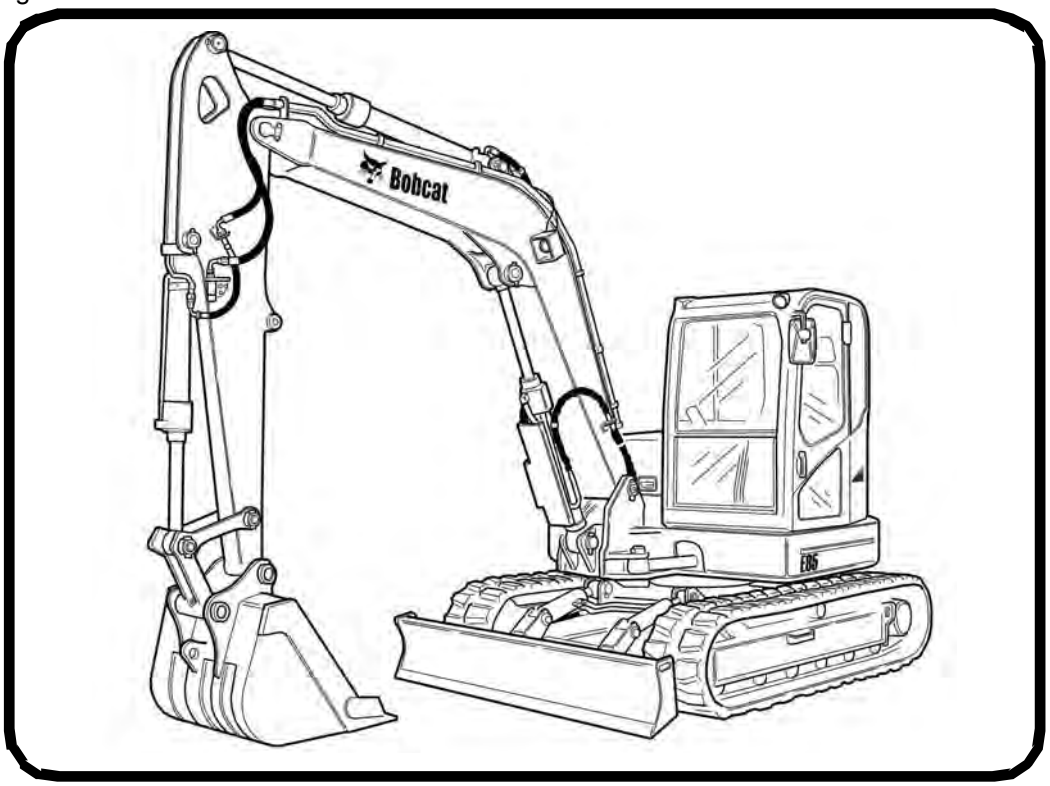
Bobcat®

Service Manual
E85 Excavator

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S/N B34T11001 & Above
S/N B34S11001 & Above



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T4-Y S3B

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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.

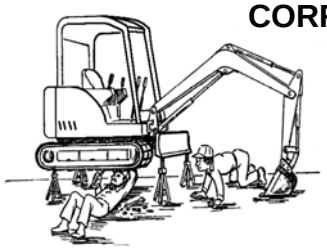
CORRECT



P-90216

Never service the Bobcat Excavator without instructions.

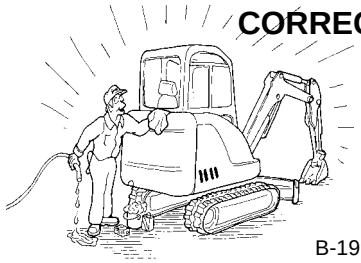
CORRECT



B-19964

Use the correct procedure to lift and support the excavator.

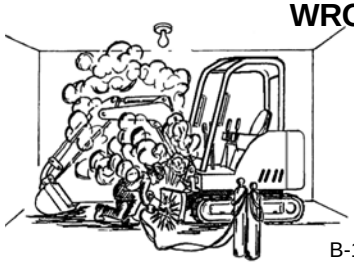
CORRECT



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

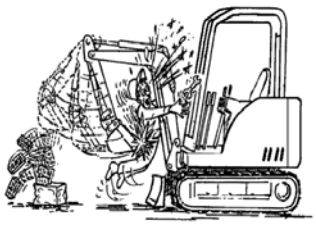


B-19960

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

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

WRONG

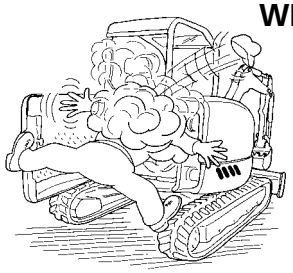


B-19966

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

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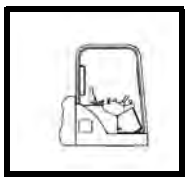
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FOREWORD

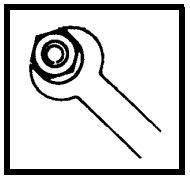
This manual is for the Bobcat excavator mechanic. It provides necessary servicing and adjustment procedures for the Bobcat excavator and its component parts and systems. Refer to the Operation & Maintenance Manual for operating instructions, starting procedure, daily checks, etc.

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

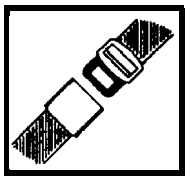
1. Check that the cab is in good condition and is not modified.



2. Check that the cab mounting hardware is tightened and is Bobcat approved.



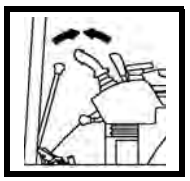
3. The seat belt must be correctly installed, functional and in good condition.



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



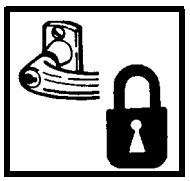
5. Travel levers, control levers and foot pedals must return to neutral. Check that the pedal locks are in working order.



6. Check for correct function of the work lights.



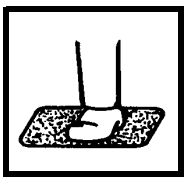
7. Enclosure door latches must open and close freely.



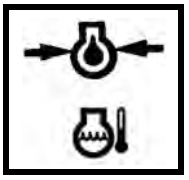
8. Attachment locking pins must function correctly and be in good condition.



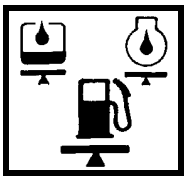
9. Safety treads must be in good condition.



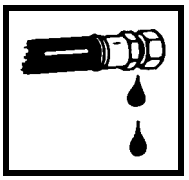
10. Check for correct function of indicator lamps.



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



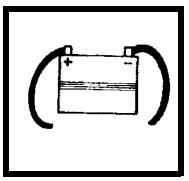
12. Inspect for fuel, oil or hydraulic fluid leaks.



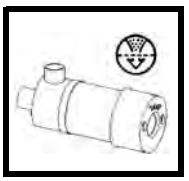
13. Lubricate the excavator.



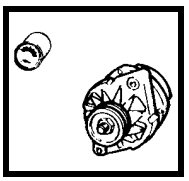
14. Check the condition of the battery and cables.



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



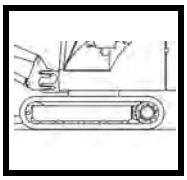
16. Check the electrical charging system.



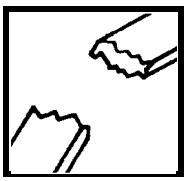
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FW EXC DSN E85 EMEA-1015 SM

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



18. Inspect for loose or broken parts or connections.



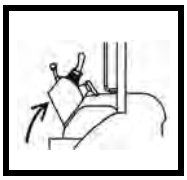
19. Check for any field modification not completed.



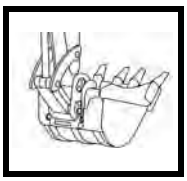
20. Operate the machine and check all functions.



21. Check the control console interlocks for correct function.



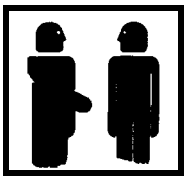
22. Inspect the attachment quick coupler for wear or damage. Repair or replace damaged parts.



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.



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SAFETY INSTRUCTIONS

Safety Alert Symbol

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

WARNING

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

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-0913 SM

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



Call Before You Dig

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.

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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.

Ultra Low Sulfur Diesel (ULSD) poses a greater static ignition hazard than earlier diesel formulations with higher Sulfur content. Avoid death or serious injury from fire or explosion. Consult with your fuel or fuel system supplier to ensure the delivery system is in compliance with fueling standards for proper grounding and bonding practices.

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 Arrester Exhaust System

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

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FIRE PREVENTION (CONT'D)

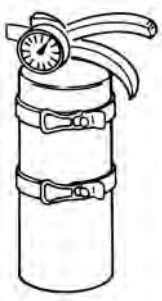
Welding And Grinding

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.

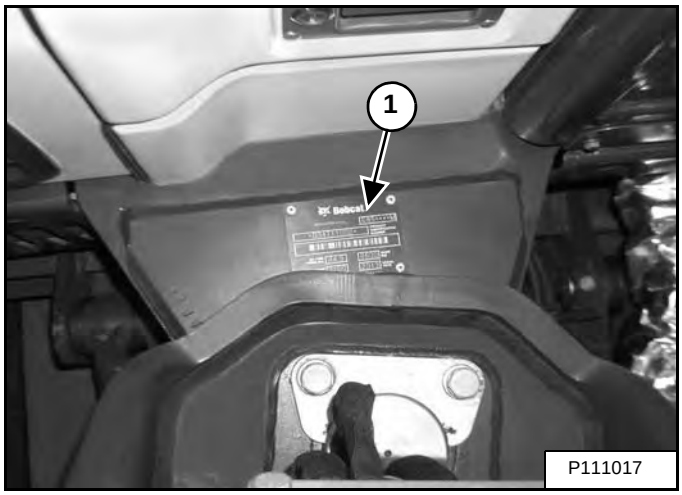
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SERIAL NUMBER LOCATIONS

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

Excavator Serial Number

Figure 1



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

Explanation of Excavator Serial Number:

XXXX XXXXX

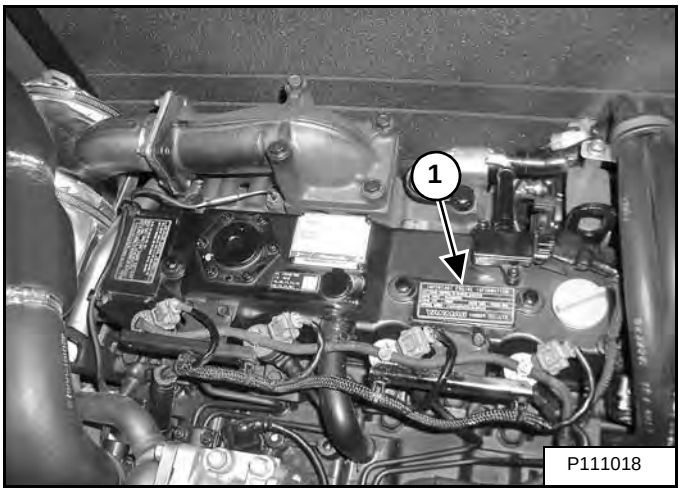
- XXXXX — Module 2. - Production Sequence (Series)
- XXXX — Module 1. - Model / Engine Combination

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

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

Engine Serial Number

Figure 2

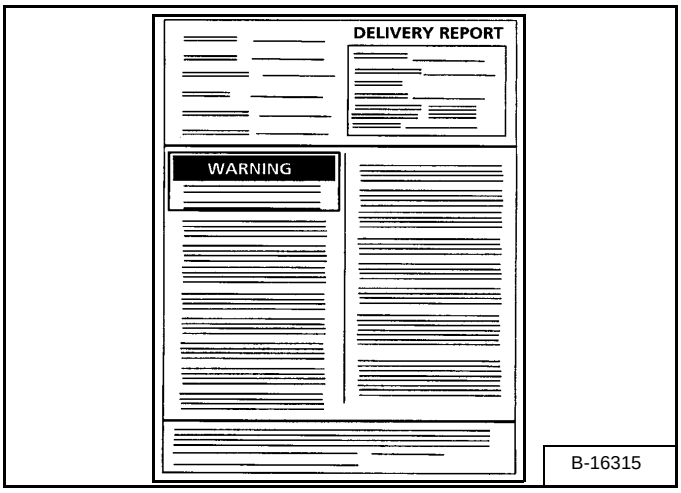


The engine serial number (Item 1) **[Figure 2]** is located on the top cover.

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DELIVERY REPORT

Figure 3

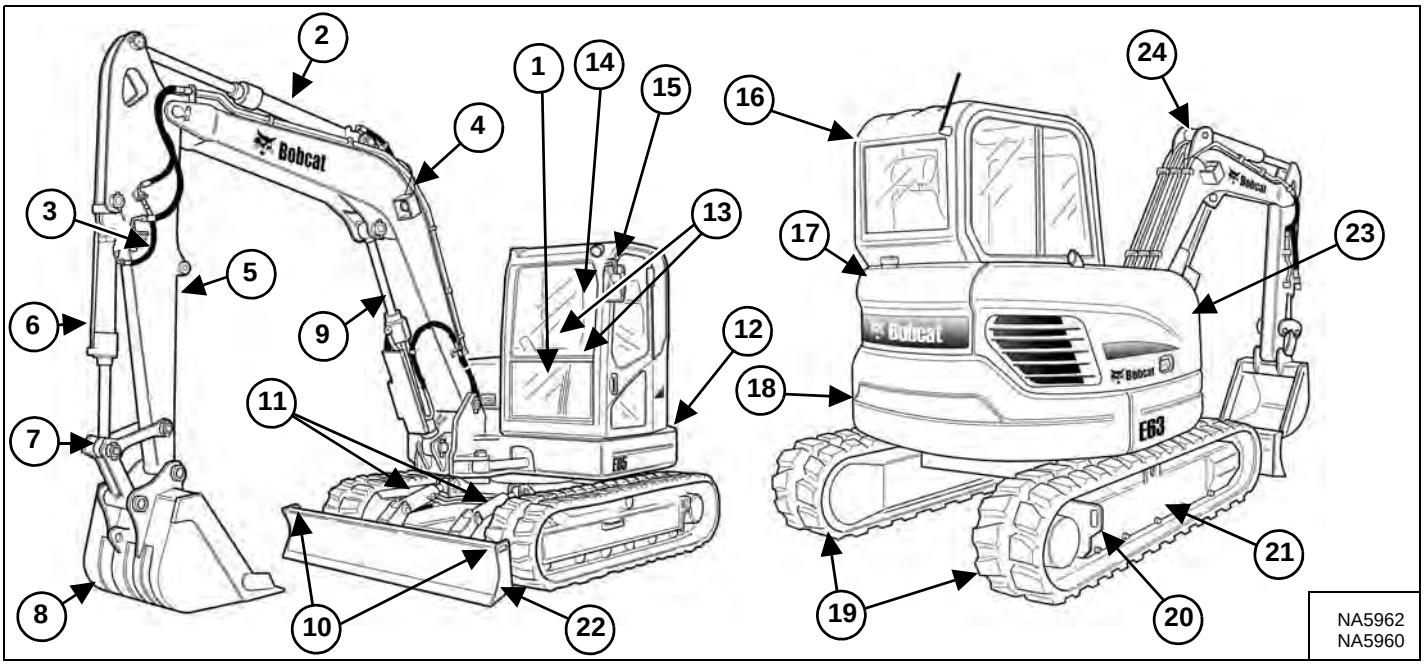


The delivery report **[Figure 3]** contains a list of items that must be explained or shown to the owner or operator by the dealer when the Bobcat excavator is delivered.

The delivery report must be reviewed and signed by the owner or operator and the dealer.

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EXCAVATOR IDENTIFICATION



ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	Operator's Handbook	**16**	Cab (ROPS / TOPS) **[C]**
2	Arm Cylinder	**17**	Rear Cover
3	Auxiliary Quick Couplers	**18**	Counterweight
4	Boom **[A]**	**19**	Tracks **[D]**
5	Arm	**20**	Tie Downs (Both Sides)
6	Bucket Cylinder	**21**	Track Frames
7	Bucket Link	**22**	Blade
8	Bucket **[B]**	**23**	Right Side Cover
9	Boom Cylinder	**24**	Lift Point
10	Tie Downs / Lift Points		
11	Blade Cylinders		
12	Upperstructure		
13	Control Levers (Joysticks)		
14	Operator's Seat with Seat Belt		
15	Mirrors		

[A] BOOM - Optional articulated boom is available.
[B] BUCKET - Several different buckets and other attachments are available for the Bobcat excavator.
[C] ROPS - (Roll Over Protective Structure) as standard equipment.
The ROPS meets ISO 12117-2; 2008.
[D] TRACKS - Optional tracks are available.

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SAFETY AND MAINTENANCE

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Procedure 10-10-1

LIFTING THE EXCAVATOR 10-20-1
Procedure 10-20-1

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Right Side Window 10-30-4
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Loading And Unloading 10-40-1
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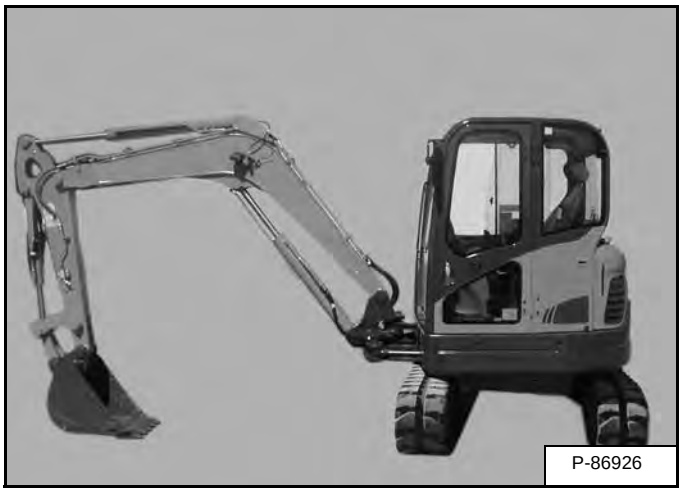
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LIFTING AND BLOCKING THE EXCAVATOR

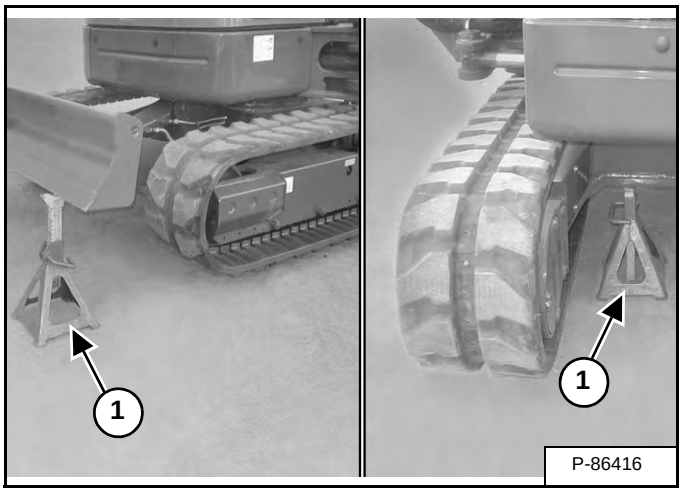
Procedure

Figure 10-10-1



Raise one side of the machine (approximately 101,6 mm [4 in]) using the boom and arm **[Figure 10-10-1]**.

Figure 10-10-2



Fully raise the blade and install jackstands (Item 1) **[Figure 10-10-2]** under the blade and track frame. Lower 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.

W-2142-0903

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.

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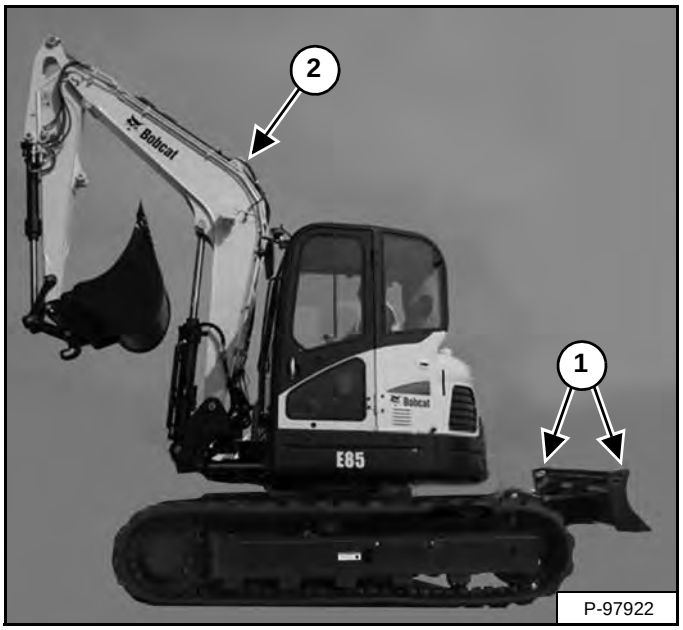


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LIFTING THE EXCAVATOR

Procedure

Figure 10-20-1



Fully extend the cylinders of the bucket, arm, boom and articulated boom (if equipped) so that the excavator is in the position as shown **[Figure 10-20-1]**.

Raise the blade fully.

Put all the control levers in neutral.

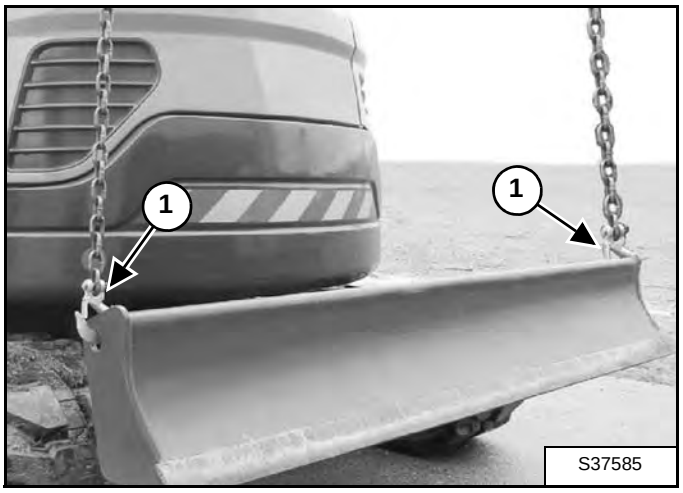
⚠ WARNING

AVOID INJURY OR DEATH

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

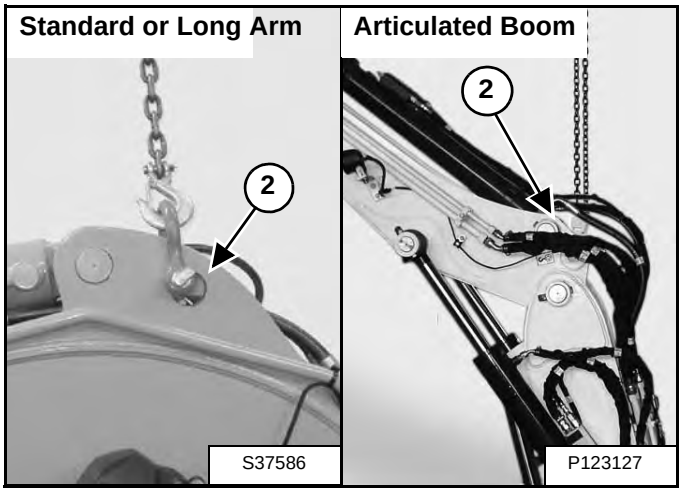
W-2434-0502

Figure 10-20-2



Fasten chains to the ends of the blade (Item 1) **[Figure 10-20-1]** and **[Figure 10-20-2]** and up to a lifting device above the cab. Place protective material between the chains and the cab and the upperstructure to prevent damage.

Figure 10-20-3

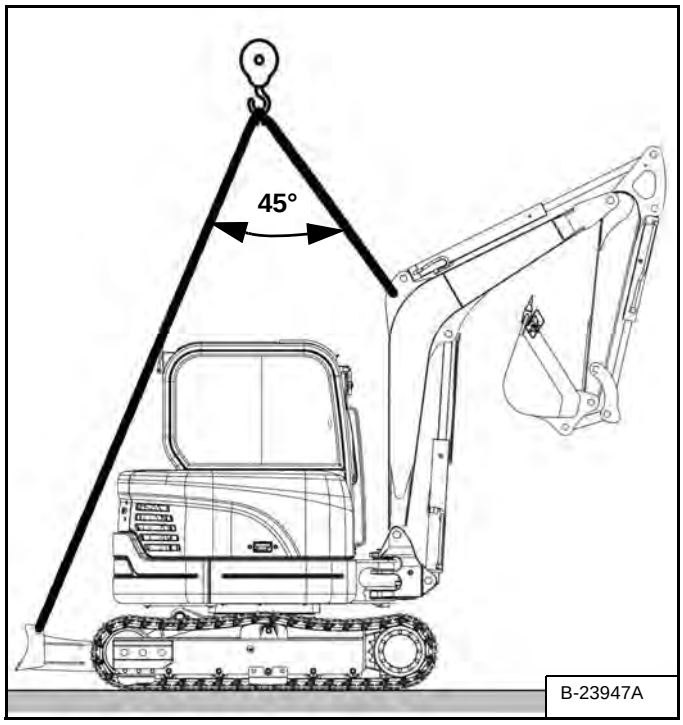


Fasten chains to the boom (Item 2) **[Figure 10-20-1]** and **[Figure 10-20-3]** and up to a lifting device above the cab. Place protective material between the chains and the cab and the upperstructure to prevent damage.

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Procedure (Cont'd)

Figure 10-20-4



The maximum angle between the front and rear chains must not exceed 45° **[Figure 10-20-4]**.

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OPERATOR CAB

Description

The Bobcat excavator has an operator cab (ROPS) as standard equipment to provide protection if the excavator is tipped over. The seat belt must be worn for ROPS protection.

Check the ROPS cab, mounting, and hardware for damage. Never modify the ROPS cab. Replace the cab and hardware if damaged. See your dealer for parts.

ROPS - Roll Over Protective Structure per ISO 12117-2: 2008.

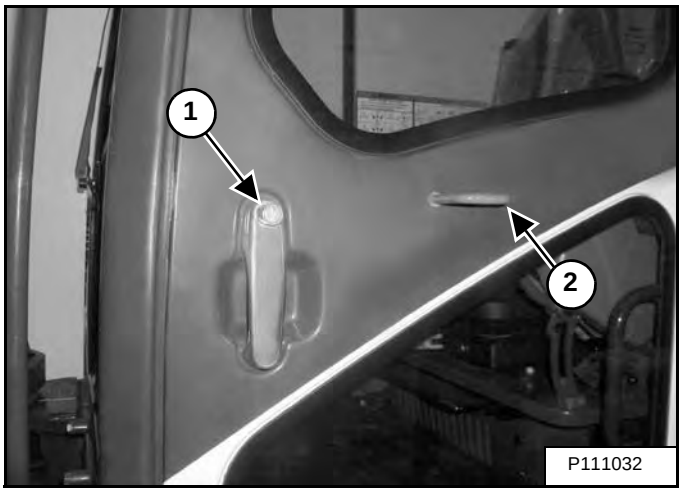
⚠ WARNING

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

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Cab Door

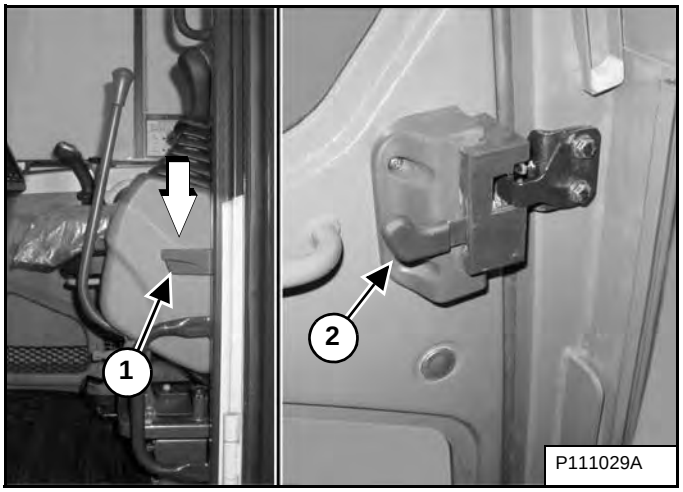
Figure 10-30-1



The cab door can be locked (Item 1) **[Figure 10-30-1]** with the same key as the starter switch.

The door can be held in the open position. Push the door all the way open until the latch (Item 2) **[Figure 10-30-1]** engages to hold the door in the open position.

Figure 10-30-2



When the door is in the open position, push down on the latch (Item 1) **[Figure 10-30-2]** and close the door.

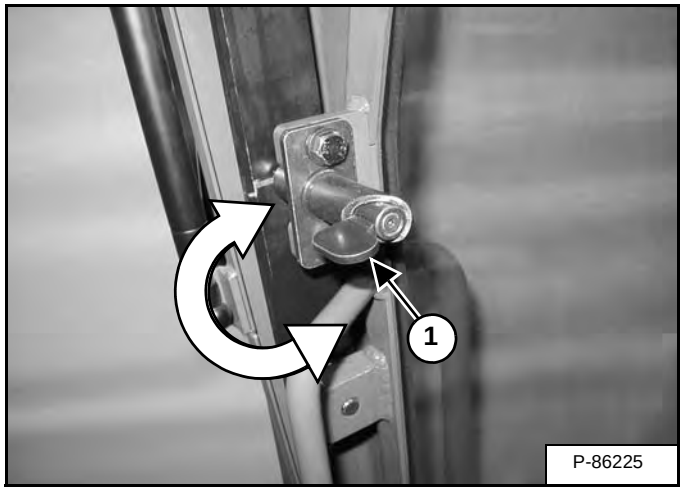
From inside the cab, open the door using the handle (Item 2) **[Figure 10-30-2]**.

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Front Window

Opening The Front Window

Figure 10-30-3



Rotate the front window latch pins (Item 1) **[Figure 10-30-3]** (Both sides).

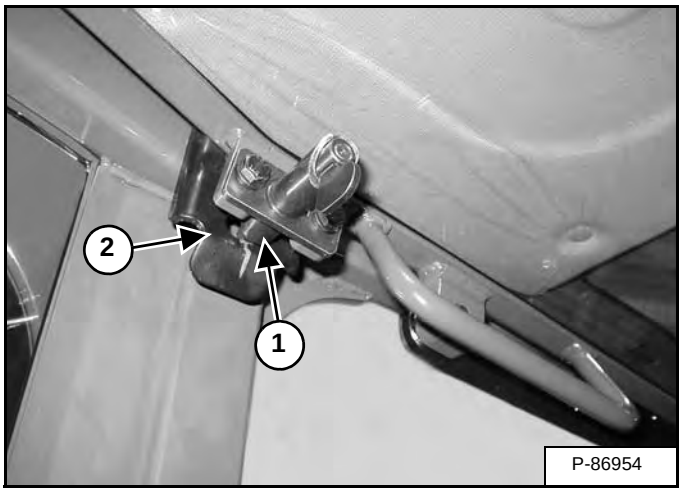
Figure 10-30-4



Use both window grab handles to pull the top of the window in **[Figure 10-30-4]**.

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

Figure 10-30-5



When the window is fully raised, push up on the window slightly until the two latch pins (Item 1) (both sides) engage into the bracket (Item 2) **[Figure 10-30-5]** to lock the window in the open position. Pull down slightly on the window to make sure the latch pins are properly seated to hold the window securely in the open position.

Closing The Front Window

Support the window while rotating both window latch pins (Item 1) **[Figure 10-30-5]** to the unlocked position.

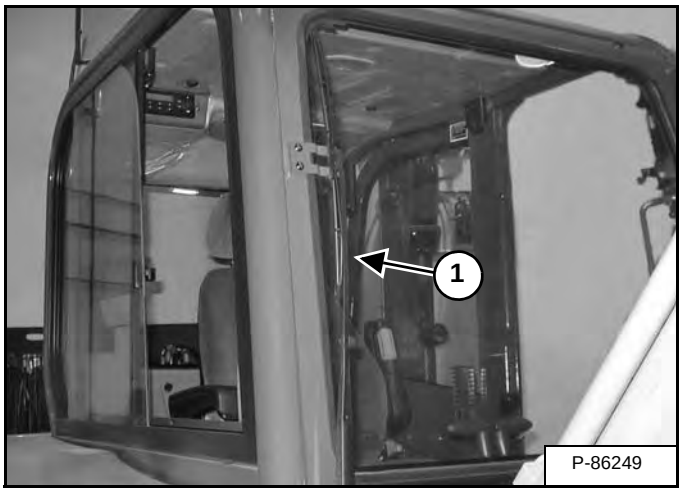
Using both window grab handles, pull the window forward and down to the closed position **[Figure 10-30-4]**.

When the window is fully lowered, push in on the window slightly until the two latch pins (Item 1) **[Figure 10-30-3]** (both sides) engage into the bracket to lock the window in the closed position.

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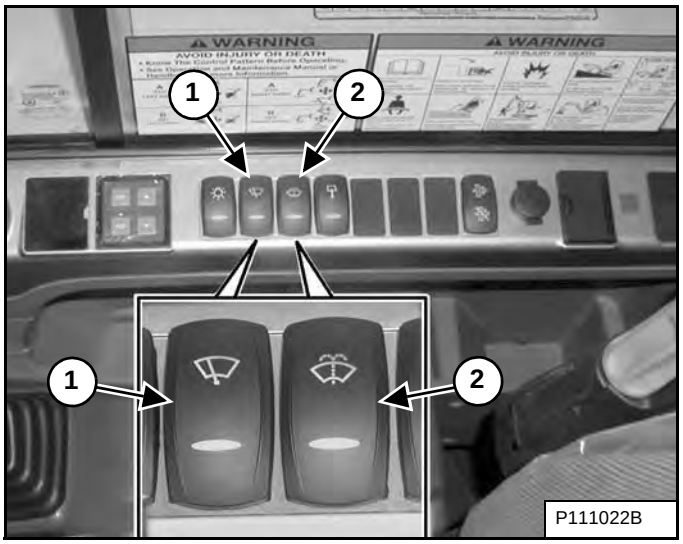
Front Wiper

Figure 10-30-6



The front window is equipped with a wiper (Item 1) **[Figure 10-30-6]** and washer.

Figure 10-30-7

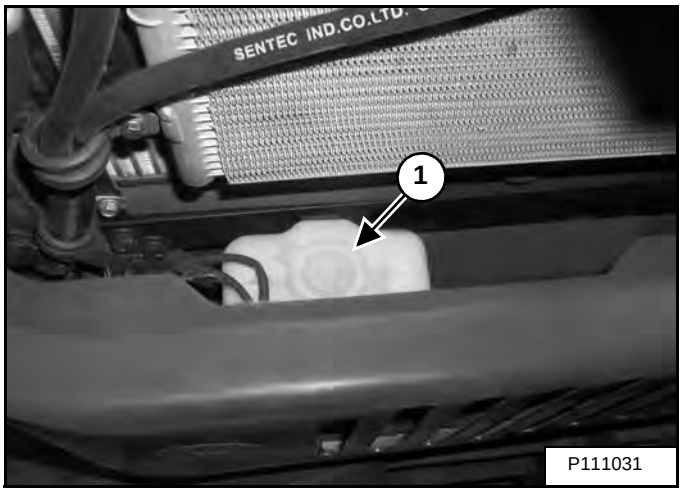


The wiper switch (Item 1) **[Figure 10-30-7]** has three positions, OFF, intermittent wiper mode and full speed.

The window washer switch (Item 2) activates the front window washer. (The wiper switch (Item 1) must be activated before the washer switch (Item 2) **[Figure 10-30-7]** will allow washer fluid to be sprayed on the front window.)

Window Washer Reservoir

Figure 10-30-8



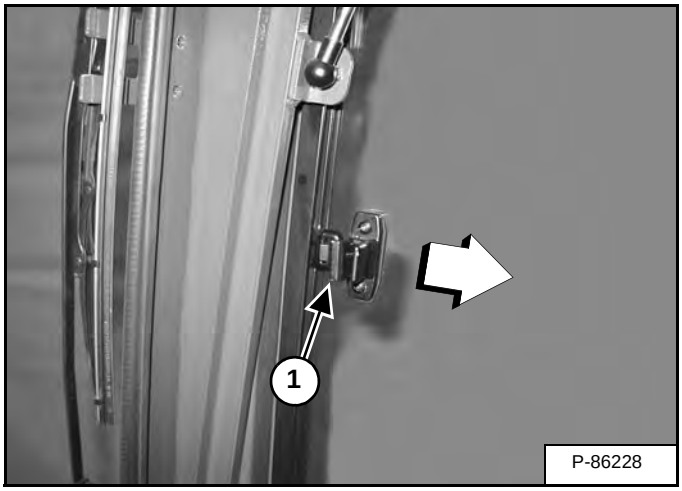
The window washer reservoir (Item 1) **[Figure 10-30-8]** is located under the right side cover, just between the grille and the condenser. (When the temperature is 0°C (32°F) or lower, fill the washer reservoir with washer fluid specified for freezing conditions. If the washer bottle is filled with water, it will freeze and damage the washer reservoir.)

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Right Side Window

Opening The Right Front Window

Figure 10-30-9



Press the latch / handle (Item 1) **[Figure 10-30-9]** together and pull back on the latch / handle to open the right side window.

Closing The Right Front Window

Push the latch / handle (Item 1) **[Figure 10-30-9]** forward until the latch / handle lock the window in the closed position.

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Heating, Ventilation And Air Conditioning Duct

Figure 10-30-10

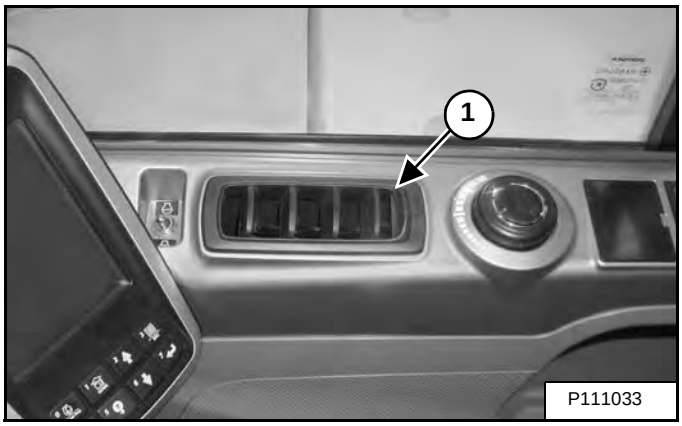


Figure 10-30-11

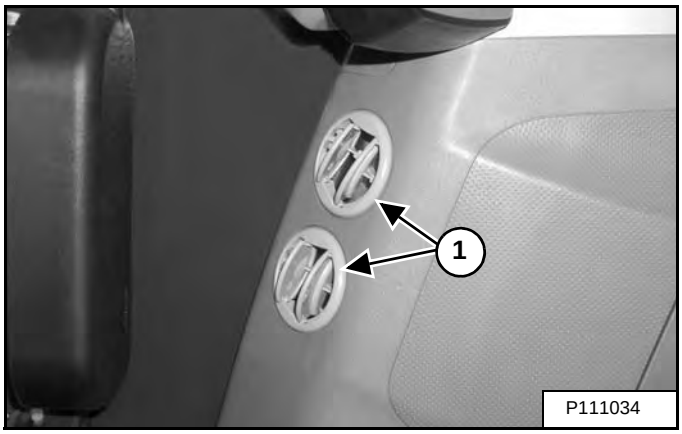
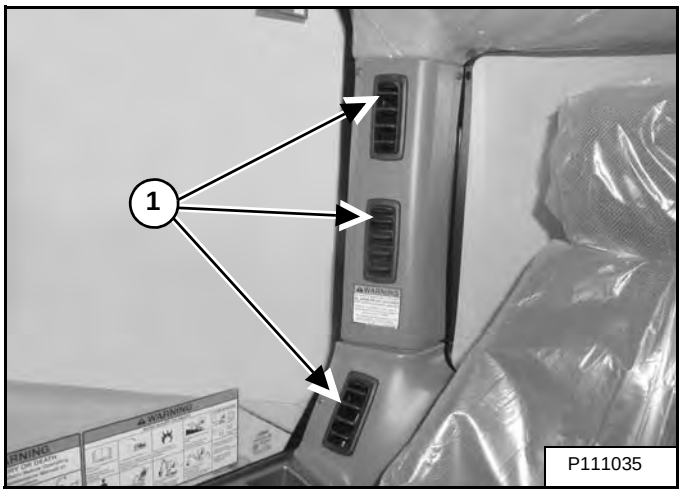
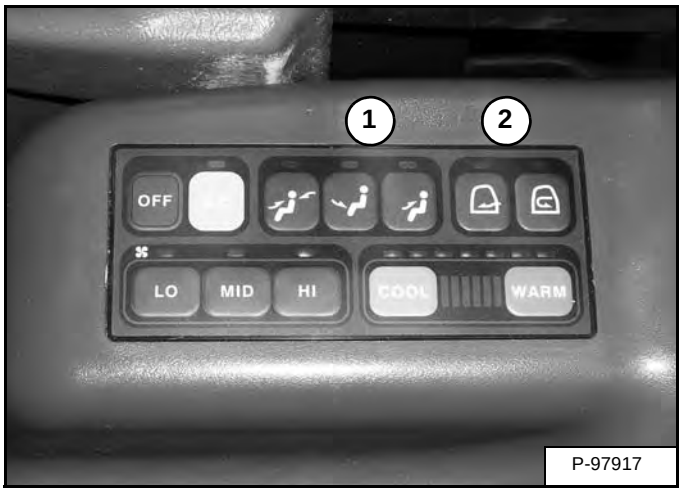


Figure 10-30-12



The excavator is equipped with seven air vents (Item 1) **[Figure 10-30-10]**, **[Figure 10-30-11]** and **[Figure 10-30-12]** that can be adjusted to deflect air flow to the desired area of the cab.

Figure 10-30-13



Use one of the three buttons (Item 1) located in the left console to control which air ducts are active and two buttons (Item 2) **[Figure 10-30-13]** that control fresh air or recirculated air.

Operating Tip: To increase heating or cooling efficiency, move the Recirculation / Fresh Air Control (Item 2) **[Figure 10-30-13]** *to the recirculation position. This will allow the air to recirculate through the HVAC system and improve temperature control. If left in the fresh air position, the HVAC system will also need to heat or cool the ambient air that is drawn in from the outside, slowing and / or reducing the temperature change inside the cab.*

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TRANSPORTING THE EXCAVATOR ON A TRAILER

Loading And Unloading

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

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

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

Use metal loading ramps with a slip resistant surface.

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

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

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

Figure 10-40-1



NOTE: When loading or unloading the machine, disengage the auto idle feature and place the two-speed travel in low range.

Move the machine forward onto the transport vehicle **[Figure 10-40-1]**.

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

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

Stop the engine and remove the key.

Put blocks at the front and rear of the tracks.

Fastening

Figure 10-40-2

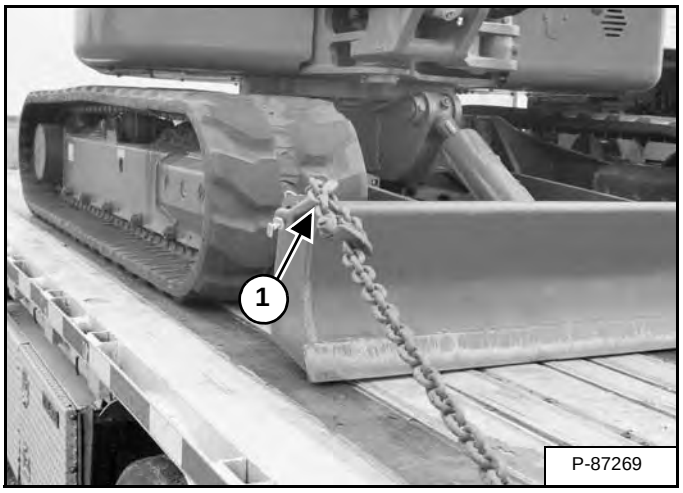
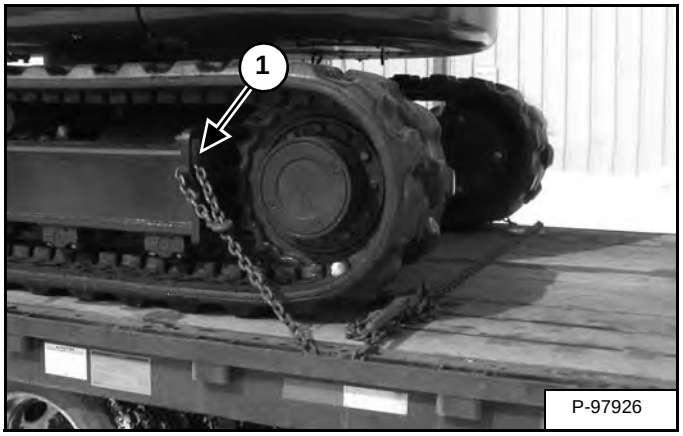


Figure 10-40-3



Fasten chains to both corners of the blade (Item 1) **[Figure 10-40-2]** (both sides) and to the tie down loop at the rear of the track frame (Item 1) **[Figure 10-40-3]** (both sides) 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

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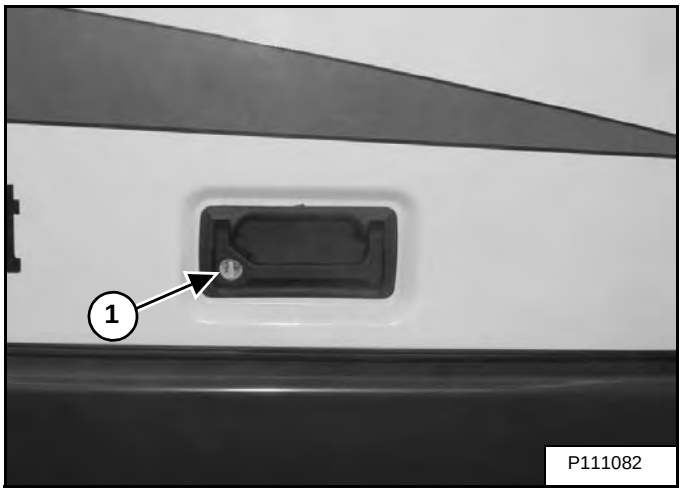


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RIGHT SIDE COVER

Opening And Closing

Figure 10-50-1



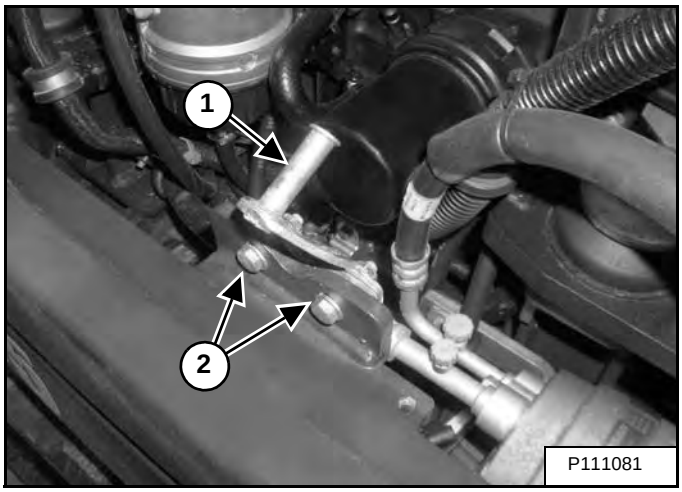
Use the start key (Item 1) **[Figure 10-50-1]** to unlock the latch.

Pull the latch (Item 1) **[Figure 10-50-1]** and raise the right side cover.

Close and lock the center cover when the service procedure is completed.

Adjusting The Latch

Figure 10-50-2



The right side cover latch (Item 1) **[Figure 10-50-2]** can be adjusted.

Loosen the bolts and nuts (Item 2) **[Figure 10-50-2]** and adjust the latch. Tighten the nuts after the adjustment is made.

Close the right side cover before operating the excavator.

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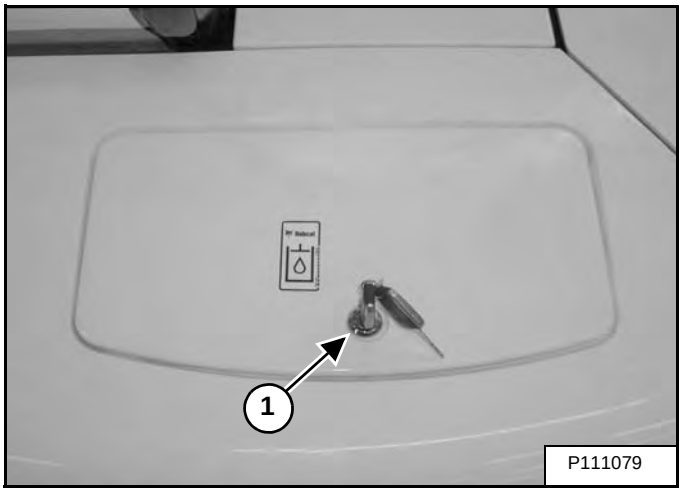
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REAR COVER

Opening And Closing

The hydraulic tank breather / filter and hydraulic oil fill cover is located under the rear cover.

Figure 10-60-1



Use the start key to unlock and open the rear cover (Item 1) **[Figure 10-60-1]**.

Close and lock the rear cover when the service procedure is completed.

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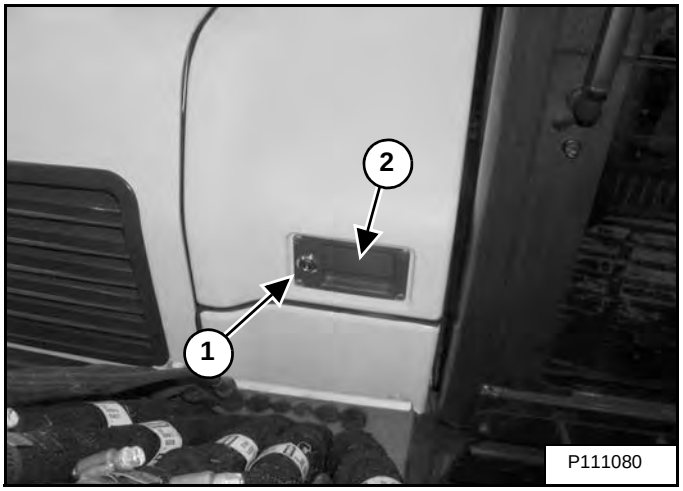
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CENTER COVER

Opening And Closing

The battery, circuit breaker, fusible links, some relays and the swing motor are located under the center cover.

Figure 10-70-1



Use the start key (Item 1) **[Figure 10-70-1]** to unlock the latch.

Pull the latch (Item 2) **[Figure 10-70-1]** and raise the cover.

Close and lock the center cover when the service procedure is completed.

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SERVICE SCHEDULE

Maintenance Intervals

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

Every 10 Hours (Before Starting The Excavator)

- **Engine Oil** - Check level and add as needed.
- **Engine Air Filters and Air System** - Check display panel. Service only when required. Check for leaks and damaged components.
- **Engine Cooling System** - Check coolant level COLD and add premixed coolant as needed.
- **Fuel Filter** - Check display panel. Remove the trapped water when required.
- **Seat Belt, Seat Belt Retractors, Seat Belt Mounting hardware, Control Console Lockout** - Check the condition of seat belt and mounting hardware. Clean or replace seat belt retractors as needed. Check the control console lockout lever for proper operation. Clean dirt and debris from moving parts.
- **Motion Alarm** - Check for proper function.
- **Operator Cab** - Check the cab condition and mounting hardware.
- **Indicators and Lights** - Check for correct operation of all indicators and lights.
- **Safety Signs** - Check for damaged signs (decals). Replace any signs that are damaged.
- **Hydraulic Fluid** - Check fluid level and add as needed.
- **Track Tension** - Check tension and adjust as needed.
- **Swing Reduction Gearbox** - Check fluid level and add as needed.
- **Swing Bearing** - Grease swing bearing every 10 hours when operating in water.
- **Blade, Boom Swing, Boom Swing Cylinder and Bucket Pivot Points** - Grease pivot points every 10 hours when operating in water.
- **Boom and Arm (Workgroup) Pivot Points** - Grease pivot points every 10 hours when operating in water.

Every 50 Hours

- **Hydraulic Hoses and Tubelines** - Check for damage and leaks. Repair or replace as needed.
- **Steering Levers and Joysticks** - Check for correct operation. Repair as needed.
- **Swing Bearing** - Grease swing bearing.
- **Blade, Boom Swing, Boom Swing Cylinder and Bucket Pivot Points** - Grease pivot points.
- **Battery** - Check cables, connections, and electrolyte level; add distilled water as needed.
- **Fuel Tank** - Drain water and sediment from fuel tank.
- **Drive Belts (Alternator, Air Conditioning, Water Pump)** - Service at first 50 hours, then as scheduled. Check condition. Replace as needed.
- **Engine Oil and Filter** - Service at first 50 hours, then as scheduled. Replace oil and filter.
- **Fuel / Water Separator Screen** - Service at first 50 hours, then as scheduled. Replace as needed.

Every 100 Hours

- **Drive Belts (Alternator, air conditioning, water pump)** - Check condition. Replace as needed.
- **Belts and Idler** - Service at first 100 hours, then as scheduled. Replace as necessary.
- **Alternator and Starter** - Service at first 100 hours, then as scheduled. Check connections.
- **Travel Motors (Final Drive)** - Service at first 100 hours, then as needed. Replace fluid.
- **Swing Reduction Gearbox** - Service at first 100 hours, then as needed. Replace fluid.

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SERVICE SCHEDULE (CONT'D)

Maintenance Intervals (Cont'd)

Every 250 Hours Or Every 12 Months

- **Boom and Arm (Workgroup) Pivot Points** - Grease pivot points.
- **Engine Oil and Filter** - Replace oil and filter.
- **Fuel / Water Separator Screen** - Replace as needed.
- **Travel Motors (Final Drive)** - Check fluid level and add as needed.
- **Hydraulic Suction Filter** - Service at first 250 hours, then as scheduled. Clean the hydraulic suction filter, replace as needed.
- **Pilot Filter** - Service at first 250 hours, then as scheduled. Replace pilot filter.

Every 500 Hours Or Every 12 Months

- **Swing Pinion** - Grease swing pinion.
- **Cooling System** - Clean debris from radiator, fuel cooler, hydraulic fluid cooler, air conditioning condenser (if equipped), and front and rear grille.
- **Fuel Filter** - Replace filter element.
- **Hydraulic Filter and Hydraulic Reservoir Breather Cap** - Replace the charge filter and the reservoir breather cap.
- **Belts and Idler** - Check condition. Replace as necessary.
- **Alternator and Starter** - Check connections.
- **Heater and Air Conditioning Filters** - Clean or replace filters as needed.

Every 1000 Hours

- **Engine Valves** - Adjust the engine valve clearance.

Every 1000 Hours Or Every 12 Months

- **Swing Reduction Gear** - Grease swing reduction gear.
- **Hydraulic Suction Filter** - Clean the hydraulic suction filter, replace as needed.
- **Travel Motors (Final Drive)** - Replace fluid.
- **Pilot Filter** - Replace the pilot filter.
- **Swing Reduction Gearbox** - Replace fluid.

Every 1500 Hours

- **Fuel Injectors** - Check for proper operation.
- **Exhaust Gas Recirculation (EGR) Cooler** - Test the EGR cooler for leaks.
- **Crankcase Ventilation Filter** - Replace the crankcase ventilation filter.
- **Positive Crankcase Ventilation (PCV) Valve** - Check the PCV valve for free movement.

Every 2000 Hours Or Every 12 Months

- **Hydraulic Reservoir** - Replace the hydraulic fluid.

Every 3000 Hours

- **Diesel Particulate Filter (DPF)** - Disassemble, clean, and reassemble the DPF. Replace the DPF after two cleaning events.
- **Exhaust Gas Recirculation (EGR) System** - Perform an EGR actuation test. Clean the gas and coolant passages.

Every 24 Months

- **Coolant** - Replace the coolant.

SS EXC E85-0616

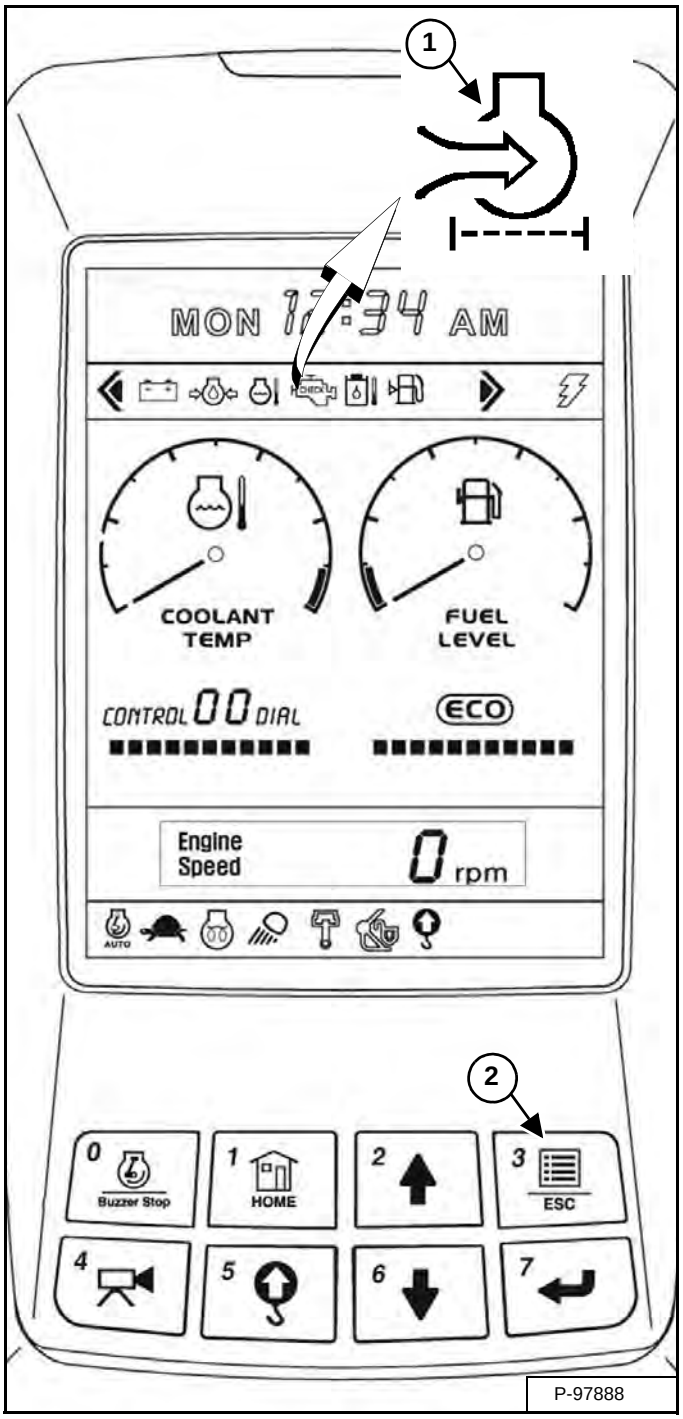
Dealer Copy -- Not for Resale

AIR CLEANER SERVICE

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 10-80-1.)

Daily Check

Figure 10-90-1



The *Check Air Cleaner Condition Icon* (Item 1) will appear in the top bar of the display panel when it is time to service the air filter. The pop up window can be temporarily inactivated by pressing the MENU / ESC button (Item 2) **[Figure 10-90-1]**. The pop up will reappear each time the engine is started until the filter(s) are serviced.

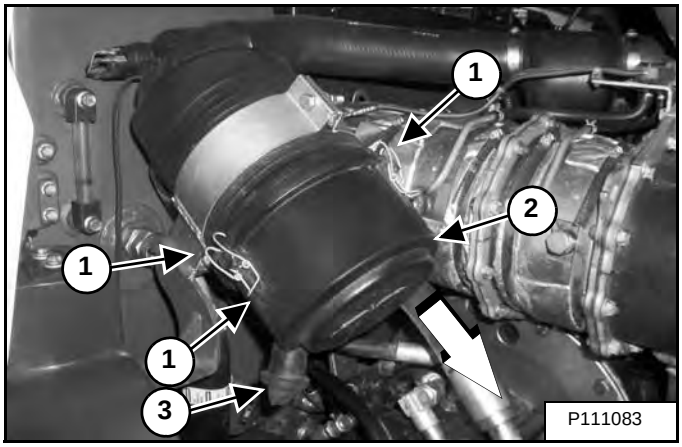
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AIR CLEANER SERVICE (CONT'D)

Replacing The Filters

Open the right side cover to access the air cleaner for service. (See Opening And Closing on Page 10-50-1.)

Figure 10-90-2



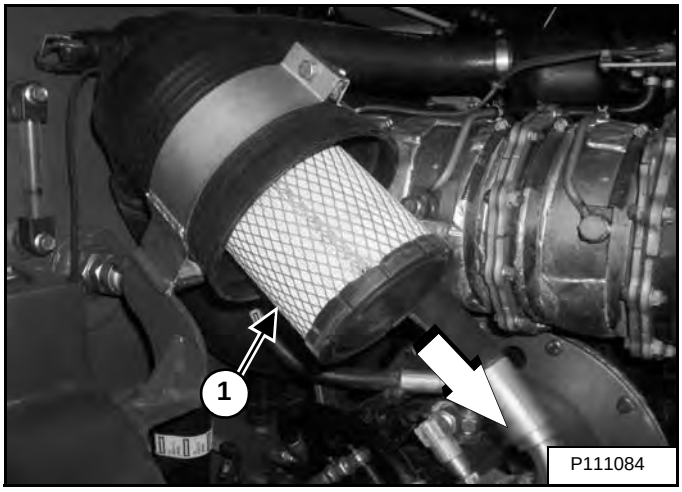
Replace the inner filter every third time the outer filter is replaced or as indicated.

Outer Filter

Pull out on the three fasteners (Item 1) and remove the cover **[Figure 10-90-2]**.

Clean the dust cup (Item 2) **[Figure 10-90-2]**.

Figure 10-90-3



Pull the outer filter (Item 1) **[Figure 10-90-3]** 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.

Install the cover (Item 2) and engage the three fasteners (Item 1) **[Figure 10-90-2]**.

Make sure the dust evacuator cup (Item 3) **[Figure 10-90-2]** is in the down position as shown.

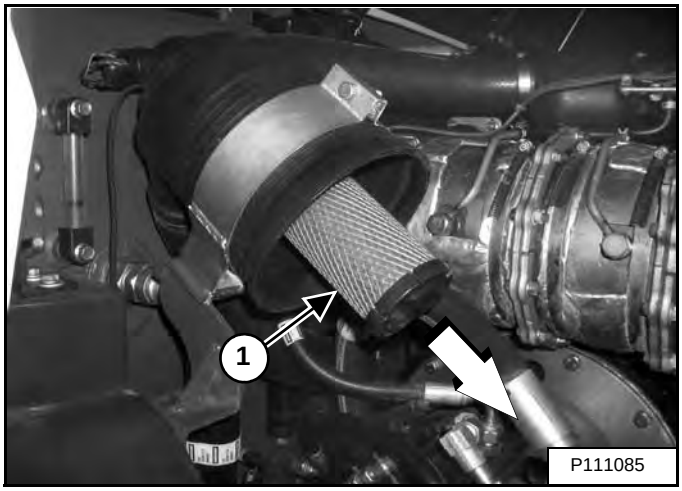
Check the air intake hose and the air cleaner housing for damage. Make sure all connections are tight.

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, start the engine. If the air cleaner condition indicator icon (Item 1) **[Figure 10-90-3]** remains ON, replace the inner filter.

Figure 10-90-4



Remove the air cleaner cover, the outer filter and the inner filter (Item 1) **[Figure 10-90-4]**.

NOTE: Make sure all sealing surfaces are free of dirt and debris. DO NOT use compressed air.

Install the new inner filter (Item 1) **[Figure 10-90-4]**.

Install the outer filter and the air cleaner cover.

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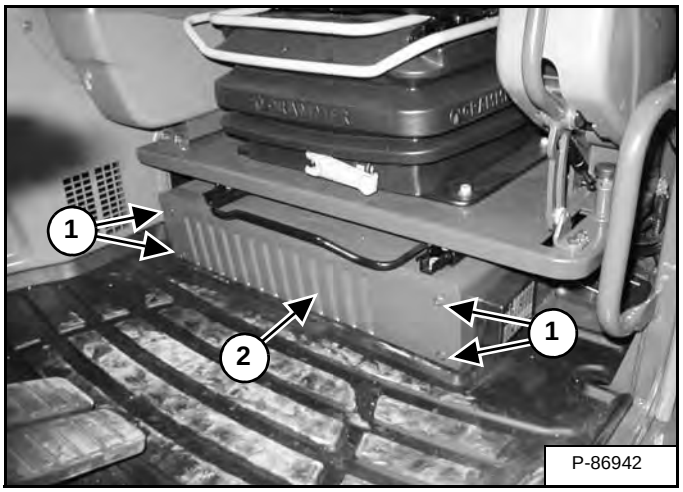
CAB FILTERS

Cleaning And Maintenance

There are two cab air filters that must be cleaned regularly. One filter is located below the operator seat. The second one is located to the left side of the operator seat. (See SERVICE SCHEDULE on Page 10-80-1.)

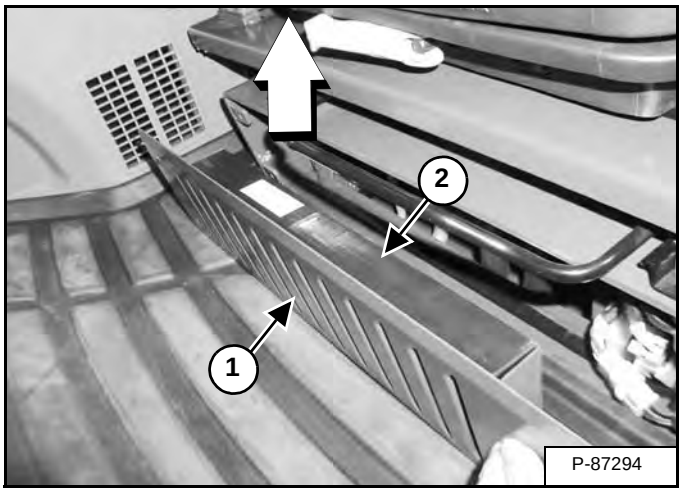
Below Seat Air Filter

Figure 10-100-1



Remove the four bolts (Item 1) from the cover (Item 2) **[Figure 10-100-1]**.

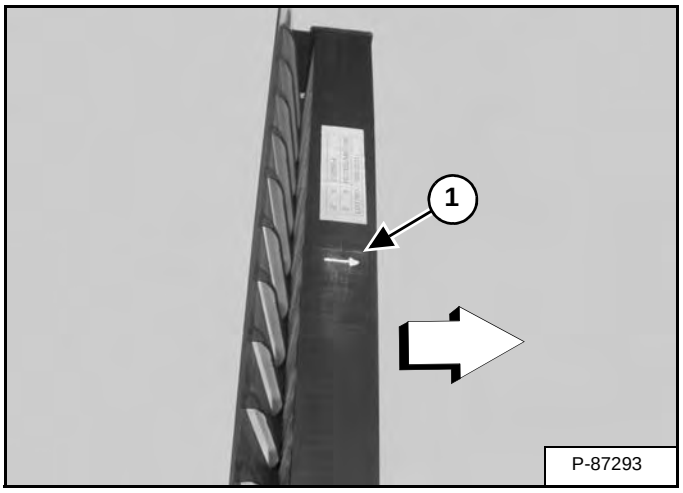
Figure 10-100-2



Remove the cover (Item 1) and pull up the filter (Item 2) **[Figure 10-100-2]** to remove from the cover.

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

Figure 10-100-3



Installation: Install the filter with the arrows that indicate air flow direction (Item 1) **[Figure 10-100-3]** pointing towards the heater / A/C housing.

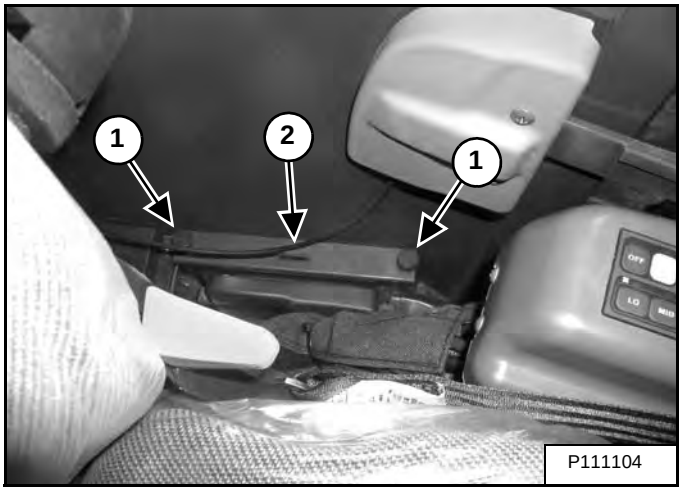
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CAB FILTERS (CONT'D)

Cleaning And Maintenance (Cont'd)

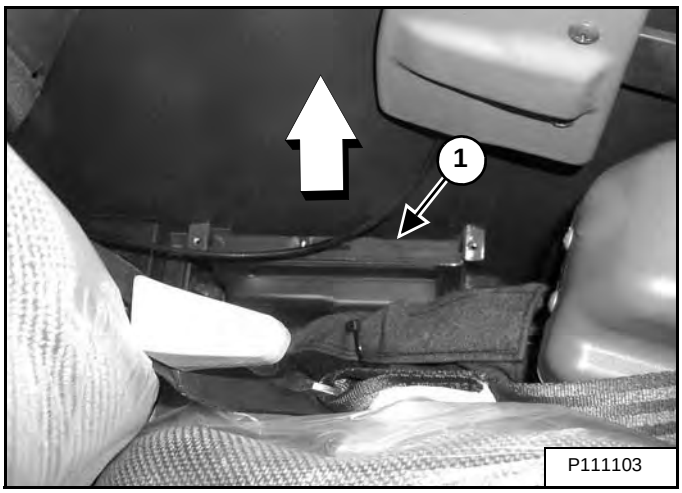
Left Side Of Seat Air Filter

Figure 10-100-4



Remove the two bolts (Item 1) and the cover (Item 2) **[Figure 10-100-4]**.

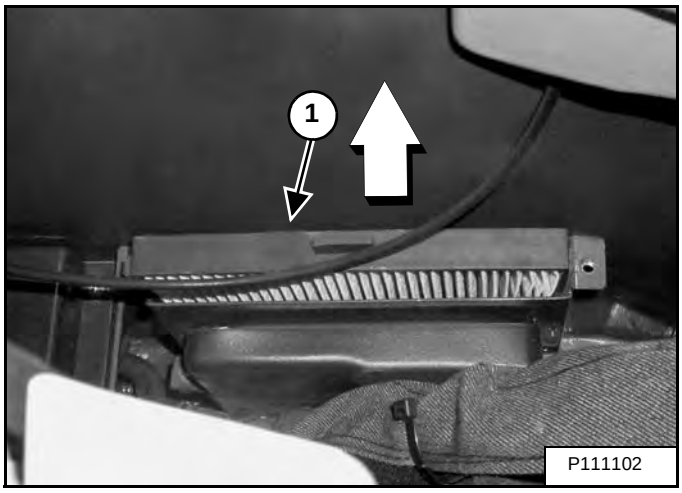
Figure 10-100-5



Pull up on and remove the filter (Item 1) **[Figure 10-100-5]**.

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

Figure 10-100-6



Installation: Install the filter with the arrows that indicate air flow direction (Item 1) **[Figure 10-100-6]** pointing towards the outside of the cab.

Install the cover (Item 2) and the two bolts (Item 1) **[Figure 10-100-4]**.

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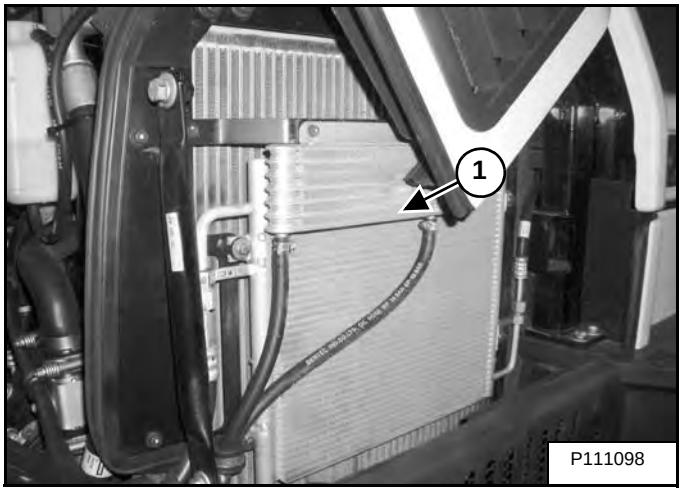
ENGINE COOLING SYSTEM

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

Cleaning

Open the right side cover. (See Opening And Closing on Page 10-50-1.)

Figure 10-110-1



Use air pressure or water pressure to clean the radiator, oil cooler, air conditioning condenser and the fuel cooler (Item 1) **[Figure 10-110-1]**. Be careful not to damage fins when cleaning.

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

Checking Level

WARNING

AVOID BURNS

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

W-2070-1203

WARNING

AVOID INJURY OR DEATH

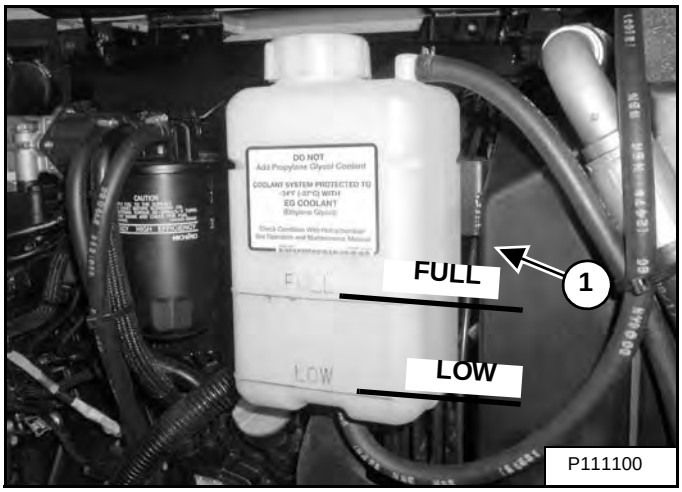
Wear safety glasses to prevent eye injury when any of the following conditions exist:

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

W-2019-0907

Open the right side cover.

Figure 10-110-2



Check the coolant level in the coolant recovery tank (Item 1) **[Figure 10-110-2]**.

The coolant level must be between the LOW and FULL marks on the coolant recovery tank (Item 1) **[Figure 10-110-2]** when the engine is cold.

NOTE: The cooling system is factory filled with ethylene glycol. 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

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Removing And Replacing Coolant

See the SERVICE SCHEDULE for correct service intervals. (See SERVICE SCHEDULE on Page 10-80-1.)

Stop the engine. Open the right side cover. (See Opening And Closing on Page 10-50-1.)

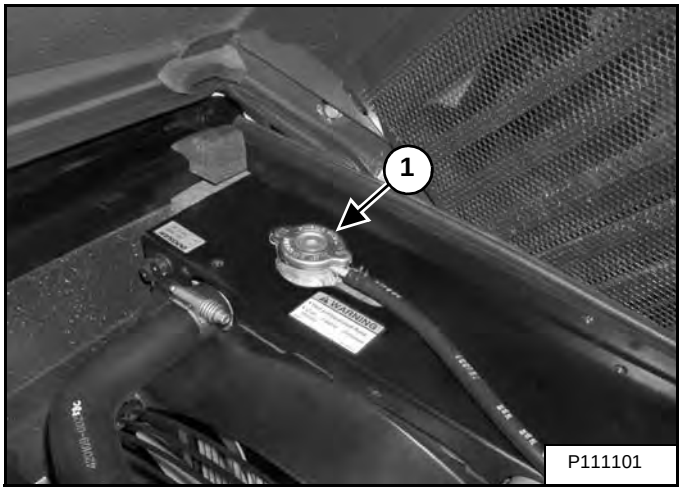
⚠ WARNING

AVOID BURNS

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

W-2070-1203

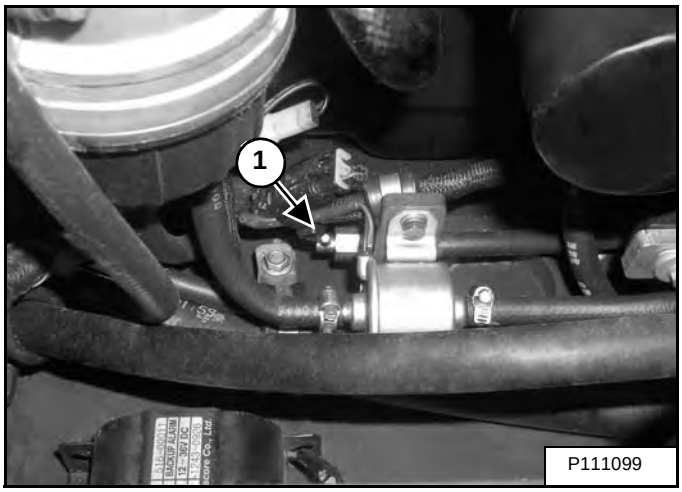
Figure 10-110-3



When the engine is cool, loosen and remove the radiator cap (Item 1) **[Figure 10-110-3]**.

Rotate the upperstructure 90° to access the lower engine access cover. Remove the lower engine access cover so coolant can be drained into a container.

Figure 10-110-4



Open the drain valve (Item 1) **[Figure 10-110-4]** (located below the oil filter) and drain the coolant into the container.

After all the coolant is removed, close the drain valves (Item 1) **[Figure 10-110-4]**.

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

Mix the coolant in a separate container. (See Capacities on Page SPEC-10-8.)

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

The correct mixture of coolant to provide a -37°C (-34°F) freeze protection is 4 L ethylene glycol mixed with 4 L of water **OR** 1 U.S. gal ethylene glycol mixed with 1 U.S. gal of water.

Add premixed coolant; 50% water and 50% ethylene glycol to the recovery tank if the coolant level is low.

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.

Reinstall the lower engine access cover.

Close the right side cover.

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FUEL SYSTEM

Fuel Specifications

NOTE: Contact your local fuel supplier to receive recommendations for your region.

Ultra low sulfur diesel fuel must be used in this machine. Ultra low sulfur is defined as 15 mg/kg (15 ppm) sulfur maximum.

U.S. Standard (ASTM D975)

Use only clean, high quality diesel fuel, Grade Number 2-D or Grade Number 1-D.

The following is one suggested blending guideline that should prevent fuel gelling during cold temperatures:

TEMPERATURE	GRADE 2-D	GRADE 1-D
Above -9°C (+15°F)	100%	0%
Down to -21°C (-5°F)	50%	50%
Below -21°C (-5°F)	0%	100%

NOTE: Biodiesel blend fuel may also be used in this machine. Biodiesel blend fuel must contain no more than five percent Biodiesel mixed with ultra low sulfur petroleum based diesel. This Biodiesel blend fuel is commonly marketed as B5 blended diesel fuel. B5 blended diesel fuel must meet ASTM specifications.

E.U. Standard (EN590)

Use only clean, high quality diesel fuel that meets the EN590 specifications listed below:

- Ultra low sulfur diesel fuel defined as 10 mg/kg (10 ppm) sulfur maximum
- Diesel fuel with cetane number of 51.0 and above.

NOTE: Biodiesel blend fuel may also be used in this machine. Biodiesel blend fuel must contain no more than seven percent Biodiesel mixed with ultra low sulfur petroleum based diesel. This Biodiesel blend fuel is commonly marketed as B7 blended diesel fuel. B7 blended diesel fuel must meet EN590 specifications.

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 that 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 operate 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 3 months.

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Filling The Fuel Tank

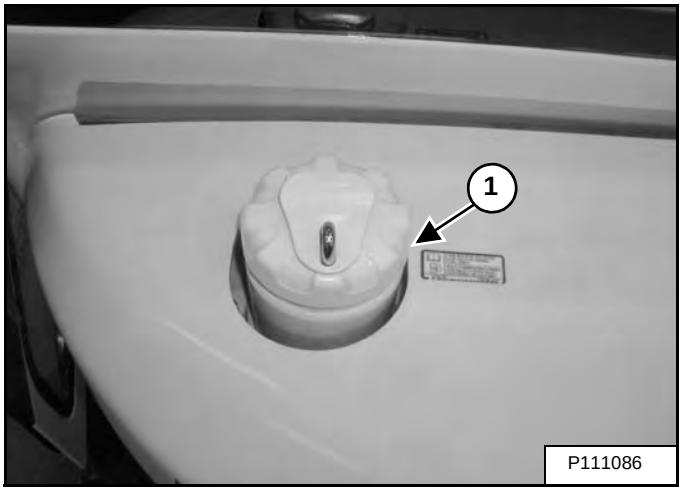
⚠ WARNING

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

Figure 10-120-1



The fuel cap (Item 1) **[Figure 10-120-1]** is located behind the left corner of the operator cab.

Rotate the fuel fill cap (Item 1) **[Figure 10-120-1]** counterclockwise to remove.

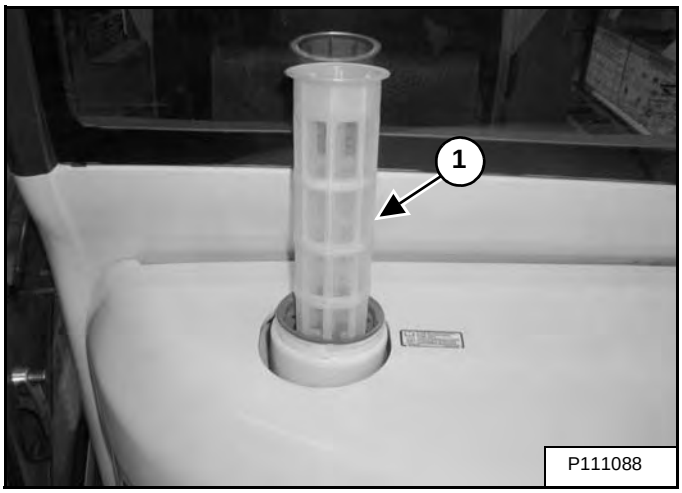
Figure 10-120-2



NOTE: The fuel cap can be locked (Item 1) [Figure 10-120-2] with the start key. The fuel cap does not automatically lock when installed. The key must be used to lock the cap.

NOTE: A paddle lock can also be used on the fuel cap latch to secure the latch closed (covering the fuel cap key lock) and not allow the start key to unlock the fuel cap.

Figure 10-120-3



Inspect the fuel strainer (Item 1) **[Figure 10-120-3]** for damage. Replace if damaged. Always have the fuel strainer installed when filling the fuel tank.

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. (Use the start key to lock the cap, if desired.)

Clean up any spilled fuel.

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Fuel Filters

Removing Water

WARNING

AVOID INJURY OR DEATH

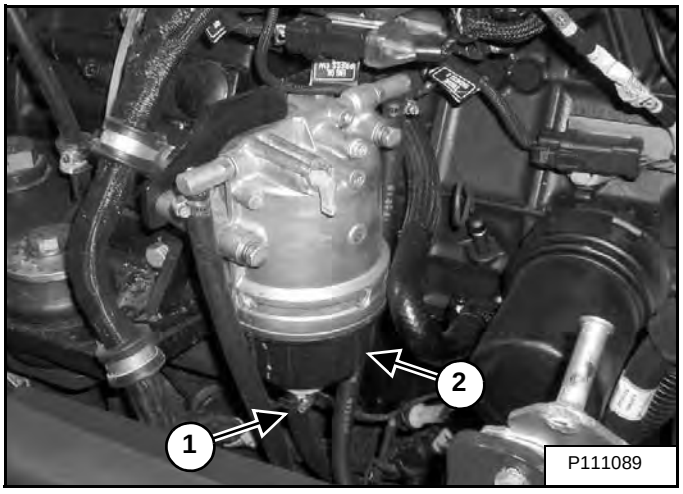
Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical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

W-2072-0807

See the SERVICE SCHEDULE for the service interval when to remove water from the fuel water separator. (See SERVICE SCHEDULE on Page 10-80-1.)

Open the right side cover. (See Opening And Closing on Page 10-50-1.)

Figure 10-120-4



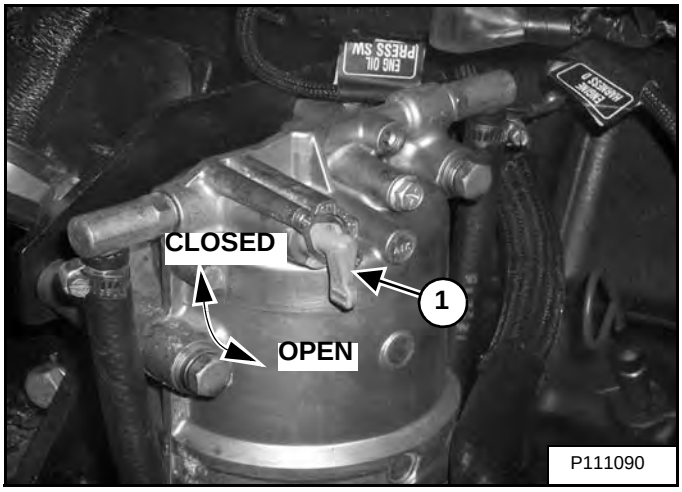
Loosen the drain (Item 1) **[Figure 10-120-4]** at the bottom of the filter (Item 2) **[Figure 10-120-4]** to drain water from the filter into a container.

Clean up any spilled fuel.

Replacing Elements

See the SERVICE SCHEDULE for the service interval when to replace the fuel filter. (See SERVICE SCHEDULE on Page 10-80-1.)

Figure 10-120-5



Fuel Water Separator

Turn the shut off valve (Item 1) **[Figure 10-120-5]** clockwise to the closed position.

Remove the housing (Item 2) **[Figure 10-120-5]** and replace the screen.

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

Turn the shut off valve (Item 1) **[Figure 10-120-5]** counterclockwise to the open position.

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Replacing Elements (Cont'd)

Fuel Filter

Figure 10-120-6



Turn the shut off valve (Item 1) **[Figure 10-120-5]** clockwise to the closed position.

Remove the filter (Item 1) **[Figure 10-120-6]**.

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

Turn the shut off valve (Item 1) **[Figure 10-120-5]** counterclockwise to the open position.

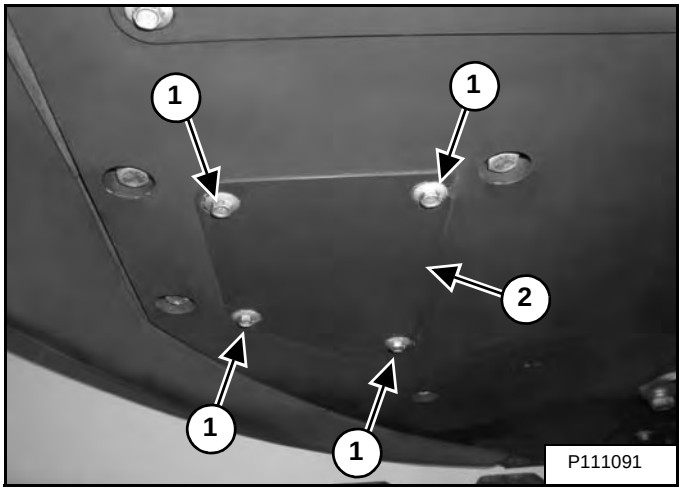
Remove the air from the fuel system. (See Removing Air From The Fuel System on Page 10-120-5.)

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Draining The Fuel Tank

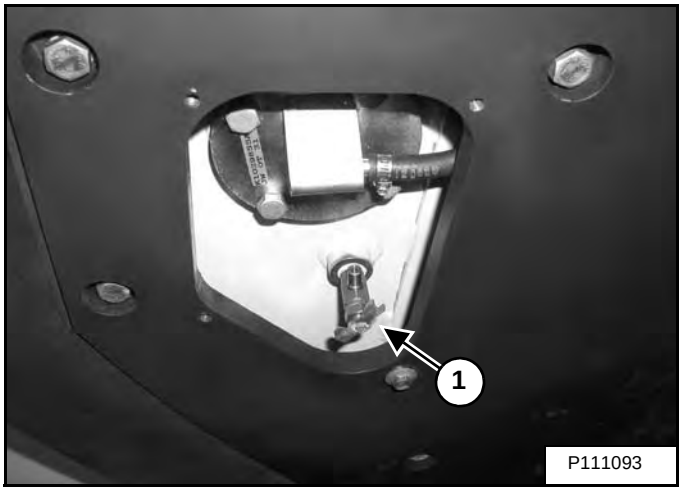
See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 10-80-1.)

Figure 10-120-7



Remove four bolts / washers (Item 1) and remove the access cover (Item 2) **[Figure 10-120-7]** from below the rear of the excavator.

Figure 10-120-8



Install a drain hose on the drain valve (Item 1) **[Figure 10-120-8]** at the bottom of the fuel tank. Route the hose to a container.

Drain the fuel into a container. Tighten the drain valve after the fuel has been removed.

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

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.

Turn the start key to the ON position for 10 - 15 seconds.

The electric fuel pump will supply fuel under pressure and force air from the system.

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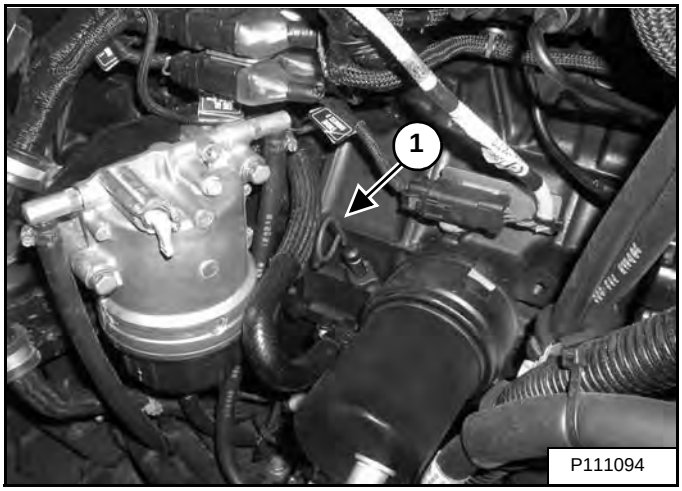
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ENGINE LUBRICATION SYSTEM

Checking And Adding Engine Oil

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

Figure 10-130-1



Open the right side cover. (See Opening And Closing on Page 10-50-1.)

Remove the dipstick (Item 1) **[Figure 10-130-1]**.

Keep the oil level between the marks on the dipstick.

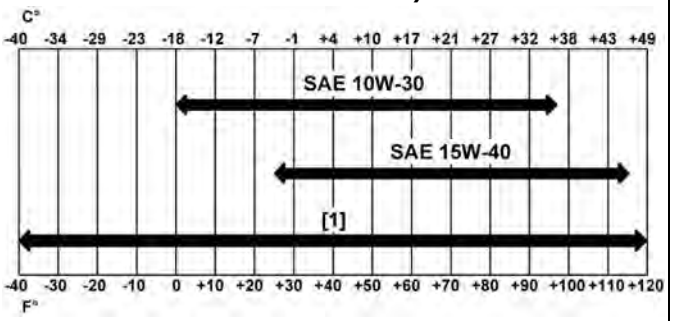
Reinstall the dipstick.

Close the right side cover. (See Opening And Closing on Page 10-50-1.)

Engine Oil Chart

Figure 10-130-2

ENGINE OIL
RECOMMENDED SAE VISCOSITY NUMBER
(LUBRICATION OILS FOR DIESEL ENGINE CRANKCASE)



TEMPERATURE RANGE ANTICIPATED BEFORE NEXT OIL CHANGE (DIESEL ENGINES MUST USE API CLASSIFICATION CJ-4 OR BETTER, OR ACEA E9 OR BETTER)

[1] Bobcat Synthetic Oil – 5W-40

Bobcat engine oils are recommended for use in this machine. If Bobcat engine oil is not available, use a good quality engine oil that meets API Service Classification of CJ-4 or better, or ACEA E9 or better **[Figure 10-130-2]**.

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

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

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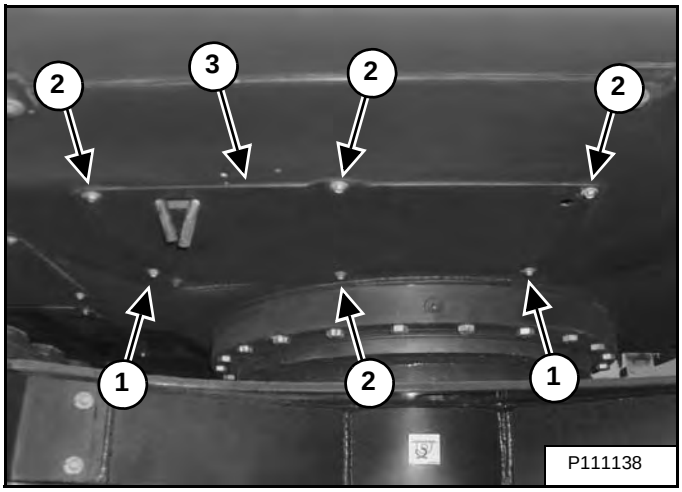
Removing And Replacing Oil And Filter

See the SERVICE SCHEDULE for the service interval for when to replace the engine oil and filter. (See SERVICE SCHEDULE on Page 10-80-1.)

Run the engine until it is at operating temperature. Rotate the upperstructure 90° for access to the bottom engine cover and the engine oil pan drain plug. Stop the engine.

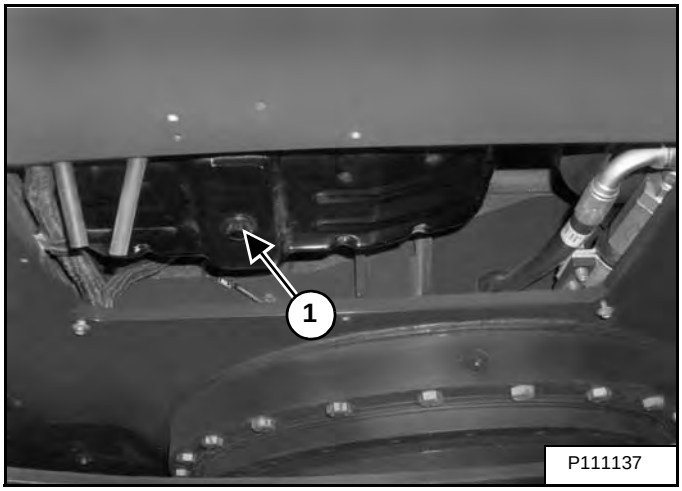
Open the right side cover.

Figure 10-130-3



From under the machine, loosen the two bolts (Item 1) and remove four bolts / washers (Item 2) from the access cover (Item 3) **[Figure 10-130-3]** from below the engine area. Remove the access cover.

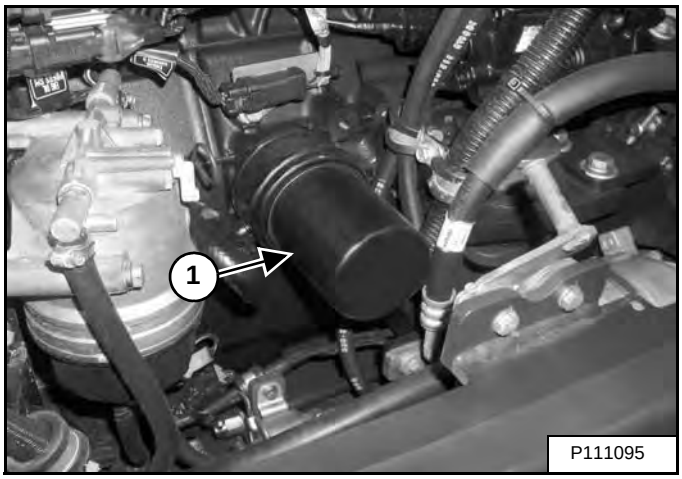
Figure 10-130-4



Remove the plug (Item 1) **[Figure 10-130-4]** from the engine oil pan. Drain the oil into a container.

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

Figure 10-130-5

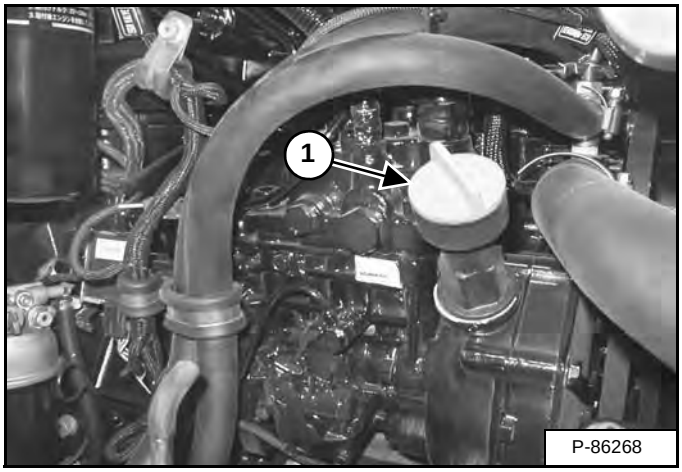


Remove the oil filter (Item 1) **[Figure 10-130-5]** and clean the filter housing surface.

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

Install and tighten the plug (Item 1) **[Figure 10-130-4]**.

Figure 10-130-6



Remove the fill cap (Item 1) **[Figure 10-130-6]**.

Put the correct amount of oil in the engine. (See Capacities on Page SPEC-10-8.)

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.

Reinstall the access cover (Item 3) **[Figure 10-130-3]** and tighten the bolts.

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HYDRAULIC SYSTEM

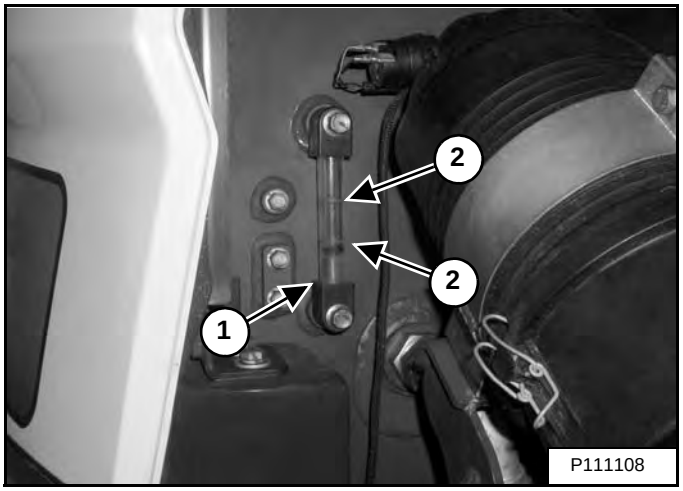
Checking And Adding Fluid

Put the machine on a level surface.

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

Open the right side cover. (See Opening And Closing on Page 10-50-1.)

Figure 10-140-1



Check the hydraulic fluid level. It must be visible in the sight gauge (Item 1) between the two red lines (Item 2) **[Figure 10-140-1]**.

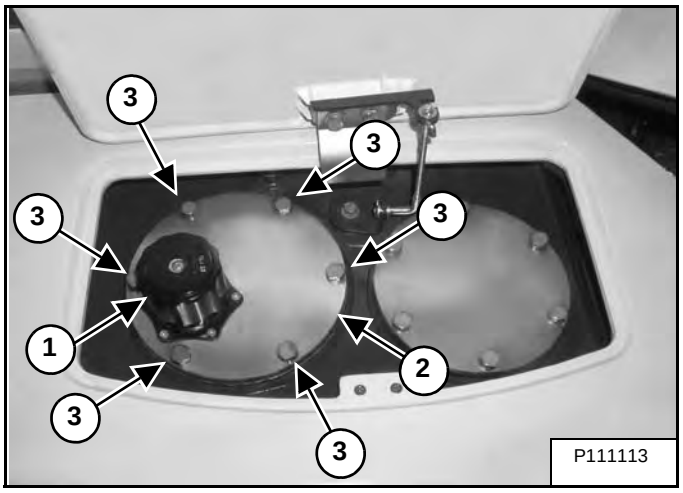
⚠ WARNING

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 10-140-2



Open the rear cover. (See Opening And Closing on Page 10-60-1.)

NOTE: When removing the hydraulic cover (Item 2), there is spring pressure under the cover. Push down on the cover while removing the bolts (Item 3) [Figure 10-140-2].

Clean the surface around the reservoir (breather) cap (Item 1) and cover (Item 2) fully. Press down on the cover (Item 2) and remove the six bolts (Item 3) from the cover (Item 2) **[Figure 10-140-2]**. Remove the cover.

Add the correct fluid to the reservoir until it is visible in the sight gauge.

Check the O-ring under the cover (Item 2) **[Figure 10-140-2]**. Replace the O-ring if damaged.

Reinstall the cover and align the bolt holes. Press down on the cover (Item 2) and install the six bolts (Item 3) **[Figure 10-140-2]**. Tighten the bolts.

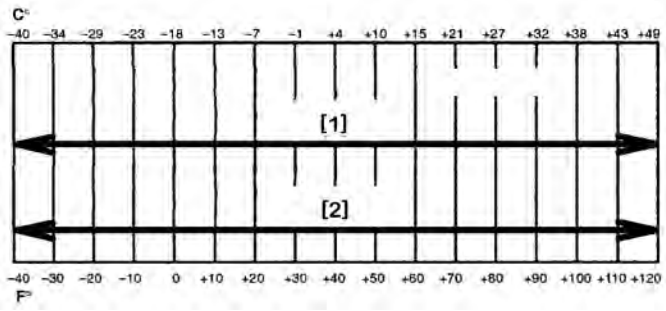
Close the rear cover.

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Hydraulic Fluid Chart

RECOMMENDED ISO VISCOSITY GRADE (VG) AND VISCOSITY INDEX (VI)

Figure 10-140-3



TEMPERATURE RANGE ANTICIPATED DURING MACHINE USE

[1] Synthetic Fluid; VG 46; Minimum VI 150
[2] BOBCAT Hydraulic / Hydrostatic Fluid

Use the correct hydraulic fluid shown in chart **[Figure 10-140-3]**.

Add hydraulic fluid as needed to bring the level to the center of sight gauge (Item 1) **[Figure 10-140-1 on Page 10-140-1]**.

Reinstall the cover and align the bolt holes. Press down on the cover (Item 2) and install the four bolts (Item 3) **[Figure 10-140-2 on Page 10-140-1]**. Tighten the bolts.

Removing And Replacing Hydraulic Filters

Hydraulic Return Filter

⚠ WARNING

AVOID INJURY OR DEATH

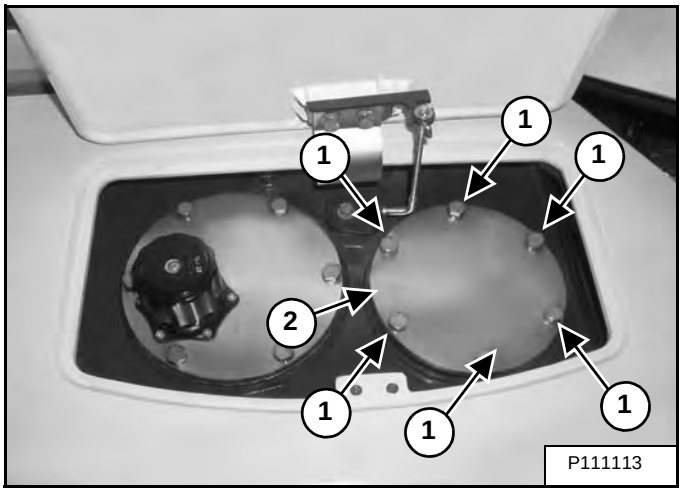
Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 10-80-1.)

Open the rear cover. (See Opening And Closing on Page 10-60-1.)

Figure 10-140-4



NOTE: When removing the cover (Item 2), there is spring pressure under the cover. Push down on the cover while removing the bolts (Item 1) [Figure 10-140-4].

Clean the surface around the cover (Item 2) **[Figure 10-140-4]** fully.

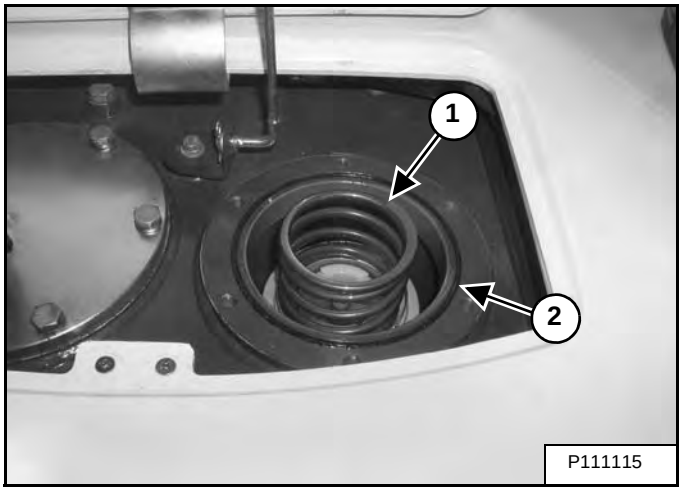
Press down on the cover (Item 2) and remove the six bolts (Item 1) **[Figure 10-140-4]** and cover.

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Removing And Replacing Hydraulic Filters (Cont'd)

Hydraulic Return Filter (Cont'd)

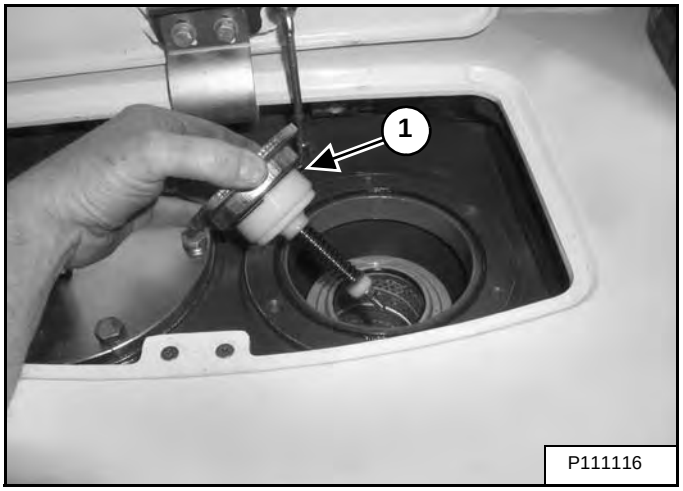
Figure 10-140-5



Remove the spring (Item 1) **[Figure 10-140-5]**.

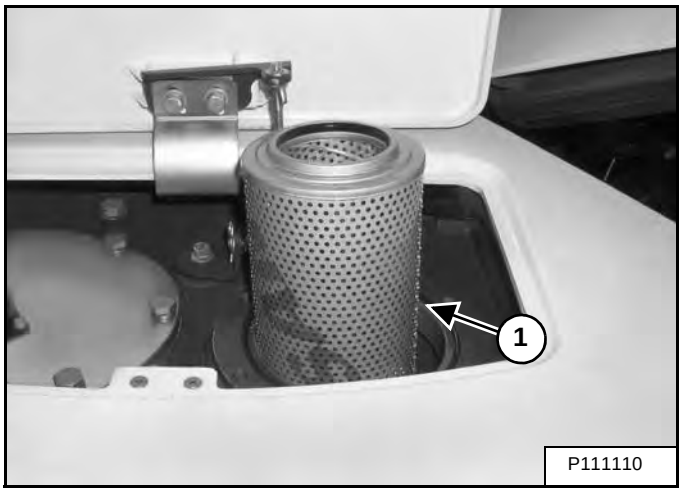
Inspect the O-ring (Item 2) **[Figure 10-140-5]** for damage. Replace if damaged.

Figure 10-140-6



Remove the valve (Item 1) **[Figure 10-140-6]**.

Figure 10-140-7



Remove the return filter (Item 1) **[Figure 10-140-7]**.

Install the new filter (Item 1) **[Figure 10-140-7]**.

Reinstall the valve (Item 1) **[Figure 10-140-6]**.

Reinstall the spring (Item 1) **[Figure 10-140-5]**.

Reinstall the cover and align the bolt holes. Press down on the cover (Item 2) and install the six bolts (Item 1) **[Figure 10-140-4 on Page 10-140-2]** and tighten the bolts.

Dealer Copy -- Not for Resale

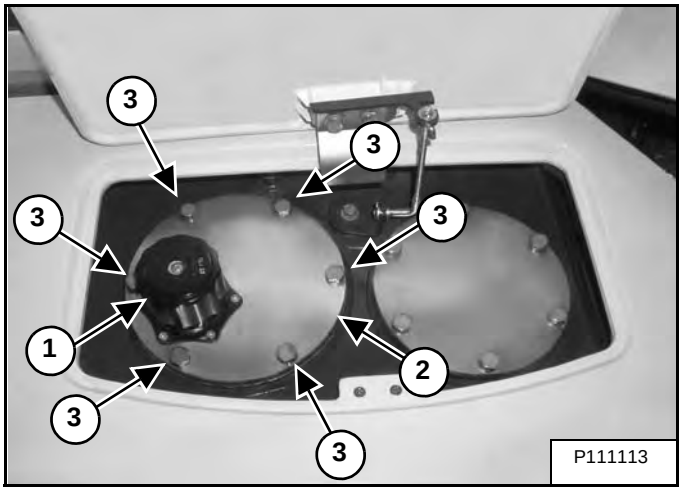
Removing And Replacing Hydraulic Filters (Cont'd)

Hydraulic Suction Filter

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 10-80-1.)

Open the rear cover. (See Opening And Closing on Page 10-60-1.)

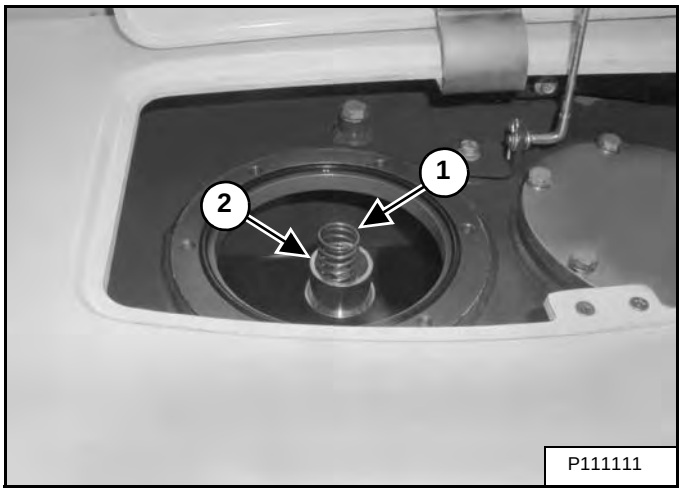
Figure 10-140-8



NOTE: When removing the cover (Item 2), there is spring pressure under the cover. Push down on the cover while removing the bolts (Item 3) [Figure 10-140-8].

Clean the surface around the reservoir (breather) cap (Item 1) and cover (Item 2) fully. Remove the six bolts (Item 3) from the cover (Item 2) **[Figure 10-140-8]** and remove the cover.

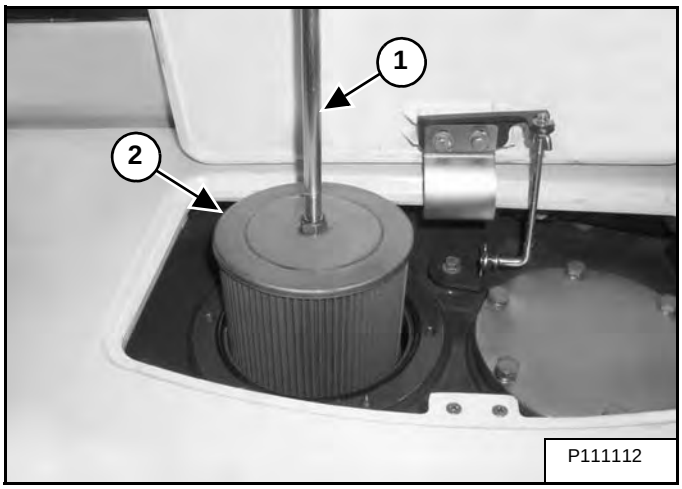
Figure 10-140-9



Remove the spring (Item 1) **[Figure 10-140-9]**.

Lift up on the rod (Item 2) **[Figure 10-140-9]**.

Figure 10-140-10



Continue to lift up on the rod (Item 1) until the filter (Item 2) **[Figure 10-140-10]** is removed from the tank.

NOTE: Before removing the filter (Item 2) [Figure 10-140-10] from the rod (Item 1) [Figure 10-140-10], measure the distance from the end of the rod to the end of the filter. Install the new filter to the same measured distance so that the spring (Item 1) [Figure 10-140-10] pressure will keep the filter installed correctly in the tank.

NOTE: When installing the new filter (Item 2) [Figure 10-140-10] into the hydraulic tank, make sure to get the filter positioned over the outlet port at the bottom of the hydraulic tank.

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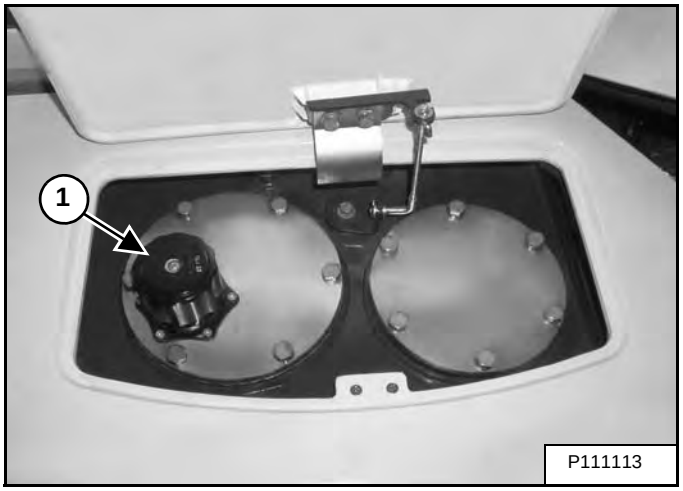
Removing And Replacing Hydraulic Filters (Cont'd)

Hydraulic Breather Filter

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 10-80-1.)

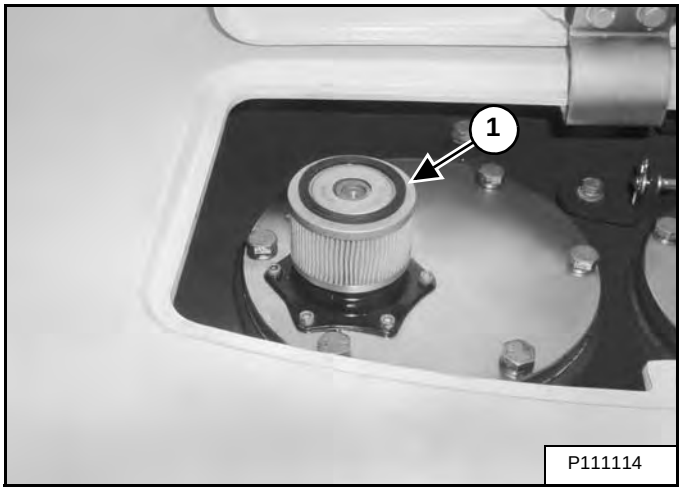
Open the rear cover. (See Opening And Closing on Page 10-60-1.)

Figure 10-140-11



Clean the surface around the reservoir (breather) cap (Item 1) **[Figure 10-140-11]** and remove the cap by turning counterclockwise.

Figure 10-140-12



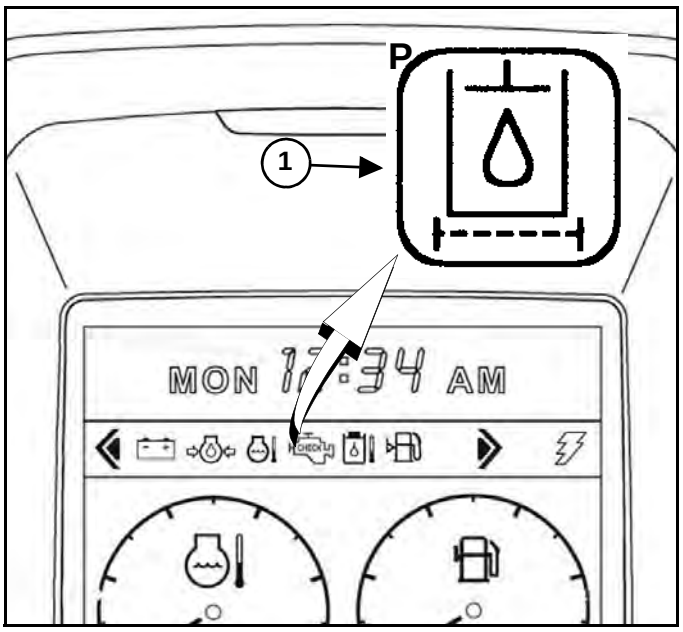
Remove and replace the breather filter (Item 1) **[Figure 10-140-12]**.

Reinstall the cap (Item 1) **[Figure 10-140-11]**.

Hydraulic Pilot Pressure Filter

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 10-80-1.)

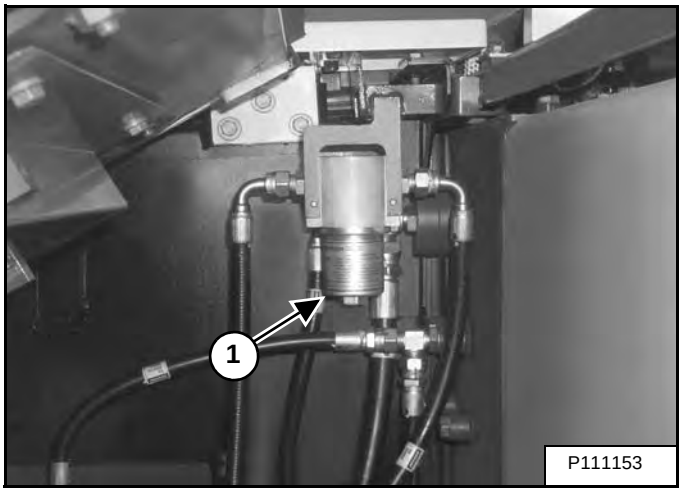
Figure 10-140-13



If the Pilot Filter Icon (Item 1) **[Figure 10-140-13]** is displayed on the instrument panel, the pilot filter will need to be changed sooner than the recommended interval on the Service Schedule.

Raise the operator cab. (See Raising And Lowering on Page 10-210-1.)

Figure 10-140-14



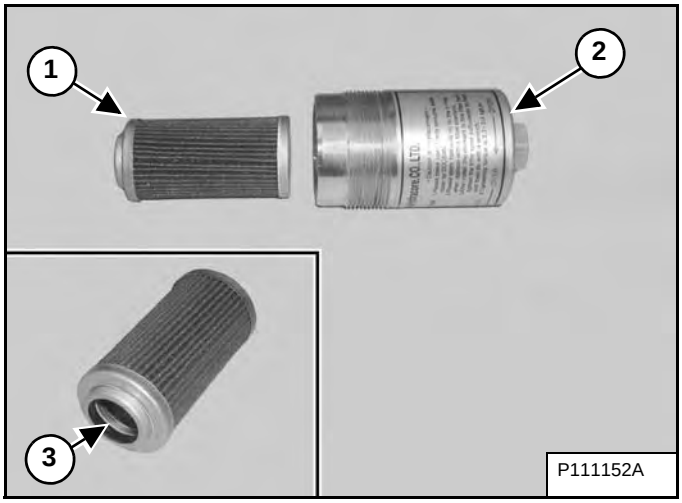
Clean the surface around the filter canister (Item 1) **[Figure 10-140-14]** and remove the canister.

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Removing And Replacing Hydraulic Filters (Cont'd)

Hydraulic Pilot Pressure Filter (Cont'd)

Figure 10-140-15



Remove the filter (Item 1) from the canister (Item 2) **[Figure 10-140-15]**.

When installing the new filter, make sure the O-ring (Item 3) **[Figure 10-140-15]** is installed inside the filter. Apply hydraulic oil to the O-ring before reinstalling the filter.

Install the filter (Item 1) inside the canister (Item 2) **[Figure 10-140-15]**.

Install the filter / canister (Item 1) **[Figure 10-140-14]**.

Hand tighten the canister, then torque the canister to 22 - 34 N•m (17 - 25 ft-lb) torque.

Removing And Replacing Hydraulic Fluid

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 10-80-1.)

⚠ WARNING

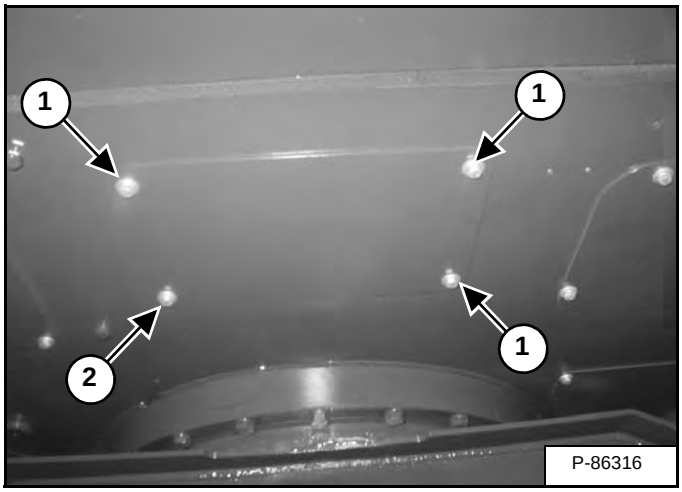
AVOID INJURY OR DEATH

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. Lower the blade to the ground. Stop the engine.

Figure 10-140-16

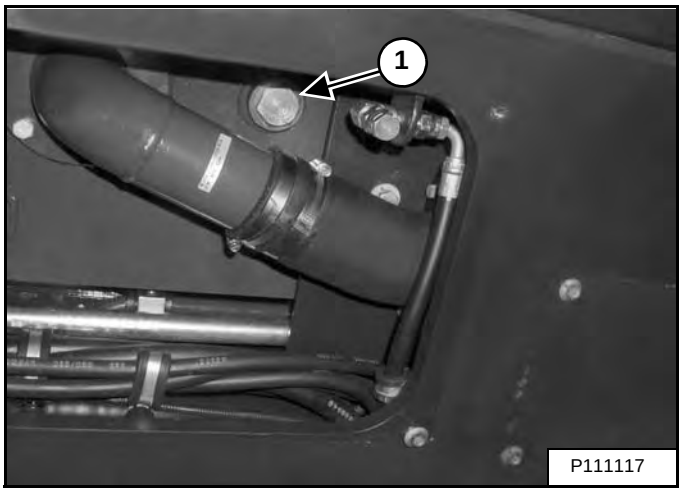


From below the rear of the excavator upperstructure, remove three bolts (Item 1) and loosen the fourth bolt (Item 2) **[Figure 10-140-16]** and rotate the cover plate to the side to access the bottom of the hydraulic tank.

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Removing And Replacing Hydraulic Fluid (Cont'd)

Figure 10-140-17



Remove the drain plug (Item 1) **[Figure 10-140-17]** from the bottom of the hydraulic tank.

Drain the fluid into a container.

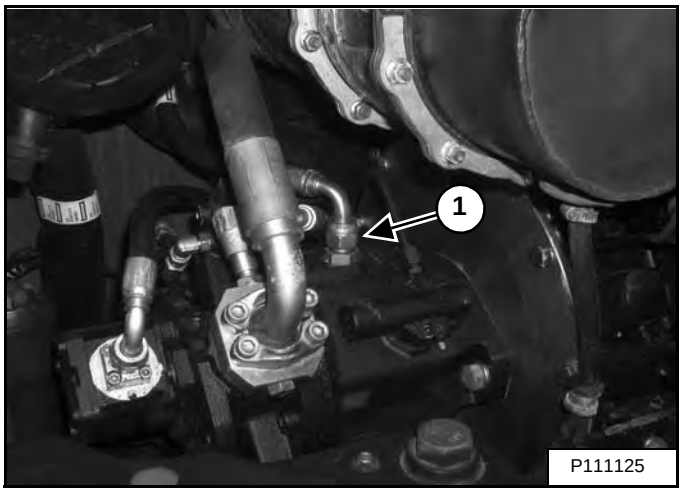
Recycle or dispose of the fluid in an environmentally safe manner.

Reinstall the drain plug (Item 1) **[Figure 10-140-17]**.

Rotate the cover plate (Item 1) back to the original location and install the three bolts (Item 2) **[Figure 10-140-16]**. Tighten the four bolts.

Always replace the filters when changing the hydraulic oil. (See Removing And Replacing Hydraulic Filters on Page 10-140-2.)

Figure 10-140-18



After the hydraulic fluid has been drained from the excavator or after the hydraulic pump has been serviced, the hydraulic pump must be flooded with hydraulic oil. Allow sufficient time for the hydraulic fluid to gravity feed into the hydraulic pump before starting the machine.

Loosen the case drain hose (Item 1) **[Figure 10-140-18]** to see if hydraulic fluid is at the fitting. If oil is present the pump has been flooded. Reinstall the hose.

If fluid is not at the fitting, reinstall the hose (Item 1). Start the engine and run at low idle for one minute. Remove the hose (Item 1) **[Figure 10-140-18]** and verify fluid is at the plug opening. Reinstall hose before operating.

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

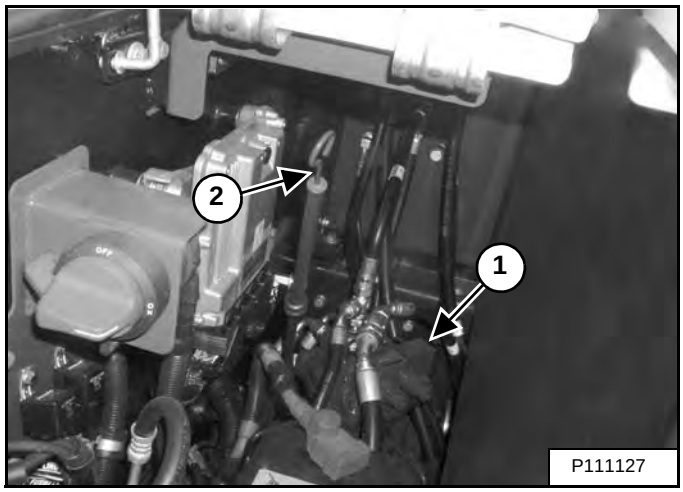
Start the engine and operate the machine through the hydraulic functions. Stop the engine. Check the fluid level and add as needed.

Install new Bobcat hydraulic fluid. (See Hydraulic Fluid Chart on Page 10-140-2.)

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Checking Swing Motor Gear Box Fluid Level

Figure 10-140-19



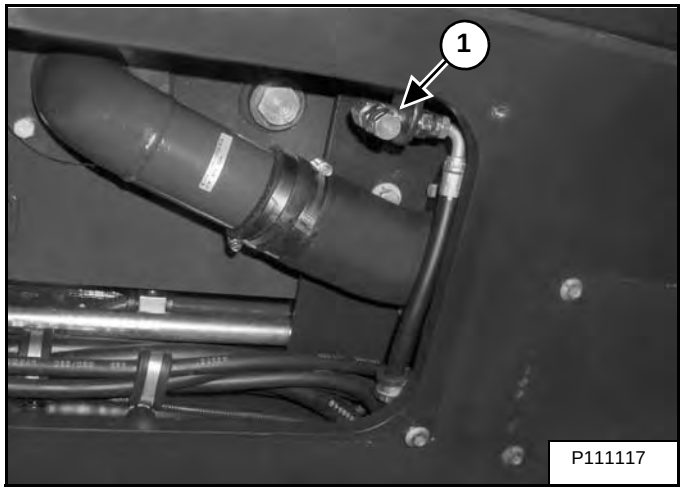
Open the center cover to access the swing motor. (See Opening And Closing on Page 10-70-1.)

The swing motor gear box (Item 1) has a dipstick (Item 2) **[Figure 10-140-19]** for checking the swing motor gear box oil level.

Keep the oil level between the marks on the dipstick.

Removing And Replacing Swing Motor Gear Box Fluid

Figure 10-140-20



The swing motor carrier drain plug is located below the engine area by the hydraulic tank drain plug.

Rotate the cover to access the drain plug. (See Removing And Replacing Hydraulic Fluid on Page 10-140-6.)

Remove the plug (Item 1) **[Figure 10-140-20]** and drain the swing motor carrier. Reinstall the drain plug.

Drain the fluid into a container.

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

Remove the dipstick (Item 2) **[Figure 10-140-19]** and add gear lube (80W-90) until it is at the correct mark on the dipstick. (See Capacities on Page SPEC-10-8.)

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LUBRICATING THE EXCAVATOR

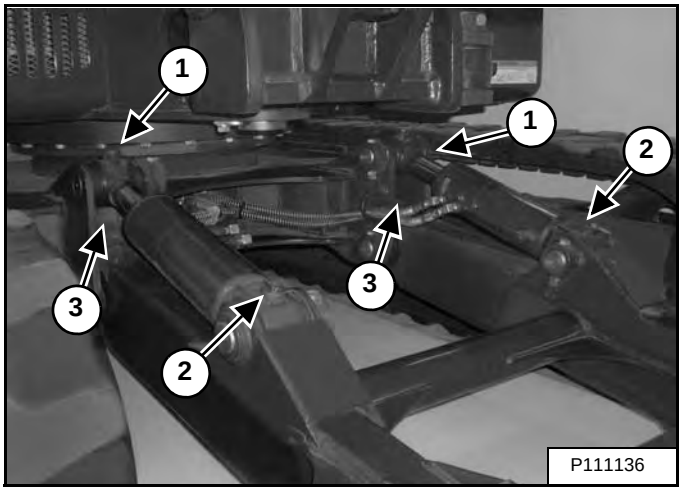
Lubrication Locations

Lubricate the excavator as specified in the SERVICE SCHEDULE for the best performance of the machine. (See SERVICE SCHEDULE on Page 10-80-1.)

Record the operating hours each time you lubricate the excavator.

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

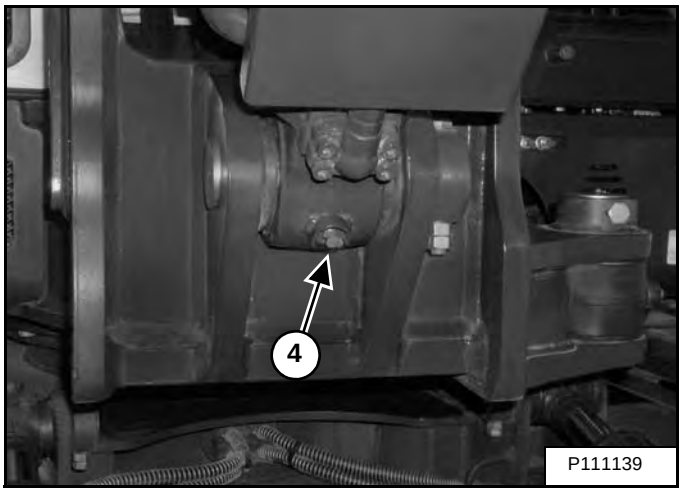
Figure 10-150-1



Ref Description (# of Fittings)

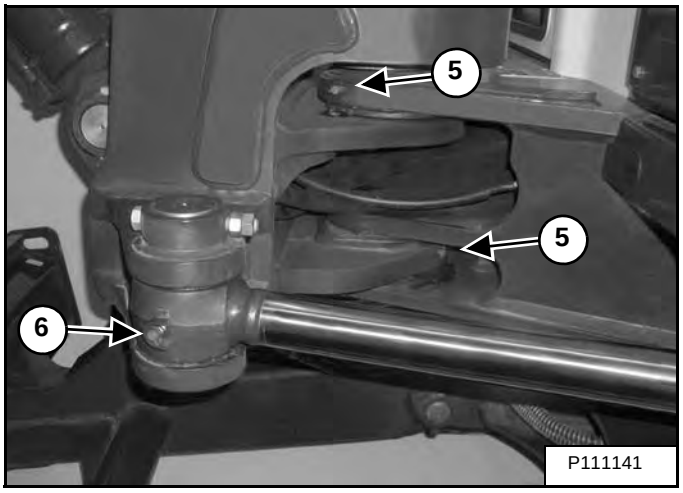
1. Blade Cylinder Rod End (1)
2. Blade Cylinder Base End (1)
3. Blade Pivots (2) **[Figure 10-150-1]**

Figure 10-150-2



4. Boom Cylinder Rod End (1) **[Figure 10-150-2]**

Figure 10-150-3



5. Boom Swing Pin (2)
6. Boom Swing Cylinder Base End (1) **[Figure 10-150-3]**

Dealer Copy -- Not for Resale

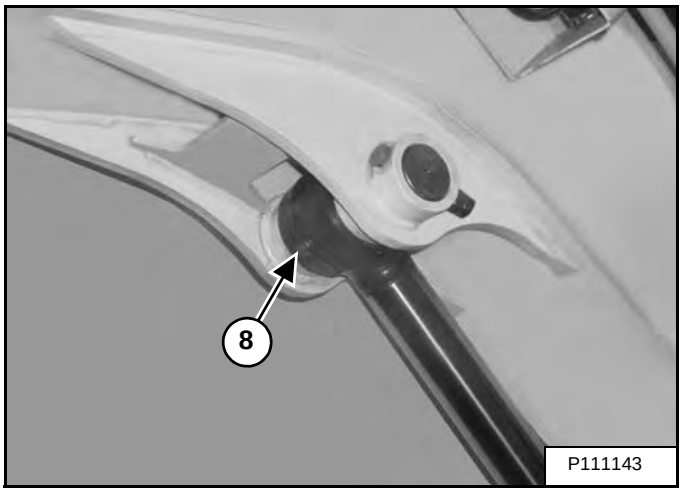
Lubrication Locations (Cont'd)

Figure 10-150-4



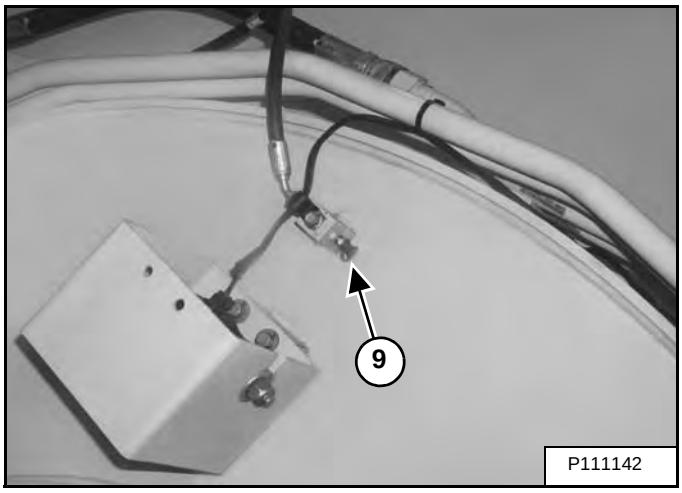
7. Boom Pivot (1) **[Figure 10-150-4]**

Figure 10-150-5



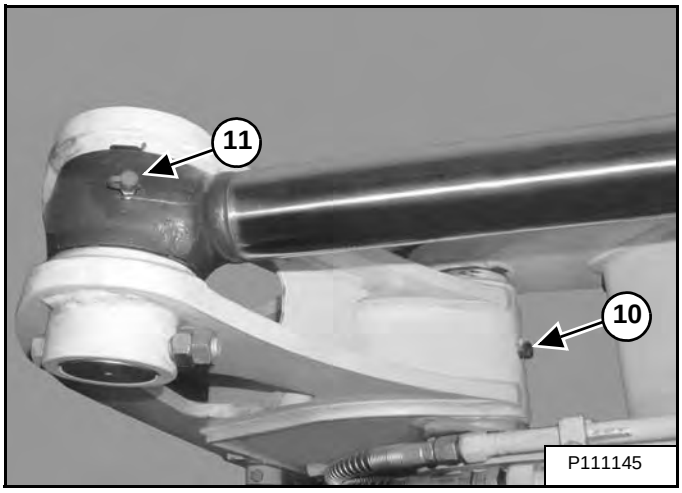
8. Boom Cylinder Rod End (1) **[Figure 10-150-5]**

Figure 10-150-6



9. Arm Cylinder Base End (1) **[Figure 10-150-6]**

Figure 10-150-7



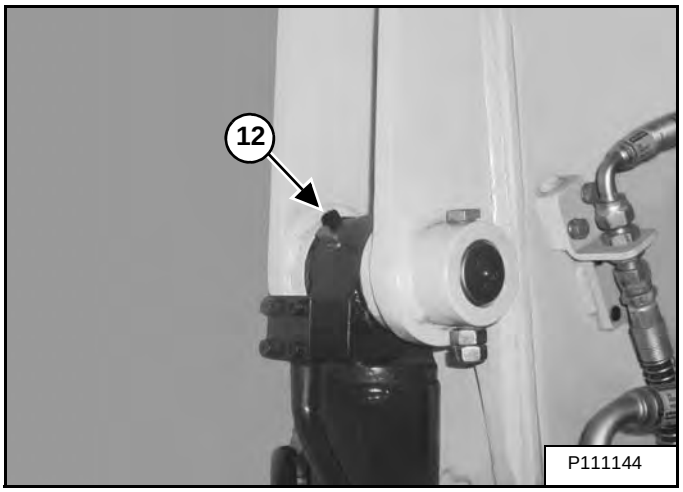
10. Arm Pivot (1) **[Figure 10-150-7]**

11. Arm Cylinder Rod End (1)

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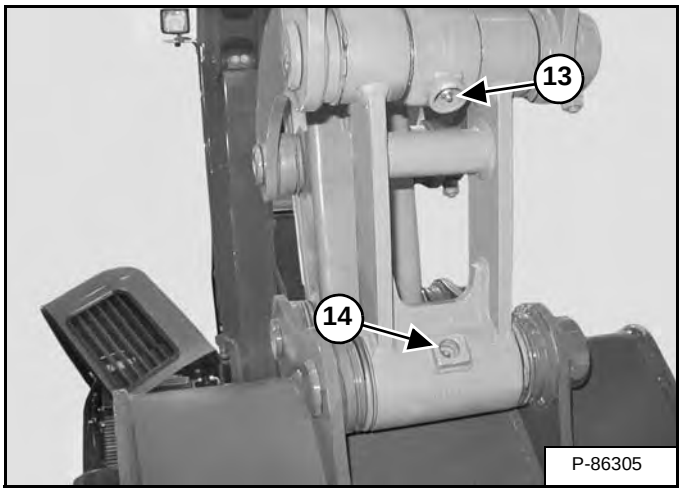
Lubrication Locations (Cont'd)

Figure 10-150-8



12. Bucket Cylinder Base End (1) **[Figure 10-150-8]**

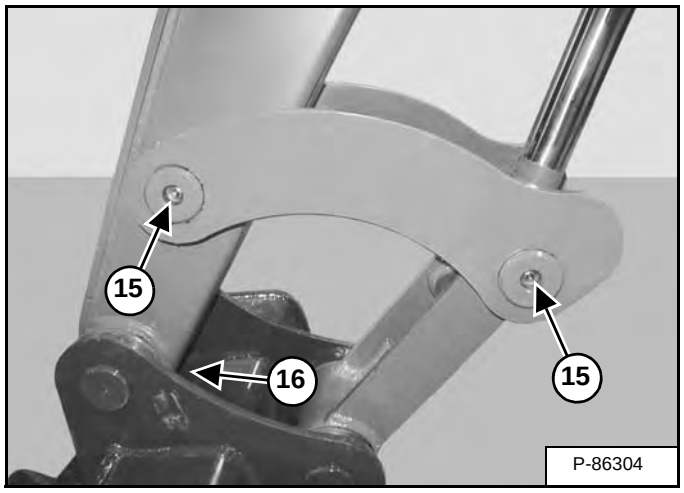
Figure 10-150-9



13. Bucket Cylinder Rod End (1)

14. Bucket Link (1) **[Figure 10-150-9]**

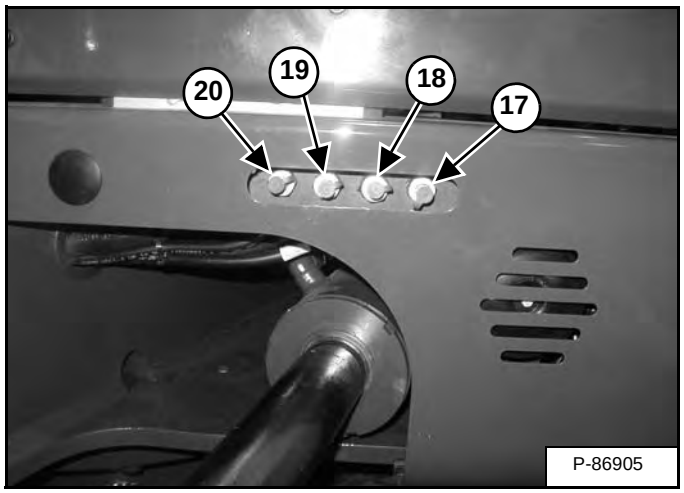
Figure 10-150-10



15. Link Pivot Pin (2)

16. Arm (1) **[Figure 10-150-10]**

Figure 10-150-11



Lubricate the following locations on the hydraulic Excavator per the SERVICE SCHEDULE for the correct lubrication intervals. (See SERVICE SCHEDULE on Page 10-80-1.)

17. Boom Swing Cylinder Base End (1)

18. Swing Motor Reduction Gear (1)

19. Slew Circle Bearing (1)

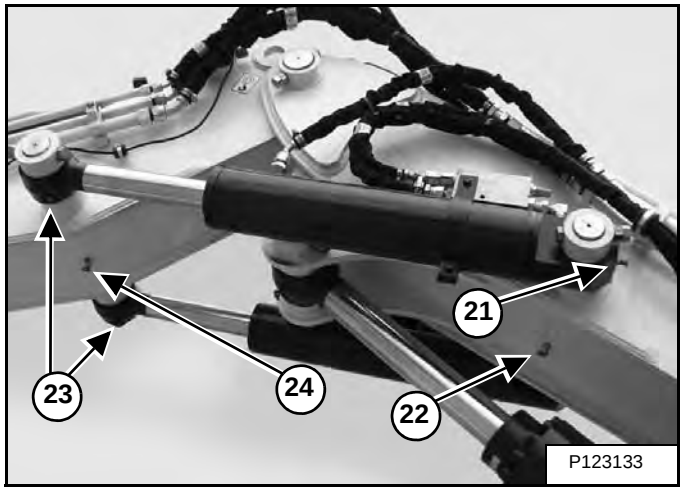
20. Slew Pinion (1). (Install 3 to 4 pumps of grease then rotate the upperstructure 90°. Install 3 to 4 pumps of grease and again rotate the upperstructure 90°. Repeat this until the slew pinion has been greased at four positions.) **[Figure 10-150-11]**.

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Lubrication Locations (Cont'd)

Articulated Boom (If Equipped)

Figure 10-150-12



21. Articulated Boom Cylinders Base End (2).

22. Articulated Boom Cylinders Base End Pivot (1).

23. Articulated Boom Cylinders Rod End (2).

24. Articulated Boom Cylinders Rod End Pivot (1). **[Figure 10-150-12]**

Figure 10-150-13



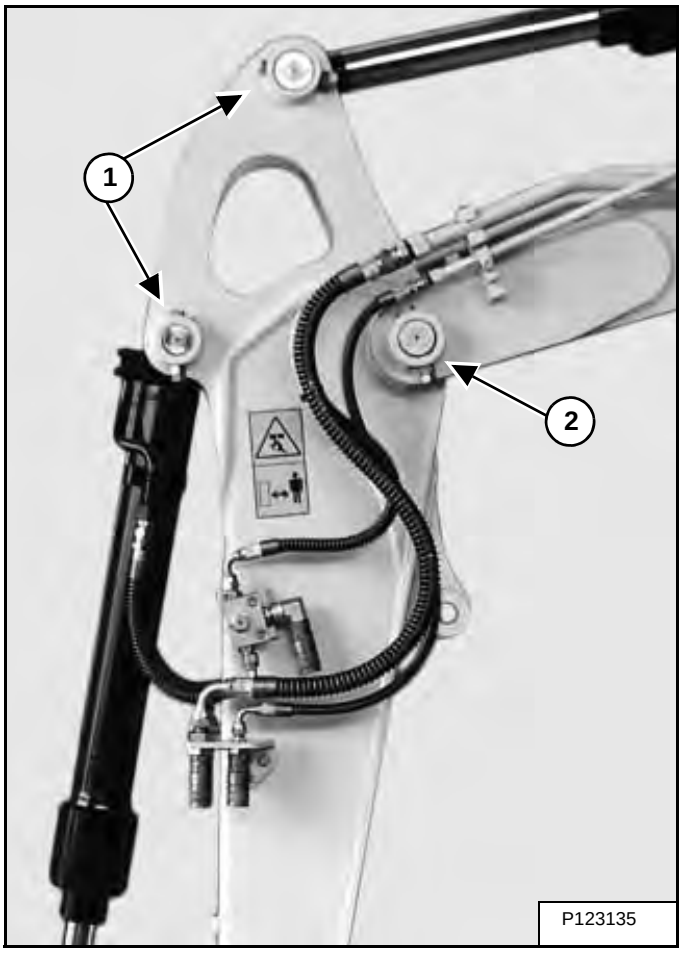
25. Articulated Boom Pivot (1) **[Figure 10-150-13]**.

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PIVOT PINS

Inspection And Maintenance

Figure 10-160-1



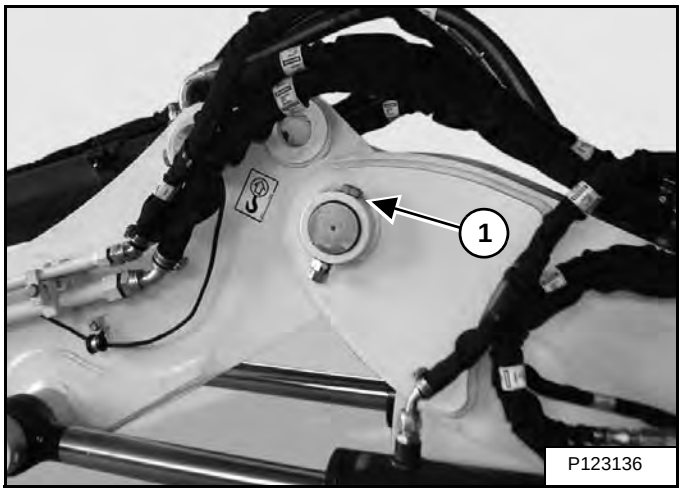
The bucket and arm cylinder pivots (Item 1) and the boom / arm pivot (Item 2) **[Figure 10-160-1]** have a large pin held in position with a bolt and two nuts.

The two nuts are used as jam nuts to hold the bolt without tightening the bolt to the pin boss. After the nuts are tightened together, the bolt should be free to spin.

Check that all pivot bolts and nuts are securely tightened and are not damaged. See your dealer for replacement parts.

Articulated Boom (If Equipped)

Figure 10-160-2



The articulated boom pivot has a large pin (Item 1) **[Figure 10-160-2]** held in position with a bolt and two nuts.

Check that all pivot bolts and nuts are securely tightened and are not damaged. See your dealer for replacement parts.

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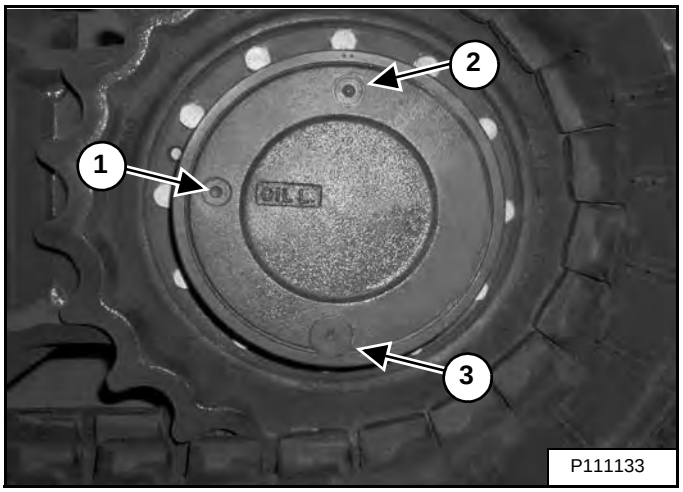


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TRAVEL MOTOR

Checking And Adding Oil

Figure 10-170-1



Park the excavator on a level surface with the plugs (Item 1, 2 and 3) **[Figure 10-170-1]** in the position as shown.

Remove the plug (Item 1) **[Figure 10-170-1]**. The lube level must be at the bottom edge of the hole.

Add lubricant (80W-90) through hole (Item 2) **[Figure 10-170-1]** if the lube level is low.

Removing And Replacing Oil

For the correct service interval. (See SERVICE SCHEDULE on Page 10-80-1.)

Park the excavator on a level surface with plugs (Item 1, 2 and 3) in the position shown. Remove plugs (Item 2 and 3) **[Figure 10-170-1]** 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 3). Add lubricant (80W-90) through the top plug (Item 2) until the lube level is at the bottom edge of the plug hole (Item 1) **[Figure 10-170-1]**.

Install the plugs (Item 1 and 2) **[Figure 10-170-1]**.

Repeat the procedure for the opposite travel motor.

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DIESEL PARTICULATE FILTER (DPF) SYSTEM

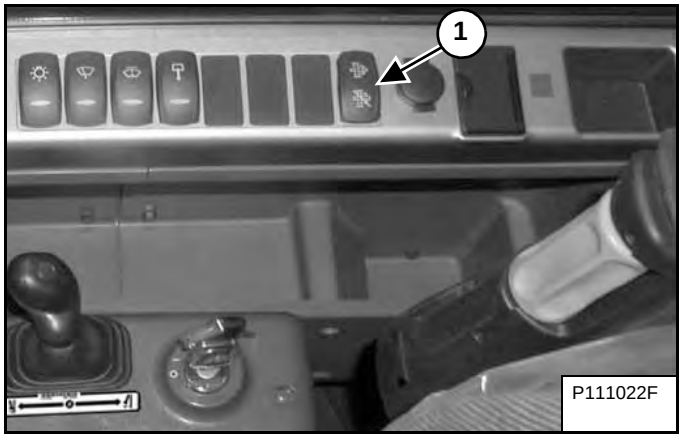
Description

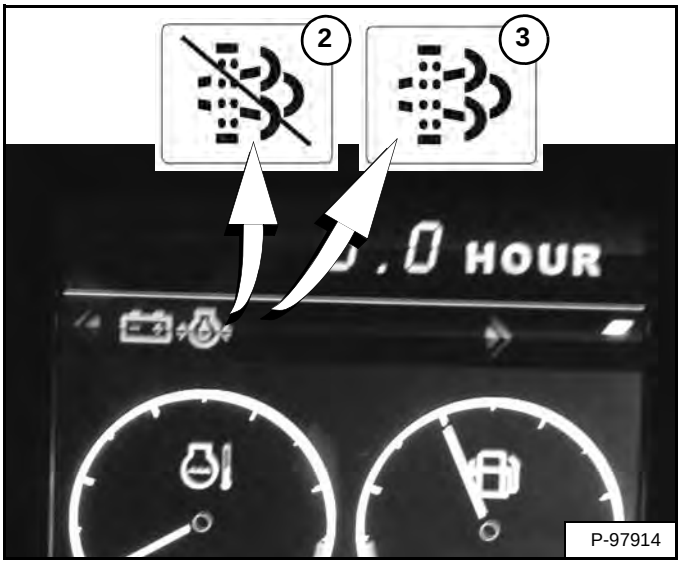
The engine exhaust system is equipped with a diesel particulate filter (DPF). The DPF is an emissions reduction device that removes diesel particulate matter (soot) from the exhaust gases of the diesel engine. The DPF will trap and collect the soot until it is burned off. The process of burning off the collected soot is called regeneration.

Ash residue will remain after the regeneration process is complete. The ash must be periodically removed from the DPF. (See DPF Ash Cleaning on Page 10-180-4.)

Forced (Stationary) Regeneration

Figure 10-180-1





This excavator is equipped with a DPF inhibited / forced regeneration switch (Item 1) **[Figure 10-180-1]** on the right console.

A forced (stationary) regeneration cycle may be required if too much soot is allowed to accumulate in the DPF. This can occur in the following situations:

1. The excavator is often operated for brief periods (less than 30 minutes) that do not allow sufficient time for the DPF to complete an automatic regeneration cycle.

2. The excavator is used with low load during extended period of time.

3. When DPF inhibited / forced regeneration switch (Item 1) is in the inhibited enabled position for an extended period of time. This will inhibit the DPF from actively regenerating and burning off the collected soot. The inhibited ICON (Item 2) will be ON when the inhibited / forced switch (Item 1) **[Figure 10-180-1]** is enabled.

When forced (stationary) regeneration is required, the red Warning LED will flash ON and OFF in the instrument panel (See Operation & Maintenance Manual for the exact location) and the pop-up message “Forced Regeneration Status” will appear.

NOTE: Failure to perform a forced (stationary) regeneration when required can result in the soot level exceeding the maximum allowable level and the engine being derated. Continued excavator operation will require exhaust system service by your dealer.

Ensure the excavator has enough fuel to operate for 30 minutes minimum.

⚠ WARNING

AVOID SERIOUS INJURY OR DEATH

Exhaust gas temperature and exhaust system components are hot during regeneration. Keep flammable material, explosive dust, and explosive gases away from exhaust system.

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DIESEL PARTICULATE FILTER (DPF) SYSTEM (CONT'D)

Forced (Stationary) Regeneration (Cont'd)

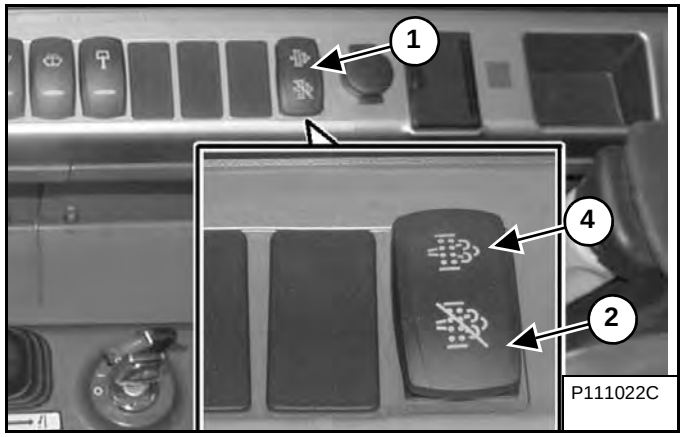
⚠ WARNING

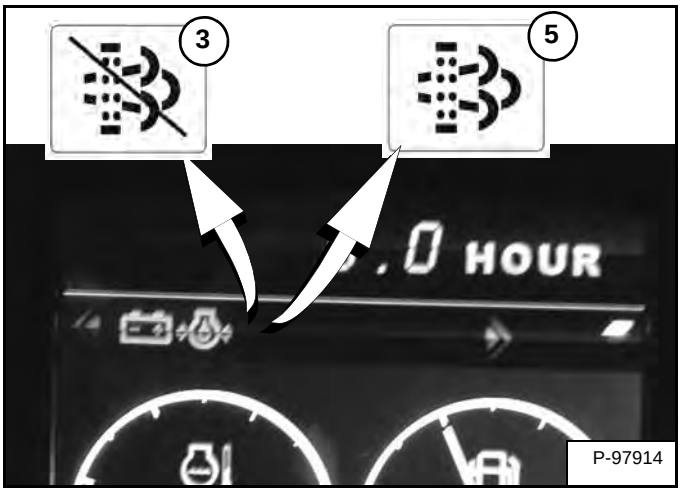
AVOID INJURY OR DEATH

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

Figure 10-180-2





1. Park the machine on flat level ground and in an open area with good ventilation. Lower the boom and blade fully.
2. Run the engine until the coolant temperature is at a minimum of 60°C (140°F).
3. Activate the auxiliary hydraulics with nothing connected to the couplers and run the engine at high idle for about 2 minutes. This will raise the DPF inlet exhaust to the necessary temperature.
4. Move engine speed control to low idle and deactivate the auxiliary hydraulics.
5. Raise the left console to the locked out position. (See Operation & Maintenance Manual for the correct procedure.)
6. When the ECU verifies the left console is raised to the locked out position, the engine is at low idle, the coolant and DPF temperatures are at operating temperatures; then the forced (stationary) regeneration cycle can be activated.
7. Press the DPF inhibited / forced regeneration switch (Item 1) to the inhibited position (Item 2) for approximately 5 seconds. The pop-up message "DPF Active Regeneration Inhibit Status" will appear. The inhibited icon (Item 3) **[Figure 10-180-2]** will turn ON. Press the inhibited / forced switch a second time to turn the inhibited icon OFF.
8. Now press and hold the DPF inhibited / forced regeneration switch (Item 1) to the regenerate position (Item 4) for approximately 15 seconds (or until the red Warning LED in the instrument panel is flashing) to start regeneration. The DPF Regeneration icon (Item 5) **[Figure 10-180-2]** will turn ON (amber colored) and the pop-up message "Regeneration Is Ready" will appear. The regeneration process will start in a few seconds.
9. Release the DPF inhibit / forced regeneration switch (Item 1) **[Figure 10-180-2]** so it returns to the center position.

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Forced (Stationary) Regeneration (Cont'd)

After the regeneration cycle starts, the engine will idle for a brief period. The engine speed will gradually increase to approximately 1950 rpm.

The regeneration cycle will take approximately 30 minutes to complete. DO not stop this cycle unless absolutely necessary.

If the regeneration cycle must be stopped, press the DPF inhibited / forced regeneration switch (Item 2) **[Figure 10-180-2]**, or rotate the speed control knob above the low idle position, or lower the lock lever or turn the start key to the OFF position. Any of above actions will cause the regeneration cycle to be aborted.

NOTE: If the forced (stationary) regeneration cycle is not completed for two consecutive times (manually stopped), the engine check light will turn ON and engine power will be reduced. Error code P2463 "Service Regeneration Required will be displayed in the instrument panel.

IMPORTANT

Stopping the engine during the regeneration cycle may cause severe damage to the DPF.

I-2352-0412

10. After the DPF regeneration is complete, the engine will return to low idle and will continue to operate for a cool down period. Once the DPF Icon (Item 5) **[Figure 10-180-2]** turns OFF, the regeneration cycle is complete. The engine can now be stopped.

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Service Regeneration

Your machine will indicate the need for service regeneration by displaying one of the following service codes:

- **[P1421]** Forced (Stationary) Regeneration Required
- **[P1424] or [P2463]** Service Regeneration Required
- **[P2458]** Regeneration Defect (stationary regeneration failure)
- **[P2459]** Regeneration Defect (stationary regeneration not performed)

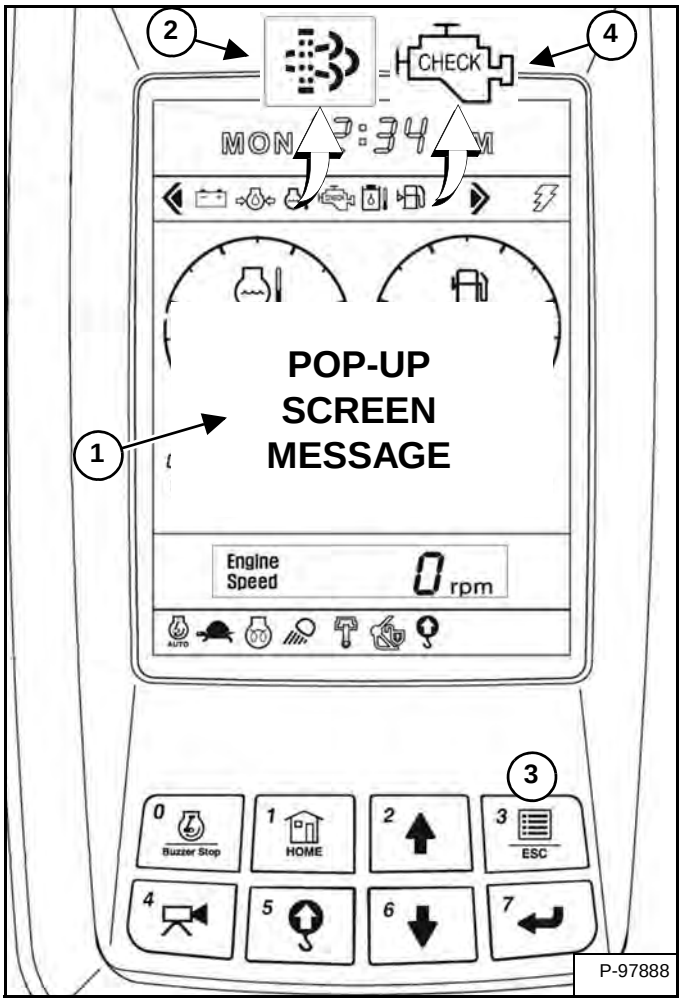
Service regeneration requires the use of specialized equipment. See your dealer for service regeneration.

NOTE: The operator can perform a forced (stationary) regeneration (Service Code P1421) but if service regeneration is requested, regeneration must be performed by your dealer. (See Forced (Stationary) Regeneration on Page 10-180-1.)

DPF Ash Cleaning

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 10-80-1.)

Figure 10-180-3



Clean the DPF at the specified interval or when indicated on the instrument panel.

A pop-up box (Item 1) will appear on the screen, the DPF icon (Item 2) and the engine check light (Item 4) icons will FLASH. Press the MENU / ESC button (Item 3) **[Figure 10-180-3]** until the display screen shows the service codes. (See DIAGNOSTIC SERVICE CODES on Page 50-80-1.) Service code **[P1420]** (DPF Service Required) will show in the display screen when DPF cleaning is necessary.

The DPF is a critical component of the engine exhaust system and must be properly maintained. Specialized equipment is required to clean the ash from the DPF. See your dealer for DPF cleaning.

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EMERGENCY EXITS

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

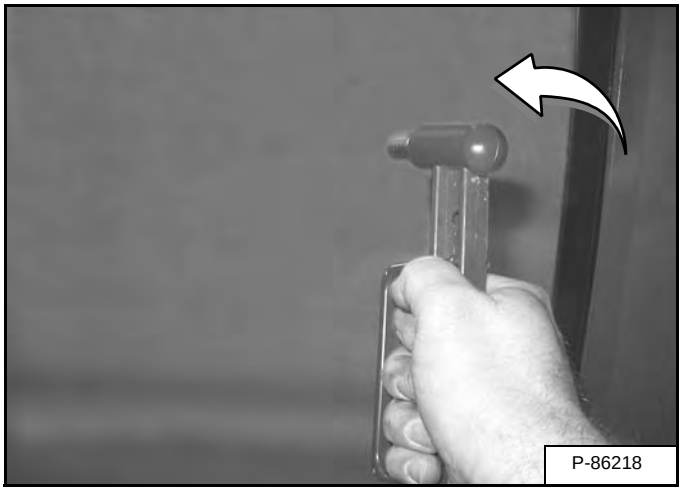
Right Rear Side Window

Figure 10-190-1



If emergency exit requires breaking a window, use the supplied hammer (Item 1) **[Figure 10-190-1]** located on the left side of the operator cab.

Figure 10-190-2



Remove the hammer from the storage position and strike the glass with the pointed end of the hammer **[Figure 10-190-2]**.

Use the hammer to remove broken glass from the edge of the window before exiting.

Figure 10-190-3



Exit through the right rear side window **[Figure 10-190-3]**.

Front Window

Figure 10-190-4



Open the front window and exit **[Figure 10-190-4]**.

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

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SEAT BELT

Inspection And Maintenance

WARNING

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

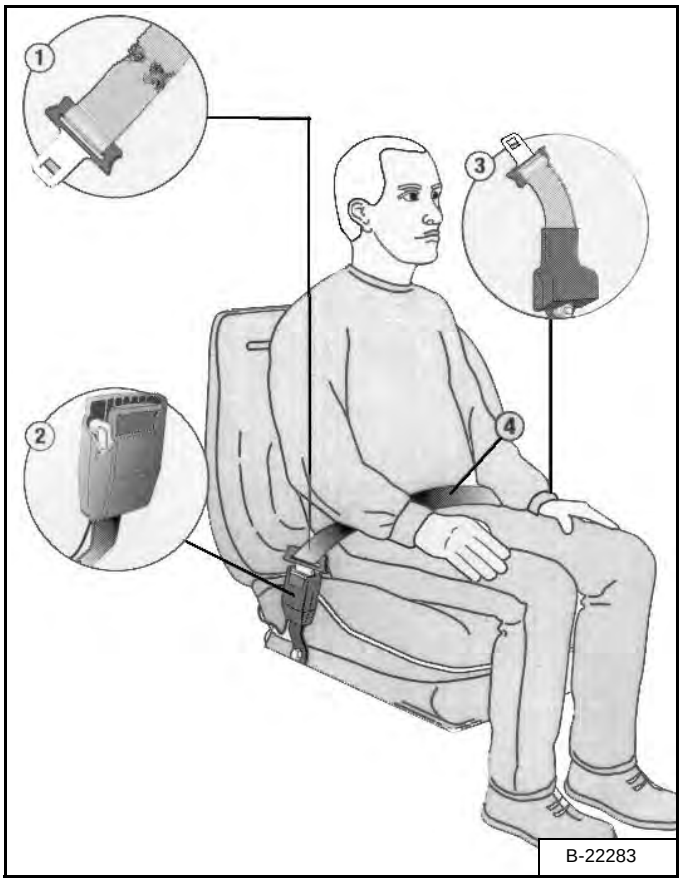
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Check the seat belt daily for correct function.

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 10-200-1



The items below are referenced in **[Figure 10-200-1]**.

1. Check the 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 correct operation. Make sure latch plate is not excessively worn, deformed or buckle is not damaged or casing broken.

3. Check the retractor web storage device (if equipped) by extending webbing to determine if it looks correct and that it spools out and retracts 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 deteriorated.

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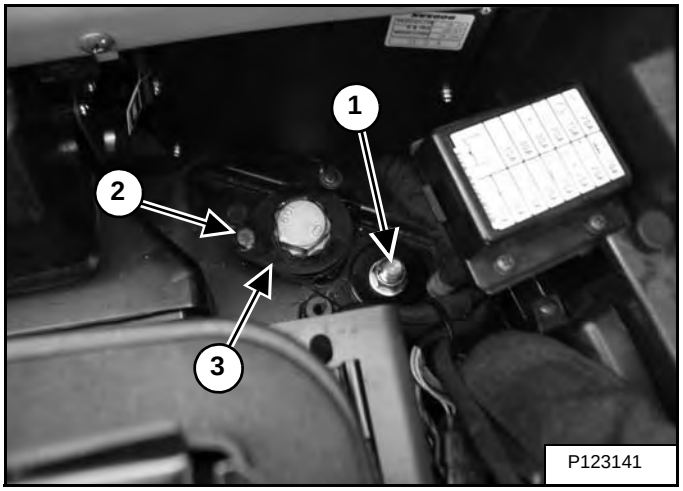
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CAB TILT PROCEDURE

Raising And Lowering

Raising The Cab

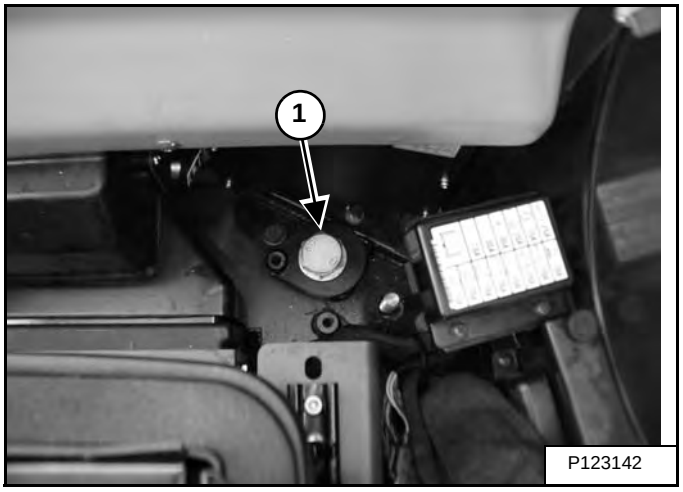
Figure 10-210-1



Remove the two nuts and washers (Item 1) **[Figure 10-210-1]** from the right and left rear corners of the cab.

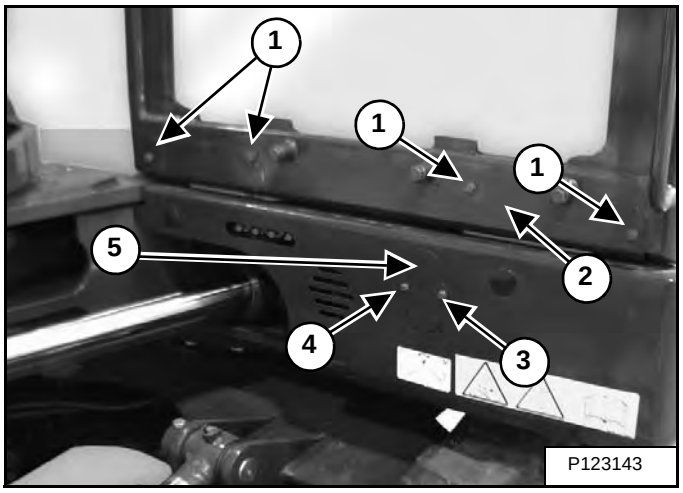
Remove the bolt (Item 2) and retaining ring (Item 3) **[Figure 10-210-1]**.

Figure 10-210-2



Remove the bolt and washer (Item 1) **[Figure 10-210-2]**.

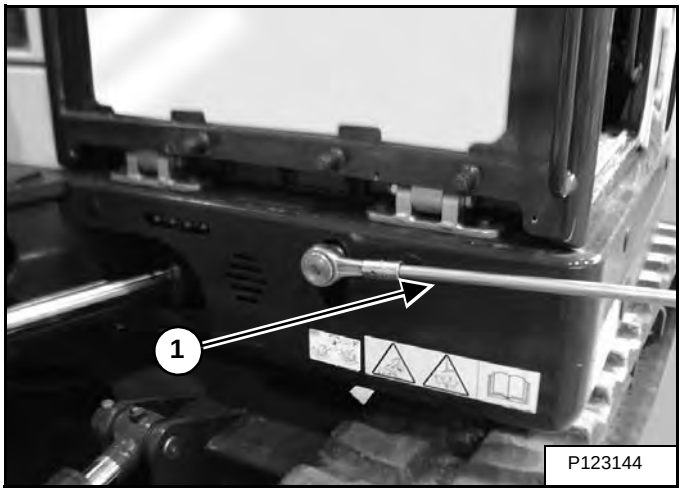
Figure 10-210-3



Remove the four bolts (Item 1) and remove the cover (Item 2) **[Figure 10-210-3]**.

Remove the bolt (Item 3), loosen the bolt (Item 4) and pivot the cover (Item 5) **[Figure 10-210-3]** down for access to the cab tilt assembly.

Figure 10-210-4



Install a wrench (Item 1) **[Figure 10-210-4]** and rotate the cab tilt assembly clockwise to raise the cab.

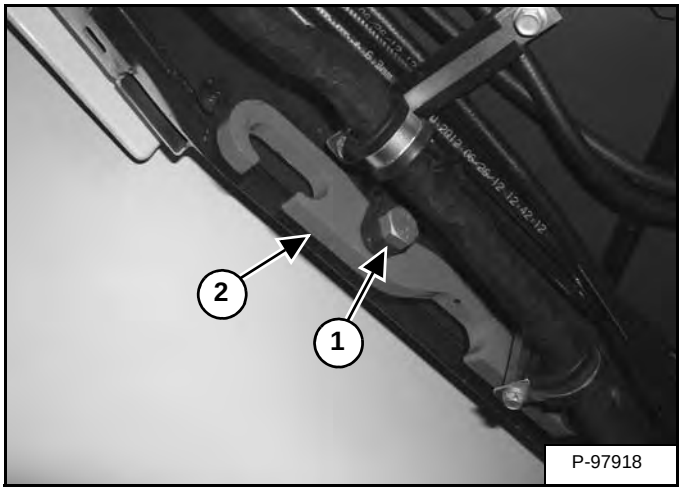
NOTE: Do Not use any type of air or electrically operated wrench. Only use a hand operated wrench. Turning the tilt assembly at higher speeds can damage the tilt assembly.

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Raising And Lowering (Cont'd)

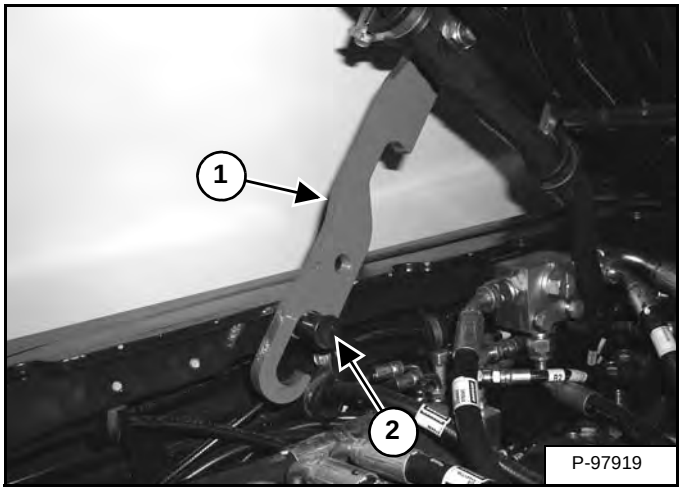
Raising The Cab (Cont'd)

Figure 10-210-5



Remove the bolt (Item 1) from the cab support device (Item 2) **[Figure 10-210-5]**.

Figure 10-210-6



Rotate the cab support device (Item 1) down to the support post (Item 2) **[Figure 10-210-6]**.

Slowly lower the cab until it is supported by the cab support device.

WARNING

AVOID INJURY OR DEATH

Never work under the excavator cab without installing an approved cab support device.

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Lowering The Cab

Raise the cab slightly and rotate the cab support device (Item 1) **[Figure 10-210-6]** to the storage position **[Figure 10-210-5]**.

Install the bolt (Item 1) **[Figure 10-210-5]**.

Slowly lower the cab completely **[Figure 10-210-4]**.

Install the two washers and nuts (item 1) **[Figure 10-210-1]** on the left and right side of the rear of the cab.

Install the bolt and washer (Item 1) **[Figure 10-210-2]** at the left rear corner of the cab. Install the retaining ring (Item 3) and Tighten bolt (Item 2) **[Figure 10-210-1]**.

Pivot the cover (Item 5) up and install the bolt (Item 3) **[Figure 10-210-3]**.

Tighten the bolts (Item 3 and 4) **[Figure 10-210-3]**.

Install the cover (Item 2) and the four bolts (Item 1) **[Figure 10-210-3]**.

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CONTROL CONSOLE LOCKOUT

Inspection And Maintenance

Figure 10-220-1



When the left console is raised **[Figure 10-220-1]** the hydraulic control levers (joysticks and traction system) must not function.

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

Raise the left console.

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

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

Service the system if these controls do not deactivate when the left control console is raised.

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TOWING THE EXCAVATOR

Procedure

There is not a recommended towing procedure for the excavators.

- The excavator can be lifted onto the transport vehicle.
- The excavator can be skidded a short distance for service (EXAMPLE: Move onto a transport vehicle) without damage to the hydraulic system. (The tracks will not turn.) There might be slight wear to the tracks when the excavator is skidded.
- The towing chain (or cable) must be rated at 1.5 times the weight of the excavator. (See Capacities on Page SPEC-10-8.)

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Parts Identification 20-90-3
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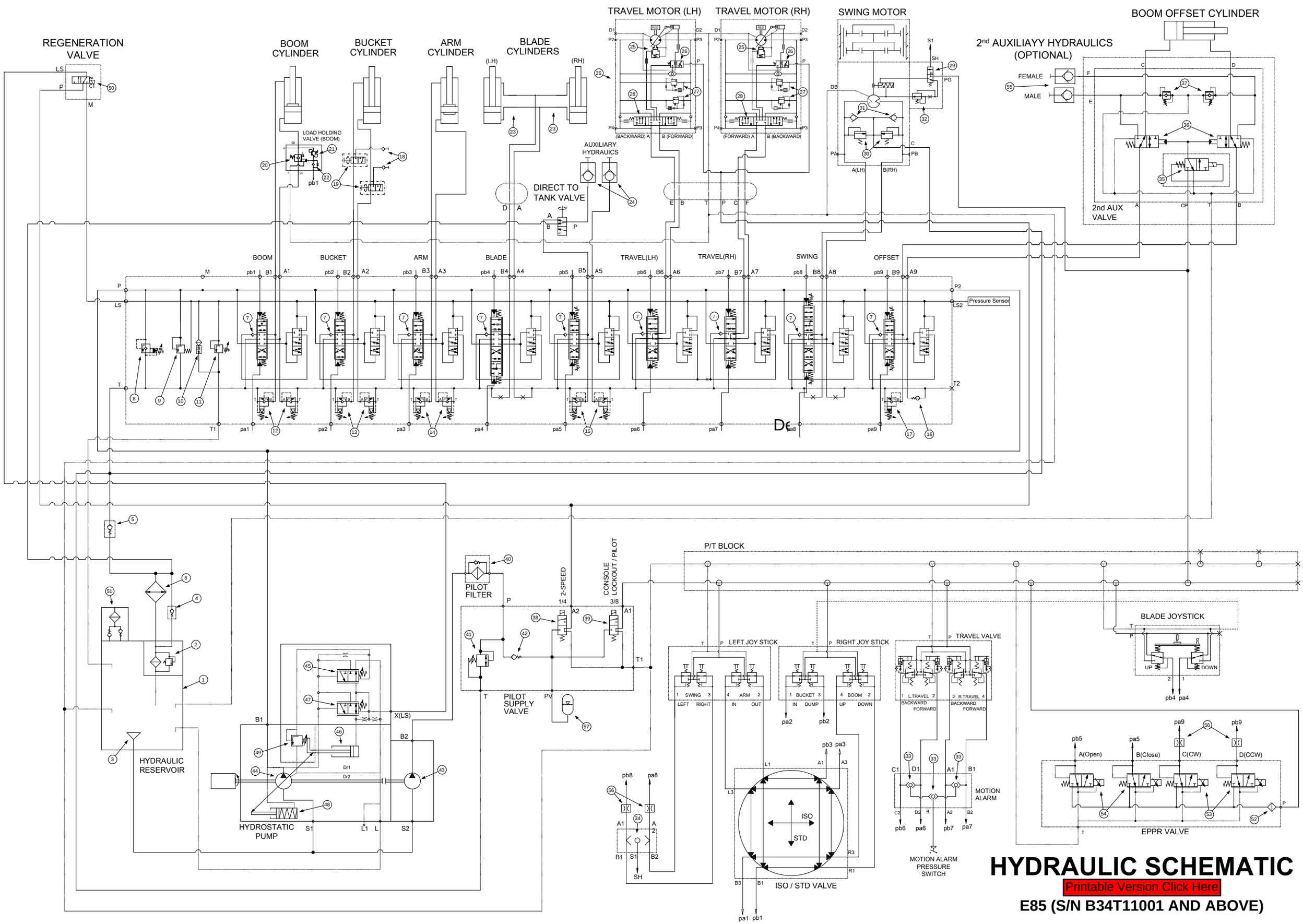
HYDRAULIC/HYDROSTATIC SCHEMATIC
E85 (S/N B34T11001 AND ABOVE)

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V-1559legend

1. HYDRAULIC RESERVOIR (PRESSURIZED)
   Reservoir – 87 L (23 U.S. gal)
   System – 127 L (39.1 U.S. gal)
2. MAIN FILTER - 10 MICRON
   With 250 kPa (2,5 bar) (36 psi) By-Pass Valve
3. SUCTION FILTER - 150 MICRON
4. CHECK VALVE – 259 kPa (2.5 bar) (36 psi)
5. CHECK VALVE – 300 kPa (3 bar) (44 psi)
6. OIL COOLER
7. LOAD CHECK
8. BACK-UP RELIEF VALVE:
   34000 kPa (340 bar) (4931 psi)
9. FLUSHING VALVE: 2500 kPa (25 bar) (362 psi)
10. LOAD SENSE BLEED VALVE
11. LOAD SENSE RELIEF VALVE:
    28000 kPa (280 bar) (4060 psi)
12. PORT RELIEF / ANTI-CAVITATION VALVE (2) - (Boom Cylinder) - 31000 kPa (310 bar) (4496 psi)
13. PORT RELIEF / ANTI-CAVITATION VALVE (2) - (Bucket Cylinder) - 31000 kPa (310 bar) (4496 psi)
14. PORT RELIEF / ANTI-CAVITATION VALVE (2) - (Arm Cylinder) - 31000 kPa (310 bar) (4496 psi)
15. PORT RELIEF / ANTI-CAVITATION VALVE - (Continuous Flow / Auxiliary Hydraulics -
    31000 kPa (310 bar) (4496 psi)
16. ANTI-CAVITATION VALVE
17. PORT RELIEF / ANTI-CAVITATION VALVE – (2nd Auxiliary – If Equipped) -
    31000 kPa (310 bar) (4496 psi)
18. 3rd AUXILIARY QUICK COUPLERS –
    Male / Female (If Equipped)
19. MANUAL DIRECTIONAL CONTROL VALVE (Bucket Cylinder – 3rd Auxiliary Couplers) – (If Equipped)
20. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE (Load Holding valve) – Boom
21. RELIEF VALVE - (Load Holding valve) – Boom
22. CHECK VALVE With Restriction - (Load Holding valve) – Boom
23. NOT USED ON THIS MODEL
24. AUXILIARY QUICK COUPLERS – Male / Female
25. BRAKE RELEASE VALVE – Travel Motor
    630 kPa (6,3 bar) (91 psi)
26. TWO SPEED SHIFT SPOOL – Travel Motor
27. CROSS PORT RELIEF VALVE (Travel Motor)
    28000 kPa (280 bar) (4061 psi)
28. COUNTERBALANCE SPOOL (Travel Motor)
29. BRAKE RELEASE VALVE - Slew Motor
    1900 kPa (19 bar) (276 psi)
30. CROSS PORT RELIEF VALVE - Slew Motor
    22000 kPa (220 bar) (3190 psi)
31. ANTI-CAVITATION VALVE – Slew Motor
32. RELIEF VALVE – Slew Motor Brake
33. SHUTTLE VALVE (Motion Alarm – If Equipped)
34. SHUTTLE VALVE (Slew Motor Brake Valve)
35. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (2nd Auxiliary)
36. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE (2) (2nd Auxiliary)
37. PORT RELIEF VALVE –(2nd Auxiliary – If Equipped) 25000 kPa (250 bar) (3626 psi)
38. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (Two Speed)
39. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE - (Console Lockout / Pilot Cut off)
40. FILTER - Pilot Witn By-Pass Valve
    170 kPa (1,7 bar) (25 psi)
41. PRESSURE REDUCING VALVE -
    3200 kPa (32 bar) (464 psi)
42. CHECK VALVE: 50 kPa (0,5 bar) (7.25 psi)
43. HYDRAULIC GEAR PUMP
    22 L/min (5.8 U.S. gpm) at High Idle
44. HYDRAULIC PISTON PUMP
    144 L/min (38 U.S. gpm) at High Idle
45. TORQUE LIMITER SUPPLY SPOOL
    2000 kPa (20 bar) (290 psi)
46. DESTROKE PISTON
47. PUMP MARGIN SPOOL:
    1500 kPa (15 bar) (218 psi)
48. MINIMUM PUMP DISPLACEMENT
    (On Stroke Piston)
49. TORQUE LIMITER 28000 kPa (280 bar) (4061 psi)
50. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (Regeneration)
51. HYDRAULIC FILL CAP With Breather Filter
52. FILTER
53. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (2) (Boom Swing)
54. SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (2nd Auxiliary)
55. 2nd AUXILIARY QUICK COUPLERS –
    Male / Female (If Equipped)
56. ORIFICE – 0,8 mm (0.031 in)
57. ACCUMULATOR - Nitrogen 1020 kPa (10.2 bar) (148 psi) Precharged

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



HYDRAULIC SCHEMATIC

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E85 (S/N B34T11001 AND ABOVE)

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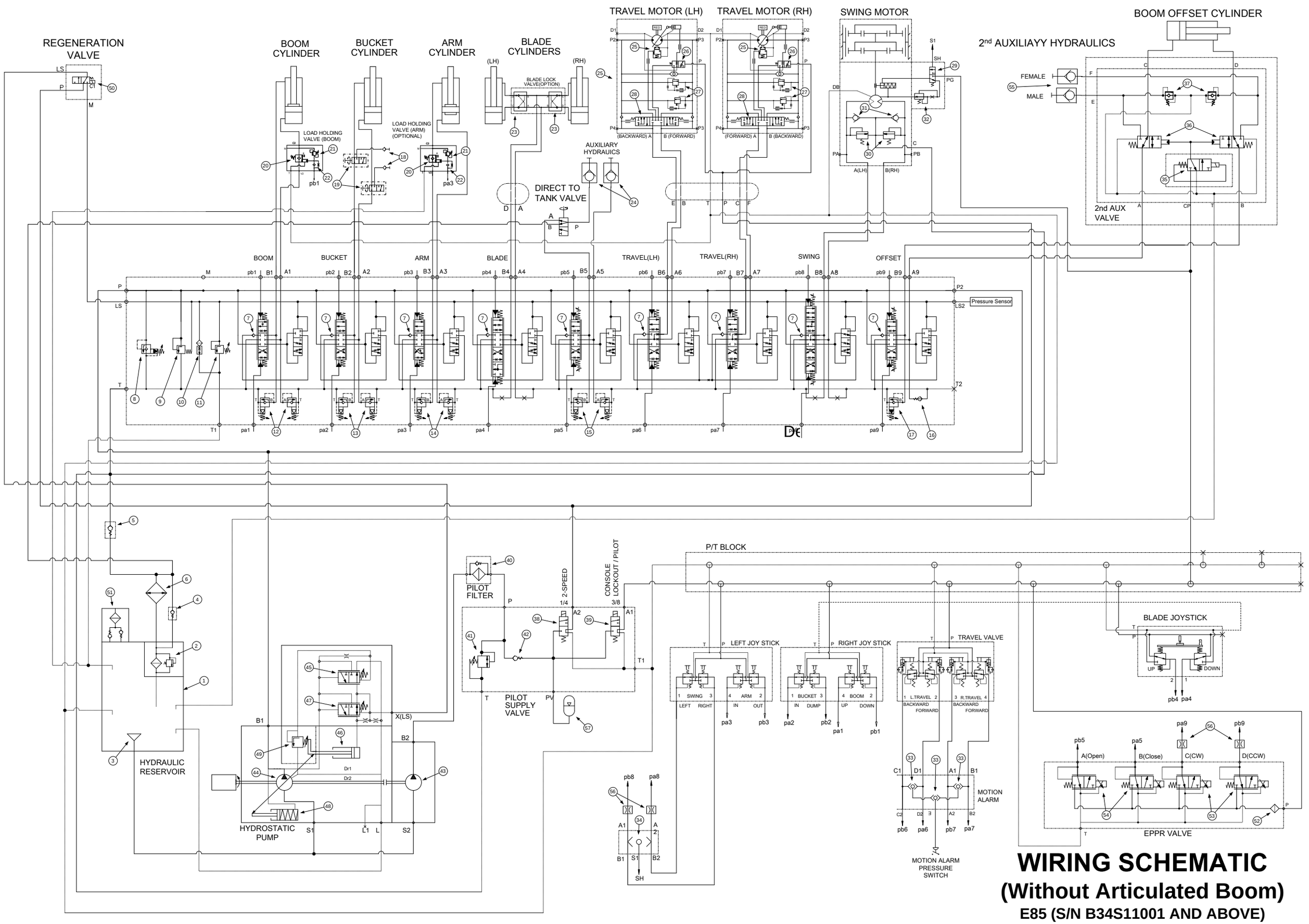
HYDRAULIC/HYDROSTATIC SCHEMATIC
Without Articulated Boom
E85 (S/N B34S11001 AND ABOVE)

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7. LOAD CHECK
8. BACK-UP RELIEF VALVE:
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15. PORT RELIEF / ANTI-CAVITATION VALVE - (Continuous Flow / Auxiliary Hydraulics -
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18. 3rd AUXILIARY QUICK COUPLERS –
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19. MANUAL DIRECTIONAL CONTROL VALVE (Bucket Cylinder – 3rd Auxiliary Couplers) – (If Equipped)
20. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE (Load Holding valve) – Boom
21. RELIEF VALVE - (Load Holding valve) – Boom
22. CHECK VALVE With Restriction - (Load Holding valve) – Boom
23. LOCK VALVES – BLADE CYLINDER (2)
    (If Equipped)
24. AUXILIARY QUICK COUPLERS – Male / Female
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    630 kPa (6,3 bar) (91 psi)
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56. ORIFICE – 0,8 mm (0.031 in)
57. ACCUMULATOR - Nitrogen 1020 kPa (10.2 bar) (148 psi) Precharged

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



WIRING SCHEMATIC
(Without Articulated Boom)
E85 (S/N B34S11001 AND ABOVE)

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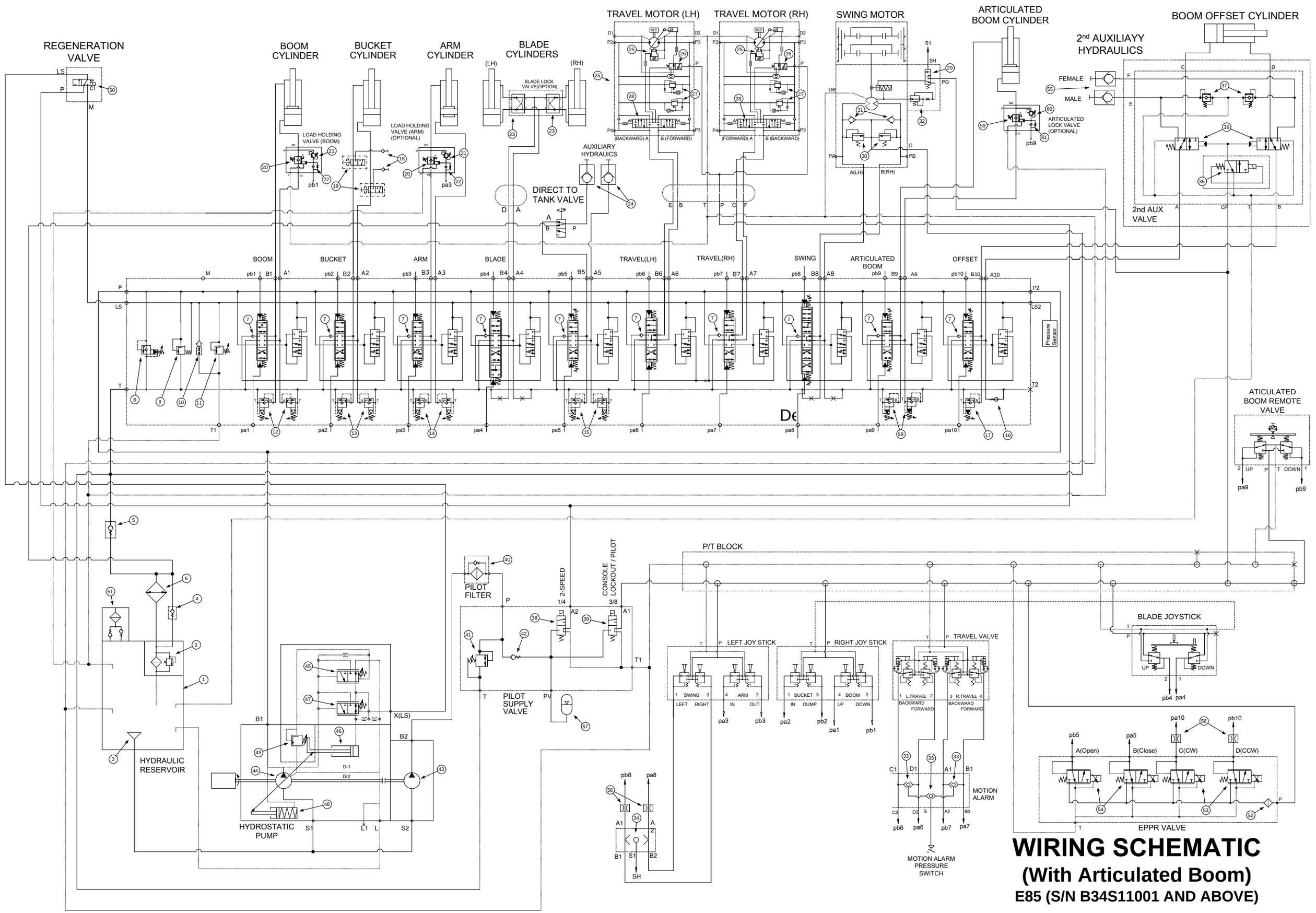
HYDRAULIC/HYDROSTATIC SCHEMATIC
With Articulated Boom
E85 (S/N B34S11001 AND ABOVE)

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56. ORIFICE – 0,8 mm (0.031 in)
57. ACCUMULATOR - Nitrogen 1020 kPa (10.2 bar) (148 psi) Precharged
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59. PILOT ACTIVATED DIRECTIONAL CONTROL VALVE (Load Holding valve) – Articulated Boom
60. RELIEF VALVE - (Load Holding valve) – Articulated Boom
61. CHECK VALVE With Restriction - (Load Holding valve) – Articulated Boom

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



WIRING SCHEMATIC

(With Articulated Boom)

E85 (S/N B34S11001 AND ABOVE)

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Glossary Of Hydraulic / Hydrostatic Symbols

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

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Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

SYMBOL DESCRIPTION

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



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



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

PUMP: To convert mechanical energy into hydraulic energy



FIXED CAPACITY DISPLACEMENT HYDRAULIC PUMP – With one direction of flow



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

MOTOR: To convert hydraulic energy into rotary mechanical energy



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

SYMBOL DESCRIPTION

CONTROL MECHANISMS



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



CONTROL VALVE ACTIVATED BY A PULL BUTTON (manual)



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



CONTROL VALVE ACTIVATED BY A LEVER (manual)



CONTROL VALVE ACTIVATED BY A PEDAL (manual)



CONTROL VALVE WITH SPRING RETURN (mechanical)



CONTROL VALVE ACTIVATED BY AN ELECTRIC SOLENOID (electrical)



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

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Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

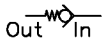
GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

SYMBOL DESCRIPTION

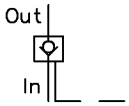
NON–RETURN VALVE, SHUTTLE VALVE: Valve which allows free flow in one direction only



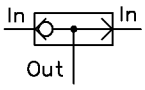
NON–RETURN VALVE (Check Valve) – Used as Replenishing Valve, Load Check Valve or Anticavitation Valve – Opens if the Inlet pressure is higher than the Outlet pressure. Often contains internal spring which has NO significant pressure value



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



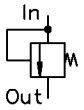
PILOT CONTROLLED NON–RETURN VALVE – It is possible to open the valve by pilot pressure



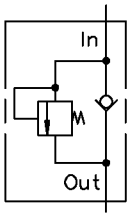
SHUTTLE VALVE – The Inlet port connected to the higher pressure is automatically connected to the Outlet port while the other Inlet port is closed

SYMBOL DESCRIPTION

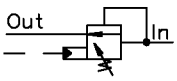
PRESSURE CONTROL VALVE: Valve ensuring the control of pressure



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



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

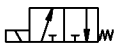


DUAL PRESSURE RELIEF VALVE – When the inlet pressure overcomes the opposing force of the spring, the valve opens permitting flow from the Outlet port. Pilot pressure provides a second pressure value.

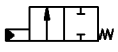
DIRECTIONAL CONTROL VALVE: Valve providing for the opening (fully or restricted) or the closing of one or more flow paths (represented by several squares)



TWO PORTS and CLOSED FLOW PATHS

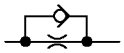


SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (Two Position) – controlled by an electric solenoid (with return spring)



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

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



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



TOW VALVE – Normally in closed position

MS-1892-3

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Troubleshooting The Hydraulic Circuit

PROBLEM	CAUSE	CORRECTION
No hydraulic operation at one or more circuits.	Hydraulic oil level low.	Refill with correct oil.
	Hydraulic pump drive coupling damaged.	Replace
	Hydraulic pump defective.	Repair or replace.
	Pump pressure too low.	Readjust or replace.
Hydraulic power insufficient to one or more circuits.	Pump pressure setting incorrect.	Readjust or replace.
All hydraulic speed too slow.	Torque limiter supply spool set too low.	Readjust.
	Hydraulic oil level or viscosity incorrect.	Fill to correct level. Use correct viscosity oil.
	Pump margin too low.	Test and adjust.
	Engine rpm reduced.	Readjust or replace.
	Torque limiter set too low / high.	Test and adjust.
	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.	Fill to correct level.
	Non recommended hydraulic oil.	Replace.
	One or more port relief valves not set correctly.	Readjust or replace.
	Extreme operating conditions. High ambient temperature. (IE: Enclosed structure).	
	Fan belt loose.	Tighten fan belt.
	Piston pump margin too high.	
Pump (Piston) response slow.	Pump minimum displacement set too low.	Readjust.

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Troubleshooting The Cylinder Circuit

PROBLEM	CAUSE	CORRECTION
Cylinder inoperable.	Pump torque limiter supply spool not shifting.	Repair or replace.
	Control console raised.	Lower control console.
	Loose fittings or broken hoses.	Repair or replace.
	Low psi at joystick.	Check, repair or replace pressure reducing valve.
	Control console lockout switch.	Readjust or replace.
	Cylinder internal leakage excessive.	Repair or replace.
	Joystick pressure reducing valve defective.	Repair or replace.
	Joystick internal leakage excessive.	Repair or replace.
	Pump margin spool not shifting.	Repair or replace.
	Load sense relief valve set too low.	Repair or replace.
Cylinder force insufficient. .	Lever linkage incorrectly adjusted.	Readjust.
	Pump pressure too low.	Readjust or replace.
	Pump torque limiter too low.	Readjust or replace.
Cylinder speed too slow.	Engine rpm low.	Check rpm or increase engine speed.
	Cylinder internal leakage excessive.	Repair or replace.
	Joystick pressure reducing valve defective.	Repair or replace.
	Control valve internal leakage excessive.	Repair or replace.
	Joystick internal leakage excessive.	Repair or replace.
	Low or dirty fluid.	Add or replace the hydraulic fluid.
	Load sense relief valve malfunctioning.	Readjust or replace.
	Pump margin too low.	Repair or replace.
	Pump torque limiter too low.	Readjust or replace.

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Troubleshooting The Swing (Slew) Circuit

PROBLEM	CAUSE	CORRECTION
Swing not operating.	Swing brake not releasing.	Repair or replace.
	Lower control console.	Lower control console.
	Control console lockout switch incorrectly adjusted or defective.	Readjust or replace.
	Swing motor gear defective.	Repair or replace.
	Joystick internal leakage excessive.	Repair or replace.
	Swing motor defective.	Repair or replace.
Swing force.	Pump pressure set too low.	Readjust or replace.
	Swing motor relief valve pressure too low.	Readjust or replace.
Swing speed too slow.	Swing brake not releasing.	Repair, replace or adjust.
	Engine rpm low.	Adjust.
	Pump flow low. (Gear pump)	Check, repair or adjust.
	Blocked or restricted line to swing motor.	Replace.
	Joystick internal leakage excessive.	Repair or replace.
	Control valve internal leakage excessive. (Three spool valve)	Repair or replace.
	Swing motor internal leakage excessive.	Repair or replace.
Swing over run excessive.	Control valve spool sticking.	Repair or replace.
	Joystick spool sticking.	Repair or replace.
	Swing motor relief valve set too low.	Repair or replace.
	Swing motor internal leakage excessive.	Repair or replace.
Swing motor seal leakage.	Return line plugged.	Inspect, clean or replace.

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Troubleshooting The Travel Circuit

PROBLEM	CAUSE	CORRECTION
Travel system inoperable.	Pilot pressure too low.	Repair or readjust.
	Console switch not closed.	Repair or replace.
	Track tension too tight.	Readjust.
	Defective pump. (Piston 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.
	Pump pressure too low.	Readjust.
Travel power.	Track tension too tight.	Readjust.
	Travel motor check valve leaking.	Readjust or replace.
	Pump pressure too low.	Readjust.
	Torque limiter too low.	Readjust.
	Swivel joint leaking.	Repair or replace.
	Travel motor counterbalance spool sticking.	Repair or replace.
Travel speed too slow.	Engine rpm low.	Readjust.
	Pilot pressure low.	Readjust.
	Pump margin too low.	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.
Travel motor seal leakage.	Case drain line plugged.	Inspect, clean or replace.

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Troubleshooting The Travel Circuit (Cont'd)

PROBLEM	CAUSE	CORRECTION
Machine not running straight.	Track tension not equal.	Readjust.
	Travel motor internal leakage not equal.	Repair or replace.
	Travel motor counter balance spool sticking.	Repair or replace.
	Pump 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.	Valve compensators not equal.	Repair or replace.
	Travel motor counterbalance valve leakage excessive.	Repair or replace.
Blade drops while machine is moving.	Cylinder internal leakage excessive.	Repair or replace.
	Control valve internal leakage excessive.	Repair or replace.
	Swivel joint internal leakage from travel motor pressure circuit into blade cylinder circuit.	Repair or replace.
High / low gear switch inoperative (two-speed).	Control valve defective.	Replace.
	Torque limiter set too low.	Readjust.
	Pump pressure set too low.	Readjust.
	Switch defective.	Replace.
	Faulty pressure reducing valve.	Repair or replace.
	Bad solenoid.	Replace.

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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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The hydraulic system has two separate hydraulic circuits.

The piston pump circuit supplies fluid to the hydraulic control valve.

The hydraulic control valve contains the boom, bucket, arm, blade, auxiliary, left and right travel, boom swing and upperstructure swing valve sections.

Figure 20-10-1

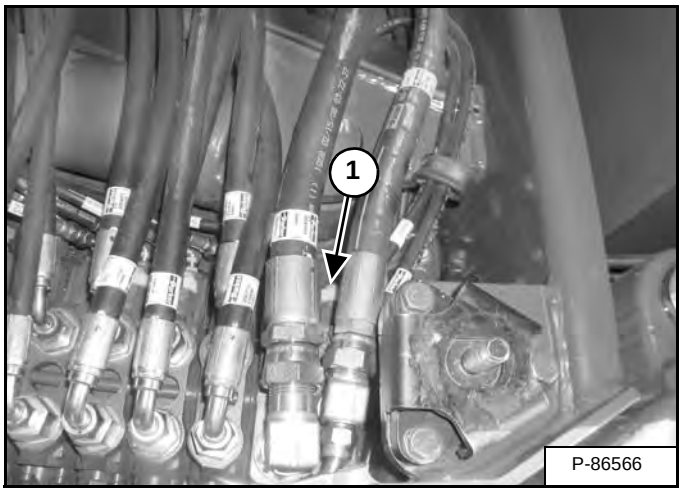
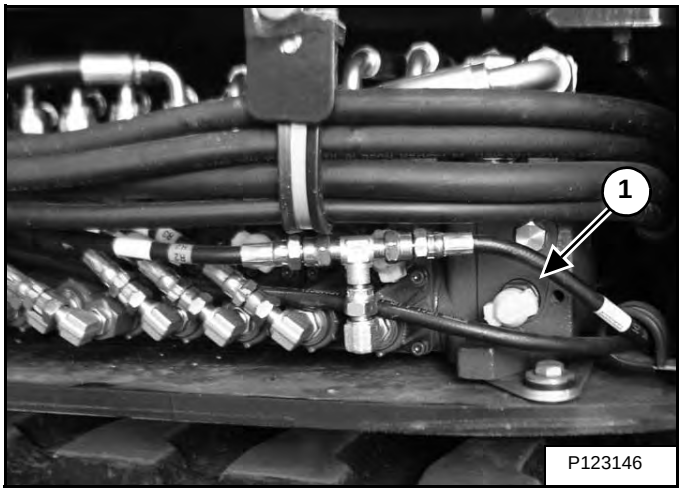


Figure 20-10-2



A load sense relief valve (Item 1) **[Figure 20-10-1]** and safety relief valve (Item 1) **[Figure 20-10-2]** protect the valve from high pressure.

The gear pump circuit supplies fluid to the manifold assembly / accumulator.

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CYLINDER (BOOM)

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.

Remove both articulated boom cylinders. (See Removal And Installation on page 20-25-3.) (Optional)

Figure 20-20-1

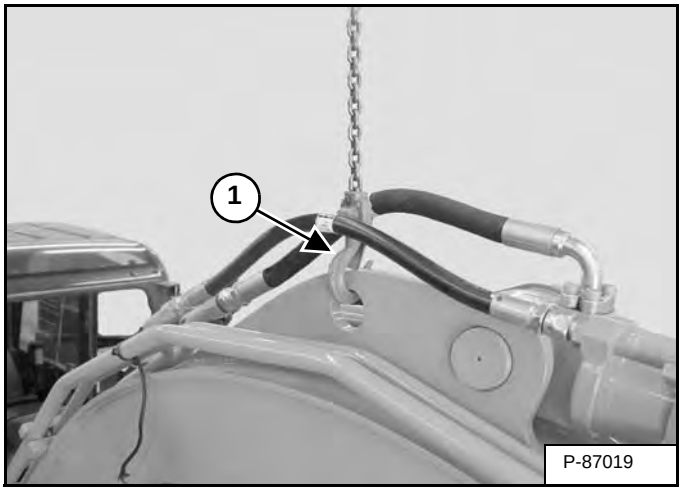
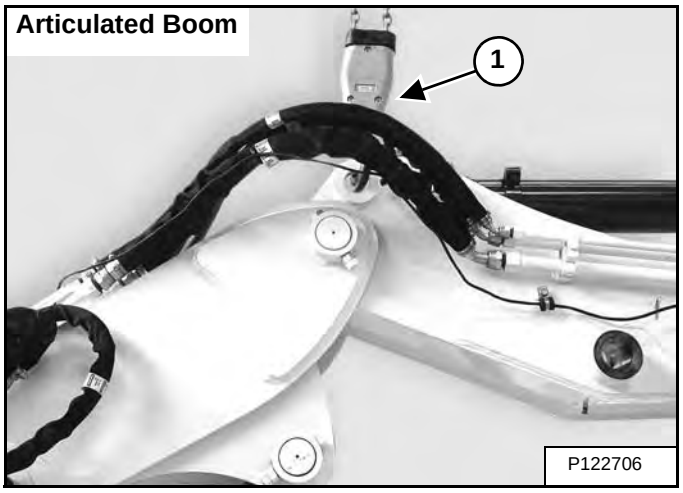


Figure 20-20-2



Support the boom with a chain hoist (Item 1) **[Figure 20-20-1]** or **[Figure 20-20-2]**.

Figure 20-20-3

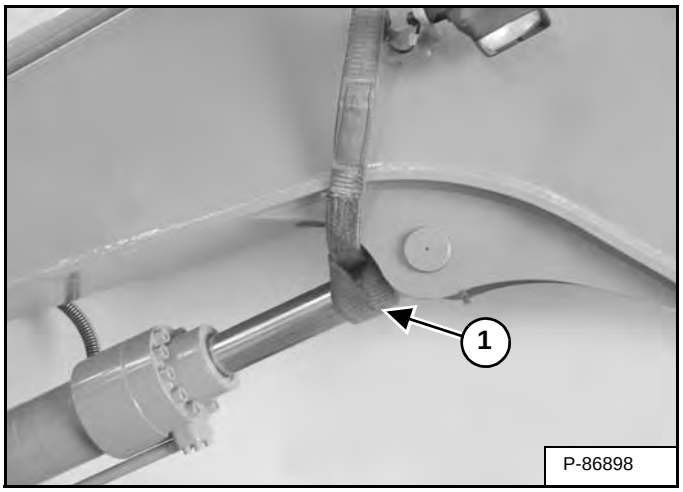
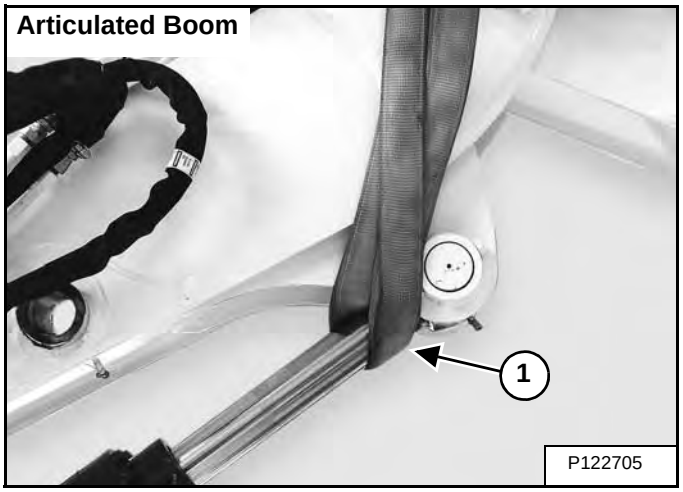


Figure 20-20-4



Install a sling (Item 1) **[Figure 20-20-3]** or **[Figure 20-20-4]** and a lifting device to the rod end of the boom cylinder.

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Testing (Cont'd)

Figure 20-20-5

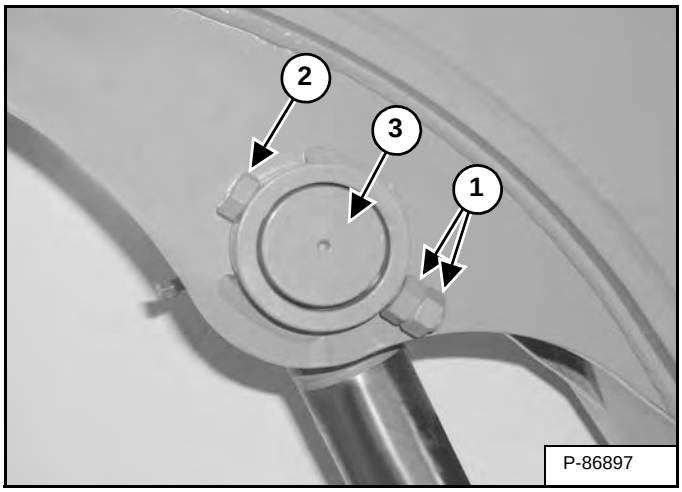
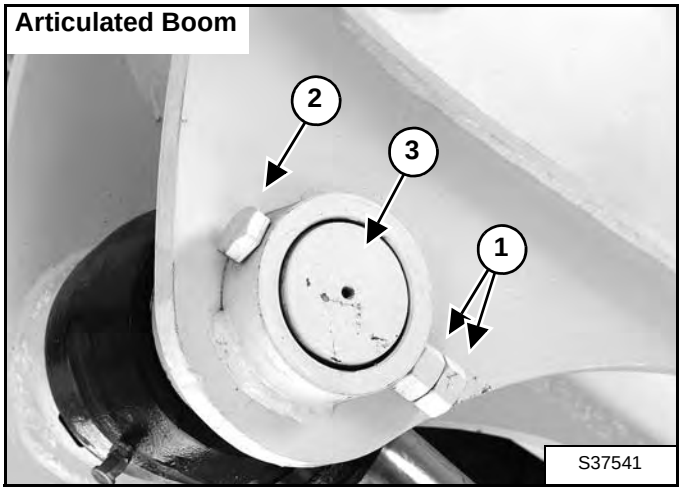


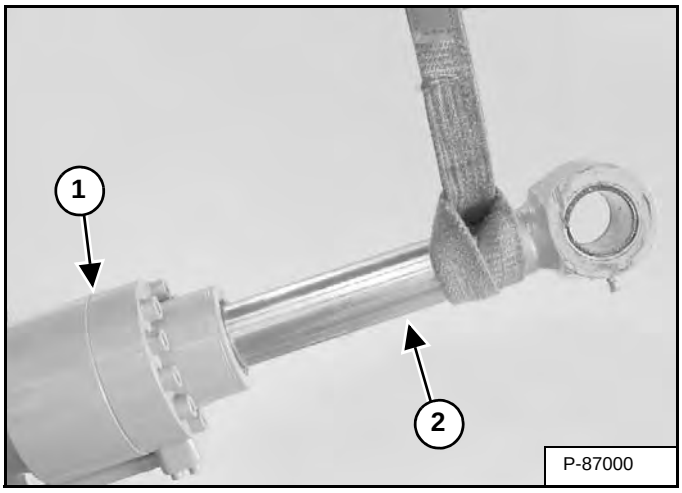
Figure 20-20-6



Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-20-5]** or **[Figure 20-20-6]**.

Remove the rod end pivot pin (Item 3) **[Figure 20-20-5]** or **[Figure 20-20-6]**.

Figure 20-20-7



Lower the cylinder (Item 1) **[Figure 20-20-7]**.

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

Stop the engine. Relieve hydraulic pressure.

WARNING

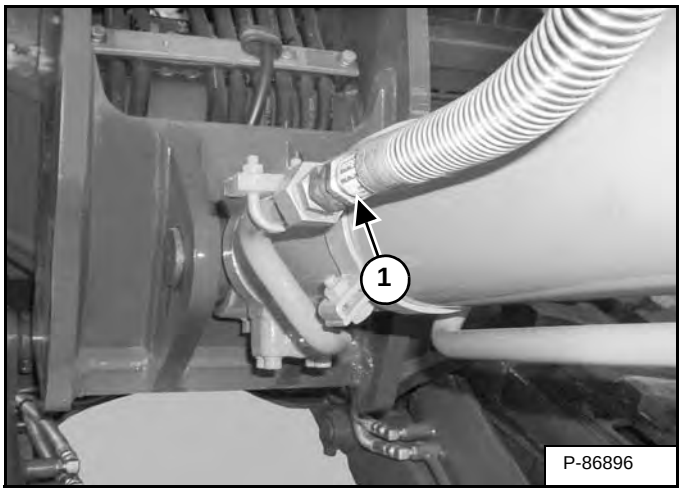
Hydraulic fluid escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. This can cause serious injury and possible death if proper medical treatment by a physician familiar with this injury is not received immediately.

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Testing (Cont'd)

Figure 20-20-8



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

Start the engine and move the hydraulic control lever to the boom cylinder retract position.

If there is any oil leakage from the base end fitting (Item 1) **[Figure 20-20-8]**, remove the cylinder for repair or replacement.

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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.

Remove both articulated boom cylinders. (See Removal And Installation on page 20-25-3.) (Optional)

Figure 20-20-9

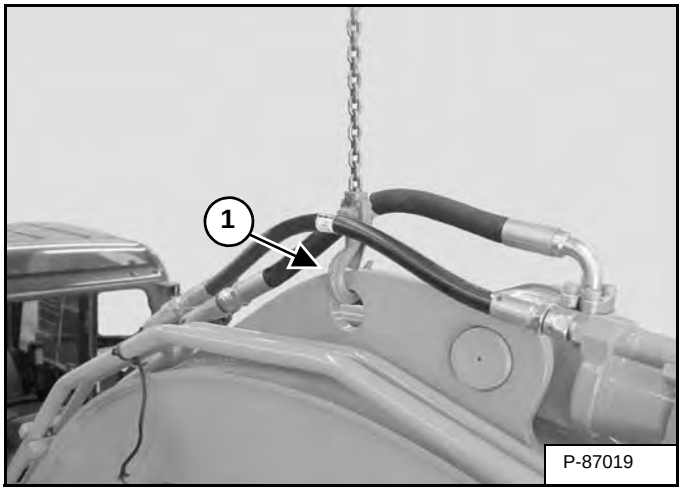
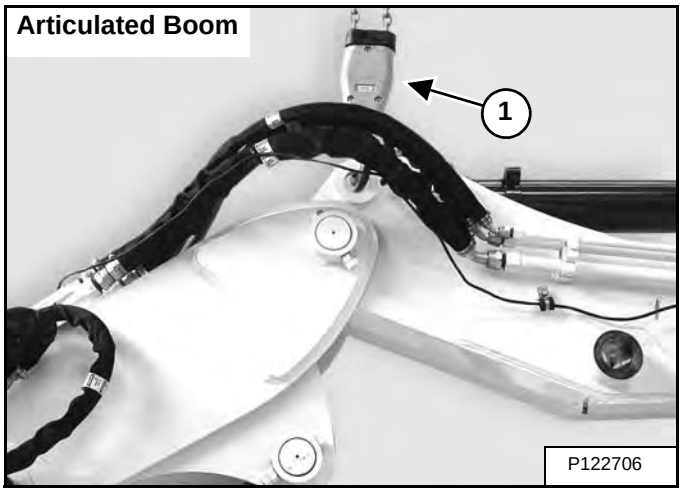


Figure 20-20-10



Support the boom with a chain hoist (Item 1) **[Figure 20-20-9]** or **[Figure 20-20-10]**.

Figure 20-20-11

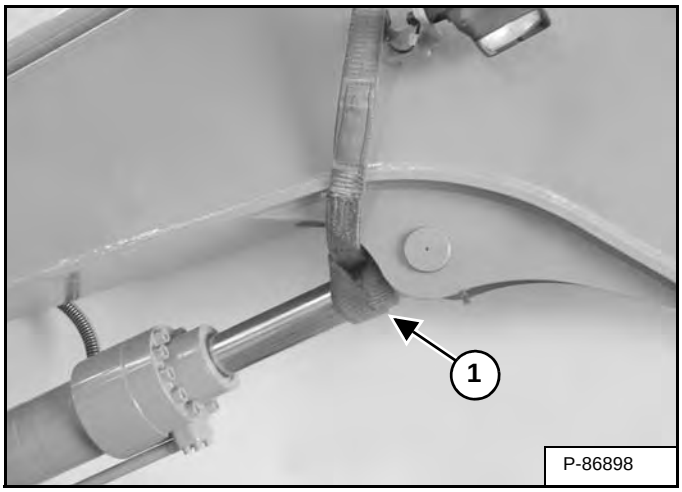
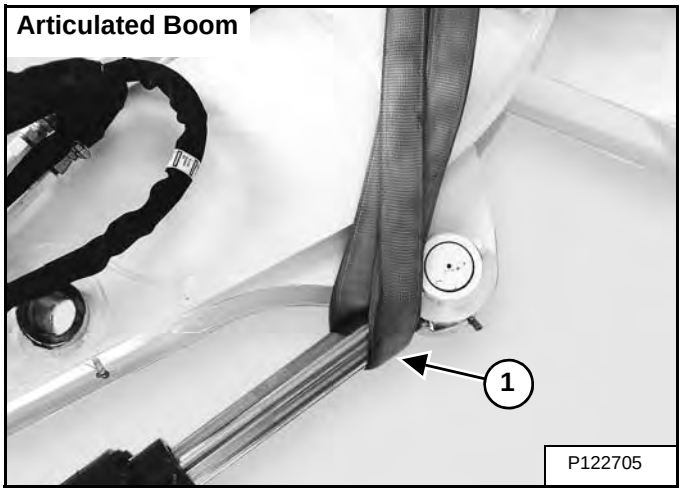


Figure 20-20-12



Install a sling (Item 1) **[Figure 20-20-11]** or **[Figure 20-20-12]** and a lifting device to the rod end of the boom cylinder.

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Removal And Installation (Cont'd)

Figure 20-20-13

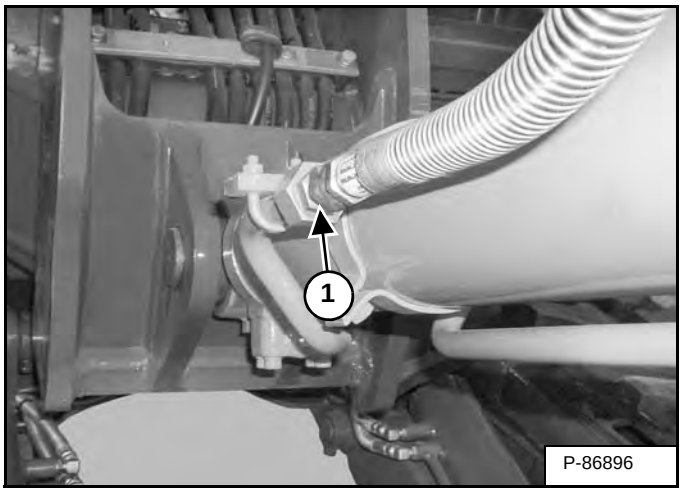
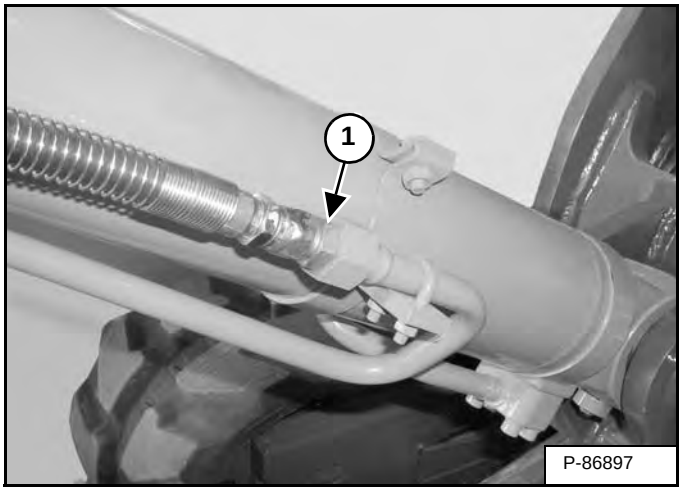


Figure 20-20-14



Remove the hoses (Item 1) **[Figure 20-20-13]** and **[Figure 20-20-14]**.

Figure 20-20-15

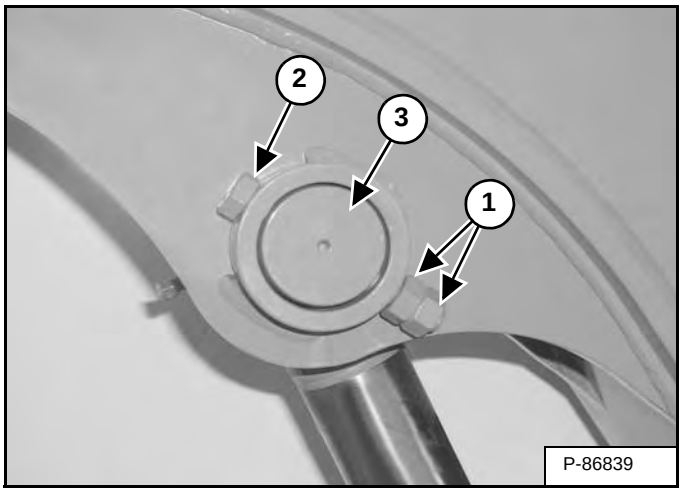
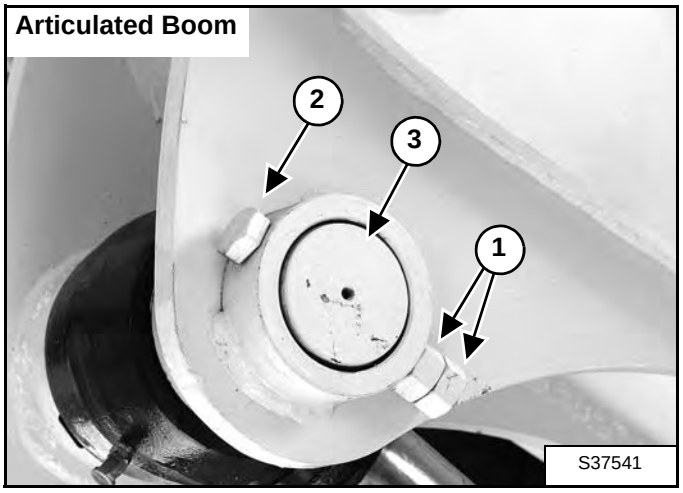


Figure 20-20-16



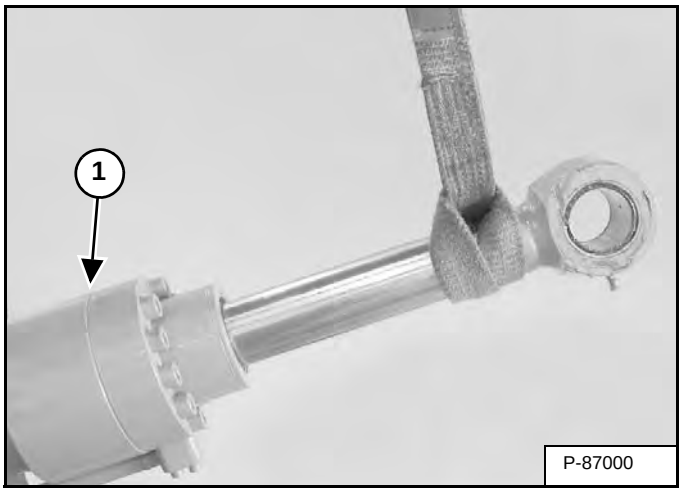
Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-20-15]**.

Remove the rod end pivot pin (Item 3) **[Figure 20-20-15]**.

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Removal And Installation (Cont'd)

Figure 20-20-17



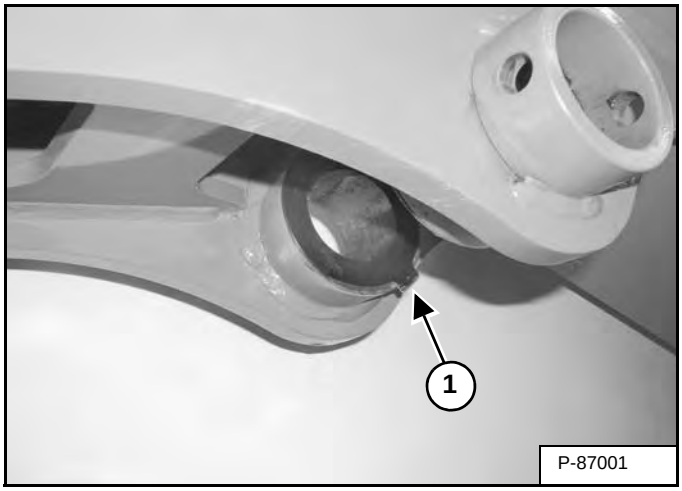
Lower the cylinder (Item 1) **[Figure 20-20-17]** until it rests on the blade.

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.

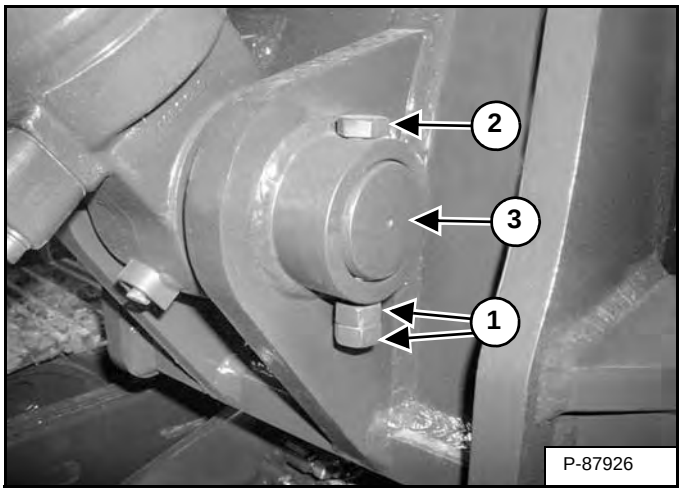
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Figure 20-20-18



Remove the shims (Item 1) **[Figure 20-20-18]** from both sides.

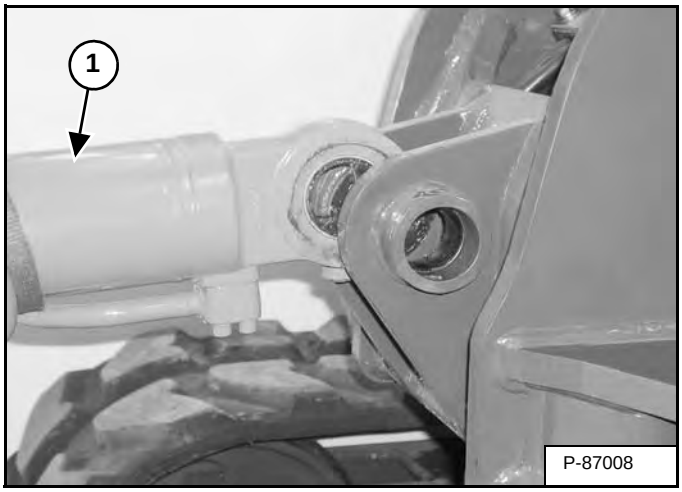
Figure 20-20-19



Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-20-19]**.

Remove the base end pivot pin (Item 3) **[Figure 20-20-19]**.

Figure 20-20-20

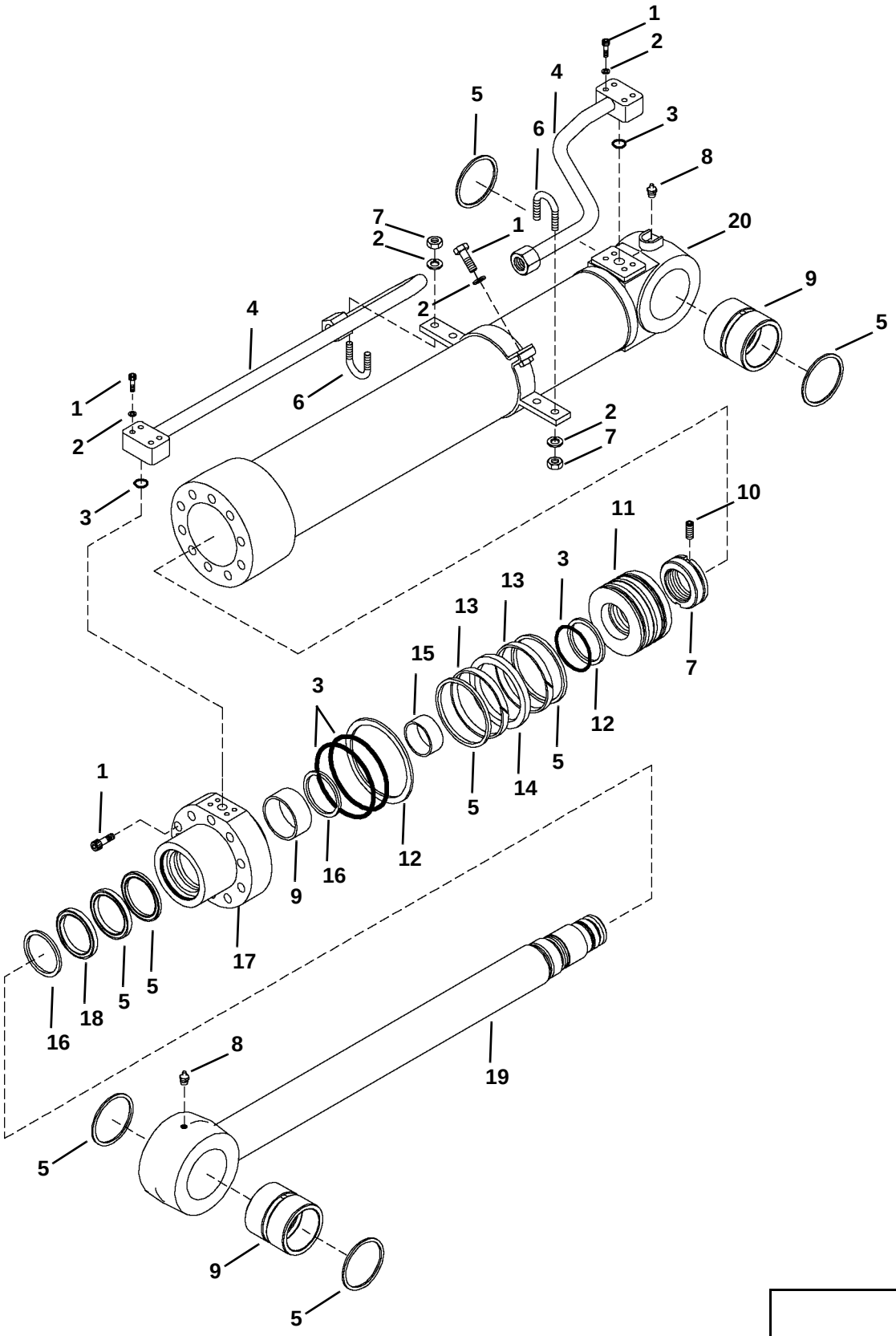


Remove the cylinder (Item 1) **[Figure 20-20-20]**.

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Parts Identification

1. Bolt
2. Washer
3. O-ring
4. Tubeline
5. Seal
6. U-bolt
7. Nut
8. Grease Fitting
9. Bushing
10. Set Screw
11. Piston
12. Back-up Ring
13. Wear Ring
14. Seal Assembly
15. Cushion Ring
16. Snap Ring
17. Head
18. Wiper Seal
19. Rod
20. Housing



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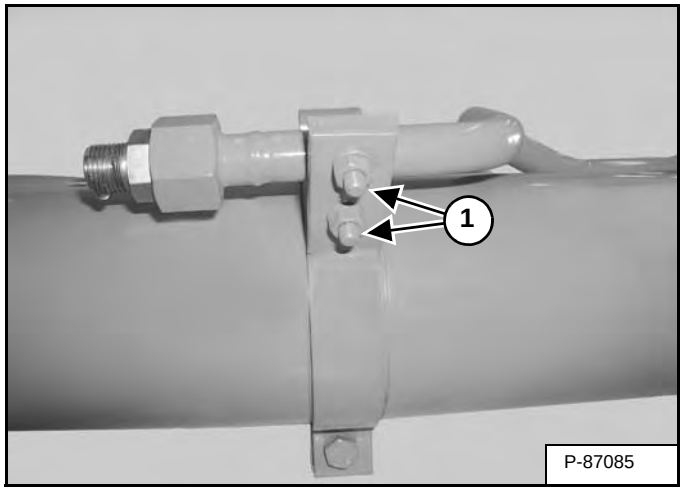
Disassembly

Use the following tools to disassemble the cylinder:

MEL1074 - O-ring Seal Hook

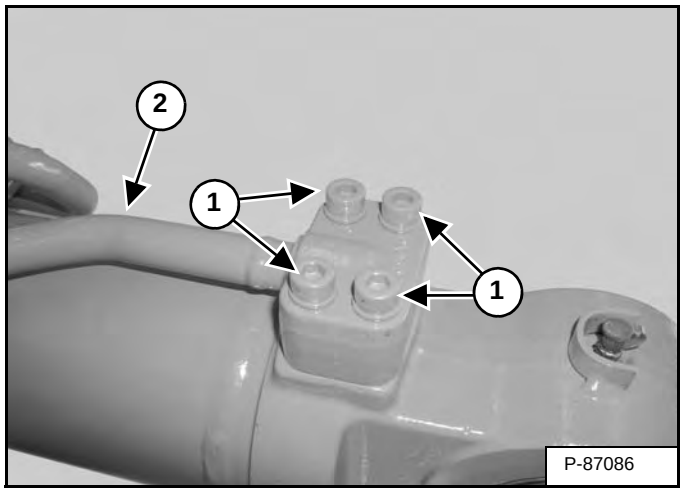
Hold the hydraulic cylinder over a drain pan and slowly move the rod in and out to remove the fluid from the cylinder.

Figure 20-20-21



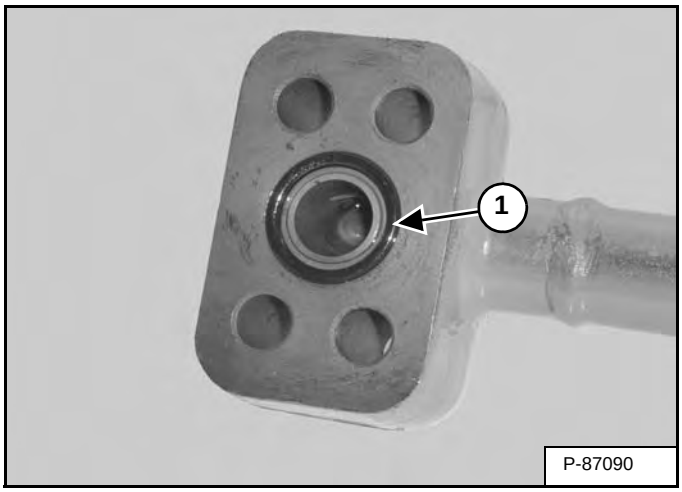
Remove the two nuts (Item 1) **[Figure 20-20-21]**, lock washers and U-bolt.

Figure 20-20-22



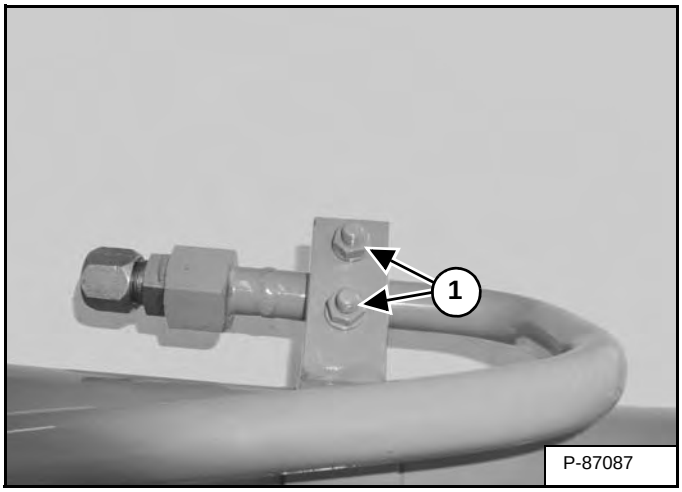
Remove the four bolts (Item 1) and the tubeline (Item 2) **[Figure 20-20-22]**.

Figure 20-20-23



Remove the O-ring (Item 1) **[Figure 20-20-23]** from the tubeline.

Figure 20-20-24

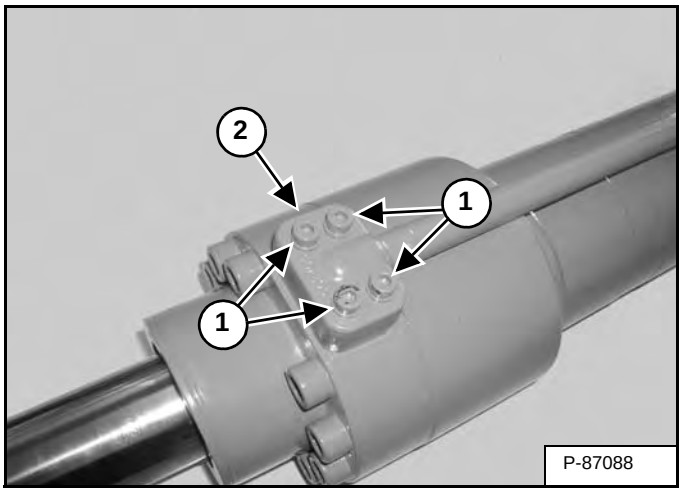


Remove the two nuts (Item 1) **[Figure 20-20-24]**, lock washers and U-bolt.

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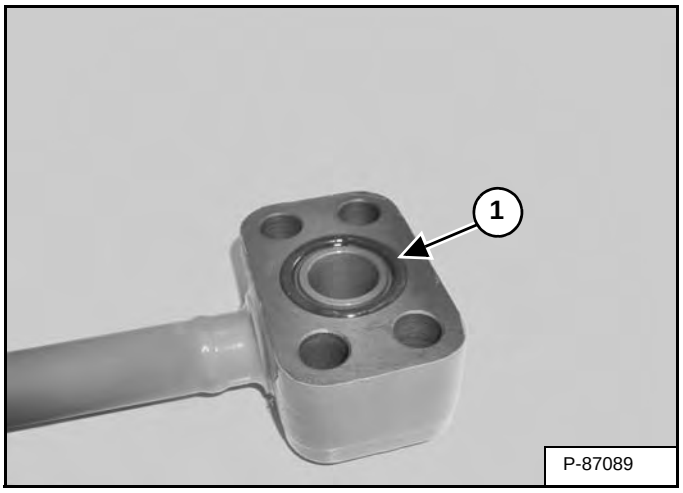
Disassembly (Cont'd)

Figure 20-20-25



Remove the four bolts (Item 1), lock washers and tubeline (Item 2) **[Figure 20-20-25]**.

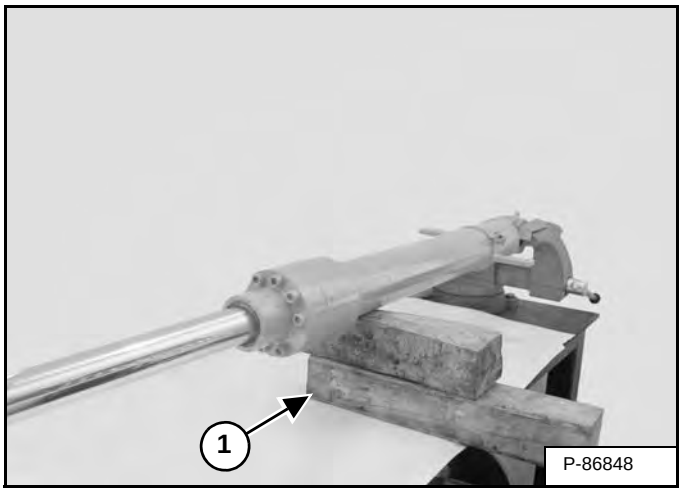
Figure 20-20-26



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

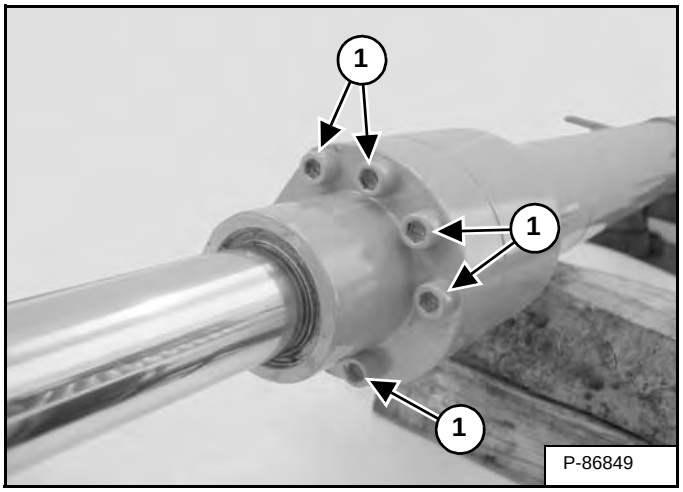
Clamp the base end of the cylinder in a vise.

Figure 20-20-27



Support the cylinder with a block (Item 1) **[Figure 20-20-27]**.

Figure 20-20-28

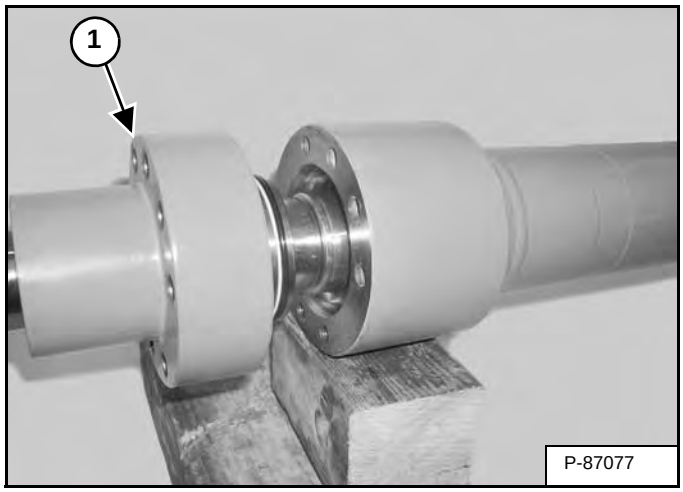


Remove the eight bolts (Item 1) **[Figure 20-20-28]**.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

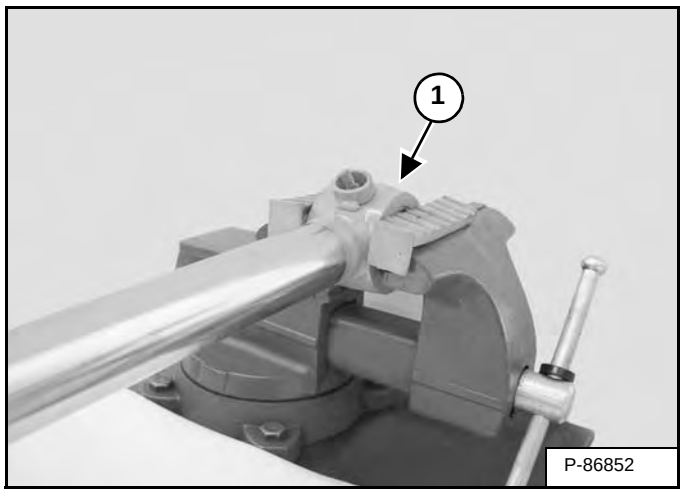
Figure 20-20-29



Remove the rod assembly (Item 1) **[Figure 20-20-29]** from the cylinder housing.

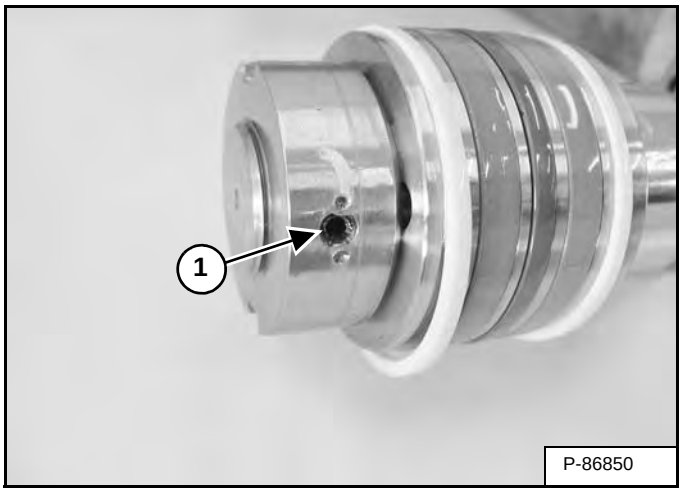
Remove the cylinder housing from the vise.

Figure 20-20-30



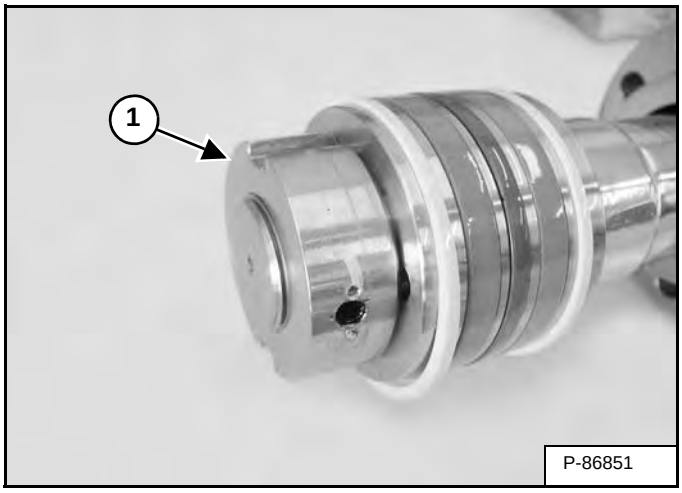
Clamp the rod end (Item 1) in a vise **[Figure 20-20-30]**.

Figure 20-20-31



Remove the set screw (Item 1) **[Figure 20-20-31]**.

Figure 20-20-32



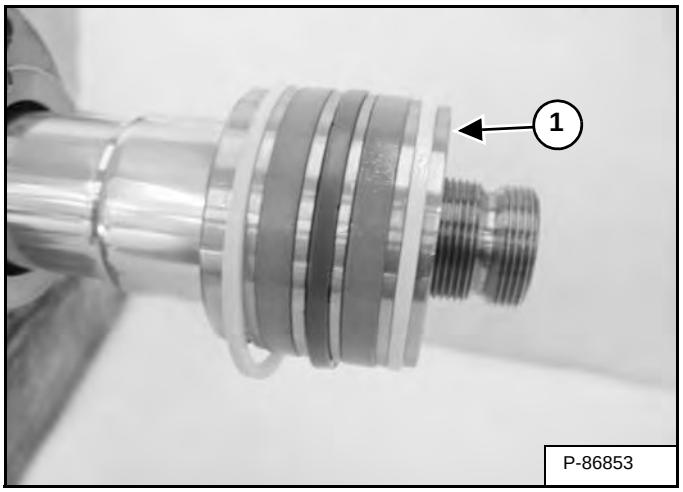
Apply moderate heat to the nut (Item 1) **[Figure 20-20-32]**.

Remove the nut.

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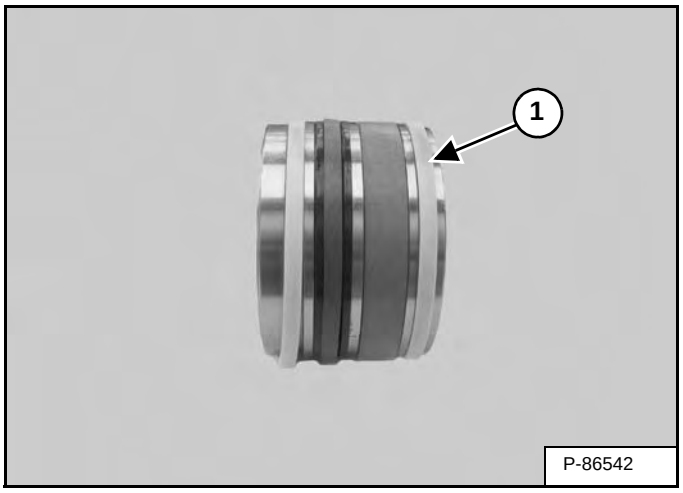
Disassembly (Cont'd)

Figure 20-20-33



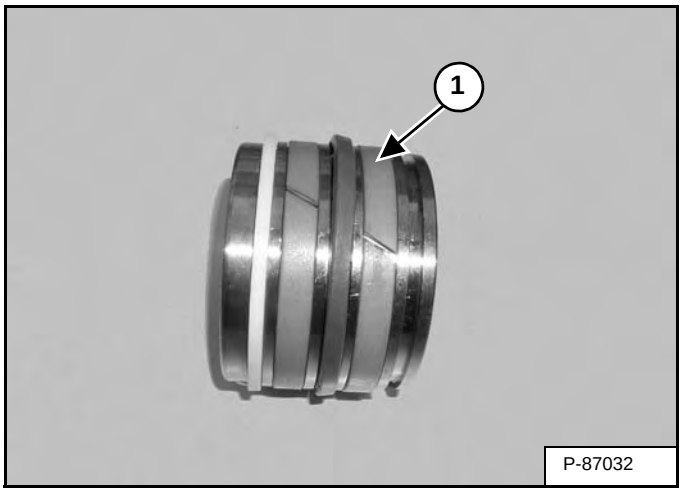
Remove the piston (Item 1) **[Figure 20-20-33]**.

Figure 20-20-34



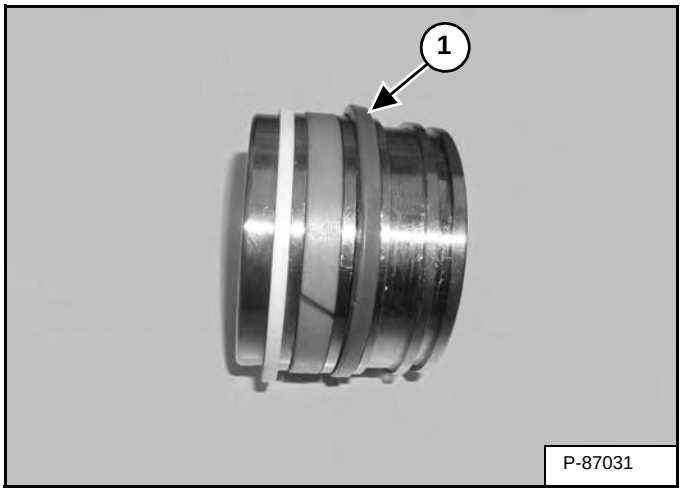
Remove the seal (Item 1) **[Figure 20-20-34]** from the piston.

Figure 20-20-35



Remove the wear ring (Item 1) **[Figure 20-20-35]** from the piston.

Figure 20-20-36

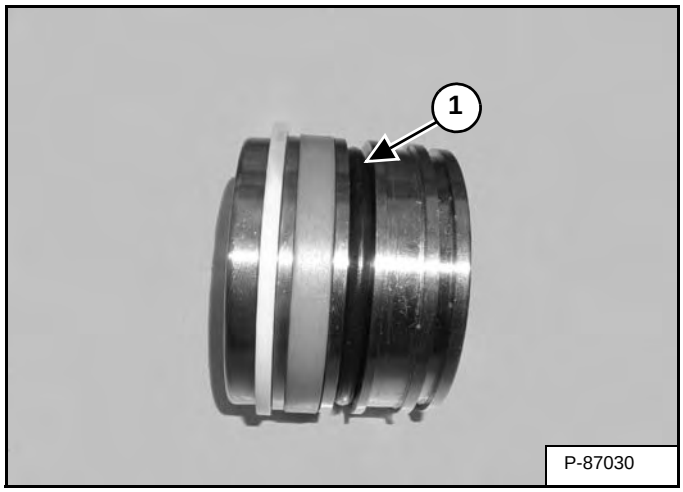


Remove the seal (Item 1) **[Figure 20-20-36]**.

Dealer Copy -- Not for Resale

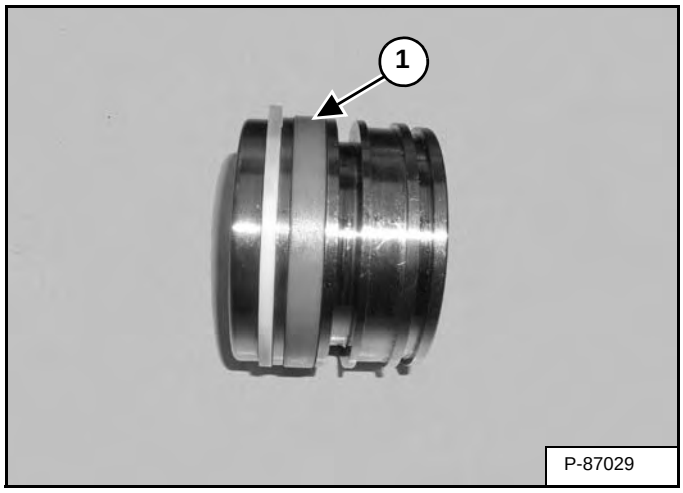
Disassembly (Cont'd)

Figure 20-20-37



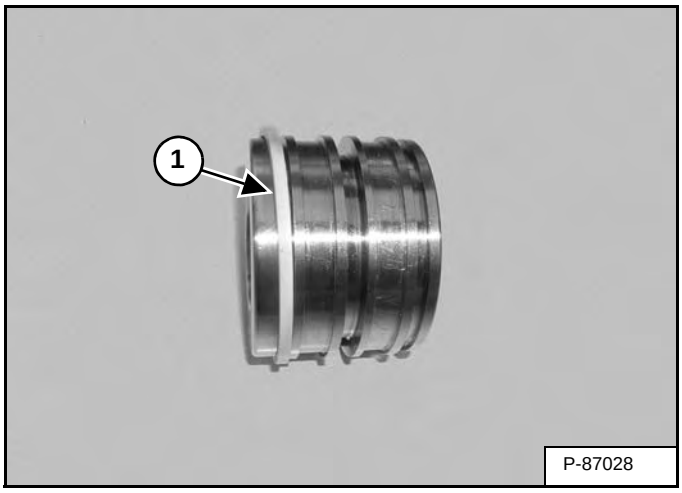
Remove O-ring (Item 1) **[Figure 20-20-37]** from the piston.

Figure 20-20-38



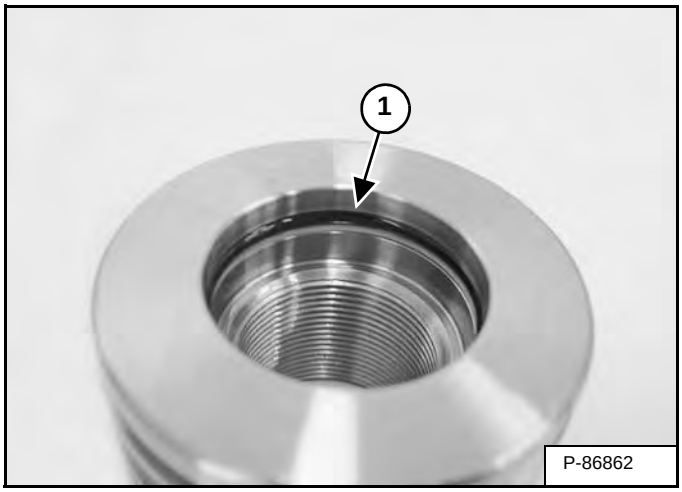
Remove the wear ring (Item 1) **[Figure 20-20-38]** from the piston.

Figure 20-20-39



Remove the seal (Item 1) **[Figure 20-20-39]** from the piston.

Figure 20-20-40

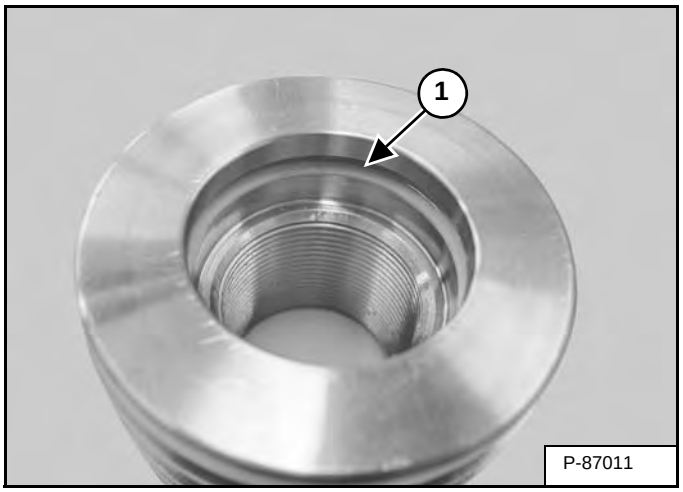


Remove the O-ring (Item 1) **[Figure 20-20-40]** from the piston.

Dealer Copy -- Not for Resale

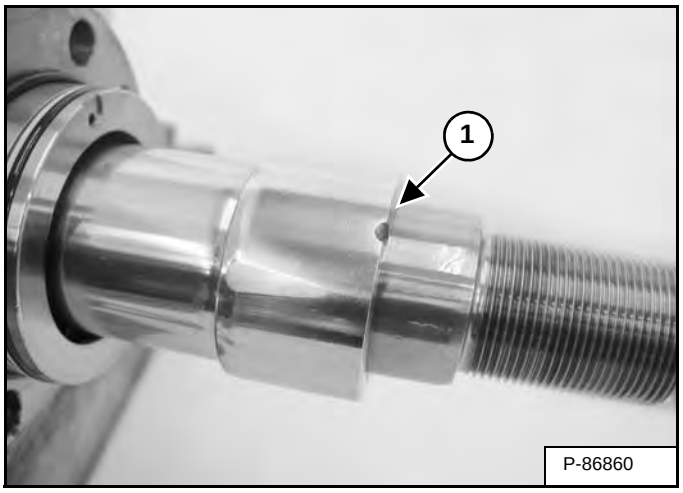
Disassembly (Cont'd)

Figure 20-20-41



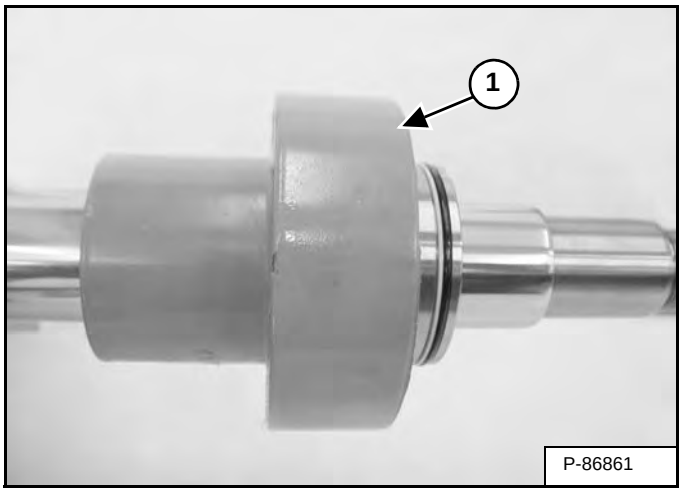
Remove the back-up ring (Item 1) **[Figure 20-20-41]** from the piston.

Figure 20-20-42



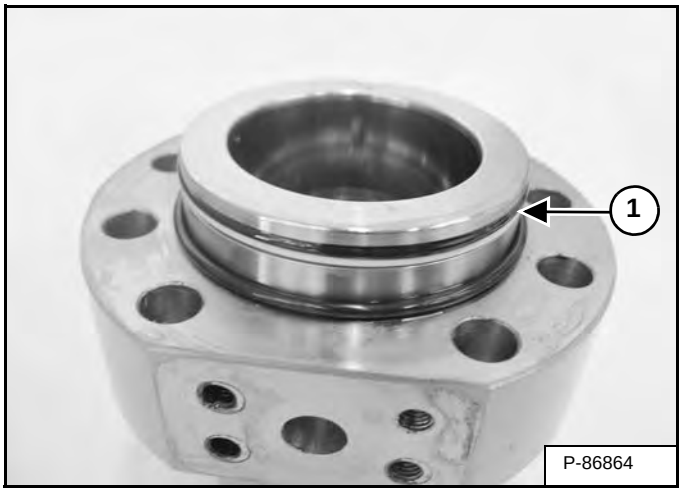
Remove the cushion ring (Item 1) **[Figure 20-20-42]** from the rod.

Figure 20-20-43



Remove the head (Item 1) **[Figure 20-20-43]** from the rod.

Figure 20-20-44

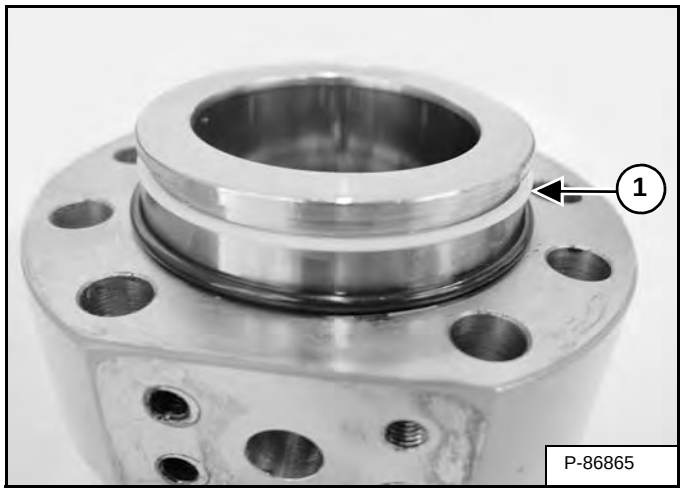


Remove the O-ring (Item 1) **[Figure 20-20-44]**.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

Figure 20-20-45



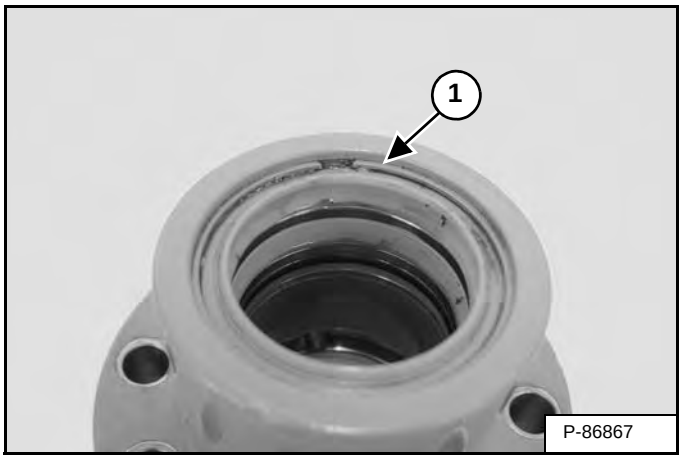
Remove the back-up ring (Item 1) **[Figure 20-20-45]**.

Figure 20-20-46



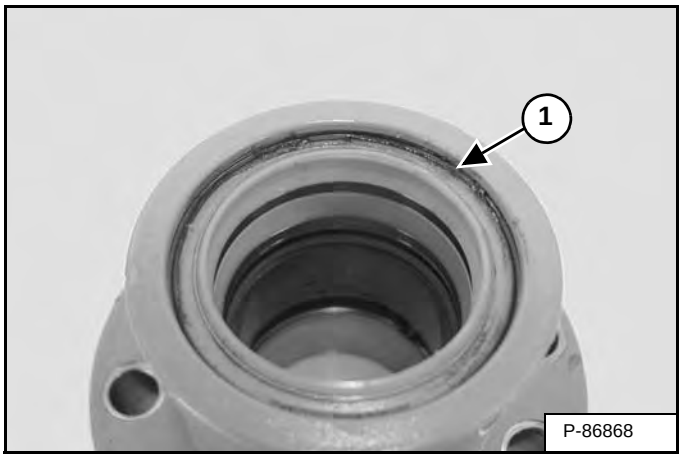
Remove the O-ring (Item 1) **[Figure 20-20-46]**.

Figure 20-20-47



Remove the snap ring (Item 1) **[Figure 20-20-47]**.

Figure 20-20-48

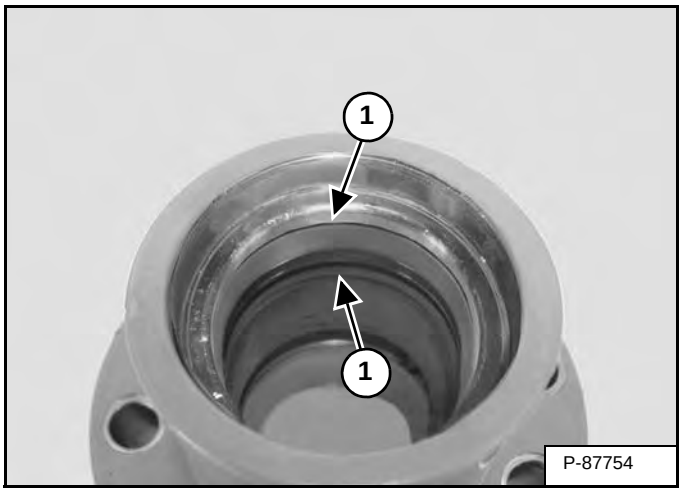


Remove the wiper seal (Item 1) **[Figure 20-20-48]**.

Dealer Copy -- Not for Resale

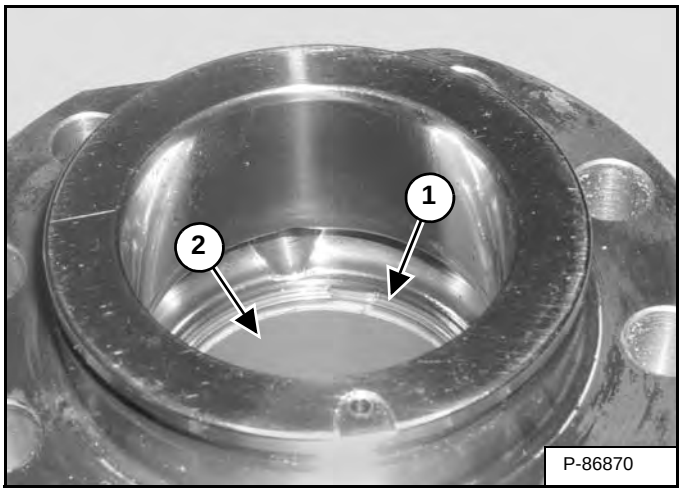
Disassembly (Cont'd)

Figure 20-20-49



Remove the two seals (Item 1) **[Figure 20-20-49]**.

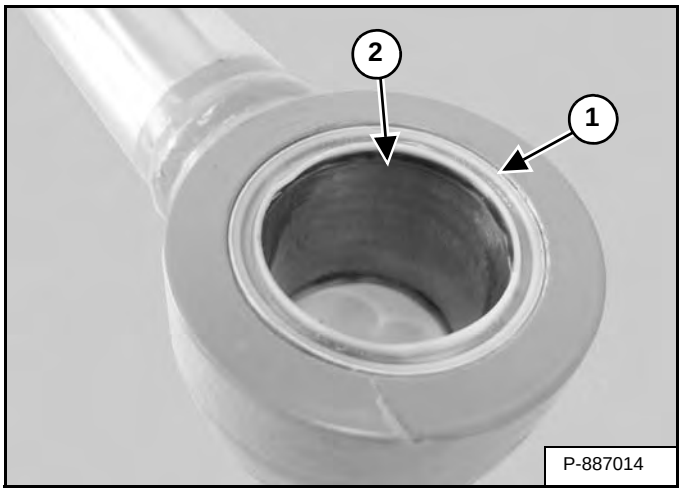
Figure 20-20-50



Remove the snap ring (Item 1) and bushing (Item 2) **[Figure 20-20-50]**.

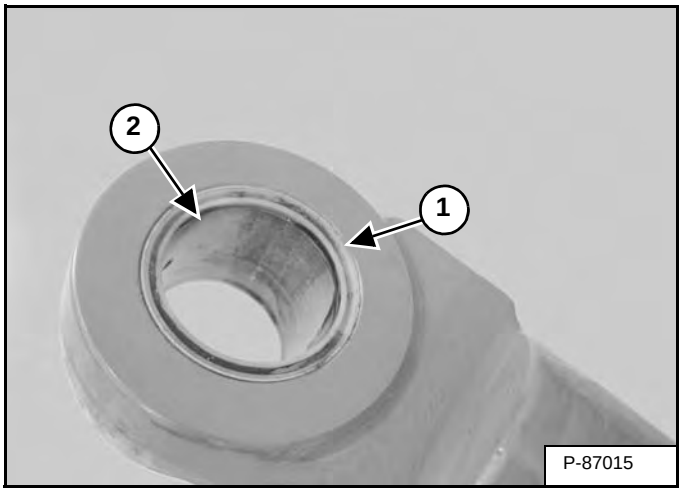
Remove the rod from the vise.

Figure 20-20-51



Remove the seal (Item 1) (both sides) and bushing (Item 2) **[Figure 20-20-51]** from the rod end.

Figure 20-20-52



Remove the seal (Item 1) (both sides) and bushing (Item 2) **[Figure 20-20-52]** from the base end.

Dealer Copy -- Not for Resale

Assembly

Use the following tools to assemble the cylinder:

MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
MEL1369-2 - Piston Ring Compressor

Wash the cylinder parts in clean solvent and dry with compressed air.

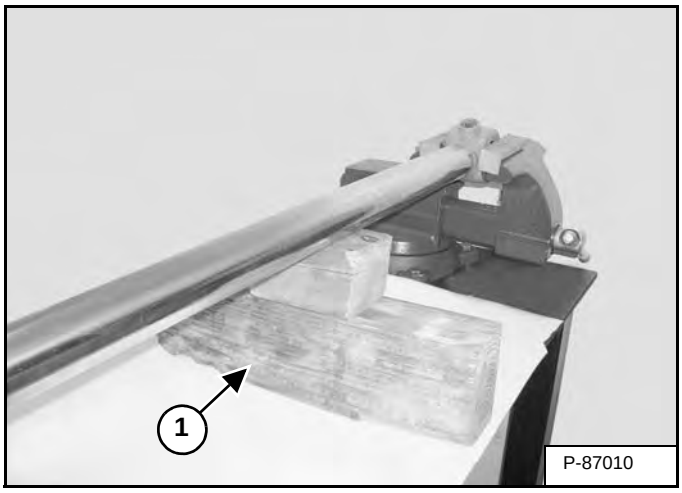
Inspect the cylinder parts for nicks, scratches and other damage. Replace any damaged parts.

Always install new O-rings and seals during assembly.

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

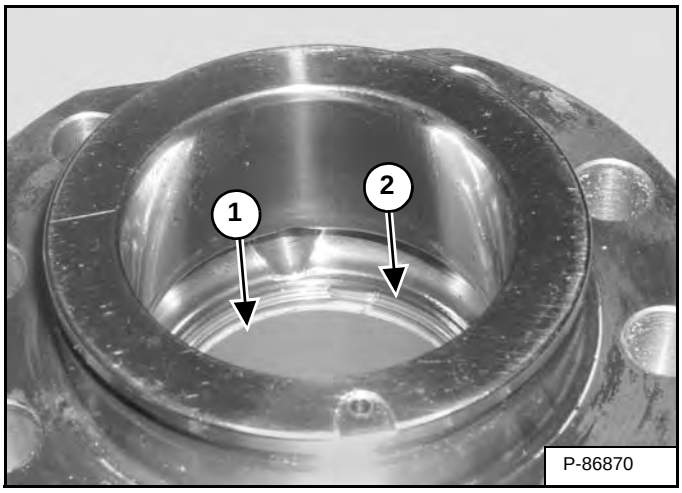
Clamp the rod end in a vise.

Figure 20-20-53



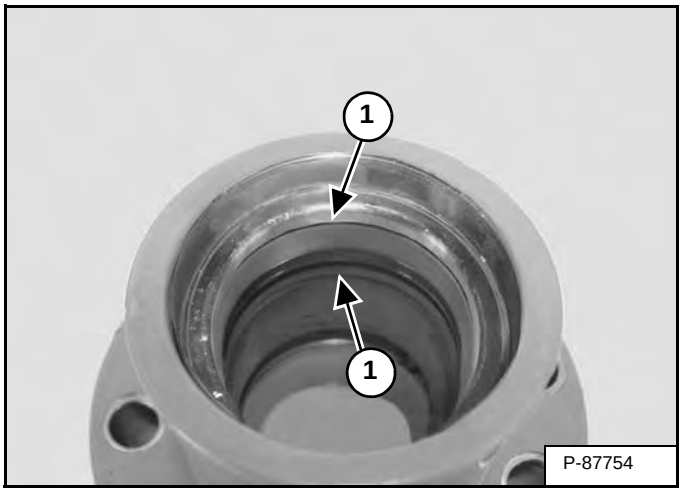
Support the end of the rod with a block (Item 1) **[Figure 20-20-53]**.

Figure 20-20-54



Install the bushing (Item 1) and snap ring (Item 2) **[Figure 20-20-54]** into the head.

Figure 20-20-55

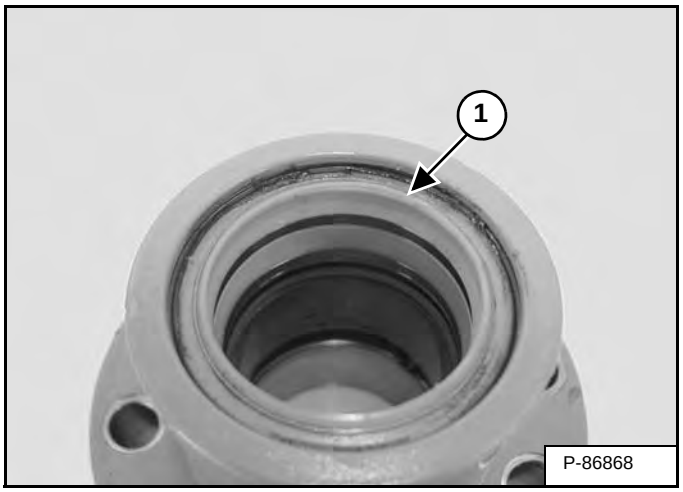


Install the two seals (Item 1) **[Figure 20-20-55]** into the head.

Dealer Copy -- Not for Resale

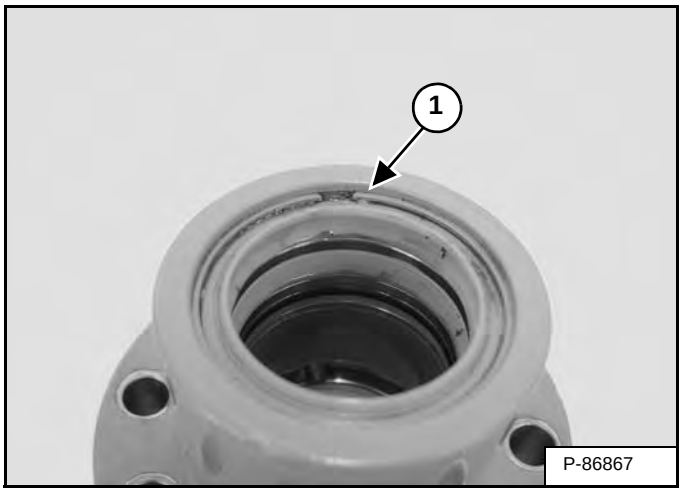
Assembly (Cont'd)

Figure 20-20-56



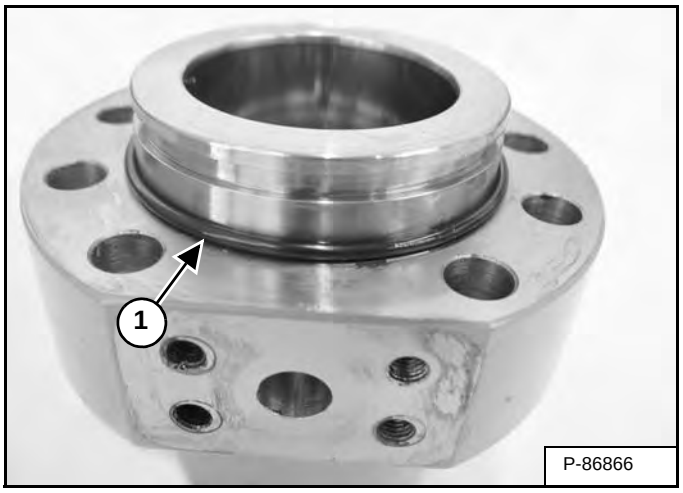
Install the wiper seal (Item 1) **[Figure 20-20-56]** into the head.

Figure 20-20-57



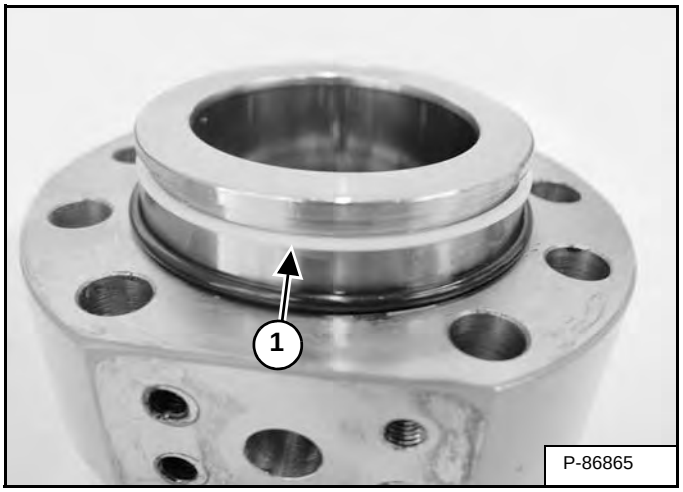
Install the snap ring (Item 1) **[Figure 20-20-57]** into the head.

Figure 20-20-58



Install the O-ring (Item 1) **[Figure 20-20-58]** onto the head.

Figure 20-20-59

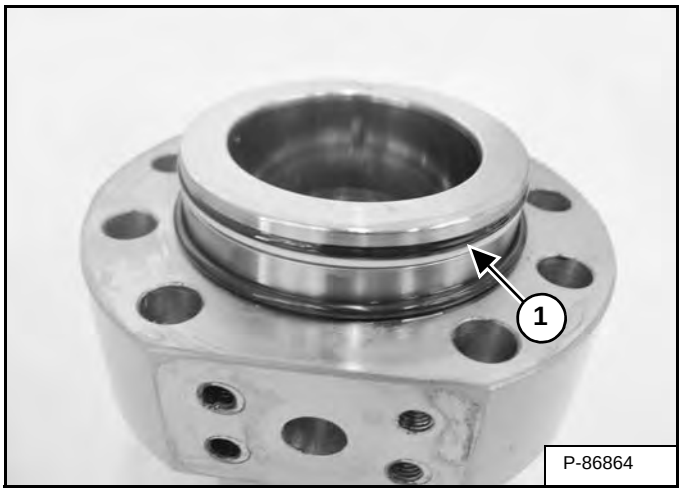


Install the back-up ring (Item 1) **[Figure 20-20-59]** onto the head.

Dealer Copy -- Not for Resale

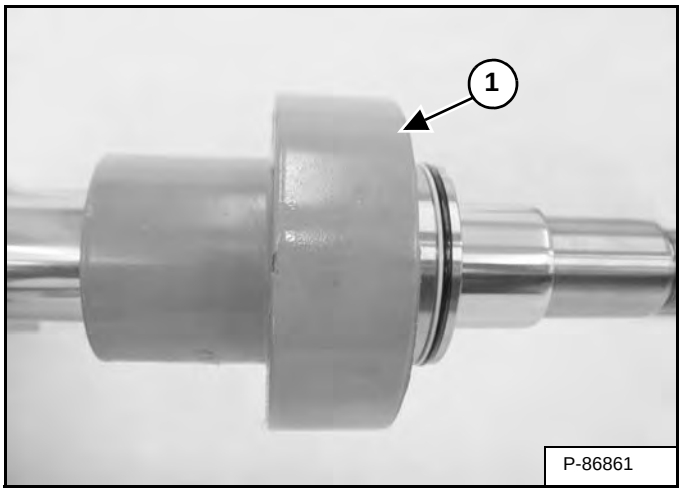
Assembly (Cont'd)

Figure 20-20-60



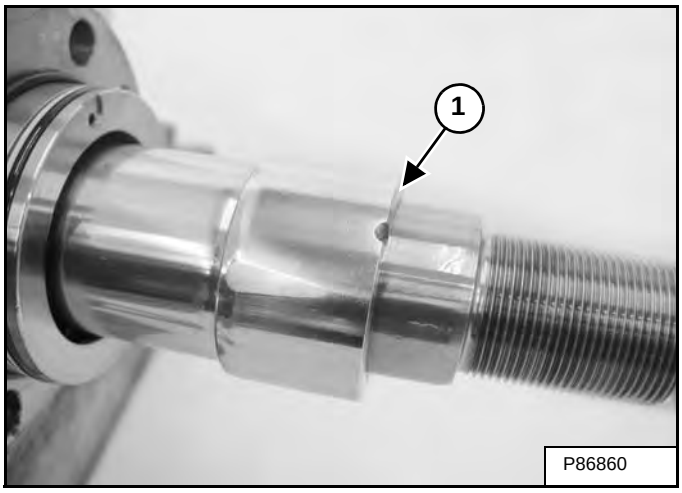
Install the O-ring (Item 1) **[Figure 20-20-60]**.

Figure 20-20-61



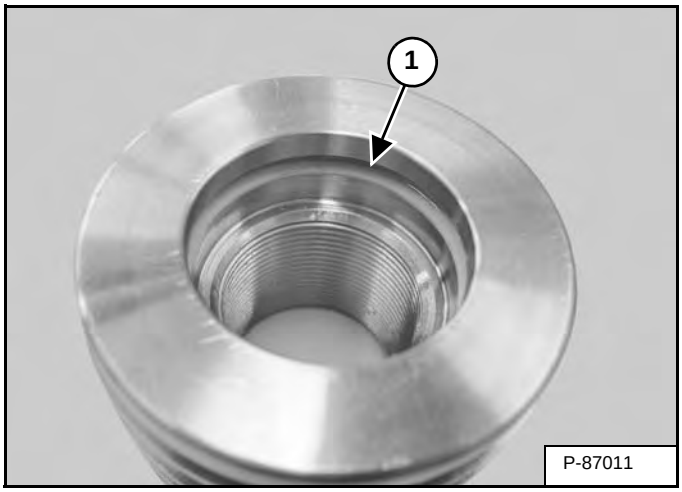
Install the head (Item 1) **[Figure 20-20-61]** onto the rod.

Figure 20-20-62



Install the cushion ring (Item 1) **[Figure 20-20-62]** onto the rod.

Figure 20-20-63

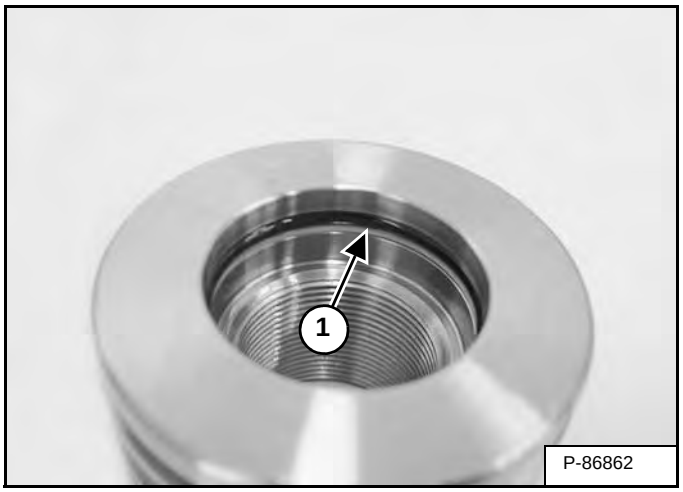


Install the back-up ring (Item 1) **[Figure 20-20-63]** into the piston.

Dealer Copy -- Not for Resale

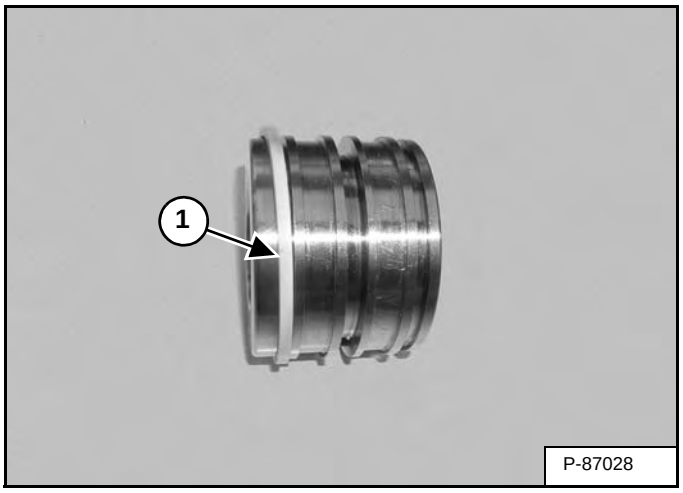
Assembly (Cont'd)

Figure 20-20-64



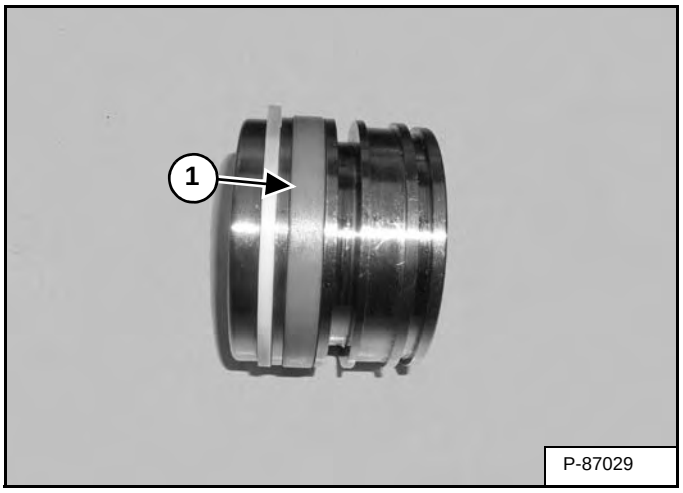
Install the O-ring (Item 1) **[Figure 20-20-64]** into the piston.

Figure 20-20-65



Install the seal (Item 1) **[Figure 20-20-65]** onto the piston.

Figure 20-20-66



Install the wear ring (Item 1) **[Figure 20-20-66]** onto the piston.

Figure 20-20-67

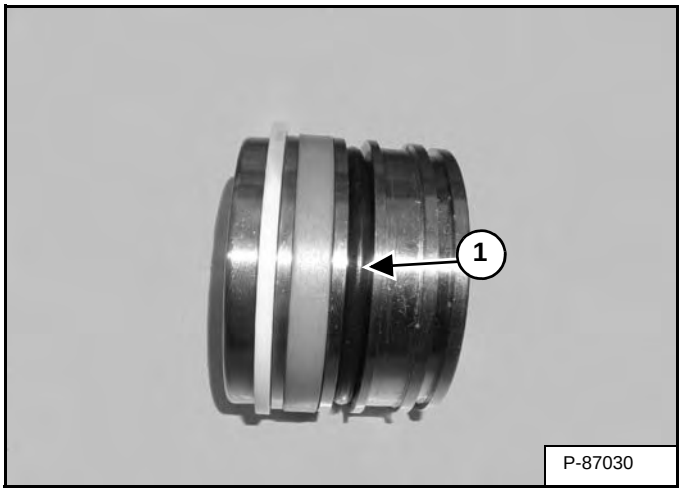
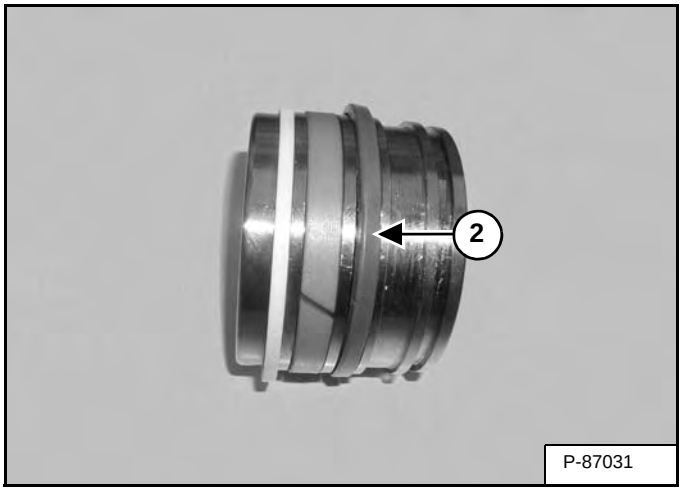


Figure 20-20-68

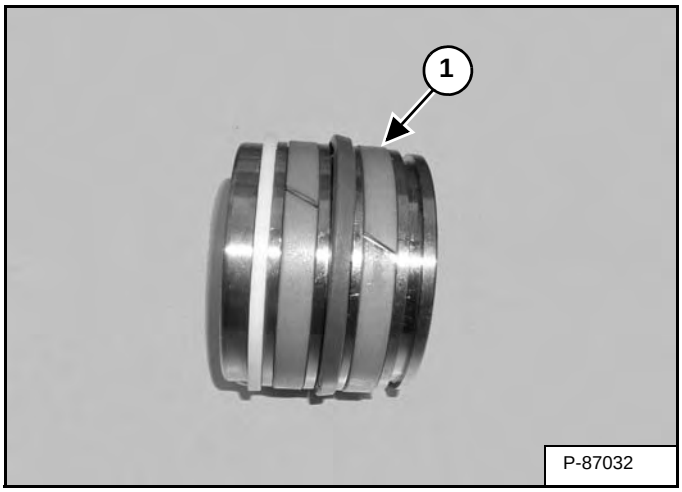


Install the O-ring (Item 1) **[Figure 20-20-67]** and seal (Item 2) **[Figure 20-20-68]** onto the piston.

Dealer Copy -- Not for Resale

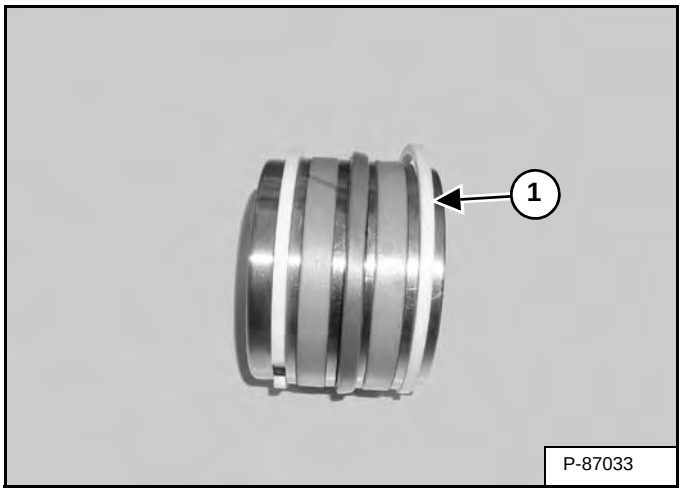
Assembly (Cont'd)

Figure 20-20-69



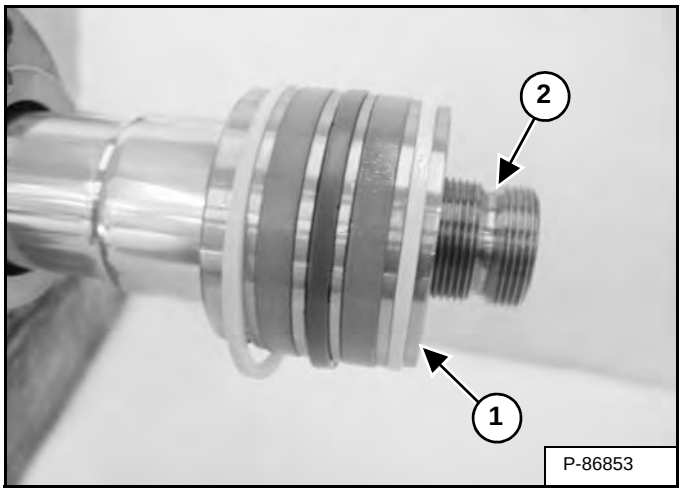
Install the wear ring (Item 1) **[Figure 20-20-69]** onto the piston.

Figure 20-20-70



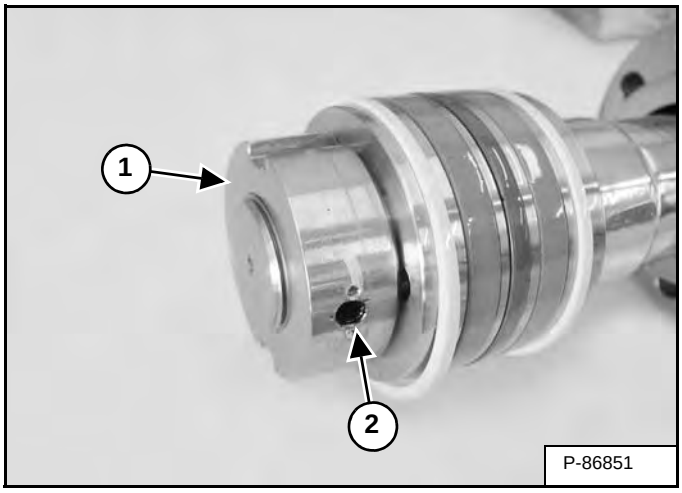
Install the seal (Item 1) **[Figure 20-20-70]** onto the piston.

Figure 20-20-71



Install the piston (Item 1) **[Figure 20-20-71]** onto the rod.

Figure 20-20-72



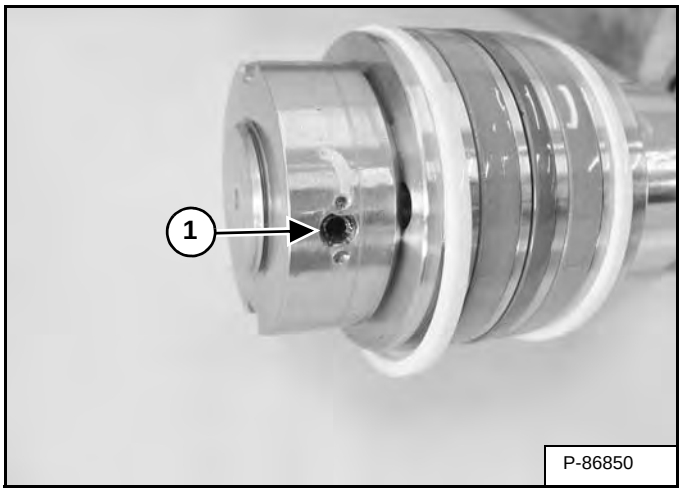
Install the nut (Item 1) **[Figure 20-20-72]**.

Tighten the nut until the bore (Item 2) **[Figure 20-20-72]** of the set screw is aligned with the groove (Item 2) **[Figure 20-20-71]** of the rod.

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Assembly (Cont'd)

Figure 20-20-73

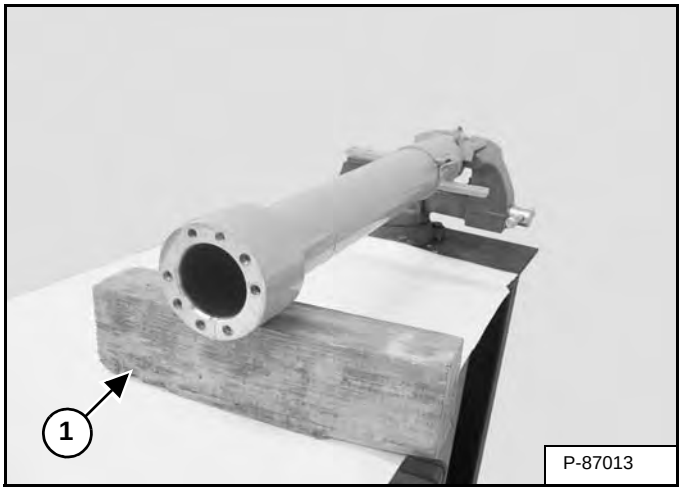


Install the set screw (Item 1) **[Figure 20-20-73]** into the nut.

Use a center punch to deform the threads of the set screw bore.

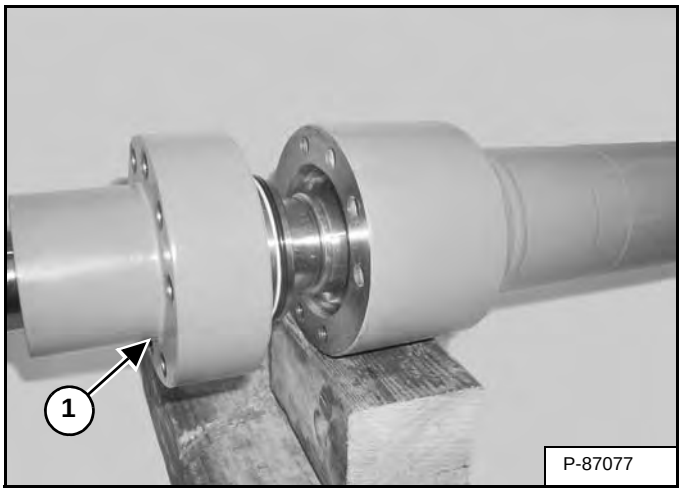
Remove the rod end from the vise.

Figure 20-20-74



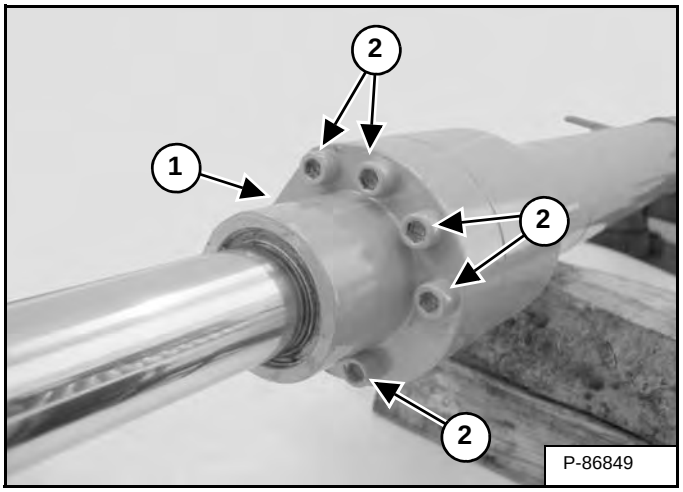
Support the housing with a block (Item 1) **[Figure 20-20-74]**.

Figure 20-20-75



Install the rod assembly (Item 1) **[Figure 20-20-75]** into the cylinder housing.

Figure 20-20-76



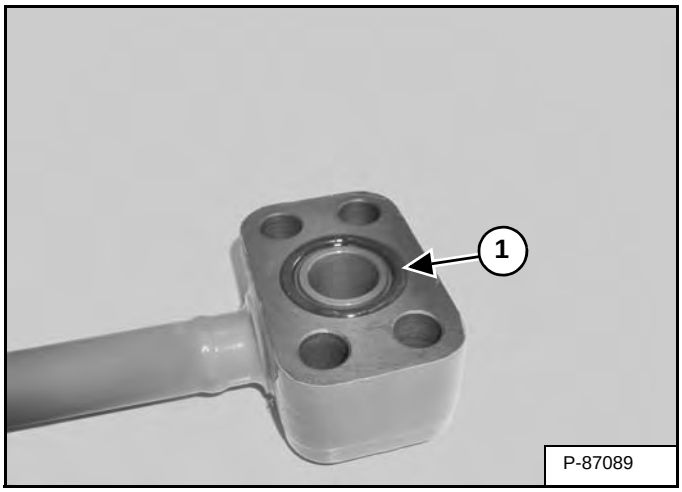
Install the head (Item 1) using the eight bolts (Item 2) **[Figure 20-20-76]**.

Tighten the bolts to 190 - 210 N•m (140 - 155 ft-lb) torque.

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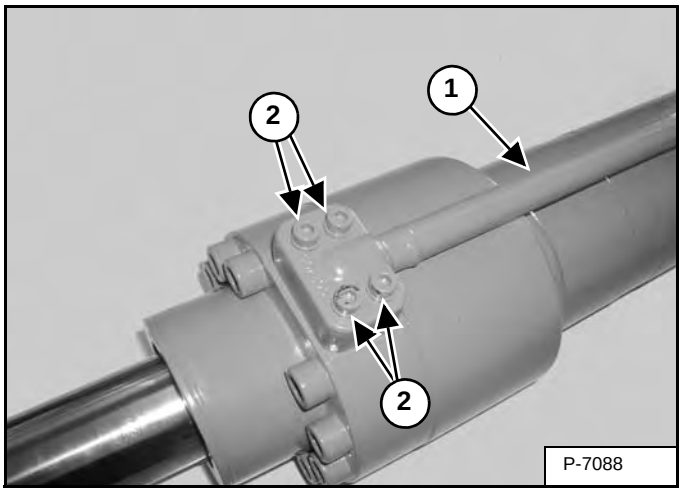
Assembly (Cont'd)

Figure 20-20-77



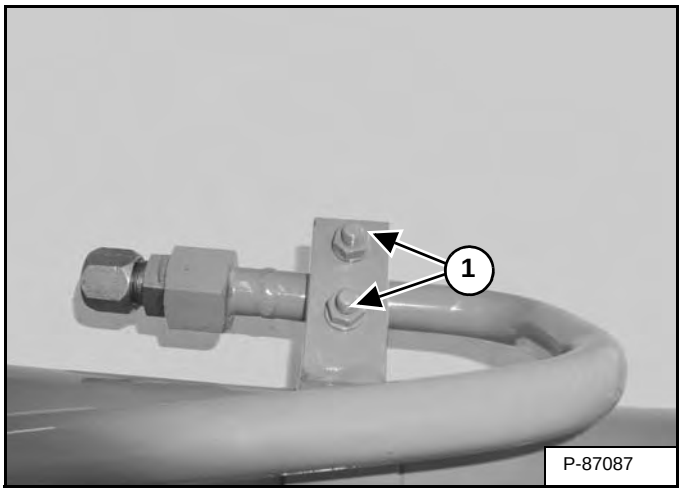
Install the O-ring (Item 1) **[Figure 20-20-77]** into the tubeline.

Figure 20-20-78



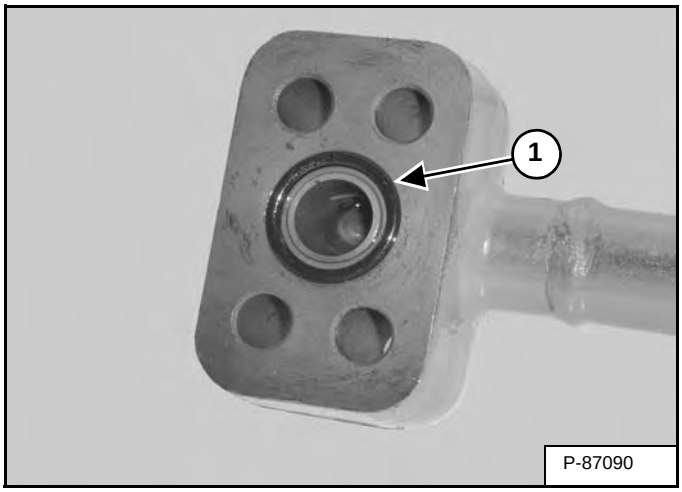
Install the tubeline (Item 1), lock washers and bolts (Item 2) **[Figure 20-20-78]** onto the cylinder housing.

Figure 20-20-79



Install the U-bolt, lock washers and nuts (Item 1) **[Figure 20-20-79]**.

Figure 20-20-80

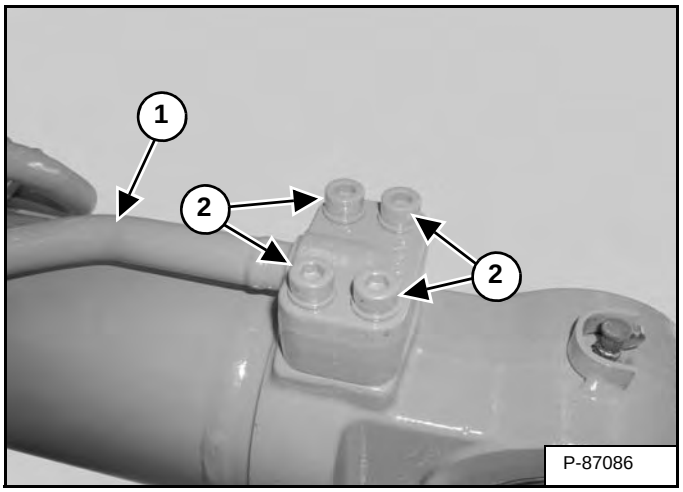


Install the O-ring (Item 1) **[Figure 20-20-80]** into the tubeline.

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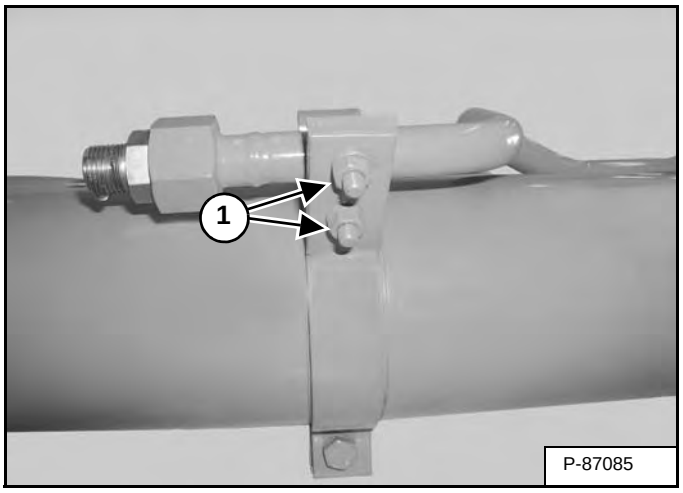
Assembly (Cont'd)

Figure 20-20-81



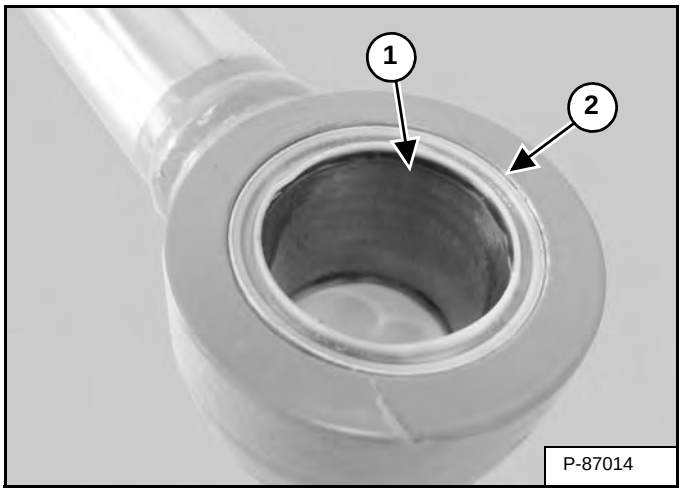
Install the tubeline (Item 1), using the four bolts (Item 2) **[Figure 20-20-81]** and lock washers.

Figure 20-20-82



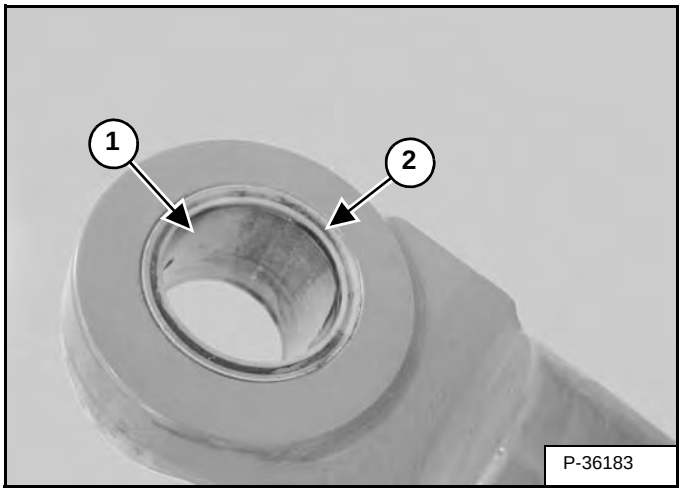
Install the U-bolt, washers and nuts (Item 1) **[Figure 20-20-82]**.

Figure 20-20-83



Install the bushing (Item 1) and seal (Item 2) **[Figure 20-20-83]** into both sides of the rod end of the cylinder.

Figure 20-20-84



Install the bushing (Item 1) and seal (Item 2) **[Figure 20-20-84]** into both sides of the base end of the cylinder.

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CYLINDER (ARM)

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

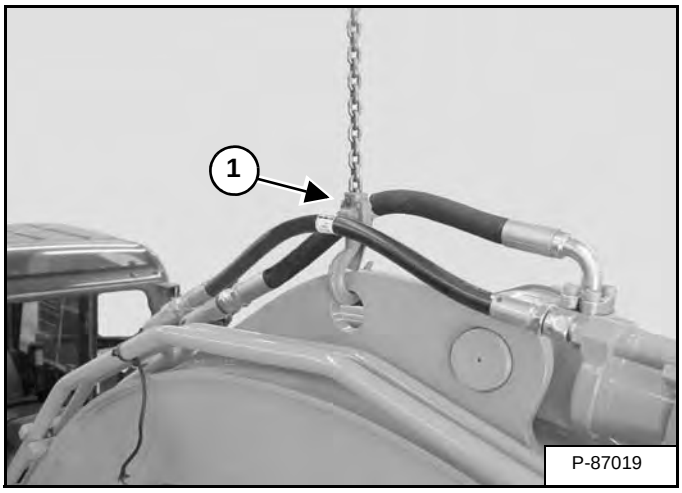
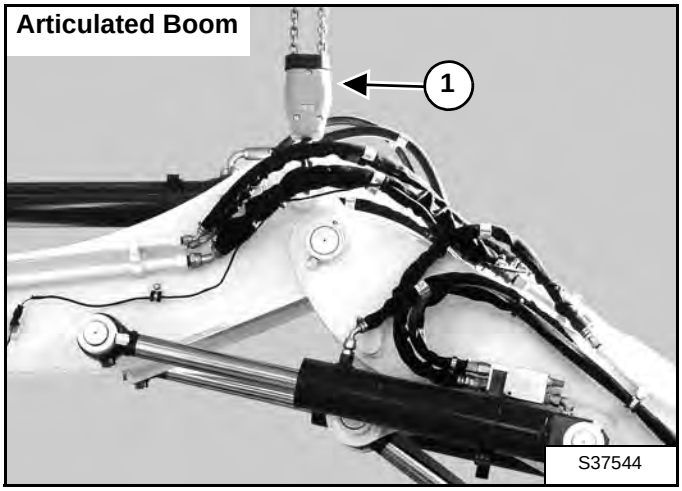
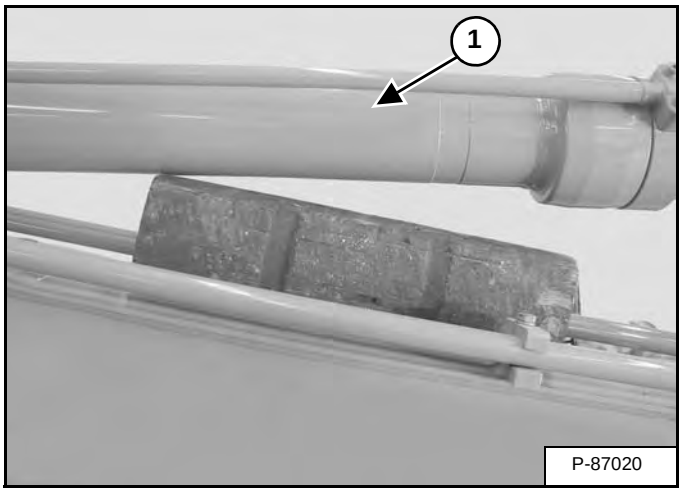


Figure 20-21-2



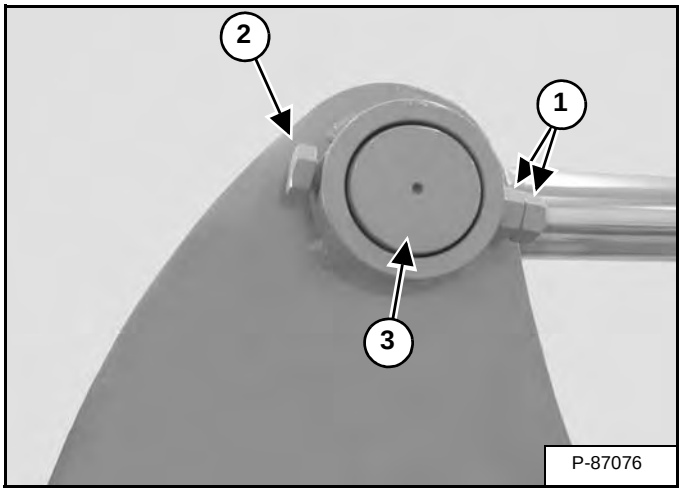
Support the boom with a chain hoist (Item 1) **[Figure 20-21-1]** or **[Figure 20-21-2]**.

Figure 20-21-3



Support the arm cylinder (Item 1) **[Figure 20-21-3]**.

Figure 20-21-4



Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-21-4]** from the rod end pivot pin.

Remove the rod end pivot pin (Item 3) **[Figure 20-21-4]**.

Start the engine and fully retract the cylinder rod.

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Testing (Cont'd)

WARNING

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

W-2145-0290

Figure 20-21-5

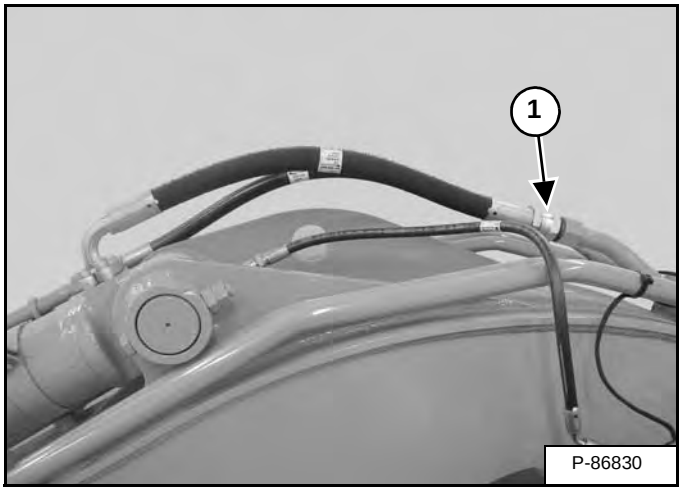
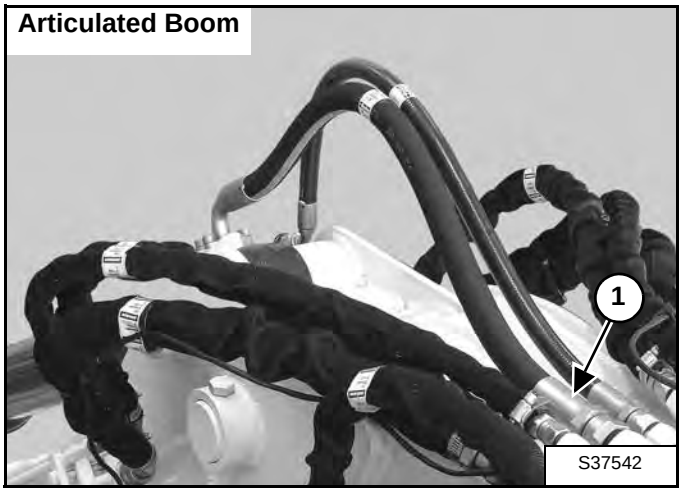
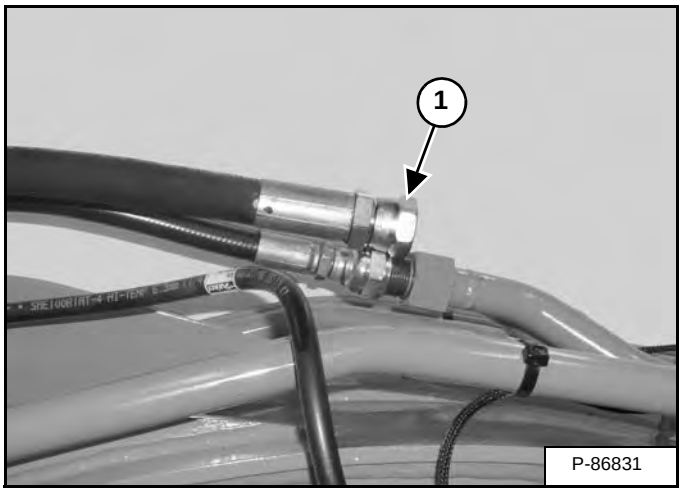


Figure 20-21-6



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

Figure 20-21-7



Install a plug (Item 1) **[Figure 20-21-7]** on the hose.

Start the engine and retract the cylinder.

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

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CYLINDER (ARM) (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 20-21-8

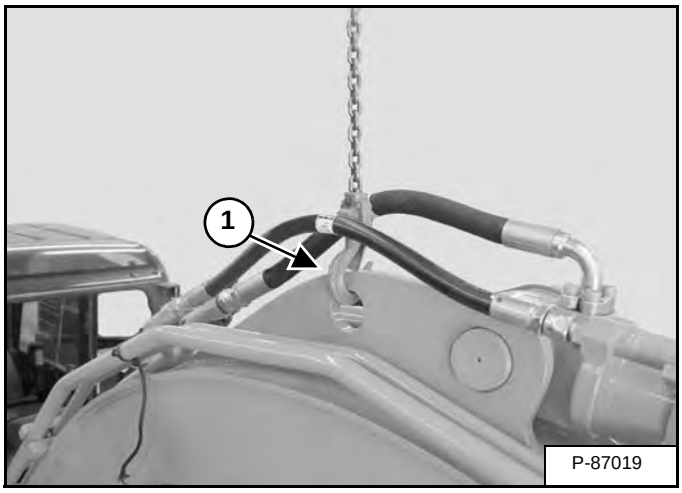
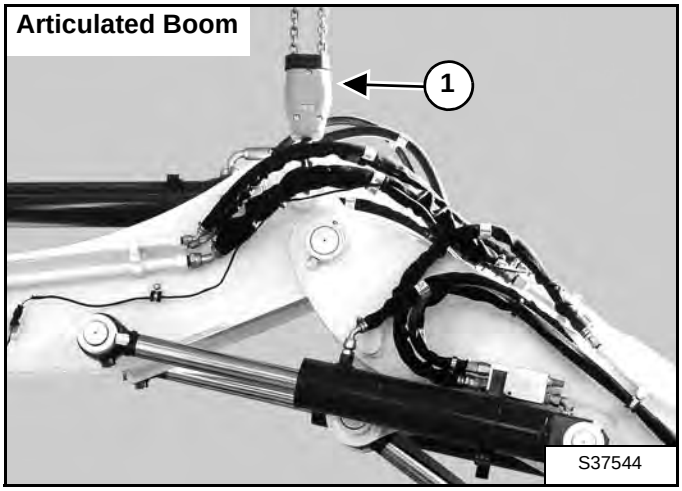
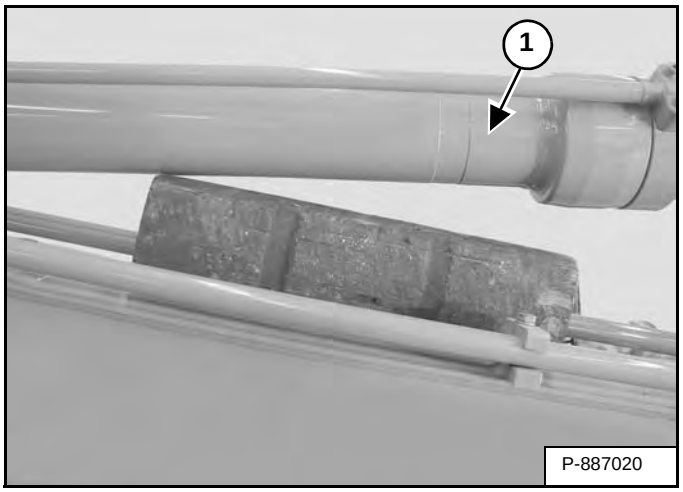


Figure 20-21-9



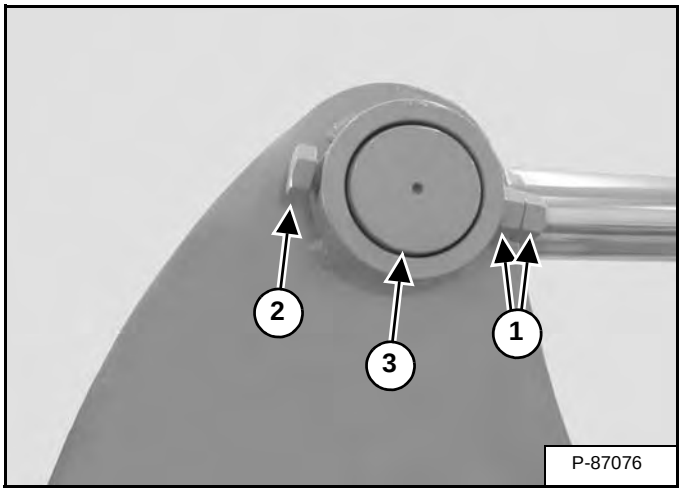
Support the boom with a chain hoist (Item 1) **[Figure 20-21-8]** or **[Figure 20-21-9]**.

Figure 20-21-10



Support the arm cylinder (Item 1) **[Figure 20-21-10]**.

Figure 20-21-11



Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-21-11]**.

Remove the rod end pivot pin (Item 3) **[Figure 20-21-11]**.

IMPORTANT

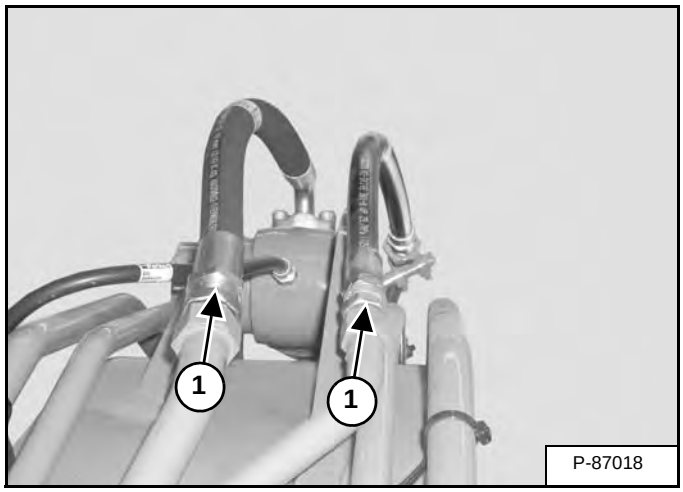
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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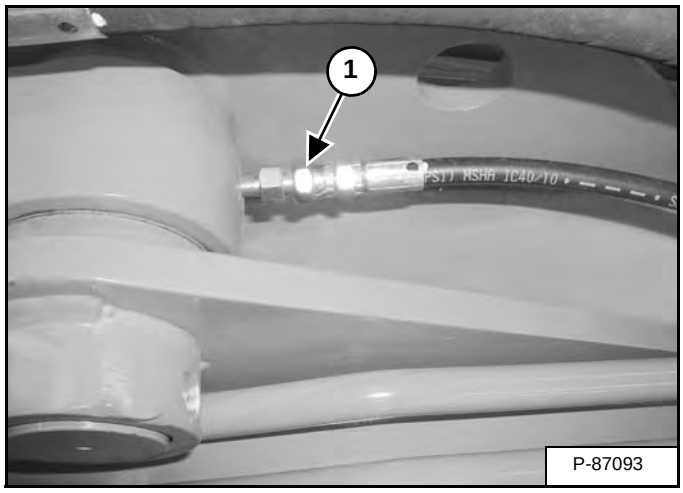
Removal And Installation (Cont'd)

Figure 20-21-12



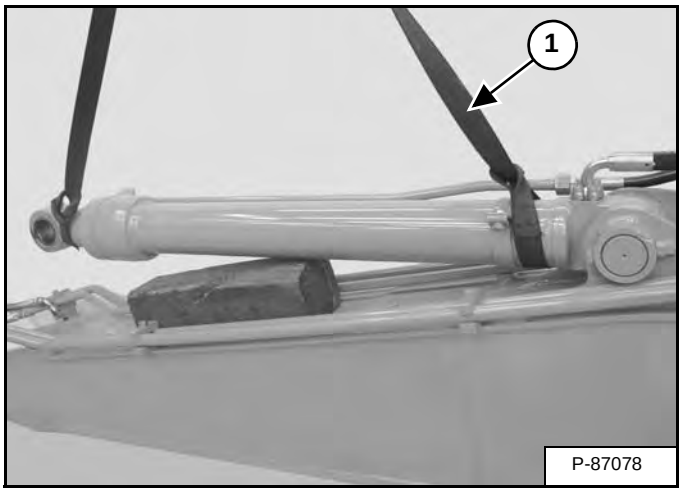
Remove the hoses (Item 1) **[Figure 20-21-12]**.

Figure 20-21-13



Remove the hose (Item 1) **[Figure 20-21-13]**.

Figure 20-21-14



Install a sling (Item 1) **[Figure 20-21-14]** on both ends of the cylinder.

Figure 20-21-15

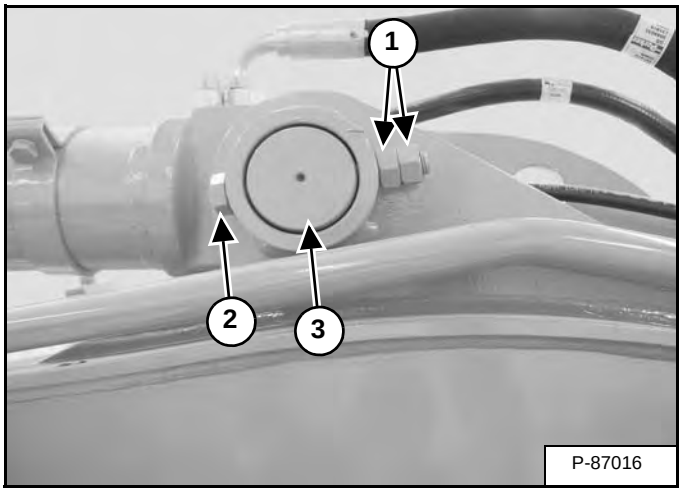
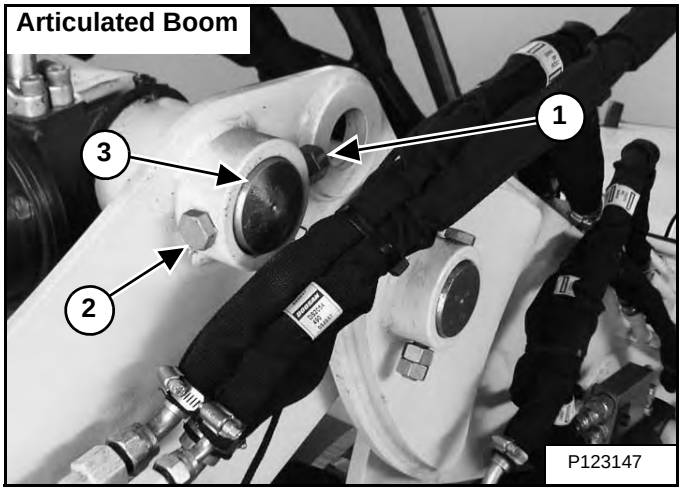


Figure 20-21-16

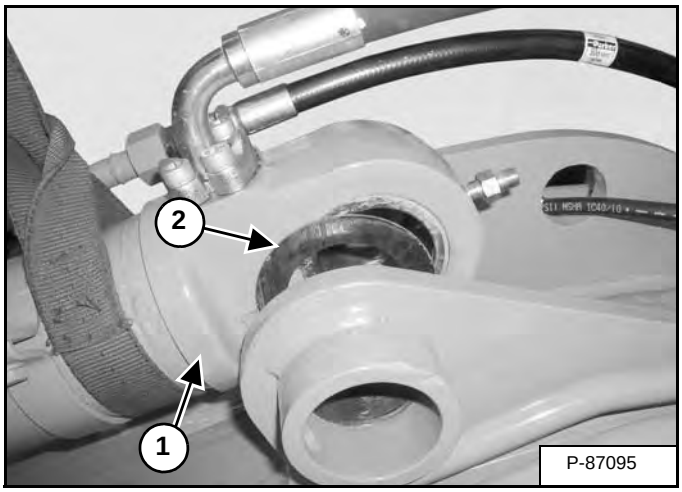


Remove the nuts (Item 1), bolt (Item 2) and base end pivot pin (Item 3) **[Figure 20-21-15]** or **[Figure 20-21-16]**.

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Removal And Installation (Cont'd)

Figure 20-21-17



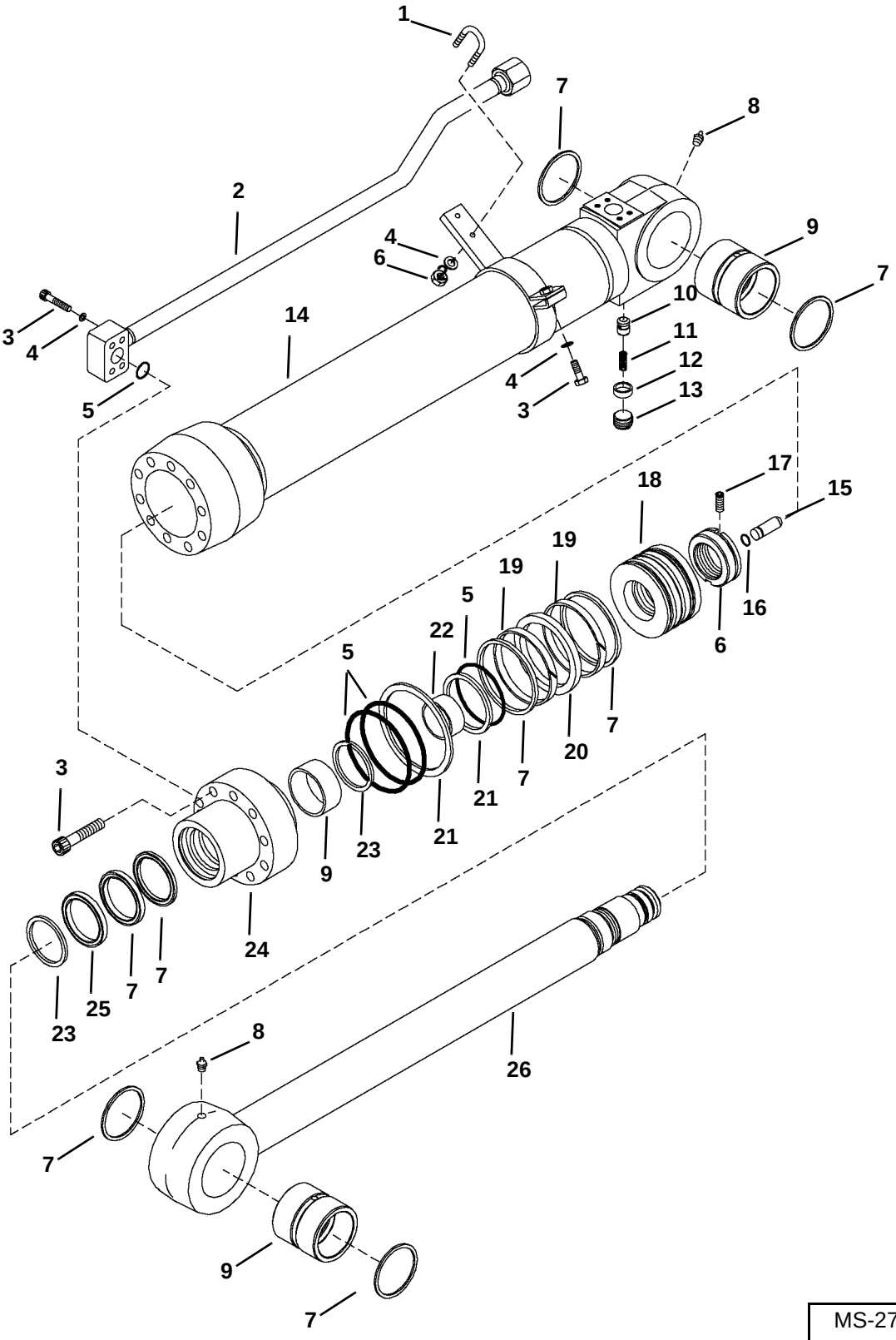
Remove the cylinder (Item 1) **[Figure 20-21-17]**.

Remove the shims (Item 2) **[Figure 20-21-17]** from both sides of the base end of the cylinder.

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Parts Identification

1. U-Bolt
2. Tubeline
3. Bolt
4. Washer
5. O-ring
6. Nut
7. Seal
8. Grease Fitting
9. Bushing
10. Check Valve
11. Spring
12. Spring Support
13. Plug
14. Housing
15. Cushion Plunger
16. Ring Stop
17. Set Screw
18. Piston
19. Wear Ring
20. Seal Assembly
21. Back-up Ring
22. Cushion Ring
23. Snap Ring
24. Head
25. Wiper Seal
26. Rod



MS-2793S

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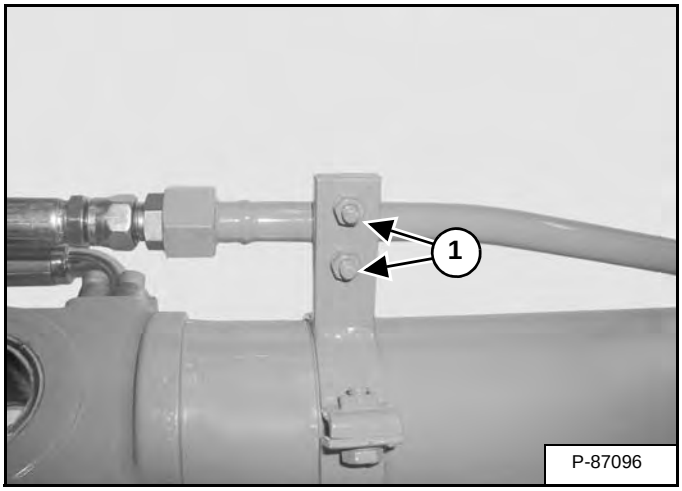
Disassembly

Use the following tools to disassemble the cylinder:

MEL1074 - O-ring Seal Hook

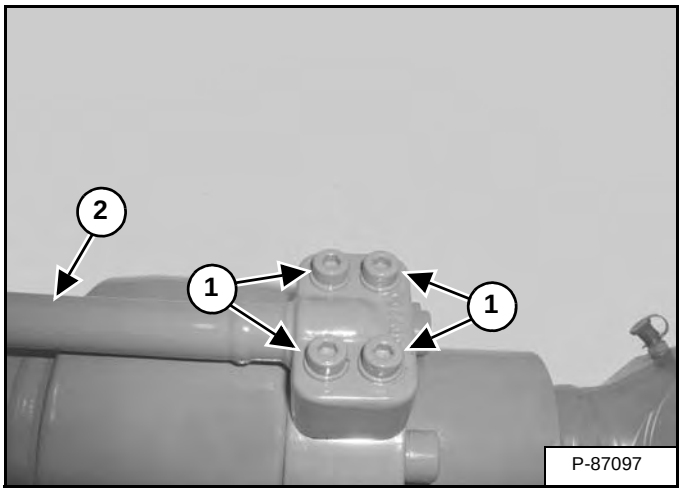
Hold the hydraulic cylinder over a drain pan and slowly move the rod in and out to remove the fluid from the cylinder.

Figure 20-21-18



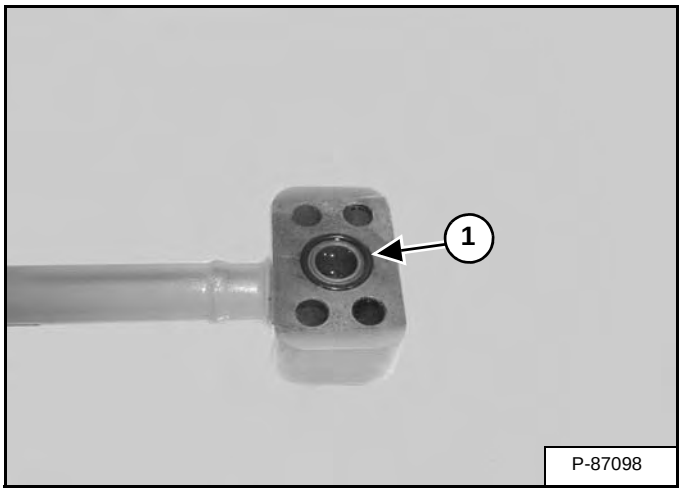
Remove the two nuts (Item 1) **[Figure 20-21-18]**, lock washers and U-bolt.

Figure 20-21-19



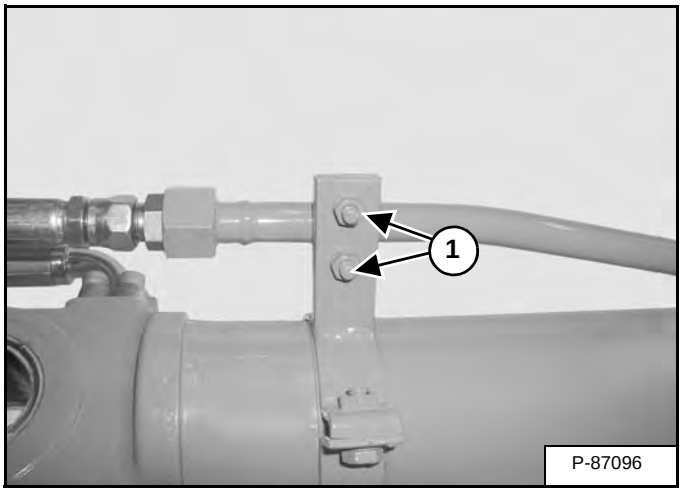
Remove the four bolts (Item 1) and tubeline (Item 2) **[Figure 20-21-19]**.

