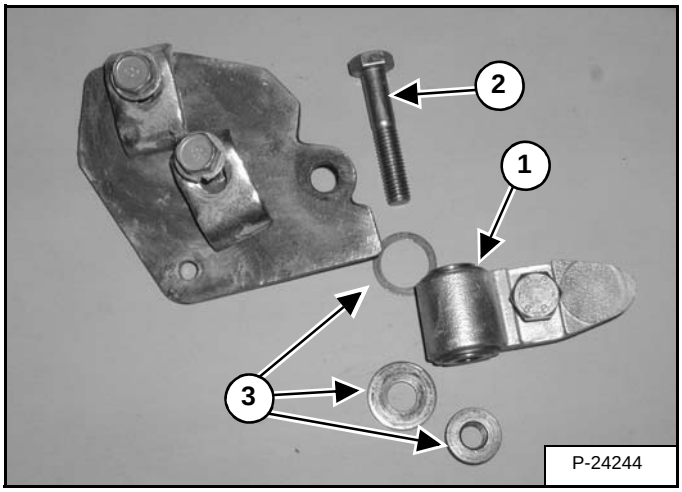
Remove the blade control pivot mount.

Figure 40-80-6



Remove the nut (Item 1) from the mount plate (Item 2) **[Figure 40-80-6]**.

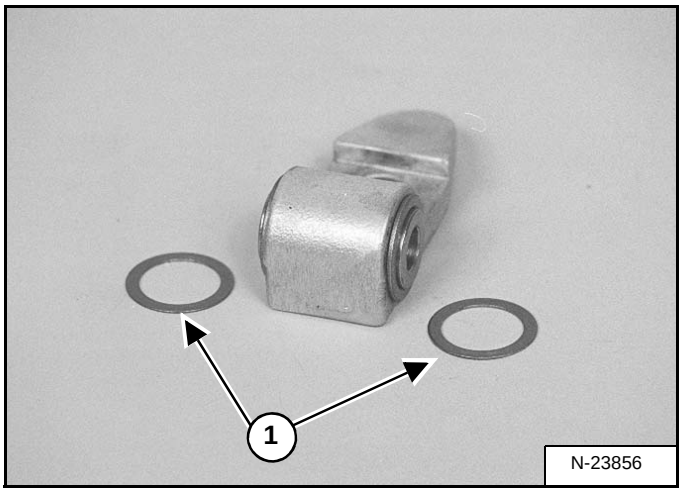
Figure 40-80-7



Remove the pivot mount (Item 1) bolt (Item 2) and washers (Item 3) **[Figure 40-80-7]**.

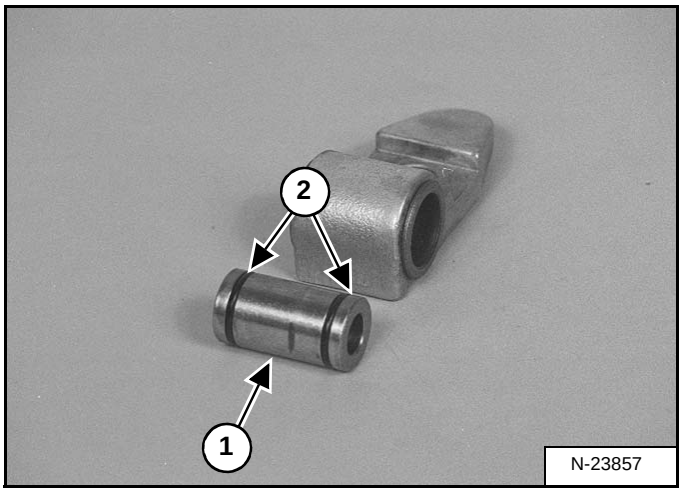
Linkage Removal And Installation (Cont'd)

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.

BLADE CONTROL (CONT'D)

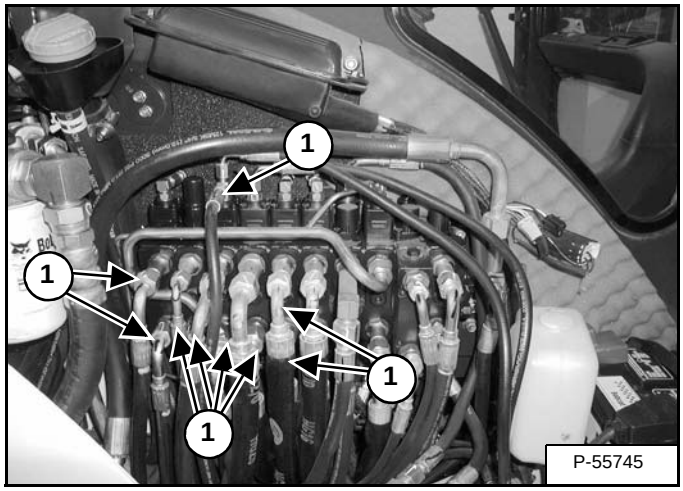
Linkage Bar Removal And Installation

Remove the right upper console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Remove the blade control lever. (See Lever Removal And Installation on Page 40-80-1.)

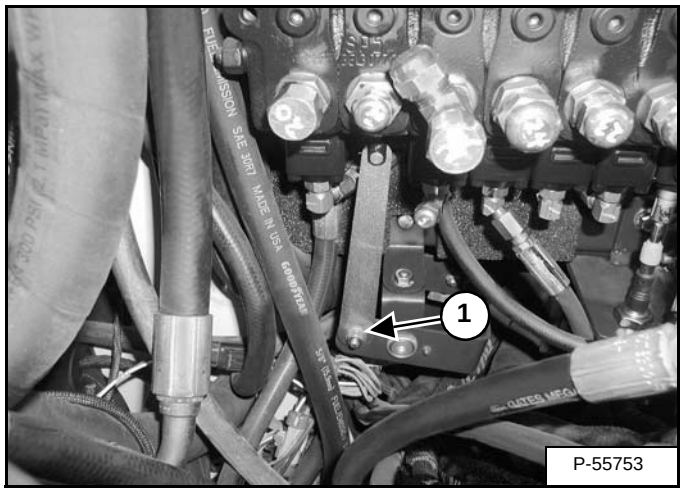
Open the right side cover.

Figure 40-80-10



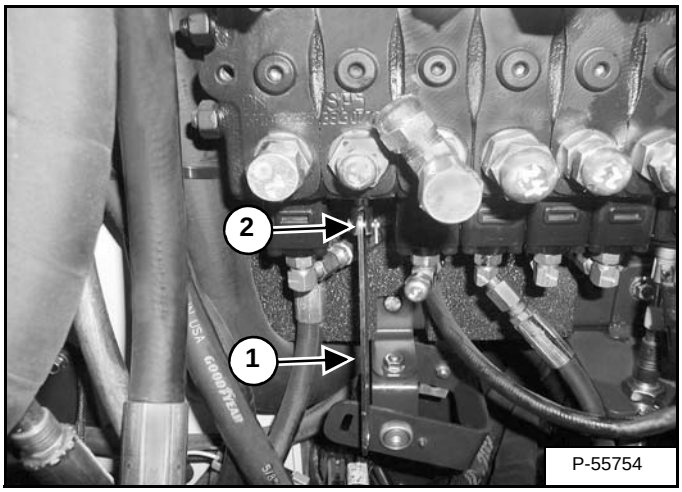
Remove the hoses (Item 1) **[Figure 40-80-10]**.

Figure 40-80-11



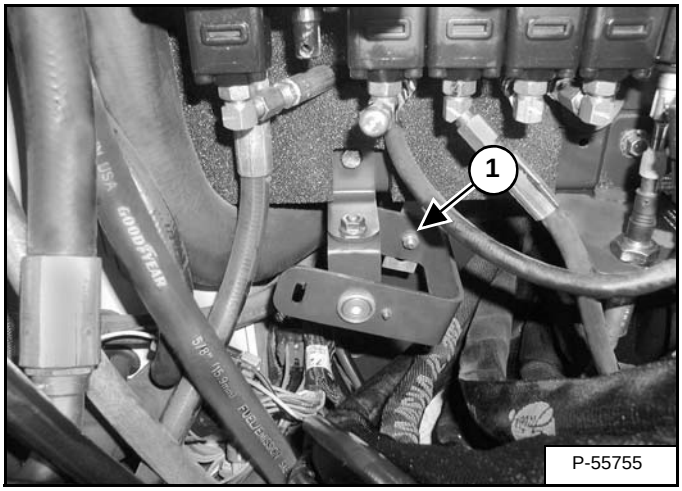
Remove the nut (Item 1) **[Figure 40-80-11]** bolt, washers and spacer.

Figure 40-80-12



Turn the linkage (Item 1) 90°. Remove the cotter pin and clevis pin (Item 2) **[Figure 40-80-12]**. Remove the linkage.

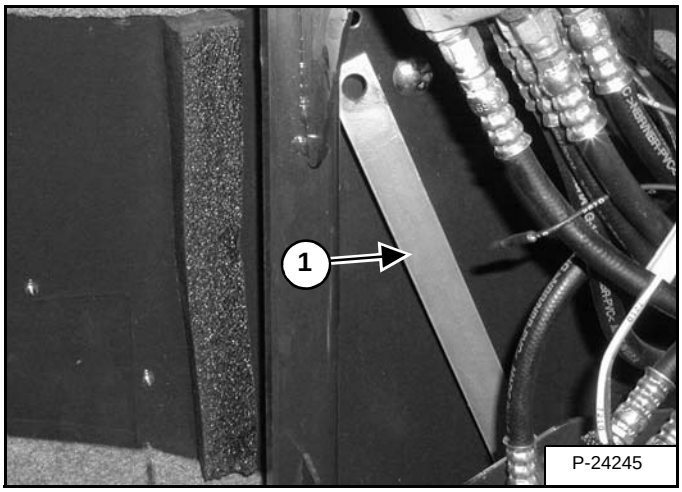
Figure 40-80-13



Remove the nut (Item 1) **[Figure 40-80-13]**, bolt, washer and spacer.

Linkage Bar Removal And Installation (Cont'd)

Figure 40-80-14



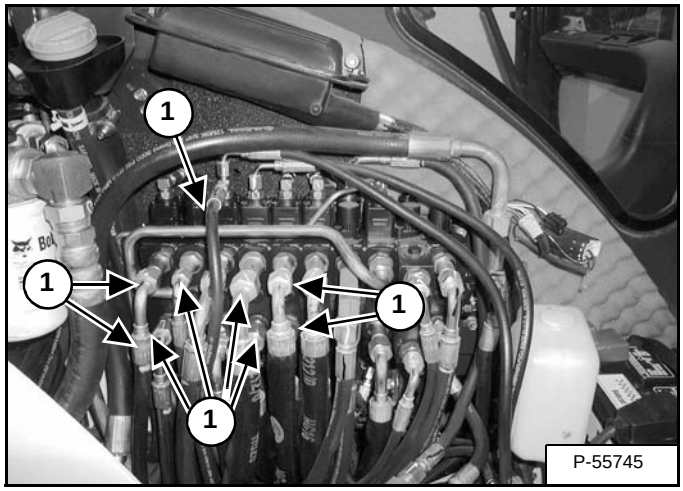
Remove the linkage bar (Item 1) **[Figure 40-80-14]** from the top.

NOTE: The console base has been removed for photo clarity.

Lower Linkage Removal And Installation

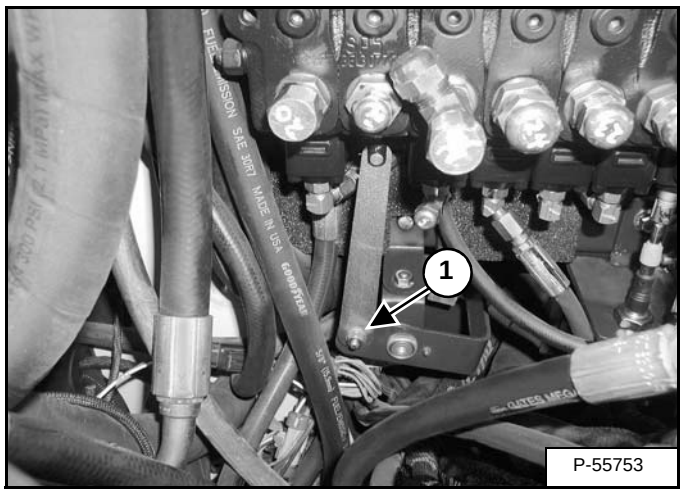
Remove the right console cover (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 40-80-15



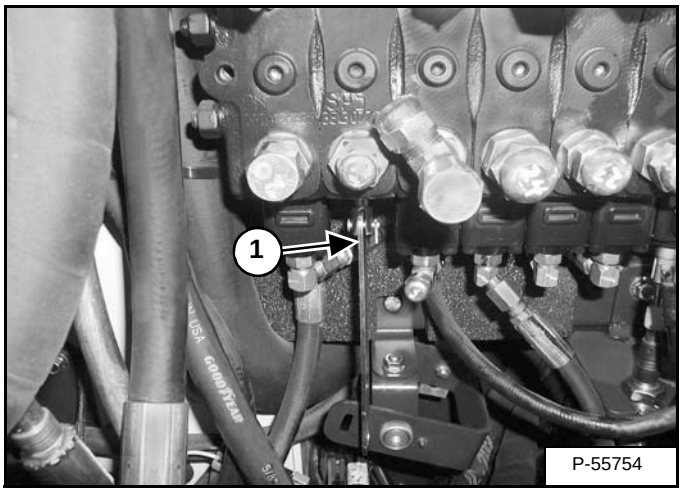
Remove the hoses (Item 1) **[Figure 40-80-15]**.

Figure 40-80-16



Remove the nut (Item 1) **[Figure 40-80-16]** bolts, washers and spacer.

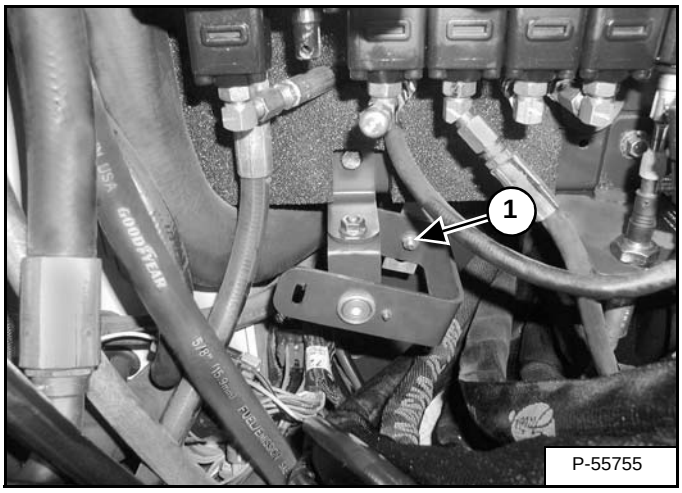
Figure 40-80-17



Turn the linkage (Item 1) 90°. Remove the cotter pin and clevis pin (Item 2) **[Figure 40-80-17]**.

Remove the linkage.

Figure 40-80-18



Remove the nut (Item 1) **[Figure 40-80-18]** bolts, washer and spacer.

Lower Linkage Removal And Installation (Cont'd)

Figure 40-80-19

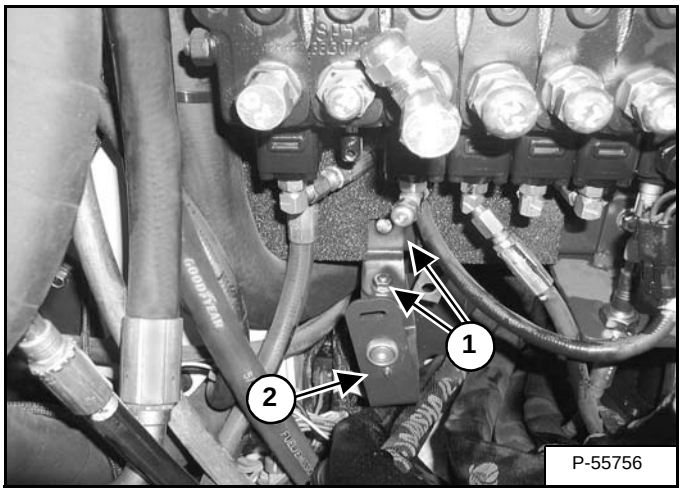
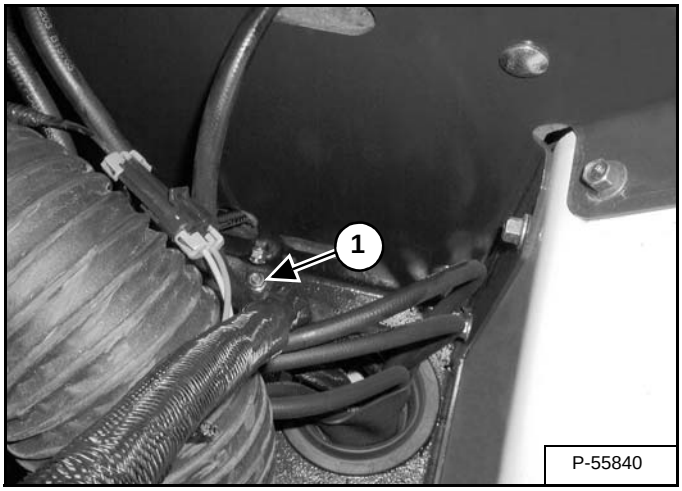


Figure 40-80-20



Remove the nuts (Item 1) **[Figure 40-80-19]** and bolts.

NOTE: Access the bolt (Item 1) [Figure 40-80-20] through the right console in the cab.

Remove the linkage assembly (Item 2) **[Figure 40-80-19]**.

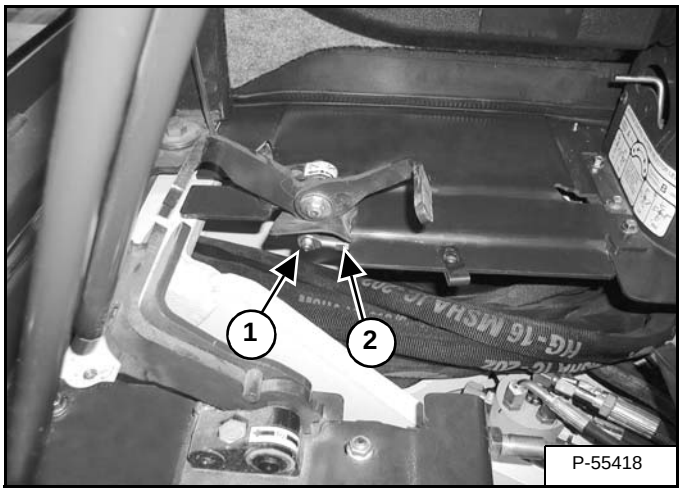

Bobcat®

RIGHT PEDAL AND LINKAGE

Pedal Removal And Installation

Remove the floor mat and floor plate. (See Removal And Installation (Canopy Equipped Excavators) on Page 40-110-1 or See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

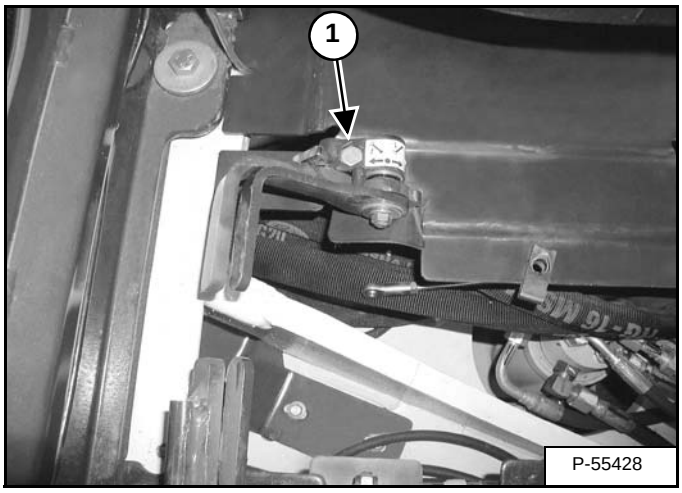
Figure 40-90-21



Remove the nut (Item 1), washers and bolt from the pedal linkage (Item 2) **[Figure 40-90-21]**.

Remove the linkage.

Figure 40-90-22

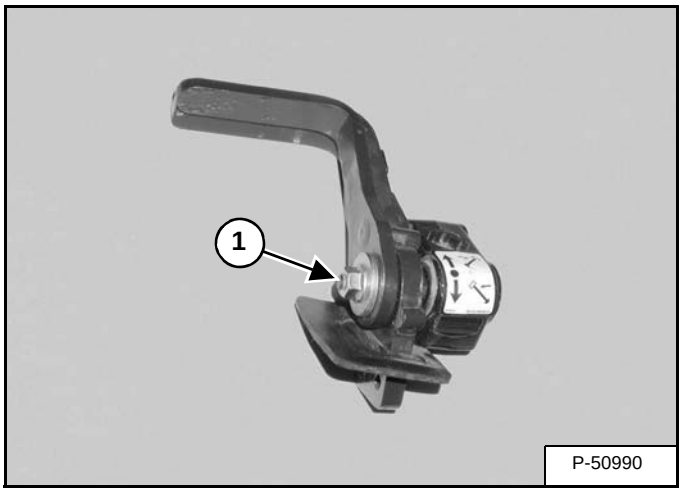


Remove the bolt (Item 1) **[Figure 40-90-22]**.

Remove the right pedal.

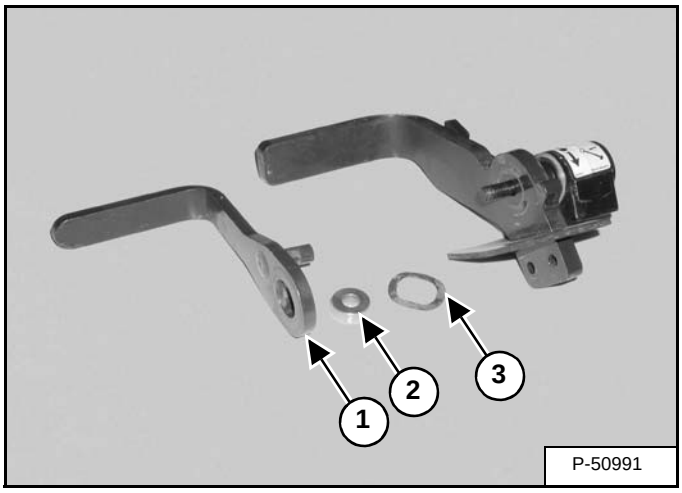
Pedal Disassembly And Assembly

Figure 40-90-23



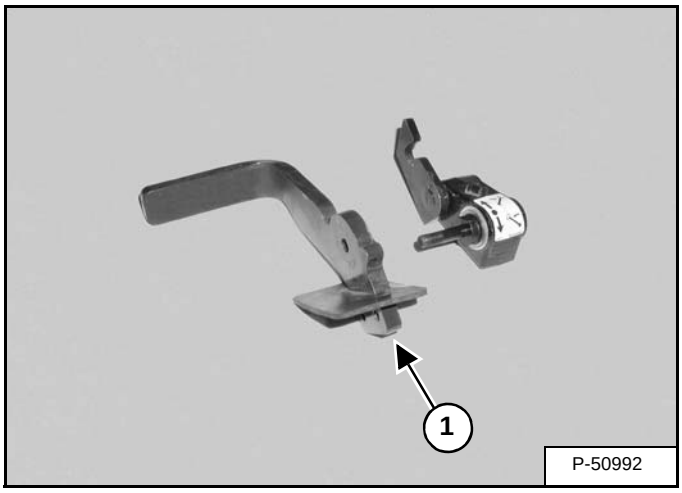
Remove the nut and washer (Item 1) **[Figure 40-90-23]**.

Figure 40-90-24



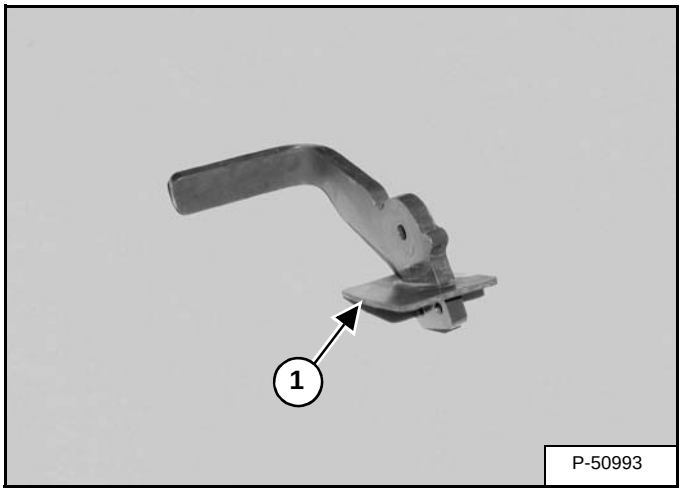
Remove the rear pedal (Item 1) bushing (Item 2) and wave washer (Item 3) **[Figure 40-90-24]**.

Figure 40-90-25



Remove the front pedal (Item 1) **[Figure 40-90-25]**.

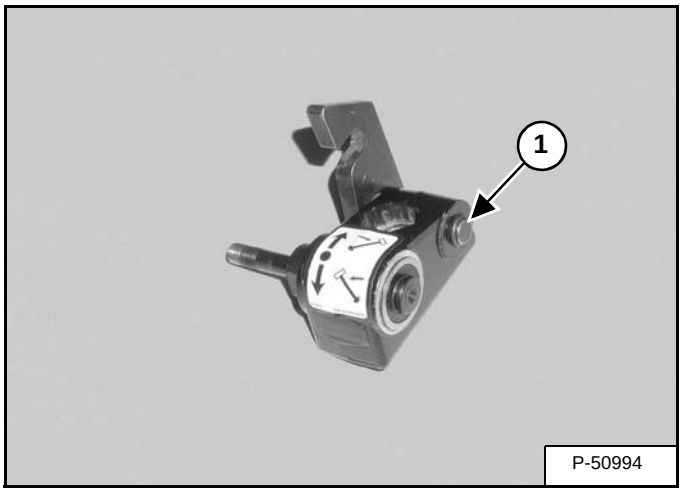
Figure 40-90-26



Remove the dust cover (Item 1) **[Figure 40-90-26]**.

Pedal Disassembly And Assembly (Cont'd)

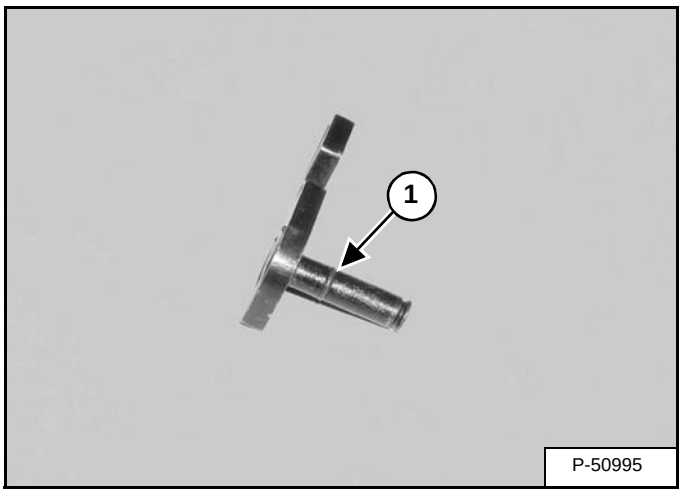
Figure 40-90-27



Remove the O-ring (Item 1) **[Figure 40-90-27]** from the pedal lock.

Remove the pedal lock from the pedal mount.

Figure 40-90-28



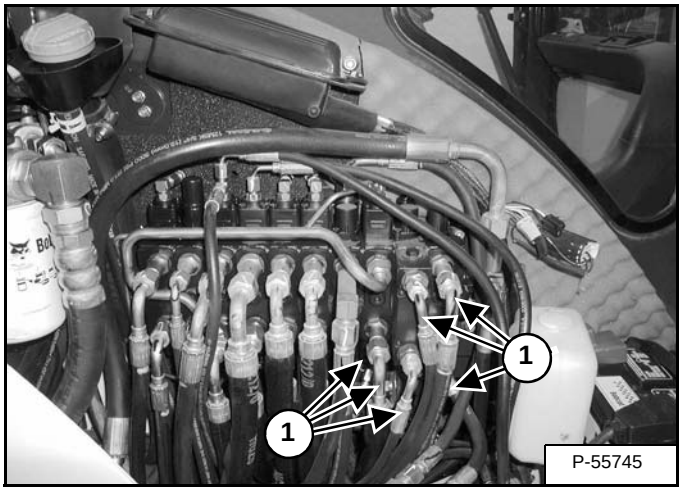
Remove the O-ring (Item 1) **[Figure 40-90-28]** from the pedal lock.

NOTE: Do not lubricate the O-rings (Item 1) [Figure 40-90-27] and [Figure 40-90-28]. The O-rings provide a friction fit to prevent the lock from moving freely.

Linkage Removal And Installation

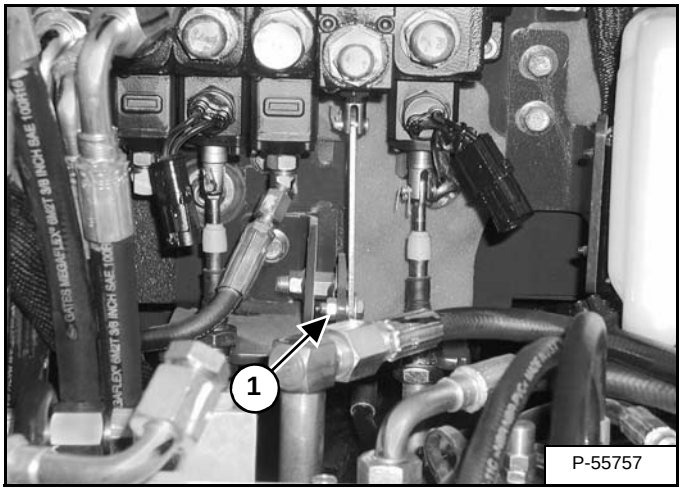
Open the right side cover.

Figure 40-90-29



Remove the hoses (Item 1) **[Figure 40-90-29]**.

Figure 40-90-30



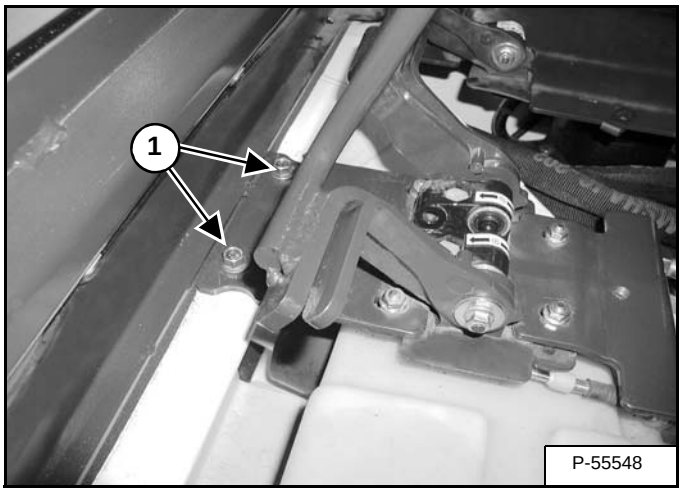
Remove the nut and bolt (Item 1). Remove the cotter pin and clevis pin (Item 2). Remove the linkage (Item 3) **[Figure 40-90-30]**.

TRAVEL CONTROLS

Removal And Installation

Remove the floor mat and floor plate. (See Removal And Installation (Canopy Equipped Excavators) on Page 40-110-1 or See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

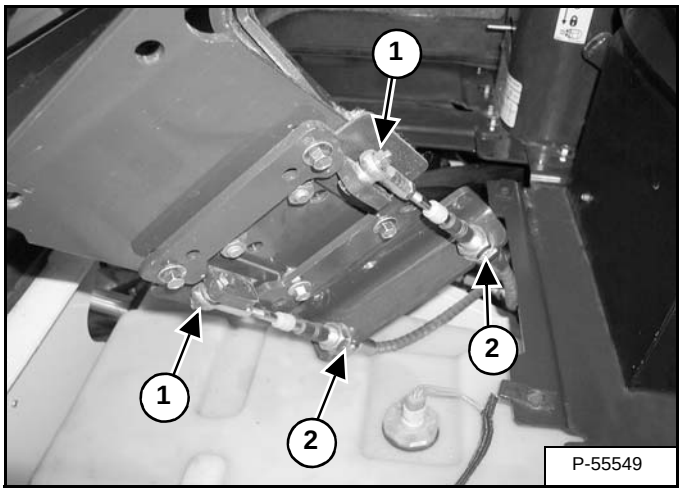
Figure 40-100-1



Remove the 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.

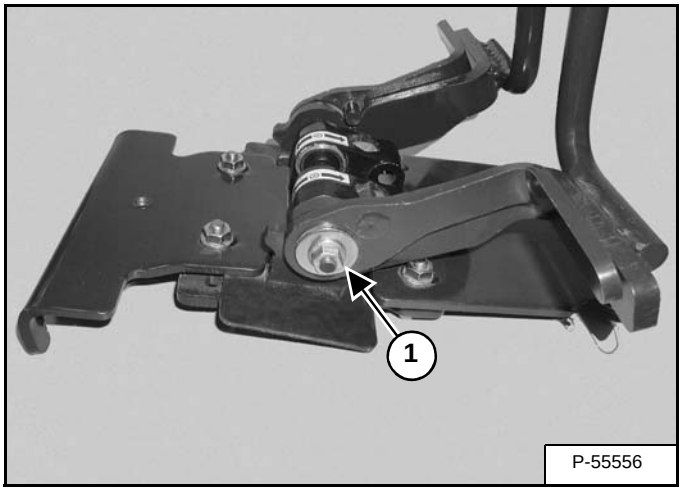
Loosen the nuts (Item 2) **[Figure 40-100-2]** and remove the cables from the travel lever mount.

Remove the travel lever mount from the excavator.

Disassembly And Assembly

Disassembly of the right travel control is shown. The procedure is the same for both the left and right travel control.

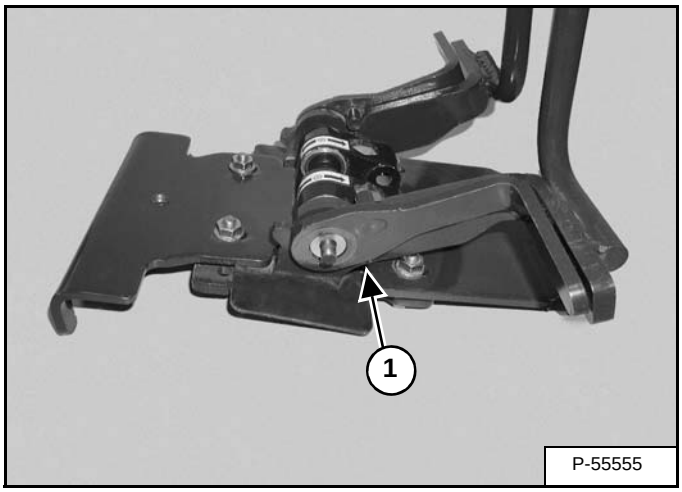
Figure 40-100-3



Remove the nut and washer (Item 1) **[Figure 40-100-3]** from the rear pedal.

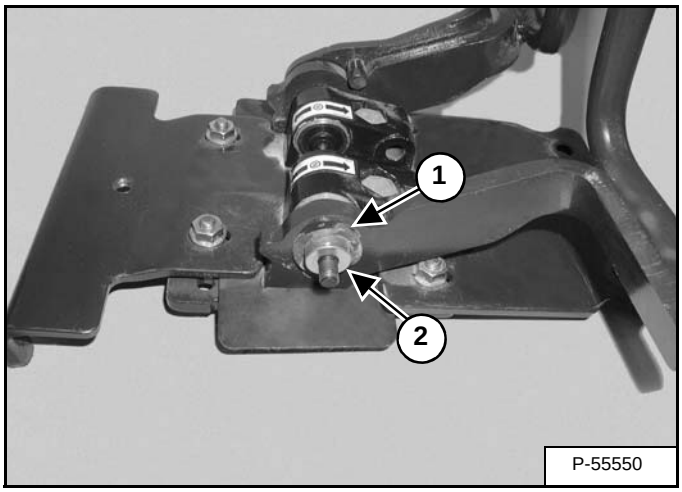
Installation: Tighten the nut to eliminate side play while allowing free travel of the pedals.

Figure 40-100-4



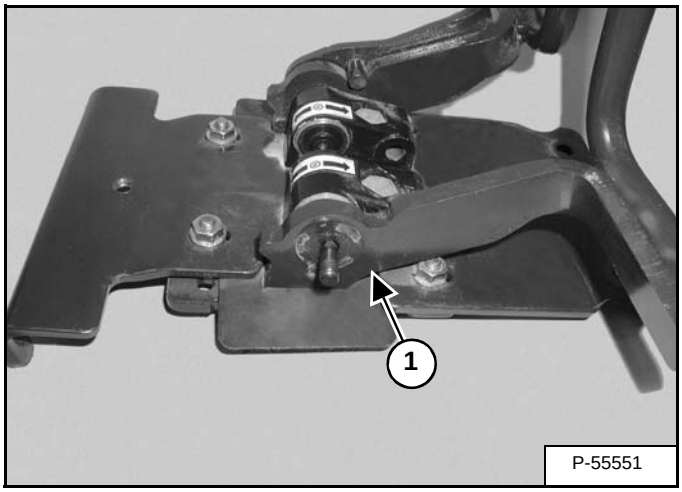
Remove the rear pedal (Item 1) **[Figure 40-100-4]**.

Figure 40-100-5



Remove the wave washer (Item 1) and bushing (Item 2) **[Figure 40-100-5]**.

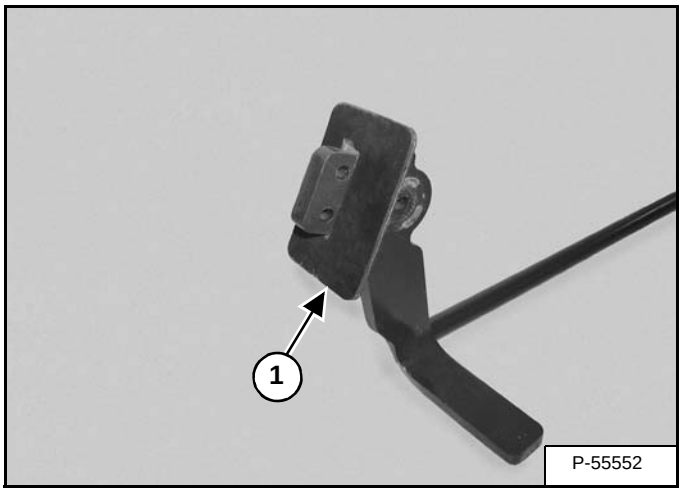
Figure 40-100-6



Remove the front pedal (Item 1) **[Figure 40-100-6]**.

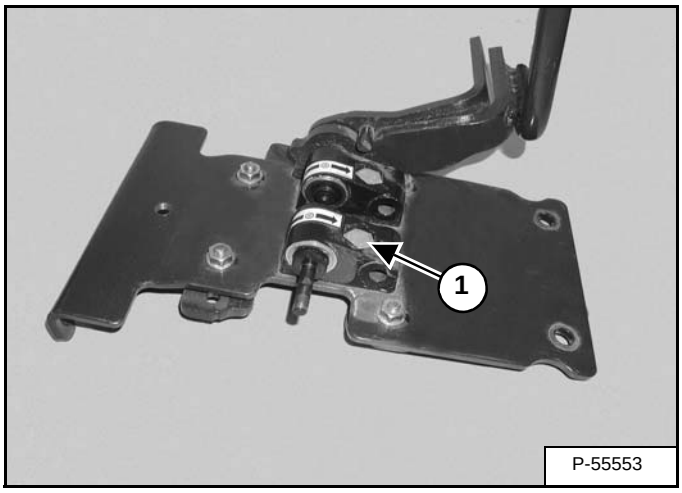
Disassembly And Assembly (Cont'd)

Figure 40-100-7



Remove the seal (Item 1) **[Figure 40-100-7]** from the front pedal.

Figure 40-100-8



Remove the bolt (Item 1) **[Figure 40-100-8]** and nut.

Installation: Clean the bolt threads and apply thread lock adhesive (Loctite® 242). Tighten the bolts to 32 - 35 ft.-lb. (43 - 47 N•m) torque.

Remove the pedal mount.

Figure 40-100-9

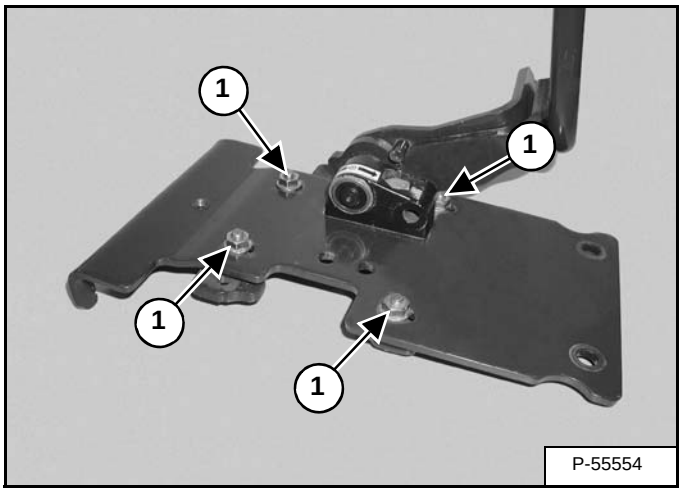
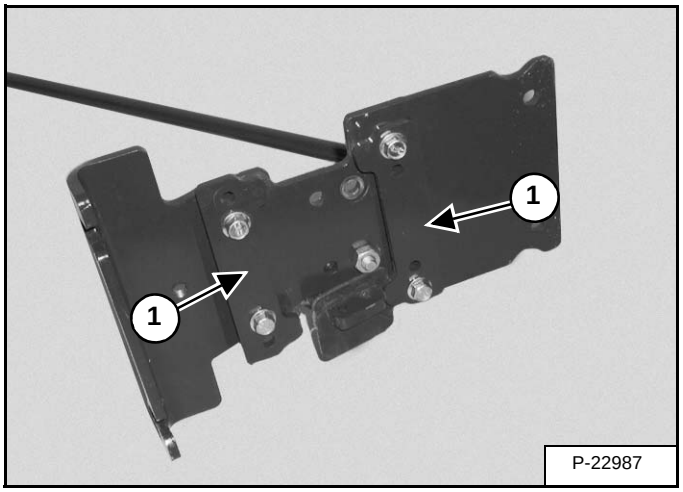


Figure 40-100-10



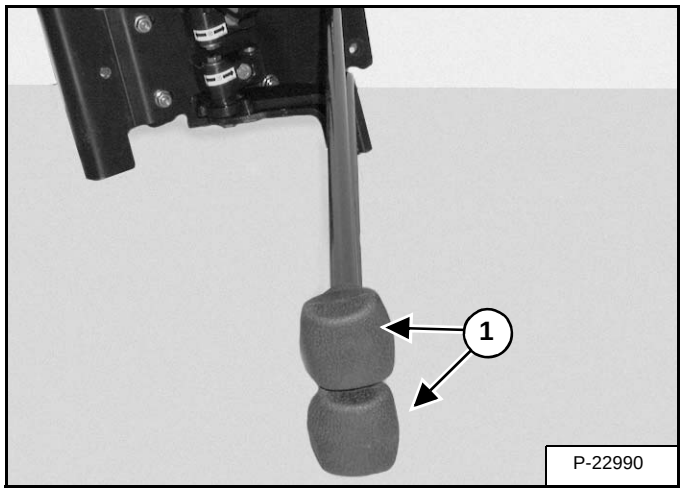
Remove the four nuts (Item 1) **[Figure 40-100-9]** that attach the pedal stops (Item 1) **[Figure 40-100-10]** to the mount plate.

Installation: Tighten the nuts to 18 - 19 ft.-lb. (24 - 26 N•m) torque.

Remove the pedal stops.

Disassembly And Assembly (Cont'd)

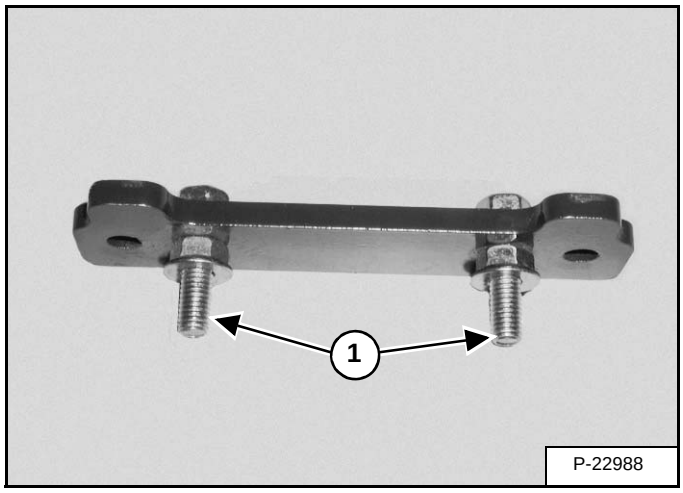
Figure 40-100-11



Installation: Adjust the pedal stops to align the hand levers (Item 1) **[Figure 40-100-11]** in both forward and reverse positions.

NOTE: This is the initial adjustment. Final adjustment must be done after the mount has been installed and the travel controller linkage has been connected.

Figure 40-100-12



Remove the bolts (Item 1) **[Figure 40-100-12]** from each of the pedal stops.

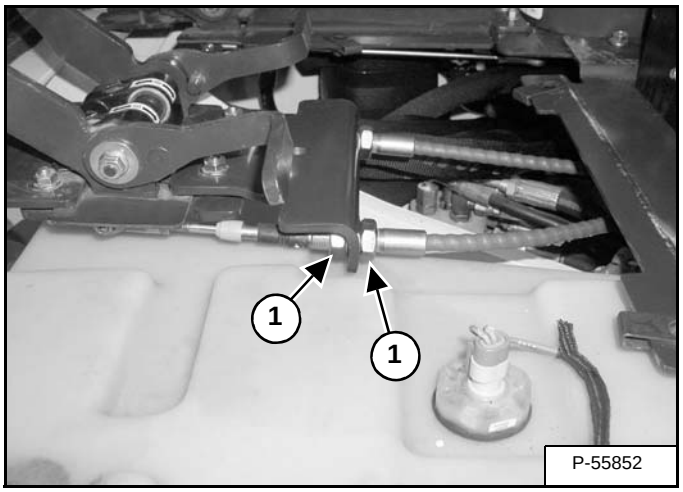
Installation: Tighten the bolts to 18 - 19 ft.-lb. (24 - 26 N•m) torque.

Adjustment

Remove the floor mat and floor plate. (See Removal And Installation (Canopy Equipped Excavators) on Page 40-110-1 or See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

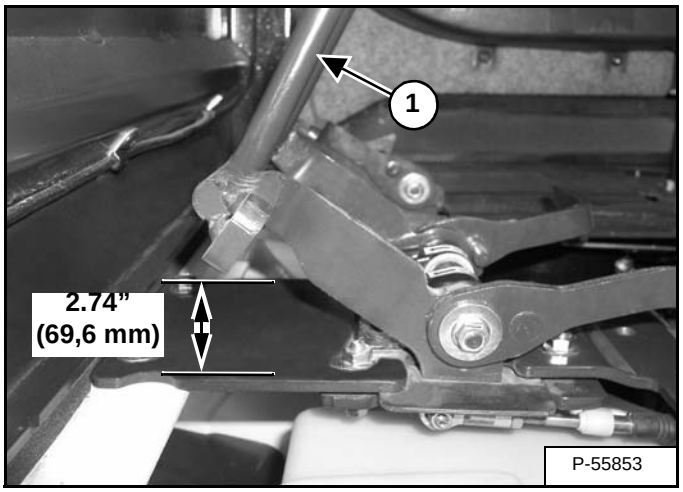
Neutral

Figure 40-100-13



Loosen the two nuts (Item 1) **[Figure 40-100-13]** on the travel linkage.

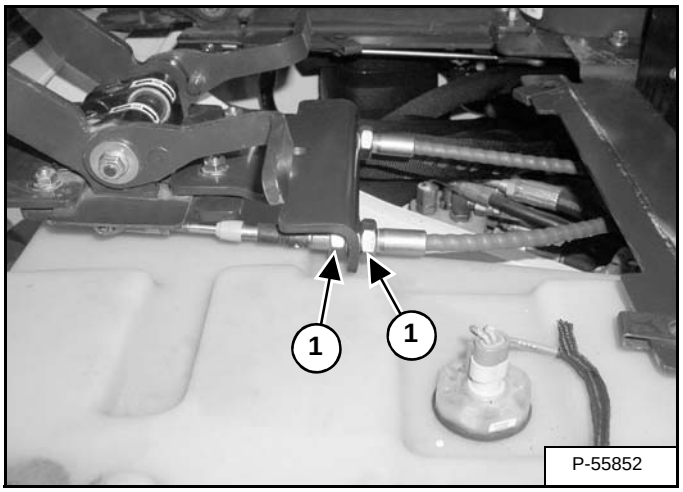
Figure 40-100-14



Hold the travel lever (Item 1) **[Figure 40-100-14]** in the neutral position.

Neutral position is 2.74 in. (69,6 mm) above the top of the pedal mount plate **[Figure 40-100-13]**.

Figure 40-100-15



Turn the nuts (Item 1) **[Figure 40-100-15]** to adjust the travel lever length.

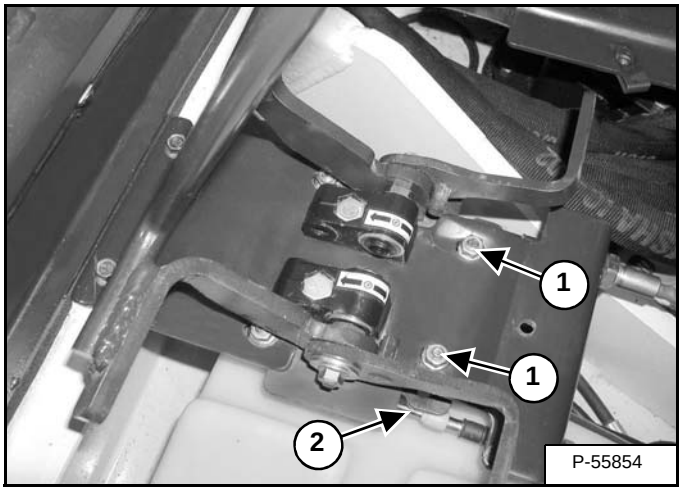
Tighten the nuts.

Repeat the procedure for the opposite travel lever.

Adjustment (Cont'd)

Forward Lever Stop:

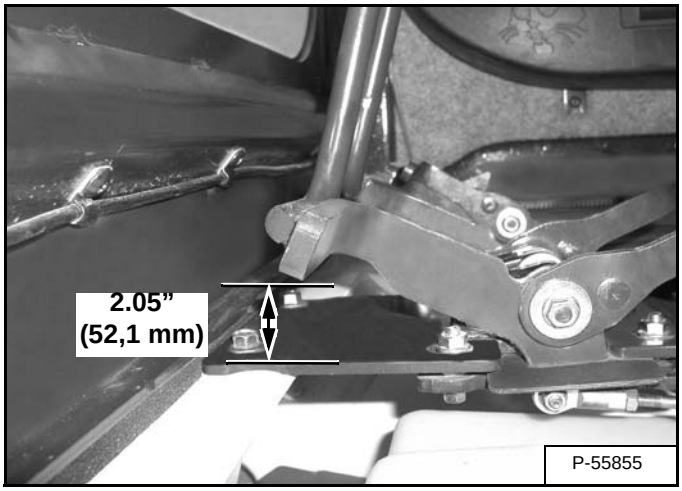
Figure 40-100-16



Loosen the bolts (Item 1) on the rear pedal stop (Item 2) **[Figure 40-100-16]**.

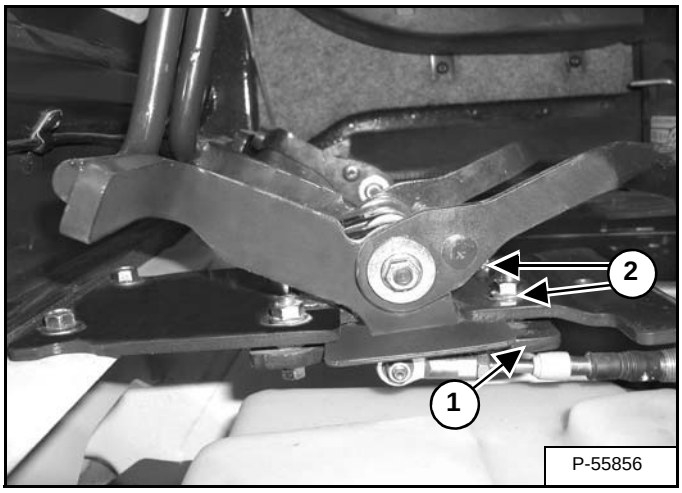
Hold both travel levers in the forward position.

Figure 40-100-17



Forward position is 2.05 in. (52,1 mm) above the top to the pedal mount plate **[Figure 40-100-17]**.

Figure 40-100-18



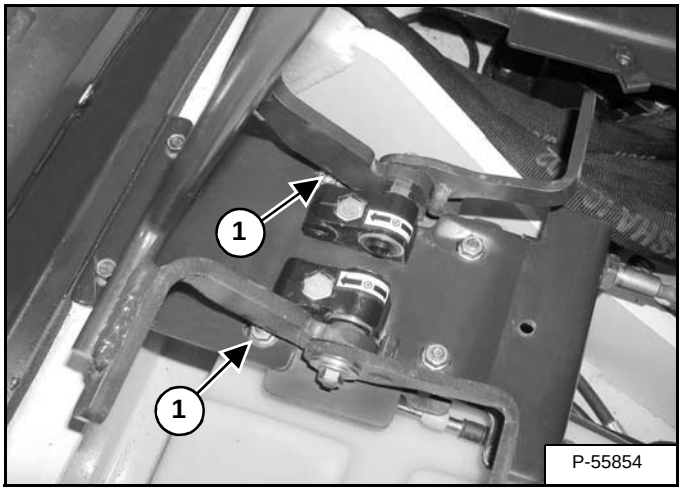
Slide the pedal stop (Item 1) **[Figure 40-100-18]** forward until it contacts both levers.

Tighten the bolts (Item 2) **[Figure 40-100-18]** on the pedal stop.

Adjustment (Cont'd)

Reverse Lever Stop:

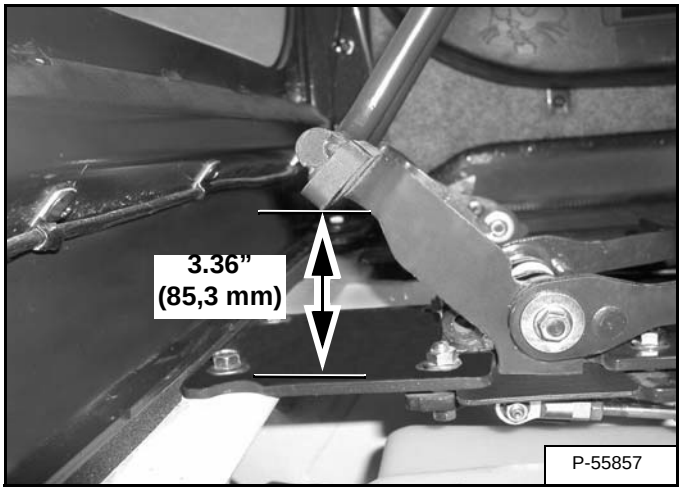
Figure 40-100-19



Loosen the bolts (Item 1) **[Figure 40-100-19]** on the front pedal stop.

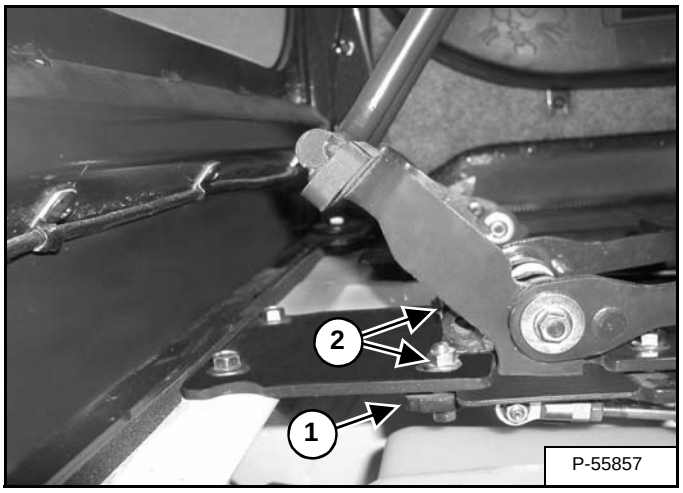
Hold both travel levers in the reverse position.

Figure 40-100-20



Reverse position is 3.36 in. (85,3 mm) above the top of the pedal mount plate **[Figure 40-100-20]**.

Figure 40-100-21



Slide the front pedal stop (Item 1) **[Figure 40-100-21]** until it contacts both levers.

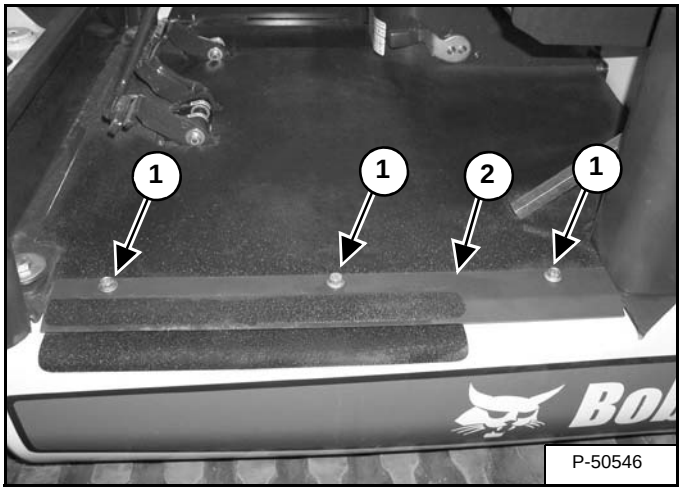
Tighten the bolts (Item 2) **[Figure 40-100-21]** on the front pedal stop.


Bobcat®

FLOOR MAT AND FLOOR PLATE

Removal And Installation (Canopy Equipped Excavators)

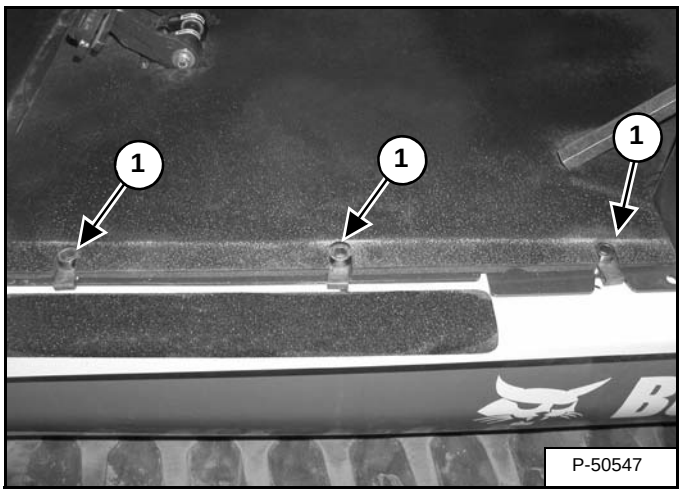
Figure 40-110-1



Remove the three bolts (Item 1) **[Figure 40-110-1]**.

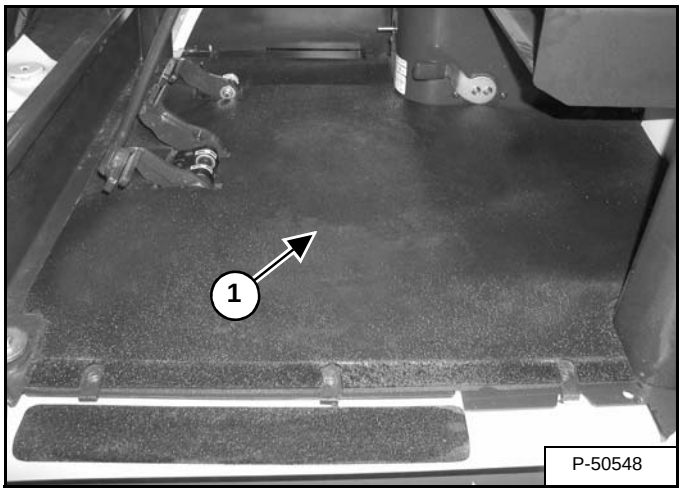
Remove the retaining plate (Item 2) **[Figure 40-110-1]**.

Figure 40-110-2



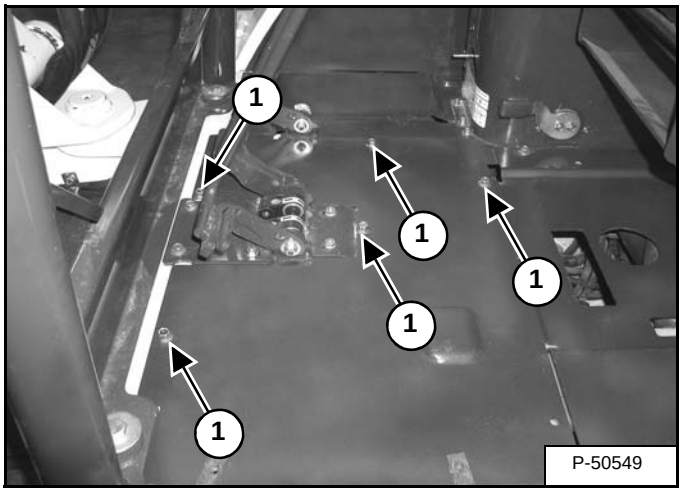
Remove the three spacers (Item 1) **[Figure 40-110-2]**.

Figure 40-110-3



Remove the floor mat (Item 1) **[Figure 40-110-3]**.

Figure 40-110-4



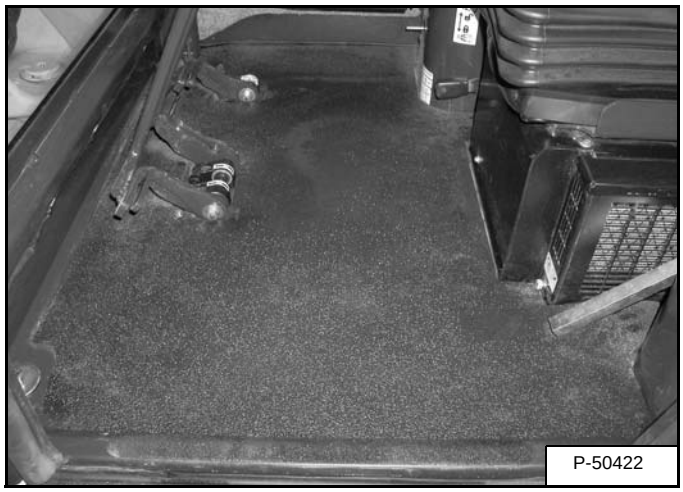
Remove the five mount bolts (Item 1) **[Figure 40-110-4]** from the floor plate.

Remove the floor plate.

FLOOR MAT AND FLOOR PLATE (CONT'D)

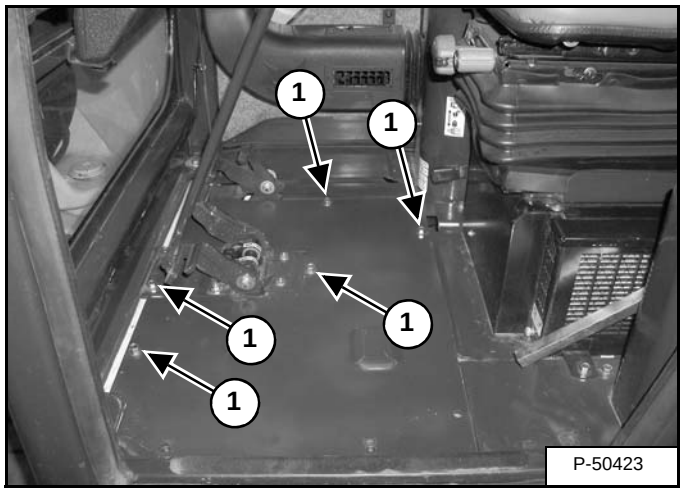
Removal And Installation (Cab Equipped Excavators)

Figure 40-110-5



Remove the floor mat **[Figure 40-110-5]** from the cab.

Figure 40-110-6



Remove the five bolts (Item 1) **[Figure 40-110-6]**.

Remove the floor plate.

FUEL TANK

Removal And Installation

Remove the floor mat and floor plate. (See Removal And Installation (Canopy Equipped Excavators) on Page 40-110-1 or See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

Remove the travel controls. (See Removal And Installation on Page 40-100-1.)

Remove the seat and seat mount. (See Removal And Installation on Page 40-40-1 or See Removal And Installation on Page 40-41-1.)

Remove the heater unit (If equipped). (See Description on Page 70-10-1.)

Remove the left console upper and lower console covers. (See Lower Console Cover Removal And Installation on Page 40-60-1 and See Upper Console Cover Removal And Installation on Page 40-60-3.)

Remove the boom swing cylinder. (See Removal And Installation on Page 20-22-3.)

Drain the fuel tank. (See Draining The Fuel Tank on Page 10-80-3.)

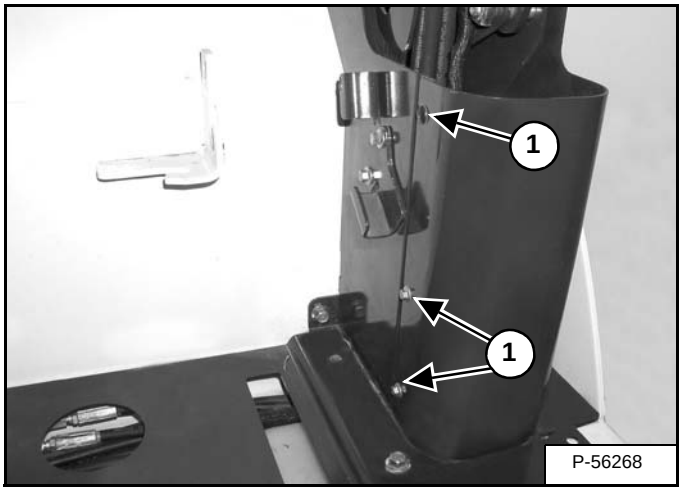
⚠ WARNING

AVOID INJURY OR DEATH

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

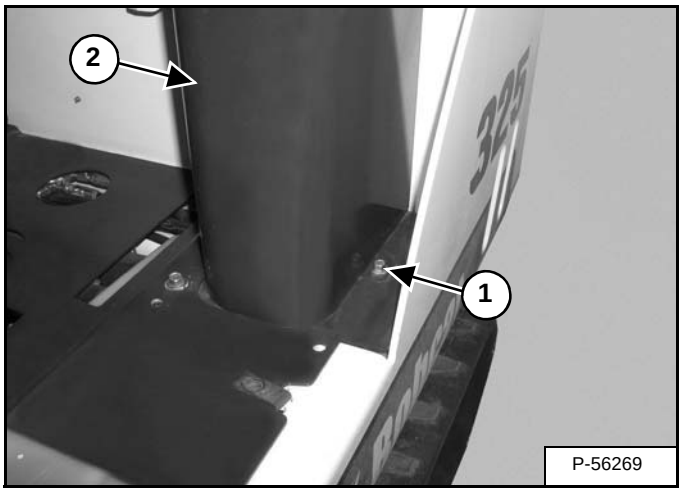
W-2103-0508

Figure 40-120-1



Remove the bolts (Item 1) **[Figure 40-120-1]**.

Figure 40-120-2



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

Removal And Installation (Cont'd)

Figure 40-120-3

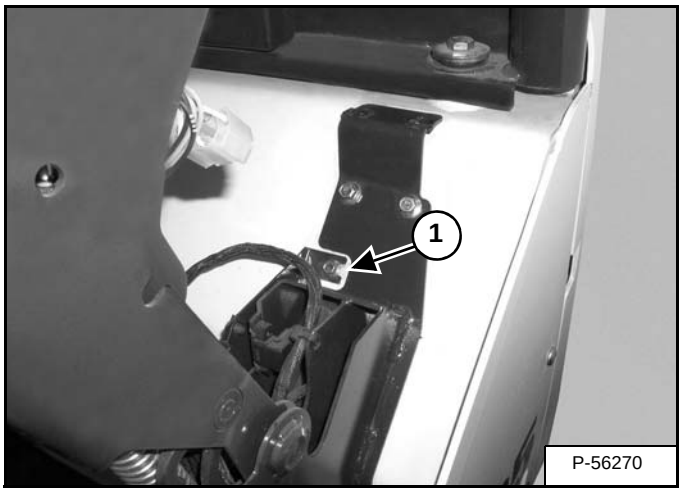
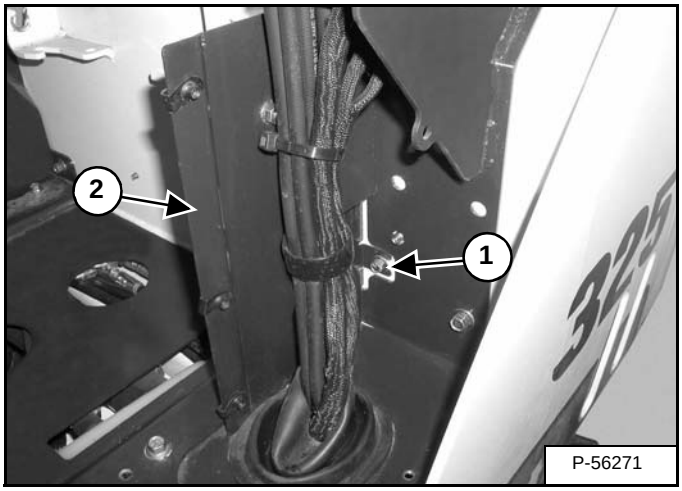
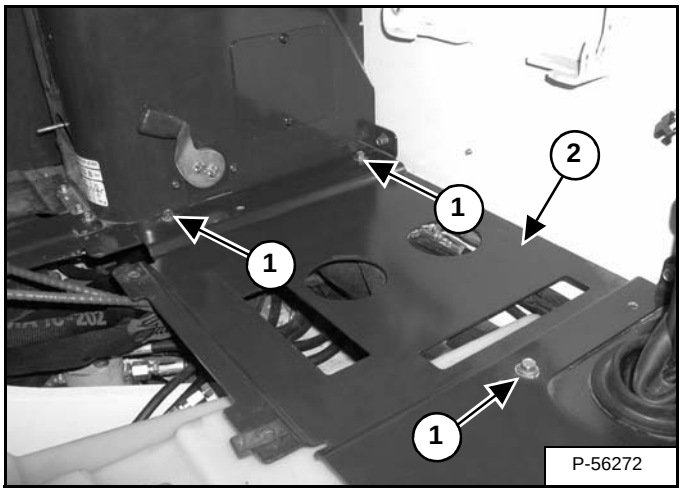


Figure 40-120-4



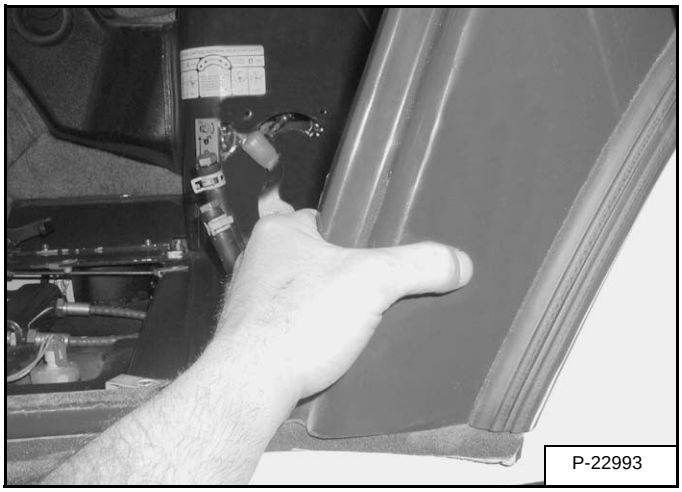
Loosen the top bolt (Item 1) **[Figure 40-120-3]** and bottom bolt (Item 1) **[Figure 40-120-4]** and remove the console side frame (Item 2) **[Figure 40-120-4]**.

Figure 40-120-5



Remove the bolts (Item 1). Remove the floor pan (Item 2) **[Figure 40-120-5]**.

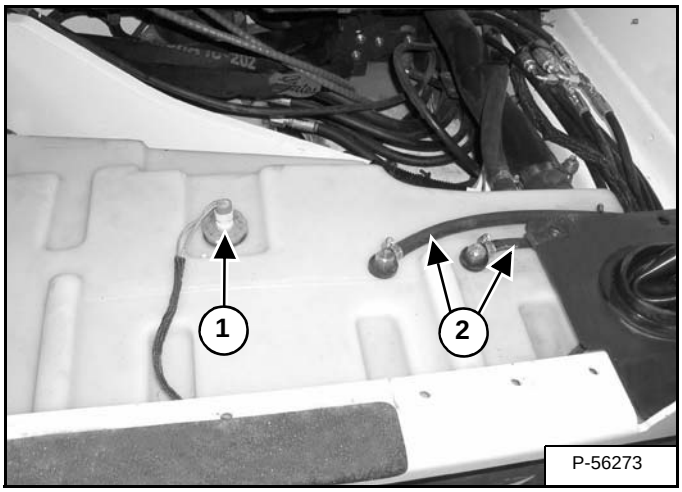
Figure 40-120-6



Pull out on the cab frame and remove the rear floor pan **[Figure 40-120-6]** (if equipped.)

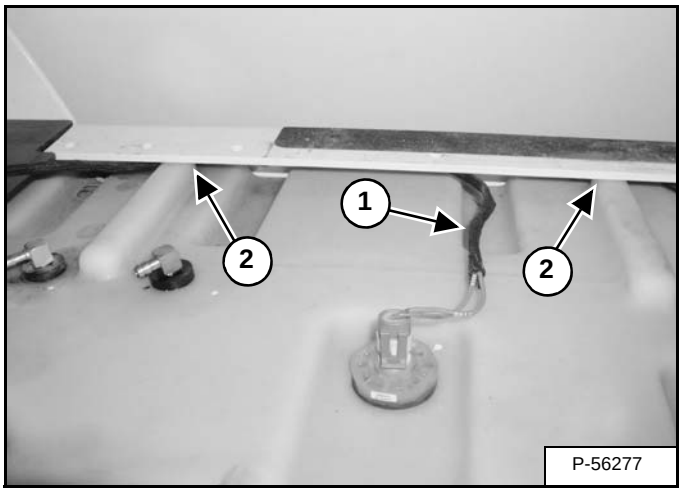
Removal And Installation (Cont'd)

Figure 40-120-7



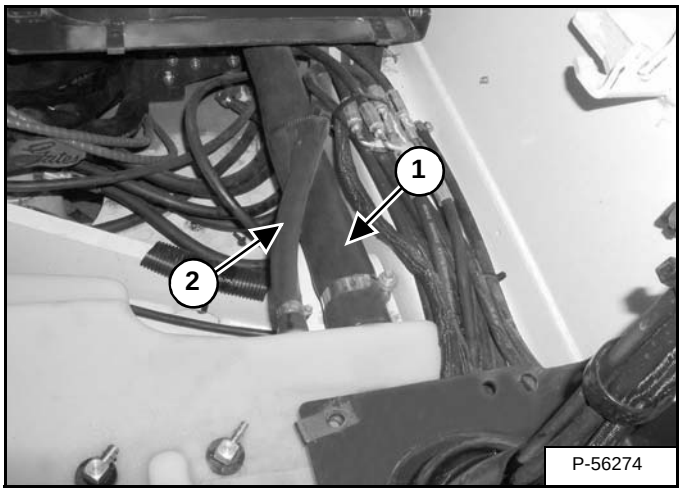
Remove the fuel sending unit wire harness (Item 1) and hoses (Item 2) **[Figure 40-120-7]**.

Figure 40-120-8



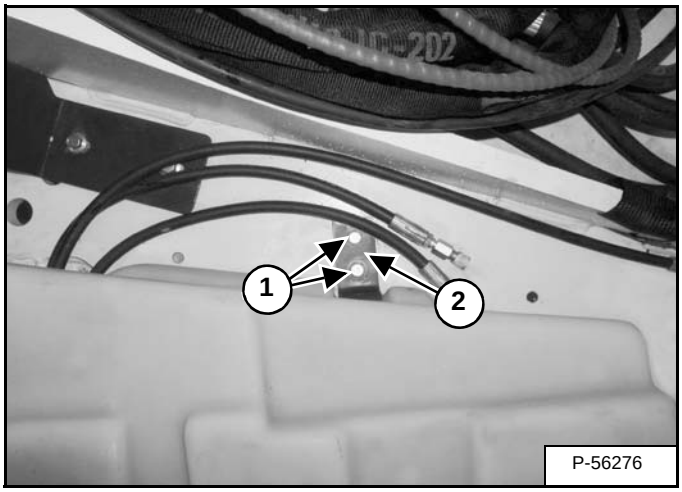
Installation: Route the wire harness (Item 1) between the ribbed sections (Item 2) **[Figure 40-120-8]** of the fuel tank.

Figure 40-120-9



Remove the fuel fill hose (Item 1) and vent hose (Item 2) **[Figure 40-120-9]**.

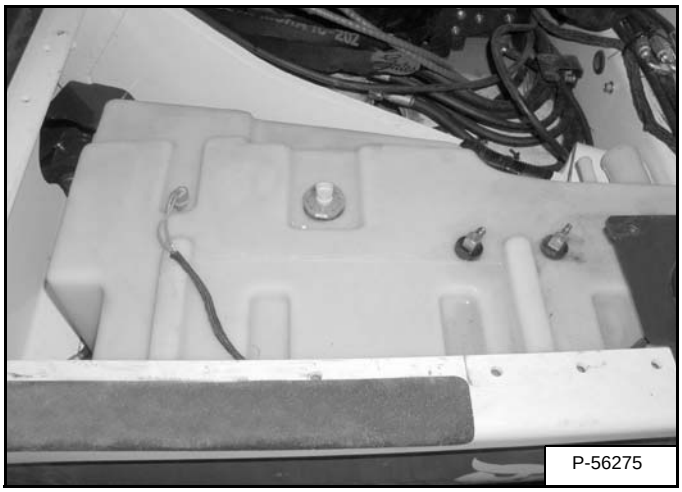
Figure 40-120-10



Remove the bolts (Item 1) and fuel tank mount (Item 2) **[Figure 40-120-10]**.

Removal And Installation (Cont'd)

Figure 40-120-11



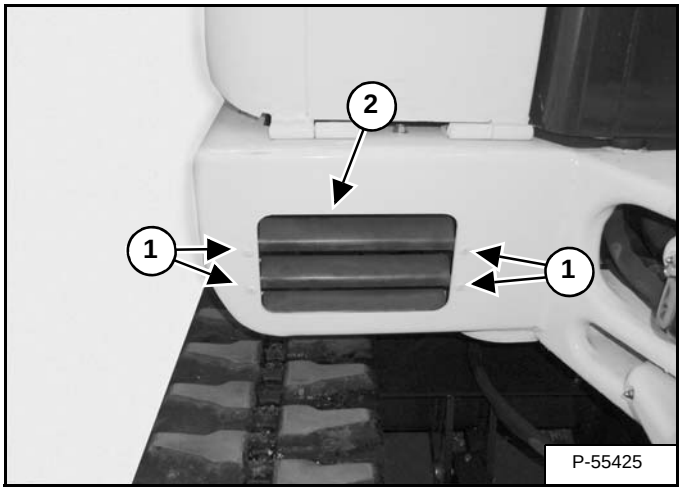
Remove the fuel tank **[Figure 40-120-11]**.

HORN

Removal And Installation

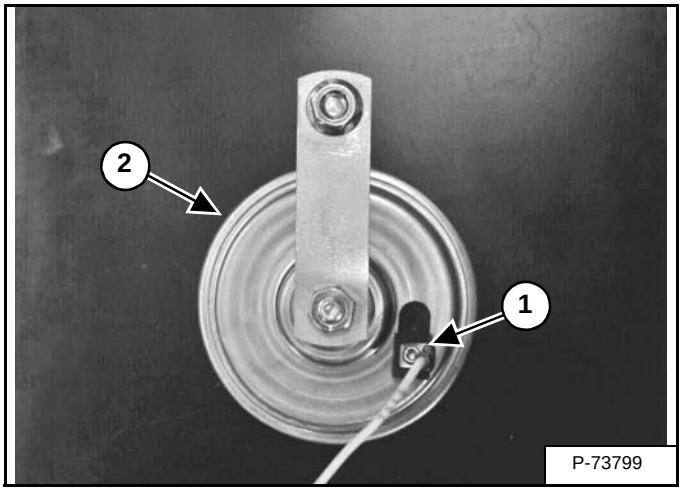
Access the horn through the right front side of the upperstructure.

Figure 40-130-1



Remove the bolts (Item 1). Remove the cover (Item 2) **[Figure 40-130-1]**.

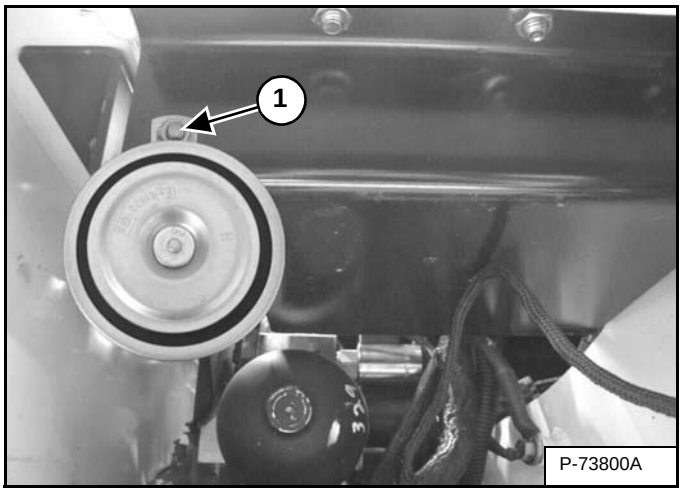
Figure 40-130-2



NOTE: Horn shown removed for visual clarity [Figure 40-130-2].

Disconnect the wire harness (Item 1) from the horn (Item 2) **[Figure 40-130-2]**.

Figure 40-130-3



Remove the nut (Item 1) **[Figure 40-130-3]** and remove the horn.


Bobcat®

SWING FRAME

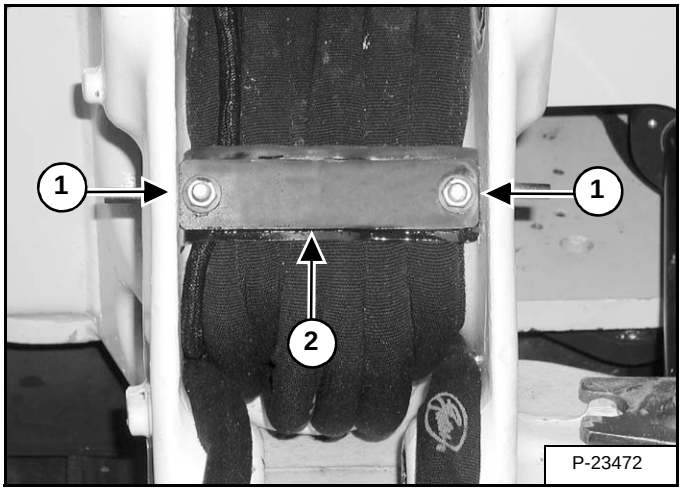
Boom Swing Bracket Removal And Installation

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.)

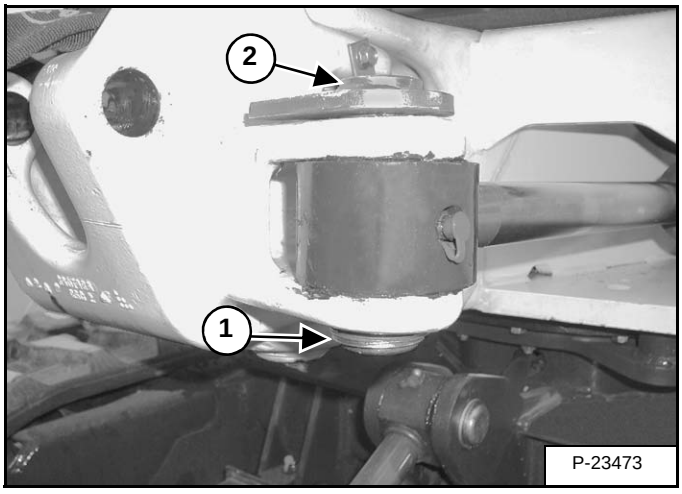
Figure 40-140-1



Remove the bolts (Item 1) and the clamp (Item 2) **[Figure 40-140-1]**.

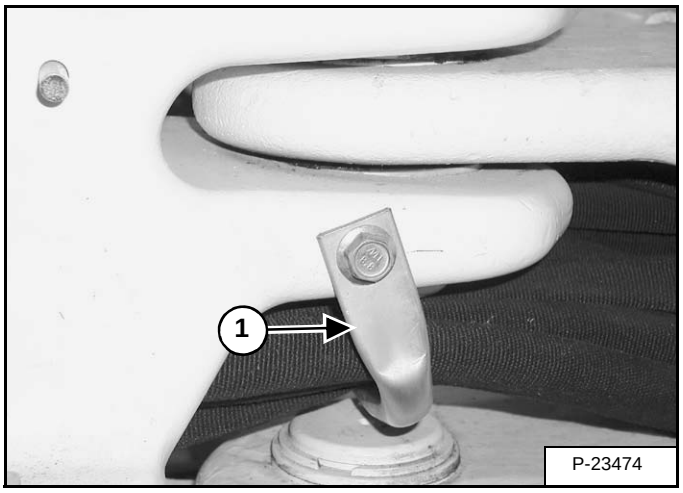
NOTE: When the hoses have been removed from the clamped position, the hoses must be measured for correct clamped length and position. (See Boom Swing Bracket Hose Installation on Page 40-140-5.)

Figure 40-140-2



Remove the snap ring (Item 1), washer, and pin (Item 2) **[Figure 40-140-2]** from the boom swing bracket.

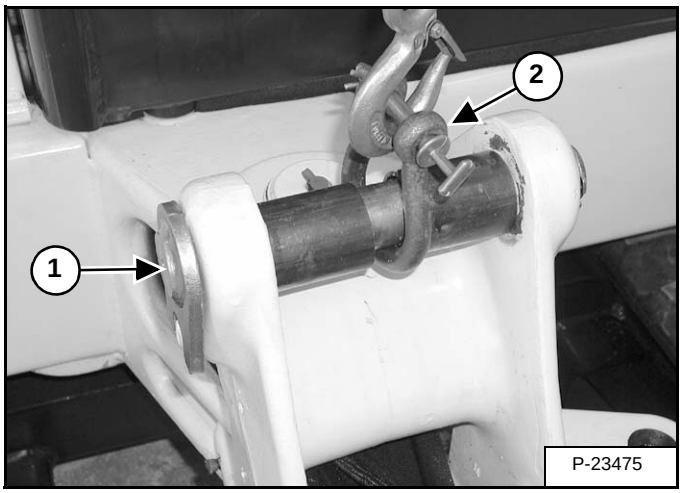
Figure 40-140-3



Remove the hose bracket (Item 1) **[Figure 40-140-3]**.

Reposition the hoses to gain clearance.

Figure 40-140-4

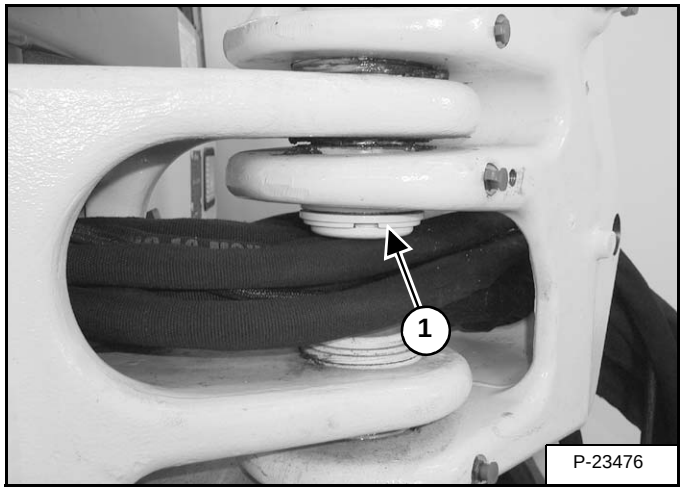


Install the boom pin (Item 1) using spacers to position a lifting clevis (Item 2) **[Figure 40-140-4]** on the center of the boom pin.

NOTE: The spacers will prevent the clevis from sliding on the boom pin causing the boom swing bracket to tip from side to side.

Boom Swing Bracket Removal And Installation (Cont'd)

Figure 40-140-5



Remove the snap ring (Item 1) **[Figure 40-140-5]** and washer from the top pin.

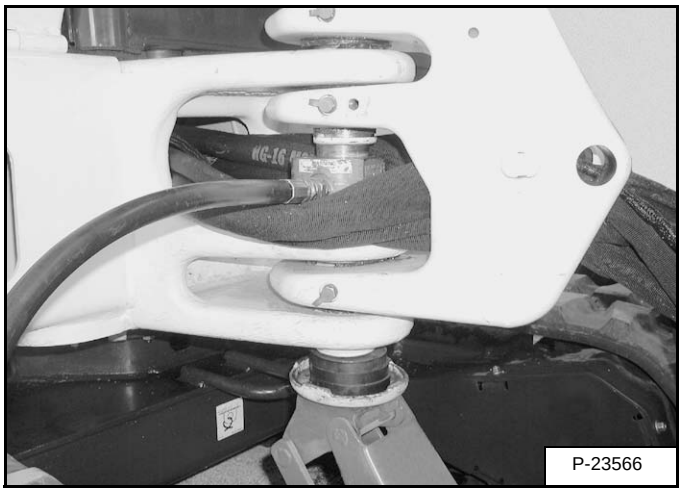
IMPORTANT

Do Not use a porta-power to press out the swing frame pivot pins without the lower pin being supported. Excess pressure can cause the swing frame casting to crack.

I-2092-1204

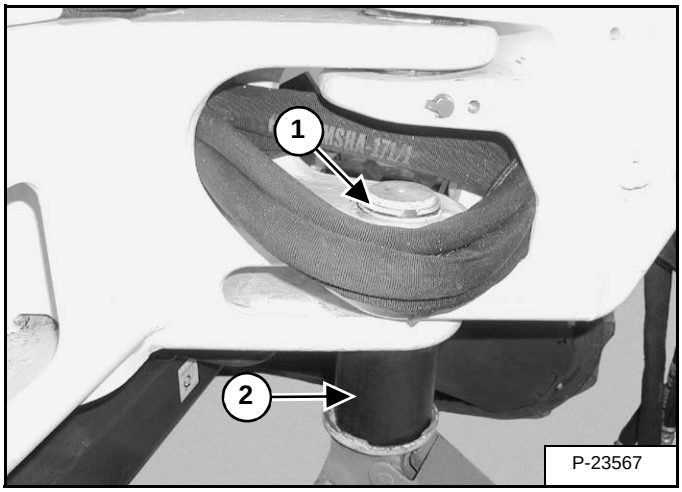
Support the bottom pin with a jack.

Figure 40-140-6



Install a porta-power between the top and bottom pins and press the top pin out **[Figure 40-140-6]**.

Figure 40-140-7

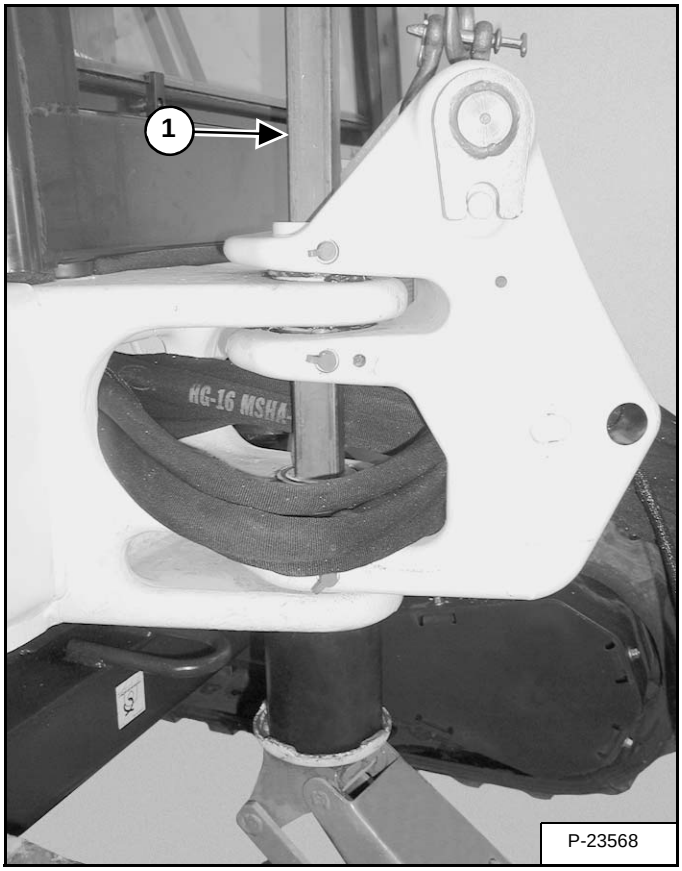


Remove the snap ring (Item 1) **[Figure 40-140-7]** and washer from the pin.