Figure 20-21-20



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

Figure 20-21-21

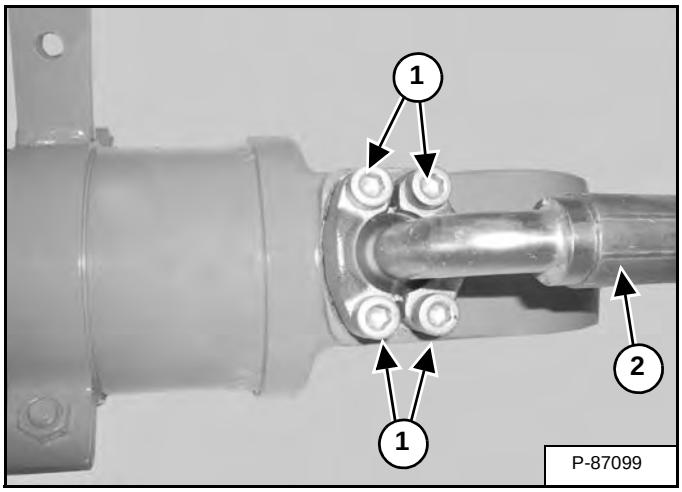


Remove the two nuts (Item 1) **[Figure 20-21-21]**, lock washers and U-bolt.

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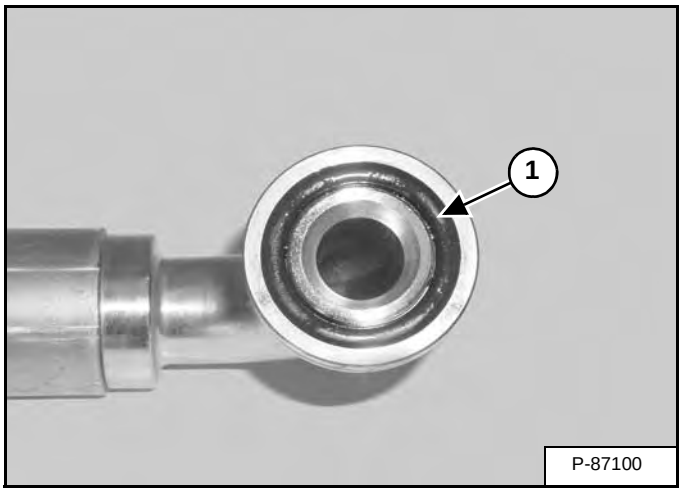
Disassembly (Cont'd)

Figure 20-21-22



Remove the four bolts (Item 1), lock washers and hose (Item 2) **[Figure 20-21-22]**.

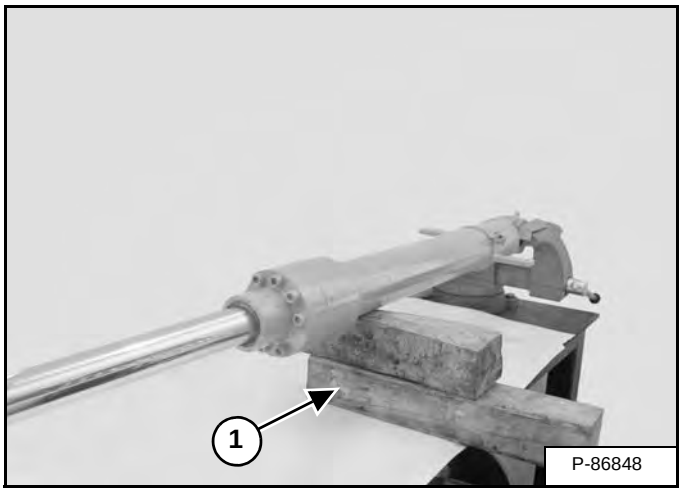
Figure 20-21-23



Remove the O-ring (Item 1) **[Figure 20-21-23]** from the tubeline.

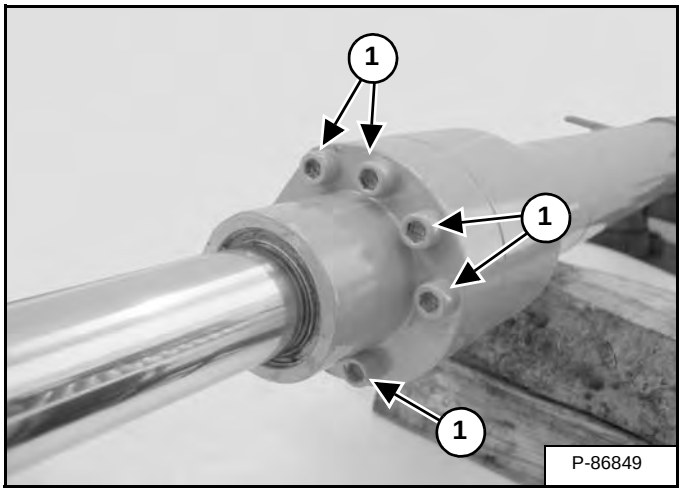
Clamp the base end of the cylinder in a vise.

Figure 20-21-24



Support the cylinder with a block (Item 1) **[Figure 20-21-24]**.

Figure 20-21-25

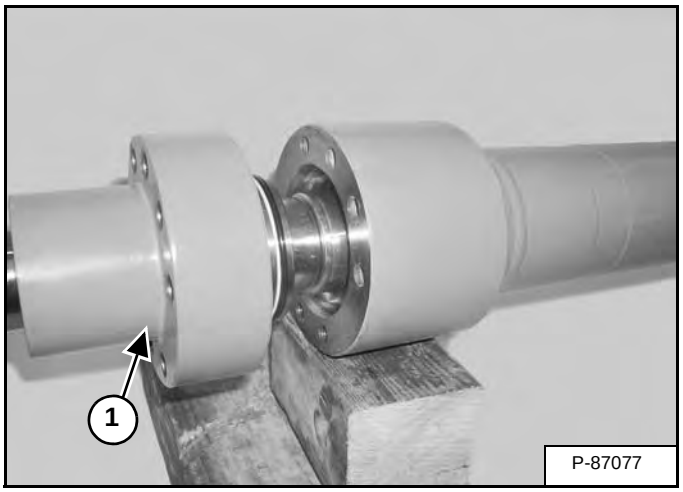


Remove the eight bolts (Item 1) **[Figure 20-21-25]**.

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Disassembly (Cont'd)

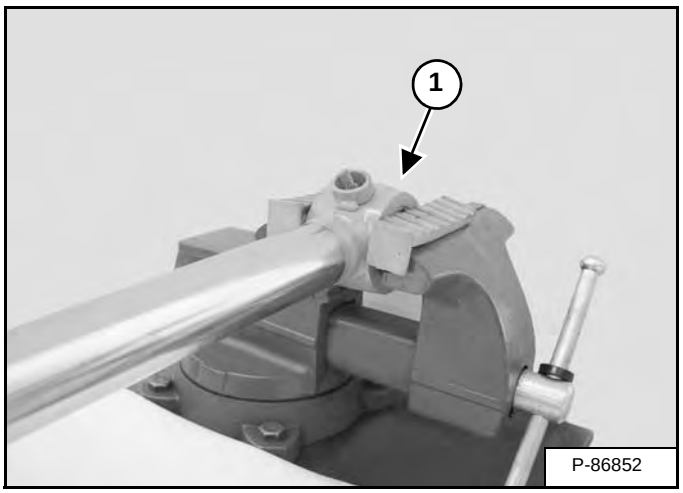
Figure 20-21-26



Remove the rod assembly (Item 1) **[Figure 20-21-26]** from the cylinder housing.

Remove the cylinder housing from the vise.

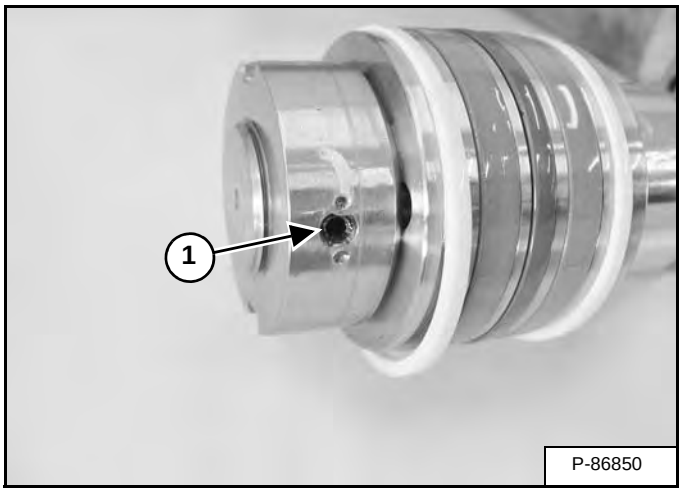
Figure 20-21-27



Clamp the rod end (Item 1) **[Figure 20-21-27]** in a vise.

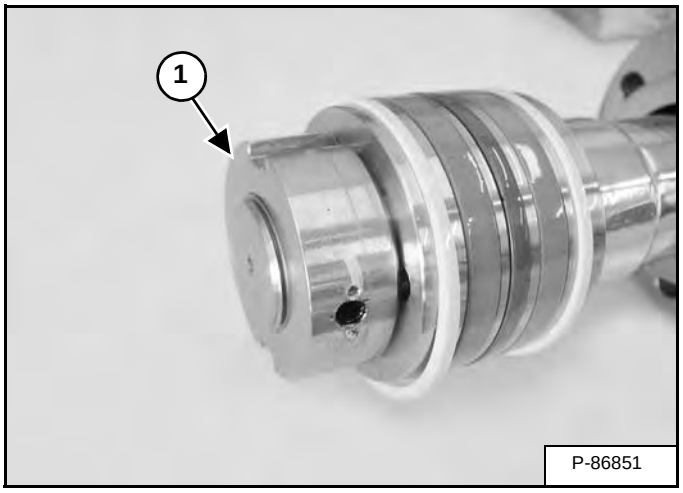
Support the end of the rod with a block.

Figure 20-21-28



Remove the set screw (Item 1) **[Figure 20-21-28]**.

Figure 20-21-29



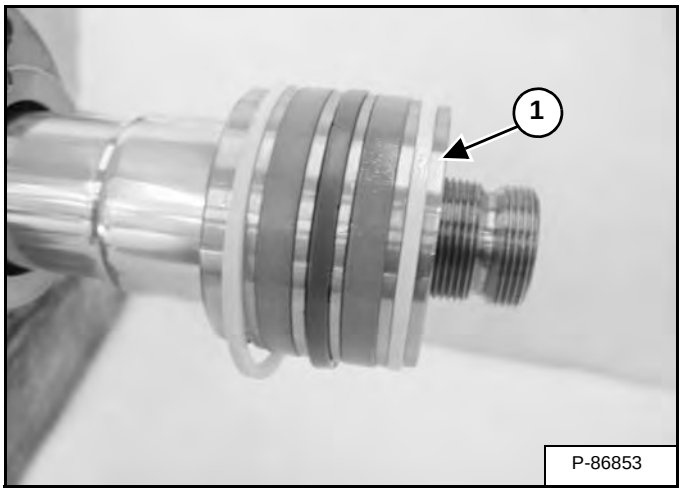
Apply moderate heat to the nut (Item 1) **[Figure 20-21-29]**.

Remove the nut.

Dealer Copy -- Not for Resale

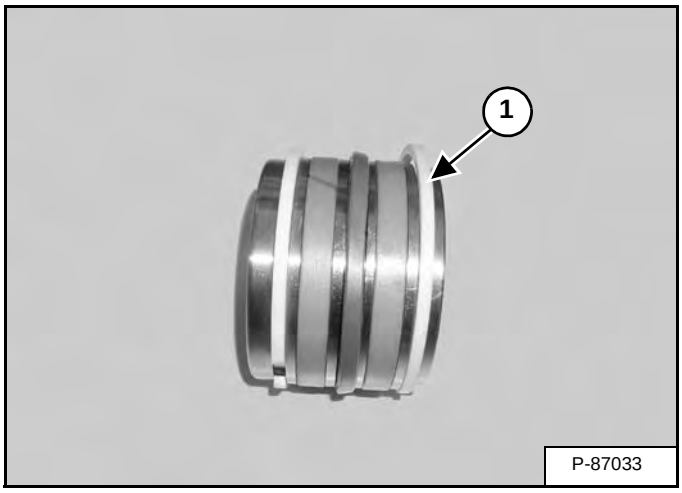
Disassembly (Cont'd)

Figure 20-21-30



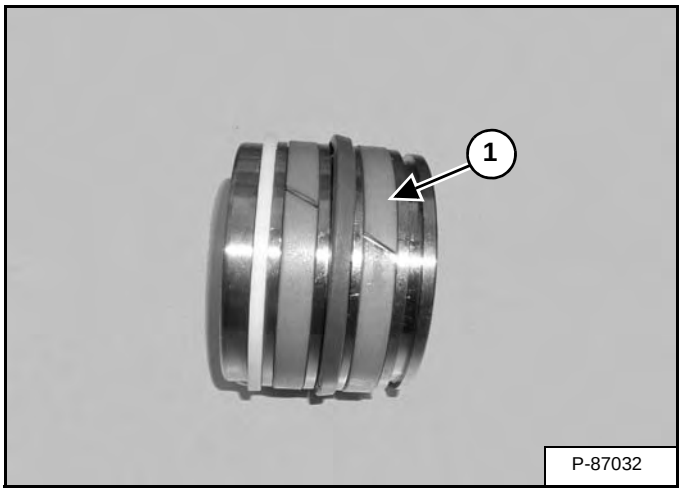
Remove the piston (Item 1) **[Figure 20-21-30]**.

Figure 20-21-31



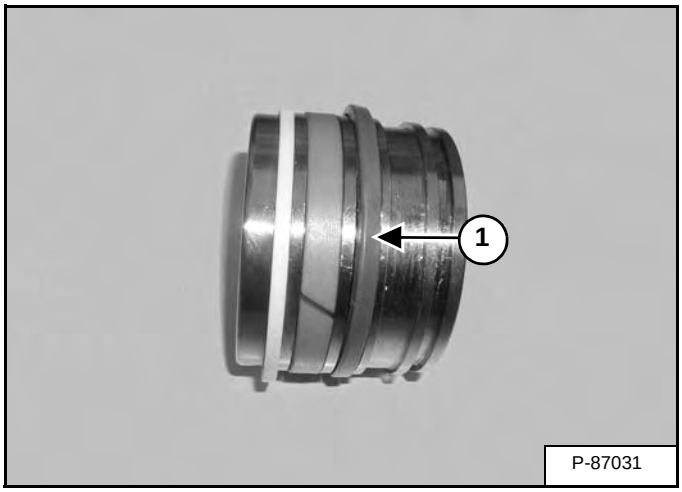
Remove the seal (Item 1) **[Figure 20-21-31]** from the piston.

Figure 20-21-32



Remove the wear ring (Item 1) **[Figure 20-21-32]** from the piston.

Figure 20-21-33

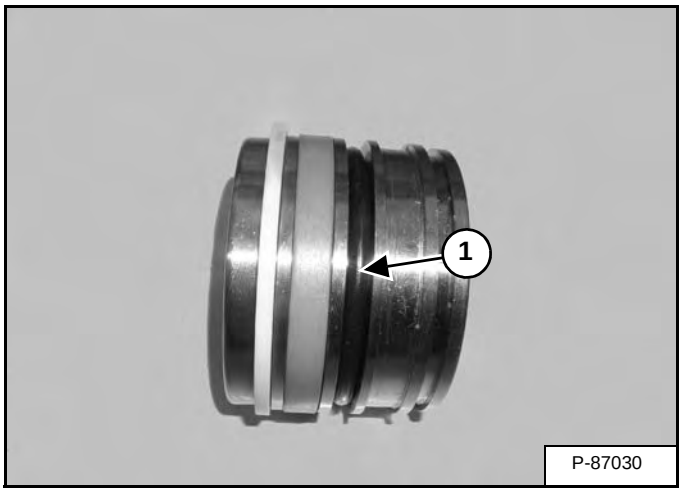


Remove the seal (Item 1) **[Figure 20-21-33]**.

Dealer Copy -- Not for Resale

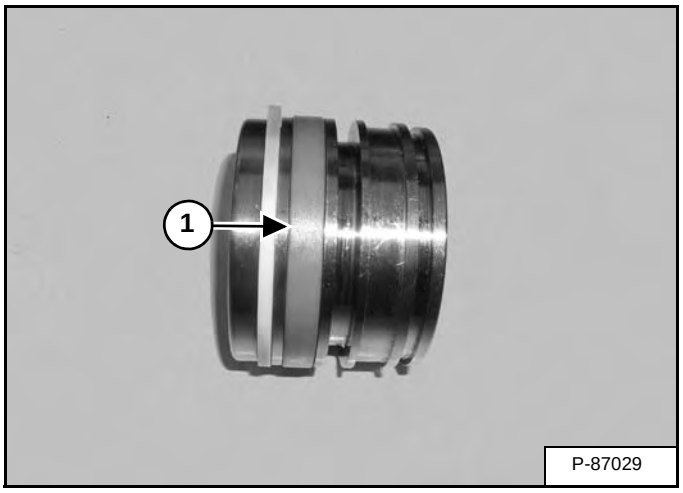
Disassembly (Cont'd)

Figure 20-21-34



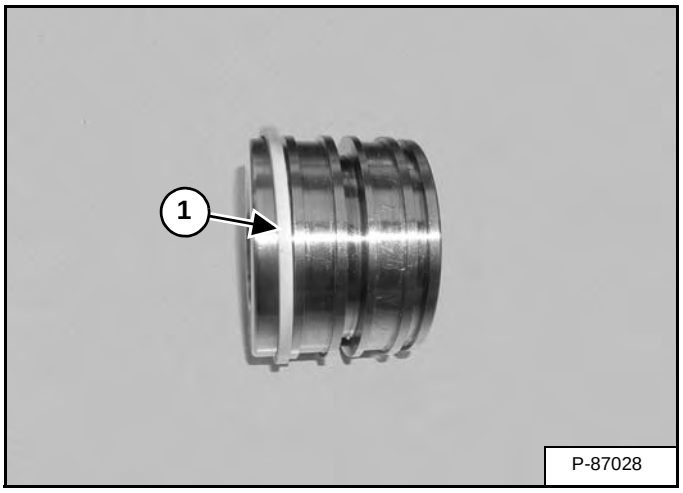
Remove the O-ring (Item 1) **[Figure 20-21-34]** from the piston.

Figure 20-21-35



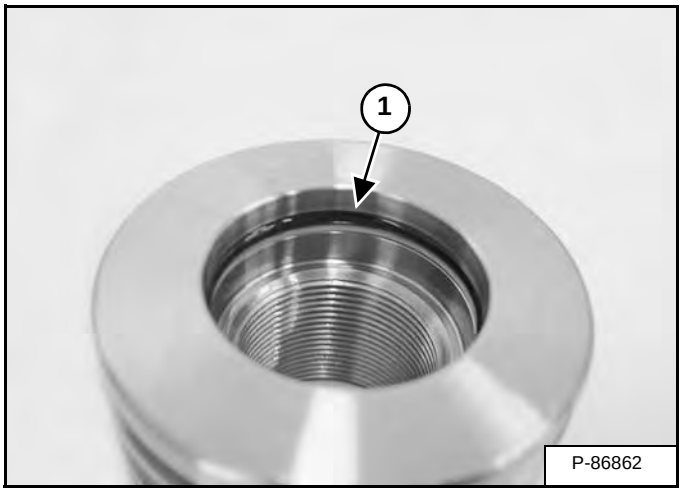
Remove the wear ring (Item 1) **[Figure 20-21-35]** from the piston.

Figure 20-21-36



Remove the seal (Item 1) **[Figure 20-21-36]** from the piston.

Figure 20-21-37

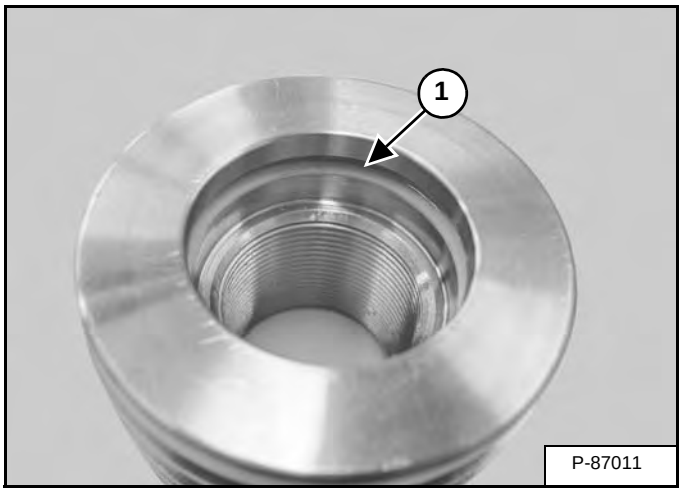


Remove the O-ring (Item 1) **[Figure 20-21-37]** from the piston.

Dealer Copy -- Not for Resale

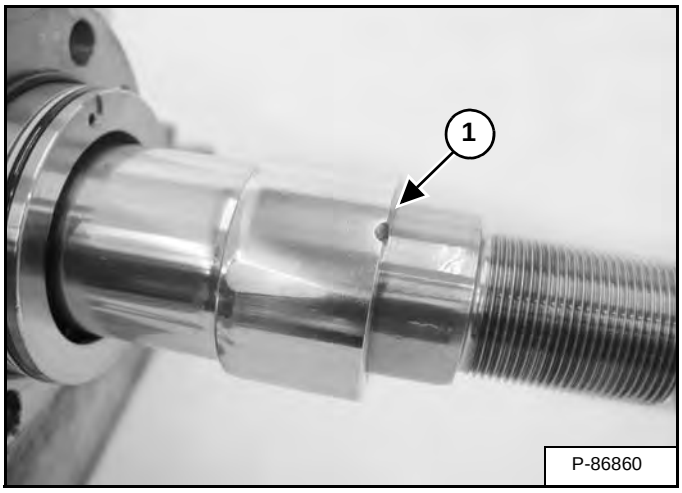
Disassembly (Cont'd)

Figure 20-21-38



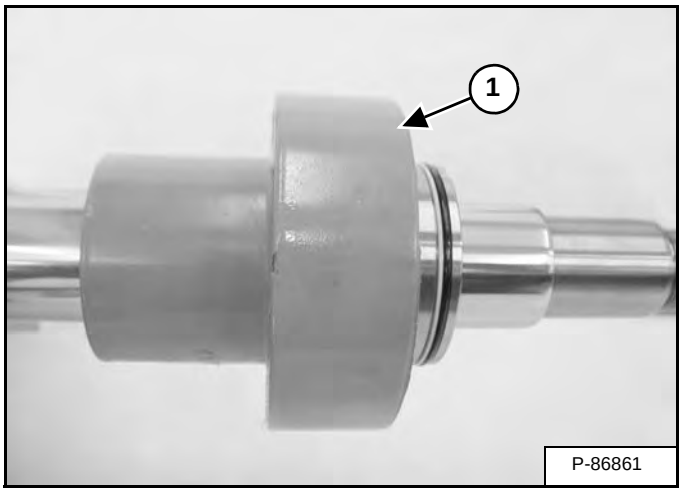
Remove the back-up ring (Item 1) **[Figure 20-21-38]**.

Figure 20-21-39



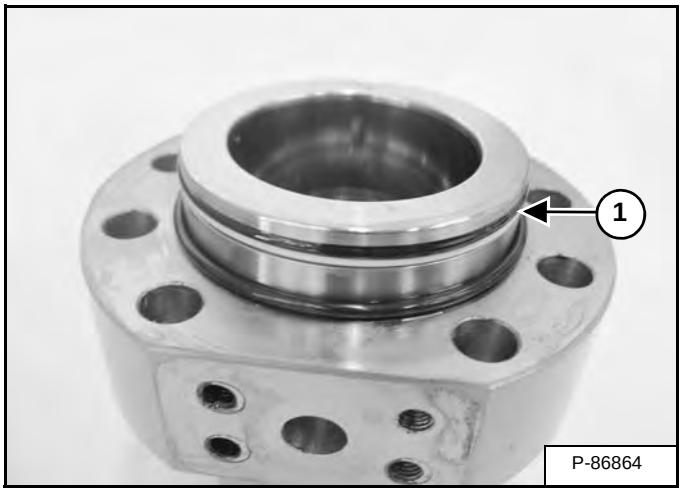
Remove the cushion ring (Item 1) **[Figure 20-21-39]** from the rod.

Figure 20-21-40



Remove the head (Item 1) **[Figure 20-21-40]** from the rod.

Figure 20-21-41

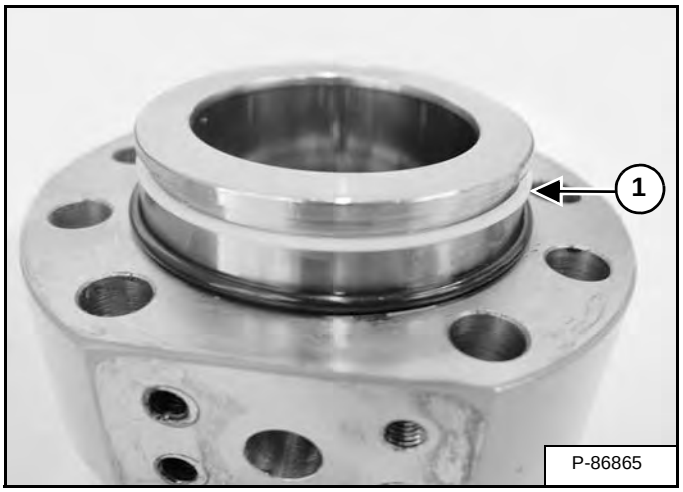


Remove the O-ring (Item 1) **[Figure 20-21-41]**.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

Figure 20-21-42



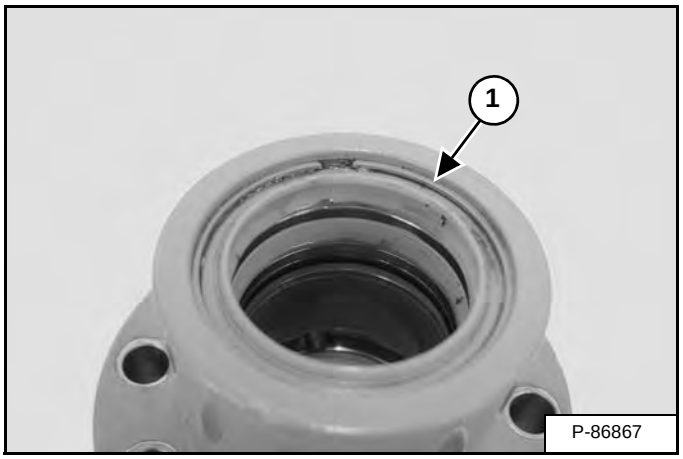
Remove the back-up ring (Item 1) **[Figure 20-21-42]**.

Figure 20-21-43



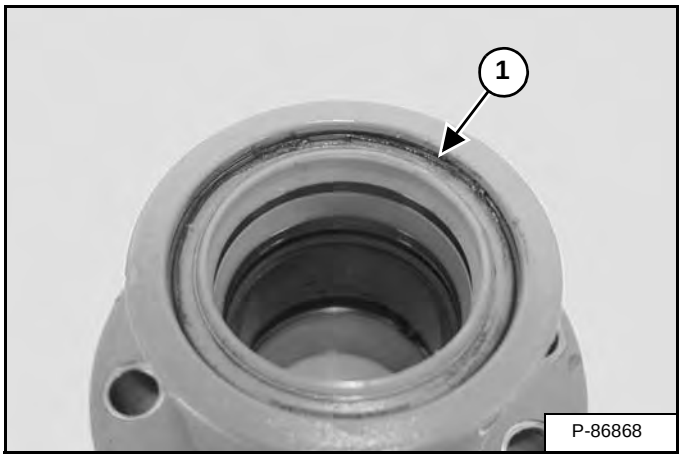
Remove the O-ring (Item 1) **[Figure 20-21-43]**.

Figure 20-21-44



Remove the snap ring (Item 1) **[Figure 20-21-44]**.

Figure 20-21-45

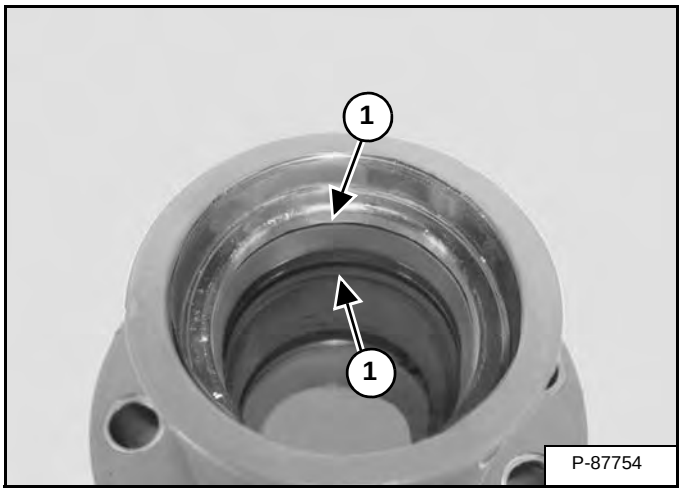


Remove the wiper seal (Item 1) **[Figure 20-21-45]**.

Dealer Copy -- Not for Resale

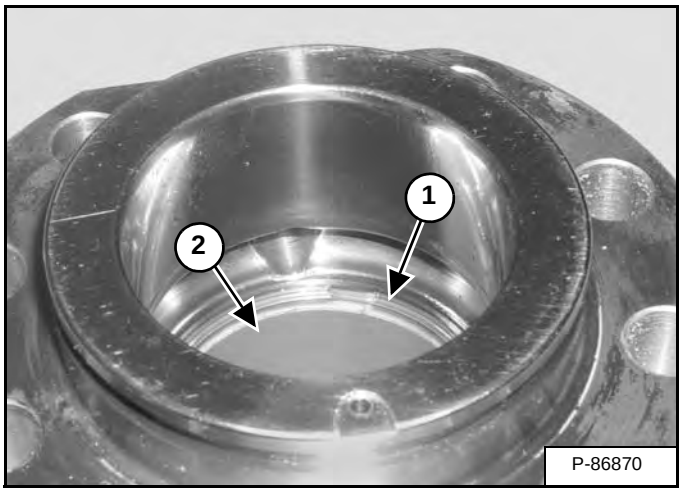
Disassembly (Cont'd)

Figure 20-21-46



Remove the two seals (Item 1) **[Figure 20-21-46]**.

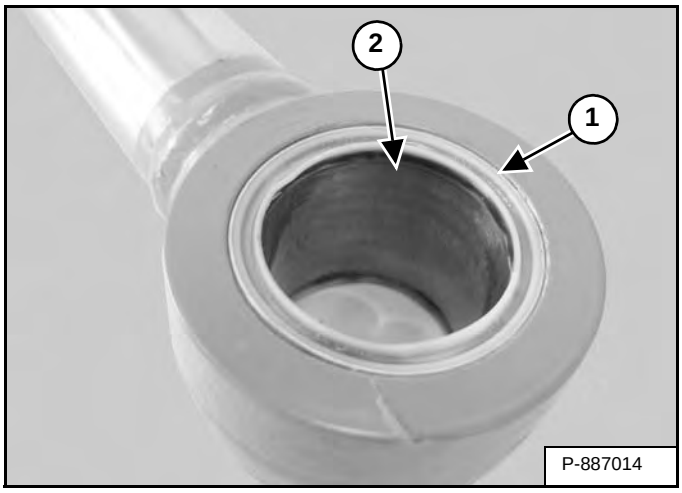
Figure 20-21-47



Remove the snap ring (Item 1) and bushing (Item 2) **[Figure 20-21-47]**.

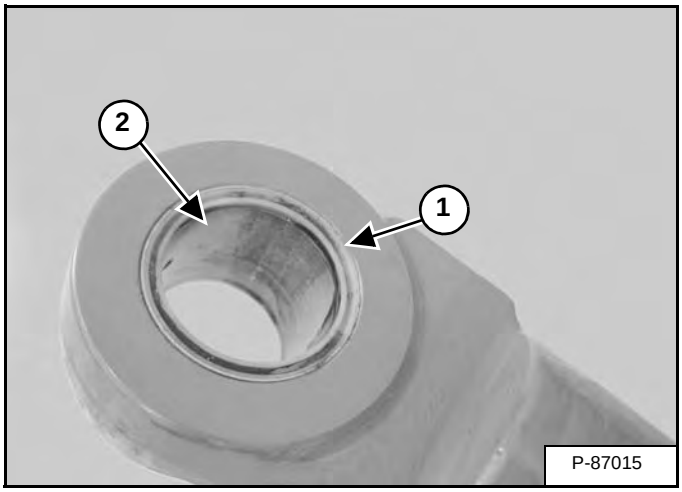
Remove the rod from the vise.

Figure 20-21-48



Remove the seal (Item 1) (both sides) and bushing (Item 2) **[Figure 20-21-48]** from the rod end.

Figure 20-21-49



Remove the seal (Item 1) (both sides) and bushing (Item 2) **[Figure 20-21-49]** from the base end.

Dealer Copy -- Not for Resale

Assembly

Use the following tools to assemble the cylinder:

MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
MEL1396-2 - Piston Ring Compressor

Wash the cylinder parts in clean solvent and dry with compressed air.

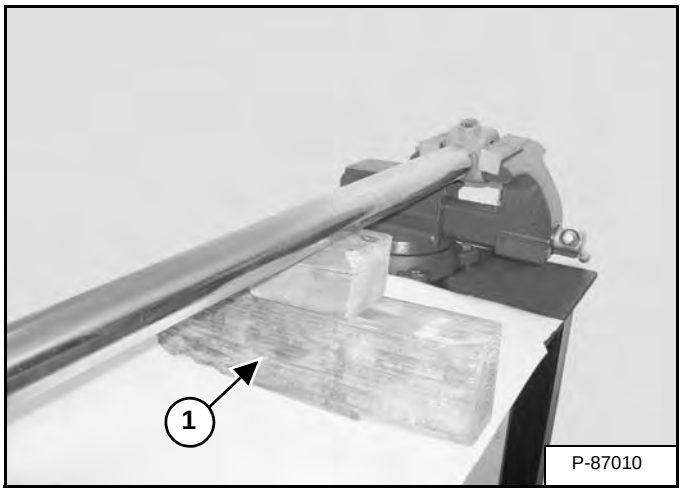
Inspect the cylinder parts for nicks, scratches and other damage. Replace any damaged parts.

Always install new O-rings and seals during assembly.

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

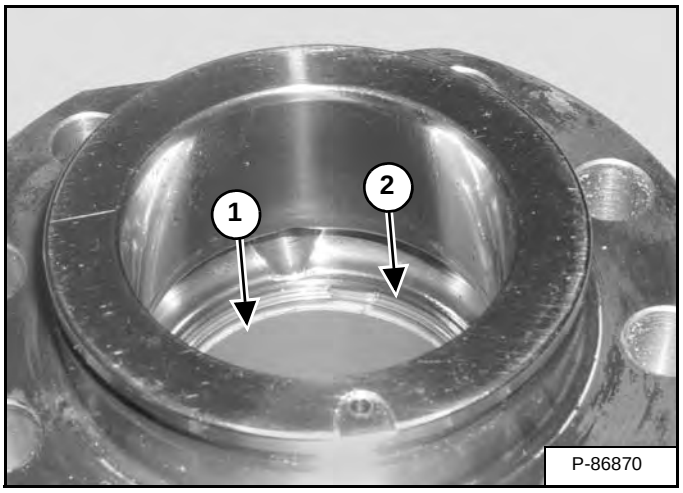
Clamp the rod end in a vise.

Figure 20-21-50



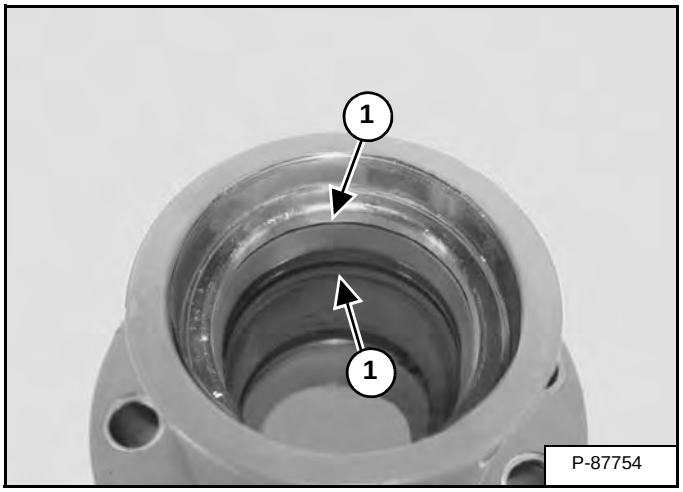
Support the end of the rod with a block (Item 1) **[Figure 20-21-50]**.

Figure 20-21-51



Install the bushing (Item 1) and snap ring (Item 2) **[Figure 20-21-51]** into the head.

Figure 20-21-52

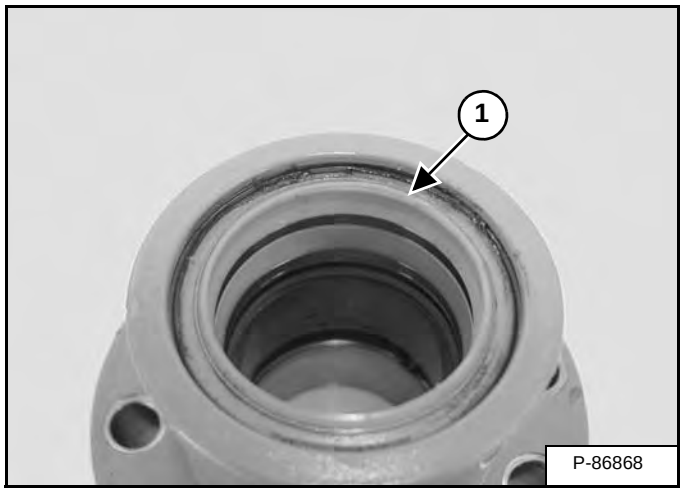


Install the two seals (Item 1) **[Figure 20-21-52]** into the head.

Dealer Copy -- Not for Resale

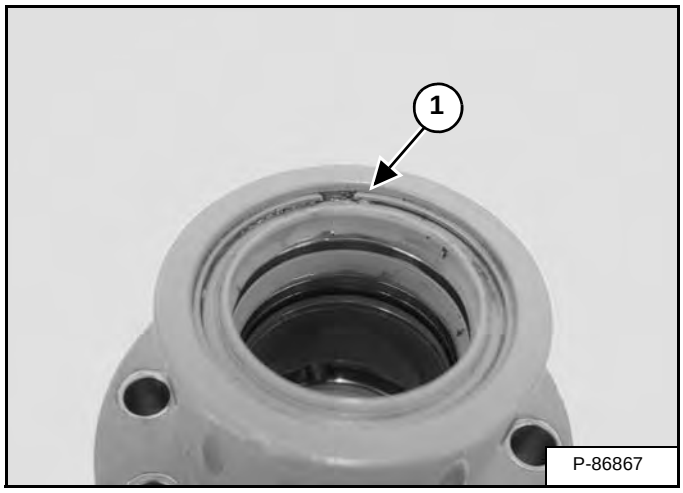
Assembly (Cont'd)

Figure 20-21-53



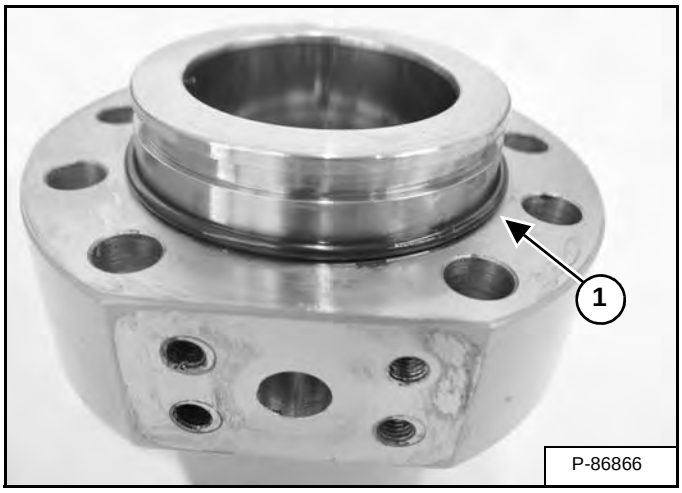
Install the wiper seal (Item 1) **[Figure 20-21-53]** into the head.

Figure 20-21-54



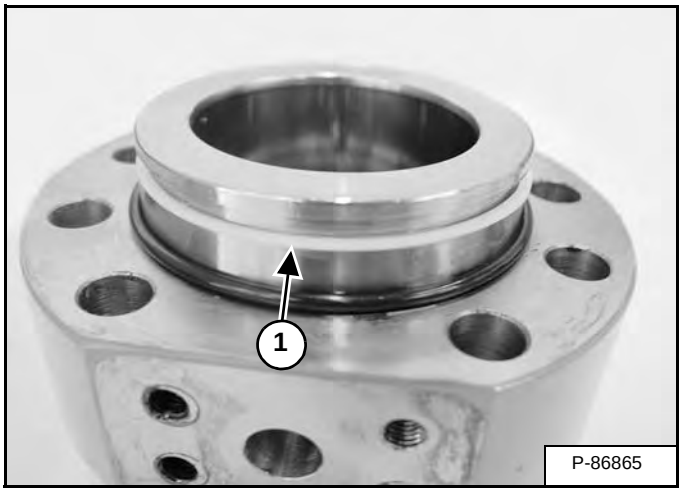
Install the snap ring (Item 1) **[Figure 20-21-54]** into the head.

Figure 20-21-55



Install the O-ring (Item 1) **[Figure 20-21-55]** onto the head.

Figure 20-21-56

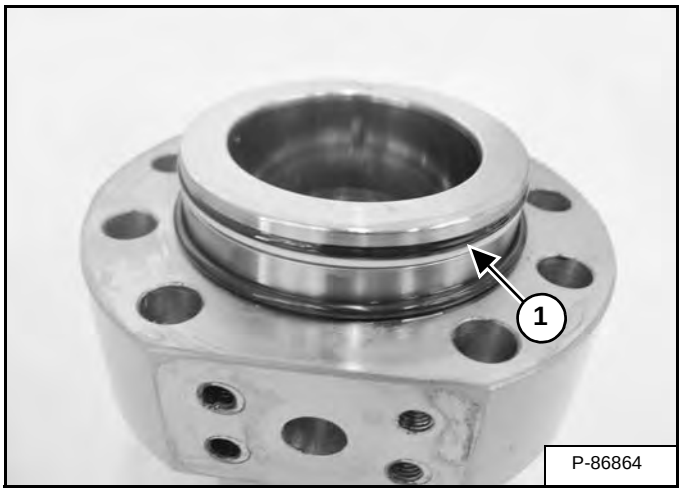


Install the back-up ring (Item 1) **[Figure 20-21-56]** onto the head.

Dealer Copy -- Not for Resale

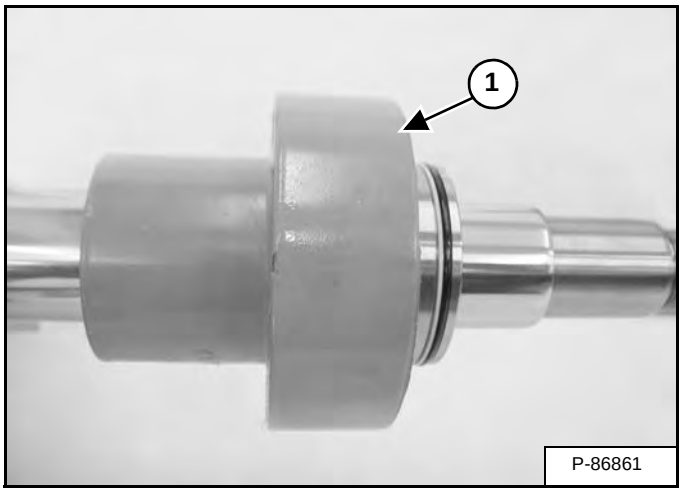
Assembly (Cont'd)

Figure 20-21-57



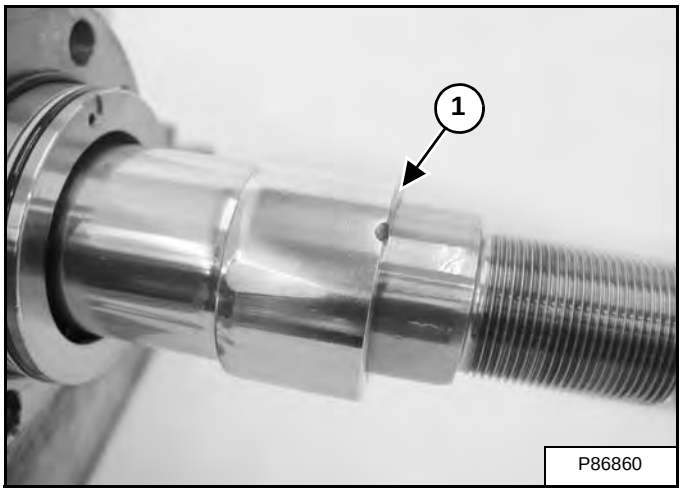
Install the O-ring (Item 1) **[Figure 20-21-57]**.

Figure 20-21-58



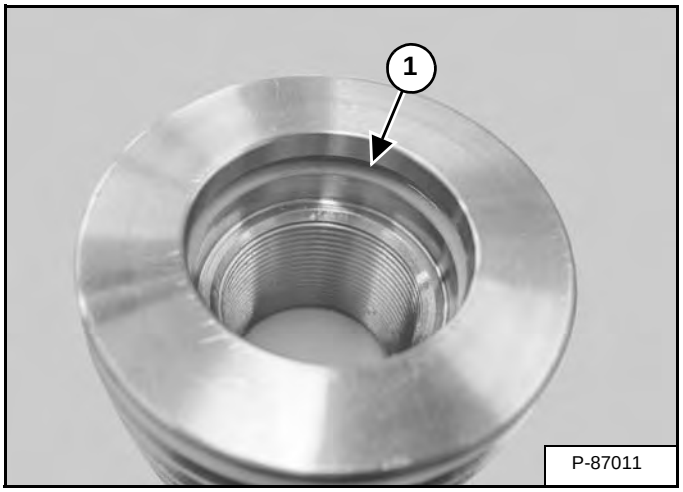
Install the head (Item 1) **[Figure 20-21-58]** onto the rod.

Figure 20-21-59



Install the cushion ring (Item 1) **[Figure 20-21-59]** on the rod.

Figure 20-21-60



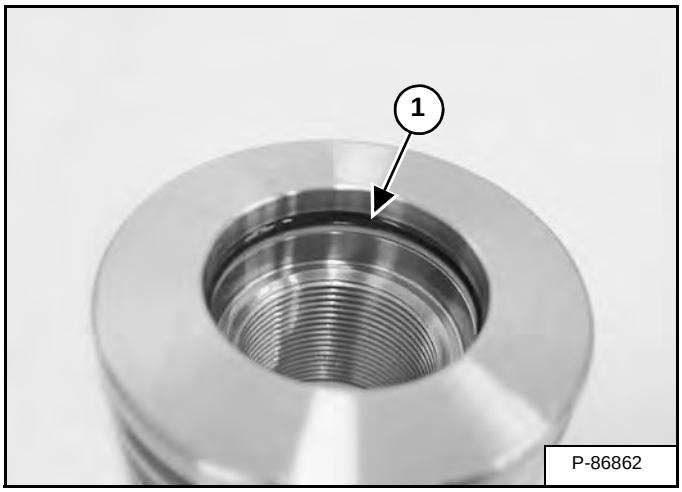
Install the back-up ring (Item 1) **[Figure 20-21-60]** into the piston.

Dealer Copy -- Not for Resale

CYLINDER (ARM) (CONT'D)

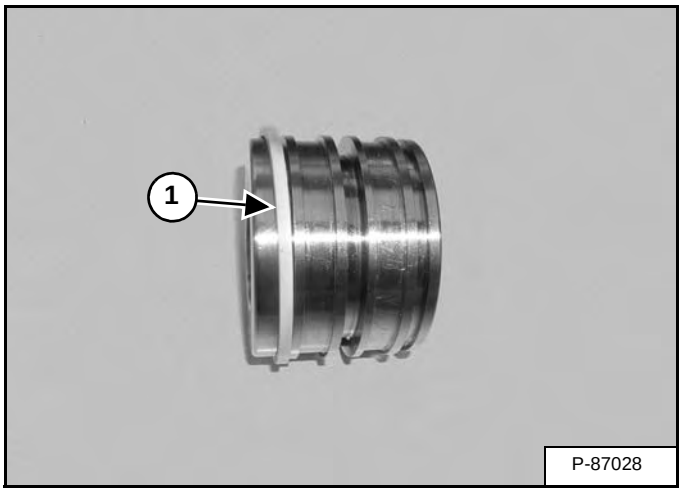
Assembly (Cont'd)

Figure 20-21-61



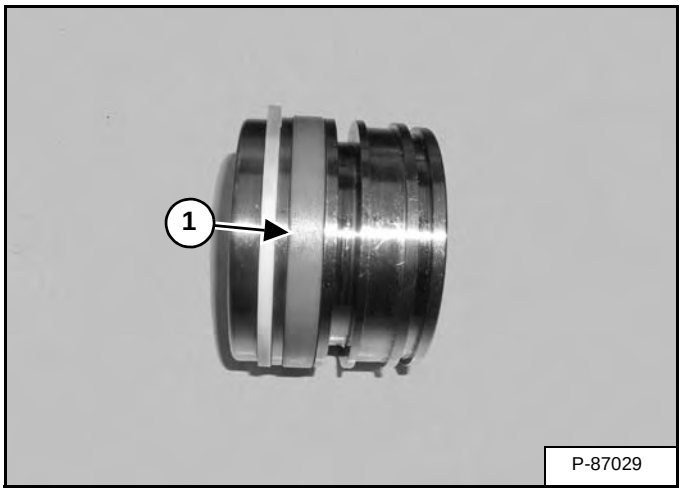
Install the O-ring (Item 1) **[Figure 20-21-61]** into the piston.

Figure 20-21-62



Install the seal (Item 1) **[Figure 20-21-62]** onto the piston.

Figure 20-21-63



Install the wear ring (Item 1) **[Figure 20-21-63]** onto the piston.

Figure 20-21-64

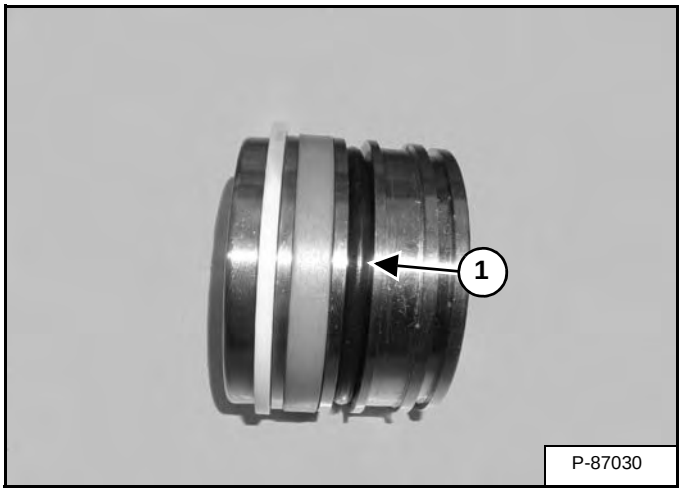
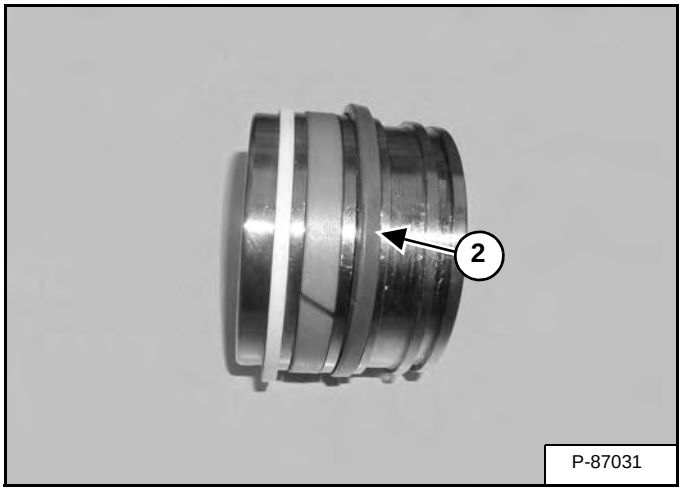


Figure 20-21-65

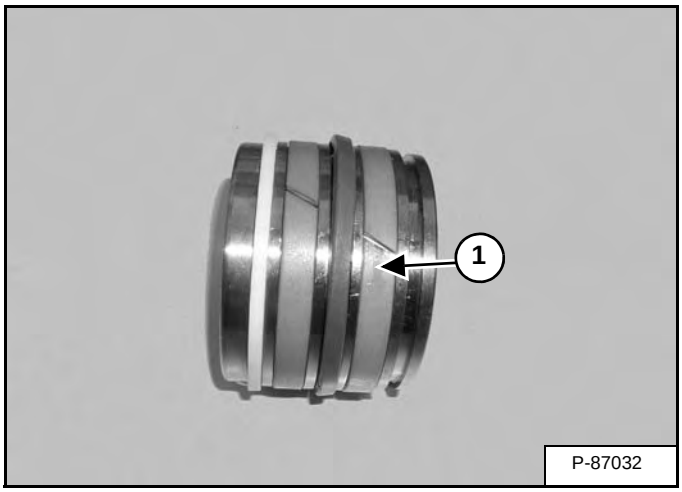


Install the O-ring (Item 1) **[Figure 20-21-64]** and seal (Item 2) **[Figure 20-21-65]** onto the piston.

Dealer Copy -- Not for Resale

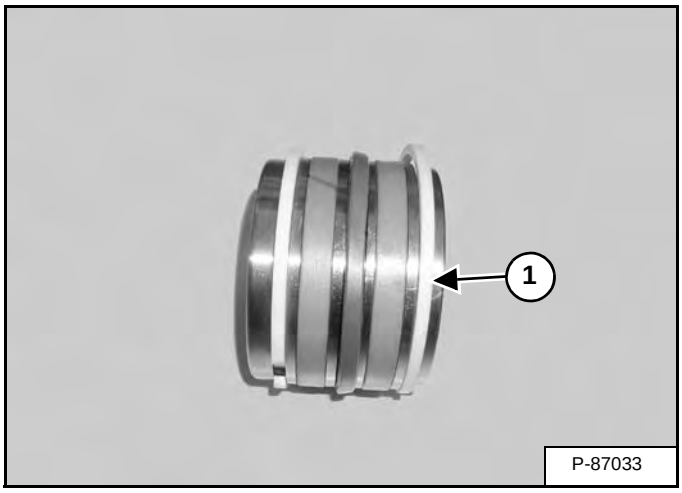
Assembly (Cont'd)

Figure 20-21-66



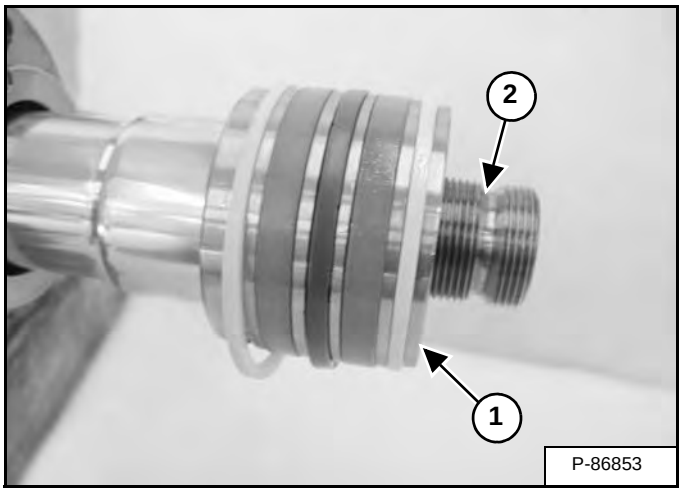
Install the wear ring (Item 1) **[Figure 20-21-66]** onto the piston.

Figure 20-21-67



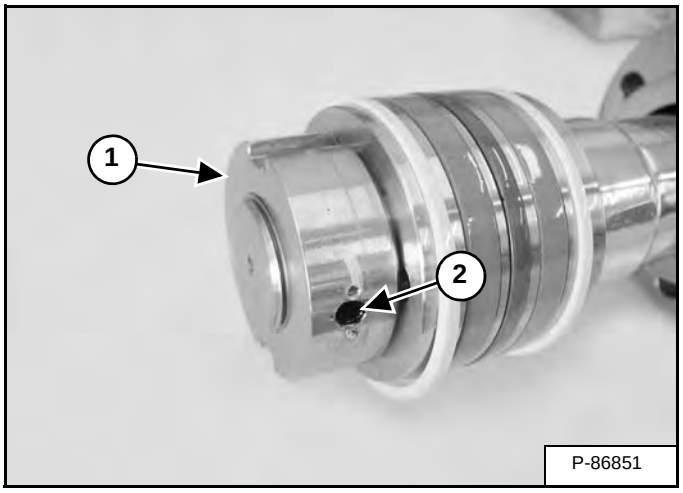
Install the seal (Item 1) **[Figure 20-21-67]** onto the piston.

Figure 20-21-68



Install the piston (Item 1) **[Figure 20-21-68]** onto the rod.

Figure 20-21-69



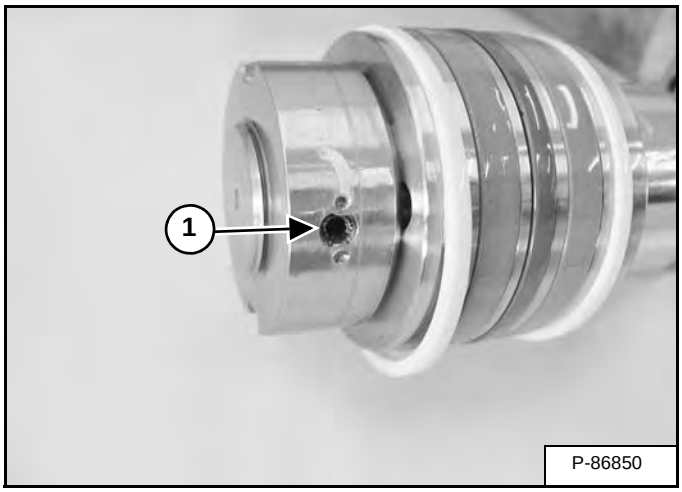
Install the nut (Item 1) **[Figure 20-21-69]**.

Tighten the nut until the bore (Item 2) **[Figure 20-21-69]** of the set screw is aligned with the groove (Item 2) **[Figure 20-21-68]** of the rod.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-21-70

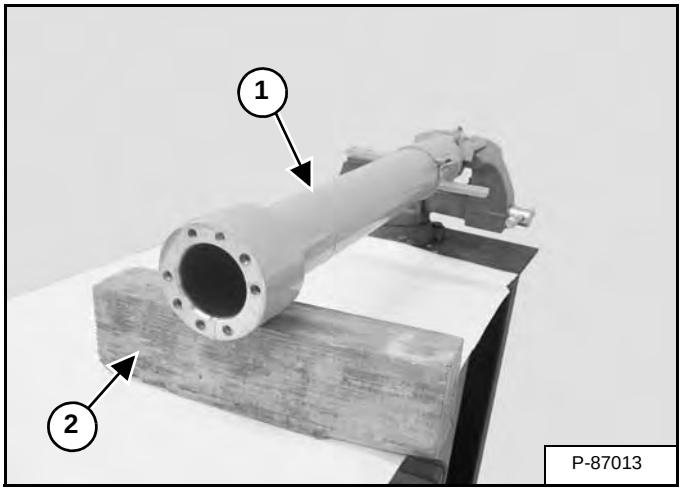


Install the set screw (Item 1) **[Figure 20-21-70]** into the nut.

Use a center punch to deform the threads of the set screw bore.

Remove the rod end from the vise.

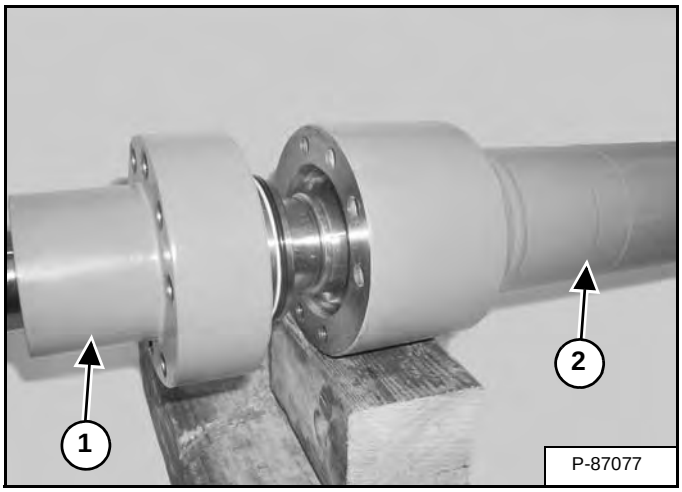
Figure 20-21-71



Install the base end of the cylinder housing (Item 1) **[Figure 20-21-71]** in a vise.

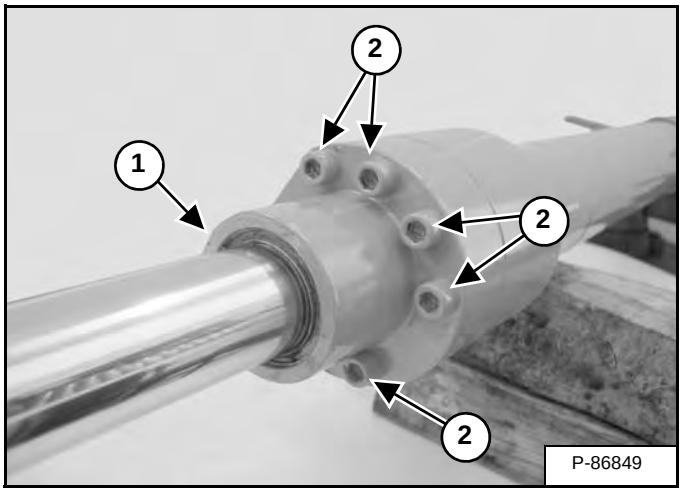
Support the housing with a block (Item 2) **[Figure 20-21-71]**.

Figure 20-21-72



Install the rod assembly (Item 1) into the cylinder housing (Item 2) **[Figure 20-21-72]**.

Figure 20-21-73



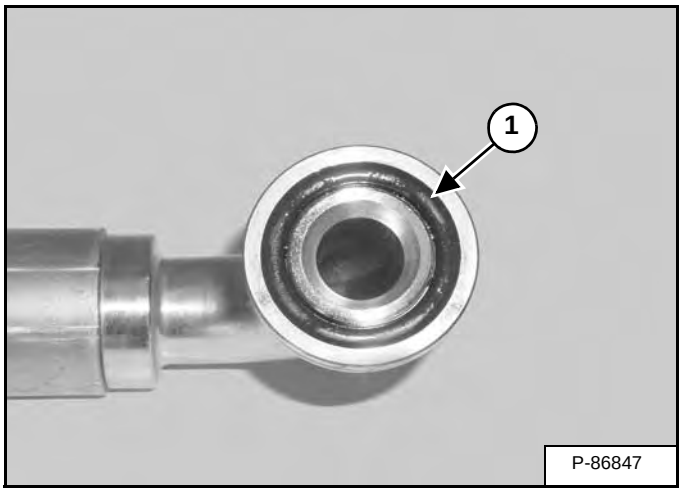
Install the head (Item 1) using the eight bolts (Item 2) **[Figure 20-21-73]**.

Tighten the bolts to 123 - 149 N•m (91 - 110 ft-lb) torque.

Dealer Copy -- Not for Resale

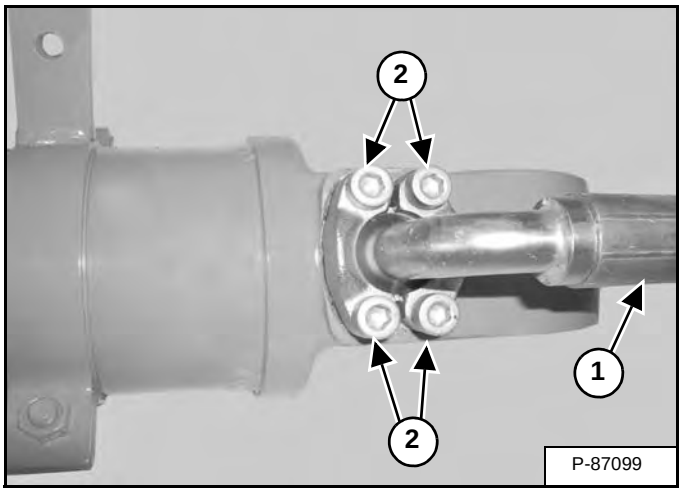
Assembly (Cont'd)

Figure 20-21-74



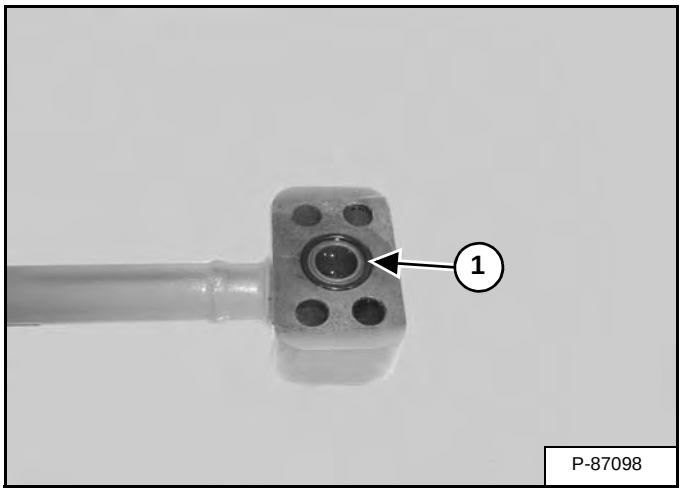
Install the O-ring (Item 1) **[Figure 20-21-74]** into the hose.

Figure 20-21-75



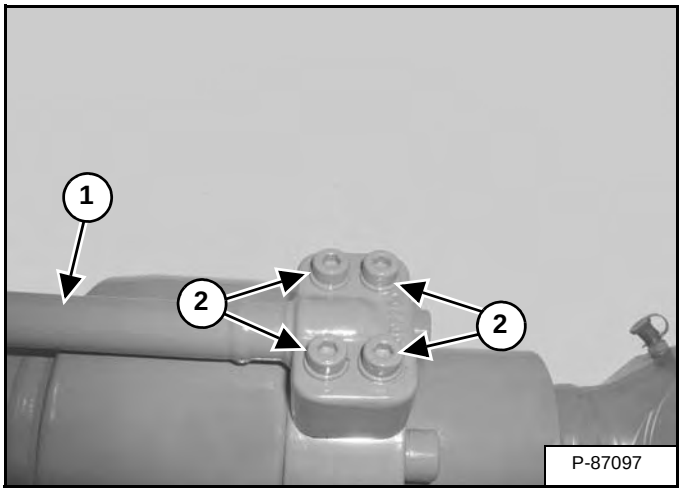
Install the hose (Item 1), lock washers and bolts (Item 2) **[Figure 20-21-75]** onto the cylinder housing.

Figure 20-21-76



Install the O-ring (Item 1) **[Figure 20-21-76]** into the tubeline.

Figure 20-21-77

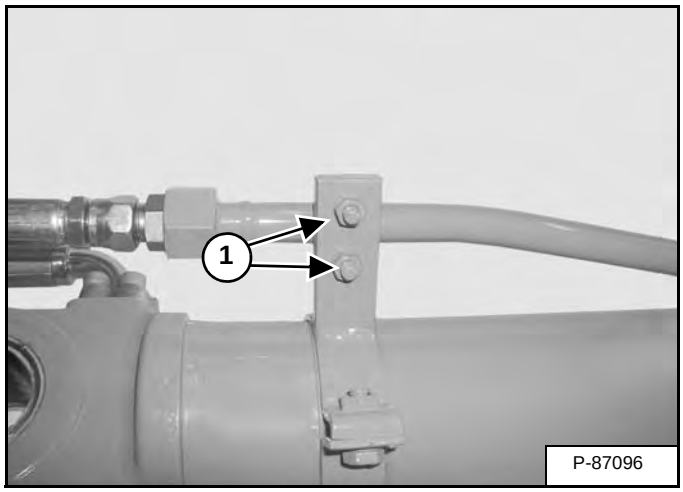


Install the tubeline (Item 1) using the four bolts (Item 2) **[Figure 20-21-77]** and lock washers.

Dealer Copy -- Not for Resale

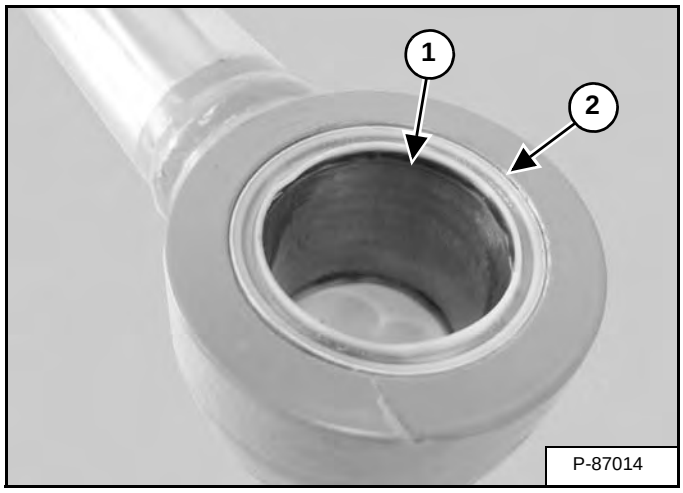
Assembly (Cont'd)

Figure 20-21-78



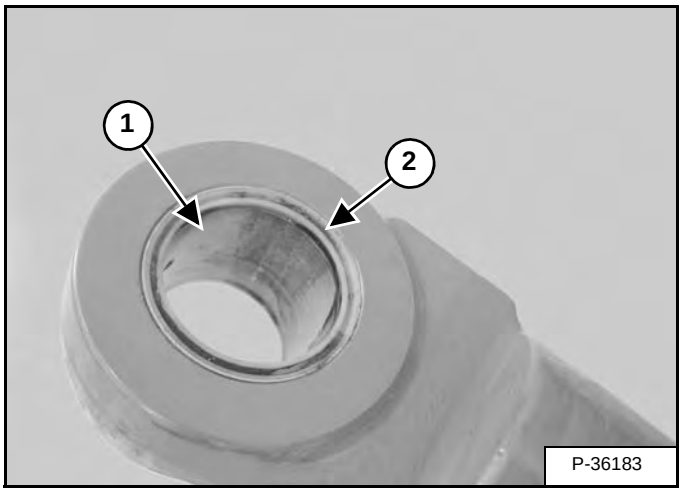
Install the U-bolt, washers and nuts (Item 1) **[Figure 20-21-78]**.

Figure 20-21-79



Install the bushing (Item 1) and seal (Item 2) **[Figure 20-21-79]** into both sides of the rod end of the cylinder.

Figure 20-21-80



Install the bushing (Item 1) and seal (Item 2) **[Figure 20-21-80]** into both sides of the base end of the cylinder.

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CYLINDER (BOOM SWING)

Testing

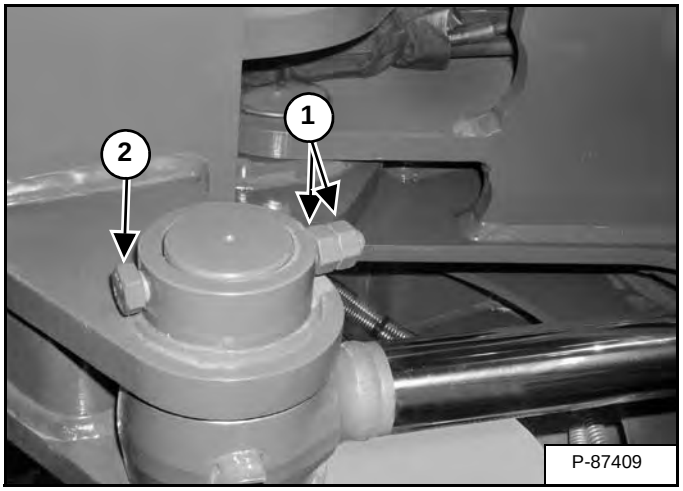
Swing the boom to the right, fully extending the boom offset cylinder.

Lower the boom / bucket to the ground.

Stop the engine.

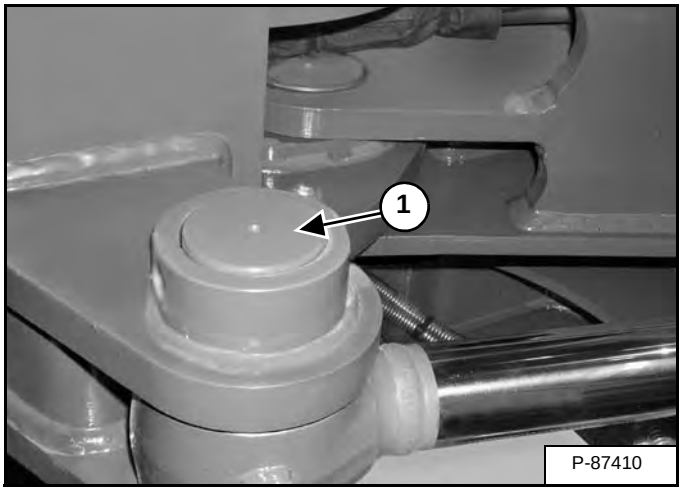
Remove the left upperstructure side cover. (See Removal And Installation on Page 40-20-1.)

Figure 20-22-1



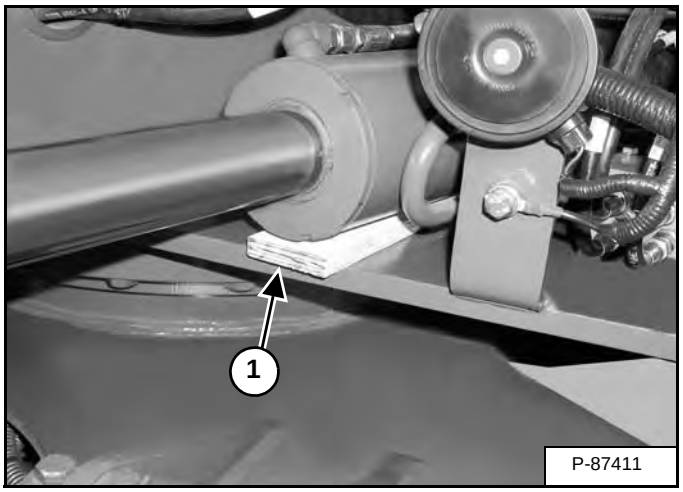
Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-22-1]**.

Figure 20-22-2



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

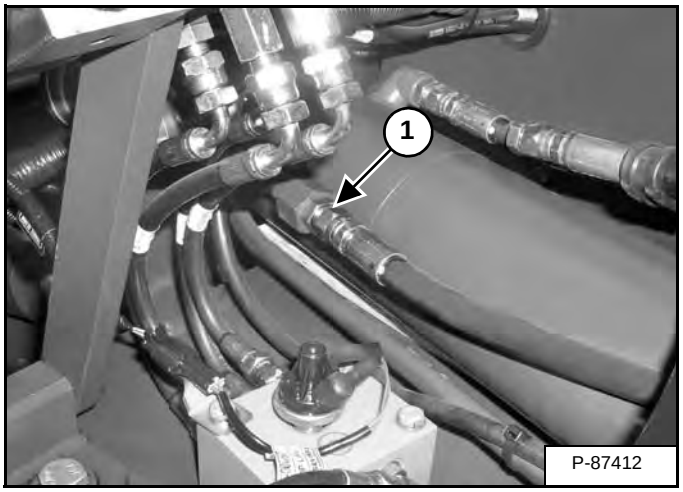
Figure 20-22-3



Place a board (Item 1) **[Figure 20-22-3]** between the cylinder and the excavator frame.

Tilt the cab. (See Raising And Lowering on Page 10-210-1.)

Figure 20-22-4



Remove the base end hose (Item 1) **[Figure 20-22-4]**.

Install a plug on the hose.

Lower the cab.

Start the engine.

Retract the cylinder.

If there is any oil leakage from the base end fitting (Item 1) **[Figure 20-22-4]** on the cylinder, remove the cylinder for repair or replacement.

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CYLINDER (BOOM SWING) (CONT'D)

Removal And Installation

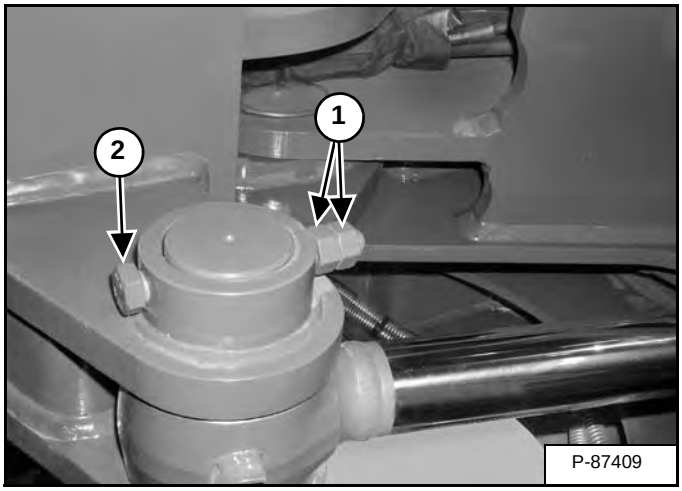
Swing the upperstructure 90° to the left or right.

Swing the boom to the right, fully extending the boom offset cylinder.

Lower the boom / bucket to the ground.

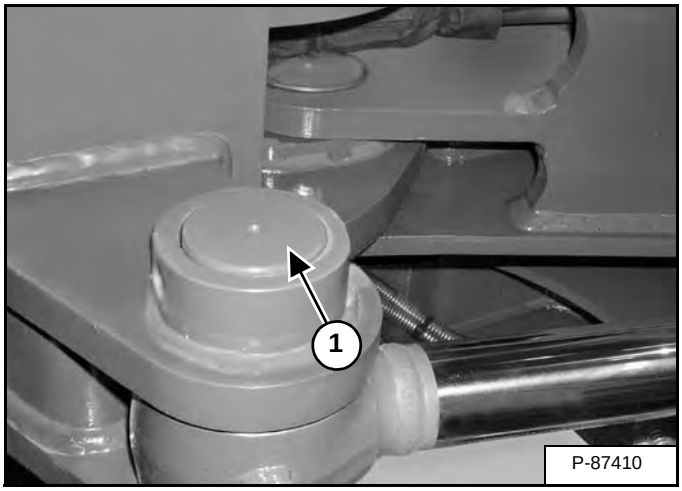
Stop the engine.

Figure 20-22-5



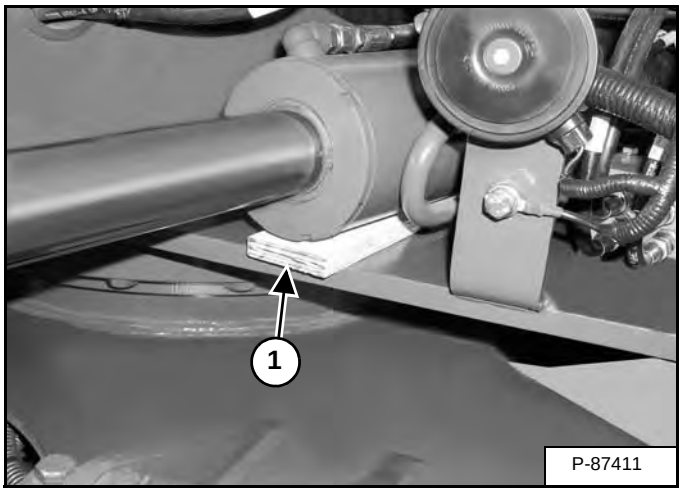
Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-22-5]**.

Figure 20-22-6



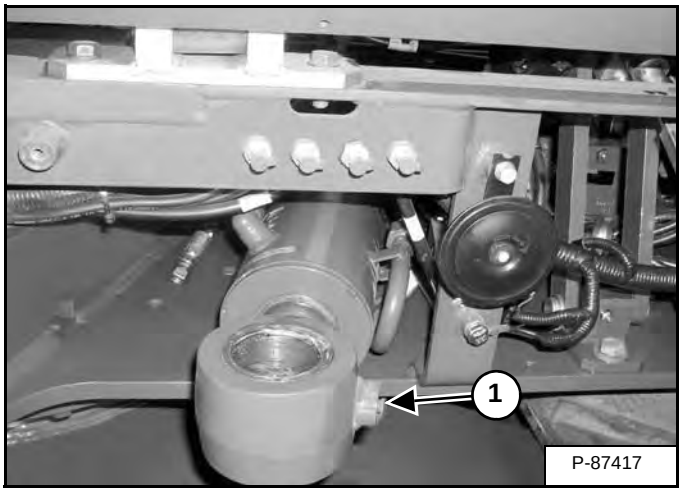
Remove the pivot pin (Item 1) **[Figure 20-22-6]**.

Figure 20-22-7



Place a board (Item 1) **[Figure 20-22-7]** between the cylinder and the excavator frame.

Figure 20-22-8



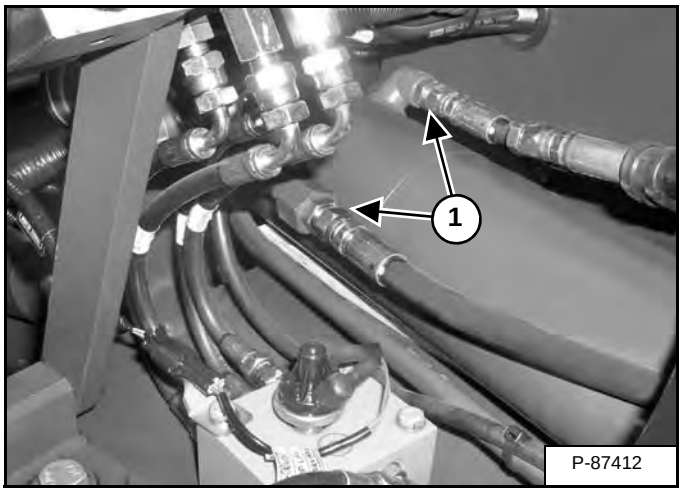
Start the excavator and fully retract the cylinder (Item 1) **[Figure 20-22-8]**.

Tilt the cab. (See Raising And Lowering on Page 10-210-1.)

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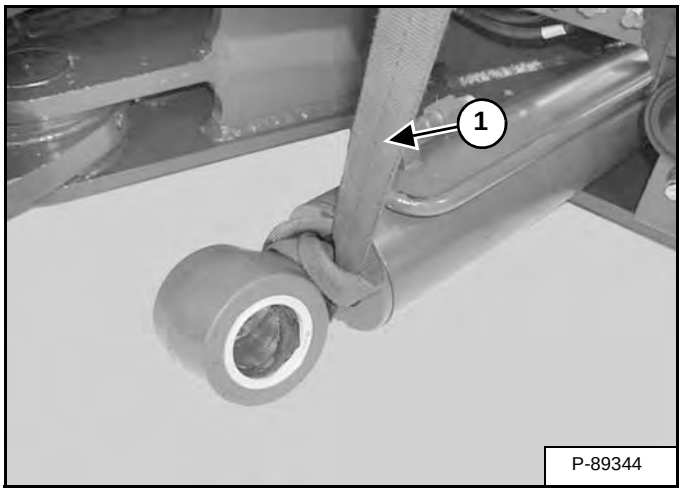
Removal And Installation (Cont'd)

Figure 20-22-9



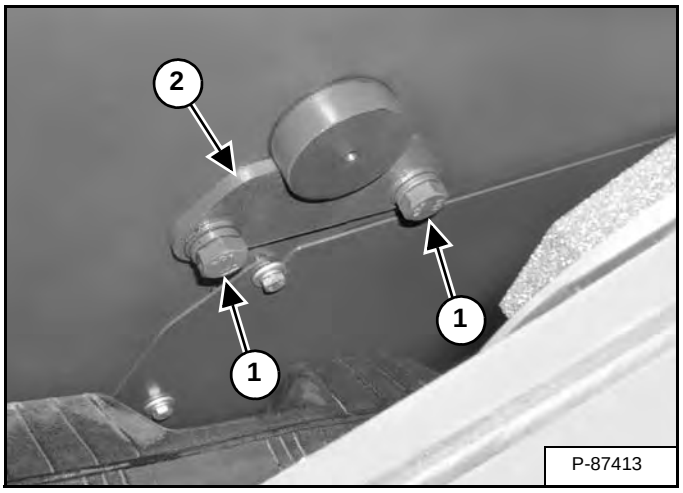
Remove the hoses (Item 1) **[Figure 20-22-9]**.

Figure 20-22-10



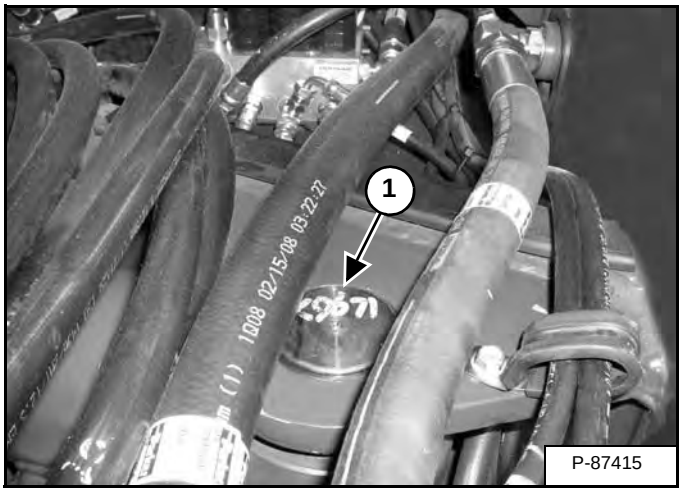
Install a sling (Item 1) **[Figure 20-22-10]** and a lifting device on the rod end of the cylinder.

Figure 20-22-11



Remove the two bolts (Item 1) and the retaining plate (Item 2) **[Figure 20-22-11]**.

Figure 20-22-12

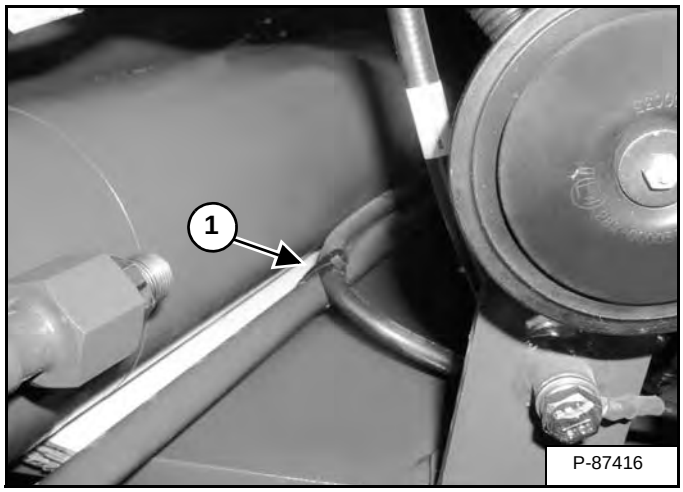


Remove the pin (Item 1) **[Figure 20-22-12]**.

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Removal And Installation (Cont'd)

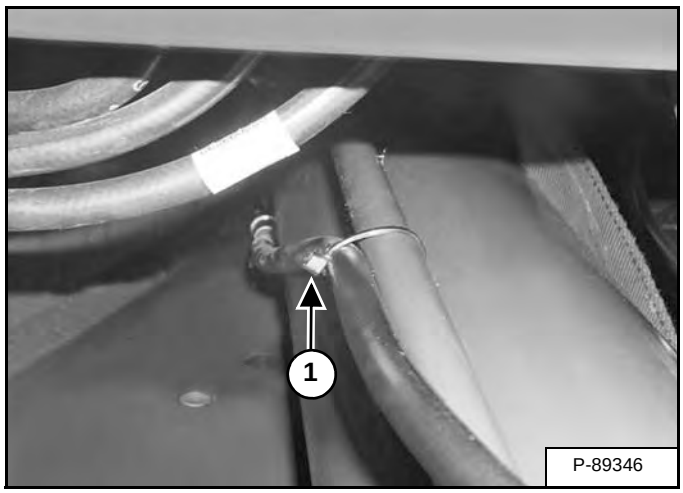
Figure 20-22-13



Slide the cylinder out of the front of the excavator until the cable tie (Item 1) **[Figure 20-22-13]** can be removed.

Remove the cable tie.

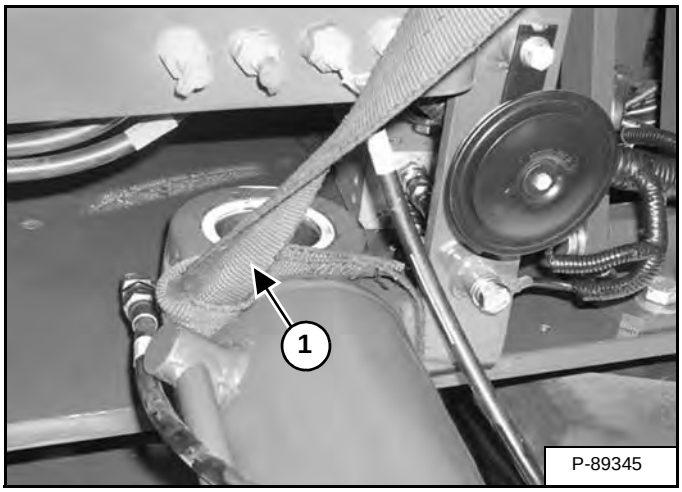
Figure 20-22-14



Continue sliding the cylinder out until the second cable tie (Item 1) **[Figure 20-22-14]** can be removed.

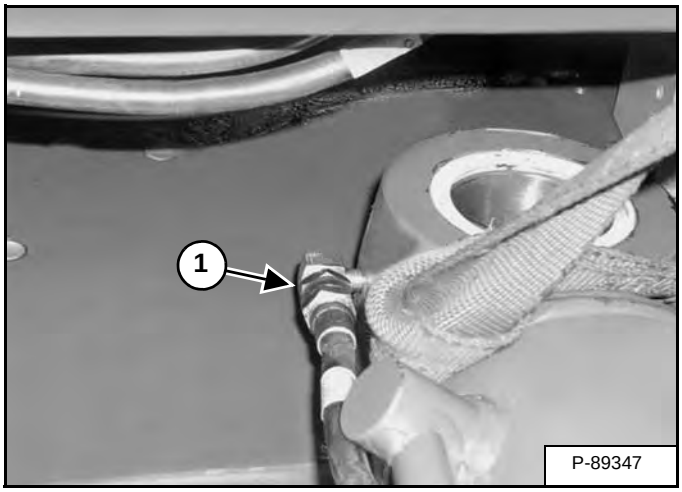
Remove the cable tie.

Figure 20-22-15



Install a sling (Item 1) **[Figure 20-22-15]** and lifting device on the base end of the cylinder.

Figure 20-22-16



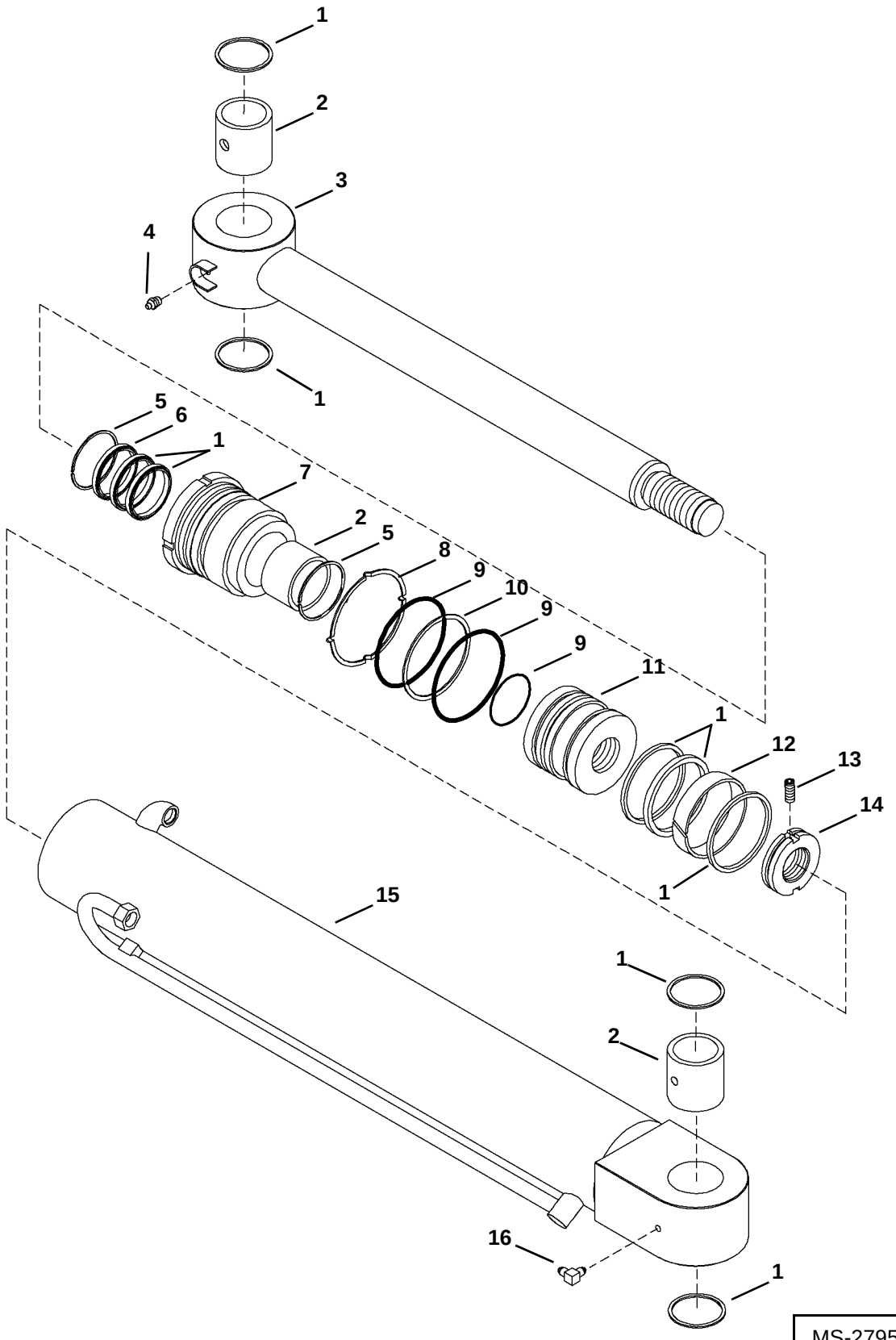
Remove the grease hose (Item 1) **[Figure 20-22-16]**.

Remove the cylinder.

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Parts Identification

1. Seal
2. Bushing
3. Rod
4. Grease Fitting
5. Snap Ring
6. Wiper
7. Head
8. Lock Ring
9. O-ring
10. Back-up Ring
11. Piston
12. Wear Ring
13. Set Screw
14. Nut
15. Housing
16. Fitting



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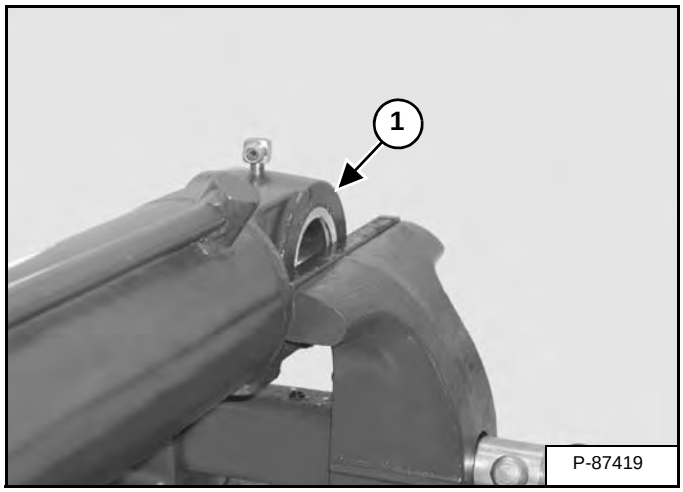
Disassembly

Use the following tools to disassemble the cylinder:

MEL1074- O-ring Seal Hook

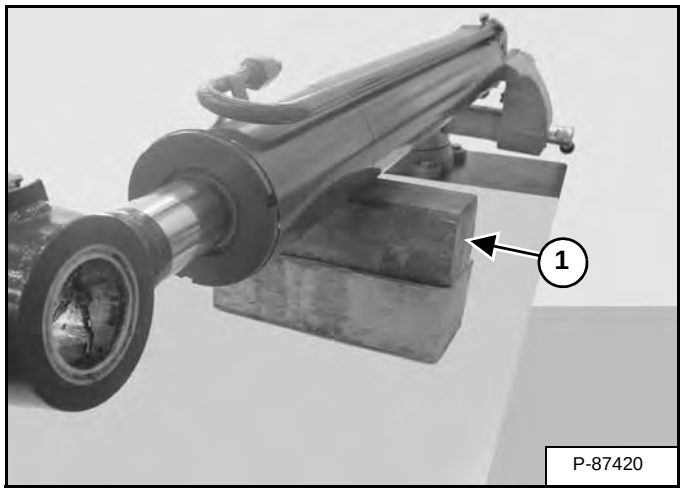
Hold the cylinder over a drain pan and slowly move the rod in and out to remove the oil from the cylinder.

Figure 20-22-17



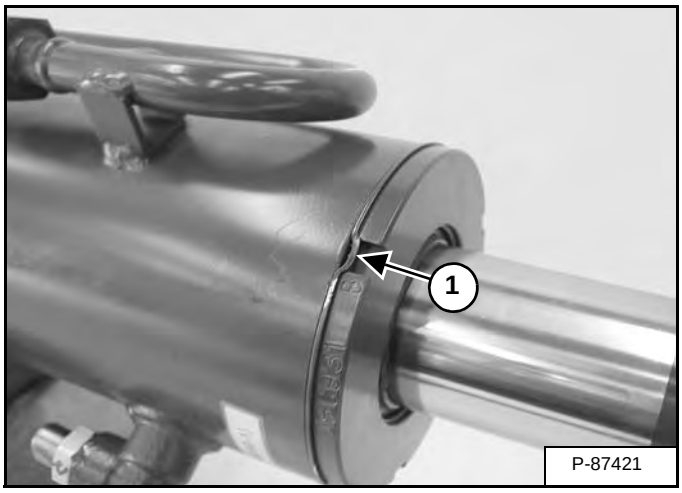
Clamp the base end (Item 1) **[Figure 20-22-17]** of the cylinder in a vise.

Figure 20-22-18



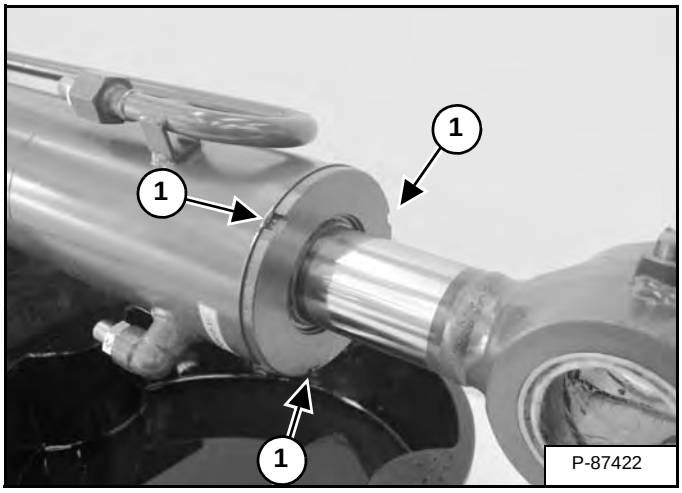
Support the cylinder with a block (Item 1) **[Figure 20-22-18]**. Be careful not to damage the cylinder housing.

Figure 20-22-19



Straighten the lock ring tab (Item 1) **[Figure 20-22-19]**.

Figure 20-22-20

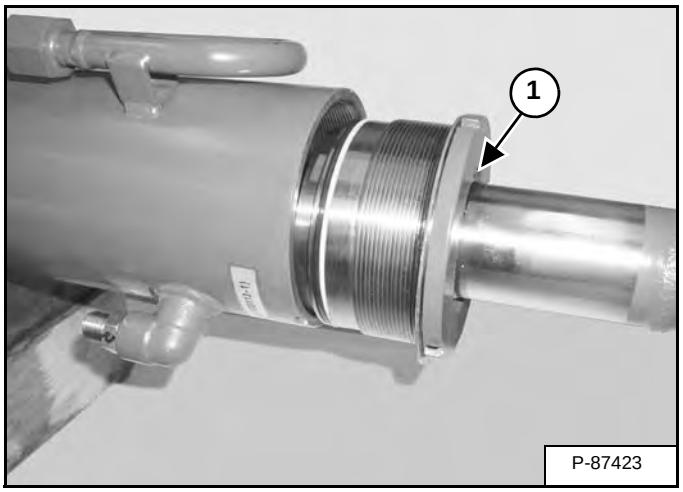


Insert the adjustable gland nut wrench into the notches (Item 1) **[Figure 20-22-20]** and loosen the head.

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Disassembly (Cont'd)

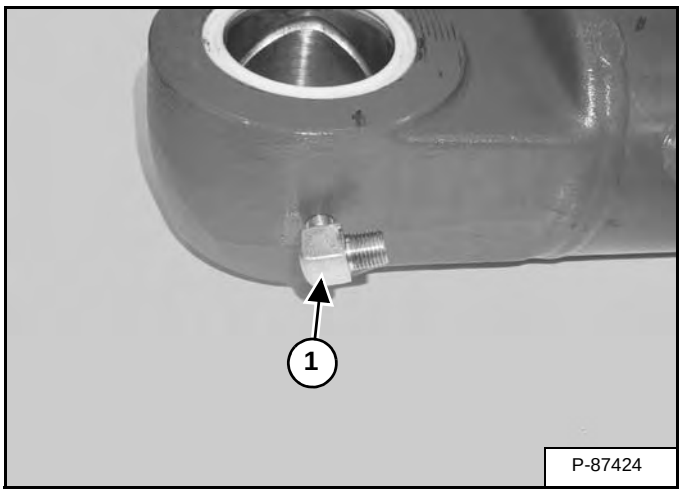
Figure 20-22-21



Remove the rod assembly (Item 1) **[Figure 20-22-21]** from the housing.

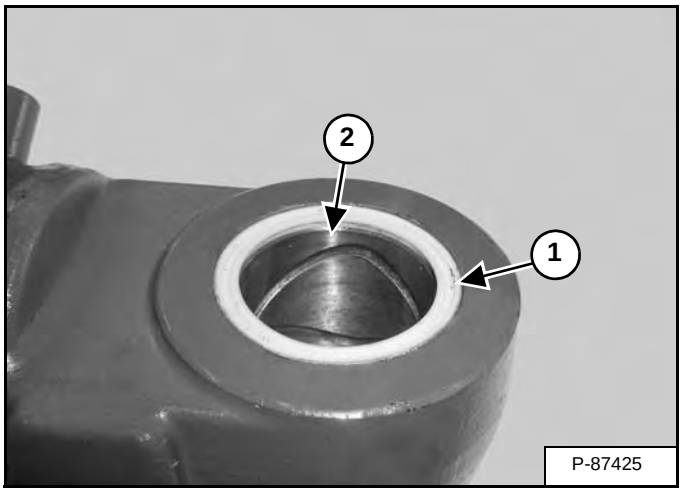
Remove the cylinder from the vise.

Figure 20-22-22



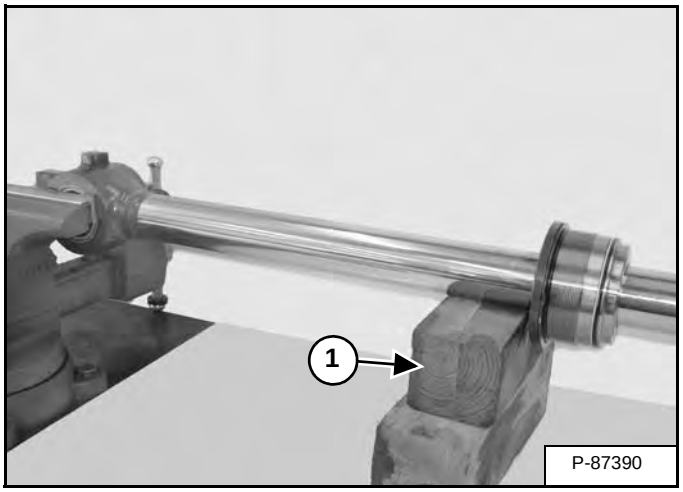
Remove the fitting (Item 1) **[Figure 20-22-22]**.

Figure 20-22-23



Remove the seal (Item 1) (both sides) and bushing (Item 2) **[Figure 20-22-23]**.

Figure 20-22-24

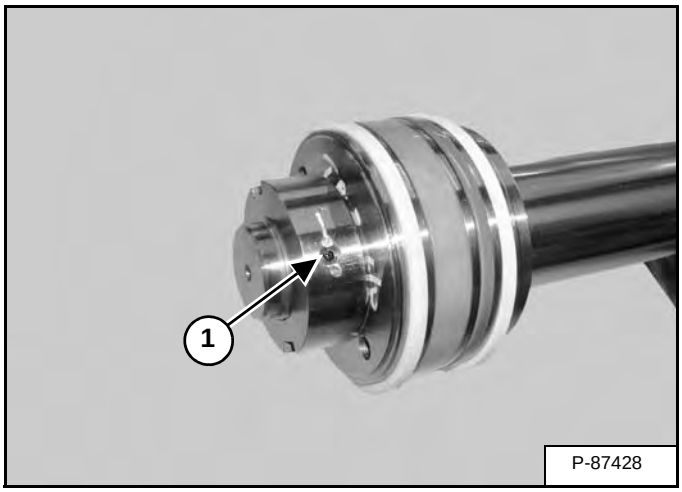


Clamp the rod end in a vise. Support the rod with a block (Item 1) **[Figure 20-22-24]**.

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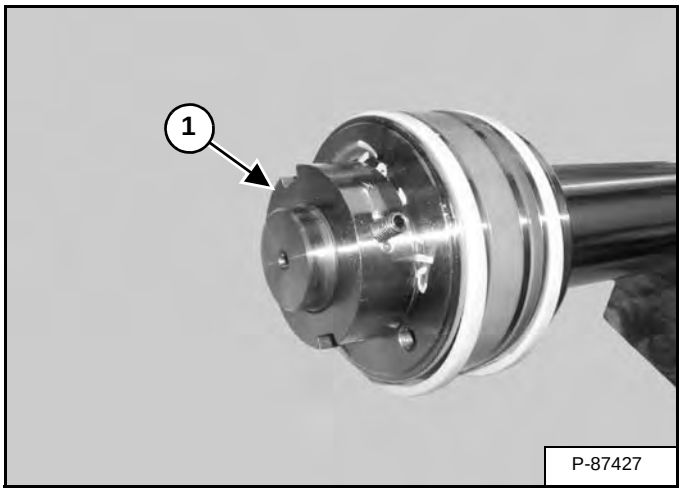
Disassembly (Cont'd)

Figure 20-22-25



Loosen the set screw (Item 1) **[Figure 20-22-25]**.

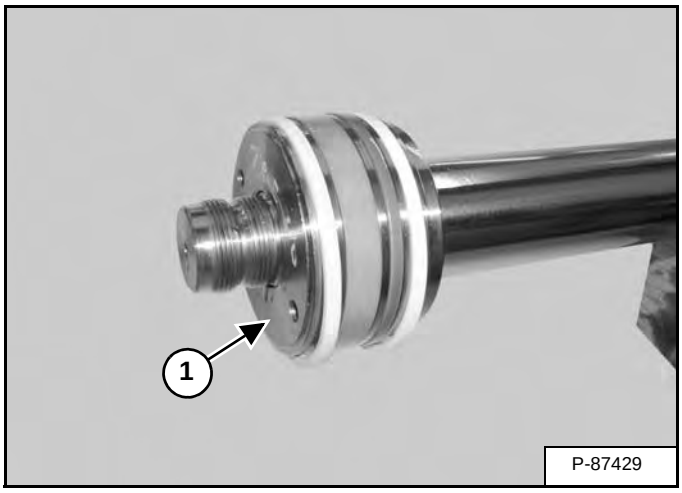
Figure 20-22-26



Apply moderate heat to the nut (Item 1) **[Figure 20-22-25]**.

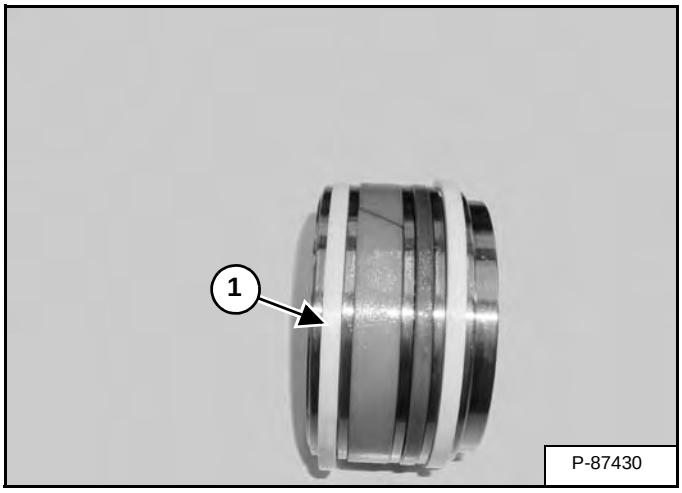
Remove the nut.

Figure 20-22-27



Remove the piston (Item 1) **[Figure 20-22-27]**.

Figure 20-22-28

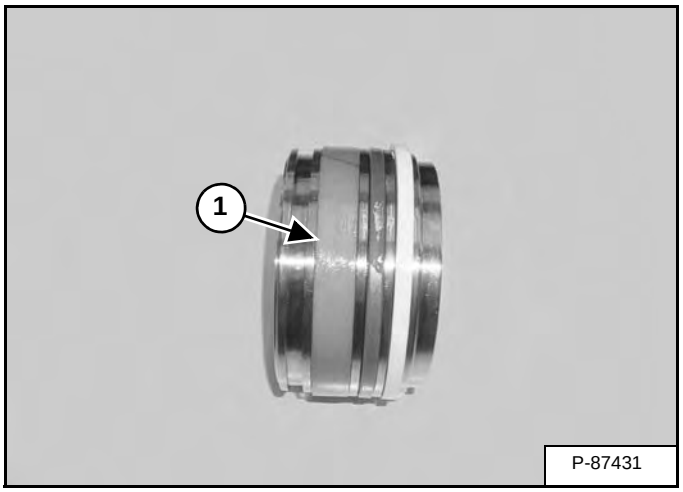


Remove the seal (Item 1) **[Figure 20-22-28]**.

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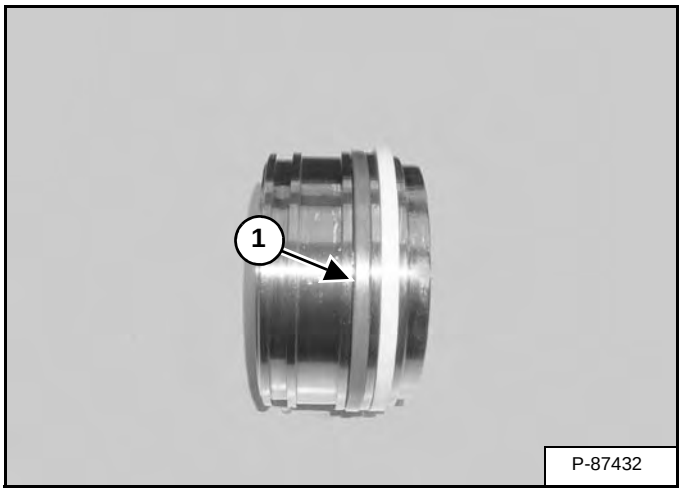
Disassembly (Cont'd)

Figure 20-22-29



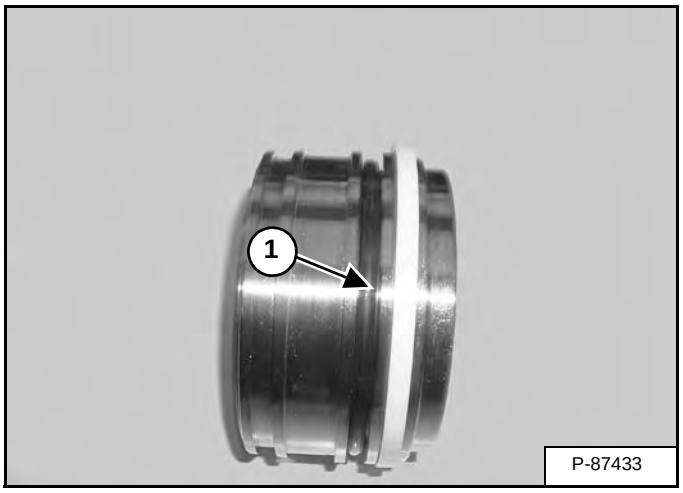
Remove the wear ring (Item 1) **[Figure 20-22-29]**.

Figure 20-22-30



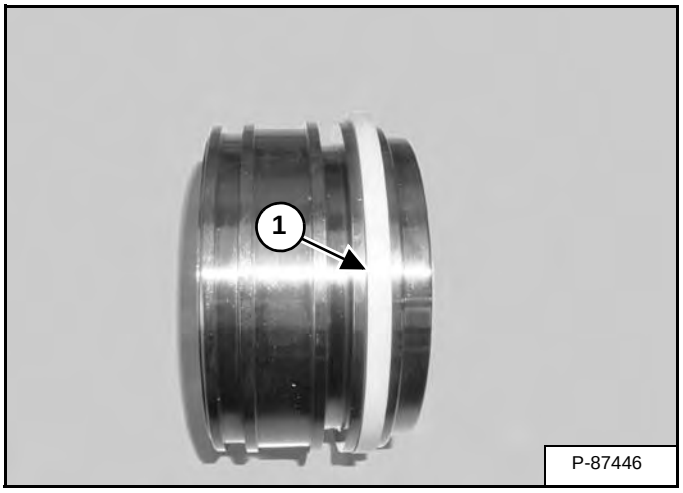
Remove the seal (Item 1) **[Figure 20-22-30]**.

Figure 20-22-31



Remove the O-ring (Item 1) **[Figure 20-22-31]**.

Figure 20-22-32

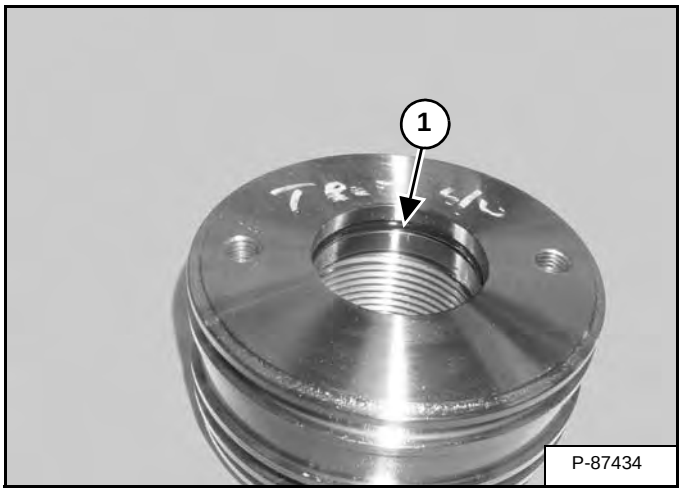


Remove the seal (Item 1) **[Figure 20-22-32]**.

Dealer Copy -- Not for Resale

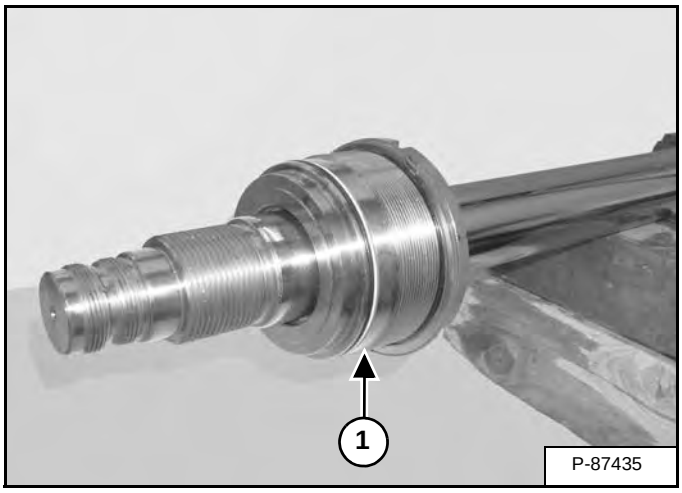
Disassembly (Cont'd)

Figure 20-22-33



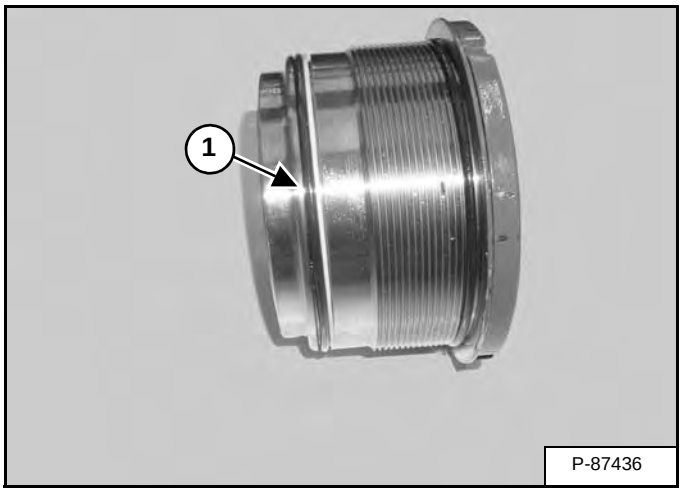
Remove the O-ring (Item 1) **[Figure 20-22-33]**.

Figure 20-22-34



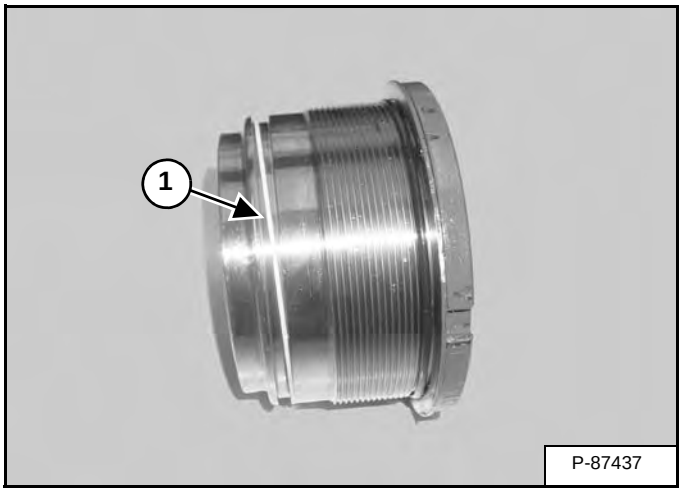
Remove the head (Item 1) **[Figure 20-22-34]**.

Figure 20-22-35



Remove the O-ring (Item 1) **[Figure 20-22-35]**.

Figure 20-22-36

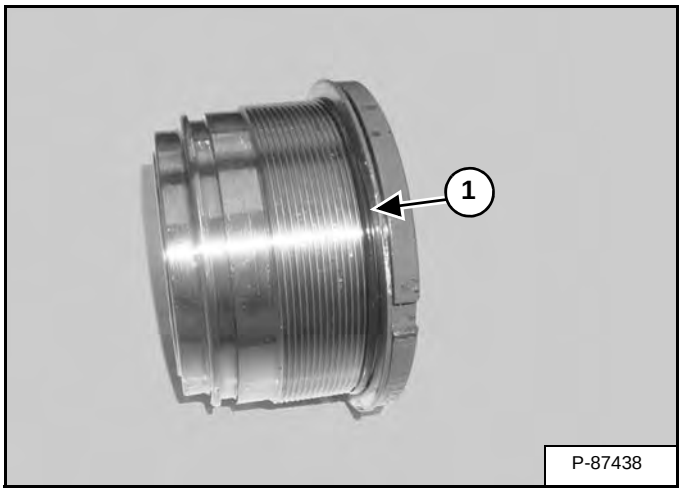


Remove the back-up ring (Item 1) **[Figure 20-22-36]**.

Dealer Copy -- Not for Resale

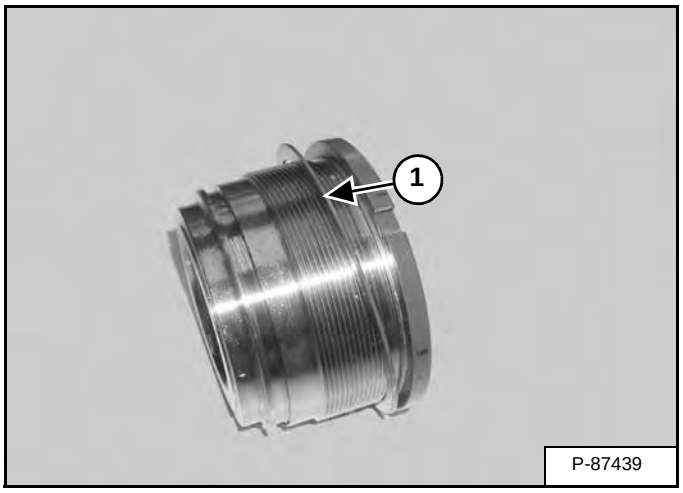
Disassembly (Cont'd)

Figure 20-22-37



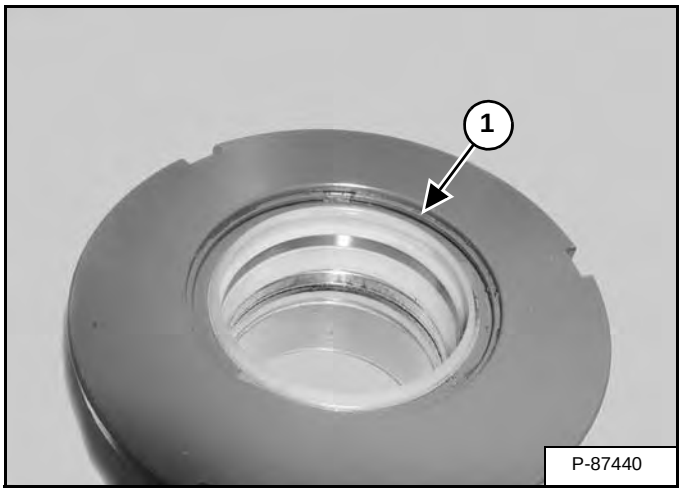
Remove the O-ring (Item 1) **[Figure 20-22-37]**.

Figure 20-22-38



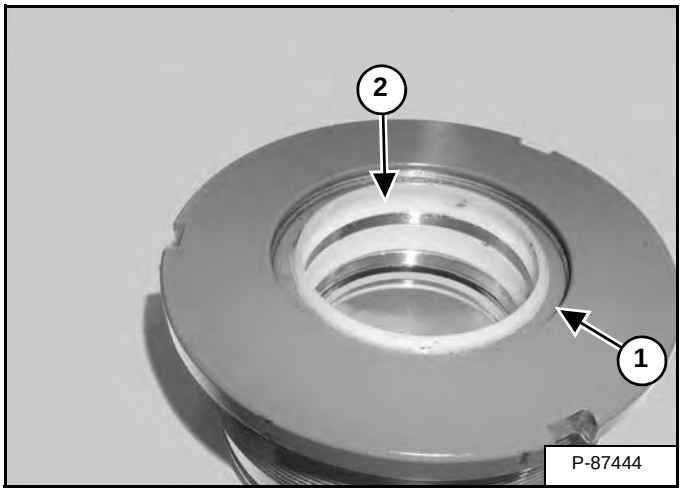
Remove the lock ring (Item 1) **[Figure 20-22-38]**.

Figure 20-22-39



Remove the snap ring (Item 1) **[Figure 20-22-39]**.

Figure 20-22-40

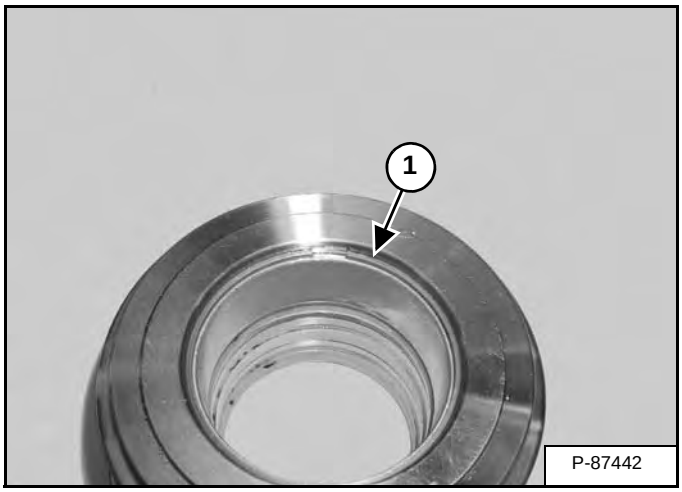


Remove the wiper seal (Item 1) and inner seal (Item 2) **[Figure 20-22-40]**.

Dealer Copy -- Not for Resale

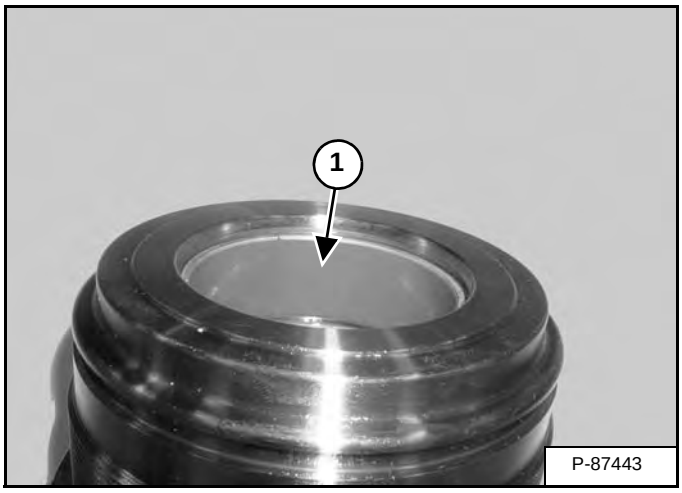
Disassembly (Cont'd)

Figure 20-22-41



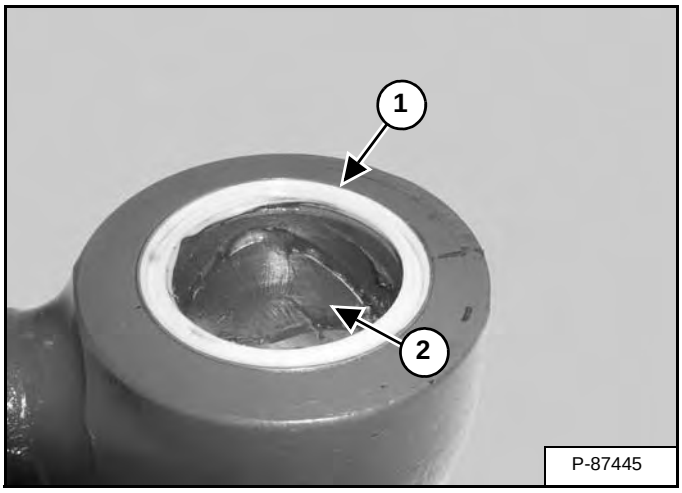
Remove the snap ring (Item 1) **[Figure 20-22-41]**.

Figure 20-22-42



Remove the bushing (Item 1) **[Figure 20-22-42]**.

Figure 20-22-43



Remove the seal (Item 1) (both sides) and bushing (Item 2) **[Figure 20-22-43]**.

Dealer Copy -- Not for Resale

Assembly

Use the following tools to assemble the cylinder:

MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
MEL1396-2 - Piston Ring Compressor

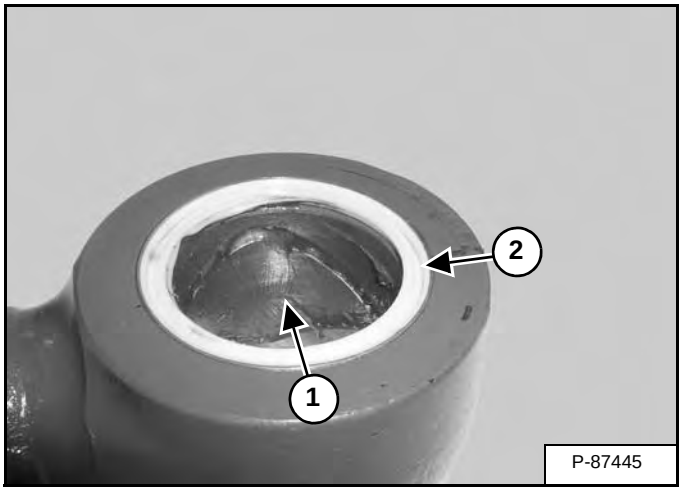
Wash the cylinder parts in clean solvent and dry with compressed air.

Inspect the cylinder parts for nicks, scratches and other damage. Replace any damaged parts.

Always install new O-rings and seals during assembly.

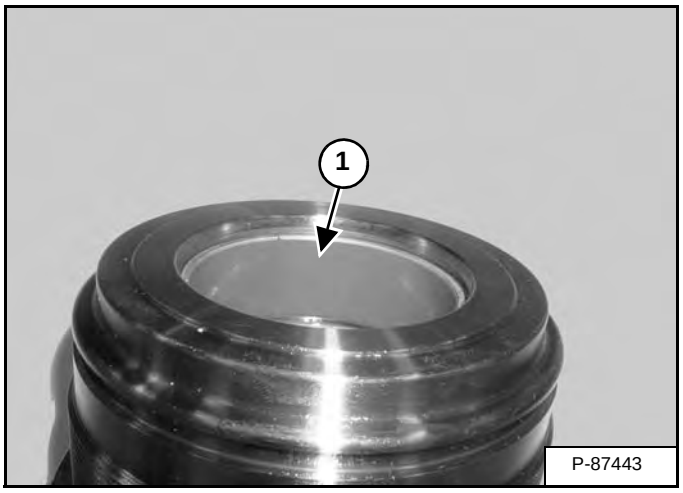
Lubricate all O-ring and seals with hydraulic oil during installation.

Figure 20-22-44



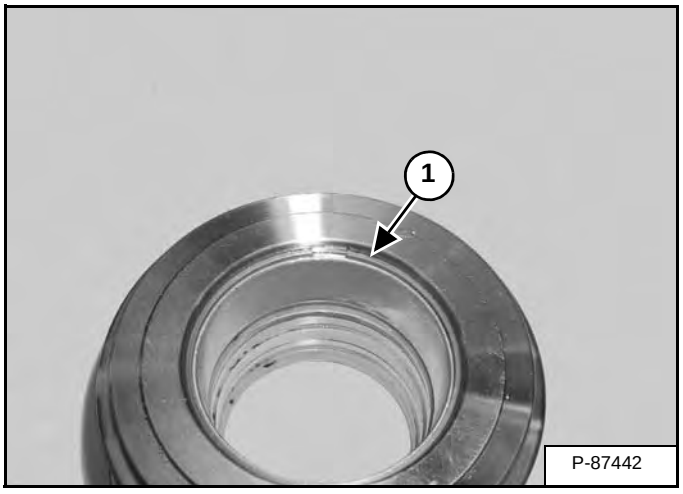
Install the bushing (Item 1) and seal (Item 2) **[Figure 20-22-44]**. (Both sides)

Figure 20-22-45



Install the bushing (Item 1) **[Figure 20-22-45]** into the head.

Figure 20-22-46

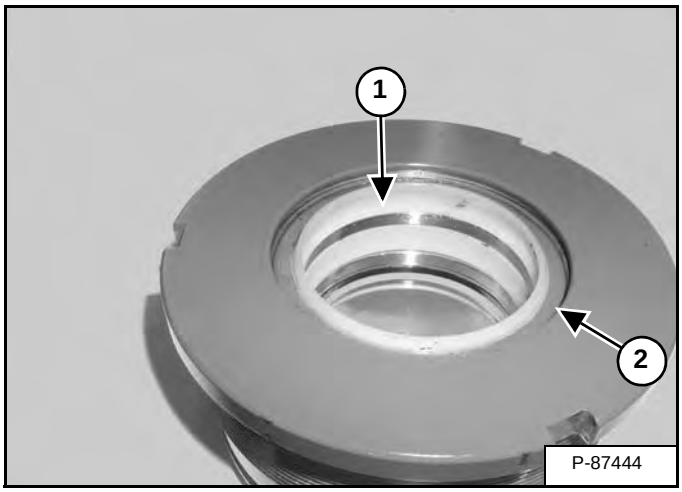


Install the snap ring (Item 1) **[Figure 20-22-46]**.

Dealer Copy -- Not for Resale

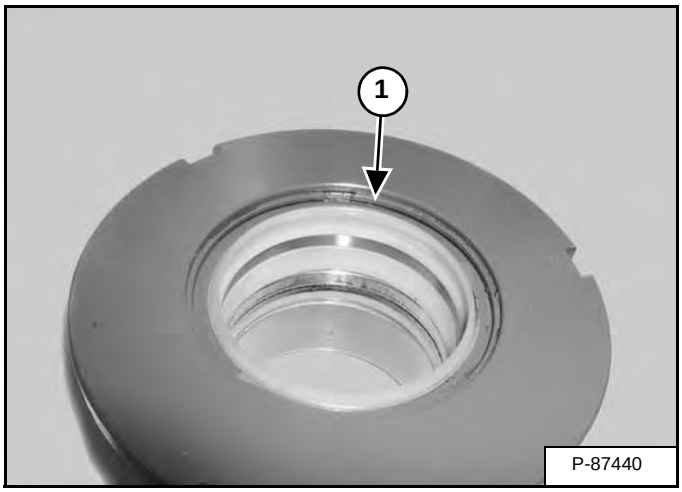
Assembly (Cont'd)

Figure 20-22-47



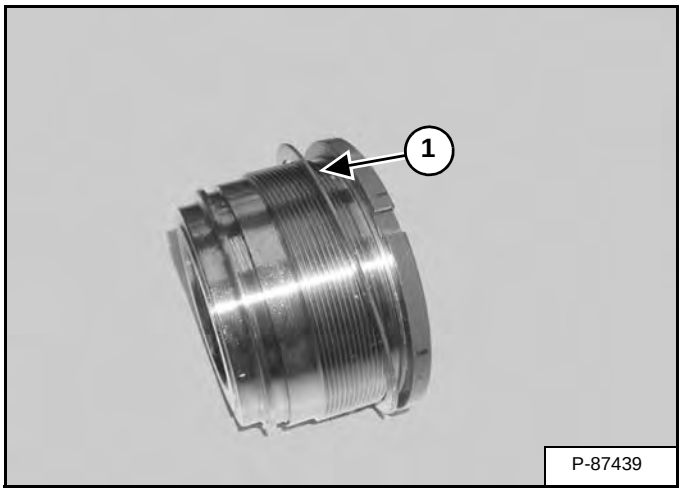
Install the inner seal (Item 1) and wiper seal (Item 2) **[Figure 20-22-47]**.

Figure 20-22-48



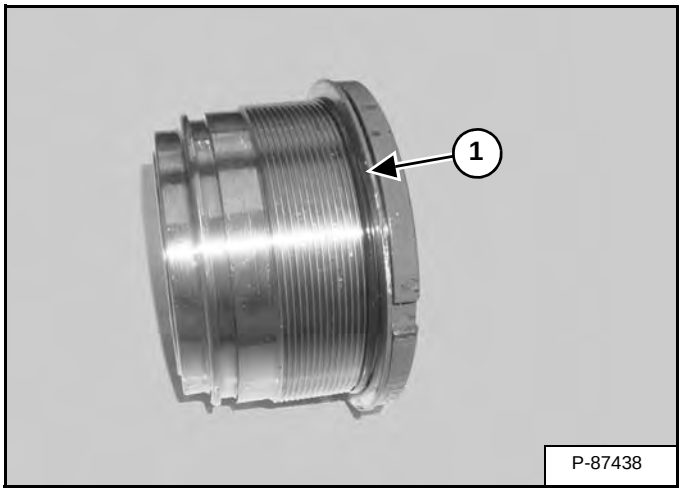
Install the snap ring (Item 1) **[Figure 20-22-48]**.

Figure 20-22-49



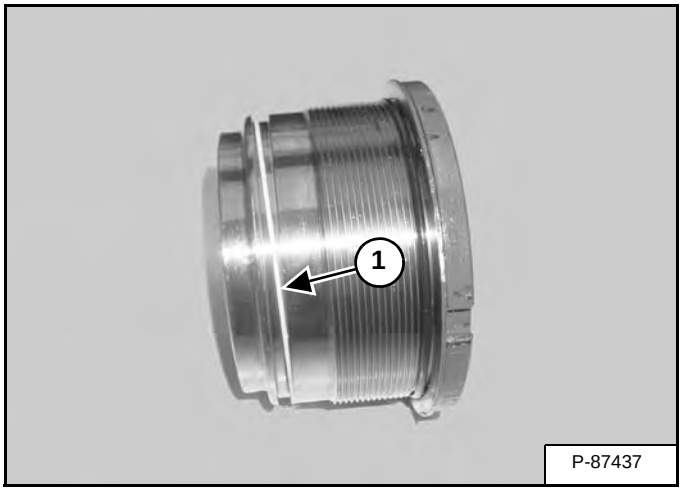
Install the lock ring (Item 1) **[Figure 20-22-49]**.

Figure 20-22-50



Install the O-ring (Item 1) **[Figure 20-22-50]**.

Figure 20-22-51

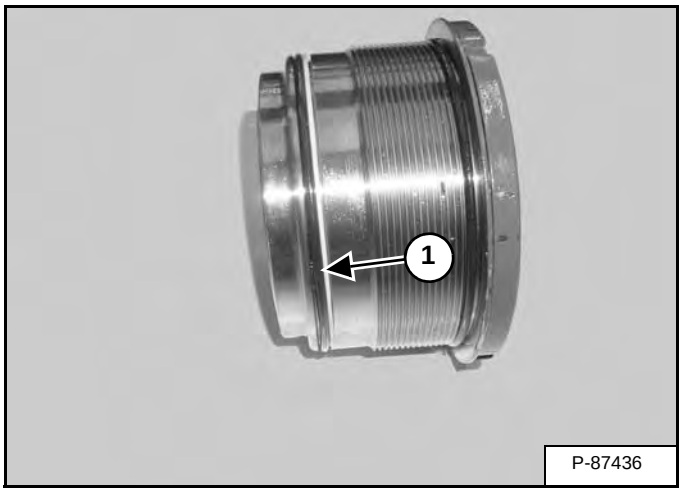


Install the back-up ring (Item 1) **[Figure 20-22-51]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

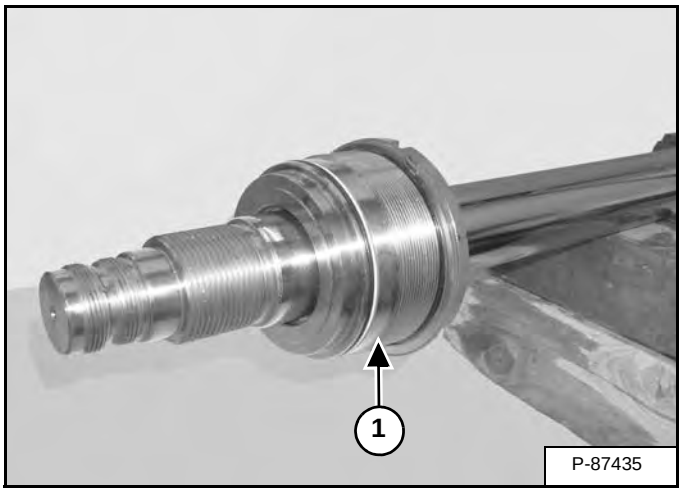
Figure 20-22-52



Install the O-ring (Item 1) **[Figure 20-22-52]**.

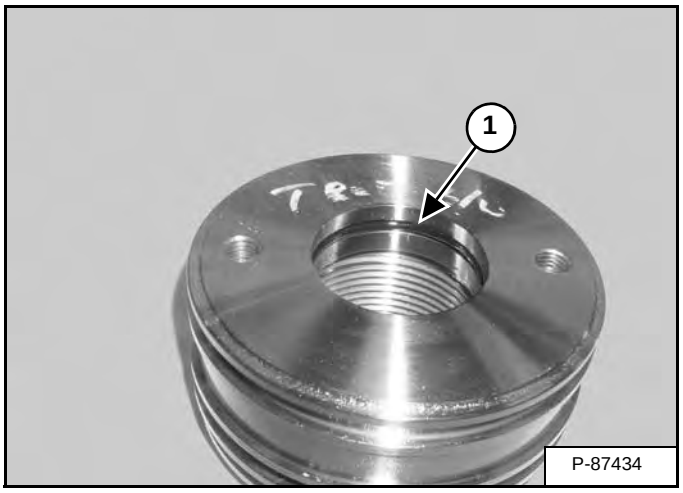
Clamp the rod end in a vise. Support the rod with a block.

Figure 20-22-53



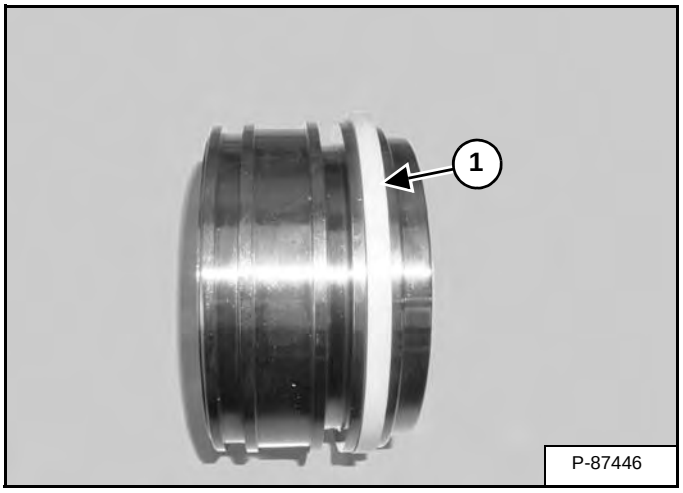
Install the head (Item 1) **[Figure 20-22-53]**.

Figure 20-22-54



Install the O-ring (Item 1) **[Figure 20-22-54]** in the piston.

Figure 20-22-55



Install the seal (Item 1) **[Figure 20-22-55]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-22-56

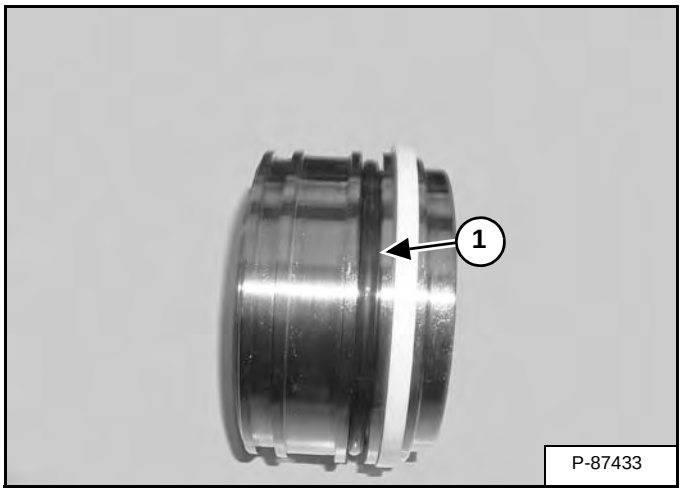
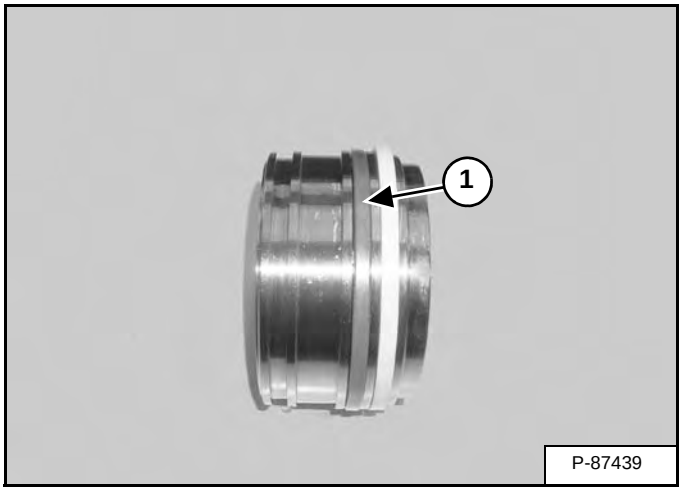
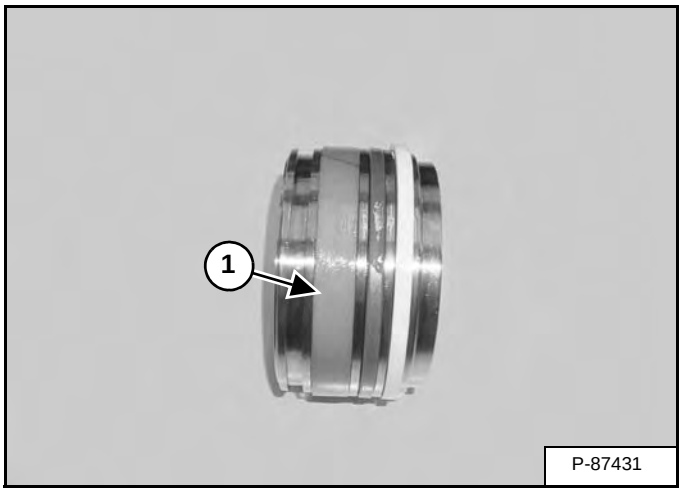


Figure 20-22-57



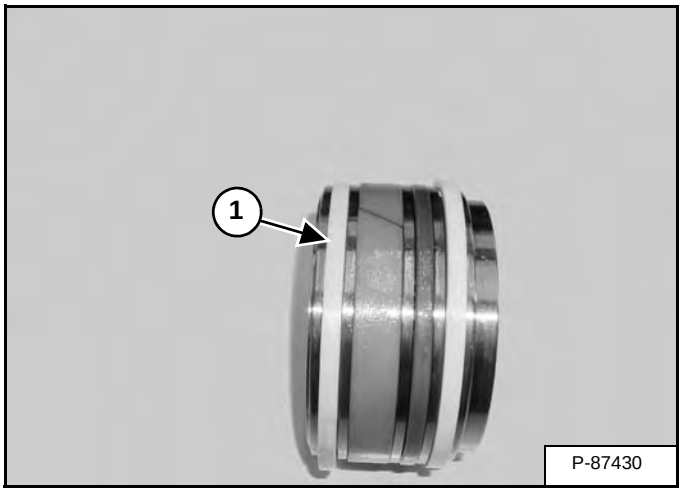
Install the O-ring (Item 1) **[Figure 20-22-56]** and seal (Item 1) **[Figure 20-22-57]**.

Figure 20-22-58



Install the wear ring (Item 1) **[Figure 20-22-58]**.

Figure 20-22-59

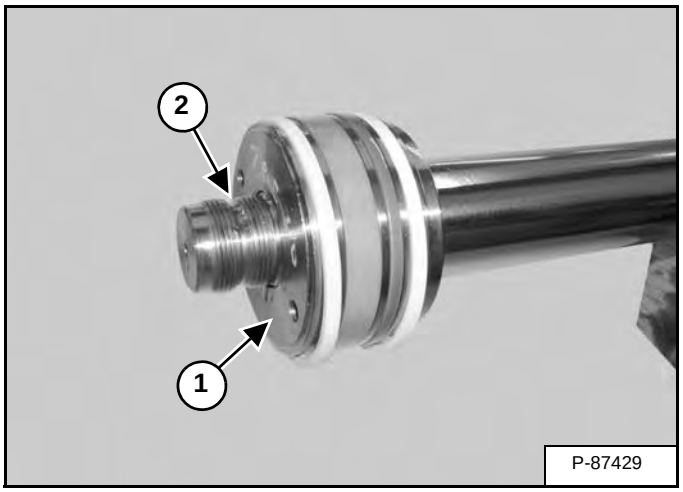


Install the seal (Item 1) **[Figure 20-22-59]**.

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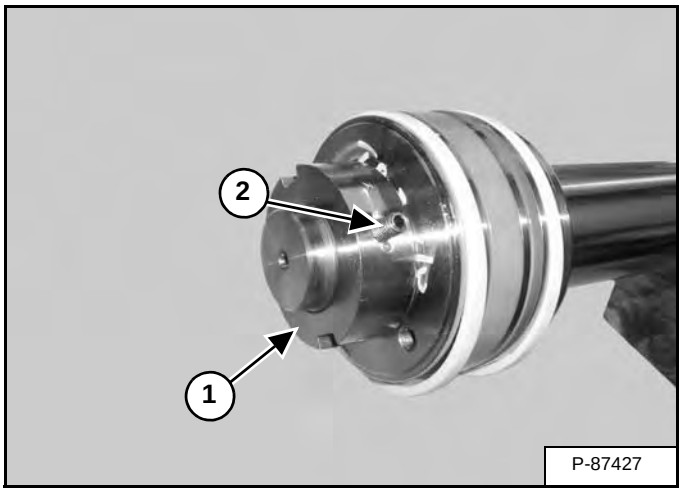
Assembly (Cont'd)

Figure 20-22-60



Install the piston (Item 1) **[Figure 20-22-60]**.

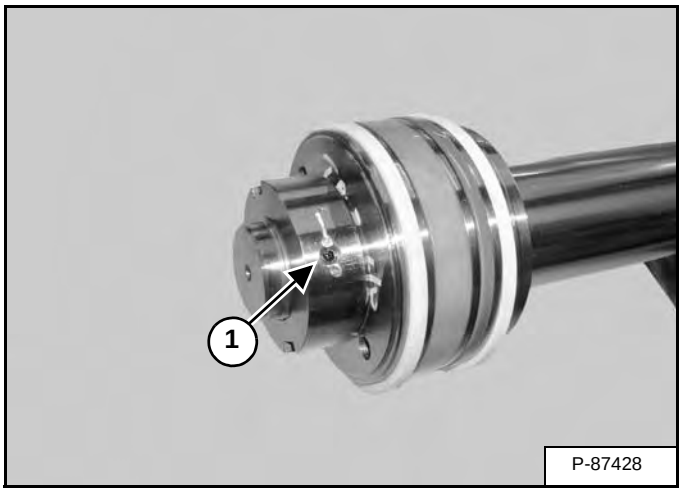
Figure 20-22-61



Install the nut (Item 1) **[Figure 20-22-61]**.

Tighten the nut until the bore (Item 2) **[Figure 20-22-61]** of the set screw is aligned with the groove (Item 2) **[Figure 20-22-60]** of the rod.

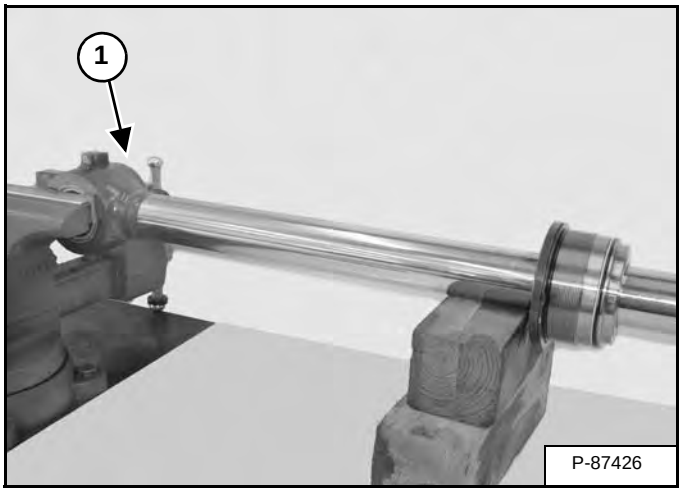
Figure 20-22-62



Install the set screw (Item 1) **[Figure 20-22-61]**.

Use a center punch to deform the threads of the set screw bore.

Figure 20-22-63

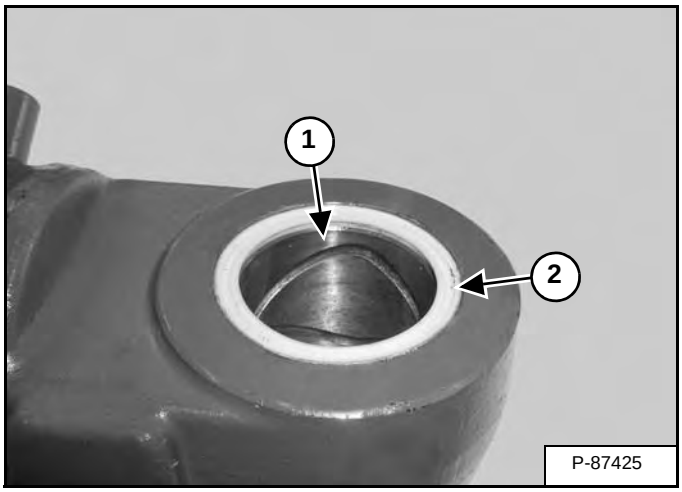


Remove the rod end (Item 1) **[Figure 20-22-63]** from the vise.

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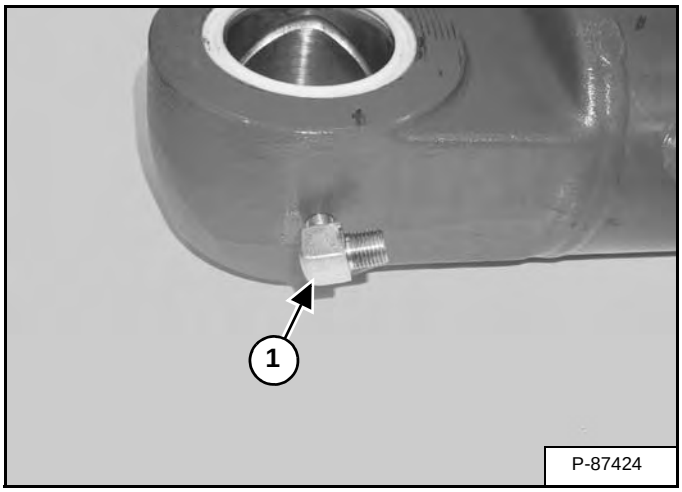
Assembly (Cont'd)

Figure 20-22-64



Install the bushing (Item 1) and seal (Item 2) **[Figure 20-22-64]** (both sides) into the rod end.

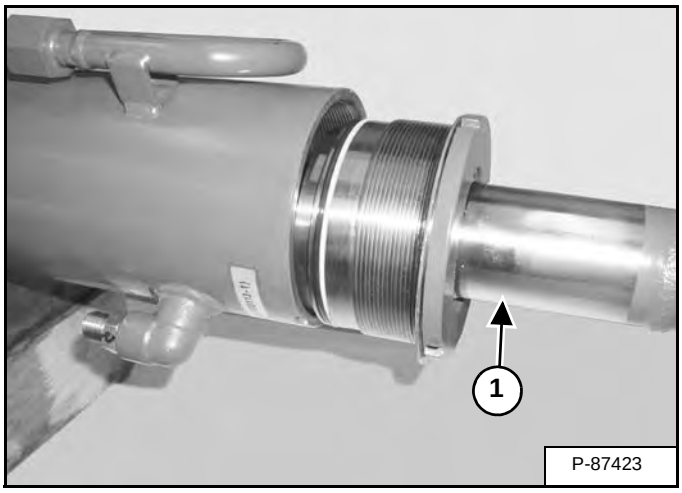
Figure 20-22-65



Install the fitting (Item 1) **[Figure 20-22-65]**.

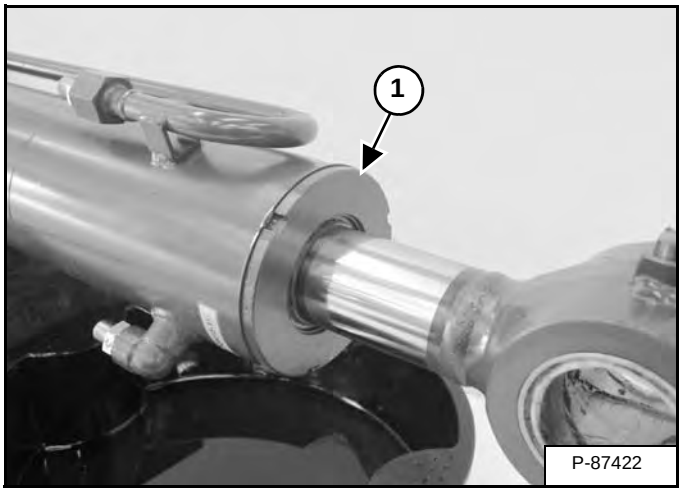
Clamp the base end of the cylinder housing in a vise.

Figure 20-22-66



Install the rod assembly (Item 1) **[Figure 20-22-66]** into the housing.

Figure 20-22-67

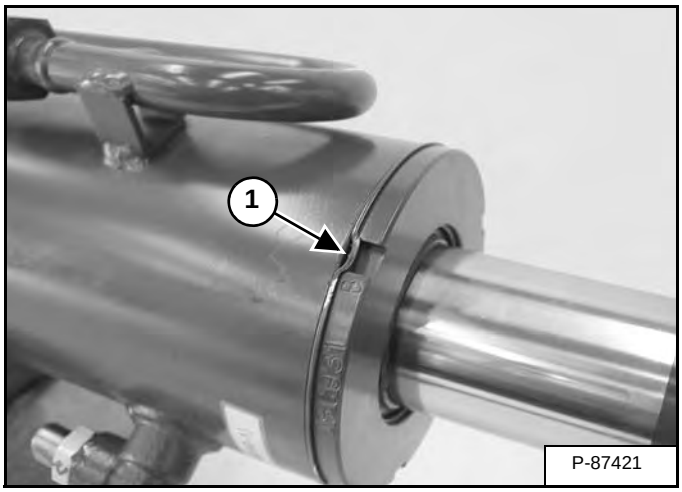


Tighten the head (Item 1) **[Figure 20-22-67]**.

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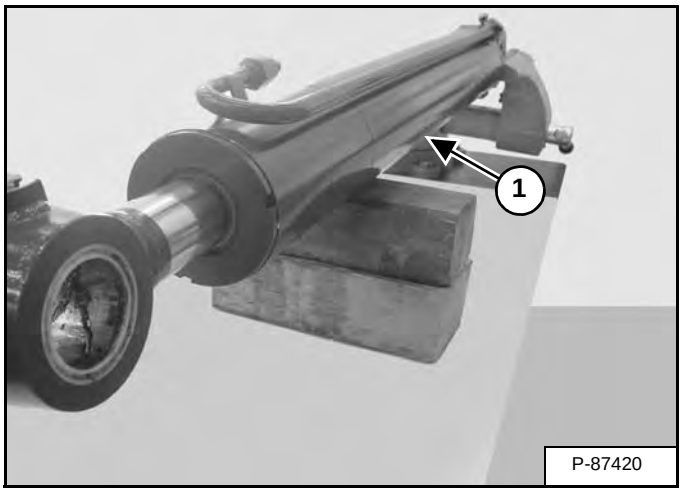
Assembly (Cont'd)

Figure 20-22-68



Bend the lock ring tab (Item 1) **[Figure 20-22-68]** into the groove on the head.

Figure 20-22-69



Remove the cylinder (Item 1) **[Figure 20-22-69]** from the vise.

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Dealer Copy -- Not for Resale

CYLINDER (BUCKET)

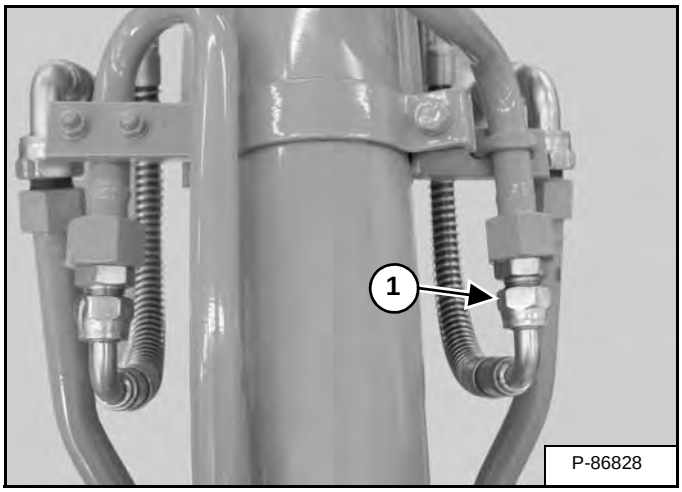
Testing

Fully retract the bucket and arm cylinders.

Lower the boom to the ground.

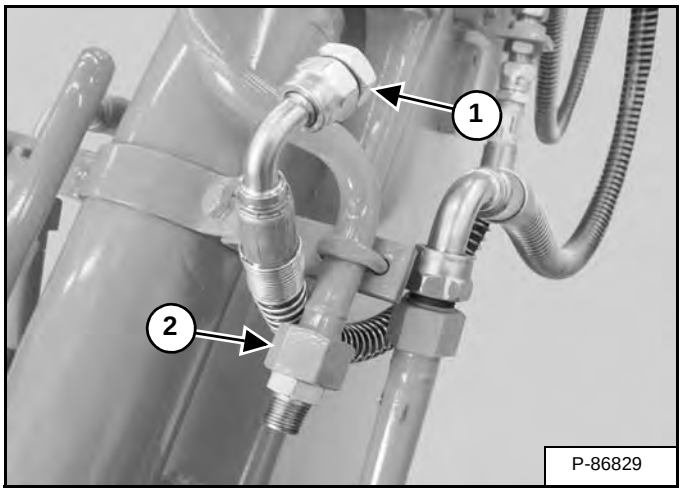
With the engine off and the key in the run position, move the joysticks to relieve hydraulic pressure.

Figure 20-23-1



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

Figure 20-23-2



Install a plug (Item 1) **[Figure 20-23-2]** on the hose.

Start the engine and retract the bucket cylinder.

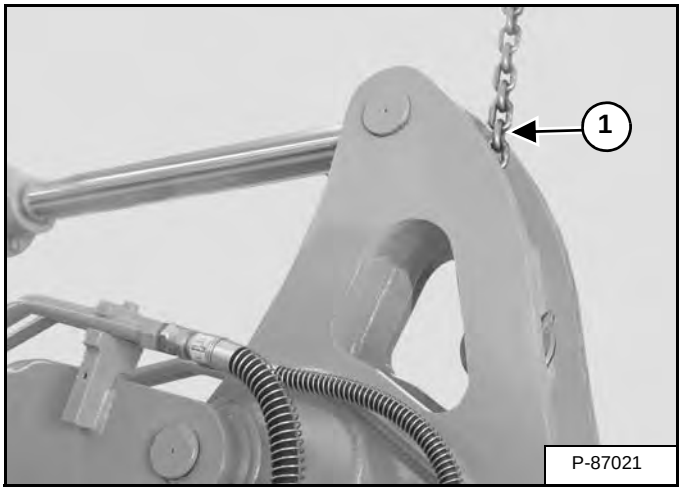
If there is any oil leakage from the base end fitting (Item 2) **[Figure 20-23-2]** on the bucket cylinder, remove the cylinder for repair or replacement.

Removal And Installation

Fully retract the bucket cylinder.

Lower the boom until the bucket is on the ground.

Figure 20-23-3



Support the arm with a chain hoist (Item 1) **[Figure 20-23-3]**.

With the engine off and the key in the run position, 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.

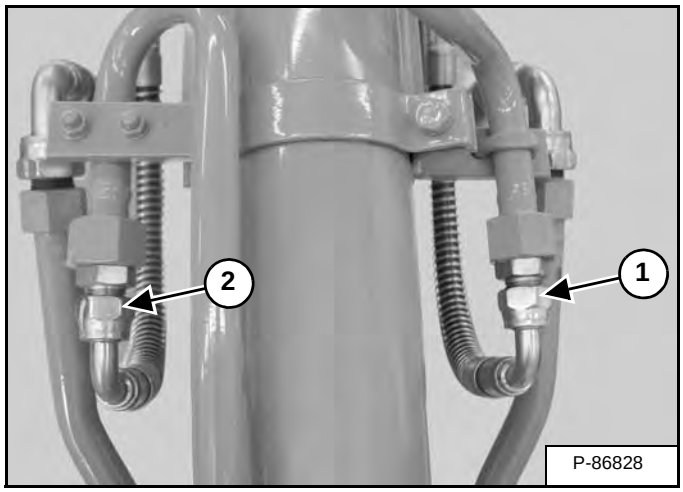
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CYLINDER (BUCKET) (CONT'D)

Removal And Installation (Cont'd)

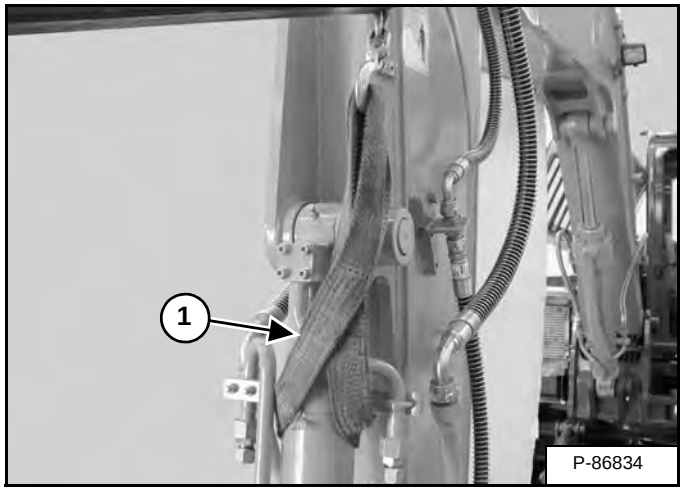
Figure 20-23-4



Remove the hose (Item 1) **[Figure 20-23-4]** from the base end.

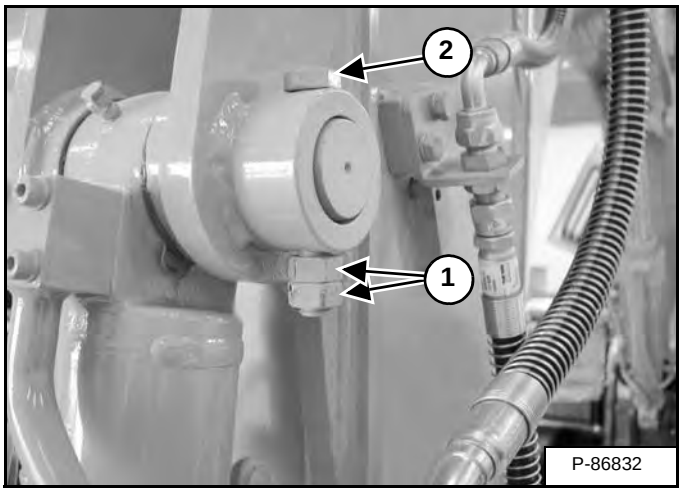
Remove the hose (Item 2) **[Figure 20-23-4]** from the rod end.

Figure 20-23-5



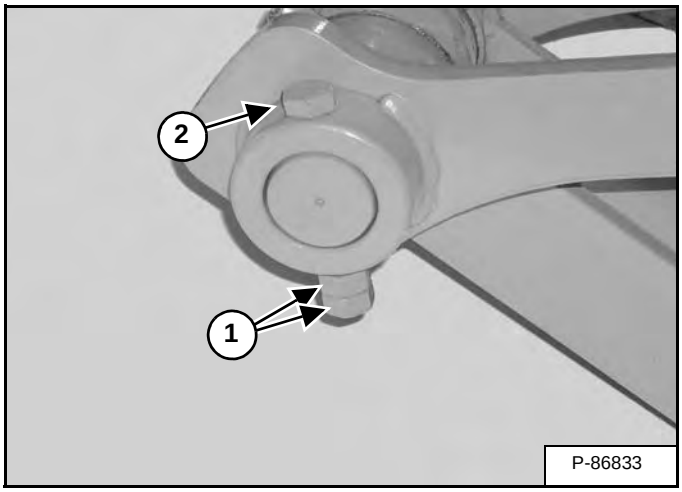
Install a strap (Item 1) **[Figure 20-23-5]** and a lifting device on the cylinder.

Figure 20-23-6



Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-23-6]** from the base end pivot pin.

Figure 20-23-7

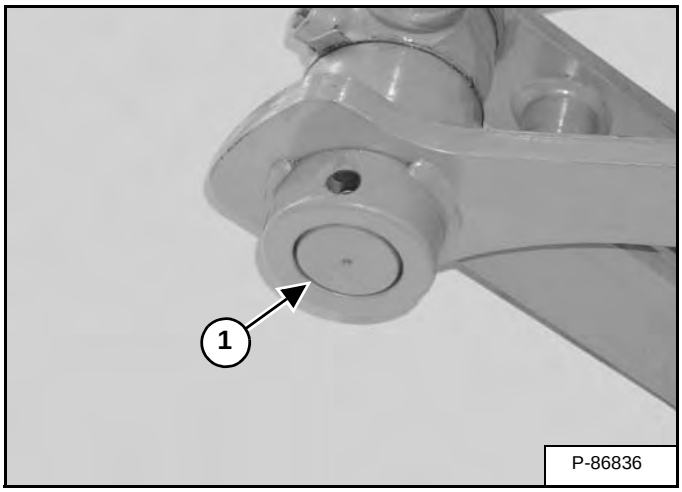


Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-23-7]** from the rod end pivot pin.

Dealer Copy -- Not for Resale

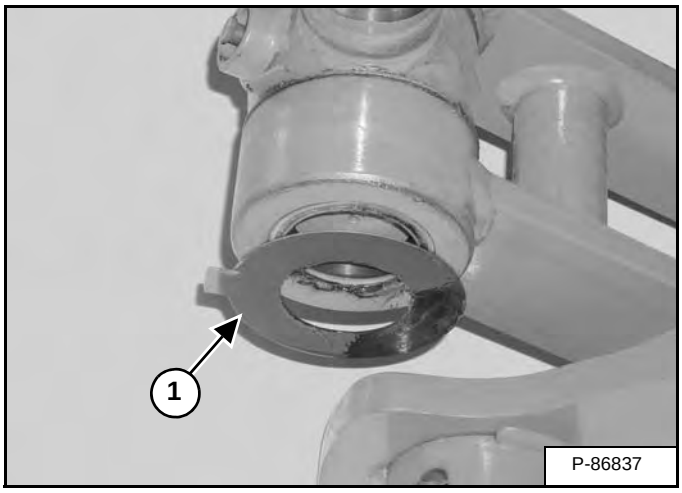
Removal And Installation (Cont'd)

Figure 20-23-8



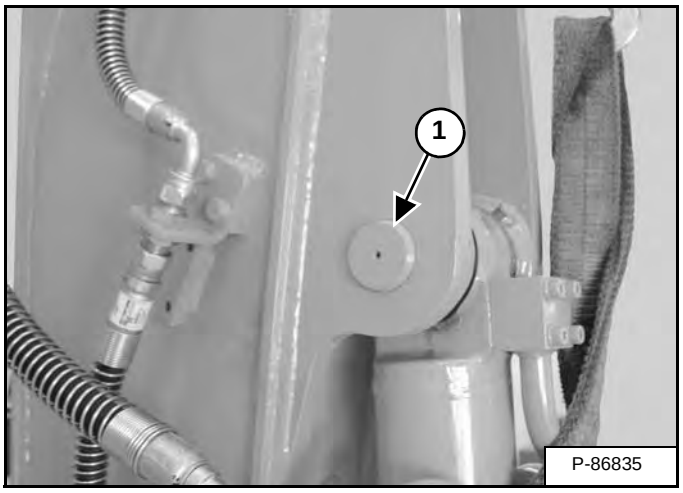
Remove the rod end pivot pin (Item 1) **[Figure 20-23-8]**.

Figure 20-23-9



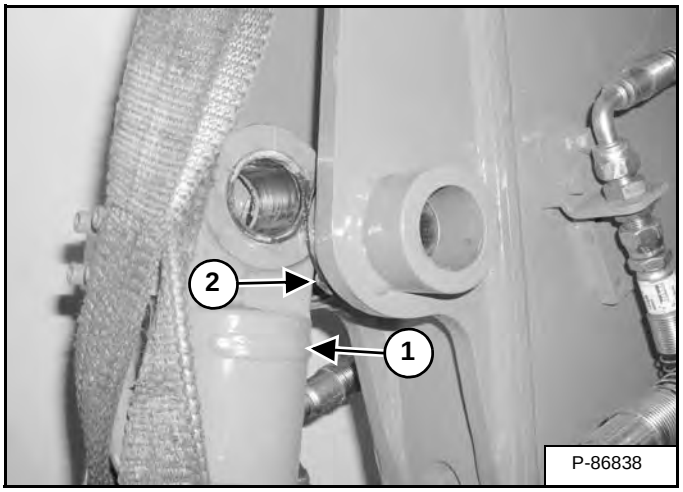
Remove the shims (Item 1) **[Figure 20-23-9]** (Both sides).

Figure 20-23-10



Remove the base end pivot pin (Item 1) **[Figure 20-23-10]** and the shims.

Figure 20-23-11



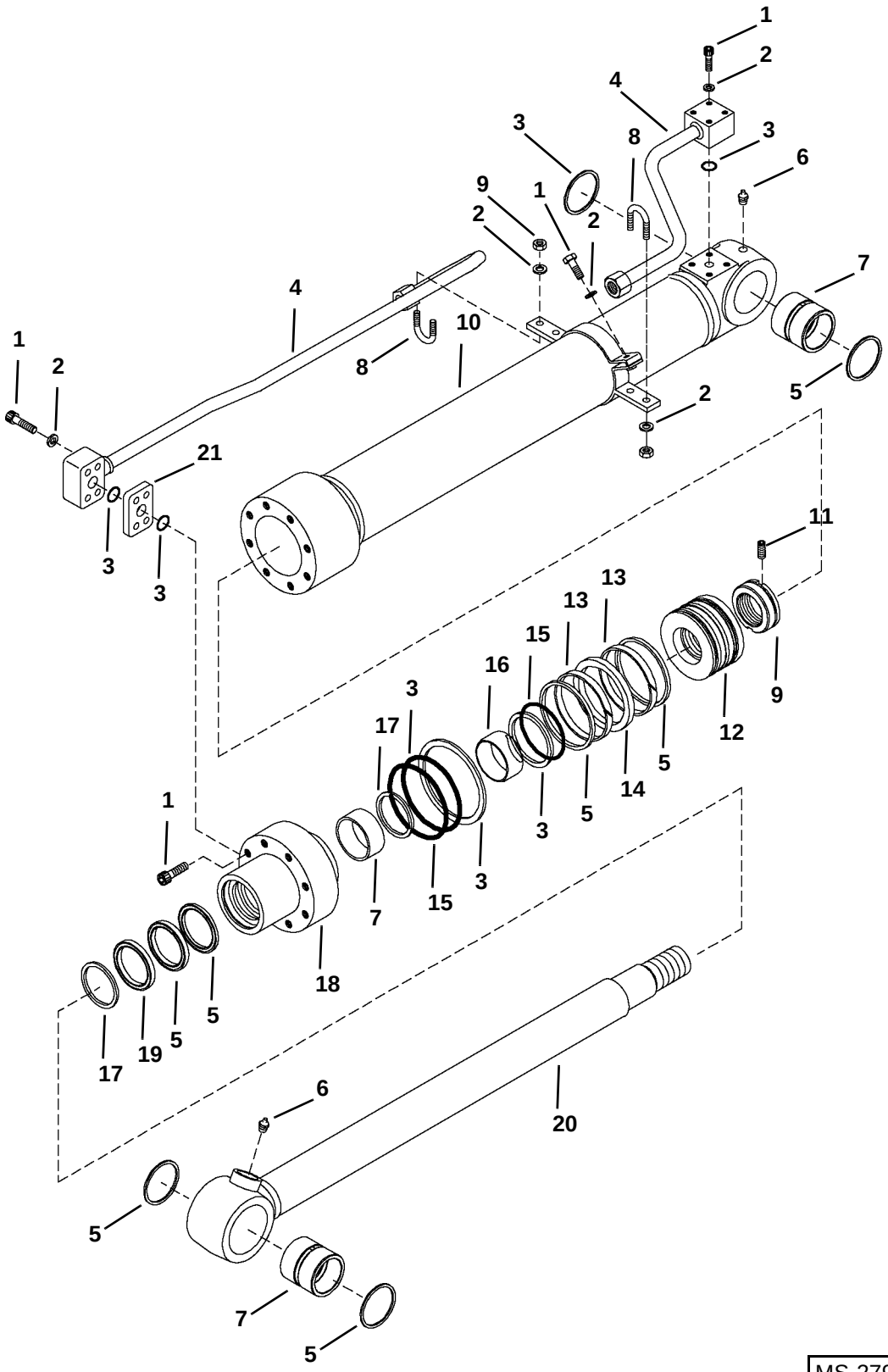
Remove the cylinder (Item 1) **[Figure 20-23-11]**.

Remove the shims (Item 2) **[Figure 20-23-11]** (Both sides).

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Parts Identification

1. Bolt
2. Lockwasher
3. O-ring
4. Tubeline
5. Seal
6. Grease Fitting
7. Bushing
8. U-Bolt
9. Nut
10. Housing
11. Set Screw
12. Piston
13. Wear Ring
14. Seal Assembly
15. Back-up Ring
16. Cushion Ring
17 Snap Ring
18. Head
19. Wiper Seal
20. Rod
21. Spacer



Dealer Copy -- Not for Resale

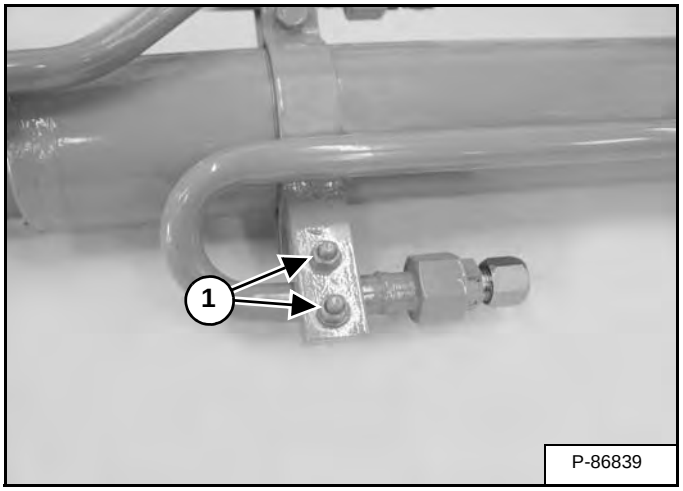
Disassembly

Use the following tools to disassemble the cylinder:

MEL1074 - O-ring Seal Hook

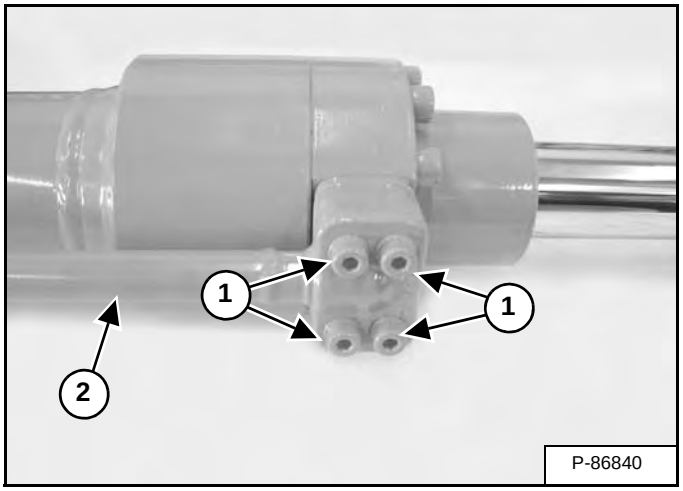
Hold the hydraulic cylinder over a drain pan and slowly move the rod in and out to remove the fluid from the cylinder.

Figure 20-23-12



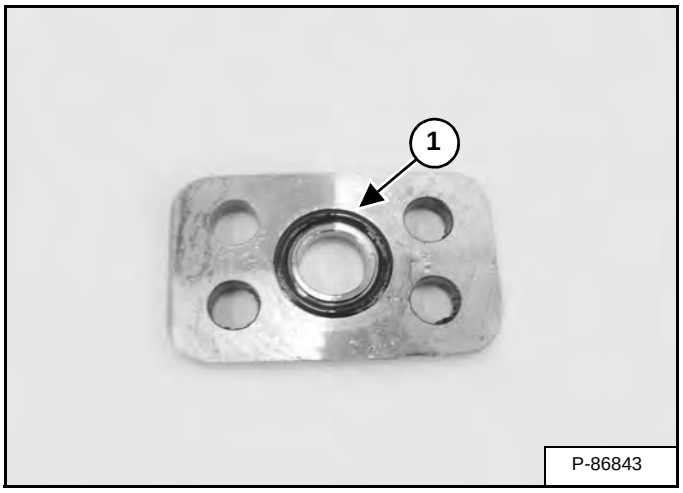
Remove the two nuts (Item 1) **[Figure 20-23-12]**, lock washers and U-bolt.

Figure 20-23-13



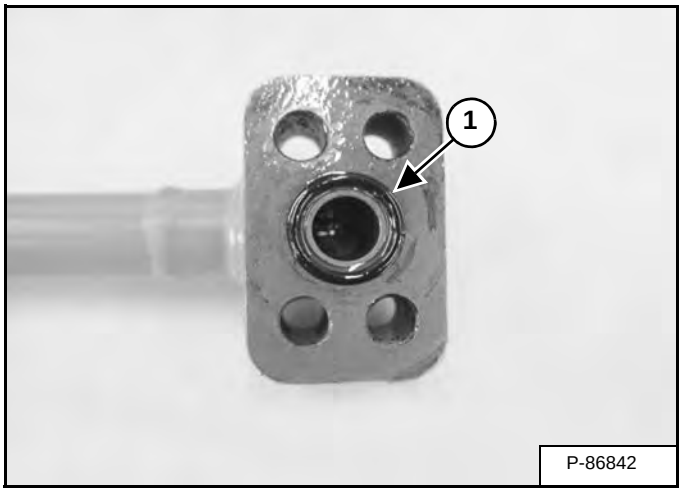
Remove the four bolts (Item 1), tubeline (Item 2) **[Figure 20-23-13]** and spacer.

Figure 20-23-14



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

Figure 20-23-15

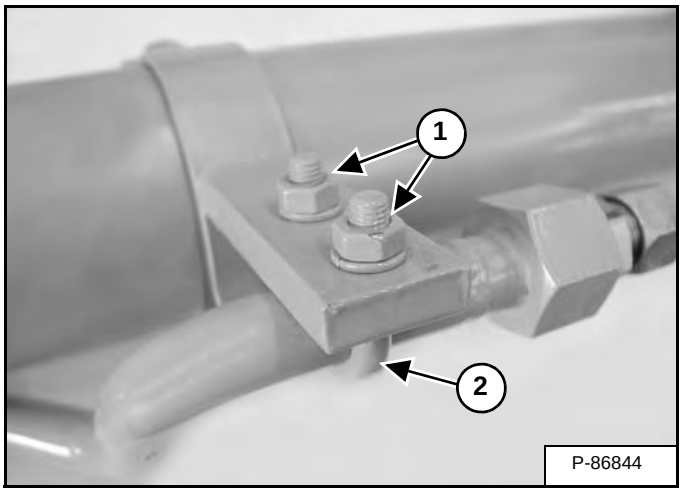


Remove the O-ring (Item 1) **[Figure 20-23-15]** from the tubeline.

Dealer Copy -- Not for Resale

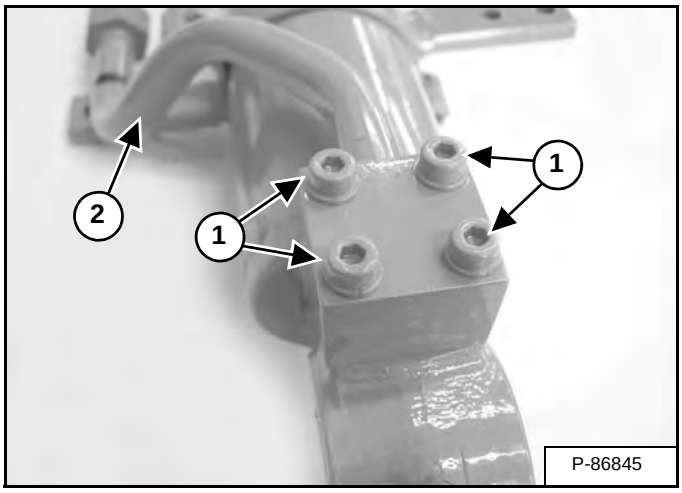
Disassembly (Cont'd)

Figure 20-23-16



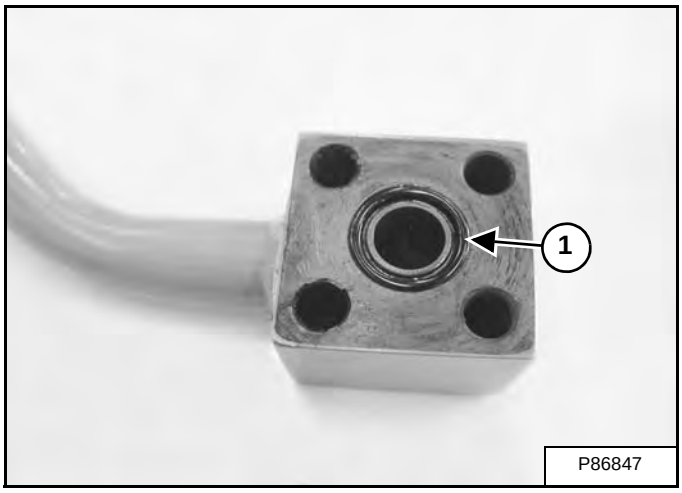
Remove the two nuts (Item 1), lock washers and U-bolt (Item 2) **[Figure 20-23-16]**.

Figure 20-23-17



Remove the four bolts (Item 1), lock washers and tubeline (Item 2) **[Figure 20-23-17]**.

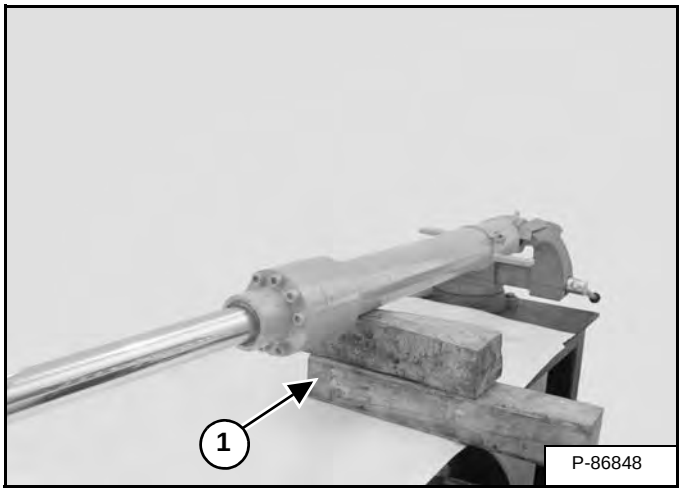
Figure 20-23-18



Remove the O-ring (Item 1) **[Figure 20-23-18]** from the tubeline.

Clamp the base end of the cylinder in a vise.

Figure 20-23-19

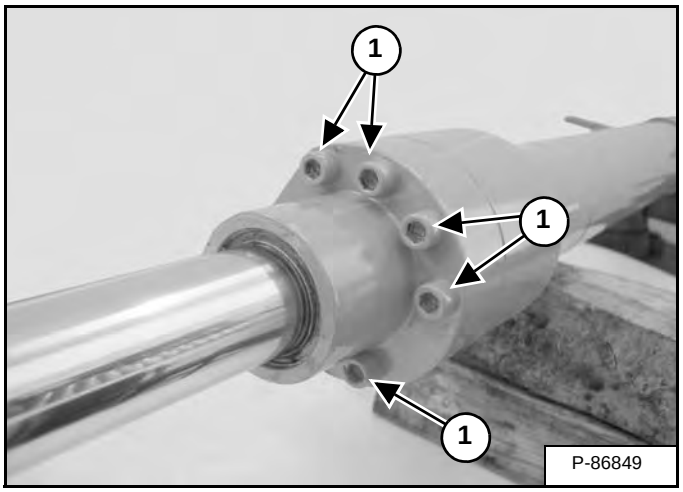


Support the cylinder with a block (Item 1) **[Figure 20-23-19]**.

Dealer Copy -- Not for Resale

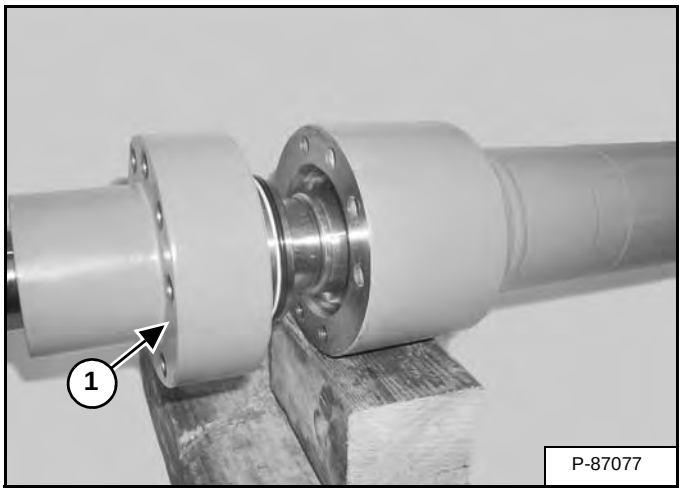
Disassembly (Cont'd)

Figure 20-23-20



Remove the eight bolts (Item 1) **[Figure 20-23-20]**.

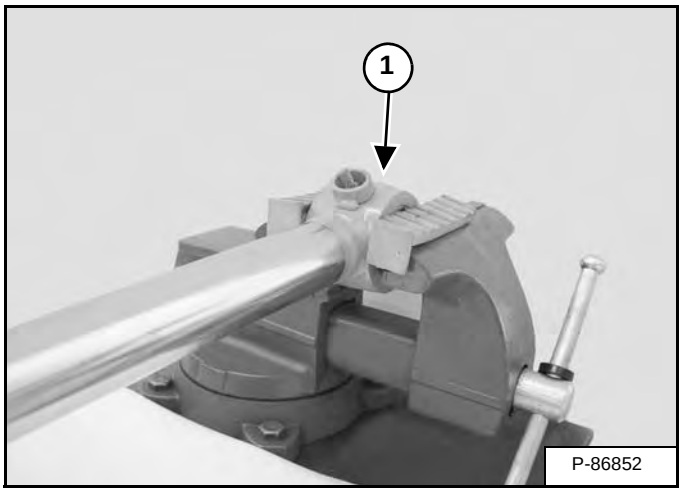
Figure 20-23-21



Remove the rod assembly (Item 1) **[Figure 20-23-21]** from the cylinder housing.

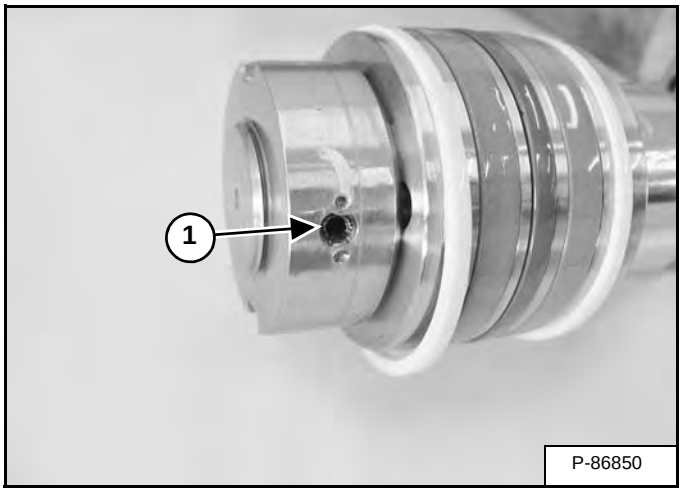
Remove the cylinder housing from the vise.

Figure 20-23-22



Clamp the rod end (Item 1) **[Figure 20-23-22]** in a vise. Support the end of the rod with a block.

Figure 20-23-23

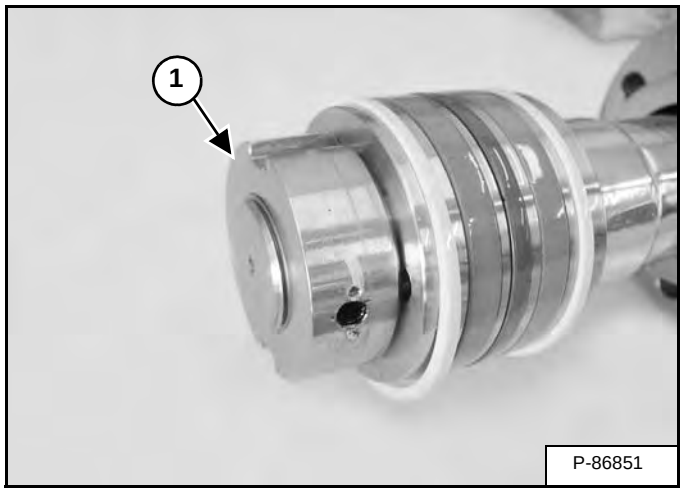


Remove the set screw (Item 1) **[Figure 20-23-23]**.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

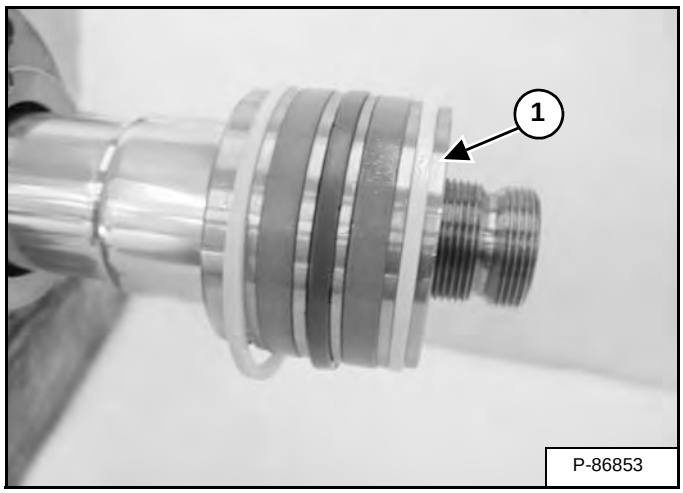
Figure 20-23-24



Apply moderate heat to the nut (Item 1) **[Figure 20-23-24]**.

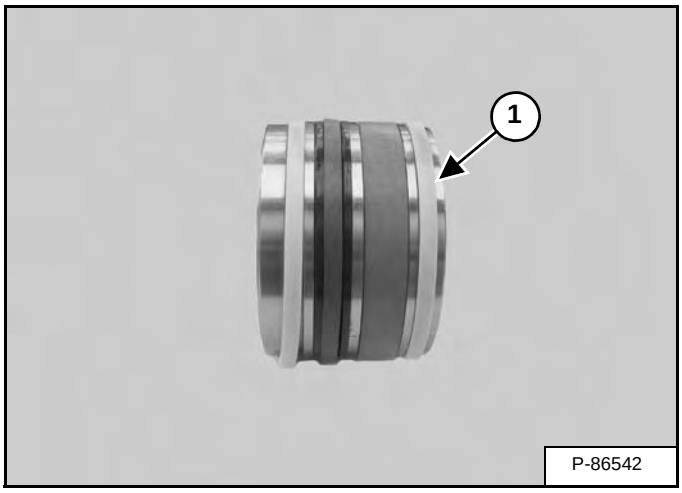
Remove the nut.

Figure 20-23-25



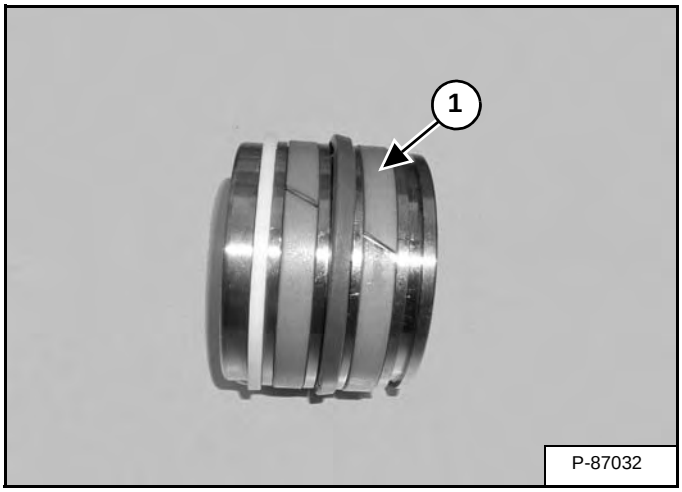
Remove the piston (Item 1) **[Figure 20-23-25]**.

Figure 20-23-26



Remove the seal (Item 1) **[Figure 20-23-26]** from the piston.

Figure 20-23-27

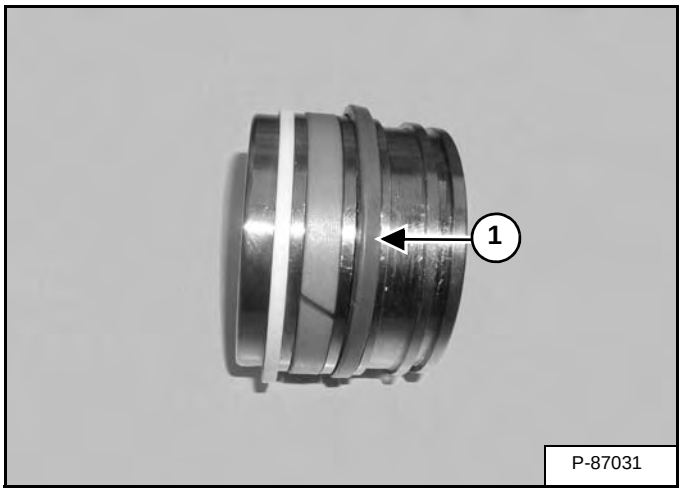


Remove the wear ring (Item 1) **[Figure 20-23-27]** from the piston.

Dealer Copy -- Not for Resale

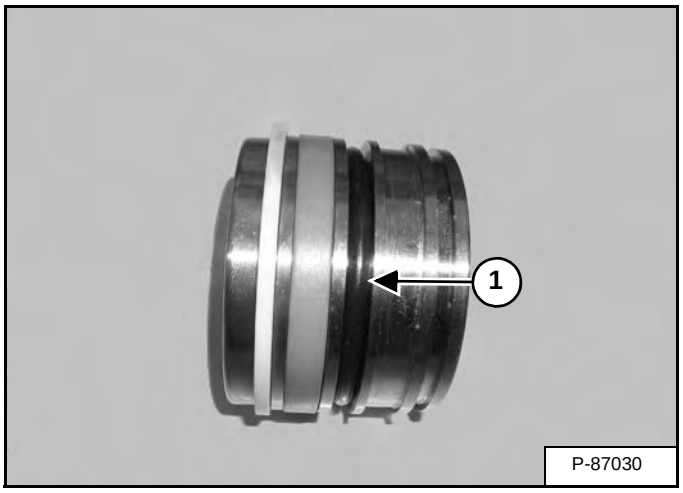
Disassembly (Cont'd)

Figure 20-23-28



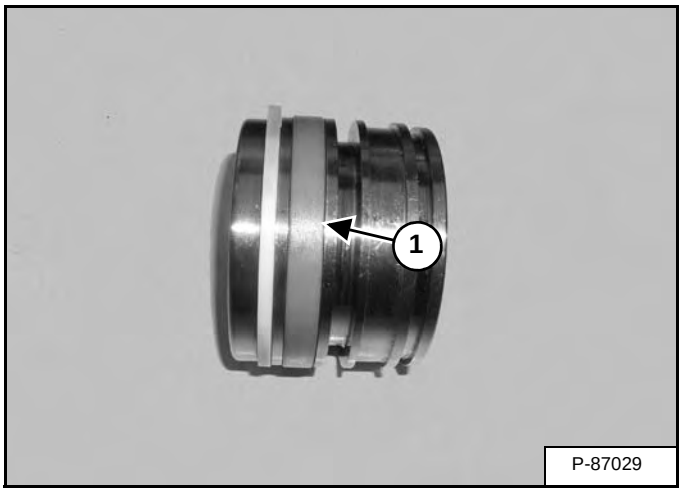
Remove the seal (Item 1) **[Figure 20-23-28]**.

Figure 20-23-29



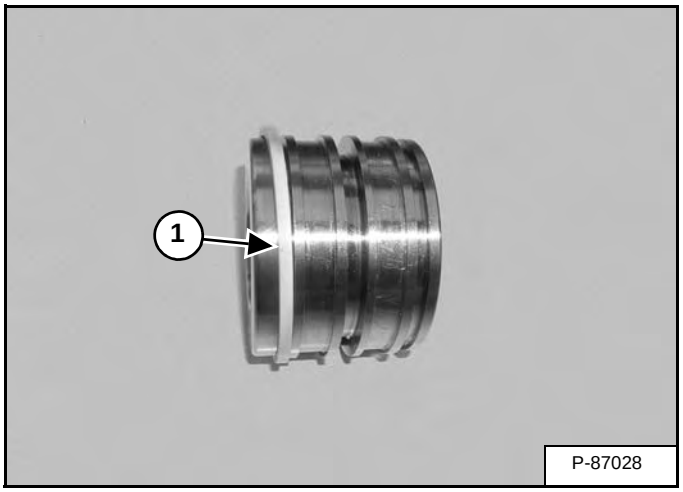
Remove the O-ring (Item 1) **[Figure 20-23-29]** from the piston.

Figure 20-23-30



Remove the wear ring (Item 1) **[Figure 20-23-30]** from the piston.

Figure 20-23-31

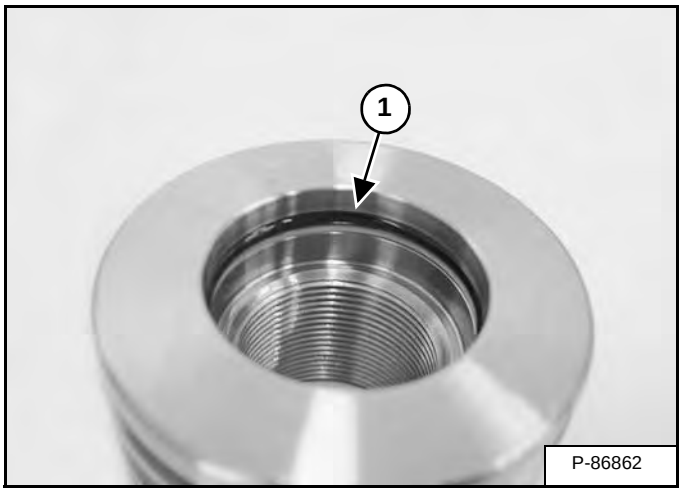


Remove the seal (Item 1) **[Figure 20-23-31]** from the piston.

Dealer Copy -- Not for Resale

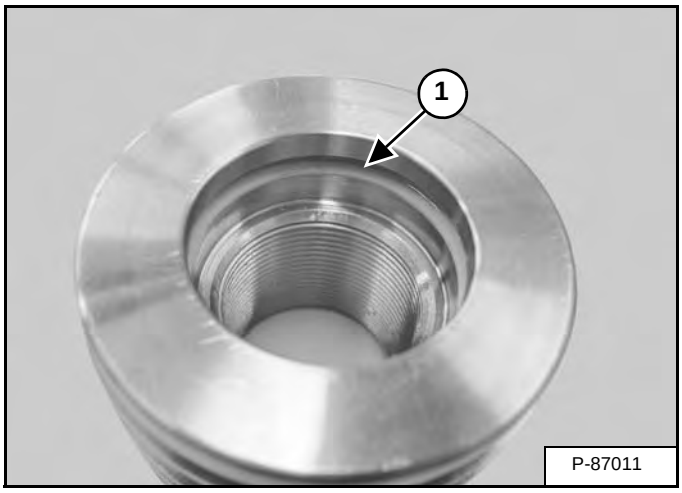
Disassembly (Cont'd)

Figure 20-23-32



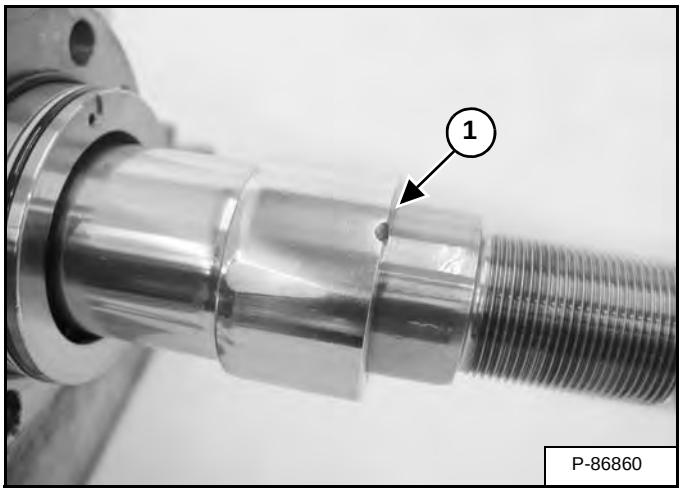
Remove the O-ring (Item 1) **[Figure 20-23-32]** from the piston.

Figure 20-23-33



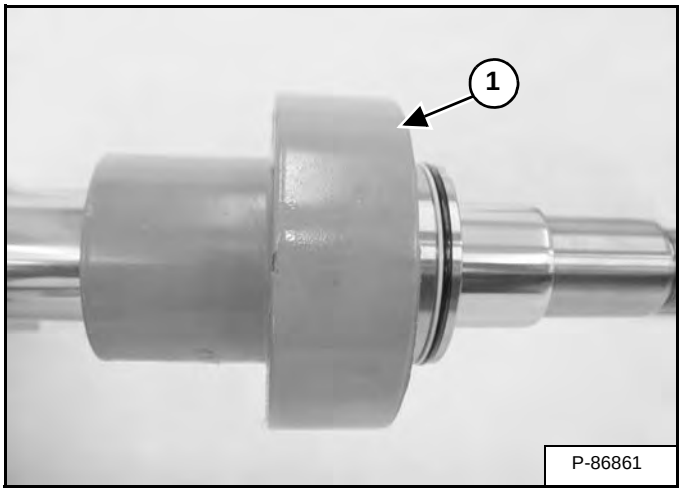
Remove the back-up ring (Item 1) **[Figure 20-23-33]** from the piston.

Figure 20-23-34



Remove the cushion ring (Item 1) **[Figure 20-23-34]** from the rod.

Figure 20-23-35

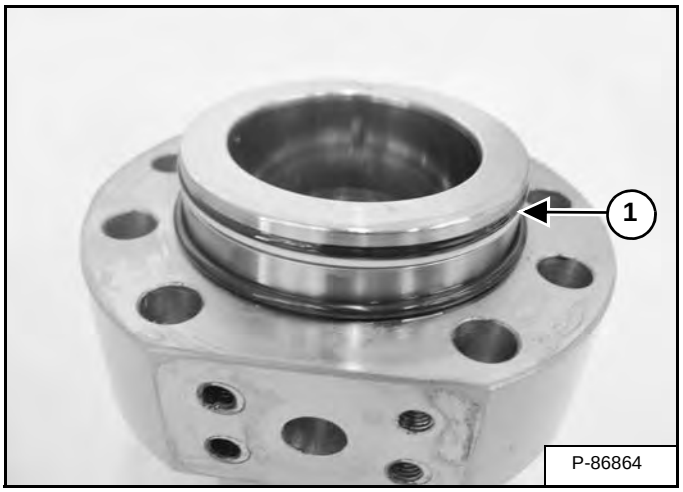


Remove the head (Item 1) **[Figure 20-23-35]** from the rod.

Dealer Copy -- Not for Resale

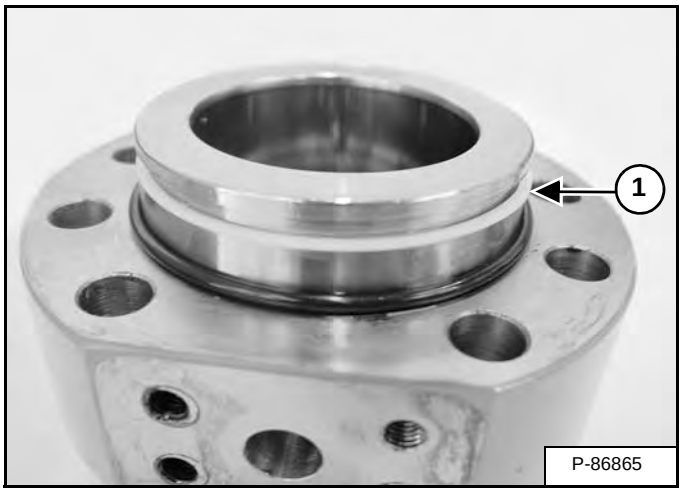
Disassembly (Cont'd)

Figure 20-23-36



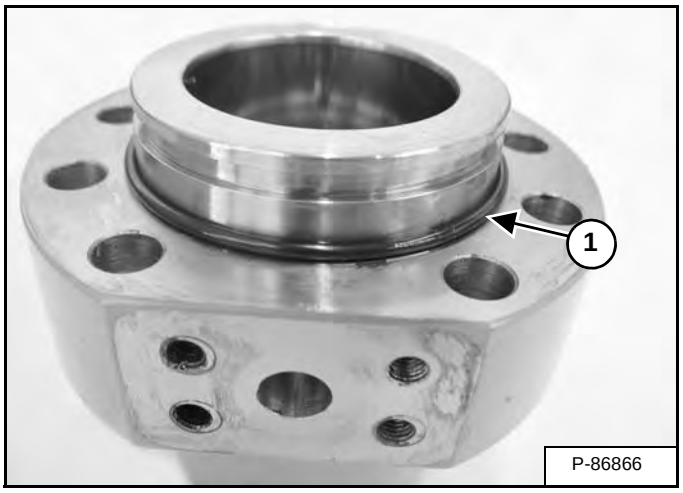
Remove the O-ring (Item 1) **[Figure 20-23-36]**.

Figure 20-23-37



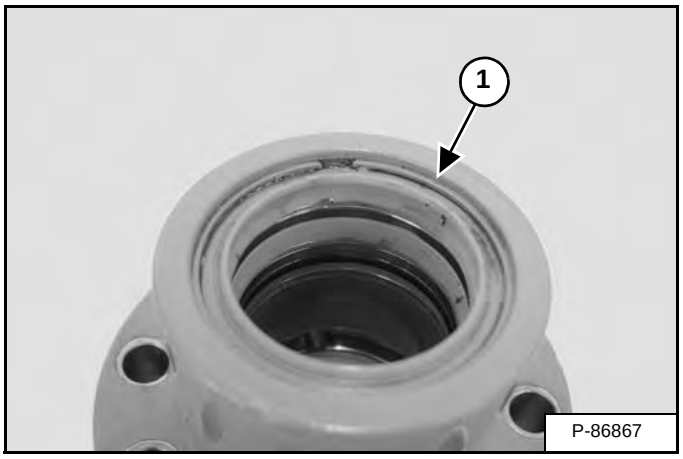
Remove the back-up ring (Item 1) **[Figure 20-23-37]**.

Figure 20-23-38



Remove the O-ring (Item 1) **[Figure 20-23-38]**.

Figure 20-23-39

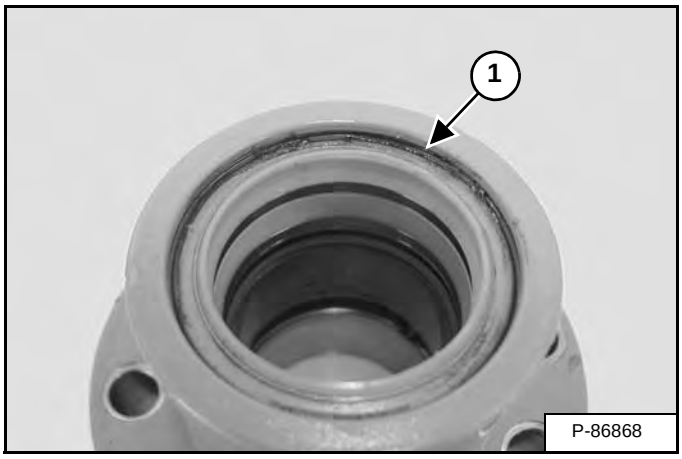


Remove the snap ring (Item 1) **[Figure 20-23-39]**.

Dealer Copy -- Not for Resale

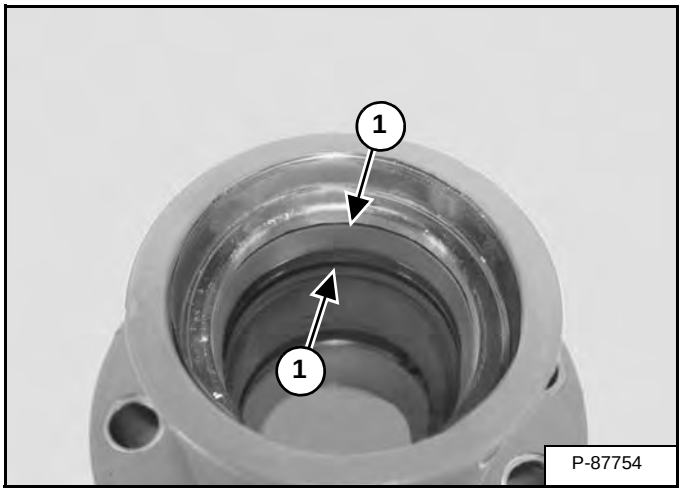
Disassembly (Cont'd)

Figure 20-23-40



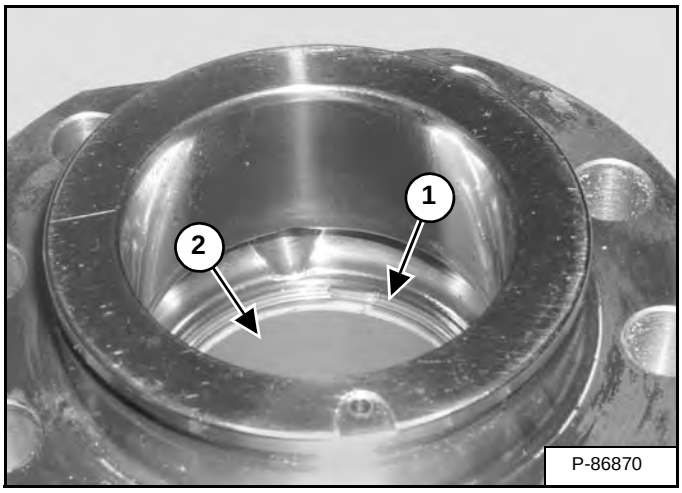
Remove the wiper seal (Item 1) **[Figure 20-23-40]**.

Figure 20-23-41



Remove the two seals (Item 1) **[Figure 20-23-41]**.

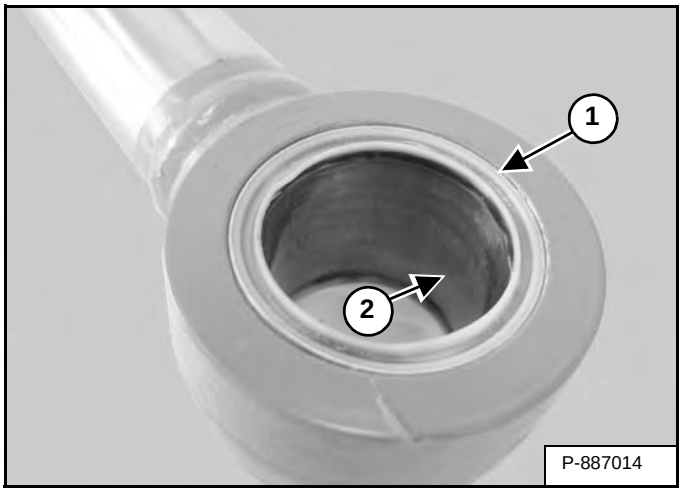
Figure 20-23-42



Remove the snap ring (Item 1) and bushing (Item 2) **[Figure 20-23-42]**.

Remove the rod from the vise.

Figure 20-23-43

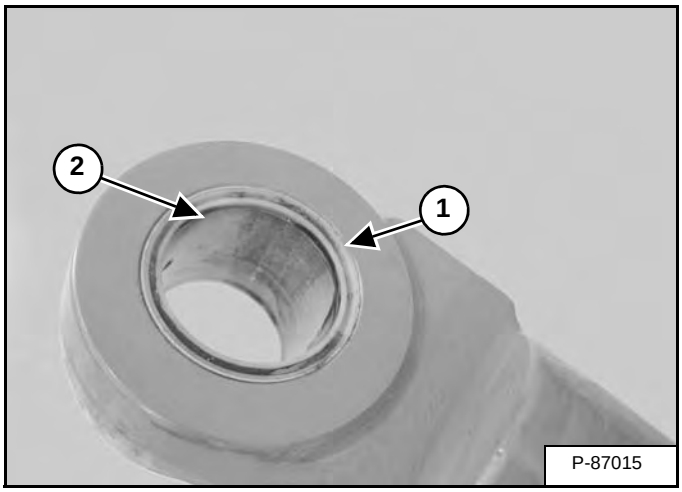


Remove the seal (Item 1) (both sides) and bushing (Item 2) **[Figure 20-23-43]** from the rod end.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

Figure 20-23-44



Remove the seal (Item 1) (both sides) and bushing (Item 2) **[Figure 20-23-44]** from the base end.

Dealer Copy -- Not for Resale

Assembly

Use the following tools to assemble the cylinder:

MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
MEL1396-2 - Piston Ring Compressor

Wash the cylinder parts in clean solvent and dry with compressed air.

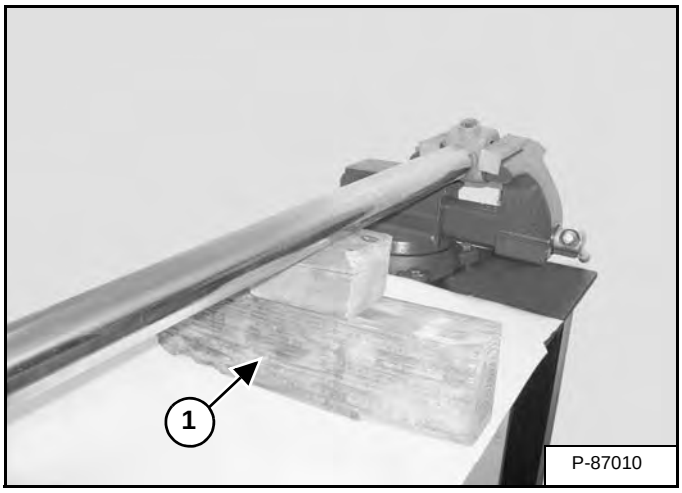
Inspect the cylinder parts for nicks, scratches and other damage. Replace any damaged parts.

Always install new O-rings and seals during assembly.

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

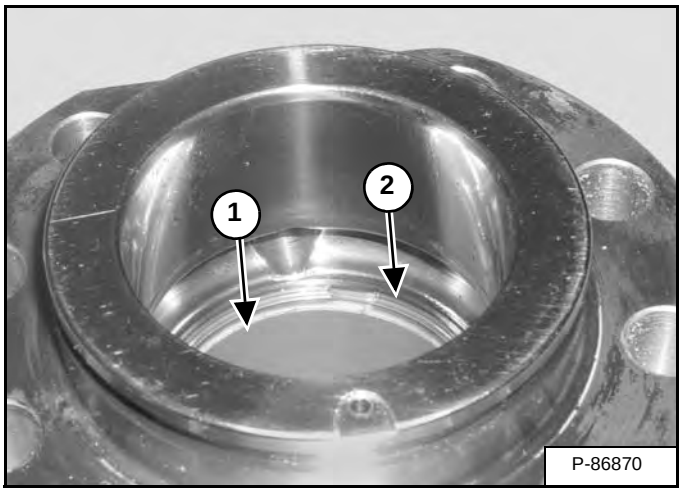
Clamp the rod end in a vise.

Figure 20-23-45



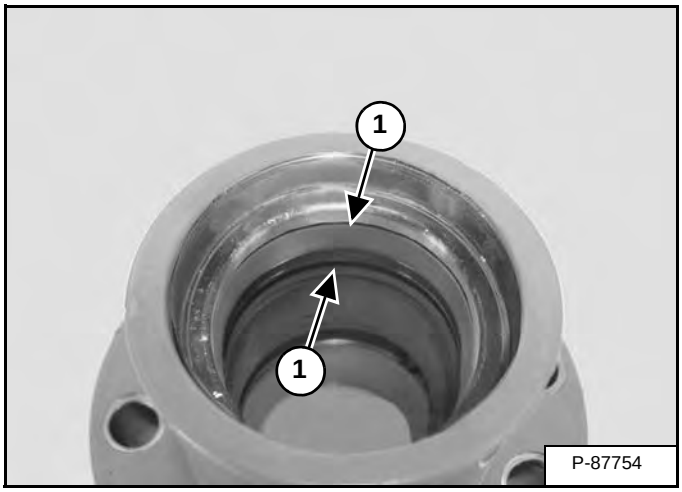
Support the end of the rod with a block (Item 1) **[Figure 20-23-45]**.

Figure 20-23-46



Install the bushing (Item 1) and snap ring (Item 2) **[Figure 20-23-46]** into the head.

Figure 20-23-47

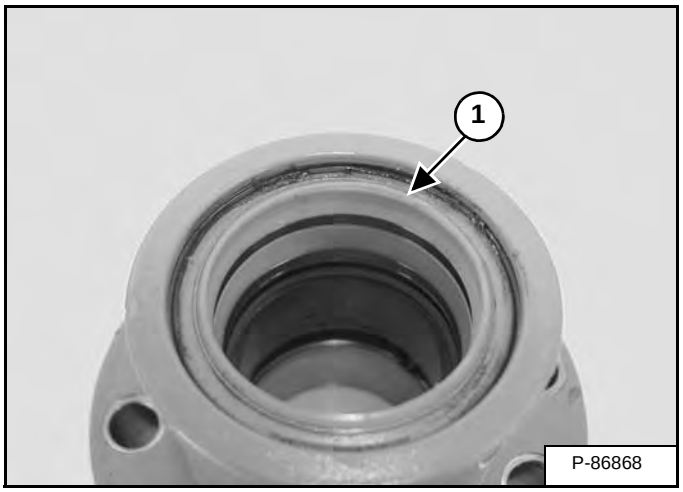


Install the two seals (Item 1) **[Figure 20-23-47]** into the head.

Dealer Copy -- Not for Resale

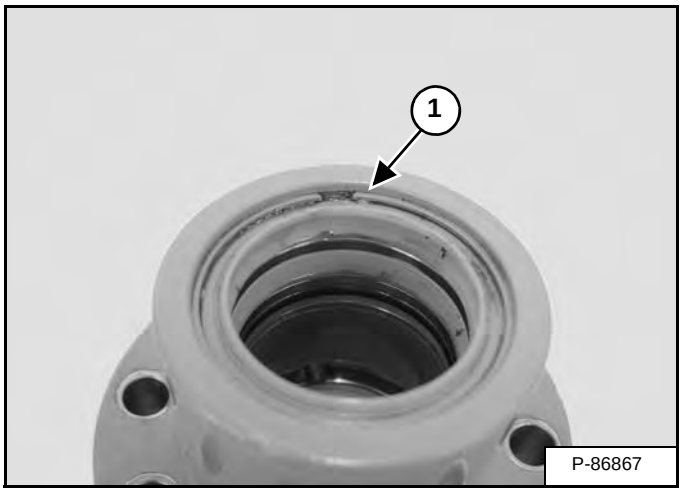
Assembly (Cont'd)

Figure 20-23-48



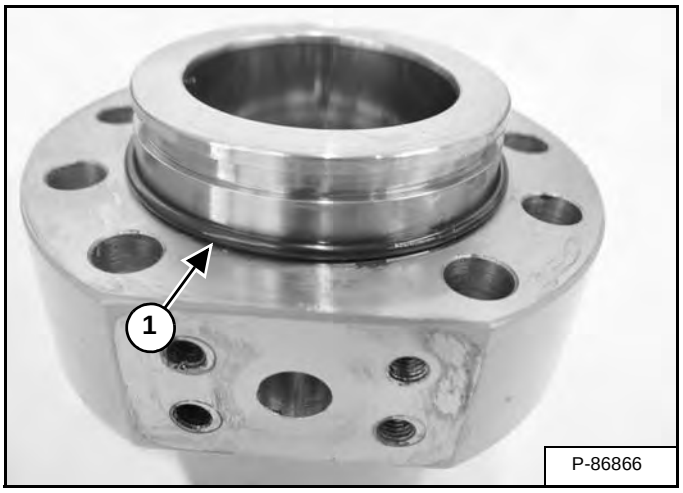
Install the wiper seal (Item 1) **[Figure 20-23-48]** into the head.

Figure 20-23-49



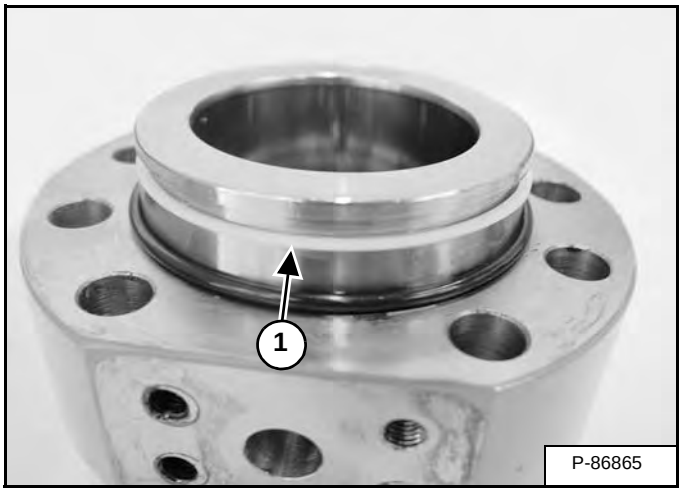
Install the snap ring (Item 1) **[Figure 20-23-49]** into the head.

Figure 20-23-50



Install the O-ring (Item 1) **[Figure 20-23-50]** onto the head.

Figure 20-23-51



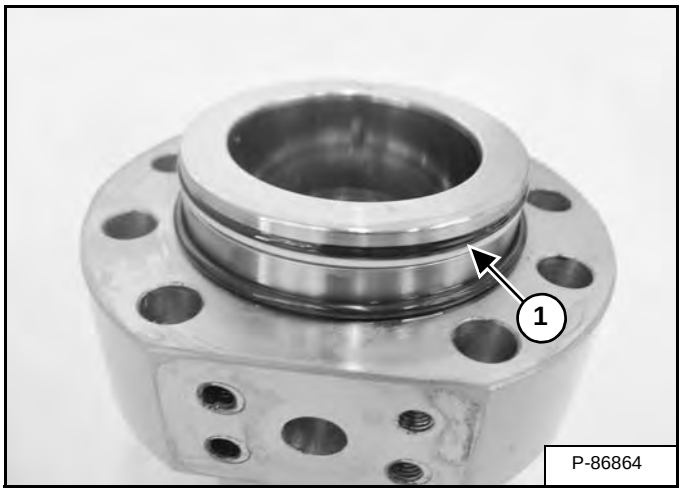
Install the back-up ring (Item 1) **[Figure 20-23-51]** onto the head.

Dealer Copy -- Not for Resale

CYLINDER (BUCKET) (CONT'D)

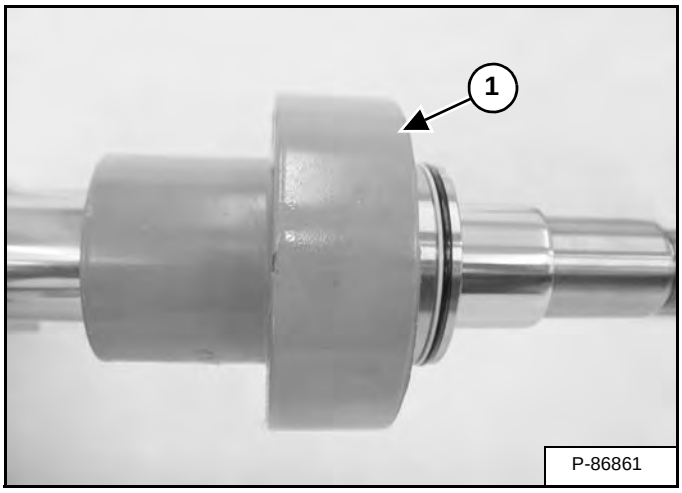
Assembly (Cont'd)

Figure 20-23-52



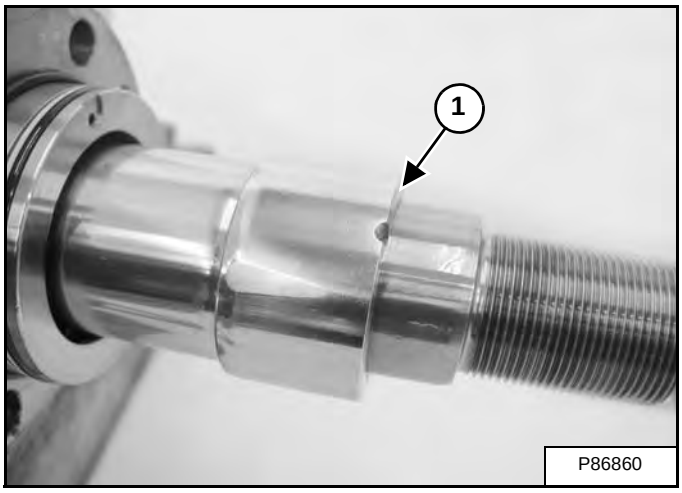
Install the O-ring (Item 1) **[Figure 20-23-52]**.

Figure 20-23-53



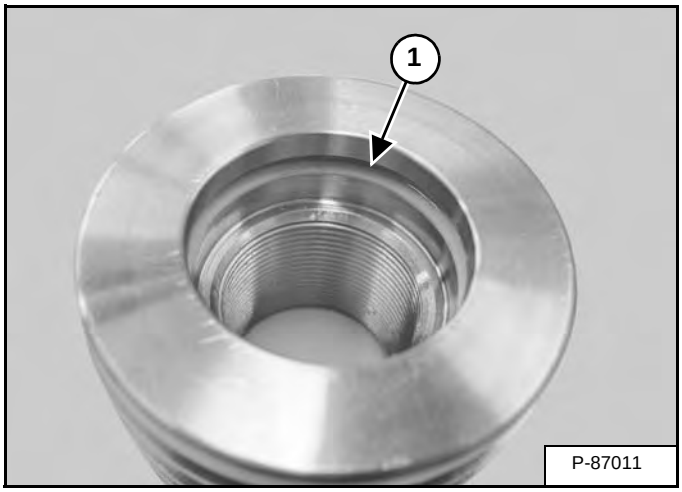
Install the head (Item 1) **[Figure 20-23-53]** onto the rod.

Figure 20-23-54



Install the cushion ring (Item 1) **[Figure 20-23-54]** on the rod.

Figure 20-23-55

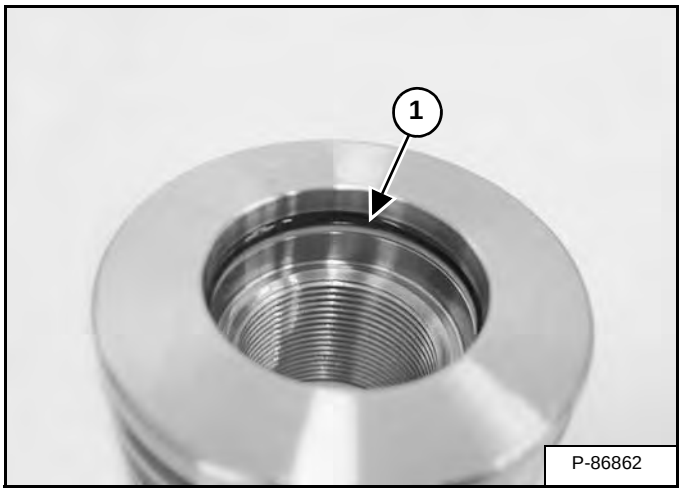


Install the back-up ring (Item 1) **[Figure 20-23-55]** in the piston.

Dealer Copy -- Not for Resale

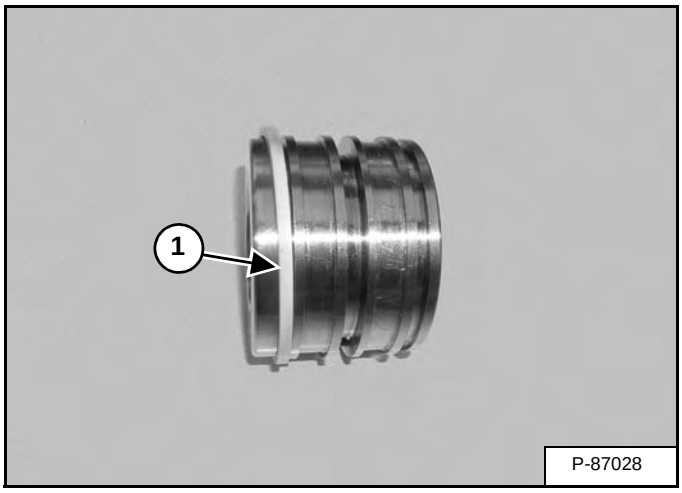
Assembly (Cont'd)

Figure 20-23-56



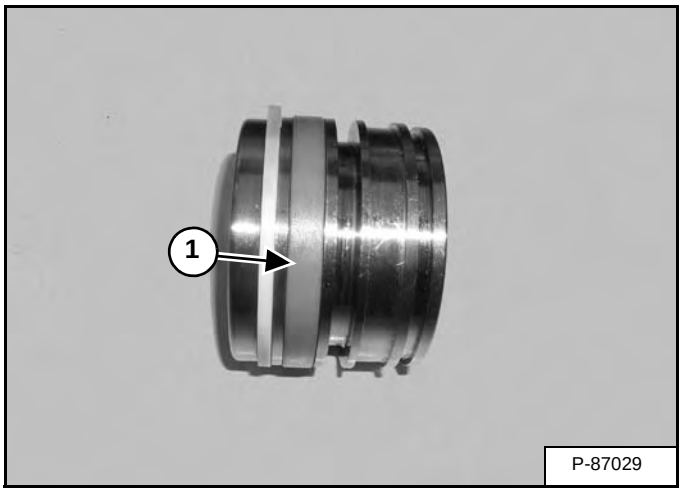
Install the O-ring (Item 1) **[Figure 20-23-56]** into the piston.

Figure 20-23-57



Install the seal (Item 1) **[Figure 20-23-57]** onto the piston.

Figure 20-23-58



Install the wear ring (Item 1) **[Figure 20-23-58]** onto the piston.

Figure 20-23-59

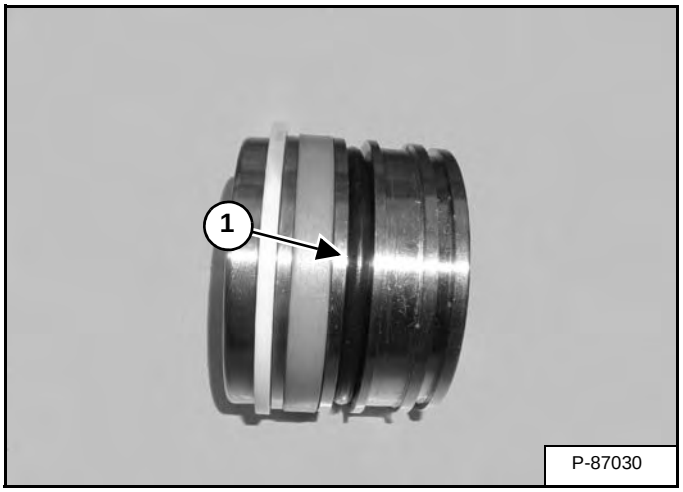
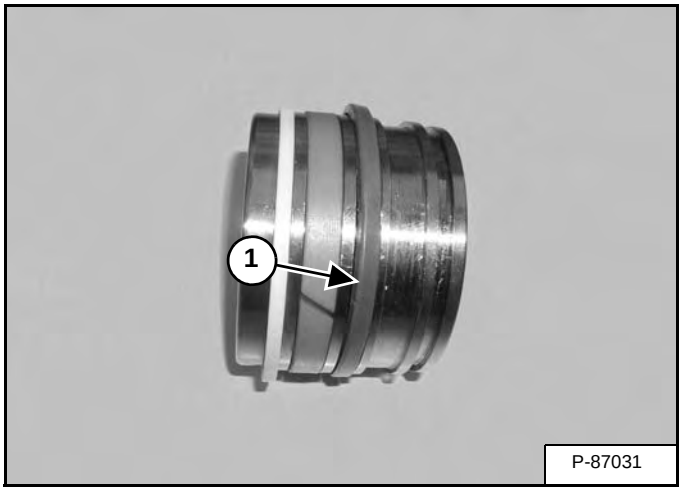


Figure 20-23-60

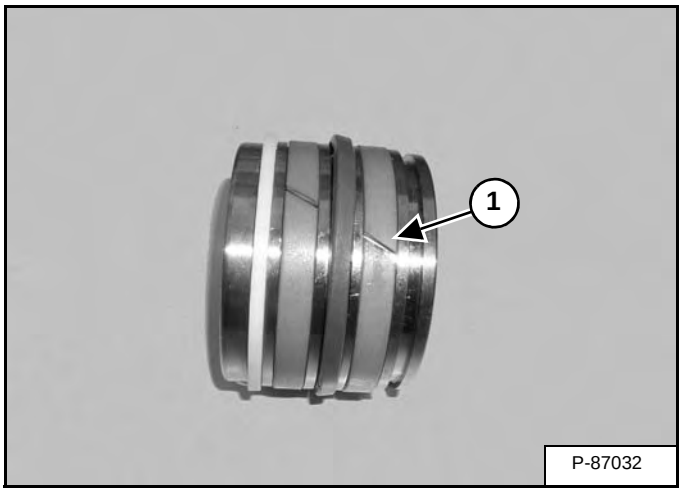


Install the O-ring (Item 1) **[Figure 20-23-59]** and seal (Item 1) **[Figure 20-23-60]** onto the piston.

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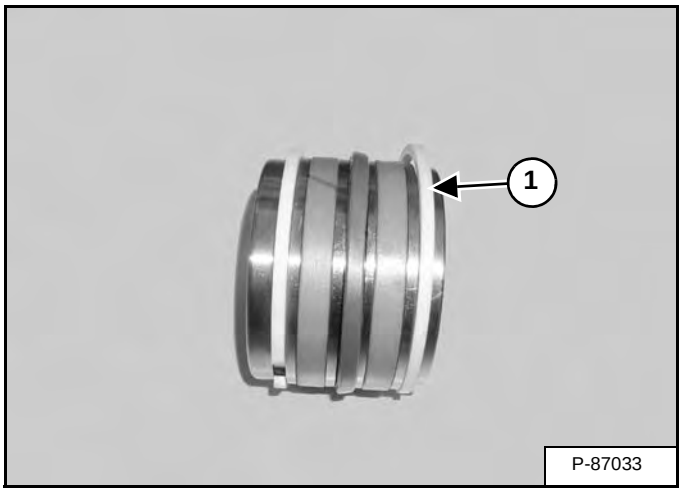
Assembly (Cont'd)

Figure 20-23-61



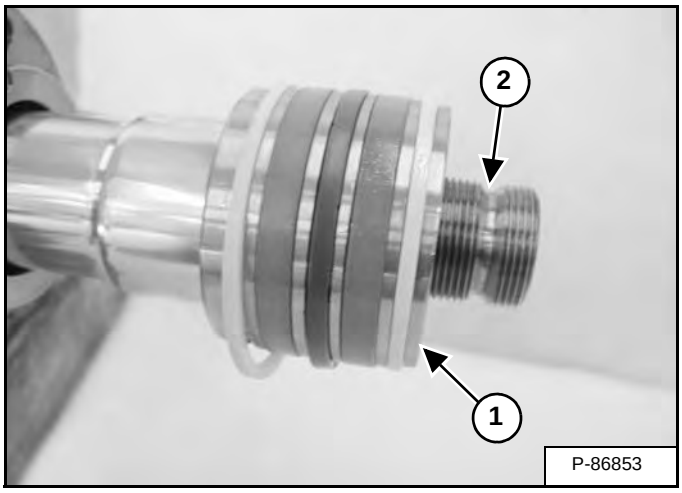
Install the wear ring (Item 1) **[Figure 20-23-61]** onto the piston.

Figure 20-23-62



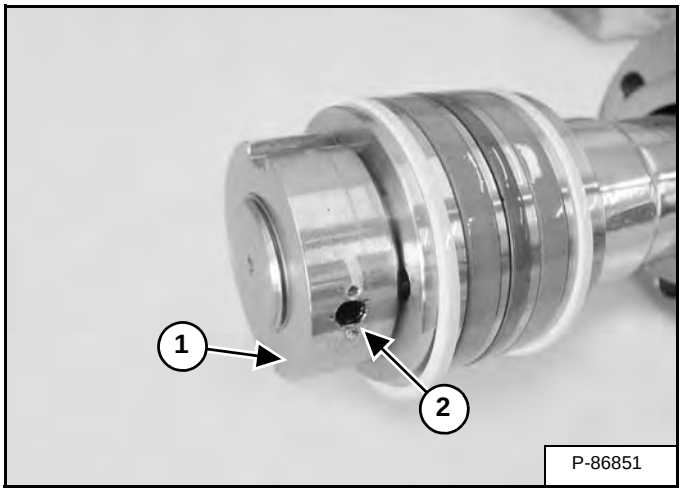
Install the seal (Item 1) **[Figure 20-23-62]** onto the piston.

Figure 20-23-63



Install the piston (Item 1) **[Figure 20-23-63]** onto the rod.

Figure 20-23-64



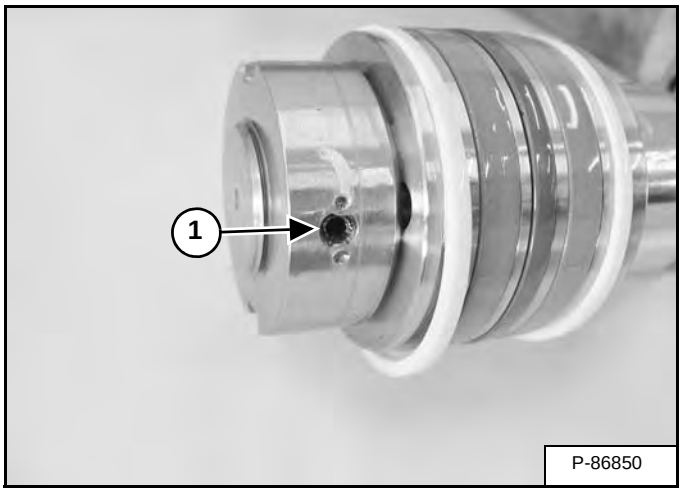
Install the nut (Item 1) **[Figure 20-23-64]**.

Tighten the nut until the bore (Item 2) **[Figure 20-23-63]** of the set screw is aligned with the groove (Item 2) **[Figure 20-23-64]** of the rod.

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Assembly (Cont'd)

Figure 20-23-65

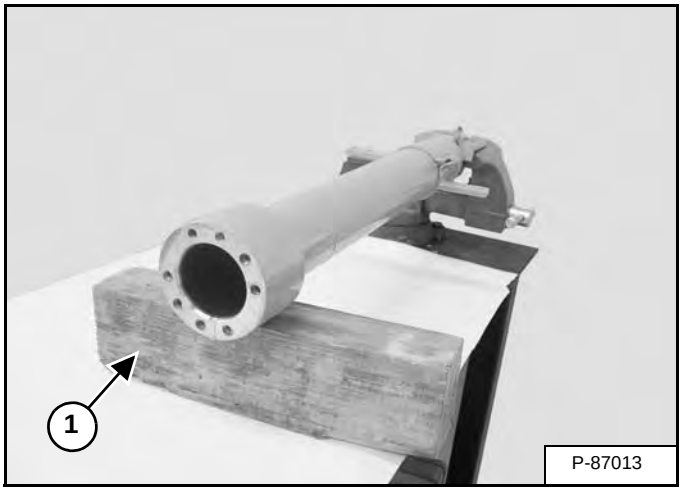


Install the set screw (Item 1) **[Figure 20-23-65]** into the nut.

Use a center punch to deform the threads of the set screw bore.

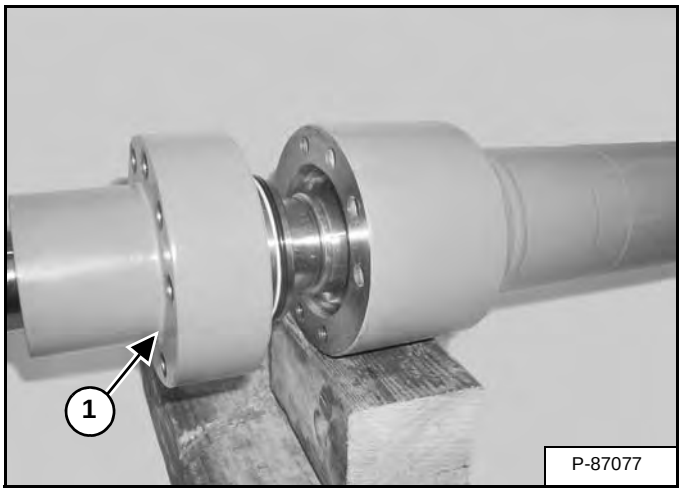
Remove the rod end from the vise.

Figure 20-23-66



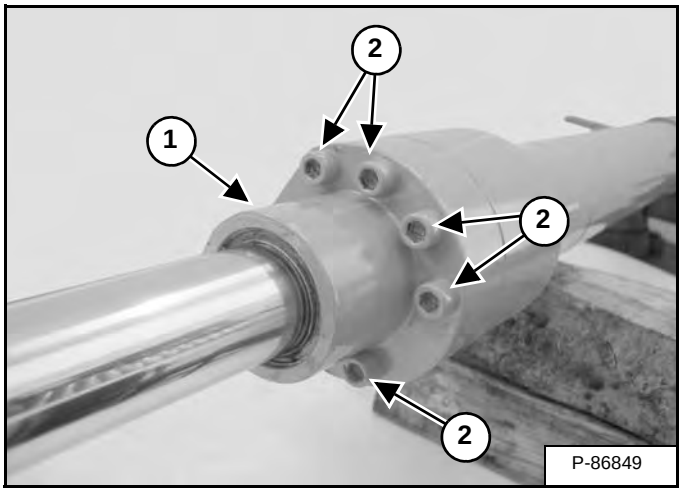
Support the housing with a block (Item 1) **[Figure 20-23-66]**.

Figure 20-23-67



Install the rod assembly (Item 1) **[Figure 20-23-67]** into the cylinder housing.

Figure 20-23-68



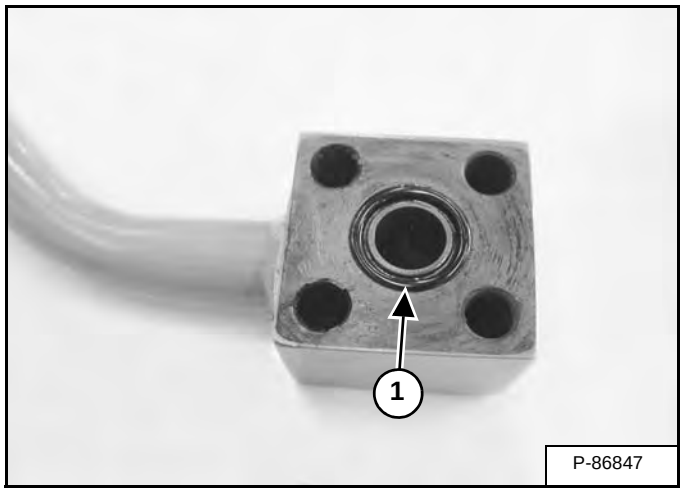
Install the head (Item 1) using the eight bolts (Item 2) **[Figure 20-23-68]**.

Tighten the bolts to 70 - 79 N•m (52 - 58 ft-lb) torque.

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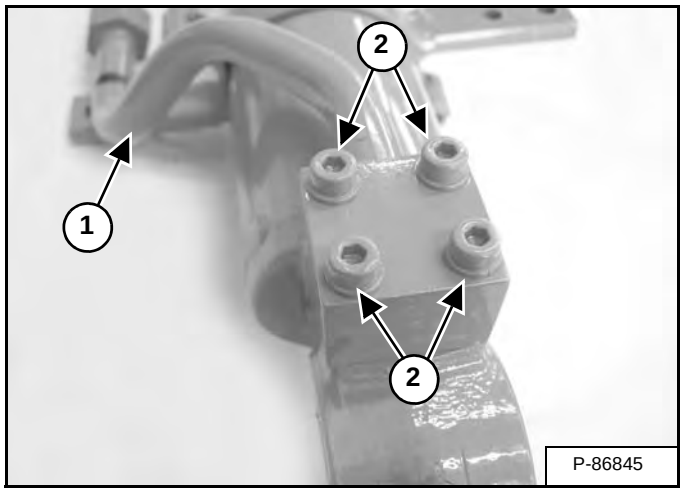
Assembly (Cont'd)

Figure 20-23-69



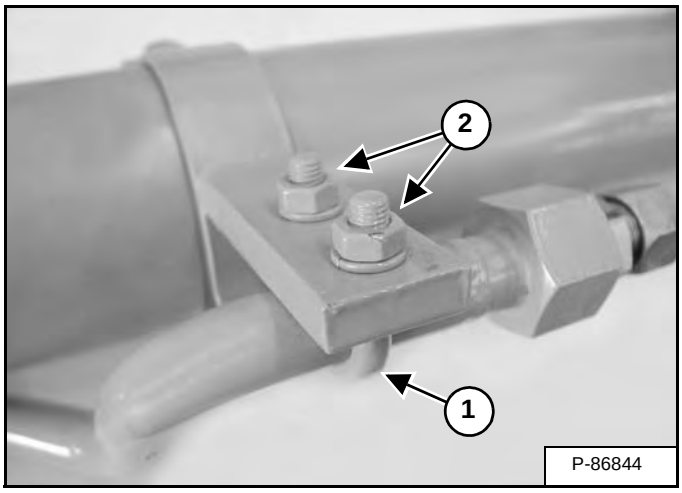
Install the O-ring (Item 1) **[Figure 20-23-69]** into the tubeline.

Figure 20-23-70



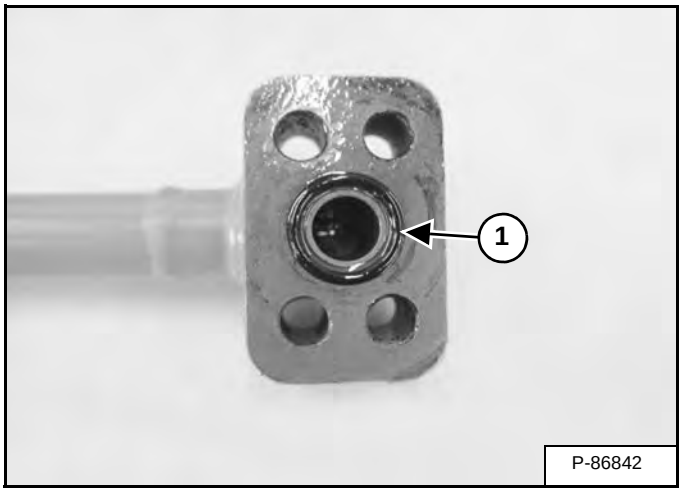
Install the tubeline (Item 1), lock washers and bolts (Item 2) **[Figure 20-23-70]** onto the cylinder housing.

Figure 20-23-71



Install the U-bolt (Item 1), lock washers and nuts (Item 2) **[Figure 20-23-71]**.

Figure 20-23-72

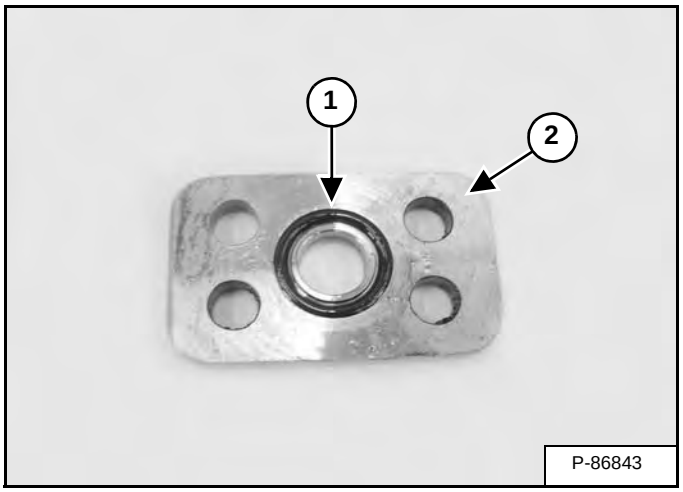


Install the O-ring (Item 1) **[Figure 20-23-72]** into the tubeline.

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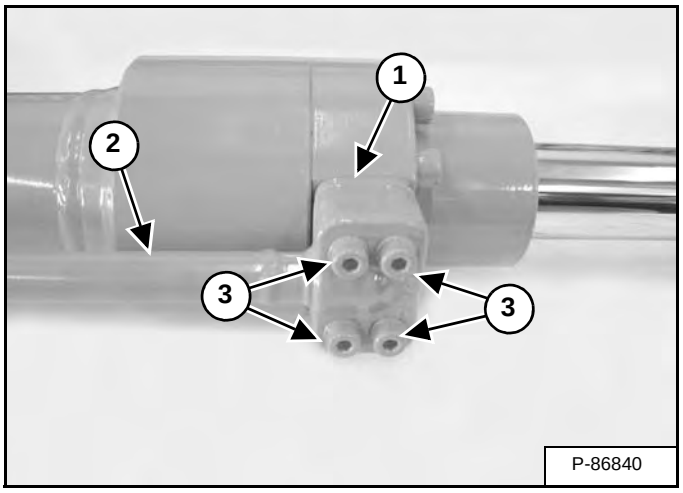
Assembly (Cont'd)

Figure 20-23-73



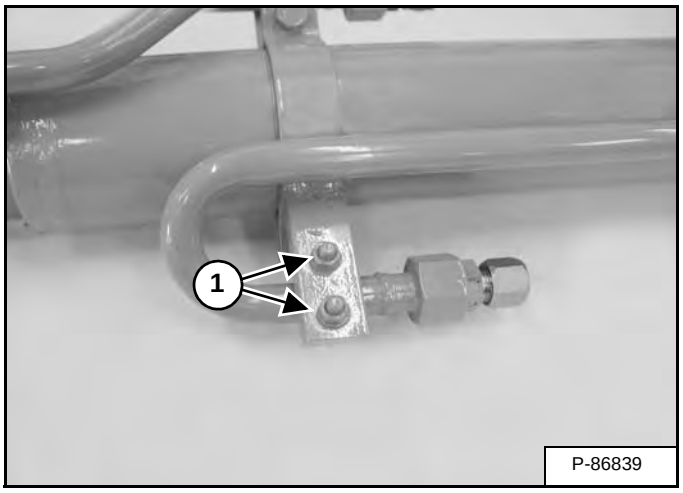
Install the O-ring (Item 1) into the spacer (Item 2) **[Figure 20-23-73]**.

Figure 20-23-74



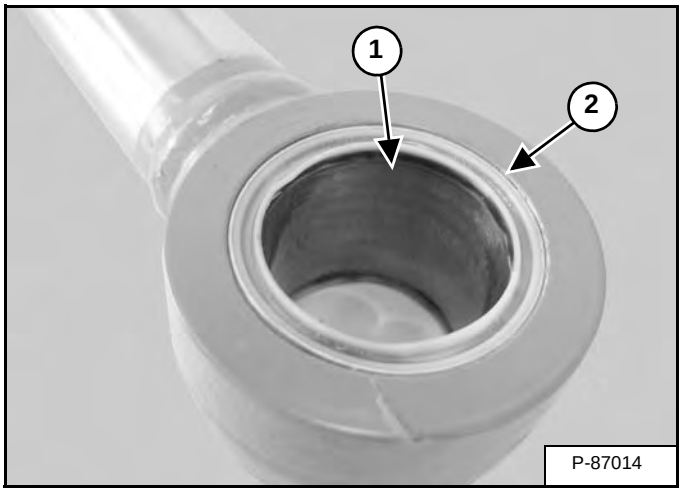
Install the spacer (Item 1) and tubeline (Item 2) using the four bolts (Item 3) **[Figure 20-23-74]** and lock washers.

Figure 20-23-75



Install the U-bolt, washers and nuts (Item 1) **[Figure 20-23-75]**.

Figure 20-23-76

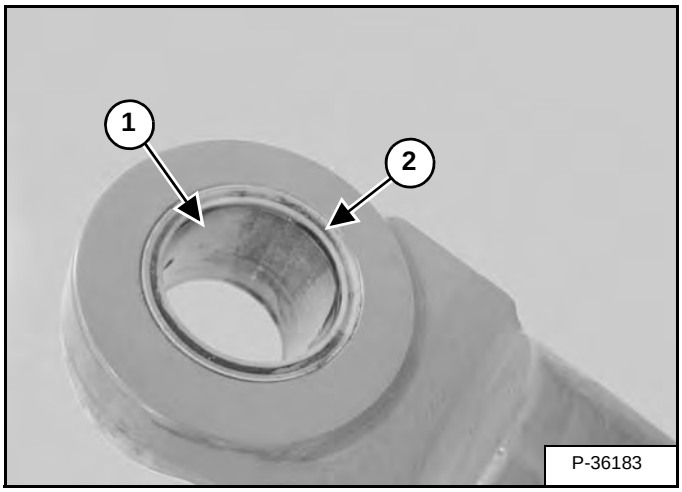


Install the bushing (Item 1) and seal (Item 2) **[Figure 20-23-76]** (both sides) into the rod end of the cylinder.

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Assembly (Cont'd)

Figure 20-23-77



Install the bushing (Item 1) and seal (Item 2) **[Figure 20-23-77]** (both sides) into the base end of the cylinder.

Dealer Copy -- Not for Resale

CYLINDER (BLADE)

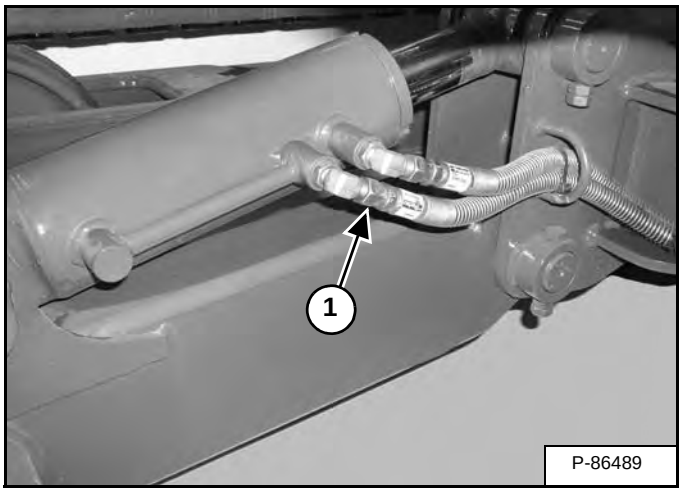
Testing

Put the bucket on the ground.

Stop the engine.

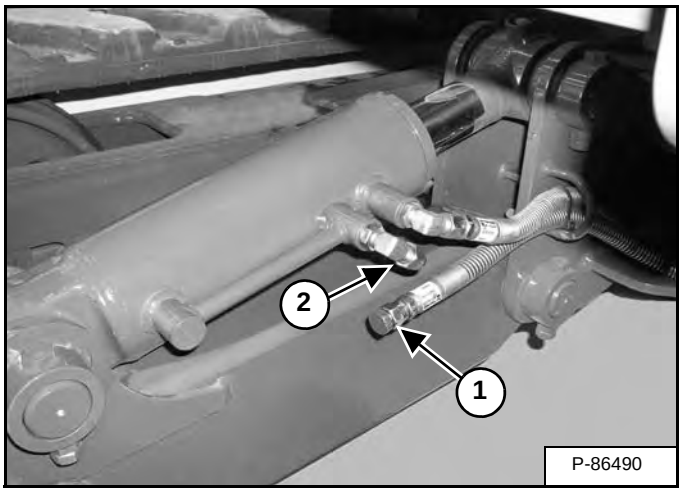
With the engine off and the key in the run position, move the blade lever to relieve hydraulic pressure.

Figure 20-24-1



Remove the hydraulic hose (Item 1) **[Figure 20-24-1]** from the base end of the blade cylinders.

Figure 20-24-2



Install a plug (Item 1) **[Figure 20-24-2]** on the hose.

Start the engine and retract the blade cylinders.

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

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CYLINDER (BLADE) (CONT'D)

Removal And Installation

NOTE: The right blade cylinder is shown. The procedure is the same for the left blade cylinder.

Put the blade on the floor.

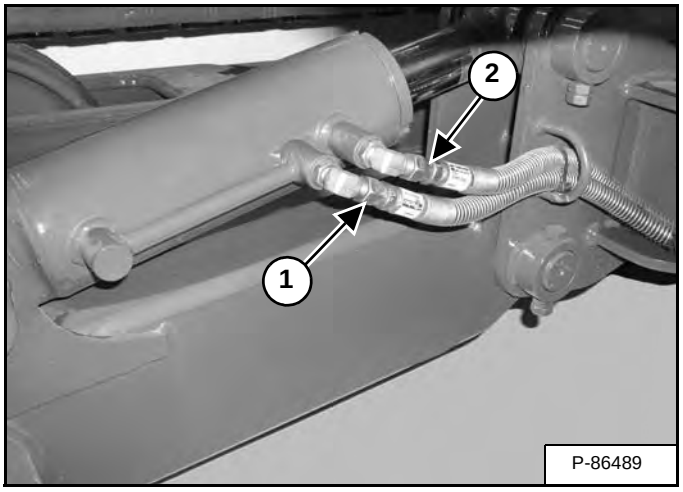
With the engine off and the key in the run position, move the blade lever to relieve hydraulic pressure.

IMPORTANT

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

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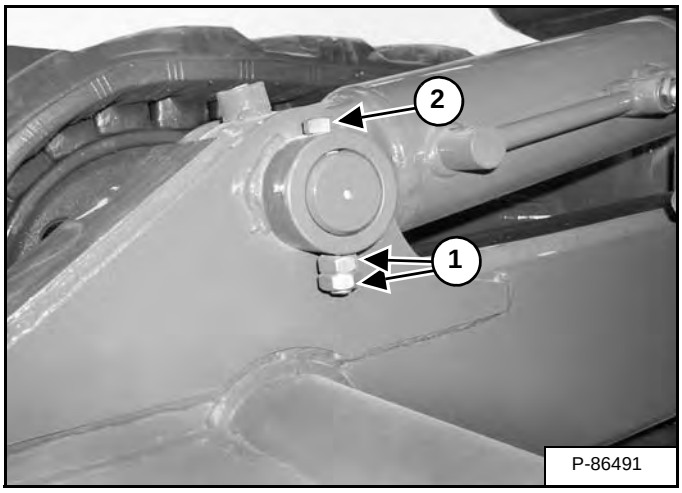
Figure 20-24-3



Remove the hose (Item 1) **[Figure 20-24-3]** from the base end of the cylinder.

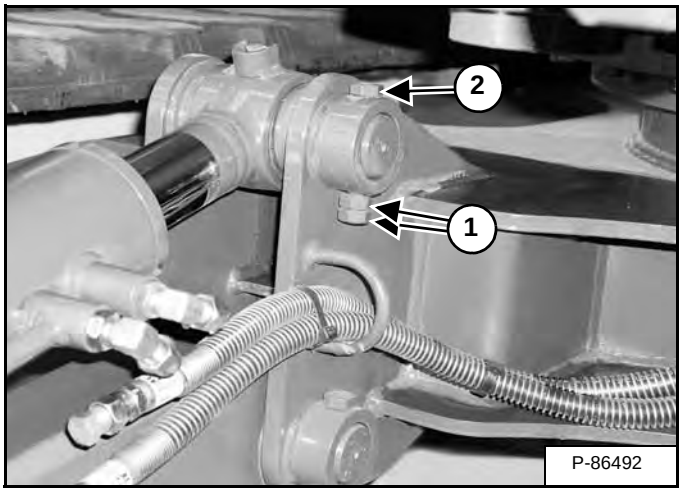
Remove the hose (Item 2) **[Figure 20-24-3]** from the rod end of the cylinder.

Figure 20-24-4



Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-24-4]** from the base end retaining pin.

Figure 20-24-5



Remove the nuts (Item 1) and bolt (Item 2) **[Figure 20-24-5]** from the rod end retaining pin.

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Removal And Installation (Cont'd)

Figure 20-24-6

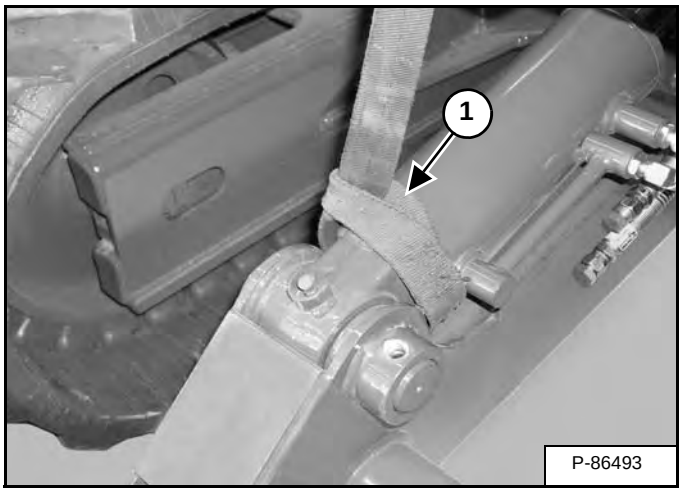
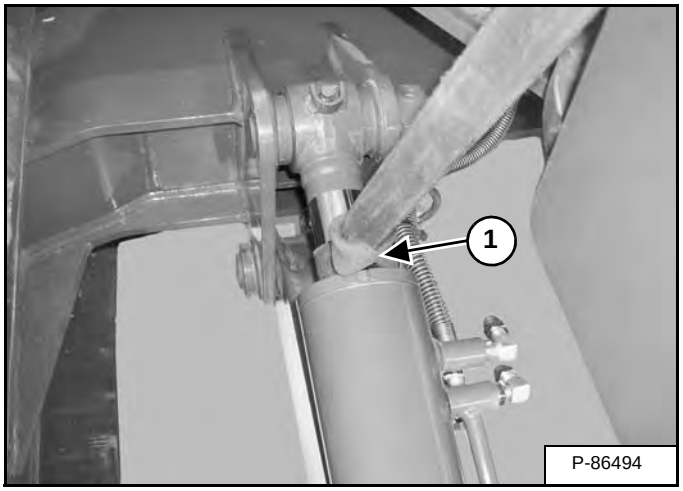


Figure 20-24-7



Install a sling (Item 1) **[Figure 20-24-6]** and **[Figure 20-24-7]** on the rod end and base end of the cylinder.

Figure 20-24-8

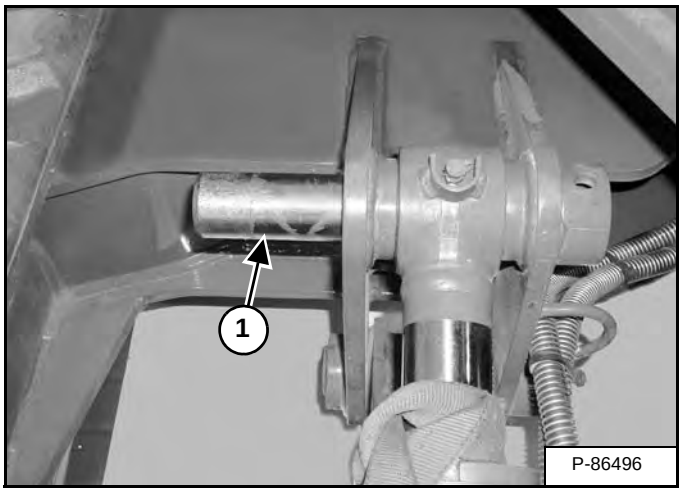
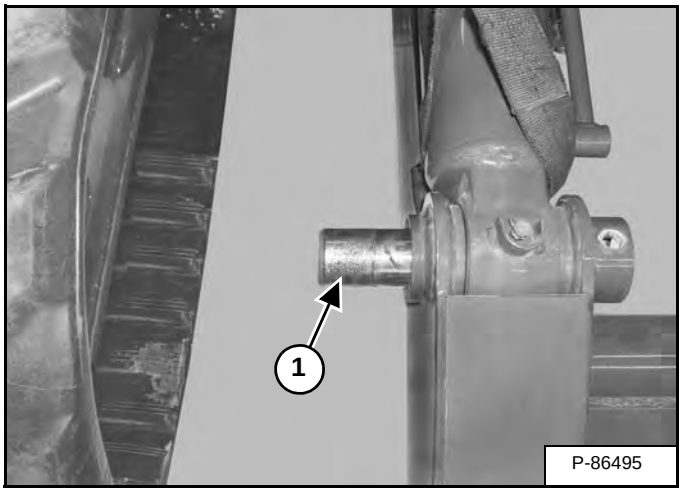


Figure 20-24-9



Remove the retaining pins (Item 1) **[Figure 20-24-8]** and **[Figure 20-24-9]**.

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Removal And Installation (Cont'd)

Figure 20-24-10

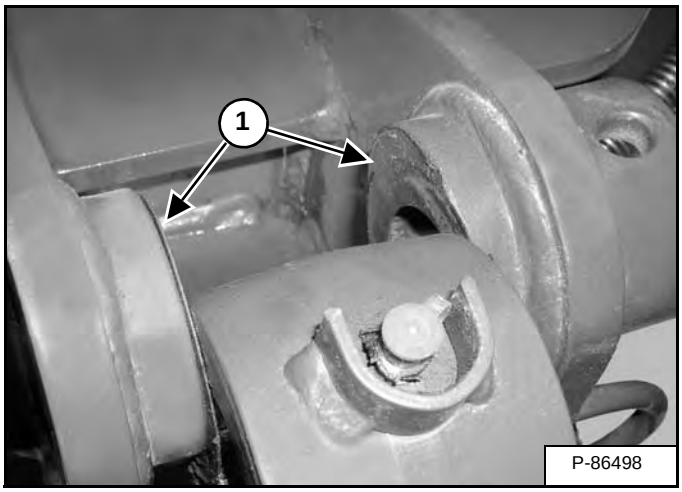
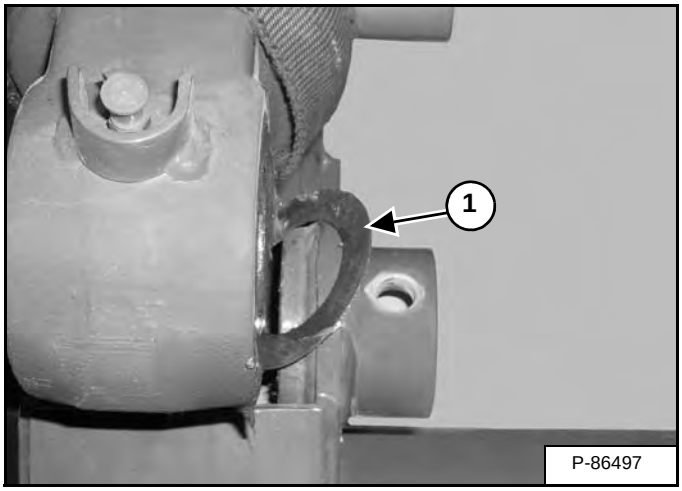


Figure 20-24-11



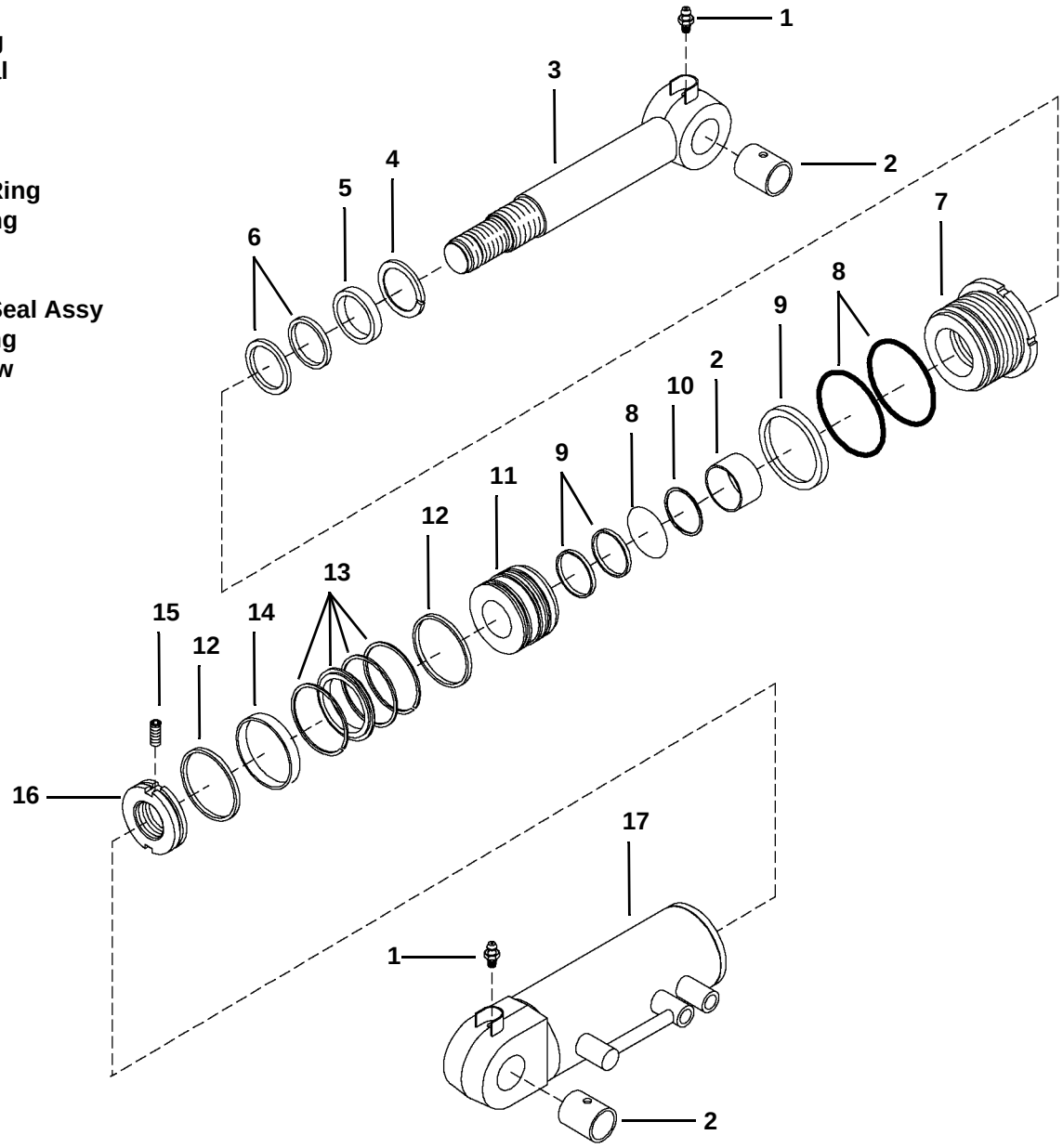
Raise the hoist and remove the shims (Item 1) **[Figure 20-24-10]** and **[Figure 20-24-11]** from both sides of the rod end and base end of the cylinder.

Remove the cylinder.

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Parts Identification

1. Grease Fitting
2. Bushing
3. Rod
4. Snap Ring
5. Wiper Seal
6. Seal
7. Head
8. O-ring
9. Back-up Ring
10. Snap Ring
11. Piston
12. Seal
13. Slipper Seal Assy
14. Wear Ring
15. Set Screw
16. Nut
17. Housing



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Disassembly

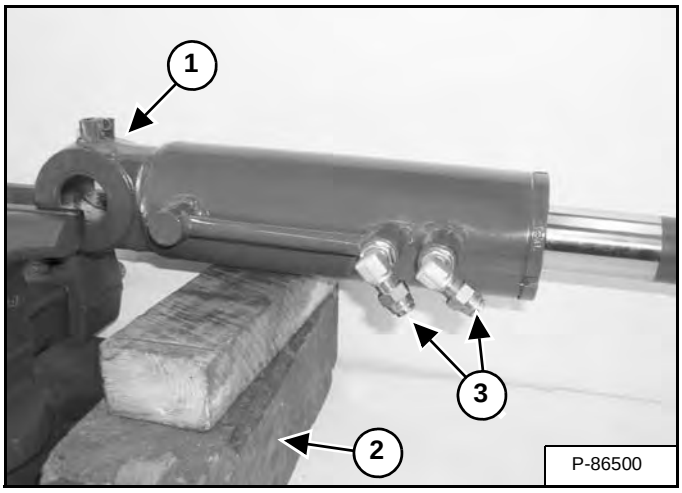
IMPORTANT

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

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

Figure 20-24-12

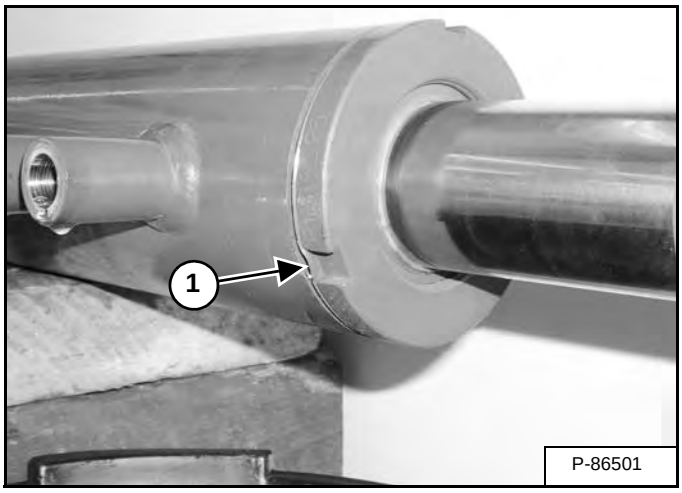


Clamp the base end (Item 1) **[Figure 20-24-12]** of the cylinder housing in a vise.

Install a block (Item 2) **[Figure 20-24-12]** to support the cylinder.

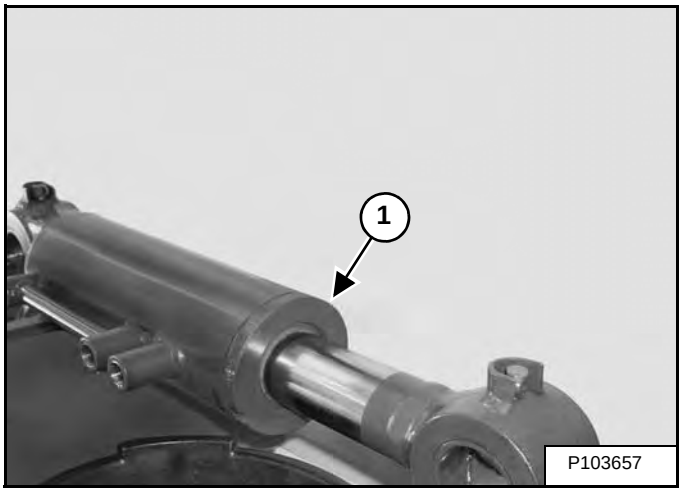
Remove the fittings (Item 3) **[Figure 20-24-12]**.

Figure 20-24-13



Straighten the head lock ring (Item 1) **[Figure 20-24-13]**.

Figure 20-24-14

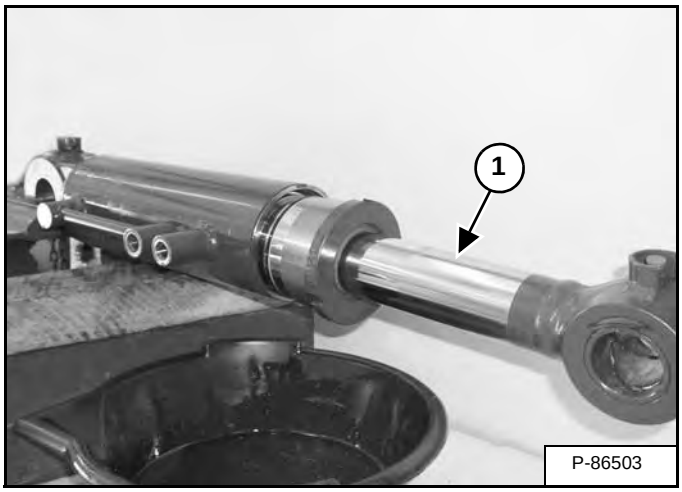


Remove the head (Item 1) **[Figure 20-24-14]** from the housing.

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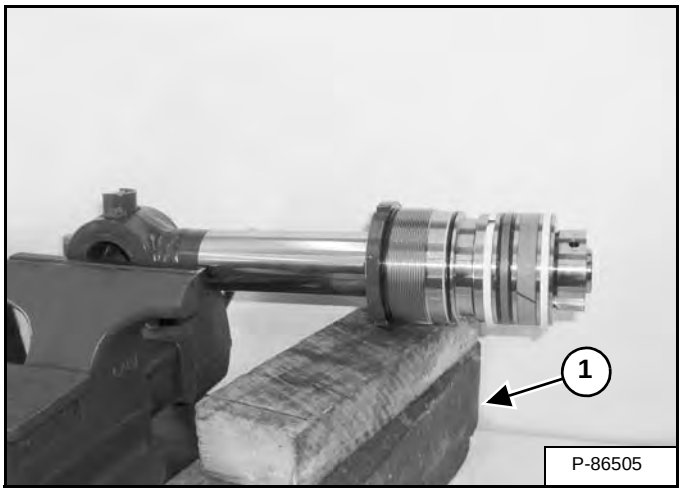
Disassembly (Cont'd)

Figure 20-24-15



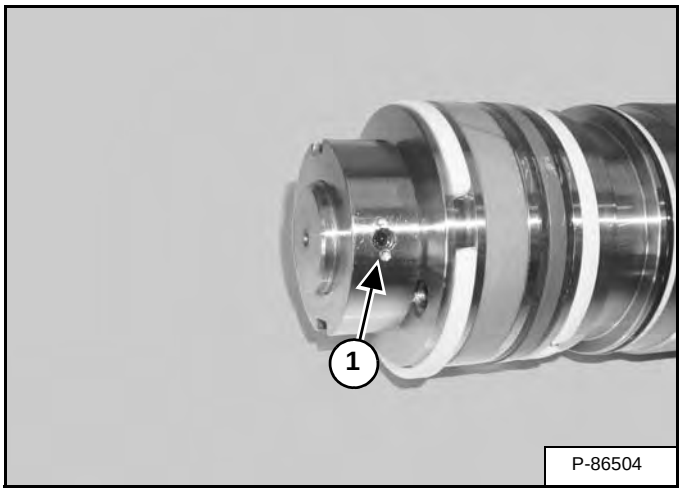
Remove the rod assembly (Item 1) **[Figure 20-24-15]** from the housing.

Figure 20-24-16



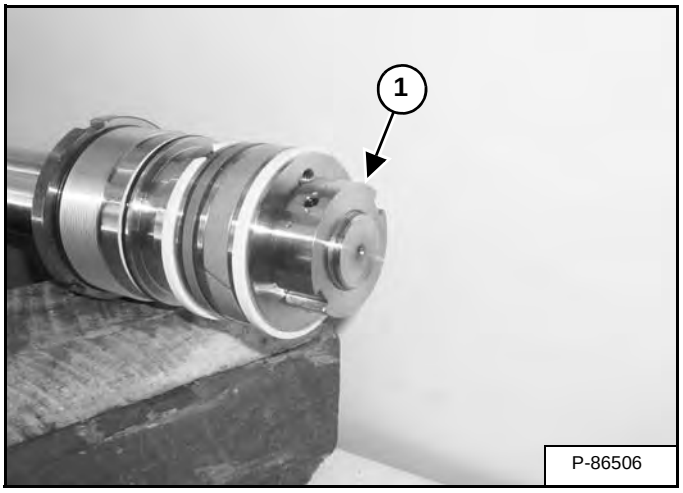
Clamp the rod end in a vise. Support the end of the rod with a block (Item 1) **[Figure 20-24-16]**.

Figure 20-24-17



Remove the set screw (Item 1) **[Figure 20-24-17]**.

Figure 20-24-18



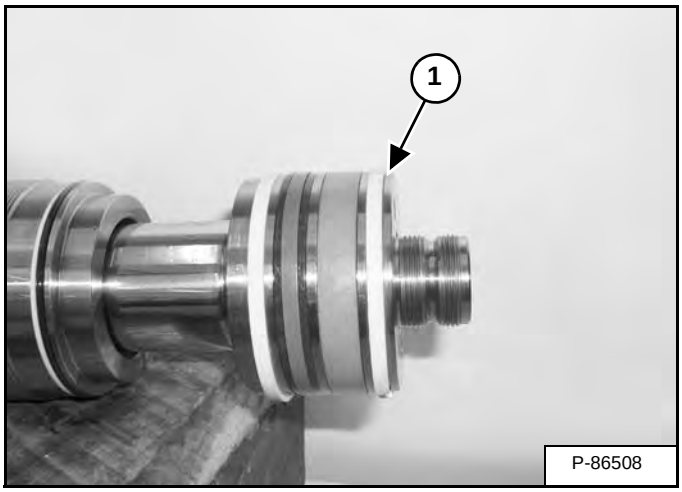
Apply moderate heat to the nut (Item 1) **[Figure 20-24-18]**.

Remove the nut.

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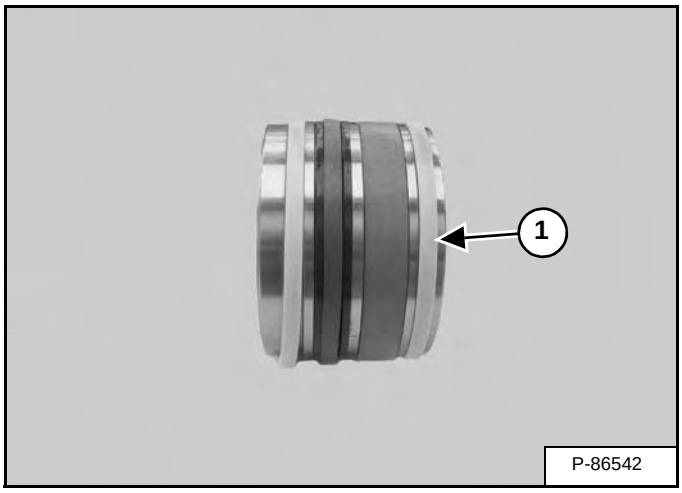
Disassembly (Cont'd)

Figure 20-24-19



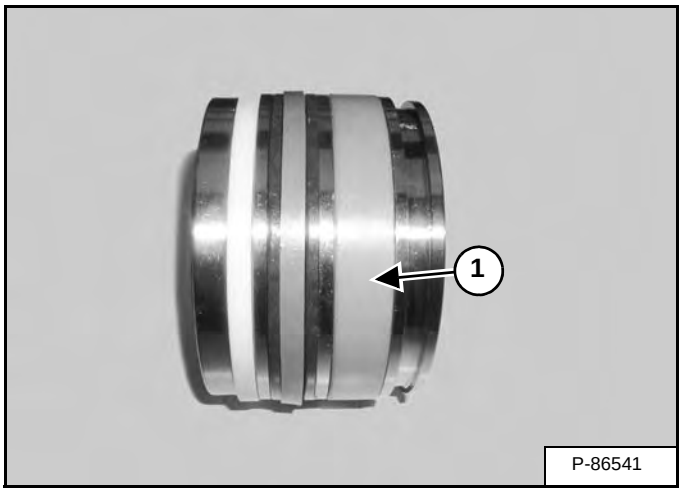
Remove the piston (Item 1) **[Figure 20-24-19]**.

Figure 20-24-20



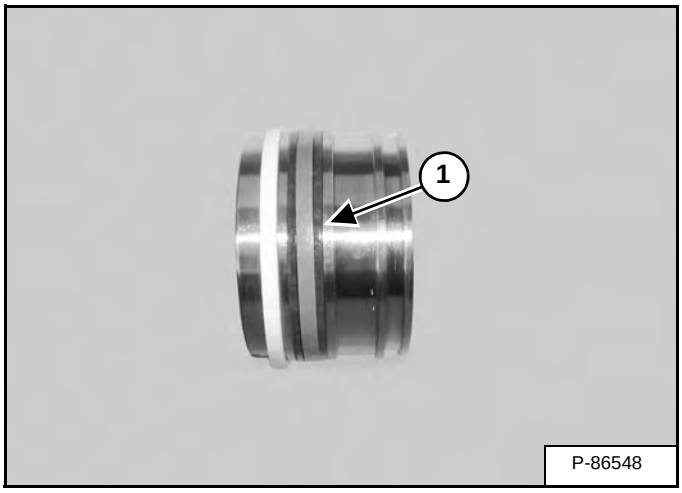
Remove the seal (Item 1) **[Figure 20-24-20]**.

Figure 20-24-21



Remove the wear ring (Item 1) **[Figure 20-24-21]**.

Figure 20-24-22



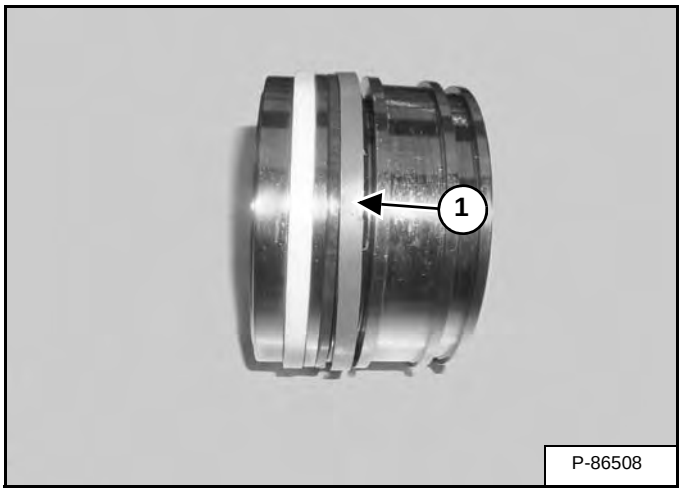
Remove the back-up ring (Item 1) **[Figure 20-24-22]**.

NOTE: The slipper seal consists of four separate pieces that are removed individually.

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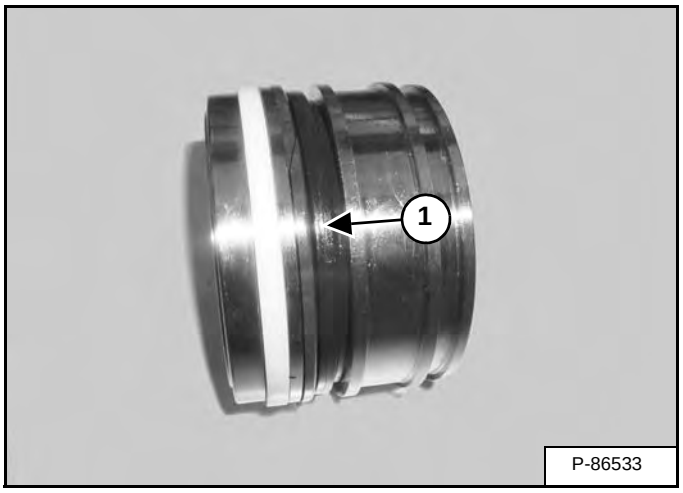
Disassembly (Cont'd)

Figure 20-24-23



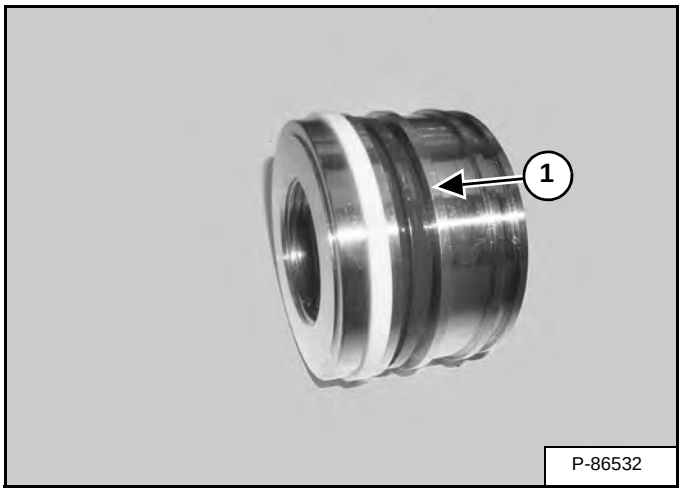
Remove the wear ring (Item 1) **[Figure 20-24-23]**.

Figure 20-24-24



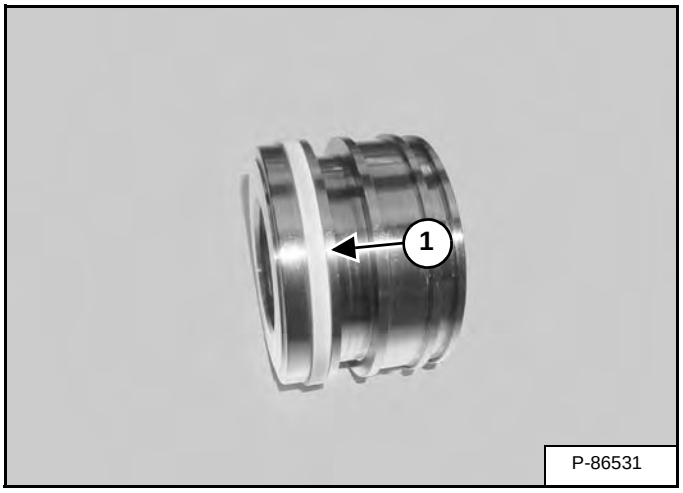
Remove the back-up ring (Item 1) **[Figure 20-24-24]**.

Figure 20-24-25



Remove the slipper seal (Item 1) **[Figure 20-24-25]**.

Figure 20-24-26

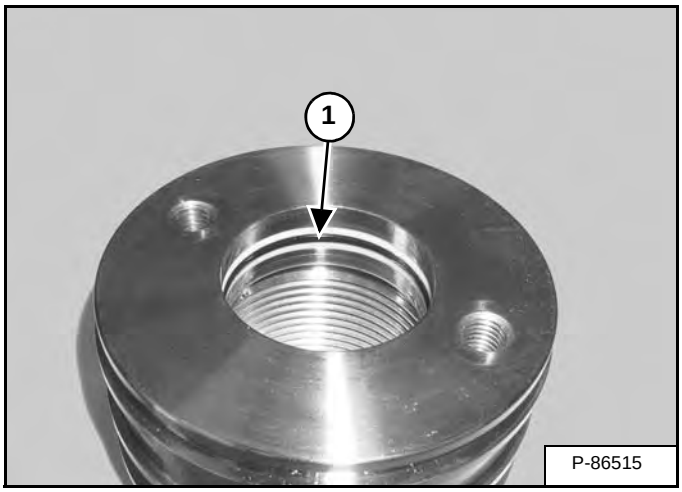


Remove the seal (Item 1) **[Figure 20-24-26]**.

Dealer Copy -- Not for Resale

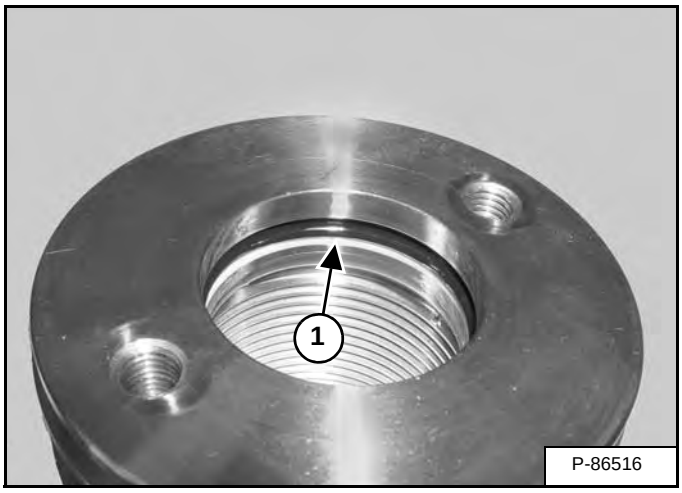
Disassembly (Cont'd)

Figure 20-24-27



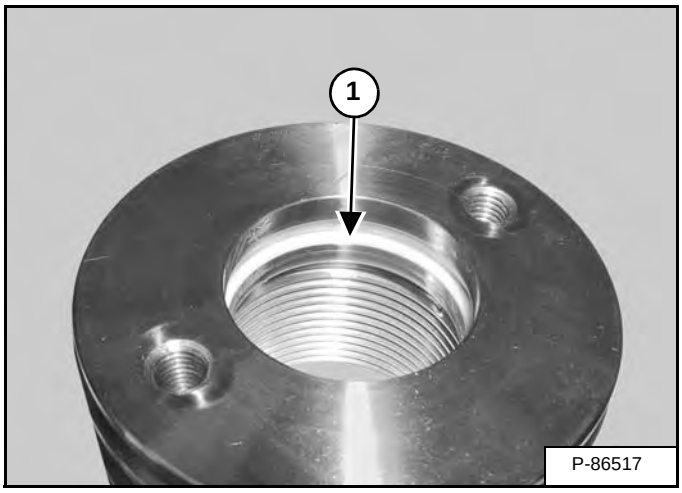
Remove the back-up ring (Item 1) **[Figure 20-24-27]** from the inside of the piston.

Figure 20-24-28



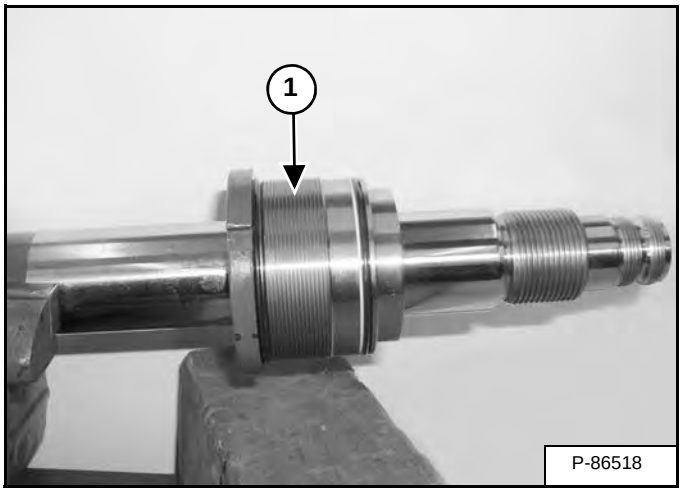
Remove the O-ring (Item 1) **[Figure 20-24-28]**.

Figure 20-24-29



Remove the back-up ring (Item 1) **[Figure 20-24-29]**.

Figure 20-24-30

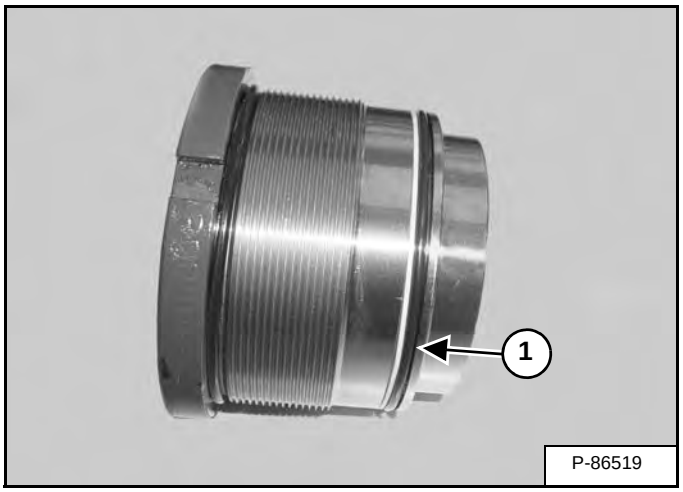


Remove the head (Item 1) **[Figure 20-24-30]** from the cylinder rod.

Dealer Copy -- Not for Resale

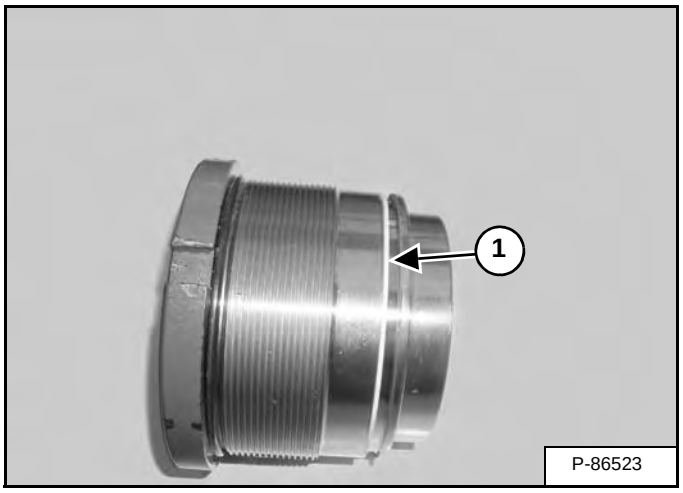
Disassembly (Cont'd)

Figure 20-24-31



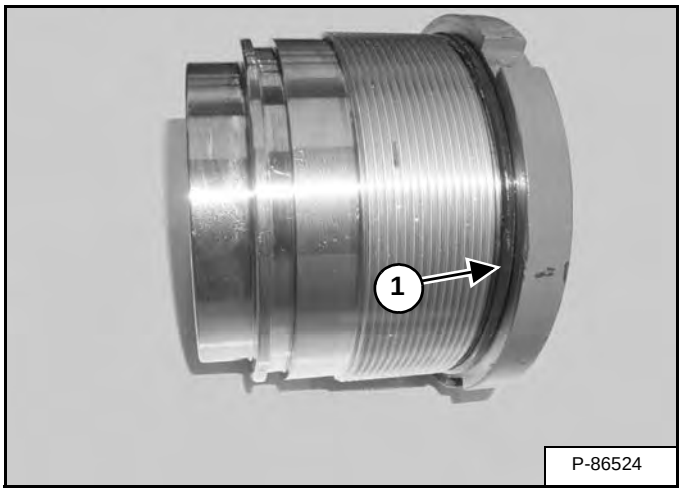
Remove the O-ring (Item 1) **[Figure 20-24-31]** from the head.

Figure 20-24-32



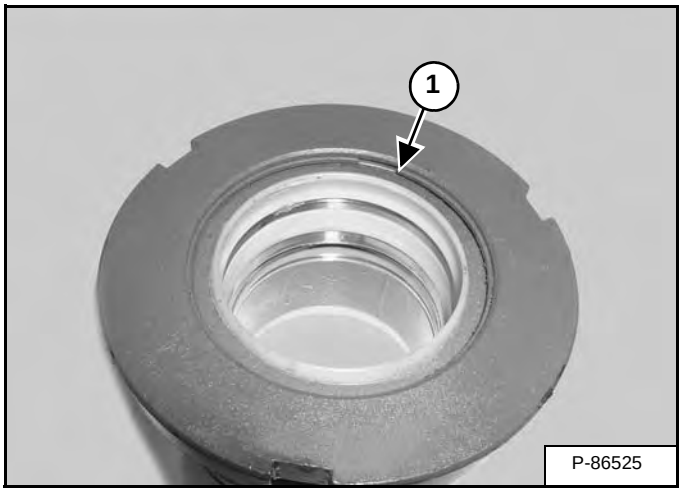
Remove the back-up ring (Item 1) **[Figure 20-24-32]**.

Figure 20-24-33



Remove the O-ring (Item 1) **[Figure 20-24-33]**.

Figure 20-24-34



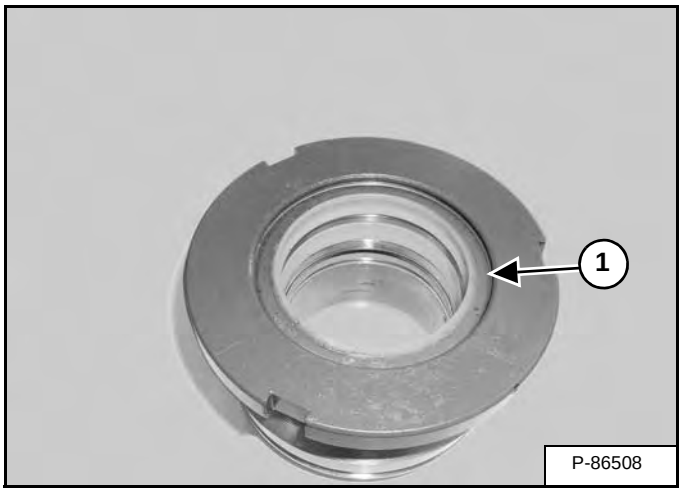
Remove the snap ring (Item 1) **[Figure 20-24-34]** from the inside of the head.

Dealer Copy -- Not for Resale

CYLINDER (BLADE) (CONT'D)

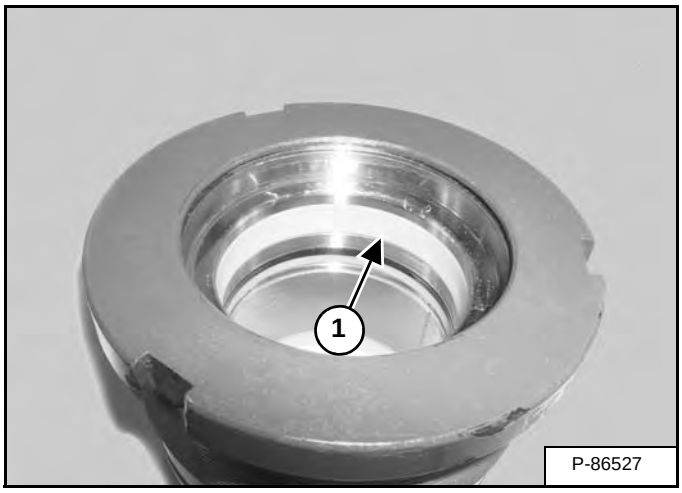
Disassembly (Cont'd)

Figure 20-24-35



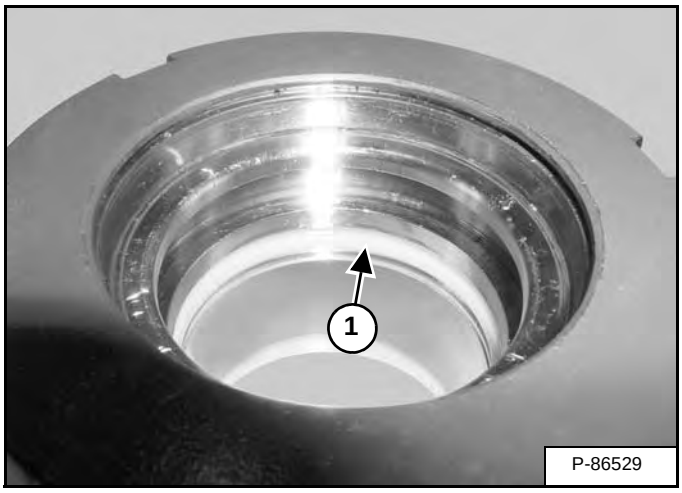
Remove the wiper seal (Item 1) **[Figure 20-24-35]**.

Figure 20-24-36



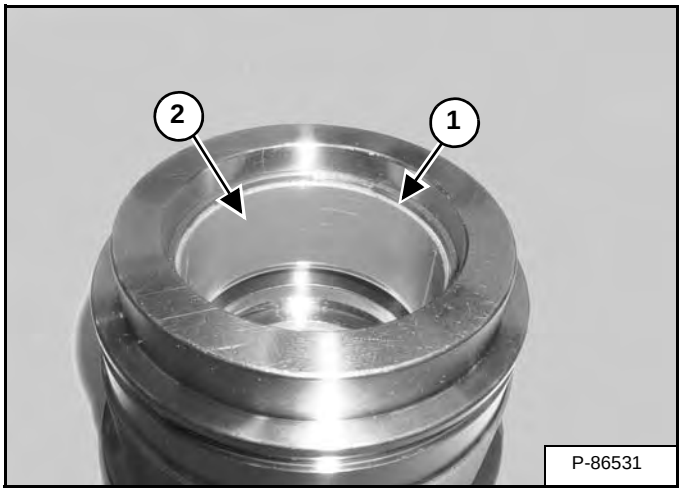
Remove the seal (Item 1) **[Figure 20-24-36]**.

Figure 20-24-37



Remove the seal (Item 1) **[Figure 20-24-37]**.

Figure 20-24-38

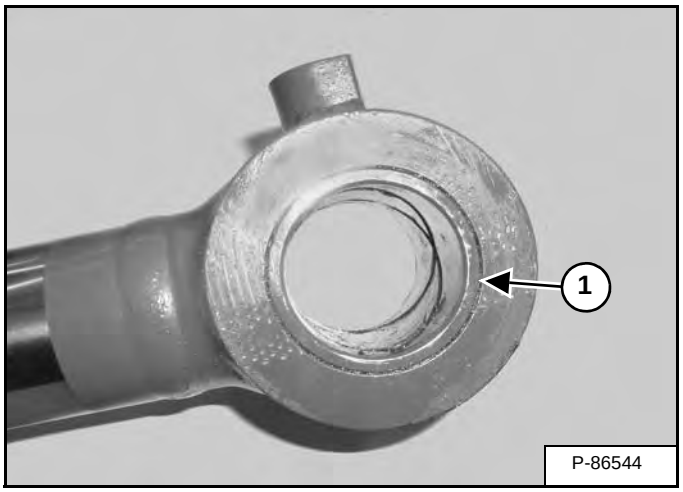


Remove the snap ring (Item 1) and bushing (Item 2) **[Figure 20-24-38]**.

Dealer Copy -- Not for Resale

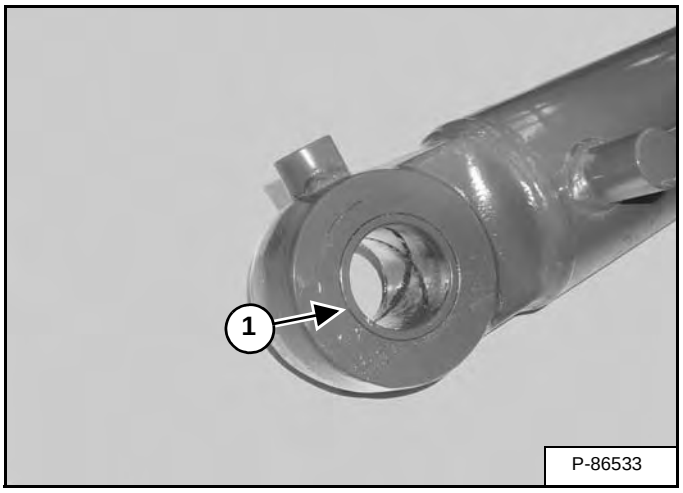
Disassembly (Cont'd)

Figure 20-24-39



Remove the bushing (Item 1) **[Figure 20-24-39]** from the rod.

Figure 20-24-40



Remove the bushing (Item 1) **[Figure 20-24-40]** from the base end.

Dealer Copy -- Not for Resale

Assembly

Use the following tools to assemble the cylinder:

MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
MEL1396-2 - Piston Ring Compressor

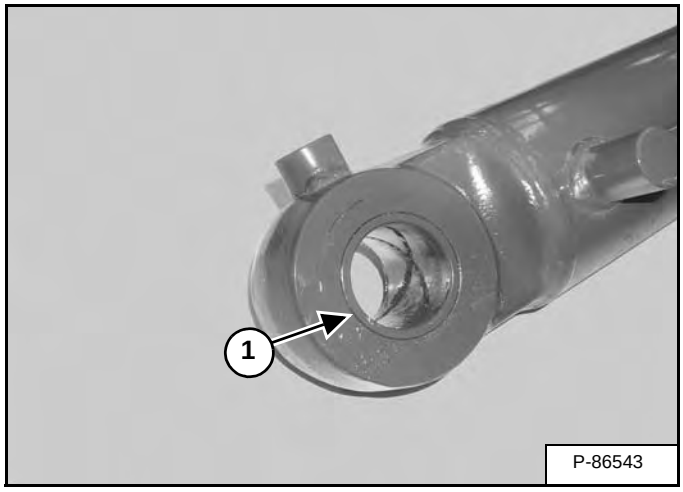
Wash the cylinder parts in clean solvent and dry with compressed air.

Inspect the cylinder parts for nicks, scratches and other damage. Replace any damaged parts.

Always install new O-rings and seals during assembly.

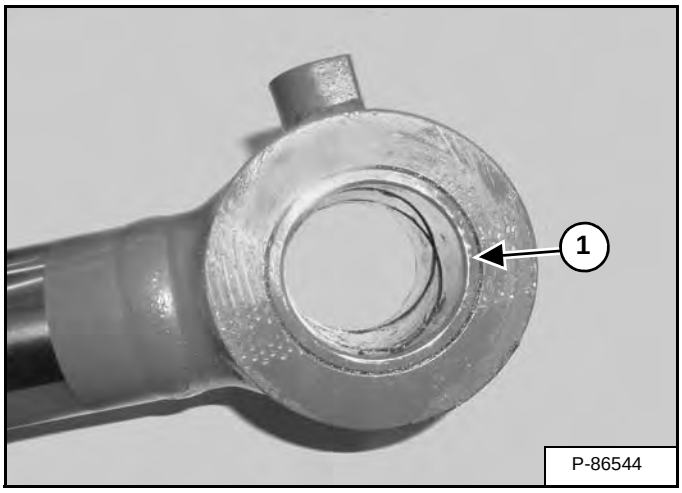
Lubricate all O-rings and seals with hydraulic oil during assembly.

Figure 20-24-41



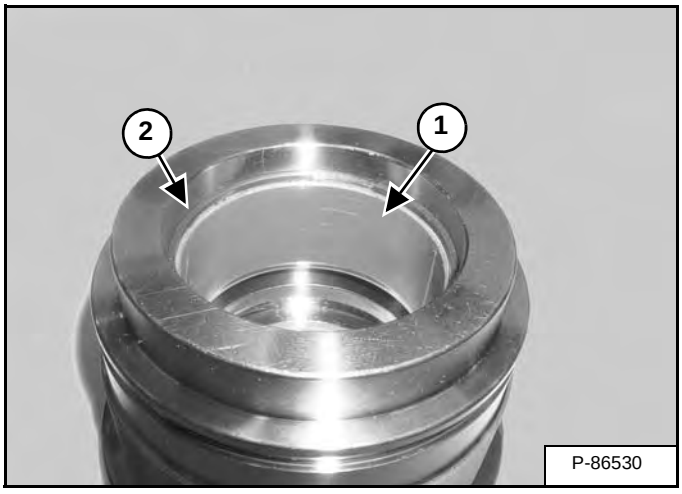
Install the bushing (Item 1) **[Figure 20-24-41]** into the base end of the housing.

Figure 20-24-42



Install the bushing (Item 1) **[Figure 20-24-42]** into the rod.

Figure 20-24-43

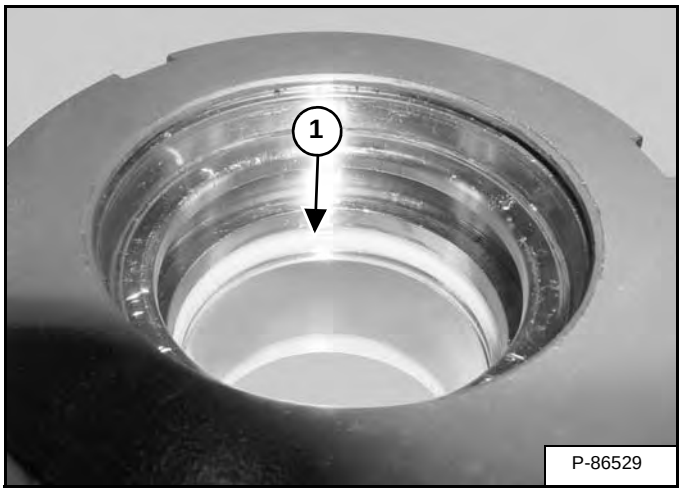


Install the bushing (Item 1) and snap ring (Item 2) **[Figure 20-24-43]** into the head.

Dealer Copy -- Not for Resale

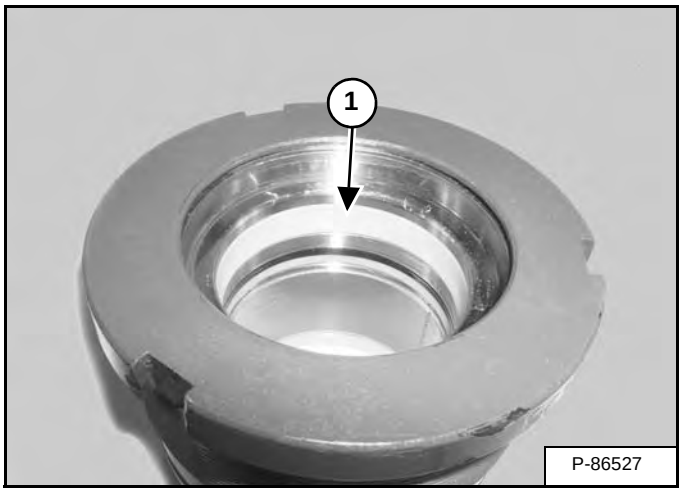
Assembly (Cont'd)

Figure 20-24-44



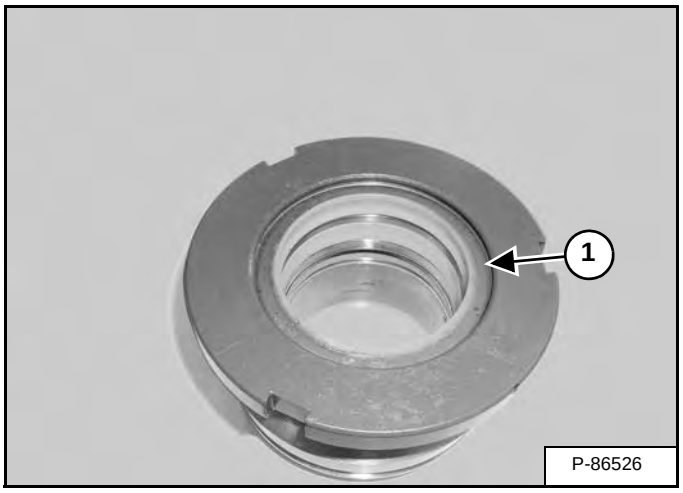
Install the seal (Item 1) **[Figure 20-24-44]**.

Figure 20-24-45



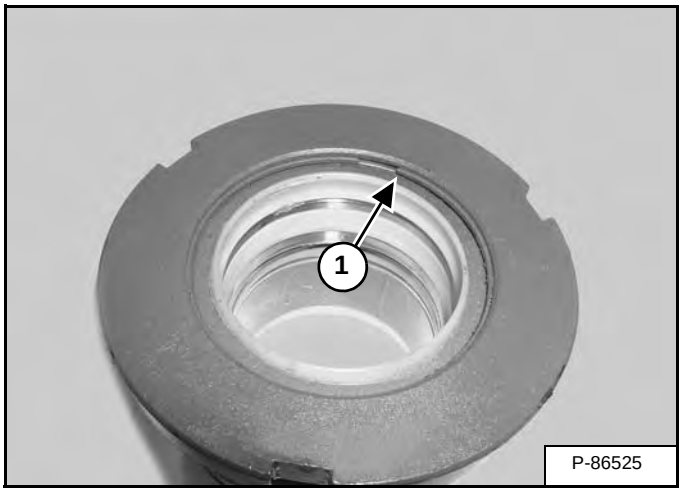
Install the seal (Item 1) **[Figure 20-24-45]**.

Figure 20-24-46



Install the wiper seal (Item 1) **[Figure 20-24-46]**.

Figure 20-24-47

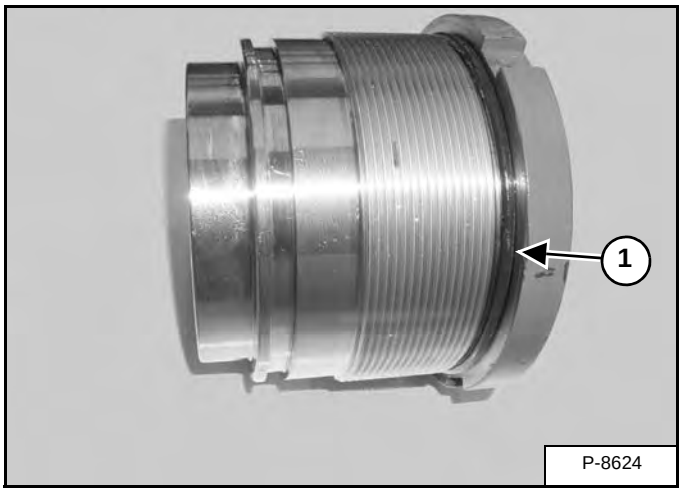


Install the snap ring (Item 1) **[Figure 20-24-47]**.

Dealer Copy -- Not for Resale

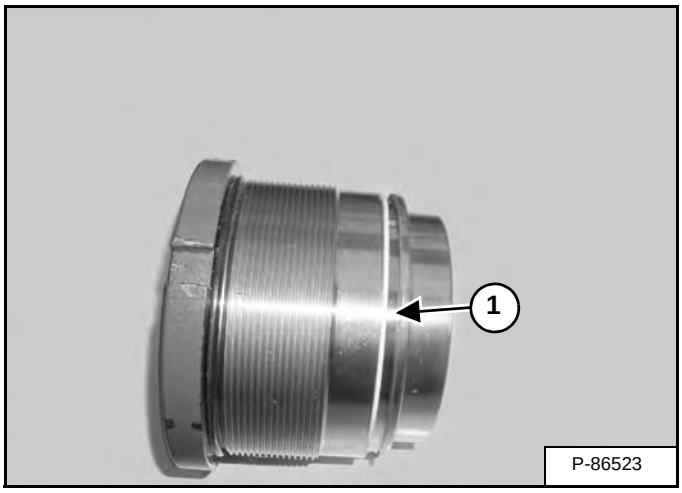
Assembly (Cont'd)

Figure 20-24-48



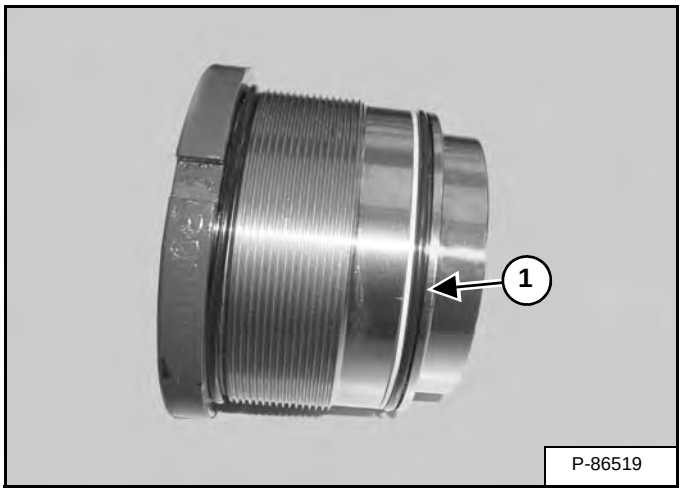
Install the O-ring (Item 1) **[Figure 20-24-48]**.

Figure 20-24-49



Install the back-up ring (Item 1) **[Figure 20-24-49]**.

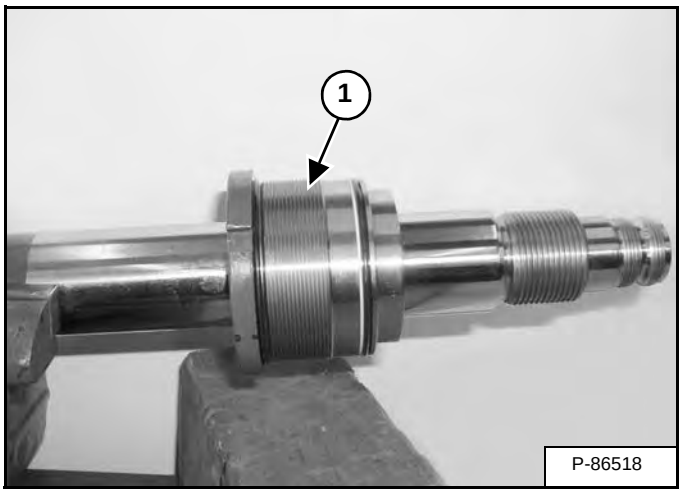
Figure 20-24-50



Install the O-ring (Item 1) **[Figure 20-24-50]**.

Install the rod end in a vise.

Figure 20-24-51

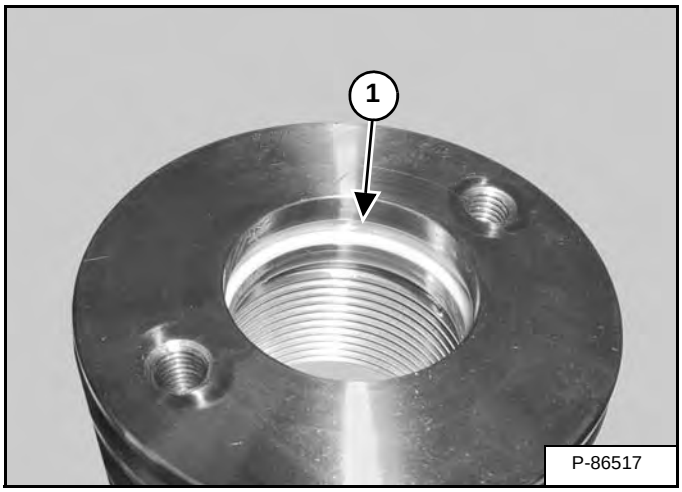


Install the head (Item 1) **[Figure 20-24-51]** onto the cylinder rod.

Dealer Copy -- Not for Resale

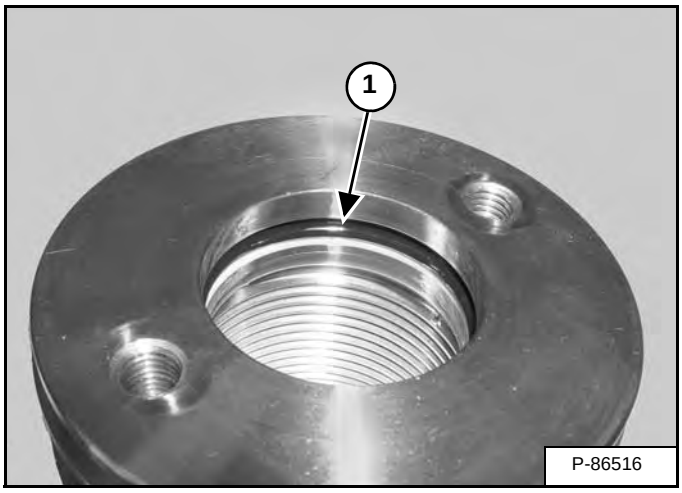
Assembly (Cont'd)

Figure 20-24-52



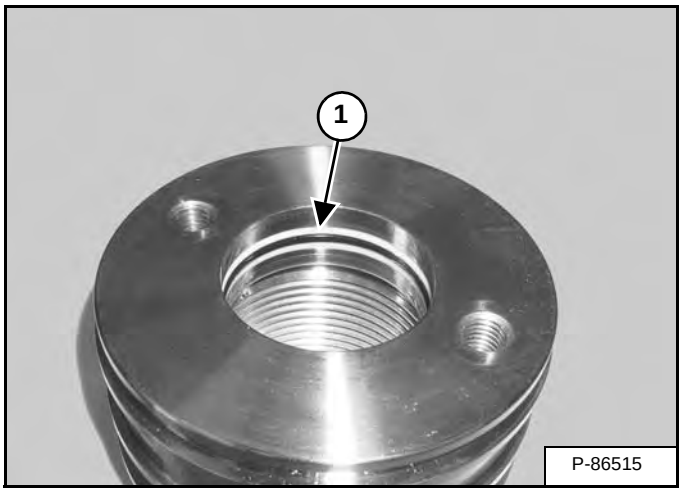
Install the back-up ring (Item 1) **[Figure 20-24-52]**.

Figure 20-24-53



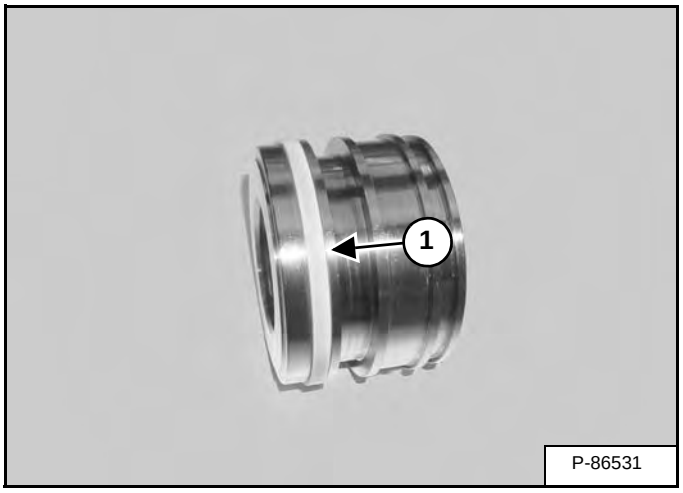
Install the O-ring (Item 1) **[Figure 20-24-53]**.

Figure 20-24-54



Install the back-up ring (Item 1) **[Figure 20-24-54]**.

Figure 20-24-55

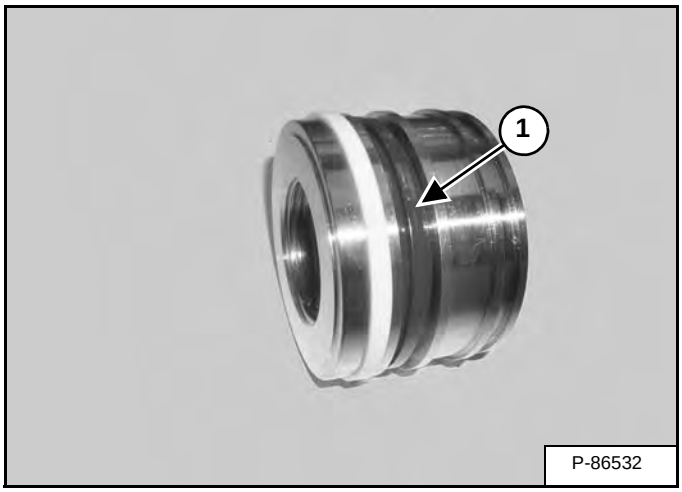


Install the seal (Item 1) **[Figure 20-24-55]**.

Dealer Copy -- Not for Resale

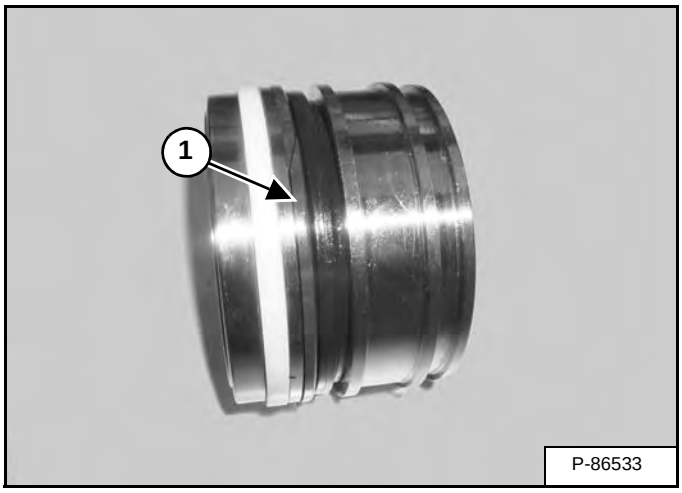
Assembly (Cont'd)

Figure 20-24-56



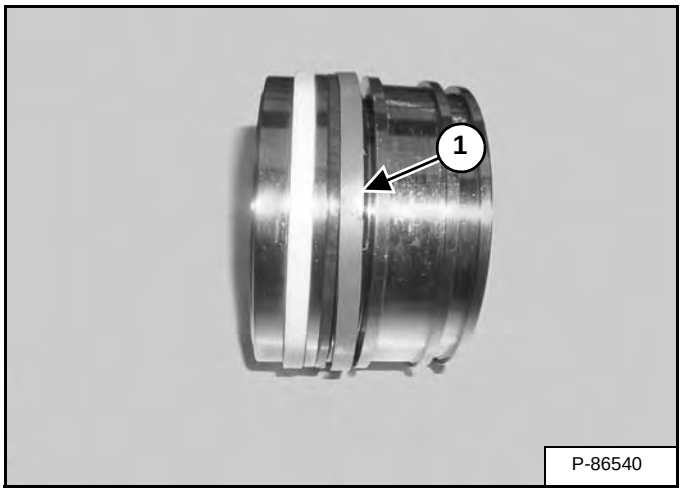
Install the slipper seal (Item 1) **[Figure 20-24-56]**.

Figure 20-24-57



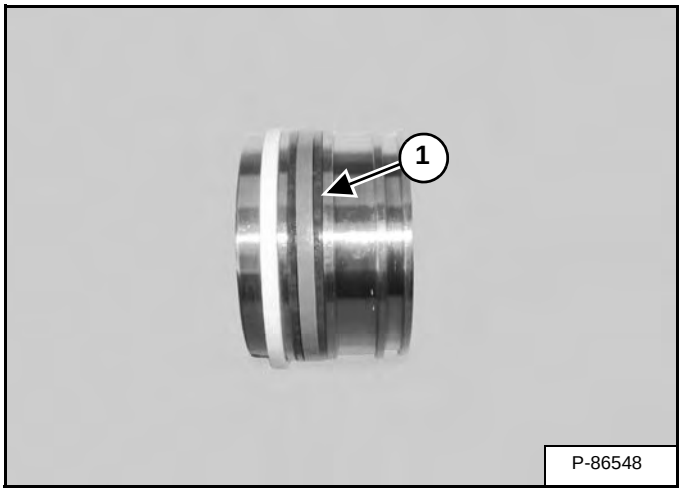
Install the back-up ring (Item 1) **[Figure 20-24-57]**.

Figure 20-24-58



Install the wear ring (Item 1) **[Figure 20-24-58]**.

Figure 20-24-59

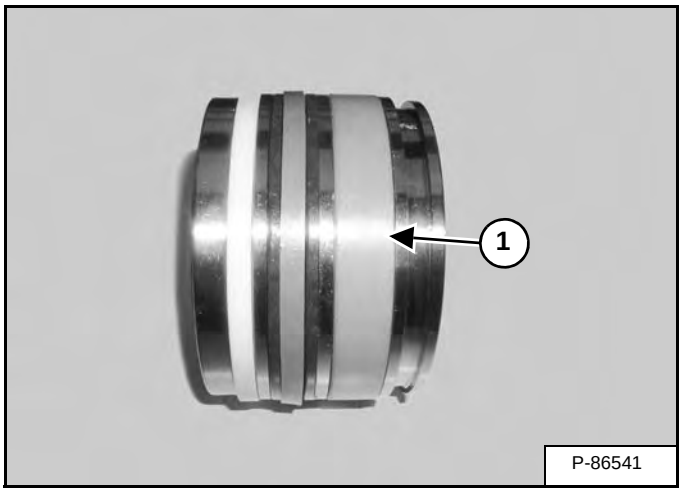


Install the back-up ring (Item 1) **[Figure 20-24-59]**.

Dealer Copy -- Not for Resale

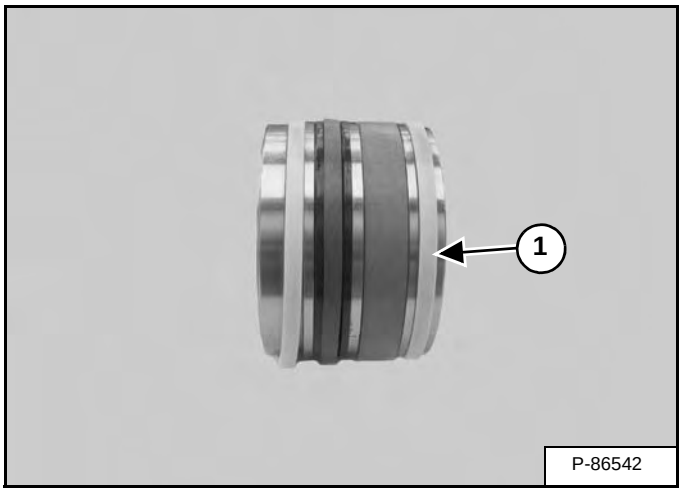
Assembly (Cont'd)

Figure 20-24-60



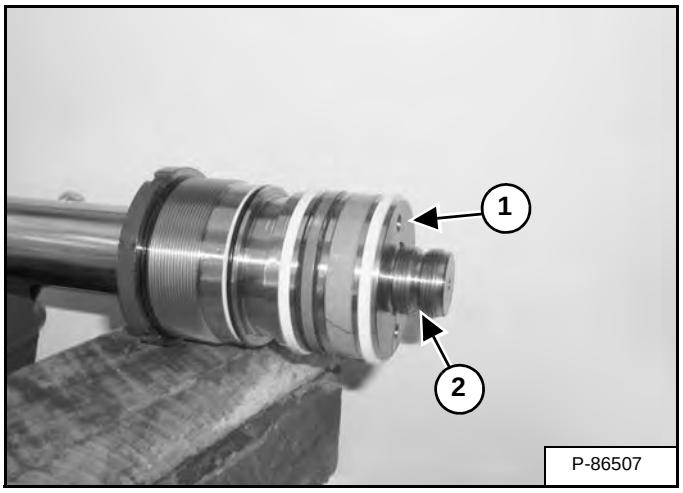
Install the wear ring (Item 1) **[Figure 20-24-60]**.