Install a spacer tube (Item 2) **[Figure 40-140-7]** and jack under the swing 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.

Boom Swing Bracket Removal And Installation (Cont'd)

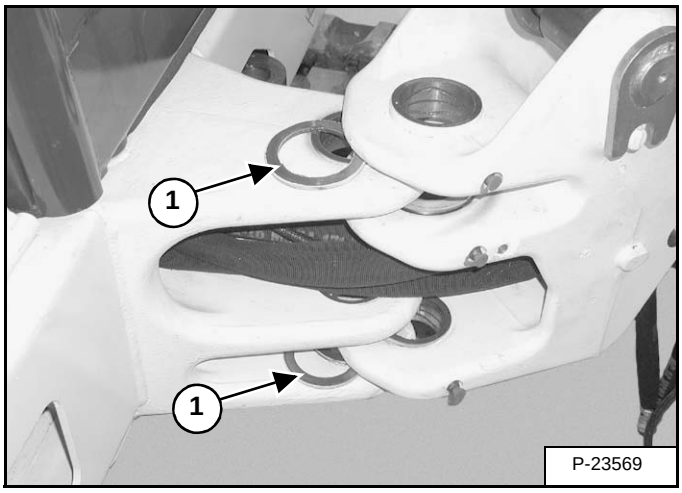
Figure 40-140-8



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.

Figure 40-140-9



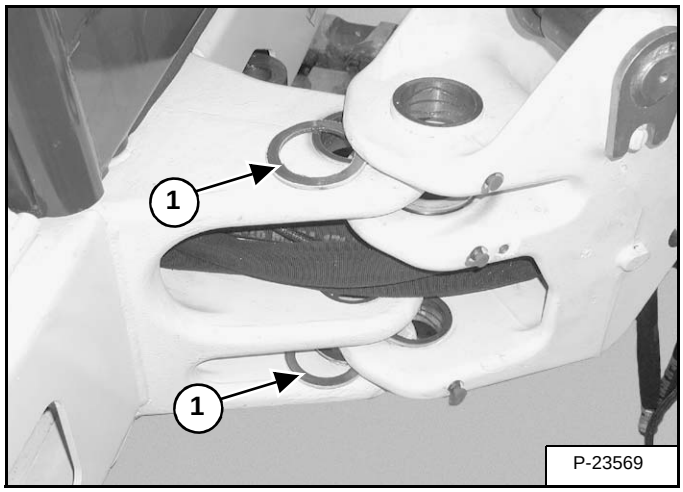
Remove the top and bottom spacer (Item 1) **[Figure 40-140-9]** from the swing bracket.

Remove the swing bracket.

Inspect the bushings for damage. Replace damaged bushings as necessary. (See Bushing Removal on Page 40-140-6.)

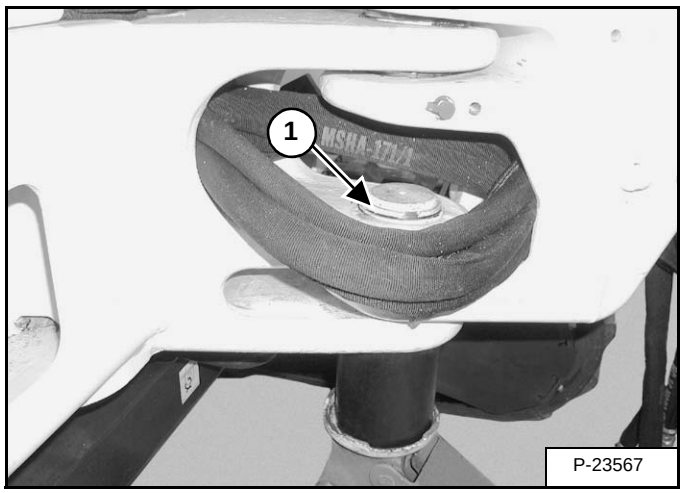
Boom Swing Bracket Removal And Installation (Cont'd)

Figure 40-140-10



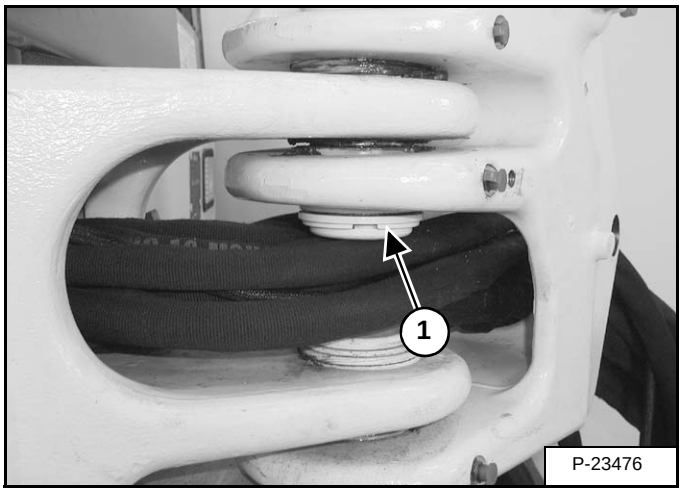
Installation: Install the top and bottom spacer (Item 1) **[Figure 40-140-10]** on the swing bracket. Install the swing bracket.

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.

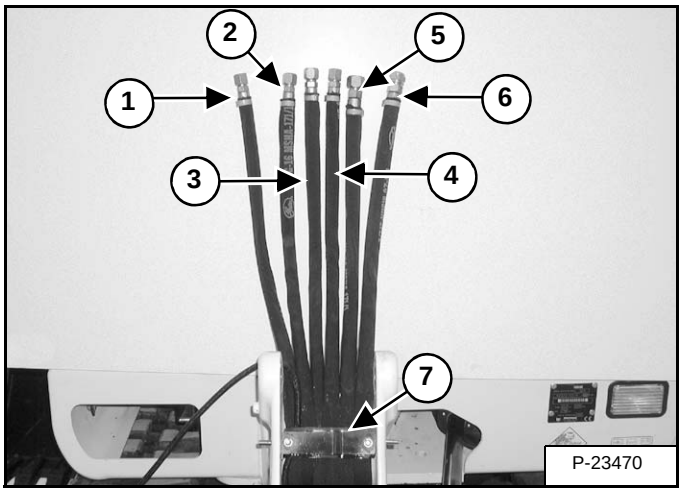
Figure 40-140-12



Installation: Install the top pin, washer and snap ring (Item 1) **[Figure 40-140-12]**.

Boom Swing Bracket Hose Installation

Figure 40-140-13



Route the hoses through the boom swing bracket as follows **[Figure 40-140-13]**:

1. Arm Rod End Hose
2. Bucket Base End Hose
3. Female Quick Coupler Hose
4. Male Quick Coupler Hose
5. Bucket Rod End Hose
6. Arm Base End Hose

Install the hoses and hose clamp (Item 7) **[Figure 40-140-13]**. Do not tighten the clamp at this time.

Figure 40-140-14



Measure the length of the hoses from the top of the clamp to the end of each hose **[Figure 40-140-14]**.

Tighten the clamp bolts when the auxiliary hoses are 29 in. (737 mm) and the arm and bucket hoses are 31 in. (787 mm) from the top of the clamp.

Bushing Removal

IMPORTANT

Do Not point (hammer) on the boom swing bracket. Excess pressure can cause the casting to crack.

I-2095-1195

The following parts will be needed for removal and installation of the boom swing bracket bushings:

Bolt - 5/8 x 4.0 in. or (15 x 101 mm) long.

Nut - 5/8 in. or (15 mm).

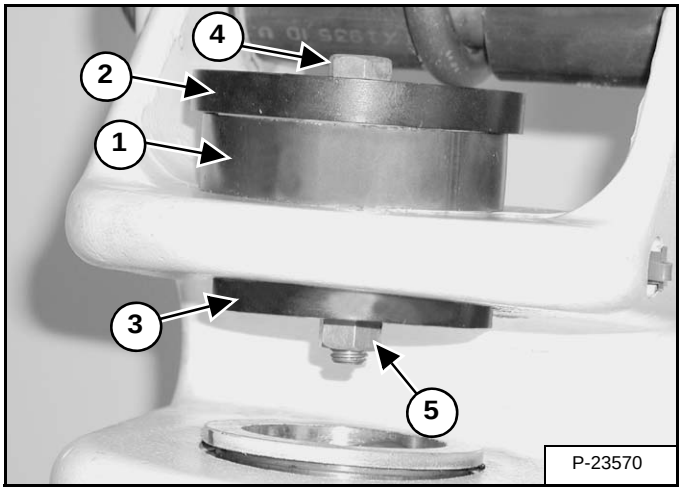
Washer -3/4 I.D. x 3 O.D. x 3/8 in. thick or (19 mm I.D. x 79 mm O.D. x 10 mm thick.

Washer - 3/4 I.D. x 3-1/2 O.D. x 3/8 in. thick or (19 mm I.D. x 79 mm O.D. x 10 mm thick).

Washer - 3/4 I.D. x 4-1/2 O.D. x 1 in. thick or (19 mm I.D. x 114 mm O.D. x 25 mm thick).

Spacer - 3-9/16 I.D. x 4-5/16 O.D. x 1-1/2 in. thick or (90 mm I.D. x 110 mm O.D. x 25 mm thick).

Figure 40-140-15



Install the spacer (Item 1) and washer (Item 2) **[Figure 40-140-15]** over the flanged end of the bushing.

The spacer (Item 1) **[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 4) and the nut (Item 5) **[Figure 40-140-15]** through the washers and the spacer.

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

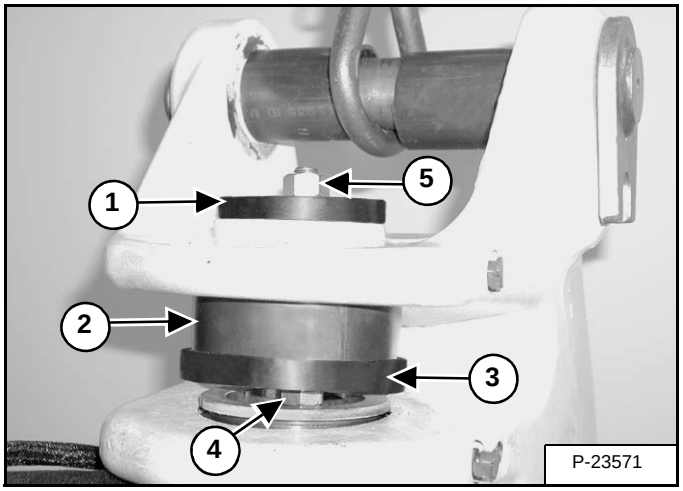
Bushing Installation

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: The bushing must be centered in the casting hole and started in the hole evenly and square.

Figure 40-140-16



Put the washer (Item 1) **[Figure 40-140-16]** over the flanged end of the bushing.

Put the spacer (Item 2) and the washer (Item 3) **[Figure 40-140-16]** over the bushing hole casting. Center the spacer and the washer over the bushing hole.

Install the bolt (Item 4) through the washers, the spacer and the bushing. Install the nut (Item 5) **[Figure 40-140-16]**.

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

Figure 40-140-17

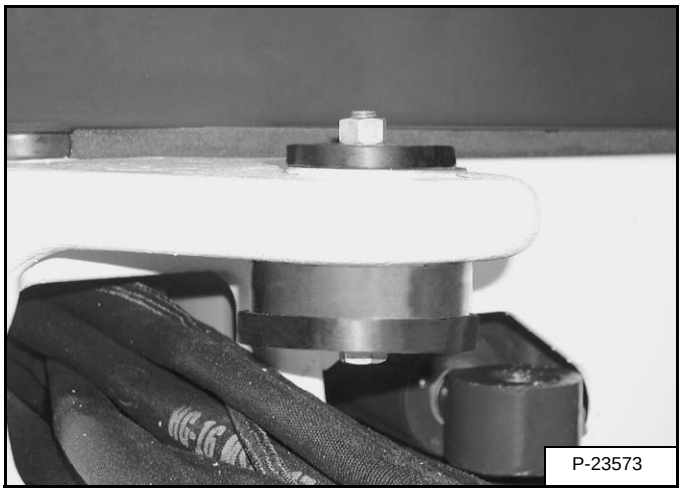
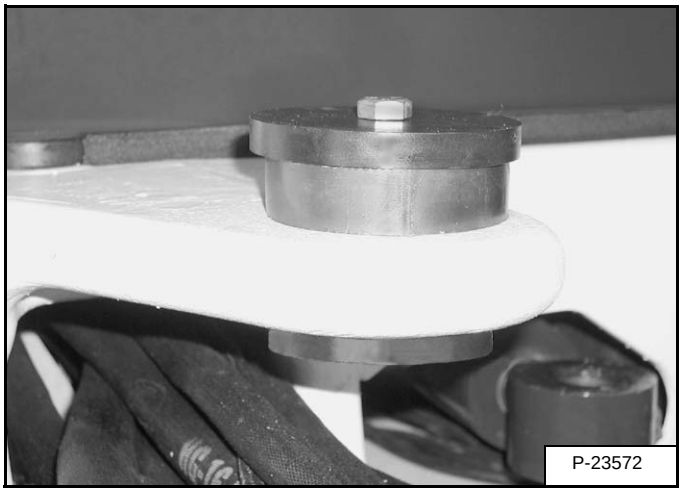


Figure 40-140-18



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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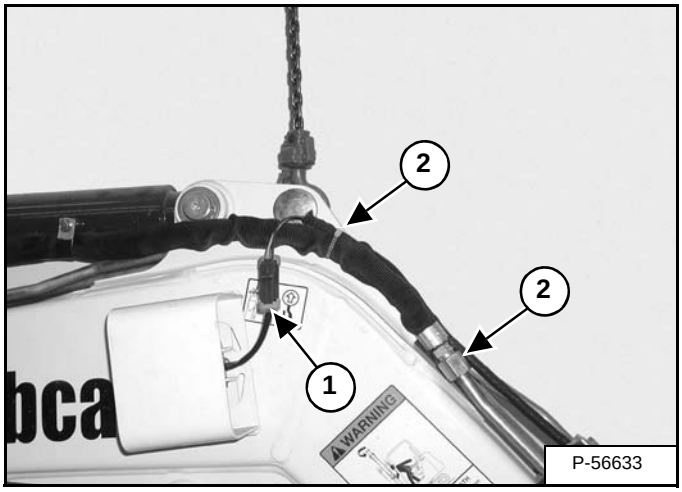
BOOM

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 20-20-4.)

Figure 40-150-1



Disconnect the wire harness (Item 1) **[Figure 40-150-1]**.

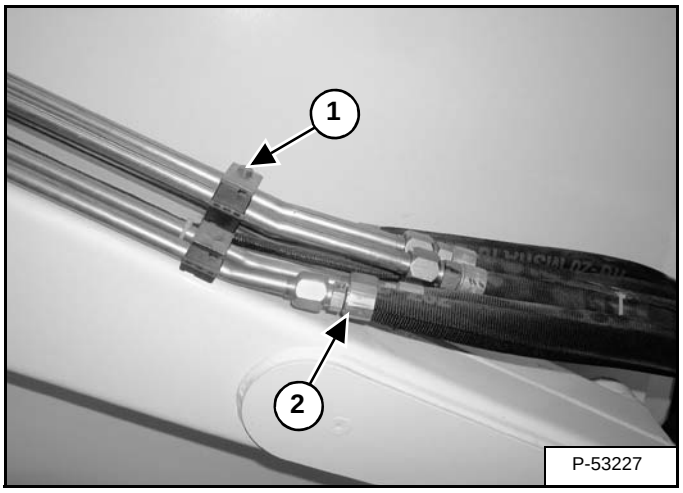
Cut and remove the cable ties (Item 2) **[Figure 40-150-1]**.

IMPORTANT

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

I-2003-0888

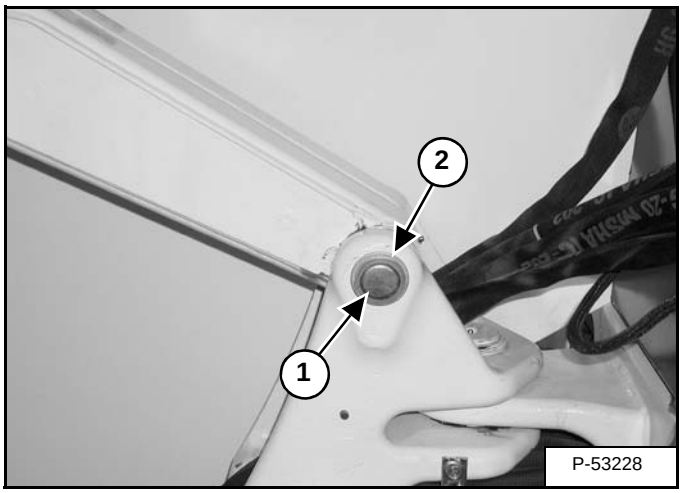
Figure 40-150-2



Remove the tubeline clamp (Item 1) **[Figure 40-150-2]**.

Mark and remove the hoses (Item 2) **[Figure 40-150-2]**.

Figure 40-150-3



Remove the snap ring (Item 1), washers (Item 2) **[Figure 40-150-3]** and pin.

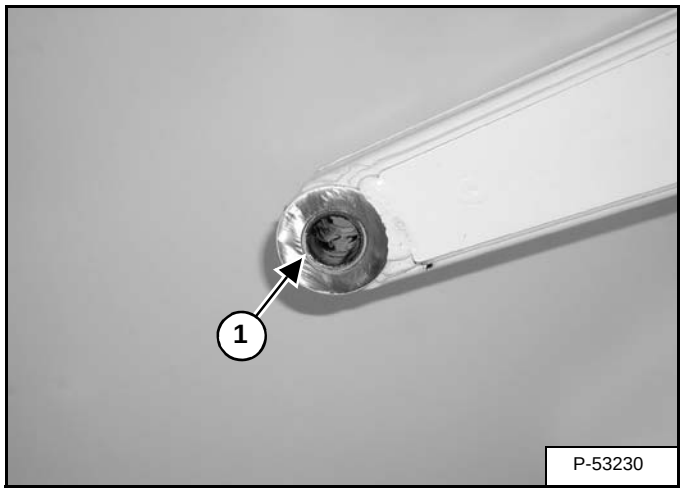
Removal And Installation (Cont'd)

Figure 40-150-4



Remove the boom **[Figure 40-150-4]**.

Figure 40-150-5

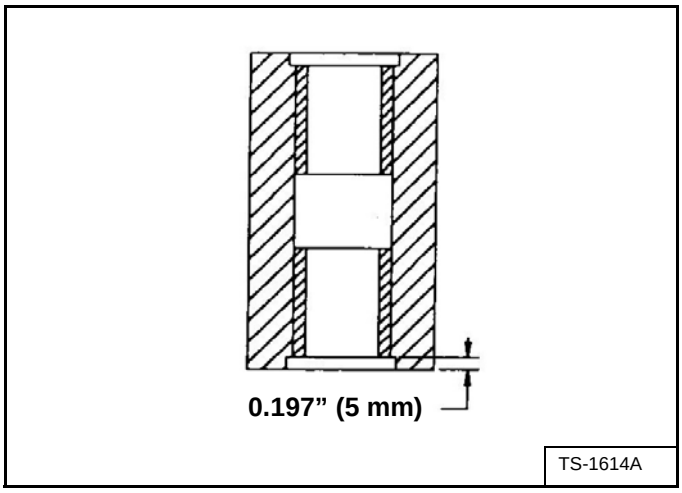


Remove the seals (Item 1) **[Figure 40-150-5]** from both sides of the boom.

Remove the bushings from both sides of the boom.

Install the new bushings in the boom.

Figure 40-150-6



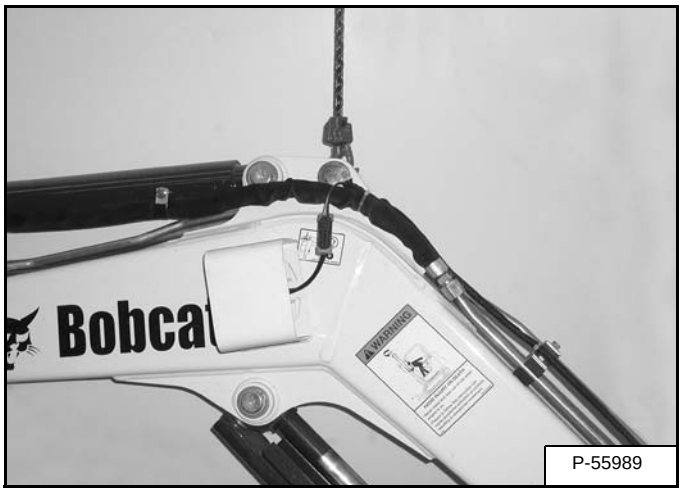
Install the bushings until they are seated 0.197 in. (5 mm) in the pin boss **[Figure 40-150-6]** (both sides.)

Install new seals on both sides of the arm.

ARM

Removal And Installation

Figure 40-160-1

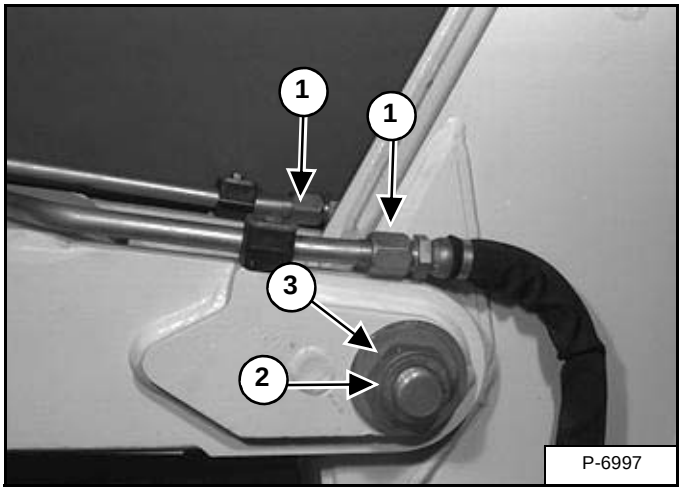


Support the boom **[Figure 40-160-1]**.

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) **[Figure 40-160-2]** and the washer (Item 3) **[Figure 40-160-2]** from the boom mounting pin.

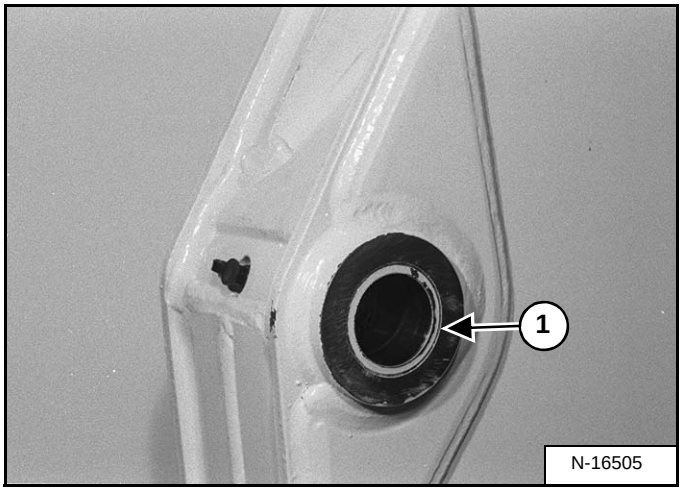
Installation: Tighten the lock nut until it is seated firmly against the boom. Do not over tighten and deflect the boom mounting plates. The arm must pivot freely.

Remove the arm.

Arm To Boom Bushing Removal And Installation

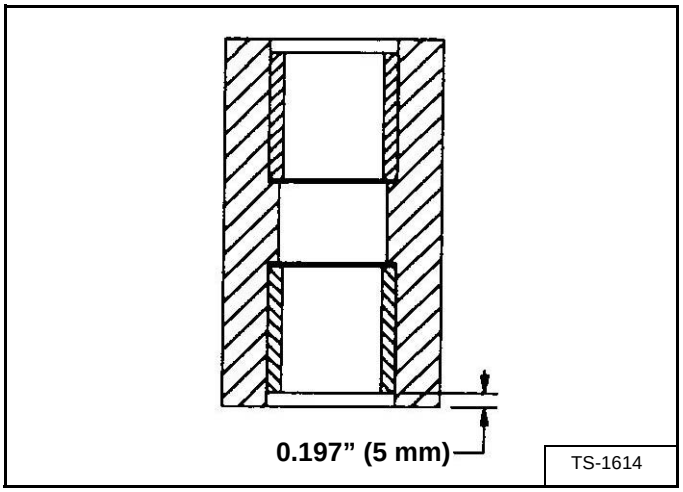
Remove the dust seal (if equipped) from both sides of the arm.

Figure 40-160-3



Remove the bushings (Item 1) **[Figure 40-160-3]** from both sides of the arm.

Figure 40-160-4

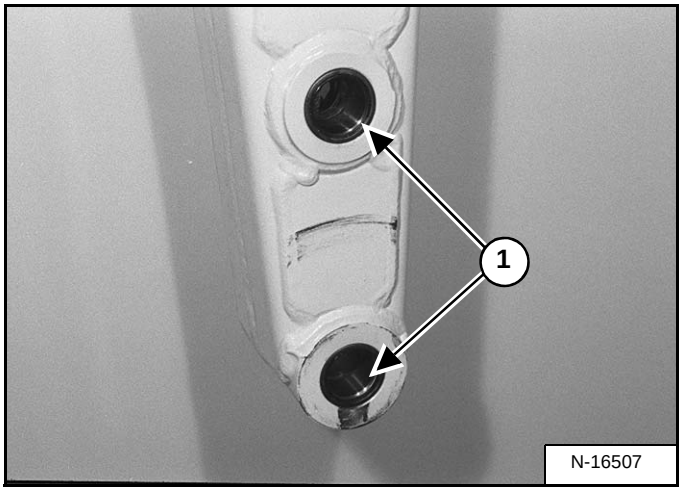


Install the bushings until they are seated 0.197 in. (5 mm) in the pin boss **[Figure 40-160-4]** (both sides).

Install new dust seals (if equipped).

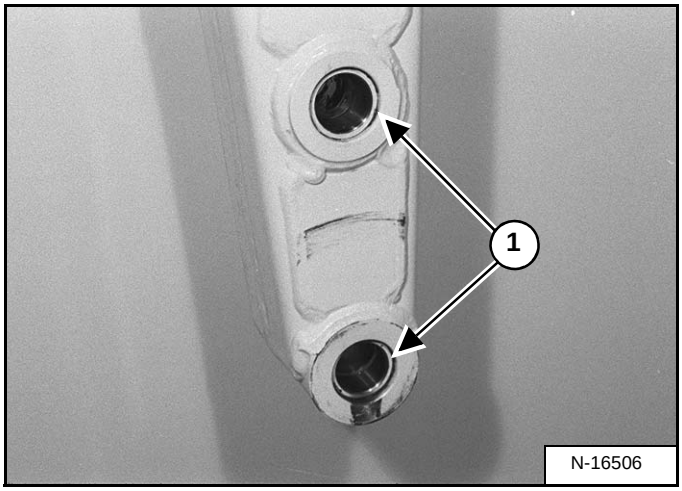
Arm To Bucket And Bucket Link Bushing Removal And Installation

Figure 40-160-5



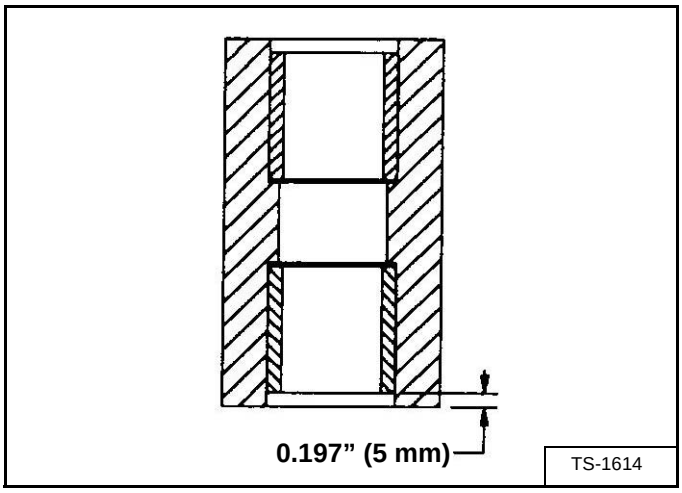
Remove the dust seals (Item 1) **[Figure 40-160-5]** from both sides of the arm.

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 in. (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.

BUCKET

Bucket Teeth Removal And Installation

WARNING

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

- **Pressurized fluids and springs or other stored energy components.**
- **Flying debris or loose material is present.**
- **Engine is running.**
- **Tools are being used.**

W-2505-0604

Position the bucket so the bucket teeth are at a 30° angle up from the ground for accessibility to the teeth.

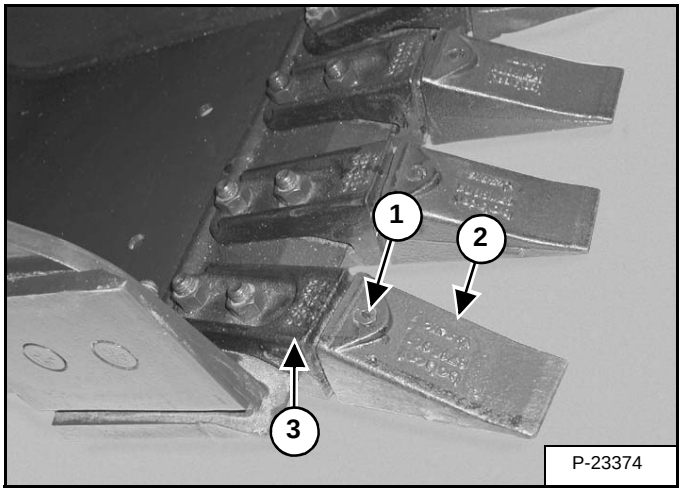
Lower the boom until the bucket is fully on the ground.

Stop the engine and exit the excavator.

NOTE: Early and later style tooth points and retaining pins are not interchangeable.

Early Style bucket Teeth

Figure 40-170-1

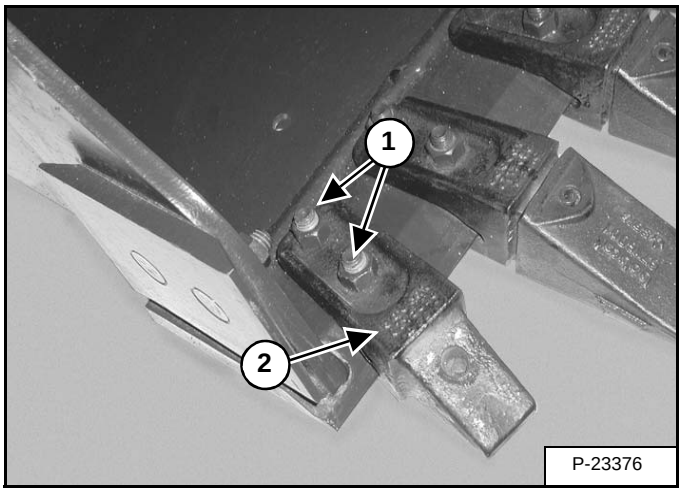


Remove the retaining pin (Item 1) from the tooth point (Item 2) **[Figure 40-170-1]**.

Remove the tooth point (Item 2) from the shank (Item 3) **[Figure 40-170-1]**.

Installation: Position the new tooth point on the shank and install a new retaining pin. Install the retaining pin until it is flush with the top of the point.

Figure 40-170-2



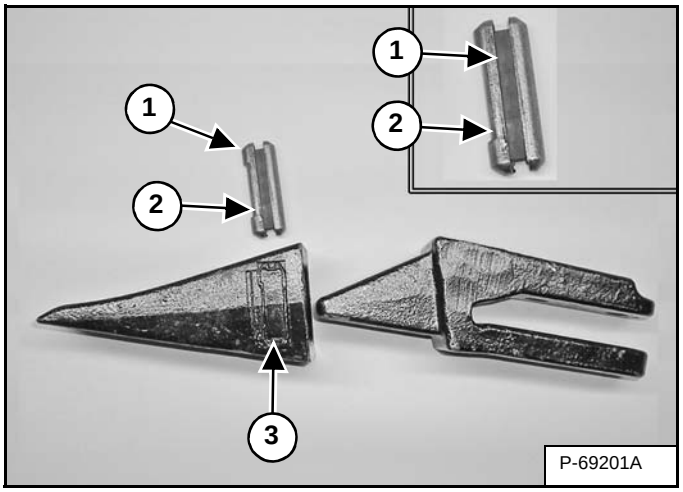
Remove the two nuts (Item 1) and bolts from the tooth shank (Item 2) **[Figure 40-170-2]**. Remove the tooth shank.

Installation: Tighten the nuts to 90 - 100 ft.-lb. (125 - 135 N•m) torque.

Later Style Bucket Teeth

The removal and installation procedure for the later style tooth point and tooth assembly is the same as the early. style.

Figure 40-170-3

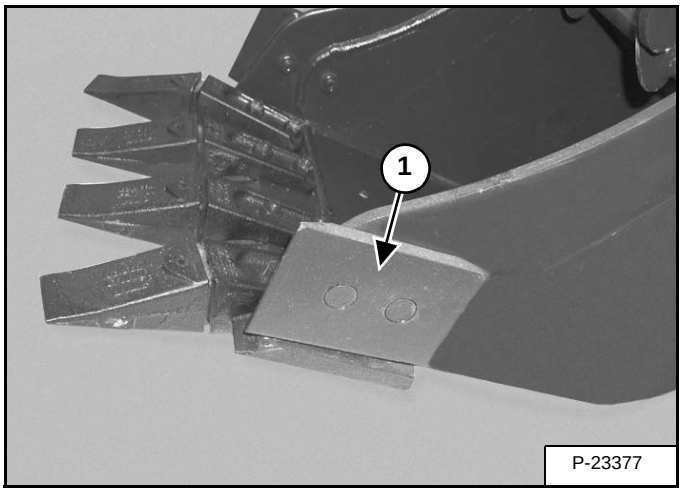


The later style tooth has a unique retaining pin (Item 1). The retaining pin must be installed as shown [notch (Item 2) to the front] for proper fit and tooth retention. The side of the tooth point (Item 3) **[Figure 40-170-3]** also shows the correct orientation of the retaining pin.

Installation: Position the new tooth point on the shank and install a new retaining pin. Install the retaining pin until it is flush with the top of the point.

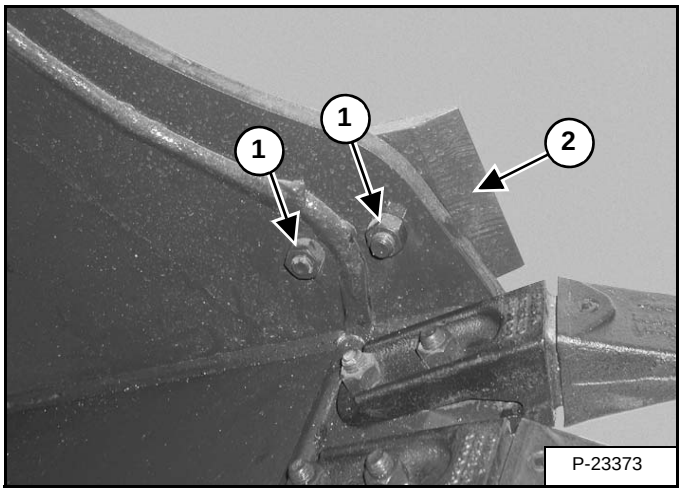
Bucket Side Cutting Edge Removal And Installation

Figure 40-170-4



The bucket side cutting edges (Item 1) **[Figure 40-170-4]** are reversible.

Figure 40-170-5



Remove the two bolts and nuts (Item 1) **[Figure 40-170-5]**.

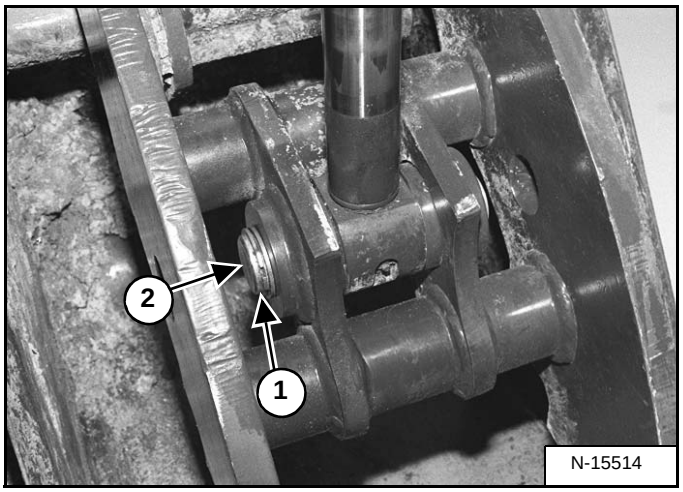
Installation: Tighten the nuts to 90 - 100 ft.-lb. (125 - 135 N•m) torque.

Remove the cutting edge (Item 2) **[Figure 40-170-5]**.

CLAMP

Removal And Installation

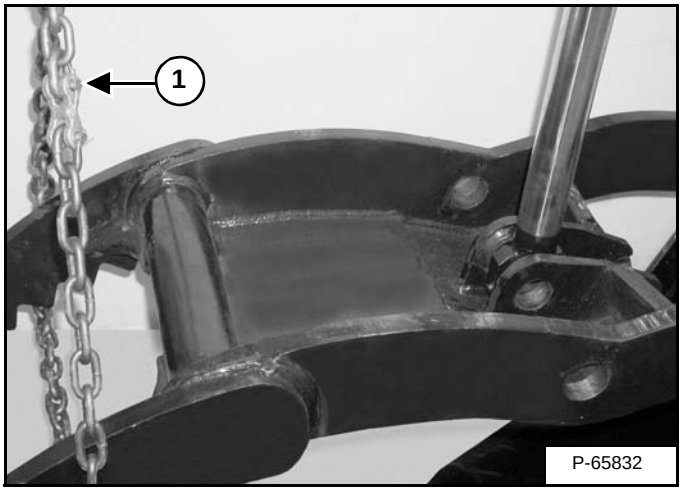
Figure 40-171-1



Remove the snap ring and washer (Item 1) **[Figure 40-171-1]** from the cylinder pin.

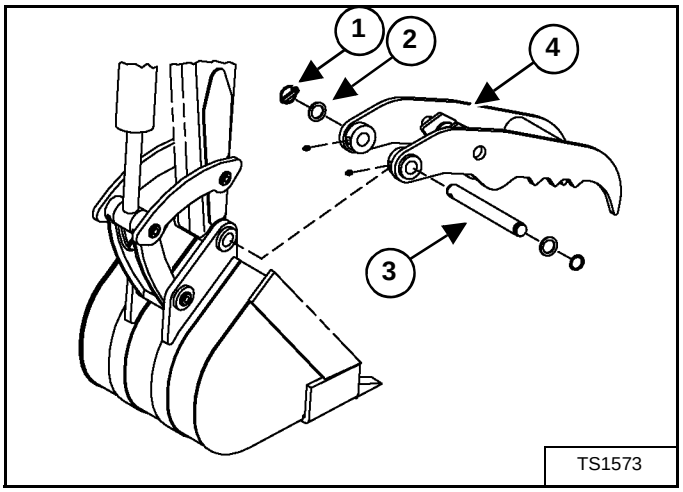
Remove the pin (Item 2) **[Figure 40-171-1]** from the rod end of the cylinder.

Figure 40-171-2



Attach a chain (Item 1) **[Figure 40-171-2]** and lifting device.

Figure 40-171-3



Remove the retainer clip (Item 1), washer (Item 2) and pivot pin (Item 3) **[Figure 40-171-3]**.

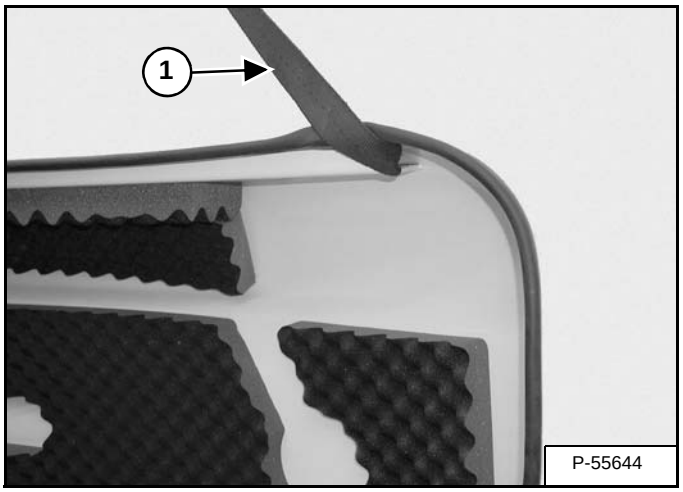
Remove the clamp (Item 4) **[Figure 40-171-3]**.


Bobcat®

TAILGATE

Removal And Installation

Figure 40-180-1



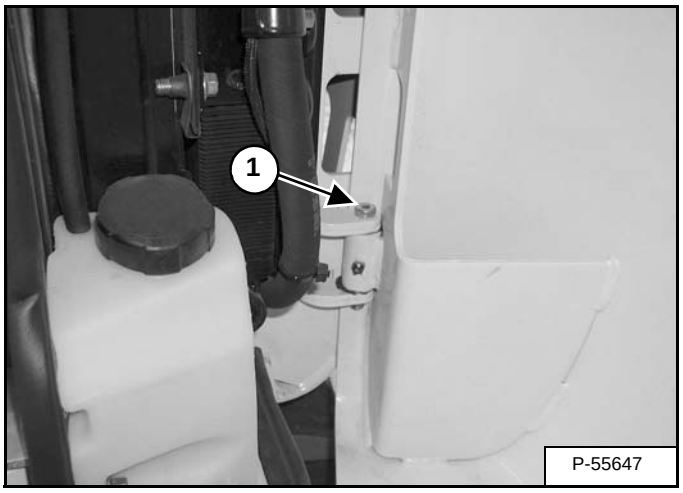
Install a sling (Item 1) **[Figure 40-180-1]** through the top tailgate brace.

Figure 40-180-2



Install an overhead hoist on the sling **[Figure 40-180-2]**.

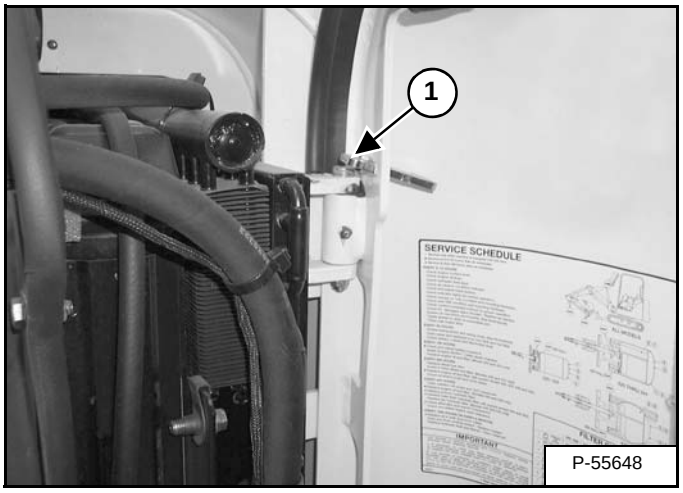
Figure 40-180-3



Remove the bottom bolt (Item 1) **[Figure 40-180-3]** and nut.

Installation: Tighten the bolts to 25 - 28 ft.-lb. (34 - 38 N•m) torque.

Figure 40-180-4



Remove the top bolt (Item 1) **[Figure 40-180-4]** and nut.

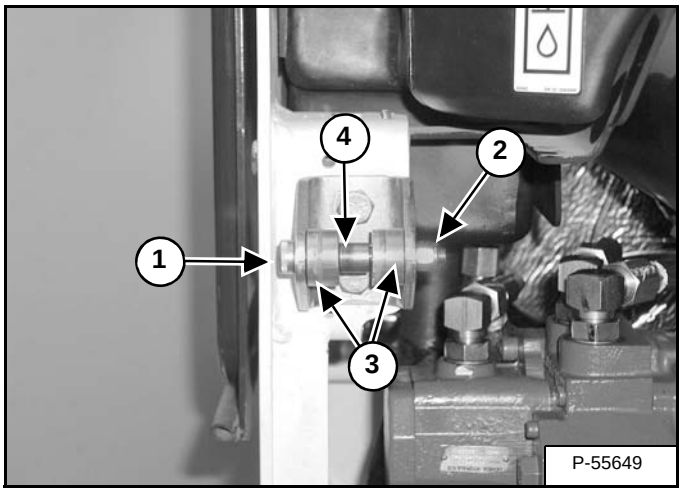
Installation: Tighten the bolt to 25 - 28 ft.-lb. (34 - 38 N•m) torque.

Remove the tailgate.

TAILGATE (CONT'D)

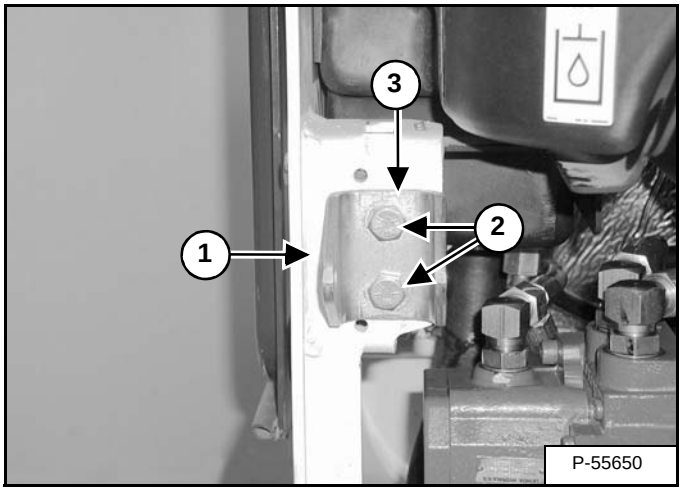
Latch Removal And Installation

Figure 40-180-5



Remove the bolt (Item 1), locknut (Item 2), outer rollers (Item 3) and inner roller (Item 4) **[Figure 40-180-5]**.

Figure 40-180-6

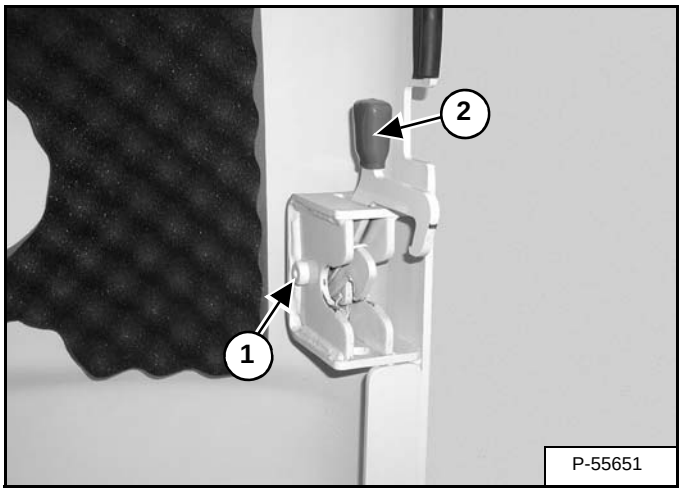


For ease of assembly, mark around the outside edge (Item 1) **[Figure 40-180-6]** of the latch bracket.

Remove the bolts (Item 2), latch bracket and washers (Item 3) **[Figure 40-180-6]**.

See latch adjustment. (See Adjusting The Latch on Page 10-40-1.)

Figure 40-180-7



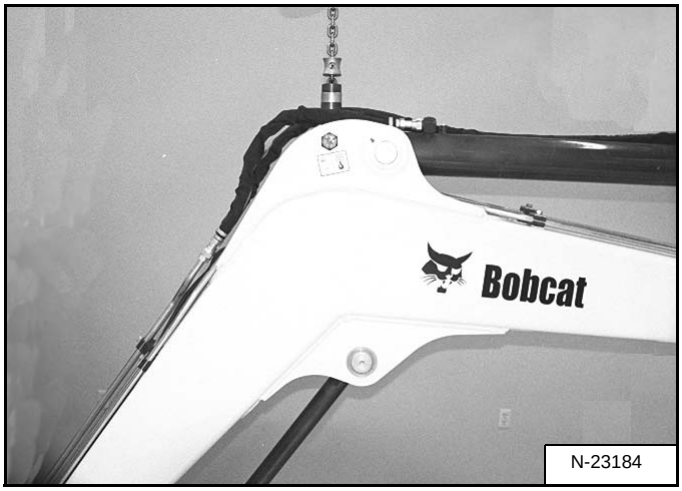
Remove the bolt (Item 1). Remove the latch assembly (Item 2) **[Figure 40-180-7]** from the tailgate.

X-CHANGE

Removal And Installation

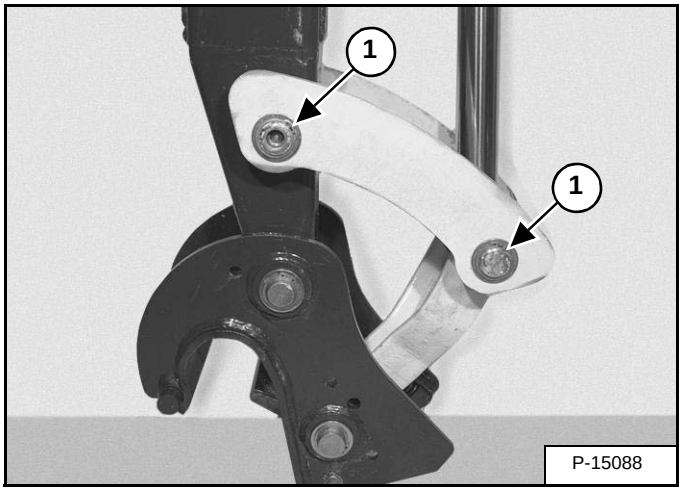
Remove the bucket. See the Operation And Maintenance Manual for the correct removal procedure. (See the Operation And Maintenance Manual.)

Figure 40-190-1



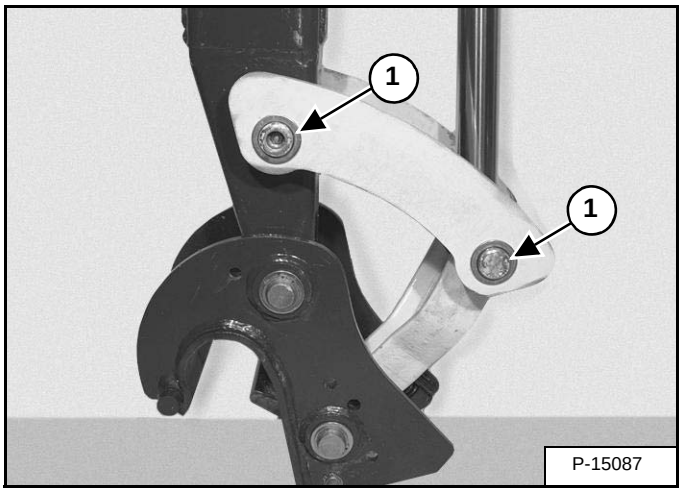
Support the boom with a hoist **[Figure 40-190-1]**.

Figure 40-190-2



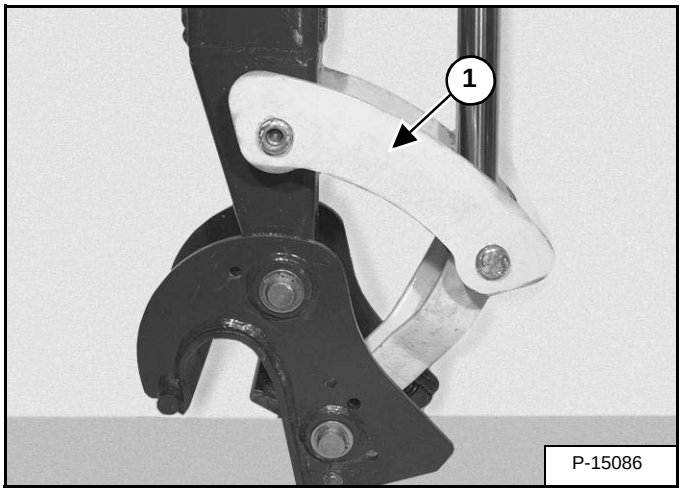
Remove the snap rings (Item 1) **[Figure 40-190-2]**.

Figure 40-190-3



Remove the washers (Item 1) **[Figure 40-190-3]**.

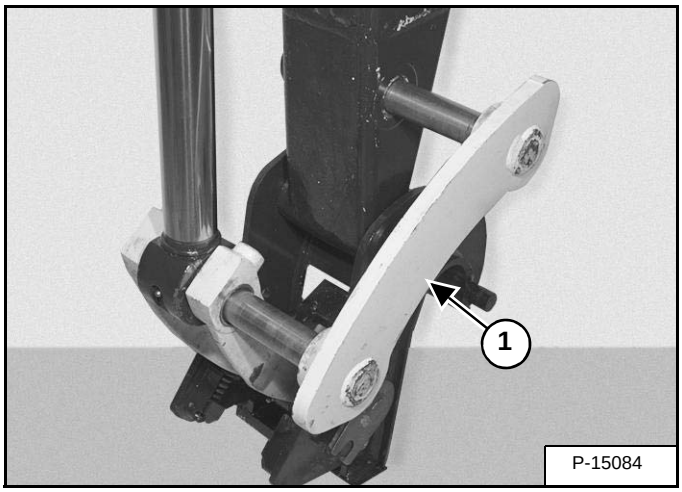
Figure 40-190-4



Remove the plate (Item 1) **[Figure 40-190-4]**.

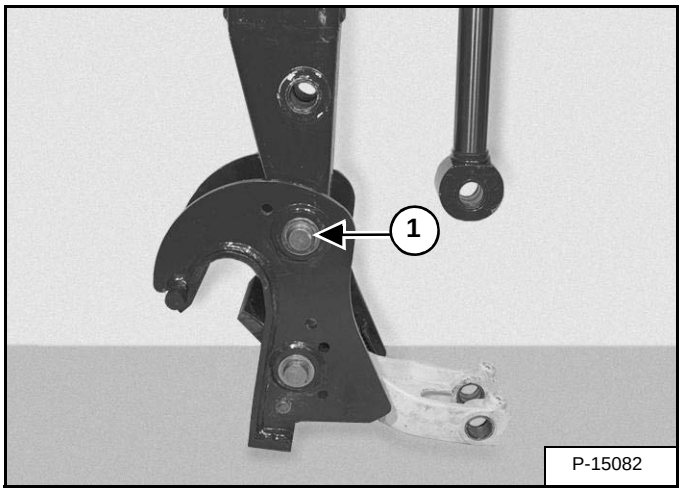
Removal And Installation (Cont'd)

Figure 40-190-5



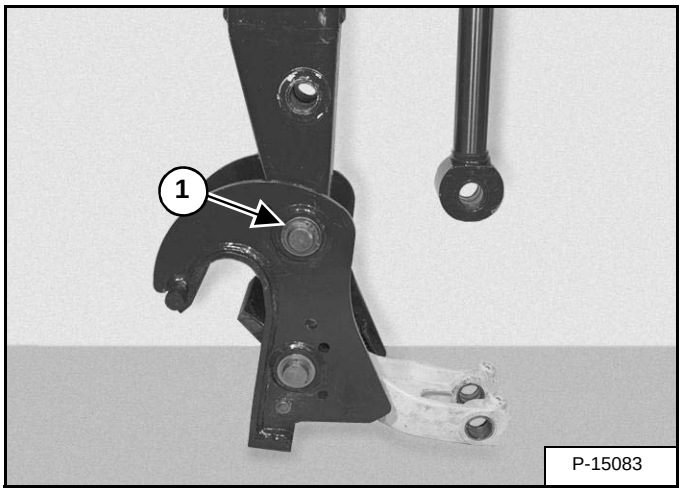
Remove the link (Item 1) **[Figure 40-190-5]**.

Figure 40-190-6



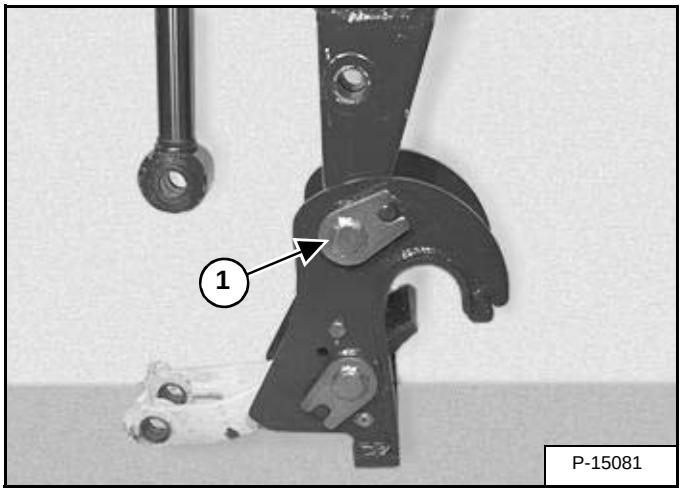
Remove the snap ring (Item 1) **[Figure 40-190-6]**.

Figure 40-190-7



Remove the washer (Item 1) **[Figure 40-190-7]**.

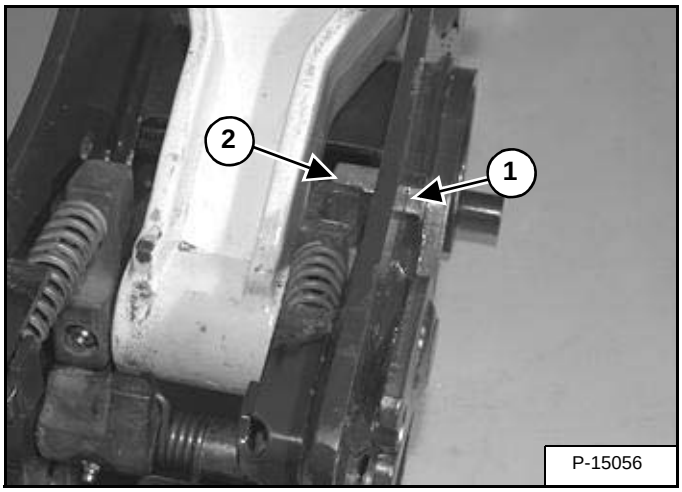
Figure 40-190-8



Remove the pin (Item 1) **[Figure 40-190-8]** and remove the X-Change from the arm.

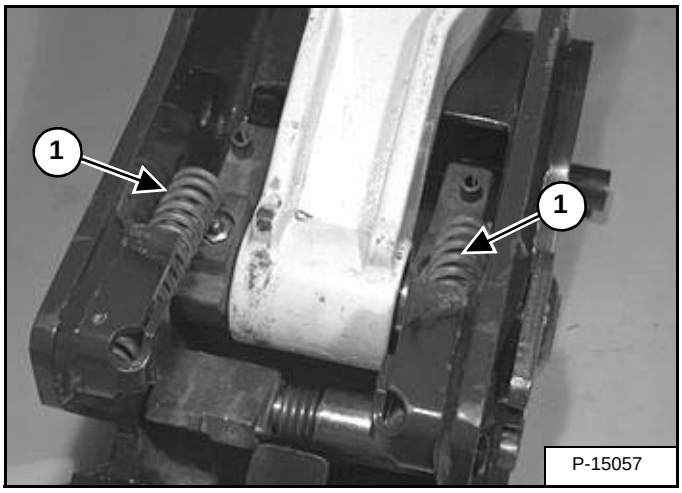
Disassembly

Figure 40-190-9



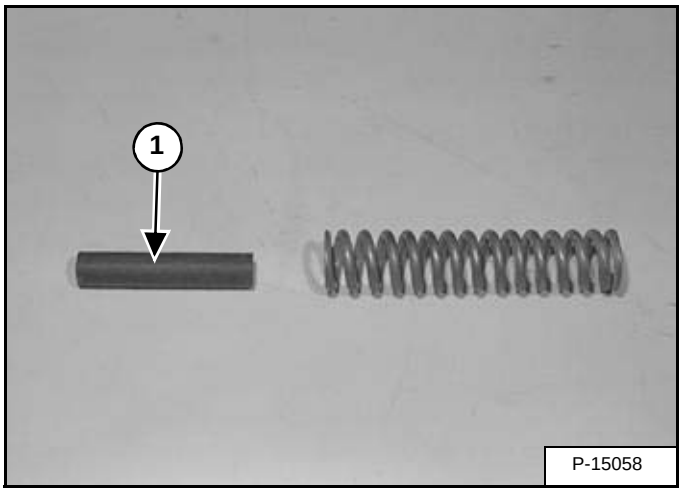
Remove the bolt (Item 1) and nut (Item 2) **[Figure 40-190-9]**.

Figure 40-190-10



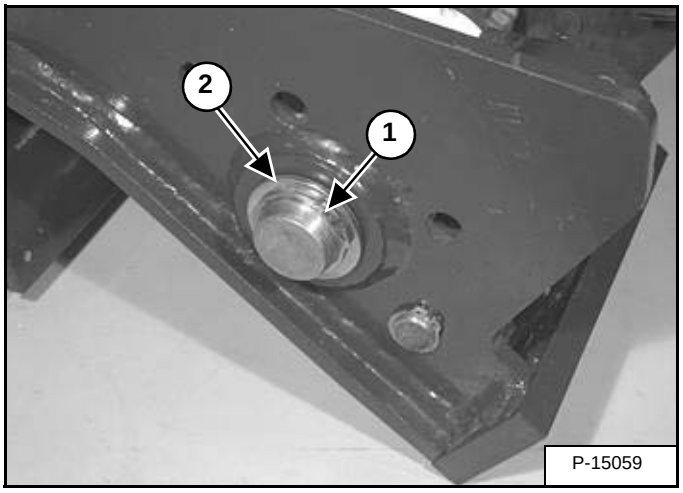
Remove the springs (Item 1) **[Figure 40-190-10]**.

Figure 40-190-11



Remove the rubber hose (Item 1) **[Figure 40-190-11]**.

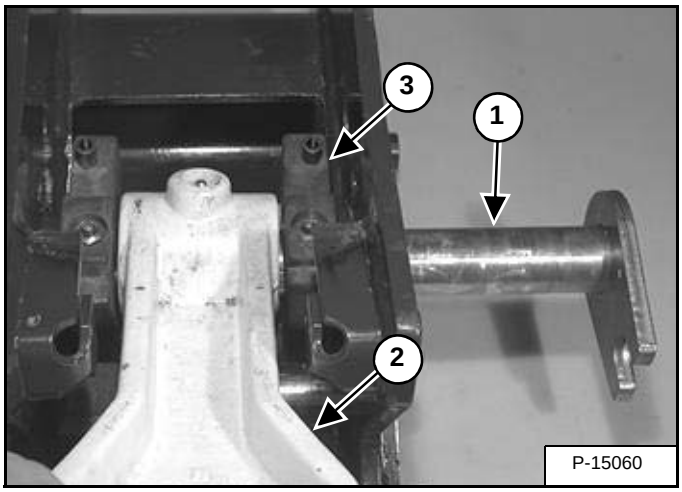
Figure 40-190-12



Remove the snap ring (Item 1) and washer (Item 2) **[Figure 40-190-12]**.

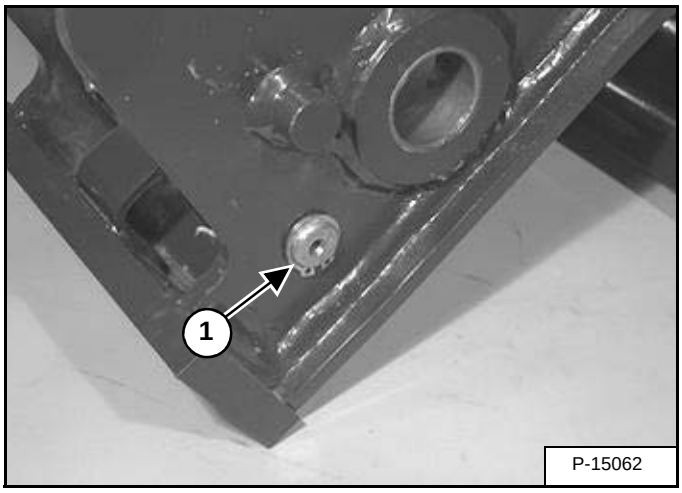
Disassembly (Cont'd)

Figure 40-190-13



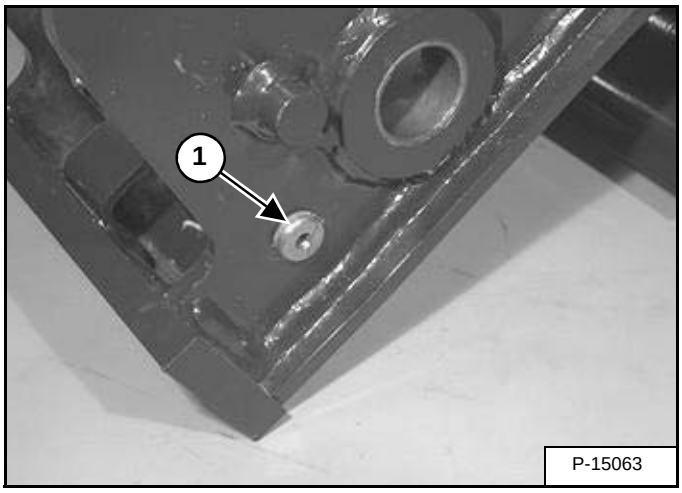
Remove the pin (Item 1), link (Item 2) and latch (Item 3) **[Figure 40-190-13]**.

Figure 40-190-14



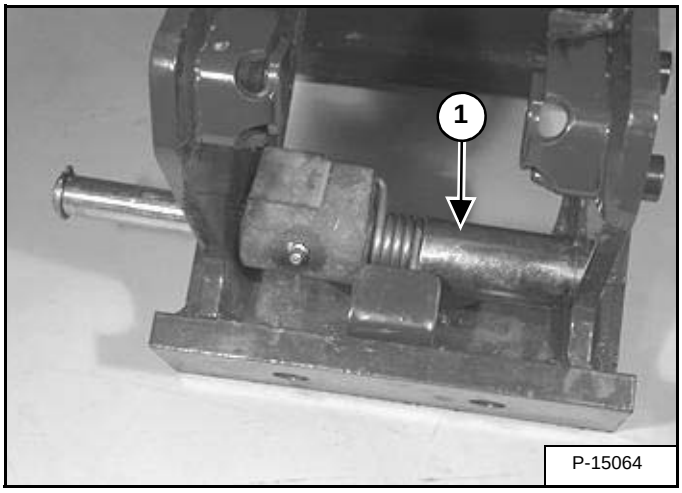
Remove the snap ring (Item 1) **[Figure 40-190-14]**.

Figure 40-190-15



Partially remove the pin (Item 1) **[Figure 40-190-15]**.

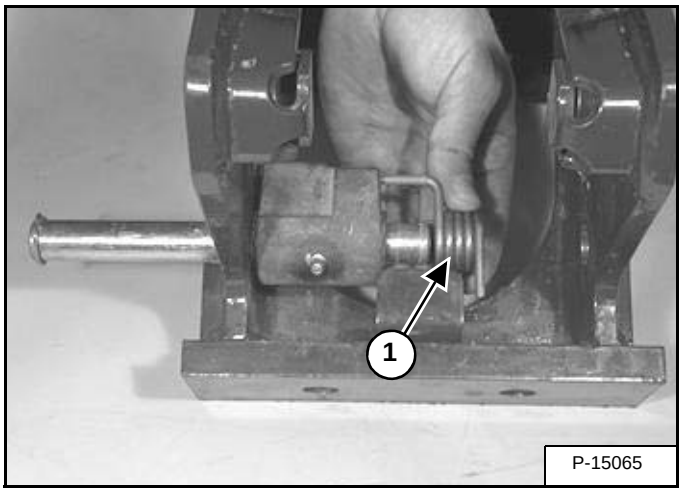
Figure 40-190-16



Remove the pin far enough to remove the spacer (Item 1) **[Figure 40-190-16]**.

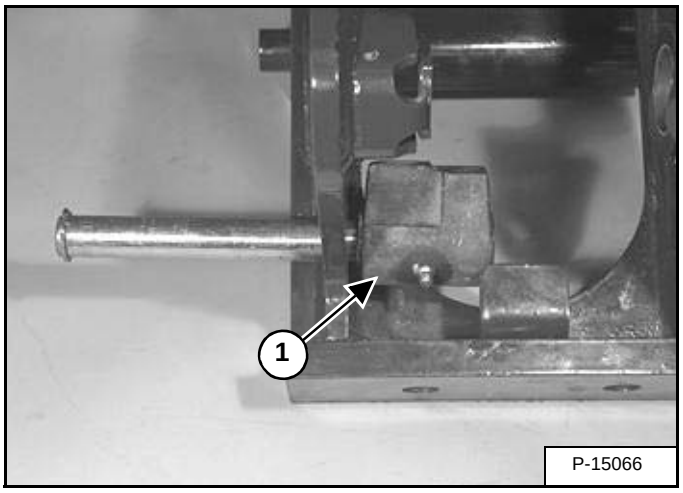
Disassembly (Cont'd)

Figure 40-190-17



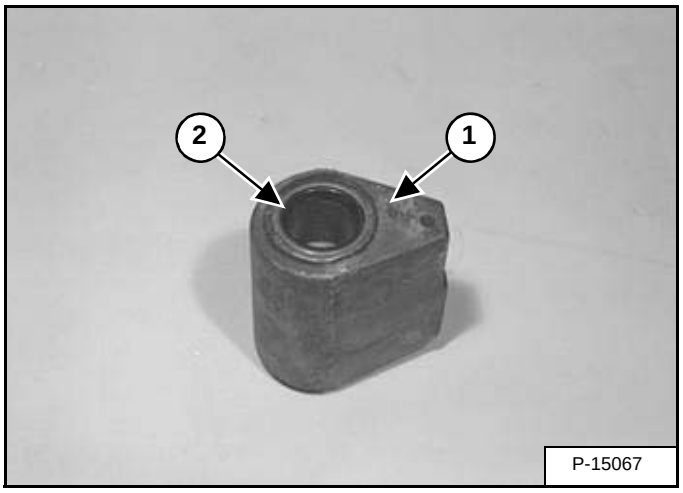
Remove the spring (Item 1) **[Figure 40-190-17]**.

Figure 40-190-18



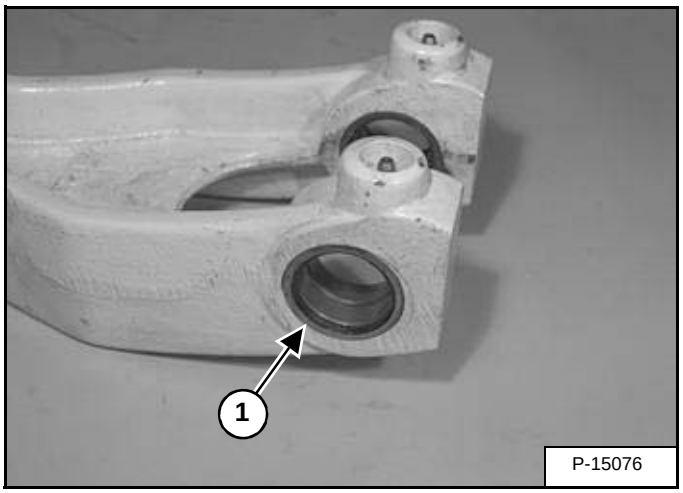
Completely remove the pin and remove the catch (Item 1) **[Figure 40-190-18]**.

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.

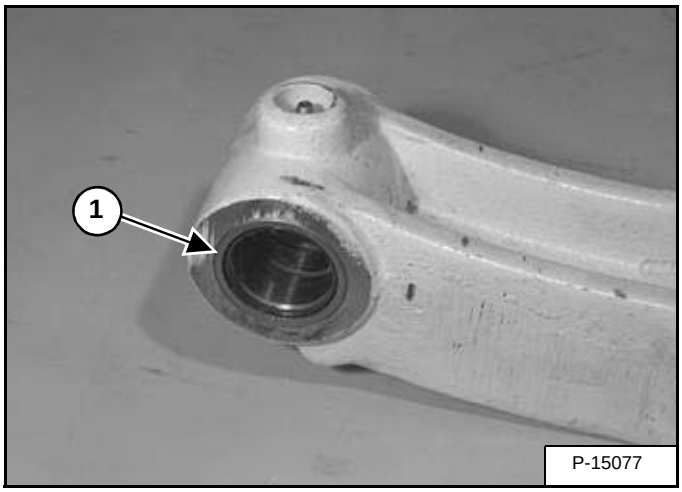
Figure 40-190-20



Remove the four seals (2 per side) (Item 1) **[Figure 40-190-20]** from the top pivot point of the link.

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

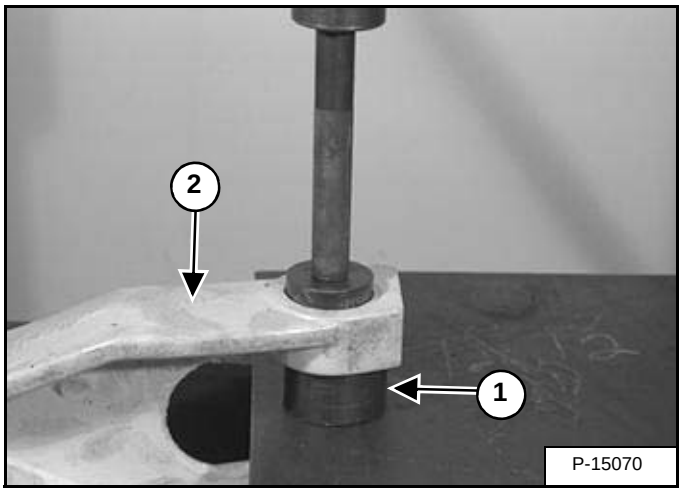
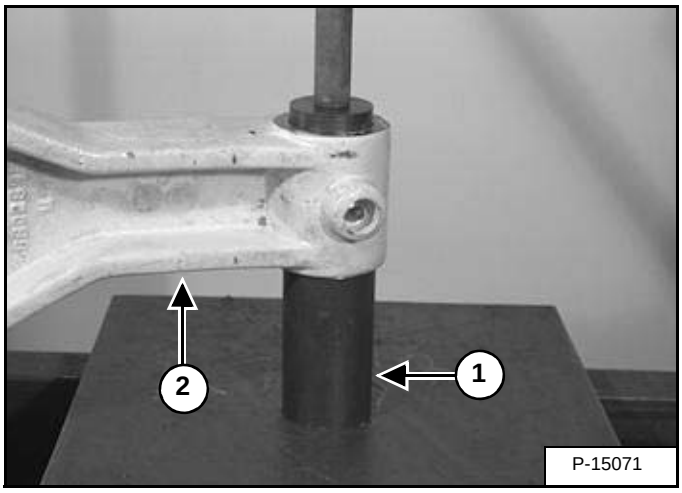


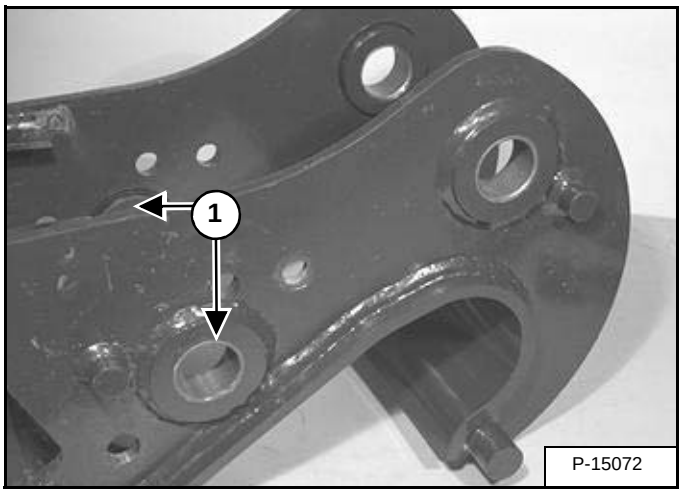
Figure 40-190-23



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.

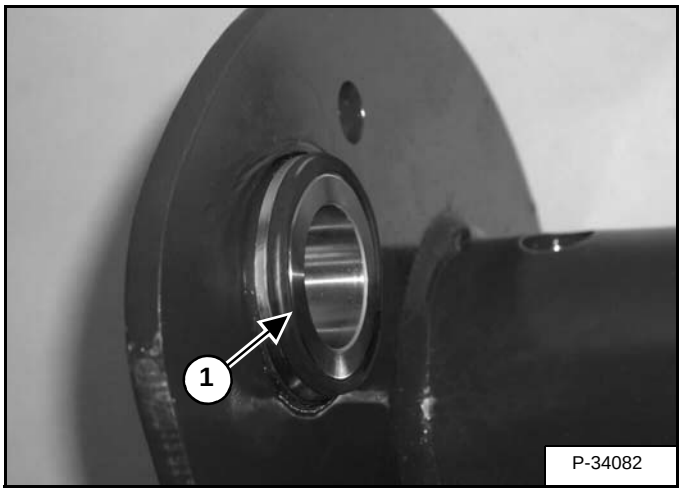
Figure 40-190-24



Remove the two bushings (Item 1) **[Figure 40-190-24]** from the X-Change frame.

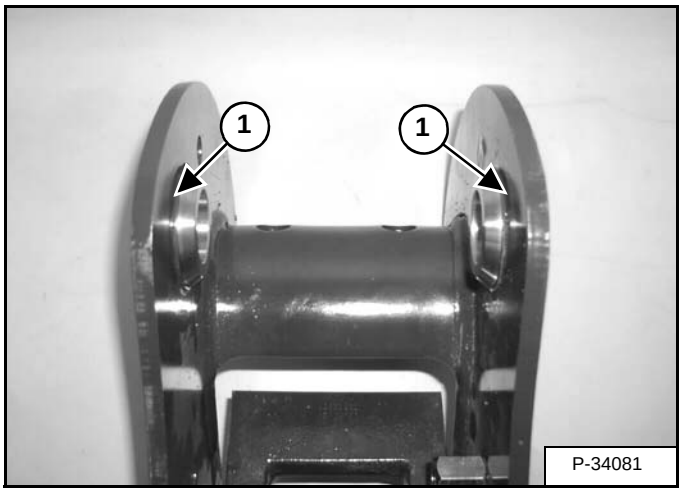
Disassembly (Cont'd)

Figure 40-190-25



Remove the O-ring (Item 1) **[Figure 40-190-25]** (both sides).

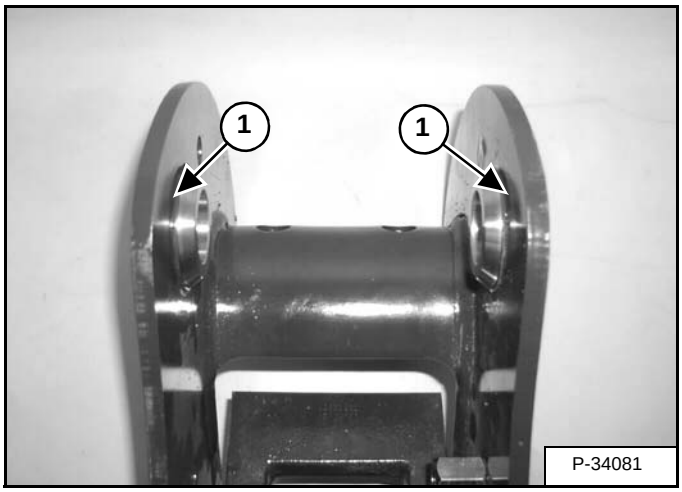
Figure 40-190-26



Remove the bushings (Item 1) **[Figure 40-190-26]**.

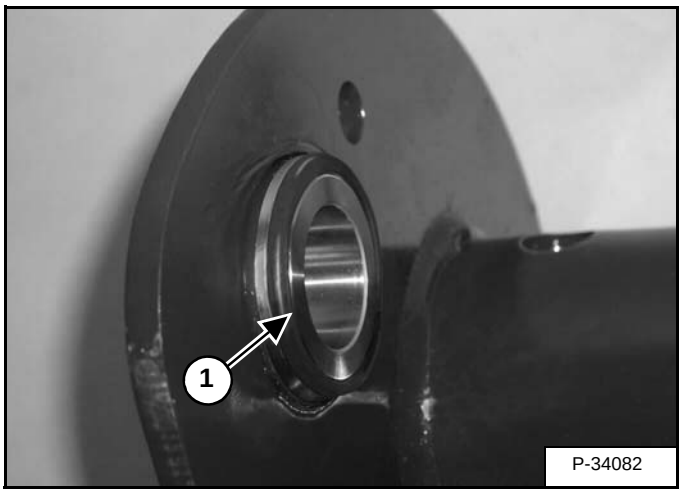
Assembly

Figure 40-190-27



Install the bushings (Item 1) **[Figure 40-190-27]**.

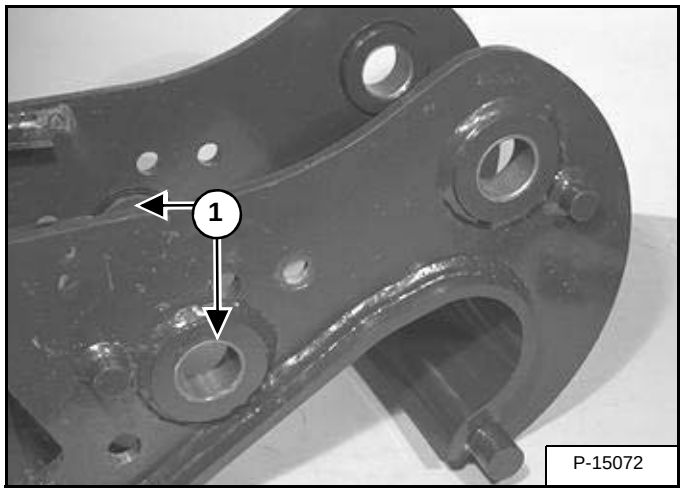
Figure 40-190-28



Install the O-ring (Item 1) **[Figure 40-190-28]** (both sides). Use grease to hold the O-rings in place.

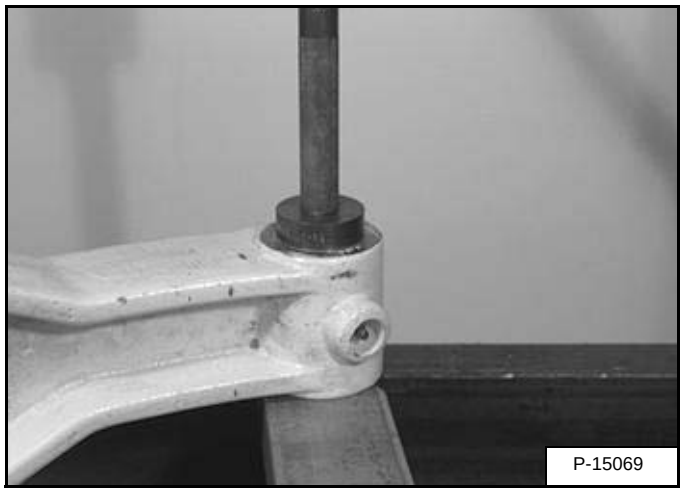
Assembly (Cont'd)

Figure 40-190-29



Install the two bushings (Item 1) **[Figure 40-190-29]** and apply grease to all four bushings.

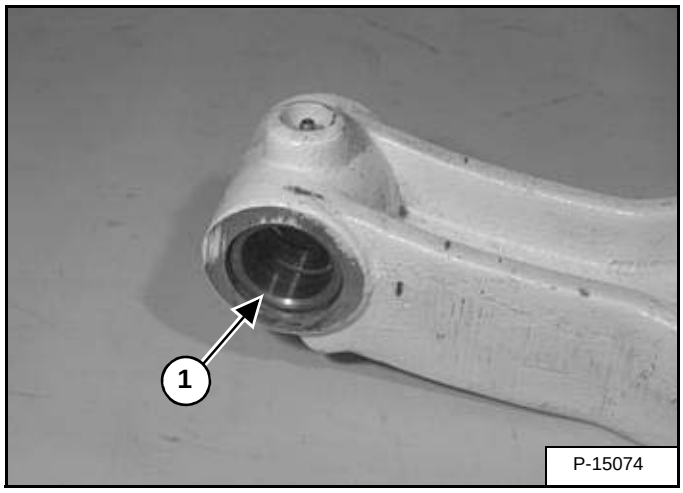
Figure 40-190-30



Install the bushings in both sides of the link **[Figure 40-190-30]**.

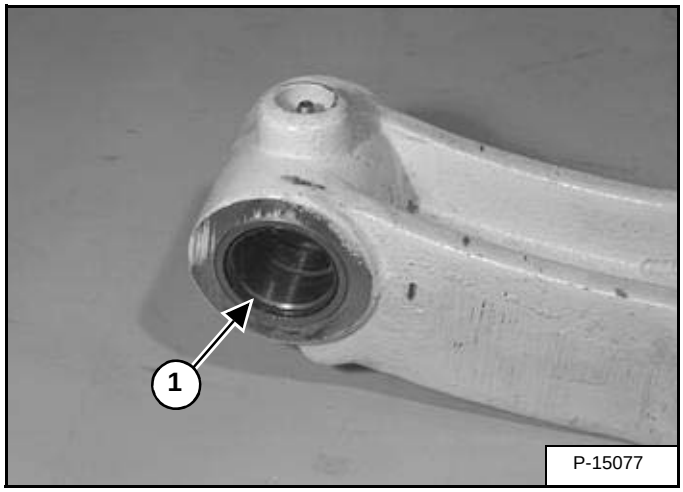
NOTE: Properly support the cast link to prevent damage when installing or removing the bushings.

Figure 40-190-31



Press the bushings (Item 1) **[Figure 40-190-31]** in until the seal will fit flush in the link.

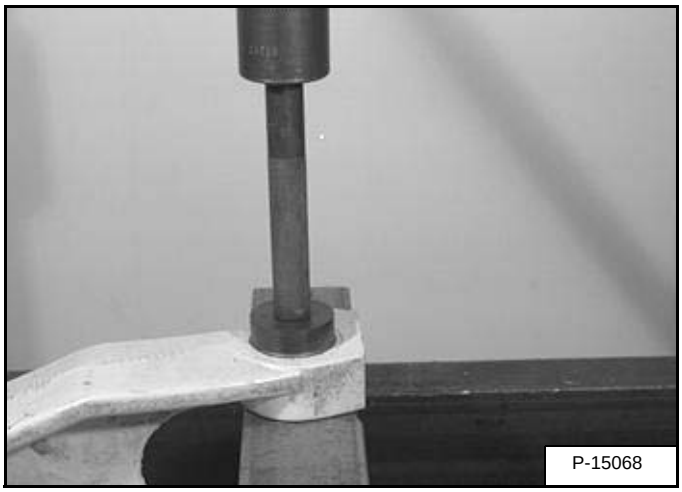
Figure 40-190-32



Install the seal (Item 1) **[Figure 40-190-32]** (both sides.)

Assembly (Cont'd)

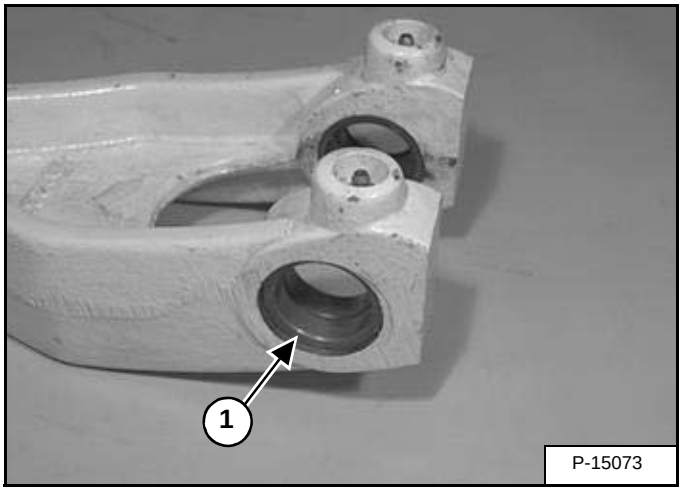
Figure 40-190-33



Install the bushings in both sides of the link **[Figure 40-190-33]**.

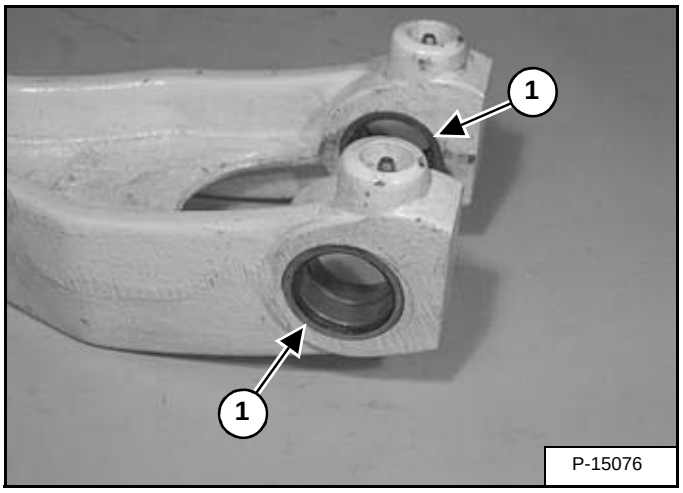
NOTE: Properly support the cast link to prevent damage when installing or removing the bushings.

Figure 40-190-34



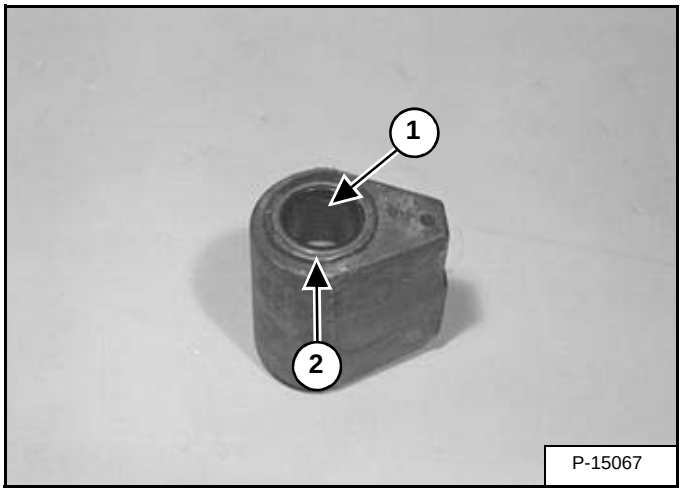
Press the bushings (Item 1) **[Figure 40-190-34]** in until the seal will fit flush.

Figure 40-190-35



Install the four seals (Item 1) **[Figure 40-190-35]** (one per side).

Figure 40-190-36

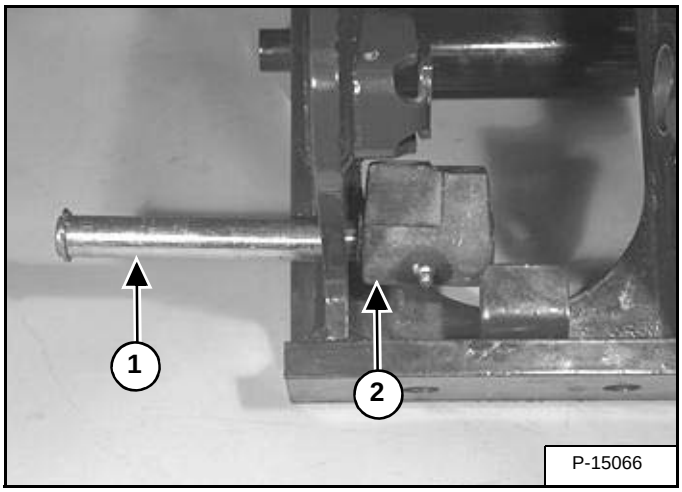


Install the bushings (Item 1) **[Figure 40-190-36]** in the catch.

Install the seal (Item 2) **[Figure 40-190-36]** on both sides of the catch.

Assembly (Cont'd)

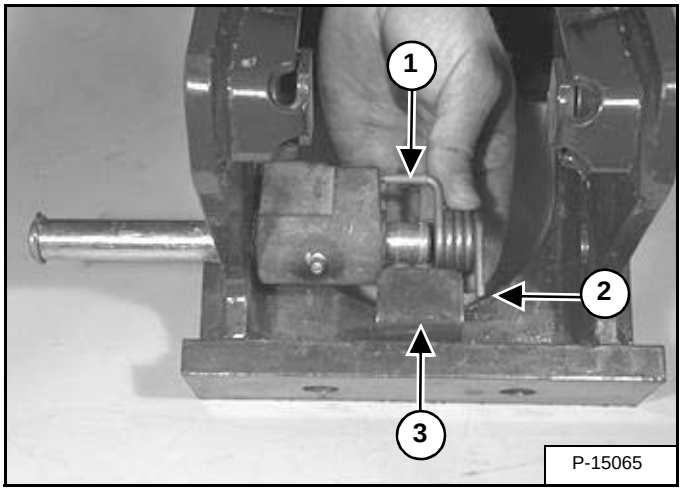
Figure 40-190-37



Partially install the pin (Item 1) **[Figure 40-190-37]**.

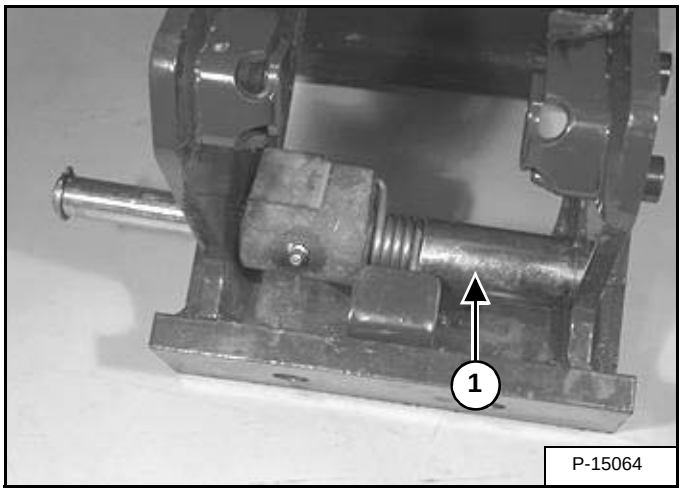
Install the catch (Item 2) **[Figure 40-190-37]** on the pin.