Figure 20-24-61



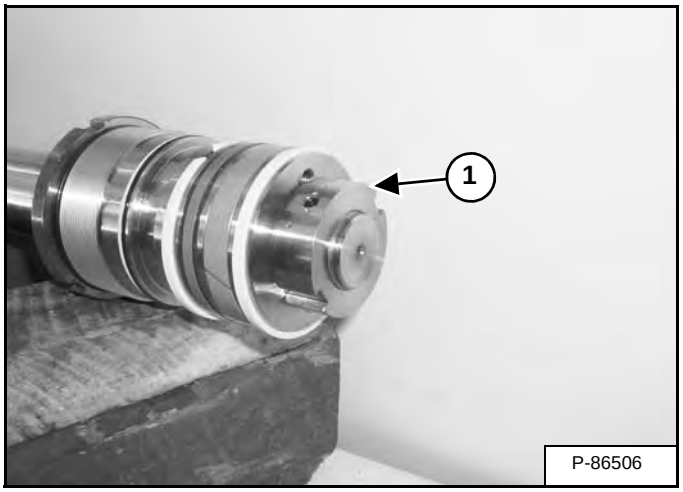
Install the seal (Item 1) **[Figure 20-24-61]**.

Figure 20-24-62



Install the piston (Item 1) **[Figure 20-24-62]** onto the cylinder rod.

Figure 20-24-63



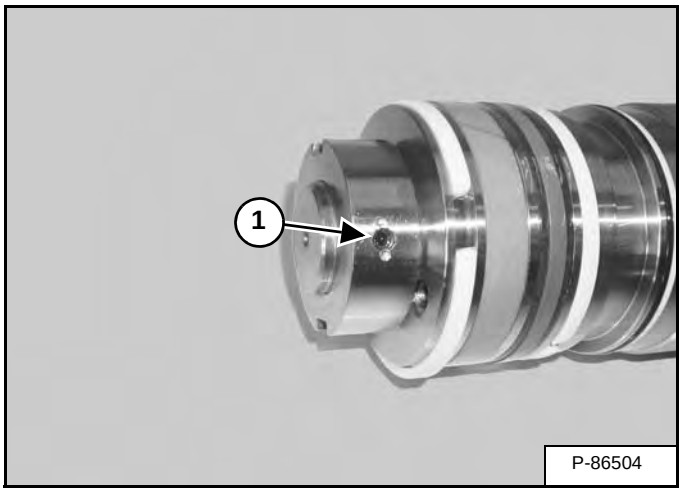
Install the nut (Item 1) **[Figure 20-24-63]**.

Tighten the nut until the bore of the set screw is aligned with the groove (Item 2) **[Figure 20-24-62]** of the rod.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-24-64



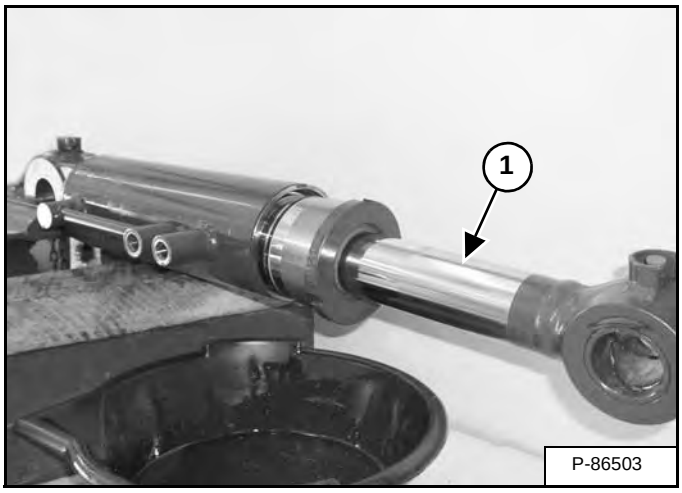
Install the set screw (Item 1) **[Figure 20-24-64]**.

Use a center punch to deform the threads of the set screw bore.

Remove the rod assembly from the vise.

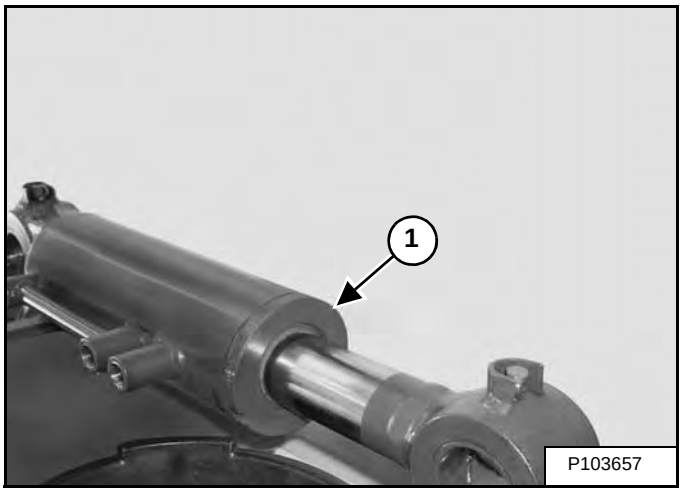
Clamp the base end of the cylinder housing in a vise.

Figure 20-24-65



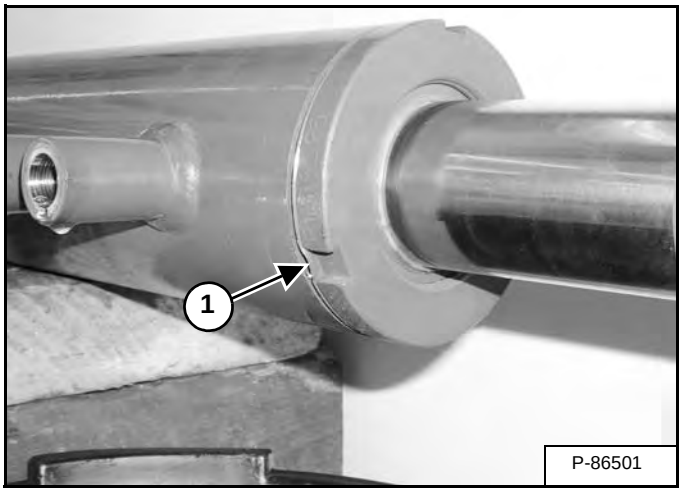
Install the rod assembly (Item 1) **[Figure 20-24-65]** into the housing.

Figure 20-24-66



Install the head (Item 1) **[Figure 20-24-66]** onto the housing.

Figure 20-24-67

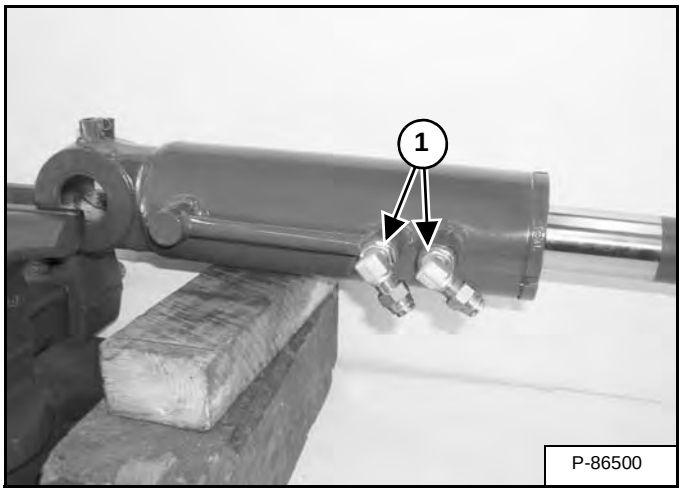


Bend the lock ring tab (Item 1) **[Figure 20-24-67]** into the groove on the head.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-24-68



Install the fittings (Item 1) **[Figure 20-24-68]** into the housing.

Dealer Copy -- Not for Resale



Dealer Copy -- Not for Resale

CYLINDER (ARTICULATED BOOM)

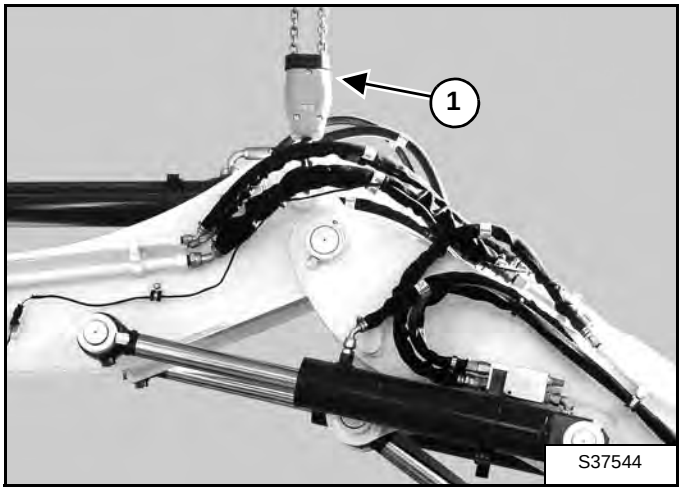
Testing

NOTE: Both cylinders share the same rod end and base end pivot pin. Removing either pivot pin will loosen both cylinders from the articulated boom.

Lower the boom / bucket and blade to the ground.

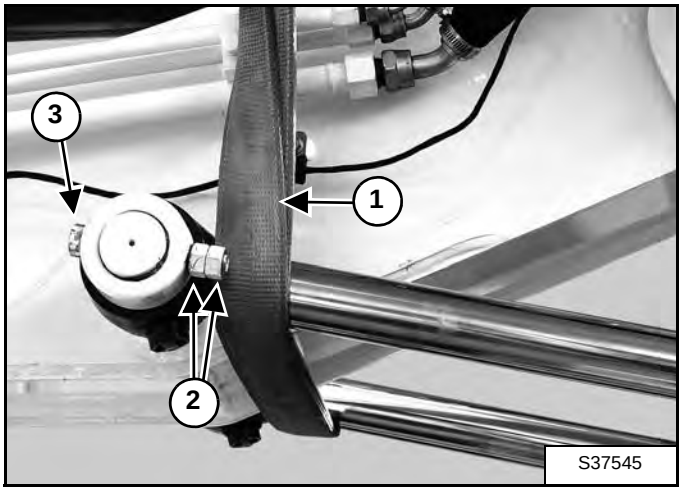
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-25-1



Support the boom with a chain hoist (Item 1) **[Figure 20-25-1]**.

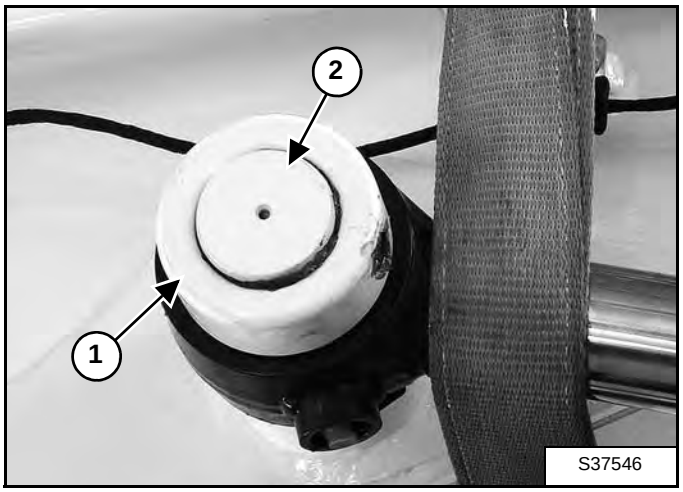
Figure 20-25-2



Install a sling (Item 1) **[Figure 20-25-2]** and lifting device to the rod end of both cylinders.

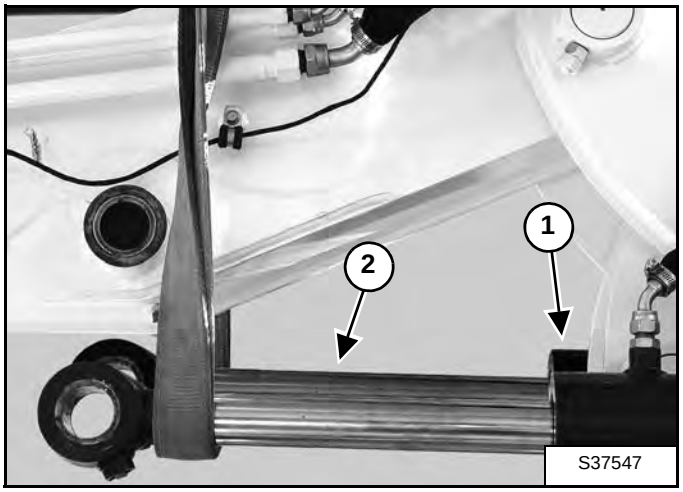
Remove the nuts (Item 2) and bolt (Item 3) **[Figure 20-25-2]**.

Figure 20-25-3



Remove the stopper (Item 1), the shim and the rod end pivot pin (Item 2) **[Figure 20-25-3]**.

Figure 20-25-4



Lower both cylinders (Item 1) **[Figure 20-25-4]**. Remove the shims.

Start the engine and fully retract the cylinder rods (Item 2) **[Figure 20-25-4]**.

Stop the engine. Relieve hydraulic pressure.

Dealer Copy -- Not for Resale

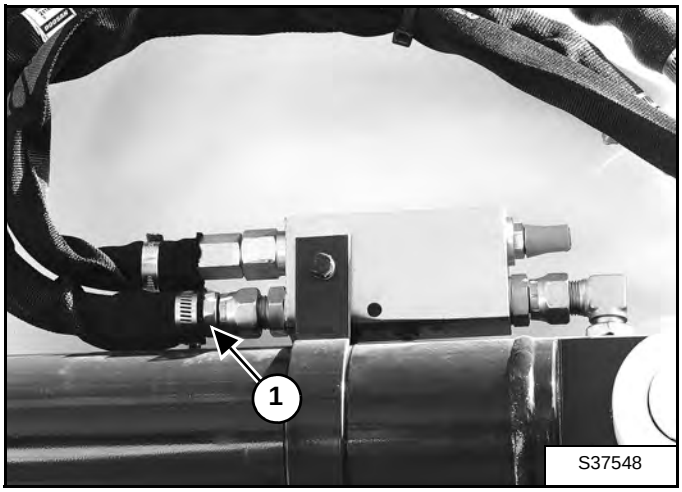
Testing (Cont'd)

⚠ WARNING

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

W-2145-0290

Figure 20-25-5



Remove the hose (Item 1) **[Figure 20-25-5]** from the base end of both cylinders. Cap the hoses.

Start the engine and retract the cylinders.

If there is any oil leakage from the base end fittings (Item 1) **[Figure 20-25-5]**, remove the cylinder for repair or replacement.

Dealer Copy -- Not for Resale

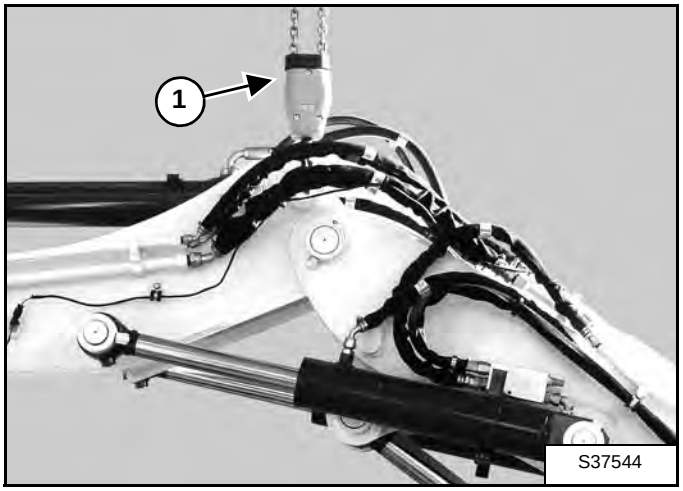
Removal And Installation

NOTE: Both cylinders share the same rod end and base end pivot pin. Removing either pivot pin will loosen both cylinders from the articulated boom.

Lower the boom / bucket and blade to the ground.

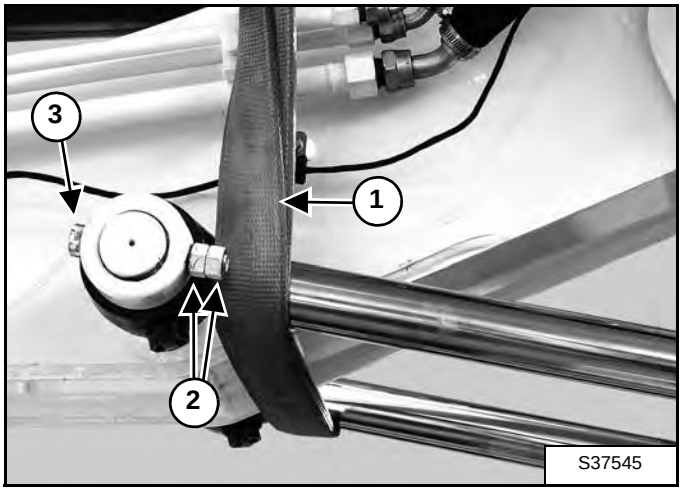
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-25-6



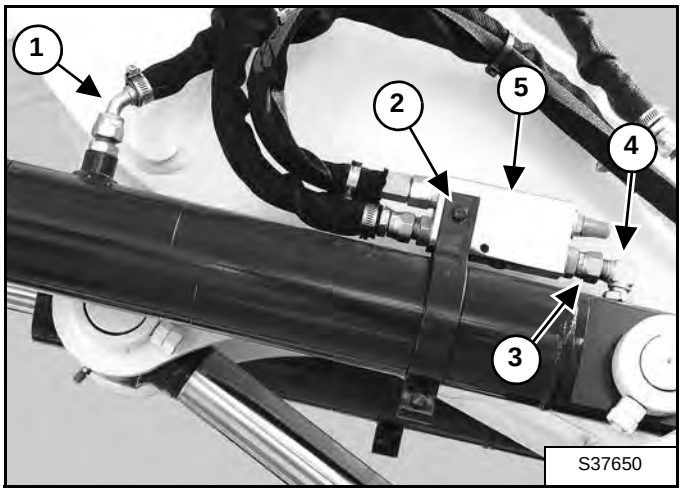
Support the boom with a chain hoist (Item 1) **[Figure 20-25-6]**.

Figure 20-25-7



Install a sling (Item 1) **[Figure 20-25-7]** and lifting device to the rod end of both cylinders.

Figure 20-25-8



Remove the hose (Item 1) **[Figure 20-25-8]** (both sides).

Remove the bolt (Item 2) **[Figure 20-25-8]** and washer (both sides).

Remove the adapter (Item 3) from the fitting (Item 4) **[Figure 20-25-8]** (both sides).

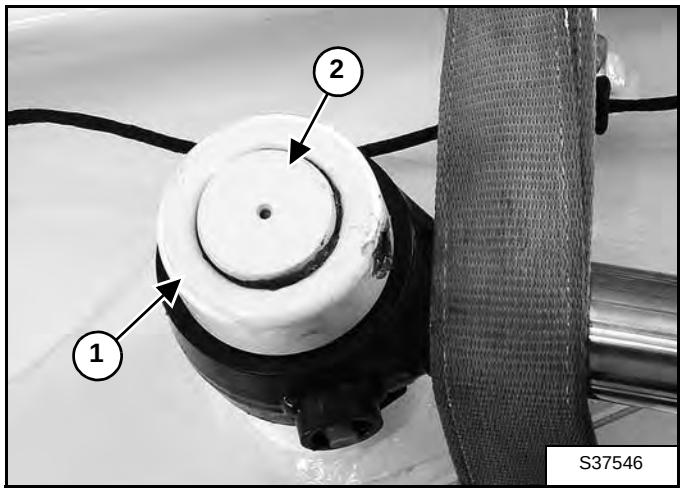
Remove the valve (Item 5) **[Figure 20-25-8]** from the cylinder housing (both sides).

Remove the nuts (Item 2) and bolt (Item 3) **[Figure 20-25-7]**.

Dealer Copy -- Not for Resale

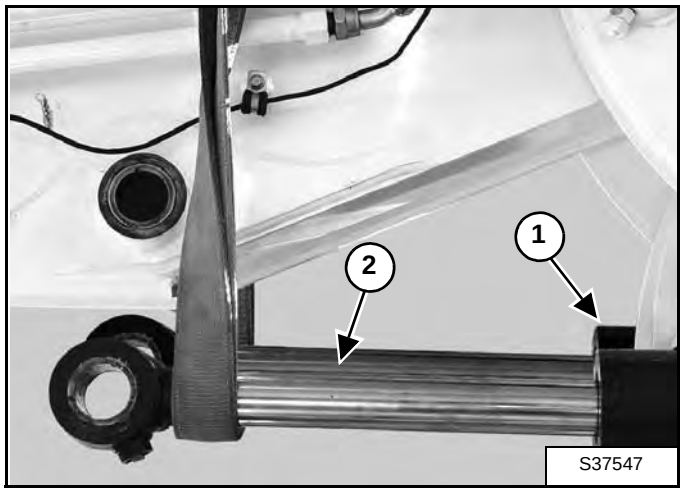
Removal And Installation (Cont'd)

Figure 20-25-9



Remove the stopper (Item 1), the shim and the rod end pivot pin (Item 2) **[Figure 20-25-9]**.

Figure 20-25-10



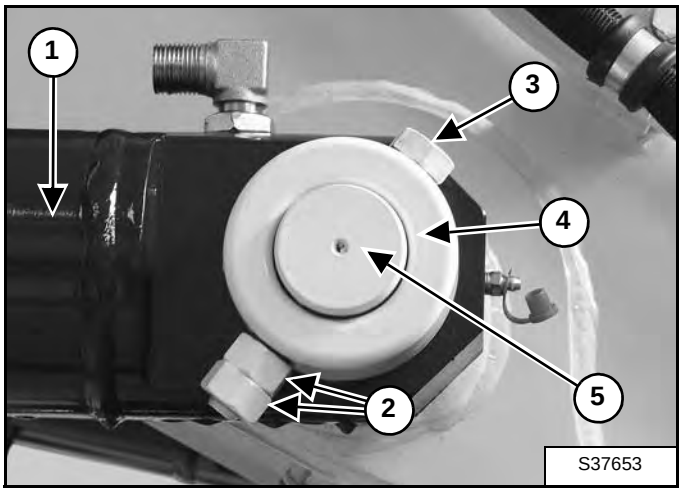
Lower both cylinders (Item 1) **[Figure 20-25-10]**. Remove the shims.

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 20-25-11



Support both cylinders (Item 1) **[Figure 20-25-11]** so the cylinders will not fall when the pivot pin is removed.

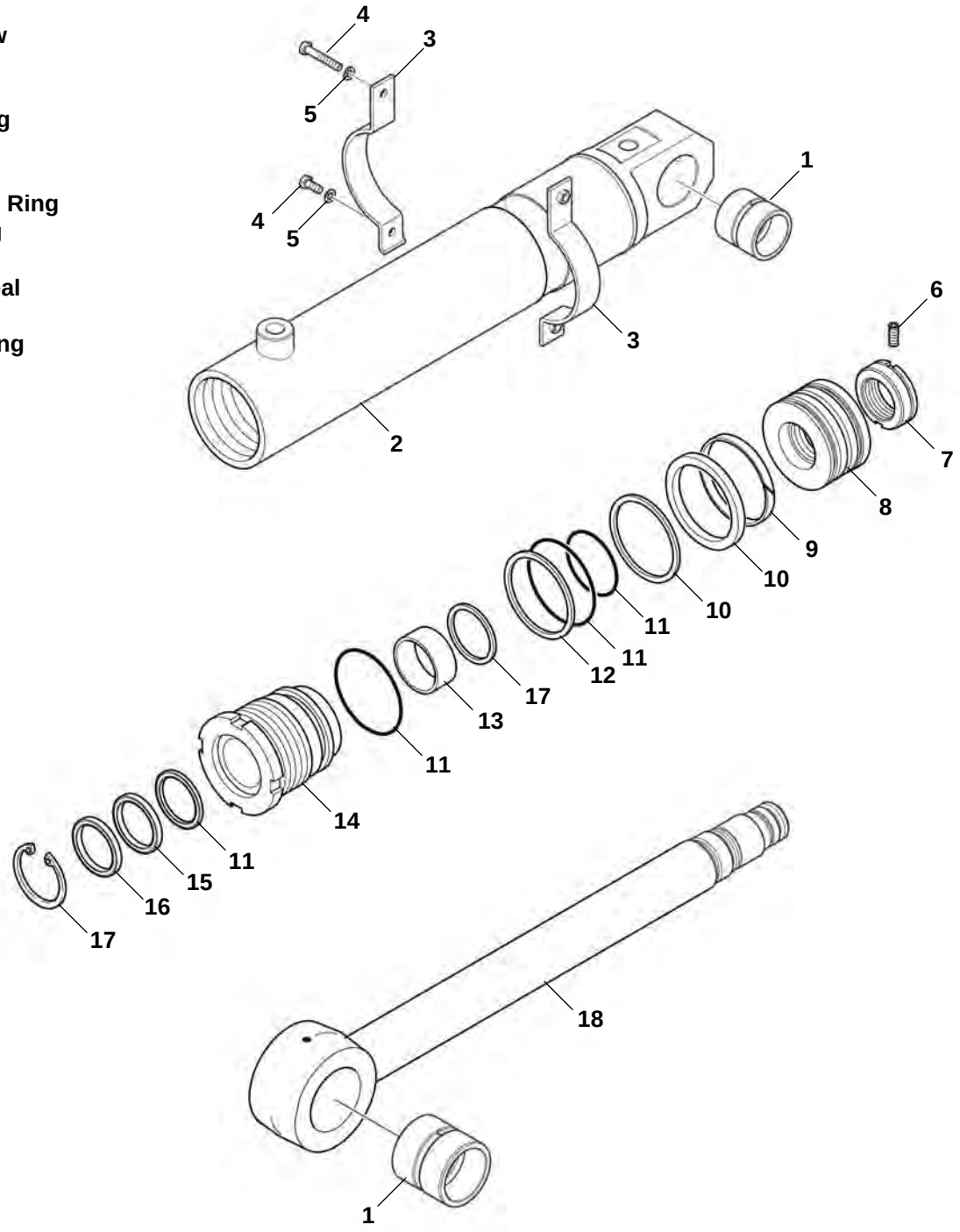
Remove the nuts (Item 2) and bolt (Item 3) **[Figure 20-25-11]**.

Remove the stopper (Item 4), the shims and the base end pivot pin (Item 5) to detach both cylinders (Item 1) from the articulated boom at the same time **[Figure 20-25-11]**.

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Parts Identification

1. Bushing
2. Housing
3. Band
4. Bolt
5. Washer
6. Set Screw
7. Nut
8. Piston
9. Wear Ring
10. Seal
11. O-ring
12. Back-up Ring
13. Bushing
14. Head
15. Inner Seal
16. Wiper
17. Snap Ring
18. Rod



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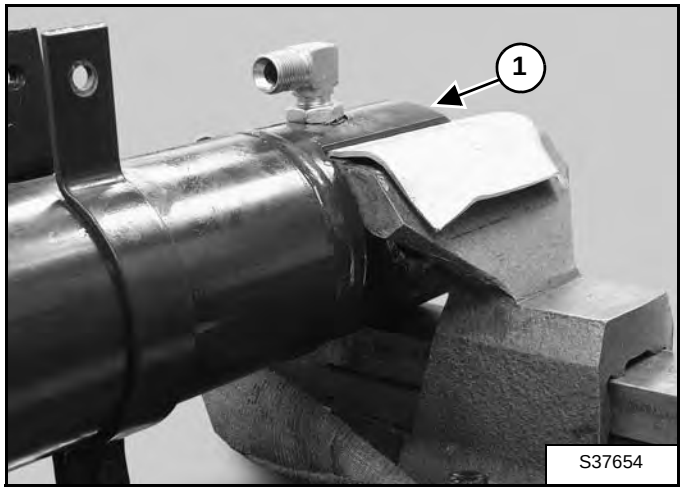
Disassembly

Use the following tools to disassemble the cylinder:

MEL1074 - O-ring Seal Hook

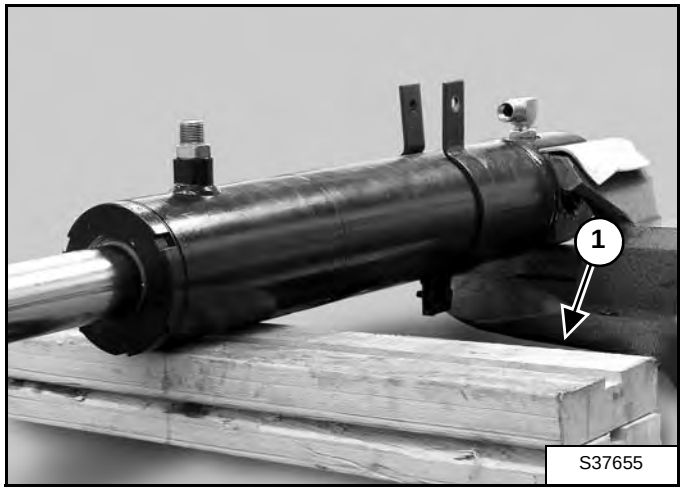
Hold the hydraulic cylinder over a drain pan and slowly move the rod in and out to remove the fluid from the cylinder.

Figure 20-25-12



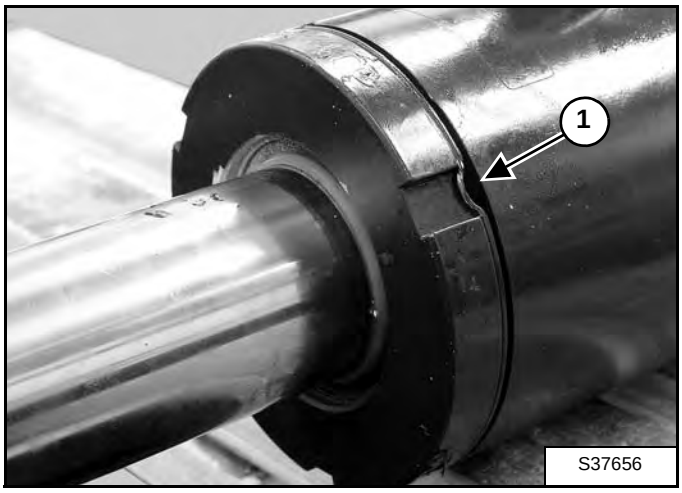
Clamp the base end (Item 1) **[Figure 20-25-12]** of the cylinder in a vise.

Figure 20-25-13



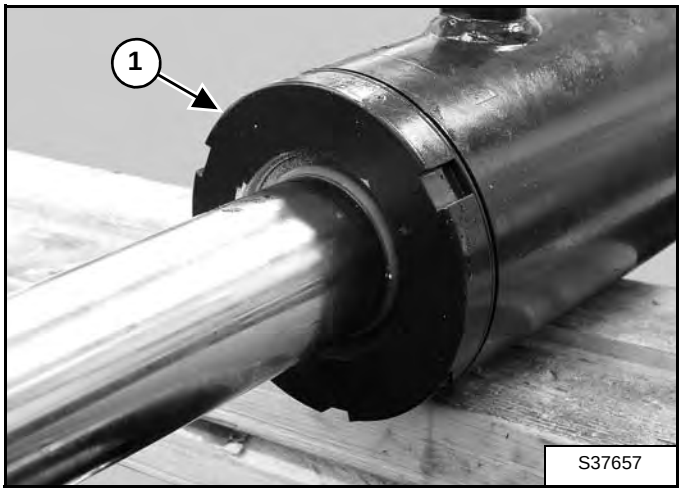
Support the cylinder with a block (Item 1) **[Figure 20-25-13]**.

Figure 20-25-14



Straighten the lock ring tab (Item 1) **[Figure 20-25-14]**.

Figure 20-25-15



Remove the head (Item 1) **[Figure 20-25-15]** from the housing.

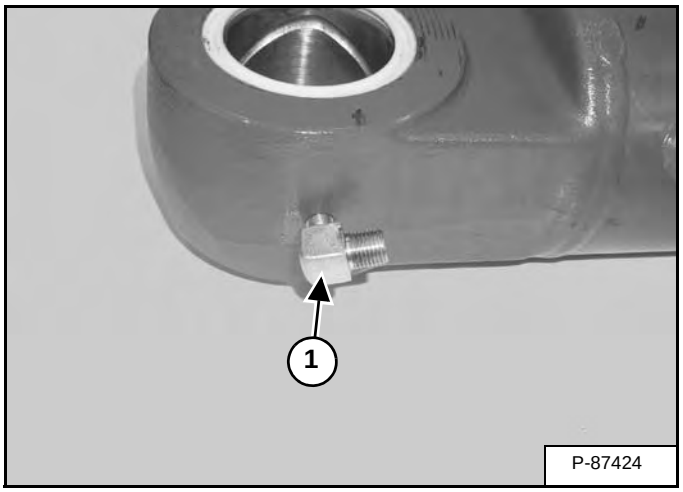
Remove the rod assembly from the housing.

Remove the cylinder from the vise.

Dealer Copy -- Not for Resale

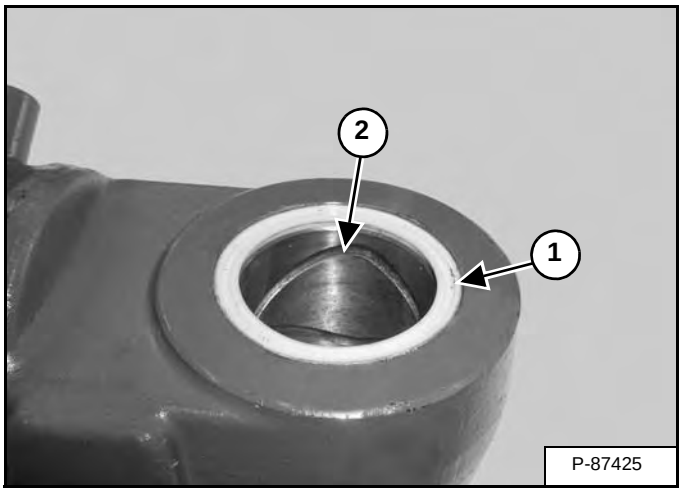
Disassembly (Cont'd)

Figure 20-25-16



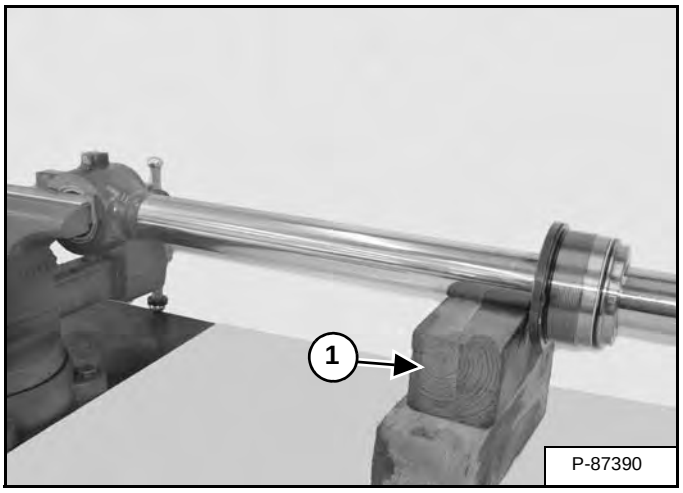
Remove the fitting (Item 1) **[Figure 20-25-16]**.

Figure 20-25-17



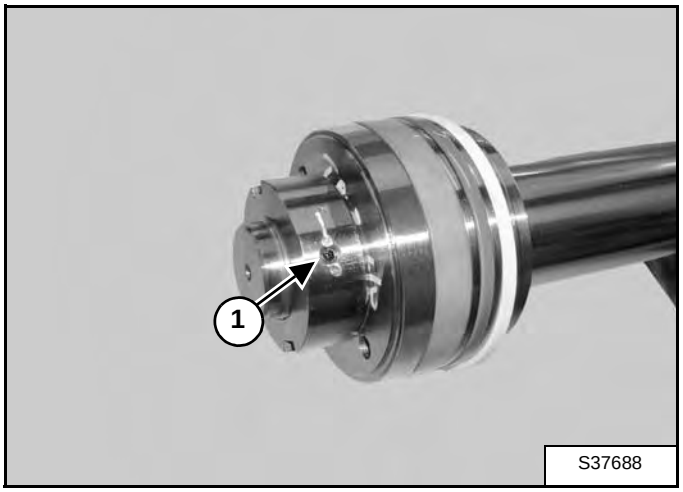
Remove the seal (Item 1) (both sides) and bushing (Item 2) **[Figure 20-25-17]**.

Figure 20-25-18



Clamp the rod end in a vise. Support the rod with a block (Item 1) **[Figure 20-25-18]**.

Figure 20-25-19

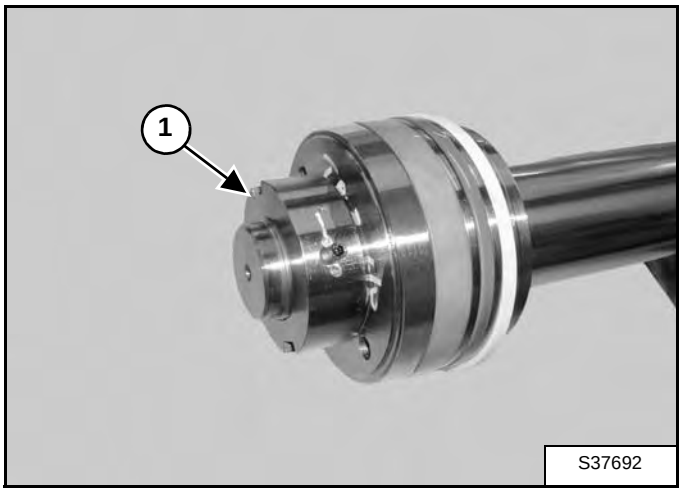


Remove the set screw (Item 1) **[Figure 20-25-19]**.

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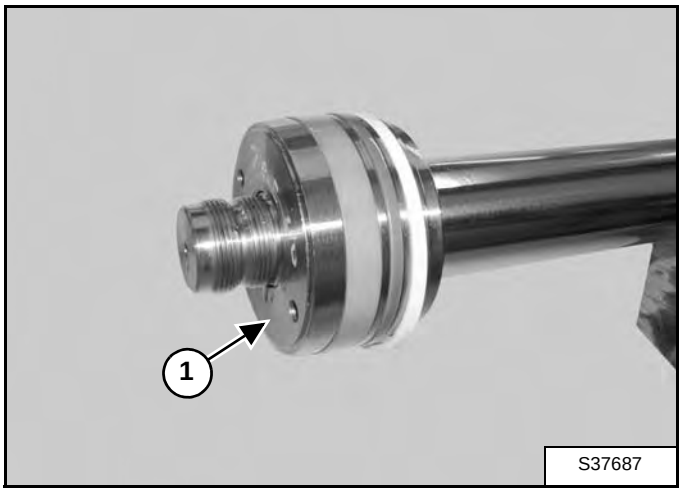
Disassembly (Cont'd)

Figure 20-25-20



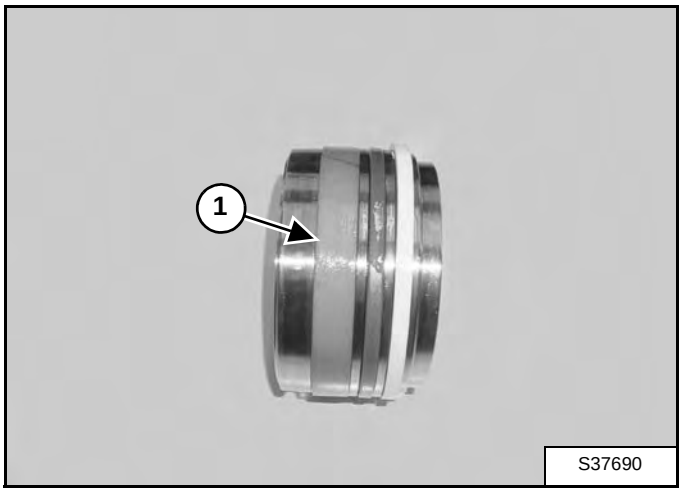
Apply moderate heat to the nut (Item 1) **[Figure 20-25-20]**. Remove the nut.

Figure 20-25-21



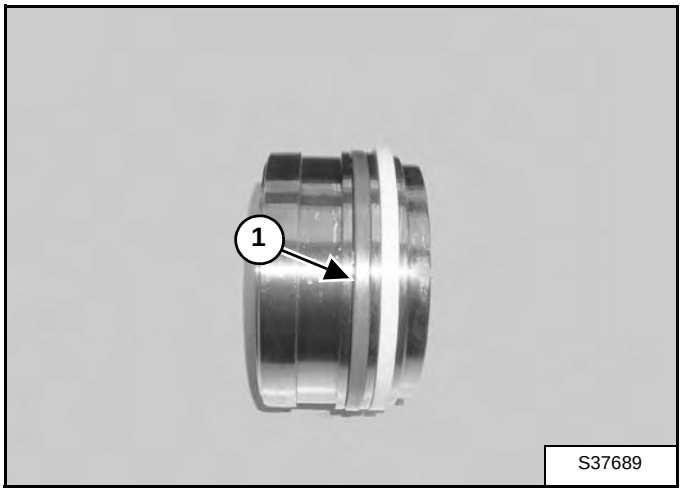
Remove the piston (Item 1) **[Figure 20-25-21]**.

Figure 20-25-22



Remove the wear ring (Item 1) **[Figure 20-25-22]**.

Figure 20-25-23

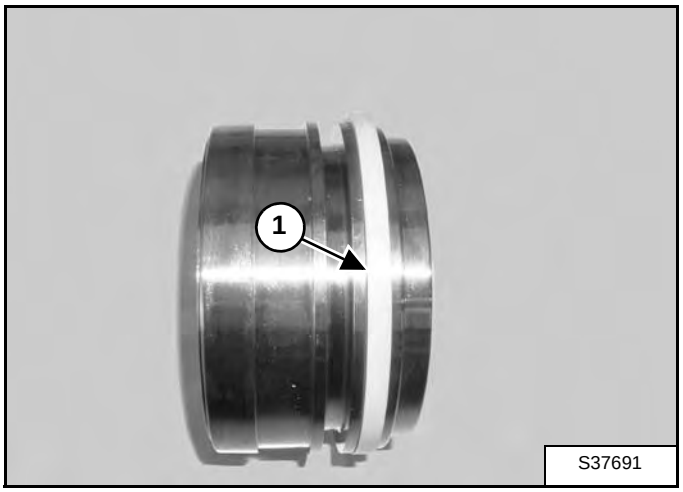


Remove the seal (Item 1) **[Figure 20-25-23]**.

Dealer Copy -- Not for Resale

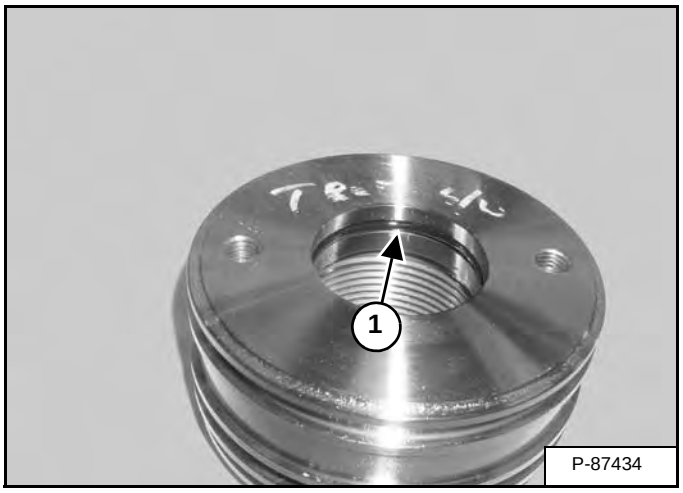
Disassembly (Cont'd)

Figure 20-25-24



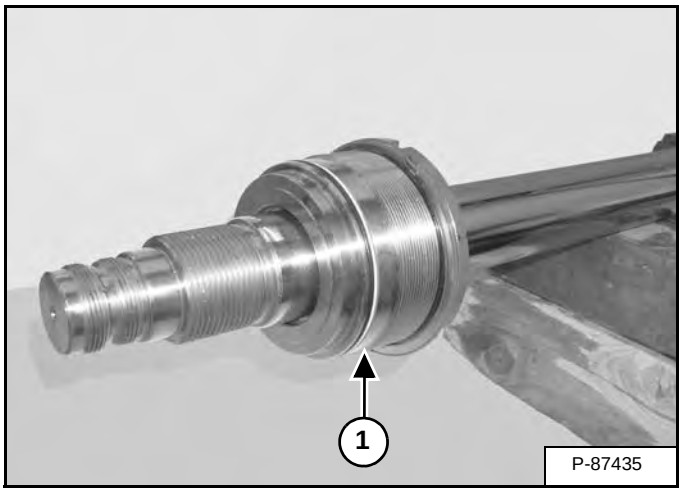
Remove the seal (Item 1) **[Figure 20-25-24]**.

Figure 20-25-25



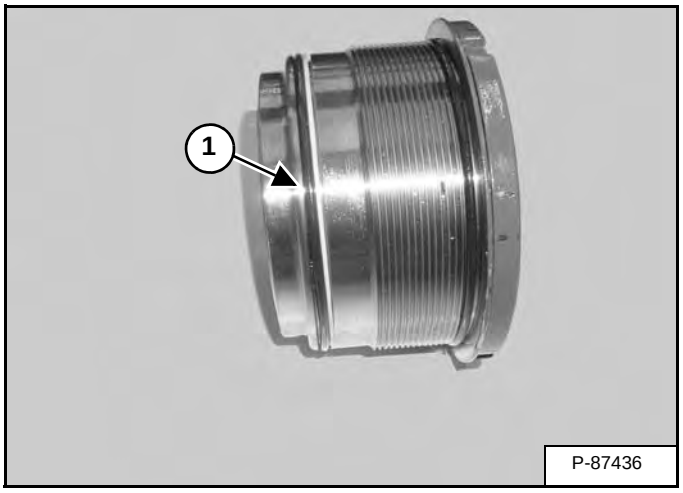
Remove the O-ring (Item 1) **[Figure 20-25-25]**.

Figure 20-25-26



Remove the head (Item 1) **[Figure 20-25-26]**.

Figure 20-25-27

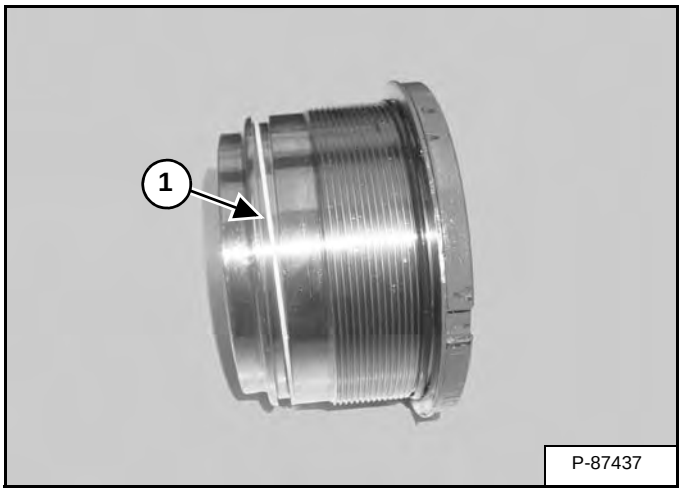


Remove the O-ring (Item 1) **[Figure 20-25-27]**.

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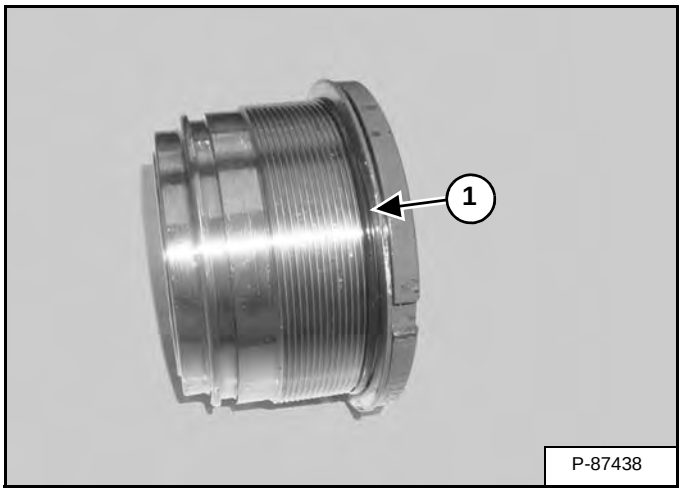
Disassembly (Cont'd)

Figure 20-25-28



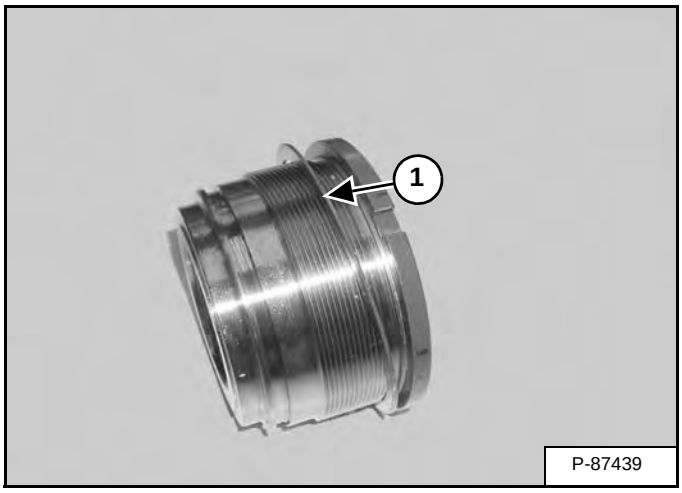
Remove the back-up ring (Item 1) **[Figure 20-25-28]**.

Figure 20-25-29



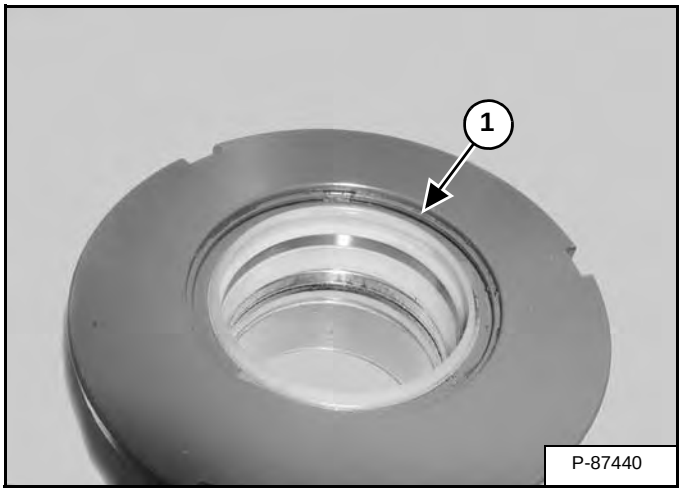
Remove the O-ring (Item 1) **[Figure 20-25-29]**.

Figure 20-25-30



Remove the lock ring (Item 1) **[Figure 20-25-30]**.

Figure 20-25-31

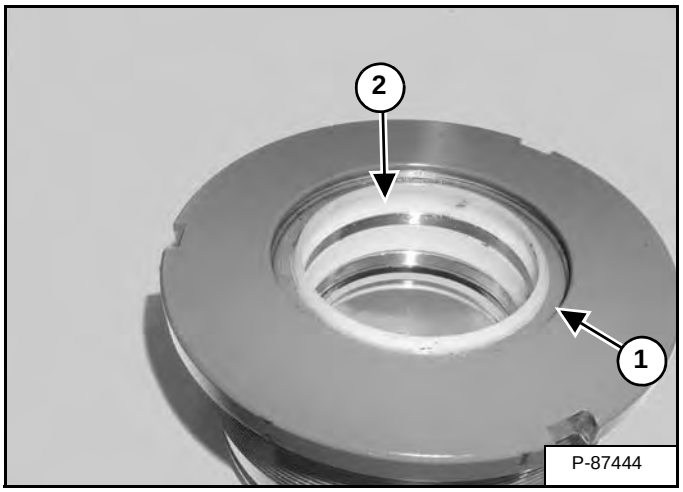


Remove the snap ring (Item 1) **[Figure 20-25-31]**.

Dealer Copy -- Not for Resale

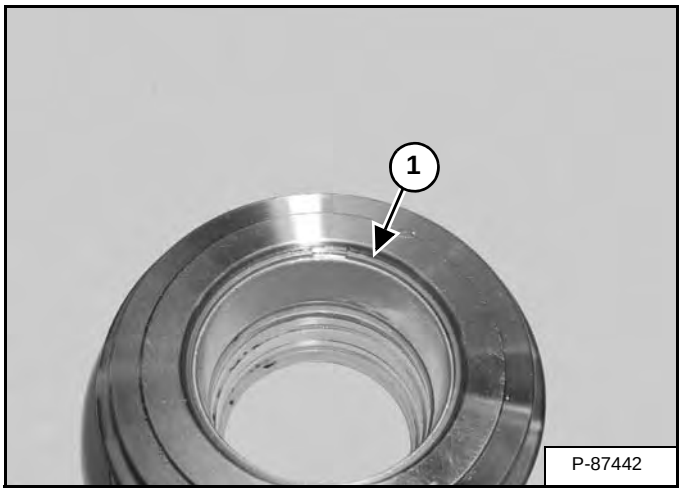
Disassembly (Cont'd)

Figure 20-25-32



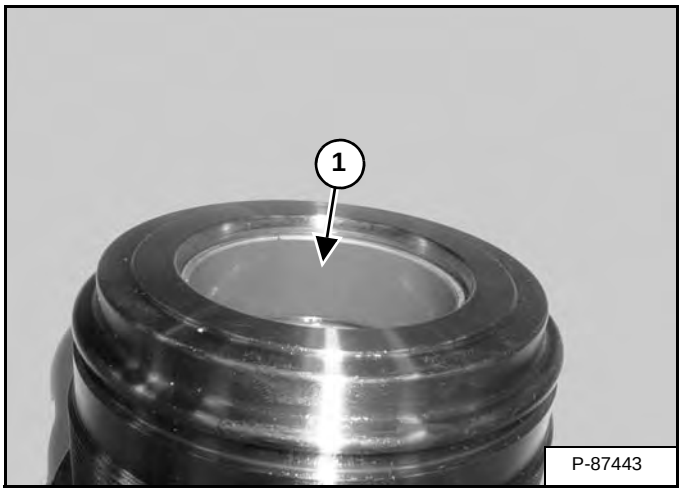
Remove the wiper seal (Item 1) and inner seal (Item 2) **[Figure 20-25-32]**.

Figure 20-25-33



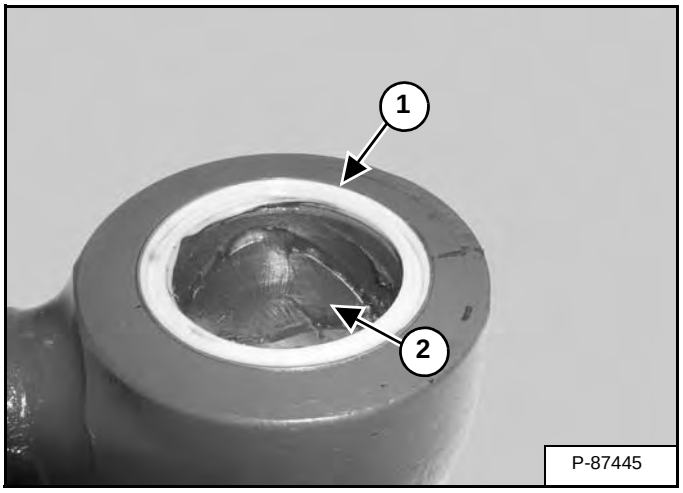
Remove the snap ring (Item 1) **[Figure 20-25-33]**.

Figure 20-25-34



Remove the bushing (Item 1) **[Figure 20-25-34]**.

Figure 20-25-35



Remove the seal (Item 1) (both sides) and bushing (Item 2) **[Figure 20-25-35]**.

Dealer Copy -- Not for Resale

Assembly

Use the following tools to assemble the cylinder:

MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
MEL1396-2 - Piston Ring Compressor

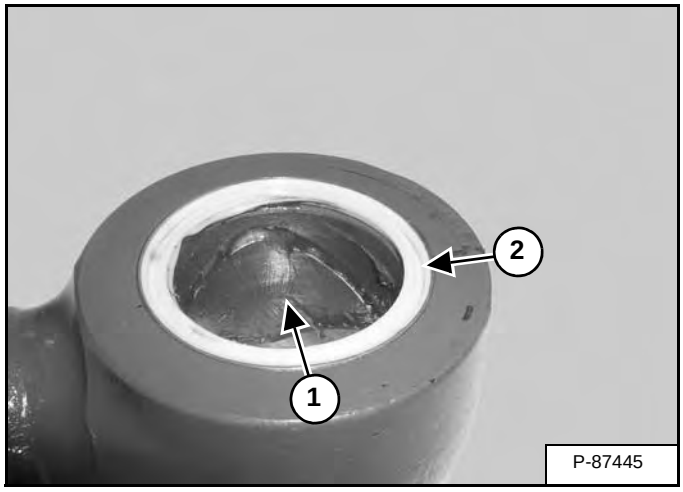
Wash the cylinder parts in clean solvent and dry with compressed air.

Inspect the cylinder parts for nicks, scratches and other damage. Replace any damaged parts.

Always install new O-rings and seals during assembly.

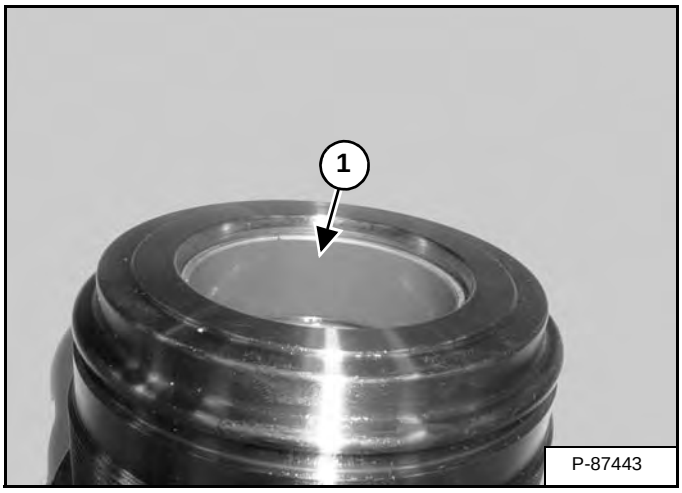
Lubricate all O-rings and seals with hydraulic oil during assembly.

Figure 20-25-36



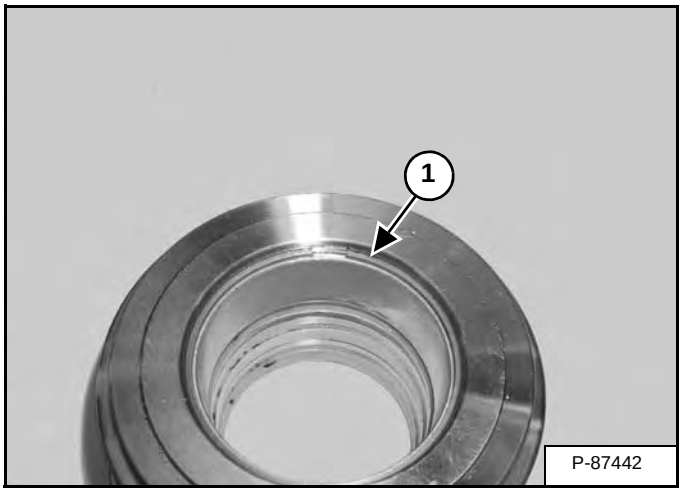
Install the bushing (Item 1) and seal (Item 2) **[Figure 20-25-36]** (Both sides).

Figure 20-25-37



Install the bushing (Item 1) **[Figure 20-25-37]** into the head.

Figure 20-25-38

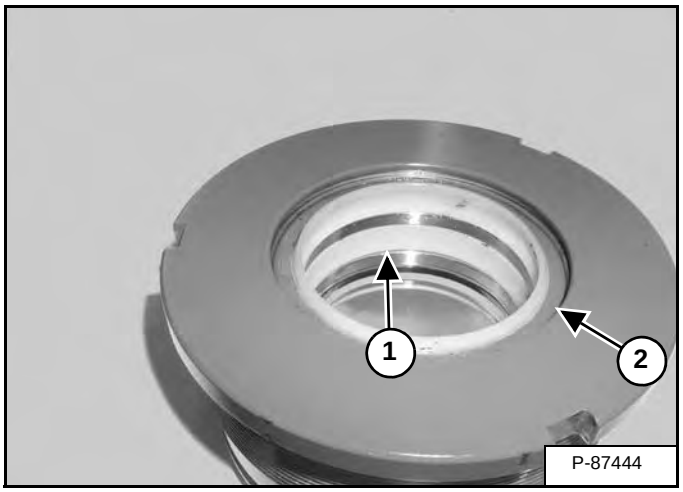


Install the snap ring (Item 1) **[Figure 20-25-38]**.

Dealer Copy -- Not for Resale

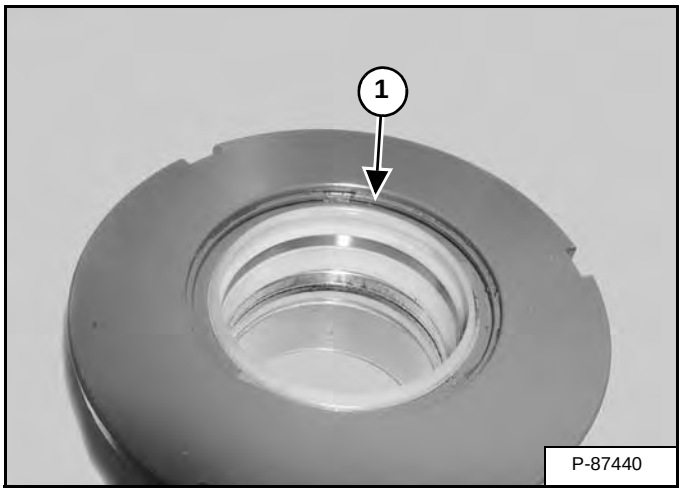
Assembly (Cont'd)

Figure 20-25-39



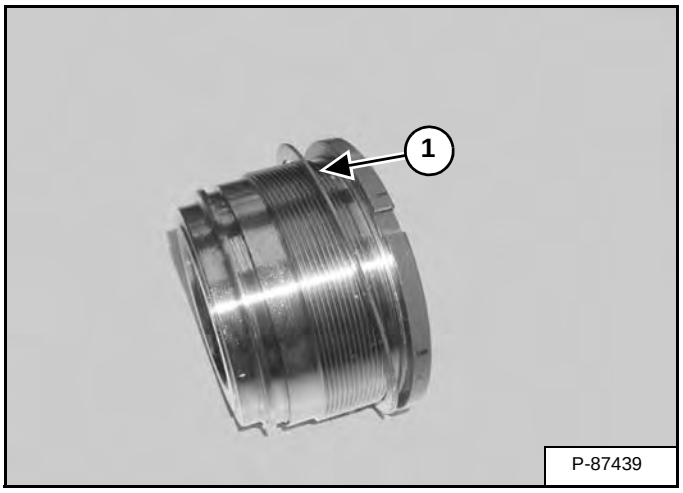
Install the inner seal (Item 1) and wiper seal (Item 2) **[Figure 20-25-39]**.

Figure 20-25-40



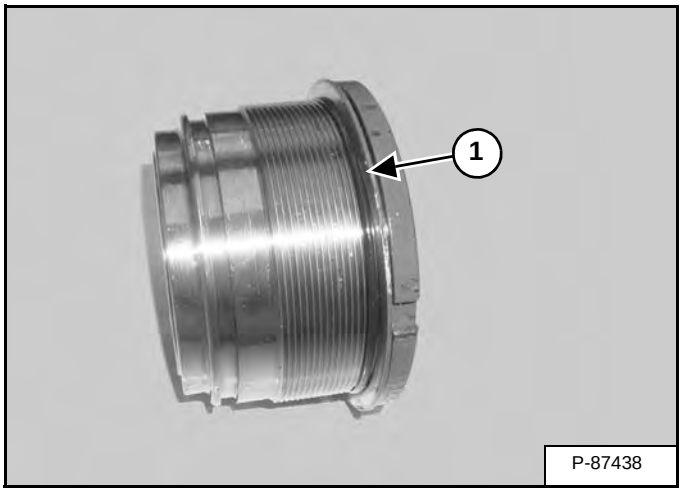
Install the snap ring (Item 1) **[Figure 20-25-40]**.

Figure 20-25-41



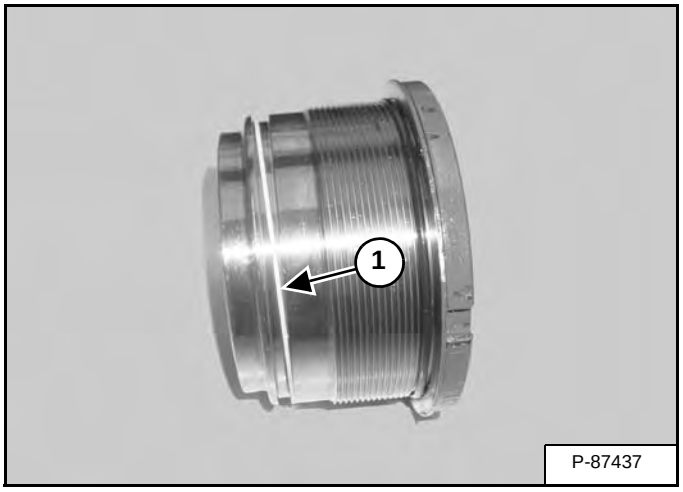
Install the lock ring (Item 1) **[Figure 20-25-41]**.

Figure 20-25-42



Install the O-ring (Item 1) **[Figure 20-25-42]**.

Figure 20-25-43

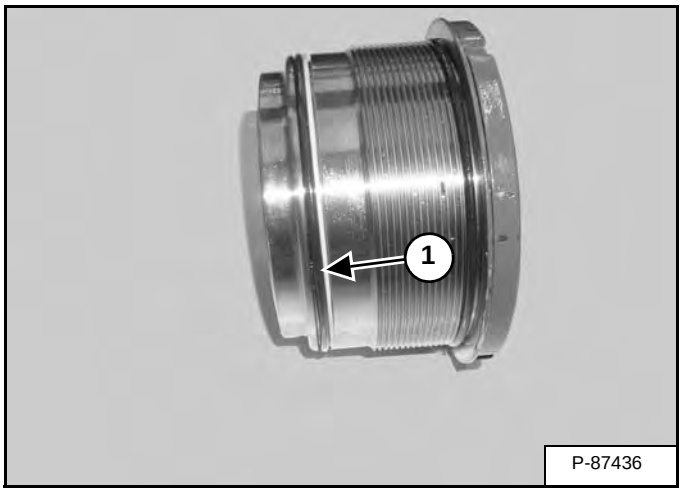


Install the back-up ring (Item 1) **[Figure 20-25-43]**.

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Assembly (Cont'd)

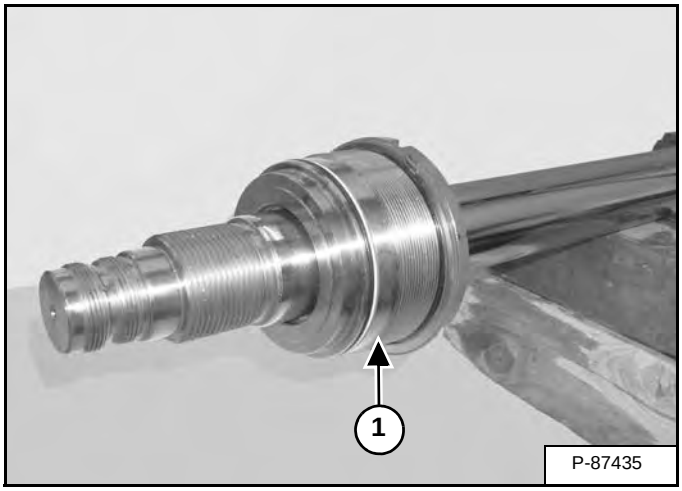
Figure 20-25-44



Install the O-ring (Item 1) **[Figure 20-25-44]**.

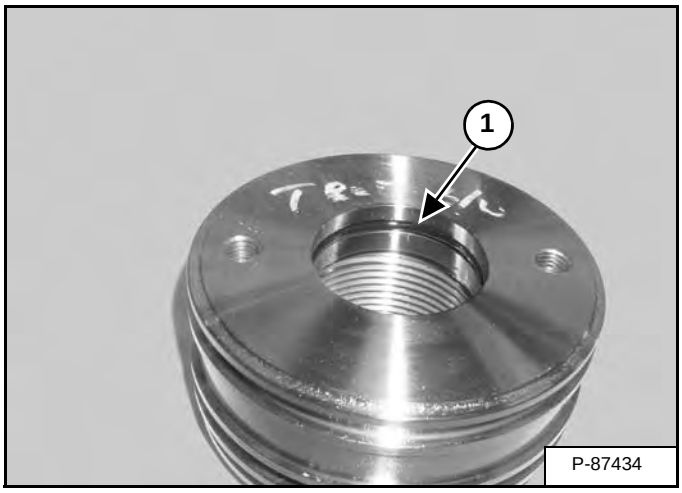
Clamp the rod end in a vise. Support the rod with a block.

Figure 20-25-45



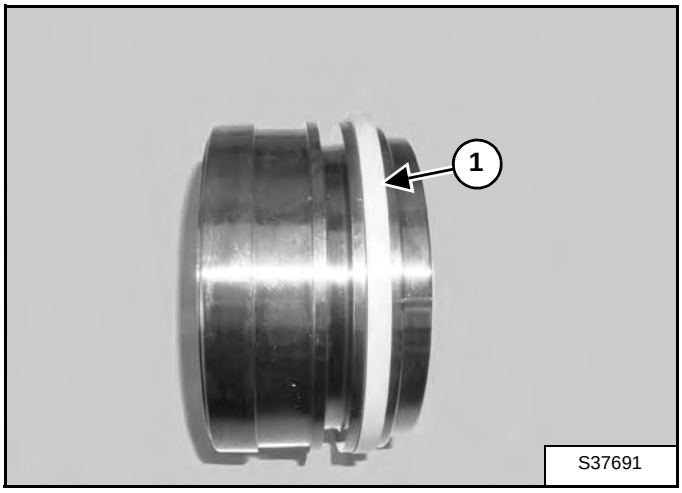
Install the head (Item 1) **[Figure 20-25-45]**.

Figure 20-25-46



Install the O-ring (Item 1) **[Figure 20-25-46]** in the piston.

Figure 20-25-47

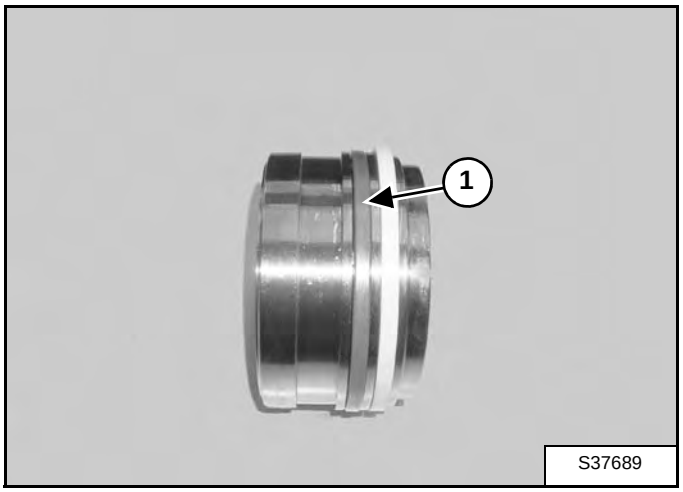


Install the seal (Item 1) **[Figure 20-25-47]**.

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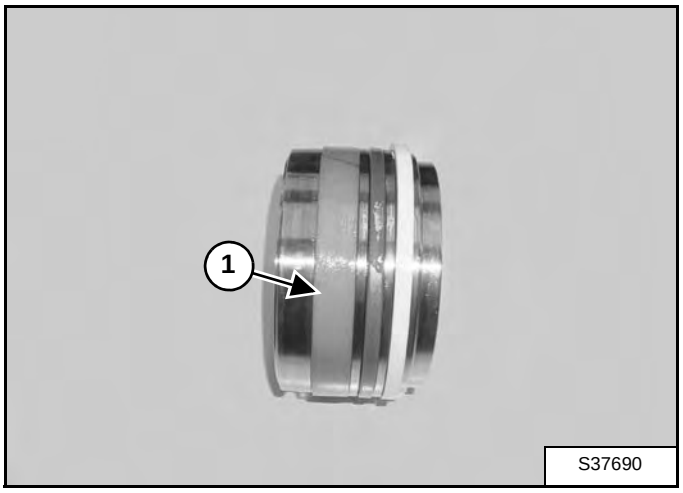
Assembly (Cont'd)

Figure 20-25-48



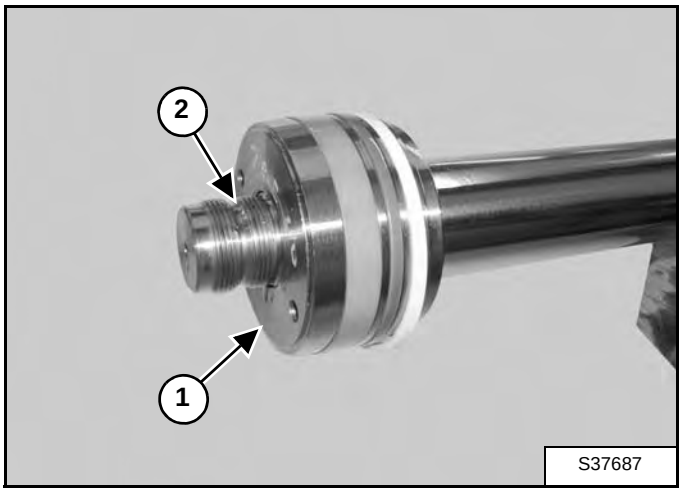
Install the seal (Item 1) **[Figure 20-25-48]**.

Figure 20-25-49



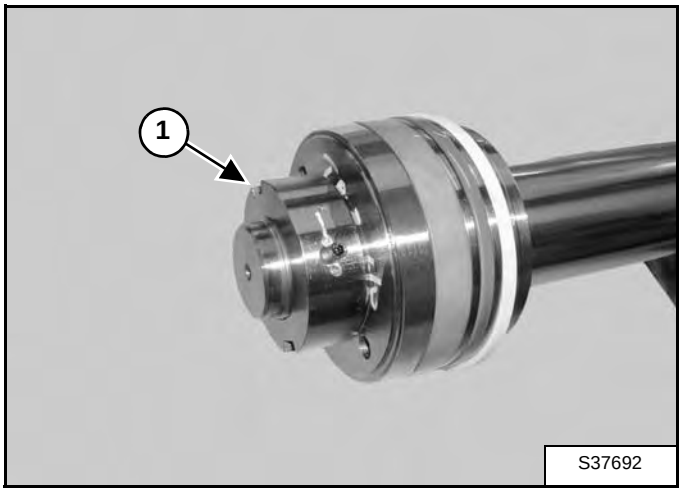
Install the wear ring (Item 1) **[Figure 20-25-49]**.

Figure 20-25-50



Install the piston (Item 1) **[Figure 20-25-50]**.

Figure 20-25-51



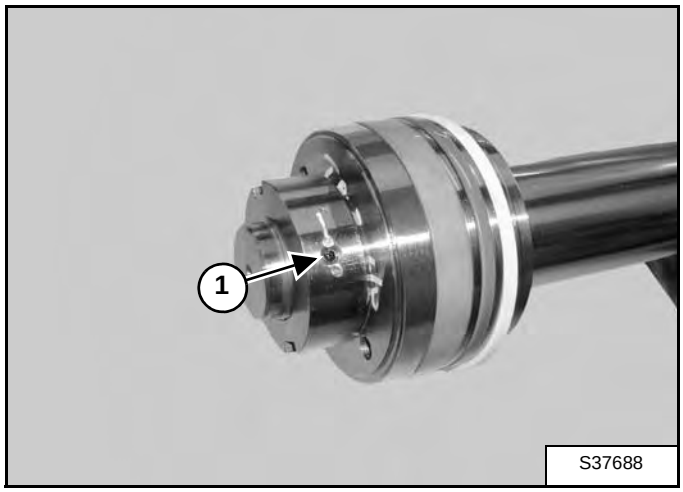
Install the nut (Item 1) **[Figure 20-25-51]**.

Tighten the nut until the bore of the set screw is aligned with the groove (Item 2) **[Figure 20-25-50]** of the rod.

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Assembly (Cont'd)

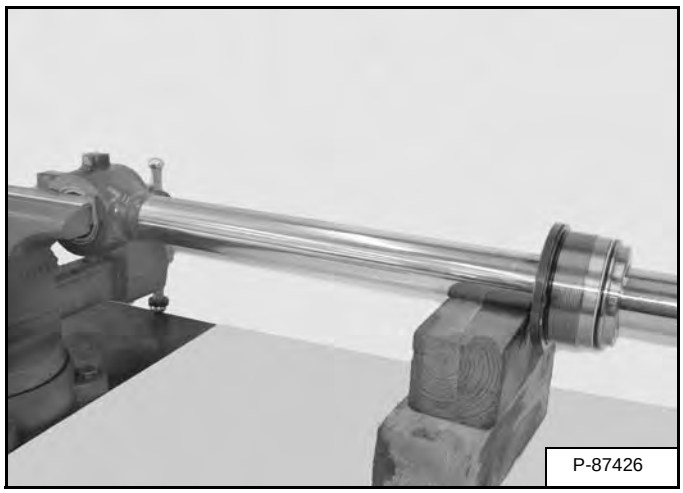
Figure 20-25-52



Install the set screw (Item 1) **[Figure 20-25-52]**.

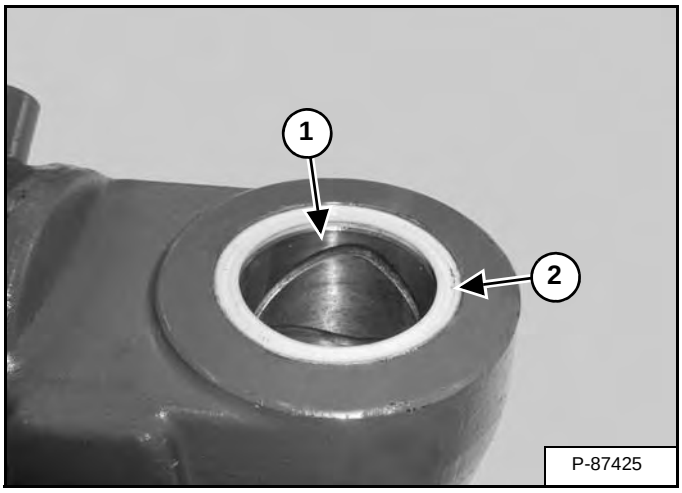
Use a center punch to deform the threads of the set screw bore.

Figure 20-25-53



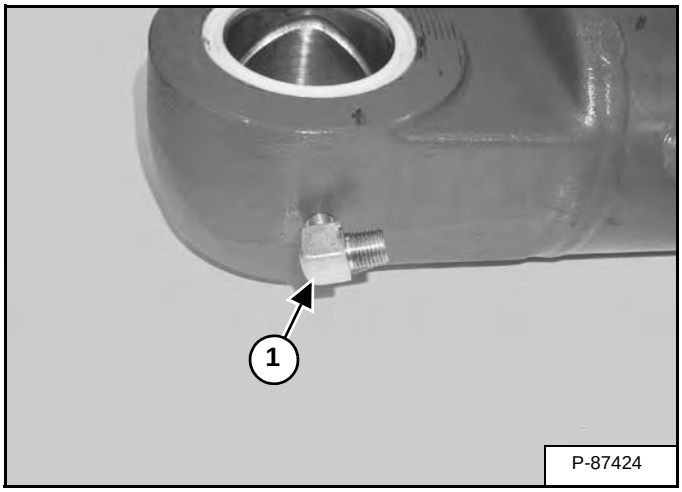
Remove the rod from the vise **[Figure 20-25-53]**.

Figure 20-25-54



Install the bushing (Item 1) and seal (Item 2) **[Figure 20-25-54]** into the rod end (Both sides).

Figure 20-25-55



Install the fitting (Item 1) **[Figure 20-25-55]**.

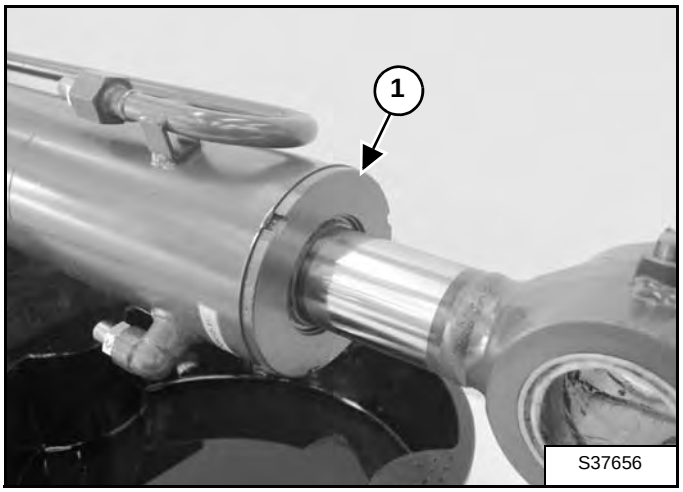
Clamp the cylinder housing in a vise. Support the cylinder with a block.

Install the rod assembly into the housing.

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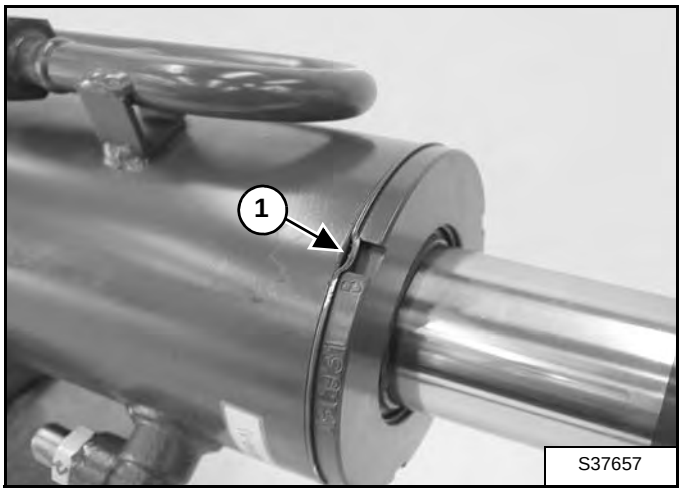
Assembly (Cont'd)

Figure 20-25-56



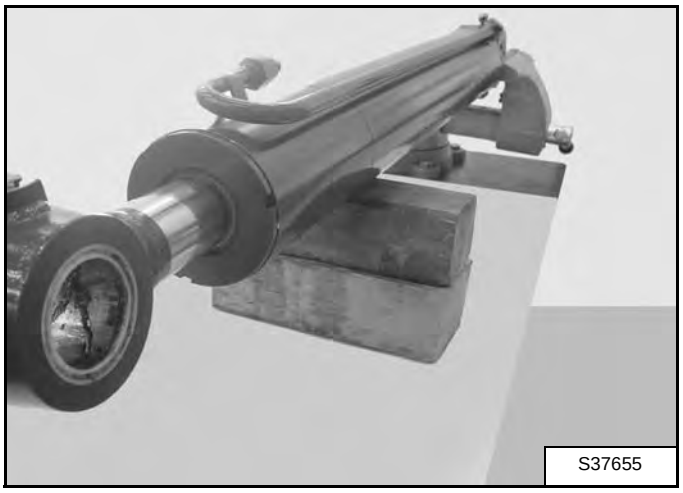
Tighten the head (Item 1) **[Figure 20-25-56]**.

Figure 20-25-57



Bend the lock ring tab (Item 1) **[Figure 20-25-57]** into the groove on the head.

Figure 20-25-58



Remove the cylinder from the vise **[Figure 20-25-58]**.

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VALVES (RELIEF)

Description

Figure 20-30-1

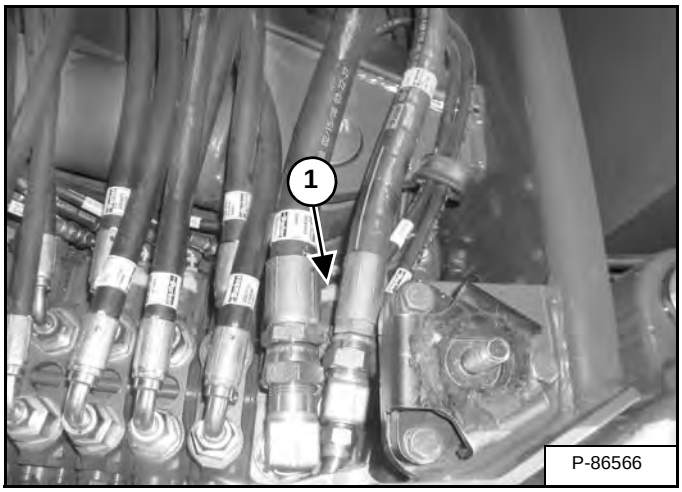
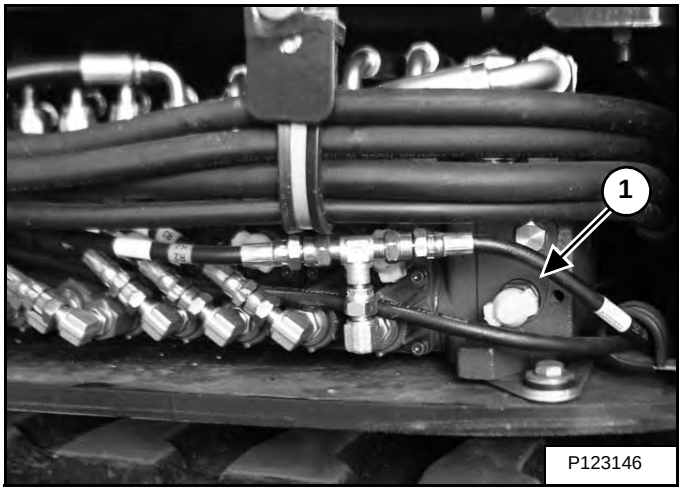


Figure 20-30-2



The piston pump circuit has one load sense relief valve (Item 1) **[Figure 20-30-1]** and one back-up relief valve (Item 1) **[Figure 20-30-2]** located on the hydraulic control valve. The load sense relief valve (Item 1) **[Figure 20-30-1]** is factory set at 28000 kPa (280 bar) (4060 psi).

The back-up relief valve (Item 1) **[Figure 20-30-2]** is set at 34000 kPa (340 bar) (4931 psi), 3000 kPa (30 bar) (435 psi) higher than the load sense relief.

The back-up relief valve and load sense relief valve are tested and adjusted during the piston pump testing and adjusting. (See Pump Testing on Page 20-50-6.)

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VALVES (PORT RELIEF)

Testing And Adjusting The Port Relief Valve 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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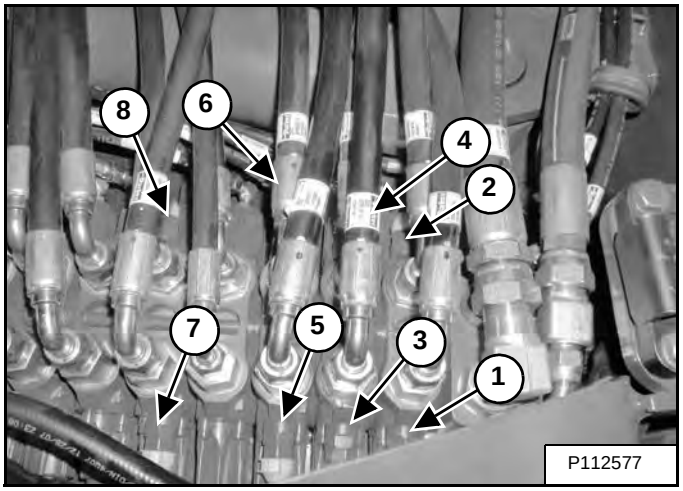
Tilt the cab. (See Raising And Lowering on Page 10-210-1.)

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 350 kPa (3,5 bar) (50 psi).

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

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

Figure 20-31-1



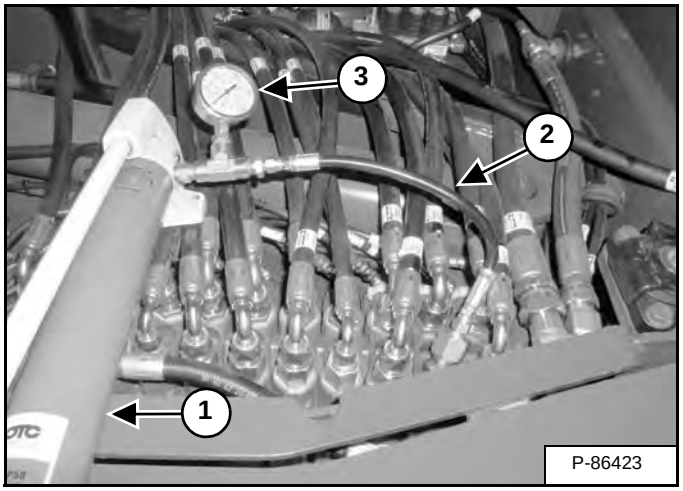
Boom Port Relief set at:
Rod End (Item 1) **[Figure 20-31-1]** 31000 kPa (310 bar) (4495 psi)
Base End (Item 2) **[Figure 20-31-1]** 31000 kPa (310 bar) (4495 psi)

Bucket Port Relief set at:
Rod End (Item 3) **[Figure 20-31-1]** 31000 kPa (310 bar) (4495 psi)
Base End (Item 4) **[Figure 20-31-1]** 31000 kPa (310 bar) (4495 psi)

Arm Port Relief set at:
Rod End (Item 5) **[Figure 20-31-1]** 31000 kPa (310 bar) (4495 psi)
Base End (Item 6) **[Figure 20-31-1]** 31000 kPa (310 bar) (4495 psi)

Auxiliary Port Relief set at:
Female Quick Coupler (Item 7) **[Figure 20-31-1]** 21000 kPa (210 bar) (3046 psi)
Male Quick Coupler (Item 8) **[Figure 20-31-1]** 21000 kPa (210 bar) (3046 psi)

Figure 20-31-2



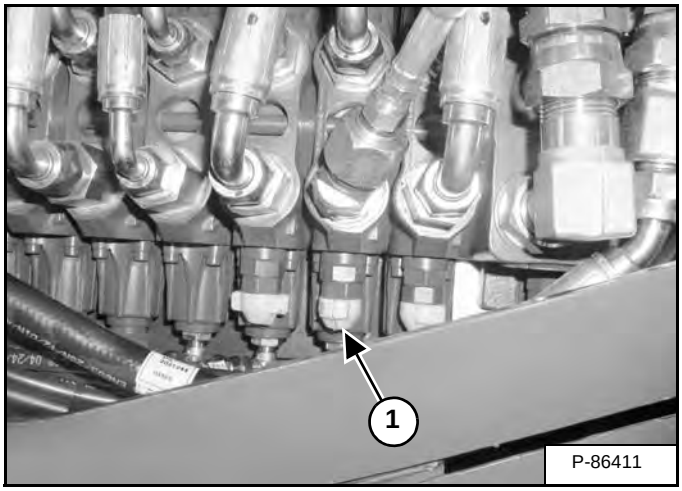
Install the hand pump (Item 1), hose (Item 2) and a pressure gauge (Item 3) **[Figure 20-31-2]** (minimum of 34500 kPa (345 bar) (5000 psi) into the valve section work port in which the port relief valve is located. Pressurize this section with the hand pump until the port relief valve opens. Record the pressure reading.

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

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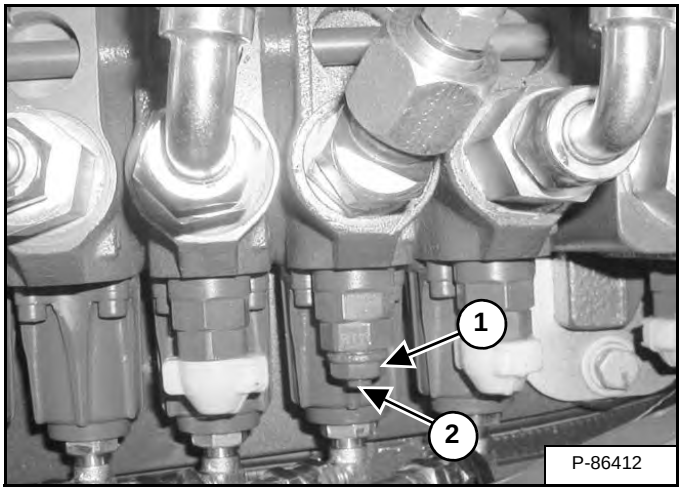
Testing And Adjusting The Port Relief Valve Pressure (Cont'd)

Figure 20-31-3



Remove the protective cap (Item 1) **[Figure 20-31-3]**.

Figure 20-31-4



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

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

NOTE: One-quarter turn is approximately 6900 kPa (69 bar) (1000 psi). When the correct pressure setting is obtained, tighten the locknut while holding the adjustment screw from turning.

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

Install the protective cap.

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VALVE (PRESSURE REDUCING RELIEF)

Testing And Adjusting The Pressure Reducing Valve

The pressure reducing valve supplies lower hydraulic pressure to joysticks.

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

Tilt the cab. (See Raising And Lowering on Page 10-210-1.)

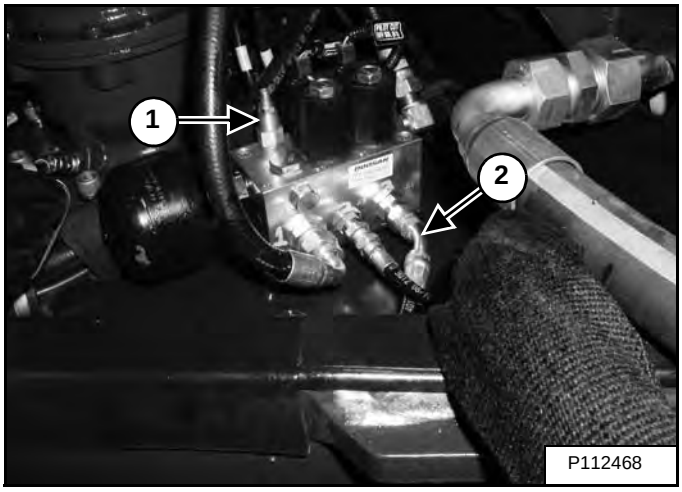
⚠ WARNING

AVOID INJURY OR DEATH

Never work under the excavator cab without installing an approved cab support device.

W-2435-0502

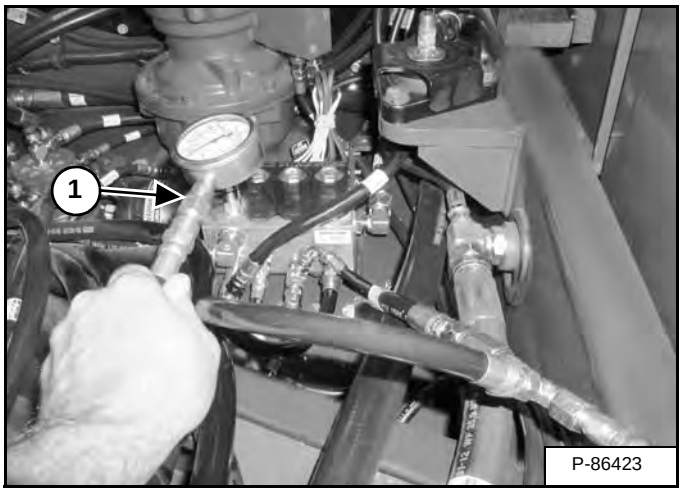
Figure 20-32-1



The pressure reducing valve (Item 1) **[Figure 20-32-1]** is located on the end of the manifold.

Remove the hose (Item 2) **[Figure 20-32-1]** from the A-1 port.

Figure 20-32-2



Install the test fittings and 6900 kPa (69 bar) (1000 psi) gauge (Item 1) **[Figure 20-32-2]** in between the A-1 port fitting and existing hose. Route the gauge to the outside of the excavator.

Lower the cab. (See Raising And Lowering on Page 10-210-1.)

Enter the cab, start the engine and warm up the hydraulic fluid to operating temperature.

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

The pressure at the gauge should be 3200 kPa (32 bar) (464 psi).

Move the engine speed control to low idle speed.

Stop the engine.

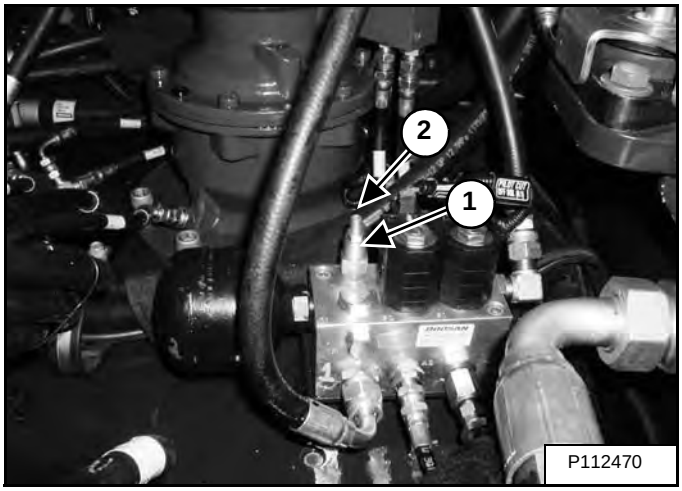
With the engine off, and the key in the run position, lower the left console and move both joysticks to relieve hydraulic pressure.

If adjustment is needed, raise the cab. (See Raising And Lowering on Page 10-210-1.)

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

Figure 20-32-3



Loosen the nut (Item 1) **[Figure 20-32-3]**.

Turn the adjustment screw (Item 2) **[Figure 20-32-3]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

NOTE: 1/4 turn is approximately 340 kPa (3,4 bar) (50 psi).

Tighten the nut (Item 1) **[Figure 20-32-3]**.

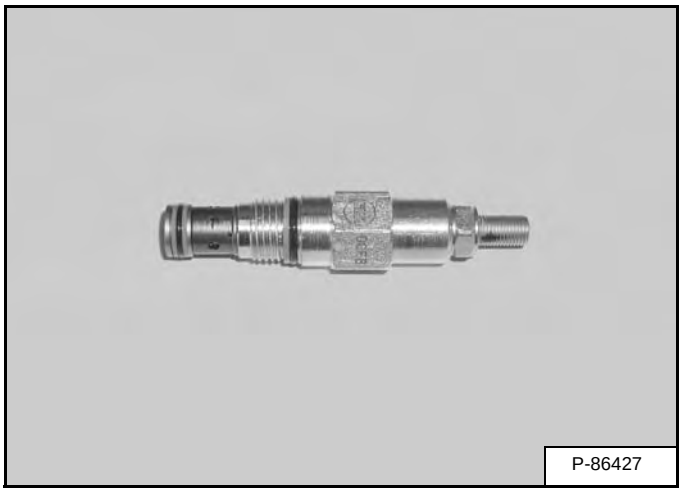
Lower the cab and retest the pressure reducing valve after adjustment.

If the pressure is still incorrect, relieve hydraulic pressure, tilt the cab 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 on the manifold assembly to verify that there is no damage. If damaged, replace the manifold assembly.

Figure 20-32-4



Inspect the O-rings and back-up rings on the pressure reducing valve **[Figure 20-32-4]**. If O-rings and back-up rings are worn or damaged, replace O-rings and back-up rings. (See Disassembly And Assembly on Page 20-60-2.)

Reinstall the pressure reducing valve in the manifold assembly.

Repeat the pressure reducing valve test.

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

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HYDRAULIC CONTROL VALVE

Description

The hydraulic control valve is located between the pump, cylinders and motors on the oil pressure circuit. Each component within the hydraulic control valve operates and controls oil flowing from the main pump. Such control changes operation, direction or speed of cylinders and motors.

The hydraulic control valve has three main relief valves that operate at 30000 kPa (300 bar) (4278 psi). The bucket, boom 1, arm 1, boom 2 / auxiliary, articulated boom (optional) and boom swing sections have 30999 kPa (310 bar) (4496 psi) work port relief valves. The rotary section has a 25000 kPa (250 bar) (3626 psi) work port relief valve.

Removal And Installation

Remove the left upperstructure cover. (See Removal And Installation on Page 40-20-1.)

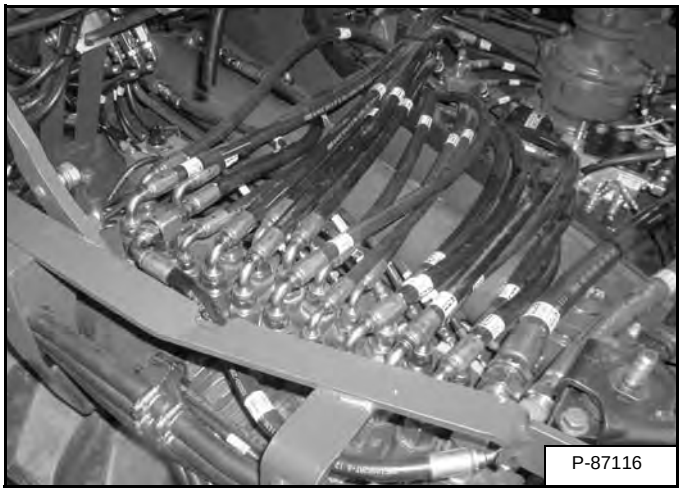
Tilt the cab. (See Raising And Lowering on Page 10-210-1.)

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.

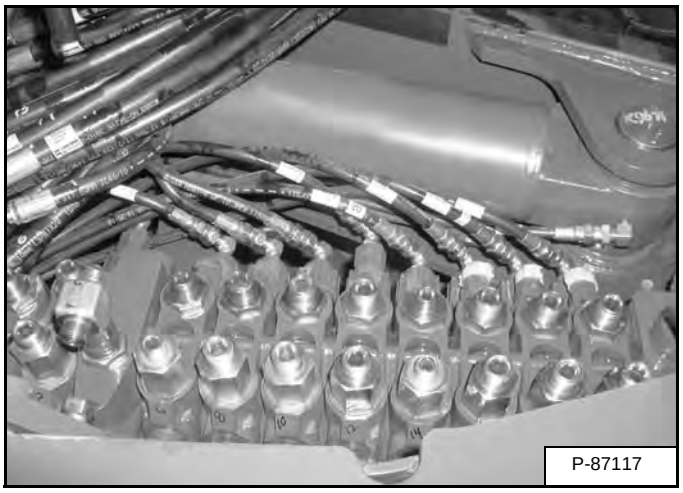
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Figure 20-40-1



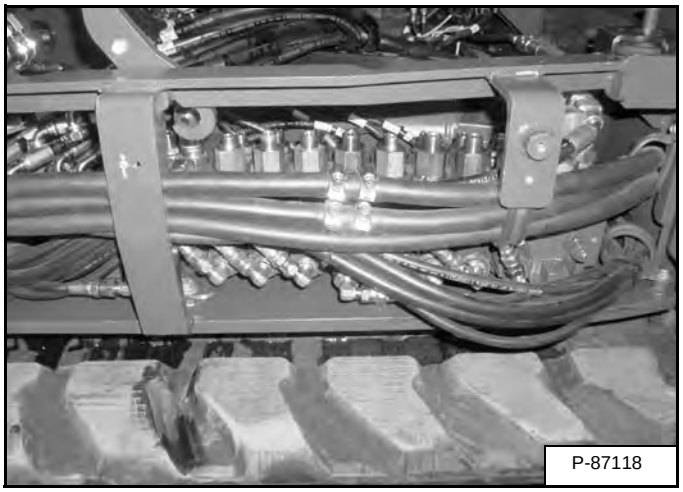
Mark and remove the hoses from the top of the valve **[Figure 20-40-1]**.

Figure 20-40-2



Remove the pilot lines from the inboard side of the valve **[Figure 20-40-2]**.

Figure 20-40-3

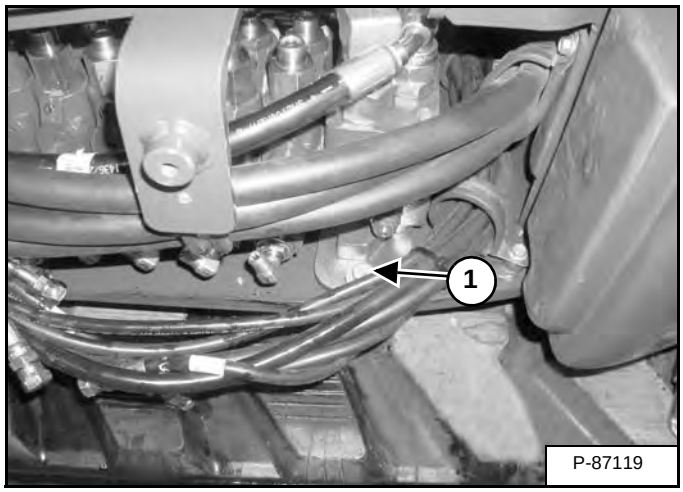


Remove the pilot lines from the outboard side of the valve **[Figure 20-40-3]**.

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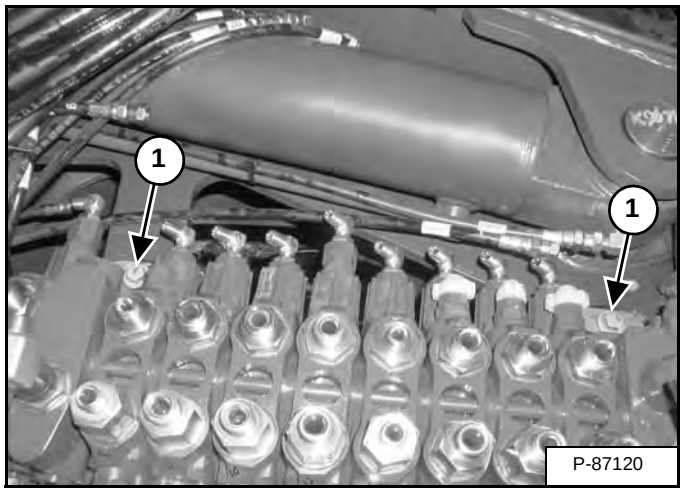
Removal And Installation (Cont'd)

Figure 20-40-4



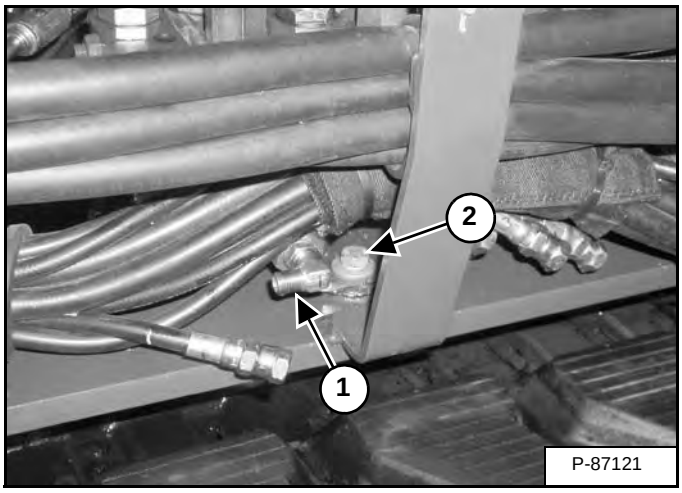
Remove the bolt (Item 1) **[Figure 20-40-4]** and washer.

Figure 20-40-5



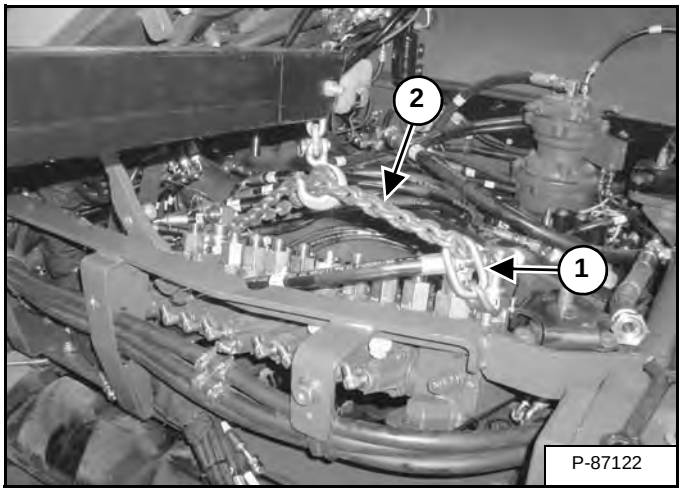
Remove the two bolts (Item 1) **[Figure 20-40-5]** and washers.

Figure 20-40-6



Remove the fitting (Item 1). Remove the bolt (Item 2) **[Figure 20-40-6]** and washer.

Figure 20-40-7

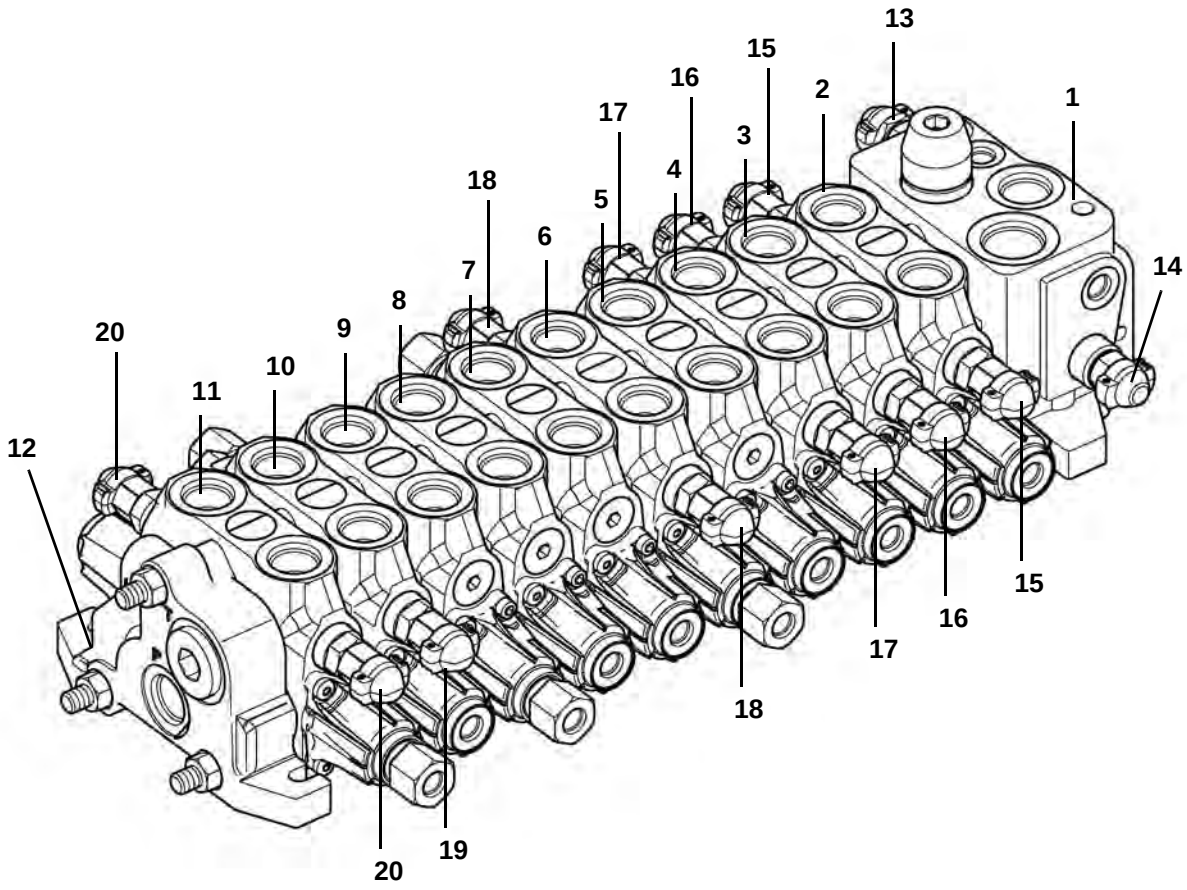


Install lifting brackets (Item 1) on both ends of the valve. Install a chain (Item 2) **[Figure 20-40-7]** and hoist on the lifting brackets. Lift and remove the valve.

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Parts Identification

1. Inlet Valve Section
2. Boom Valve Section
3. Bucket Valve Section
4. Arm Valve Section
5. Blade Valve Section
6. Auxiliary Valve Section
7. Left Travel Valve Section
8. Right Travel Valve Section
9. Upperstructure Swing Valve Section
10. Boom Swing Valve Section
11. Articulated Boom Valve Section
12. Outlet Valve Section
13. Load Sense Relief Valve 28000 kPa (280 bar) (4060 psi)
14. Back-up Relief Valve 34000 kPa (340 bar) (4931 psi)
15. Boom Port Relief Valves 30999 kPa (310 bar) (4496 psi)
16. Bucket Port Relief Valves 30999 kPa (310 bar) (4496 psi)
17. Arm Port Relief Valves 30999 kPa (310 bar) (4496 psi)
18. Auxiliary Port Relief Valves 21001 kPa (210 bar) (3046 psi)
19. Boom Swing Port Relief Valve 30999 kPa (310 bar) (4496 psi)
20. Articulated Boom Port Relief Valves 30999 kPa (310 bar) (4496 psi)

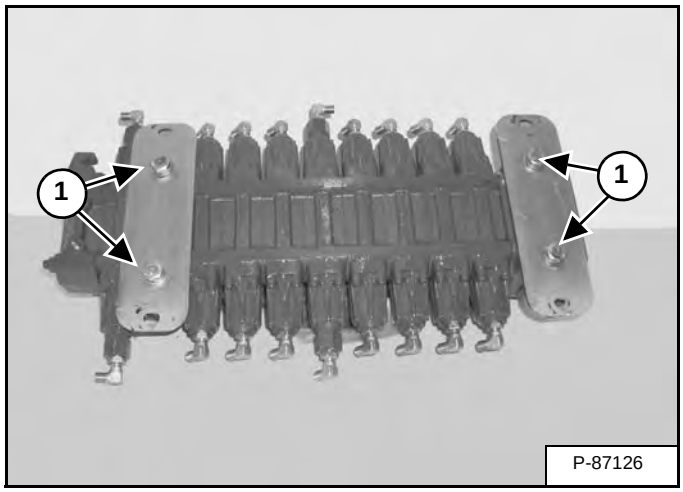


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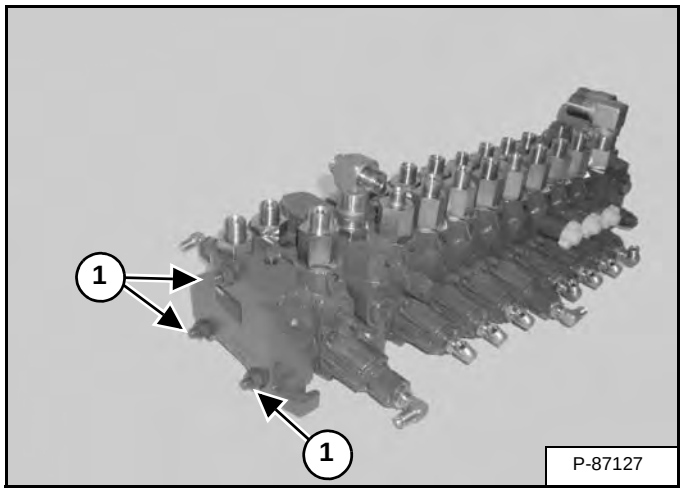
Disassembly And Assembly

Figure 20-40-8



Remove the bolts (Item 1) **[Figure 20-40-8]**, washers and mounts.

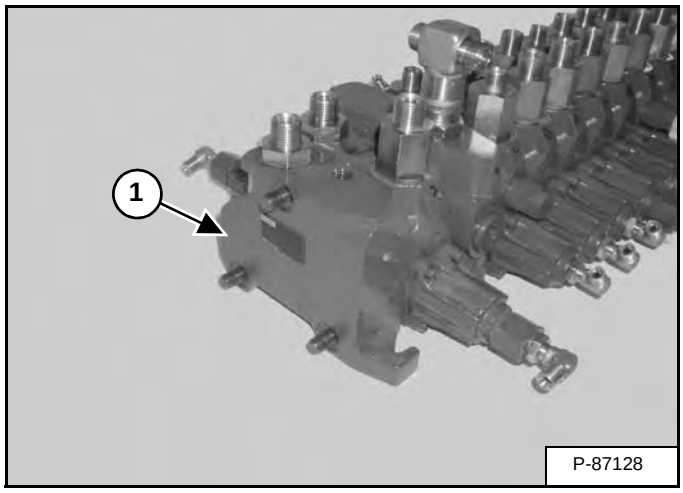
Figure 20-40-9



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

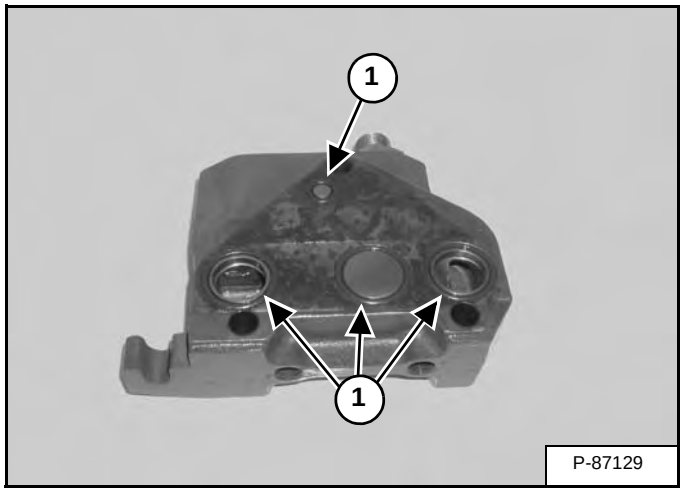
Installation: Tighten the nuts to 32 - 38 N•m (24 - 28 ft-lb) torque.

Figure 20-40-10



Remove the outlet valve section (Item 1) **[Figure 20-40-10]**.

Figure 20-40-11

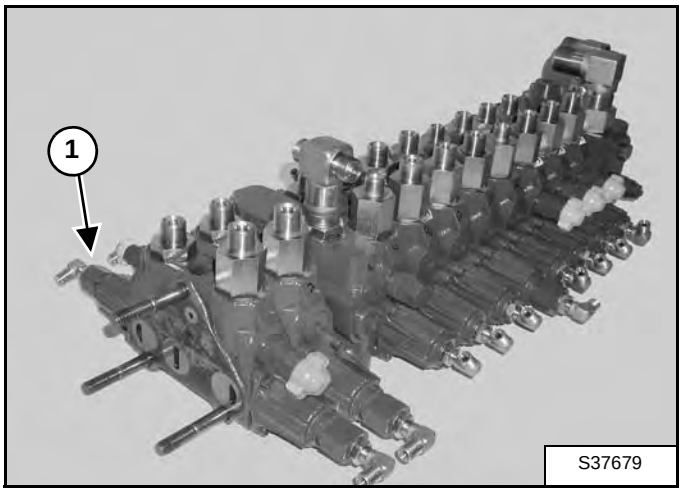


Remove the four O-rings (Item 1) **[Figure 20-40-11]**.

Dealer Copy -- Not for Resale

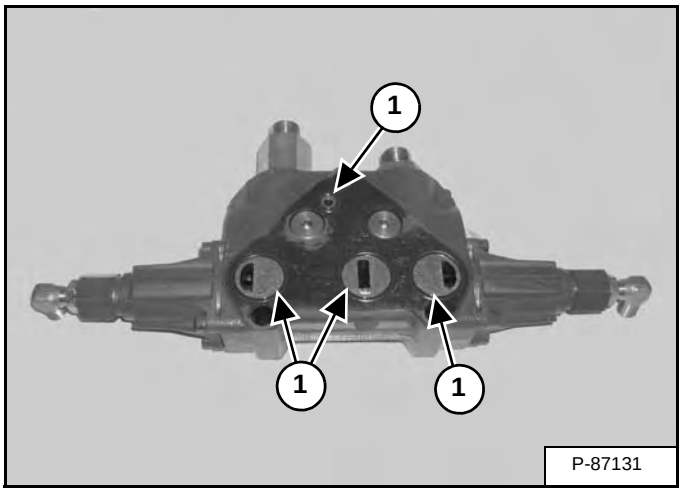
Disassembly And Assembly (Cont'd)

Figure 20-40-12



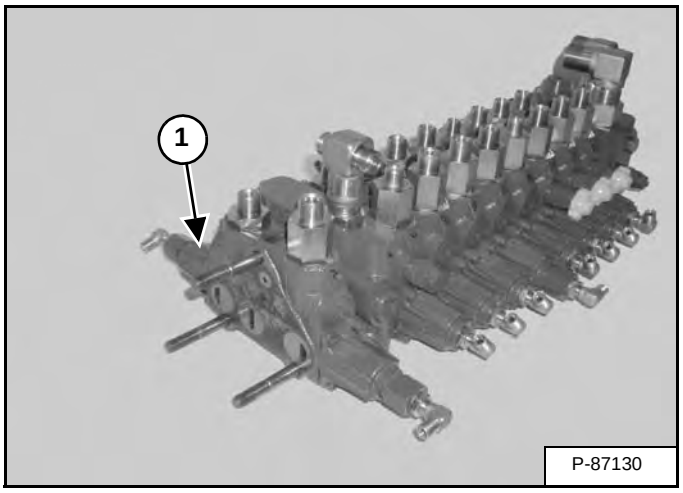
Remove the articulated boom valve section (Item 1) **[Figure 20-40-12]**. (If equipped.)

Figure 20-40-13



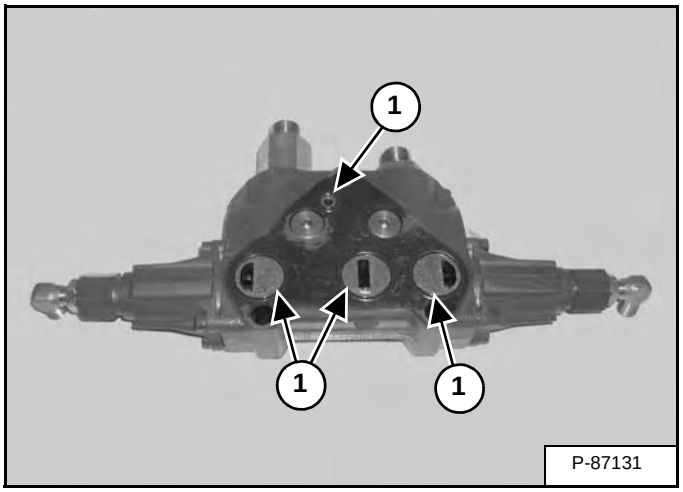
Remove the four O-rings (Item 1) **[Figure 20-40-13]**.

Figure 20-40-14



Remove the swing valve section (Item 1) **[Figure 20-40-14]**.

Figure 20-40-15

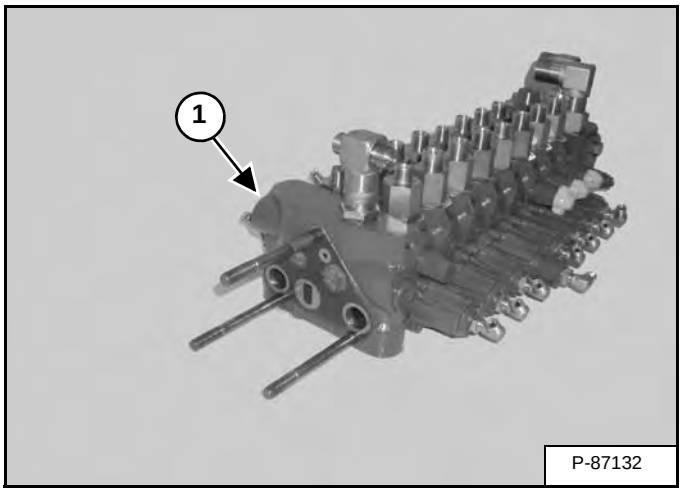


Remove the four O-rings (Item 1) **[Figure 20-40-15]**.

Dealer Copy -- Not for Resale

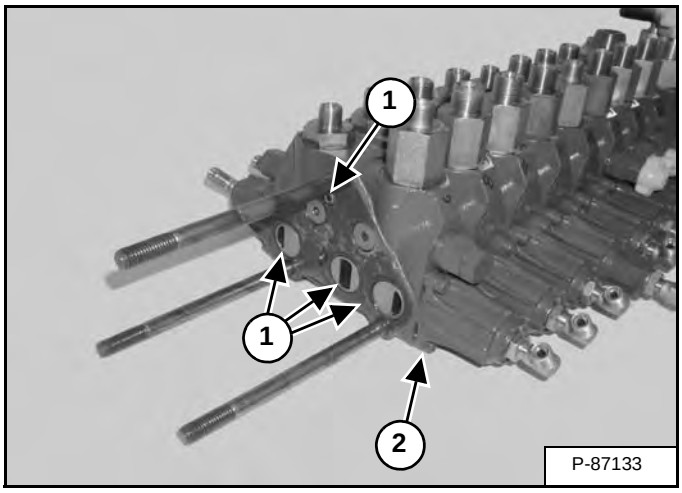
Disassembly And Assembly (Cont'd)

Figure 20-40-16



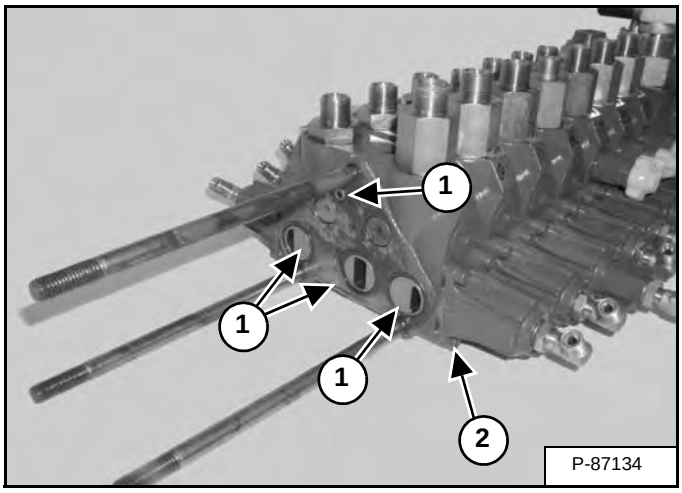
Remove the mid inlet (Item 1) **[Figure 20-40-16]** valve section.

Figure 20-40-17



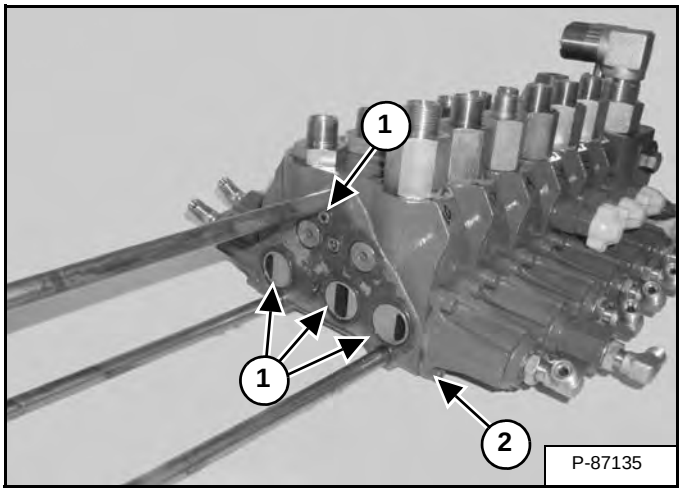
Remove the four O-rings (Item 1). Remove the boom swing valve section (Item 2) **[Figure 20-40-17]**.

Figure 20-40-18



Remove the four O-rings (Item 1). Remove the right hand travel valve section (Item 2) **[Figure 20-40-18]**.

Figure 20-40-19

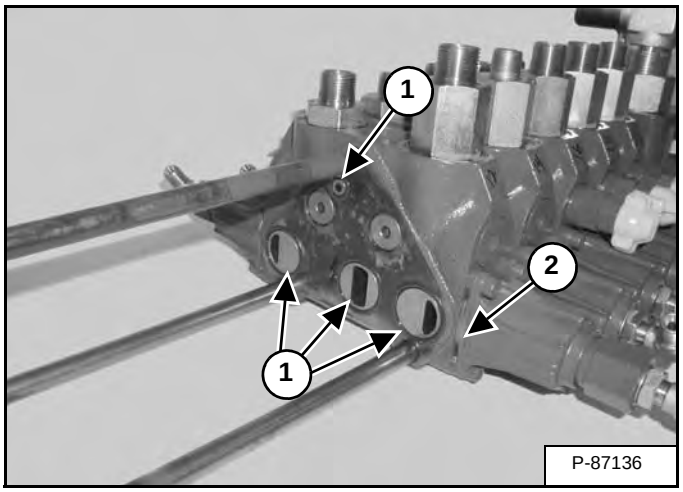


Remove the four O-rings (Item 1). Remove the left hand travel valve section (Item 2) **[Figure 20-40-19]**.

Dealer Copy -- Not for Resale

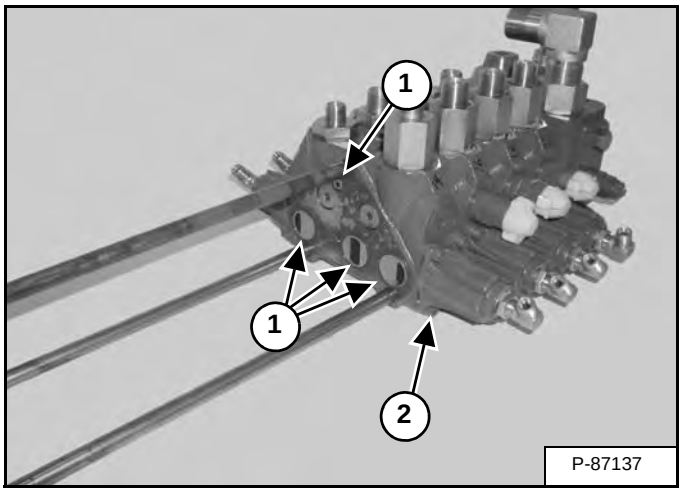
Disassembly And Assembly (Cont'd)

Figure 20-40-20



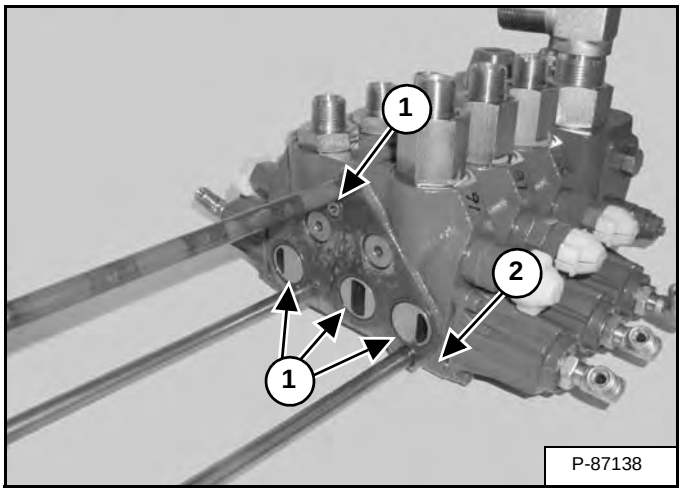
Remove the four O-rings (Item 1). Remove the auxiliary valve section (Item 2) **[Figure 20-40-20]**.

Figure 20-40-21



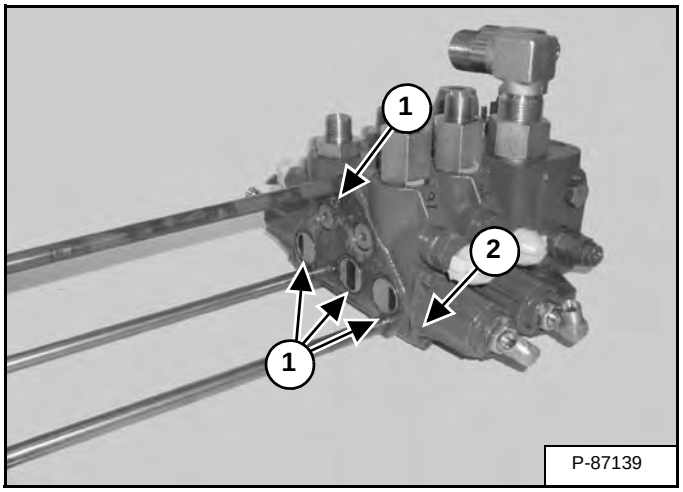
Remove the four O-rings (Item 1). Remove the blade valve section (Item 2) **[Figure 20-40-21]**.

Figure 20-40-22



Remove the four O-rings (Item 1). Remove the arm valve section (Item 2) **[Figure 20-40-22]**.

Figure 20-40-23

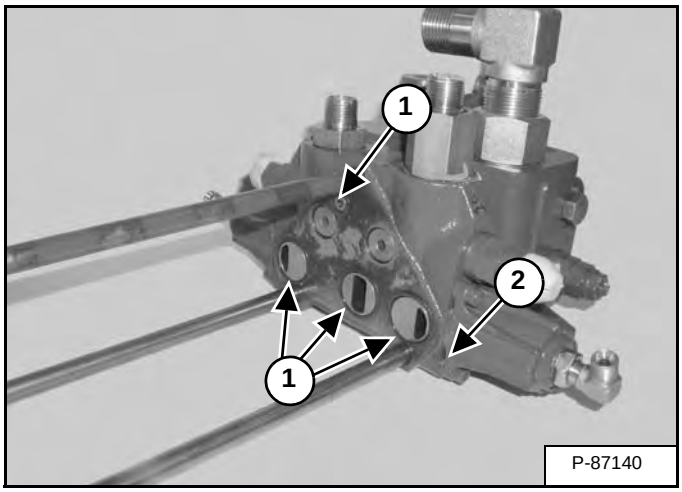


Remove the four O-rings (Item 1). Remove the bucket valve section (Item 2) **[Figure 20-40-23]**.

Dealer Copy -- Not for Resale

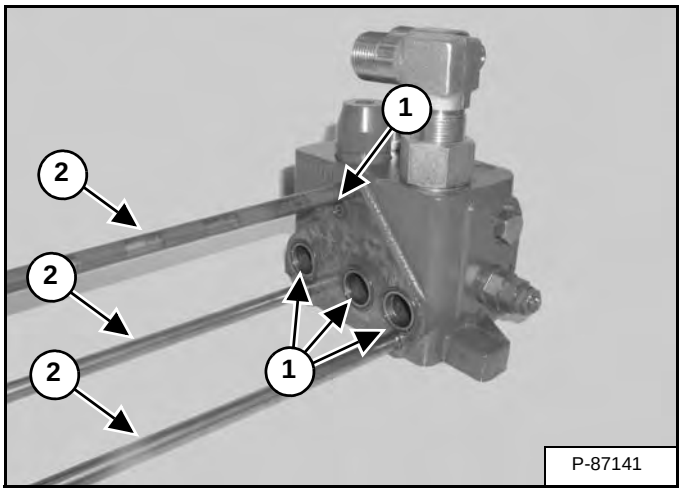
Disassembly And Assembly (Cont'd)

Figure 20-40-24



Remove the four O-rings (Item 1). Remove the boom valve section (Item 2) **[Figure 20-40-24]** valve section.

Figure 20-40-25

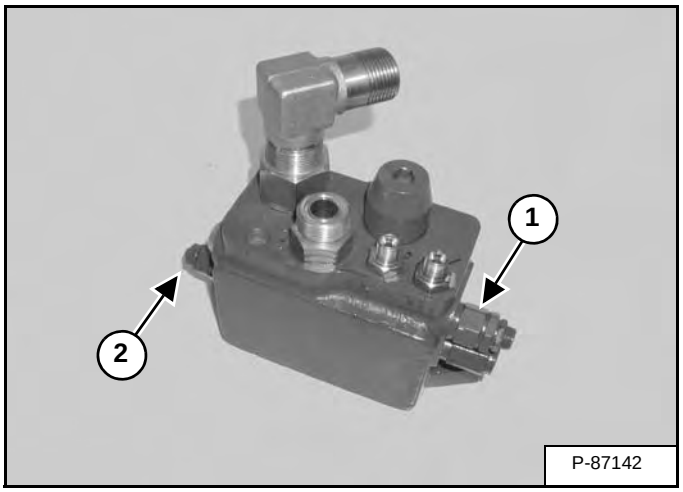


Remove the four O-rings (Item 1). Remove the tie rods (Item 2) **[Figure 20-40-25]** from the inlet valve section.

Dealer Copy -- Not for Resale

Inlet Valve Section Disassembly And Assembly

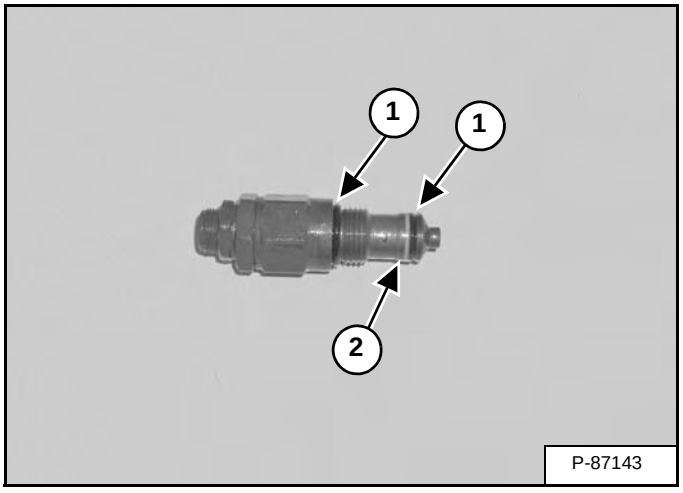
Figure 20-40-26



Remove the load sense relief valve (Item 1) and back-up relief valve (Item 2) **[Figure 20-40-26]**.

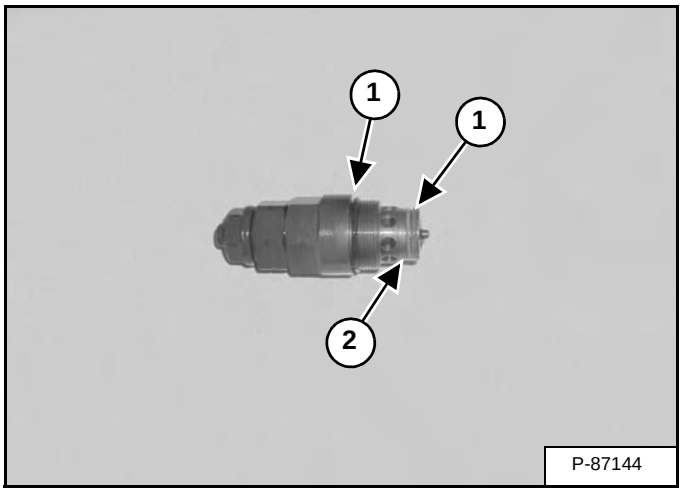
Installation: Tighten the relief valves to 41 - 49 N•m (30 - 60 ft-lb) torque.

Figure 20-40-27



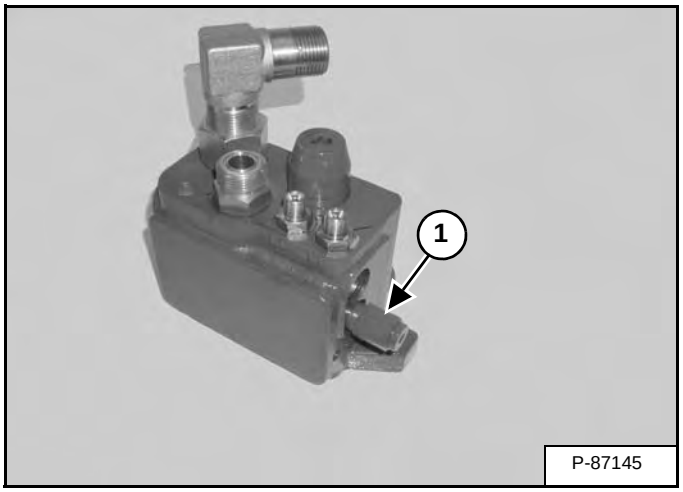
Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-27]** from the load sense relief valve.

Figure 20-40-28



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-28]** from the back-up relief valve.

Figure 20-40-29



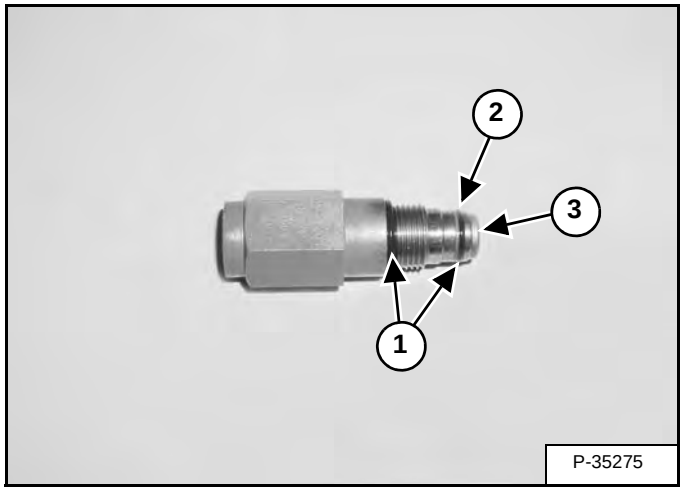
Remove the load sense bleed cartridge (Item 1) **[Figure 20-40-29]**.

Installation: Tighten the cartridge to 18 - 22 N•m (13 - 17 ft-lb) torque.

Dealer Copy -- Not for Resale

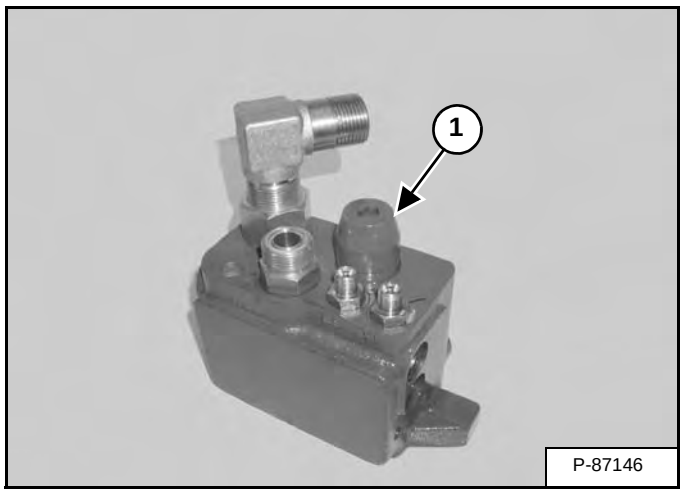
Inlet Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-30



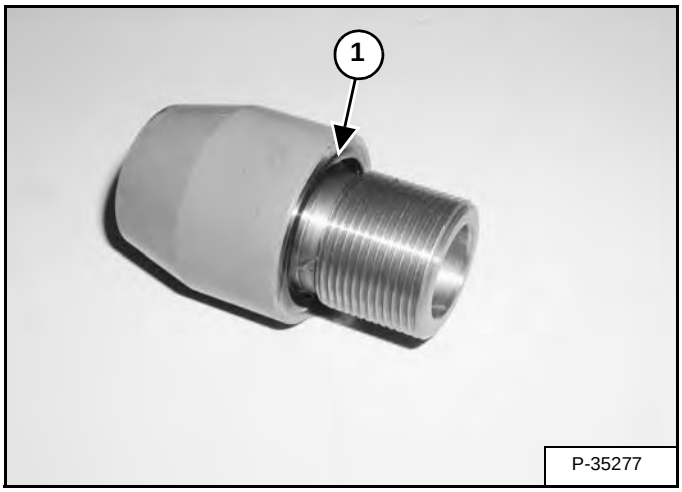
Remove the O-rings (Item 1) and back-up ring (Item 2) from the flow regulator. Remove the filter (Item 3) **[Figure 20-40-30]** from the end of the cartridge.

Figure 20-40-31



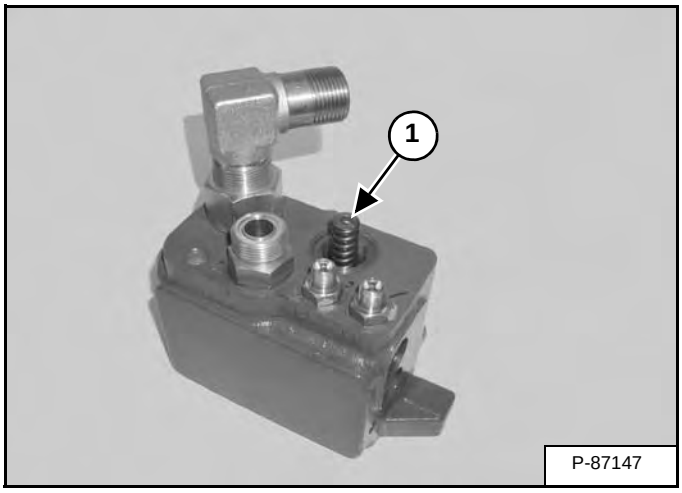
Remove the plug (Item 1) **[Figure 20-40-31]**.

Figure 20-40-32



Remove the O-ring (Item 1) **[Figure 20-40-32]**.

Figure 20-40-33

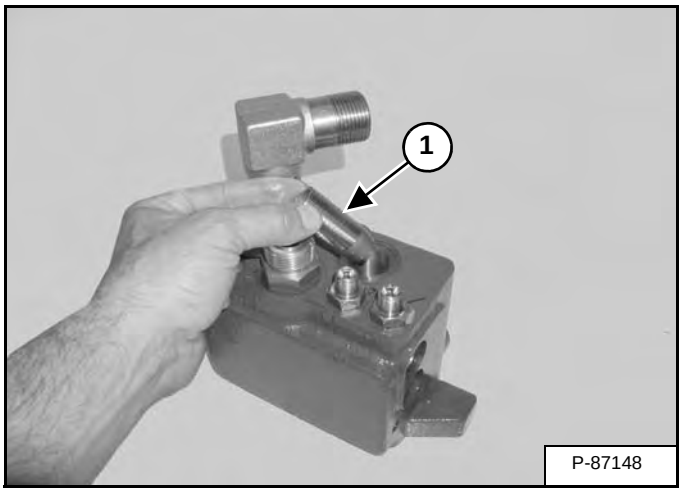


Remove the spring (Item 1) **[Figure 20-40-33]**.

Dealer Copy -- Not for Resale

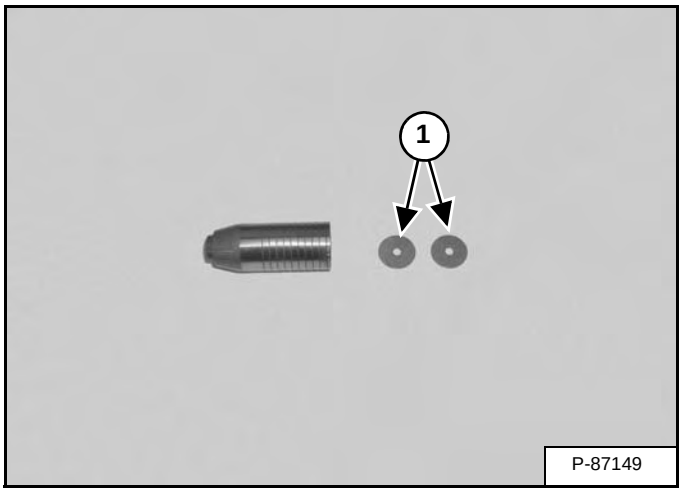
Inlet Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-34



Remove the spool (Item 1) **[Figure 20-40-34]**.

Figure 20-40-35

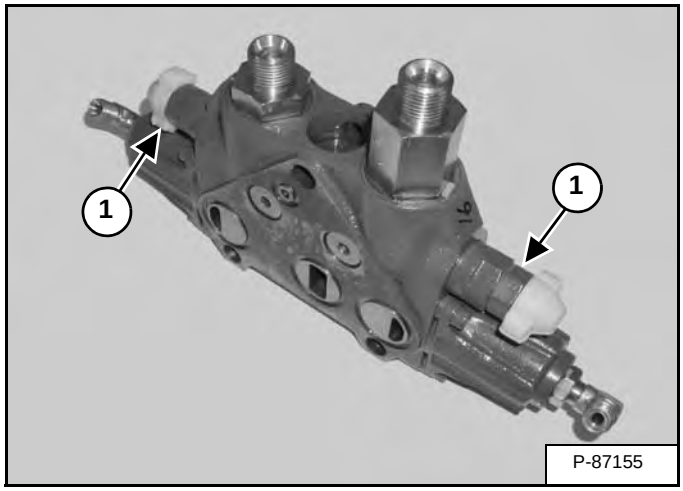


Remove the shims (Item 1) **[Figure 20-40-35]** from the spool.

Dealer Copy -- Not for Resale

Boom, Arm And Bucket Valve Section Disassembly And Assembly

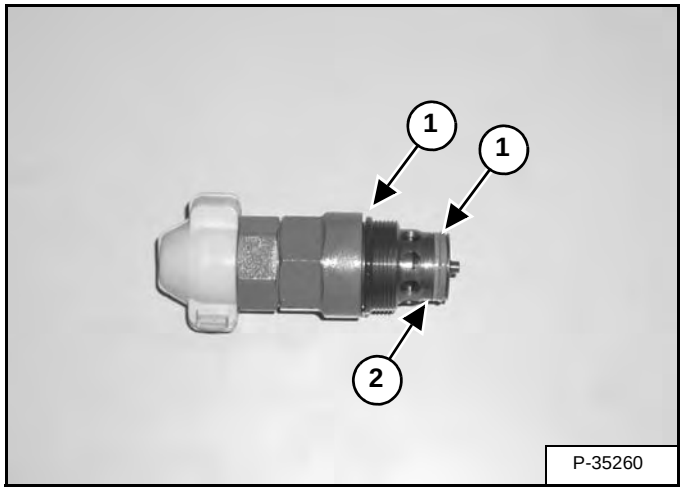
Figure 20-40-36



Remove the relief valves (Item 1) **[Figure 20-40-36]**.

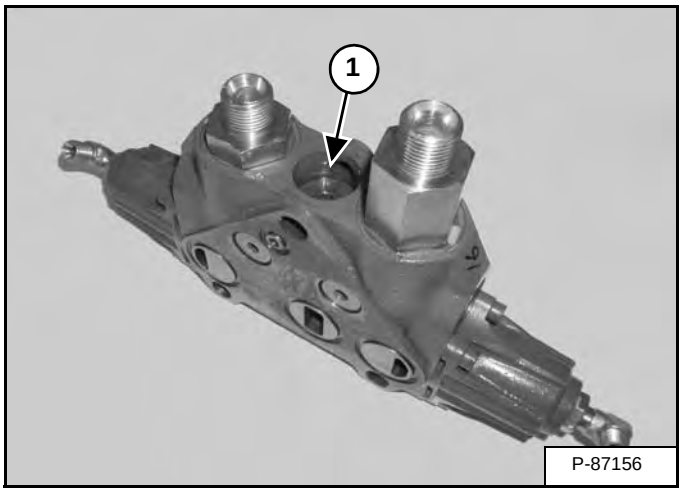
Installation: Tighten the valves to 70 N•m (52 ft-lb) torque.

Figure 20-40-37



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-37]**.

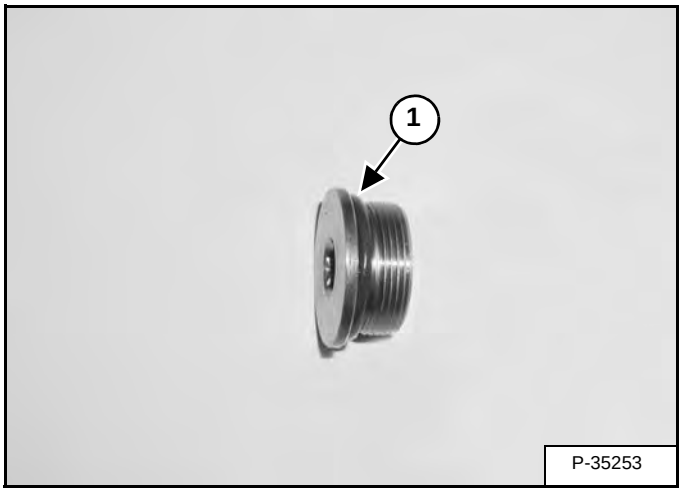
Figure 20-40-38



Remove the plug (Item 1) **[Figure 20-40-38]**.

Installation: Tighten the plug to 54 - 66 N•m (40 - 48 ft-lb) torque.

Figure 20-40-39

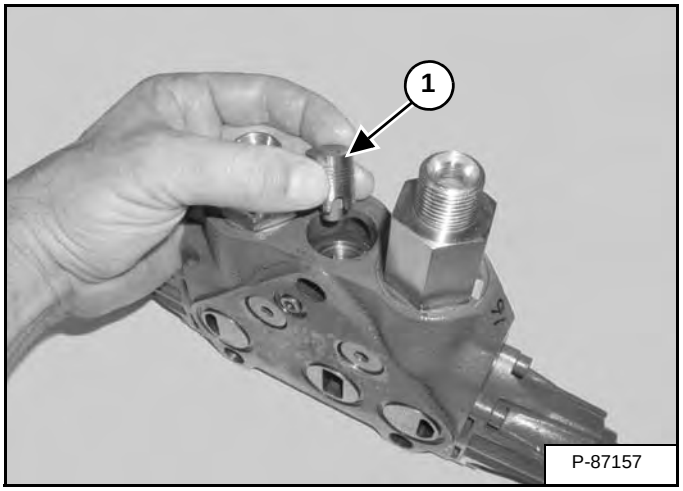


Remove the O-ring (Item 1) **[Figure 20-40-39]**.

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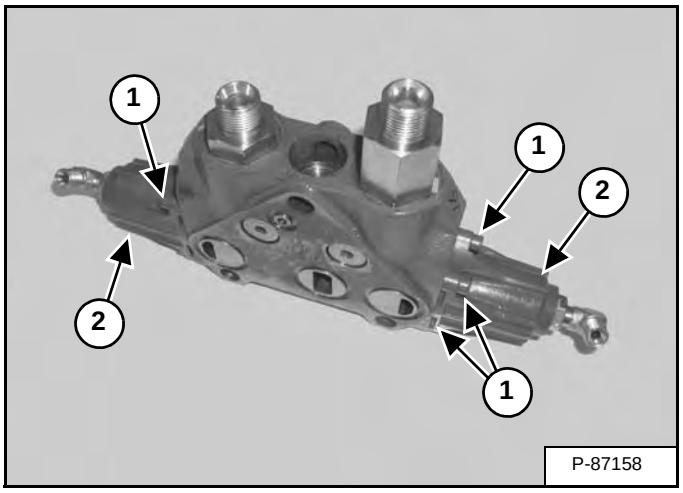
Boom, Arm And Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-40



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

Figure 20-40-41

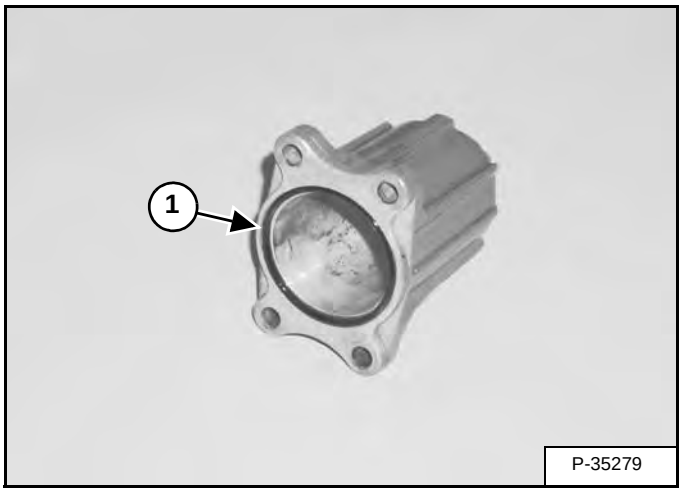


Remove the four screws (Item 1) **[Figure 20-40-41]** from both ends of the valve.

Installation: Tighten the screws to 25 N•m (18 ft-lb) torque.

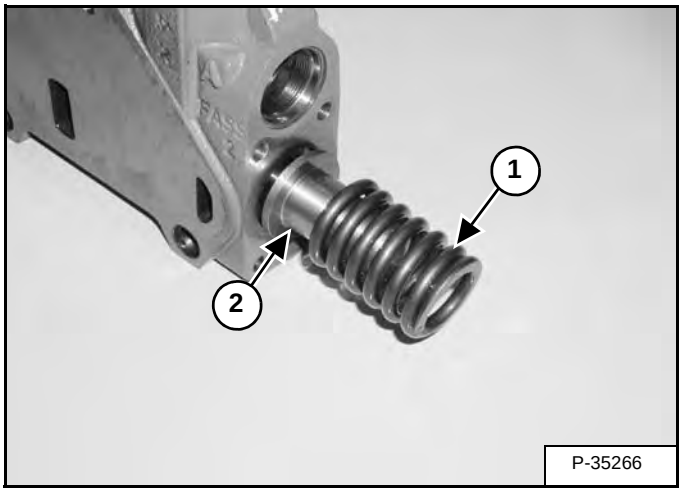
Remove both covers (Item 2) **[Figure 20-40-41]**.

Figure 20-40-42



Remove the O-ring (Item 1) **[Figure 20-40-42]** from both covers.

Figure 20-40-43



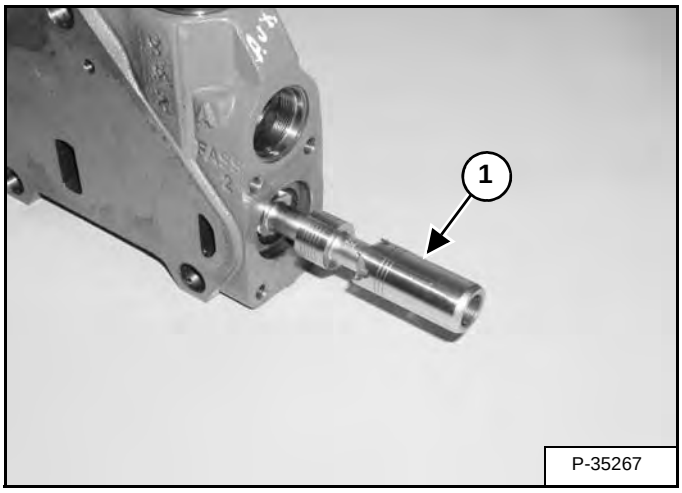
Remove the centering spring (Item 1) **[Figure 20-40-43]** from both ends.

Remove the spring seat (Item 2) **[Figure 20-40-43]** from both ends.

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Boom, Arm And Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-44



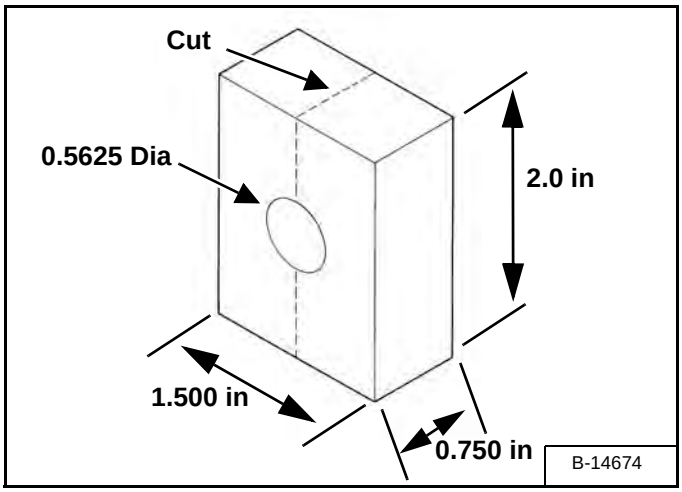
Record the orientation of the spool (Item 1) **[Figure 20-40-44]**.

Remove the spool (Item 1) **[Figure 20-40-44]**.

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

NOTE: The boom spool can be disassembled. Follow the steps from [Figure 20-40-45] through [Figure 20-40-48] to disassemble the spool.

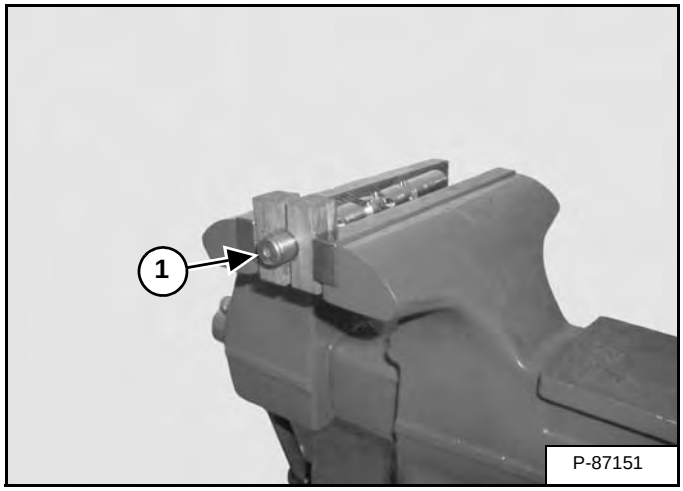
Figure 20-40-45



To remove the plugs from the boom spool, a holding fixture will have to be made from a 19 mm thick x 38 mm wide x 50 mm long (0.750 in thick x 1.500 in wide x 2.0 in long) piece of hardwood. Drill a 14 mm (0.5625 in) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-45]**.

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

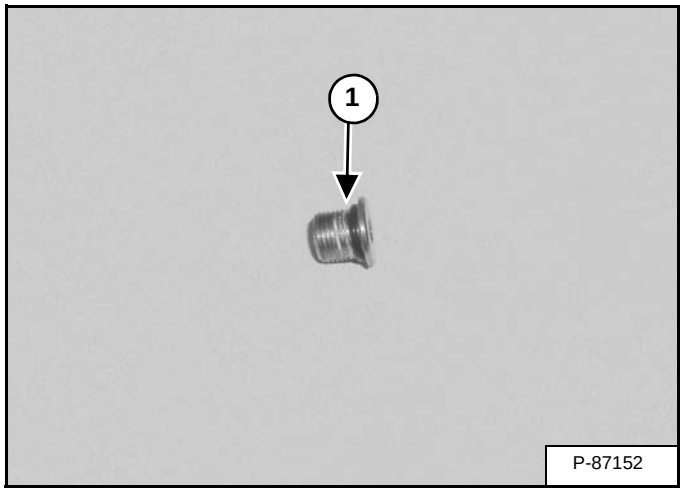
Figure 20-40-46



Apply moderate heat to the plug (Item 1) **[Figure 20-40-46]** to melt the thread adhesive. Remove the plug from both ends of the spool.

Installation: Apply thread adhesive (Loctite® 242) to the plug threads.

Figure 20-40-47

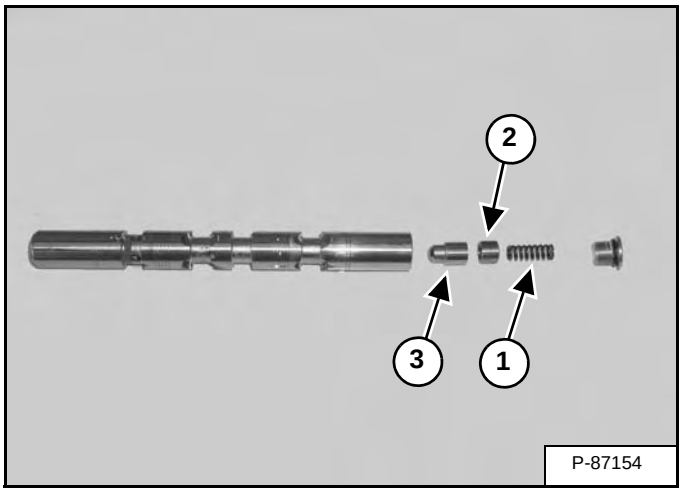


Remove the O-ring (Item 1) **[Figure 20-40-47]** from the plugs.

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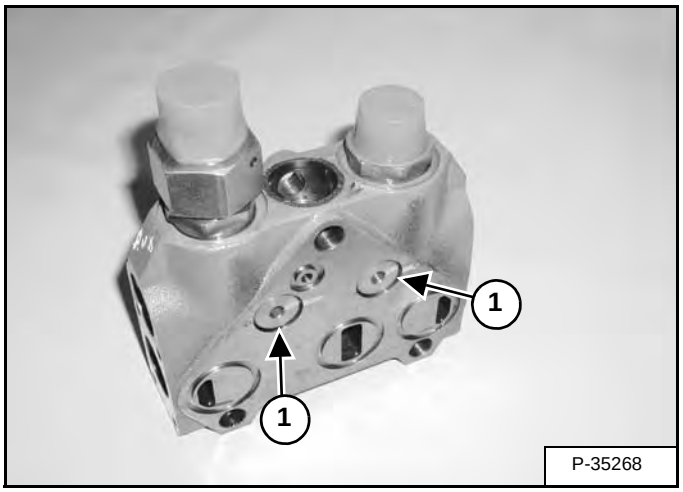
Boom, Arm And Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-48



Remove the spring (Item 1), sleeve (Item 2) and poppet (Item 3) **[Figure 20-40-48]** from both ends of the spool.

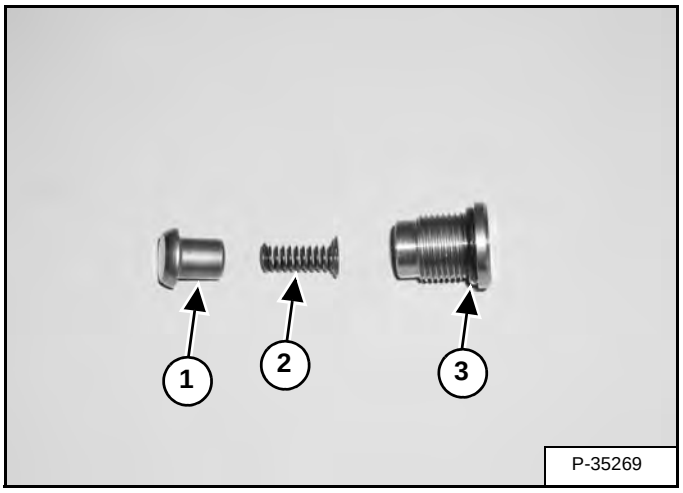
Figure 20-40-49



Remove the check valves (Item 1) **[Figure 20-40-49]**.

Installation: Tighten the check valves to 27 - 33 N•m (20 - 24 ft-lb) torque.

Figure 20-40-50

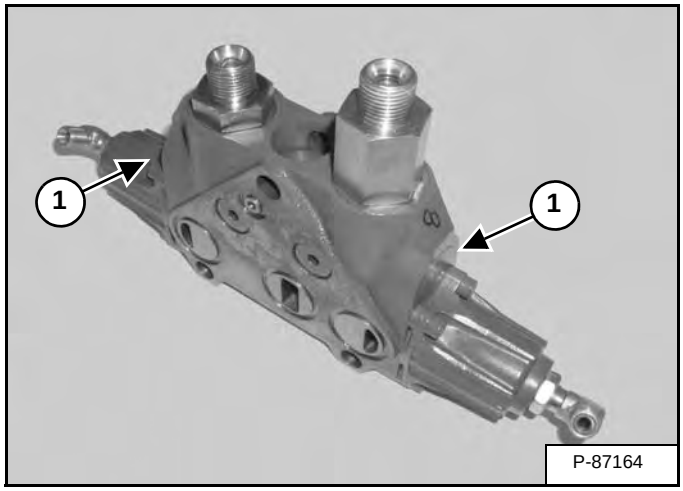


Remove the poppet (Item 1) and spring (Item 2) from the plug. Remove the O-ring (Item 3) **[Figure 20-40-50]** from the plug.

Dealer Copy -- Not for Resale

Left Travel, Right Travel And Blade Valve Section Disassembly And Assembly

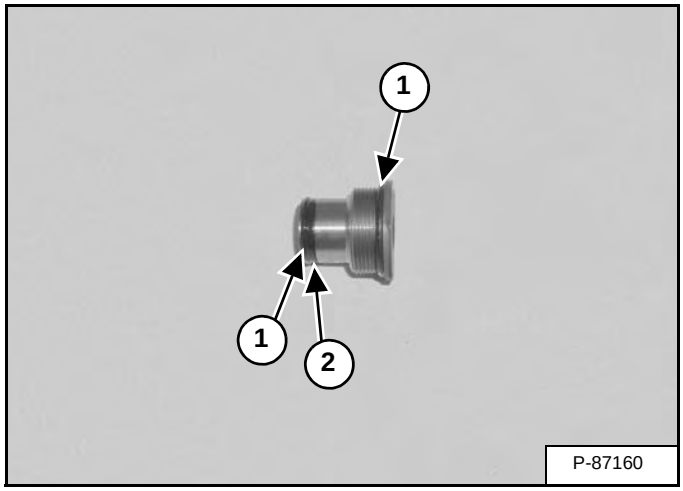
Figure 20-40-51



Remove the plugs (Item 1) **[Figure 20-40-51]**.

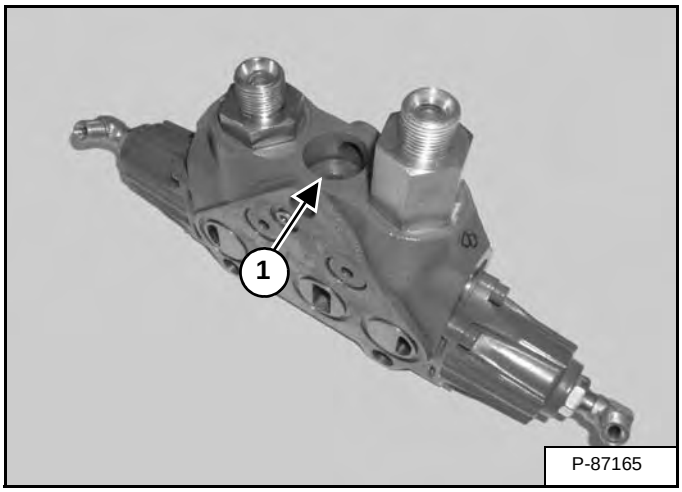
Installation: Tighten the plugs to 70 N•m (52 ft-lb) torque.

Figure 20-40-52



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-52]**.

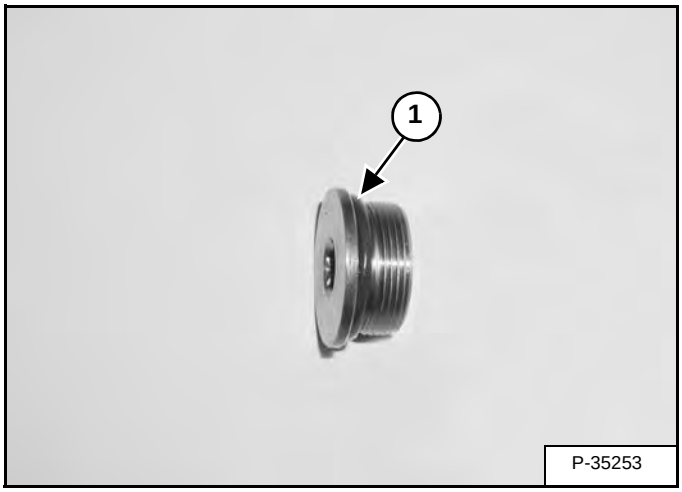
Figure 20-40-53



Remove the plug (Item 1) **[Figure 20-40-53]**.

Installation: Tighten the plug to 54 - 66 N•m (40 - 48 ft-lb) torque.

Figure 20-40-54

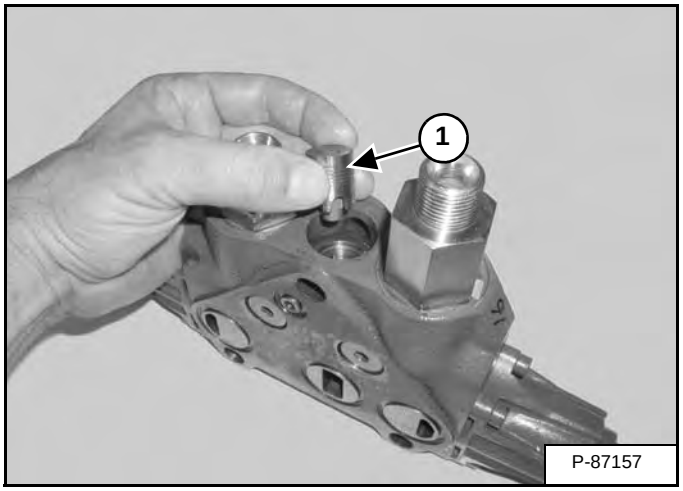


Remove the O-ring (Item 1) **[Figure 20-40-54]**.

Dealer Copy -- Not for Resale

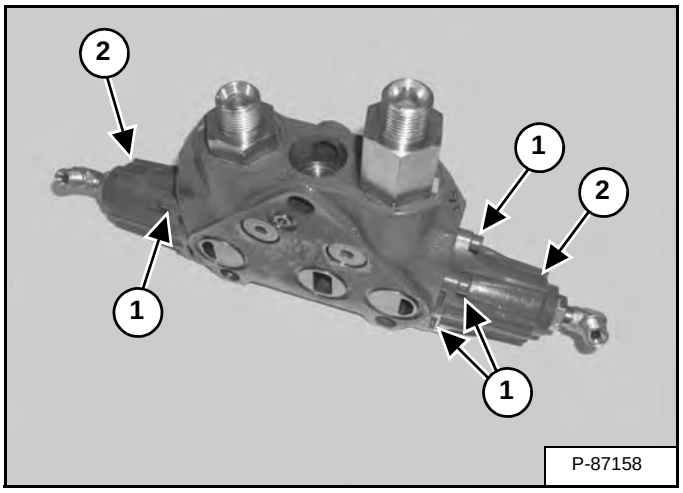
Left Travel, Right Travel And Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-55



Remove the compensator (Item 1) **[Figure 20-40-55]**.

Figure 20-40-56

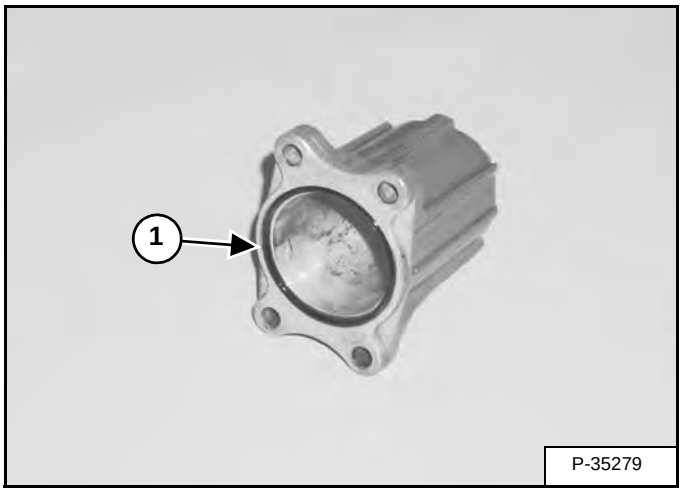


Remove the four screws (Item 1) **[Figure 20-40-56]** from both ends of the valve.

Installation: Tighten the screws to 25 N•m (18 ft-lb) torque.

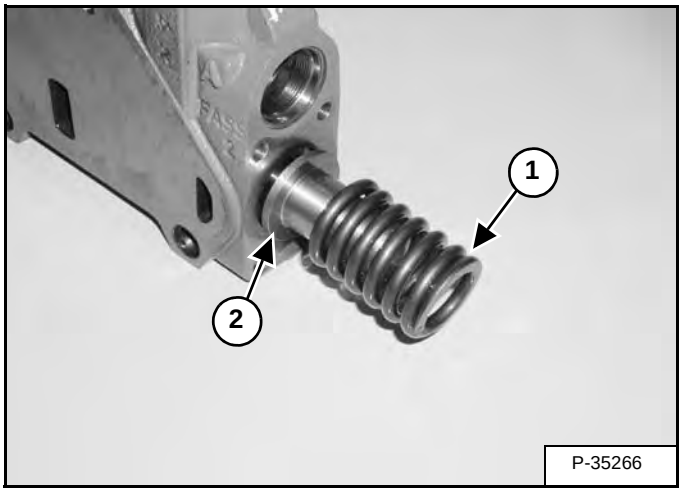
Remove both covers (Item 2) **[Figure 20-40-56]**.

Figure 20-40-57



Remove the O-ring (Item 1) **[Figure 20-40-57]**.

Figure 20-40-58



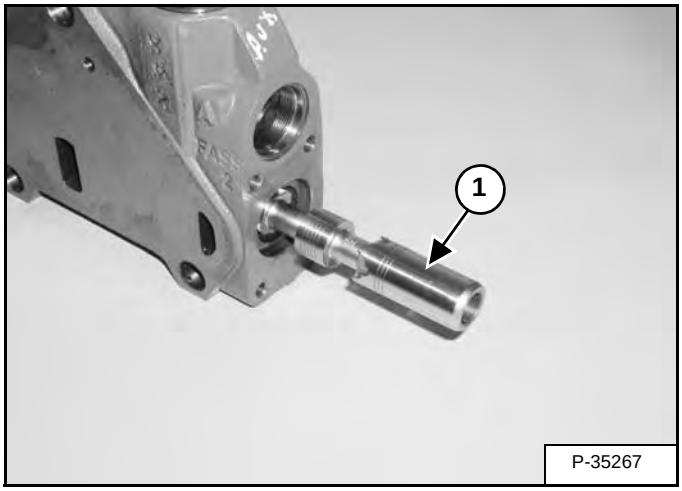
Remove the centering spring (Item 1) **[Figure 20-40-58]** from both ends.

Remove the spring seat (Item 2) **[Figure 20-40-58]** from both ends.

Dealer Copy -- Not for Resale

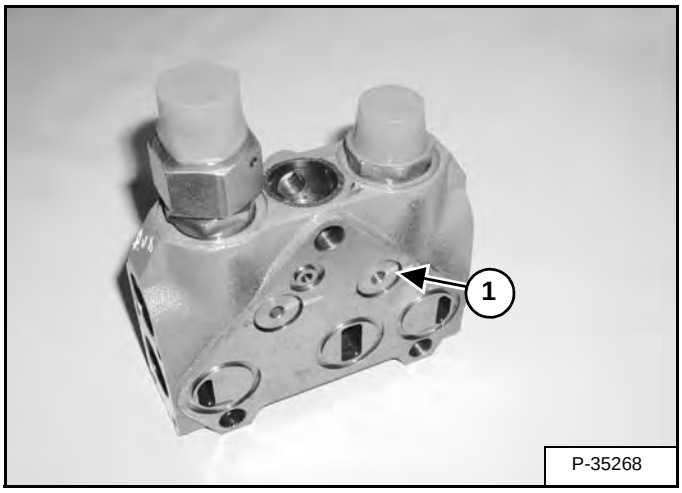
Left Travel, Right Travel And Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-59



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

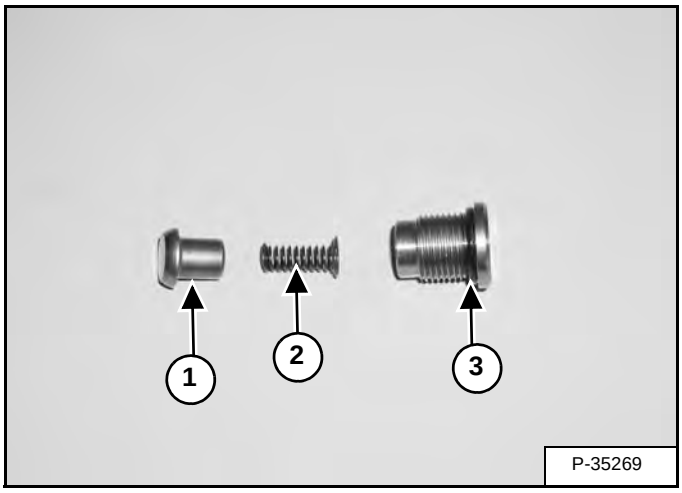
Figure 20-40-60



Remove the check valves (Item 1) **[Figure 20-40-60]**.

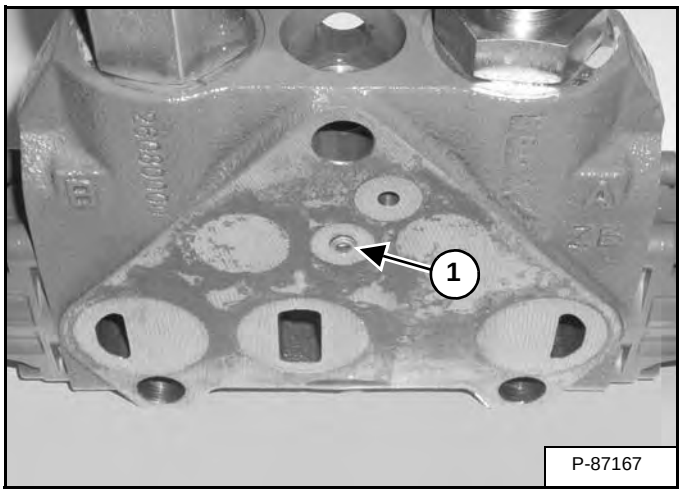
Installation: Tighten the check valves to 27 - 33 N•m (20 - 24 ft-lb) torque.

Figure 20-40-61



Remove the poppet (Item 1) and spring (Item 2) from the plug. Remove the O-ring (Item 3) **[Figure 20-40-61]** from the plug.

Figure 20-40-62



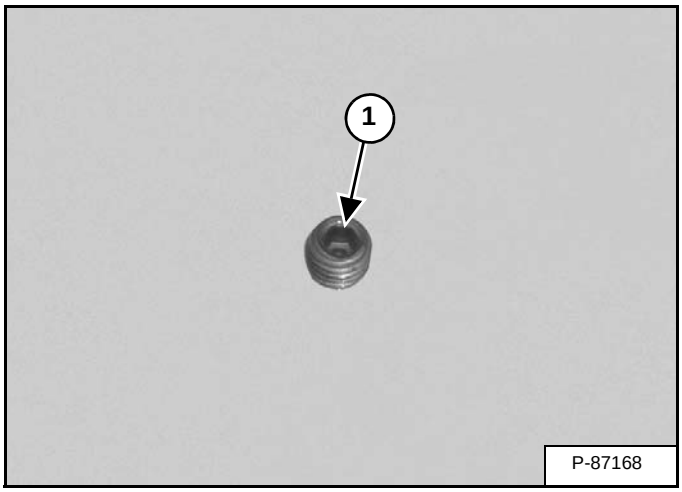
Remove the orifice (Item 1) **[Figure 20-40-62]**.

NOTE: The right travel valve section is the only section equipped with an orifice.

Dealer Copy -- Not for Resale

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

Figure 20-40-63

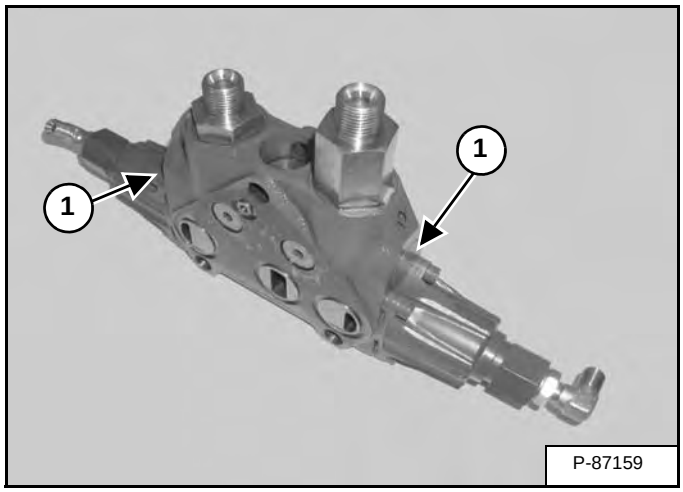


Inspect the orifice (Item 1) **[Figure 20-40-63]** for damage and plugging.

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Auxiliary And Slew Valve Section Disassembly And Assembly

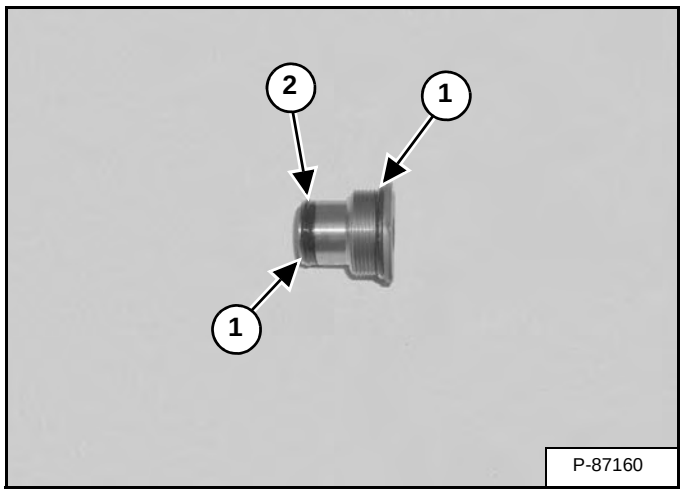
Figure 20-40-64



Remove the plugs (Item 1) **[Figure 20-40-64]**.

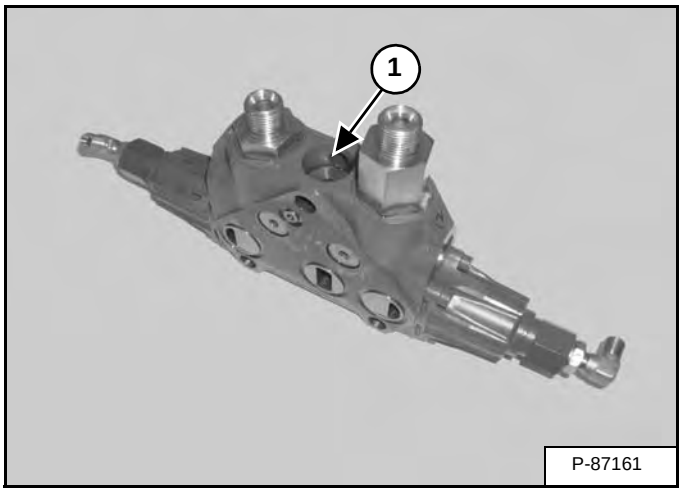
Installation: Tighten the plug to 70 N•m (52 ft-lb) torque.

Figure 20-40-65



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-65]**.

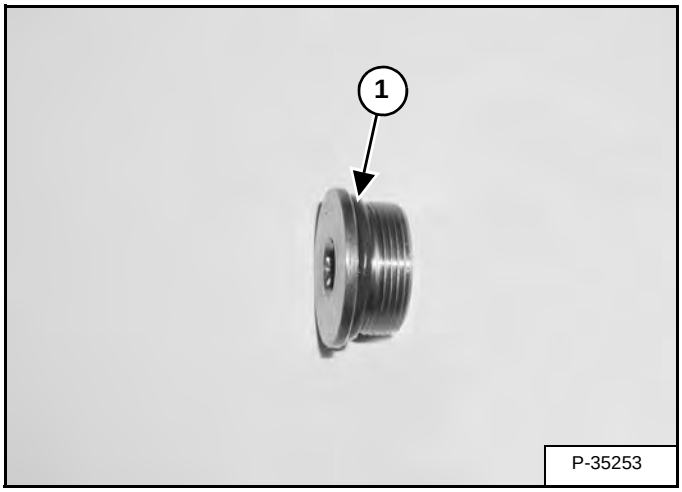
Figure 20-40-66



Remove the plug (Item 1) **[Figure 20-40-66]**.

Installation: Tighten the plug to 54 - 66 N•m (40 - 48 ft-lb) torque.

Figure 20-40-67

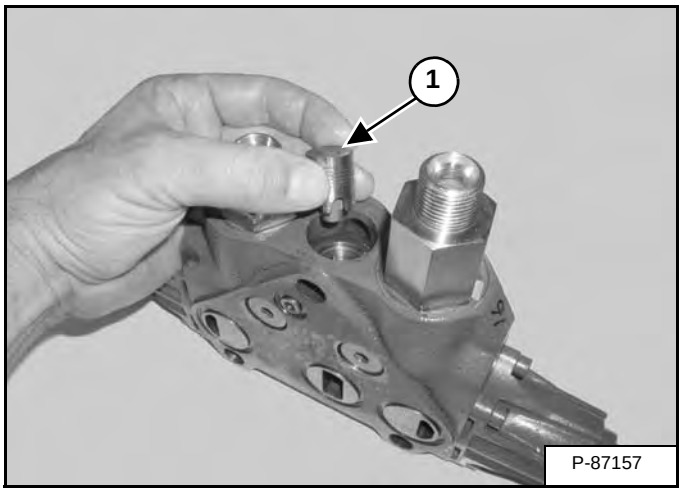


Remove the O-ring (Item 1) **[Figure 20-40-67]**.

Dealer Copy -- Not for Resale

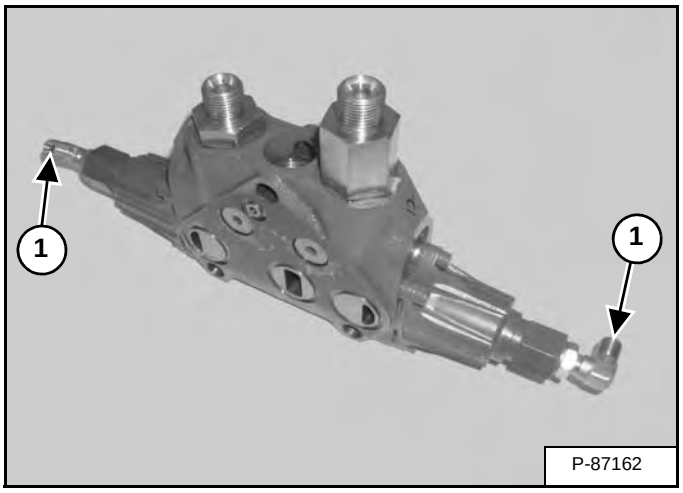
Auxiliary And Slew Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-68



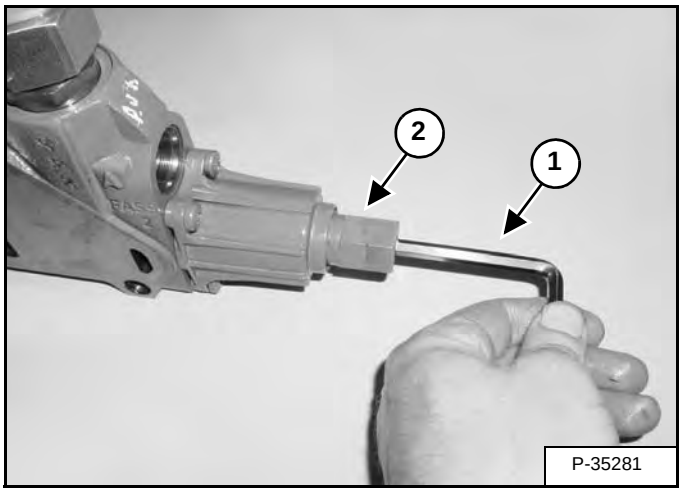
Remove the compensator (Item 1) **[Figure 20-40-68]**.

Figure 20-40-69



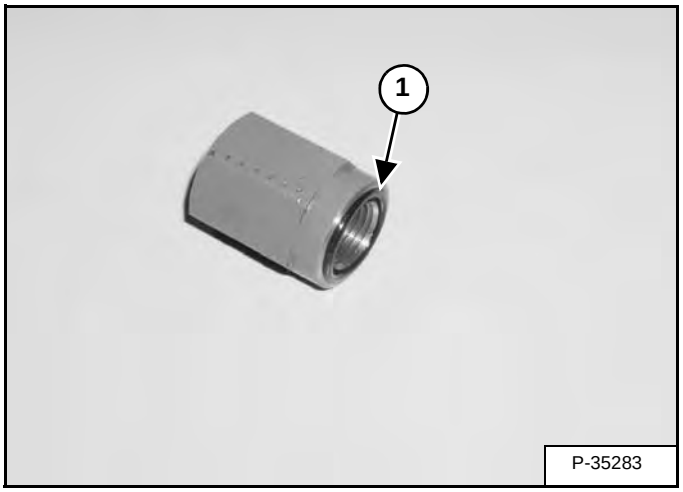
Remove the fittings (Item 1) **[Figure 20-40-69]** from both ends of the valve section.

Figure 20-40-70



Hold the spool stroke limitation adjustment screw (Item 1) to remove the fitting (Item 2) **[Figure 20-40-70]**.

Figure 20-40-71

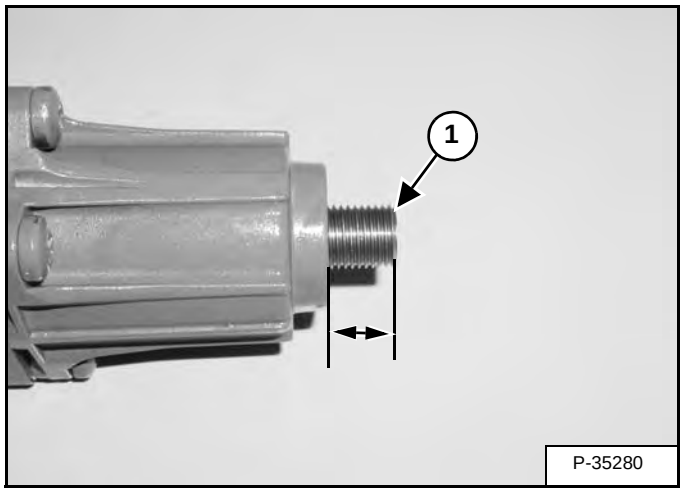


Remove the O-ring (Item 1) **[Figure 20-40-71]**.

Dealer Copy -- Not for Resale

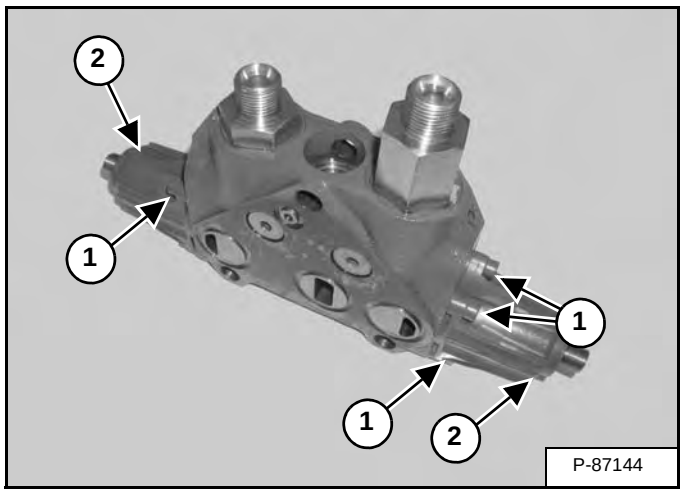
Auxiliary And Slew Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-72



Record the distance of the spool stroke limitation adjustment screw (Item 1) **[Figure 20-40-72]** for correct installation.

Figure 20-40-73

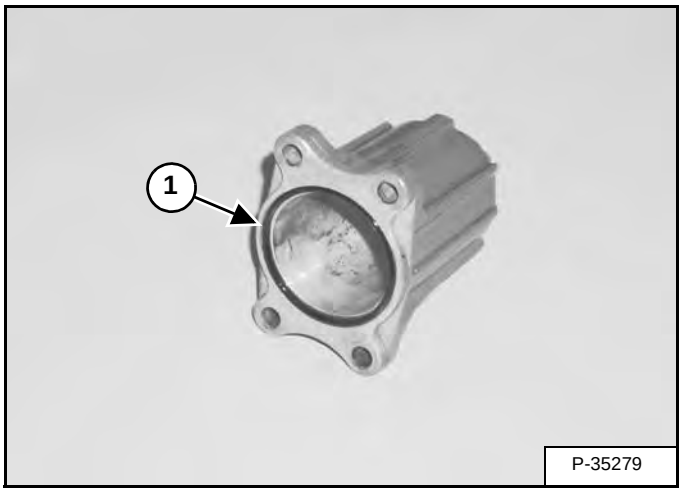


Remove the four screws (Item 1) **[Figure 20-40-73]** from both ends of the value.

Installation: Tighten the screws to 25 N•m (18 ft-lb) torque.

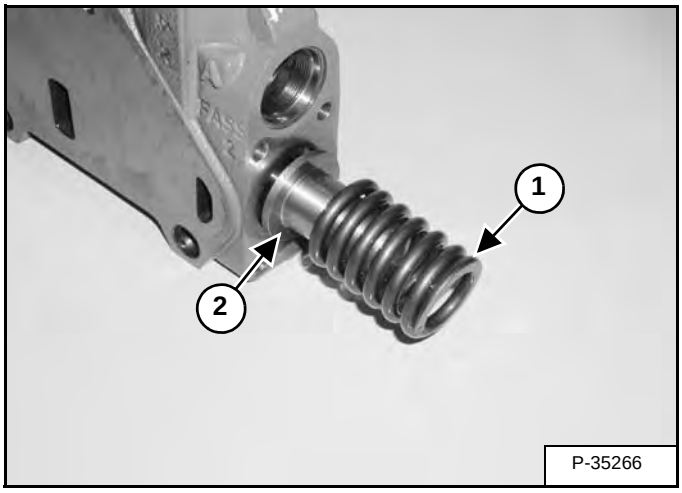
Remove both covers (Item 2) **[Figure 20-40-73]**

Figure 20-40-74



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

Figure 20-40-75



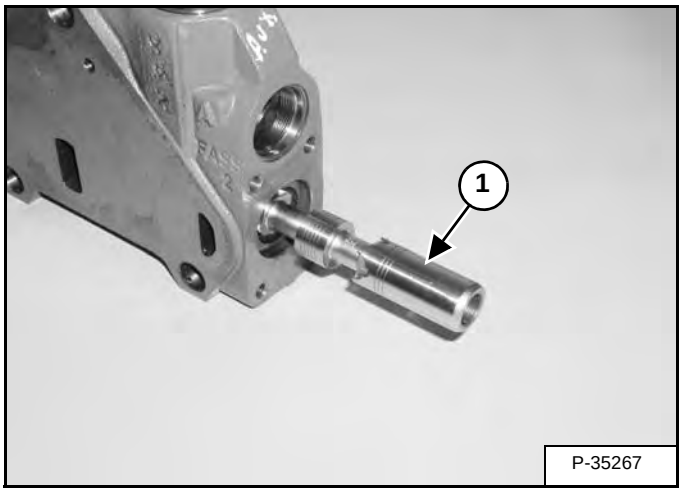
Remove the centering spring (Item 1) **[Figure 20-40-75]**.

Remove the spring seat (Item 2) **[Figure 20-40-75]** from both ends.

Dealer Copy -- Not for Resale

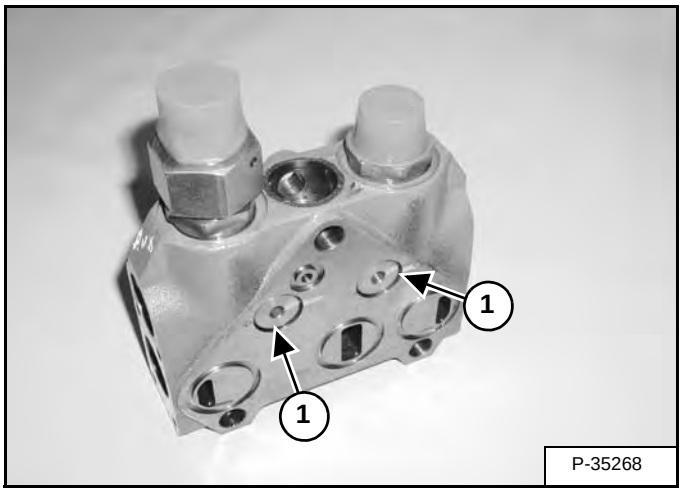
Auxiliary And Slew Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-76



Remove the spool (Item 1) **[Figure 20-40-76]**.

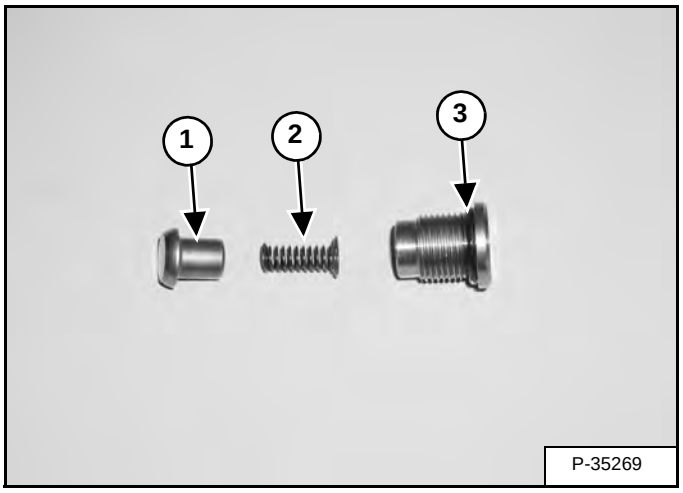
Figure 20-40-77



Remove the check valves (Item 1) **[Figure 20-40-77]**.

Tighten the check valves to 27 - 33 N•m (20 - 24 ft-lb) torque.

Figure 20-40-78

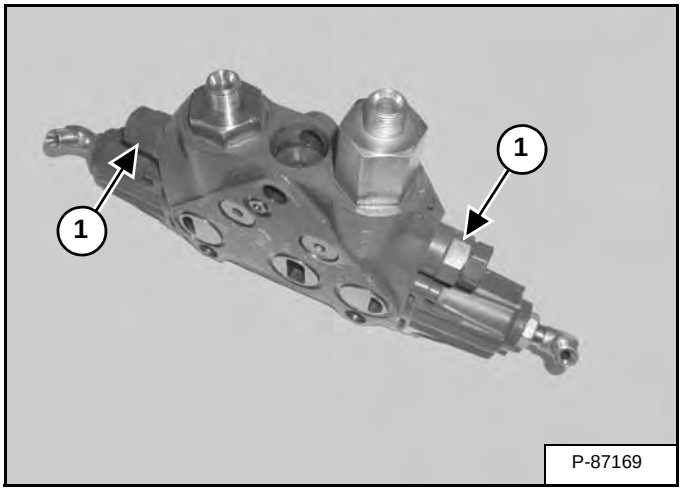


Remove the poppet (Item 1) and spring (Item 2) from the plug. Remove the O-ring (Item 3) **[Figure 20-40-78]** from the plug.

Dealer Copy -- Not for Resale

Boom Swing Valve Section Disassembly And Assembly

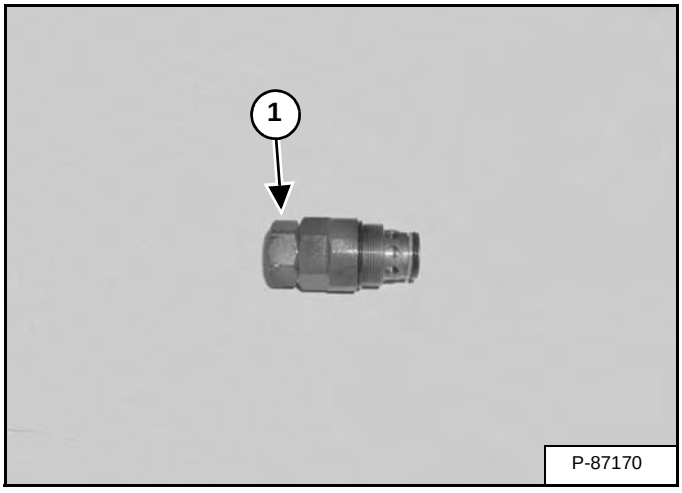
Figure 20-40-79



Remove the valves (Item 1) **[Figure 20-40-79]**.

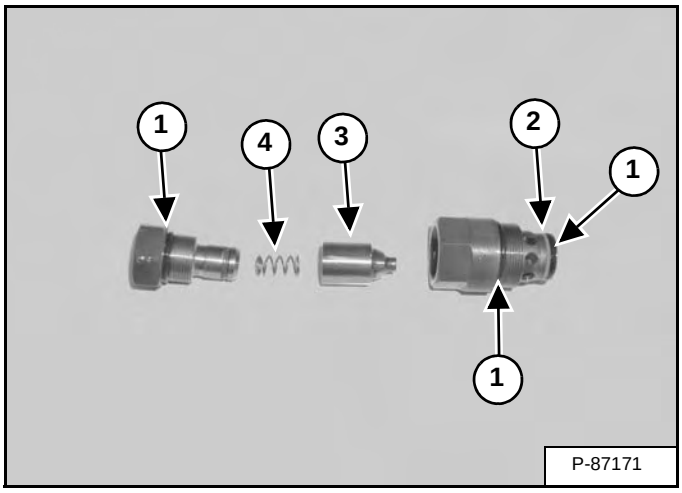
Installation: Tighten the valves to 70 N•m (52 ft-lb) torque.

Figure 20-40-80



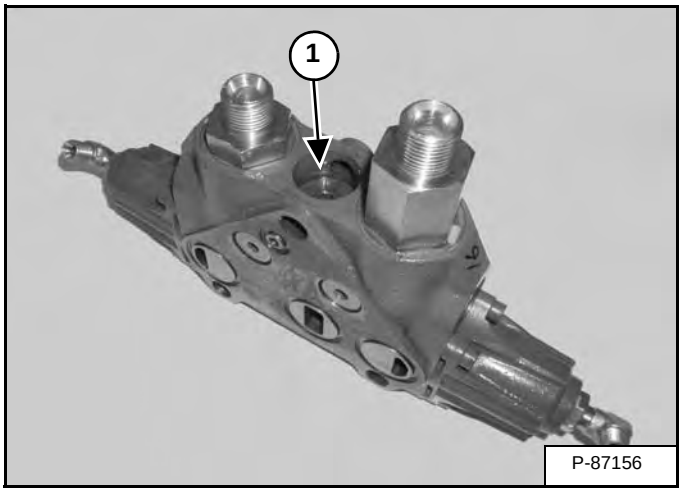
Remove the plug (Item 1) **[Figure 20-40-80]** from the body.

Figure 20-40-81



Remove the O-rings (Item 1) and back-up ring (Item 2) from the plug and the body. Remove the poppet (Item 3) and spring (Item 4) **[Figure 20-40-81]**.

Figure 20-40-82



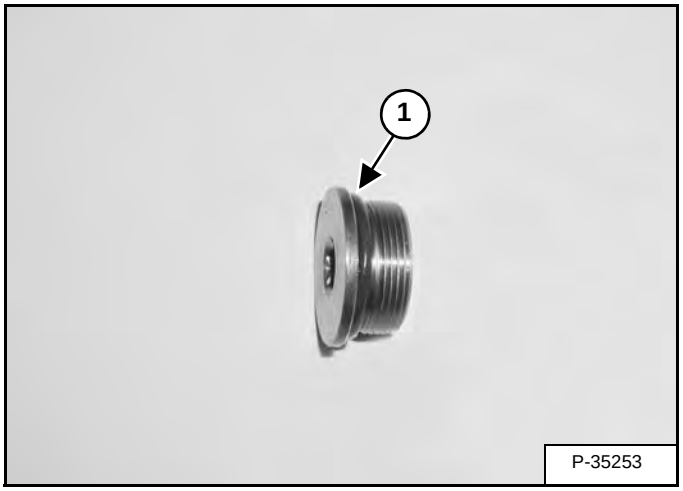
Remove the plug (Item 1) **[Figure 20-40-82]**.

Installation: Tighten the plug to 54 - 66 N•m (40 - 48 ft-lb) torque.

Dealer Copy -- Not for Resale

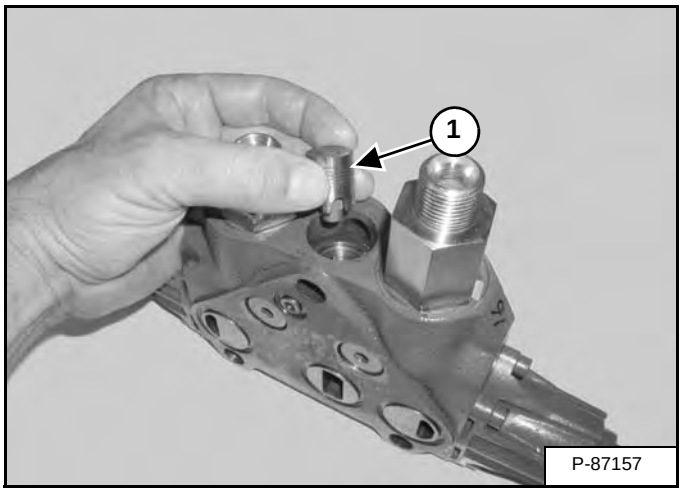
Boom Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-83



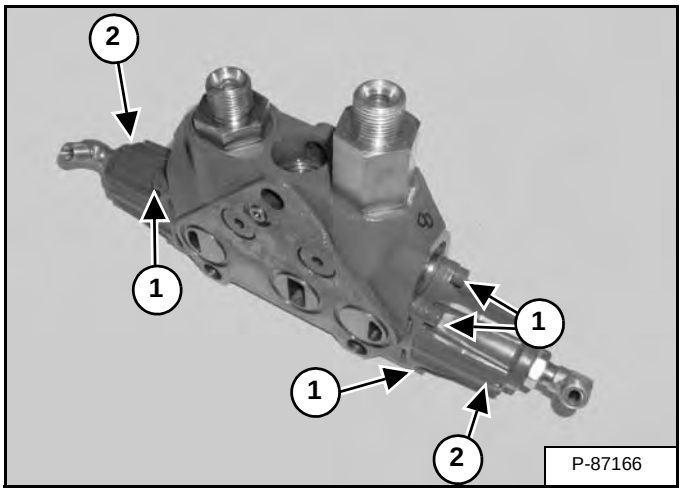
Remove the O-ring (Item 1) **[Figure 20-40-83]**.

Figure 20-40-84



Remove the compensator (Item 1) **[Figure 20-40-84]**.

Figure 20-40-85

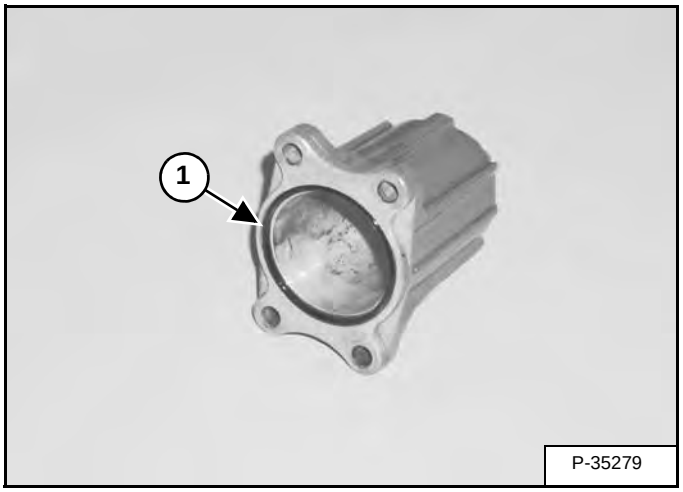


Remove the four screws (Item 1) **[Figure 20-40-85]** from both ends of the valve.

Installation: Tighten the screws to 25 N•m (18 ft-lb) torque.

Remove both covers (Item 2) **[Figure 20-40-85]**.

Figure 20-40-86

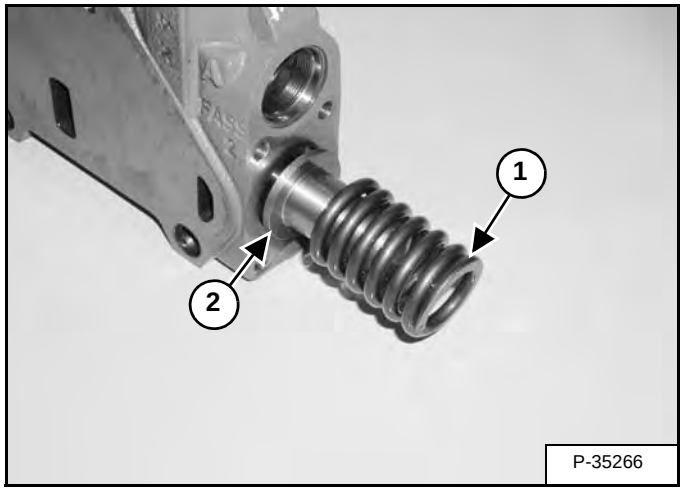


Remove the O-ring (Item 1) **[Figure 20-40-86]**.

Dealer Copy -- Not for Resale

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

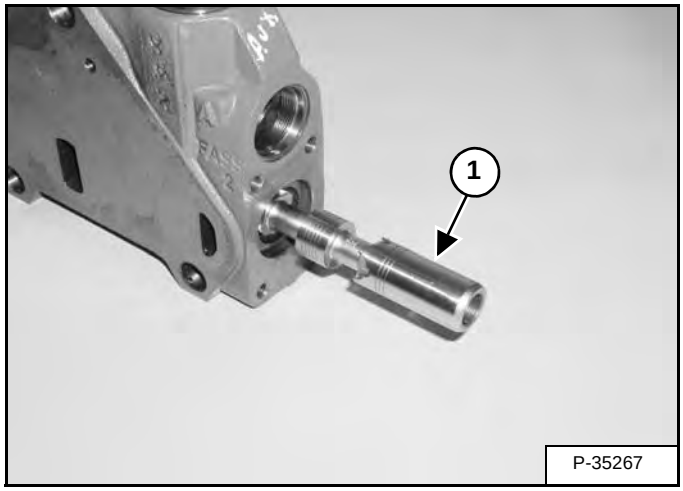
Figure 20-40-87



Remove the centering spring (Item 1) **[Figure 20-40-87]** from both ends.

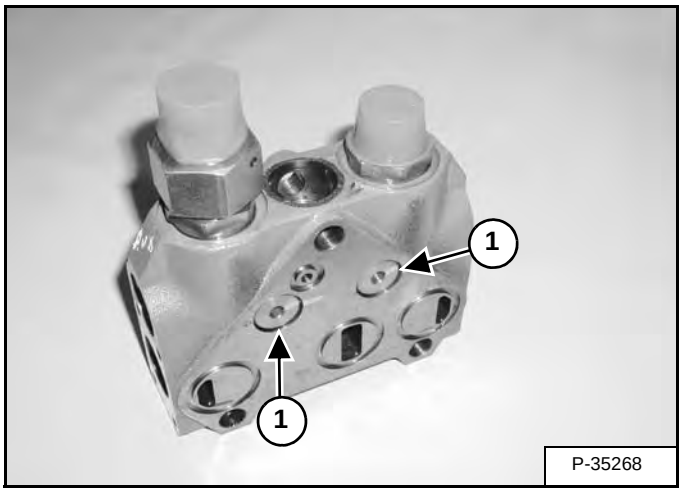
Remove the spring seat (Item 2) **[Figure 20-40-87]** from both ends.

Figure 20-40-88



Remove the spool (Item 1) **[Figure 20-40-88]**.

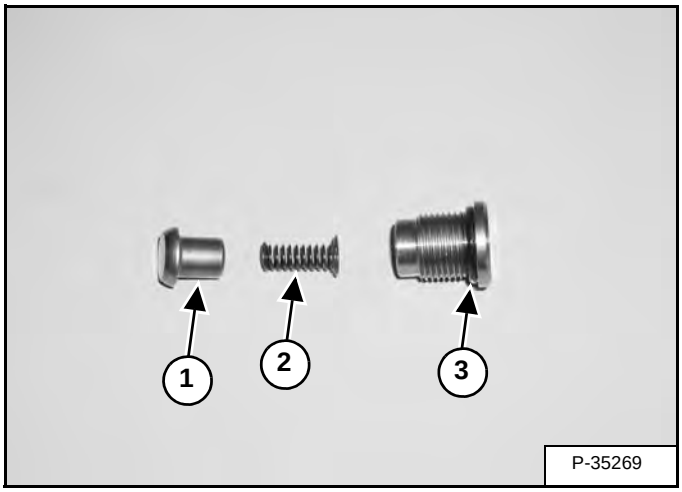
Figure 20-40-89



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

Installation: Tighten the check valves to 27 - 33 N•m (20 - 24 ft-lb) torque.

Figure 20-40-90



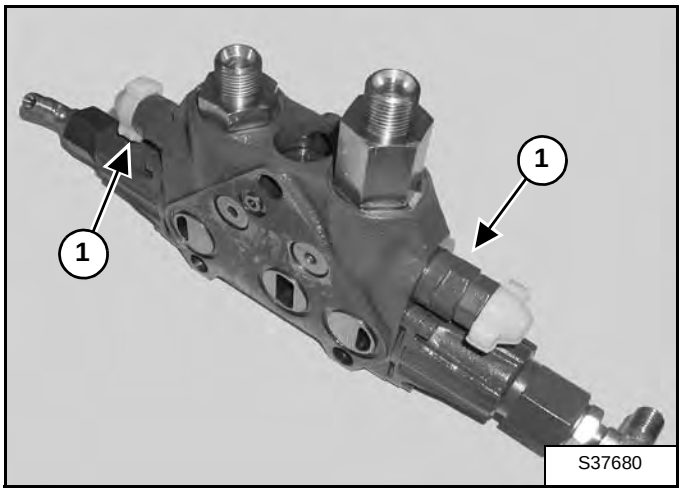
Remove the poppet (Item 1) and spring (Item 2) from the plug. Remove the O-ring (Item 3) **[Figure 20-40-90]** from the plug.

Dealer Copy -- Not for Resale

Articulated Boom Valve Section Disassembly And Assembly

The articulated boom valve section (if equipped) controls the hydraulic movement of the articulated boom cylinders (optional).

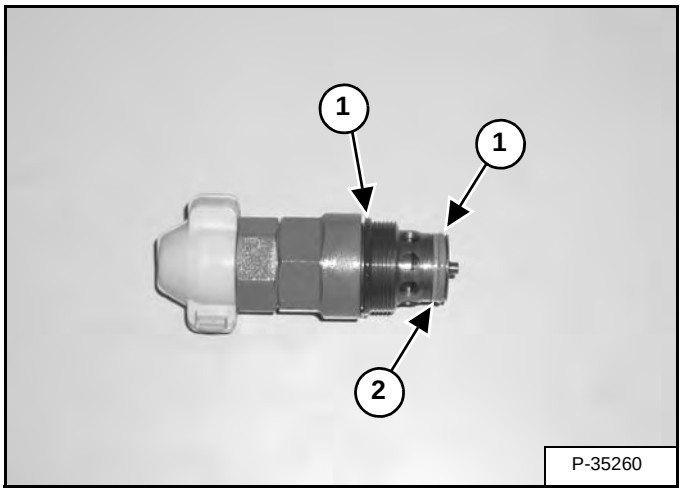
Figure 20-40-91



Remove the relief valves (Item 1) **[Figure 20-40-91]**.

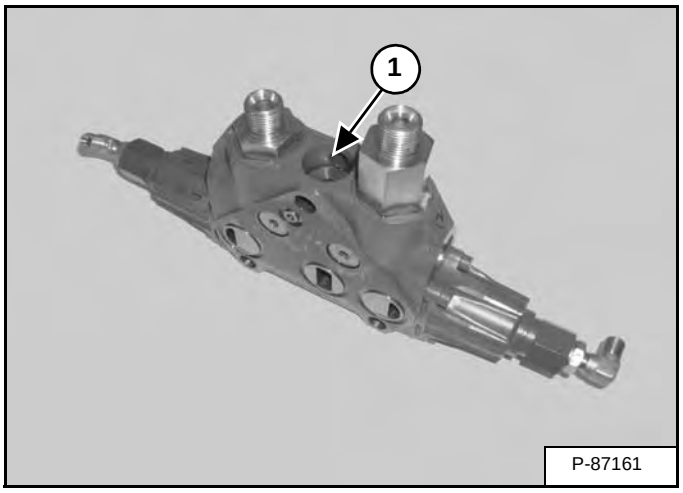
Installation: Tighten the valves to 70 N•m (52 ft-lb) torque.

Figure 20-40-92



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-40-92]**.

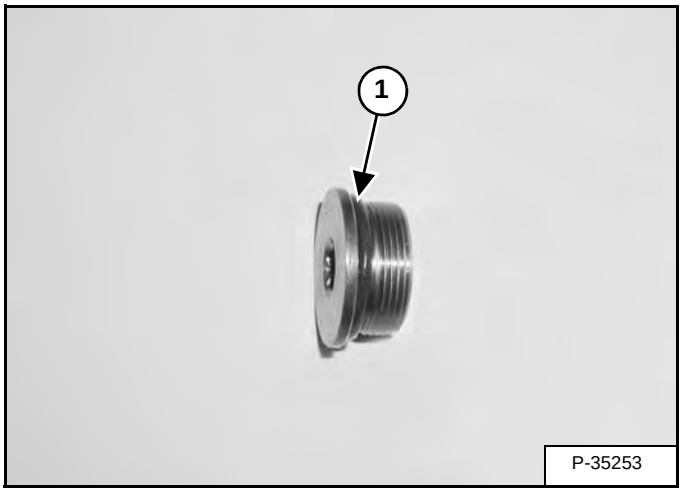
Figure 20-40-93



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

Installation: Tighten the plug to 54 - 66 N•m (40 - 48 ft-lb) torque.

Figure 20-40-94

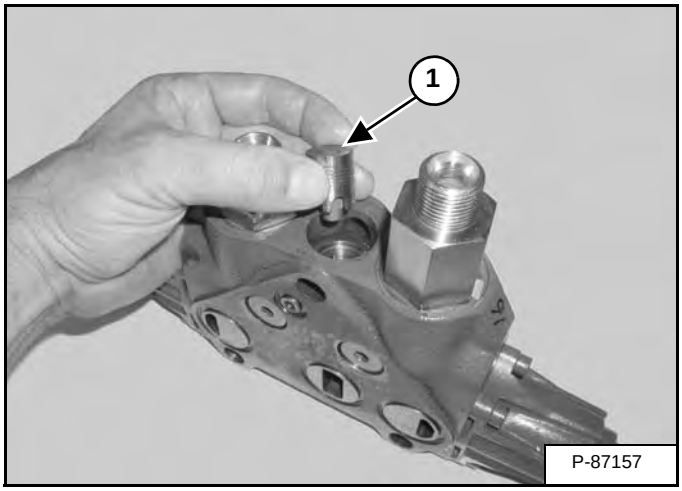


Remove the O-ring (Item 1) **[Figure 20-40-94]**.

Dealer Copy -- Not for Resale

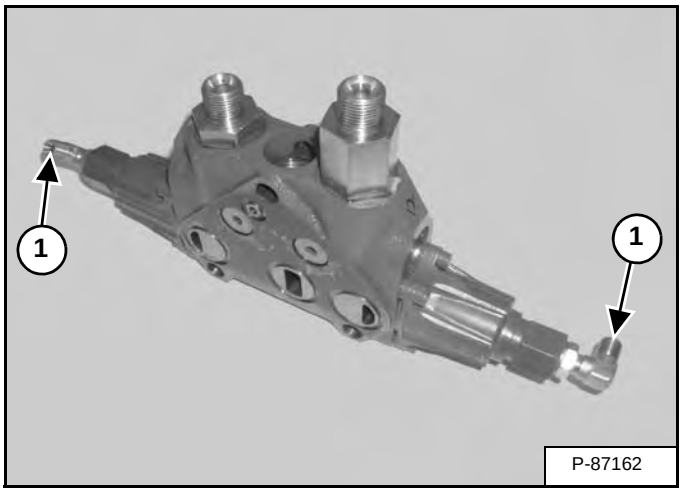
Articulated Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-95



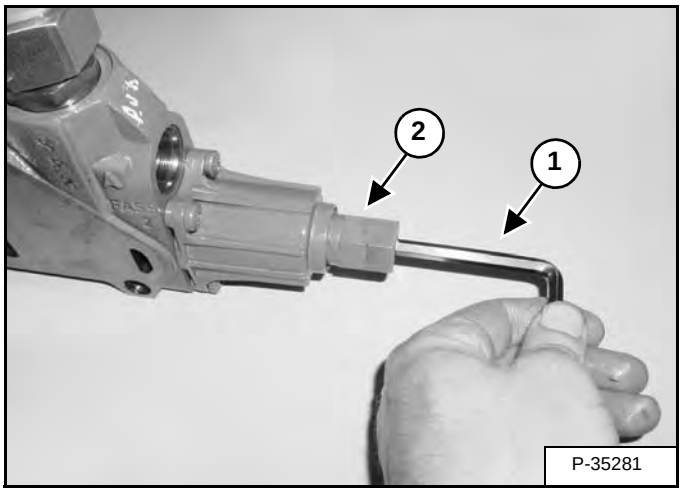
Remove the compensator (Item 1) **[Figure 20-40-95]**.

Figure 20-40-96



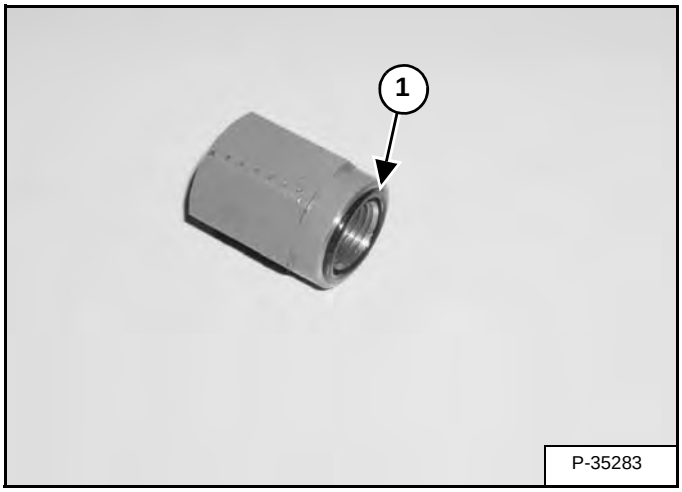
Remove the fittings (Item 1) **[Figure 20-40-96]** from both ends of the valve section.

Figure 20-40-97



Hold the spool stroke limitation adjustment screw (Item 1) to remove the fitting (Item 2) **[Figure 20-40-97]**.

Figure 20-40-98

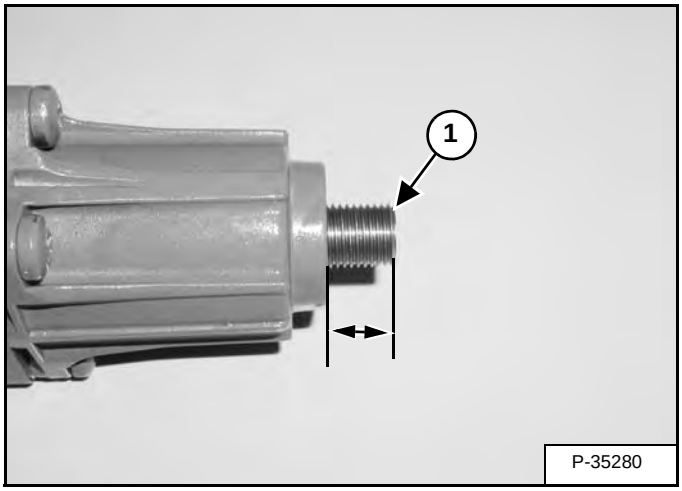


Remove the O-ring (Item 1) **[Figure 20-40-98]**.

Dealer Copy -- Not for Resale

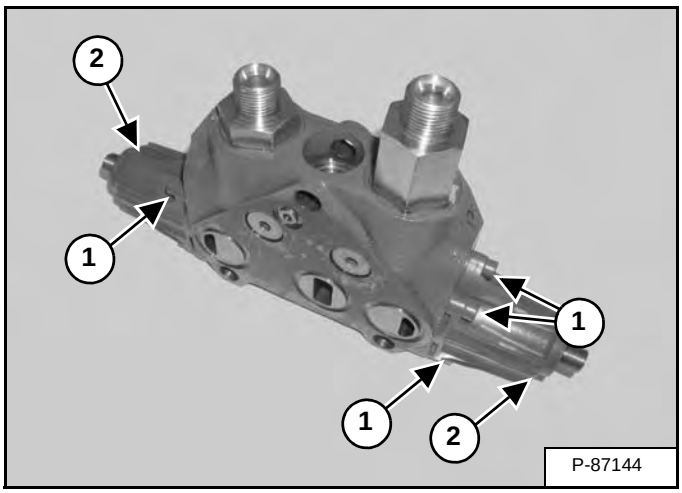
Articulated Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-99



Record the distance of the spool stroke limitation adjustment screw (Item 1) **[Figure 20-40-99]** for correct installation.

Figure 20-40-100

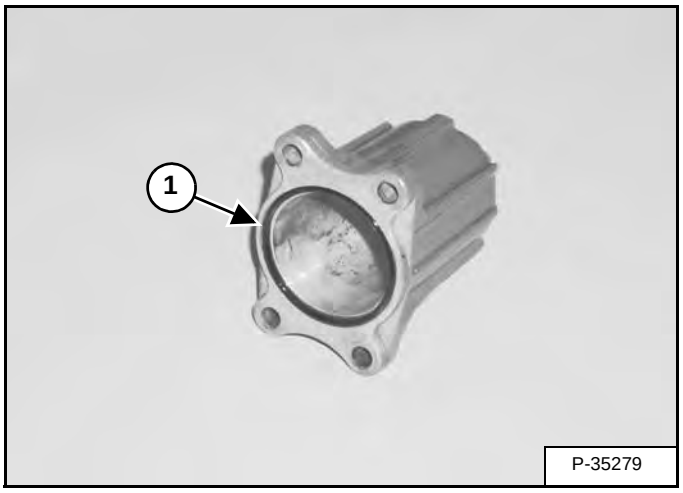


Remove the four screws (Item 1) **[Figure 20-40-100]** from both ends of the valve.

Installation: Tighten the screws to 25 N•m (18 ft-lb) torque.

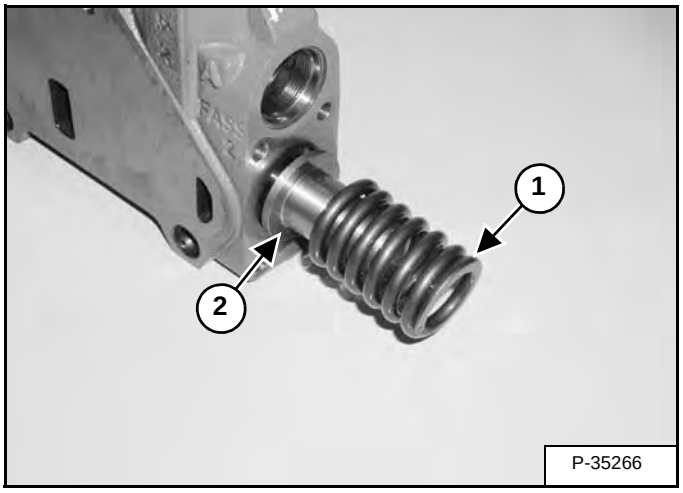
Remove both covers (Item 2) **[Figure 20-40-100]**

Figure 20-40-101



Remove the O-ring (Item 1) **[Figure 20-40-101]**.

Figure 20-40-102



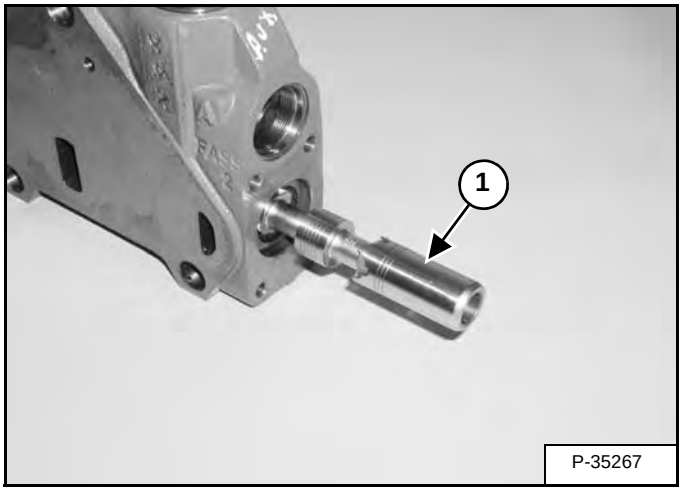
Remove the centering spring (Item 1) **[Figure 20-40-102]**.

Remove the spring seat (Item 2) **[Figure 20-40-102]** from both ends.

Dealer Copy -- Not for Resale

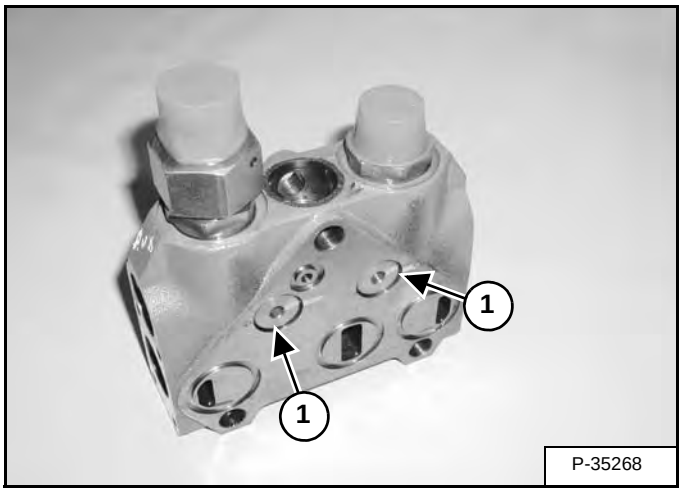
Articulated Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-103



Remove the spool (Item 1) **[Figure 20-40-103]**.

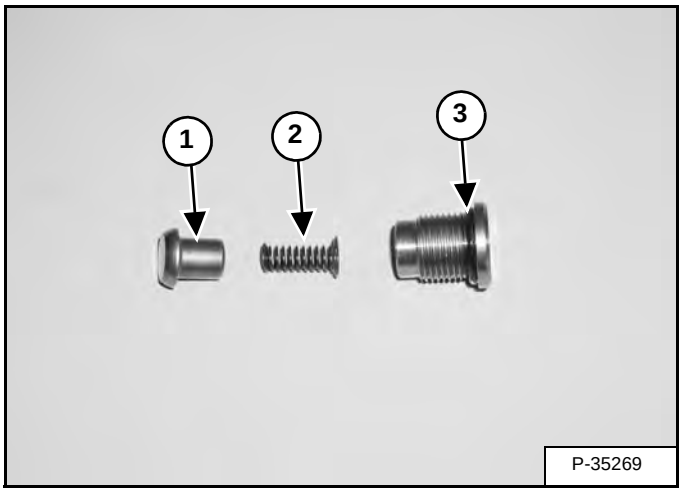
Figure 20-40-104



Remove the check valves (Item 1) **[Figure 20-40-104]**.

Tighten the check valves to 27 - 33 N•m (20 - 24 ft-lb) torque.

Figure 20-40-105



Remove the poppet (Item 1) and spring (Item 2) from the plug. Remove the O-ring (Item 3) **[Figure 20-40-105]** from the plug.

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PUMP (HYDRAULIC PISTON)

Hydraulic Pump Work Sheet

Please review pump procedure as illustrated in Pump Testing on Page 20-50-6.

If any of the following adjustments are not obtainable, pump repair is required.

The outline listed below, gives the five adjustments for setting the hydraulic pump. The adjustments are listed in the order in which they ***MUST*** be performed. Below each adjustment is a list of the steps. Behind each adjustment is the page location within the Service Manual for the complete adjustment procedure.

I. Torque Limiter Supply Pressure Adjustment on Page 20-50-6.

1. Bottom out pump margin spool (Approximately six turns in).
2. Remove the plug and install fitting and hose from the torque limit supply spool to a drain pan.
3. Install a 5000 kPa (50 bar) (725 psi) pressure gauge on the test port on the hydraulic control valve.
4. Warm hydraulic fluid to 50 - 60°C (122 - 144°F).
5. Run engine at high idle
6. Adjust as necessary to get 2000 ± 138 kPa (20 ± 1,38 bar) (290 ± 20 psi).
7. Record pressure

_____ **TLS PRESSURE**

8. Remove the hose and fitting from the torque limiter supply spool and plug the port
9. Reset pump margin spool (Approximately six turns out.)

II. Pump Margin Pressure Adjustment on Page 20-50-7.

10. Run engine at high idle
11. Adjust as necessary to get 1800 ± 138 kPa (18 ± 1,38 bar) (260 ± 20 psi).
12. Record pressure

_____ **PM PRESSURE**

13. Remove 5000 kPa (50 bar) (725 psi) pressure gauge.

III. Back-up Relief Valve Adjustment on Page 20-50-7.

14. Install 69000 kPa (690 bar) (10000 psi) gauge on the test port on the hydraulic control valve.
15. Turn the load sense relief valve in 1 turn.
16. Run engine at high idle and raise the blade until the blade cylinders are fully retracted and the relief valve opens.
17. Adjust back-up relief valve as necessary to get 34000 ± 345 kPa (340 ± 3,45 bar) (4931 ± 50 psi).

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Hydraulic Pump Work Sheet (Cont'd)

18. Record pressure

19. Reset load sense relief valve (one turn out)

_____ **PRESSURE**

IV. Load Sense Relief Valve Adjustment on Page 20-50-9.

20. Install 69000 kPa (690 bar) (10000 psi) gauge on the test port on the hydraulic control valve.

21. Run engine at high idle and raise the blade until the blade cylinders are fully retracted and the relief valve opens.

22. Adjust load sense relief valve as necessary to get 28000 ± 345 kPa (280 ± 3,45 bar) (4060 ± 50 psi).

23. Record pressure

_____ **PRESSURE**

24. Remove the 69000 kPa (690 bar) (10000 psi) gauge, from the diagnostic coupler at the hydraulic control valve.

V. Torque Limiter Adjustment on Page 20-50-10.

25. Remove the outlet hose from the pump, install a cap on the hose and install the inlet hose from the hydraulic tester, to the outlet of the pump.

26. Route the outlet hose of the hydraulic tester to the tee fitting installed on the hydraulic reservoir adapter.

27. Bottom out the pump margin spool (approximately six turns in)

28. Run engine at high idle.

29. Free flow on the hydraulic tester is 144 L/min (38 U.S. gpm)

30. Adjust the hydraulic tester to 10300 kPa (103 bar) (1500 psi)

31. Adjust torque limiter to 129 - 136 L/min (34 - 36 U.S. gpm).

32. Record flow and engine rpm.

_____ **FLOW**

33. Adjust the hydraulic tester to 24100 kPa (241 bar) (3500 psi).

34. Adjust the torque limiter to obtain 57 - 64 L/min (15 - 17 U.S. gpm)

35. Record flow and engine rpm.

_____ **FLOW**

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Hydraulic Pump Work Sheet (Cont'd)

36. Remove the hydraulic tester

37. Install the pump outlet hose on the hydraulic control valve.

38. Reset pump margin spool to 1800 ± 138 kPa (18 ± 1,38 bar) (260 ± 20 psi).

ALL PUMP ADJUSTMENTS ARE NOW COMPLETED

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Testing Information

The testing of the piston pump must be done in the following order:

Torque limiter supply pressure
Pump margin pressure
Back-up Relief Valve
Load sense relief valve
Torque Limiter

All testing is done with the hydraulic oil at 50 - 60°C (122 - 140°F).

Check and adjust the engine high idle as needed before any hydraulic testing.

The hydraulic hoses, tubelines and fittings on the E80 Excavator are BSPP fittings.

To test the piston pump, order the test kit:

MEL1713 - Hydraulic Test Kit

Use the gauge and hose assembly from test kit MEL1173A.

Figure 20-50-1

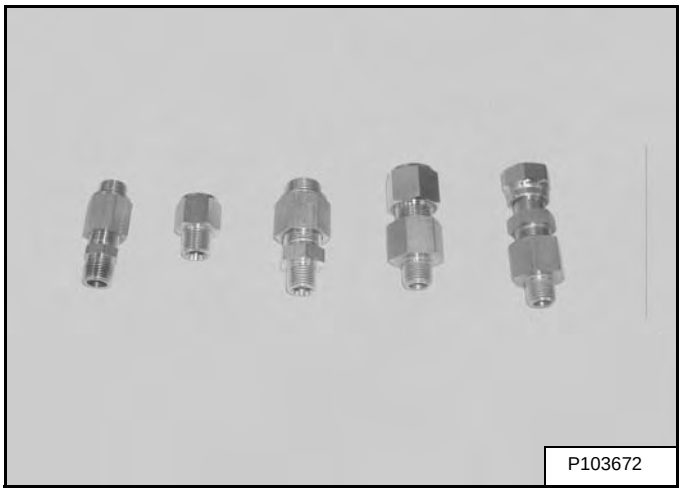


Figure 20-50-2



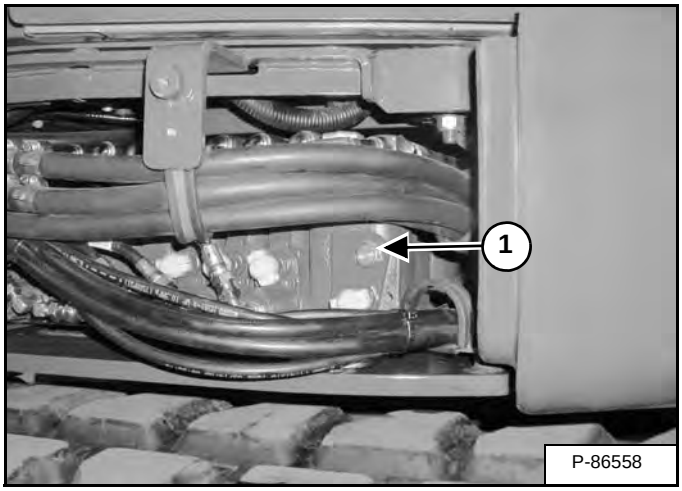
[Figure 20-50-1] and **[Figure 20-50-2]** show the components of MEL1713 Hydraulic Test Kit.

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Testing Information (Cont'd)

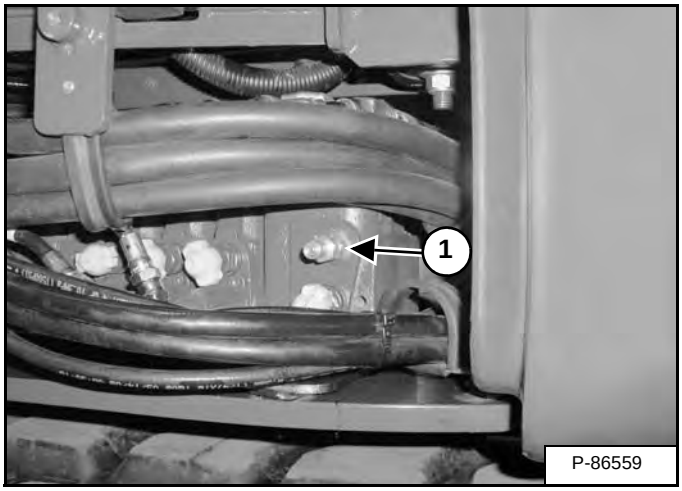
Remove the left upperstructure cover. (See Removal And Installation on Page 40-20-1.)

Figure 20-50-3



Remove the plug (Item 1) **[Figure 20-50-3]** from the hydraulic control valve.

Figure 20-50-4



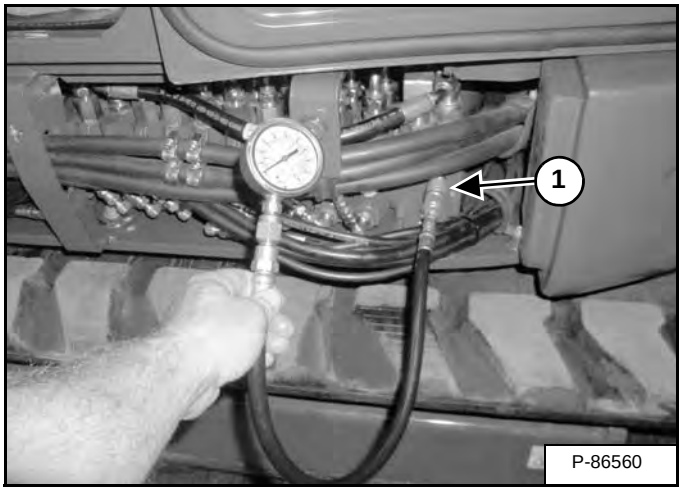
Install the test coupler (Item 1) **[Figure 20-50-4]**.

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Pump Testing

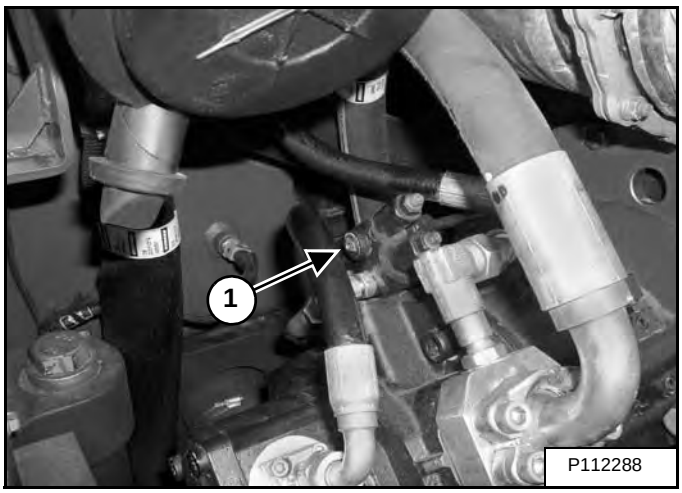
Torque Limiter Supply Pressure Adjustment

Figure 20-50-5



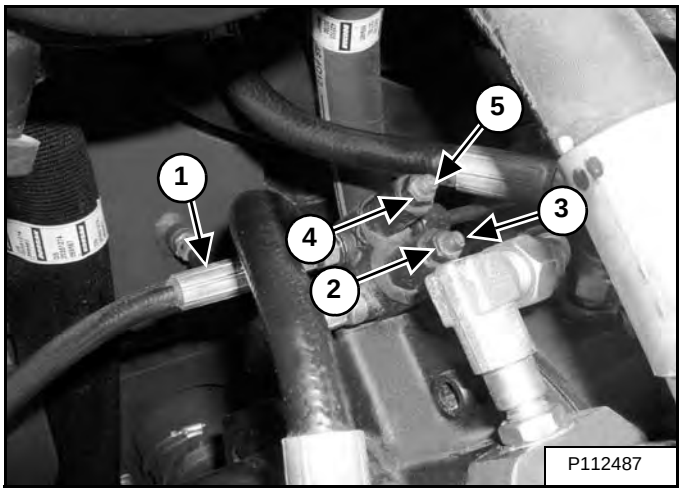
Install a 50000 kPa (500 bar) (725 psi) pressure gauge on the test coupler (Item 1) **[Figure 20-50-5]**.

Figure 20-50-6



Remove the plug (Item 1) **[Figure 20-50-6]**.

Figure 20-50-7



Install a fitting and drain hose (Item 1) **[Figure 20-50-7]**. Place the other end of the hose in a drain pan.

NOTE: To adjust the Torque Limiter Supply Pressure, the Pump Margin Spool must be temporarily bottomed out.

Loosen the nut (Item 2) **[Figure 20-50-7]**.

Turn the pump margin spool (bottom spool) (Item 3) **[Figure 20-50-7]** all the way in (approximately six turns).

Start the engine and run it at high idle.

Loosen the nut (Item 4) and adjust the torque limiter supply pressure spool (Item 5) **[Figure 20-50-7]** until the pressure gauge reads 2000 kPa (20 bar) (290 psi).

Turn the adjustment screw clockwise to increase pressure and counterclockwise to decrease pressure.

NOTE: 1/4 turn is approximately 241 kPa (2,41 bar) (35 psi).

Tighten the nut (Item 4) **[Figure 20-50-7]**.

Stop the engine.

Repeat the procedure listed above until the pressure is set.

Turn the pump margin spool (bottom spool) (Item 3) **[Figure 20-50-7]** back to its original position (approximately six turns).

Tighten the nut (Item 2) **[Figure 20-50-7]**.

Remove the hose (Item 1) **[Figure 20-50-7]** and fitting. Install the plug.

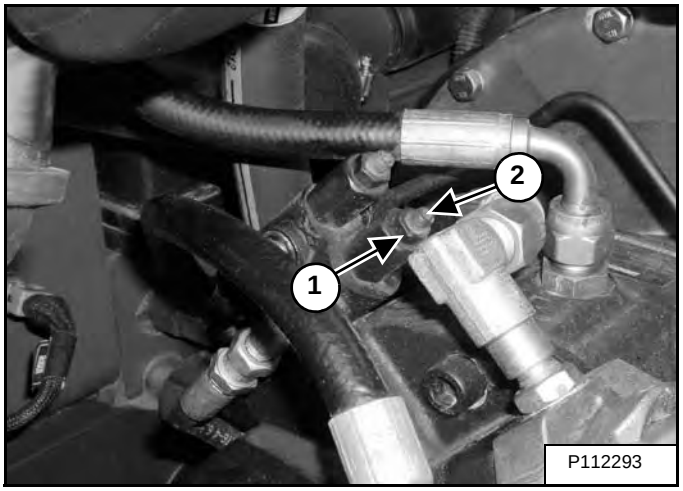
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Pump Testing (Cont'd)

Pump Margin Pressure Adjustment

Start the engine and run at high idle.

Figure 20-50-8



Loosen the nut (Item 1) and adjust the pump margin pressure adjustment spool (Item 2) **[Figure 20-50-8]** until the pressure gauge reads 1800 kPa (18 bar) (260 psi).

Turn the adjustment screw clockwise to increase pressure and counterclockwise to decrease pressure.

NOTE: 1/4 turn is 345 kPa (3,45 bar) (50 psi).

Tighten the nut (Item 1) **[Figure 20-50-8]**.

Stop the engine.

Remove the gauge from the test coupler.

⚠ WARNING

AVOID INJURY OR DEATH

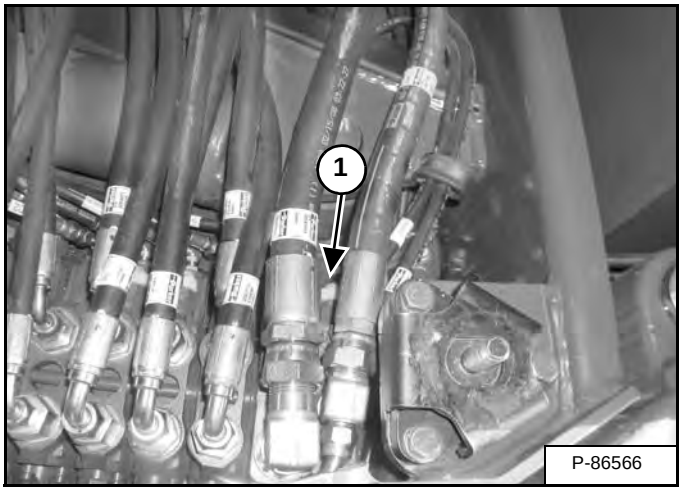
Never work under the excavator cab without installing an approved cab support device.

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Back-up Relief Valve Adjustment

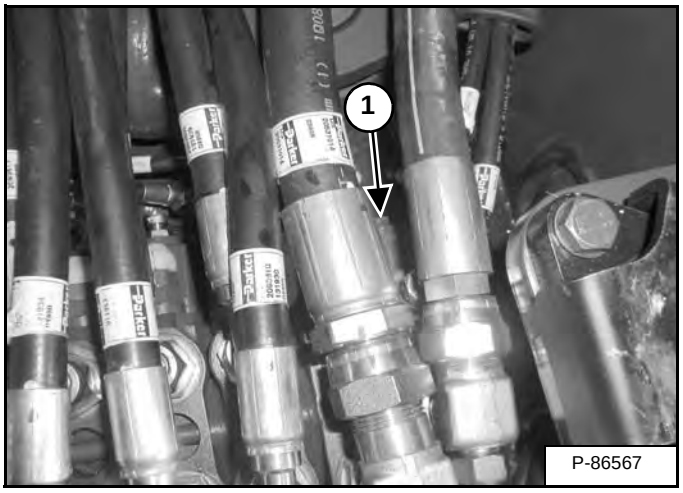
Tilt the cab. (See Raising And Lowering on Page 10-210-1.)

Figure 20-50-9



Remove the plastic cap (Item 1) **[Figure 20-50-9]**.

Figure 20-50-10



Loosen the locknut and turn the load sense relief valve adjustment screw (Item 1) **[Figure 20-50-10]** in 1.5 turn, increasing the relief pressure approximately 8274 kPa (83 bar) (1200 psi) to 36266 kPa (363 bar) (5260 psi). The load sense relief is now set to a higher pressure.

Lower the cab.

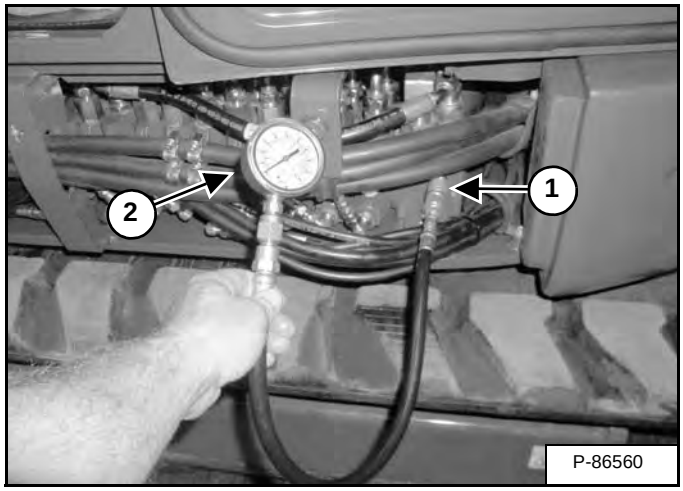
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PUMP (HYDRAULIC PISTON) (CONT'D)

Pump Testing (Cont'd)

Back-up Relief Valve Adjustment (Cont'd)

Figure 20-50-11



Install a 69000 kPa (690 bar) (10000 psi) pressure gauge on the test coupler (Item 1) **[Figure 20-50-11]**.

Start the excavator and warm up the hydraulic oil to operating temperature.

Move the engine speed control to the high speed position.

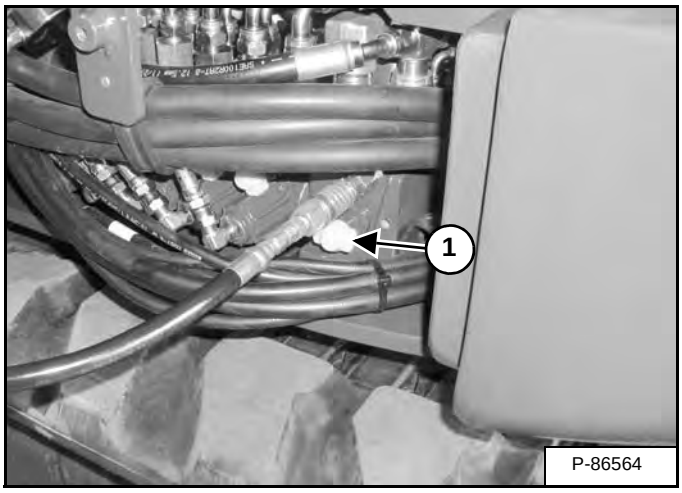
Raise the blade until the blade cylinders are fully retracted and the relief valve opens.

Record the pressure.

The pressure at the gauge (Item 2) **[Figure 20-50-11]** should be 34000 kPa (340 bar) (4931 psi).

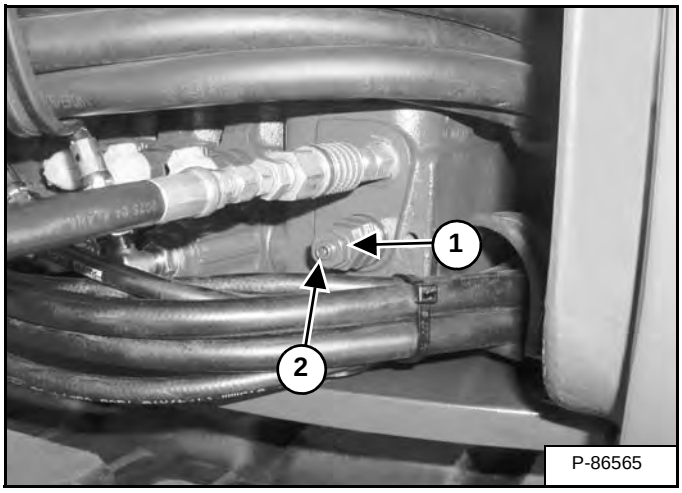
Stop the engine.

Figure 20-50-12



Remove the plastic cap (Item 1) **[Figure 20-50-12]**.

Figure 20-50-13



Loosen the lock nut (Item 1) **[Figure 20-50-13]**.

Turn the adjustment screw (Item 2) **[Figure 20-50-13]** inwards to increase pressure and outwards to decrease pressure.

NOTE: One quarter turn is approximately 1380 kPa (13,8 bar) (200 psi).

Tighten the nut and retest the back-up relief valve.

Tilt the cab and turn the load sense relief valve adjustment screw (Item 1) **[Figure 20-50-10]** one turn outwards to the original setting.

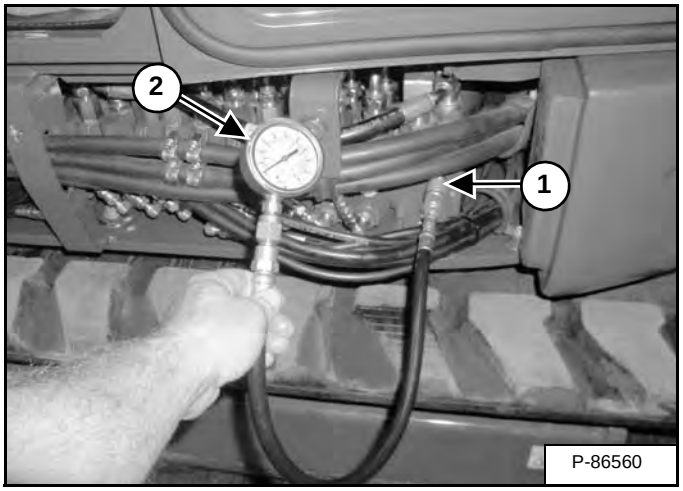
Lower the cab.

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Pump Testing (Cont'd)

Load Sense Relief Valve Adjustment

Figure 20-50-14



Install a 69000 kPa (690 bar) (10000 psi) pressure gauge on the test coupler (Item 1) **[Figure 20-50-14]**.

Move the engine speed control to the high idle position.

Raise the blade until the blade cylinders are fully retracted and the relief valve opens.

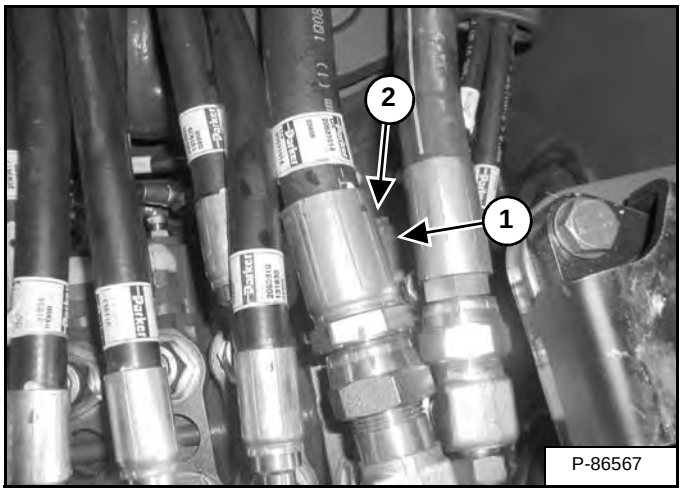
Record the pressure.

The pressure at the gauge (Item 2) **[Figure 20-50-14]** should be 28000 (280 bar) (4060 psi).

Stop the engine.

Tilt the cab. (See Raising And Lowering on Page 10-210-1.)

Figure 20-50-15



Loosen the lock nut (Item 1) **[Figure 20-50-15]**.

Turn the adjustment screw (Item 2) **[Figure 20-50-15]** inwards to increase pressure and outwards to decrease pressure.

NOTE: One quarter turn is approximately 1380 kPa (13,8 bar) (200 psi).

Tighten the lock nut and lower the cab.

⚠ WARNING

AVOID INJURY OR DEATH

Never work under the excavator cab without installing an approved cab support device.

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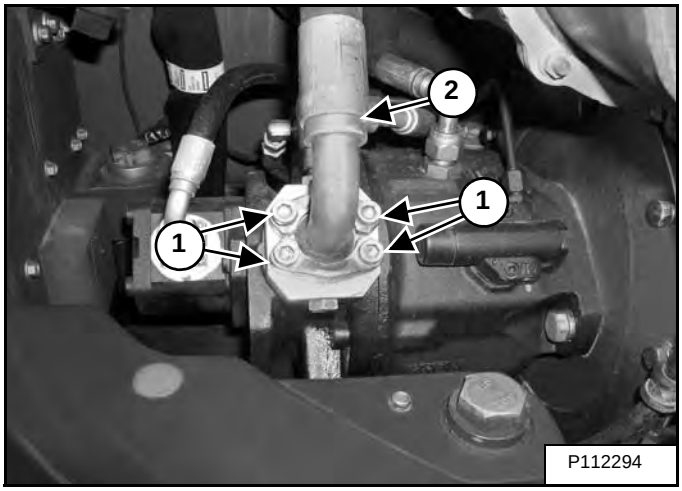
Retest the load sense relief valve.

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Pump Testing (Cont'd)

Torque Limiter Adjustment

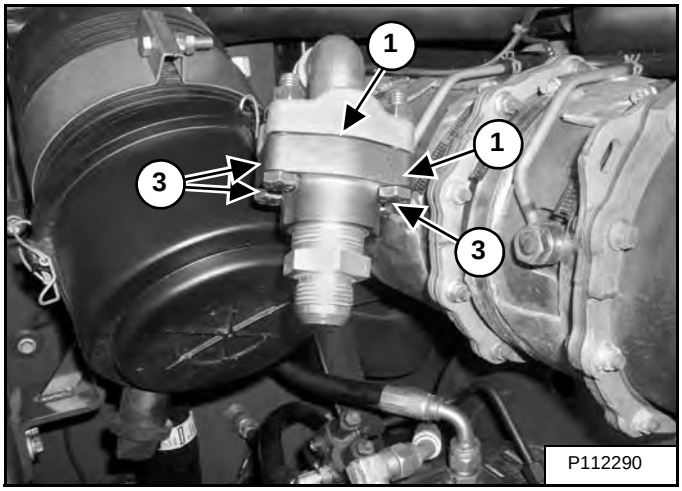
Figure 20-50-16



Remove the four bolts (Item 1) **[Figure 20-50-16]** and flanges.

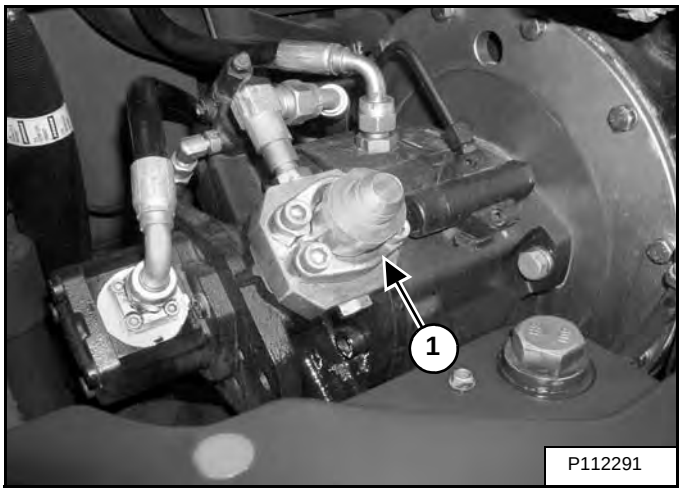
Remove the outlet hose (Item 2) **[Figure 20-50-16]** from the pump.

Figure 20-50-17



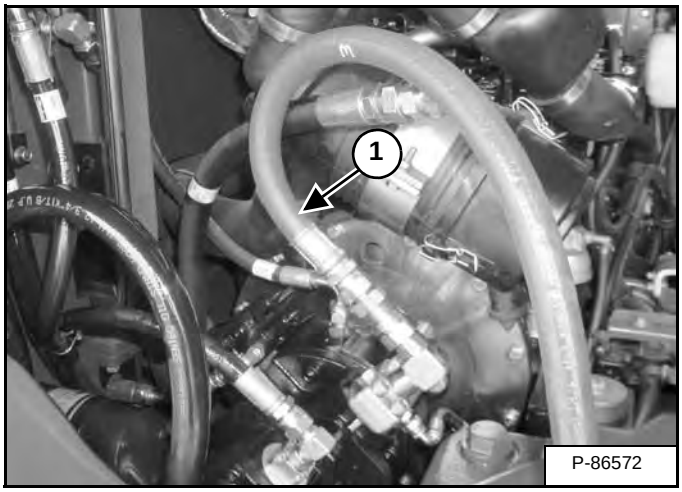
Install the adapter (Item 1), plate (Item 2) and bolts (Item 3) **[Figure 20-50-17]** on the hose.

Figure 20-50-18



Install the adapter (Item 1) on the pump using the existing flanges (Item 2) **[Figure 20-50-18]** and bolts.

Figure 20-50-19



Connect the inlet hose (Item 1) **[Figure 20-50-19]** from the tester to pump.

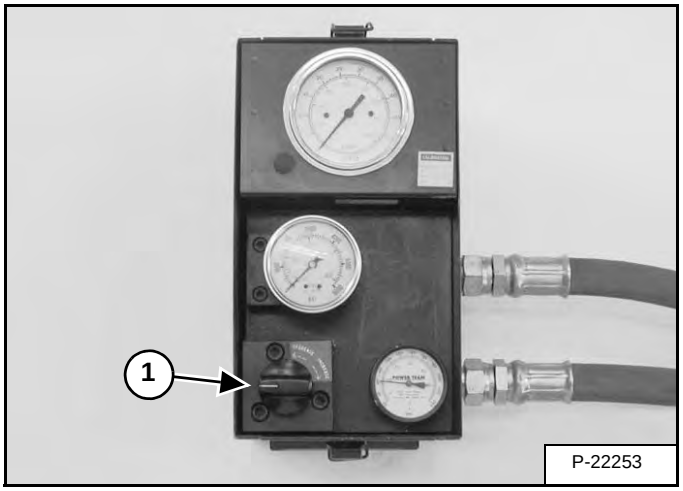
Connect the outlet hose (Item 2) **[Figure 20-50-19]** from the tester to the hose.

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Pump Testing (Cont'd)

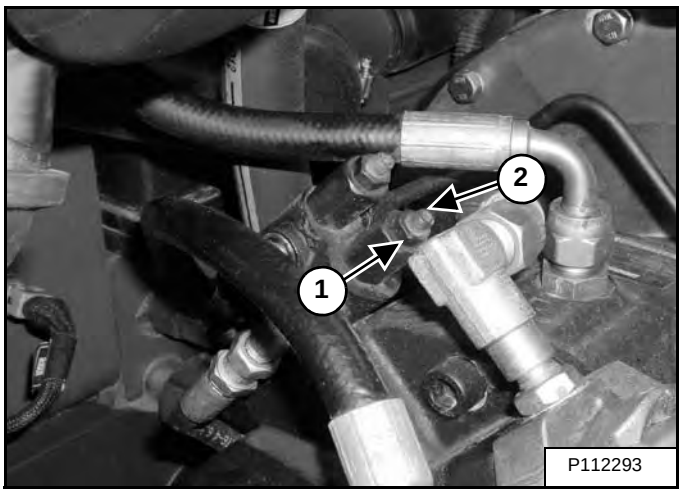
Torque Limiter Adjustment (Cont'd)

Figure 20-50-20



Fully open the hydraulic tester flow control (Item 1) **[Figure 20-50-20]**.

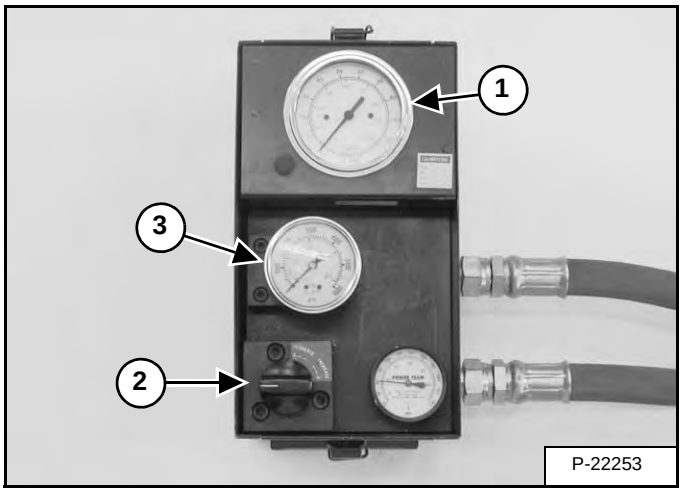
Figure 20-50-21



Loosen the nut (Item 1) and turn the pump margin adjustment screw (Item 2) **[Figure 20-50-21]** all the way in (approximately six turns).

Start the engine and run it at high idle.

Figure 20-50-22

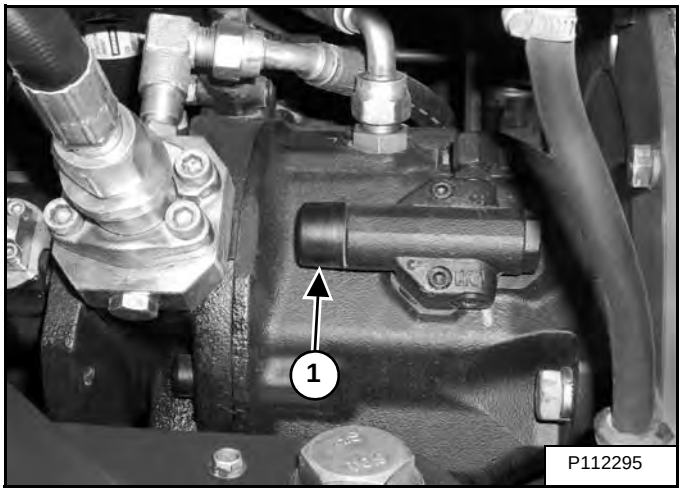


The flow should be 144 L/m (38 U.S. gpm) on the flow tester (Item 1) **[Figure 20-50-22]**.

Turn the hydraulic tester flow control (Item 2) clockwise until the gauge (Item 3) **[Figure 20-50-22]** shows 10300 kPa (103 bar) (1500 psi).

The gauge (Item 1) **[Figure 20-50-22]** should show 129 - 136 L/min (34 - 36 U.S. gpm) which is *flow at low pressure*.

Figure 20-50-23



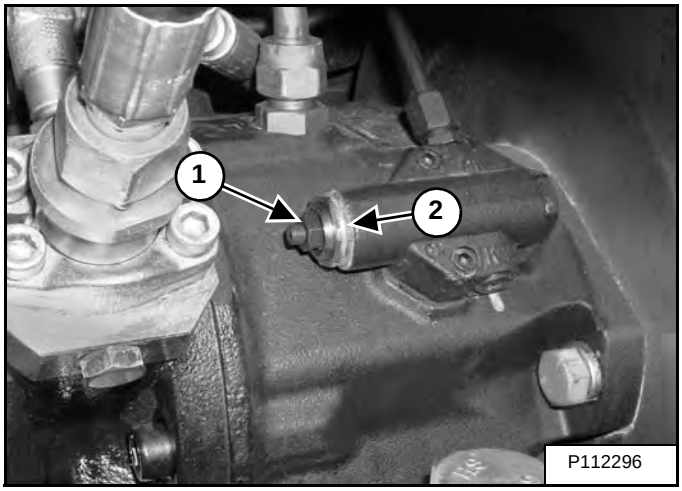
Remove the dust cover (Item 1) **[Figure 20-50-23]**.

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Pump Testing (Cont'd)

Torque Limiter Adjustment (Cont'd)

Figure 20-50-24



Check that the 13 mm nut (Item 1) **[Figure 20-50-24]** is locked in place.

Adjust the flow at the hydraulic pump torque limiter. Loosen the 27 mm nut (Item 2) **[Figure 20-50-24]** and adjust the *flow at low pressure* with an Allen wrench.

When the proper flow is obtained, 129 - 136 L/min (34 - 36 U.S. gpm) at 10300 kPa (103 bar) (1500 psi), lock the 27 mm nut (Item 2) **[Figure 20-50-24]**.

NOTE: Changing the flow at low pressure (27 mm nut) will affect the flow at high pressure (13 mm nut).

Turn the hydraulic tester flow control (Item 2) clockwise until the gauge (Item 3) **[Figure 20-50-22]** reads 24100 kPa (241 bar) (3500 psi).

NOTE: Do not exceed 33998 kPa (340 bar) (4931 psi) with the hydraulic tester or the pump will be damaged.

The gauge should show 57 - 64 L/min (15 - 17 U.S. gpm) which is *flow at high pressure.*

Adjust the flow at the hydraulic pump torque limiter. Loosen the 13 mm nut (Item 1) **[Figure 20-50-24]** and adjust the *flow at high pressure* with an Allen wrench.

When the proper flow is obtained, 57 - 64 L/min (15 - 17 U.S. gpm) at 24100 kPa (241 bar) (3500 psi), lock the 13 mm nut (Item 1) **[Figure 20-50-24]**.

NOTE: If adjustments were made to *flow at high pressure* **verify the** *flow at low pressure***.**

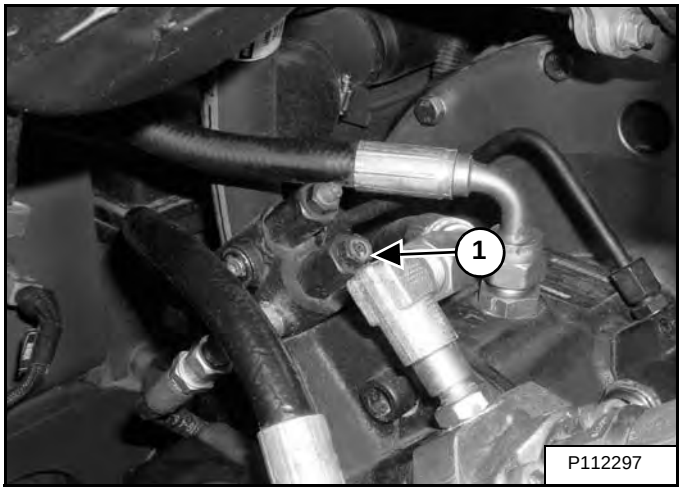
Install the protective cap on the hydraulic pump torque limiter.

Remove the hydraulic tester, fittings and adapter hose.

Install the outlet hose on the pump.

Install the return line on the reservoir.

Figure 20-50-25



Adjust the pump margin spool (Item 1) **[Figure 20-50-25]** back to the original position (approximately six turns outwards).

Retest and adjust the pump margin spool as needed. (See Pump Margin Pressure Adjustment on Page 20-50-7.)

ALL PUMP ADJUSTMENTS ARE NOW COMPLETED.

Remove the test fitting from the valve. Install the left upperstructure cover. (See Removal And Installation on Page 40-20-1.)

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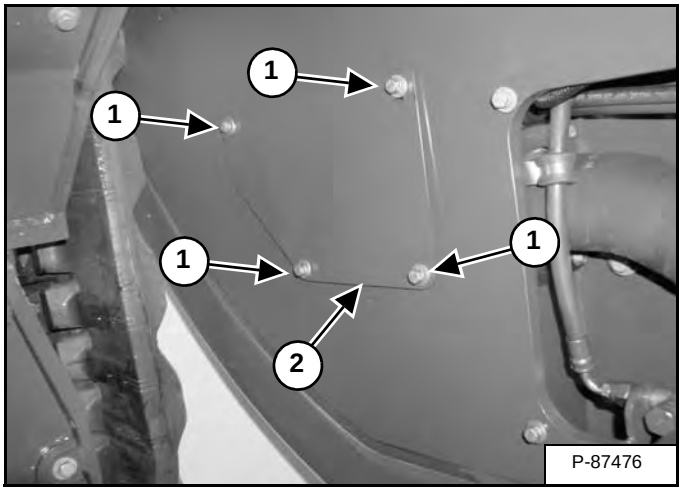
Removal And Installation

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-140-6.)

Remove the air cleaner. (See Housing Removal And Installation on Page 60-40-1.)

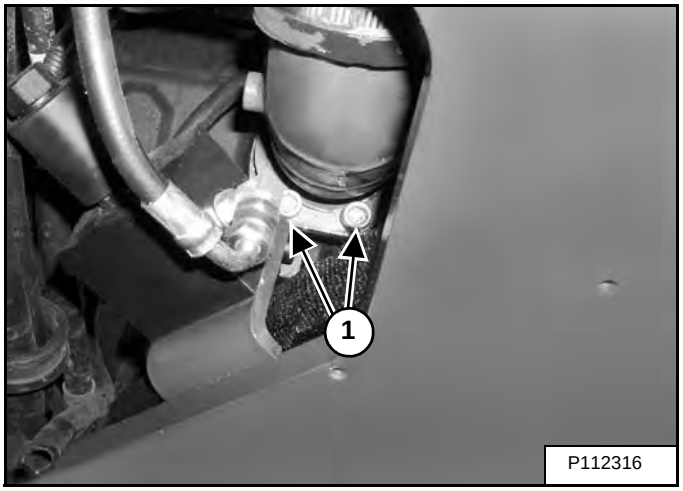
Remove the gear pump. (See Removal And Installation on Page 20-51-3.)

Figure 20-50-26



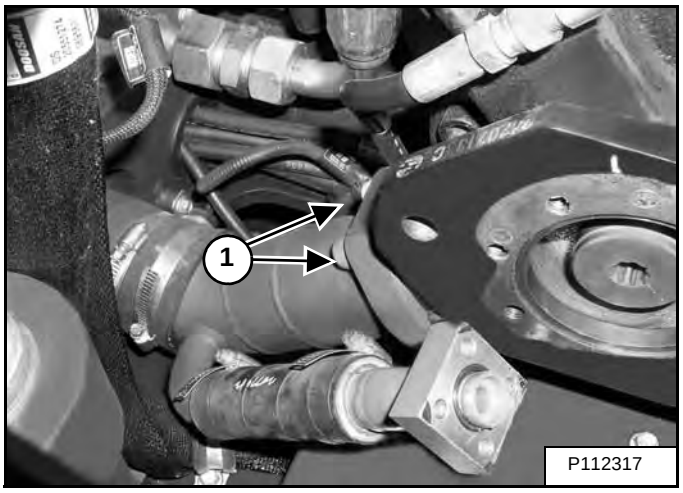
Remove the four bolts (Item 1) and remove the cover (Item 2) **[Figure 20-50-26]**.

Figure 20-50-27



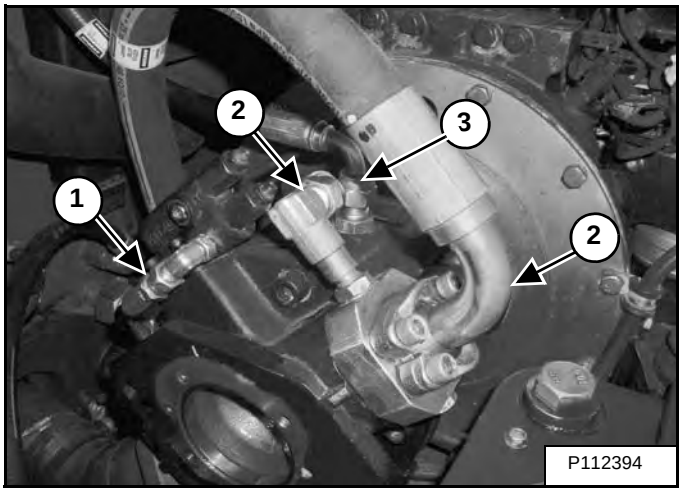
Remove the bottom inlet flange bolts (Item 1) **[Figure 20-50-27]**.

Figure 20-50-28



Remove the top inlet flange bolts (Item 1) **[Figure 20-50-28]**.

Figure 20-50-29

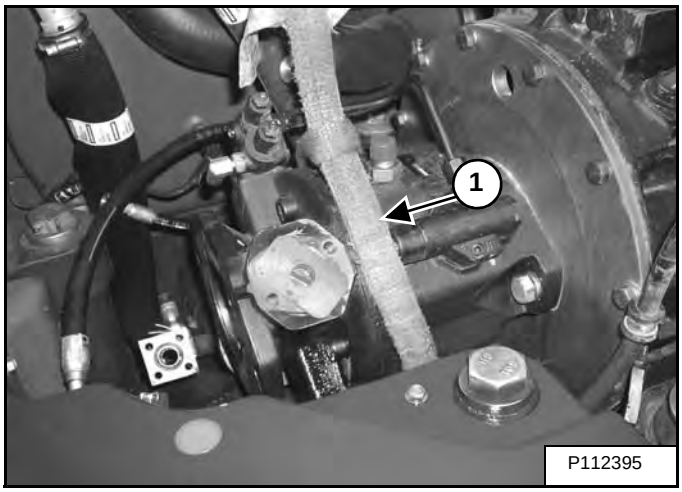


Remove the load sense line (Item 1), high pressure lines (Item 2) and case drain line (Item 3) **[Figure 20-50-29]**.

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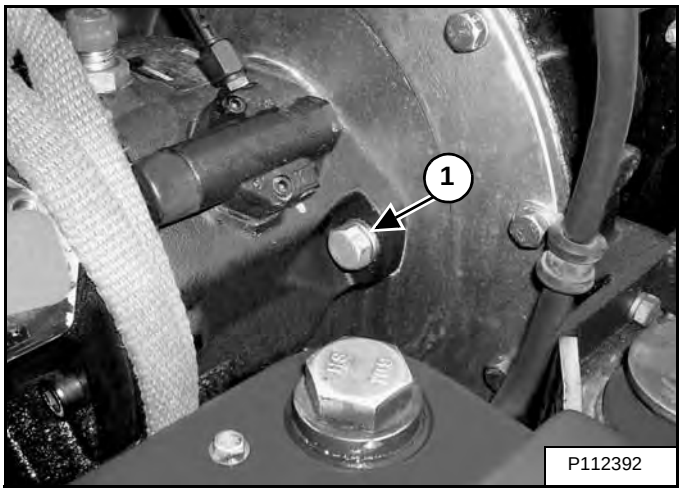
Removal And Installation (Cont'd)

Figure 20-50-30



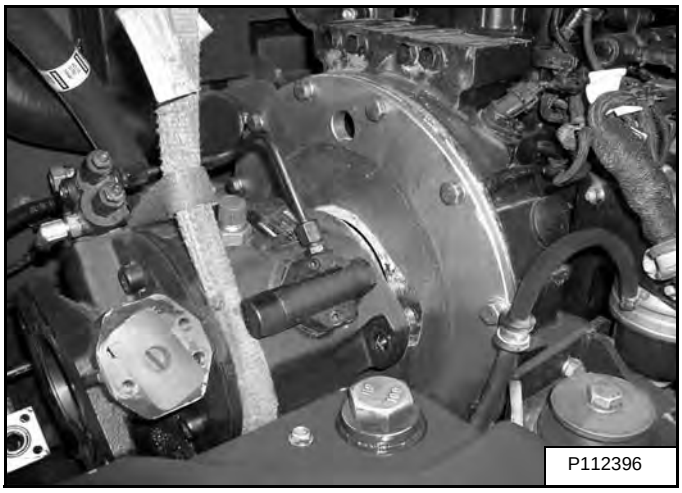
Install a sling (Item 1) **[Figure 20-50-30]** and hoist on the pump.

Figure 20-50-31



Remove the bolts (Item 1) **[Figure 20-50-31]** and washers.

Figure 20-50-32

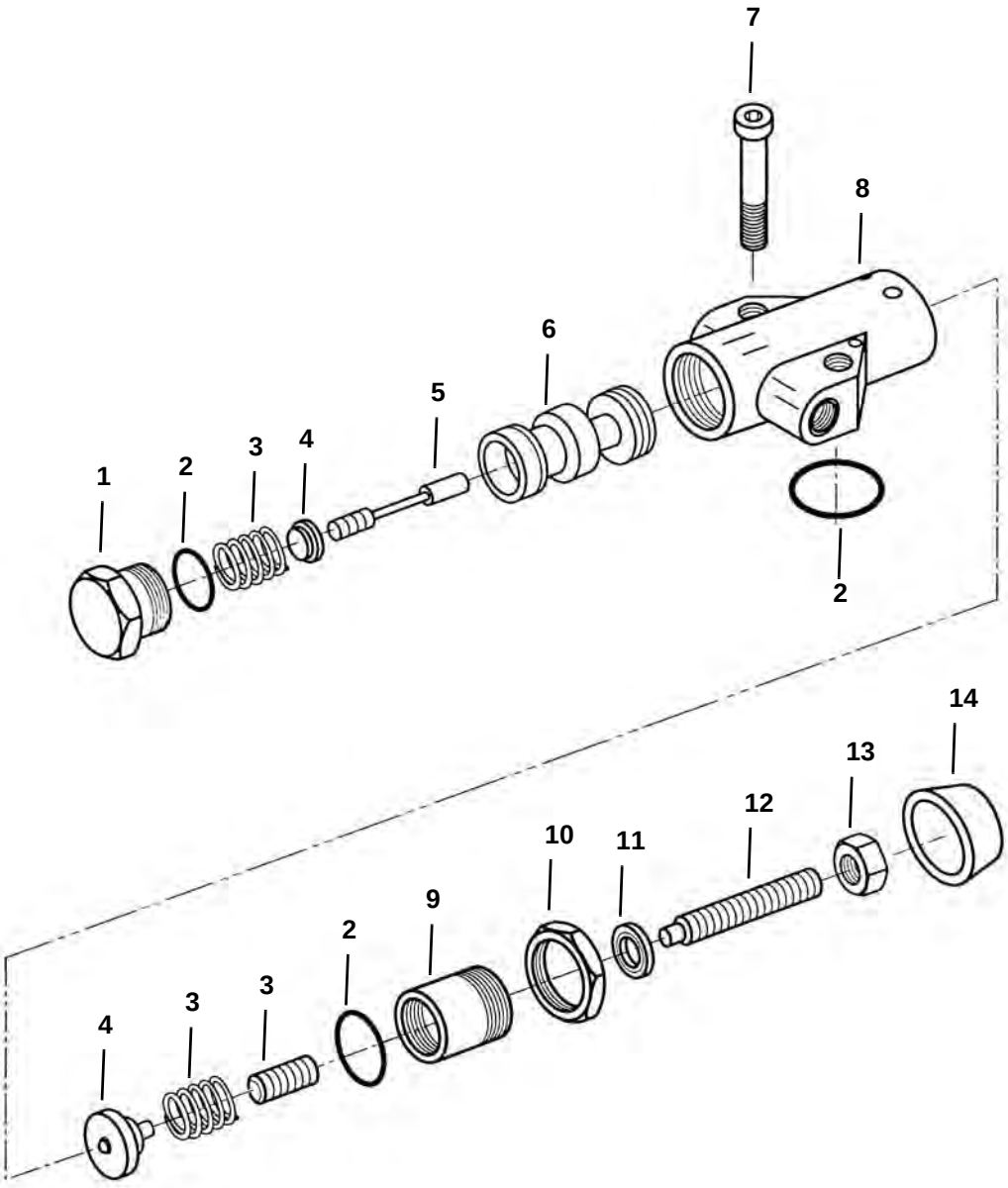


Slide the pump away from the engine and remove the pump **[Figure 20-50-32]**.

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Torque Limiter Valve Parts Identification

1. Plug
2. O-ring
3. Spring
4. Spring Seat
5. Spool Assembly
6. Spool
7. Bolt
8. Housing
9. Body
10. Locknut
11. Washer
12. Screw
13. Nut
14. Cap



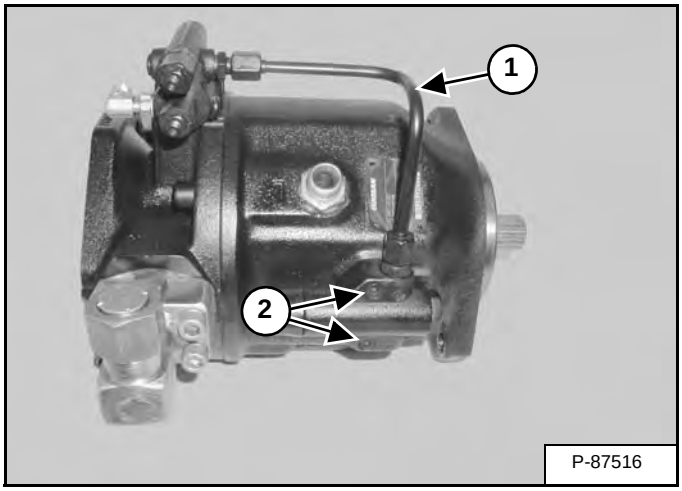
MS-2790S

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Torque Limiter Valve Removal And Installation

Clean the outside of the pump with clean solvent and dry it with compressed air before removing any components from the pump.

Figure 20-50-33



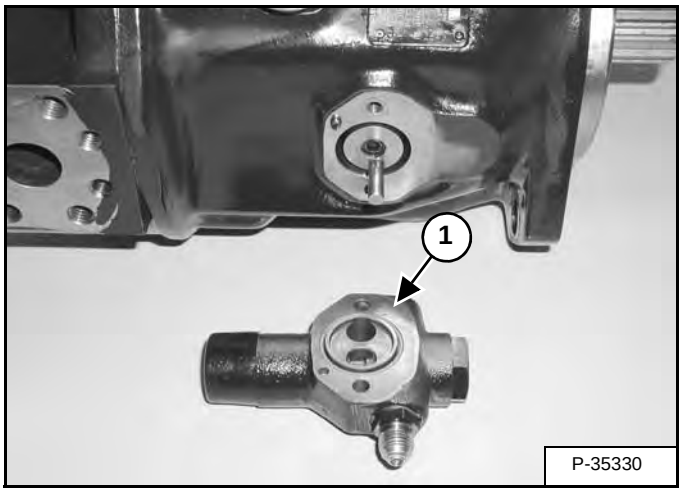
Remove the tubeline (Item 1) **[Figure 20-50-33]** from the pump control and torque limiter valve.

NOTE: Mark the tubeline for correct installation.

Loosen and remove the two mounting bolts (Item 2) **[Figure 20-50-33]** from the torque limiter valve.

Installation: Tighten the mounting bolts to 9,5 - 10,5 N•m (7.0 - 7.5 ft-lb) torque.

Figure 20-50-34

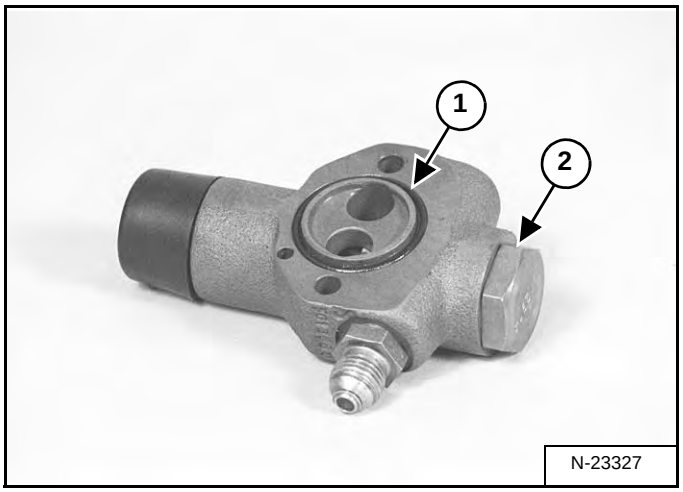


Remove the torque limiter (Item 1) **[Figure 20-50-34]** from the pump.

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Torque Limiter Valve Disassembly

Figure 20-50-35



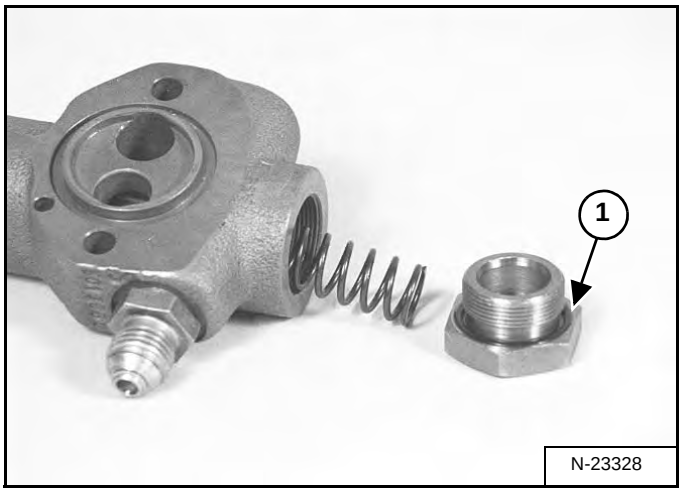
Remove the O-ring (Item 1) **[Figure 20-50-35]** from the torque limiter valve.

NOTE: Do not scratch or damage the mounting surface on the valve body.

Remove the plug (Item 2) **[Figure 20-50-35]**.

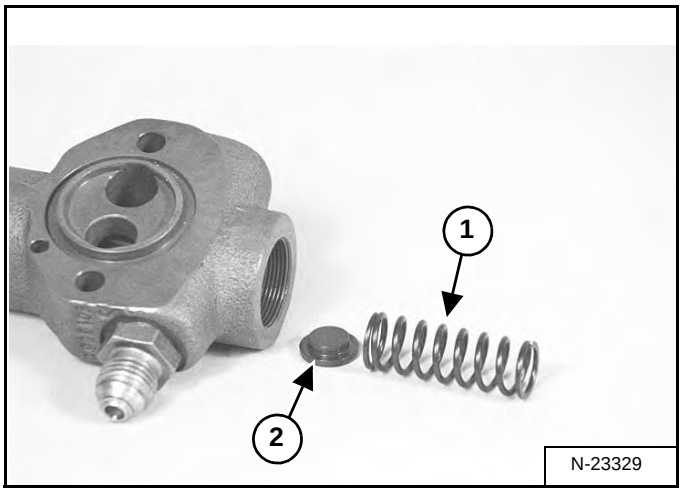
NOTE: The plug (Item 2) [Figure 20-50-35] is under spring pressure.

Figure 20-50-36



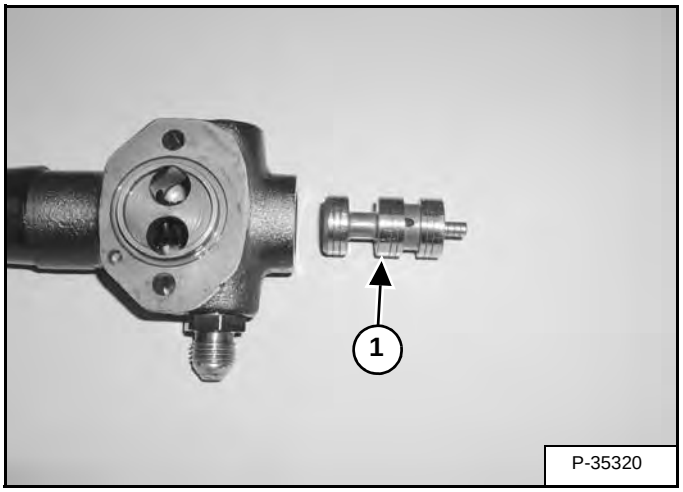
Remove the O-ring (Item 1) **[Figure 20-50-36]**.

Figure 20-50-37



Remove the spring (Item 1) and spring seat (Item 2) **[Figure 20-50-37]**.

Figure 20-50-38



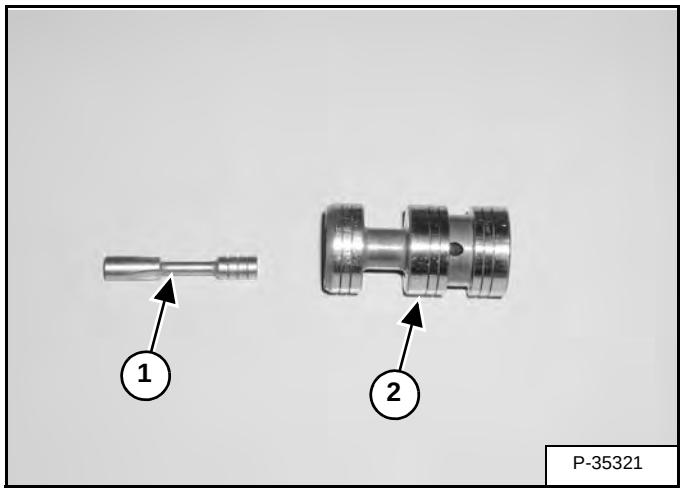
Remove the control spool assembly (Item 1) **[Figure 20-50-38]**.

NOTE: Do not scratch or damage the spool. Scratches in the spool can cause internal leakage.

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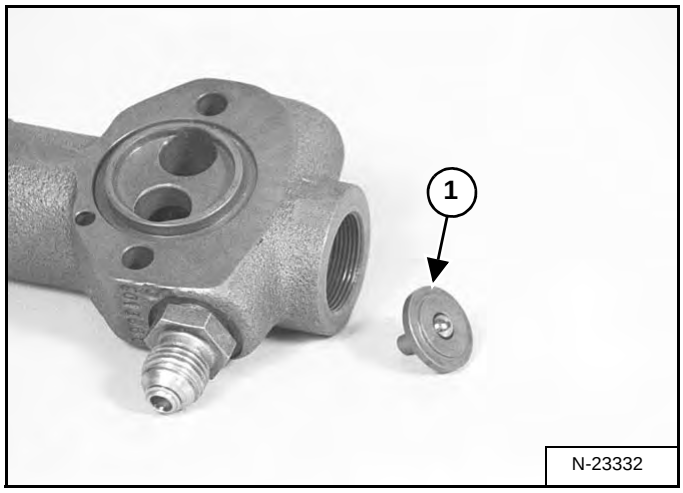
Torque Limiter Valve Disassembly (Cont'd)

Figure 20-50-39



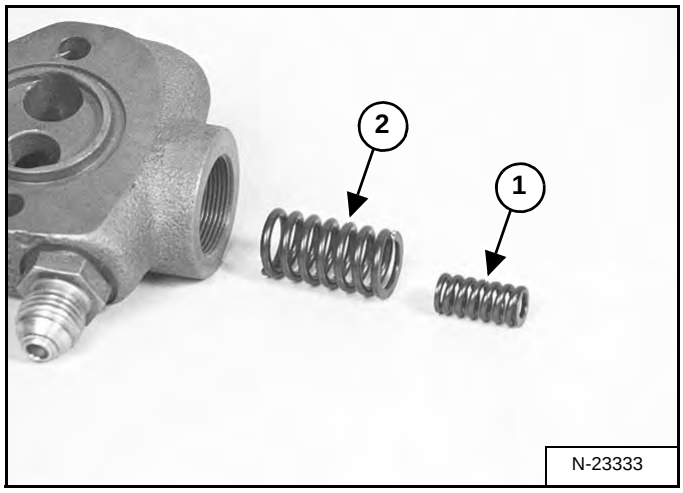
Remove the metering spool (Item 1) from the control spool (Item 2) **[Figure 20-50-39]**.

Figure 20-50-40



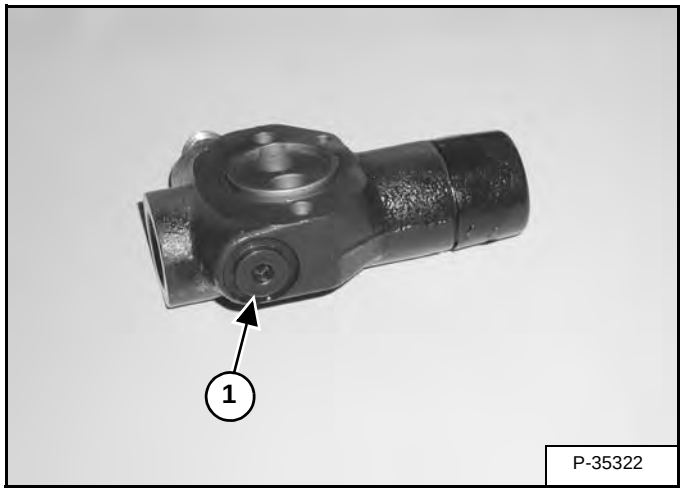
Remove the spring retainer (Item 1) **[Figure 20-50-40]** from the torque limiter valve.

Figure 20-50-41



Remove the two springs (Items 1 and 2) **[Figure 20-50-41]**.

Figure 20-50-42

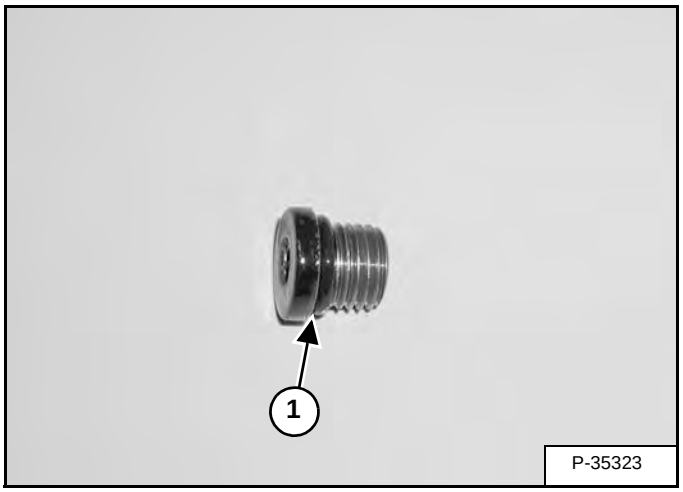


Remove the plug (Item 1) **[Figure 20-50-42]**.

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Torque Limiter Valve Disassembly (Cont'd)

Figure 20-50-43

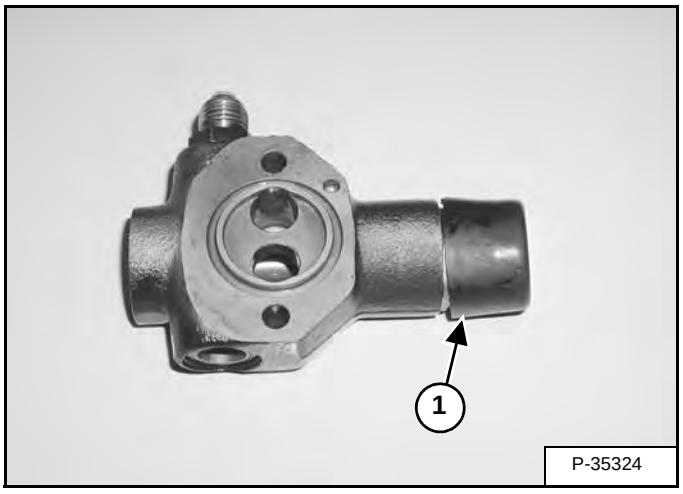


Remove the O-ring (Item 1) **[Figure 20-50-43]**.

The following procedures are only used if the adjustment assembly is removed.

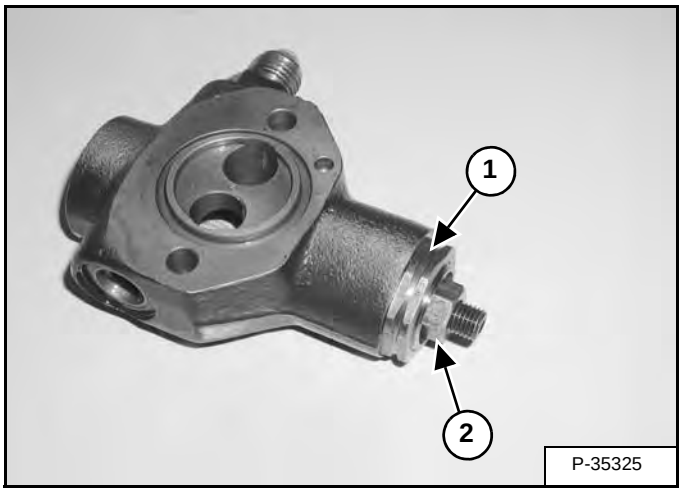
NOTE: If the adjustment assembly is removed and / or disassembled, the torque limiter must be tested and adjusted after the pump assembly is installed in the machine. (See Initial Torque Limiter Valve Setting on Page 20-50-25.)

Figure 20-50-44



Remove the dust cap (Item 1) **[Figure 20-50-44]**.

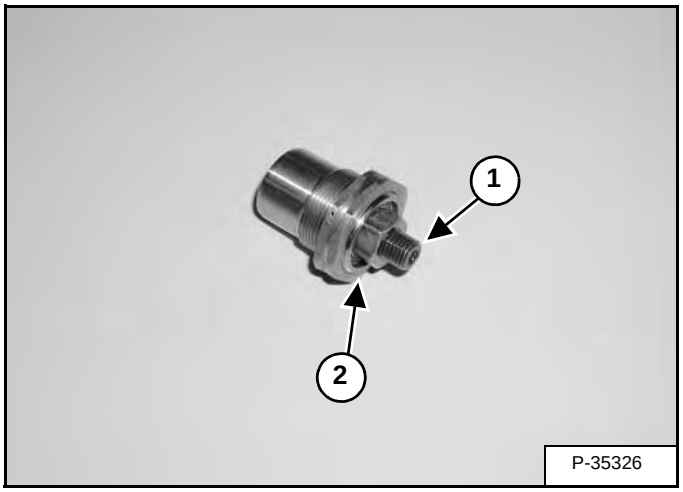
Figure 20-50-45



Loosen the large nut (Item 1) **[Figure 20-50-45]**.

Turn the small nut (Item 2) **[Figure 20-50-45]** to remove the adjustment body.

Figure 20-50-46

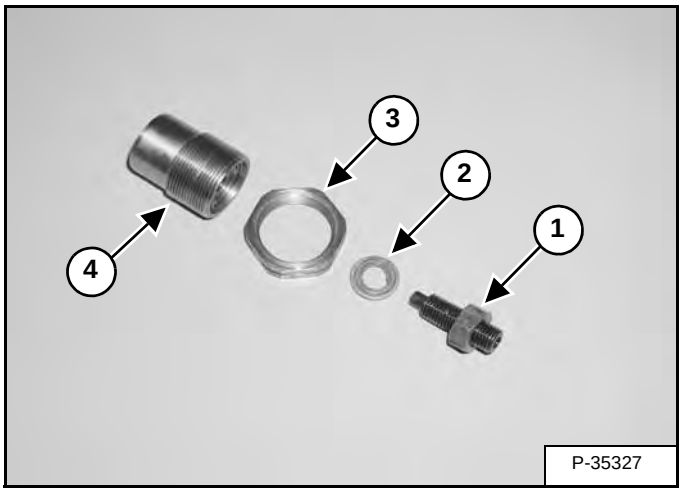


Hold the adjustment bolt (Item 1) with an Allen wrench and loosen the nut (Item 2) **[Figure 20-50-46]**.

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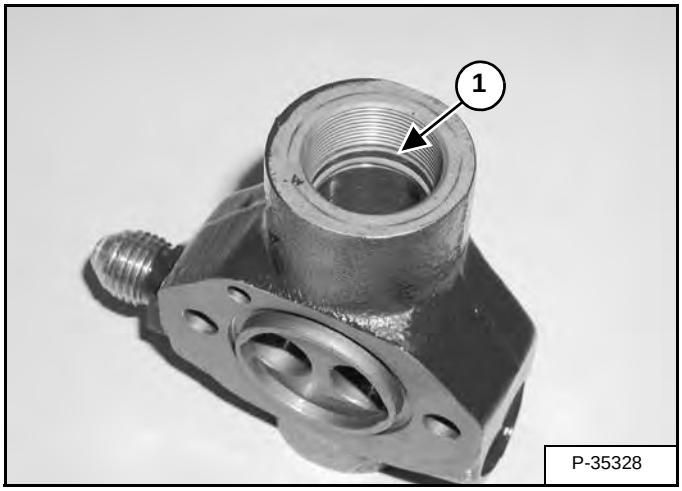
Torque Limiter Valve Disassembly (Cont'd)

Figure 20-50-47



Remove the adjustment screw (Item 1), O-ring washer (Item 2) and large nut (Item 3) from the adjustment body (Item 4) **[Figure 20-50-47]**.

Figure 20-50-48



Remove the O-ring (Item 1) **[Figure 20-50-48]**.

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Torque Limiter Valve Assembly

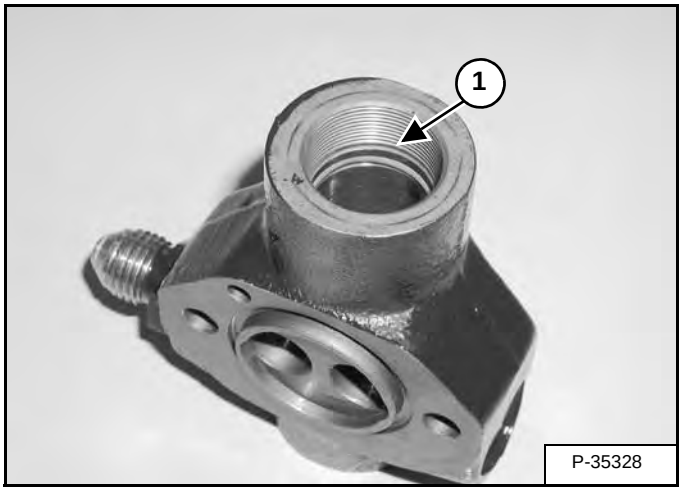
Clean all the parts in solvent and dry with compressed air.

Inspect seats and spools for wear.

Apply clean oil to new O-rings and spools.

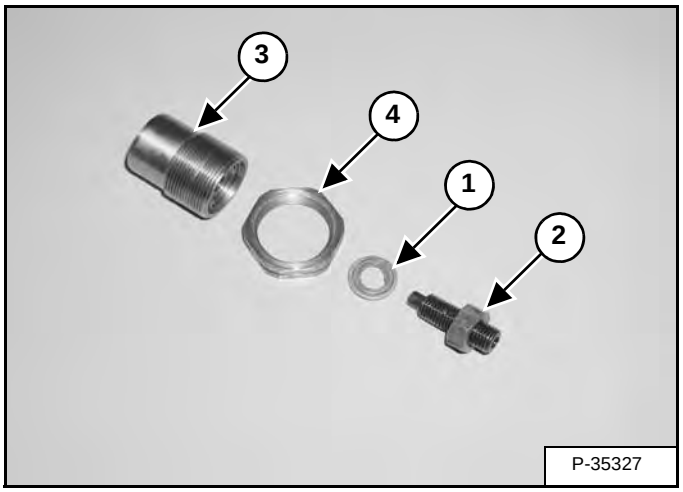
The following procedures are only used if the adjustment assembly is removed.

Figure 20-50-49



Install the O-ring (Item 1) **[Figure 20-50-49]**.

Figure 20-50-50

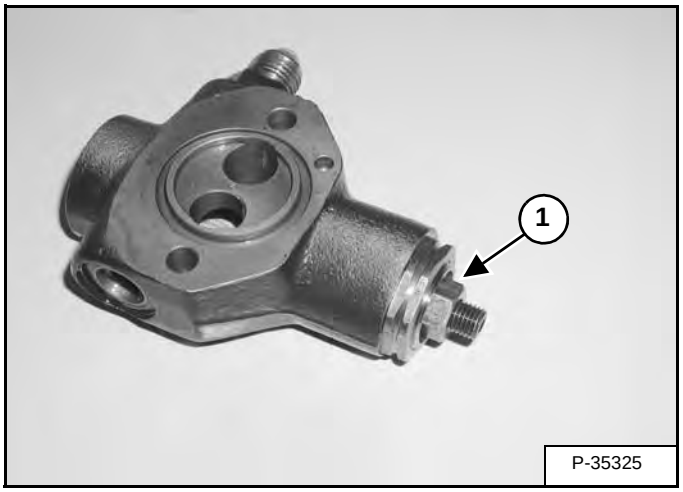


Install the O-ring washer (Item 1) on the adjustment screw (Item 2) **[Figure 20-50-50]**.

Install the adjustment screw (Item 2) in the adjustment body (Item 3) **[Figure 20-50-50]**.

Install the nut (Item 4) **[Figure 20-50-50]** on the adjustment body.

Figure 20-50-51

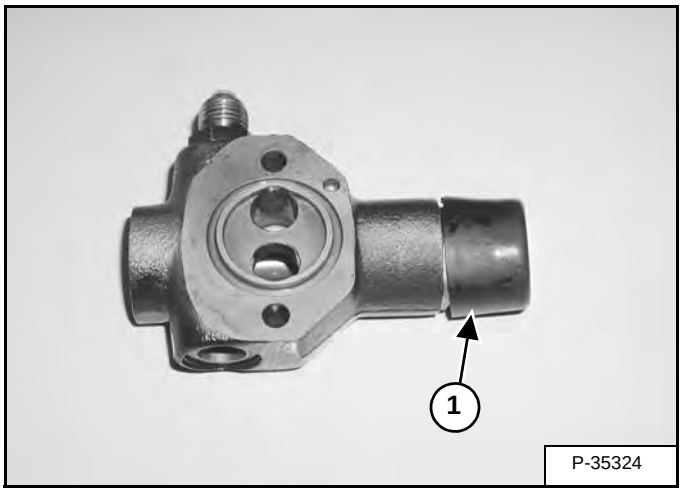


Install the adjustment screw / adjustment body (Item 1) **[Figure 20-50-51]** assembly into the valve body.

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Torque Limiter Valve Assembly (Cont'd)

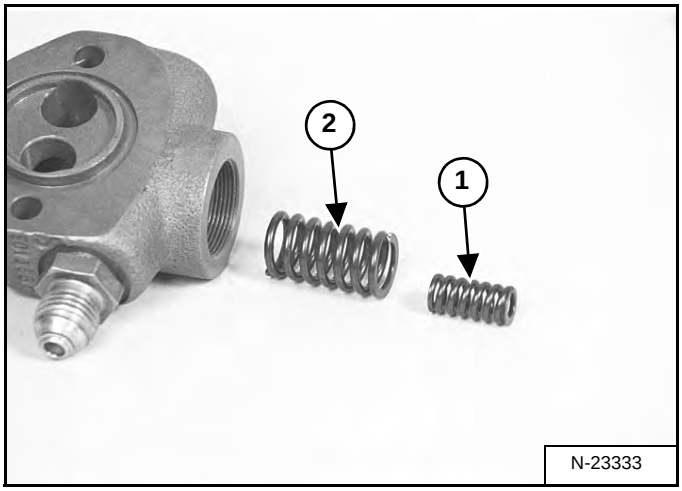
Figure 20-50-52



Install the dust cap (Item 1) **[Figure 20-50-52]**.

NOTE: After the pump assembly is installed in the machine, the torque limiter must be tested and adjusted. (See Initial Torque Limiter Valve Setting on Page 20-50-25.)

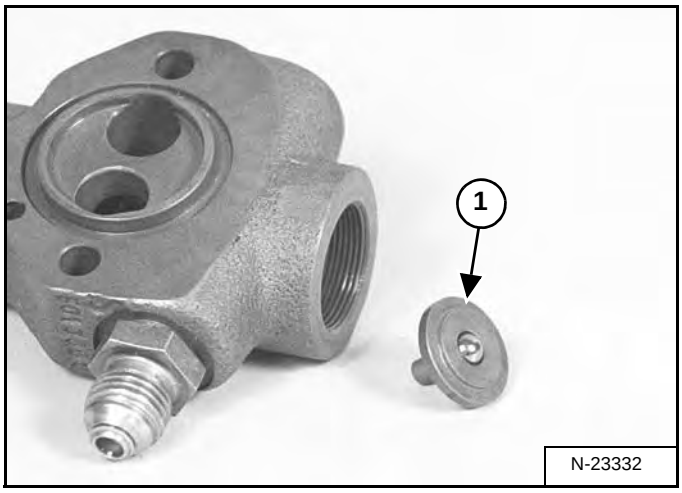
Figure 20-50-53



Install the two springs (Items 1 and 2) **[Figure 20-50-53]** in the valve body.

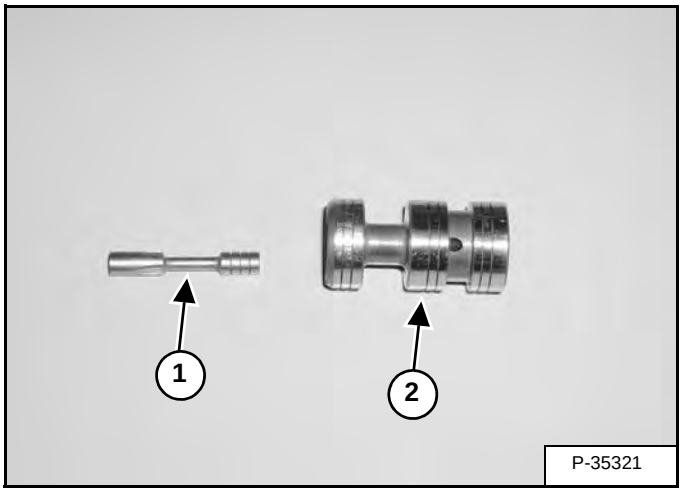
NOTE: Install the big spring first.

Figure 20-50-54



Install the spring seat (Item 1) **[Figure 20-50-54]** in the valve body with the ball side facing the control spool.

Figure 20-50-55



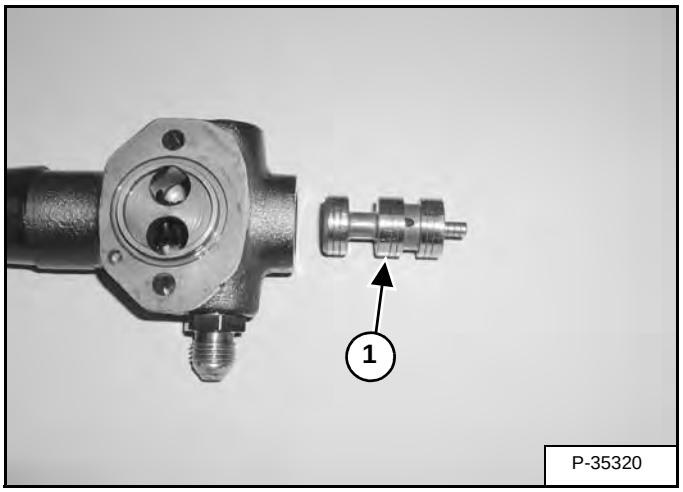
Put oil on the metering spool (Item 1) and install it in the control spool (Item 2) **[Figure 20-50-55]**.

NOTE: The end of the metering spool with the three rings should enter the control spool first.

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Torque Limiter Valve Assembly (Cont'd)

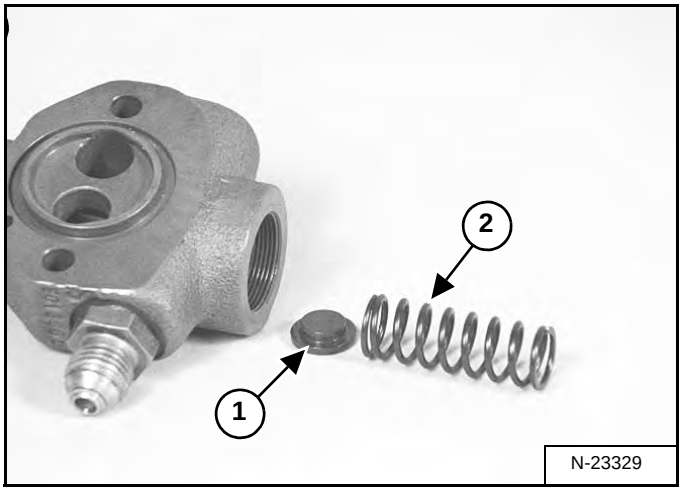
Figure 20-50-56



Install the control spool assembly (Item 1) **[Figure 20-50-56]** in the valve body.

NOTE: Do not scratch or damage the spool (Item 1) [Figure 20-50-56]. Scratches in the spool can cause internal leakage.

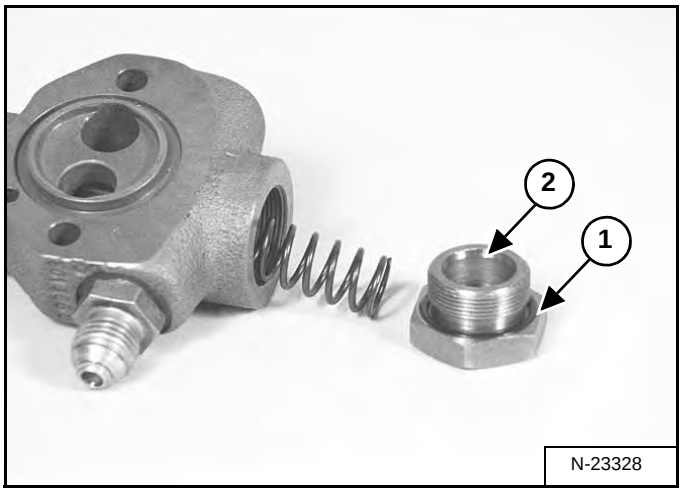
Figure 20-50-57



Install the spring seat (Item 1) **[Figure 20-50-57]** in the valve body, with the smaller side facing the spring.

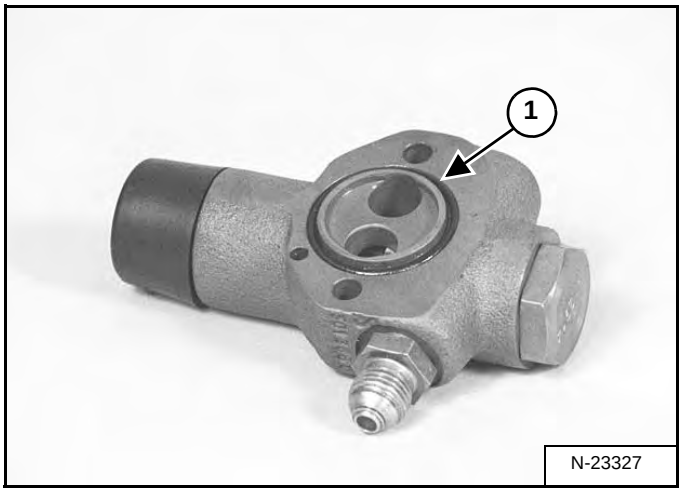
Install the spring (Item 2) **[Figure 20-50-57]** in the valve body.

Figure 20-50-58



Install the O-ring (Item 1) on the plug. Install the plug (Item 2) **[Figure 20-50-58]**.

Figure 20-50-59

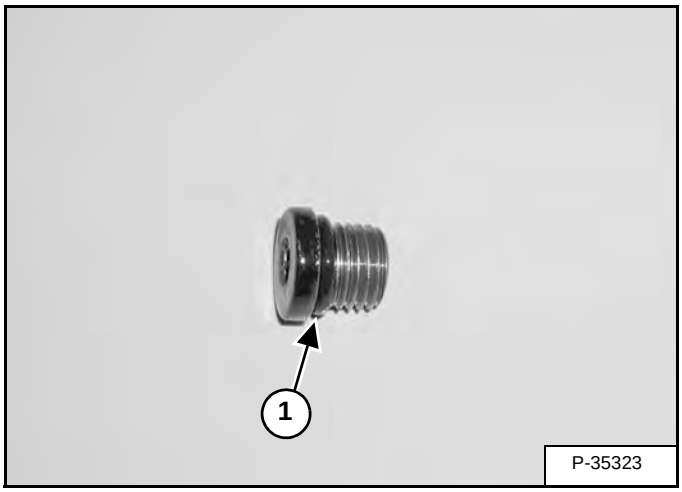


Install the O-ring (Item 1) **[Figure 20-50-59]**.

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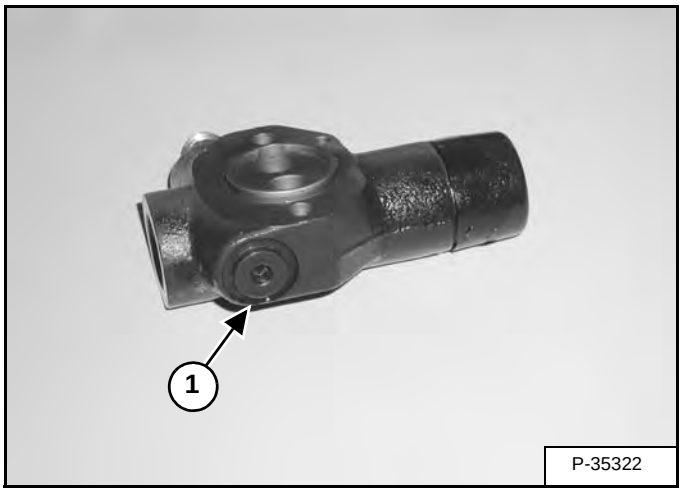
Torque Limiter Valve Assembly (Cont'd)

Figure 20-50-60



Install the O-ring (Item 1) **[Figure 20-50-60]** on the plug.

Figure 20-50-61



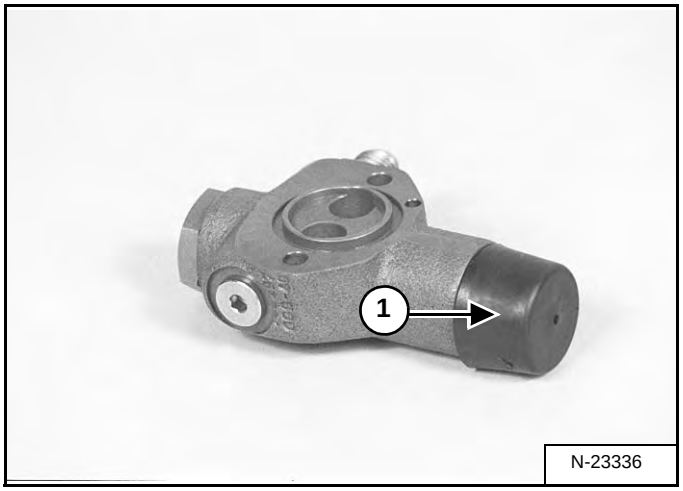
Install the plug (Item 1) **[Figure 20-50-61]**.

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Initial Torque Limiter Valve Setting

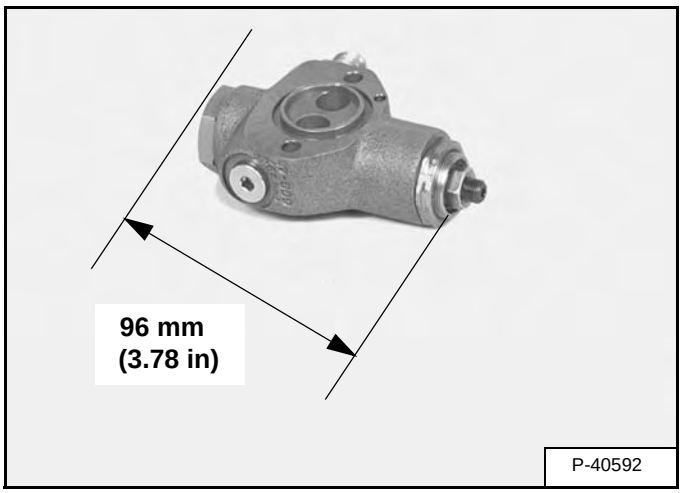
The following procedures are only used if the adjustment assembly is removed.

Figure 20-50-62



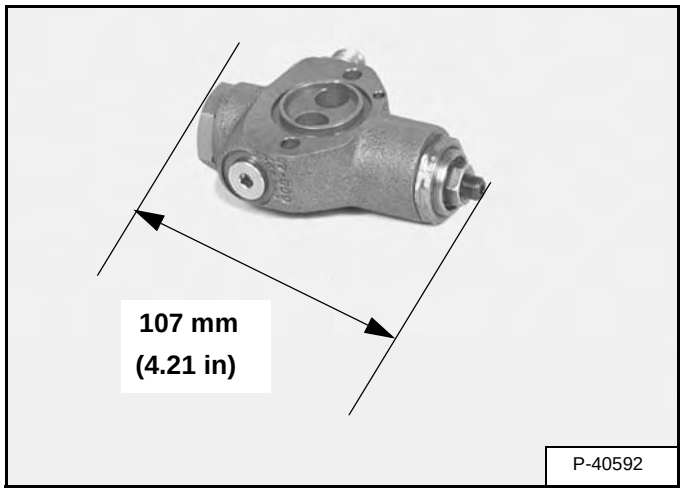
Remove the dust cap (Item 1) **[Figure 20-50-62]**.

Figure 20-50-63



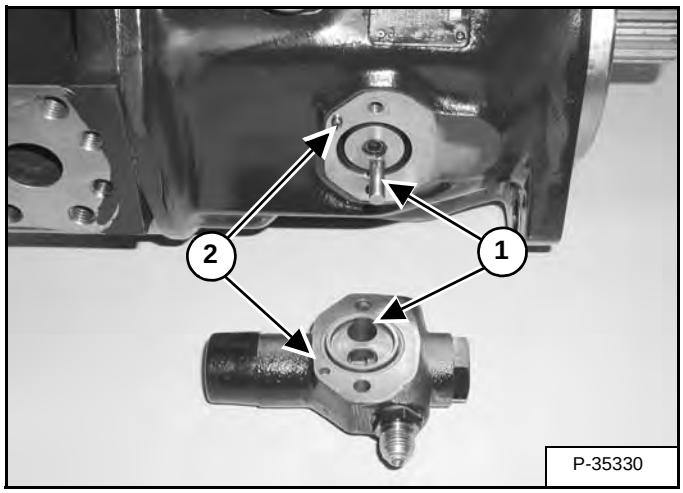
Measure from the plug to the top of the large adjustment screw. Set the large adjustment screw to 96 mm (3.78 in) **[Figure 20-50-63]**.

Figure 20-50-64



Measure from the plug to the top of the small adjusting screw **[Figure 20-50-64]**. Set the small adjustment screw to 106 mm (4.15 in).

Figure 20-50-65



Align the linkage pin (Item 1) on the hydraulic piston pump into the hole (Item 1) **[Figure 20-50-65]** in the torque limiter valve.

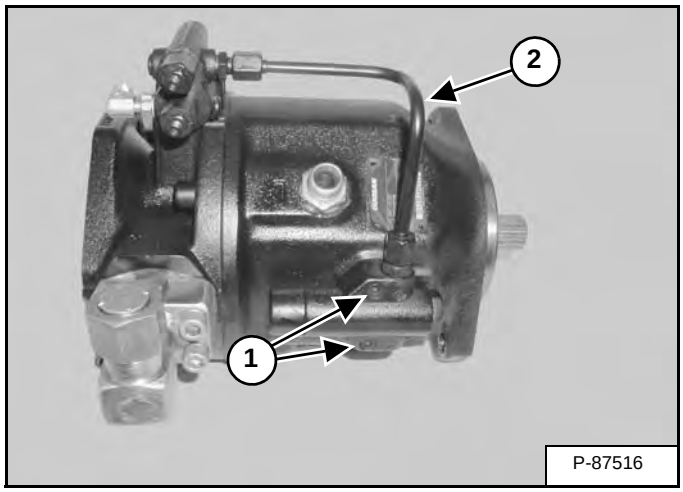
Turn the valve slightly to align the dowel pin (Item 2) on the hydraulic piston pump into the hole (Item 2) **[Figure 20-50-65]** in the torque limiter valve.

NOTE: Before tightening the bolts, make sure the dowel pin is aligned with the housing.

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Initial Torque Limiter Valve Setting (Cont'd)

Figure 20-50-66



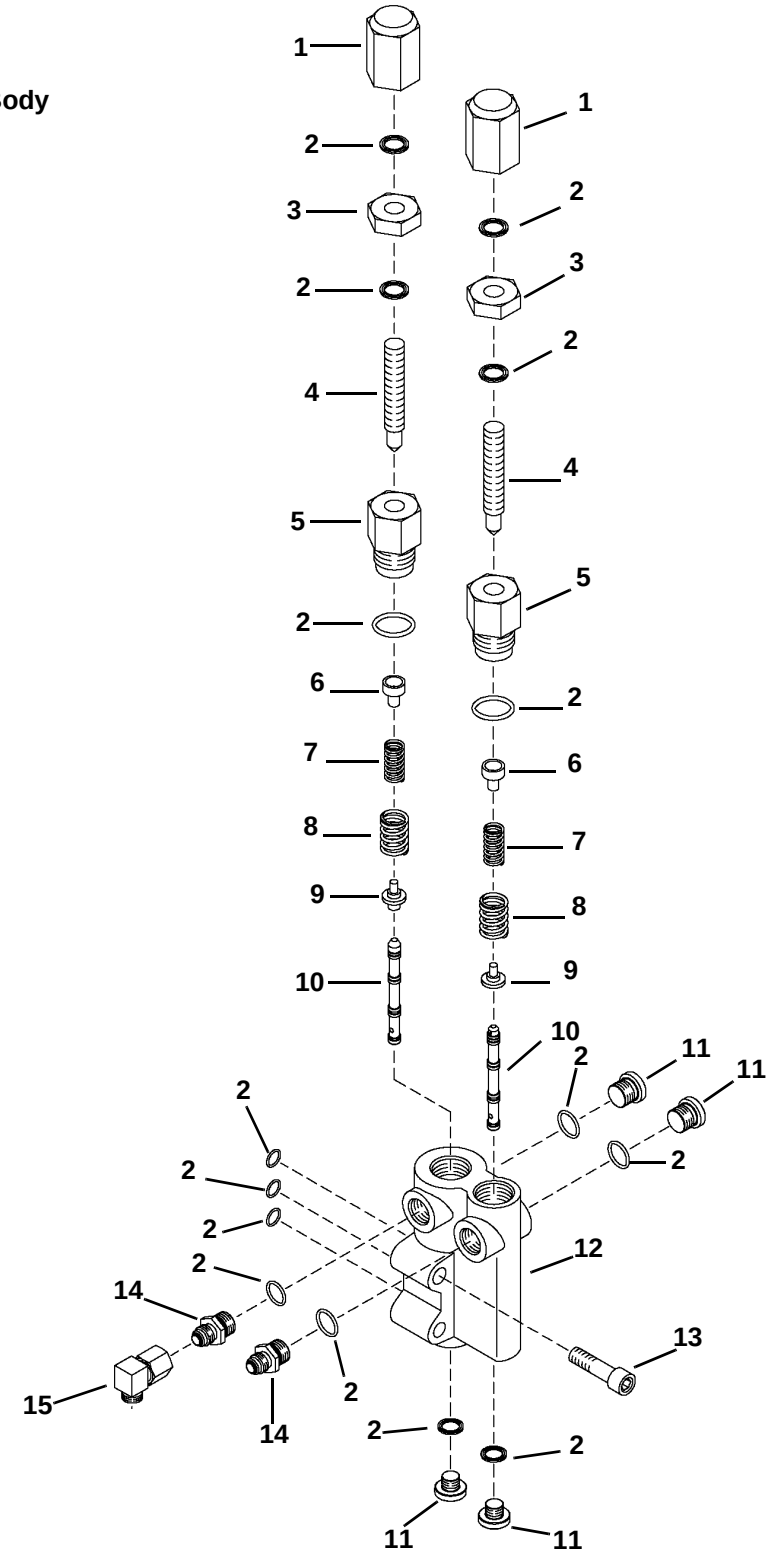
Tighten the bolts (Item 1) **[Figure 20-50-66]** to 9,5 - 10,5 N•m (7.0 - 7.5 ft-lb) torque.

Install the tubeline (Item 2) **[Figure 20-50-66]**.

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Pump Control Parts Identification

1. Cap (If Equipped)
2. O-ring
3. Nut
4. Adjusting Screw
5. Adjustment Screw Body
6. Spring Seat
7. Spring
8. Spring
9. Spring Seat
10. Spool
11. Plug
12. Valve Body
13. Bolt
14. Fitting
15. Elbow



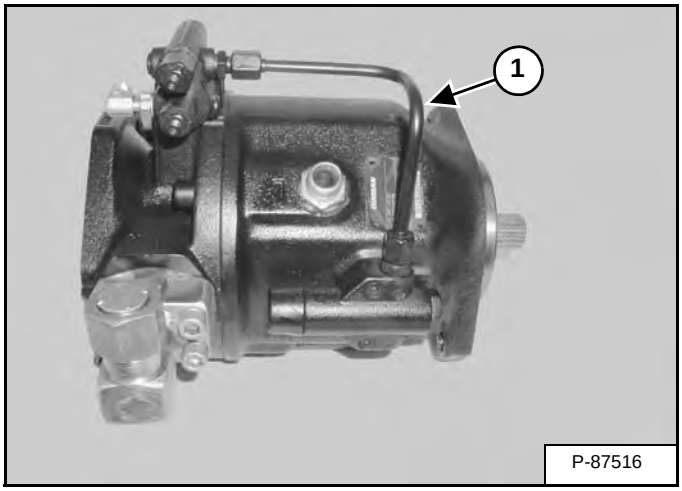
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Pump Control Removal And Installation

Clean the outside of the pump with clean solvent and dry it with compressed air before removing any components from the pump.

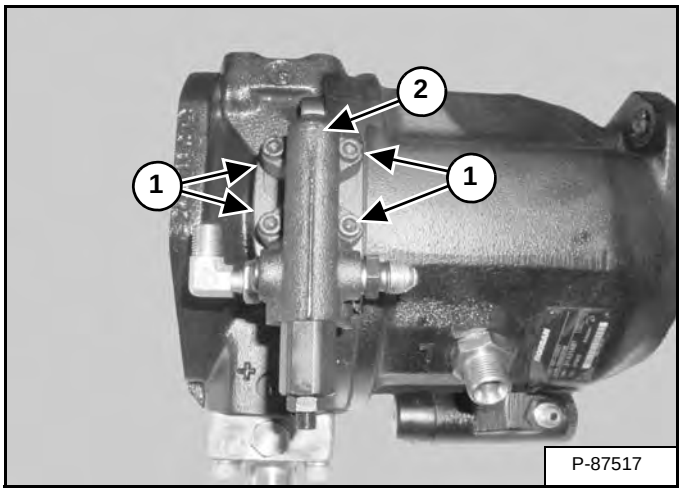
Figure 20-50-67



Mark the tubeline (Item 1) **[Figure 20-50-67]** for correct assembly.

Remove the tubeline (Item 1) **[Figure 20-50-67]** from the pump control and torque limiter valve.

Figure 20-50-68



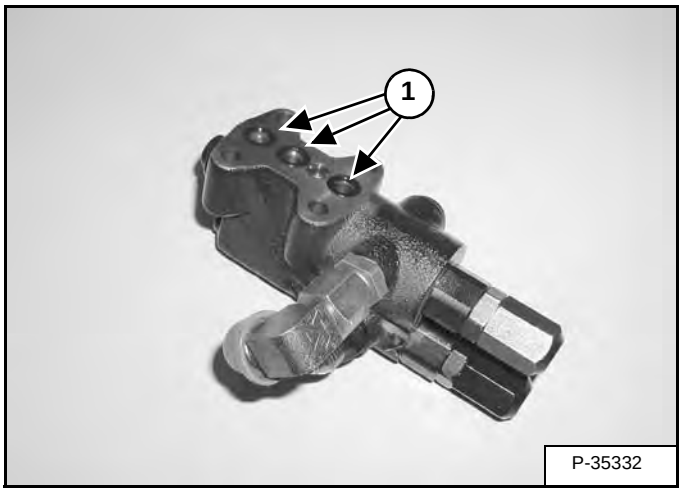
Remove the four bolts (Item 1) and remove the pump control (Item 2) **[Figure 20-50-68]** from the hydraulic piston pump.

Installation: Tighten the bolts to 13 N•m (10 ft-lb) torque.

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Pump Control Disassembly And Assembly

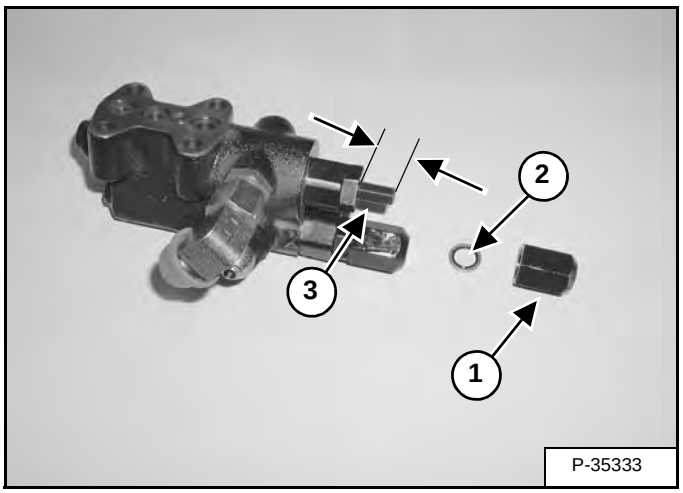
Figure 20-50-69



Remove the three O-rings (Item 1) **[Figure 20-50-69]** from the valve.

Pump Margin Control

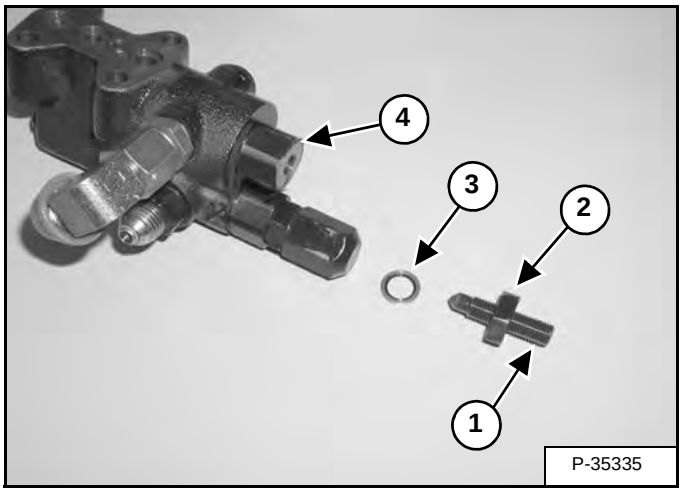
Figure 20-50-70



Before disassembling the pump margin control, remove the cap (Item 1) and O-ring washer (Item 2) **[Figure 20-50-70]** from the adjustment assembly (If equipped.)

Measure the adjustment screw (Item 3) **[Figure 20-50-70]** thread length for the correct initial adjustment.

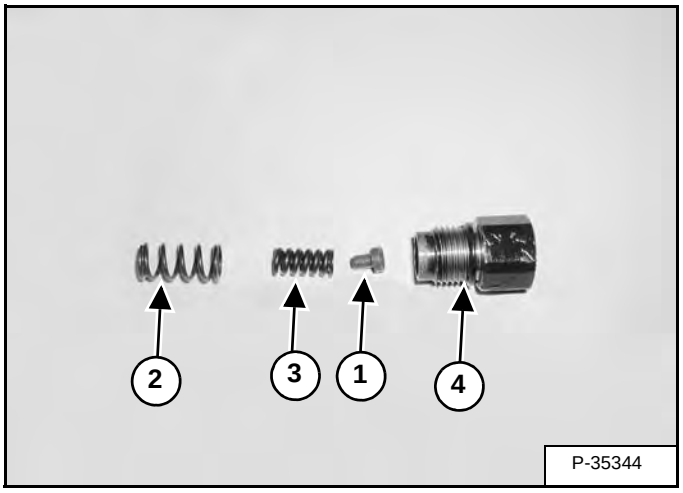
Figure 20-50-71



Remove the adjustment screw (Item 1), nut (Item 2), and O-ring washer (Item 3) from the adjustment assembly (Item 4) **[Figure 20-50-71]**.

Remove the adjustment assembly (Item 4) **[Figure 20-50-71]**.

Figure 20-50-72



Remove the adjustment seat (Item 1), large spring (Item 2), and the small spring (Item 3) **[Figure 20-50-72]** from the adjustment assembly.

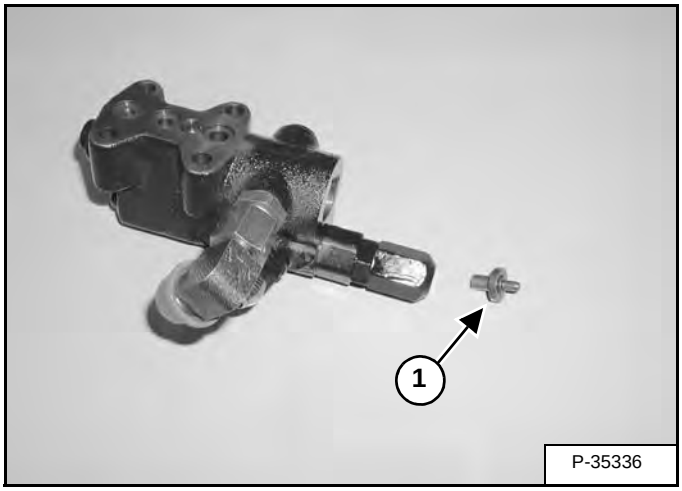
Remove the O-ring (Item 4) **[Figure 20-50-72]**.

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Pump Control Disassembly And Assembly (Cont'd)

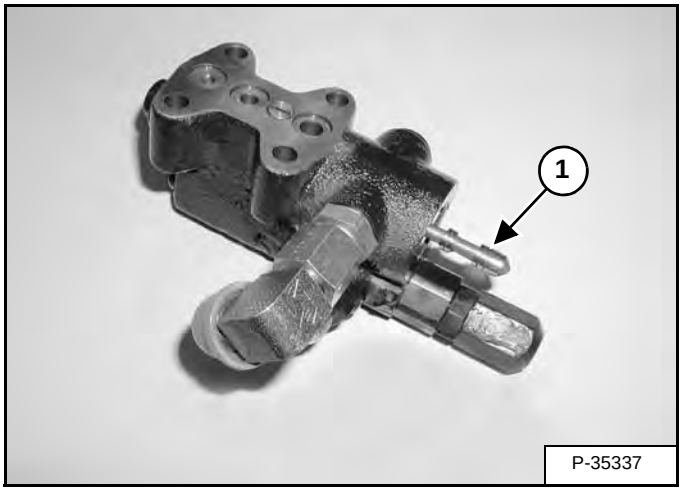
Pump Margin Control (Cont'd)

Figure 20-50-73



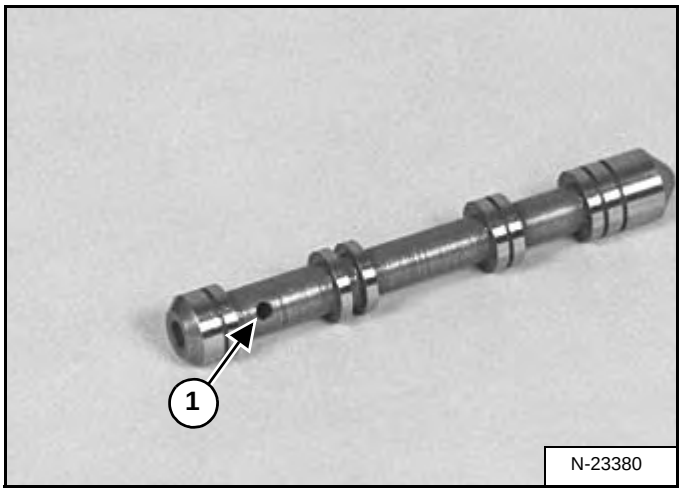
Remove the spring seat (Item 1) **[Figure 20-50-73]**.

Figure 20-50-74



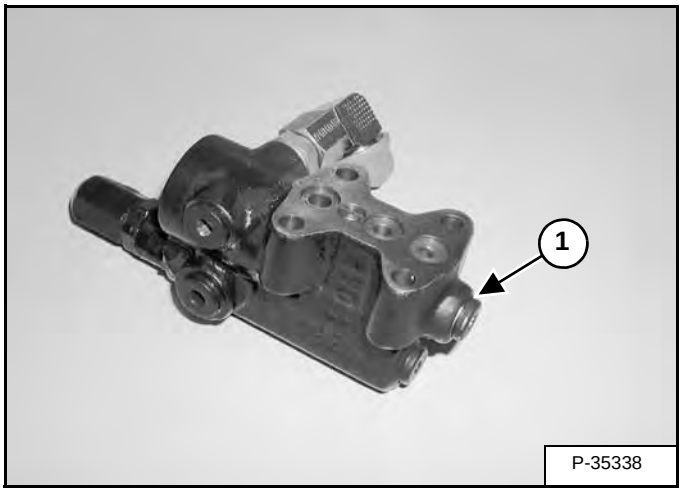
Remove the spool (Item 1) **[Figure 20-50-74]**.

Figure 20-50-75



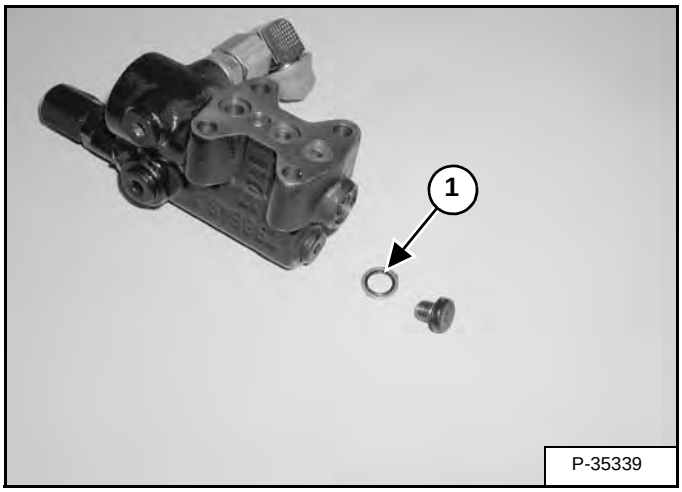
Check the spool for scratches and make sure the orifice (Item 1) **[Figure 20-50-75]** is not plugged.

Figure 20-50-76



Remove the plug (Item 1) **[Figure 20-50-76]**.

Figure 20-50-77



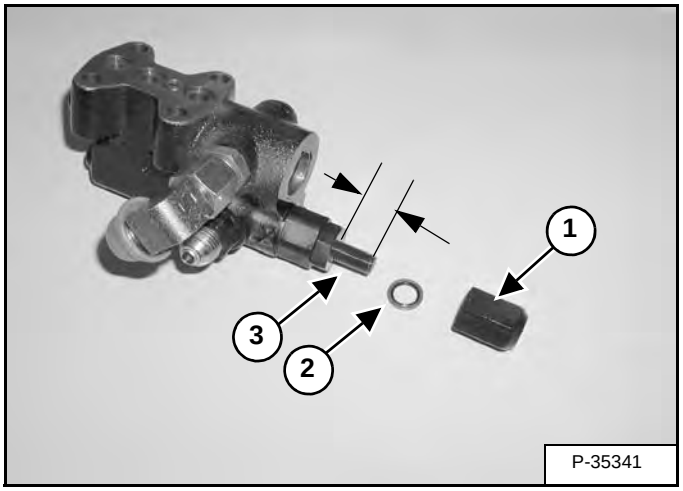
Remove the O-ring washer (Item 1) **[Figure 20-50-77]**.

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Pump Control Disassembly And Assembly (Cont'd)

Torque Limiter Supply Control

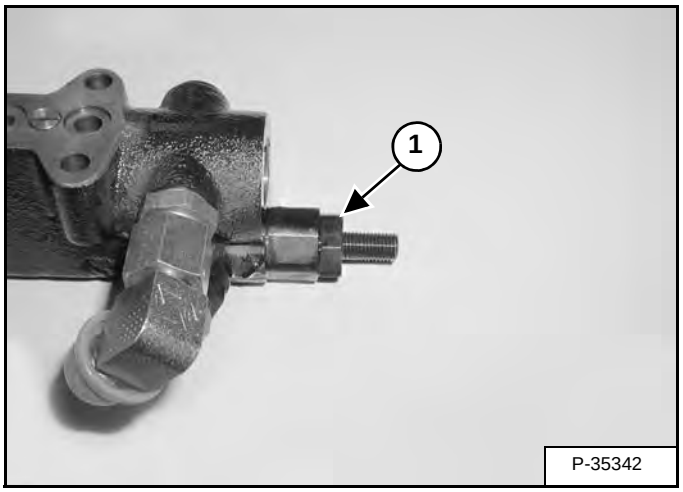
Figure 20-50-78



Before disassembling the pump torque limiter supply control, remove the cap (Item 1) and O-ring washer (Item 2) **[Figure 20-50-78]** from the adjustment assembly (If equipped).

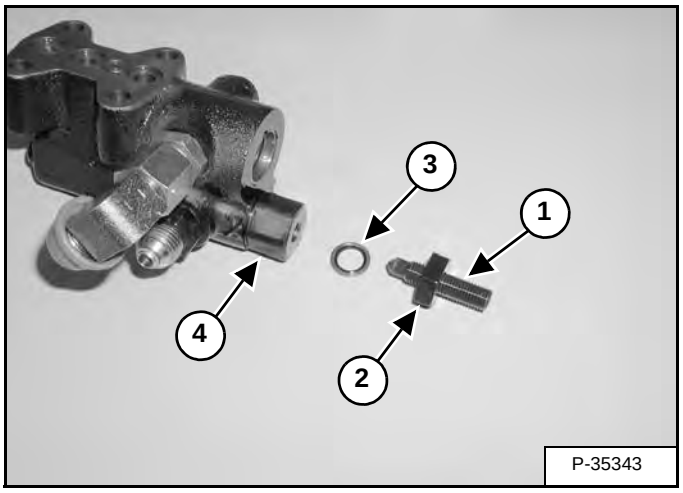
Measure the adjustment screw (Item 3) **[Figure 20-50-78]** thread length for the correct initial adjustment.

Figure 20-50-79



Loosen the nut (Item 1) **[Figure 20-50-79]**.

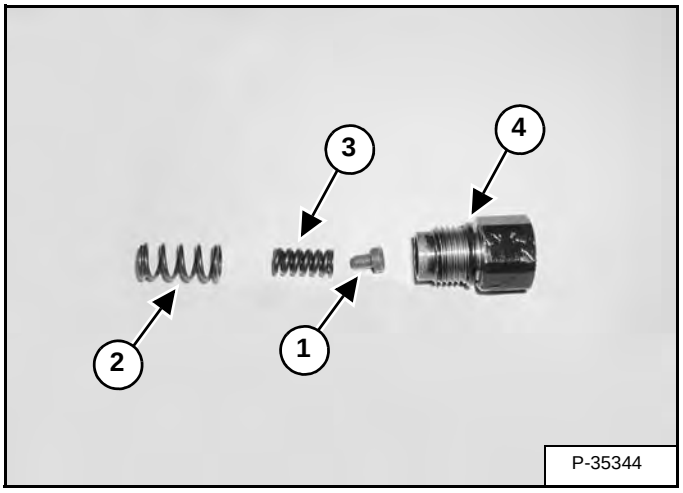
Figure 20-50-80



Remove the adjustment screw (Item 1), nut (Item 2), and O-ring washer (Item 3) from the adjustment assembly (Item 4) **[Figure 20-50-80]**.

Remove the adjustment assembly (Item 4) **[Figure 20-50-80]**.

Figure 20-50-81



Remove the adjustment seat (Item 1), large spring (Item 2) **[Figure 20-50-81]**, and small spring (Item 3) from the adjustment assembly.

Remove the O-ring (Item 4) **[Figure 20-50-81]**.

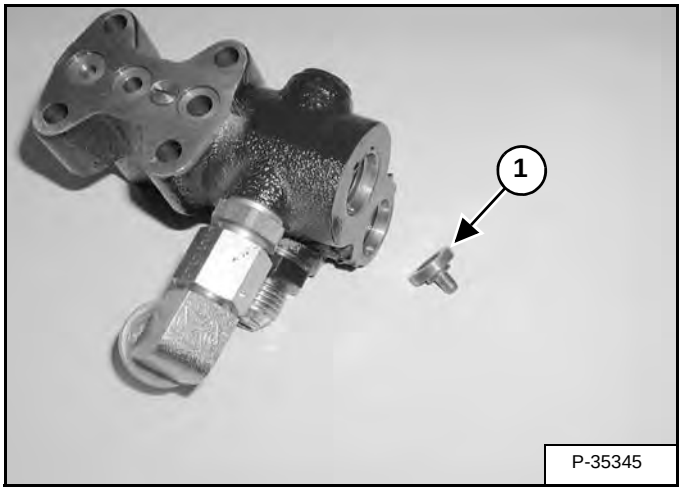
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PUMP (HYDRAULIC PISTON) (CONT'D)

Pump Control Disassembly And Assembly (Cont'd)

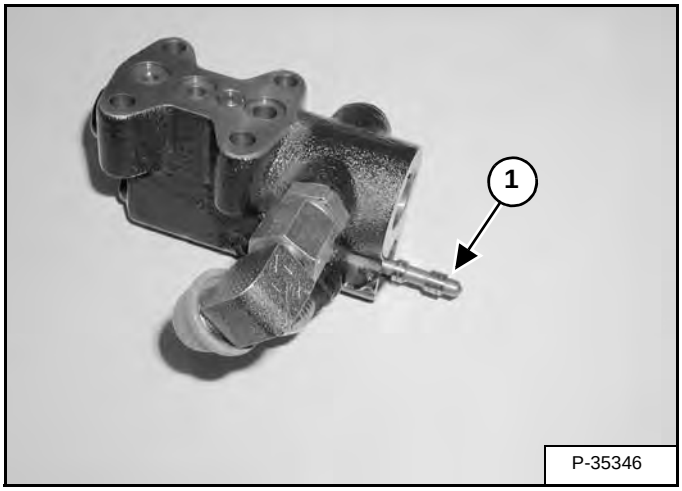
Torque Limiter Supply Control (Cont'd)

Figure 20-50-82



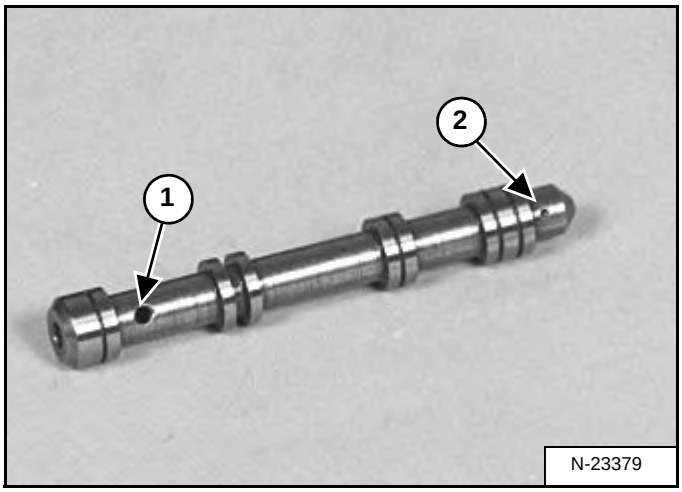
Remove the spring seat (Item 1) **[Figure 20-50-82]**.

Figure 20-50-83



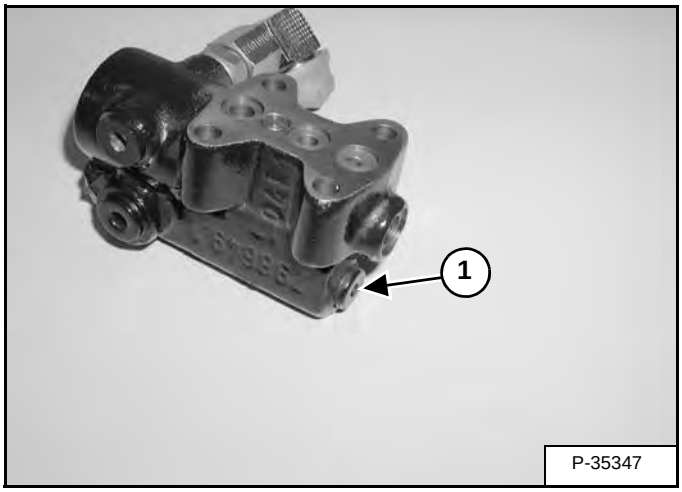
Remove the spool (Item 1) **[Figure 20-50-83]**.

Figure 20-50-84



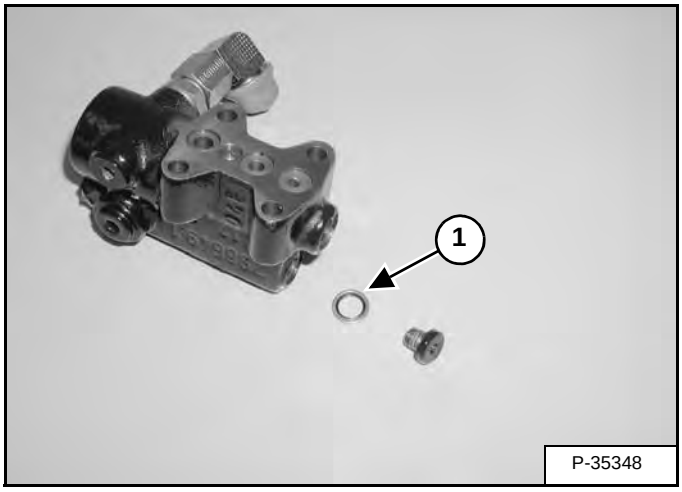
Check the spool for scratches and make sure the orifices (Items 1 and 2) **[Figure 20-50-84]** are not plugged.

Figure 20-50-85



Remove the plug (Item 1) **[Figure 20-50-85]**.

Figure 20-50-86

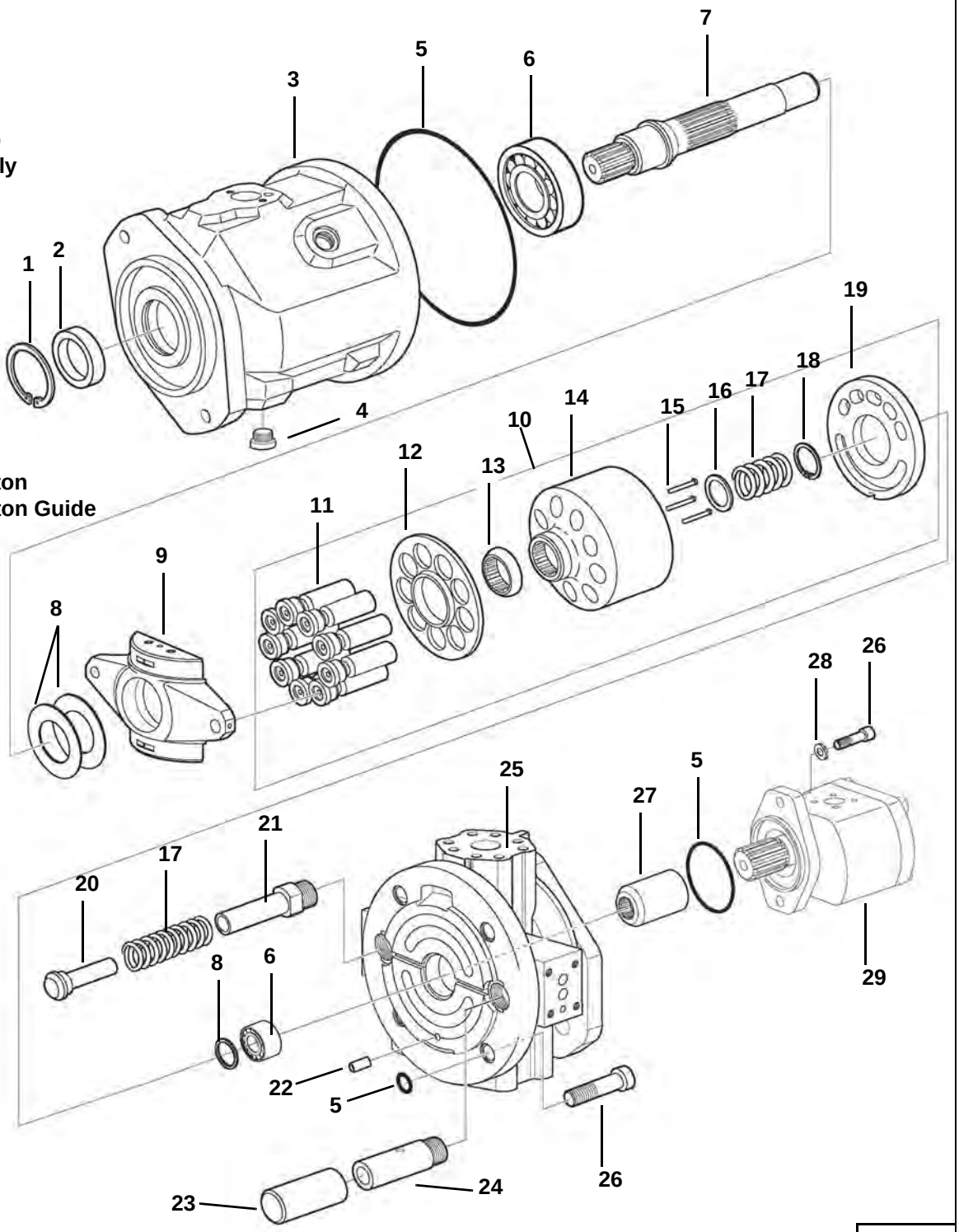


Remove the O-ring washer (Item 1) **[Figure 20-50-86]**.

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Parts Identification

1. Snap Ring
2. Seal
3. Housing
4. Plug
5. O-ring
6. Bearing
7. Shaft
8. Shim
9. Swash Plate
10. Rotating Group
11. Piston Assembly
12. Retaining Plate
13. Ball Guide
14. Cylinder Block
15. Pin
16. Thrust Washer
17. Spring
18. Snap Ring
19. Valve Plate
20. Piston
21. Piston Guide
22. Dowel Pin
23. Destroking Piston
24. Destroking Piston Guide
25. End Cap
26. Bolt
27. Coupler
28. Lock Washer
29. Gear Pump



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Disassembly

IMPORTANT

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

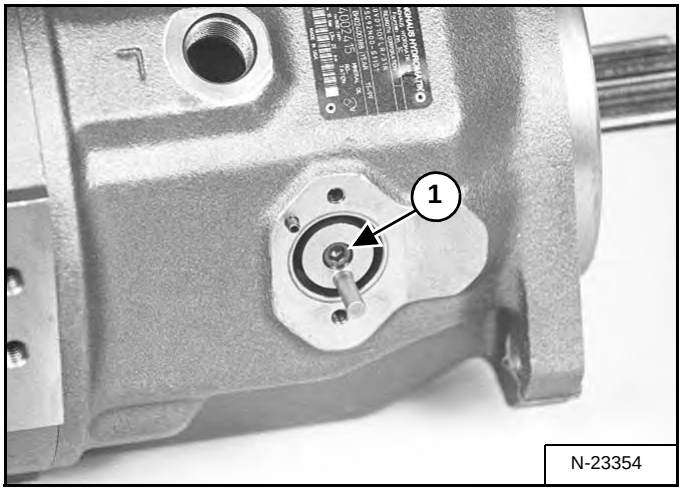
I-2003-0888

Clean the outside of the hydraulic piston pump with solvent and dry with compressed air.

Remove the torque limiter valve. (See Torque Limiter Valve Removal And Installation on Page 20-50-16.)

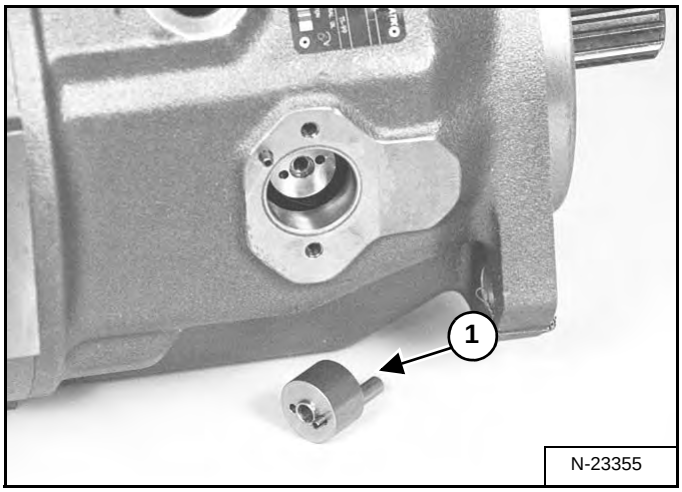
Remove the pump control assembly. (See Pump Control Removal And Installation on Page 20-50-28.)

Figure 20-50-87



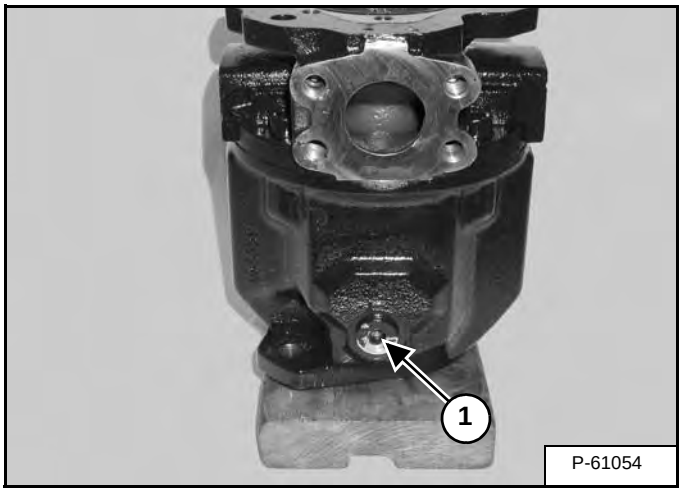
Remove the screw (Item 1) **[Figure 20-50-87]** from the pin assembly.

Figure 20-50-88



Remove the pin assembly (Item 1) **[Figure 20-50-88]**.

Figure 20-50-89

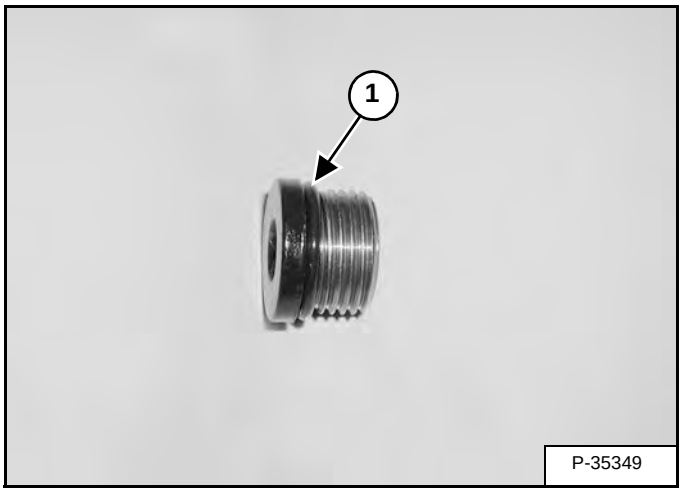


Remove the plug (Item 1) **[Figure 20-50-89]** from the pump housing and drain the oil.

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Disassembly (Cont'd)

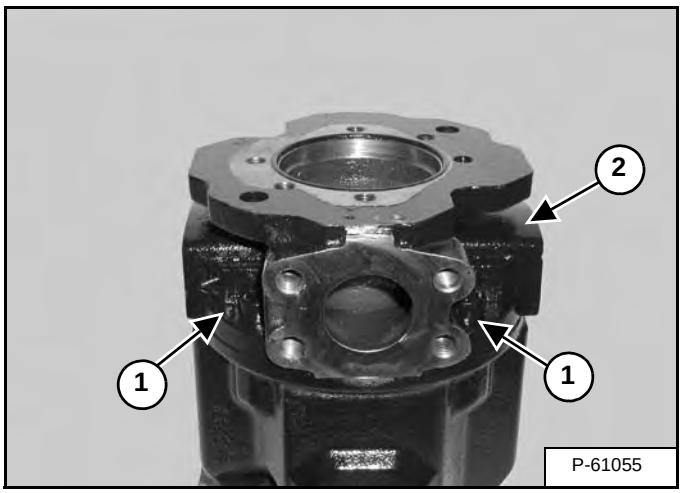
Figure 20-50-90



Remove the O-ring (Item 1) **[Figure 20-50-90]** from the plug.

Mark the pump housing for proper installation.

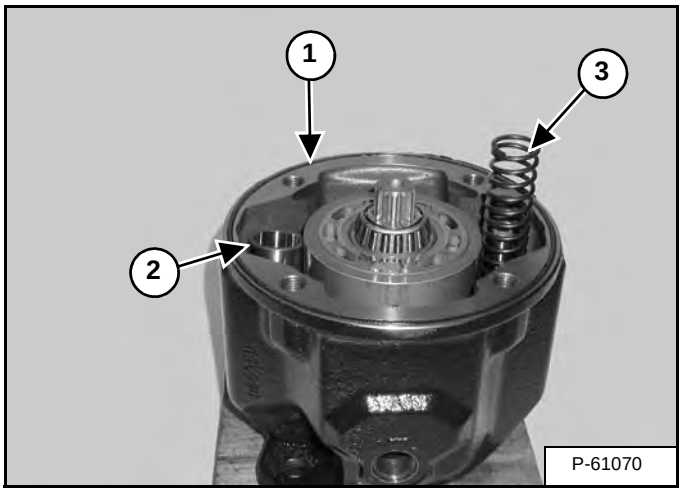
Figure 20-50-91



Remove the four bolts (Item 1) **[Figure 20-50-91]**.

Remove the end cap (Item 2) **[Figure 20-50-91]** from the pump.

Figure 20-50-92

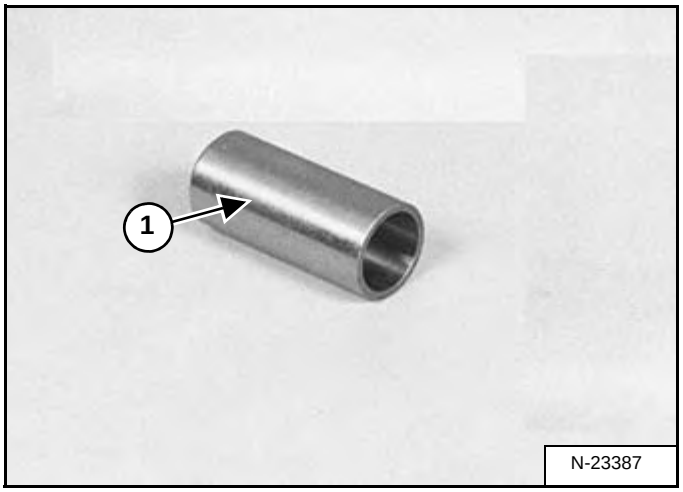


Remove the O-ring (Item 1) **[Figure 20-50-92]**.

Remove the destroking piston (Item 2) **[Figure 20-50-92]**.

Remove the stroking piston / spring assembly (Item 3) **[Figure 20-50-92]**.

Figure 20-50-93

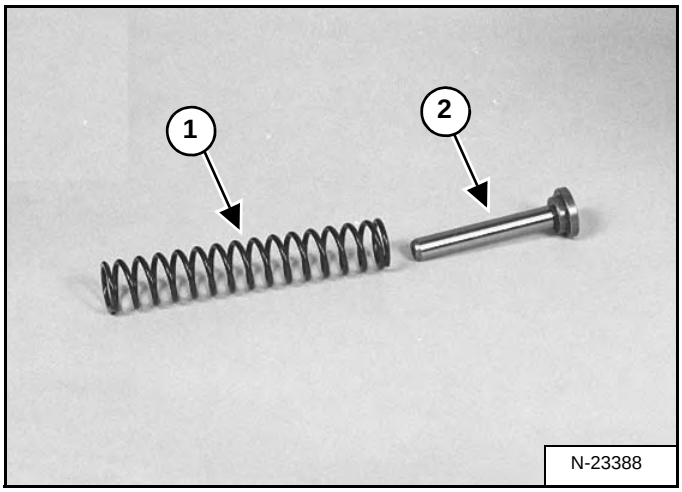


Inspect the destroking piston (Item 1) **[Figure 20-50-93]** for scratches and replace it if needed.

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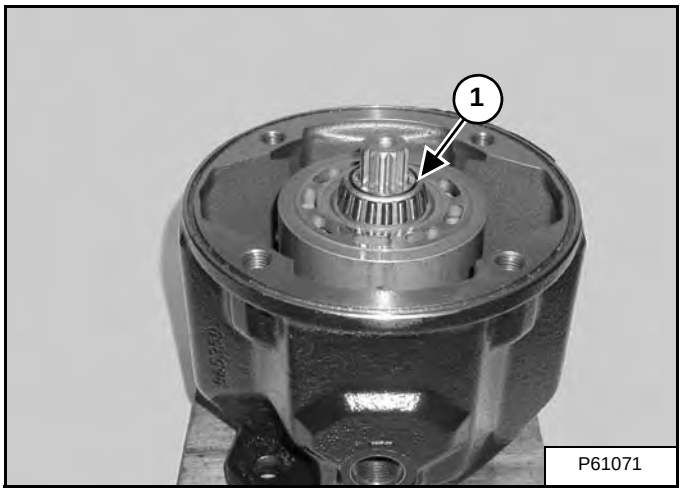
Disassembly (Cont'd)

Figure 20-50-94



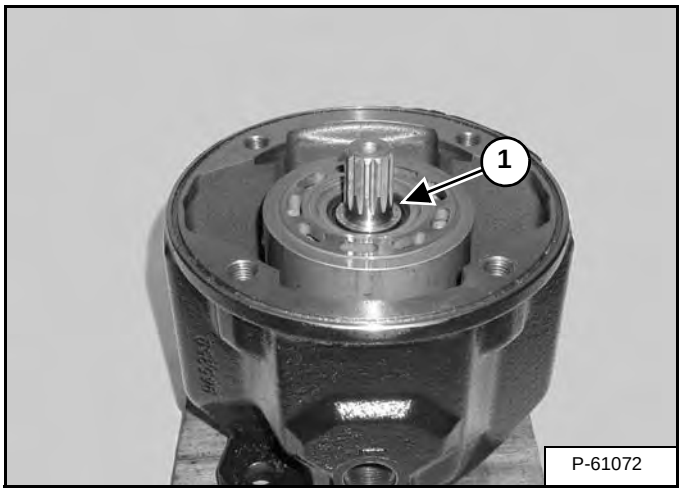
Remove the spring (Item 1) from the stroking piston (Item 2) **[Figure 20-50-94]**.

Figure 20-50-95



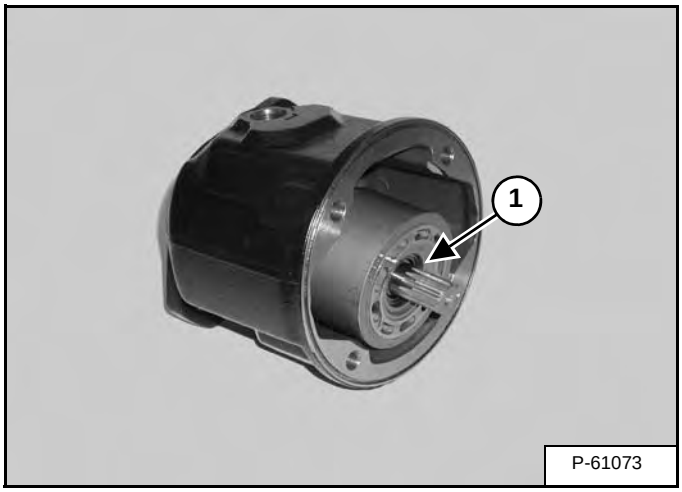
Remove the bearing (Item 1) **[Figure 20-50-95]**.

Figure 20-50-96



Remove the shim(s) (Item 1) **[Figure 20-50-96]** from the pump shaft.

Figure 20-50-97

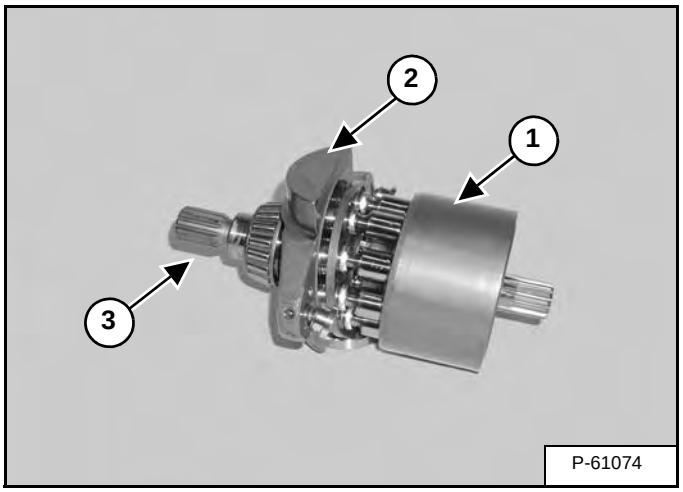


Lay the pump assembly on its side and remove the rotary group, swash plate, and shaft (Item 1) **[Figure 20-50-97]** from the housing.

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Disassembly (Cont'd)

Figure 20-50-98

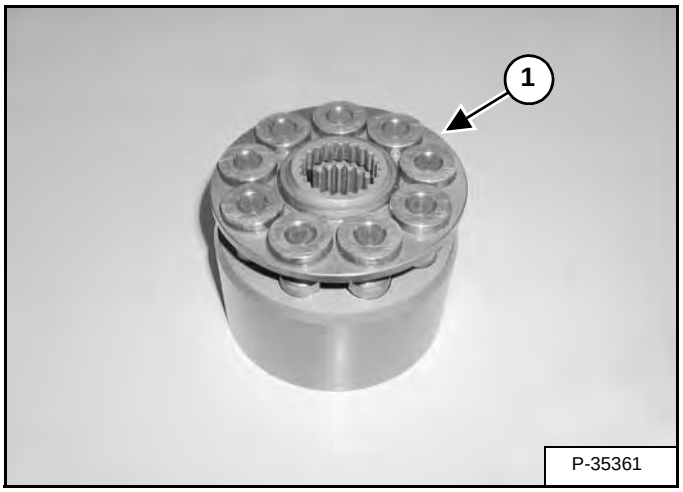


Slide the rotary group (Item 1) and swash plate (Item 2) from the shaft assembly (Item 3) **[Figure 20-50-98]**.

NOTE: It is NOT important that the pistons are installed in their original positions.

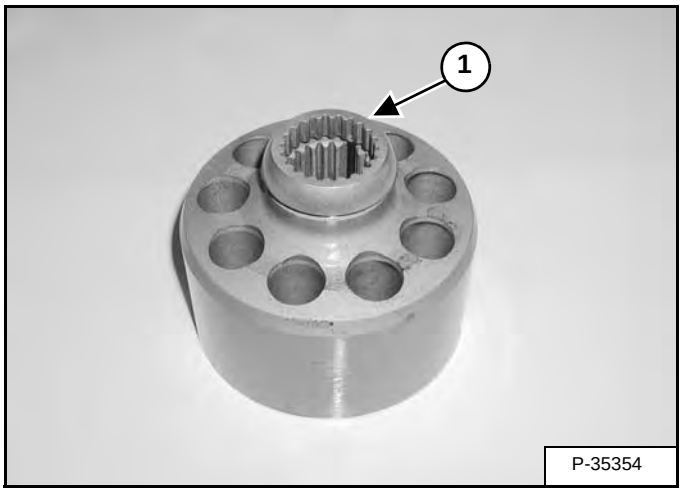
NOTE: Check that there are no scratches or metal deposits on the sliding surface. (Pistons must be replaced in sets.)

Figure 20-50-99



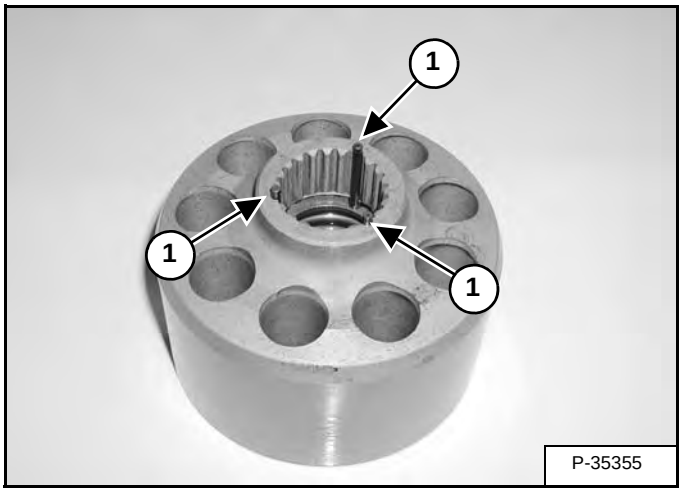
Remove the retainer plate and pistons (Item 1) **[Figure 20-50-99].**

Figure 20-50-100



Remove the retaining ball (Item 1) **[Figure 20-50-100]**.

Figure 20-50-101



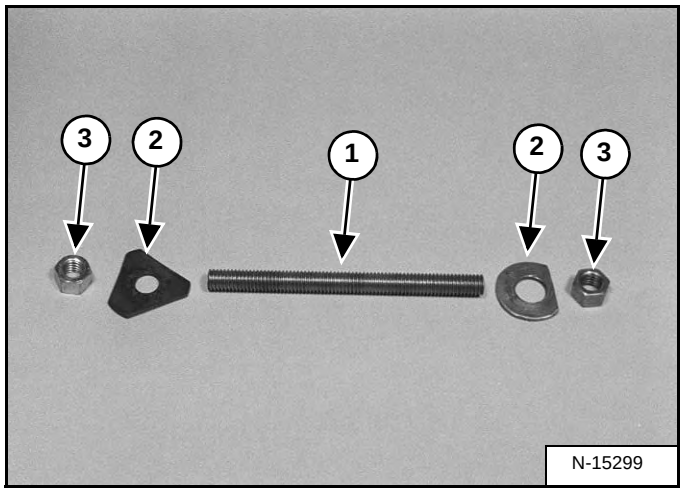
Inspect the three pins (Item 1) **[Figure 20-50-101]** for wear and / or damage.

NOTE: The following procedure is only to disassemble the rotating group for inspection. The rotating group parts can not be ordered separately and must be ordered as an assembly.

Dealer Copy -- Not for Resale

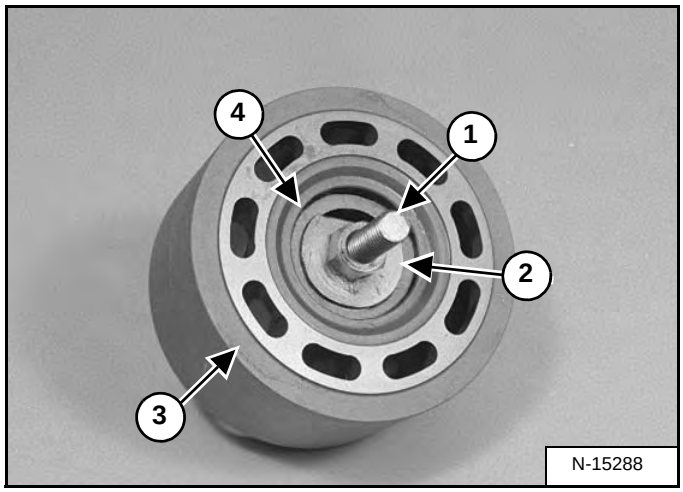
Disassembly (Cont'd)

Figure 20-50-102



To remove the spring from inside the cylinder block, use a threaded rod (or bolt) (Item 1), two trimmed washers (Item 2), and two nuts (Item 3) **[Figure 20-50-102]**.

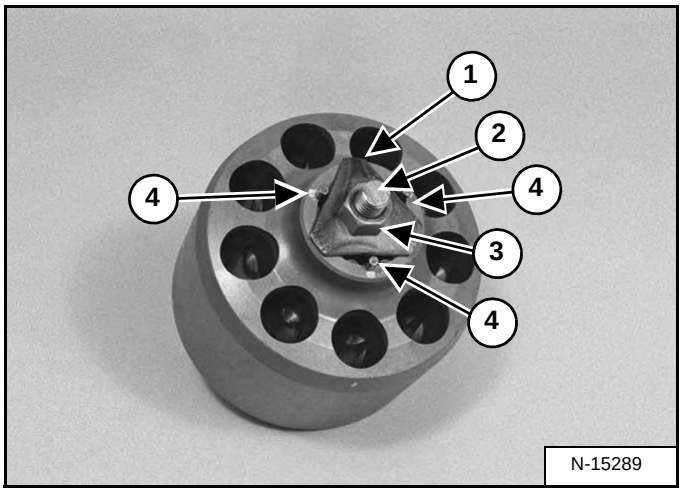
Figure 20-50-103



Install the threaded rod and nut (Item 1) through the trimmed washer (Item 2) and through the block assembly (Item 3) **[Figure 20-50-103]**.

NOTE: The modified washer (Item 2) must fit over the spring, but must also fit inside the snap ring (Item 4) [Figure 20-50-103].

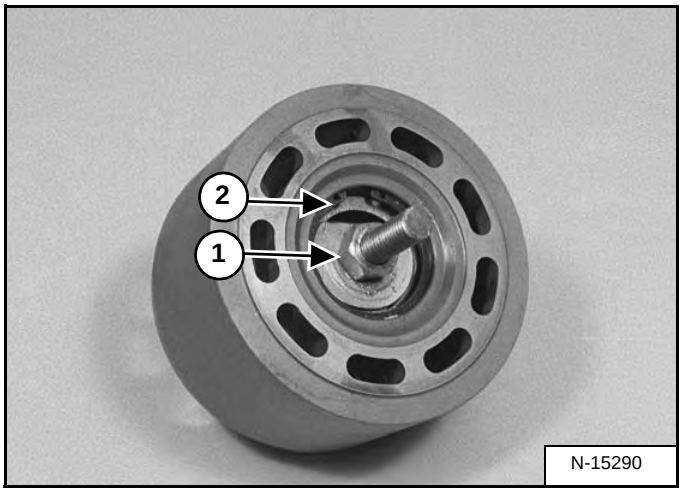
Figure 20-50-104



Install the second trimmed washer (Item 1) over the threaded rod (Item 2) and install the nut (Item 3) **[Figure 20-50-104]**.

NOTE: The modified washer (Item 1) must fit between the three pins (Item 4) [Figure 20-50-104].

Figure 20-50-105



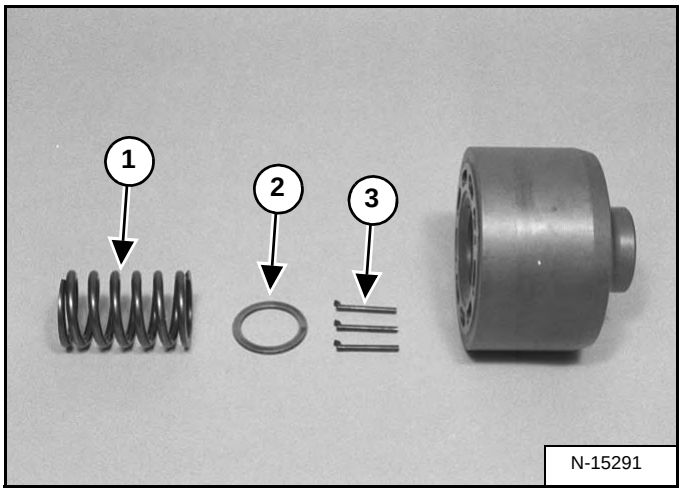
Tighten the nut (Item 1) until the spring is compressed enough to remove the snap ring (Item 2) **[Figure 20-50-105]**.

Loosen the nut to release the tension on the spring and remove the bolts and washers.

Dealer Copy -- Not for Resale

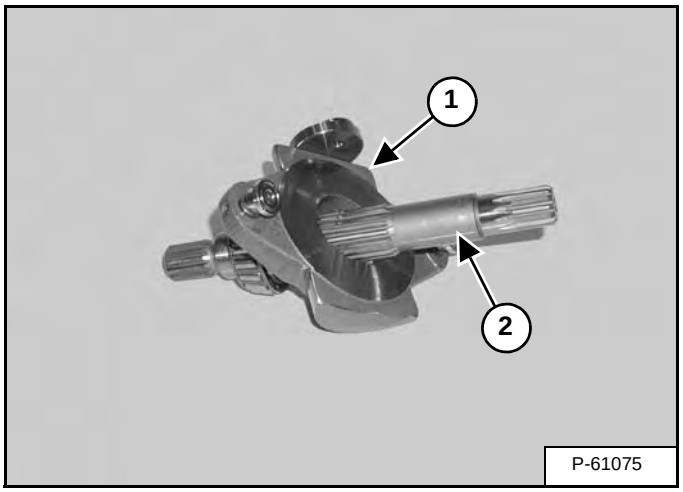
Disassembly (Cont'd)

Figure 20-50-106



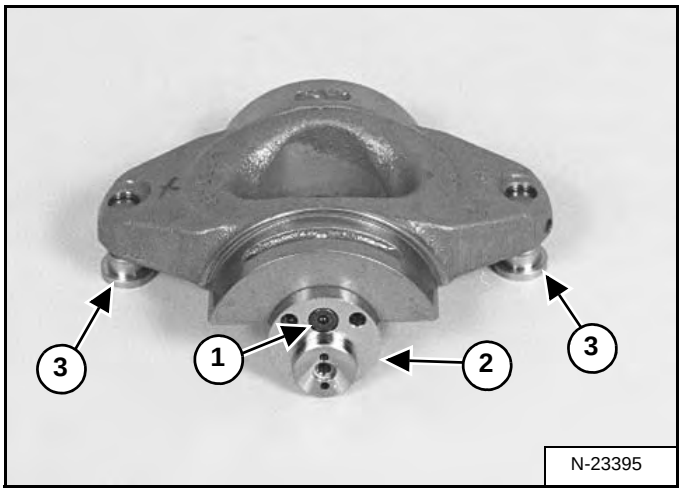
Remove the spring (Item 1), washer (Item 2) and the three pins (Item 3) **[Figure 20-50-106]** from the cylinder block.

Figure 20-50-107



Remove the swash plate (Item 1) from the shaft (Item 2) **[Figure 20-50-107]**.

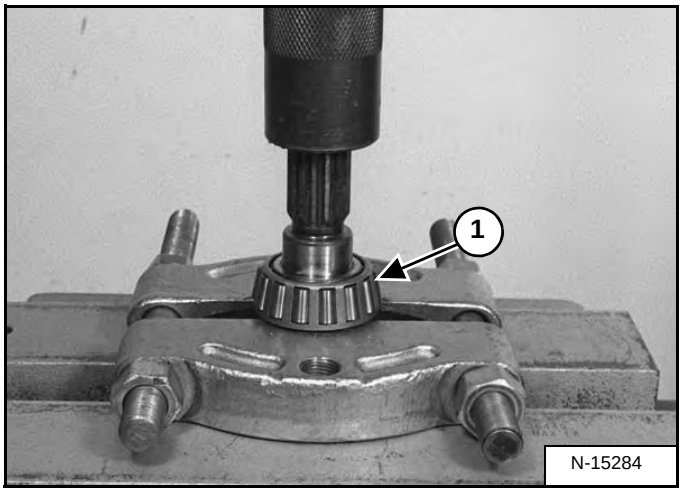
Figure 20-50-108



Remove the bolt (Item 1) and remove the torque limiter plate (Item 2) **[Figure 20-50-108]**.

NOTE: The caps (Item 3) [Figure 20-50-108] cannot be replaced, order a new swash plate if necessary.

Figure 20-50-109

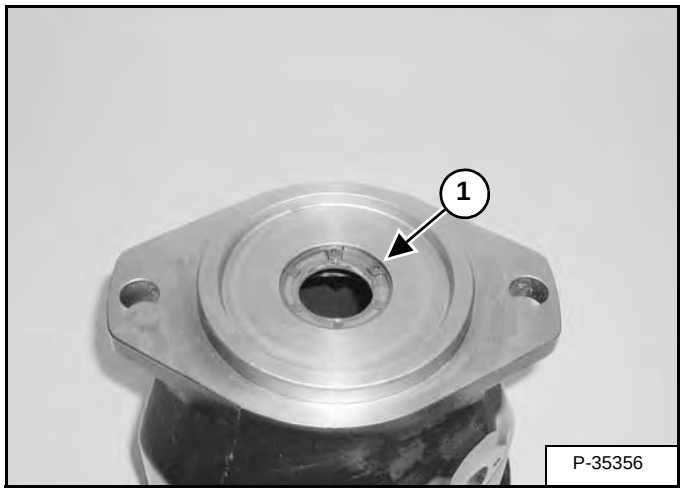


Press the bearing (Item 1) **[Figure 20-50-109]** off the shaft.

Dealer Copy -- Not for Resale

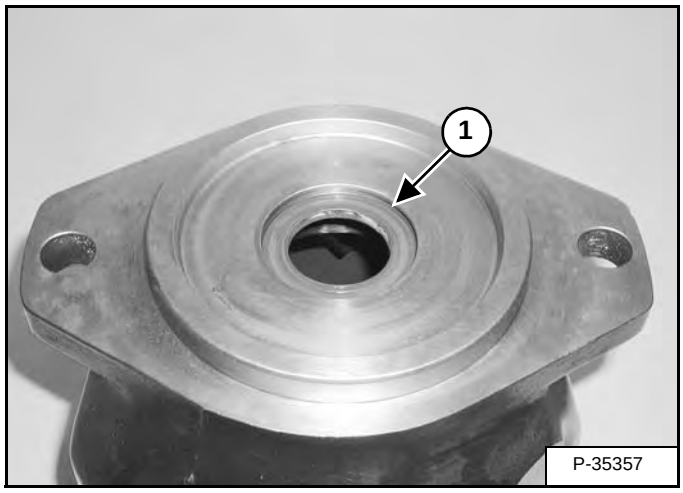
Disassembly (Cont'd)

Figure 20-50-110



Remove the snap ring (Item 1) **[Figure 20-50-110]** from the housing.

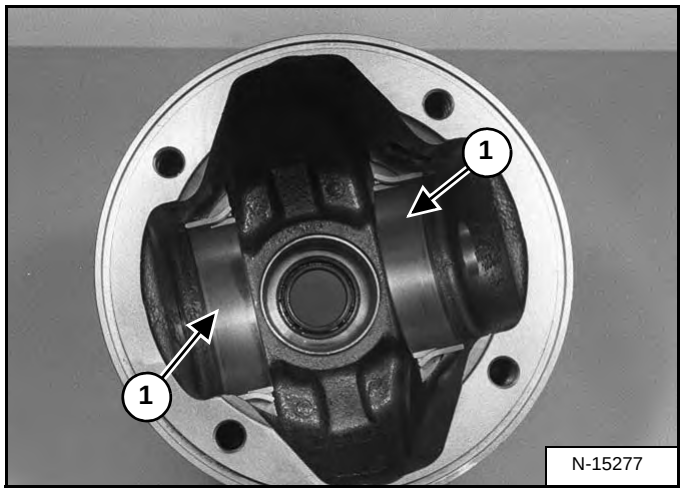
Figure 20-50-111



Remove the seal (Item 1) **[Figure 20-50-111]** from the housing.

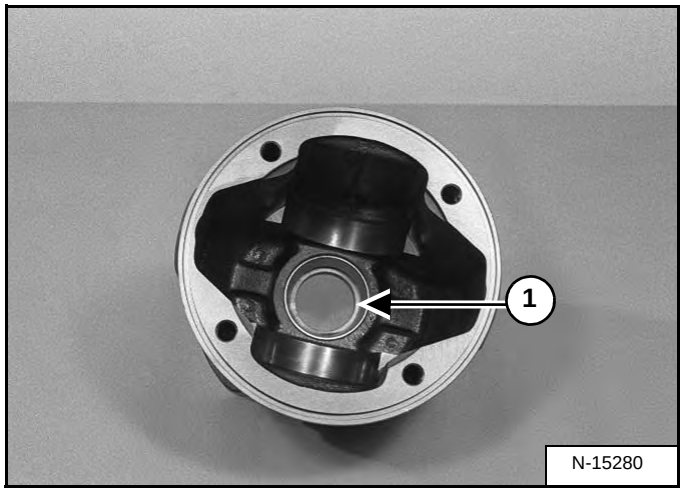
NOTE: The shaft seal can be removed without disassembling the pump.

Figure 20-50-112



Remove the two brass bearings (Item 1) **[Figure 20-50-112]** from the housing.

Figure 20-50-113

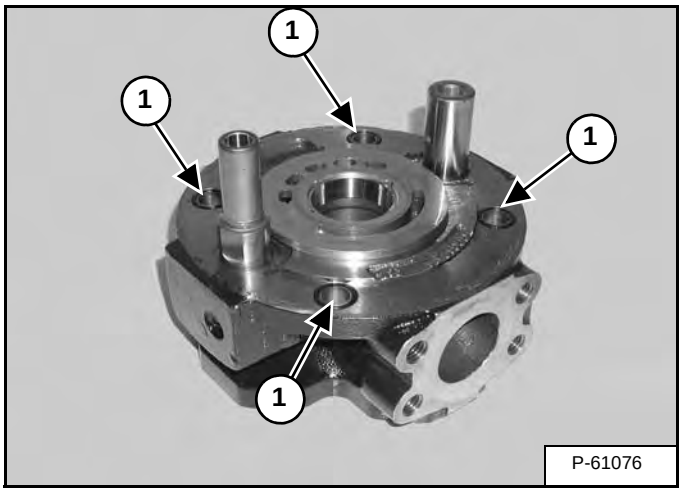


Remove the race (Item 1) **[Figure 20-50-113]** from the housing.

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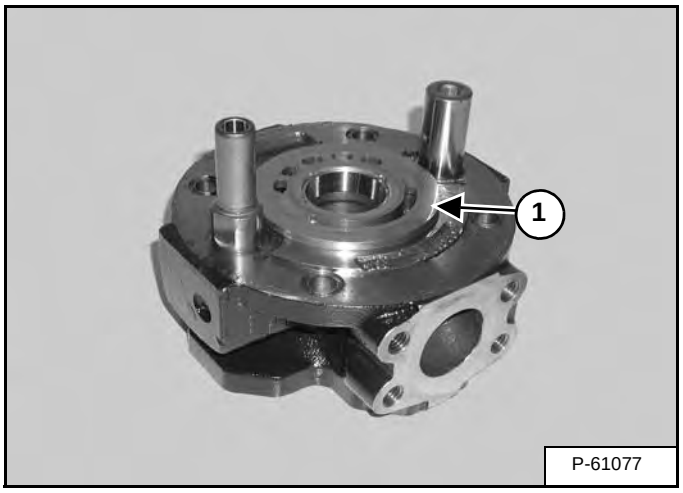
Disassembly (Cont'd)

Figure 20-50-114



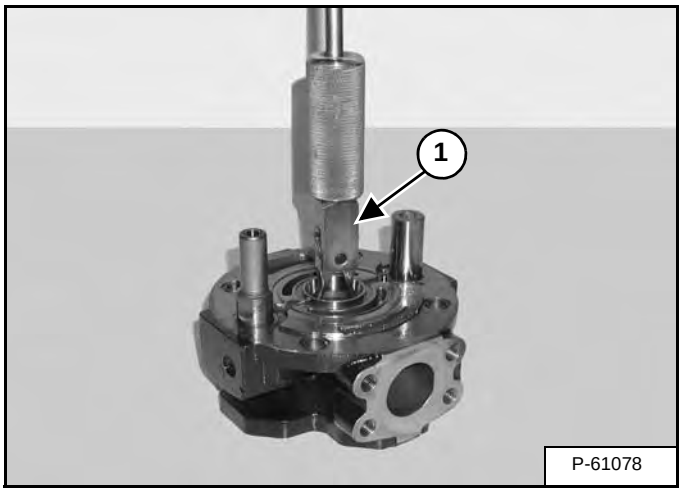
Remove the O-rings (Item 1) **[Figure 20-50-114]**.

Figure 20-50-115



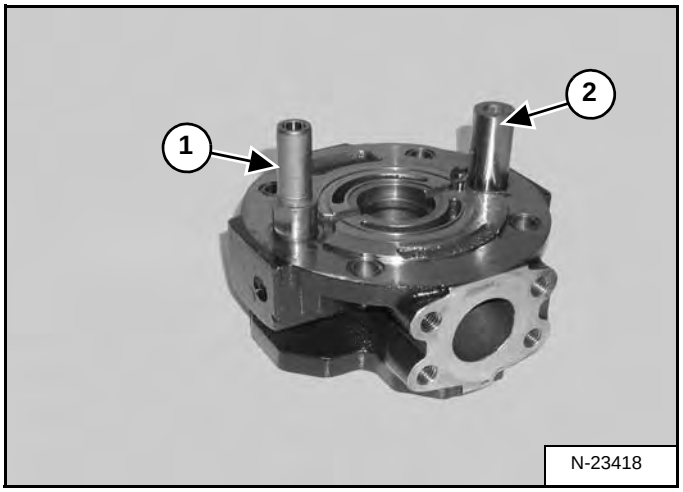
Remove the valve plate (Item 1) **[Figure 20-50-115]**.

Figure 20-50-116



Remove the bearing race from the port block assembly with a bearing puller (Item 1) **[Figure 20-50-116]**.

Figure 20-50-117



Remove the stroking piston (Item 1) **[Figure 20-50-117]**. (Spring Side)

Remove the destroking piston (Item 2) **[Figure 20-50-117]**.

Dealer Copy -- Not for Resale

Assembly

IMPORTANT

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

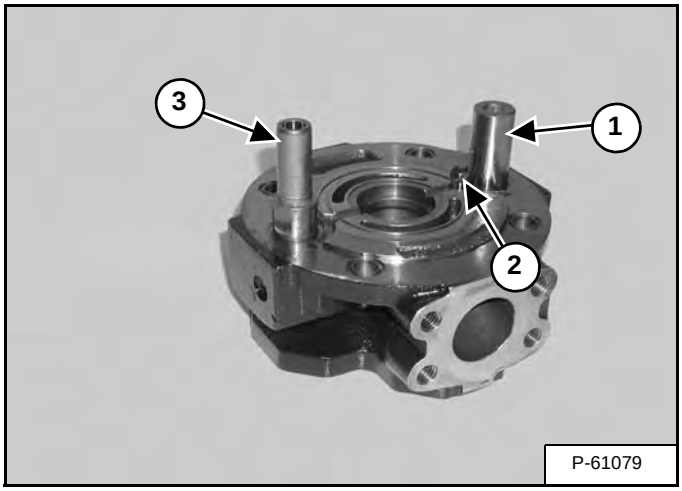
I-2003-0888

Clean all parts in solvent and dry with compressed air.

Inspect all parts for wear and damage.

Replace any worn or damaged parts.

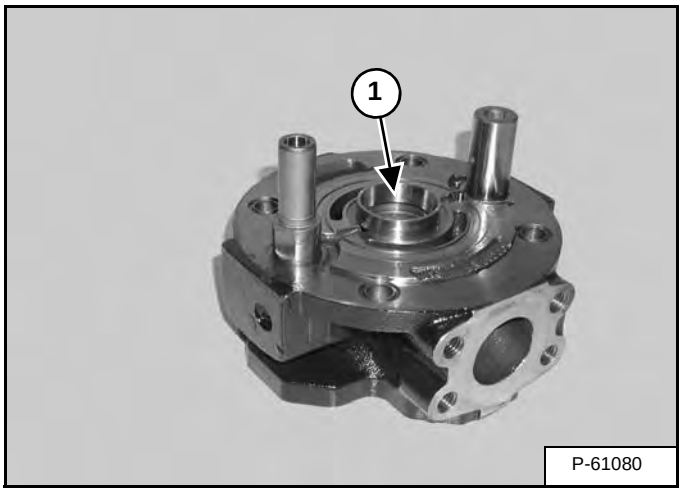
Figure 20-50-118



Apply Loctite® 241 or equivalent on the threads and install the destroking piston (Item 1) in the hole next to the alignment pin (Item 2) **[Figure 20-50-118]**.

Apply Loctite® 241 or equivalent on the threads and install the stroking piston (Item 3) **[Figure 20-50-118]**.

Figure 20-50-119

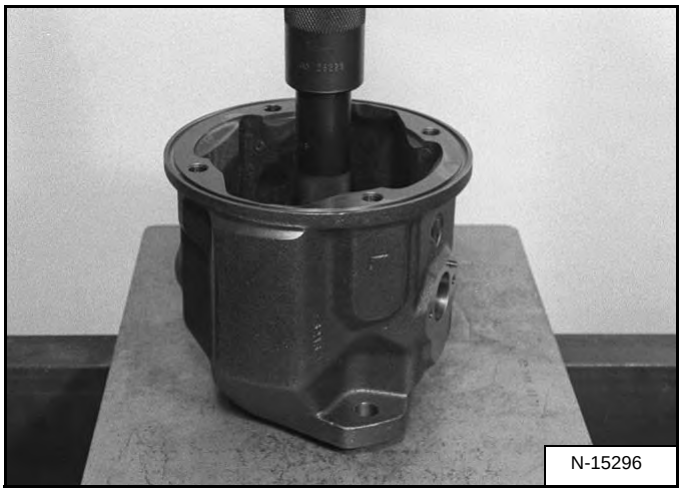


Install the bearing race (Item 1) **[Figure 20-50-119]** in the port block assembly.

Dealer Copy -- Not for Resale

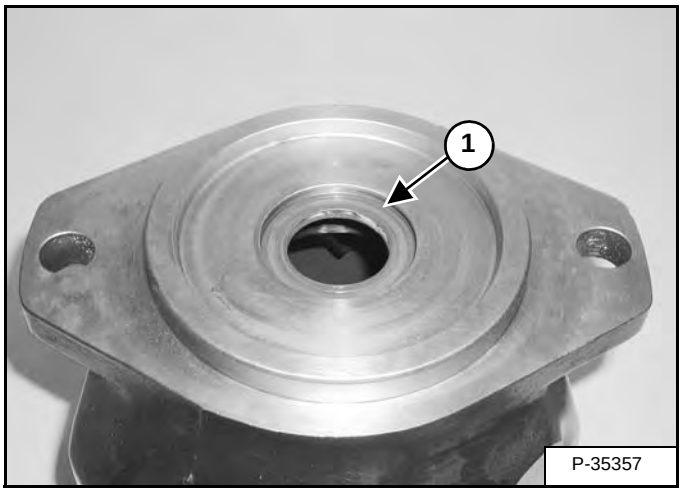
Assembly (Cont'd)

Figure 20-50-120



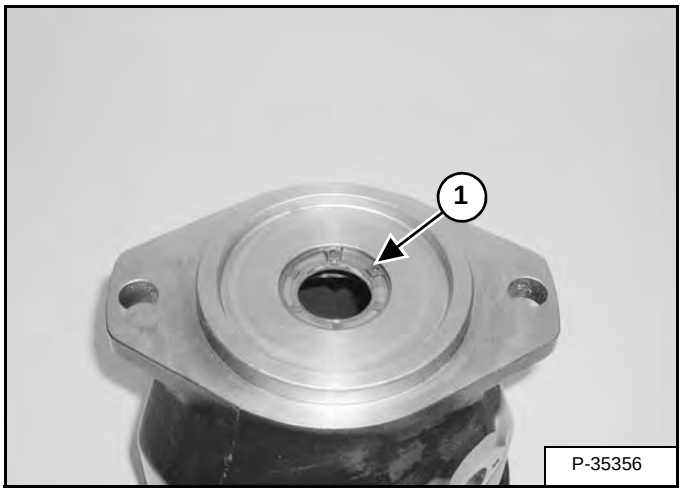
Press the race into the housing **[Figure 20-50-120]**.

Figure 20-50-121



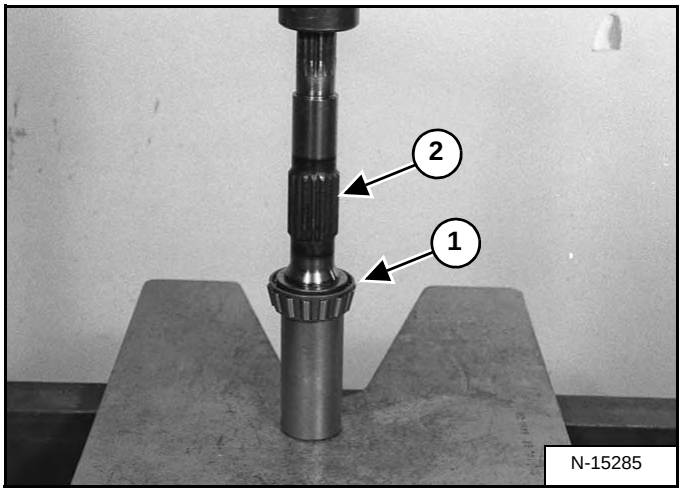
Install the shaft seal (Item 1) **[Figure 20-50-121]**.

Figure 20-50-122



Install the snap ring (Item 1) **[Figure 20-50-122]**.

Figure 20-50-123

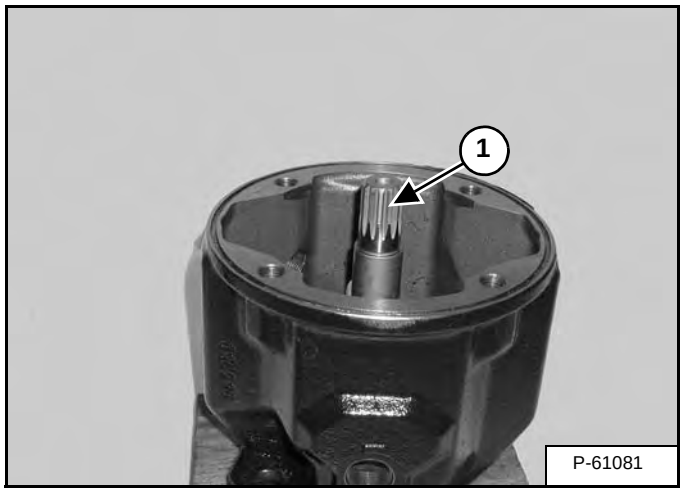


Press the bearing (Item 1) on the shaft (Item 2) **[Figure 20-50-123]**.

Dealer Copy -- Not for Resale

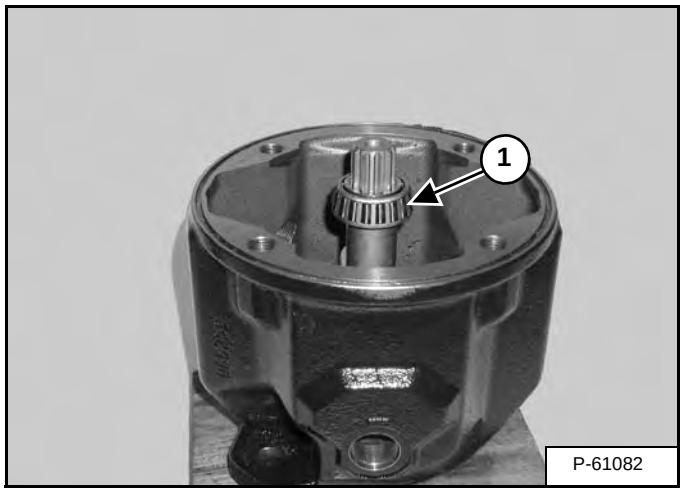
Assembly (Cont'd)

Figure 20-50-124



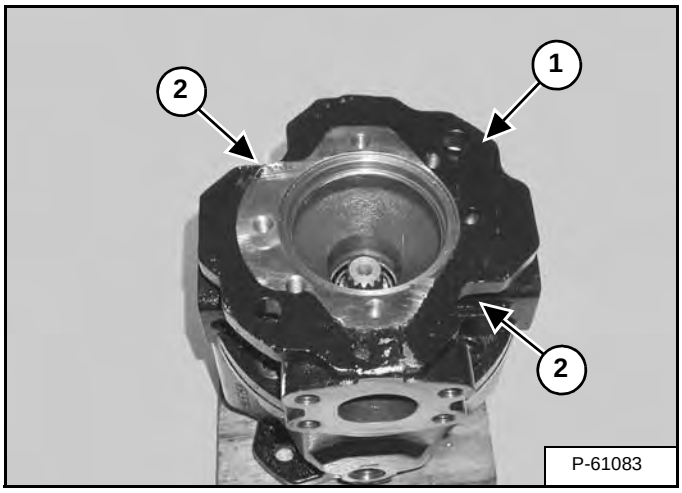
To find the correct shim washer thickness for bearing end play, the shaft / bearing assembly (Item 1) **[Figure 20-50-124]** must be installed in the housing.

Figure 20-50-125



Install the bearing (Item 1) **[Figure 20-50-125]** on the shaft.

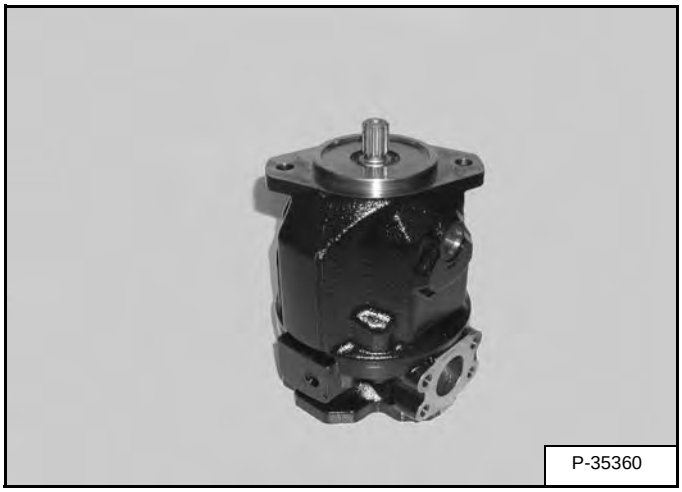
Figure 20-50-126



Install the port block (Item 1) **[Figure 20-50-126]**.

Install the four bolts (Item 2) **[Figure 20-50-126]** and tighten them to 119 N•m (88 ft-lb) torque.

Figure 20-50-127

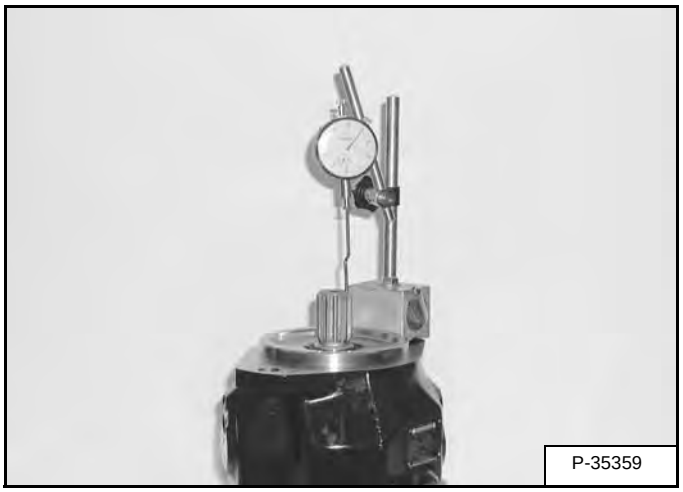


Turn over the pump assembly **[Figure 20-50-127]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-50-128



Install a dial indicator on the housing as shown **[Figure 20-50-128]** and set it to zero.

Pull the shaft up as far as it will go and record the reading on the dial indicator. Repeat the procedure several times. The reading must be the same each time.

Add the nominal preload of 0,025 mm (0.001 in) to the reading found on the dial indicator **[Figure 20-50-128]**. The actual preload is 0,000 mm (0.000 in) to 0,050 mm (0.002 in)

Example: (In Inches)

0.150 Measured movement of the shaft

0.001 Nominal Preload

= 0.151 ± thickness of the shim needed. (See Assembly on Page 20-50-42.)

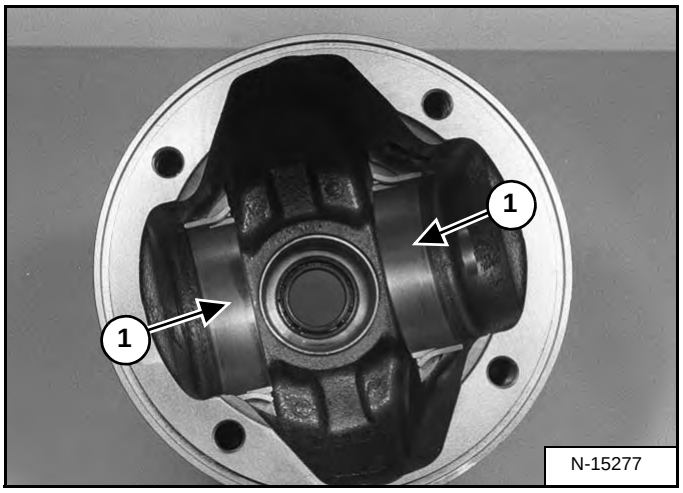
When the proper thickness of the shim washer is determined, remove the dial indicator from the pump housing.

Remove the two mounting bolts.

Remove the port block.

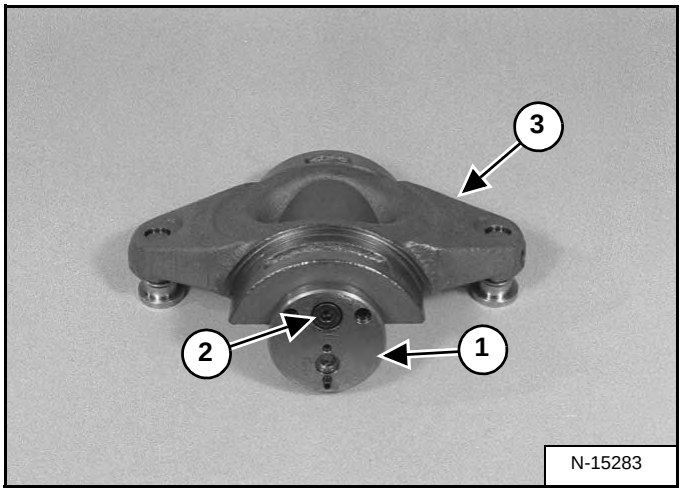
Remove the bearing and shaft from the pump housing.

Figure 20-50-129



Install the two brass bearings (Item 1) **[Figure 20-50-129]**.

Figure 20-50-130

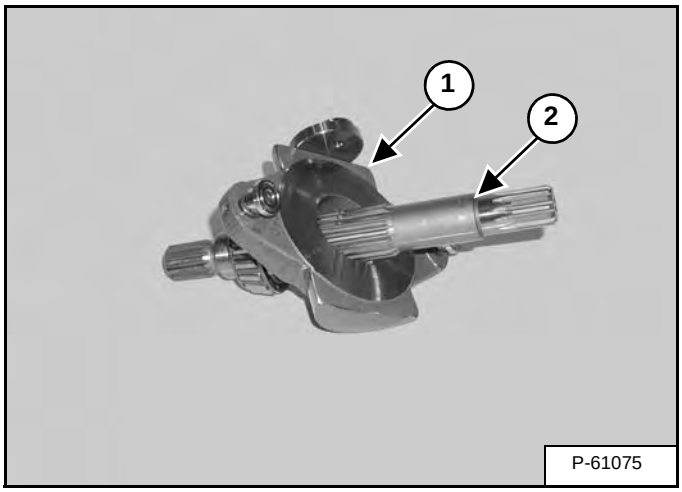


Apply Loctite® 241 or equivalent and install the torque limiter plate (Item 1) and bolt (Item 2) on the swash plate (Item 3) **[Figure 20-50-130]**.

Dealer Copy -- Not for Resale

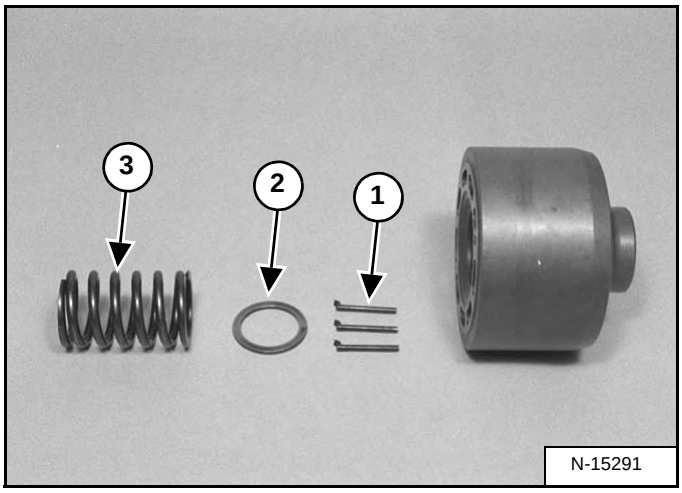
Assembly (Cont'd)

Figure 20-50-131



Install the swash plate (Item 1) on the shaft (Item 2) **[Figure 20-50-131]**.

Figure 20-50-132

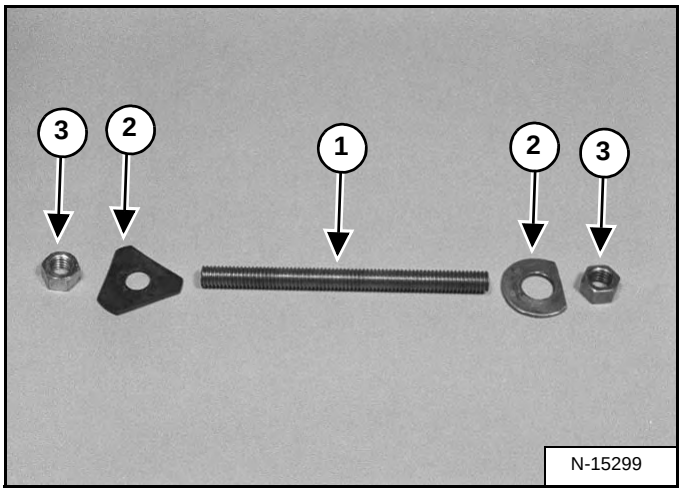


Apply clean grease to the three pins (Item 1) **[Figure 20-50-132]** and install them in the appropriate groove.

Install the washer (Item 2) and the spring (Item 3) **[Figure 20-50-132]**.

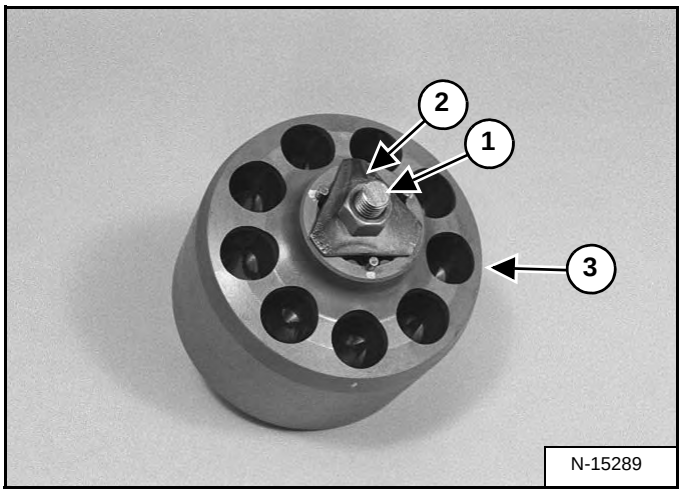
NOTE: If the rotating group is damaged, the parts can not be ordered separately and must be ordered as an assembly.

Figure 20-50-133



To compress the spring inside the cylinder block, use a threaded rod (or bolt) (Item 1), two trimmed washers (Item 2), and two nuts (Item 3) **[Figure 20-50-133]**.

Figure 20-50-134

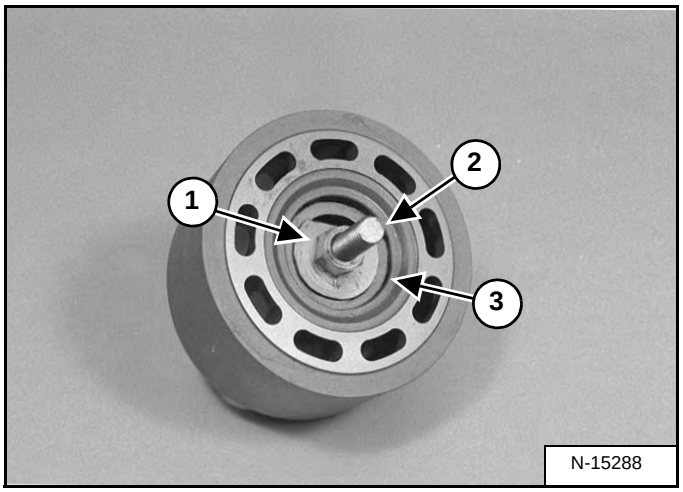


Install the threaded rod and nut (Item 1) through the modified washer (Item 2) and the block assembly (Item 3) **[Figure 20-50-134]**.

Dealer Copy -- Not for Resale

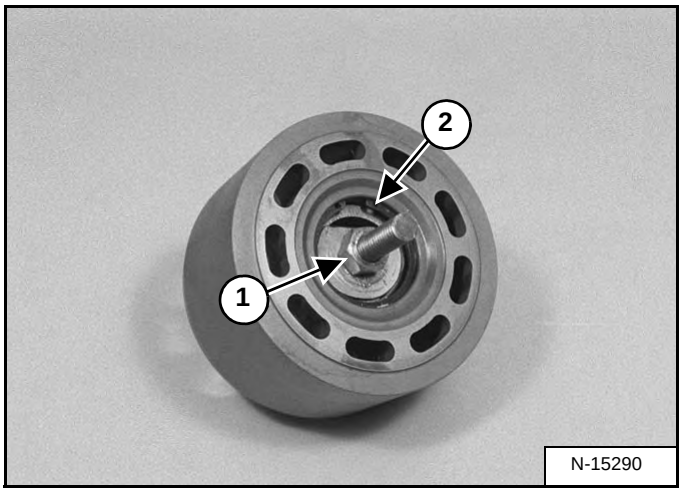
Assembly (Cont'd)

Figure 20-50-135



NOTE: The modified washer (Item 1) must fit over the spring (Item 2), but must also fit inside the snap ring (Item 3) [Figure 20-50-135].

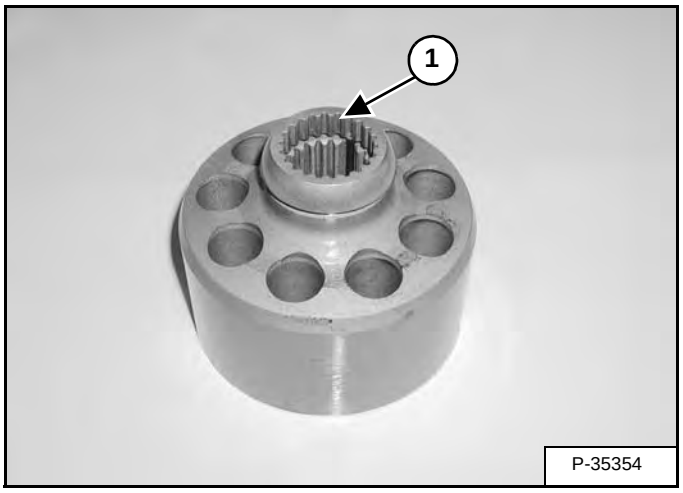
Figure 20-50-136



Tighten the nut (Item 1) until the spring is compressed enough to install the snap ring (Item 2) **[Figure 20-50-136]**.

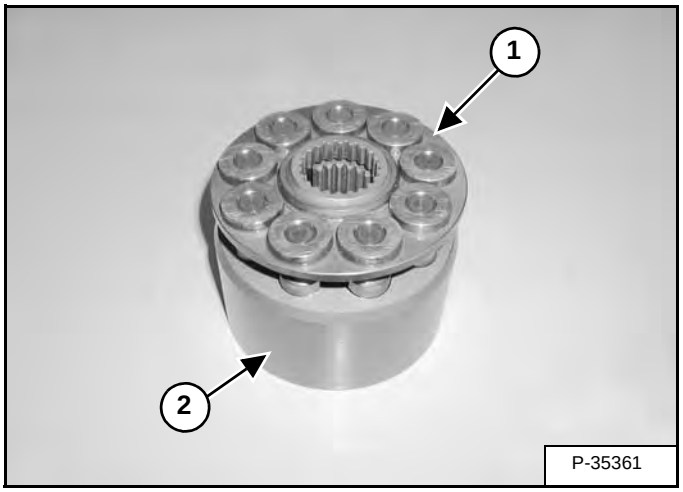
Remove the threaded rod / washer assembly.

Figure 20-50-137



Install the retaining ball (Item 1) **[Figure 20-50-137]** on the three pins.

Figure 20-50-138



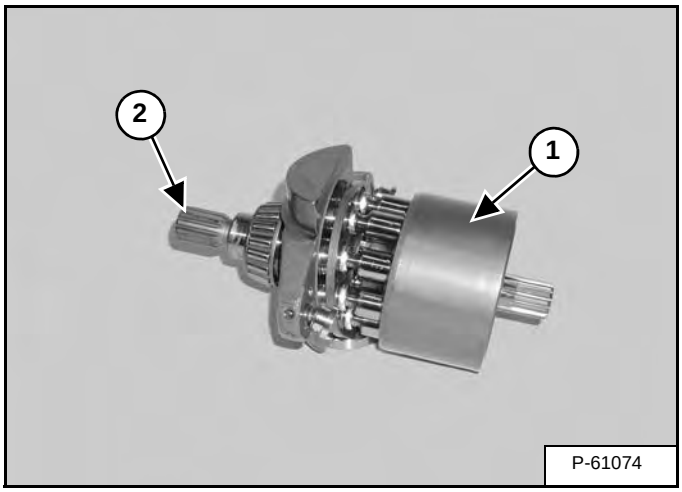
Install the retainer and piston assembly (Item 1) in the cylinder block (Item 2) **[Figure 20-50-138]**.

NOTE: It is NOT important that the pistons are installed in their original positions.

Dealer Copy -- Not for Resale

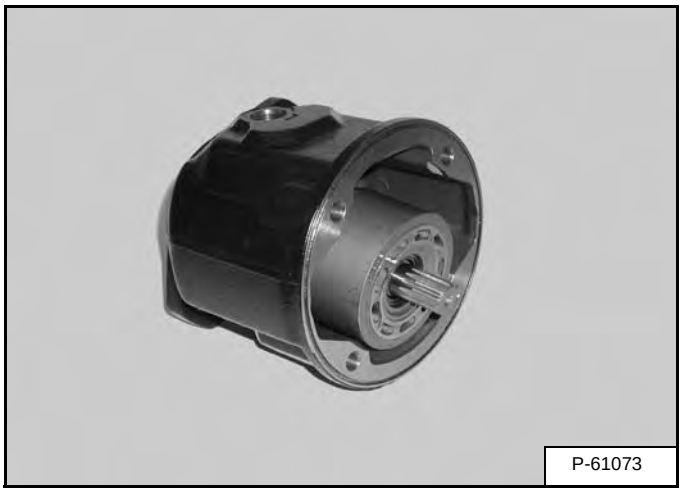
Assembly (Cont'd)

Figure 20-50-139



Slide the rotary group assembly (Item 1) on the shaft (Item 2) **[Figure 20-50-139]**.

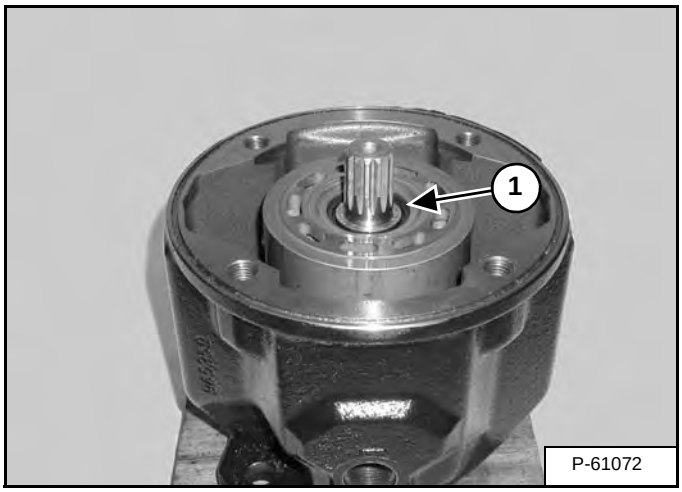
Figure 20-50-140



Lay the pump housing on its side and install the rotary group assembly, swash plate and shaft in the housing **[Figure 20-50-140]**.

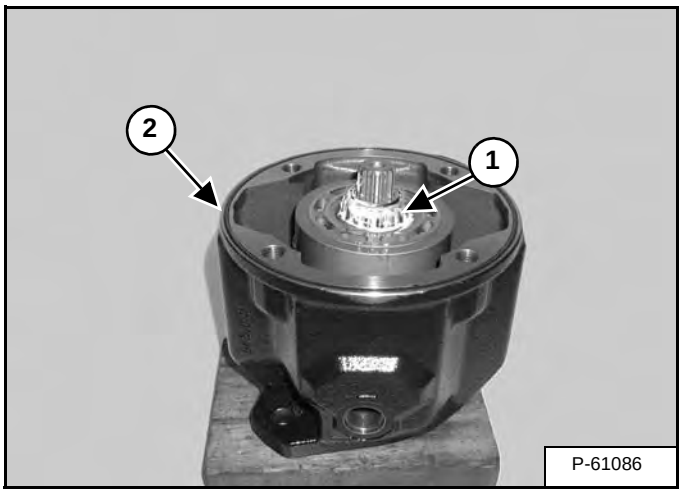
Set the pump housing in the up-right position.

Figure 20-50-141



Install the shim (Item 1) **[Figure 20-50-141]**.

Figure 20-50-142



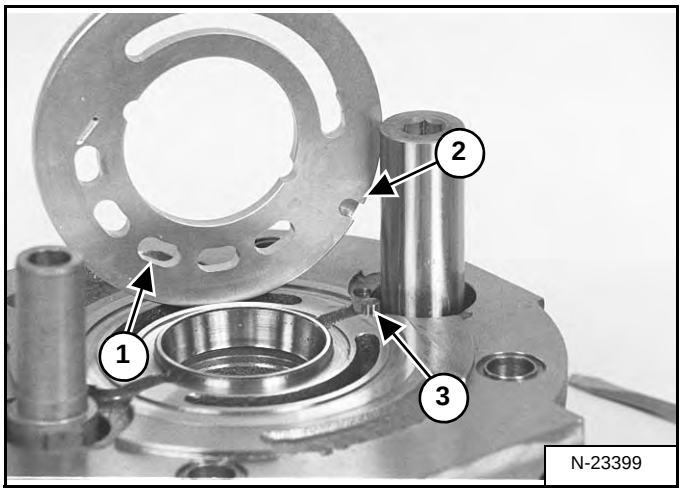
Install the bearing (Item 1) **[Figure 20-50-142]** on the shaft.

Install the O-ring (Item 2) **[Figure 20-50-142]**.

Dealer Copy -- Not for Resale

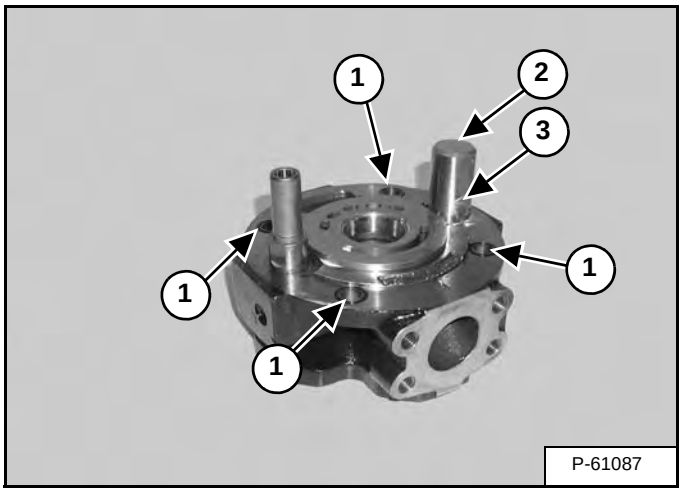
Assembly (Cont'd)

Figure 20-50-143



Install the valve plate (Item 1) on the port block assembly. The valve plate can only be installed by aligning the groove (Item 2) with the pin (Item 3) **[Figure 20-50-143]**.

Figure 20-50-144

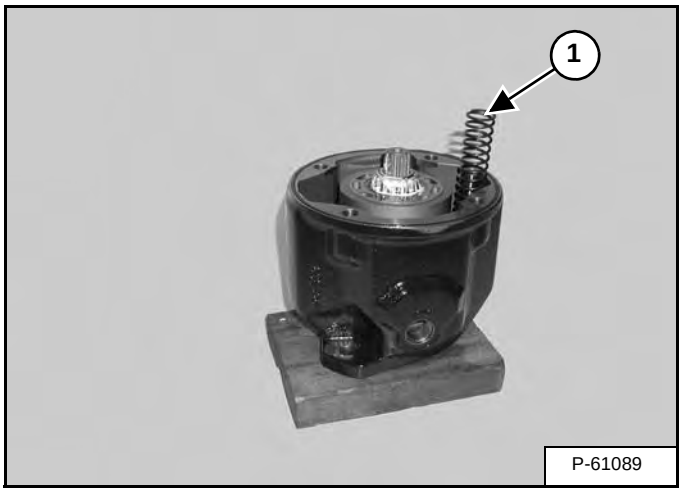


Install the O-rings (Item 1) **[Figure 20-50-144]**.

Grease the inside of the control piston (Item 2) **[Figure 20-50-144]**.

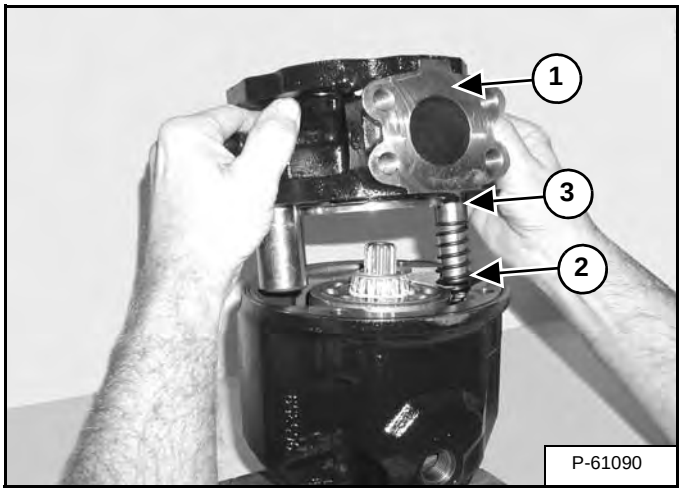
Install the control piston (Item 2) on the control piston shaft (Item 3) **[Figure 20-50-144]**.

Figure 20-50-145



Install the stroking piston assembly (Item 1) **[Figure 20-50-145]**.

Figure 20-50-146



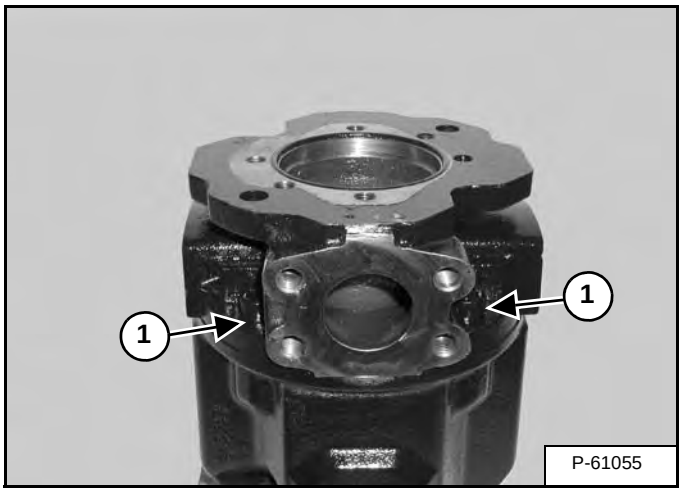
Install the end cap (Item 1) **[Figure 20-50-146]**.

NOTE: Align the stroking piston assembly (Item 2) with the shaft (Item 3) [Figure 20-50-146].

Dealer Copy -- Not for Resale

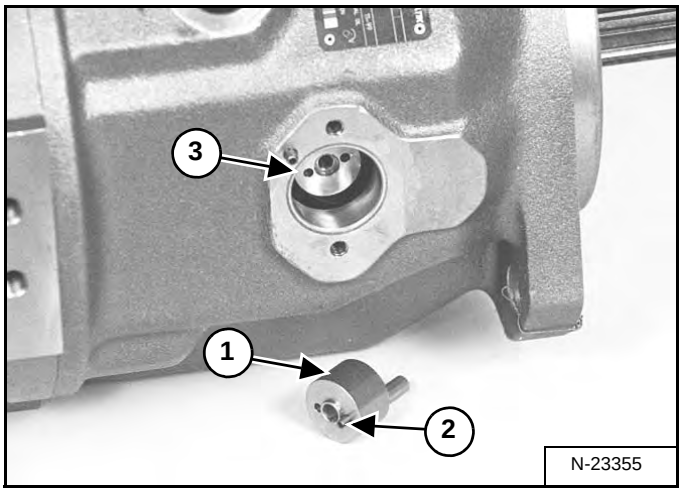
Assembly (Cont'd)

Figure 20-50-147



Install the four bolts (Item 1) **[Figure 20-50-147]** and tighten to 119 N•m (88 ft-lb) torque.

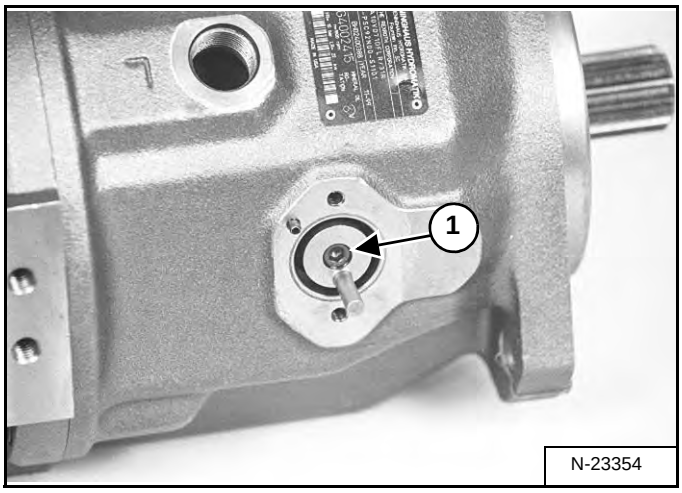
Figure 20-50-148



Install the pin assembly (Item 1) **[Figure 20-50-148]**.

The dowel pin (Item 2) must be fully seated in the hole (Item 3) **[Figure 20-50-148]** on the swash plate.

Figure 20-50-149



Apply Loctite® 241 or equivalent on the bolt (Item 1) **[Figure 20-50-149]**. Tighten the bolt to 13 N•m (10 ft-lb) torque.

Install the torque limiter valve. (See Torque Limiter Valve Removal And Installation on Page 20-50-16.)

Install the pump control assembly. (See Pump Control Removal And Installation on Page 20-50-28.)

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PUMP (GEAR)

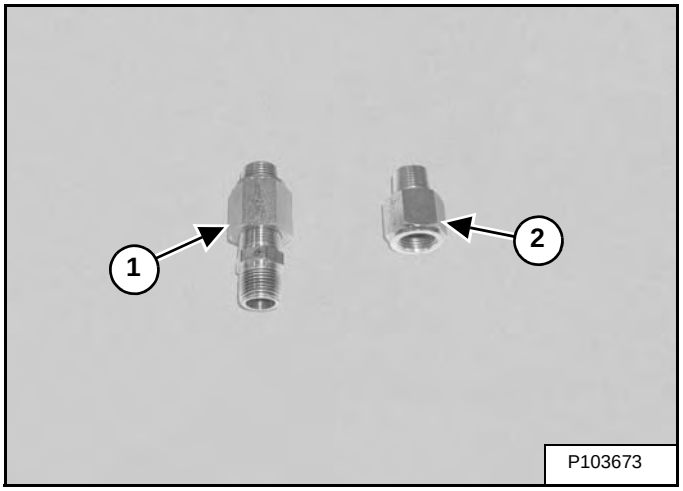
Testing Information

All testing is done with the hydraulic oil at 50 - 60°C (122 - 140°F).

Check and adjust the engine high idle as needed before any hydraulic testing.

The hydraulic hoses, tubelines and fittings on the E80 Excavator are BSPP fittings.

Figure 20-51-1



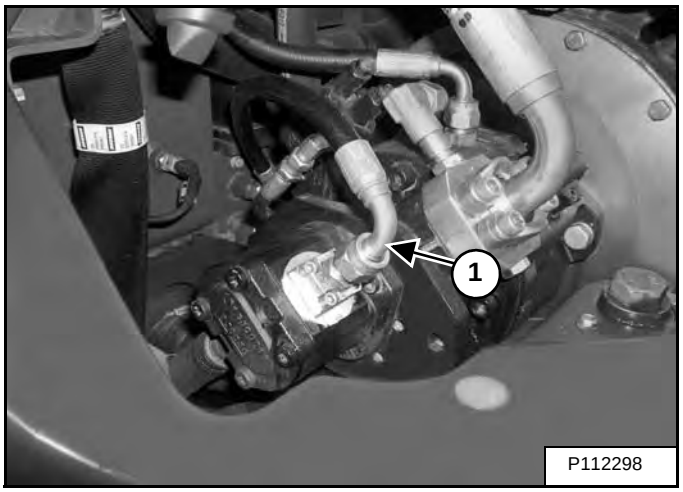
To test the gear pump, use the following fittings from MEL1713 Hydraulic Test Kit:

Item 1 **[Figure 20-51-1]**: MEL1713-1 Male-8 BSPP to Male 8 NPTF.

Item 2 **[Figure 20-51-1]**: MEL1713-2 Female-8 to Male-8 NPTF.

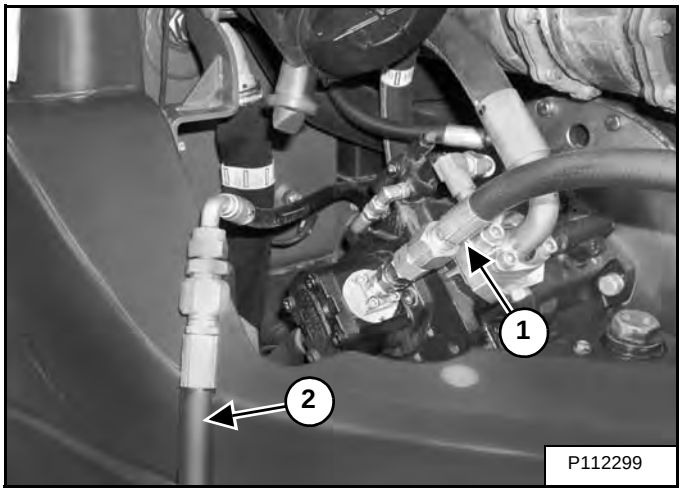
Pump Testing

Figure 20-51-2



Remove the hose (Item 1) **[Figure 20-51-2]** from the gear pump.

Figure 20-51-3



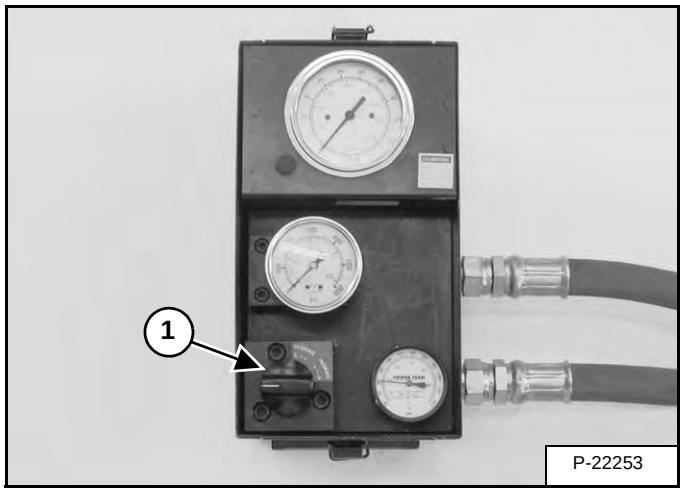
Connect the hydraulic tester inlet side (Item 1) **[Figure 20-51-3]** and adapter fitting to the gear pump.

Connect the hydraulic tester outlet side (Item 2) **[Figure 20-51-3]** and adapter fitting to the hose removed from the gear pump.

Dealer Copy -- Not for Resale

Pump Testing (Cont'd)

Figure 20-51-4



Turn the hydraulic tester flow control (Item 1) **[Figure 20-51-4]** counterclockwise until all restriction is removed.

NOTE: This is a direct pump test. There is no relief valve in the system.

Start and run the engine at a 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 up the hydraulic fluid to a temperature of 50 - 60°C (122 - 140°F) by turning the restrictor valve until the gauge reads about 6900 kPa (69 bar) (1000 psi).

Fully open the restrictor valve when the temperature is correct.

Record the pump free flow L/min (U.S. gpm).

Pump flow on a new pump is 21,9 L/min (5.8 U.S. gpm) at 2200 engine rpm.

Slowly close the flow control knob (Item 1) **[Figure 20-51-4]** to 13400 kPa (134 bar) (1950 psi).

Record the pump high pressure flow L/min (U.S. gpm).

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

$$\%= \frac{\text{HIGH PRESSURE FLOW (L/min [U.S. gpm])}}{\text{FREE FLOW (L/min [U.S. gpm])}} \text{ X } 100$$

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

Dealer Copy -- Not for Resale

Removal And Installation

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-140-6.)

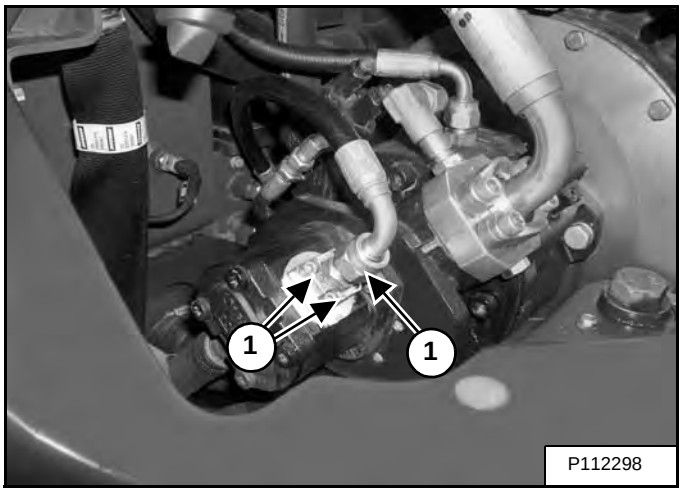
Mark the pump for correct installation.

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.

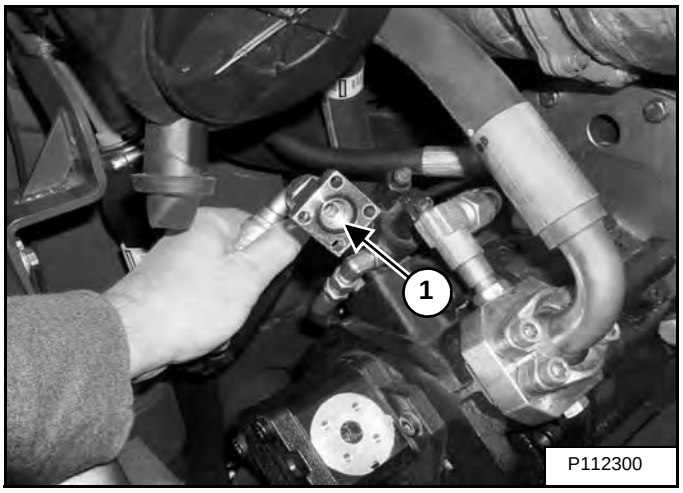
I-2003-0888

Figure 20-51-5



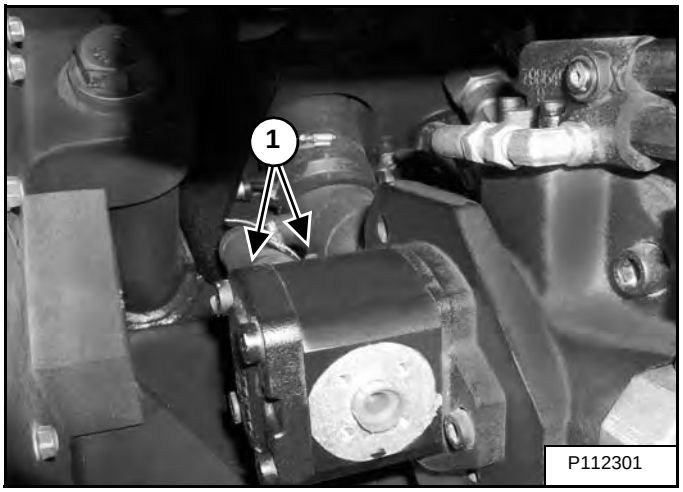
Remove the four bolts (Item 1) **[Figure 20-51-5]**, flange and hose from the high pressure side of the pump.

Figure 20-51-6



Installation: Install the O-ring (Item 1) **[Figure 20-51-6]** in the O-ring groove of the flange.

Figure 20-51-7

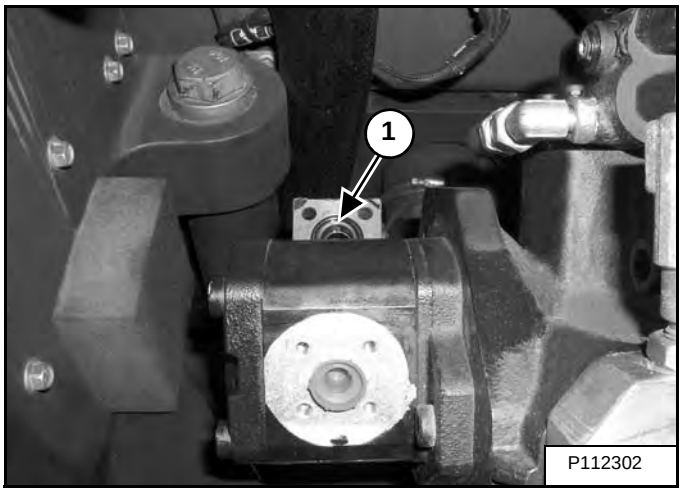


Remove the four bolts, flange (Item 1) **[Figure 20-51-7]** and hose from the suction side of the pump.

Dealer Copy -- Not for Resale

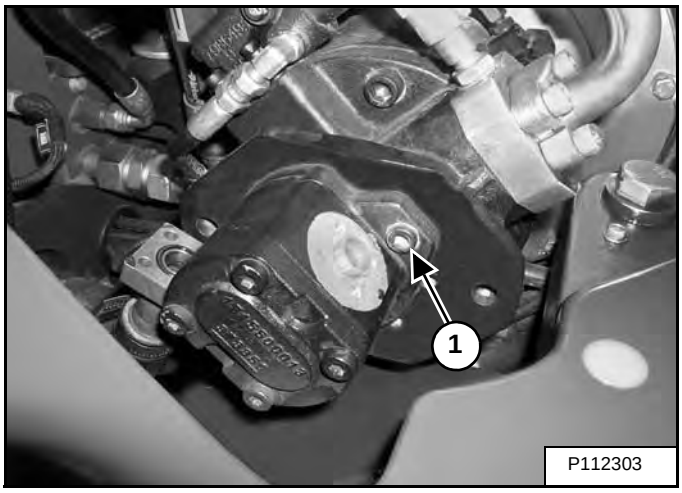
Removal And Installation (Cont'd)

Figure 20-51-8



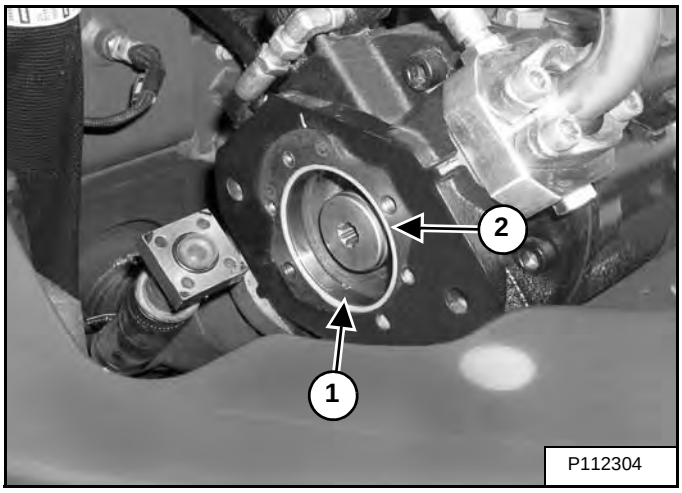
Installation: Install the O-ring (Item 1) **[Figure 20-51-8]** in the O-ring groove of the flange.

Figure 20-51-9



Remove the bolts (Item 1) **[Figure 20-51-9]** and the pump.

Figure 20-51-10

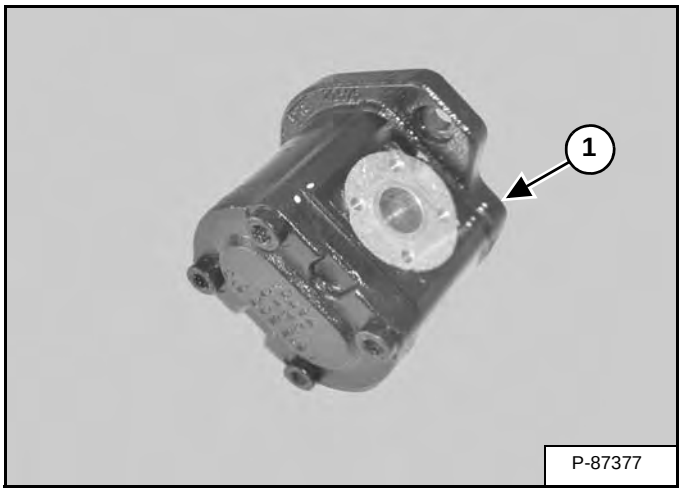


Remove the O-ring (Item 1) and coupler (Item 2) **[Figure 20-51-10]**.

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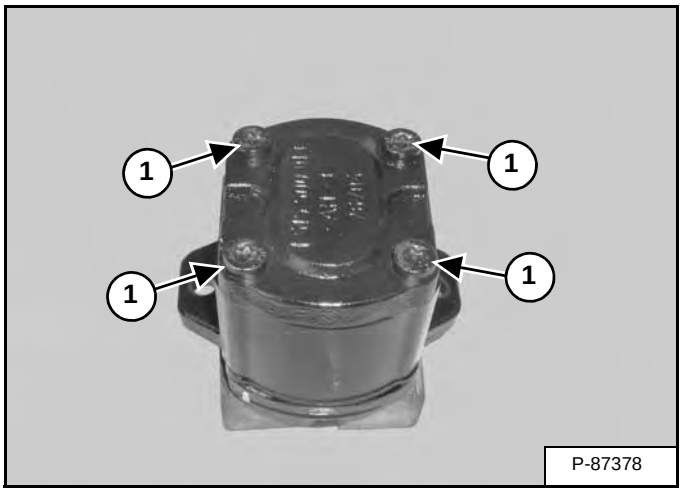
Disassembly And Assembly

Figure 20-51-11



Mark the pump (Item 1) **[Figure 20-51-11]** for correct assembly.

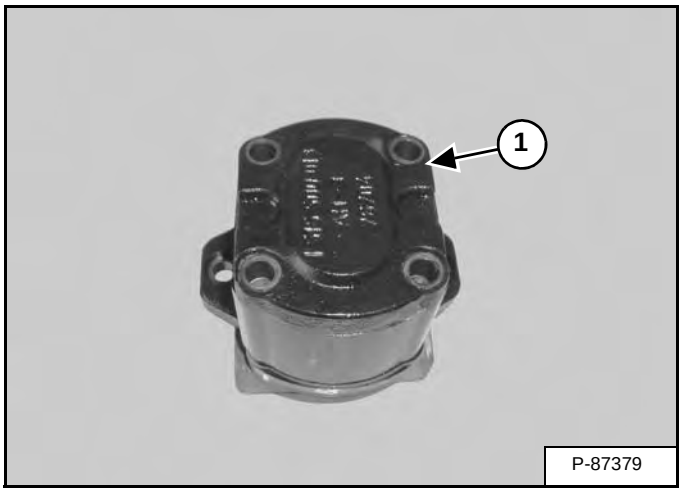
Figure 20-51-12



Remove the four bolts (Item 1) **[Figure 20-51-12]**.

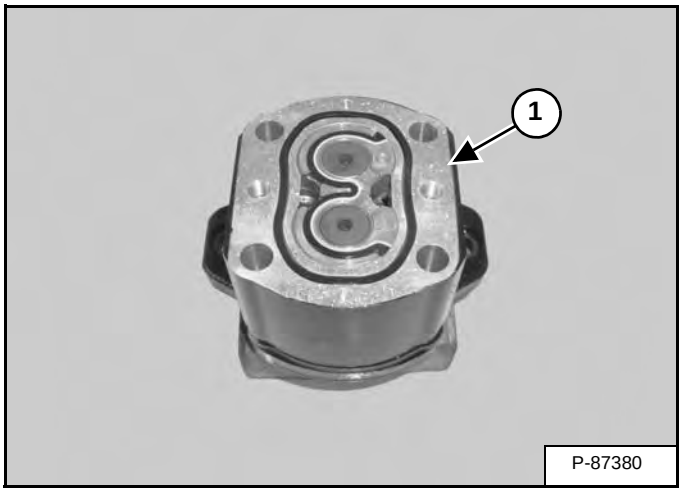
Installation: Tighten the bolts to 61 N•m (45 ft-lb) torque.

Figure 20-51-13



Remove the end cap (Item 1) **[Figure 20-51-13]**.

Figure 20-51-14

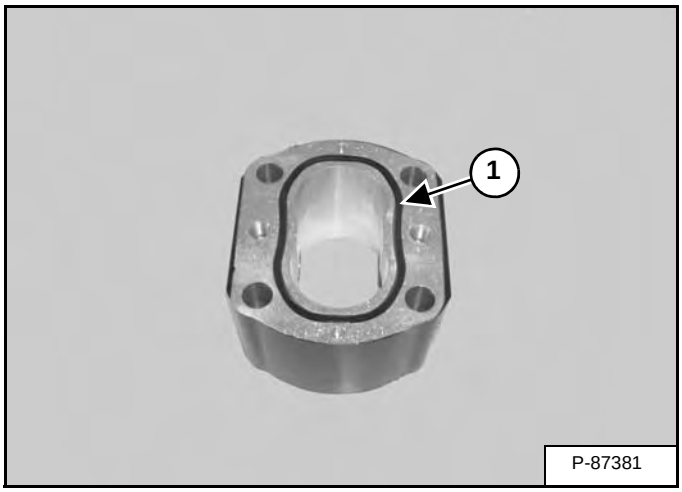


Remove the gear housing (Item 1) **[Figure 20-51-14]**.

Dealer Copy -- Not for Resale

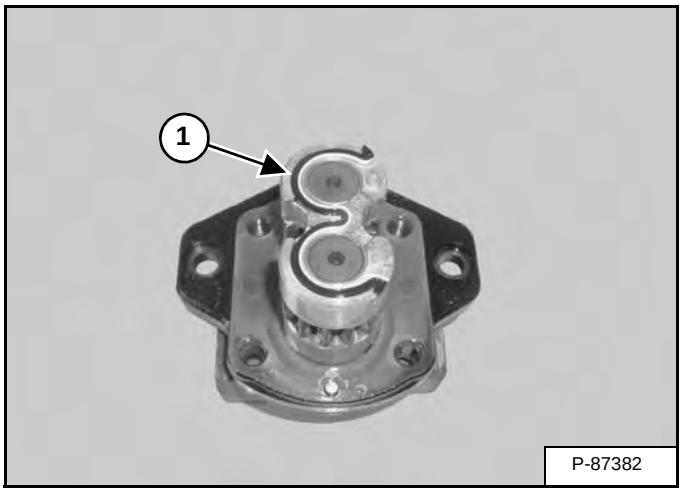
Disassembly And Assembly (Cont'd)

Figure 20-51-15



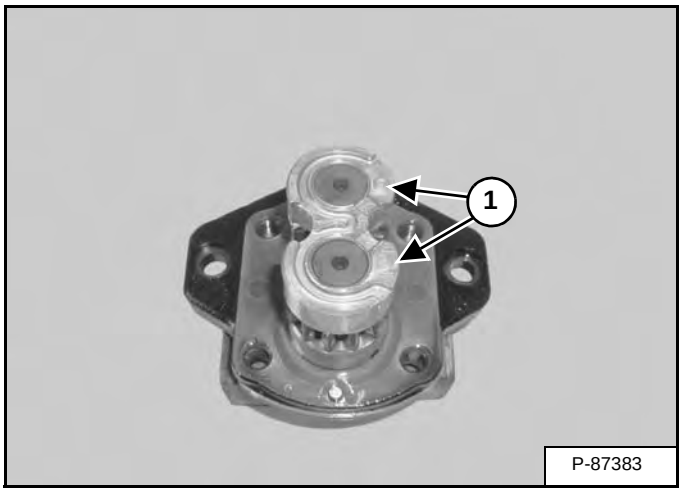
Remove the square cut seal (Item 1) **[Figure 20-51-15]** from both sides of the gear housing.

Figure 20-51-16



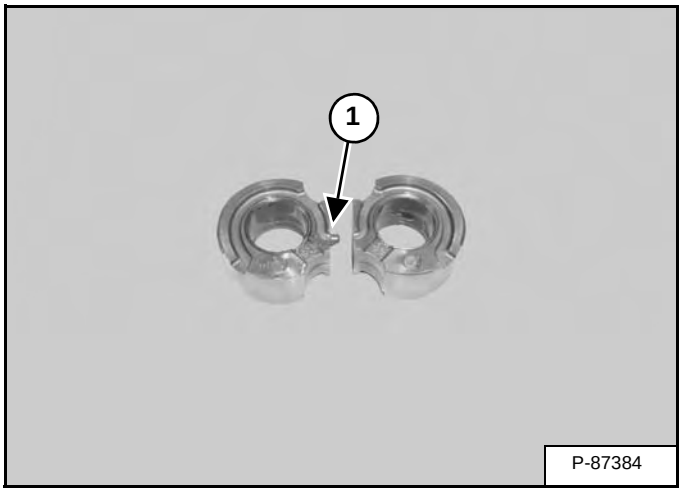
Remove the seal and back-up ring (Item 1) **[Figure 20-51-16]**.

Figure 20-51-17



Remove the bearings (Item 1) **[Figure 20-51-17]**.

Figure 20-51-18

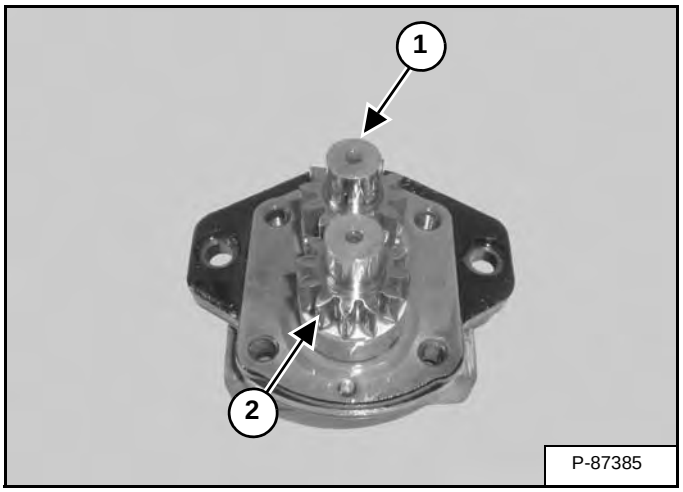


Separate the bearings and remove the dowel pin (Item 1) **[Figure 20-51-18]**.

Dealer Copy -- Not for Resale

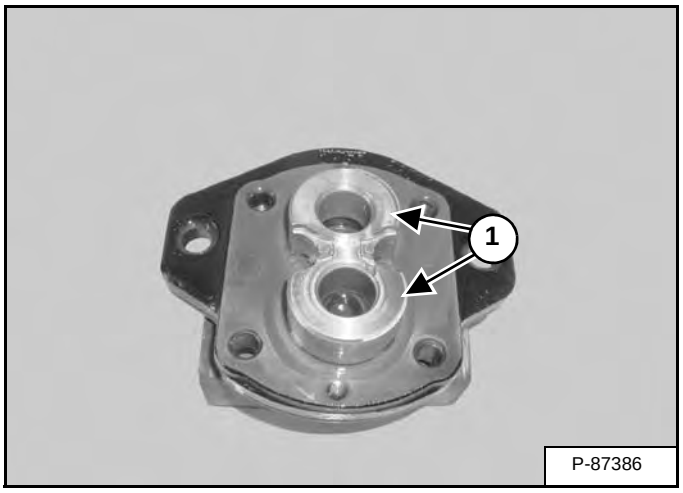
Disassembly And Assembly (Cont'd)

Figure 20-51-19



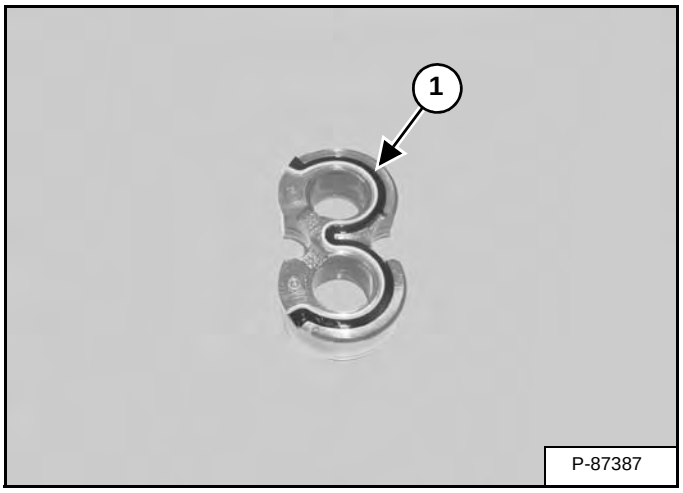
Remove the drive gear (Item 1). Remove the idler gear (Item 2) **[Figure 20-51-19]**.

Figure 20-51-20



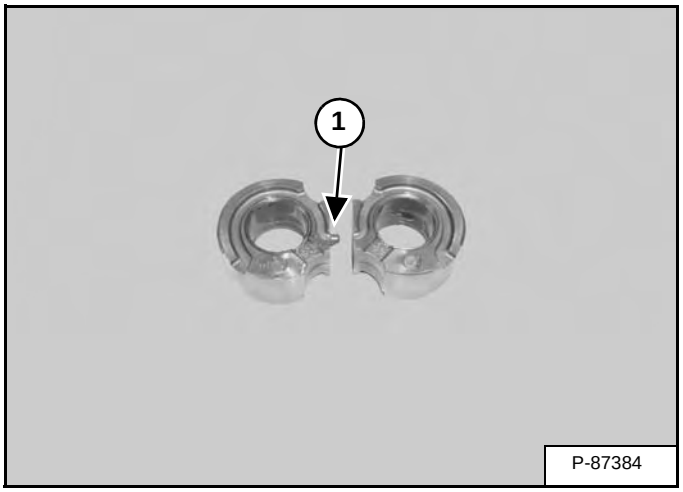
Remove the bearings (Item 1) **[Figure 20-51-20]**.

Figure 20-51-21



Remove the seal and back-up ring (Item 1) **[Figure 20-51-21]**.

Figure 20-51-22

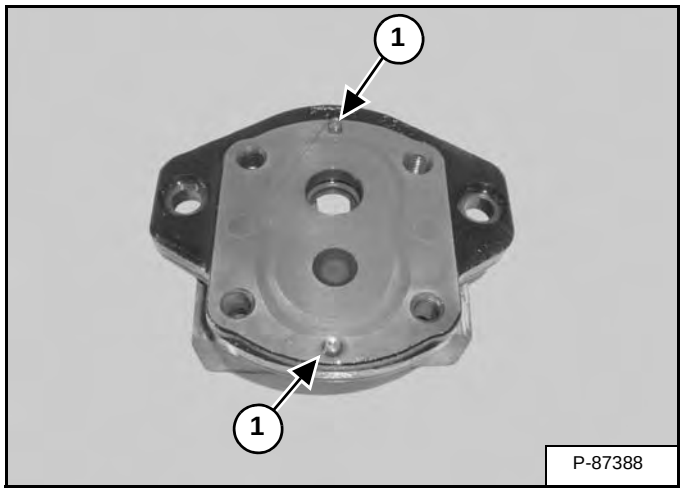


Separate the bearings and remove the dowel pin (Item 1) **[Figure 20-51-22]**.

Dealer Copy -- Not for Resale

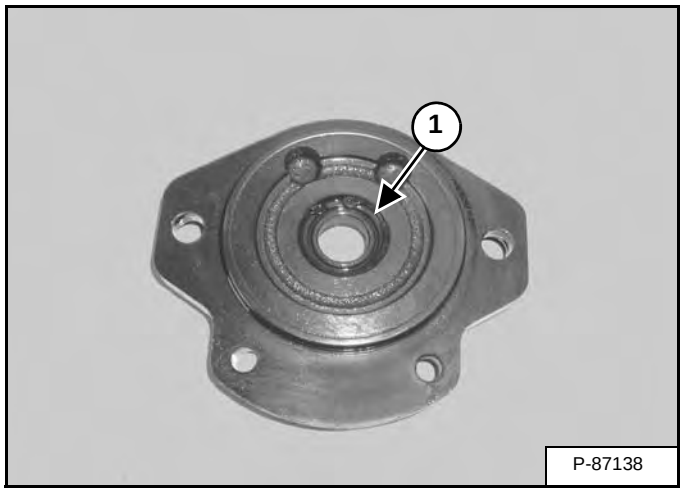
Disassembly And Assembly (Cont'd)

Figure 20-51-23



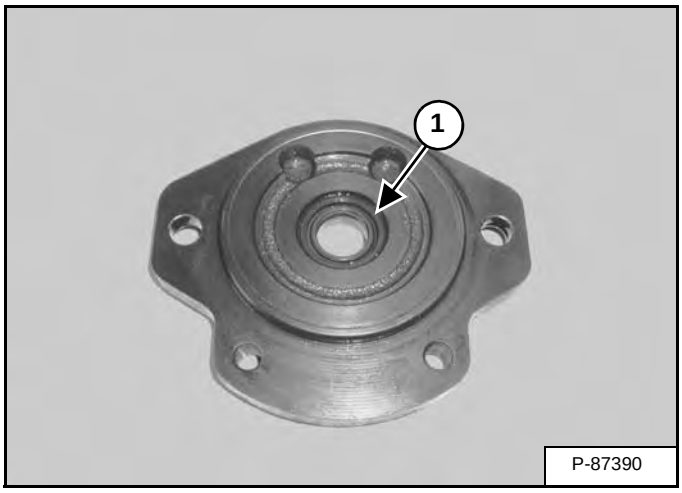
Remove the dowel pins (Item 1) **[Figure 20-51-23]**.

Figure 20-51-24



Remove the snap ring (Item 1) **[Figure 20-51-24]**.

Figure 20-51-25



Remove the seal (Item 1) **[Figure 20-51-25]**.

Dealer Copy -- Not for Resale

MANIFOLD ASSEMBLY / ACCUMULATOR

Description

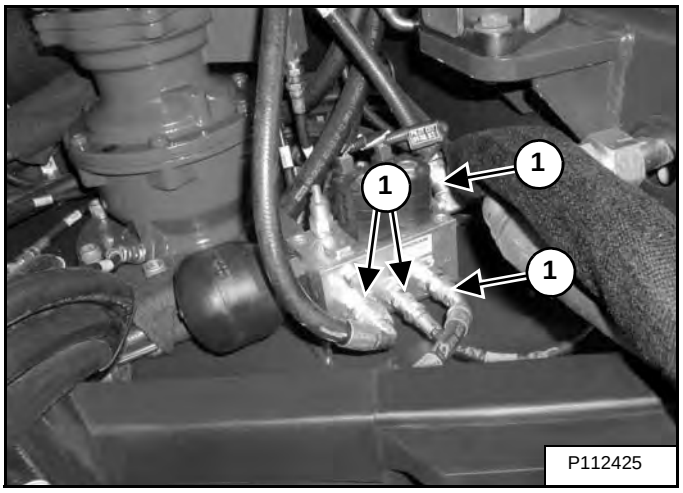
The accumulator provides short term reserve pressure for joystick function with the engine off and the key in the run position.

Removal And Installation

With the engine off and the key in the run position, move the control levers to relieve hydraulic pressure.

Tilt the cab. (See Raising And Lowering on Page 10-210-1.)

Figure 20-60-1



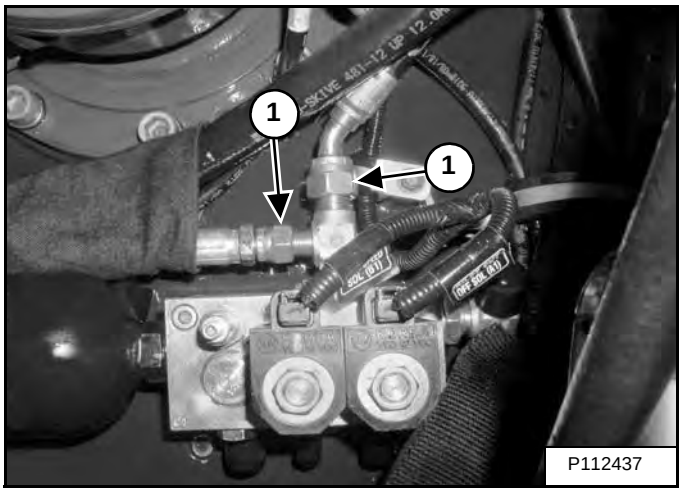
Mark and remove the hoses (Item 1) **[Figure 20-60-1]**.

IMPORTANT

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

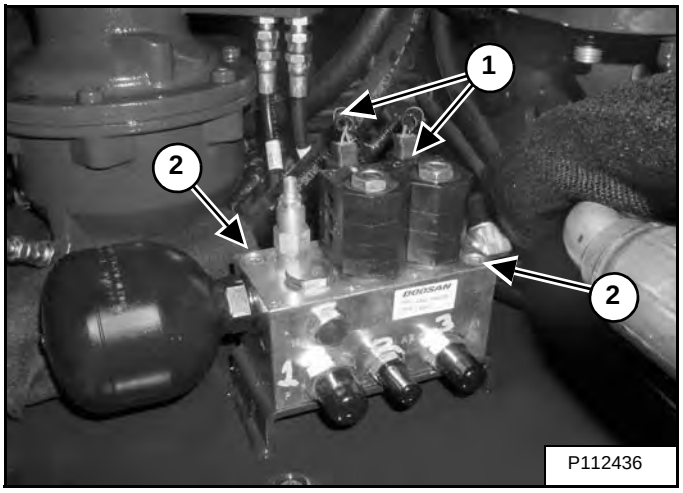
I-2003-0888

Figure 20-60-2



Mark and remove the hoses (Item 1) **[Figure 20-60-2]**.

Figure 20-60-3



Mark and disconnect the wire harness (Item 1) **[Figure 20-60-3]**.

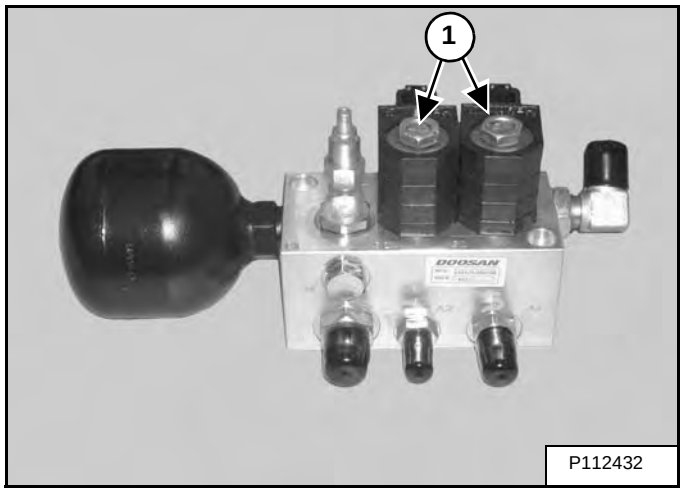
Remove the bolts (Item 2) **[Figure 20-60-3]** and remove the manifold.

Dealer Copy -- Not for Resale

MANIFOLD ASSEMBLY / ACCUMULATOR (CONT'D)

Disassembly And Assembly

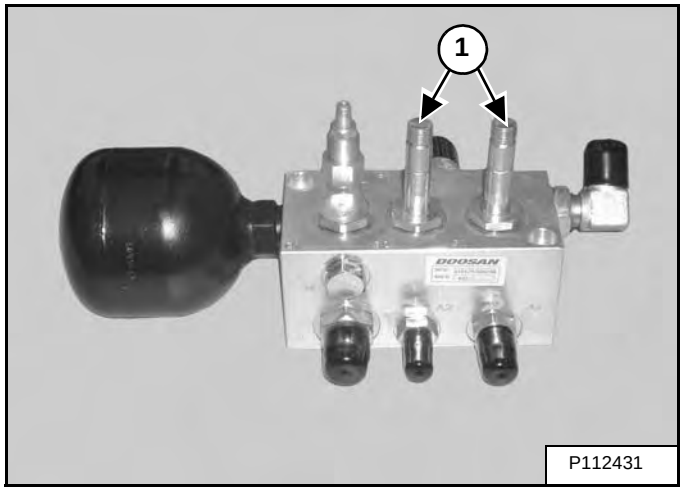
Figure 20-60-4



Remove the nuts (Item 1) **[Figure 20-60-4]** and remove the coils.

Installation: Tighten the nuts to 4,8 - 5,2 N•m (3.5 - 3.8 ft-lb) torque.

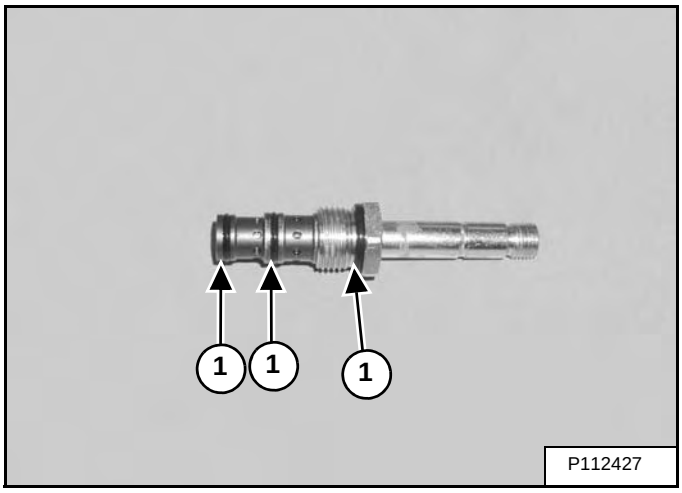
Figure 20-60-5



Remove the spools (Item 1) **[Figure 20-60-5]**.

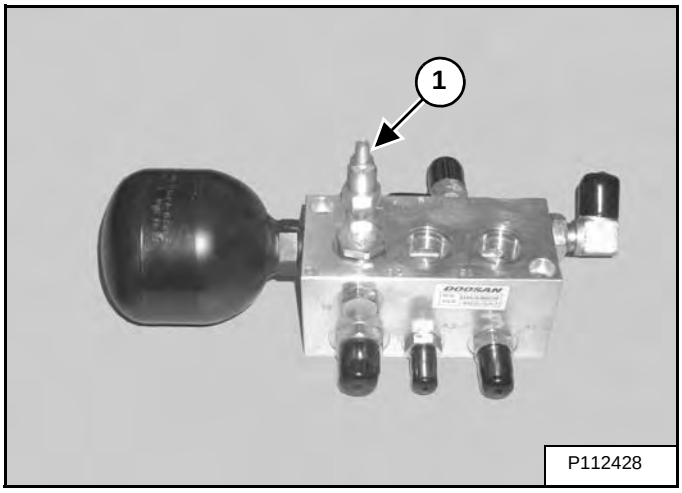
Installation: Tighten the spools to 34 - 34,5 N•m (25 - 25.5 ft-lb) torque.

Figure 20-60-6



Remove the O-rings (Item 1) **[Figure 20-60-6]**.

Figure 20-60-7



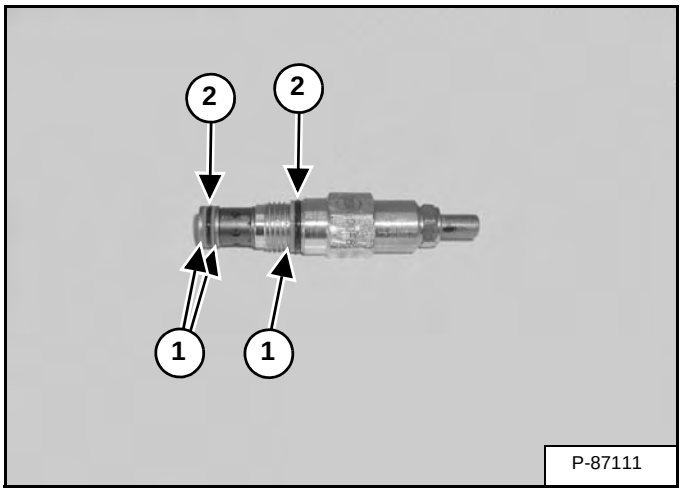
Remove the pressure reducing valve (Item 1) **[Figure 20-60-7]**.

I***nstallation:*** Tighten the valve to 37 - 39,4 N•m (28.8 - 29 ft-lb) torque.

Dealer Copy -- Not for Resale

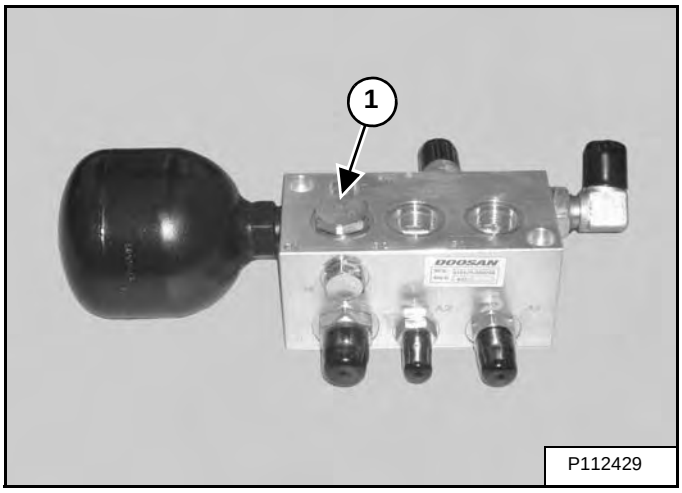
Disassembly And Assembly (Cont'd)

Figure 20-60-8



Remove the back-up rings (Item 1) and O-rings (Item 2) **[Figure 20-60-8]**.

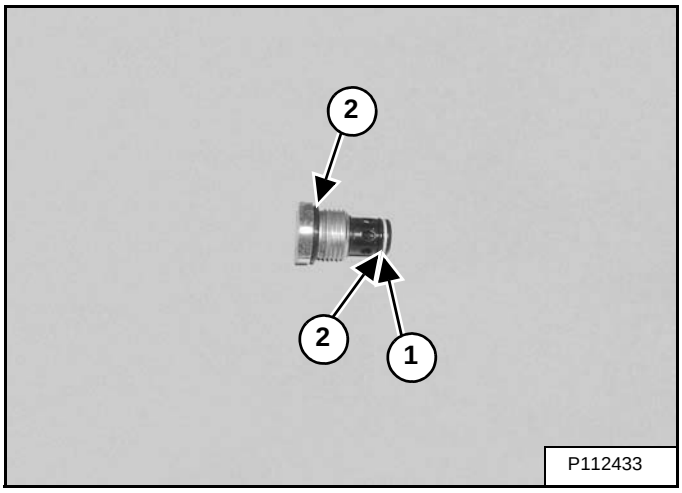
Figure 20-60-9



Remove the check valve (Item 1) **[Figure 20-60-9]**.

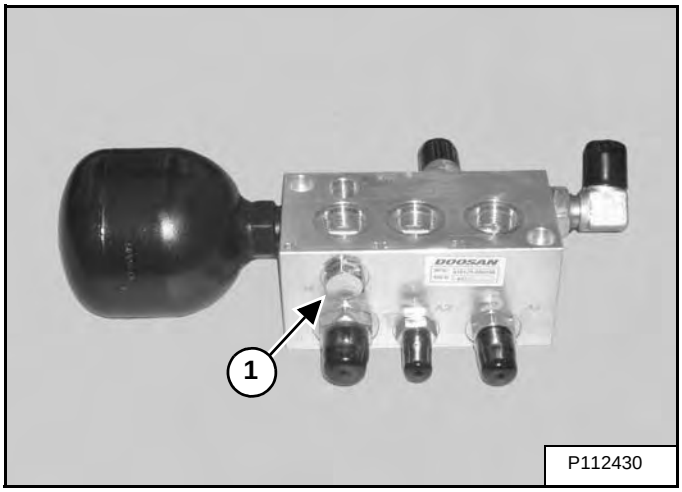
Installation: Tighten the check valve to 39 - 39,4 N•m (28.8 - 29 ft-lb) torque.

Figure 20-60-10



Remove the back-up ring (Item 1) and O-rings (Item 2) **[Figure 20-60-10]**.

Figure 20-60-11



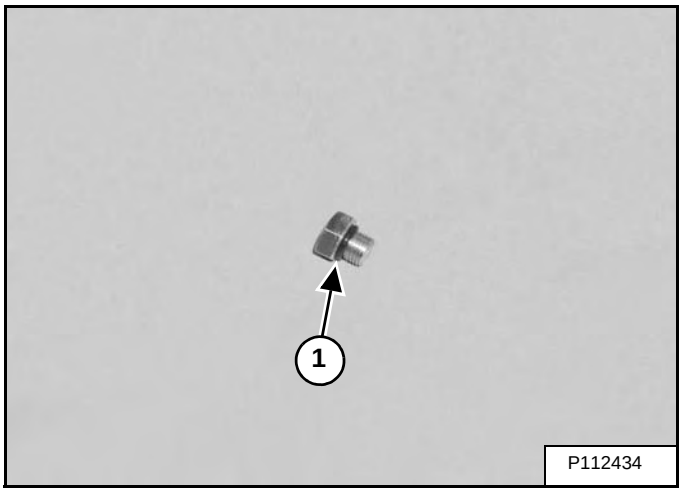
Remove the plug (Item 1) **[Figure 20-60-11]**.

Installation: Tighten the plug to 24,3 - 24,7 N•m (17.9 - 18.2 ft-lb) torque.

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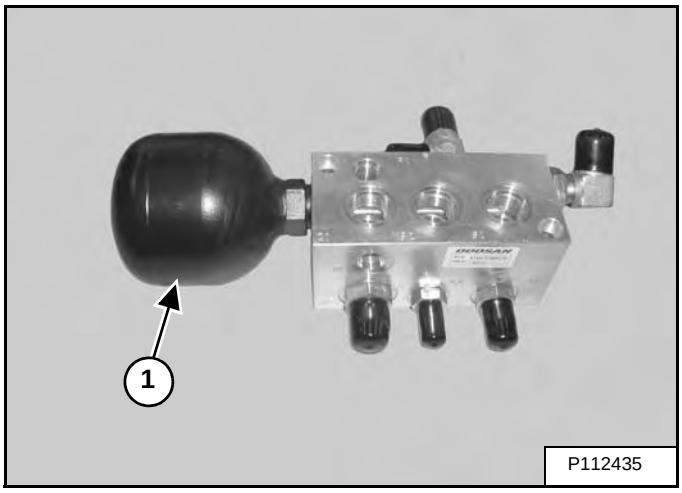
Disassembly And Assembly (Cont'd)

Figure 20-60-12



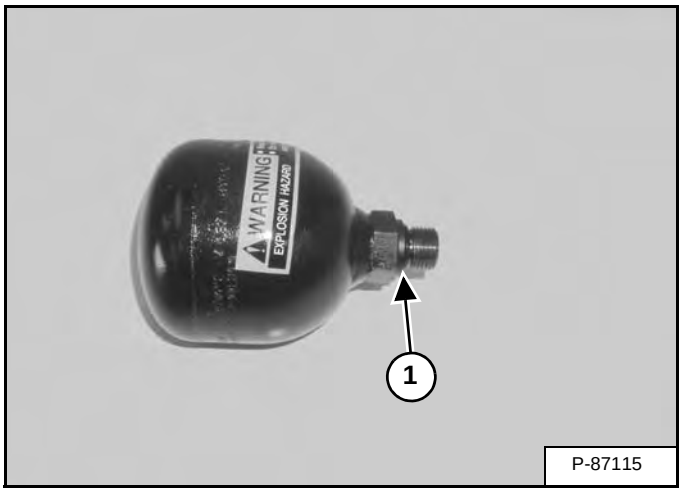
Remove the O-ring (Item 1) **[Figure 20-60-12]**.

Figure 20-60-13



Remove the accumulator (Item 1) **[Figure 20-60-13]**.

Figure 20-60-14



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

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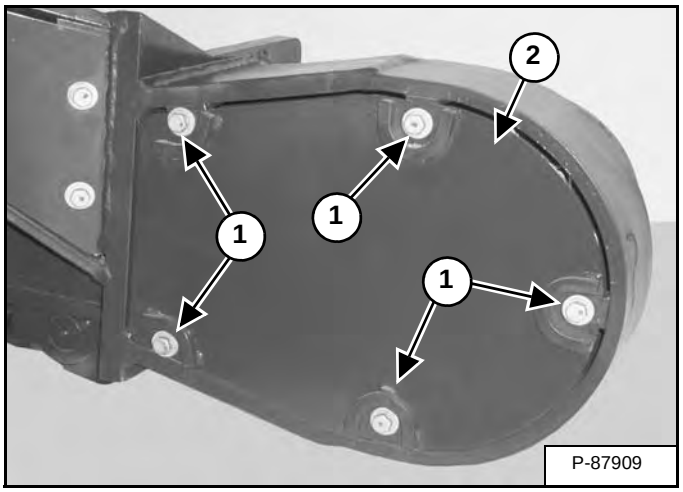
TRAVEL MOTOR

Removal And Installation

Remove the track. (See Track Removal And Installation on Page 30-20-3.) or (See Track Removal And Installation on Page 30-20-3.)

Remove the drive sprocket. (See Sprocket Removal And Installation on Page 30-20-35.)

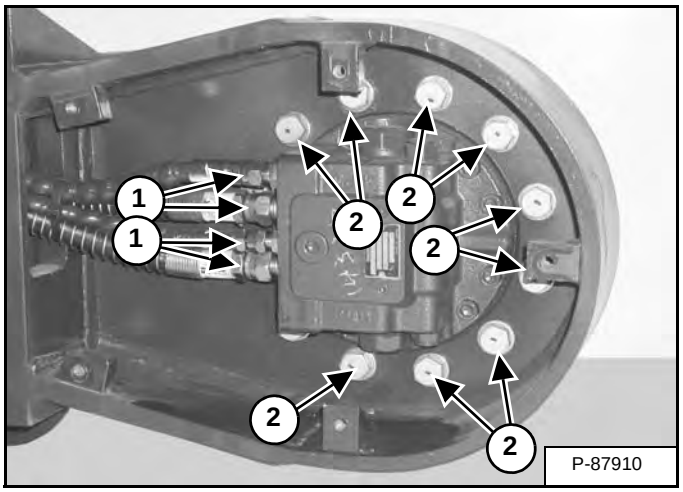
Figure 20-70-1



Remove the bolts (Item 1) **[Figure 20-70-1]**.

Remove the cover (Item 2) **[Figure 20-70-1]**.

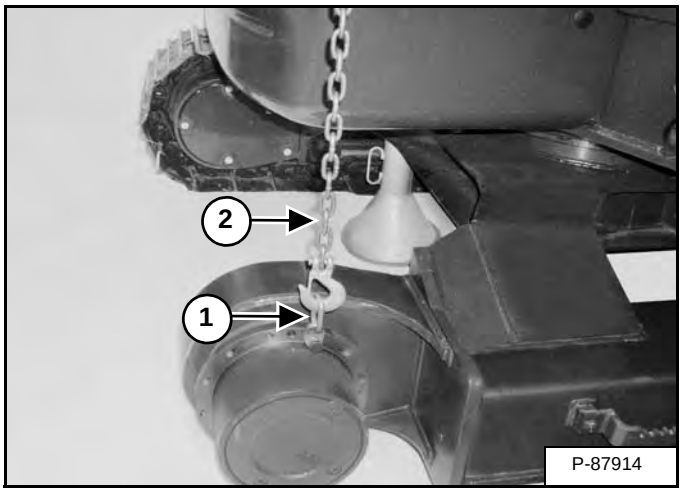
Figure 20-70-2



Remove the hoses (Item 1) and bolts (Item 2) **[Figure 20-70-2]**.

Installation: Apply thread lock adhesive (Loctite® 242 or equivalent) to the bolt threads. Tighten the bolts to 265 N•m (195 ft-lb) torque.

Figure 20-70-3



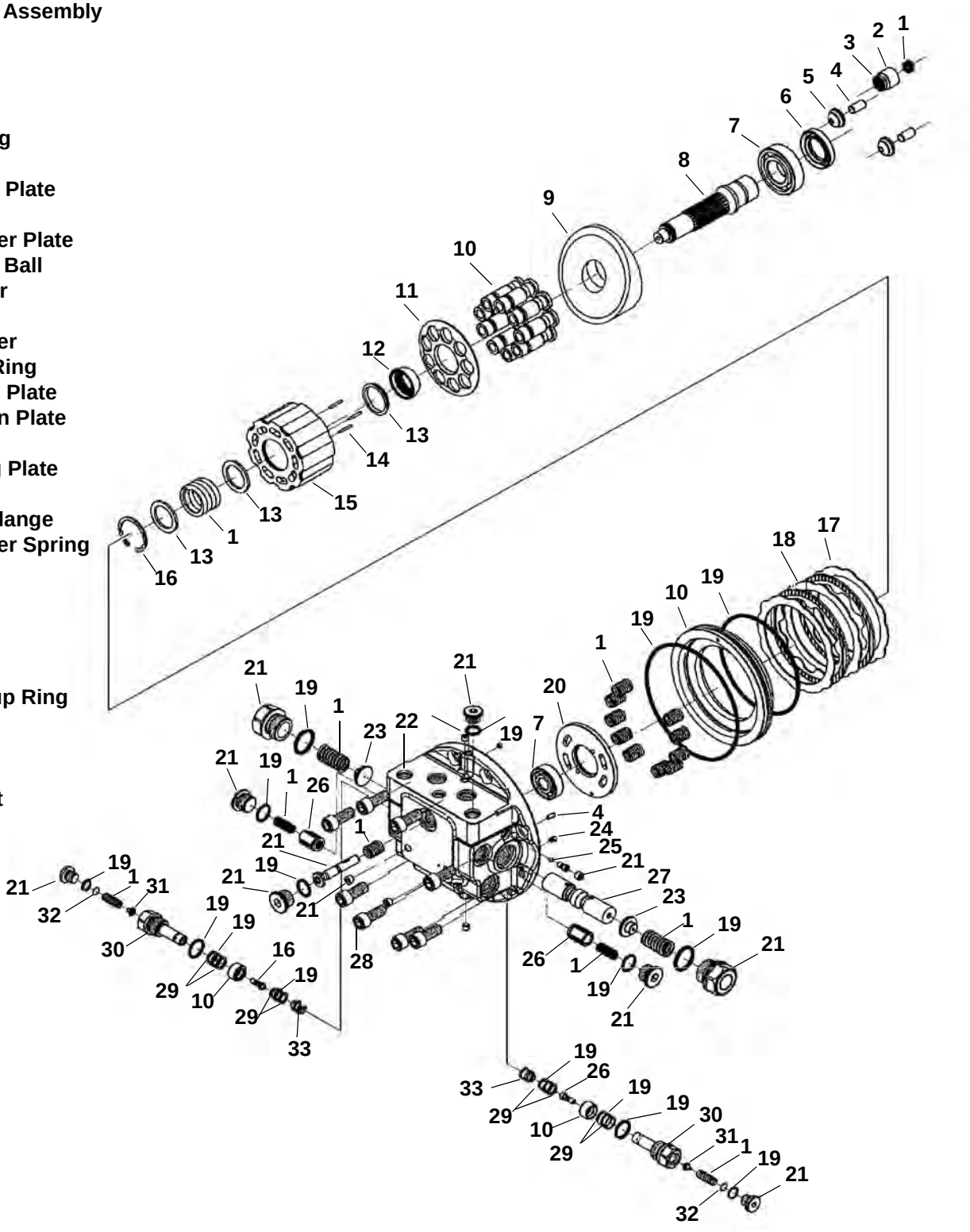
Attach a lifting hook (Item 1) and chain (Item 2) **[Figure 20-70-3]** to the travel motor.

Remove the travel motor.

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Parts Identification

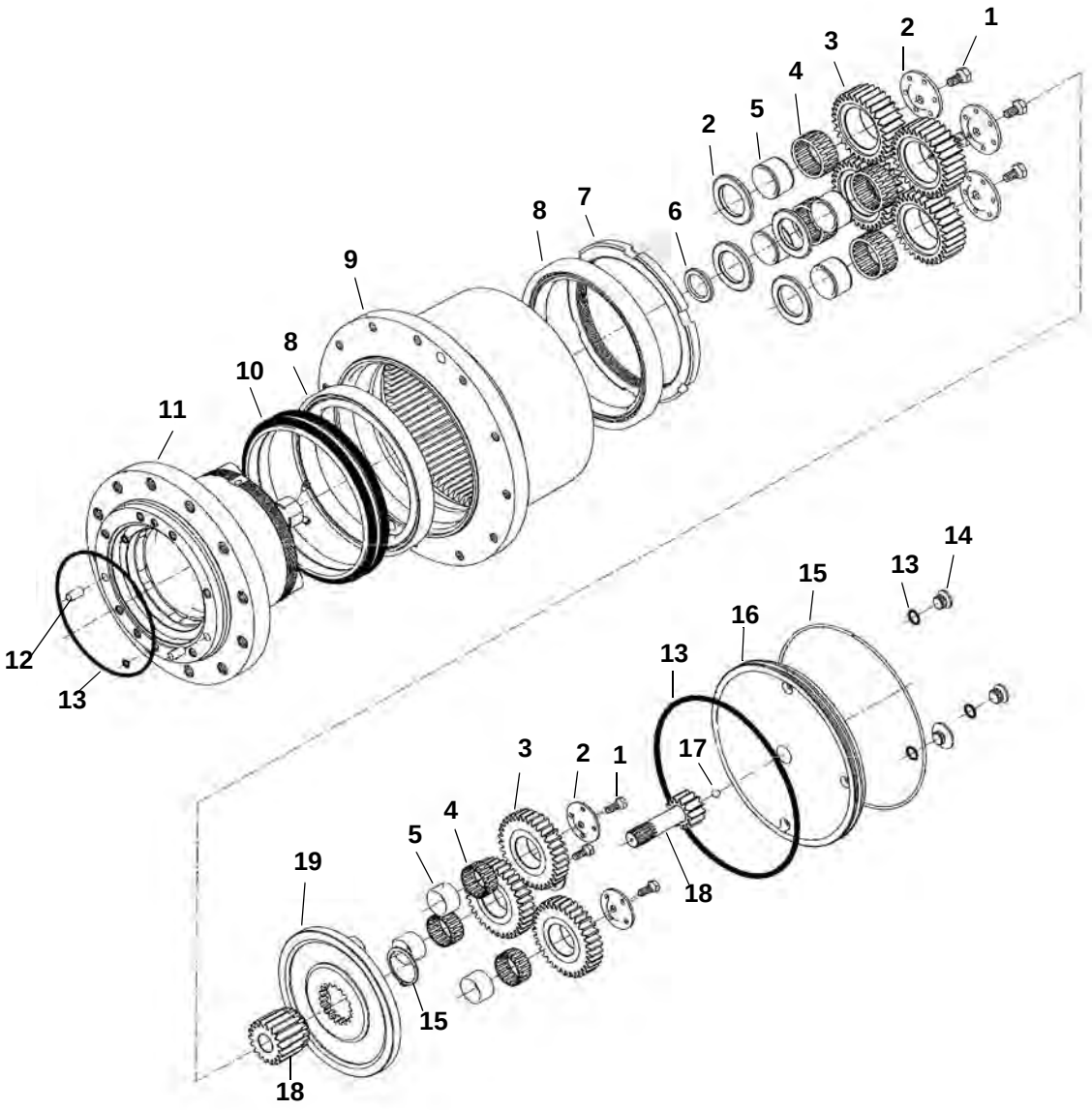
1 Spring
2 Piston Assembly
3 Shoe
4 Pin
5 Pivot
6 Seal
7 Bearing
8 Shaft
9 Swash Plate
10 Piston
11 Retainer Plate
12 Thrust Ball
13 Washer
14 Pin
15 Cylinder
16 Snap Ring
17 Mating Plate
18 Friction Plate
19 O-ring
20 Timing Plate
21 Plug
22 Rear Flange
23 Retainer Spring
24 Filter
25 Ball
26 Valve
27 Spool
28 Bolt
29 Back-up Ring
30 Sleeve
31 Collar
32 Shim
33 Poppet



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Parts Identification Gear Reduction Hub

1 Bolt
2 Thrust Washer
3 Planetary Gear
4 Roller Bearing
5 Inner Ring
6 Collar
7 Nut
8 Ball Bearing
9 Hub
10 Seal
11 Spindle
12 Pin
13 O-ring
14 Plug
15 Snap Ring
16 Cover
17 Steel Ball
18 Sun Gear
19 Carrier



B-23946

Dealer Copy -- Not for Resale

Disassembly

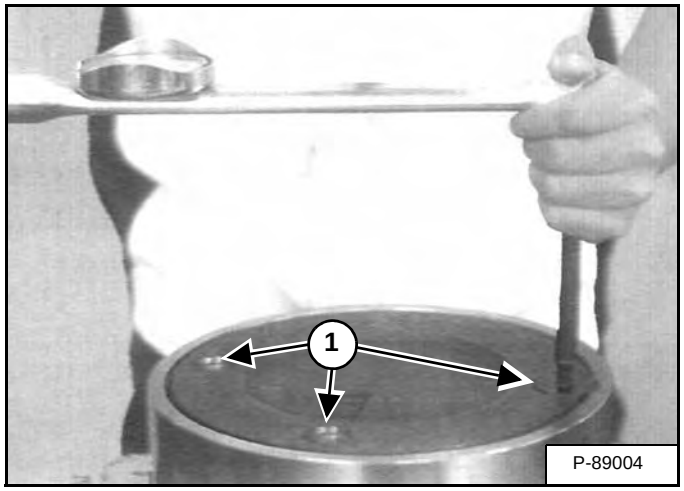
Clean the outside of the travel motor before disassembly.

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

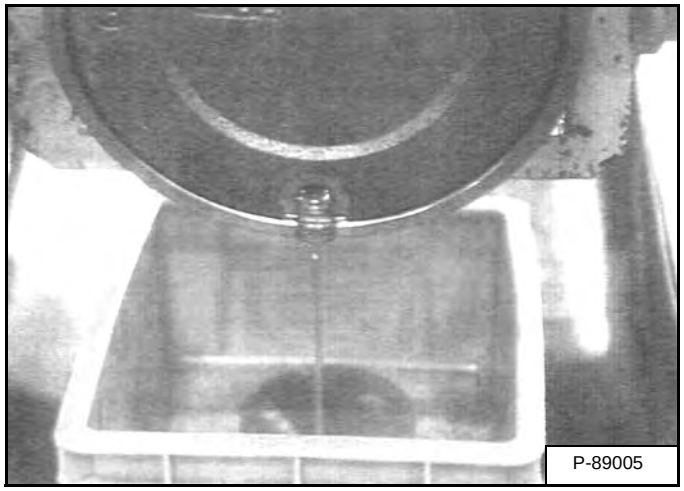
Figure 20-70-4



Remove the plugs (Item 1) **[Figure 20-70-4]**.

Remove and discard the O-rings from the plugs.

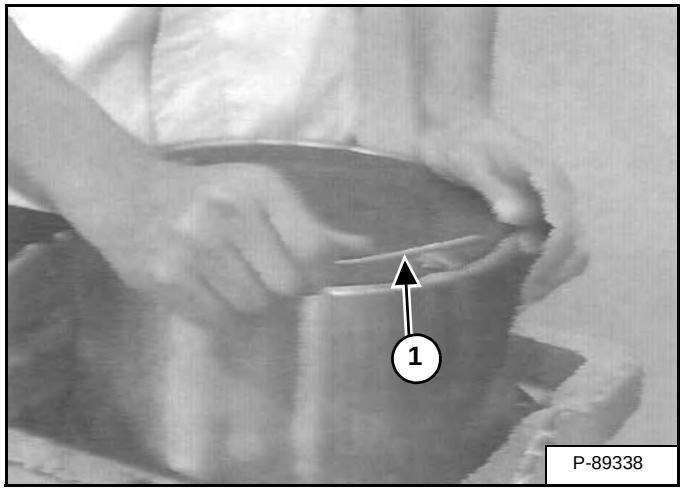
Figure 20-70-5



Drain the fluid from the travel motor **[Figure 20-70-5]**.

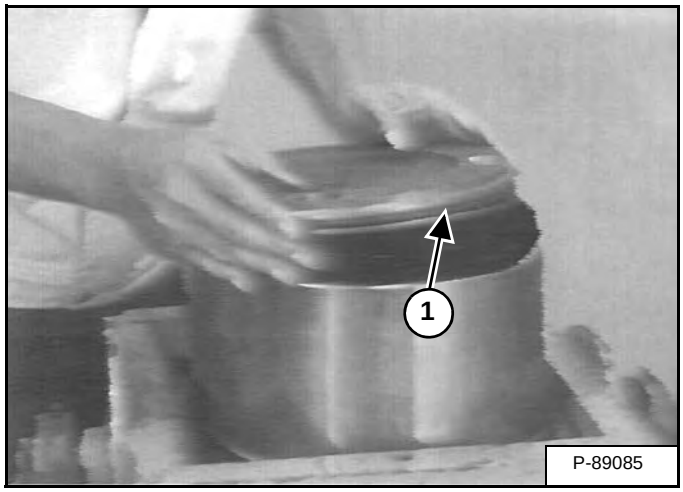
Recycle or dispose of used fluid in an environmentally safe manner.

Figure 20-70-6



Remove the snap ring (Item 1) **[Figure 20-70-6]**.

Figure 20-70-7



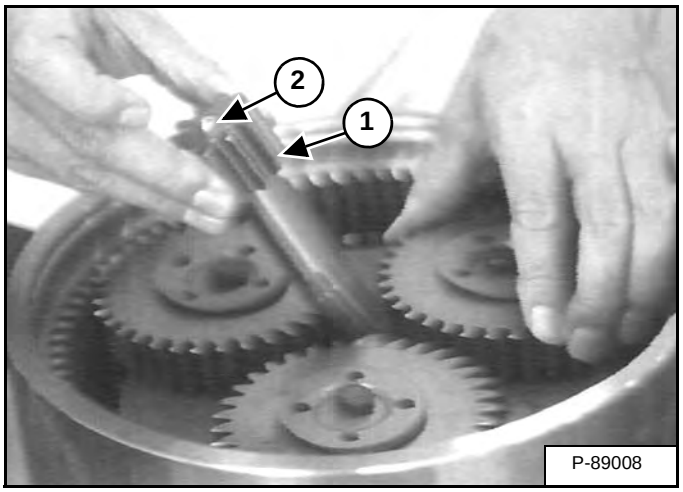
Remove the cover (Item 1) **[Figure 20-70-7]**.

Remove and discard the O-ring from the cover.

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Disassembly (Cont'd)

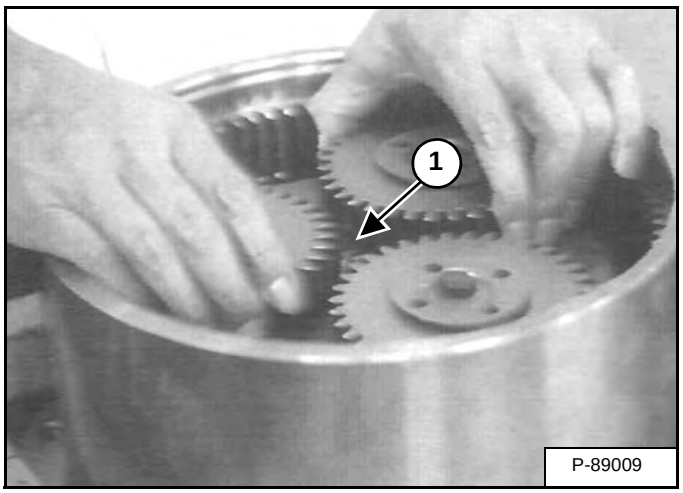
Figure 20-70-8



Remove the sun gear (Item 1) **[Figure 20-70-8]**.

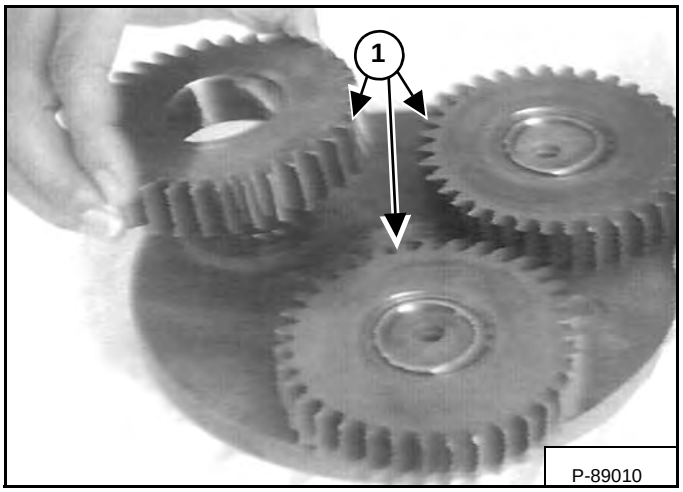
Remove the steel ball (Item 2) **[Figure 20-70-8]** from the sun gear.

Figure 20-70-9



Remove the carrier assembly (Item 1) **[Figure 20-70-9]** from the hub.

Figure 20-70-10

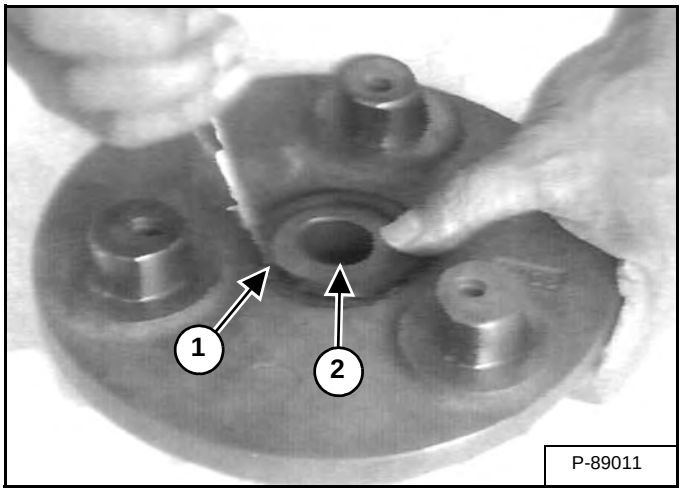


Remove the bolts, thrust washers, and planetary gears (Item 1) **[Figure 20-70-10]**.

Remove the roller bearing and inner ring from the carrier.

NOTE: Do not reuse the bolts holding the planetary gears to the carrier.

Figure 20-70-11

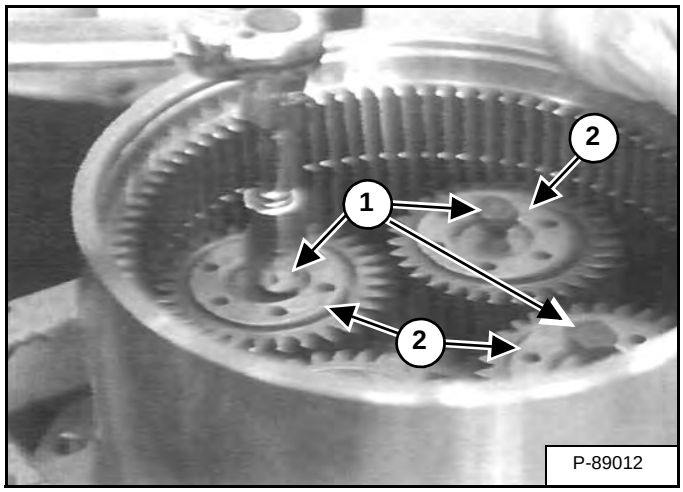


Remove the snap ring (Item 1) and sun gear (Item 2) **[Figure 20-70-11]** from the carrier.

Dealer Copy -- Not for Resale

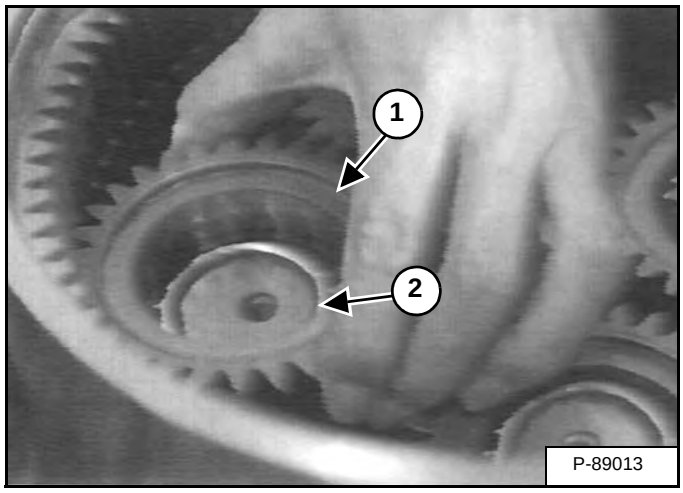
Disassembly (Cont'd)

Figure 20-70-12



Remove the bolts (Item 1) and thrust washers (Item 2) **[Figure 20-70-12]**.

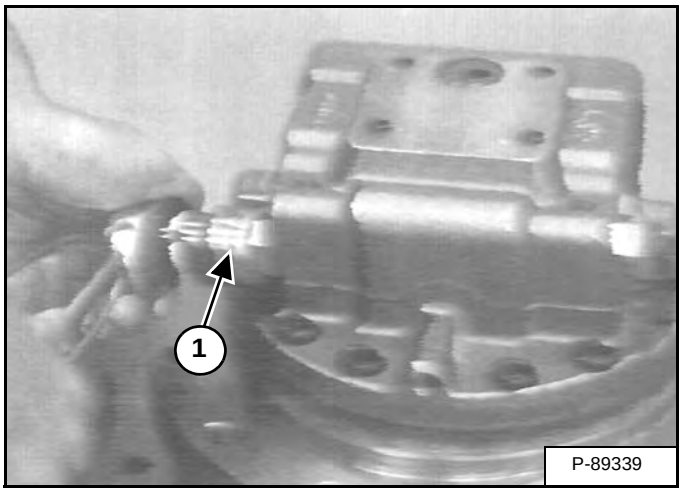
Figure 20-70-13



Remove the planetary gears (Item 1), roller bearings and inner rings (Item 2) **[Figure 20-70-13]**.

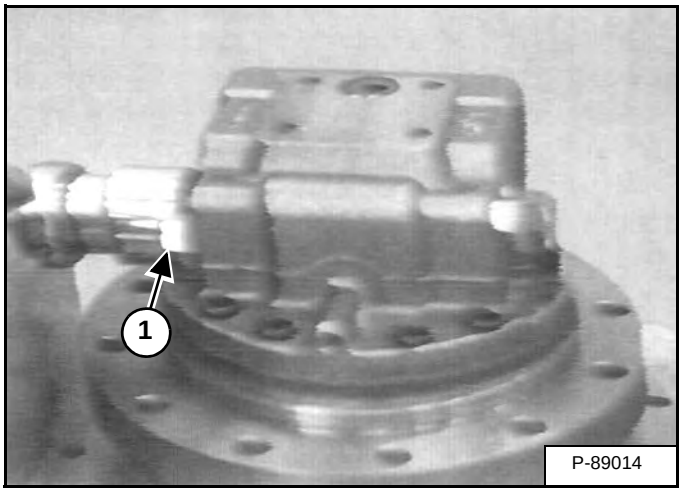
Remove the thrust washers and thrust collars from the spindle.

Figure 20-70-14



Remove the sleeve (Item 1) **[Figure 20-70-14]**.

Figure 20-70-15

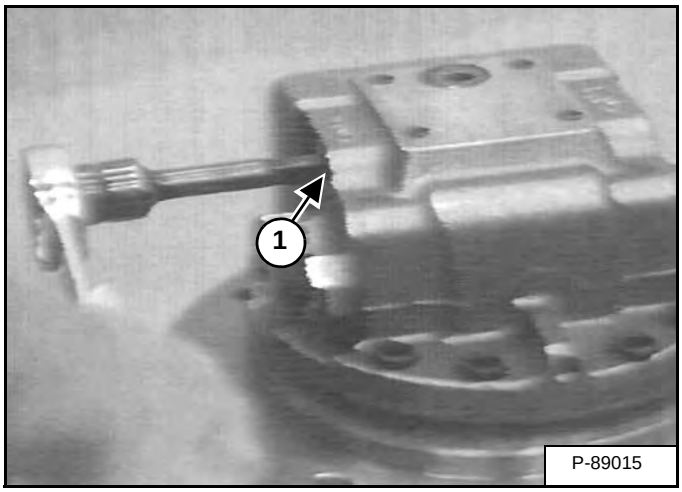


Remove the plug (Item 1) **[Figure 20-70-15]**.

Dealer Copy -- Not for Resale

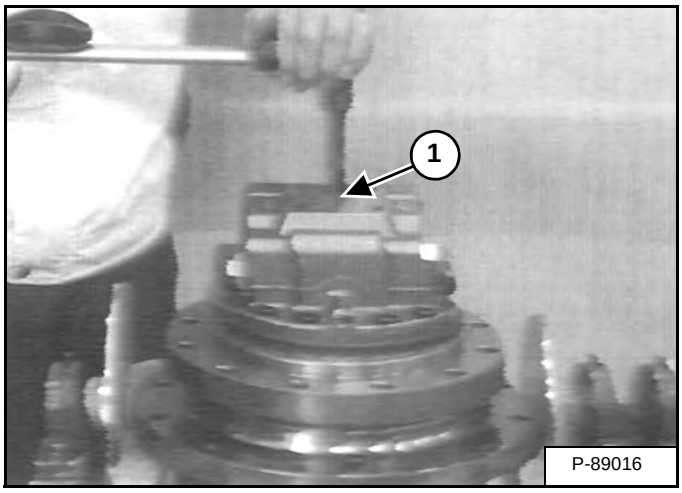
Disassembly (Cont'd)

Figure 20-70-16



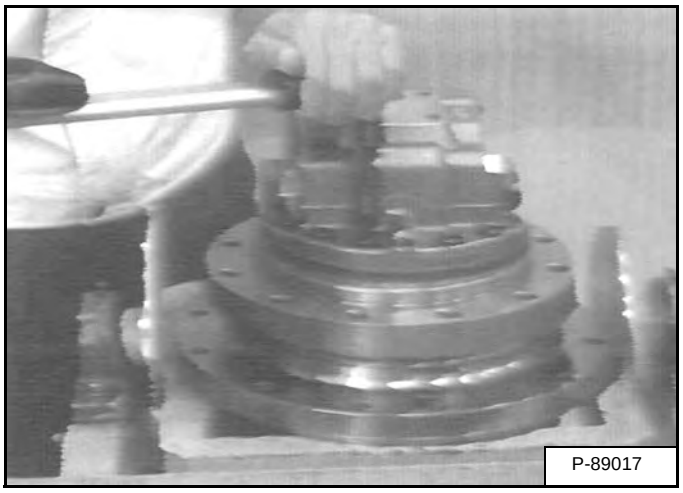
Remove the plug (Item 1) **[Figure 20-70-16]**.

Figure 20-70-17



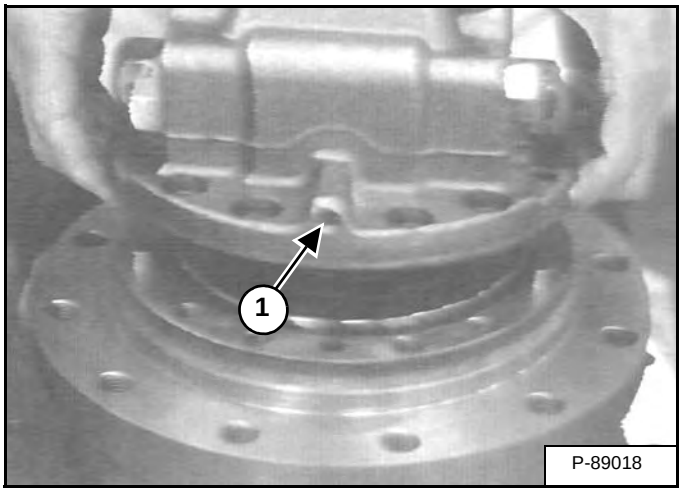
Remove the plug (Item 1) **[Figure 20-70-17]**.

Figure 20-70-18



Remove the bolts from the rear flange **[Figure 20-70-18]**.

Figure 20-70-19

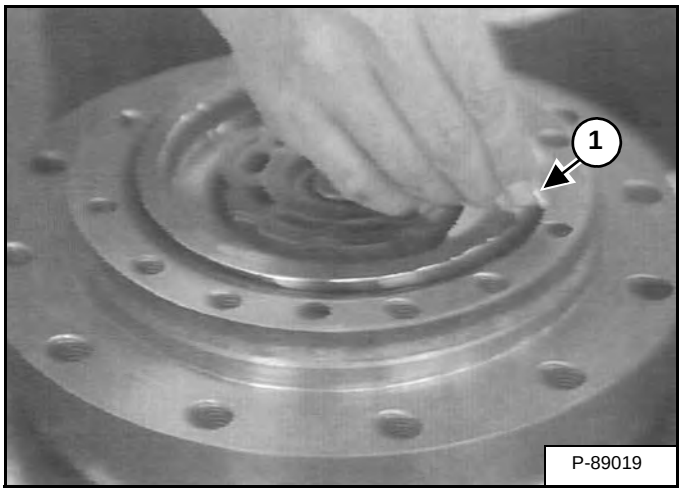


Remove the rear flange (Item 1) **[Figure 20-70-19]**.

Dealer Copy -- Not for Resale

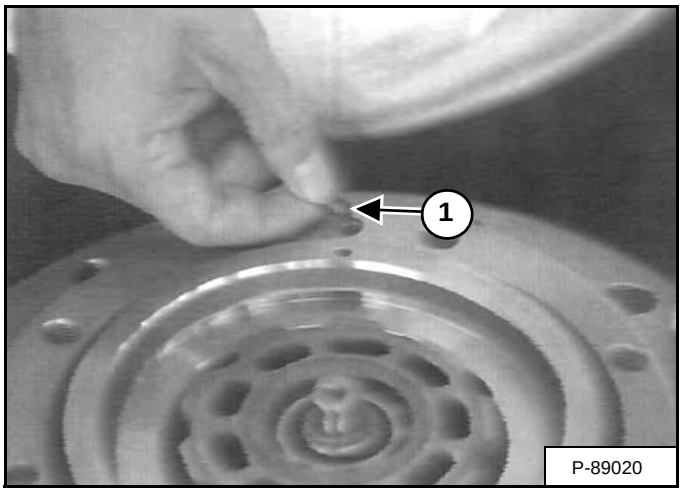
Disassembly (Cont'd)

Figure 20-70-20



Remove the pins (Item 1) **[Figure 20-70-20]**.

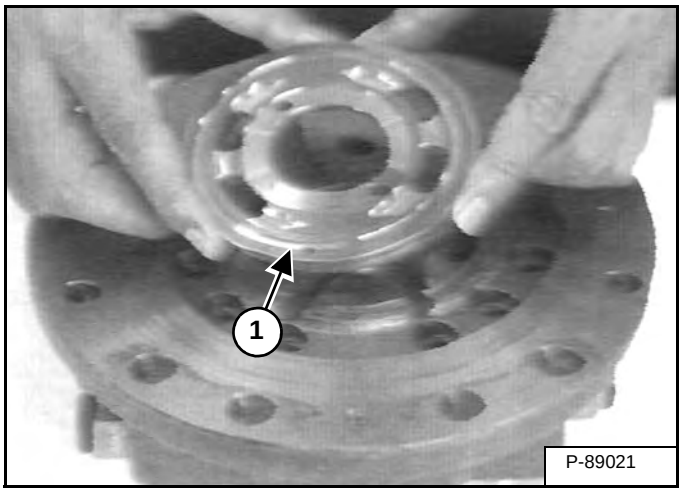
Figure 20-70-21



Remove and discard the two O-rings (Item 1) **[Figure 20-70-21]**.

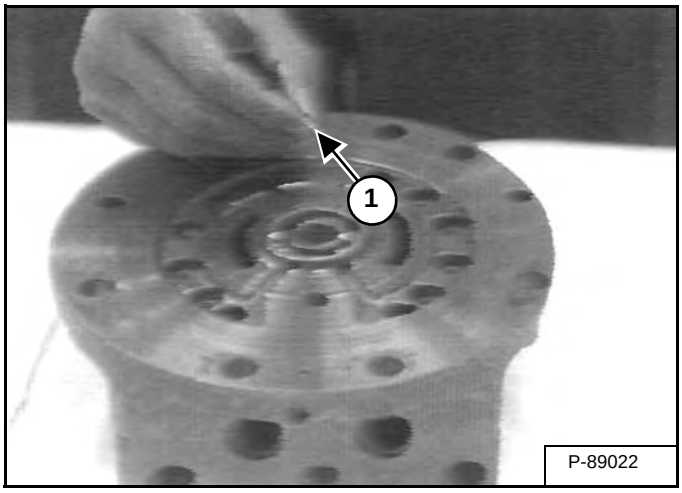
Remove the ten springs from the rear flange.

Figure 20-70-22



Remove the timing plate (Item 1) **[Figure 20-70-22]**.

Figure 20-70-23

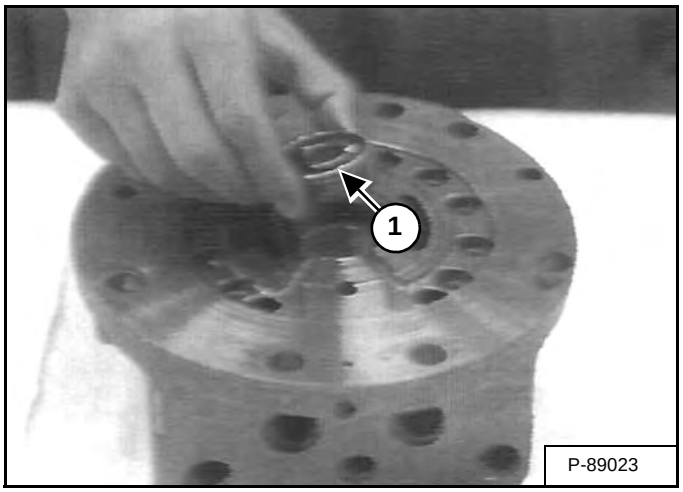


Remove the pin (Item 1) **[Figure 20-70-23]** from the rear flange.

Dealer Copy -- Not for Resale

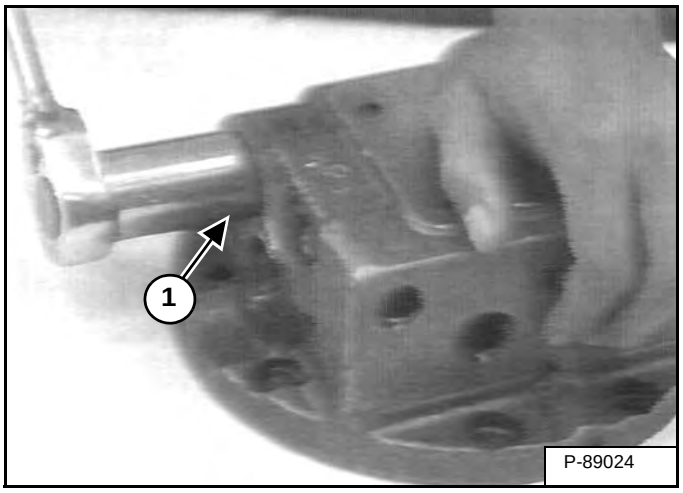
Disassembly (Cont'd)

Figure 20-70-24



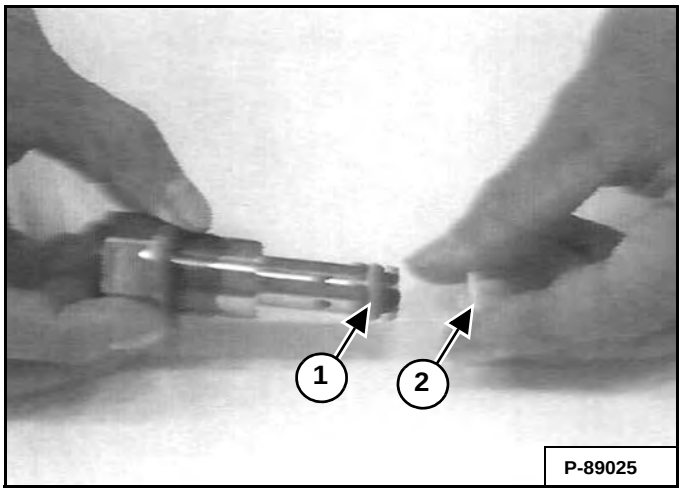
Remove the bearing (Item 1) **[Figure 20-70-24]**.

Figure 20-70-25



Remove the sleeve (Item 1) **[Figure 20-70-25]**.

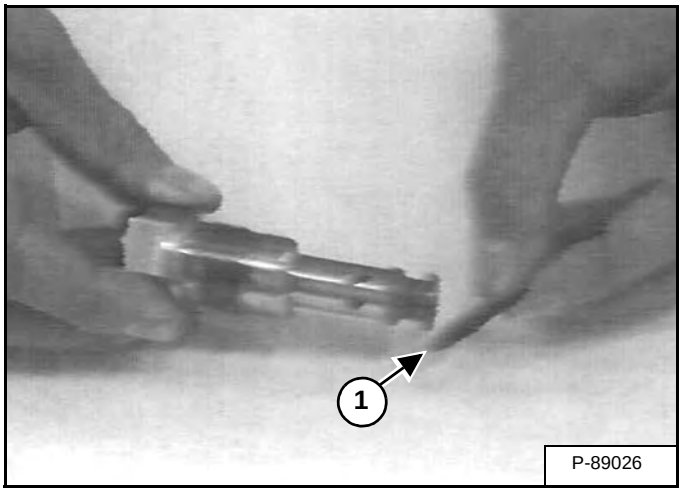
Figure 20-70-26



Remove the O-ring (Item 1) and back-up rings (Item 2) **[Figure 20-70-26]** from the valve seat.

Discard the O-ring and back-up rings.

Figure 20-70-27



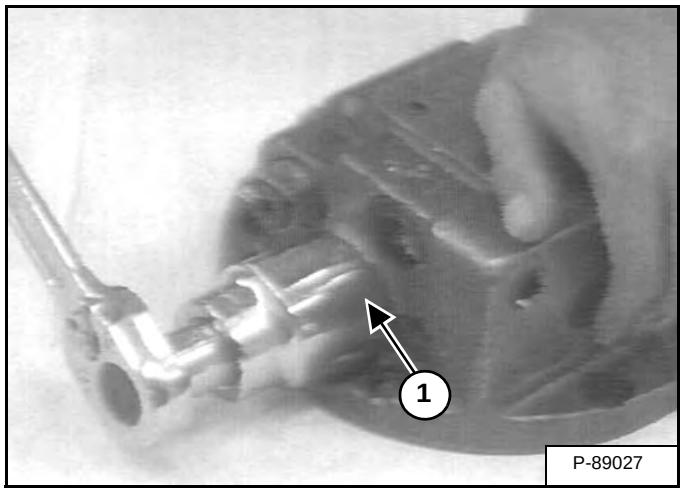
Remove the O-ring (Item 1) **[Figure 20-70-27]** from the sleeve.

Discard the O-ring.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

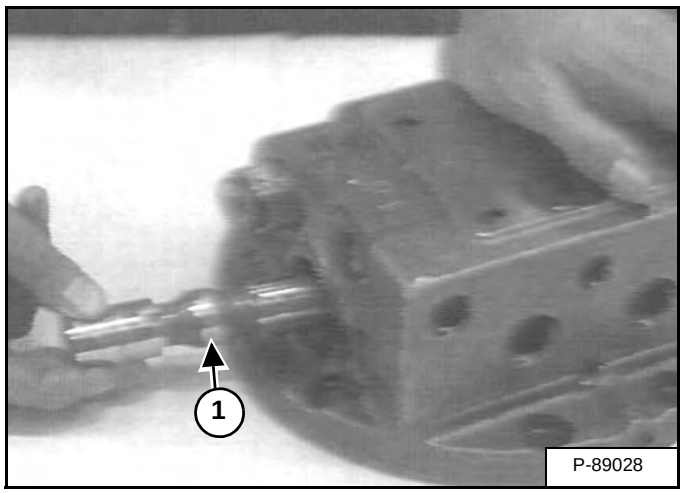
Figure 20-70-28



Remove the plug (Item 1) **[Figure 20-70-28]** from the rear flange. (Both sides)

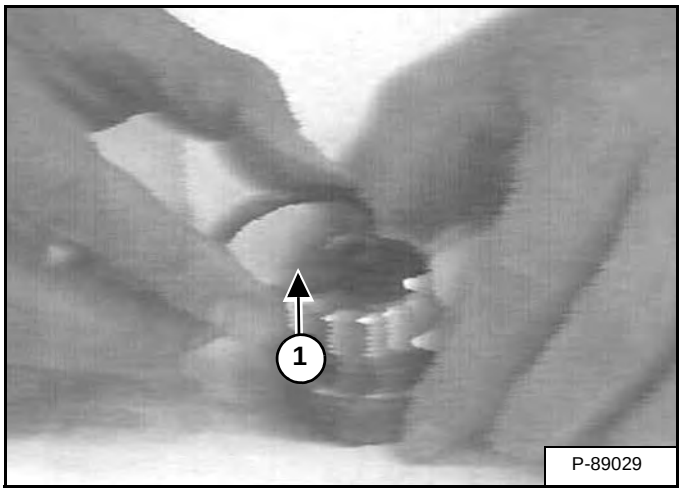
Remove the spring retainer and spring. (Both sides)

Figure 20-70-29



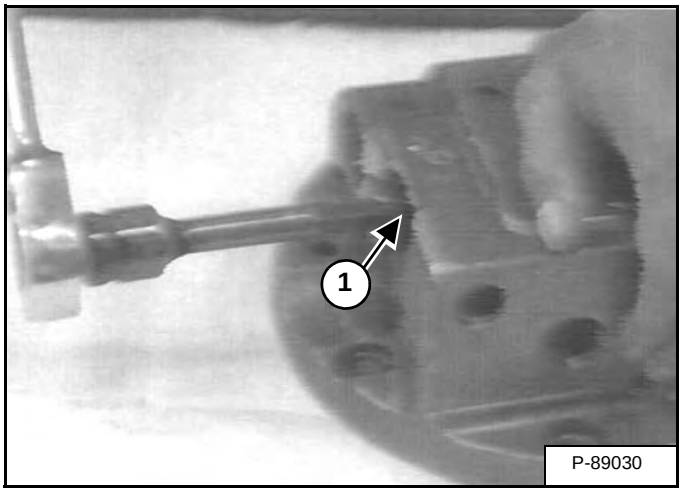
Remove the spool (Item 1) **[Figure 20-70-29]**.

Figure 20-70-30



Remove the O-ring (Item 1) **[Figure 20-70-30]** from the plug.

Figure 20-70-31

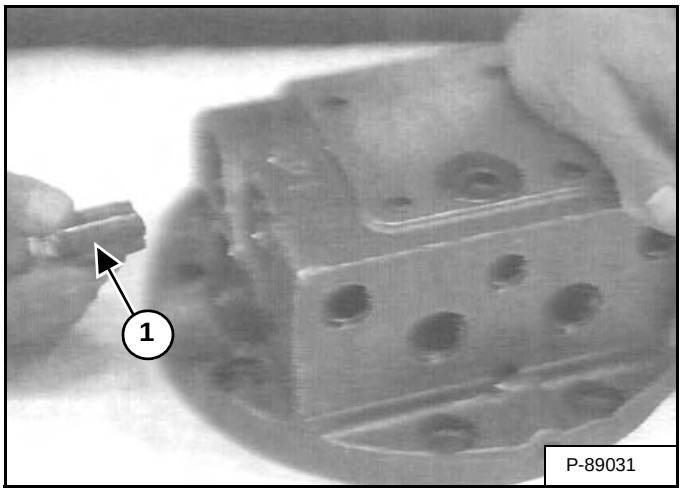


Remove the plug (Item 1) **[Figure 20-70-31]**.

Dealer Copy -- Not for Resale

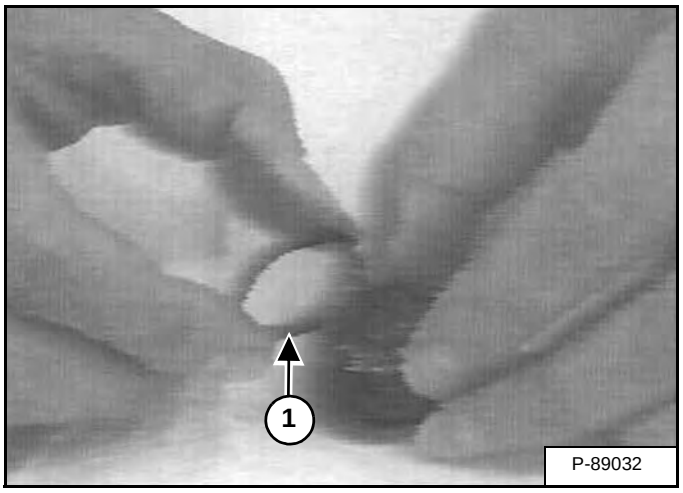
Disassembly (Cont'd)

Figure 20-70-32



Remove the spring and valve (Item 1) **[Figure 20-70-32]**.

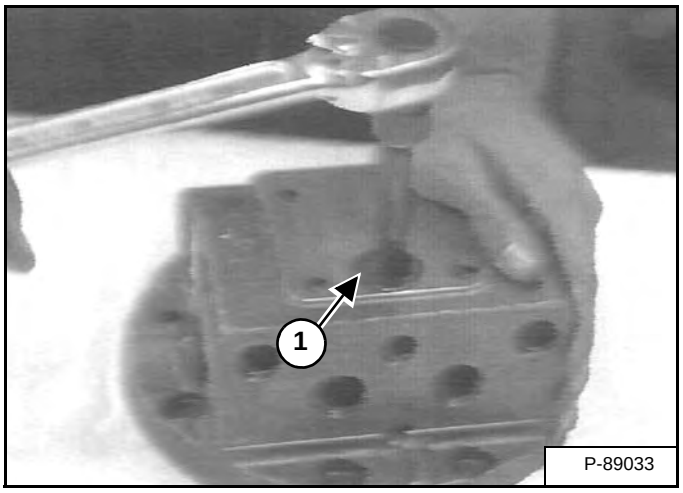
Figure 20-70-33



Remove the O-ring (Item 1) **[Figure 20-70-33]** from the plug.

Discard the O-ring.

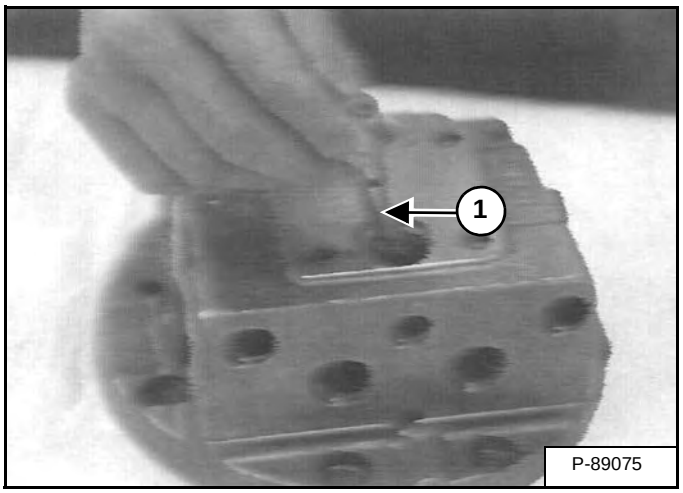
Figure 20-70-34



Remove the plug (Item 1) **[Figure 20-70-34]**.

Remove and discard the O-ring from the plug.

Figure 20-70-35

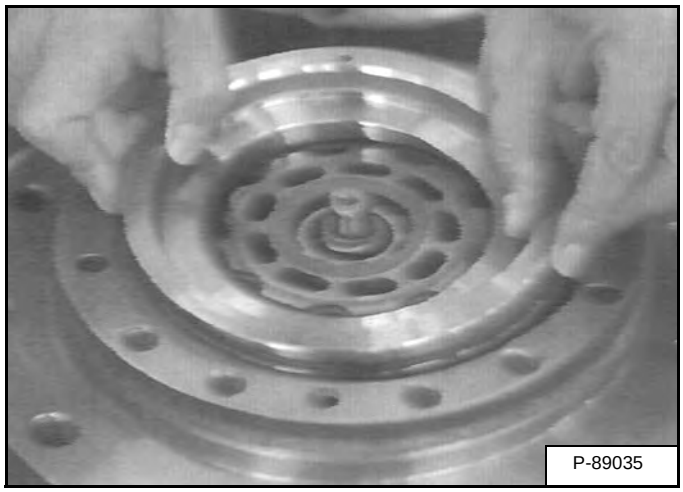


Remove the spool (Item 1) **[Figure 20-70-35]** and spring.

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Disassembly (Cont'd)

Figure 20-70-36



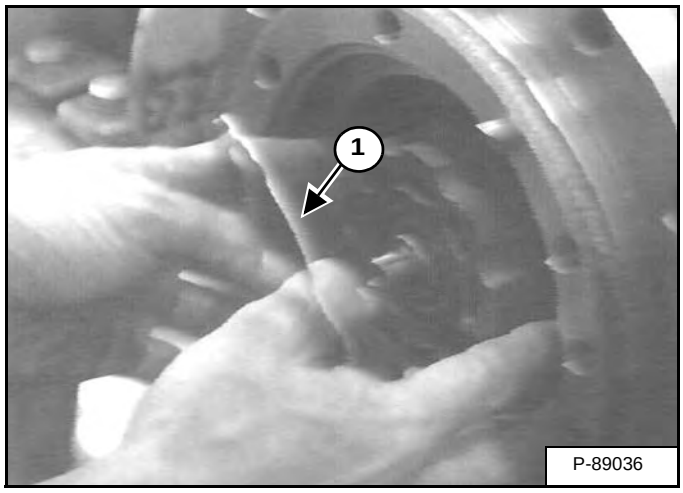
Remove the piston by injecting low air pressure into the access hole in the spindle **[Figure 20-70-36]**.

Remove the O-ring from the piston.

Discard the O-ring.

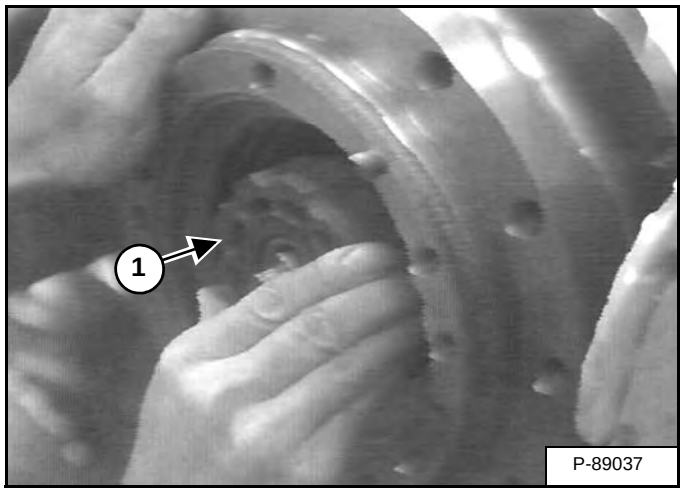
Turn the motor on its side and drain the hydraulic fluid into an approved container.

Figure 20-70-37



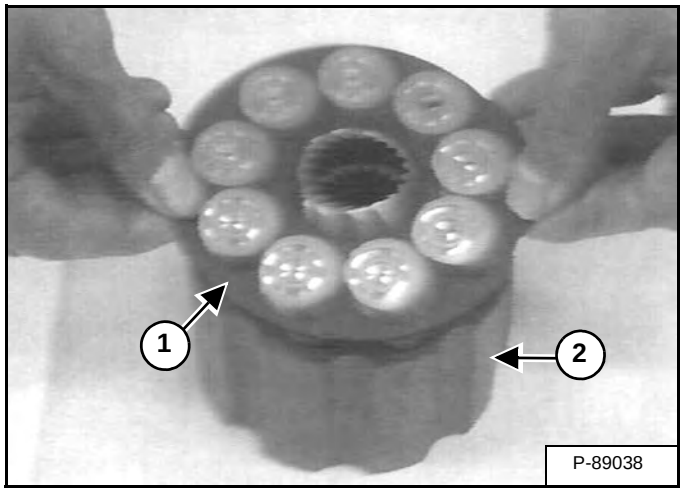
Remove the mating plates and friction plates (Item 1) **[Figure 20-70-37]**.

Figure 20-70-38



Remove the cylinder block assembly (Item 1) **[Figure 20-70-38]**.

Figure 20-70-39

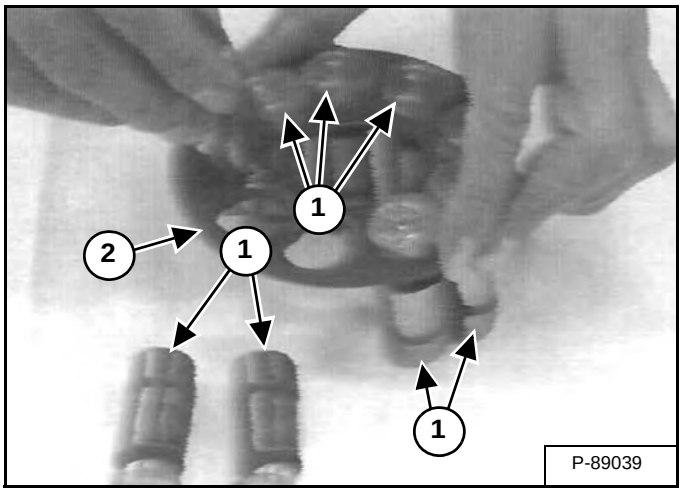


Remove the piston assembly (Item 1) from the cylinder block (Item 2) **[Figure 20-70-39]**.

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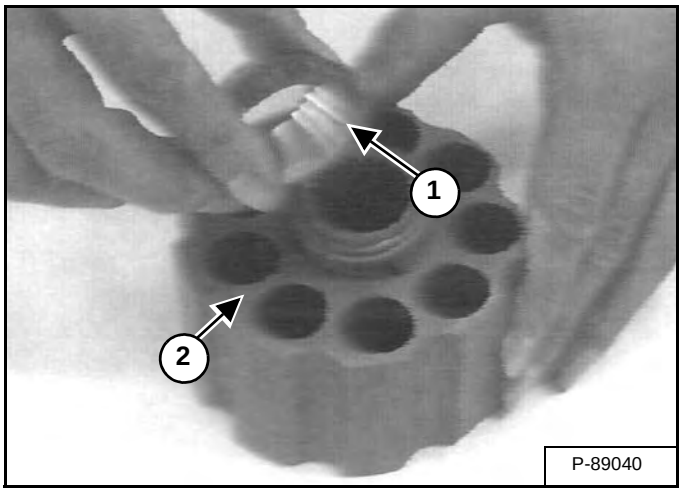
Disassembly (Cont'd)

Figure 20-70-40



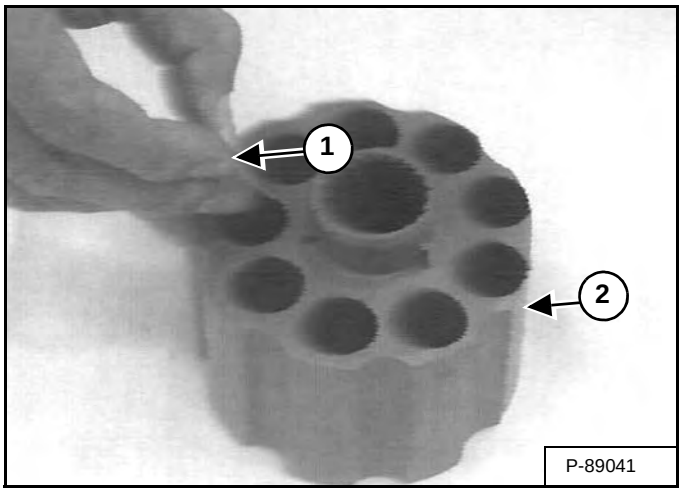
Remove the pistons (Item 1) from the retainer plate (Item 2) **[Figure 20-70-40]**.

Figure 20-70-41



Remove the thrust ball (Item 1) from the cylinder block (Item 2) **[Figure 20-70-41]**.

Figure 20-70-42

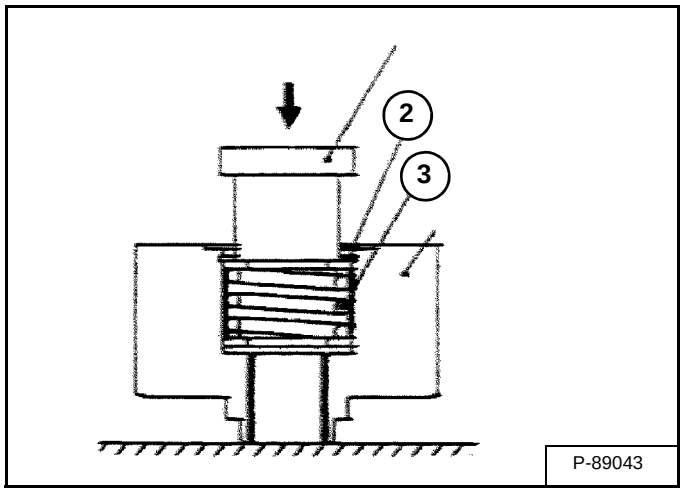


Remove the washer and pins (Item 1) from the cylinder block (Item 2) **[Figure 20-70-42]**.

Dealer Copy -- Not for Resale

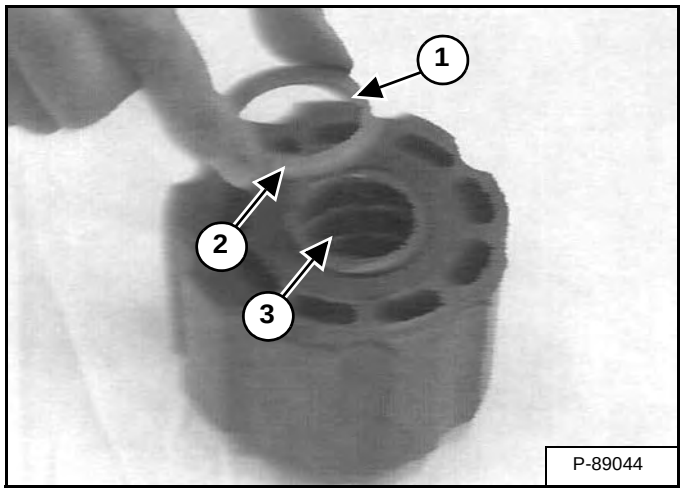
Disassembly (Cont'd)

Figure 20-70-43



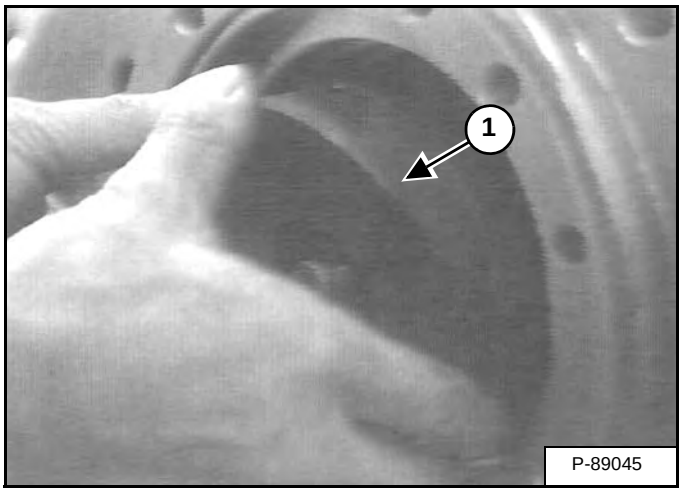
Place the cylinder block in a press **[Figure 20-70-43]**.

Figure 20-70-44



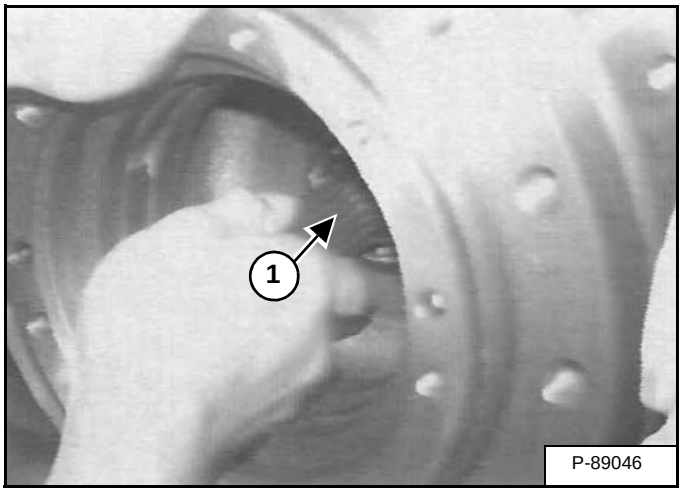
Remove the snap ring (Item 1), washer (Item 2), and spring (Item 3) **[Figure 20-70-43]** and **[Figure 20-70-44]**.

Figure 20-70-45



Remove the swash plate (Item 1) **[Figure 20-70-45]**.

Figure 20-70-46

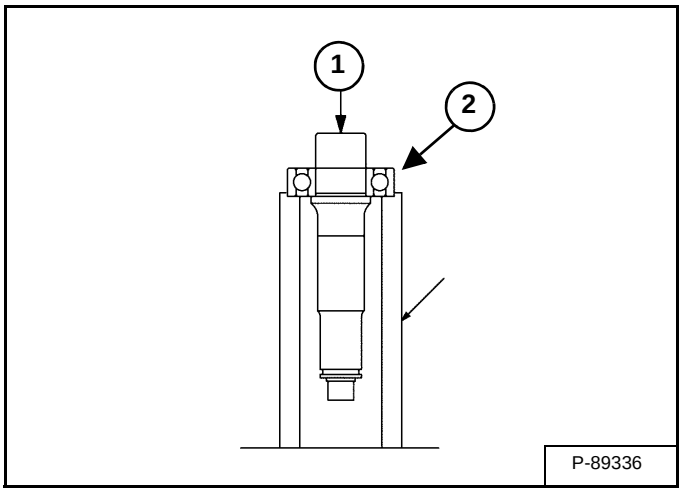


Remove the shaft (Item 1) **[Figure 20-70-46]**.

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Disassembly (Cont'd)

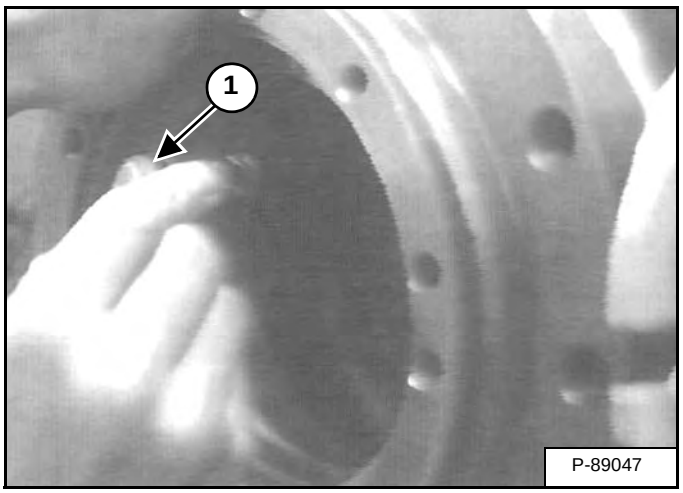
Figure 20-70-47



Place the shaft (Item 1) in a press and remove the bearing (Item 2) **[Figure 20-70-47]**.

Do not reuse the bearing.

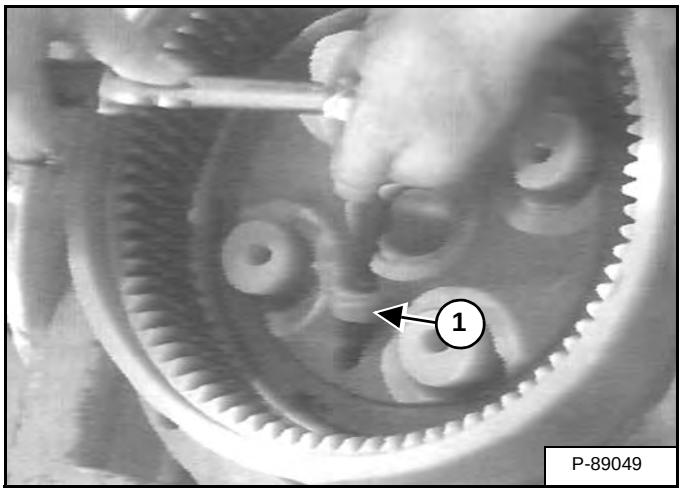
Figure 20-70-48



Remove the pivots and parallel pins (Item 1) **[Figure 20-70-48]**.

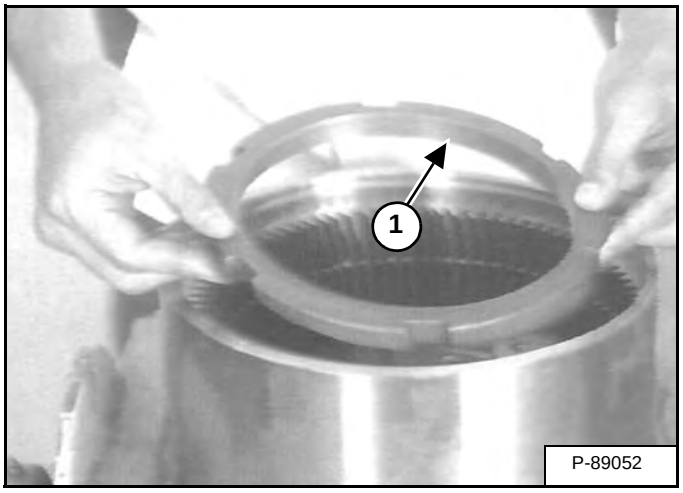
Remove the two-speed pistons and springs by applying low air pressure to the oil passages.

Figure 20-70-49



Remove the set screws (Item 1) **[Figure 20-70-49]**.

Figure 20-70-50



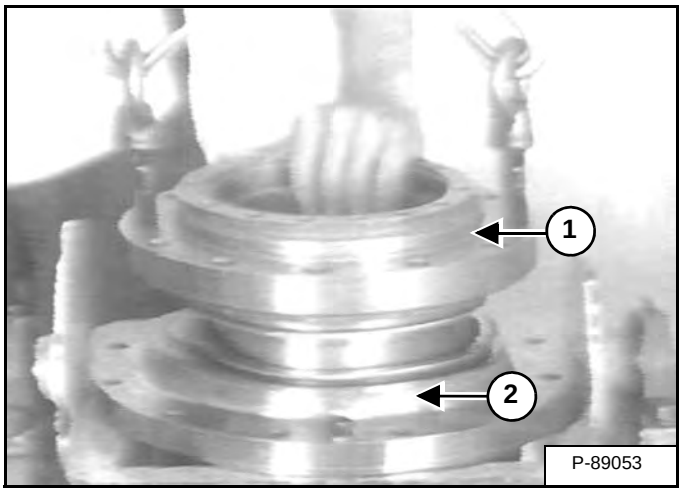
Remove the nut (Item 1) **[Figure 20-70-50]**.

Do not reuse the nut.

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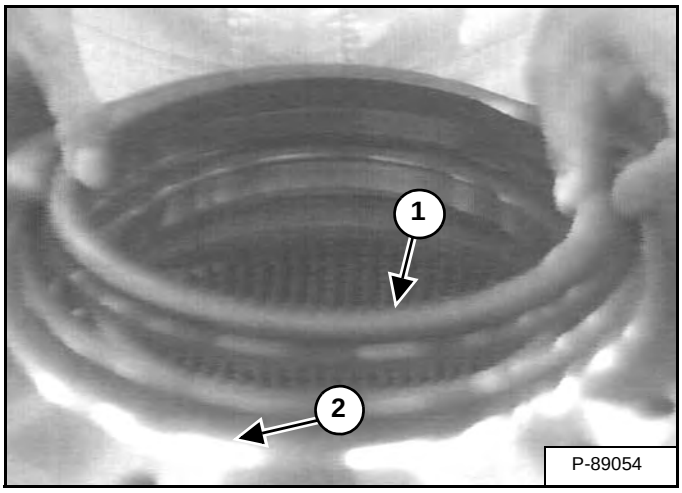
Disassembly (Cont'd)

Figure 20-70-51



Separate the spindle (Item 1) from the hub (Item 2) **[Figure 20-70-51]**.

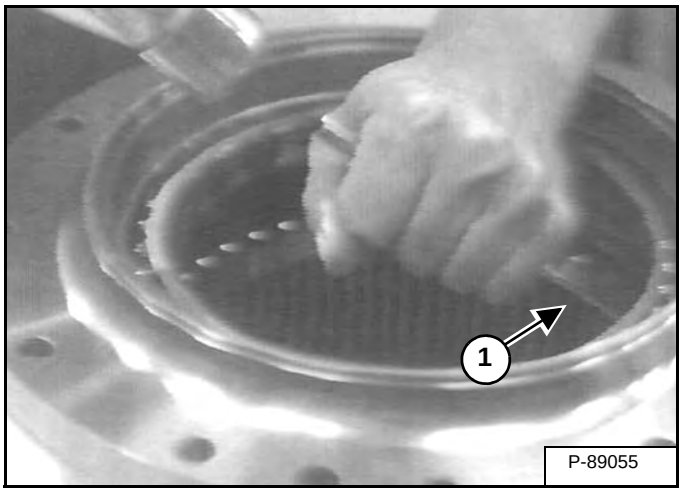
Figure 20-70-52



Remove the seal ring assembly (Item 1) from the hub (Item 2) **[Figure 20-70-52]**.

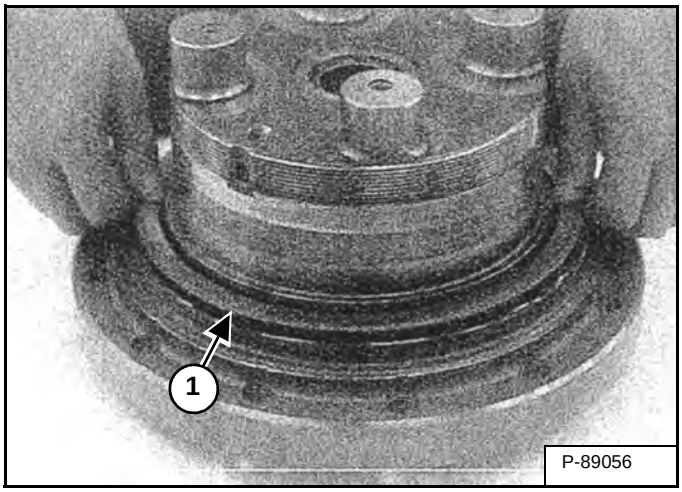
NOTE: Do not reuse the seal.

Figure 20-70-53



Remove the bearing (Item 1) **[Figure 20-70-53]** from both sides of the hub.

Figure 20-70-54

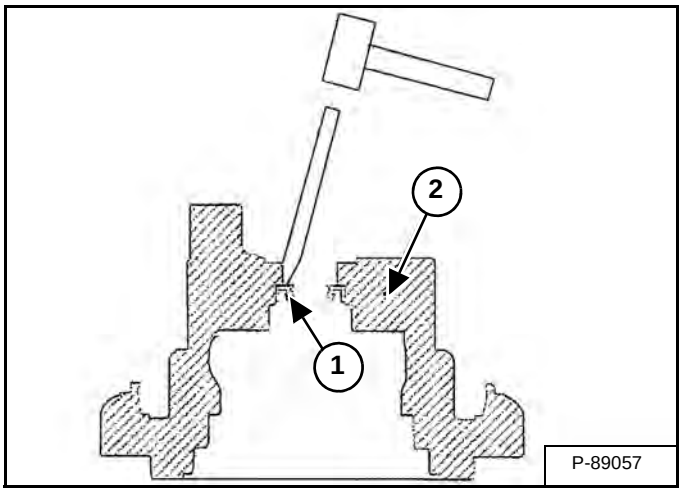


Remove the seal ring assembly (Item 1) **[Figure 20-70-54]** from the spindle.

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Disassembly (Cont'd)

Figure 20-70-55



Remove the oil seal (Item 1) from the spindle (Item 2) **[Figure 20-70-55]**.

Dealer Copy -- Not for Resale

Assembly

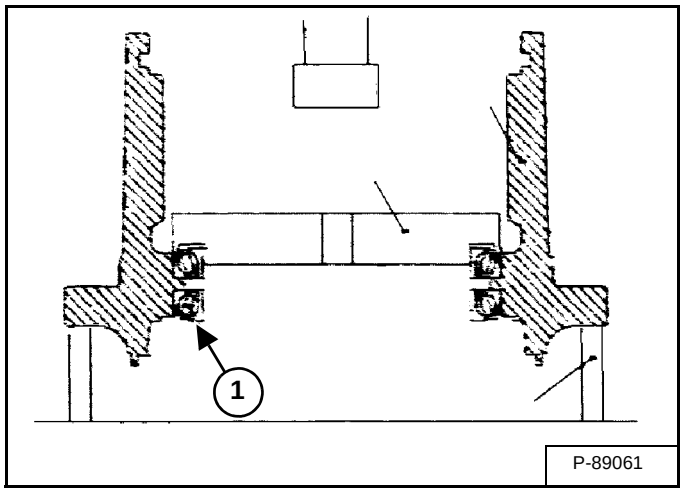
Clean all parts in solvent and dry with compressed air. Inspect all parts and replace those that are damaged. If any of the planetary gears are damaged, replace all the planetary gears and the sun gear from that planetary.

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.

Position the hub in a press.

Figure 20-70-56

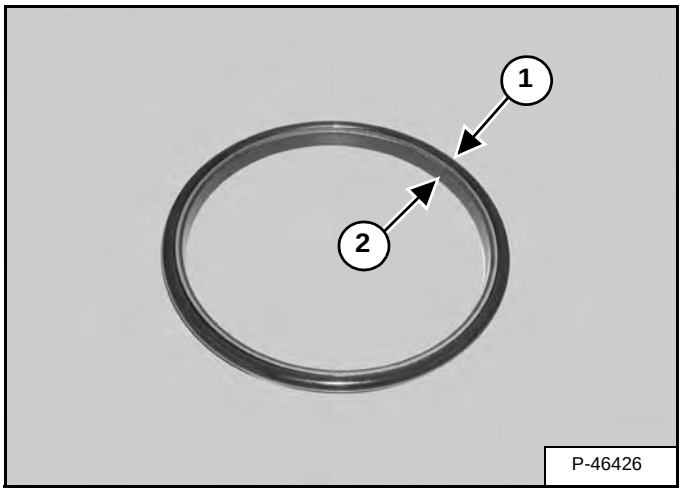


Install the bearing (Item 1) **[Figure 20-70-56]**.

Use the same procedure to install the bearing on the opposite side of the hub.

Apply a light film of grease onto the O-ring of the seal ring assemblies.

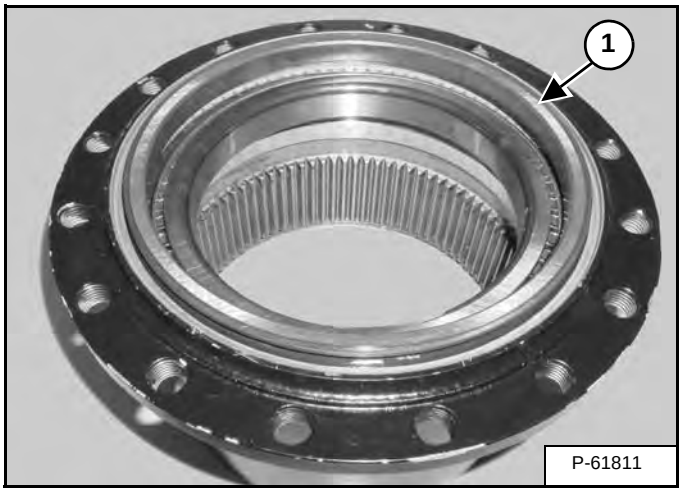
Figure 20-70-57



Install the O-ring (Item 1) on both seal rings (Item 2) **[Figure 20-70-57]**.

NOTE: Inspect the seal ring for burrs before installing the O-ring. Make sure the O-ring is not twisted when installing it. To remove any twists, gently pull a section of the O-ring and let it snap back.

Figure 20-70-58



Install the seal ring assembly (Item 1) **[Figure 20-70-58]**.

Use firm even pressure to *pop* the O-ring into the housing.

Apply a light film of oil to the metal seal ring.

Dealer Copy -- Not for Resale

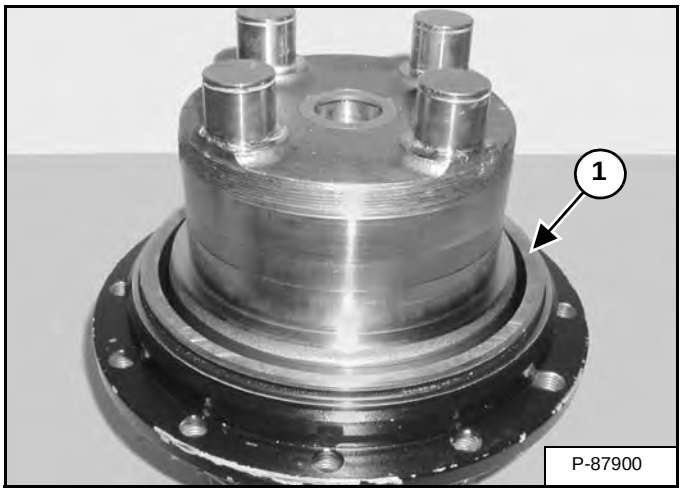
Assembly (Cont'd)

Figure 20-70-59



The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 20-70-59]**.

Figure 20-70-60

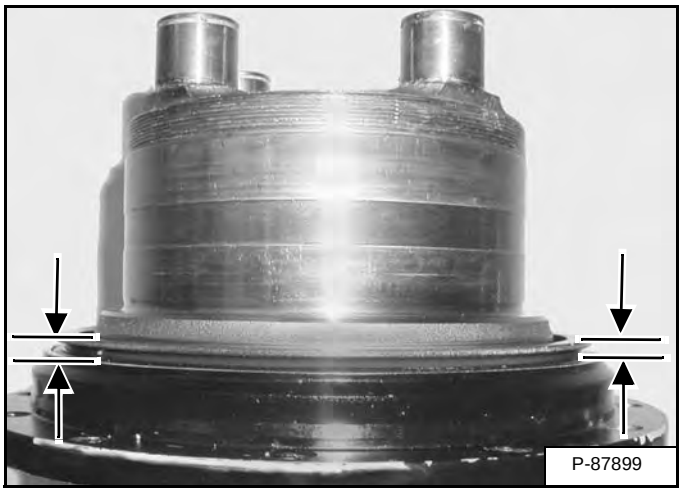


Install the seal ring assembly (Item 1) **[Figure 20-70-60]**.

Use firm even pressure to *pop* the O-ring into the housing.

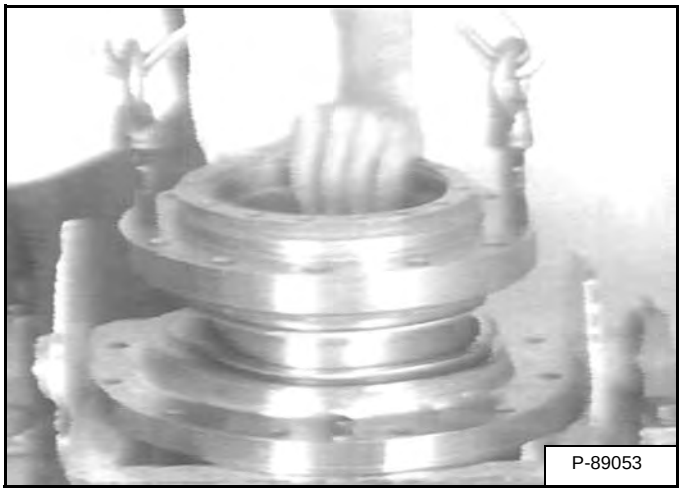
Apply a light film of oil to the metal seal ring.

Figure 20-70-61



The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 20-70-61]**.

Figure 20-70-62



Install the spindle onto the hub **[Figure 20-70-62]**.

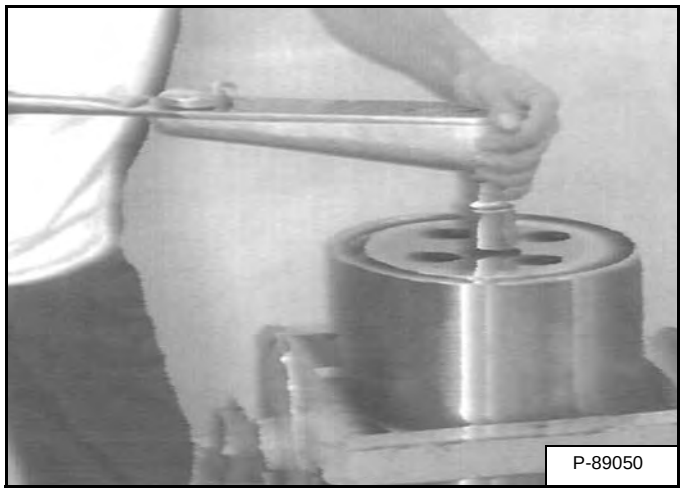
Apply Loctite® 270 (or equivalent) to a new ring nut.

Install the ring nut with the chamfer towards the bearing.

Dealer Copy -- Not for Resale

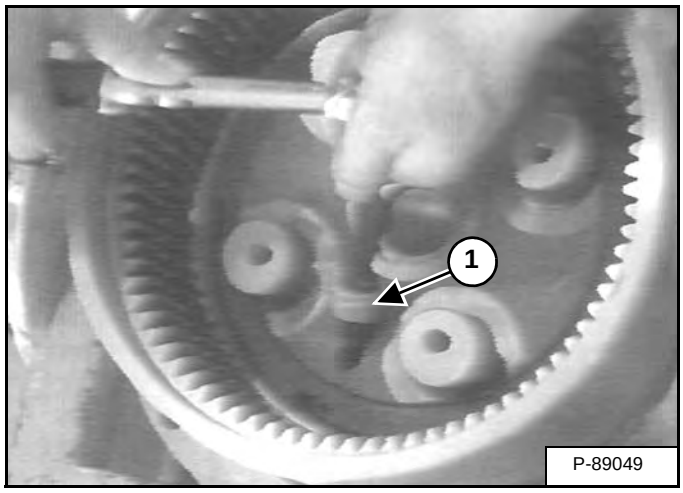
Assembly (Cont'd)

Figure 20-70-63



Use a spanner wrench and tighten the nut to 533 - 644 N•m (393 - 475 ft-lb) torque **[Figure 20-70-63]**.

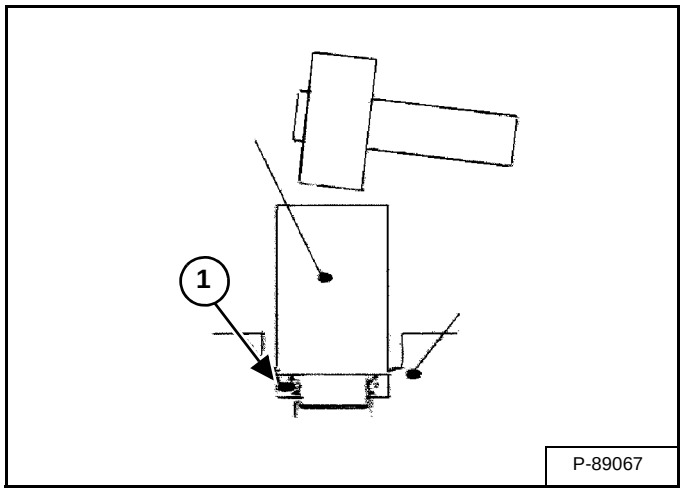
Figure 20-70-64



Install the set screws (Item 1) **[Figure 20-70-64]**.

Tighten the set screws to 8 - 11 N•m (6 - 8 ft-lb).

Figure 20-70-65

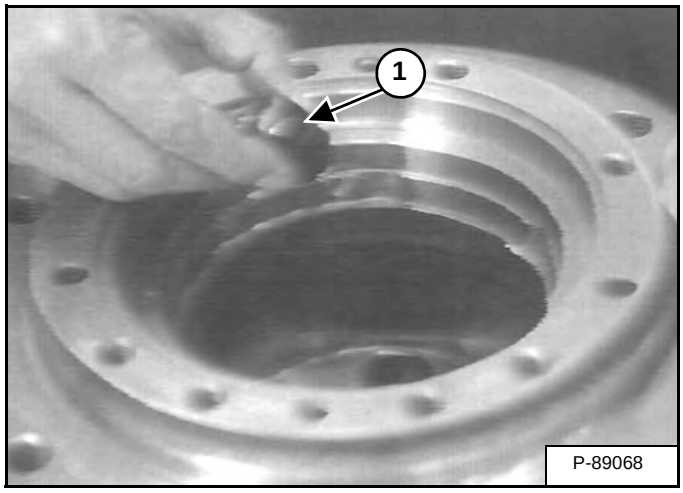


Install the oil seal (Item 1) **[Figure 20-70-65]** into the spindle.

Install the parallel pin / pivot assemblies.

Install the spring into the piston.

Figure 20-70-66

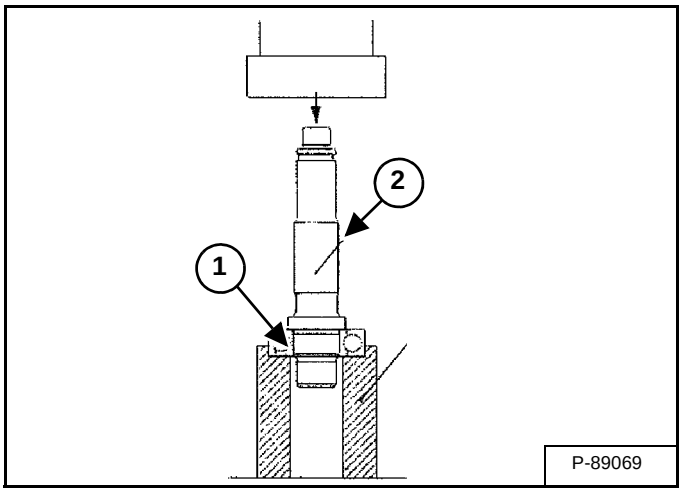


Install the piston assembly (Item 1) **[Figure 20-70-66]** into the spindle.

Dealer Copy -- Not for Resale

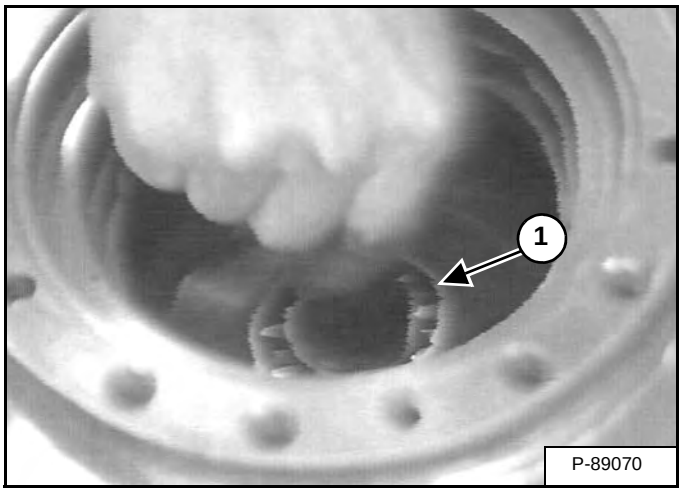
Assembly (Cont'd)

Figure 20-70-67



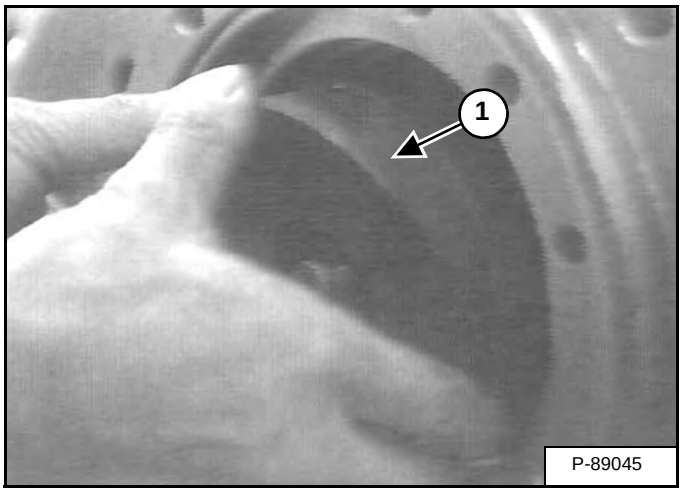
Heat the bearing (Item 1) to 72 - 128°C (162 - 262°F) and install the shaft (Item 2) **[Figure 20-70-67]**.

Figure 20-70-68



Install the shaft (Item 1) **[Figure 20-70-68]** into the spindle.

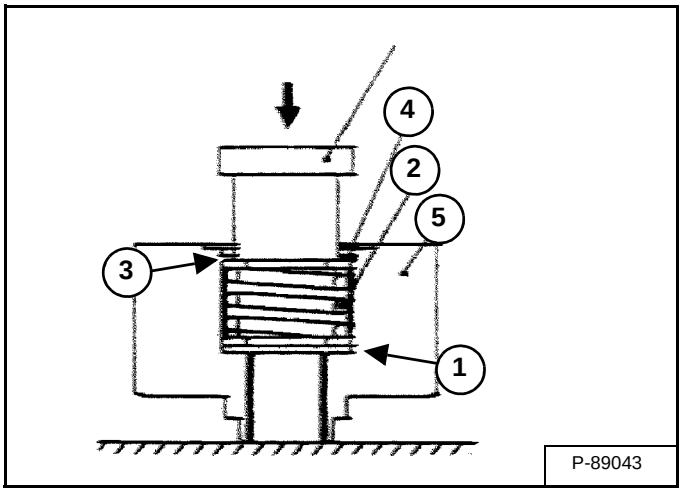
Figure 20-70-69



Install the swash plate (Item 1) **[Figure 20-70-69]**.

NOTE: Make sure the pivots mounted on the spindle enter the pivot holes of the swash plate.

Figure 20-70-70

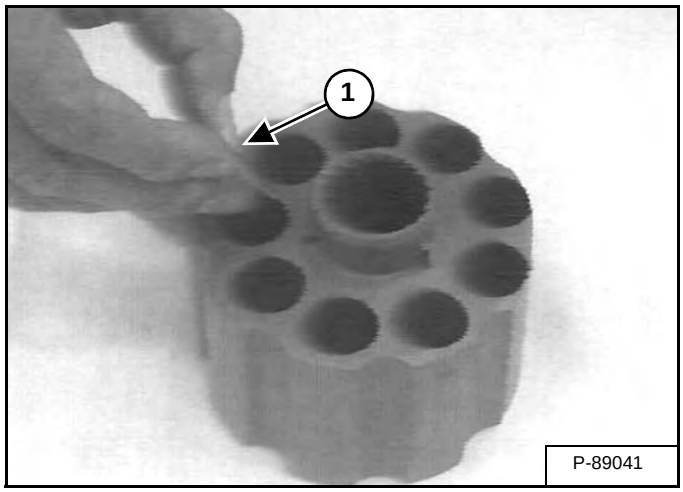


Install the washer (Item 1), spring (Item 2), washer (Item 3) and snap ring (Item 4) into the cylinder block (Item 5) **[Figure 20-70-70]**.

Dealer Copy -- Not for Resale

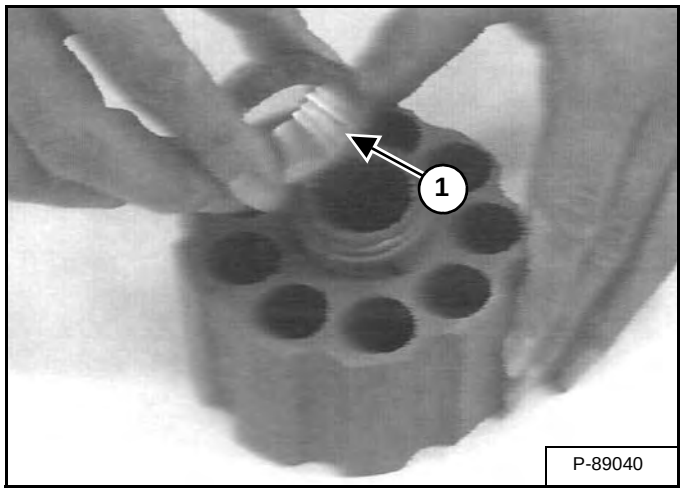
Assembly (Cont'd)

Figure 20-70-71



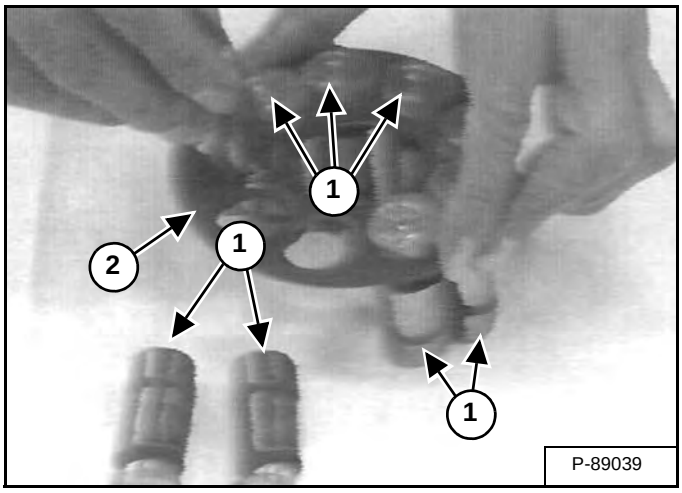
Install the pins (Item 1) **[Figure 20-70-71]** into the cylinder block.

Figure 20-70-72



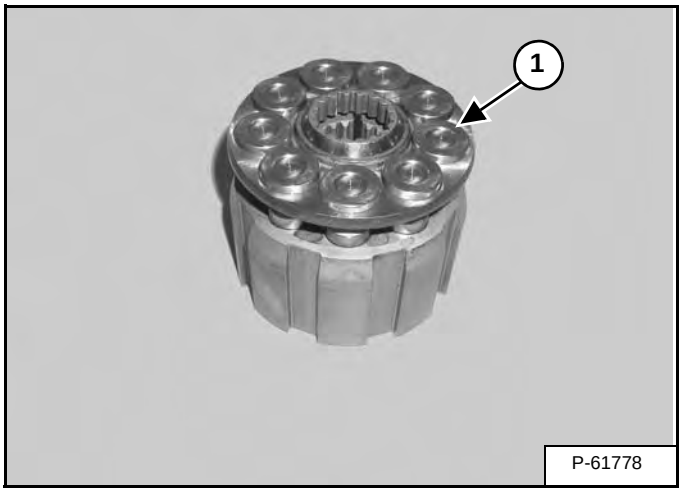
Install the washer and thrust ball (Item 1) **[Figure 20-70-72]** onto the cylinder block.

Figure 20-70-73



Install the pistons (Item 1) into the retainer plate (Item 2) **[Figure 20-70-73]**.

Figure 20-70-74

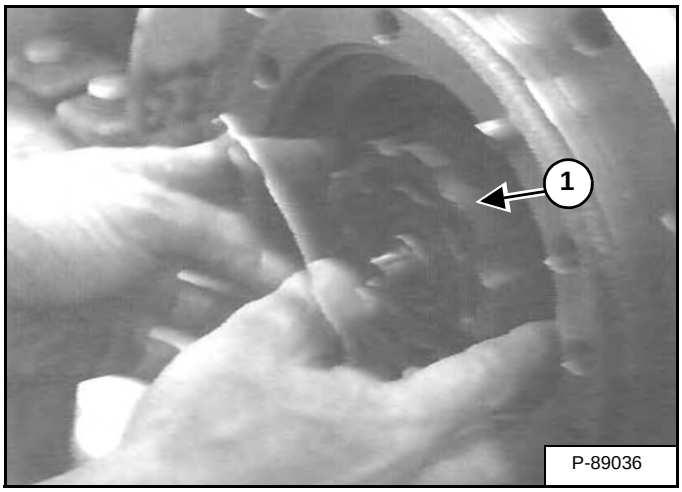


Install the piston assembly (Item 1) **[Figure 20-70-74]** into the cylinder block.

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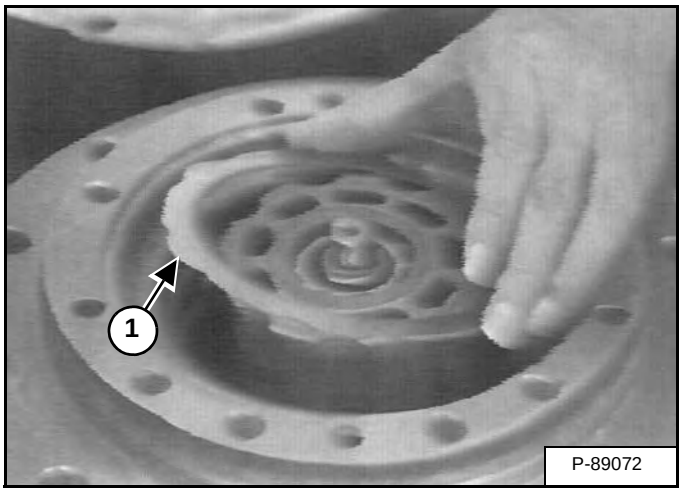
Assembly (Cont'd)

Figure 20-70-75



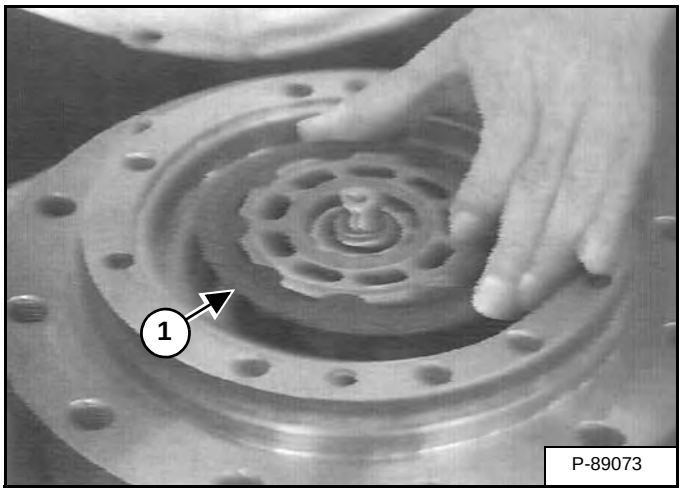
Install the cylinder block assembly (Item 1) **[Figure 20-70-75]** onto the shaft.

Figure 20-70-76



Install the mating plate (Item 1) **[Figure 20-70-76]**.

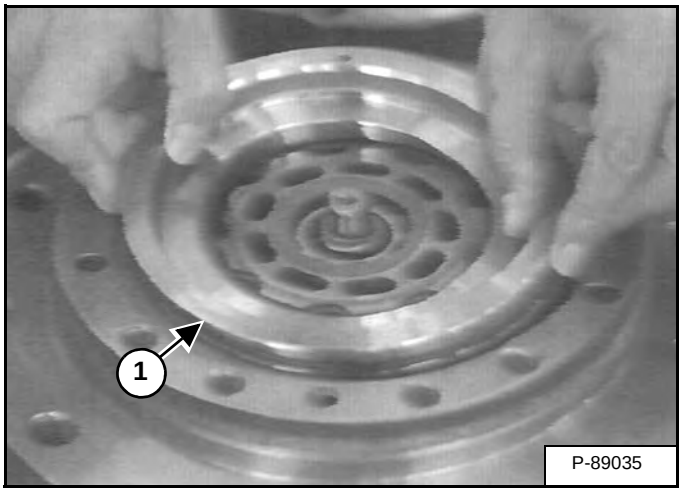
Figure 20-70-77



Install the friction plate (Item 1) **[Figure 20-70-77]**. Install the remaining mating plates and friction plates alternately.

NOTE: Immerse the friction plates in hydraulic fluid prior to installation.

Figure 20-70-78

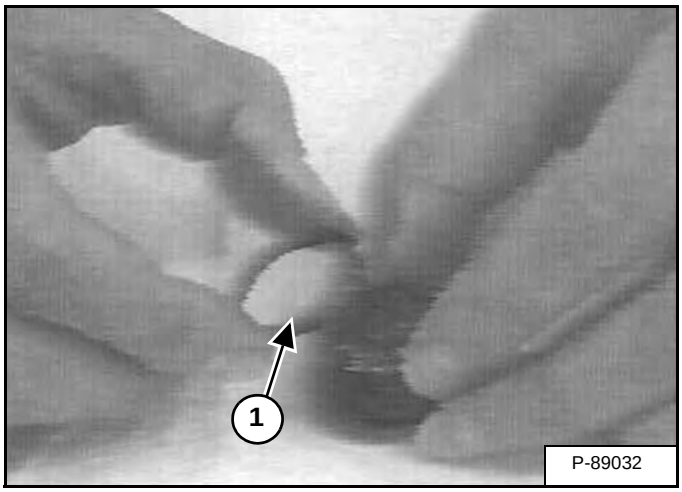


Install the O-ring onto the piston. Install the piston (Item 1) **[Figure 20-70-78]** into the spindle.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

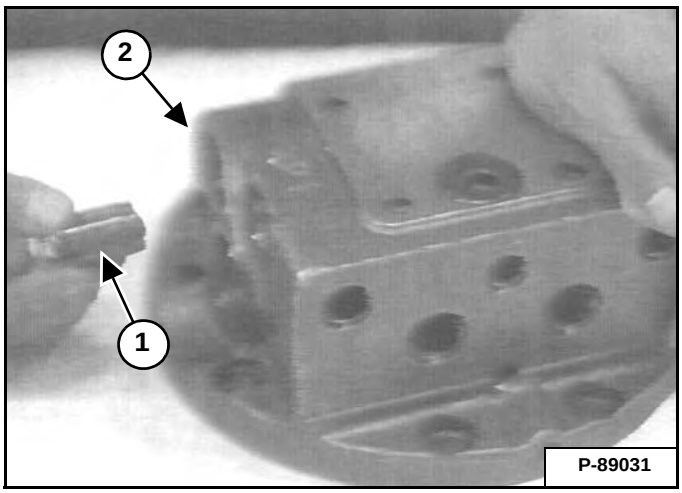
Figure 20-70-79



Install the O-ring (Item 1) **[Figure 20-70-79]** onto the plug.

Install the valve and spring into the plug.

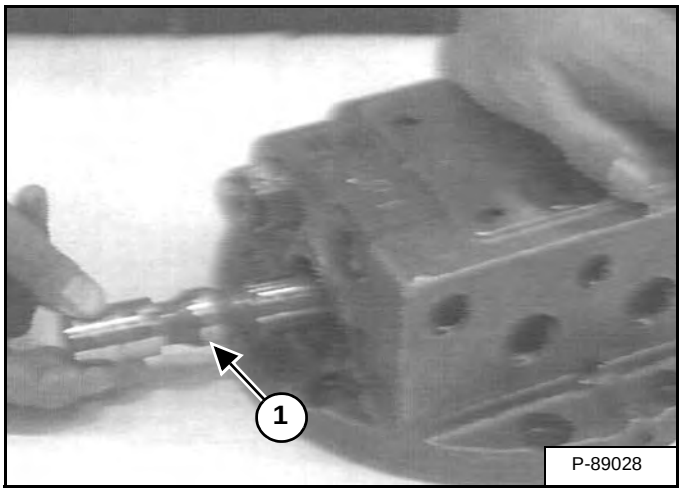
Figure 20-70-80



Install the plug assembly (Item 1) into the rear flange (Item 2) **[Figure 20-70-80]**.

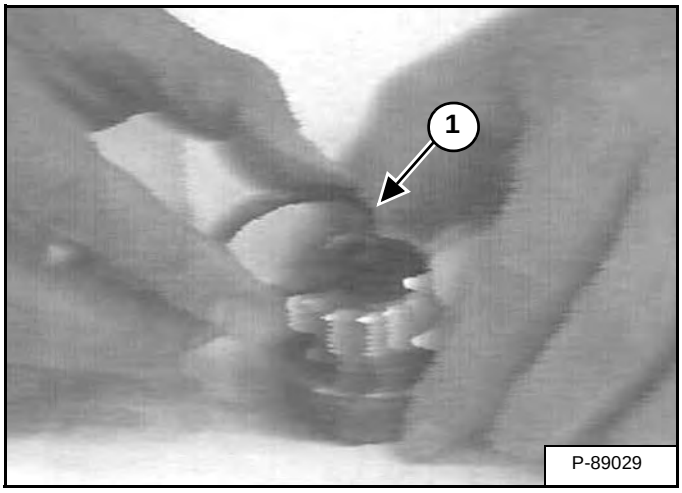
Do not tighten it yet.

Figure 20-70-81



Install the spool (Item 1) **[Figure 20-70-81]**.

Figure 20-70-82

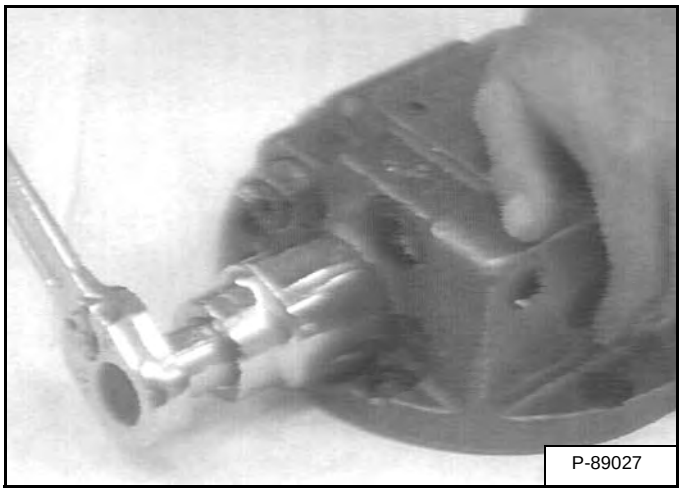


Install the O-ring (Item 1) **[Figure 20-70-82]** onto the plug.

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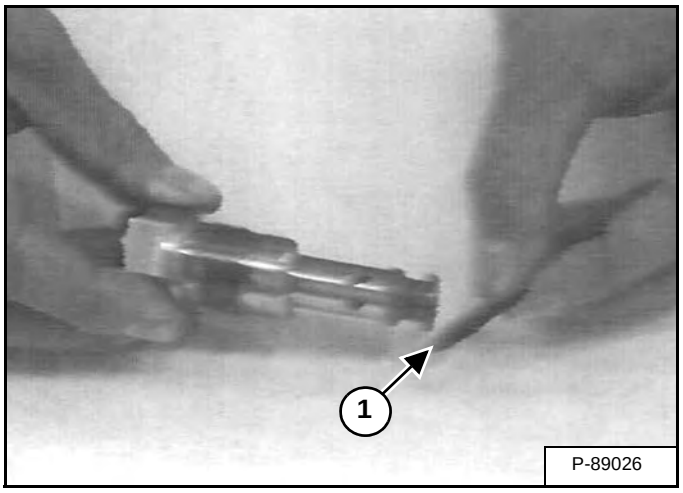
Assembly (Cont'd)

Figure 20-70-83



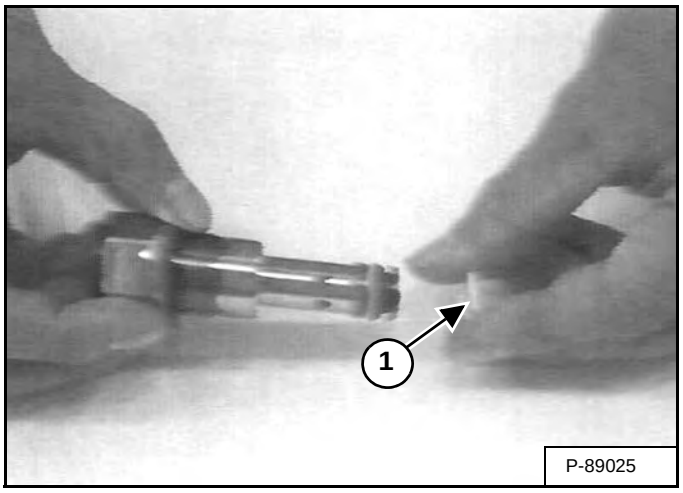
Install the spring retainer, spring and plug (both ends of the spool) **[Figure 20-70-83]**.

Figure 20-70-84



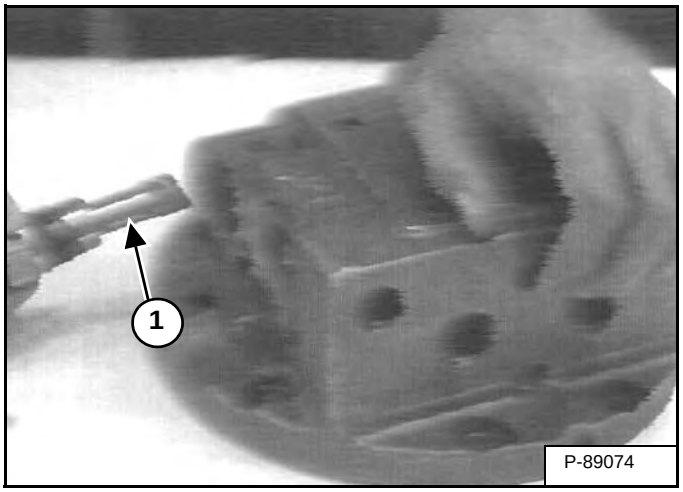
Install the O-ring (Item 1) **[Figure 20-70-84]** onto the valve.

Figure 20-70-85



Install the O-ring and back-up ring (Item 1) **[Figure 20-70-85]**.

Figure 20-70-86

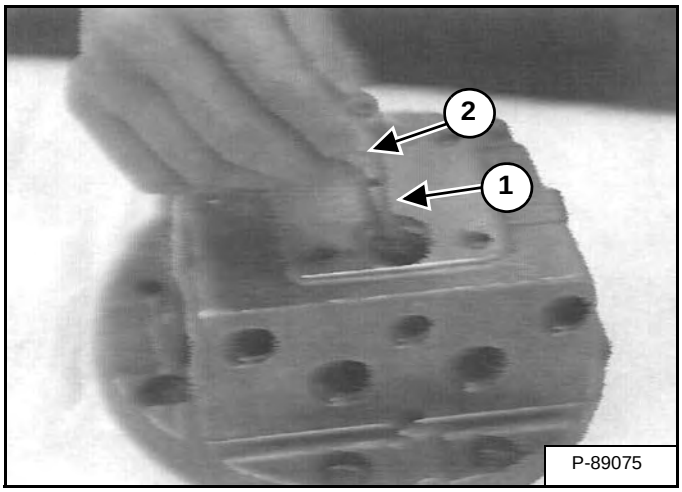


Install the valve (Item 1) **[Figure 20-70-86]**.

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Assembly (Cont'd)

Figure 20-70-87

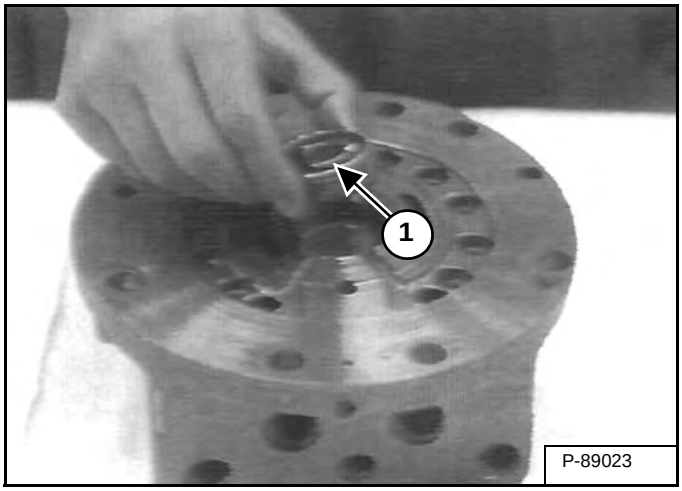


Install the spring (Item 1) and spool (Item 2) **[Figure 20-70-87]**.

Install the O-ring on the plug and install the plug.

Do not tighten it yet.

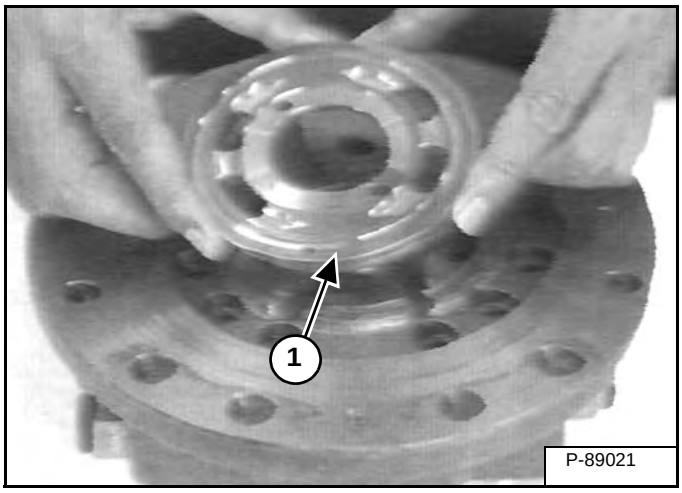
Figure 20-70-88



Install the bearing (Item 1) **[Figure 20-70-88]**.

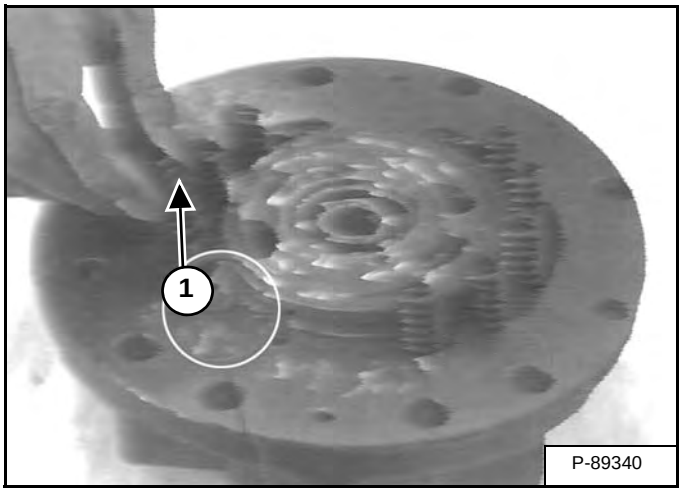
Install the parallel pins.

Figure 20-70-89



Install the timing plate (Item 1) **[Figure 20-70-89]**.

Figure 20-70-90

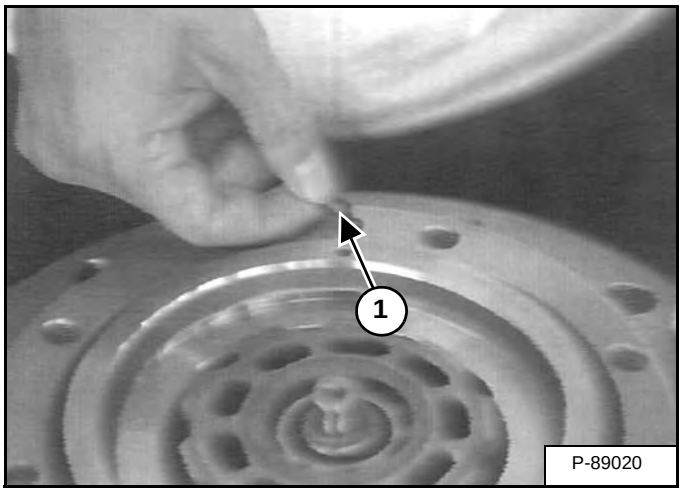


Install the springs (Item 1) **[Figure 20-70-90]**.

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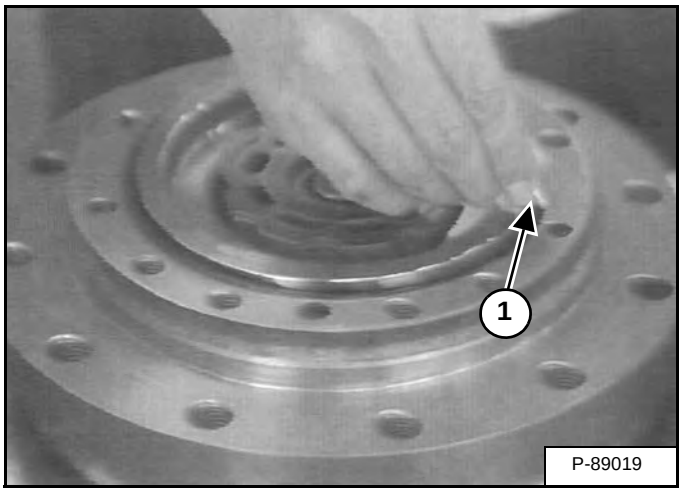
Assembly (Cont'd)

Figure 20-70-91



Install the O-rings (Item 1) **[Figure 20-70-91]** into the groove of the spindle.

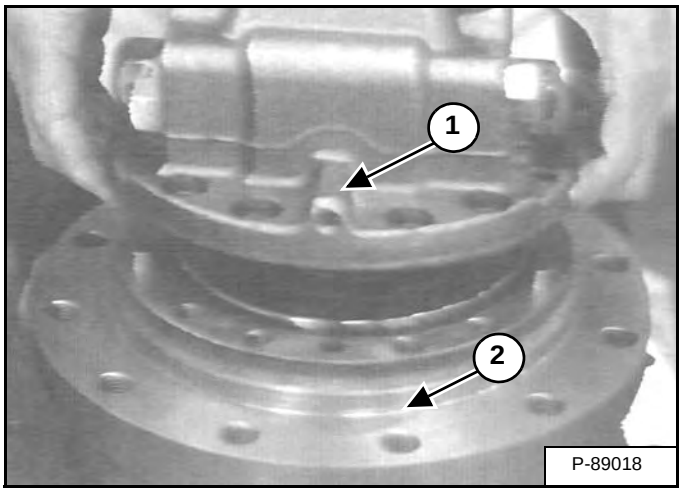
Figure 20-70-92



Install the parallel pins (Item 1) **[Figure 20-70-92]**.

Add 1,2 L (1.3 qt) of hydraulic fluid to the spindle.

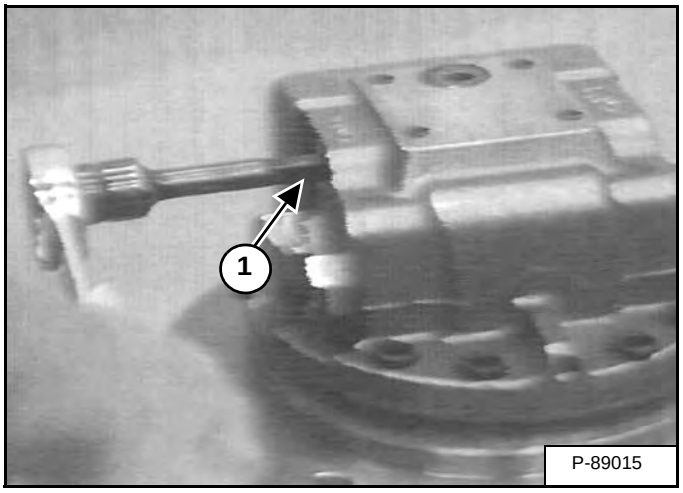
Figure 20-70-93



Install the rear flange (Item 1) onto the spindle (Item 2) **[Figure 20-70-93]**. Make sure the pins on the spindle align with the holes in the rear flange.

Tighten the bolts to 85 - 118 N•m (63 - 87 ft-lb) torque.

Figure 20-70-94

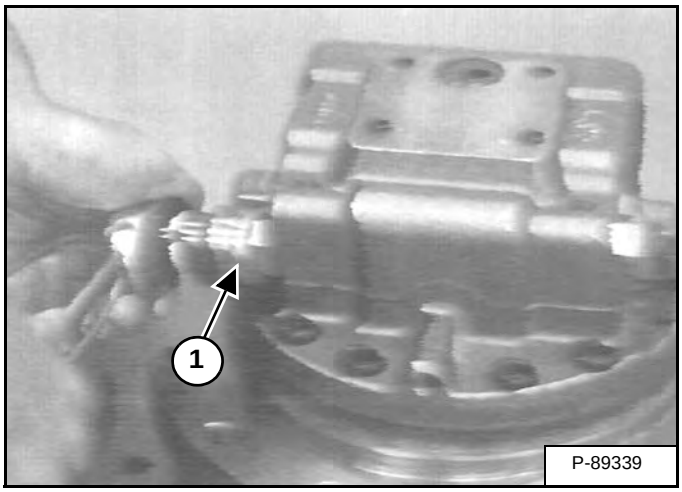


Tighten the plug (Item 1) **[Figure 20-70-94]** to 78 - 117 N•m (58 - 86 ft-lb) torque.

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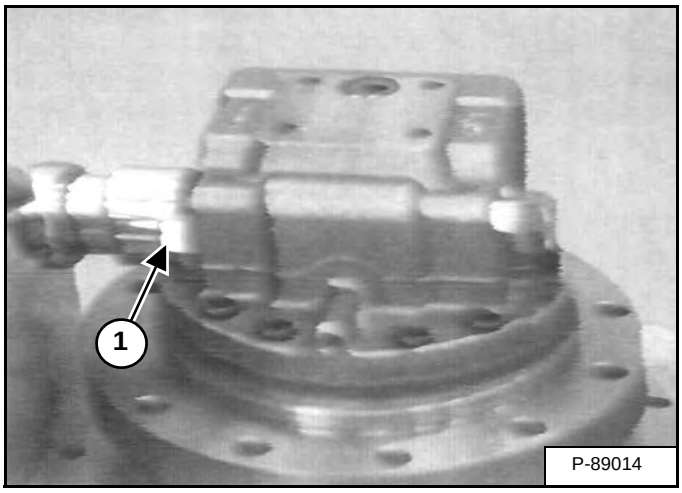
Assembly (Cont'd)

Figure 20-70-95



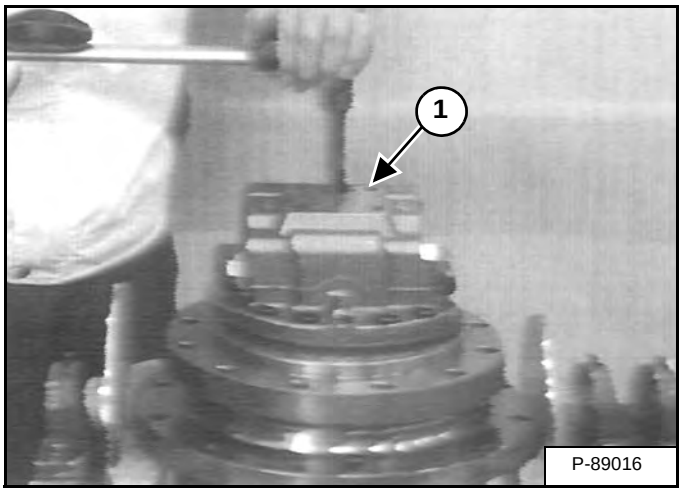
Tighten the valve (Item 1) **[Figure 20-70-95]** to 122 - 152 N•m (90 - 112 ft-lb) torque.

Figure 20-70-96



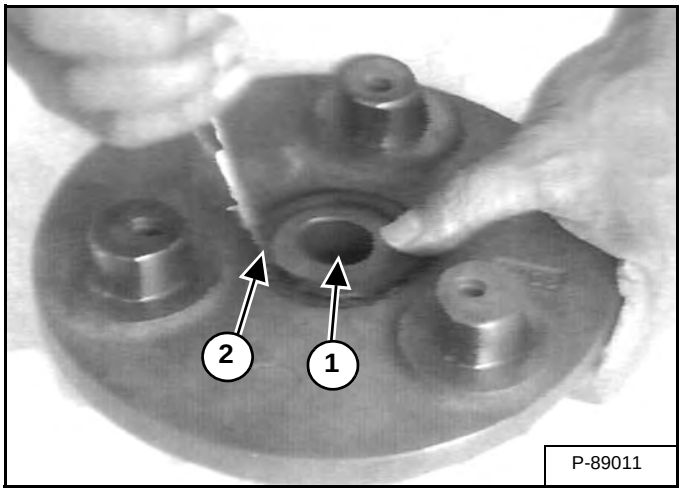
Tighten the plug (Item 1) **[Figure 20-70-96]** to 313 - 392 N•m (231 - 289 ft-lb) torque.

Figure 20-70-97



Tighten the plug (Item 1) **[Figure 20-70-97]** to 74 - 117 N•m (58 - 86 ft-lb) torque.

Figure 20-70-98

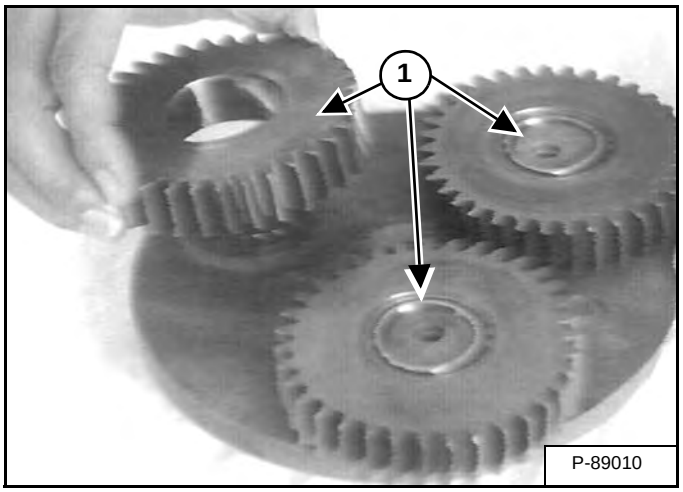


Insert the sun gear (Item 1) into the carrier and install the snap ring (Item 2) **[Figure 20-70-98]**.

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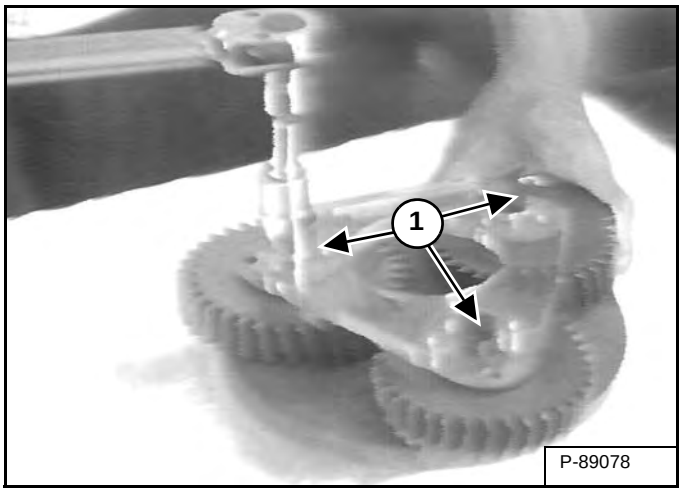
Assembly (Cont'd)

Figure 20-70-99



Install the inner race, bearing and planetary gears (Item 1) **[Figure 20-70-99]** onto the carrier.

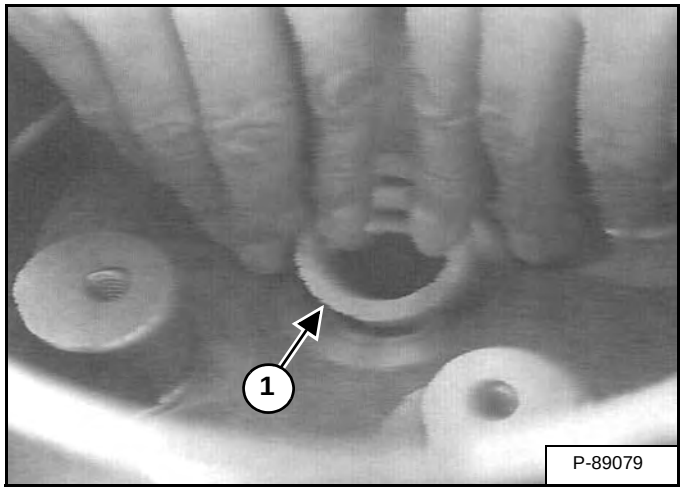
Figure 20-70-100



Install thrust washers and new bolts (Item 1) **[Figure 20-70-100]**.

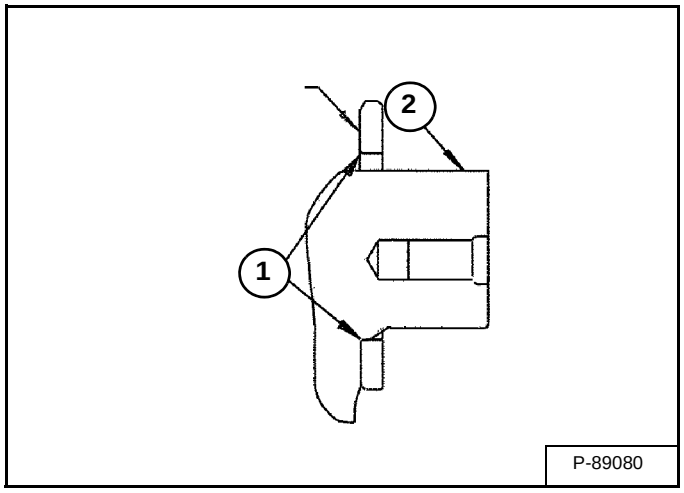
Tighten the bolts to 28 - 39 N•m (21 - 29 ft-lb) torque

Figure 20-70-101



Install the thrust collar (Item 1) **[Figure 20-70-101]**.

Figure 20-70-102

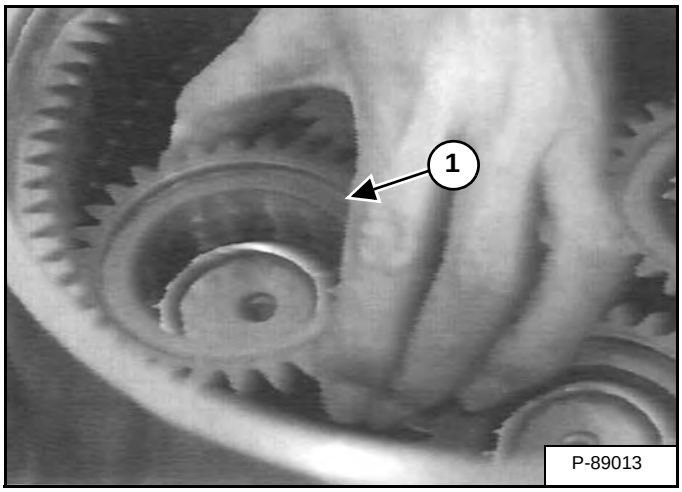


Install the thrust washer (Item 1) onto the spindle shaft (Item 2) **[Figure 20-70-102]**.

Dealer Copy -- Not for Resale

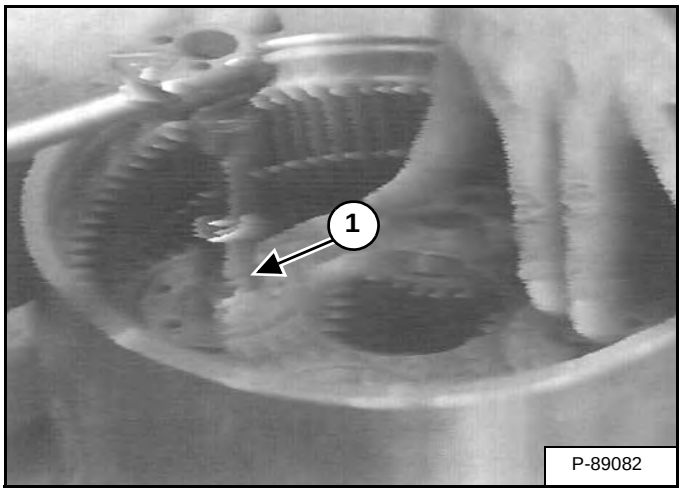
Assembly (Cont'd)

Figure 20-70-103



Install the inner race, bearing and planetary gear (Item 1) **[Figure 20-70-103]**.

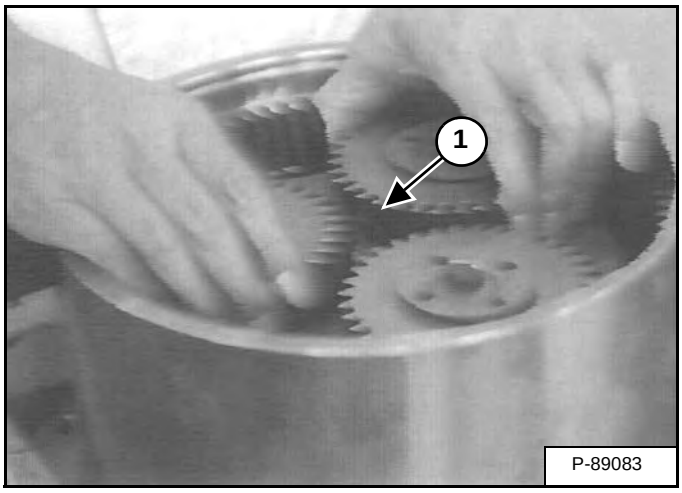
Figure 20-70-104



Install the thrust washers and new bolts (Item 1) **[Figure 20-70-104]**.

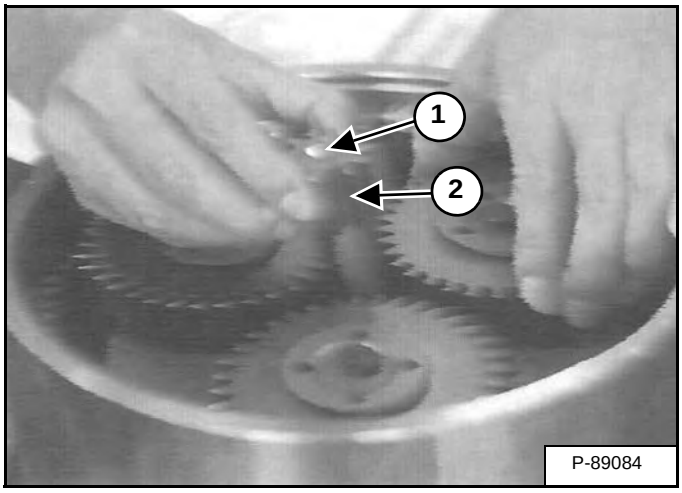
Tighten the bolts to 49 - 68 N•m (36 - 50 ft-lb) torque

Figure 20-70-105



Install the carrier assembly (Item 1) **[Figure 20-70-105]**.

Figure 20-70-106



Install the steel ball (Item 1) onto the sun gear (Item 2) **[Figure 20-70-106]**.

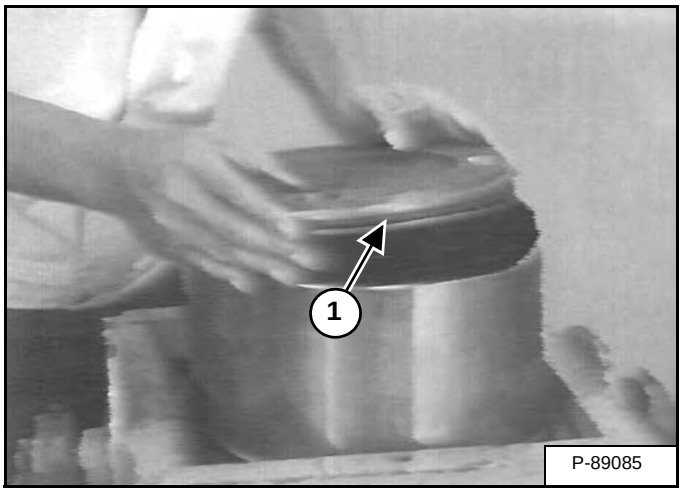
Install the sun gear.

Install the O-ring into the groove in the hub

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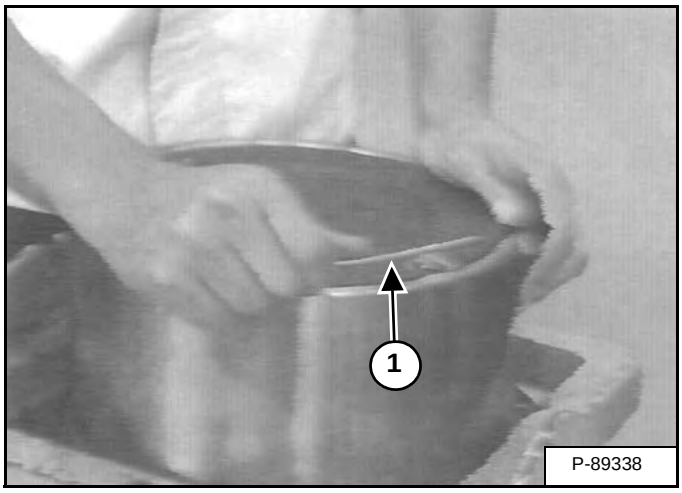
Assembly (Cont'd)

Figure 20-70-107



Install the hub cover (Item 1) **[Figure 20-70-107]**.

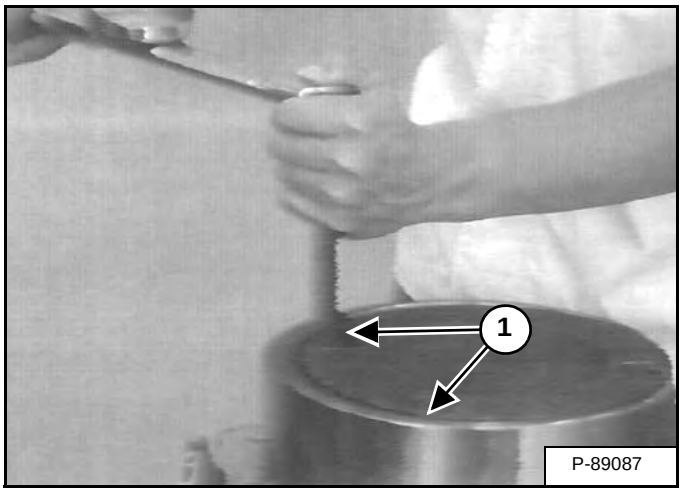
Figure 20-70-108



Install the snap ring (Item 1) **[Figure 20-70-108]**.

Install O-rings on the plugs.

Figure 20-70-109



Install the plugs (Item 1) **[Figure 20-70-109]**.

Tighten the plugs to 49 - 68 N•m (36 - 50 ft-lb) torque.

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SWIVEL JOINT

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.

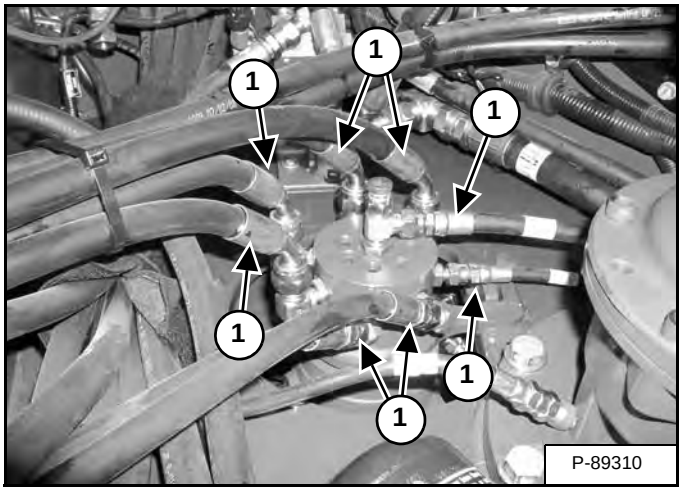
I-2003-0888

Tilt the cab. (See Raising And Lowering on Page 10-210-1.)

Remove the center cover. (See Removal And Installation on Page 40-70-1.)

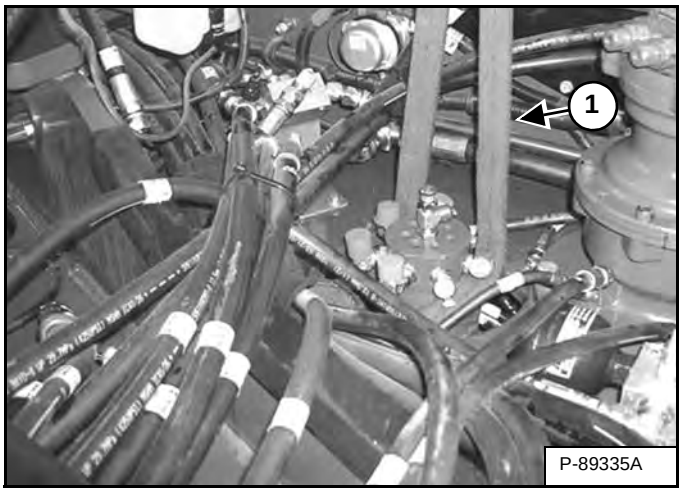
Mark the hoses.

Figure 20-80-1



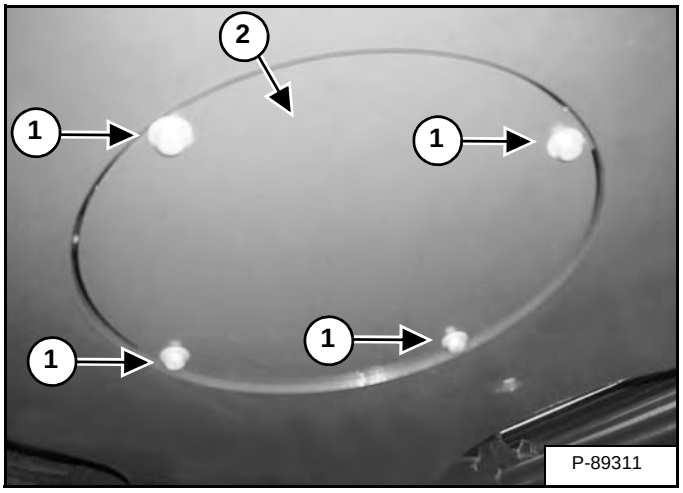
Remove the hoses (Item 1) **[Figure 20-80-1]** from the top of the swivel joint.

Figure 20-80-2



Attach a sling (Item 1) **[Figure 20-80-2]**.

Figure 20-80-3



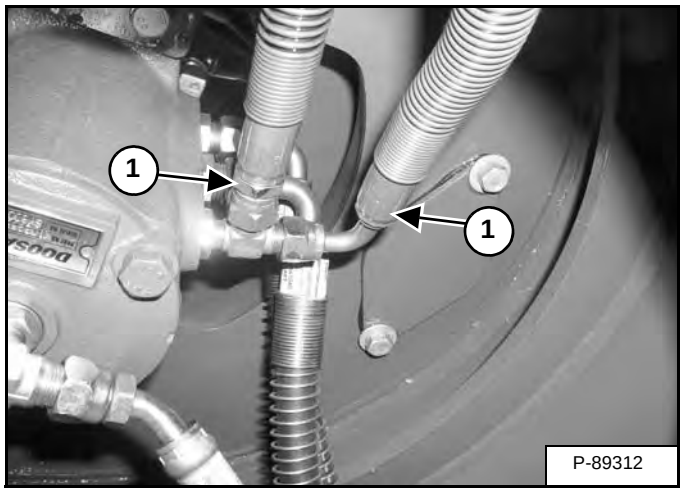
Remove the bolts (Item 1) and bottom access plate (Item 2) **[Figure 20-80-3]**.

Mark the hoses for ease of installation.

Dealer Copy -- Not for Resale

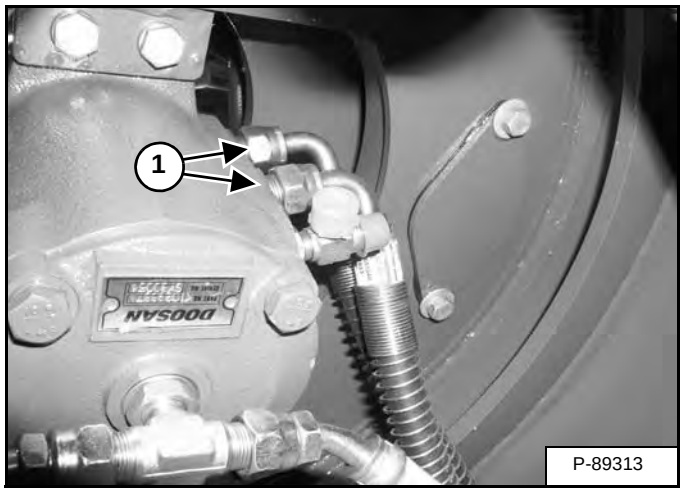
Removal And Installation (Cont'd)

Figure 20-80-4



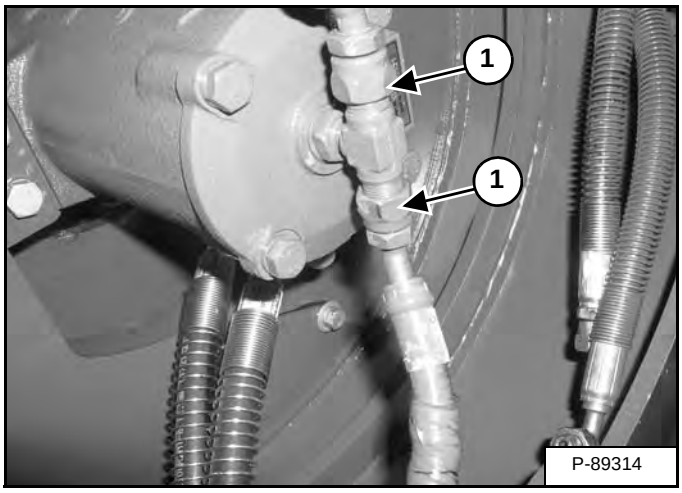
Remove the hoses (Item 1) **[Figure 20-80-4]**.

Figure 20-80-5



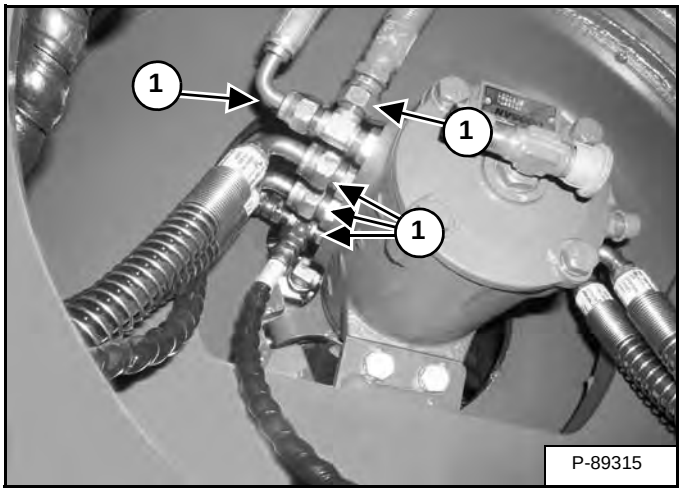
Remove the hoses (Item 1) **[Figure 20-80-5]**.

Figure 20-80-6



Remove the hoses (Item 1) **[Figure 20-80-6]**.

Figure 20-80-7

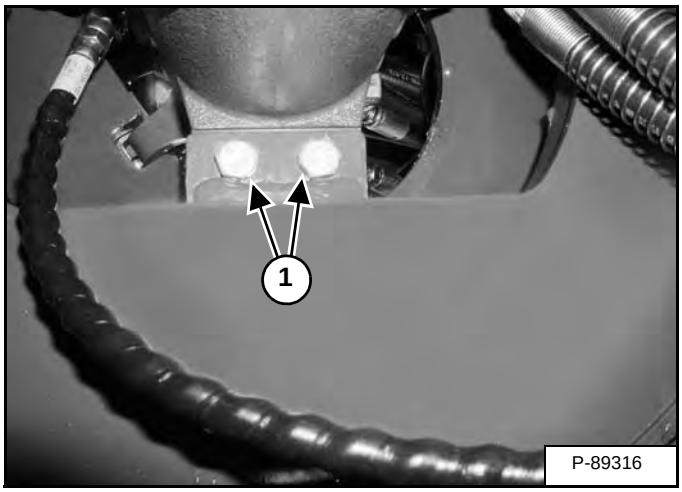


Remove the hoses (Item 1) **[Figure 20-80-7]**.

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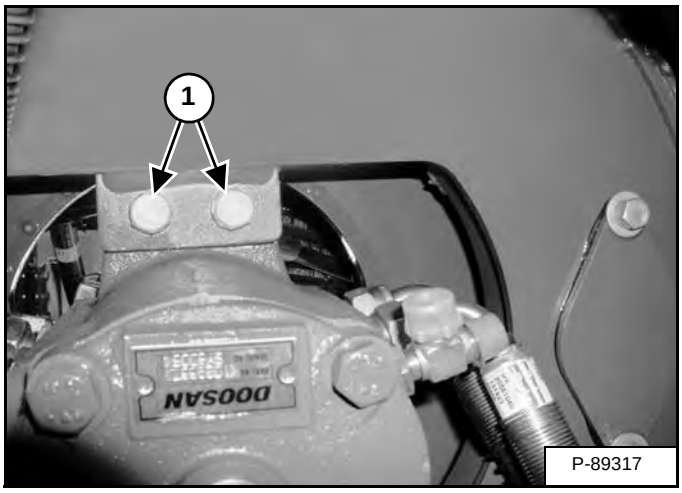
Removal And Installation (Cont'd)

Figure 20-80-8



Remove the bolts (Item 1) **[Figure 20-80-8]**.

Figure 20-80-9

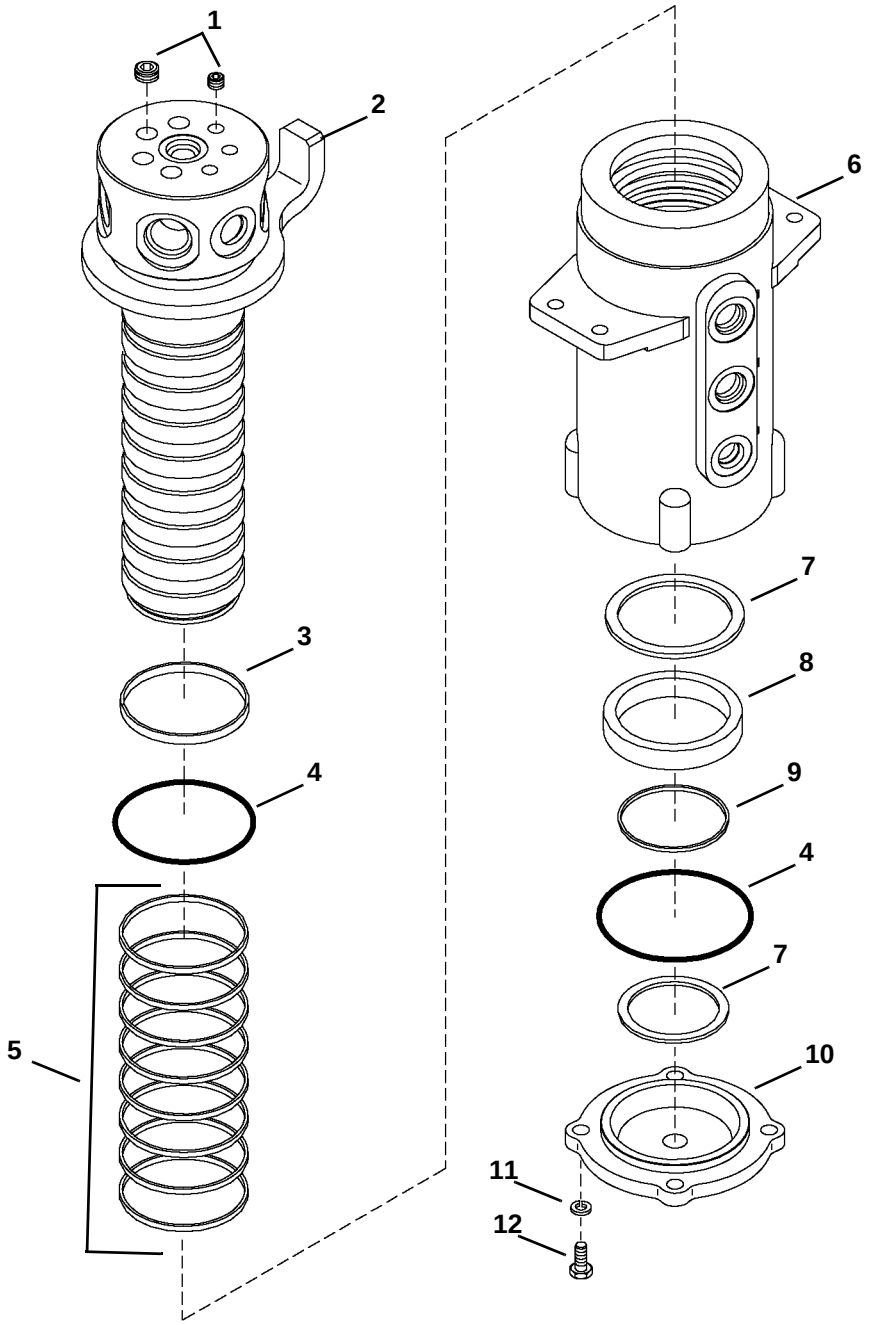


Remove the bolts (Item 1) **[Figure 20-80-9]**.

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Parts Identification

1. Plug
2. Rotor
3. Dust Seal
4. O-ring
5. Seal
6. Housing
7. Shim
8. Spacer
9. Retainer
10. Cover
11. Washer
12. Bolt

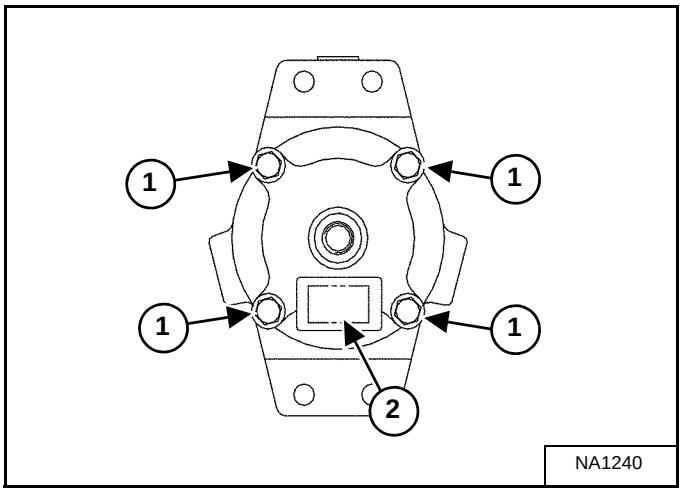


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Disassembly

Figure 20-80-10

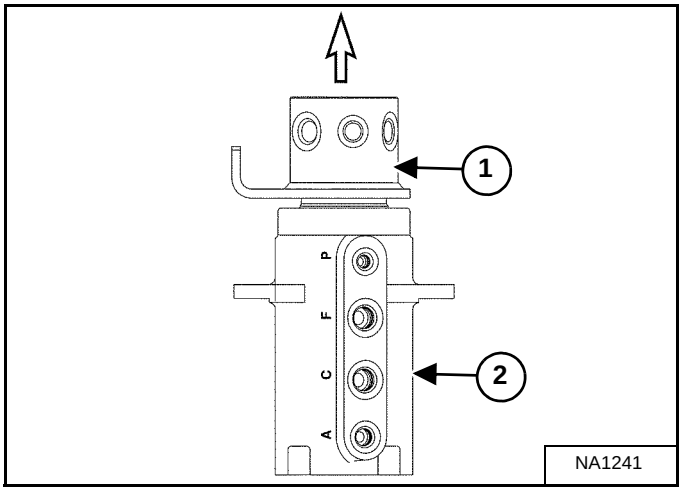


Remove the bolts (Item 1) and cover (Item 2) **[Figure 20-80-10]**.

Remove the shim and O-ring from the cover.

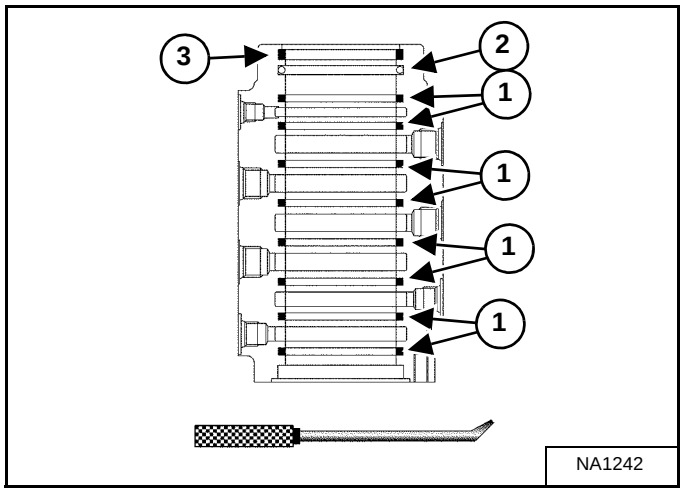
Remove the snap ring, spacer and shim from the bottom of the rotor.

Figure 20-80-11



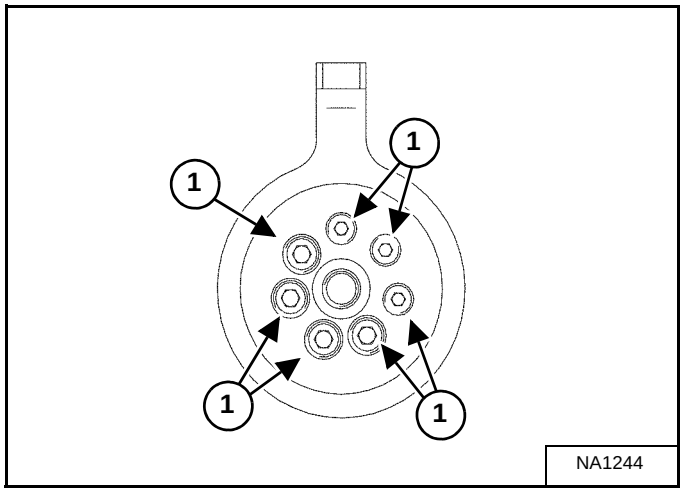
Remove the rotor (Item 1) from the housing (Item 2) **[Figure 20-80-11]**.

Figure 20-80-12



Remove the seals (Item 1), O-ring (Item 2) and dust seal (Item 3) **[Figure 20-80-12]** from the housing.

Figure 20-80-13



Remove the plugs (Item 1) **[Figure 20-80-13]**.

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Assembly

Clean all components in solvent and dry with compressed air.

NOTE: Be careful not to scratch the rotor surface as damage to the finished surface could cause internal leakage.

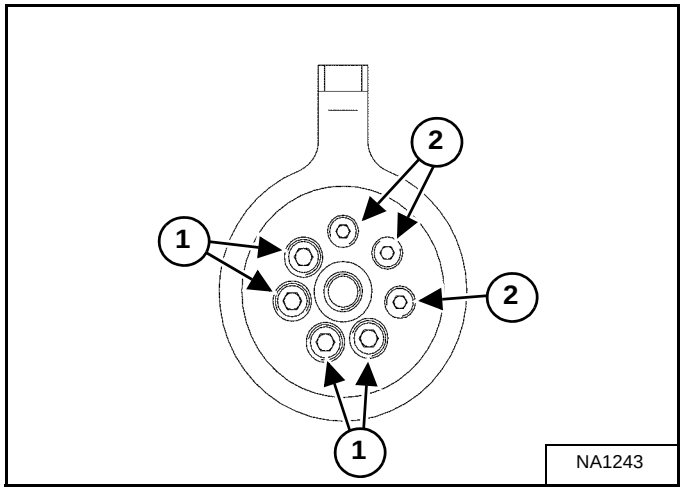
Check the components for wear and damage.

Always use new seals and O-rings.

Apply clean hydraulic oil to the components during installation.

Wrap the plugs with teflon tape.

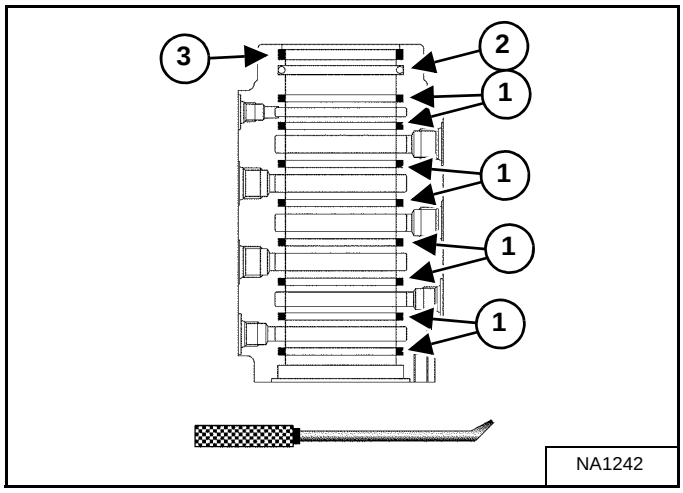
Figure 20-80-14



Install the plugs (Item 1) **[Figure 20-80-14]**. Tighten the plugs to 58 - 69 N•m (43 - 51 ft-lb) torque.

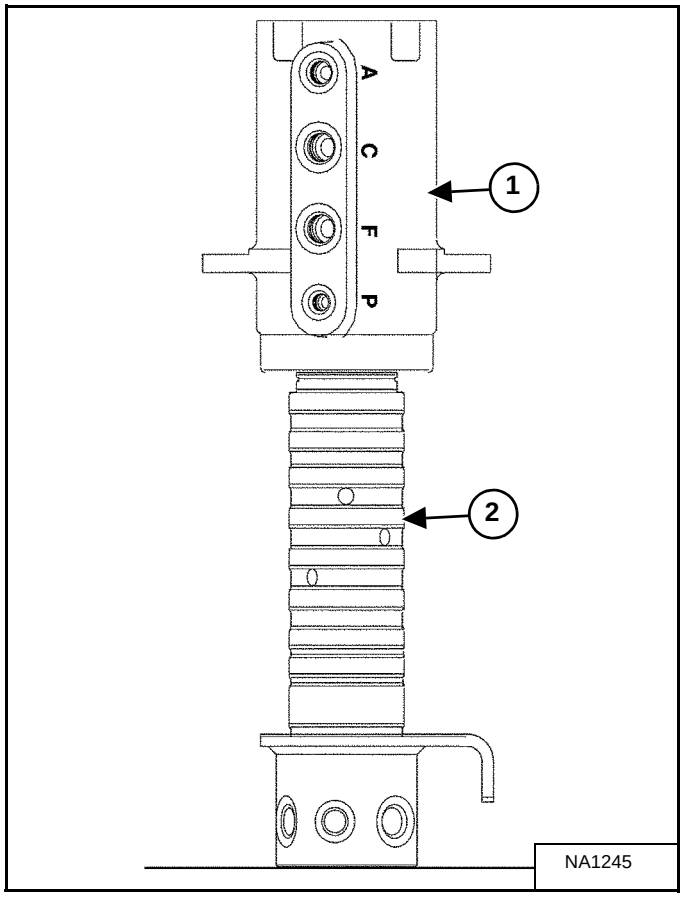
Install the plugs (Item 2) **[Figure 20-80-14]**. Tighten the plugs to 30 - 39 N•m (22 - 29 ft-lb) torque.

Figure 20-80-15



Install the seals (Item 1), O-ring (Item 2) and dust seal (Item 3) **[Figure 20-80-15]** in the housing.

Figure 20-80-16

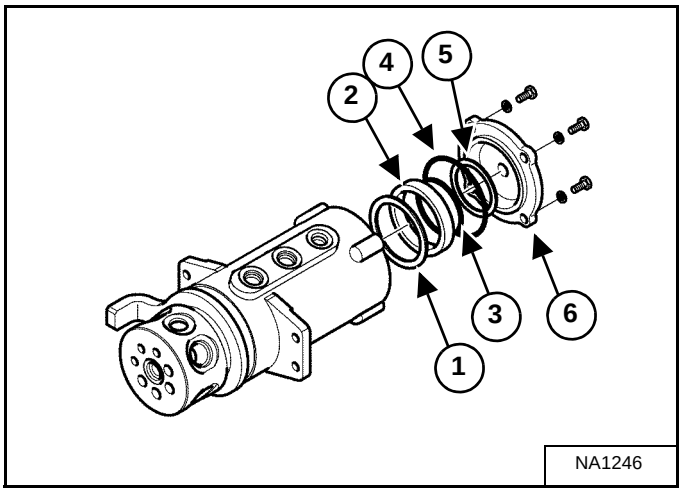


Install the housing (Item 1) on the rotor (Item 2) **[Figure 20-80-16]**.

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Assembly (Cont'd)

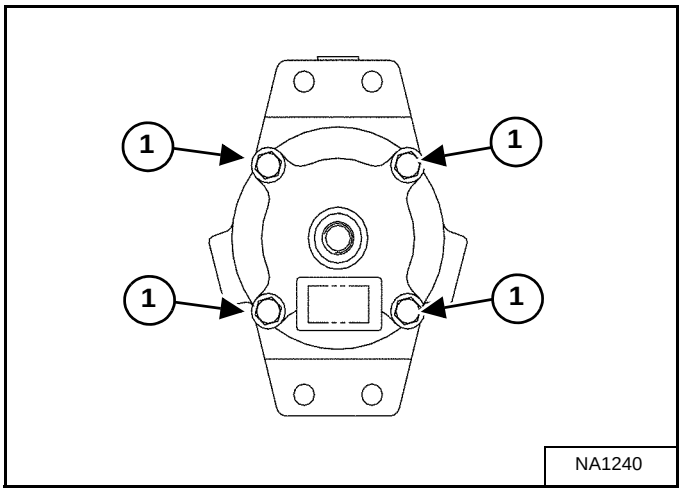
Figure 20-80-17



Install the shim (Item 1), spacer (Item 2) and snap ring (Item 3) **[Figure 20-80-17]**.

Install the O-ring (Item 4), shim (Item 5) and cover (Item 6) **[Figure 20-80-17]**.

Figure 20-80-18



Install the bolts (Item 1) **[Figure 20-80-18]**. Tighten the bolts to 49 - 59 N•m (36 - 44 ft-lb) torque.

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SWING MOTOR

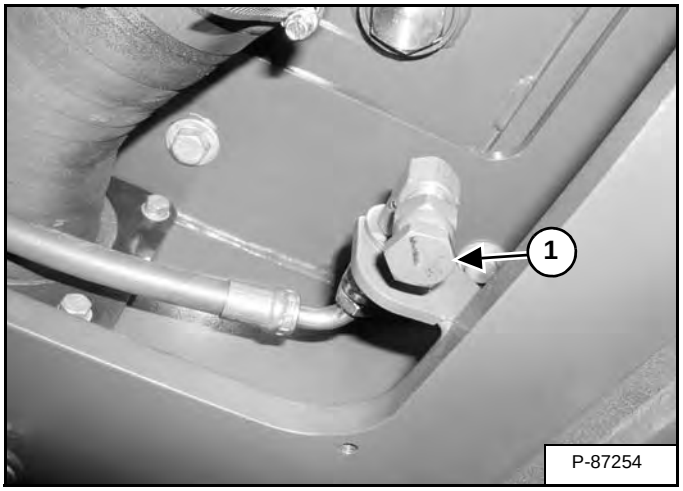
Removal And Installation

Remove the center cover. (See Removal And Installation on Page 40-70-1.)

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-140-6.)

Tilt the cab. (See Raising And Lowering on Page 10-210-1.)

Figure 20-90-1



Remove the plug (Item 1) **[Figure 20-90-1]** and drain the swing motor drive carrier.

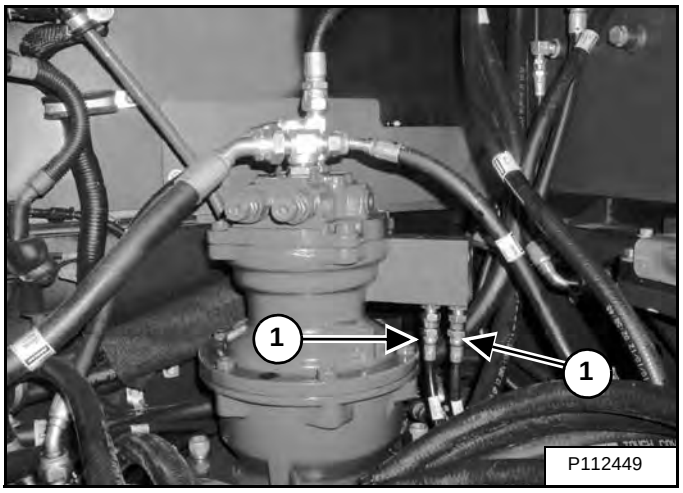
IMPORTANT

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

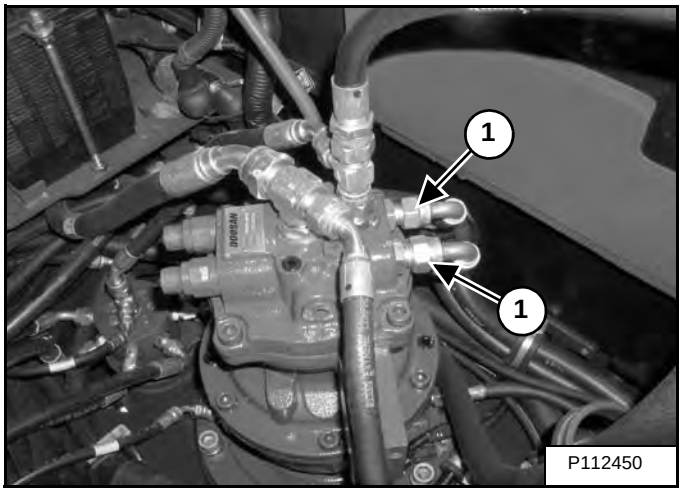
NOTE: Mark all hoses before removal for ease of installation.

Figure 20-90-2



Remove the hoses (Item 1) **[Figure 20-90-2]** from the PG and SH ports.

Figure 20-90-3

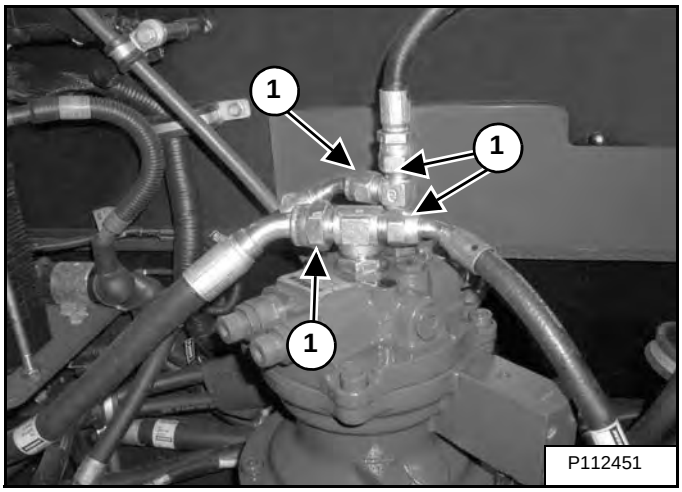


Remove the hoses (Item 1) **[Figure 20-90-3]** from the A and B ports.

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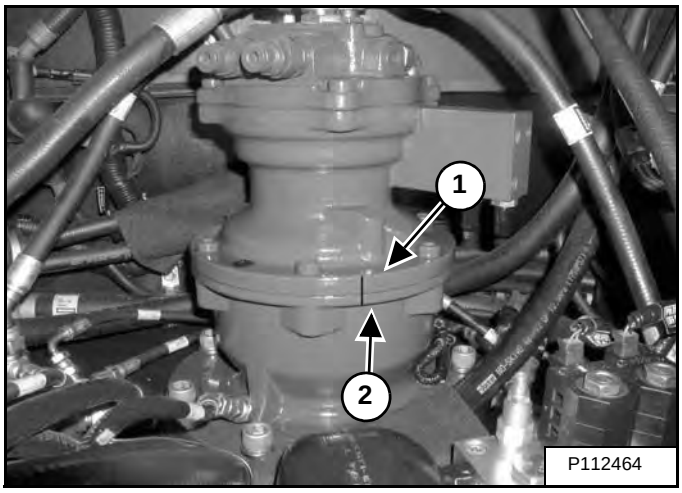
Removal And Installation (Cont'd)

Figure 20-90-4



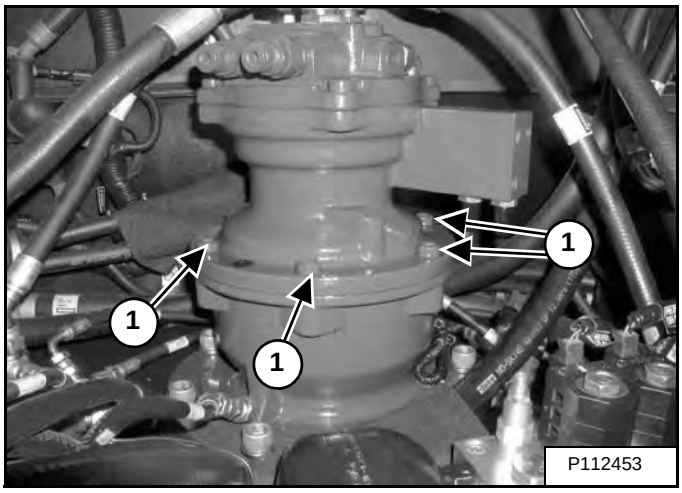
Remove the hoses (Item 1) **[Figure 20-90-4]**.

Figure 20-90-5



Mark the swing motor (Item 1) and swing motor drive carrier (Item 2) **[Figure 20-90-5]** for proper installation.

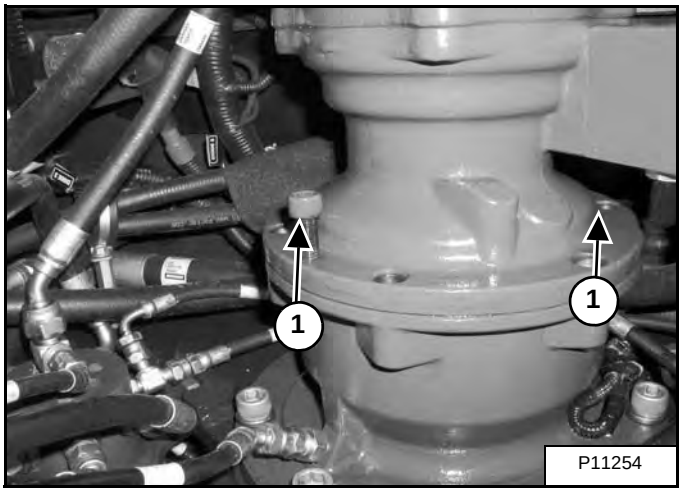
Figure 20-90-6



Remove the bolts (Item 1) **[Figure 20-90-6]**.

Installation: Tighten the bolts to 101,7 ± 16 N•m (75 ± 12 ft-lb) torque.