Figure 40-190-38



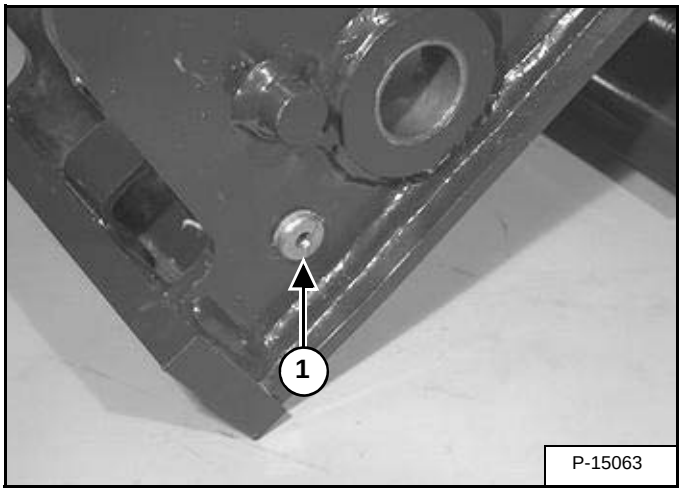
Install the spring on the pin, with the angled end of the spring (Item 1) engaging the hole in the catch. Put the straight end of the spring (Item 2) under the spring retainer (Item 3) **[Figure 40-190-38]**.

Figure 40-190-39



Install the spacer (Item 1) **[Figure 40-190-39]**.

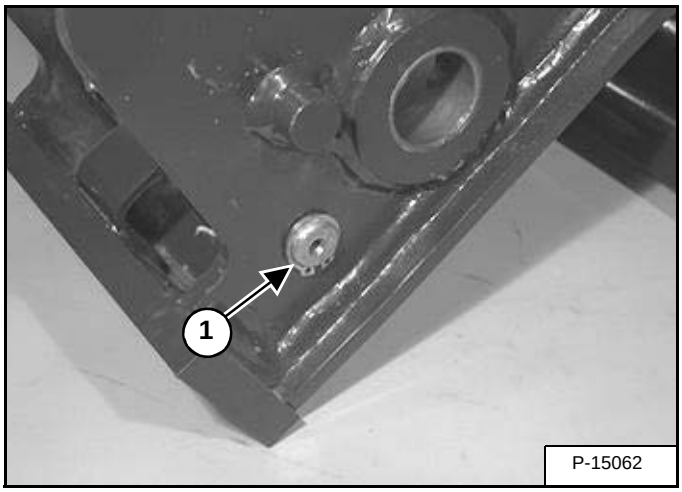
Figure 40-190-40



Completely install the pin (Item 1) **[Figure 40-190-40]**.

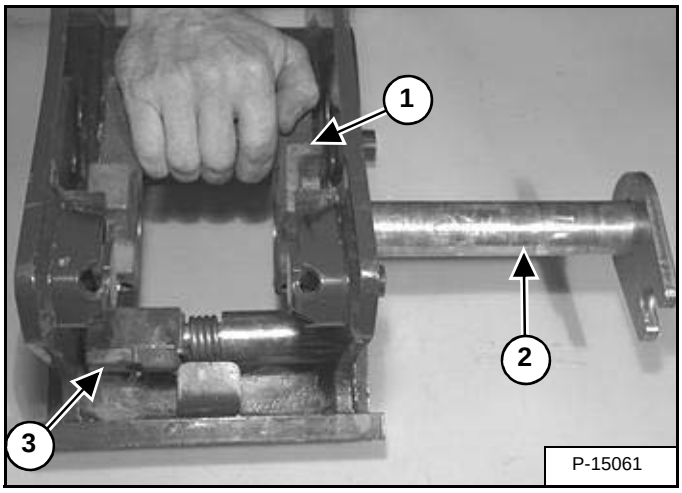
Assembly (Cont'd)

Figure 40-190-41



Install the snap ring (Item 1) **[Figure 40-190-41]**.

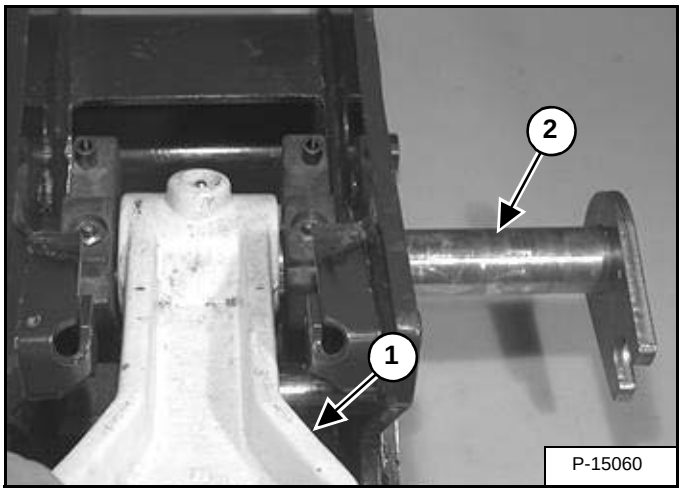
Figure 40-190-42



Align the latch (Item 1) and partially install the pin (Item 2) **[Figure 40-190-42]**.

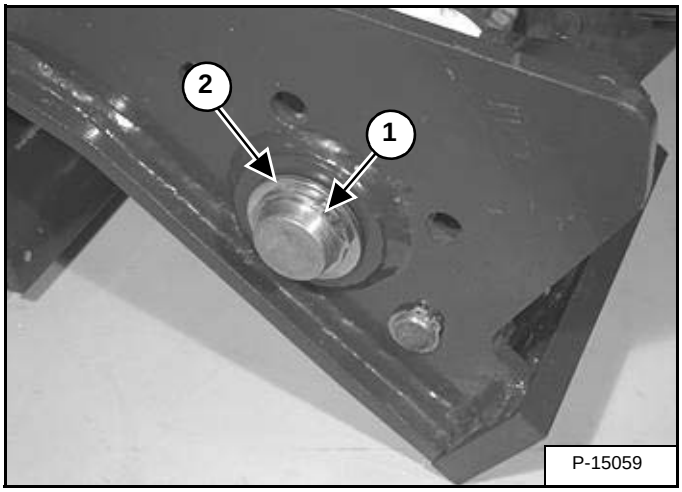
Rotate the catch toward the latch so the end of the catch (Item 3) **[Figure 40-190-42]** is under the latch.

Figure 40-190-43



Install the link (Item 1) and completely install the pin (Item 2) **[Figure 40-190-43]**.

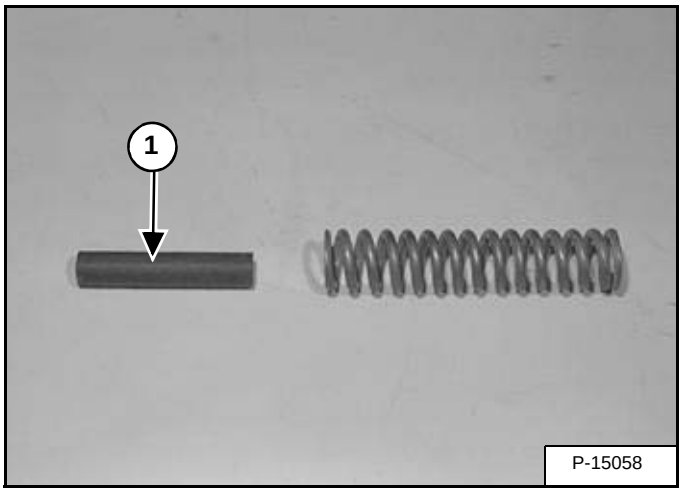
Figure 40-190-44



Install the washer (Item 1) and snap ring (Item 2) **[Figure 40-190-44]**.

Assembly (Cont'd)

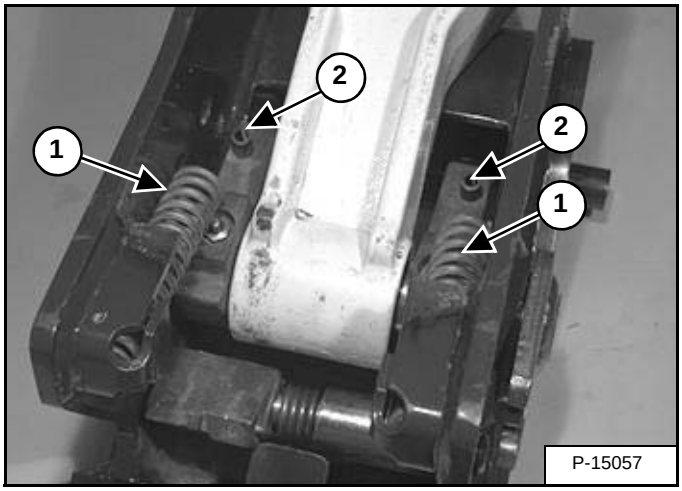
Figure 40-190-45



Install the hose (Item 1) **[Figure 40-190-45]** in the spring.

NOTE: The hose helps prevent the spring from being filled with dirt or mud. When replacing the hose, cut to a length of 2.750 - 3.0 in. (108 - 118 mm).

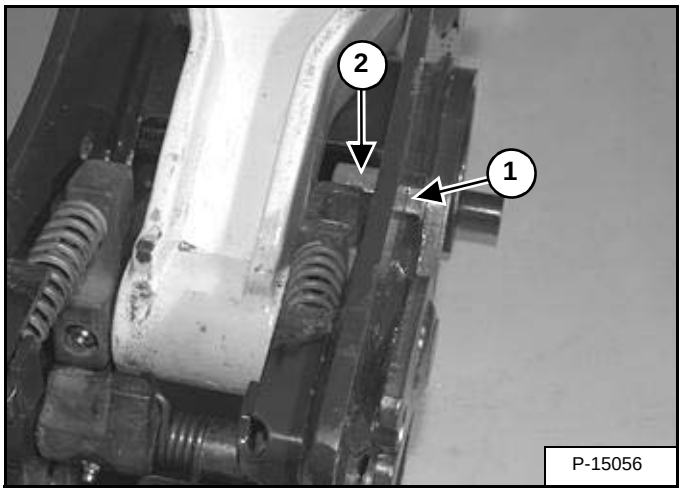
Figure 40-190-46



Install the springs (Item 1) **[Figure 40-190-46]** in the X-Change.

Pull the latch up until the springs (Item 1) seat over the roll pins (Item 2) **[Figure 40-190-46]**.

Figure 40-190-47

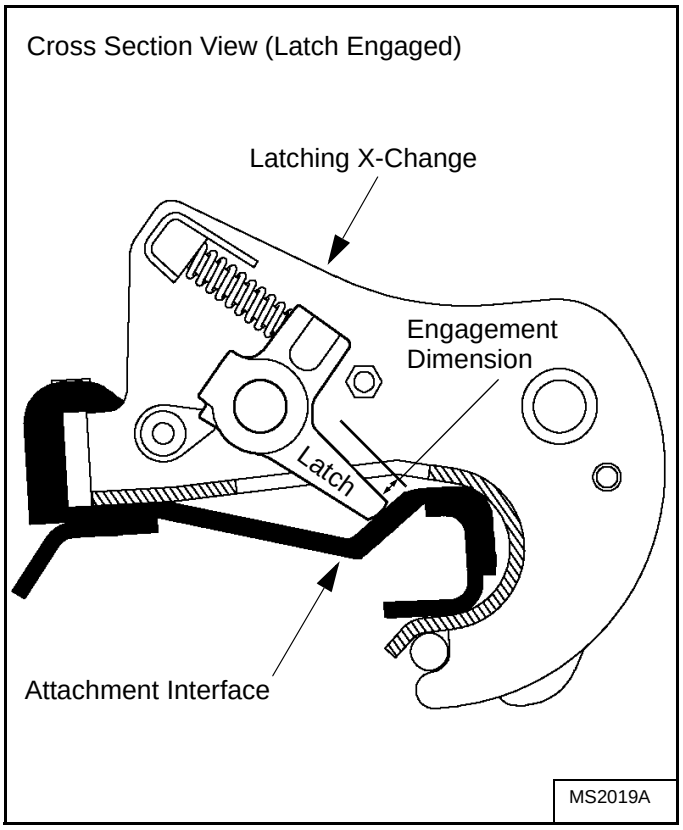


Apply thread lock adhesive (Loctite® 242) to the bolt threads and install the bolt (Item 1) and nut (Item 2) **[Figure 40-190-47]**.

Tighten the bolt to 118 - 133 ft.-lb. (160 - 180 N•m) torque.

Check Proper Latch Engagement

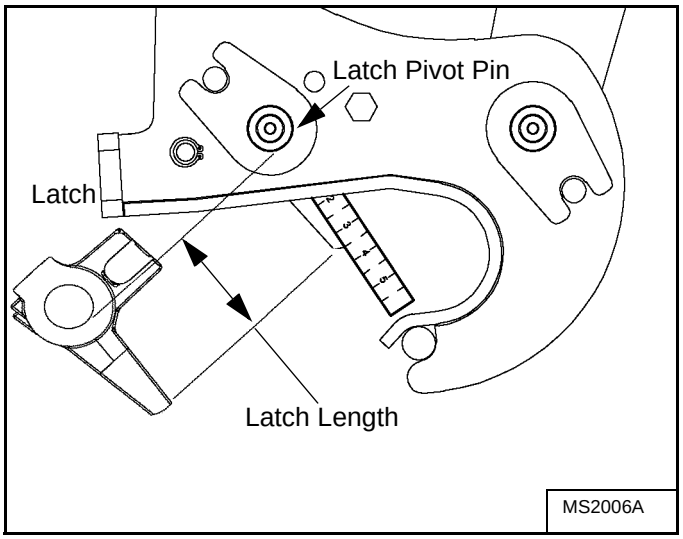
Figure 40-190-48



Maximum latch length and minimum latch engagement dimensions are provided. ***Latch length must be checked before checking latch engagement*** **[Figure 40-190-48]**.

Before making any measurements, clean the excavator X-Change and the attachment interface. Inspect both components to be certain they are free of debris and are not damaged.

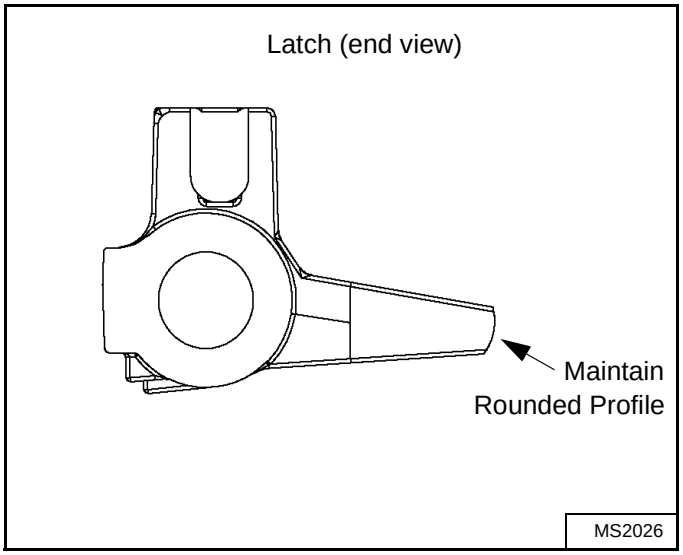
Figure 40-190-49



Measure the installed latch length. Measure from the edge of the latch pivot pin to the end of the latch. ***The latch does not need to be removed to measure. Maximum latch length is 3.52 in. (89,4 mm)*** **[Figure 40-190-49]**.

If the latch length is greater than maximum, it should be replaced or the end can be ground to achieve maximum latch length.

Figure 40-190-50



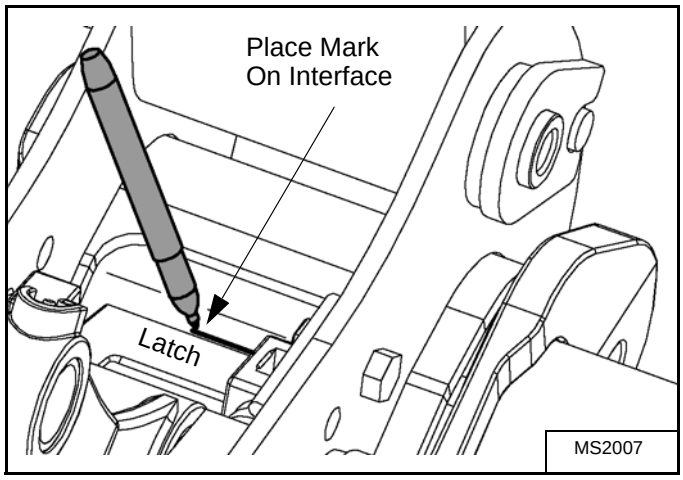
If you grind the latch, maintain the rounded profile of the end **[Figure 40-190-50]**.

After verifying the latch length, check the attachment interface.

Install the attachment.

Check Proper Latch Engagement (Cont'd)

Figure 40-190-51

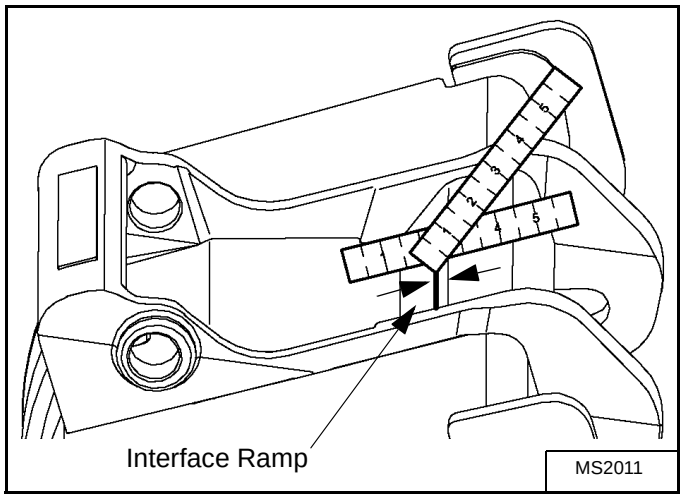


With the attachment installed on the machine and lowered to the ground, place a mark on the interface just above the latch **[Figure 40-190-51]**.

Note: The mark should reflect the line of sight across the top edge of the latch. It is not intended to reflect the actual contact point of the latch and interface.

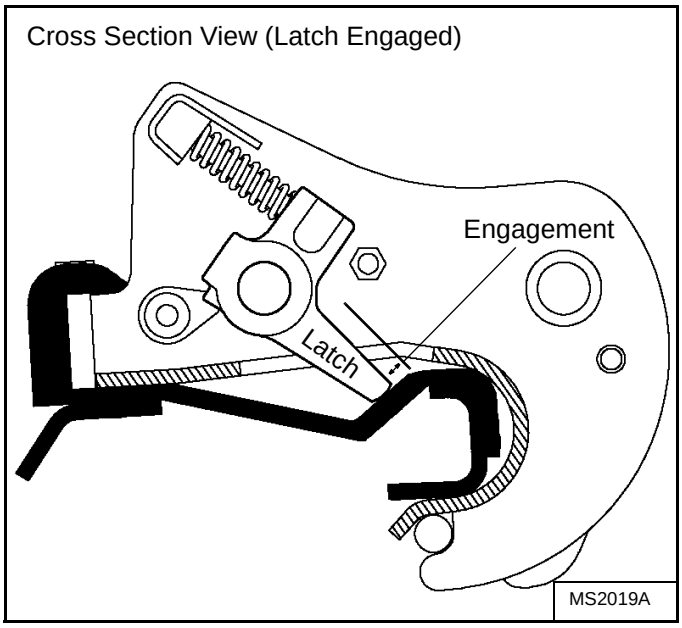
Remove the attachment.

Figure 40-190-52



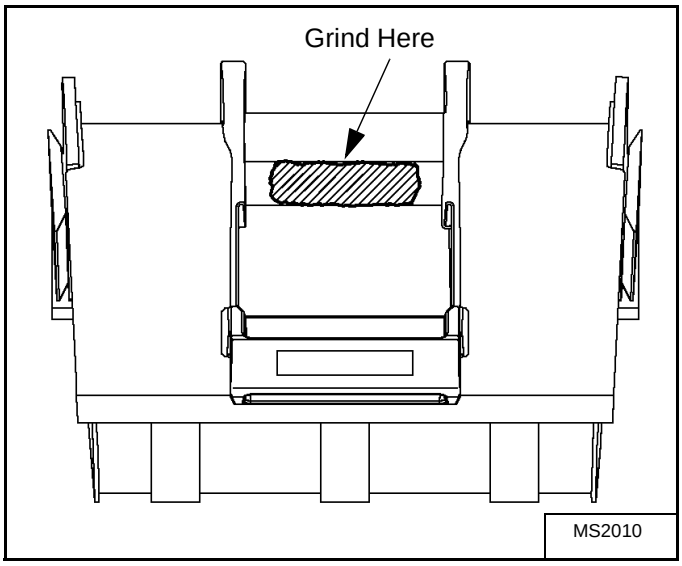
Measure the latch engagement. Measure from the mark previously made to the center of the radius at the top of the interface ramp. Two rulers are required. **Minimum latch engagement is 0.50 in. (12,7 mm) [Figure 40-190-52]**.

Figure 40-190-53



If latch engagement is less than 0.50 in. (12,7 mm), remove material from the ramp of the interface **[Figure 40-190-52]** & **[Figure 40-190-53]**.

Figure 40-190-54



Using a grinder, remove material from the interface ramp in the area shown. ***The grind area must be wider than the latch, but does not need to extend all the way to the sides of the interface.*** Maintain the original profile and flatness of the ramp. Remove between 0.06 - 0.12 in. (1,5 - 3,0 mm) of material **[Figure 40-190-54]**.

Install the attachment on the machine, mark the interface **[Figure 40-190-51]** and measure the new latch engagement **[Figure 40-190-52]**.

Check Proper Latch Engagement (Cont'd)

⚠ WARNING

AVOID INJURY OR DEATH

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

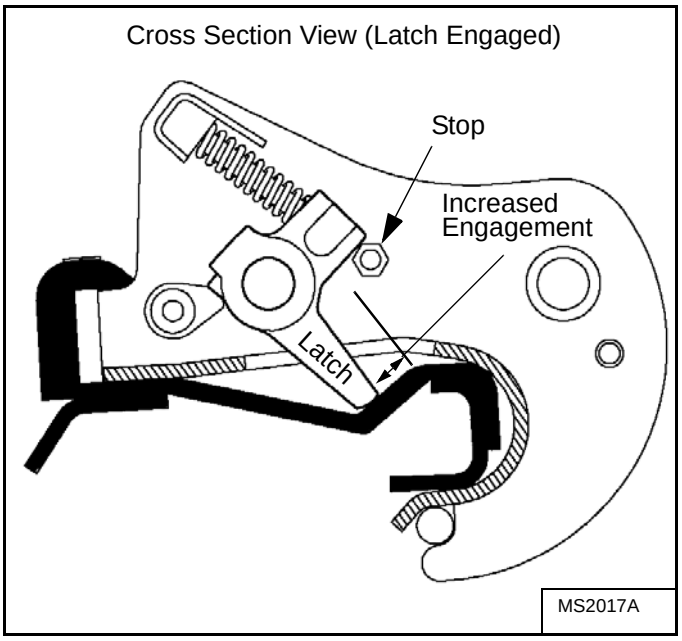
- **When fluids are under pressure.**
- **Flying debris or loose material is present.**
- **Engine is running.**
- **Tools are being used.**

W-2019-0907

If latch engagement is less than 0.50 in. (12,7 mm), remove more material from the ramp of the interface.

Install the attachment on the machine, mark the interface and measure the new latch engagement again to verify latch engagement is 0.50 in. (12,7 mm) or more.

Figure 40-190-55



The latch may wear and become shorter, increasing latch engagement. Latch wear is dependent on the type of attachment used and the application. If wear becomes excessive, the latch will rest on the stop. The attachment will remain securely installed on the machine in this position, however the attachment can exhibit rattling noise during operation because the attachment interface is shifting slightly within the X-Change. Visual inspection can detect if the latch is resting on the stop without measurement. Latch replacement is recommended when wear becomes this excessive. **[Figure 40-190-55]**.

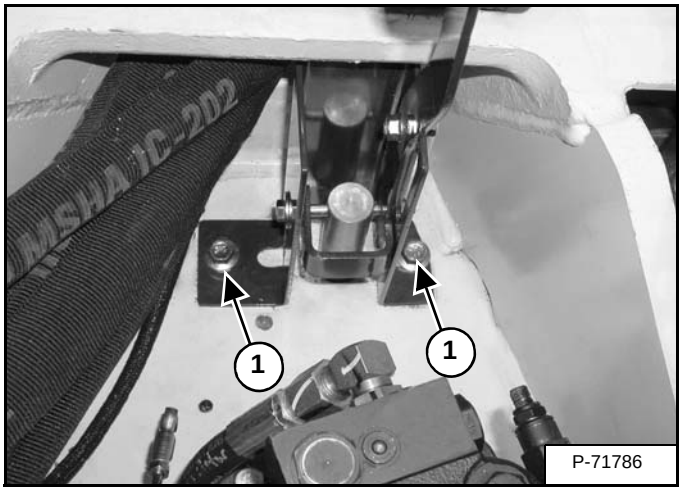

Bobcat®

UPPERSTRUCTURE SLEW LOCK

Removal And Installation

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

Figure 40-200-1

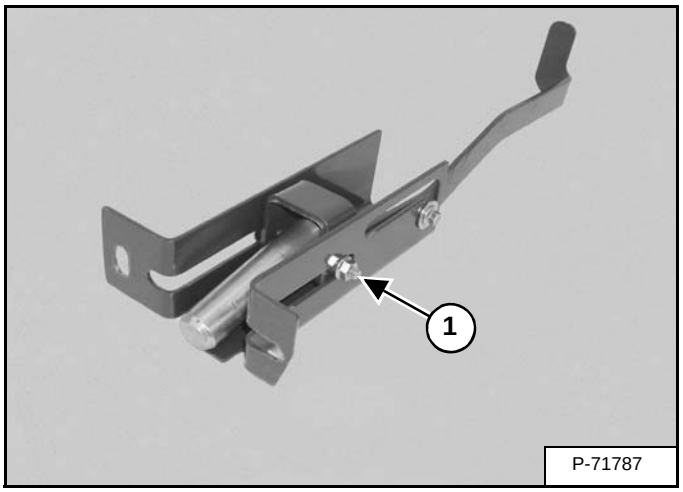


Remove the two bolts (Item 1) **[Figure 40-200-1]**.

Remove the upperstructure slew lock.

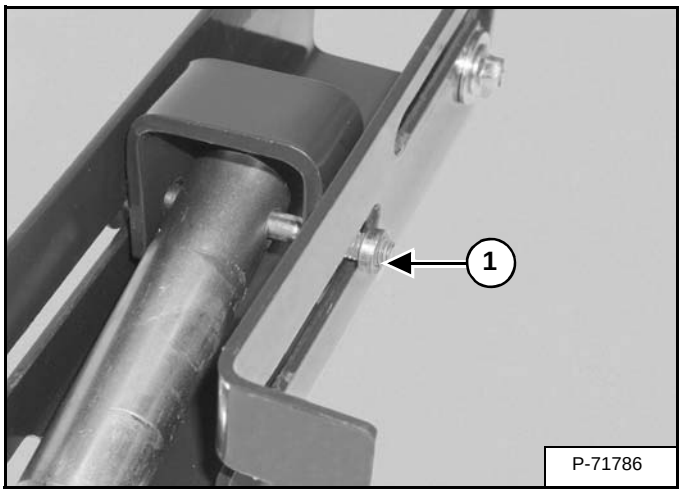
Disassembly And Assembly

Figure 40-200-2



Remove the nut (Item 1) **[Figure 40-200-2]**.

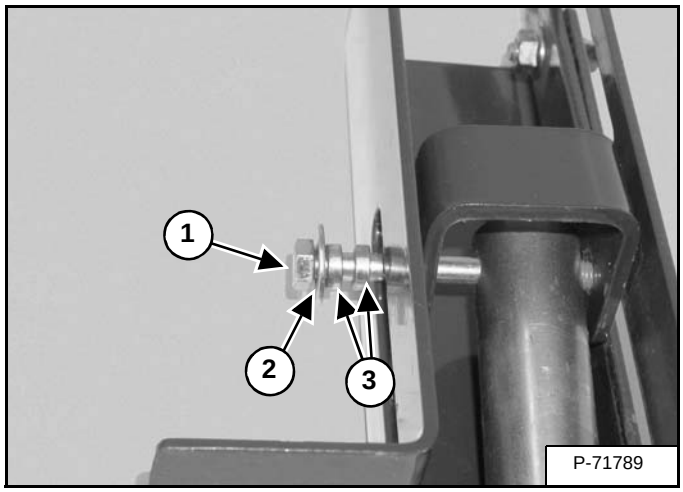
Figure 40-200-3



Remove the spacer (Item 1) **[Figure 40-200-3]**.

Disassembly And Assembly (Cont'd)

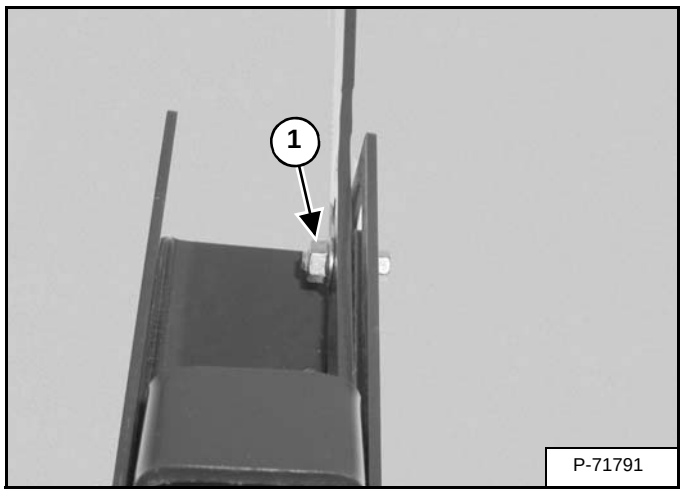
Figure 40-200-4



Remove the bolt (Item 1), washer (Item 2) and spacers (Item 3) **[Figure 40-200-4]**.

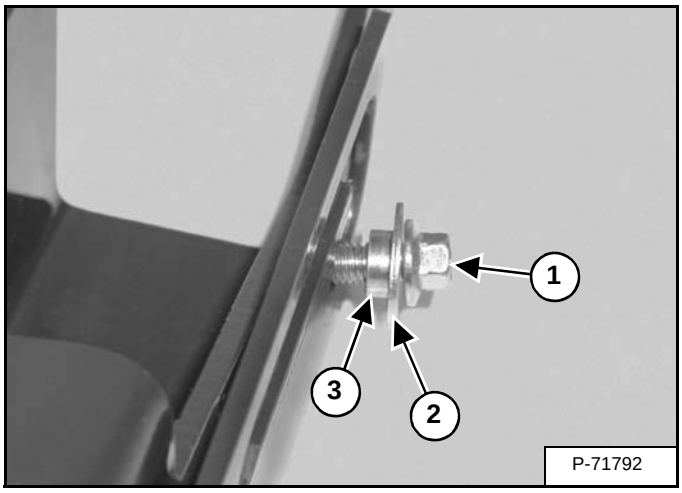
Remove the pin.

Figure 40-200-5



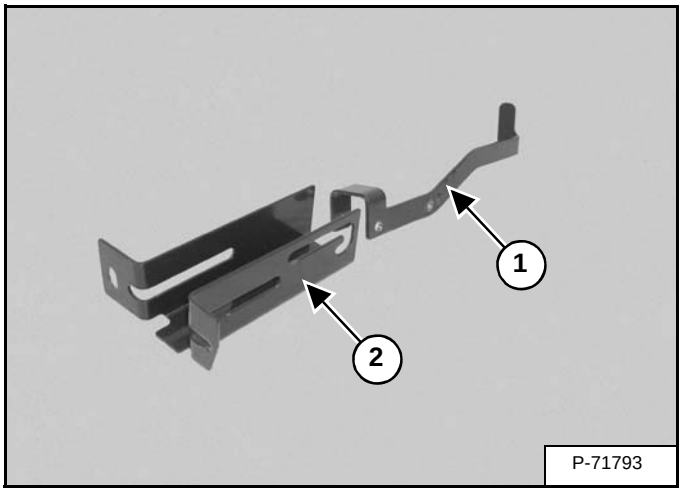
Remove the nut (Item 1) **[Figure 40-200-5]**.

Figure 40-200-6



Remove the bolt (Item 1), washer (Item 2) and spacer (Item 3) **[Figure 40-200-6]**.

Figure 40-200-7



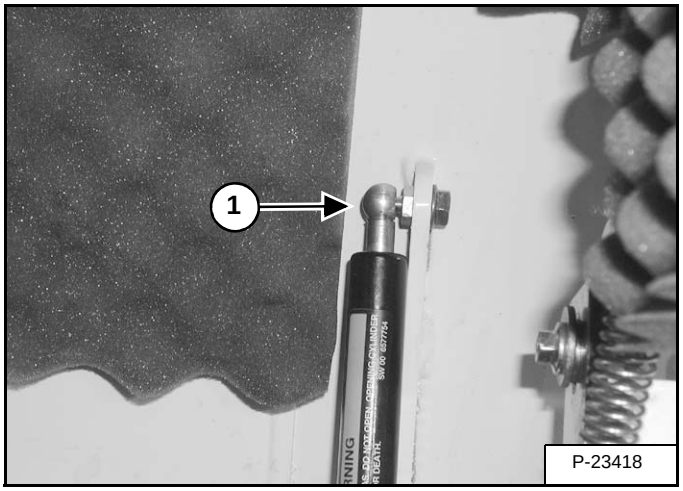
Separate the slide (Item 1) from the housing (Item 2) **[Figure 40-200-7]**

RIGHT SIDE COVER

Removal And Installation

Open the cover.

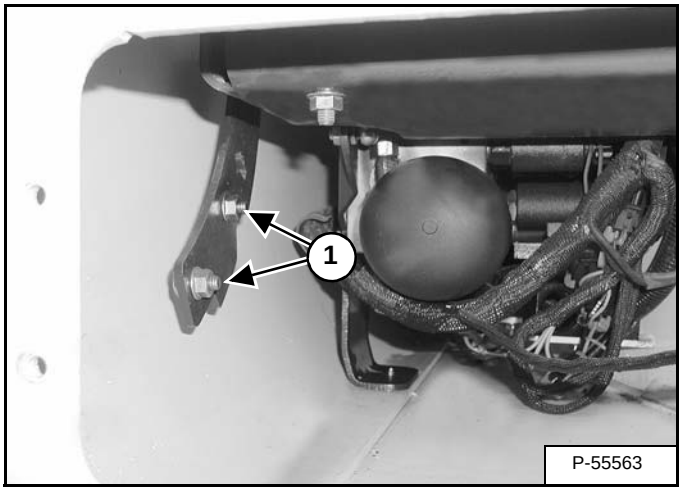
Figure 40-210-1



Remove the gas spring retaining clip (Item 1) **[Figure 40-210-1]** and disconnect the gas spring.

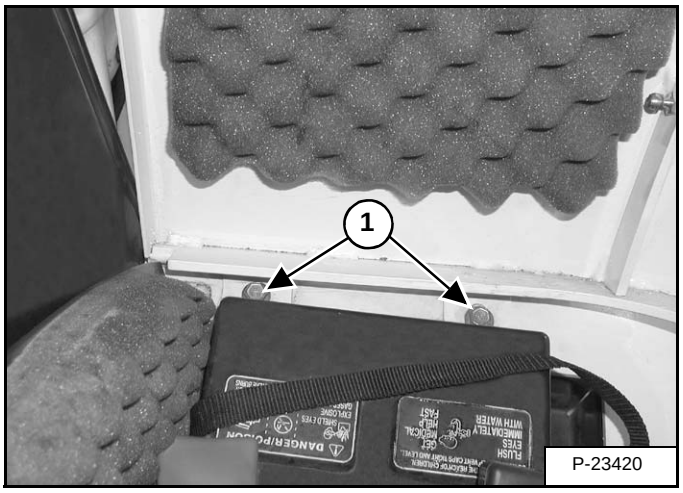
Rotate the gas spring towards the rear of the excavator.

Figure 40-210-2



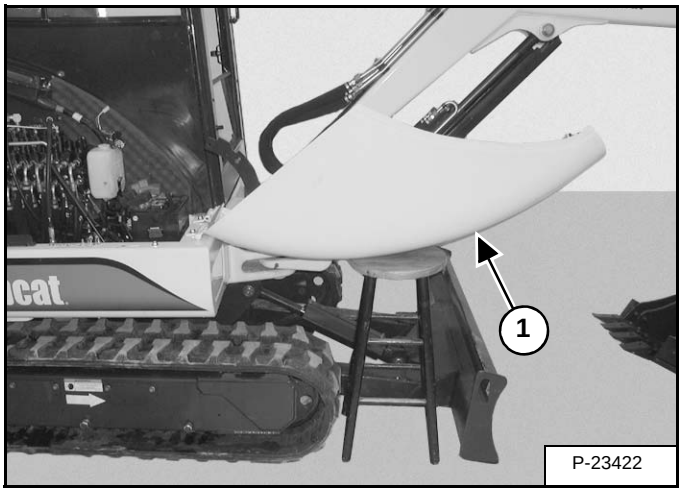
Close the cover. Remove the stop bolts and nuts (Item 1) **[Figure 40-210-2]**.

Figure 40-210-3



Open the cover. Loosen the two bolts (Item 1) **[Figure 40-210-3]** and nuts.

Figure 40-210-4

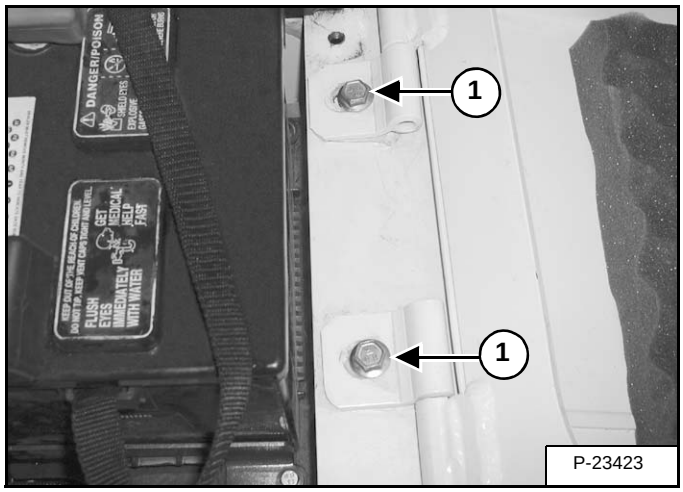


Fully open and support the cover (Item 1) **[Figure 40-210-4]**.

RIGHT SIDE COVER (CONT'D)

Removal And Installation (Cont'd)

Figure 40-210-5



Remove the two nuts and bolts (Item 1) **[Figure 40-210-5]**.

Remove the cover.

ELECTRICAL SYSTEM AND ANALYSIS

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- Servicing 50-20-1
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Continued On Next Page

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- Boom Light Removal And Installation 50-50-2
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- Removal And Installation 50-40-1

TWO SPEED SWITCH 50-60-1
- Removal And Installation 50-60-1

TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION SPEC-01) UNLESS OTHERWISE SPECIFIED.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE AND STANDARD ITEMS MAY VARY.

WIRING SCHEMATIC

325 (S/N AAC511001 AND ABOVE)
(S/N A9K011001 AND ABOVE)
328 (S/N A9K111001 AND ABOVE)

(PRINTED FEBRUARY 2008)
V-0979

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

RIGHT HAND CONSOLE HARNESS 6810761

LH CONSOLE HARNESS 7102874

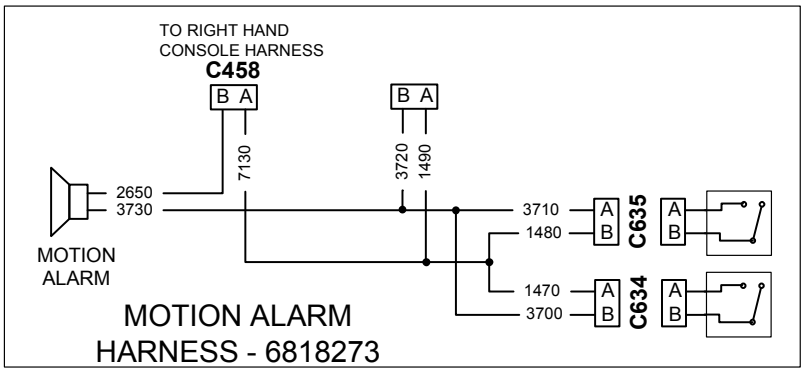
CAB HARNESS 7102834 (IF EQUIPPED)

ENGINE HARNESS 7125860

V-0979 (1-17-08)

WIRING SCHEMATIC
325 (S/N AAC5111001 AND ABOVE)
(S/N A9K0111001 AND ABOVE)
328 (S/N A9K111001 AND ABOVE)

(PRINTED FEBRUARY 2008)
V-0980



ELECTRICAL SYSTEM INFORMATION

Troubleshooting Chart

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

⚠ WARNING

AVOID INJURY OR DEATH

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

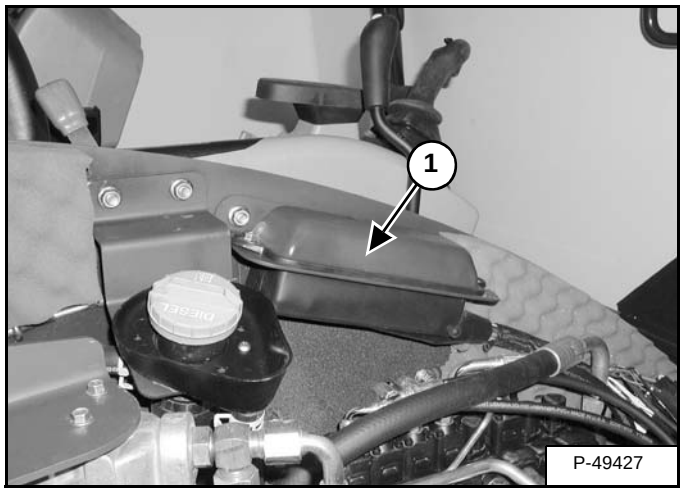
W-2003-0807

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

KEY TO CORRECT THE CAUSE
1. 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.

Description

Figure 50-10-1



The excavator has a 12 volt, negative ground electrical system. The electrical system is protected by fuses located under the right side cover of the excavator (Item 1) **[Figure 50-10-1]**. The fuses will protect the electrical system when there is an electrical overload. The reason for the overload must be found before starting the engine again.

The battery cables must be clean and tight. Check the electrolyte level in the battery. Add distilled water as needed. Remove acid or corrosion from the battery and cables with a sodium bicarbonate and water solution.

Put Battery Saver P/N 6664458 or grease on the battery terminals and cable ends to prevent corrosion.

⚠ WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

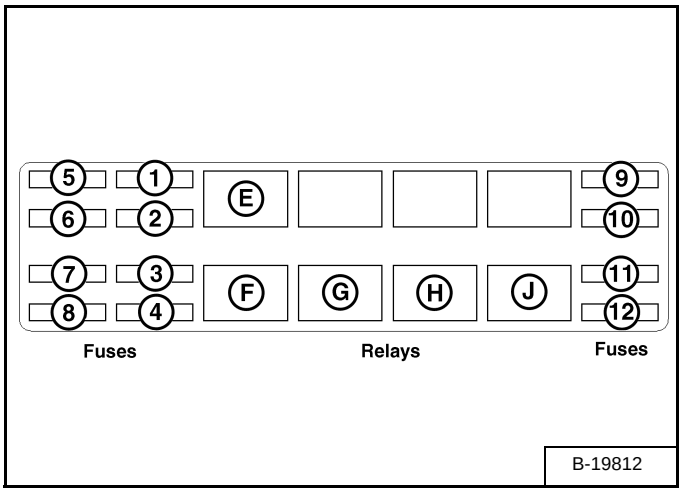
W-2065-0807

Fuse And Relay Location

A decal is inside the cover to show location and amp ratings.

Remove the cover to check or replace the fuses and relays.

Figure 50-10-2



The location and sizes are shown below and **[Figure 50-10-2]**.

REF	DESCRIPTION	AMP	REF	DESCRIPTION	AMP
5	***Not Used***	- -	11	Lights	20
6	Heater	25	12	ACC Plug	15
7	Ignition	5			
8	Fuel Solenoid	25			
1	Wiper	5			
2	Switch Power	20			
3	Alternator/ Heater	25			
4	ACD	25			
9	Controller	25			
10	ACD	25			

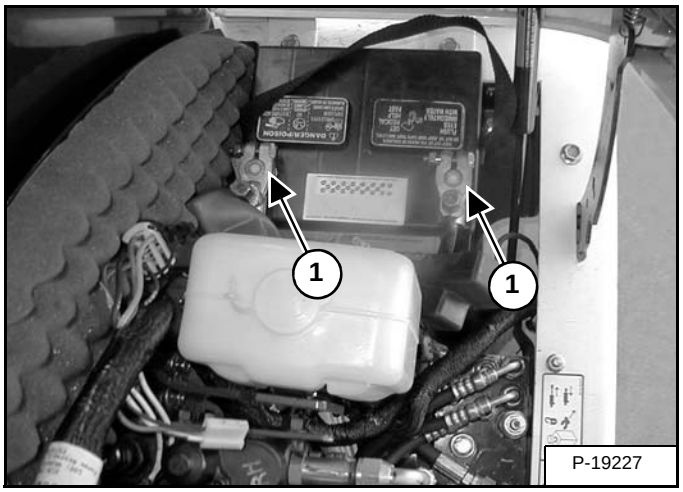
Always replace fuses using the same type and capacity.

REF	DESCRIPTION
E	**Switch Power**
F	Fuel Solenoid
G	Lights
H	Glow Plug
J	Starter

BATTERY

Servicing

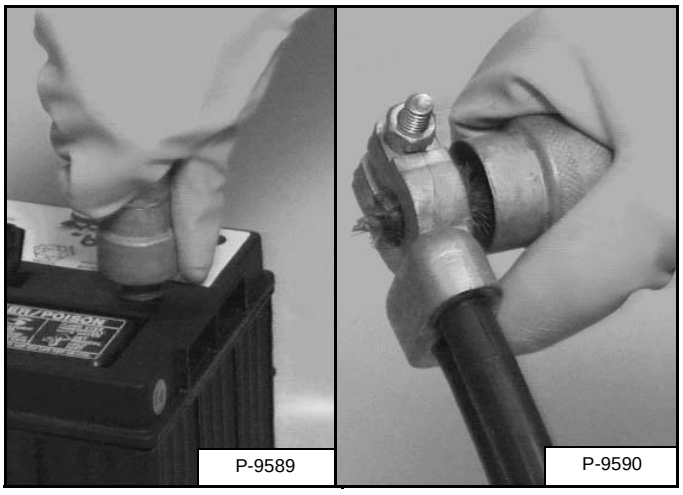
Figure 50-20-1



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 in. (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

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

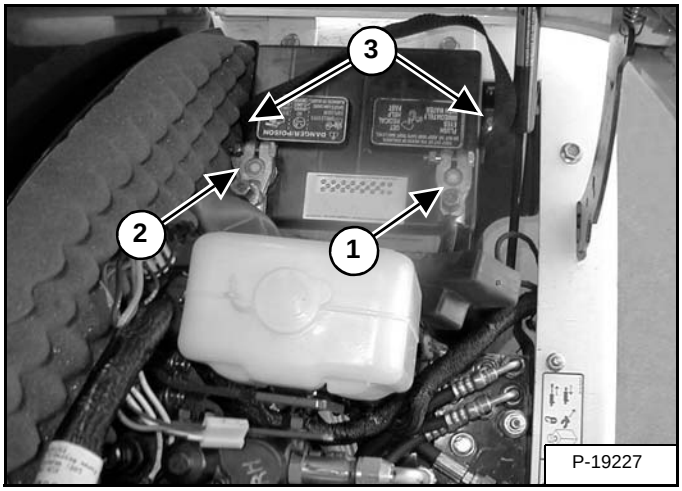
W-2065-0807

BATTERY (CONT'D)

Removing And Installing The Battery

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.

Using A Booster Battery (Jump Starting)

IMPORTANT

If jump starting the excavator from a second machine:

When jump starting the excavator from a battery installed in a second machine, make sure the engine is NOT running while using the glow plugs. High voltage spikes from a running machine can burn out the glow plugs.

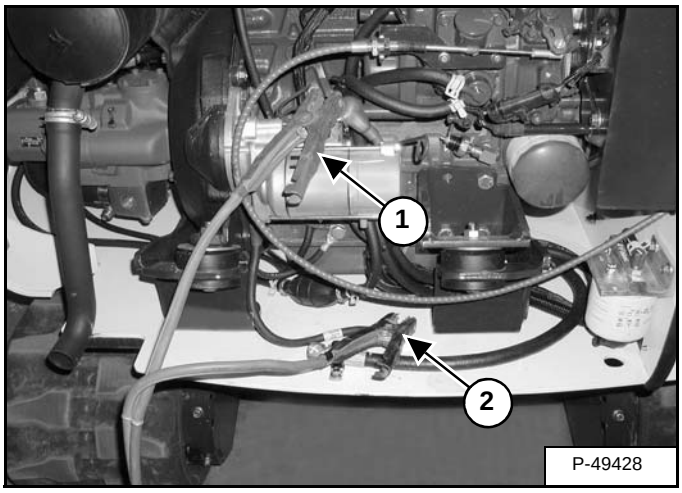
I-2060-0906

If it is necessary to use a booster battery to start the engine, BE CAREFUL! There must be one person in the operator's seat and one person to connect and disconnect the battery cables.

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 one end of the second cable to the negative (-) terminal of the booster battery. Connect the other end of the same cable to the negative excavator cable (Item 2) **[Figure 50-20-4]** where it is fastened to the frame.

WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

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 on Page 2]**.

Disconnect the cable from the excavator starter (Item 1) **[Figure 50-20-4 on Page 2]**.

WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

WARNING

AVOID INJURY OR DEATH

Keep arcs, sparks flames and lighted tobacco away from batteries. When *jumping* from booster battery make final connection (negative) at machine frame.

Do not jump start or charge a frozen or damaged battery. Warm battery to 60°F (16°C) before connecting to a charger. Unplug charger before connecting or disconnecting cables to battery. Never lean over battery while boosting, testing or charging.

Battery gas can explode and cause serious injury.

W-2066-0705

IMPORTANT

Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the excavator. (Remove both cables from the battery.)**
- **Extra battery cables (booster cables) are connected wrong.**

I-2222-0903

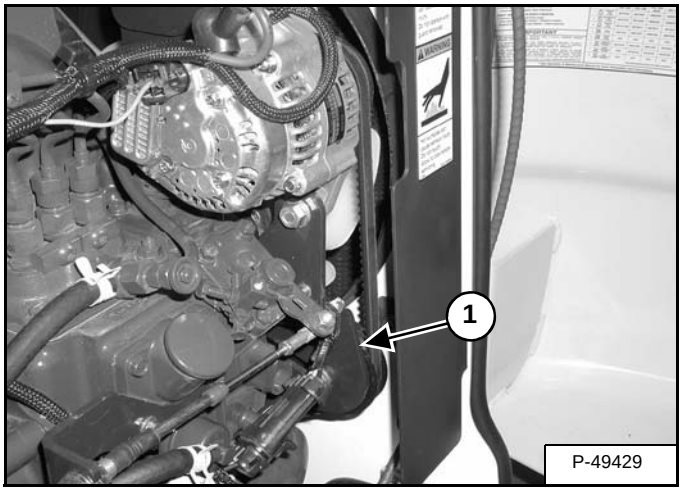

Bobcat®

ALTERNATOR

Engine Accessory Drive Belt

Open the tailgate.

Figure 50-30-1

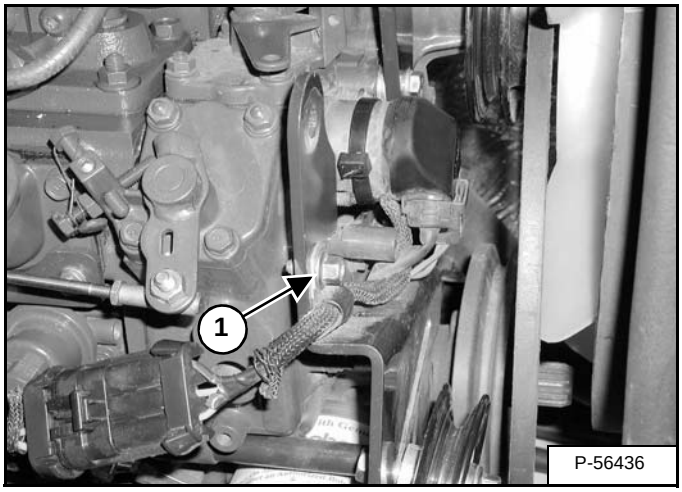


The engine accessory drive belt (Item 1) **[Figure 50-30-1]** must be checked and adjusted as needed, every 100 hours of operation. (See Belt Adjustment on Page 10-140-1.)

Engine Accessory Drive Belt Tensioner Removal And Installation

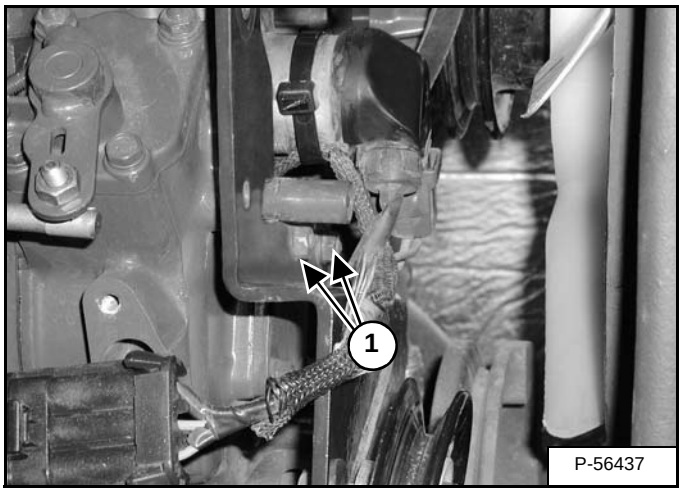
Remove the alternator. (See Removal And Installation on Page 50-30-3.)

Figure 50-30-2



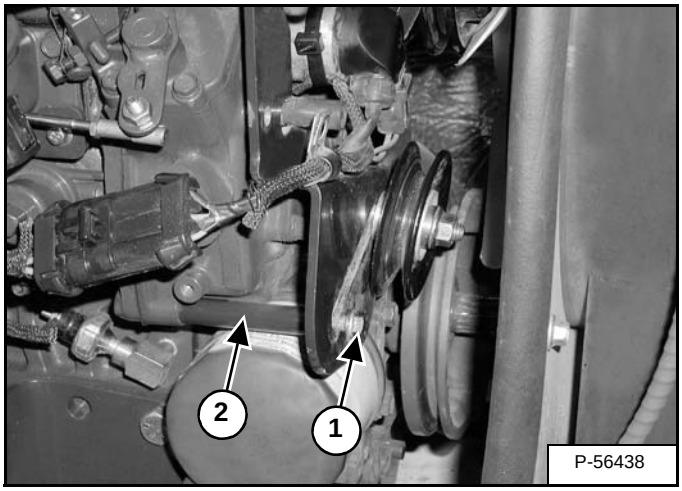
Remove the bolt (Item 1) **[Figure 50-30-2]**.

Figure 50-30-3



Remove the nuts (Item 1) **[Figure 50-30-3]**.

Figure 50-30-4



Remove the bolt, washer (Item 1) and spacer (Item 2) **[Figure 50-30-4]**.

Remove the bracket.

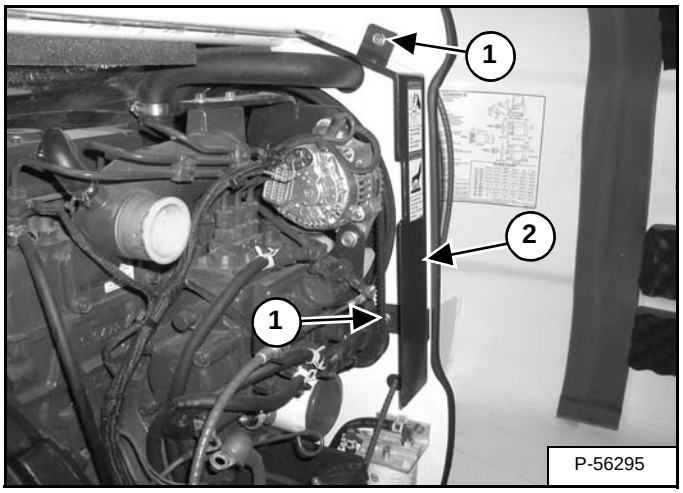
ALTERNATOR (CONT'D)

Removal And Installation

Open the tailgate.

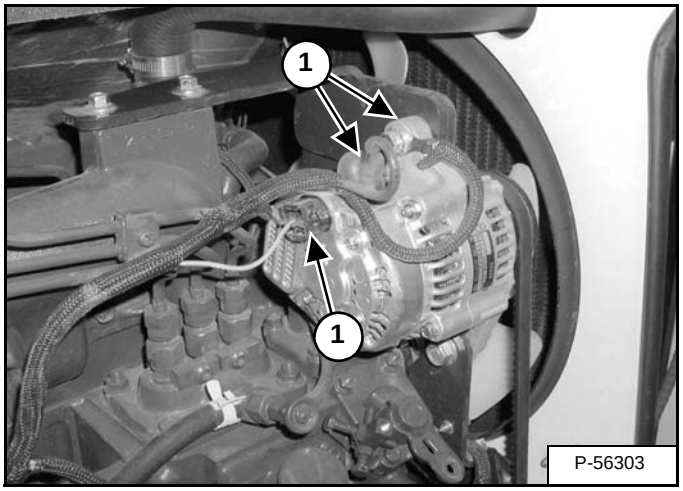
Disconnect the negative (-) battery cable. (See Removing And Installing The Battery on Page 50-20-2.)

Figure 50-30-5



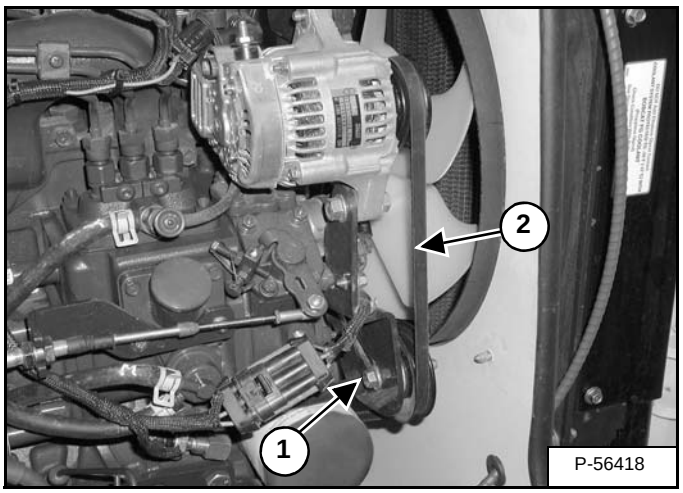
Remove the bolts (Item 1) and guard (Item 2) **[Figure 50-30-5]**.

Figure 50-30-6



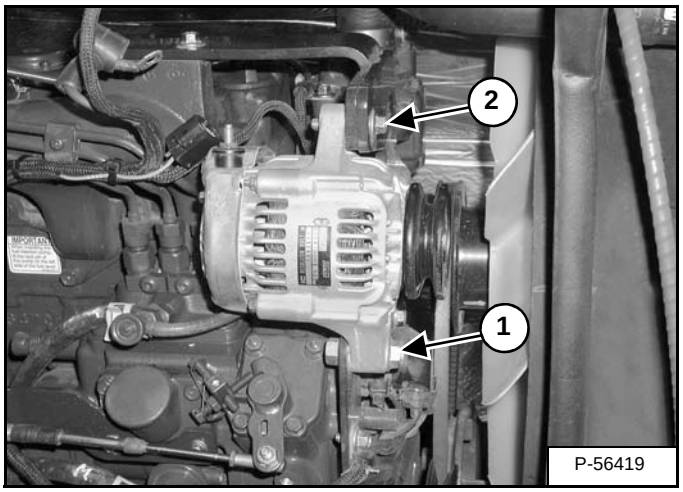
Remove the wires (Item 1) **[Figure 50-30-6]** from the alternator.

Figure 50-30-7



Loosen the bolt (Item 1) on the tensioner and remove the belt (Item 2) **[Figure 50-30-7]** from the alternator.

Figure 50-30-8

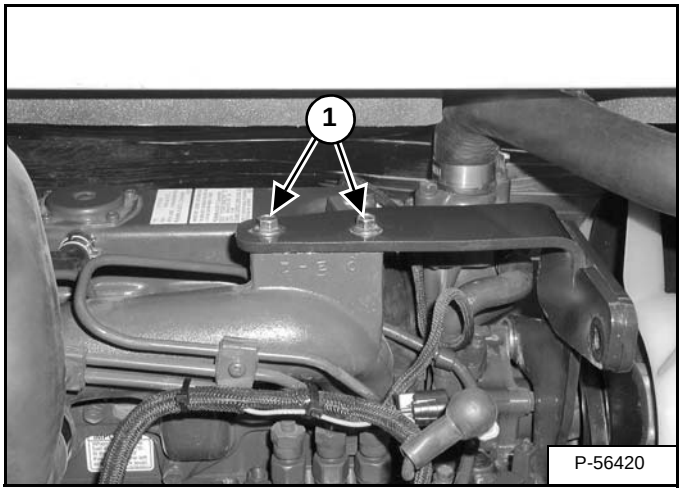


Remove the bottom bolt (Item 1) and nut. Remove the top bolt (Item 2) **[Figure 50-30-8]**.

Bracket Removal And Installation

Remove the alternator. (See Removal And Installation on Page 50-30-3.)

Figure 50-30-9



Remove the bolts (Item 1) **[Figure 50-30-9]**.

Figure 50-30-10

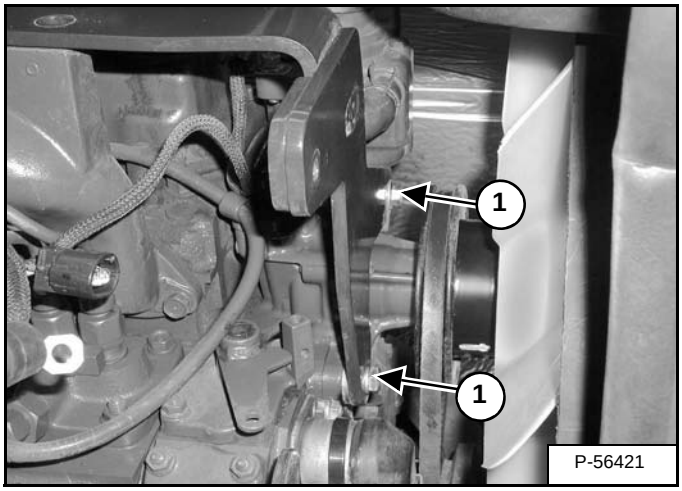
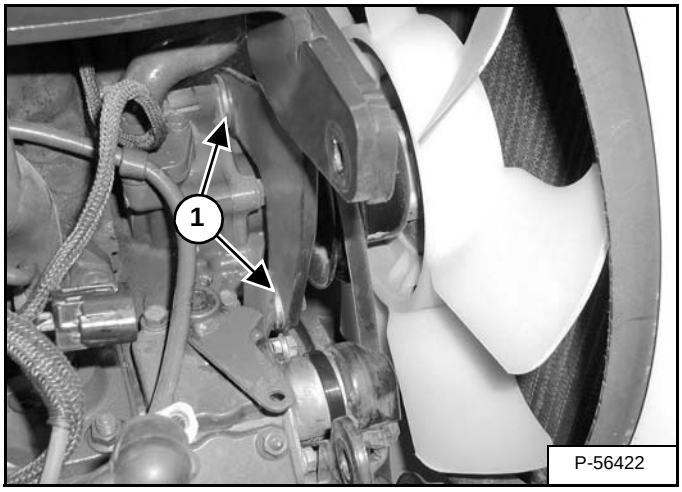


Figure 50-30-11

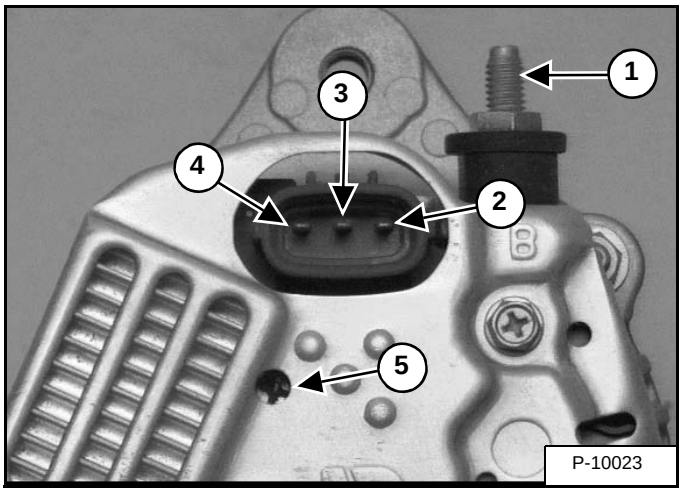


Remove the bolts (Item 1) **[Figure 50-30-10]** and washers (Item 1) **[Figure 50-30-11]**.

Remove the bracket.

Description

Figure 50-30-12



The output terminal (Item 1) **[Figure 50-30-12]**.

The open terminal (Item 2) **[Figure 50-30-12]** is not used in the excavator harness.

The ignition terminal (Item 3) **[Figure 50-30-12]**.

The open terminal (Item 4) **[Figure 50-30-12]** is not used in the excavator harness.

Access hole for full field test (Item 5) **[Figure 50-30-12]**.

Tests

Perform the following alternator tests in this order:

Alternator Output Test: Tests the alternator and regulator output.

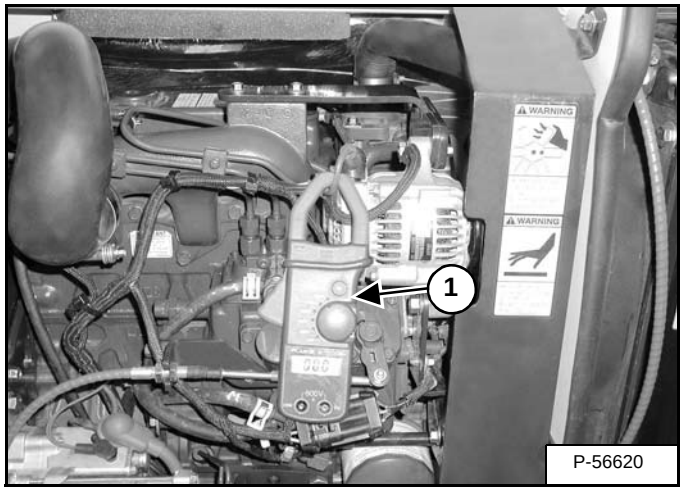
Full Field Test: Tests the maximum amperage output of the alternator.

Alternator Regulator Test: Tests the regulator voltage output.

Alternator Output Test

Check battery and battery connections. (See BATTERY on Page 50-20-1.)

Figure 50-30-13



Use the induction meter and loop around positive (+) wire (Item 1) **[Figure 50-30-13]** at the alternator.

Start the engine and run at full RPM.

The ammeter reading should be between 35 and 40 amps.

If the ammeter reading is less than 35 amps do the full field test.

⚠ WARNING

AVOID INJURY OR DEATH

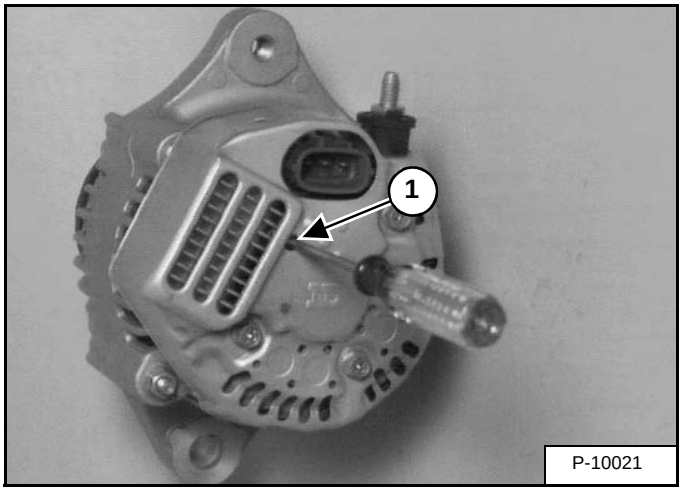
When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

W-2050-0807

Full Field Test

Start the engine and run at full RPM.

Figure 50-30-14



Place a small screwdriver in the test port (Item 1) **[Figure 50-30-14]** to provide a ground to the alternator case. This will give maximum amperage output from the alternator.

NOTE: The Full Field Test should only last long enough to get ammeter reading to prevent damage to the alternator.

The ammeter reading should be above 35 amps.

If the ammeter reading is low, repair or replace the alternator.

⚠ WARNING

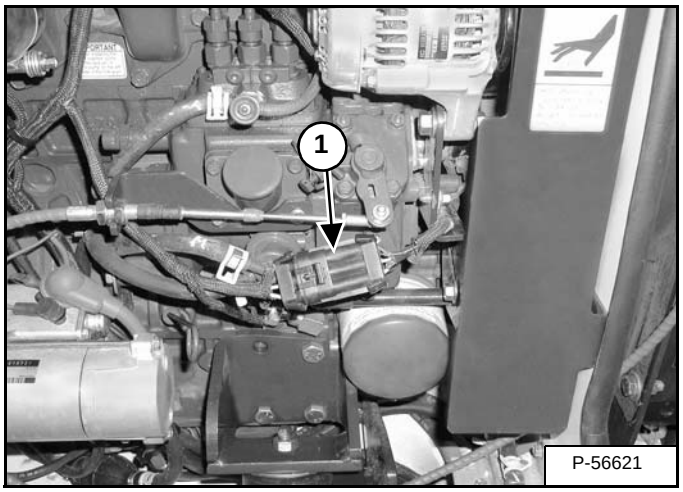
AVOID INJURY OR DEATH

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

W-2050-0807

Alternator Regulator Test

Figure 50-30-15



Disconnect the fuel stop solenoid connector (Item 1) **[Figure 50-30-15]**.

Turn the lights on 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.

IMPORTANT

Damage to the alternator can occur if:

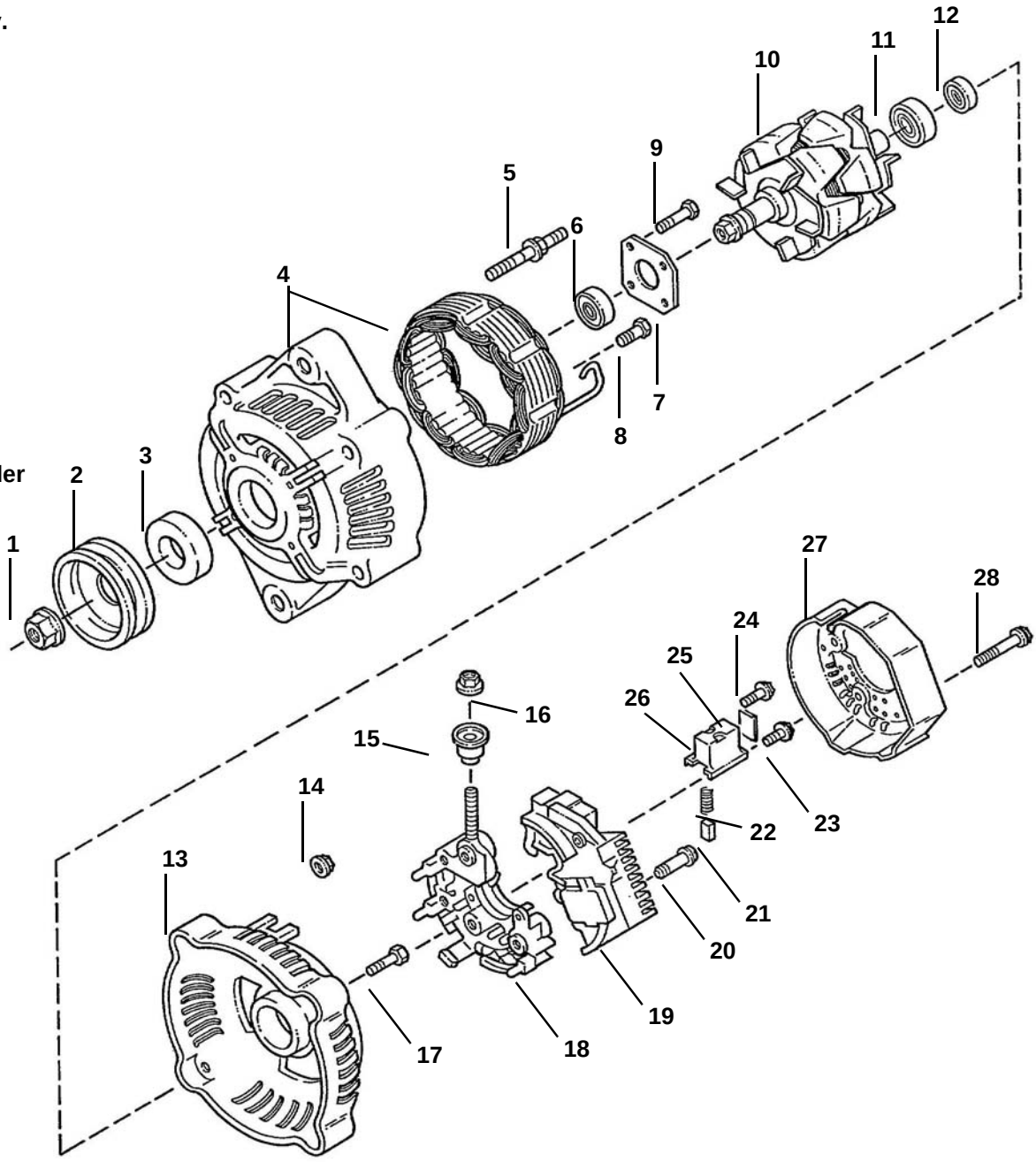
- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the loader. (Remove both cables from the battery.)**
- **Extra battery cables (booster cables) are connected wrong.**

I-2023-1285

ALTERNATOR

Parts Identification

1. Nut
2. Pulley
3. Spacer
4. Frame Assy.
5. Stud
6. Bearing
7. Plate
8. Screw
9. Screw
10. Rotor Assy.
11. Bearing
12. Cover
13. Frame End
14. Nut
15. Insulator
16. Nut
17. Bolt
18. Rectifier
19. Regulator
20. Screw
21. Brush
22. Spring
23. Screw
24. Screw
25. Seal
26. Brush Holder
27. Cover
28. Bolt

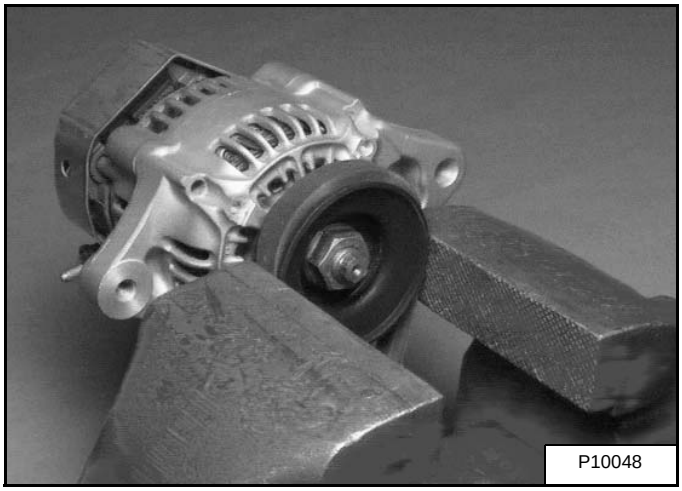


C-3456A

Disassembly And Assembly

Remove the alternator.

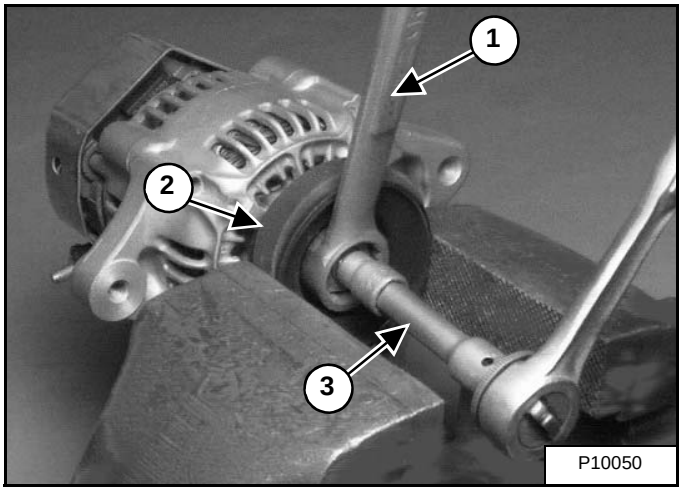
Figure 50-30-16



Wrap a V-belt in the alternator pulley and clamp the pulley into a vise as shown **[Figure 50-30-16]**.

Do not over tighten the vise.

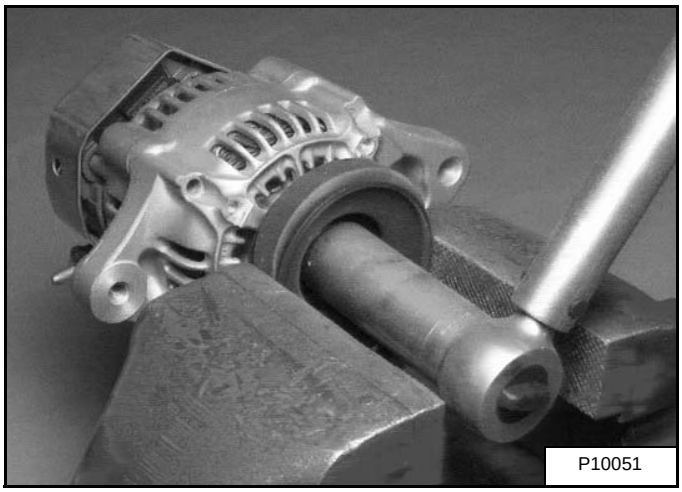
Figure 50-30-17



Use a box end wrench (Item 1) to remove the nut while the pulley shaft (Item 2) is held firmly with a 6-point socket (Item 3) **[Figure 50-30-17]** (10 mm).

NOTE: A six point box end wrench should be used, a twelve point box end wrench may damage the corners of the nut.

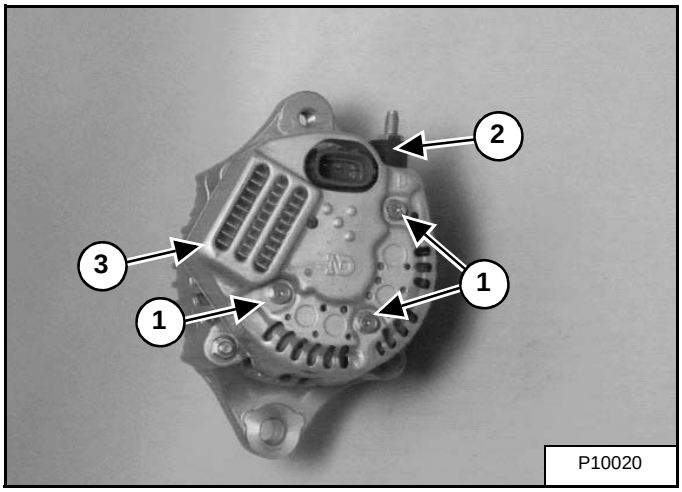
Figure 50-30-18



Assembly: Tighten the pulley nut to 70 - 94 ft.-lb. (94 - 127 N•m) torque **[Figure 50-30-18]**.

Remove the alternator.

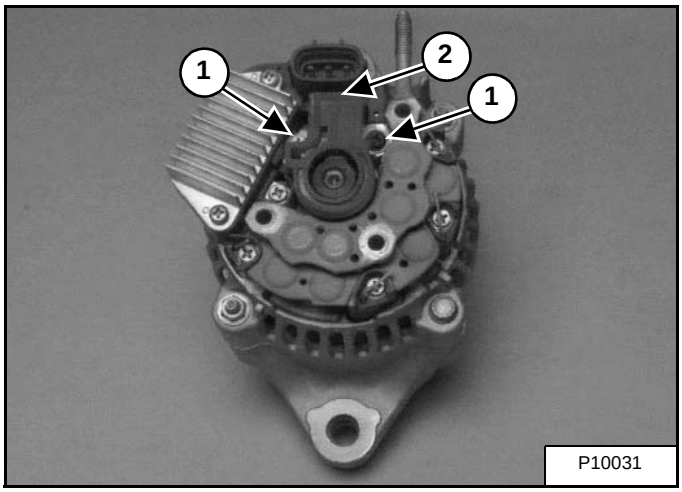
Figure 50-30-19



Remove the screws (Item 1), the nut, and insulator (Item 2) and the end cover (Item 3) **[Figure 50-30-19]**.

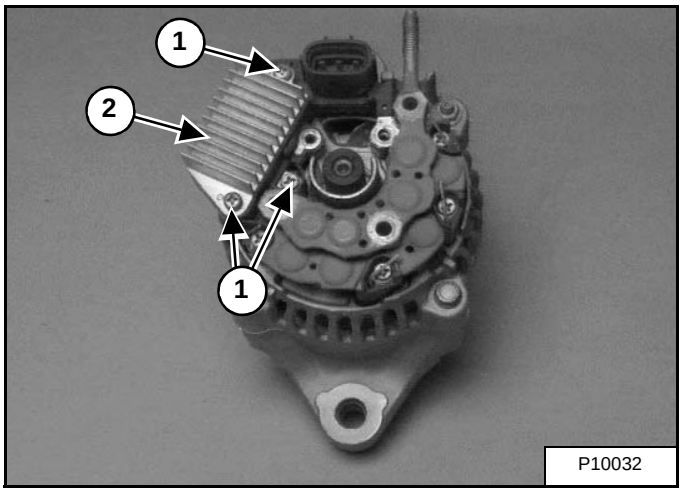
Disassembly And Assembly (Cont'd)

Figure 50-30-20



Remove the screws (Item 1) and remove the brush holder (Item 2) **[Figure 50-30-20]**.

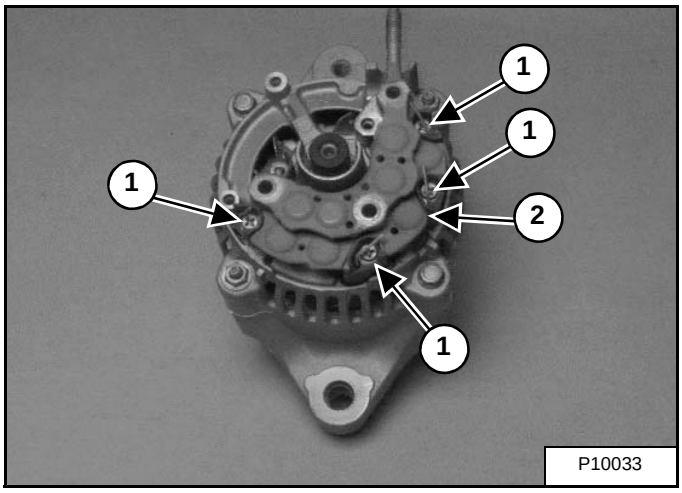
Figure 50-30-21



Remove the screws (Item 1) and remove the regulator (Item 2) **[Figure 50-30-21]**.

NOTE: The lengths of the screws are different, and must be marked prior to disassembly. If the wrong screw is used, damage to the alternator may occur.

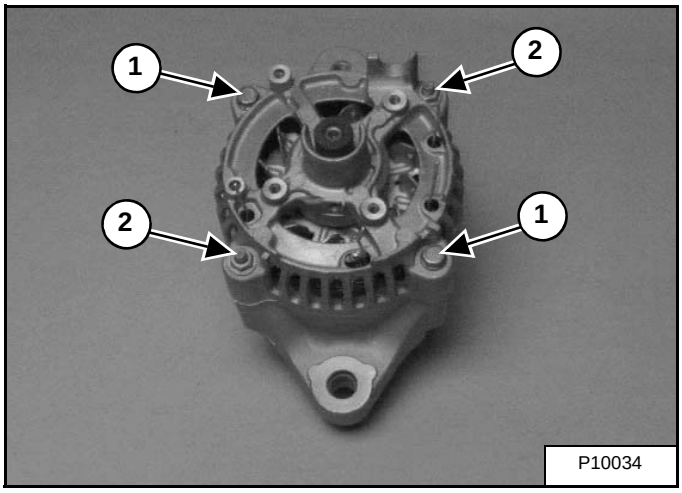
Figure 50-30-22



Loosen the screws (Item 1) that hold the rectifier lead wires. Unwrap and straighten the rectifier lead wires from the screws, and lift the rectifier (Item 2) **[Figure 50-30-22]** from the stator.

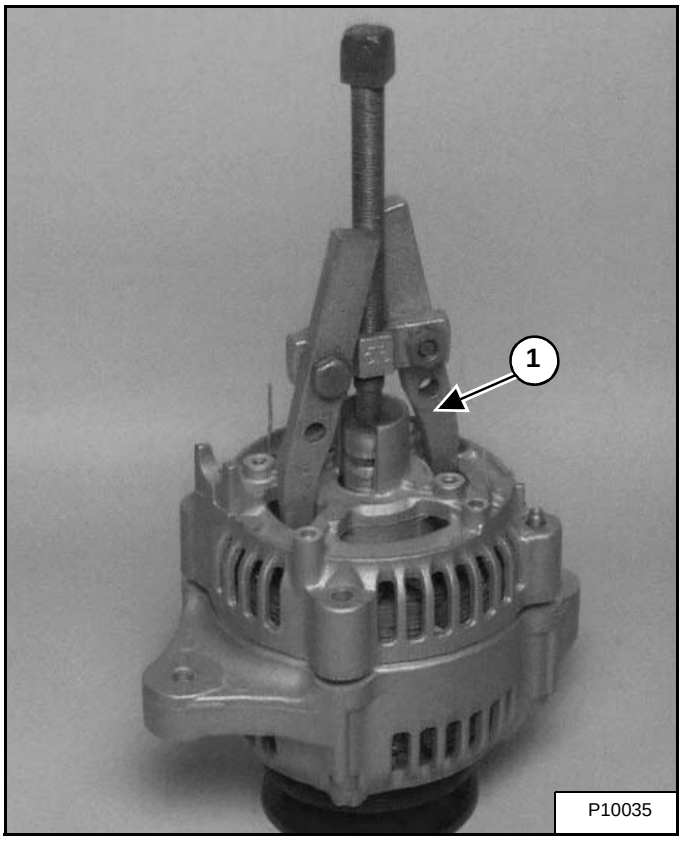
Remove the alternator.

Figure 50-30-23



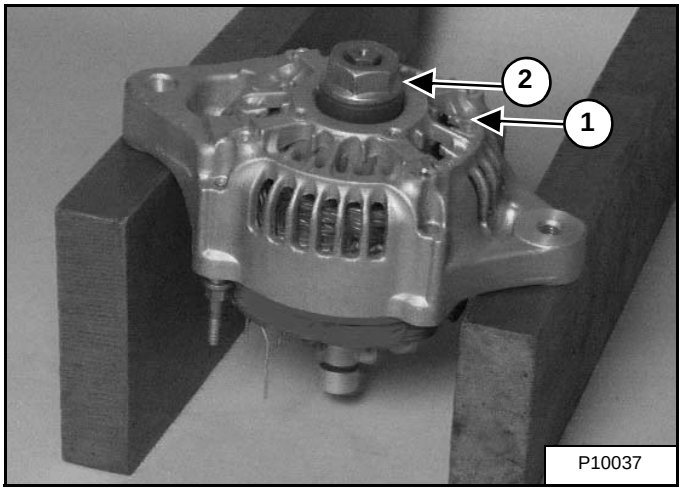
Remove the bolts (Item 1) and nuts (Item 2) **[Figure 50-30-23]**.

Figure 50-30-24



Using a puller (Item 1) **[Figure 50-30-24]** remove the rear housing.

Figure 50-30-25

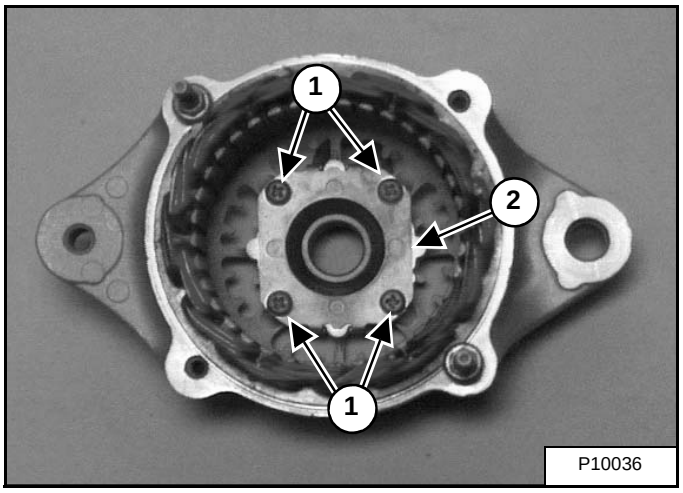


Support the alternator housing (Item 1) **[Figure 50-30-25]** on blocks.

With the nut (Item 2) **[Figure 50-30-25]** on the pulley shaft, tap the rotor out of the bearing. A press may be needed if the bearing is stuck to the rotor shaft.

NOTE: Care should be used not to damage the fan, slip ring, etc.

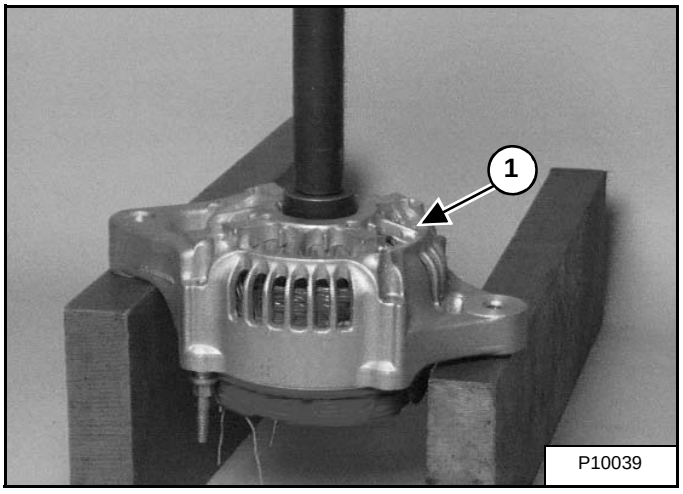
Figure 50-30-26



Remove the screws (Item 1) and remove the retainer plate (Item 2) **[Figure 50-30-26]**.

Remove the alternator.

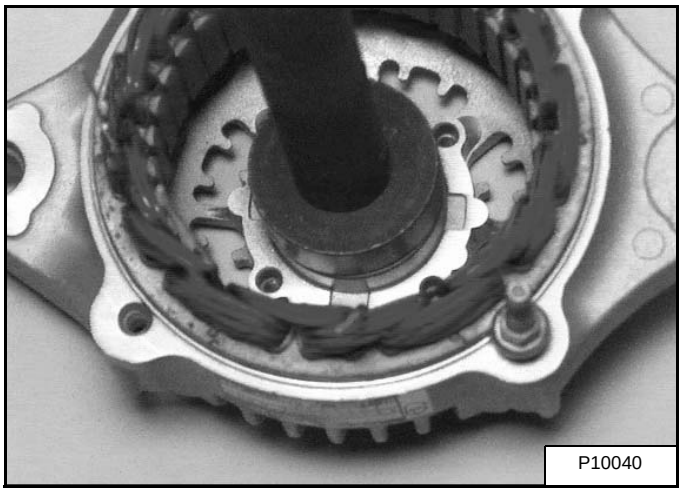
Figure 50-30-27



Support the alternator housing (Item 1) **[Figure 50-30-27]** on the blocks, and press the bearing from the housing.

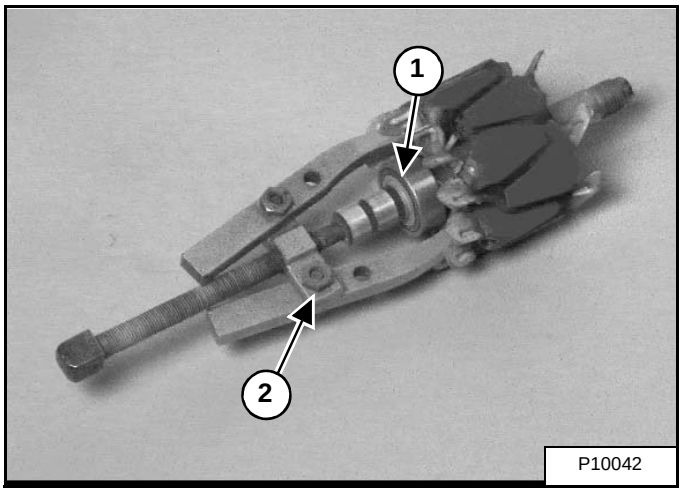
Disassembly And Assembly (Cont'd)

Figure 50-30-28



Assembly: Press a new bearing in the housing **[Figure 50-30-28]**.

Figure 50-30-29

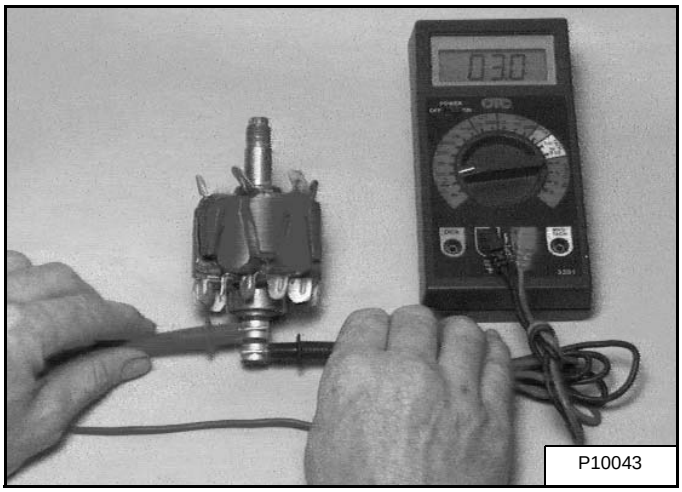


Remove the bearing (Item 1) from the rotor shaft, using a puller (Item 2) **[Figure 50-30-29]**.

NOTE: A vise with padded jaws may be used to secure the rotor assembly. Do not over tighten the vise.

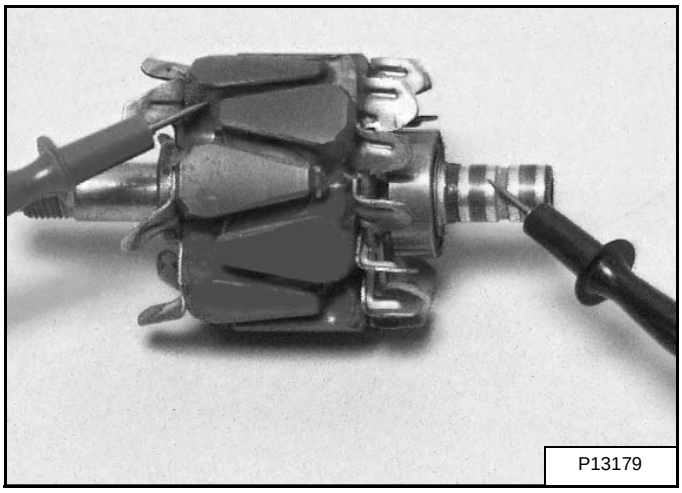
Rotor Continuity Test

Figure 50-30-30



Touch the probes to the slip rings **[Figure 50-30-30]**.

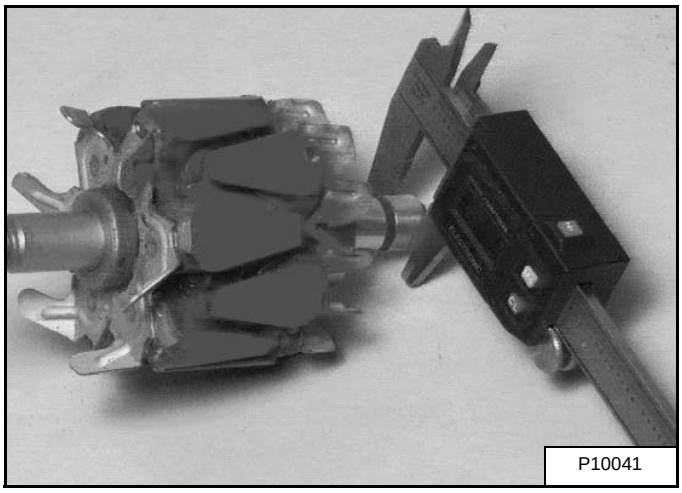
Figure 50-30-31



Check the continuity across the slip rings (Item 1) to the core of the rotor (Item 2) **[Figure 50-30-31]** with an ohmmeter.

If there is continuity, replace the rotor.

Figure 50-30-32



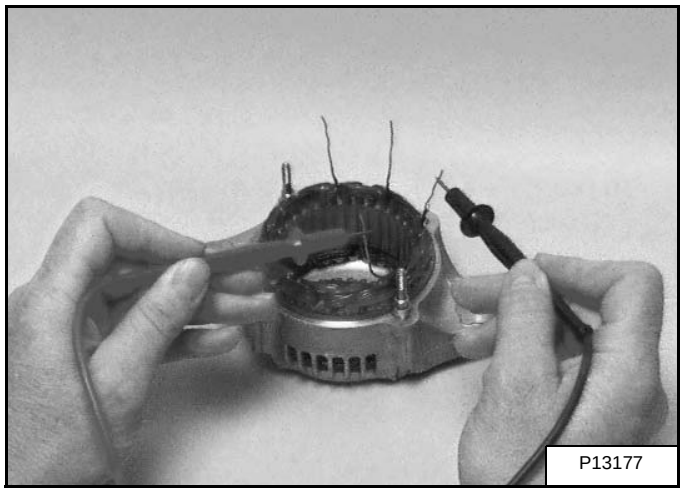
Measure the slip ring shaft **[Figure 50-30-32]**.

Standard measurement is 0.57 in. (14,45 mm) allowable limit is 0.55 in. (14,0 mm).

Check the slip ring for stained or rough surfaces, use fine sandpaper to clean the shaft.

Rotor Continuity Test

Figure 50-30-33

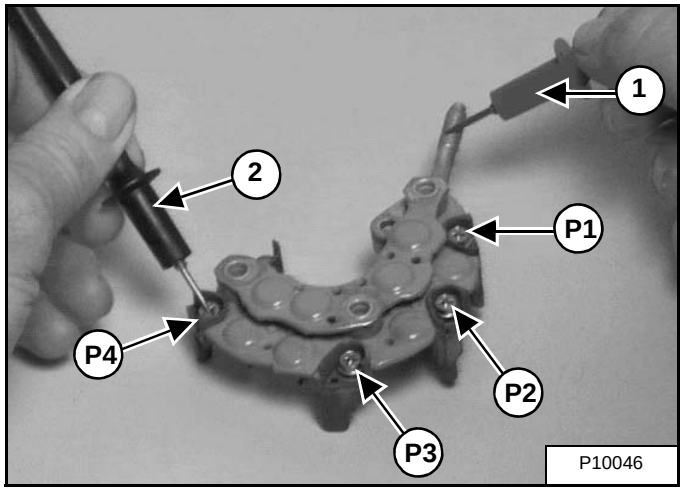


Check the continuity across each of the four leads of the stator coil with an ohmmeter **[Figure 50-30-33]**.

If there is no continuity, replace the stator.

Rectifier Continuity (Diode) Test

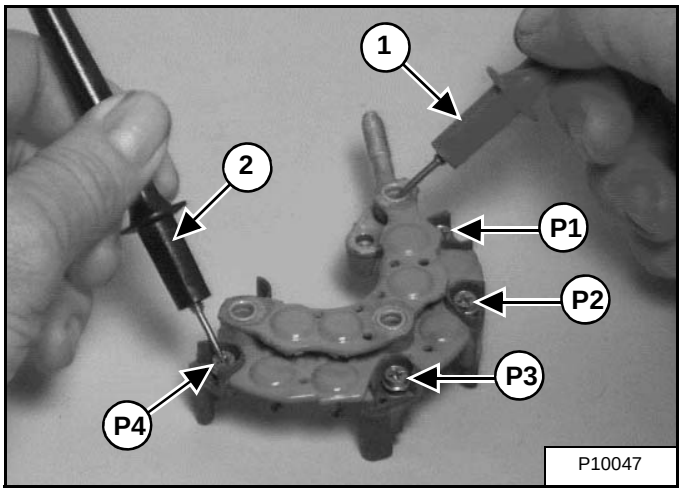
Figure 50-30-34



Test 1: Touch the positive (+) test probe (Item 1) to the positive terminal. Touch the (-) negative test probe (Item 2) **[Figure 50-30-34]** to the P1, P2, P3, and P4 terminals. There should be no reading.

Test 2: Reverse the positions of the test probes from Test 1, there should be a reading.

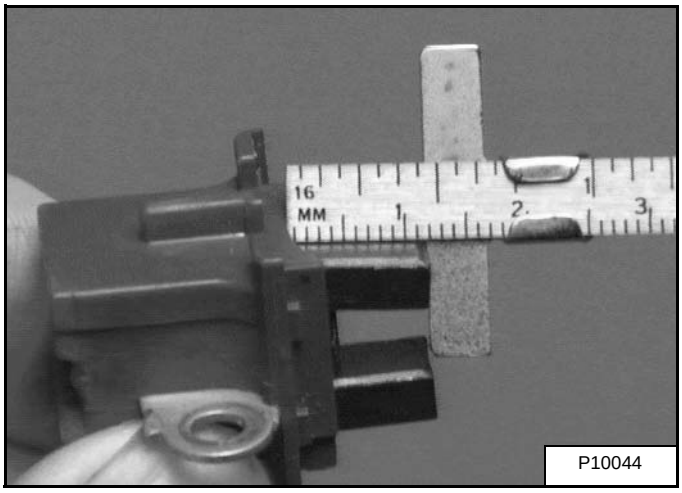
Figure 50-30-35



Test 3: Touch the positive (+) test probe (Item 1) to the ground terminals. Touch the (-) test probe (Item 2) **[Figure 50-30-35]** to the P1, P2, P3, and P4 terminals. There should be a reading.

Test 4: Reverse the positions of the test probes from test 3, there should be no reading.

Figure 50-30-36



Measure the length of the brush protruding from the brush holder **[Figure 50-30-36]**.

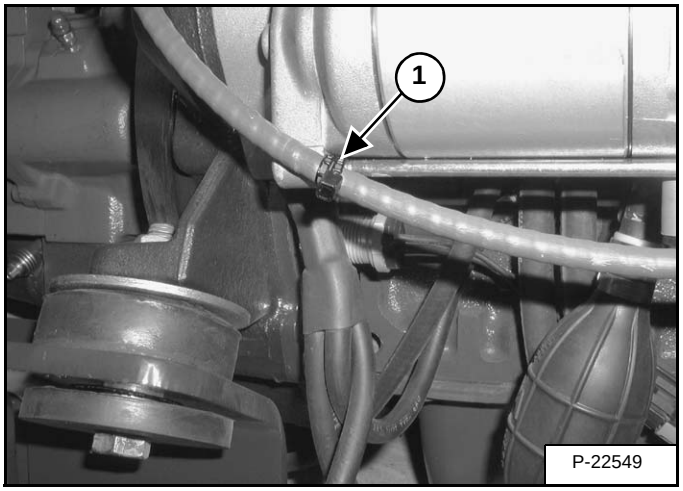
Standard measurement is 0.41 in (10,5 mm) allowable limit is 0.18 in (4,5 mm).

STARTER

Removal And Installation

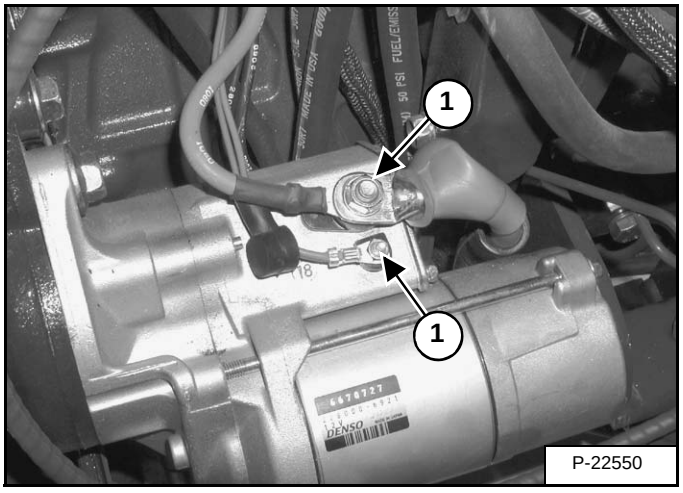
Disconnect the negative (-) cable from the battery. (See Removing And Installing The Battery on Page 50-20-2.)

Figure 50-40-1



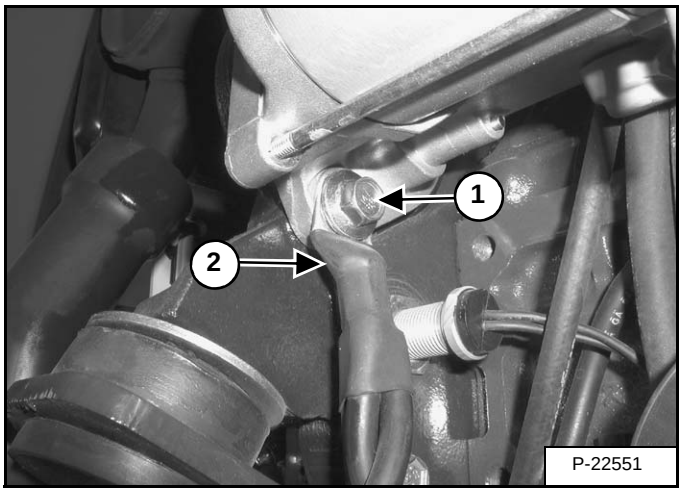
Cut and remove the cable tie (Item 1) **[Figure 50-40-1]** from the starter frame bolt.

Figure 50-40-2



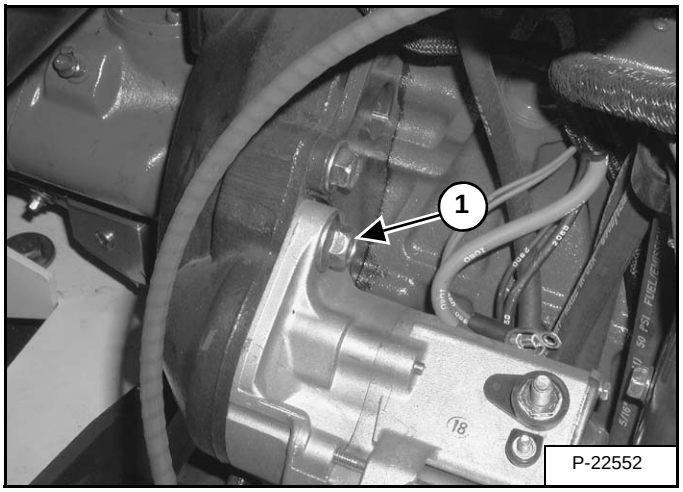
Disconnect the wires (Item 1) **[Figure 50-40-2]** from the starter.

Figure 50-40-3



Remove the bottom mounting bolt (Item 1) and ground cable (Item 2) **[Figure 50-40-3]**.

Figure 50-40-4

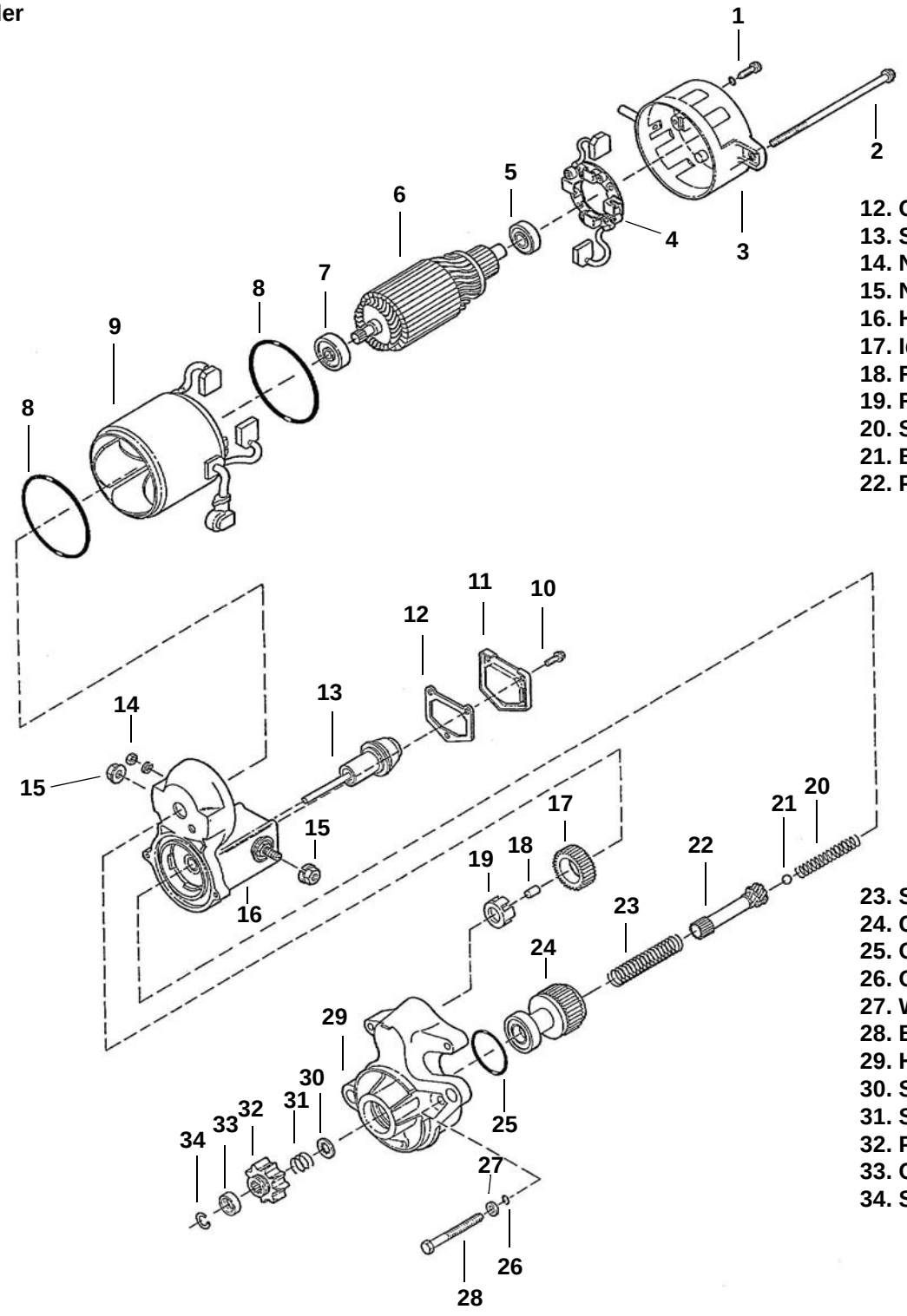


Remove the top mounting bolt (Item 1) **[Figure 50-40-4]**.

Remove the starter.

Parts Identification

1. Screw
2. Bolt
3. Brush Cover
4. Brush Holder
5. Bearing
6. Armature
7. Bearing
8. O-Ring
9. Frame
10. Bolt
11. Cover

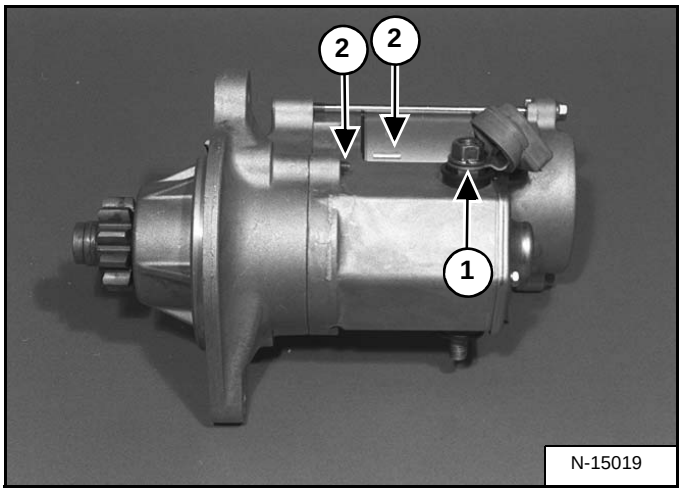


12. Gasket
13. Switch
14. Nut
15. Nut
16. Housing
17. Idler Gear
18. Roller
19. Retainer
20. Spring
21. Ball
22. Pinion Shaft
23. Spring
24. Clutch
25. O-Ring
26. O-Ring
27. Washer
28. Bolt
29. Housing
30. Spring Seat
31. Spring
32. Pinion Gear
33. Collar
34. Snap Ring

D-2396

Disassembly

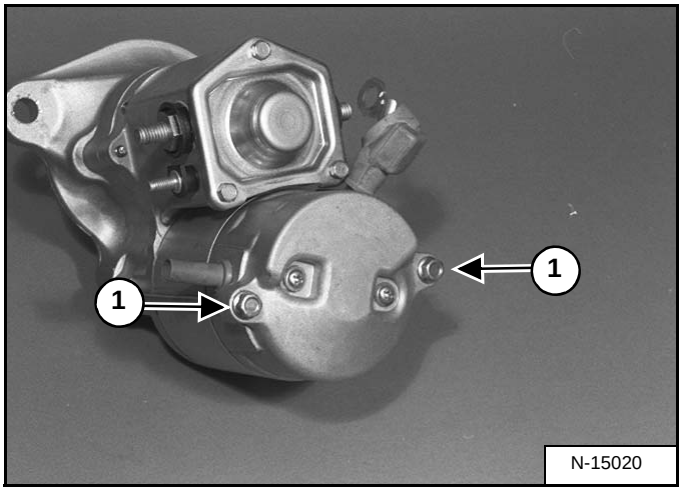
Figure 50-40-5



Remove the cable (Item 1) **[Figure 50-40-5]** from the magnetic switch.

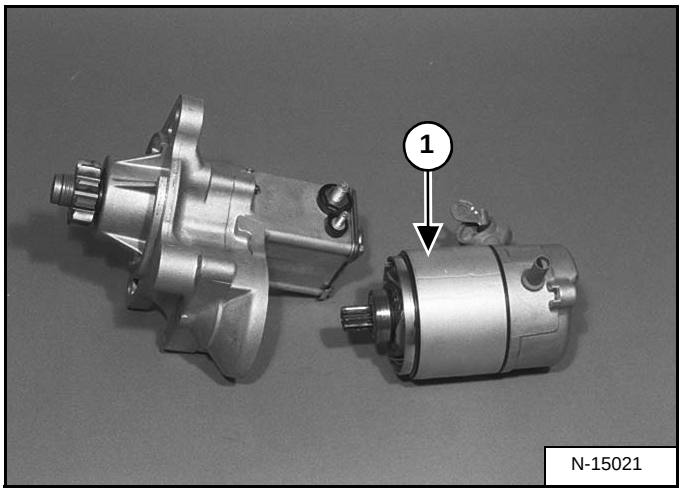
Mark the frame and magnetic switch (Item 2) **[Figure 50-40-5]** for ease of assembly.

Figure 50-40-6



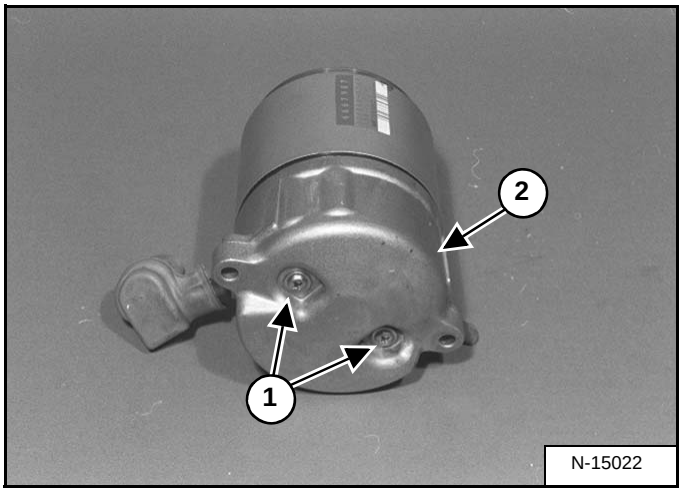
Remove the bolts (Item 1) **[Figure 50-40-6]**.

Figure 50-40-7



Remove the frame (Item 1) **[Figure 50-40-7]** from the magnetic switch.

Figure 50-40-8

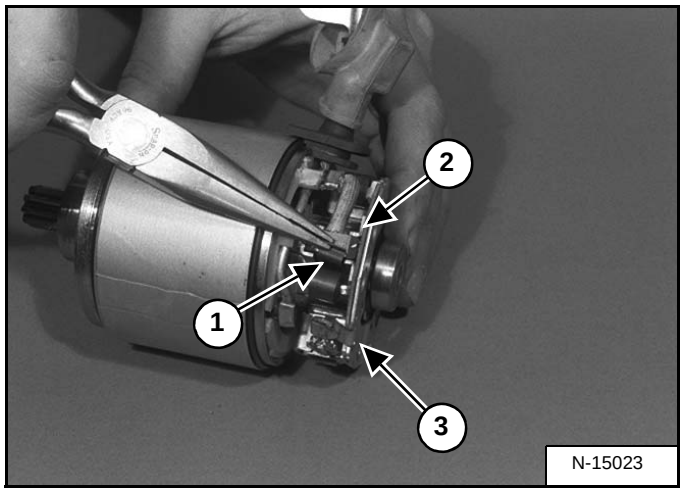


Remove the screws (Item 1) from the brush cover (Item 2) **[Figure 50-40-8]**.

Remove the cover (Item 2) **[Figure 50-40-8]**.

Disassembly (Cont'd)

Figure 50-40-9

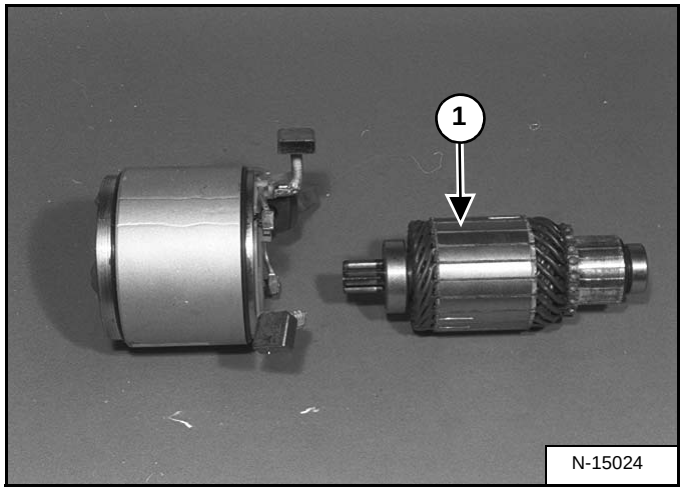


Using a needle nose pliers, pull the brush springs (Item 1) back and remove the brushes (Item 2) **[Figure 50-40-9]**.

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).

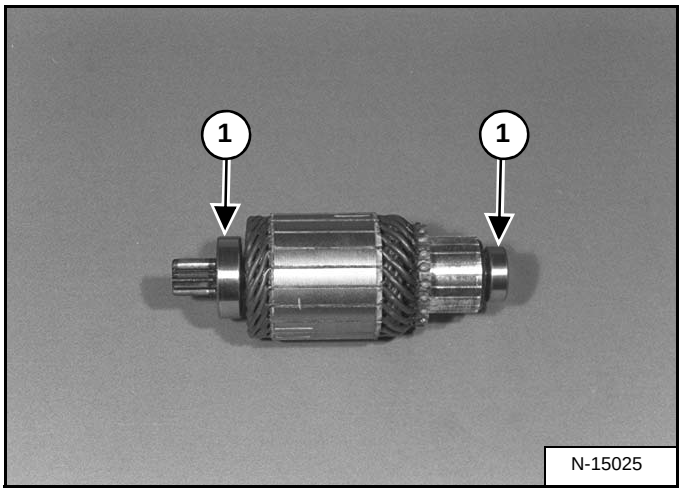
Remove the brush holder (Item 3) **[Figure 50-40-9]** from the end of the armature.

Figure 50-40-10



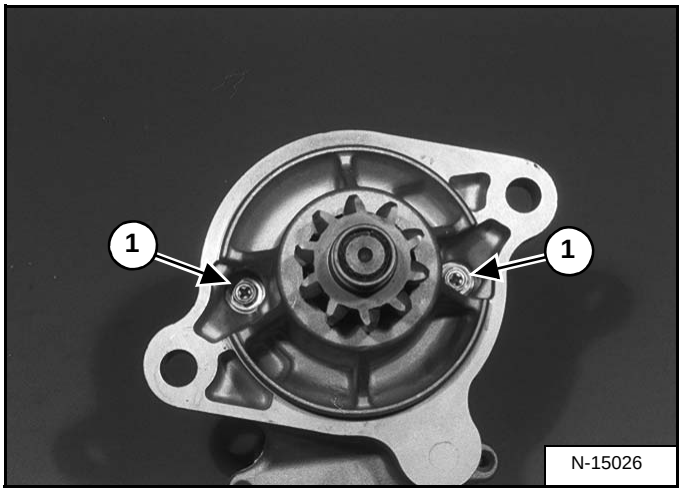
Remove the armature (Item 1) **[Figure 50-40-10]** from the frame.

Figure 50-40-11



Remove the bearings (Item 1) **[Figure 50-40-11]** from both ends of the armature.

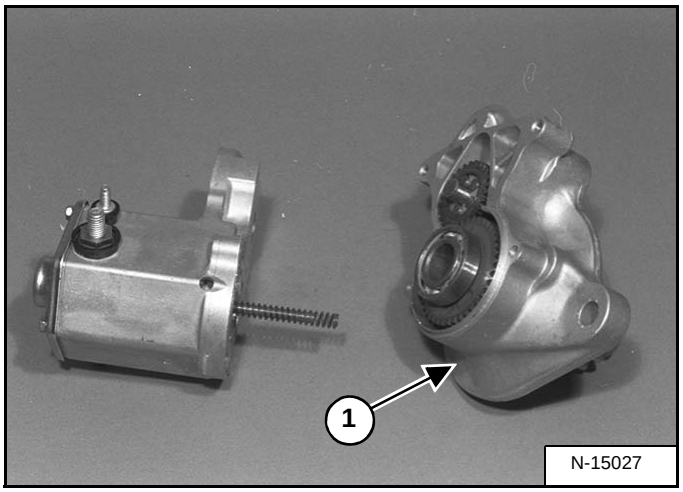
Figure 50-40-12



Remove the bolts (Item 1) **[Figure 50-40-12]** from the starter housing.

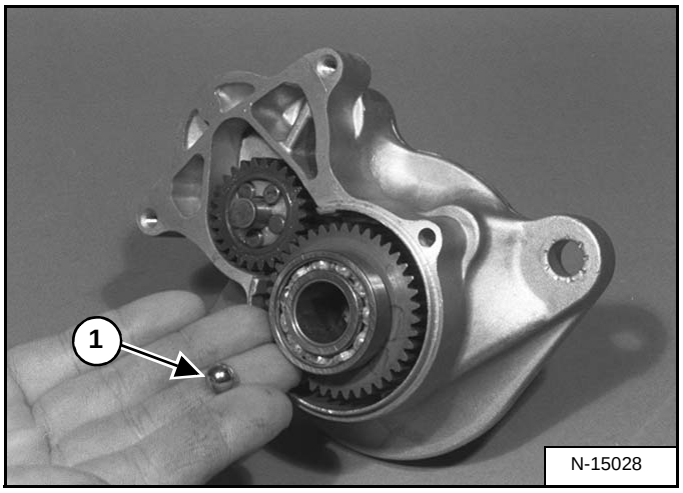
Disassembly (Cont'd)

Figure 50-40-13



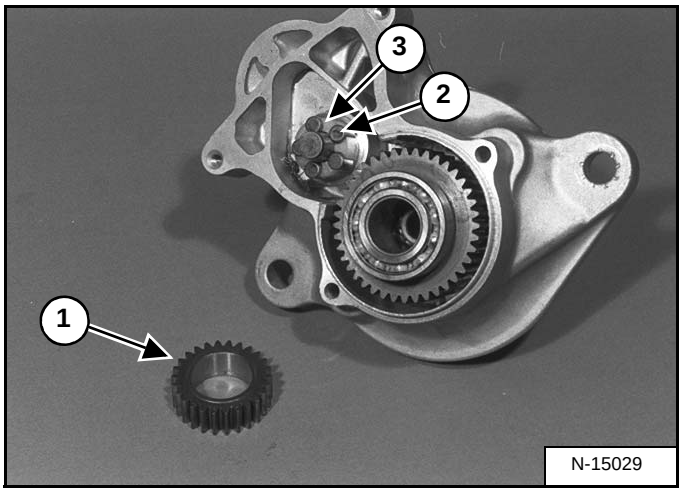
Remove the starter housing (Item 1) **[Figure 50-40-13]** from the magnetic switch housing.

Figure 50-40-14



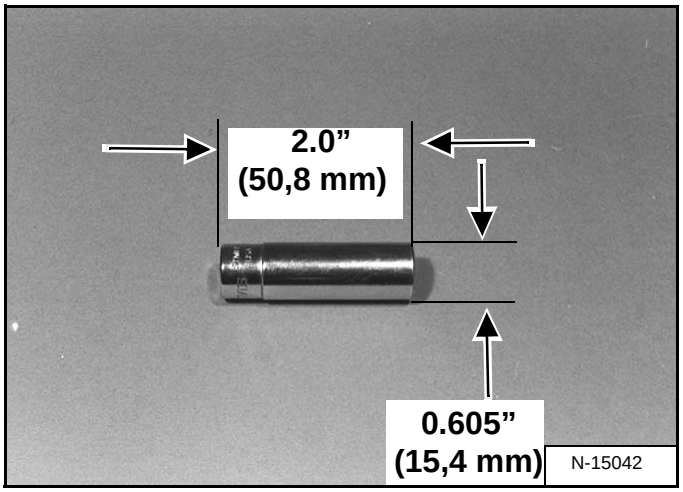
Remove the ball (Item 1) **[Figure 50-40-14]** from the pinion shaft.

Figure 50-40-15



Remove the idler gear (Item 1), rollers (Item 2) and retainer (Item 3) **[Figure 50-40-15]**.

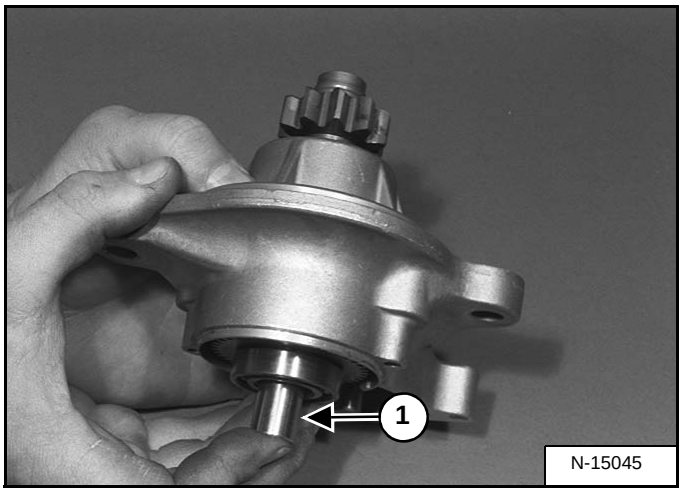
Figure 50-40-16



In order to remove the snap ring from the pinion shaft, a tube 0.605 in. (15,4 mm) in diameter by 2.0 in. (50,8 mm) in length is needed **[Figure 50-40-16]**.

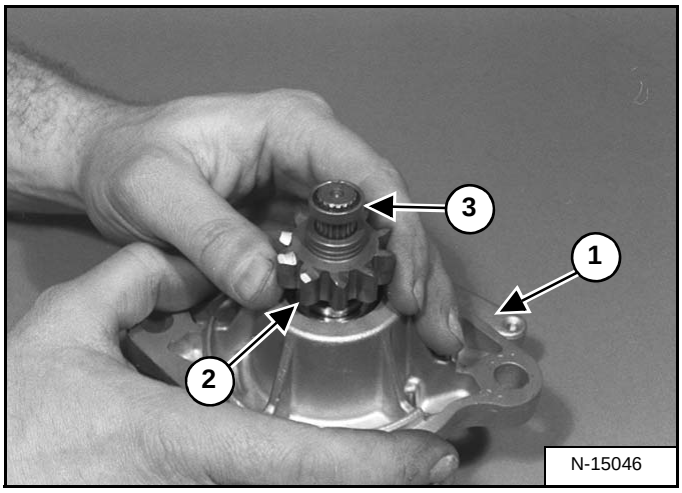
Disassembly (Cont'd)

Figure 50-40-17



Install the tube (Item 1) **[Figure 50-40-17]** in the over running clutch.

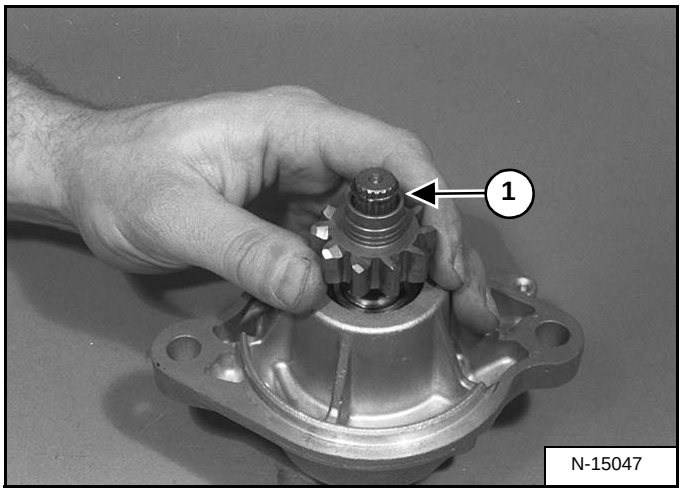
Figure 50-40-18



Press down on the starter carrier (Item 1) to extend the pinion shaft. Press down on the pinion (Item 2) **[Figure 50-40-18]**.

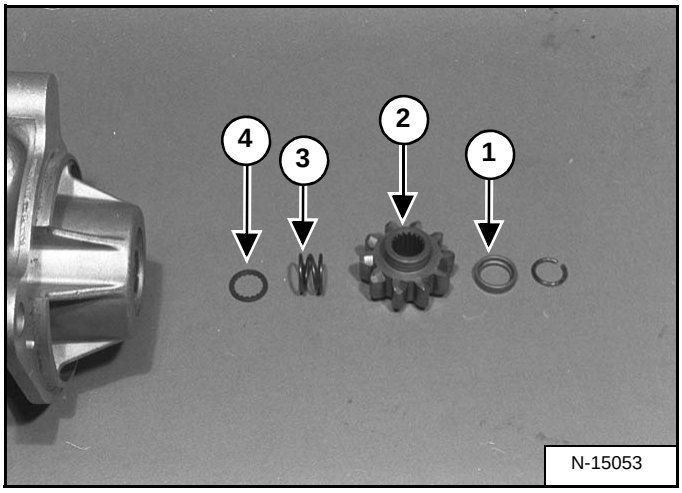
Press the collar (Item 3) **[Figure 50-40-18]** down to gain access to the snap ring.

Figure 50-40-19



Remove the snap ring (Item 1) **[Figure 50-40-19]**.

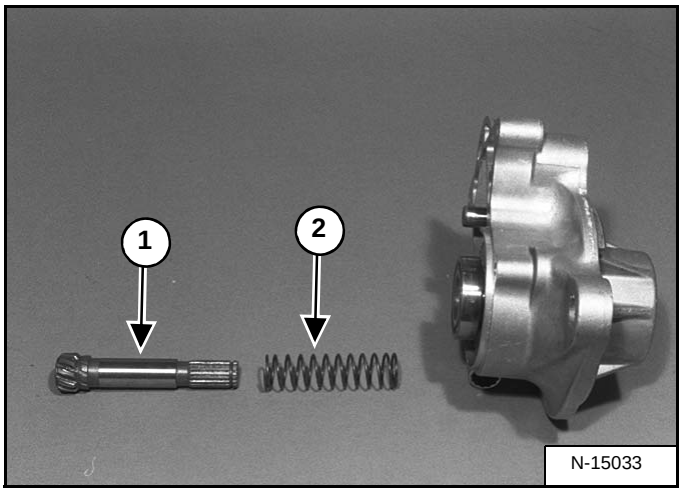
Figure 50-40-20



Remove the collar (Item 1), pinion (Item 2), spring (Item 3), and spring seat (Item 4) **[Figure 50-40-20]**.

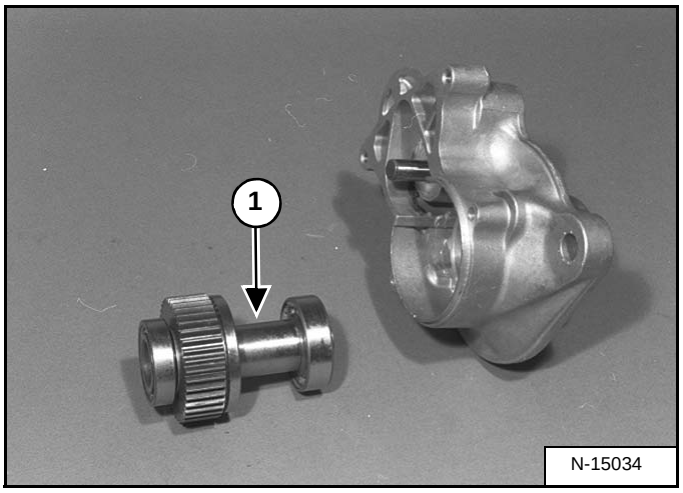
Disassembly (Cont'd)

Figure 50-40-21



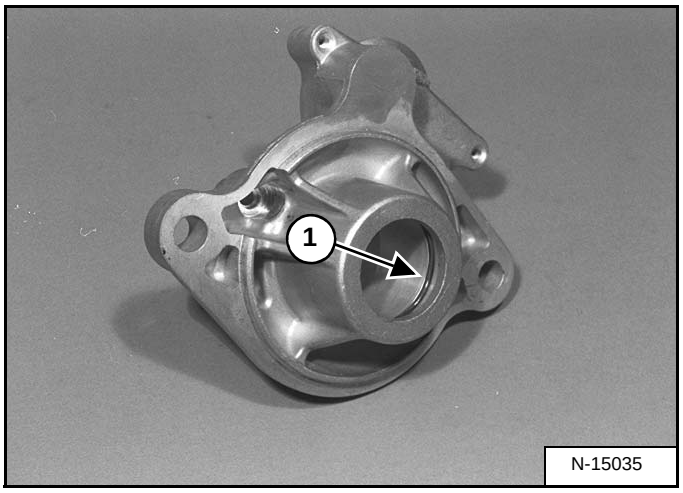
Remove the pinion shaft (Item 1) and spring (Item 2) **[Figure 50-40-21]** from the starter drive.

Figure 50-40-22



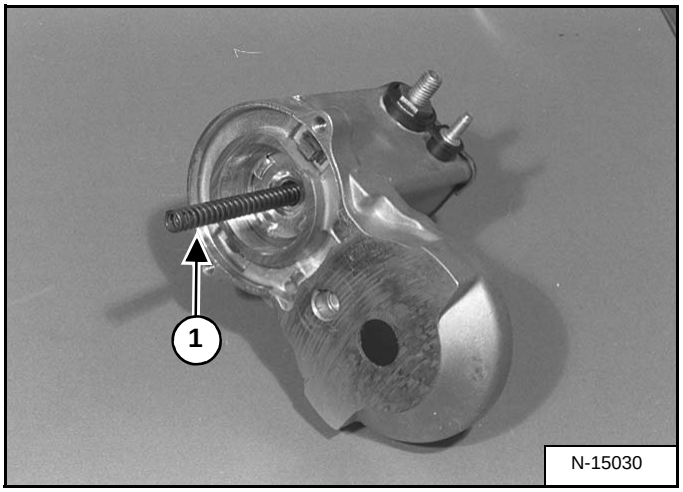
Remove the over running clutch (Item 1) **[Figure 50-40-22]**.

Figure 50-40-23



Remove the O-ring (Item 1) **[Figure 50-40-23]** from the starter housing.

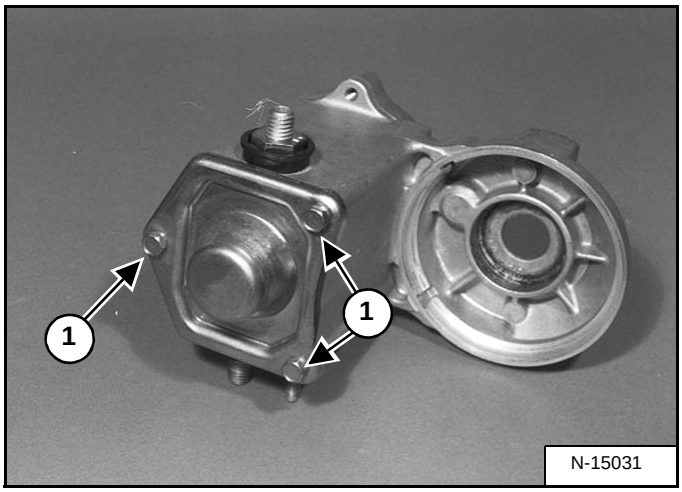
Figure 50-40-24



Remove the spring (Item 1) **[Figure 50-40-24]** from the magnetic switch.

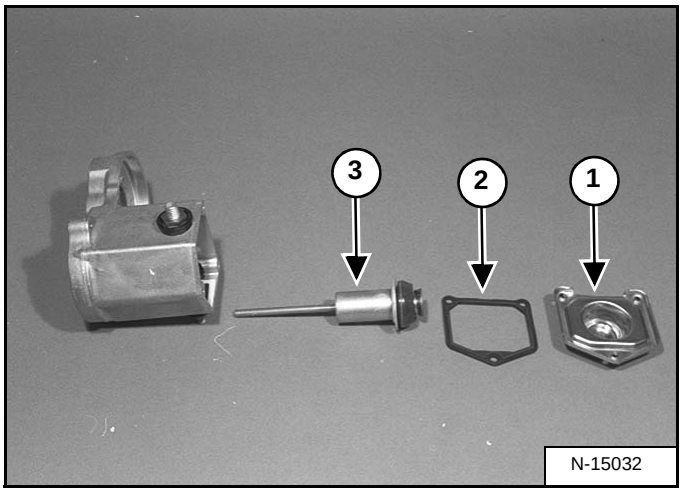
Disassembly (Cont'd)

Figure 50-40-25



Remove the bolts (Item 1) **[Figure 50-40-25]** from the magnetic switch cover.

Figure 50-40-26



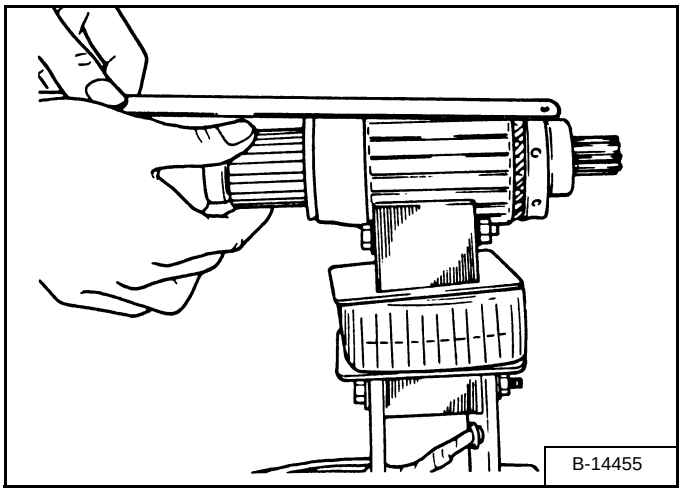
Remove the cover (Item 1), gasket (Item 2) and switch (Item 3) **[Figure 50-40-26]**.

Inspection And Repair

Inspect the brush cover for discoloration, indicating the starter has been overheated.

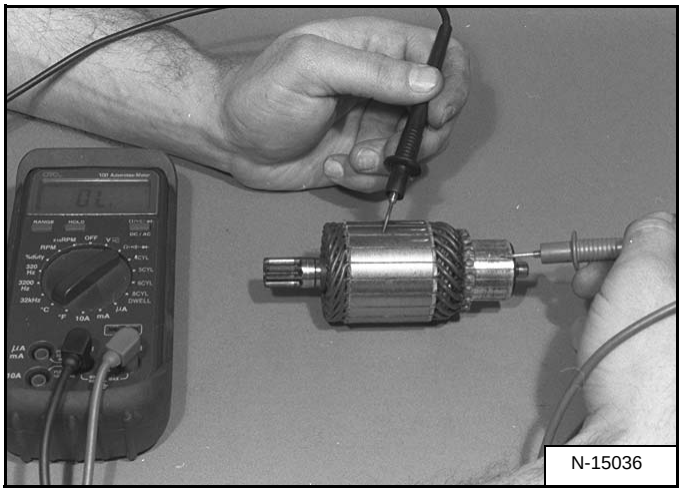
Inspect the pinion teeth for wear and damage.

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.

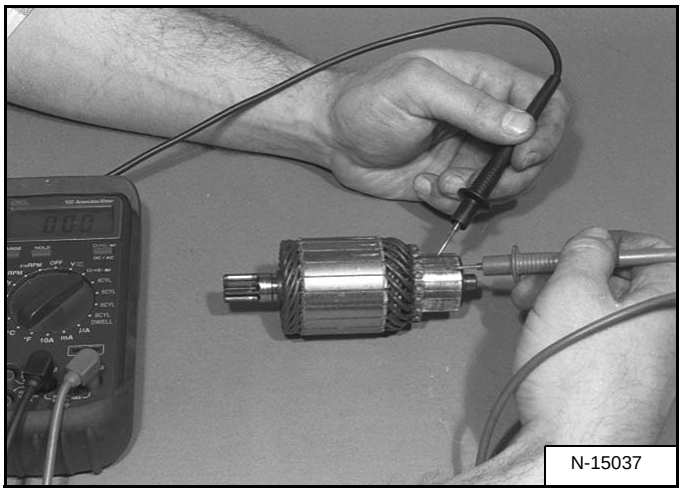
Figure 50-40-28



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.

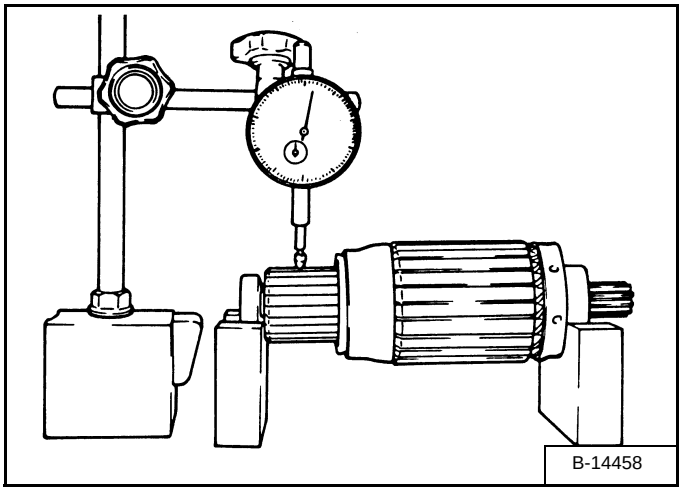
Inspection And Repair (Cont'd)

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

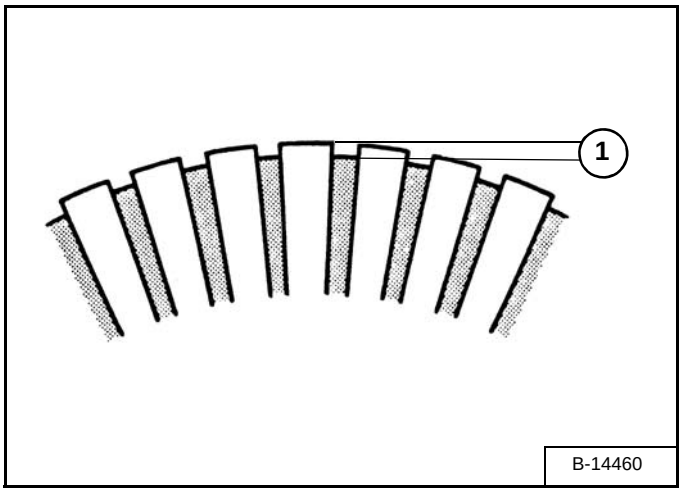


Commutator Run-Out Test: Check the commutator run-out as shown in **[Figure 50-40-30]**.

Service Limit - 0.020 in. (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 in. (0,2 mm)

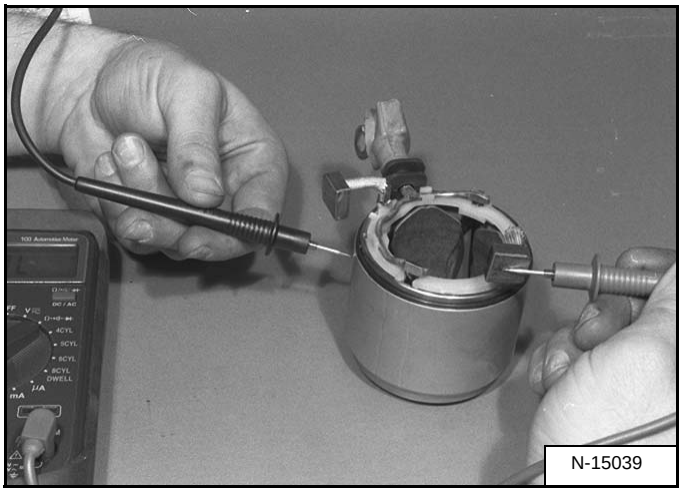
If it is worn, replace the armature.

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

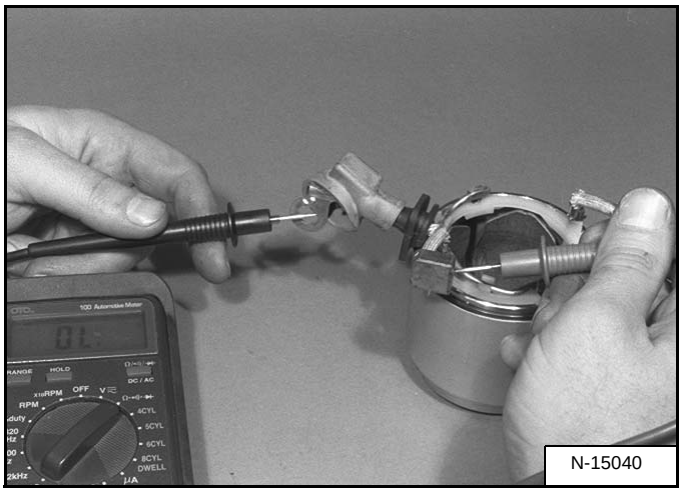


Field Winding Ground Test: Use a circuit tester, touch one probe to the field winding end of the brush and the other probe to the surface of the frame **[Figure 50-40-32]**. There should be no continuity. If there is continuity, the field windings are grounded.

Replace the field windings.

Inspection And Repair (Cont'd)

Figure 50-40-33



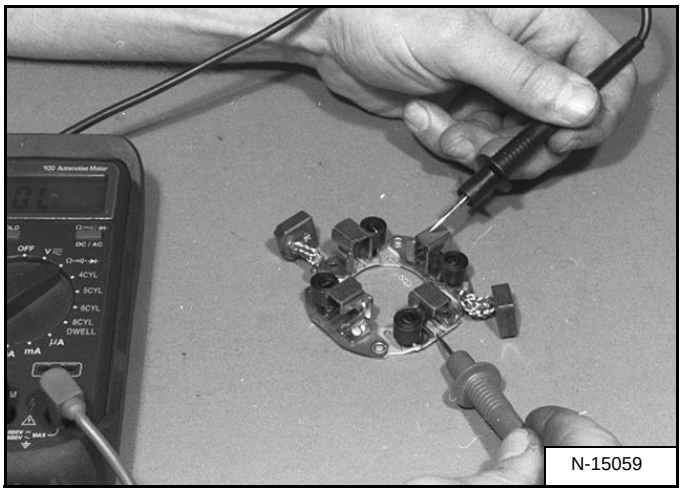
Field Windings Continuity Test: Use a circuit tester, touch one probe to the wire and the other probe to the brush **[Figure 50-40-33]**. There must be continuity. If there is no continuity, the field windings are open-circuited. Replace the yoke if the field windings have an open circuit.

Inspect the brushes for wear and damage.

Replace the brush holder or yoke assembly if the brushes are worn or damaged.

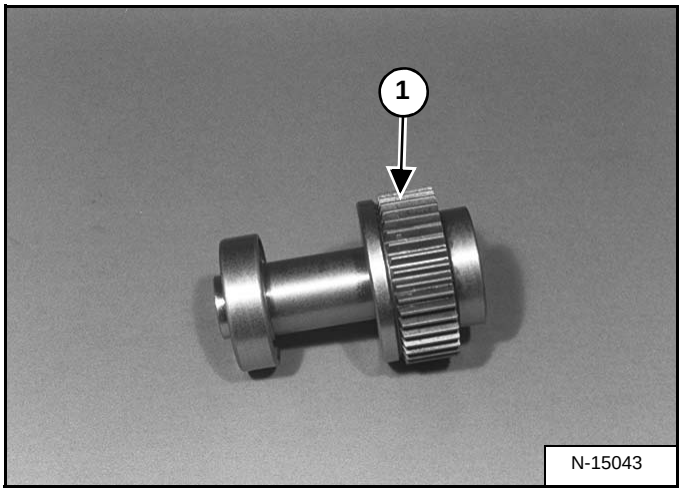
Check brush springs, for damage or rust. Replace as needed.

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

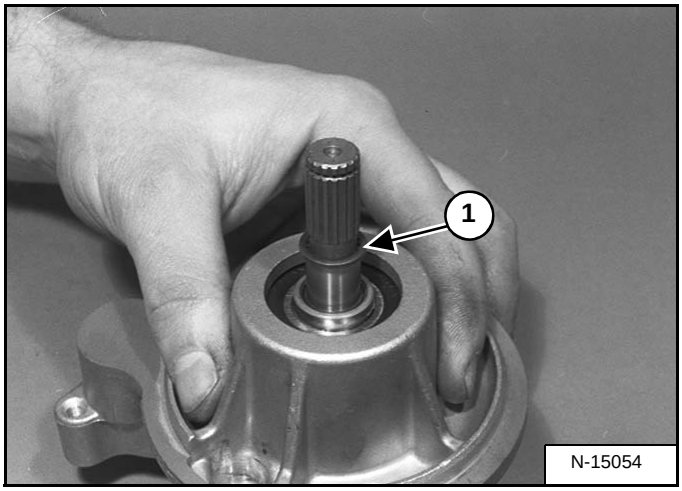


Inspect the over running clutch (Item 1) **[Figure 50-40-35]**, it must rotate freely in the direction of the starter rotation and locked in the opposite rotation.

Assembly

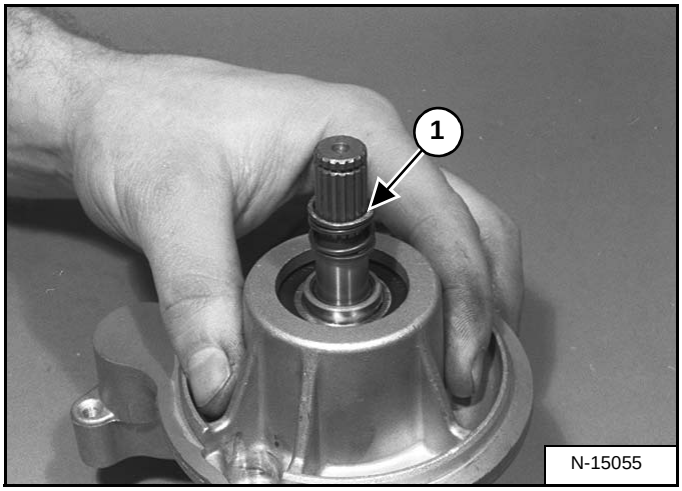
Place the starter drive on the bench, and press down on the starter drive housing.

Figure 50-40-36



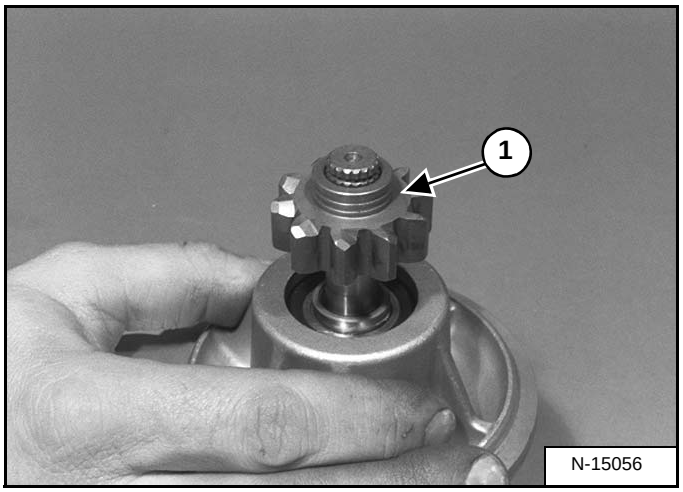
Install the spring seat (Item 1) **[Figure 50-40-36]** on the pinion shaft.

Figure 50-40-37



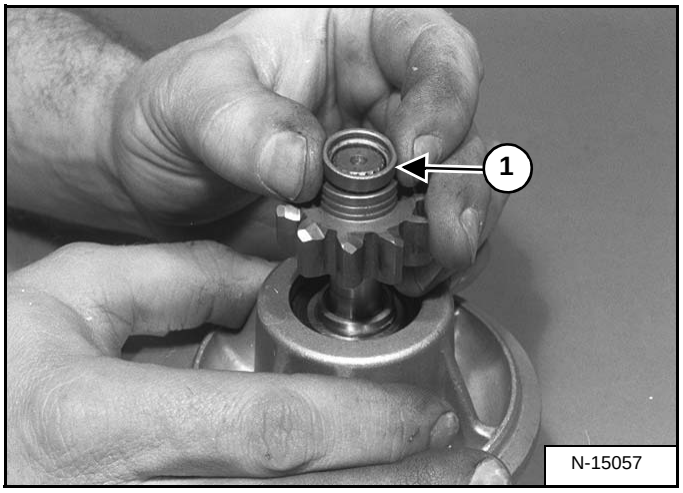
Install the spring (Item 1) **[Figure 50-40-37]**.

Figure 50-40-38



Install the pinion (Item 1) **[Figure 50-40-38]**.

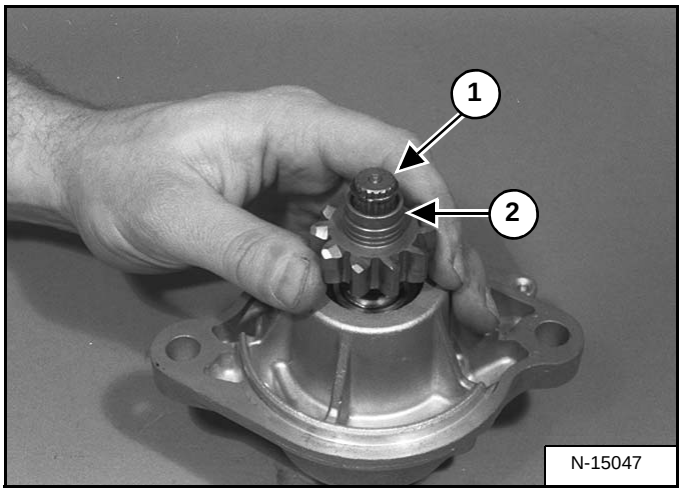
Figure 50-40-39



Install the collar (Item 1) **[Figure 50-40-39]**.

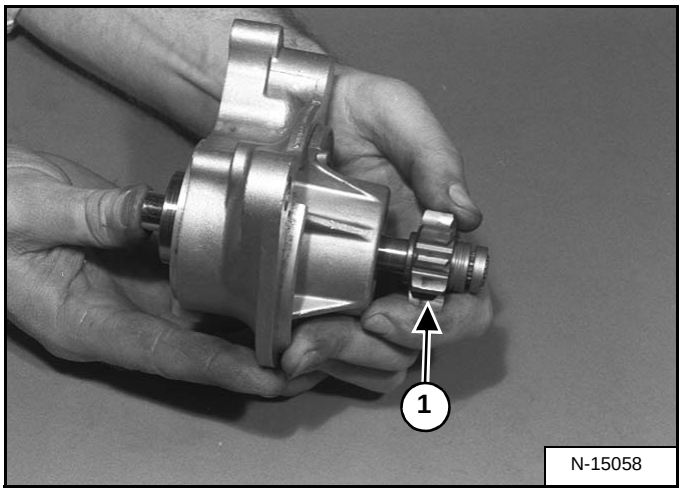
Assembly (Cont'd)

Figure 50-40-40



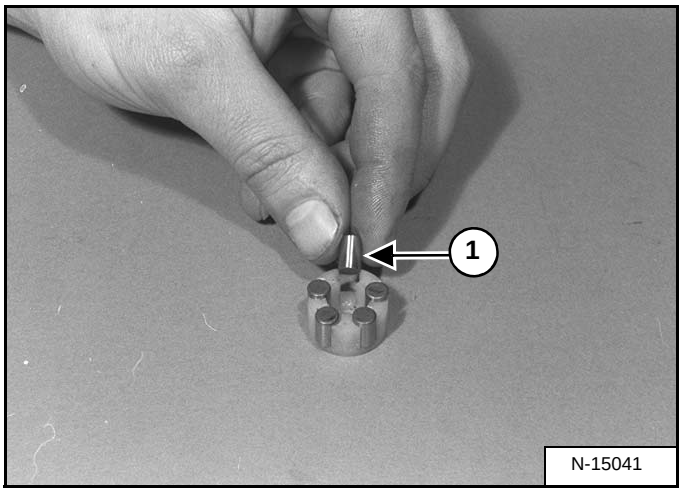
Install the snap ring (Item 1). Pull the collar (Item 2) **[Figure 50-40-40]** over the snap ring.

Figure 50-40-41



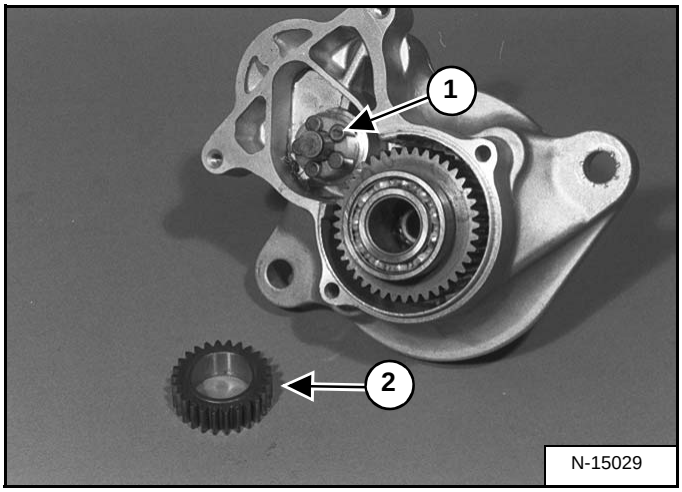
With the pinion shaft extended, extend and release the pinion (Item 1) **[Figure 50-40-41]**. The pinion must return to the fully retracted position.

Figure 50-40-42



Install the rollers (Item 1) **[Figure 50-40-42]** in the retainer.

Figure 50-40-43

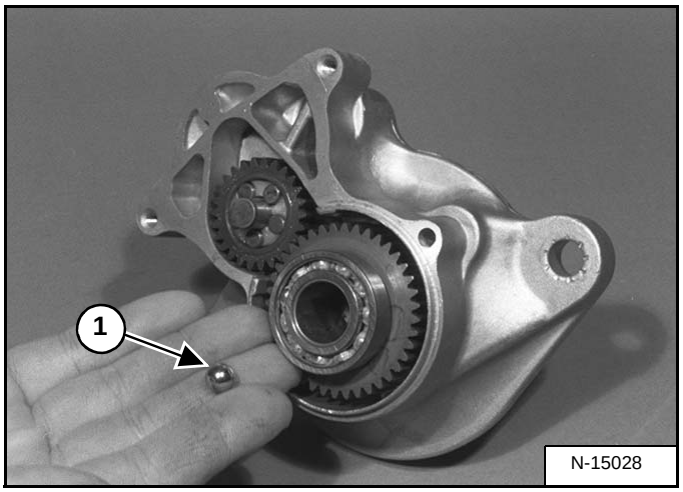


Install the roller/retainer assembly (Item 1) **[Figure 50-40-43]** on the starter housing.

Install the idler gear (Item 2) **[Figure 50-40-43]** over the roller/retainer assembly.

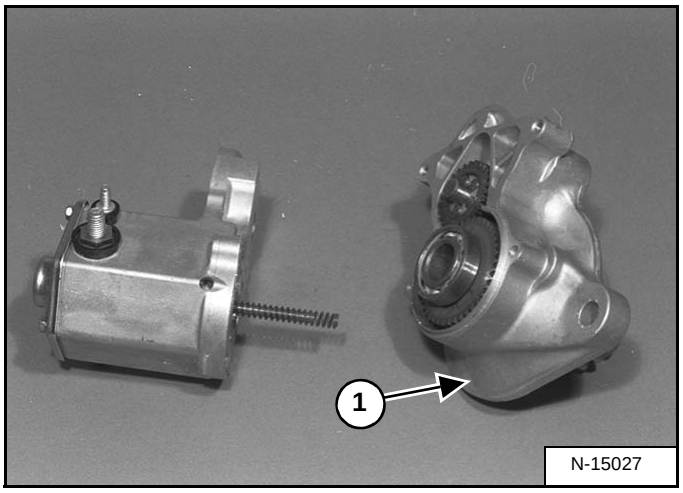
Assembly (Cont'd)

Figure 50-40-44



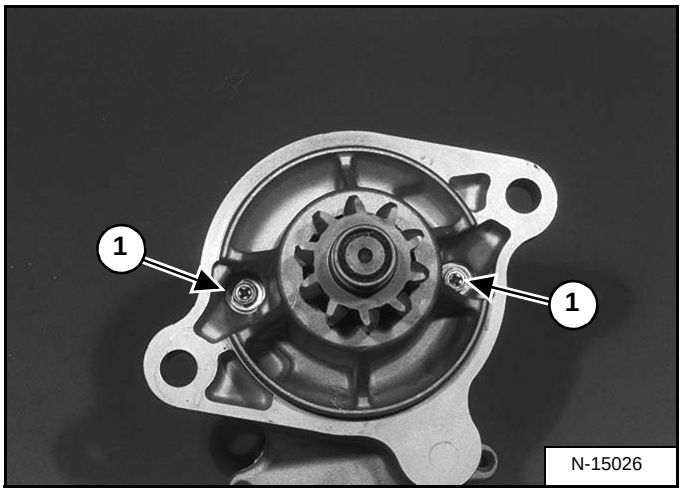
Install the ball (Item 1) **[Figure 50-40-44]** in the pinion shaft.

Figure 50-40-45



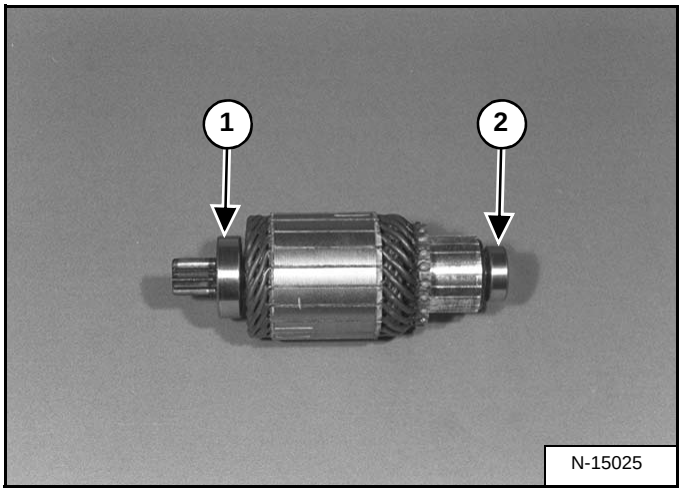
Install the starter drive (Item 1) **[Figure 50-40-45]** on the magnetic switch.

Figure 50-40-46



Install the two bolts (Item 1) **[Figure 50-40-46]**. Tighten the bolts to 60 - 104 in.-lb. (7 - 12 N•m) torque.

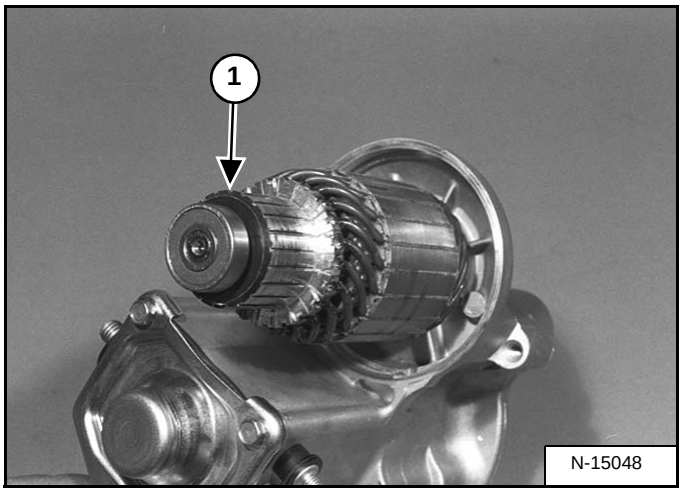
Figure 50-40-47



Install the bearings (Items 1 & 2) **[Figure 50-40-47]** on the armature.

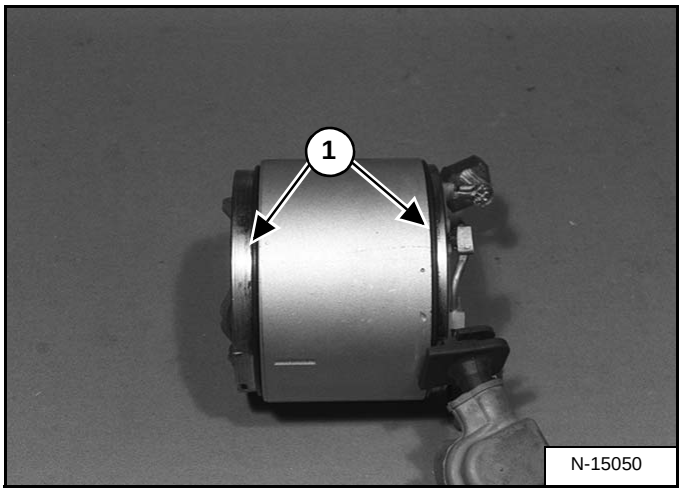
Assembly (Cont'd)

Figure 50-40-48



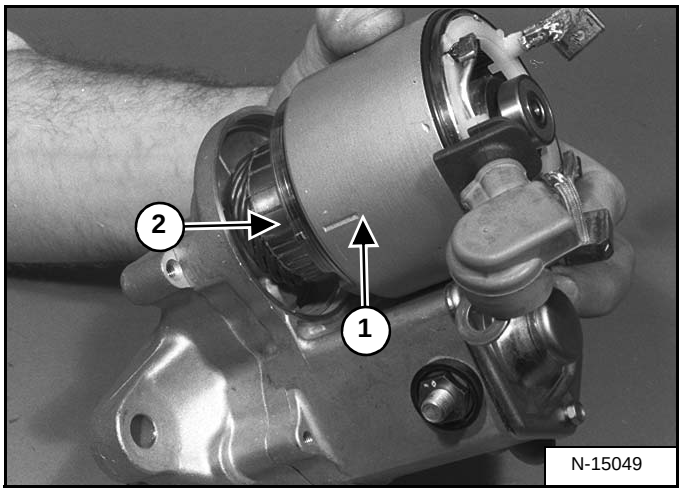
Install the armature (Item 1) **[Figure 50-40-48]** in the magnetic switch housing.

Figure 50-40-49



Install the new O-rings (Item 1) **[Figure 50-40-49]** on both ends of the frame.

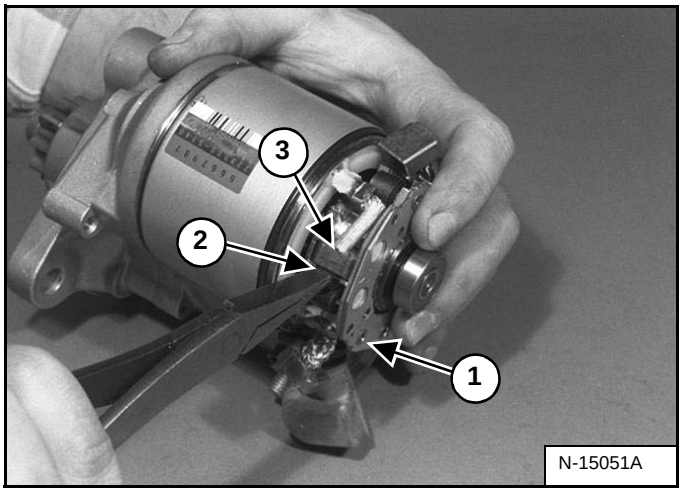
Figure 50-40-50



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

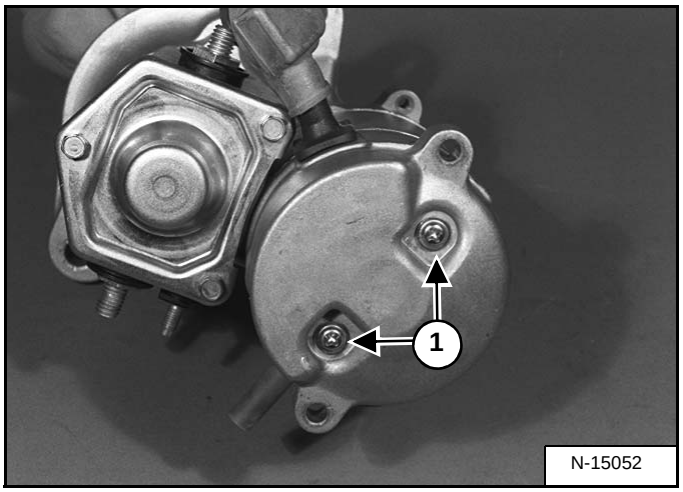


Install the brush holder (Item 1) **[Figure 50-40-51]** on the armature.

Using a needle nose pliers, pull the spring (Item 2) back and install the brushes (Item 3) **[Figure 50-40-51]**.

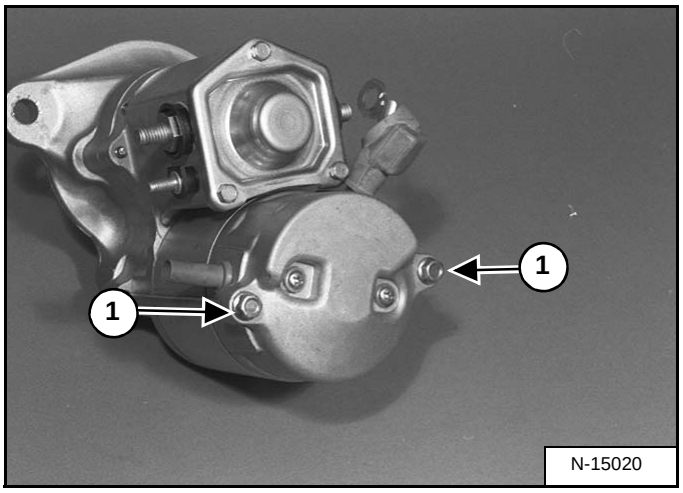
Assembly (Cont'd)

Figure 50-40-52



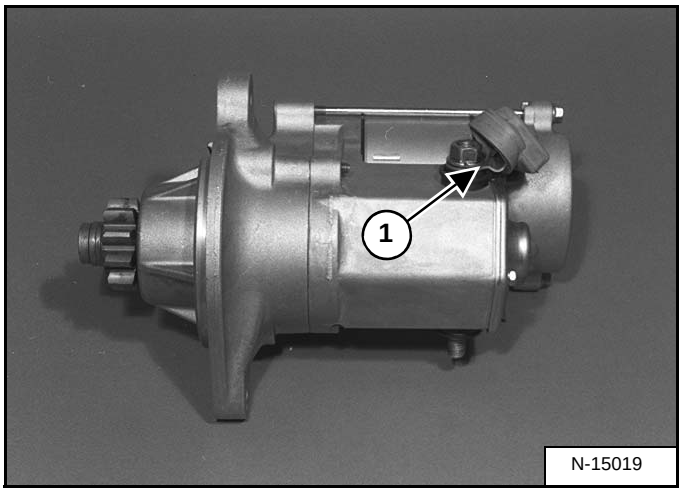
Install the brush cover and screws (Item 1) **[Figure 50-40-52]**.

Figure 50-40-53



Install the bolts (Item 1) **[Figure 50-40-53]**. Tighten the bolts to 60 - 104 in.-lb. (7 - 12 N•m) torque.

Figure 50-40-54



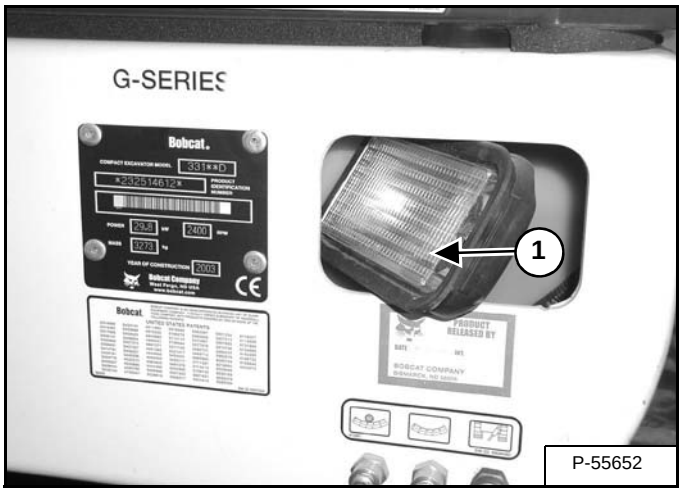
Install the cable (Item 1) **[Figure 50-40-54]** on the terminal. Tighten the terminal nut to 4 - 7 ft.-lb. (5 - 9 N•m) torque.


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LIGHTS

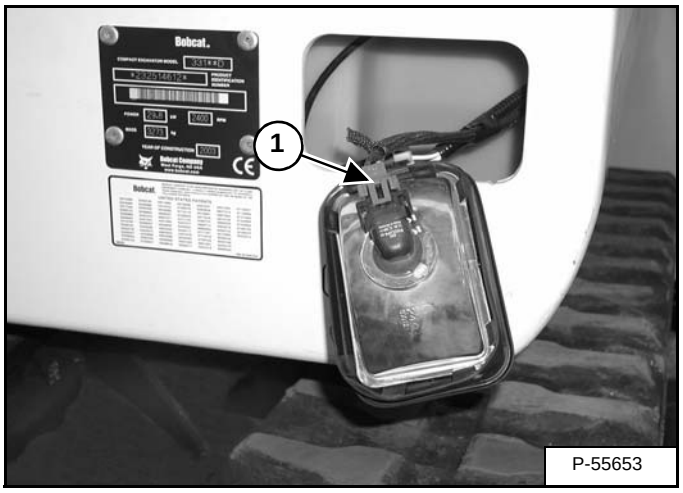
Removal And Installation

Figure 50-50-1



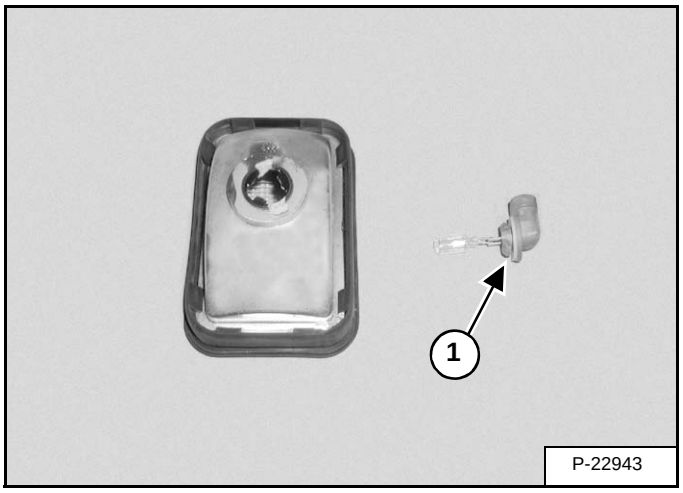
To remove the upperstructure light, pivot the light (Item 1) **[Figure 50-50-1]** back inside the frame.

Figure 50-50-2



Disconnect the wire harness (Item 1) **[Figure 50-50-2]**.

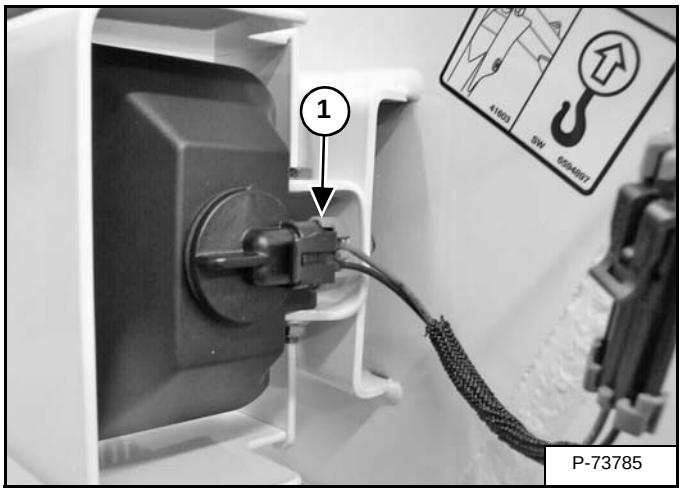
Figure 50-50-3



Remove the light bulb assembly (Item 1) **[Figure 50-50-3]** from the lens.

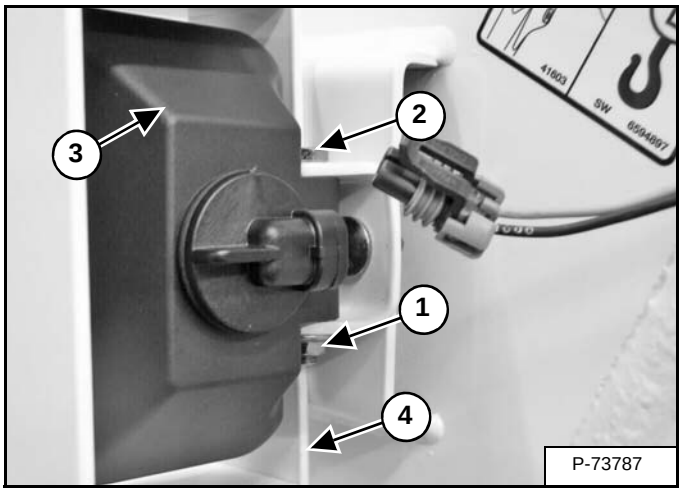
Boom Light Removal And Installation

Figure 50-50-4



Disconnect the wire harness (Item 1) **[Figure 50-50-4]**.

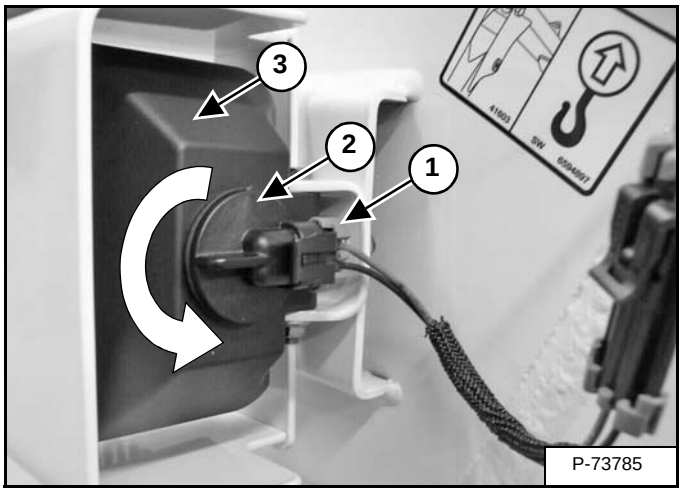
Figure 50-50-5



Remove the nut (Item 1) and bolt (Item 2). Remove the boom light (Item 3) from the boom light guard (Item 4) **[Figure 50-50-5]**.

Boom Light Bulb Replacement

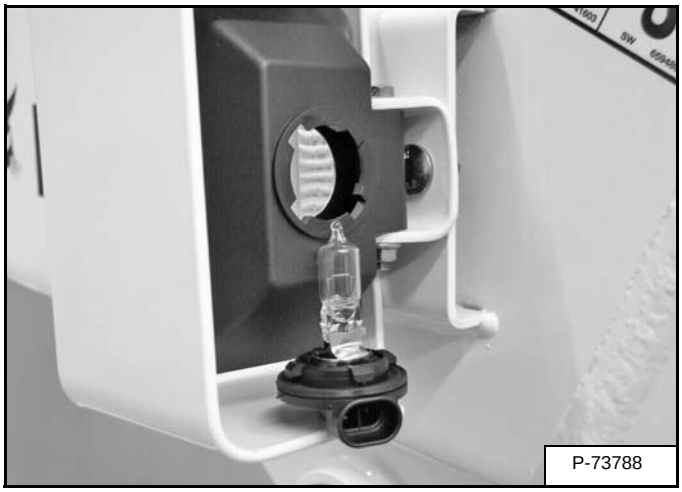
Figure 50-50-6



Disconnect the wire harness (Item 1) **[Figure 50-50-6]**.

Rotate light bulb assembly (Item 2) counterclockwise and pull straight out from the boom light (Item 3) **[Figure 50-50-6]**.

Figure 50-50-7

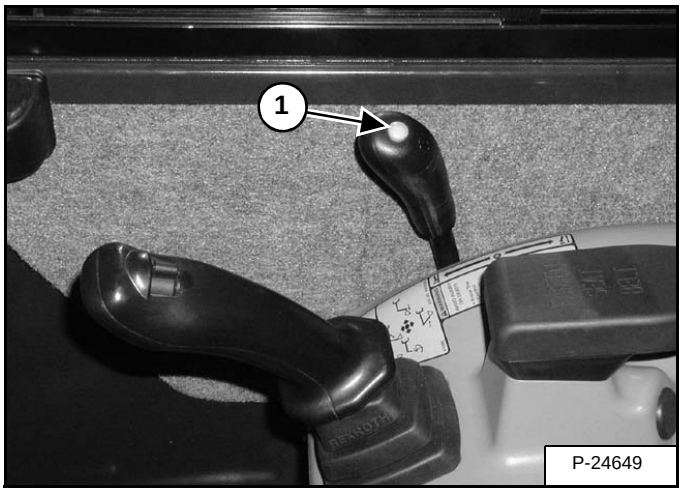


NOTE: Do not touch glass of halogen bulb with your fingers or allow bulb to come in contact with oils. If contaminated, the bulb should be cleaned with mild alcohol and clean cloth [Figure 50-50-7].

TWO SPEED SWITCH

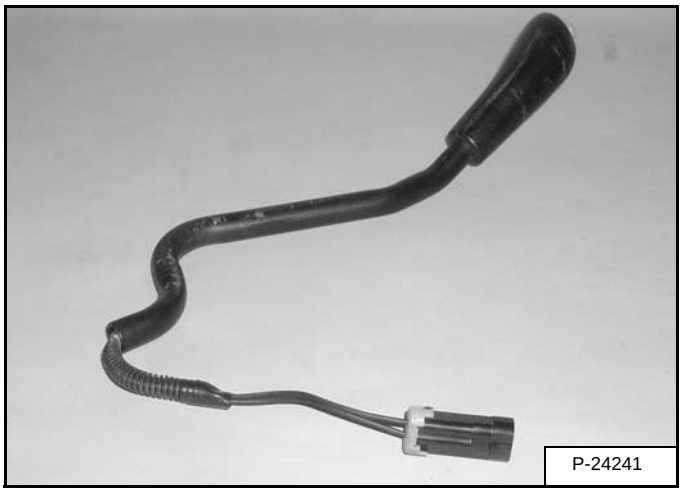
Removal And Installation

Figure 50-60-1



The two-speed switch (Item 1) **[Figure 50-60-1]** is located in the blade handle.

Figure 50-60-2



Remove the blade control lever from the excavator **[Figure 50-60-2]**. (See Lever Removal And Installation on Page 40-80-1.)

NOTE: If the two-speed switch needs to be replaced, the complete blade control lever must be replaced.


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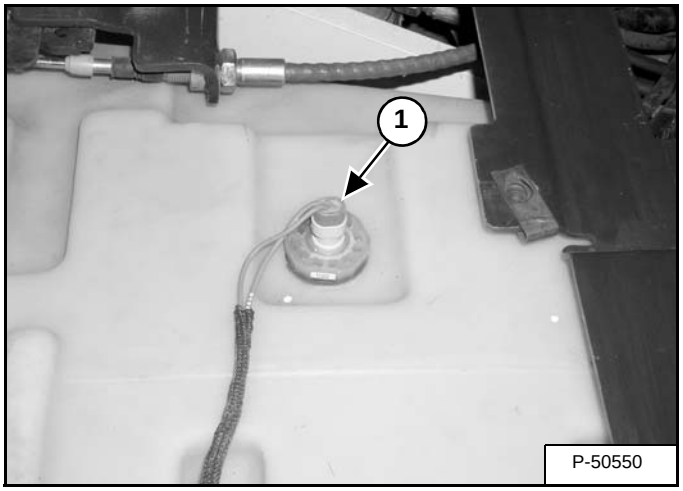
FUEL LEVEL SENDER

Removal And Installation

Remove the negative battery cable. (See Removing And Installing The Battery on Page 50-20-2.)