Figure 20-90-7



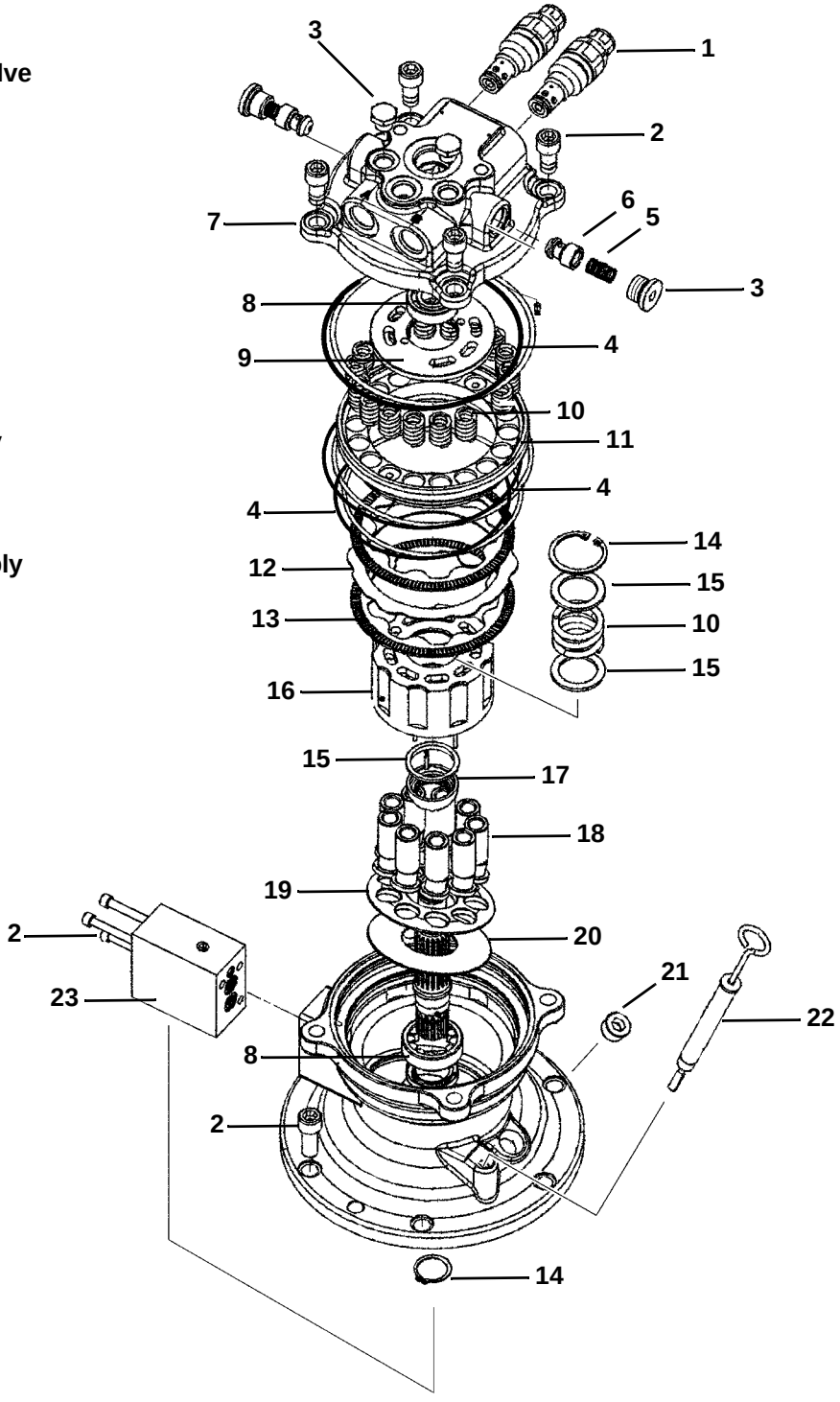
Install two bolts (Item 1) **[Figure 20-90-7]** (removed in previous step) in the threaded holes in the swing motor. Tighten the bolts evenly to separate the swing motor from the swing motor drive carrier.

Remove the swing motor.

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Parts Identification

1. Relief Valve
2. Bolt
3. Plug
4. O-ring
5. Spring
6. Anti-cavitation Valve
7. End Cap
8. Bearing
9. Valve Plate
10. Spring
11. Brake Piston
12. Separation Plate
13. Friction Plate
14. Snap Ring
15. Washer
16. Cylinder Block
17. Ball Guide
18. Piston Assembly
19. Piston Retainer
20. Thrust Plate
21. Pipe Plug
22. Dipstick Assembly
23. Brake Valve

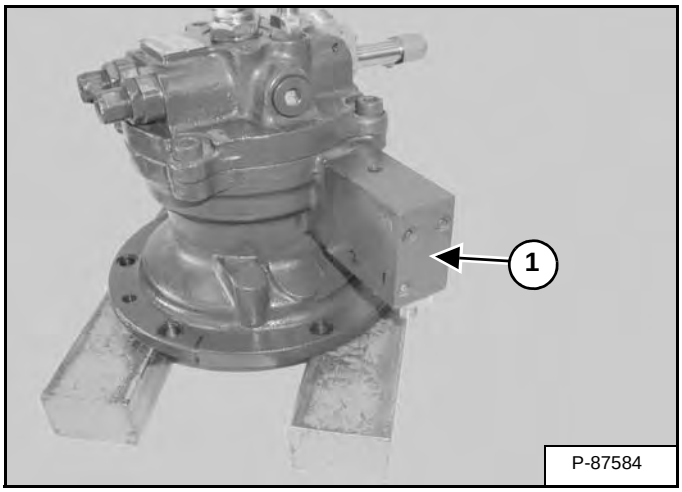


NA-1044

Dealer Copy -- Not for Resale

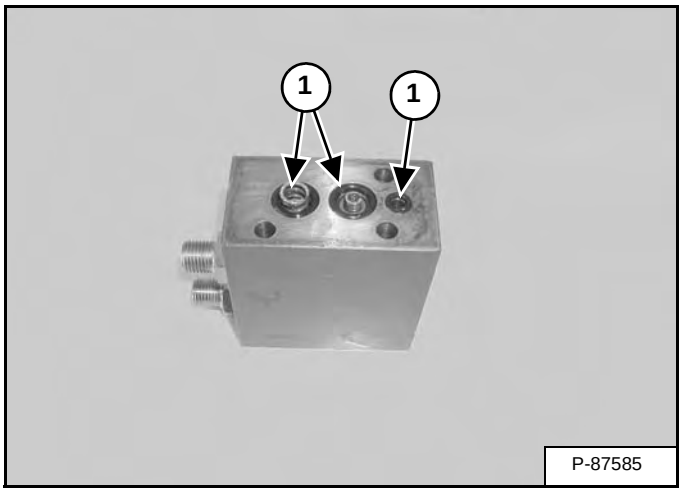
Disassembly And Assembly

Figure 20-90-8



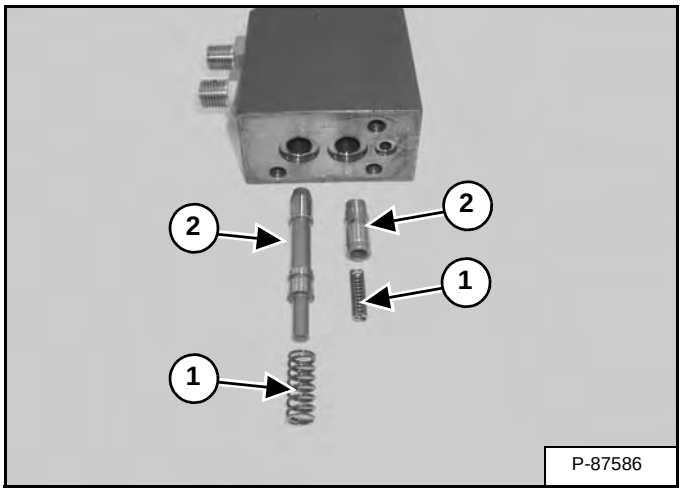
Remove the three bolts and remove the brake valve (Item 1) **[Figure 20-90-8]**.

Figure 20-90-9



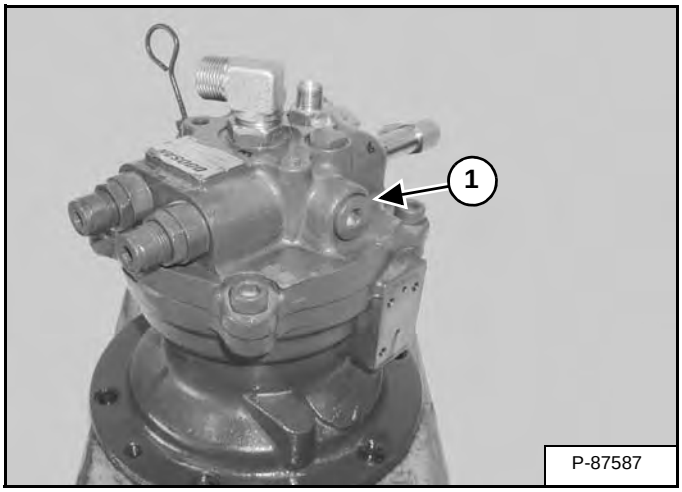
Remove the O-rings (Item 1) **[Figure 20-90-9]**.

Figure 20-90-10



Remove the springs (Item 1) and spools (Item 2) **[Figure 20-90-10]**.

Figure 20-90-11



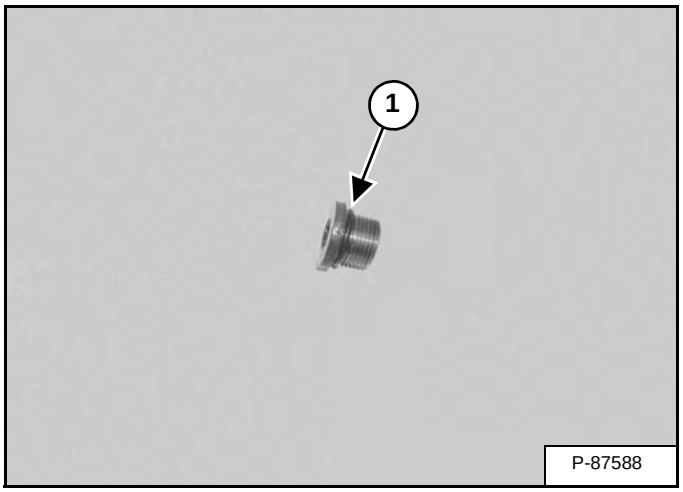
Remove the plug (Item 1) **[Figure 20-90-11]** from both sides of the end cap.

Installation: Tighten the plugs to 79 - 98 N•m (58 - 72 ft-lb) torque.

Dealer Copy -- Not for Resale

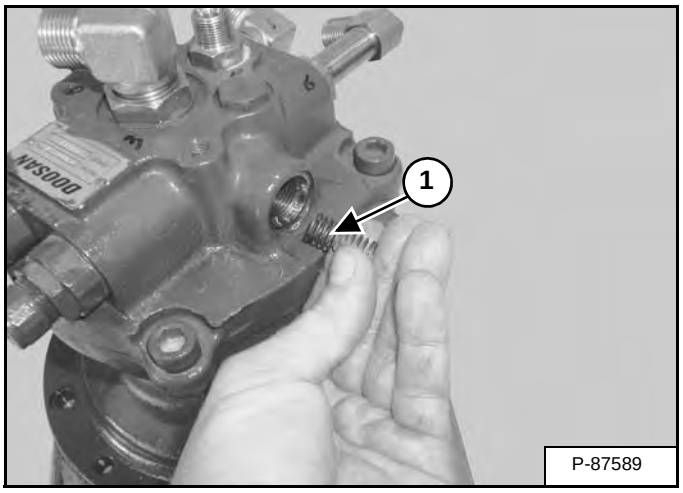
Disassembly And Assembly (Cont'd)

Figure 20-90-12



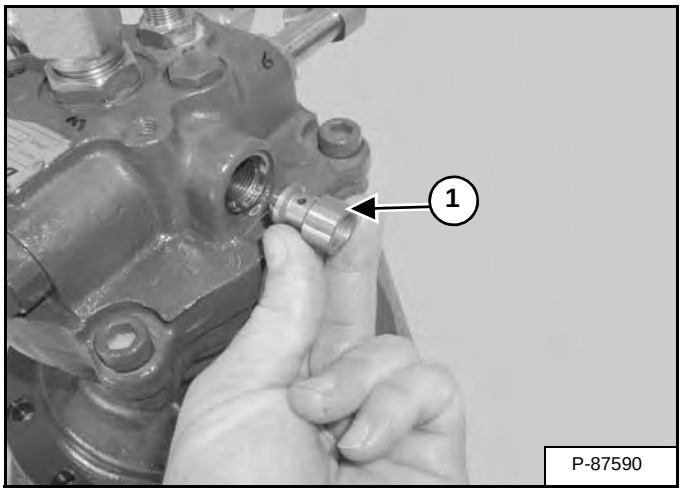
Remove the O-ring (Item 1) **[Figure 20-90-12]** from both plugs.

Figure 20-90-13



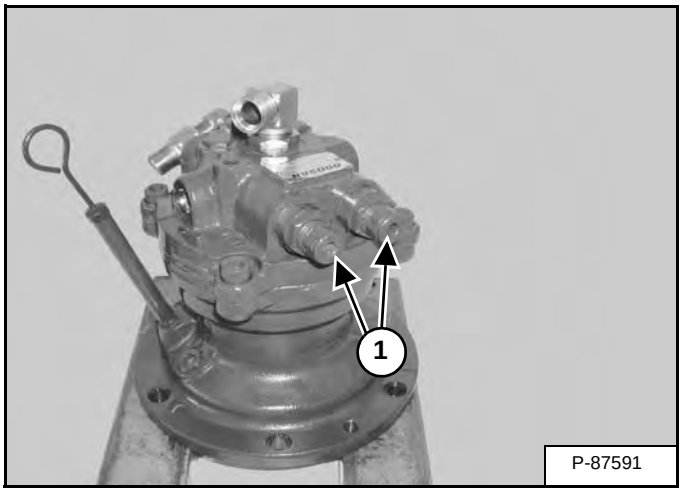
Remove the spring (Item 1) **[Figure 20-90-13]** from both sides of the end cap.

Figure 20-90-14



Remove the spool (Item 1) **[Figure 20-90-14]** from both sides of the end cap.

Figure 20-90-15



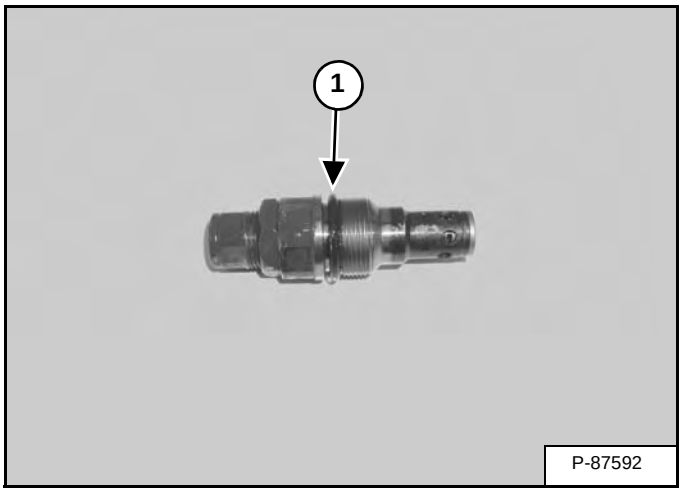
Remove the relief valves (Item 1) **[Figure 20-90-15]**.

Installation: Tighten the relief valves to 148 - 167 N•m (109 - 123 ft-lb) torque.

Dealer Copy -- Not for Resale

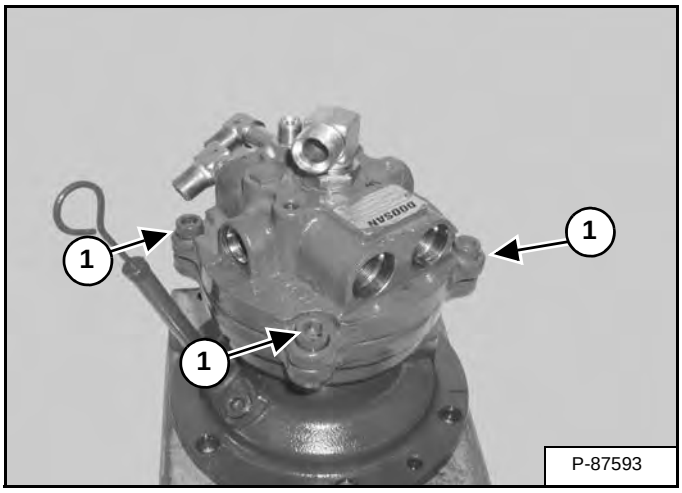
Disassembly And Assembly (Cont'd)

Figure 20-90-16



Remove the O-ring (Item 1) **[Figure 20-90-16]** from both relief valves.

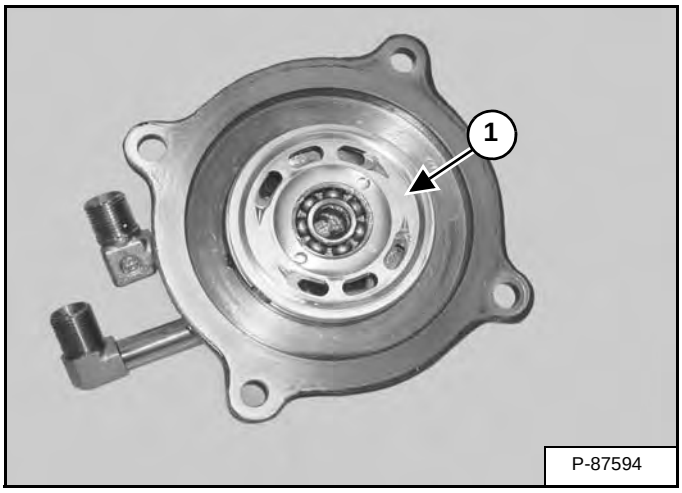
Figure 20-90-17



Remove the four bolts (Item 1) **[Figure 20-90-17]** and remove the end cap.

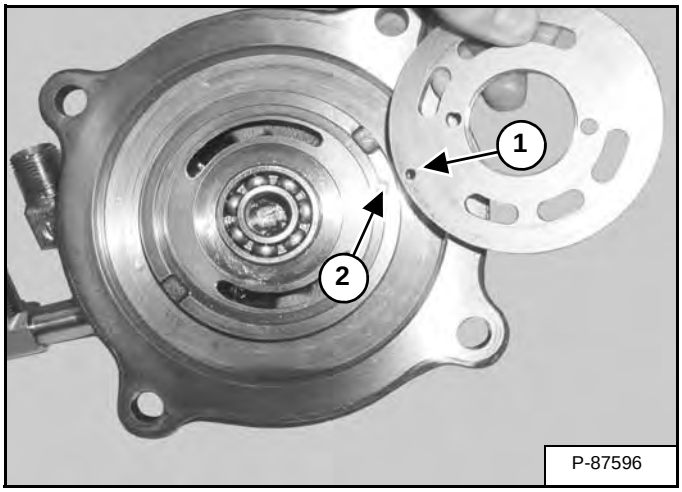
Installation: Tighten the bolts to 85 - 118 N•m (63 - 87 ft-lb) torque.

Figure 20-90-18



Remove the valve plate (Item 1) **[Figure 20-90-18]** from the end cap.

Figure 20-90-19

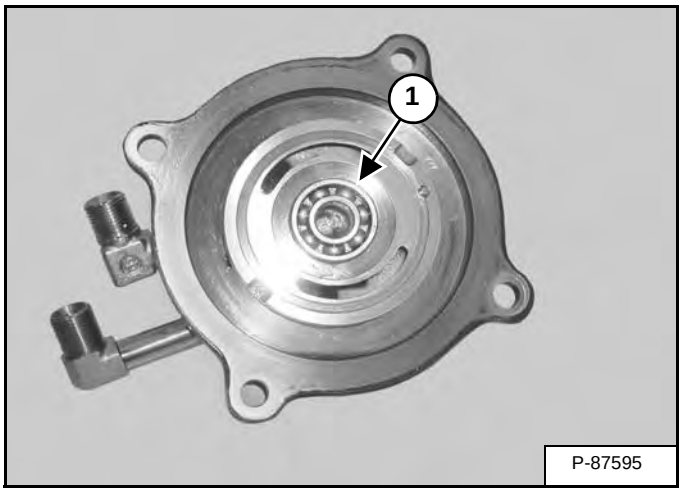


Installation: The hole (Item 1) in the valve plate must engage the pin (Item 2) **[Figure 20-90-19]** on the end cap.

Dealer Copy -- Not for Resale

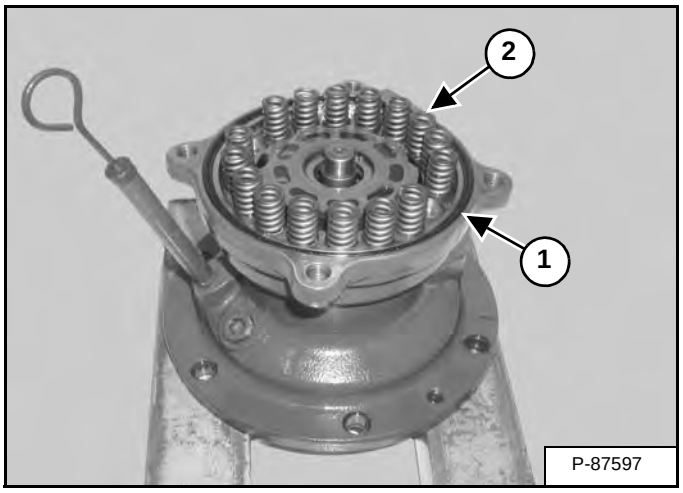
Disassembly And Assembly (Cont'd)

Figure 20-90-20



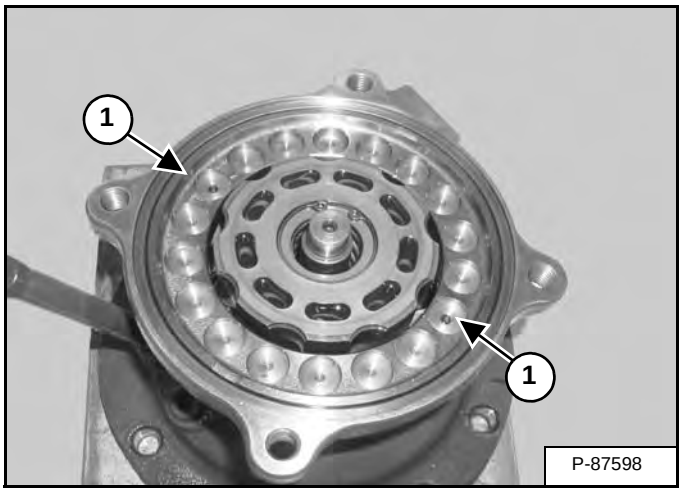
Remove the bearing (Item 1) **[Figure 20-90-20]**.

Figure 20-90-21



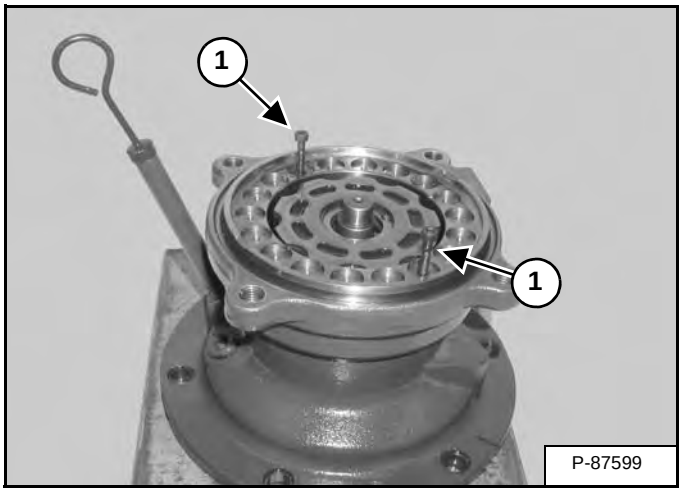
Remove the O-ring (Item 1). Remove the sixteen springs (Item 2) **[Figure 20-90-21]**.

Figure 20-90-22



Installation: Do not install springs in the spring bores with threaded holes (Item 1) **[Figure 20-90-22]**.

Figure 20-90-23

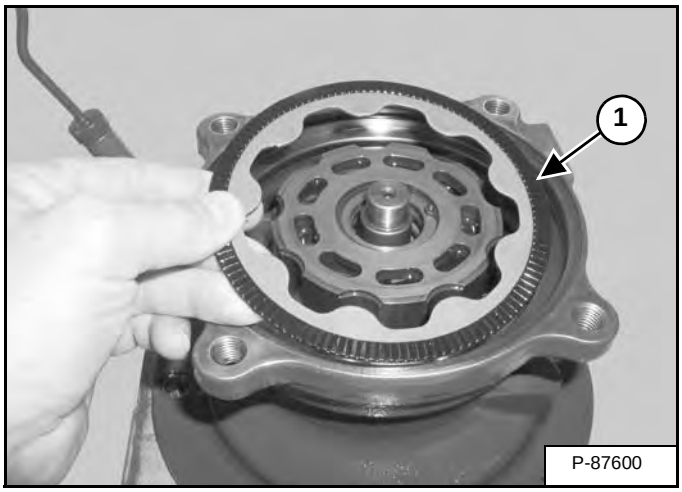


Install two screws (Item 1) **[Figure 20-90-23]** in the threaded holes of the brake piston. Pull up on the screws and remove the brake piston.

Dealer Copy -- Not for Resale

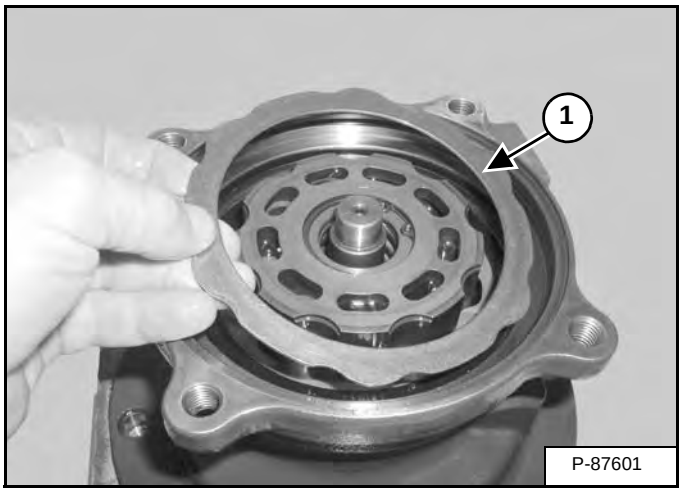
Disassembly And Assembly (Cont'd)

Figure 20-90-24



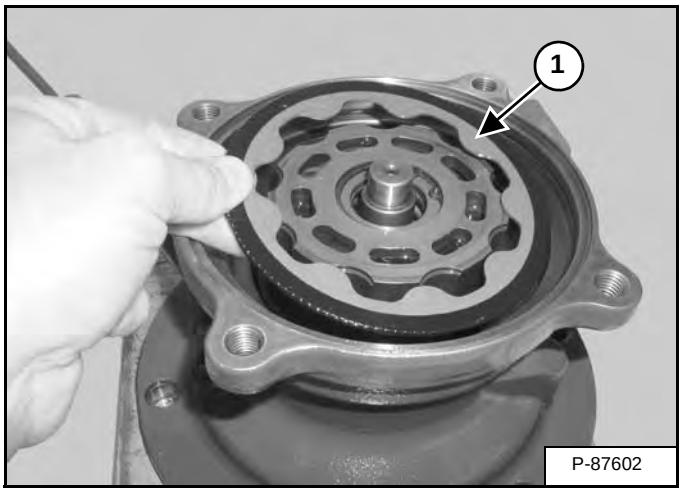
Remove the friction plate (Item 1) **[Figure 20-90-24]**.

Figure 20-90-25



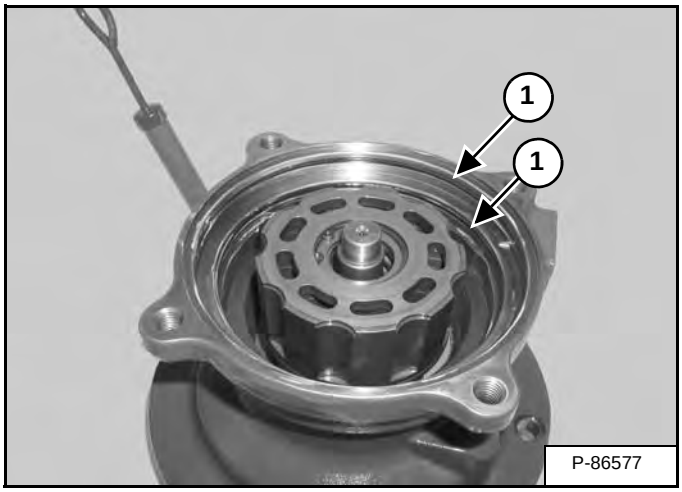
Remove the separation plate (Item 1) **[Figure 20-90-25]**.

Figure 20-90-26



Remove the second friction plate (Item 1) **[Figure 20-90-26]**.

Figure 20-90-27

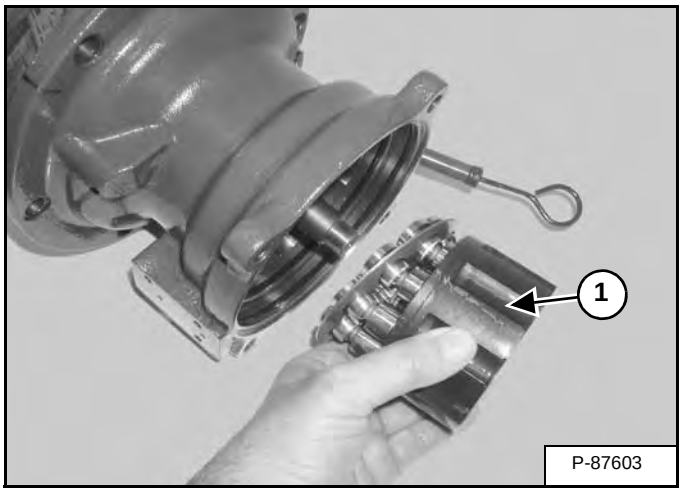


Remove the O-rings (Item 1) **[Figure 20-90-27]**.

Dealer Copy -- Not for Resale

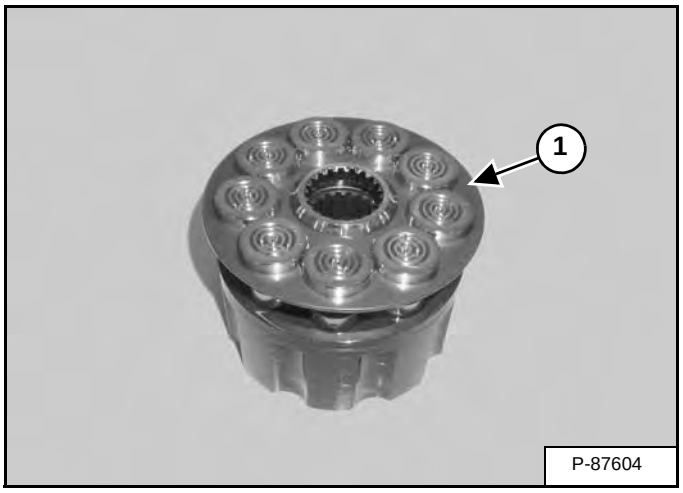
Disassembly And Assembly (Cont'd)

Figure 20-90-28



Tip the housing and remove the rotating group (Item 1) **[Figure 20-90-28]**.

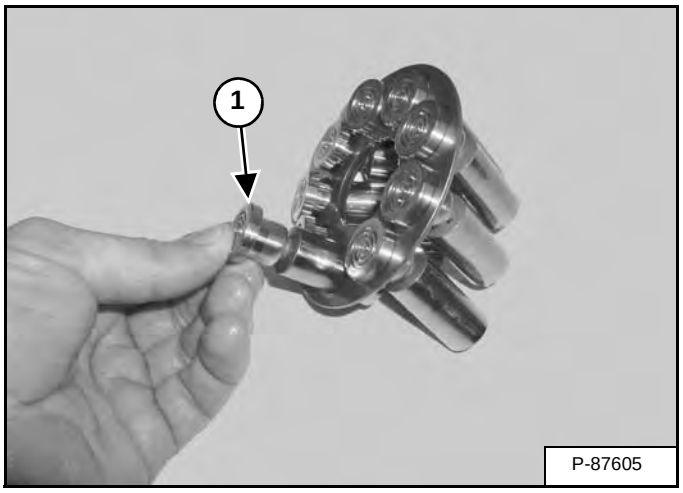
Figure 20-90-29



Remove the piston assemblies / retainer (Item 1) **[Figure 20-90-29]** from the cylinder block.

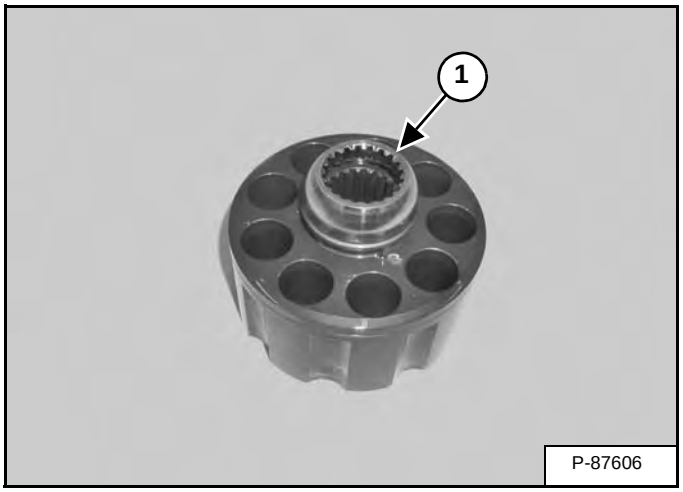
NOTE: It is not important that the pistons are installed in the original bores.

Figure 20-90-30



Remove the piston assemblies (Item 1) **[Figure 20-90-30]** from the retainer.

Figure 20-90-31

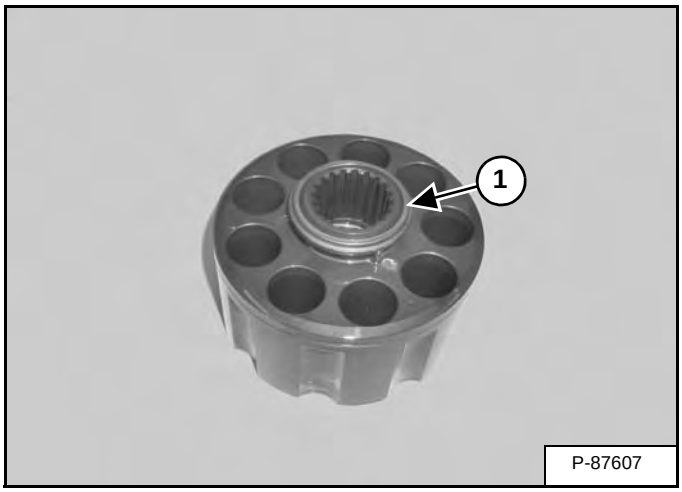


Remove the ball guide (Item 1) **[Figure 20-90-31]**.

Dealer Copy -- Not for Resale

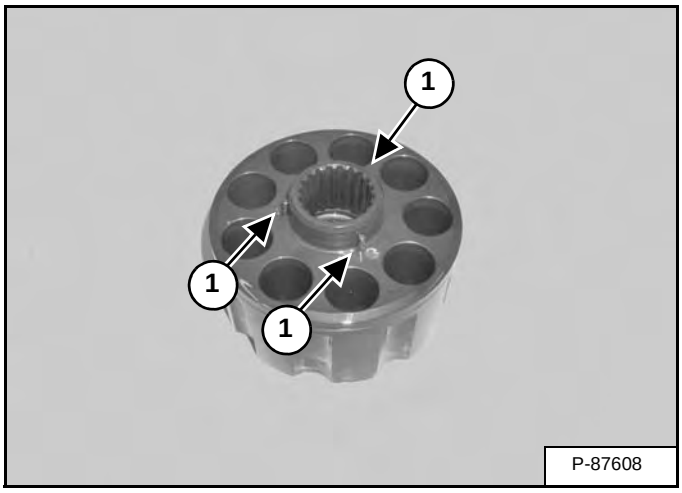
Disassembly And Assembly (Cont'd)

Figure 20-90-32



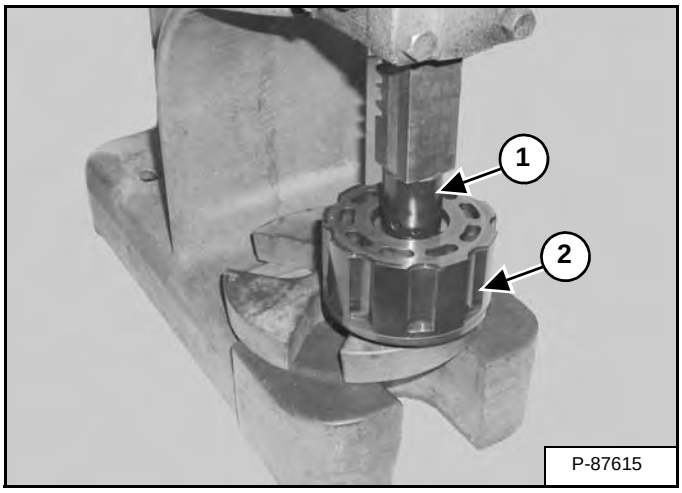
Remove the washer (Item 1) **[Figure 20-90-32]**.

Figure 20-90-33



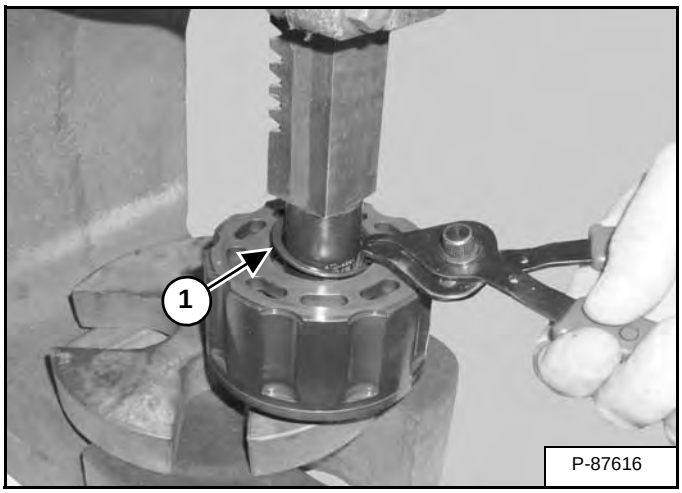
Remove the three pins (Item 1) **[Figure 20-90-33]**.

Figure 20-90-34



Using a press and an appropriately sized spacer (Item 1), compress the spring in the cylinder block (Item 2) **[Figure 20-90-34]**.

Figure 20-90-35

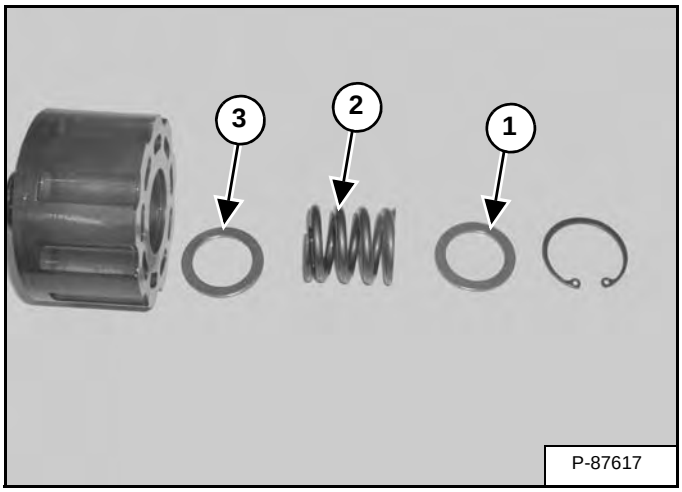


Remove the snap ring (Item 1) **[Figure 20-90-35]**. Remove the cylinder block from the press.

Dealer Copy -- Not for Resale

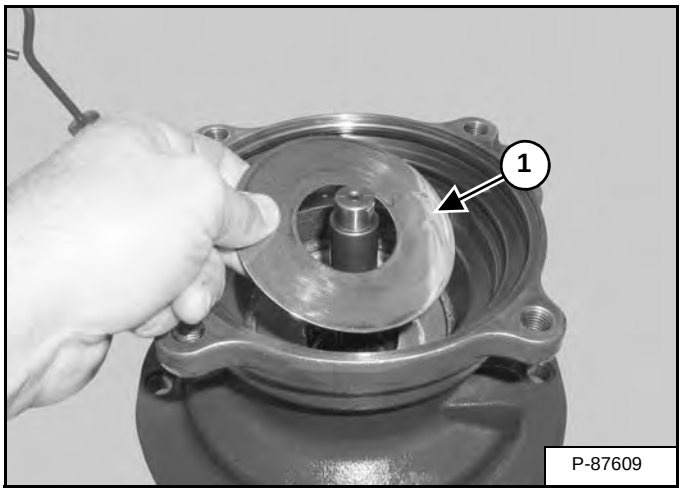
Disassembly And Assembly (Cont'd)

Figure 20-90-36



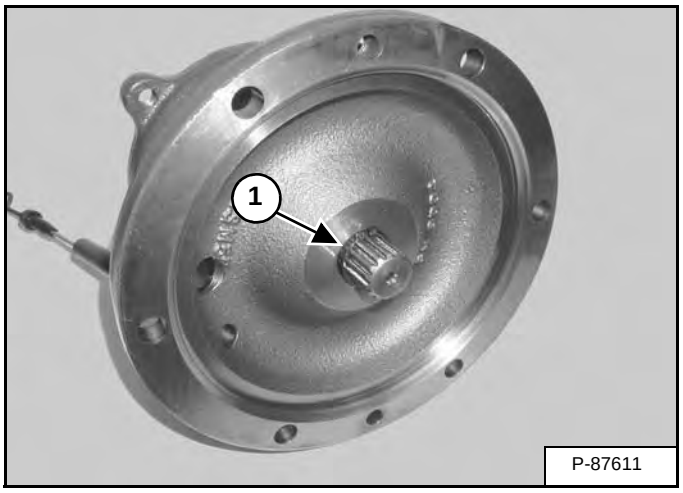
Remove the top washer (Item 1), spring (Item 2) and bottom washer (Item 3) **[Figure 20-90-36]**.

Figure 20-90-37



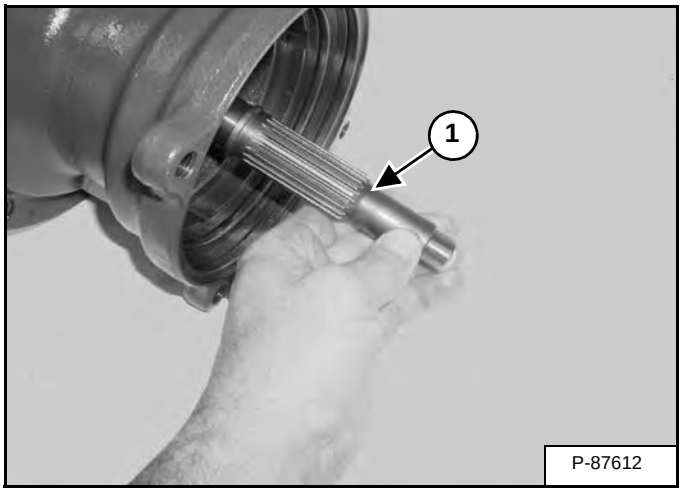
Remove the thrust plate (Item 1) **[Figure 20-90-37]**.

Figure 20-90-38



Remove the snap ring (Item 1) **[Figure 20-90-38]** from the shaft.

Figure 20-90-39

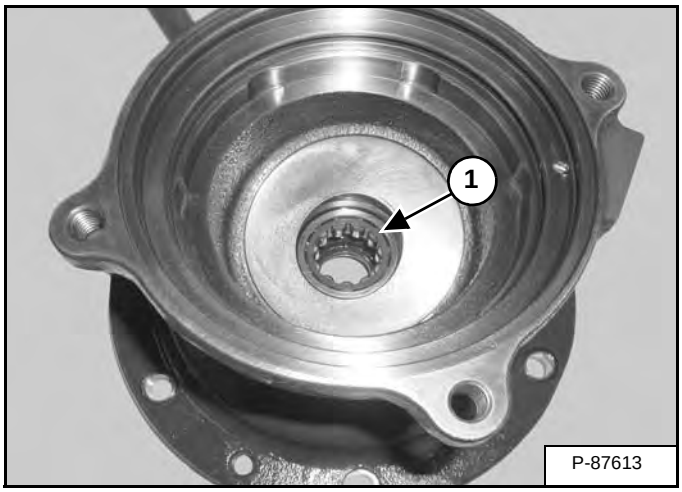


Remove the shaft (Item 1) **[Figure 20-90-39]**.

Dealer Copy -- Not for Resale

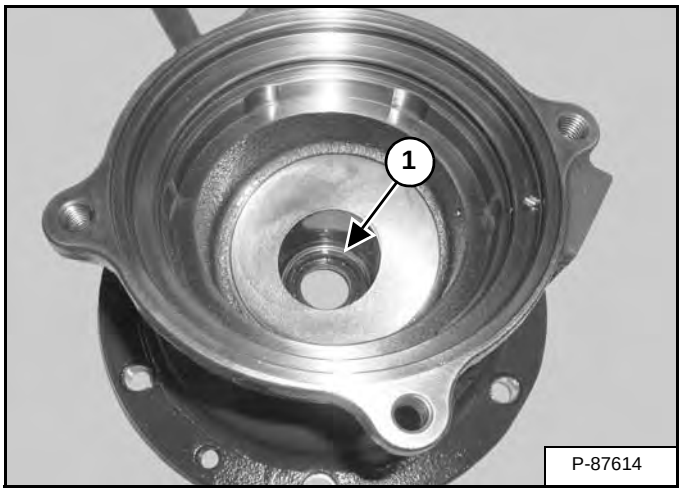
Disassembly And Assembly (Cont'd)

Figure 20-90-40



Remove the bearing (Item 1) **[Figure 20-90-40]**.

Figure 20-90-41



Remove the seal (Item 1) **[Figure 20-90-41]**.

Prior to assembly perform the following steps:

Clean all parts in solvent and dry with compressed air.

Check the components for wear and damage.

Always use new O-rings and seals.

Apply clean hydraulic oil to the components during installation.

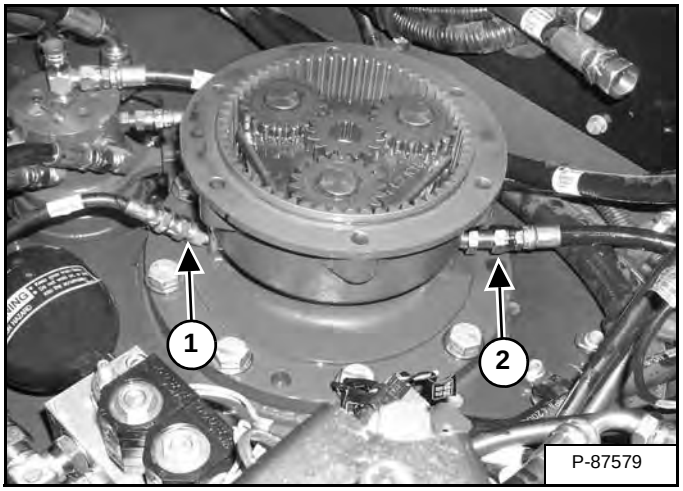
Dealer Copy -- Not for Resale

SWING MOTOR (DRIVE CARRIER)

Removal And Installation

Remove the swing motor. (See Removal And Installation on Page 20-90-1.)

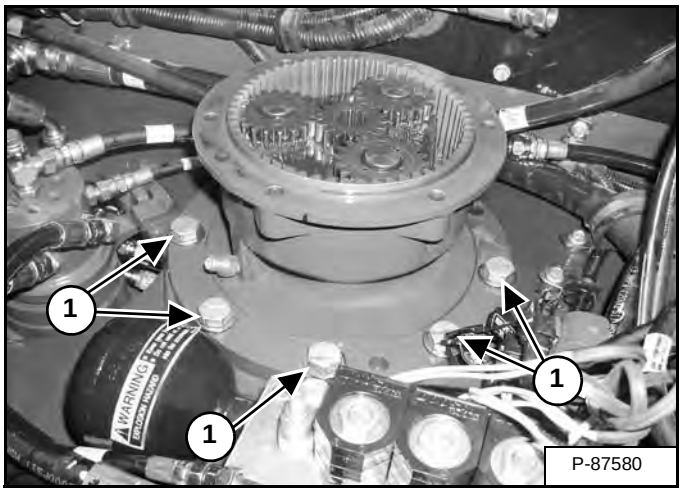
Figure 20-91-1



Remove the grease hose (Item 1) and the drain hose (Item 2) **[Figure 20-91-1]**.

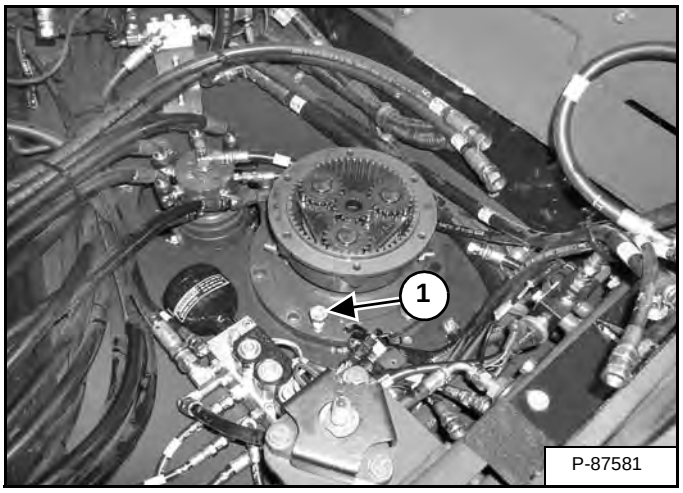
NOTE: Mark the swing motor drive carrier and frame for proper installation.

Figure 20-91-2



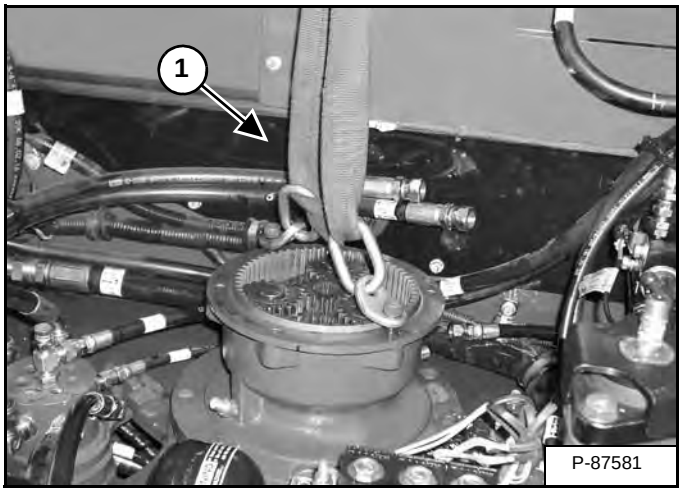
Remove the bolts (Item 1) **[Figure 20-91-2]**.

Figure 20-91-3



Install two bolts (Item 1) **[Figure 20-91-3]** (removed in previous step) in the threaded holes in the swing motor drive carrier. Tighten the bolts evenly to separate the swing motor drive carrier from the frame.

Figure 20-91-4



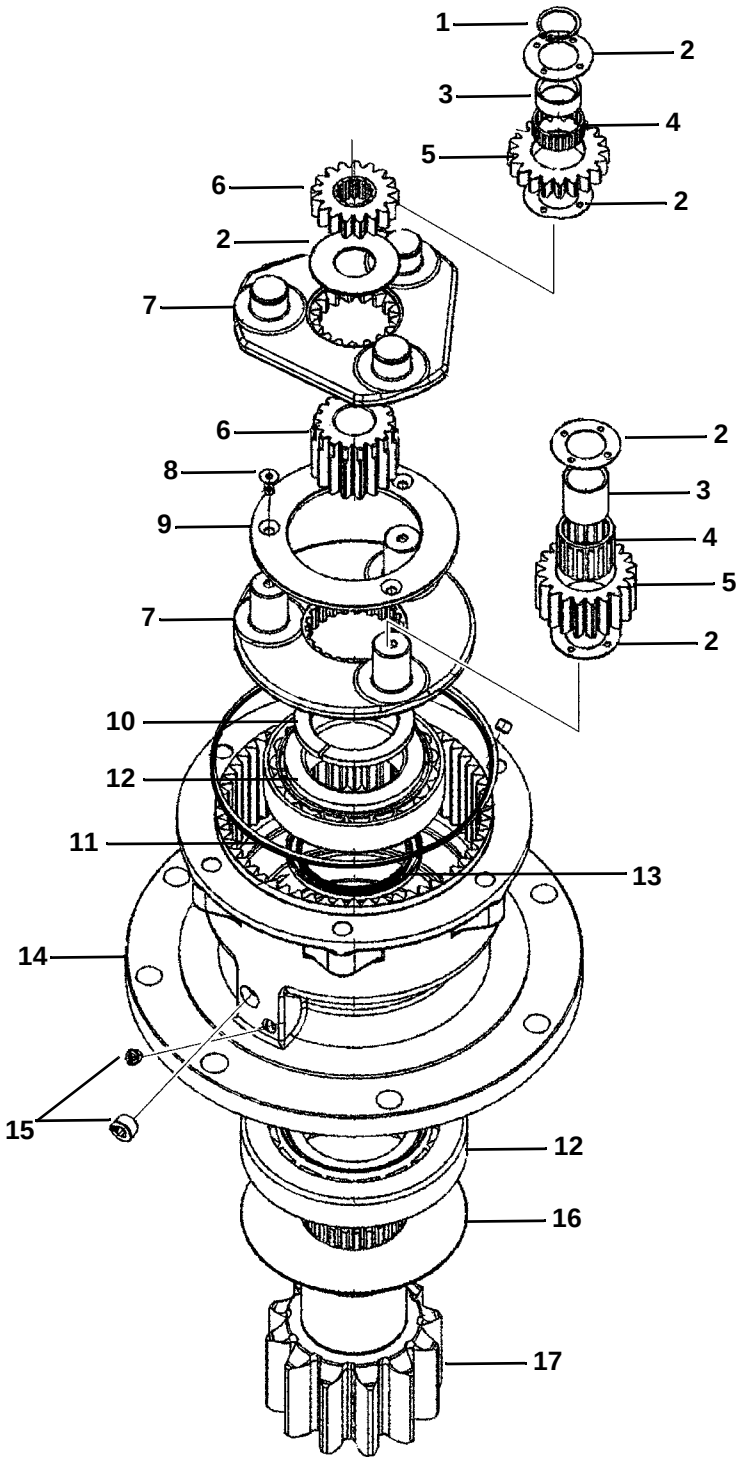
Install a sling (Item 1) **[Figure 20-91-4]** and hoisting device to the swing motor drive carrier.

Remove the swing motor drive carrier.

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Parts Identification

1. Snap Ring
2. Thrust Washer
3. Bearing Race
4. Needle Bearing
5. Planetary Gear
6. Sun Gear
7. Carrier
8. Screw
9. Thrust Plate
10. Collar
11. O-ring
12. Bearing
13. Seal
14. Housing
15. Plug
16. Dust Seal
17. Pinion Shaft

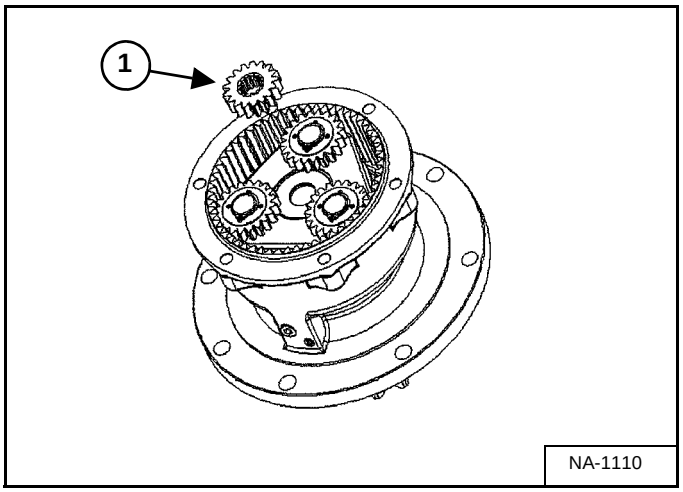


NA-1043

Dealer Copy -- Not for Resale

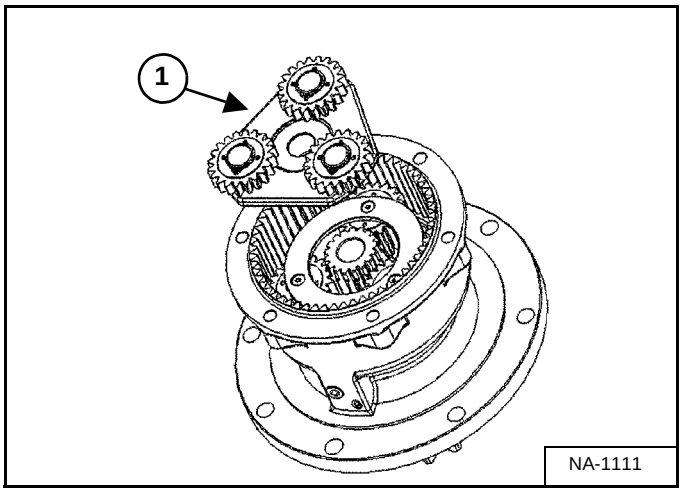
Disassembly And Assembly

Figure 20-91-5



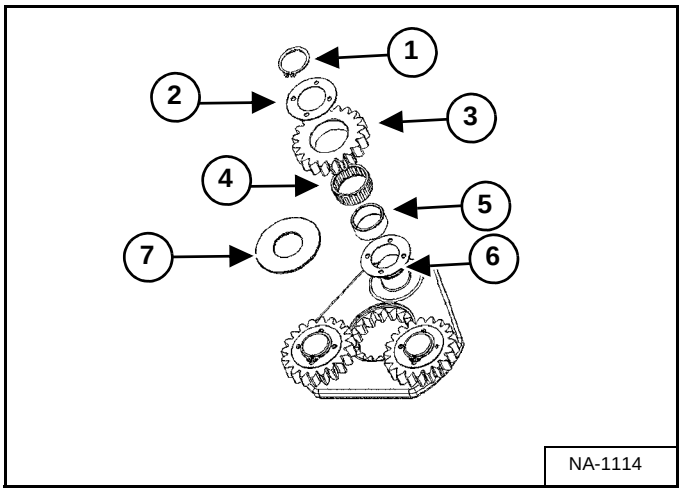
Remove the sun gear (Item 1) **[Figure 20-91-5]**.

Figure 20-91-6



Remove the carrier assembly (Item 1) **[Figure 20-91-6]**.

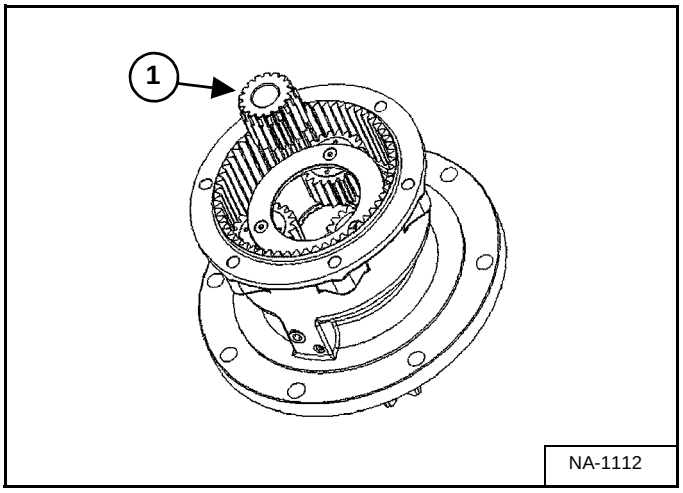
Figure 20-91-7



Remove the snap ring (Item 1), thrust washer (Item 2), planetary gear (Item 3), bearing (Item 4) bearing race (Item 5) and thrust washer (Item 6) **[Figure 20-91-7]**.

Remove the sun gear thrust washer (Item 7) **[Figure 20-91-7]**.

Figure 20-91-8

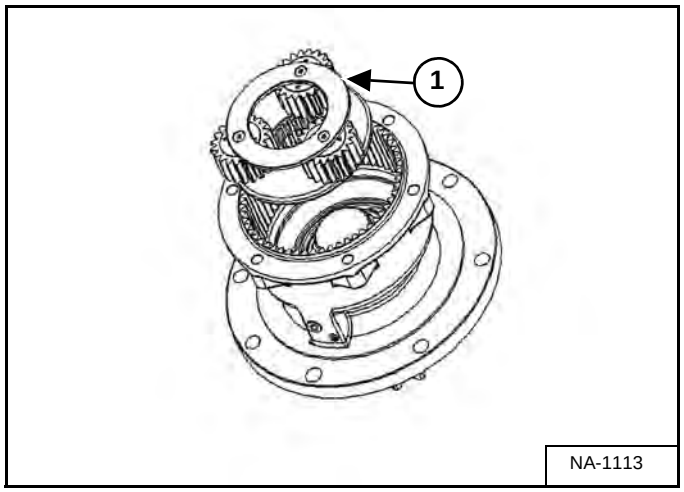


Remove the sun gear (Item 1) **[Figure 20-91-8]**.

Dealer Copy -- Not for Resale

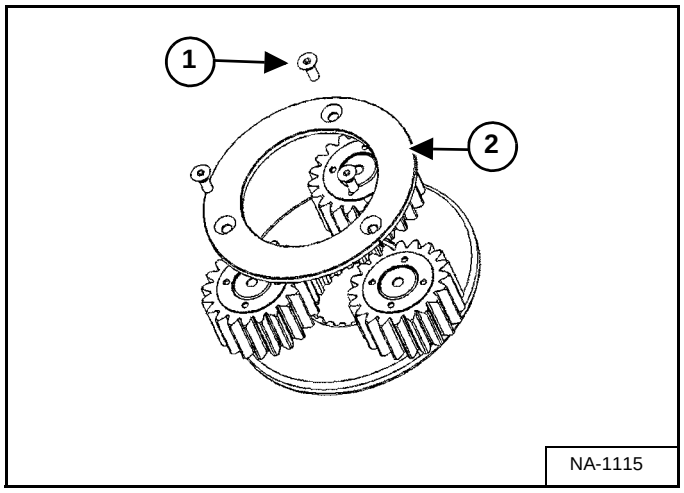
Disassembly And Assembly (Cont'd)

Figure 20-91-9



Remove the carrier assembly (Item 1) **[Figure 20-91-9]**.

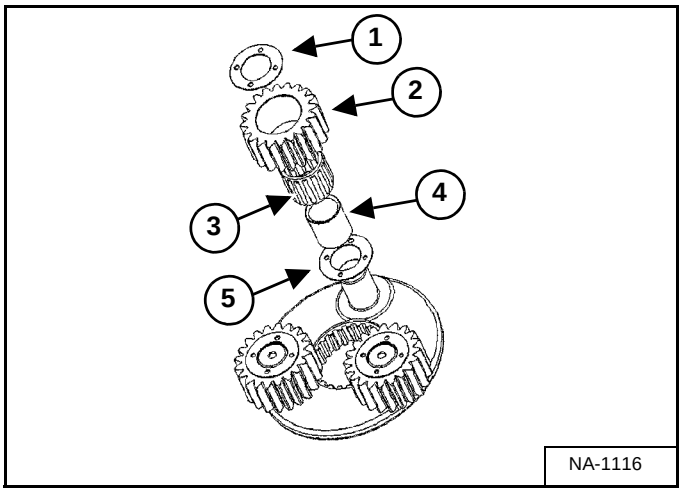
Figure 20-91-10



Heat the screws (Item 1) **[Figure 20-91-10]** to melt the thread adhesive.

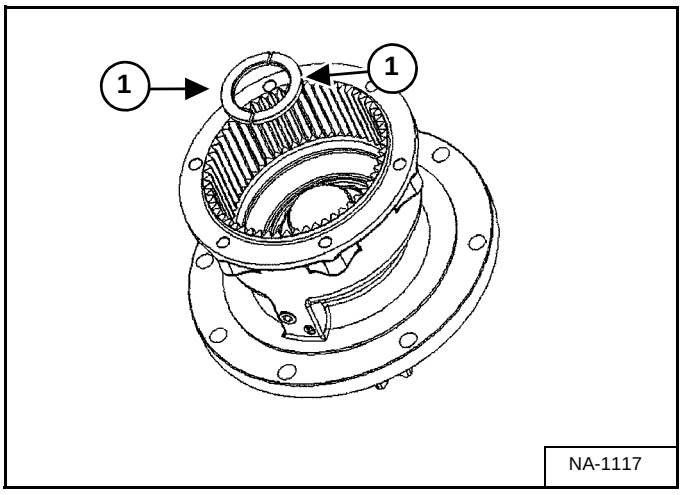
Remove the screws (Item 1) and remove the thrust plate (Item 2) **[Figure 20-91-10]**.

Figure 20-91-11



Remove the thrust washer (Item 1), planetary gear (Item 2), bearing (Item 3), bearing race (Item 4) and thrust washer (Item 5) **[Figure 20-91-11]**.

Figure 20-91-12

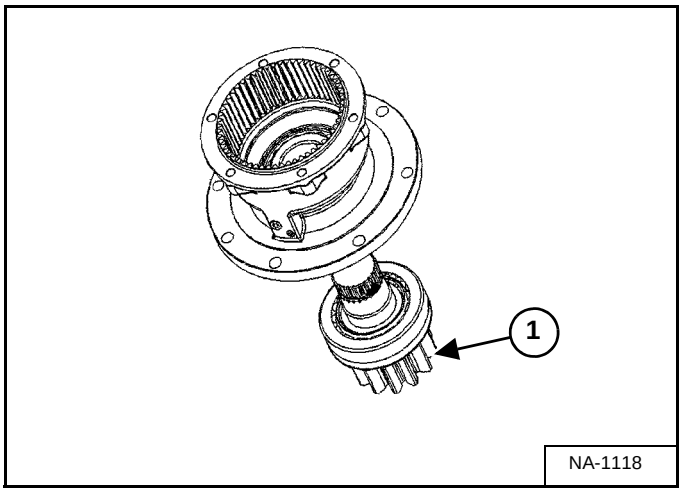


Remove both halves of the collar (Item 1) **[Figure 20-91-12]**.

Dealer Copy -- Not for Resale

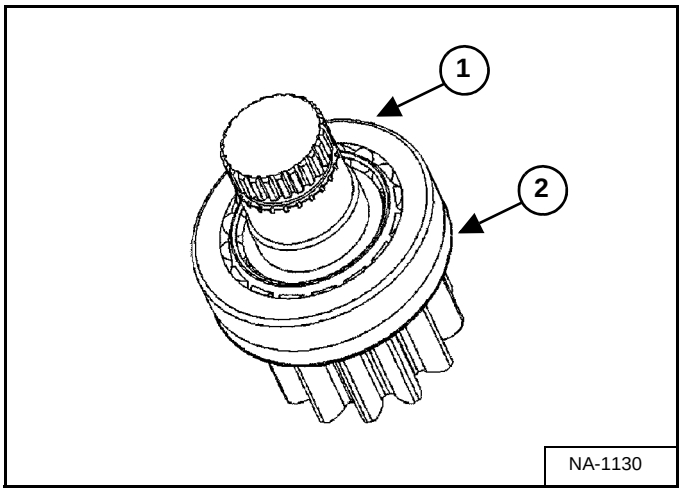
Disassembly And Assembly (Cont'd)

Figure 20-91-13



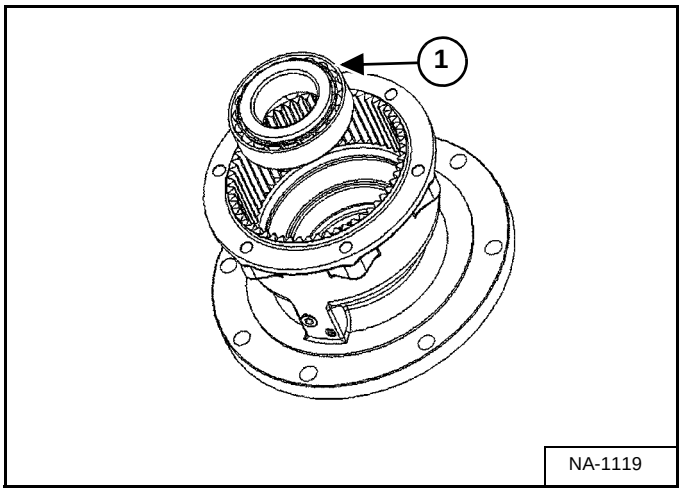
Remove the pinion shaft (Item 1) **[Figure 20-91-13]**.

Figure 20-91-14



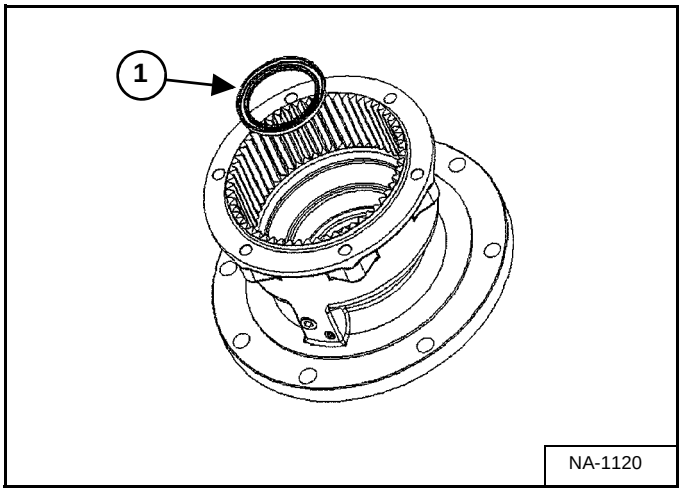
Remove the bearing (Item 1) and dust seal (Item 2) **[Figure 20-91-14]** from the pinion shaft.

Figure 20-91-15



Remove the bearing (Item 1) **[Figure 20-91-15]**.

Figure 20-91-16



Remove the seal (Item 1) **[Figure 20-91-16]**.

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Dealer Copy -- Not for Resale

CONTROL PATTERN SELECTOR VALVE

Removal And Installation

Remove the left upperstructure cover. (See Removal And Installation on Page 40-20-1.)

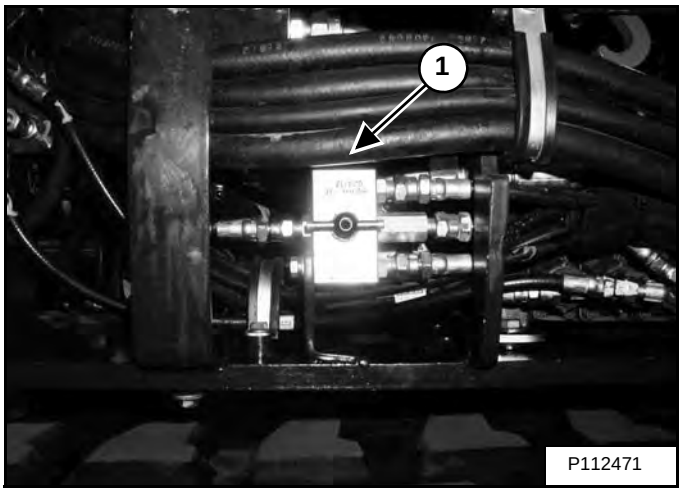
Mark all hoses for proper installation.

IMPORTANT

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

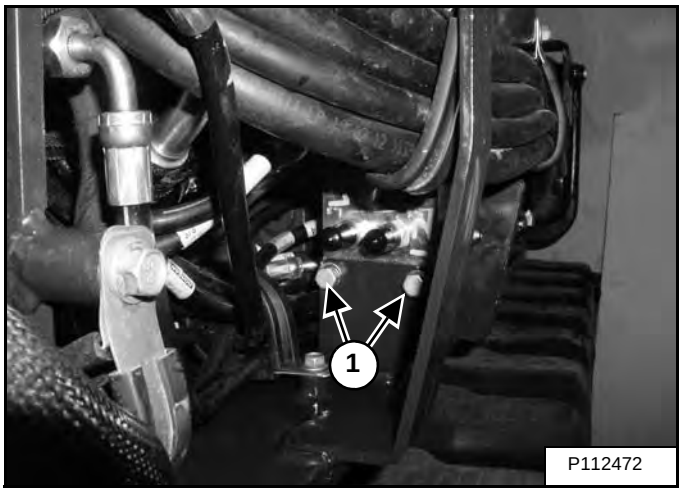
I-2003-0888

Figure 20-100-1



Remove the eight hoses from the control pattern selector valve (Item 1) **[Figure 20-100-1]**.

Figure 20-100-2

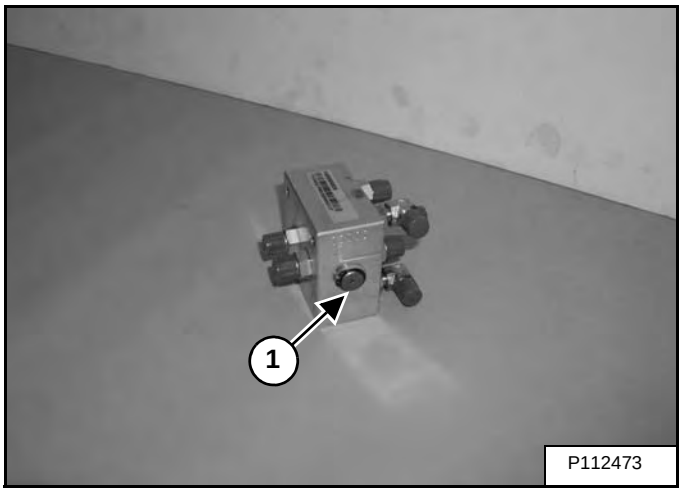


Remove the two bolts (Item 1) **[Figure 20-100-2]**, lock washers and flat washers.

Dealer Copy -- Not for Resale

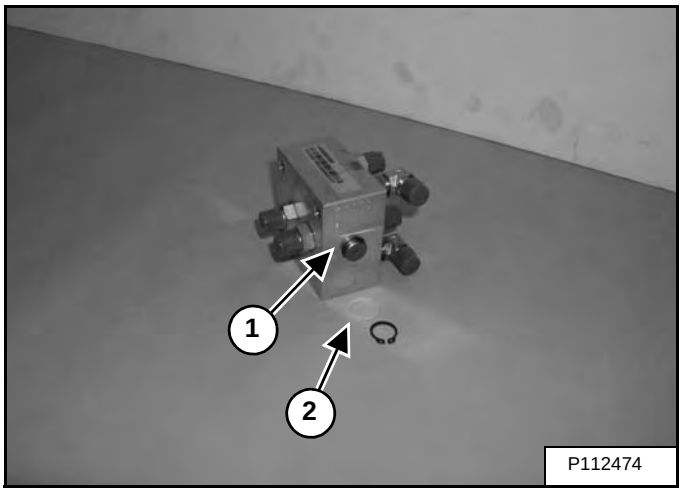
Disassembly And Assembly

Figure 20-100-3



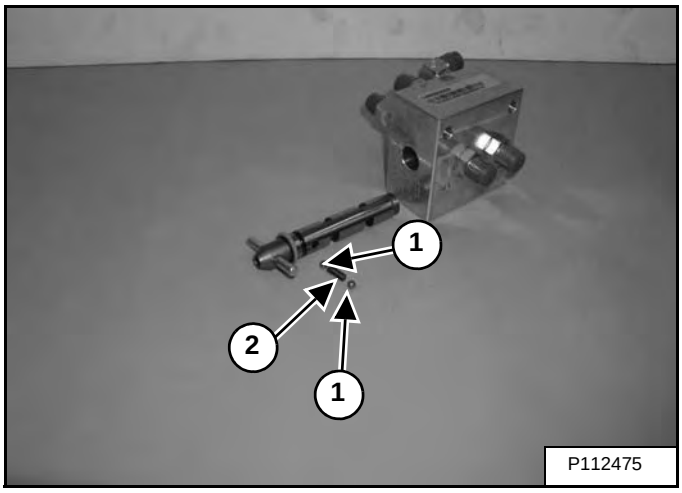
Remove the snap ring (Item 1) **[Figure 20-100-3]**.

Figure 20-100-4



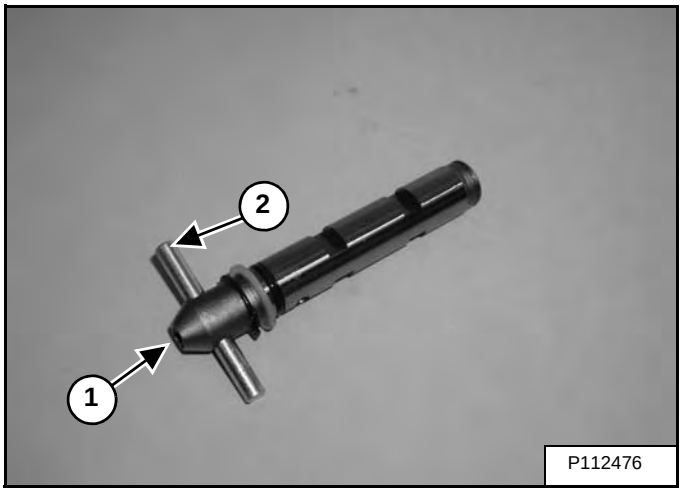
Remove the bushing (Item 1) push the spool (Item 2) **[Figure 20-100-4]** on the front of the valve block.

Figure 20-100-5



Remove the bolts (Item 1) and spring (Item 2) **[Figure 20-100-5]** from the spool.

Figure 20-100-6

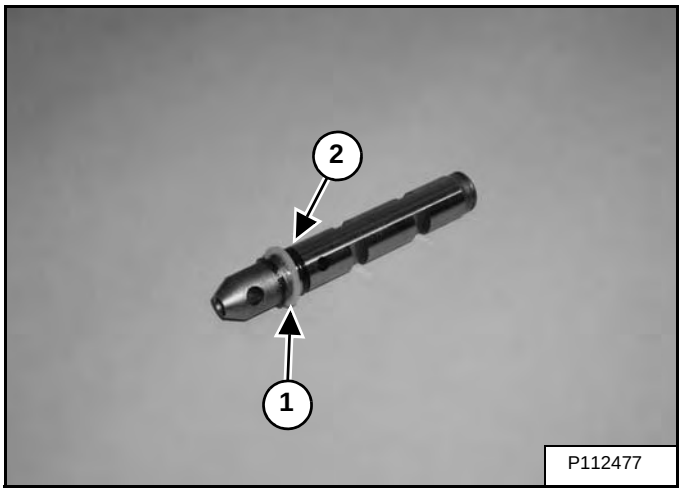


Remove the set screw (Item 1) and handle (Item 2) **[Figure 20-100-6]**.

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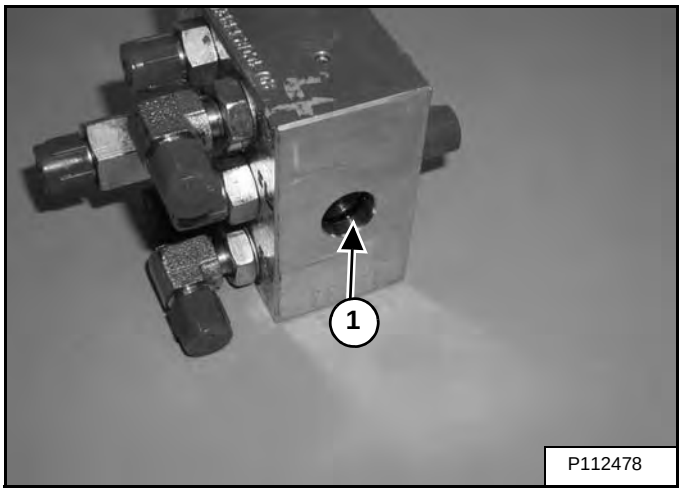
Disassembly And Assembly (Cont'd)

Figure 20-100-7



Remove the bushing (Item 1) and O-ring (Item 2) **[Figure 20-100-7]**.

Figure 20-100-8



Remove the O-ring (Item 1) **[Figure 20-100-8]** from the valve block.

Dealer Copy -- Not for Resale



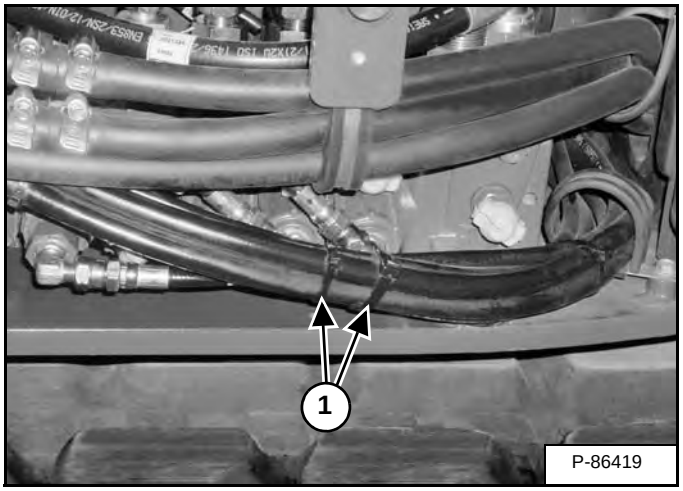
Dealer Copy -- Not for Resale

RIGHT CONTROL LEVER (JOYSTICK)

Testing

Remove the left upperstructure cover. (See Removal And Installation on Page 40-20-1.)

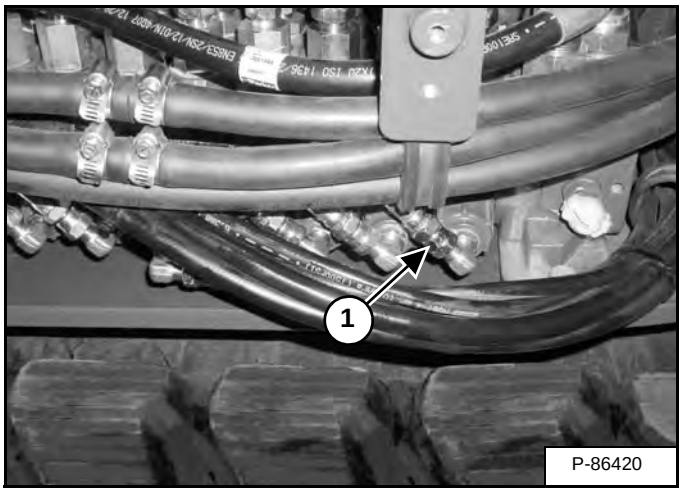
Figure 20-110-1



Cut and remove the cable ties (Item 1) **[Figure 20-110-1]**.

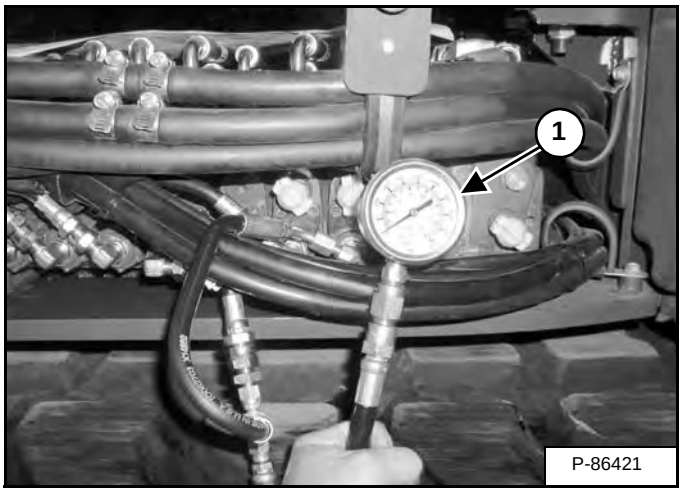
Find the pilot line of the control lever that is to be checked at the control valve assembly.

Figure 20-110-2



Disconnect the hydraulic hose (Item 1) **[Figure 20-110-2]** from the control valve.

Figure 20-110-3



Install a 6900 kPa (69 bar) (1000 psi) gauge (Item 1) **[Figure 20-110-3]** on the pilot line. Start the excavator and warm up the hydraulic oil to operating temperature.

Engage the circuit to be tested. Record the operating pressure.

The operating pressure should be approximately 2800 kPa (28 bar) (415 psi).

If the operating pressure is correct, check the valve section spool for proper operation. If the operating pressure is incorrect, test the pressure reducing valve. (See Testing And Adjusting The Pressure Reducing Valve on Page 20-32-1.)

If the pressure reducing valve is incorrect, adjust the pressure reducing valve. (See Testing And Adjusting The Pressure Reducing Valve on Page 20-32-1.) Retest the right control lever.

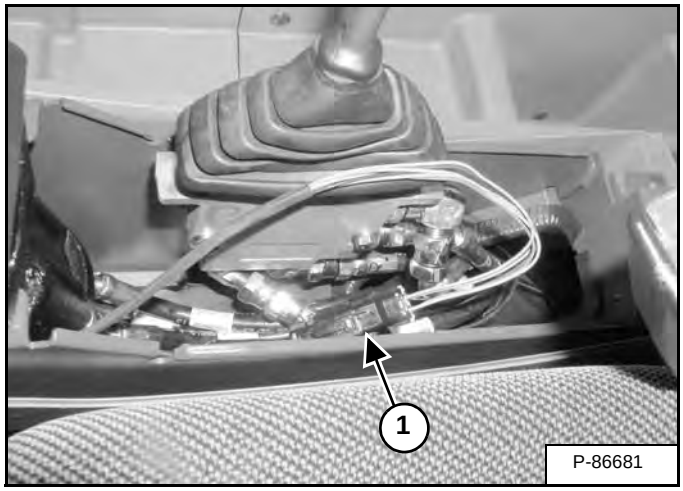
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RIGHT CONTROL LEVER (JOYSTICK) (CONT'D)

Handle Removal And Installation

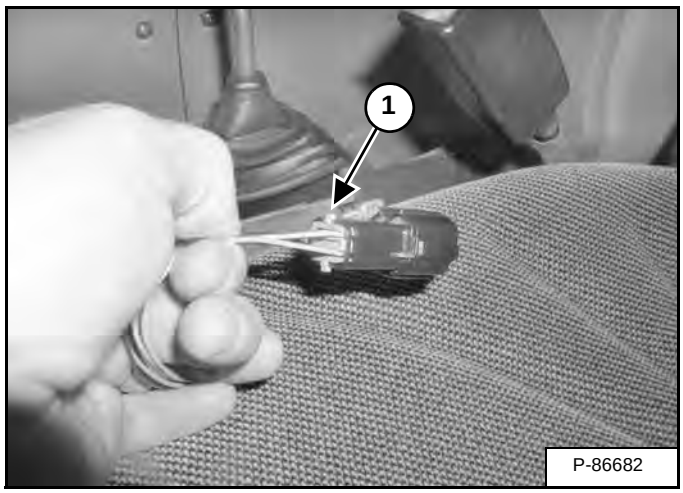
Remove the right console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 20-110-4



Disconnect the wire harness (Item 1) **[Figure 20-110-4]**.

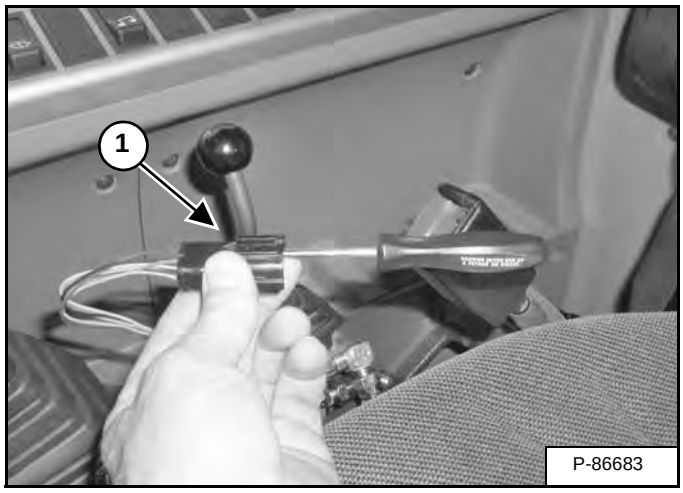
Figure 20-110-5



Remove the lock (Item 1) **[Figure 20-110-5]** from the connector body.

Mark the wires to the connector bodies.

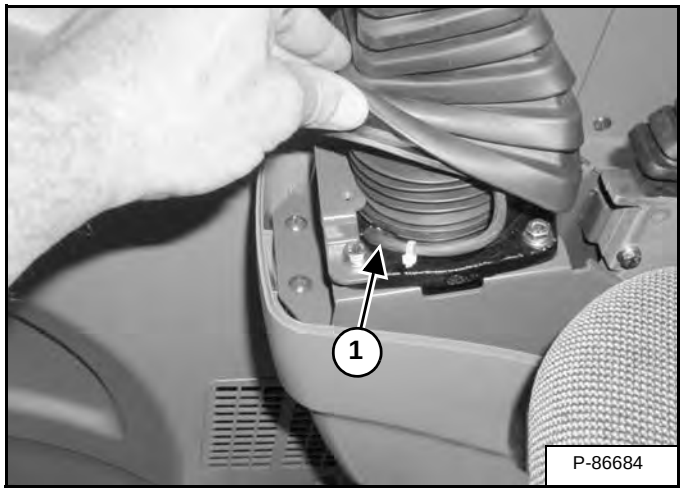
Figure 20-110-6



Use a small flat blade screwdriver to depress the wire terminal tabs, and remove the individual wires from the connector body (Item 1) **[Figure 20-110-6]**.

Installation: Use a small flat blade screwdriver to bend the wire terminal tabs on each wire before installing the individual wires in the connector bodies.

Figure 20-110-7

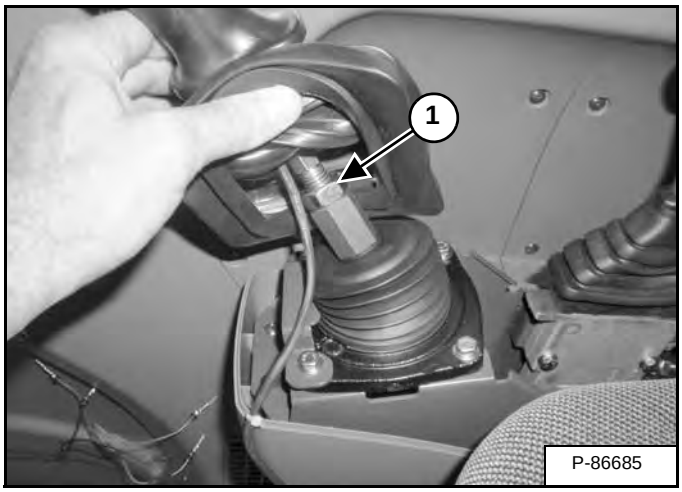


Pull the harness (Item 1) **[Figure 20-110-7]** out of the housing.

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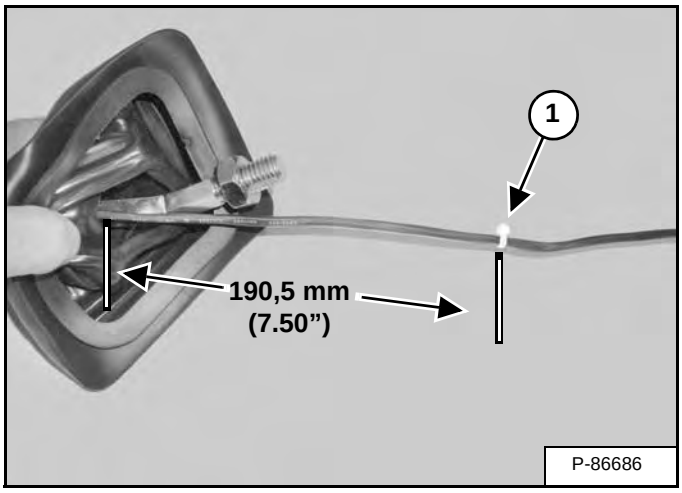
Handle Removal And Installation (Cont'd)

Figure 20-110-8



Loosen the nut (Item 1) **[Figure 20-110-8]** and unthread the handle.

Figure 20-110-9

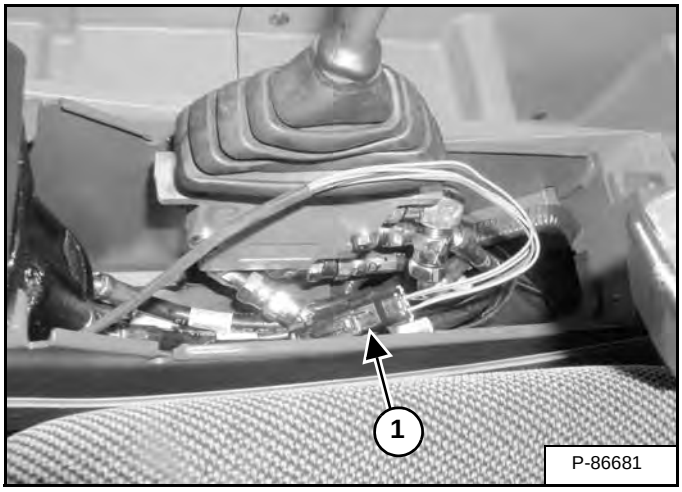


Installation: Install the cable tie (Item 1) **[Figure 20-110-9]** at 190,5 mm (7.5 in) from the base of the handle. This provides the correct amount of slack in the handle wire harness.

Joystick Assembly Removal And Installation

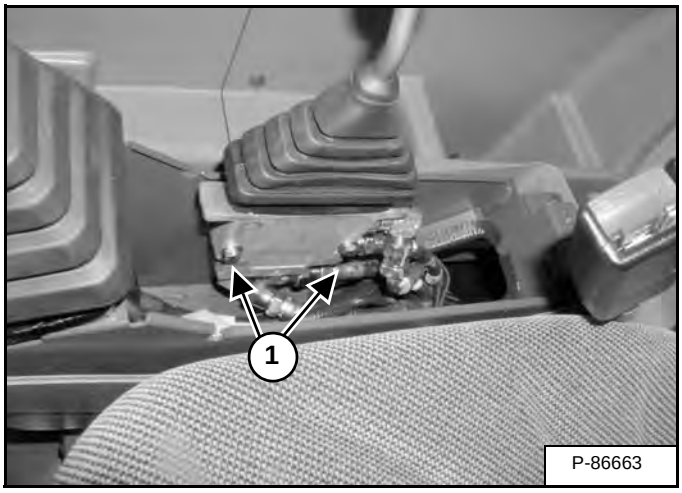
Remove the right console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 20-110-10



Disconnect the wire harness (Item 1) **[Figure 20-110-10]**.

Figure 20-110-11



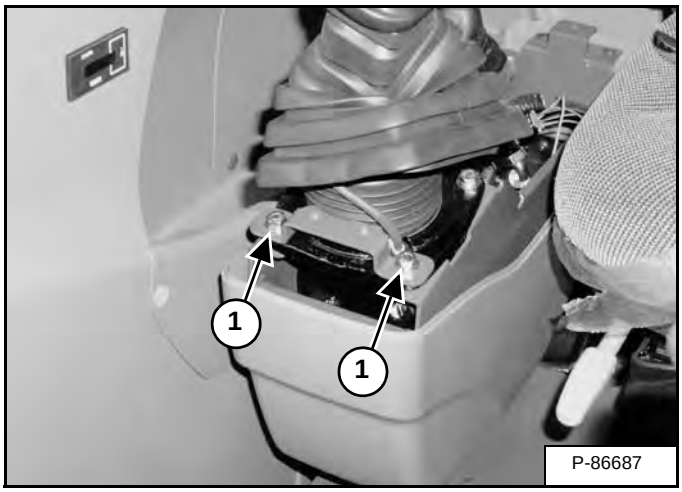
Remove the bolts (Item 1) **[Figure 20-110-11]** and washers from the blade control valve.

Reposition the blade control valve towards the rear of the cab.

Dealer Copy -- Not for Resale

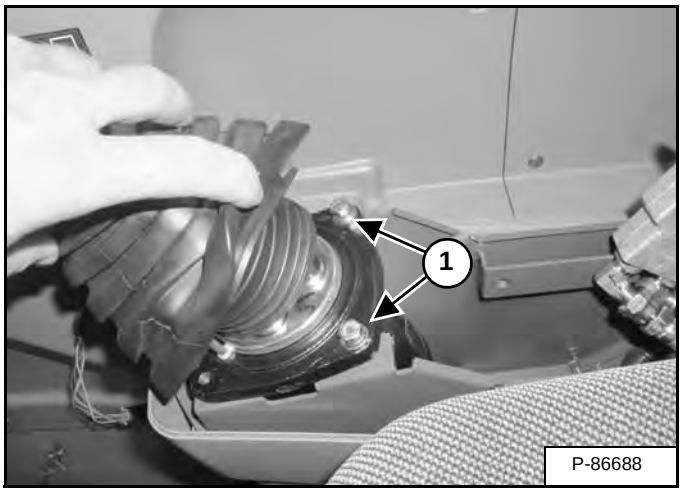
Joystick Assembly Removal And Installation (Cont'd)

Figure 20-110-12



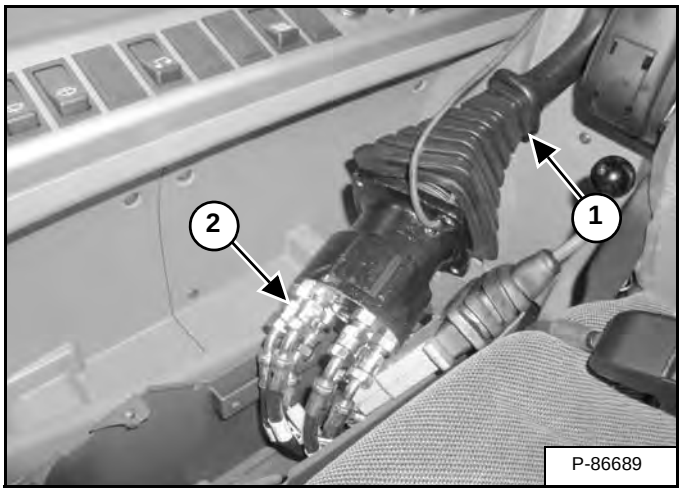
Remove the bolts (Item 1) **[Figure 20-110-12]**, flat washers and lock washers from the front of the joystick.

Figure 20-110-13



Remove the bolts (Item 1) **[Figure 20-110-13]**, flat washers and lock washers from the rear of the joystick.

Figure 20-110-14



Tilt the joystick (Item 1) towards the rear of the cab. Mark and remove the hoses (Item 2) **[Figure 20-110-14]**.

Remove the joystick.

IMPORTANT

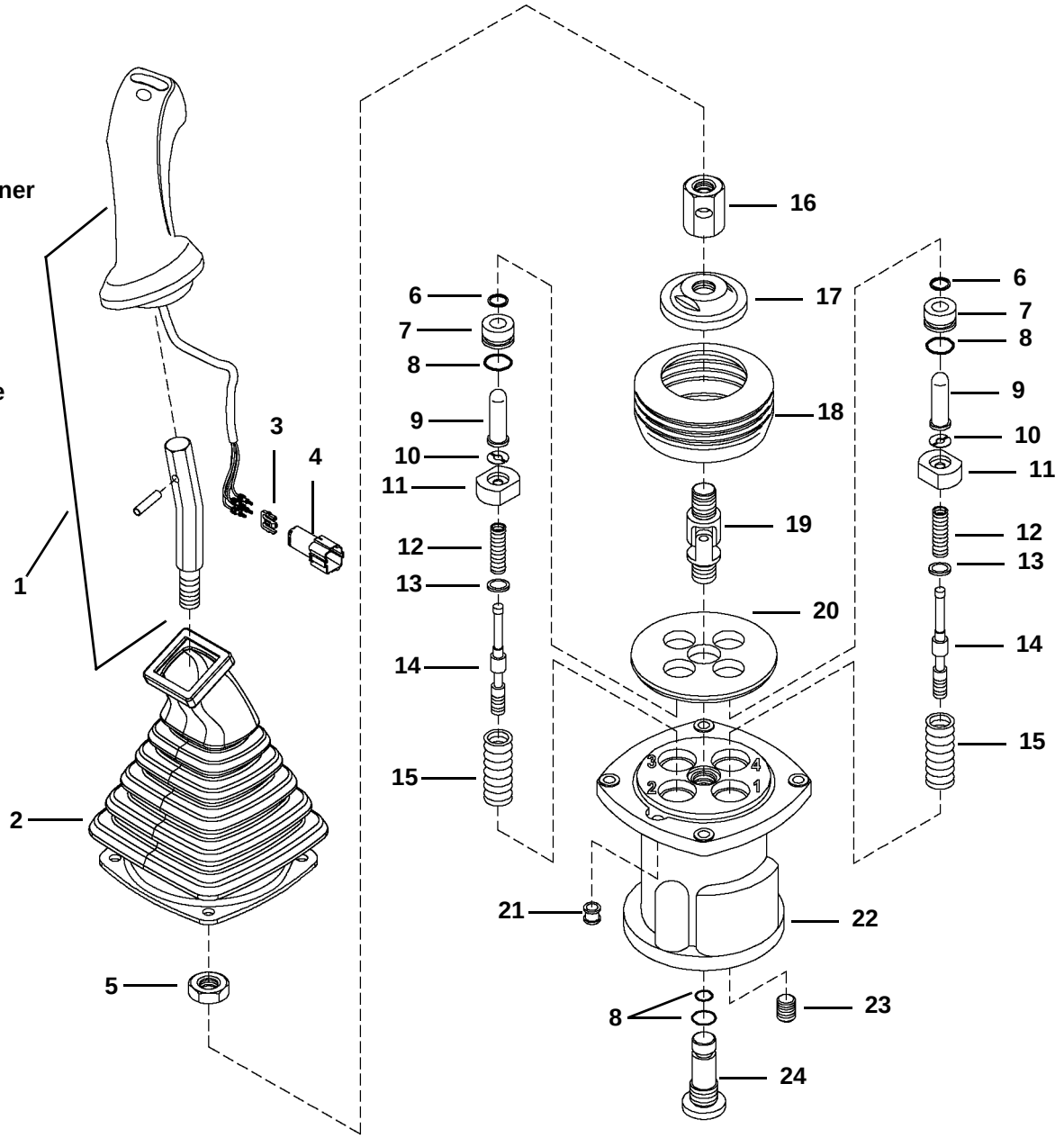
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

Dealer Copy -- Not for Resale

Parts Identification

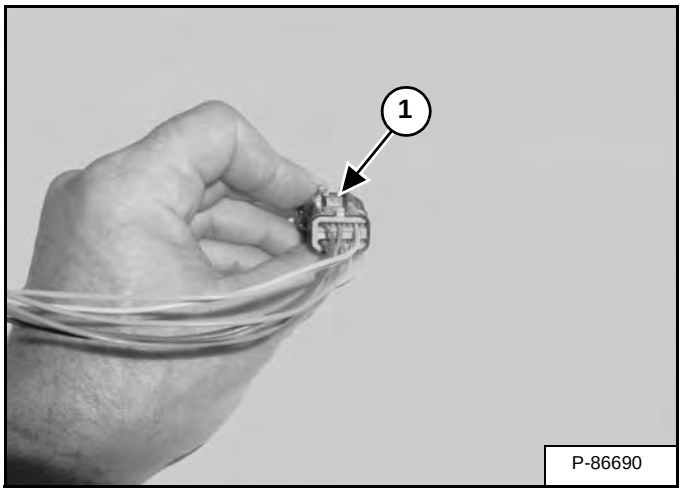
1. Handle Assembly
2. Dust Boot
3. Connector Lock
4. Connector
5. Nut
6. Seal
7. Plug
8. O-ring
9. Push Rod
10. Spring Retainer
11. Spring Seat
12. Spring
13. Washer
14. Spool
15. Spring
16. Nut
17. Control Plate
18. Dust Boot
19. U-Joint
20. Plate
21. Grommet
22. Body
23. Pipe Plug
24. Plug



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Disassembly And Assembly

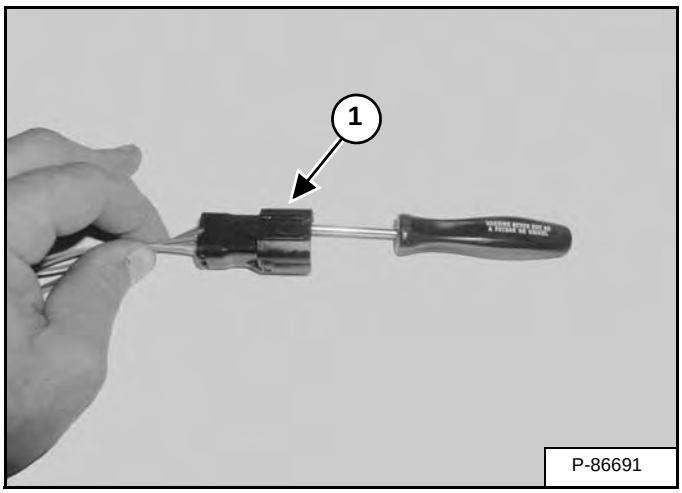
Figure 20-110-15



Remove the lock (Item 1) **[Figure 20-110-15]** from the connector body.

Mark the wires to the connector body.

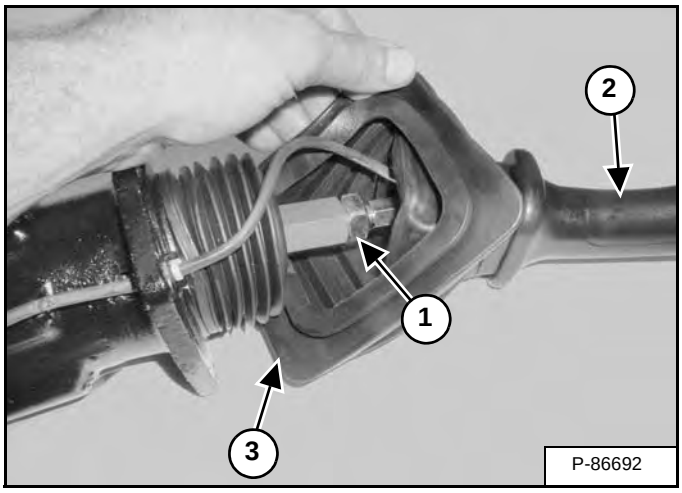
Figure 20-110-16



Use a small flat blade screwdriver to depress the wire terminal tabs, and remove the individual wires from the connector body (Item 1) **[Figure 20-110-16]**.

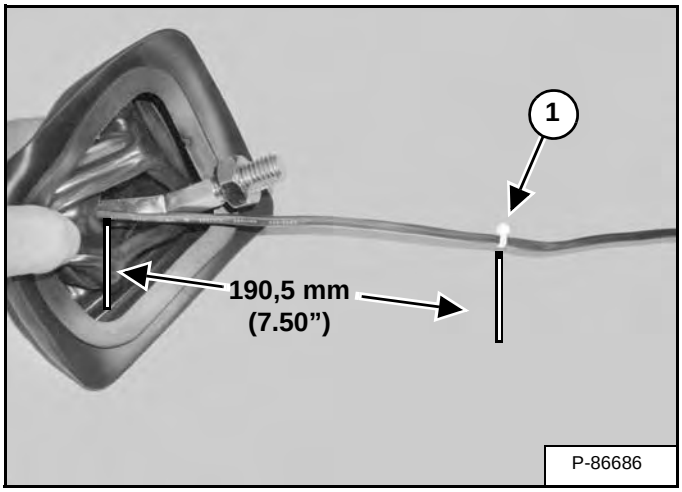
Installation: Use a small flat blade screwdriver to bend the wire terminal tabs on each wire before installing the individual wires in the connector bodies.

Figure 20-110-17



Loosen the nut (Item 1) and remove the handle (Item 2) and boot (Item 3) **[Figure 20-110-17]**.

Figure 20-110-18

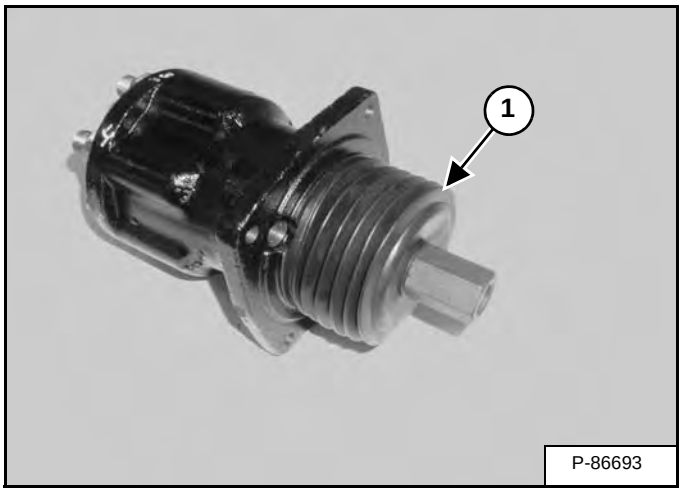


Installation: Install the cable tie (Item 1) **[Figure 20-110-18]** at 190,5 mm (7.5 in) from the base of the handle. This provides the correct amount of slack in the handle wire harness.

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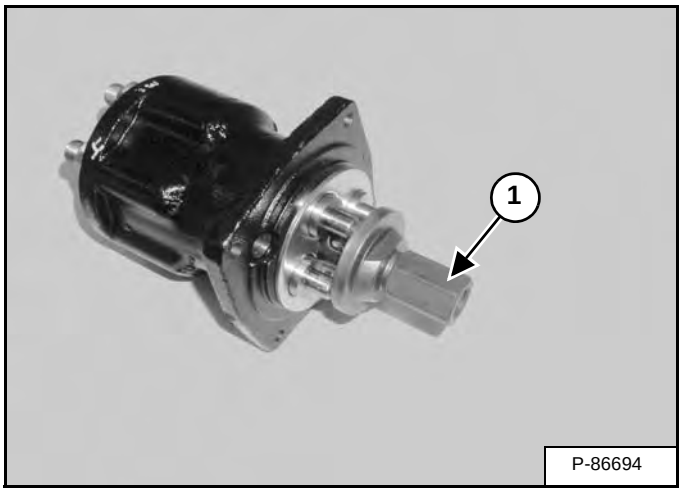
Disassembly And Assembly (Cont'd)

Figure 20-110-19



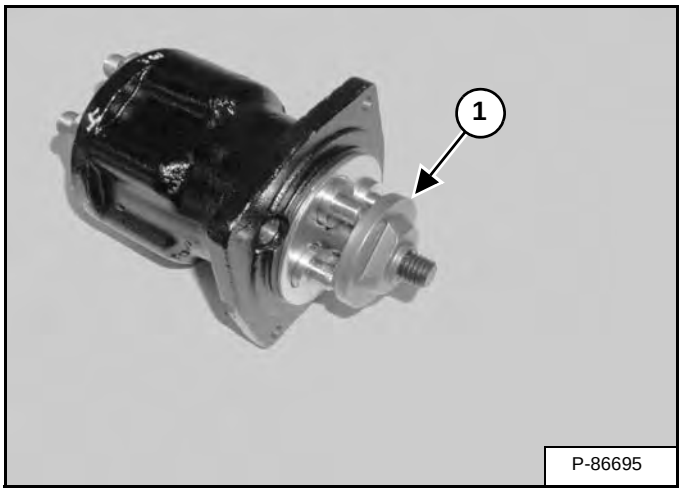
Remove the dust boot (Item 1) **[Figure 20-110-19]**.

Figure 20-110-20



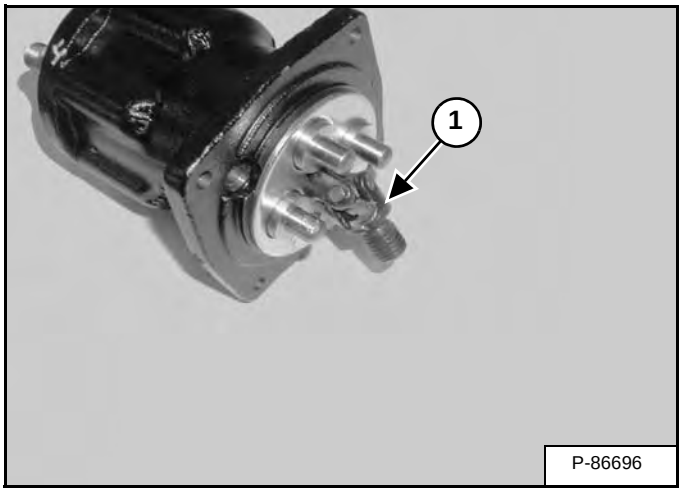
Remove the nut (Item 1) **[Figure 20-110-20]**.

Figure 20-110-21



Remove the control plate (Item 1) **[Figure 20-110-21]**.

Figure 20-110-22

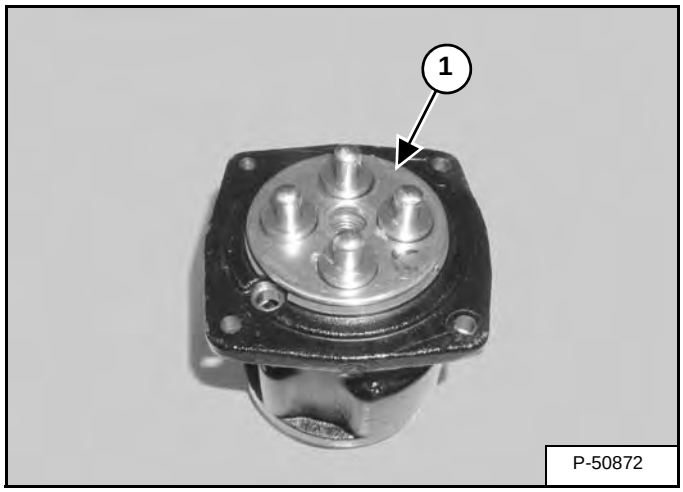


Remove the U-joint (Item 1) **[Figure 20-110-22]**.

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Disassembly And Assembly (Cont'd)

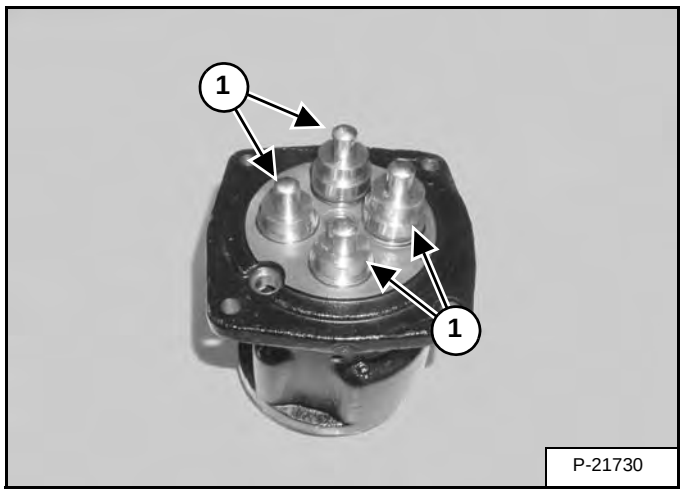
Figure 20-110-23



Mark the plate (Item 1) **[Figure 20-110-23]** for correct installation.

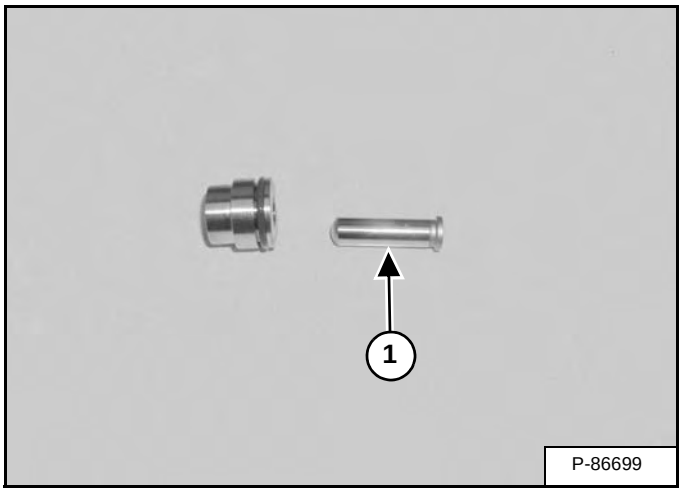
Remove the plate.

Figure 20-110-24



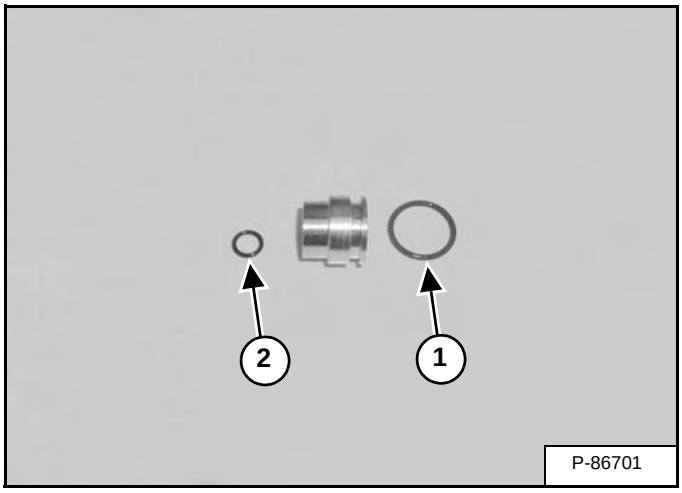
Remove the plug assemblies (Item 1) **[Figure 20-110-24]**.

Figure 20-110-25



Remove the push rod (Item 1) **[Figure 20-110-25]**.

Figure 20-110-26

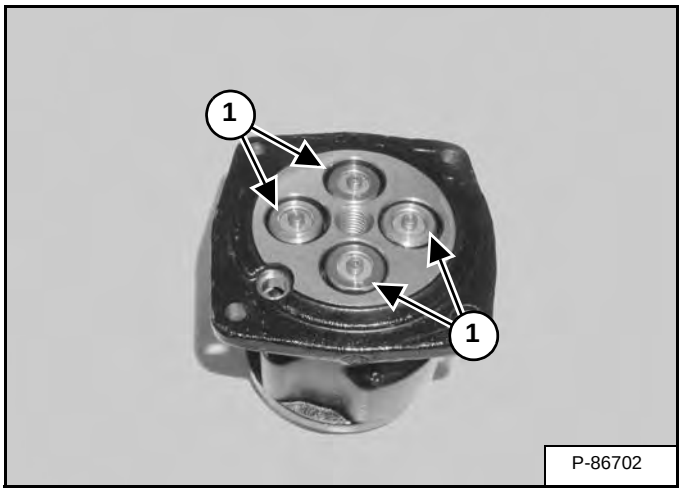


Remove the O-ring (Item 1) from the O.D. of the plug. Remove the seal (Item 2) **[Figure 20-110-26]** from the I.D. of the plug.

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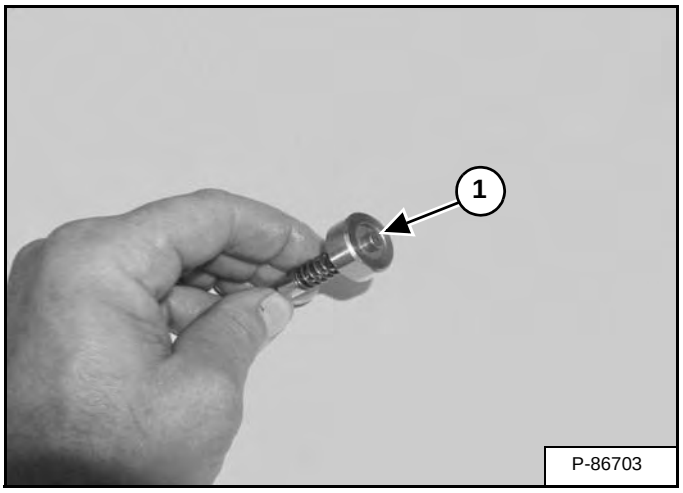
Disassembly And Assembly (Cont'd)

Figure 20-110-27



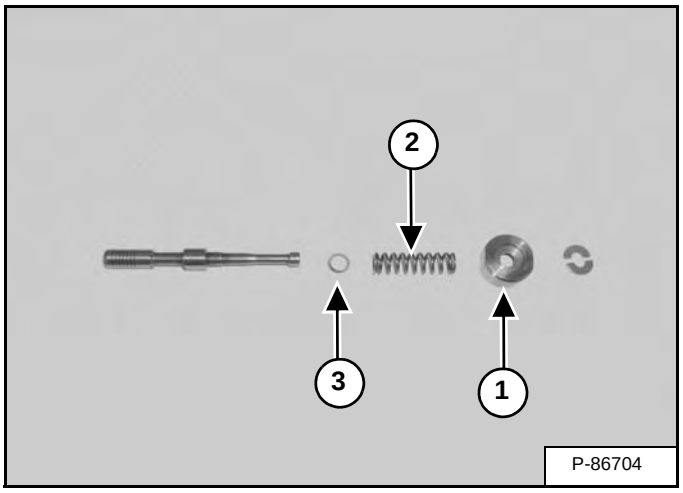
Remove the spool assemblies (Item 1) **[Figure 20-110-27]**.

Figure 20-110-28



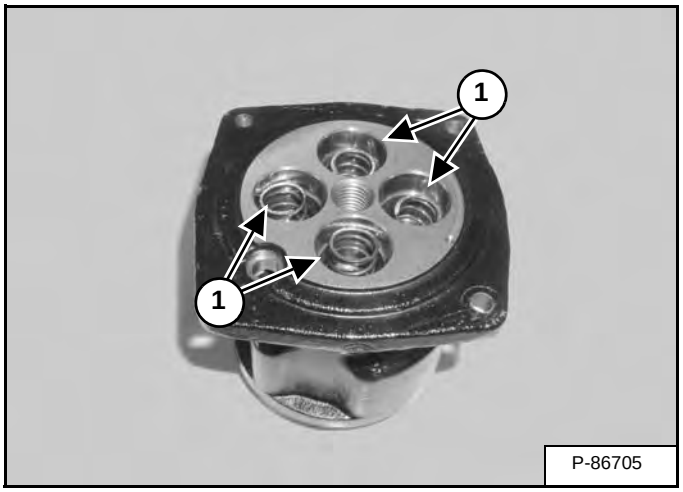
Compress the spring and remove the spring retainers (Item 1) **[Figure 20-110-28]**.

Figure 20-110-29



Remove the spring seat (Item 1), spring (Item 2), and washer (Item 3) **[Figure 20-110-29]** from the spool.

Figure 20-110-30



Remove the springs (Item 1) **[Figure 20-110-30]**.

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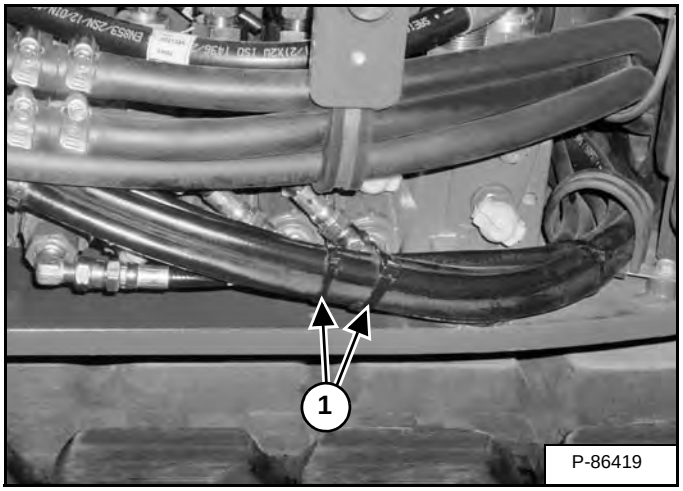
Dealer Copy -- Not for Resale

LEFT CONTROL LEVER (JOYSTICK)

Testing

Remove the left upperstructure cover. (See Removal And Installation on Page 40-20-1.)

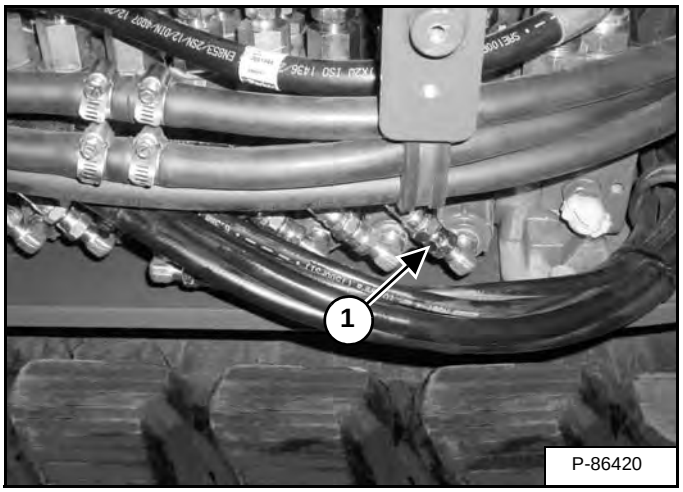
Figure 20-120-1



Cut and remove the cable ties (Item 1) **[Figure 20-120-1]**.

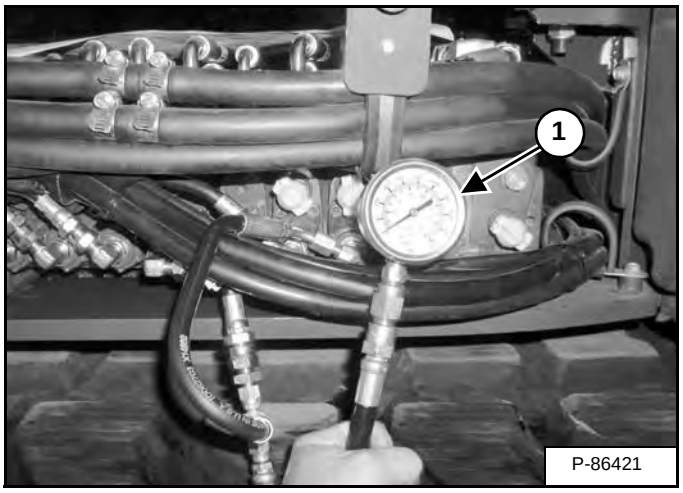
Find the pilot line of the control lever that is to be checked at the control valve assembly.

Figure 20-120-2



Disconnect the hydraulic hose (Item 1) **[Figure 20-120-2]** from the control valve.

Figure 20-120-3



Install a 6900 kPa (69 bar) (1000 psi) gauge (Item 1) **[Figure 20-120-3]** on the pilot line. Start the excavator and warm up the hydraulic oil to operating temperature.

Engage the circuit to be tested. Record the operating pressure.

The operating pressure should be approximately 2800 kPa (28 bar) (415 psi).

If the operating pressure is correct, check the valve section spool for proper operation. If the operating pressure is incorrect, test the pressure reducing valve. (See Testing And Adjusting The Pressure Reducing Valve on Page 20-32-1.)

If the pressure reducing valve is incorrect, adjust the pressure reducing valve. (See Testing And Adjusting The Pressure Reducing Valve on Page 20-32-1.) Retest the right control lever.

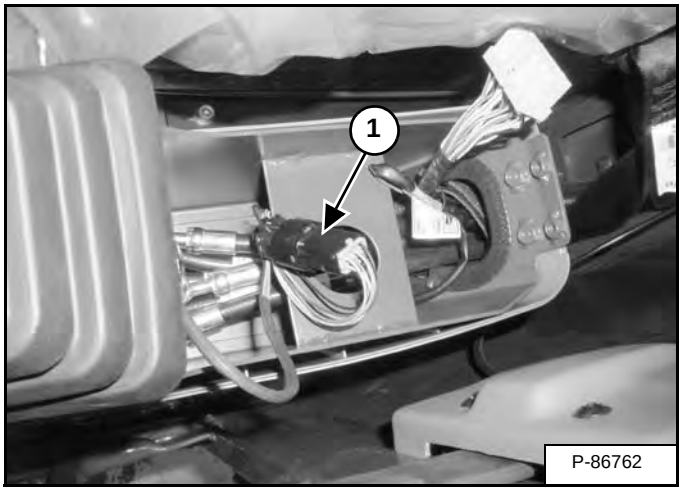
Dealer Copy -- Not for Resale

LEFT CONTROL LEVER (JOYSTICK) (CONT'D)

Handle Removal And Installation

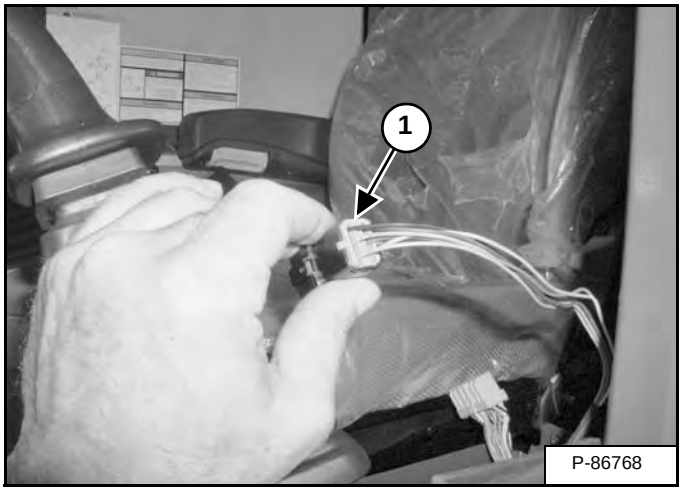
Remove the upper left console cover. (See Upper Console Cover Removal And Installation on Page 40-60-2.)

Figure 20-120-4



Disconnect the wire harness (Item 1) **[Figure 20-120-4]**.

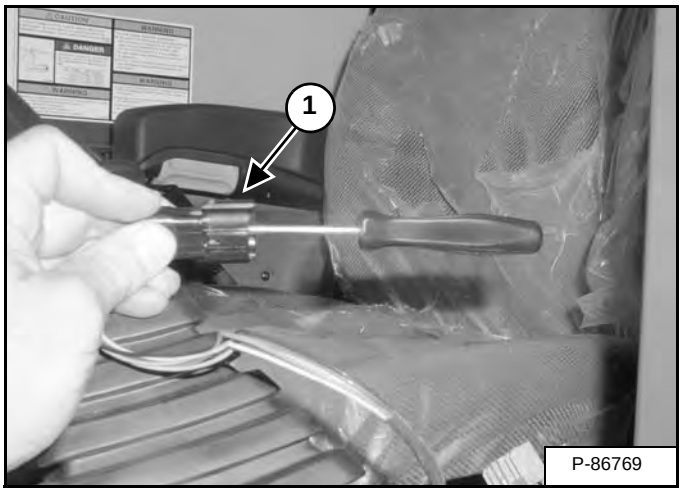
Figure 20-120-5



Remove the lock (Item 1) **[Figure 20-120-5]** from the connector body.

Mark the wires to the connector bodies.

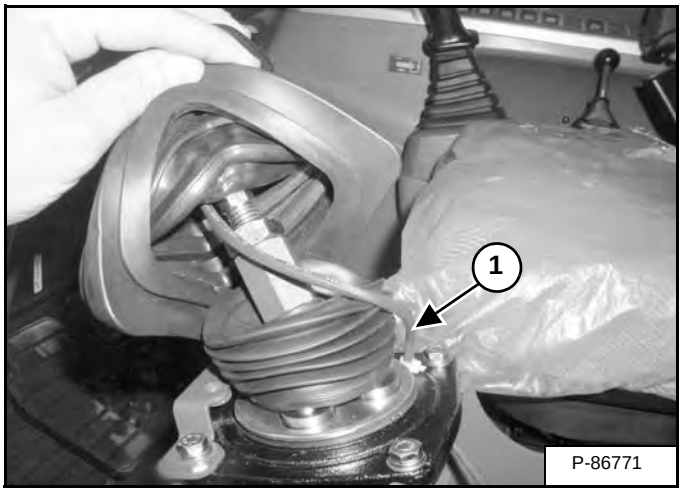
Figure 20-120-6



Use a small flat blade screwdriver to depress the wire terminal tabs, and remove the individual wires from the connector body (Item 1) **[Figure 20-120-6]**.

Installation: Use a small flat blade screwdriver to bend the wire terminal tabs on each wire before installing the individual wires in the connector body.

Figure 20-120-7

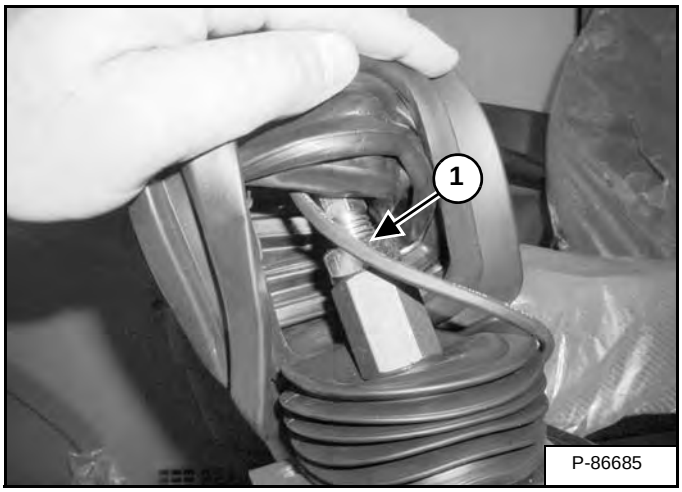


Pull the harness (Item 1) **[Figure 20-120-7]** out of the housing.

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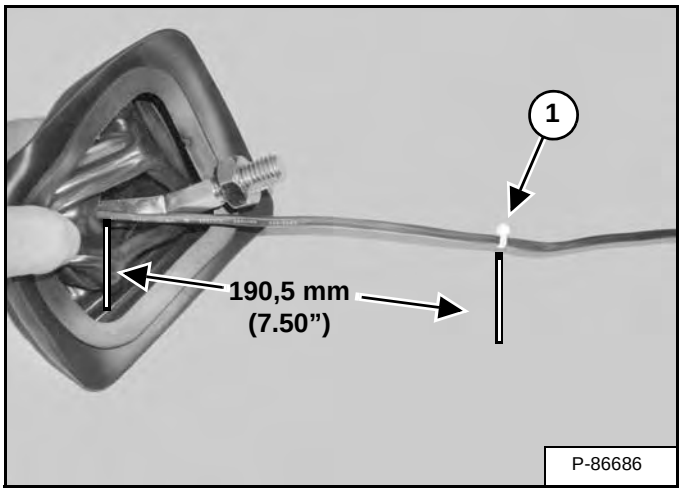
Handle Removal And Installation (Cont'd)

Figure 20-120-8



Loosen the nut (Item 1) **[Figure 20-120-8]** and unthread the handle.

Figure 20-120-9



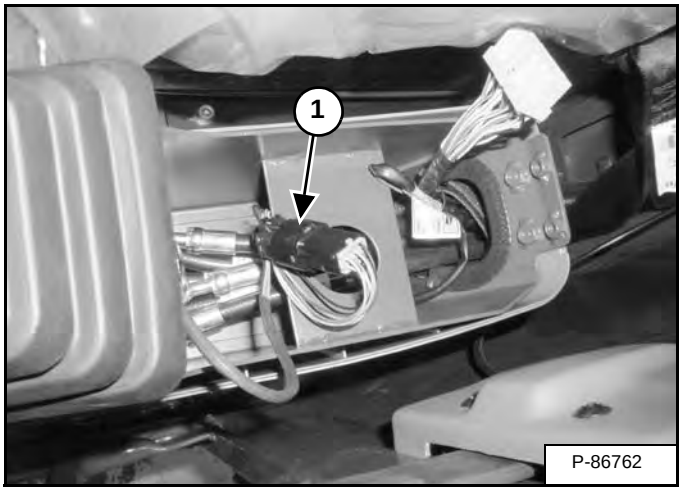
Installation: Install the cable tie (Item 1) **[Figure 20-120-9]** at 190,5 mm (7.5 in) from the base of the handle. This provides the correct amount of slack in the handle wire harness.

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Joystick Assembly Removal And Installation

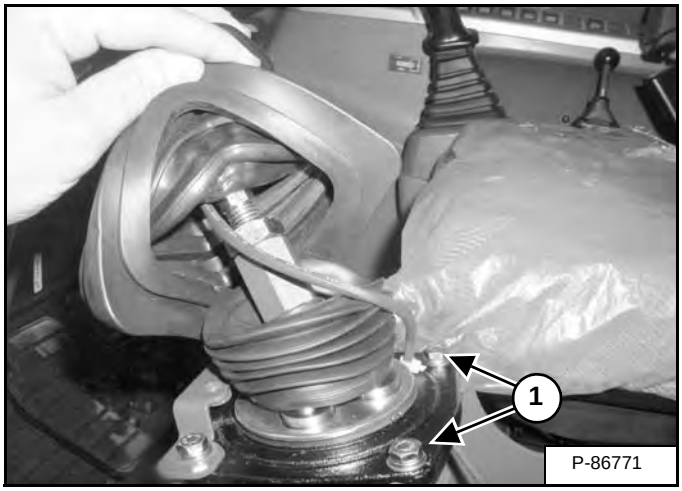
Remove the upper left console cover. (See Upper Console Cover Removal And Installation on Page 40-60-2.)

Figure 20-120-10



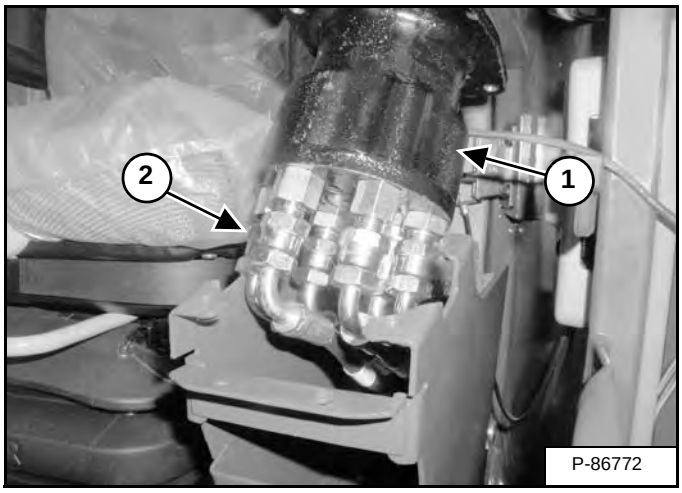
Disconnect the wire harness (Item 1) **[Figure 20-120-10]**.

Figure 20-120-11



Remove the four bolts (Item 1) **[Figure 20-120-11]**, flat washers and lock washers from the joystick.

Figure 20-120-12



Tilt the joystick (Item 1) towards the rear of the cab. Mark and remove the hoses (Item 2) **[Figure 20-120-12]**.

Remove the joystick.

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.

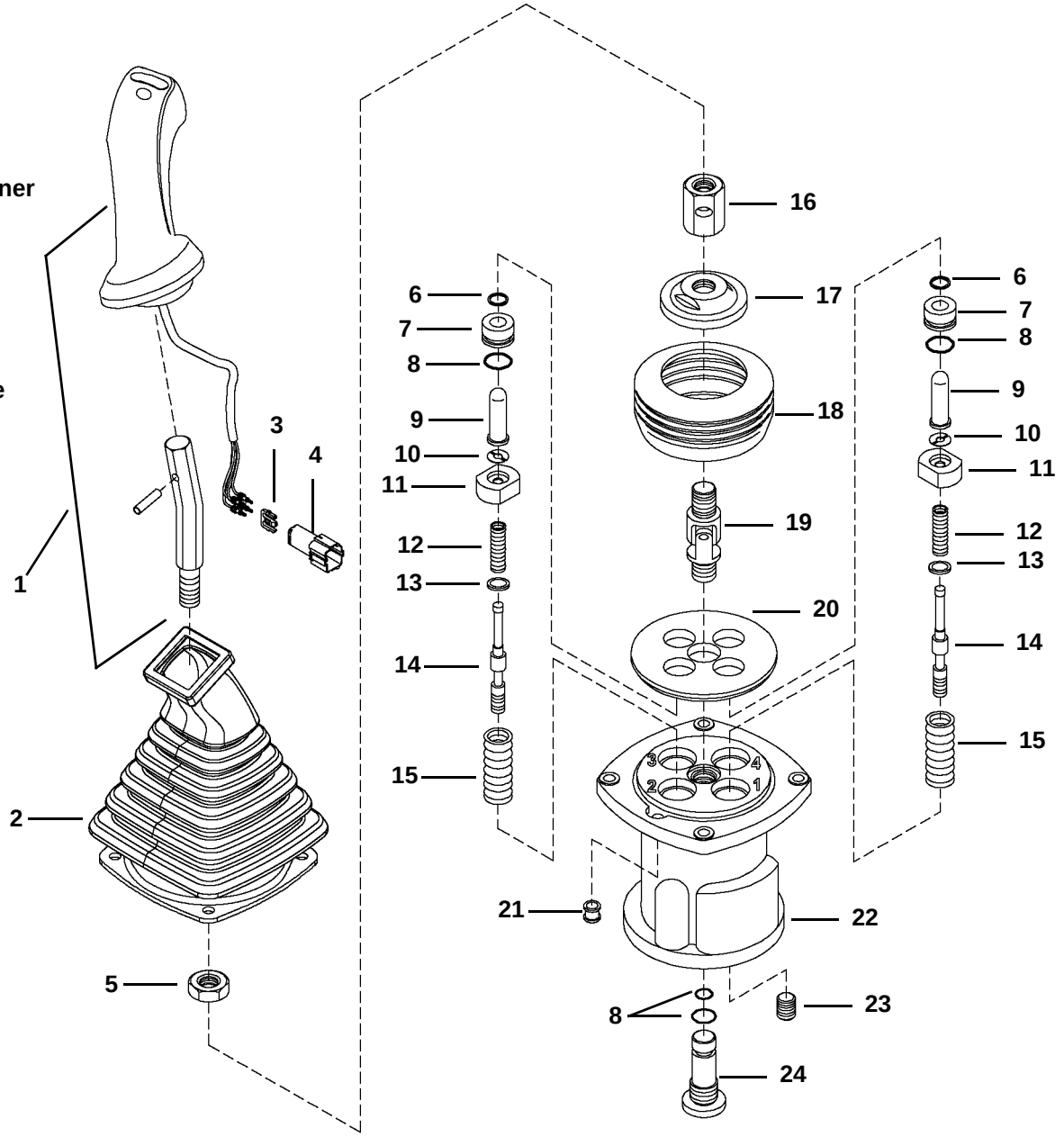
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LEFT CONTROL LEVER (JOYSTICK) (CONT'D)

Parts Identification

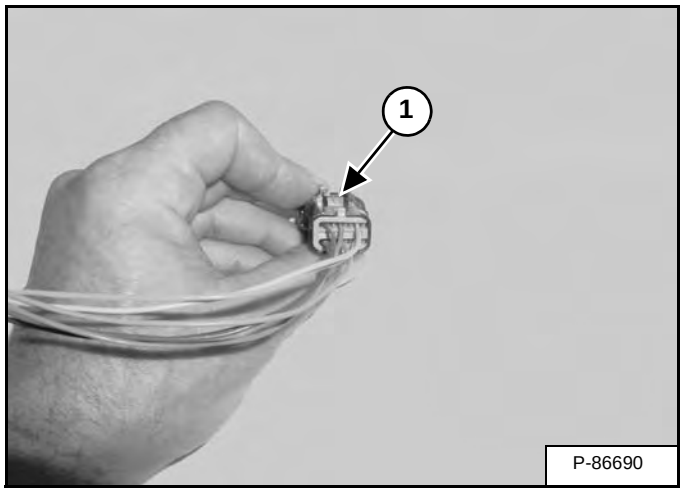
1. Handle Assembly
2. Dust Boot
3. Connector Lock
4. Connector
5. Nut
6. Seal
7. Plug
8. O-ring
9. Push Rod
10. Spring Retainer
11. Spring Seat
12. Spring
13. Washer
14. Spool
15. Spring
16. Nut
17. Control Plate
18. Dust Boot
19. U-Joint
20. Plate
21. Grommet
22. Body
23. Pipe Plug
24. Plug



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Disassembly And Assembly

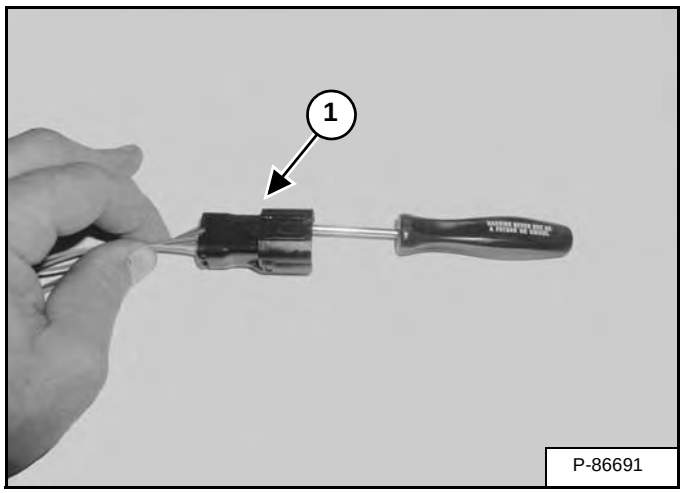
Figure 20-120-13



Remove the lock (Item 1) **[Figure 20-120-13]** from the connector body.

Mark the wires to the connector bodies.

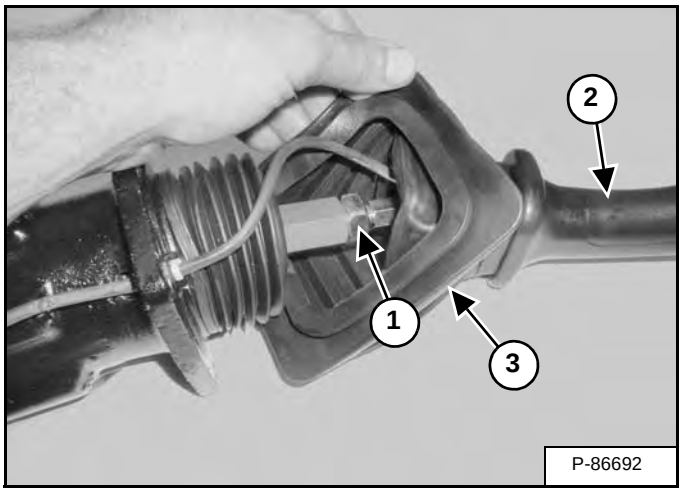
Figure 20-120-14



Use a small flat blade screwdriver to depress the wire terminal tabs, and remove the individual wires from the connector body (Item 1) **[Figure 20-120-14]**.

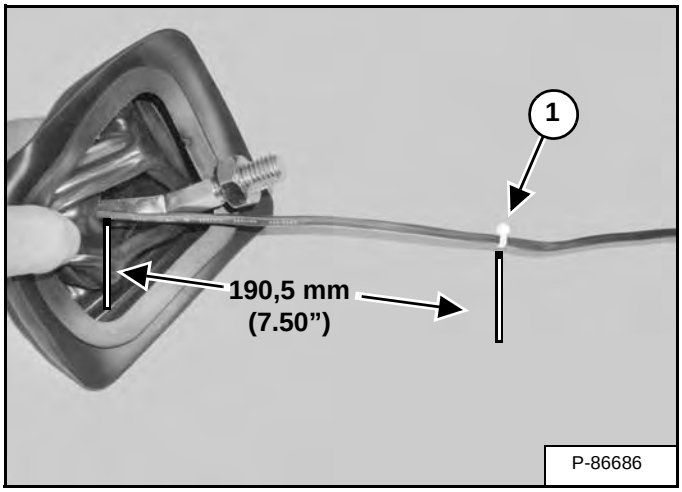
Installation: Use a small flat blade screwdriver to bend the wire terminal tabs on each wire before installing the individual wires in the connector bodies.

Figure 20-120-15



Loosen the nut (Item 1) and remove the handle (Item 2) and boot (Item 3) **[Figure 20-120-15]**.

Figure 20-120-16

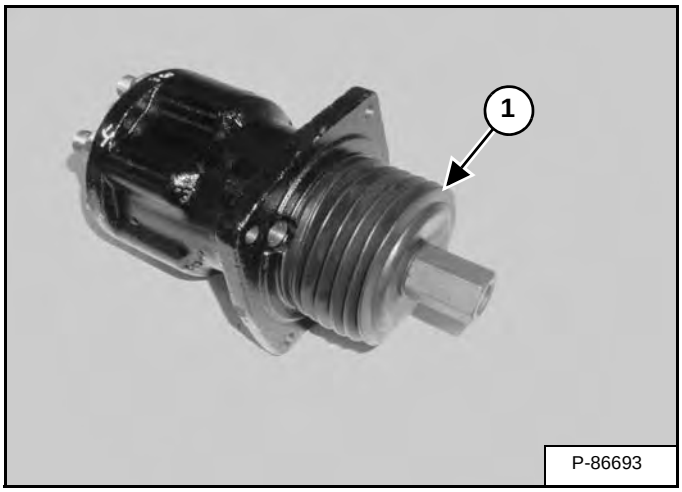


Installation: Install the cable tie (Item 1) **[Figure 20-120-16]** at 190,5 mm (5.5 in) from the base of the handle. This provides the correct amount of slack in the handle wire harness.

Dealer Copy -- Not for Resale

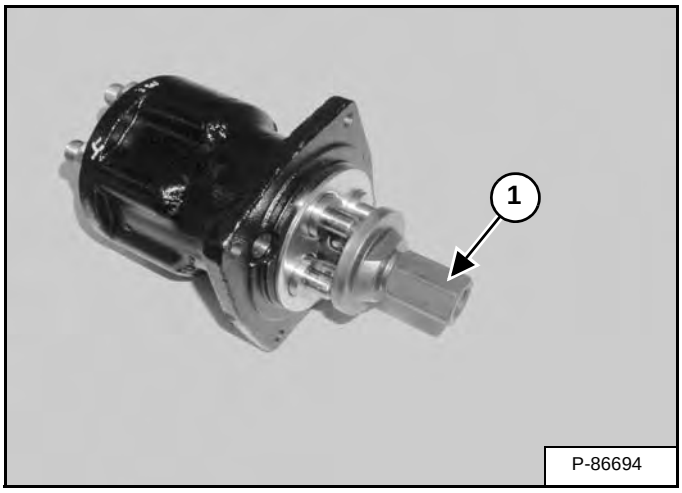
Disassembly And Assembly (Cont'd)

Figure 20-120-17



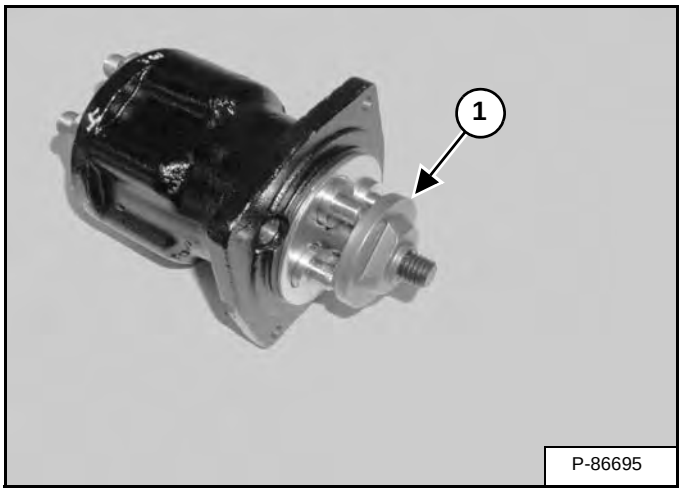
Remove the dust boot (Item 1) **[Figure 20-120-17]**.

Figure 20-120-18



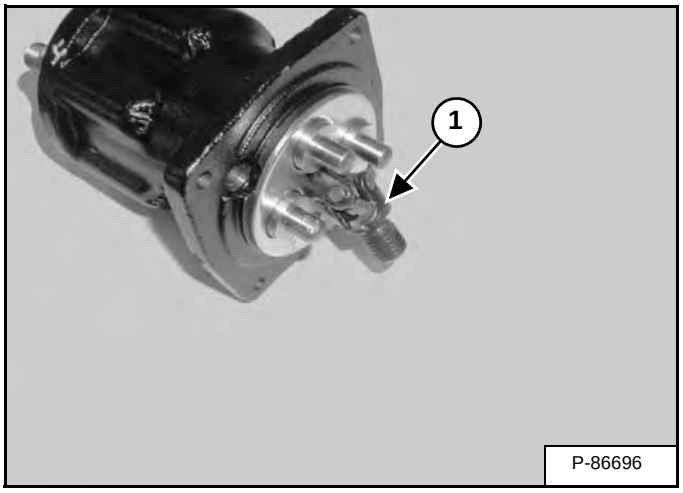
Remove the nut (Item 1) **[Figure 20-120-18]**.

Figure 20-120-19



Remove the control plate (Item 1) **[Figure 20-120-19]**.

Figure 20-120-20

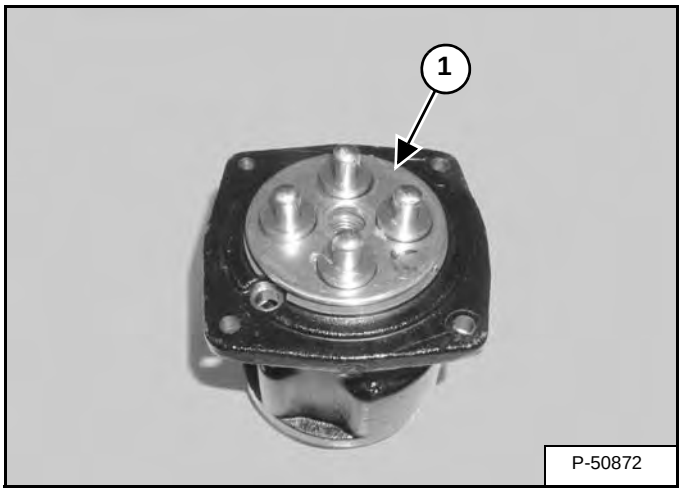


Remove the U-joint (Item 1) **[Figure 20-120-20]**.

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Disassembly And Assembly (Cont'd)

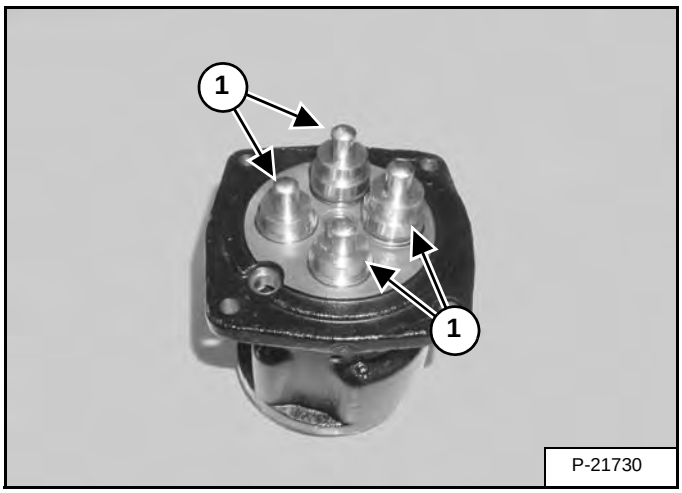
Figure 20-120-21



Mark the plate (Item 1) **[Figure 20-120-21]** for correct installation.

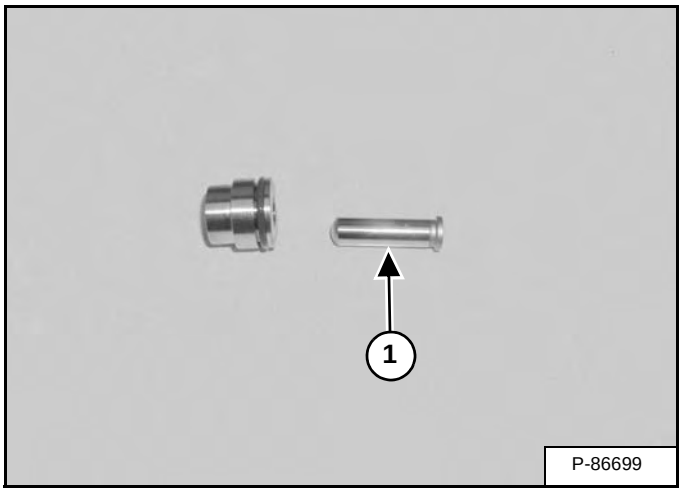
Remove the plate.

Figure 20-120-22



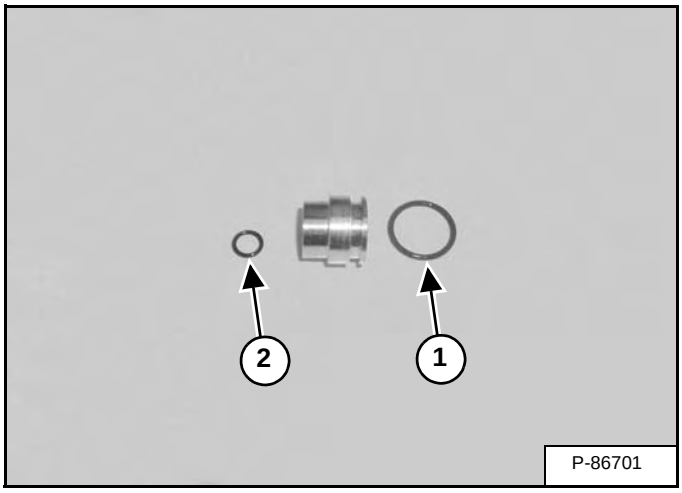
Remove the plug assemblies (Item 1) **[Figure 20-120-22]**.

Figure 20-120-23



Remove the push rod (Item 1) **[Figure 20-120-23]**.

Figure 20-120-24

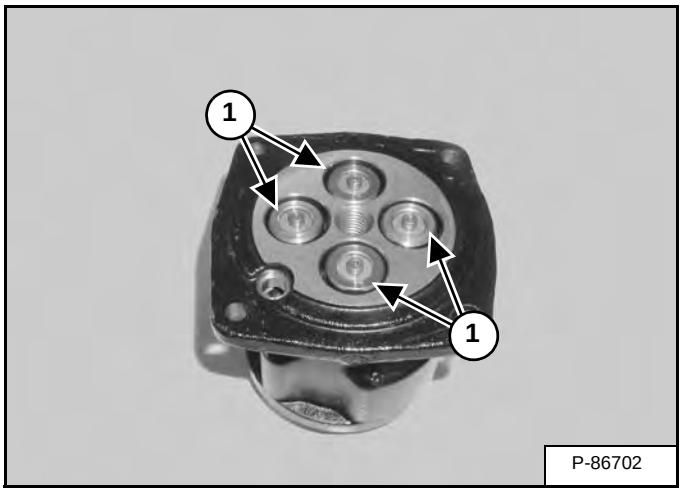


Remove the O-ring (Item 1) from the O.D. of the plug. Remove the seal (Item 2) **[Figure 20-120-24]** from the I.D. of the plug.

Dealer Copy -- Not for Resale

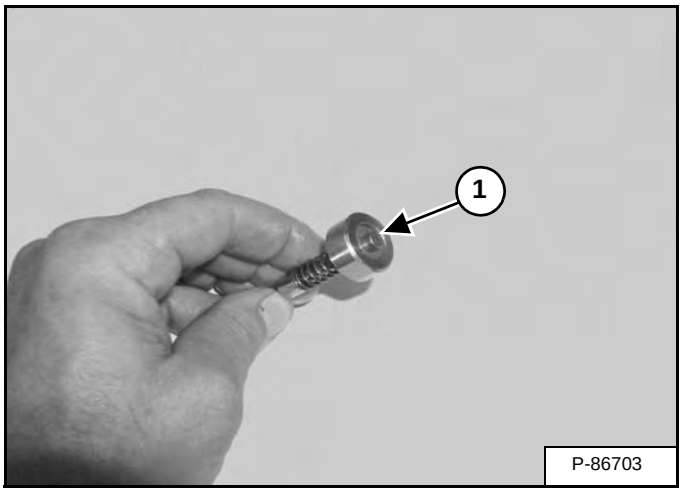
Disassembly And Assembly (Cont'd)

Figure 20-120-25



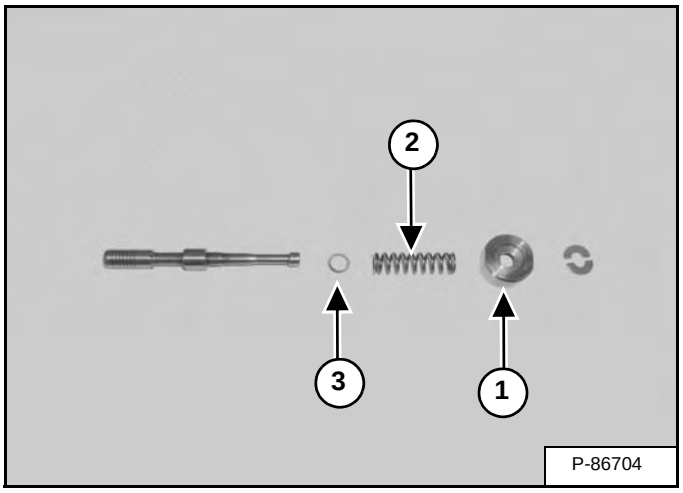
Remove the spool assemblies (Item 1) **[Figure 20-120-25]**.

Figure 20-120-26



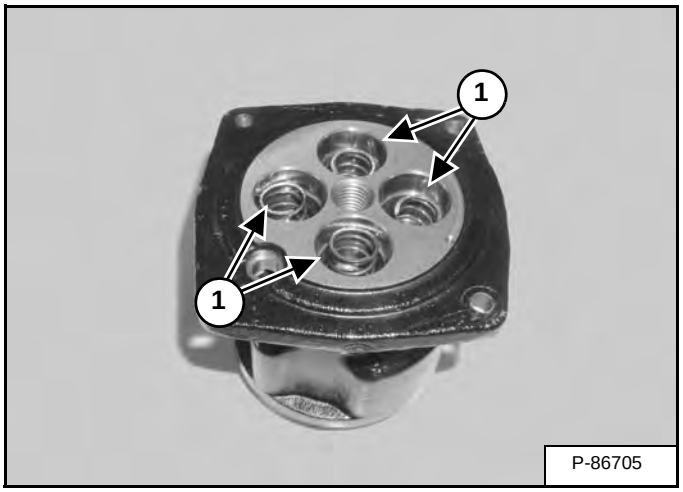
Compress the spring and remove the spring retainers (Item 1) **[Figure 20-120-26]**.

Figure 20-120-27



Remove the spring seat (Item 1), spring (Item 2), and washer (Item 3) **[Figure 20-120-27]** from the spool.

Figure 20-120-28



Remove the springs (Item 1) **[Figure 20-120-28]**.

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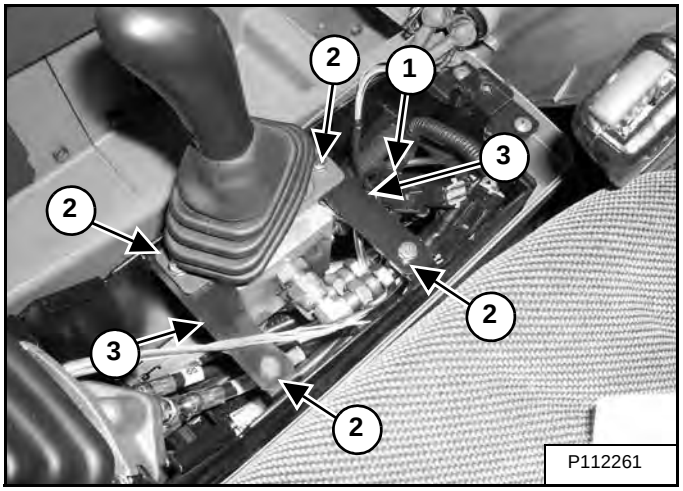
Dealer Copy -- Not for Resale

BLADE CONTROL VALVE

Removal And Installation

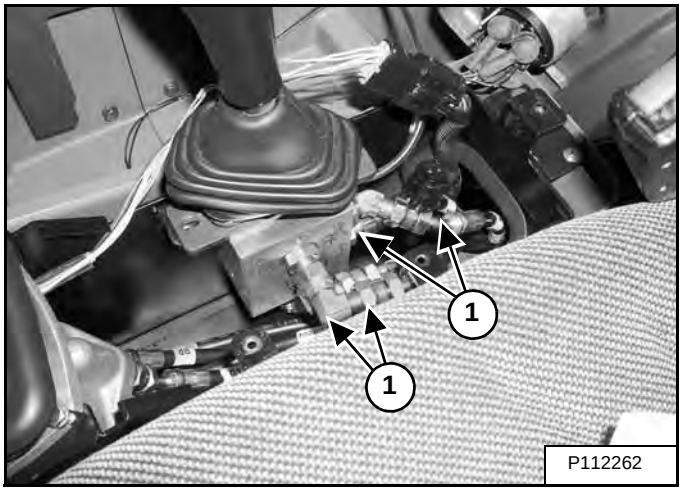
Remove the right console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 20-130-1



Disconnect the wire harness (Item 1). Remove the bolts (Item 2) and plates (Item 3) **[Figure 20-130-1]**.

Figure 20-130-2



Mark and remove the four hoses (Item 1) **[Figure 20-130-2]**. Tilt the valve towards the rear of the cab and move the two hoses on the bottom of the valve.

Remove the valve.

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.

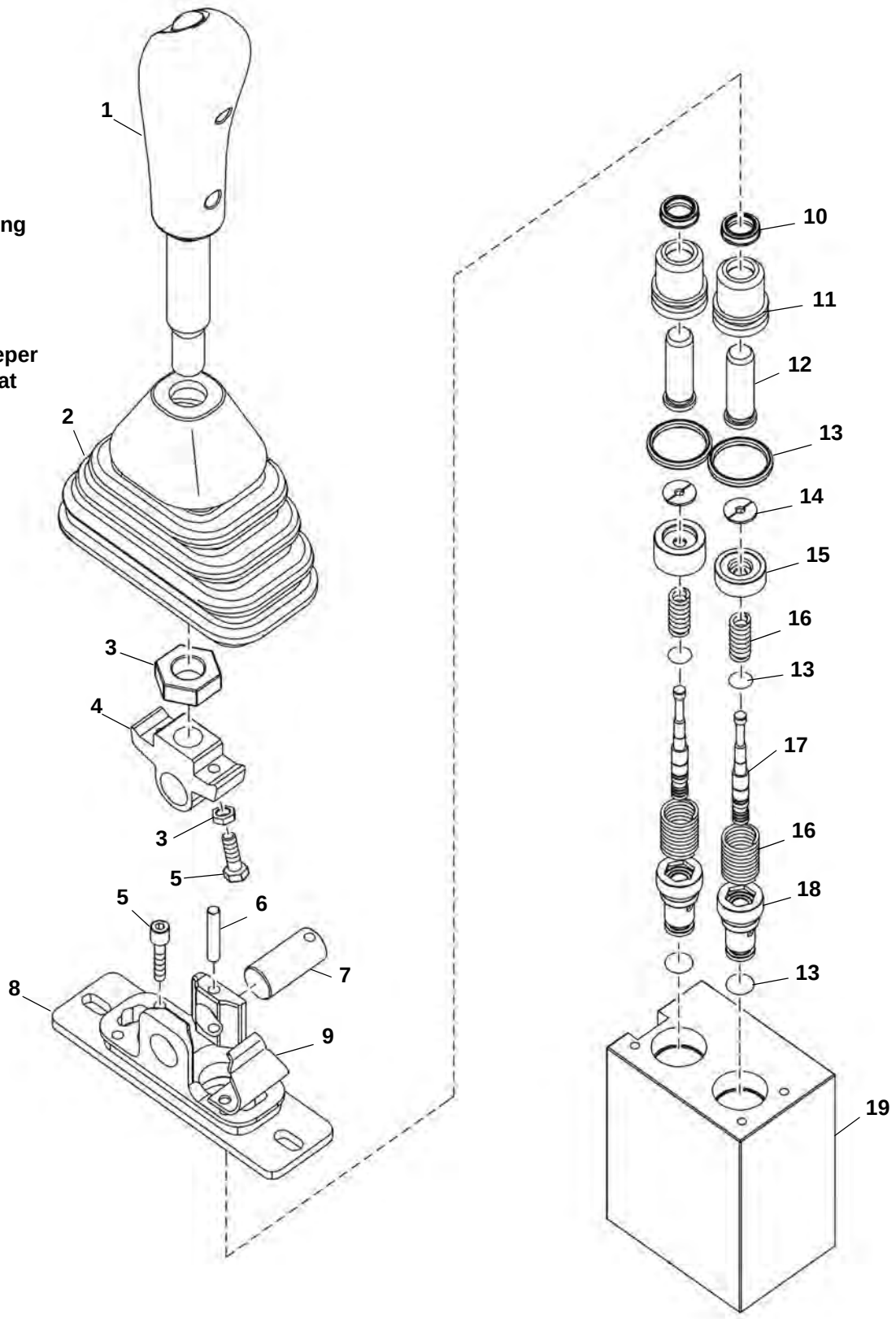
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BLADE CONTROL VALVE (CONT'D)

Parts Identification

1. Lever
2. Dust Boot
3. Nut
4. Guide
5. Bolt
6. Roll Pin
7. Pin
8. Cover
9. Detent Spring
10. Seal
11. Plug
12. Plunger
13. O-ring
14 Spring Keeper
15. Spring Seat
16. Spring
17. Spool
18. Plug
19. Body

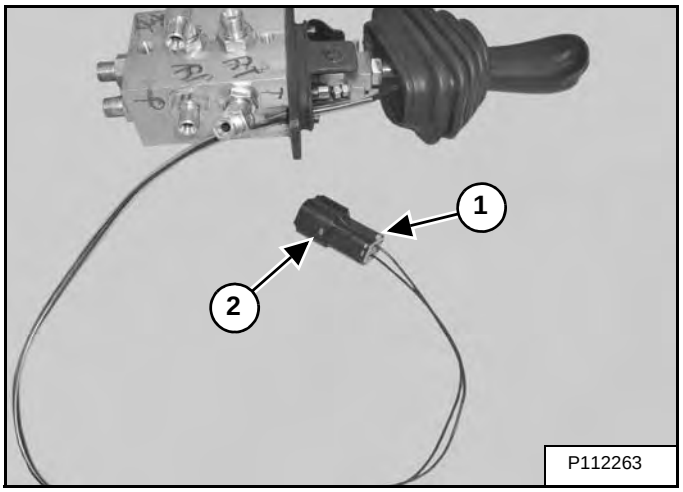


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Dealer Copy -- Not for Resale

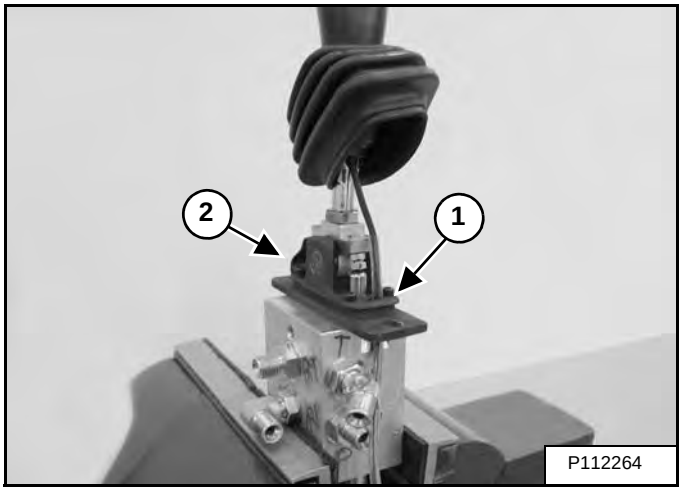
Disassembly And Assembly

Figure 20-130-3



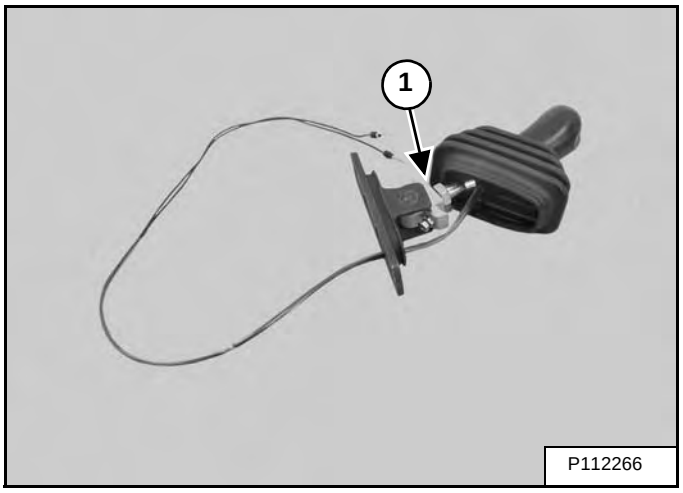
Remove the connector lock (Item 1) and remove the connector (Item 2) **[Figure 20-130-3]** from the wire harness.

Figure 20-130-4



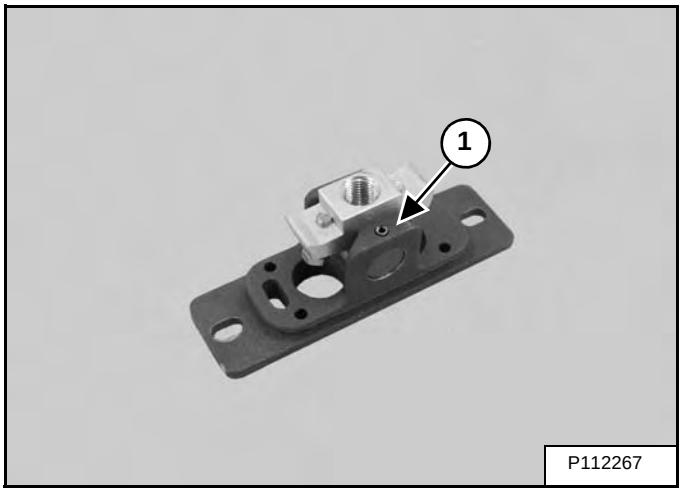
Remove the four bolts (Item 1) and detent spring (Item 2) **[Figure 20-130-4]**.

Figure 20-130-5



Loosen the nut (Item 1) **[Figure 20-130-5]** and remove the handle.

Figure 20-130-6

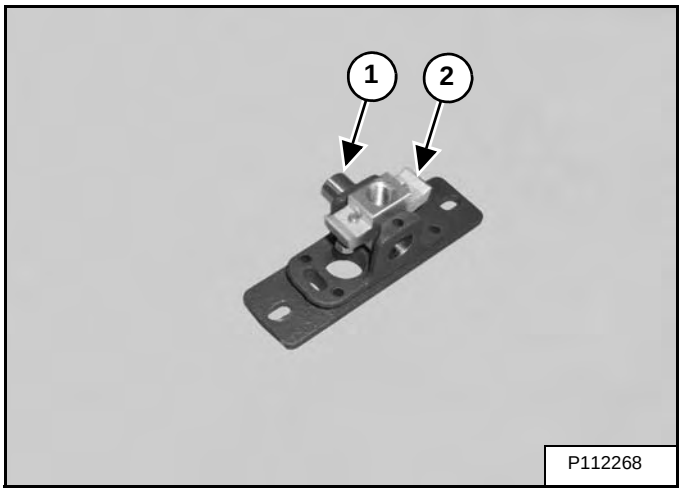


Remove the roll pin (Item 1) **[Figure 20-130-6]**.

Dealer Copy -- Not for Resale

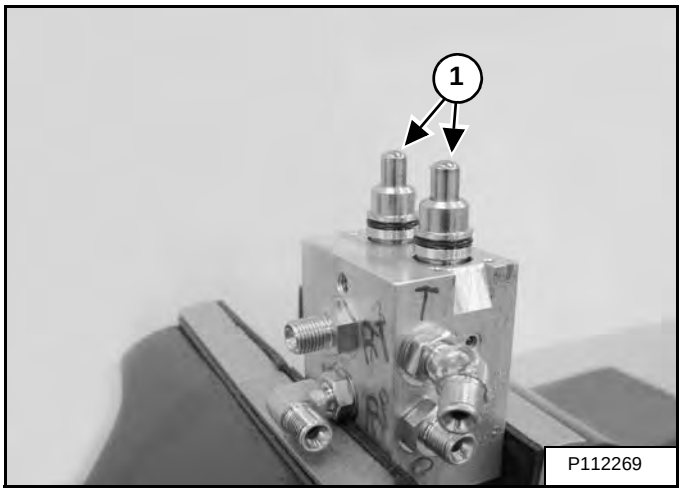
Disassembly And Assembly (Cont'd)

Figure 20-130-7



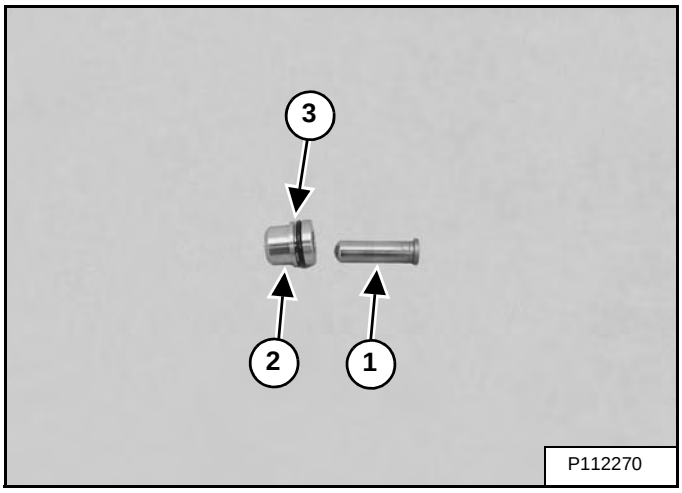
Remove the pin (Item 1) and guide (Item 2) **[Figure 20-130-7]**.

Figure 20-130-8



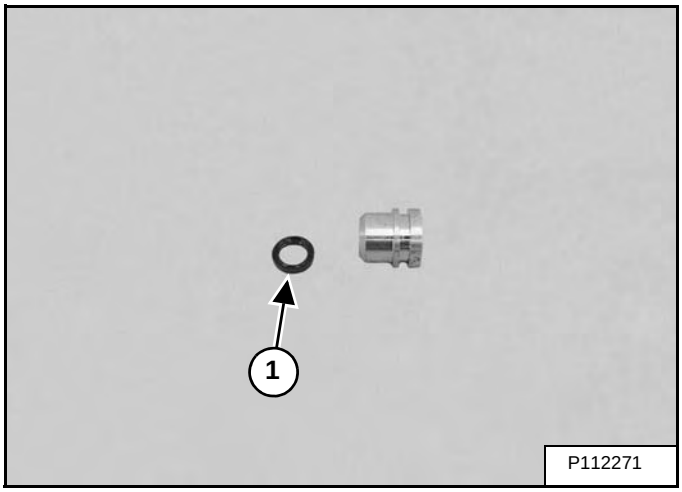
Remove the plunger / plug assemblies (Item 1) **[Figure 20-130-8]**.

Figure 20-130-9



Remove the plunger (Item 1) from the plug (Item 2). Remove the O-ring (Item 3) **[Figure 20-130-9]**.

Figure 20-130-10

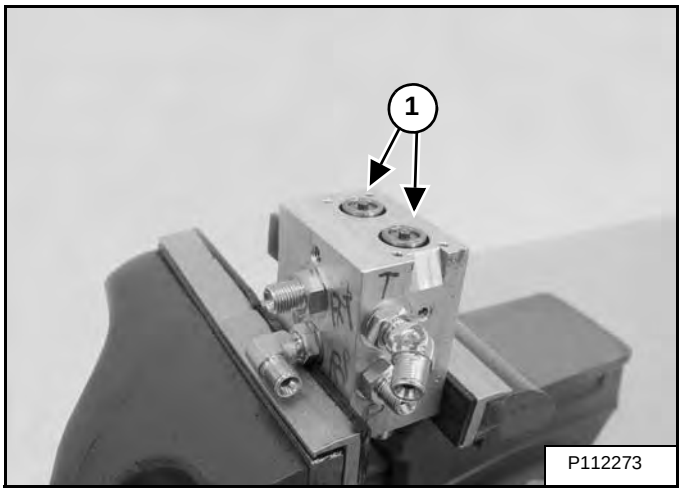


Remove the seal (Item 1) **[Figure 20-130-10]** from the inside of the plug.

Dealer Copy -- Not for Resale

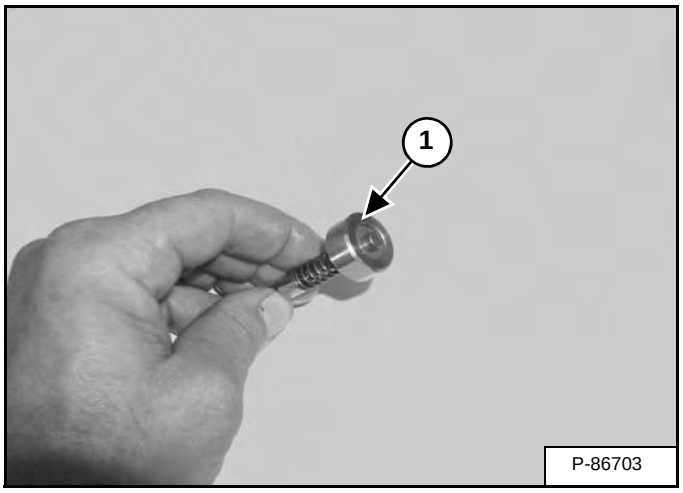
Disassembly And Assembly (Cont'd)

Figure 20-130-11



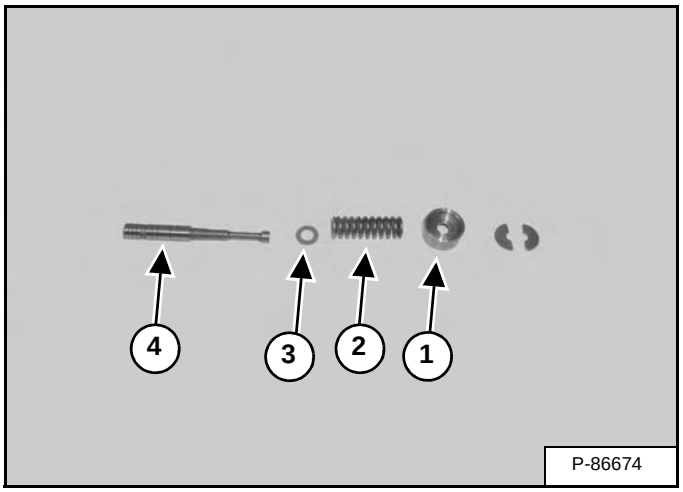
Remove the spool assemblies (Item 1) **[Figure 20-130-11]**.

Figure 20-130-12



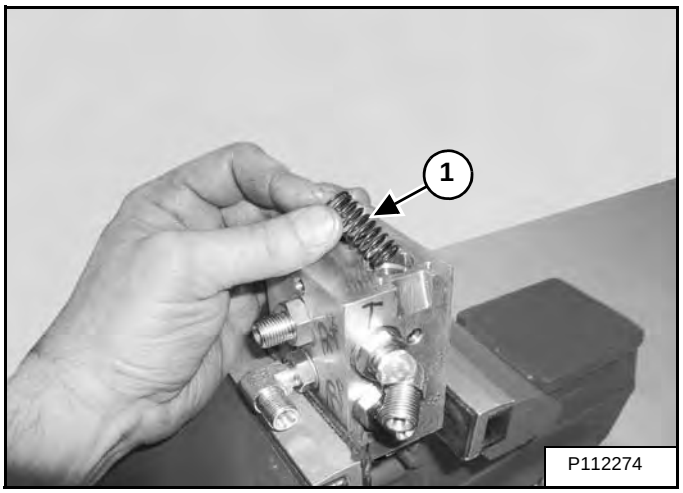
Compress the spring and remove the spring keepers (Item 1) **[Figure 20-130-12]**.

Figure 20-130-13



Remove the spring seat (Item 1), spring (Item 2), and washer (Item 3) from the spool (Item 4) **[Figure 20-130-13]**.

Figure 20-130-14

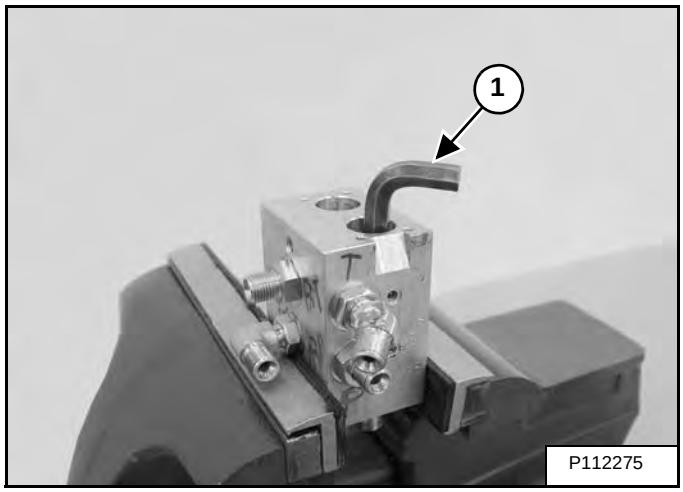


Remove the springs (Item 1) **[Figure 20-130-14]**.

Dealer Copy -- Not for Resale

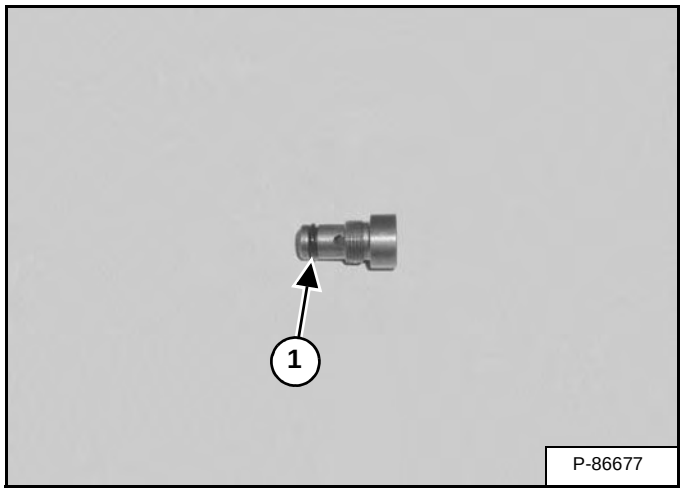
Disassembly And Assembly (Cont'd)

Figure 20-130-15



Use a 10 mm hex wrench (Item 1) **[Figure 20-130-15]** to remove the plugs.

Figure 20-130-16



Remove the O-ring (Item 1) **[Figure 20-130-16]** from the plug.

Dealer Copy -- Not for Resale

HYDRAULIC RESERVOIR

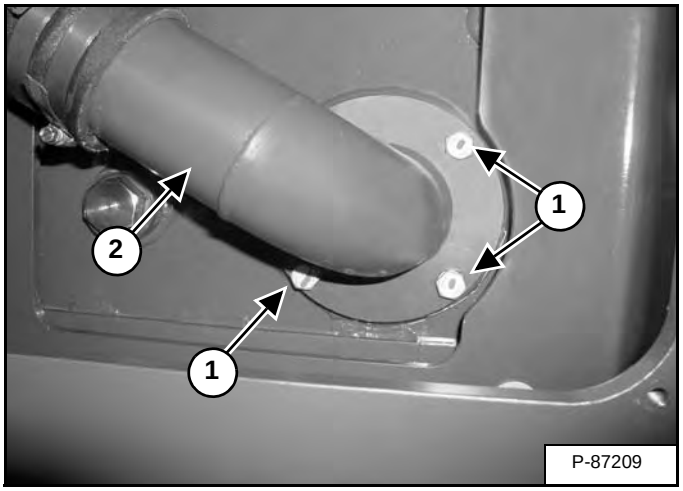
Removal And Installation

Remove the fuel tank. (See Removal And Installation on Page 40-110-1.)

Drain the hydraulic fluid. (See Removing And Replacing Hydraulic Fluid on Page 10-140-6.)

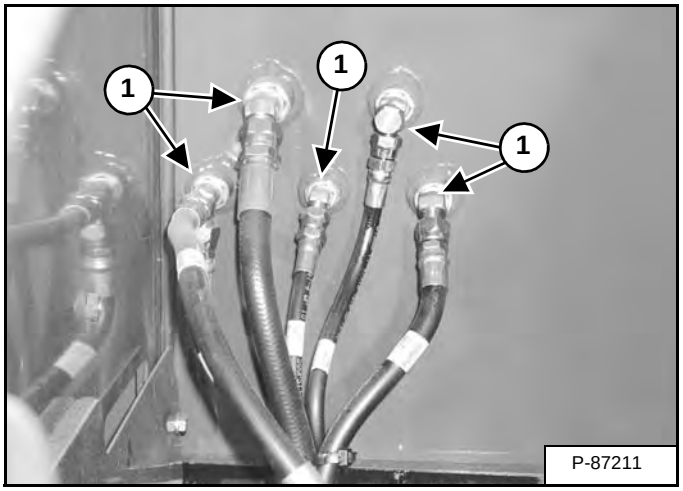
Remove the suction filter. (See Removing And Replacing Hydraulic Filters on Page 10-140-2.)

Figure 20-140-1



Remove the bolts (Item 1), washers and suction tube (Item 2) **[Figure 20-140-1]**.

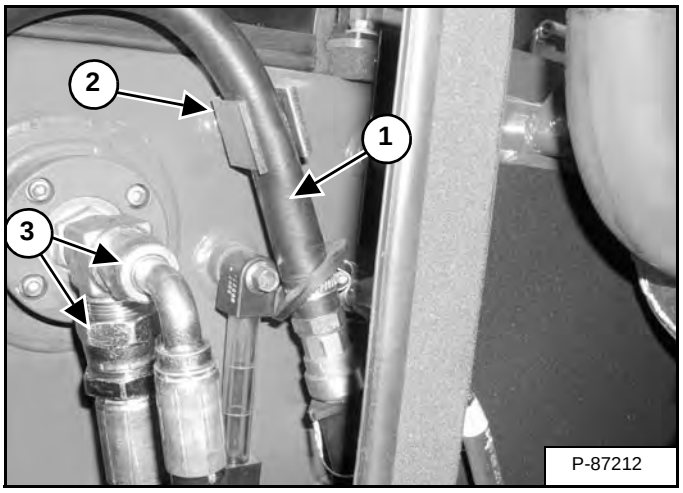
Figure 20-140-2



Remove the hydraulic return lines (Item 1) **[Figure 20-140-2]** from the front of the tank.

NOTE: Mark the hydraulic hoses for ease of installation.

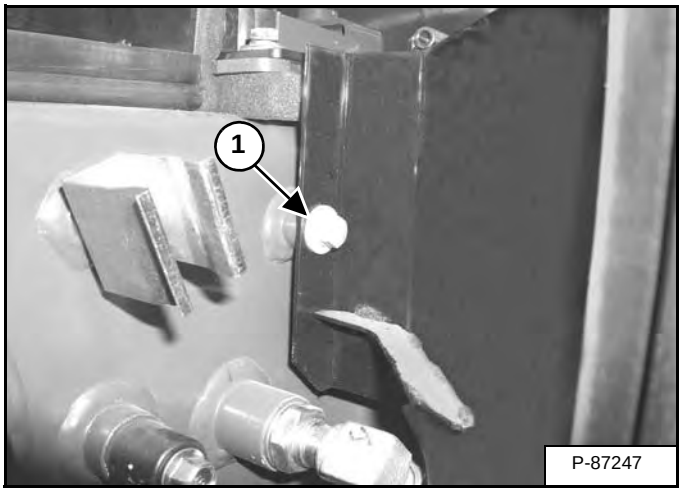
Figure 20-140-3



Remove the fuel transfer line (Item 1) from the hose restraint (Item 2) **[Figure 20-140-3]**.

Remove the hoses (Item 3) **[Figure 20-140-3]**.

Figure 20-140-4

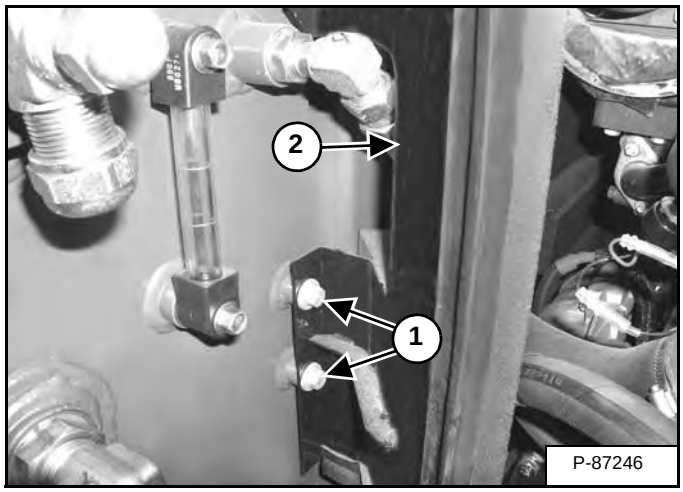


Remove the bolt (Item 1) **[Figure 20-140-4]**.

Dealer Copy -- Not for Resale

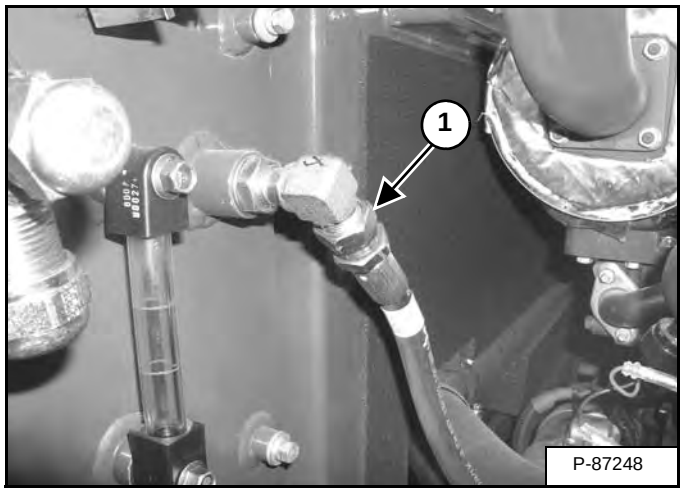
Removal And Installation (Cont'd)

Figure 20-140-5



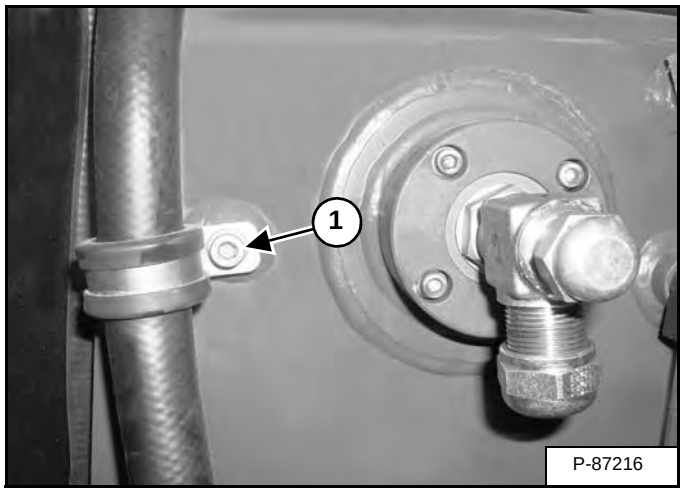
Remove the bolts (Item 1) and shield (Item 2) **[Figure 20-140-5]**.

Figure 20-140-6



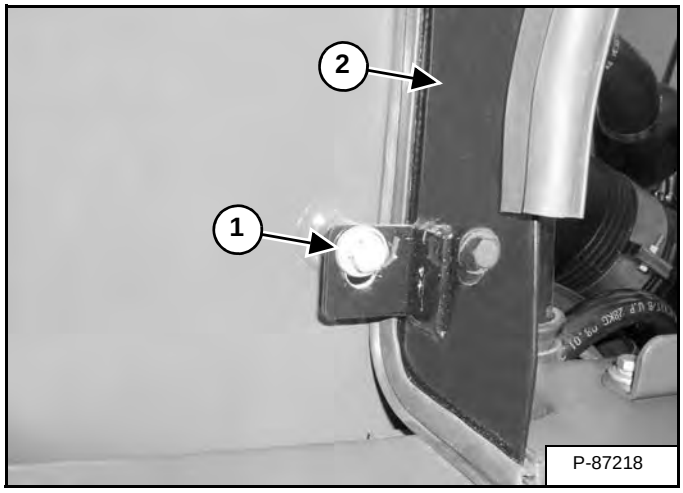
Remove the hydraulic hose (Item 1) **[Figure 20-140-6]**.

Figure 20-140-7



Remove the bolt (Item 1) **[Figure 20-140-7]**.

Figure 20-140-8

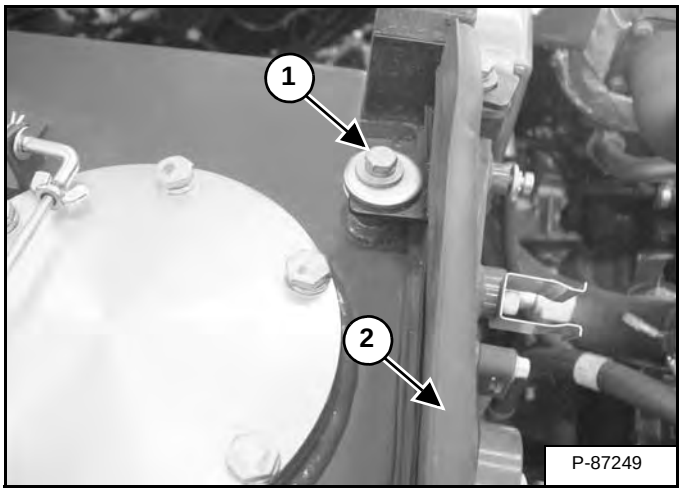


Remove the bolt (Item 1) and shield (Item 2) **[Figure 20-140-8]**.

Dealer Copy -- Not for Resale

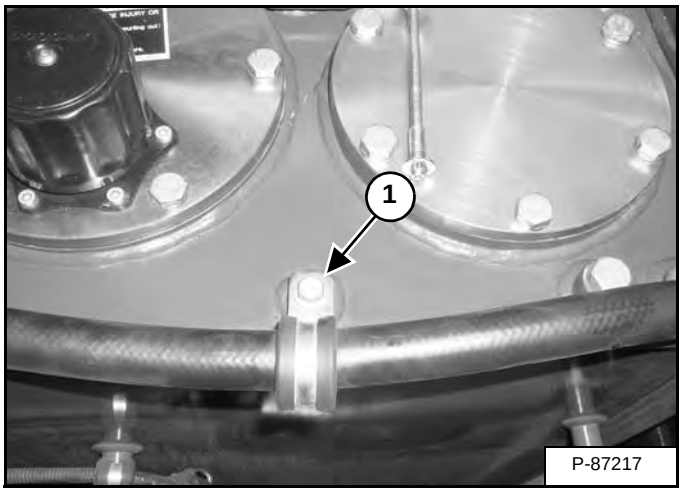
Removal And Installation (Cont'd)

Figure 20-140-9



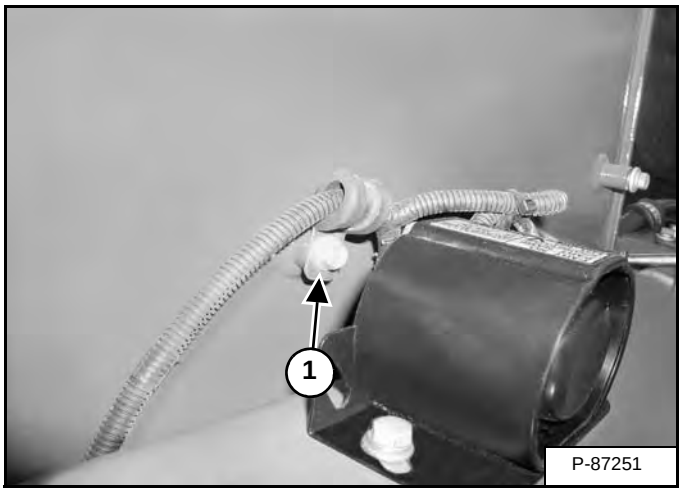
Remove the bolt (Item 1) and shield (Item 2) **[Figure 20-140-9]**.

Figure 20-140-10



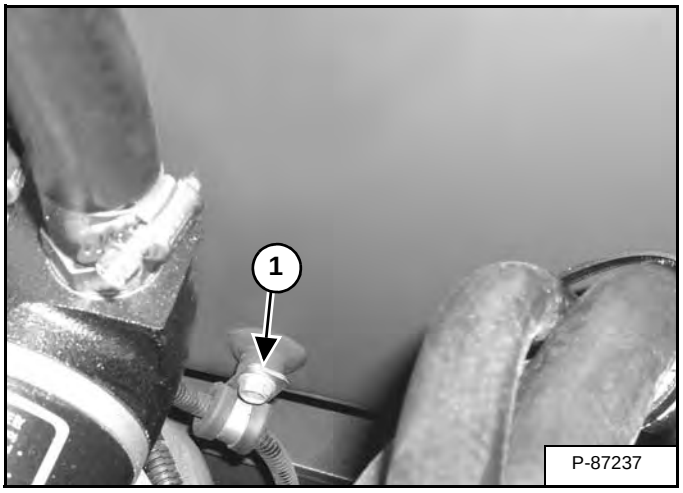
Remove the P-clamp bolt (Item 1) **[Figure 20-140-10]** and reposition the hose so that it will not interfere with the removal of the tank.

Figure 20-140-11



Remove the bolt (Item 1) **[Figure 20-140-11]**.

Figure 20-140-12

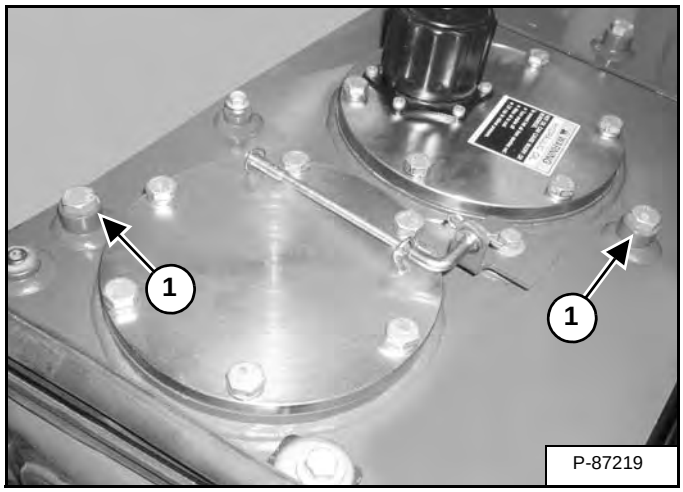


Remove the bolt (Item 1) **[Figure 20-140-12]**.

Dealer Copy -- Not for Resale

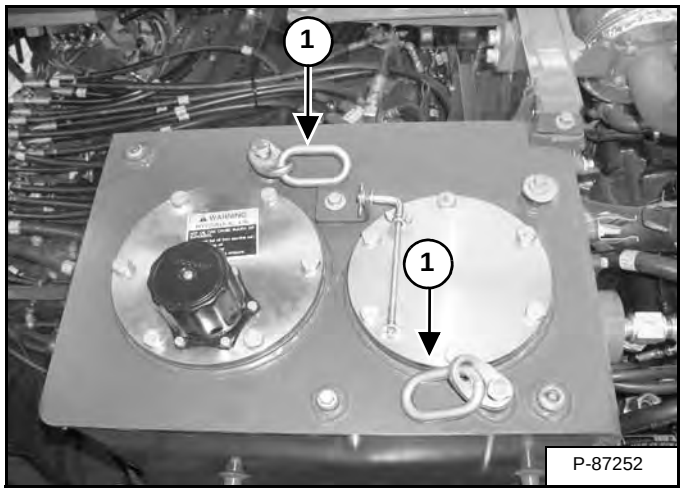
Removal And Installation (Cont'd)

Figure 20-140-13



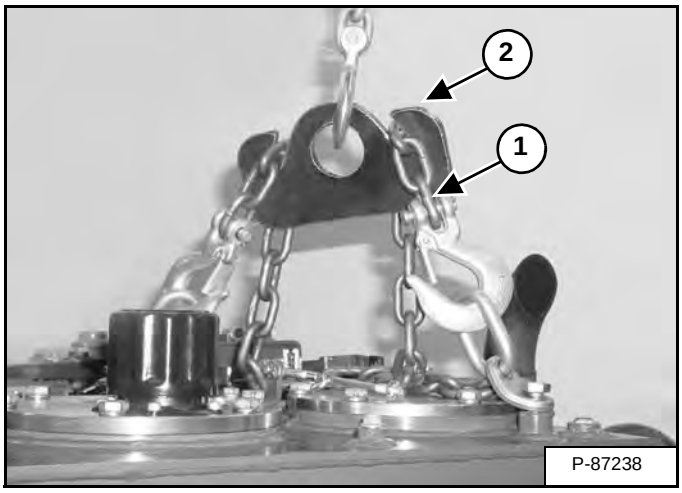
Remove the bolts (Item 1) **[Figure 20-140-13]** from the reservoir lifting points.

Figure 20-140-14



Install lifting rings (Item 1) **[Figure 20-140-14]**.

Figure 20-140-15

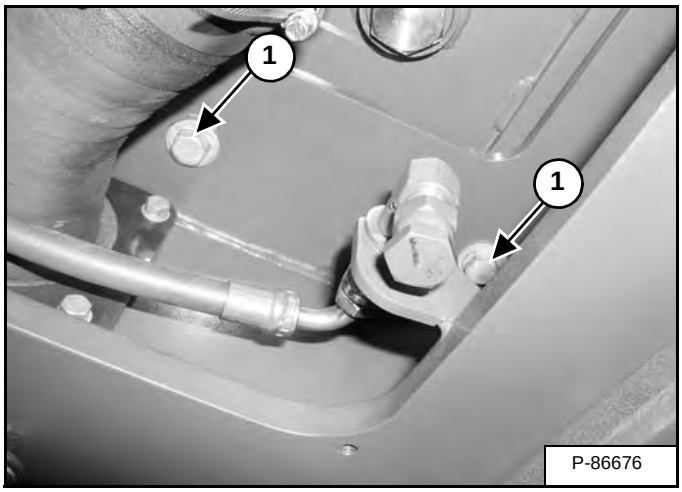


Attach a chain (Item 1) and lifting device (Item 2) **[Figure 20-140-15]**.

Dealer Copy -- Not for Resale

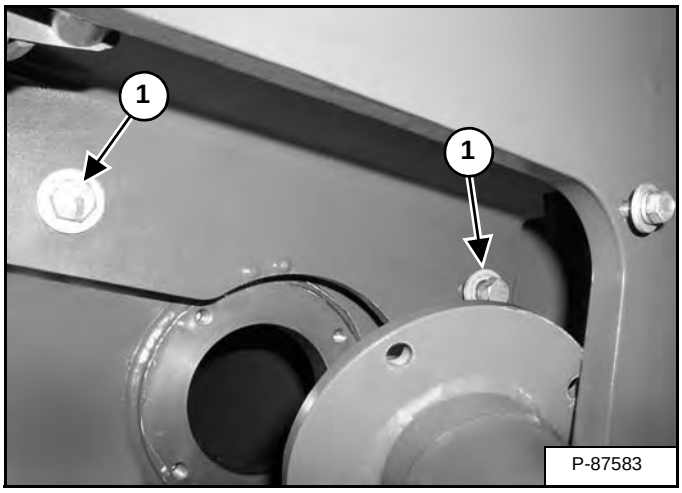
Removal And Installation (Cont'd)

Figure 20-140-16



Remove the bolts (Item 1) **[Figure 20-140-16]** and washers.

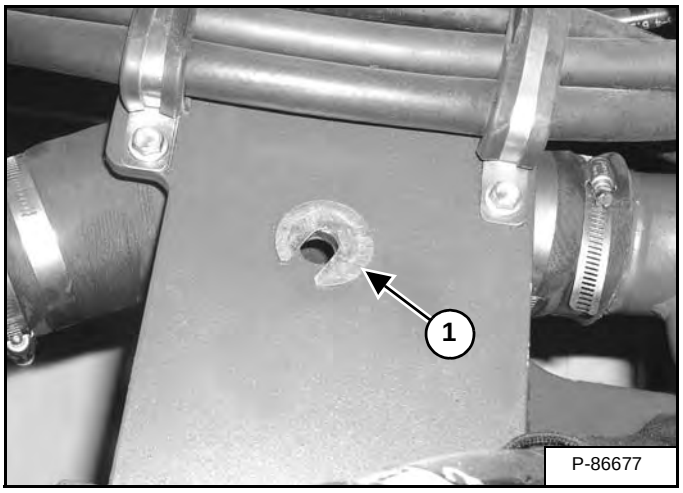
Figure 20-140-17



Remove the bolts (Item 1) **[Figure 20-140-17]** and washers.

Remove the hydraulic reservoir.

Figure 20-140-18



Inspect the mounting plate for shims (Item 1) **[Figure 20-140-18]**. Record the number and the locations of the shims for ease of installation.

Dealer Copy -- Not for Resale



Dealer Copy -- Not for Resale

OIL COOLER

Removal And Installation

The oil cooler and radiator are removed from the excavator as a unit. (See Radiator Removal And Installation on Page 60-50-1.)

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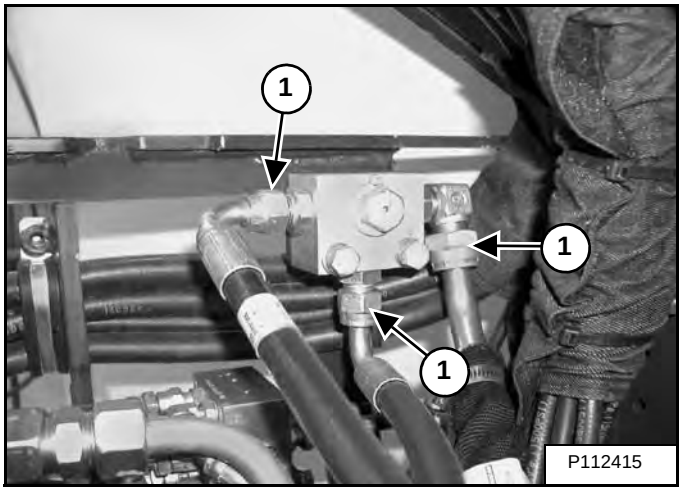
Dealer Copy -- Not for Resale

DIRECT TO TANK VALVE

Removal And Installation

Raise the cab.

Figure 20-160-1



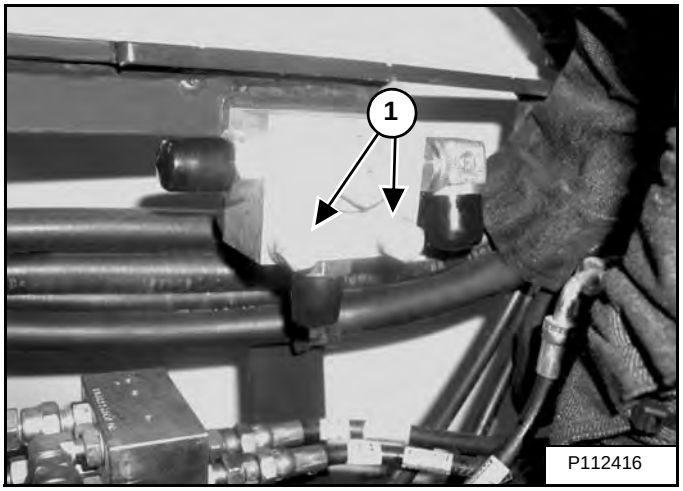
Mark and remove the three hoses (Item 1) **[Figure 20-160-1]**.

IMPORTANT

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

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Figure 20-160-2

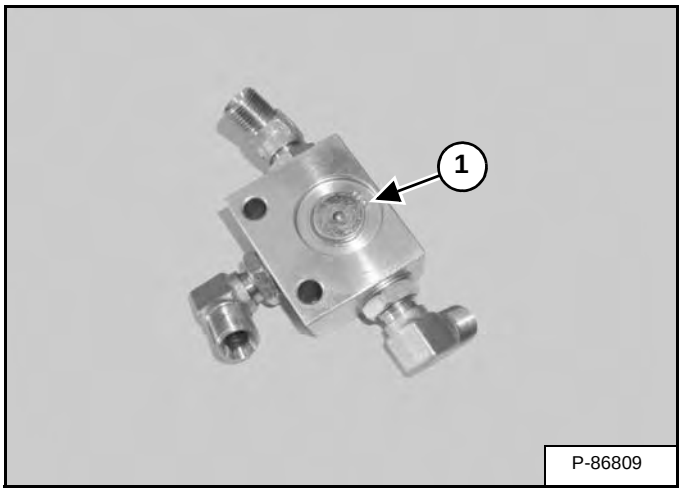


Remove the bolts (Item 1) **[Figure 20-160-2]** and washers. Remove the valve from the machine.

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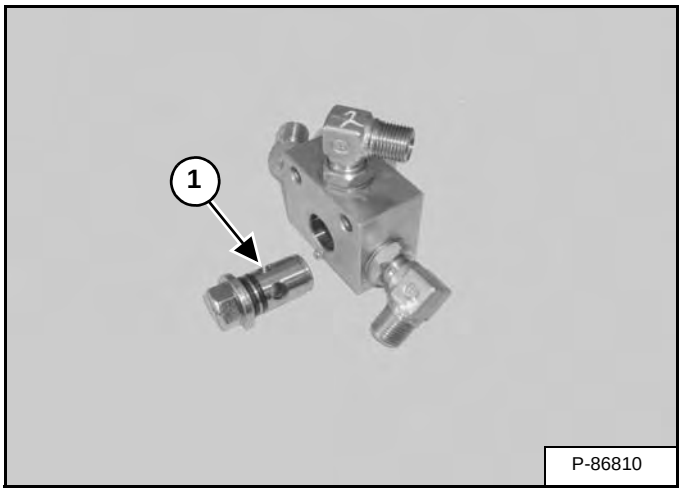
Disassembly And Assembly

Figure 20-160-3



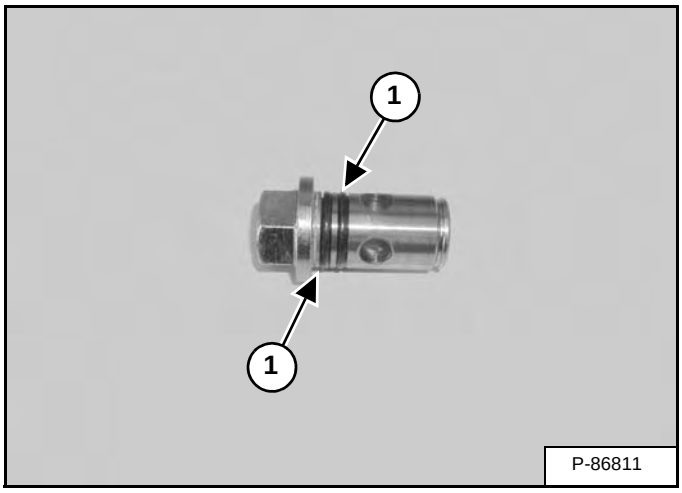
Remove the snap ring (Item 1) **[Figure 20-160-3]**.

Figure 20-160-4



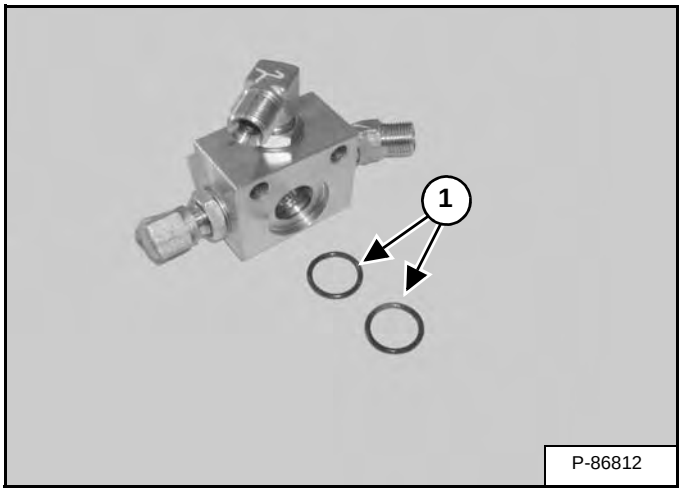
Remove the spool (Item 1) **[Figure 20-160-4]**.

Figure 20-160-5



Remove the O-rings (Item 1) **[Figure 20-160-5]** from the spool.

Figure 20-160-6



Remove the O-rings (Item 1) **[Figure 20-160-6]** from the inside bore of the valve.

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SWING MOTOR BRAKE RELEASE

Description

When the left or right swing function is engaged, the swing motor brake release directs pilot pressure to the brake on the swing motor, releasing the brake.

Removal And Installation

Remove the left upperstructure cover. (See Removal And Installation on Page 40-20-1.)

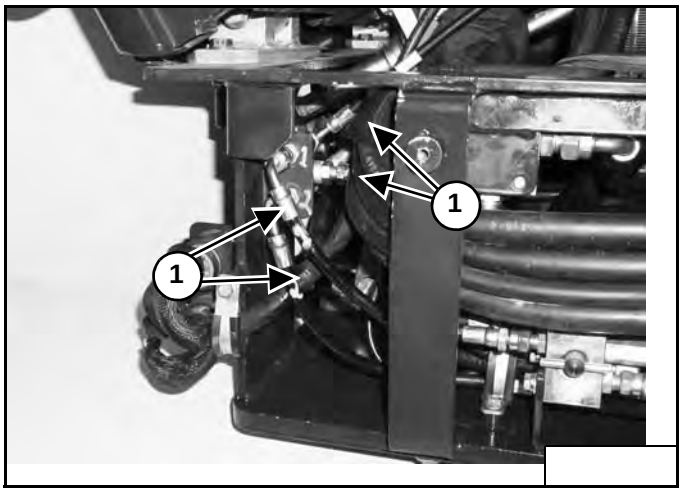
Mark all hoses for proper installation.

IMPORTANT

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

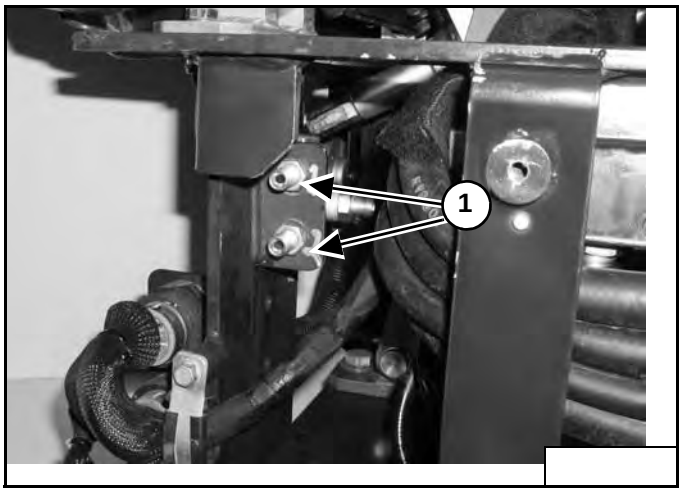
I-2003-0888

Figure 20-170-1



Remove the five hoses (Item 1) **[Figure 20-170-1]**.

Figure 20-170-2

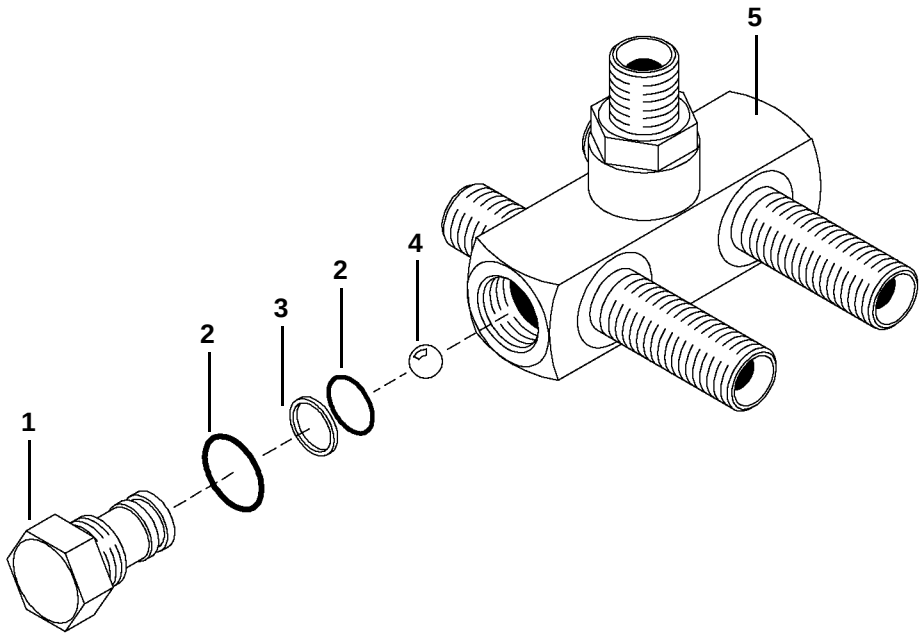


Remove the nut from both fittings (Item 1) **[Figure 20-170-2]** and remove the valve.

Dealer Copy -- Not for Resale

Parts Identification

1. Plug
2. O-ring
3. Back-up Ring
4. Ball
5. Valve Block

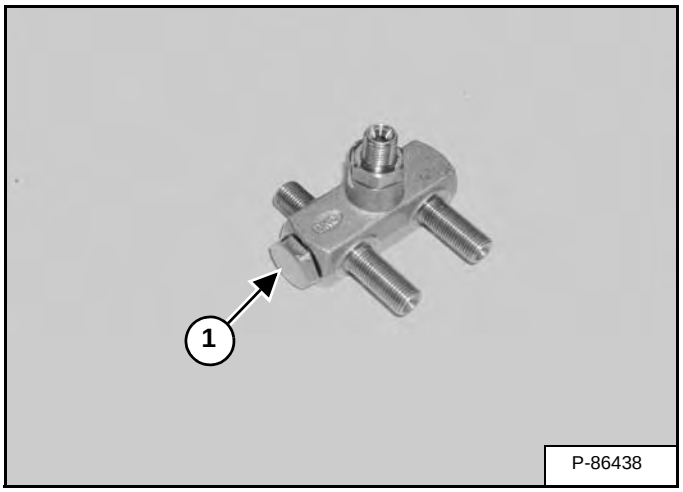


MS-2810S

Dealer Copy -- Not for Resale

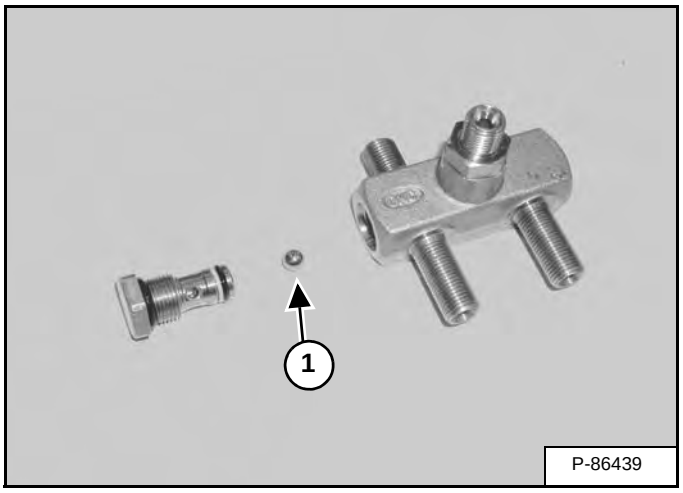
Disassembly And Assembly

Figure 20-170-3



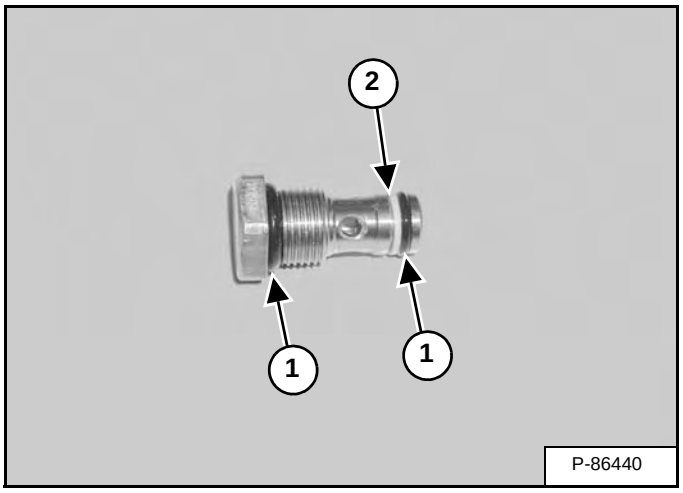
Remove the plug (Item 1) **[Figure 20-170-3]**.

Figure 20-170-4



Remove the ball (Item 1) **[Figure 20-170-4]**.

Figure 20-170-5



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-170-5]** from the plug.

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Dealer Copy -- Not for Resale

EPPR VALVE

Description

The EPPR valve (Electro proportional pressure reducing valve) is a solenoid operated valve that controls the pilot pressure for the boom swing and auxiliary hydraulic functions.

Removal And Installation

Tilt the cab. (See Raising And Lowering on Page 10-210-1.)

⚠ WARNING

AVOID INJURY OR DEATH

Never work under the excavator cab without installing an approved cab support device.

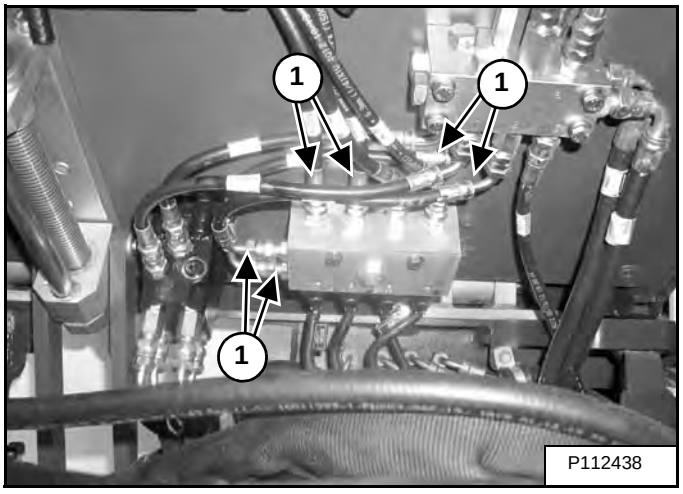
W-2435-0502

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.

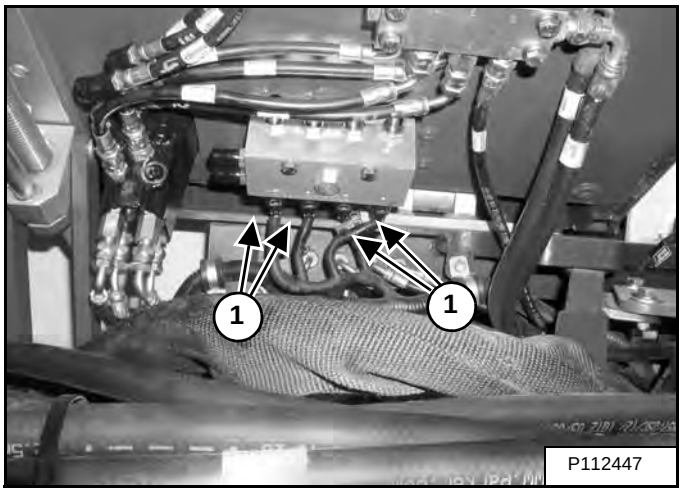
I-2003-0888

Figure 20-180-1



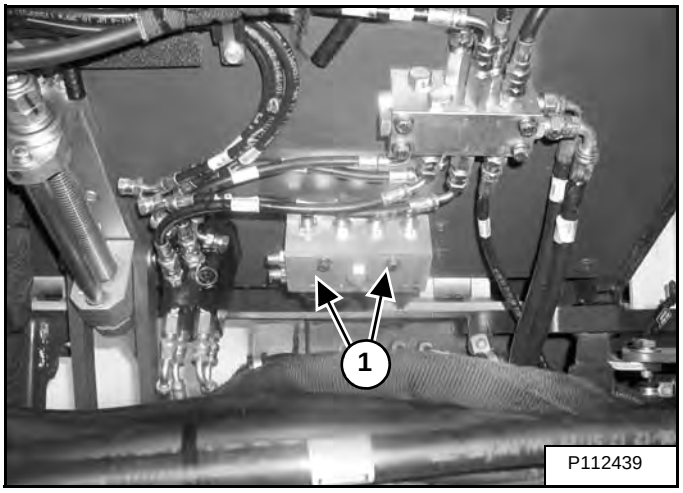
Remove the hoses (Item 1) **[Figure 20-180-1]**.

Figure 20-180-2



Disconnect the wire harness (Item 1) **[Figure 20-180-2]**.

Figure 20-180-3

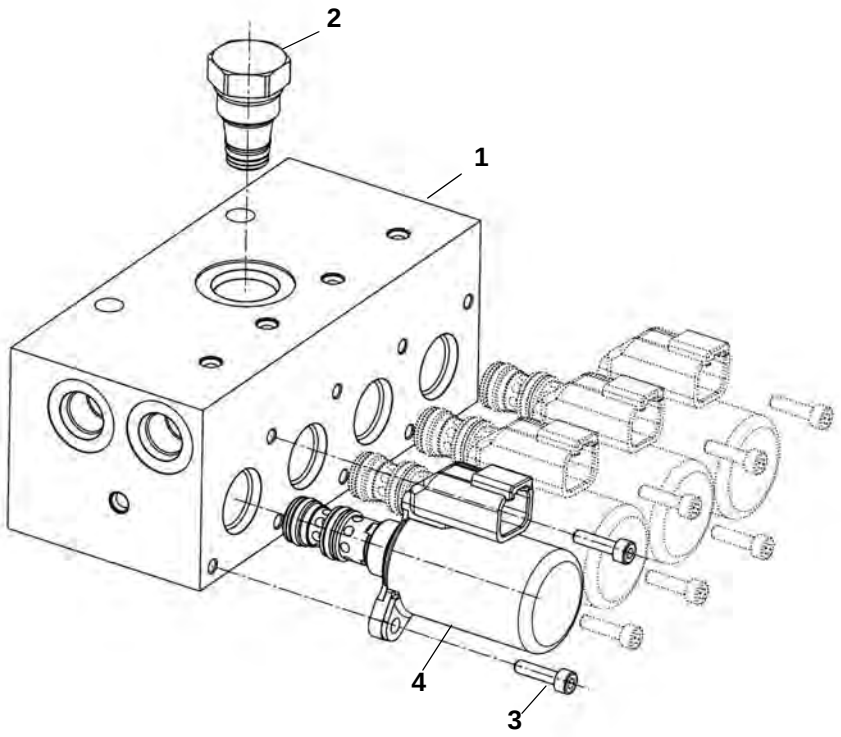


Remove the bolts (Item 1) **[Figure 20-180-3]** and remove the valve.

Dealer Copy -- Not for Resale

Parts Identification

1. Valve Body
2. Filter Screen
3. Screw
4. Solenoid Valve

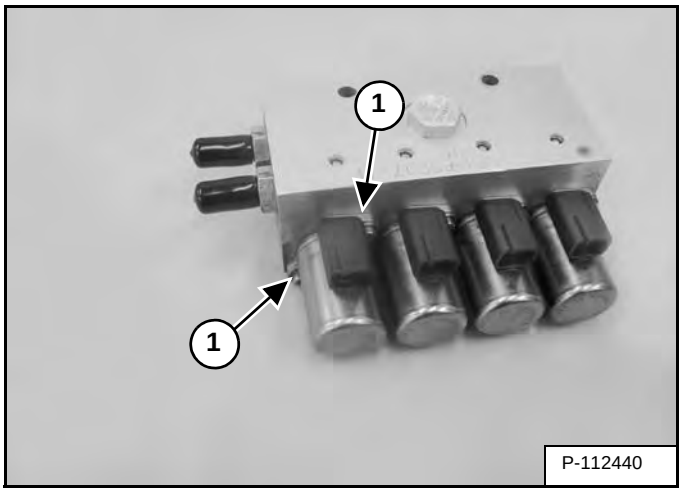


NA5989S

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Disassembly And Assembly

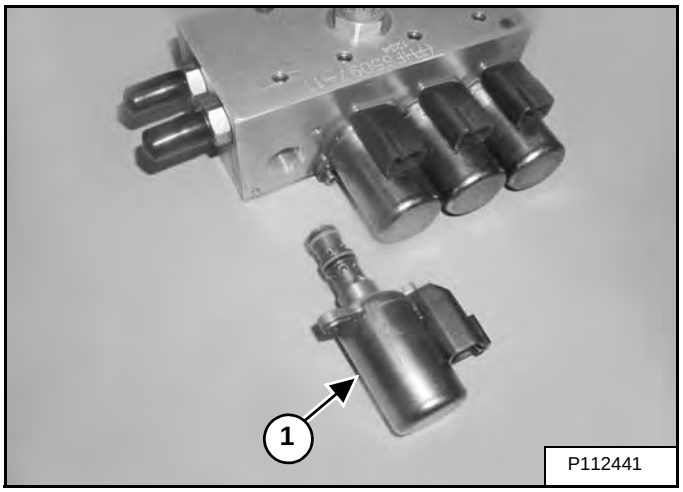
Figure 20-180-4



Remove the screws (Item 1) **[Figure 20-180-4]**.

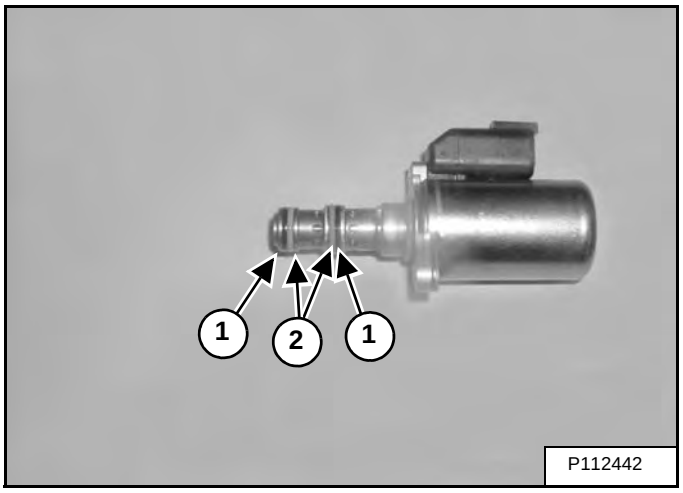
Installation: Tighten the screws to 1,5 N•m (8.8 in lb)

Figure 20-180-5



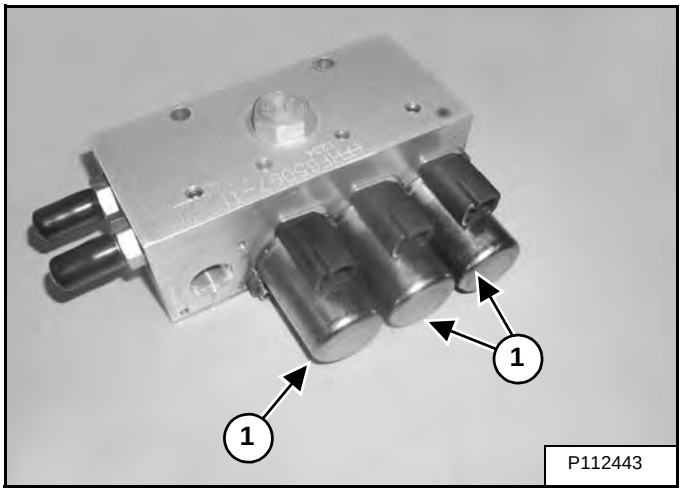
Remove the solenoid valve (Item 1) **[Figure 20-180-5]**.

Figure 20-180-6



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-180-6]**.

Figure 20-180-7

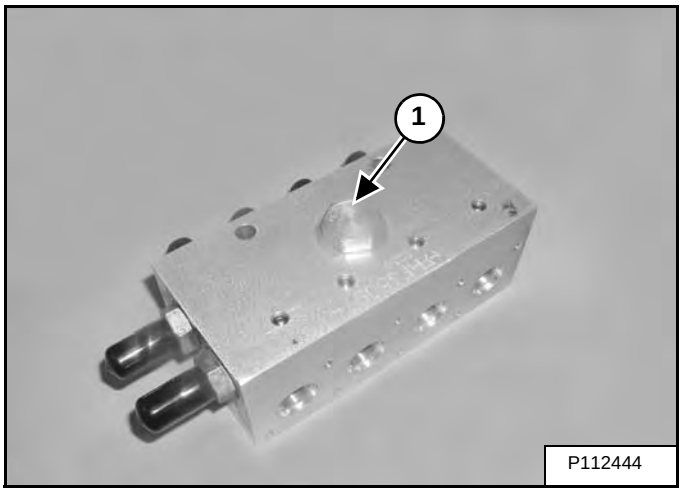


Repeat the procedure for the remaining solenoid valves (Item 1) **[Figure 20-180-7]**.

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Disassembly And Assembly (Cont'd)

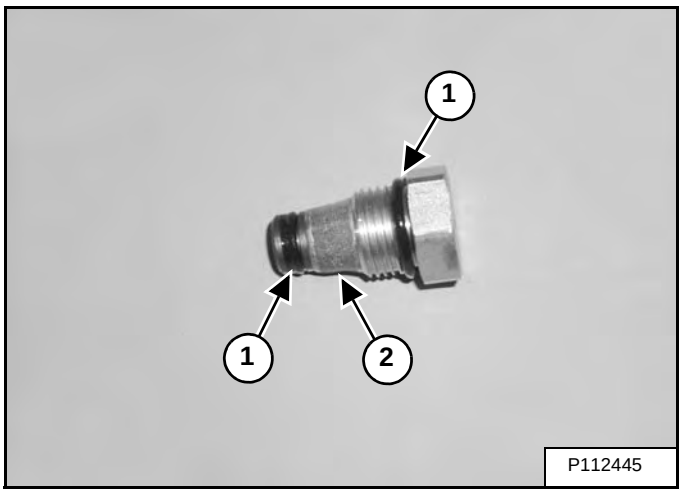
Figure 20-180-8



Remove the filter screen (Item 1) **[Figure 20-180-8]**.

Installation: Tighten the filter screen to 27,1 N•m (20 ft-lb) torque.

Figure 20-180-9



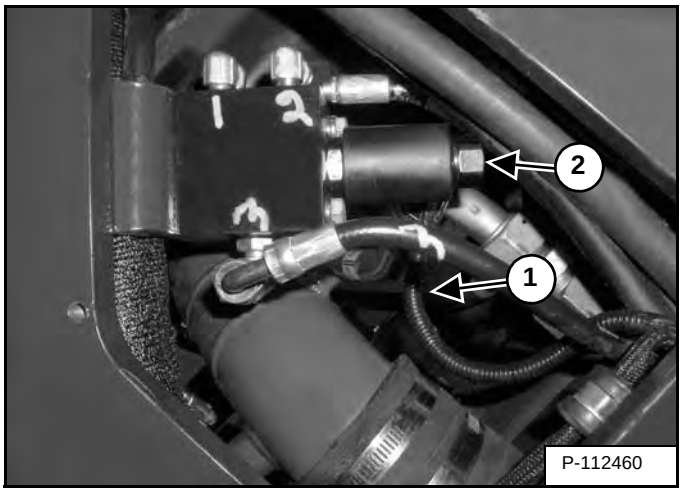
Remove the O-rings (Item 1). Inspect the screen (Item 2) **[Figure 20-180-9]** for damage.

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FORCED REGENERATION VALVE

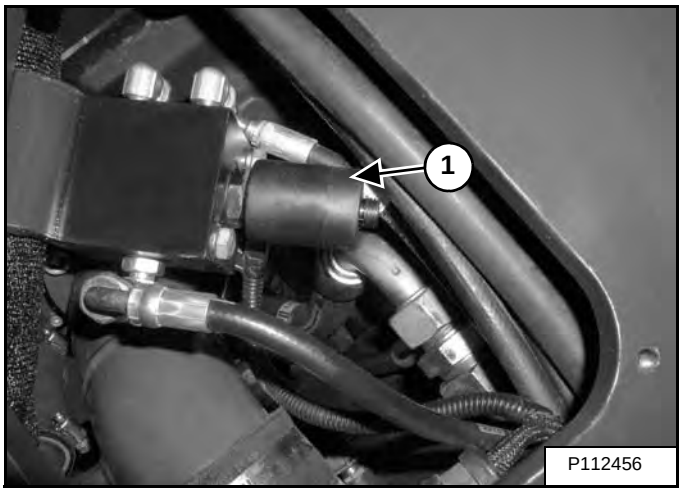
Removal And Installation

Figure 20-190-1



Disconnect the wire harness (Item 1) from the coil. Remove the nut (Item 2) **[Figure 20-190-1]** from the coil.

Figure 20-190-2



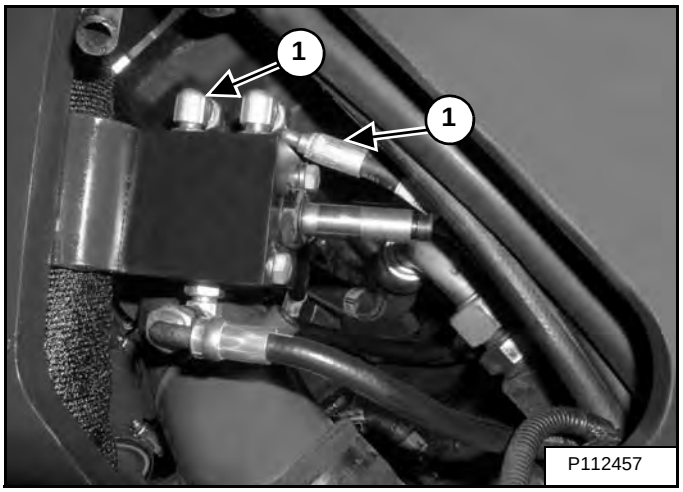
Remove the coil (Item 1) **[Figure 20-190-2]**.

IMPORTANT

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

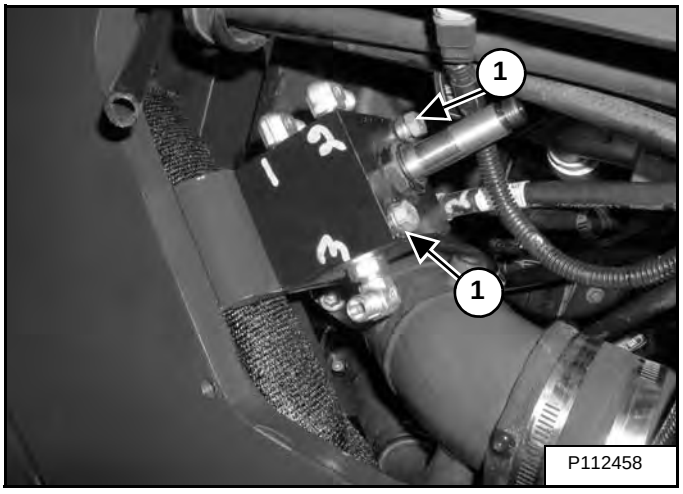
I-2003-0888

Figure 20-190-3



Remove the hoses (Item 1) **[Figure 20-190-3]**.

Figure 20-190-4

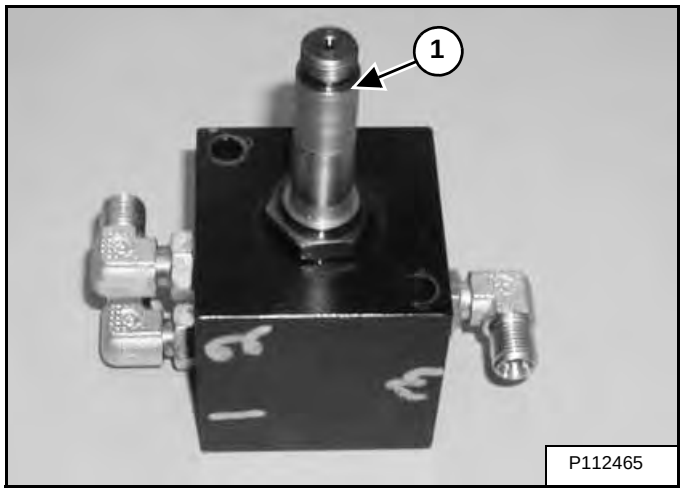


Remove the bolts (Item 1) **[Figure 20-190-4]** and remove the valve.

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Disassembly And Assembly

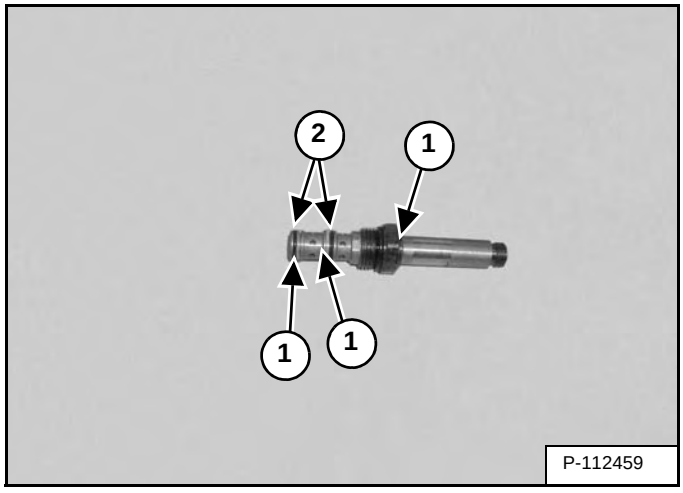
Figure 20-190-5



Remove the solenoid (Item 1) **[Figure 20-190-5]** from the valve body.

Installation: Tighten the solenoid to 20,5 - 25,5 N•m (15.1 - 18.8 ft-lb) torque.

Figure 20-190-6



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-190-6]** from the solenoid.

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ARTICULATED BOOM VALVE (OPTIONAL)

Removal And Installation

Remove the floor mat. (See Removal And Installation on Page 40-100-1.)

Tilt the cab. (See CAB TILT PROCEDURE on Page 10-210-1.)

WARNING

AVOID INJURY OR DEATH

Never work under the excavator cab without installing an approved cab support device.

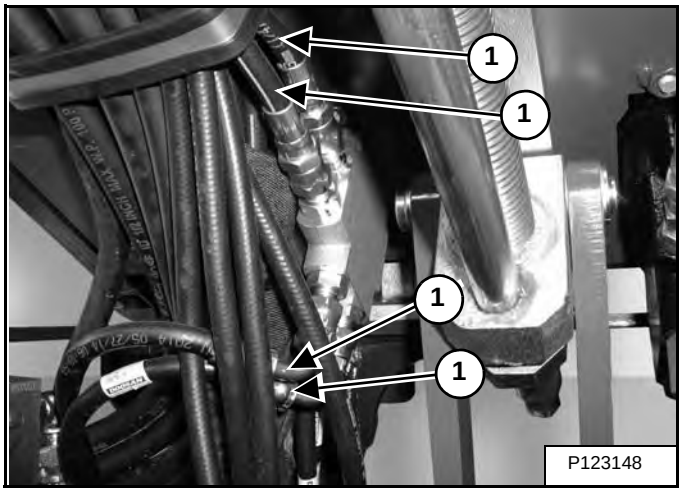
W-2435-0502

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.

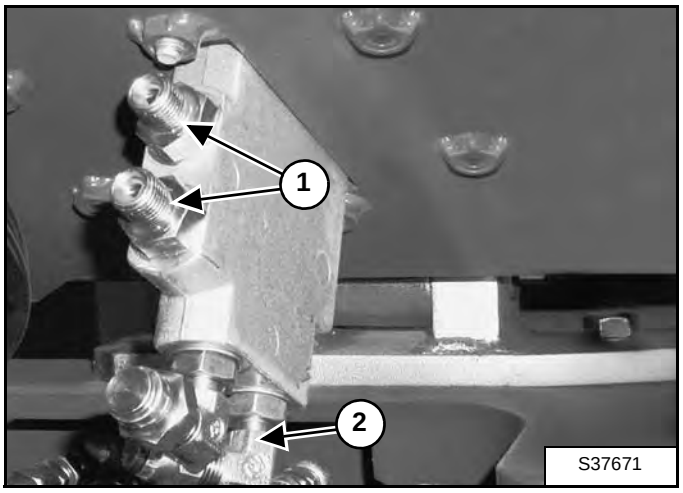
I-2003-0888

Figure 20-200-1



Mark and remove the four hoses (Item 1) **[Figure 20-200-1]**.

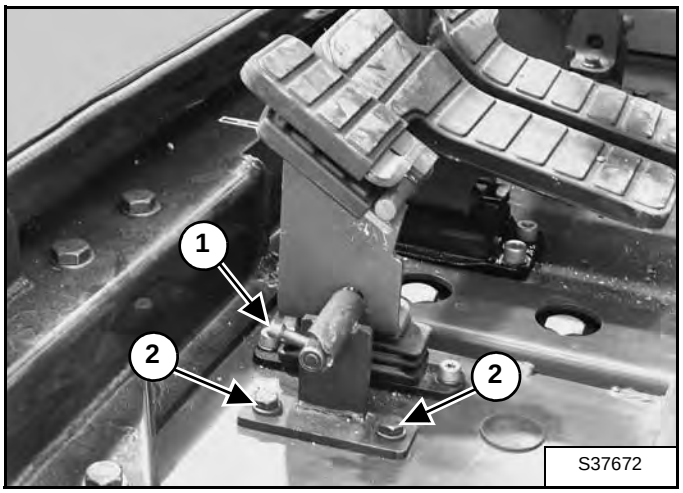
Figure 20-200-2



Remove the two fittings (Item 1) **[Figure 20-200-2]**.

Loosen the bottom fitting (Item 2) **[Figure 20-200-2]**.

Figure 20-200-3



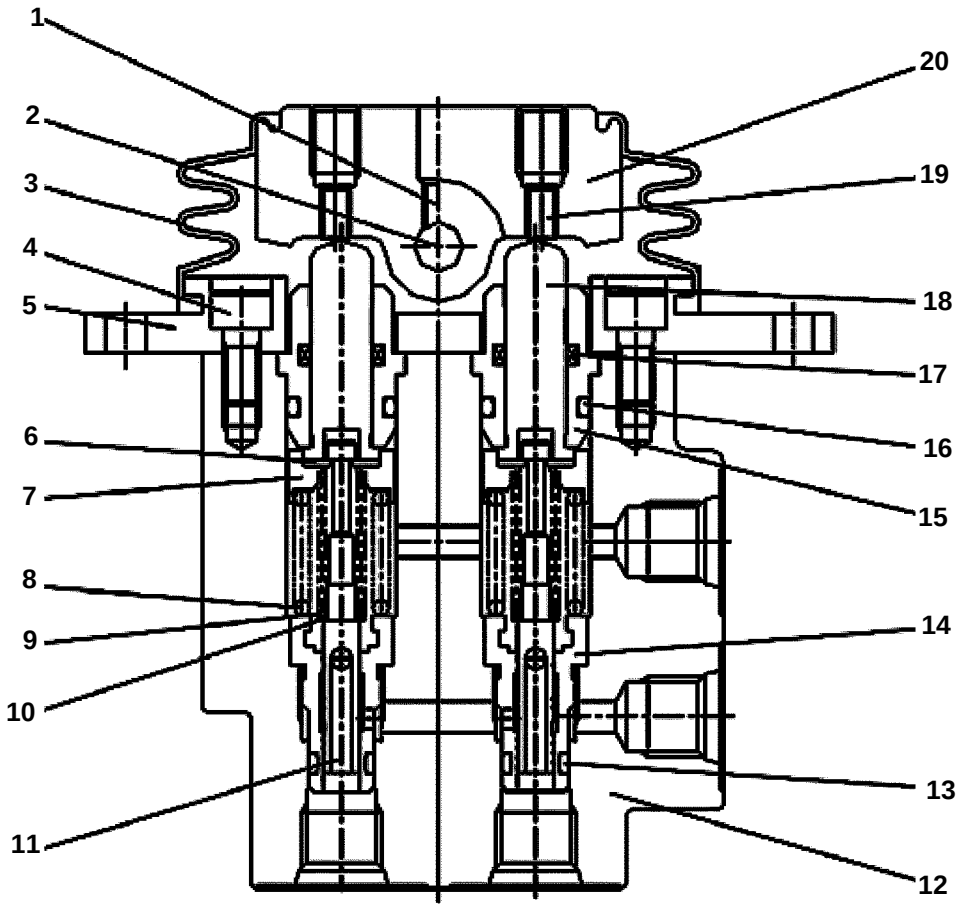
Disengage the pedal lock (Item 1) and remove the two bolts (Item 2) **[Figure 20-200-2]**.

Remove the valve.

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Parts Identification

1. Bolt
2. Pin
3. Dust Boot
4. Bolt
5. Cover
6. Spring Retainer
7. Spring Seat
8. Spring
9. Spring
10. Washer
11. Spool
12. Body
13. O-ring
14. Plug
15. Plug
16. O-ring
17. Seal
18. Push rod
19. Screw
20. Cam

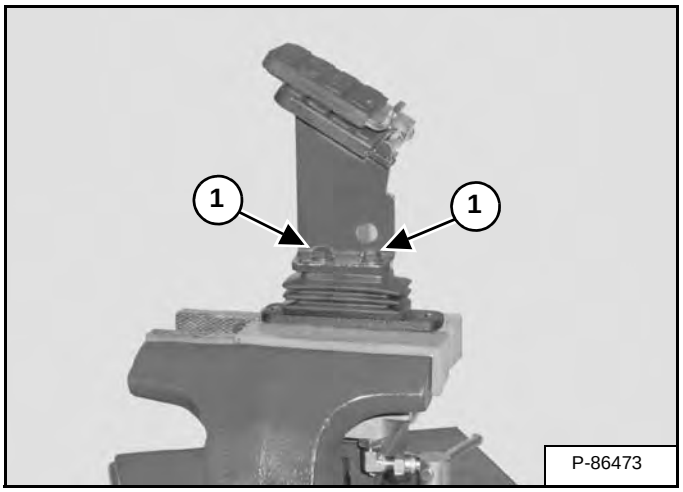


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Disassembly And Assembly

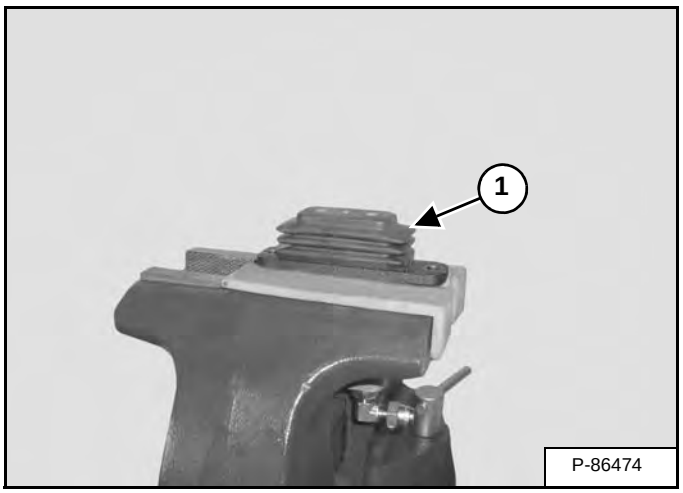
Figure 20-200-4



Remove the two bolts (Item 1) **[Figure 20-200-4]** and washers.

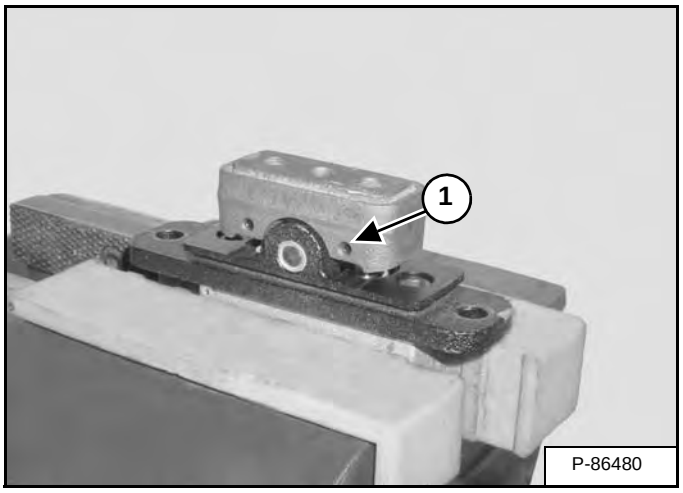
Remove the pedal.

Figure 20-200-5



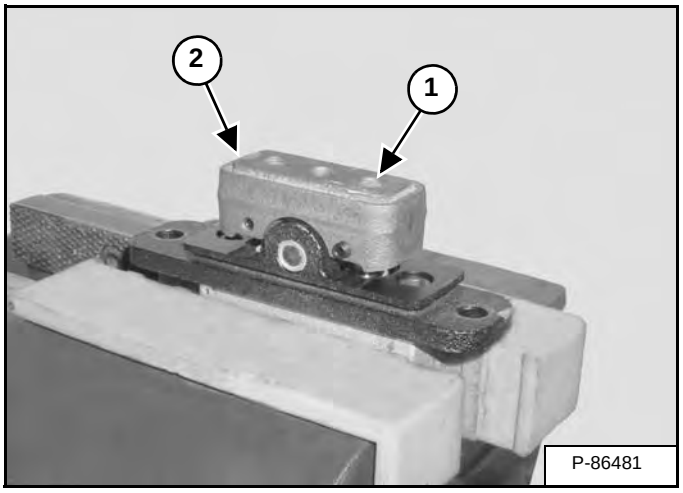
Remove the dust boot (Item 1) **[Figure 20-200-5]**.

Figure 20-200-6



Loosen the screw (Item 1) **[Figure 20-200-6]**.

Figure 20-200-7



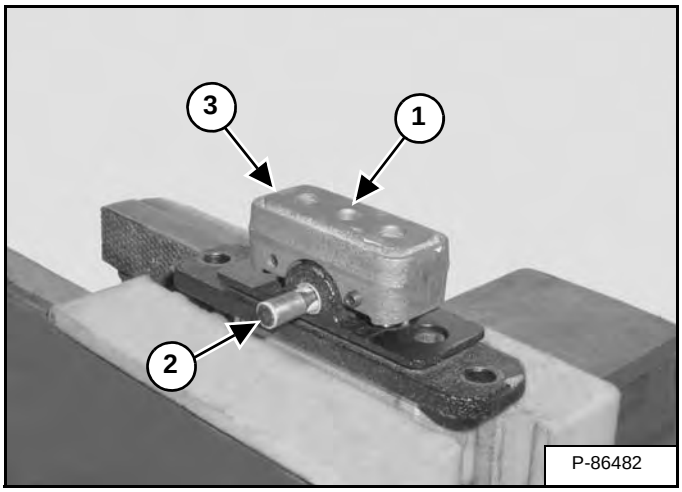
Loosen the screw (Item 1) until the spring tension is released from the cam (Item 2) **[Figure 20-200-7]**.

Installation: Tighten the screw (Item 1) **[Figure 20-200-7]** until all free play is removed from the cam.

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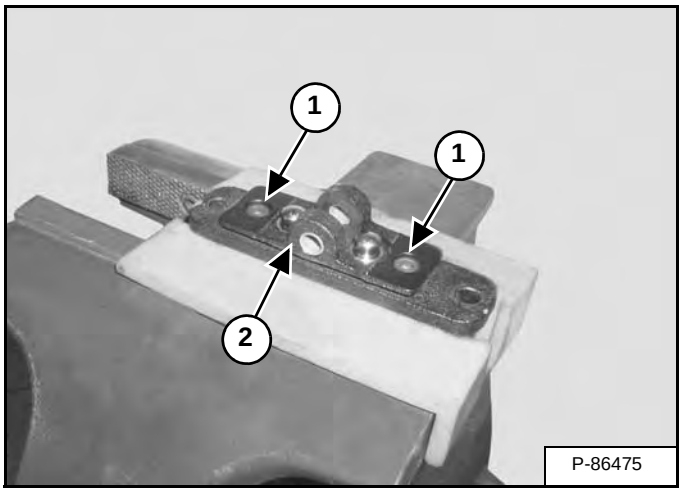
Disassembly And Assembly (Cont'd)

Figure 20-200-8



Remove the screw (Item 1) and pin (Item 2). Remove the cam (Item 3) **[Figure 20-200-8]**.

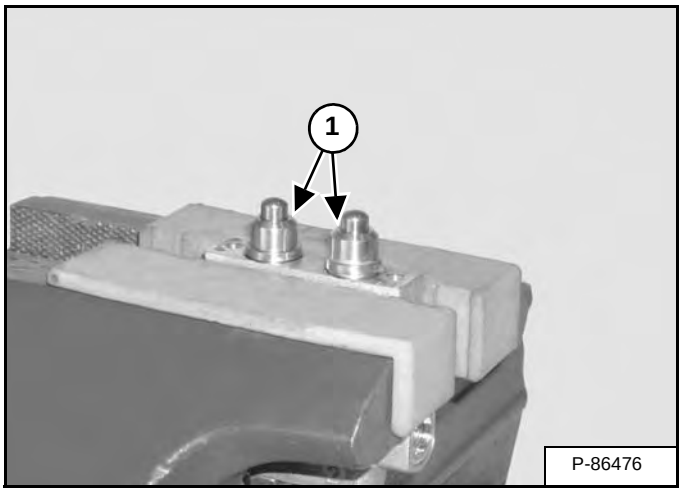
Figure 20-200-9



Loosen and remove the bolts (Item 1) evenly as the cover (Item 2) **[Figure 20-200-9]** is under spring tension.

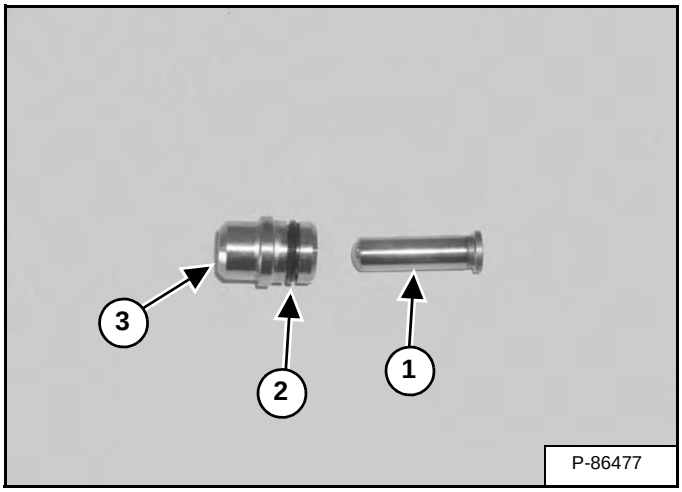
Remove the cover.

Figure 20-200-10



Remove the push rod / plug assemblies (Item 1) **[Figure 20-200-10]**.

Figure 20-200-11



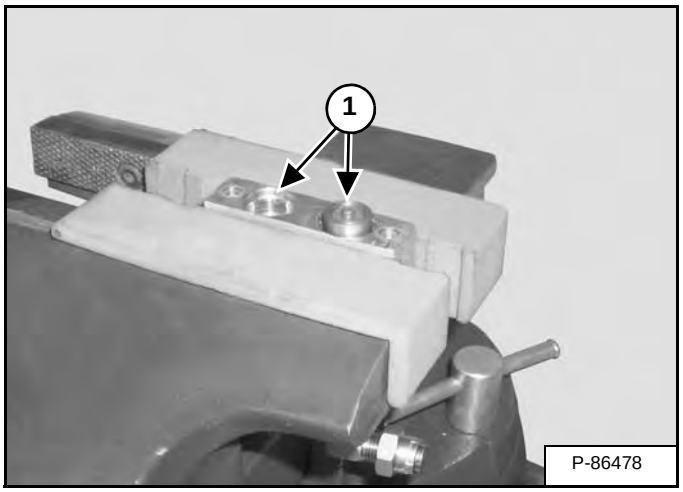
Remove the push rod (Item 1) and O-ring (Item 2) **[Figure 20-200-11]** from the plug.

Remove the seal (Item 3) **[Figure 20-200-11]** from the inside diameter of the plug.

Dealer Copy -- Not for Resale

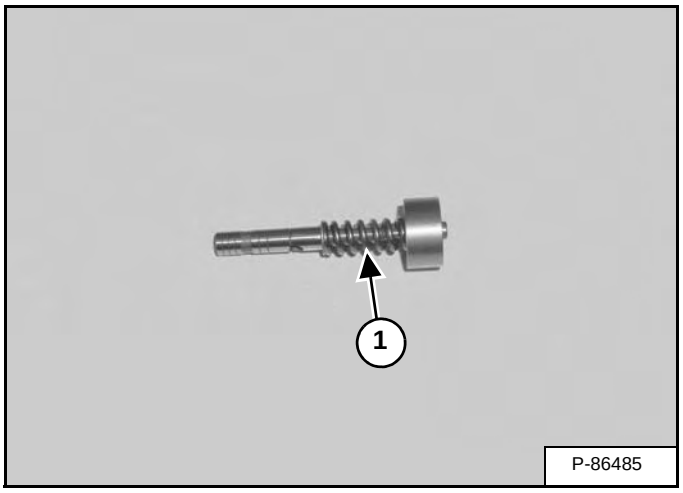
Disassembly And Assembly (Cont'd)

Figure 20-200-12



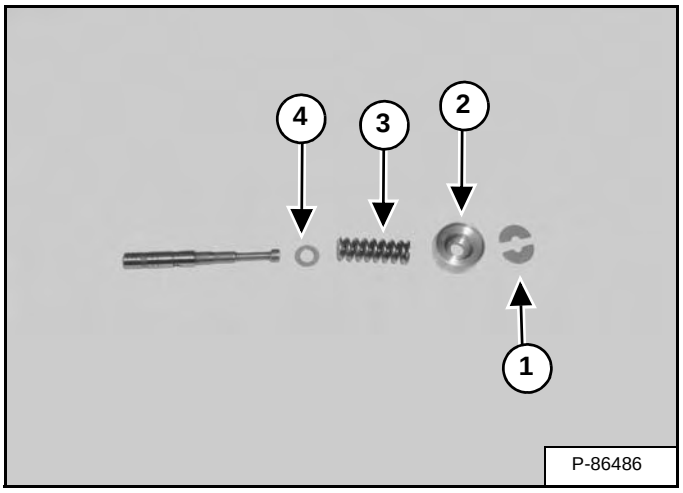
Remove the spool assemblies (Item 1) **[Figure 20-200-12]**.

Figure 20-200-13



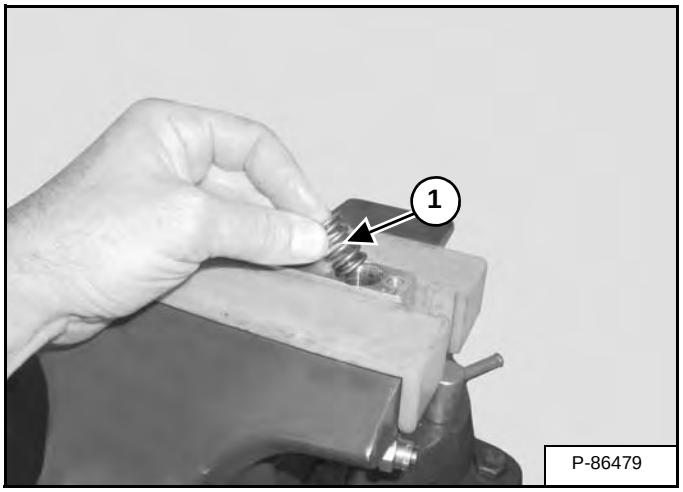
Compress the spring (Item 1) **[Figure 20-200-13]** and remove the spring keepers (Item 1) **[Figure 20-200-14]**.

Figure 20-200-14



Remove the spring seat (Item 2), spring (Item 3) and washer (Item 4) **[Figure 20-200-14]** from the spool.

Figure 20-200-15

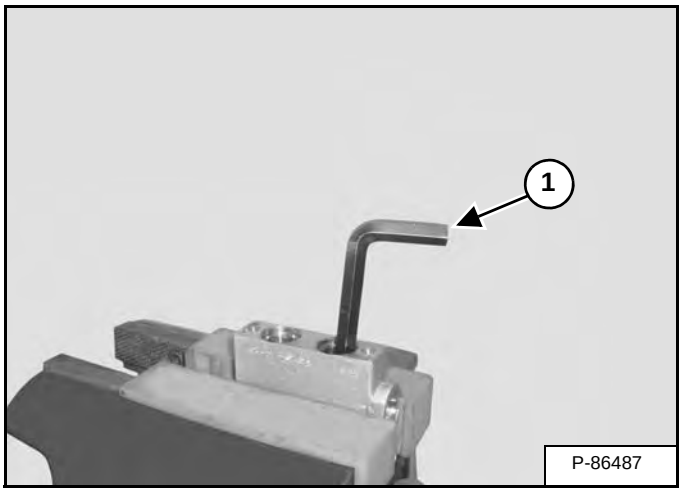


Remove the spring (Item 1) **[Figure 20-200-15]** from the bores.

Dealer Copy -- Not for Resale

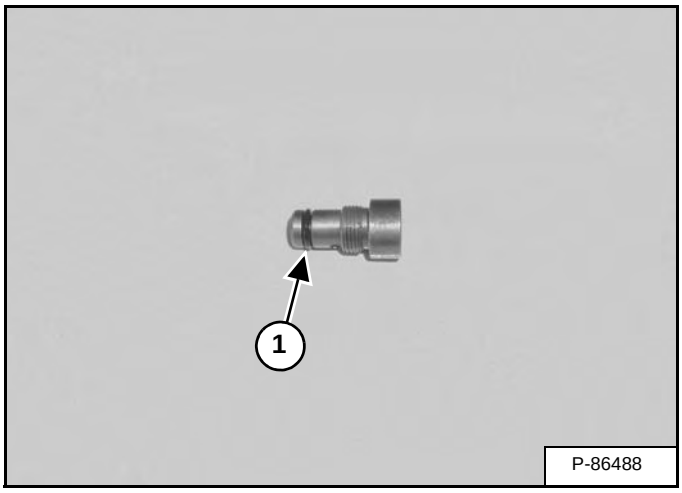
Disassembly And Assembly (Cont'd)

Figure 20-200-16



Use a 10 mm hex wrench (Item 1) **[Figure 20-200-16]** to remove the plug.

Figure 20-200-17



Remove the O-ring (Item 1) **[Figure 20-200-17]** from the plug.

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TRAVEL CONTROL VALVE

Removal And Installation

Remove the floor mat. (See Removal And Installation on Page 40-100-1.)

Tilt the cab. (See Raising And Lowering on Page 10-210-1.)

WARNING

AVOID INJURY OR DEATH

Never work under the excavator cab without installing an approved cab support device.

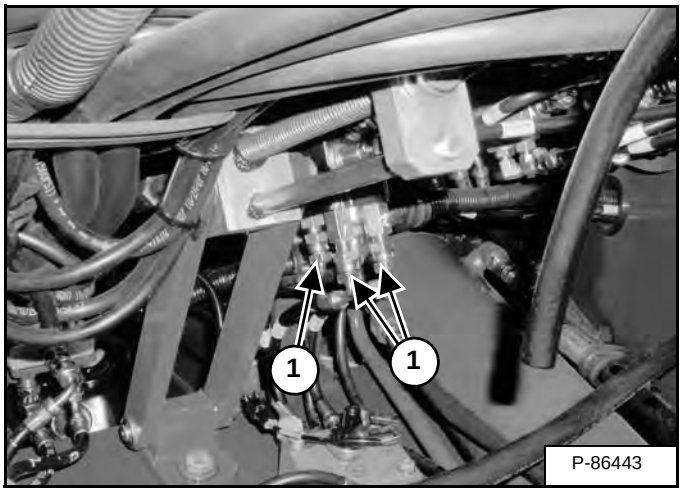
W-2435-0502

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.

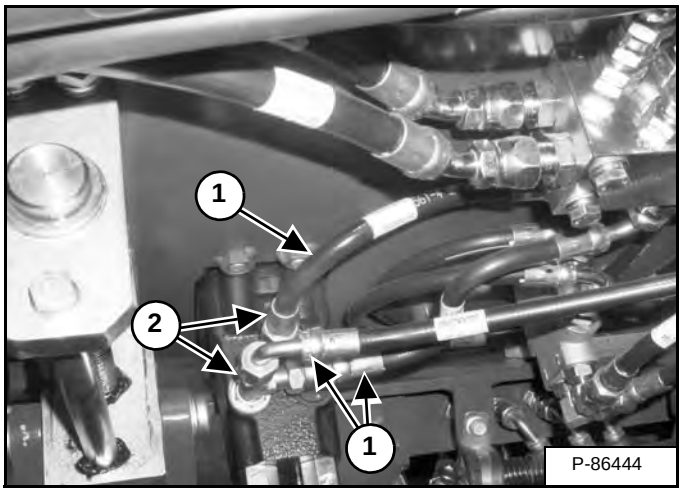
I-2003-0888

Figure 20-210-1



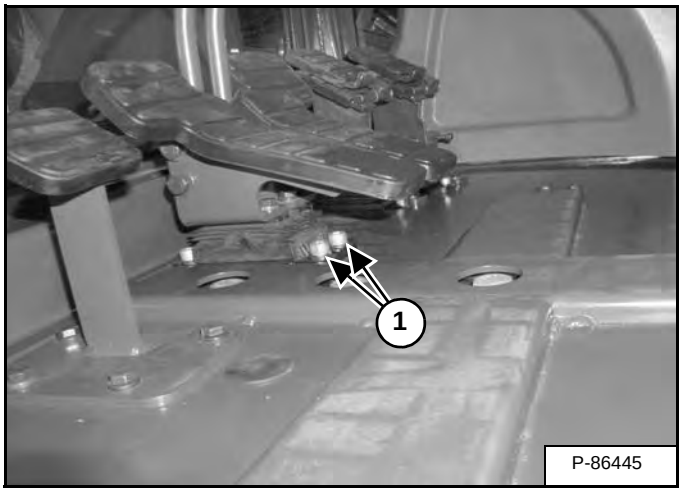
Mark and remove the four hoses (Item 1) **[Figure 20-210-1]** from the bottom of the valve.

Figure 20-210-2



Remove the three hoses (Item 1) from the side of the valve. Remove the fittings (Item 2) **[Figure 20-210-2]**.

Figure 20-210-3

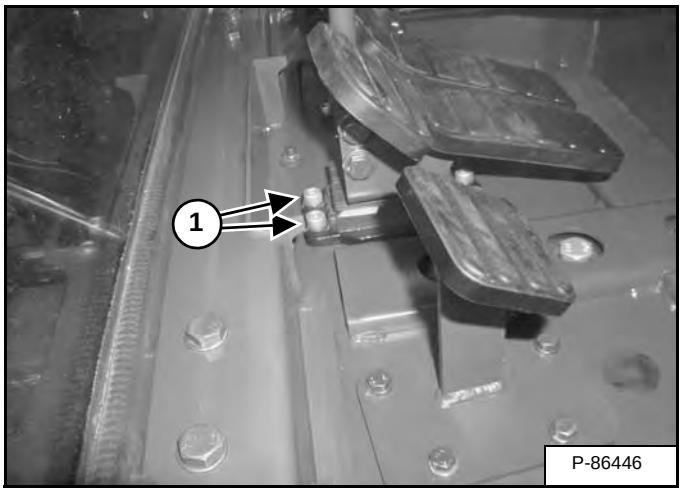


Remove the bolts (Item 1) **[Figure 20-210-3]** and washers from the rear of the valve.

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Removal And Installation (Cont'd)

Figure 20-210-4



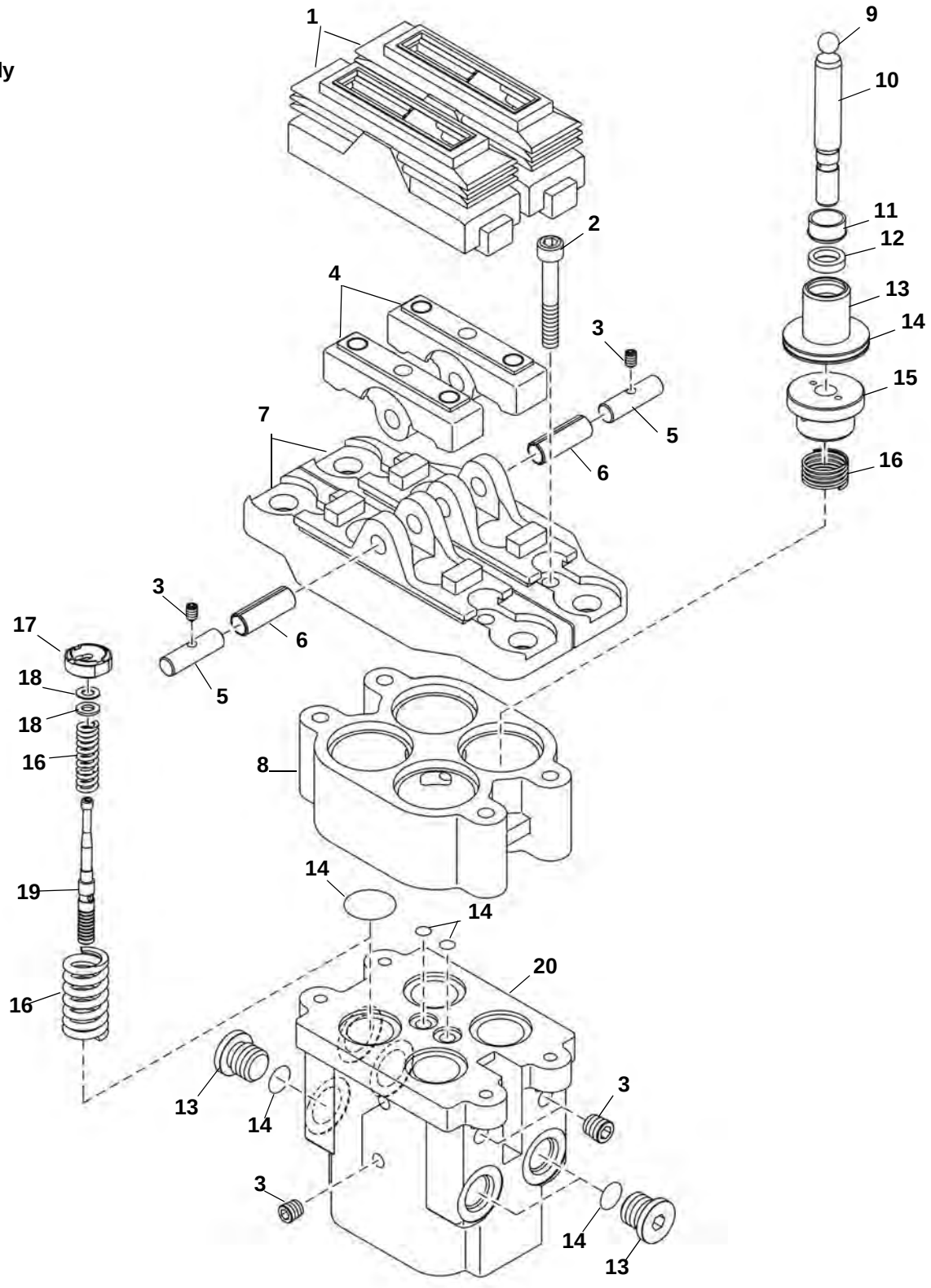
Remove the bolts (Item 1) **[Figure 20-210-4]** from the front of the valve.

Remove the valve / lever assembly from the cab.

Dealer Copy -- Not for Resale

Parts Identification

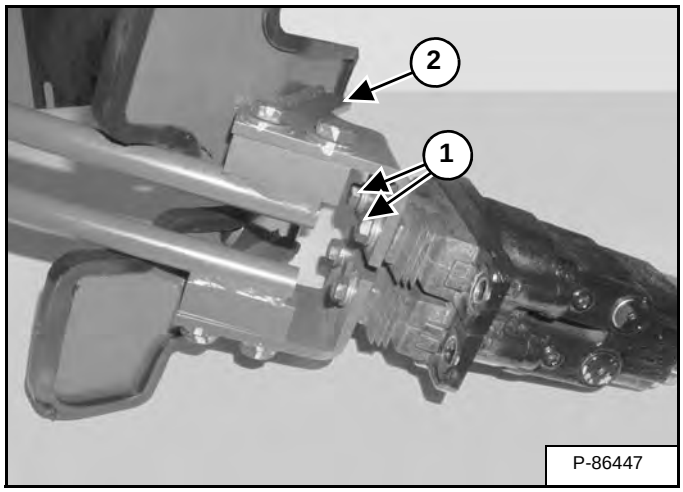
1. Dust Boot
2. Bolt
3. Set Screw
4. Cam Assembly
5. Pin
6. Bushing
7. Cover
8. Cover
9. Ball
10. Push Rod
11. Grease Cap
12 Dust Seal
13. Plug
14. O-ring
15. Piston
16. Spring
17. Spring Seat
18. Washer
19. Spool
20. Housing



Dealer Copy -- Not for Resale

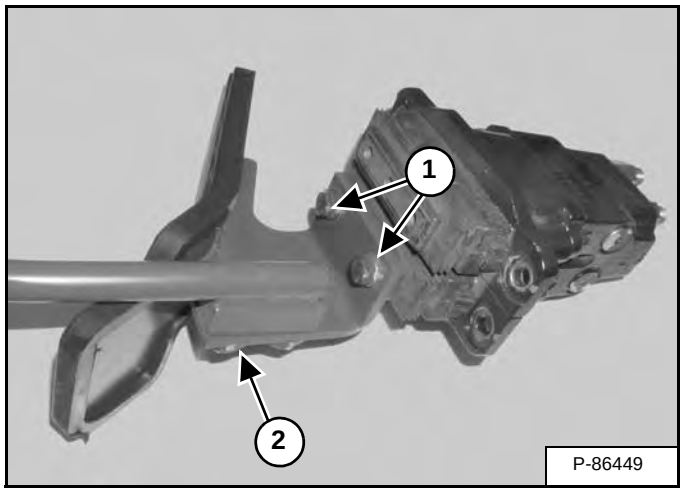
Disassembly And Assembly

Figure 20-210-5



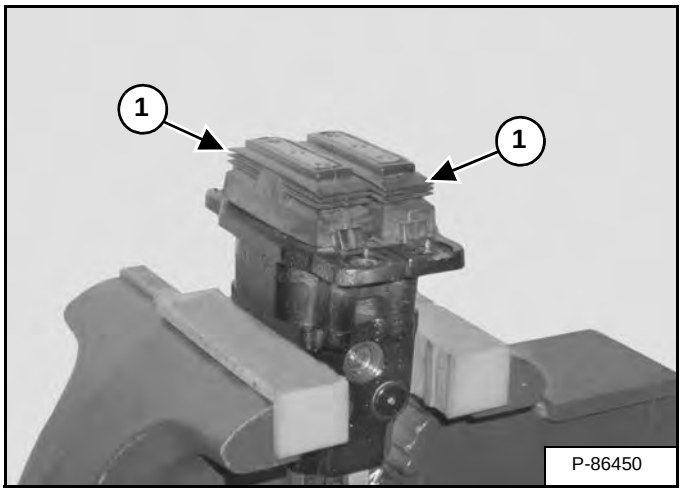
Remove the two bolts (Item 1) and washers. Remove the left travel control lever / foot pedal (Item 2) **[Figure 20-210-5]**.

Figure 20-210-6



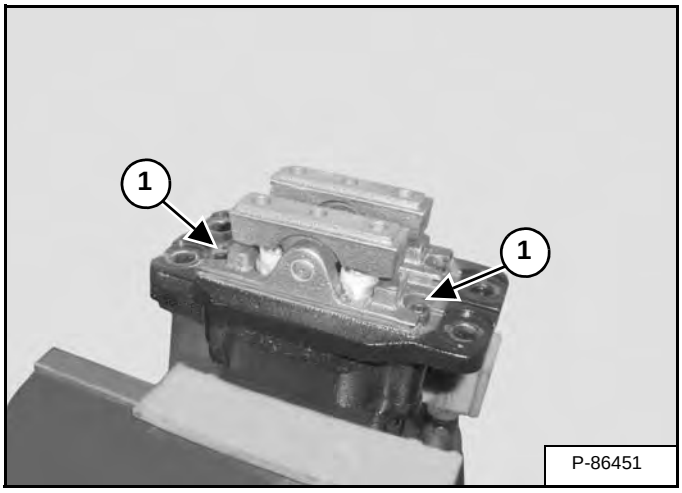
Remove the two bolts (Item 1) and washers. Remove the right travel control lever / foot pedal (Item 2) **[Figure 20-210-6]**.

Figure 20-210-7



Remove the dust boots (Item 1) **[Figure 20-210-7]**.

Figure 20-210-8

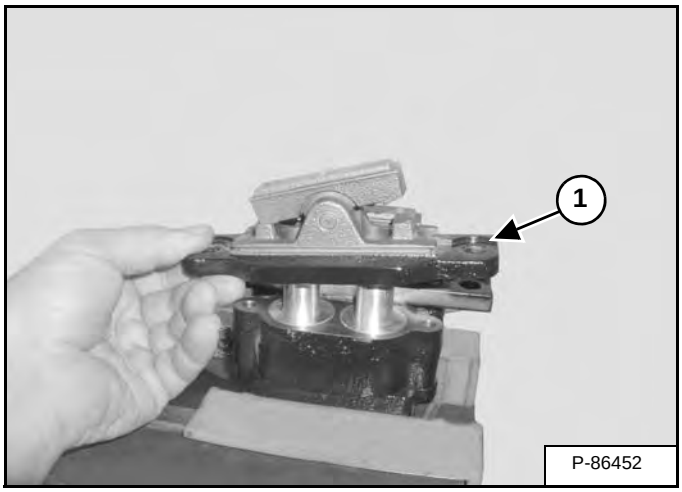


Loosen and remove the bolts (Item 1) **[Figure 20-210-8]** evenly, as the cover is under spring pressure.

Dealer Copy -- Not for Resale

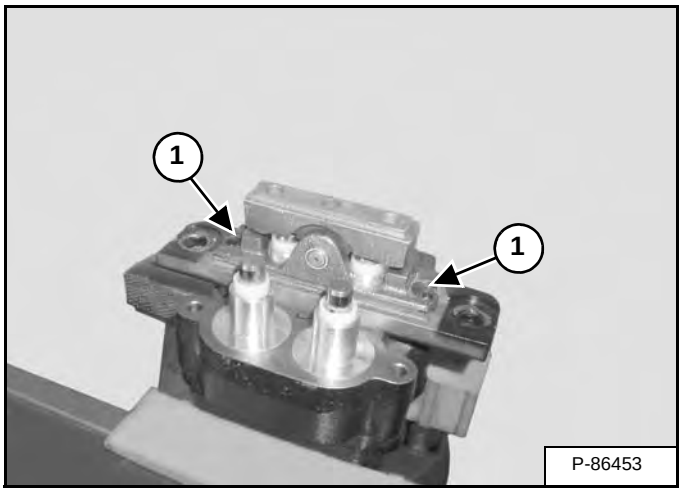
Disassembly And Assembly (Cont'd)

Figure 20-210-9



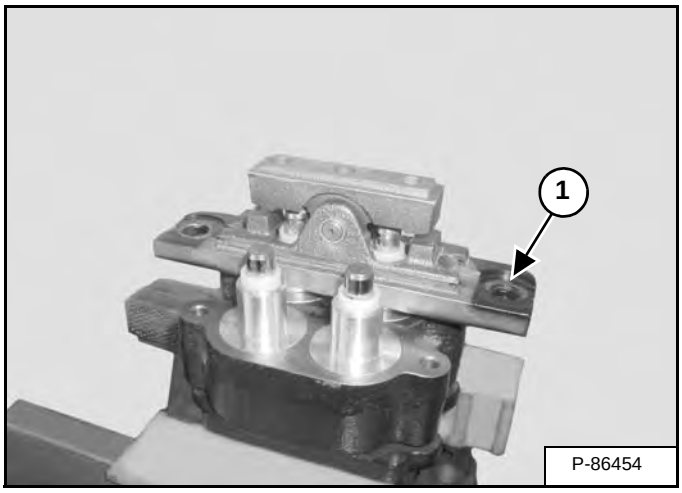
Remove the cover / cam assembly (Item 1) **[Figure 20-210-9]**.

Figure 20-210-10



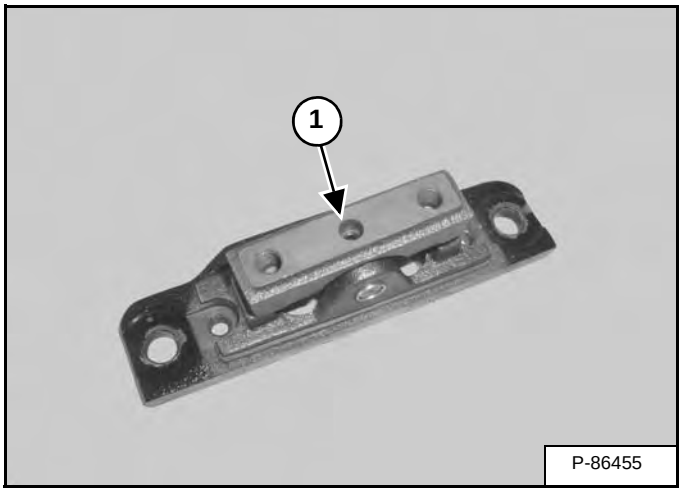
Loosen and remove the bolts (Item 1) **[Figure 20-210-10]** evenly, as the cover is under spring pressure.

Figure 20-210-11



Remove the cover / cam assembly (Item 1) **[Figure 20-210-11]**.

Figure 20-210-12



Loosen the screw (Item 1) **[Figure 20-210-12]** on both cam assemblies.

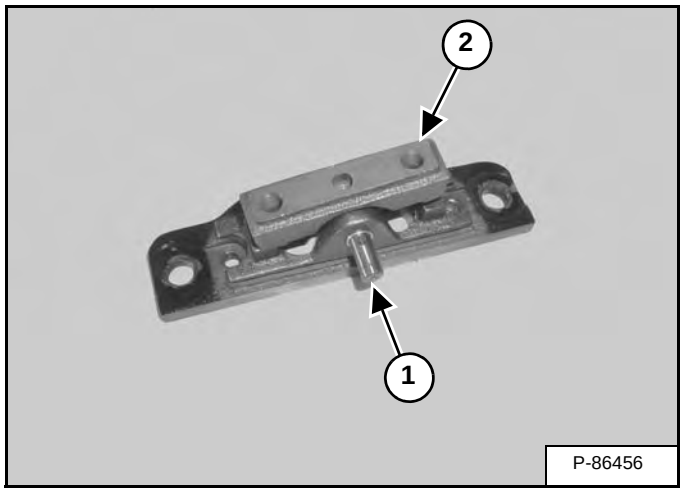
NOTE: Heat the screw to melt the thread adhesive.

Installation: Apply Loctite® 242 or equivalent to the screw.

Dealer Copy -- Not for Resale

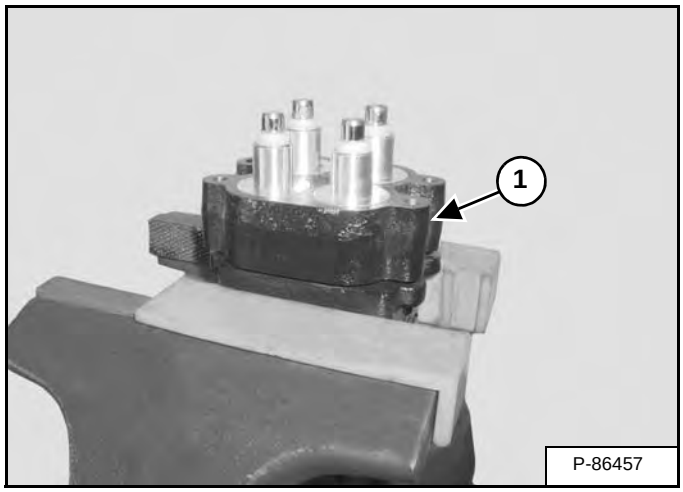
Disassembly And Assembly (Cont'd)

Figure 20-210-13



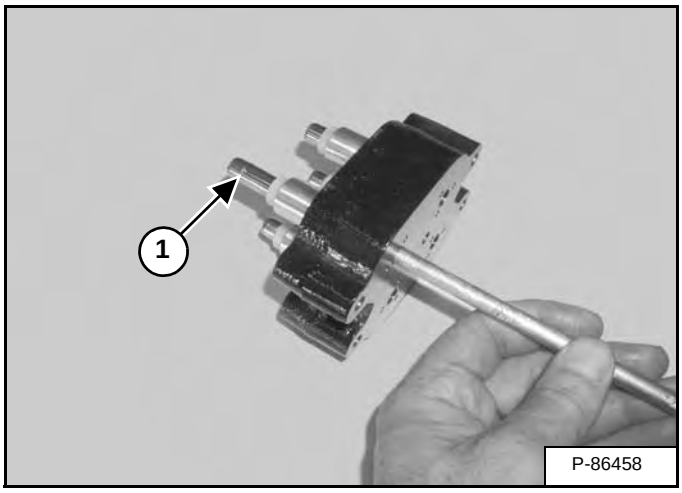
Remove the pin (Item 1) from both cover / cam assemblies. Remove the cam (Item 2) **[Figure 20-210-13]** from the cover.

Figure 20-210-14



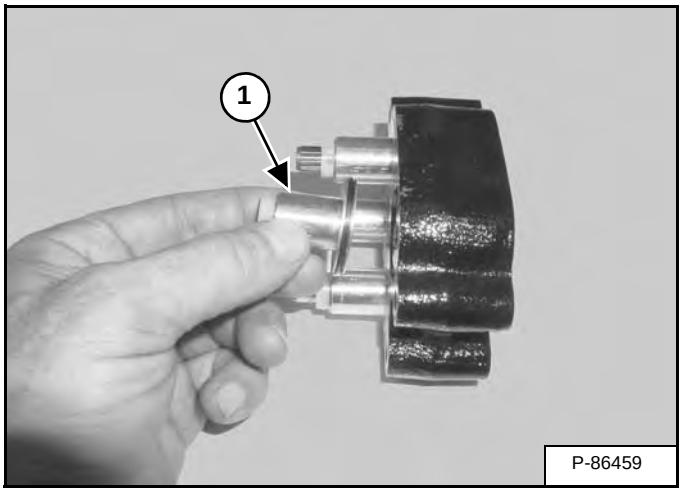
Remove the cover (Item 1) **[Figure 20-210-14]**.

Figure 20-210-15



Using a blunt tool, push the push rod (Item 1) **[Figure 20-210-15]** out of the plug.

Figure 20-210-16

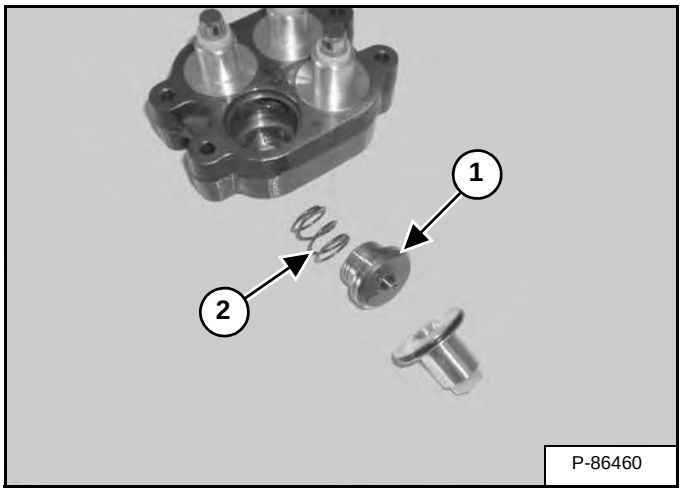


Remove the plug (Item 1) **[Figure 20-210-16]** from the bores.

Dealer Copy -- Not for Resale

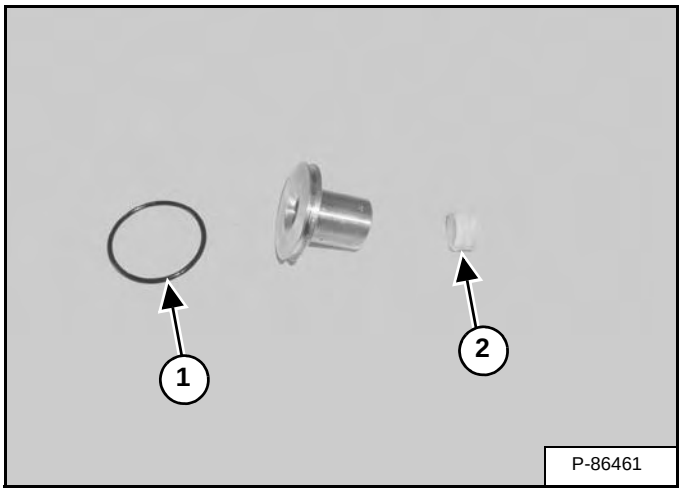
Disassembly And Assembly (Cont'd)

Figure 20-210-17



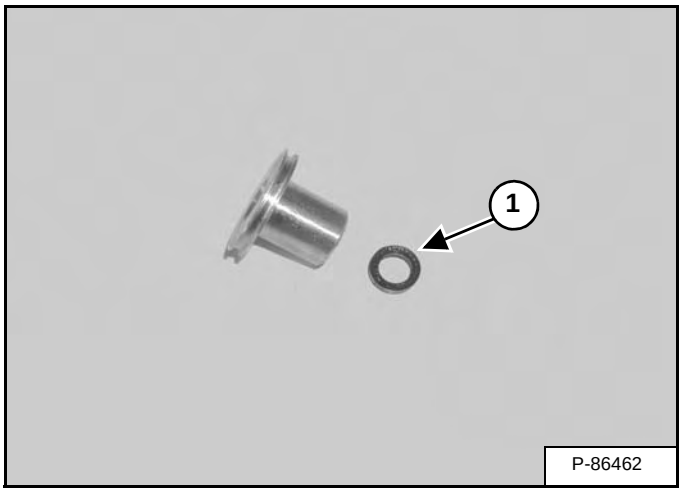
Remove the piston (Item 1) and spring (Item 2) **[Figure 20-210-17]**.

Figure 20-210-18



Remove the O-ring (Item 1) and grease cap (Item 2) **[Figure 20-210-18]** from the plug.

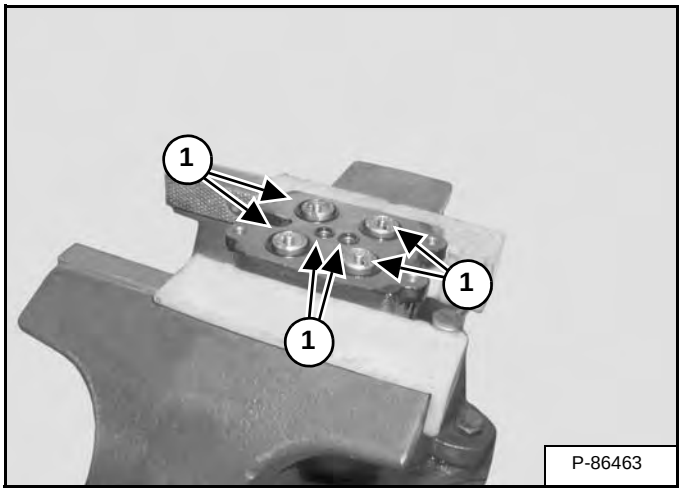
Figure 20-210-19



Remove the dust seal (Item 1) **[Figure 20-210-19]** from the inside diameter of the plug.

Repeat the procedure for the three remaining plugs.

Figure 20-210-20

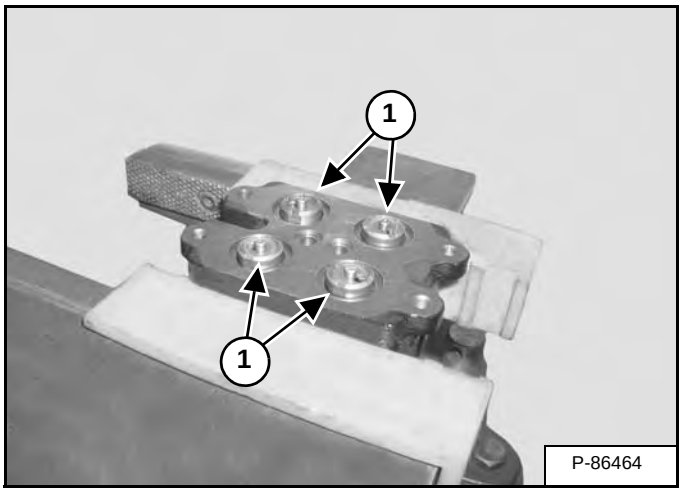


Remove the O-rings (Item 1) **[Figure 20-210-20]**.

Dealer Copy -- Not for Resale

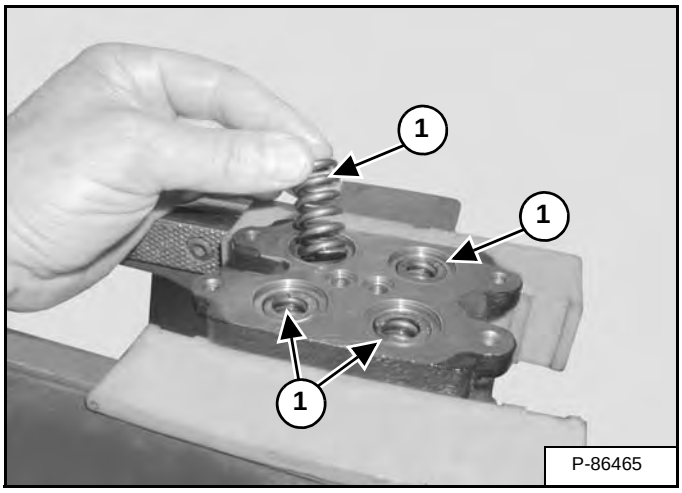
Disassembly And Assembly (Cont'd)

Figure 20-210-21



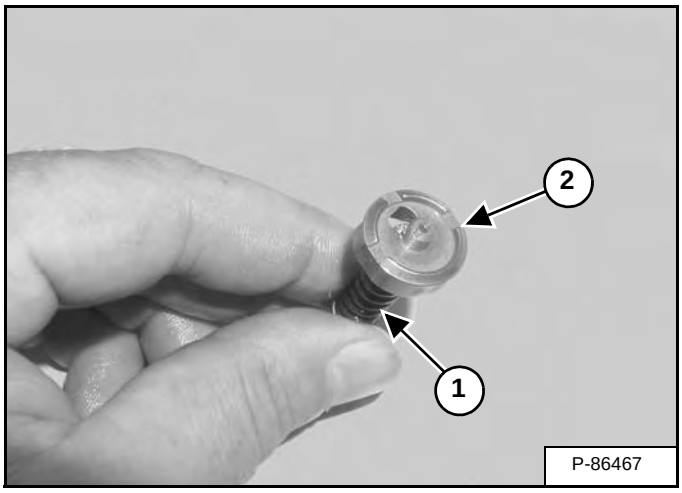
Remove the spool / spring assemblies (Item 1) **[Figure 20-210-21]**.

Figure 20-210-22



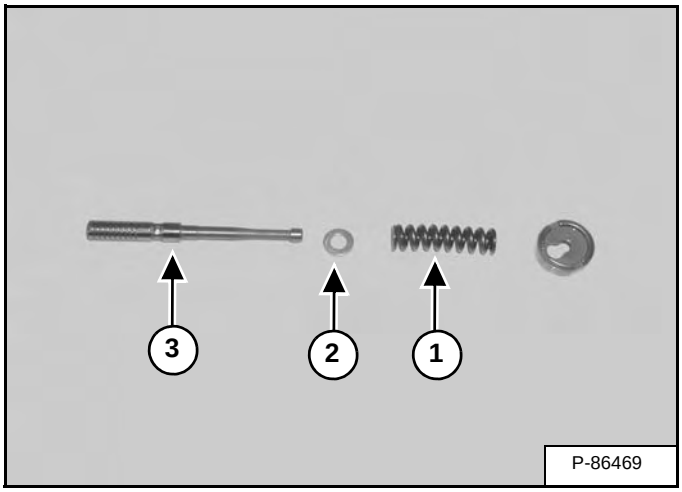
Remove the springs (Item 1) **[Figure 20-210-22]**.

Figure 20-210-23



Compress the springs (Item 1) and remove the spring seat (Item 2) **[Figure 20-210-23]**.

Figure 20-210-24



Remove the spring (Item 1) and washer (Item 2) from the spool (Item 3) **[Figure 20-210-24]**.

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AUTO IDLE

Description

The auto Idle function is controlled by the ECU. The auto idle pressure switch is located on the hydraulic control valve. See Page 50-01 for auto idle pressure switch removal and installation.

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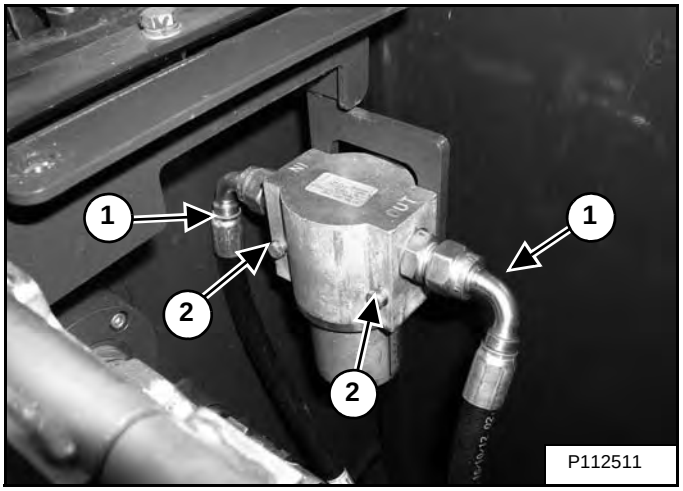
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HYDRAULIC PILOT PRESSURE FILTER ASSEMBLY

Removal And Installation

Remove the center cover. (See Removal And Installation on Page 40-70-1.)

Figure 20-230-1



Remove the hoses (Item 1) **[Figure 20-230-1]**.

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

Remove the bolts (Item 2) **[Figure 20-230-1]** and remove the filter assembly.

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UNDERCARRIAGE

BLADE 30-10-1
Removal And Installation 30-10-1

TRACK UNDERCARRIAGE COMPONENTS (RUBBER TRACK) 30-20-1
Track Lug Height 30-20-1
Checking Tension 30-20-2
Adjusting Tension 30-20-3
Track Removal And Installation 30-20-3
Idler Removal And Installation 30-20-5
Idler Parts Identification 30-20-6
Idler Disassembly 30-20-7
Idler Assembly 30-20-10
Track Tensioner Removal And Installation 30-20-15
Track Tensioner Parts Identification 30-20-16
Track Tensioner Disassembly And Assembly 30-20-17
Roller Removal And Installation 30-20-19
Lower Roller Parts Identification 30-20-21
Lower Roller Disassembly 30-20-22
Lower Roller Assembly 30-20-25
Upper Roller Parts Identification 30-20-31
Upper Roller Disassembly And Assembly 30-20-32
Sprocket Removal And Installation 30-20-35

TRACK UNDERCARRIAGE COMPONENTS (STEEL TRACK) 30-21-1
Checking Tension 30-21-1
Adjusting Tension 30-21-2
Track Removal 30-21-3
Track Installation 30-21-5
Idler Removal And Installation 30-21-6
Idler Parts Identification 30-21-7
Idler Disassembly 30-21-8
Idler Assembly 30-21-11
Track Tensioner Removal And Installation 30-21-16
Track Tensioner Parts Identification 30-21-17
Track Tensioner Disassembly And Assembly 30-21-18
Roller Removal And Installation 30-21-20
Guide Plate Removal And Installation 30-21-22
Lower Roller Parts Identification 30-21-23
Lower Roller Disassembly 30-21-24
Lower Roller Assembly 30-21-27
Upper Roller Parts Identification 30-21-33
Upper Roller Disassembly And Assembly 30-21-34
Sprocket Removal And Installation 30-21-37

TRACK MAINTENANCE 30-30-1
Track Damage Identification 30-30-1

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SWING CIRCLE GEAR 30-40-1
Swing Bearing Removal 30-40-1
Swing Bearing Installation 30-40-2

LOWER TRACK ROLLER 30-50-1
Parts Identification 30-50-1
Disassembly 30-50-2
Assembly 30-50-5

UPPER TRACK ROLLER 30-60-1
Parts Identification 30-60-1
Disassembly And Assembly 30-60-2

Dealer Copy -- Not for Resale

BLADE

Removal And Installation

Lower the blade the ground.

Remove the blade cylinders. (See Removal And Installation on Page 20-24-2.)

Figure 30-10-1

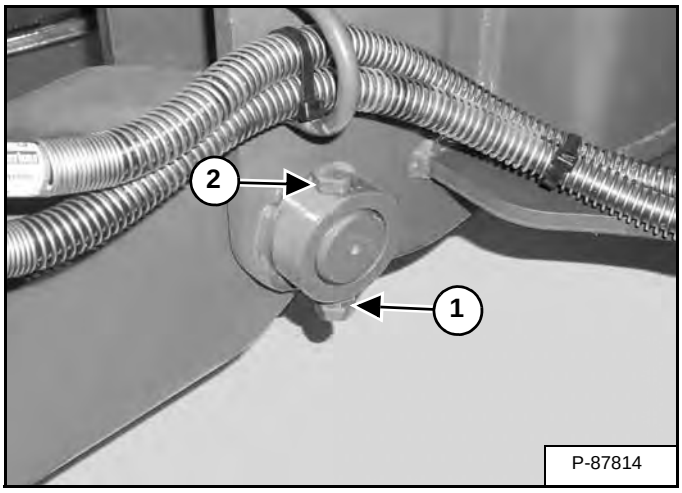
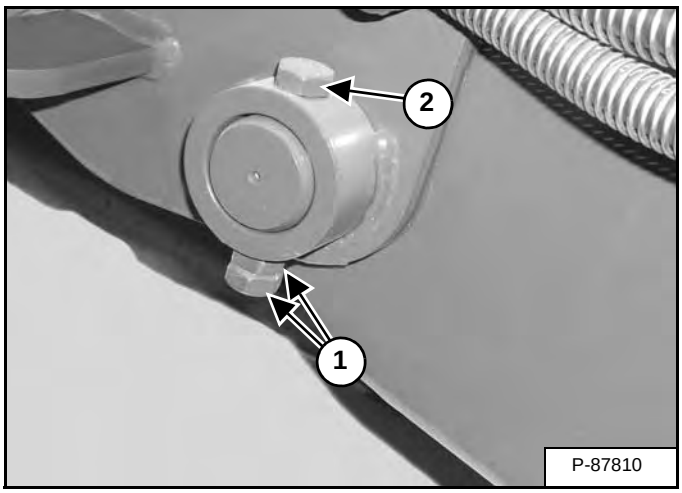
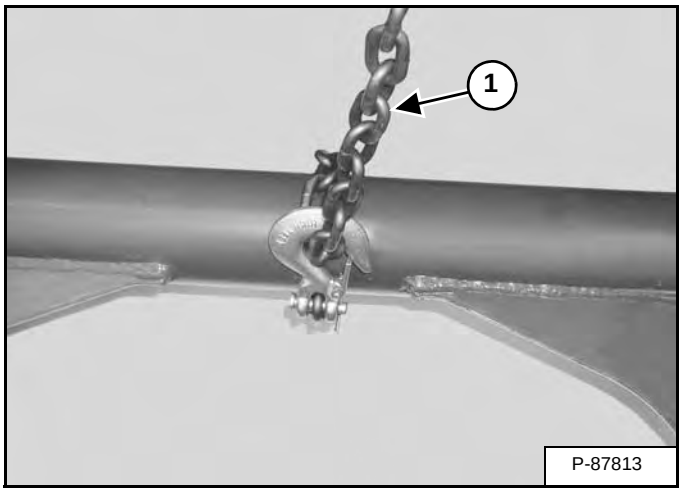


Figure 30-10-2



Remove the right and left pivot pin retaining nuts (Item 1) and bolt (Item 2) **[Figure 30-10-1]** and **[Figure 30-10-2]**.

Figure 30-10-3



Install a chain hoist (Item 1) **[Figure 30-10-3]** in the center of the blade crossmember.

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Removal And Installation (Cont'd)

Figure 30-10-4

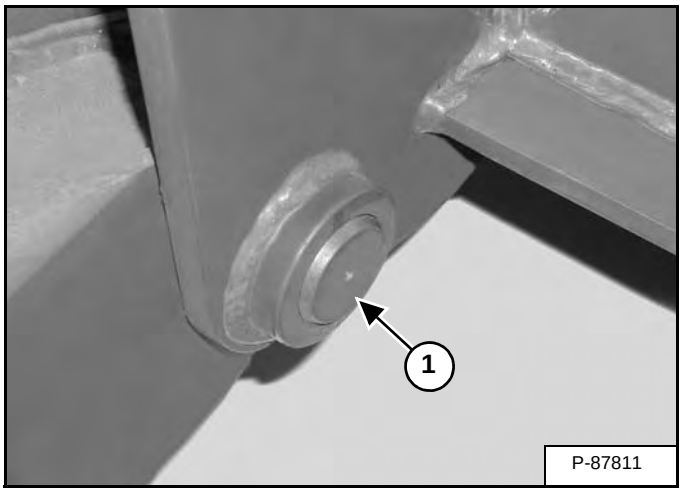
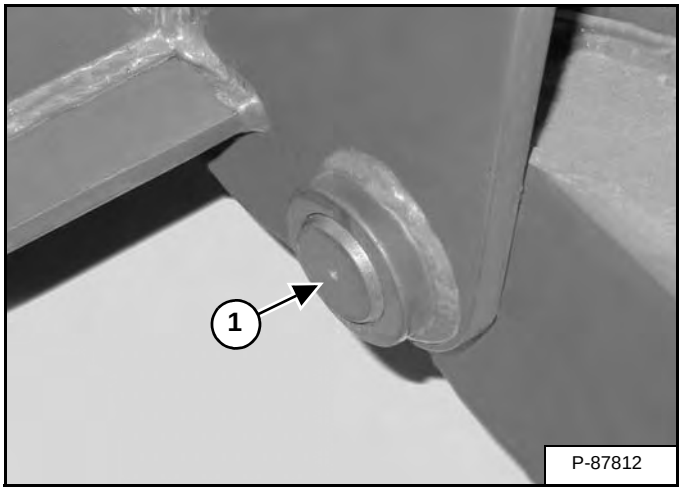


Figure 30-10-5



Remove the right and left pivot pin (Item 1) **[Figure 30-10-4]** and **[Figure 30-10-5]** and shims.

Lift and remove the blade.

Dealer Copy -- Not for Resale

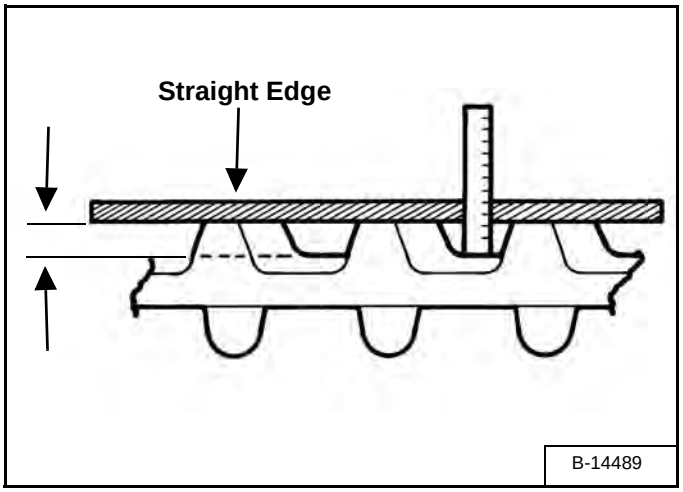
TRACK UNDERCARRIAGE COMPONENTS (RUBBER TRACK)

Track Lug Height

Rubber Track

The lug height of a new rubber track is 29,2 mm (1.15 in).

Figure 30-20-1



To find the percentage of wear on a excavator track, measure the height of the lug by placing a straight edge across the top of three lugs and measuring 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 23,4 mm (0.92 in)

$$\frac{0.92}{1.15} \times 100 = 80$$

80% of the track lug is remaining, with 20% wear on the track lugs.

Dealer Copy -- Not for Resale

Checking Tension

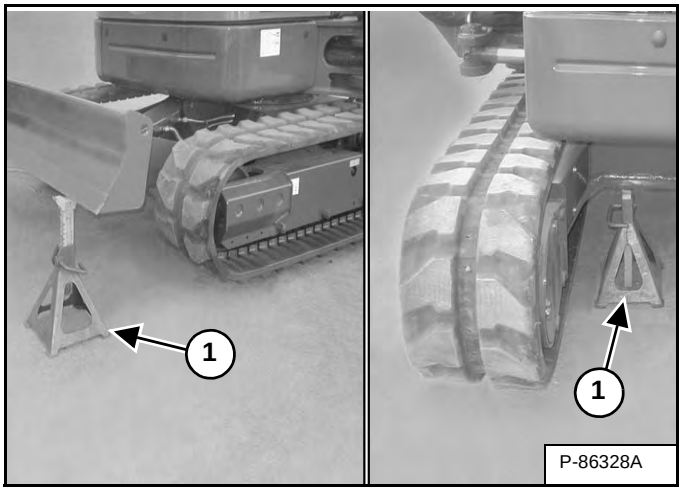
NOTE: The wear of the pins and bushings on the undercarriage varies with the working conditions and the types of soil. It is necessary to inspect track tension to maintain the correct tension. See SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 10-80-1.)

Figure 30-20-2



Raise the side of the machine (approximately 102 mm [4 in]) using the boom and arm **[Figure 30-20-2]**.

Figure 30-20-3



Fully raise the blade and install jackstands (Item 1) **[Figure 30-20-3]** under the blade and track frame. 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.

W-2142-0903

Figure 30-20-4

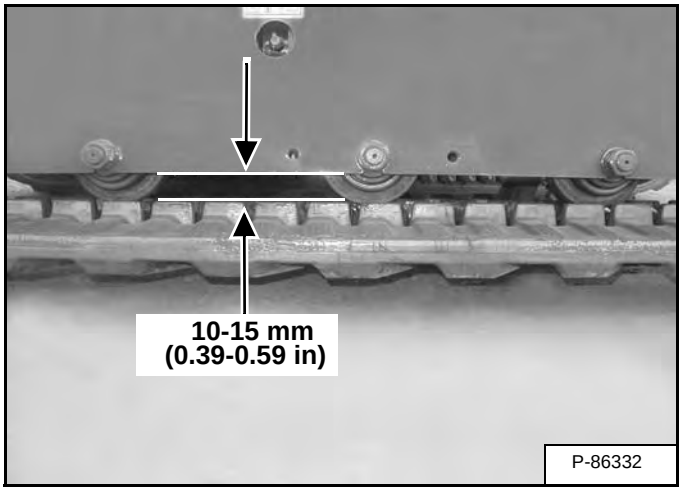
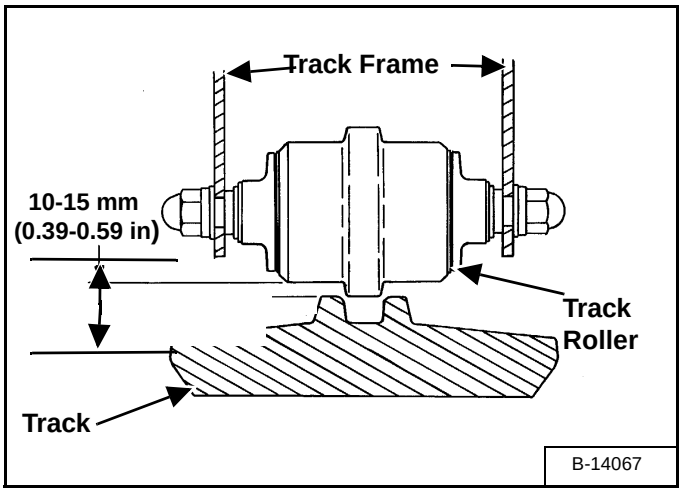


Figure 30-20-5



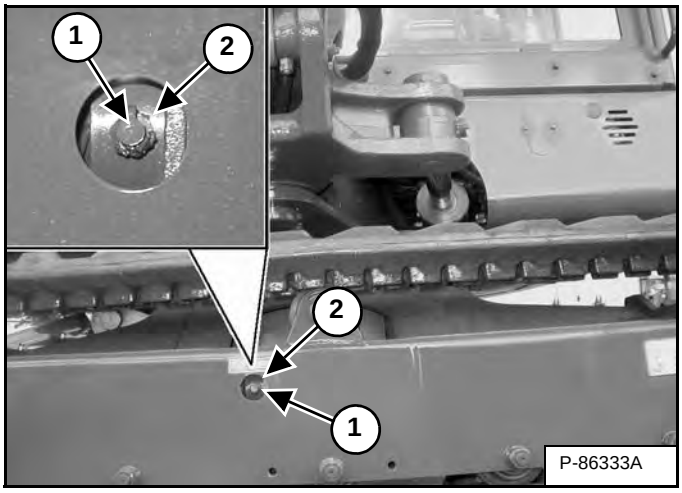
Measure the clearance at the middle track roller. Do not put your fingers into the pinch points between the track and the track roller. Use a bolt or a dowel of the appropriate size to check the gap between the contact edge of the roller and the top edge of the track guide **[Figure 30-20-4]** and **[Figure 30-20-5]**.

Track Clearance	10 - 15 mm (0.39 - 0.59 in)

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Adjusting Tension

Figure 30-20-6



NOTE: The track tension grease fitting (Item 1) is installed into the end of the bleed fitting (Item 2). DO NOT loosen the grease fitting (Item 1), loosen the bleed fitting (Item 2) [Figure 30-20-6] ONLY (maximum of 1-1/2 turns) when releasing track pressure.

Add grease to the fitting (Item 1) **[Figure 30-20-6]** until the track tension is correct.

To release track pressure, loosen the bleed fitting (Item 2) **[Figure 30-20-6]** to release tension from the track.

NOTE: Do not loosen the grease fitting (Item 1) [Figure 30-20-6].

Repeat the procedure for the other side.

⚠ WARNING

AVOID INJURY OR DEATH

- **Do not loosen bleed fitting more than 1-1/2 turns.**
- **Do not loosen parts other than bleed fitting. Grease is under high pressure.**

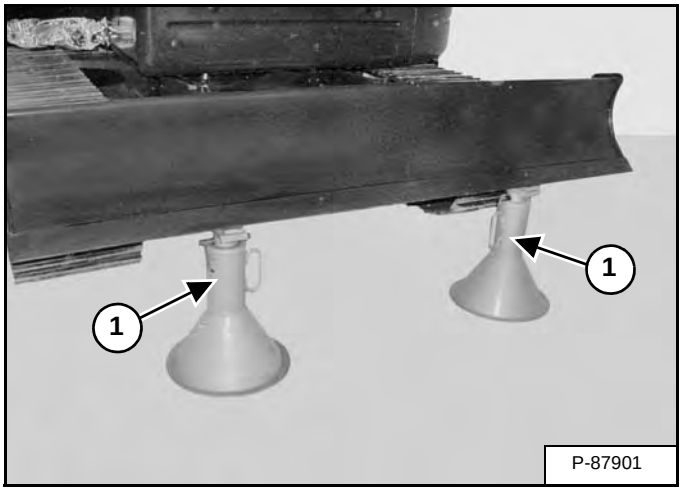
W-2474-0104

Track Removal And Installation

Lift and block both sides of the machine as follows:

Fully raise the blade.

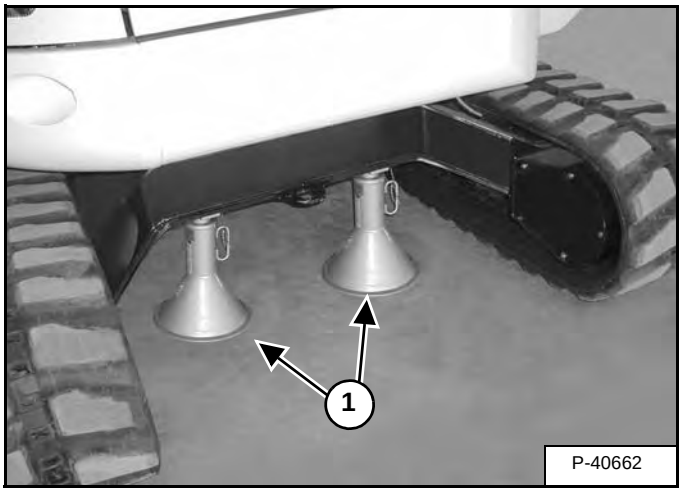
Figure 30-20-7



Use the boom and arm to lift up the blade end of the machine, and install jackstands (Item 1) **[Figure 30-20-7]** under the blade.

Raise the boom.

Figure 30-20-8



Swing the upperstructure 180° and use the boom and arm to slowly lift the opposite end of the undercarriage, and install jackstands (Item 1) **[Figure 30-20-8]** under the undercarriage.

Raise the boom until the weight of the machine is supported by the jackstands.

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Track Removal And Installation (Cont'd)

⚠ 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.

Release track tension. (See Adjusting Tension on Page 30-20-3.)

⚠ WARNING

AVOID INJURY OR DEATH

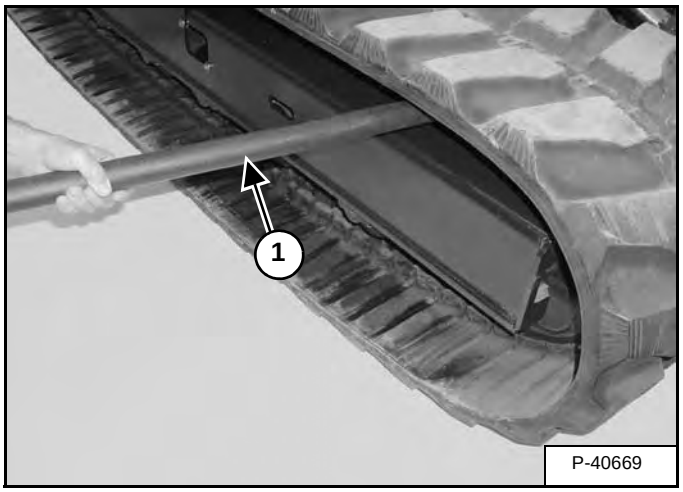
- **Do not loosen bleed fitting more than 1-1/2 turns.**
- **Do not loosen parts other than bleed fitting. Grease is under high pressure.**

W-2474-0104

Start the engine.

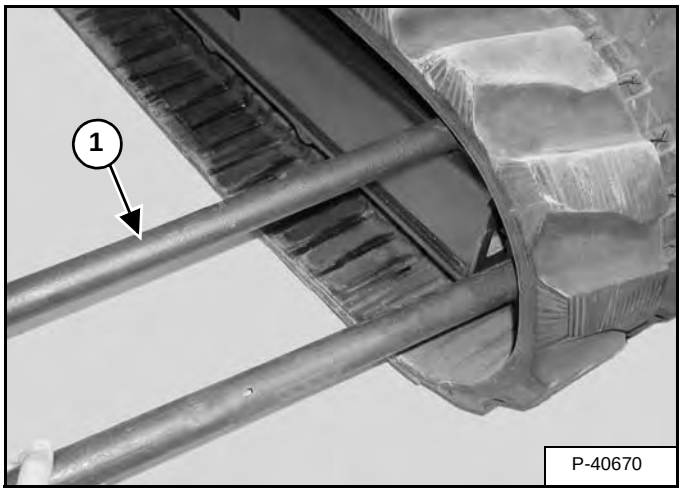
Slowly turn the track in the forward direction.

Figure 30-20-9



Insert a steel rod or pipe (Item 1) **[Figure 30-20-9]** (Approximately 44,5 mm [1.750 in] diameter) between the track and the idler wheel.

Figure 30-20-10



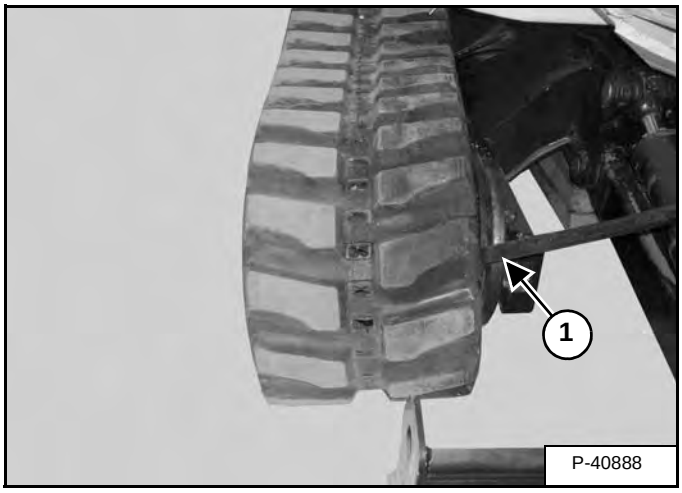
Insert a second steel rod or pipe (Item 1) **[Figure 30-20-10]**, at a distance of two lugs, between the track and the idler wheel. Continue to turn the track until the first pipe contacts the track frame.

Stop the engine.

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Track Removal And Installation (Cont'd)

Figure 30-20-11



Insert a pry bar (Item 1) **[Figure 30-20-11]** between the track and the idler wheel, and pry out on the track until the track slides off the idler wheel.

Remove the track.

To install the rubber track:

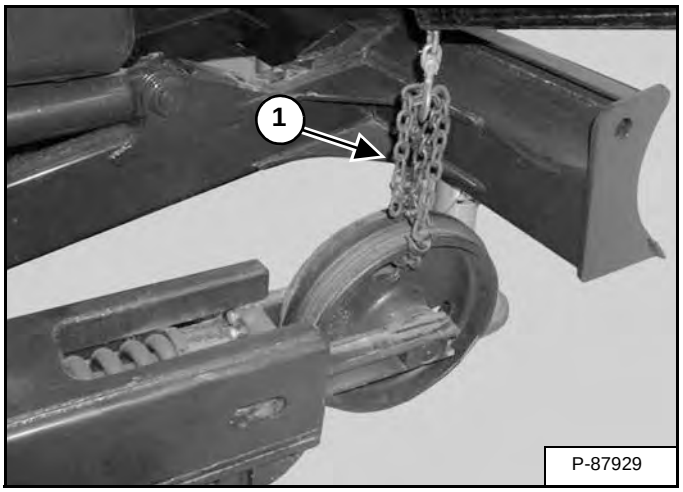
Put the track over the rear drive sprocket lugs.

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 Adjusting Tension on Page 30-20-3.)

Idler Removal And Installation

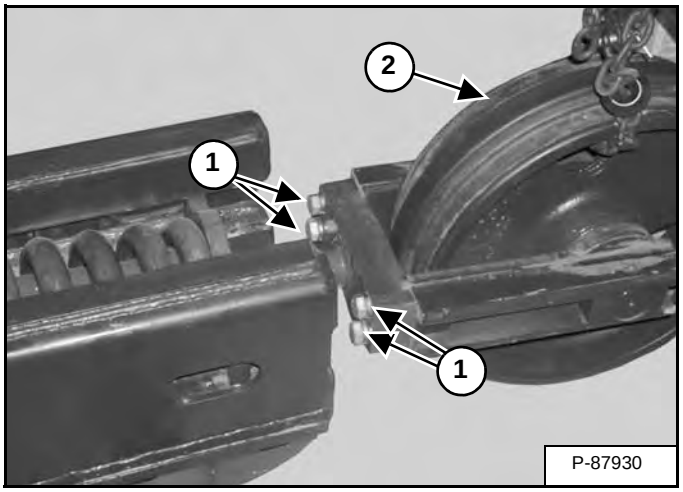
Figure 30-20-12



Remove the track. (See Track Removal And Installation on Page 30-20-3.)

Install a chain (Item 1) **[Figure 30-20-12]** and hoist to the idler and slide the idler towards the front of the track frame.

Figure 30-20-13



Remove the four bolts (Item 1) and washers. Remove the idler (Item 2) **[Figure 30-20-13]**.

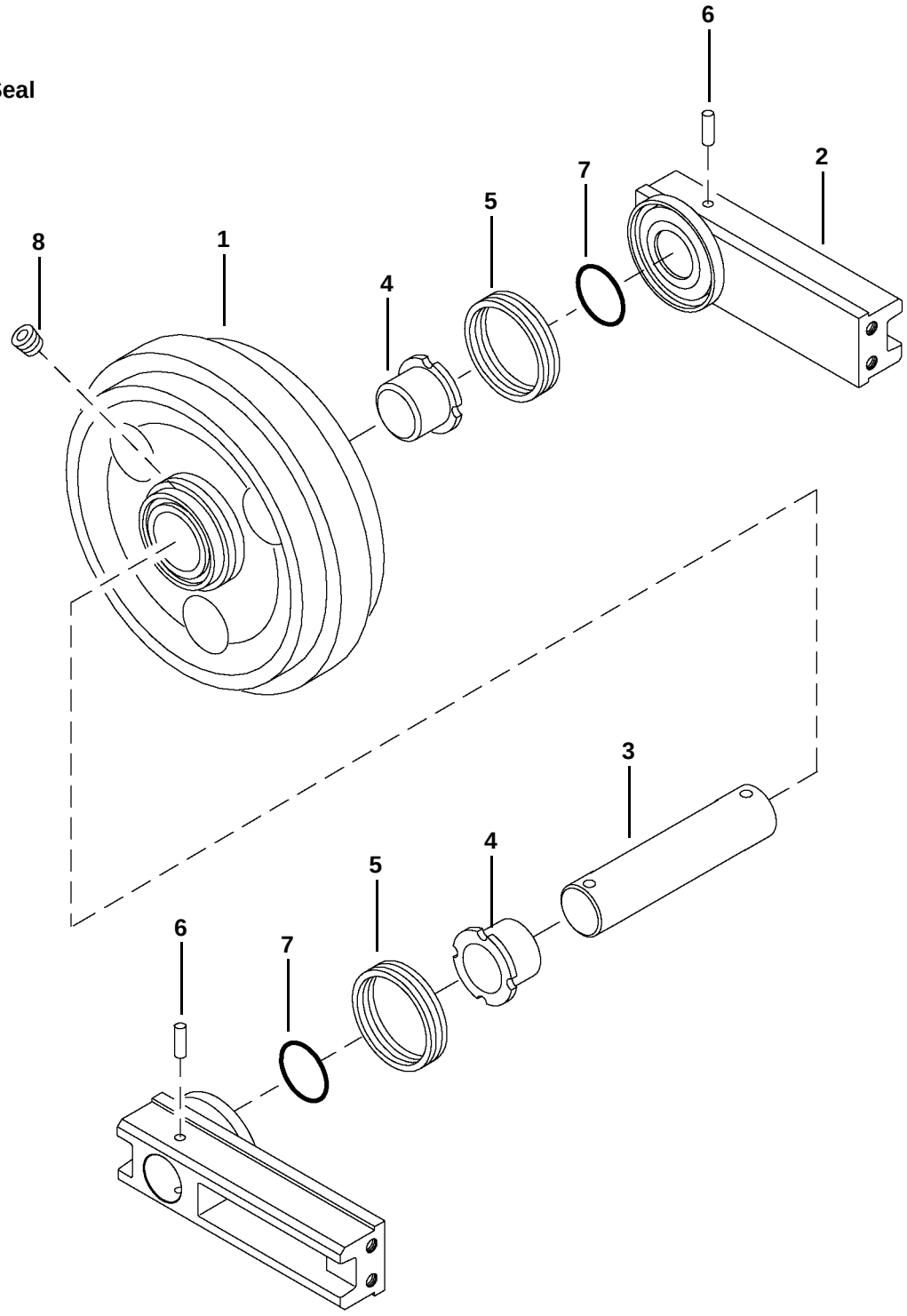
NOTE: The bolts may need to be heated to melt the thread adhesive.

Installation: Apply thread adhesive (Loctite® 262 or equivalent) to the bolt threads. Tight the bolts to 255 - 285 N•m (188 - 210 ft-lb) torque.

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Idler Parts Identification

1. Idler
2. Support
3. Shaft
4. Bushing
5. Floating Seal
6. Pin
7. O-ring
8. Plug

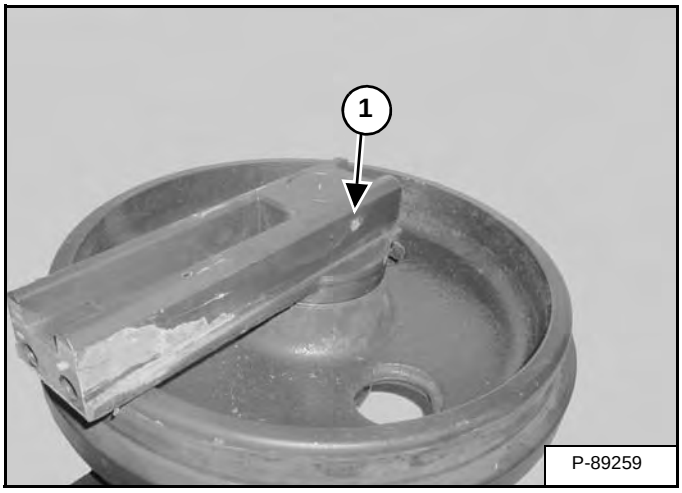


E80-2120S

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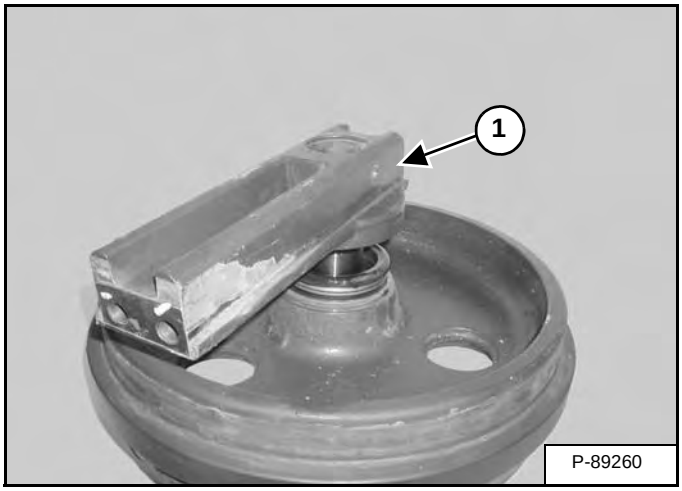
Idler Disassembly

Figure 30-20-14



Remove the roll pin (Item 1) **[Figure 30-20-14]**.

Figure 30-20-15



Pull up on and remove the support (Item 1) **[Figure 30-20-15]**.