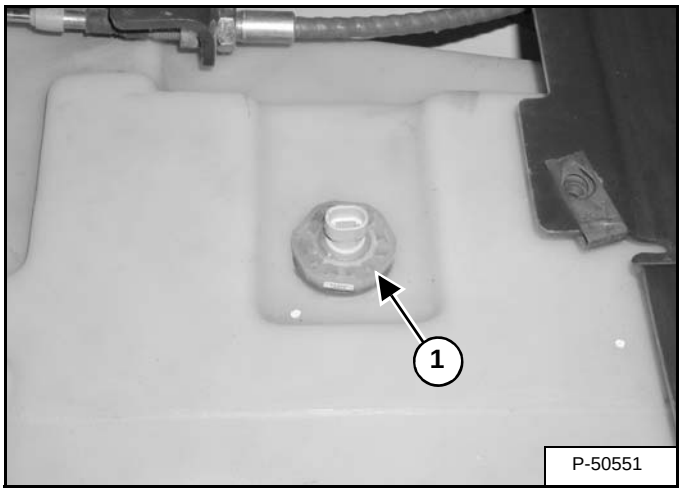
Remove the floor mat and floor plate. (Removal And Installation (Canopy Equipped Excavators) on Page 40-110-1 or Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

Figure 50-70-1



Disconnect the harness connector (Item 1) **[Figure 50-70-1]** from the fuel sender.

Figure 50-70-2

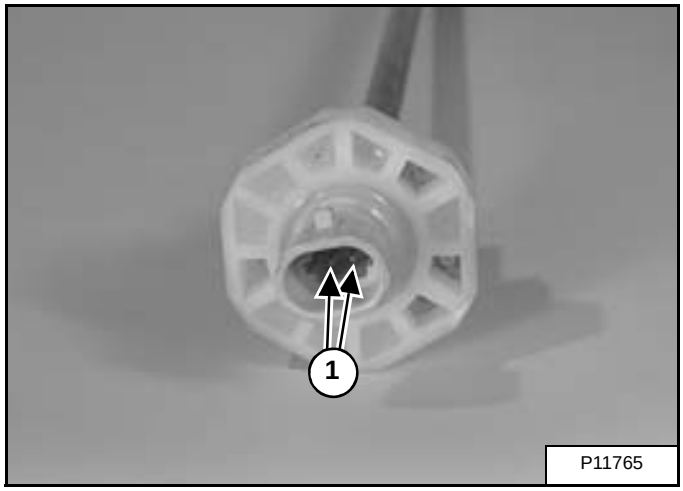


Remove the fuel sender (Item 1) **[Figure 50-70-2]**. The sender threads into the tank, use a wrench to remove the sender.

Testing

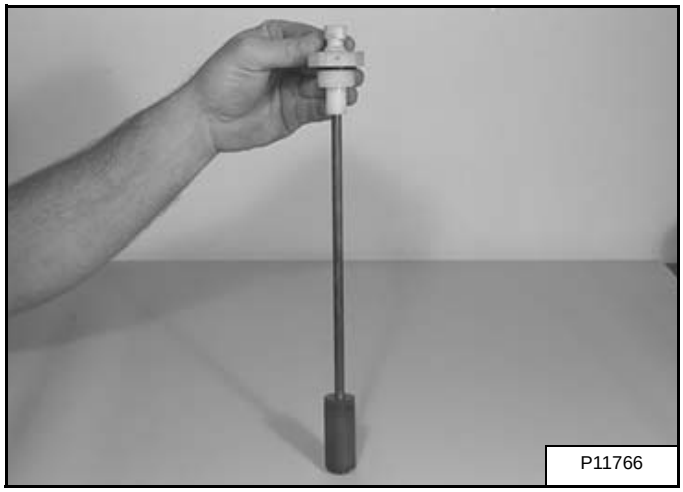
Use an ohmmeter to check the resistance of the fuel sender.

Figure 50-70-3



Insert one of the ohm tester leads into each of the fuel sender electrical connectors (Item 1) **[Figure 50-70-3]** in the end of the fuel sender.

Figure 50-70-4



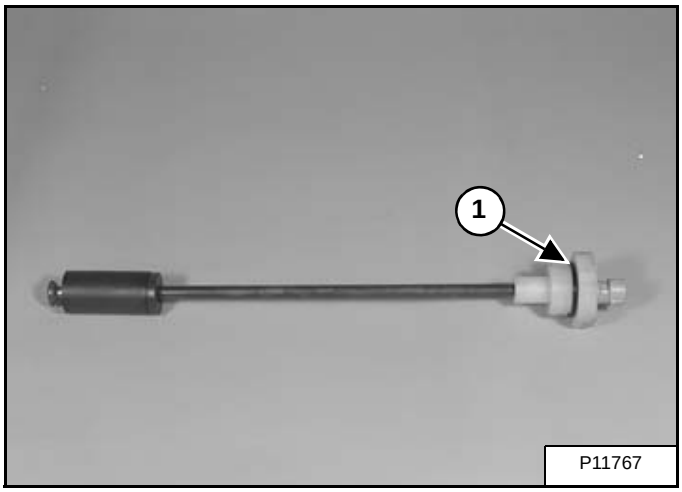
With the fuel sender in the position shown **[Figure 50-70-4]**, read the ohms in the empty position. Slide the float upwards and the ohm reading will decrease. See resistance chart below.

The resistance should read as follows:

FULL: 15-35 Ohms.
HALF: 82-97 Ohms.
EMPTY: 230-250 Ohms.

Testing (Cont'd)

Figure 50-70-5



Inspect the O-ring (Item 1) **[Figure 50-70-5]** and replace as needed

DIAGNOSTICS SERVICE CODE

Number Codes List

CODE		CODE	
02-16	Hydraulic charge filter not connected	20-02	Two speed output error ON
02-17	Hydraulic charge filter plugged	20-03	Two speed output error OFF
03-09	Battery voltage low	21-02	Glow plug output error ON
03-10	Battery voltage high	21-03	Glow plug output error OFF
03-11	Battery voltage extremely high		
03-14	Battery voltage extremely low	22-02	Starter relay output error ON
03-22	Battery voltage out of range low	22-03	Starter relay output error OFF
04-14	Oil pressure extremely low	26-02	Front base output error ON
04-15	Oil pressure shutdown level	26-03	Front base output error OFF
05-09	Hydraulic charge pressure low	27-02	Front rod output error ON
05-14	Hydraulic charge pressure extremely low	27-03	Front rod output error OFF
05-15	Hydraulic charge pressure shutdown level		
05-21	Hydraulic charge pressure out of range high	28-02	Diverter output error ON
05-22	Hydraulic charge pressure out of range low	28-03	Diverter output error OFF
06-10	Engine speed high	30-28	Watch dog failure
06-11	Engine speed extremely high		
06-15	Engine speed shutdown level	31-28	Recovery mode failure
06-18	Engine speed out of range high		
		33-23	Controller not calibrated
07-10	Hydraulic oil temperature high		
07-11	Hydraulic oil temperature extremely high		
07-15	Hydraulic oil temperature shutdown level	60-21	Sec. aux. thumbswitch out of range high
07-21	Hydraulic oil temperature out of range high	60-22	Sec. aux. thumbswitch out of range low
07-22	Hydraulic oil temperature out of range low	60-23	Sec. aux. thumbswitch not calibrated
08-10	Engine coolant temperature high	62-04	Load moment monitoring in error
08-11	Engine coolant temperature extremely high		
08-15	Engine coolant temperature shutdown level	63-05	Work group/travel console sensor
08-21	Engine coolant temperature out of range high	63-06	Work group/travel console sensor
08-22	Engine coolant temperature out of range low		
		64-05	Switched power/acc. relay short to battery
09-09	Fuel level low	64-06	Switched power/acc. relay short to ground
09-21	Fuel level out of range high	64-07	Switched power/acc. relay open circuit
09-22	Fuel level out of range low		
		65-02	Work group/travel lockout solenoid error ON
12-21	Primary auxiliary PWM switch out of range high	65-03	Work group/travel lockout solenoid error OFF
12-22	Primary auxiliary PWM switch out of range low	65-05	Work group/travel lockout solenoid short to battery
12-23	Primary auxiliary PWM switch not calibrated	65-06	Work group/travel lockout solenoid short to ground
		65-07	Work group/travel lockout solenoid open circuit
13-05	Fuel shut-off hold solenoid short to battery		
13-06	Fuel shut-off hold solenoid short to ground	66-05	Travel solenoid short to battery
		66-06	Travel solenoid short to ground
14-02	Fuel shut-off hold solenoid short to batter		
14-03	Fuel shut-off hold solenoid short to ground		


Bobcat®

DELUXE INSTRUMENT PANEL SETUP

Passwords

All new machines with Deluxe Instrumentation arrive at Bobcat Dealerships with the panel in locked mode. This means that a password must be used to start the engine.

For security purposes, your dealer may change the password and also set it in the locked mode. Your dealer will provide you with the password.

Master Password:
A permanent, randomly selected password is set at the factory which cannot be changed. This password is used for service by the Bobcat dealer if the Owner Password is not known; or to change the Owner Password.

Owner Password:
There is only one Owner Password (**CodE 0**). It must be used to change the owner or operator passwords. (See Password Entry (For Starting And Operating The Machine) on Page 50-90-1.)

Operator Password:
There can be up to three operator Passwords (**CodE 1, CodE 2, CodE 3**). See below for changing the Operator Password.

Password Entry (For Starting And Operating The Machine)

Press ENTER CODE button (Item 1). The panel will become lighted and there will be two short beeps. **CodE** will appear on the LCD (Item 2) **[Figure 50-90-1]**.

NOTE: After you press ENTER CODE you have 40 seconds to use the keypad (Item 3) [Figure 50-90-1] to enter the password. (If more than 40 seconds is used, the process will abort and you will need to start over.

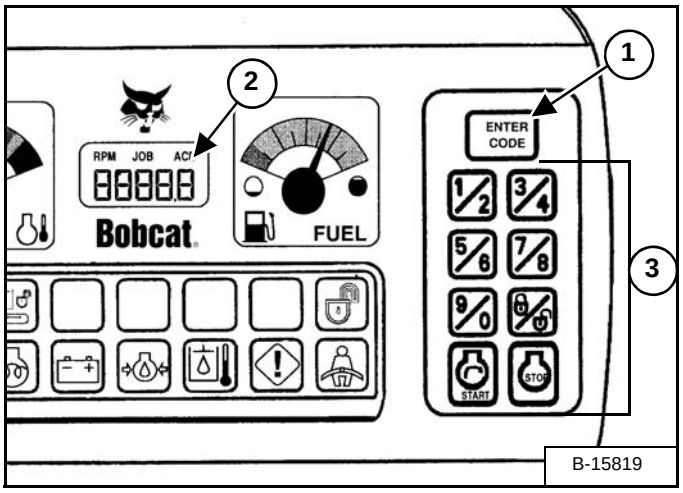
Enter the password. For each digit that you enter, a dash will appear on the LCD. If the password was entered correctly, there will be one long beep.

NOTE: If the password was incorrect there will be three short beeps and *Error* will appear on the LCD. Press the ENTER CODE button again and start over. After three failed attempts, you must wait three minutes to try again.

You are now ready to start and operate the machine.

If you will be changing passwords, do not start the engine. (See Changing The Owner or Operator Password on Page 50-90-1.)

Figure 50-90-1



Changing The Owner or Operator Password

Perform Password Entry at left, but do not start the engine.

Press and hold the ENTER CODE button (Item 1) for three seconds. CodE 1 will appear on the LCD (Item 2) **[Figure 50-90-1]**.

Press the ENTER CODE button until the desired Code (CodE 0, **CodE 1, CodE 2, CodE 3**) appears. CodE 0 is Owner Password. The other codes are Operator passwords. You now have 40 seconds to use the keypad (Item 3) **[Figure 50-90-1]** to enter each digit of a new four digit password.

Enter the new four digit password. After the fourth digit is entered, there will be two short beeps and **rPEAt** will appear.

Re-enter the new four digit password to verify. If the new passwords match, there will be two short beeps, **Code** will appear for one second and then the LCD will return to HOURMETER function.

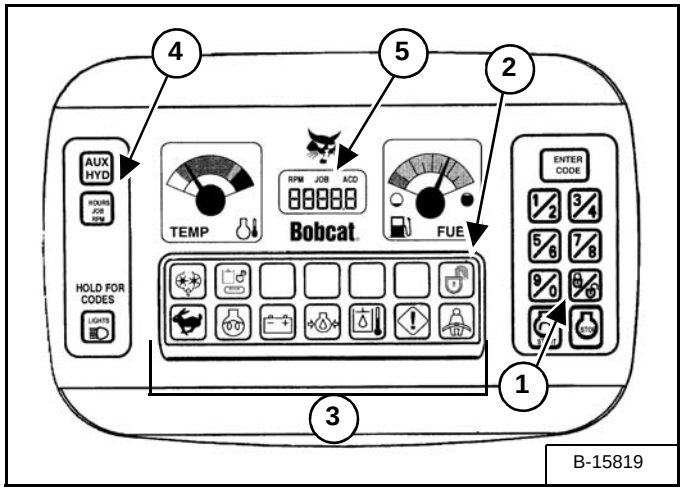
NOTE: If the new passwords do not match, there will be one long beep and Error will appear for one second and then the LCD will return to HOURMETER function.

Password Lockout Feature

This allows the operator to Unlock the password feature so that a password does not need to be used every time you start the engine.

Perform Password Entry (See Password Entry (For Starting And Operating The Machine) on Page 50-90-1.) The Password Entry can be performed with the engine off or with the engine running.

Figure 50-90-2



Press the Lock/Unlock button (Item 1) **[Figure 50-90-2]**. The LCD will continuously alternate from **UnLoc** to **CodE** for 1 second periods.

Perform Password Entry again.

UnLoc will appear in the LCD (Item 5), the Unlocked Icon (Item 2) will appear in the Icon Display Area (Item 3) **[Figure 50-90-2]** and there will be two short beeps.

To start an Unlocked system, press the ENTER CODE button and press the START button.

When you stop the engine with the system unlocked, you will hear one long beep every three seconds for 15 seconds.

To lock the system again, press the Lock/Unlock button (Item 1) **[Figure 50-90-2]** and enter the password during the 15 second period.

Job Clock

The JOB CLOCK can be set to record accumulated hours for a particular job.

Press and release the HOURS/JOB/RPM button (Item 4) until JOB light is ON at the top, center of the LCD (Item 5) **[Figure 50-90-2]**.

While the JOB light is ON, press and hold the HOURS/JOB/RPM button (Item 4) **[Figure 50-90-2]** until the LCD returns to zero.

This process will clear the accumulated hours and will begin recording JOB CLOCK time again. (This does not affect the HOURMETER which continues to record the total operating hours of the excavator.)

Pressing the HOURS/JOB/RPM button again or pressing the START button will return the LCD to HOURMETER function.

RPM

The LCD (Item 5) **[Figure 50-90-2]** can be set to display engine RPM.

With the engine running, press and release the HOURS/JOB/RPM button (Item 4) until RPM light is ON at the top, center of the LCD (Item 5) **[Figure 50-90-2]**.

Engine RPM is now displayed in the LCD.

Press the HOURS/JOB/RPM button (Item 4) **[Figure 50-90-2]** again the return to HOURMETER function.

ENGINE SERVICE

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Removal And Installation 60-30-1

ENGINE. 60-60-1
Removal And Installation 60-60-1

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- Camshaft Servicing 60-80-14
- Checking Engine Oil Pressure 60-80-19
- Crankshaft And Bearings Removal And Installation 60-80-25
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- Cylinder Bore, Checking 60-80-31
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- Timing Gearcase Cover Removal And Installation 60-80-10
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TROUBLESHOOTING 60-10-1
- Chart 60-10-1

TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION SPEC-01) UNLESS OTHERWISE SPECIFIED.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE AND STANDARD ITEMS MAY VARY.

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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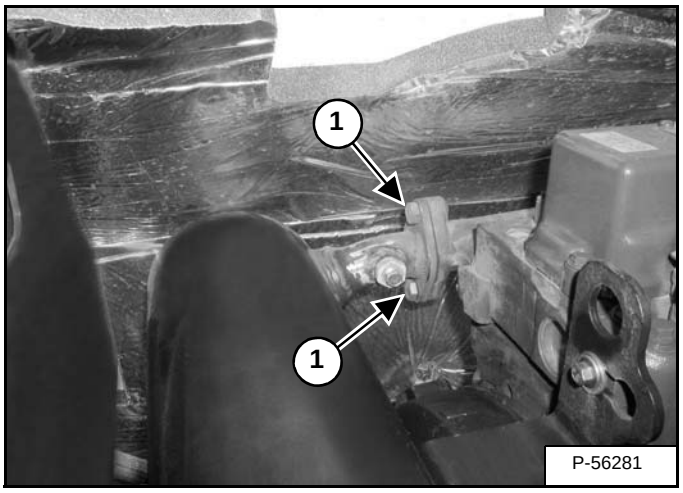
MUFFLER

Removal And Installation

Remove the air cleaner. (See Removal And Installation on Page 60-30-1.)

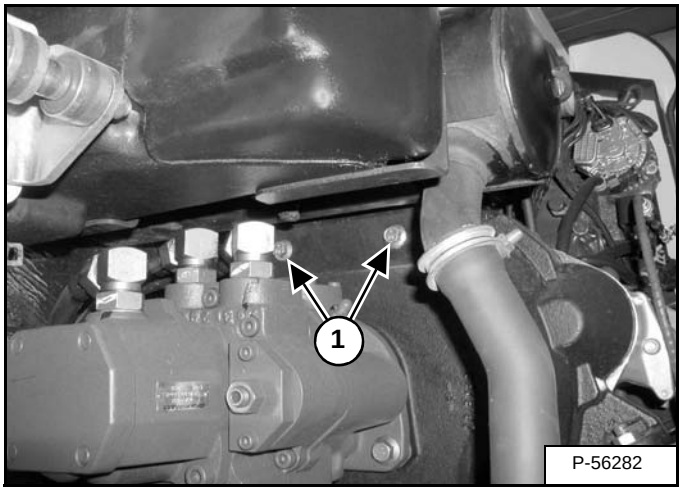
Open the tail gate.

Figure 60-20-1



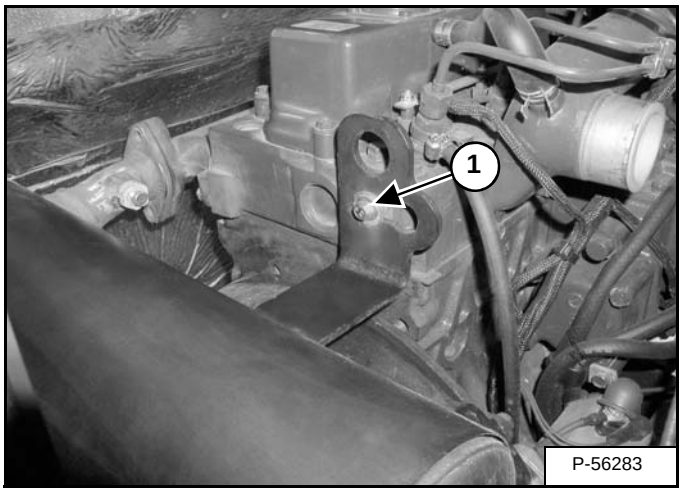
Remove the bolts (Item 1) **[Figure 60-20-1]**.

Figure 60-20-2



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

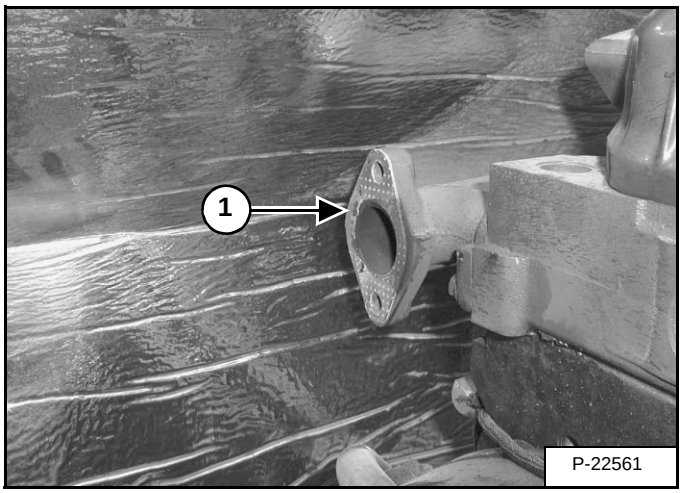
Figure 60-20-3



Remove the top bolt (Item 1) **[Figure 60-20-3]**.

Remove the muffler.

Figure 60-20-4



Remove the gasket (Item 1) **[Figure 60-20-4]** from the exhaust manifold.

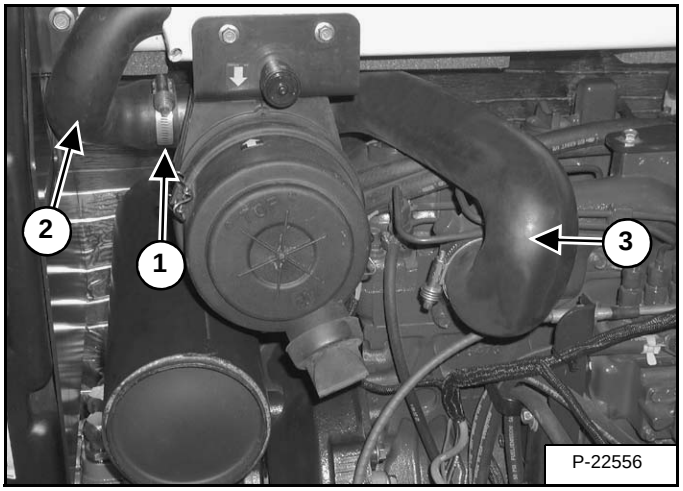

Bobcat®

AIR CLEANER

Removal And Installation

Open the tailgate.

Figure 60-30-1



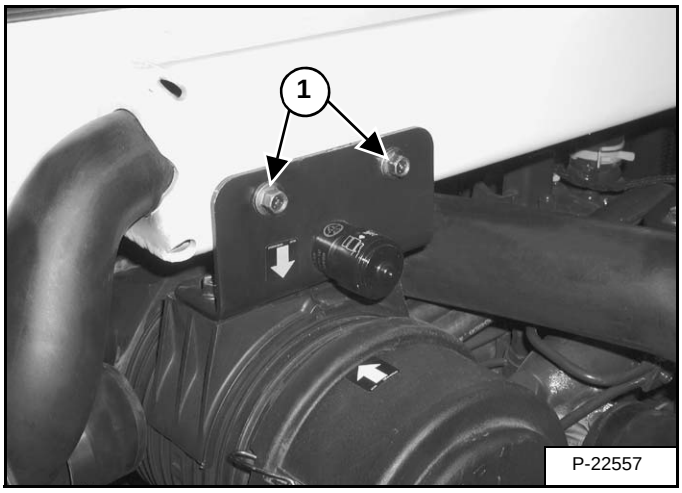
Loosen the hose clamp (Item 1) **[Figure 60-30-1]** on the air intake hoses.

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.


Bobcat®

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 10-70-3.)

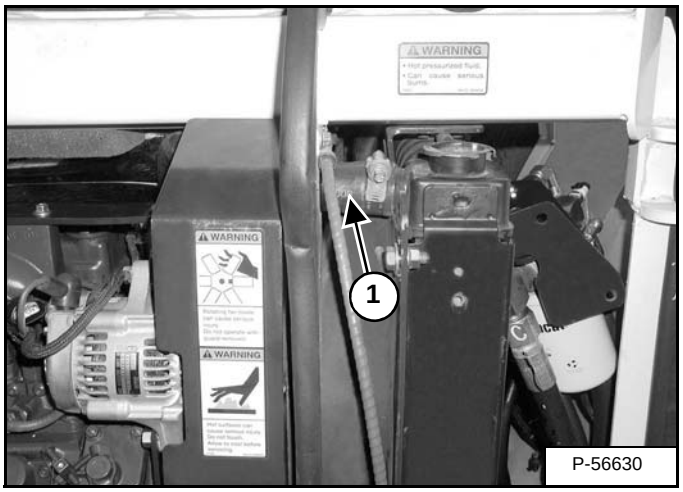
WARNING

AVOID BURNS

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

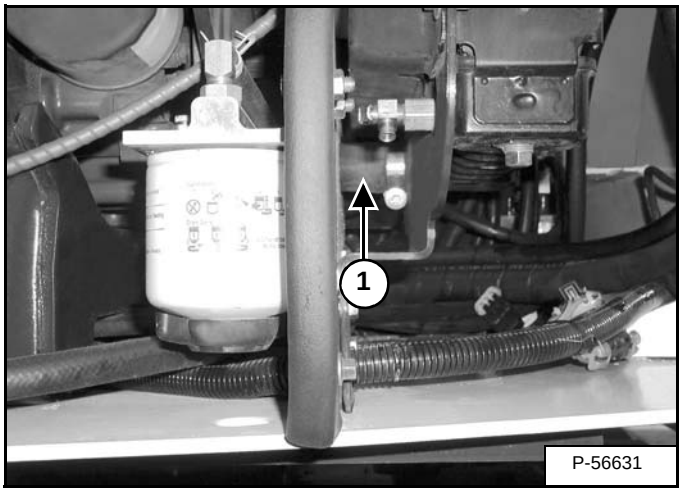
W-2070-1203

Figure 60-40-1



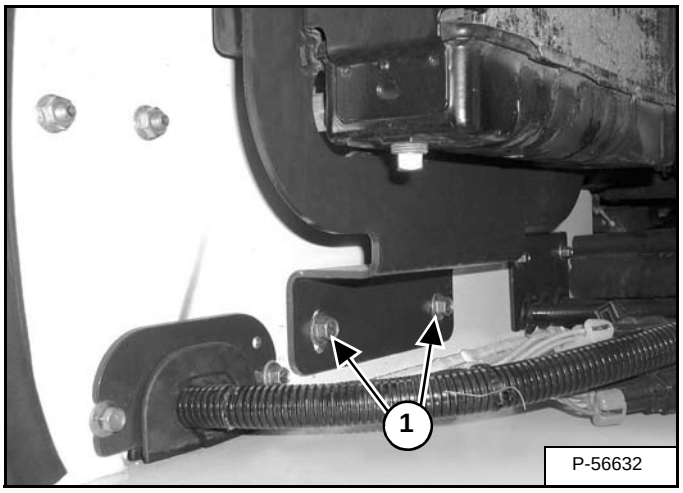
Remove the hose (Item 1) **[Figure 60-40-1]**.

Figure 60-40-2



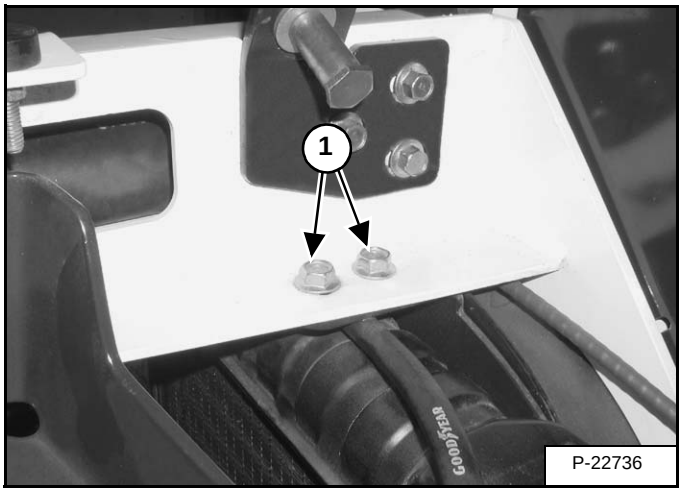
Remove the hose (Item 1) **[Figure 60-40-2]**.

Figure 60-40-3



Remove the bottom bolts and nuts (Item 1) **[Figure 60-40-3]**.

Figure 60-40-4

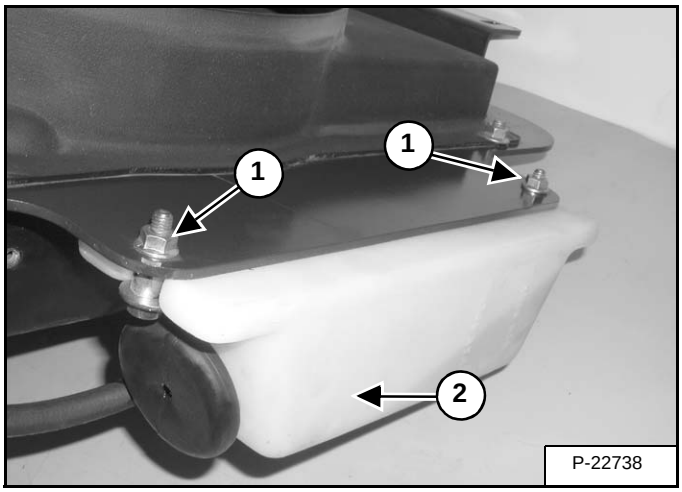


Remove the bolts (Item 1) **[Figure 60-40-4]**.

Remove the radiator, mount and shroud assembly from the excavator.

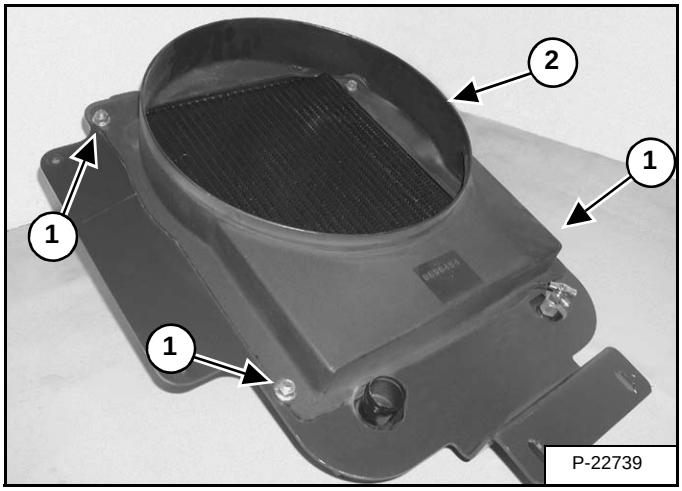
Removal And Installation (Cont'd)

Figure 60-40-5



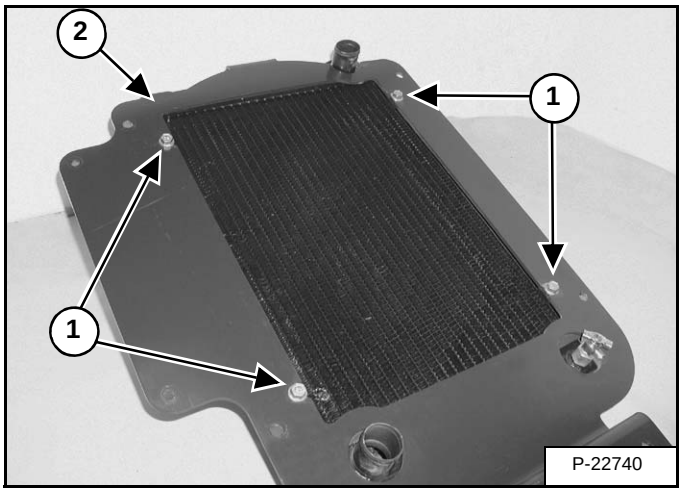
Remove the bolts, washers and spacers (Item 1) from the coolant recovery tank (Item 2) **[Figure 60-40-5]**. Remove the tank.

Figure 60-40-6



Remove the three bolts and nuts (Item 1). Remove the fan shroud (Item 2) **[Figure 60-40-6]**.

Figure 60-40-7



Remove the bolts (Item 1) **[Figure 60-40-7]**.

Remove the radiator from the mount (Item 2) **[Figure 60-40-7]**.

ENGINE COMPONENTS AND TESTING

Engine Compression Checking

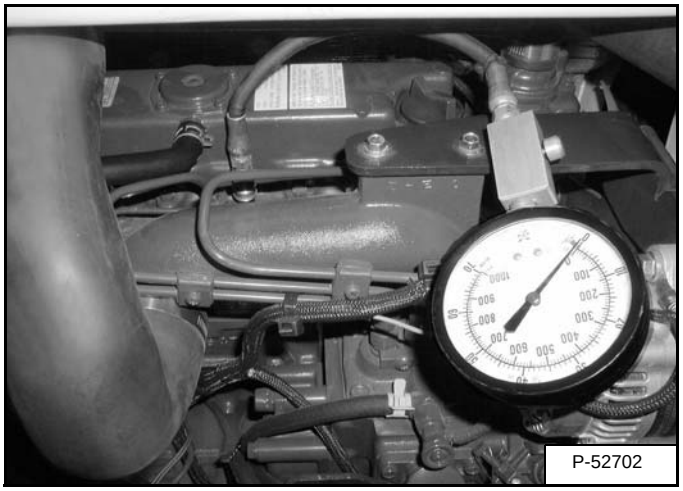
The tools listed will be needed to do the following procedure:

MEL10630 - Engine Compression Kit
MEL 1352 - Compression Adapter

The engine must be at operating temperature.

Remove the glow plugs. (See Glow Plugs Removal And Installation on Page 60-50-2.)

Figure 60-50-1



Install the correct compression adapter into the cylinder head **[Figure 60-50-1]**.

Connect the compression gauge **[Figure 60-50-1]**.

Make sure the speed control lever is at low engine idle.

Disconnect the fuel stop solenoid.

Crank the engine with the starter at 200-300 RPM.

Compression Pressure	470 - 540 PSI (32 - 37 Bar)
Allowable Limit (minimum)	370 PSI (26 Bar)

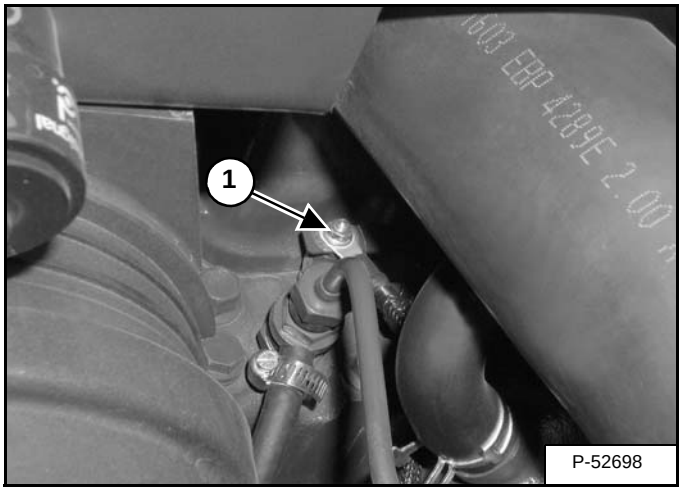
The compression must be no lower than the allowable limit, with no more than 10% variance among cylinders.

Connect the fuel stop solenoid.

Glow Plugs Removal And Installation

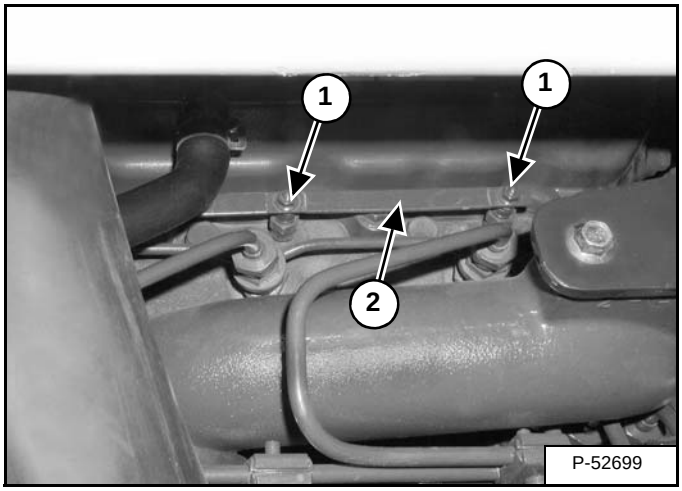
Disconnect the negative (-) cable from the battery.

Figure 60-50-2



Remove the nut and wire harness (Item 1) **[Figure 60-50-2]**.

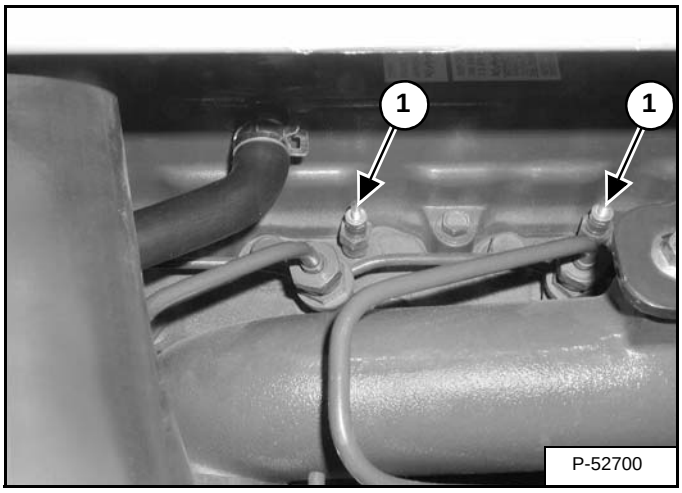
Figure 60-50-3



Remove the nut (Item 1) **[Figure 60-50-3]** from the three remaining glow plugs.

Remove the connecting strap (Item 2) **[Figure 60-50-3]** from the glow plugs.

Figure 60-50-4



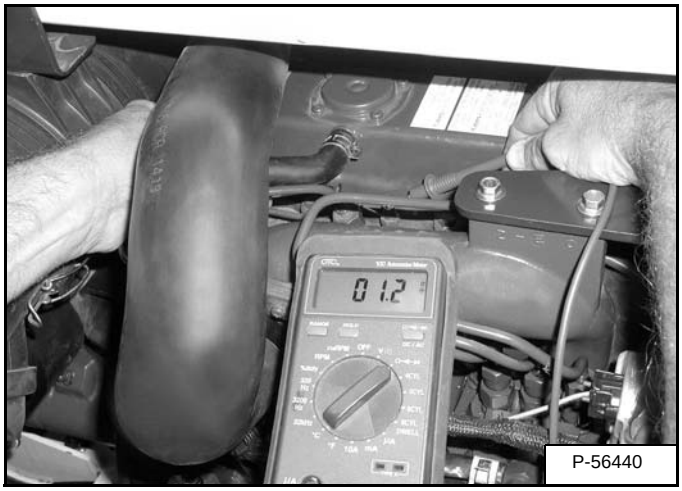
Remove the three glow plugs (Item 1) **[Figure 60-50-4]**.

Installation: Tighten the glow plugs to 15 - 18 ft.-lb. (20 - 24 N•m) torque.

Checking The Glow Plug

Disconnect the glow plug wire harness and connecting strap.

Figure 60-50-5



Use an ohmmeter to check the glow plugs **[Figure 60-50-5]**.

Touch one probe to the end of the glow plug and the other probe to the body of the glow plug.

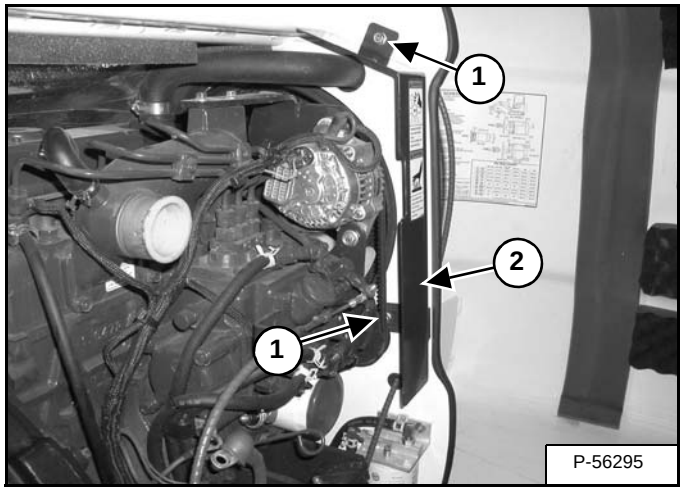
The reading should be approximately 1.0 ohms. If the resistance is infinite, the coil of the glow plug is broken. If the resistance is 0 the glow plug is short circuited.

Repeat the procedure for each glow plug.

Fuel Shut-Off Solenoid Removal And Installation

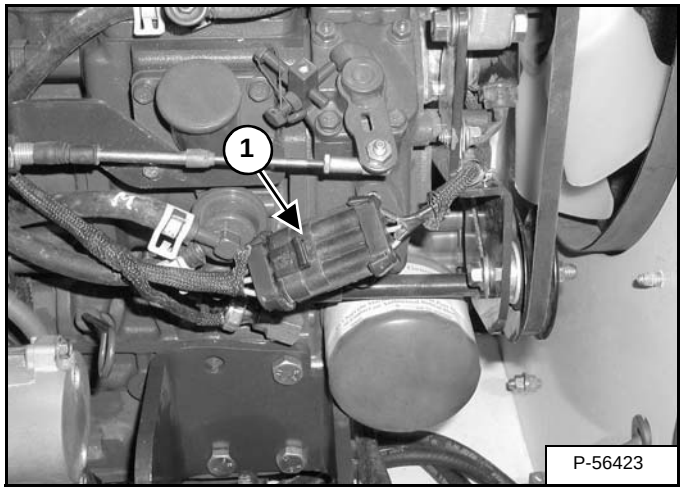
Disconnect the glow plug wire harness and connecting strap.

Figure 60-50-6



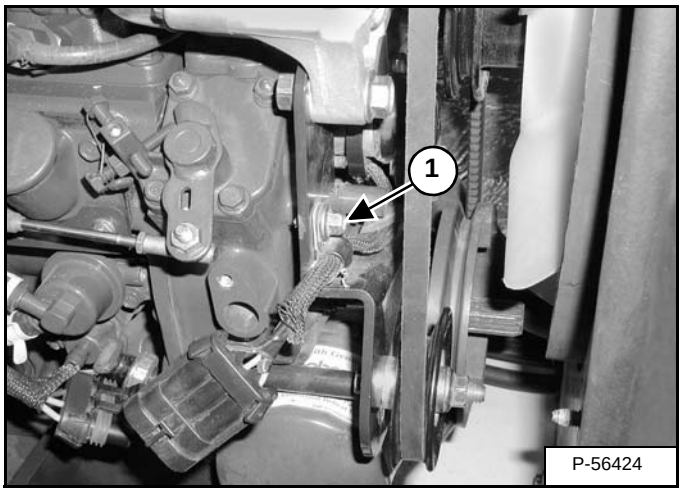
Remove the bolts (Item 1) and guard (Item 2) **[Figure 60-50-6]**.

Figure 60-50-7



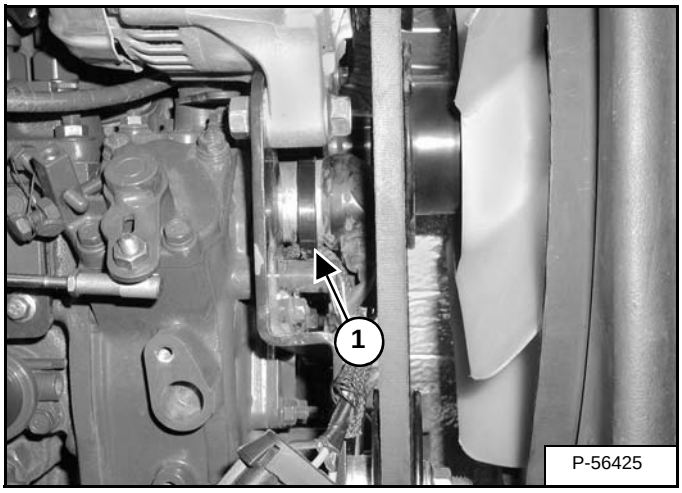
Disconnect the wire harness (Item 1) **[Figure 60-50-7]**.

Figure 60-50-8



Remove the bolt (Item 1) **[Figure 60-50-8]**.

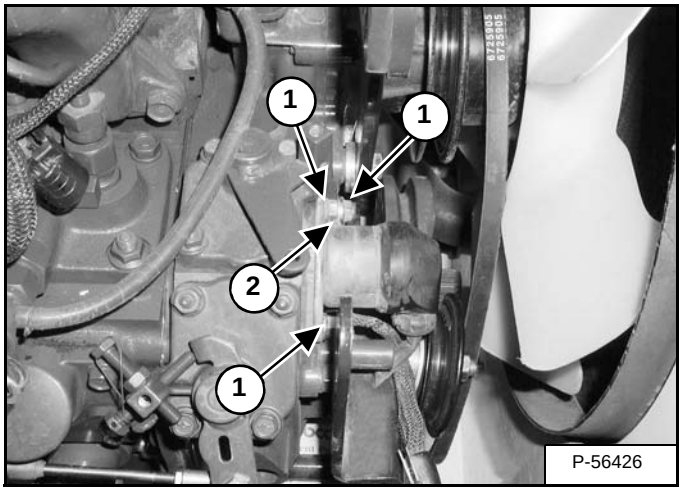
Figure 60-50-9



Remove the tie strap (Item 1) **[Figure 60-50-9]**.

Fuel Shut-Off Solenoid Removal And Installation (Cont'd)

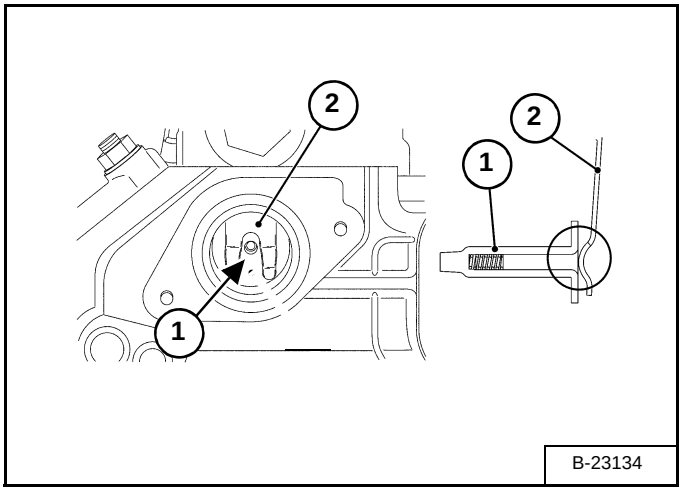
Figure 60-50-10



Remove the nuts (Item 1) and wire harness (Item 2) **[Figure 60-50-10]**.

NOTE: The alternator is shown removed for photo clarity.

Figure 60-50-11



Installation: The guide (Item 1) on the fuel shut-off solenoid must contact the boost lever (Item 2) **[Figure 60-50-11]**.

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

AVOID INJURY OR DEATH

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

W-2072-0807

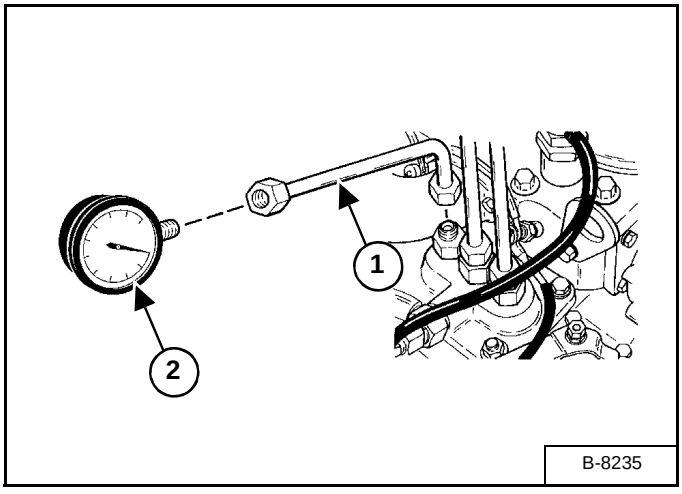
The tools listed will be needed to do the following procedure:

MEL 1237 - Adapter Fuel Line
MEL 1173-1 Pressure Gauge

To check the discharge pressure at the fuel injection pump, use the following procedure:

Disconnect a high pressure fuel line from the injection pump. Loosen the other end of the same fuel line so it can be turned away from the fitting.

Figure 60-50-12



Connect the adapter fuel line (Item 1) to the fitting and connect the pressure gauge (Item 2) **[Figure 60-50-12]**.

Move the speed control lever to the high engine idle position.

Turn the flywheel to increase the pressure. If the pressure can not reach the allowable limit, replace the injection pump assembly.

Fuel Tightness of Pump Element Allowable Limit	1991 PSI (137,3 Bar)

With the speed control lever at the low engine idle position, turn the flywheel until the pressure is at 1991 PSI (187 - 201 Bar).

Turn the flywheel back approximately one-half turn. Keep the flywheel at this position, and measure the time it takes the pressure to decrease from 1991-1849 PSI (137.3 - 127.5 Bar).

Fuel Tightness of Delivery Valve Allowable Limit	5 Seconds

Fuel Injection Pump Removal And Installation

IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

I-2029-0289

IMPORTANT

Do not attempt to maintain or adjust unless you are trained and have the correct equipment.

I-2028-0289

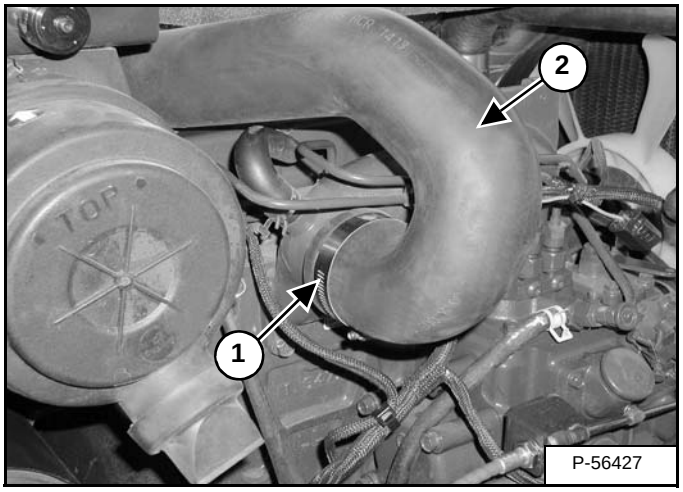
Disconnect the negative (-) cable from the battery.

Remove the alternator. (See Removal And Installation on Page 50-30-3.)

Remove the alternator mount. (See Bracket Removal And Installation on Page 50-30-4.)

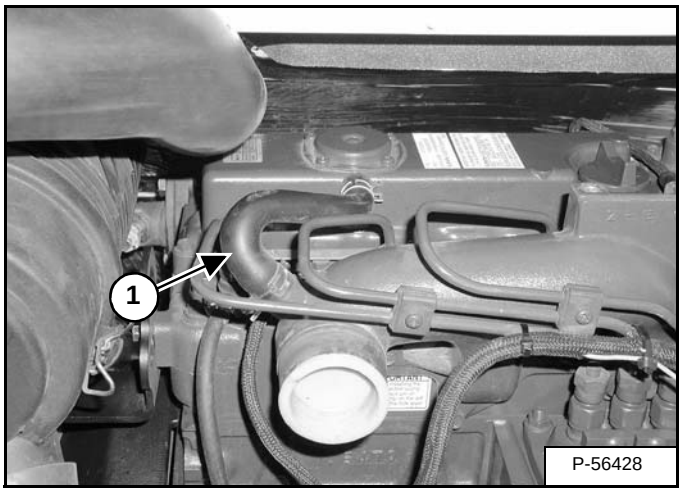
Clean around the injection pump.

Figure 60-50-13



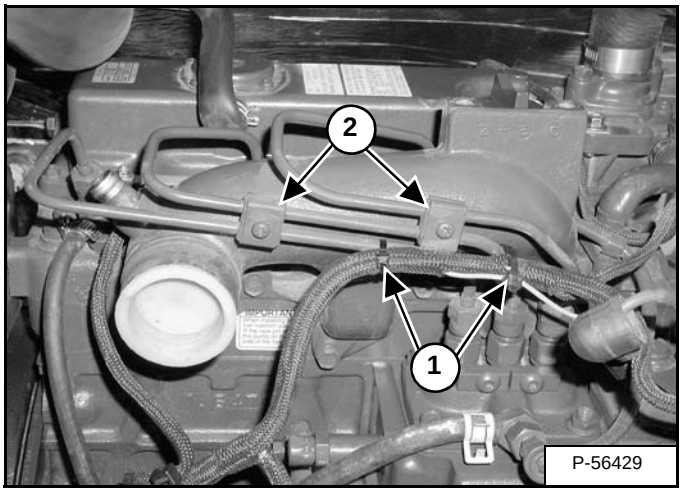
Loosen the clamp (Item 1). Remove the hose (Item 2) **[Figure 60-50-13]**.

Figure 60-50-14



Remove the hose (Item 1) **[Figure 60-50-14]**.

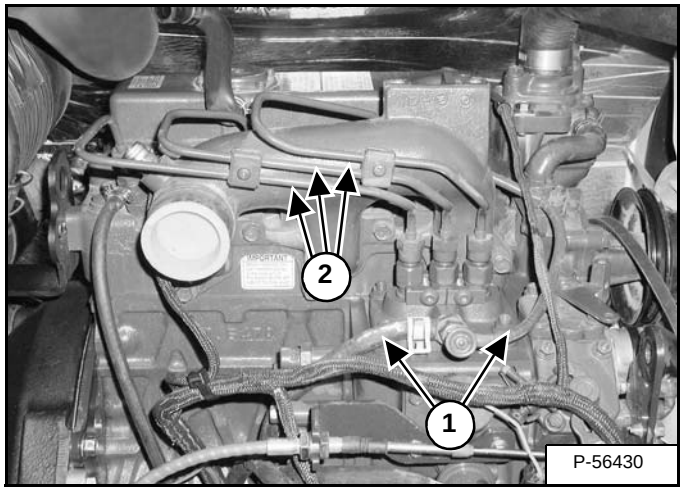
Figure 60-50-15



Remove the tie straps (Item 1) and loosen the clamps (Item 2) **[Figure 60-50-15]**.

Fuel Injection Pump Removal And Installation (Cont'd)

Figure 60-50-16

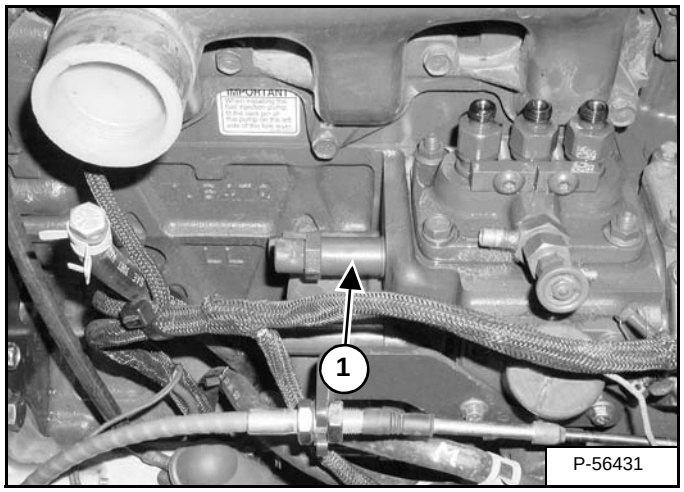


Remove the fuel lines (Item 1) **[Figure 60-50-16]**.

Disconnect the high pressure fuel lines (Item 2) **[Figure 60-50-16]** from the fuel injectors and fuel injection pump.

Remove the fuel shut-off solenoid. (See Fuel Shut-Off Solenoid Removal And Installation on Page 60-50-4.)

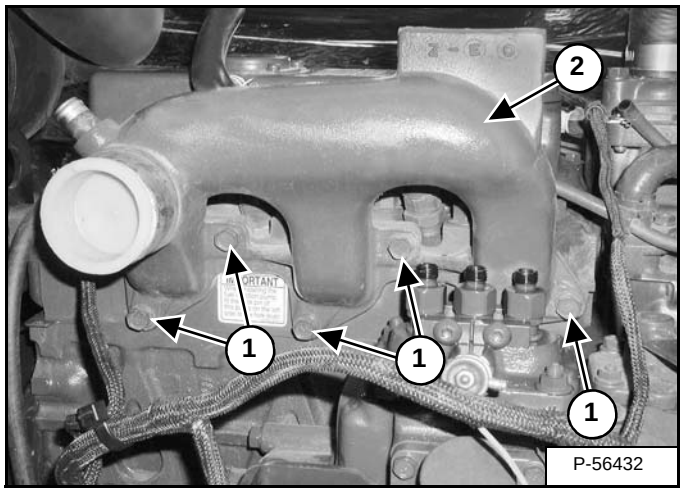
Figure 60-50-17



Remove the high idle body (Item 1) **[Figure 60-50-17]**.

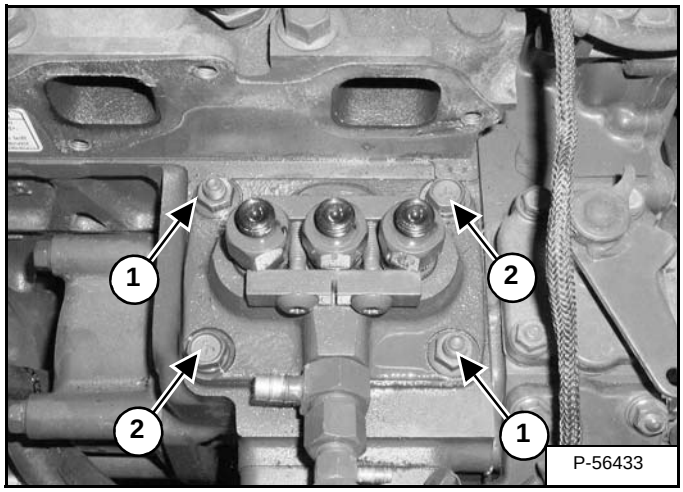
Installation: Tighten the high idle body to 33 - 36 ft.-lb. (44 - 49 N•m) torque.

Figure 60-50-18



Remove the bolts (Item 1) and remove the intake manifold (Item 2) **[Figure 60-50-18]**.

Figure 60-50-19

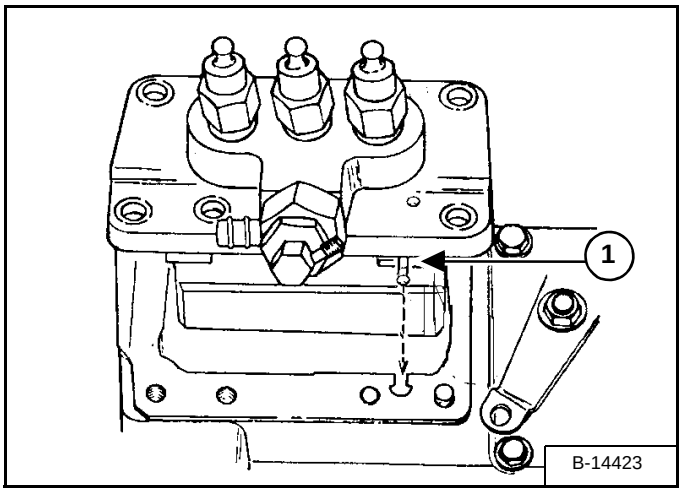


Remove the nuts (Item 1) and bolts (Item 2) **[Figure 60-50-19]**.

Remove the injection pump.

Fuel Injection Pump Removal And Installation (Cont'd)

Figure 60-50-20



Installation: When the injection pump is installed, the rack pin (Item 1) **[Figure 60-50-20]** must be aligned with the slot in the engine block and positioned on the left side of the fork lever.

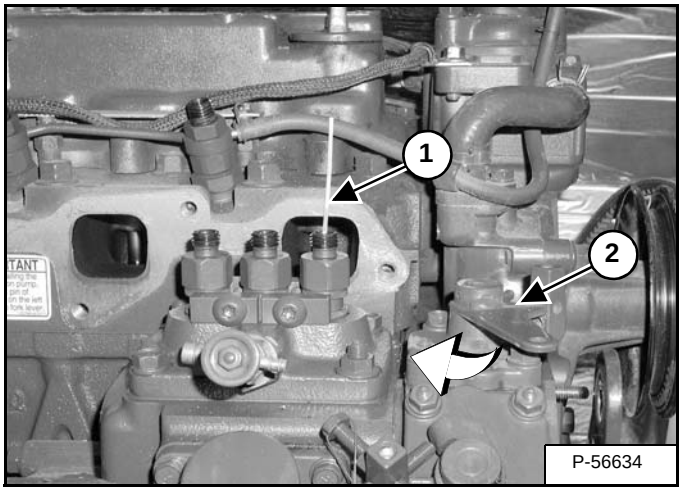
If the rack pin is not installed correctly engine damage can result.

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

Fuel Injection Pump Timing

Timing the injection pump is done by changing the number of shims between the injection pump and engine block.

Figure 60-50-21



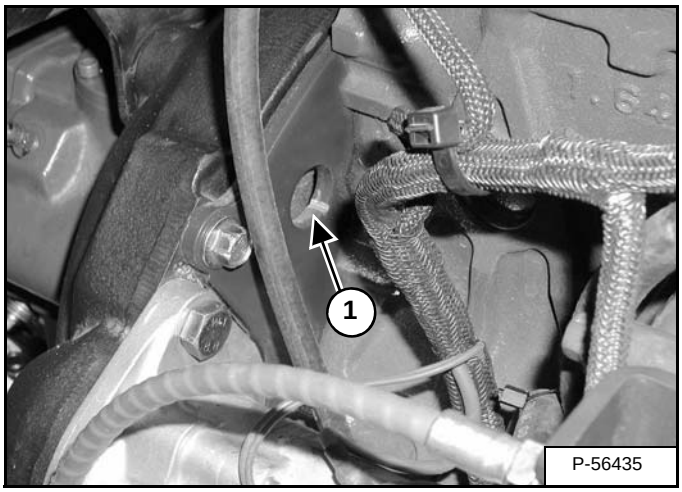
Turn the fuel supply lever to the ON position. Install a short plastic tube (Item 1) **[Figure 60-50-21]** in the fitting of the number one cylinder port. Point the tube up (vertical).

Turn the engine counter clockwise until fuel flows out of the injection pumps number one cylinder nozzle. (Install a tool on the crankshaft at the front of the engine to turn the engine.)

NOTE: The fuel must flow out of the nozzle for one firing cycle before timing can be attempted.

Pull the stop lever (Item 2) **[Figure 60-50-21]** 0.232 - 0.302 in. (5.9 - 7.7 mm) from the free position toward the stop position.

Figure 60-50-22

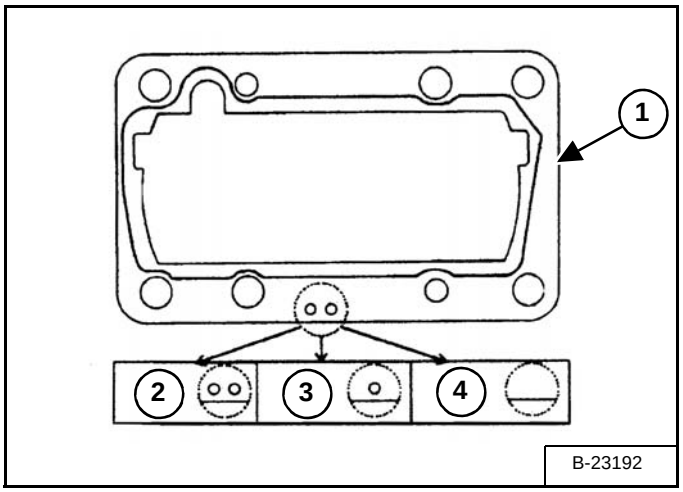


Continue to turn the engine slowly (for approximately one and three-quarter turn after fuel stops flowing from the injection pump nozzle), until the timing mark on the side of the flywheel is at the bottom edge of the timing hole (Item 1) **[Figure 60-50-22]** in the flywheel housing.

Slowly turn the engine counterclockwise: as soon as fuel starts to flow at the top of the injection pump nozzle, stop turning the engine.

Fuel Injection Pump Timing (Cont'd)

Figure 60-50-23



The correct engine timing is 15.5 - 17.0 B.T.D.C. Add or subtract shims (Item 1) **[Figure 60-50-23]** to time the engine to 15.5 - 17.0 B.T.D.C. The engine is correctly timed when the correct mark on the flywheel is aligned with the notch in the timing hole.

NOTE: Shims (Item 1) are available in three thicknesses, shims with the two holes (Item 2) are 0.20 mm thick, shims with one hole (Item 3) are 0.25 mm thick, and shims with no holes (Item 4) [Figure 60-50-23] are 0.30 thick.

NOTE: Increasing the thickness of the shim pack by 0.050 mm retards the injection timing by 0.500°. Decreasing the shim pack by 0.050 mm advances the timing by 0.500°.

Fuel Injector Nozzles Removal And Installation

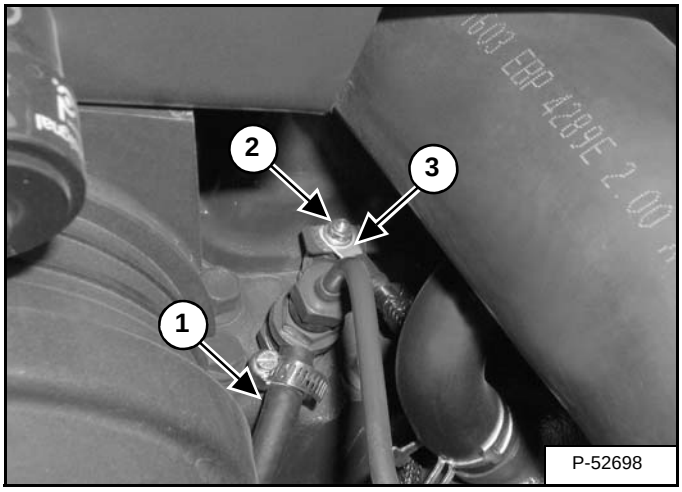
IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

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Open the tailgate.

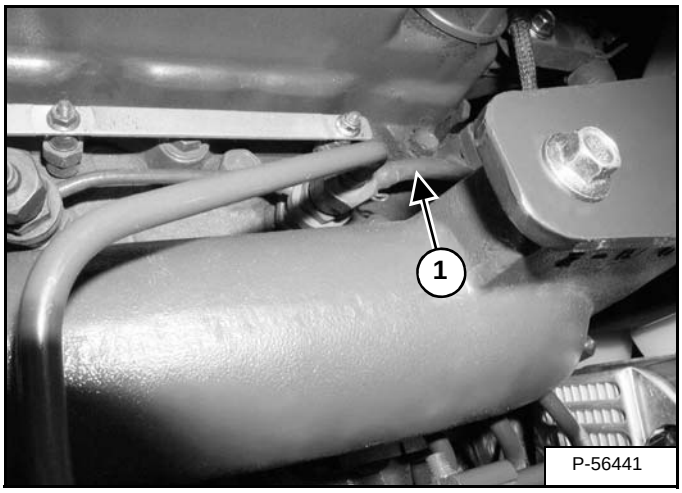
Figure 60-50-24



Remove the fuel line (Item 1) **[Figure 60-50-24]**.

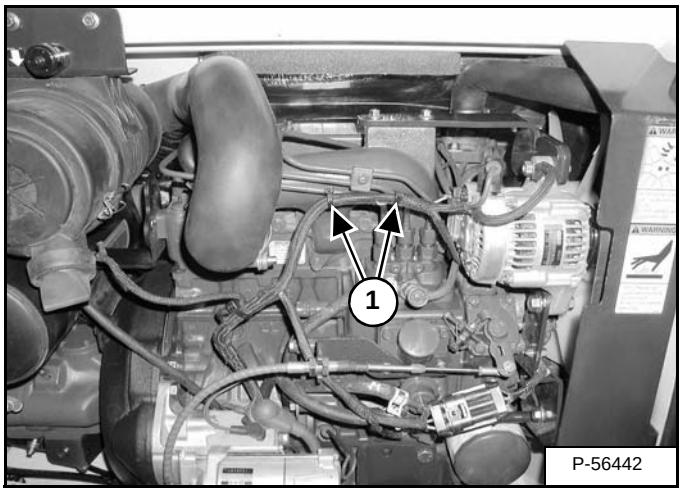
Remove the nut (Item 2) and wire harness (Item 3) **[Figure 60-50-24]**.

Figure 60-50-25



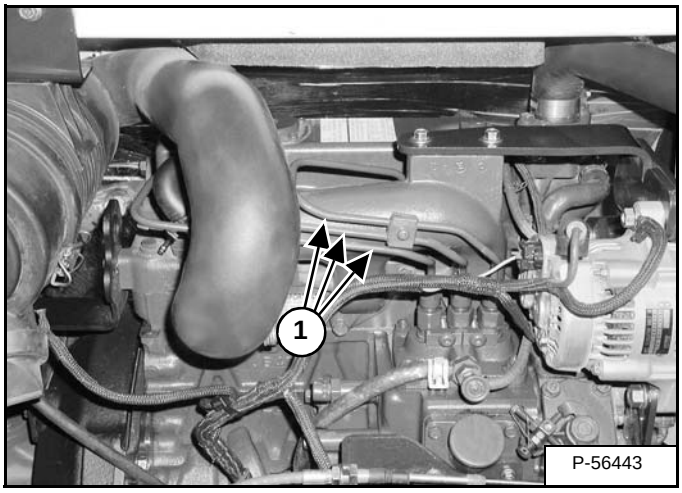
Remove the fuel line (Item 1) **[Figure 60-50-25]**.

Figure 60-50-26



Remove the tie straps (Item 1) **[Figure 60-50-26]**.

Figure 60-50-27



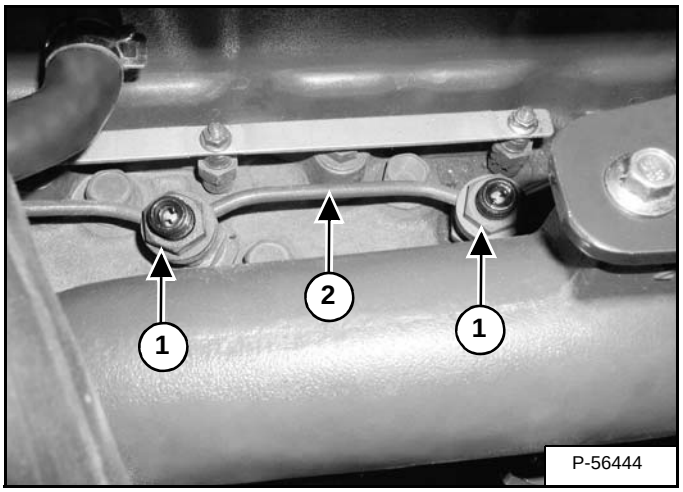
Disconnect the high pressure fuel lines (Item 1) **[Figure 60-50-27]** from the fuel injectors.

Disconnect the fuel lines from the fuel injection pump.

Remove the high pressure fuel lines.

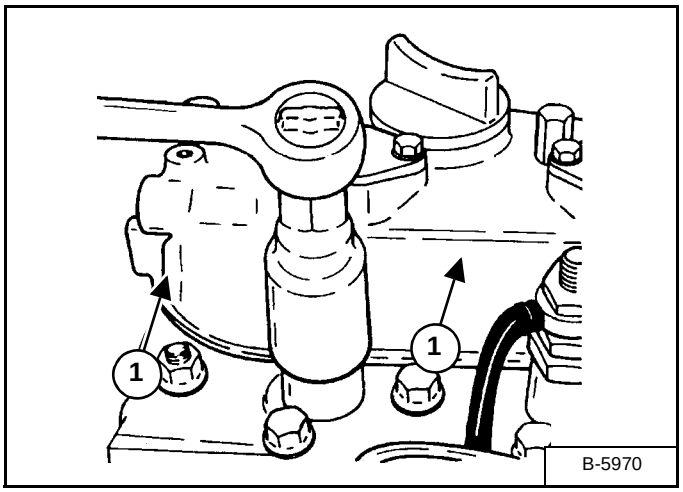
Fuel Injector Nozzles Removal And Installation (Cont'd)

Figure 60-50-28



Remove the nuts (Item 1) from the three injectors. Remove the fuel line (Item 2) **[Figure 60-50-28]**.

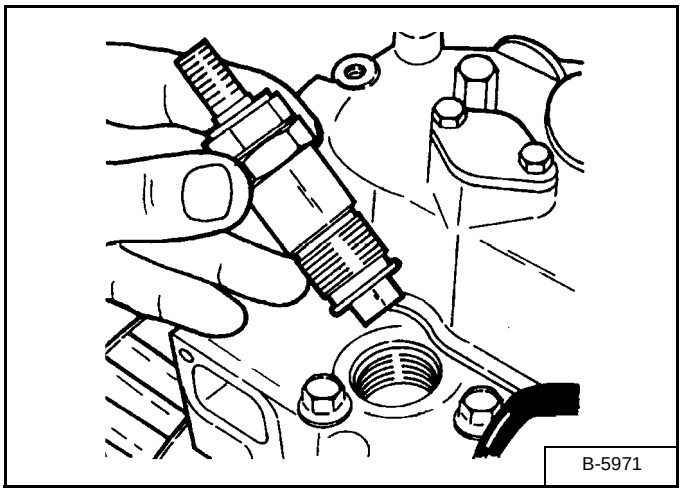
Figure 60-50-29



Loosen the fuel injector with a special socket (MEL-1485) **[Figure 60-50-29]**.

Installation: Tighten the injectors to 37 - 50 ft.-lb. (49 - 68 N•m) torque.

Figure 60-50-30



Remove the fuel injector nozzle from the engine **[Figure 60-50-30]**.

Fuel Injector Nozzle Check

⚠ WARNING

AVOID INJURY OR DEATH

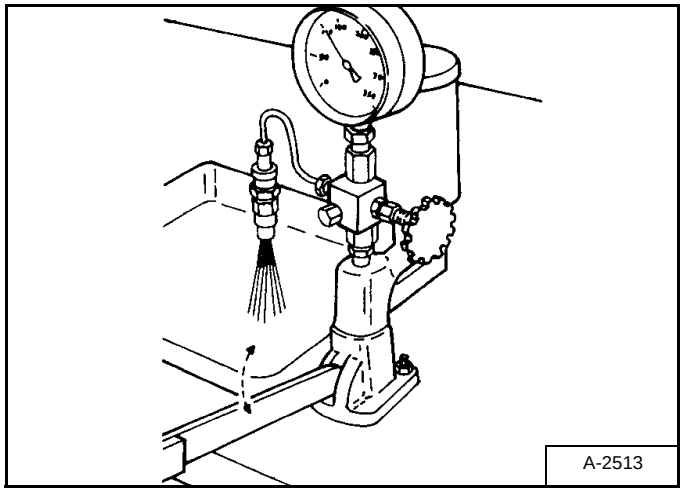
Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical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

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

MEL 10018 - Injector Nozzle Tester

Figure 60-50-31

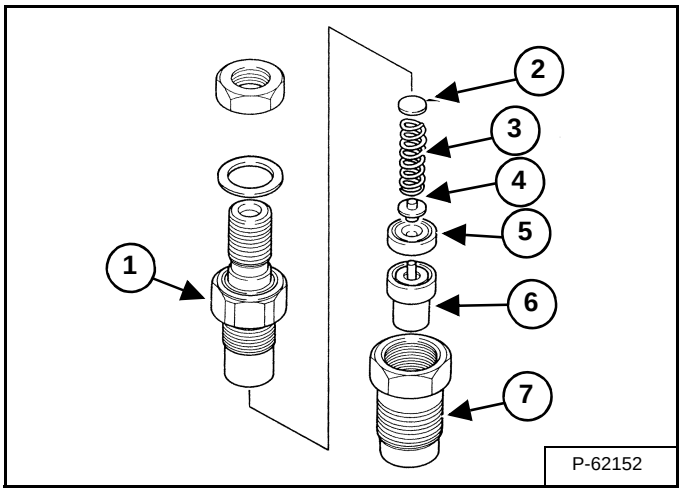


Connect the nozzle to the tester with the nozzle down **[Figure 60-50-31]**.

Operate the hand lever at a slow rate and record the opening pressure. If the pressure is not correct, replace the fuel injection nozzle.

Fuel Injection Pressure	1991 - 2134 PSI (137 - 147 Bar)

Figure 60-50-32



1.Nozzle Holder

2.Adjusting Spacer.

3.Nozzle Spring

4.Push Rod

5.Distance Piece

6.Nozzle Piece

7.Nozzle Retaining Nut

Tighten the Nozzle Holder (Item 1) **[Figure 60-50-32]** to 26 - 28 ft.-lb. (35 - 39 N•m) torque.

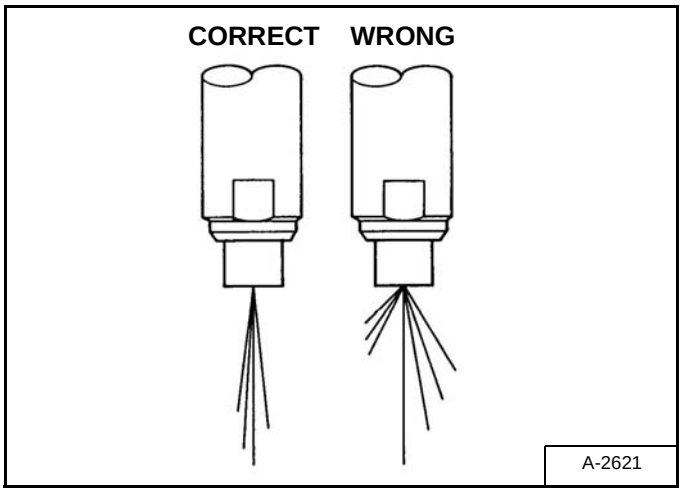
Tighten the Overflow pipe nut to 15 - 18 ft.-lb. (20 - 24 N•m) torque.

Tighten the Nozzle Holder Assembly to 37 - 50 ft.-lb. (49,0 - 68 N•m) torque.

NOTE: You can adjust the release pressure of the injector nozzle by adding or removing spacers (Item 2) from the top of the nozzle spring (Item 3) [Figure 60-50-32]. Spacers are available in different thicknesses.

Fuel Injector Nozzle Check

Figure 60-50-33

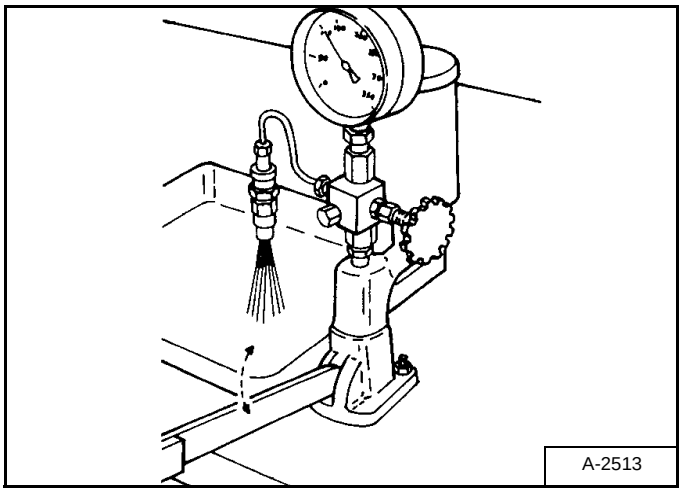


Check that the spray pattern is correct **[Figure 60-50-33]**.

1. Fuel does not come out the side of the nozzle.
2. Drops of fuel are not present at the nozzle.
3. The injector has an even flow coming from the nozzle.

Valve Seat Tightness

Figure 60-50-34



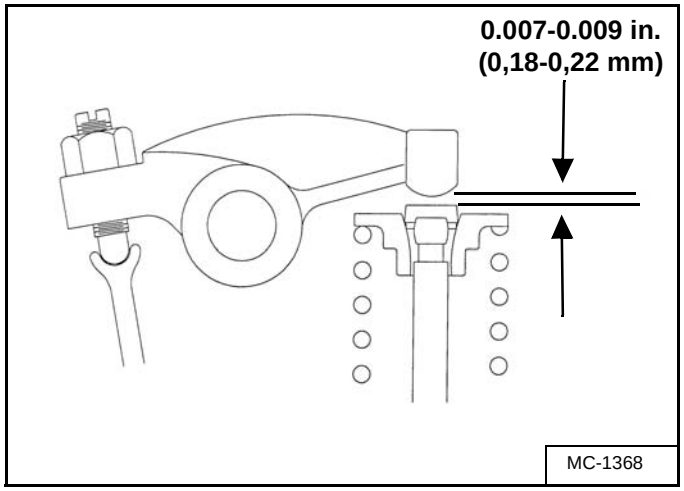
Connect the injector nozzle to the tester with the nozzle in the down position **[Figure 60-50-34]**.

Check for inside leakage. Operate the hand lever until the pressure reaches 1849 PSI (127 bar). Make a record of the pressure. Release the hand lever. Check the pressure decrease in 10 seconds. If any leak is found, replace the nozzle.

Valve Clearance Adjustment

Adjust the valve clearance with the engine stopped and cold.

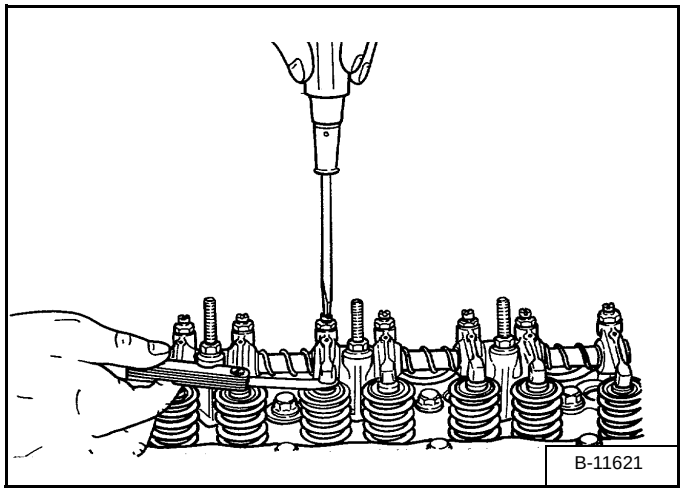
Figure 60-50-35



The correct valve clearance is 0.007 - 0.0087 in. (0,18 - 0,22 mm) **[Figure 60-50-35]**.

Make sure the piston is at T.D.C. when making the adjustment for the valves of the particular cylinder.

Figure 60-50-36



Put the correct size feeler gauge between the rocker arm and valve stem. Turn the adjustment bolt until the clearance is correct **[Figure 60-50-36]**.


Bobcat®

ENGINE

Removal And Installation

Disconnect the negative (-) cable on the battery. (See Removing And Installing The Battery on Page 50-20-2.)

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

Drain the radiator. (See Replacing The Coolant on Page 10-70-3.)

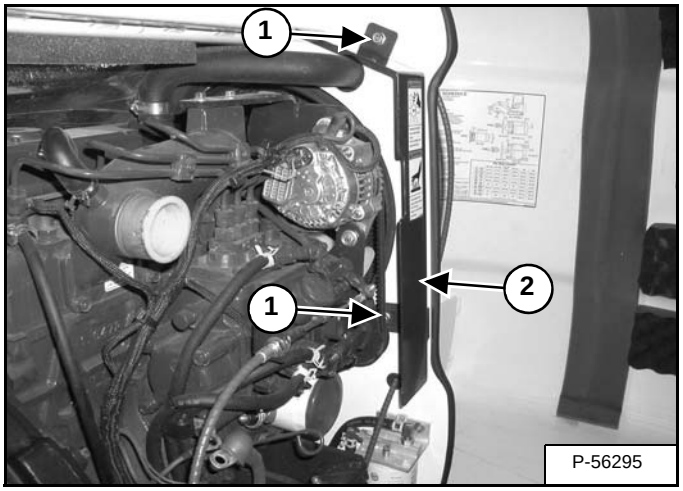
Remove the muffler. (See Removal And Installation on Page 60-20-1.)

Remove the air cleaner. (See Removal And Installation on Page 60-30-1.)

Remove the starter. (See Removal And Installation on Page 50-40-1.)

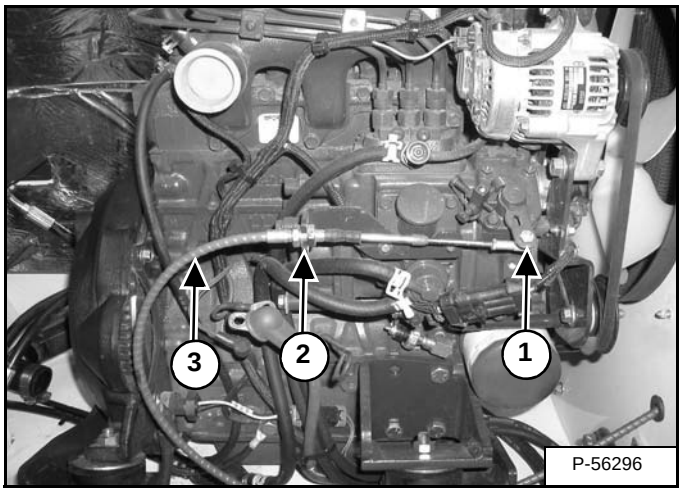
Remove the hydraulic pump. (See Removal And Installation on Page 20-50-8.)

Figure 60-60-1



Remove the nuts (Item 1) and guard (Item 2) **[Figure 60-60-1]**.

Figure 60-60-2

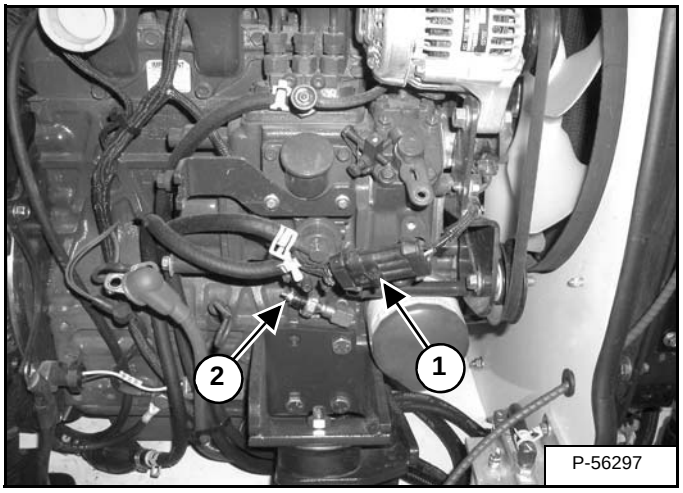


Remove the nut (Item 1) **[Figure 60-60-2]**.

Loosen the nut (Item 2) and remove the engine speed control cable (Item 3) **[Figure 60-60-2]**.

Remove the cable from the mount.

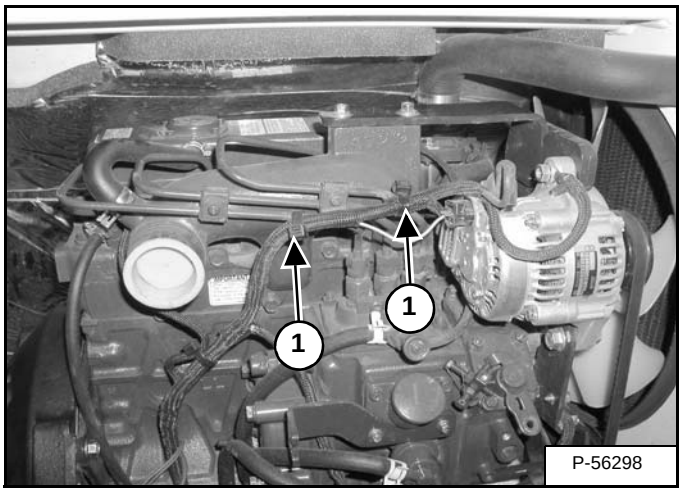
Figure 60-60-3



Disconnect the fuel shut off solenoid (Item 1) and oil pressure sending unit (Item 2) **[Figure 60-60-3]** connectors.

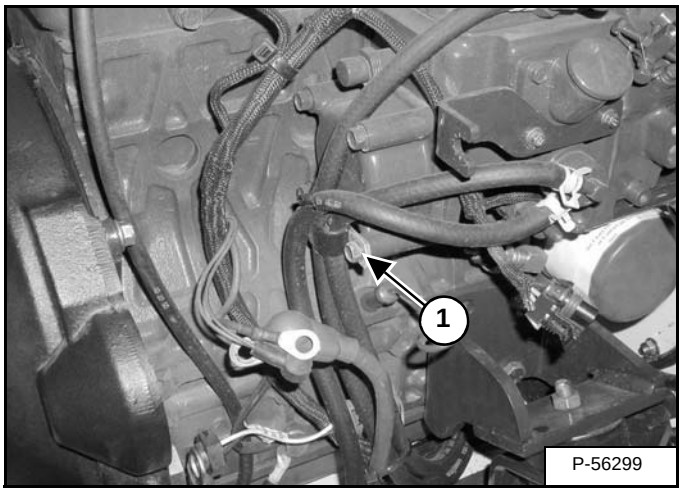
Removal And Installation (Cont'd)

Figure 60-60-4



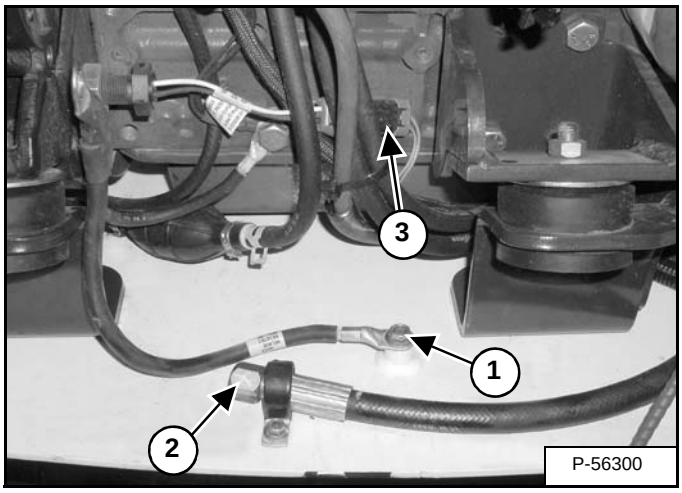
Cut and remove the tie straps (Item 1) **[Figure 60-60-4]**.

Figure 60-60-5



Remove the bolt (Item 1) **[Figure 60-60-5]**.

Figure 60-60-6

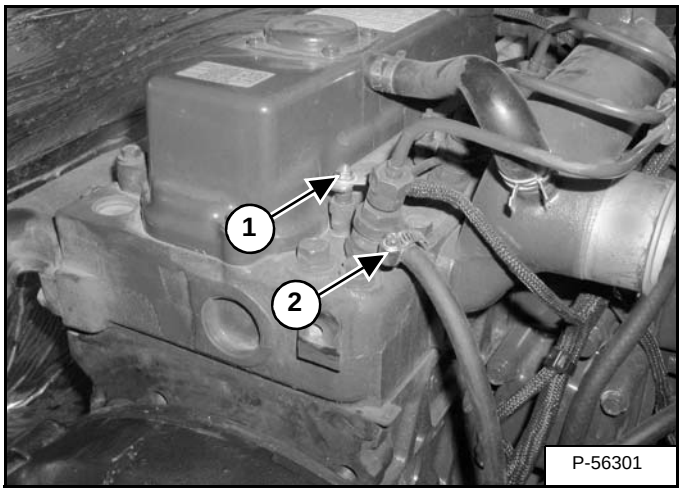


Remove the ground cable (Item 1) and oil drain hose (Item 2) **[Figure 60-60-6]**.

Disconnect the wire harness (Item 3) **[Figure 60-60-6]** from the engine speed sensor.

Removal And Installation (Cont'd)

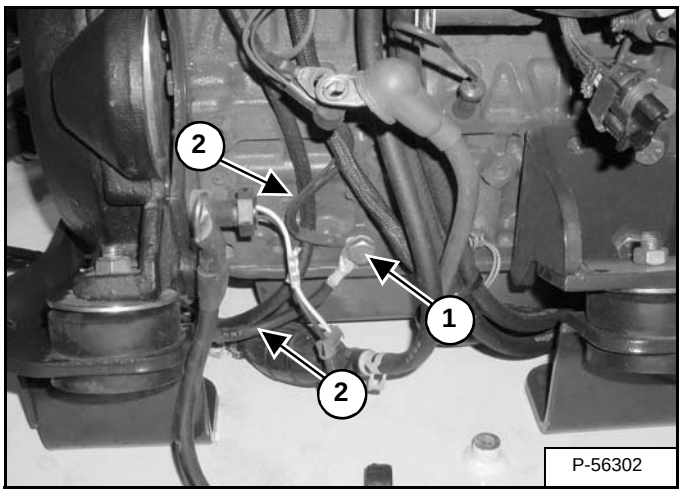
Figure 60-60-7



Remove the wire (Item 1) **[Figure 60-60-7]** from the glow plug.

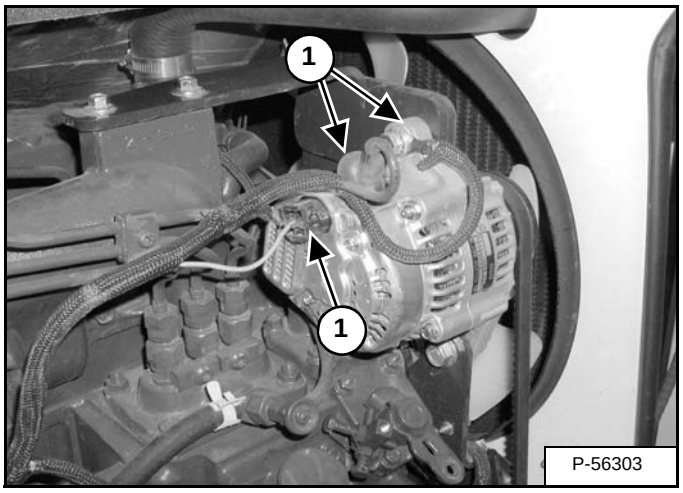
Remove the hose (Item 2) **[Figure 60-60-7]**.

Figure 60-60-8



Remove the bolt (Item 1) and ground cables (Item 2) **[Figure 60-60-8]**.