Figure 30-20-16

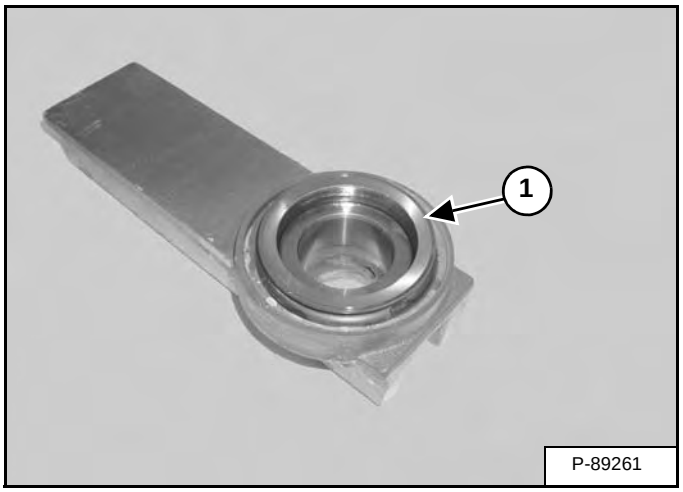
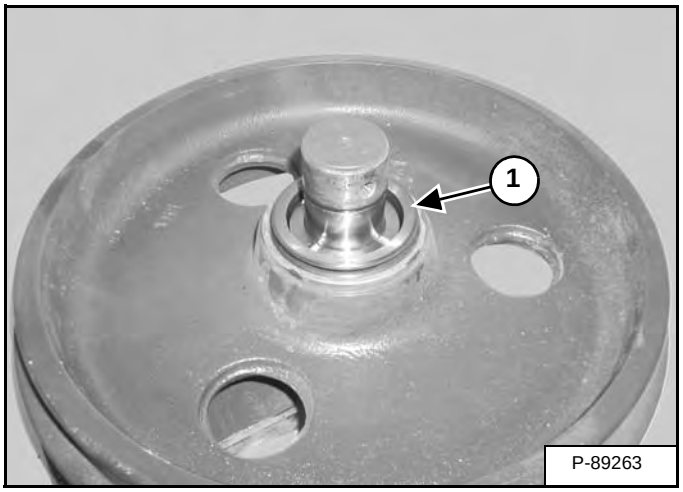


Figure 30-20-17

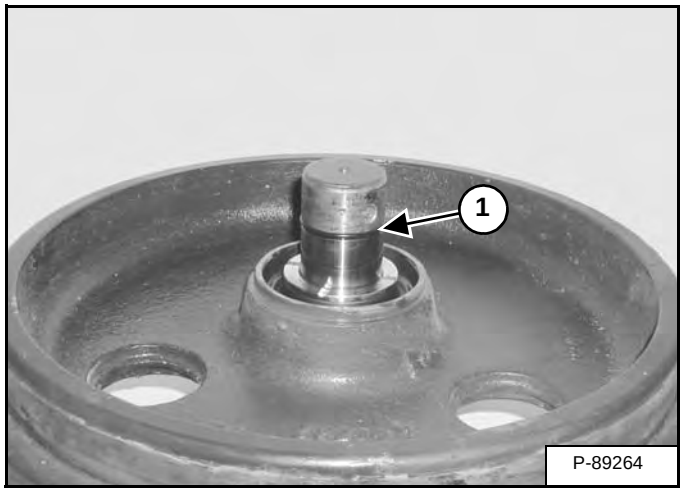


Remove the floating seal (Item 1) **[Figure 30-20-16]** and **[Figure 30-20-17]** from the support and idler.

Dealer Copy -- Not for Resale

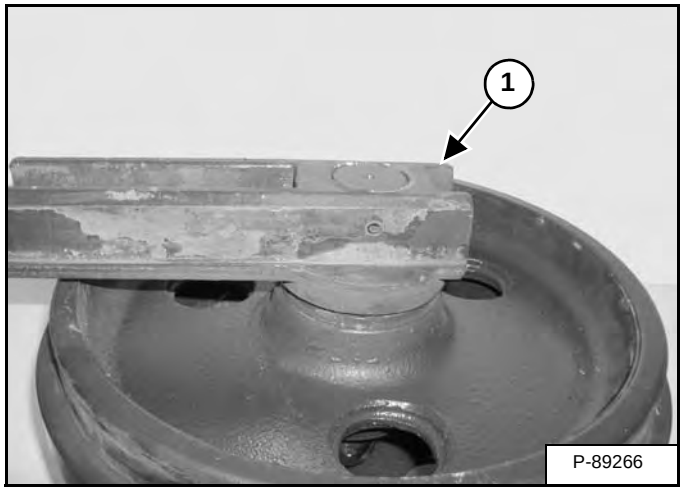
Idler Disassembly (Cont'd)

Figure 30-20-18



Remove the O-ring (Item 1) **[Figure 30-20-18]** from the shaft.

Figure 30-20-19



Tip the idler over and remove the support / shaft assembly (Item 1) **[Figure 30-20-19]**.

Figure 30-20-20

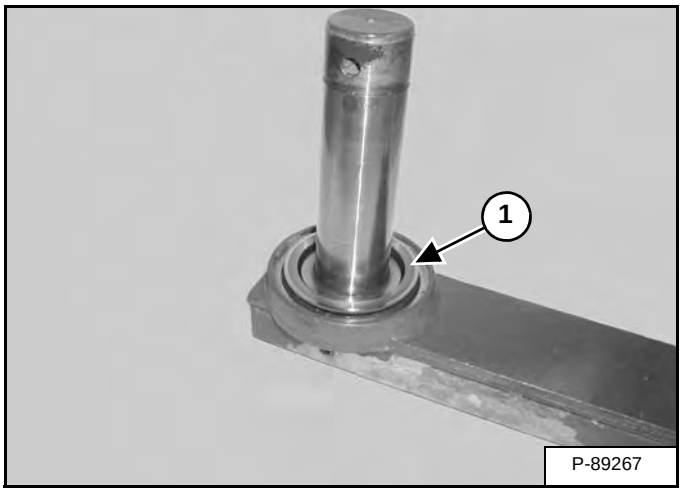
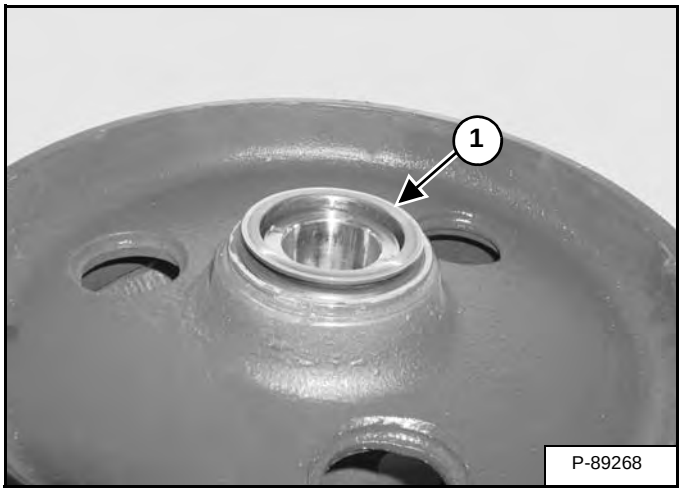


Figure 30-20-21

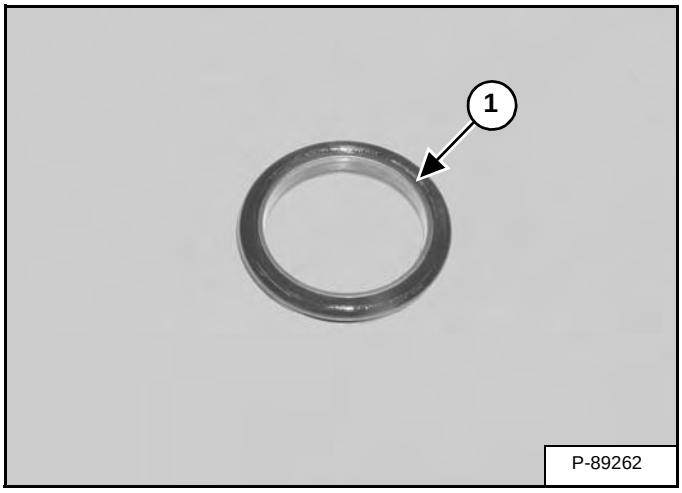


Remove the floating seal (Item 1) **[Figure 30-20-20]** and **[Figure 30-20-21]** from the support and idler.

Dealer Copy -- Not for Resale

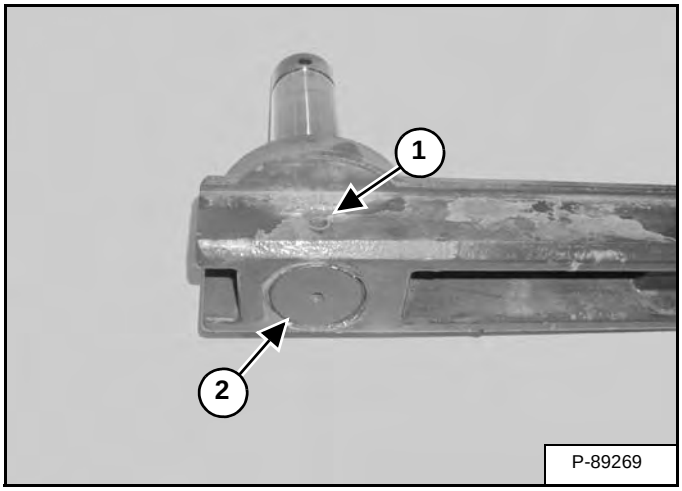
Idler Disassembly (Cont'd)

Figure 30-20-22



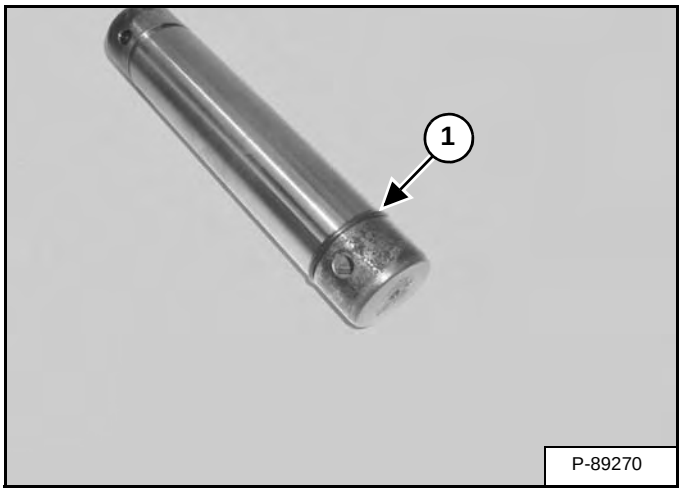
Remove the O-ring (Item 1) **[Figure 30-20-22]** from all four of the steel seals.

Figure 30-20-23



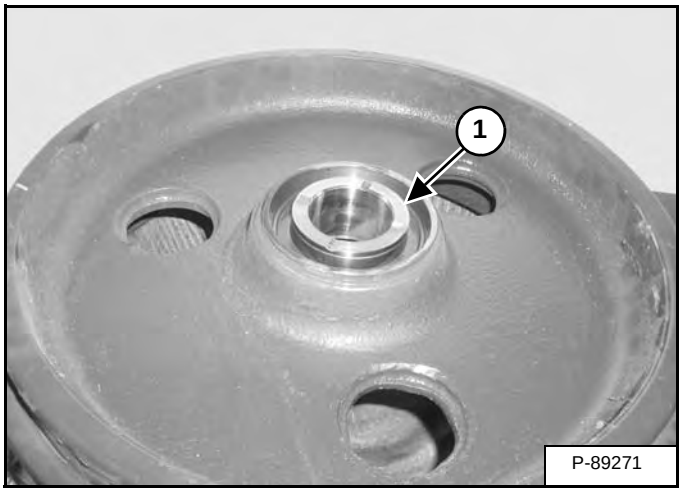
Remove the roll pin (Item 1). Remove the shaft (Item 2) **[Figure 30-20-23]** from the support.

Figure 30-20-24



Remove the O-ring (Item 1) **[Figure 30-20-24]**.

Figure 30-20-25



Remove the bushings (Item 1) **[Figure 30-20-25]** from both sides of the idler.

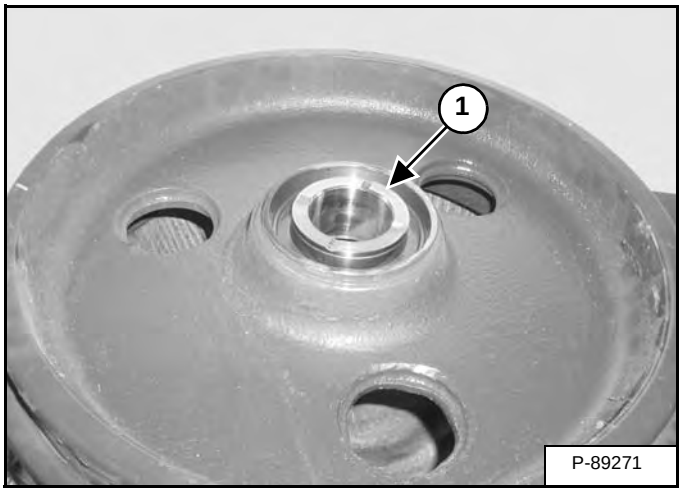
Dealer Copy -- Not for Resale

Idler Assembly

Clean all parts in solvent and dry with compressed air.

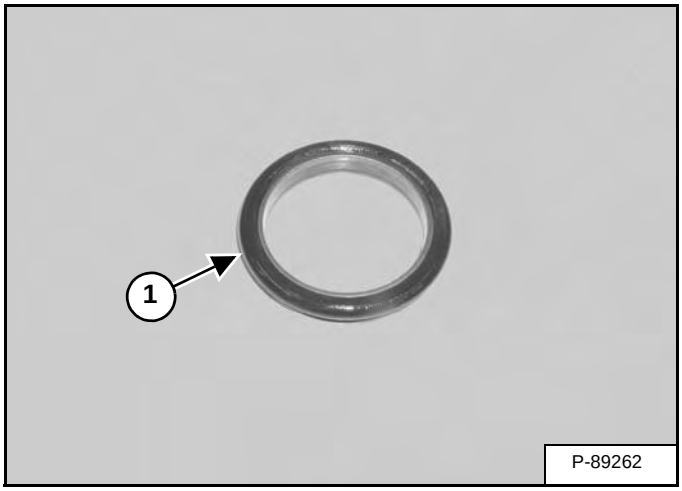
The seal assemblies are a matched set and must be replaced in pairs.

Figure 30-20-26



Install the bushings (Item 1) **[Figure 30-20-26]** on both sides of the idler.

Figure 30-20-27

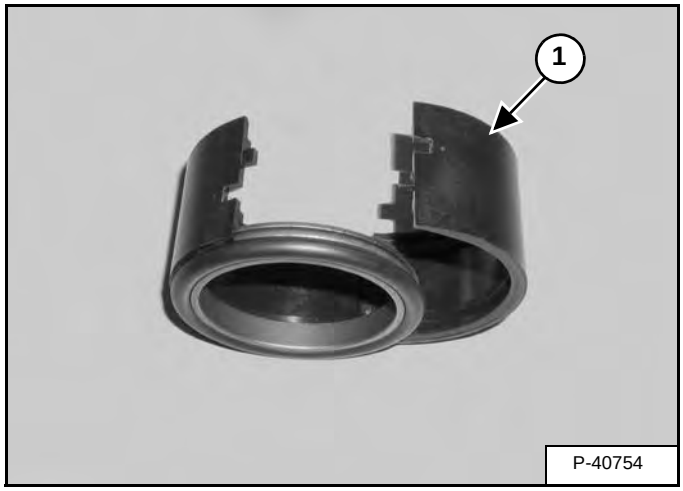


Install the O-ring (Item 1) **[Figure 30-20-27]** on the seal ring. Repeat this procedure on all four seal assemblies.

The O-ring and seal ring must be clean and free of any dust, oil film and foreign matter.

NOTE: Inspect the seal ring for damage before installing the O-ring. Make sure that the O-ring is not twisted when installing it. To remove any twists, gently pull a section of the O-ring and let it snap back.

Figure 30-20-28

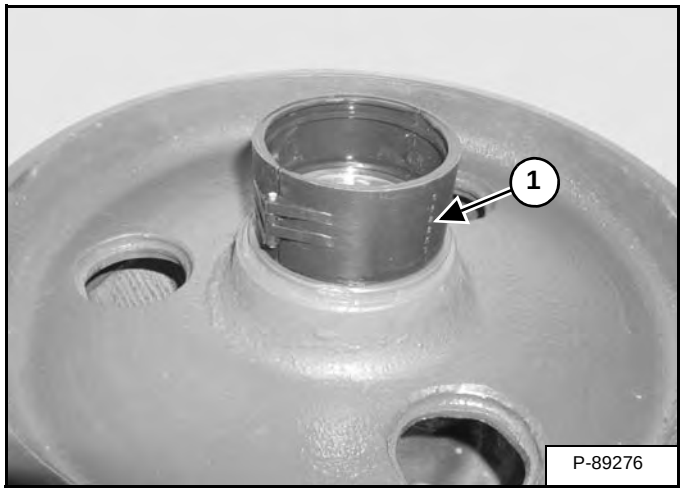


Place the seal assembly in the installation tool (Item 1) **[Figure 30-20-28]**.

The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the seal assembly in a pan of alcohol.

Figure 30-20-29



Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-20-29]** in the idler.

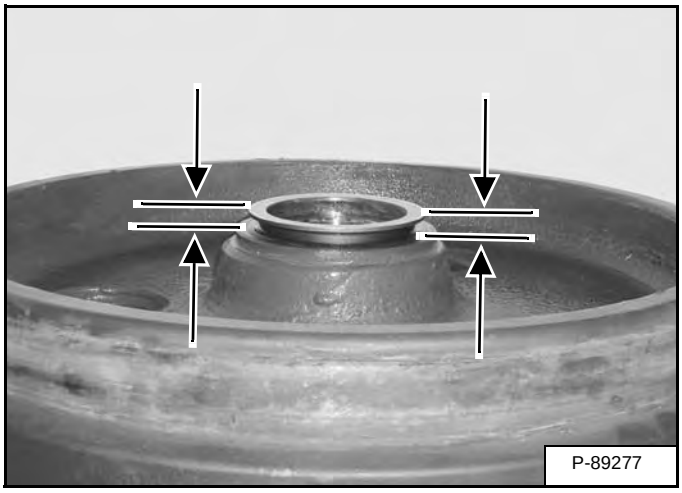
Use firm, even pressure on the installation tool to *pop* the O-ring into the housing.

Remove the installation tool.

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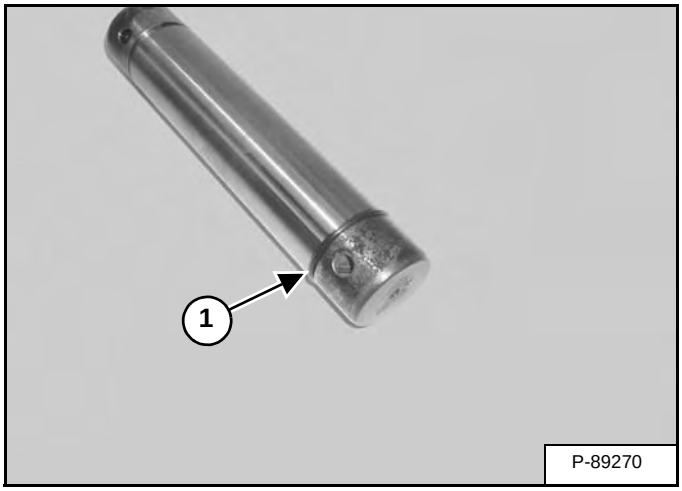
Idler Assembly (Cont'd)

Figure 30-20-30



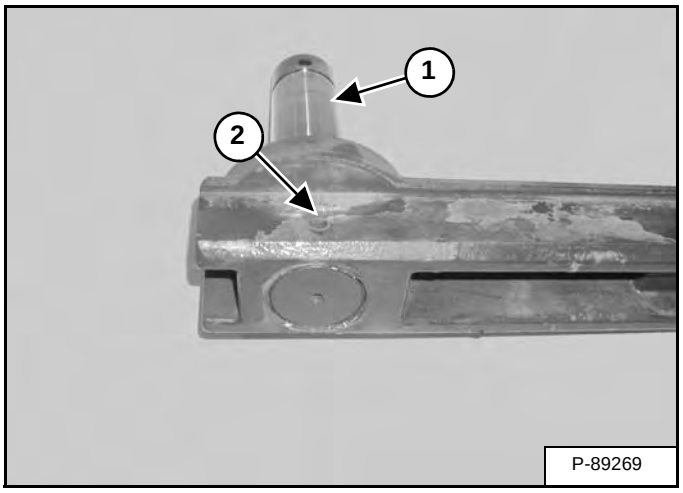
The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 30-20-30]**.

Figure 30-20-31



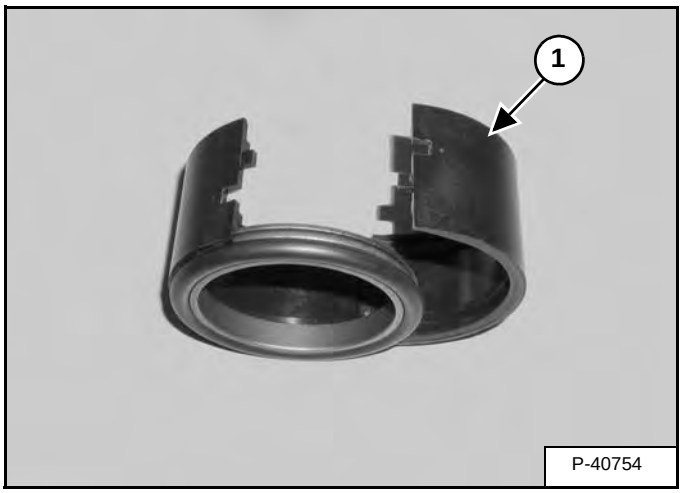
Install the O-ring (Item 1) **[Figure 30-20-31]** onto the shaft.

Figure 30-20-32



Install the shaft (Item 1) in the support. Install the roll pin (Item 2) **[Figure 30-20-32]** through the shaft and support assembly.

Figure 30-20-33



Place the seal assembly (Item 1) **[Figure 30-20-33]** in the installation tool.

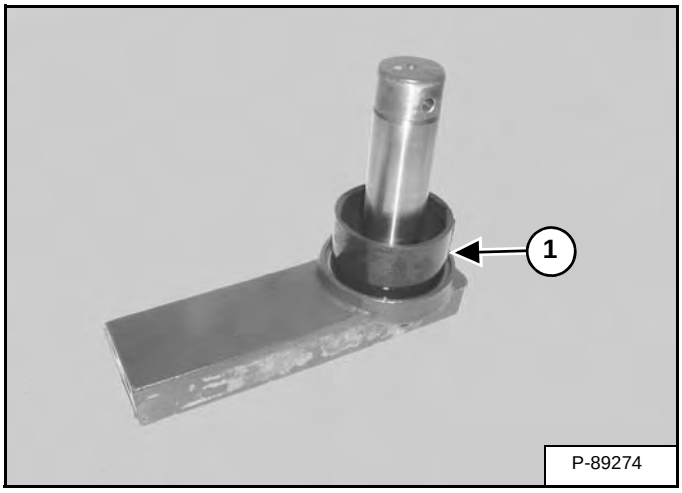
The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the seal assembly in a pan of alcohol.

Dealer Copy -- Not for Resale

Idler Assembly (Cont'd)

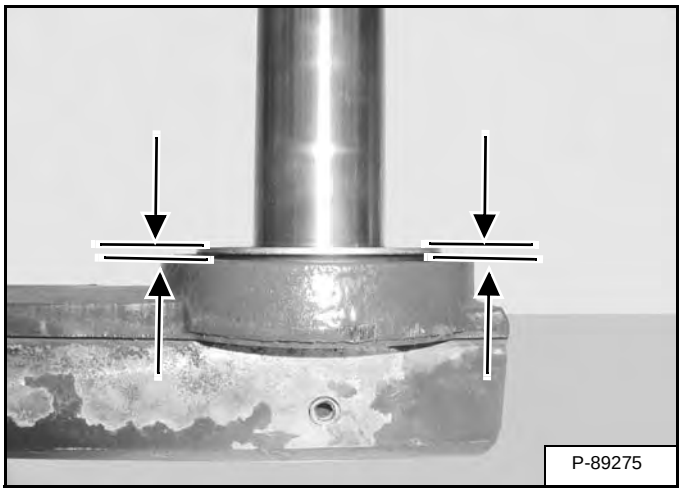
Figure 30-20-34



Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-20-34]** in the support.

Use firm, even pressure on the installation tool to *pop* the O-ring into the housing.

Figure 30-20-35

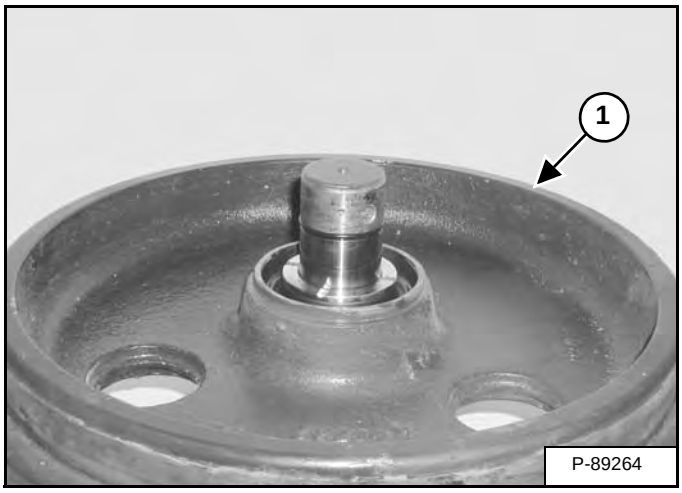


The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 30-20-35]**.

Apply a light film of oil to both metal seal rings.

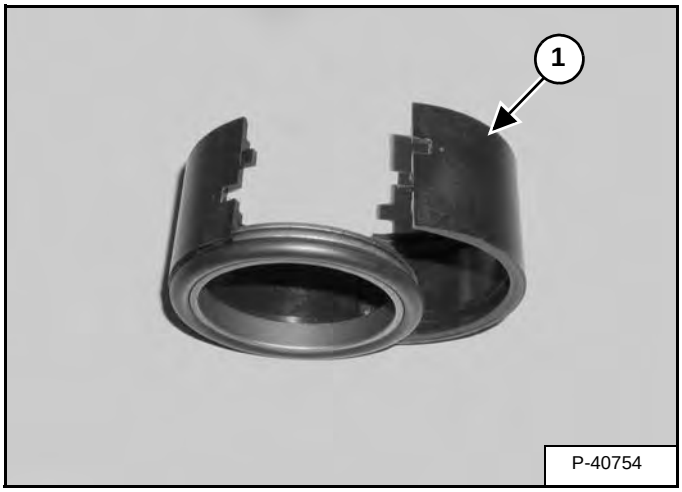
NOTE: Do not get any oil on the rubber O-rings.

Figure 30-20-36



Install the idler (Item 1) **[Figure 30-20-36]** on the shaft / support assembly.

Figure 30-20-37



Place the seal assembly (Item 1) **[Figure 30-20-37]** in the installation tool.

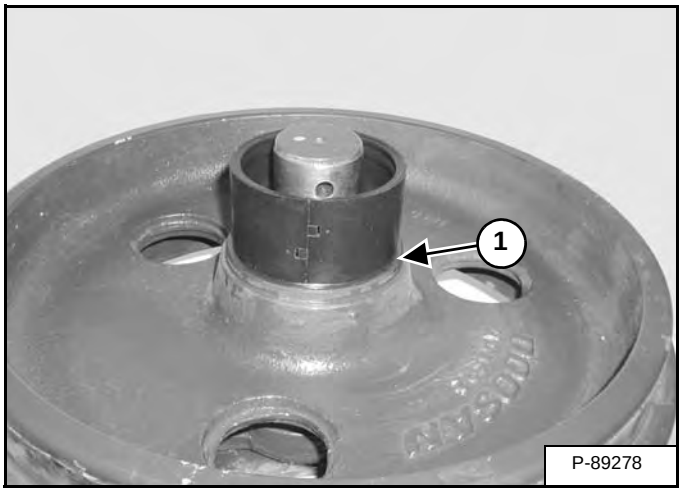
The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the seal assembly in a pan of alcohol.

Dealer Copy -- Not for Resale

Idler Assembly (Cont'd)

Figure 30-20-38

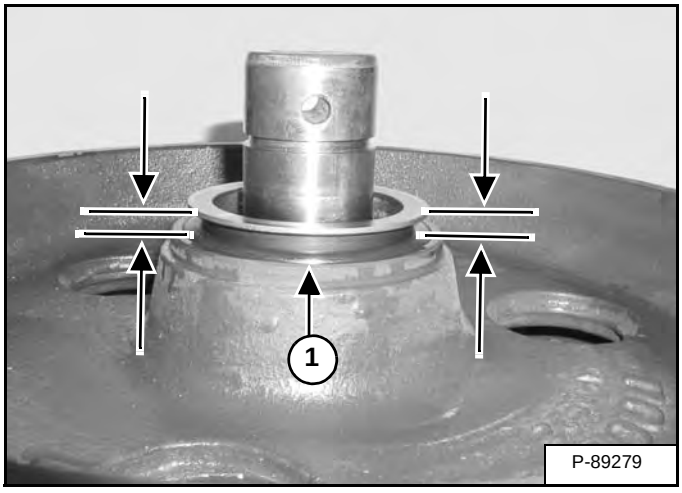


Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-20-38]** in the idler.

Use firm, even pressure on the installation tool to *pop* the O-ring into the housing.

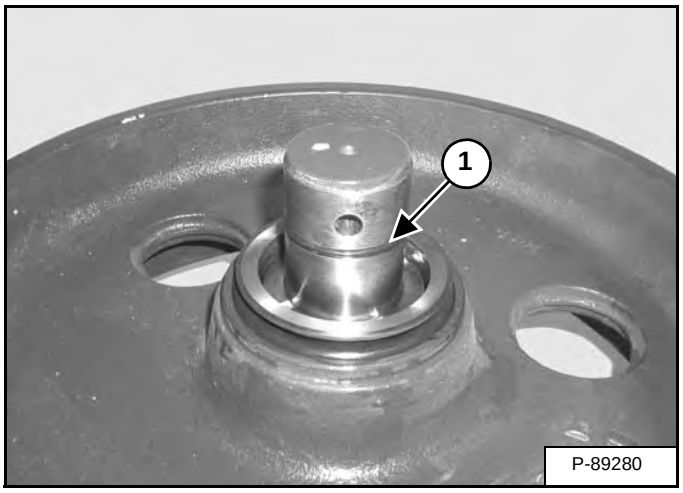
Remove the installation tool.

Figure 30-20-39



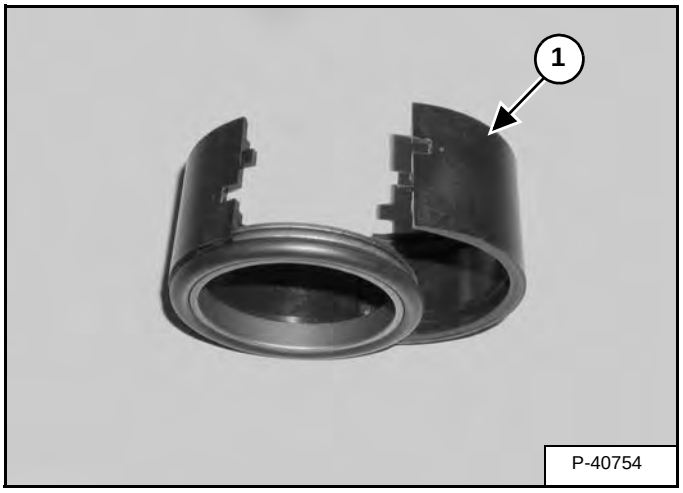
The seal assembly stand off height must be equal and the O-ring (Item 1) **[Figure 30-20-39]** must not be twisted.

Figure 30-20-40



Install the O-ring (Item 1) **[Figure 30-20-40]** on the shaft.

Figure 30-20-41



Place the seal assembly (Item 1) **[Figure 30-20-41]** in the installation tool.

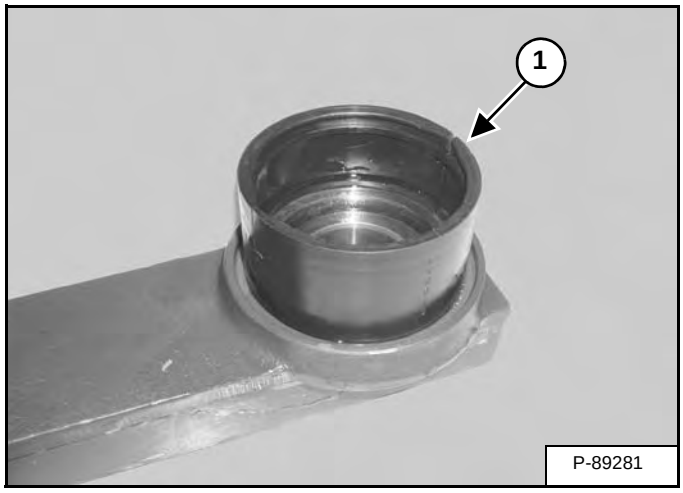
The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the seal assembly in a pan of alcohol.

Dealer Copy -- Not for Resale

Idler Assembly (Cont'd)

Figure 30-20-42

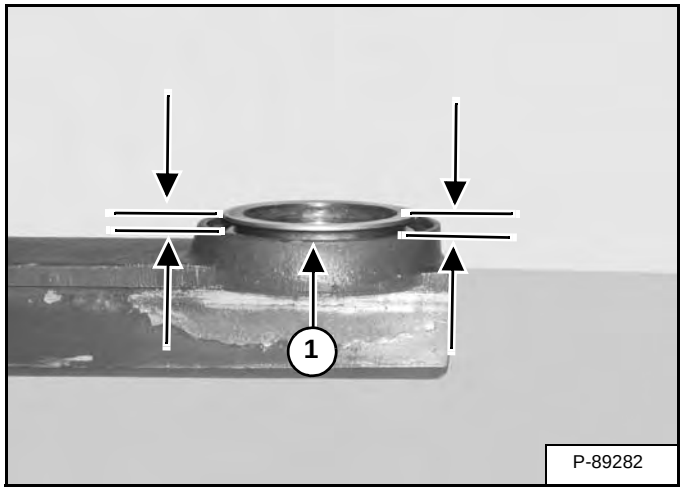


Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-20-42]** in the idler.

Use firm, even pressure on the installation tool to *pop* the O-ring into the housing.

Remove the installation tool.

Figure 30-20-43

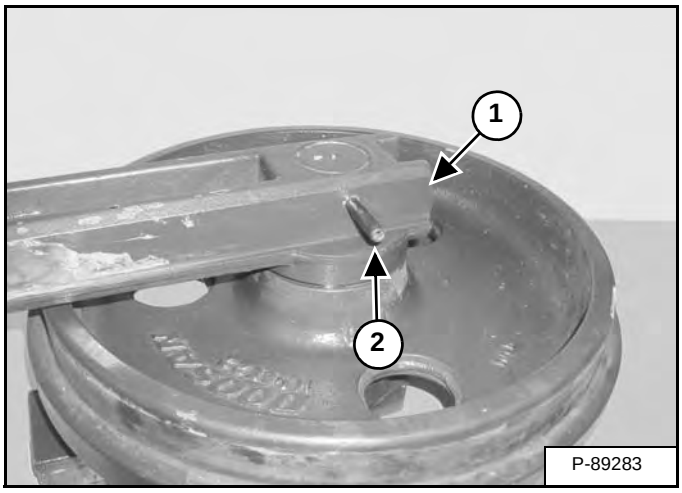


The seal stand off height must be equal and the O-ring (Item 1) **[Figure 30-20-43]** must not be twisted.

Apply a light film of oil to both metal seal rings.

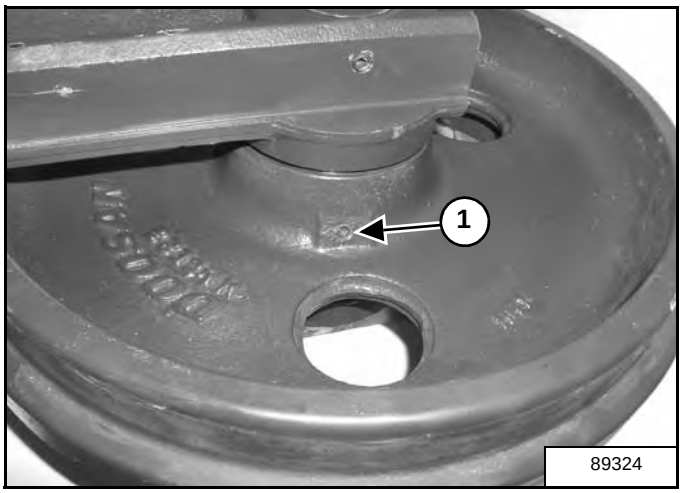
NOTE: Do not get any oil on the rubber O-rings.

Figure 30-20-44



Install the support (Item 1) on the shaft. Press down on the support and install the roll pin (Item 2) **[Figure 30-20-44]**.

Figure 30-20-45



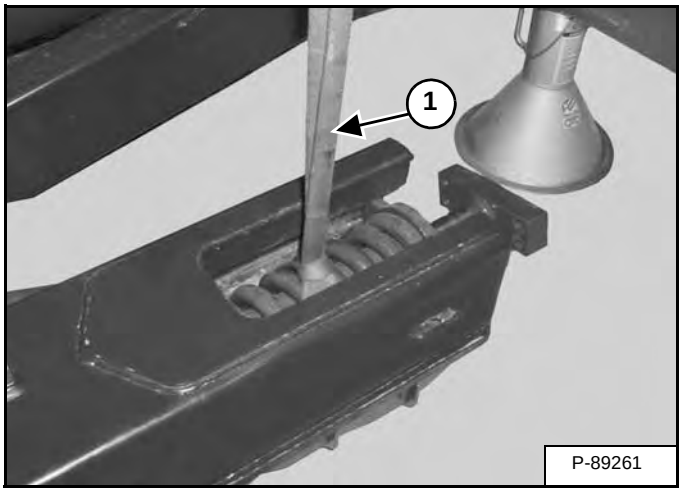
Remove the plug (Item 1) **[Figure 30-20-45]**.

Add 0,101 - 0,139 L (3.4 - 4.7 U.S. fl oz) 30W oil to the idler. Install the plug (Item 1) **[Figure 30-20-45]**.

Dealer Copy -- Not for Resale

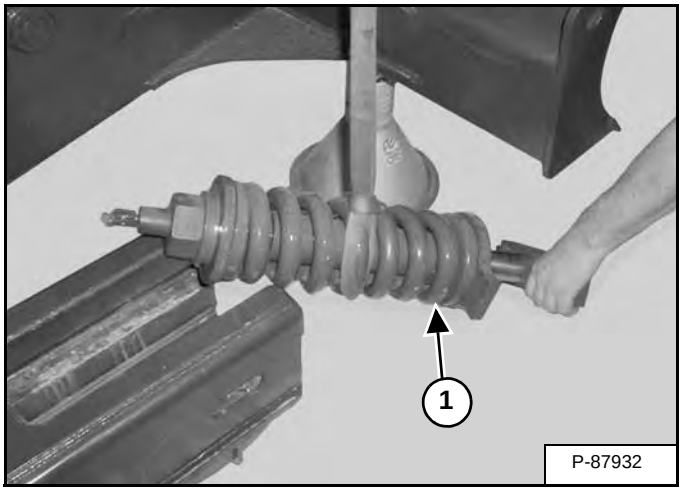
Track Tensioner Removal And Installation

Figure 30-20-46



Install a sling (Item 1) **[Figure 30-20-46]** and hoist on the grease cylinder.

Figure 30-20-47



Guide the grease cylinder (Item 1) **[Figure 30-20-47]** out of the track frame.

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY (Item 1) **[Figure 30-20-47]**.

⚠ WARNING



P-62574

AVOID INJURY OR DEATH

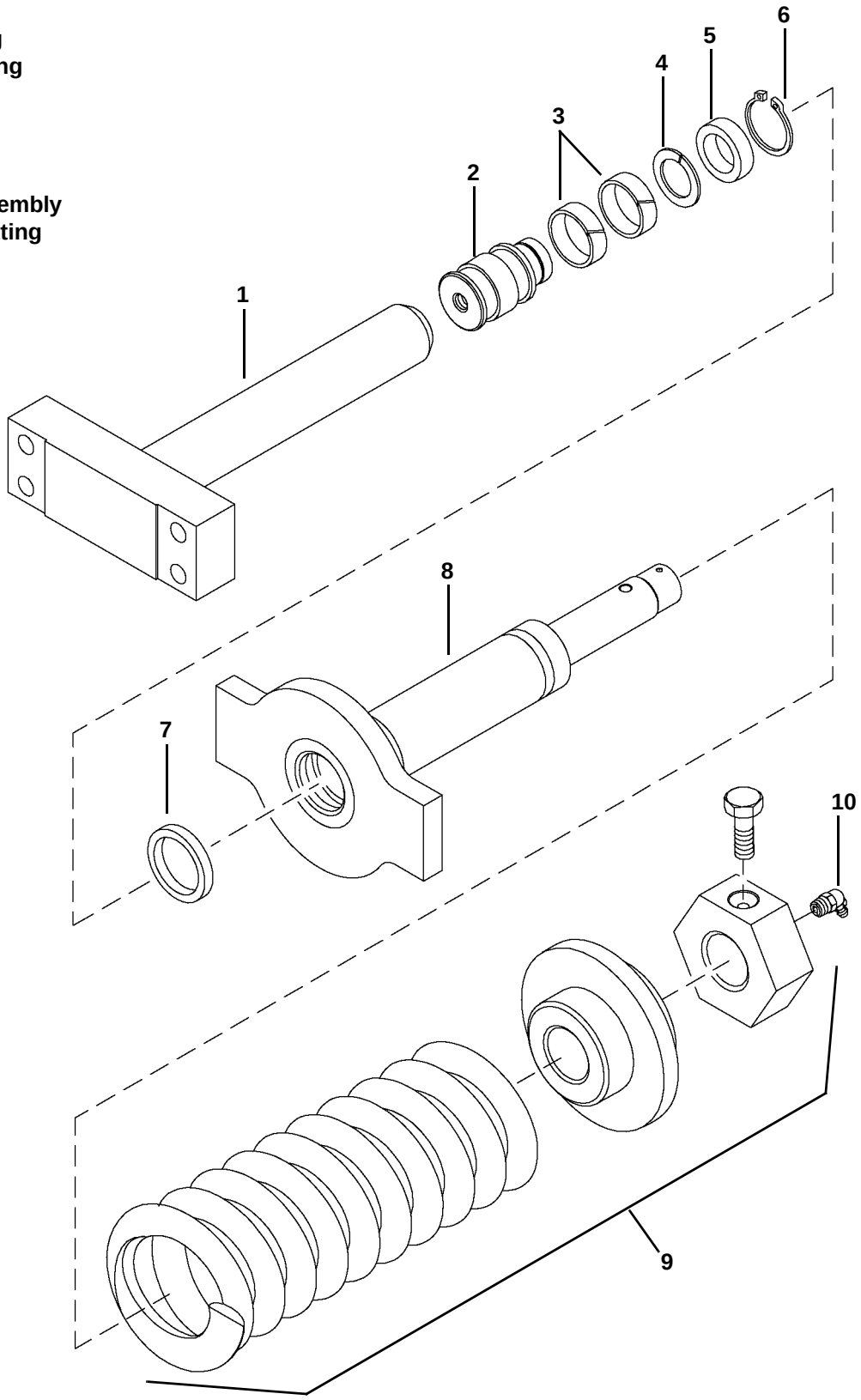
- **Spring loaded components under pressure can cause serious injury or death.**
- **Do not disassemble the coil spring assembly**

W-2617-1004

Dealer Copy -- Not for Resale

Track Tensioner Parts Identification

1. Piston Rod
2. Piston
3. Piston Ring
4. Back-up Ring
5. Packing
6. Snap Ring
7. Dust Seal
8. Cylinder
9. Spring Assembly
10. Grease Fitting

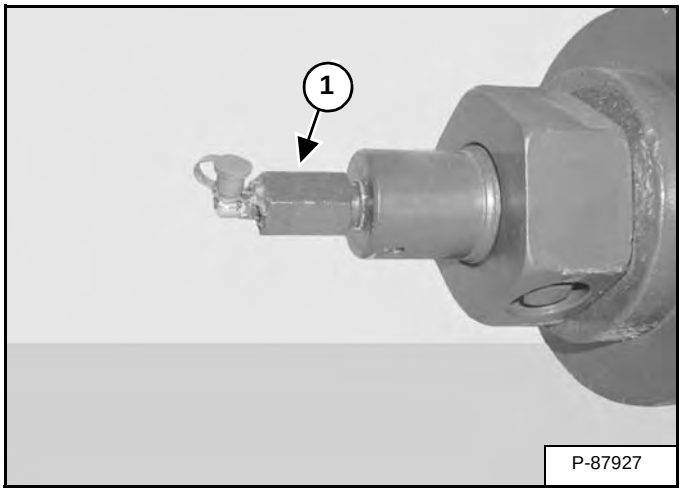


EM7807

Dealer Copy -- Not for Resale

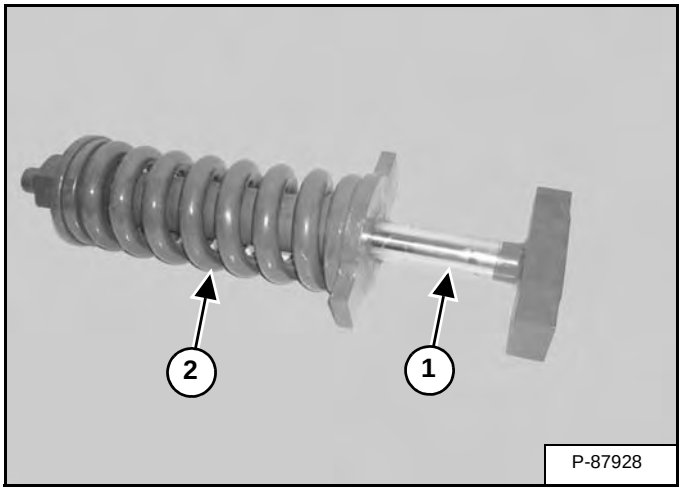
Track Tensioner Disassembly And Assembly

Figure 30-20-48



Remove the grease fitting and adapter (Item 1) **[Figure 30-20-48]**.

Figure 30-20-49



Remove the piston rod (Item 1) **[Figure 30-20-49]** from the cylinder.

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY (Item 2) **[Figure 30-20-49]**

WARNING



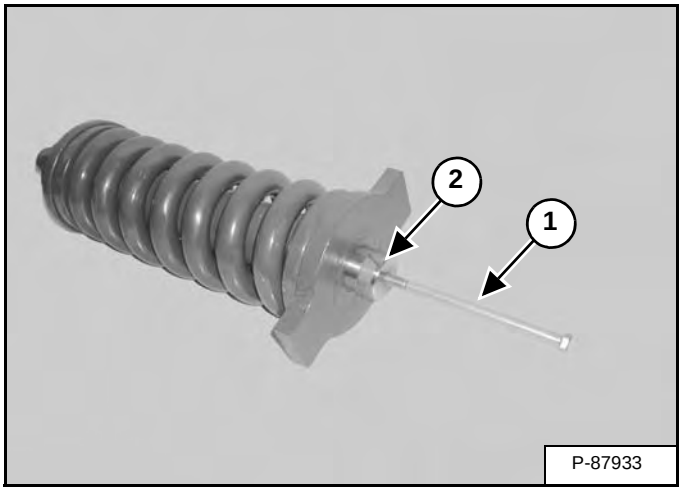
P-62574

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 30-20-50

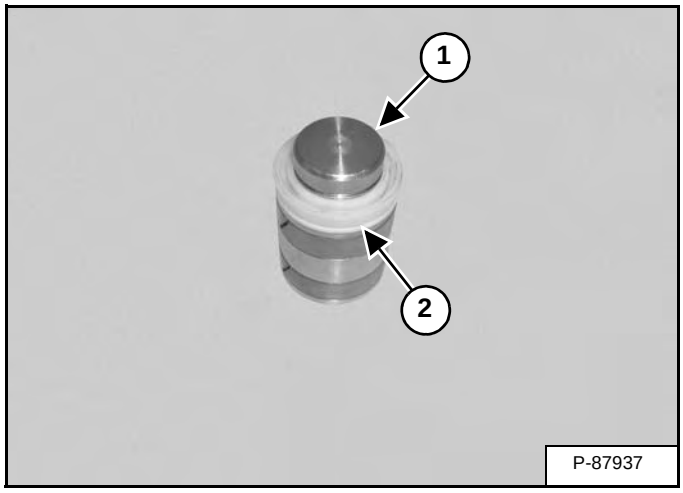


Use a 12 mm x 1,75 x 203 mm long bolt to thread the bolt (Item 1) into the piston (Item 2) **[Figure 30-20-50]**. Pull the piston out of the cylinder.

Dealer Copy -- Not for Resale

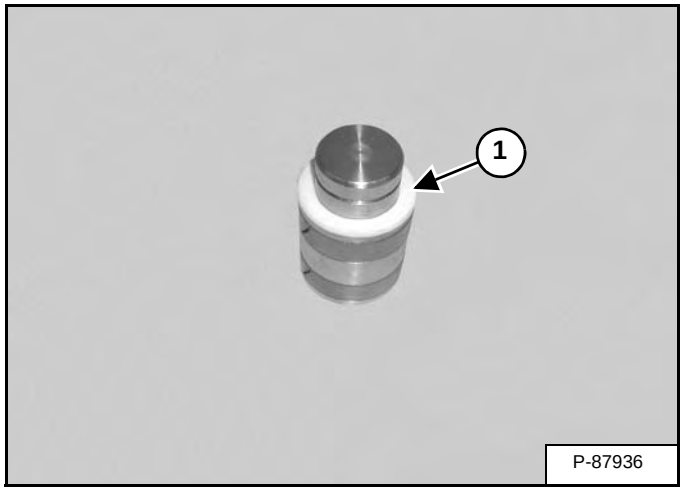
Track Tensioner Disassembly And Assembly (Cont'd)

Figure 30-20-51



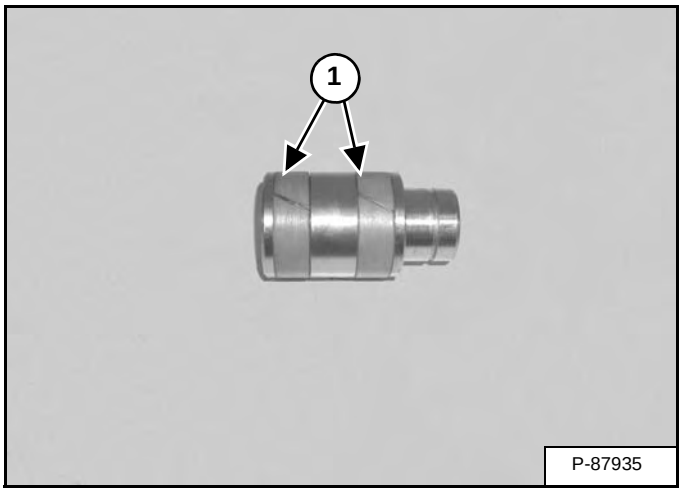
Remove the snap ring (Item 1) and packing (Item 2) **[Figure 30-20-51]**.

Figure 30-20-52



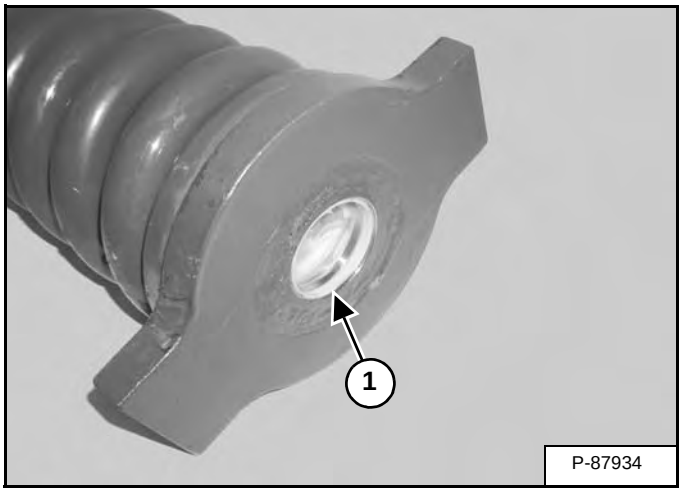
Remove the back-up ring (Item 1) **[Figure 30-20-52]**.

Figure 30-20-53



Remove the two piston rings (Item 1) **[Figure 30-20-53]**.

Figure 30-20-54



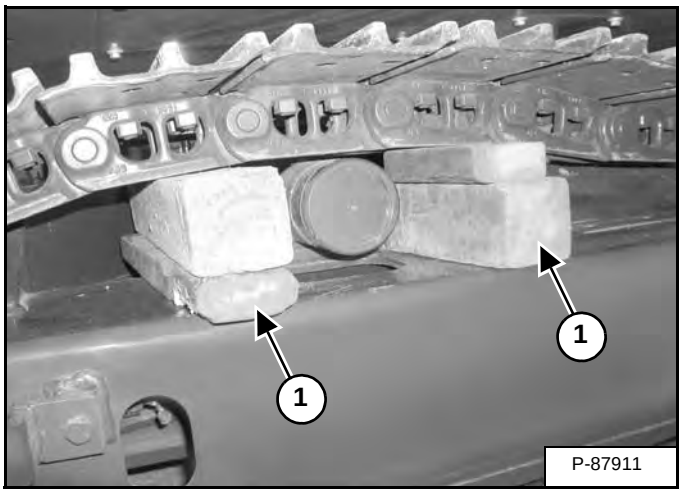
Remove the dust seal (Item 1) **[Figure 30-20-54]**.

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Roller Removal And Installation

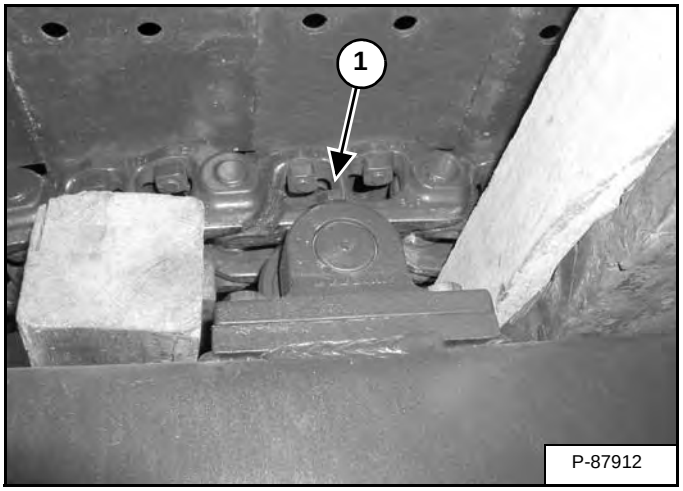
NOTE: The track does not have to be removed to remove the top roller.

Figure 30-20-55



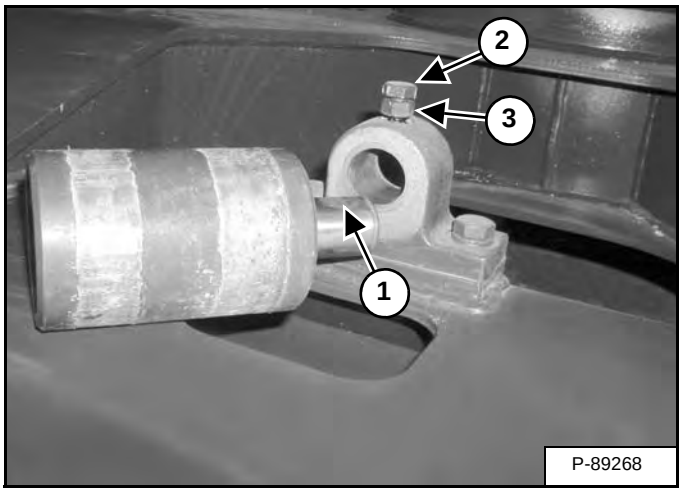
Install blocks (Item 1) **[Figure 30-20-55]** between the track frame and track. Loosen the track. (See Adjusting Tension on Page 30-20-3.)

Figure 30-20-56



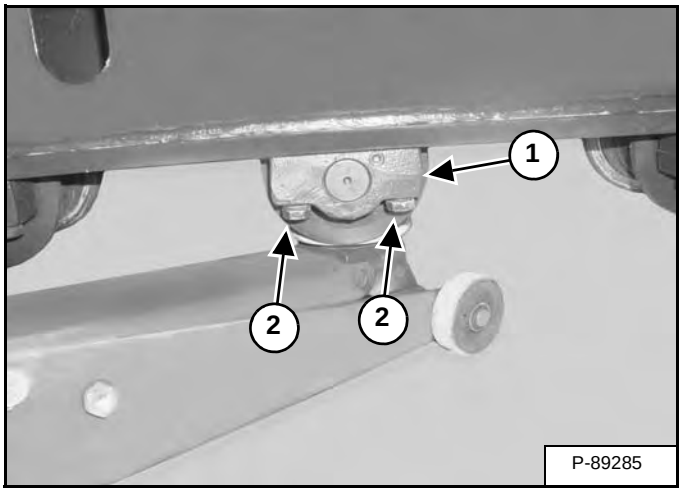
Loosen the nut (Item 1) **[Figure 30-20-56]** and bolt. Remove the top roller.

Figure 30-20-57



Installation: Install the flat spot of the shaft (Item 1) to the top of the mount. Tighten the bolt (Item 2) to 105 - 115 N•m (78 - 85 ft-lb) torque. Tighten the nut (Item 3) **[Figure 30-20-57]** against the mount.

Figure 30-20-58



NOTE: Remove the track to remove the bottom roller.

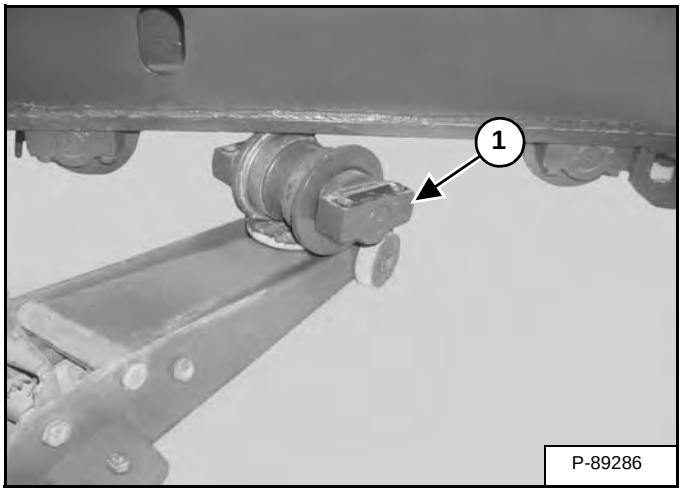
Place a jack under the bottom roller (Item 1). Remove the four bolts (Item 2) **[Figure 30-20-58]**.

Installation: Apply thread adhesive (Loctite® 242 or equivalent) to the bolt threads. Tighten the bolts to 160 - 180 N•m (118 - 113 ft-lb) torque.

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Roller Removal And Installation (Cont'd)

Figure 30-20-59

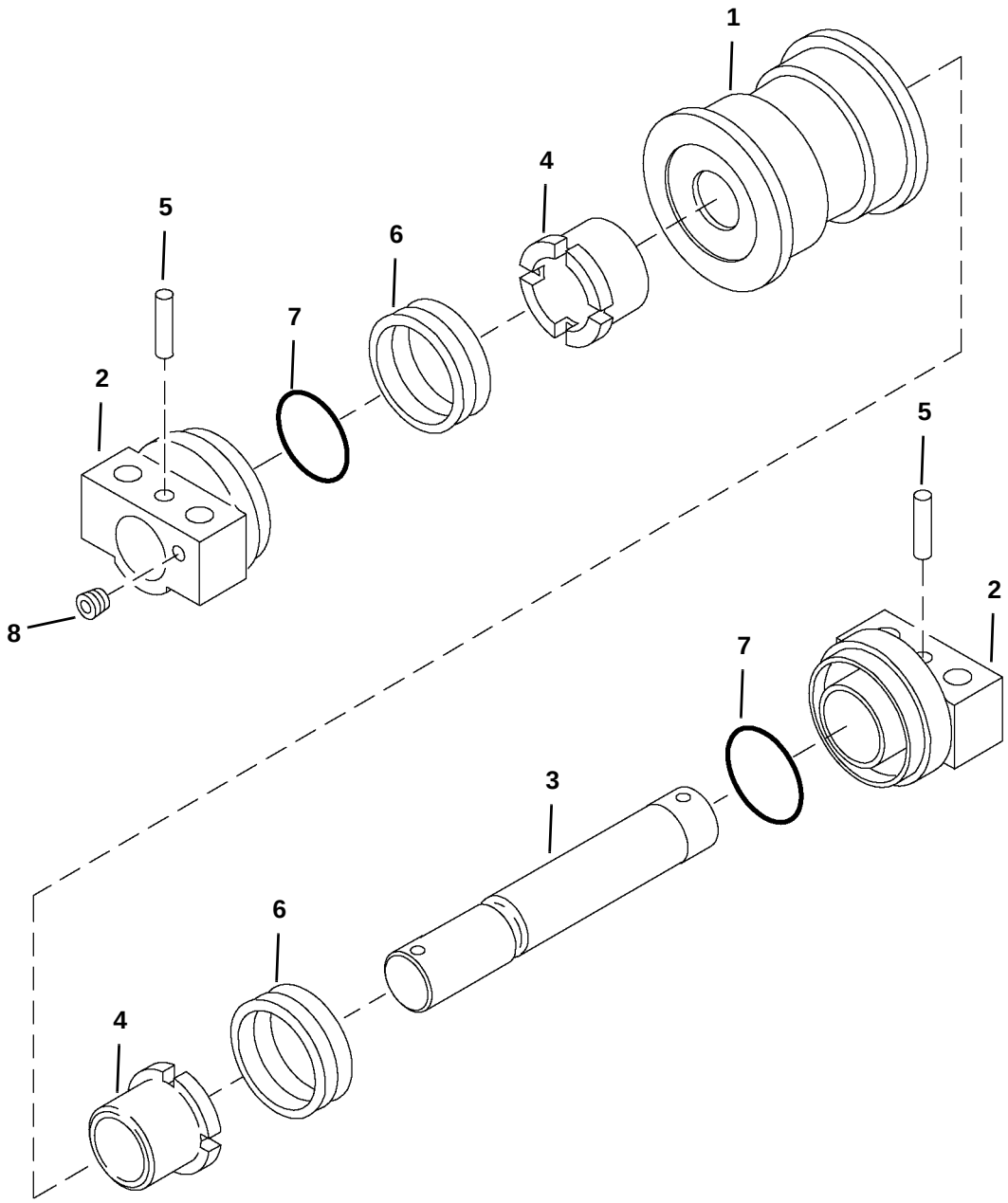


Lower the jack and remove the roller (Item 1) **[Figure 30-20-59]**.

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Lower Roller Parts Identification

1. Roller
2. Collar
3. Shaft
4. Bushing
5. Pin
6. Seal
7. O-ring
8. Plug

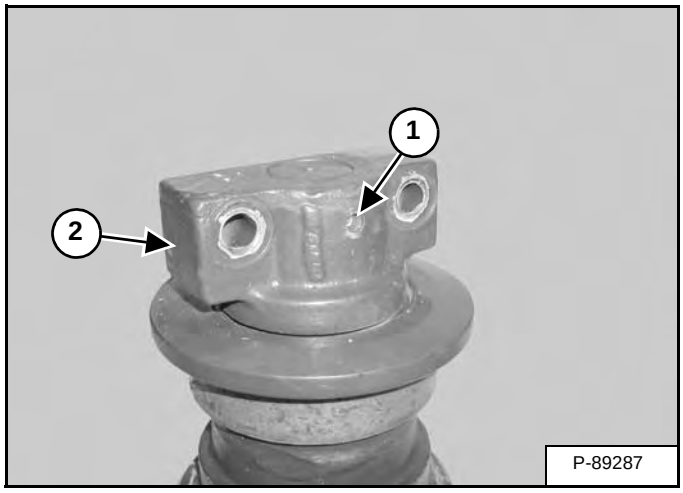


E80-2150S

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Lower Roller Disassembly

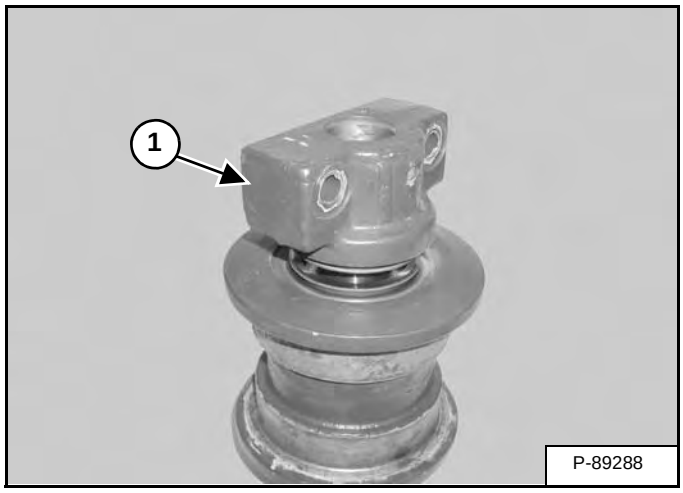
Figure 30-20-60



Drive the pin (Item 1) towards the top of the collar (Item 2) **[Figure 30-20-60]**.

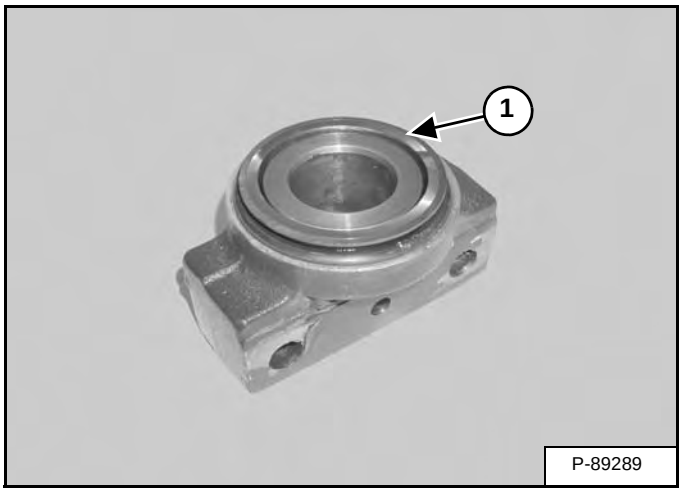
NOTE: The pin bore in the collar is stepped.

Figure 30-20-61



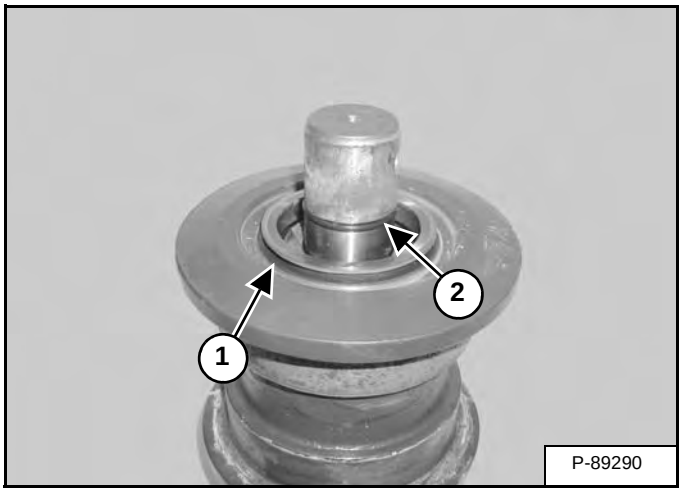
Remove the collar (Item 1) **[Figure 30-20-61]**.

Figure 30-20-62



Remove the seal assembly (Item 1) **[Figure 30-20-62]**.

Figure 30-20-63

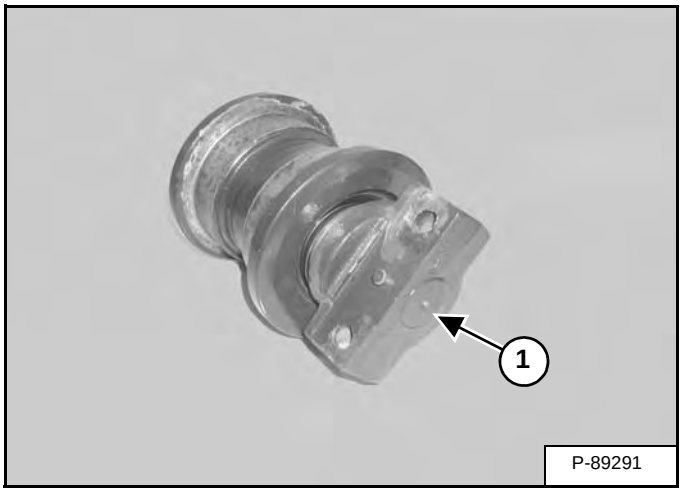


Remove the seal assembly (Item 1). Remove the O-ring (Item 2) **[Figure 30-20-63]**.

Dealer Copy -- Not for Resale

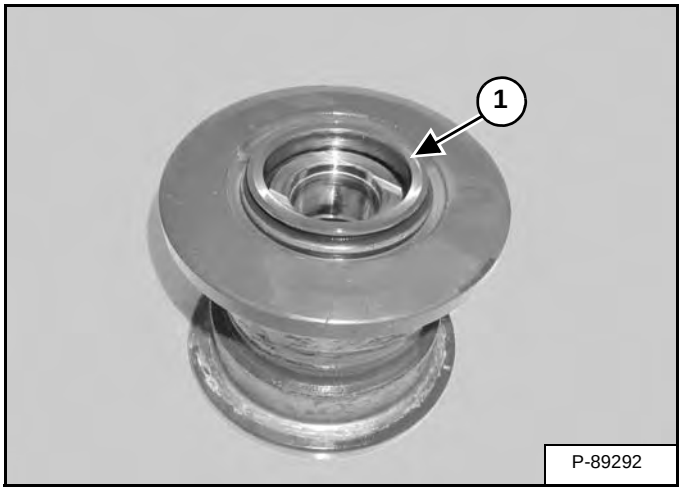
Lower Roller Disassembly (Cont'd)

Figure 30-20-64



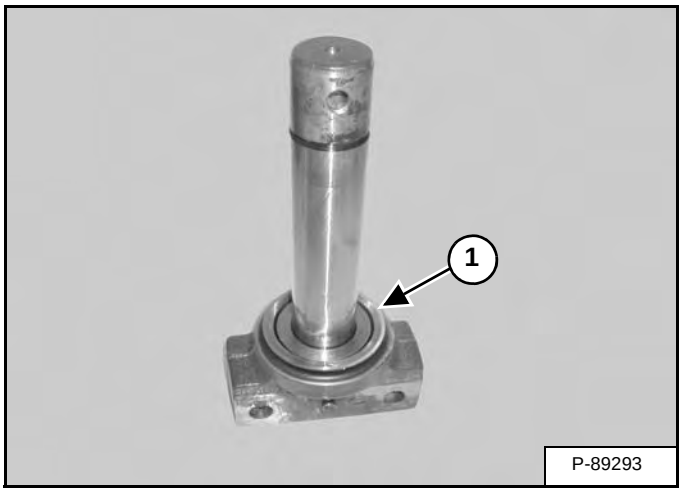
Remove the shaft assembly (Item 1) **[Figure 30-20-64]** from the roller.

Figure 30-20-65



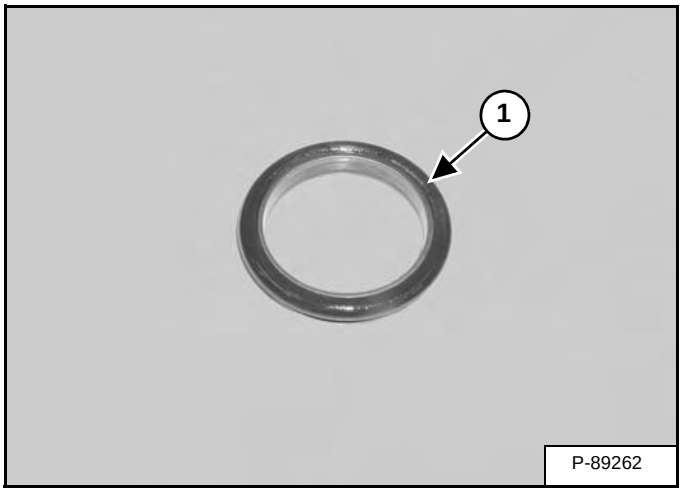
Remove the seal assembly (Item 1) **[Figure 30-20-65]** from the roller.

Figure 30-20-66



Remove the seal assembly (Item 1) **[Figure 30-20-66]** from the collar.

Figure 30-20-67

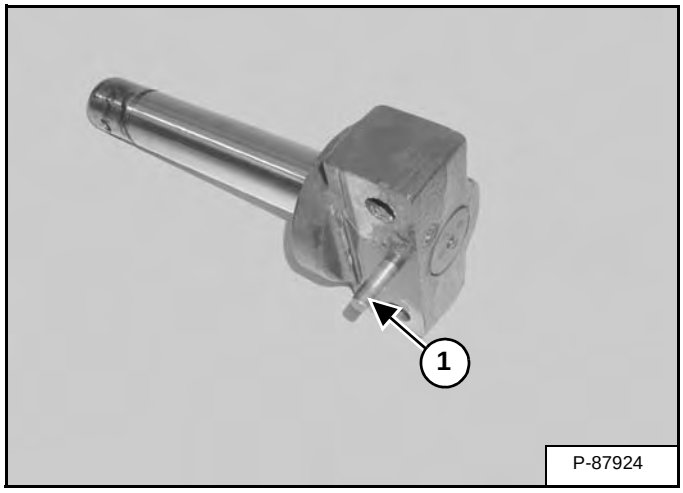


Remove the O-ring (Item 1) **[Figure 30-20-67]** from all four seal rings.

Dealer Copy -- Not for Resale

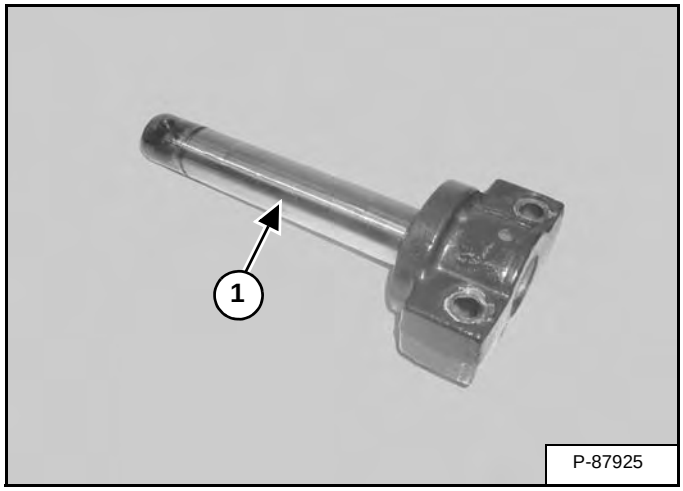
Lower Roller Disassembly (Cont'd)

Figure 30-20-68



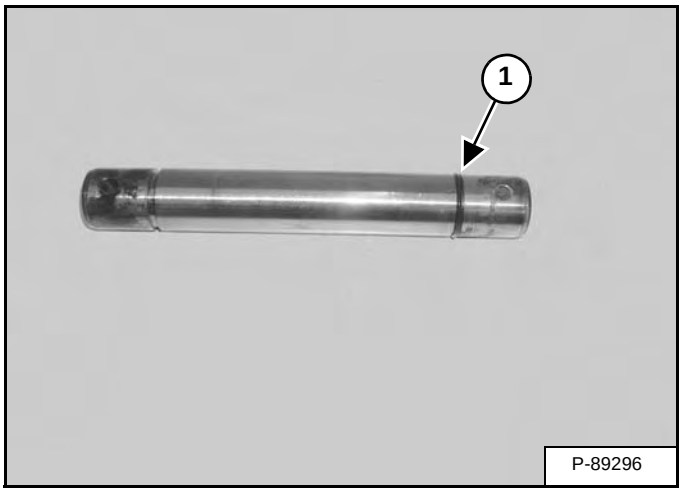
Remove the pin (Item 1) **[Figure 30-20-68]**.

Figure 30-20-69



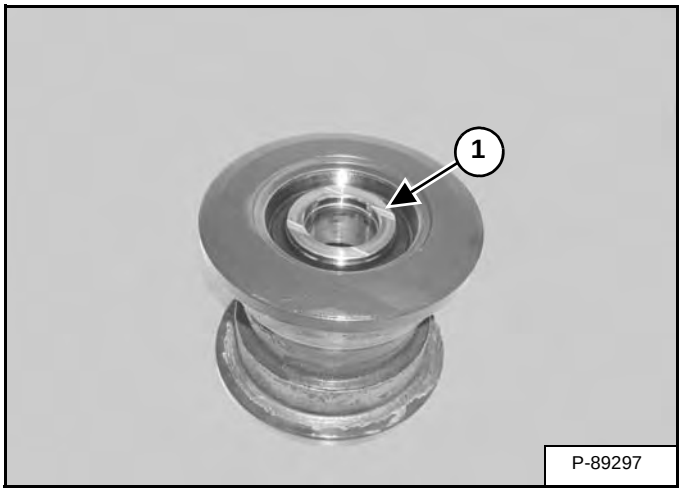
Remove the shaft (Item 1) **[Figure 30-20-69]**.

Figure 30-20-70



Remove the O-ring (Item 1) **[Figure 30-20-70]**.

Figure 30-20-71



Remove the bushing (Item 1) **[Figure 30-20-71]** from both sides of the roller.

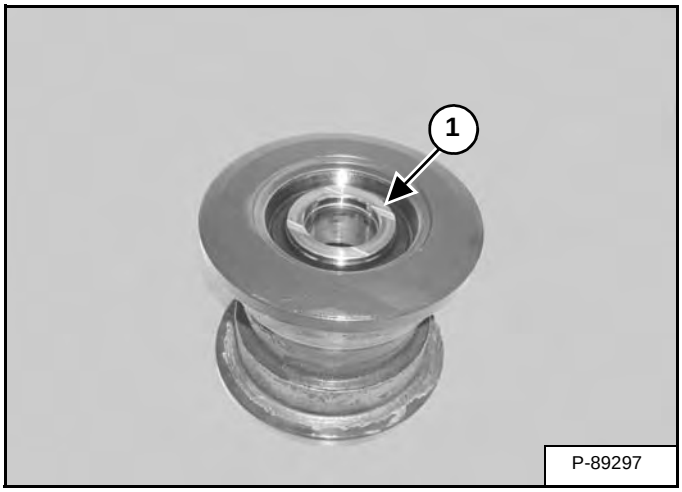
Dealer Copy -- Not for Resale

Lower Roller Assembly

Clean all parts in solvent and dry with compressed air.

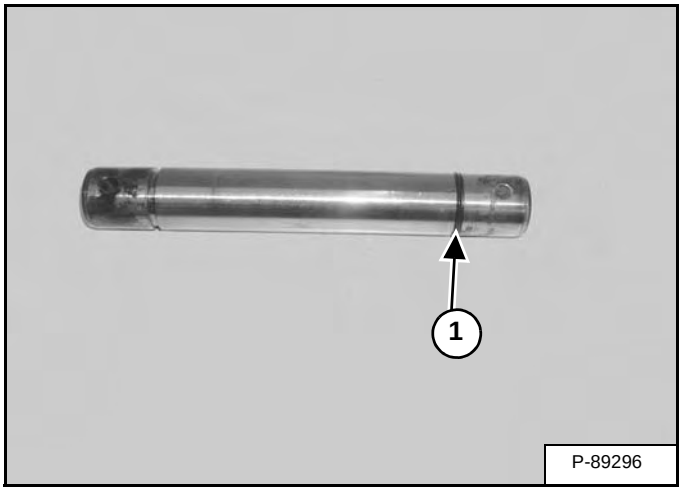
The seal assemblies are a matched set and must be replaced in pairs.

Figure 30-20-72



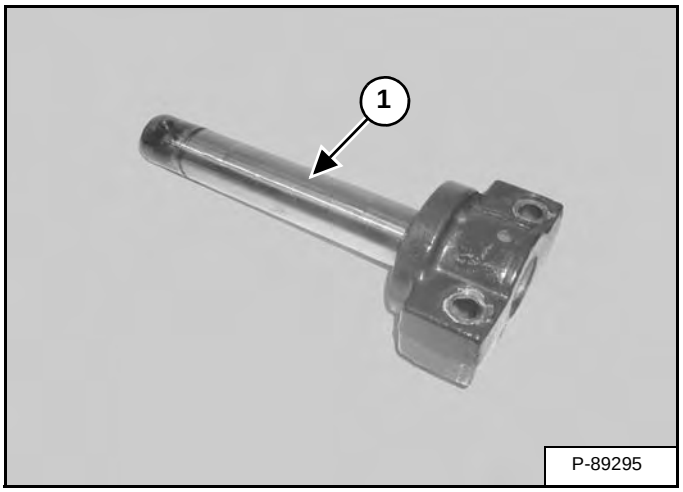
Install the bushing (Item 1) **[Figure 30-20-72]** on both sides of the roller.

Figure 30-20-73



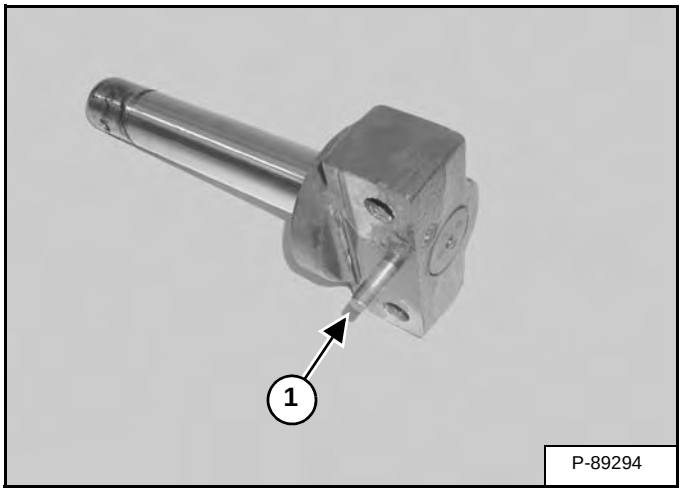
Install the O-ring (Item 1) **[Figure 30-20-73]** on the shaft.

Figure 30-20-74



Install the shaft (Item 1) **[Figure 30-20-74]** in the collar.

Figure 30-20-75

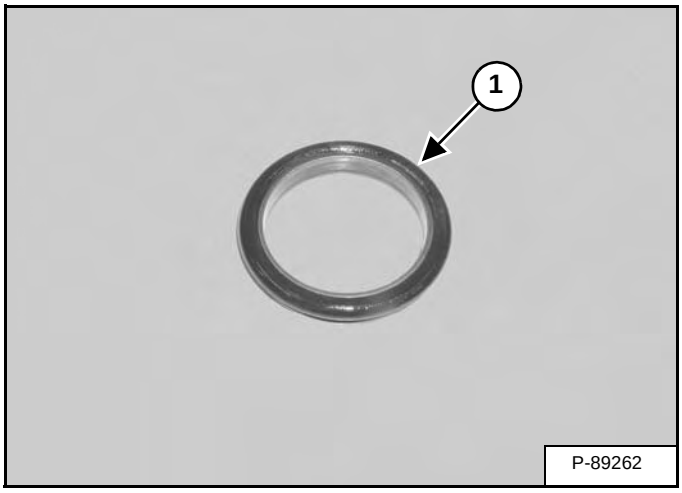


Install the pin (Item 1) **[Figure 30-20-75]** in the collar and through the shaft.

Dealer Copy -- Not for Resale

Lower Roller Assembly (Cont'd)

Figure 30-20-76

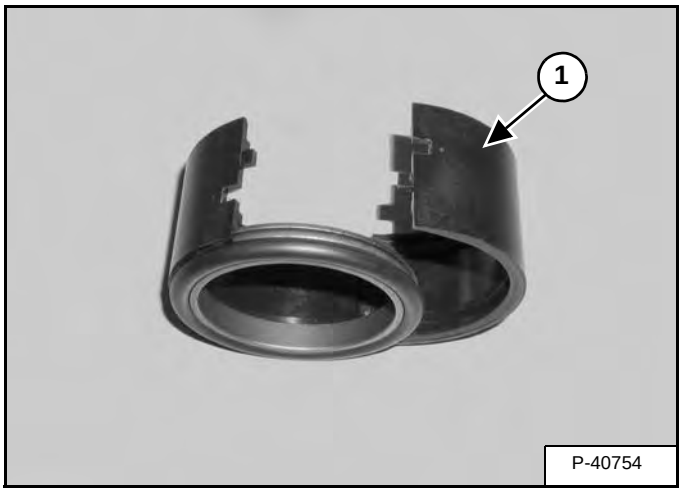


Install the O-ring (Item 1) **[Figure 30-20-76]** on the seal ring. Repeat this procedure on all four seal assemblies.

The O-ring and seal ring must be clean and free of any dust, oil film and foreign matter.

NOTE: Inspect the seal ring for damage before installing the O-ring. Make sure that the O-ring is not twisted when installing it. To remove any twists, gently pull a section of the O-ring and let it snap back.

Figure 30-20-77

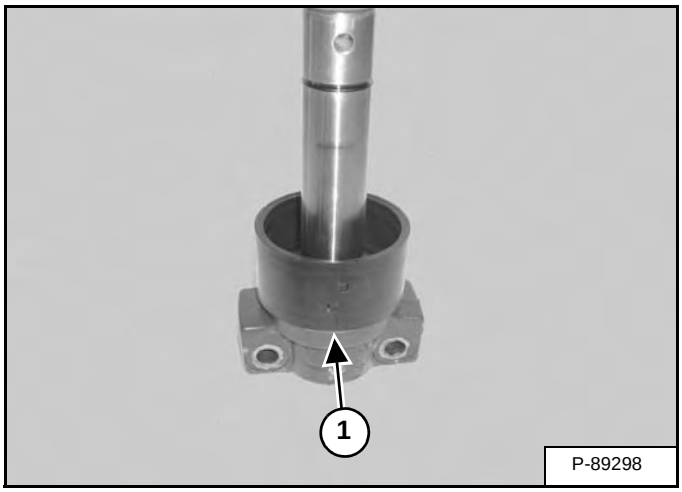


Place the seal assembly in the installation tool (Item 1) **[Figure 30-20-77]**.

The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the seal assembly in a pan of alcohol.

Figure 30-20-78

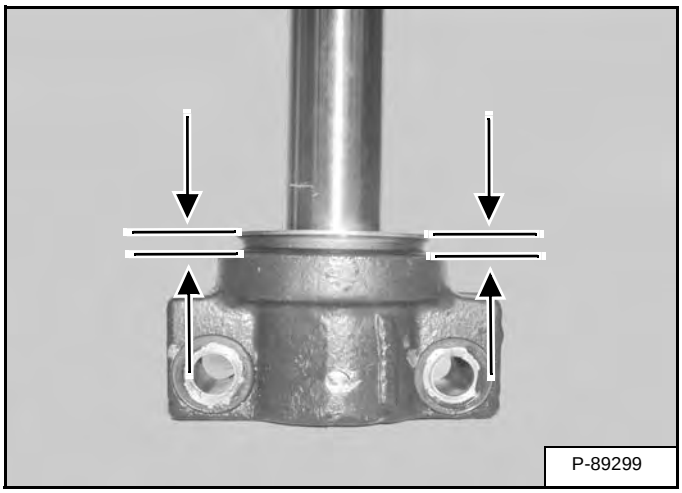


Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-20-78]** in the collar.

Use firm, even pressure on the installation tool to *pop* the O-ring in to the collar.

Remove the installation tool.

Figure 30-20-79

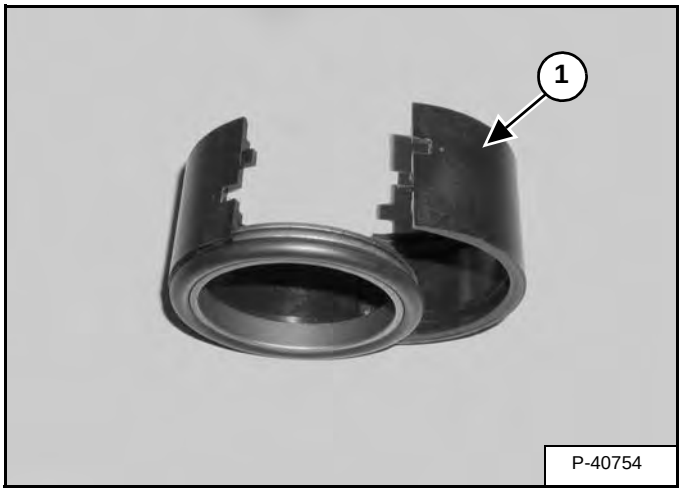


The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 30-20-79]**.

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Lower Roller Assembly (Cont'd)

Figure 30-20-80

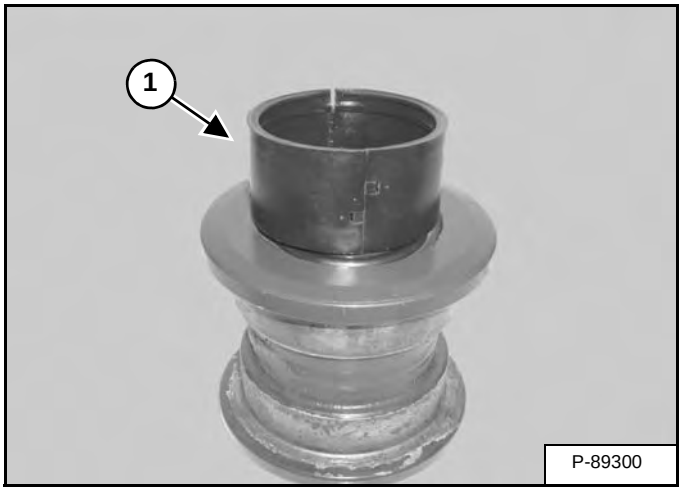


Place the seal assembly (Item 1) **[Figure 30-20-80]** in the installation tool.

The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the O-ring and seal assembly in a pan of alcohol.

Figure 30-20-81

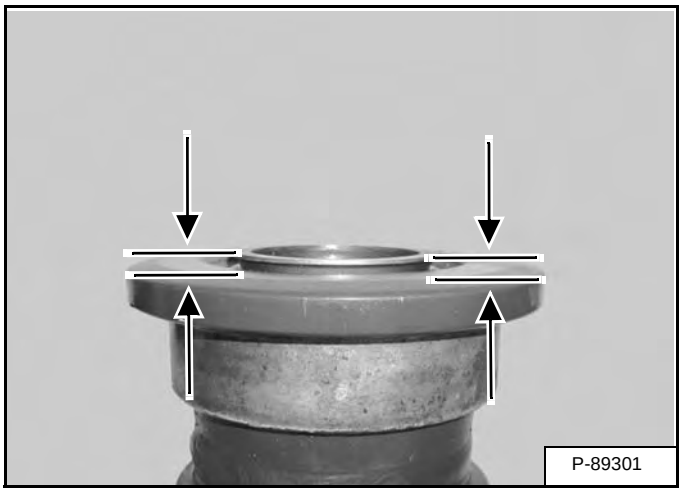


Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-20-81]** in the roller.

Use firm, even pressure on the installation tool to *pop* the O-ring in to the collar.

Remove the installation tool.

Figure 30-20-82

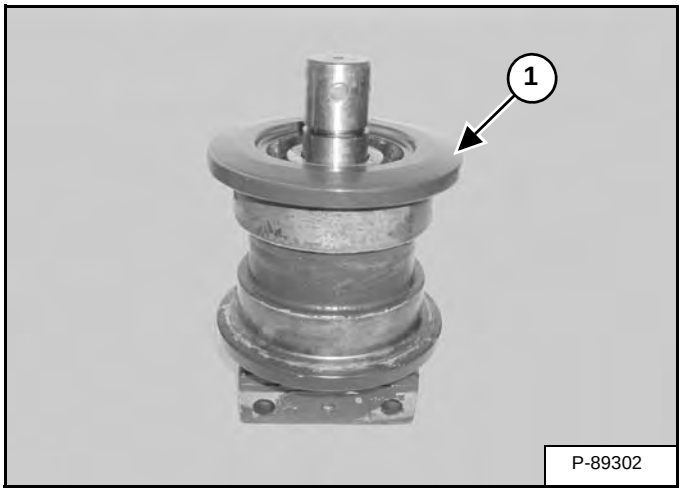


The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 30-20-82]**.

Apply a light film of oil to both metal seal rings.

NOTE: Do not get any oil on the rubber O-rings.

Figure 30-20-83

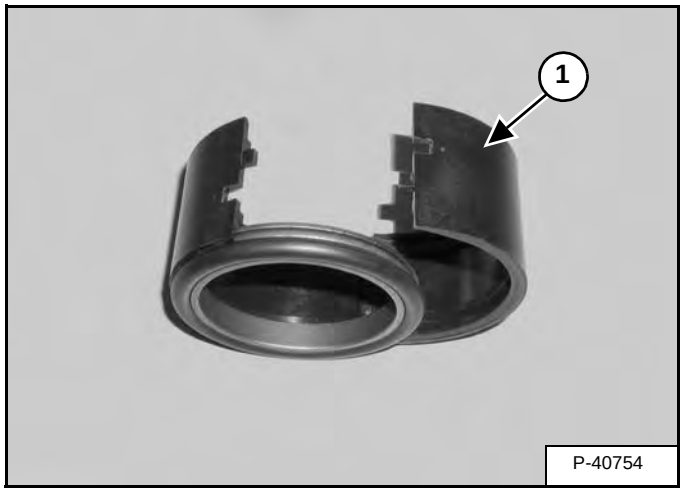


Install the roller (Item 1) **[Figure 30-20-83]** on the shaft.

Dealer Copy -- Not for Resale

Lower Roller Assembly (Cont'd)

Figure 30-20-84

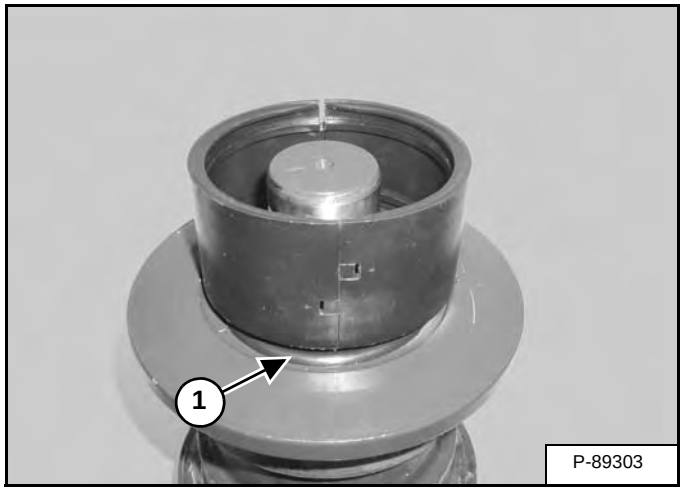


Place the seal assembly in the installation tool (Item 1) **[Figure 30-20-84]**.

The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the O-ring and seal ring assembly in a pan of alcohol.

Figure 30-20-85

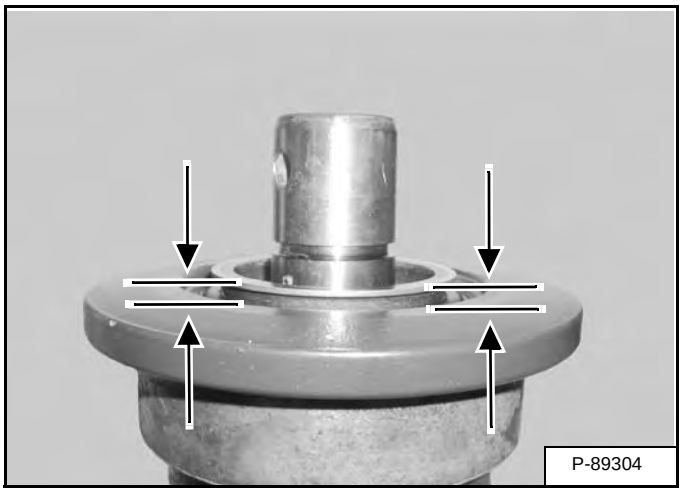


Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-20-85]** in the roller.

Use firm, even pressure on the installation tool to *pop* the O-ring in to the collar.

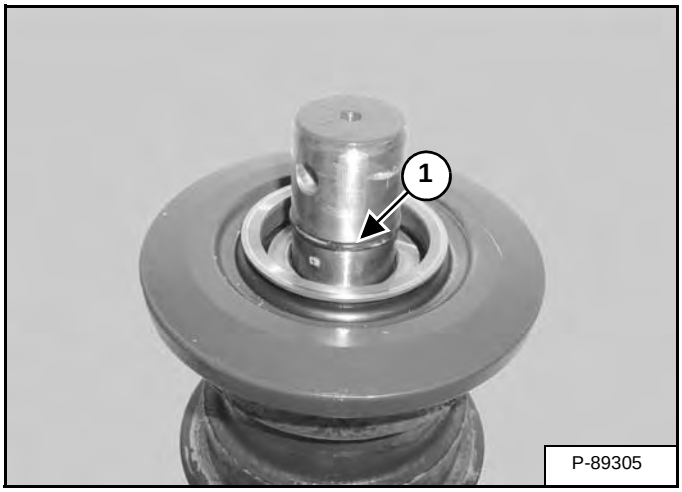
Remove the installation tool.

Figure 30-20-86



The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 30-20-86]**.

Figure 30-20-87

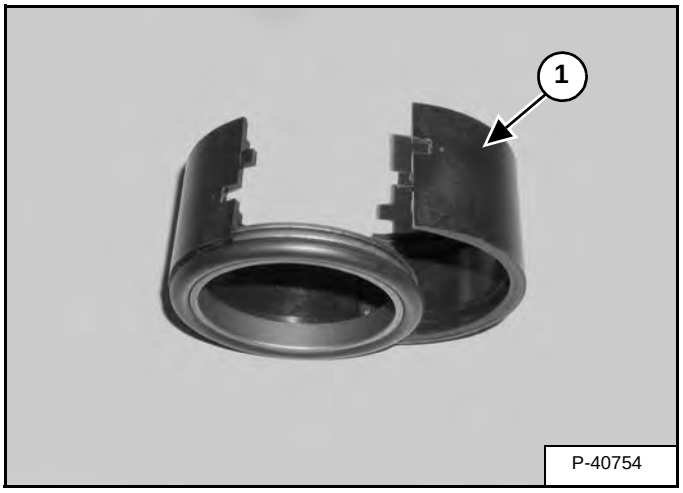


Install the O-ring (Item 1) **[Figure 30-20-87]**.

Dealer Copy -- Not for Resale

Lower Roller Assembly (Cont'd)

Figure 30-20-88

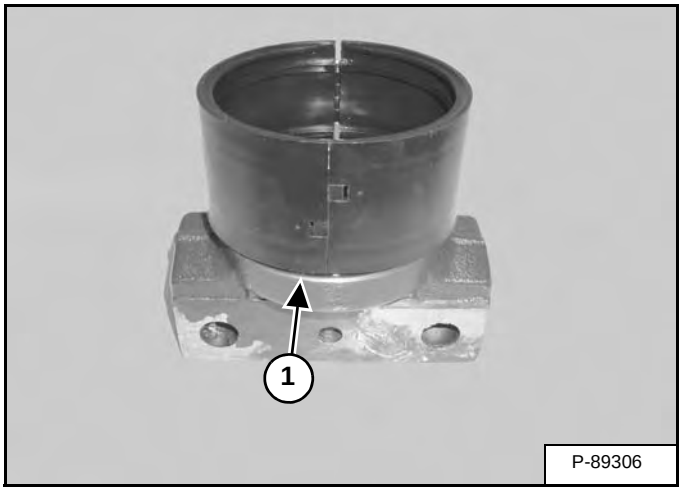


Place the seal assembly in the installation tool (Item 1) **[Figure 30-20-88]**.

The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the O-ring and seal ring assembly in a pan of alcohol.

Figure 30-20-89

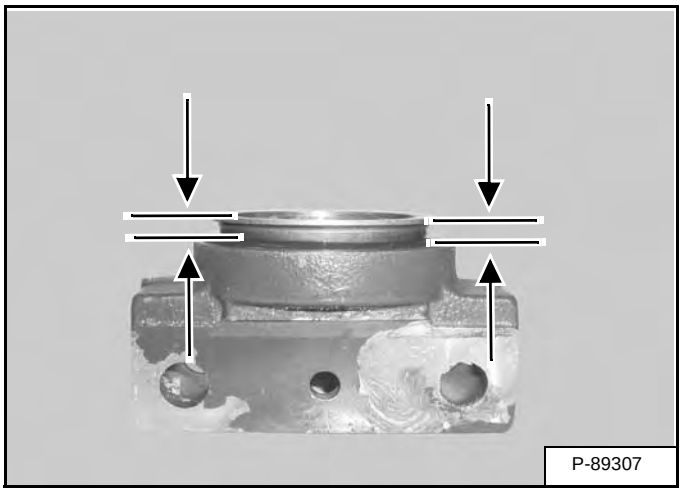


Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-20-89]** in the roller.

Use firm, even pressure on the installation tool to *pop* the O-ring in to the collar.

Remove the installation tool.

Figure 30-20-90

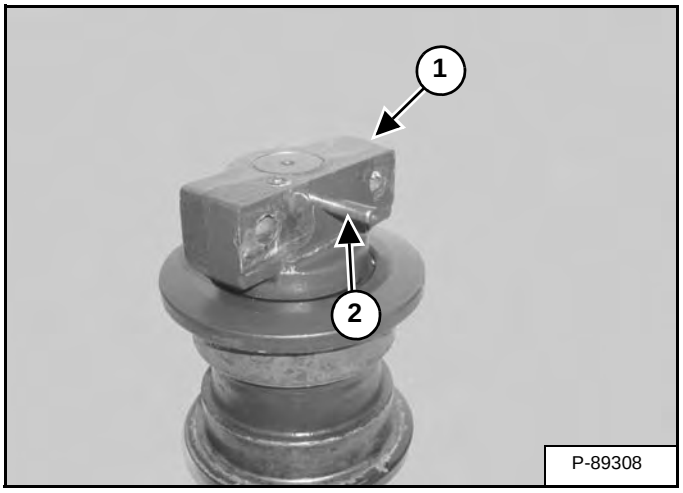


The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 30-20-90]**.

Apply a light film of oil to both metal seal rings.

NOTE: Do not get any oil on the rubber O-rings.

Figure 30-20-91

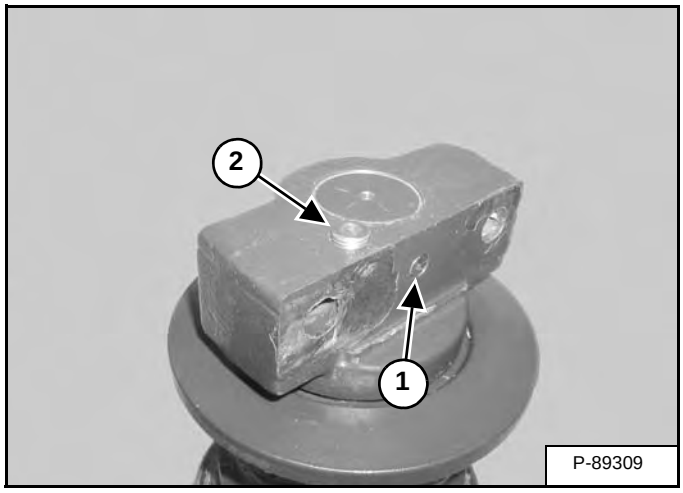


Install the collar (Item 1) on the shaft. Install the pin (Item 2) **[Figure 30-20-91]** in the collar.

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Lower Roller Assembly (Cont'd)

Figure 30-20-92



Push down on the collar until the pin bore of the collar is aligned with the pin bore of the shaft. Fully seat the pin (Item 1) **[Figure 30-20-92]**.

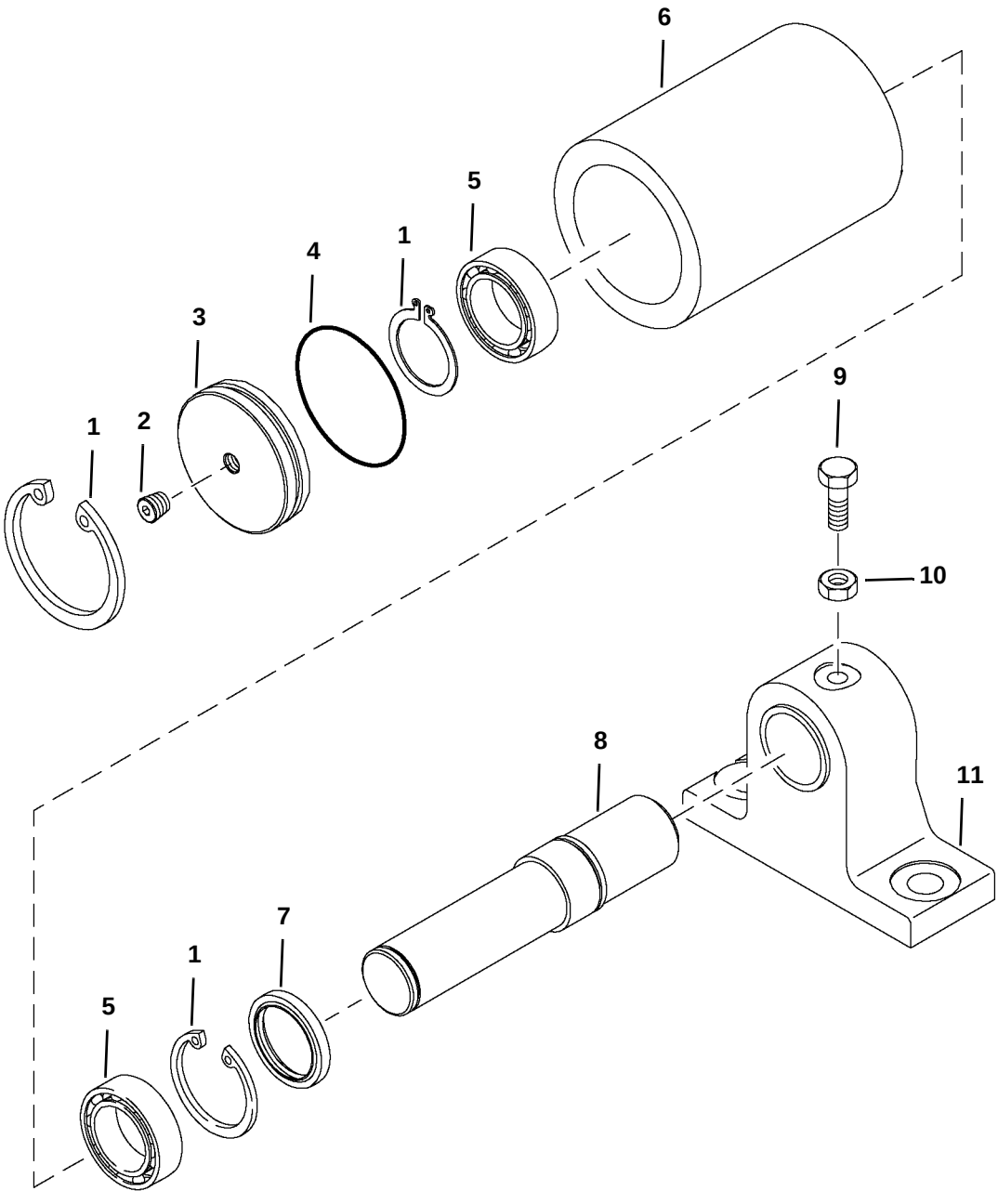
Remove the plug (Item 2) **[Figure 30-20-92]**. Add 0,121 - 0,160 L (4.1 - 5.4 U.S. fl oz) of 30W oil to the roller.

Install the plug.

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Upper Roller Parts Identification

1. Snap Ring
2. Pipe Plug
3. Cover
4. O-ring
5. Bearing
6. Roller
7. Seal
8. Shaft
9. Bolt
10. Nut
11. Mount

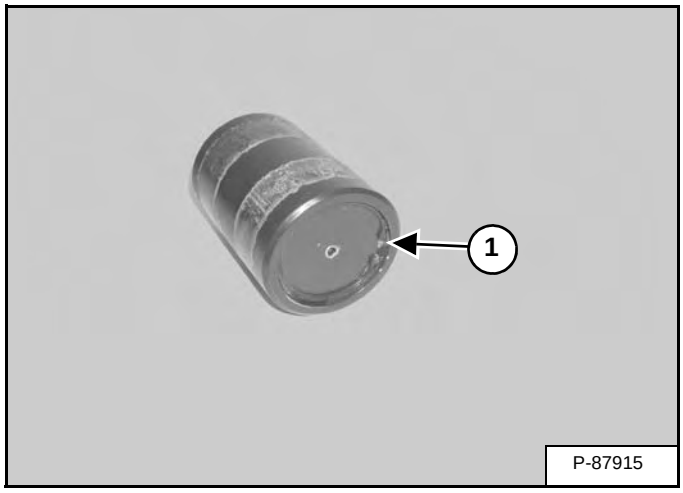


E80-2140S

Dealer Copy -- Not for Resale

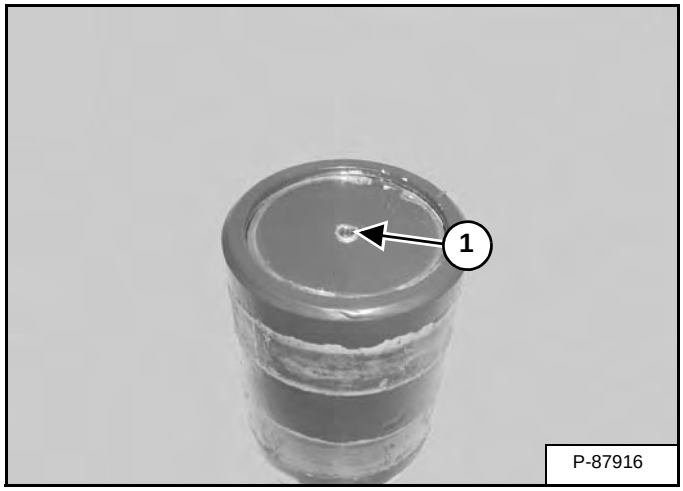
Upper Roller Disassembly And Assembly

Figure 30-20-93



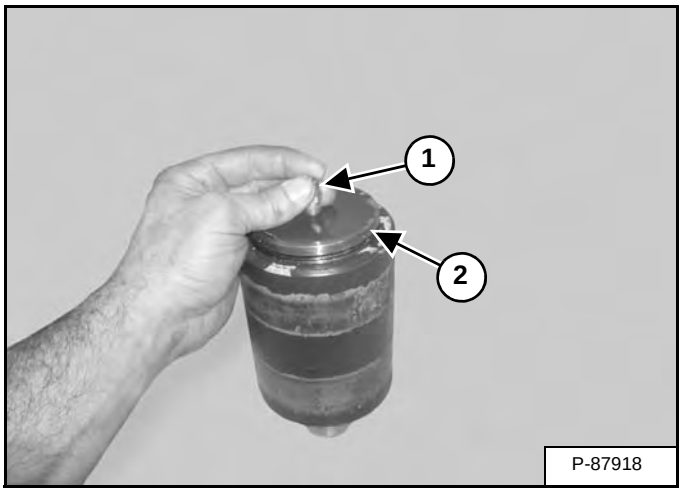
Remove the snap ring (Item 1) **[Figure 30-20-93]**.

Figure 30-20-94



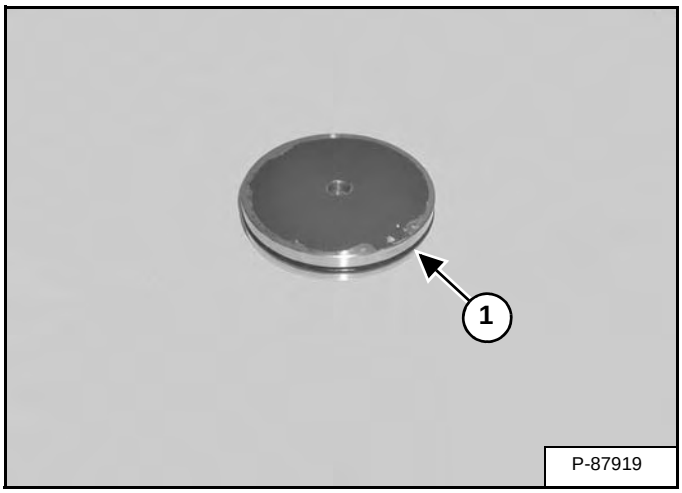
Remove the pipe plug (Item 1) **[Figure 30-20-94]**.

Figure 30-20-95



Install a 50,8 mm (2.0 in) long 3,175 mm (1/8 in) NPT pipe (Item 1) into the cover. Pull up on the pipe to remove the cover (Item 2) **[Figure 30-20-95]**.

Figure 30-20-96

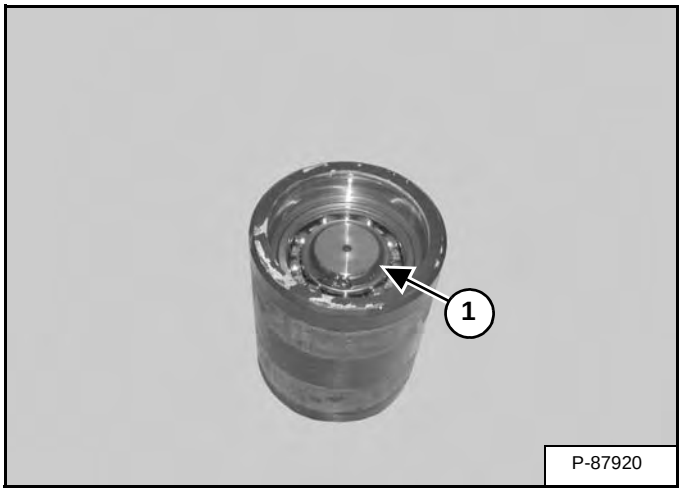


Remove the O-ring (Item 1) **[Figure 30-20-96]**.

Dealer Copy -- Not for Resale

Upper Roller Disassembly And Assembly (Cont'd)

Figure 30-20-97

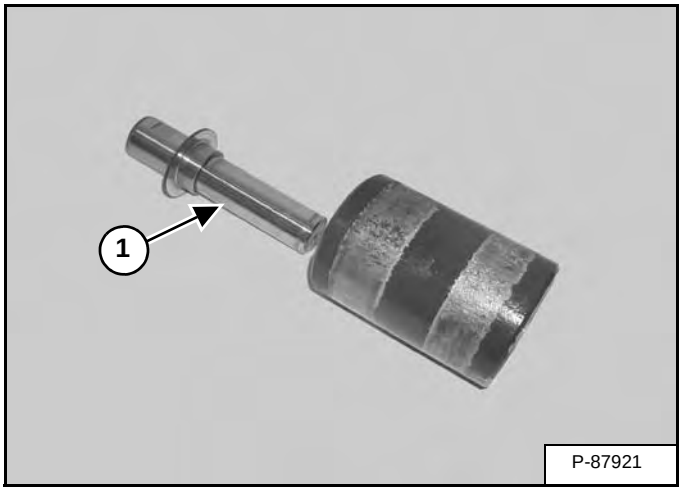


Remove the snap ring (Item 1) **[Figure 30-20-97]**.

Turn the roller over and drain the oil.

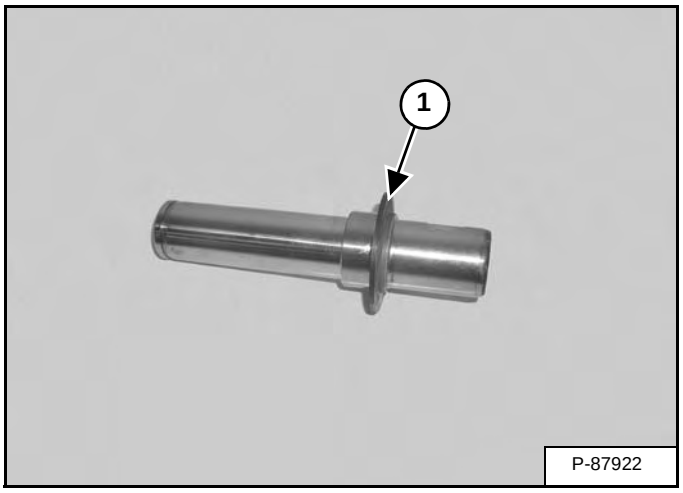
Assembly: Add 0,133 - 0,169 L (4.5 - 5.7 U.S. fl oz) of 30W oil to the roller before installing the cover.

Figure 30-20-98



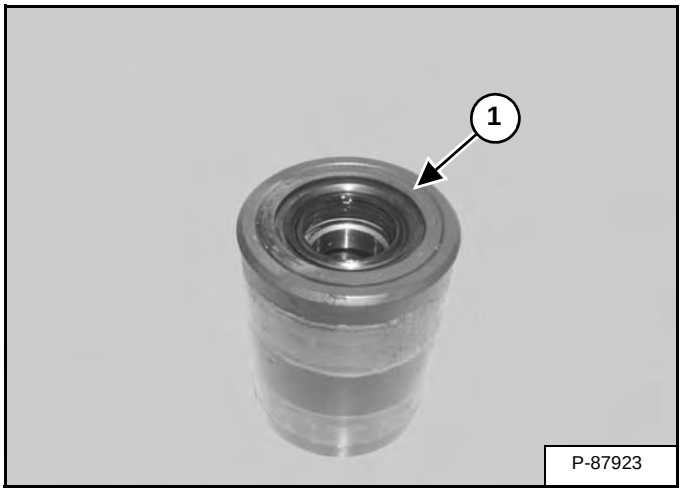
Remove the shaft (Item 1) **[Figure 30-20-98]** from the roller.

Figure 30-20-99



Remove the seal (Item 1) **[Figure 30-20-99]** from the shaft.

Figure 30-20-100

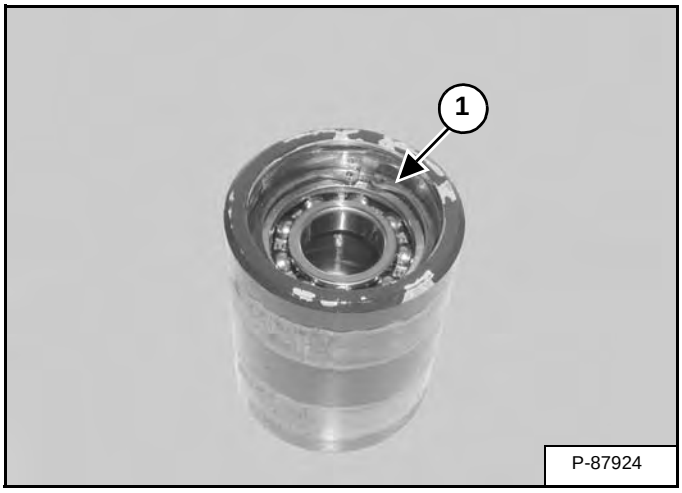


Remove the seal (Item 1) **[Figure 30-20-100]** from the roller.

Dealer Copy -- Not for Resale

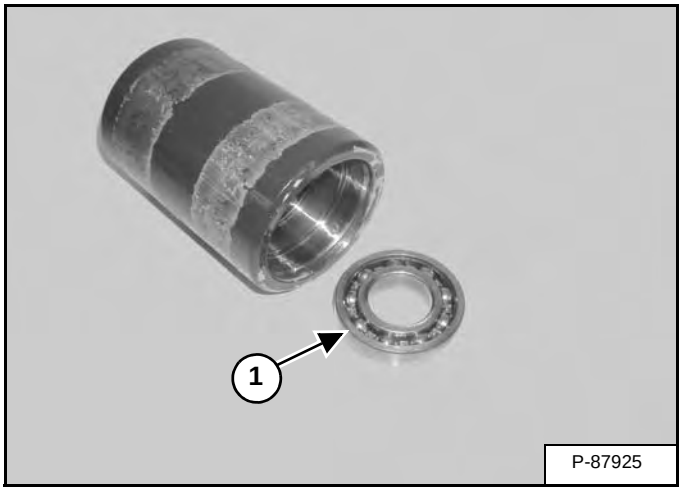
Upper Roller Disassembly And Assembly (Cont'd)

Figure 30-20-101



Remove the snap ring (Item 1) **[Figure 30-20-101]**.

Figure 30-20-102

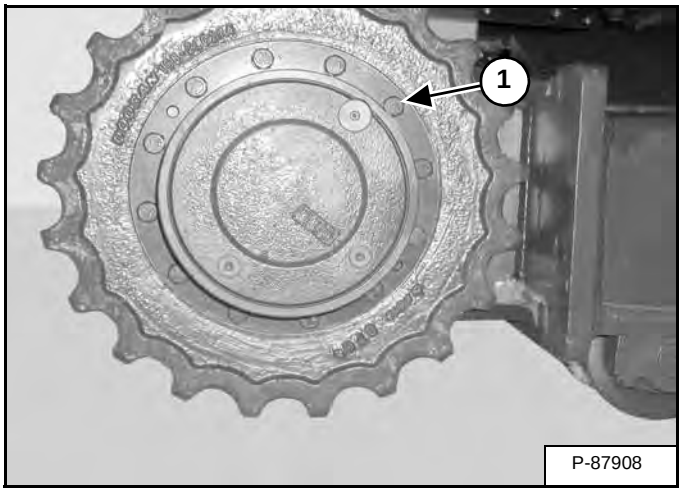


Remove the bearings (Item 1) **[Figure 30-20-102]** from both ends of the roller.

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Sprocket Removal And Installation

Figure 30-20-103



Remove the drive sprocket bolts (Item 1) **[Figure 30-20-103]**.

Installation: Apply thread adhesive (Loctite® 242 or equivalent) to the bolt threads. Tighten the bolts to 160 - 180 N•m (118 - 133 ft-lb) torque.

Remove the drive sprocket from the travel motor.

Dealer Copy -- Not for Resale



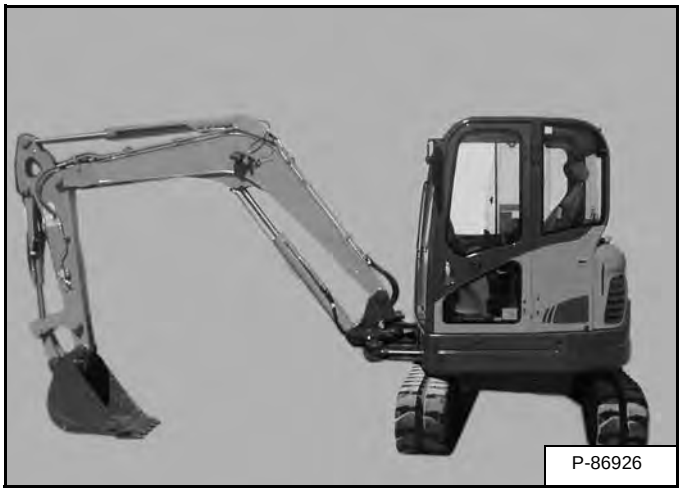
Dealer Copy -- Not for Resale

TRACK UNDERCARRIAGE COMPONENTS (STEEL TRACK)

Checking Tension

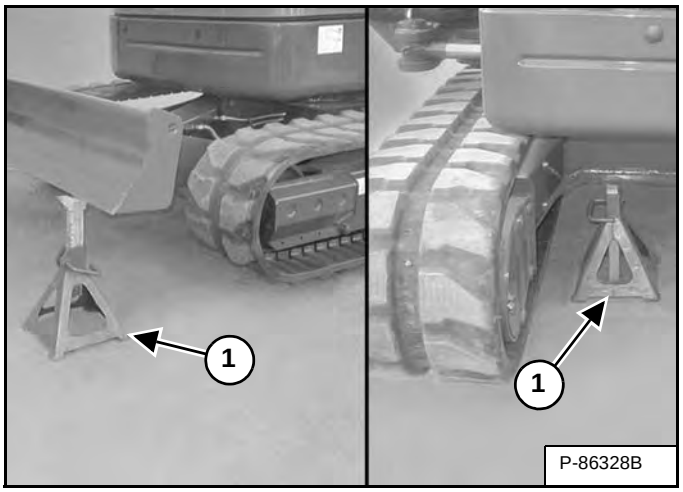
NOTE: The wear of the pins and bushings on the undercarriage vary with the working conditions and the different types of soil conditions. It is necessary to inspect track tension to maintain the correct tension. See Service Schedule for the correct service interval. (See SERVICE SCHEDULE on Page 10-80-1.)

Figure 30-21-1



Raise the side of the machine approximately 153 mm (6 in) using the boom and arm **[Figure 30-21-1]**.

Figure 30-21-2



Raise the blade fully and install jack stands (Item 1) **[Figure 30-21-2]** under the blade and track frame. Raise the boom until all machine weight is on the jack stands.

Stop the engine.

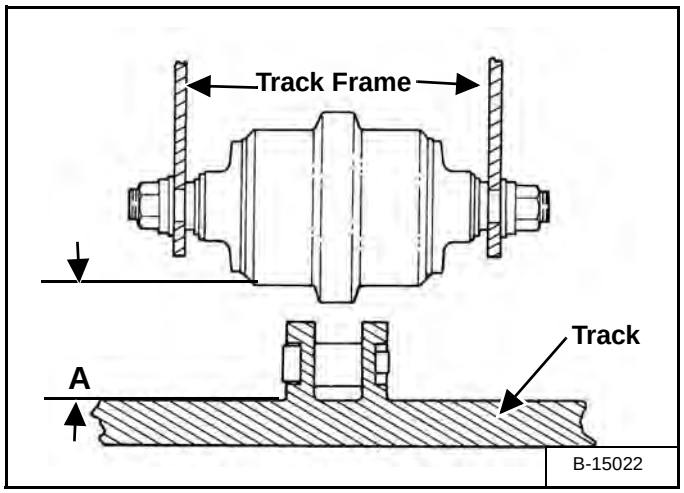
⚠ WARNING

AVOID INJURY

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

W-2142-0903

Figure 30-21-3



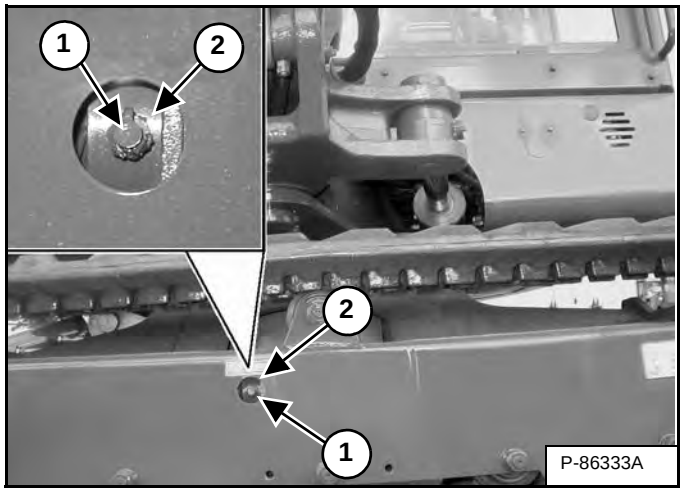
Measure the clearance at the middle track roller. Do not get fingers into pinch points between the track and the track roller. Check the gap between the bottom edge of the track frame and the top surface of the track **[Figure 30-21-3]**.

TERRIAN TYPE	DIMENSION A
Soil	140 - 150 mm (5.51 - 5.91 in)
Gravel, Sand, Soft Soil	150 - 160 mm (5.91 - 6.30 in)
Rock Bed	120 - 130 mm (4.72 - 5.12 in)

Dealer Copy -- Not for Resale

Adjusting Tension

Figure 30-21-4



NOTE: The track tension grease fitting (Item 1) is installed into the end of the bleed fitting (Item 2). DO NOT loosen the grease fitting (Item 1), loosen the bleed fitting (Item 2) [Figure 30-21-4] ONLY (maximum of 1.5 turns) when releasing track pressure.

Add grease to the fitting (Item 1) **[Figure 30-21-4]** until the track tension is correct.

To release track pressure, loosen the bleed fitting (Item 2) **[Figure 30-21-4]** to release tension from the track.

NOTE: Do not loosen the grease fitting (Item 1) [Figure 30-21-4].

Repeat the procedure for the other side.

⚠ WARNING

HIGH PRESSURE GREASE CAN CAUSE SERIOUS INJURY

- **Do not loosen grease fitting.**
- **Do not loosen bleed fitting more than 1 - 1/2 turns.**

W-2781-0109

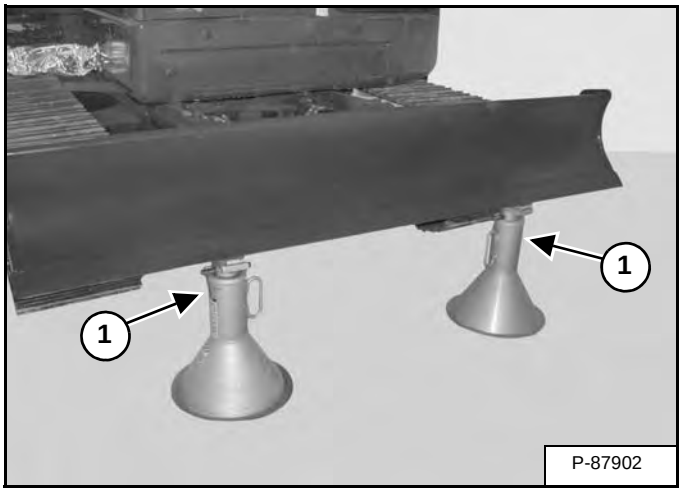
Dealer Copy -- Not for Resale

Track Removal

Lift and block both sides of the machine as follows:

Raise the blade fully.

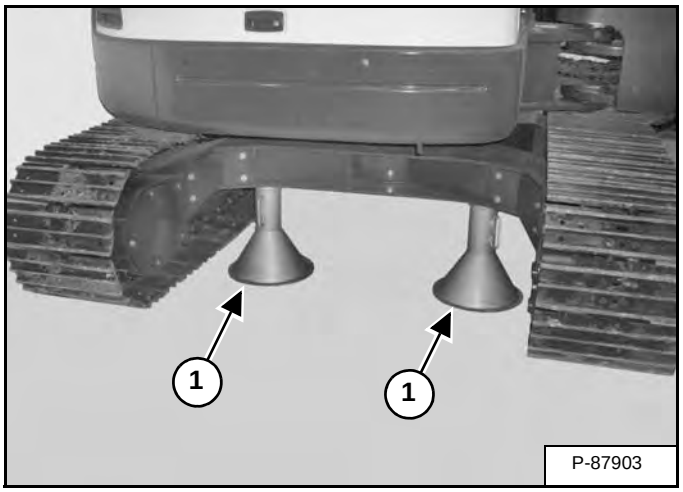
Figure 30-21-5



Use the boom and arm to lift the blade end of the machine up about 75 mm (3.0 in) and install jack stands (Item 1) **[Figure 30-21-5]** under the blade.

Raise the boom.

Figure 30-21-6



Swing the upperstructure 180 degrees and use the boom and arm to slowly lift the opposite end of the undercarriage and install jack stands (Item 1) **[Figure 30-21-6]** under the undercarriage.

Raise the boom until the weight of the machine is supported by the jack stands.

⚠ 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.

Release track tension (See Adjusting Tension on Page 30-21-2.)

With the excavator raised and the bleed fitting loosened, start the excavator. (See Adjusting Tension on Page 30-21-2.)

Slowly turn the track. This will force more grease out of the grease spring.

⚠ WARNING

AVOID INJURY OR DEATH

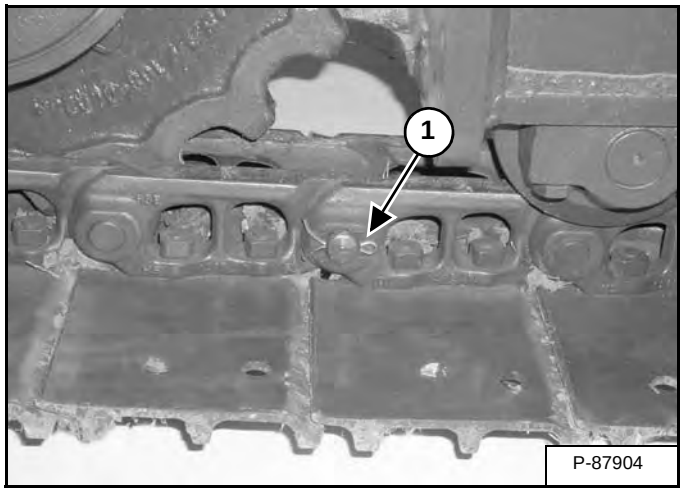
Keep fingers and hands out of pinch points when removing the track.

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Dealer Copy -- Not for Resale

Track Removal (Cont'd)

Figure 30-21-7

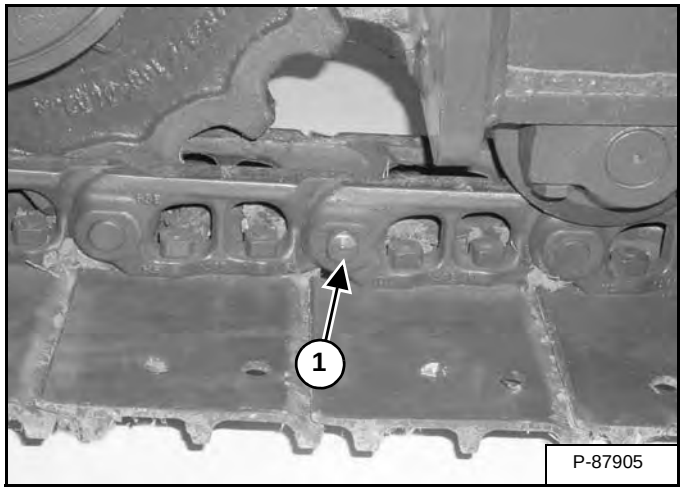


Rotate the track until the master link and cotter pin (Item 1) **[Figure 30-21-7]** are at the bottom of the track frame, between the drive motor and rear lower roller.

Stop the engine.

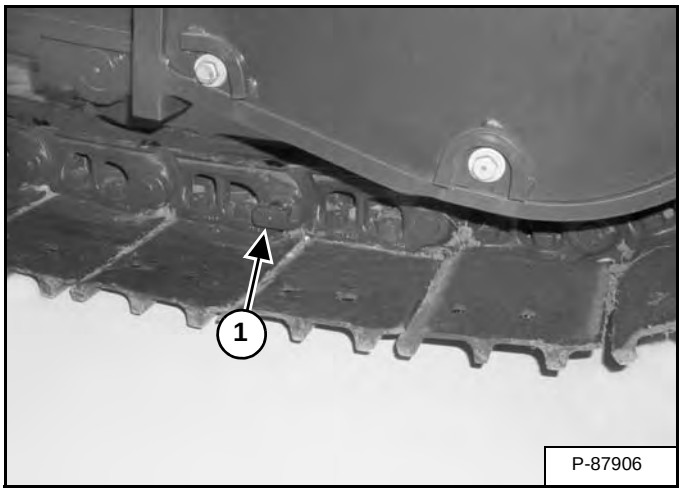
Remove the cotter pin (Item 1) **[Figure 30-21-7]**.

Figure 30-21-8



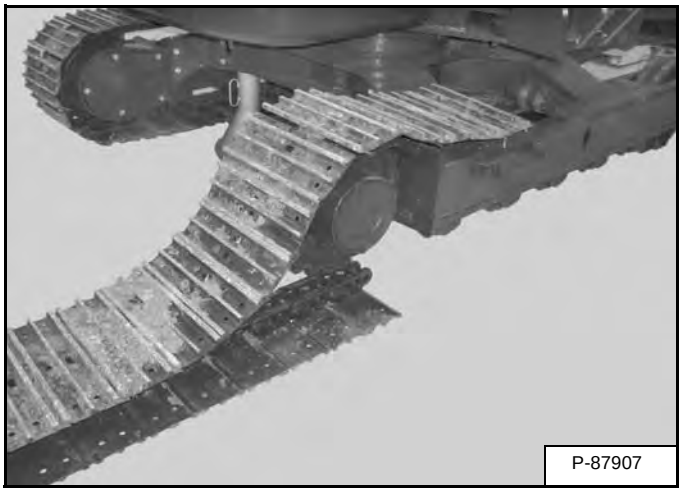
Drive the master pin (Item 1) **[Figure 30-21-8]** towards the inside of the track frame.

Figure 30-21-9



Remove the pin (Item 1) **[Figure 30-21-9]**.

Figure 30-21-10



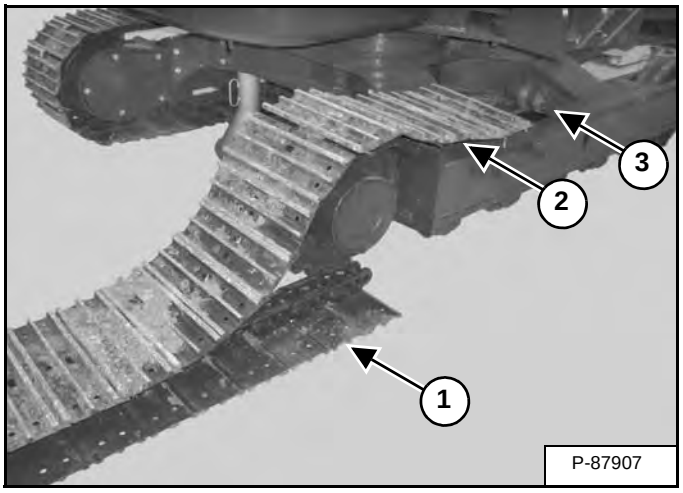
Start the excavator and run it at low idle. Slowly engage the travel motor in the reverse direction. Continue to engage the travel motor in the reverse direction until the track has been driven off the track frame **[Figure 30-21-10]**.

Stop the engine.

Dealer Copy -- Not for Resale

Track Installation

Figure 30-21-11



Place the steel track (Item 1) under the track frame and in line with the travel motor. Place the opposite end of the track (Item 2) **[Figure 30-21-11]** over the drive sprocket.

⚠ WARNING

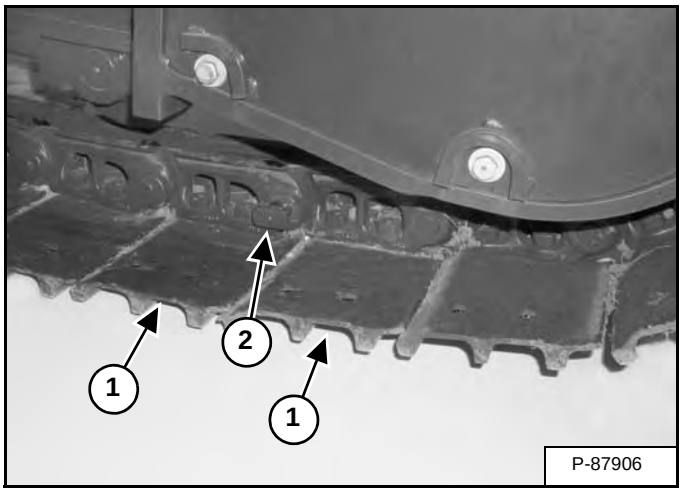
AVOID INJURY OR DEATH

Drive motor must be operated slowly to avoid any sudden movements that could cause injury or death.

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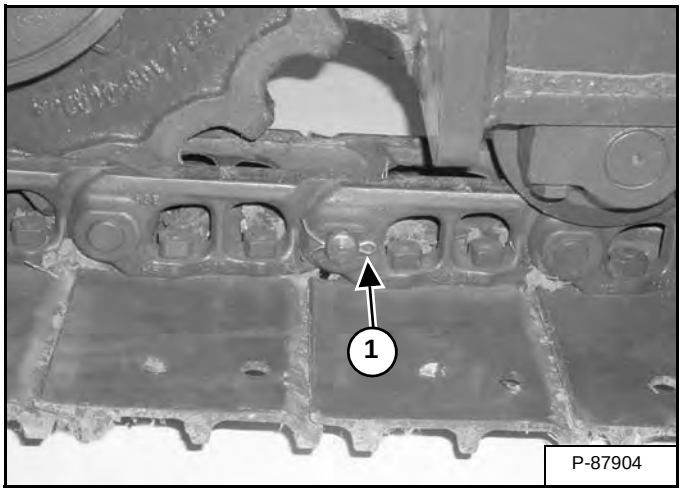
With the help of a second person, start the excavator. Use the travel lever (on the side of the excavator the track in being installed) to slowly turn the drive motor in the forward direction. Guide the track over the upper roller (Item 3) **[Figure 30-21-11]** and on to the front idler.

Figure 30-21-12



Rotate the track until the track links (Item 1) are located on the bottom of the track frame, between the drive motor and rear lower roller. Install the master pin (Item 2) **[Figure 30-21-12]** from the inside of the track frame.

Figure 30-21-13

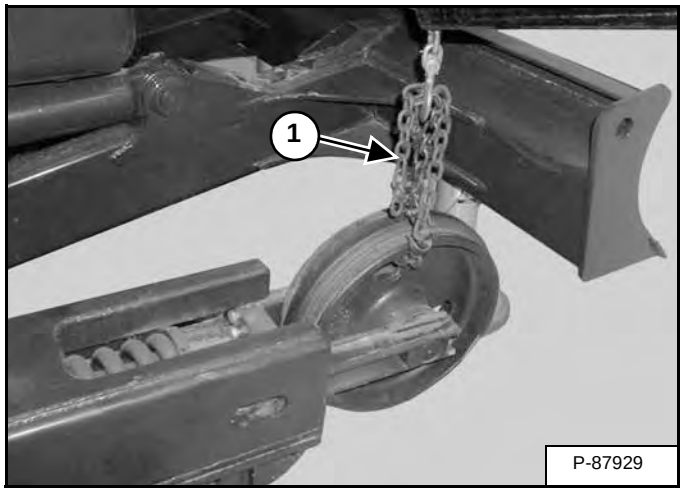


Install the cotter pin (Item 1) **[Figure 30-21-13]**

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Idler Removal And Installation

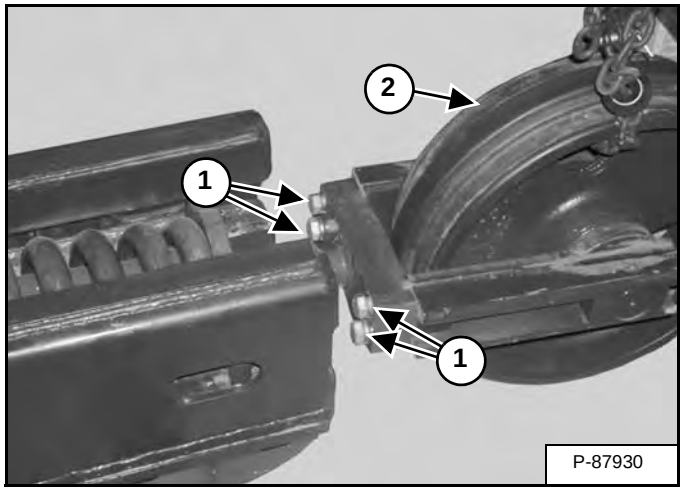
Figure 30-21-14



Remove the track. (See Track Removal on Page 30-21-3.)

Install a chain (Item 1) **[Figure 30-21-14]** and hoist to the idler and slide the idler towards the front of the track frame.

Figure 30-21-15



Remove the four bolts (Item 1) and washers. Remove the idler (Item 2) **[Figure 30-21-15]**.

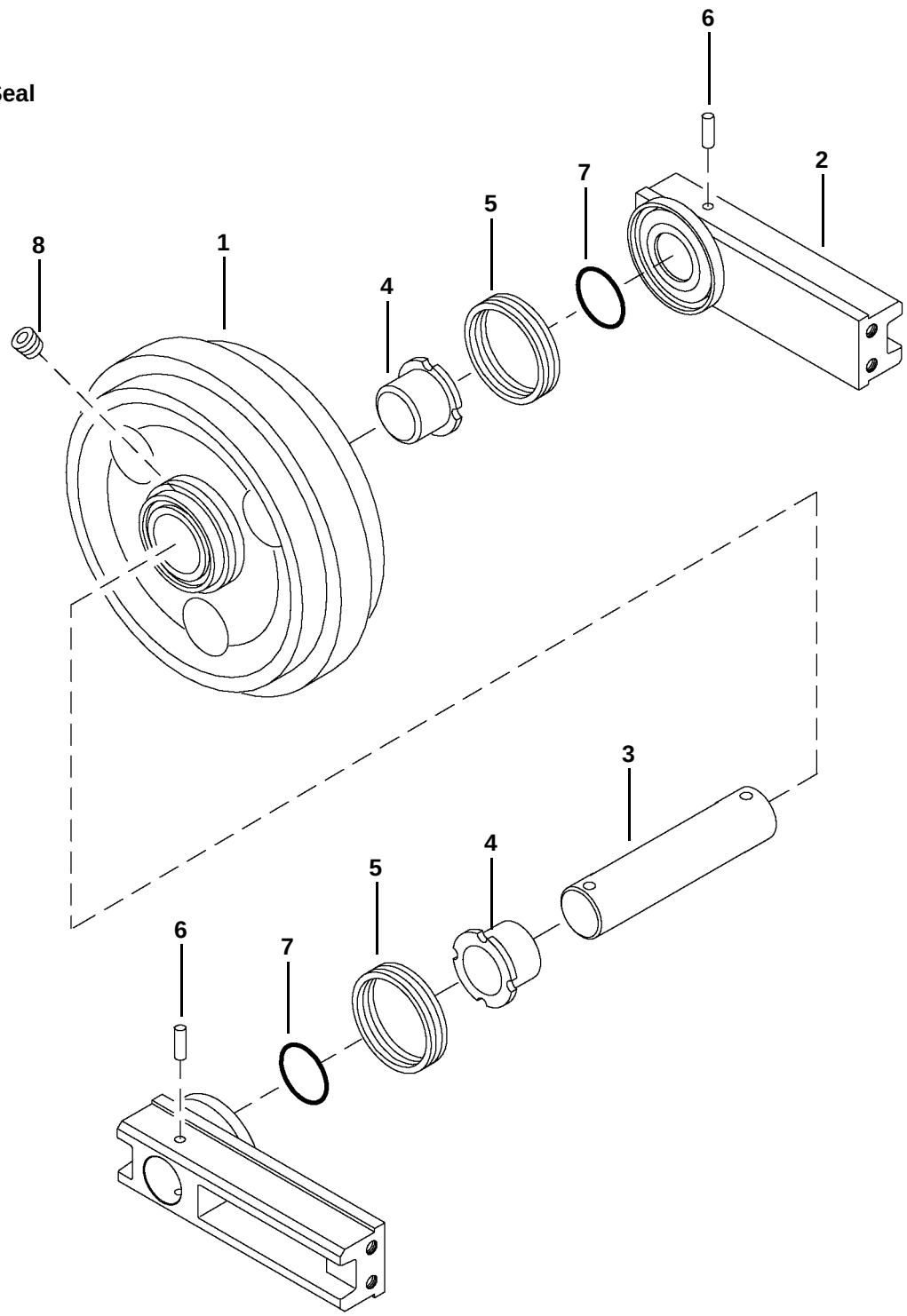
NOTE: The bolts may need to be heated to melt the thread adhesive.

Installation: Apply thread adhesive (Loctite® 262 or equivalent) to the bolt threads. Tighten the bolts to 255 - 285 •m (188 - 210 ft-lb) torque.

Dealer Copy -- Not for Resale

Idler Parts Identification

1. Idler
2. Support
3. Shaft
4. Bushing
5. Floating Seal
6. Pin
7. O-ring
8. Plug

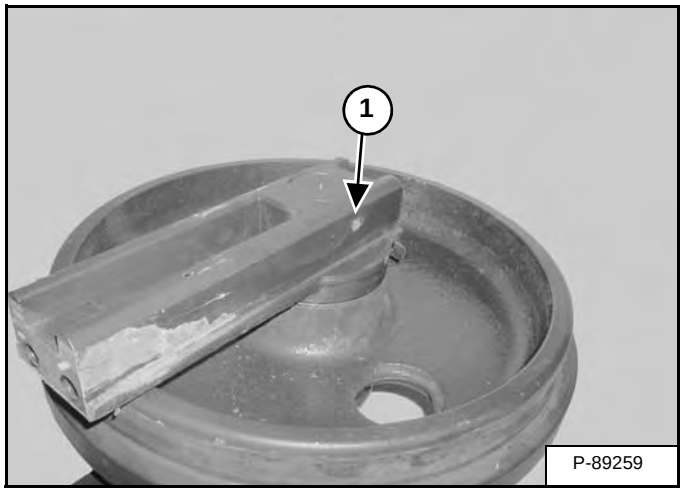


E80-2120S

Dealer Copy -- Not for Resale

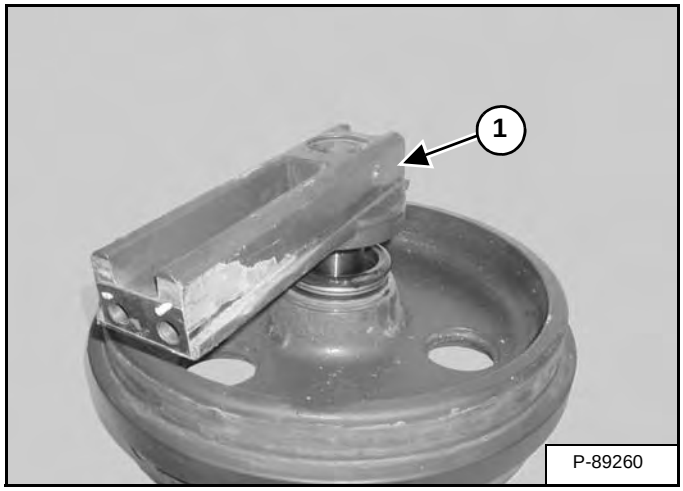
Idler Disassembly

Figure 30-21-16



Remove the roll pin (Item 1) **[Figure 30-21-16]**.

Figure 30-21-17



Pull up on and remove the support (Item 1) **[Figure 30-21-17]**.

Figure 30-21-18

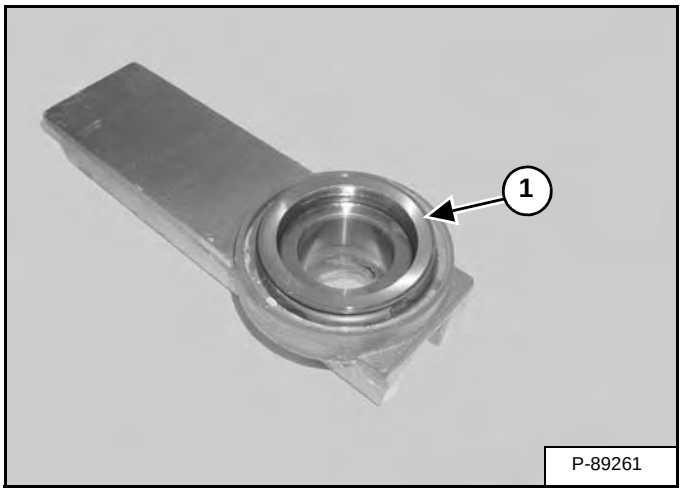
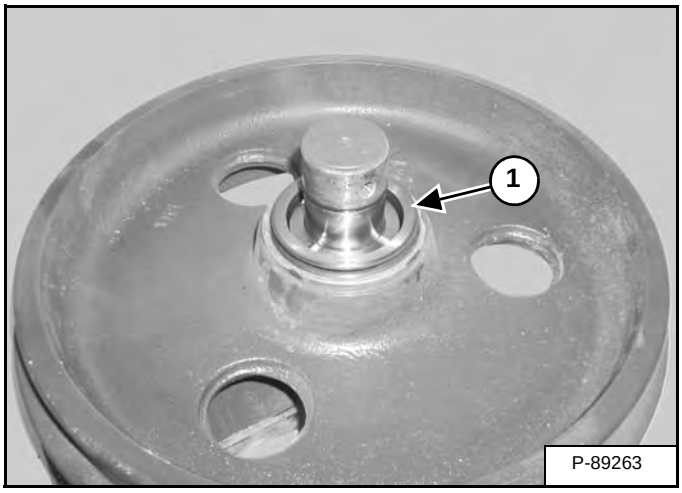


Figure 30-21-19

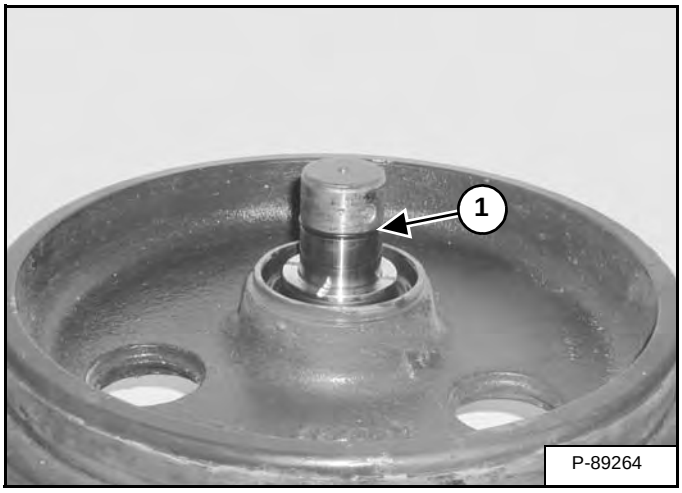


Remove the floating seal (Item 1) **[Figure 30-21-18]** and **[Figure 30-21-19]** from the support and idler.

Dealer Copy -- Not for Resale

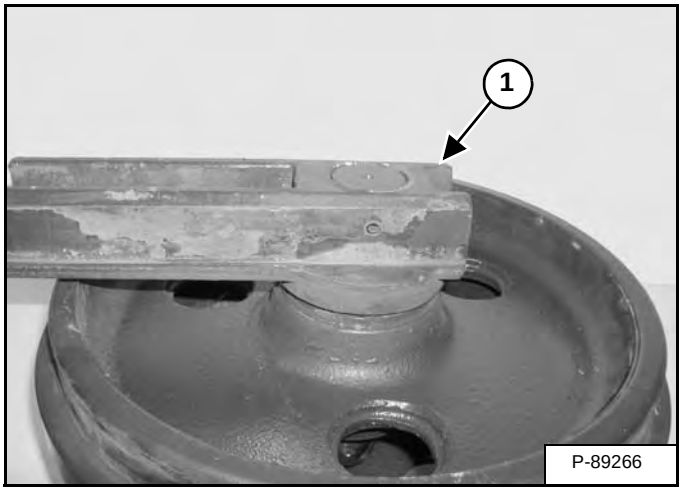
Idler Disassembly (Cont'd)

Figure 30-21-20



Remove the O-ring (Item 1) **[Figure 30-21-20]** from the shaft.

Figure 30-21-21



Tip the idler over and remove the support / shaft assembly (Item 1) **[Figure 30-21-21]**.

Figure 30-21-22

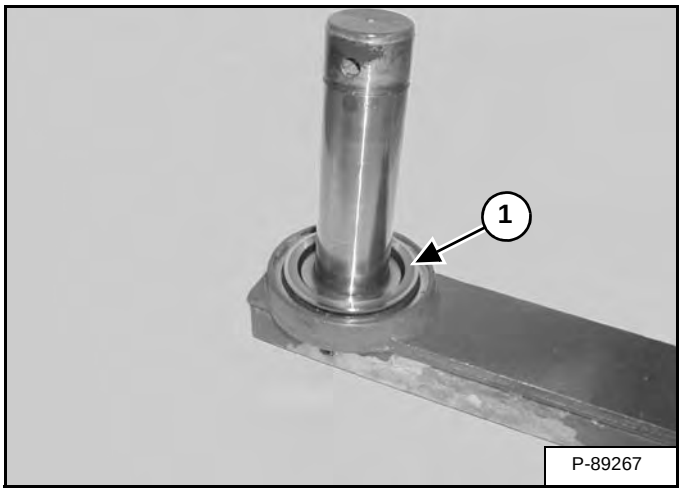
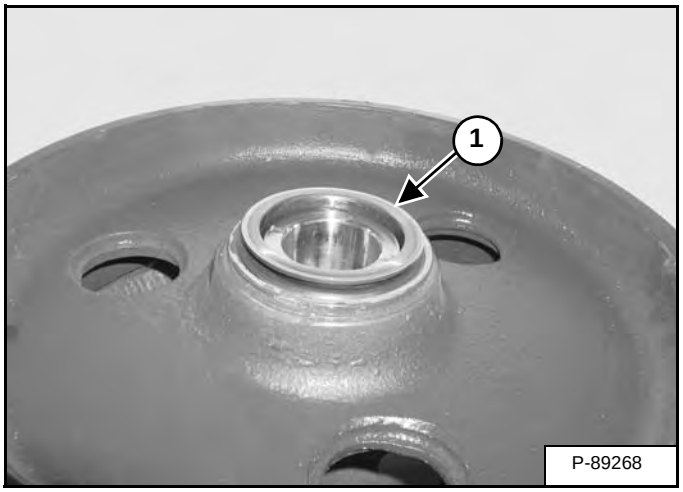


Figure 30-21-23

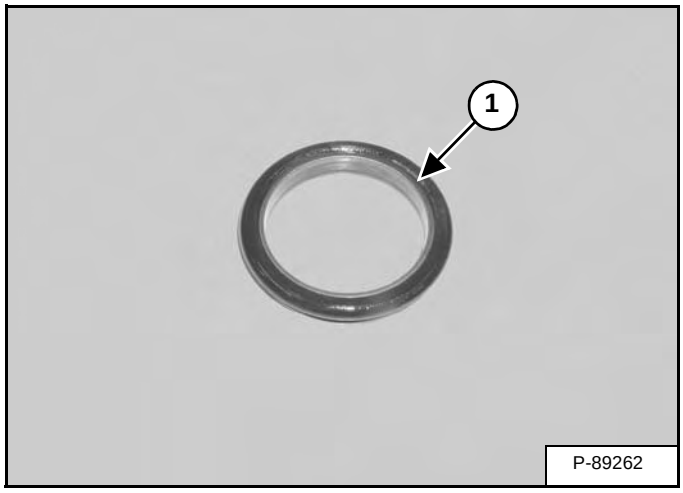


Remove the floating seal (Item 1) **[Figure 30-21-22]** and **[Figure 30-21-23]** from the support and idler.

Dealer Copy -- Not for Resale

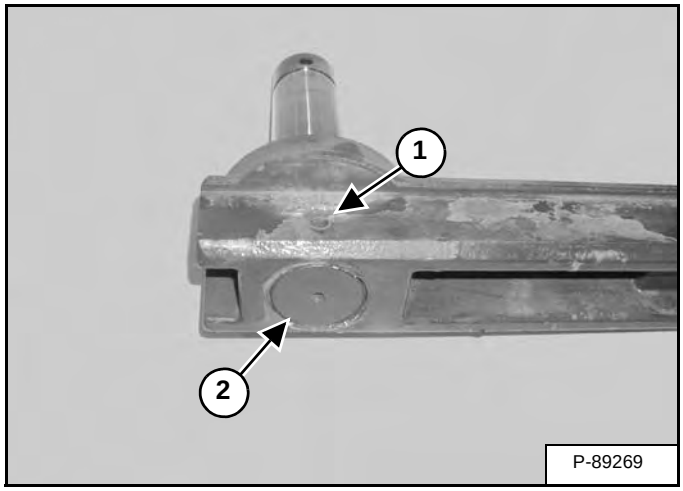
Idler Disassembly (Cont'd)

Figure 30-21-24



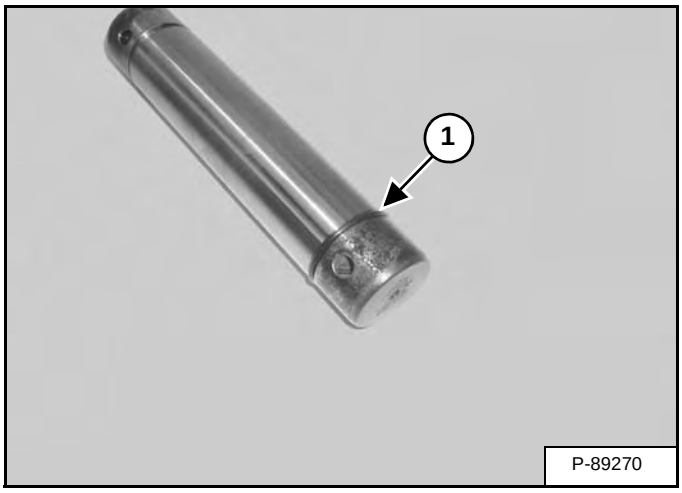
Remove the O-ring (Item 1) **[Figure 30-21-24]** from all four of the steel seals.

Figure 30-21-25



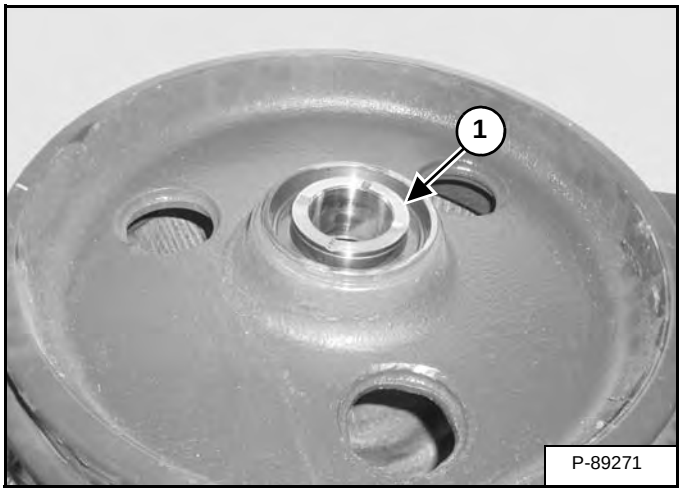
Remove the roll pin (Item 1). Remove the shaft (Item 2) **[Figure 30-21-25]** from the support.

Figure 30-21-26



Remove the O-ring (Item 1) **[Figure 30-21-26]**.

Figure 30-21-27



Remove the bushings (Item 1) **[Figure 30-21-27]** from both sides of the idler.

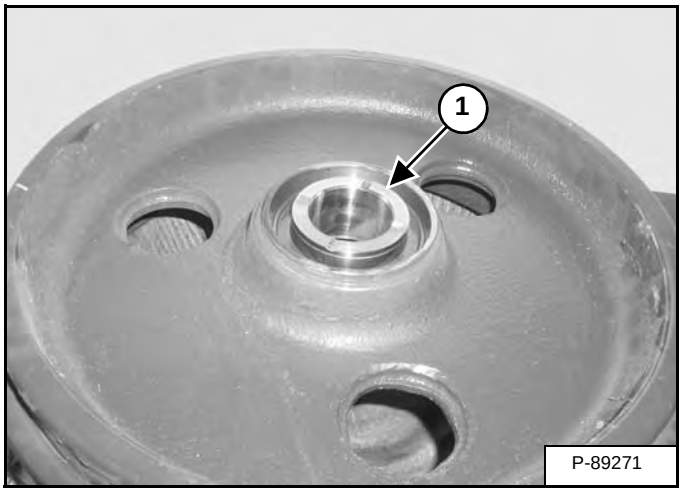
Dealer Copy -- Not for Resale

Idler Assembly

Clean all parts in solvent and dry with compressed air.

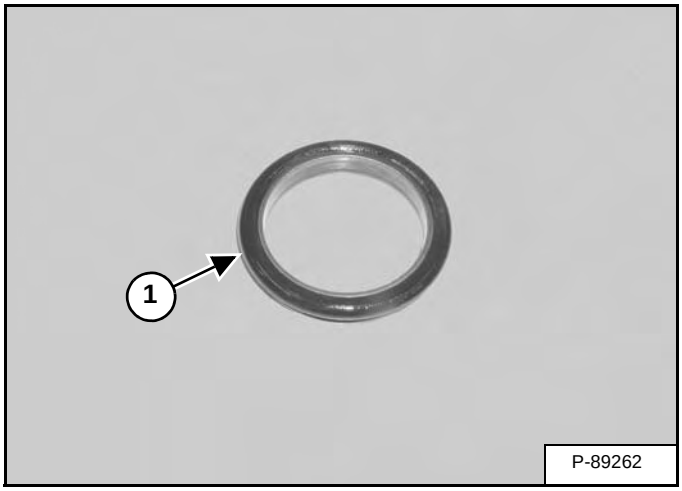
The seal assemblies are a matched set and must be replaced in pairs.

Figure 30-21-28



Install the bushings (Item 1) **[Figure 30-21-28]** on both sides of the idler.

Figure 30-21-29

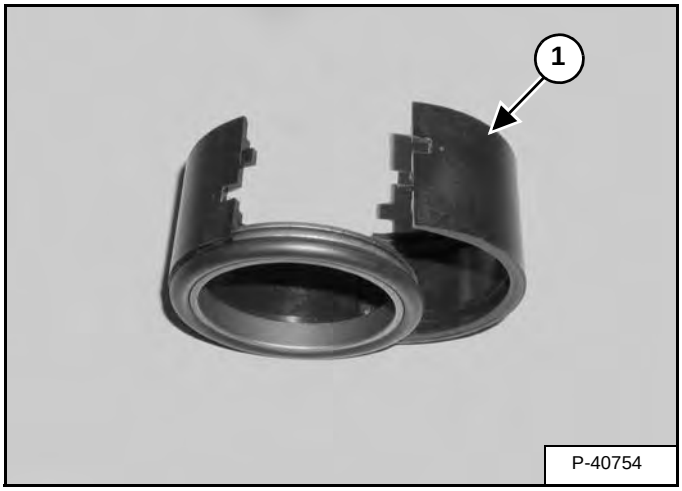


Install the O-ring (Item 1) **[Figure 30-21-29]** on the seal ring. Repeat this procedure on all four seal assemblies.

The O-ring and seal ring must be clean and free of any dust, oil film and foreign matter.

NOTE: Inspect the seal ring for damage before installing the O-ring. Make sure that the O-ring is not twisted when installing it. To remove any twists, gently pull a section of the O-ring and let it snap back.

Figure 30-21-30

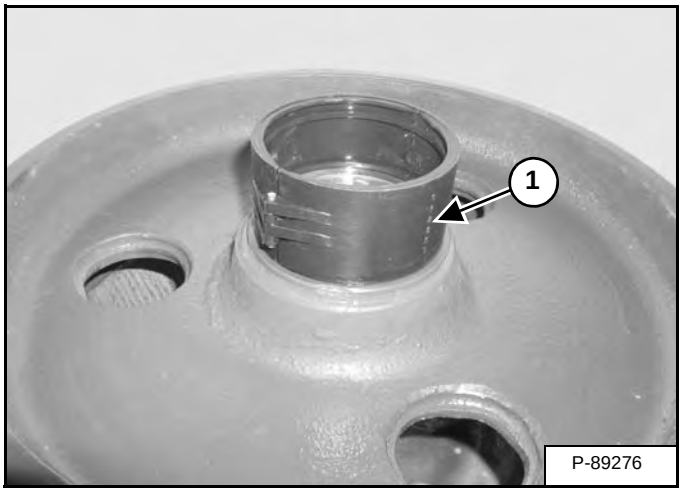


Place the seal assembly in the installation tool (Item 1) **[Figure 30-21-30]**.

The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the seal assembly in a pan of alcohol.

Figure 30-21-31



Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-21-31]** in the idler.

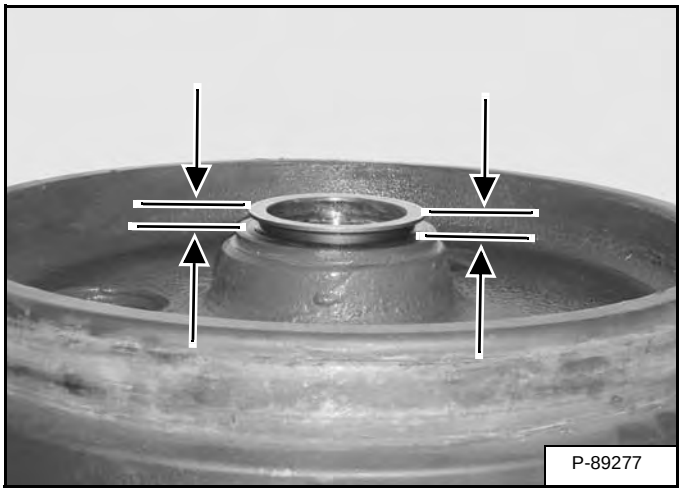
Use firm, even pressure on the installation tool to *pop* the O-ring into the housing.

Remove the installation tool.

Dealer Copy -- Not for Resale

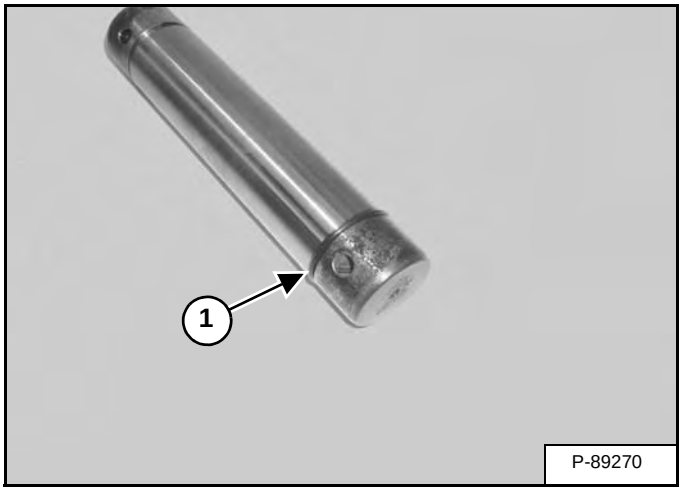
Idler Assembly (Cont'd)

Figure 30-21-32



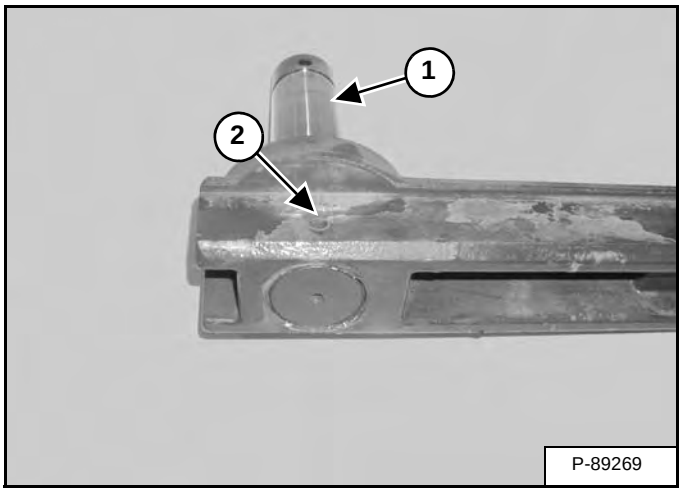
The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 30-21-32]**.

Figure 30-21-33



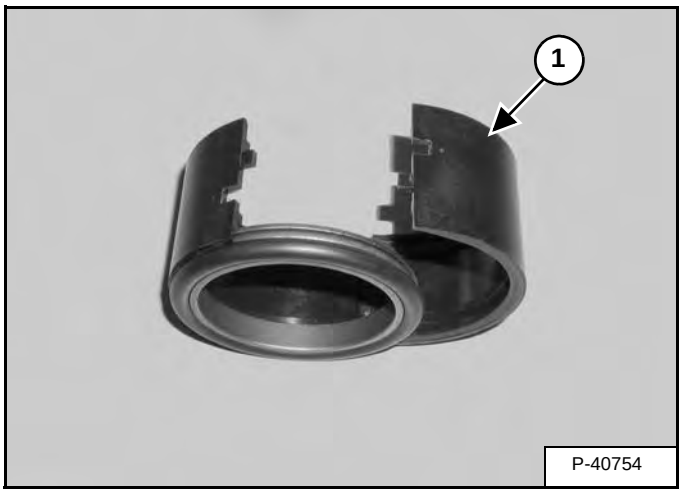
Install the O-ring (Item 1) **[Figure 30-21-33]** onto the shaft.

Figure 30-21-34



Install the shaft (Item 1) in the support. Install the roll pin (Item 2) **[Figure 30-21-34]** through the shaft and support assembly.

Figure 30-21-35



Place the seal assembly (Item 1) **[Figure 30-21-35]** in the installation tool.

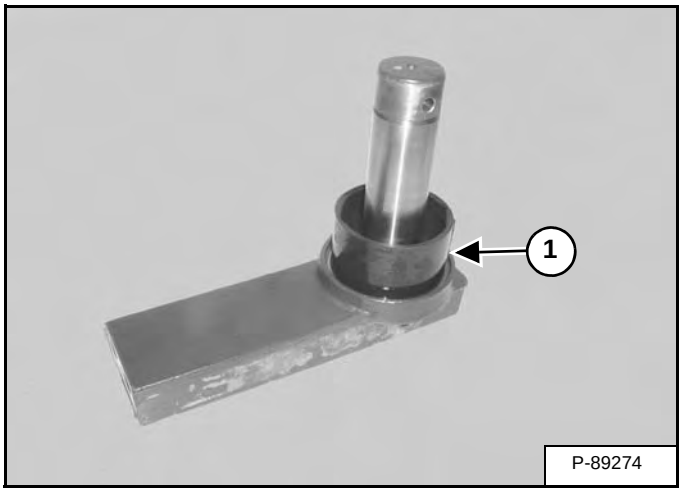
The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the seal assembly in a pan of alcohol.

Dealer Copy -- Not for Resale

Idler Assembly (Cont'd)

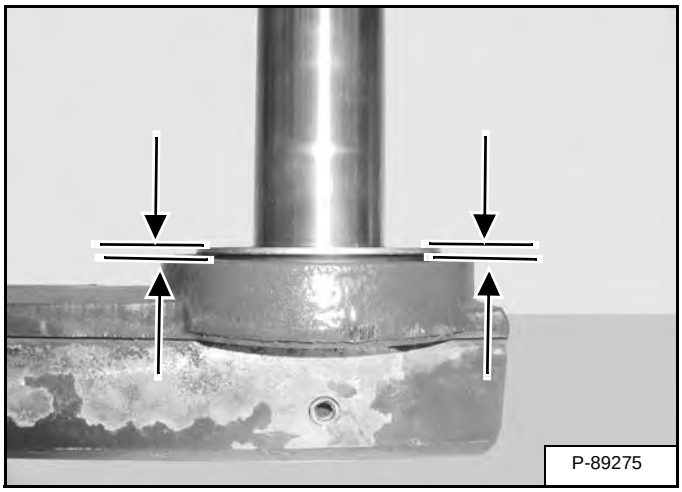
Figure 30-21-36



Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-21-36]** in the support.

Use firm, even pressure on the installation tool to *pop* the O-ring into the housing.

Figure 30-21-37

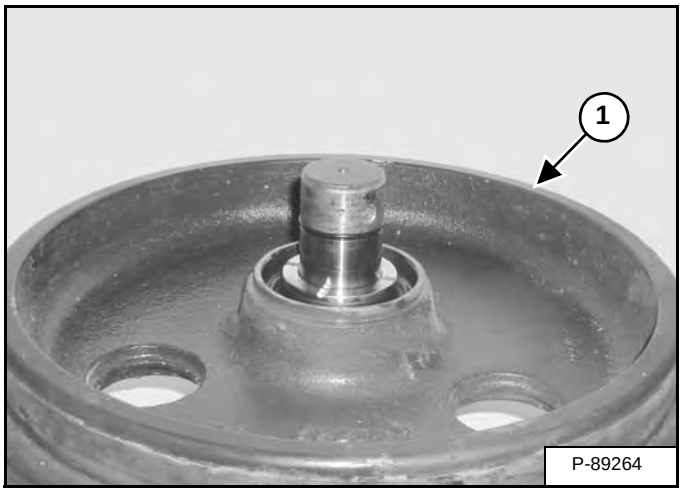


The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 30-21-37]**.

Apply a light film of oil to both metal seal rings.

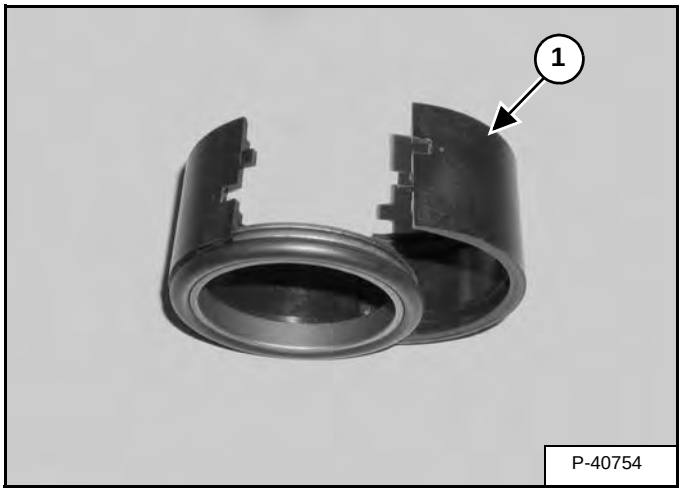
NOTE: Do not get any oil on the rubber O-rings.

Figure 30-21-38



Install the idler (Item 1) **[Figure 30-21-38]** on the shaft / support assembly.

Figure 30-21-39



Place the seal assembly (Item 1) **[Figure 30-21-39]** in the installation tool.

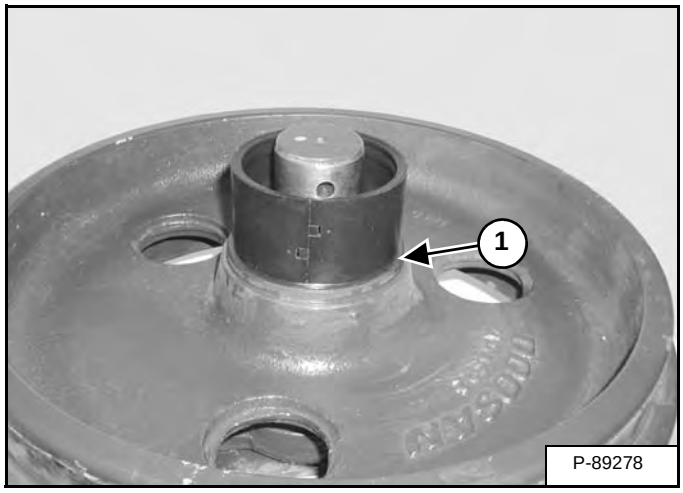
The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the seal assembly in a pan of alcohol.

Dealer Copy -- Not for Resale

Idler Assembly (Cont'd)

Figure 30-21-40

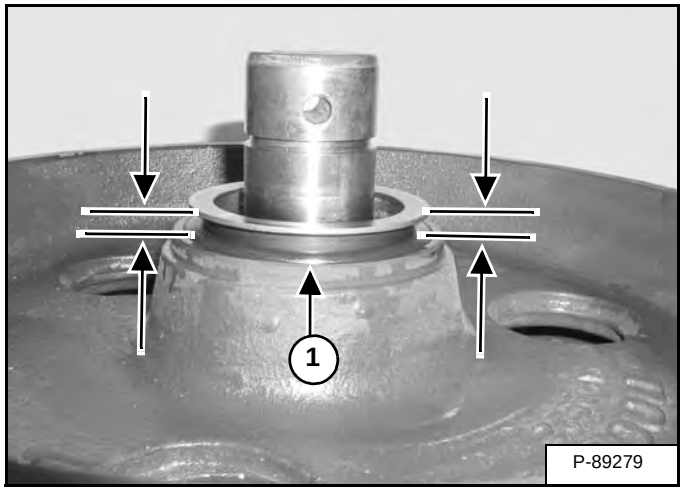


Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-21-40]** in the idler.

Use firm, even pressure on the installation tool to *pop* the O-ring into the housing.

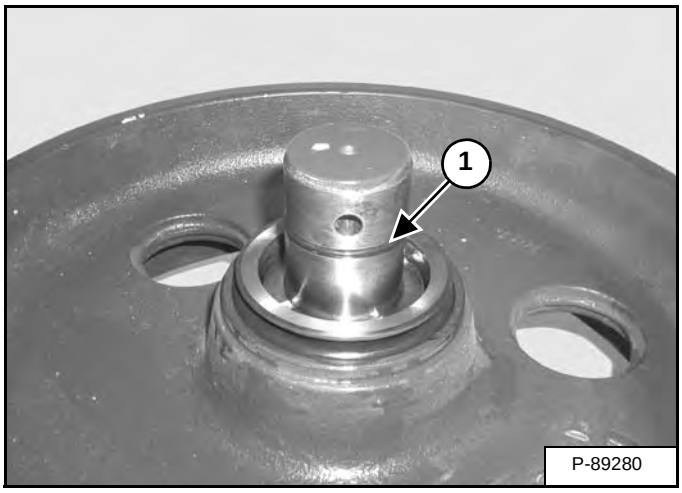
Remove the installation tool.

Figure 30-21-41



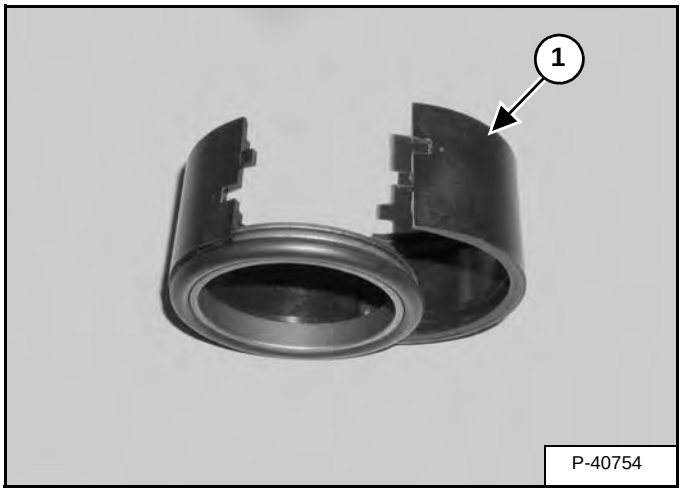
The seal assembly stand off height must be equal and the O-ring (Item 1) **[Figure 30-21-41]** must not be twisted.

Figure 30-21-42



Install the O-ring (Item 1) **[Figure 30-21-42]** on the shaft.

Figure 30-21-43



Place the seal assembly (Item 1) **[Figure 30-21-43]** in the installation tool.

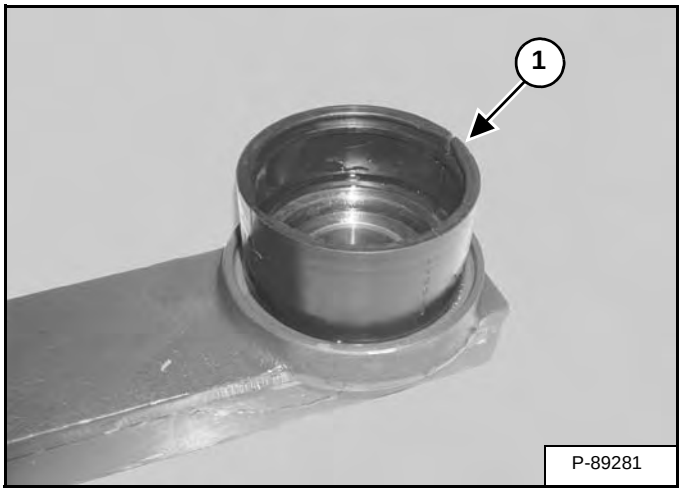
The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the seal assembly in a pan of alcohol.

Dealer Copy -- Not for Resale

Idler Assembly (Cont'd)

Figure 30-21-44

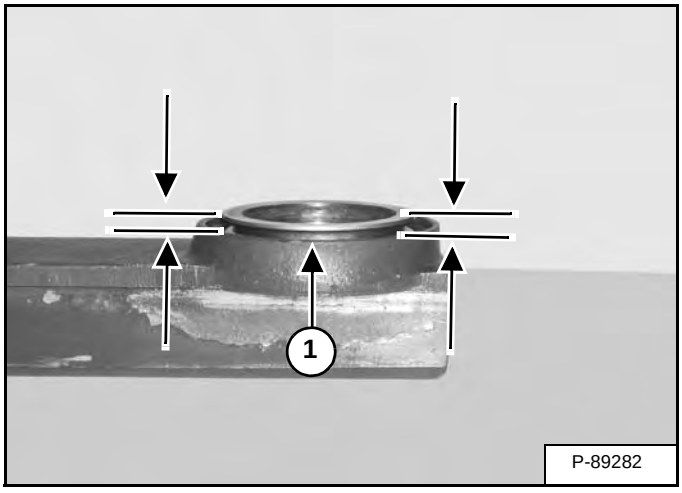


Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-21-44]** in the idler.

Use firm, even pressure on the installation tool to *pop* the O-ring into the housing.

Remove the installation tool.

Figure 30-21-45

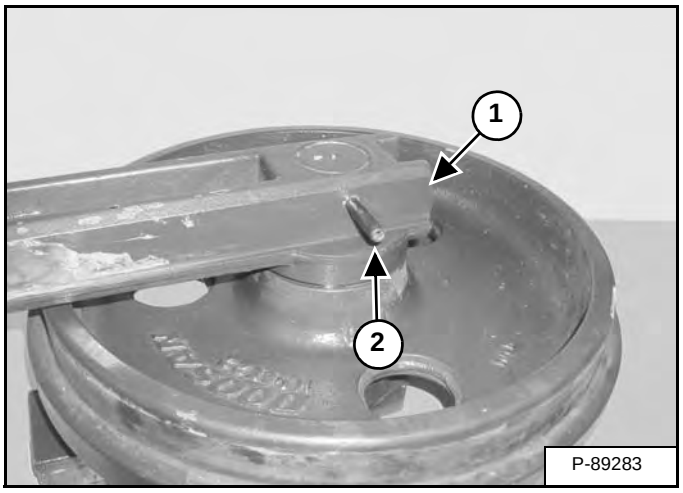


The seal stand off height must be equal and the O-ring (Item 1) **[Figure 30-21-45]** must not be twisted.

Apply a light film of oil to both metal seal rings.

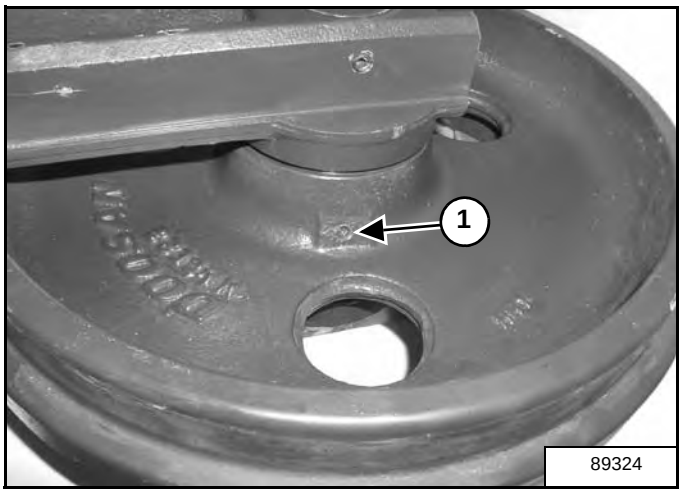
NOTE: Do not get any oil on the rubber O-rings.

Figure 30-21-46



Install the support (Item 1) on the shaft. Press down on the support and install the roll pin (Item 2) **[Figure 30-21-46]**.

Figure 30-21-47



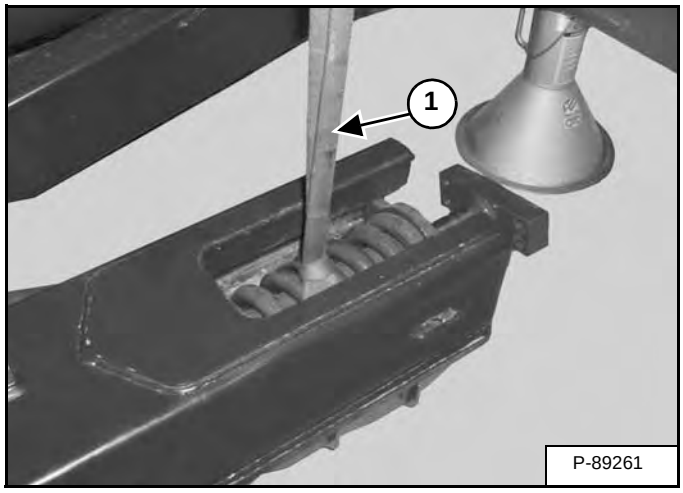
Remove the plug (Item 1) **[Figure 30-21-47]**.

Add 0,101 - 0,139 L (3.4 - 4.7 U.S. fl oz) 30W oil to the idler. Install the plug (Item 1) **[Figure 30-21-47]**.

Dealer Copy -- Not for Resale

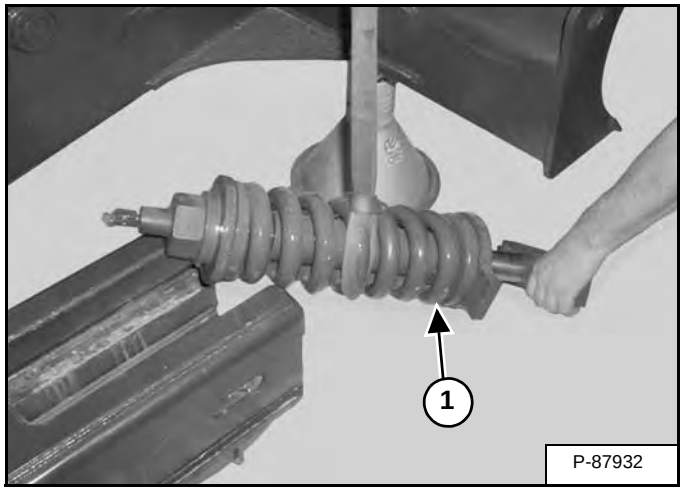
Track Tensioner Removal And Installation

Figure 30-21-48



Install a sling (Item 1) **[Figure 30-21-48]** and hoist on the grease cylinder.

Figure 30-21-49



Guide the grease cylinder (Item 1) **[Figure 30-21-49]** out of the track frame.

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY (Item 1) **[Figure 30-21-49]**.

⚠ WARNING



P-62574

AVOID INJURY OR DEATH

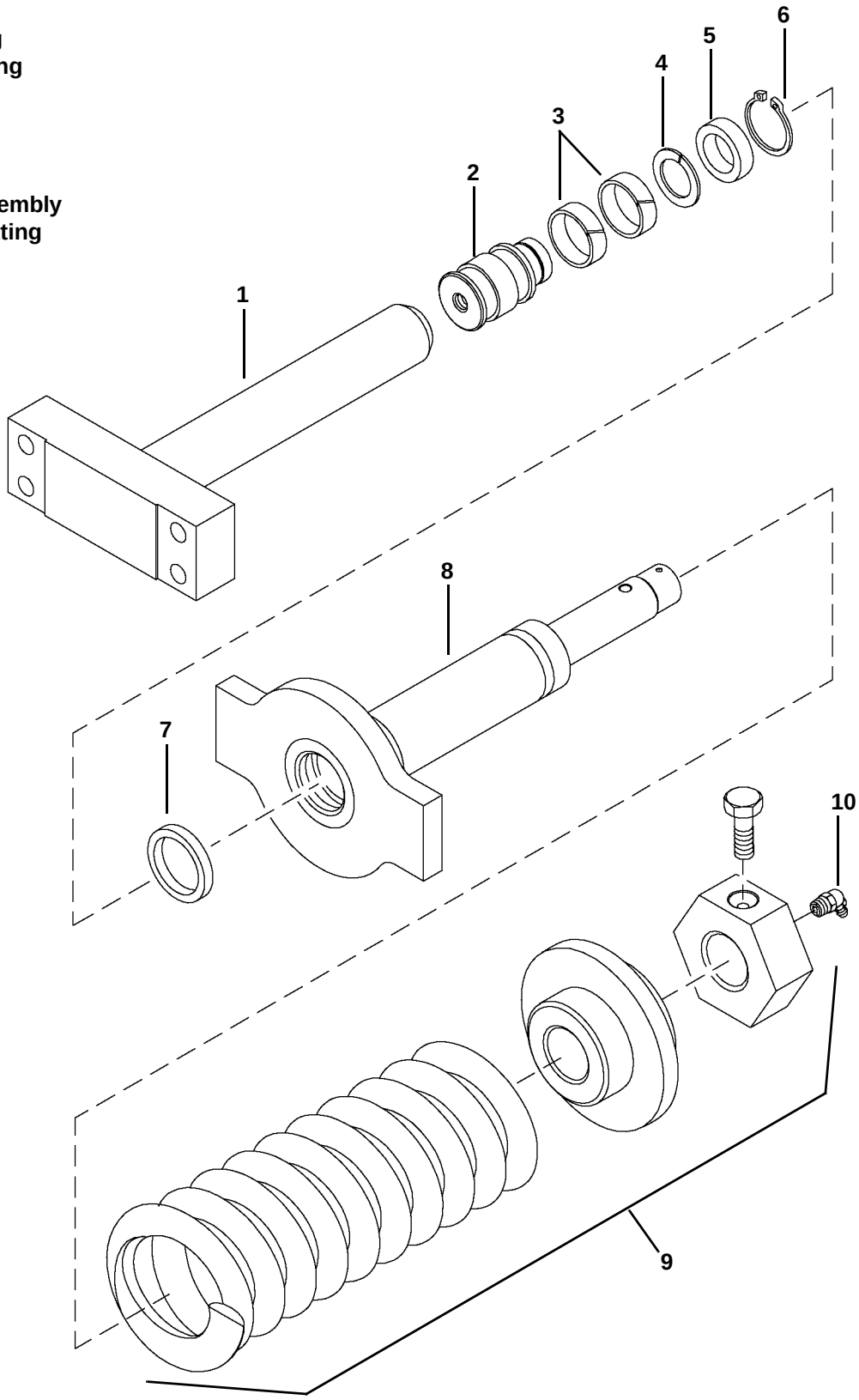
- **Spring loaded components under pressure can cause serious injury or death.**
- **Do not disassemble the coil spring assembly**

W-2617-1004

Dealer Copy -- Not for Resale

Track Tensioner Parts Identification

1. Piston Rod
2. Piston
3. Piston Ring
4. Back-up Ring
5. Packing
6. Snap Ring
7. Dust Seal
8. Cylinder
9. Spring Assembly
10. Grease Fitting

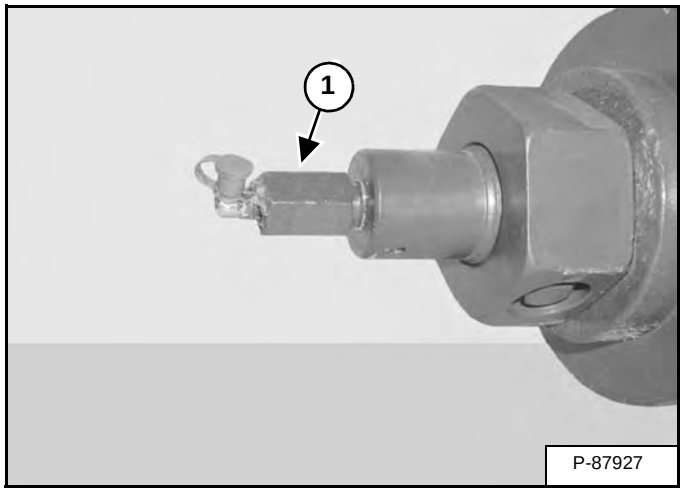


EM7807

Dealer Copy -- Not for Resale

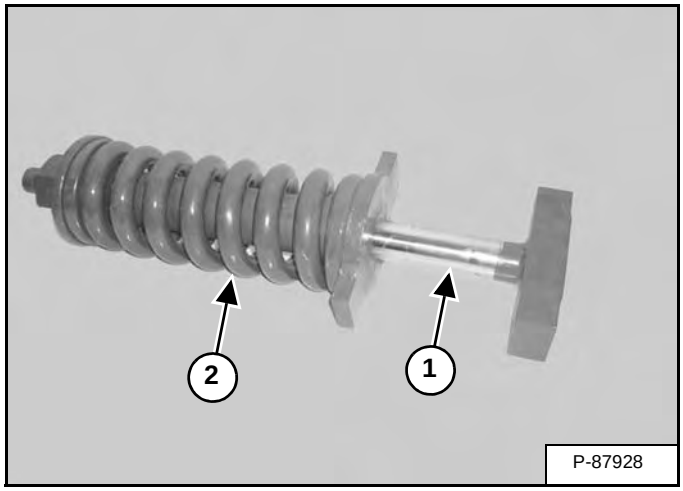
Track Tensioner Disassembly And Assembly

Figure 30-21-50



Remove the grease fitting and adapter (Item 1) **[Figure 30-21-50]**.

Figure 30-21-51



Remove the piston rod (Item 1) **[Figure 30-21-51]** from the cylinder.

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY (Item 2) **[Figure 30-21-51]**

⚠ WARNING



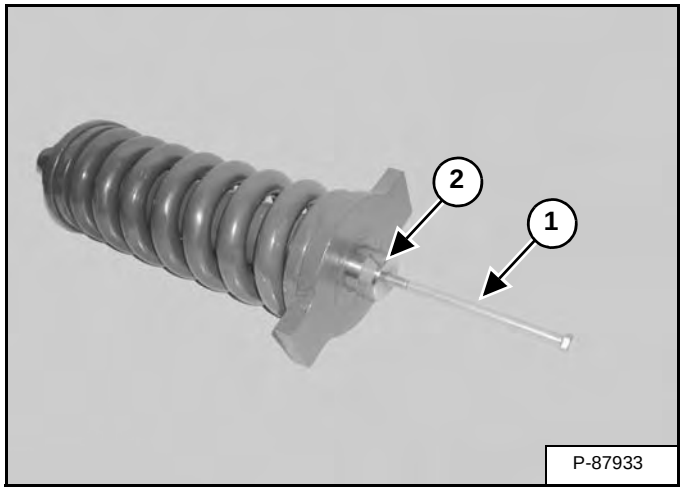
P-62574

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 30-21-52

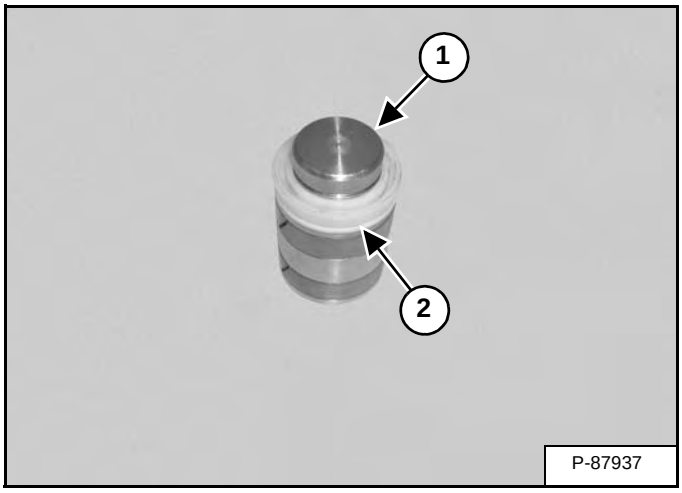


Use a 12 mm x 1,75 x 203 mm long bolt to thread the bolt (Item 1) into the piston (Item 2) **[Figure 30-21-52]**. Pull the piston out of the cylinder.

Dealer Copy -- Not for Resale

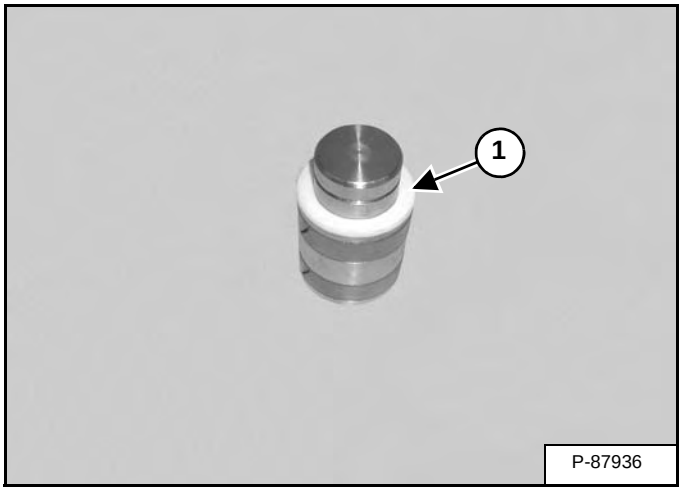
Track Tensioner Disassembly And Assembly (Cont'd)

Figure 30-21-53



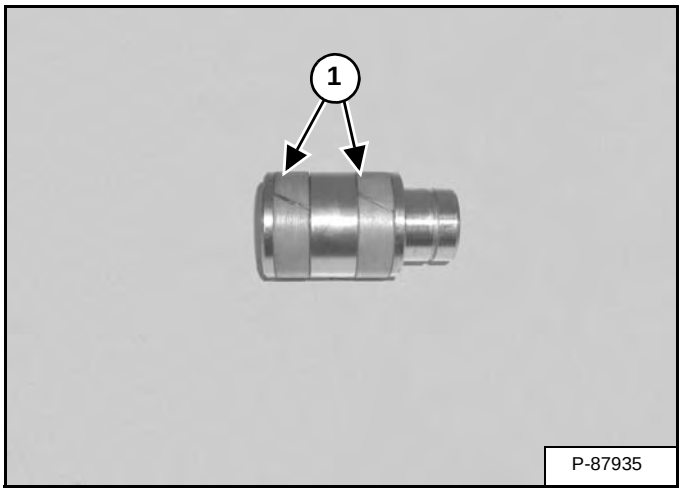
Remove the snap ring (Item 1) and packing (Item 2) **[Figure 30-21-53]**.

Figure 30-21-54



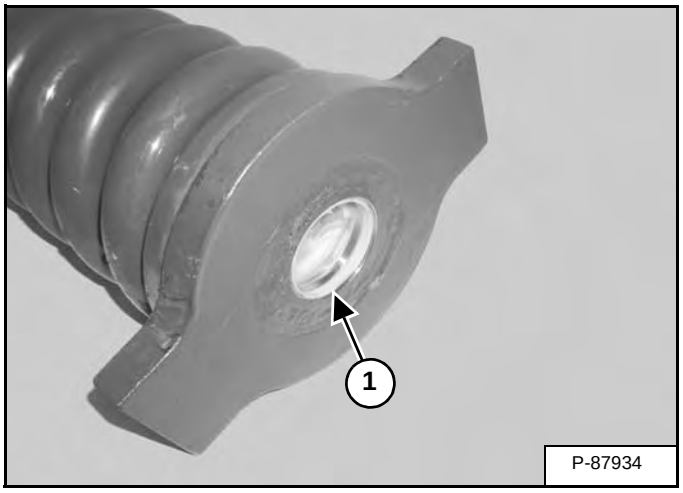
Remove the back-up ring (Item 1) **[Figure 30-21-54]**.

Figure 30-21-55



Remove the two piston rings (Item 1) **[Figure 30-21-55]**.

Figure 30-21-56



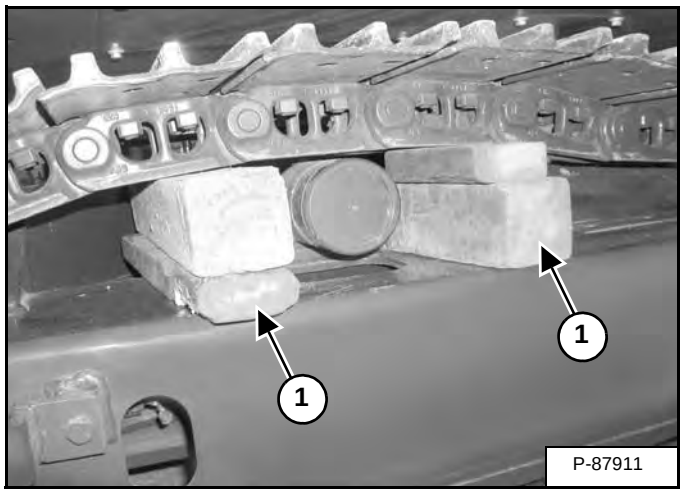
Remove the dust seal (Item 1) **[Figure 30-21-56]**.

Dealer Copy -- Not for Resale

Roller Removal And Installation

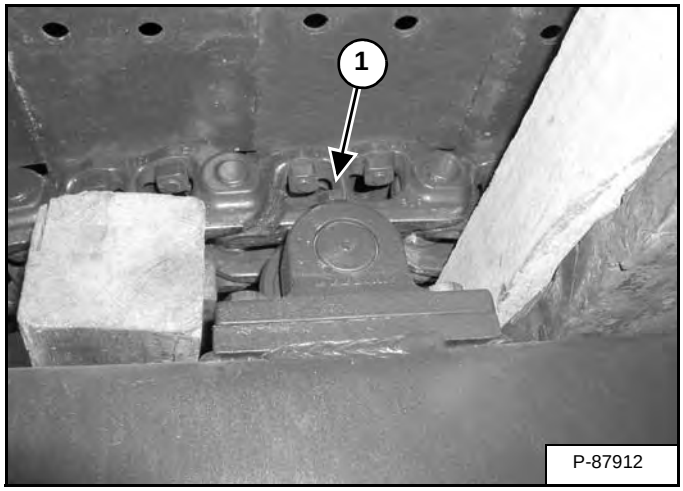
NOTE: The track does not have to be removed to remove the top roller.

Figure 30-21-57



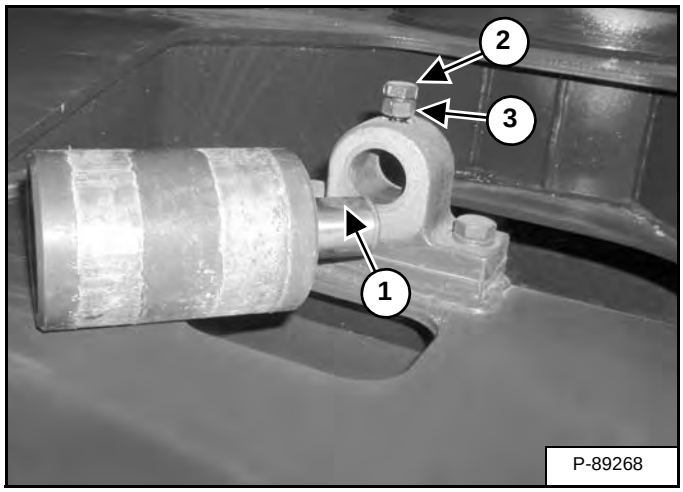
Install blocks (Item 1) **[Figure 30-21-57]** between the track frame and track. Loosen the track. (See Adjusting Tension on Page 30-21-2.)

Figure 30-21-58



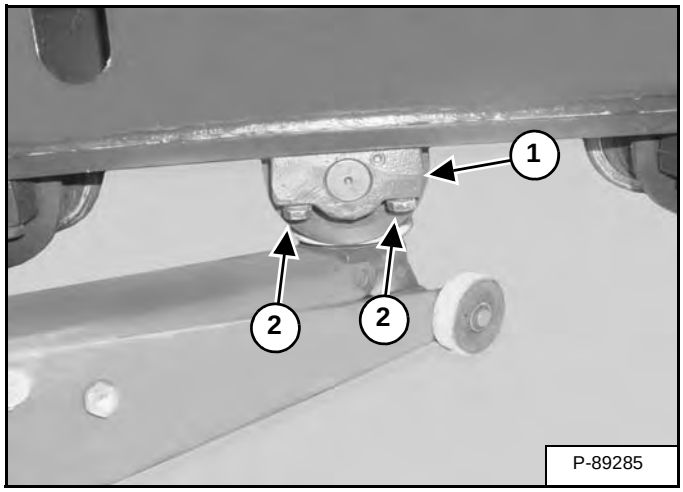
Loosen the nut (Item 1) **[Figure 30-21-58]** and bolt. Remove the top roller.

Figure 30-21-59



Installation: Install the flat spot of the shaft (Item 1) to the top of the mount. Tighten the bolt (Item 2) to 105 - 115 N•m (78 - 85 ft-lb) torque. Tighten the nut (Item 3) **[Figure 30-21-59]** against the mount.

Figure 30-21-60



NOTE: Remove the track to remove the bottom roller.

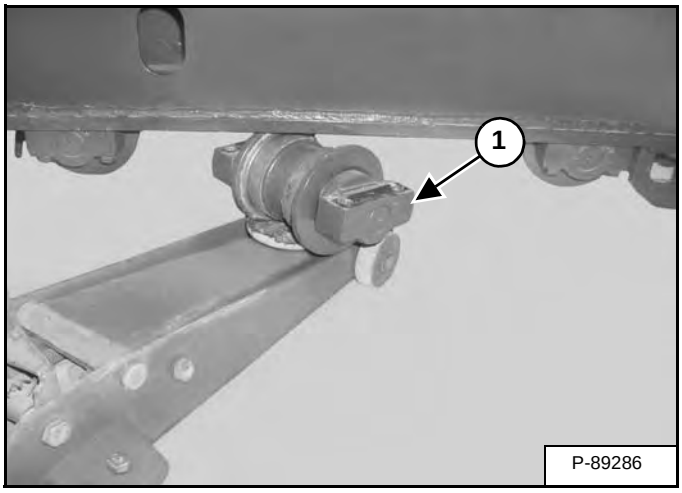
Place a jack under the bottom roller (Item 1). Remove the four bolts (Item 2) **[Figure 30-21-60]**.

Installation: Apply thread adhesive (Loctite® 242 or equivalent) to the bolt threads. Tighten the bolts to 160 - 180 N•m (118 - 113 ft-lb) torque.

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Roller Removal And Installation (Cont'd)

Figure 30-21-61

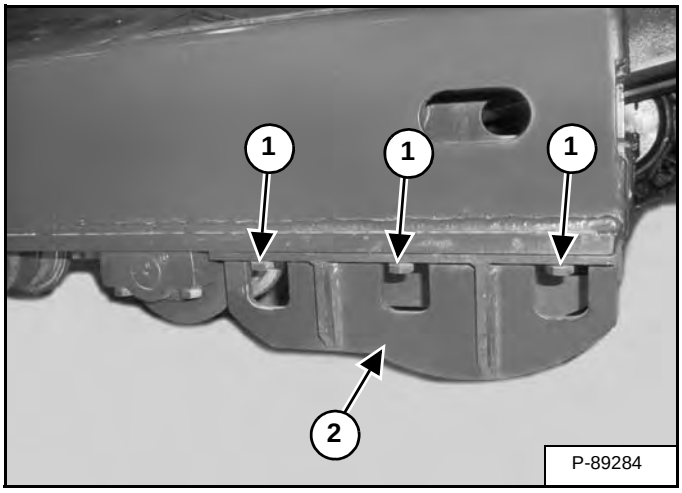


Lower the jack and remove the roller (Item 1) **[Figure 30-21-61]**.

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Guide Plate Removal And Installation

Figure 30-21-62

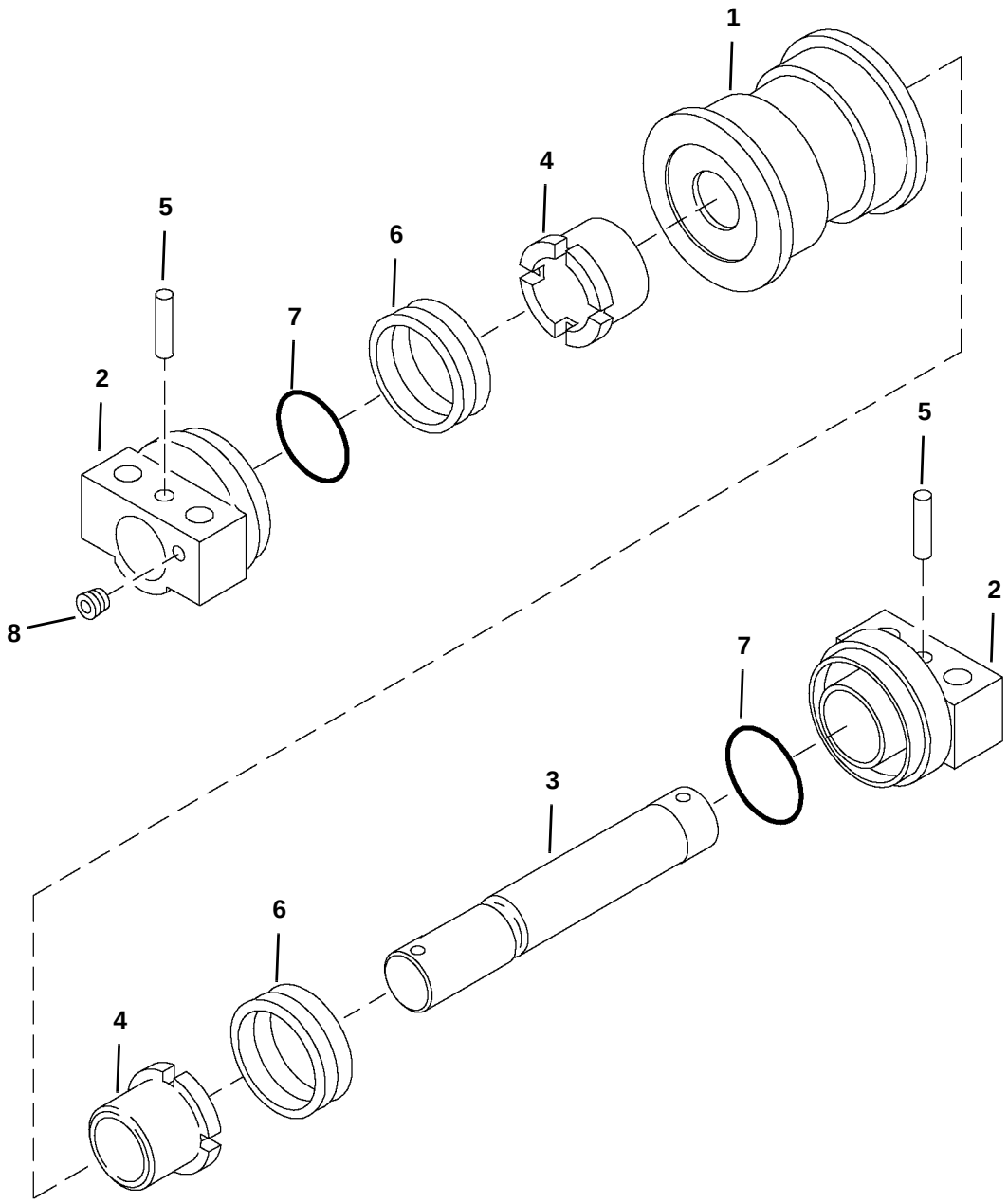


Remove the bolts (Item 1) and remove the four guide plates (two per side) (Item 2) **[Figure 30-21-62]**.

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Lower Roller Parts Identification

1. Roller
2. Collar
3. Shaft
4. Bushing
5. Pin
6. Seal
7. O-ring
8. Plug

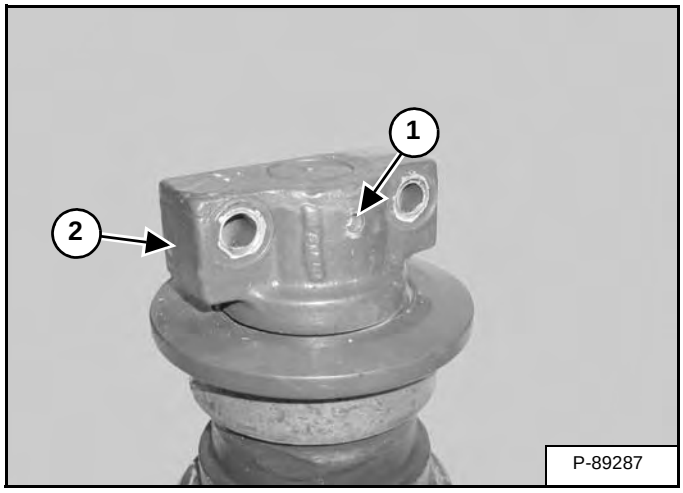


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Lower Roller Disassembly

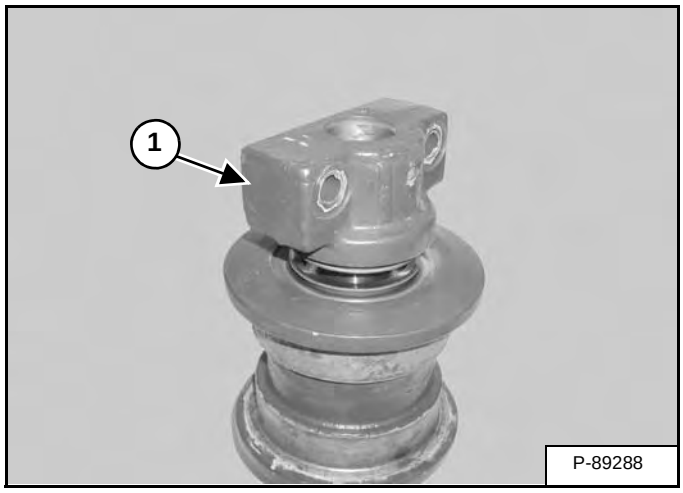
Figure 30-21-63



Drive the pin (Item 1) towards the top of the collar (Item 2) **[Figure 30-21-63]**.

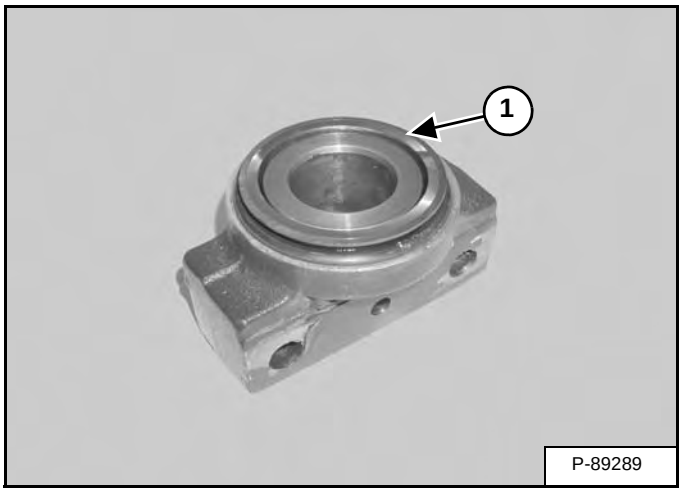
NOTE: The pin bore in the collar is stepped.

Figure 30-21-64



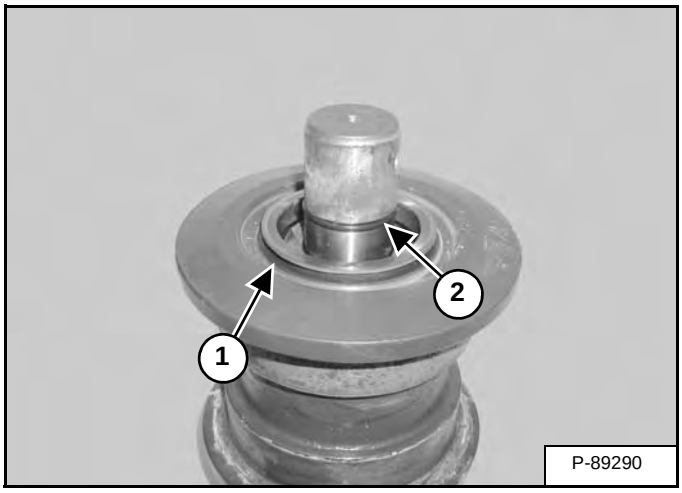
Remove the collar (Item 1) **[Figure 30-21-64]**.

Figure 30-21-65



Remove the seal assembly (Item 1) **[Figure 30-21-65]**.

Figure 30-21-66

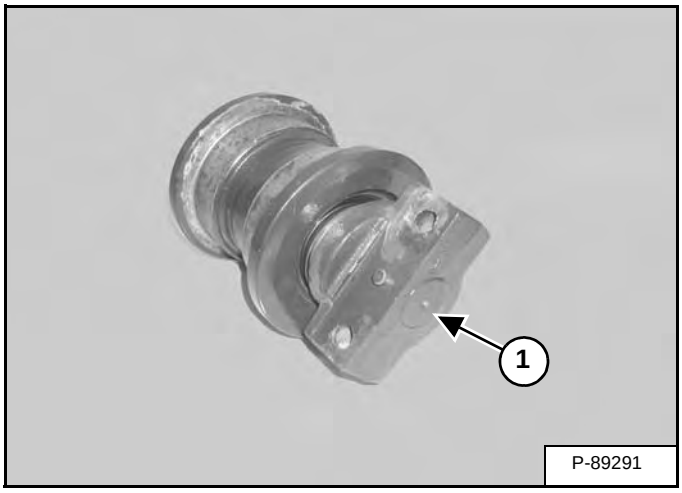


Remove the seal assembly (Item 1). Remove the O-ring (Item 2) **[Figure 30-21-66]**.

Dealer Copy -- Not for Resale

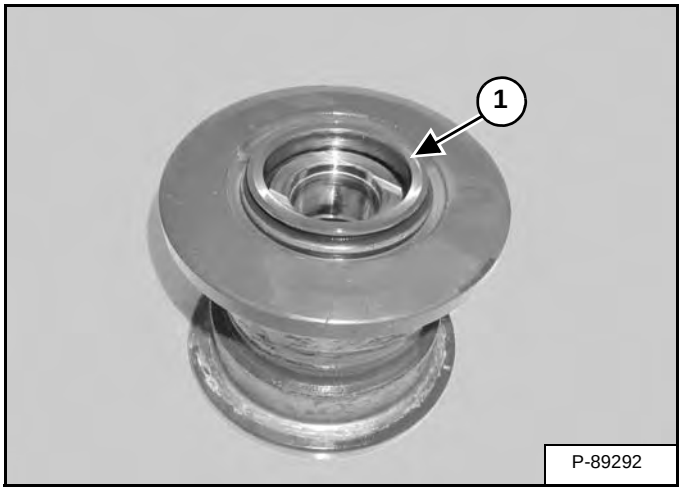
Lower Roller Disassembly (Cont'd)

Figure 30-21-67



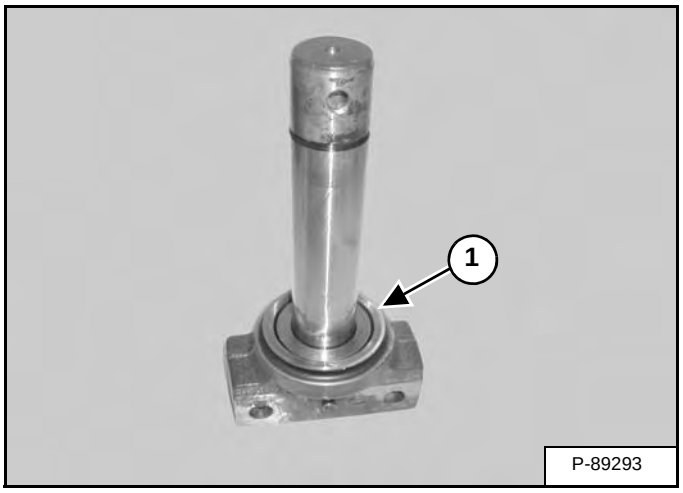
Remove the shaft assembly (Item 1) **[Figure 30-21-67]** from the roller.

Figure 30-21-68



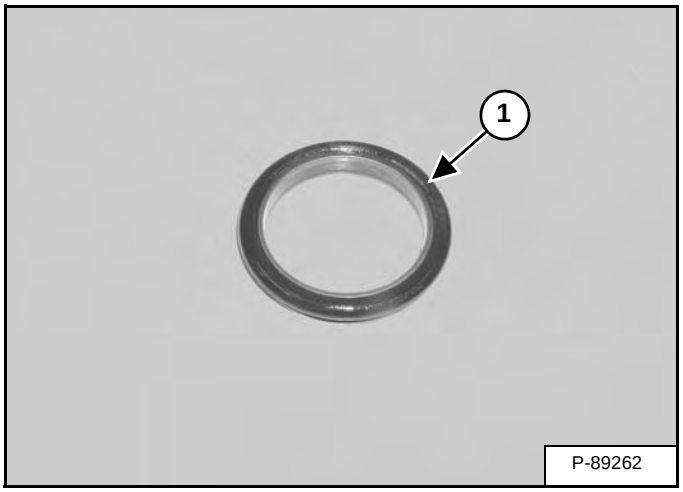
Remove the seal assembly (Item 1) **[Figure 30-21-68]** from the roller.

Figure 30-21-69



Remove the seal assembly (Item 1) **[Figure 30-21-69]** from the collar.

Figure 30-21-70

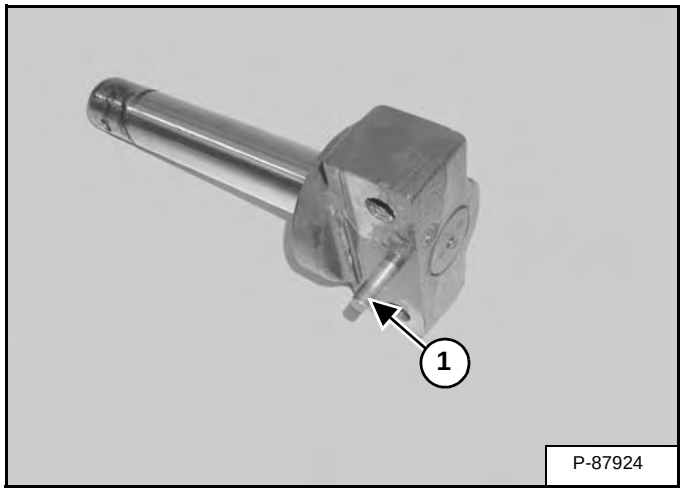


Remove the O-ring (Item 1) **[Figure 30-21-70]** from all four seal rings.

Dealer Copy -- Not for Resale

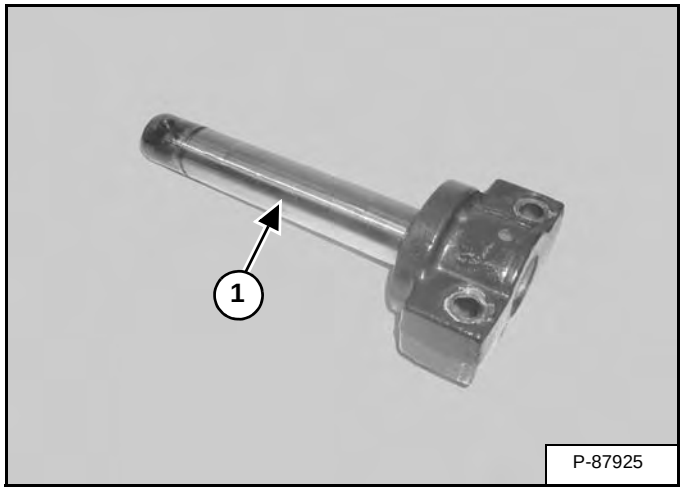
Lower Roller Disassembly (Cont'd)

Figure 30-21-71



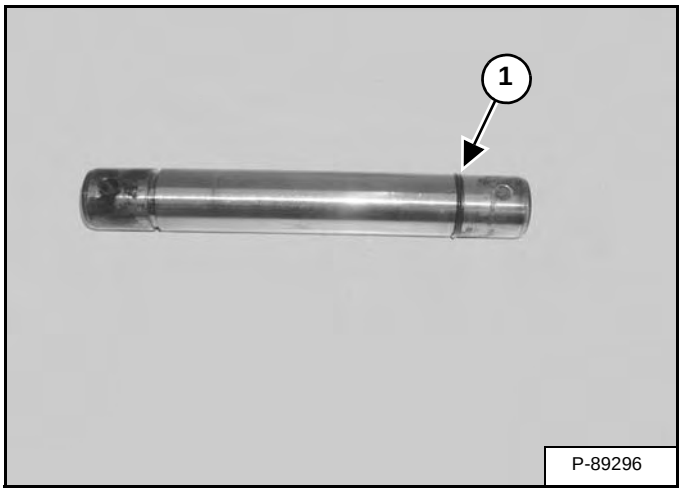
Remove the pin (Item 1) **[Figure 30-21-71]**.

Figure 30-21-72



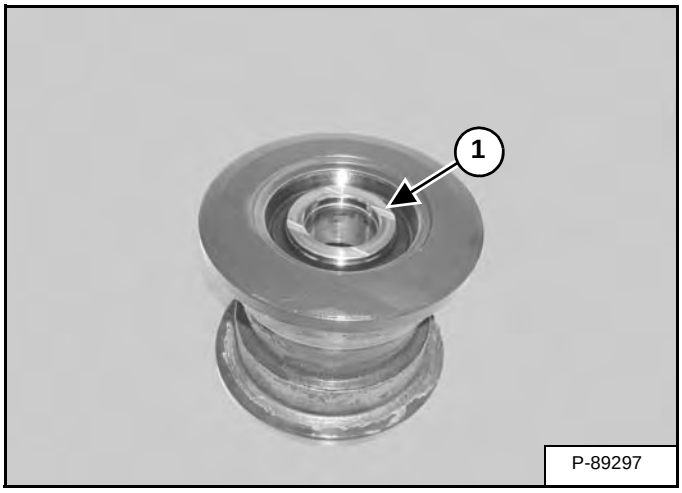
Remove the shaft (Item 1) **[Figure 30-21-72]**.

Figure 30-21-73



Remove the O-ring (Item 1) **[Figure 30-21-73]**.

Figure 30-21-74



Remove the bushing (Item 1) **[Figure 30-21-74]** from both sides of the roller.

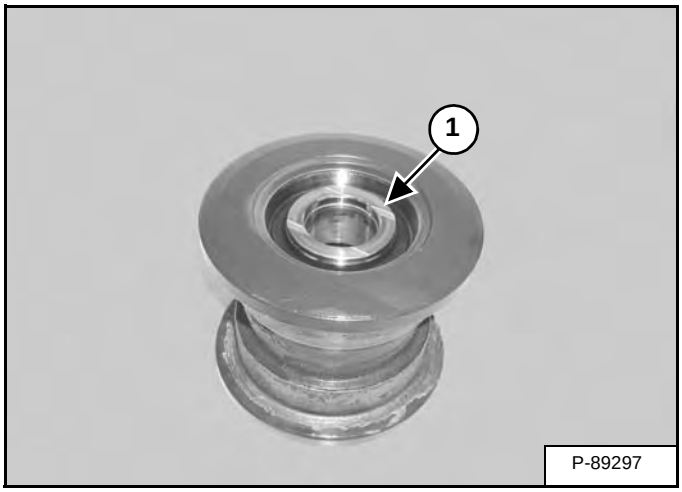
Dealer Copy -- Not for Resale

Lower Roller Assembly

Clean all parts in solvent and dry with compressed air.

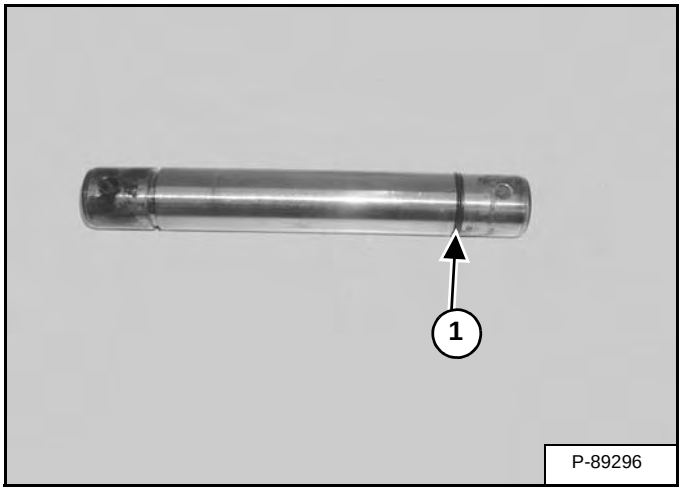
The seal assemblies are a matched set and must be replaced in pairs.

Figure 30-21-75



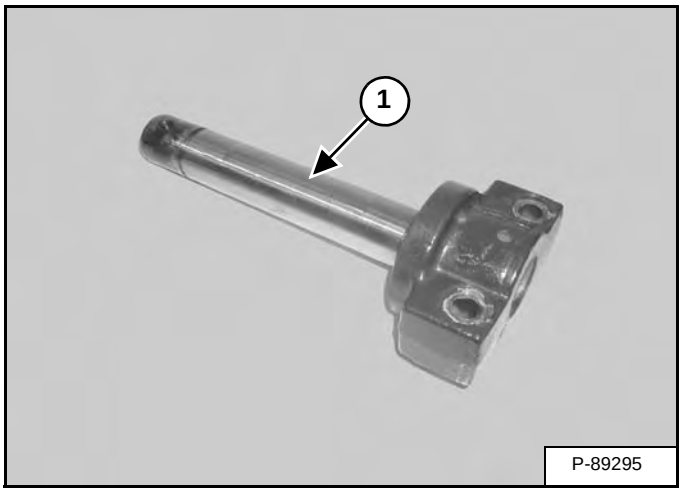
Install the bushing (Item 1) **[Figure 30-21-75]** on both sides of the roller.

Figure 30-21-76



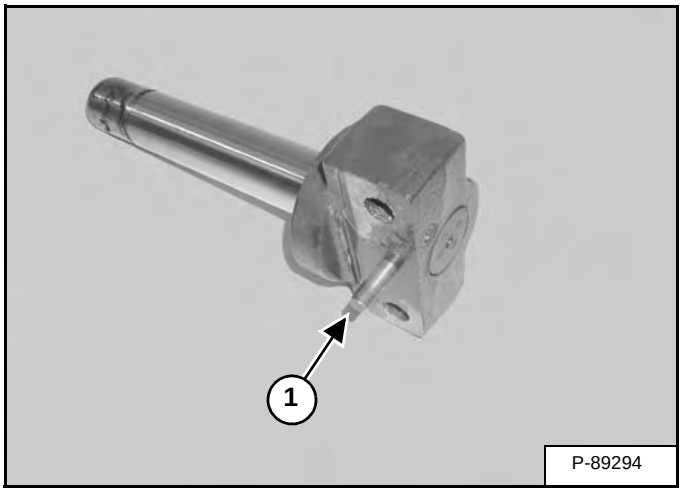
Install the O-ring (Item 1) **[Figure 30-21-76]** on the shaft.

Figure 30-21-77



Install the shaft (Item 1) **[Figure 30-21-77]** in the collar.

Figure 30-21-78

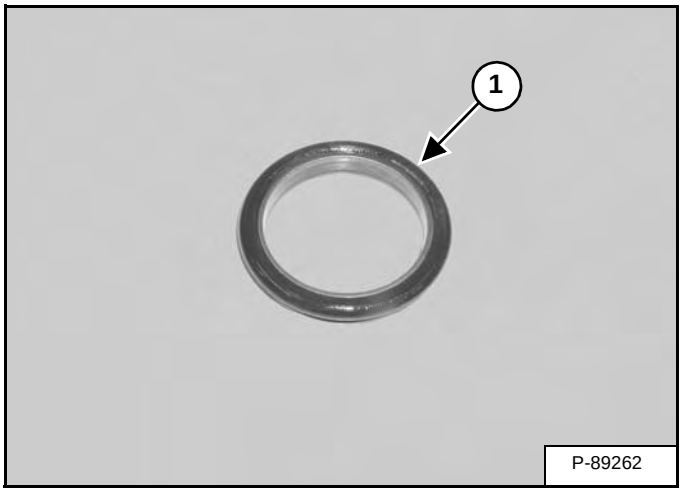


Install the pin (Item 1) **[Figure 30-21-78]** in the collar and through the shaft.

Dealer Copy -- Not for Resale

Lower Roller Assembly (Cont'd)

Figure 30-21-79

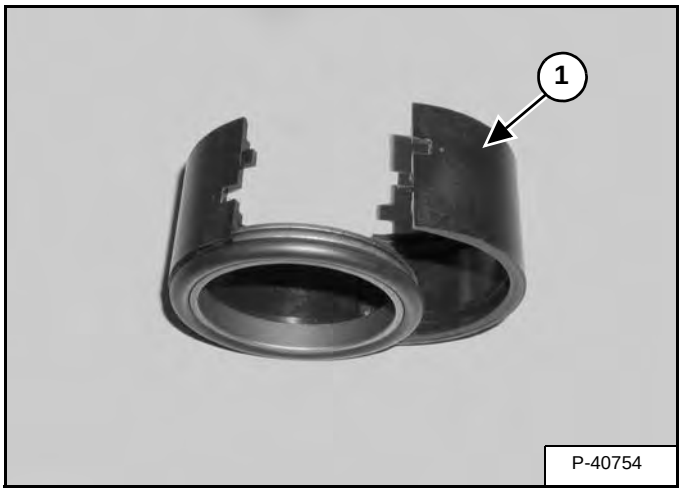


Install the O-ring (Item 1) **[Figure 30-21-79]** on the seal ring. Repeat this procedure on all four seal assemblies.

The O-ring and seal ring must be clean and free of any dust, oil film and foreign matter.

NOTE: Inspect the seal ring for burrs before installing the O-ring. Make sure that the O-ring is not twisted when installing it. To remove any twists, gently pull a section of the O-ring and let it snap back.

Figure 30-21-80

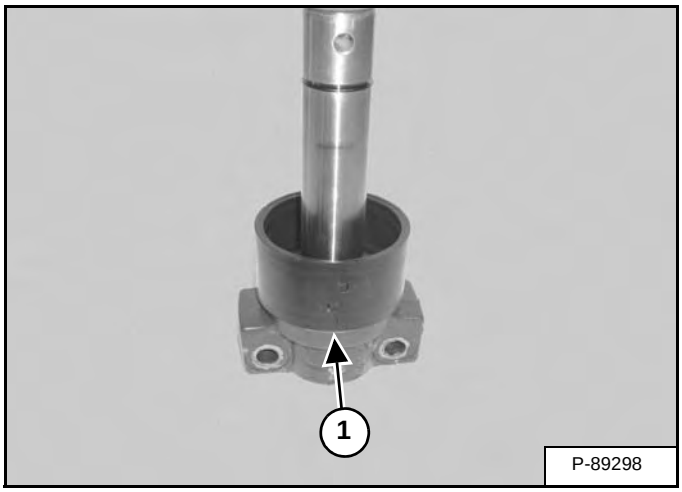


Place the seal assembly in the installation tool (Item 1) **[Figure 30-21-80]**.

The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the seal assembly in a pan of alcohol.

Figure 30-21-81

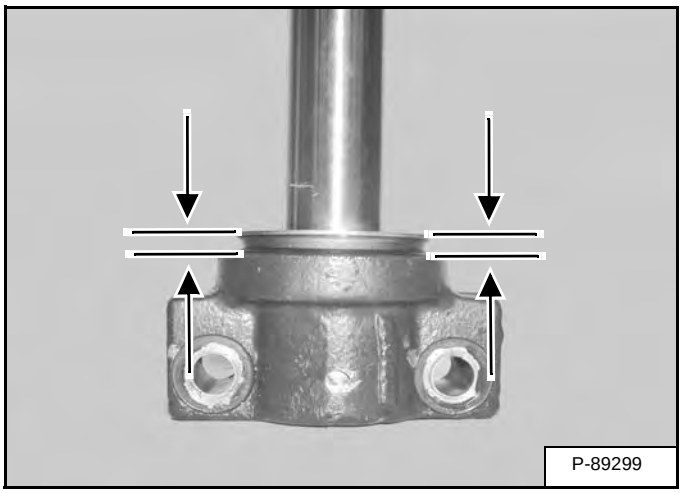


Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-21-81]** in the collar.

Use firm, even pressure on the installation tool to *pop* the O-ring in to the collar.

Remove the installation tool.

Figure 30-21-82

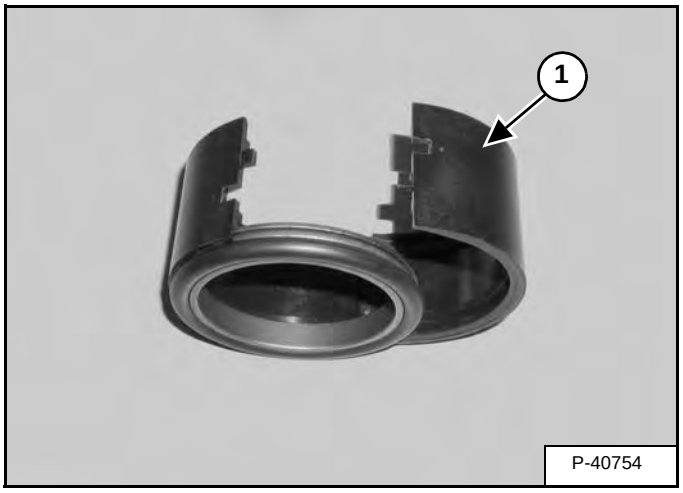


The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 30-21-82]**.

Dealer Copy -- Not for Resale

Lower Roller Assembly (Cont'd)

Figure 30-21-83

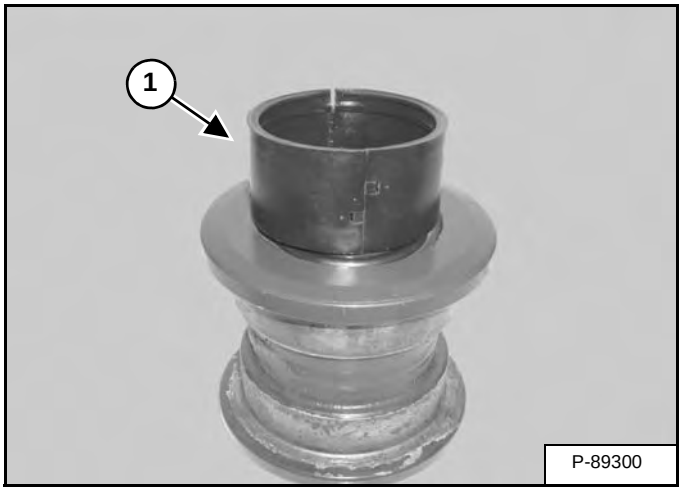


Place the seal assembly (Item 1) **[Figure 30-21-83]** in the installation tool.

The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the O-ring and seal assembly in a pan of alcohol.

Figure 30-21-84

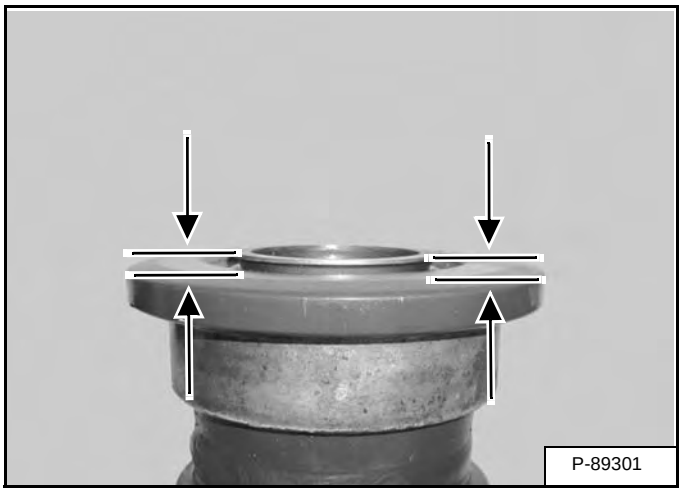


Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-21-84]** in the roller.

Use firm, even pressure on the installation tool to *pop* the O-ring in to the collar.

Remove the installation tool.

Figure 30-21-85

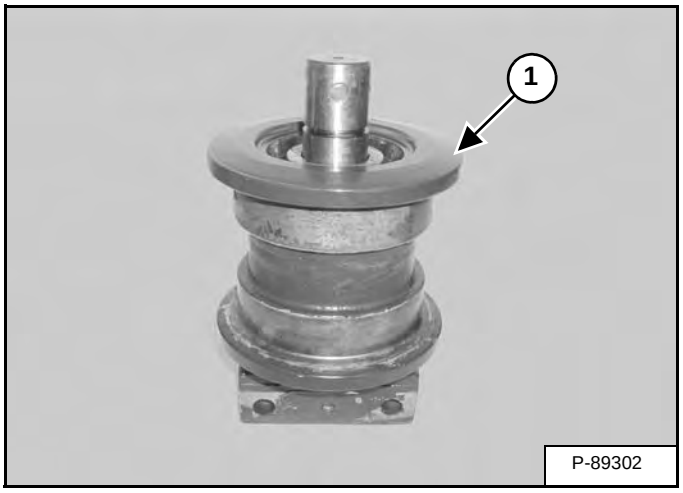


The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 30-21-85]**.

Apply a light film of oil to both metal seal rings.

NOTE: Do not get any oil on the rubber O-rings.

Figure 30-21-86

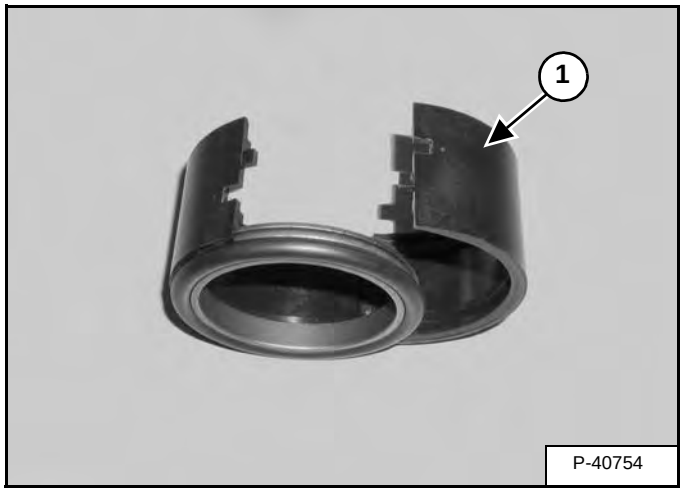


Install the roller (Item 1) **[Figure 30-21-86]** on the shaft.

Dealer Copy -- Not for Resale

Lower Roller Assembly (Cont'd)

Figure 30-21-87

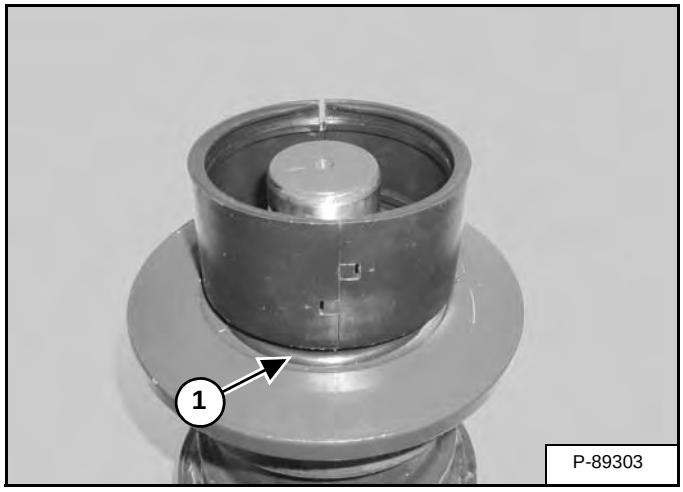


Place the seal assembly in the installation tool (Item 1) **[Figure 30-21-87]**.

The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the O-ring and seal ring assembly in a pan of alcohol.

Figure 30-21-88

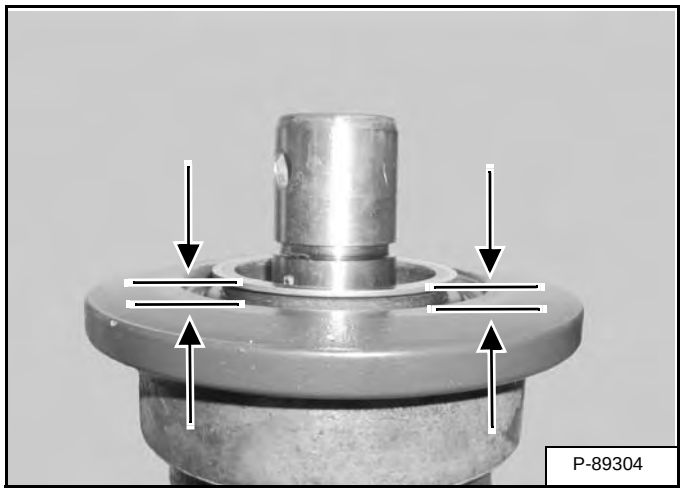


Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-21-88]** in the roller.

Use firm, even pressure on the installation tool to *pop* the O-ring in to the collar.

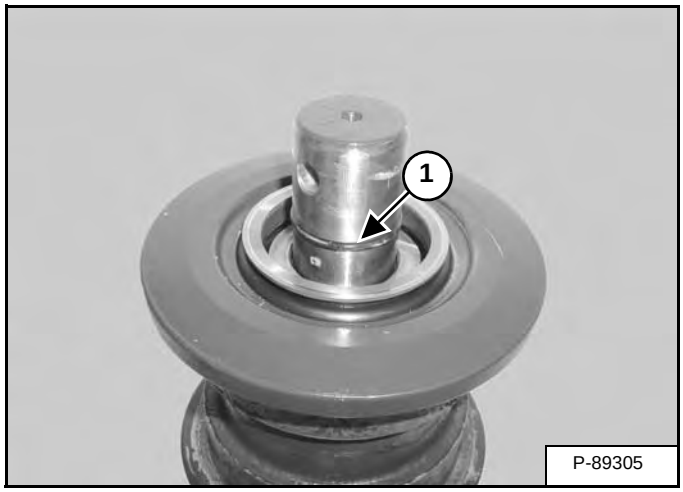
Remove the installation tool.

Figure 30-21-89



The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 30-21-89]**.

Figure 30-21-90

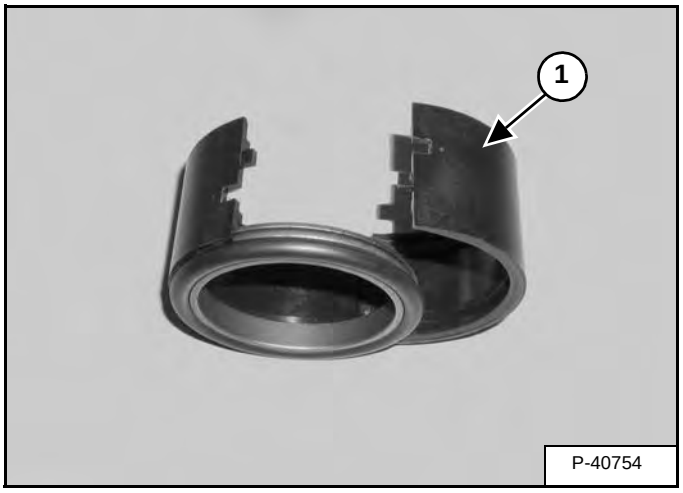


Install the O-ring (Item 1) **[Figure 30-21-90]**.

Dealer Copy -- Not for Resale

Lower Roller Assembly (Cont'd)

Figure 30-21-91

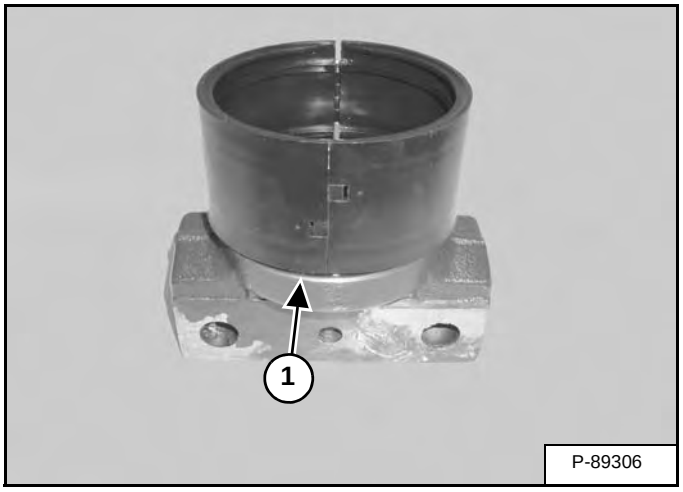


Place the seal assembly in the installation tool (Item 1) **[Figure 30-21-91]**.

The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the O-ring and seal ring assembly in a pan of alcohol.

Figure 30-21-92

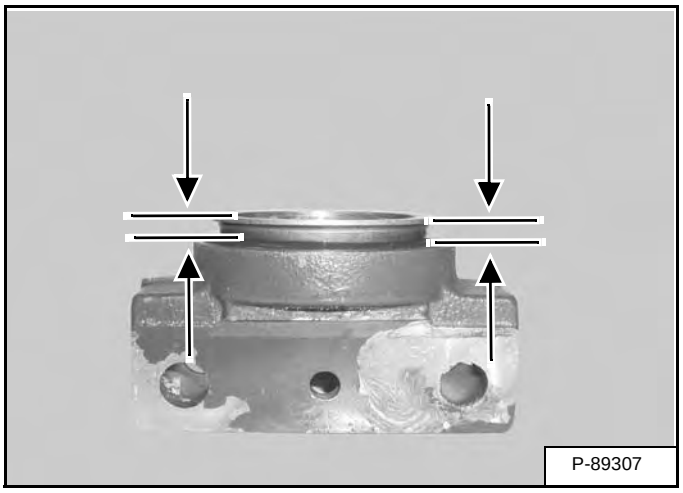


Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-21-92]** in the roller.

Use firm, even pressure on the installation tool to *pop* the O-ring in to the collar.

Remove the installation tool.

Figure 30-21-93

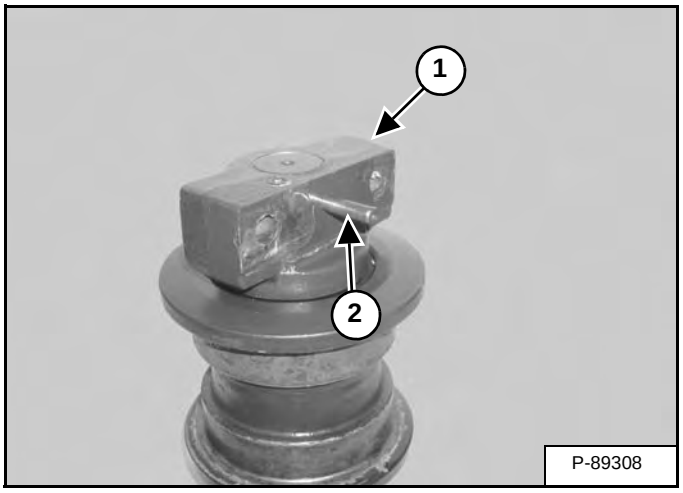


The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 30-21-93]**.

Apply a light film of oil to both metal seal rings.

NOTE: Do not get any oil on the rubber O-rings.

Figure 30-21-94

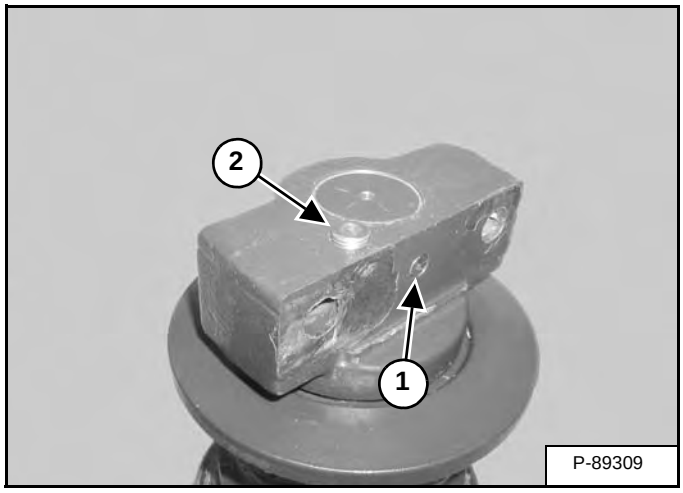


Install the collar (Item 1) on the shaft. Install the pin (Item 2) **[Figure 30-21-94]** in the collar.

Dealer Copy -- Not for Resale

Lower Roller Assembly (Cont'd)

Figure 30-21-95



Push down on the collar until the pin bore of the collar is aligned with the pin bore of the shaft. Fully seat the pin (Item 1) **[Figure 30-21-95]**.

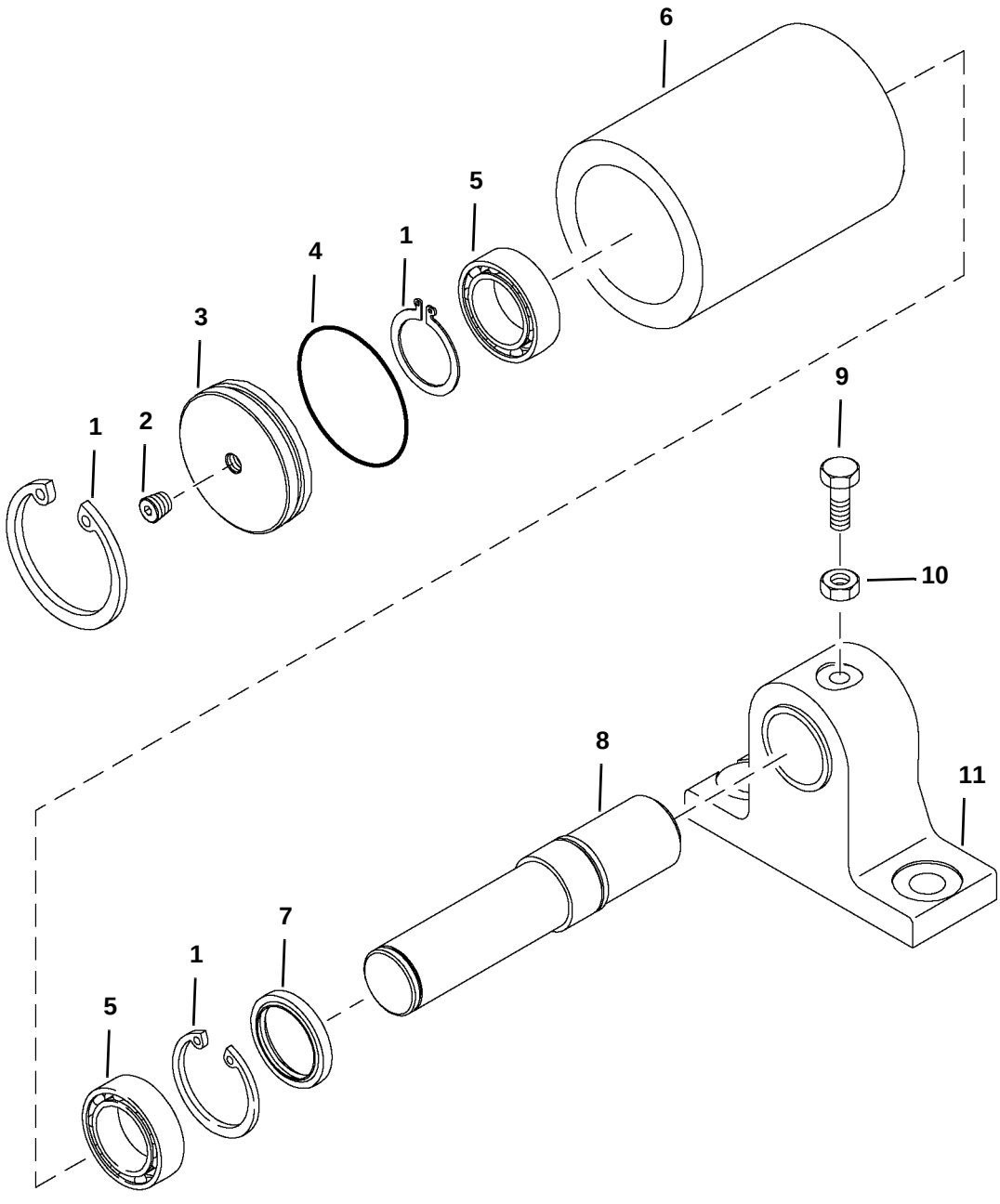
Remove the plug (Item 2) **[Figure 30-21-95]**. Add 0,121 - 0,160 L (4.1 - 5.4 U.S. fl oz) of 30W oil to the roller.

Install the plug.

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Upper Roller Parts Identification

1. Snap Ring
2. Pipe Plug
3. Cover
4. O-ring
5. Bearing
6. Roller
7. Seal
8. Shaft
9. Bolt
10. Nut
11. Mount

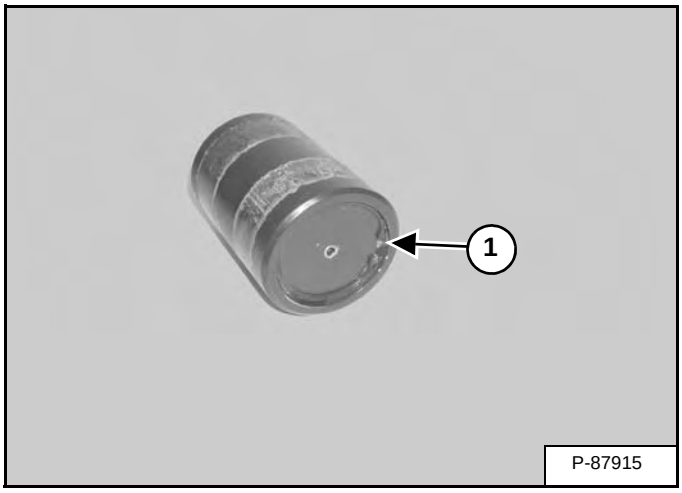


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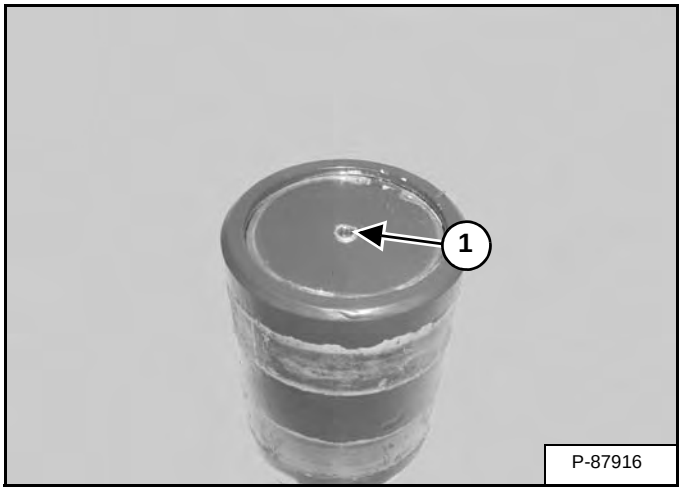
Upper Roller Disassembly And Assembly

Figure 30-21-96



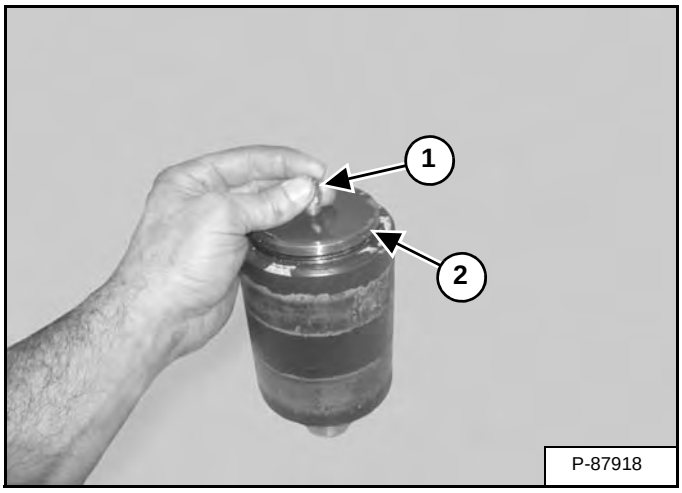
Remove the snap ring (Item 1) **[Figure 30-21-96]**.

Figure 30-21-97



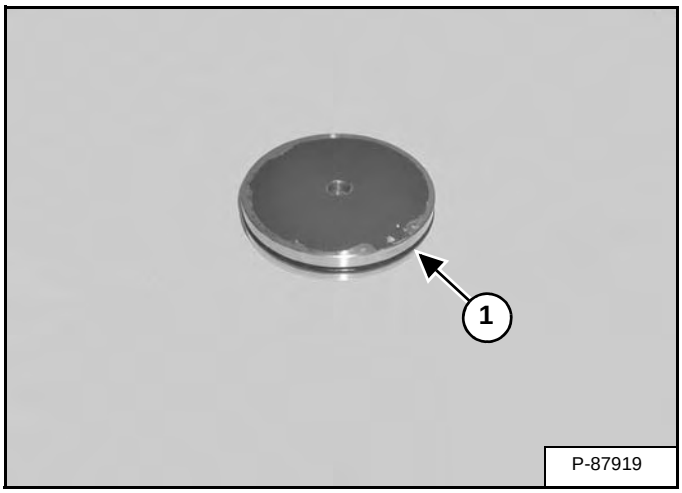
Remove the pipe plug (Item 1) **[Figure 30-21-97]**.

Figure 30-21-98



Install a 50,8 mm (2.0 in) long 1/8 in NPT pipe (Item 1) into the cover. Pull up on the pipe to remove the cover (Item 2) **[Figure 30-21-98]**.

Figure 30-21-99

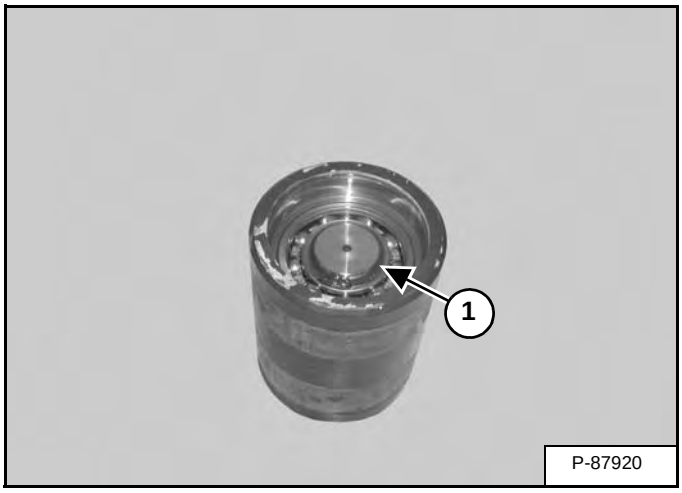


Remove the O-ring (Item 1) **[Figure 30-21-99]**.

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Upper Roller Disassembly And Assembly (Cont'd)

Figure 30-21-100

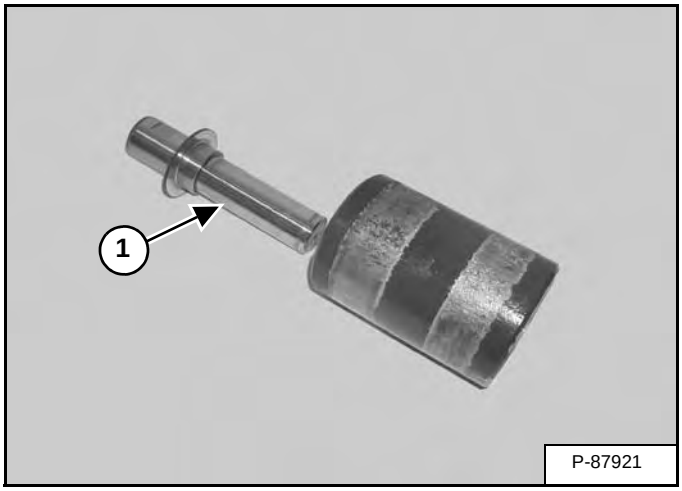


Remove the snap ring (Item 1) **[Figure 30-21-100]**.

Turn the roller over and drain the oil.

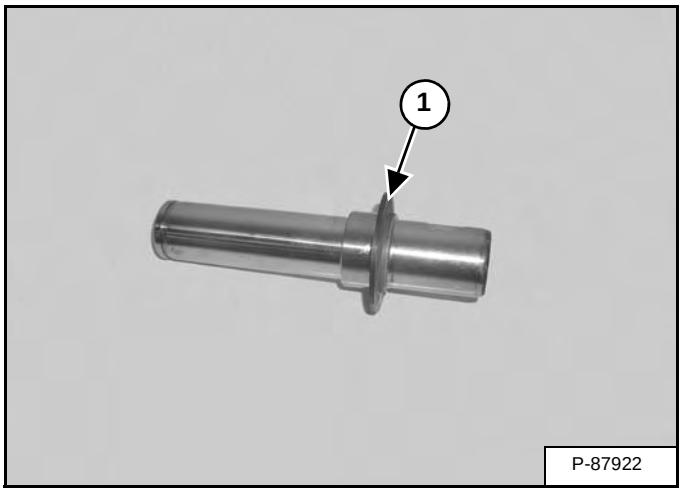
Assembly: Add 0,133 - 0,169 L (4.5 - 5.7 U.S. fl oz) of 30W oil to the roller before installing the cover.

Figure 30-21-101



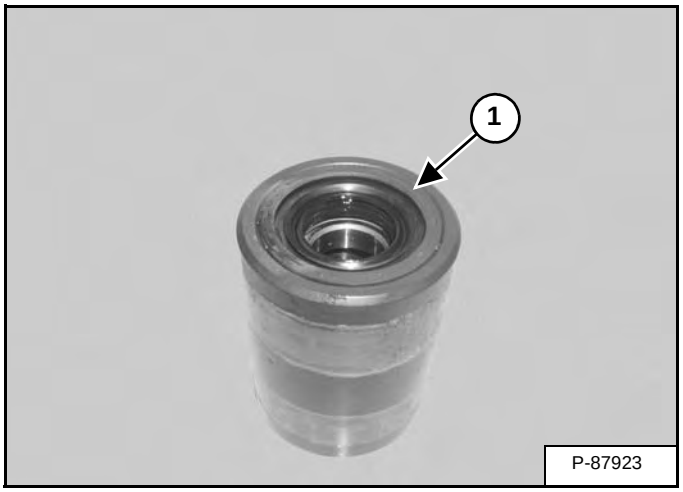
Remove the shaft (Item 1) **[Figure 30-21-101]** from the roller.

Figure 30-21-102



Remove the seal (Item 1) **[Figure 30-21-102]** from the shaft.

Figure 30-21-103

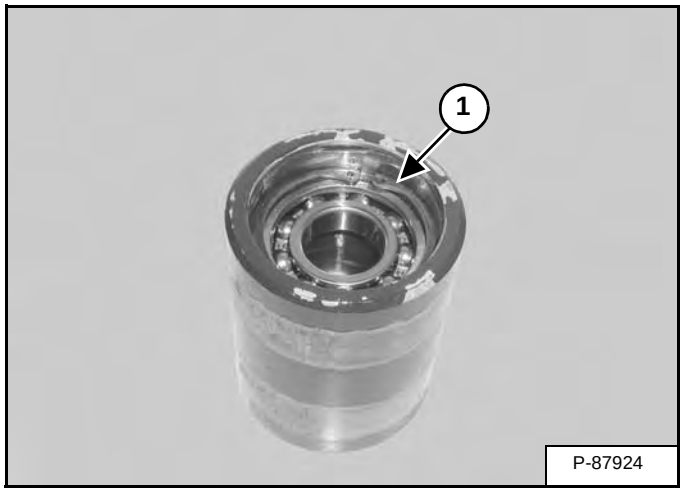


Remove the seal (Item 1) **[Figure 30-21-103]** from the roller.

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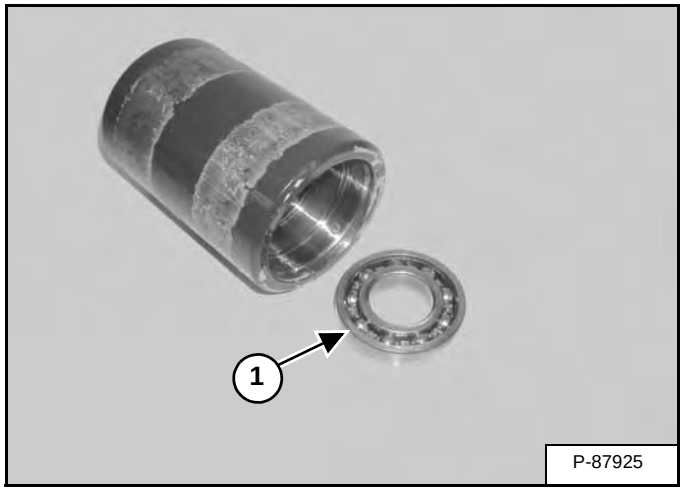
Upper Roller Disassembly And Assembly (Cont'd)

Figure 30-21-104



Remove the snap ring (Item 1) **[Figure 30-21-104]**.

Figure 30-21-105

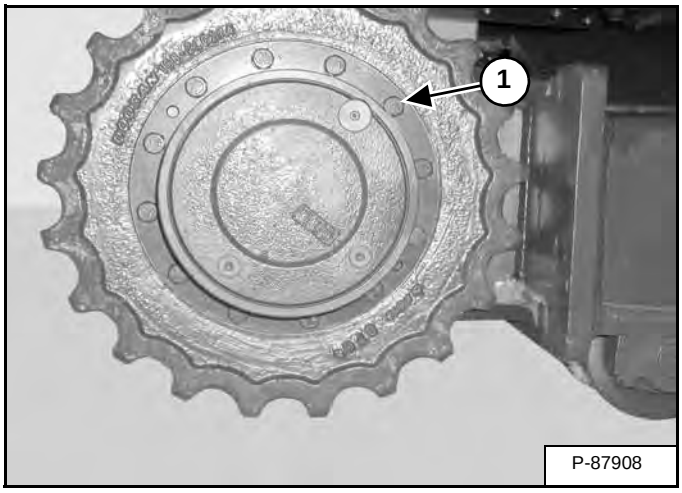


Remove the bearings (Item 1) **[Figure 30-21-105]** from both ends of the roller.

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Sprocket Removal And Installation

Figure 30-21-106



Remove the drive sprocket bolts (Item 1) **[Figure 30-21-106]**.

Installation: Apply thread adhesive (Loctite® 242 or equivalent) to the bolt threads. Tighten the bolts to 160 - 180 N•m (118 - 133 ft-lb) torque.

Remove the drive sprocket from the travel motor.

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TRACK MAINTENANCE

Track Damage Identification

The following pages show photos and illustrations of track damage and their probable cause. These pages are intended to be used for identifying the reason for track damage and how to avoid future track damage.

Cutting Of Steel Cords

Figure 30-30-1

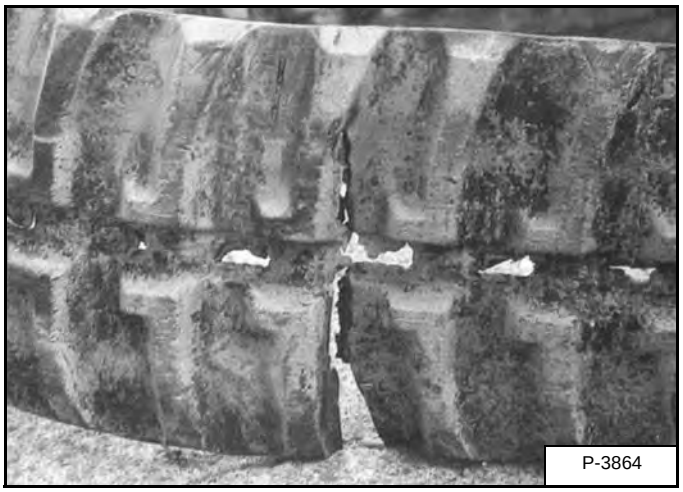
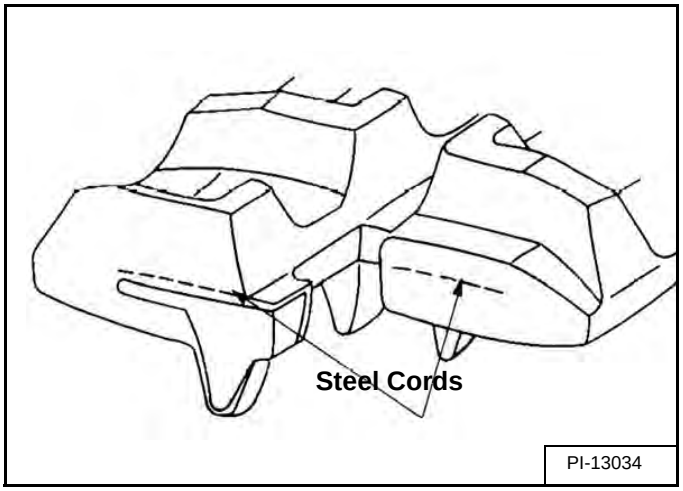


Figure 30-30-2



Damage:

Embedded steel cords are cut off **[Figure 30-30-1]** and **[Figure 30-30-2]**.

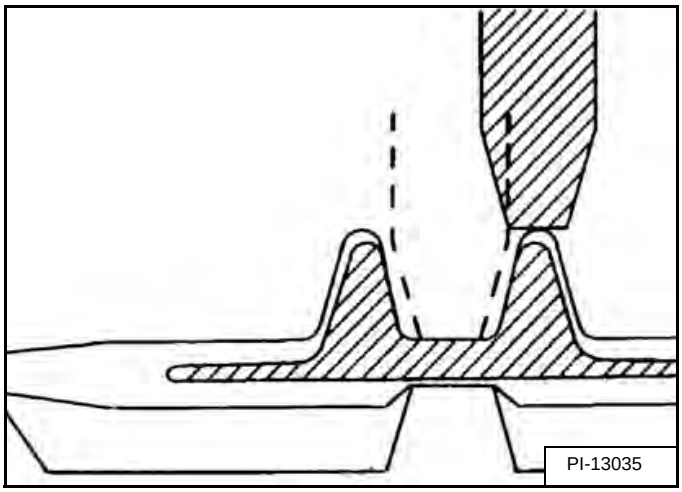
Replacement:

Replacement is required.

Causes of the damage:

When applied to rubber tracks under the following circumstances, tension in excess of the breaking strength of the embedded steel cords causes steel cords to be cut:

Figure 30-30-3



When the rubber track is detracting, the idler or sprocket rides on the projections of the embedded metal **[Figure 30-30-3]**.

When the rubber track is detracted, projections of rubber tracks get stuck between the frame of the undercarriage.

The rubber track is clogged with stones or foreign obstacles.

When moisture invades through a cut on the lug side rubber surface, the embedded steel cords will corrode. The deterioration of the design strength may lead to the breaking off of the steel cords.

Prevention:

The following preventions should be taken to minimize the risk of this damage:

Periodical checking of the recommended track tension. (See Checking Tension on Page 30-20-2.)

Avoiding quick turns on bumpy and rocky fields.

Drive carefully to prevent stones and other articles from clogging the rubber tracks.

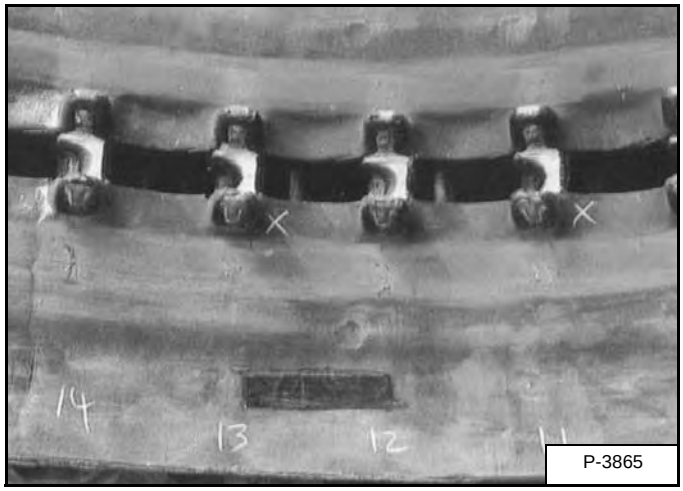
Driving over sharp objects should be avoided. If this is impossible, do not make turns while driving over sharp objects.

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Track Damage Identification (Cont'd)

Abrasion Of Embedded Metals

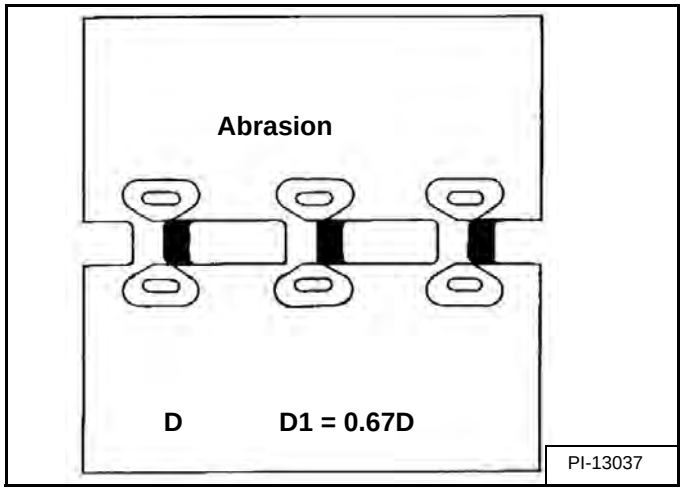
Figure 30-30-4



Damage:

In proportion to the service time, embedded metals will gradually wear away by friction **[Figure 30-30-4]**.

Figure 30-30-5



Replacement:

Replacement is required when the width of the embedded metals (D1) becomes 67% of the original width (D) **[Figure 30-30-5]**.

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:

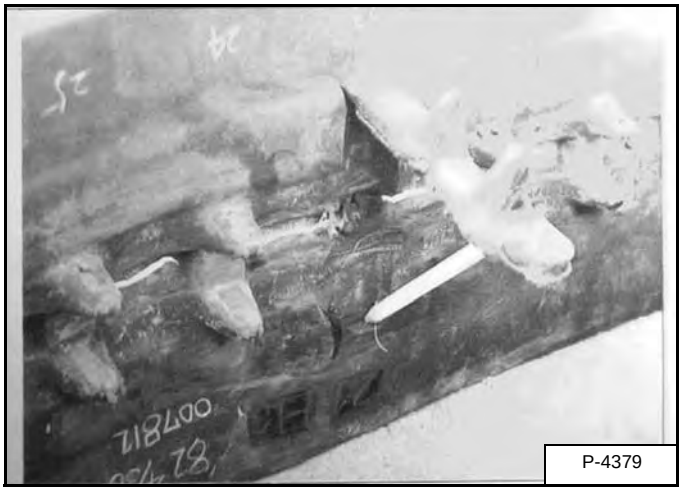
As long as rubber tracks are used under normal operating conditions, abnormal abrasion is unlikely to occur. The level of abrasion should be carefully checked when the machines are used for dozing which generates a heavy load for rubber tracks, and when they are operated under a sandy field condition for a long time.

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Track Damage Identification (Cont'd)

Separation Of Embedded Metals

Figure 30-30-6



Damage:

Extraordinary outer forces applied to embedded metals cause their separation from the rubber track's body **[Figure 30-30-6]**.

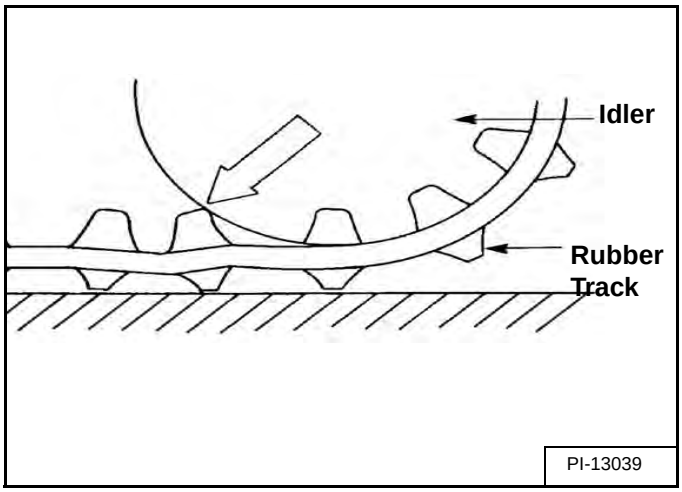
Replacement:

Even a partial separation of embedded metals requires replacement of the track.

Causes of the damage:

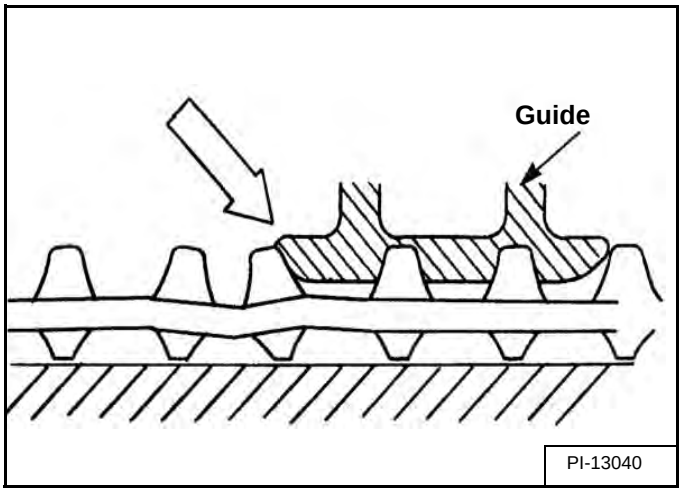
Embedded metals are adhered between the steel cords and the rubber body. The following cases generate external forces greater than the adhesion strength, causing separation of the embedded metals:

Figure 30-30-7



When the idler continually rides on the projections of embedded metals, the embedded metals will eventually peel off **[Figure 30-30-7]**.

Figure 30-30-8



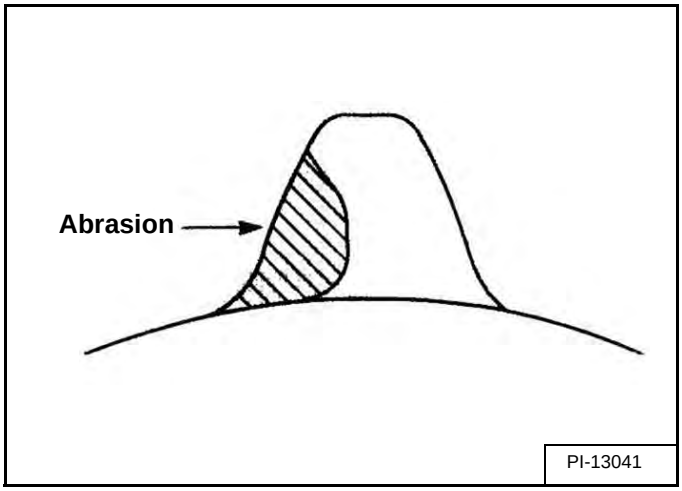
When a rubber track is detracted, it becomes stuck between the guide or the undercarriage frame, causing the separation of embedded metals **[Figure 30-30-8]**.

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Track Damage Identification (Cont'd)

Separation Of Embedded Metals (Cont'd)

Figure 30-30-9



Abnormally worn sprockets will pull embedded metals out **[Figure 30-30-9]**.

Prevention:

Similar to the prevention against the cutting of the steel cords:

Track tension should be periodically checked. (See Checking Tension on Page 30-20-2.)

Quick turns on bumpy and rocky fields should be avoided.

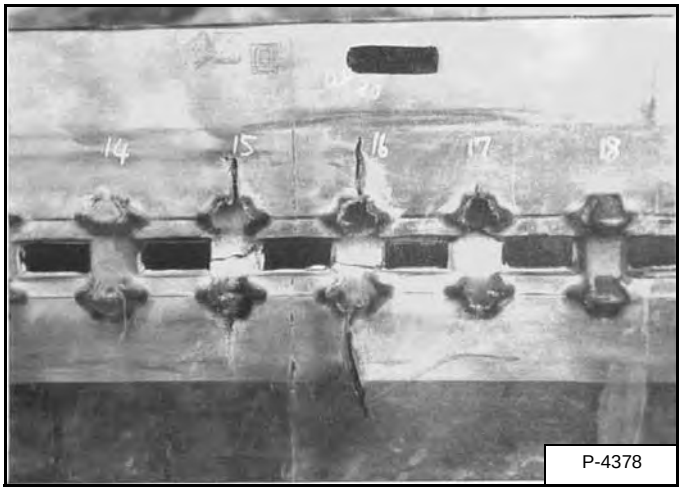
If abnormal wear of sprockets is observed, they should be replaced immediately.

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Track Damage Identification (Cont'd)

Separation Of Embedded Metals Due To Corrosion

Figure 30-30-10



Damage:

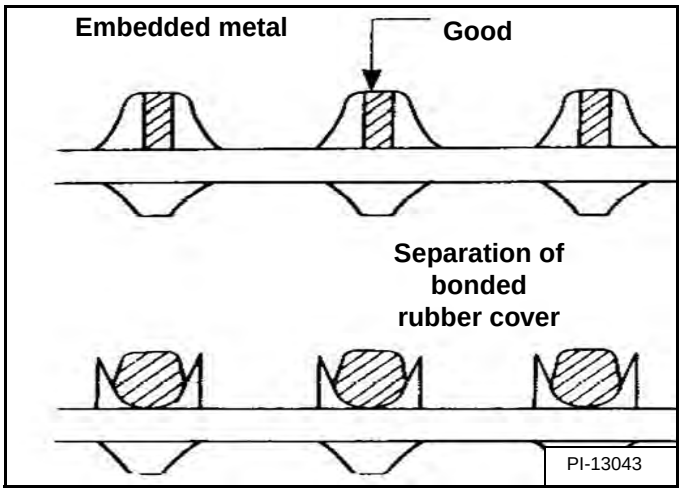
Due to corrosion of embedded metals, the adhesion to the rubber body deteriorates, resulting in complete separation **[Figure 30-30-10]**.

Replacement:

Even a partial separation of embedded metals requires a rubber track replacement.

Causes of the damage:

Figure 30-30-11



Embedded metals are bonded to the rubber body. The following operating conditions cause embedded metals to corrode, causing deterioration of the bonding, and finally resulting in separation of the embedded metals from the rubber body **[Figure 30-30-11]**:

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 the side of the track roller, causing exposure of the embedded metals. Consequently the embedded metals will corrode resulting in their separation from the rubber body.

Prevention:

If rubber tracks are used under such field conditions as described under (Causes of the damage). The tracks should be washed with plenty of water. After being completely dried, they should be stored correctly.

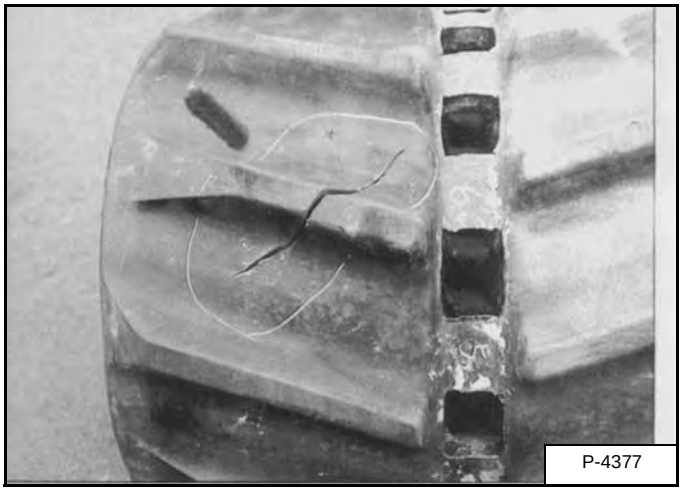
When the bonded rubber cover is separated from the embedded metal projections and the metals in the rubber body become loose, it is time to consider replacing the rubber track.

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Track Damage Identification (Cont'd)

Cuts On The Lug Side Rubber

Figure 30-30-12



Damage:

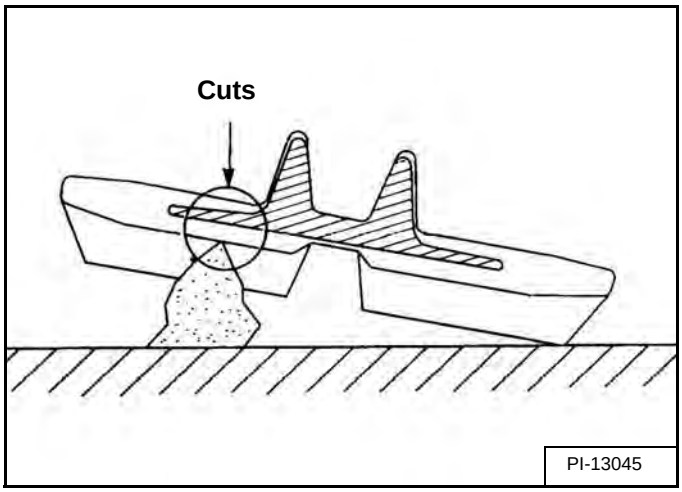
Cuts on the lug side rubber are one of the most occurring types of track damage **[Figure 30-30-12]**.

Replacement:

When a cut on the lug side rubber reaches the embedded steel cords, it should be immediately repaired with cold vulcanization rubber.

Causes of the damage:

Figure 30-30-13



When rubber tracks drive over projections or sharp stones in the fields, the concentrated forces applied cause cuts on the lug side rubber surface. In case of making turns on projections, the lug side rubber surface will have an even higher chance to be cut. If the cuts run through the embedded steel cords, it might result in the steel cords' breakage due to their corrosion. It is highly recommended to repair the cuts with cold vulcanization rubber as soon as they are observed **[Figure 30-30-13]**.

Prevention:

Machine operators are requested to drive with great attention to the ground's surface especially in terrains of the following type:

Construction sites

Demolition sites

Paths covered with rocks and wood

Concrete ridges

Stumpy fields.

When operating on terrains as mentioned above, high speed, quick turns and overloading should be avoided.

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Track Damage Identification (Cont'd)

Cracks On The Lug Side Rubber Due To Fatigue

Figure 30-30-14

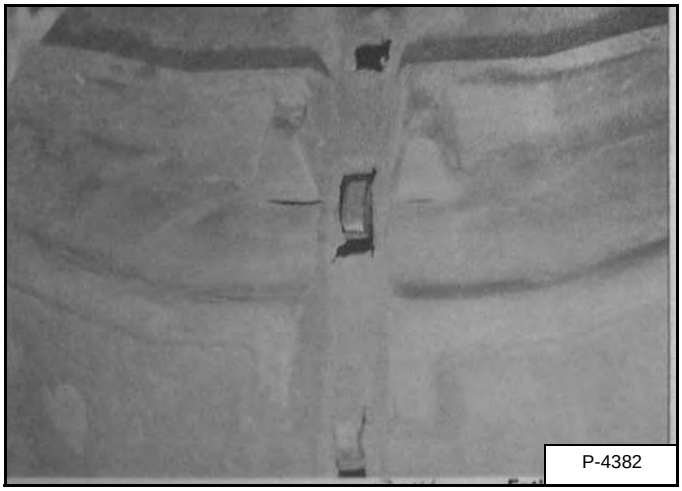
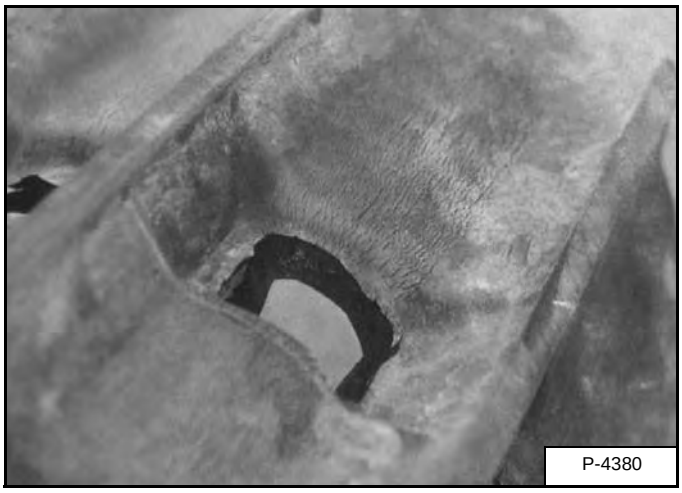


Figure 30-30-15



Damage:

Small cracks around the root of the lug caused by operation fatigue **[Figure 30-30-14]** and **[Figure 30-30-15]**.

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 causes cracks, especially on the lug side rubber surface. Once the cracks occur, they gradually deteriorate with even small external cracks. When operating near seashores or under cold temperatures, rubber tracks are more likely to suffer from ozone cracks.

Prevention:

Rubber tracks are designed with special rubber compounds to prevent cracks due to fatigue. External injuries on the lug side rubber sometimes cause more chance of cracking. Machine operators should observe soil conditions when driving, so as not to cause external injuries to the lug side rubber. In order to minimize the occurrence of ozone cracks, attention should be paid to the following instructions for maintenance:

Avoid exposing stored tracks to direct sun light.

Avoid exposing stored tracks to direct rain and snow fall.

Store tracks in well ventilated warehouses.

Use the tracks at least once a month.

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Track Damage Identification (Cont'd)

Lug Abrasion

Figure 30-30-16

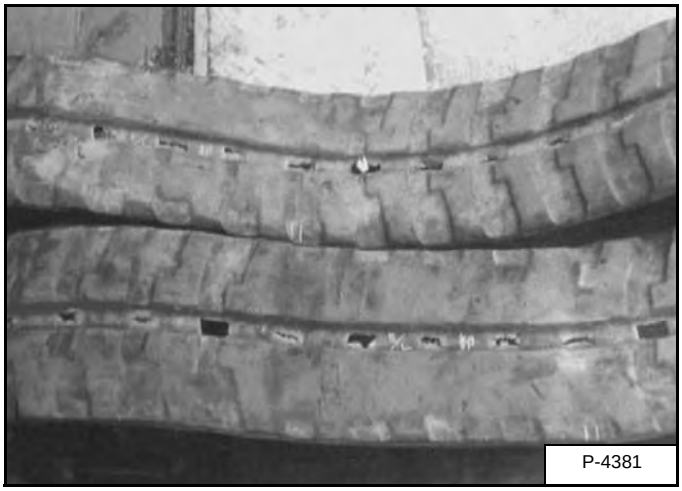
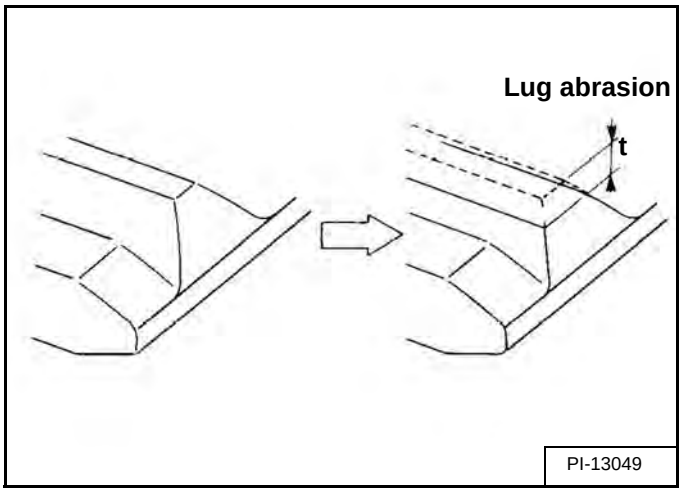


Figure 30-30-17



Damage:

As its service time proceeds, the lug side inevitably undergoes abrasion **[Figure 30-30-16]** and **[Figure 30-30-17]**.

Replacement:

No replacement is required.

Causes of the damage:

Lug abrasion is inevitable. Even if lug abrasion is proceeding, the rubber track can still be used. As the traction performance deteriorates accordingly, it is highly recommended to replace the abraded tracks with new ones when the lug height becomes less than 5 mm (0.197 in).

Prevention:

In order to prevent the rubber track from abnormal or premature abrasion, following operating conditions should be avoided:

Making quick and repeated turns on concrete and asphalt roads.

Driving up and down hilly paths with slippage.

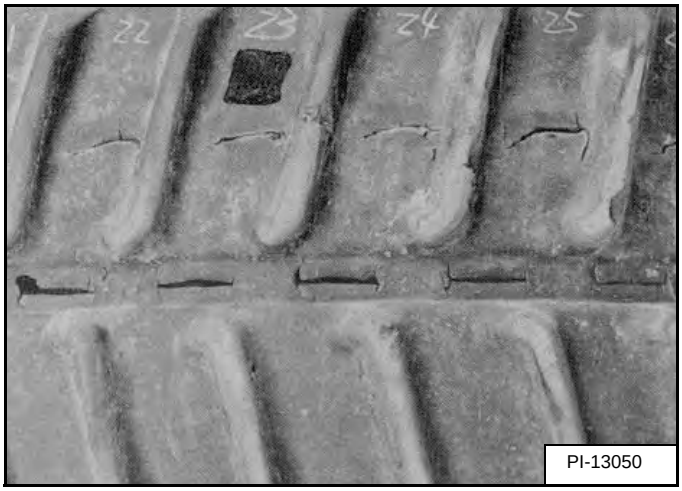
Making frequent turns on paths covered with rocks and wood.

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Track Damage Identification (Cont'd)

Cracks And Cuts On The Lug Side Rubber

Figure 30-30-18



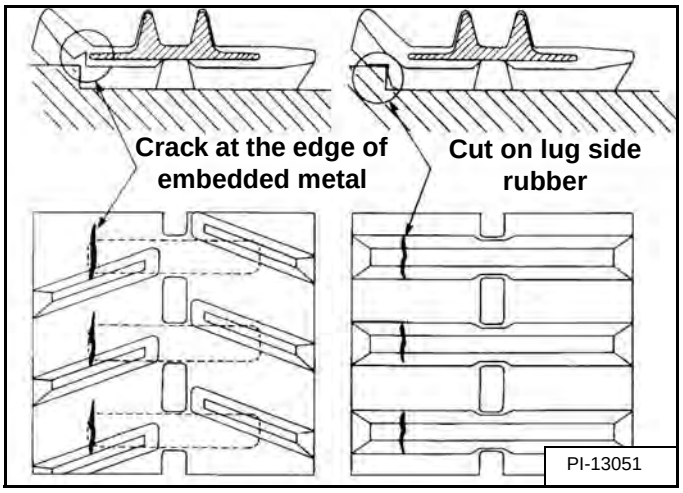
Damage:

Sometimes cracks and cuts on the lug side rubber at the edges of the embedded metals can be observed **[Figure 30-30-18]**.

Replacement:

No replacement is required unless the cuts on the lug side rubber are discovered all around the edges of the embedded metals, as this will result in a complete cut off.

Figure 30-30-19



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 30-30-19]**.

Prevention:

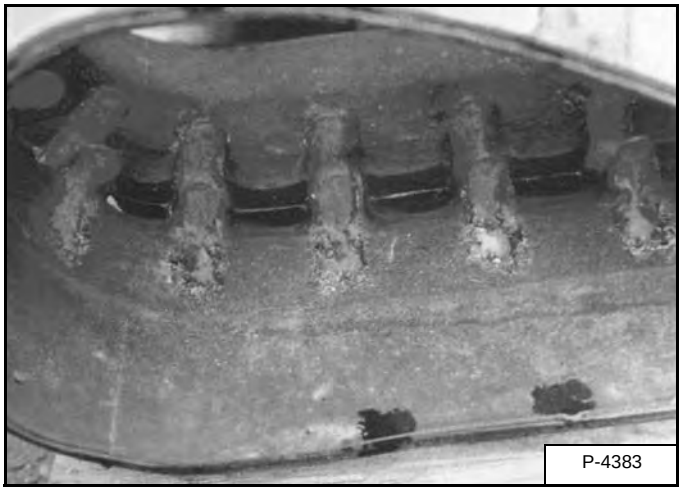
To avoid extensive stress applied to the lug root where metals are embedded, machine operators are requested to avoid driving over stumps and ridges.

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Track Damage Identification (Cont'd)

Abrasion Of The Track Roller Side

Figure 30-30-20



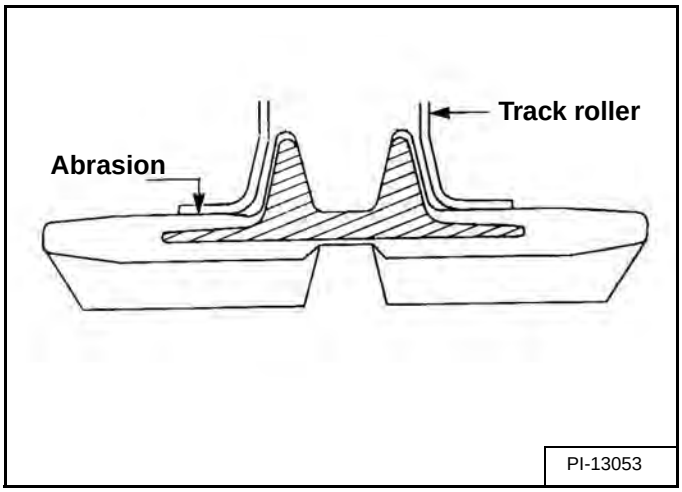
Damage:

The rubber surface on which track rollers run is gradually abraded. It will end in the exposure of the embedded metals **[Figure 30-30-20]**.

Replacement:

It is recommended to replace the rubber track when more than half of the embedded metals are completely exposed.

Figure 30-30-21



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 causing the abrasion **[Figure 30-30-21]**.

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 on the track rollers completely. When operating on gravel paths and stony grounds, machines should be driven slowly and the turning radius should be big enough to prevent stones and gravel from getting stuck to the track roller side rubber.

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Track Damage Identification (Cont'd)

Cuts On The Edges Of Track Roller Side

Figure 30-30-22

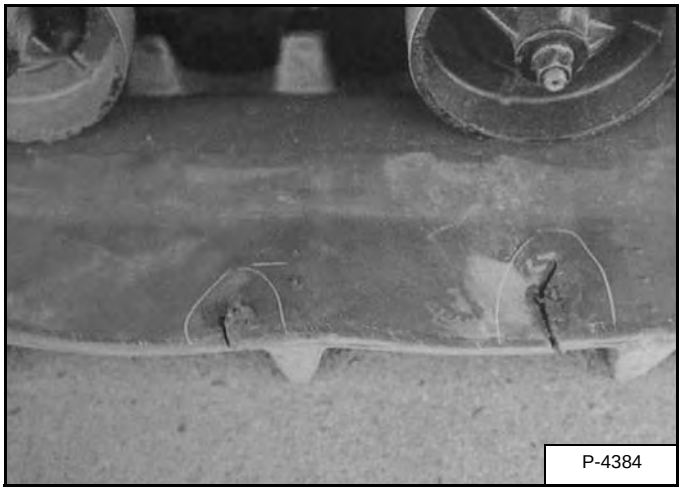
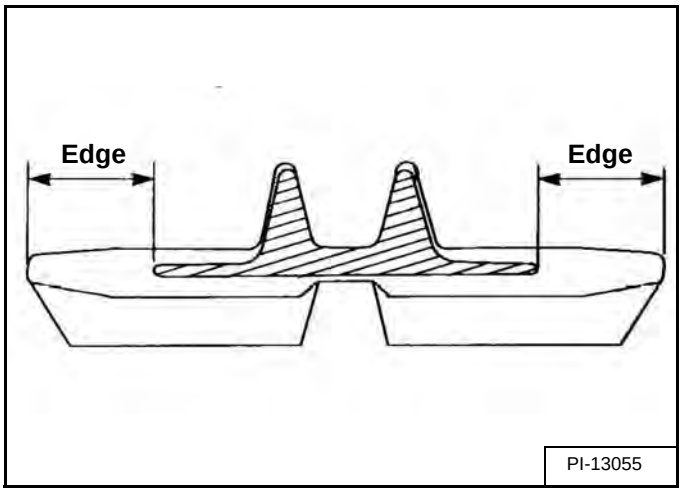


Figure 30-30-23



Damage:

Both edges of the rubber track have no special reinforcements. It sometimes occurs during operation that they are cut or torn off **[Figure 30-30-22]** and **[Figure 30-30-23]**.

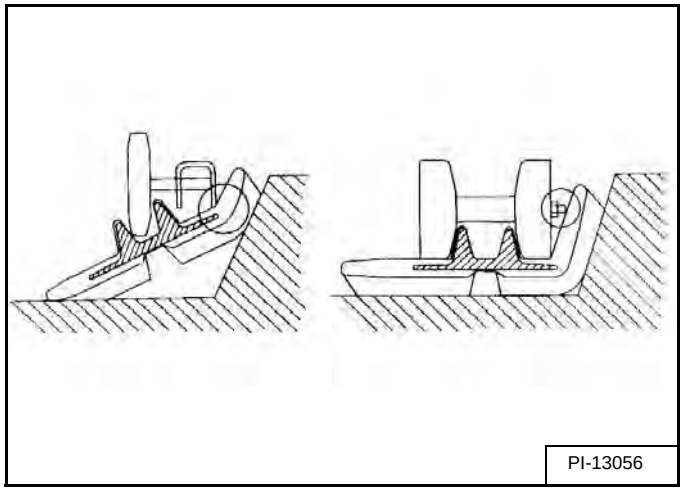
Replacement:

In such case, the rubber track does not have to be replaced.

Causes of the damage:

This damage is caused by objects on the field or by interference with the machine frame.

Figure 30-30-24



In case of damage by objects on the operating ground:

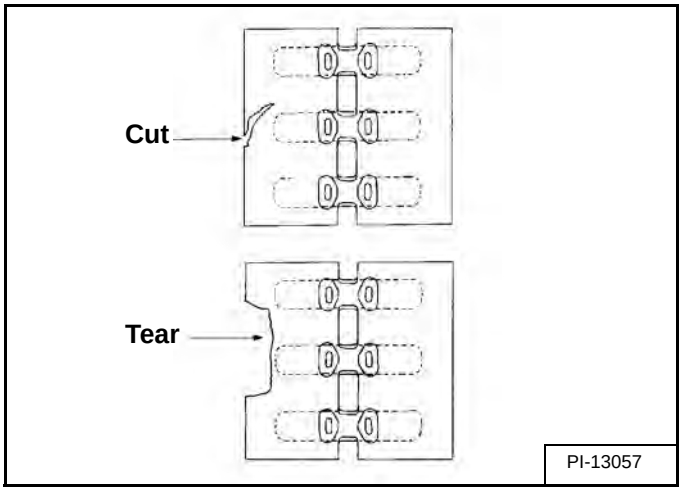
The edges of rubber track are often deformed, mainly due to a bumpy ground surface, stones and other objects, which cause extensive stress on the edges resulting in the damage. When a machine drives over concrete ridges, this type of damage easily occurs **[Figure 30-30-24]**.

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Track Damage Identification (Cont'd)

Cuts On The Edges Of Track Roller Side (Cont'd)

Figure 30-30-25



In case of damage by interference with the machine frame:

If a machine continues operating with rubber tracks being detracted, the rubber tracks may get caught up in the machine frame or undercarriage parts, resulting in damage. When a machine travels along side slopes, the rubber tracks are deformed so much that they come into contact with the machine frame and undercarriage parts, which causes cutting, gouging and rubbing of rubber tracks in the end **[Figure 30-30-25]**.

Prevention:

When traveling, a machine operator should be careful not to drive over any projections on the ground. He should also prevent rubber tracks from coming into contact with concrete walls, ditches and ridges. If rubber tracks are detracked, the machine should be stopped immediately for retracking.

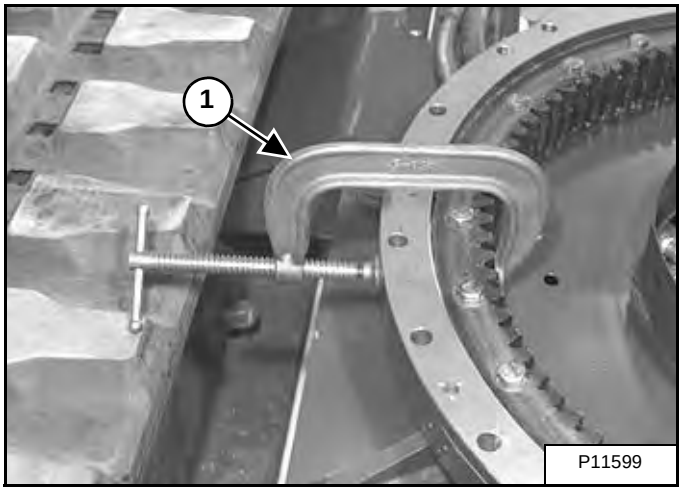
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SWING CIRCLE GEAR

Swing Bearing Removal

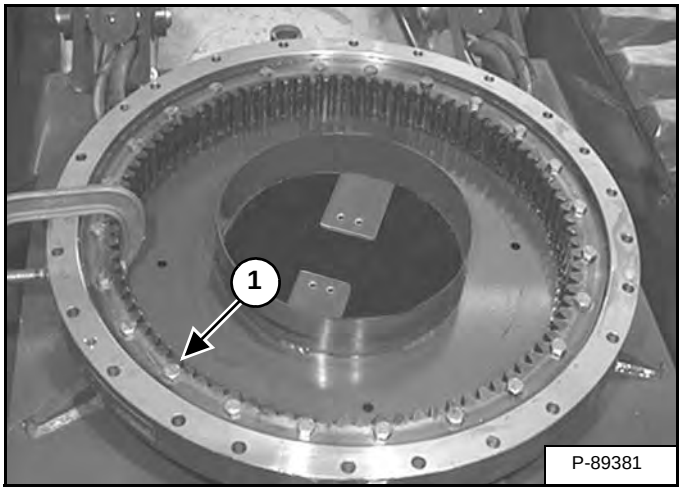
Remove the upperstructure. (See Removal on Page 40-10-1.)

Figure 30-40-1



Install a C-clamp (Item 1) **[Figure 30-40-1]** to prevent the swing bearing from turning while being removed.

Figure 30-40-2



Remove the twenty-four bolts and nuts that hold the swing bearing on the track frame (Item 1) **[Figure 30-40-2]**.

Remove the swing bearing.

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Swing Bearing Installation

Figure 30-40-3

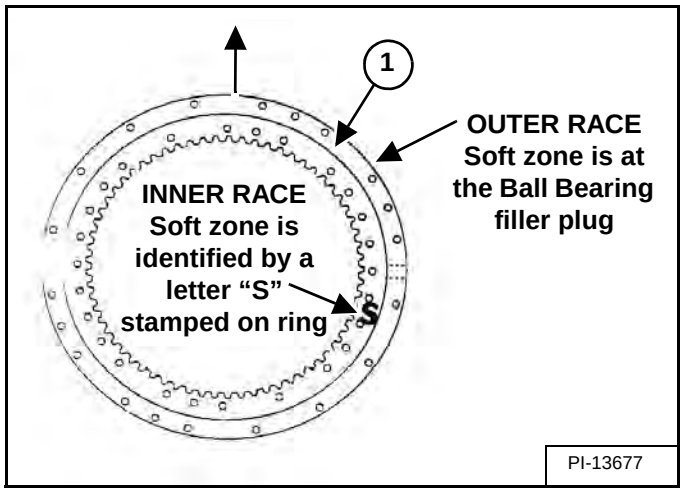
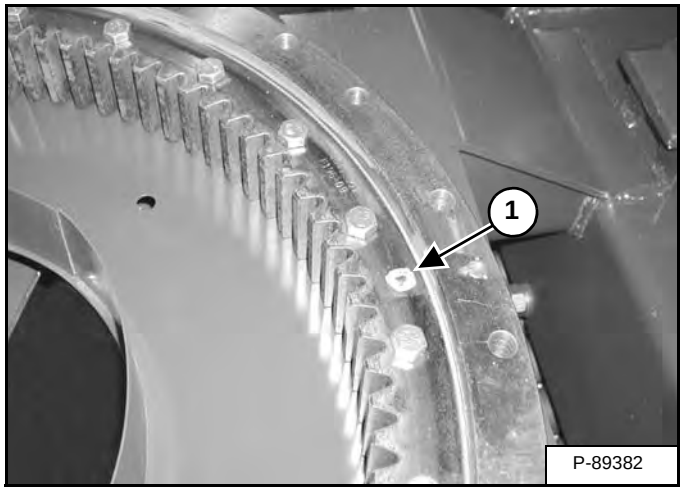


Figure 30-40-4

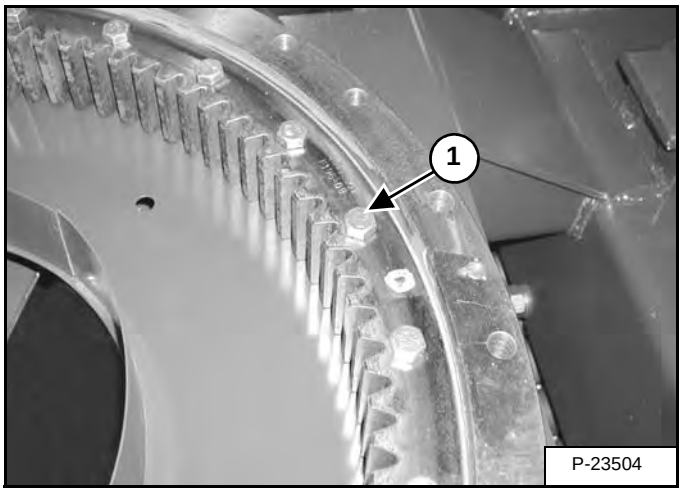


If reusing the existing swing bearing, use top, side and edge aligning marks to put the swing bearing in the correct location. If installing a new swing bearing find the soft zone area (Item 1) **[Figure 30-40-3]** and **[Figure 30-40-4]**.

Install the swing bearing so the inside soft zone (Item 1) **[Figure 30-40-3]** and **[Figure 30-40-4]** is at the right hand side of the excavator.

NOTE: Do not put the soft zone to the front or rear of the excavator.

Figure 30-40-5



Install the swing bearing bolts (Item 1) **[Figure 30-40-5]** and lock nuts.

Tighten the bolts to 392 N•m (289 ft-lb) torque.

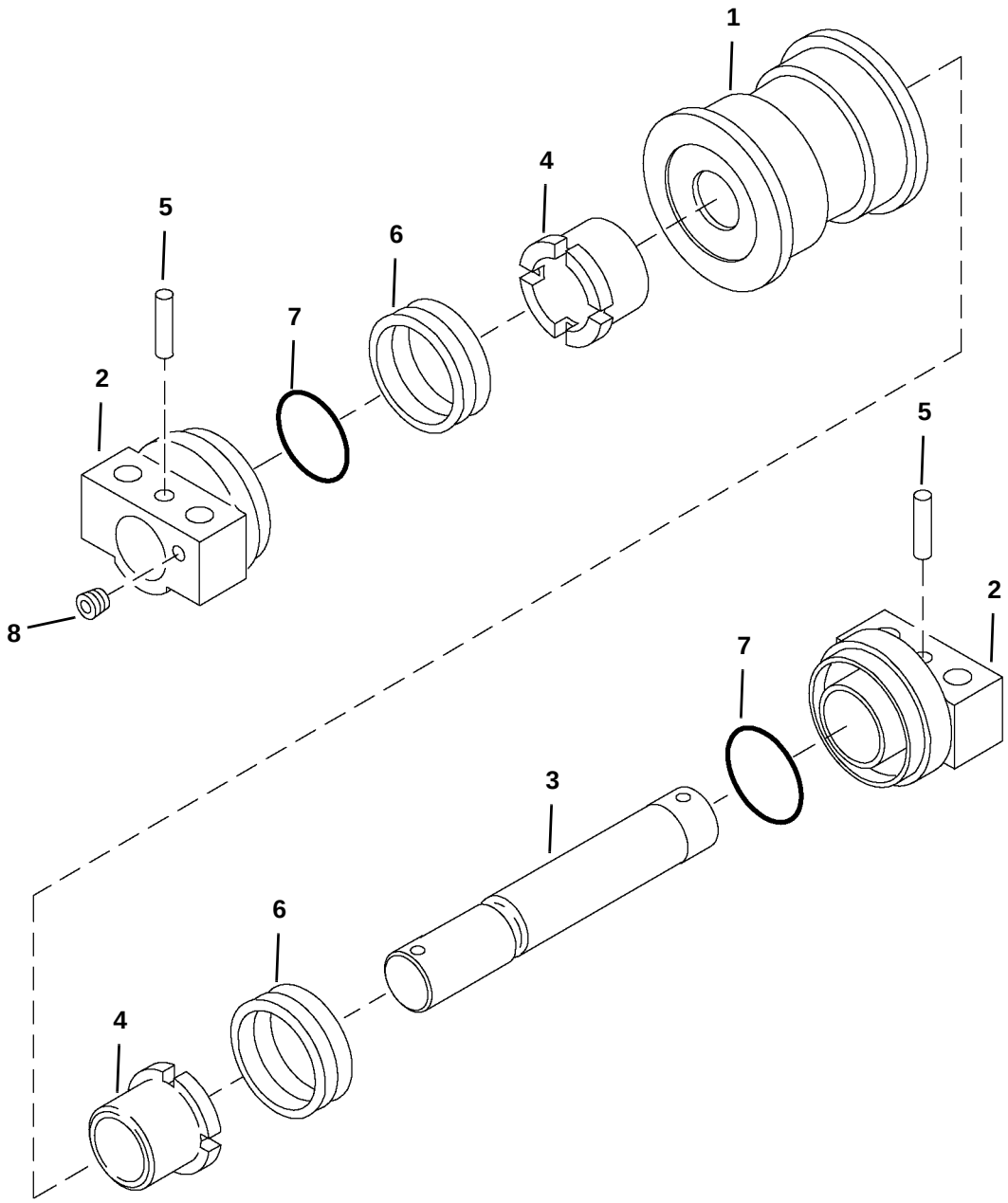
Put lubriplate grease or an equivalent on the swing bearing gear.

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LOWER TRACK ROLLER

Parts Identification

1. Roller
2. Collar
3. Shaft
4. Bushing
5. Pin
6. Seal
7. O-ring
8. Plug



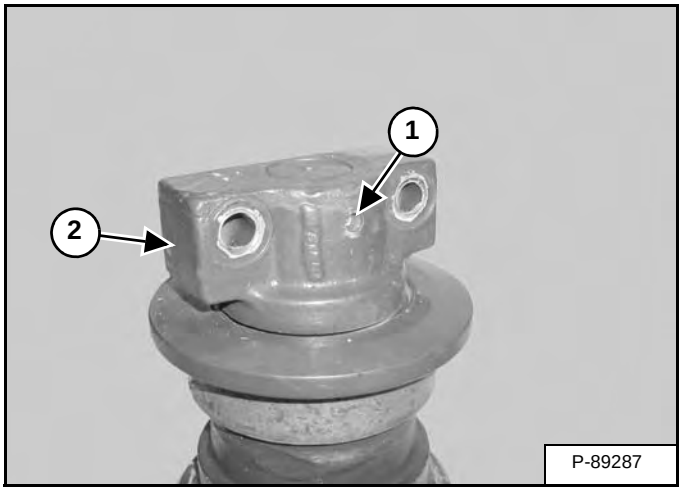
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Disassembly

NOTE: The procedure is shown on a steel track roller. The procedure is the same for the rubber track roller.

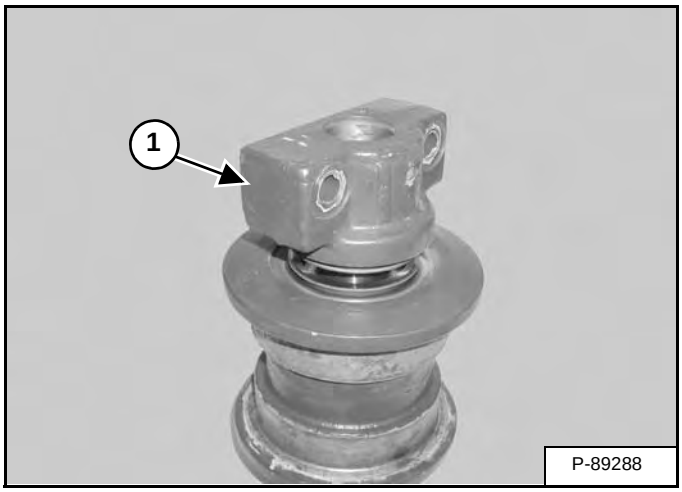
Figure 30-50-1



Drive the pin (Item 1) towards the top of the collar (Item 2) **[Figure 30-50-1]**.

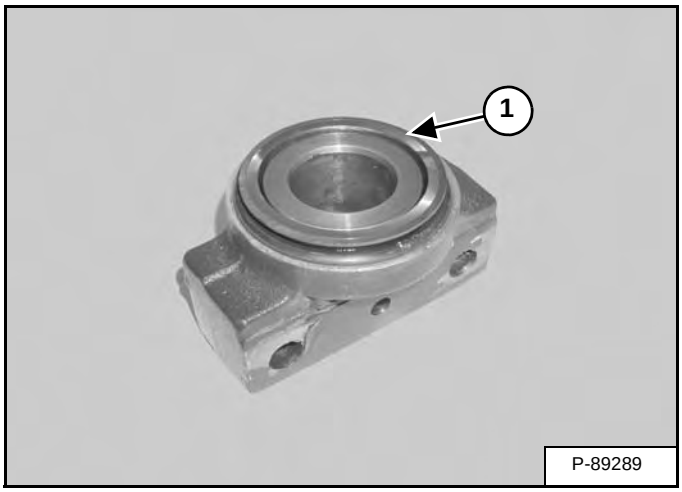
NOTE: The pin bore in the collar is stepped.

Figure 30-50-2



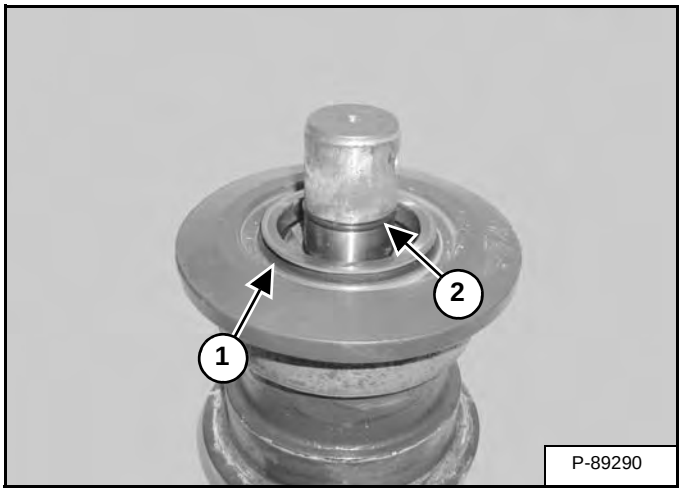
Remove the collar (Item 1) **[Figure 30-50-2]**.

Figure 30-50-3



Remove the seal assembly **[Figure 30-50-3]**.

Figure 30-50-4

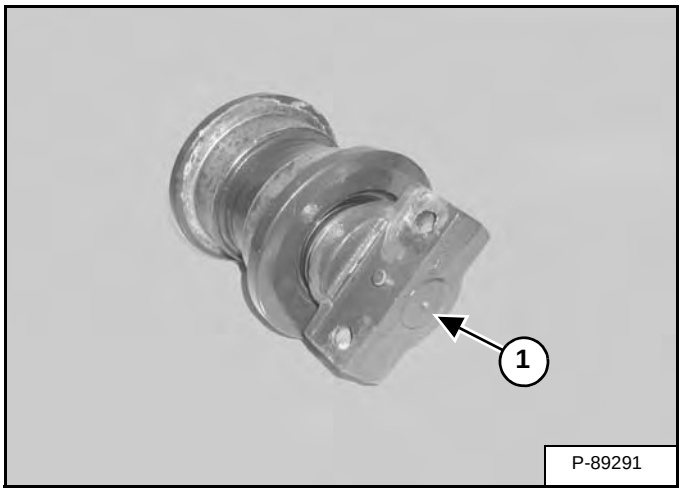


Remove the seal assembly (Item 1). Remove the O-ring (Item 2) **[Figure 30-50-4]**.

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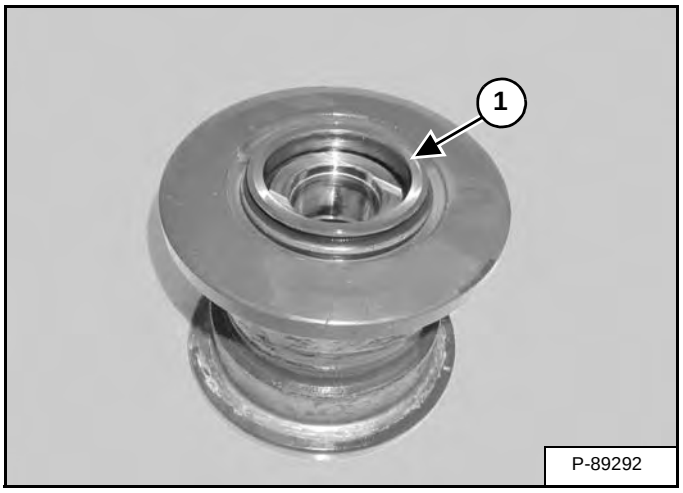
Disassembly (Cont'd)

Figure 30-50-5



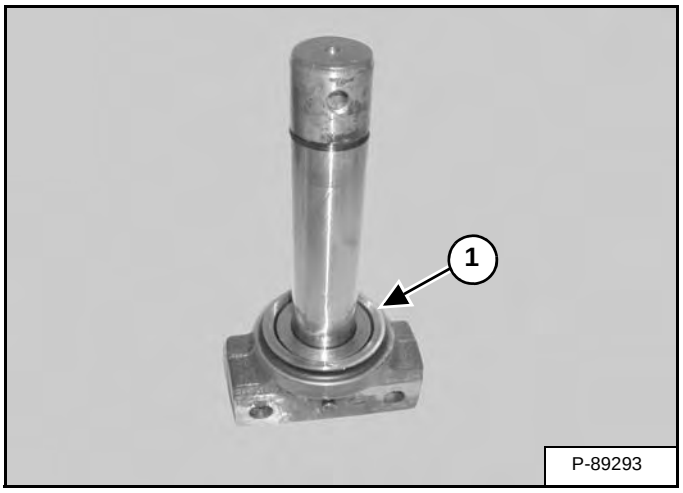
Remove the shaft assembly (Item 1) **[Figure 30-50-5]** from the roller.

Figure 30-50-6



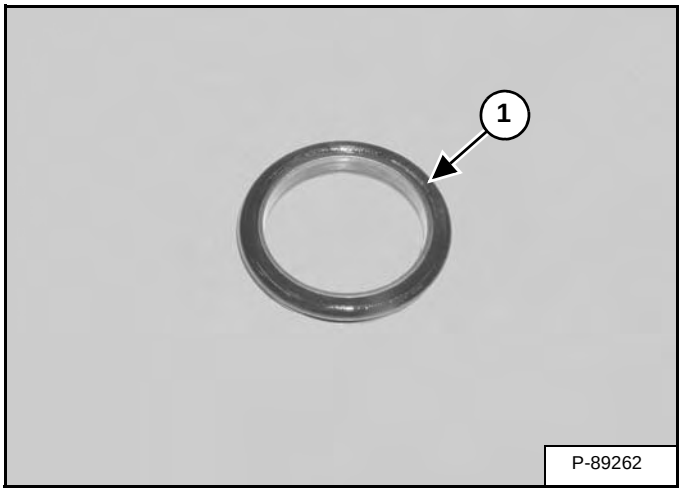
Remove the seal assembly (Item 1) **[Figure 30-50-6]** from the roller.

Figure 30-50-7



Remove the seal assembly (Item 1) **[Figure 30-50-7]** from the collar.

Figure 30-50-8

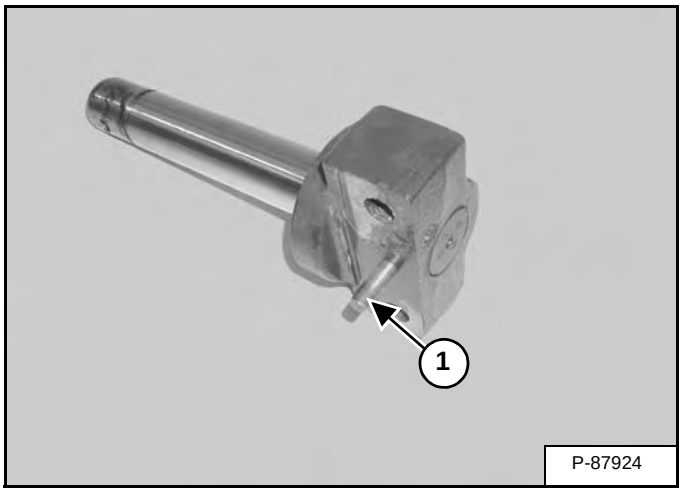


Remove the O-ring (Item 1) **[Figure 30-50-8]** from all four seal rings.

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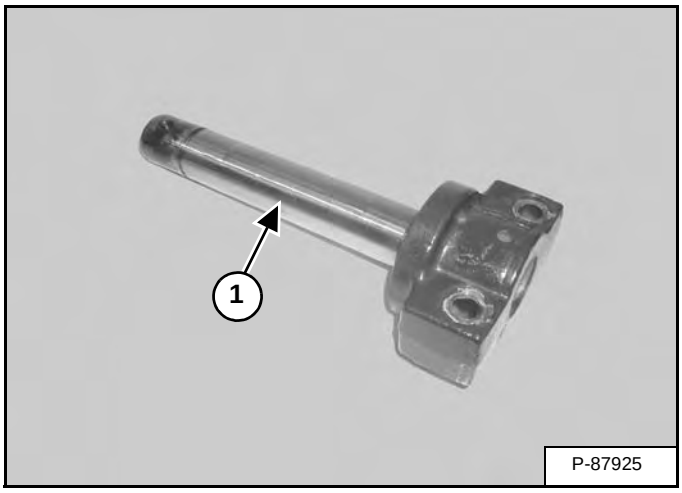
Disassembly (Cont'd)

Figure 30-50-9



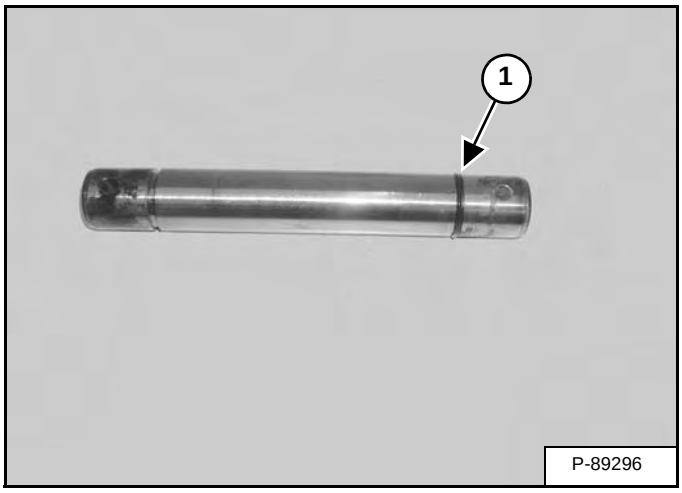
Remove the pin (Item 1) **[Figure 30-50-9]**.

Figure 30-50-10



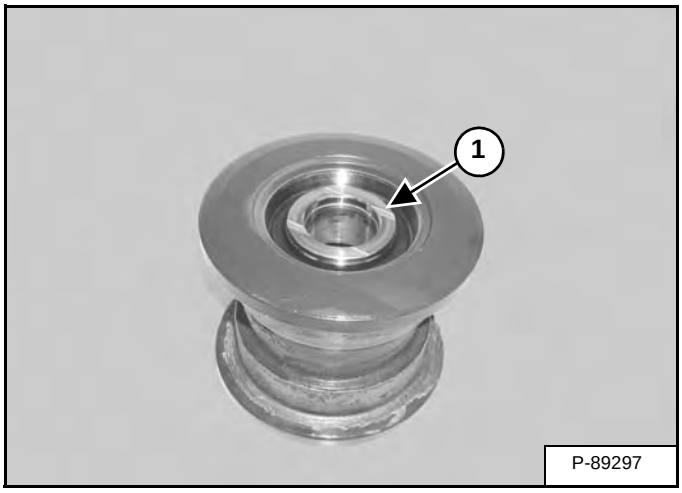
Remove the shaft (Item 1) **[Figure 30-50-10]**.

Figure 30-50-11



Remove the O-ring (Item 1) **[Figure 30-50-11]**.

Figure 30-50-12



Remove the bushing (Item 1) **[Figure 30-50-12]** from both sides of the roller.

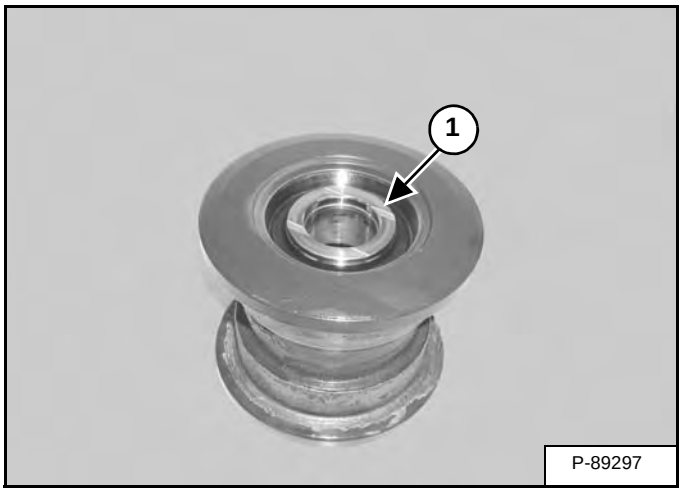
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Assembly

Clean all parts in solvent and dry them with compressed air.

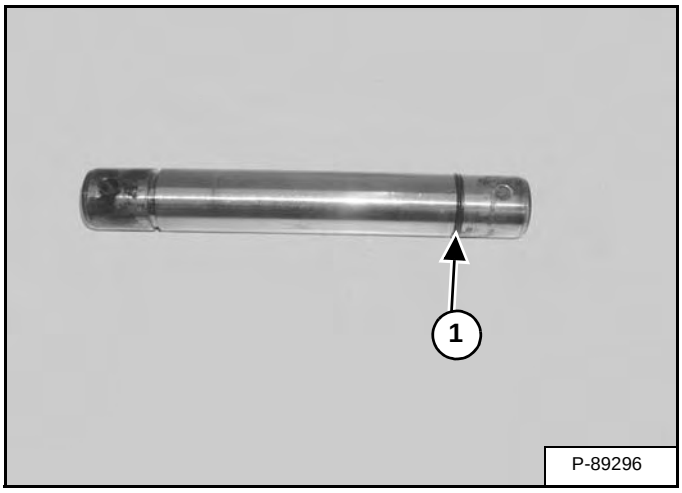
The seal assemblies are a matched set and must be replaced in pairs.

Figure 30-50-13



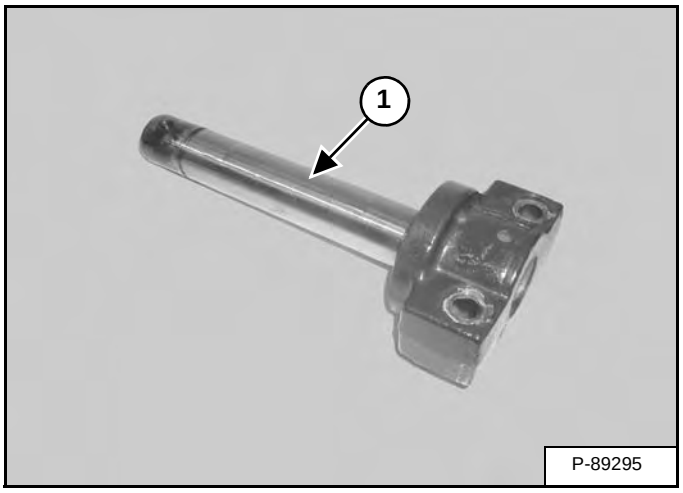
Install the bushing (Item 1) **[Figure 30-50-13]** on both sides of the roller.

Figure 30-50-14



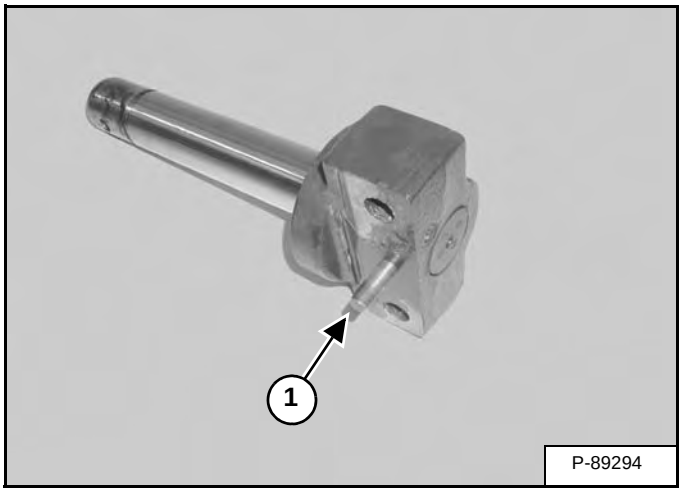
Install the O-ring (Item 1) **[Figure 30-50-14]** on the shaft.

Figure 30-50-15



Install the shaft (Item 1) **[Figure 30-50-15]** in the collar.

Figure 30-50-16

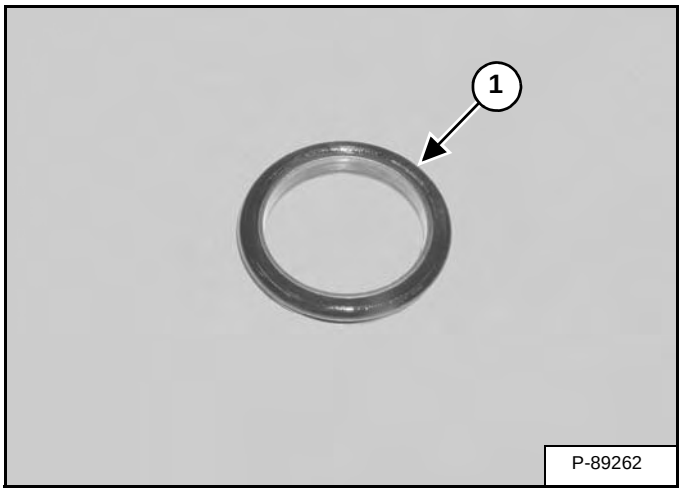


Install the pin (Item 1) **[Figure 30-50-16]** in the collar and through the shaft.

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Assembly (Cont'd)

Figure 30-50-17

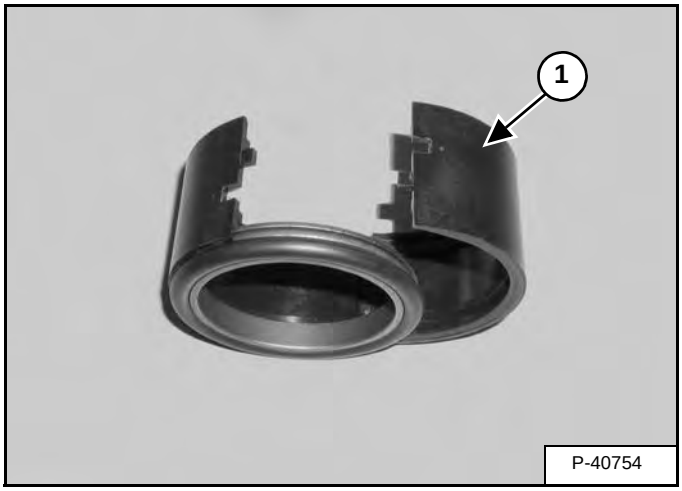


Install the O-ring (Item 1) **[Figure 30-50-17]** on the seal ring. Repeat this procedure on all four seal assemblies.

The O-ring and seal ring must be clean and free of any dust, oil film and foreign matter.

NOTE: Inspect the seal ring for burrs before installing the O-ring. Make sure that the O-ring is not twisted when installing it. To remove any twists, gently pull a section of the O-ring and let it snap back.

Figure 30-50-18

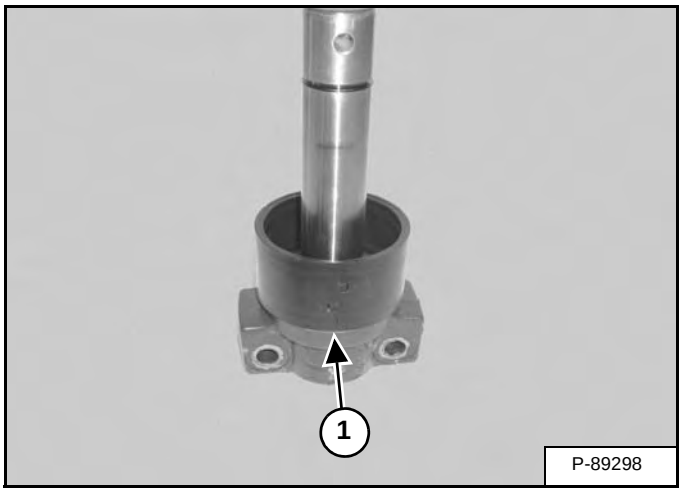


Place the seal assembly in the installation tool (Item 1) **[Figure 30-50-18]**.

The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the seal assembly in a pan of alcohol.

Figure 30-50-19

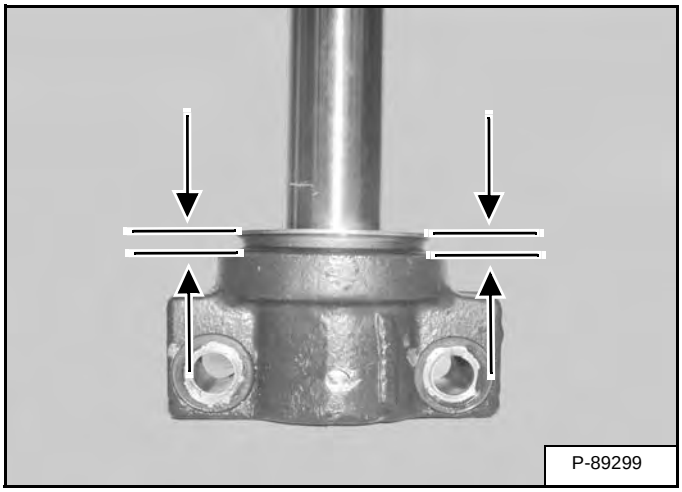


Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-50-19]** in the collar.

Use firm, even pressure on the installation tool to *pop* the O-ring in to the collar.

Remove the installation tool.

Figure 30-50-20

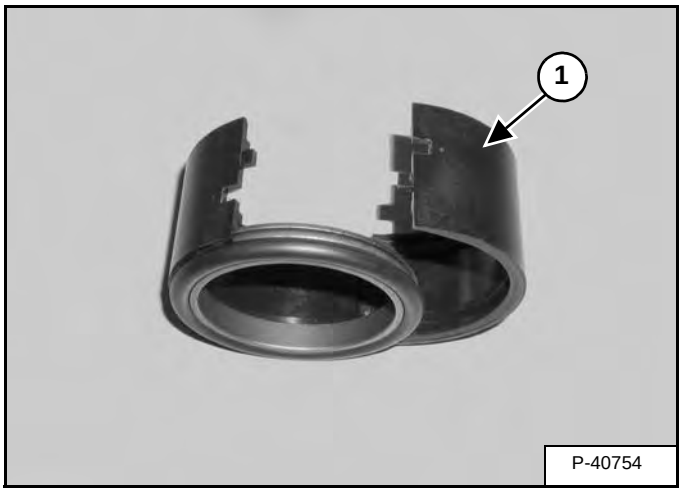


The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 30-50-20]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 30-50-21

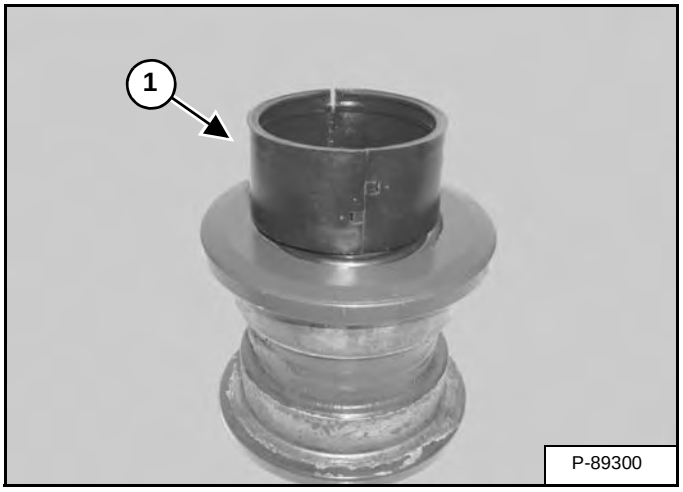


Place the seal assembly (Item 1) **[Figure 30-50-21]** in the installation tool.

The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the O-ring and seal assembly in a pan of alcohol.

Figure 30-50-22

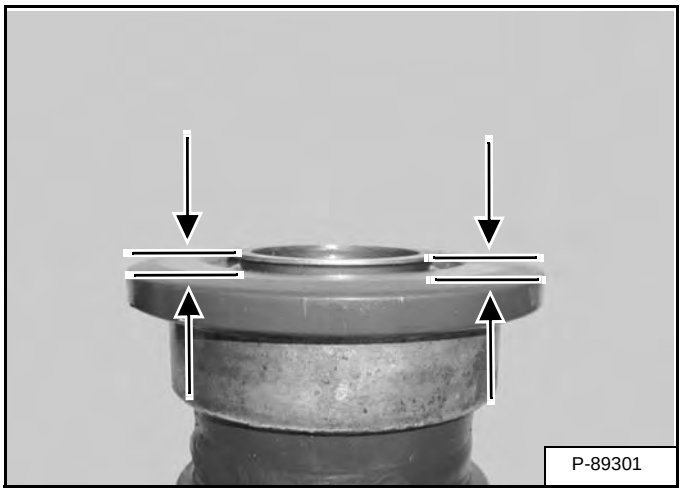


Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-50-22]** in the roller.

Use firm, even pressure on the installation tool to *pop* the O-ring in to the collar.

Remove the installation tool.

Figure 30-50-23

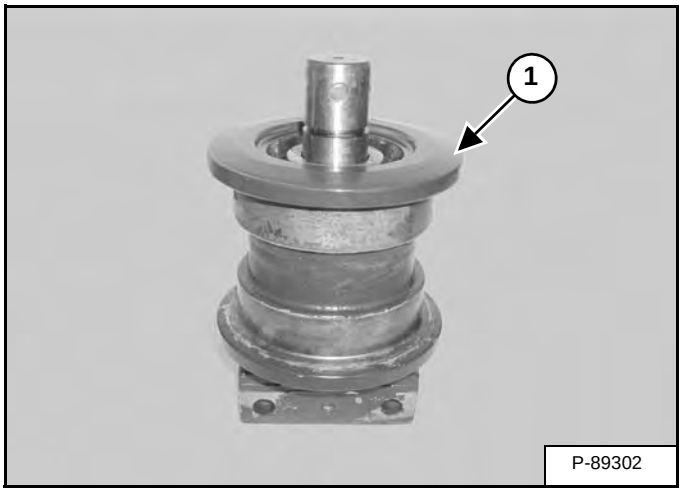


The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 30-50-23]**.

Apply a light film of oil to both metal seal rings.

NOTE: Do not get any oil on the rubber O-rings.

Figure 30-50-24

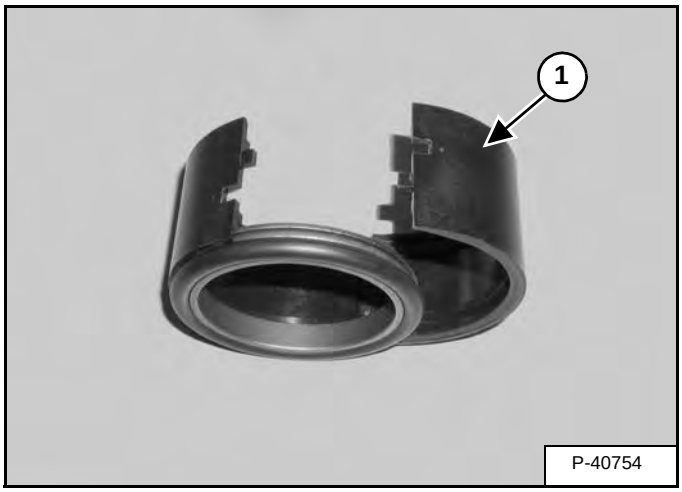


Install the roller (Item 1) **[Figure 30-50-24]** on the shaft.

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Assembly (Cont'd)

Figure 30-50-25

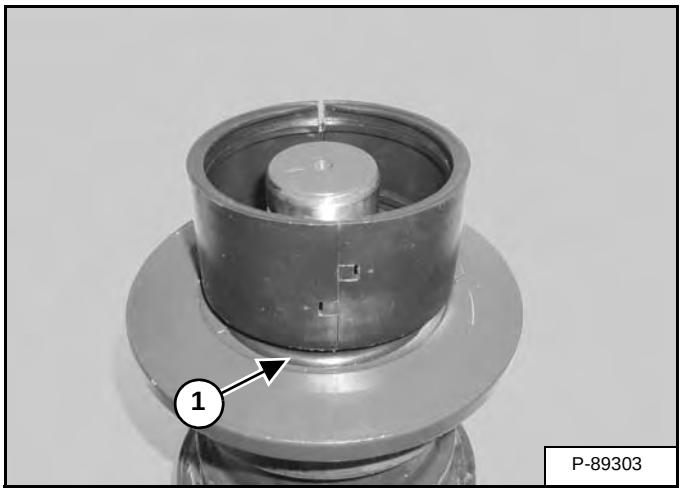


Place the seal assembly in the installation tool (Item 1) **[Figure 30-50-25]**.

The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the O-ring and seal ring assembly in a pan of alcohol.

Figure 30-50-26

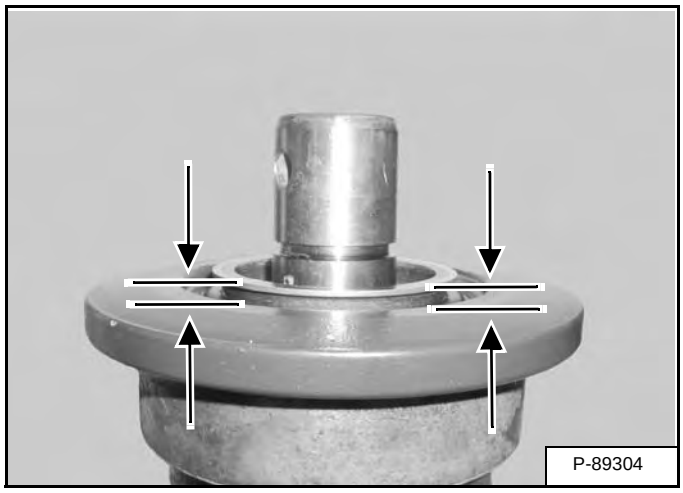


Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-50-26]** in the roller.

Use firm, even pressure on the installation tool to *pop* the O-ring in to the collar.

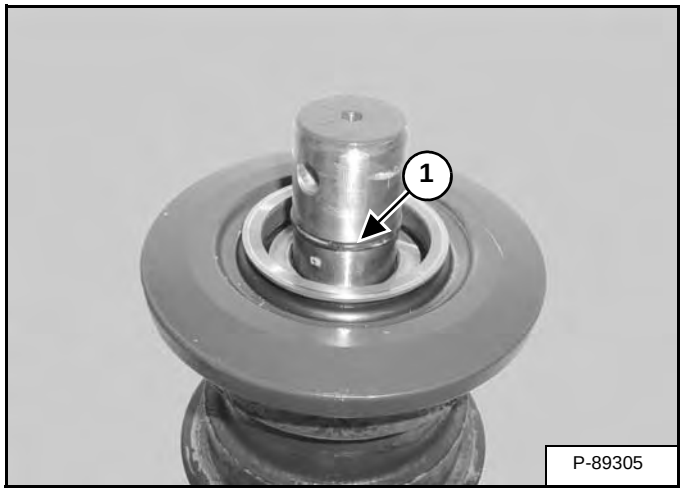
Remove the installation tool.

Figure 30-50-27



The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 30-50-27]**.

Figure 30-50-28

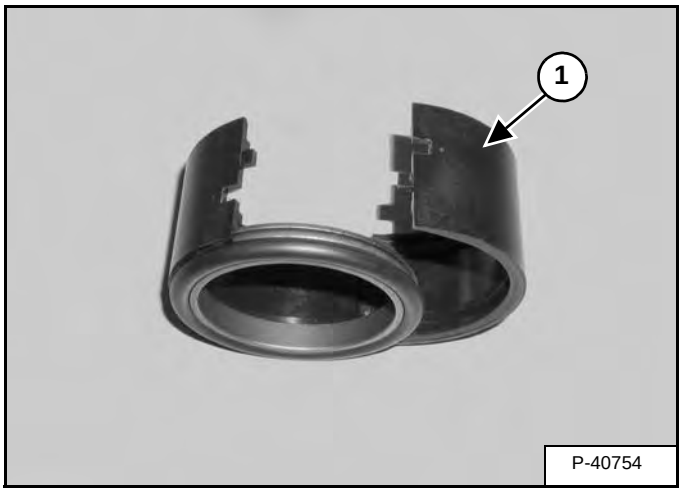


Install the O-ring (Item 1) **[Figure 30-50-28]**.

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Assembly (Cont'd)

Figure 30-50-29

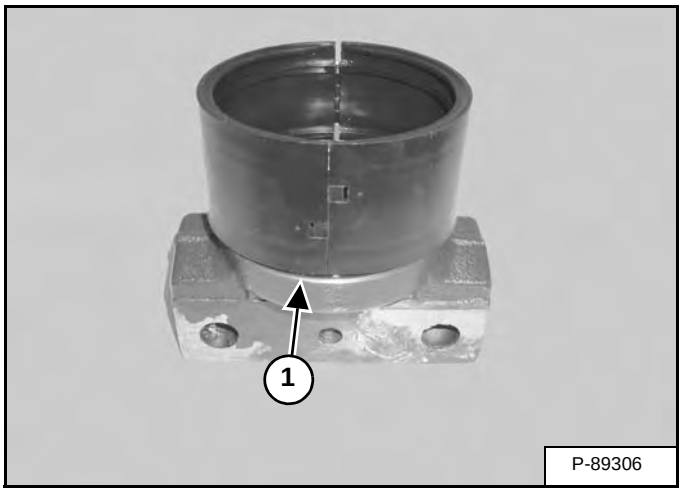


Place the seal assembly in the installation tool (Item 1) **[Figure 30-50-29]**.

The O-ring and seal ring assembly have to be lubricated with alcohol, so that the O-ring will slip past the housing retaining ring and seal uniformly in the housing radius.

Dip the O-ring and seal ring assembly in a pan of alcohol.

Figure 30-50-30

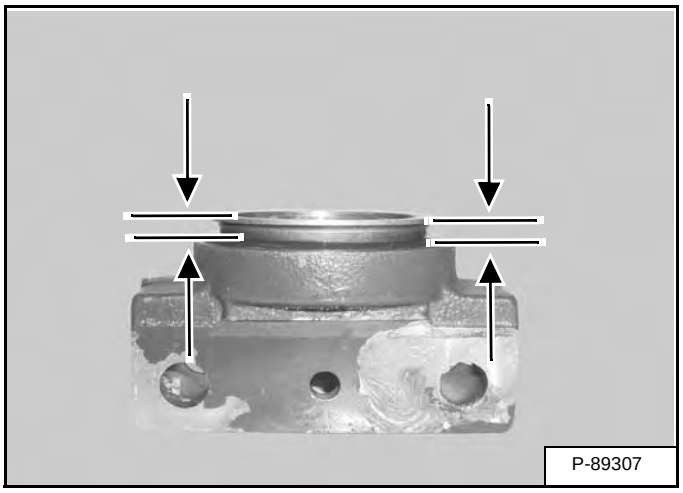


Shake off the excess alcohol and install the seal assembly (Item 1) **[Figure 30-50-30]** in the roller.

Use firm, even pressure on the installation tool to *pop* the O-ring in to the collar.

Remove the installation tool.

Figure 30-50-31

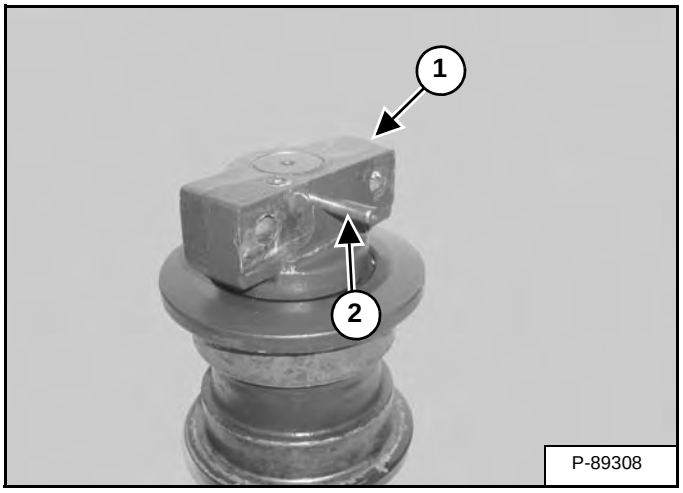


The seal assembly stand off height must be equal and the O-ring must not be twisted **[Figure 30-50-31]**.

Apply a light film of oil to both metal seal rings.

NOTE: Do not get any oil on the rubber O-rings.

Figure 30-50-32

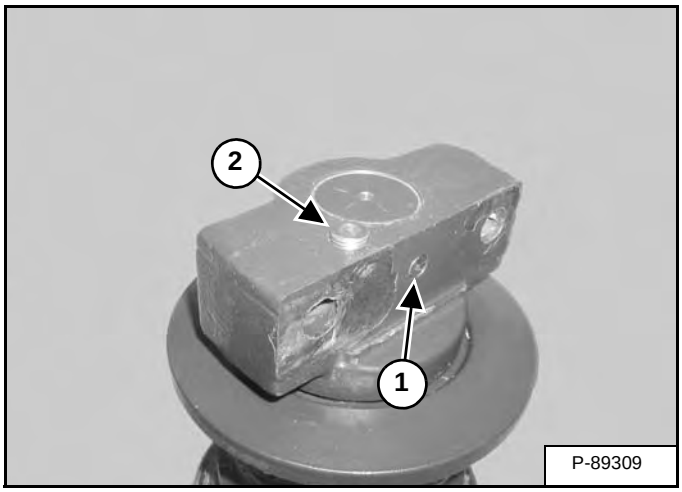


Install the collar (Item 1) on the shaft. Install the pin (Item 2) **[Figure 30-50-32]** in the collar.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 30-50-33



Push down on the collar until the pin bore of the collar is aligned with the pin bore of the shaft. Fully seat the pin (Item 1) **[Figure 30-50-33]**.

Remove the plug (Item 2) **[Figure 30-50-33]**. Add 120 - 160 cc (4.1 - 5.4 oz.) of 30W oil to the roller.

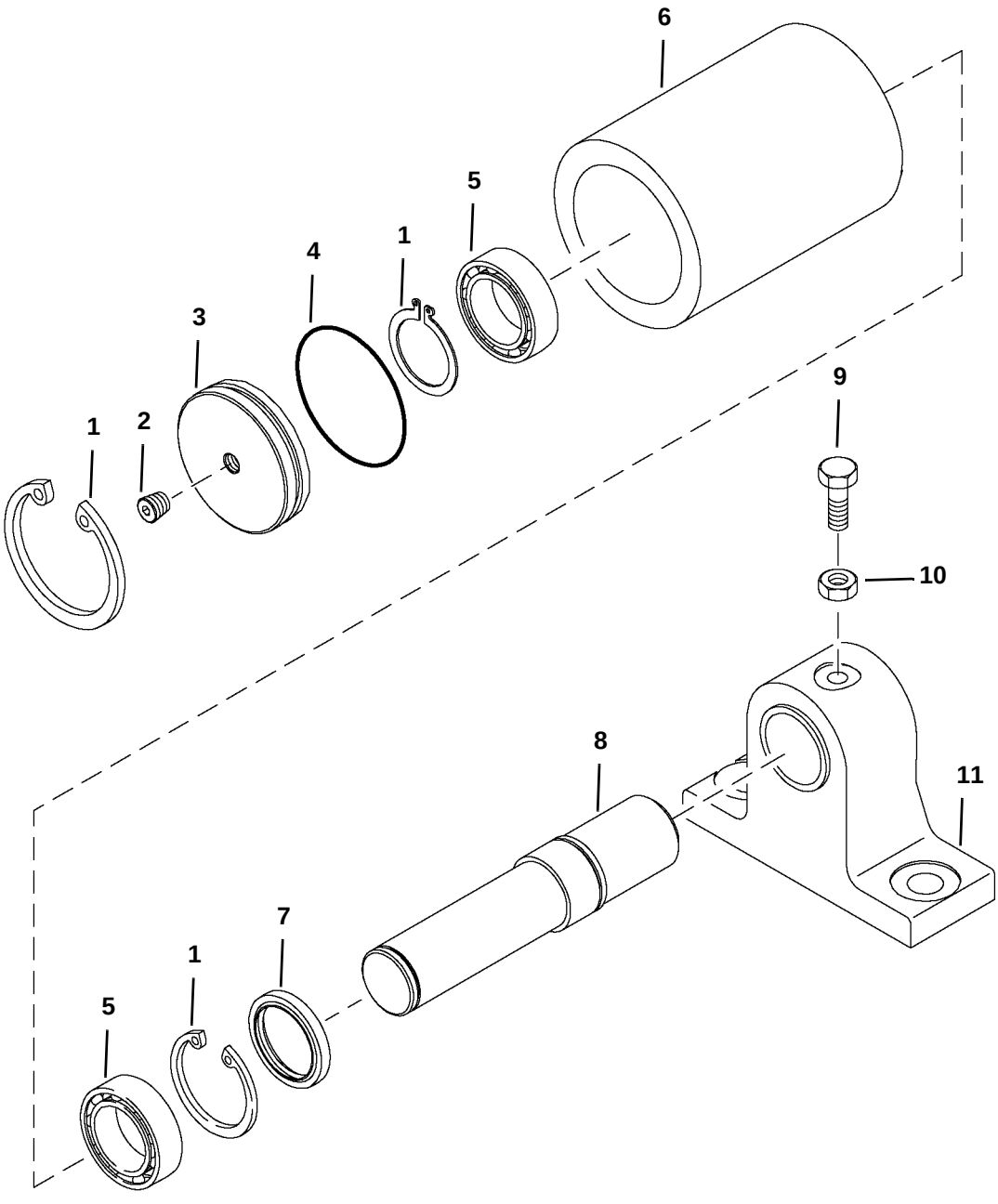
Install the plug.

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UPPER TRACK ROLLER

Parts Identification

1. Snap Ring
2. Pipe Plug
3. Cover
4. O-ring
5. Bearing
6. Roller
7. Seal
8. Shaft
9. Bolt
10. Nut
11. Mount

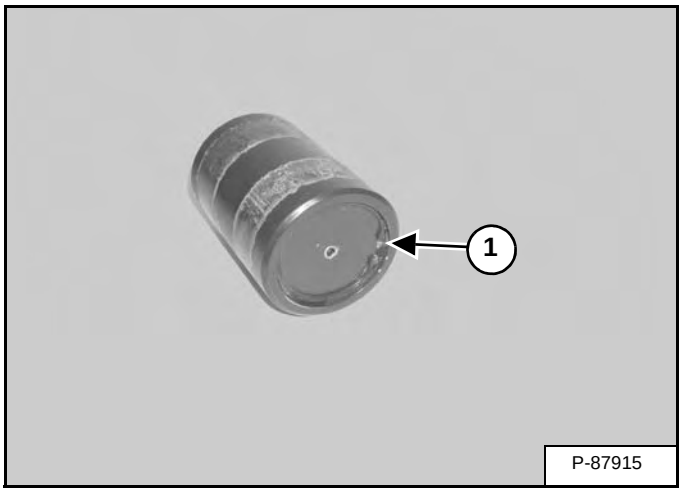


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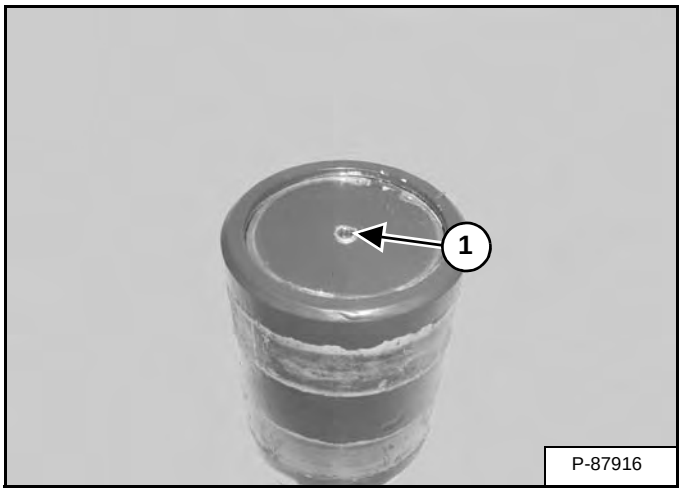
Disassembly And Assembly

Figure 30-60-1



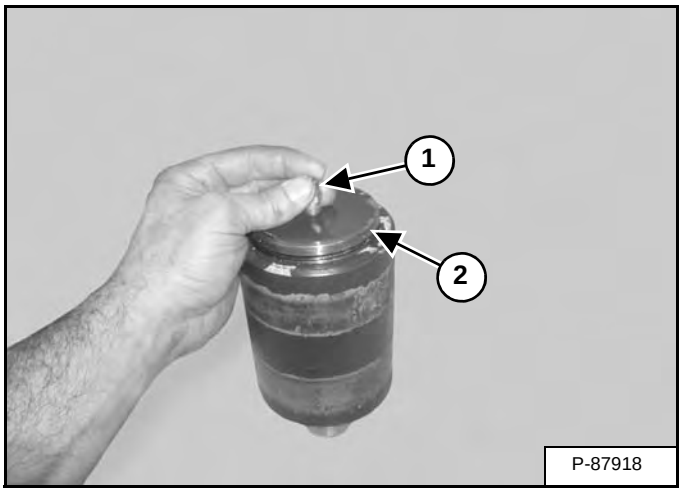
Remove the snap ring (Item 1) **[Figure 30-60-1]**.

Figure 30-60-2



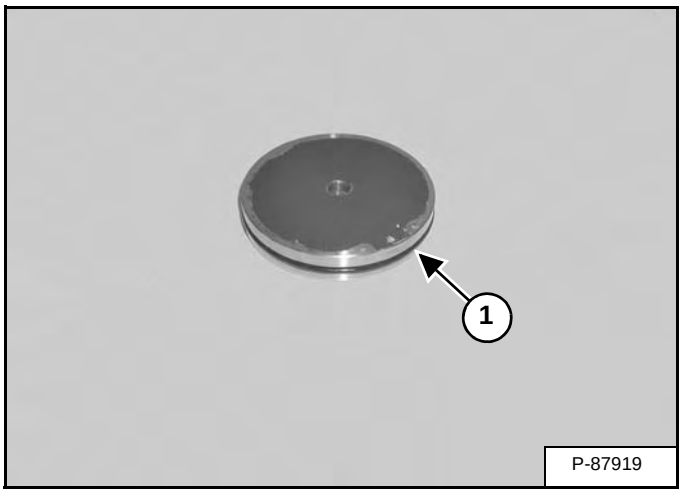
Remove the pipe plug (Item 1) **[Figure 30-60-2]**.

Figure 30-60-3



Install a 50,8 mm (2.0 in) long 3,175 mm (1/8 in) NPT pipe (Item 1) into the cover. Pull up on the pipe to remove the cover (Item 2) **[Figure 30-60-3]**.

Figure 30-60-4

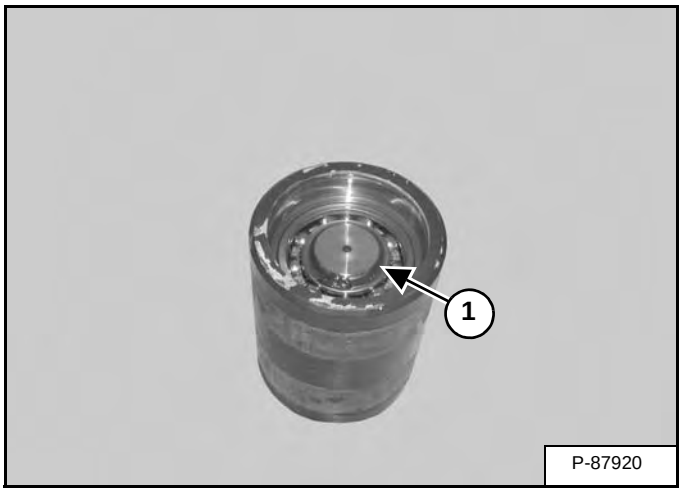


Remove the O-ring (Item 1) **[Figure 30-60-4]**.

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Disassembly And Assembly (Cont'd)

Figure 30-60-5

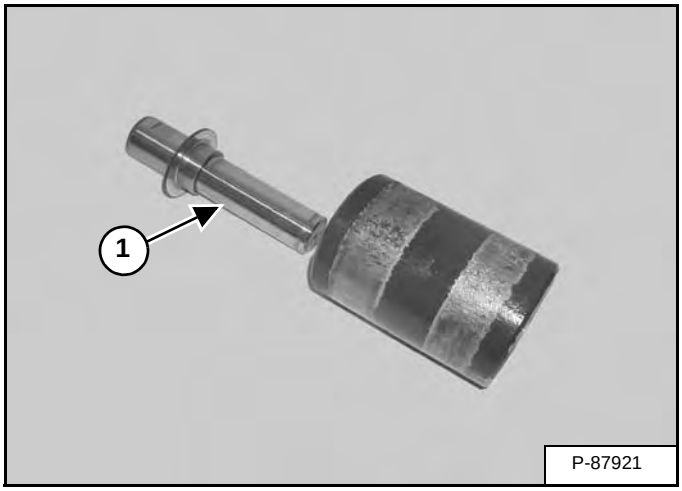


Remove the snap ring (Item 1) **[Figure 30-60-5]**.

Turn the roller over and drain the oil.

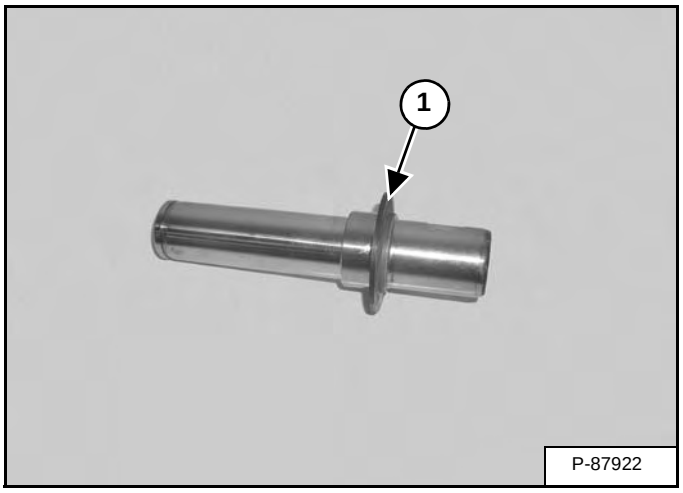
Assembly: Add 130 - 170 cc (4.5 - 5.7 oz) of 30W oil to the roller before installing the cover.

Figure 30-60-6



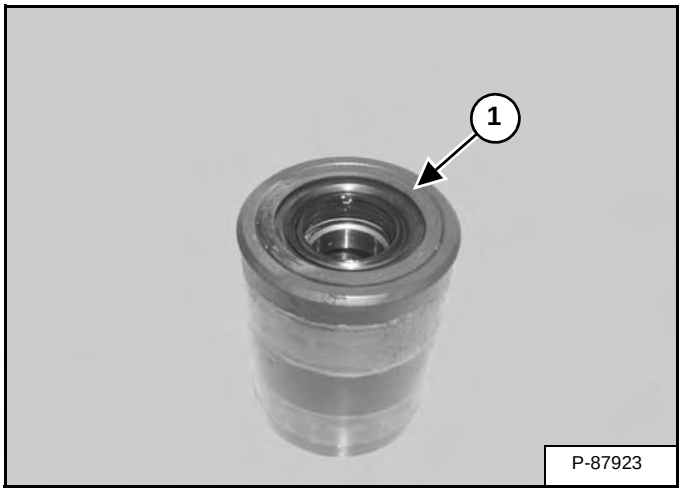
Remove the shaft (Item 1) **[Figure 30-60-6]** from the roller.

Figure 30-60-7



Remove the seal (Item 1) **[Figure 30-60-7]** from the shaft.

Figure 30-60-8

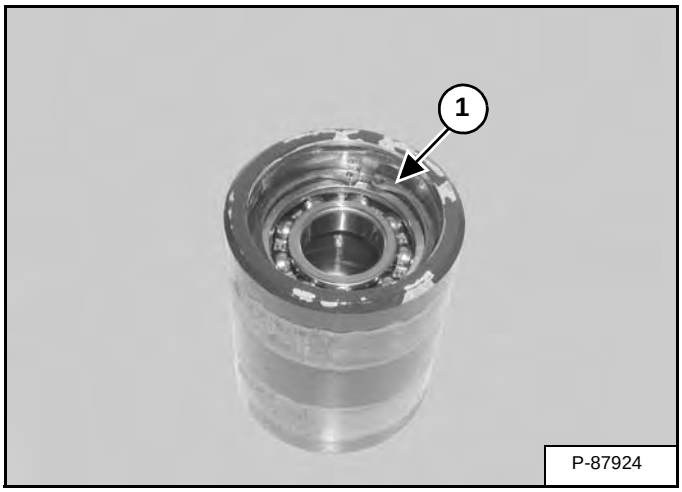


Remove the seal (Item 1) **[Figure 30-60-8]** from the roller.

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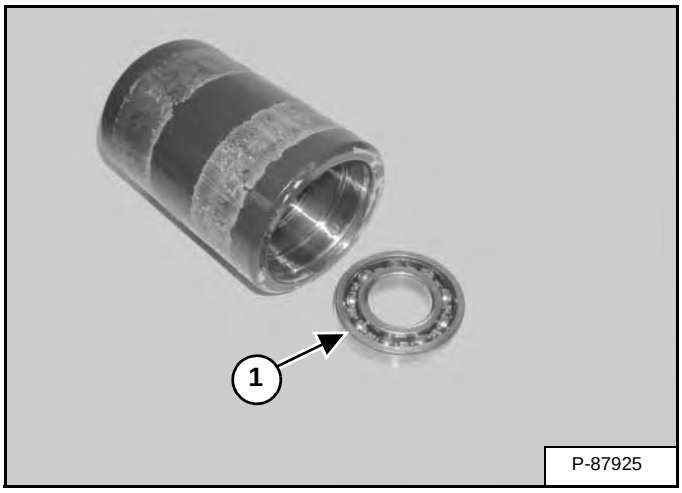
Disassembly And Assembly (Cont'd)

Figure 30-60-9



Remove the snap ring (Item 1) **[Figure 30-60-9]**.

Figure 30-60-10



Remove the bearings (Item 1) **[Figure 30-60-10]** from both ends of the roller.

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UPPERSTRUCTURE AND SWING SECTION

UPPERSTRUCTURE 40-10-1
Removal 40-10-1
Installation 40-10-3

UPPERSTRUCTURE SIDE COVER (LEFT) 40-20-1
Removal And Installation 40-20-1

UPPERSTRUCTURE SIDE COVER (RIGHT) 40-21-1
Removal And Installation 40-21-1

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Removal And Installation 40-30-1
Door Removal And Installation 40-30-11
Front Window Removal And Installation 40-30-12
Lower Front Window Removal And Installation 40-30-13
Glass Installation 40-30-14
Front Window Strut Removal And Installation 40-30-19
Front Window Slide Bar Removal And Installation 40-30-20
Cab Tilt Assembly Removal And Installation 40-30-21
Cab Tilt Parts Identification 40-30-22
Cab Tilt Assembly Disassembly And Assembly 40-30-23
Headliner Removal And Installation 40-30-24

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RIGHT CONSOLE 40-50-1
Console Cover Removal And Installation 40-50-1

LEFT CONSOLE 40-60-1
Lower Console Cover Removal And Installation 40-60-1
Upper Console Cover Removal And Installation 40-60-2
Gas Strut Removal And Installation 40-60-3
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Lock Lever Disassembly And Assembly 40-60-5
Console Removal And Installation 40-60-6

CENTER COVER 40-70-1
Removal And Installation 40-70-1

CENTER ACCESS COVER 40-80-1
Removal And Installation 40-80-1

COUNTERWEIGHT 40-90-1
Removal And Installation 40-90-1

Dealer Copy -- Not for Resale

FLOOR MAT 40-100-1
Removal And Installation 40-100-1

FUEL TANK 40-110-1
Removal And Installation 40-110-1

HORN 40-120-1
Removal And Installation 40-120-1

SWING FRAME 40-130-1
Removal And Installation 40-130-1
Bushing Removal 40-130-5
Bushing Installation 40-130-6

BOOM 40-140-1
Removal And Installation 40-140-1
Bushing Removal And Installation 40-140-2

BOOM (ARTICULATED) (OPTIONAL) 40-141-1
Removal And Installation 40-141-1

ARM 40-150-1
Removal And Installation 40-150-1
Arm To Boom Bushing Removal And Installation 40-150-2
Bucket And Link Bushing Removal And Installation 40-150-3

QUICK COUPLER (KLAC™ SYSTEM) 40-160-1
Troubleshooting 40-160-1
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Disassembly And Assembly (MS03) 40-161-5
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BUCKET 40-170-1
Bucket Teeth Removal And Installation 40-170-1
Bucket Side Cutting Edge Removal And Installation 40-170-2

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RIGHT SIDE COVER 40-180-1
Removal And Installation 40-180-1
Latch Adjustment 40-180-2

REAR COVER 40-190-1
Removal And Installation 40-190-1

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UPPERSTRUCTURE

Removal

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-140-6.)

Drain the fuel tank. (See Draining The Fuel Tank on Page 10-120-5.)

Remove the swing motor drive carrier. (See Removal And Installation on Page 20-91-1.)

Remove the swivel joint. (See Removal And Installation on Page 20-80-1.)

Remove the boom. (See Removal And Installation on Page 40-110-1.)

Remove the cab. (See Removal And Installation on Page 40-30-1.)

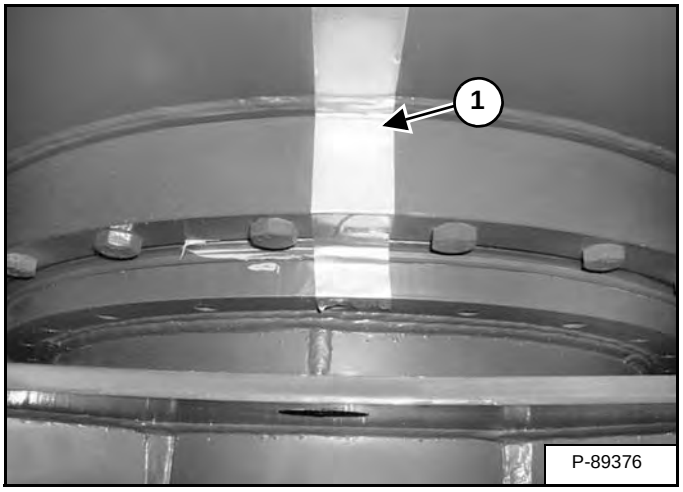
Remove the engine. (See Engine Removal And Installation on Page 60-10-11.)

Remove the counterweight. (See Removal And Installation on Page 40-90-1.)

Remove the hydraulic reservoir. (See Removal And Installation on Page 20-140-1.)

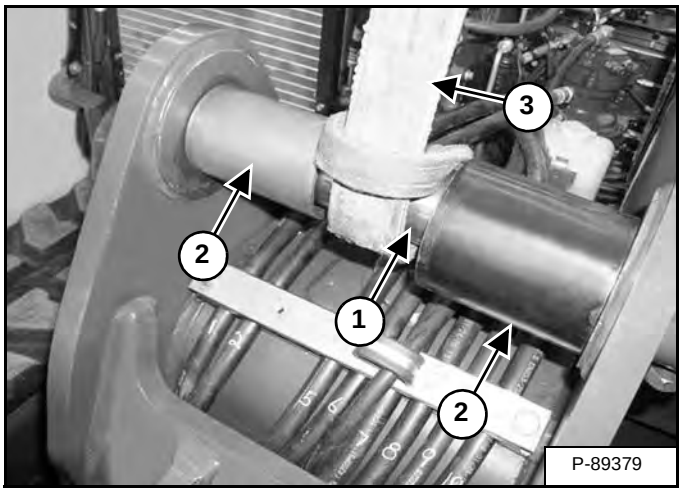
Remove the fuel tank. (See Removal And Installation on Page 40-110-1.)

Figure 40-10-1



Mark the track frame to swing bearing (Item 1) **[Figure 40-10-1]**.

Figure 40-10-2



Install the boom pivot pin (Item 1), spacers (Item 2) and strap (Item 3) **[Figure 40-10-2]** on the pivot pin.

NOTE: The spacers are needed to prevent the strap from sliding on the pivot pin causing the upperstructure to tip side to side.

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Removal (Cont'd)

Figure 40-10-3

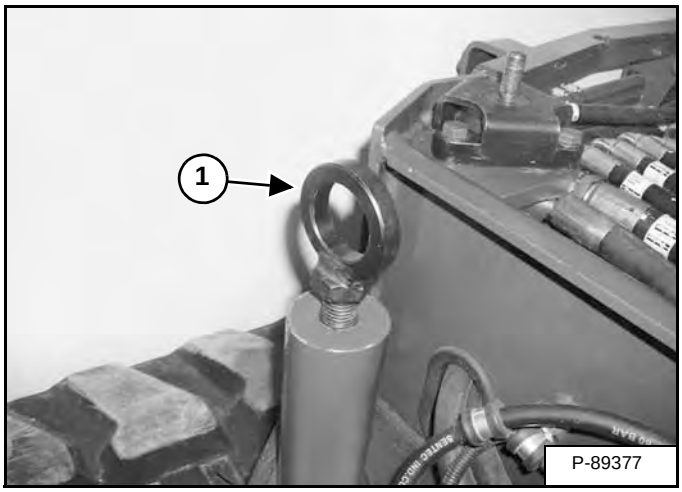
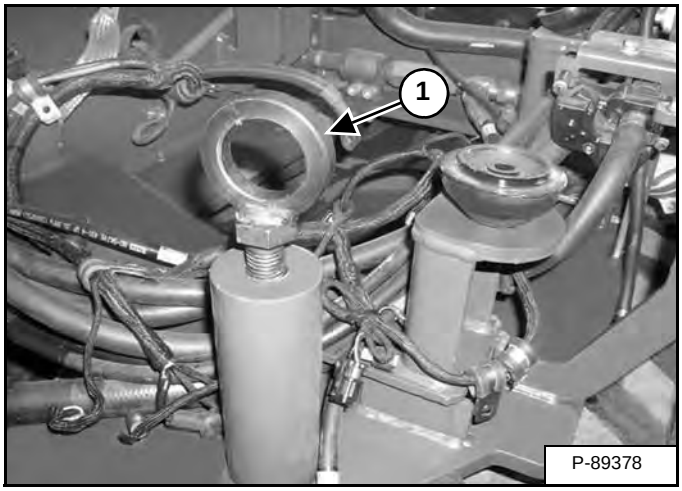


Figure 40-10-4



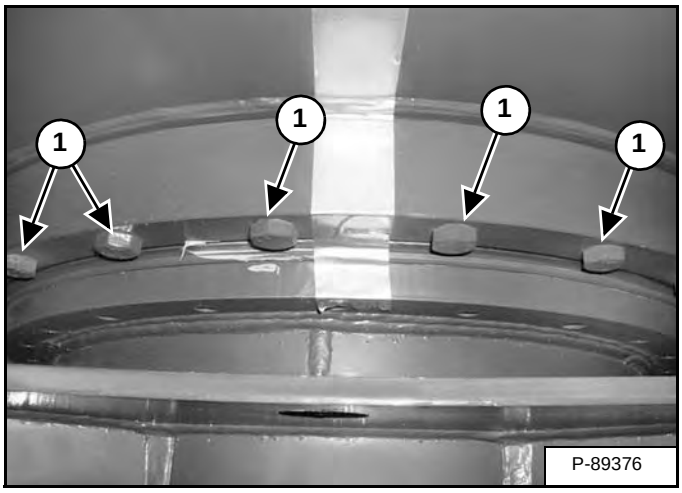
Install the rear lifting brackets (Item 1) **[Figure 40-10-3]** and **[Figure 40-10-4]**.

Install chains and a hoist to the lifting brackets.

NOTE: The chain hoist the lifting chains are attached to must have a swivel hook to allow the upperstructure to be turned.

Apply a small amount of lifting pressure to the upperstructure with the chain hoist.

Figure 40-10-5

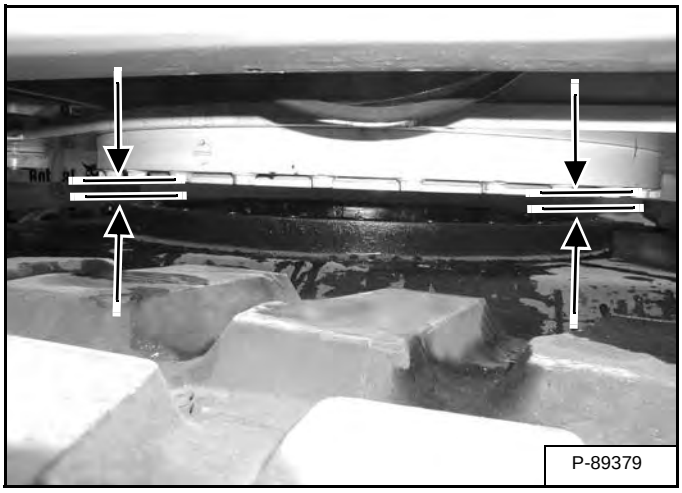


Remove the bolts (Item 1) **[Figure 40-10-5]**.

Rotate the upperstructure by hand and continue removing the bolts.

NOTE: The upperstructure is mounted to the track frame with twenty-four bolts.

Figure 40-10-6



Raise the upperstructure. Make sure the upperstructure is level as it is being raised **[Figure 40-10-6]**.

Lower the upperstructure and adjust the lifting chains as needed, to pull the upperstructure squarely off the track frame.

Remove the upperstructure and position it on suitable support stands or blocks.

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Installation

Figure 40-10-7

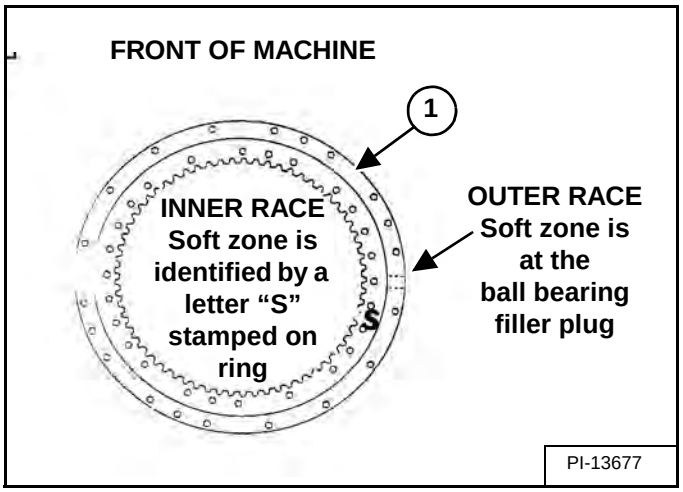
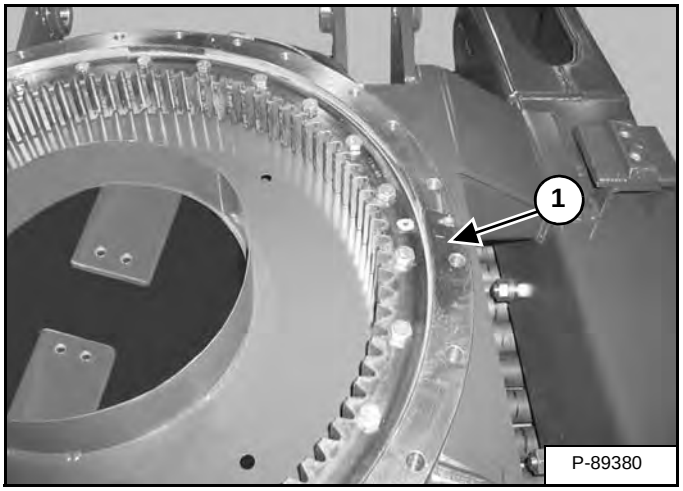


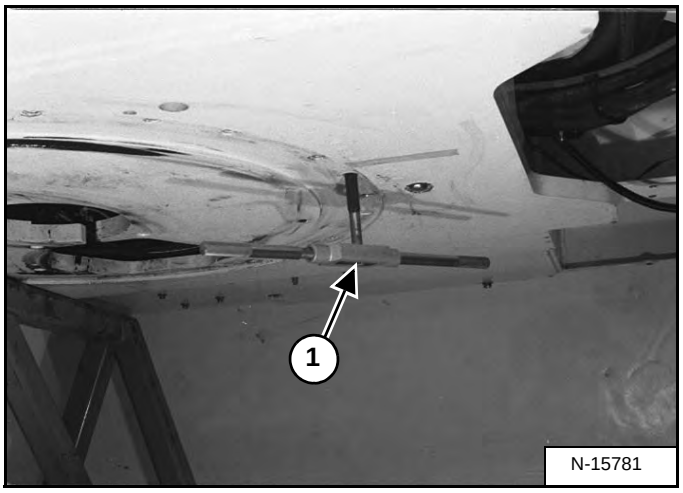
Figure 40-10-8



Rotate the swing bearing so the outside soft zone (Item 1) **[Figure 40-10-7]** and **[Figure 40-10-8]** is to the right hand side of the excavator.

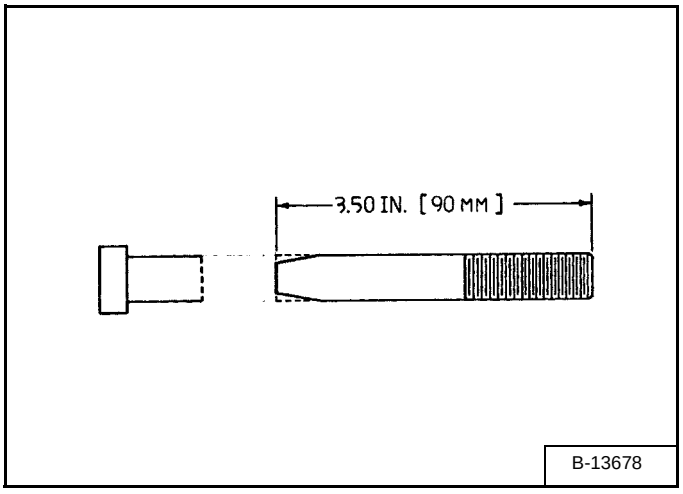
NOTE: The upperstructure can only be installed on the swing bearing in one position. Match the mount holes in the swing bearing to the mount holes in the upperstructure.

Figure 40-10-9



Use a 18 mm tap in the holes (Item 1) **[Figure 40-10-9]** of the upperstructure to remove any dried thread lock adhesive.

Figure 40-10-10

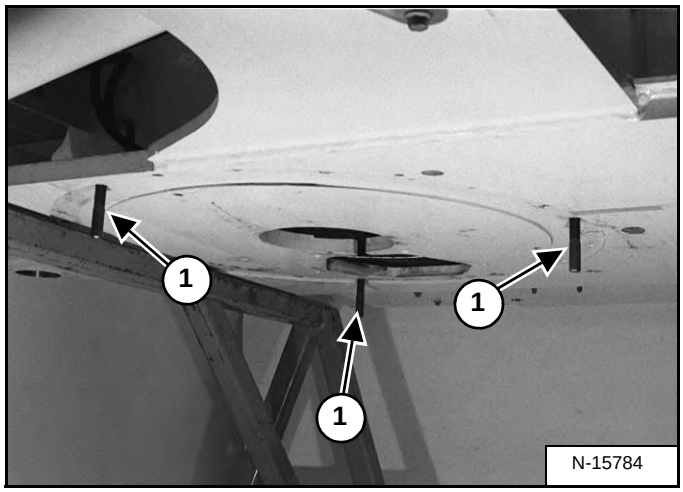


Make three alignment pins by using M18 X 110 mm long bolts. Cut the head off these bolts at 90 mm (3.50 in), then taper the end of the bolts **[Figure 40-10-10]**.

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Installation (Cont'd)

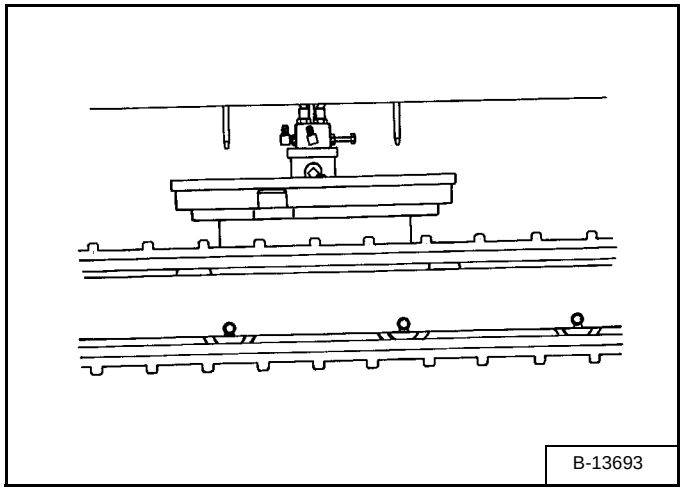
Figure 40-10-11



Install the pins (Item 1) **[Figure 40-10-11]** into the upperstructure at approximately 120° apart. These will act as alignment pins while lowering the upperstructure onto the swing bearing.

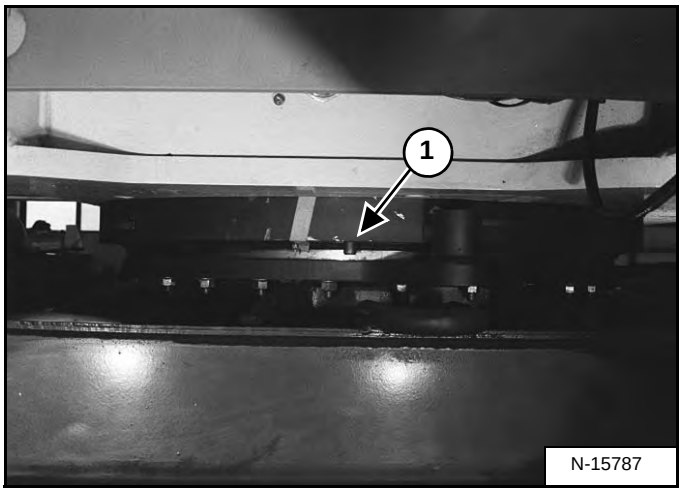
Install the upperstructure onto the swing bearing using the alignment marks and the alignment pins.

Figure 40-10-12



Make sure the swivel joint is centered into the upperstructure access hole **[Figure 40-10-12]**.

Figure 40-10-13



Remove the three, 90 mm (3.50 in) alignment pins (Item 1) **[Figure 40-10-13]** from the upperstructure.

These headless pins can be removed from the bottom.

Apply thread adhesive (Loctite® 242 or equivalent) to the threads of the bolts. Install the bolts into all holes (except the three with the alignment bolts installed). Tighten these bolts to 392 N•m (289 ft-lb) torque.

Remove the chains and lifting brackets.

Install the swing motor drive carrier. (See Removal And Installation on Page 20-91-1.)

Check the backlash between the gears by moving the frame back and forth at several points throughout 360° of frame rotation. There must be some backlash present.

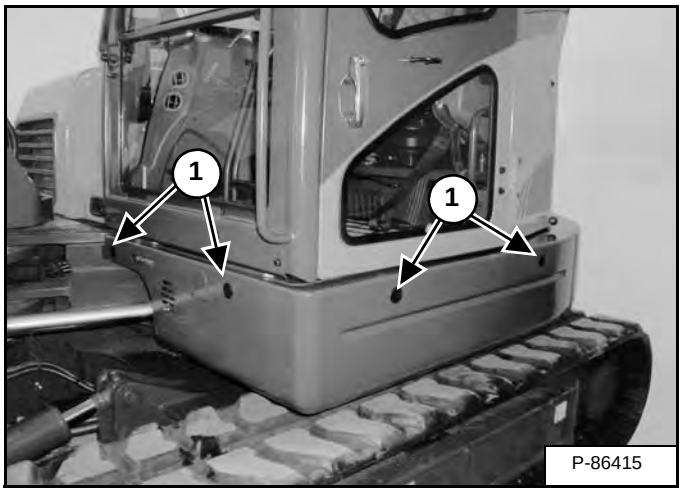
Install the swing motor. (See Removal And Installation on Page 20-90-1.)

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UPPERSTRUCTURE SIDE COVER (LEFT)

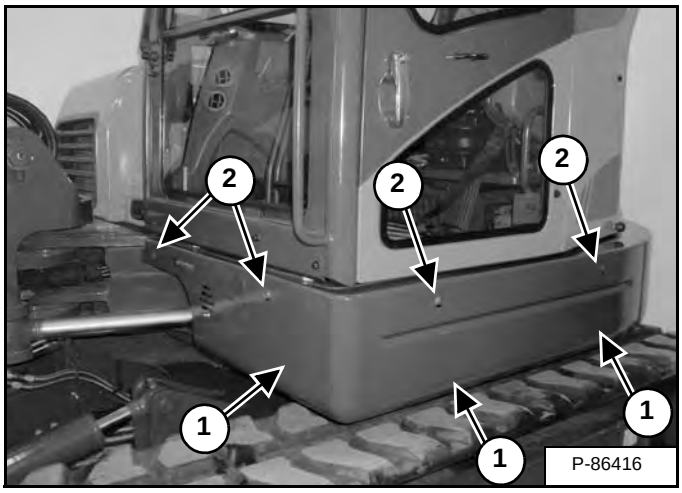
Removal And Installation

Figure 40-20-1



Remove the four rubber plugs (Item 1) **[Figure 40-20-1]**.

Figure 40-20-2



Remove the three bottom bolts (Item 1), flat washers and lock washers. Remove the four top bolts (Item 2) **[Figure 40-20-2]**, flat washers and lock washers.

Remove the cover.

Note the number and position of the shims located between the cover and upperstructure. Place the shims in the correct position for installation.

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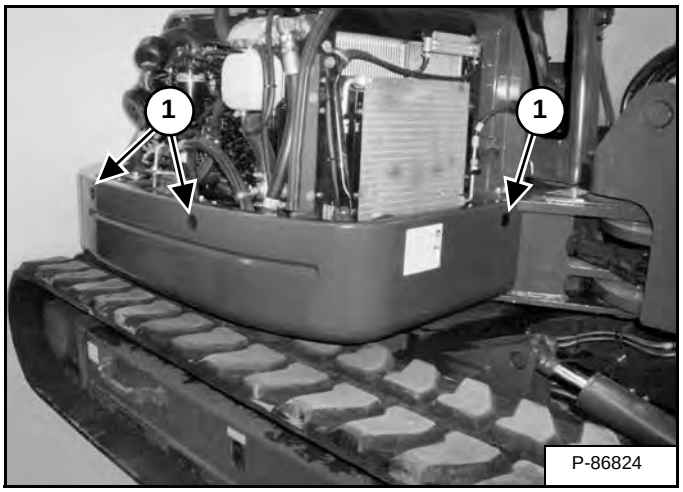


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UPPERSTRUCTURE SIDE COVER (RIGHT)

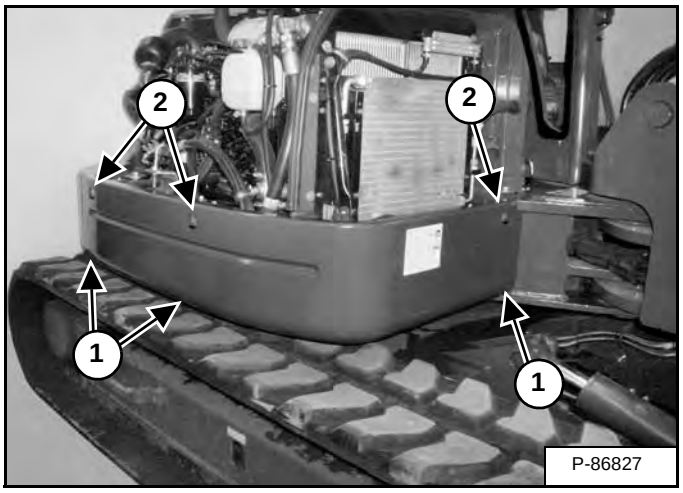
Removal And Installation

Figure 40-21-1



Remove the three rubber plugs (Item 1) **[Figure 40-21-1]**.

Figure 40-21-2



Remove the three bottom bolts (Item 1), flat washers and lock washers. Remove the three top bolts (Item 2) **[Figure 40-21-2]**, flat washers and lock washers.

Remove the cover.

Note the number and position of the shims located between the cover and upperstructure. Place the shims in the correct position for installation.

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CAB

Removal And Installation

Remove the door. (See Door Removal And Installation on Page 40-30-11.)

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

Remove the floor mat. (See Removal And Installation on Page 40-100-1.)

Remove the instrument panel. (See Removal And Installation on Page 50-100-1.)

Figure 40-30-1

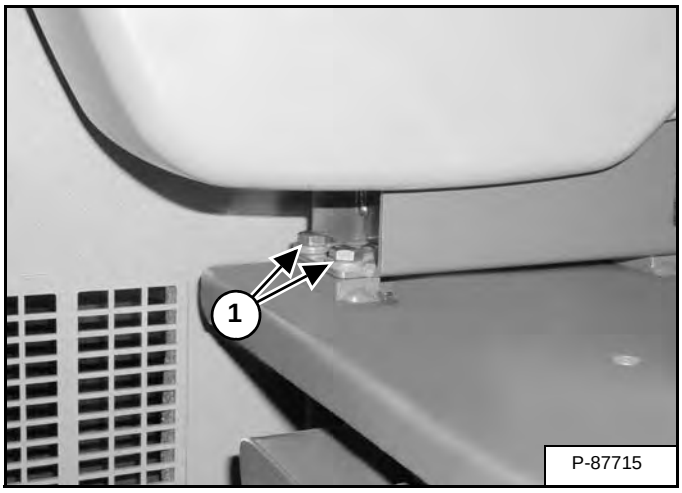
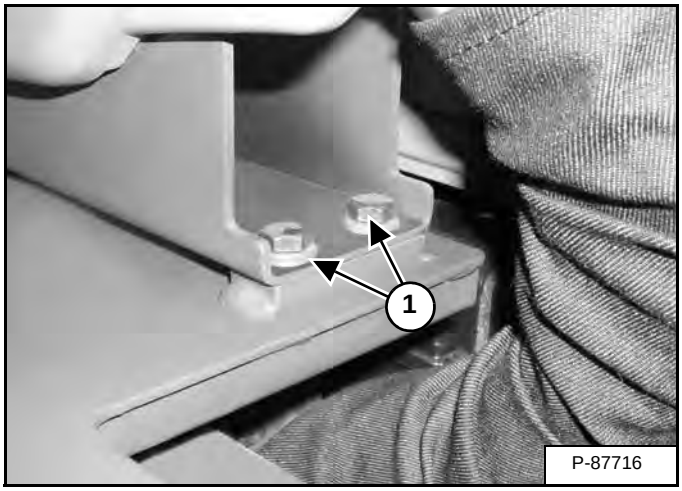
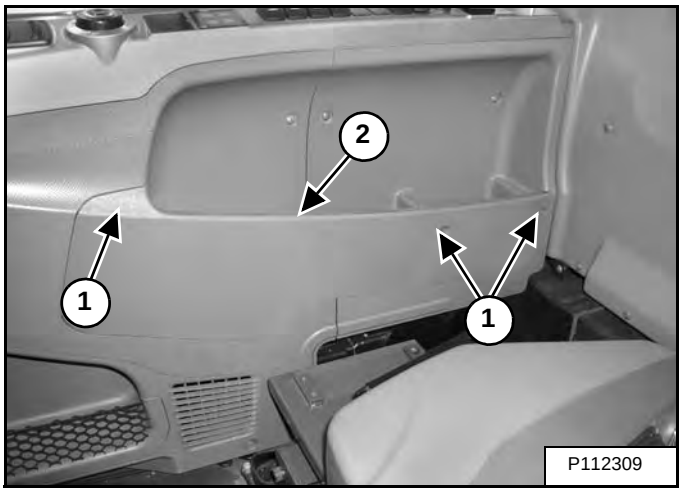


Figure 40-30-2



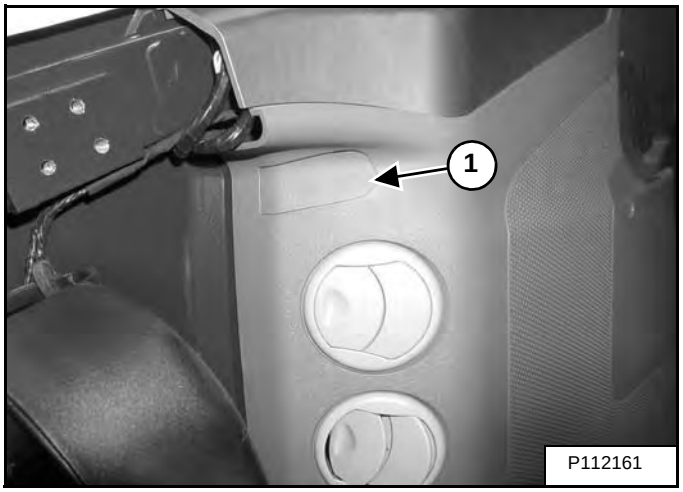
Remove the bolts (Item 1) **[Figure 40-30-1]** and **[Figure 40-30-2]** from the base of the right console. Reposition the right console to create access to the side covers.

Figure 40-30-3



Remove the screws (Item 1) and the right pocket cover (Item 2) **[Figure 40-30-3]**.

Figure 40-30-4

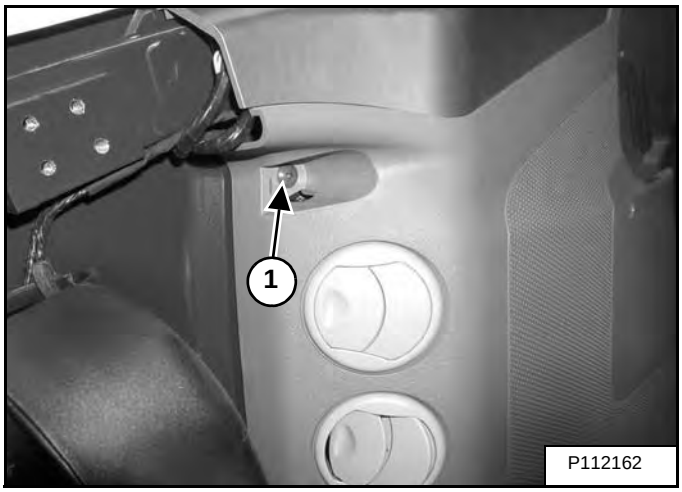


Remove the cover (Item 1) **[Figure 40-30-4]**.

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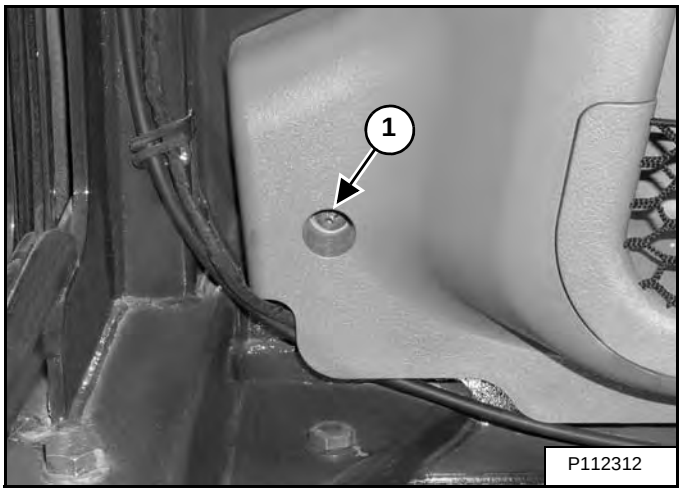
Removal And Installation (Cont'd)

Figure 40-30-5



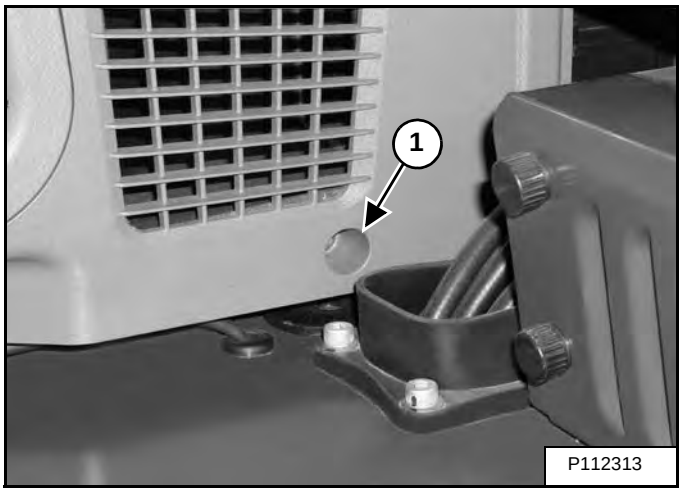
Remove the screw (Item 1) **[Figure 40-30-5]**.

Figure 40-30-6



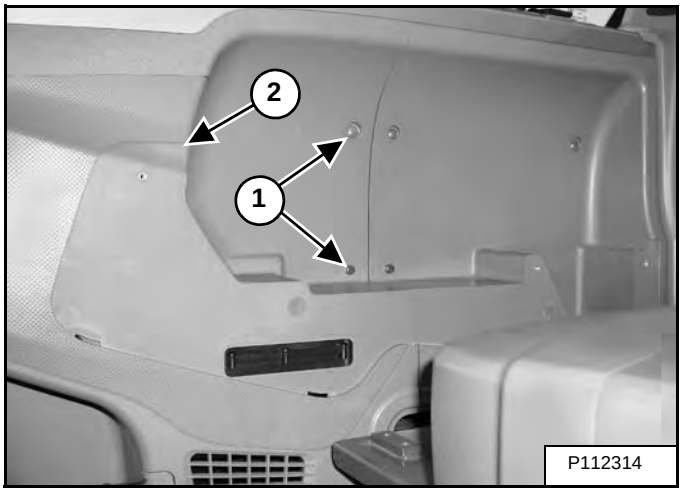
Remove the screw (Item 1) **[Figure 40-30-6]**.

Figure 40-30-7



Remove the screw (Item 1) **[Figure 40-30-7]**.

Figure 40-30-8

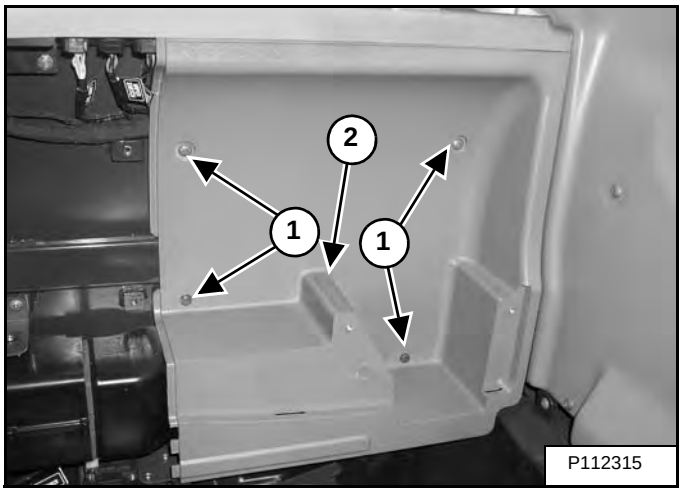


Remove the screws (Item 1) and remove the panel (Item 2) **[Figure 40-30-8]**.

Dealer Copy -- Not for Resale

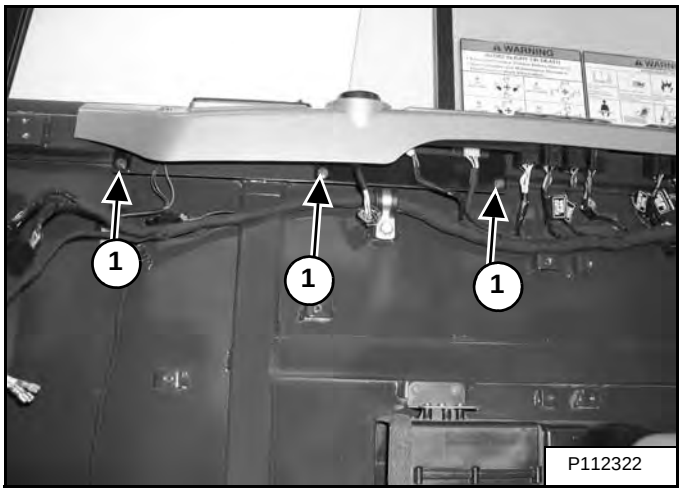
Removal And Installation (Cont'd)

Figure 40-30-9



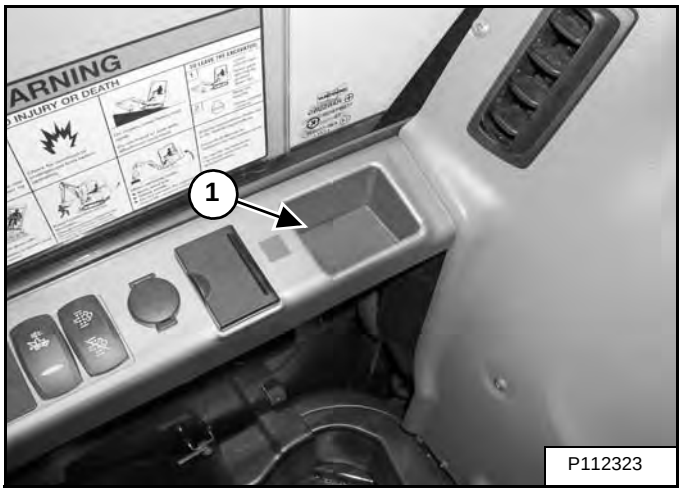
Remove the screws (Item 1) and right side cover (Item 2) **[Figure 40-30-9]**.

Figure 40-30-10



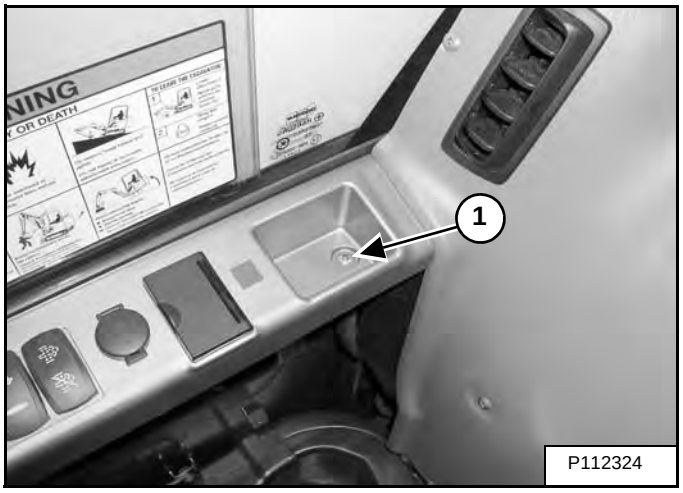
Remove the screws (Item 1) **[Figure 40-30-10]**.

Figure 40-30-11



Remove the pad (Item 1) **[Figure 40-30-11]**.

Figure 40-30-12

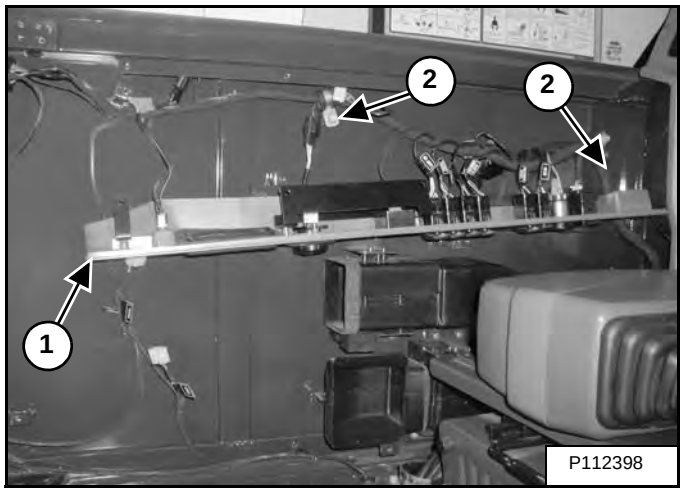


Remove the screw (Item 1) **[Figure 40-30-12]**.

Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

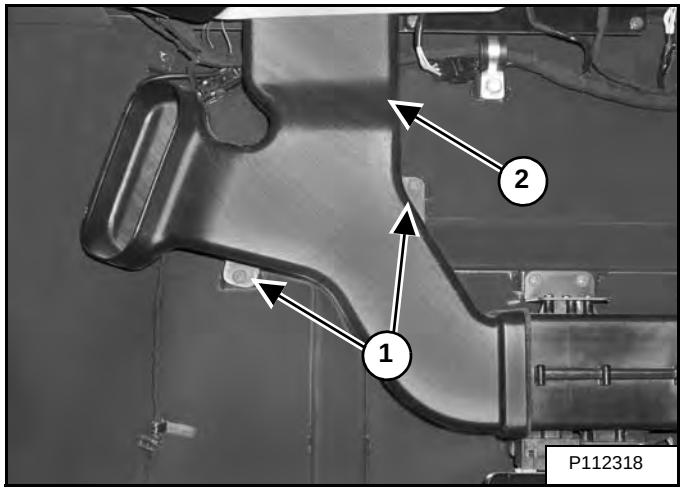
Figure 40-30-13



Disconnect the wire harness and remove the switch panel (Item 1) **[Figure 40-30-13]**.

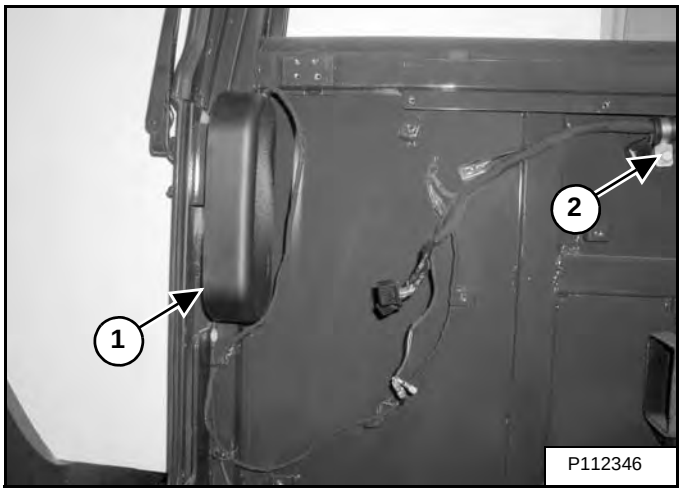
Remove the bolts (Item 2) **[Figure 40-30-13]** from the wire harness clamps.

Figure 40-30-14



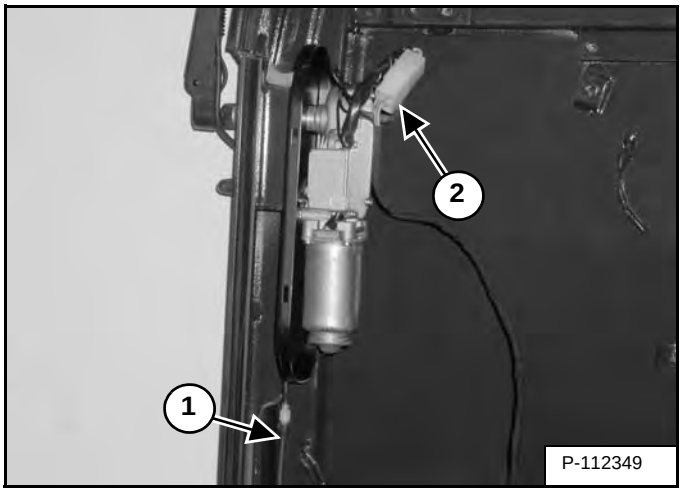
Remove the screws (Item 1) and air duct (Item 2) **[Figure 40-30-14]**.

Figure 40-30-15



Remove the cover (Item 1) from the wiper motor. Remove bolt (Item 2) **[Figure 40-30-15]** from the clamp.

Figure 40-30-16

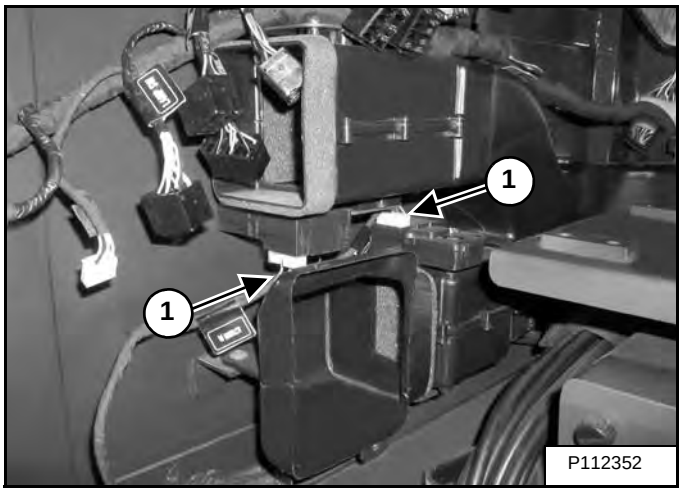


Disconnect the washer hose (Item 1) and wire harness (Item 2) **[Figure 40-30-16]**.

Dealer Copy -- Not for Resale

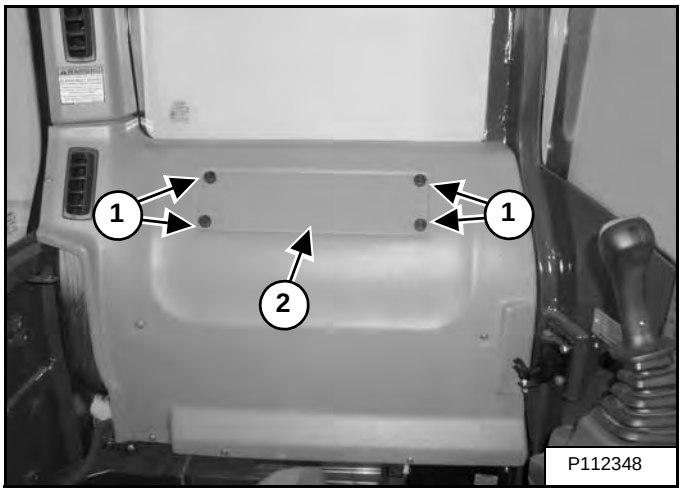
Removal And Installation (Cont'd)

Figure 40-30-17



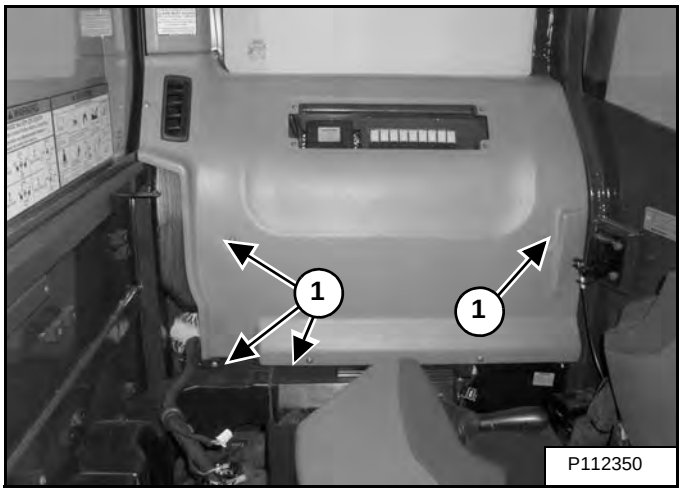
Disconnect the wire harness (Item 1) **[Figure 40-30-17]**.

Figure 40-30-18



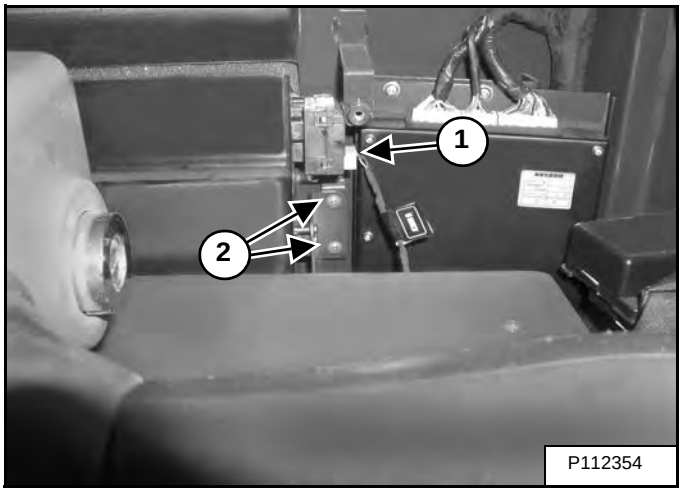
Remove the screws (Item 1) and cover (Item 2) **[Figure 40-30-18]**.

Figure 40-30-19



Remove the screws (Item 1) **[Figure 40-30-19]** and rear cover.

Figure 40-30-20

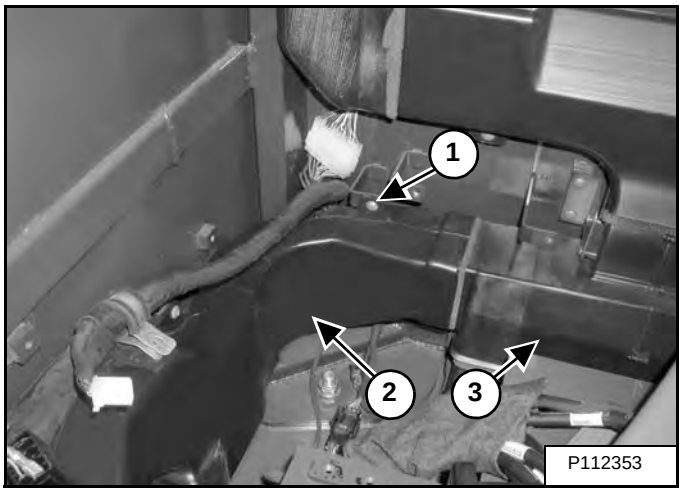


Disconnect the wire harness (Item 1) and remove the screws (Item 2) **[Figure 40-30-20]**.

Dealer Copy -- Not for Resale

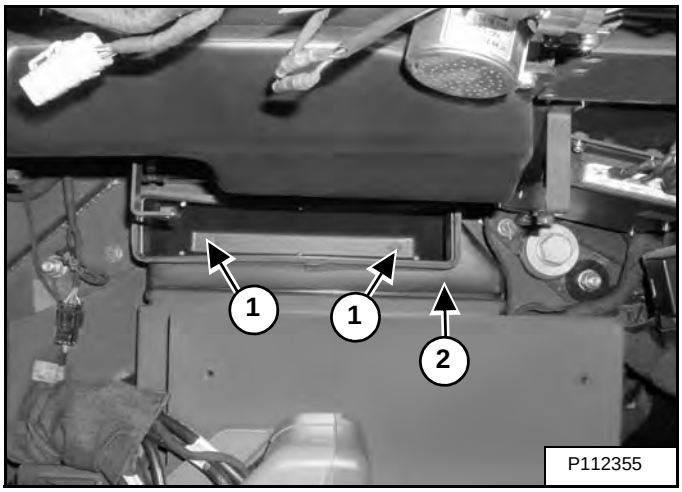
Removal And Installation (Cont'd)

Figure 40-30-21



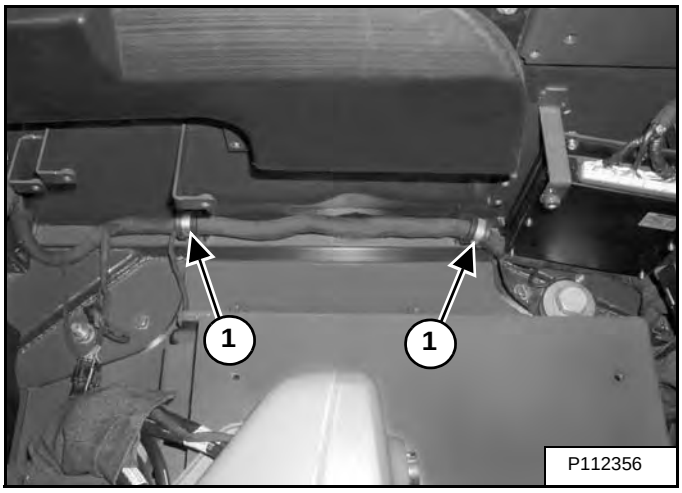
Remove the screws (Item 1). Remove the ducts (Item 2 and 3) **[Figure 40-30-21]**.

Figure 40-30-22



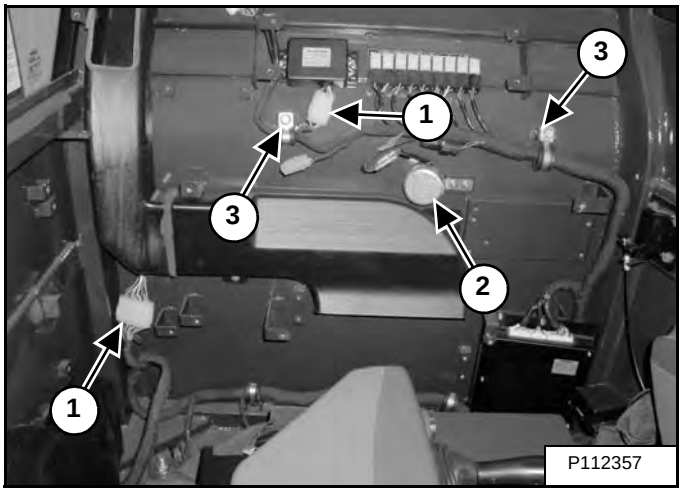
Remove the screws (Item 1) and remove the duct (Item 2) **[Figure 40-30-22]**.

Figure 40-30-23



Remove the bolts (Item 1) **[Figure 40-30-23]** from the wire harness clamps.

Figure 40-30-24

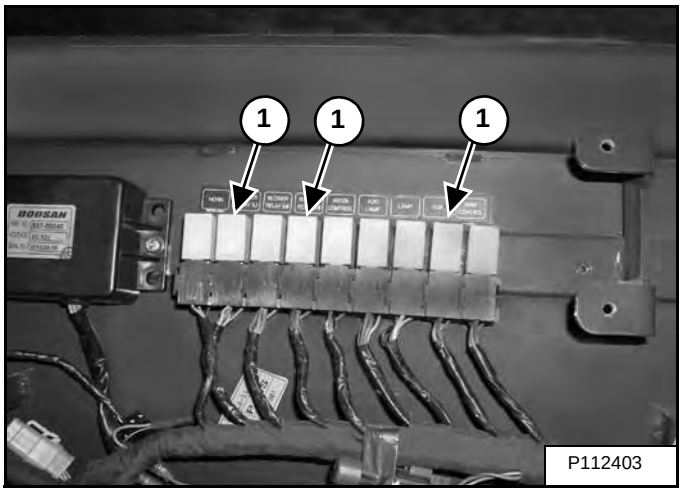


Disconnect the wire harness (Item 1), remove the screws and reposition the alarm (Item 2). Remove the bolts (Item 3) **[Figure 40-30-24]** from the wire harness clamps.

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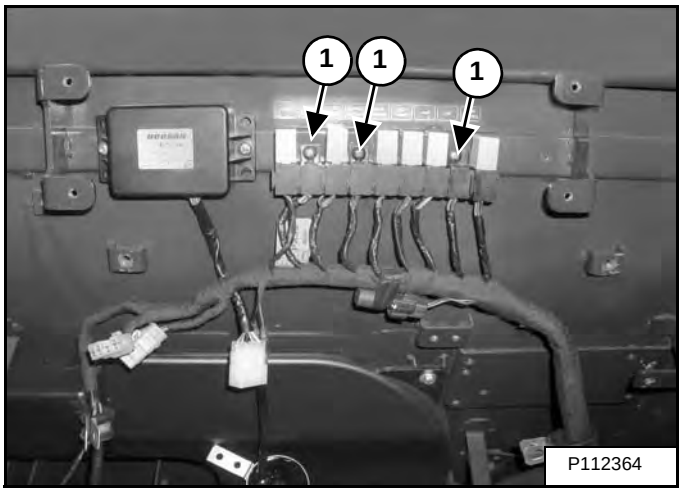
Removal And Installation (Cont'd)

Figure 40-30-25



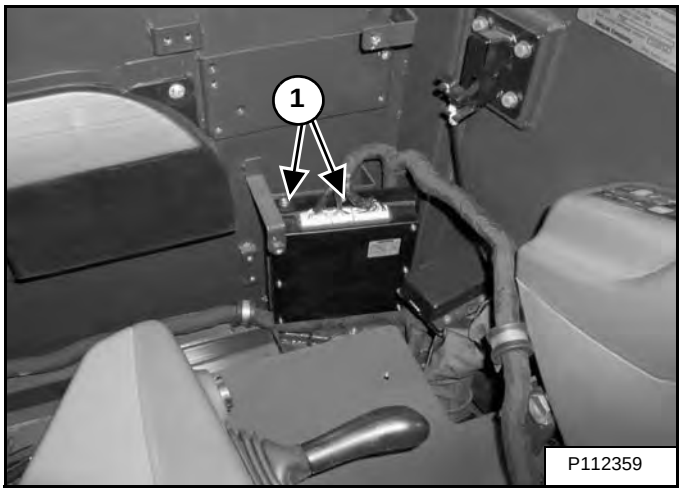
Remove the relays (Item 1) **[Figure 40-30-25]**.

Figure 40-30-26



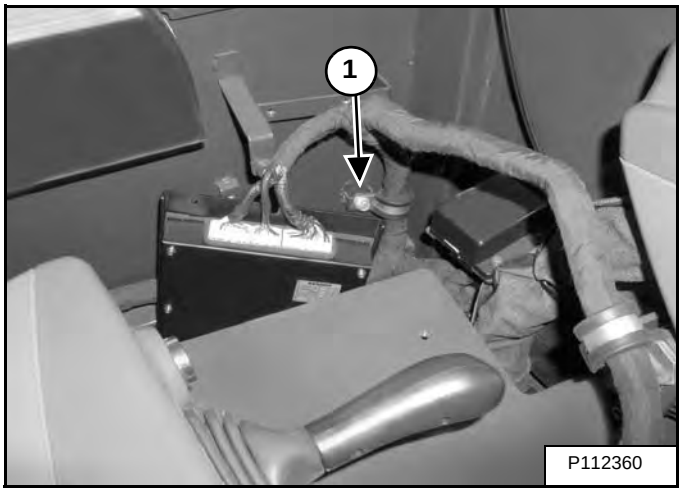
Remove the screws (Item 1) **[Figure 40-30-26]** and reposition the wire harness.

Figure 40-30-27



Remove the top screws (Item 1) **[Figure 40-30-27]** and loosen the bottom screws. Reposition the controller.

Figure 40-30-28

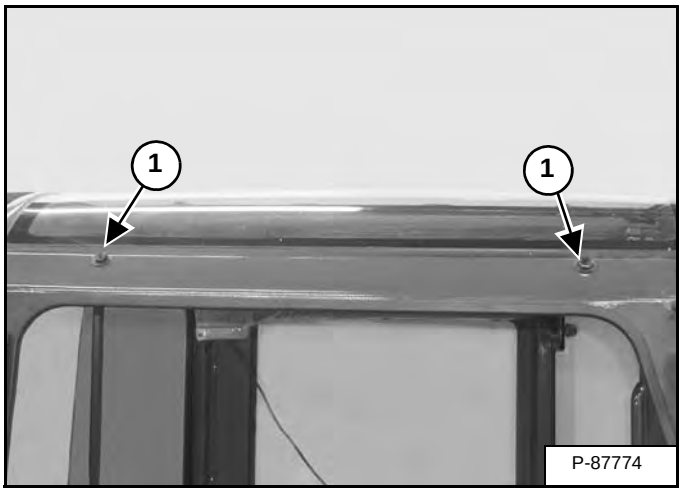


Remove the bolt (Item 1) **[Figure 40-30-28]** from the wire harness clamp.

Dealer Copy -- Not for Resale

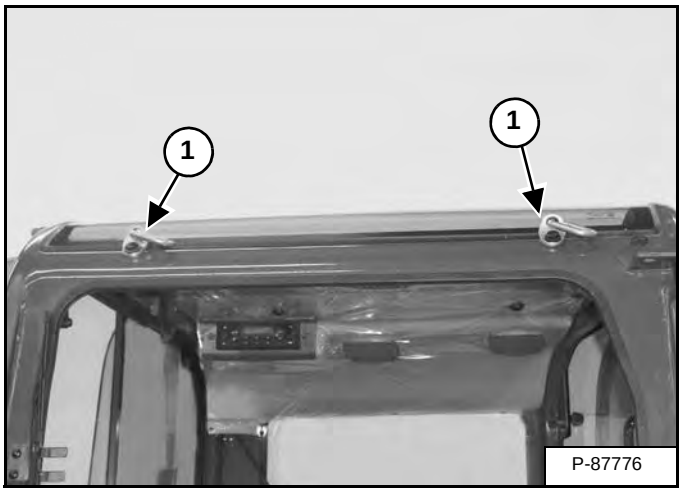
Removal And Installation (Cont'd)

Figure 40-30-29



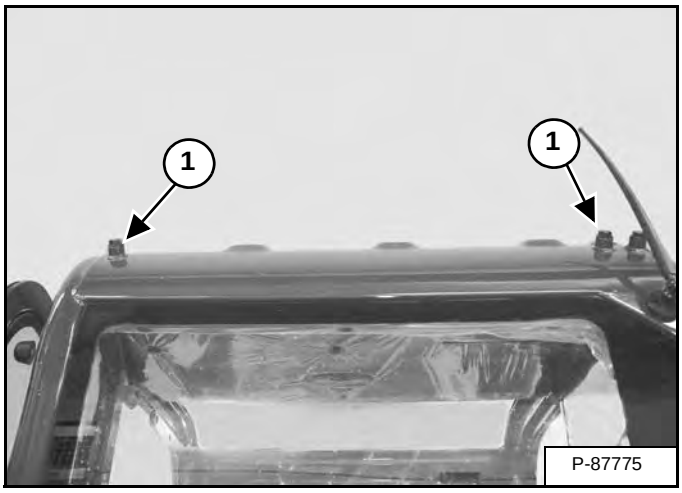
Remove the bolts (Item 1) **[Figure 40-30-29]** from the front of the cab.

Figure 40-30-30



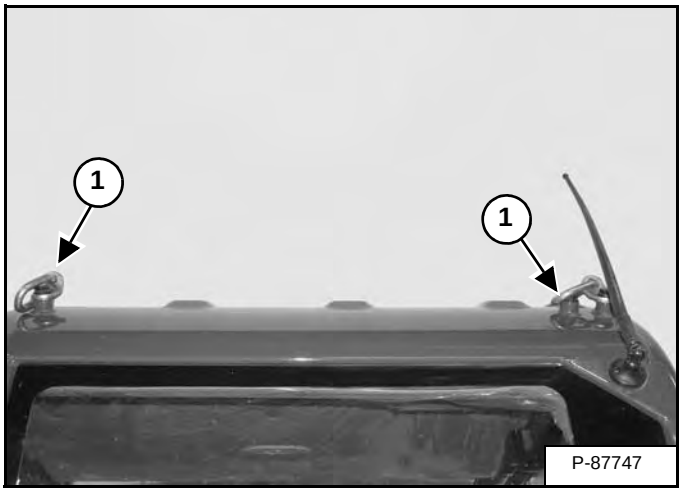
Install the lifting hooks (Item 1) **[Figure 40-30-30]**.

Figure 40-30-31



Remove the bolts (Item 1) **[Figure 40-30-31]**.

Figure 40-30-32

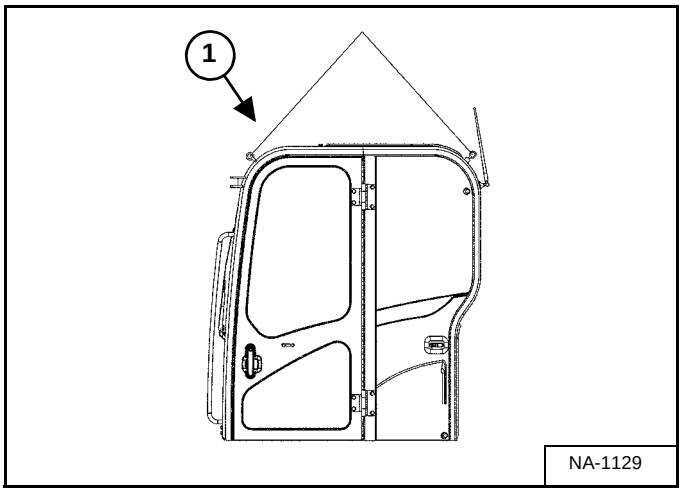


Install lifting hooks (Item 1) **[Figure 40-30-32]**.

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Removal And Installation (Cont'd)

Figure 40-30-33

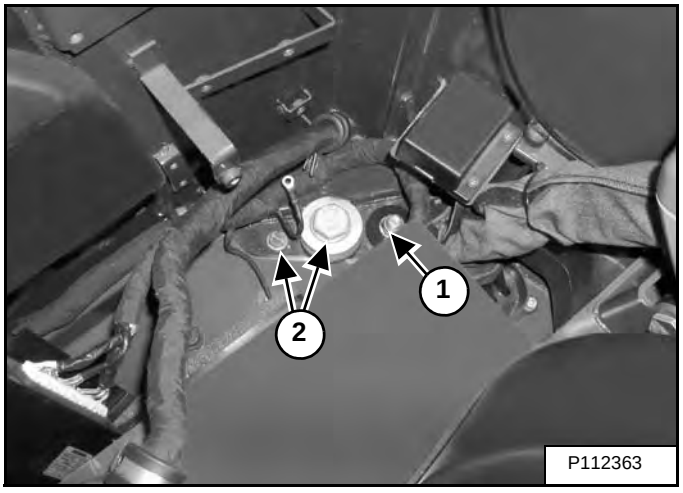


Attach lifting straps (Item 1) **[Figure 40-30-33]** to the lifting hooks.

Attach a lifting device to the straps.

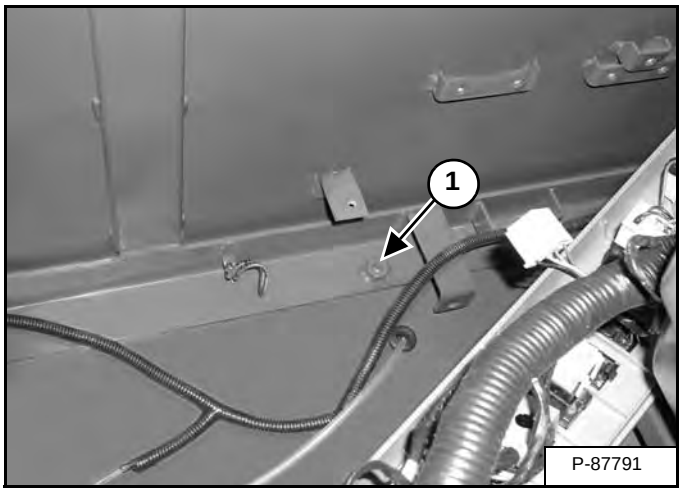
NOTE: The cab weighs approximately 480 kg (1058 lb)

Figure 40-30-34



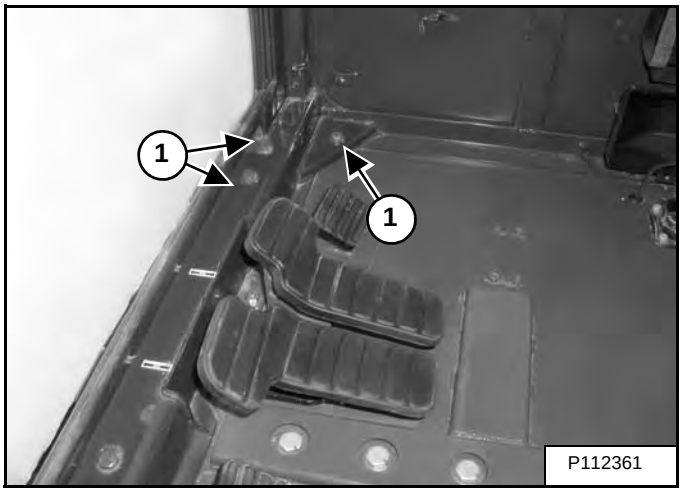
Remove the rear corner nuts (Item 1) and bolts (Item 2) **[Figure 40-30-34]** (Both sides).

Figure 40-30-35



Remove the right side bolt (Item 1) **[Figure 40-30-35]**.

Figure 40-30-36

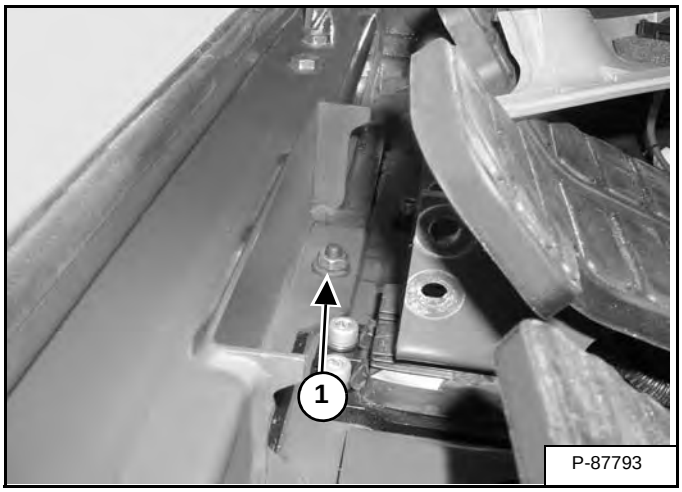


Remove the right front bolts (Item 1) **[Figure 40-30-36]**.

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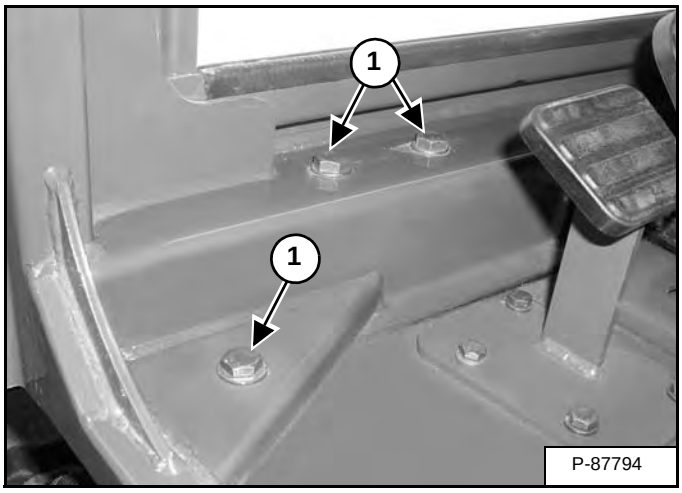
Removal And Installation (Cont'd)

Figure 40-30-37



Remove the front center nuts (Item 1) **[Figure 40-30-37]**.

Figure 40-30-38



Remove the left front bolts (Item 1) **[Figure 40-30-38]**.

Figure 40-30-39

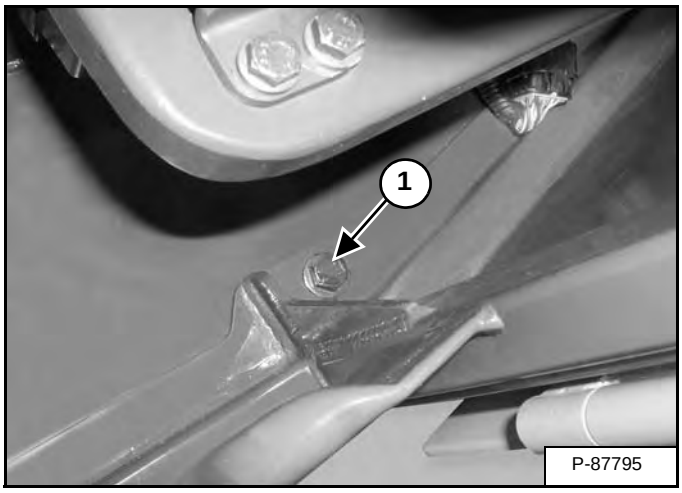
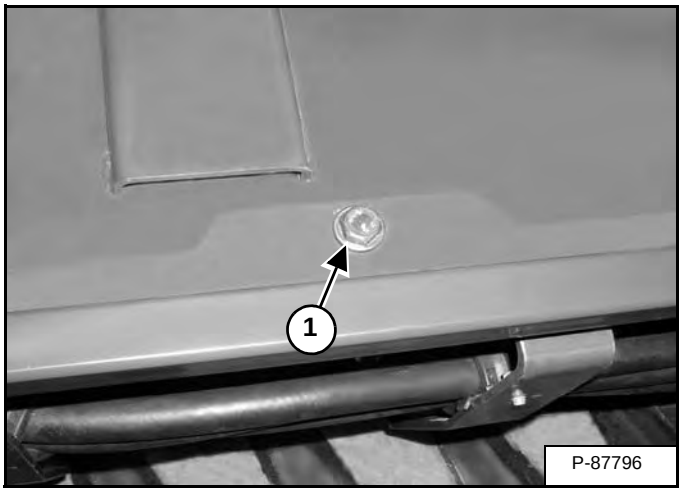


Figure 40-30-40



Remove the left side bolts (Item 1) **[Figure 40-30-39]** and **[Figure 40-30-40]**.

Remove the cab.

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Door Removal And Installation

Figure 40-30-41



Remove the hinge bolts (Item 1) **[Figure 40-30-41]**.

Remove the door.

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Front Window Removal And Installation

Open the front window to the fully open and locked position.

Figure 40-30-42

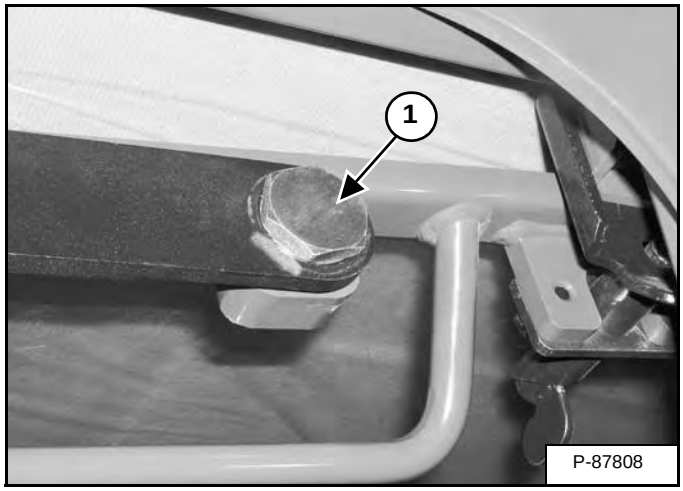
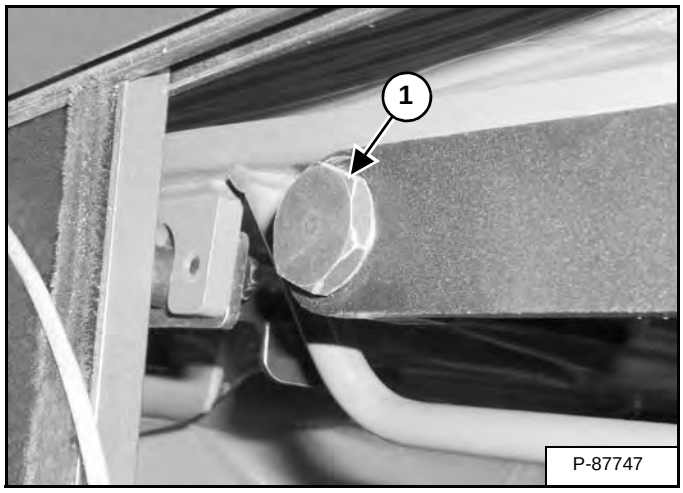
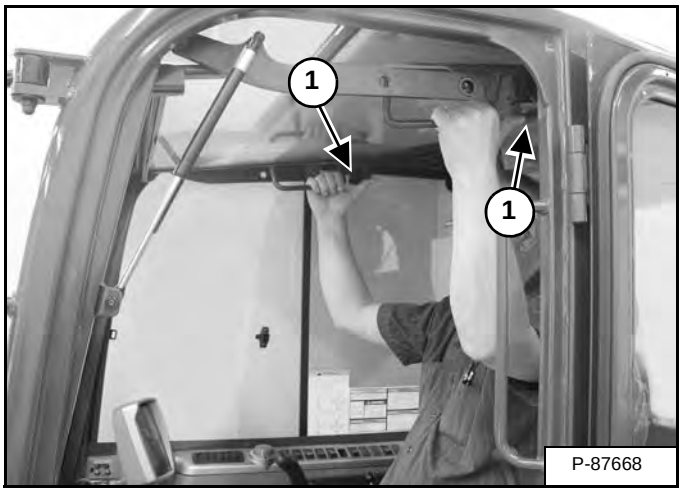


Figure 40-30-43



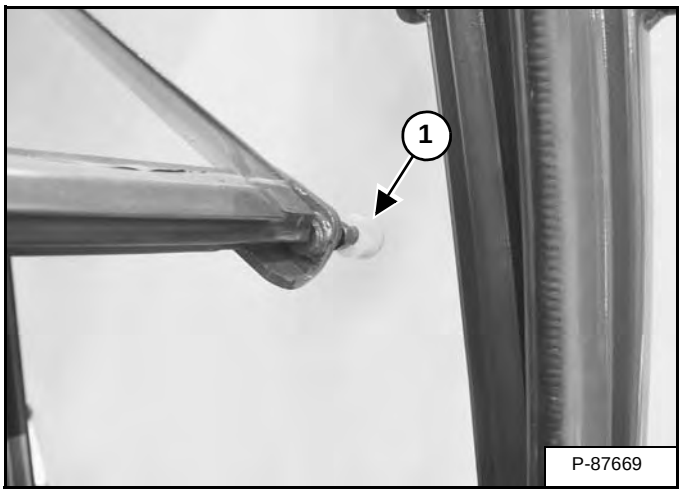
Remove the window slide bar bolts (Item 1) **[Figure 40-30-42]** and **[Figure 40-30-43]**.

Figure 40-30-44



With the help of a second person supporting the window, release the window latches (Item 1) **[Figure 40-30-44]** and partially lower the window.

Figure 40-30-45



Tilt the front window and remove the roller (Item 1) **[Figure 40-30-45]** (Both sides).

Remove the window.

Dealer Copy -- Not for Resale

Lower Front Window Removal And Installation

Open the front window.

Figure 40-30-46



Grasp the lower window and pull it upwards until the window is out of the channel **[Figure 40-30-46]**.

Remove the window.

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Glass Installation

Top, Right Side, Left Side And Rear Glass

NOTE: See your dealer for the correct urethane adhesive, combo primer, glass cleaner and bumpers for correctly installing the new glass.

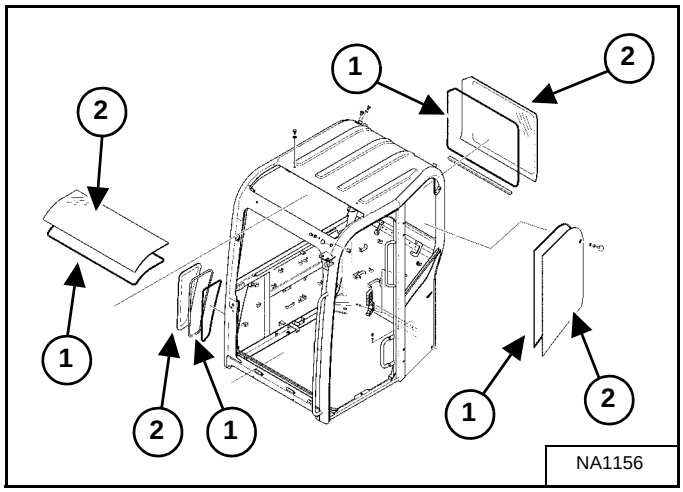
Remove the majority of the old urethane adhesive from the perimeter of the cab.

NOTE: Leave a thin film (0,79 mm (0.03 in) thick) of the old urethane on the cab frame. Fresh urethane will bond to the remaining film.

Prime and paint any bare metal or scratches.

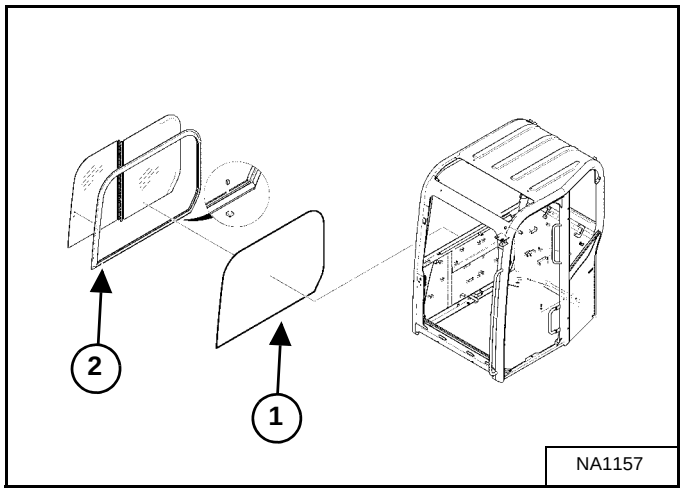
Clean the metal surfaces with general purposes adhesive cleaner. Clean the glass surface with glass cleaner.

Figure 40-30-47



Install the damper (Item 1) on the glass (Item 2) **[Figure 40-30-47]**.

Figure 40-30-48



Install the damper (Item 1) on the frame (Item 2) **[Figure 40-30-48]**.

Shake the combo primer for one minute.

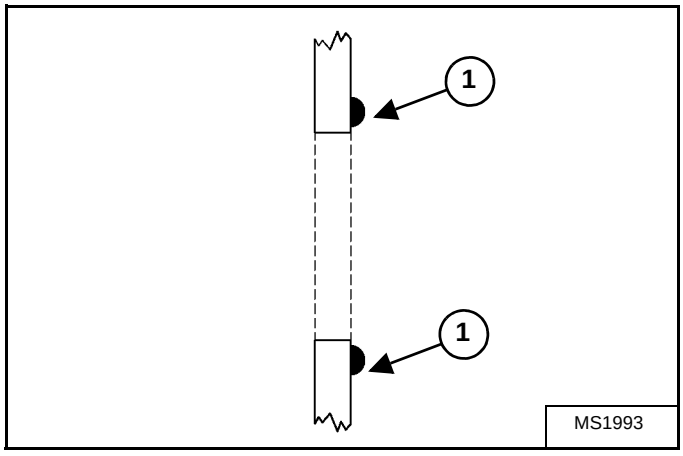
Apply one coat of the combo primer to the perimeter of the cab and damper (Item 1) **[Figure 40-30-48]**.

Shake the combo primer for one minute.

Allow the combo primer to dry for at least 15 minutes. Excess primer can be removed from the glass using a razor blade.

Cut the tip of the adhesive tube to the desired shape and size to provide a bead with sufficient height to give good contact with the glass around the entire perimeter.

Figure 40-30-49



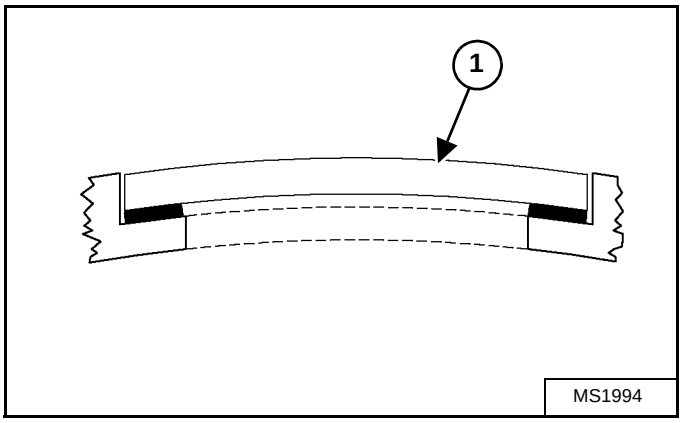
Apply a 6,4 X 9,5 mm (0.25 X 0.375 in) triangle shaped bead of urethane adhesive (Item 1) **[Figure 40-30-49]** to the perimeter of the cab.

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Glass Installation (Cont'd)

Top, Right Side, Left Side And Rear Glass (Cont'd)

Figure 40-30-50



Install the glass and damper assembly (Item 1) **[Figure 40-30-50]**. Press the glass into the cab to make complete contact with the adhesive. Tape the glass in place.

Allow the adhesive to cure for a minimum of twelve hours at 70° F and 20% relative humidity.

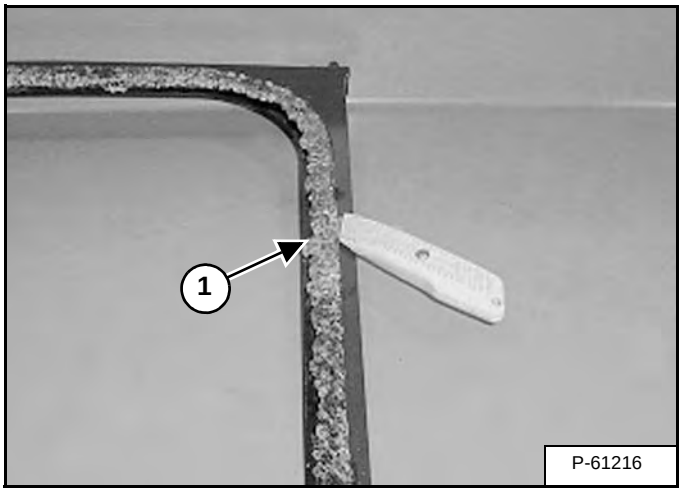
Remove the tape after the adhesive is cured.

Door And Front Window Glass

NOTE: The door and front windows are supplied as kits that include the glass, urethane adhesive, combo primer, glass cleaner and damper for correctly installing the new glass.

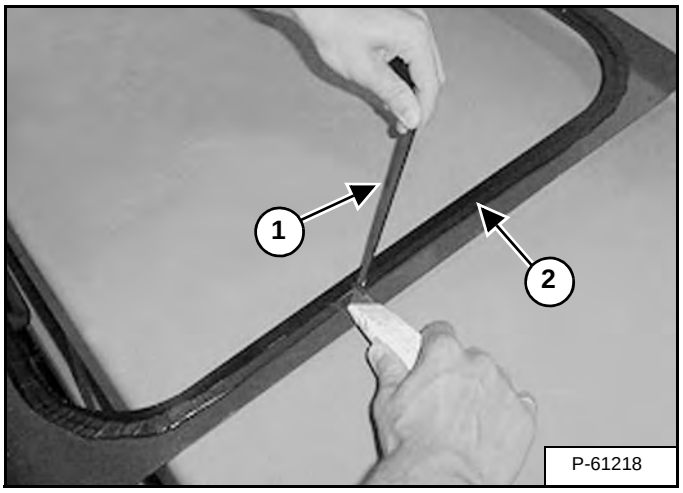
Remove the front window or door that is to be repaired from the excavator.

Figure 40-30-51



Remove the broken glass (Item 1) **[Figure 40-30-51]**.

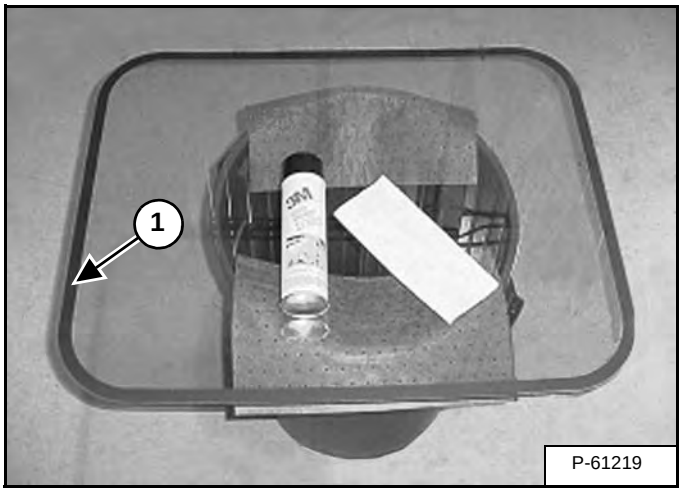
Figure 40-30-52



Cut and remove the old urethane adhesive (Item 1) leaving less than a 0,79 mm (0.03 in) thick layer (Item 2) **[Figure 40-30-52]** for the new adhesive to bond to.

NOTE: Be careful not to scratch the paint on the frame.

Figure 40-30-53



Place the glass on a flat surface with the painted side of the glass (Item 1) **[Figure 40-30-53]** facing up.

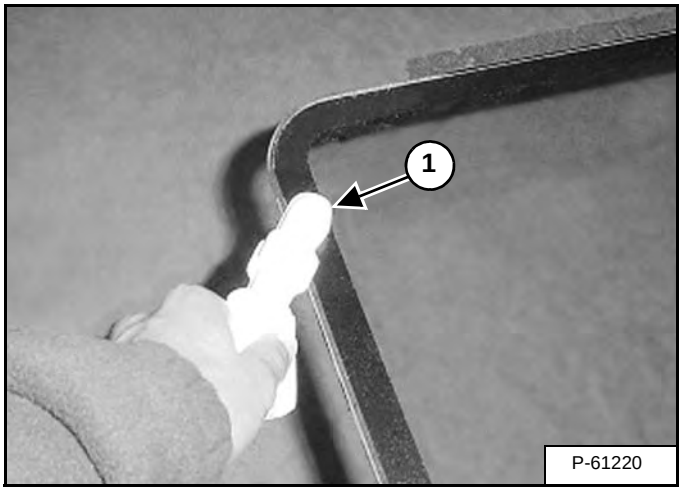
Thoroughly clean the entire glass with glass cleaner.

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Glass Installation (Cont'd)

Door And Front Window Glass (Cont'd)

Figure 40-30-54



Apply one coat of combo primer (Item 1) **[Figure 40-30-54]** on the painted edge of the glass.

Apply the combo primer to any scratches on the door / front window frame in the area where the glass is installed.

Allow the primer to dry for a minimum of 15 minutes.

Excess primer may be removed from the glass using a razor blade.

Figure 40-30-55

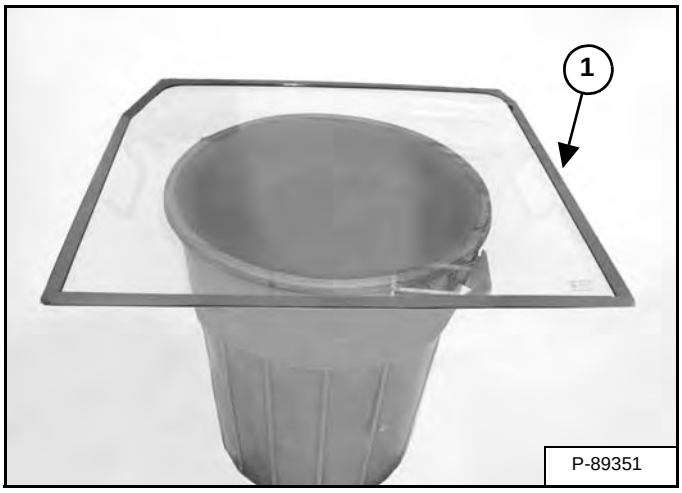
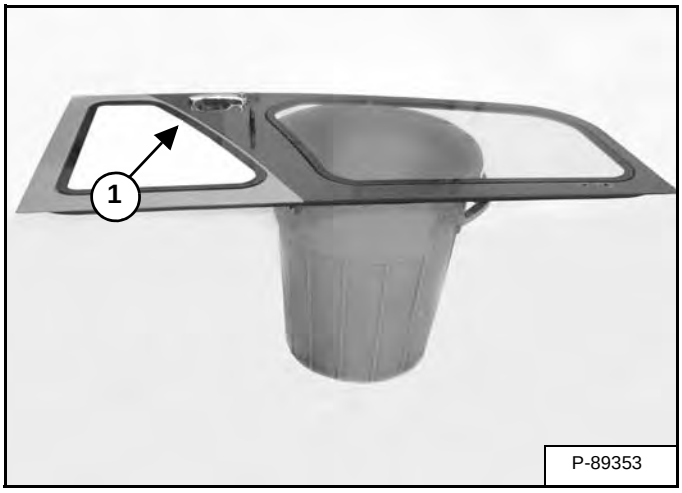


Figure 40-30-56



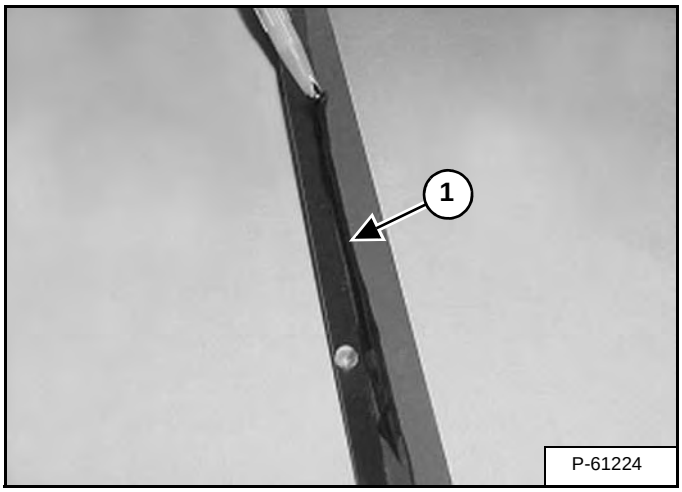
Install the dampers on the front window frame (Item 1) **[Figure 40-30-55]** or on the door frame (Item 1) **[Figure 40-30-56]**. (The dampers are used to space the glass away from the metal so there is no glass to metal contact.)

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Glass Installation (Cont'd)

Door And Front Window Glass (Cont'd)

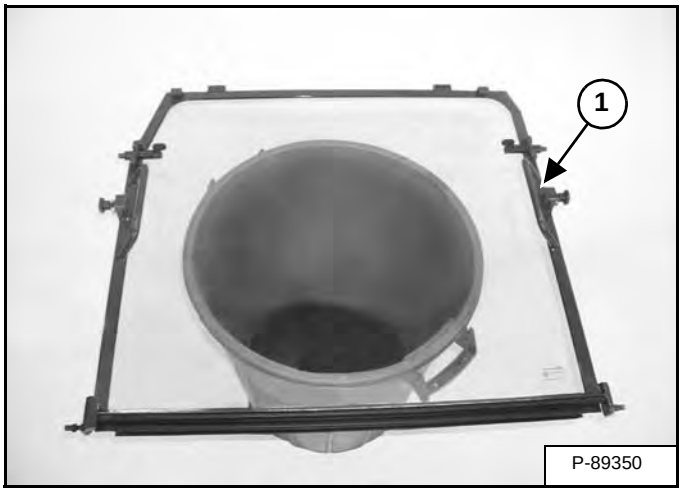
Figure 40-30-57



Apply a 6,4 X 9,5 mm (0.25 X 0.375 in) triangle shaped bead of urethane adhesive (Item 1) **[Figure 40-30-57]** around the front window / door frame.

Apply the adhesive directly on top of the old adhesive.

Figure 40-30-58



Place the frame (Item 1) **[Figure 40-30-58]** on the glass. The frame must be centered on the glass, and the glass must not have direct contact with the front window / door frame.

IMPORTANT

If the glass has direct contact with the metal frame, the glass may break due to machine vibration.

I-2236-0105

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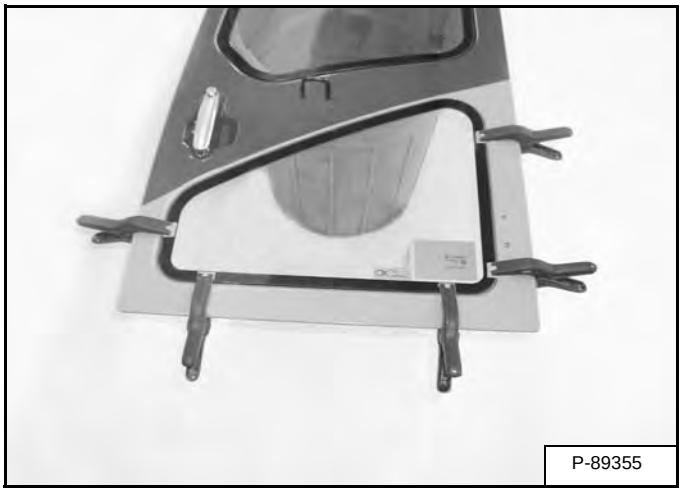
Glass Installation (Cont'd)

Door And Front Window Glass (Cont'd)

Figure 40-30-59



Figure 40-30-60



Clamp the frame and glass together **[Figure 40-30-59]** and **[Figure 40-30-60]**.

Place the clamps over the rubber bumpers on the frame.

Allow the adhesive to cure for a minimum of twelve hours at 70° F and 20% relative humidity before removing the clamps.

Install the front window / door on the excavator. (See the correct Service Manual for installation procedure)

Install the wiper assembly on the front window. (See the correct Service Manual for installation procedure)

IMPORTANT

If the glass has direct contact with the metal frame, the glass may break due to machine vibration.

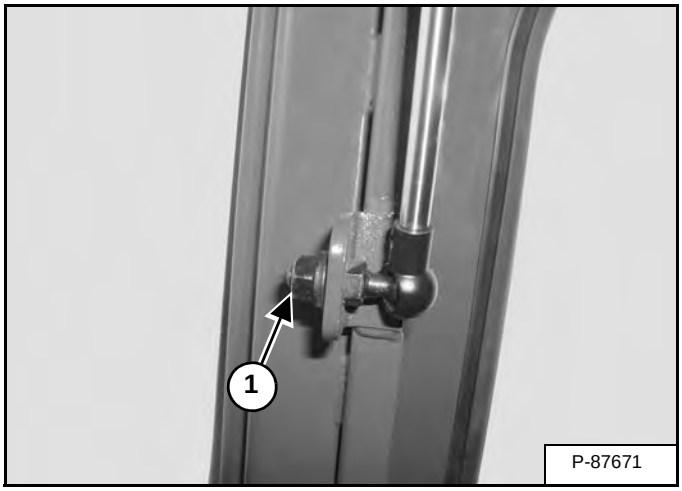
I-2236-0105

Dealer Copy -- Not for Resale

Front Window Strut Removal And Installation

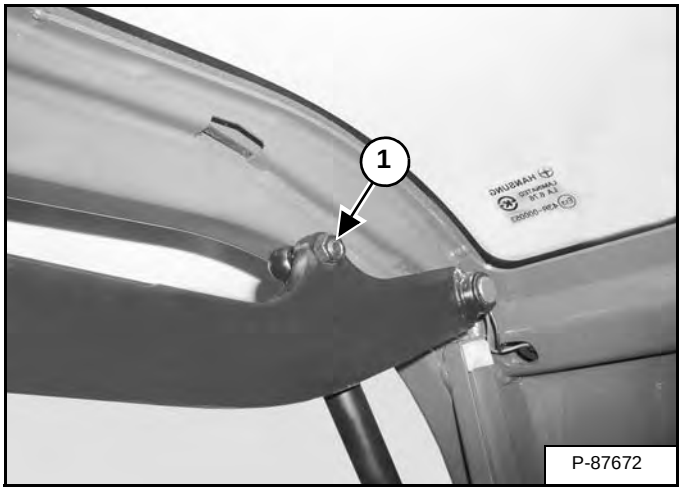
Remove the front window. (See Front Window Removal And Installation on Page 40-30-12.)

Figure 40-30-61



Remove the nut (Item 1) **[Figure 40-30-61]** from the bottom of the strut.

Figure 40-30-62



Remove the nut (Item 1) **[Figure 40-30-62]** from the top of the strut.

Remove the strut.

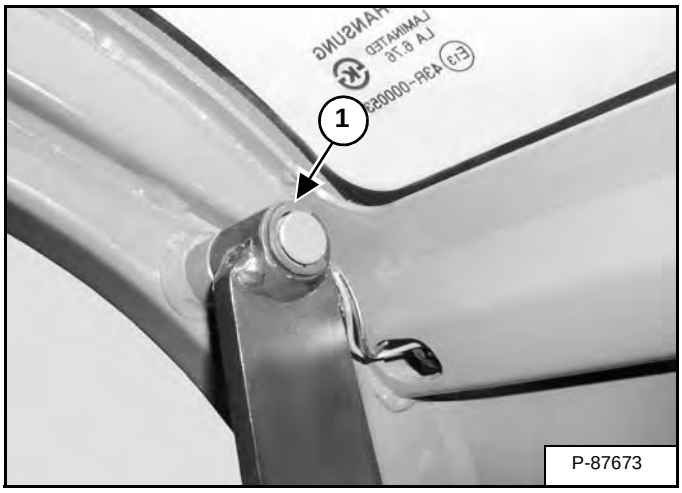
Dealer Copy -- Not for Resale

Front Window Slide Bar Removal And Installation

Remove the front window. (See Front Window Removal And Installation on Page 40-30-12.)

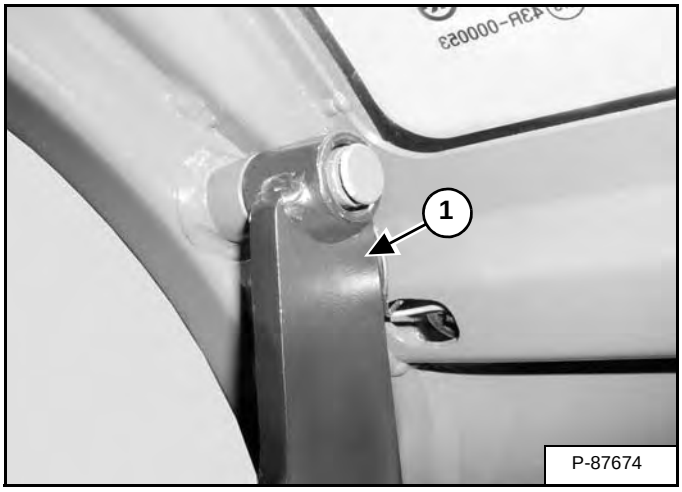
Remove the front window strut. (See Front Window Strut Removal And Installation on Page 40-30-19.)

Figure 40-30-63



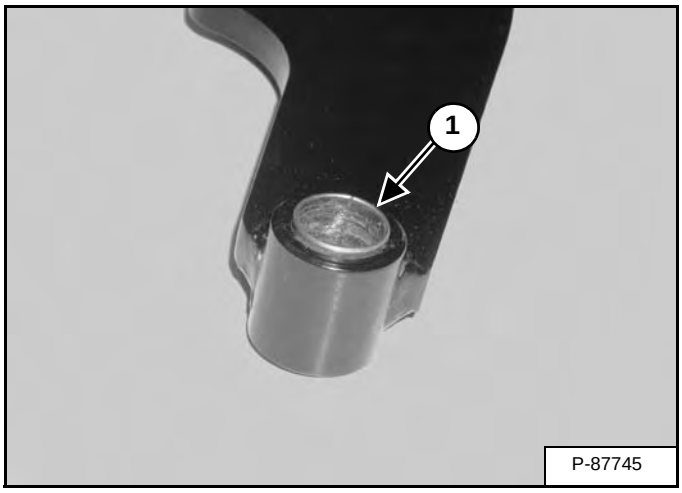
Remove the C-clip (Item 1) **[Figure 40-30-63]**.

Figure 40-30-64



Remove the slide bar (Item 1) **[Figure 40-30-64]**.

Figure 40-30-65



Remove the bushing (Item 1) **[Figure 40-30-65]** from the side bar.

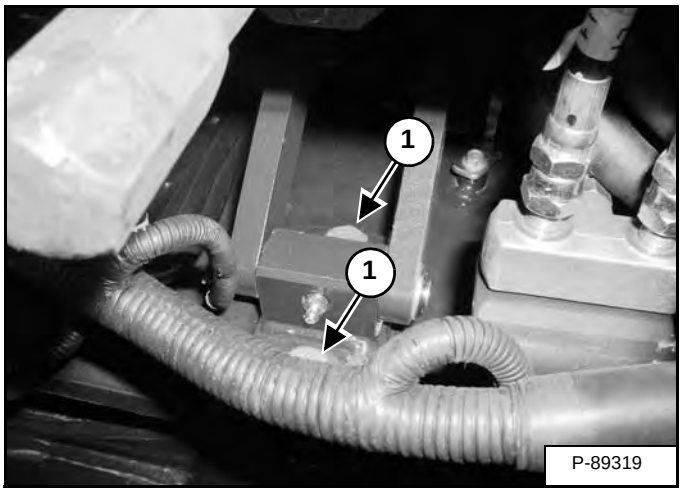
Dealer Copy -- Not for Resale

Cab Tilt Assembly Removal And Installation

Remove the floor mat. (See Removal And Installation on Page 40-100-1.)

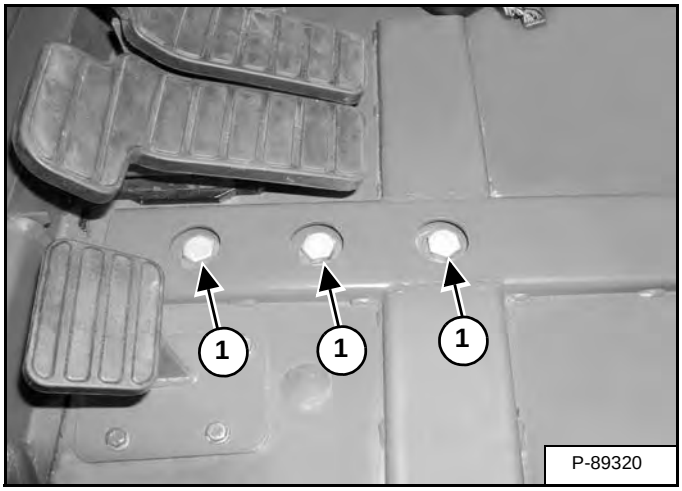
Remove the left upperstructure side cover. (See Removal And Installation on Page 40-20-1.)

Figure 40-30-66



Remove the bolts (Item 1) **[Figure 40-30-66]**.

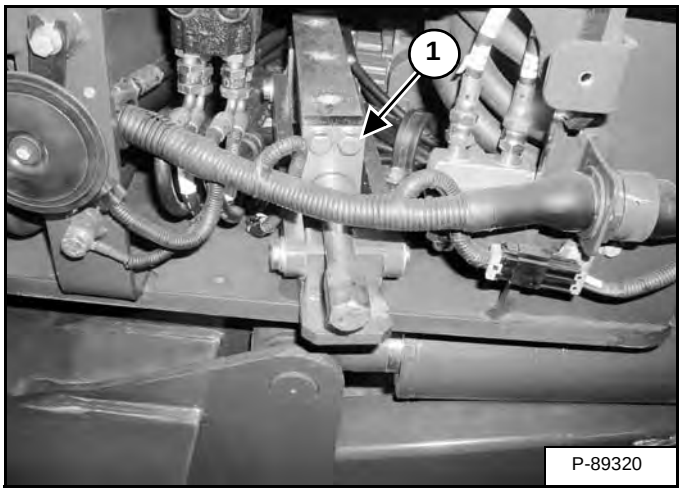
Figure 40-30-67



Support the assembly and remove the bolts (Item 1) **[Figure 40-30-67]**.

Support the tilt assembly when removing the last bolt.

Figure 40-30-68

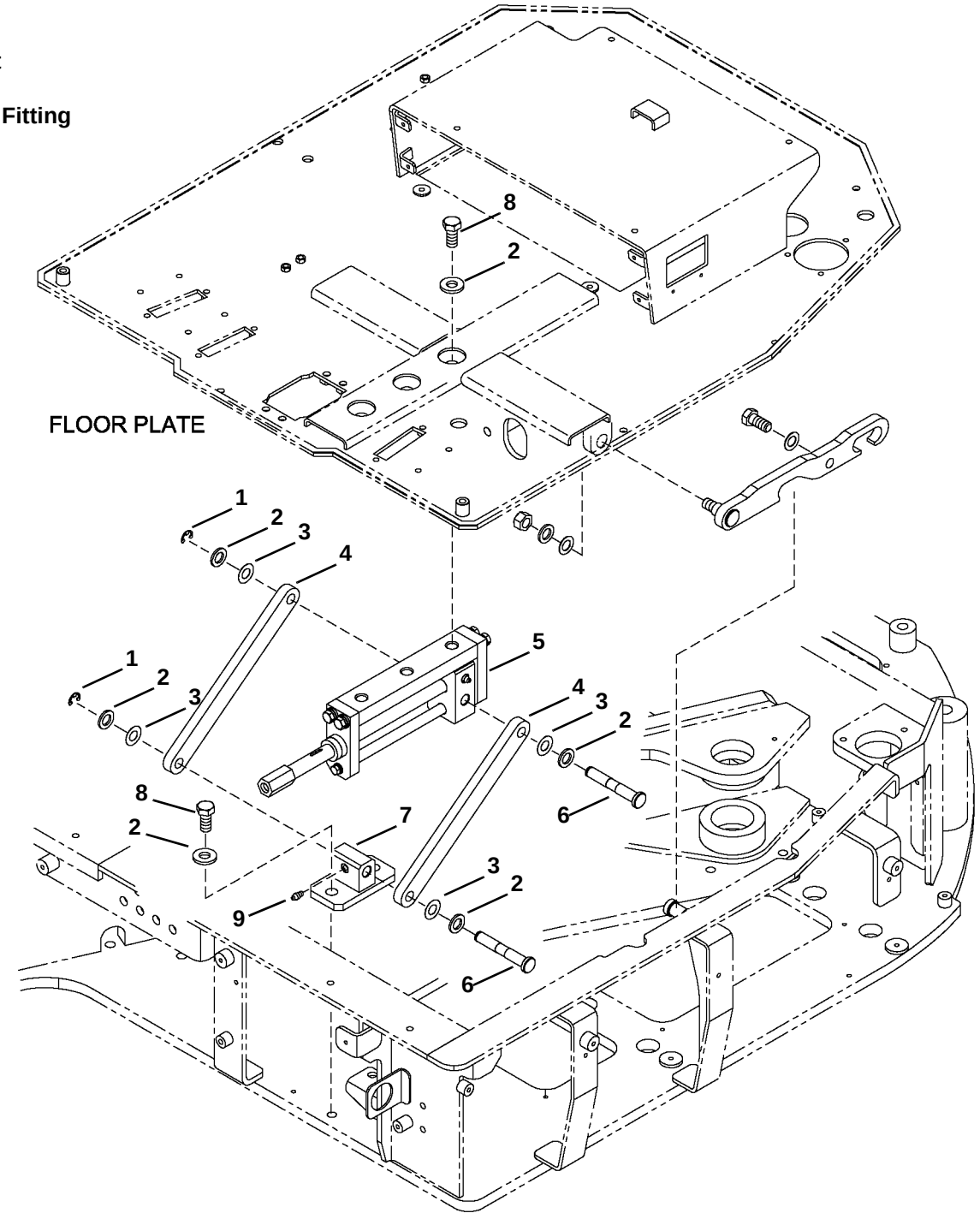


Remove the tilt assembly (Item 1) **[Figure 40-30-68]**.

Dealer Copy -- Not for Resale

Cab Tilt Parts Identification

1. Clip
2. Washer
3. Shim
4. Link
5. Plate
6. Pin
7. Bracket
8. Bolt
9. Grease Fitting

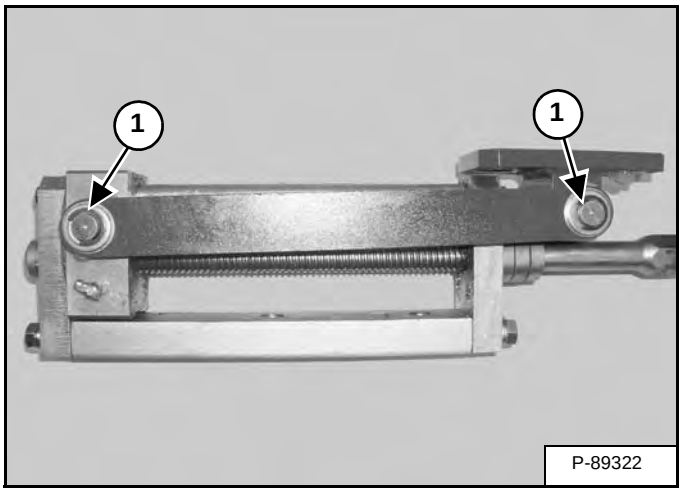


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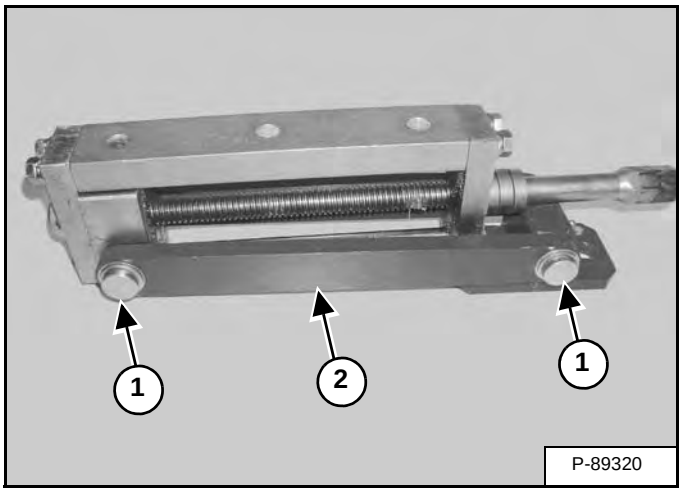
Cab Tilt Assembly Disassembly And Assembly

Figure 40-30-69



Remove the clips (Item 1) **[Figure 40-30-69]** and washers.

Figure 40-30-70



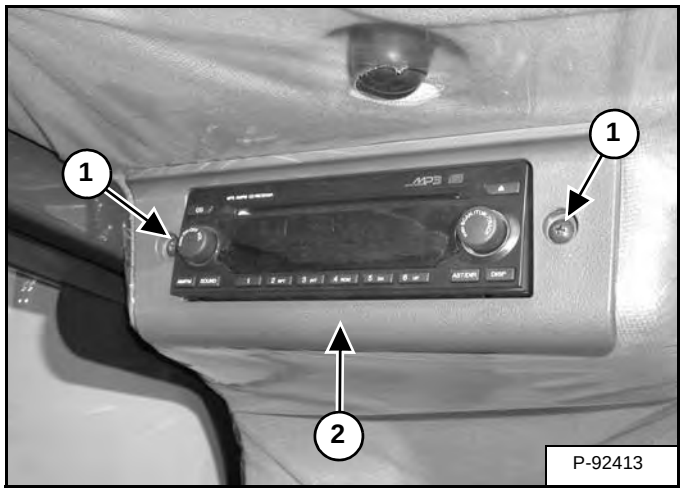
Remove the pins (Item 1) **[Figure 40-30-70]** and washers.

Remove the links (Item 2) **[Figure 40-30-70]**.

Dealer Copy -- Not for Resale

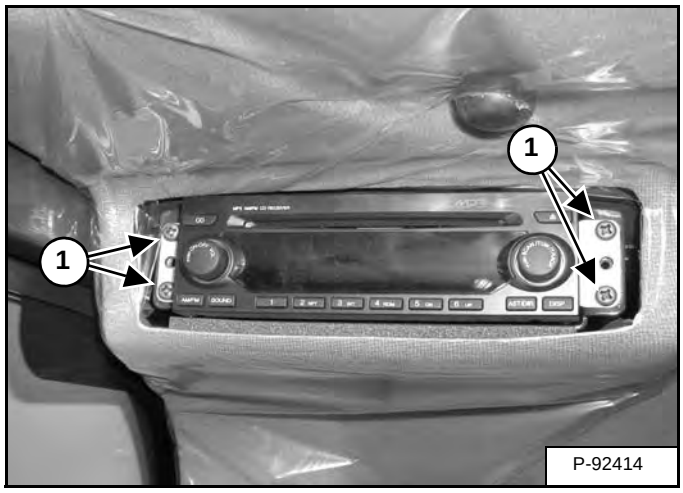
Headliner Removal And Installation

Figure 40-30-71



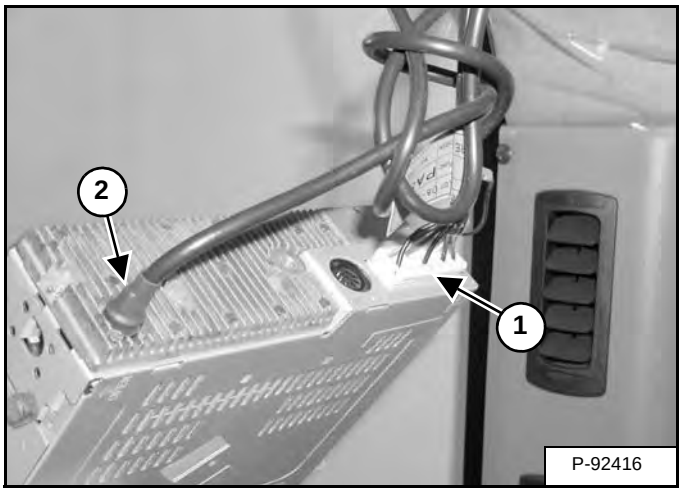
Remove the screws (Item 1) and faceplate (Item 2) **[Figure 40-30-71]**.

Figure 40-30-72



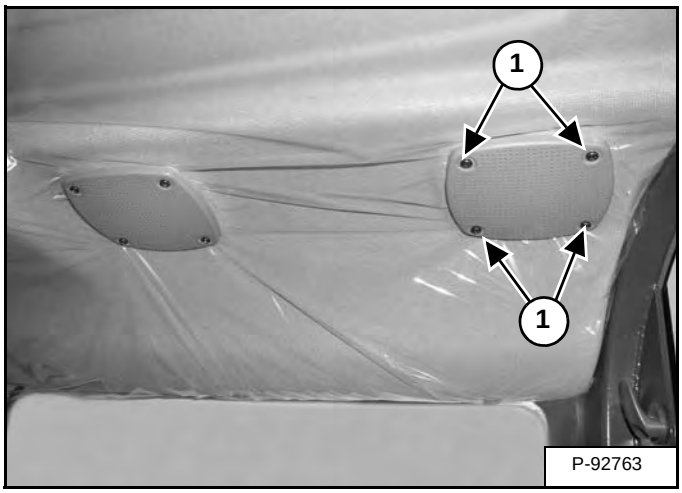
Remove the mounting screws for the radio (if equipped) (Item 1) **[Figure 40-30-72]**.

Figure 40-30-73



Slide the radio (if equipped) out of the opening and disconnect the radio harness (Item 1) and antenna cable (Item 2) **[Figure 40-30-73]**.

Figure 40-30-74

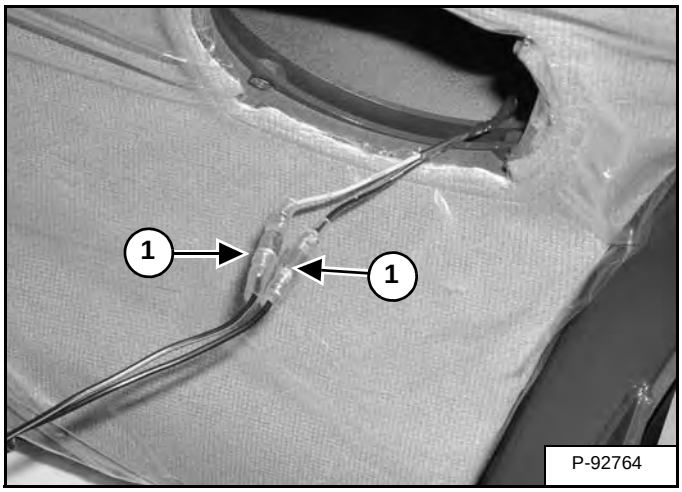


Remove the screws (Item 1) **[Figure 40-30-74]**.

Dealer Copy -- Not for Resale

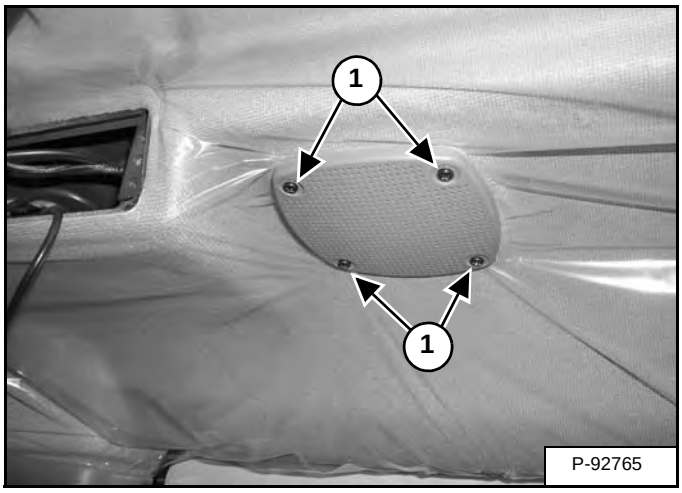
Headliner Removal And Installation (Cont'd)

Figure 40-30-75



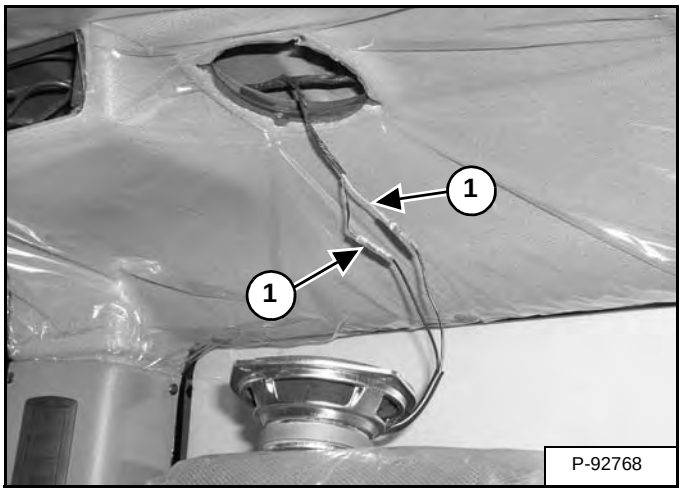
Remove the speaker (if equipped) from the headliner and disconnect the wires (Item 1) **[Figure 40-30-75]**.

Figure 40-30-76



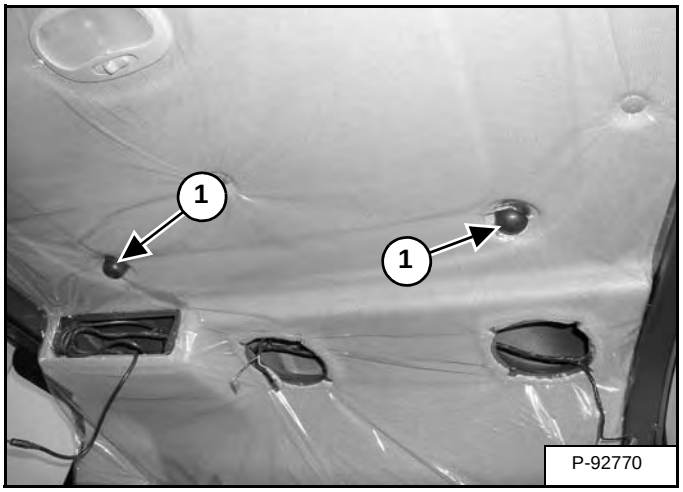
Remove the screws (Item 1) **[Figure 40-30-76]**.

Figure 40-30-77



Remove the speaker (if equipped) from the headliner and disconnect the wires (Item 1) **[Figure 40-30-77]**.

Figure 40-30-78

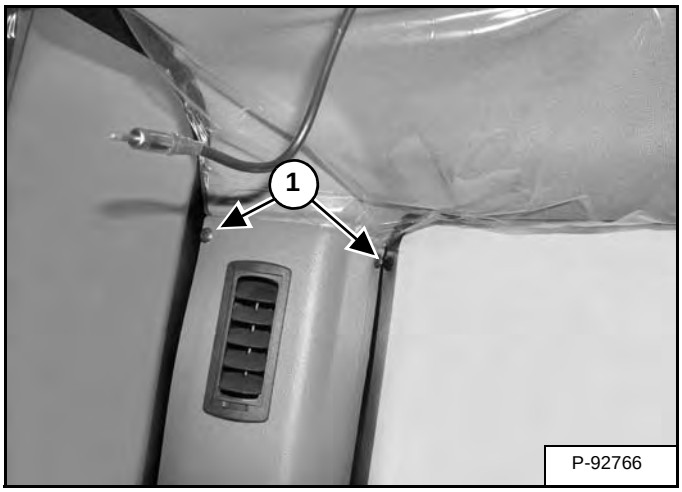


Remove the front window bumpers (Item 1) **[Figure 40-30-78]**.

Dealer Copy -- Not for Resale

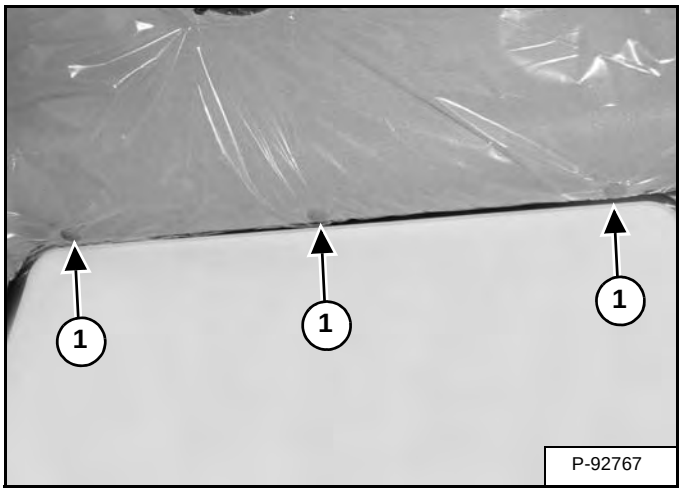
Headliner Removal And Installation (Cont'd)

Figure 40-30-79



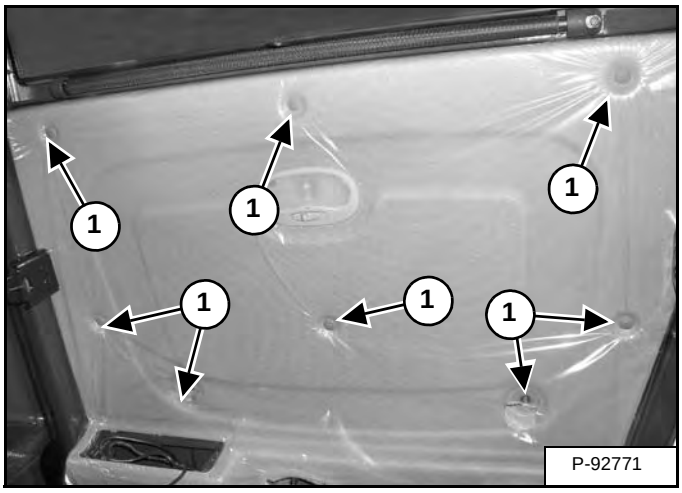
Remove the screws (Item 1) **[Figure 40-30-79]**.

Figure 40-30-80



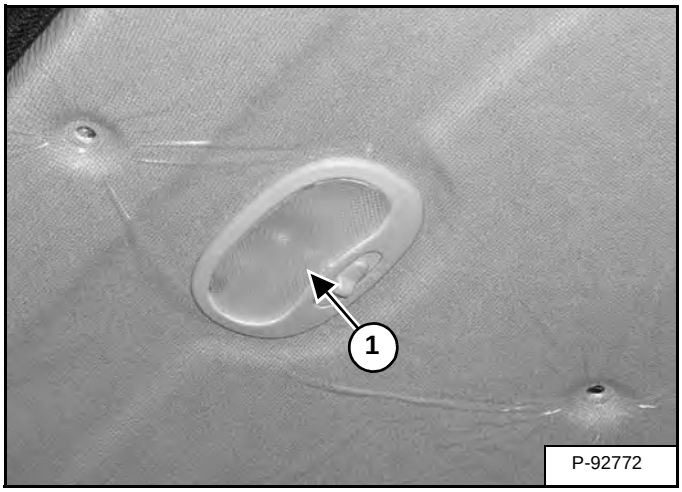
Remove the screws (Item 1) **[Figure 40-30-80]**.

Figure 40-30-81



Remove the remaining screws (Item 1) **[Figure 40-30-81]**.

Figure 40-30-82

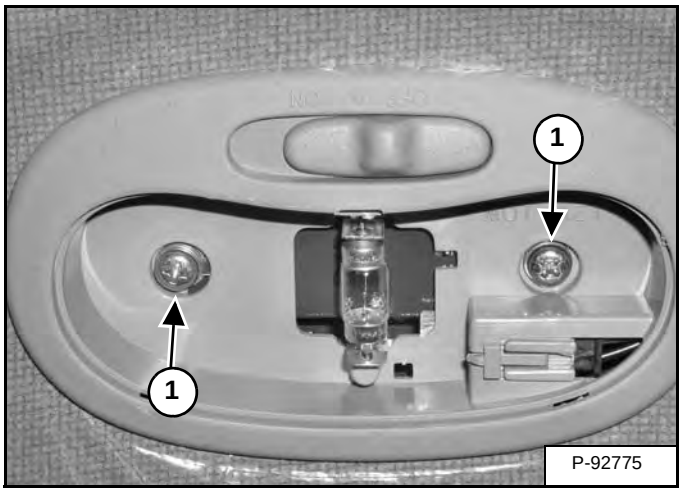


Remove the dome light lens (Item 1) **[Figure 40-30-82]**.

Dealer Copy -- Not for Resale

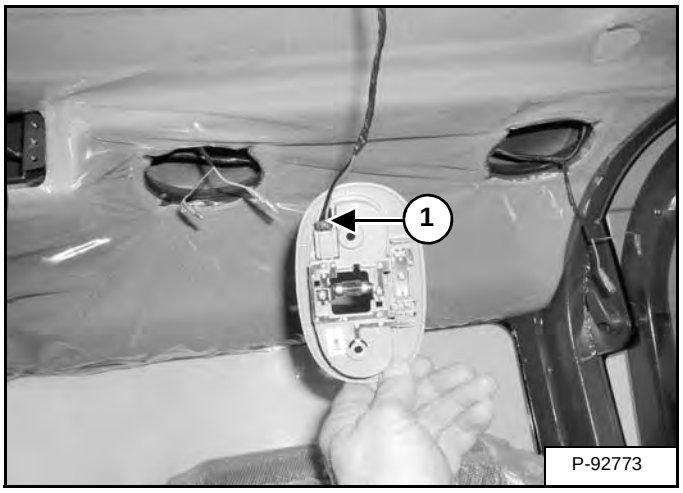
Headliner Removal And Installation (Cont'd)

Figure 40-30-83



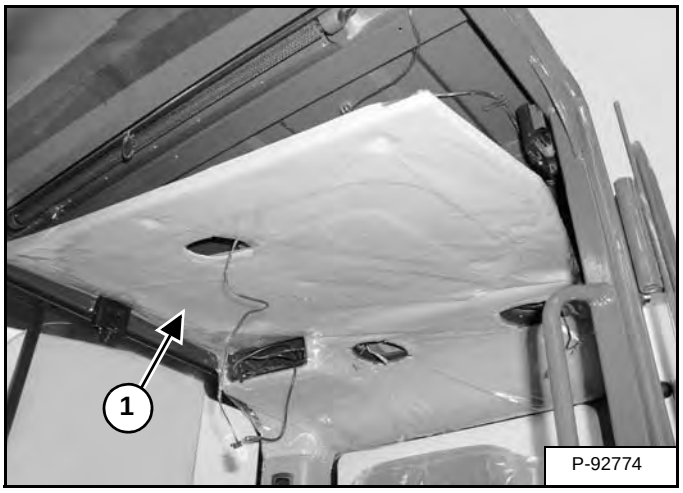
Remove the screws (Item 1) **[Figure 40-30-83]**.

Figure 40-30-84



Remove the dome light and disconnect the electrical connector (Item 1) **[Figure 40-30-84]**.

Figure 40-30-85



Remove the headliner (Item 1) **[Figure 40-30-85]**.

Dealer Copy -- Not for Resale



Dealer Copy -- Not for Resale

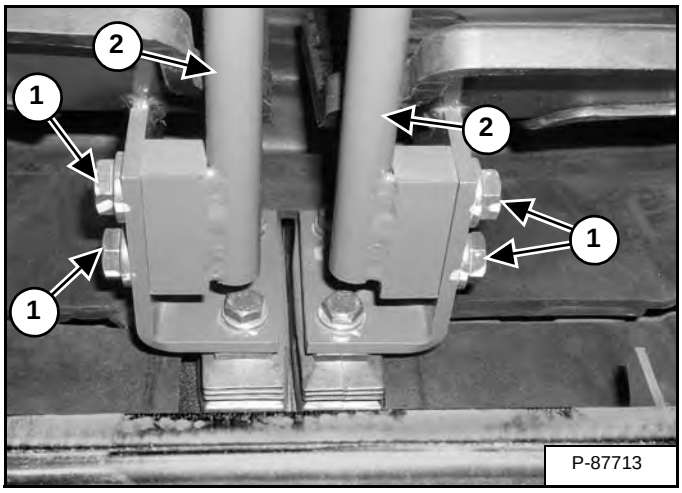
SEAT

Seat Removal And Installation

Open the upper front window. (See Front Window on Page 10-30-2.)

Remove the lower front window. (See Lower Front Window Removal And Installation on Page 40-30-13.)

Figure 40-40-1



Remove the bolts (Item 1) and travel control levers (Item 2) **[Figure 40-40-1]**.

Figure 40-40-2

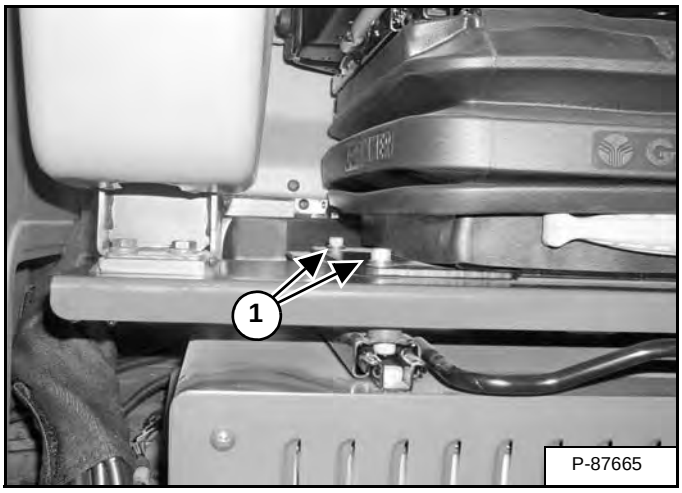
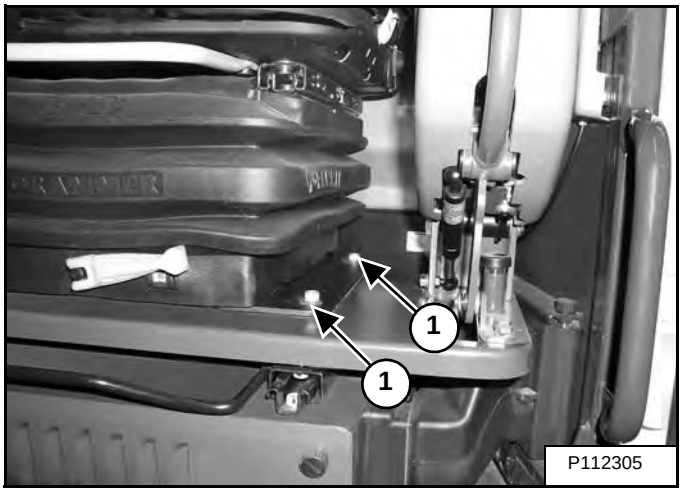


Figure 40-40-3



Remove the bolts (Item 1) **[Figure 40-40-2]** and **[Figure 40-40-3]**.

Remove the seat through the front of the cab.

Dealer Copy -- Not for Resale

Seat Mount Removal And Installation

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

Figure 40-40-4

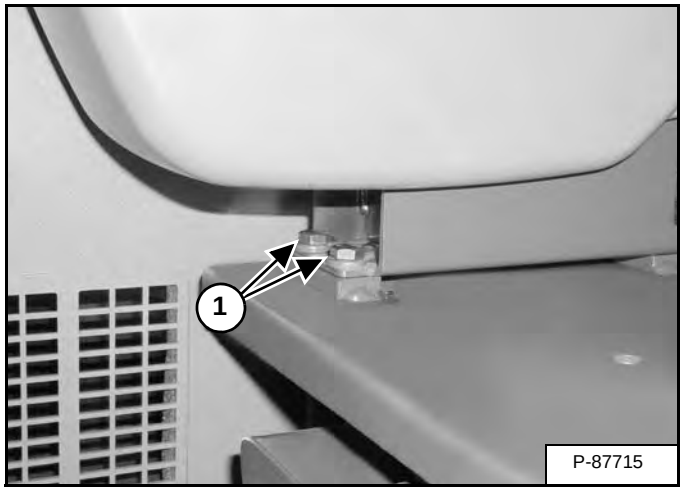
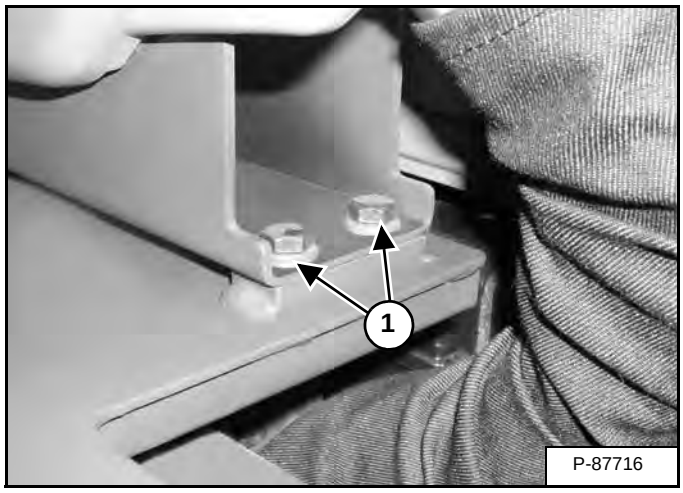


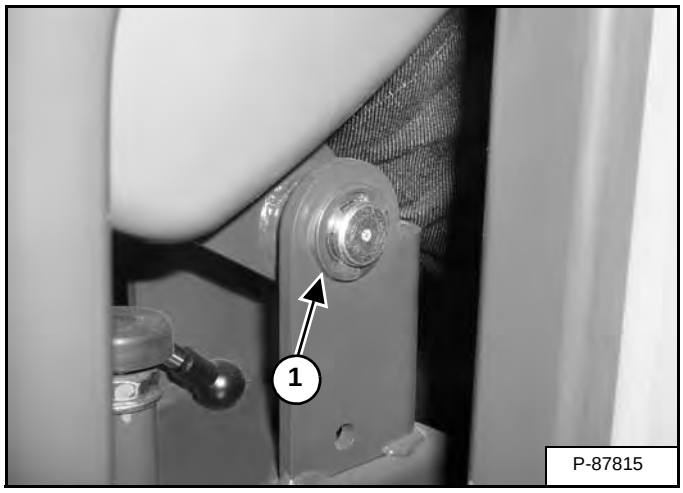
Figure 40-40-5



Remove the bolts (Item 1) **[Figure 40-40-4]** and **[Figure 40-40-5]** from the right console.

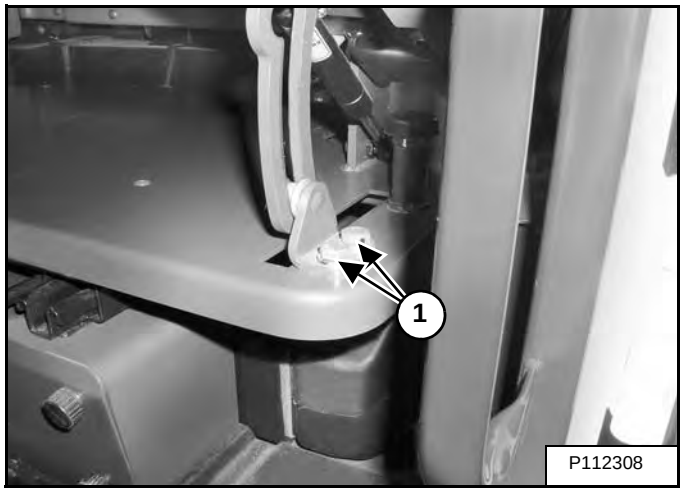
Lay the console off to the side.

Figure 40-40-6



Remove the C-clip (Item 1) **[Figure 40-40-6]** from the left console.

Figure 40-40-7

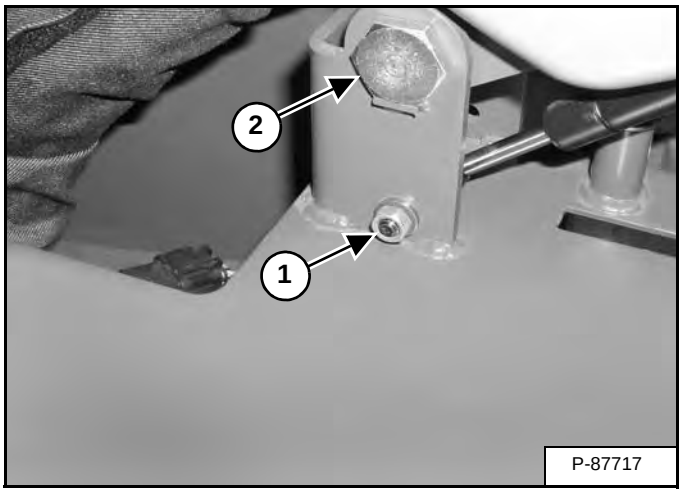


Remove the bolts (Item 1) **[Figure 40-40-7]**.

Dealer Copy -- Not for Resale

Seat Mount Removal And Installation (Cont'd)

Figure 40-40-8



Remove the nut (Item 1) and pin (Item 2) **[Figure 40-40-8]**.

Figure 40-40-9

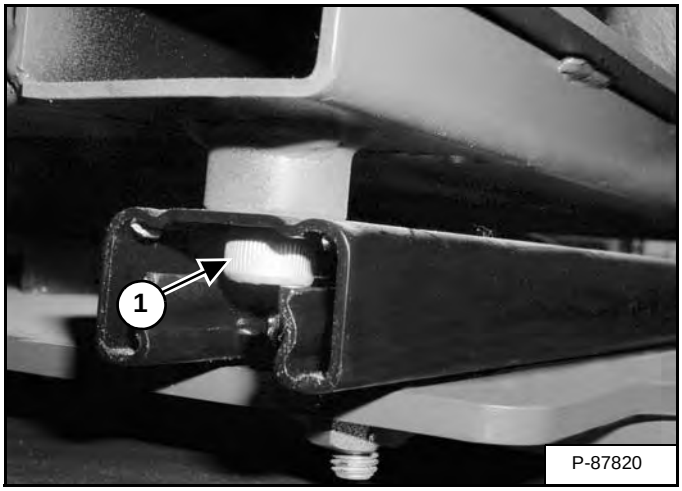
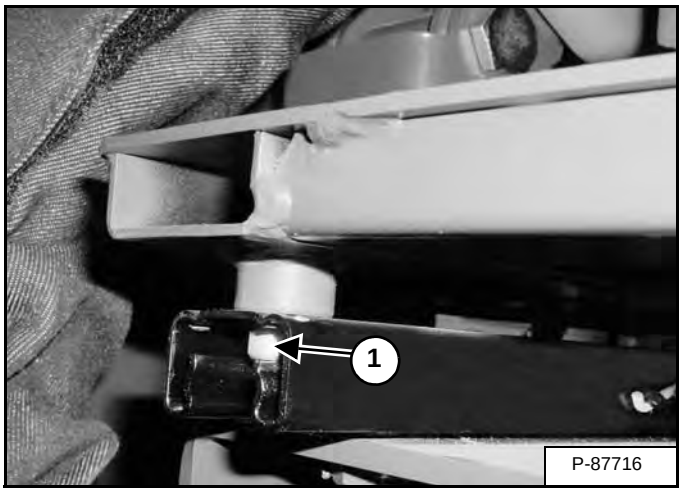


Figure 40-40-10



Slide the seat mount to the rear and remove the bolts (Item 1) **[Figure 40-40-9]** and **[Figure 40-40-10]**.

Figure 40-40-11

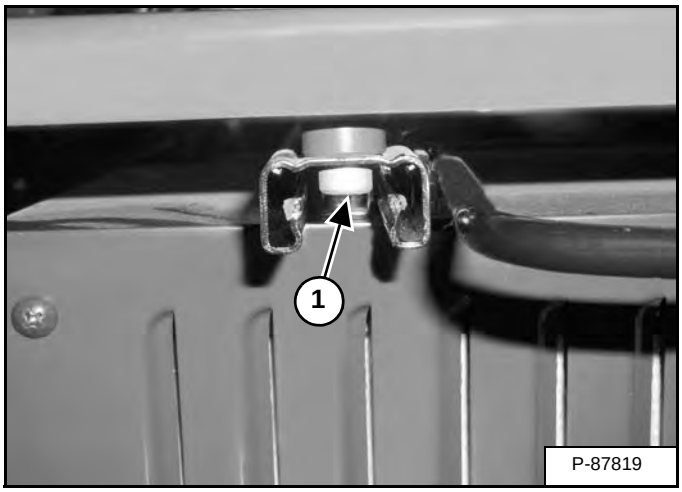
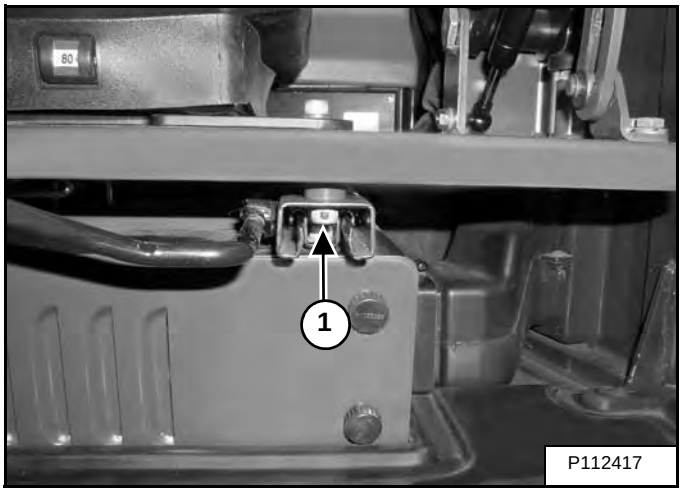


Figure 40-40-12



Slide the seat mount forward and remove the bolts (Item 1) **[Figure 40-40-11]** and **[Figure 40-40-12]**.

Remove the seat mount.

Dealer Copy -- Not for Resale

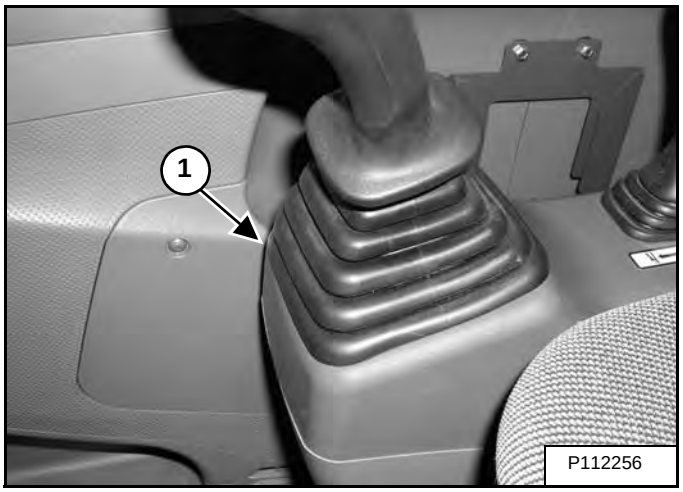


Dealer Copy -- Not for Resale

RIGHT CONSOLE

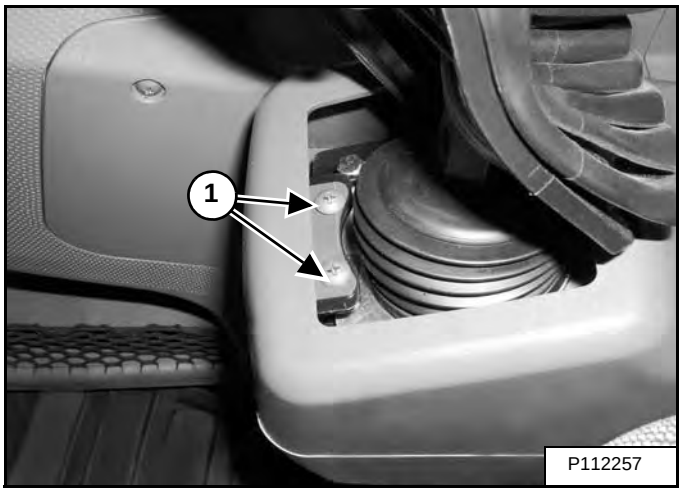
Console Cover Removal And Installation

Figure 40-50-1



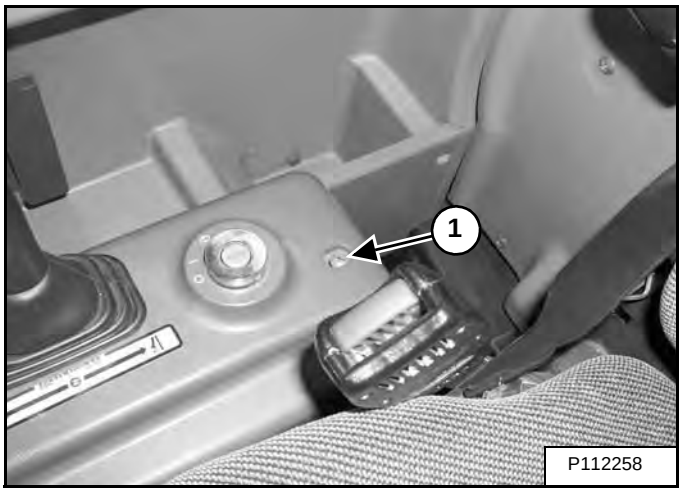
Pull the dust boot (Item 1) **[Figure 40-50-1]** towards the rear of the cab.

Figure 40-50-2



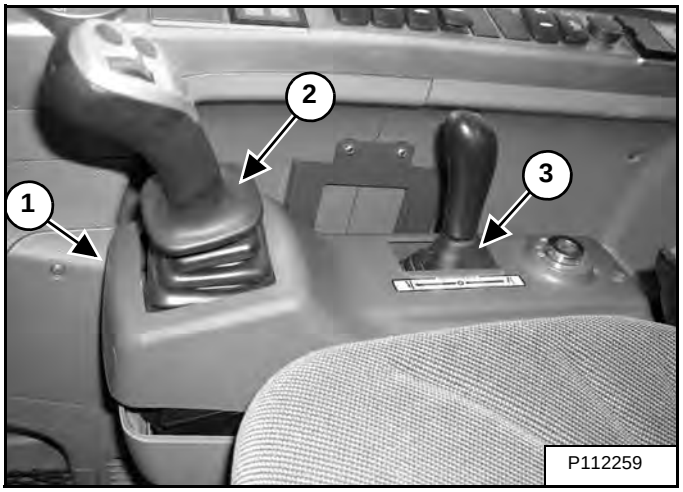
Remove the screws (Item 1) **[Figure 40-50-2]**.

Figure 40-50-3



Remove the screw (Item 1) **[Figure 40-50-3]** from the rear of the cover.

Figure 40-50-4

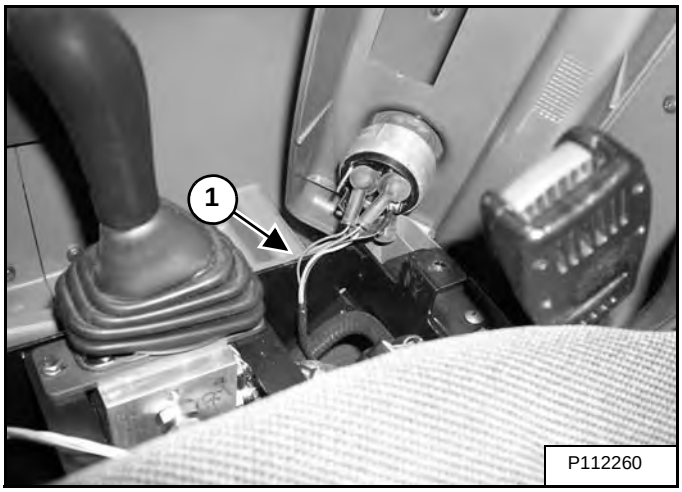


Lift the cover (Item 1) up until the cover is free of the joystick dust boot (Item 2) and blade lever dust boot (Item 3) **[Figure 40-50-4]**.

Dealer Copy -- Not for Resale

Console Cover Removal And Installation (Cont'd)

Figure 40-50-5



Tilt the cover towards the rear of the cab and disconnect the wire harness (Item 1) **[Figure 40-50-5]**.

Remove the cover.

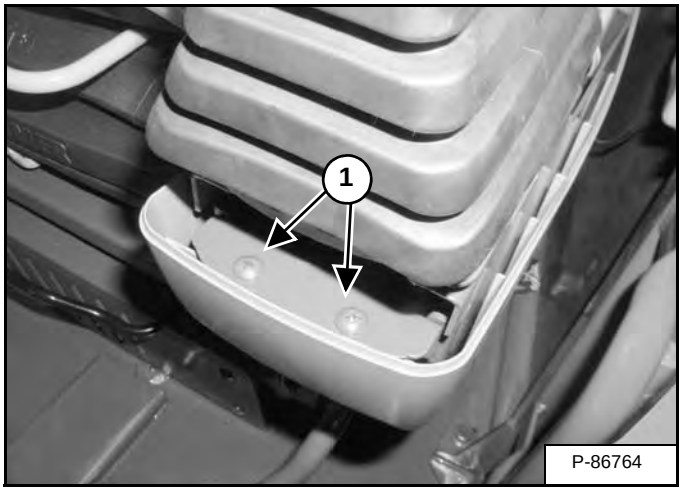
Dealer Copy -- Not for Resale

LEFT CONSOLE

Lower Console Cover Removal And Installation

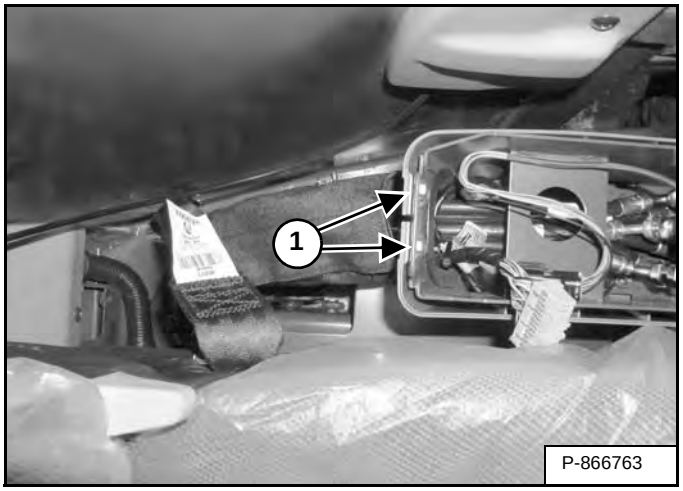
Remove the upper console cover. (See Upper Console Cover Removal And Installation on Page 40-60-2.)

Figure 40-60-1



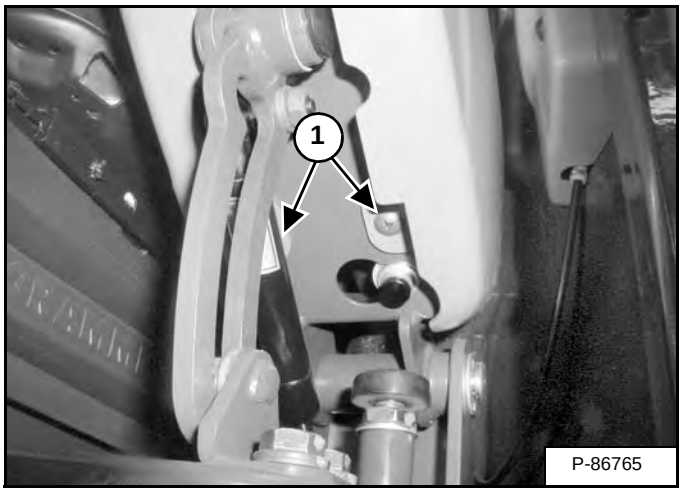
Remove the two screws (Item 1) **[Figure 40-60-1]** from the front of the cover.

Figure 40-60-2



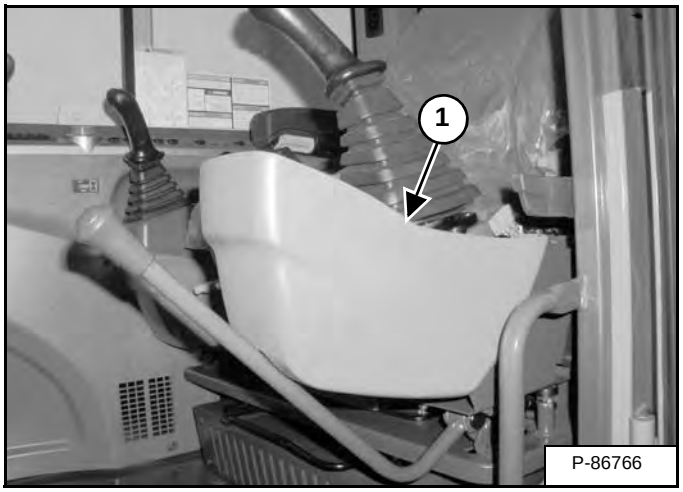
Remove the two screws (Item 1) **[Figure 40-60-2]** from the rear of the cover.

Figure 40-60-3



Raise the console and remove the two screws (Item 1) **[Figure 40-60-3]** from the bottom of the cover.

Figure 40-60-4

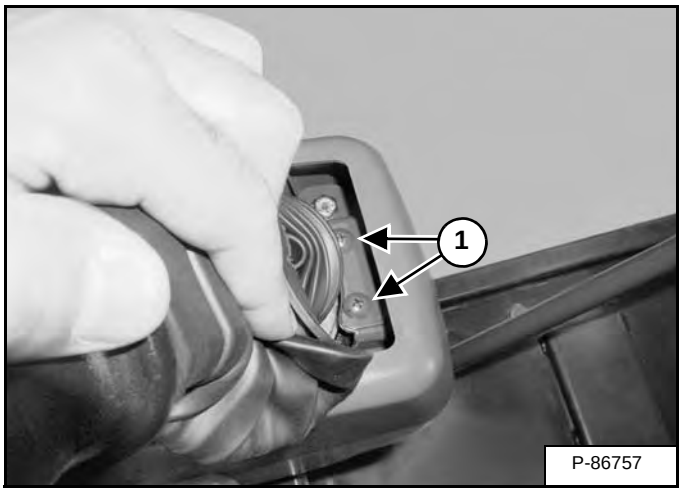


Lower the console and remove the cover (Item 1) **[Figure 40-60-4]**.

Dealer Copy -- Not for Resale

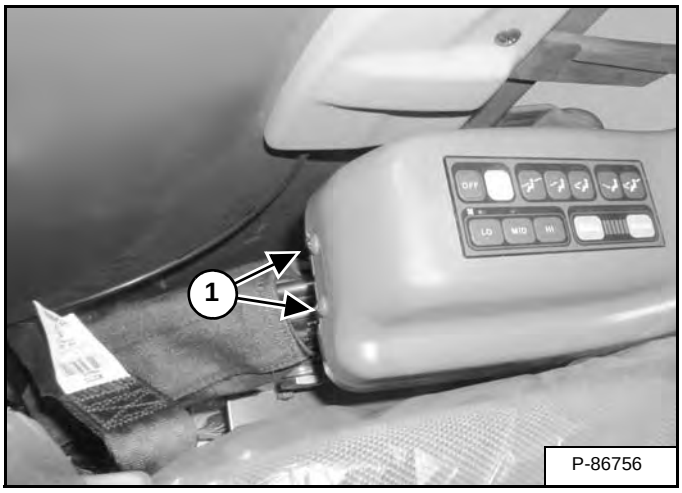
Upper Console Cover Removal And Installation

Figure 40-60-5



Pull the dust boot towards the rear of the cab and remove the two screws (Item 1) **[Figure 40-60-5]**.

Figure 40-60-6



Remove the two screws (Item 1) **[Figure 40-60-6]** from the rear of the cover.

Figure 40-60-7



Tilt the cover towards the rear of the cab and disconnect the wire harness (Item 1) **[Figure 40-60-7]**.

Remove the cover.

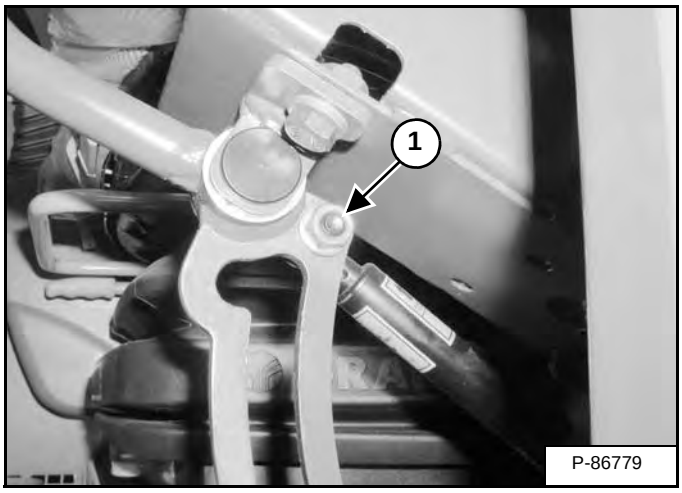
Dealer Copy -- Not for Resale

Gas Strut Removal And Installation

Remove the upper console cover. (See Upper Console Cover Removal And Installation on Page 40-60-2.)

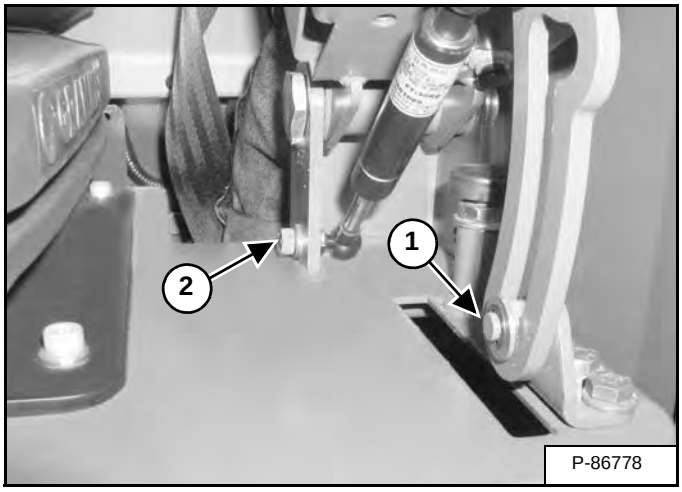
Remove the lower console cover. (See Lower Console Cover Removal And Installation on Page 40-60-1.)

Figure 40-60-8



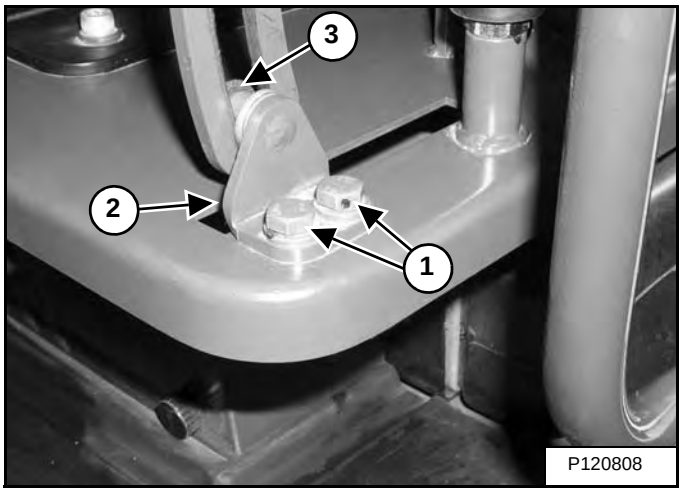
Remove the nut (Item 1) **[Figure 40-60-8]**.

Figure 40-60-9



Remove the snap ring (Item 1) and washer. Remove the nut (Item 2) **[Figure 40-60-9]**.

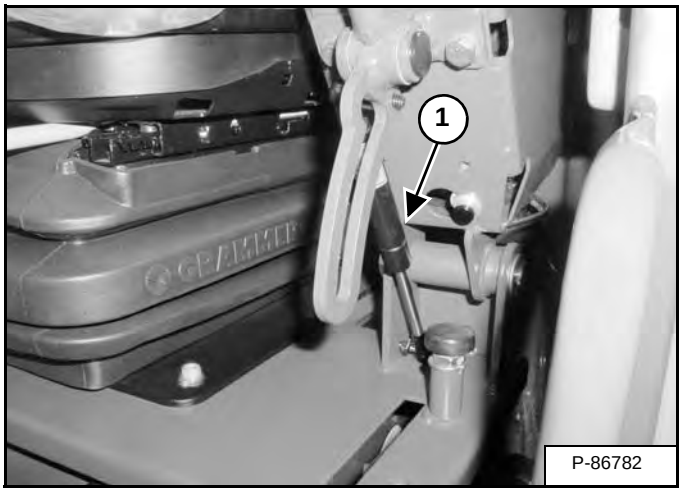
Figure 40-60-10



Remove the two bolts (Item 1), mount (Item 2) and bushing (Item 3) **[Figure 40-60-10]**.

NOTE: Loosen and remove the bolts evenly until the gas strut is fully extended.

Figure 40-60-11



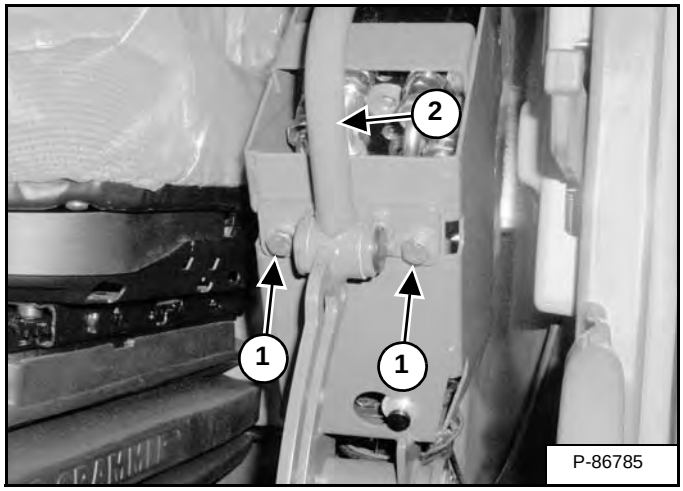
Support the console and remove the gas strut (Item 1) **[Figure 40-60-11]**.

Dealer Copy -- Not for Resale

Lock Lever Removal And Installation

Remove the gas strut (See Gas Strut Removal And Installation on Page 40-60-3.)

Figure 40-60-12

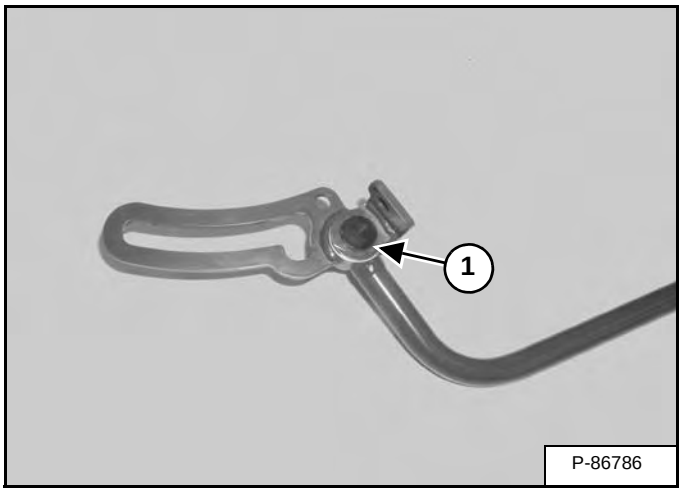


Remove the bolts (Item 1) and lever (Item 2) **[Figure 40-60-12]**.

Dealer Copy -- Not for Resale

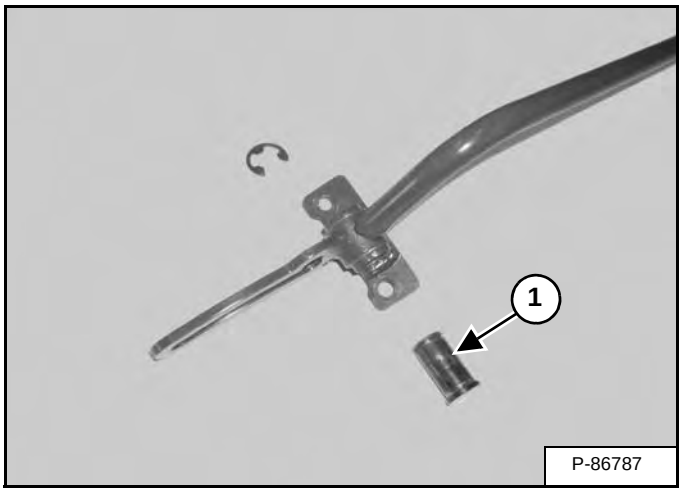
Lock Lever Disassembly And Assembly

Figure 40-60-13



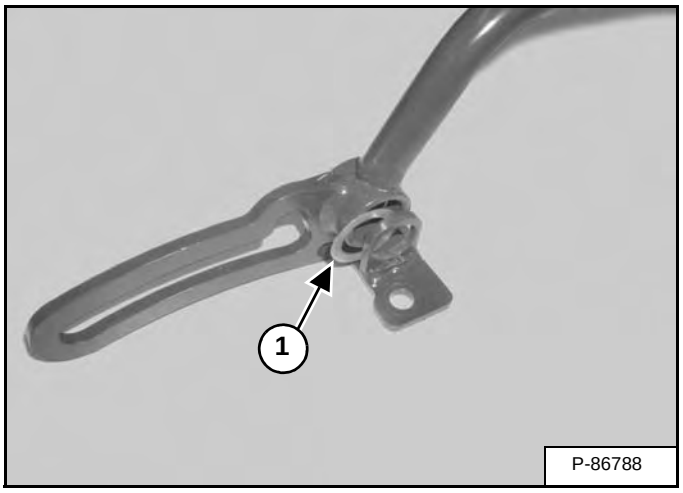
Remove the snap ring (Item 1) **[Figure 40-60-13]**.

Figure 40-60-14



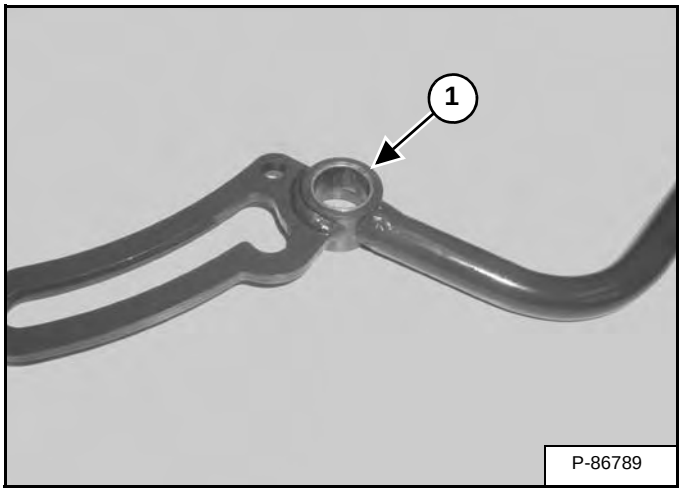
Remove the pin (Item 1) **[Figure 40-60-14]**.

Figure 40-60-15



Remove the shims (Item 1) **[Figure 40-60-15]** from both sides of the lever.

Figure 40-60-16



Remove the bushing (Item 1) **[Figure 40-60-16]** from the lever.

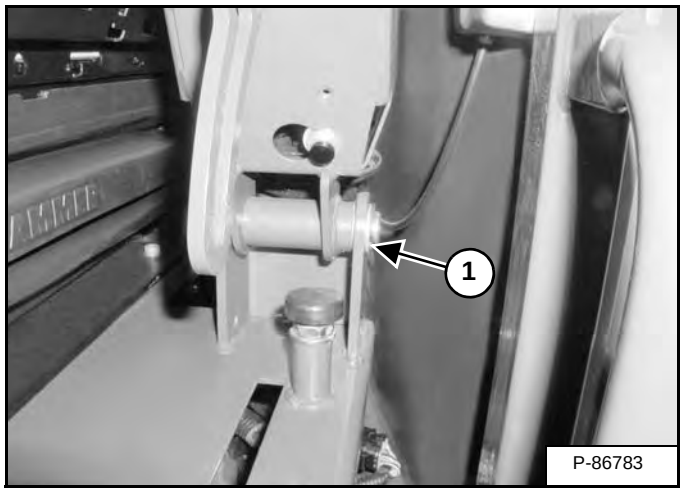
Dealer Copy -- Not for Resale

Console Removal And Installation

Remove the left joystick. (See Joystick Assembly Removal And Installation on Page 20-120-4.)

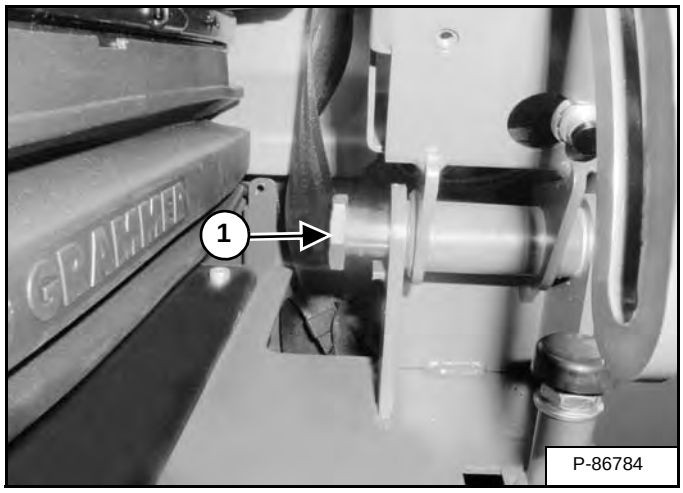
Remove the gas strut. (See Gas Strut Removal And Installation on Page 40-60-3.)

Figure 40-60-17



Remove the snap ring (Item 1) **[Figure 40-60-17]** and washer.

Figure 40-60-18



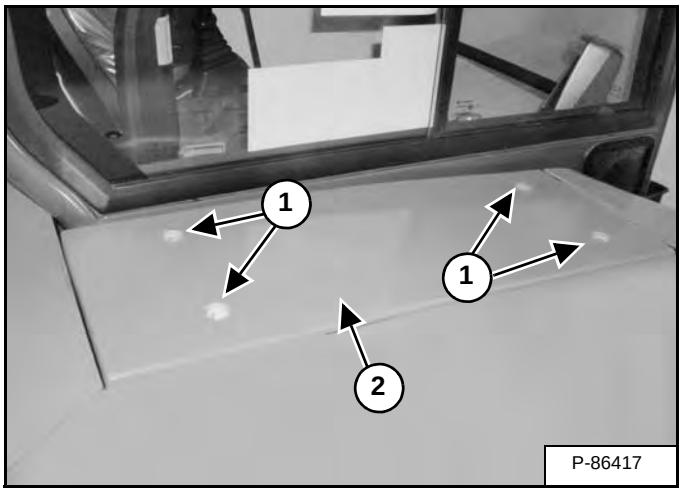
Remove the pin (Item 1) **[Figure 40-60-18]** and remove the console.

Dealer Copy -- Not for Resale

CENTER COVER

Removal And Installation

Figure 40-70-1



Remove the four bolts (Item 1) and the cover (Item 2) **[Figure 40-70-1]**.

Dealer Copy -- Not for Resale



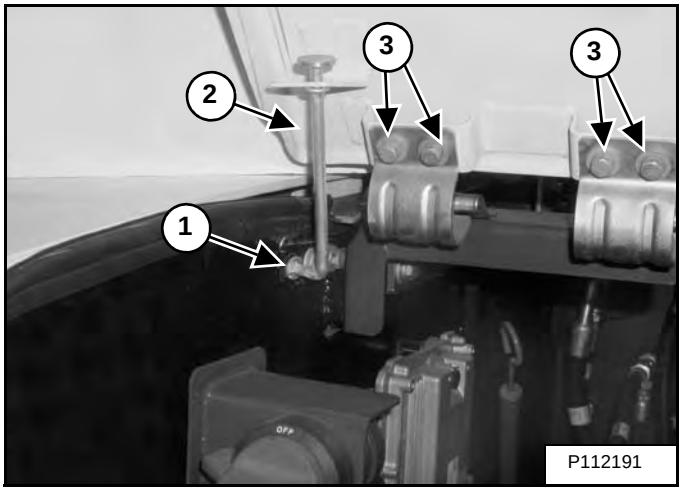
Dealer Copy -- Not for Resale

CENTER ACCESS COVER

Removal And Installation

Open the cover.

Figure 40-80-1



Remove the clip (Item 1) and remove the prop rod (Item 2) from the bracket. Remove the bolts (Item 3) **[Figure 40-80-1]** and cover.

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Dealer Copy -- Not for Resale

COUNTERWEIGHT

Removal And Installation

Tilt the cab. (See Raising And Lowering on Page 10-210-1.)

Remove the rear cover. (See Removal And Installation on Page 40-190-1.)

Figure 40-90-1

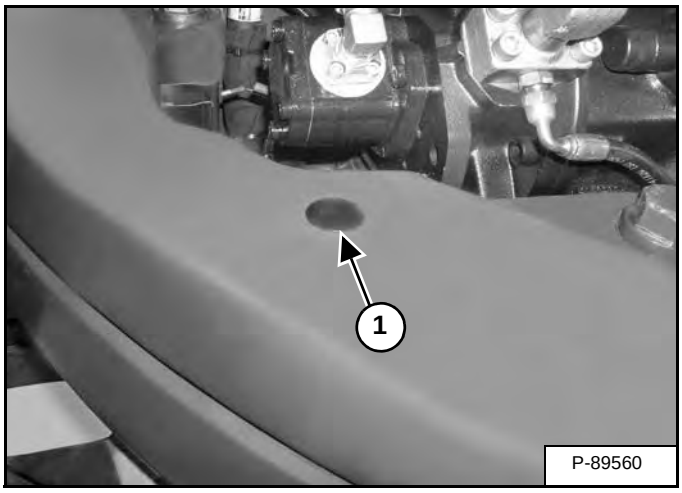
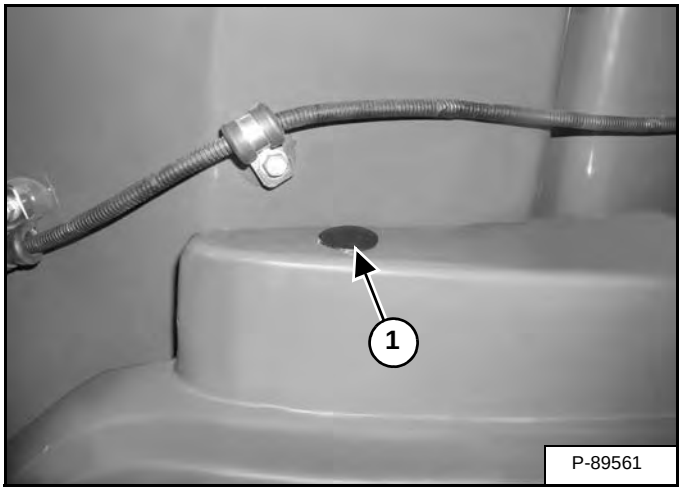


Figure 40-90-2



Remove the two plugs (Item 1) **[Figure 40-90-1]** and **[Figure 40-90-2]**.

Figure 40-90-3

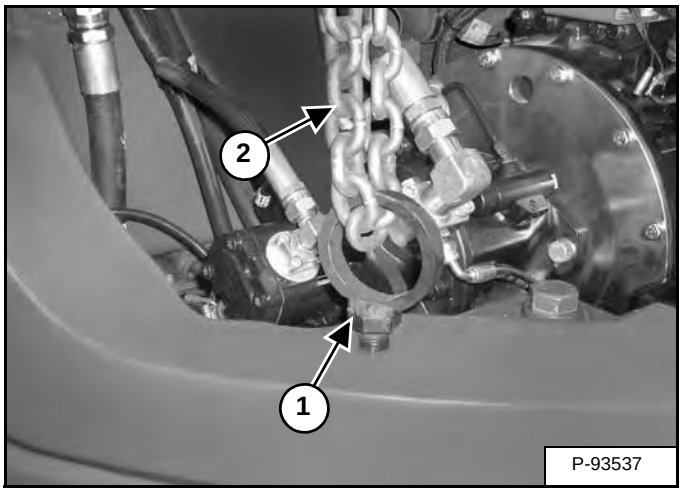
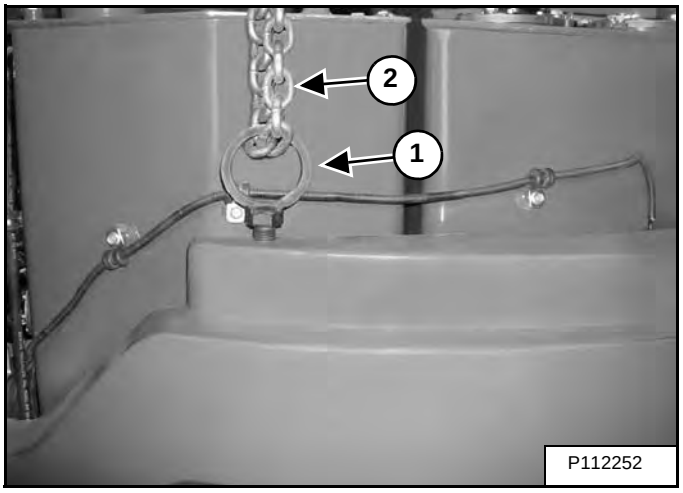


Figure 40-90-4



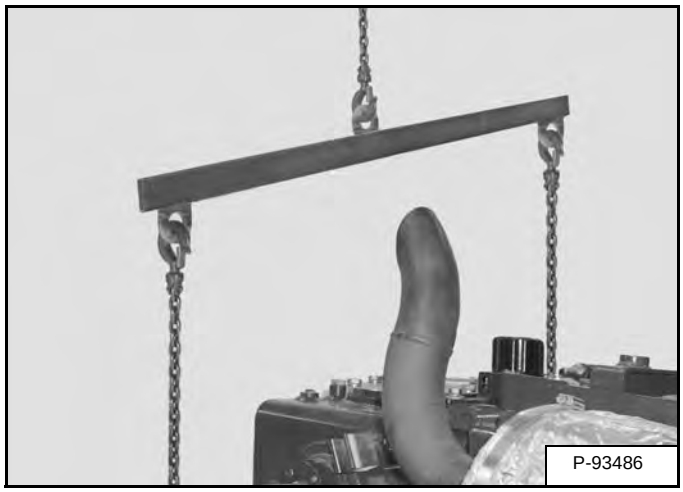
Install lifting rings (Item 1) and chains (Item 2) **[Figure 40-90-3]** and **[Figure 40-90-4]**.

Dealer Copy -- Not for Resale

COUNTERWEIGHT (CONT'D)

Removal And Installation (Cont'd)

Figure 40-90-5



Install a lifting device to the lifting chains **[Figure 40-90-5]**.

NOTE: The counterweight weighs 1274 kg (2806 lb). Use a lifting device of sufficient capacity. Raise the hoist until the weight of the counterweight is supported by the hoist.

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2202-0607

Figure 40-90-6

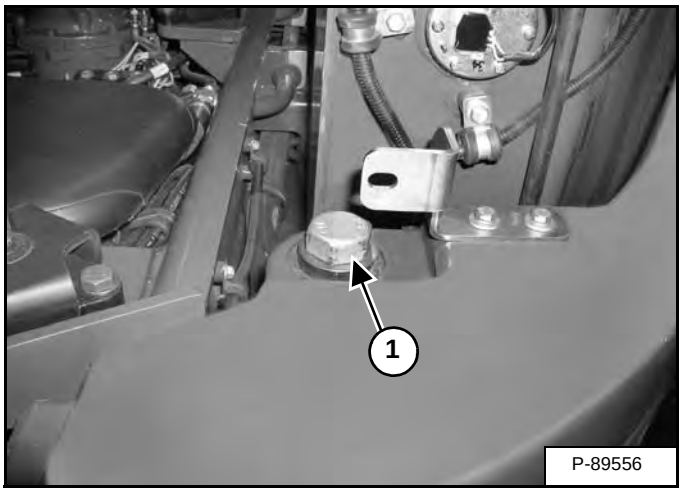


Figure 40-90-7

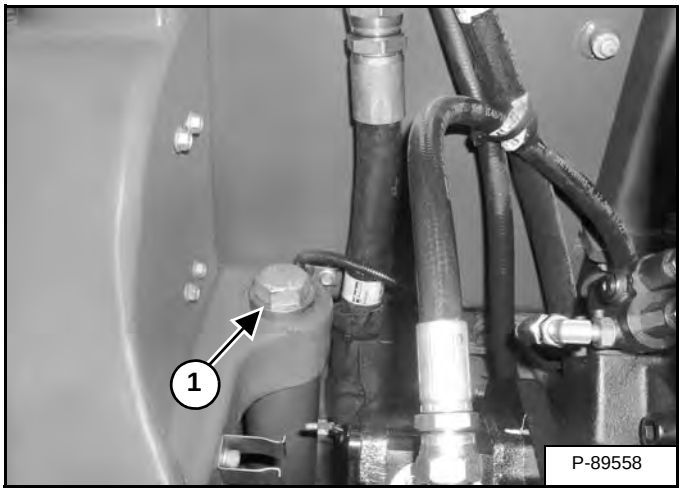
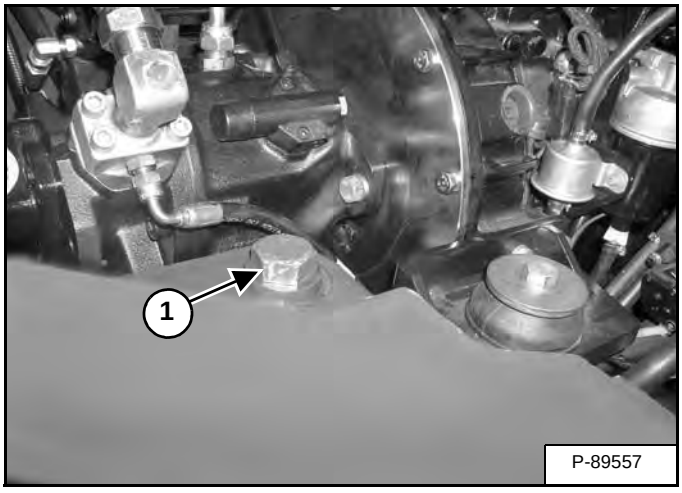


Figure 40-90-8



Remove the bolts (Item 1) **[Figure 40-90-6]**, **[Figure 40-90-7]** and **[Figure 40-90-8]**.

Installation: Tighten the bolts to 1372 N•m (1010 ft-lb) torque.

Remove the counterweight.

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FLOOR MAT

Removal And Installation

Figure 40-100-1

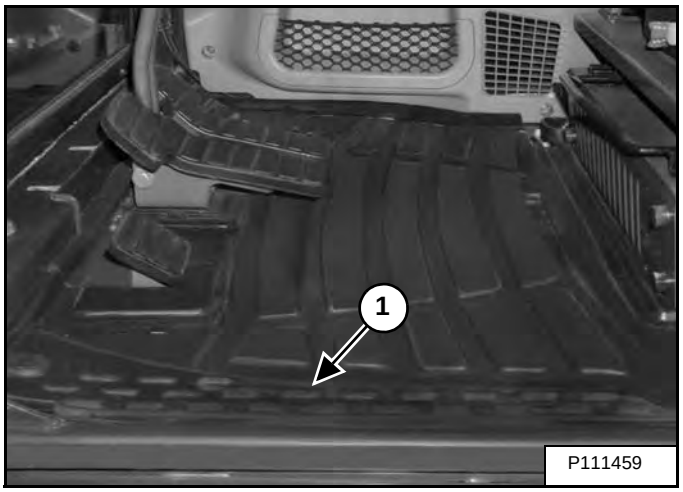
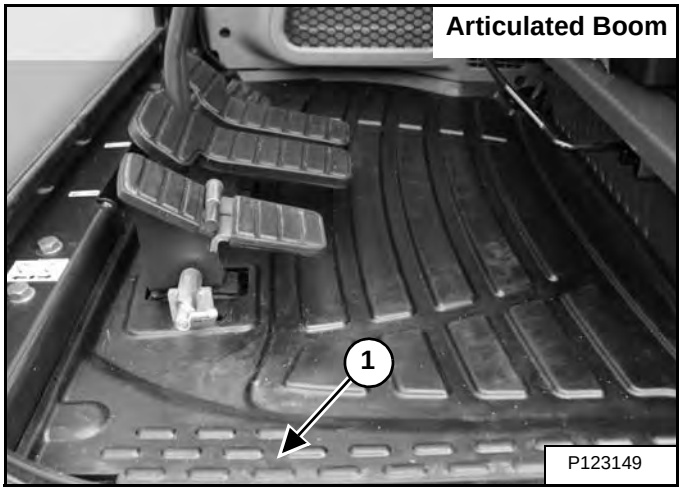


Figure 40-100-2



Pull up on and remove the floor mat (Item 1) **[Figure 40-100-1]** or **[Figure 40-100-2]**.

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Dealer Copy -- Not for Resale

FUEL TANK

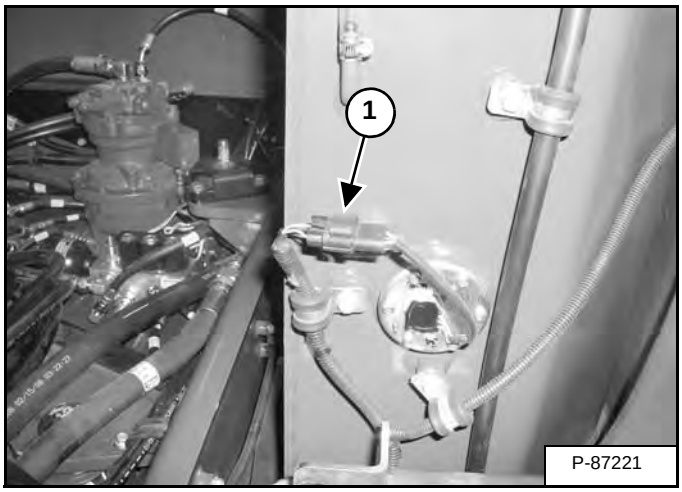
Removal And Installation

Remove the rear cover. (See Removal And Installation on Page 40-190-1.)

Drain the fuel tank.

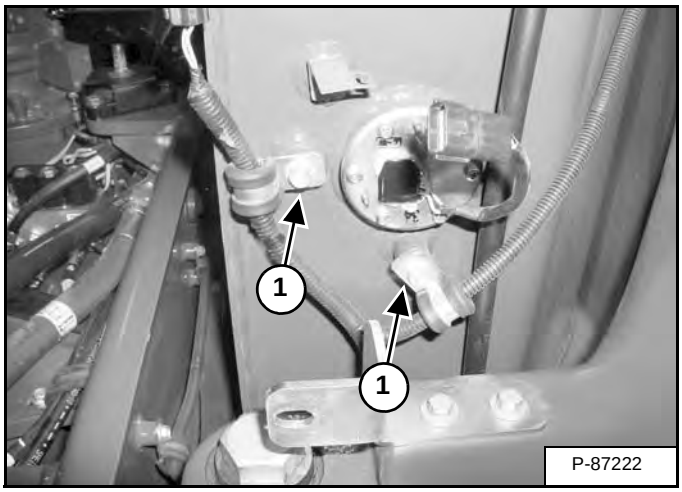
Open the right side cover.

Figure 40-110-1



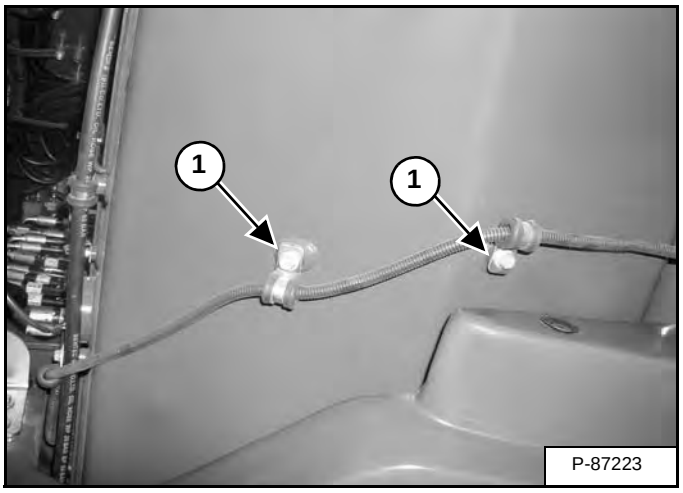
Disconnect the fuel sending unit wire harness (Item 1) **[Figure 40-110-1]**.

Figure 40-110-2



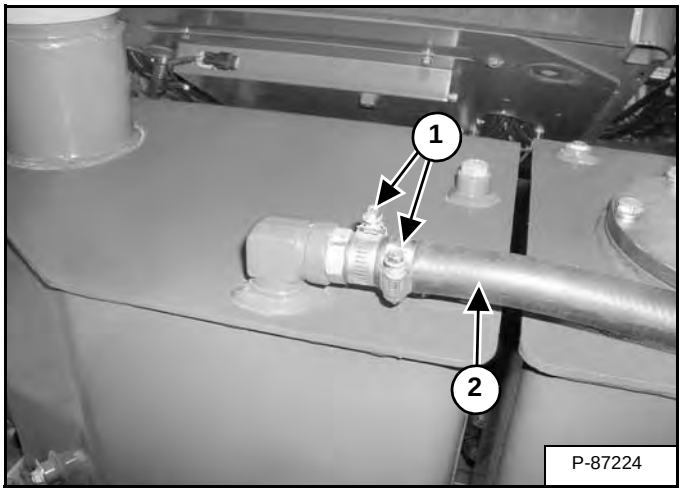
Remove the two bolts (Item 1) **[Figure 40-110-2]**.

Figure 40-110-3



Remove the bolts (Item 1) **[Figure 40-110-3]** and reposition the wire harness.

Figure 40-110-4

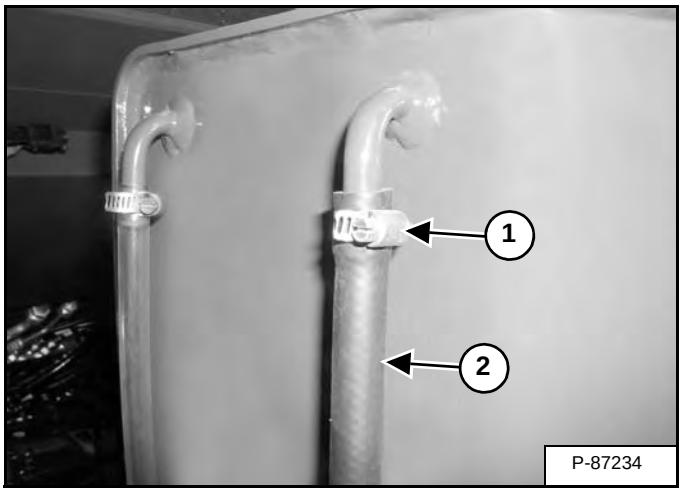


Loosen the hose clamps (Item 1) and remove the hose (Item 2) **[Figure 40-110-4]** from the top of the fuel tank.

Dealer Copy -- Not for Resale

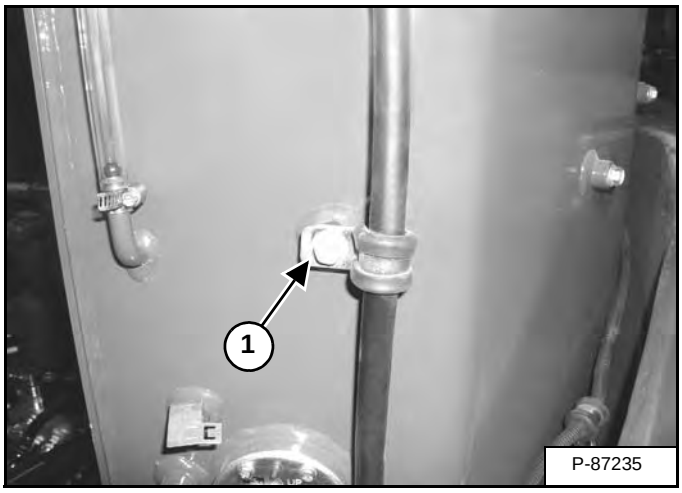
Removal And Installation (Cont'd)

Figure 40-110-5



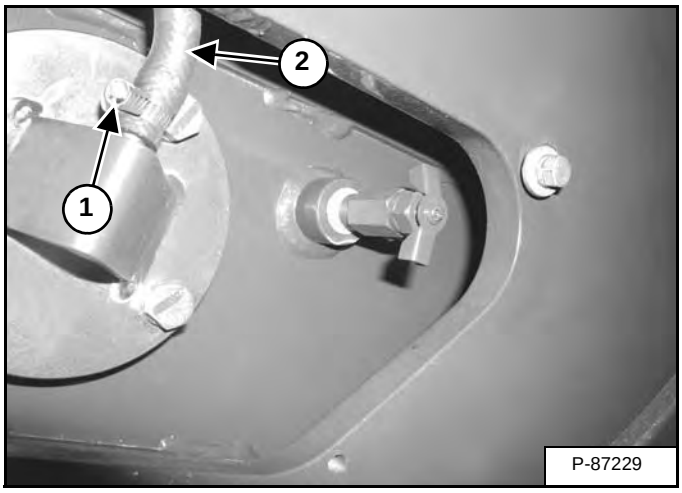
Loosen the hose clamp (Item 1) and remove the hose (Item 2) **[Figure 40-110-5]**.

Figure 40-110-6



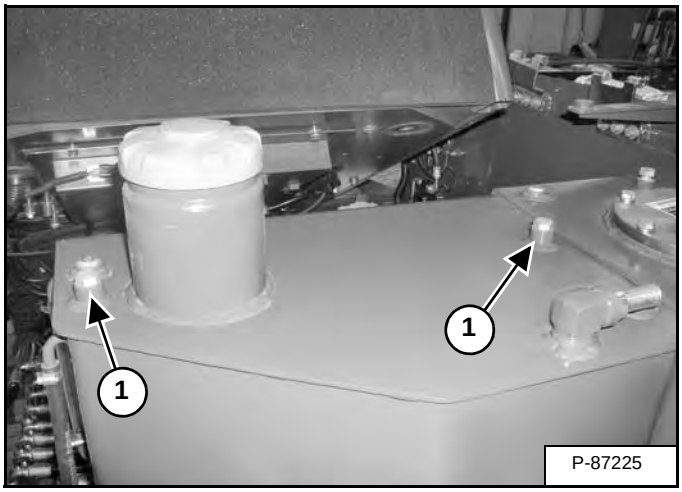
Remove the bolt (Item 1) **[Figure 40-110-6]**.

Figure 40-110-7



Loosen the hose clamp (Item 1) and remove the fuel supply line (Item 2) **[Figure 40-110-7]**.

Figure 40-110-8

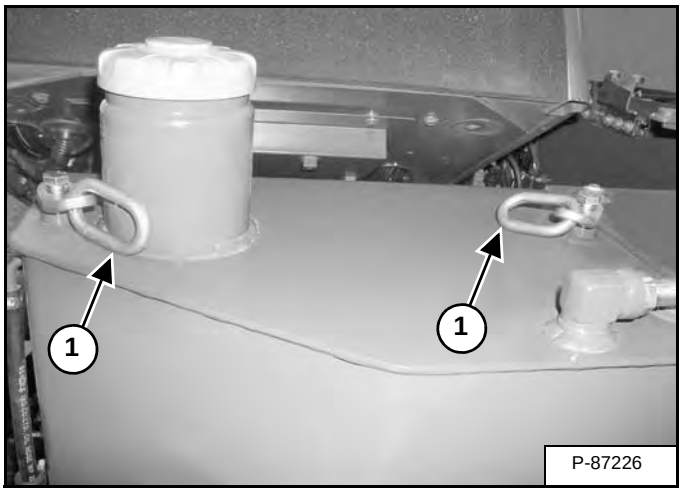


Remove the bolts (Item 1) **[Figure 40-110-8]** from the tank lifting points.

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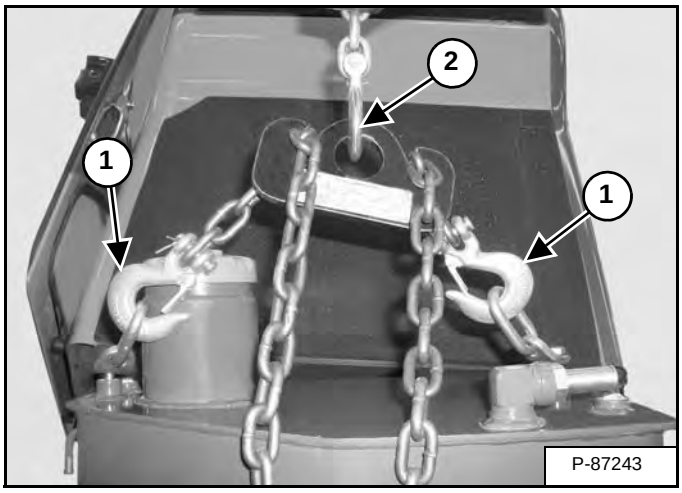
Removal And Installation (Cont'd)

Figure 40-110-9



Install lifting hooks (Item 1) **[Figure 40-110-9]**.

Figure 40-110-10



Attach a chain (Item 1) and lifting device (Item 2) **[Figure 40-110-10]** to the lifting hooks.

Figure 40-110-11

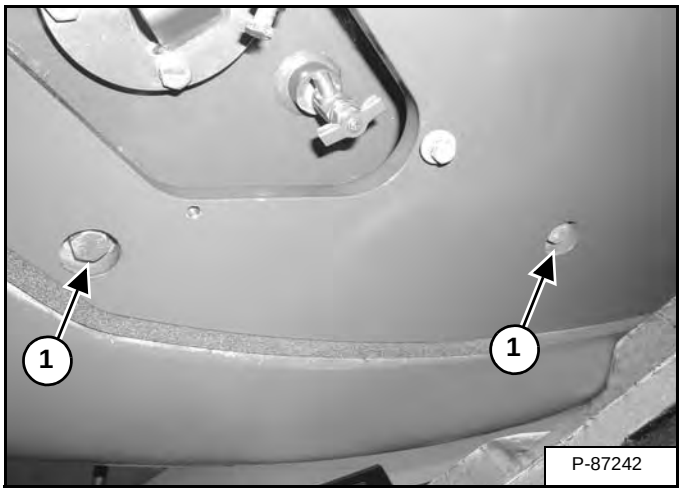
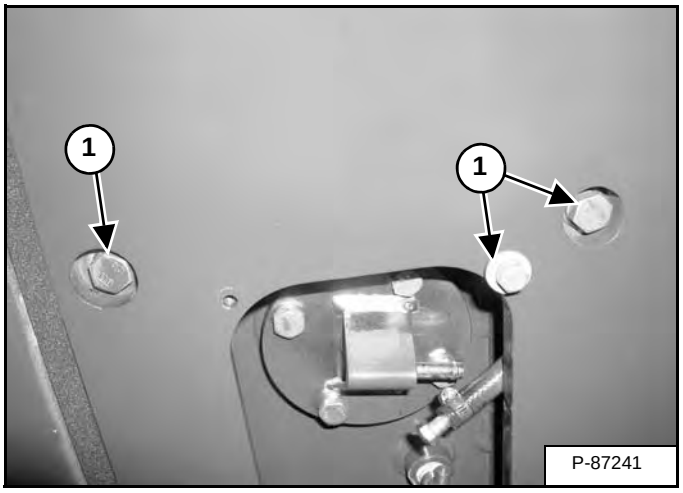


Figure 40-110-12

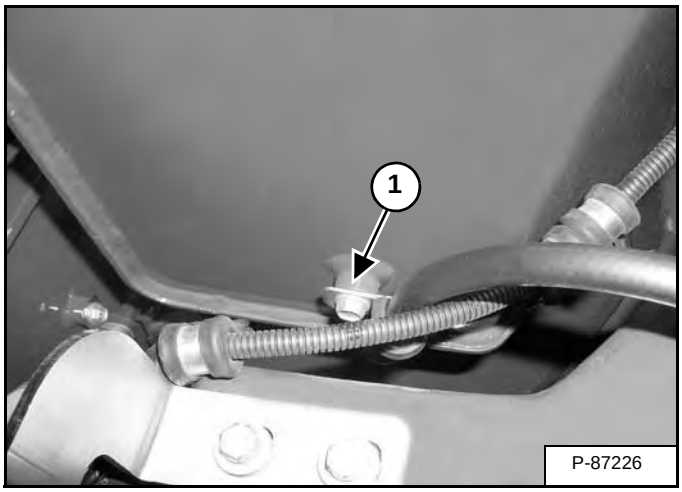


Remove the tank mounting bolts (Item 1) **[Figure 40-110-11]** and **[Figure 40-110-12]**.

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Removal And Installation (Cont'd)

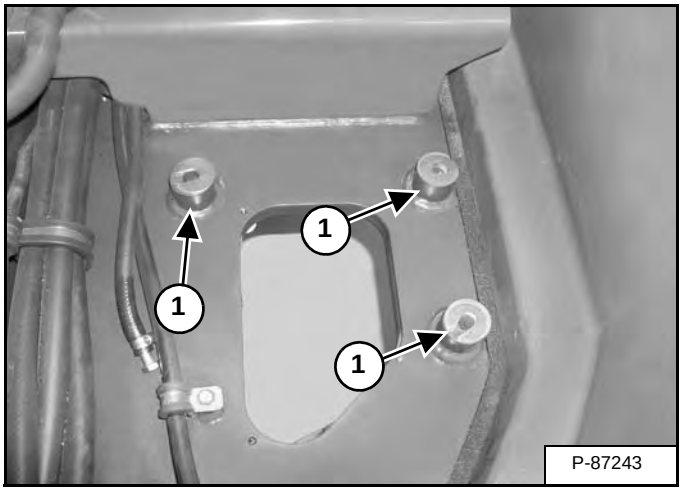
Figure 40-110-13



Lift the tank high enough to access the bolt (Item 1) **[Figure 40-110-13]** on the left side of the fuel tank. Remove the bolt.

Remove the fuel tank.

Figure 40-110-14



Record the number and location of the shims (Item 1) **[Figure 40-110-14]**.

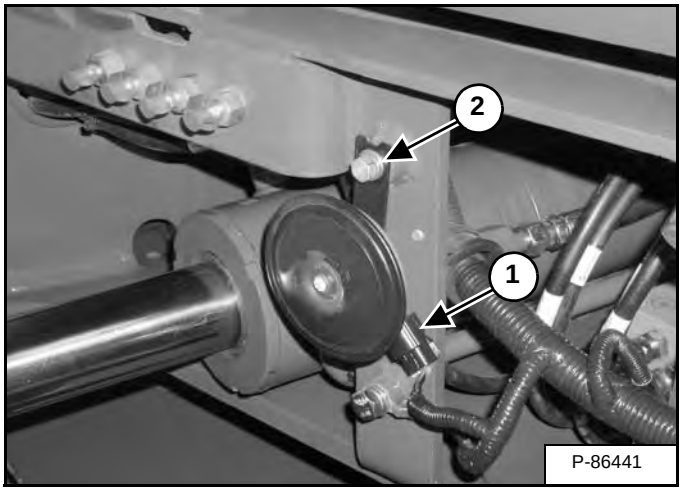
Dealer Copy -- Not for Resale

HORN

Removal And Installation

Remove the left upperstructure side cover. (See Removal And Installation on Page 40-20-1.)

Figure 40-120-1



Disconnect the wire harness (Item 1). Remove the bolt (Item 2) **[Figure 40-120-1]** and washer.

Remove the horn.

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Dealer Copy -- Not for Resale

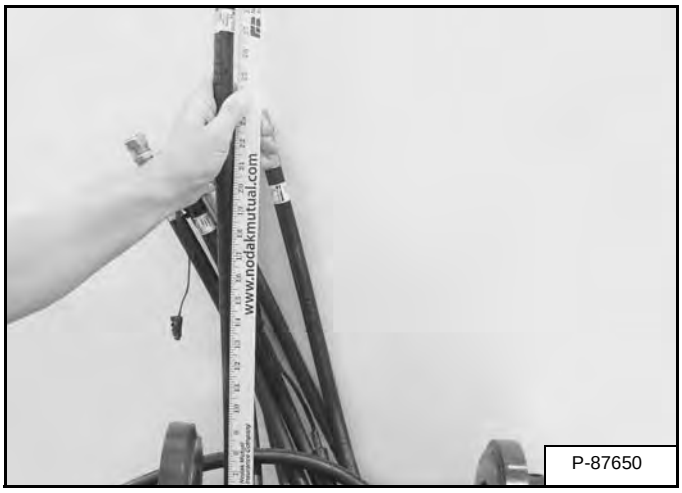
SWING FRAME

Removal And Installation

Rotate the upperstructure so that the blade is to the rear of the excavator.

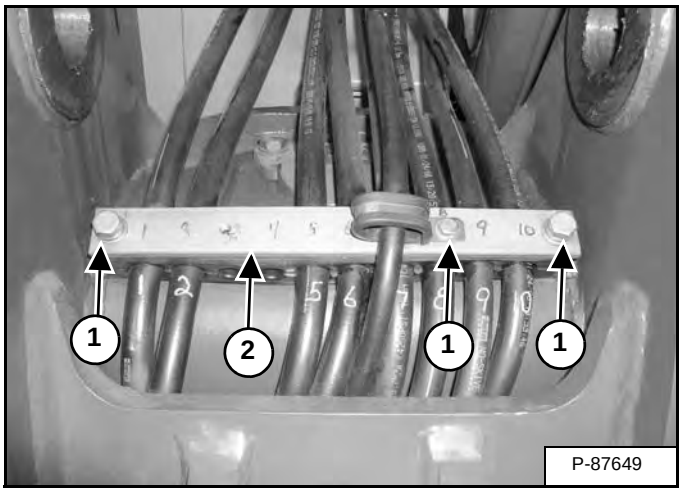
Remove the boom. (See Removal And Installation on Page 40-140-1.)

Figure 40-130-1



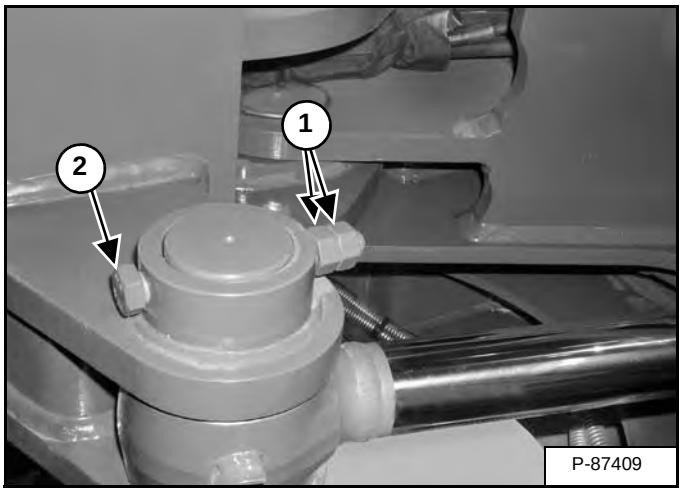
Measure the length of the hoses from the top of the clamp to the end of each hose **[Figure 40-130-1]**.

Figure 40-130-2



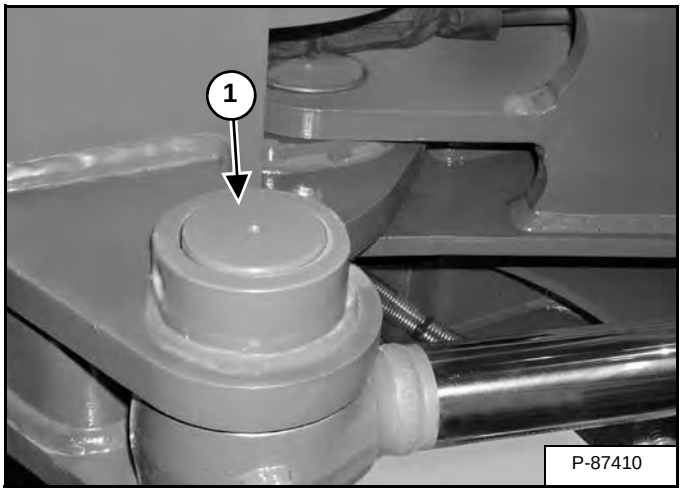
Remove the bolts (Item 1) and the clamp (Item 2) **[Figure 40-130-2]**.

Figure 40-130-3



Remove the nuts (Item 1) and bolt (Item 2) **[Figure 40-130-3]**.

Figure 40-130-4

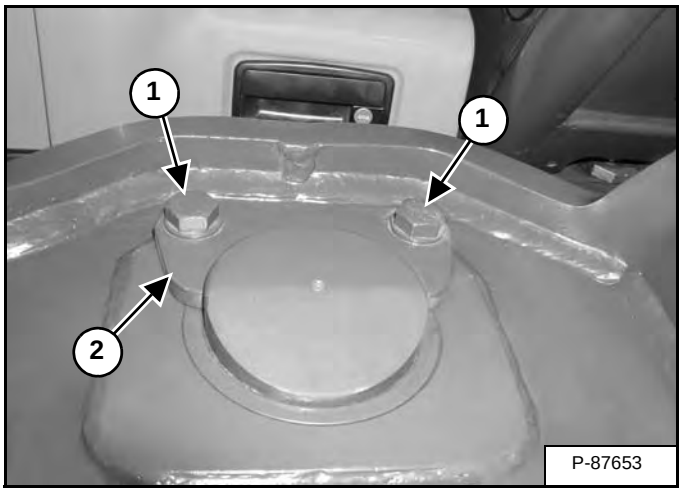


Remove the pivot pin (Item 1) **[Figure 40-130-4]** from the rod end of the swing cylinder.

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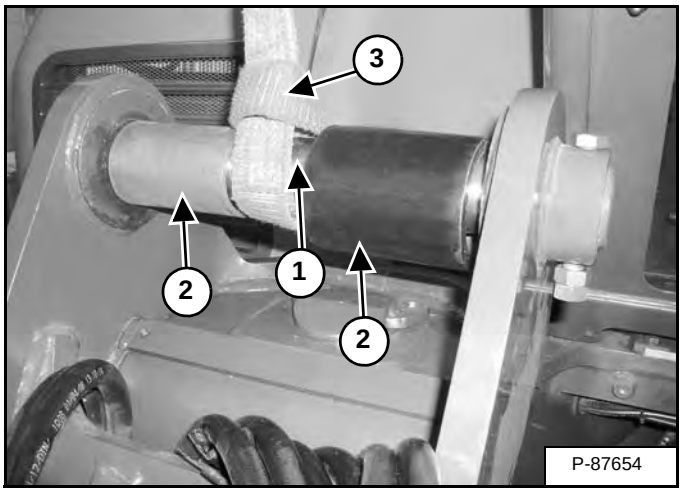
Removal And Installation (Cont'd)

Figure 40-130-5



Remove the bolts (Item 1) and plate (Item 2) **[Figure 40-130-5]**.

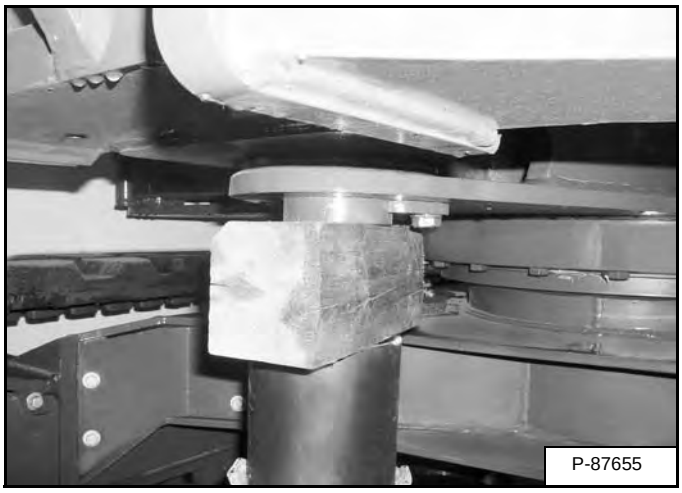
Figure 40-130-6



Install the boom pin (Item 1) using spacers (Item 2) to position a lifting strap (Item 3) **[Figure 40-130-6]** on the center of the boom pin.

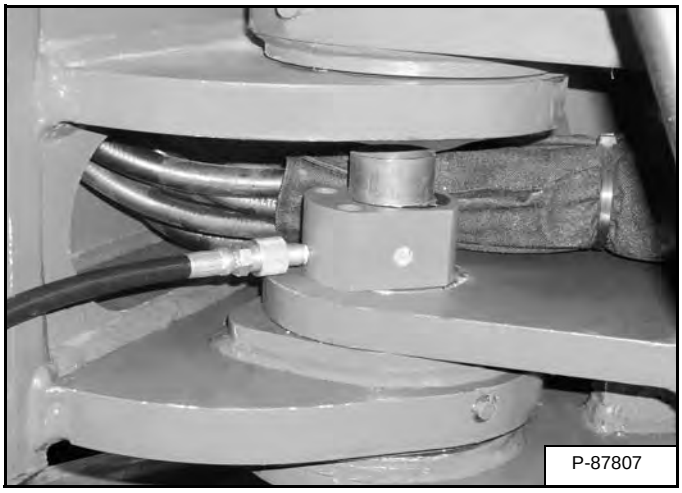
NOTE: The spacers will prevent the strap from sliding on the boom pin, causing the swing frame to tip from side to side.

Figure 40-130-7



Support the bottom pin **[Figure 40-130-7]**.

Figure 40-130-8

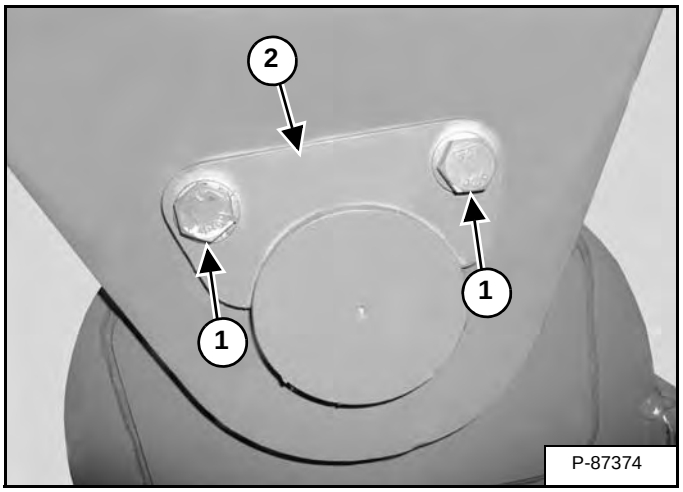


Install a porta-power between the top and bottom pins, and press the top pin out **[Figure 40-130-8]**.

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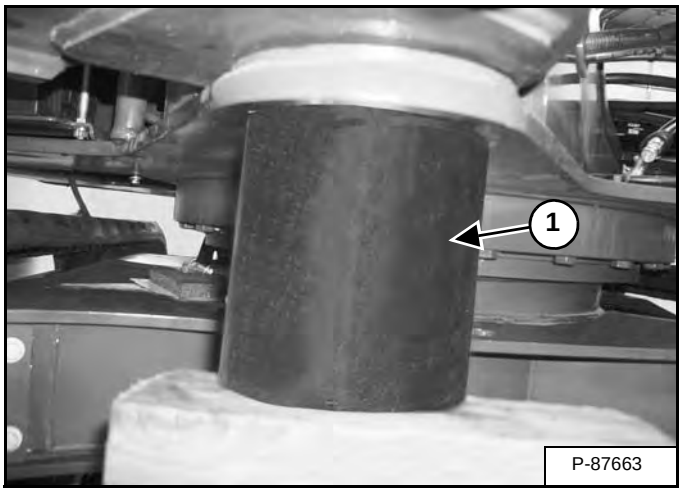
Removal And Installation (Cont'd)

Figure 40-130-9



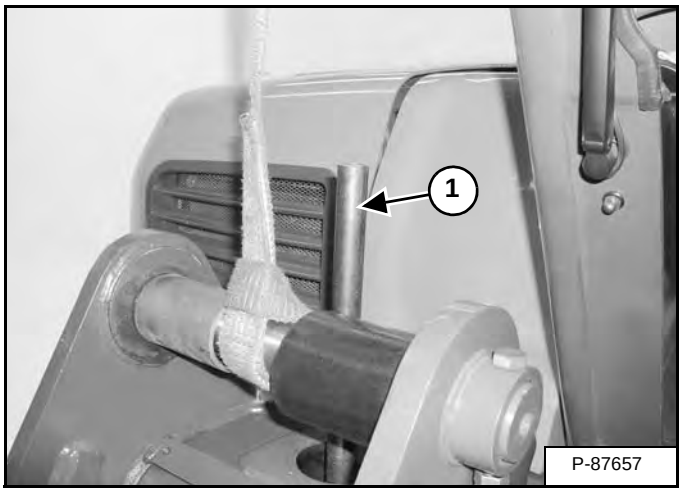
Remove the bolts (Item 1) and plate (Item 2) **[Figure 40-130-9]**.

Figure 40-130-10



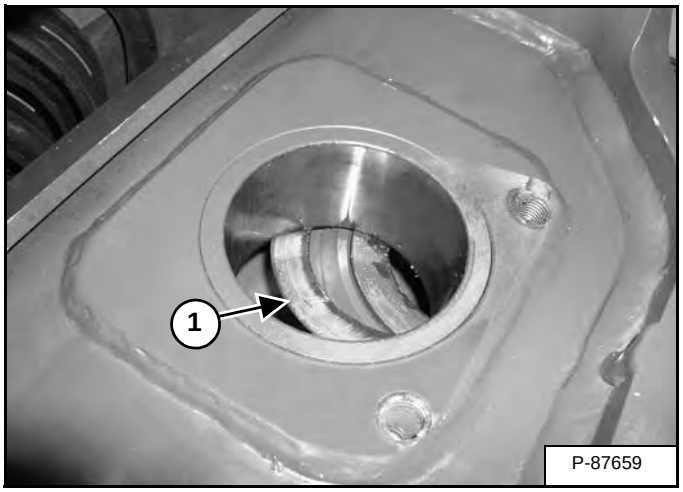
Install a spacer tube (Item 1) **[Figure 40-130-10]** and jack under the swing frame. The spacer tube must be large enough to allow the pin to be driven into the center of the spacer for pin removal.

Figure 40-130-11



Use a large punch (Item 1) **[Figure 40-130-11]** and drive the bottom swing frame pin out.

Figure 40-130-12

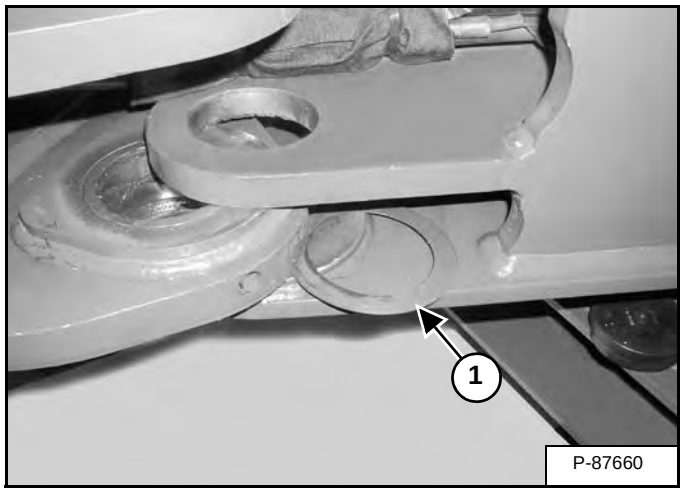


Remove the top spacer (Item 1) **[Figure 40-130-12]** from the swing frame.

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Removal And Installation (Cont'd)

Figure 40-130-13



Remove the bottom spacer (Item 1) **[Figure 40-130-13]** from the swing frame.

Remove the swing frame.

Dealer Copy -- Not for Resale

Bushing Removal

IMPORTANT

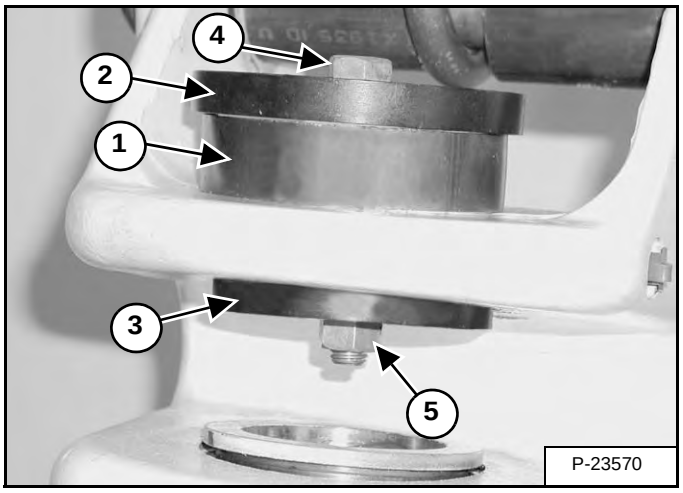
Do Not point (hammer) on the boom swing bracket. Excess pressure can cause the casting to crack.

I-2095-1195

The following parts will be needed for removal and installation of the swing frame bushings:

1. Bolt - 19 x 153 mm or (3/4 x 6 in).
2. Nut - 19 mm or (3/4 in).
3. Washer - 22 mm I.D. x 102 mm O.D. x 10 mm thick or (7/8 I.D. x 4-1/64 O.D. x 3/8 in thick).
4. Washer - 22 mm I.D. x 119 mm O.D. x 10 mm thick or (7/8 I.D. x 4-11/16 O.D. x 3/8 in thick).
5. Washer - 22 mm I.D. 146 mm O.D. x 13 mm thick or (7/8 I.D. x 5-3/4 O.D. x 1/2 in thick).
6. Spacer - 119 mm I.D. x 140 mm O.D. x 38 mm thick or (4-11/16 I.D. x 5-1/2 O.D. x 2 in thick).

Figure 40-130-14



Install the spacer (Item 1) and washer (Item 2) **[Figure 40-130-14]** over the flanged end of the bushing.

The spacer (Item 1) **[Figure 40-130-14]** must be centered over the bushing to avoid contact between the bushing and the spacer during removal.

Install the washer (Item 3) **[Figure 40-130-14]** 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 40-130-14]** through the washers and the spacer.

Tighten the bolt and nut to remove the bushing from the casting.

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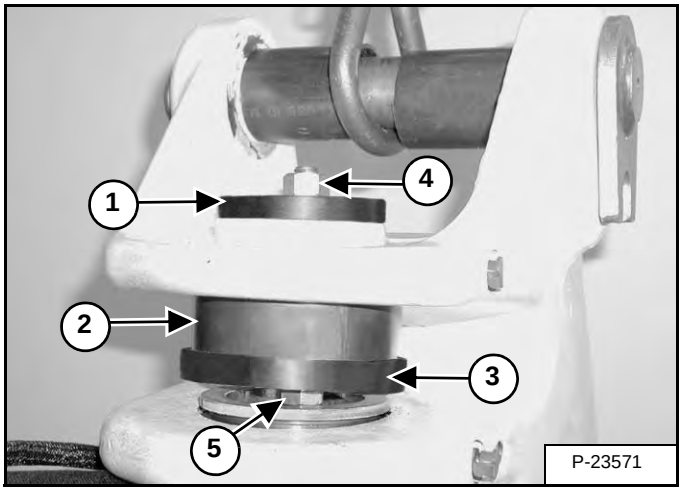
Bushing Installation

Apply a film of grease to the outer diameter of the bushing and to the inner diameter of the casting.

Center the bushing on the casting hole.

NOTE: Make sure that the bushing is centered into the casting hole and that it starts in the hole evenly and square.

Figure 40-130-15



Put the washer (Item 1) **[Figure 40-130-15]** over the flanged end of the bushing.

Put the spacer (Item 2) and the washer (Item 3) **[Figure 40-130-15]** 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 40-130-15]**.

Tighten the bolt and nut until the bushing is seated in the casting.

Figure 40-130-16

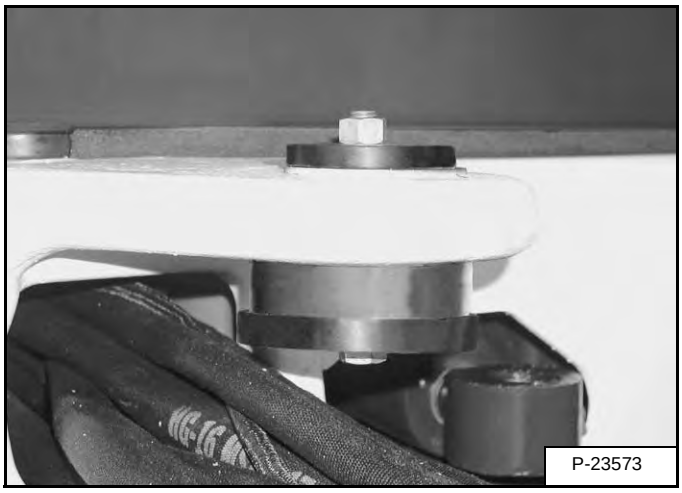
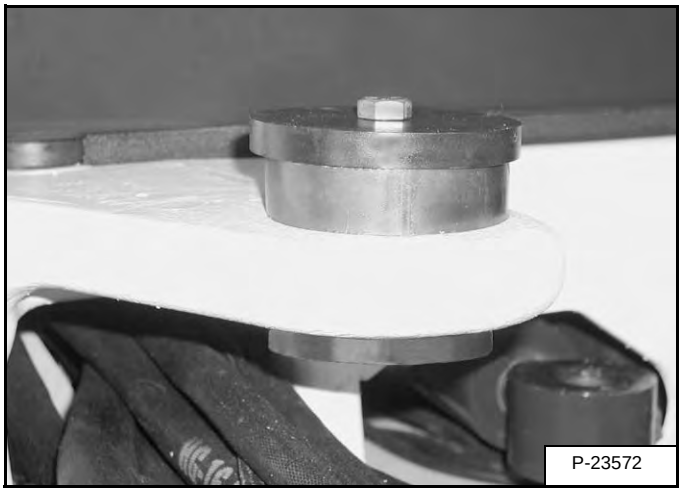


Figure 40-130-17



The same procedure is used to remove and install the bushings in the frame castings **[Figure 40-130-16]** and **[Figure 40-130-17]**.

Dealer Copy -- Not for Resale

BOOM

Removal And Installation

Remove the arm. (See Removal And Installation on Page 40-150-1.)

Remove the articulated boom (if equipped). (See Removal And Installation on Page 40-141-1.)

Remove the boom cylinder. (See Removal And Installation on Page 20-20-4.)

Figure 40-140-1

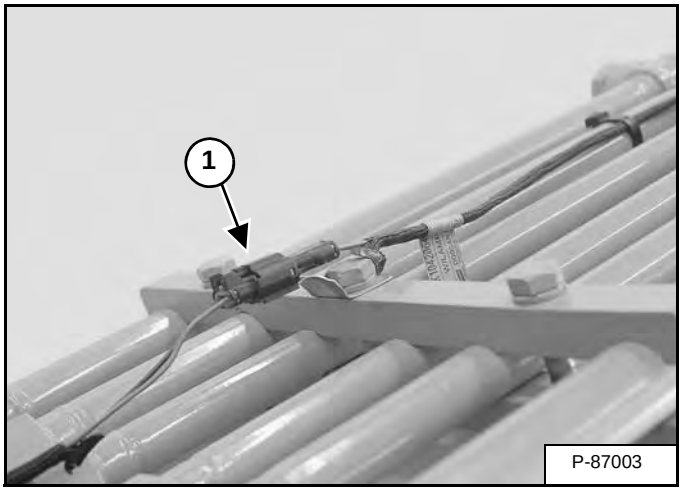
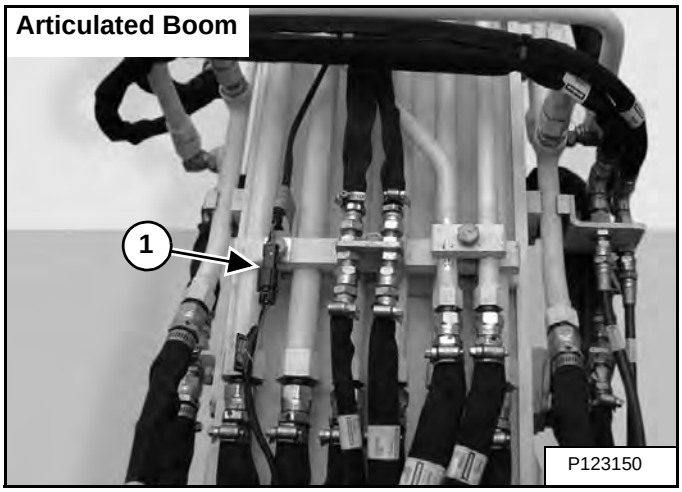


Figure 40-140-2



Disconnect the wire harness (Item 1) **[Figure 40-140-1]** or **[Figure 40-140-2]**.

IMPORTANT

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

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Figure 40-140-3

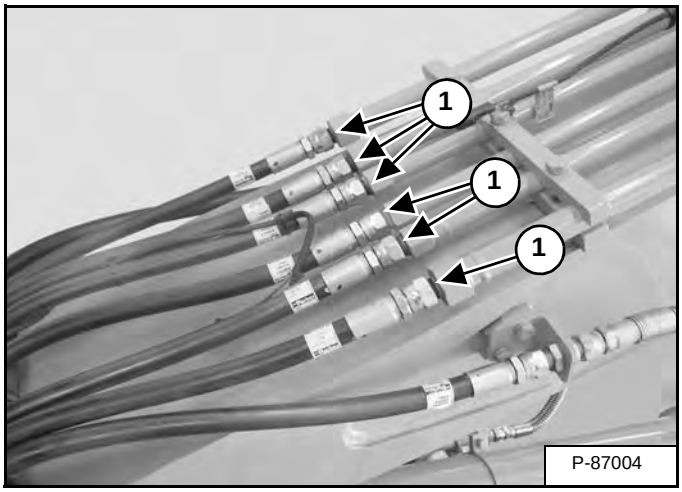
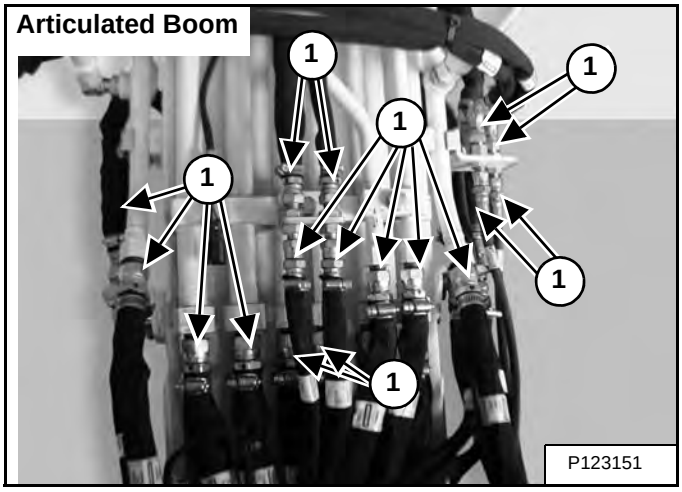


Figure 40-140-4

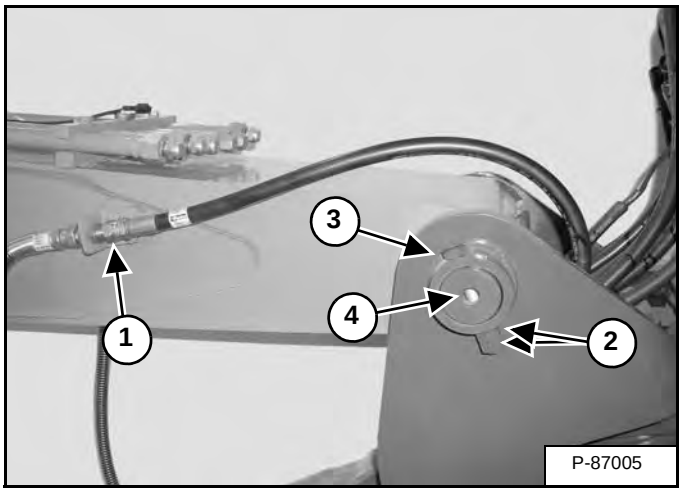


Mark and remove the hoses (Item 1) **[Figure 40-140-3]** or **[Figure 40-140-4]**.

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Removal And Installation (Cont'd)

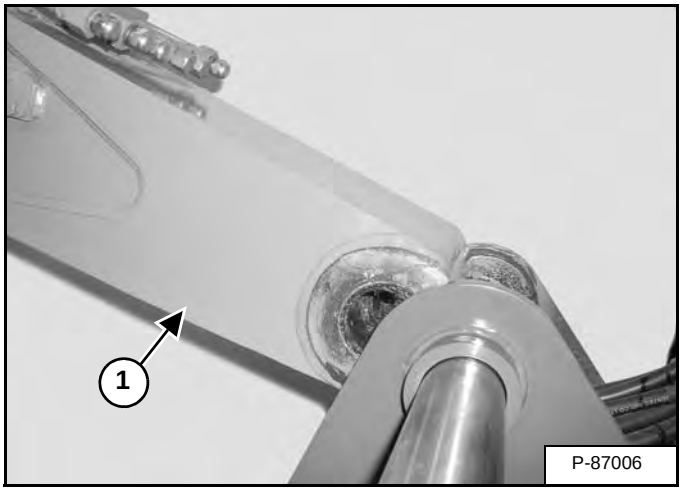
Figure 40-140-5



Remove the hose (Item 1) **[Figure 40-140-5]** (Both sides).

Remove the nuts (Item 2), bolt (Item 3), and pivot pin (Item 4) **[Figure 40-140-5]**.

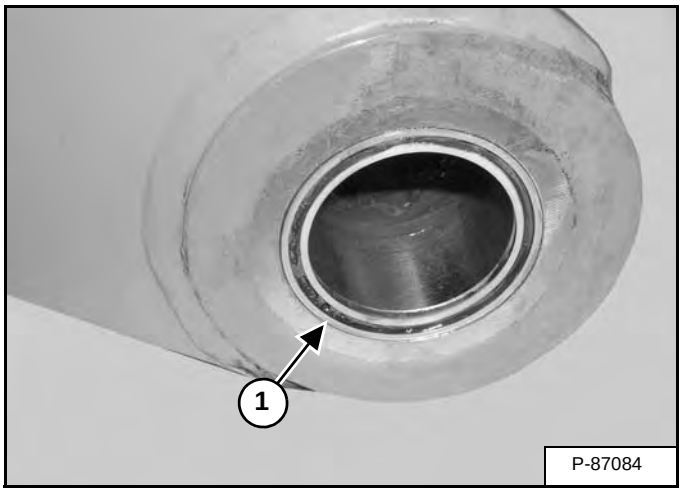
Figure 40-140-6



Remove the boom (Item 1) **[Figure 40-140-6]**.

Bushing Removal And Installation

Figure 40-140-7

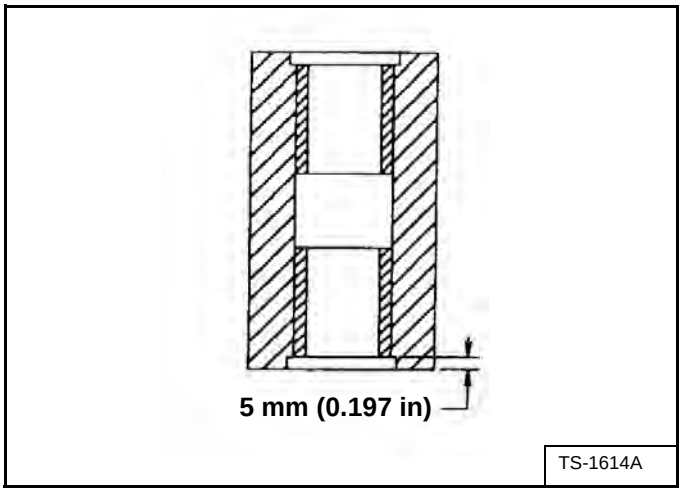


Remove the seals (Item 1) **[Figure 40-140-7]** from both sides of the boom.

Remove the bushings from both sides of the boom.

Install new bushings in the boom.

Figure 40-140-8



Install the bushings until they are seated 5 mm (0.197 in) in the pin boss **[Figure 40-140-8]**.

Install new seals on both sides of the boom.

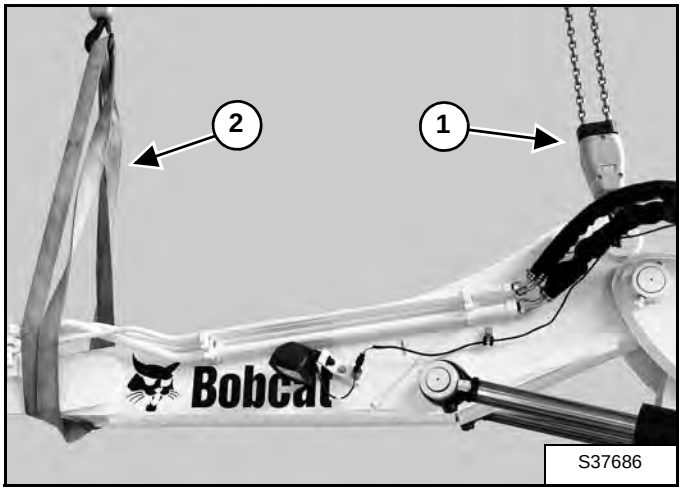
Dealer Copy -- Not for Resale

BOOM (ARTICULATED) (OPTIONAL)

Removal And Installation

Remove the arm. (See Removal And Installation on Page 40-150-1.)

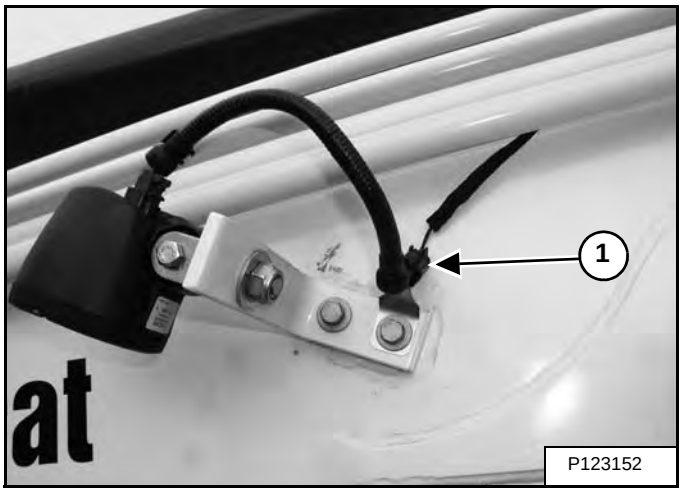
Figure 40-141-1



Support the articulated boom with a chain hoist (Item 1) in the articulated boom lifting point, and with a hoist at the front of the articulated boom (Item 2) **[Figure 40-141-1]**.

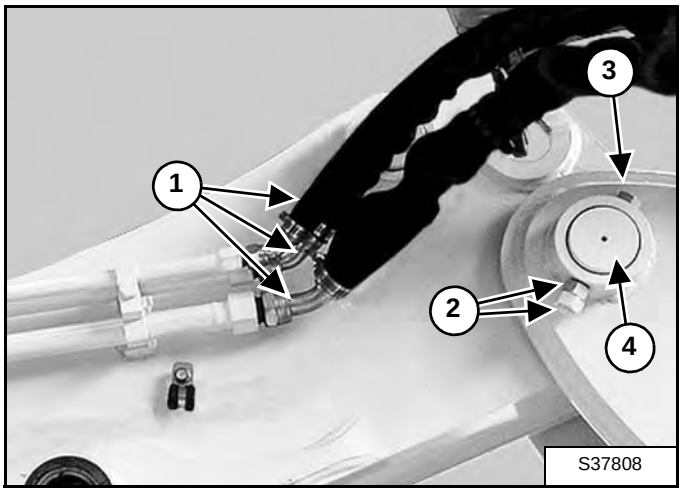
Remove the articulated boom cylinders. (See Removal And Installation on Page 20-25-3.)

Figure 40-141-2



Disconnect the wire harness (Item 1) **[Figure 40-141-2]** from the boom light (Both sides).

Figure 40-141-3



Mark and remove the hoses (Item 1) **[Figure 40-141-3]** (Both sides).

Remove the nuts (Item 2) and bolt (Item 3) **[Figure 40-141-3]** (Both sides).

Remove the pivot pin (Item 4) **[Figure 40-141-3]**.

Remove the articulated boom.

IMPORTANT

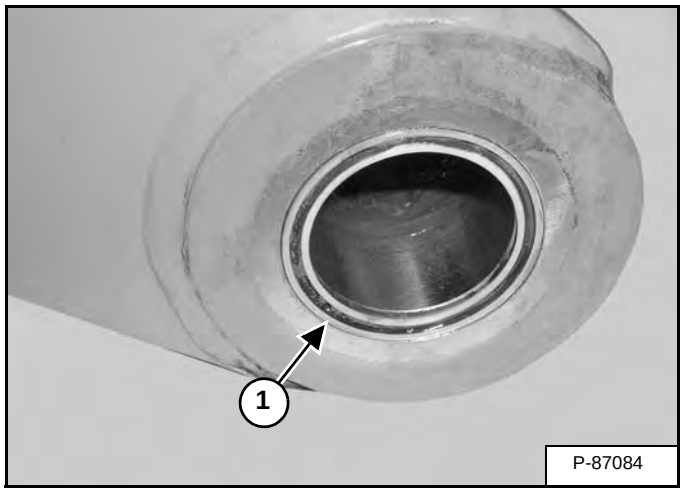
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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Removal And Installation (Cont'd)

Figure 40-141-4

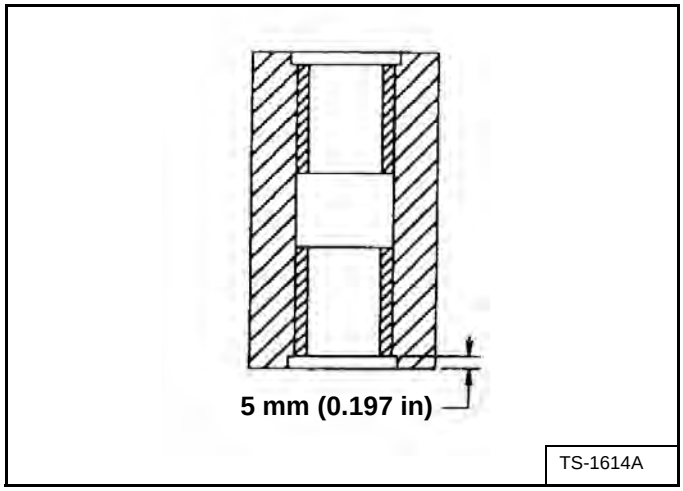


Remove the seals (Item 1) **[Figure 40-141-4]** from both sides of the articulated boom.

Remove the bushings from both sides of the articulated boom.

Install new bushings in the articulated boom.

Figure 40-141-5



Install the bushings until they are seated 5 mm (0.197 in) in the pin boss **[Figure 40-141-5]**.

Install new seals on both sides of the articulated boom.

Dealer Copy -- Not for Resale

ARM

Removal And Installation

Remove the bucket or attachment.

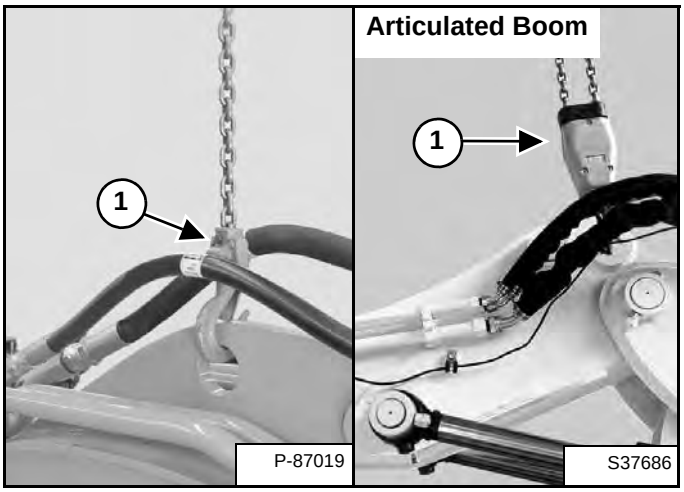
Remove the bucket cylinder. (See Removal And Installation on Page 20-23-1.)

Remove the arm cylinder. (See Removal And Installation on Page 20-21-3.)

Lower the boom / arm and blade to the ground.

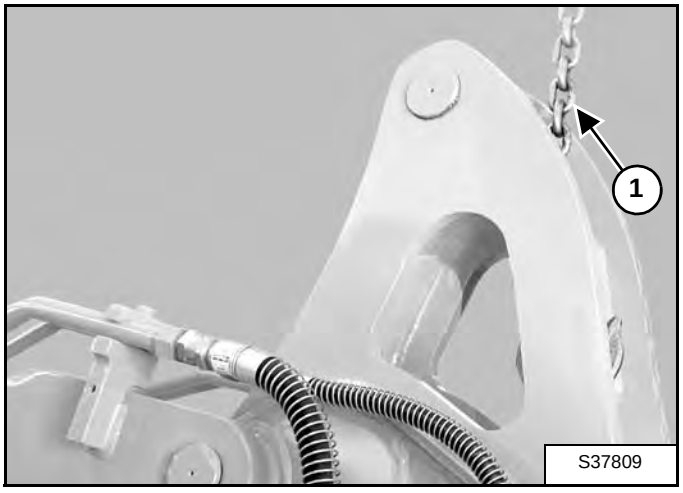
With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 40-150-1



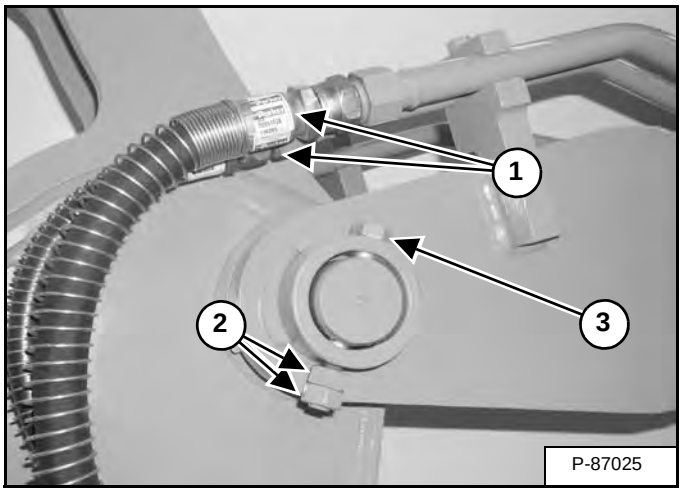
Support the boom with a chain hoist (Item 1) **[Figure 40-150-1]**.

Figure 40-150-2



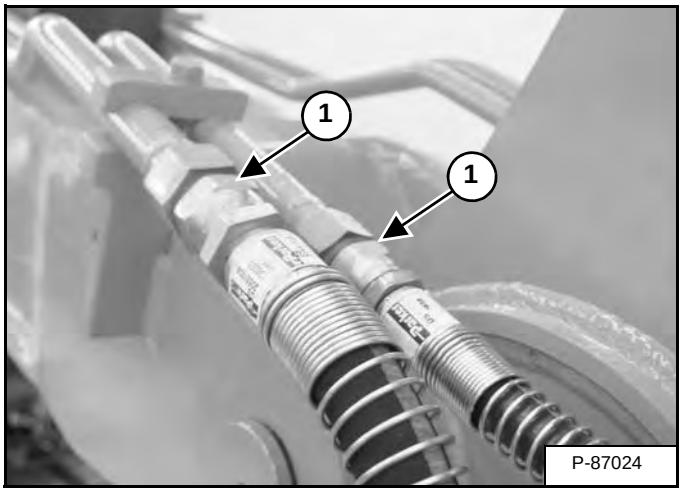
Support the arm with a chain hoist (Item 1) **[Figure 40-150-2]**.

Figure 40-150-3



Remove the nuts (Item 2) and bolt (Item 3) **[Figure 40-150-3]**.

Figure 40-150-4

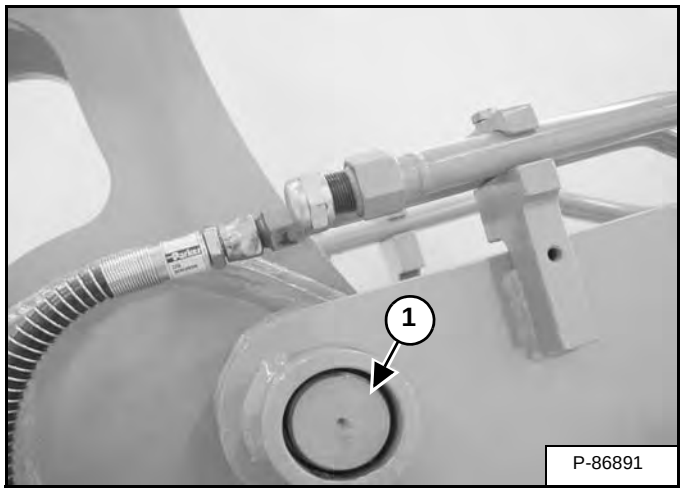


Remove the hydraulic lines (Item 1) on both sides of the arm **[Figure 40-150-3]** and **[Figure 40-150-4]**.

Dealer Copy -- Not for Resale

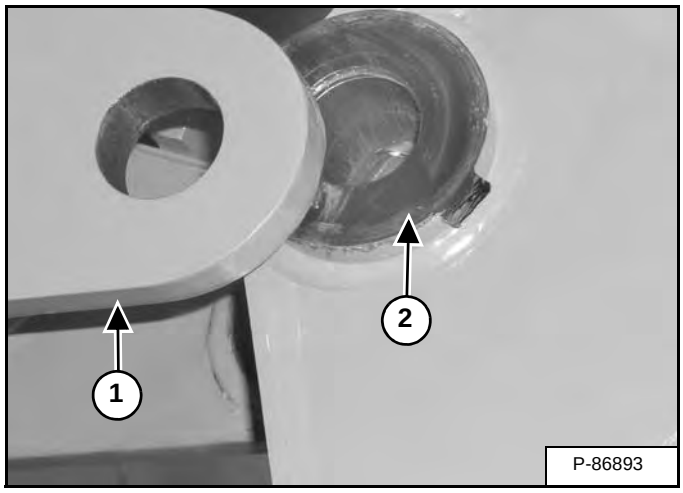
Removal And Installation (Cont'd)

Figure 40-150-5



Remove the pivot pin (Item 1) **[Figure 40-150-5]**.

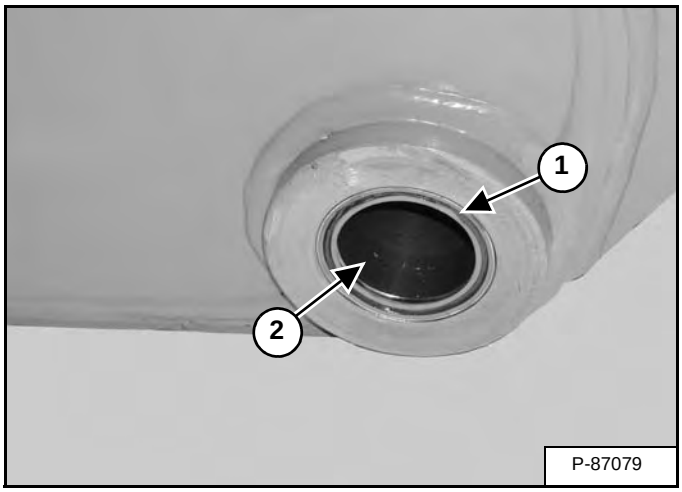
Figure 40-150-6



Remove the arm (Item 1) and shims (Item 2) **[Figure 40-150-6]**.

Arm To Boom Bushing Removal And Installation

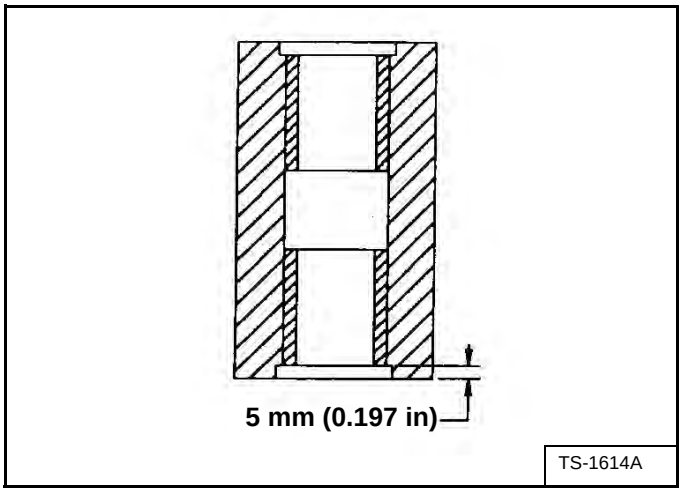
Figure 40-150-7



Remove the seal (Item 1) and bushing (Item 2) **[Figure 40-150-7]** from both sides of the arm.

Install the new bushings in the arm.

Figure 40-150-8



Install the bushings until they are seated 5 mm (0.197 in) in the pin boss **[Figure 40-150-8]** (Both sides).

Install new seals on both sides of the arm.

Dealer Copy -- Not for Resale

Bucket And Link Bushing Removal And Installation

Figure 40-150-9

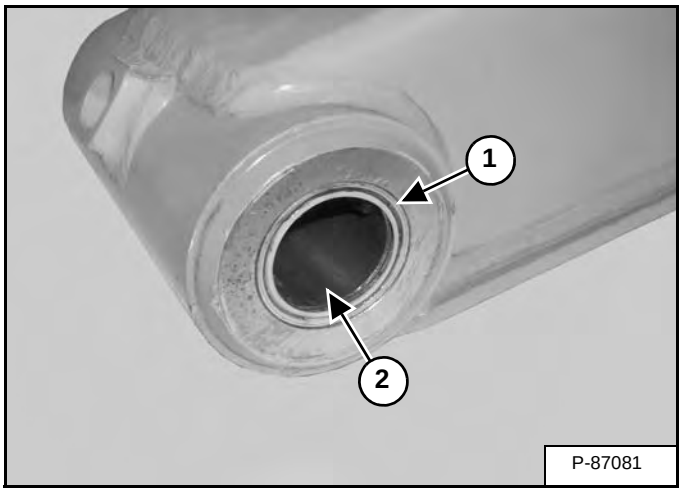
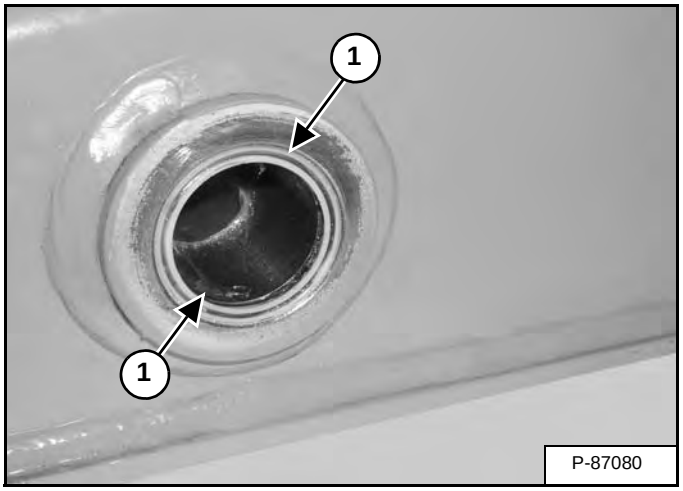


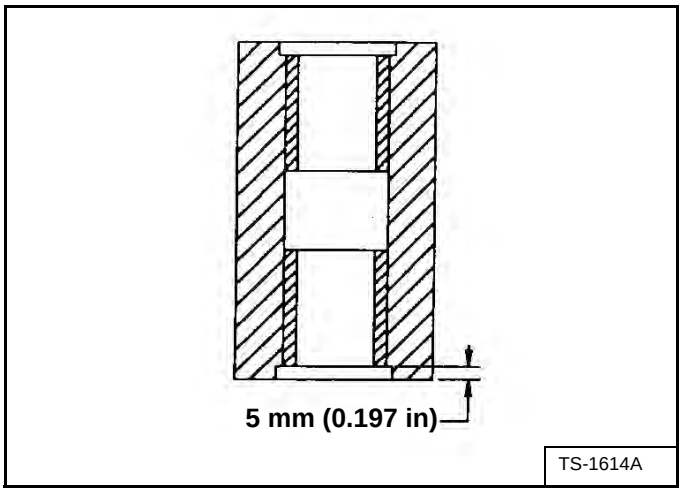
Figure 40-150-10



Remove the seals (Item 1) and bushings (Item 2) **[Figure 40-150-9]** and **[Figure 40-150-10]** from both sides of the arm.

Install the new bushings in the arm.

Figure 40-150-11



Install the bushings until they are seated 5 mm (0.197 in) in the pin boss **[Figure 40-150-11]** (Both sides).

Dealer Copy -- Not for Resale



Dealer Copy -- Not for Resale

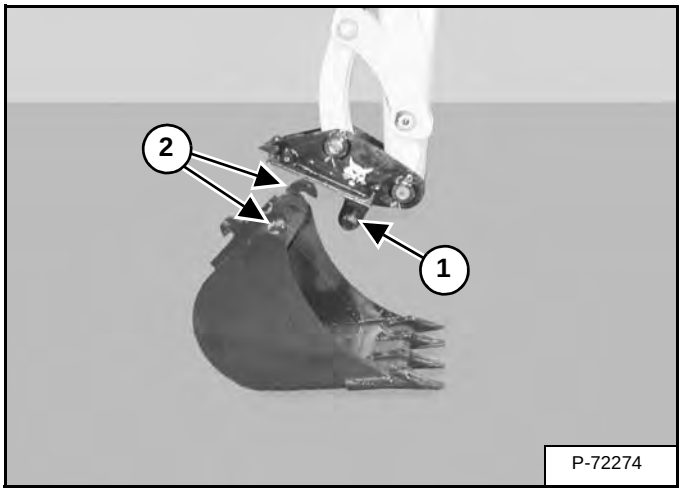
QUICK COUPLER (KLAC™ SYSTEM)

Troubleshooting

PROBLEM	CAUSE	CORRECTION
Coupler does not seat properly on the attachment mounting frame.	Mud, dirt, stones or debris are lodged between the coupler and the attachment mounting frame.	Remove mud, dirt, stones and debris from between the coupler and the attachment mounting frame.
	Worn locking mechanism.	Repair or replace worn pins and locking mechanisms.
	Attachment mounting frame damaged.	Repair or replace the attachment mounting frame.

Daily Inspection

Figure 40-160-1



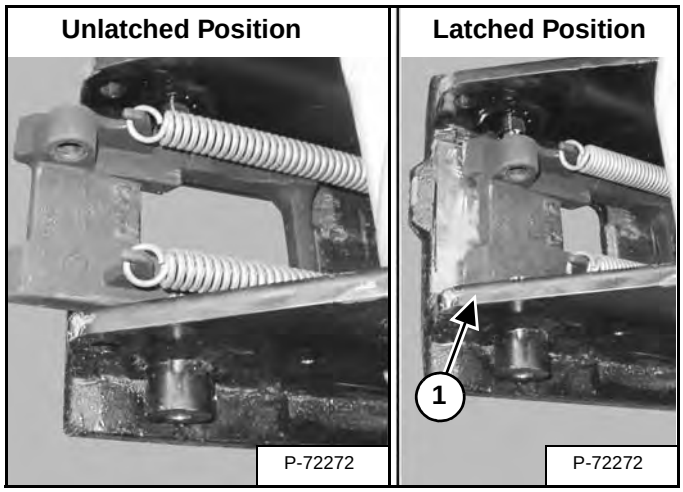
Inspect the quick coupler for wear or damage. Inspect the quick locking shaft (Item 1) and the hooks (Item 2) **[Figure 40-160-1]** (on the attachment) for wear or damage.

Repair or replace damaged parts.

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Removal And Installation

Figure 40-160-2



Remove the attachment.

The quick coupler must be in the latched position (Item 1) **[Figure 40-160-2]** for disassembly.

Inspect the quick coupler to make sure the latch is in the latched position.

If the latch is in the unlatched position, see **[Figure 40-160-3]** for additional information.

If the latch is in the latched position, proceed to **[Figure 40-160-4]**.

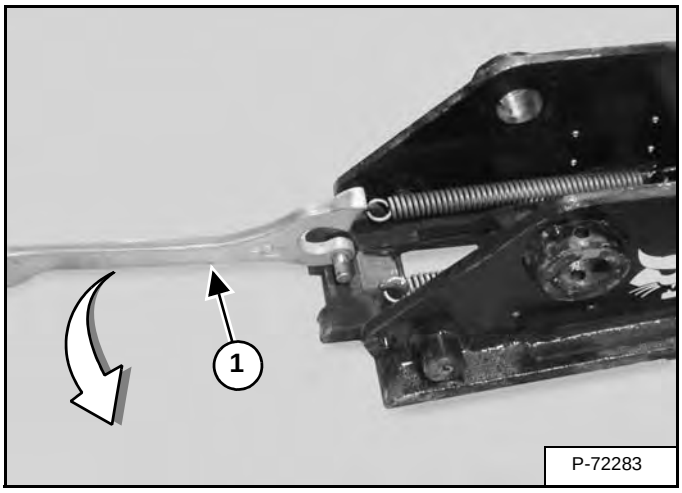
⚠ WARNING

AVOID INJURY

Keep fingers and hands out of pinch points when latching and unlatching the attachment quick coupler.

W-2541-1106

Figure 40-160-3



Install the tool (Item 1) **[Figure 40-160-3]** in the quick coupler as shown. Push down on the tool until the latch snaps closed.

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Removal And Installation (Cont'd)

WARNING

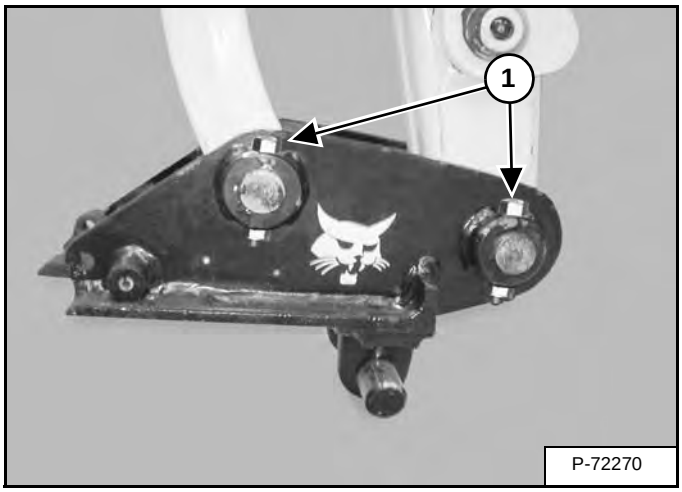
AVOID INJURY OR DEATH

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

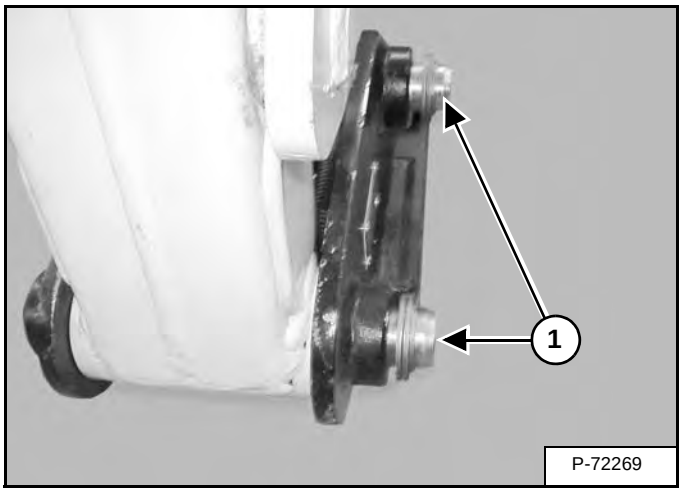
Figure 40-160-4



Remove the bolts (Item 1) **[Figure 40-160-4]** and nuts.

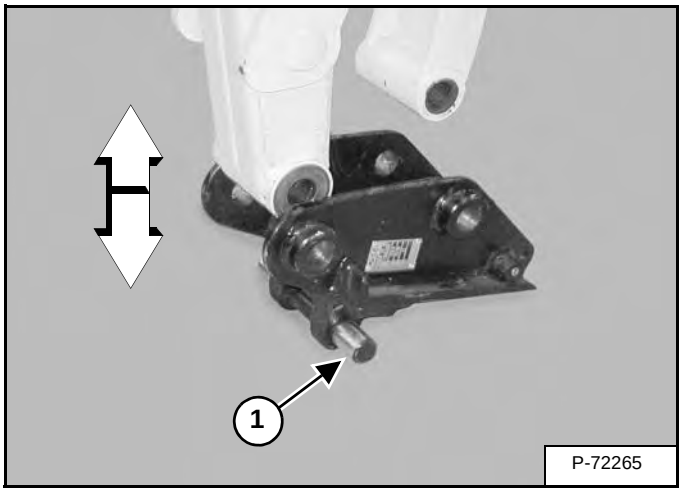
Installation: Align the holes of the connecting pins with the holes in the coupler. Install the two bolts (Item 1) **[Figure 40-160-4]** and nuts. Tighten the nuts securely against the couple.

Figure 40-160-5



Remove pins (Item 1) **[Figure 40-160-5]**.

Figure 40-160-6



Raise the arm and bucket link until the coupler is free **[Figure 40-160-6]**.

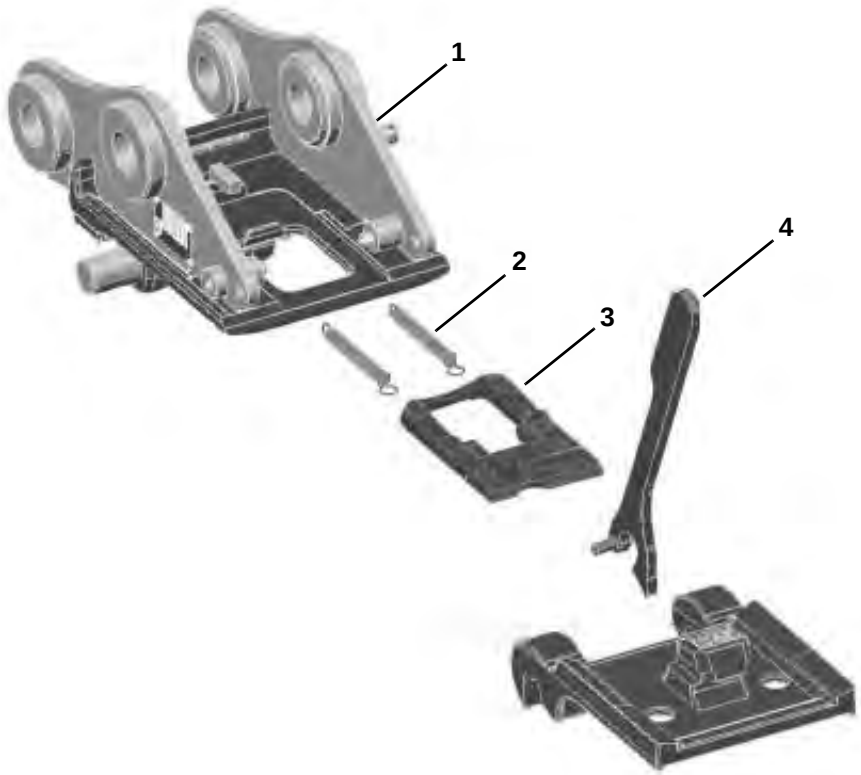
Installation: Align the arm and bucket link with the coupler **[Figure 40-160-6]**. Lower the arm and bucket link into the coupler.

NOTE: Place the coupler on the ground with the mounting pin (Item 1) [Figure 40-160-6] facing towards the excavator.

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Parts Identification

1. Coupler Body
2. Spring
3. Locking Plate
4. Tool



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Disassembly

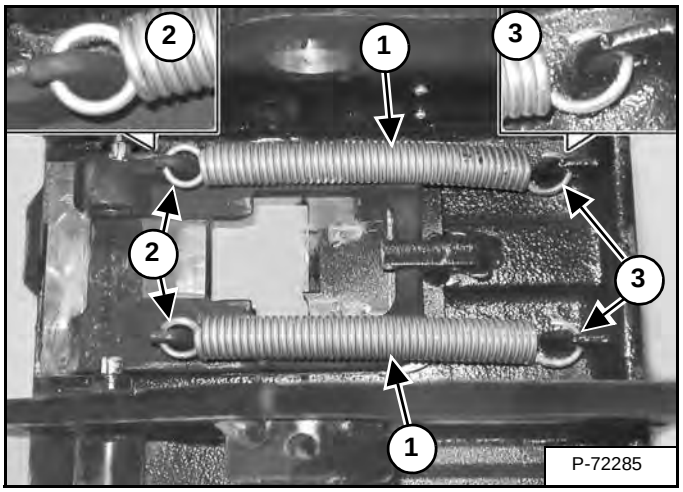
⚠ WARNING

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

Figure 40-160-7



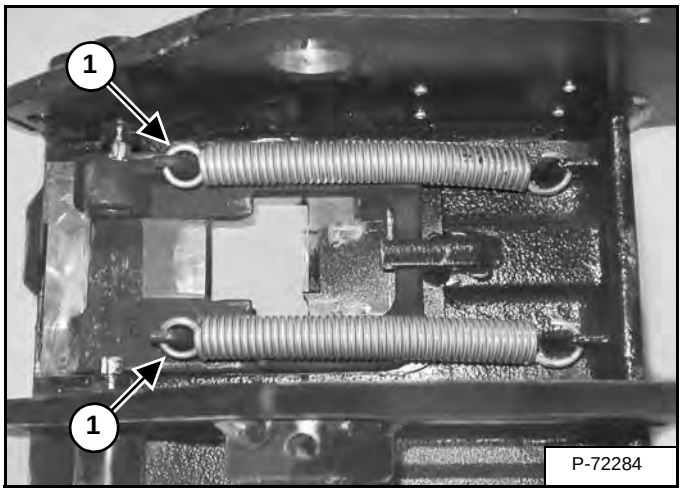
The two springs (Item 1) **[Figure 40-160-7]** have different style of end hooks.

The spring hook (Item 2) **[Figure 40-160-7]** are full circle hooks.

The spring hook (Item 3) **[Figure 40-160-7]** are partial circle hooks.

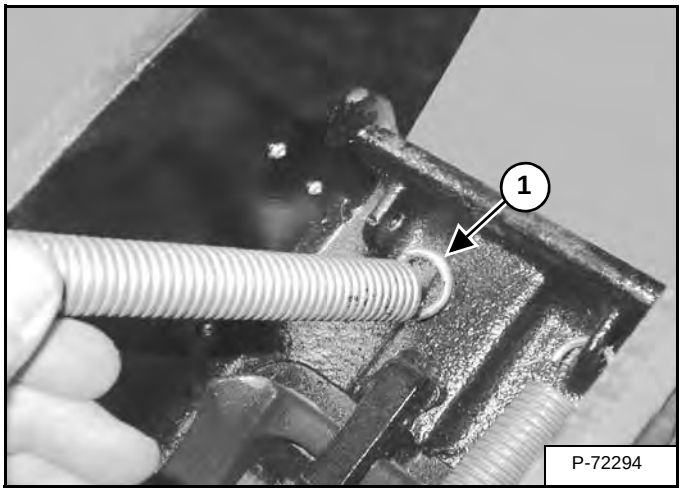
The spring ends must be positioned as shown when assembled.

Figure 40-160-8



Remove the spring end hook (Item 1) **[Figure 40-160-8]** from the quick coupler.

Figure 40-160-9

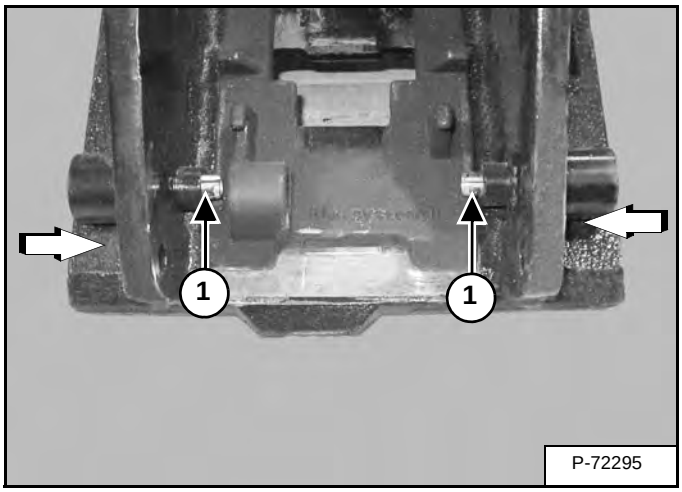


Remove the opposite end of the two springs (Item 1) **[Figure 40-160-9]**.

Dealer Copy -- Not for Resale

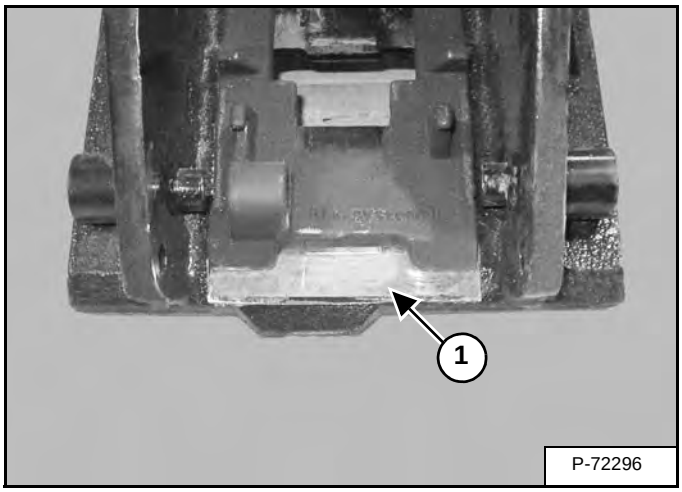
Disassembly (Cont'd)

Figure 40-160-10



Remove the two roll pins (Item 1) **[Figure 40-160-10]**. Drive the roll pins inwards to remove.

Figure 40-160-11

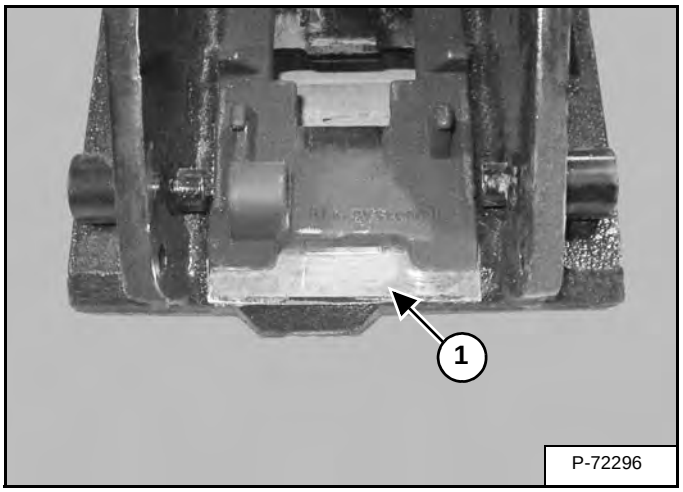


Remove the latch (Item 1) **[Figure 40-160-11]**.

Dealer Copy -- Not for Resale

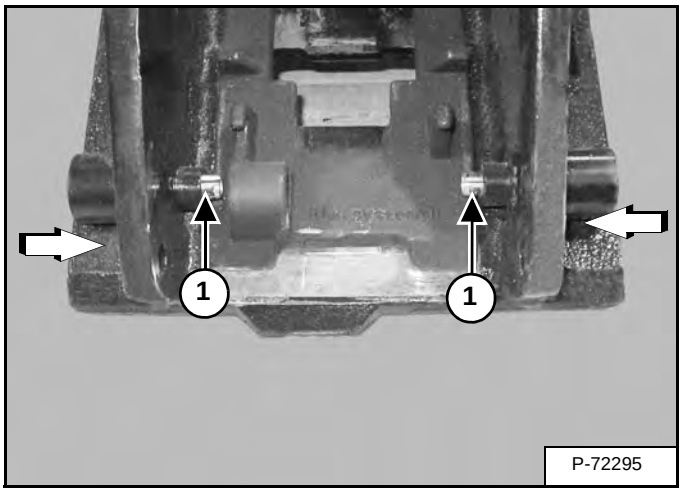
Assembly

Figure 40-160-12



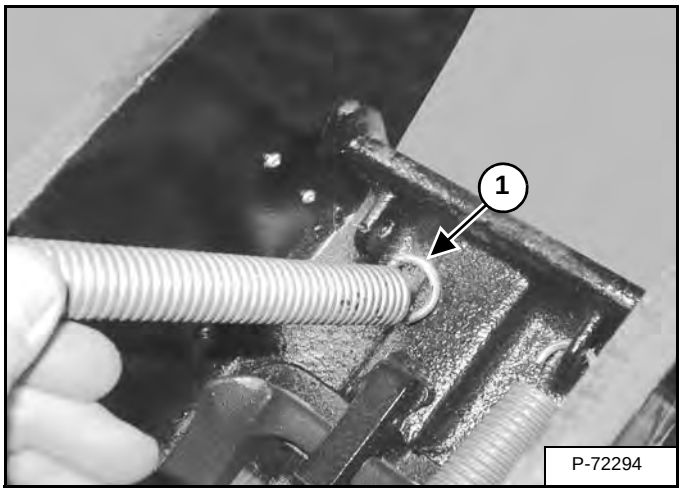
Install the latch (Item 1) **[Figure 40-160-12]**.

Figure 40-160-13



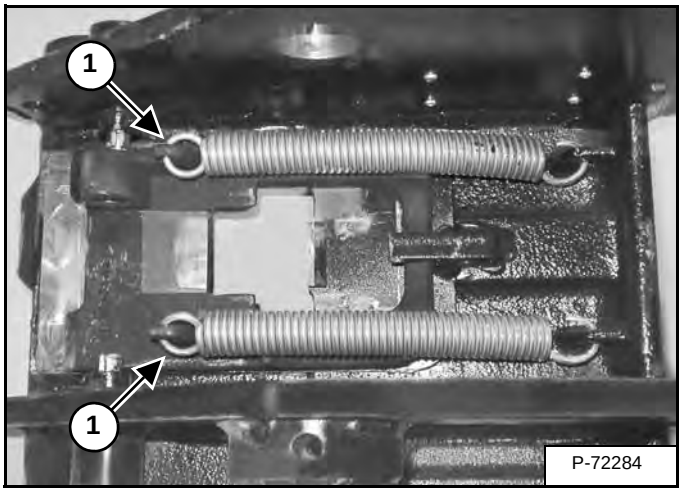
Install the two roll pins (Item 1) **[Figure 40-160-13]**. Drive the roll pins inwards until the roll pins are flush with the outside edge of the quick coupler.

Figure 40-160-14



Install the partial circle hook end of the spring (Item 1) **[Figure 40-160-14]**.

Figure 40-160-15



Install the full circle end of the spring hook (Item 1) **[Figure 40-160-15]** on the quick coupler.

Do not lubricate the quick coupler. Lubrication will cause dirt to collect and interfere with proper movement of the quick coupler.

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Dealer Copy -- Not for Resale

QUICK COUPLER (LEHNHOFF® SYSTEM)

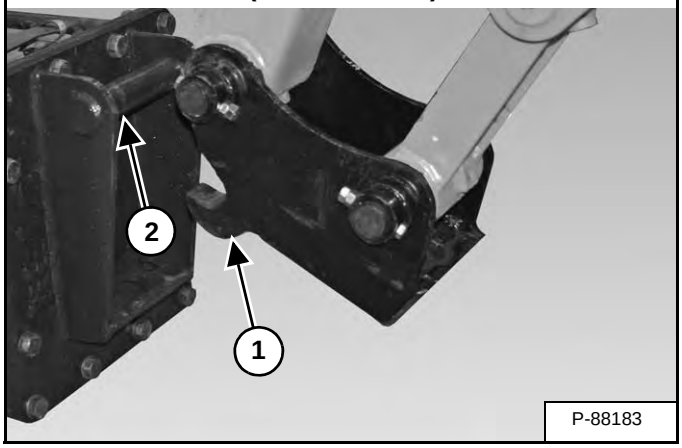
Troubleshooting

PROBLEM	CAUSE	CORRECTION
Coupler does not seat properly on the attachment mounting frame.	Mud, dirt, stones or debris are lodged between the coupler and the attachment mounting frame.	Remove mud, dirt, stones and debris from between the coupler and the attachment mounting frame.
	Worn locking mechanism.	Repair or replace worn pins and locking mechanisms.
	Attachment mounting frame damaged.	Repair or replace the attachment mounting frame.

Daily Inspection

Figure 40-161-1

(MS03 & MS08)



Inspect the quick coupler for wear or damage. Inspect the hooks (Item 1) and coupler locking shaft (Item 2) **[Figure 40-161-1]** (on the attachment) for wear or damage.

Repair or replace damaged parts.

Dealer Copy -- Not for Resale

Removal (MS03 And MS08)

⚠ WARNING

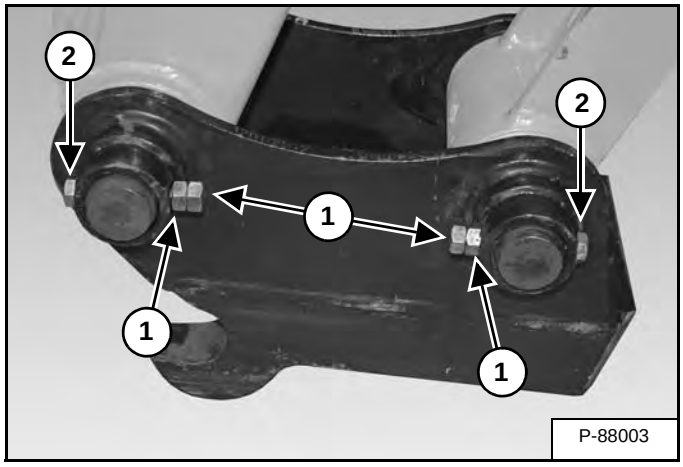
AVOID INJURY OR DEATH

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.**

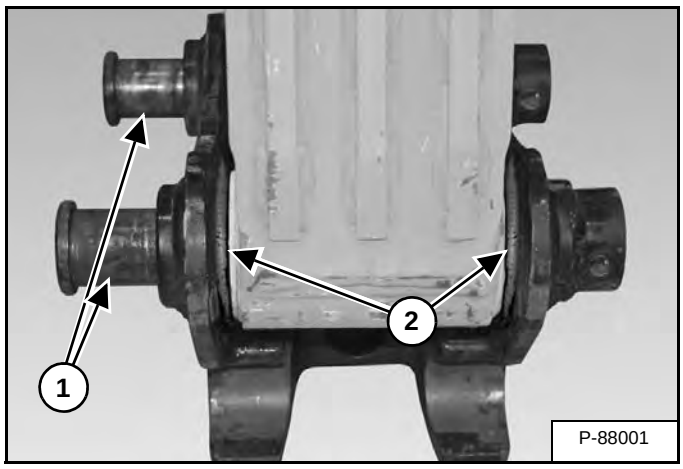
W-2019-0907

Figure 40-161-2



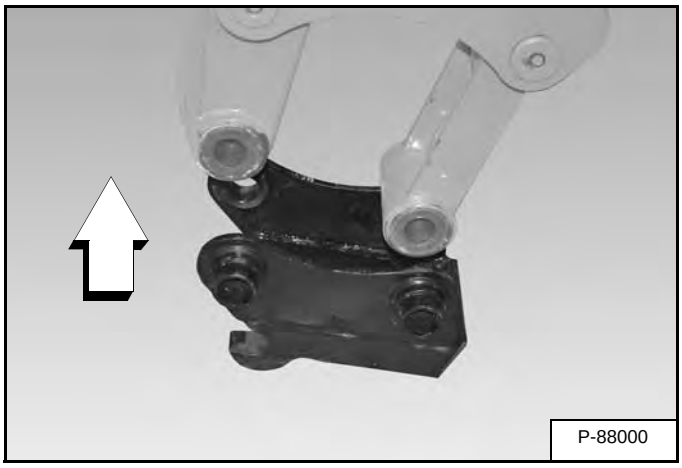
Remove the four nuts (Items 1). Remove the two bolts (Item 2) **[Figure 40-161-2]**.

Figure 40-161-3



Remove the two connecting pins (Item 1) and O-rings (Item 2) **[Figure 40-161-3]**.

Figure 40-161-4

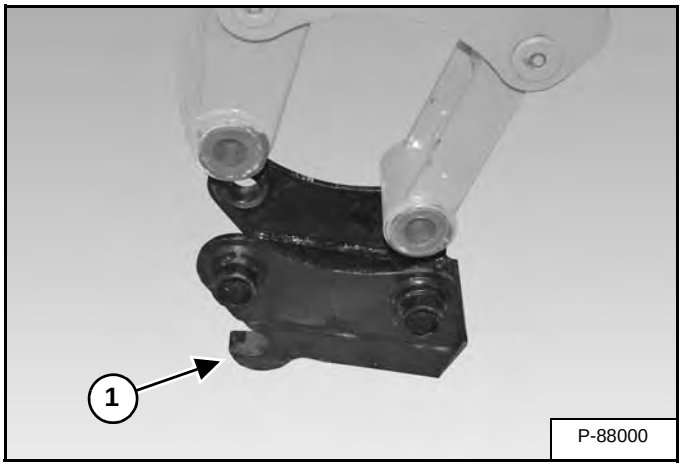


Raise the arm and bucket link until the quick coupler is free **[Figure 40-161-4]**.

Dealer Copy -- Not for Resale

Installation (MS03 And MS08)

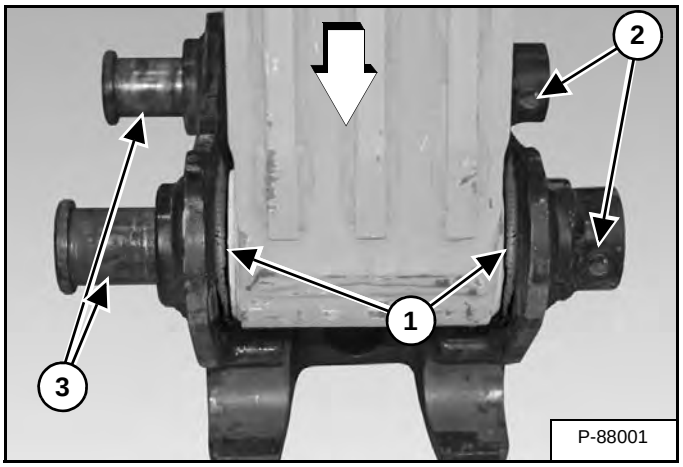
Figure 40-161-5



Place the coupler on the ground with the hooks (Item 1) **[Figure 40-161-5]** facing towards the excavator.

Align the arm and bucket link with the coupler **[Figure 40-161-5]**.

Figure 40-161-6



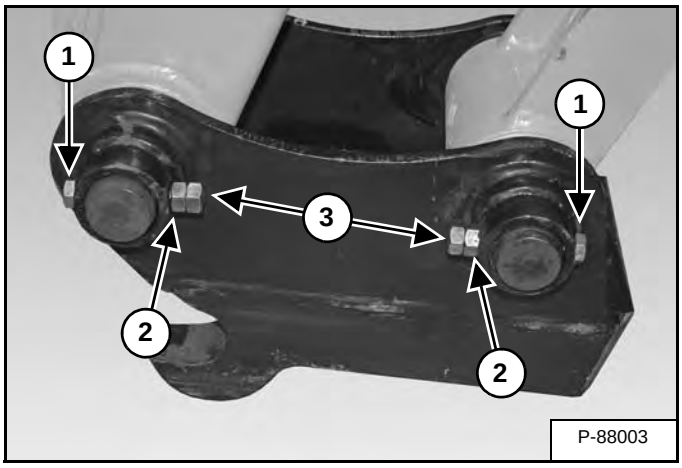
Install the O-rings (Item 1) **[Figure 40-161-6]** between the coupler pivot point and the arm and bucket link when lowering into position.

NOTE: The O-rings will prevent dirt and debris from entering the pivot points of the coupler.

Align the holes of the connecting pins with the holes (Item 2) **[Figure 40-161-6]** in the coupler.

Install the two pins (Item 3) **[Figure 40-161-6]** through the coupler, arm and bucket link.

Figure 40-161-7



Install the two bolts (Item 1) **[Figure 40-161-7]**.

Install nuts (Item 2) **[Figure 40-161-7]** just until contact is made with the coupler.

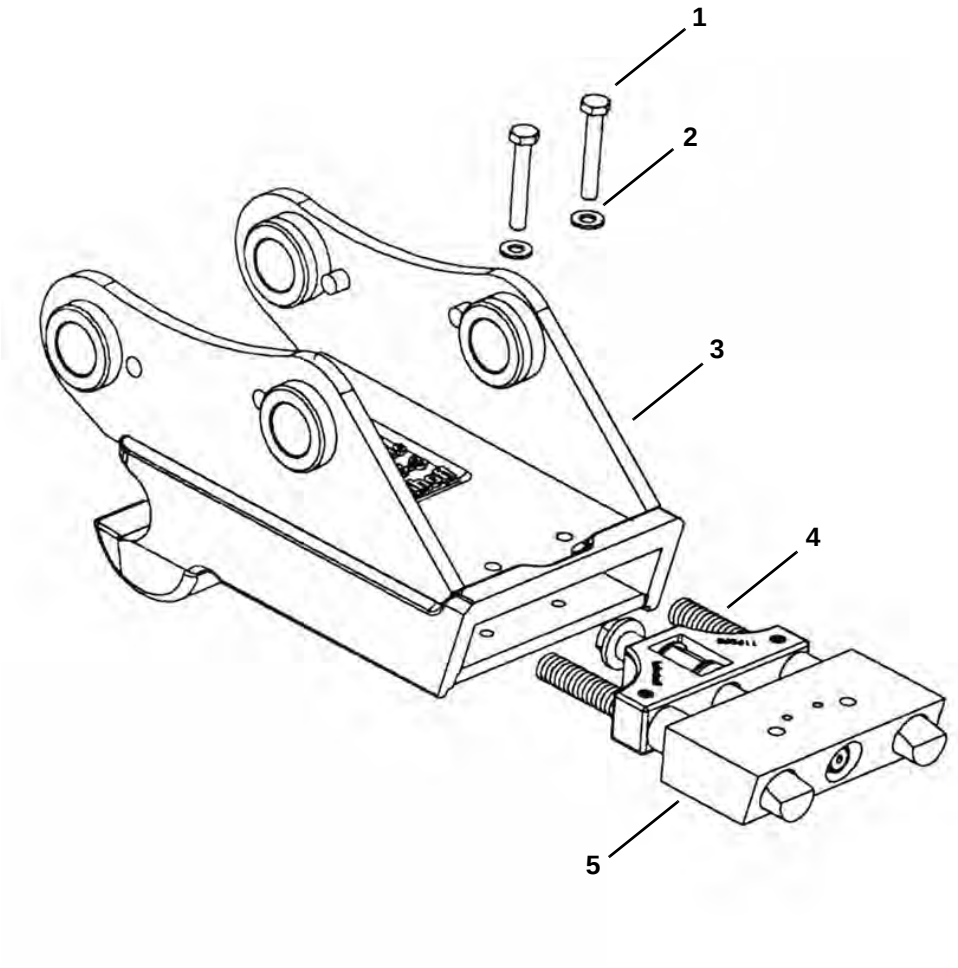
NOTE: Do Not tighten nuts (Item 2) [Figure 40-161-7] against the coupler. The retaining bolt must rotate freely.

Install and tighten nuts (Item 3) securely against the two nuts (Item 2) **[Figure 40-161-7]**. The retaining bolts must rotate freely.