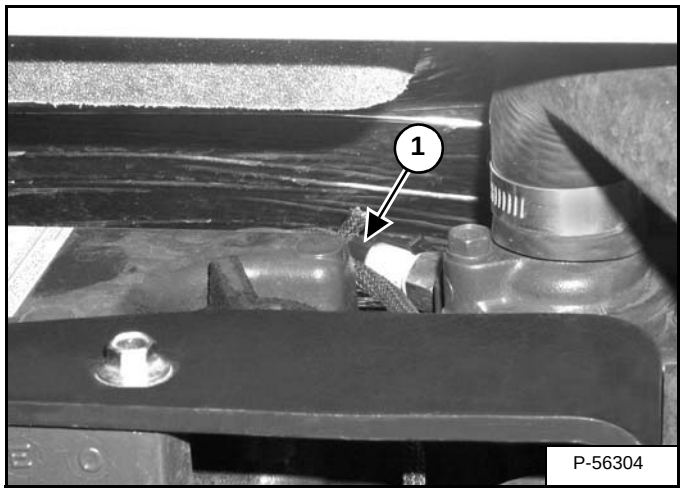
Figure 60-60-9



Remove the wires (Item 1) **[Figure 60-60-9]** from the alternator.

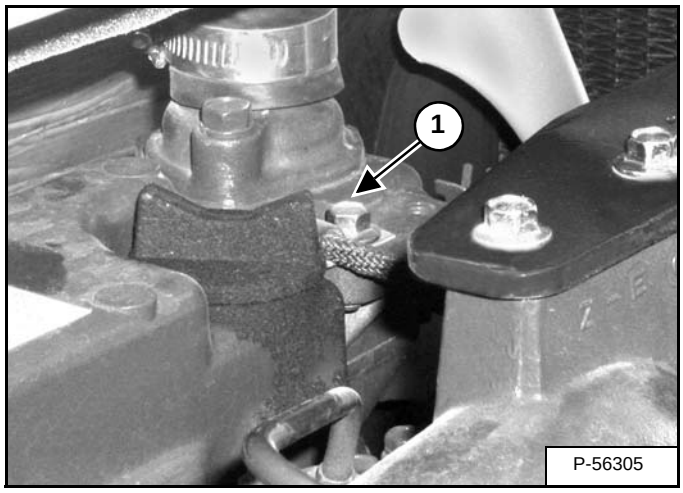
Removal And Installation (Cont'd)

Figure 60-60-10



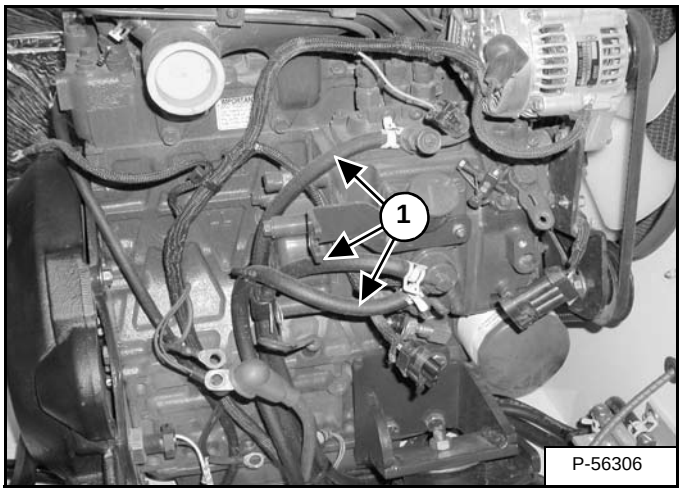
Remove the wire harness (Item 1) **[Figure 60-60-10]** from the temperature sensor.

Figure 60-60-11



Remove the bolt (Item 1) **[Figure 60-60-11]** from the wire harness clamp.

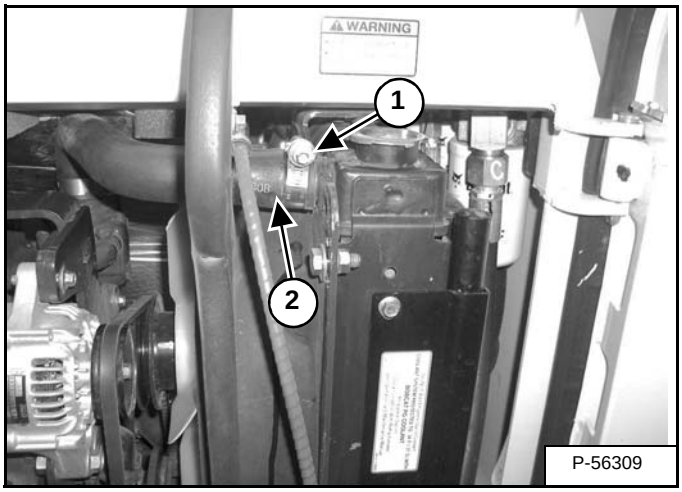
Figure 60-60-12



Mark and remove the fuel lines (Item 1) **[Figure 60-60-12]**.

Plug the fuel lines.

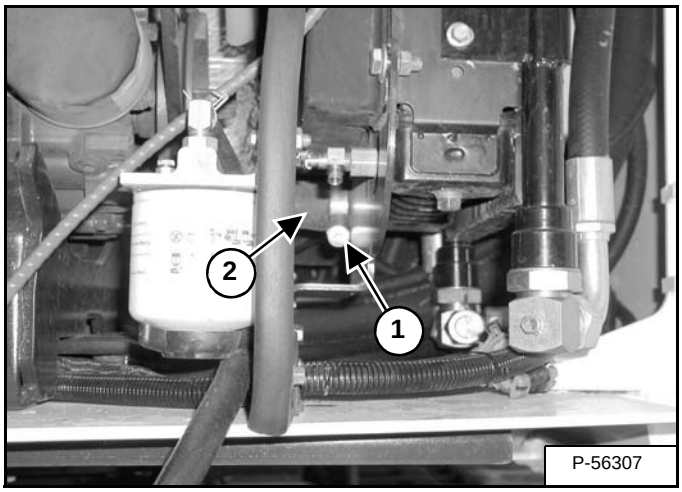
Figure 60-60-13



Loosen the hose clamp (Item 1) and remove the top radiator hose (Item 2) **[Figure 60-60-13]**.

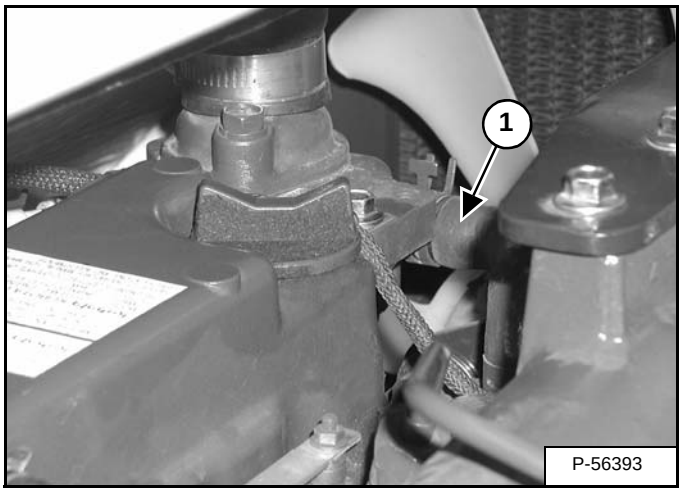
Removal And Installation (Cont'd)

Figure 60-60-14



Loosen the clamp (Item 1) and remove the lower radiator hose (Item 2) **[Figure 60-60-14]** from the radiator.

Figure 60-60-15



Remove the heater hose (Item 1) **[Figure 60-60-15]** (if equipped.)

Figure 60-60-16

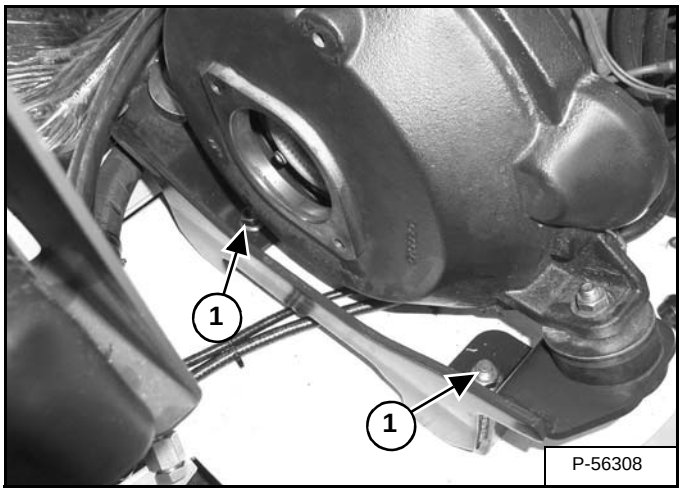
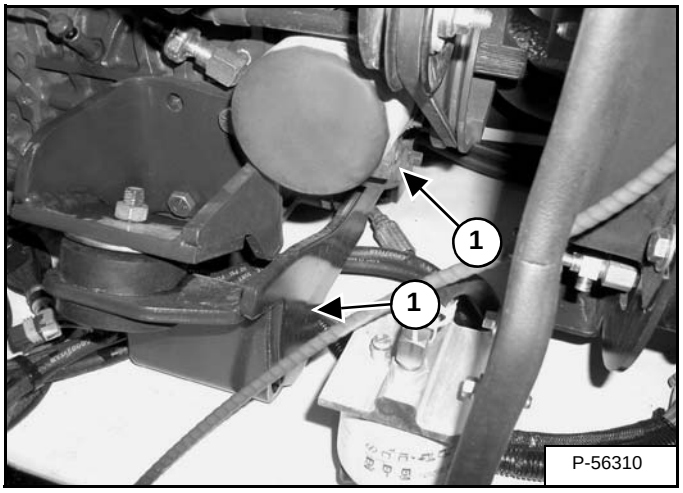


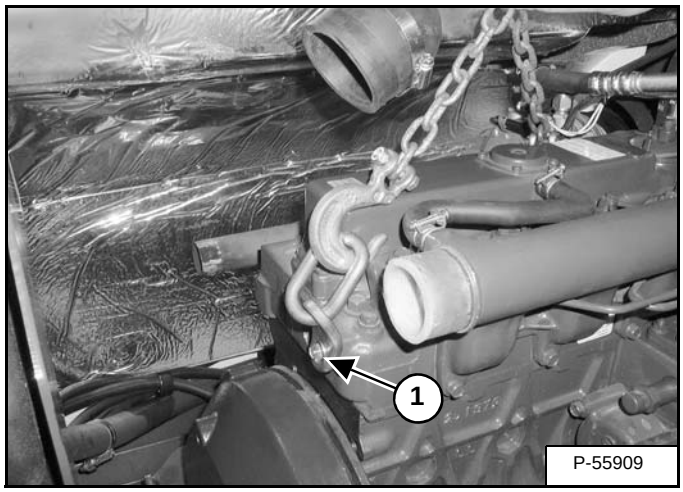
Figure 60-60-17



Remove the four engine mount bolts and nuts (Item 1) **[Figure 60-60-16]** & **[Figure 60-60-17]**.

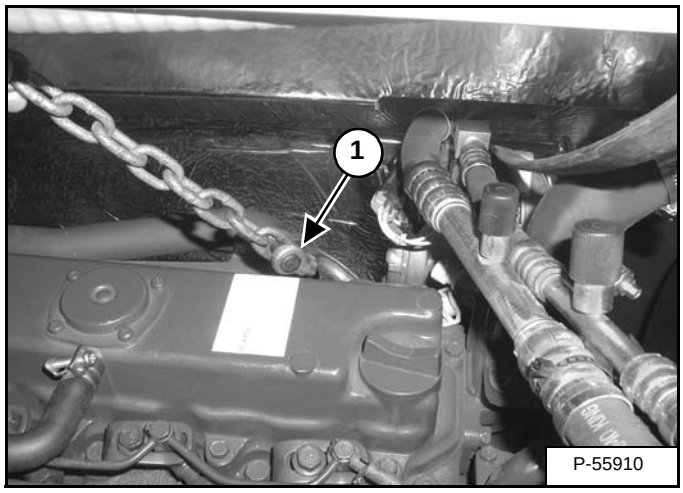
Removal And Installation (Cont'd)

Figure 60-60-18



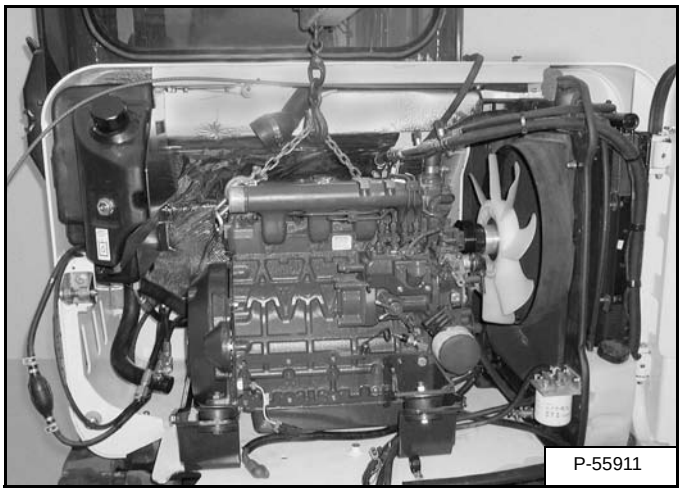
Attach a lifting bracket (Item 1) **[Figure 60-60-18]** and chain to the pump end of the engine.

Figure 60-60-19



Attach a chain (Item 1) **[Figure 60-60-19]** to the lifting bracket on the front of the engine.

Figure 60-60-20



Attach a hoist to the chain, slightly raise and support the engine. and rotate the pump end of the engine toward the back of the excavator **[Figure 60-60-20]**.

Relocate all wires and hoses away from the engine.

Raise the hoist and remove the engine.

ENGINE FLYWHEEL

Flywheel Removal And Installation

Open the tailgate.

Remove the air cleaner. (See Removal And Installation on Page 60-30-1.)

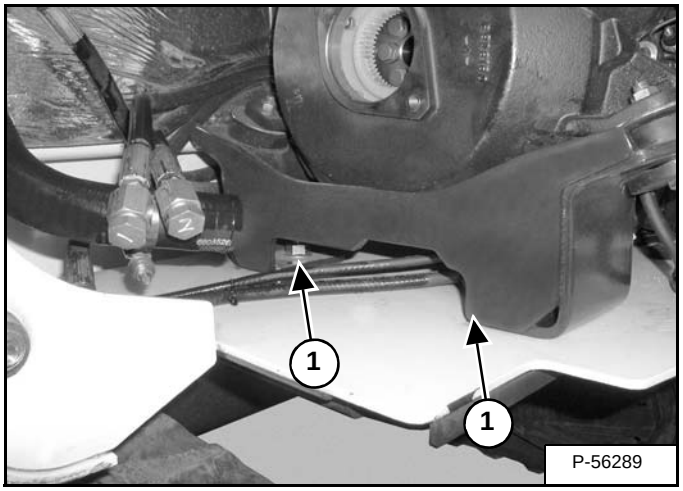
Drain the hydraulic reservoir. (See Replacing The Hydraulic Oil on Page 10-100-2.)

Remove the muffler. (See Removal And Installation on Page 60-20-1.)

Remove the hydraulic pump. (See Removal And Installation on Page 20-50-8.)

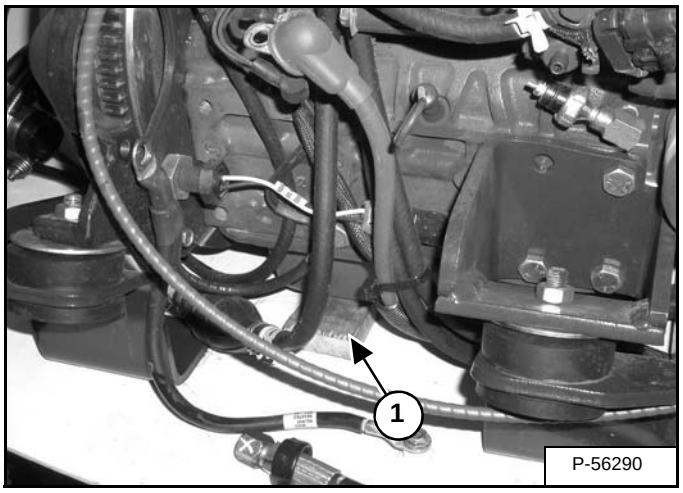
Remove the starter. (See Removal And Installation on Page 50-40-1.)

Figure 60-70-1



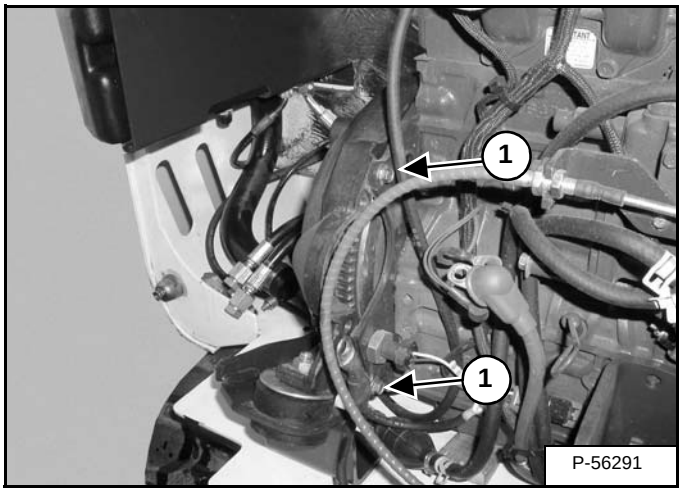
Remove the bolts (Item 1) **[Figure 60-70-1]** from the engine mount.

Figure 60-70-2



Slightly raise the flywheel end of the engine, and place a support (Item 1) **[Figure 60-70-2]** under the oil pan.

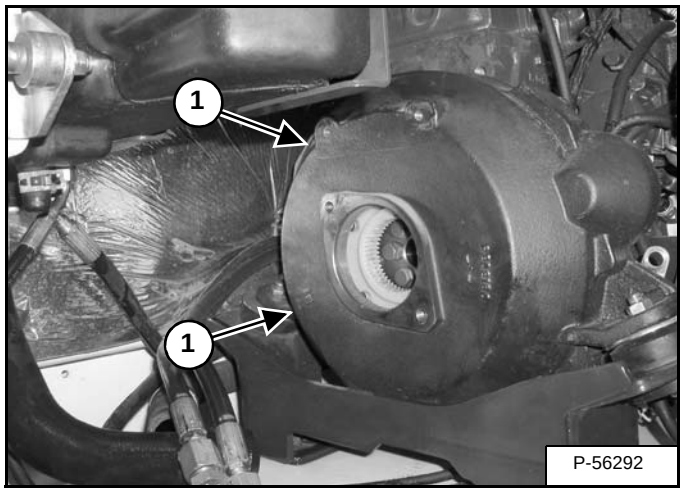
Figure 60-70-3



Remove the bolts (Item 1) **[Figure 60-70-3]**.

Flywheel Removal And Installation (Cont'd)

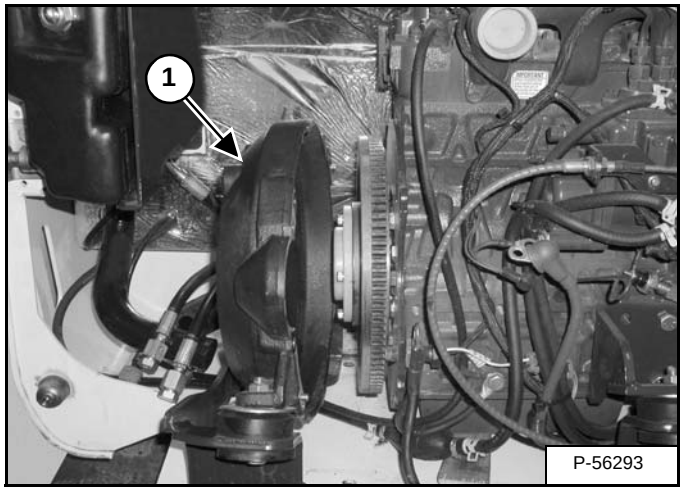
Figure 60-70-4



Remove the two flywheel housing bolts (Item 1) **[Figure 60-70-4]** from the front side of the engine.

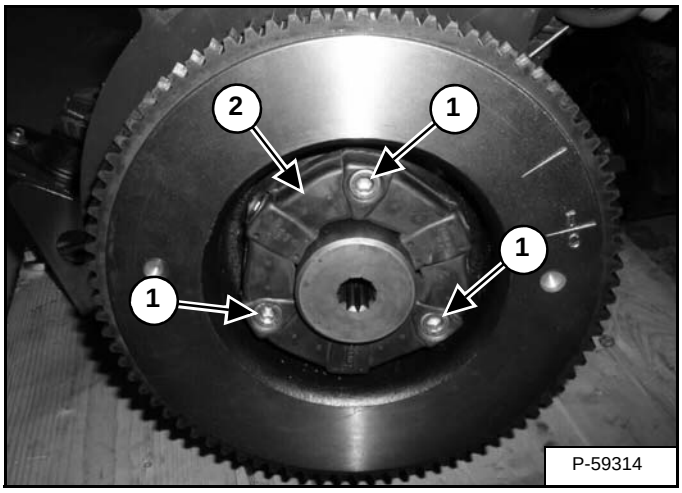
Installation: Position the housing over the alignment pins and tighten the bolts to 30 - 37 ft.-lb. (40 - 50 N•m) torque.

Figure 60-70-5



Remove the flywheel housing (Item 1) **[Figure 60-70-5]** from the engine.

Figure 60-70-6



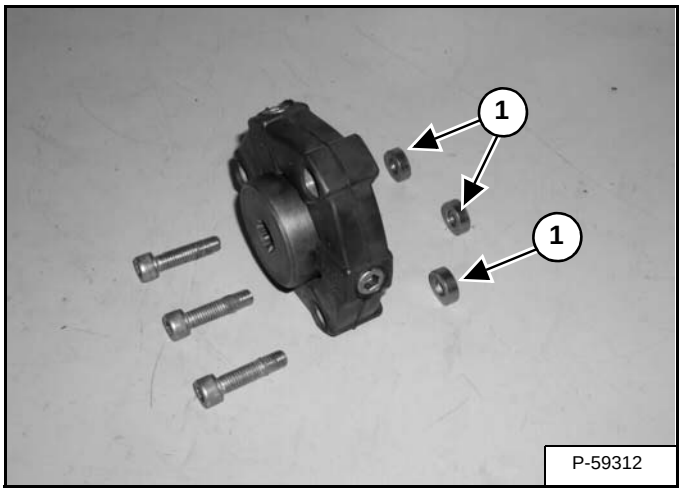
Remove the three bolts (Item 1) from the hydraulic pump coupler (Item 2) **[Figure 60-70-6]**.

Installation: Apply Loctite® 242. to bolts and tighten the bolts to 27 - 32 ft.-lb. (37 - 43 N•m) torque.

Remove the coupler.

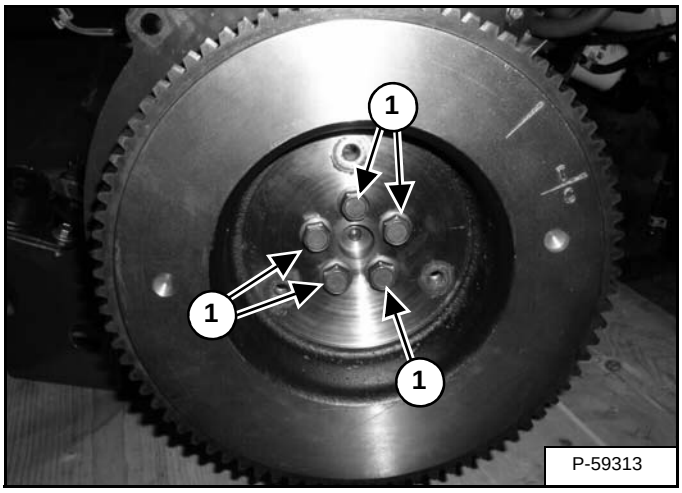
Flywheel Removal And Installation (Cont'd)

Figure 60-70-7



Each hydraulic pump coupler bolt has a spacer (Item 1) **[Figure 60-70-7]** between the coupler and flywheel.

Figure 60-70-8



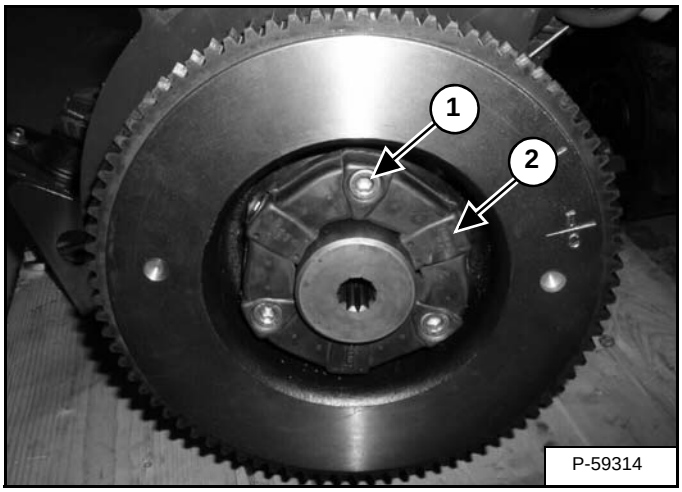
Remove the five bolts (Item 1) **[Figure 60-70-8]** from the flywheel.

Installation: Tighten the bolts to 40 - 43 ft.-lb. (54 - 59 N•m) torque.

Remove the flywheel.

Hydraulic Pump Coupler

Figure 60-70-9

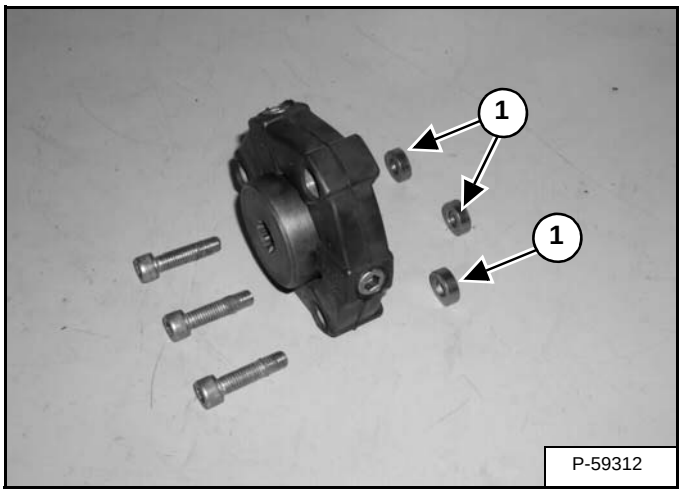


Remove the three bolts (Item 1) from the hydraulic pump coupler (Item 2) **[Figure 60-70-9]**.

Installation: Apply Loctite® 242 to bolts and tighten the bolts to 27 - 32 ft.-lb. (37 - 43 N•m) torque.

Remove the hydraulic pump coupler.

Figure 60-70-10



Each hydraulic pump coupler bolt has a spacer **[Figure 60-70-10]** between coupler and flywheel.

Flywheel Ring Gear

⚠ WARNING

AVOID INJURY OR DEATH

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-2019-0907

The ring gear on the flywheel is an interference fit. Heat the ring gear enough to expand it and hit it with a hammer evenly to remove it.

Clean the outer surface of the flywheel to give a smooth fit.

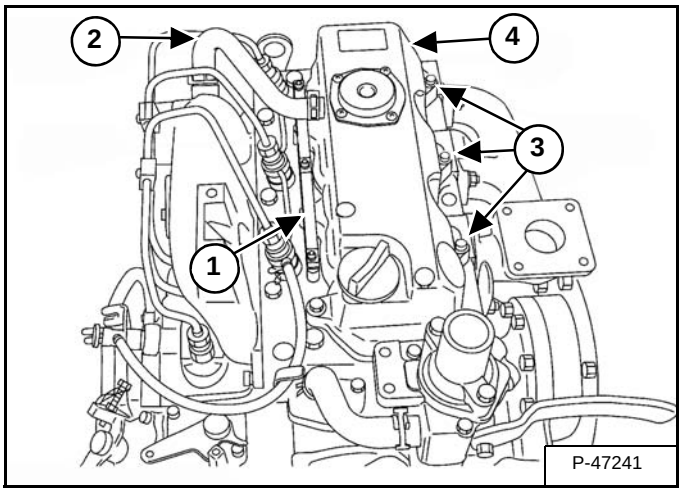
Clean the new ring gear and heat it to a temperature of 450 - 500° F (232 - 260° C).

Fit the ring gear over the flywheel. Make sure the gear is seated correctly.

RECONDITIONING THE ENGINE

Cylinder Head Removal And Installation

Figure 60-80-1

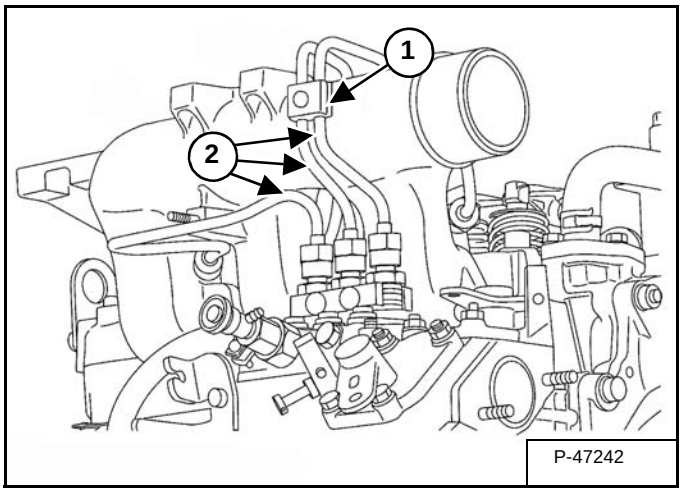


Remove the glow plug lead (Item 1), breather hose (Item 2), and valve cover bolts (Item 3) **[Figure 60-80-1]**.

Remove the valve cover (Item 4) **[Figure 60-80-1]** and gasket.

Installation: Tighten the valve cover bolts to 5 - 8 ft.-lb. (7 - 11 N•m)

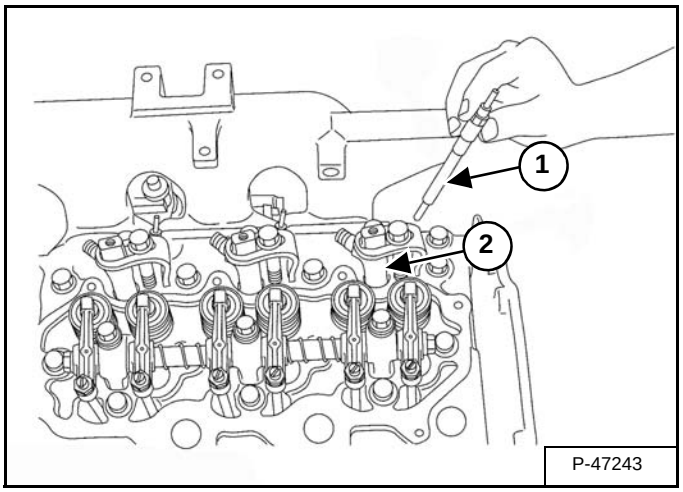
Figure 60-80-2



Loosen the bolts on the clamps (Item 1) and remove the injection tubes (Item 2) **[Figure 60-80-2]**.

Remove the overflow tube assembly.

Figure 60-80-3

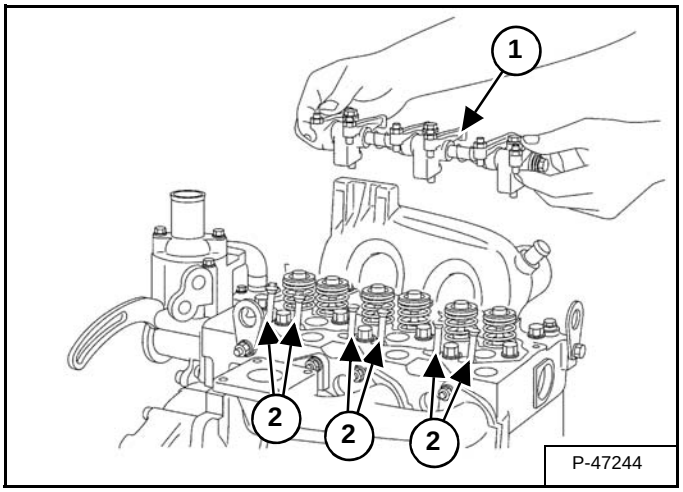


Remove the glow plugs (Item 1) and fuel injector holder assemblies (Item 2) **[Figure 60-80-3]**.

Installation: Tighten the glow plugs to 15 - 18 ft.-lb. (20 - 24 N•m) torque.

Tighten the injector holders to 26 - 28 ft.-lb. (35 - 39 N•m) torque.

Figure 60-80-4



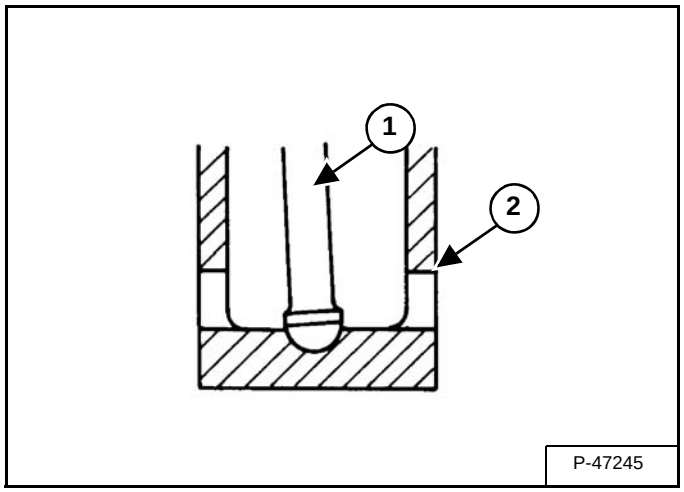
Remove the rocker arm bolts and remove the rocker arm assembly (Item 1) **[Figure 60-80-4]**.

Installation: Tighten the bolts to 18 - 20 ft.-lb. (24 - 27 N•m) torque.

Remove the pushrods (Item 2) **[Figure 60-80-4]**.

Cylinder Head Removal And Installation (Cont'd)

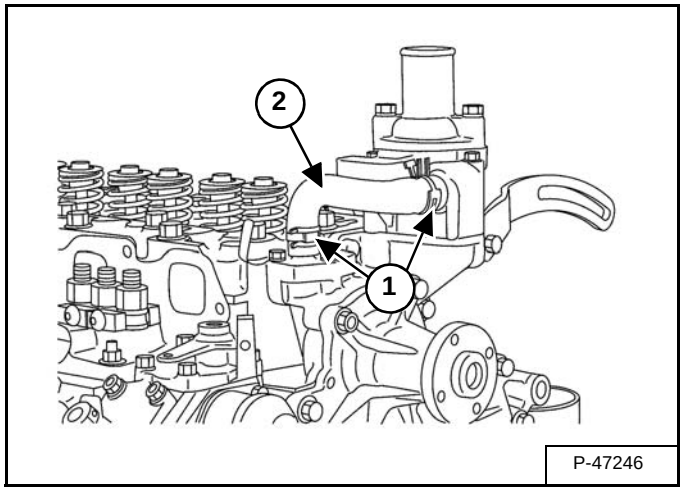
Figure 60-80-5



Installation: The push rod (Item 1) must be seated in the tappet (Item 2) **[Figure 60-80-5]** correctly or the push rods will be damaged.

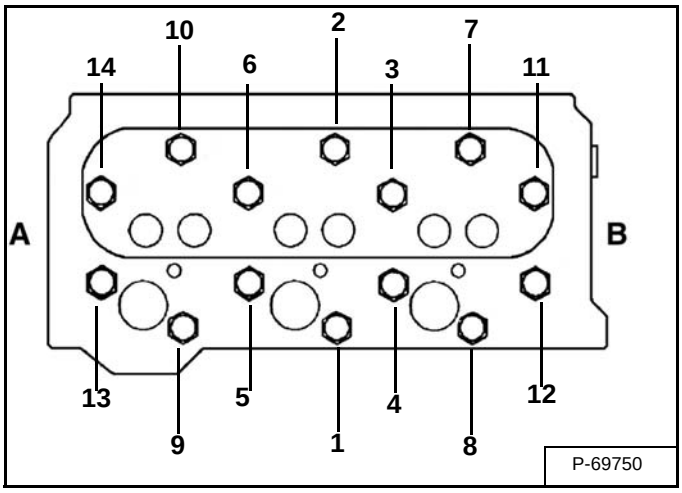
After installing the rocker arm assembly and push rods, the valve lash must be adjusted. (See Valve Clearance Adjustment on Page 60-50-15.)

Figure 60-80-6



Remove the clamps (Item 1) and remove the hose (Item 2) **[Figure 60-80-6]**.

Figure 60-80-7



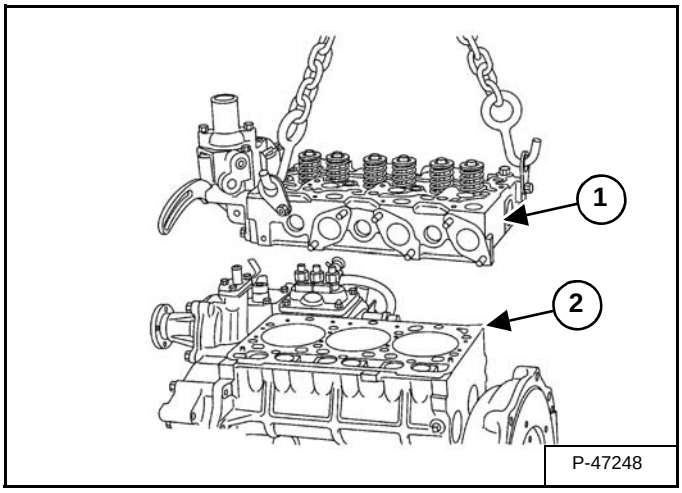
Remove the cylinder head bolts in order of **14** to **1** **[Figure 60-80-7]**.

NOTE: (A) is the gearcase side, (B) is the flywheel side.

Installation: Put oil on the bolt threads. Tighten the bolts in the correct sequence in order of **1** through **14** to 69 - 72 ft.-lb. (93 - 98 N•m).

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

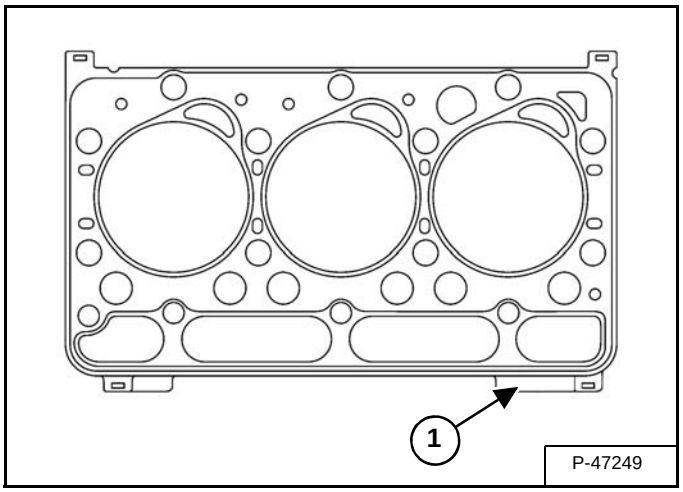
Figure 60-80-8



Remove the cylinder head (Item 1) and gasket (Item 2) **[Figure 60-80-8]**.

Cylinder Head Removal And Installation (Cont'd)

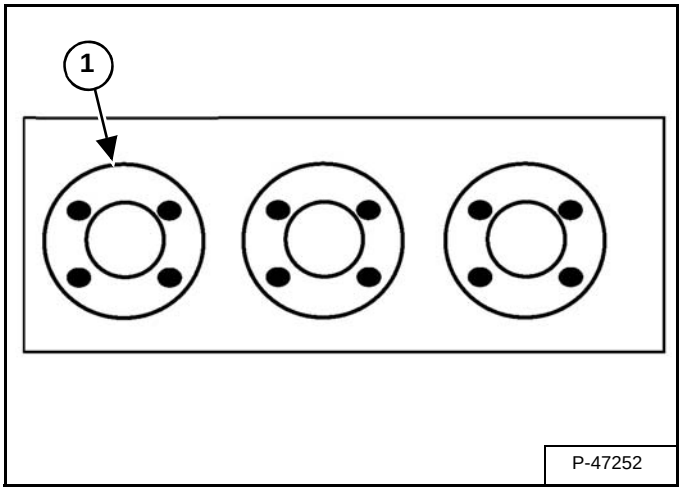
Figure 60-80-9



When replacing just the gasket, use a new gasket that has the same mark (Item 1) **[Figure 60-80-9]** as the original gasket.

When replacing the gasket after an engine rebuild, the piston protrusion must be measured. (See Cylinder Head Top Clearance on Page 60-80-5.)

Figure 60-80-10



Measure and record the protrusion of each piston in the four places shown (Item 1) **[Figure 60-80-10]**. Find the average of each piston, then find the combined average of the four pistons.

Figure 60-80-11

Gasket Size (Number)	Piston Protrusion
15	0,500 - 0,540 mm 0.0197 - 0.0212 in.
20	0,550 - 0,590 mm 0.0217 - 0.0232 in.
25	0,600 - 0,640 mm 0.0237 - 0.0251 in.
30	0,650 - 0,690 mm 0.0256 - 0.0271 in.
35	0,700 - 0,740 mm 0.0276 - 0.0291 in.

Select the correct gasket size (thickness) from the chart **[Figure 60-80-11]**.

Find the measurement of the highest piston protrusion and the lowest piston protrusion (recorded earlier) for each piston.

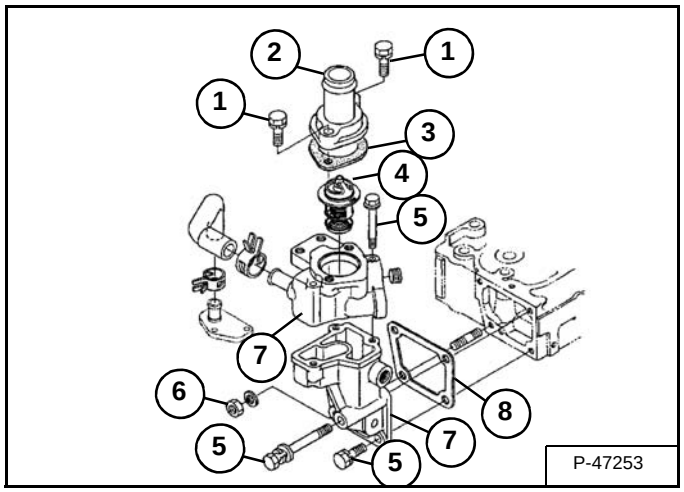
If the highest measurement exceeds the piston protrusion of the selected gasket, use the gasket which is one size larger. If the measurement exceeds gasket size 35, the engine must be disassembled, clearances checked, and reassembled.

If the measurement is two sizes smaller than the selected gasket or smaller than gasket size 15, the engine must be disassembled, clearances checked, and reassembled.

After the gasket and cylinder head have been installed, turn the crankshaft by hand to be sure there is no interference between the piston, cylinder, and valves.

Cylinder Head Disassembly And Assembly

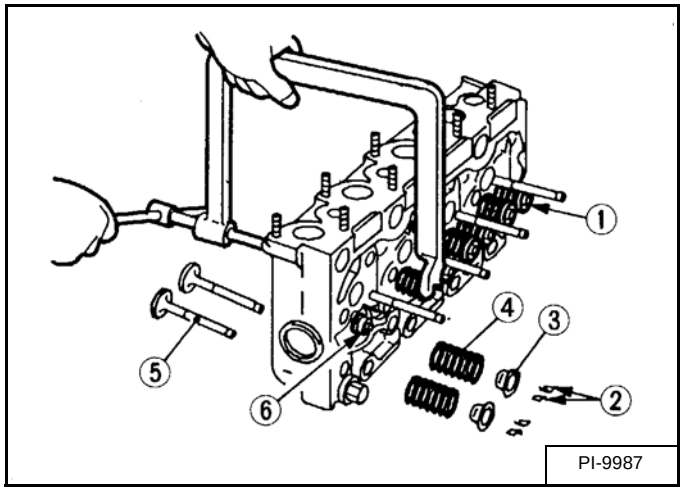
Figure 60-80-12



Remove the bolts (Item 1), housing (Item 2), gasket (Item 3) and thermostat (Item 4) **[Figure 60-80-12]**.

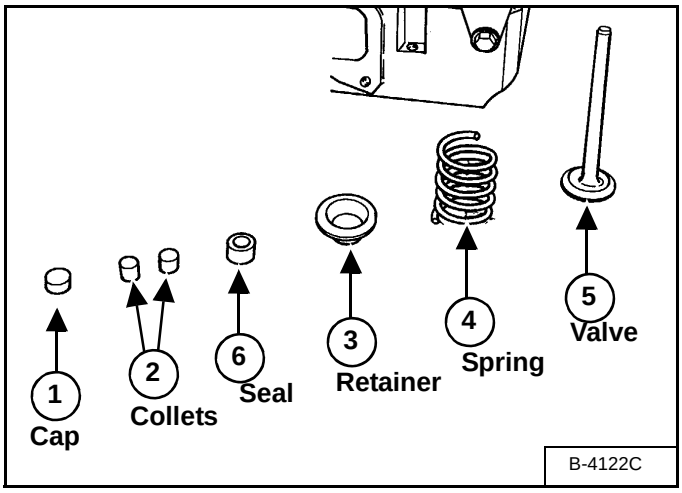
Remove bolts (Item 5), nut (Item 6), top and bottom housing (Item 7), and gasket (Item 8) from the cylinder head **[Figure 60-80-12]**.

Figure 60-80-13



Use a valve spring compressor to compress the valve spring **[Figure 60-80-13]**.

Figure 60-80-14



Remove the valve cap (Item 1) and valve spring collet (Item 2) **[Figure 60-80-13]** & **[Figure 60-80-14]**.

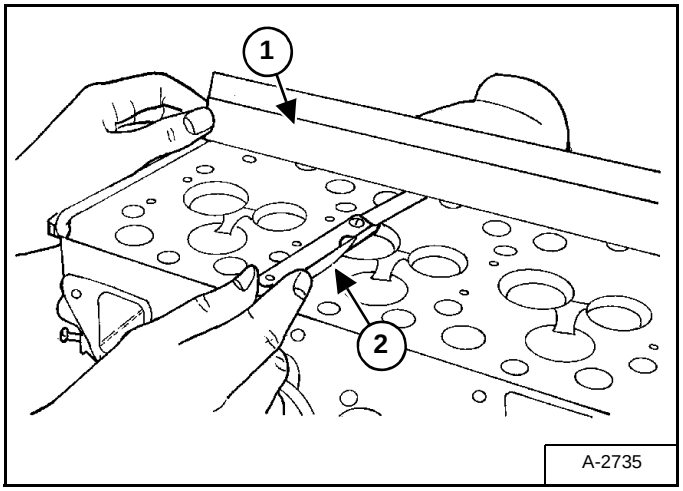
Remove the valve spring retainer (Item 3) and the spring (Item 4) **[Figure 60-80-13]** & **[Figure 60-80-14]**.

Remove the seal (Item 6) and the valve (Item 5) **[Figure 60-80-13]** & **[Figure 60-80-14]**.

Cylinder Head Servicing

Clean the surface of the cylinder head.

Figure 60-80-15

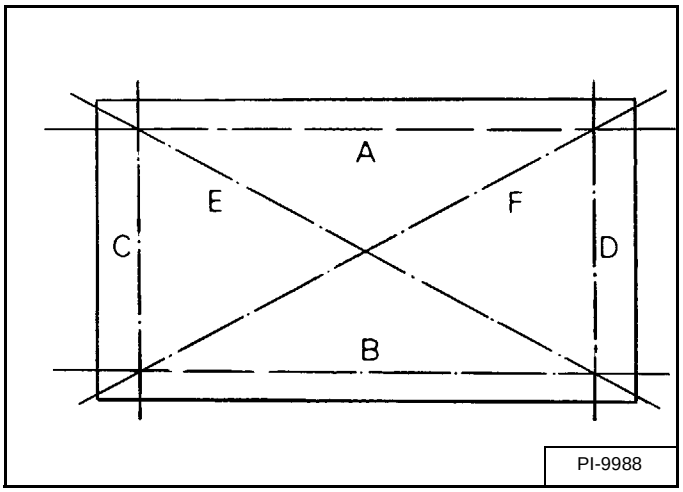


Put a straight edge (Item 1) **[Figure 60-80-15]** on the cylinder head.

NOTE: Do not put the straight edge across combustion chambers.

Put a feeler gauge (Item 2) **[Figure 60-80-15]** between the straight edge and the surface of the cylinder head.

Figure 60-80-16

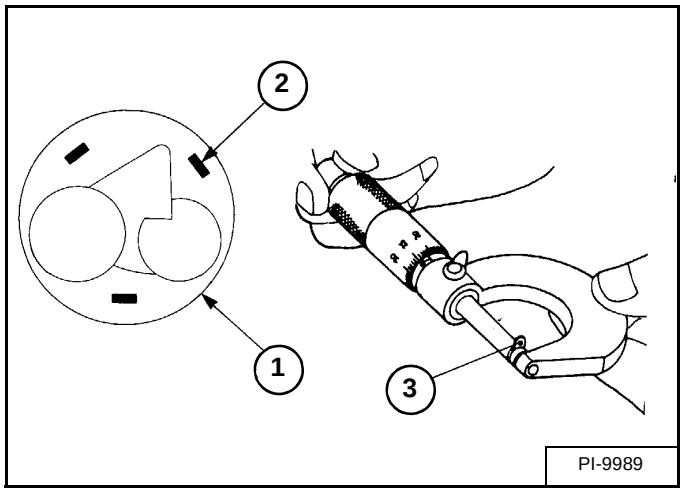


Put the straight edge on the cylinder heads four sides and two diagonal as shown **[Figure 60-80-16]**.

The maximum distortion of the head surface is ± 0.002 in. (± 0,05 mm). If the measurement exceeds the specification, replace the cylinder head.

Cylinder Head Top Clearance

Figure 60-80-17



Install the cylinder head gasket. Put the piston (Item 1) **[Figure 60-80-17]** being checked at T.D.C.

Put three pieces of 0.06 in. (1,5 mm) diameter solder (Item 2) **[Figure 60-80-17]** on the top of the piston. Use grease to hold them in position.

NOTE: Put the solder in position so they do not touch the valves.

Turn the piston to bottom dead center.

Install the cylinder head and tighten to the correct torque in the correct sequence. (See Cylinder Head Removal And Installation on Page 60-80-1.)

Turn the crankshaft until the piston exceeds T.D.C. Remove the cylinder head.

Remove the solder wire (Item 3) **[Figure 60-80-17]** and measure it.

If the measurement exceeds the specifications, check the oil clearance of the crank pin journal or the piston pin.

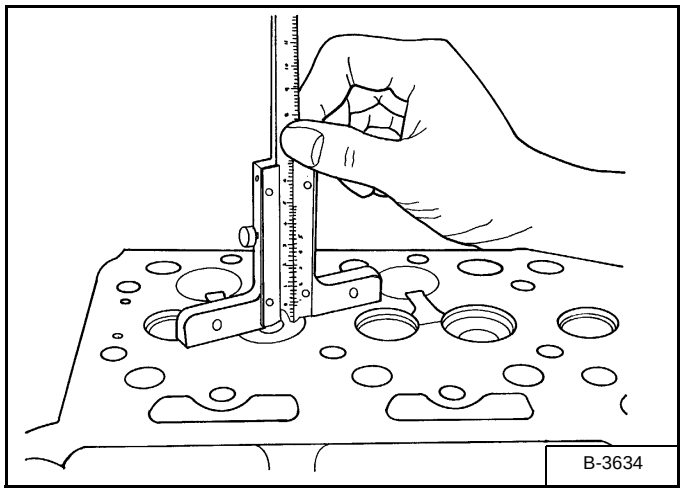
Top Clearance	0.0227 - 0.0265 in. (0.575 - 0.675 mm)

Valve Guide Checking

Remove the valve and spring from the cylinder head. (See Cylinder Head Disassembly And Assembly on Page 60-80-4.)

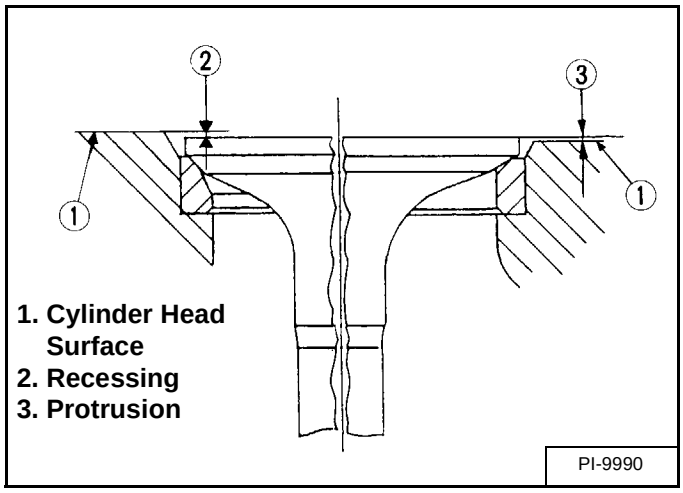
Clean the valve seat and combustion chamber.

Figure 60-80-18



Install the valve into the guide. Measure the valve recessing or protrusion with a depth gauge **[Figure 60-80-18]**.

Figure 60-80-19



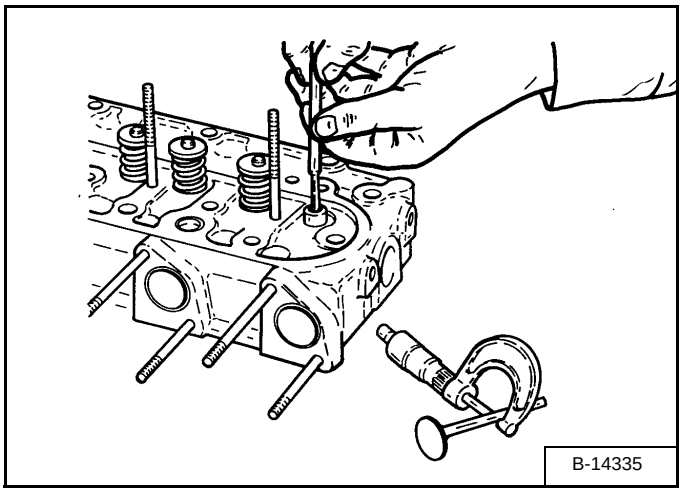
1. Cylinder Head Surface
2. Recessing
3. Protrusion

If the measurement exceeds the allowable limit, replace the valve or cylinder head **[Figure 60-80-19]**.

Protrusion	0.002 in. (0,05 mm)
Recessing	0.006 in. (0,15 mm)
Allowable Limit (Recessing)	0.016 in. (0,4 mm)

Remove the carbon from the valve guide.

Figure 60-80-20



Measure the valve stem O.D. **[Figure 60-80-20]**.

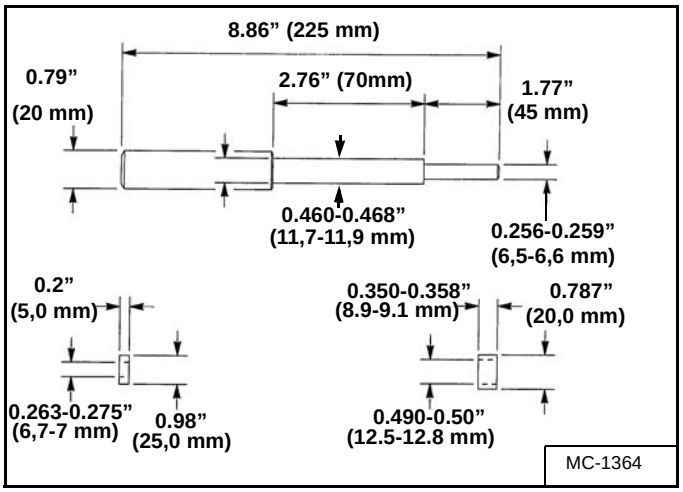
Measure the valve guide I.D. **[Figure 60-80-20]**.

Calculate the clearance. If the clearance exceeds the allowable limit, replace the valve and/or valve guide.

Valve Guide I.D.	0.3156 - 0.3161 in. (8,015 - 8,03 mm)
Valve Stem O.D.	0.3134 - 0.3139 in. (7,96 - 7,98 mm)
Clearance Between Valve Stem and Guide	0.0016 - 0.0027 in. (0,04 - 0,07 mm)
Allowable Limit	0.0039 in. (0,1 mm)

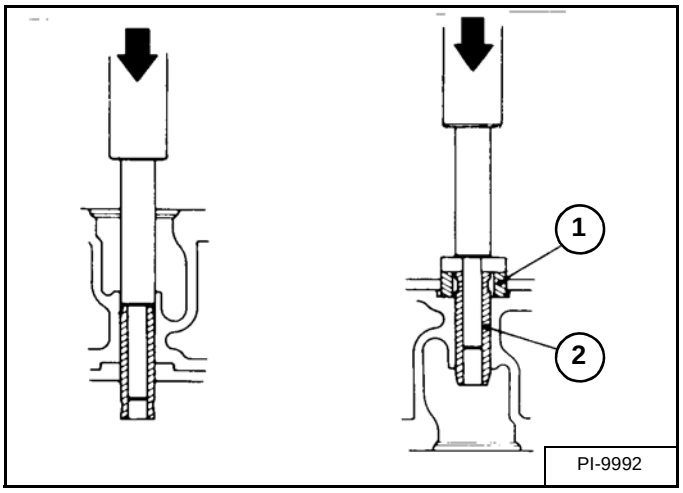
Valve Guide Checking (Cont'd)

Figure 60-80-21



To remove and replace the valve guide, make the driver tool as shown **[Figure 60-80-21]**.

Figure 60-80-22



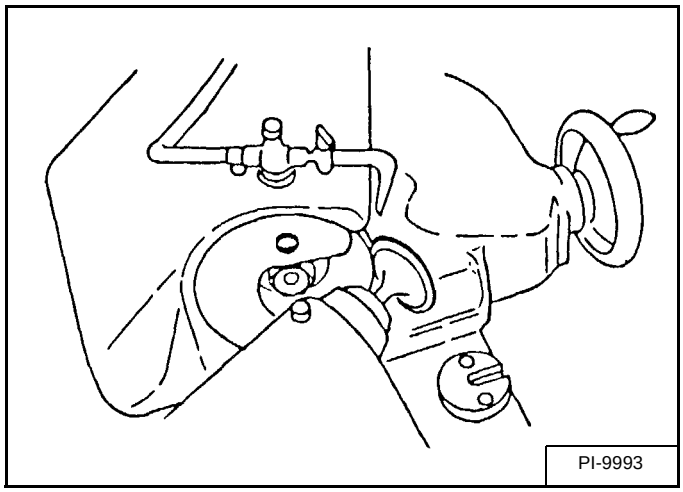
Press the used valve guide out of the cylinder head using the special driver tool **[Figure 60-80-22]**.

Put oil on the outside diameter of the new valve guide. Press the new valve guide into the cylinder head from the top side. Use the special driver tools (Items 1 & 2) **[Figure 60-80-22]**, press the new guide until the tool contacts the cylinder head.

Ream the valve guide to the correct specifications.

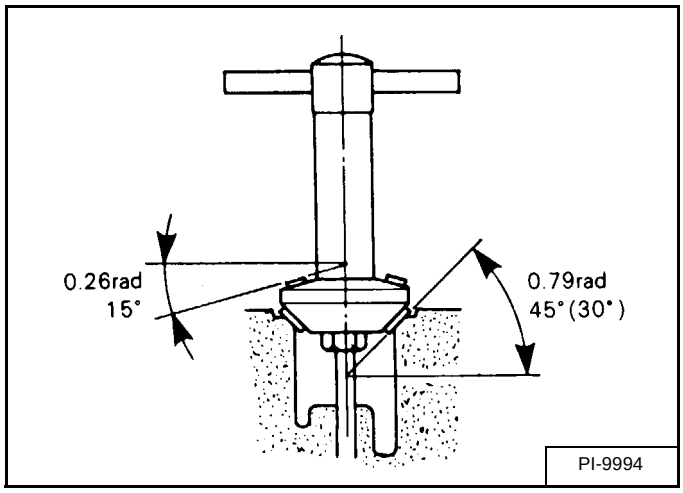
Reconditioning The Valve And Valve Seat

Figure 60-80-23



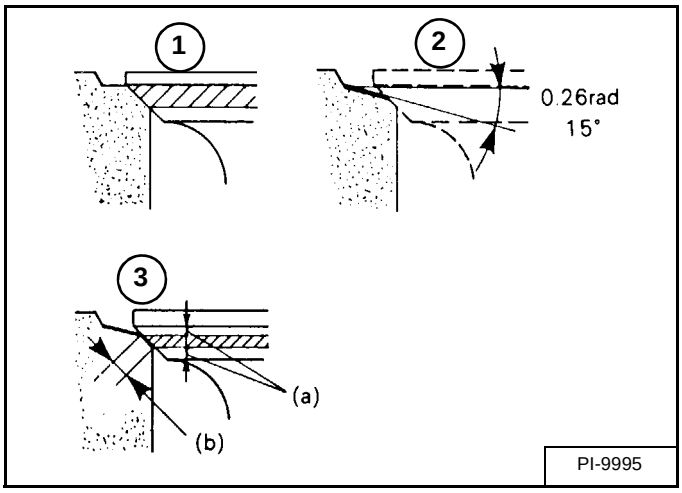
Grind the valve face to the correct angle using a valve refacer **[Figure 60-80-23]**.

Figure 60-80-24



Grind the valve seat surface in the cylinder head to the correct angle **[Figure 60-80-24]**.

Figure 60-80-25



Check the seat surface and valve face (Item 1) **[Figure 60-80-25]**.

If the seat surface is too wide, use a 15 degree cutter on the exhaust or a 30 degree cutter on the intake (Item 2) to get the correct width (Item 3) **[Figure 60-80-25]**.

Valve Seat Width

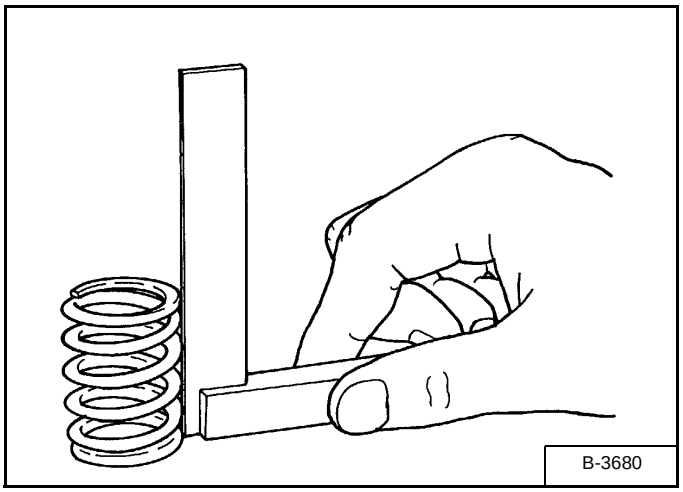
Intake	0.0835 in. (2,12 mm)
Exhaust	0.0835 in. (2,12 mm)

Valve Seat & Face Angle

Intake	60°
Exhaust	45°

Valve Spring

Figure 60-80-26



Measure the length of the valve spring. If the measurement is less than the allowable limit, replace the spring **[Figure 60-80-26]**.

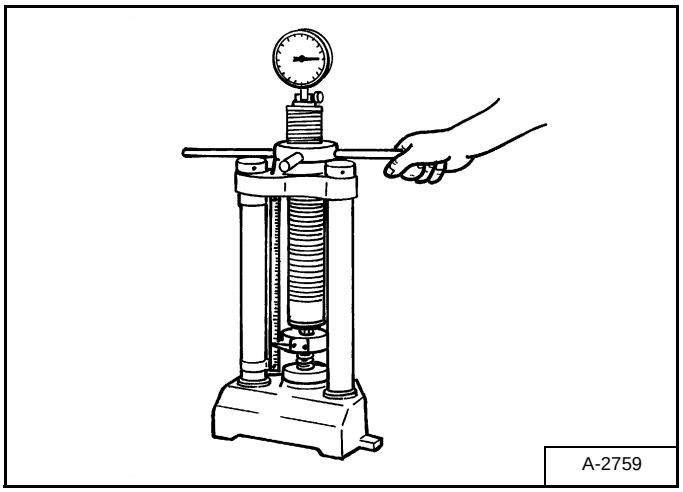
Free Length	1.65 - 1.66 in. (41,7 - 42,2 mm)
Allowable Limit	1.622 in. (41,2 mm)

Put the spring on a flat surface, place a square on the side of the spring **[Figure 60-80-26]**.

Rotate the spring and measure the maximum tilt. If the measurement excess the allowable limit, replace the spring.

Tilt	0.039 in. (1,0 mm)

Figure 60-80-27



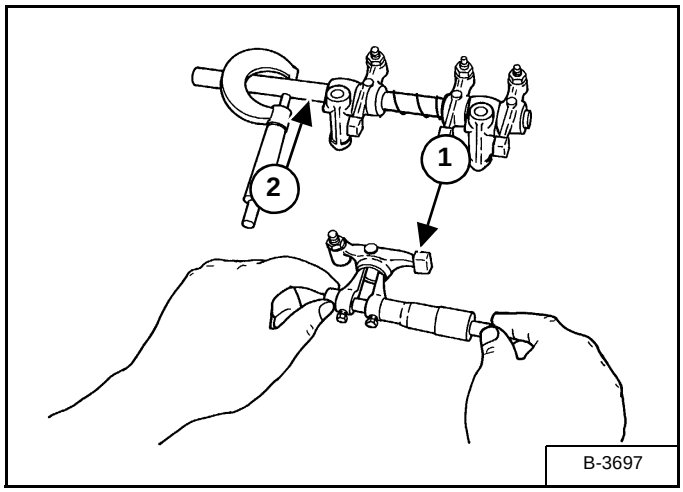
Put the spring on a tester and compress to specified length **[Figure 60-80-27]**.

Read the compressed load on the gauge. If the measurement exceeds allowable limit, replace the spring.

Setting Length	1.38 in. (35,0 mm)
Setting Load	26.5 lb. (117,6 N)
Allowable Limit	22.5 lb. (100,0 N)

Rocker Arm And Shaft Checking

Figure 60-80-28



Measure the rocker arm I.D. (Item 1) **[Figure 60-80-28]** with an inside micrometer.

Measure the rocker arm shaft O.D. (Item 2) **[Figure 60-80-28]** with an outside micrometer.

If the clearance exceeds the allowable limit, replace the bushing.

If the clearance still exceeds the allowable limit after the bushing is replace, replace the rocker arm shaft.

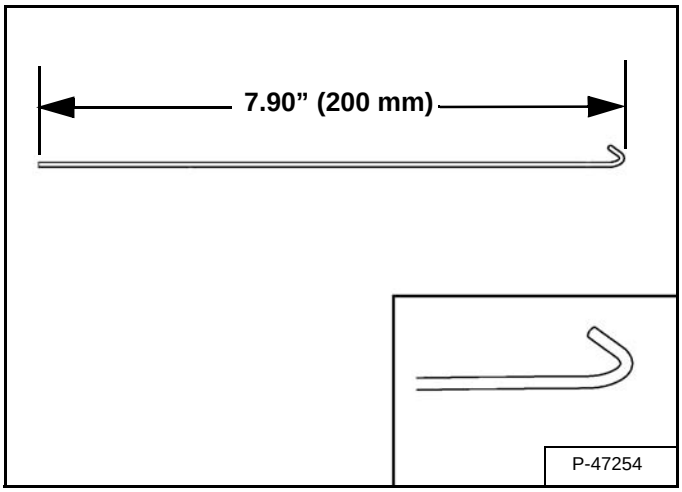
Oil Clearance Between Rocker Arm & Shaft	0.0006 - 0.0017 in. (0,02 - 0,05 mm)
Allowable Limit	0.004 in. (0,10 mm)
Rocker Arm Shaft O.D.	0.5501 - 0.5506 in. (13,97 - 13,98 mm)
Rocker Arm I.D.	0.5512 - 0.5520 in. (14,0 - 14,02 mm)

Timing Gearcase Cover Removal And Installation

Remove the fuel injection pump. (See Fuel Injection Pump Removal And Installation on Page 60-50-7.)

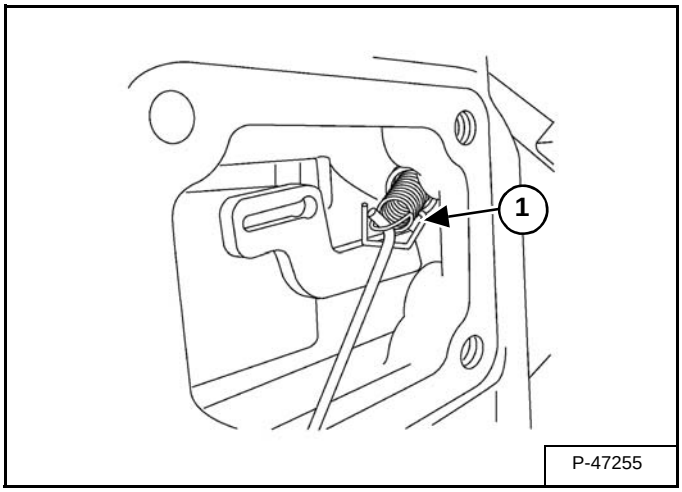
Remove the cylinder head, rocker arms and push rods. (See Cylinder Head Removal And Installation on Page 60-80-1.)

Figure 60-80-29



Bend a hook on the end of a 7.90 in. (200 mm) long, 0.050 in. (1,2 mm) diameter hard wire **[Figure 60-80-29]**.

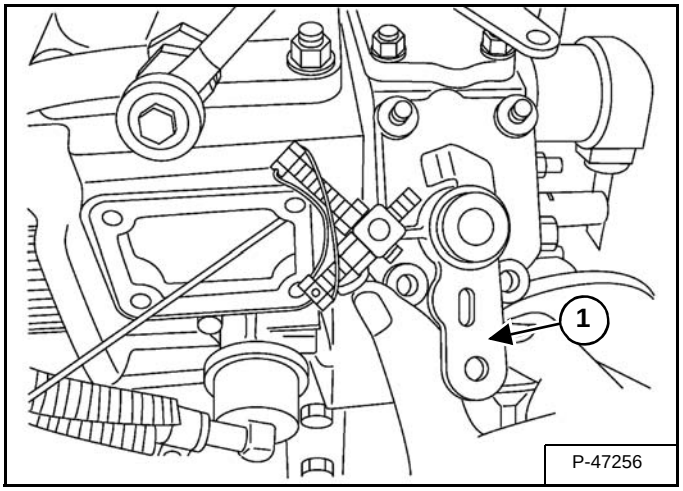
Figure 60-80-30



Disconnect the two governor springs (Item 1) **[Figure 60-80-30]**.

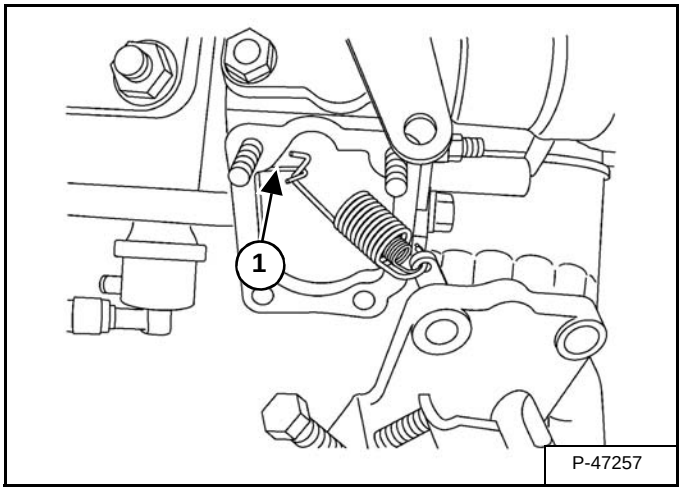
Timing Gearcase Cover Removal And Installation (Cont'd)

Figure 60-80-31



Remove the speed control plate (Item 1) **[Figure 60-80-31]**.

Figure 60-80-32



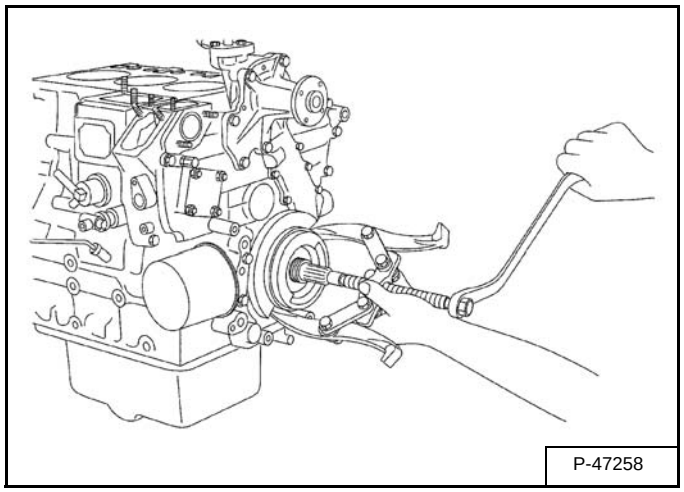
Remove the wire (Item 1) **[Figure 60-80-32]** from the springs.

Installation: Do not drop the governor springs into the gear case.

Remove the crankshaft pulley nut.

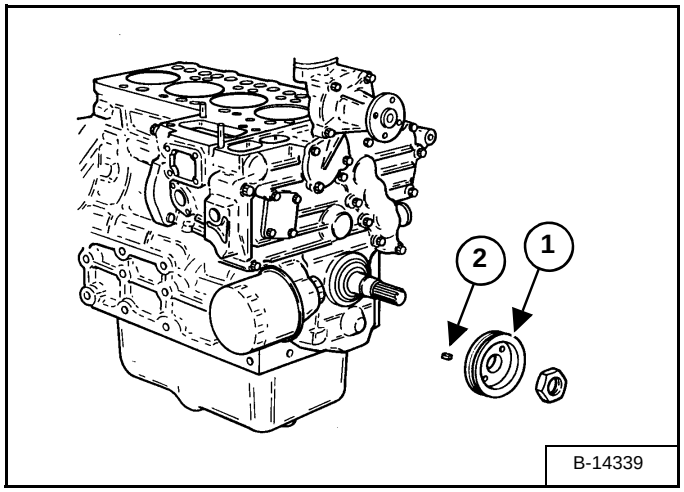
Installation: Tighten the nut to 102 - 115 ft.-lb. (138 - 156 N•m) torque.

Figure 60-80-33



Use a puller and remove the crankshaft pulley. **[Figure 60-80-33]**.

Figure 60-80-34



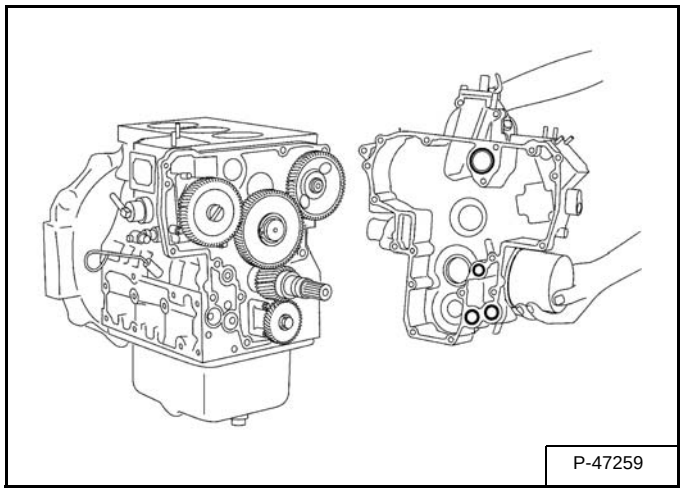
Remove the crankshaft pulley (Item 1) and key (Item 2) **[Figure 60-80-34]**.

Remove the bolts from the timing gearcase cover.

Installation: Tighten the bolts to 18 - 20 ft.-lb. (24 - 27 N•m) torque.

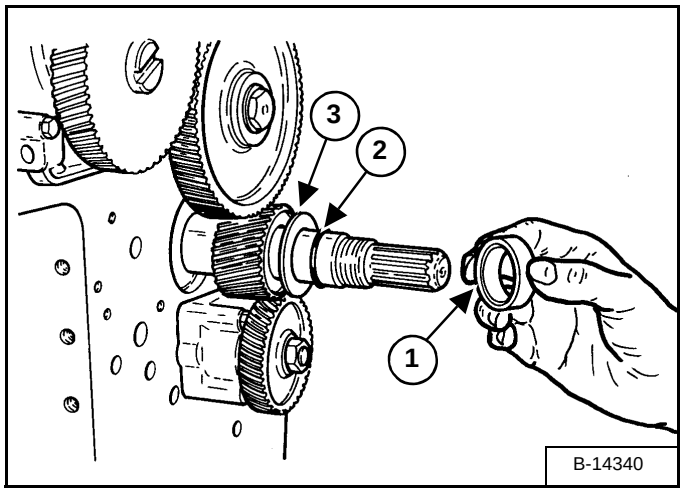
Timing Gearcase Cover Removal And Installation (Cont'd)

Figure 60-80-35



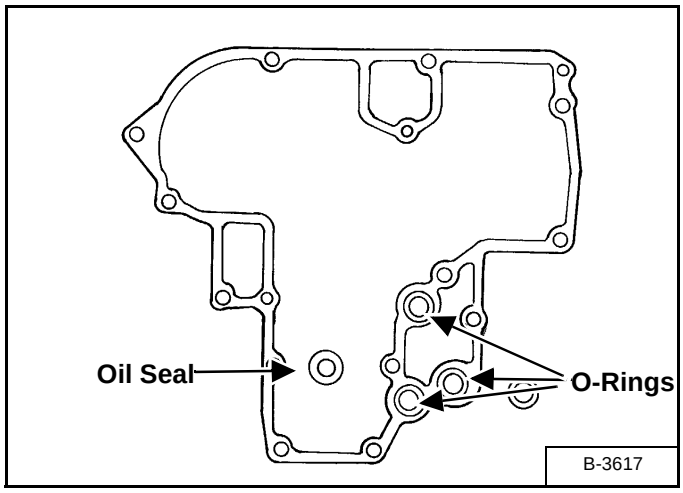
Remove the timing gearcase cover **[Figure 60-80-35]**.

Figure 60-80-36



Remove the crankshaft collar (Item 1), O-ring (Item 2) and oil slinger (Item 3) **[Figure 60-80-36]**.

Figure 60-80-37

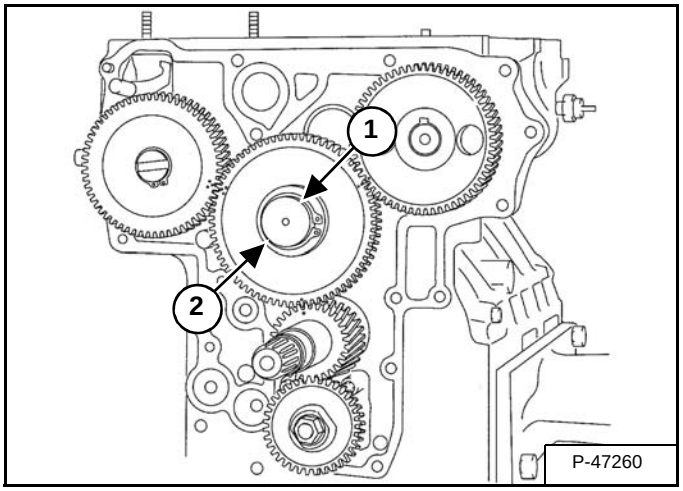


Installation: Install new O-rings and oil seal into the timing gearcase cover **[Figure 60-80-37]**.

Idler Gear And Camshaft Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-80-10.)

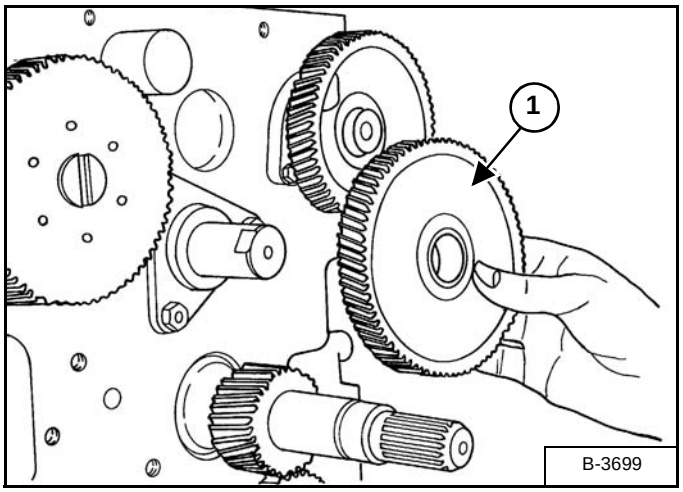
Figure 60-80-38



Remove the snap ring (Item 1) and collar from the idler gear shaft (Item 2) **[Figure 60-80-38]**.

Installation: Make sure the timing marks are in correct alignment when installing the timing gears **[Figure 60-80-38]**.

Figure 60-80-39

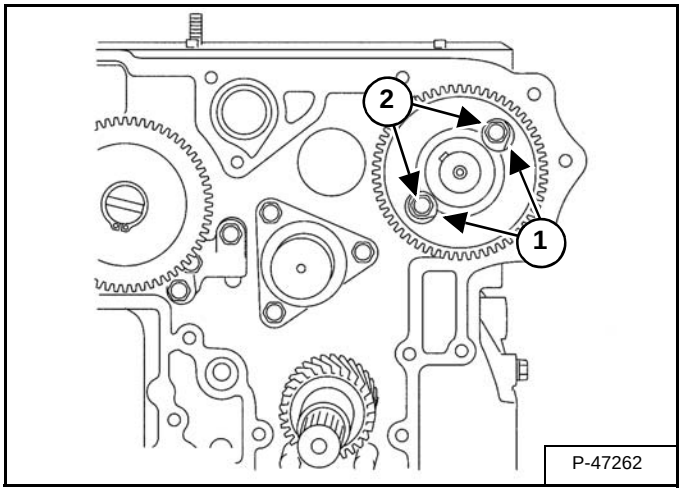


Remove the idler gear (Item 1) **[Figure 60-80-39]**.

Installation: Check the idler gear end play. If the clearance exceeds the allowable limit, replace the gear collar.

Idler Gear End Play	0.048 - 0.018 in. (0,12 - 0,48 mm)
Allowable Limit	0.04 in. (0,9 mm)

Figure 60-80-40

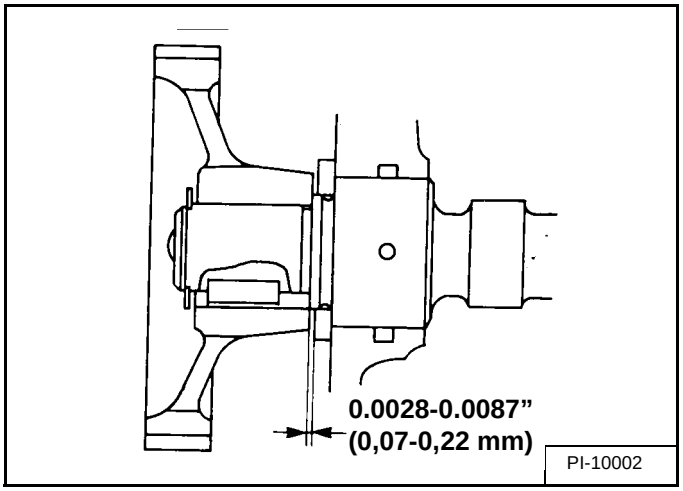


Align the holes (Item 1) on the camshaft gear with the camshaft retainer plate bolts (Item 2) **[Figure 60-80-40]**. Remove the bolts.

Installation: Tighten the camshaft retainer bolts to 18 - 20 ft.-lb. (24 - 27 N•m) torque.

Remove the camshaft from the engine block.

Figure 60-80-41

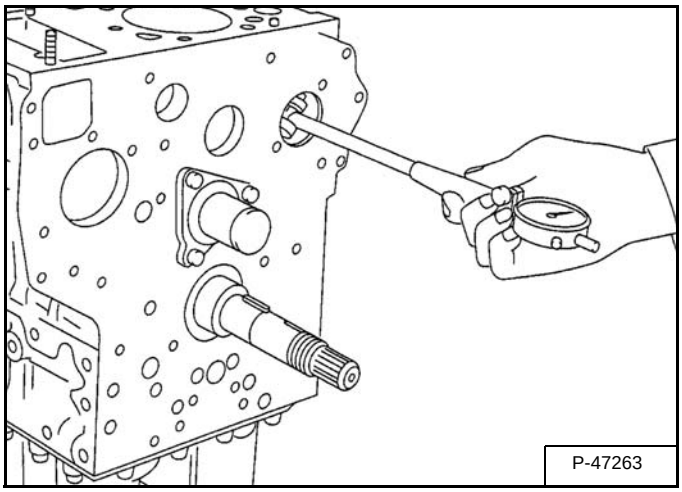


Installation: Check the camshaft end play. If clearance exceeds the allowable limit, replace the camshaft retainer plate **[Figure 60-80-41]**.

Camshaft End Play	0.0028 - 0.0086 in. (0,07 - 0,22 mm)
Allowable Limit	0.012 in. (0,3 mm)

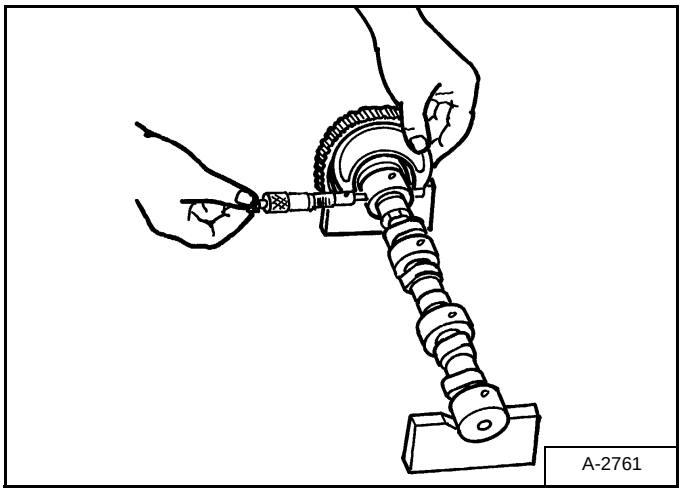
Camshaft Servicing

Figure 60-80-42



Measure the cylinder block bore in the engine block **[Figure 60-80-42]**.

Figure 60-80-43

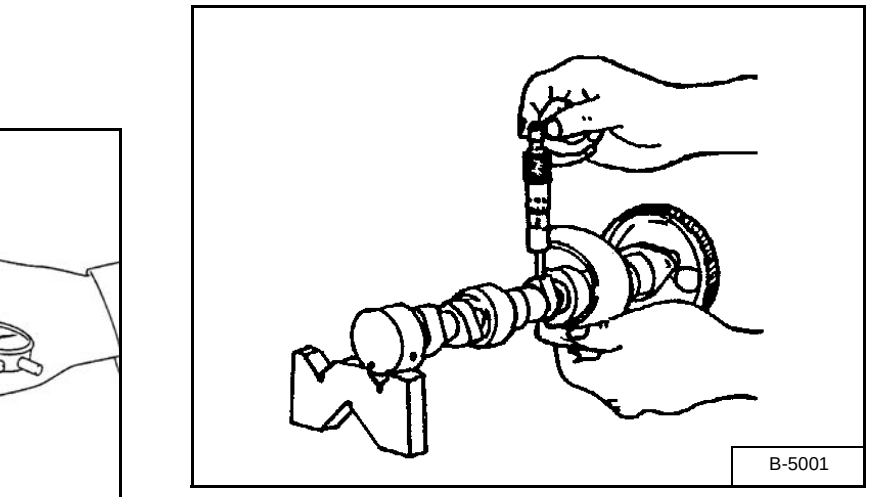


Measure the camshaft journal **[Figure 60-80-43]**.

Calculate the oil clearance. If the clearance exceeds the allowable limit, replace the camshaft.

Cylinder Block Bore I.D.	1.575 - 1.576 in. (40,0 - 40,025 mm)
Journal O.D.	1.572 - 1.573 in. (39,93 - 39,95 mm)
Oil Clearance of Camshaft Journal	0.002 - 0.0036 in. (0,05 - 0,091 mm)
Allowable Limit	0.006 in. (0,15 mm)

Figure 60-80-44

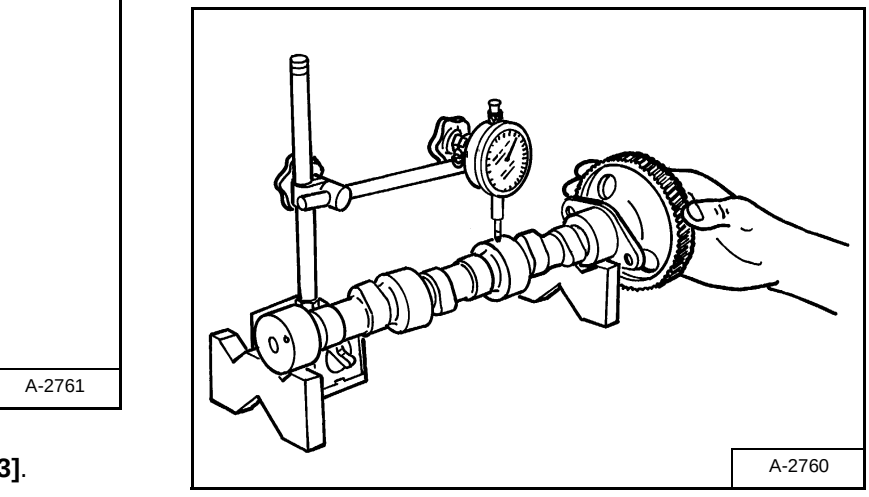


Measure the cam lobes at their highest point **[Figure 60-80-44]**.

If the measurement is less than the allowable limit, replace the camshaft.

Cam Lobe Height	1.335 in. (33,9 mm)
Allowable Limit	1.333 in. (33,85 mm)

Figure 60-80-45



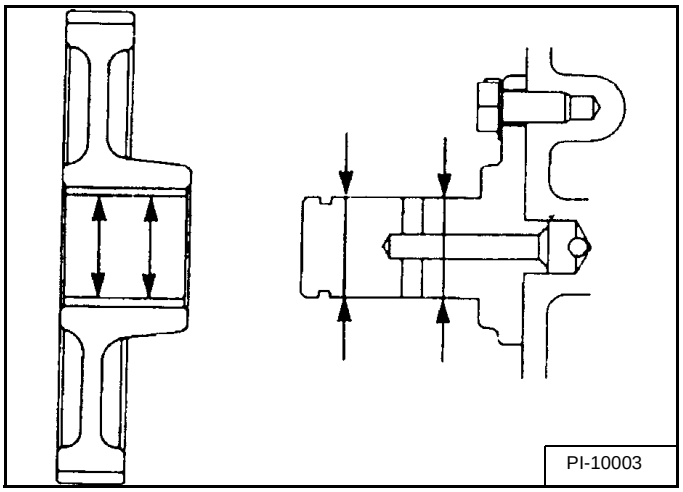
Put the camshaft in V-blocks. Install a dial indicator **[Figure 60-80-45]**.

Turn the camshaft at a slow rate. If the misalignment exceeds the allowable limit, replace the camshaft.

Camshaft Alignment Allowable Limit	0.0004 in. (0,01 mm)

Idler Gear And Shaft Servicing

Figure 60-80-46



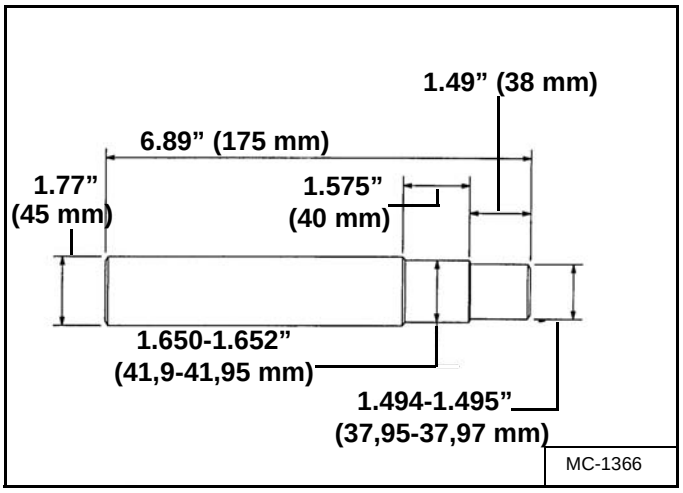
Measure the O.D. of the idler gear shaft **[Figure 60-80-46]**.

Measure the I.D. of the idler gear bushing **[Figure 60-80-46]**.

If the clearance exceeds the allowable limit, replace the bushing.

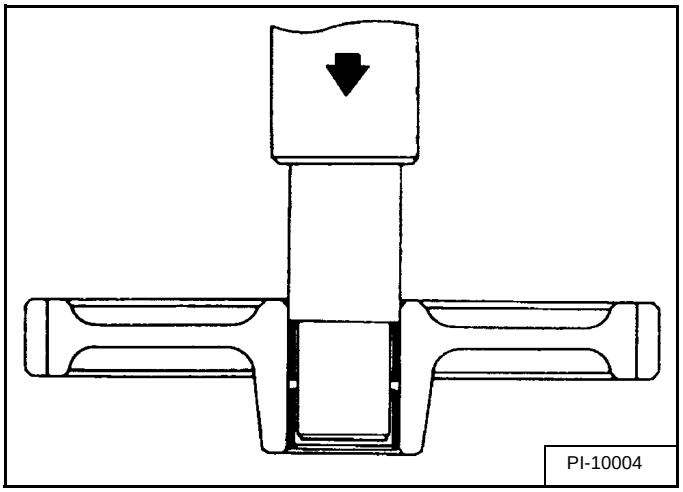
Idler Gear Shaft O.D.	1.494 - 1.495 in. (37,96 - 37,98 mm)
Idler Gear Bushing I.D.	1.496 - 1.497 in. (38,0 - 38,03 mm)
Clearance Between Idler Shaft & Gear Bushing	0.001 - 0.0026 in. (0,025 - 0,066 mm)
Allowable Limit	0.004 in. (0,1 mm)

Figure 60-80-47



To replace the idler gear bushing, make a driver tool as shown **[Figure 60-80-47]**.

Figure 60-80-48

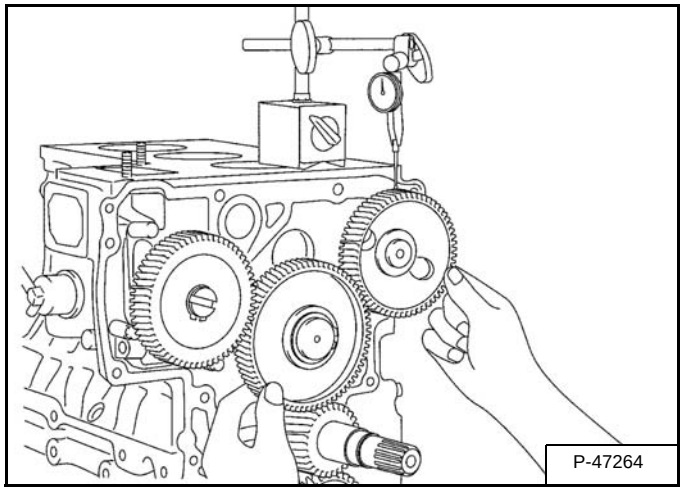


Use a press and special driver tool, to remove the old bushing and install the new bushing **[Figure 60-80-48]**.

Timing Gears Checking Backlash

When the gears are installed, check the backlash of the gears.

Figure 60-80-49



Install a dial indicator **[Figure 60-80-49]**.

Hold one gear while turning the other gear **[Figure 60-80-49]**.

If the backlash exceeds the allowable limit, check the oil clearance of the shaft and gear. If the oil clearance is correct, replace the gear.

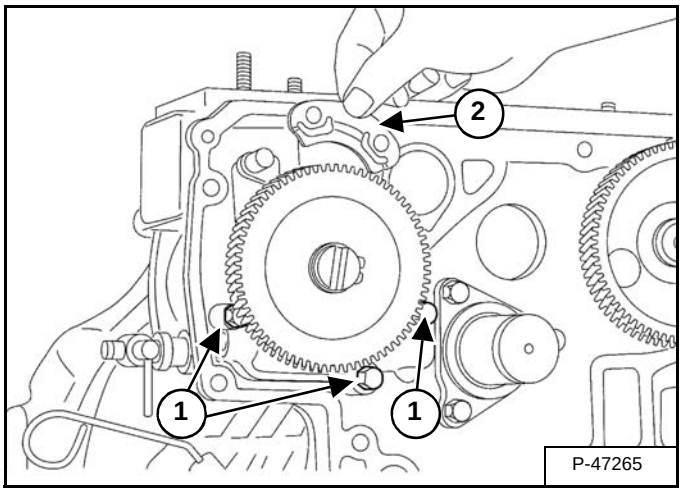
Crank Gear & Idler Gear	0.0016 - 0.0044 in. (0,042 - 0,112)
Allowable Limit	0.006 in. (0,15 mm)
Cam Gear & Idler Gear	0.0016 - 0.0045 in. (0,042 - 0,115 mm)
Allowable Limit	0.006 in. (0,15 mm)
Injection Pump Gear & Idler Gear	0.0016 - 0.0045 in. (0,042 - 0,115 mm)
Allowable Limit	0.006 in. (0,15 mm)
Oil Pump Gear & Crank Gear	0.0016 - 0.0043 in. (0,042 - 0,109 mm)
Allowable Limit	0.006 in. (0,15 mm)

Fuel Camshaft Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-80-10.)

Remove the idler gear. (See Idler Gear And Camshaft Removal And Installation on Page 60-80-13.)

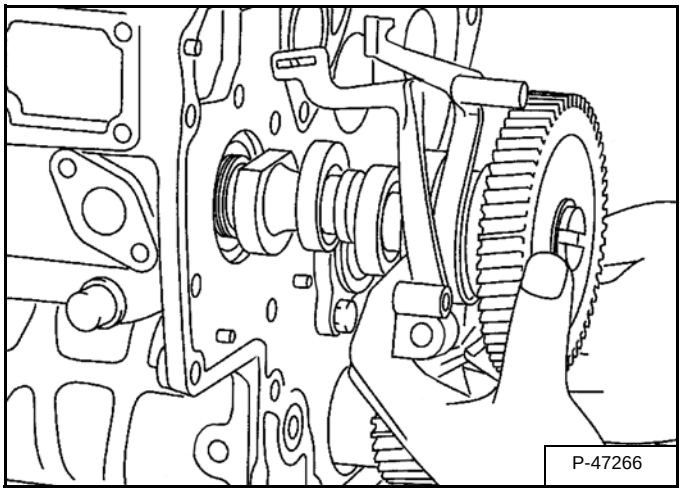
Figure 60-80-50



Remove the three bolts (Item 1) **[Figure 60-80-50]**.

Remove the two bolts and fuel camshaft retainer plate (Item 2) **[Figure 60-80-50]**.

Figure 60-80-51

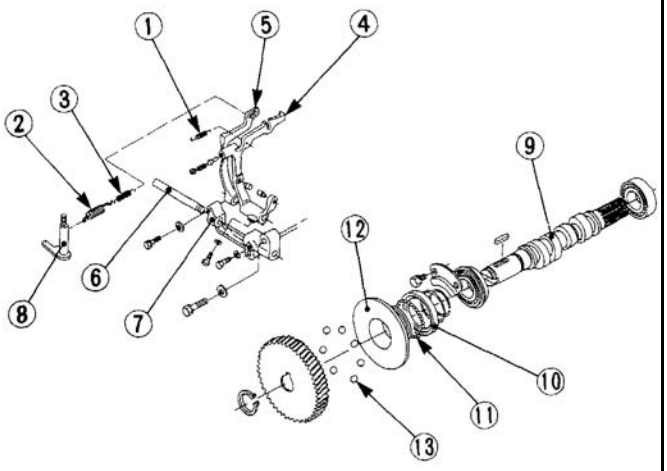


Remove the fuel camshaft and fork lever assembly at the same time **[Figure 60-80-51]**.

Fuel Camshaft Governor

The governor serves to keep the engine speed constant by automatically adjusting the amount of fuel supplied to the engine according to changes in the load.

Figure 60-80-52



1. Start Spring
2. Governor Spring
3. Governor Spring
4. Fork Lever
5. Fork Lever
6. Fork Lever Shaft
7. Fork Lever Holder
8. Governor Lever
9. Fuel Camshaft
10. Governor Ball Case
11. Steel Balls
12. Governor Sleeve
13. Steel Ball

PI-10008

Disassemble and assemble the governor and fuel camshaft as shown **[Figure 60-80-52]**.

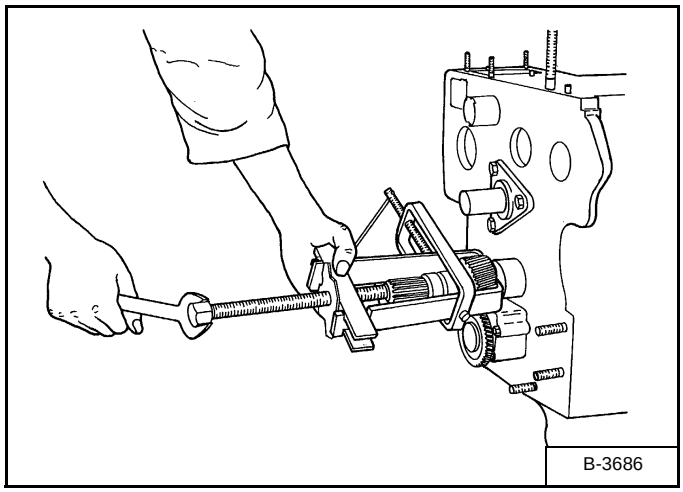
Check all the parts for wear or damage and replace as needed.

Crankshaft Gear Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-80-10.)

Remove the idler gear. (See Idler Gear And Camshaft Removal And Installation on Page 60-80-13.)

Figure 60-80-53



B-3686

Remove the crankshaft gear with a puller **[Figure 60-80-53]**.

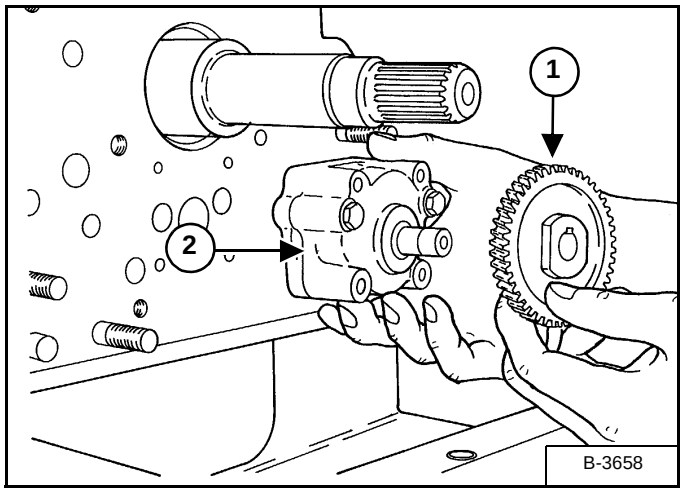
Remove the crankshaft key.

Oil Pump Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-80-10.)

Remove the crankshaft gear. (See Crankshaft Gear Removal And Installation on Page 60-80-17.)

Figure 60-80-54



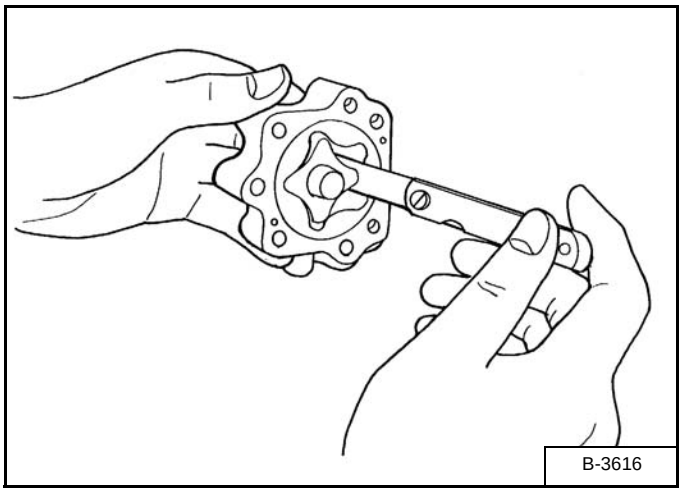
Remove the nut from the oil pump shaft. Use a puller to remove the oil pump gear (Item 1) **[Figure 60-80-54]**.

Remove the oil pump mounting bolts. Remove the oil pump (Item 2) **[Figure 60-80-54]**.

Installation: Tighten the oil pump mounting bolts to 60 - 72 in.-lb. (6,9 - 8,1 N•m) torque.

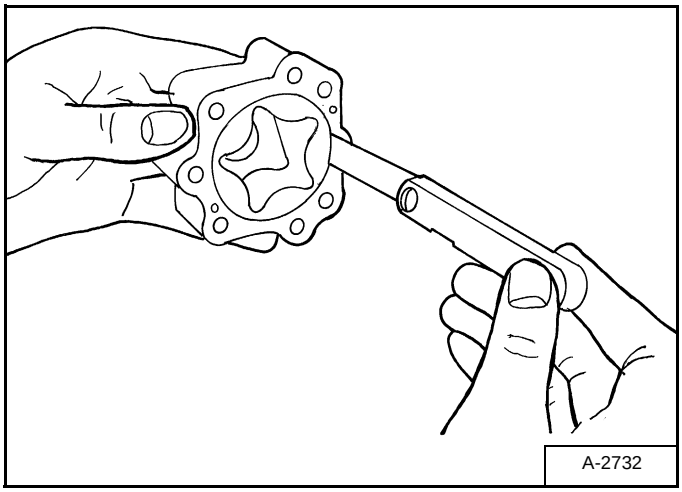
Oil Pump Service

Figure 60-80-55



Measure the clearance between the lobes of the inner rotor and outer rotor **[Figure 60-80-55]**.

Figure 60-80-56



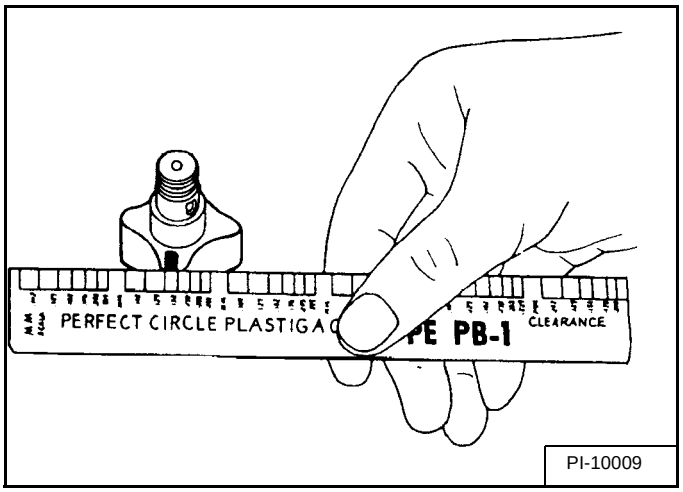
Measure the clearance between the outer rotor and pump body **[Figure 60-80-56]**.

If the clearance exceeds the allowable limit, replace the oil pump.

Clearance Between Inner & Outer Rotor	0.0012 - 0.0055 in. (0,03 - 0,14 mm)
Clearance Between Outer Rotor & Body	0.0044 - 0.0074 in. (0,11 - 0,19 mm)

Oil Pump Service (Cont'd)

Figure 60-80-57



Put a piece of press gauge on the rotor face **[Figure 60-80-57]**.

Install the cover and tighten the bolts.

Remove the cover carefully. Measure the width of the press gauge **[Figure 60-80-57]**.

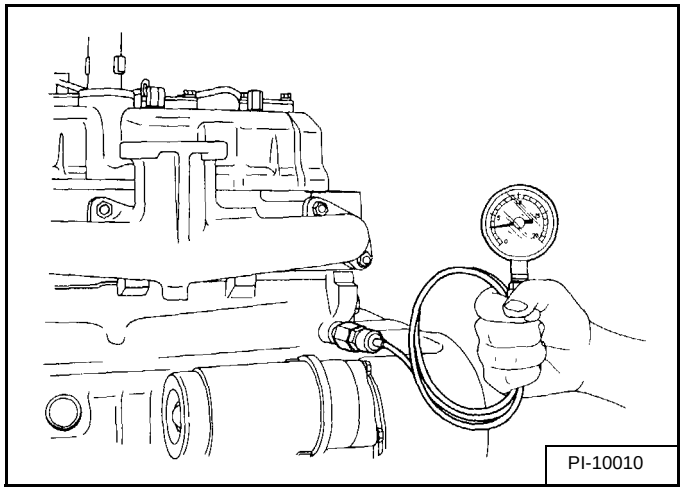
If the clearance exceeds the allowable limit replace the oil pump.

End Clearance	0.0041 - 0.0059 in. (0,105 - 0,15 mm)

Checking Engine Oil Pressure

Remove the oil pressure sender.

Figure 60-80-58



Install a pressure gauge **[Figure 60-80-58]**.

Start the engine and run until it is at operating temperature.

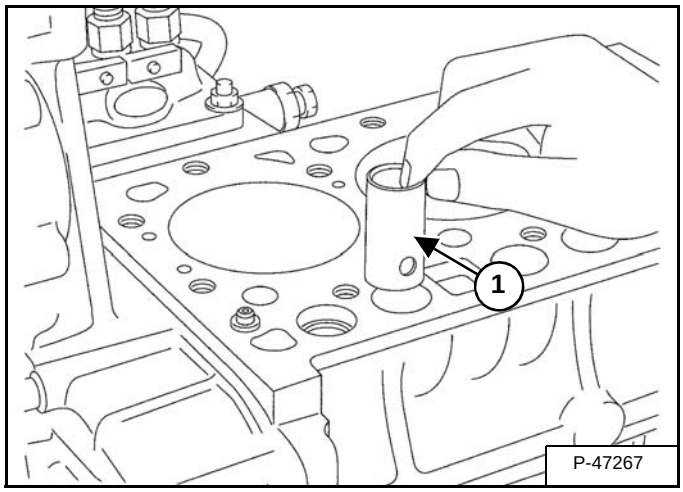
If the oil pressure is less than the allowable limit, check the following items:

* Engine Oil Level Low
* Oil Pump Defective
* Oil Galley Plugged
* Oil Strainer Plugged
* Excessive Clearance at the Rod & Main Bearings
* Oil Pump Relief Valve Stuck

At Idle Speed Allowable Limit	7 PSI (0,48 bar)
At Rated Speed	43 - 64 PSI (2,9 - 4,4 bar)
Allowable Limit	36 PSI (2,48 bar)

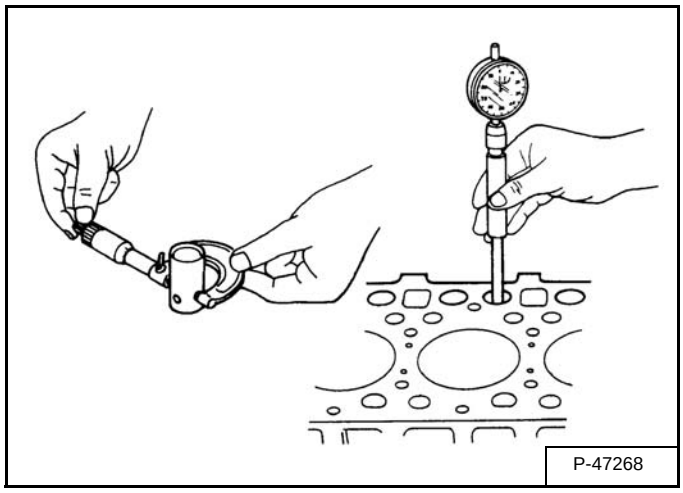
Valve Tappets

Figure 60-80-59



Remove the valve tappets (Item 1) **[Figure 60-80-59]**.

Figure 60-80-60



Measure the O.D. of the tappet **[Figure 60-80-60]**.

Measure the ID of the tappet bore **[Figure 60-80-60]**.

If the clearance exceeds the allowable limit, replace the tappets.

Tappet OD	0.943 - 0.944 in. (23,96 - 23,98 mm)
Tappet Bore ID	0.945 - 0.946 in. (24,0 - 24,021 mm)
Clearance Between Tappet and Tappet Bore	0.0008 - 0.0024 in. (0,02 - 0,062 mm)
Allowable limit	0.003 in. (0,07 mm)

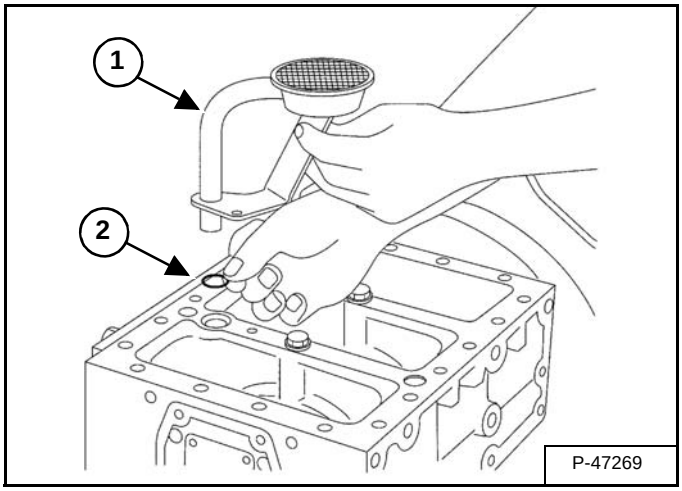
Piston And Connecting Rod Removal And Installation

Remove the cylinder head. (See Cylinder Head Removal And Installation on Page 60-80-1.)

Remove the top edge from the cylinder bore with a ridge reamer.

Remove the oil pan.

Figure 60-80-61



Remove the oil pump strainer (Item 1) and O-ring (Item 2) **[Figure 60-80-61]** by tapping the edge of the strainer with a soft faced hammer.

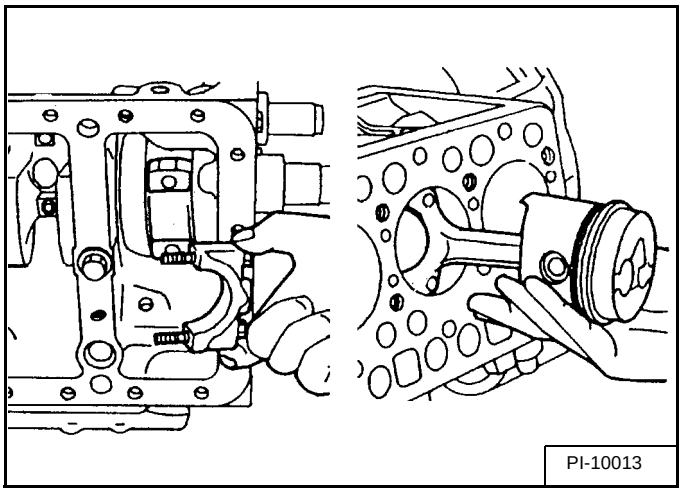
Turn the flywheel and put a pair of connecting rods at bottom dead center.

Remove the connecting rod bolts.

Installation: Tighten the connecting rod bolts to 33 - 36 ft.-lb. (44 - 49 N•m) torque.

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

Figure 60-80-62

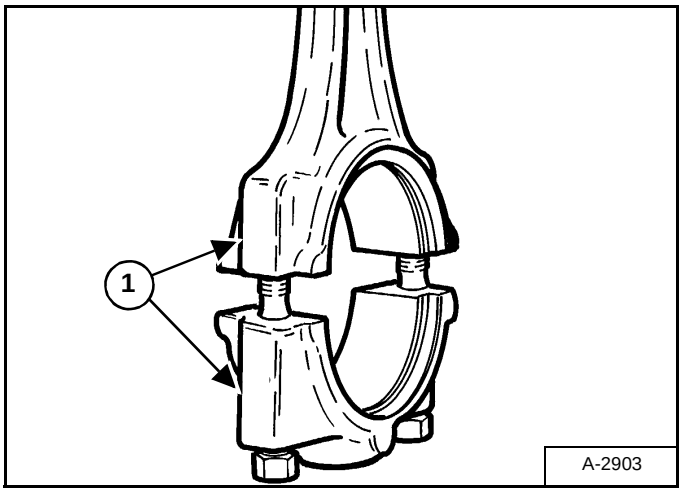


Remove the rod cap and bearing **[Figure 60-80-62]**.

Use a hammer handle and push the piston/connecting rod assembly out of the cylinder bore **[Figure 60-80-62]**.

NOTE: Make sure the pistons are marked so they will be returned to the same cylinder bore.

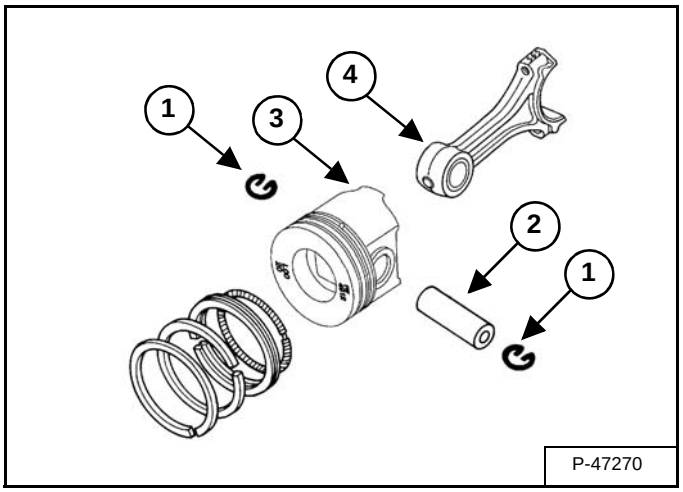
Figure 60-80-63



Installation: Make sure the marks (Item 1) **[Figure 60-80-63]** on the connecting rod and bearing are aligned when installing the bearing cap.

Repeat the procedure to remove the other piston/ connecting rod assemblies from the engine block.

Figure 60-80-64

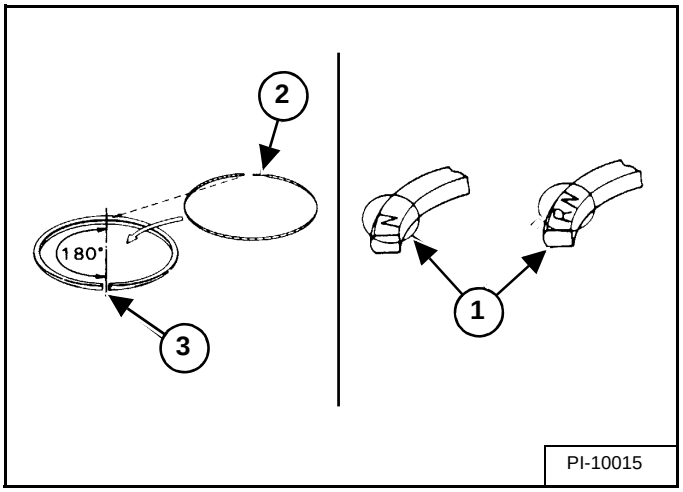


Remove the piston rings **[Figure 60-80-64]**.

Remove the snap ring (Item 1) and piston pin (Item 2) **[Figure 60-80-64]**.

Separate the piston (Item 3) from the connecting rod (Item 4) **[Figure 60-80-64]**.

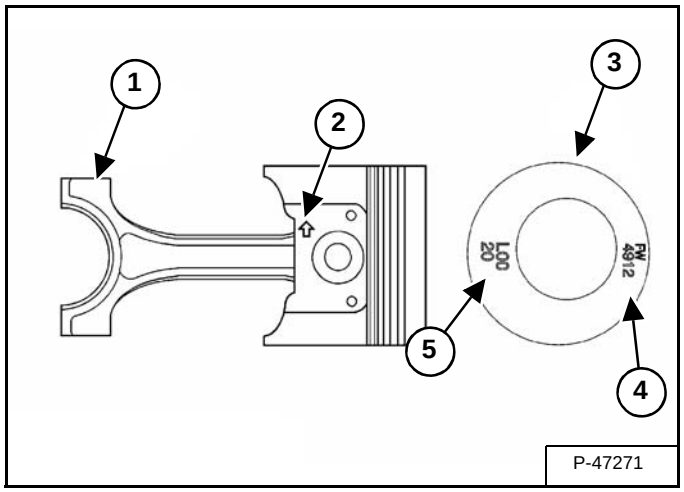
Figure 60-80-65



Installation: When installing new rings, assemble the ring so the mark (Item 1) near the gap faces the top of the piston. When installing the oil ring, place the expander joint (Item 2) on the opposite side of the oil ring gap (Item 3) **[Figure 60-80-65]**.

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

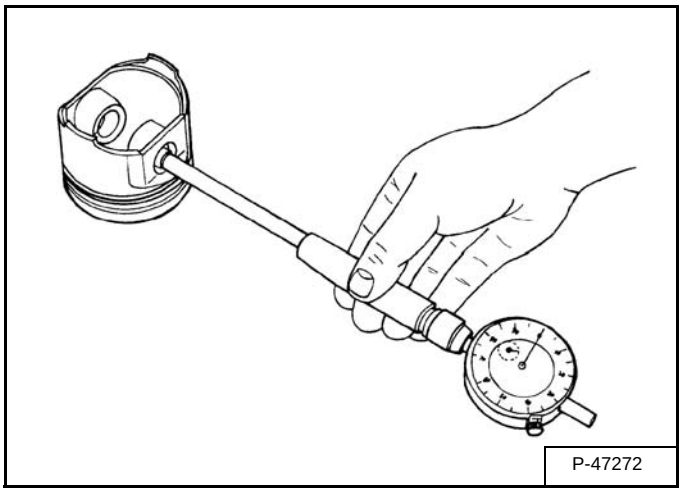
Figure 60-80-66



Installation: When reassembling, align the marks on the connecting rod (Item 1) and piston (Item 2). Heat the piston in clean engine oil to 176° F. (80° C.) and tap the piston pin into position. Place the piston rings so that there are gaps every 120° (Items 3, 4 & 5) **[Figure 60-80-66]** with no gap facing the piston pin in the cylinder.

Piston And Connecting Rod Servicing

Figure 60-80-67

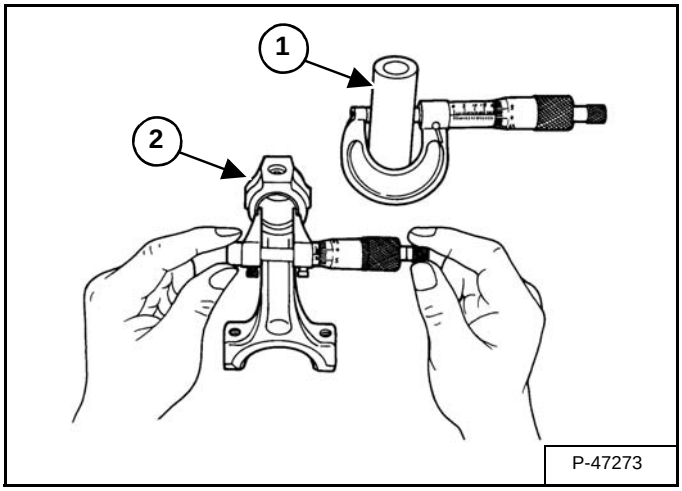


Measure the I.D. of the piston pin bore in both horizontal and vertical directions **[Figure 60-80-67]**.

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

Piston Bore I.D.	0.984 - 0.985 in. (25,0 - 25,013 mm)
Allowable Limit	0.986 in. (25,05 mm)

Figure 60-80-68



Measure the O.D. of the piston pin (Item 1) **[Figure 60-80-68]**.

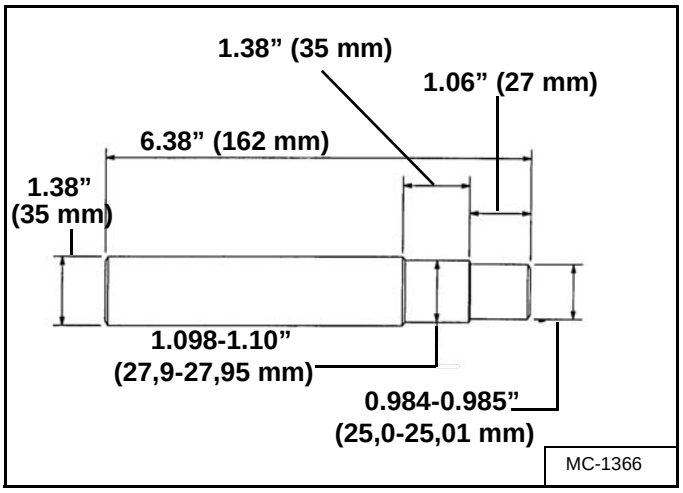
Measure the I.D. of the connecting rod small end (Item 2) **[Figure 60-80-68]**.

Piston And Connecting Rod Servicing (Cont'd)

Calculate the oil clearance. If the clearance exceeds the allowable limit, replace the bushing. If it still exceeds the specifications, replace the piston pin.

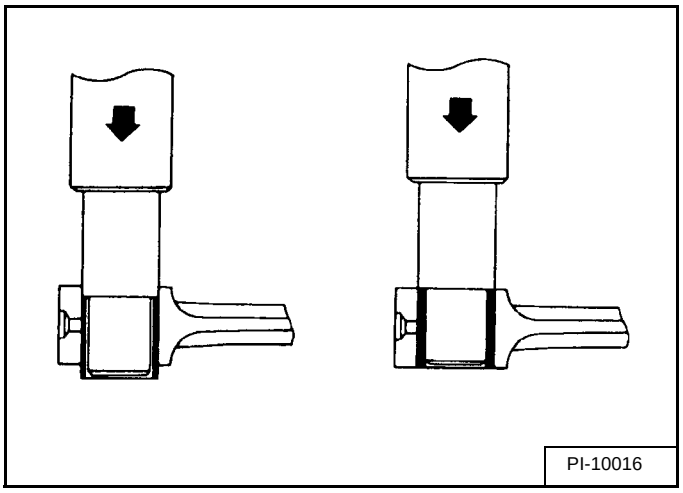
Piston Pin O.D.	0.984 - 0.985 in. (25,0 - 25,011 mm)
Bushing I.D.	0.985 - 0.986 in. (25,025 - 25,04 mm)
Oil Clearance Between Piston Pin & Bushing	0.0006 - 0.0015 in. (0,014 - 0,038 mm)
Allowable Limit	0.006 in. (0,15 mm)

Figure 60-80-69



To replace the connecting rod small end bushing, make a driver tool as shown **[Figure 60-80-69]**.

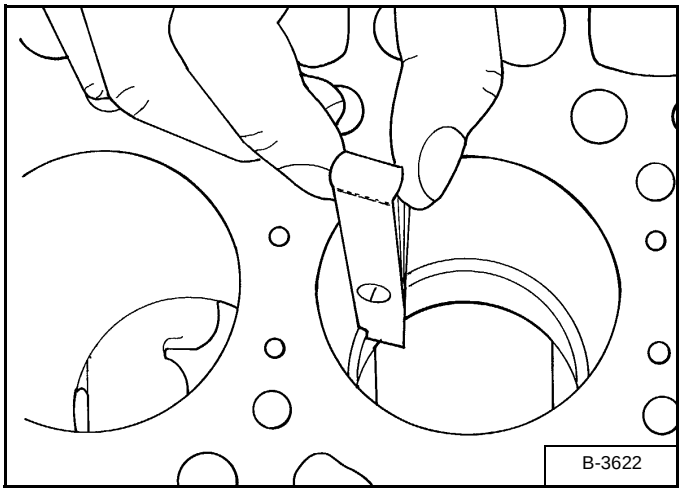
Figure 60-80-70



Use a press and special driver tool to remove the small end bushing **[Figure 60-80-70]**.

Installation: Clean the small end bushing and bore. Put oil on the bushing and press into the connecting rod until it is flush **[Figure 60-80-70]**.

Figure 60-80-71



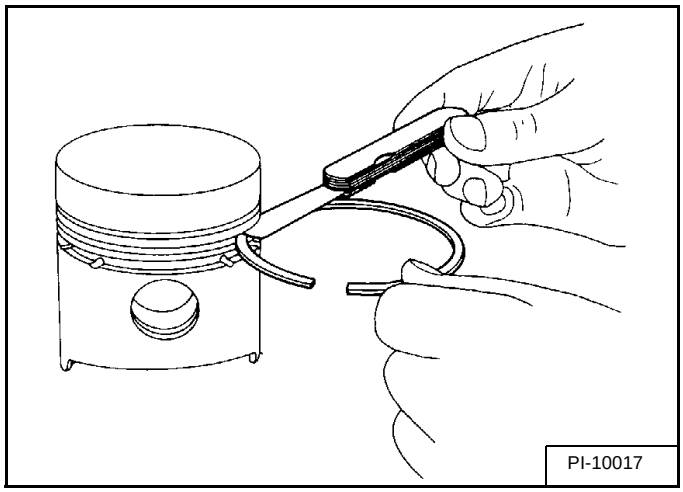
Install a piston ring into the lower part of the cylinder bore. Measure the ring gap with a feeler gauge **[Figure 60-80-71]**.

If the gap exceeds the allowable limit, replace the ring.

Top Ring Gap	0.009 - 0.015 in. (0,25 - 0,40 mm)
Second Ring Gap	0.012 - 0.017 in. (0,30 - 0,45 mm)
Oil Ring Gap	0.0098 - 0.0177 in. (0,25 - 0,45 mm)
Allowable Limit	0.05 in. (1,25 mm)

Piston And Connecting Rod Servicing (Cont'd)

Figure 60-80-72



Remove the carbon from the ring grooves. Measure the clearance between the ring and groove with a feeler gauge **[Figure 60-80-72]**.

If the clearance exceeds the allowable limit, replace the ring. If the clearance still exceeds the allowable limit, replace the piston.

Compression Rings	0.0037 - 0.005 in. (0,093 - 0,13 mm)
Oil Ring	0.0079 - 0.0023 in. (0.02 - 0.06 mm)

Connecting Rod Alignment

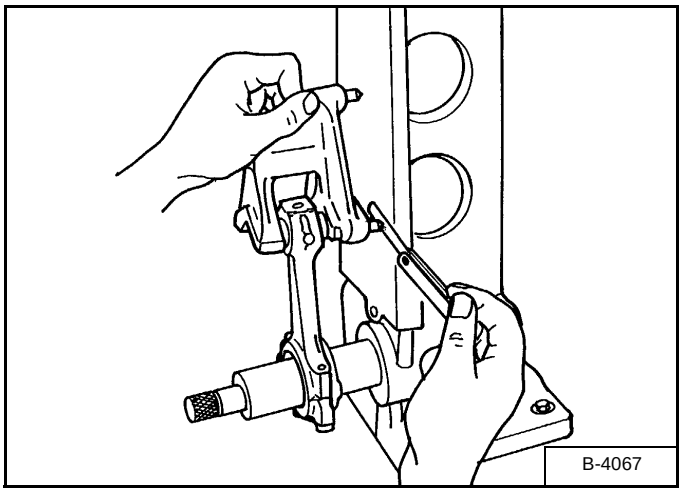
NOTE: The small end bushing is the basis of this check, check the bushing for wear before doing this check.

Install the piston pin into the connecting rod.

Install the connecting rod on an alignment tool.

Put the gauge over the piston pin and move it against the face plate.

Figure 60-80-73



If the gauge does not fit squarely against the face plate, measure the space between the gauge and face plate **[Figure 60-80-73]**.

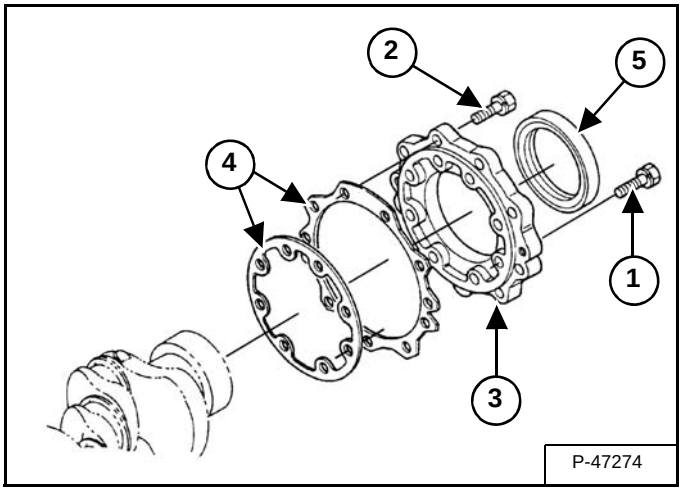
If the measurement exceeds the allowable limit, replace the connecting rod.

Rod Alignment	0.002 in. (0,05 mm)

Crankshaft And Bearings Removal And Installation

Remove the piston and connecting rod assemblies. (See Piston And Connecting Rod Removal And Installation on Page 60-80-20.)

Figure 60-80-74



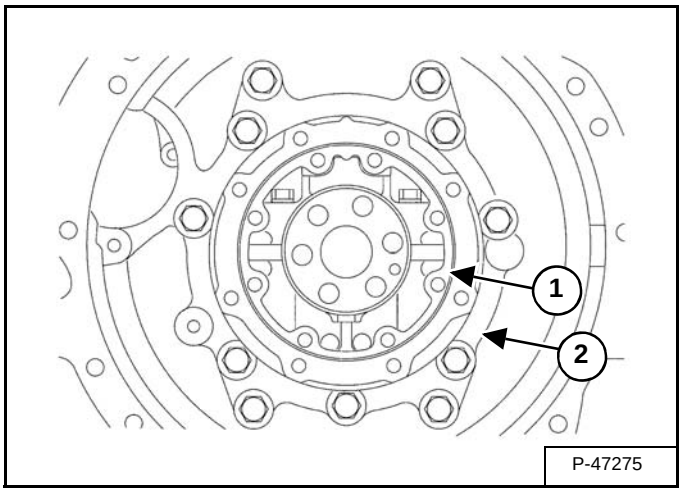
Mark and remove the inside screws (Item 1) first, then remove the outside screws (Item 2) **[Figure 60-80-74]**.

NOTE: The inside bolts are different length than the outside bolts.

Install two bolts in the bearing case cover and remove the cover (Item 3) **[Figure 60-80-74]**.

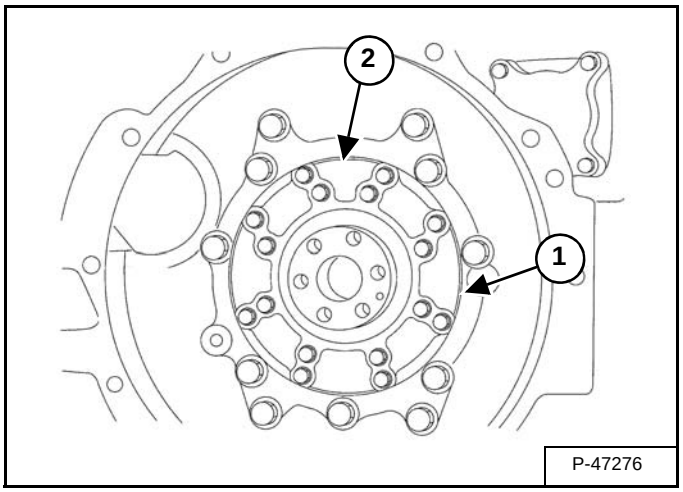
Remove the two gaskets (Item 4) and oil seal (Item 5) **[Figure 60-80-74]** from the cover.

Figure 60-80-75



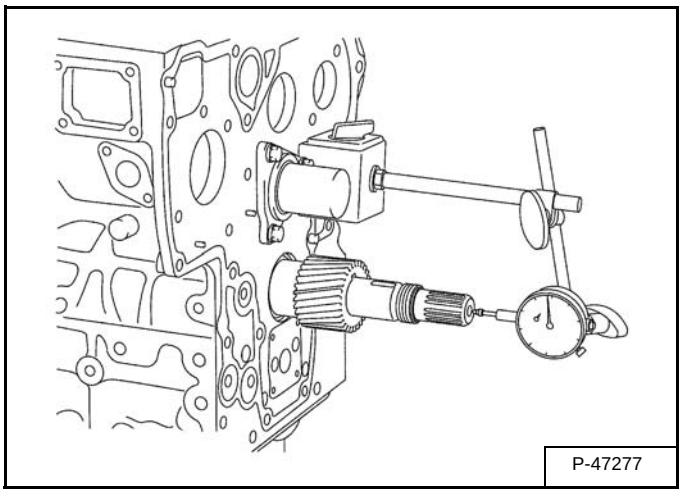
Installation: Install the gaskets (Item 1) & (Item 2) **[Figure 60-80-75]** as shown.

Figure 60-80-76



Install the bearing case cover (Item 1) with the casting mark (Item 2) **[Figure 60-80-76]** in the upward position. Tighten the bolts to 18 - 20 ft.-lb. (24 - 27 N•m) torque.

Figure 60-80-77



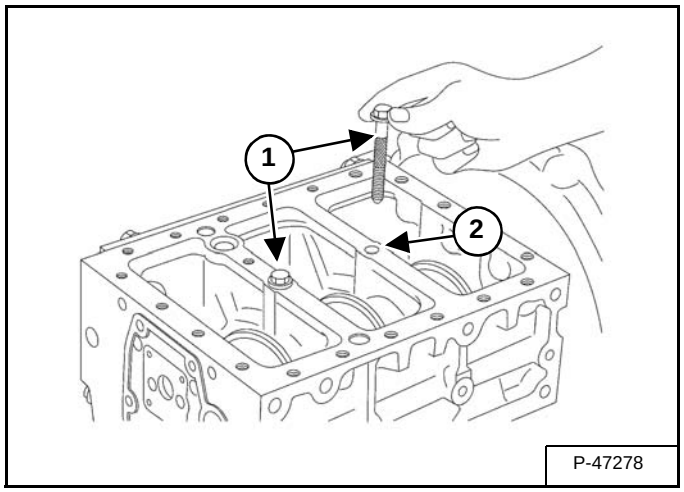
Before removing the crankshaft/main bearings, check the end play. Install a dial indicator. Move the crankshaft **[Figure 60-80-77]** to the flywheel side, zero the dial indicator. Measure the end play by pulling the crankshaft toward the gearcase side.

If the measurement exceeds the allowable limit, replace the thrust washers **[Figure 60-80-77]**.

End Play	0.006 - 0.012 in. (0,15 - 0,31 mm)
Allowable Limit	0.020 in. (0,5 mm)

Crankshaft And Bearings Removal And Installation (Cont'd)

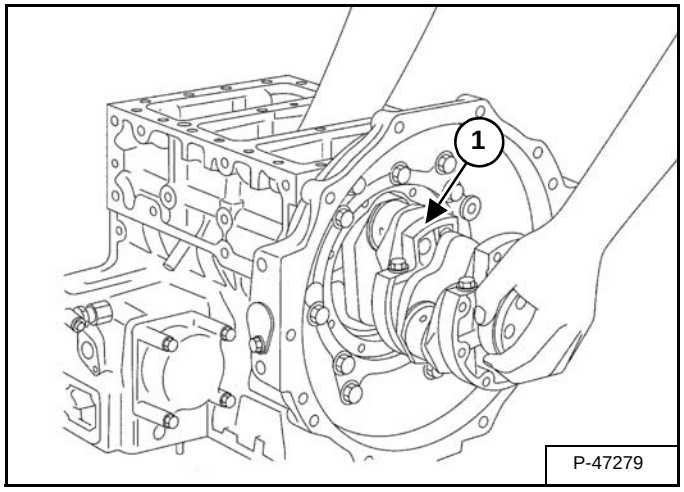
Figure 60-80-78



Remove the main bearing bolts (Item 1) **[Figure 60-80-78]**.

Installation: Align the bearing case hole with the hole (Item 2) **[Figure 60-80-78]** in the block. Put oil on the bolt threads and tighten to 51 - 54 ft.-lb. (69 - 73 N•m) torque.

Figure 60-80-79

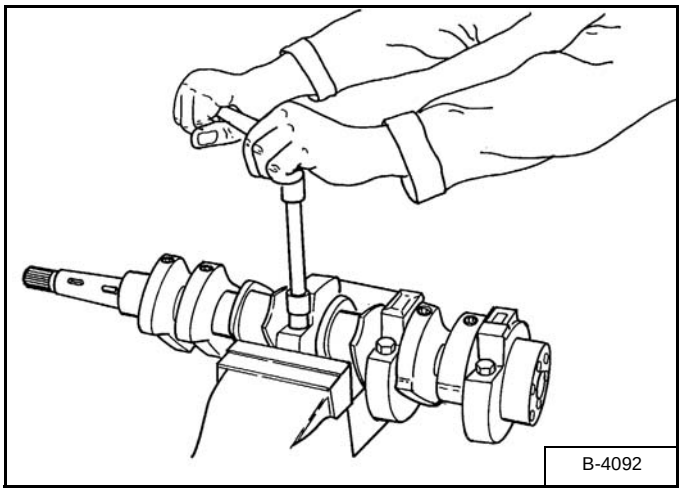


Remove the crankshaft/main bearing assembly from the engine block **[Figure 60-80-79]**.

NOTE: Turn the crankshaft as needed to allow the crank pin journals to pass through the cut out (Item 1) [Figure 60-80-79] of the engine block.

Mark the bearing case halves for correct installation.

Figure 60-80-80

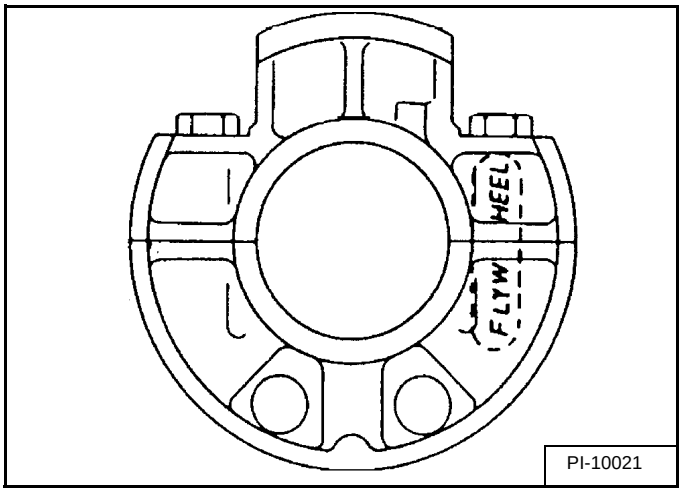


Remove the two bearing case bolts **[Figure 60-80-80]**.

Remove the bearing case and bearing.

Installation: Tighten the bearing case bolts to 34 - 37 ft.-lb. (46 - 50 N•m) torque.

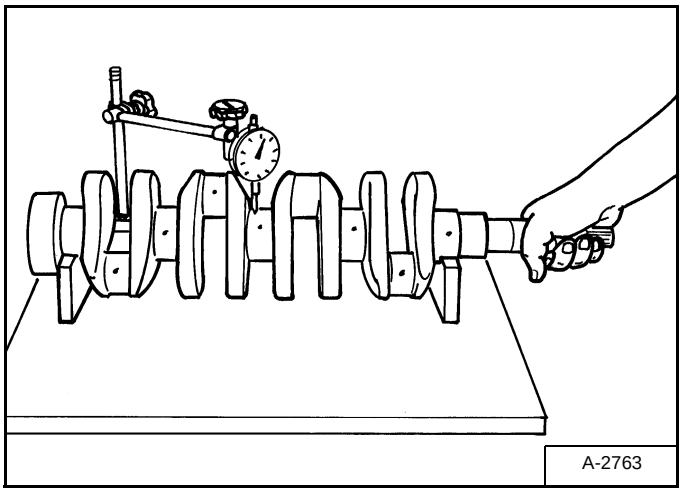
Figure 60-80-81



Installation: When installing the main bearing case assemblies, face the mark FLYWHEEL to the flywheel side of the engine block **[Figure 60-80-81]**. The thrust washers oil grooves must face outward.

Crankshaft And Bearings, Servicing

Figure 60-80-82



Put the crankshaft on V-blocks. Install a dial indicator on the center journal **[Figure 60-80-82]**.

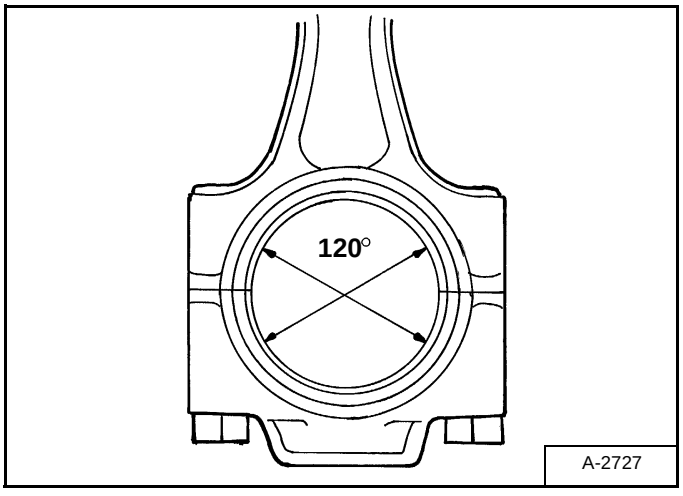
Turn the crankshaft at a slow rate to obtain the misalignment (one half of the alignment measurement).

If the misalignment exceeds the allowable limit, replace the crankshaft.

Alignment	0.0008 in. (0,02 mm)

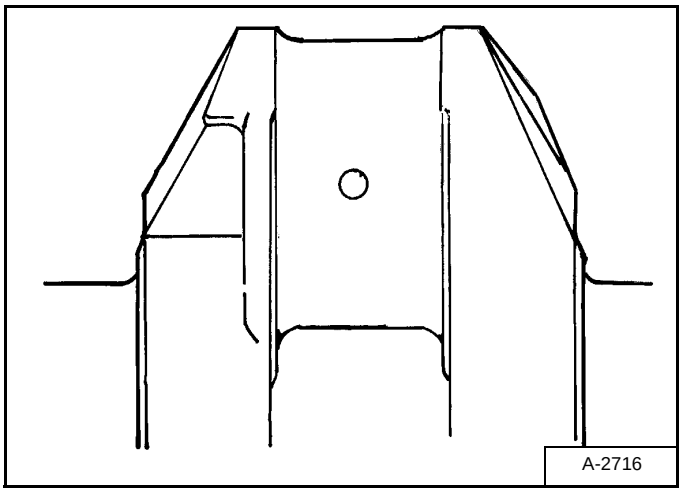
Tighten the connecting rod bolts to 33 - 36 ft.-lb. (44 - 49 N•m) torque.

Figure 60-80-83



Measure the crankpin bearing I.D. **[Figure 60-80-83]**.

Figure 60-80-84

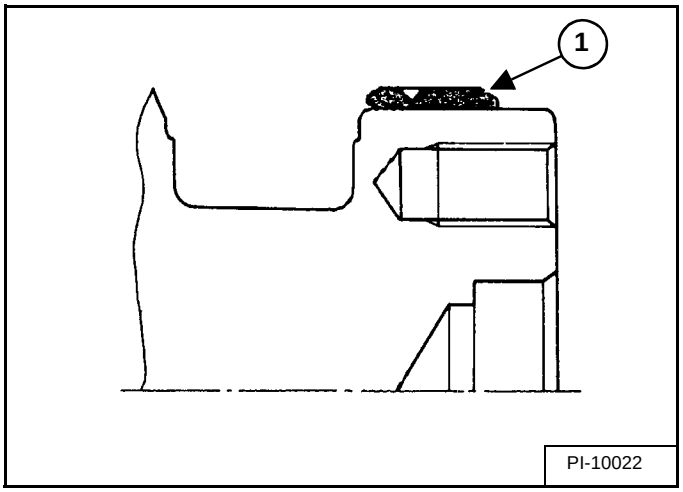


Measure the crankpin O.D. **[Figure 60-80-84]**.

Calculate the oil clearance.

Crankpin Bearing I.D.	1.850 - 1.852 in. (47,0 - 47,05 mm)
Crankpin O.D.	1.8488 - 1.8494 in. (46,96 - 46,98 mm)
Oil Clearance	0.001 - 0.0034 in. (0,025 - 0,087mm)
Allowable Limit	0.008 in. (0,2 mm)

Figure 60-80-85



Check the wear on the crankshaft sleeve **[Figure 60-80-85]**.

If the wear exceeds the allowable limit or the seal leaks oil, replace the sleeve.

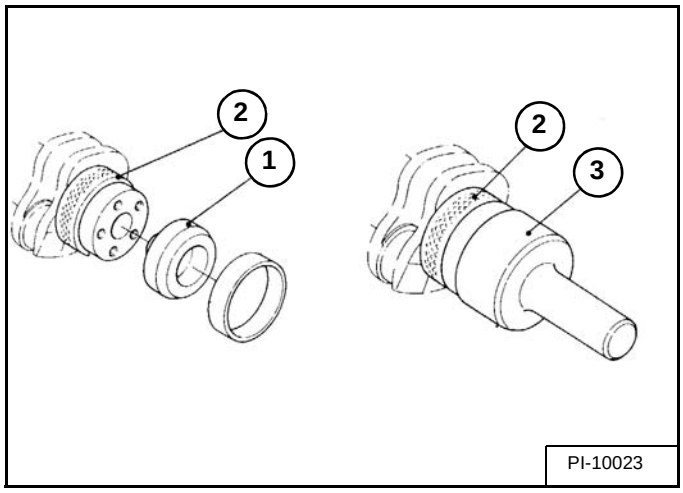
Wear of Sleeve	0.0004 in. (0,1 mm)

Crankshaft And Bearings, Servicing (Cont'd)

The special tool set will be needed to replace the crankshaft sleeve.

Remove the sleeve.

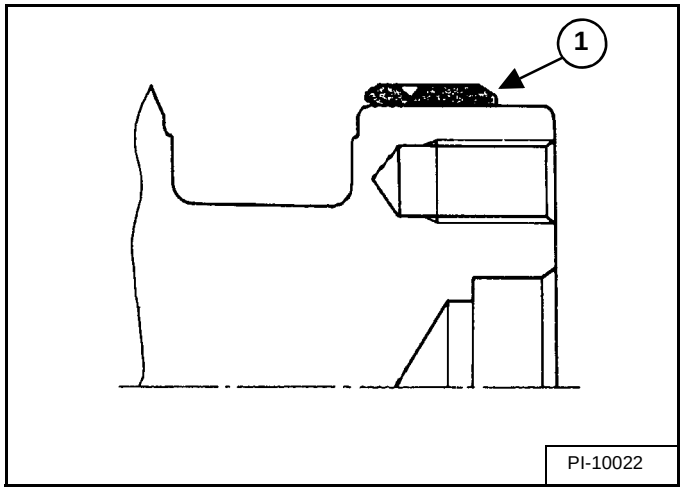
Figure 60-80-86



Install the sleeve guide (Item 1) and stop (Item 2) **[Figure 60-80-86]**.

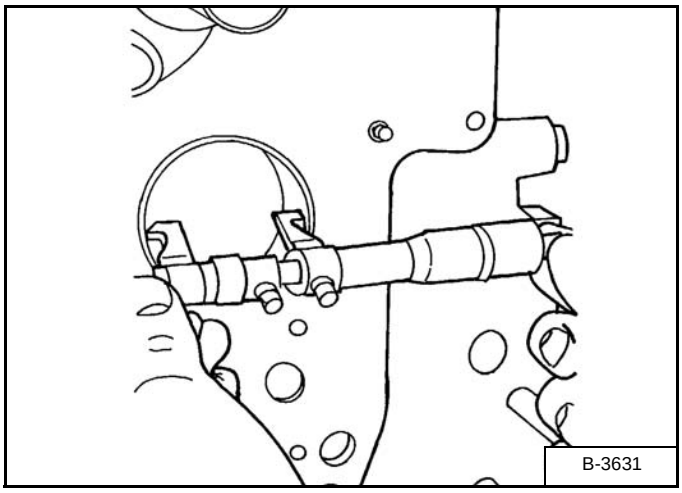
Heat the sleeve to 302 - 392° F (150 - 200° C). Install the sleeve on the crankshaft using the special driver tool (Item 3) **[Figure 60-80-86]**.

Figure 60-80-87



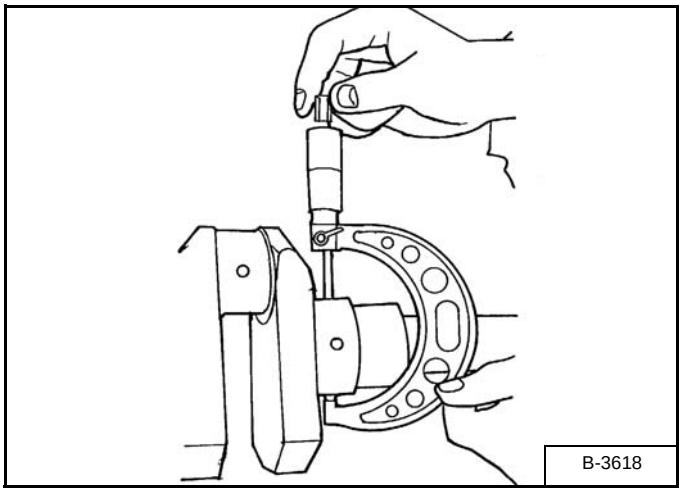
NOTE: The sleeve is installed with the larger chamfered surface (Item 1) [Figure 60-80-87] to the front of the crankshaft.

Figure 60-80-88



Measure the I.D. of the No. 1 crankshaft bearing **[Figure 60-80-88]**.

Figure 60-80-89



Measure the O.D. of the crankshaft journal **[Figure 60-80-89]**.

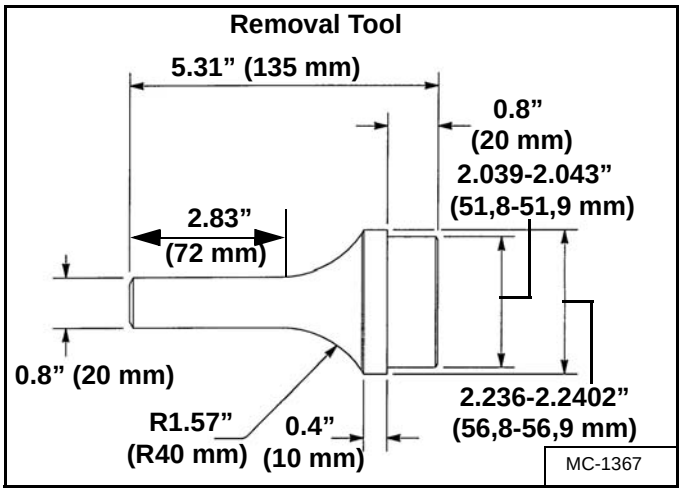
Calculate the oil clearance.

Crankshaft And Bearings, Servicing (Cont'd)

If the clearance exceeds the allowable limit, replace the crankshaft bearing.

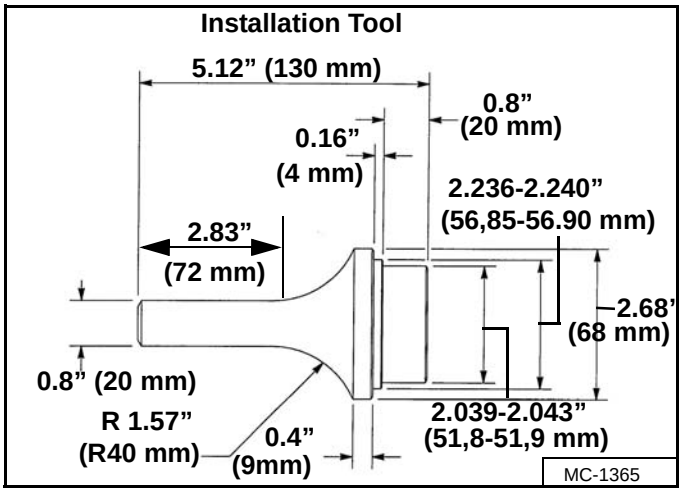
Bearing I.D.	2.3615 - 2.3631 in. (59,98 - 60,025 mm)
Crankshaft Journal O.D.	2.3591 - 2.3598 in. (59,92 - 59,940 mm)
Oil Clearance	0.0016 - 0.0041 in. (0,04 - 0,104 mm)
Allowable Limit	0.008 in. (0,2 mm)

Figure 60-80-90



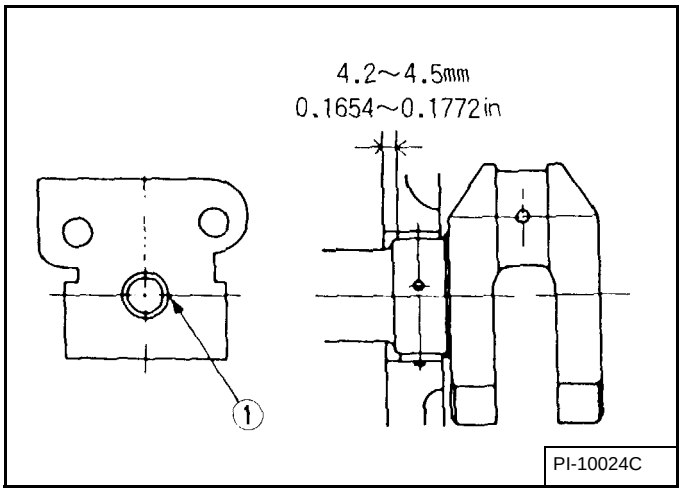
To remove the front bearing make the tool as shown **[Figure 60-80-90]**.

Figure 60-80-91



To install the front bearing make the tool as shown **[Figure 60-80-91]**.

Figure 60-80-92



Remove the front bearing with the special removal tool **[Figure 60-80-92]**.

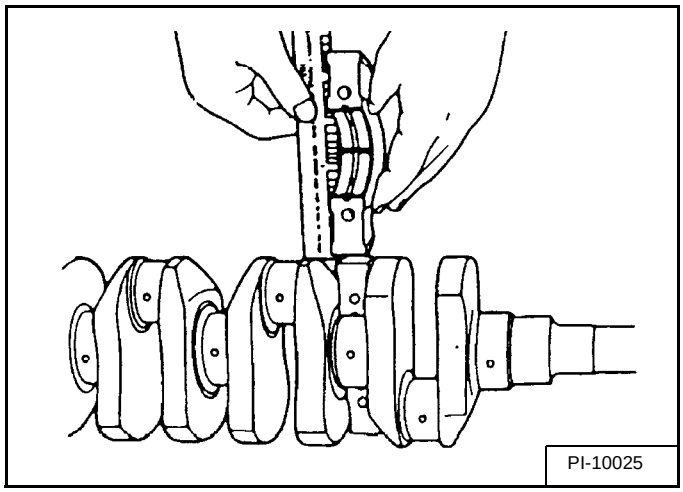
Installation: Clean the new bearing and bore, apply oil to the bearing and bore. Install the new bearing with the seam (Item 1) **[Figure 60-80-92]** towards the exhaust manifold side, using the installation driver tool.

Clean the crankshaft journal and bearing. Put a strip of press gauge on the center journal.Install the main bearing case halves and tighten the bolts. Remove the bearing case halves.

NOTE: DO NOT turn the crankshaft with the press gauge installed. Incorrect measurements will be obtained.

Crankshaft And Bearings, Servicing (Cont'd)

Figure 60-80-93



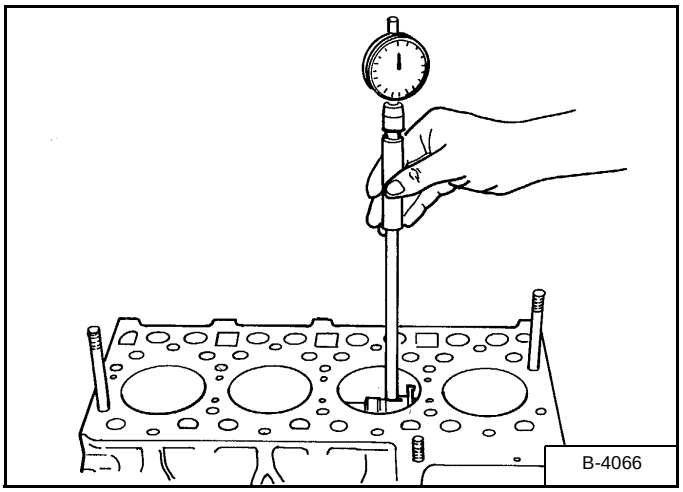
Measure the flattened press gauge **[Figure 60-80-93]**.

If the clearance exceeds the allowable limit, replace the crankshaft bearing.

Bearing I.D.	2.3614 - 2.3632 in. (59,98 - 60,025 mm)
Crankshaft Journal O.D.	2.3591 - 2.3598 in. (59,92 - 59,94 mm)
Oil Clearance	0.001 - 0.0034 in. (0,025 - 0,087 mm)
Allowable Limit	0.008 in. (0,2 mm)

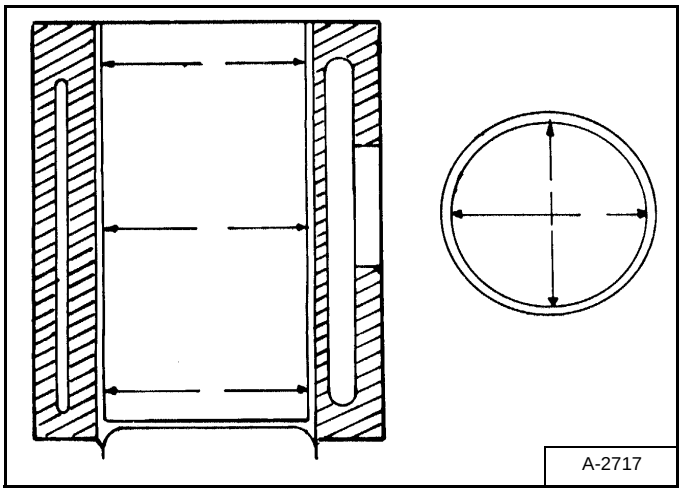
Cylinder Bore, Checking

Figure 60-80-94



Use a gauge to check the inside measurement of the cylinder bore **[Figure 60-80-94]**.

Figure 60-80-95



Measure the six points as shown in figure **[Figure 60-80-95]** to find the maximum wear.

The specifications is 3.4252 - 3.4260 in. (87,0 - 87,022 mm). The wear limit is +0.0059 in. (+0,15 mm).

If the cylinder bore is not within specifications, re-bore the cylinder for oversize piston.

Water Pump Removal And Installation

Drain the cooling system.

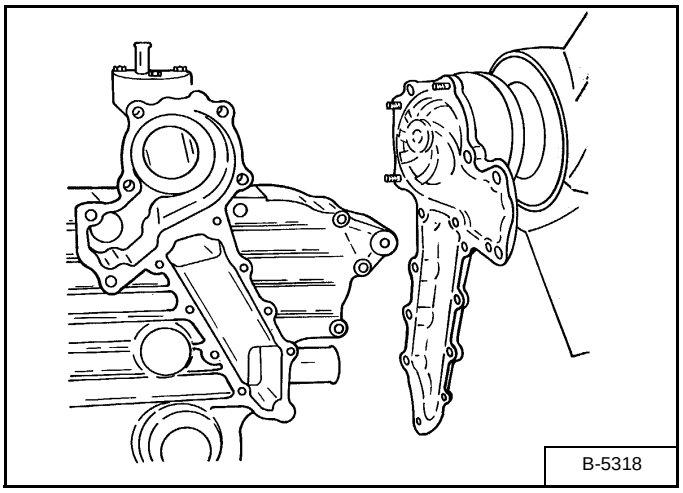
Remove the radiator. (See Removal And Installation on Page 60-40-1.)

Remove the alternator belt.

Remove the fan.

Remove the water pump bolts.

Figure 60-80-96

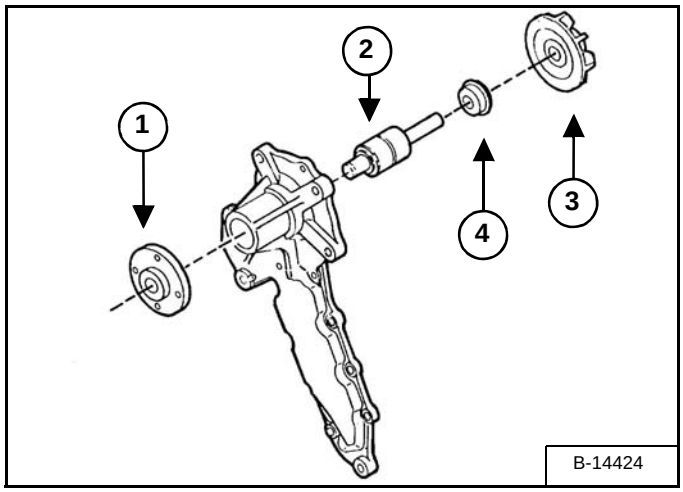


Remove the water pump **[Figure 60-80-96]**.

Installation: Always use a new gasket when installing the water pump.

Water Pump Disassembly And Assembly

Figure 60-80-97



Remove the flange (Item 1) **[Figure 60-80-97]**.

Press the shaft (Item 2) and impeller (Item 3) **[Figure 60-80-97]** out the impeller side of the water pump.

Remove the impeller (Item 3) **[Figure 60-80-97]** from the shaft.

Remove the seal (Item 4) **[Figure 60-80-97]**.

Install a new seal (Item 4) **[Figure 60-80-97]** when assembling the water pump.

HEATER

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HEATER VALVE 70-70-1
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TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION SPEC-01) UNLESS OTHERWISE SPECIFIED.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE AND STANDARD ITEMS MAY VARY.


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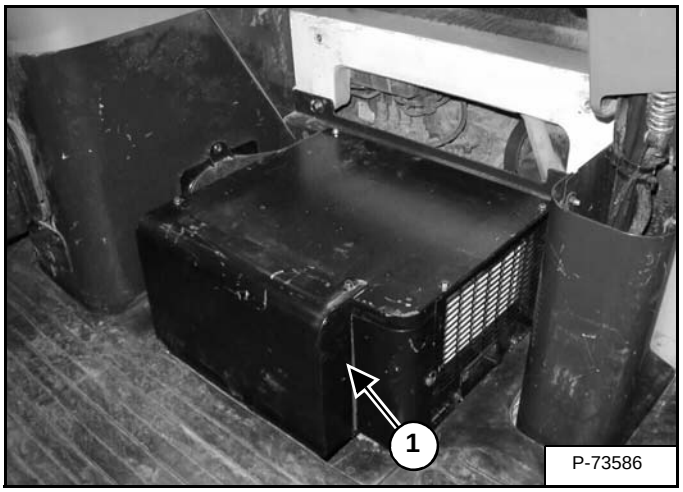
HEATER SYSTEM

Description

The heater system includes the heater unit which is located on the floor under the seat. The heater unit includes the heater coil, fan motor, blower cage, and filter.

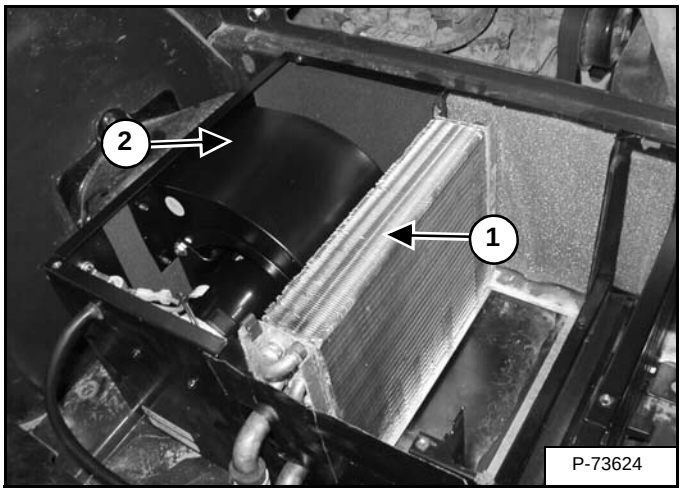
Components

Figure 70-10-1



Heater Unit: The heater unit (Item 1) **[Figure 70-10-1]** is located on the floor under the seat. The unit delivers the warm air for heat into the cab.

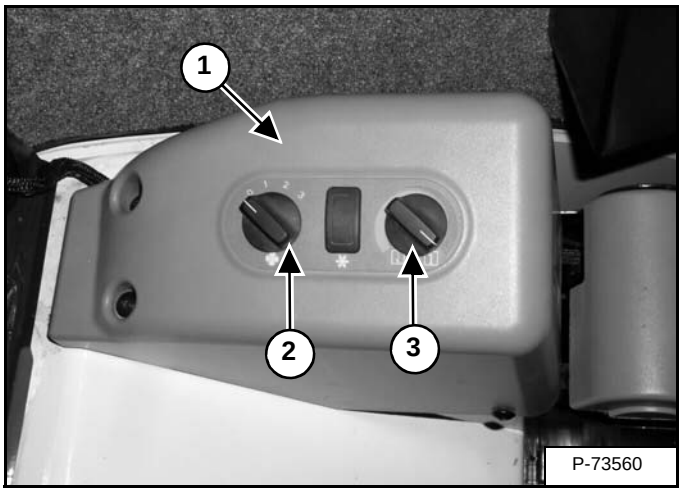
Figure 70-10-2



Heater Coil: The heater coil (Item 1) **[Figure 70-10-2]** supplies the warm air into the cab by passing air through the coil

Heater Fan: The fan (Item 2) **[Figure 70-10-2]** is used to push air through the heater coil and into the cab.

Figure 70-10-3

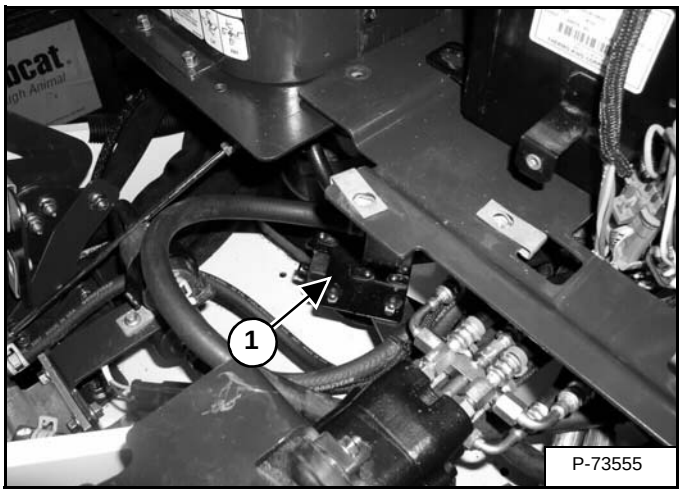


Control Panel: The panel (Item 1) **[Figure 70-10-3]** has two separate components.

Fan Switch: This is a four position rotary switch (Item 2) **[Figure 70-10-3]**.

Temperature Switch: The temperature switch (Item 3) **[Figure 70-10-3]** controls the Heat Valve from fully Off to fully On.

Figure 70-10-4



Heater Valve: The heater valve (Item 1) **[Figure 70-10-4]** manually controls the amount of engine coolant that flows to the heater coil.


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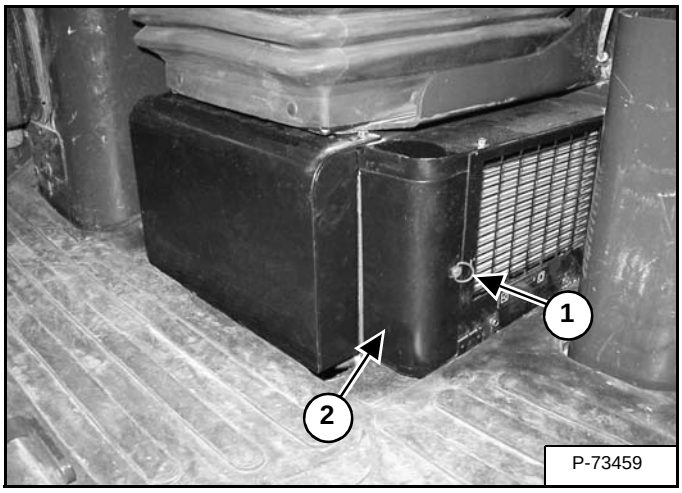
REGULAR MAINTENANCE

Filter Element Removal And Installation

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

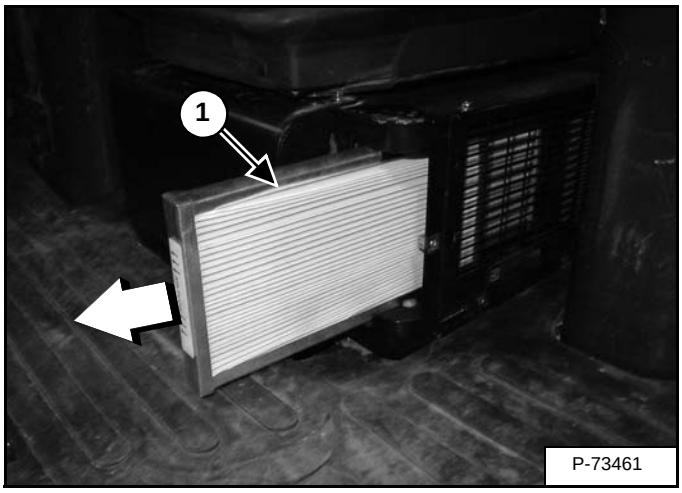
The heater filter must be cleaned regularly. The filter is located at the left of the operator seat.

Figure 70-20-1



Turn the fastener (Item 1) 1/4 turn and remove the cover (Item 2) **[Figure 70-20-1]**.

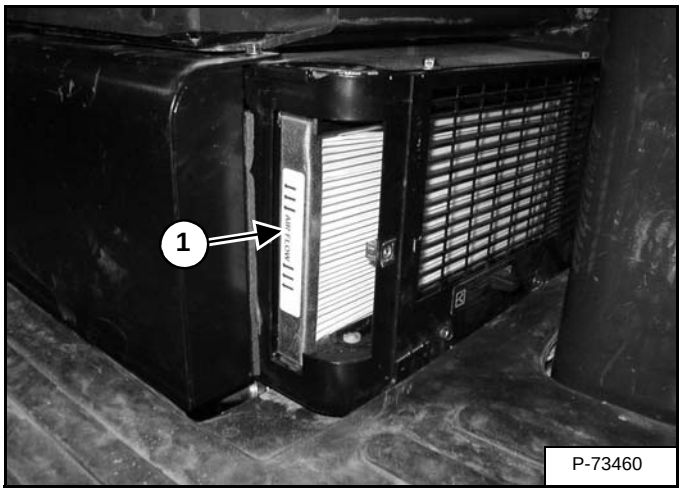
Figure 70-20-2



Pull the filter (Item 1) **[Figure 70-20-2]** out of the heater housing.

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

Figure 70-20-3



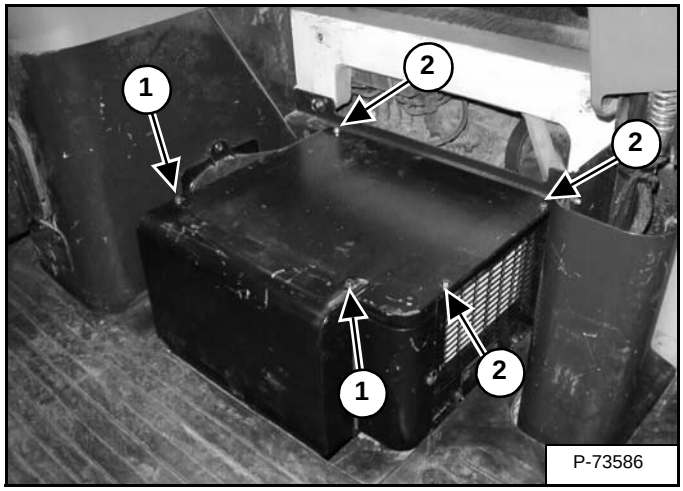
Installation: Install the filter with the arrows that indicate air flow direction (Item 1) **[Figure 70-20-3]** pointing towards the heater housing.

The filter must be cleaned regularly.

Heater Coil

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

Figure 70-20-4

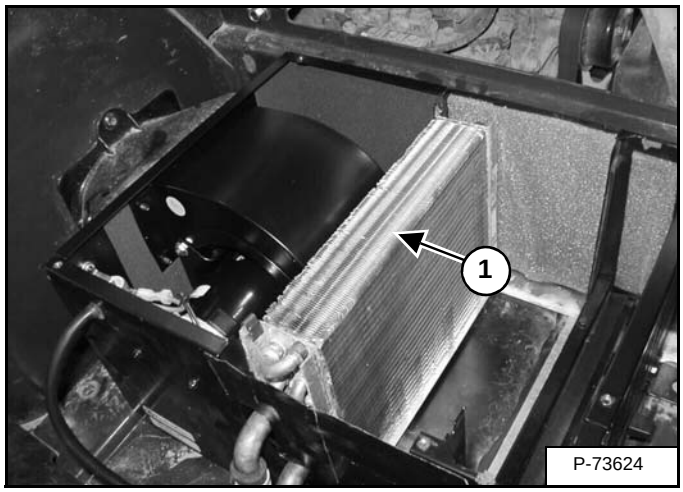


Remove the bolts (Item 1) **[Figure 70-20-4]** from the heater unit front cover.

Remove the front cover from the unit.

Remove the screws (Item 2) **[Figure 70-20-4]** from the heater cover and remove cover.

Figure 70-20-5



The heater coil (Item 1) **[Figure 70-20-5]** can now be cleaned with low pressure water or air. High pressure may damage the fins of the heater coil.

TROUBLESHOOTING

Blower Motor Does Not Operate

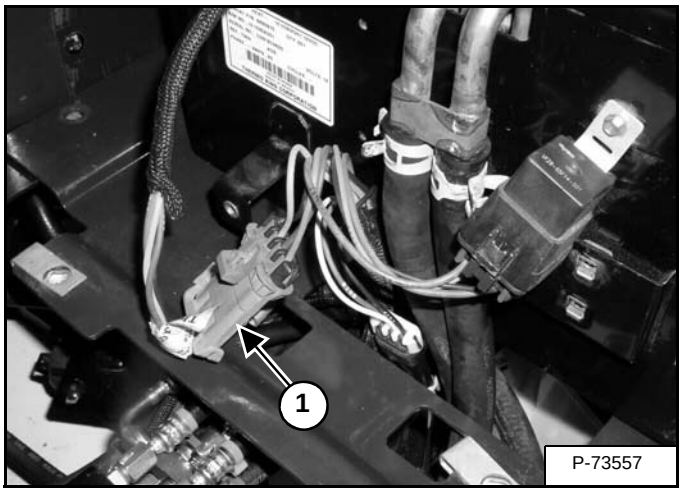
Possible Cause	Inspection	Solution
1. Blown fuse.	Inspect the fuse/wiring.	Replace fuse/repair wiring.
2. Broken wiring or bad connection.	Check the fan motor ground and connectors.	Repair the wiring or connector.
3. Fan motor malfunction.	Check the lead wires from the motor with a circuit tester.	Replace motor.
4. Resistor malfunction.	Check resistor using a circuit tester.	Replace resistor.
5. Fan motor switch malfunction.	Check power into and out of the fan switch.	Replace fan switch.

Blower Motor Operates Normally, But Air Flow Is Insufficient

Possible Cause	Inspection	Solution
1. Evaporator inlet obstruction.	Check evaporator for plugging.	Remove obstruction and clean evaporator fins with air or water.
2. Air leak.	Check to make sure air hoses are properly hooked to louvers, and air ducts.	Repair or adjust.
3. Plugged cab filters.	Check cab filter condition.	Clean or replace filters.

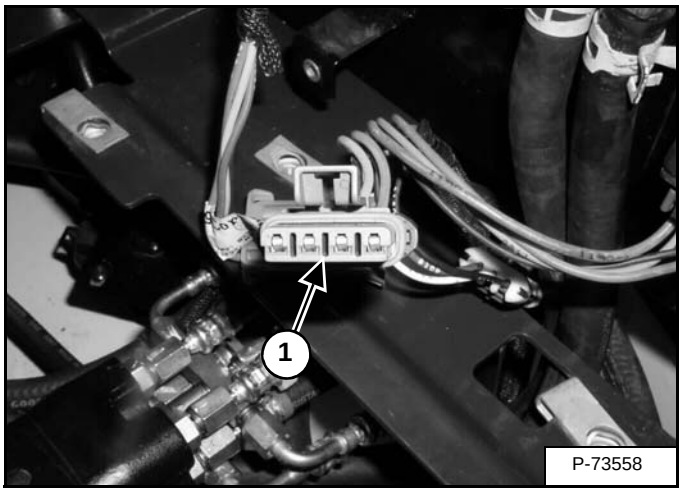
Electrical System

Figure 70-30-1



Disconnect the wire harness (Item 1) **[Figure 70-30-1]**.

Figure 70-30-2



Check the wire harness (Item 1) **[Figure 70-30-2]** for voltage to the blower fan.

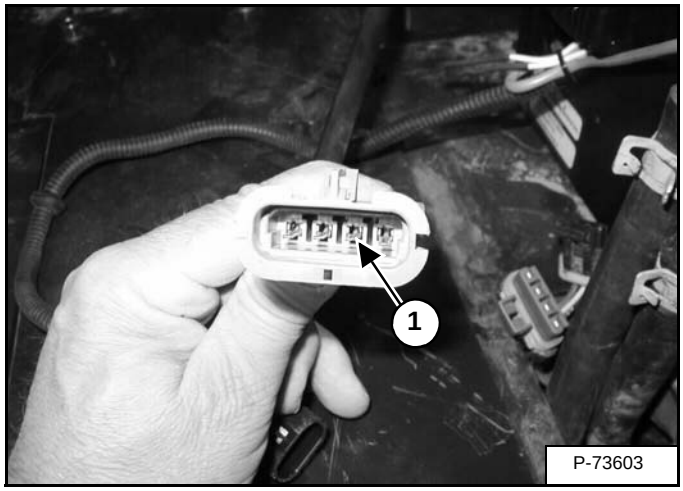
In the cab, place the blower switch in position 1. Check for voltage at the harness connector (Item 1) **[Figure 70-30-2]**, Pin 3. (YELLOW wire # 5000). The voltage should be 12 volts.

In the cab, place the blower switch in position 2. Check for voltage at the harness connector (Item 1) **[Figure 70-30-2]**, Pin 2. (RED wire # 1200). The voltage should be 12 volts.

In the cab, place the blower switch in position 3. Check for voltage at the harness connector (Item 1) **[Figure 70-30-2]**, Pin 1. (ORANGE wire # 1010). The voltage should be 12 volts.

If there is no voltage at the wiring harness, check the harness for broken wires.

Figure 70-30-3



If there is voltage at the wiring harness, check the resistance to the blower fan at the thermostat/blower fan wiring connector (Item 1) **[Figure 70-30-3]**.

Check the resistance between Pin 4 (BLACK wire # 2200) and Pin 3 (YELLOW wire # 5000).

Check the resistance between Pin 4 (BLACK wire # 2200) and Pin 2 (RED wire # 1200).

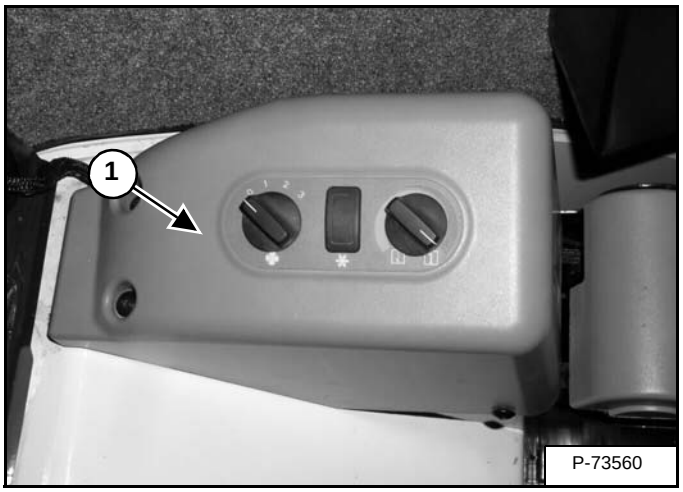
Check the resistance between Pin 4 (BLACK wire # 2200) and Pin 1 (ORANGE wire # 1010).

If there is no resistance value at any of these pins, replace the blower fan. (See Removal And Installation on Page 70-60-1.)

If there is resistance value at any of the pins, check the climate controls at the control panel inside the excavator cab.

Electrical System (Cont'd)

Figure 70-30-4



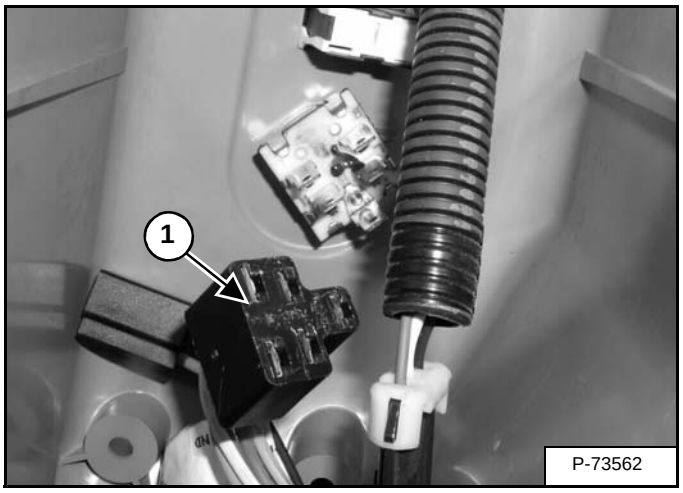
Remove the left rear console cover (Item 1) **[Figure 70-30-4]**. (See Console Switch Removal And Installation on Page 40-60-15.)

Figure 70-30-5



Position the console and wiring harness in the cab so the wiring harness can be checked **[Figure 70-30-5]**.

Figure 70-30-6



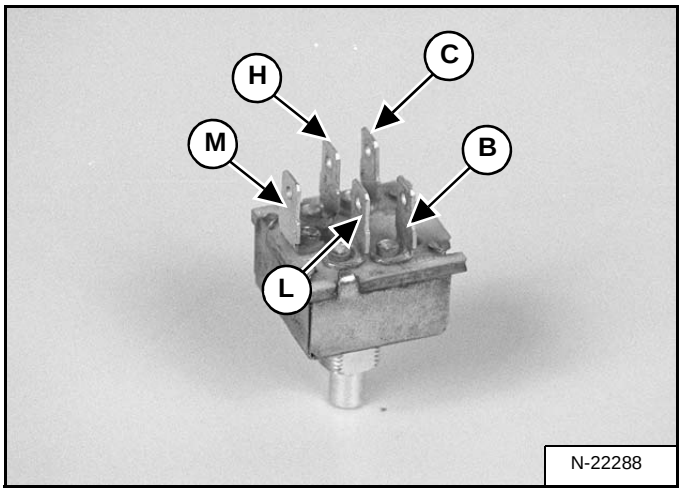
Disconnect the wiring harness (Item 1) **[Figure 70-30-6]** from the blower switch.

Check the harness for voltage. The voltage should be approximately 12 volts.

If there is no voltage at the wiring harness, check the harness for broken wires.

Electrical System (Cont'd)

Figure 70-30-7



If there is voltage at the wiring harness, check the blower switch **[Figure 70-30-7]** for resistance.

With the switch in the OFF position, there should be zero resistance between all terminals.

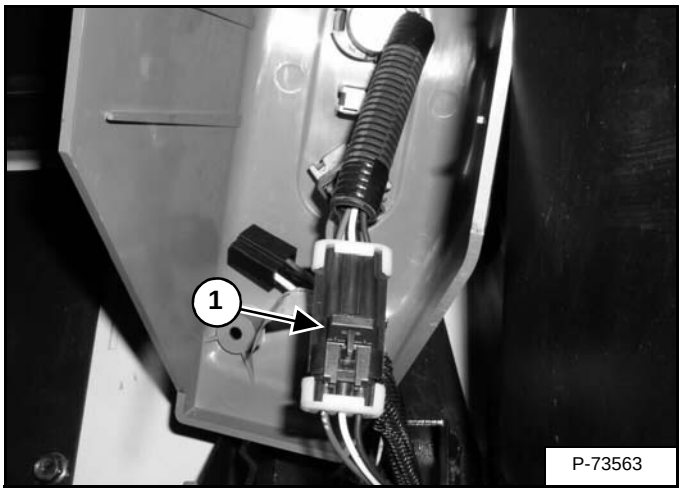
With the switch in the **1** position, there should be resistance between **C** terminal and the **B** terminal. And also between the **C** terminal and the **L** terminal frame **[Figure 70-30-7]**.

With the switch in the **2** position, there should be resistance between **C** terminal and the **B** terminal. And also between the **C** terminal and the **M** terminal frame **[Figure 70-30-7]**.

With the switch in the **3** position, there should be resistance between **C** terminal and the **B** terminal. And also between the **C** terminal and the **H** terminal frame **[Figure 70-30-7]**.

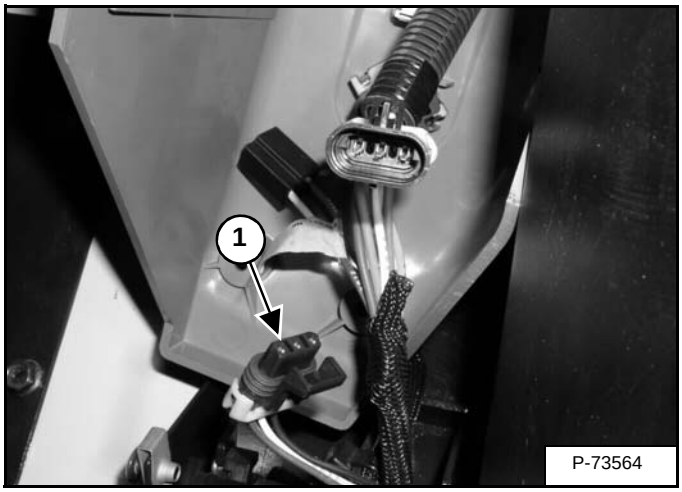
If any of the above resistance tests fail, replace the blower switch.

Figure 70-30-8



Disconnect the wire harness (Item 1) **[Figure 70-30-8]** from the potentiometer.

Figure 70-30-9

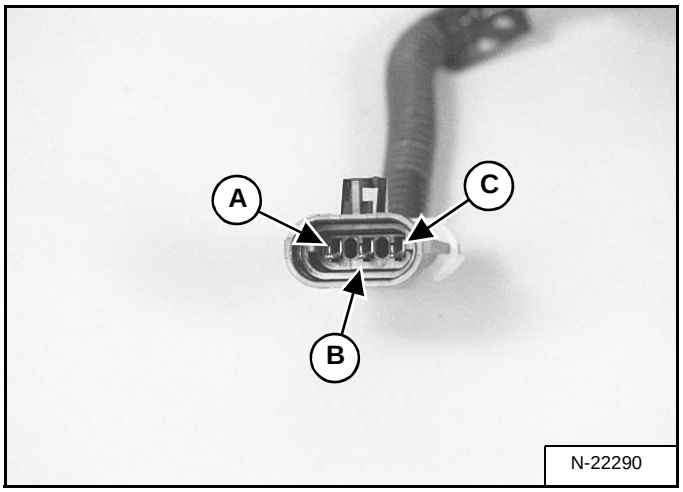


Check the wire harness (Item 1) **[Figure 70-30-9]** for voltage. Between pins **A** and **C** the voltage should be approximately 12 volts.

If there is no voltage at the wiring harness, check the harness for broken wires.

Electrical System (Cont'd)

Figure 70-30-10

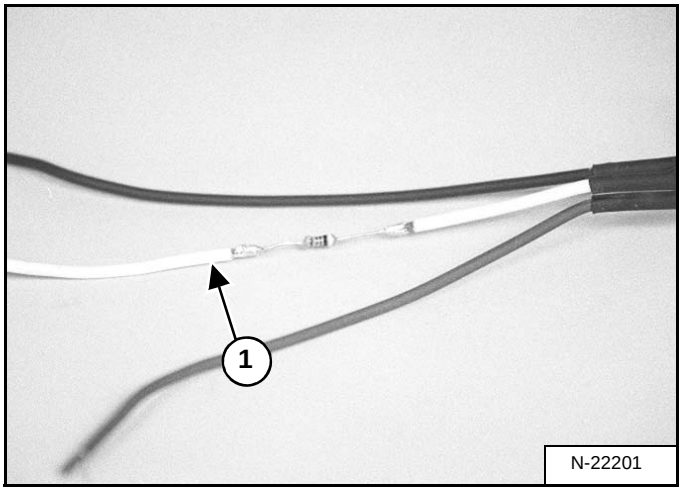


If there is voltage at the wiring harness, check the potentiometer **[Figure 70-30-10]** for resistance.

The resistance should be 10K ohms between wire terminal **A** and wire terminal **C** frame **[Figure 70-30-10]**.

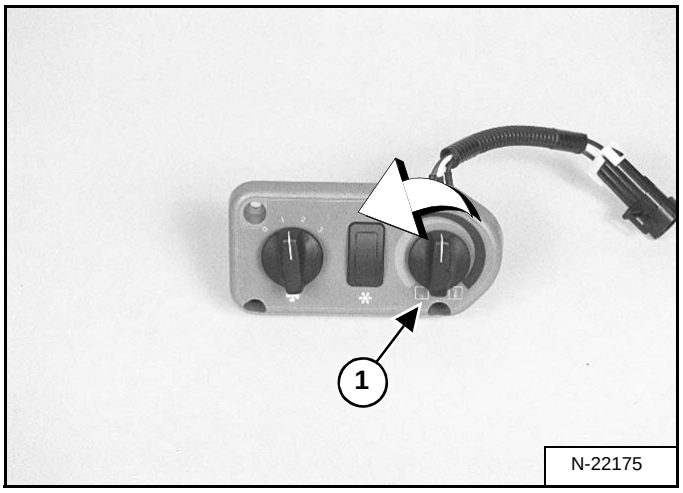
If no resistance is found replace the potentiometer.

Figure 70-30-11



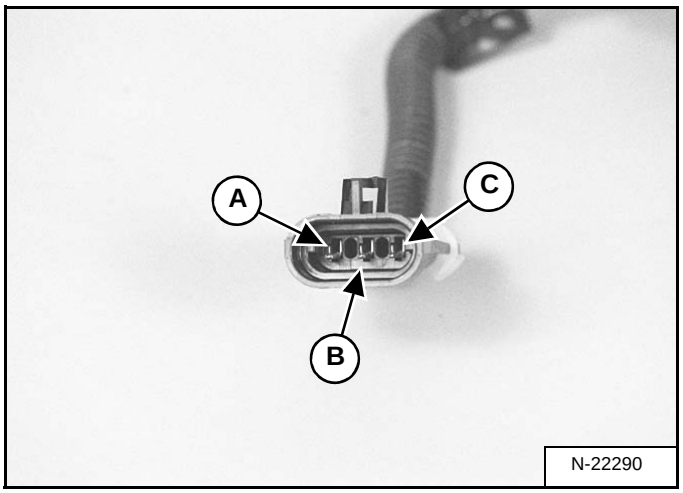
The white wire **B**, (Item 1) **[Figure 70-30-11]**, on the potentiometer, is a resister wire.

Figure 70-30-12



To check the resistance of the white wire, turn the potentiometer control (Item 1) **[Figure 70-30-12]** to the full A/C position.

Figure 70-30-13

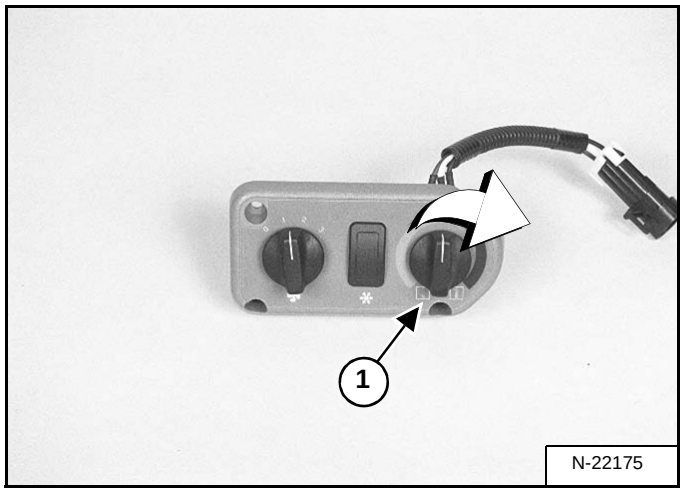


The resistance between the wire terminal **A** and wire terminal **B** frame **[Figure 70-30-13]** should be approximately 49K ohms.

Check the resistance between the wire terminal **C** and wire terminal **B** frame **[Figure 70-30-13]** should be approximately 39K ohms.

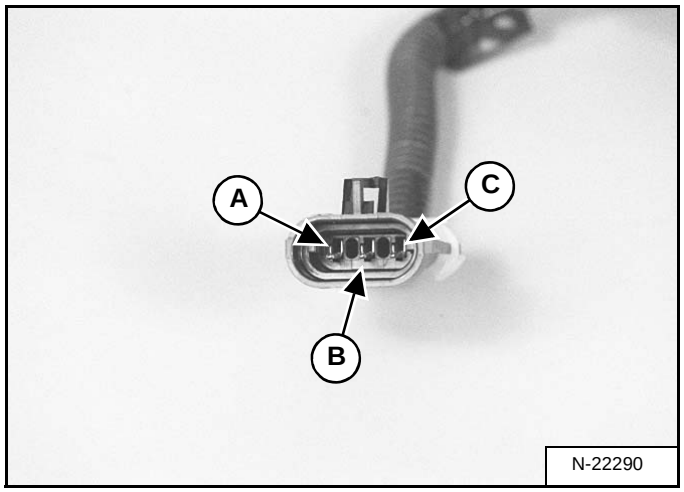
Electrical System (Cont'd)

Figure 70-30-14



To check the resistance of the white wire, turn the potentiometer control (Item 1) **[Figure 70-30-14]** to the full heater position.

Figure 70-30-15

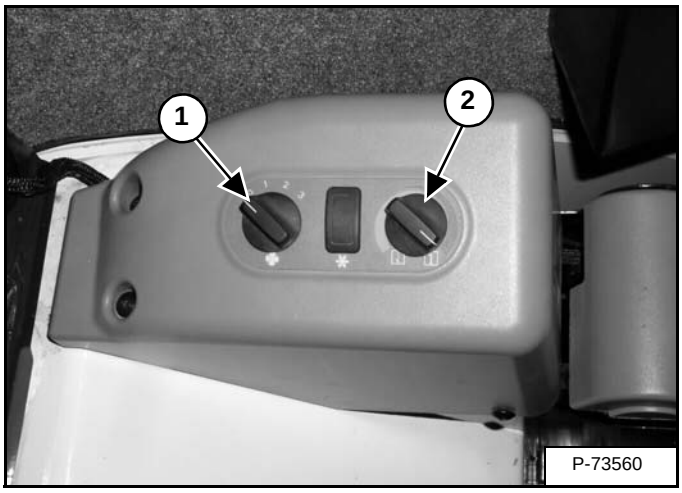


Check the resistance between the wire terminal **A** and wire terminal **B** frame **[Figure 70-30-15]** should be approximately 39K ohms.

Check the resistance between the wire terminal **C** and wire terminal **B** frame **[Figure 70-30-15]** should be approximately 49K ohms.

If the resistance is not found replace the potentiometer.

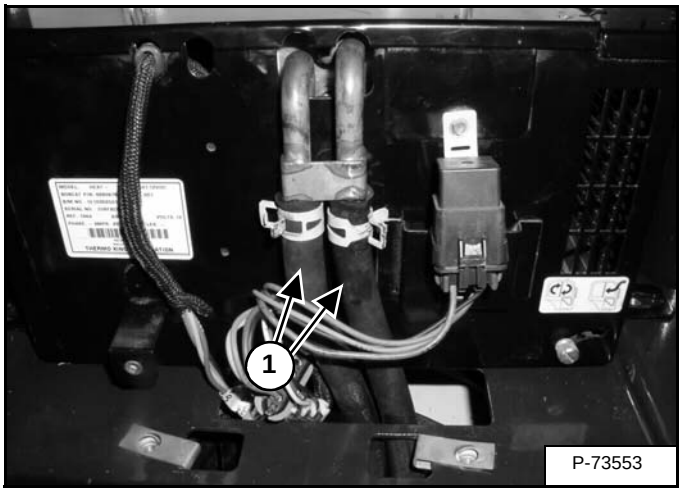
Figure 70-30-16



Turn the fan switch (Item 1) to the High Speed position., Turn the temperature control (Item 2) **[Figure 70-30-16]** to the High cold position, with the key switch OFF.

Start the excavator and run at high idle, for ten minutes.

Figure 70-30-17



Check the temperature of the heater hoses (Item 1) **[Figure 70-30-17]**.

If the hoses are hot, the heater valve is leaking internally, and needs to be replaced.

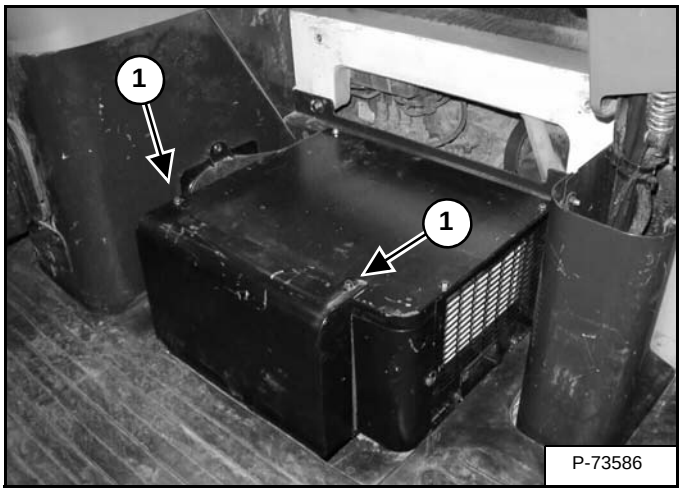
HEATER UNIT

Removal And Installation

Drain the engine coolant. (See Replacing The Coolant on Page 10-70-3.)

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

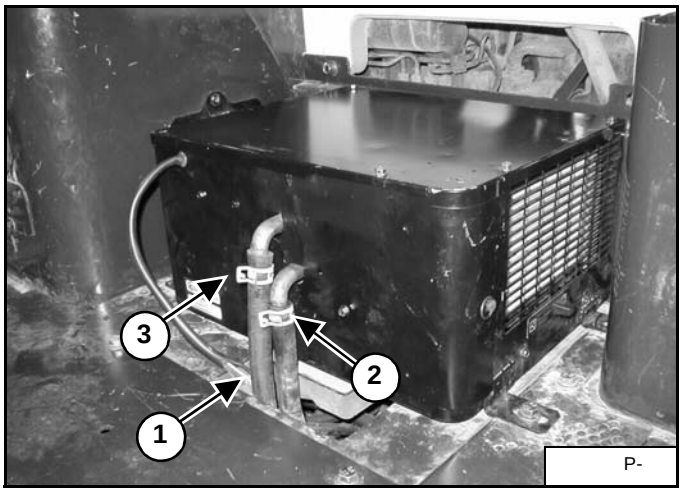
Figure 70-40-1



Remove the bolts (Item 1) **[Figure 70-40-1]** from the heater unit front cover.

Remove the front cover from the unity.

Figure 70-40-2



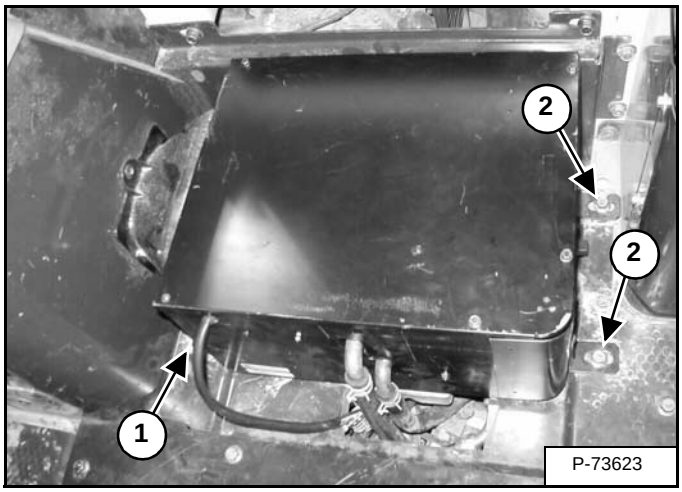
Disconnect the wire harness (Item 1) **[Figure 70-40-2]**.

Remove the clamps (Item 2) **[Figure 70-40-2]** from the heater hoses.

Cap and plug the hoses with the proper caps and plugs.

Remove the heater hoses from the heater coil.

Figure 70-40-3



Remove the bolt (Item 1) **[Figure 70-40-3]** on the right side of the heater unit.

Remove the bolts (Item 2) **[Figure 70-40-3]** from the left side of the heater unit and remove the unit from the excavator.


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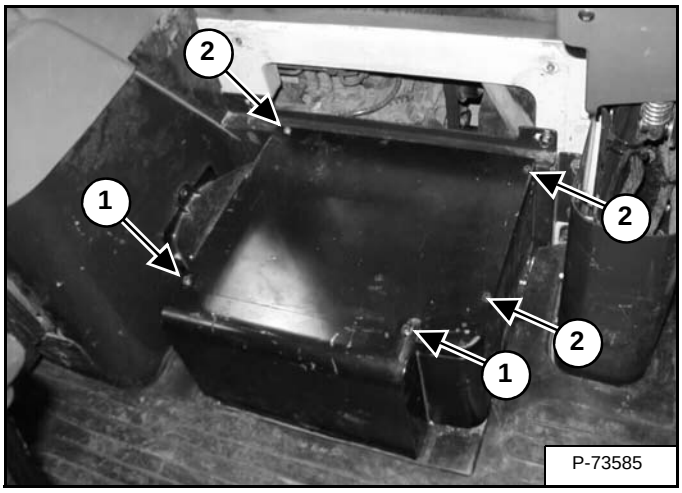
HEATER COIL

Removal And Installation

Drain the engine coolant. (See Replacing The Coolant on Page 10-70-3.)

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

Figure 70-50-1

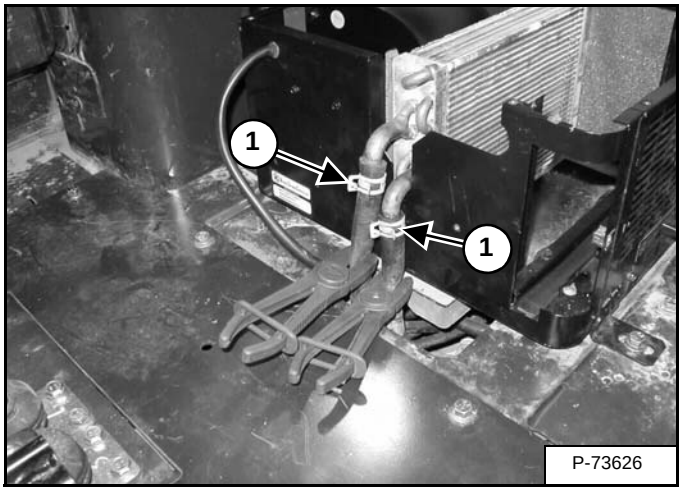


Remove the bolts (Item 1) **[Figure 70-50-1]** from the heater unit front cover.

Remove the front cover from the unit.

Remove the screws (Item 2) **[Figure 70-50-1]** from the heater cover and remove cover.

Figure 70-50-2

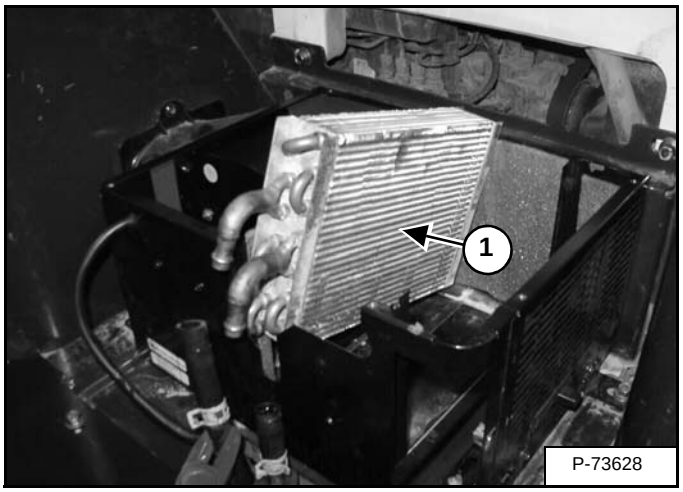


Clamp both heater hoses with clamping pliers. Remove the hose clamps (Item 1) **[Figure 70-50-2]** from the heater hoses.

Remove the heater hoses from the heater coil.

Cap and plug the hoses with the proper caps and plugs.

Figure 70-50-3



Remove the heater coil (Item 1) **[Figure 70-50-3]**.


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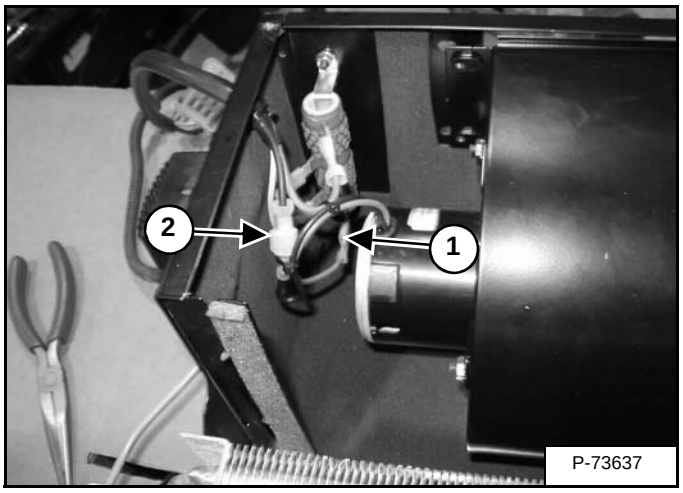
BLOWER FAN

Removal And Installation

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

Remove the heater unit. (See Removal And Installation on Page 70-40-1.)

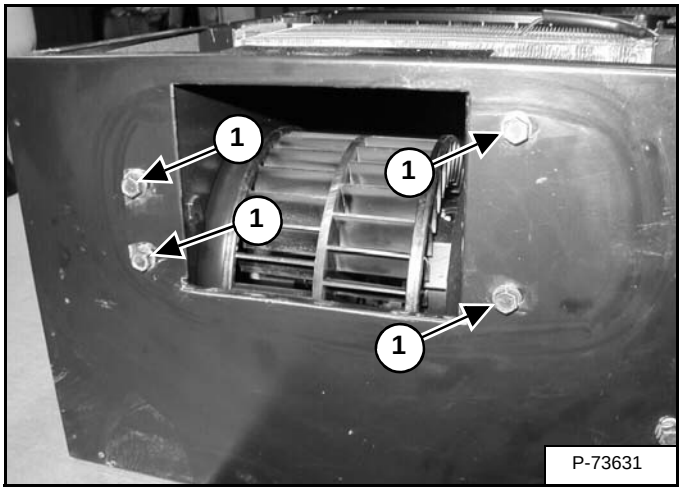
Figure 70-60-1



Disconnect the orange fan motor wire (Item 1) **[Figure 70-60-1]** from the resistor.

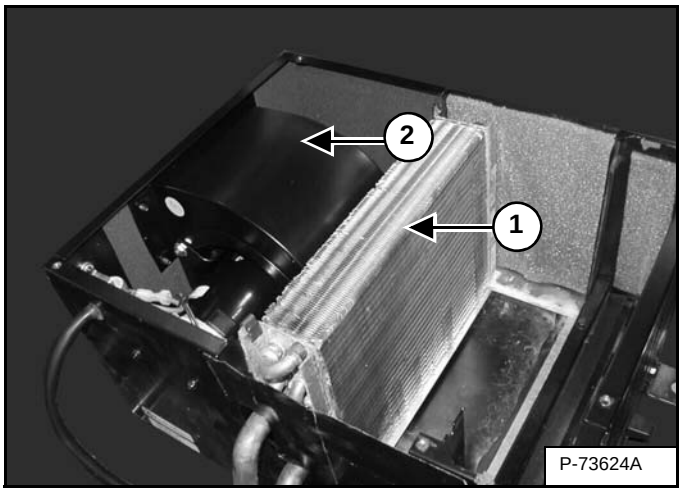
Disconnect the black fan motor wire (Item 2) **[Figure 70-60-1]** from the black wire on the wire harness.

Figure 70-60-2



Remove the four bolts (Item 1) **[Figure 70-60-2]** from the blower fan housing in the heater unit.

Figure 70-60-3



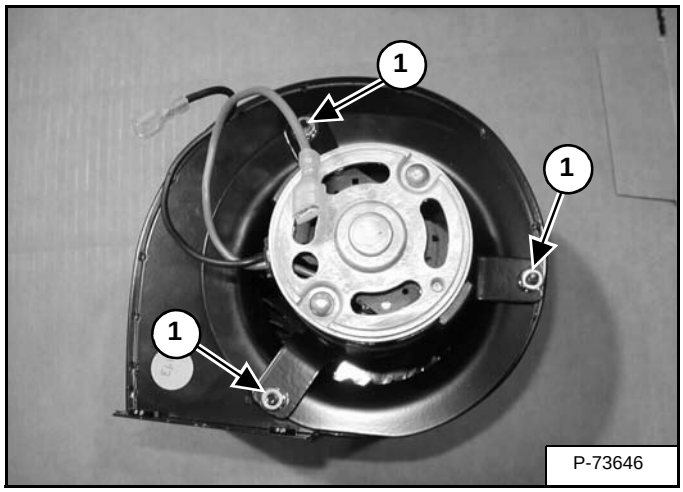
Lift the heater coil (Item 1) **[Figure 70-60-3]** straight up from the heater unit.

Remove the blower fan (Item 1) **[Figure 70-60-3]**.

BLOWER FAN (CONT'D)

Disassembly And Assembly

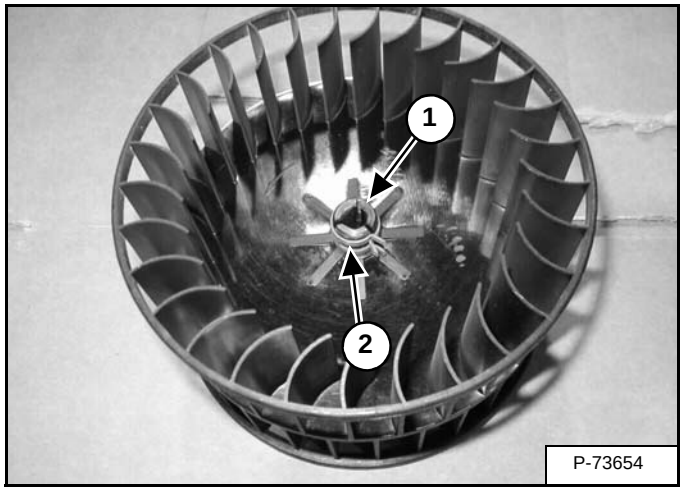
Figure 70-60-4



Remove the three mounting nuts (Item 1) **[Figure 70-60-4]** from the blower fan housing.

Remove the blower motor and fan from the blower housing unit.

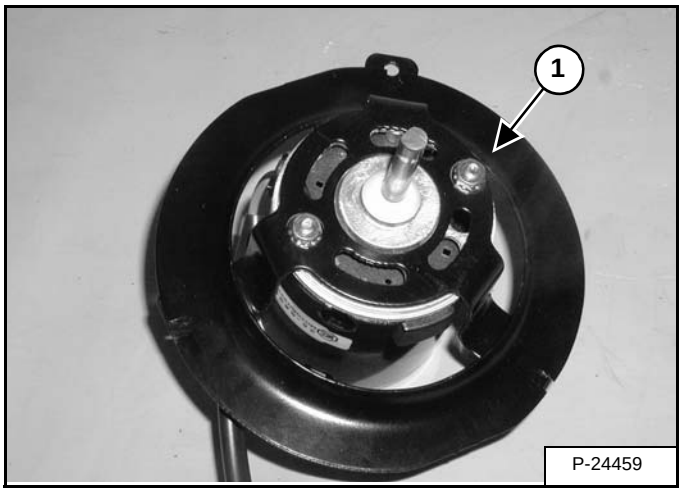
Figure 70-60-5



Mark the fan shaft (Item 1) **[Figure 70-60-5]** and blower wheel, for the proper installation of the blower wheel.

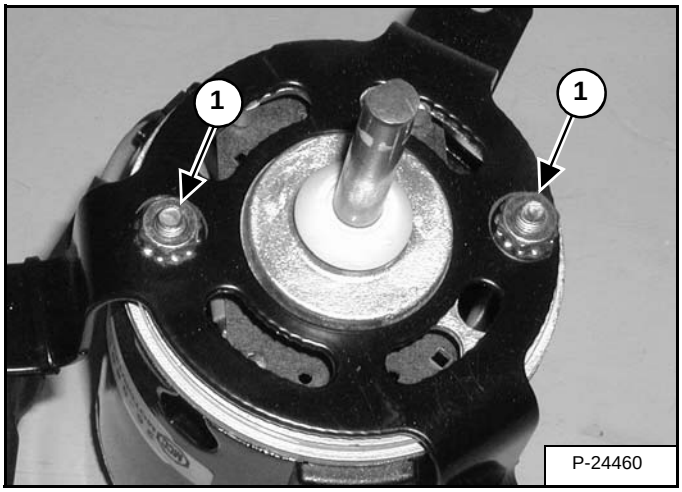
Remove the clamp (Item 2) **[Figure 70-60-5]** and remove the blower wheel from the fan shaft.

Figure 70-60-6



Remove the outside ring (Item 1) **[Figure 70-60-6]** from the fan motor.

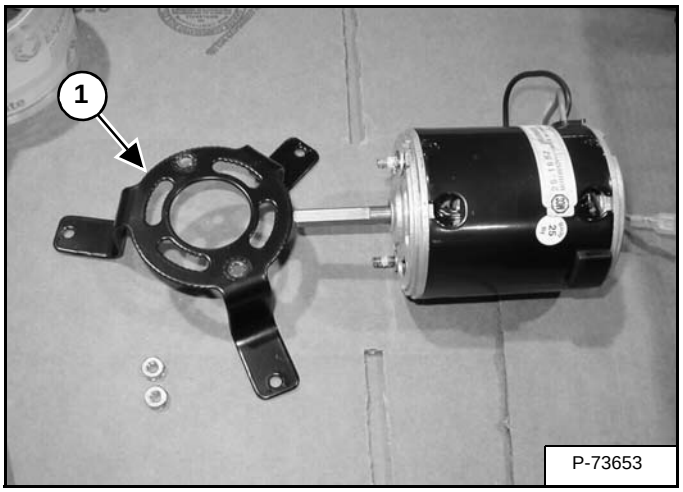
Figure 70-60-7



Remove the two mounting nuts (Item 1) **[Figure 70-60-7]** from the fan motor mount bracket.

Disassembly And Assembly (Cont'd)

Figure 70-60-8

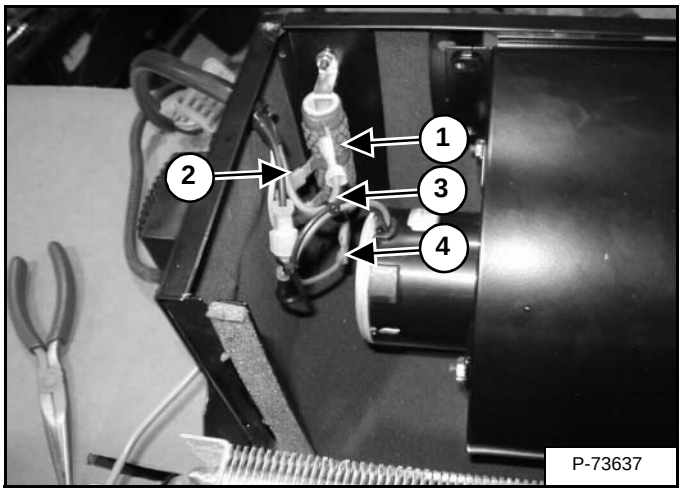


Remove the fan motor mount bracket (Item 2) **[Figure 70-60-8]** from the motor.

Inspect the fan motor, and if it needs replacing, it must be replaced as a complete unit.

Resistor Removal And Installation

Figure 70-60-9



Remove the four electrical wires from the resistor **[Figure 70-60-9]**.

Wire Installation

Install the Orange wire from the wire harness (Item 1) **[Figure 70-60-9]** on the top terminal of the resistor.

Install the Red wire from the wire harness (Item 2) **[Figure 70-60-9]** on the second terminal of the resistor.

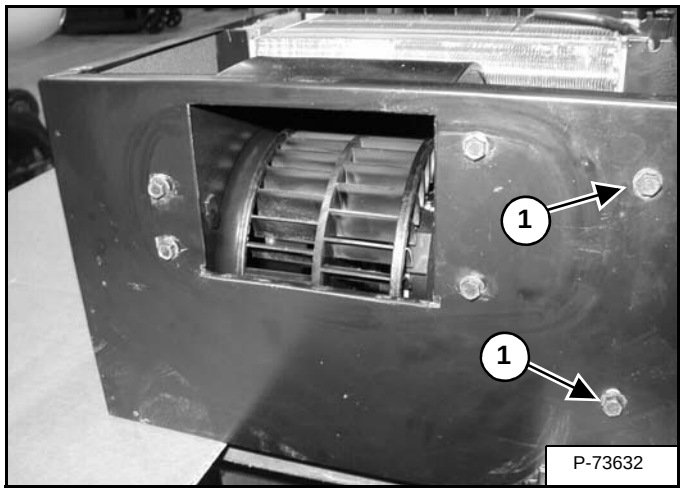
Install the Yellow wire from the wire harness (Item 3) **[Figure 70-60-9]** on the third terminal of the resistor.

Install the Orange wire from the heater fan motor (Item 4) **[Figure 70-60-9]** on the bottom terminal of the resistor.

BLOWER FAN (LATER MODELS) (CONT'D)

Resistor Removal And Installation (Cont'd)

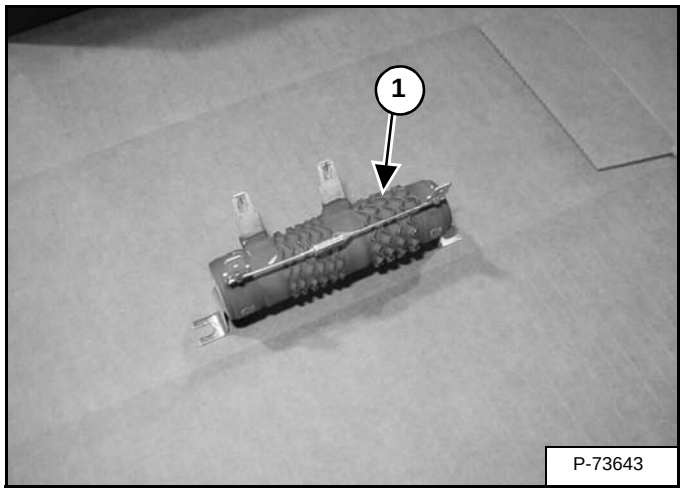
Figure 70-60-10



Loosen the two resistor mount bolts **[Figure 70-60-10]**.

Remove the resistor from the unit.

Figure 70-60-11



Inspect the resistor (Item 1) **[Figure 70-60-11]** and replace as needed.

HEATER VALVE

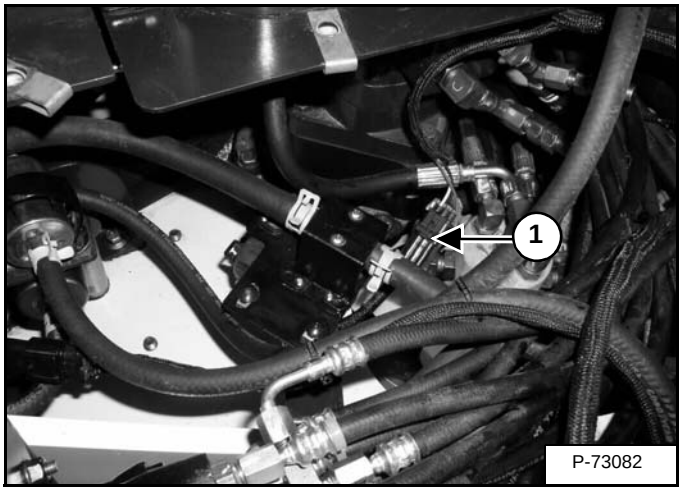
Removal And Installation

Drain the engine coolant. (See Replacing The Coolant on Page 10-70-3)

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

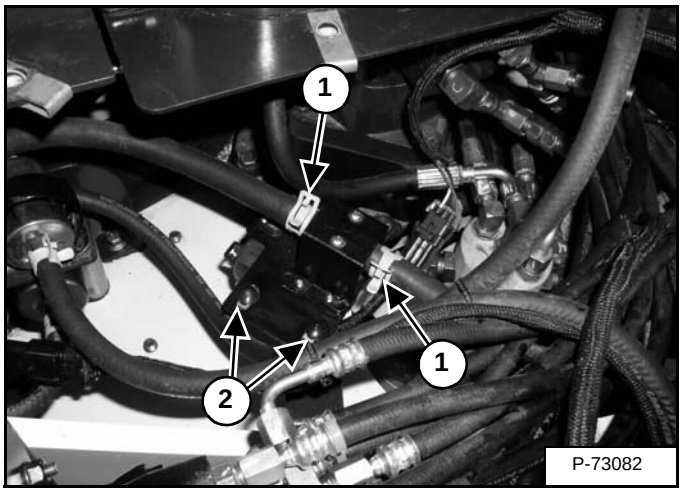
Remove the heater unit. (See Removal And Installation on Page 70-40-1)

Figure 70-70-1



Disconnect the wire harness (Item 1) **[Figure 70-70-1]** from the heater valve.

Figure 70-70-2



Mark and remove the hoses (Item 1). Remove the two bolts (Item 2) **[Figure 70-70-2]** from the heater valve.

Remove the heater valve from the excavator.

The heater valve is not serviceable and must be replaced as a complete unit.


Bobcat®

SPECIFICATIONS

CONVERSIONS SPEC-70-1
Decimal And Millimeter Equivalents. SPEC-70-1
U.S. To Metric Conversion SPEC-70-2

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Crankshaft SPEC-20-4
Crankshaft Re-Grind Data SPEC-20-6
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Cylinders SPEC-20-3
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Fuel Injection Nozzles SPEC-20-1
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- 325/328 Excavator Machine Dimensions. SPEC-10-1
- 325 With Long Arm Option And 328 Excavator Machine Dimensions SPEC-10-3
- Controls SPEC-10-4
- Drive System SPEC-10-6
- Electrical SPEC-10-7
- Engine SPEC-10-4
- Hydraulic Cycle Times SPEC-10-6
- Hydraulic Cylinders SPEC-10-5
- Hydraulic System. SPEC-10-5
- Performance SPEC-10-4
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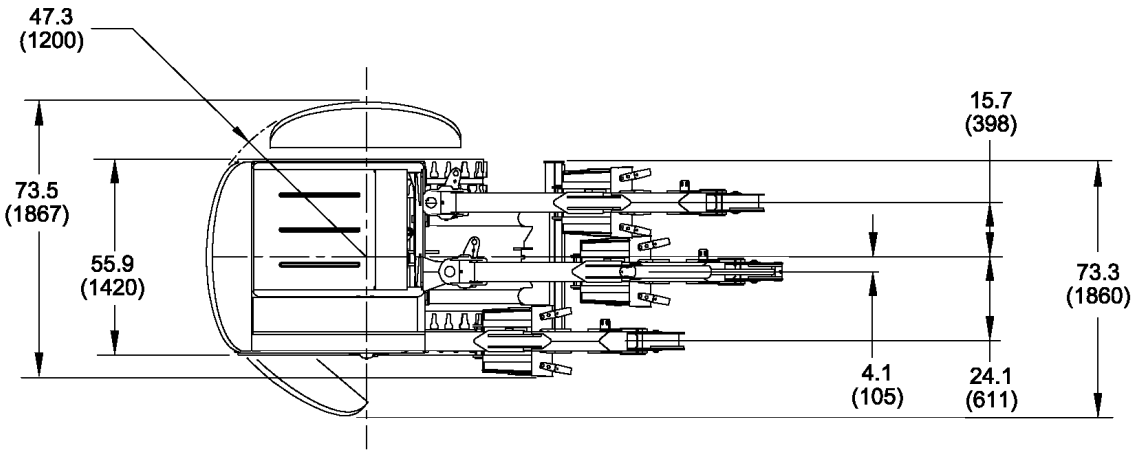
TORQUE SPECIFICATIONS SPEC-30-1
- Torque For General Metric Bolts SPEC-30-2
- Torque for General SAE Bolts SPEC-30-1

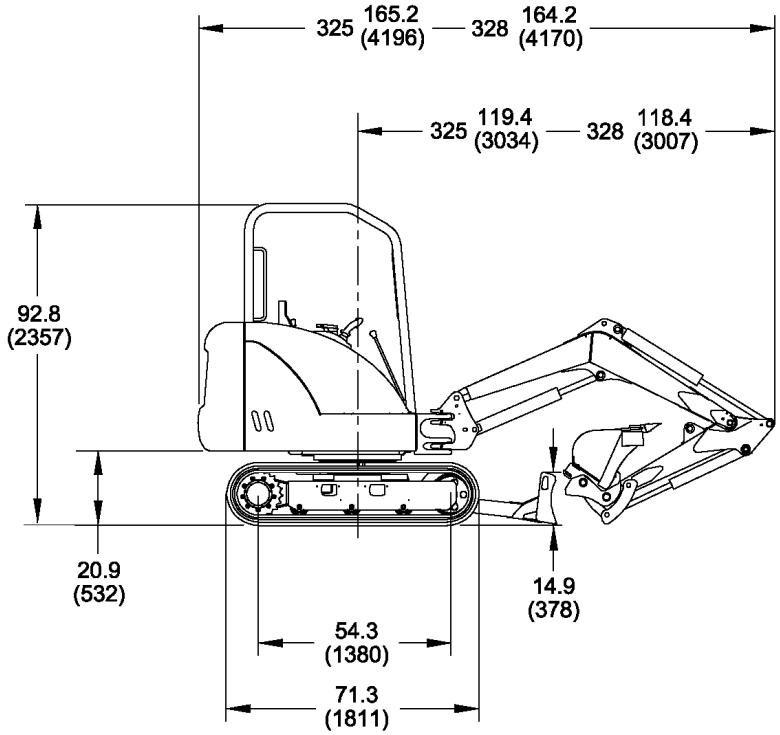
TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION SPEC-01) UNLESS OTHERWISE SPECIFIED.

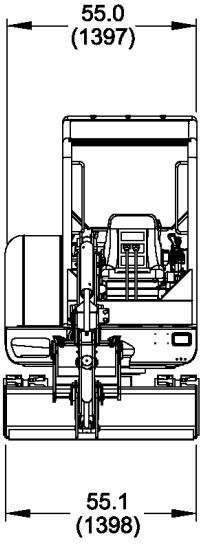
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE AND STANDARD ITEMS MAY VARY.

325/328 Excavator Machine Dimensions

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



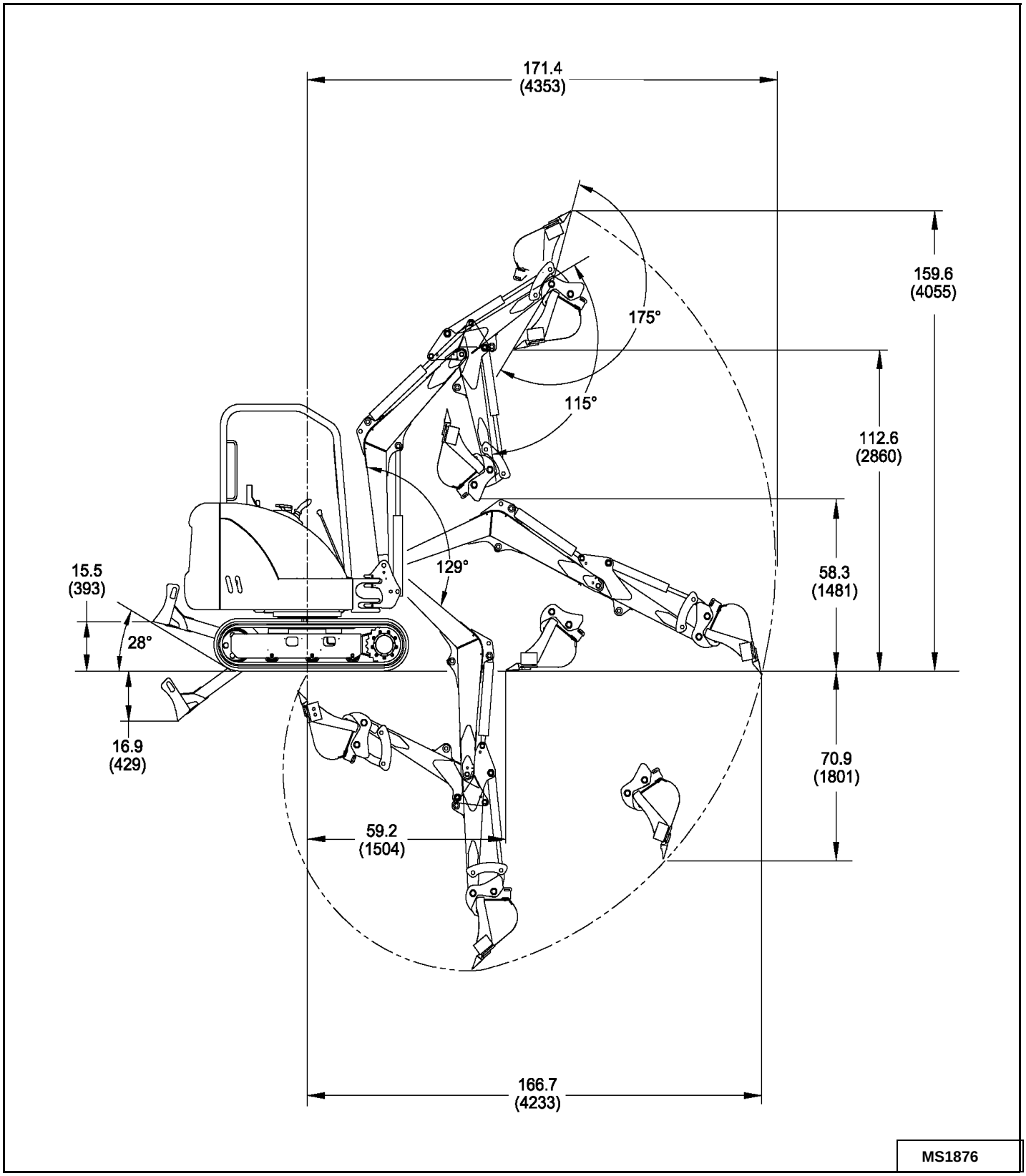




MS1875

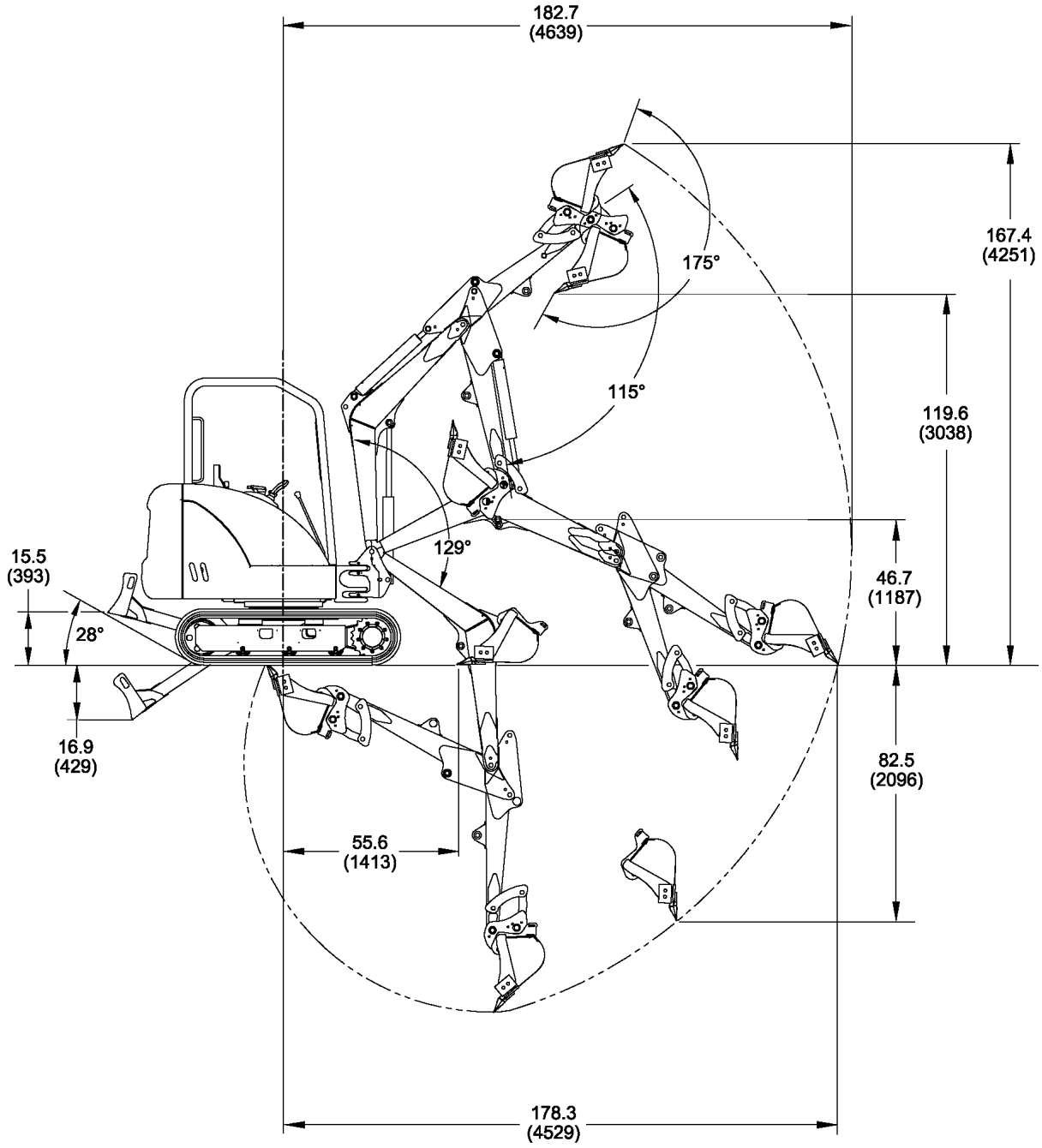
325 Excavator Machine Dimensions

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



325 With Long Arm Option And 328 Excavator Machine Dimensions

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



Performance

325 operating weight w/ canopy, rubber tracks, and 20 in. (508 mm) bucket	6145 lb. (2788 kg)
325 With Long Arm Option & 328 operating weight w/ canopy, rubber tracks, and 20 in. (508 mm) bucket	6477 lb. (2939 kg)
Travel Speed	Low Range 1.2 mph (1,9 km/hr.) High Range 1.9 mph (3,1 km/hr.)
Steel tracks add 146 lb. (66 kg) Cab w/heater add 263 lb. (119 kg)	

Controls

Steering	Two hand levers or foot pedals
Hydraulics	Two hand operated levers (joysticks) control boom, bucket, arm and upperstructure slew
Auxiliary Hydraulics	Electric switch in right joystick
Blade	Right hand lever
Boom Swing	Right foot pedal
Upperstructure Slew Lock Service Holding	 Hydraulic lock on motor Mechanical pin lock
Vehicle Steering	Direction and speed controlled by two pilot operated hand levers/foot pedals.

Engine

Make/Model	Kubota V 1703-M-E28
Fuel/Cooling	Diesel/Liquid
Horsepower, Maximum	27.7 HP (20.6 kw)
High Idle Speed	2420 RPM
Low Idle Speed	1325 - 1375 RPM
Maximum Torque	73 ft.-lb. (103,4 N•m)
Number Of Cylinders	3
Displacement	104 ci (1,7L)
Bore/Stroke	3.43 x 3.64 in. (87 x 92,4 mm)
Lubrication	Forced Lubrication by Trochoid Pump
Crankcase Ventilation	Closed Breathing
Air Cleaner	Dry replaceable paper dual cartridge
Ignition	Diesel-Compression

Hydraulic System

Pump - Hydraulic	Engine driven, dual outlet variable displacement piston/gear pump
Pump Capacity Gear Pump (One) Piston Pump (Two)	 7.03 GPM (26,6 L/min) 5.23 GPM (19,8 L/min)
Auxiliary Flow	12.3 GPM (46,6 L/mm)
Control Valve	10 spool open center parallel/series
Drive Motor (Two)	Axial piston
Slew Motor	Orbit motor
System Relief Pressure Boom, Boom Swing Bucket, Arm, Auxiliary Blade	 2500 PSI (172 bar) 2500 PSI (172 bar) 3820 PSI (263 bar)
Slew Relief Pressure	1700 PSI (117 bar)
Joystick Pressure	428 PSI (30 bar)
Arm Port Relief Base And Rod End	2900 PSI (200 bar)
Boom Port Relief Base End And Rod End	 3335 PSI (230 bar)
Bucket Port Relief Base End Rod End	2900 PSI (200 bar) 3335 PSI (230 bar)
Main Hydraulic Filter Bypass	50 PSI (3,5 bar)
Case Drain Filter Bypass	20 PSI (1,4 bar)

Hydraulic Cylinders

Cylinder	Bore	Rod	Stroke
Boom (Cushion Up)	3.00 in. (76,2 mm)	1.62 in. (41,3 mm)	18.68 in. (423,7 mm)
Arm (Cushion Retract)	3.00 in. (76,2 mm)	1.5 in. (38,1 mm)	19.11 in. (485,4 mm)
Bucket	2.5 in. (63,5 mm)	1.5 in. (38,1 mm)	18.34 in. (465,8 mm)
Boom Swing (Cushion Left/Right)	2.38 in. (60,3 mm)	1.38 in. (34,9 mm)	15.75 in. (400 mm)
Blade	2.75 in. (69,9 mm)	1.50 in. (38,1 mm)	7.68 in. (195 mm)

Hydraulic Cycle Times

Bucket Curl	2.0 seconds
Bucket Dump	1.5 seconds
Arm Retract	3.0 seconds
Arm Extend	2.2 seconds
Boom Raise	3.4 seconds
Boom Lower	4.5 seconds
Boom Swing Left	5.8 seconds
Boom Swing Right	5.1 seconds
Blade Raise	2.4 seconds
Blade Lower	2.4 seconds
Slew	9.2 RPM

Drive System

Travel Motor	Each track is driven by axial piston motor
Drive Reduction	44.3:1 two stage planetary
Max Draw Bar Pull (theoretical @ 90% efficiency)	5480 lbf (24376 N)

Undercarriage

Crawler	Tractor Design
Rollers	Sealed rollers with box section track roller frame
Track Adjusters	Grease type track adjusters with shock absorbing recoil spring

Track

Width	12.6 in. (320 mm)
Number of shoes (steel track)	37
Number of rollers	3
325 Ground Pressure Rubber Track Steel Track	 4.12 PSI (0,284 bar) 4.22 PSI (0,291 bar)
325 with Long Arm Option & 328 Ground Pressure Rubber Track Steel Track	 4.12 PSI (0,284 bar) 4.22 PSI (0,291 bar)

Electrical

Alternator	12 volts, 40 Amp open frame w/ internal regulator
Battery	12 volts negative ground 12 volts 500 CCA @ 0° F (-18° C), 75 min. reserve capacity
Starter	12 volts gear reduction 1.9 HP (1,4 kW)


Bobcat®

ENGINE SPECIFICATIONS

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Fuel Injection Nozzles

Opening Pressure	2702 - 2916 PSI (187 - 201 bar)
Fuel Tightness Nozzle Seat	Dry Nozzle at 1850 PSI (127,6 bar)

Fuel Injection Pump

Fuel Tightness Plunger	10 sec: initial pressure 1849 PSI (12,75 bar)
Allowable Limit	5 seconds
Injection Timing	15.5 - 17 degrees B.T.D.C.

Cylinder Head

Cylinder Head Surface Distortion	0.002 (0,05) in 19.70 (500) Max.
Top Clearance (Piston to Head)	0.0227 - 0.0265 (0.575 - 0.675)
Compression	470 - 540 PSI (32 - 37 bar) @ 290 RPM
Allowable Limit	370 PSI (26 bar) @ 290 RPM
Allowable Difference Between Cylinders	10% or less

Valves

Valve Seat Width (Intake & Exhaust)	0.0835 (2,12)
O.D. of Valve Stems	0.3134 - 0.3140 (7,96 - 7,98)
I.D. of Valve Guides	0.3156 - 0.3161 (8,015 - 8,03)
Clearance Between Valve Stem & Guide	0.0016 - 0.0027 (0,04 - 0,07)
Allowable Limit	0.0039 (0,1)
Valve Clearance (Cold)	0.007 - 0.0087 (0,18 - 0,22)
Valve Recessing (Protrusion)	0.002 (0,05)
(Recess)	0.006 (0,15)
Allowable Limit (Recess)	0.0157 (0,4)
Valve Seat Angle (Int.)	60 degrees
Valve Seat Angle (Exh.)	45 degrees

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Valve Springs

Free Length	1.65 - 1.661 (41,7 - 42,2)
Allowable Limit	1.622 (41,2)
Fitted Length	1.378 (35,0)
Compress to Fitted Length	26.5 lb. (118 N)
Allowable Limit	22.5 lb. (100,0 N)
Inclination Allowable Limit	0.039 (1,0)

Valve Timing

Intake Valve (Open)	12 degrees B.T.D.C.
(Close)	36 degrees A.B.D.C.
Exhaust Valve (Open)	57 degrees B.B.D.C.
(Close)	12 degrees A.T.D.C.

Rocker Arms

O.D. of Rocker Arm Shaft	0.5501 - 0.5506 (13,97 - 13,98)
I.D. of Rocker Arm	0.5512 - 0.5520(14,0 - 14,02)
Clearance Between Rocker Arm & Shaft	0.0006 - 0.0018 (0,02 - 0,05)
Allowable Limit	0.004 (0,1)

Camshaft

Journal O.D.	1.572 - 1.573 (39,93 - 39,95)
Cylinder Block Bore I.D.	1.575 - 1.576 (40,0 - 40,025)
Oil Clearance	0.002 - 0.0036 (0,05 - 0,091)
Allowable Limit	0.006 (0,15)
Alignment Allowable Limit	0.0004 (0,01)
Cam Lobe Height	1.335 (33,9)
Allowable Limit	1.333 (33,85)
End Clearance	0.0028 - 0.0087 (0,07 - 0,22)
Allowable Limit	0.012 (0,3)

Tappet

Clearance Between Tappet & Guide	0.0008 - 0.0024 (0,02 - 0,062)
Allowable Limit	0.003 (0,07)
Tappet O.D.	0.943 - 0.944 (23,96 - 23,98)
Tappet Guide I.D.	0.945 - 0.946 (24,0 - 24,021)

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Cylinders

Cylinder Bore I.D. (Standard)	3.42519 - 3.42606 (87,00 - 87,022)
Allowable Limit (Standard)	+0.0059 (+0,15)
Cylinder Bore I.D. (Oversize)	3.43503 - 3.43590 (87,250 - 87,272)
Allowable Limit (Oversize)	+0.0059 (+0,15)

Piston Rings

Ring Gap (Top)	0.009 - 0.015 (0,25 - 0,40)
Ring Gap (2nd Ring)	0.012 - 0.017 (0,30 - 0,45)
Ring Gap (Oil Ring)	0.0098 - 0.0177 (0,25 - 0,45)
Allowable Limit (All Rings)	0.05 (1,25)
Side Clearance of Ring Groove:	
Top Ring & 2nd Ring	0.0037 - 0.005 (0,093 - 0,13)
Allowable Limit	0.008 (0,20)
Oil Ring	0.008 - 0.0023 (0,2 - 0,06)
Allowable Limit	0.006 (0,15)

Pistons

Piston Pin Bore	0.984 - 0.985 (25,0 - 25,013)
Allowable Limit	0.986 (25,05)

Connecting Rods

Piston Pin O.D.	0.984 - 0.985 (25,0 - 25,011)
Small End Bushing I.D.	0.985 - 0.986 (25,025 - 25,04)
Clearance Between Piston Pin & Small End Bushing	0.0006 - 0.0015 (0,014 - 0,038)
Connecting Rod Alignment Limit Permitted	0.002 (0,05)

Oil Pump

Oil Pressure at Rated RPM	43 - 64 PSI (2,9 - 4,4 bar)
Allowable Limit	36 PSI (2,48 bar)
Idle Speed Allowable Limit	7 PSI (0,48 bar)
Clearance Between Inner Rotor & Outer Rotor	0.0012 - 0.0055 (0,03 - 0,14)
Outer Rotor & Pump Body	0.0044 - 0.0075 (0,11 - 0,19)
End Clearance Between Inner Rotor & Cover	0.0041 - 0.0059 (0,105 - 0,15)
Allowable Limit	0.008 (0,2)

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Crankshaft

Crankshaft Alignment Allowable Limit	0.008 (0,02)
Oil Clearance Between Journal & Bearing #1	0.0016 - 0.0046 (0,04 - 0,118)
Allowable Limit	0.008 (0,2)
Journal O.D. #1	2.3591 - 2.3598 (59,921 - 59,940)
Bearing I.D. #1	2.3614 - 2.3637 (59,980 - 60,039)
Oil Clearance Between Journal & Bearing #2	0.0016 - 0.0041 (0,04 - 0,104)
Allowable Limit	0.008 (0,2)
Journal O.D. #2	2.3591 - 2.3598 (59,921 - 59,940)
Bearing I.D. #2	2.3614 - 2.3632 (59,980 - 60,025)
Oil Clearance Between Crank Pin & Bearing	0.001 - 0.0034 (0,025 - 0,087)
Allowable Limit	0.008 (0,2)
Crank Pin O.D.	1.8488 - 1.8494 (46,96 - 46,98)
Crank Pin Bearing I.D.	1.850 - 1.852 (47,0 - 47,05)
Crankshaft Side Clearance	0.006 - 0.012 (0,15 - 0,31)
Allowable Limit	0.020 (0,5)

Timing Gear

Timing Gear Backlash	
Crank Gear - Idle Gear	0.0016 - 0.0044 (0,042 - 0,112)
Idle Gear - Cam Gear	0.0016 - 0.0045 (0,042 - 0,115)
Idle Gear - Injection Pump Gear	0.0016 - 0.0045 (0,042 - 0,115)
Crank Gear - Oil Pump Gear	0.0016 - 0.0043 (0,042 - 0,109)
Allowable Limit	0.006 (0,15)
Clearance Between Idle Gear Shaft & Idle Gear Bushing	0.001 - 0.0025 (0,025 - 0,066)
Allowable Limit	0.004 (0,10)
Idler Gear Side Clearance	0.005 - 0.019 (0,12 - 0,48)

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Thermostat

Valve Opening Temperature	157° - 162° F (70° - 73° C)
Valve Fully Open	185° F (85° C)

Engine Bolt Torque

	ft.-Lb.	**N•m**
Camshaft Retainer Plate Bolts	18 - 20	24 - 27
* Connecting Rod Bolts	33 - 36	44 - 49
* Crankshaft Nut	101 - 116	137 - 157
* Cylinder Head Bolts	69 - 72	93 - 98
* Flywheel Bolts	72 - 80	98 - 108
Fuel Camshaft Retainer Bolts	5 - 6	6,8 - 8,1
Fuel Injection Tubeline Fittings	11 - 18	15 - 25
Glow Plugs	15 - 18	20 - 25
* Idler Gear Shaft Bolt	18 - 20	24 - 27
Injection Nozzle Clamp	19 - 21	26 - 29
Injection Pump Mounting Nuts	18 - 20	24 - 27
* Main Bearing Bolts	51 - 54	69 - 73
* Main Bearing Case Bolts	34 - 37	46 - 50
Oil Switch	11 - 15	15 - 20
Rear Bearing Case Cover Bolts	17 - 20	23,5 - 27,5

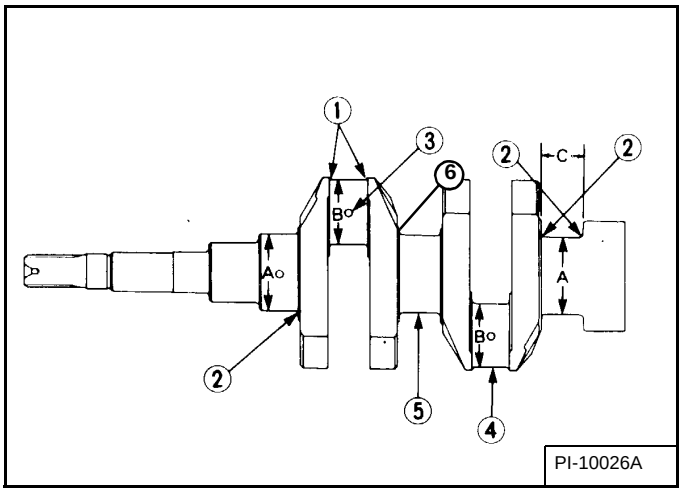
* Lightly Oiled Threads

Crankshaft Re-Grind Data

If the standard size bearing cannot be used due to excessive wear of the crankpin and crank journal use undersize or oversize bearings.

For undersize or oversize bearing use, follow the precautions noted below.

Figure SPEC-20-3



Grind the crankpin and journal with a wheel which has specified round corner and width without shoulder **[Figure SPEC-20-3]**.

1. 0.1299 - 0.1457 in. (3,3 - 3,7 mm) radius.
2. 0.1102 - 0.1260 in. (2,8 - 3,2 mm) radius.
3. Chamfer the oil hole circumference to 0.04 - 0.06 in. (1,0 - 1,5 mm) radius with an oil stone.
4. The crankpin must be fine finished to higher than (0,8S).
5. The crank journal must be fine-finished to higher than (0,8S).
6. The crank journal side surface must be fine-finished to higher than (0,8S).

SIZE	CODE NO.	NAME OF BEARING	BEARING MARK	CRANKSHAFT PROCESSING DIM.	
-0.008 in. (0,2 mm)	1A091-23911	Crankshaft Bearing 1 0.008 in. minus (0,2 minus)	020 US	A	2.0363 - 2.037 in. (51,721 - 51,74 mm)
-0.008 in. (0,2 mm)	1A091-23931	Crankshaft Bearing 2 0.008 in. minus (0,2 minus)	020 US		
-0.016 in. (0,4 mm)	1A091-23921	Crankshaft Bearing 1 0.016 in. minus (0,4 minus)	040 US	A	2.0284 - 2.0291 in. (51,521 - 51,54 mm)
-0.016 in. (0,4 mm)	1A091-23941	Crankshaft Bearing 2 0.016 in. minus (0,4 minus)	040 US		
-0.008 in. (0,2 mm)	17331-22970	Crank Pin Bearing 0.008 in. minus (0,2 minus)	020 US	B	1.8409 - 1.8415 in. (46,759 - 46,775 mm)
-0.016 in. (0,4 mm)	17331-22980	Crank Pin Bearing 0.016 in. minus (0,4 minus)	040 US	B	1.8330 - 1.8337 in. (46,559 - 46,575 mm)
+0.008 in. (+0,2 mm)	1A091-23951	Thrust Bearing 1 - 0.008 in. plus (0,2 mm plus)	020 OS	C	1.0315 - 1.0335 in. (26,20 - 26,25 mm)
	1A091-23971	Thrust Bearing 2 - 0.008 in. plus (0,2 mm plus)			
+0.016 in. (+0,4 mm)	1A091-23961	Thrust Bearing 1 - 0.016 in. plus (0,4 mm plus)	040 OS	C	1.0394 - 1.0413 in. (26,4 - 26,45 mm)
	1A091-23981	Thrust Bearing 2 - 0.016 in. plus (0,4 mm plus)			

TORQUE SPECIFICATIONS

Torque for General SAE Bolts

The following table shows standard torque specifications for bolts with zinc phosphate coating. Bolts purchased from Bobcat that have zinc phosphate coating are specified by the letter H following the part number.

THREAD SIZE		SAE GRADE 5	SAE GRADE 8
in.-lb. (N•m)	0.250	80 - 90 (9,0 - 10,2)	110 - 120 (12,4 - 13,6)
	0.3125	180 - 200 (20,3 - 22,6)	215 - 240 (24,2 - 27,1)
ft.-lb. (N•m)	0.375	25 - 28 (34 - 38)	35 - 40 (47 - 54)
	0.4375	40 - 45 (54 - 61)	60 - 65 (81 - 88)
	0.500	65 - 70 (88 - 95)	90 - 100 (122 - 136)
	0.5625	90 - 100 (122 - 136)	125 - 140 (170 - 190)
	0.625	125 - 140 (170 - 190)	175 - 190 (240 - 260)
	0.750	220 - 245 (300 - 330)	300 - 330 (410 - 450)
	0.875	330 - 360 (450 - 490)	475 - 525 (645 - 710)
	1.000	475 - 525 (645 - 710)	725 - 800 (985 - 1085)
	1.125	650 - 720 (880 - 975)	1050 - 1175 (1425 - 1600)
	1.250	900 - 1000 (1200 - 1360)	1475 - 1625 (2000 - 2200)
	1.375	1200 - 1350 (1630 - 1830)	2000 - 2200 (2720 - 2980)
	1.500	1500 - 1650 (2040 - 2240)	2600 - 2850 (3530 - 3870)
	1.625	2000 - 2800 (2720 - 2980)	3450 - 3800 (4680 - 5150)
	1.750	2500 - 2750 (3390 - 3730)	4300 - 4800 (5830 - 6500)
	1.875	3150 - 3500 (4270 - 4750)	5500 - 6100 (7450 - 8300)
	2.000	3800 - 4200 (5150 - 5700)	6500 - 7200 (8800 - 9800)

TORQUE SPECIFICATIONS (CONT'D)

Torque For General Metric Bolts

GRADE		STANDARD SCREW AND BOLT			SPECIAL SCREW AND BOLT		
							
NOMINAL DIAMETER	**UNIT**	**N•m**	**KFG M**	**ft.-lb.**	**N•m**	**KFG M**	**ft.-lb.**
M6		7,9 - 9,3	0.80 - 0.95	5.8 - 6.9	9,8 - 11,3	1.00 - 1.15	7.23 - 8.32
M8		18 - 20	1.8 - 2.1	13.0 - 15	24 - 27	2.4 - 2.8	18 - 20
M10		40 - 45	4.0 - 4.6	29 - 33	49 - 55	5.0 - 5.7	37 - 41
M12		63 - 72	6.4 - 7.4	47 - 53	78 - 90	7.9 - 9.2	58 - 66

HYDRAULIC CONNECTION SPECIFICATIONS

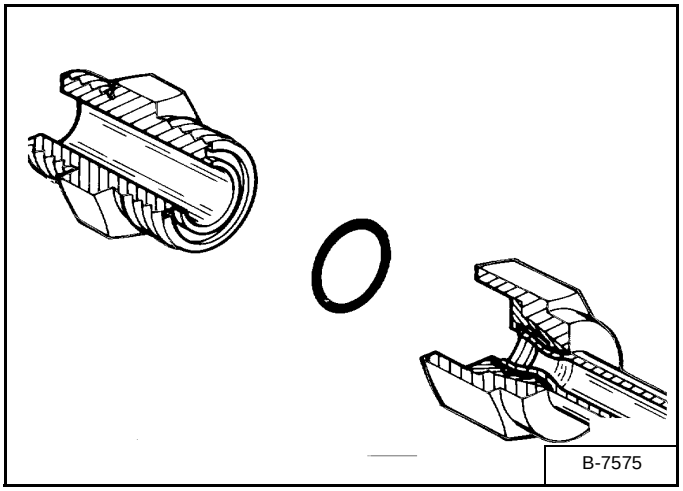
O-ring Face Seal Connection

IMPORTANT

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

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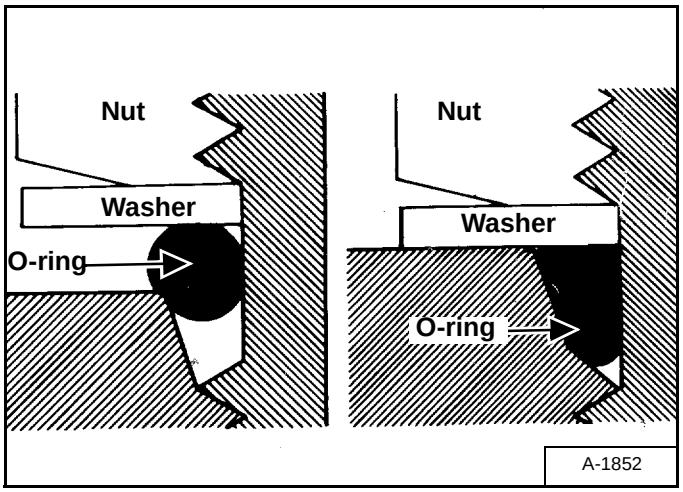
Figure SPEC-40-4



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-40-4]**.

Straight Thread O-Ring Fitting

Figure SPEC-40-5



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-40-5]**.

Tubelines And Hoses

Replace any tubelines that are bent or flattened. They will restrict flow, which will slow hydraulic action and cause heat.

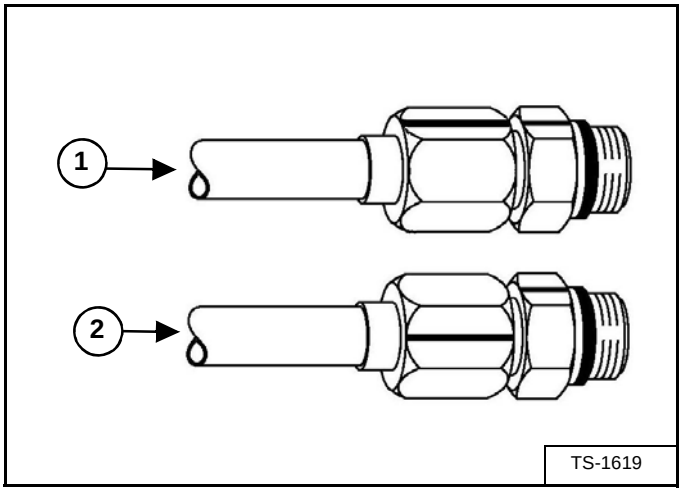
Replace hoses which show signs of wear, damage or weather cracked rubber.

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-40-6



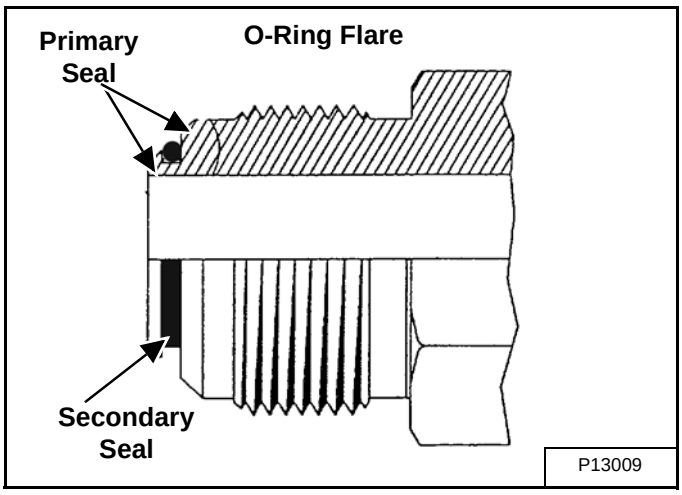
Tighten the nut until it makes contact with the seat. Make a mark across the *flats* of both the male and female parts of the connection (Item 1) **[Figure SPEC-40-6]**.

Use the chart below to find the correct tightness needed (Item 2) **[Figure SPEC-40-6]**. If the fitting leaks after tightening, disconnect and inspect the seat area for damage.

FLARE FITTING TIGHTENING TORQUE					
WRENCH SIZE	**TUBELINE OUTSIDE DIAMETER**	**THREAD SIZE**	**TORQUE ft.-lb. (N•m)**	**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-40-7

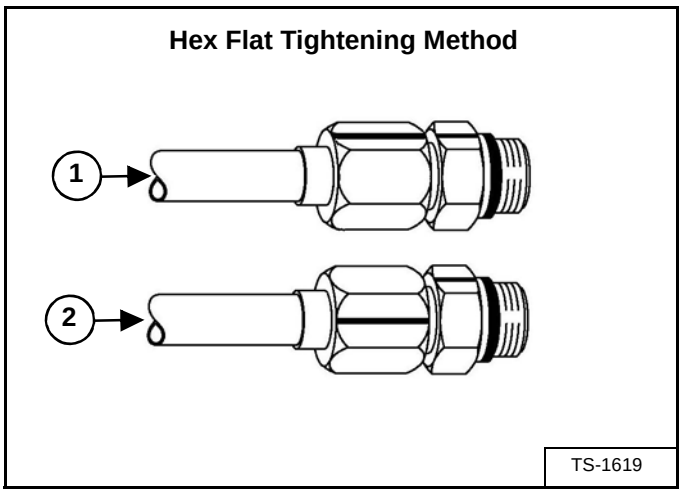


The flare is the primary seal, the O-ring is the secondary seal and helps absorb vibration and pressure pulses at the connection **[Figure SPEC-40-7]**.

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-40-8



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-40-8]**.

Use the chart below to find the correct tightness needed (Item 2) **[Figure SPEC-40-8]**. If the fitting leaks after tightening, disconnect it and inspect the seat area for

O-RING FLARE FITTING TIGHTENING TORQUE					
WRENCH SIZE	**TUBELINE OUTSIDE DIAMETER**	**THREAD SIZE**	**TORQUE ft.-lb. (N•m)**	**** 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 using the hex flat tightening method to tighten a new fitting to a new hose/tubeline.
* If a torque wrench is used to tighten a used fitting to a new hose/tubeline.	** If using the hex flat tightening method to tighten a new fitting to a used hose/tubeline.
* If a torque wrench is used to tighten a new fitting to a new hose/tubeline.	*** If using the hex flat tightening method to tighten a used fitting to a new hose/tubeline.

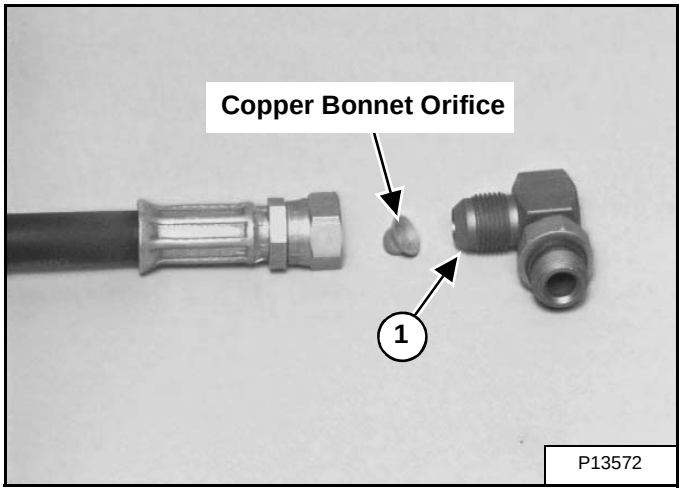
HYDRAULIC CONNECTION SPECIFICATIONS (CONT'D)

O-ring Flare Fitting (Cont'd)

NOTE: O-ring flare fittings are not recommended in all applications. Use the standard flare fittings in these applications.

Do not use a O-ring flare fitting when a copper bonnet orifice is used. When tightened the connection at the bonnet may distort the flare face and prevent it from sealing.

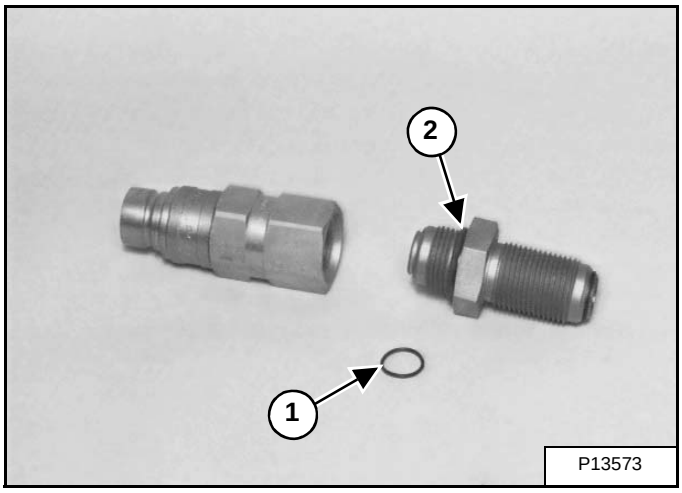
Figure SPEC-40-9



Use a standard flare fitting (Item 1) **[Figure SPEC-40-9]** as shown.

When a O-ring flare fitting is used as a straight thread port adapter the O-ring flare face is not used to seal. The O-ring may come off the fitting and enter the system.

Figure SPEC-40-10

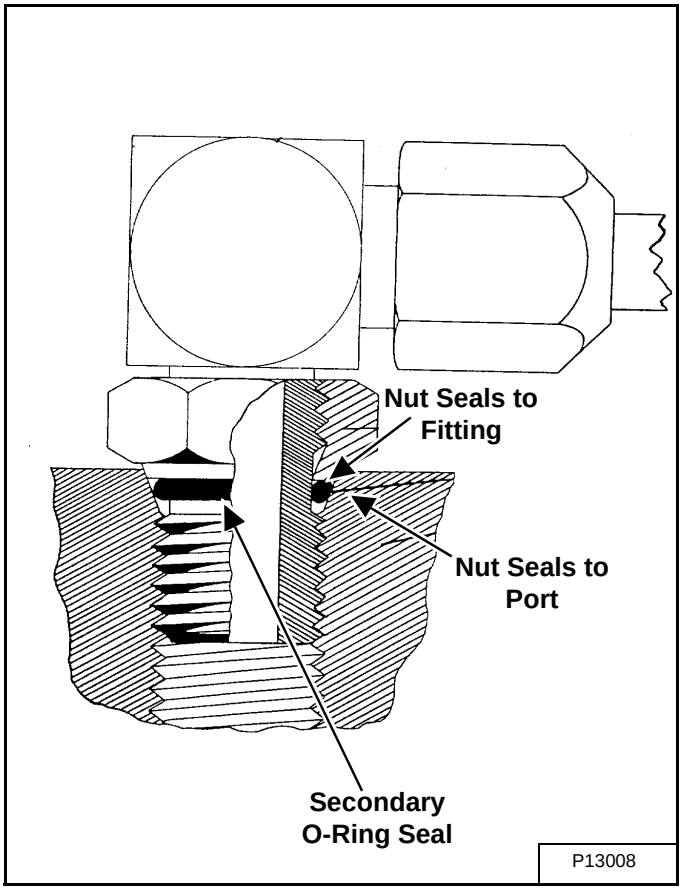


Always remove the O-ring (Item 1) **[Figure SPEC-40-10]** from the flare face as shown.

An O-ring (Item 2) **[Figure SPEC-40-10]** is added to the flat boss of the fitting to seal the connection in this application.

Port Seal Fitting

Figure SPEC-40-11



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-40-11]**.

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 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.

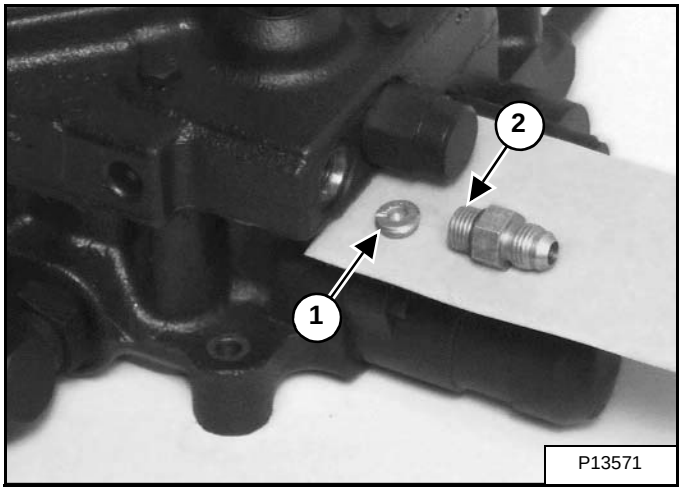
Do not over tighten the port seal fitting.

PORT SEAL AND O-RING BOSS TIGHTENING TORQUE		
FITTING NUT WRENCH SIZE	**THREAD SIZE (N•m)**	**TORQUE ft.-lb. (N•m)**
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)

NOTE: If a torque wrench cannot be used, use the hex flat tightening method as an approximate guideline.

NOTE: Port seal fittings are not recommended in all applications. Use O-ring boss fittings in these applications.

Figure SPEC-40-12



Do not use port seal fittings when a thread in orifice (Item 1) **[Figure SPEC-40-12]** is used in the port. The orifice may interfere with the fitting and prevent it from sealing.

Use an O-ring boss fitting (Item 1) **[Figure SPEC-40-12]** as shown.


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HYDRAULIC FLUID SPECIFICATIONS

Specifications

Use only Bobcat hydraulic fluid.

DO NOT use automatic transmission fluids in the excavator or permanent damage to the hydraulic system will result.

Bobcat hydraulic fluid is available in:

- 2.5 Gal. (9,5 L) qty 2 (P/N 6903117)
- 55 Gal. (208 L) (P/N 6903119)
- 5 Gal. (18,9 L) (P/N 6903118)

WARNING

AVOID INJURY OR DEATH

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

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When temperatures below zero degree F (-18° C) are common, the excavator must be kept in a warm building. Extra warm-up time must be used each time the excavator is started during cold temperature conditions. Cold fluid will not flow easily and it makes action of the hydraulic function slower. Loss of fluid flow to the hydraulic pump can cause damage in less than 60 seconds.

WARNING

During cold weather (32°F [0°C] and below), do not operate machine until the engine has run for at least five minutes at less than half throttle. This warm-up period is necessary for foot pedal operation and safe stopping. Do not operate controls during warm-up period.

When temperatures are below -20°F (-30°C), the hydrostatic oil must be heated or kept warm. The hydrostatic system will not get enough oil at low temperatures. Park the machine in an area where the temperature will be above 0°F (-18°C) if possible.

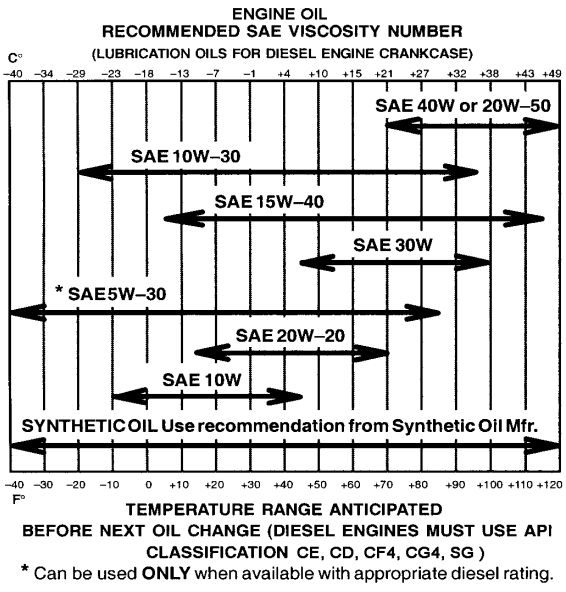
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FUEL, COOLANT AND LUBRICANTS

Chart

Use this chart for correct selection of Fuel, Coolant and Lubricants.

RESERVOIR	KIND OF FLUID	RECOMMENDED SAE VISCOSITY NUMBER (LUBRICATION OILS FOR DIESEL ENGINE CRANKCASE)	CAPACITY REFILL
Engine oil w/ filter	*Use SAE Viscosity Number as Listed With API Classification CD or Better		5.6 qt. (1.5 g)
Fuel Tank	Diesel Fuel No. 2-D (ASTM D975)	Temp. F× / No. 2 / No.1 +15× (9×) 100% 0% Down to -20× (-29×) 50% 50% Below -20× (-29×) 0% 100%	14.1 gal. (53,3 L)
Cooling System	**Coolant Mixture		4.5 Gal. (17,0 L)
Hydraulic Tank	Bobcat Fluid	P/N 6903117 - 2.5 Gal. (9,5 L) P/N 6903118 - 5 Gal. (18,9 L) P/N 6903119 - 55 Gal. (208 L)	Tank Cap. 9.7 Gal. (18,2 L)
Travel Motor (each)	Gear Lube	SAE-90W	0.55 qt. (0,5 L)

ENGINE OIL SPECIFICATIONS

When fuel sulphur content is less than 0.5% change the engine oil and filter as shown See Service Schedule. (See SERVICE SCHEDULE on Page 10-50-1.)

Change engine oil and filter according to the following chart if fuel sulphur content is above 0.5%.

FUEL SULPHUR CONTENT	CHANGE INTERVAL OF ENGINE & OIL FILTER
0.5 to 1.0%	1/2 of Regular Interval
Above 1.0%	1/4 of Regular Interval

***** *COOLANT MIXTURE*

Propylene Glycol (Factory Installed)

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

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

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


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CONVERSIONS

Decimal And Millimeter Equivalents

FRACTIONS	DECIMALS	MM
1/64	0.015625	0.397
1/32	0.03125	0.794
3/64	0.046875	1.191
1/16	0.0625	1.588
5/64	0.078125	1.984
3/32	0.09375	2.381
7/64	0.109375	2.778
1/8	0.1250	3.175
9/64	0.140625	3.572
5/32	0.15625	3.969
11/64	0.171875	4.366
3/16	0.1876	4.762
13/64	0.203125	5.159
7/32	0.21875	5.556
15/64	0.234375	5.953
1/4	0.2500	6.350
17/64	0.265625	6.747
9/32	0.28125	7.144
19/64	0.296875	7.541
5/16	0.3125	7.938
21/64	0.328125	8.334
11/32	0.34375	8.731
23/64	0.359375	9.128
3/8	0.3750	9.525
25/64	0.390625	9.922
13/32	0.40625	10.319
27/64	0.421875	10.716
7/16	0.4375	11.112
29/64	0.453125	11.509
15/32	0.46875	11.906
31/64	0.484375	12.303
1/2	0.5000	12.700
33/64	0.515625	13.097
17/32	0.53125	13.494
35/64	0.546875	13.891
9/16	0.5625	14.288
37/64	0.578125	14.684
19/32	0.59375	15.081
39/64	0.609375	15.478
5/8	0.6250	15.875
41/64	0.640625	16.272
21/32	0.65625	16.669
43/64	0.671875	17.066
11/16	0.6875	17.462
45/64	0.703125	17.859
23/32	0.71875	18.256
47/64	0.734375	18.653
3/4	0.7500	19.050
49/64	0.765625	19.447
25/32	0.78125	19.844
51/64	0.796875	20.241
13/16	0.8125	20.638
53/64	0.828125	21.034
27/32	0.84375	21.431
55/64	0.859375	21.828
7/8	0.8750	22.225
57/64	0.890625	22.622
29/32	0.90625	23.019
59/64	0.921875	23.416
15/16	0.9375	23.812
61/64	0.953125	24.209
31/32	0.96875	24.606
63/64	0.984375	25.003
1	1.000	25.400

1 mm = 0.03937”

0.001 = 0.0254 mm

CONVERSIONS (CONT'D)

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

Bobcat

SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	☐
SERVICE MANAGER	X
SALES MANAGER	☐

NOTICE **Insert This Sheet With The Below Listed Manual For Future Reference.**

Revision No: **325 / 328 - 1**
Date: **5 May 2009**
Product: **Bobcat Excavator**
Model: **325 / 328**
Manual No: **6986940 (5-09)**

The following Sections are a revision to the above Service Manual.

COVER
MAINTENANCE SAFETY
ALPHABETICAL INDEX
FOREWORD

10-01

20-01
HYDRAULIC / HYDROSTATIC SCHEMATICS
20-30
20-32
20-50
20-220

30-01
30-30
30-70

40-01
40-171 ADDED

50-01

60-01
60-50

70-01

SPEC-01

Printed in U.S.A.


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SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	
SERVICE MANAGER	X
SALES MANAGER	

NOTICE **Insert This Sheet With The Below Listed Manual For Future Reference.**

Revision No: **325 / 328 - 2**
Date: **25 September 2009**
Product: **Bobcat Excavator**
Model: **325 / 328**
Manual No: **6986940 (10-09)**

The following Sections are a revision to the above Service Manual.

COVER	
30-30	
30-70	

Printed in U.S.A.


Bobcat®