Dealer Copy -- Not for Resale

Parts Identification (MS03)

1. Bolt
2. Lock Washer
3. Coupler Housing
4. Pressure Spring
5. Locking Mechanism

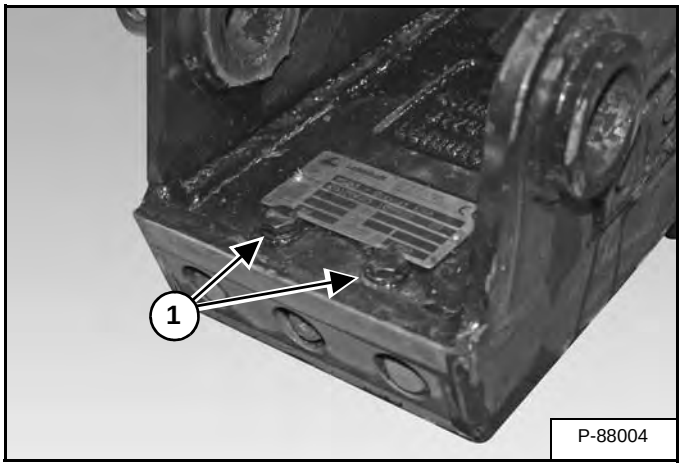


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Dealer Copy -- Not for Resale

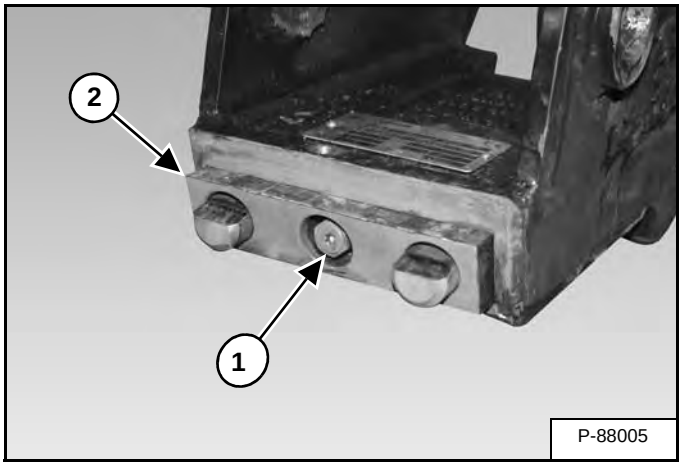
Disassembly And Assembly (MS03)

Figure 40-161-8



Remove the two bolts (Item 1) **[Figure 40-161-8]** and lock washers.

Figure 40-161-9

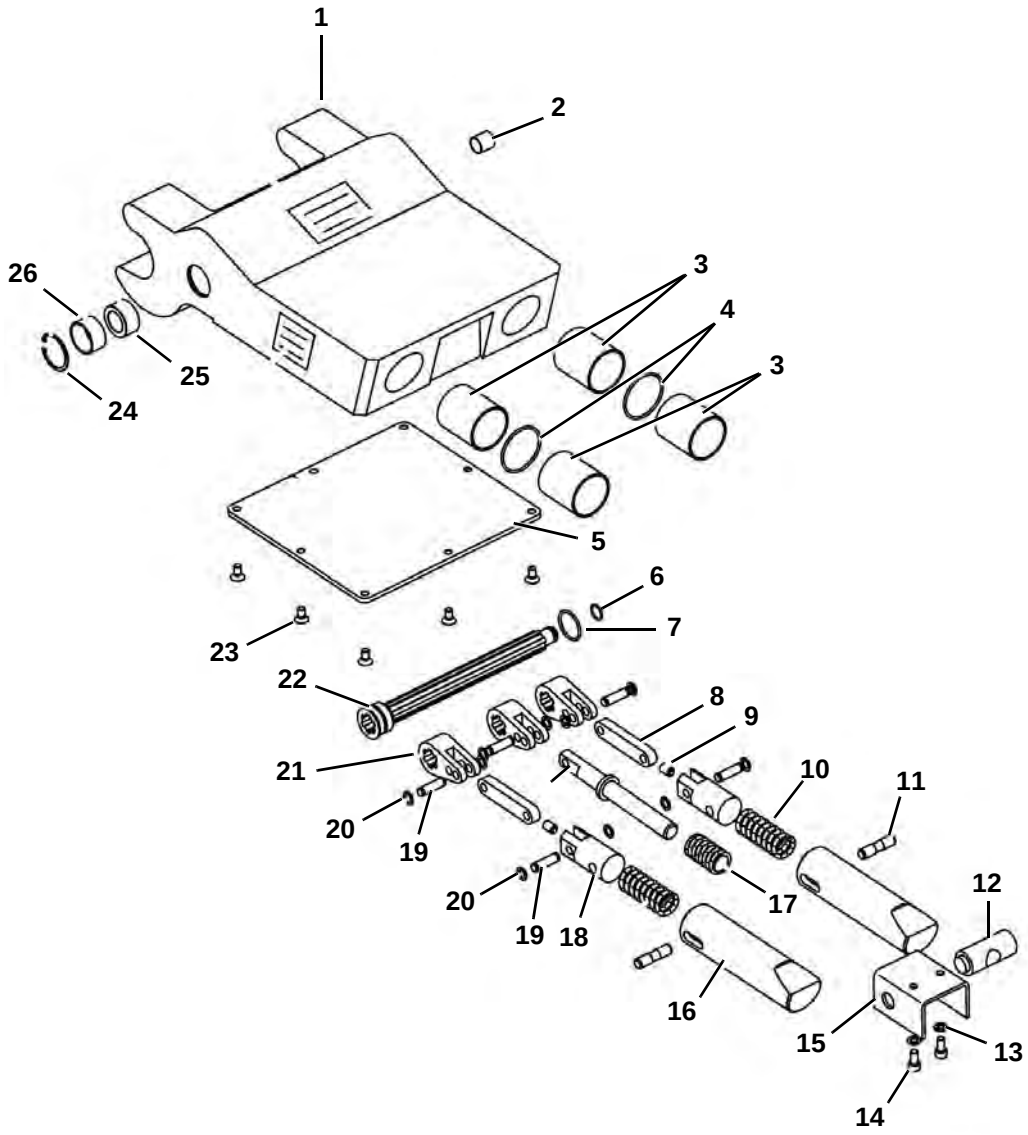


Turn the threaded spindle (Item 1) counterclockwise until the locking mechanism (Item 2) **[Figure 40-161-9]** is free from the housing.

Dealer Copy -- Not for Resale

Parts Identification (MS08)

1. Housing
2. Bushing
3. Bushing
4. O-ring
5. Cover
6. O-ring
7. O-ring
8. Reversing Lever
9. Threaded Pin
10. Pressure Spring
11. Pin
12. Pivoting Journal
13. Spring Washer
14. Bolt
15. Bearing Block
16. Locking Pin
17. Pressure Spring
18. Thrust Journal
19. Pin
20. O-ring
21. Driving Fork
22. Control Shaft
23. Bolt
24. Snap Ring
25. Bushing
26. Bushing



P-88115

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Disassembly (MS08)

⚠ WARNING

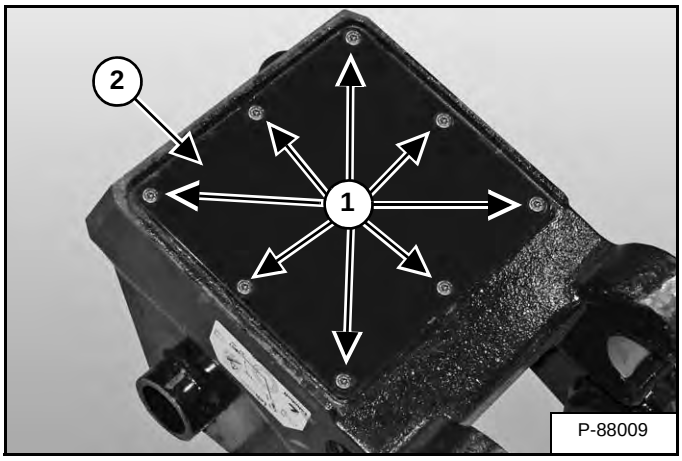
AVOID INJURY OR DEATH

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.**

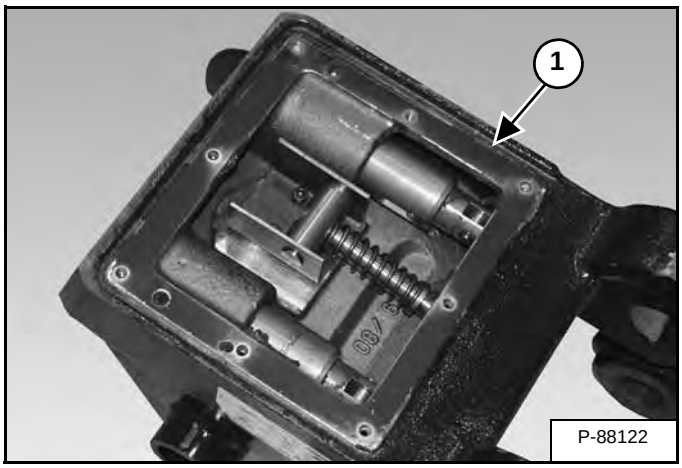
W-2019-0907

Figure 40-161-10



Remove the eight bolts (Item 1) and cover (Item 2) **[Figure 40-161-10]**.

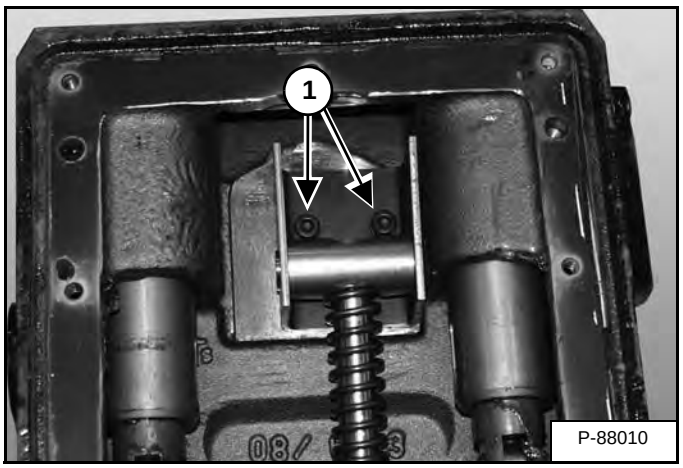
Figure 40-161-11



Remove all sealant (Item 1) **[Figure 40-161-11]** from the housing and cover.

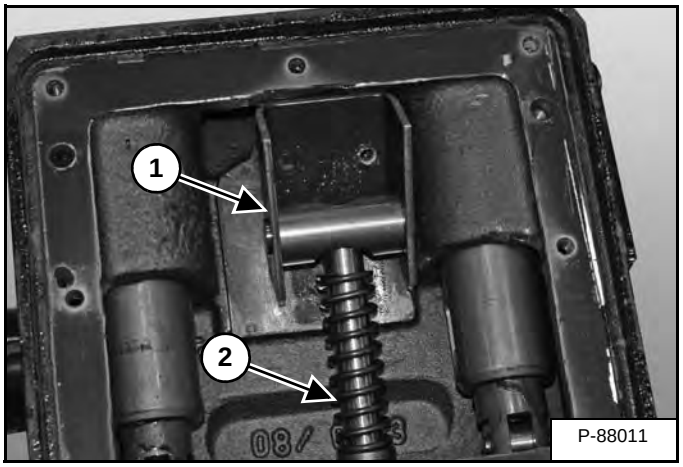
NOTE: Do not scratch the mounting surface while removing sealant.

Figure 40-161-12



Remove the two bolts (Item 1) **[Figure 40-161-12]**.

Figure 40-161-13

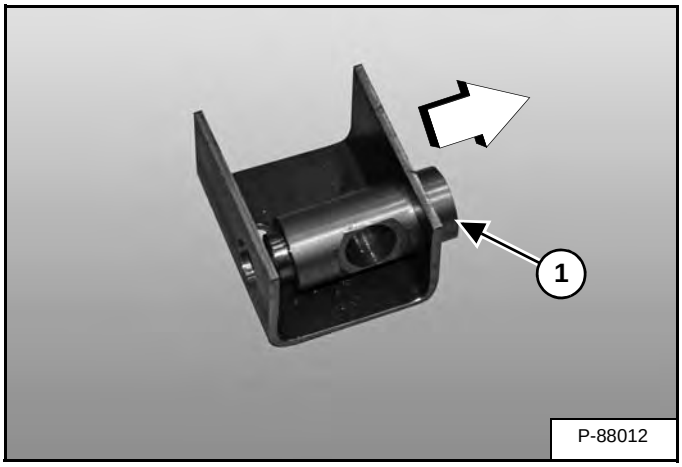


Tilt the bearing block and pivoting journal (Item 1) up and remove from the spring guide (Item 2) **[Figure 40-161-13]**.

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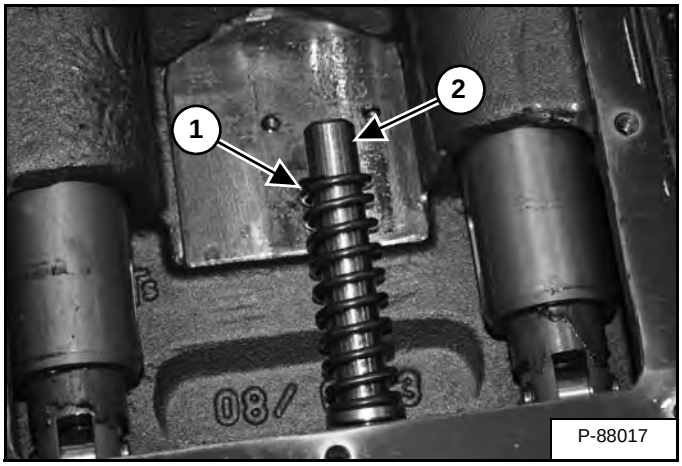
Disassembly (MS08) (Cont'd)

Figure 40-161-14



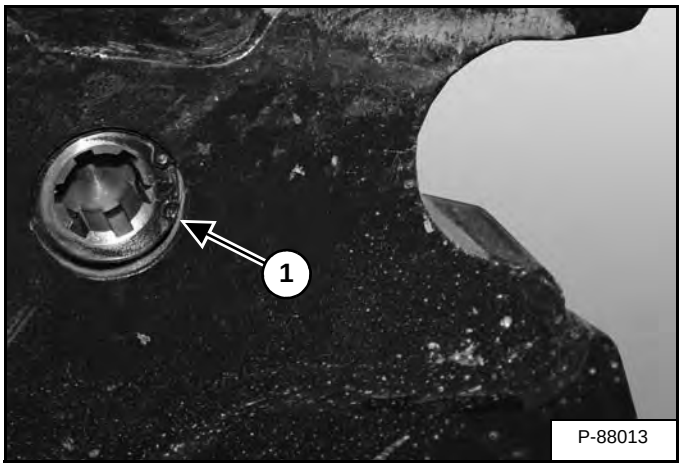
Remove the pivoting journal (Item 1) **[Figure 40-161-14]** from the bearing block.

Figure 40-161-15



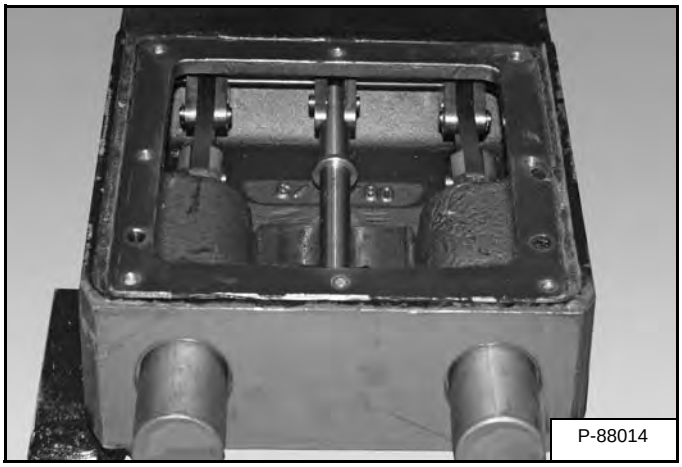
Remove the pressure spring (Item 1) from the spring guide (Item 2) **[Figure 40-161-15]**.

Figure 40-161-16



Remove the snap ring (Item 1) **[Figure 40-161-16]**.

Figure 40-161-17

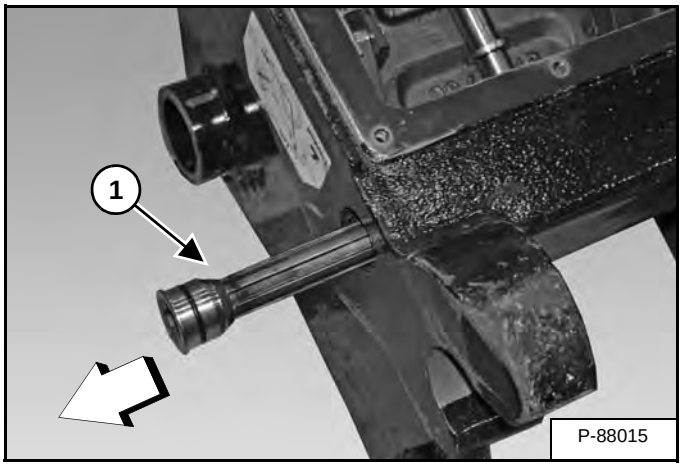


NOTE: Before removing the control shaft, note the position of each of the components so that when the coupler is reassembled all components are positioned correctly on the control shaft [Figure 40-161-17].

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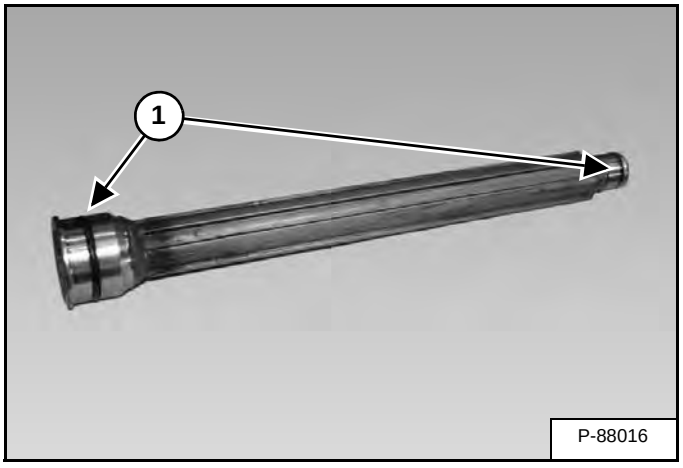
Disassembly (MS08) (Cont'd)

Figure 40-161-18



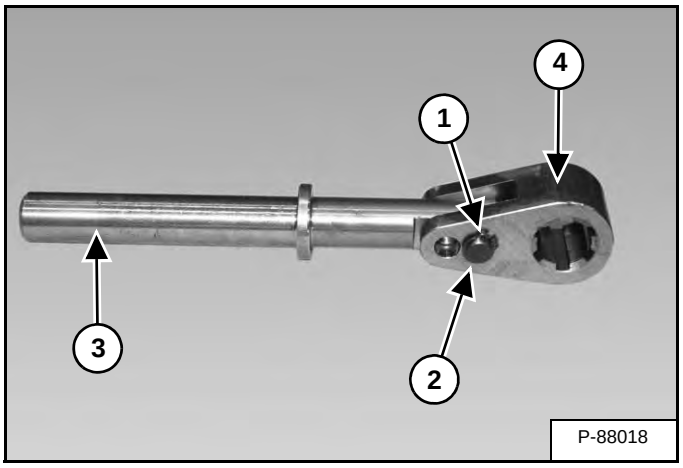
Remove the control shaft (Item 1) **[Figure 40-161-18]**.

Figure 40-161-19



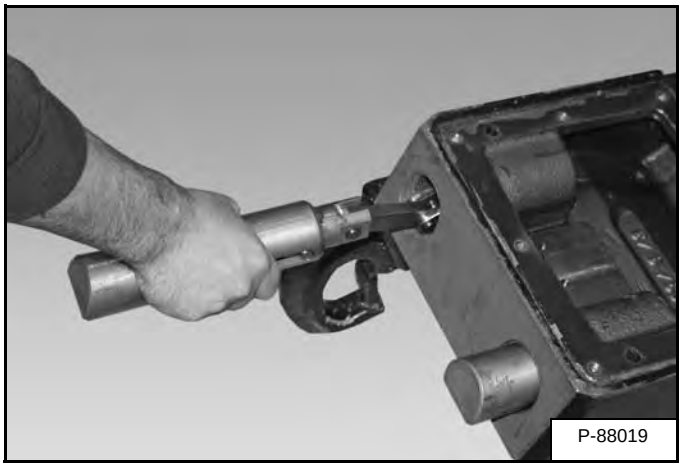
Remove O-rings (Item 1) **[Figure 40-161-19]**.

Figure 40-161-20



Remove the snap ring (Item 1) and pin (Item 2). Remove the spring guide (Item 3) from the driving fork (Item 4) **[Figure 40-161-20]**.

Figure 40-161-21

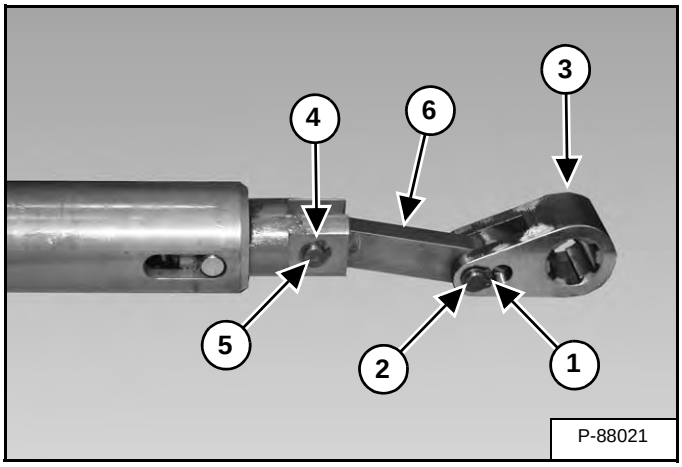


Remove the locking pin assemblies **[Figure 40-161-21]**.

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Disassembly (MS08) (Cont'd)

Figure 40-161-22

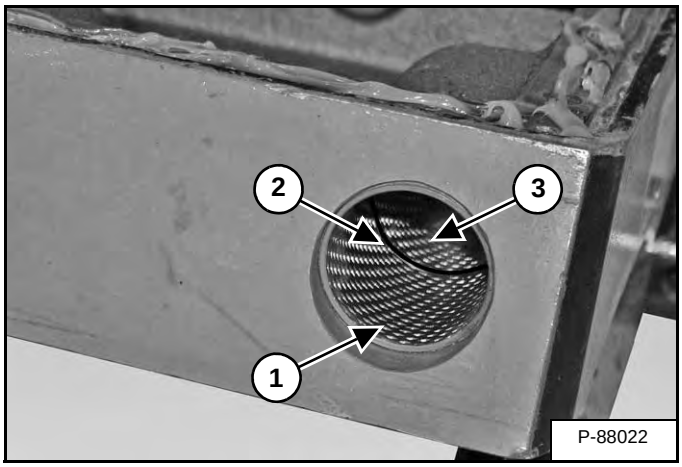


Remove the snap ring (Item 1) and pin (Item 2). Remove the driving fork (Item 3) **[Figure 40-161-22]**.

Remove the snap ring (Item 4) and pin (Item 5). Remove the reversing lever (Item 6) **[Figure 40-161-22]**.

Repeat the procedure for the other locking pin.

Figure 40-161-23

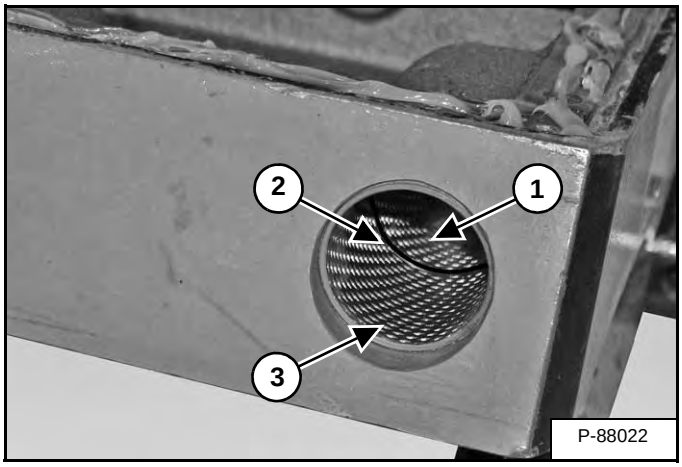


Remove the bushing (Item 1), O-ring (Item 2) and bushing (Item 3) **[Figure 40-161-23]** from both locking pin bores.

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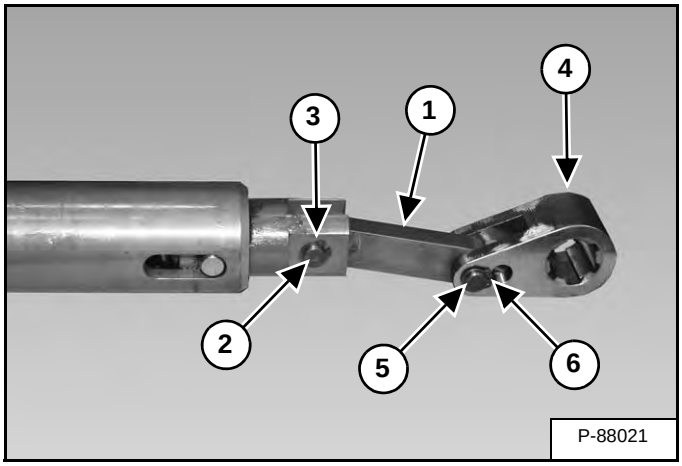
Assembly (MS08)

Figure 40-161-24



Install bushing (Item 1), O-ring (Item 2) and bushing (Item 3) **[Figure 40-161-24]** in both locking pin bores.

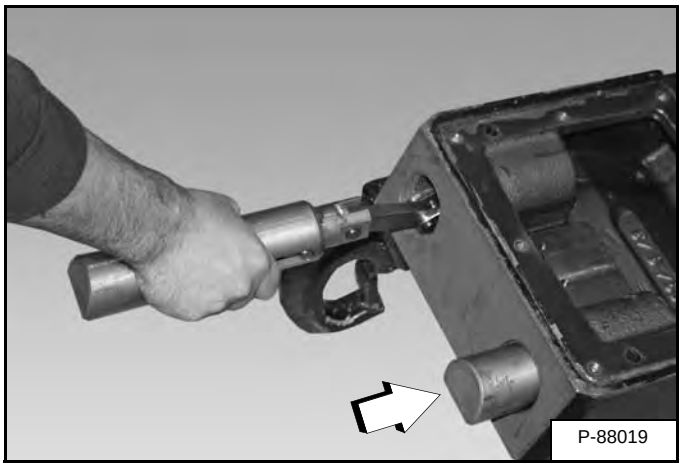
Figure 40-161-25



Install reversing lever (Item 1), pin (Item 2) and snap ring (Item 3) **[Figure 40-161-25]** on the locking pin.

Install the driving fork (Item 4), pin (Item 5) and snap ring (Item 6) **[Figure 40-161-25]** on the reversing lever. Repeat the procedure for the other locking pin.

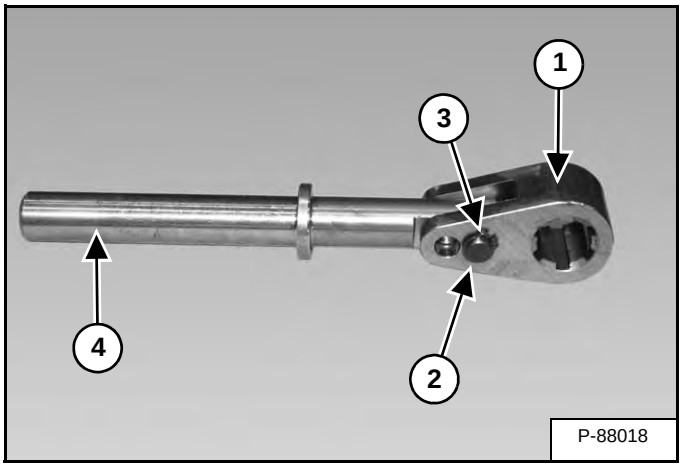
Figure 40-161-26



Install the locking pin assemblies **[Figure 40-161-26]**.

NOTE: Position the locking levers with the flat side down and away from the cover.

Figure 40-161-27

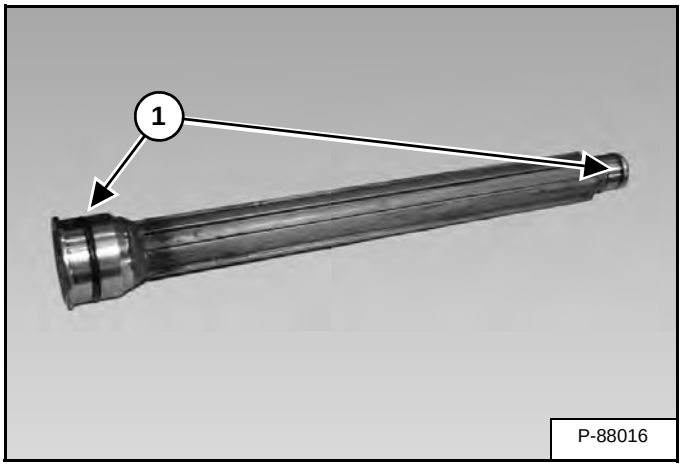


Install the driving fork (Item 1), pin (Item 2) and snap ring (Item 3) on the spring guide (Item 4) **[Figure 40-161-27]**.

Dealer Copy -- Not for Resale

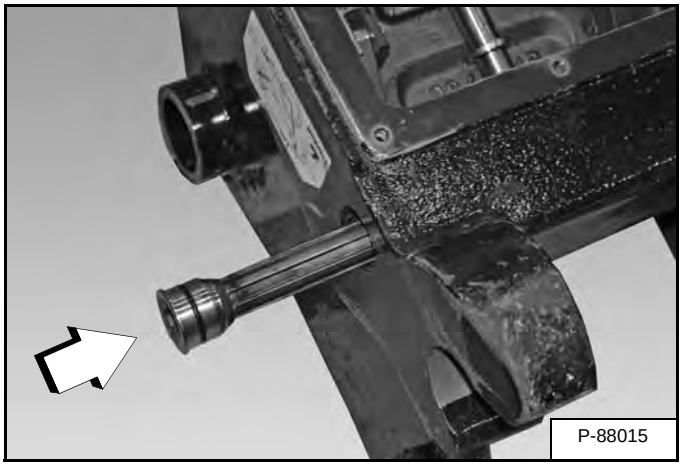
Assembly (MS08) (Cont'd)

Figure 40-161-28



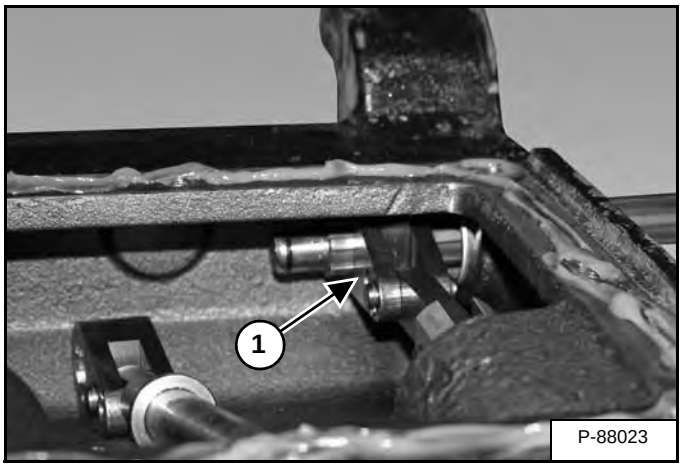
Install the O-rings (Item 1) **[Figure 40-161-28]**.

Figure 40-161-29



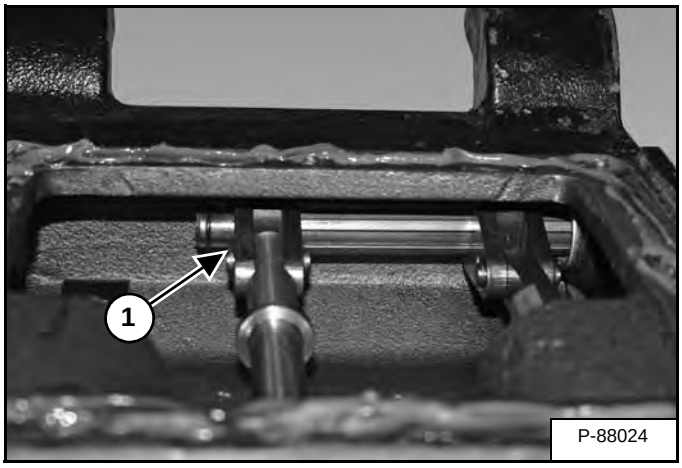
Install the control shaft (Item 1) **[Figure 40-161-29]**.

Figure 40-161-30



Install the control shaft through the first locking lever driving fork (Item 1) **[Figure 40-161-30]**.

Figure 40-161-31

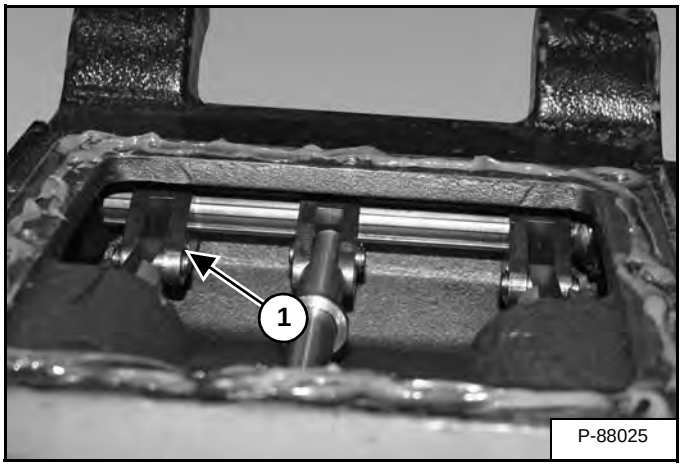


Install the control shaft through the spring guide driving fork (Item 1) **[Figure 40-161-31]**.

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Assembly (MS08) (Cont'd)

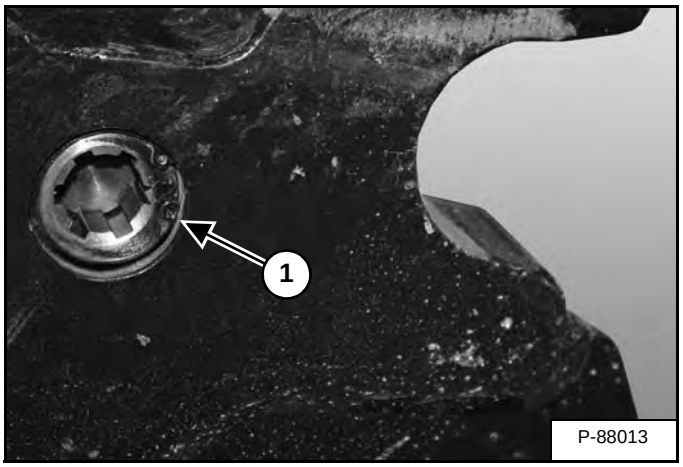
Figure 40-161-32



Install the control shaft through the second locking lever driving fork (Item 1) **[Figure 40-161-32]**.

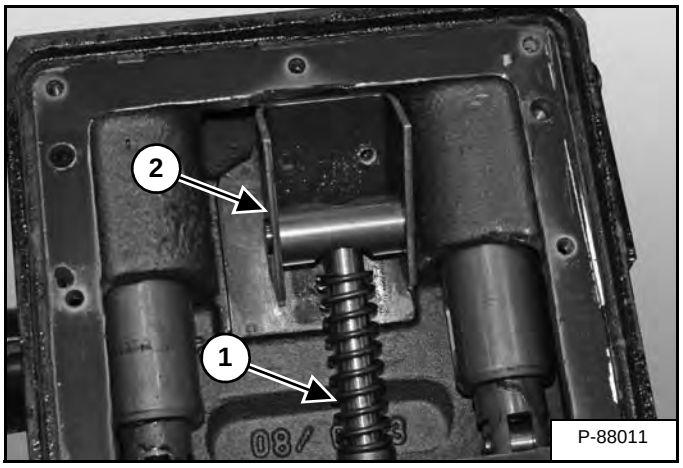
NOTE: Check proper alignment of all three driving forks on the control shaft. If not aligned properly, repeat the procedure.

Figure 40-161-33



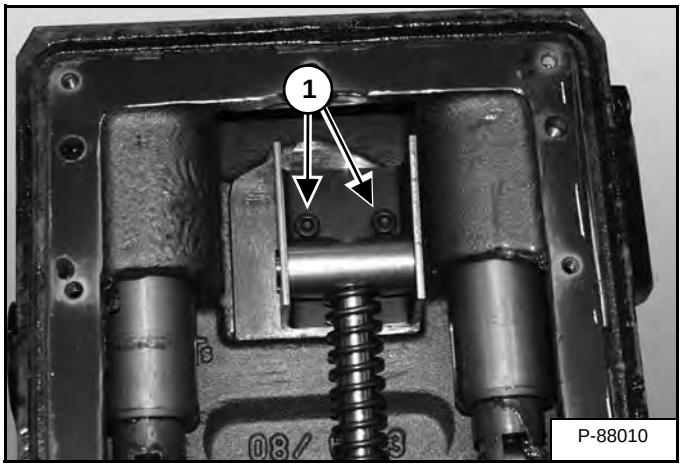
Install the snap ring (Item 1) **[Figure 40-161-33]**.

Figure 40-161-34



Install pressure spring (Item 1) on the spring guide. Tilt the bearing block and pivoting journal (Item 2) **[Figure 40-161-34]** down and install on the spring guide.

Figure 40-161-35

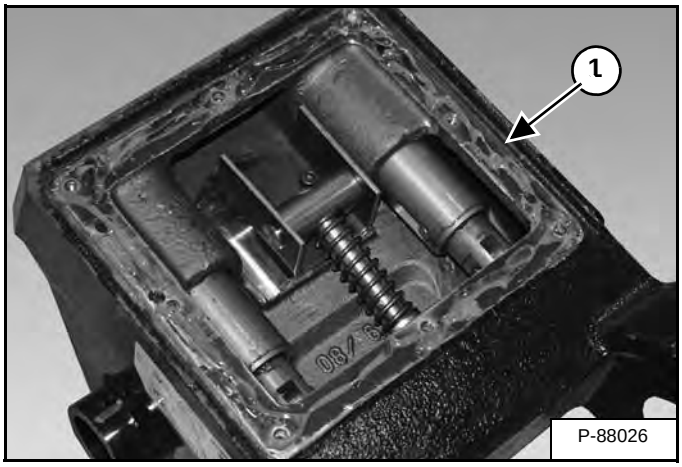


Install the two bolts (Item 1) **[Figure 40-161-35]**.

Dealer Copy -- Not for Resale

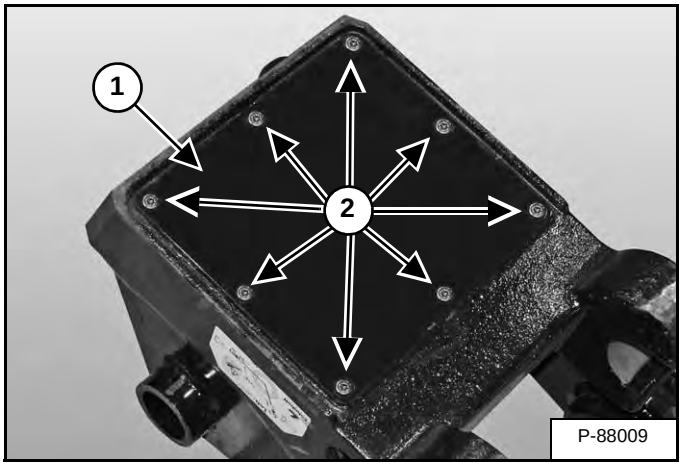
Assembly (MS08) (Cont'd)

Figure 40-161-36



Apply a bead of sealant around the cover mounting surface (Item 1) **[Figure 40-161-36]**.

Figure 40-161-37



Install the cover (Item 1) **[Figure 40-161-37]**.

Apply Loctite® 242 on the eight bolts.

Install the eight bolts (Item 2) **[Figure 40-161-37]**.

Dealer Copy -- Not for Resale

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.**

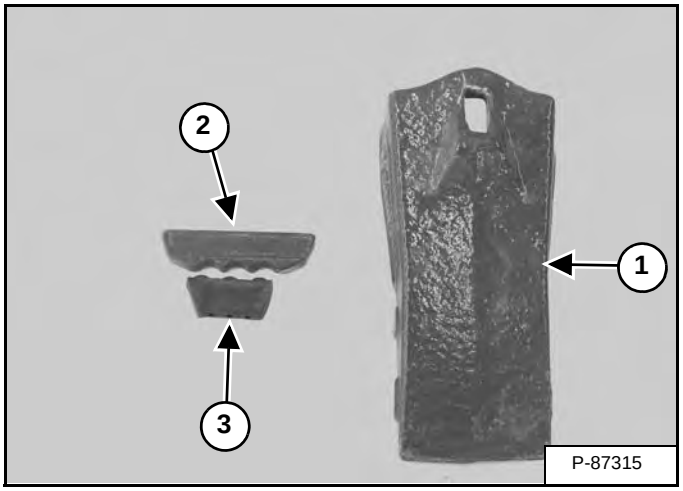
W-2505-0604

Position the bucket at a 30° angle up from the ground so that the bucket teeth are easily accessible. Install a block under the bucket.

Lower the boom until the bucket is fully on the ground and resting on the block.

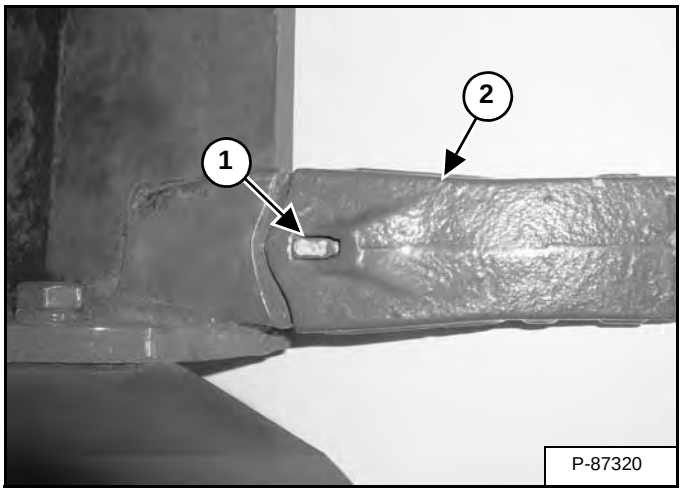
Stop the engine and exit the excavator.

Figure 40-170-1



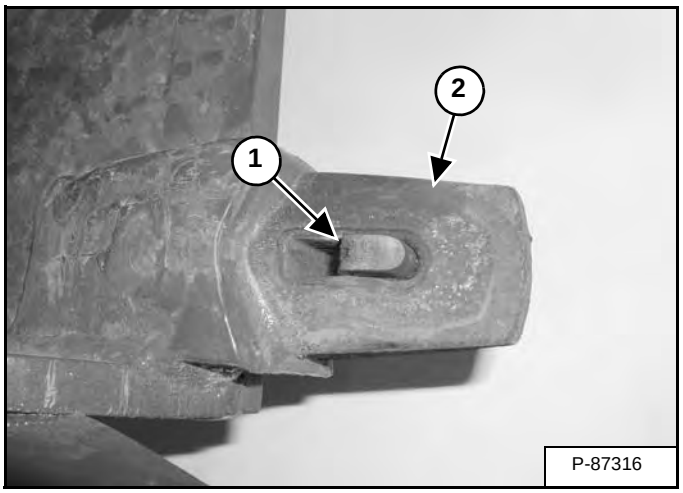
The bucket tooth (Item 1) has a unique retaining pin (Item 2) and rubber retainer (Item 3). The retaining pin (Item 2) must be installed as shown, with the notch towards the rubber retainer (Item 3). The rubber retainer (Item 3) **[Figure 40-170-1]** will be installed into the shank before the tooth is installed on the shank.

Figure 40-170-2



Use a punch and a hammer and drive the retainer pin (Item 1) down and out the bottom of the tooth (Item 2) **[Figure 40-170-2]**. Remove the tooth from the shank.

Figure 40-170-3



Remove the rubber retainer (Item 1) from the shank (Item 2) **[Figure 40-170-3]**.

Installation: Install the rubber retainer (Item 1) into the tooth shank (Item 2) **[Figure 40-170-3]**.

Position the new tooth point (Item 2) **[Figure 40-170-2]** on the shank (Item 2) **[Figure 40-170-3]**.

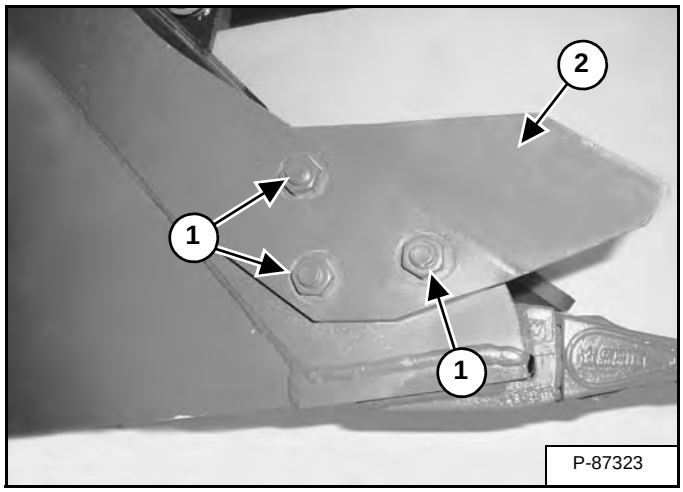
Install the retainer pin (Item 1) **[Figure 40-170-3]** until it is flush with the top of the tooth.

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BUCKET (CONT'D)

Bucket Side Cutting Edge Removal And Installation

Figure 40-170-4



Remove the three nuts (Item 1) and bolts. Remove the cutting edge (Item 2) **[Figure 40-170-4]**.

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RIGHT SIDE COVER

Removal And Installation

Remove the center access cover. (See Removal And Installation on Page 40-80-1.)

Remove the center cover. (See Removal And Installation on Page 40-70-1.)

Open the right side cover. (See Opening And Closing on Page 10-50-1.)

Figure 40-180-1

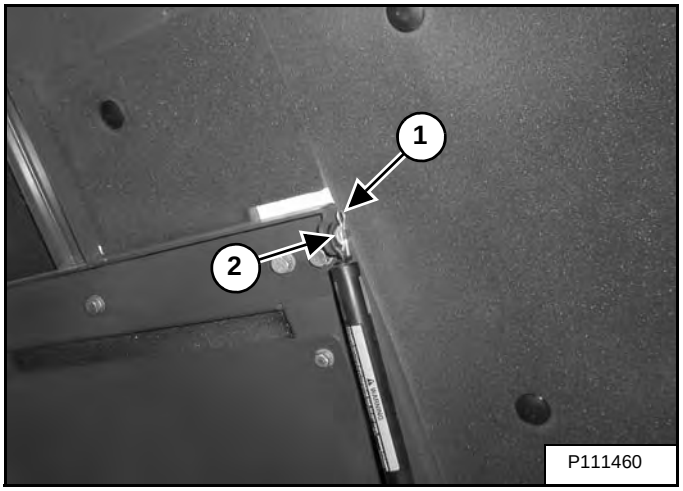
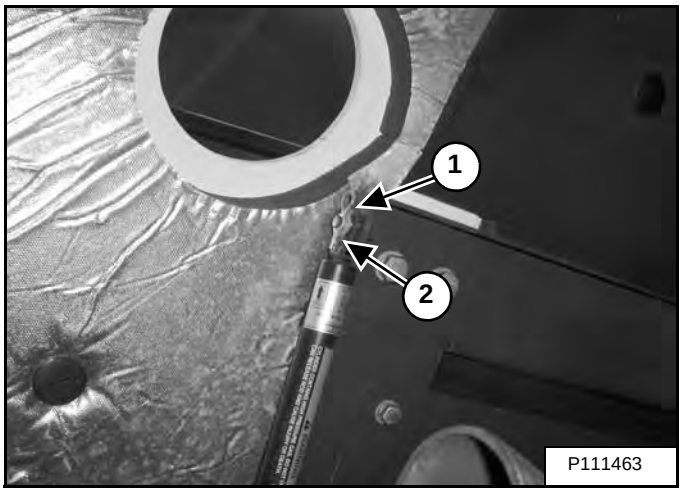


Figure 40-180-2



Remove the clip (Item 1) and washer (Item 2) **[Figure 40-180-1]** and **[Figure 40-180-2]** from the top of the gas struts.

Figure 40-180-3

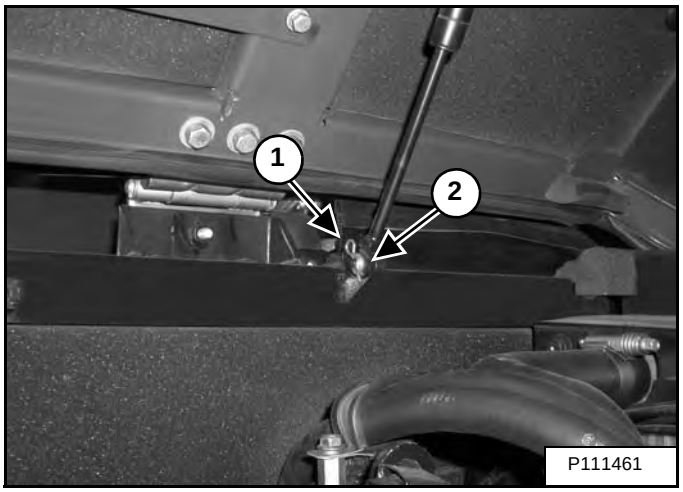
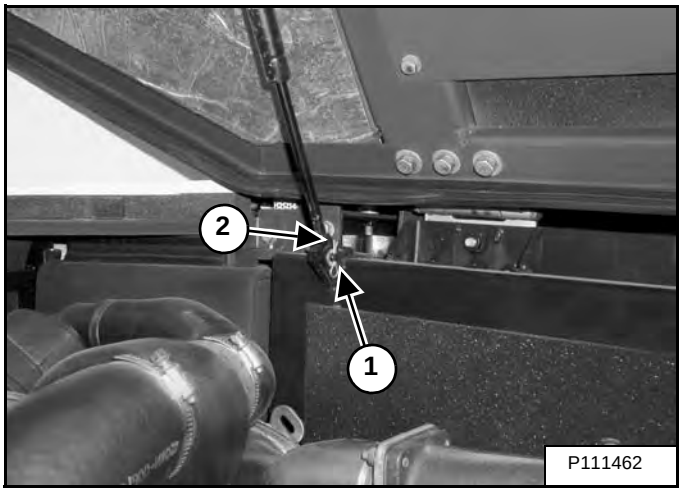


Figure 40-180-4



Remove the clip (Item 1) and washers (Item 2) **[Figure 40-180-3]** and **[Figure 40-180-4]** from the bottom of the gas struts.

Support the cover and remove the gas struts.

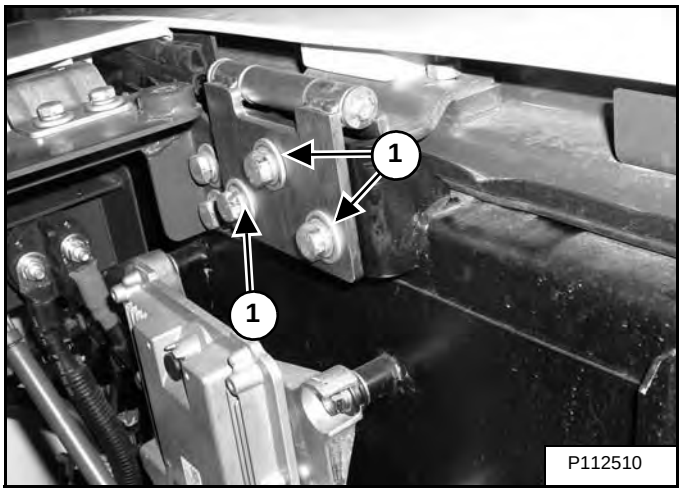
Close the right side cover.

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RIGHT SIDE COVER (CONT'D)

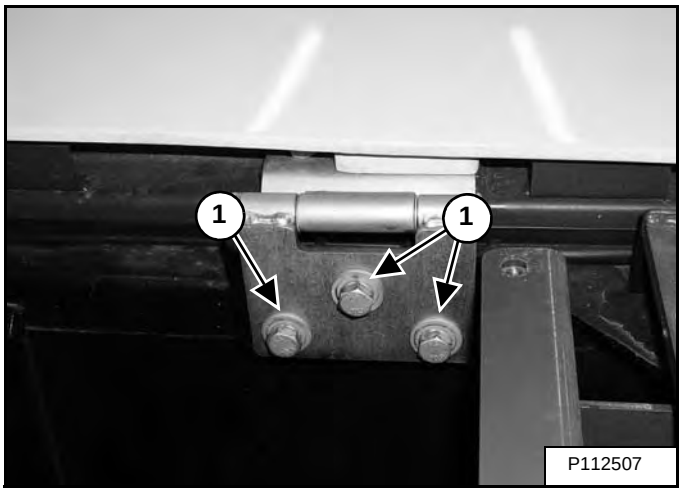
Removal And Installation (Cont'd)

Figure 40-180-5



Remove the three bolts (Item 1) **[Figure 40-180-5]**, washers and shims (if equipped).

Figure 40-180-6

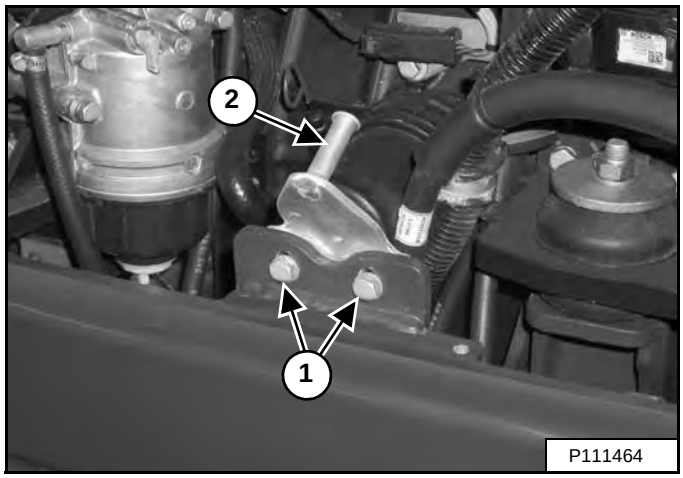


Remove the three bolts (Item 1) **[Figure 40-180-6]**, washers and shims (if equipped).

Remove the cover.

Latch Adjustment

Figure 40-180-7



Loosen the two bolts (Item 1) and adjust the latch (Item 2) **[Figure 40-180-7]**. Tighten the nut after the adjustment is made.

Close the right side cover before operating the excavator.

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REAR COVER

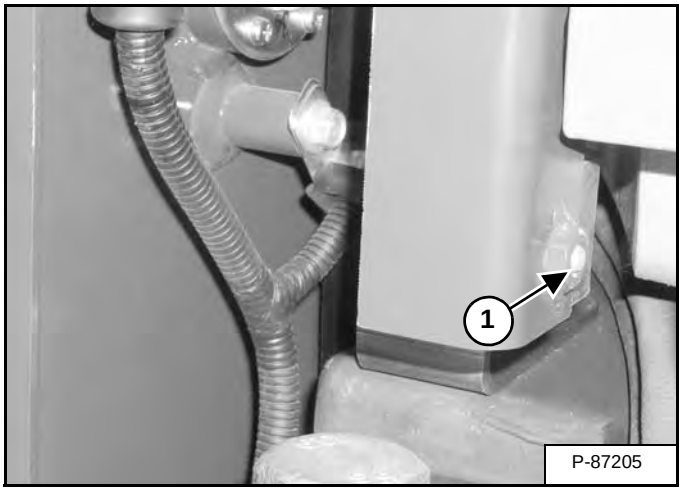
Removal And Installation

Remove the center access cover. (See Removal And Installation on Page 40-80-1.)

Remove the center cover. (See Removal And Installation on Page 40-70-1.)

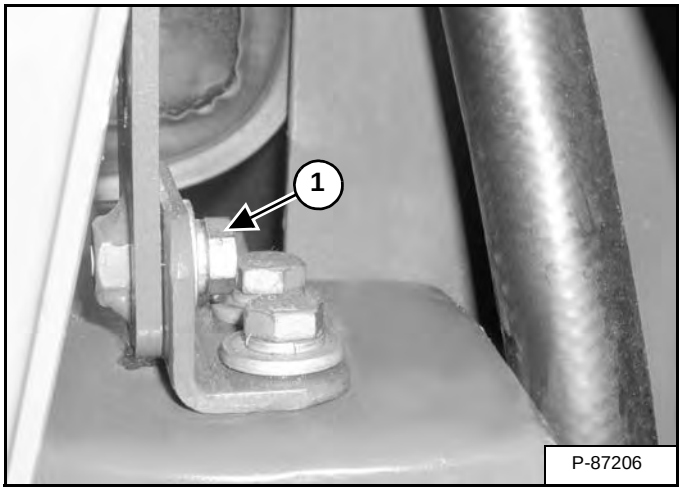
Tilt the cab. (See Raising And Lowering on Page 10-210-1.)

Figure 40-190-1



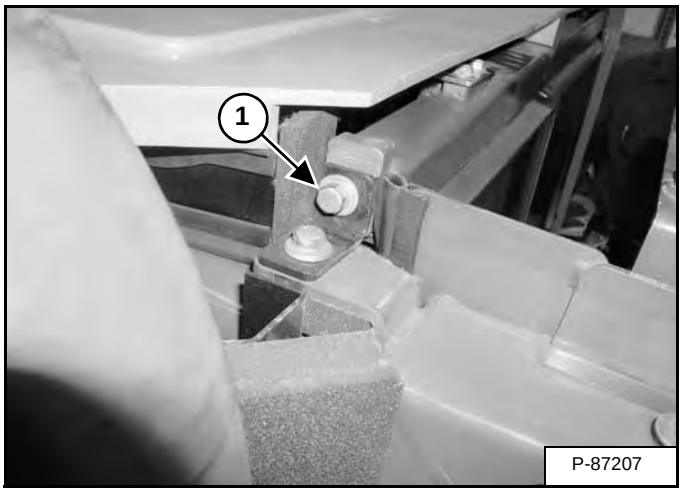
Remove the bolt (Item 1) **[Figure 40-190-1]** from the lower left side of the rear cover.

Figure 40-190-2



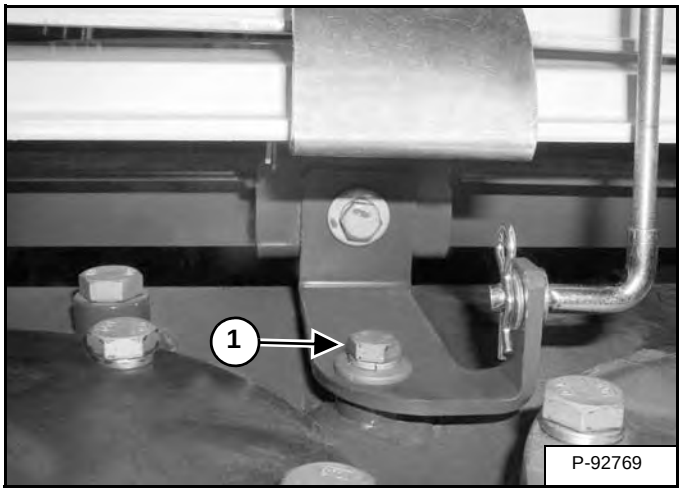
Remove the bolt (Item 1) **[Figure 40-190-2]** from the lower right side of the rear cover.

Figure 40-190-3



Remove the bolt (Item 1) **[Figure 40-190-3]** from the upper right side of the rear cover.

Figure 40-190-4



Remove the bolt (Item 1) **[Figure 40-190-4]**.

Remove the rear cover.

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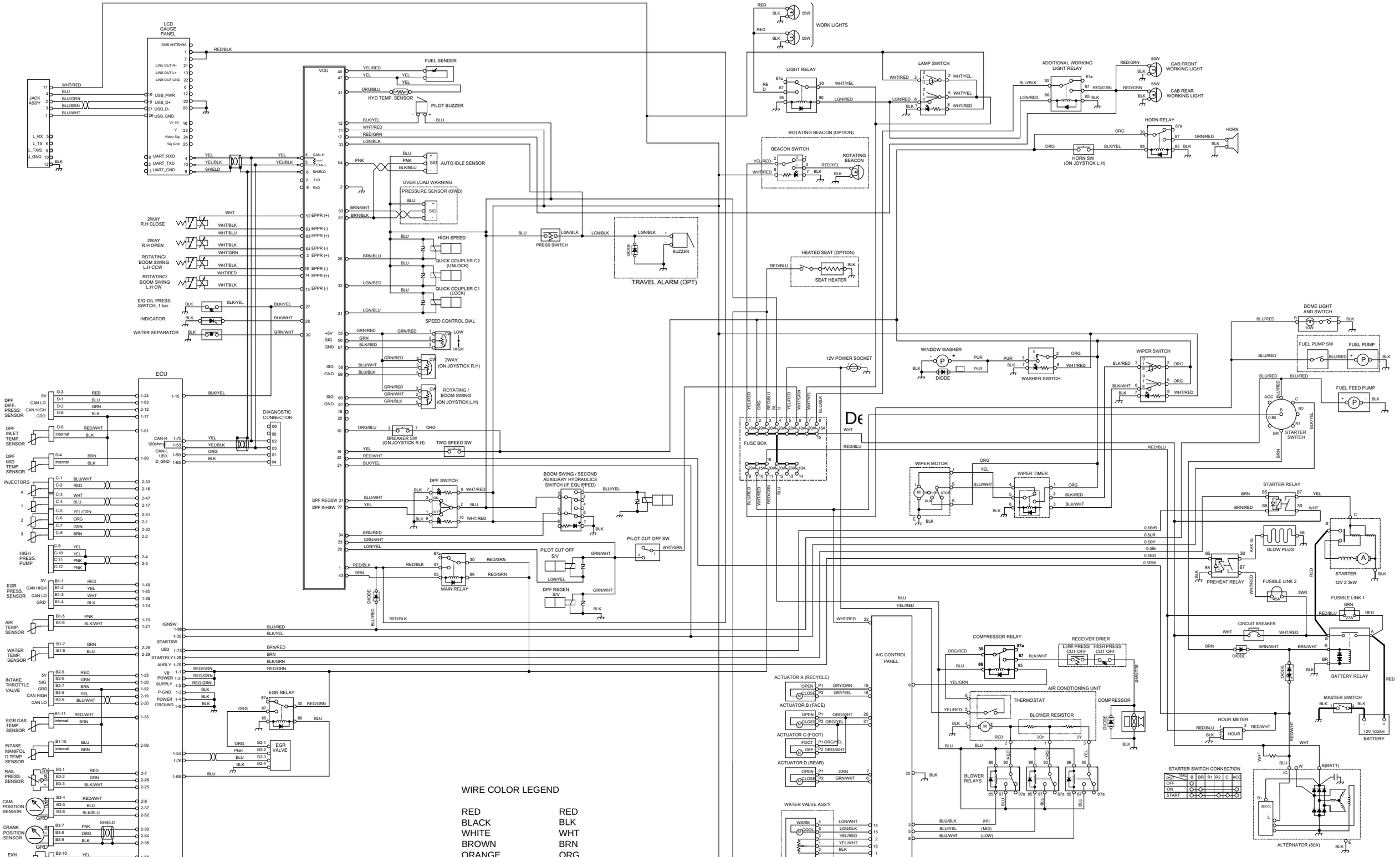
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WIRE COLOR LEGEND

RED	RED
BLACK	BLK
WHITE	WHT
BROWN	BRN
ORANGE	ORG
YELLOW	YEL
PURPLE	PUR
PINK	PNK
GRAY	GRY
TAN	TAN
LIGHT BLUE	LBU
DARK BLUE	DBU
LIGHT GREEN	GRN
DARK GREEN	DGN

WIRING SCHEMATIC

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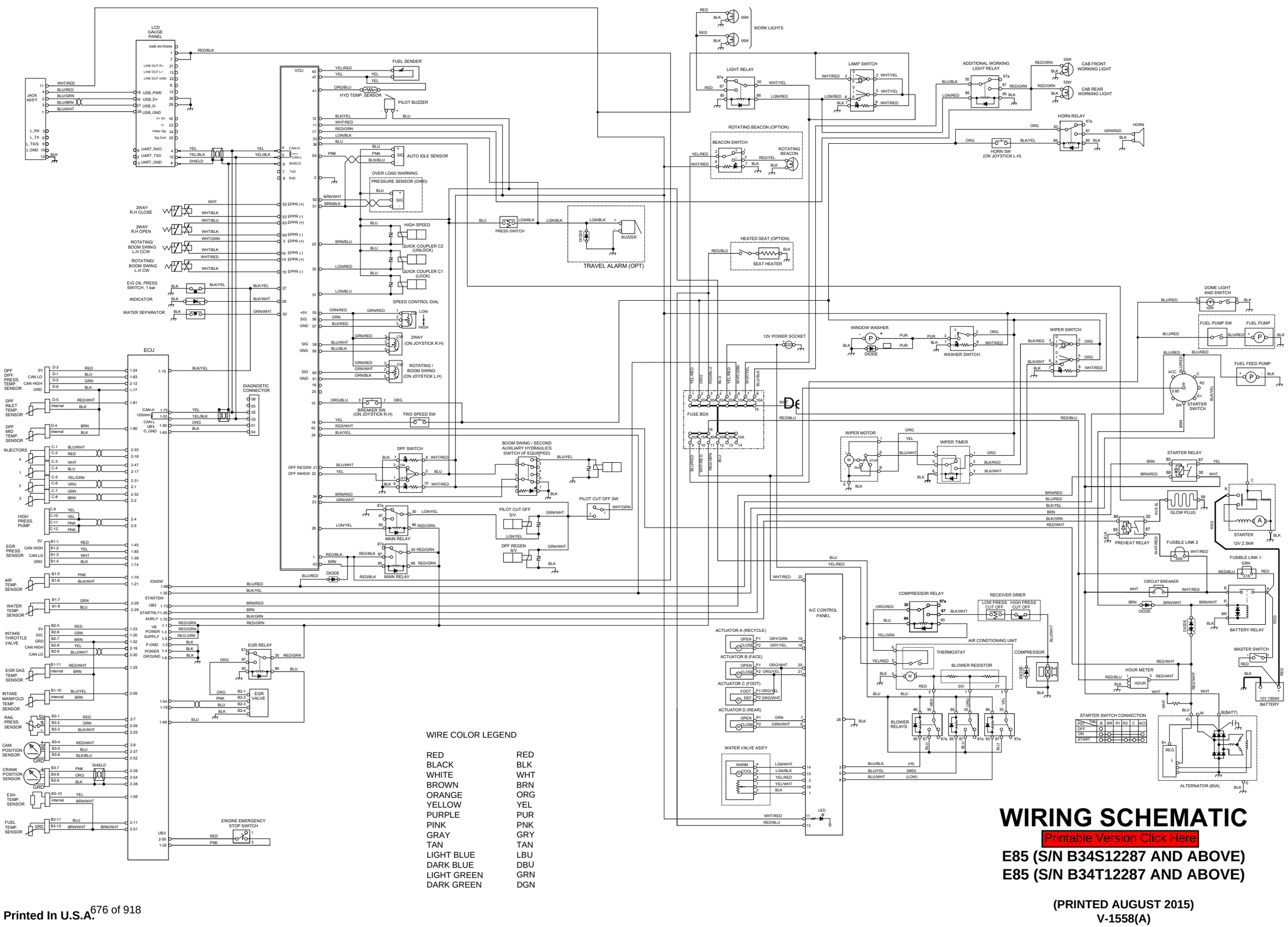
E85 (S/N B34S11001 - B34S12286)

E85 (S/N B34T11001 - B34T12286)

(PRINTED AUGUST 20135)

V-1558 (0)

Printed In U.S.A.



WIRE COLOR LEGEND

RED	RED
BLACK	BLK
WHITE	WHT
BROWN	BRN
ORANGE	ORG
YELLOW	YEL
PURPLE	PUR
PINK	PNK
GRAY	GRY
TAN	TAN
LIGHT BLUE	LBU
DARK BLUE	DBU
LIGHT GREEN	GRN
DARK GREEN	DGN

WIRING SCHEMATIC

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E85 (S/N B34T12287 AND ABOVE)

(PRINTED AUGUST 2015)
V-1558(A)

ELECTRICAL SYSTEM INFORMATION

Troubleshooting Chart

The following troubleshooting chart is provided for assistance in locating and correcting the most common problems.

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.

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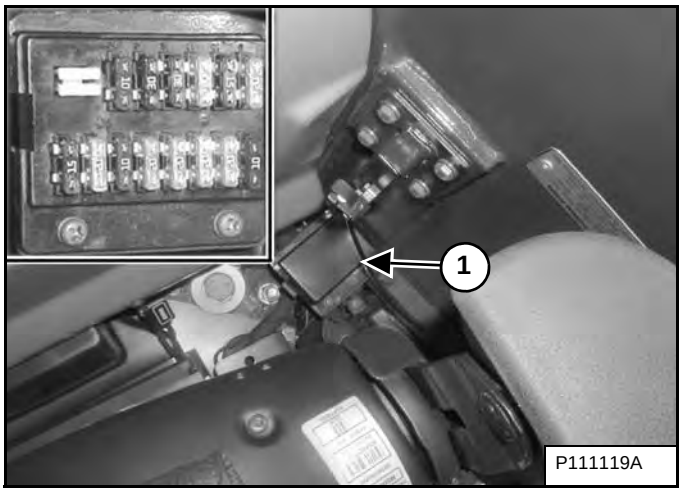
PROBLEM	CAUSE
Battery will not take charge.	1, 2, 3, 4, 5
Alternator will not charge.	1, 2, 5
Starter will not turn engine.	2, 3, 4, 6, 7, 8, 9

KEY TO CORRECT THE CAUSE
1. Alternator belt is loose or damaged.
2. Battery connections are dirty or loose.
3. Battery is damaged.
4. The ground connection is not making a good contact.
5. The alternator is damaged.
6. The engine is locked.
7. The starter is damaged.
8. The wiring or the solenoid is damaged.
9. Check the fuses.

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Description

Figure 50-10-1



The excavator has a 12 volt, negative ground electrical system. The electrical system is protected by fuses located below the left rear side of the operator's seat (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.

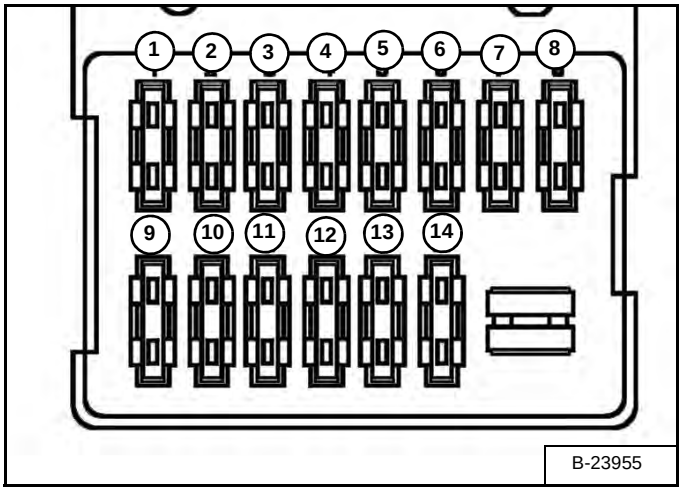
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Fuse And Relay Location / Identification

A decal is on the cover to show location and amp ratings.

Remove the cover to check or replace the fuses.

Figure 50-10-2



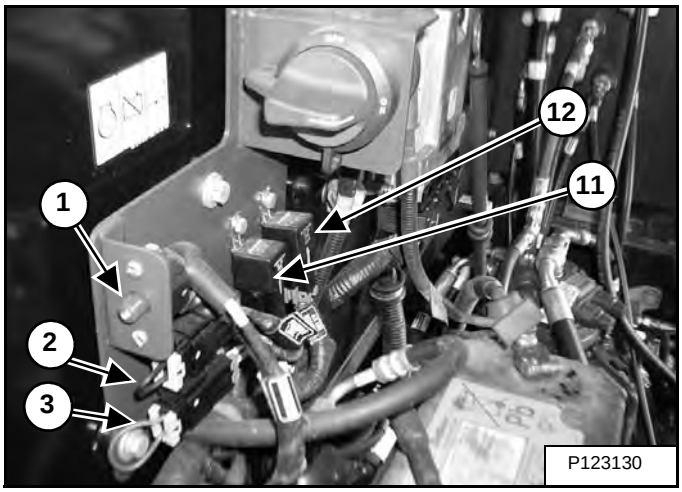
The fuse location and sizes are shown **[Figure 50-10-2]** and in the below chart.

REF	DESCRIPTION	AMP
1	Beacon / Strobe Light (Optional)	10
2	Horn, Wiper, Washer	20
3	Heated Seat (Optional), HVAC Panel	20
4	Stereo	20
5	12 Power Port, HVAC Unit	20
6	Pilot Cutoff	10
7	Work Lights	20
8	Cab Lights	15
9	Interior Lights, Fuel Pump	20
10	Start Switch	15
11	Instrument Panel, VCU, ECU	30
12	A/C Compressor	30
13	Spare Fuse	30
14	Spare Fuse	10

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Fuse And Relay Location / Identification (Cont'd)

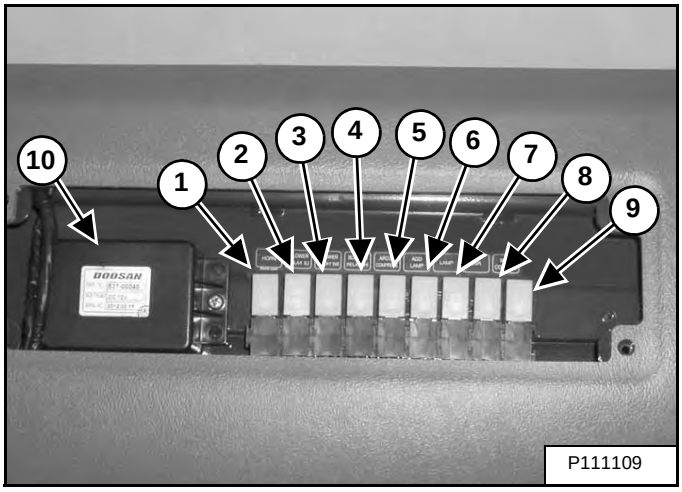
Figure 50-10-3



A 60 amp circuit breaker (Item 1) and two fusible links (Item 2) 27 amp and (Item 3) 45 amp **[Figure 50-10-3]** are located under the front center cover.

The 27 amp fusible link (Item 2) is for the start circuit and the 45 amp fusible link (Item 3) **[Figure 50-10-3]** is for the preheat circuit.

Figure 50-10-4



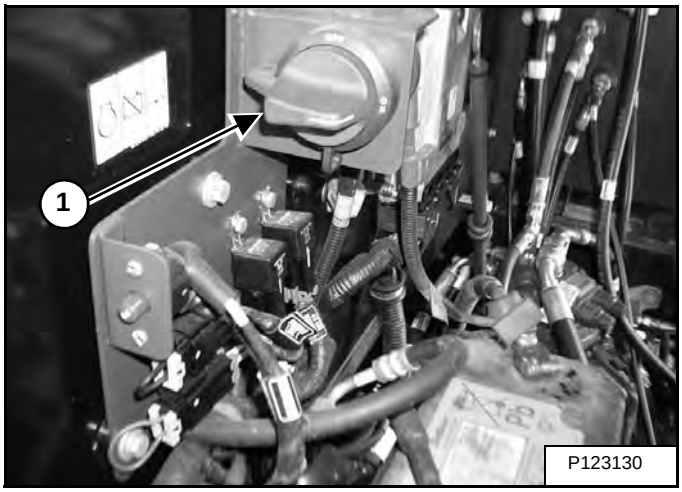
The relays are shown in **[Figure 50-10-4]** and in the below chart. The relays are located behind the access panel that is located behind the operator's seat.

REF	DESCRIPTION
1	Horn
2	Blower (1) (Lo)
3	Blower (2) (Med)
4	Blower (3) (High)
5	Compressor
6	Additional Lights (Cab Work Lights)
7	Lights
8	EGR
9	Main Controller
10	Controller
11	Preheat
12	Starter

NOTE: Relays (Item 11 and 12) [Figure 50-10-3] are located under the center cover.

Master Disconnect Switch

Figure 50-10-5



The excavator has a master disconnect switch (Item 1) **[Figure 50-10-5]** located under the center cover. The switch will disconnect the positive circuit between the battery and the electric / electronic devices.

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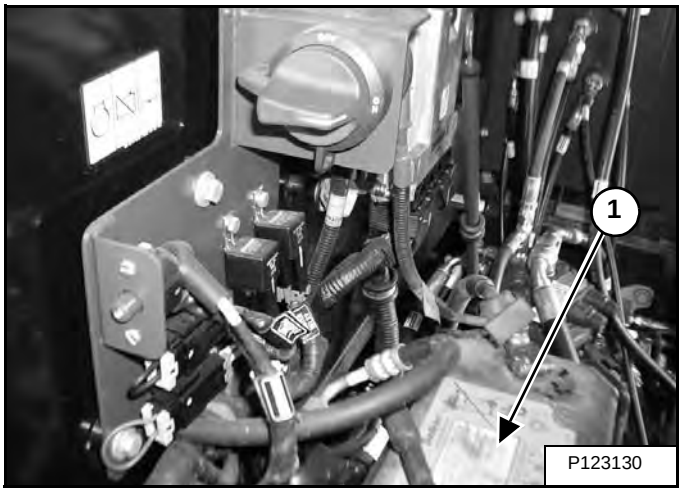
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BATTERY

Battery Maintenance

Open the center cover. (See Opening And Closing on Page 10-70-1.)

Figure 50-20-1



The battery (Item 1) **[Figure 50-20-1]** is located under the center cover.

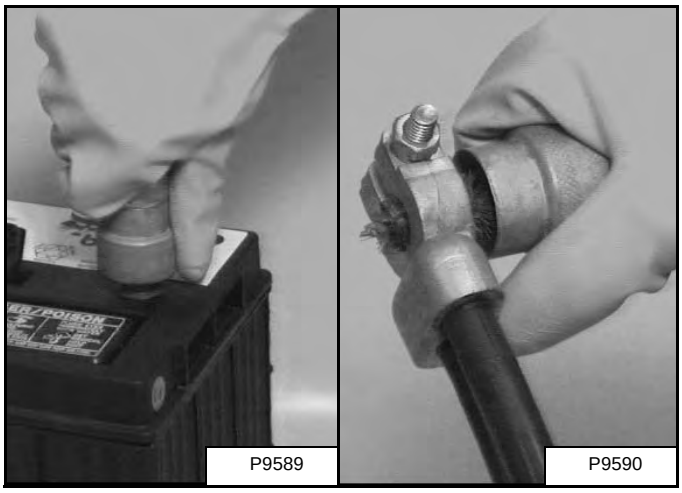
IMPORTANT

AVOID ELECTRICAL COMPONENT DAMAGE

Disconnecting the battery while the engine is running can cause damage to electrical components. Disconnect battery only when the engine is turned OFF.

I-2374-0513

Figure 50-20-2



The battery cables must be clean and tight **[Figure 50-20-2]**. Remove acid or corrosion from the battery and cables using a sodium bicarbonate and water solution. Cover the battery terminals and cable ends with battery saver grease to prevent corrosion.

Check for broken or loose connections.

If the battery cables are removed for any reason, disconnect the negative (-) cable first. When installing the battery cables, make the last connection the negative (-) cable to the battery.

The original equipment battery is maintenance free. If a replacement battery is installed, check the electrolyte level in the battery.

If the electrolyte level is lower than 13 mm (0.50 in) above the plates, add distilled water only.

⚠ WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

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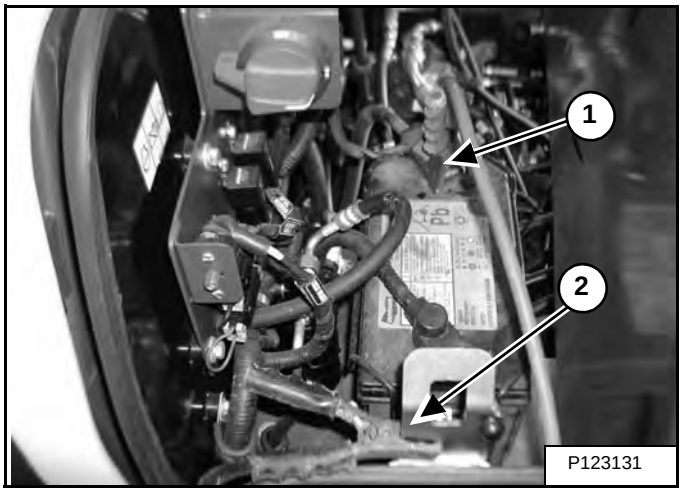
Using A Booster Battery (Jump Starting)

If it is necessary to use a booster battery to start the engine, BE CAREFUL! There must be one person in the operator's seat and one person to connect and disconnect the battery cables.

Be sure the key switch is OFF. The booster battery must be 12 volt.

Open the center cover. (See Opening And Closing on Page 10-70-1.)

Figure 50-20-3



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 50-20-3]** of the excavator battery.

Connect one end of the second cable to the negative (-) terminal of the booster battery. Connect the other end of the same cable to a frame ground (Item 2) **[Figure 50-20-3]** (not at the battery negative (-) post).

Start the engine. After the engine has started, remove the ground (-) cable first (Item 2) **[Figure 50-20-3]**.

Remove the positive (+) cable (Item 1) **[Figure 50-20-3]** and the other cables.

NOTE: (See Cold Temperature Starting in the Operation And Maintenance Manual.)

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-2223-0903

⚠ 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.

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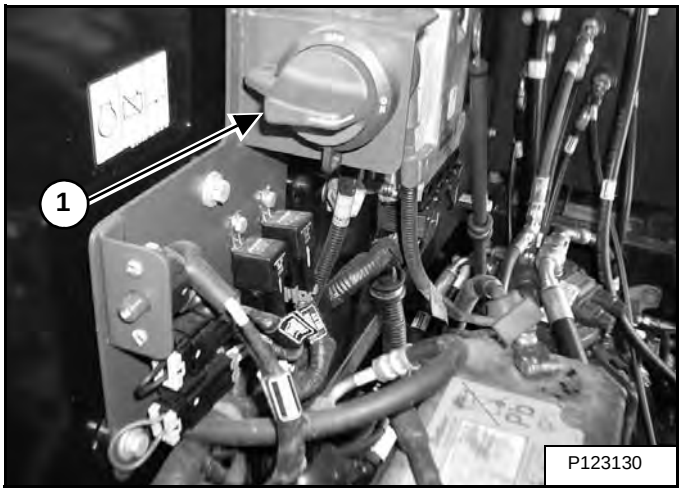
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BATTERY (CONT'D)

Removing And Installing Battery

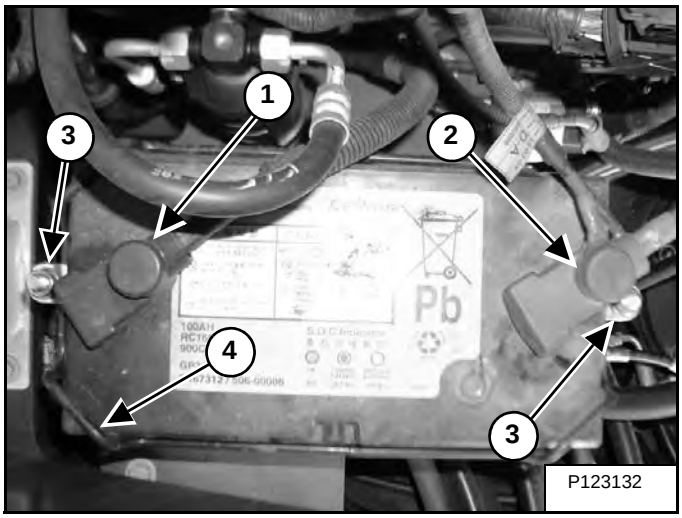
Open the center cover. (See Opening And Closing on Page 10-70-1.)

Figure 50-20-4



Rotate the master disconnect switch (Item 1) **[Figure 50-20-4]** counterclockwise to the OFF position.

Figure 50-20-5



Disconnect the negative (-) cable (Item 1) **[Figure 50-20-5]** first.

Disconnect the positive (+) cable (Item 2) **[Figure 50-20-5]**.

Remove the two nuts and washers (Item 3) and remove the hold down clamp (Item 4) **[Figure 50-20-5]**.

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, washers and tighten the nuts.

Connect the battery cables. Connect the negative (-) cable (Item 1) **[Figure 50-20-5]** last to prevent sparks.

Rotate the master disconnect switch (Item 1) **[Figure 50-20-4]** clockwise to the ON position.

Close the center cover. (See Opening And Closing on Page 10-70-1.)

⚠ 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.

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ALTERNATOR

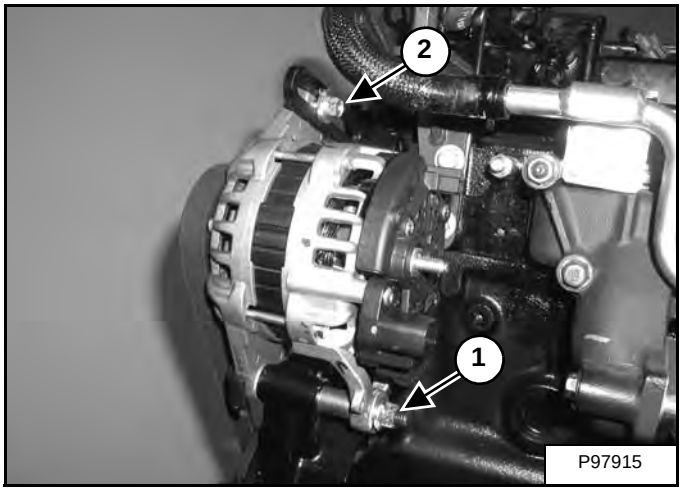
Belt Adjustment

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 10-80-1.)

Open the right side cover. (See Opening And Closing on Page 10-50-1.)

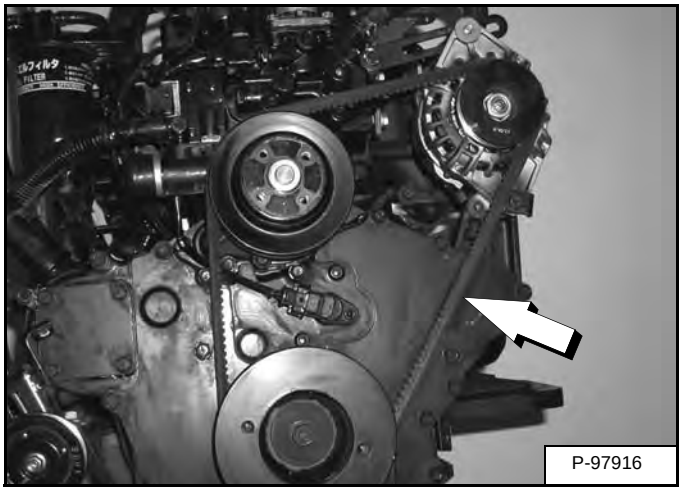
NOTE: The following photos show the engine removed for photo clarity.

Figure 50-30-1



Loosen the alternator mounting nut (item 1) and the adjusting strap mounting bolt (Item 2) **[Figure 50-30-1]**.

Figure 50-30-2

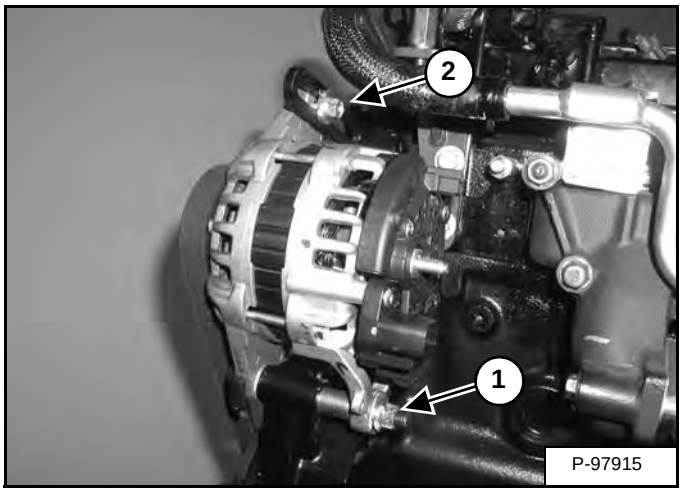


Press down on the belt midway between the fan pulley and the alternator pulley. The correct tension should allow the belt to deflect 10 mm (0.375 in) **[Figure 50-30-2]**.

When belt tension is correct, tighten the alternator bolts.

Belt Replacement

Figure 50-30-3



Loosen the alternator mounting nut (item 1) and the adjusting strap mounting bolt (Item 2) **[Figure 50-30-3]**.

Remove the old belt and install a new belt.

When belt tension is correct, tighten the alternator adjusting strap mounting bolt (Item 2) and the nut (item 1) **[Figure 50-30-3]**.

⚠ WARNING

AVOID INJURY OR DEATH

- **Do Not Operate with damaged or missing screens, shields or rubber deflectors.**
- **Stop engine before cleaning or servicing.**
- **Contact with moving parts or flying objects can cause injury or death.**

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Charging System Inspection

⚠ WARNING

BATTERY GAS CAN EXPLODE AND CAUSE SERIOUS 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 16°C (60°F) before connecting to a charger. Unplug charger before connecting or disconnecting cables to battery. Never lean over battery while boosting, testing or charging.

W-2066-0910

IMPORTANT

Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the excavator. (Remove both cables from the battery.)**
- **Extra battery cables (booster cables) are connected wrong.**

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If the charging system malfunctions, check the following:

Check the condition and tension of the alternator belt. If the belt is worn or deteriorated, replace the belt. (See Belt Replacement on Page 50-30-1.)

Inspect the alternator wiring harness and connectors at alternator. Harness and connectors must be clean and tight.

Check the electrolyte level in the battery. Add distilled water as needed. (Does not apply to maintenance free batteries.)

Verify the charge of the battery. Make sure battery is fully charged.

Disconnect the battery cables (negative first, then positive). Inspect the cable clamps and battery posts for corrosion. Remove acid or corrosion from the battery and cables with a sodium bicarbonate and water solution. Put grease on the cable ends and battery terminals to prevent corrosion. Reconnect the cable to the positive terminal.

⚠ 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.

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Figure 50-30-4

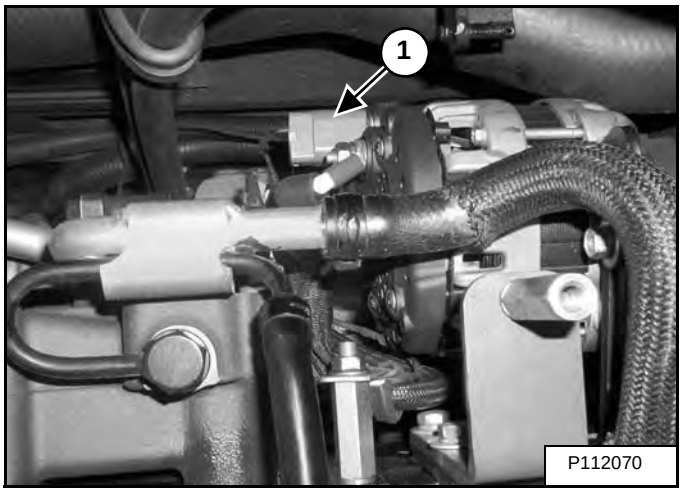


With the key in the run position and the engine off, the icon (Item 1) **[Figure 50-30-4]** must be illuminated.

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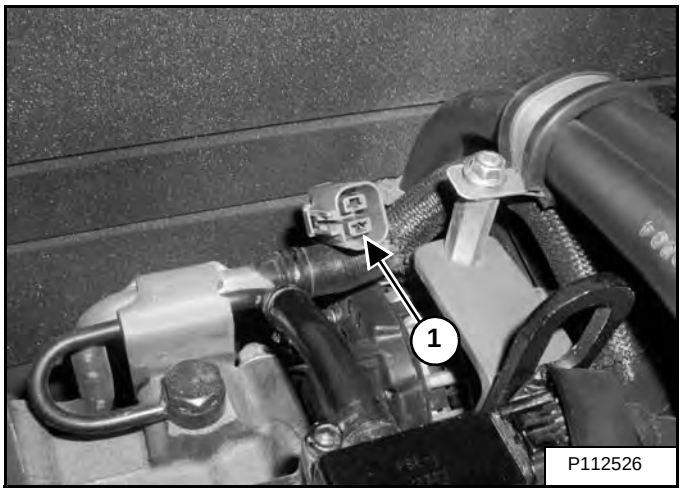
Charging System Inspection (Cont'd)

Figure 50-30-5



If the icon does not illuminate, disconnect the harness (Item 1) **[Figure 50-30-5]** from the alternator.

Figure 50-30-6

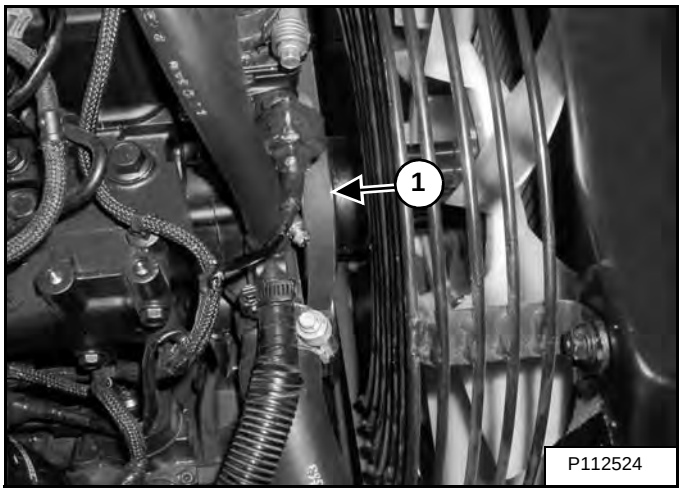


Ground the terminal (Item 1) **[Figure 50-30-6]**.

If the icon still does not illuminate, replace the indicator.

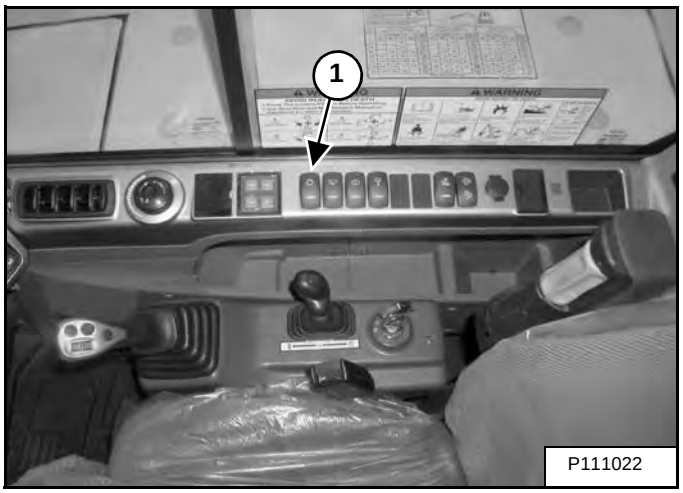
If the icon is illuminated, inspect the rotor assembly and brushes for wear or damage.

Figure 50-30-7



Start the engine. At low idle, the icon must be off. If the icon is on, inspect the alternator belt (Item 1) **[Figure 50-30-7]** for correct tension.

Figure 50-30-8

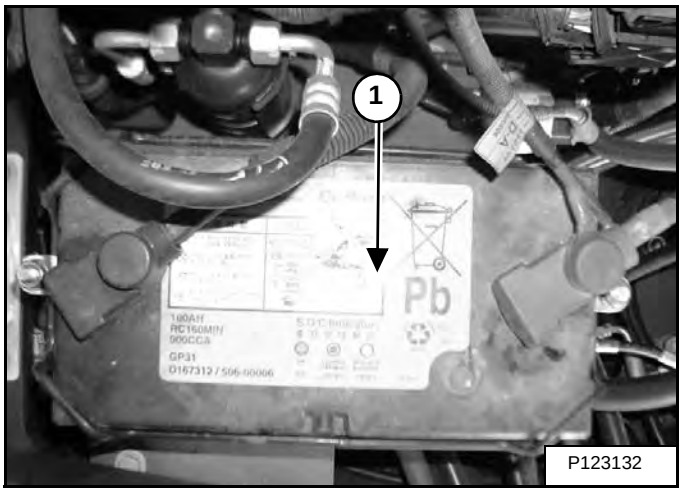


Increase engine speed to approximately 1500 rpm. Turn the boom work light (Item 1) **[Figure 50-30-8]** to the on position.

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Charging System Inspection (Cont'd)

Figure 50-30-9



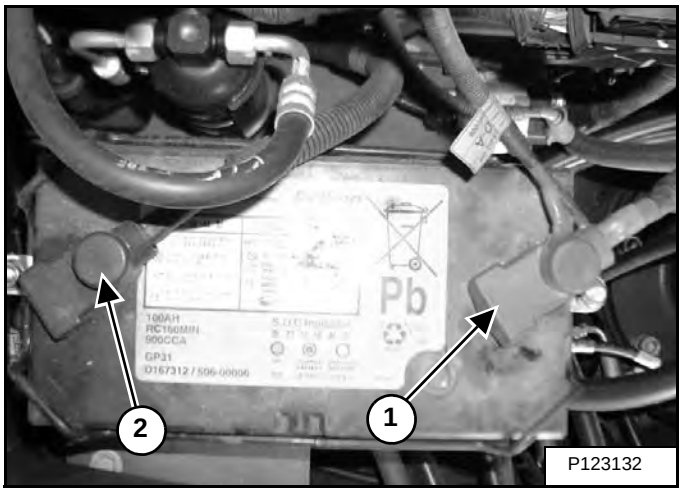
If the icon is illuminated, measure the voltage at the battery (Item 1) **[Figure 50-30-9]**.

Battery voltage should be between 13 and 15 volts.

If the voltage is less than 13 volts or over 15.5 volts, replace the alternator.

Alternator Voltage Testing

Figure 50-30-10



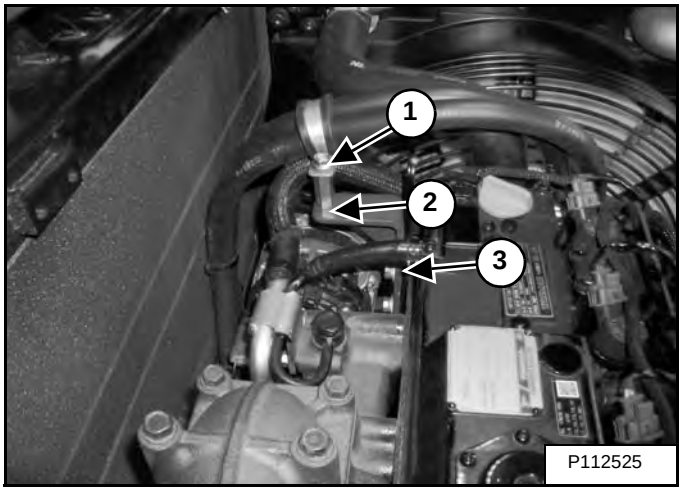
Run the engine at rated speed. Check to make sure that all accessories are turned OFF. Connect the positive lead of the voltmeter to the positive terminal (Item 1) of the battery. Connect the negative lead of the volt meter to the negative terminal (Item 2) **[Figure 50-30-10]**. If the reading on the voltmeter is less than 13 volts or more than 15.5 volts, replace the alternator.

Dealer Copy -- Not for Resale

Removal And Installation

Open the right side cover. (See Opening And Closing on Page 10-50-1.)

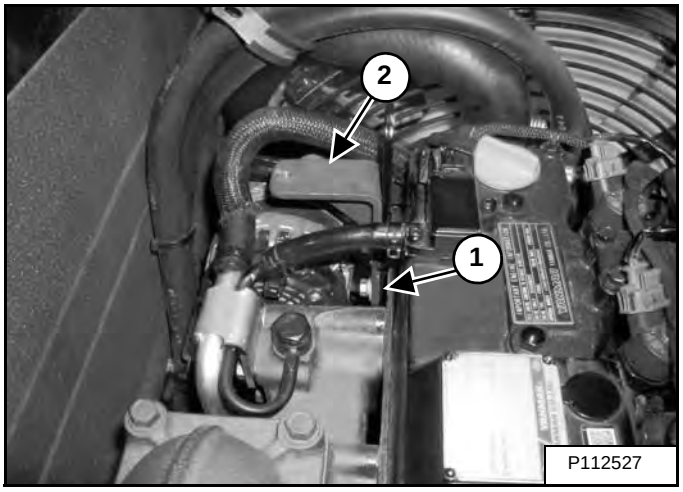
Figure 50-30-11



Remove the bolt (Item 1) and stand off (Item 2) **[Figure 50-30-11]**. Reposition the heater hoses as needed.

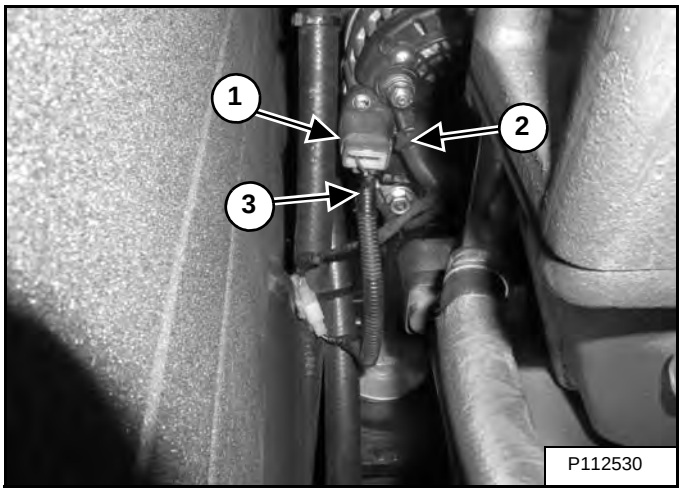
Remove the bolt (Item 3) **[Figure 50-30-11]**.

Figure 50-30-12



Loosen the bolt (Item 1) and rotate the bracket (Item 2) **[Figure 50-30-12]** towards the rear of the engine.

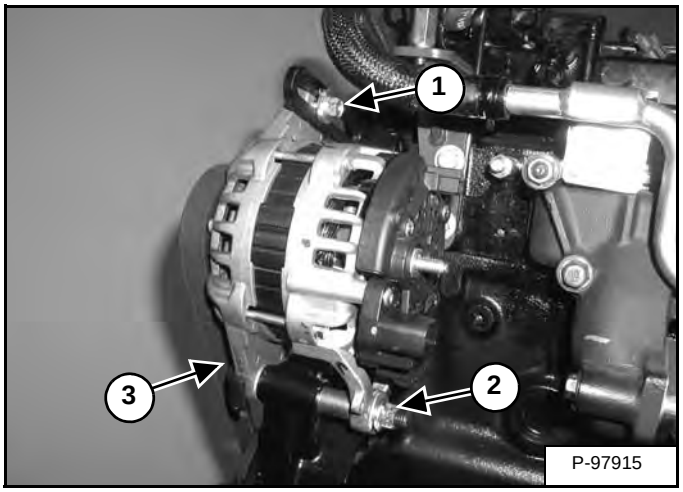
Figure 50-30-13



Disconnect the wire harness (Item 1). Remove the nut and washer. Remove the wire (Item 2) **[Figure 50-30-13]**.

Remove the bolt (Item 3) **[Figure 50-30-13]** and remove the ground wire from the alternator case.

Figure 50-30-14



Loosen the top bolt (Item 1), bottom bolt (Item 2) **[Figure 50-30-14]** and nut.

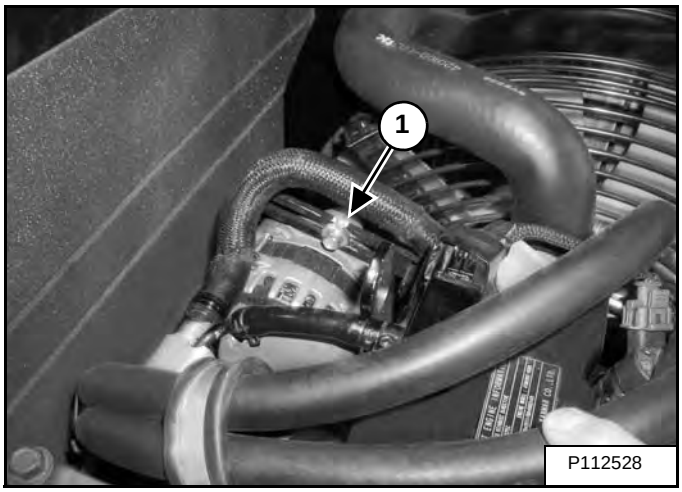
Remove the belt (Item 3) **[Figure 50-30-14]**.

NOTE: Engine is shown removed for photo clarity.

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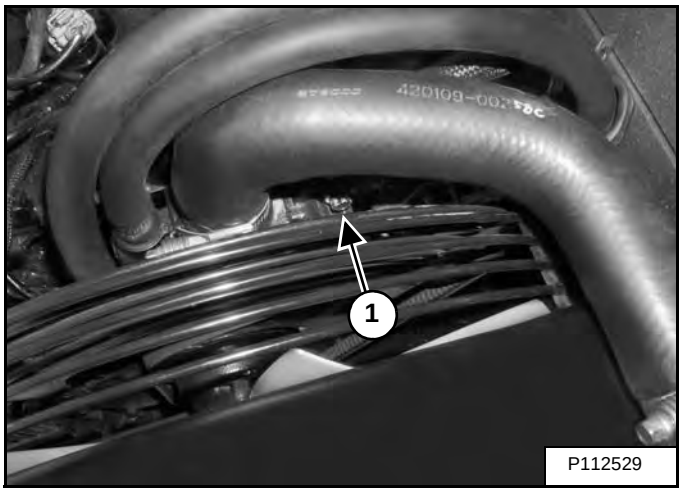
Removal And Installation (Cont'd)

Figure 50-30-15



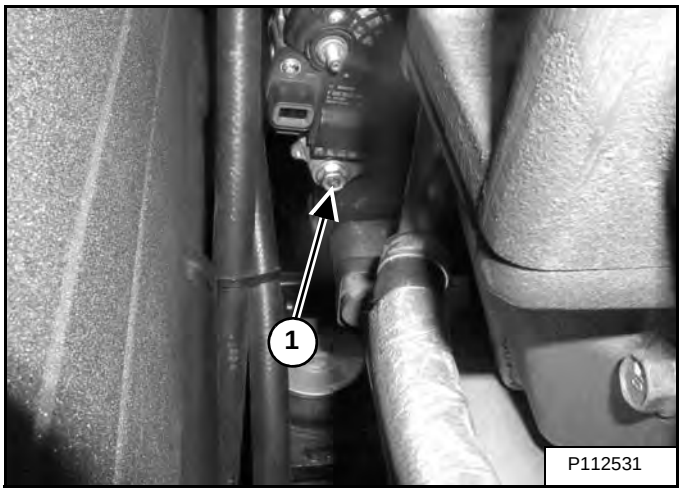
Remove the bolt (Item 1) **[Figure 50-30-15]** from the alternator.

Figure 50-30-16



Remove the bolt (Item 1) **[Figure 50-30-16]** from the alternator bracket. Remove the bracket.

Figure 50-30-17



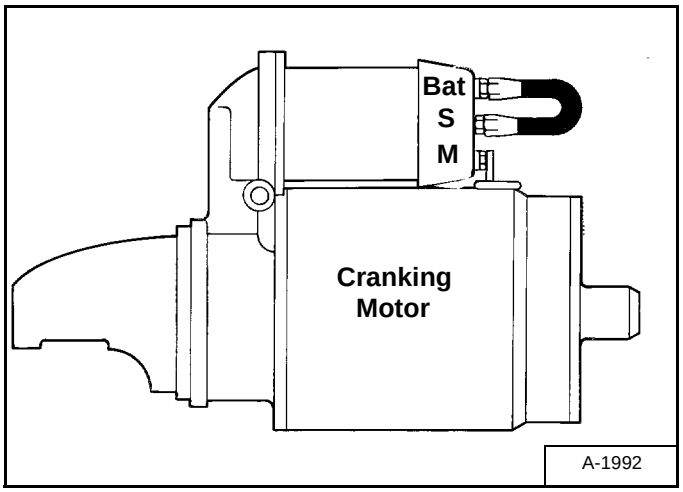
Remove the bottom bolt (Item 1) **[Figure 50-30-17]**, nut, washer and spacer.

Remove the alternator from the machine.

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Testing

Figure 50-40-1



The key switch must be in the OFF position.

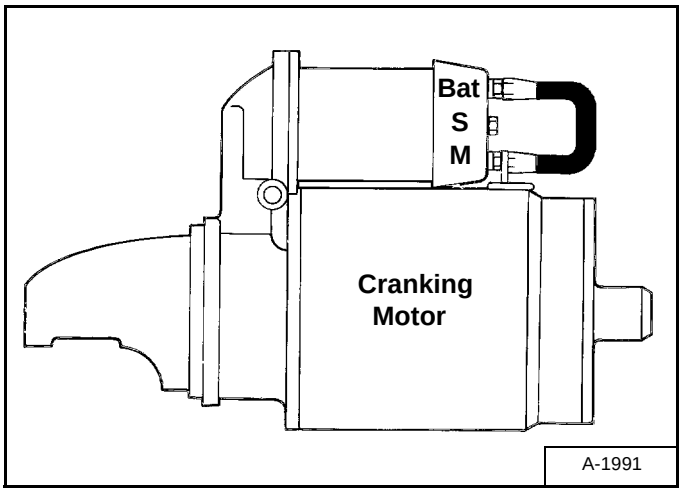
The battery must be at full charge.

The cable connections on the battery must be clean and tight.

Connect a jumper wire between S terminal and BAT terminal **[Figure 50-40-1]**.

If the starter turns but does not turn the engine, the starter drive has a defect.

Figure 50-40-2



Connect a jumper wire (of at least 4 gauge in size) between the M terminal and the BAT terminal **[Figure 50-40-2]**.

If the starter turns, the defect is in the solenoid.

If the starter does not turn, the starter is defective.

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STARTER (CONT'D)

Removal And Installation

Open the right side cover.

Disconnect the negative cable from the battery. (See Removing And Installing Battery on Page 50-20-3.)

Tilt the cab. (See Tilting the Cab on Page 10-210-1.)

Figure 50-40-3

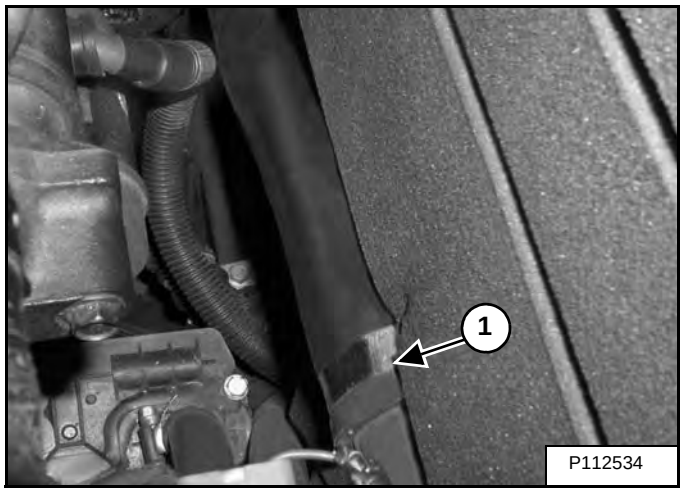
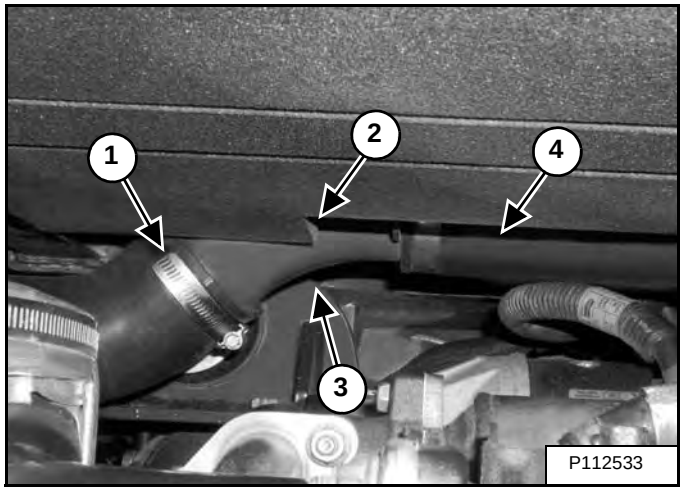


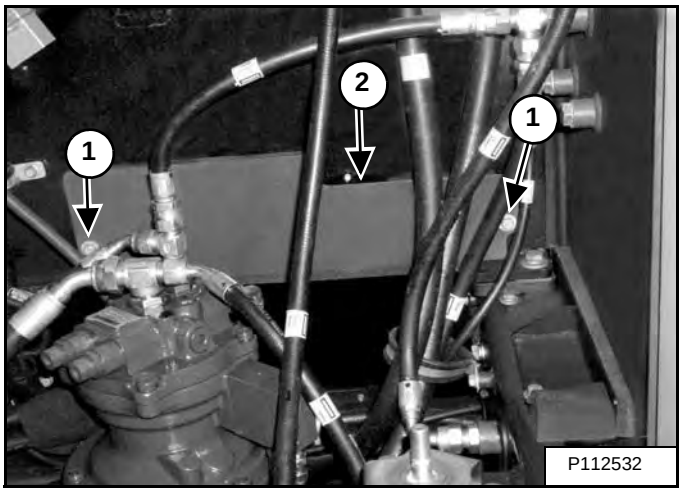
Figure 50-40-4



Loosen the air intake hose clamps (Item 1) **[Figure 50-40-3]** and **[Figure 50-40-4]**

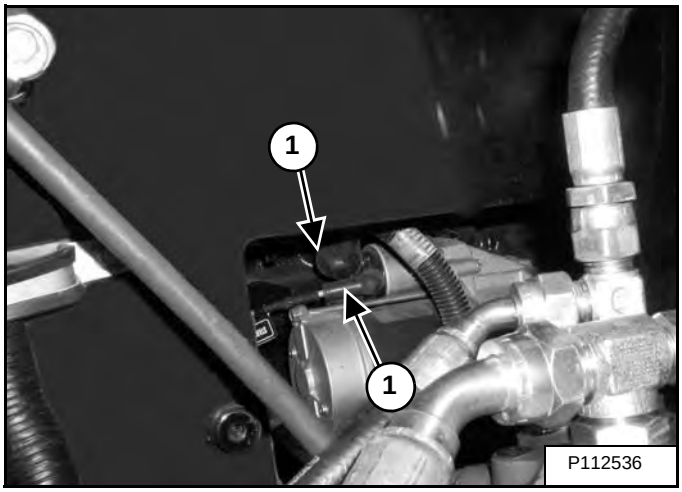
Remove the bolts (Item 2). Remove the elbow (Item 3) and hose (Item 4) **[Figure 50-40-4]**.

Figure 50-40-5



Remove the bolts (Item 1) and cover (Item 2) **[Figure 50-40-5]**.

Figure 50-40-6

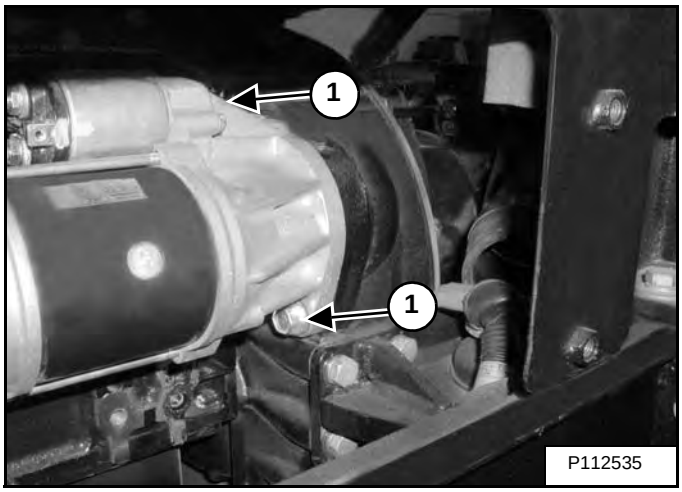


Disconnect the wire harness (Item 1) **[Figure 50-40-6]** from the starter.

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Removal And Installation (Cont'd)

Figure 50-40-7

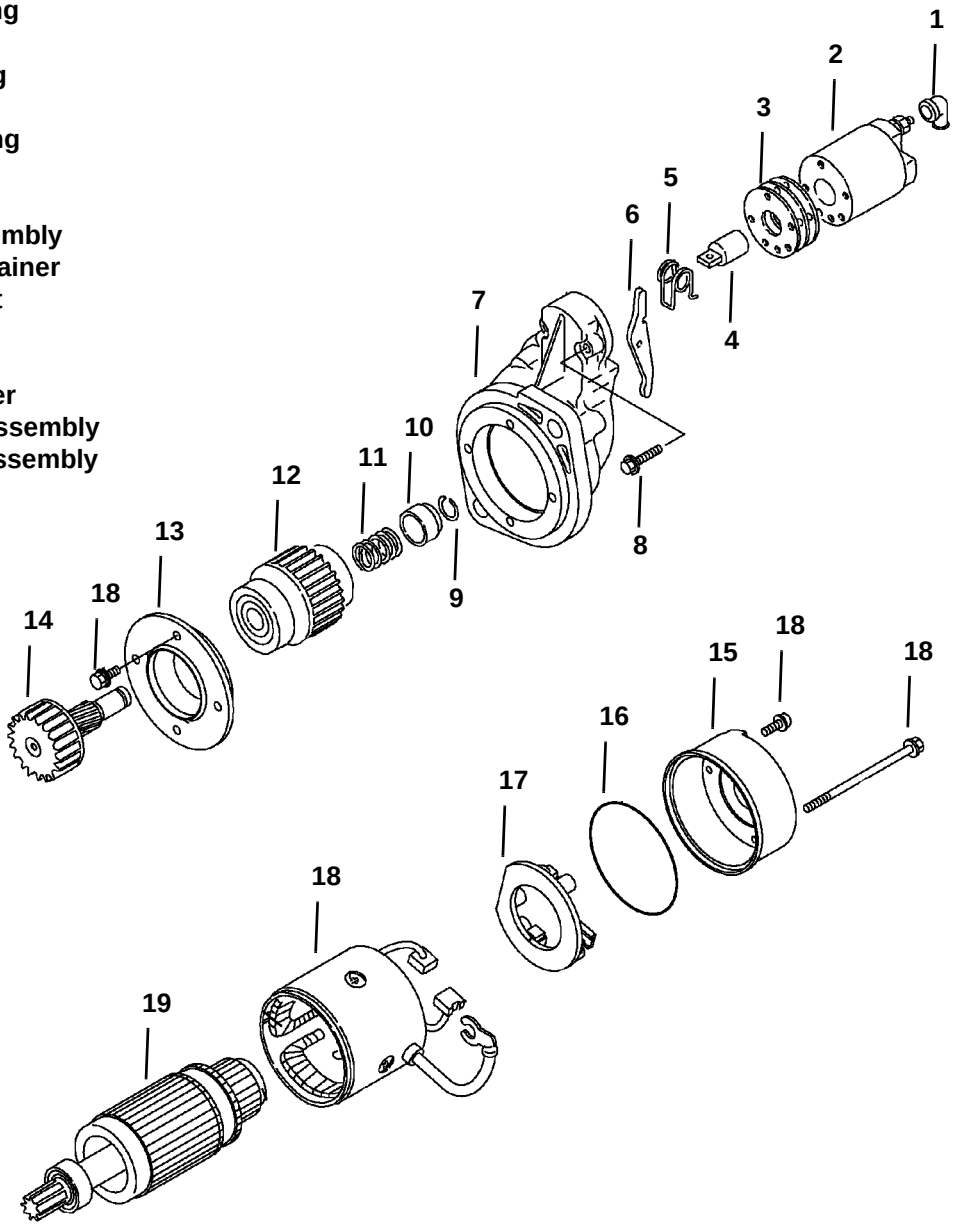


Remove the bolts (Item 1) **[Figure 50-40-7]** and remove the starter.

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Parts Identification

1. Rubber cover
2. Solenoid
3. Shims
4. Plunger
5. Torsion Spring
6. Shift Lever
7. Gear Housing
8. Bolt
9. Retaining Ring
10. Pinion Stop
11. Spring
12. Clutch Assembly
13. Bearing Retainer
14. Pinion Shaft
15. Rear Cover
16. O-ring
17. Brush Holder
18. Field Coil Assembly
19. Armature Assembly



E80025S

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STARTER RELAY

Removal And Installation

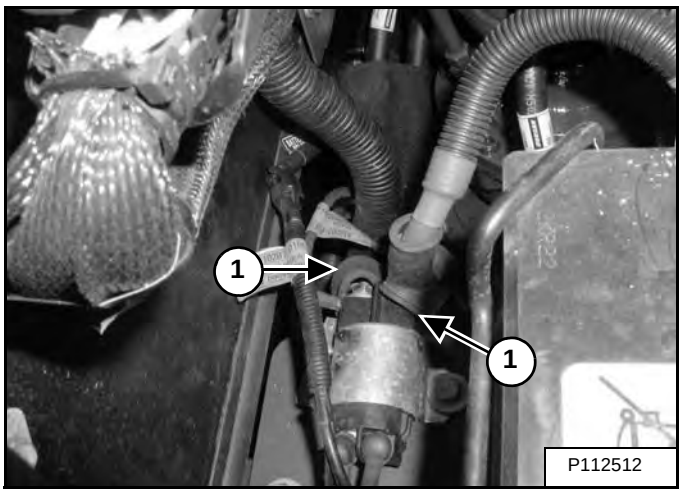
Open the center cover.

Figure 50-41-1



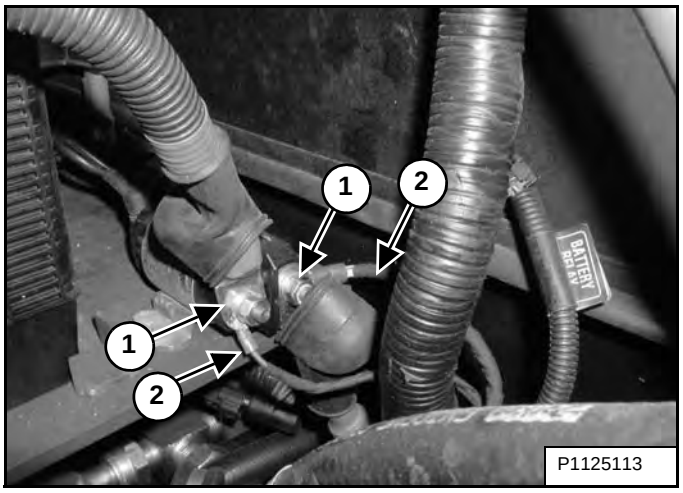
The starter relay (Item 1) **[Figure 50-41-1]** is located below the ECU, beside the battery.

Figure 50-41-2



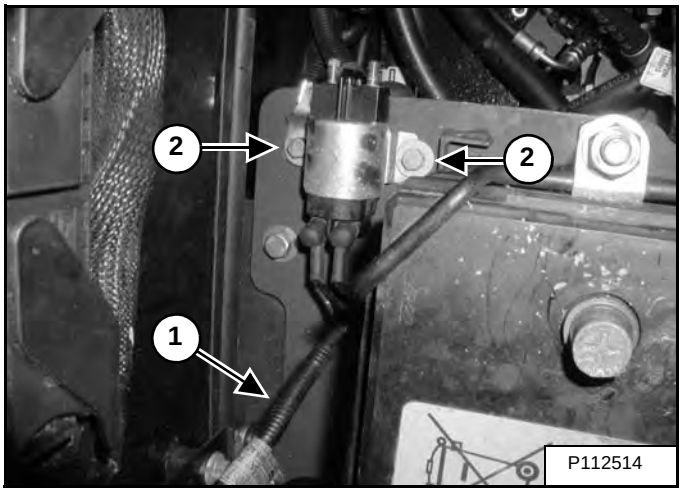
Pull the ends of the wire harness (Item 1) **[Figure 50-41-2]** back.

Figure 50-41-3



Remove the nuts (Item 1). Remove the wires (Item 2) **[Figure 50-41-3]** from the relay.

Figure 50-41-4

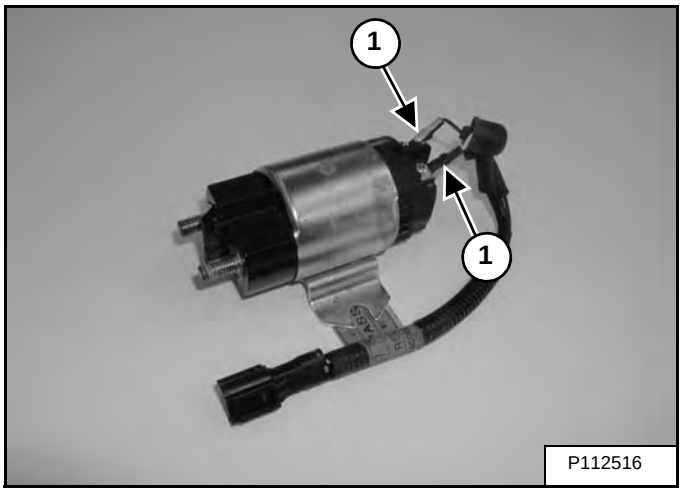


Disconnect the wire harness (Item 1). Remove the bolts (Item 2) **[Figure 50-41-4]** and remove the relay.

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Removal And Installation (Cont'd)

Figure 50-41-5



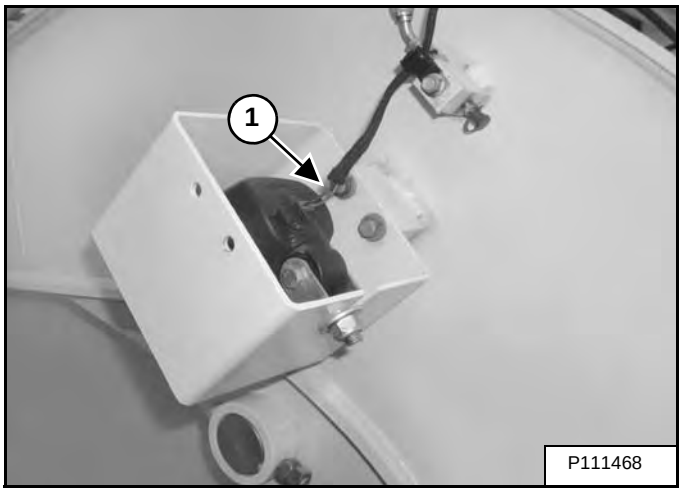
Mark and remove the wire harness (Item 1) **[Figure 50-41-5]** from the relay.

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LIGHTS

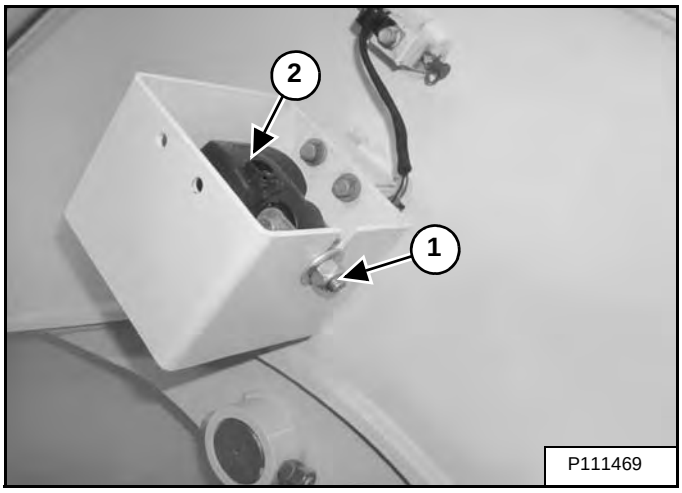
Boom Light Removal And Installation

Figure 50-50-1



Disconnect the wire harness (Item 1) **[Figure 50-50-1]**.

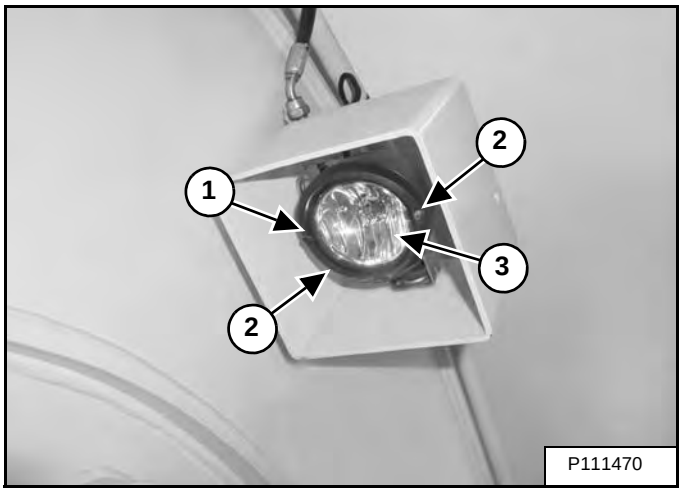
Figure 50-50-2



Remove the nut (Item 1) and washers. Remove the light (Item 2) **[Figure 50-50-2]** from the boom.

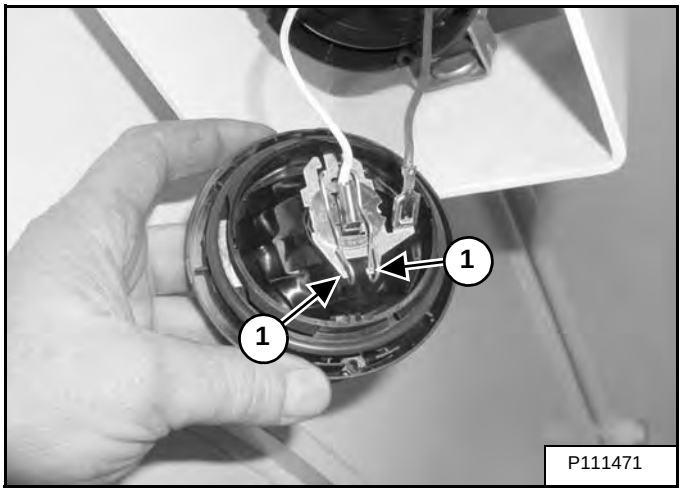
Boom Light Bulb Replacement

Figure 50-50-3



Remove the screws (Item 1) and bezel (Item 2). Pull the lens (Item 3) **[Figure 50-50-3]** out of the housing.

Figure 50-50-4

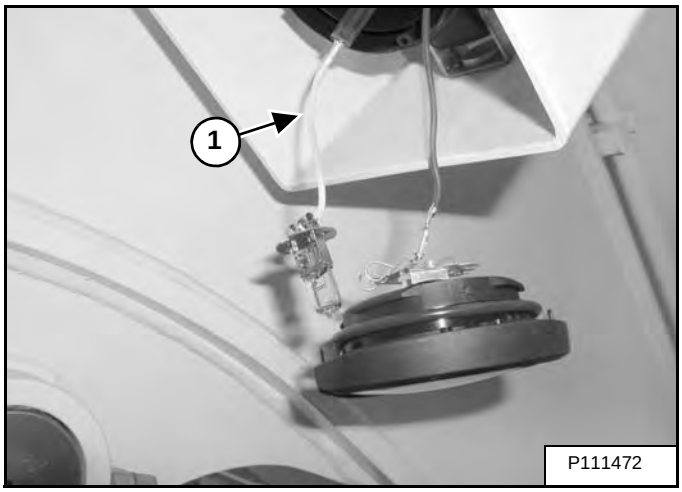


Squeeze the retainer (Item 1) **[Figure 50-50-4]** together and remove the bulb from the lens.

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Boom Light Bulb Replacement (Cont'd)

Figure 50-50-5



Disconnect the wire harness (Item 1) **[Figure 50-50-5]** and remove the harness / bulb assembly.

NOTE: Do not touch the glass of the halogen bulb with your fingers or allow the bulb to come in contact with oils. If contaminated, the bulb must be cleaned with mild alcohol and a clean cloth [Figure 50-50-5].

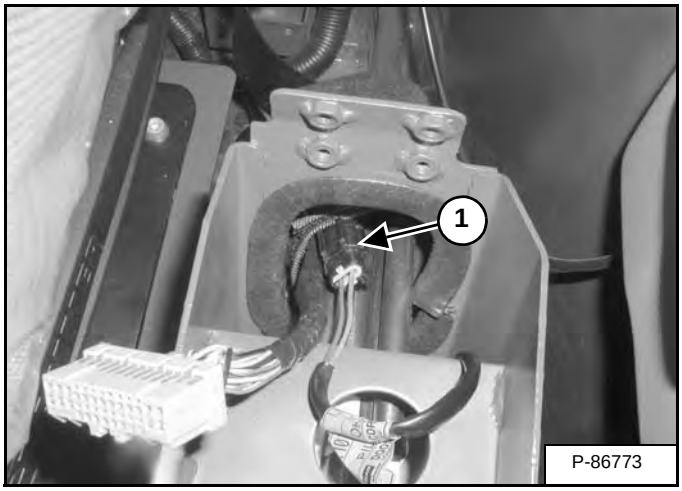
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CONSOLE LOCKOUT SWITCH

Testing / Adjustment

Remove the upper left console cover. (See Upper Console Cover Removal And Installation on Page 40-60-2.)

Figure 50-60-1



Disconnect the wire harness (Item 1) **[Figure 50-60-1]**.

Connect a multimeter to the switch wire harness.

Figure 50-60-2



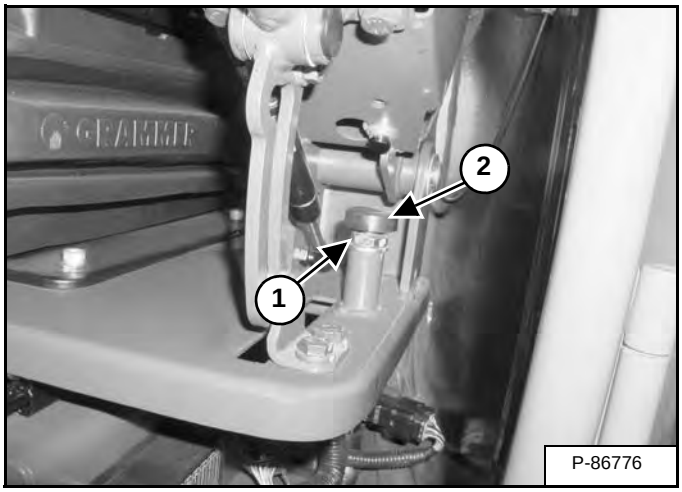
There must be no continuity when the console is in the raised position **[Figure 50-60-2]**.

Figure 50-60-3



There must be continuity when the console is in the down and locked position **[Figure 50-60-3]**.

Figure 50-60-4



Loosen the nut (Item 1) and turn the stop (Item 2) **[Figure 50-60-4]** out to raise the stop, or in to lower the stop.

Tighten the nut (Item 1) **[Figure 50-60-4]** after adjusting the stop height.

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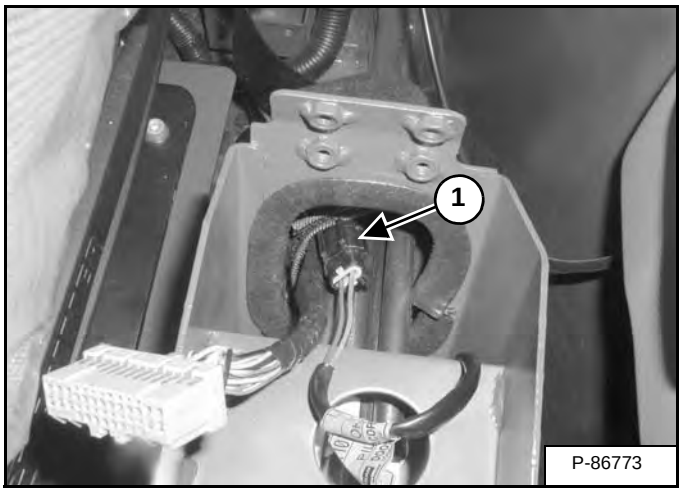
CONSOLE LOCKOUT SWITCH (CONT'D)

Removal And Installation

Remove the upper console cover. (See Upper Console Cover Removal And Installation on Page 40-60-2.)

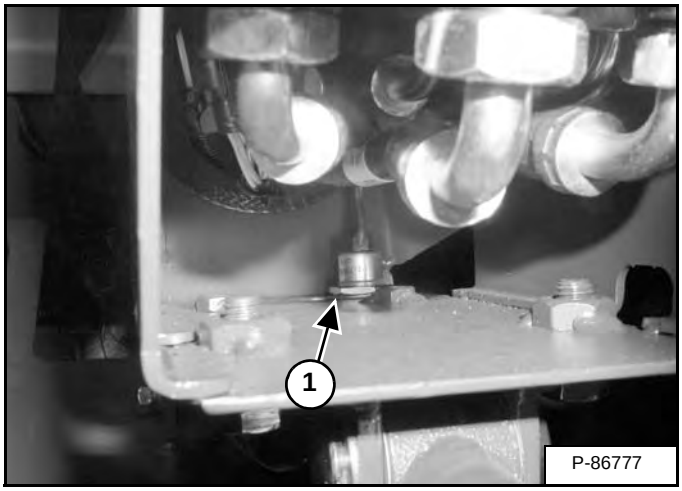
Remove the lower console cover. (See Lower Console Cover Removal And Installation on Page 40-60-1.)

Figure 50-60-5



Disconnect the wire harness (Item 1) **[Figure 50-60-5]**.

Figure 50-60-6



Loosen the nut (Item 1) **[Figure 50-60-6]** and remove the switch.

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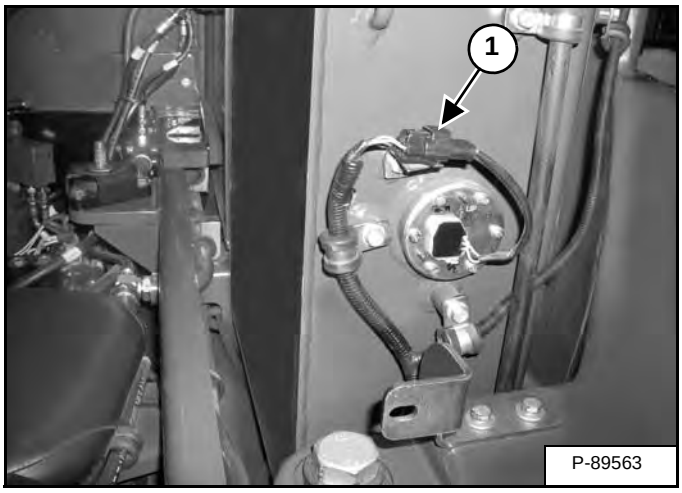
FUEL LEVEL SENDER

Removal And Installation

Disconnect the negative battery cable. (See Removing And Installing Battery on Page 50-20-3.)

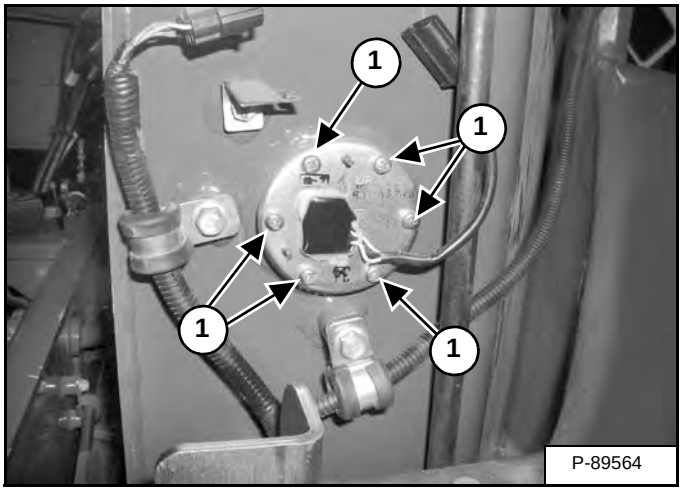
Remove the rear cover. (See Removal And Installation on Page 40-190-1.)

Figure 50-70-1



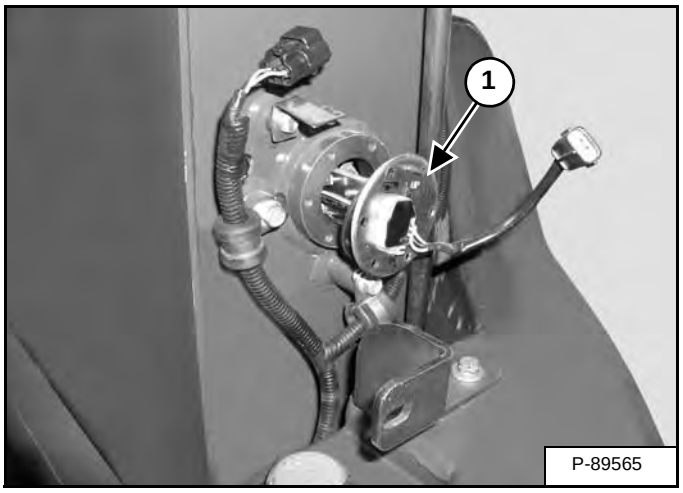
Disconnect the harness (Item 1) **[Figure 50-70-1]**.

Figure 50-70-2



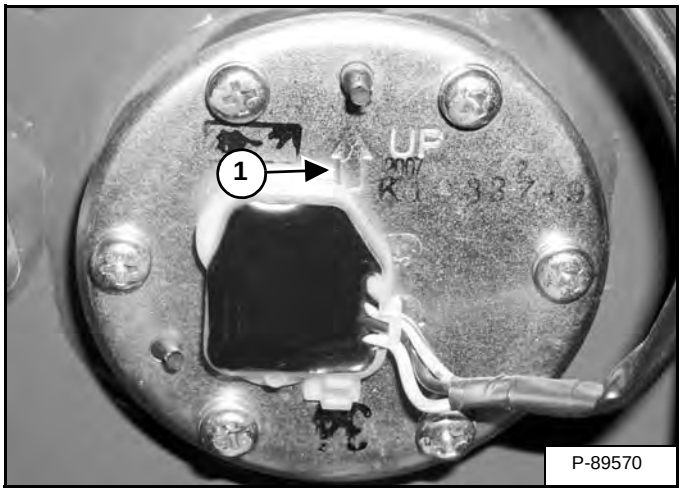
Remove the screws (Item 1) **[Figure 50-70-2]**.

Figure 50-70-3



Remove the sender (Item 1) **[Figure 50-70-3]**.

Figure 50-70-4



Installation: Install the sender with the arrow (Item 1) **[Figure 50-70-4]** pointing up.

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DIAGNOSTIC SERVICE CODES

Service Codes List

Figure 50-80-1



The error codes will be displayed on the instrument panel (Item 1) **[Figure 50-80-1]** under the *"Real Time Failure Information"* screen.

Enter the display panel *REAL TIME FAILURE INFORMATION* screen.

See the following chart for the codes.

CODE	FMI	DESCRIPTION
C0001	20	CAN Communication Data Drifted High (VCU)
C0002	21	CAN Communication Data Drifted Low (VCU)
C0003	20	CAN Communication Data Drifted High (GP)
C0004	21	CAN Communication Data Drifted Low (GP)
C0005	12	CAN Communication Data Failed (ECU)
E0001	0	Engine Speed Dial Above Normal Range (ECU)
E0002	3	Rack Position Sensor Voltage Above Normal (ECU)
E0003	4	Rack Position Sensor Voltage Below Normal (ECU)
E0004	2	Coolant Sensor Incorrect Signal (ECU)
E0005	3	Coolant Sensor Voltage Above Normal (ECU)
E0006	4	Coolant Sensor Voltage Below Normal (ECU)
E0007	4	Power Voltage Below Normal (ECU)
E0008	2	Rack Actuator Relay Incorrect Signal (ECU)
E0009	3	Rack Actuator Relay Voltage Above Normal (ECU)
E0010	4	Rack Actuator Relay Voltage Below Normal (ECU)
E0011	7	Rack Actuator Relay Out Of Adjustment (ECU)
P0008	5	No Signal on both crank and cam speed sensor
P000F	16	PLV Open Valve
P0088	0	Actual Rail Pressure Rise Error
P0093	15	Rail Pressure Deviation error during the actual rail pressure Rise
P0094	18	Rail Pressure Deviation error during the actual rail pressure drop
P0112	4	New Air Temperature Sensor Fault (Low Voltage)
P0113	3	New Air Temperature Sensor Fault (High Voltage)

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DIAGNOSTIC SERVICE CODES (CONT'D)

Service Codes List (Cont'd)

CODE	FMI	DESCRIPTION
P0117	4	Cooling Water Temperature Sensor Fault (Low Voltage)
P0118	3	Cooling Water Temperature Sensor Fault (High Voltage)
P0122	4	Accelerator sensor 1 (Insufficient Sensor Output)
P0123	3	Accelerator sensor 1 (Excessive Sensor Output)
P0168	0	Fuel Temperature Sensor Temperature Abnormal High (Overheat)
P0182	4	Fuel Temperature Sensor Fault (Low Voltage)
P0183	3	Fuel Temperature Sensor Fault (High Voltage)
P0192	4	Rail Pressure Sensor fault (Low Voltage)
P0193	3	Rail Pressure Sensor fault (High Voltage)
P0201	5	Injector 3 (Cylinder 1: Port 2-2) Open Circuit (Inherent location of the injector)
P0202	5	Injector 2 (Cylinder 2: Port 2-1) Open Circuit (Inherent location of the injector)
P0203	5	Injector 4 (Cylinder 3: Port 1-1) Open Circuit (Inherent location of the injector)
P0204	5	Injector 1 (Cylinder 4: Port 1-2) Open Circuit (Inherent location of the injector)
P0217	0	Cooling Water Temperature Sensor Temperature Abnormal High (Overheat)
P0219	16	Over speed
P0222	4	Accelerator Sensor 2 (Insufficient Sensor Output)
P0223	3	Accelerator Sensor 2 (Excessive Sensor Output)
P0227	4	Accelerator Sensor 3 (Insufficient Sensor Output)
P0228	3	Accelerator Sensor 3 (Excessive Sensor Output)
P0236	13	EGR Low Pressure Side Sensor fault (Abnormal Learning Value)
P0237	4	EGR Low Pressure Side Sensor fault (Low Voltage)
P0238	3	EGR Low Pressure Side Sensor fault (High Voltage)
P0262	6	Injector 3 (Cylinder 1: Port 2-2) coil short circuit
P0265	6	Injector 2 (Cylinder 2: Port 2-1) coil short circuit
P0268	6	Injector 4 (Cylinder 3: Port 1-1) coil short circuit
P0271	6	Injector 1 (Cylinder 4: Port 1-2) coil short circuit
P02E8	4	Intake Throttle opening sensor fault (Low Voltage)
P02E9	3	Intake Throttle opening sensor fault (High Voltage)
P0336	2	Crank Signal Malfunction
P0337	5	No Crank Signal
P0341	2	Cam Signal Malfunction
P0342	5	No Cam Signal
P0403	12	Open circuit between the EGR motor coils
P0404	0	EGR over-voltage fault
P040C	4	Intake Manifold Temperature Sensor Fault (Low Voltage)
P040D	3	Intake Manifold Temperature Sensor Fault (High Voltage)
P041C	4	EGR Gas Temperature Sensor Fault (Low Voltage)
P041D	3	EGR Gas Temperature Sensor Fault (High Voltage)
P0420	1	DPF Intermediate Temperature Sensor Temperature Abnormal Low Temperature

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Service Codes List (Cont'd)

CODE	FMI	DESCRIPTION
P0471	13	EGR High Pressure Side Sensor fault (Abnormal Learning Value)
P0472	4	EGR High Pressure Side Sensor fault (Low Voltage)
P0473	3	EGR High Pressure Side Sensor fault (High Voltage)
P0488	12	EGR position sensor malfunction
P049D	7	EGR initialization malfunction
P0541	6	Startup Assist Relay GND Interrupted
P0543	5	Startup Assist Relay Interrupted
P0545	4	Exhaust Manifold Temperature Sensor Fault (Low Voltage)
P0546	3	Exhaust Manifold Temperature Sensor Fault (High Voltage)
P0601	12	EEPROM memory deletion error
P0611	12	Injector drive IC Error
P0627	5	High Pressure Pump Drive Circuit (Open Circuit)
P0629	3	High Pressure Pump Drive Circuit (High Side VB short-circuit)
P062A	6	High Pressure Pump Drive Circuit (Drive current (high level))
P0660	5	No-Load of throttle valve drive H bridge circuit
P068A	2	Main Relay Early Opening
P068B	7	Main Relay Contact Stuck
P1101	0	Air Cleaner Clogged Alarm
P1125	1	Accelerator Sensor 3 (Foot Pedal in close position)
P1126	0	Accelerator Sensor 3 (Foot Pedal in open position)
P1146	6	Injector Drive Circuit Bank 1 Short Circuit (Common Circuit for No. 1 and No. 4 Cylinders)
P1149	6	Injector Drive Circuit Bank 2 Short Circuit (Common Circuit for No. 2 and No. 3 Cylinders)
P1151	0	Oil/Water Separator Alarm
P1192	4	Oil Pressure Switch Open Circuit
P1198	1	Low Oil Pressure Fault Alarm
P1227	8	Pulse Sensor Failure (Pulse Communication)
P1231	10	Atmospheric Pressure Sensor Characteristic Fault
P1262	3	Injector 3 (Cylinder 1: Port 2-2) short circuit
P1265	3	Injector 2 (Cylinder 2: Port 2-1) short circuit
P1268	3	Injector 4 (Cylinder 3: Port 1-1) short circuit
P1271	3	Injector 1 (Cylinder 4: Port 1-2) short circuit
P1341	7	Angle Offset Fault
P1404	1	EGR under-voltage fault
P1405	12	Short circuit between the EGR motor coils
P1409	7	EGR feedback malfunction
P1410	1	EGR high temperature thermistor malfunction
P1411	1	EGR low temperature thermistor malfunction
P1420	0	Ash Cleaning Request 2
P1421	16	Stationary Regeneration Standby

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Service Codes List (Cont'd)

CODE	FMI	DESCRIPTION
P1424	0	Back-up Mode
P1425	14	Reset Regeneration Prohibited
P1426	0	DPF Intermediate Temperature Sensor Temperature Abnormal High (Post-injection failure)
P1427	4	DPF Inlet Temperature Sensor fault (Low Voltage)
P1428	3	DPF Inlet Temperature Sensor fault (High Voltage)
P1434	3	DPF Intermediate Temperature Sensor Fault (High Voltage)
P1435	4	DPF Intermediate Temperature Sensor Fault (Low Voltage)
P1436	0	DPF Inlet Temperature Sensor abnormal high
P1438	12	Exhaust Throttle (Voltage fault)
P1439	12	Exhaust Throttle (Motor Fault)
P1440	12	Exhaust Throttle (Sensor System Fault)
P1441	12	Exhaust Throttle (MPU Fault)
P1442	12	Exhaust Throttle (PCB Fault)
P1443	19	Exhaust Throttle (CAN Fault)
P1445	9	Recovery Regeneration Failure
P1446	7	Recovery Regeneration Prohibition
P1454	4	DPF High Pressure Side Sensor Fault (Low Voltage)
P1455	3	DPF High Pressure Side Sensor Fault (High Voltage)
P1463	0	Over accumulation (Method P)
P1467	6	Actuator Drive Circuit 3 short to ground
P1469	12	AD Converter Fault 1
P1470	12	AD Converter Fault 2
P1471	12	External Monitoring IC and CPU Fault 1
P1472	12	External Monitoring IC and CPU Fault 2
P1473	12	ROM Fault
P1474	12	Shutoff path fault 1
P1475	12	Shutoff path fault 2
P1476	12	Shutoff path fault 3
P1477	12	Shutoff path fault 4
P1478	12	Shutoff path fault 5
P1479	12	Shutoff path fault 6
P1480	12	Shutoff path fault 7
P1481	12	Shutoff path fault 8
P1482	12	Shutoff path fault 9
P1483	12	Shutoff path fault 10
P1484	0	Recognition error of engine speed
P148A	7	EGR stuck open valve malfunction
P1562	5	Charge Switch Open Circuit
P1568	1	Charge Alarm

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Service Codes List (Cont'd)

CODE	FMI	DESCRIPTION
P1608	12	Excessive voltage of supply 1
P1609	12	Sensor supply voltage error 1
P160E	12	EEPROM memory read error
P160F	12	EEPROM memory write error
P1613	12	CY 146 SPI Communication Fault
P1617	12	Insufficient voltage of Supply 1
P1618	12	Sensor supply voltage error 2
P1619	12	Sensor supply voltage error 3
P1626	4	Actuator Drive Circuit 1 short to ground
P1633	4	Actuator Drive Circuit 2 short to ground
P1641	3	High Pressure Pump Drive Circuit (Low Side VB short-circuit)
P1642	6	High Pressure Pump Drive Circuit (High Side GND short-circuit)
P1643	6	High Pressure Pump Drive Circuit (Low Side GND short-circuit)
P1645	11	High Pressure Pump Drive Circuit (Pump Overload Error)
P1646	7	Dual accelerator sensor (closed position) failure
P1647	7	Dual accelerator sensor (open position) failure
P1648	13	IQA Corrected Injection Amount for Injector 1 Error
P1649	13	IQA Corrected Injection Amount for Injector 2 Error
P1650	13	IQA Corrected Injection Amount for Injector 3 Error
P1651	13	IQA Corrected Injection Amount for Injector 4 Error
P1658	3	Power short circuit of throttle valve drive H bridge Output 1
P1659	4	GND short circuit of throttle valve drive H bridge output 1
P1660	6	Overload on the drive H bridge circuit of throttle valve
P1661	3	VB Power short circuit of throttle valve drive H bridge output 2
P1662	4	GND short circuit of throttle valve drive H bridge output 2
P1665	9	Rail pressure Fault (Controlled rail pressure error after PLV Valve Opening)
P1666	0	Rail Pressure Fault (PLV Valve opening time error)
P1667	0	Rail Pressure Fault (PLV Valve opening time error)
P1668	0	Rail Pressure Fault (The actual rail pressure is too high during PRV limp home)
P1669	0	Rail Pressure Fault (Injector B/F temperature error during PLV4 Limp Home)
P1670	7	Rail Pressure Fault (Operation time error during RPS Limp Home)
P2228	4	Atmospheric Pressure Sensor Fault (Low Voltage)
P2229	3	Atmospheric Pressure Sensor Fault (High Voltage)
P242F	16	Ash Cleaning Request 1
P2452	0	DPF Differential Pressure Sensor Differential Pressure Abnormal High
P2453	13	DPF Differential Pressure Sensor (Abnormal learning value)
P2454	4	DPF Differential Pressure Sensor Fault (Low Voltage)
P2455	3	DPF Differential Pressure Sensor Fault (High Voltage)
P2458	7	Regeneration defect (Stationary Regeneration Failure)

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Service Codes List (Cont'd)

CODE	FMI	DESCRIPTION
P2459	11	Regeneration defect (Stationary Regeneration not performed)
P2463	0	Over accumulation (Method C)
U010B	9	CAN1 (for EGR) reception time out
U0168	31	VI (CAN Message) reception time out
U0292	9	TSC1 (CAN Message) reception time out (SA1)
U0401	9	EGR ECM data fault
U1107	9	Exhaust throttle (CAN message from the exhaust throttle time out)
U1292	9	Y_ECR1(CAN Message) reception time out
U1293	9	Y_EC (CAN Message) reception time out
U1294	9	Y_RSS (CAN Message) reception time out
U1296	9	VH (CAN Message) reception time out
U1298	9	Y_ECM3 (CAN Message) reception time out
U1300	9	Y_ETCP1 (CAN Message) reception time out
U1301	9	TSC1 (CAN Message) reception time out (SA2)
U1302	9	EBC1 (CAN Message) reception time out
U1303	9	Y_DPFIF (CAN Message) reception time out
U1401	12	EGR target value out of range
U3002	13	VI (CAN Message) reception data fault
V0001	1	Engine Oil Pressure Above Normal Range (VCU)
V0002	3	Air Filter Voltage Above Normal (VCU)
V0003	3	Water Separator Voltage Above Normal (VCU)
V0004	1	Fuel Warning Switch Below Normal Range (VCU)
V0005	1	Fuel Sensor Below Normal Range (VCU)
V0006	0	Coolant Sensor Above Normal Range (VCU)
V0008	1	Power Voltage Below Normal Range (VCU)
V0009	0	Overload Sensor Above Normal Range (VCU)
V0010	3	Fuel Sensor Voltage Above Normal (VCU)
V0011	3	Coolant Sensor Voltage Above Normal (VCU)
V0012	4	Coolant Sensor Voltage Below Normal (VCU)
V0013	0	Power Voltage Above Normal Range (VCU)
V0014	3	Overload Sensor Voltage Above Normal (VCU)
V0015	4	Overload Sensor Voltage Below Normal (VCU)
V0016	3	Engine Speed Dial Voltage Above Normal (VCU)
V0017	4	Engine Speed Dial Voltage Below Normal (VCU)
V0022	3	Work Light Relay Voltage Above Normal (VCU)
V0023	2	Thumb Wheel Switch (R.H.) Incorrect Signal (VCU)
V0024	2	Thumb Wheel Switch (L.H.) Incorrect Signal (VCU)

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Failure Mode Indicator Information

FMI (FAILURE MODE INDICATOR)	DESCRIPTION
0	Above Normal Range
1	Below Normal Range
2	Incorrect Signal
3	Voltage Above Normal
4	Voltage Below Normal
5	Current Below Normal
6	Current Above Normal
7	Mechanical System Not Responding Or Out Of Adjustment
8	Abnormal Signal
9	Abnormal Update
10	Abnormal Rate Of Change
11	Failure Mode Not Identifiable
12	Failed
13	Out Of Calibration
14	Special Instructions
15	Data Valid But Above Normal Operating Range Least Severe Level
16	Data Valid But Above Normal Operating Range Moderately Severe Level
17	Data Valid But Below Normal Operating Range Least Severe Level
18	Data Valid But Below Normal Operating Range Moderately Severe Level
19	Received Network Data In Error
20	Data Drifted High
21	Data Drifted Low
31	Condition Exists

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Code Retrieval Through The Dash

Real Time Failure

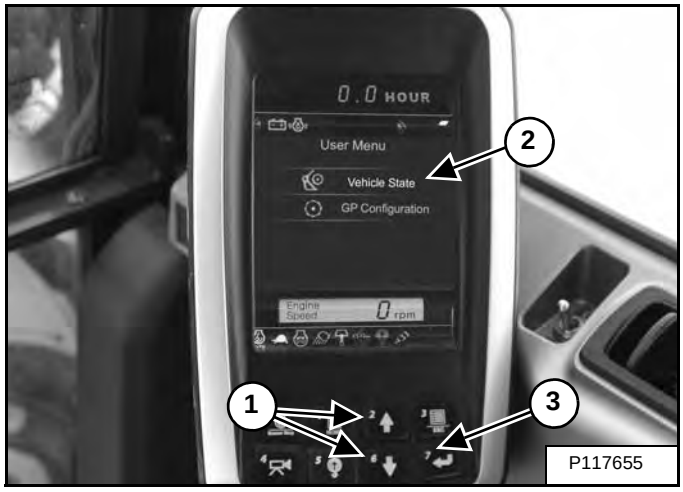
Use the following procedure to access the Real Time Failure Codes.

Figure 50-80-2



With the engine OFF and the key switch in the ON position, press 3 (Item 1) **[Figure 50-80-2]**.

Figure 50-80-3



Use 2 or 6 (Item 1) to select vehicle state (Item 2). Press 7 (Item 3) **[Figure 50-80-3]**.

Figure 50-80-4



Scroll down through the menu to Real Time Failure info (Item 1) and press 7 (Item 2) **[Figure 50-80-4]**. The codes will be displayed

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Code Retrieval Through The Dash (Cont'd)

Failure Information

Use the following procedure to access the Failure Information (stored codes).

Figure 50-80-5



With the engine OFF and the key switch in the ON position, press and hold 3 (Item 1) for five seconds **[Figure 50-80-5]**.

Figure 50-80-6



The main menu will open. Scroll down to Failure Information (Item 1) and press 7 (Item 2) **[Figure 50-80-6]** The codes will be displayed.

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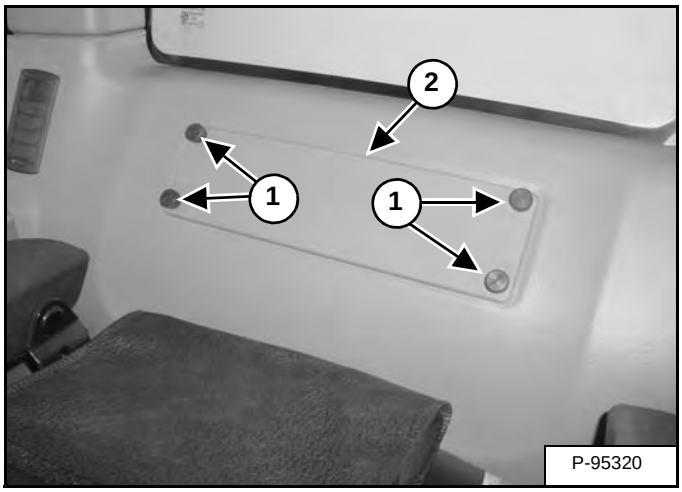


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DIAGNOSTIC TOOL

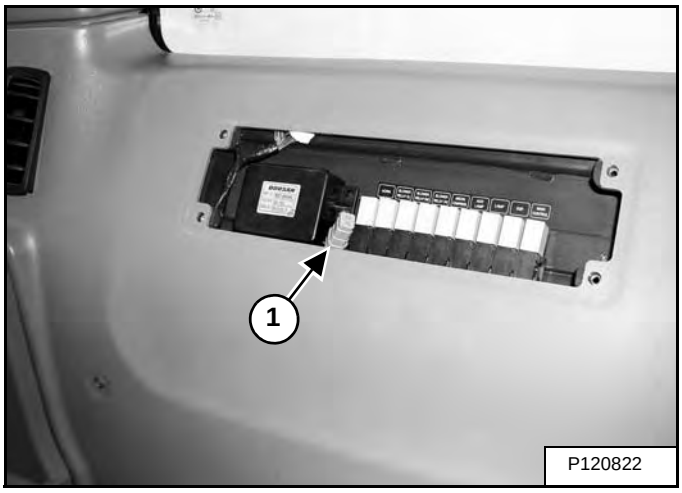
Installation

Figure 50-90-1



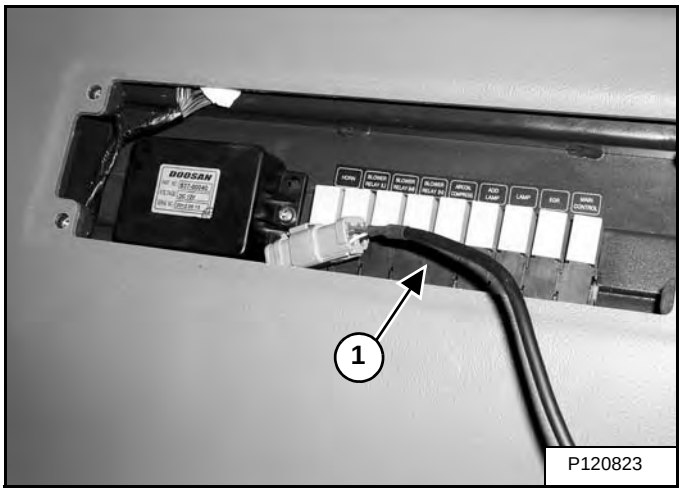
Tilt the seat back forward and remove the four screws (Item 1). Remove the cover (Item 2) **[Figure 50-90-1]**.

Figure 50-90-2



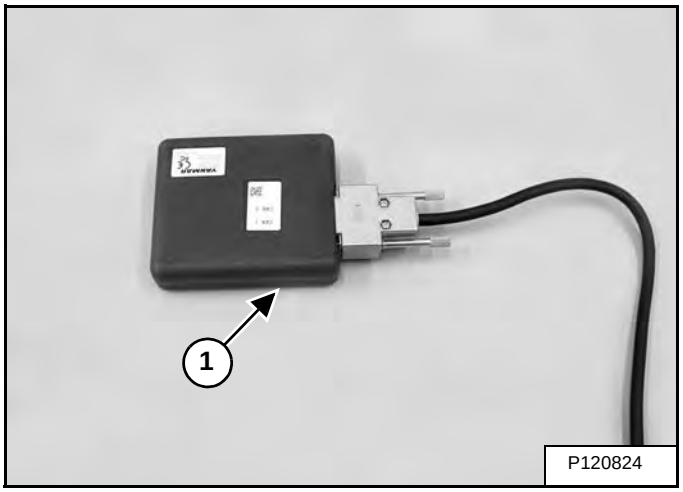
Locate the CAN checker connector (Item 1) **[Figure 50-90-2]**.

Figure 50-90-3



Connect the diagnostic cable (Item 1) **[Figure 50-90-3]** to the CAN checker connector.

Figure 50-90-4



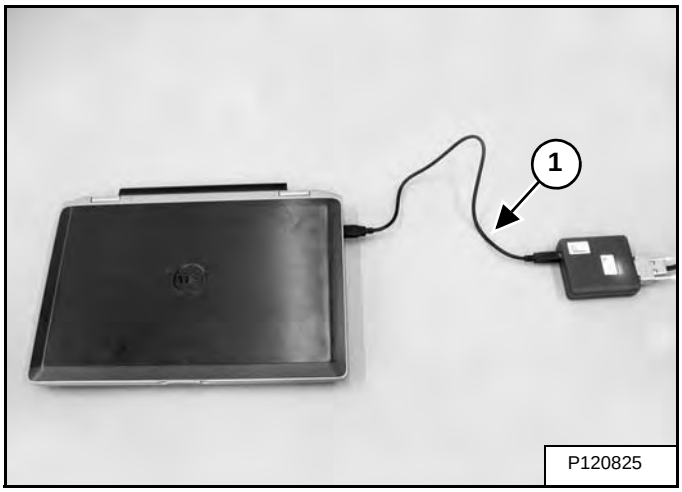
Connect the opposite end of the cable to the diagnosis interface box **[Figure 50-90-4]**.

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DIAGNOSTIC TOOL (CONT'D)

Installation (Cont'd)

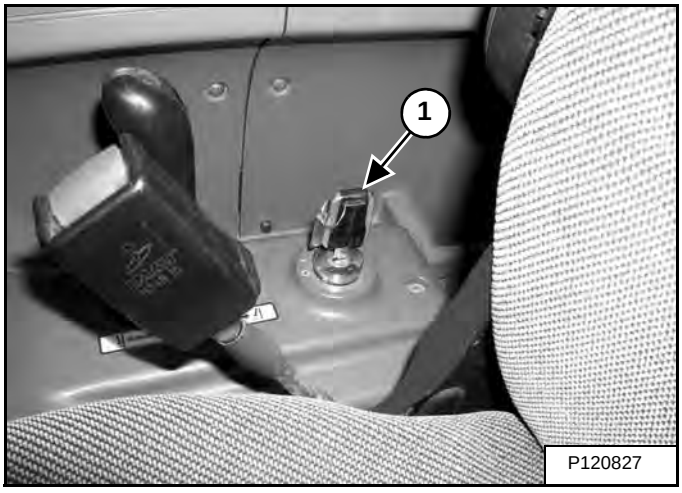
Figure 50-90-5



Connect the USB cable (Item 1) **[Figure 50-90-5]** to the diagnosis interface box. Connect the opposite end of the cable to the Service PC.

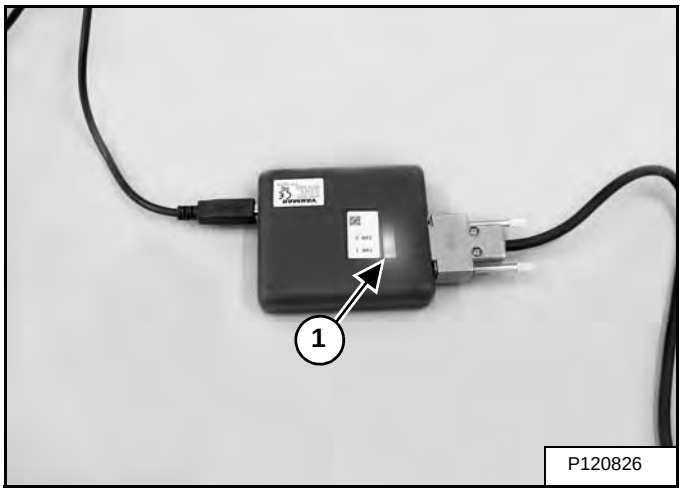
Turn the Service PC on.

Figure 50-90-6



With the engine off, turn the key (Item 1) **[Figure 50-90-6]** to the run position.

Figure 50-90-7



When connected correctly the lights (Item 1) **[Figure 50-90-7]** on the interface box will be illuminated.

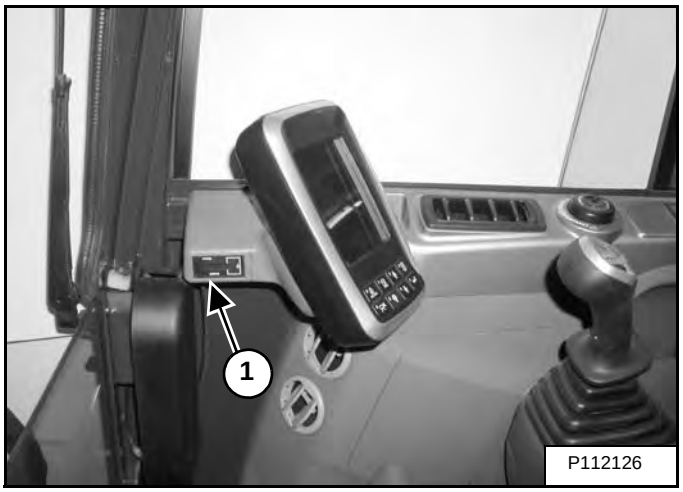
Follow the instructions provided on the www.BobcatDealerNet.com (for dealers in Europe, go to dealers.bobcat.eu) to download, register and use Yanmar SA-D (SmartAssist-Direct) Software.

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INSTRUMENT PANEL

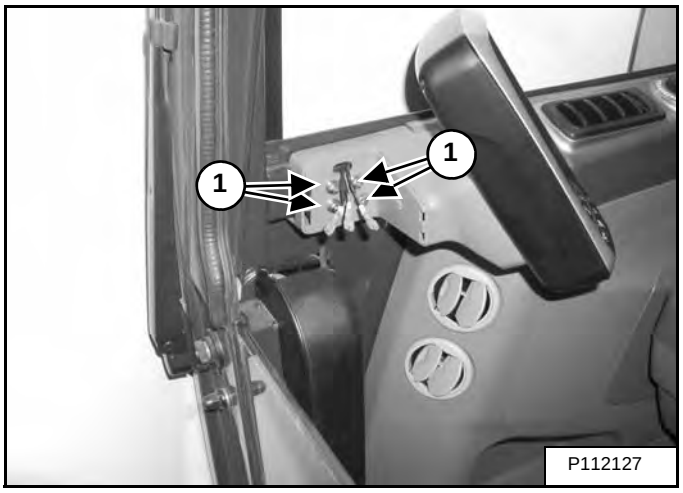
Removal And Installation

Figure 50-100-1



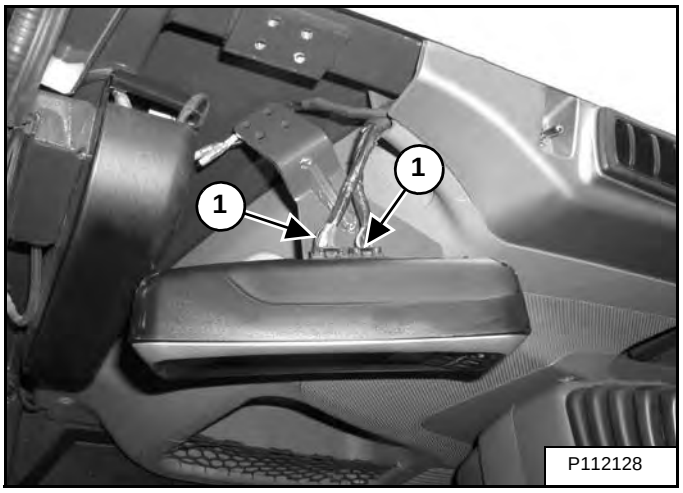
Pull out and remove the hourmeter (Item 1) **[Figure 50-100-1]**.

Figure 50-100-2



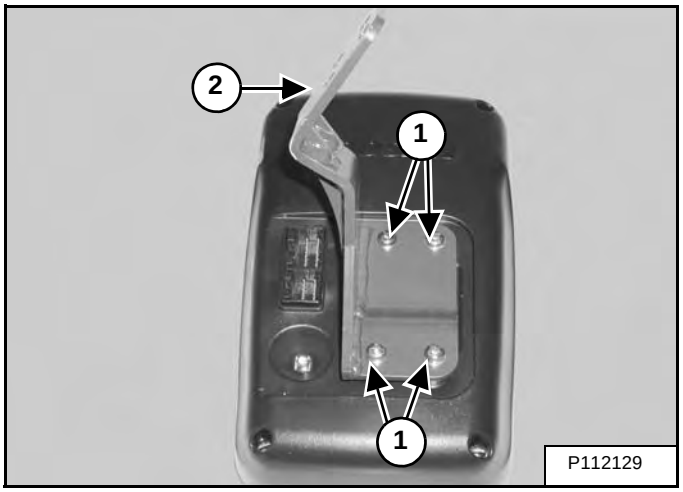
Remove the four screws (Item 1) **[Figure 50-100-2]**.

Figure 50-100-3



Disconnect the two wire harness connectors (Item 1) **[Figure 50-100-3]**.

Figure 50-100-4



Remove the four screws (Item 1) and bracket (Item 2) **[Figure 50-100-4]**.

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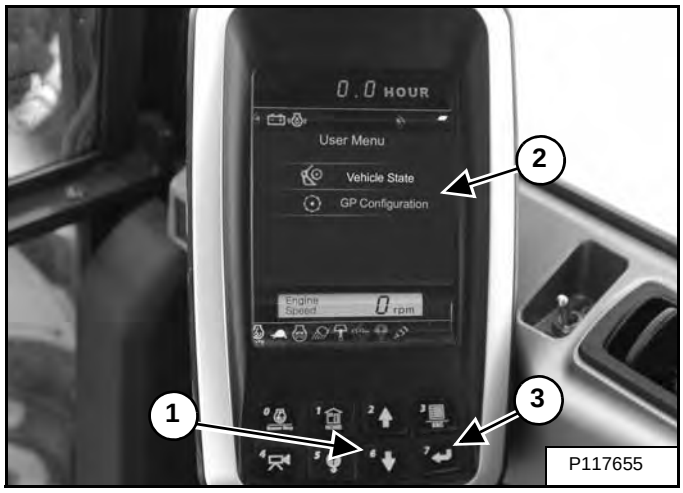
Setting The Operator Four Digit Password

Figure 50-100-5



With the engine OFF and the key in the ON position, press 3 (Item 1) **[Figure 50-100-5]**.

Figure 50-100-6



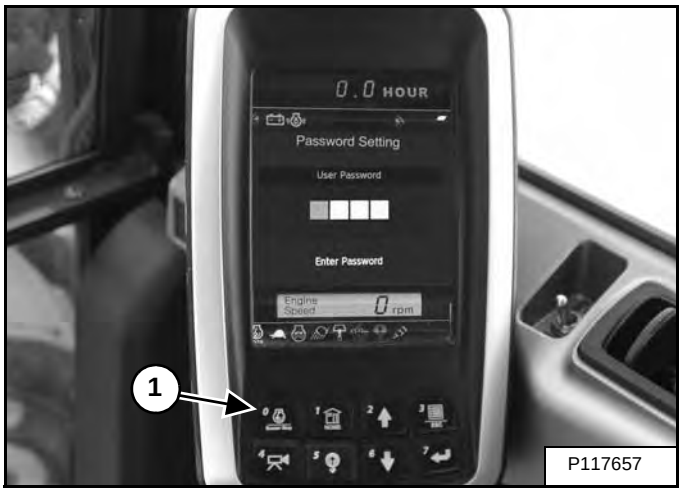
Press 6 (Item 1) and select the GP Configuration (Item 2). Press 7 (Item 3) **[Figure 50-100-6]**.

Figure 50-100-7



Press 6 (Item 1) and select password setting (Item 2). Press 7 (Item 3) **[Figure 50-100-7]**.

Figure 50-100-8

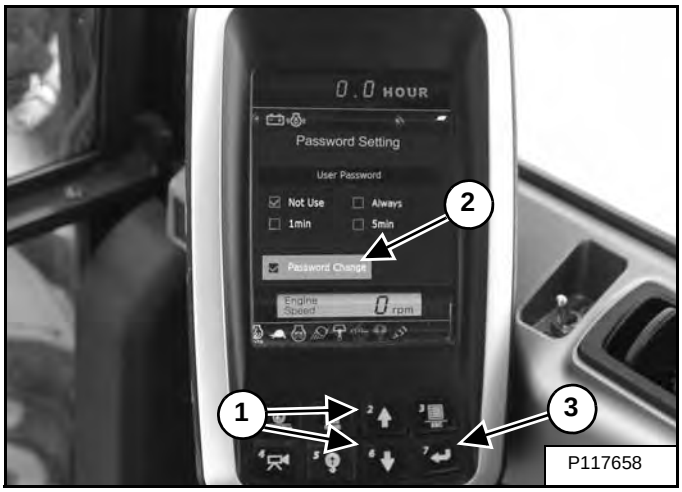


Press 0 (Item 1) **[Figure 50-100-8]** four times.

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Setting The Operator Four Digit Password (Cont'd)

Figure 50-100-9



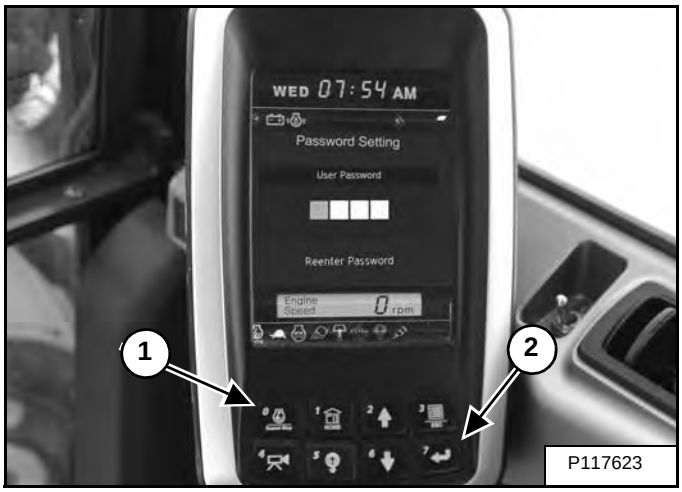
Press 6 or 2 (Item 1) and select password change (Item 2). Press 7 (Item 3) **[Figure 50-100-9]**.

Figure 50-100-10



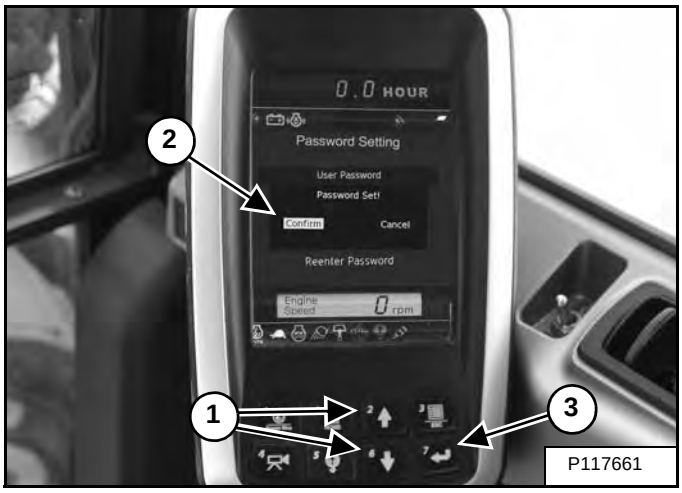
Enter the new password using the number pad (Item 1) **[Figure 50-100-10]**.

Figure 50-100-11



Enter the new password using the number pad (Item 1) a second time. Press 7 (Item 2) **[Figure 50-100-11]**.

Figure 50-100-12

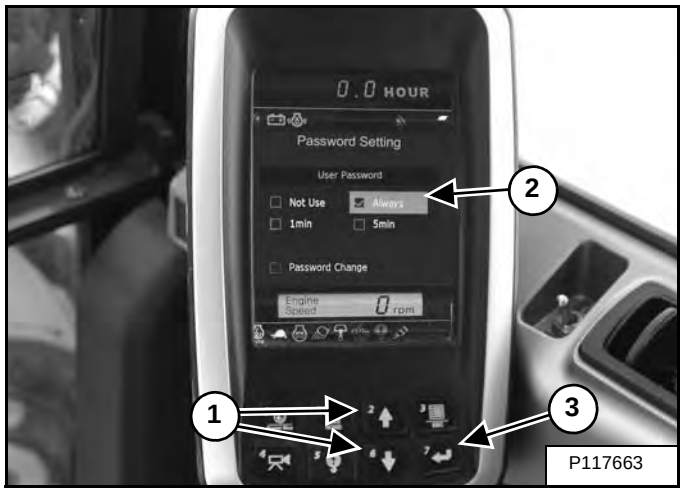


Press 6 or 2 (Item 1) and select confirm (Item 2). Press 7 (Item 3) **[Figure 50-100-12]**.

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Setting The Operator Four Digit Password (Cont'd)

Figure 50-100-13



Press 6 or 2 (Item 1) and select a time (Item 2) for password use. Press 7 (Item 3) **[Figure 50-100-13]**.

By selecting **NOT USE**, the password is disabled.

By selecting **ALWAYS**, the password must be entered every time to start the engine.

By selecting **1 min** or **5 min**, the engine can be started within one minute or five minutes of shutdown without reentering the password.

Cycle the key switch and the new operator password is installed.

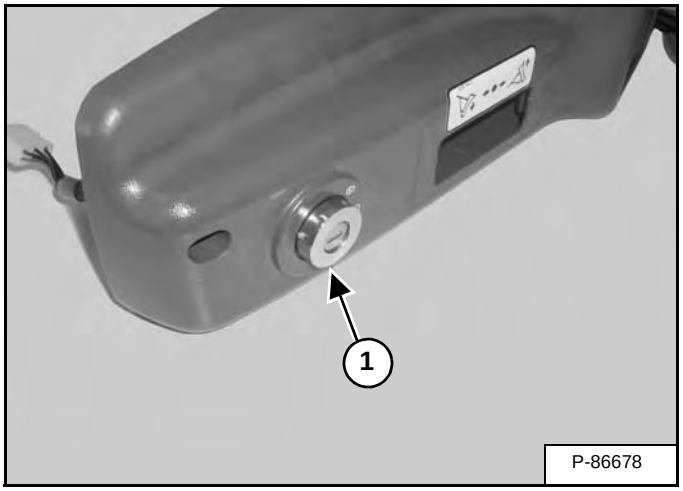
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KEY SWITCH

Removal And Installation

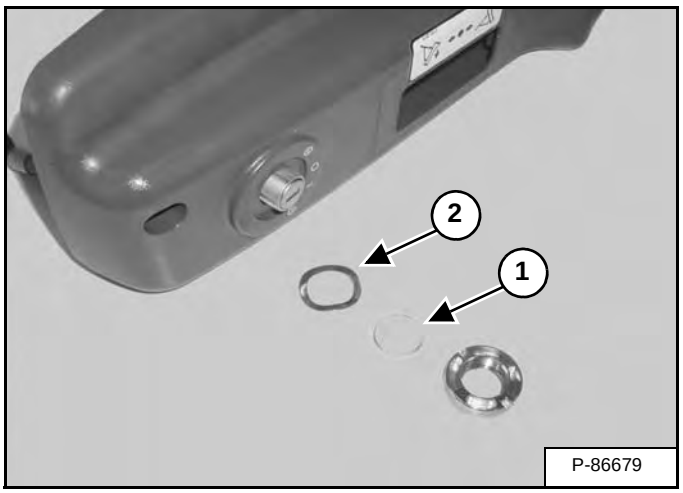
Remove the right console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 50-110-1



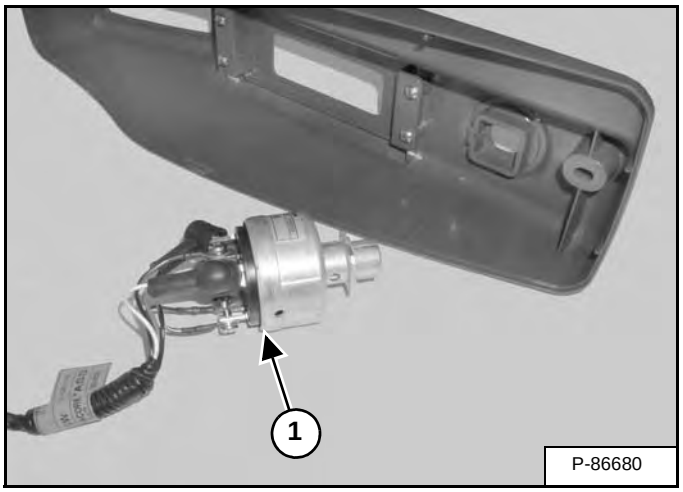
Remove the nut (Item 1) **[Figure 50-110-1]**.

Figure 50-110-2



Remove the flat washer (Item 1) and wave washer (Item 2) **[Figure 50-110-2]**.

Figure 50-110-3



Remove the switch assembly (Item 1) **[Figure 50-110-3]** from the back of the console cover.

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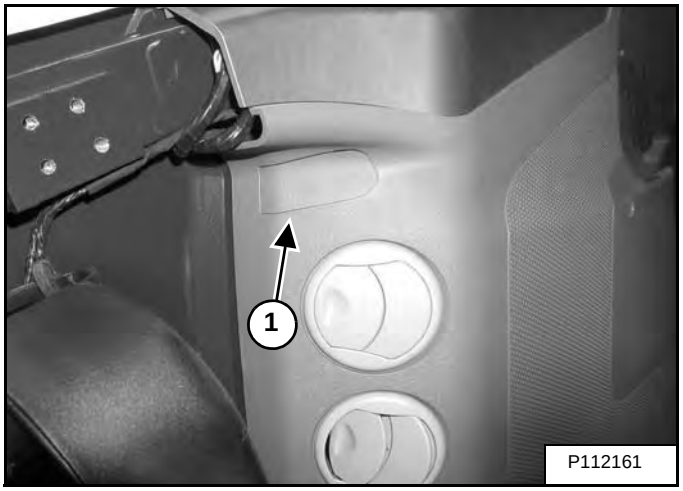
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RIGHT CONSOLE SWITCH COVER

Removal And Installation

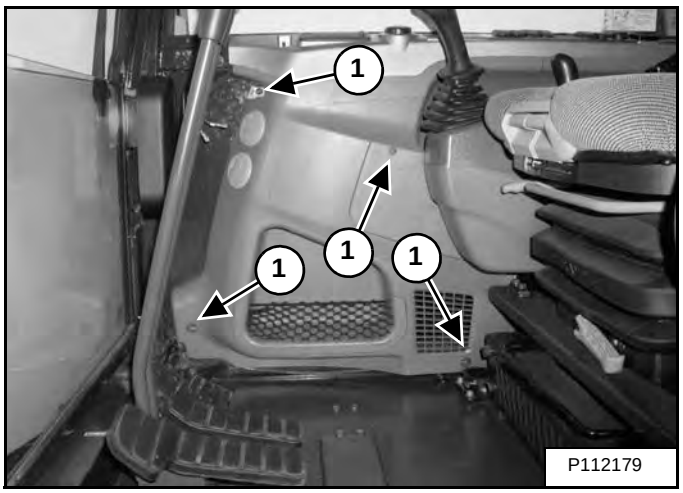
Remove the instrument panel (See Removal And Installation on Page 50-100-1.)

Figure 50-120-1



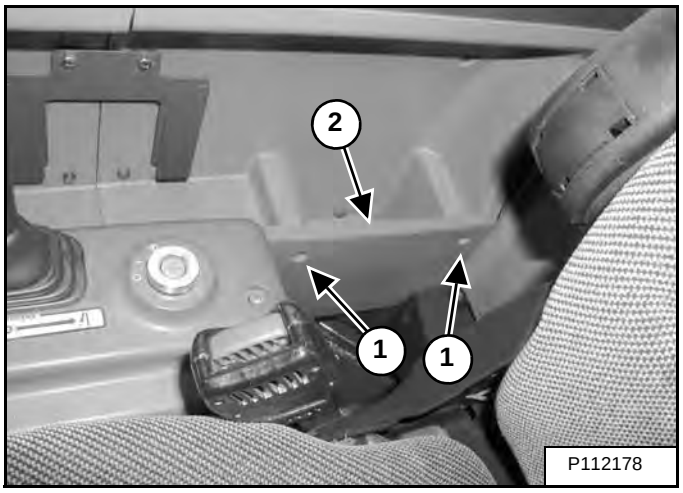
Remove the cover (Item 1) **[Figure 50-120-1]**.

Figure 50-120-2



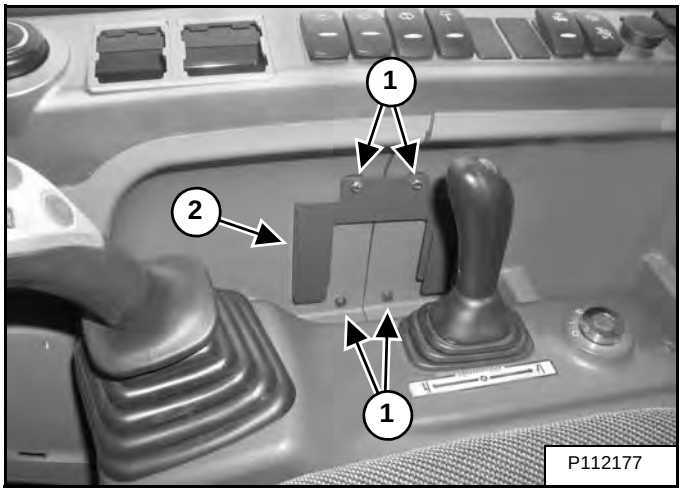
Remove the screws (Item 1) **[Figure 50-120-2]**.

Figure 50-120-3



Remove the screws (Item 1) and panel (Item 2) **[Figure 50-120-3]**.

Figure 50-120-4

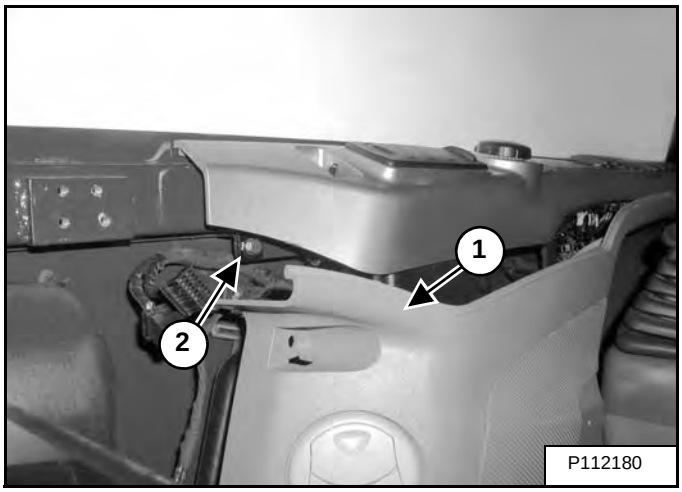


Remove the screws (Item 1) and plate (Item 2) **[Figure 50-120-4]**.

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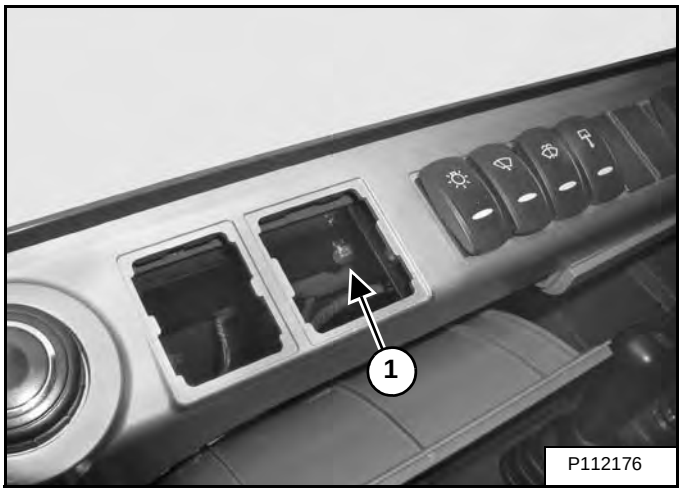
Removal And Installation (Cont'd)

Figure 50-120-5



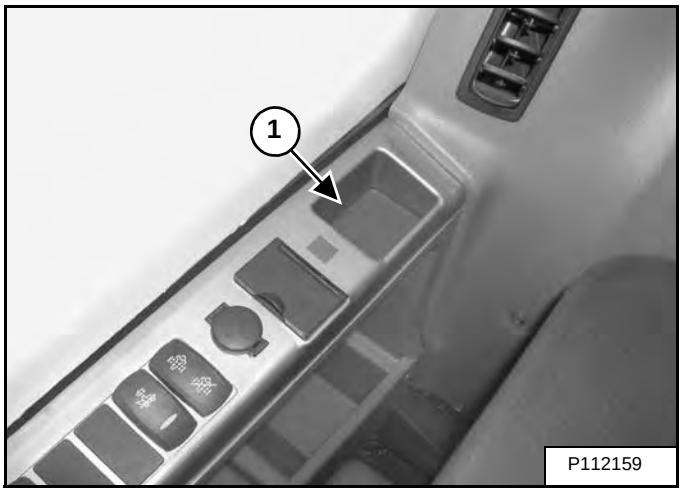
Pull the panel (Item 1) away from the side of the cab. Remove the bolt (Item 2) **[Figure 50-120-5]**.

Figure 50-120-6



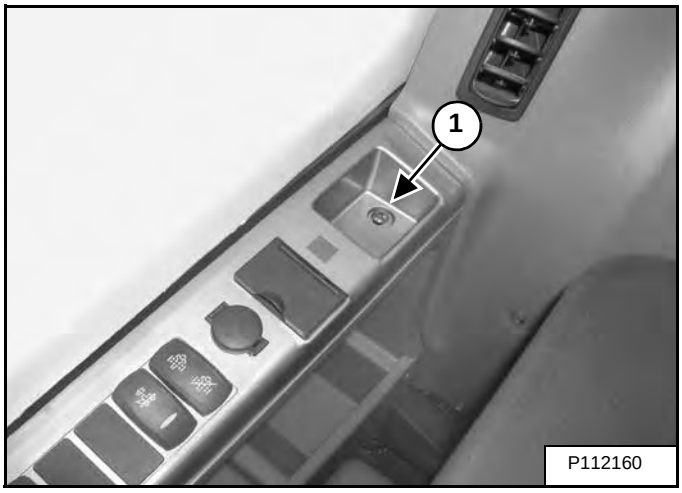
Remove the bolt (Item 1) **[Figure 50-120-6]**.

Figure 50-120-7



Remove the cover (Item 1) **[Figure 50-120-7]**.

Figure 50-120-8



Remove the screw (Item 1) **[Figure 50-120-8]**.

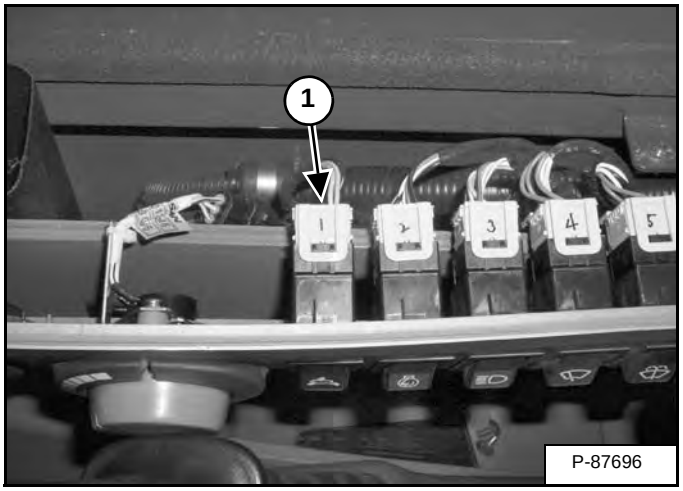
Tilt the cover towards the operator seat.

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Rocker Switch Removal And Installation

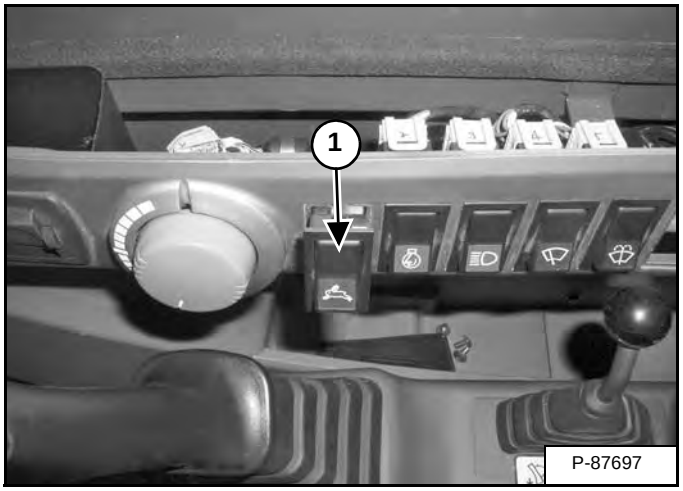
NOTE: The removal of the two-speed switch is shown, all rocker switch removal is the same.

Figure 50-120-9



Disconnect the wire harness (Item 1) **[Figure 50-120-9]** from the switch.

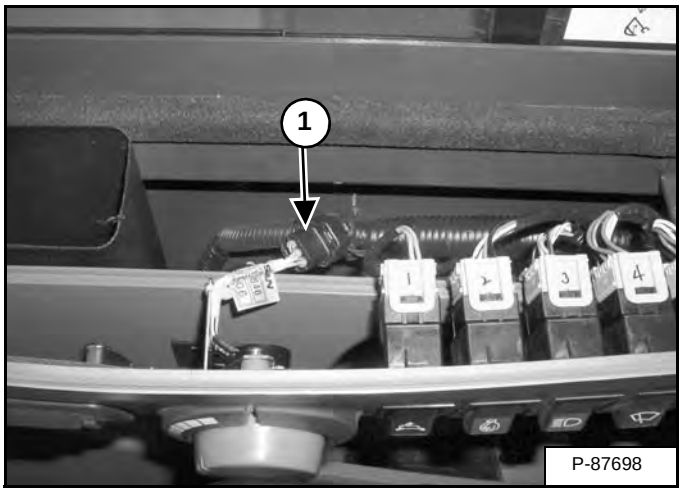
Figure 50-120-10



Depress the tabs on both sides of the switch and remove the switch (Item 1) **[Figure 50-120-10]** from the cover.

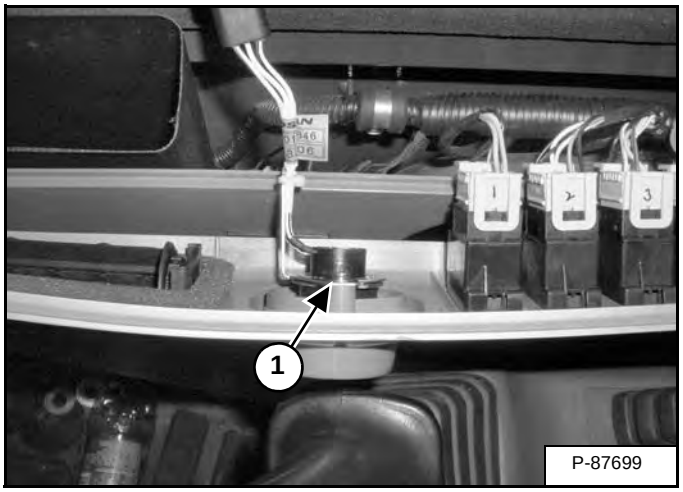
Speed Control Removal And Installation

Figure 50-120-11



Disconnect the wire harness (Item 1) **[Figure 50-120-11]**.

Figure 50-120-12

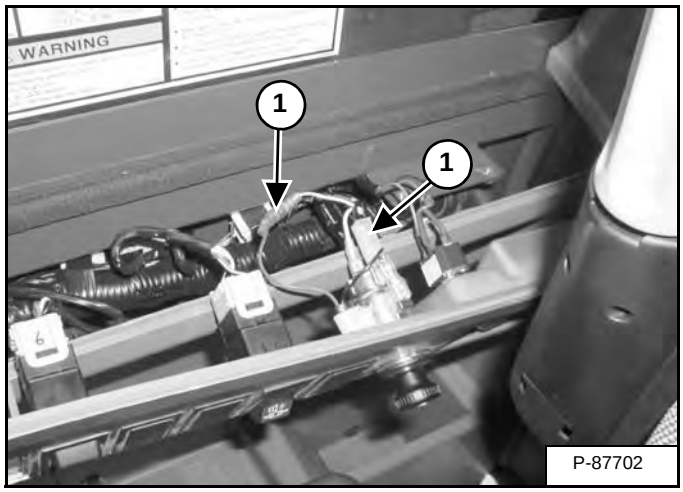


Remove the two screws (Item 1) **[Figure 50-120-12]** and the speed control.

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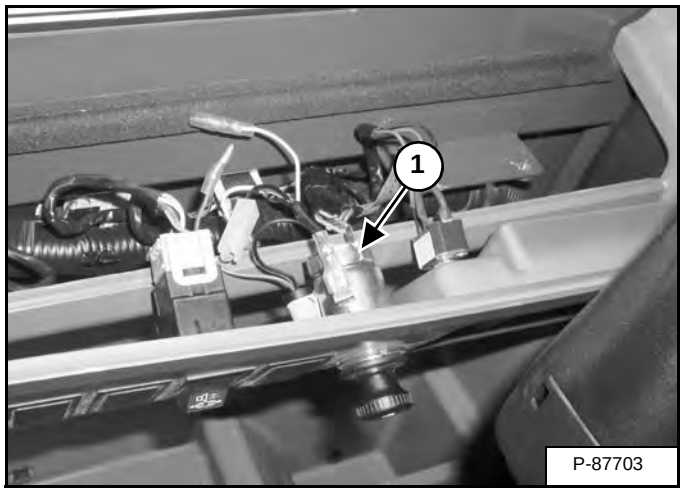
Auxiliary Power Outlet Removal And Installation

Figure 50-120-13



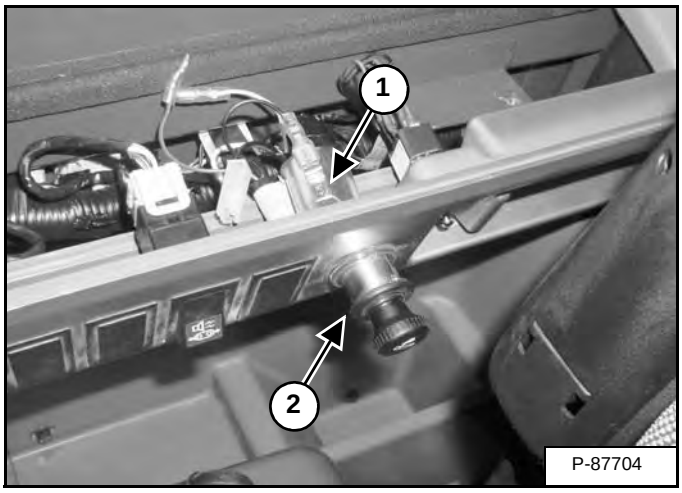
Disconnect the wire harness (Item 1) **[Figure 50-120-13]**.

Figure 50-120-14



Remove the nut (Item 1) **[Figure 50-120-14]**.

Figure 50-120-15



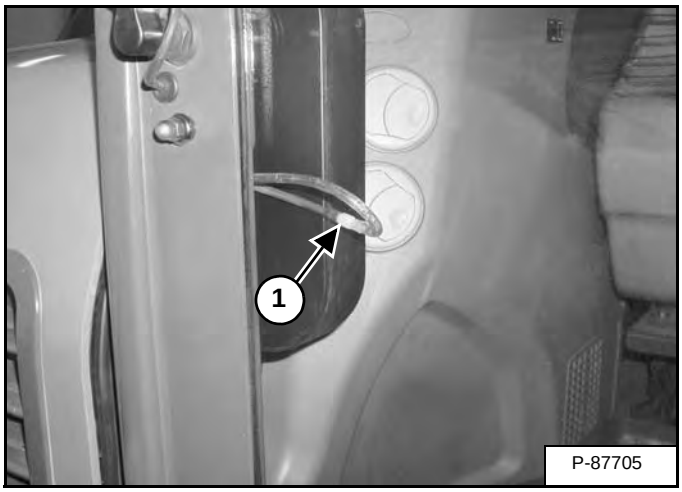
Remove the collar (Item 1) and slide the housing (Item 2) **[Figure 50-120-15]** out of the cover.

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WIPER MOTOR

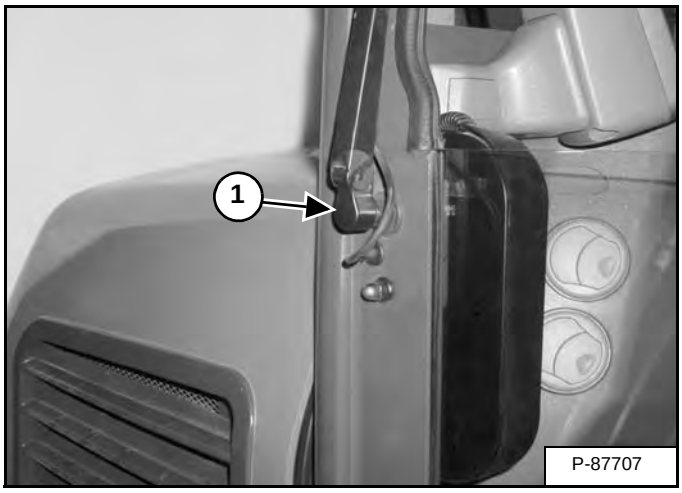
Removal And Installation

Figure 50-130-1



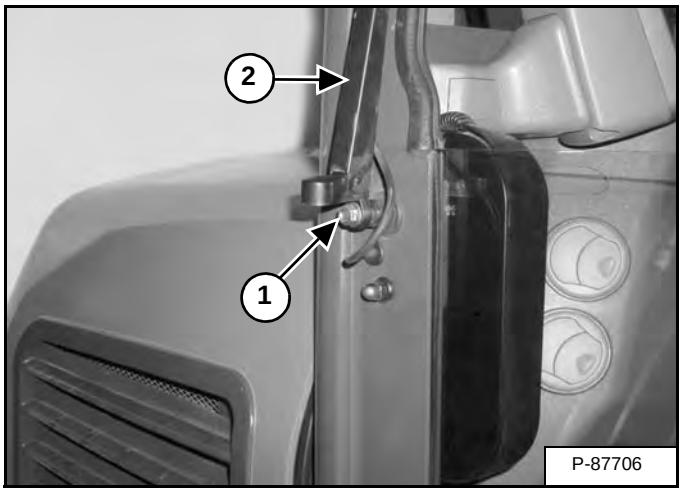
Disconnect the washer hose (Item 1) **[Figure 50-130-1]** inside the cab.

Figure 50-130-2



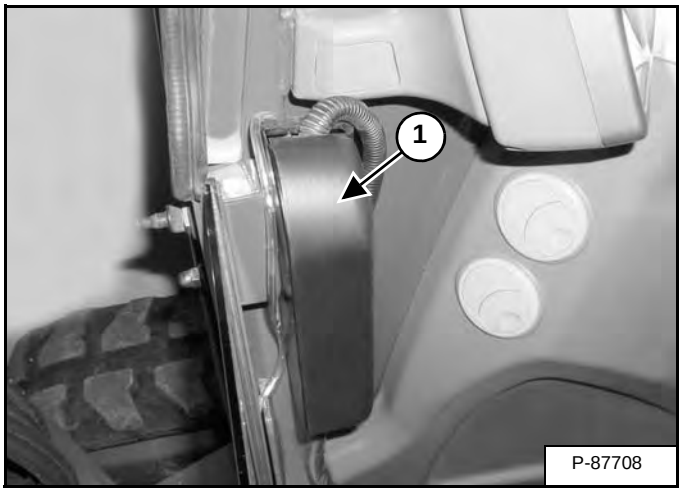
Tilt the cover (Item 1) **[Figure 50-130-2]** on the wiper arm to the open position.

Figure 50-130-3



Remove the nut (Item 1) and remove the upper arm (Item 2) **[Figure 50-130-3]**.

Figure 50-130-4

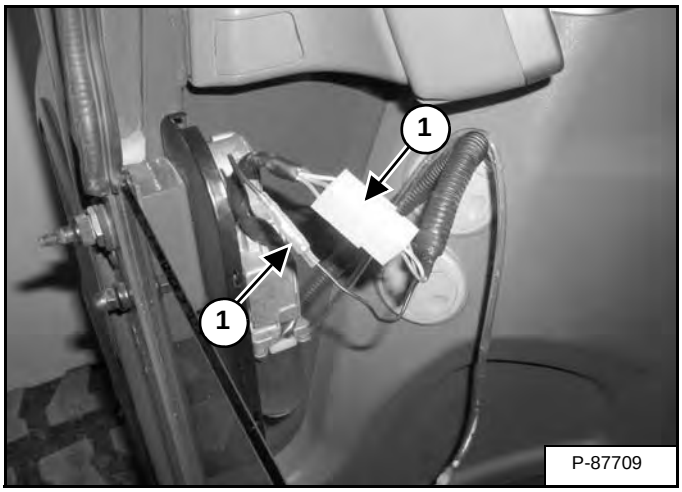


Remove the wiper motor cover (Item 1) **[Figure 50-130-4]**.

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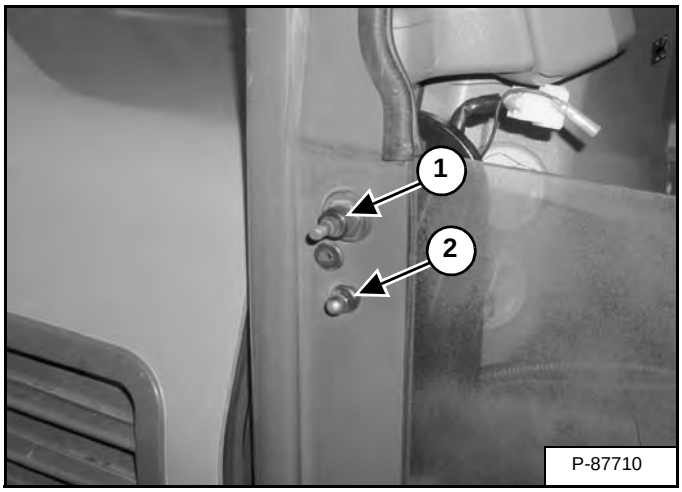
Removal And Installation (Cont'd)

Figure 50-130-5



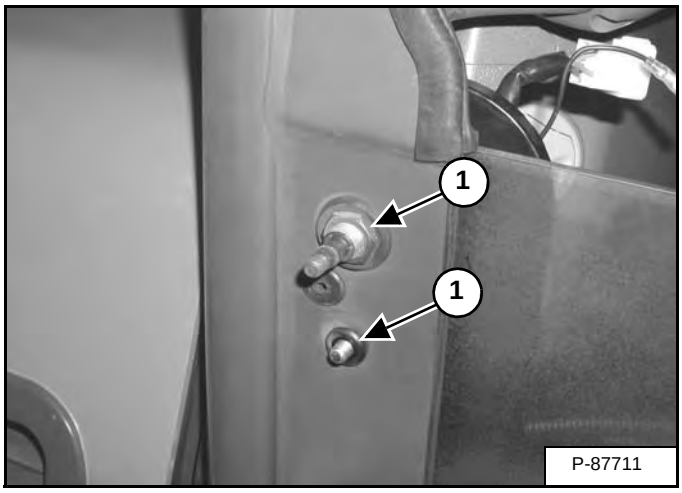
Disconnect the wire harness connectors (Item 1) **[Figure 50-130-5]**.

Figure 50-130-6



Remove the plastic nut (Item 1) and castle nut (Item 2) **[Figure 50-130-6]**.

Figure 50-130-7



Remove the top and bottom nut (Item 1) **[Figure 50-130-7]** and remove the wiper motor.

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MOTION ALARM SYSTEM

Description

This excavator is 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. Slight movement of the steering levers in either the forward or reverse direction is required with hydraulic components before the motion alarm will sound.

Inspecting

Figure 50-140-1



Inspect for damaged or missing motion alarm decal (Item 1) **[Figure 50-140-1]**. Replace if required.

NOTE: The excavator will need to be moved slightly in both the forward and reverse direction to test the motion alarm. Keep all bystanders away from machine during test.

Make sure there are no bystanders in the area.

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

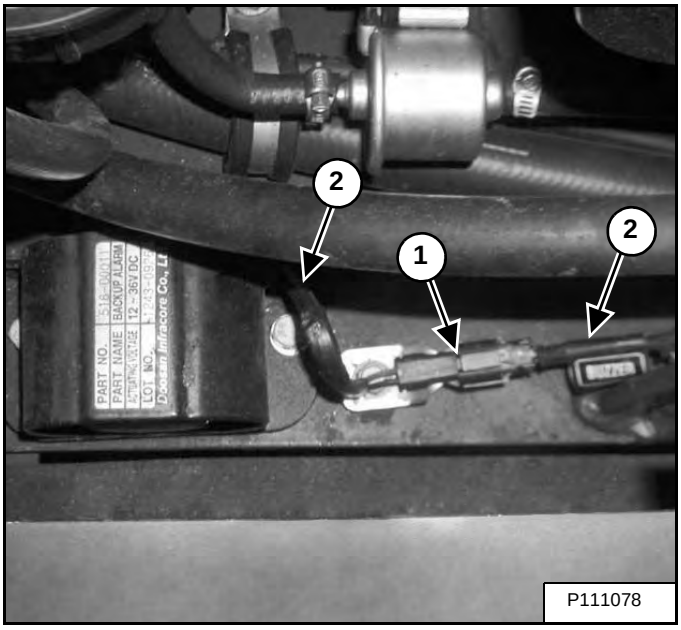
Sit in the operator's seat. Perform the PRE-STARTING PROCEDURE. (See PRE-STARTING PROCEDURE in the Operation and Maintenance Manual). Start the engine.

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.

Return both levers to neutral and turn excavator key to OFF position. Exit the excavator. (See Operation & Maintenance Manual for the correct procedure.)

The motion alarm is located inside the lower part of the engine compartment.

Figure 50-140-2



Inspect the motion alarm electrical connector (Item 1) and wire harness (Item 2) **[Figure 50-140-2]** for damage. Repair or replace any damaged components.

If the motion alarm sensor requires adjustment, see the following information.

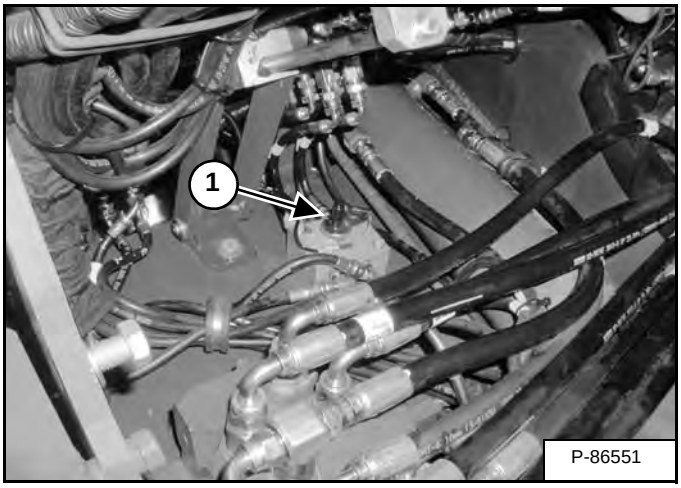
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MOTION ALARM SYSTEM (CONT'D)

Adjusting Switch Position

Stop the engine. Raise the operator cab. (See Service Manual for correct procedure.)

Figure 50-140-3



The motion alarm sensor (Item 1) **[Figure 50-140-3]** is hydraulic pressure activated and located under the operator cab in the motion alarm valve.

The sensor (Item 1) **[Figure 50-140-3]** is non-adjustable. It must be fully installed into the valve housings and tightened.

Inspect the motion alarm system for proper function if sensor is replaced.

⚠ WARNING

This machine is equipped with a motion alarm.
ALARM MUST SOUND!
when operating forward or backward.

Failure to maintain a clear view in the direction of travel could result in serious injury or death.

The operator is responsible for the safe operation of this machine.

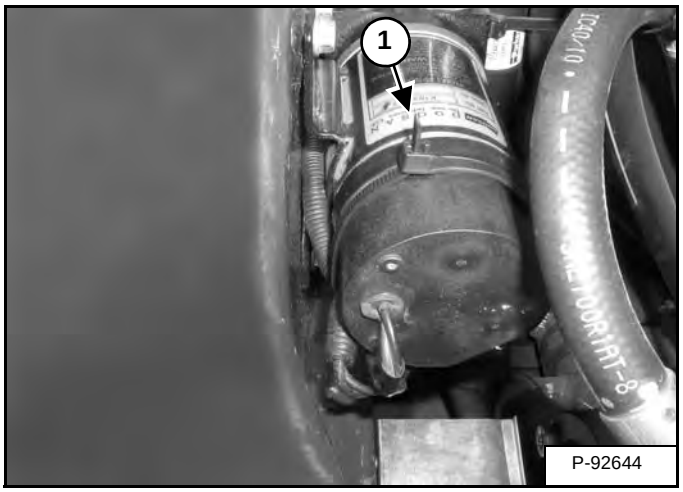
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FUEL TRANSFER PUMP

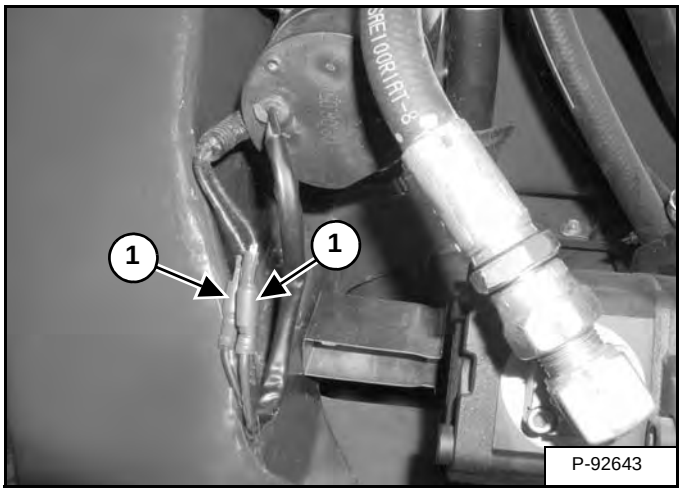
Removal And Installation

Figure 50-150-1



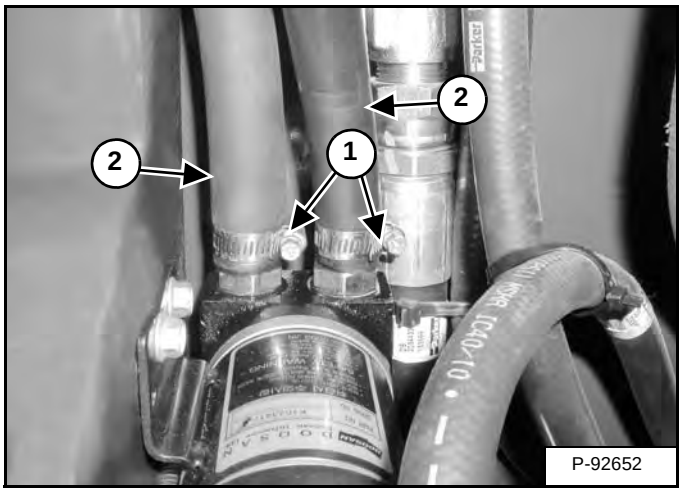
Remove the tie strap (Item 1) **[Figure 50-150-1]**.

Figure 50-150-2



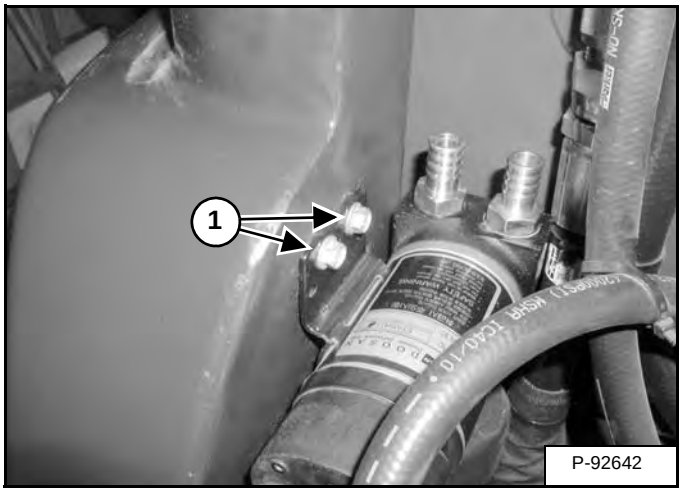
Disconnect the wires (Item 1) **[Figure 50-150-2]**.

Figure 50-150-3



Loosen the clamps (Item 1) and remove the hoses (Item 2) **[Figure 50-150-3]**.

Figure 50-150-4



Remove the upper bolts (Item 1) **[Figure 50-150-4]** and lower bolts.

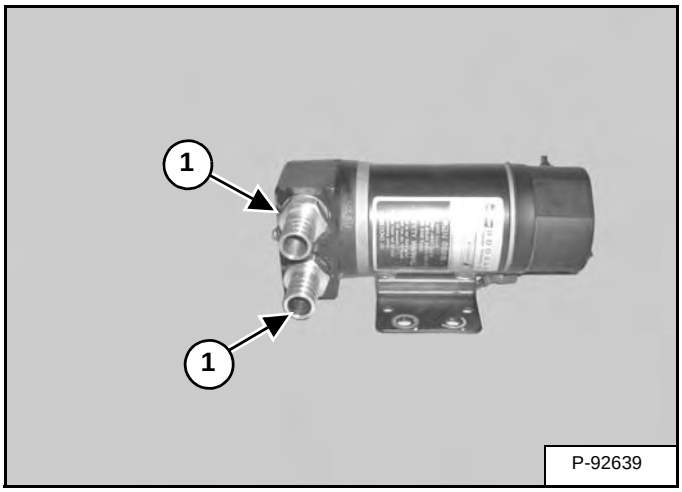
Remove the pump.

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FUEL TRANSFER PUMP (CONT'D)

Removal And Installation (Cont'd)

Figure 50-150-5



Remove the fittings (Item 1) **[Figure 50-150-5]**.

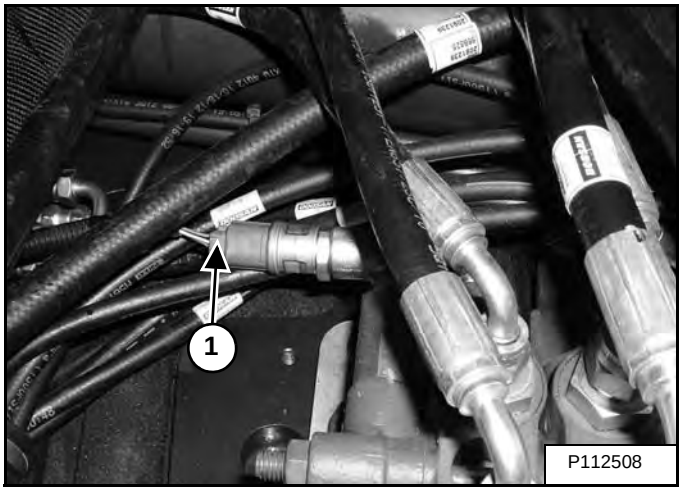
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AUTO IDLE PRESSURE SWITCH

Removal And Installation

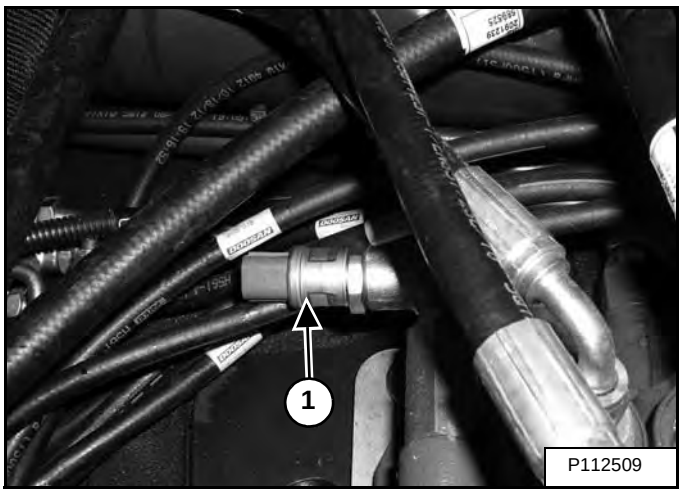
Tilt the cab. (See CAB TILT PROCEDURE on Page 10-210-1.)

Figure 50-160-1



Disconnect the wire harness (Item 1) **[Figure 50-160-1]**.

Figure 50-160-2



Remove the switch (Item 1) **[Figure 50-160-2]** from the hydraulic control valve.

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ENGINE CONTROL UNIT (ECU)

Description

The engine ECU controls the amount, timing, mixture and pressure of fuel that is injected. The engine ECU operates each kind of control based on the signals from each type of sensor.

The actuator for controlling the amount, timing and mixture of fuel injection is the injector, while the actuator for controlling fuel pressure is the supply pump.

The amount of fuel to be injected is determined using a basic injection amount, which is calculated based on the state of the engine and driving conditions, with corrections added for parameters such as water temperature, fuel temperature, intake pressure, etc.

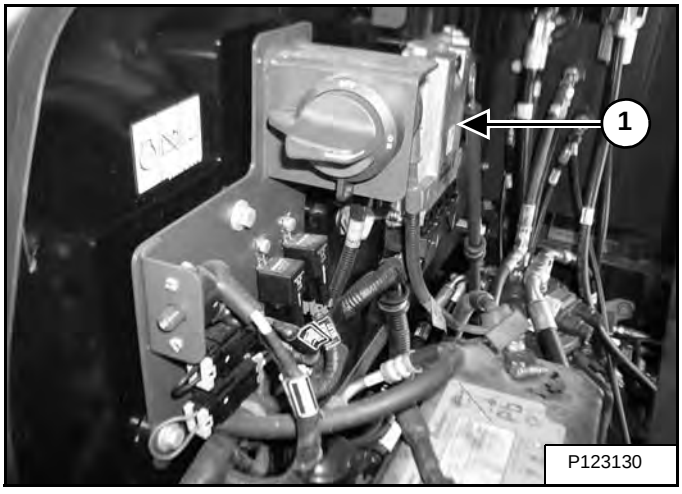
The ECU controls the timing for starting to energize the injectors, first determining the timing for the main injection and then the timing of other injections, such as pilot injections.

By conducting a pilot injection, the initial fuel mixture is kept to a minimum, mitigating the explosive initial combustion and reducing NOx and noise.

The ECU calculates the set fuel injection pressure based on the engine load (last injection amount and engine RPM) and controls the amount the supply pump supplies and the fuel pressure inside the rail.

The ECU monitors the diesel particulate filter (DPF) and determines when regeneration and level of regeneration should occur.

Figure 50-170-1



The ECU is located under the center cover (Item 1) **[Figure 50-170-1]**.

IMPORTANT

Avoid damage to the Engine Control Unit (ECU). Water entering ECU atmospheric pressure sensor will damage the ECU. Do not use high water pressure around the ECU when cleaning the engine compartment.

I-2357-0512

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ENGINE CONTROL UNIT (ECU) (CONT'D)

Removal And Installation

Clean the ECU and connectors before disconnecting the wire harness.

NOTE: Do not use high pressure water to clean the ECU.

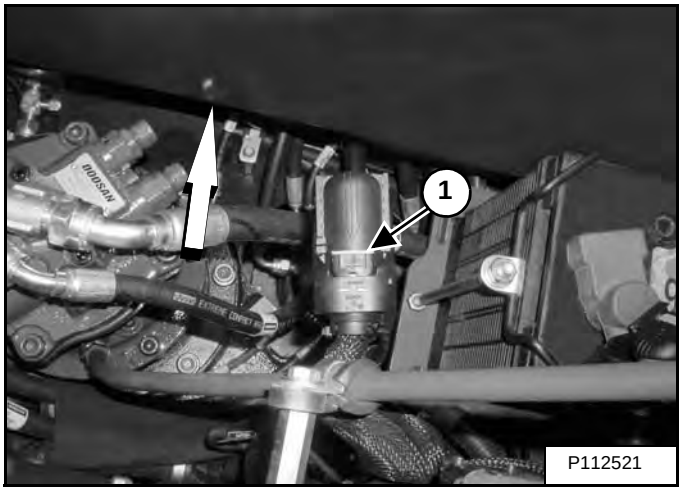
IMPORTANT

Avoid damaging the Engine Control Unit (ECU) and electrical connectors. Use care when removing or installing the ECU connectors.

I-2356-0512

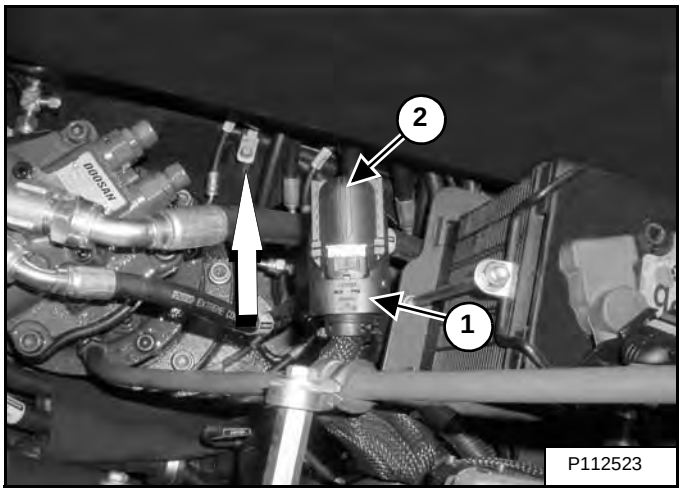
NOTE: The wire harness connector is shown removed from the ECU to show wire harness connector operation.

Figure 50-170-2



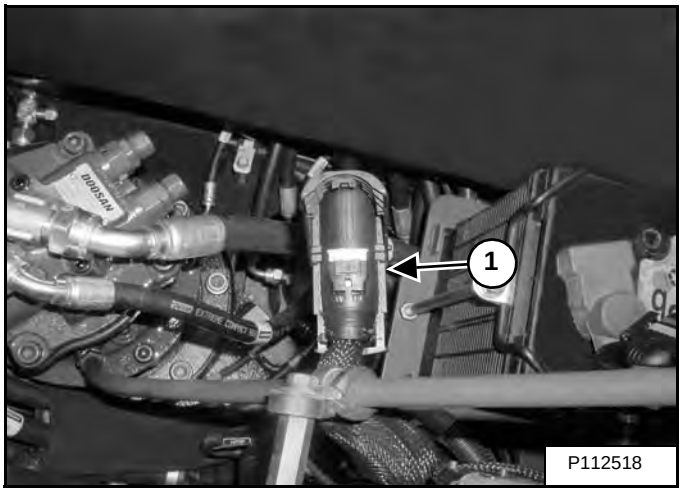
Slide the lock (Item 1) **[Figure 50-170-2]** forward.

Figure 50-170-3



Lift the lever (Item 1) and push fully forward to remove the connector (Item 2) **[Figure 50-170-3]**.

Figure 50-170-4

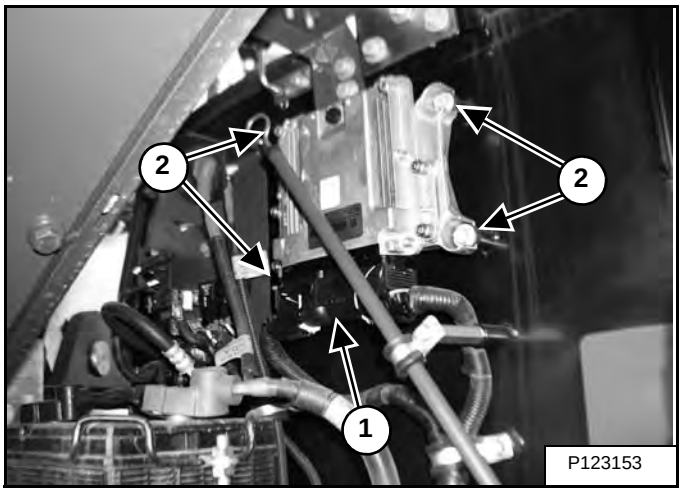


Pull the connector (Item 1) **[Figure 50-170-4]** straight out to avoid damage.

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Removal And Installation (Cont'd)

Figure 50-170-5



Remove the connectors (Item 1) **[Figure 50-170-5]** from the bottom of the ECU.

Remove the four mounting bolts (Item 2) and remove the ECU **[Figure 50-170-5]**.

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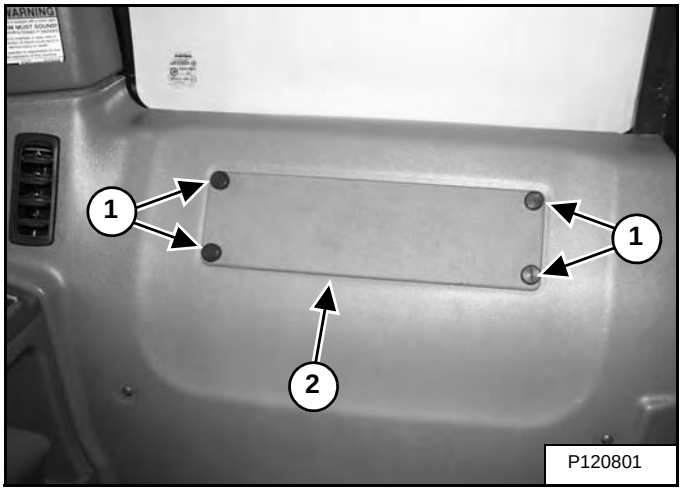
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VEHICLE CONTROL UNIT (VCU)

Removal And Installation

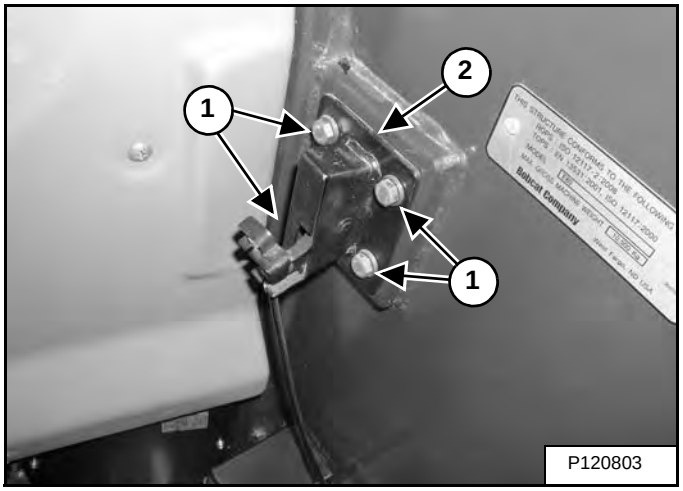
Disconnect the battery. (See Master Disconnect Switch on Page 50-10-3.)

Figure 50-180-1



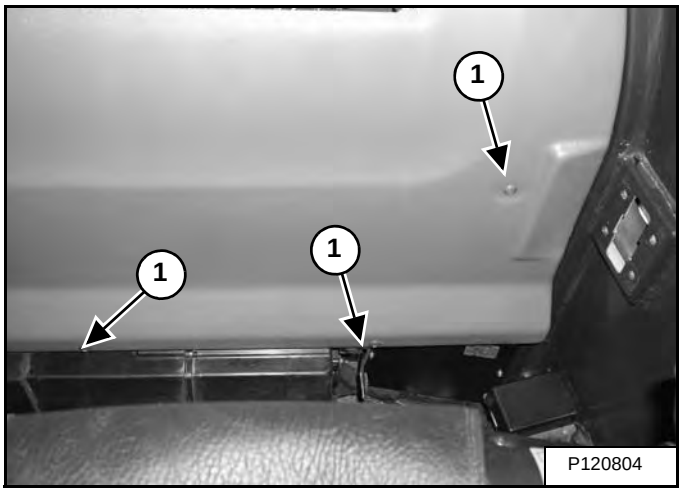
Remove the fasteners (Item 1) and remove the cover (Item 2) **[Figure 50-180-1]**.

Figure 50-180-2



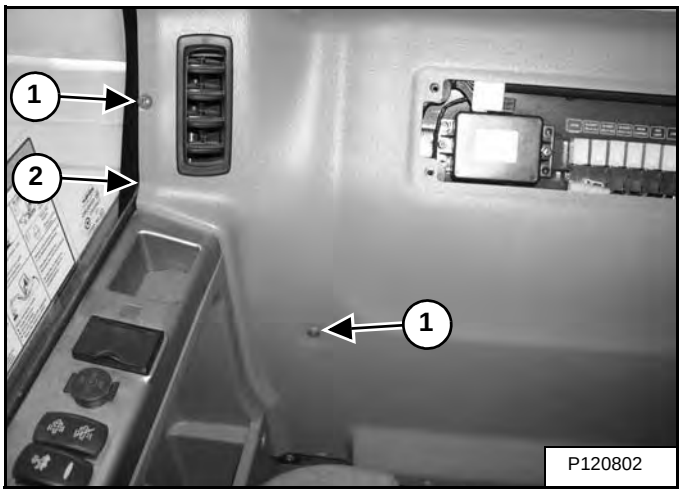
Remove the bolts (Item 1) and reposition the door latch (Item 2) **[Figure 50-180-2]**.

Figure 50-180-3



Remove the screws (Item 1) **[Figure 50-180-3]**.

Figure 50-180-4

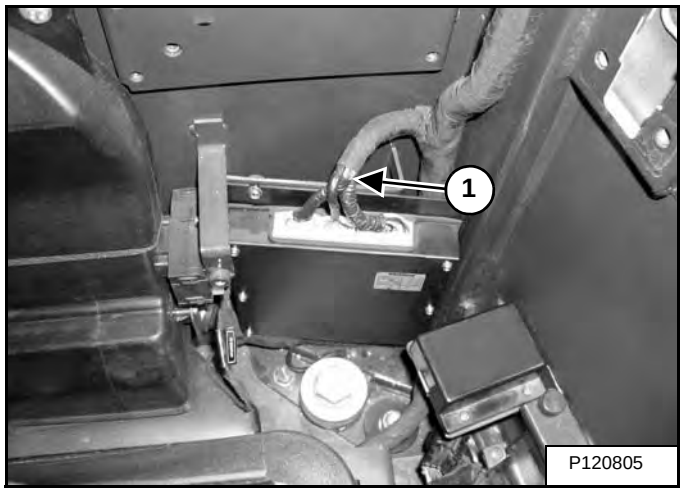


Remove the screws (Item 1) and remove the cover (Item 2) **[Figure 50-180-4]**.

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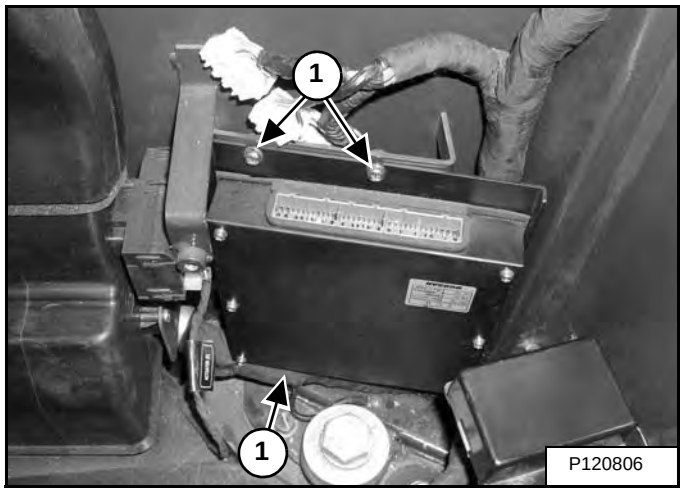
Removal And Installation (Cont'd)

Figure 50-180-5



Disconnect the wire harness (Item 1) **[Figure 50-180-5]** from the VCU.

Figure 50-180-6



Remove the three screws (Item 1) **[Figure 50-180-6]** and remove the VCU.

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ENGINE SERVICE

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- Compression - Testing 60-10-18

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- Removal And Installation 60-30-2

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- Housing Removal And Installation 60-40-1

ENGINE COOLING SYSTEM 60-50-1
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- Radiator Disassembly And Assembly 60-50-5
- Fan Removal And Installation 60-50-7
- Fuel Cooler Removal And Installation 60-50-8
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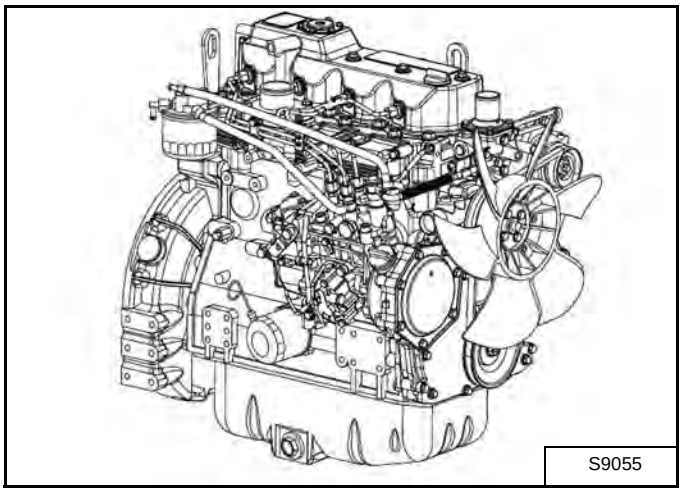
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ENGINE INFORMATION

Description

Figure 60-10-1



The E85 Excavator has a Yanmar direct injected 4TNV98C-VDB8 diesel engine with a displacement of 3,3 L (203 in³). The engine is rated at an SAE Gross 44,3 kW (59.4 hp) and has a closed crankcase ventilation system **[Figure 60-10-1]**.

The engine has 4 cylinders and the rotation is counter-clockwise (viewed from the flywheel side). It is equipped with an air heater, installed in the intake manifold, for assisting in cold starts.

The engine serial number is stamped on the engine and the model number is located on top of the valve cover. Use these numbers to obtain the correct service parts.

The engine is liquid cooled with a ethylene glycol / water mixture in a radiator. Coolant flow is controlled by a thermostat. The cooling fan is driven by the engine. The speed of the fan is determined by the engine rpm.

An Electronic Engine Control System (EECS) (See Electronic Fuel Injection Schematic - Components on Page 60-70-1.) regulates the exhaust gas recirculation flow rate and the fuel injection volume depending on the engine load and speed signals from the engine controller (E-ECU). The engine is also equipped with the Common Rail System and the Exhaust Gas Recirculation (EGR) system to conform to the engine emission regulations (EPA 2012 rules). The EECS also controls the diesel particulate filter (DPF) regeneration mode operation by managing the condition of the DPF (clogging) by controlling the intake throttle.

Features of the electronic engine control system include:

- Engine speed control schemes
  Droop control / low-idling speed up / auto deceleration / high-idling speed down / black smoke suppression
- Starting aid
  Auto preheating / after heating
- Engine failure detection
- CAN communication with the control system of the driven machine

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Specifications

Cylinder Head

Cylinder Head Surface Distortion	0,05 mm (0.0020 in) or less
Cylinder Had Surface Distortion Allowable Limit	0,15 mm (0.0059 in)
Compression	3330 - 3540 kPa (33,3 - 35,4 Bar) (483 - 513 psi)
Compression Allowable Limit	2650 - 2860 kPa (26,5 - 28,6 Bar) (384 - 414 psi)
Allowable Difference Between Cylinders	200 - 290 kPa (2,0 - 2,9 Bar) (29 - 43 psi)

Valves

Valve Seat Width	
Intake Valve Stem O.D	6,945 - 6,960 mm (0.2734 - 0.2740 in)
Intake Valve Stem O.D. Allowable Limit	6,9 mm (0.2717 in)
Intake Valve Guide I.D.	7,0 - 7,015 mm (0.2756 - 0.2762 in)
Intake Valve Guide I.D. Allowable Limit	7,08 mm (0.2787 in)
Intake Valve Stem Bend	0,04 - 0,07 mm (0.0016 - 0.0028 in)
Intake Valve Stem Bend Allowable Limit	0,17 mm (0.0067 in)
Exhaust Valve Stem O.D.	6,940 - 6,955 mm (0.2732 - 0.2738 in)
Exhaust Valve Stem O.D. Allowable Limit	6,90 mm (0.2717 in)
Exhaust Valve Guide I.D.	7,0 - 7,015 mm (0.2756 - 0.2762 in)
Exhaust Valve Guide I.D. Allowable Limit	7,08 mm (0.2787 in)
Exhaust Valve Stem Bend	0,045 - 0,075 mm (0.0018 - 0.0030 in)
Exhaust Valve Stem Bend Allowable Limit	0,17 mm (0.0067 in)
Valve Guide Projection From Cylinder Head	14,71 - 15,00 mm (0.5791 - 0.5905 in)
Valve Guide Projection From Cylinder Head (4 Valves)	18,7 - 19,0 mm (0.736 - 0.748 in)
Intake Valve Recession	0,36 - 0,56 mm (0.0142 - 0.0220 in)
Intake Valve Recession Allowable Limit	0,8 mm (0.0318 in)
Exhaust Valve Recession	0,35 - 0,55 mm (0.0138 - 0.0217 in)
Exhaust Valve Recession Allowable Limit	0,8 mm (0.0315 in)
Valve Clearance	0,15 - 0,25 mm (0.006 - 0.010 in)
Valve Seat Angle (Int.)	120°
Valve Seat Angle (Exh.)	90°
Valve Seat Correction Angle	40°, 150°

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Specifications (Cont'd)

Valve Springs

Free Length	47,5 mm (1.8701 in)
Allowable Limit	47,0 mm (1.8504 in)
Inclination Allowable Limit	1,2 mm (0.0472 in)

Rocker Arm And Shaft

O.D. Of Rocker Arm Shaft	18,470 - 18,490 mm (0.7272 - 0.7280 in)
O.D. Of Rocker Arm Shaft Allowable Limit	18,44 mm (0.7260 in)
I.D. Of Rocker Arm	18,5 - 18,52 mm (0.7283 - 0.7291 in)
I.D. of Rocker Arm Allowable Limit	18,57 mm (0.7311 in)
Clearance Between Rocker Arm And Shaft	0,01 - 0,05 mm (0.0004 - 0.0020 in)
Clearance Between Rocker Arm & Shaft Allowable Limit	0,13 mm (0.0051 in)

Camshaft

Endplay	0,05 - 0,20 mm (0.0020 - 0.0079 in)
Endplay Allowable Limit	0,030 mm (0.0118 in)
Alignment (1/2 dial gauge reading)	0,0 - 0,02 mm (0.0 - 0.0008 in)
Alignment Allowable Limit	0,05 mm (0.0020 in)
Cam Lobe Height	42,435 - 42,565 mm (1.6707- 1.6758 in)
Cam Lob Height Allowable Limit	42,185mm (1.6608 in)
Gear End Bushing I.D.	49,99 - 50,055 mm (1.9681 - 1.9707 in)
Gear End Bushing I.D. Allowable Limit	50,13 mm (1.9736 in)
Gear End Camshaft O.D.	49,925 - 49,950 mm (1.9655 - 1.9665 in)
Gear End Camshaft O.D. Allowable Limit	49,890 mm (1.9642 in)
Gear End Oil Clearance	0,04 - 0,130 mm (0.0016 - 0.0051 in)
Gear End Oil Clearance Allowable Limit	0,240 mm (0.0094 in)
Intermediate Bore I.D.	50,0 - 50,025 mm (1.9685 - 1.9695 in)
Intermediate Bore I.D. Allowable Limit	50,1 mm (1.9724 in)
Intermediate Camshaft O.D.	49,91 - 49,935 mm (1.9650 - 1.9659 in)
Intermediate Camshaft O.D. Allowable Limit	49,875 mm (1.9636 in)
Intermediate Camshaft Oil Clearance	0,065 - 0,115 mm (0.0026 - 0.0045 in)
Intermediate Camshaft Oil Clearance Allowable Limit	0,225 mm (0.0089 in)
Flywheel End Inside Bore	50,0 - 50,025 mm (1.9685 - 1.9695 in)
Flywheel End Inside Bore Allowable Limit	50,1 mm (1.9724 in)
Flywheel End Camshaft O.D.	49,925 - 49,950 mm (1.9655 - 1.9665 in)
Flywheel End Camshaft O.D. Allowable Limit	49,890 mm (1.9642 in)
Flywheel End Oil Clearance	0,050 - 0,10 mm (0.0020 - 0.0039 in)
Flywheel End Oil Clearance Allowable Limit	0,210 mm (0.0083 in)

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Specifications (Cont'd)

Tappet

Tappet Bore I.D.	12,0 - 12,018 mm (0.4724 - 0.4731 in)
Tappet Bore I.D. Allowable Limit	12,038 mm (0.4739 in)
Tappet Stem O.D.	11,975 - 11,990 mm (0.4715 - 0.4720 in)
Tappet Stem O.D. Allowable Limit	11,955 mm (0.4707 in)
Oil Clearance	0,010 - 0,043 mm (0.0004 - 0.0017 in)
Oil Clearance Allowable Limit	0,083 mm (0.0033 in)

Push Rod

Push Rod Bend Allowable Limit	0,03 mm (0.0012 in)

Cylinders

Cylinder Bore I.D.	98,000 - 98,030 mm (3.8583 - 3.8594 in)
Allowable limit	98,130 mm (3.8634 in)
Roundness	87,25 - 87,27 mm (3.435 - 3.436 in) 0,01 mm (0.0004 in) or less / Limit - 0,03 mm (0.0012 in)
Taper	+0,15 mm (+0.006 in) 0,01 mm (0.0004 in) or less / Limit - 0,03 mm (0.0012 in)

Piston Rings

Top Ring End Gap	0,250 - 0,450 mm (0.0098 - 0.0177 in)
Top Ring End Gap Allowable Limit	0,540 mm (0.0213 in)
Top Ring Side Clearance	0,080 - 0,120 mm (0.0031 - 0.0047 in)
Top Ring Width	1,940 - 1,960 mm (0.0764 - 0.0772 in)
Top Ring Width Allowable Limit	1,920 mm (0.0756 in)
2nd Ring End Gap	0,450 - 0,650 mm (0.017 - 0.0256 in)
2nd Ring End Gap Allowable Limit	0,730 mm (0.0287 in)
2nd Ring Side Clearance	0,90 - 0,125 mm (0.0035 - 0.0049 in)
2nd Ring Side Clearance Allowable Limit	0,245 mm (0.0096 in)
2nd Ring Width	1,970 1,990 mm (0.0776 - 0.0783 in)
2nd Ring Width Allowable Limit	1,950 mm (0.0768 in)
Oil Ring End Gap	0,250 - 0,450 mm (0.0098 - 0.0177 in)
Oil Ring End Gap Allowable Limit	0,550 mm (0.0217 in)
Oil Ring Side Clearance	0,025 - 0,060 mm (0.0010 - 0.0024 in)
Oil Ring Side Clearance Allowable Limit	0,180 mm (0.0071 in)
Oil Ring Width	2,970 - 2,990 mm (0.1169 - 0.1177 in)
Oil Ring Width Allowable Limit	2,950 mm (0.1161 in)

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Specifications (Cont'd)

Pistons

*Piston O.D. @ 90 to Piston Pin	97,940 - 97,950 mm (3.8559 - 3.8563 in)
*Piston O.D. @ 90 To Piston Pin Allowable Limit	97,905 mm (3.8545 in)
Piston Pin Bore	30,0 - 30,009 mm (1.1811 - 1.815 in)
Piston Pin Bore Allowable Limit	30,039 mm (1.1826 in)
Piston Pin O.D.	29,989 - 30,0 mm (1.1807 - 1.1811 in)
Piston Pin O.D. Allowable Limit	29,959 mm (1.1795 in)
Oil Clearance	0,000 - 0,020 mm (0.0000 - 0.0008 in)
Oil Clearance Allowable Limit	0,080 mm (0.0031 in)

*Piston O.D is measured @ 22,0 mm (0.8661 in) from the bottom of the piston skirt.

Connecting Rods

Piston Pin Bushing I.D.	30,025 - 30,038 mm (1.1821 - 1.1826 in)
Piston Pin Bushing I.D. Allowable Limit	30,068 mm (1.1838 in)
Piston Pin O.D.	29,987 - 30,000 mm (1.1806 - 1.1811 in)
Piston Pin O.D. Allowable Limit	29,959 mm (1.1795 in)
Oil Clearance	0,025 - 0,051 mm (0.0010 - 0.0020 in)
Oil Clearance Allowable Limit	0,109 mm (0.0043 in)
Side Clearance	0,20 - 0,40 mm (0.0079 - 0.0157 in)

Oil Pump

Oil Pressure @ Rated rpm	290 - 390 kPa (2,9 - 3,9 Bar) (42 - 57 psi)
Idle Speed Allowable Limit	60 kPa (0,6 Bar) (9 psi)
Outer Rotor Outside Clearance	0,100 - 0,155 mm (0.0039 - 0.0061 in)
Outer Rotor Outside Clearance Limit	0,25 mm (0.0098 in)
Outer Rotor Side Clearance	0,05 - 0,10 mm (0.0020 - 0.0039 in)
Outer Rotor Side Clearance Limit	0,15 mm (0.0059 in)
Outer Rotor To Inner Rotor Tip Clearance	0,16 mm (0.0063 in)
Gear Case Bearing Inside Diameter	12,980 - 13,020 mm (0.5110 - 0.5126 in)
Gear Case Bearing Inside Diameter Allowable Limit	13,050 mm (0.5138 in)
Rotor Shaft Outside Diameter	12,955 - 12,965 mm (0.5100 - 0.5104 in)
Rotor Shaft Outside Diameter Allowable Limit	12,945 mm (0.5096 in)
Rotor Clearance	0,0006 - 0,0026 mm (0.015 - 0.065 in)
Rotor Clearance Allowable Limit	0,105 mm (0.0041 in)

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Specifications (Cont'd)

Crankshaft

Crankshaft Alignment Allowable Limit (1/2 Dial Gauge Reading)	0,02 mm (0.0008 in)
Connecting Rod Journal O.D.	57,952 - 57,962 mm (2.2816 - 2.2820 in)
Connecting Rod Journal O.D. Allowable Limit	57,902 mm (2.2796 in)
Connecting Rod Bearing I.D.	58,0 - 58,026 mm (2.2835 - 2.2845 in)
Connecting Rod Bearing Thickness	1,492 - 1,5 mm (0.0587 - 0.0591 in)
Oil Clearance Between Connecting Rod Journal And Bearing	0,038 - 0,074 mm (0.0015 - 0.0029 in)
Oil Clearance Between Connecting Rod Journal And Bearing Allowable Limit	0,150 mm (0.0059 in)
Main Bearing Journal O.D.	64,952 - 64,962 mm (2.5572 - 2.5576 in)
Main Bearing Journal O.D. Allowable Limit	64,902 mm (2.5552 in)
Main Bearing I.D.	65,0 - 65,020 mm (2.5590 - 2.5598 in)
Main Bearing Thickness	1,995 - 2,010 mm (0.0785 - 0.0791 in)
Oil Clearance Between Main Bearing Journal And Bearing	0,038 - 0,068 mm (0.0015 - 0.0027 in)
Oil Clearance Between Main Bearing Journal And Bearing Allowable Limit	0,150 mm (0.0059 in)

Thrust Bearing

Crankshaft End Play	0,13 - 0,23 mm (0.0051 - 0.0091 in)
Crankshaft End Play Allowable Limit	0,28 mm (0.0110 in)

Timing Gear Backlash

Crank Gear	0,08 - 0,14 mm (0.0031 - 0.0055 in)
Crank Gear Allowable Limit	0,16 mm (0.0063 in)
Cam Gear	0,08 - 0,14 mm (0.0031 - 0.0055 in)
Cam Gear Allowable Limit	0,16 mm (0.0063 in)
Idler Gear	0,08 - 0,14 mm (0.0031 - 0.0055 in)
Idler Gear Allowable Limit	0,16 mm (0.0063 in)
Fuel Injection Pump Gear	0,08 - 0,14 mm (0.0031 - 0.0055 in)
Fuel Injection Pump Gear Allowable Limit	0,16 mm (0.0063 in)
PTO Gear	0,08 - 0,14 mm (0.0031 - 0.0055 in)
PTO Gear Allowable Limit	0,16 mm (0.0063 in)

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Specifications (Cont'd)

Idler Gear Shaft And Bushing

Shaft O.D.	45,950 - 45,975 mm (1.8091 - 1.8100 in)
Shaft O.D. Allowable Limit	45,900 mm (1.8071 in)
Bushing I.D.	46,0 - 46,025 mm (1.8110 - 1.8120 in)
Busing I.D. Allowable Limit	46,075 mm (1.8140 in)
Oil Clearance	0,025 - 0,075 mm (0.0010 - 0.0030 in)
Oil Clearance Allowable Limit	0,175 mm (0.0069 in)

Torque Values *(* Lightly oiled threads)*

	N•m	**ft-lb**
*Cylinder Head Bolt	101,1 - 112,9	76 - 83
*Connecting rod Bolt	53,9 - 58,8	40 - 43
*Flywheel Bolt	186,2 - 205,8	137 - 152
*Main Bearing Cap Bolt	108,1 - 117,9	80 - 87
*Crankshaft Pulley Bolt	107,9 - 127,5	80 - 94
Fuel Injector Bolt	22,6 - 28,4	17 - 21
Supply Pump Drive Gear Nut	75 - 85	55 - 63
High Pressure Fuel Lines Nuts (Common Rail, Injector, Supply Pump)	29,4 - 34,3	21.7 - 25.3
Speed Sensor Flywheel	6,0 - 10,0	4.4 - 7.4
Speed Sensor Camshaft	7,5 - 8,5	5.5 - 6.3
Pipe, EGR Valve	58,7 - 63,7	43.3 - 47.0
Sensor, Fresh Air Temp. (M6 x 1.0)	5,6 - 8,4	4.1 - 6.2
Sensor, Fresh Air Temp. (M14 x 1.5)	11,0 - 17,0	8.1 - 12.5
Sensor, DPF Temp.	25,0 - 40,0	18.4 - 29.5
Sensor, Differential Press	6,6 - 8,4	4.9 - 6.2
Sensor, Differential Press DPF	45,0 - 55,0	33.2 - 40.5
Nut, Valve Cover	12,0 - 15,0	8.9 - 11.0
Glow Plug	15,0 - 20,0	11 - 14.8
Glow Connector Nut	1,0 - 1,5	0.7 - 1.1

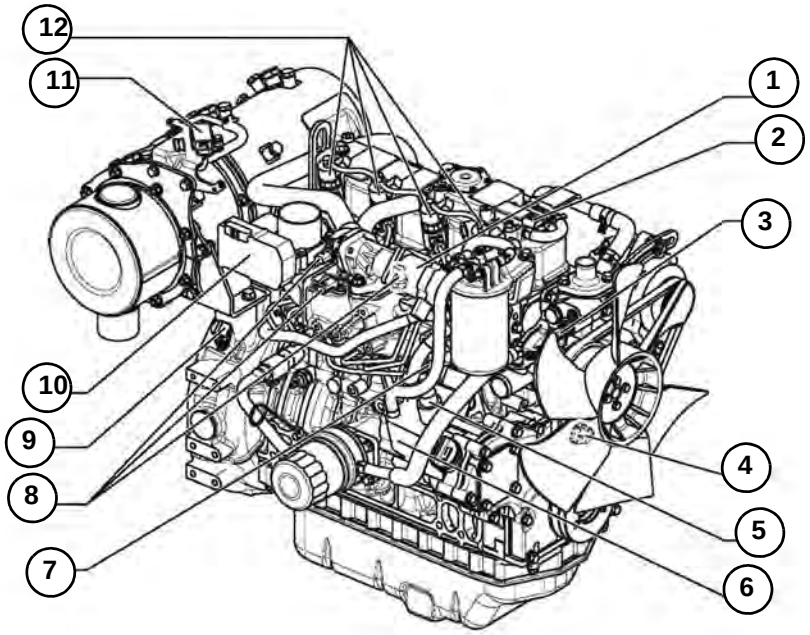
(* Lightly oiled threads)

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Sensor Location

Figure 60-10-2

1. EGR Valve
2. Pressure Sensor
3. Water Temperature Sensor
4. Cam Speed Sensor
5. Pump Discharge Control Valve
6. Fuel Temperature Sensor
7. Fuel Rail Pressure Sensor
8. New Air Temperature Sensor
9. Crank Rotation Sensor
10. Intake Air Throttles
11. Differential Pressure Sensor
12. Fuel Injectors



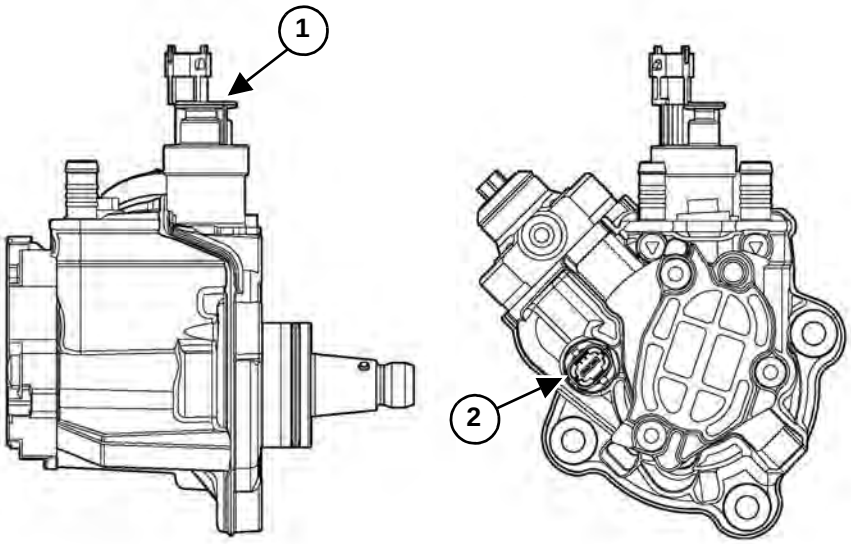
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Sensor Location (Cont'd)

Figure 60-10-3

1. MPROP
2. Fuel Temperature Sensor



NA5995

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Troubleshooting

The following troubleshooting chart is provided for assistance in locating and correcting problems which are most common.

PROBLEM	CAUSE
Slow cranking speed	1, 2, 3, 4
Engine will not start	2, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 19, 27, 28, 29
Difficult to start	5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 25, 27, 28, 29
No power from engine	8, 9, 10, 11, 12, 13, 15, 16, 17, 21, 22, 24, 25, 26, 28, 29
Engine is mis-firing	8, 9, 11, 12, 13, 15, 16, 17, 21, 22, 24, 25, 26, 28
Too much fuel consumption	10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29
Black exhaust	10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29
Blue / white exhaust	4, 10, 15, 16, 17, 21, 23, 27, 29, 30, 50
Low oil pressure	4, 31, 32, 33, 34, 35, 37, 38, 39, 52
Engine knocking	13, 15, 16, 19, 22, 24, 25, 27, 29, 31, 40, 41, 53
Engine running rough	7, 8, 9, 10, 11, 12, 13, 17, 18, 22, 24, 25, 26, 29, 40, 53
Vibration	12, 13, 17, 21, 22, 25, 26, 29, 40, 42, 43
High oil pressure	4, 33, 36
Overheating	10, 12, 13, 15, 16, 20, 21, 40, 44, 45, 46, 47, 48, 51
Too much crankcase pressure	22, 27, 29, 30, 40, 49
Poor compression	10, 16, 21, 24, 25, 27, 28, 29, 30, 41, 53
Start and stop	9, 10, 11

KEY TO CORRECT THE CAUSE	
1. Battery capacity low	28. Worn valves and seat
2. Bad electrical connections	29. Broken or worn piston rings
3. Faulty starter motor	30. Worn valve stems or guides
4. Incorrect grade of oil	31. Worn or damaged bearings
5. Low cranking speed	32. Not enough oil in the oil pan
6. Fuel tank empty	33. Switch is defective
7. Faulty stop control operation	34. Oil pump worn
8. Plugged fuel line	35. Relief valve is stuck open
9. Plugged fuel filter	36. Relief valve is stuck closed
10. Restriction in the air cleaner	37. Broken relief valve spring
11. Air in the fuel system	38. Faulty suction pipe
12. Faulty fuel injection pump	39. Plugged oil filter
13. Faulty fuel injectors	40. Piston seizure
14. Broken injection pump drive	41. Incorrect piston height
15. Incorrect injection pump timing	42. Faulty engine mounting
16. Incorrect valve timing	43. Incorrect alignment of flywheel
17. Poor compression	44. Faulty thermostat
18. Plugged fuel tank vent	45. Restriction in water jacket
19. Incorrect grade of fuel	46. Loose alternator belt
20. Exhaust pipe restriction	47. Plugged radiator
21. Cylinder head gasket leaking	48. Plugged breather pipe
22. Over heating	49. Plugged breather pipe
23. Cold running	50. Damaged valve stem oil deflectors
24. Incorrect tappet adjustment	51. Coolant level too low
25. Sticking valves	52. Plugged oil pump pipe strainer
26. Incorrect high pressure fuel lines	53. Broken valve spring
27. Worn cylinder bores	

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Engine Removal And Installation

Disconnect the battery. (See Removing And Installing Battery on Page 50-20-3.)

Remove the right side upperstructure cover. (See Removal And Installation on Page 40-21-1.)

Remove the right side cover. (See Removal And Installation on Page 40-180-1.)

Remove the hydraulic piston pump. (See Removal And Installation on Page 20-50-13.)

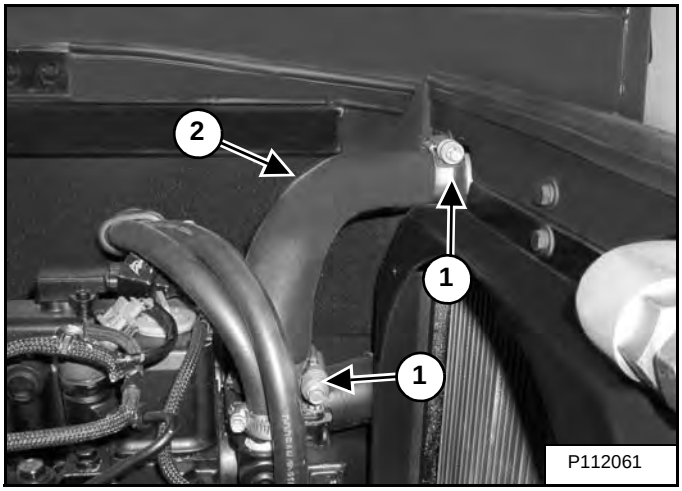
Drain the radiator. (See Removing And Replacing Coolant on Page 10-110-2.)

Remove the muffler. (See Removal And Installation on Page 60-30-2.)

Remove the fan. (See Fan Removal And Installation on Page 60-50-7.).

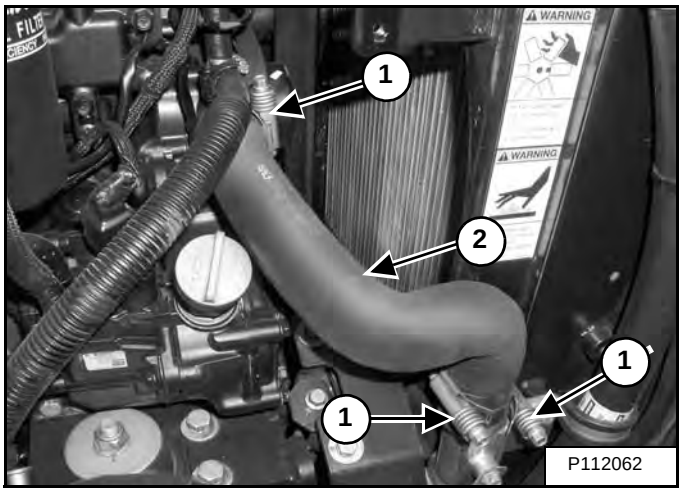
Remove the air cleaner. (See Housing Removal And Installation on Page 60-40-1.)

Figure 60-10-4



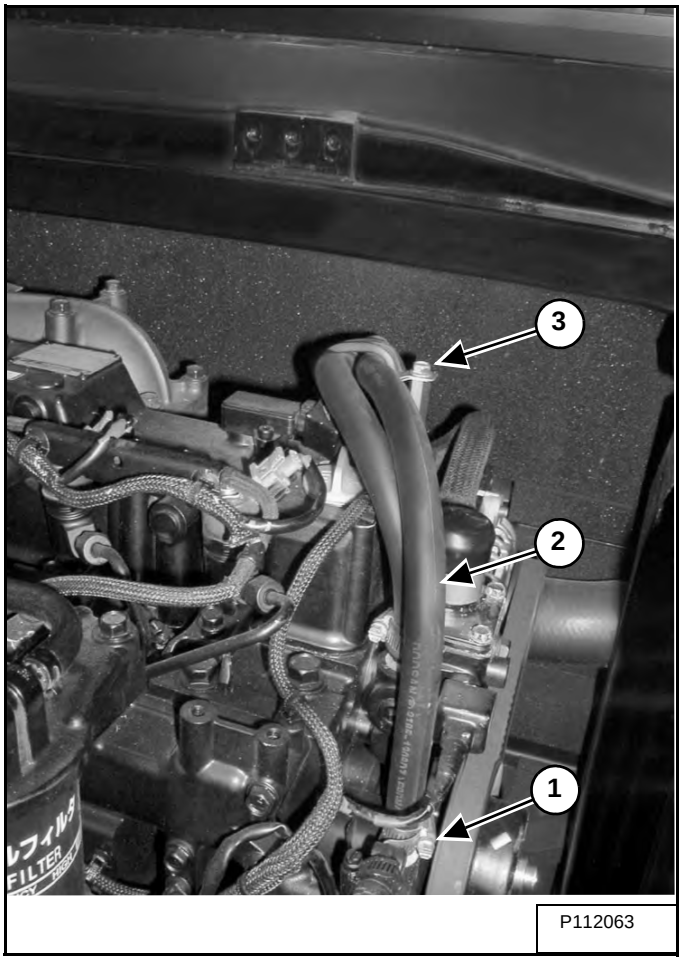
Loosen the clamps (Item 1) and remove the upper radiator hose (Item 2) **[Figure 60-10-4]**.

Figure 60-10-5



Loosen the clamps (Item 1) and remove the lower radiator hose (Item 2) **[Figure 60-10-5]**.

Figure 60-10-6

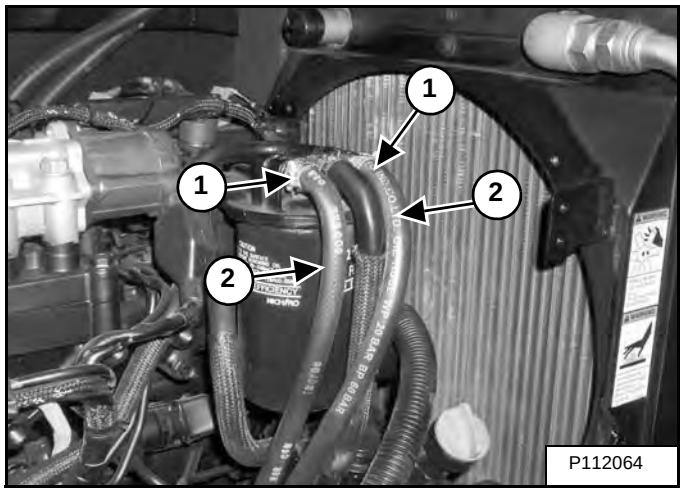


Loosen the hose clamps (Item 1) and remove the heater hoses (Item 2). Remove the bolt (Item 3) **[Figure 60-10-6]** from the clamp. Reposition the hoses.

Dealer Copy -- Not for Resale

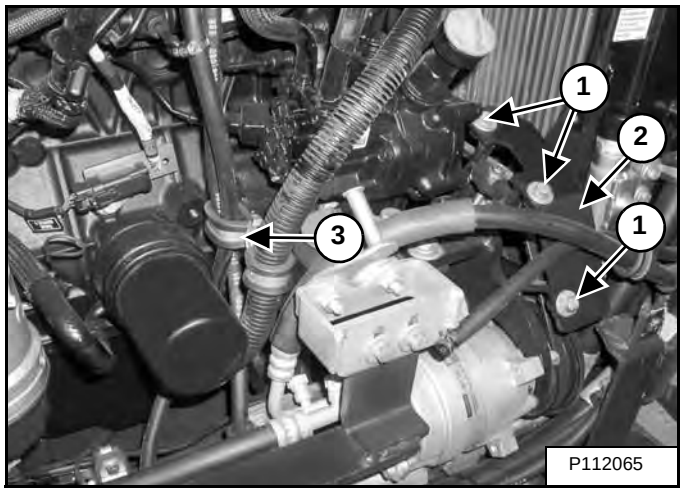
Engine Removal And Installation (Cont'd)

Figure 60-10-7



Loosen the hose clamps (Item 1) and remove the fuel lines (Item 2) **[Figure 60-10-7]**.

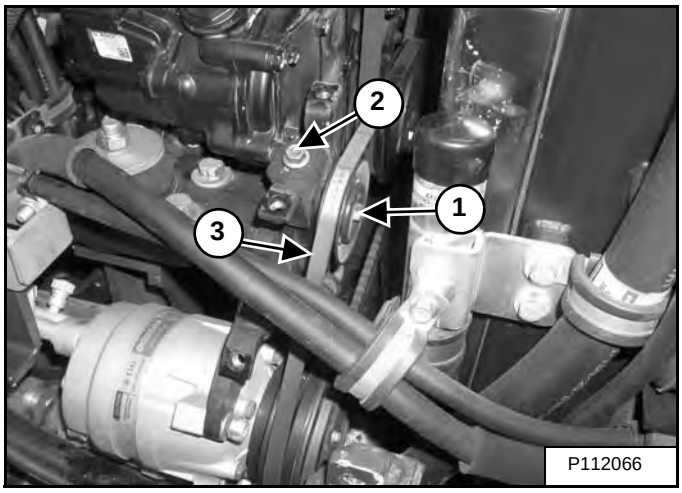
Figure 60-10-8



Remove the bolts (Item 1) and washers. Remove the belt shield (Item 2) **[Figure 60-10-8]**.

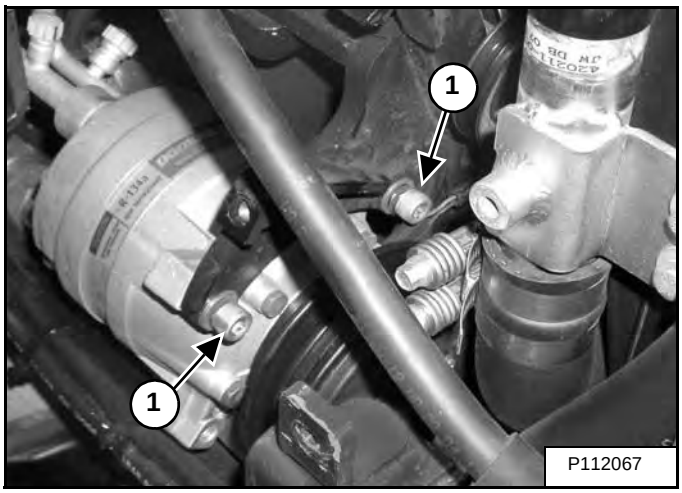
Remove the bolt (Item 3) **[Figure 60-10-8]** and reposition the fuel lines.

Figure 60-10-9



Loosen the nut (Item 1). Loosen the adjustment bolt (Item 2) and remove the belt (Item 3) **[Figure 60-10-9]** from the A/C compressor pulley.

Figure 60-10-10

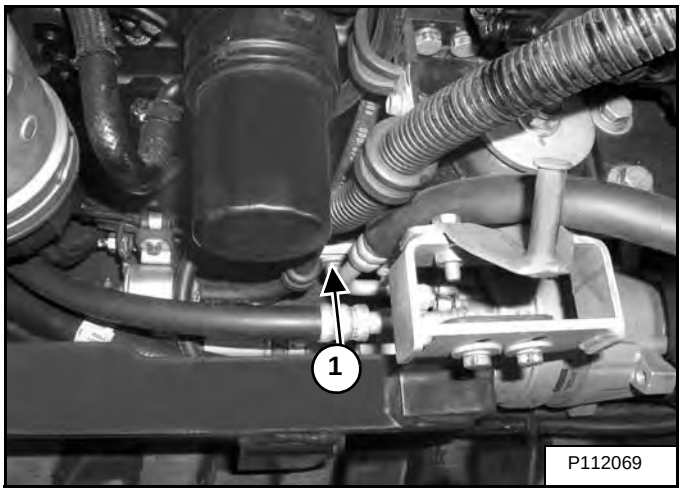


Remove the three bolts (Item 1) **[Figure 60-10-10]**.

Dealer Copy -- Not for Resale

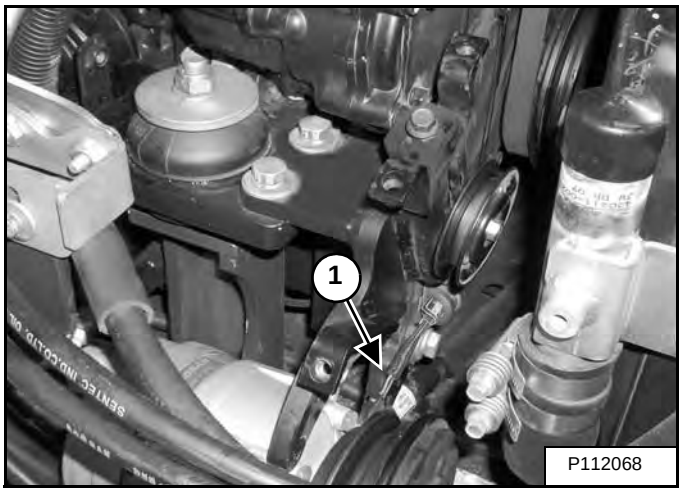
Engine Removal And Installation (Cont'd)

Figure 60-10-11



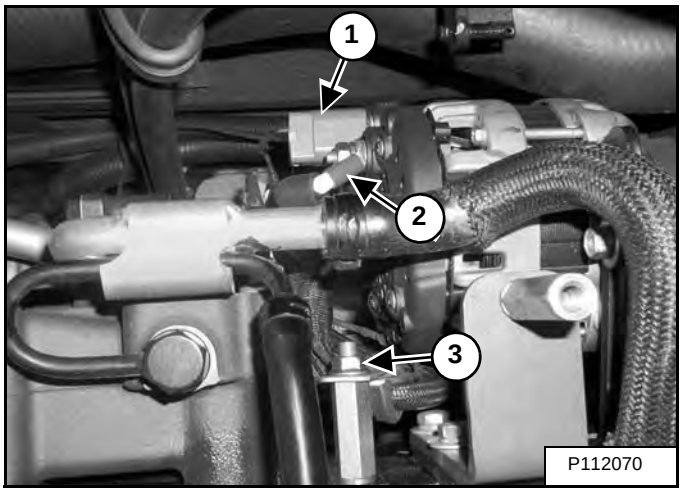
Remove the bolt (Item 1) **[Figure 60-10-11]** and lower the compressor to the excavator frame.

Figure 60-10-12



Disconnect the wire harness (Item 1) **[Figure 60-10-12]** from the compressor.

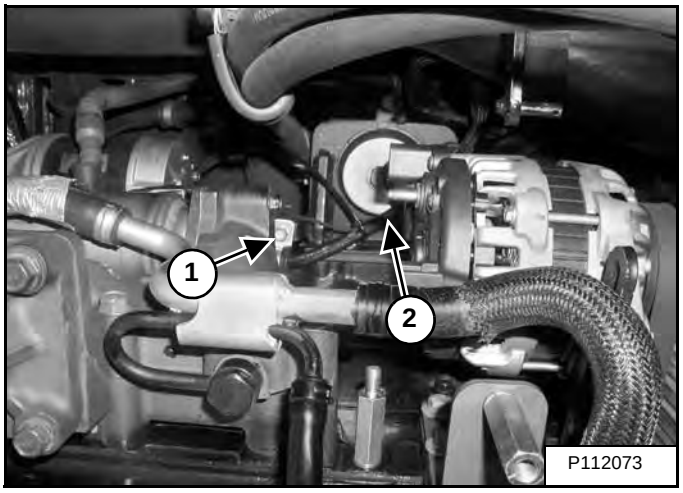
Figure 60-10-13



Disconnect the wire harness (Item 1). Remove the nut and wire harness (Item 2) **[Figure 60-10-13]** from the alternator.

Remove the nut (Item 3) **[Figure 60-10-13]** and wire harness clamp from the stud.

Figure 60-10-14



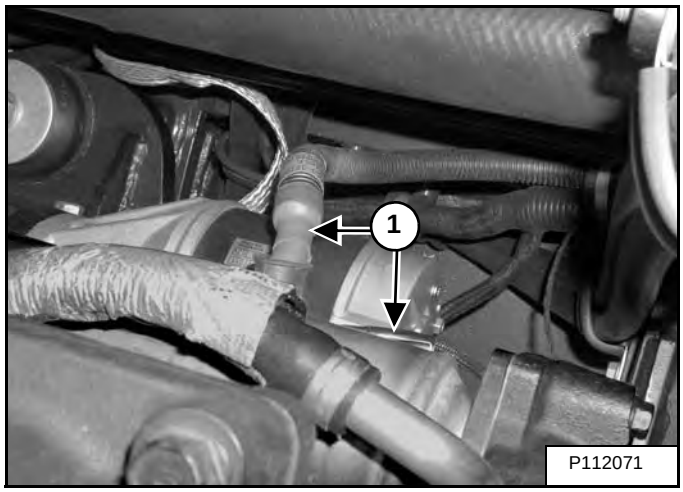
Remove the bolt (Item 1) **[Figure 60-10-14]** and wire harness clamp.

Remove the bolt and ground wire (Item 2) **[Figure 60-10-14]** from the back of the alternator.

Dealer Copy -- Not for Resale

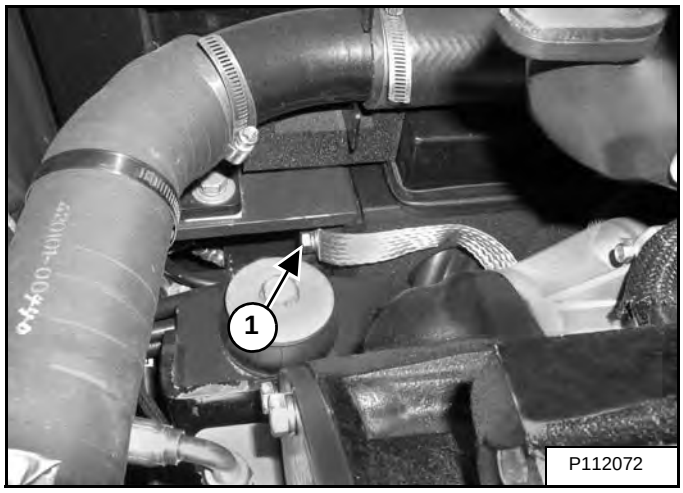
Engine Removal And Installation (Cont'd)

Figure 60-10-15



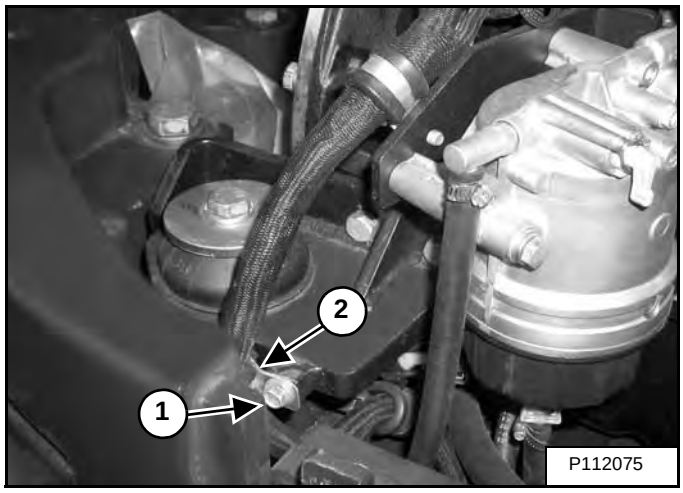
Remove the nuts and disconnect the wire harness (Item 1) **[Figure 60-10-17]** from the starter.

Figure 60-10-16



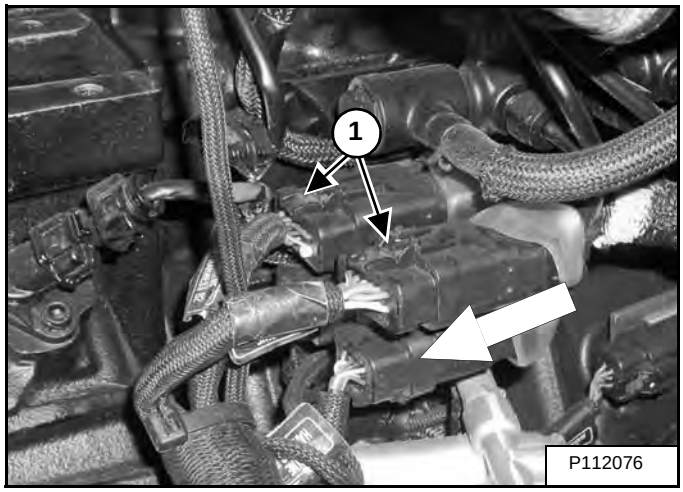
Remove the bolt (Item 1) **[Figure 60-10-18]** and ground strap.

Figure 60-10-17



Remove the bolts (Item 1) and clamps (Item 2) **[Figure 60-10-17]**.

Figure 60-10-18

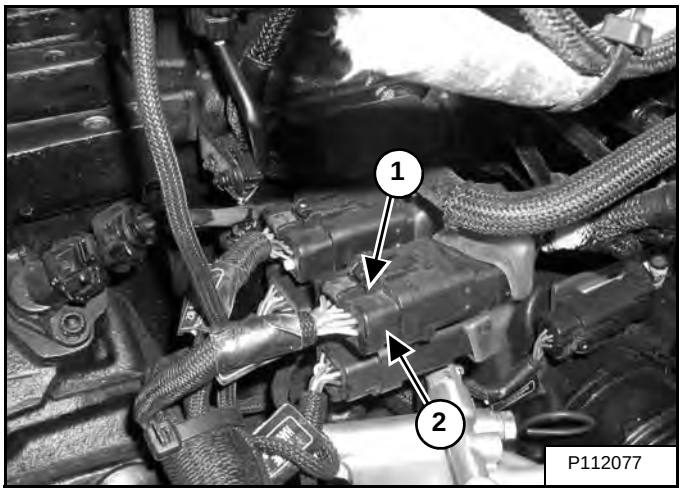


Slide the wire harness connector locks (Item 1) **[Figure 60-10-18]** back.

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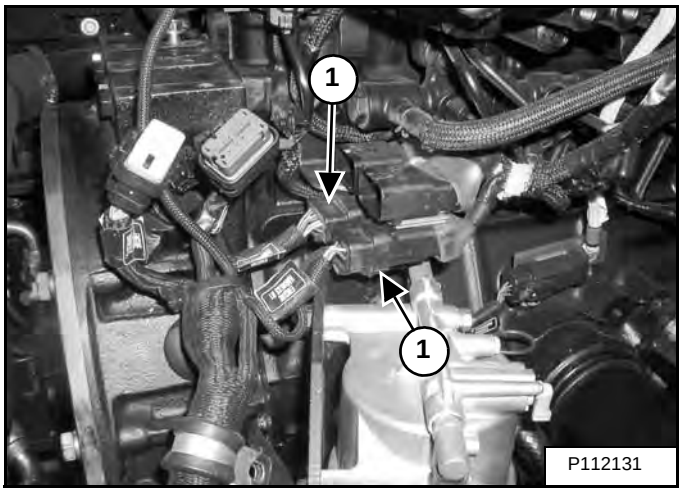
Engine Removal And Installation (Cont'd)

Figure 60-10-19



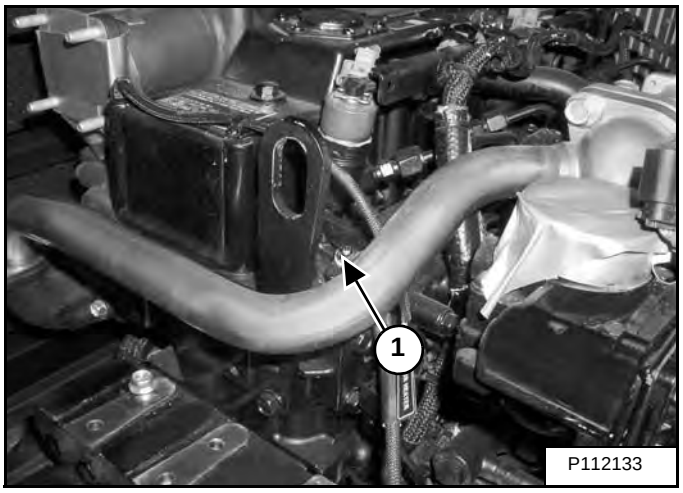
Depress the tabs (Item 1) **[Figure 60-10-19]** and disconnect the wire harness (Item 2).

Figure 60-10-20



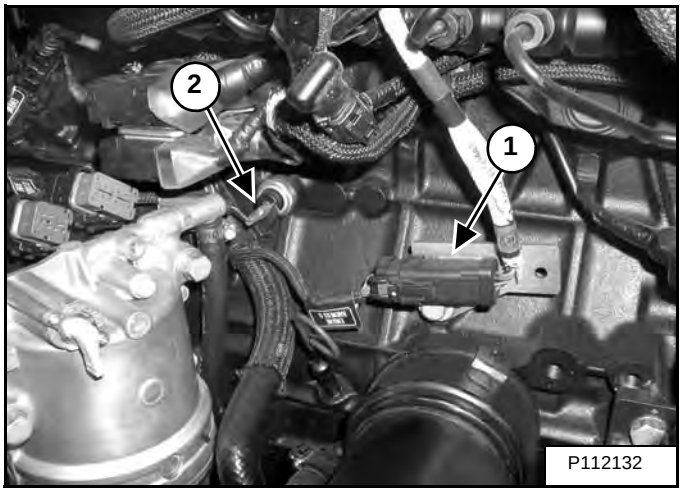
Repeat the procedure for the bottom wire harness connectors (Item 1) **[Figure 60-10-20]**.

Figure 60-10-21



Remove the nut (Item 1) **[Figure 60-10-21]** and remove the wire harness from the glow plug.

Figure 60-10-22

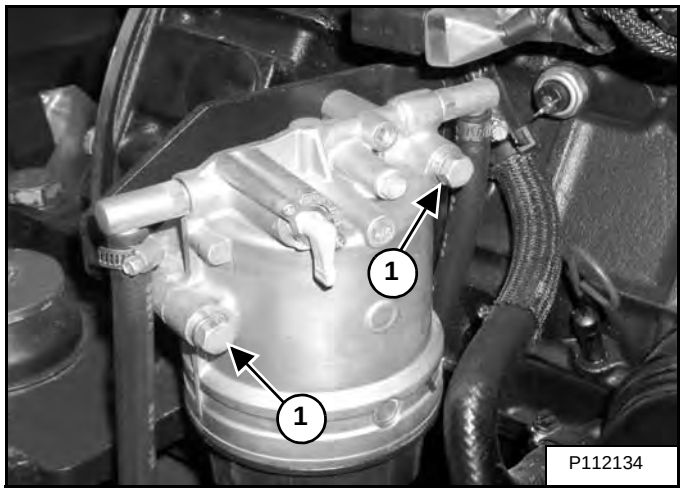


Disconnect the wire harness (Item 1) and (Item 2) **[Figure 60-10-22]**.

Dealer Copy -- Not for Resale

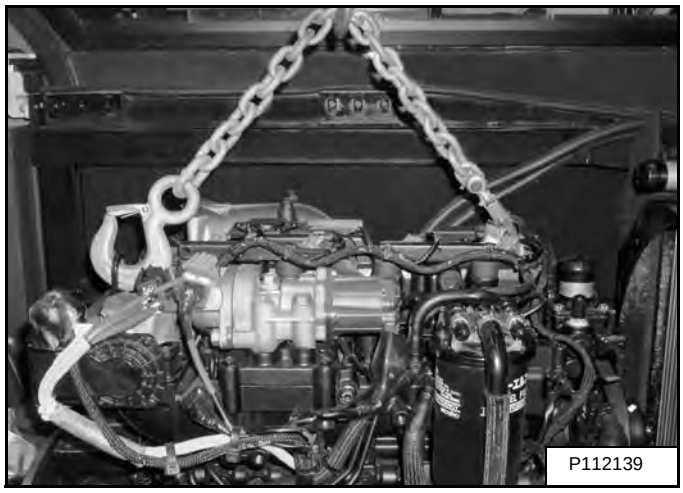
Engine Removal And Installation (Cont'd)

Figure 60-10-23



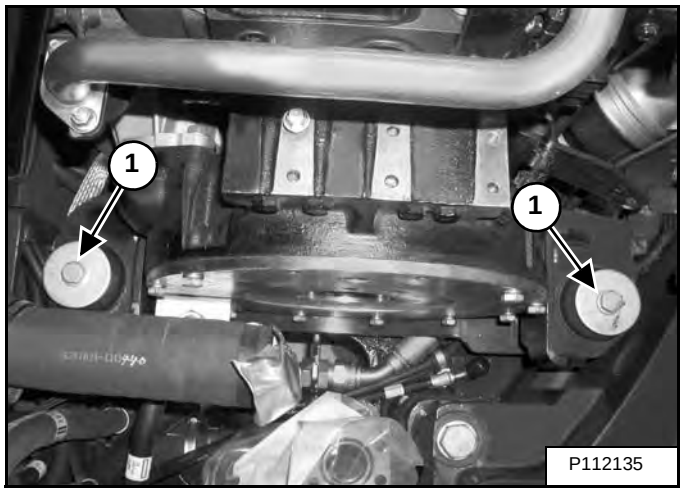
Remove the bolts (Item 1) **[Figure 60-10-23]** and reposition the fuel filter.

Figure 60-10-24



Install a lifting hoist and chain on the engine lifting points **[Figure 60-10-24]**.

Figure 60-10-25



Remove the two rear bolts (Item 1) **[Figure 60-10-25]**, washers and top half of the mount.

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Engine Removal And Installation (Cont'd)

Figure 60-10-26

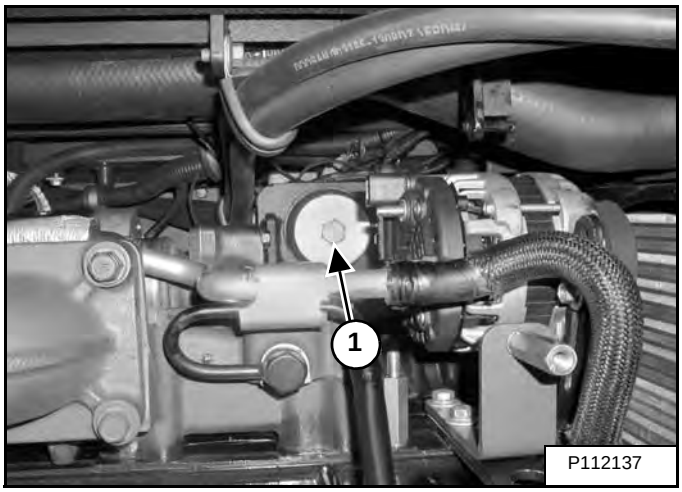
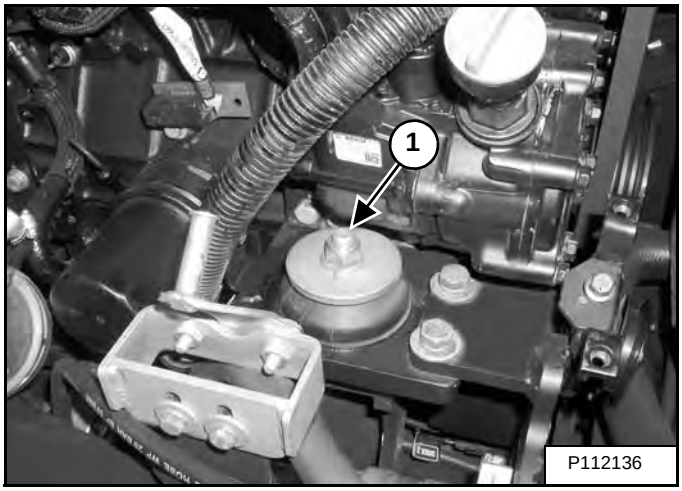
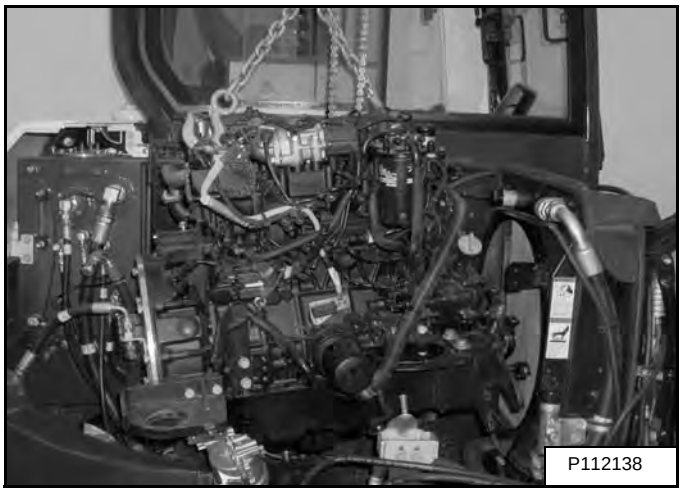


Figure 60-10-27



Remove the front two bolts (Item 1) **[Figure 60-10-26]** and **[Figure 60-10-27]** nuts, washers and top half of the mount

Figure 60-10-28



Raise the hoist and remove the engine **[Figure 60-10-28]**.

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Compression - Testing

The tools listed will be needed to do the following procedure:

MEL10630B - Engine Compression Kit
MEL1743 - Compression Adapter

NOTE: Compression testing is best done using SA-D diagnostic tool software. (See DIAGNOSTIC TOOL on Page 50-90-1.)

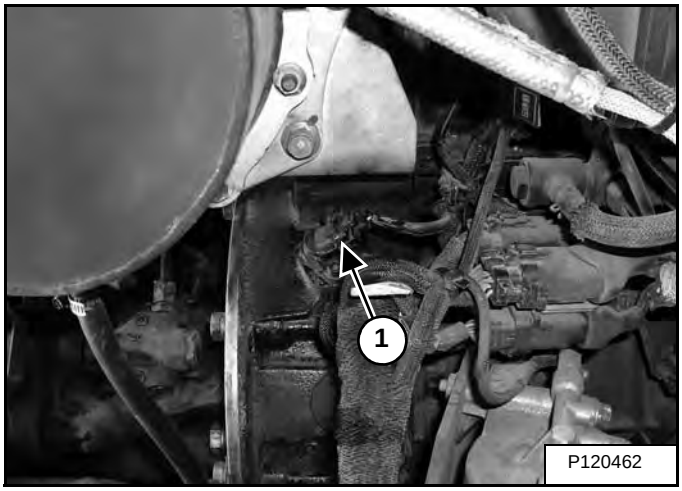
Run the engine until it reaches operating temperature.

Stop the engine.

Remove the glow plugs (See Removal And Installation on Page 60-120-2.)

If SA-D diagnostic tool software is not available, disconnect the crankshaft position speed sensor and the camshaft speed sensor to prevent the engine from starting:

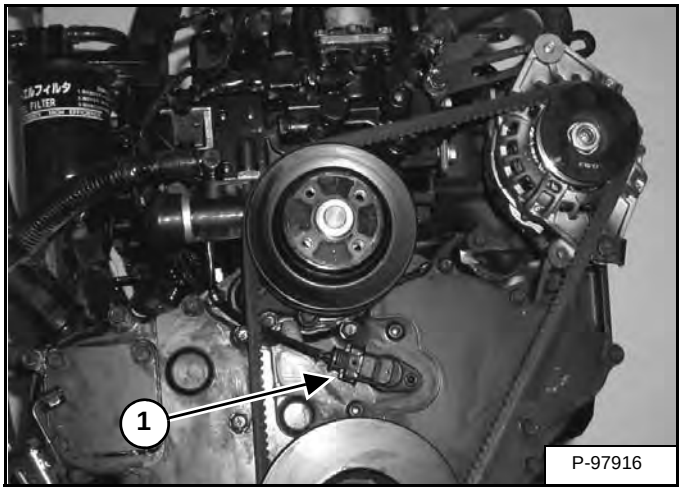
Figure 60-10-29



Disconnect the crankshaft position speed sensor (Item 1) **[Figure 60-10-29]**.

NOTE: The following photo shows the engine removed for photo clarity.

Figure 60-10-30

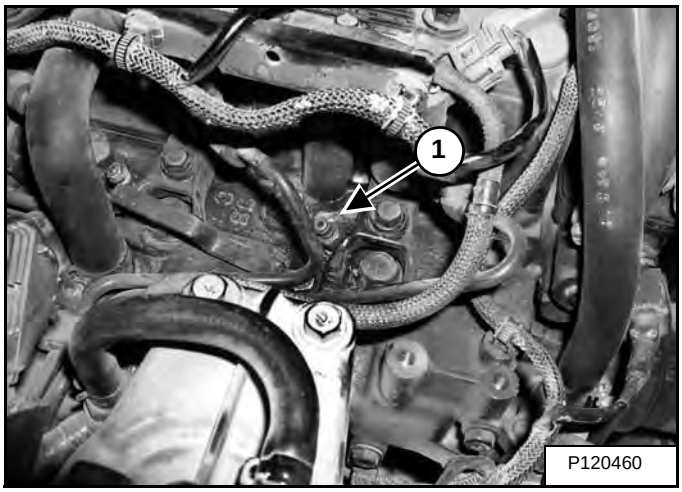


Disconnect the camshaft speed sensor (Item 1) **[Figure 60-10-30]**.

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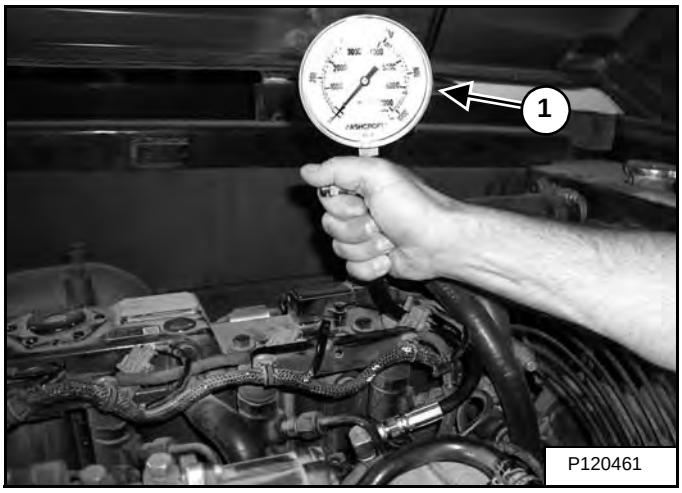
Compression - Testing (Cont'd)

Figure 60-10-31



Install the compression adapter (Item 1) **[Figure 60-10-31]**.

Figure 60-10-32



Install the gauge (Item 1) **[Figure 60-10-32]** on the adapter.

Crank the engine with the starter at 250 rpm.

Compression pressure at 250 rpm	3330 - 3540 kPa (33,3 - 35,4 bar) (483 - 513 psi)
Allowable Limit	2650 - 2860 kPa (26,5 - 28,6 bar) (384 - 414 psi)
Variance among cylinders	200 - 300 kPa (2 - 3 bar) (29 - 43 psi)

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Dealer Copy -- Not for Resale

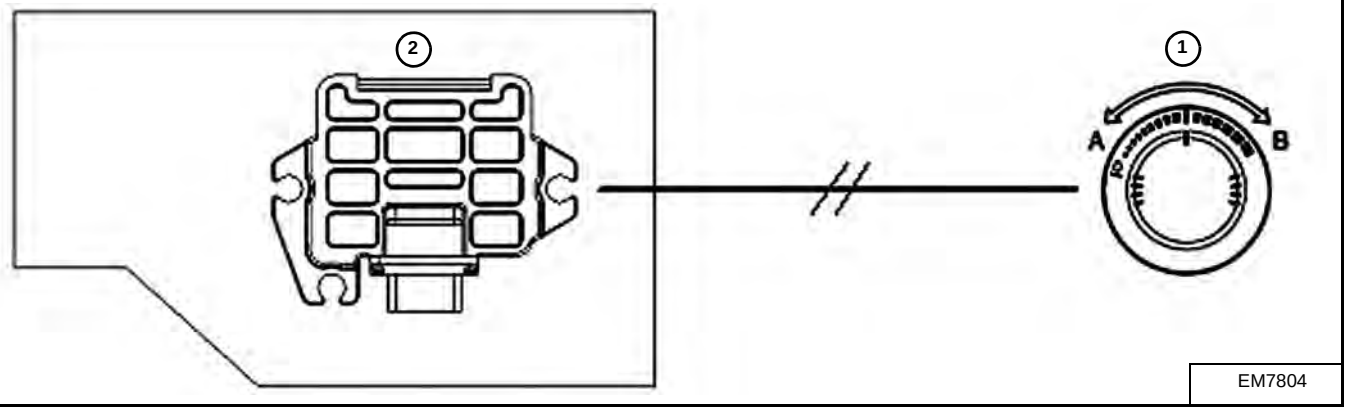
ENGINE SPEED CONTROL

Adjustment

Figure 60-20-1

1 Engine Control Dial

2 ECU (Engine Control Unit)



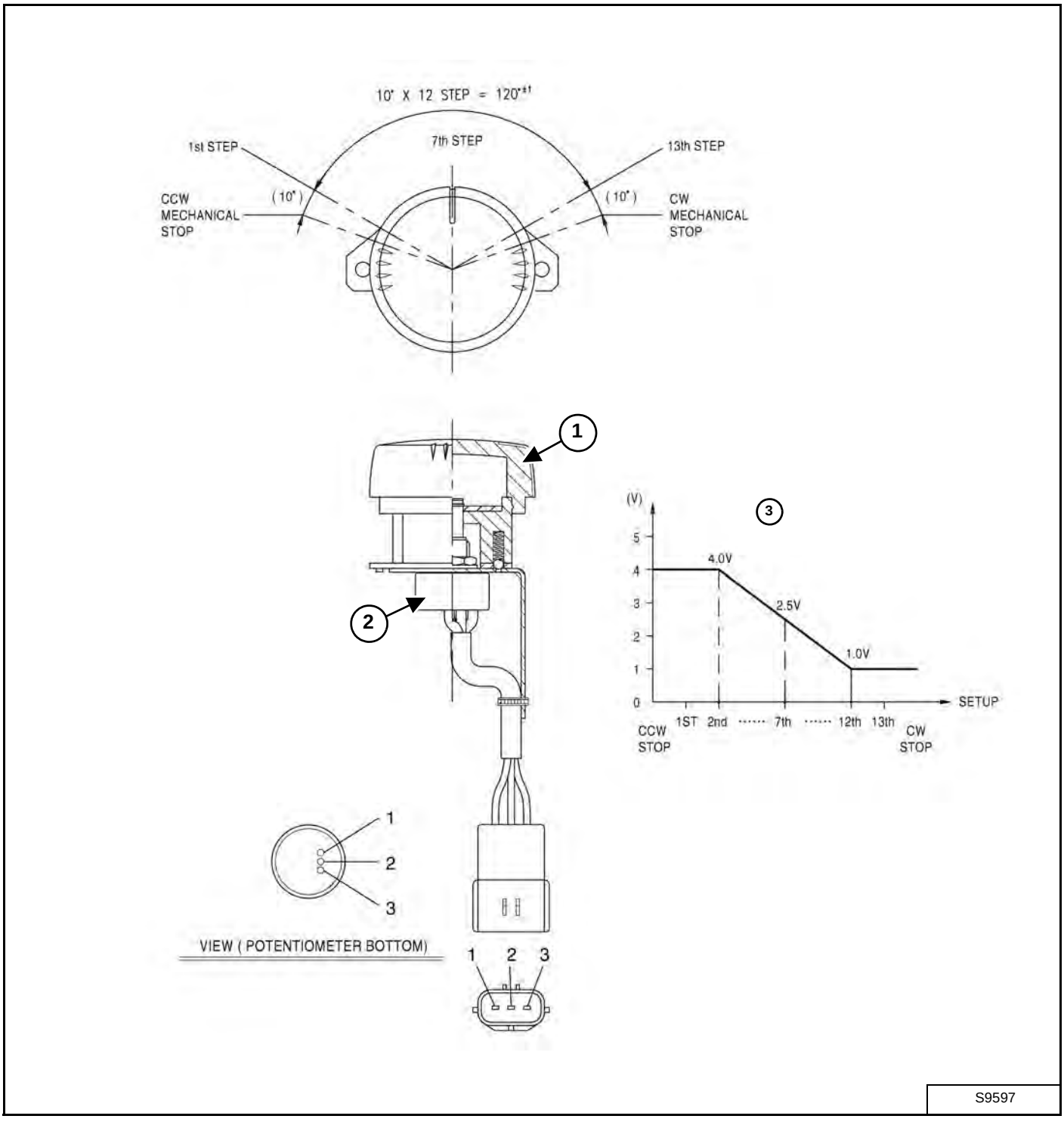
When the engine control dial is moved, the output voltage changes according to the dial position **[Figure 60-20-1]**.

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ENGINE SPEED CONTROL (CONT'D)

Adjustment (Cont'd)

Figure 60-20-2



The engine control dial has a built-in potentiometer (Item 1). When the control knob (Item 2) is moved, the output voltage (through 2 and 3 terminals) will vary from the 5V supplied from the engine throttle controller, as shown in the graph (Item 3) **[Figure 60-20-2]**.

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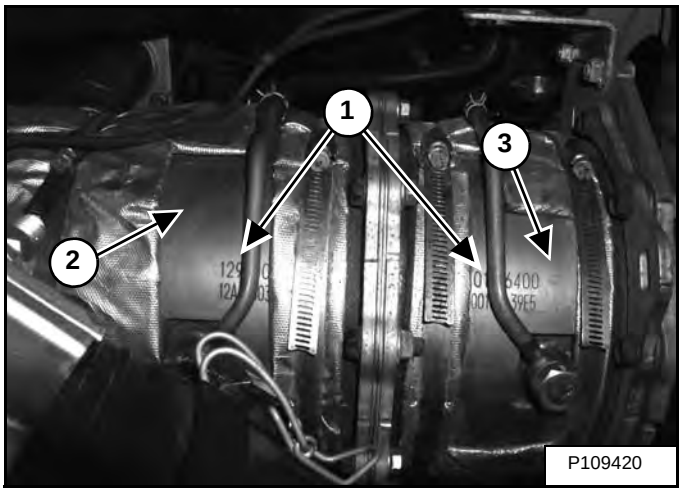
DIESEL PARTICULATE FILTER (DPF) SYSTEM

Description

The engine exhaust system is equipped with a diesel particulate filter (DPF). The DPF is an emissions reduction device that removes diesel particulate matter (soot) from the exhaust gases of the diesel engine. The DPF will trap and collect the soot until it is burned off. The process of burning off the collected soot is called regeneration.

Ash residue will remain after the regeneration process is complete. The ash must be periodically removed from the DPF.

Figure 60-30-1



The DPF muffler full assembly serial number (Item 1) is located on the side of the DPF (Item 2) and on the differential pressure sensor (Item 3) **[Figure 60-30-1]**.

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Removal And Installation

⚠ WARNING

HOT SURFACES CAN CAUSE SERIOUS INJURY

- **Do not touch.**
- **Allow to cool before servicing.**

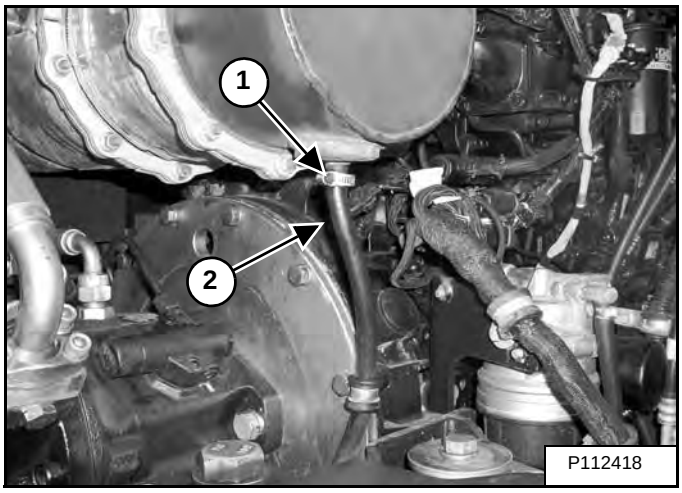
W-2533-1012

NOTE: Use care during removal and installation since the DPF cannot be reused if dropped or given a shock, even if there is no outward damage, replace with a new one.

Before removing the DPF, connect the diagnostic tool, check the failure history and save the project.

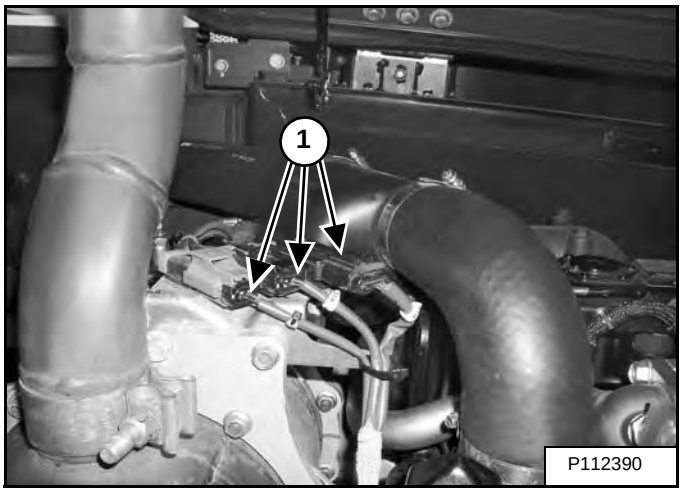
Open the right side cover. (See Opening And Closing on Page 10-50-1.)

Figure 60-30-2



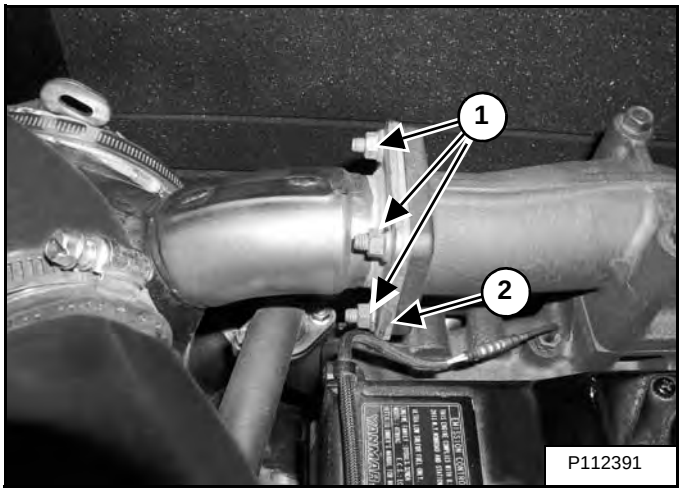
Loosen the clamp (Item 1) and remove the drain hose (Item 2) **[Figure 60-30-2]**.

Figure 60-30-3



Mark the location of the three sensor connectors (Item 1) **[Figure 60-30-3]** and disconnect.

Figure 60-30-4



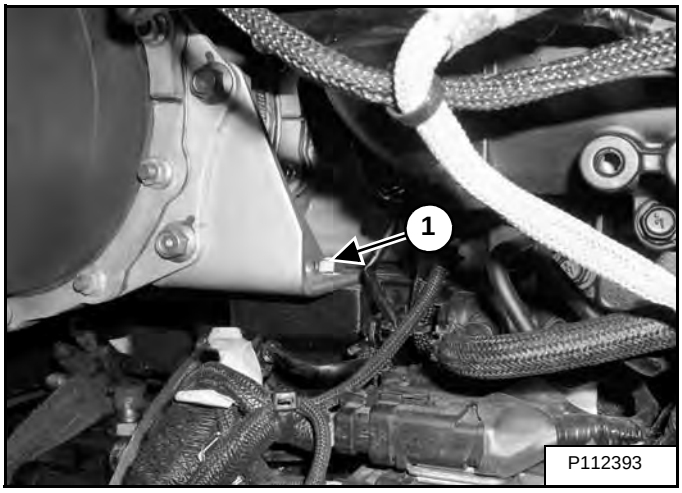
Remove the four nuts (Item 1) from exhaust manifold to the DPF. After removal of the DPF, remove and discard the gasket (Item 2) **[Figure 60-30-4]**.

Installation: Tighten the nuts to 49 - 55 N•m (37 - 41 ft-lb) torque.

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Removal And Installation (Cont'd)

Figure 60-30-5



Remove the four bolts (Item 1) **[Figure 60-30-5]**. Remove the DPF assembly.

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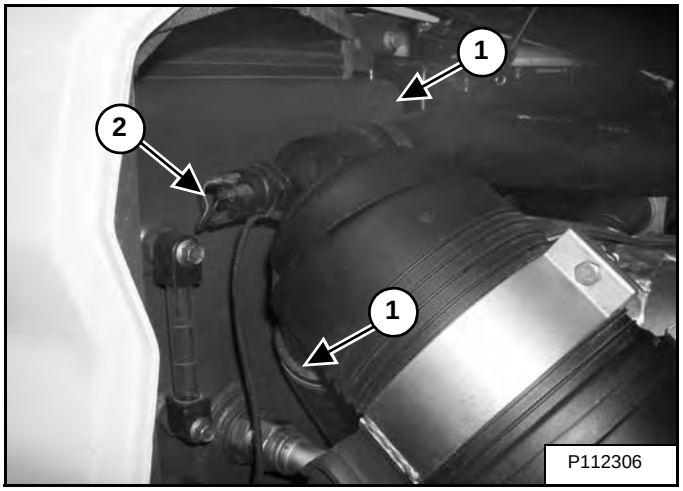
Dealer Copy -- Not for Resale

AIR CLEANER

Housing Removal And Installation

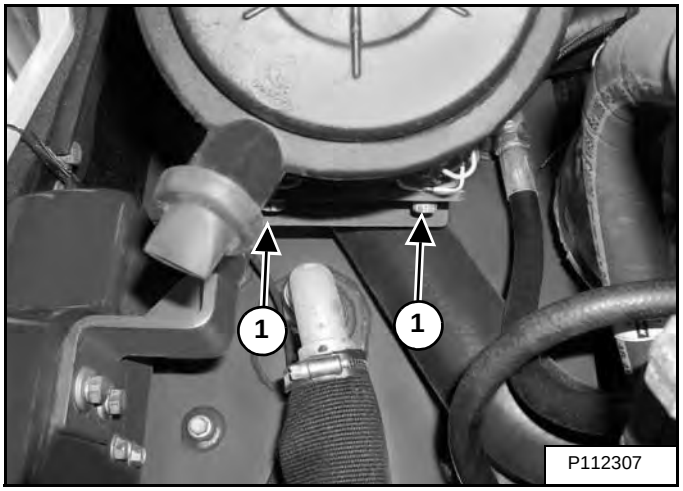
Open the right side cover.

Figure 60-40-1



Loosen the hose clamps (Item 1) and remove the hoses from the air cleaner housing. Disconnect the wire harness (Item 2) **[Figure 60-40-1]**.

Figure 60-40-2



Remove the two bolts (Item 1) **[Figure 60-40-2]** and washers.

Remove the air cleaner housing.

NOTE: Plug the intake to keep contamination out of the engine.

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Dealer Copy -- Not for Resale

Radiator Removal And Installation

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-140-6.)

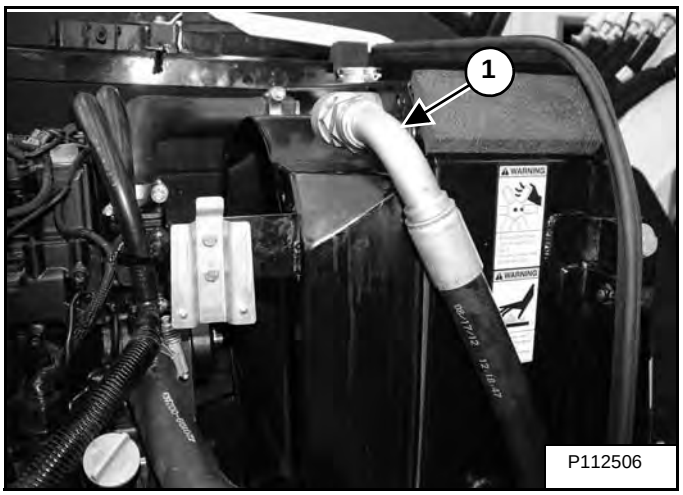
Drain the radiator. (See Removing And Replacing Coolant on Page 10-110-2.)

Remove the right side cover. (See Removal And Installation on Page 40-180-1.)

Remove the right upperstructure side cover. (See Removal And Installation on Page 40-21-1.)

Remove the fan. (See Fan Removal And Installation on Page 60-50-7.)

Figure 60-50-1



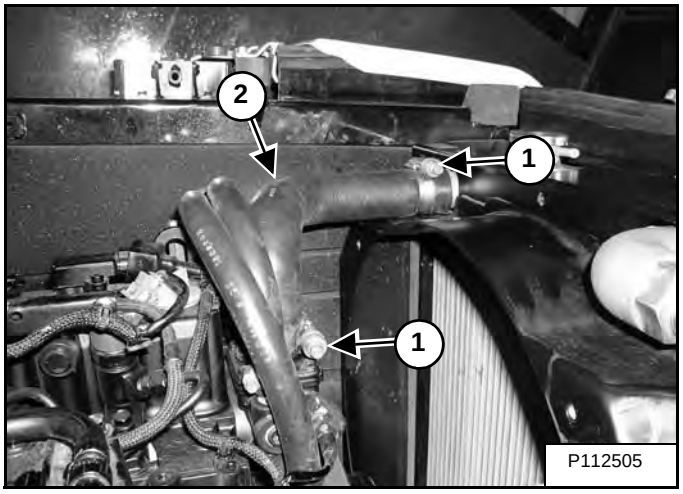
Remove the top oil cooler hose (Item 1) **[Figure 60-50-1]**.

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.

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Figure 60-50-2



Loosen the clamps (Item 1) and top radiator hose (Item 2) **[Figure 60-50-2]**.

Figure 60-50-3

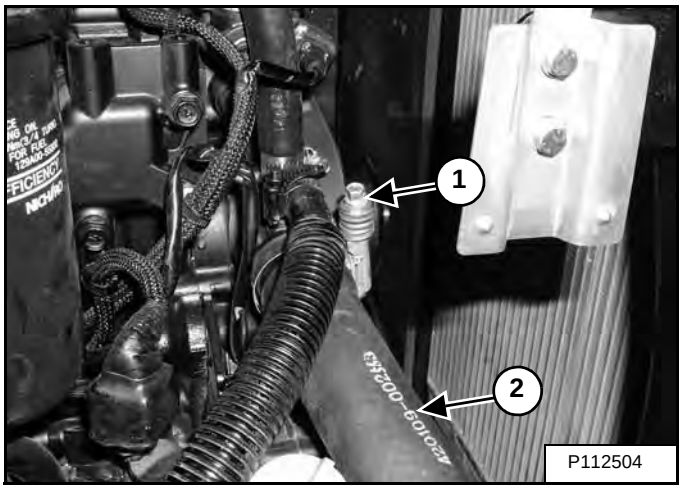
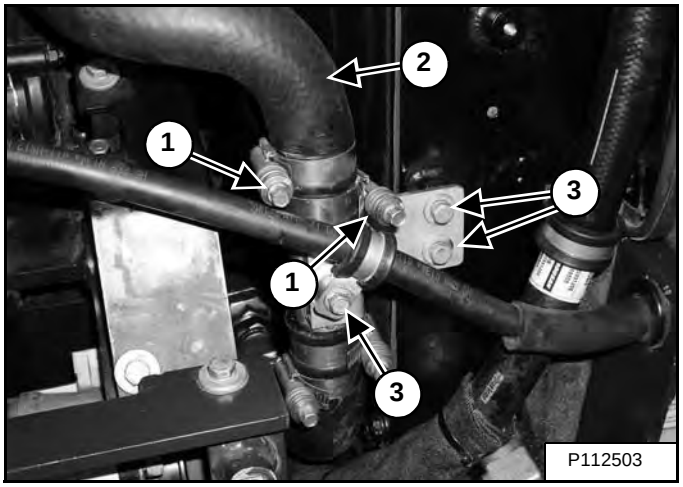


Figure 60-50-4



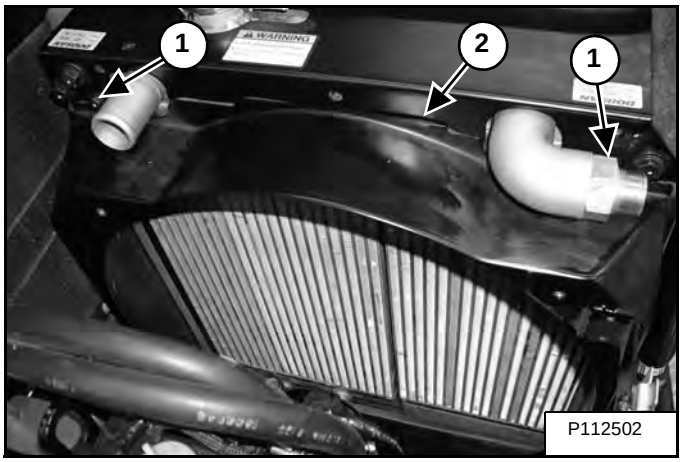
Loosen the clamps (Item 1) and remove the hose (Item 2) **[Figure 60-50-3]** and **[Figure 60-50-4]**.

Remove the bolt (Item 3) **[Figure 60-50-4]** and clamp.

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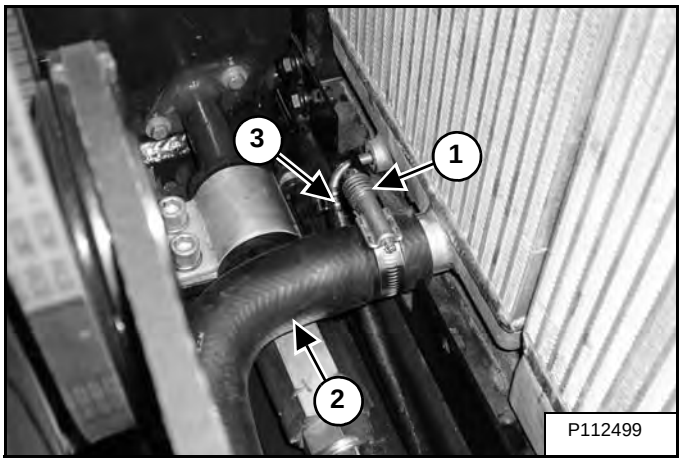
Radiator Removal And Installation (Cont'd)

Figure 60-50-5



Remove the two top bolts (Item 1), three bottom bolts, and fan shield (Item 2) **[Figure 60-50-5]**.

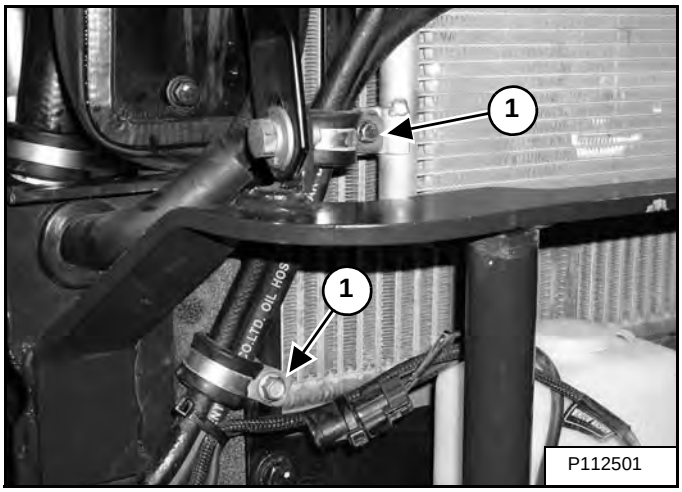
Figure 60-50-6



Loosen the hose clamp (Item 1) and remove the lower radiator hose (Item 2) **[Figure 60-50-6]**.

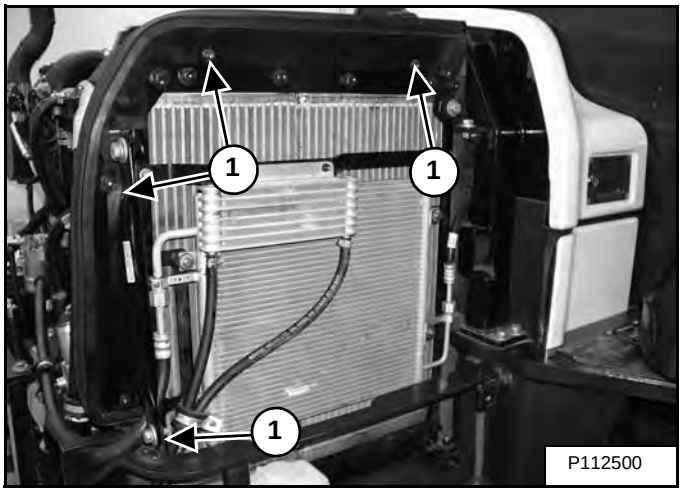
Remove the radiator drain hose (Item 3) **[Figure 60-50-6]**.

Figure 60-50-7



Remove the bolts (Item 1) **[Figure 60-50-7]** and reposition the hoses.

Figure 60-50-8

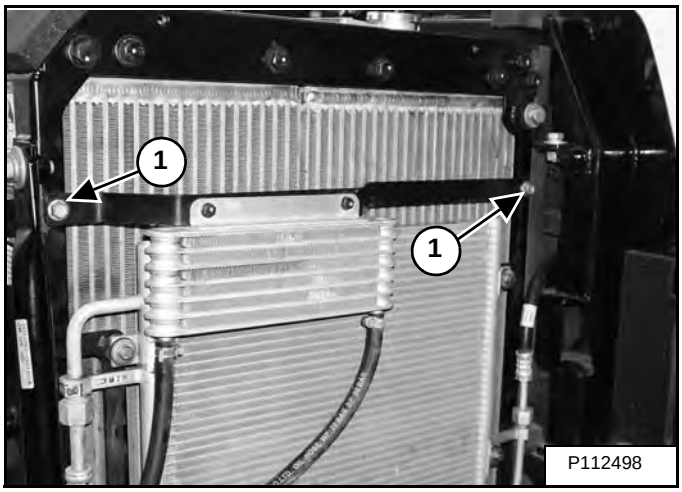


Remove the bolts (Item 1) **[Figure 60-50-8]** and remove the plates.

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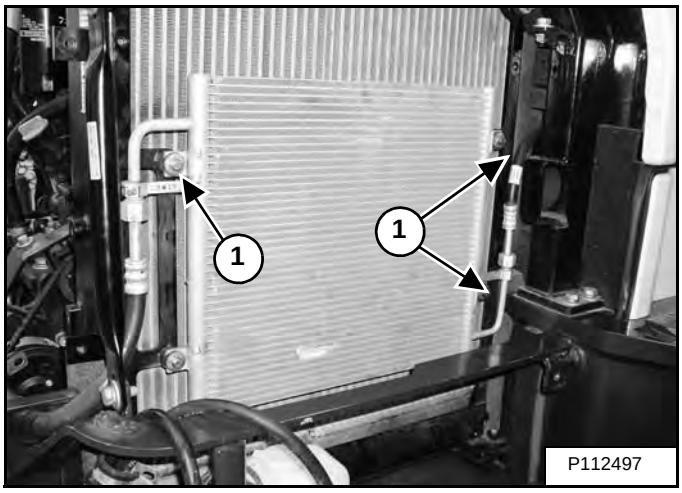
Radiator Removal And Installation (Cont'd)

Figure 60-50-9



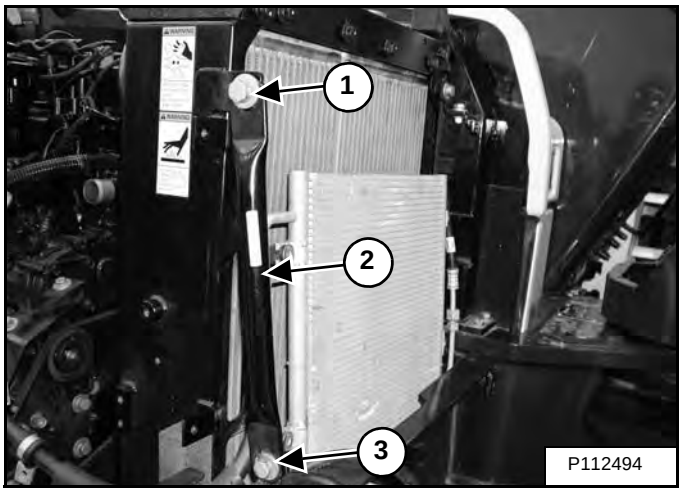
Remove the bolts (Item 1) **[Figure 60-50-9]** and reposition the fuel cooler.

Figure 60-50-10



Remove the bolts (Item 1) **[Figure 60-50-10]** and reposition the air conditioning condenser.

Figure 60-50-11



Remove the top bolt (Item 1), and loosen the bottom bolt (Item 2) and pivot the brace (Item 3) **[Figure 60-50-11]** towards the front of the excavator.

Figure 60-50-12

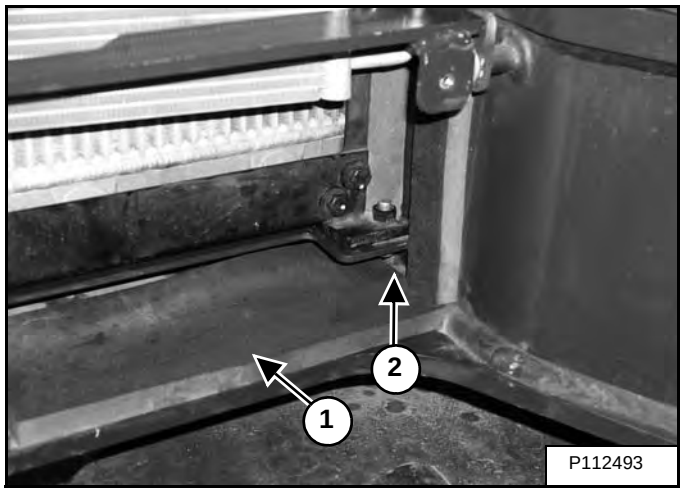


Remove the two shroud bolts and install lifting eyes, chain and hoist **[Figure 60-50-12]**.

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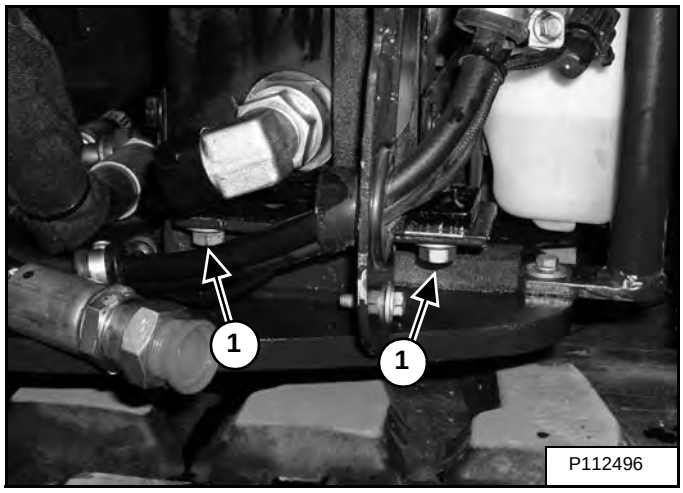
Radiator Removal And Installation (Cont'd)

Figure 60-50-13



Pull the foam insulation bar (Item 1) back, and remove the two bolts (Item 2) **[Figure 60-50-13]**.

Figure 60-50-14



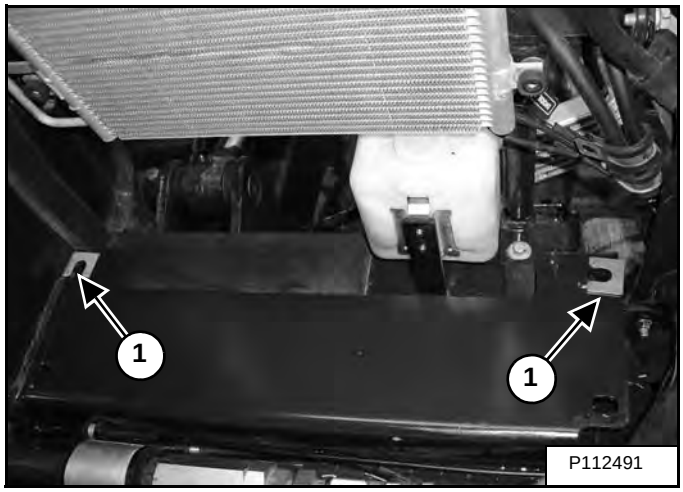
Remove the bolts (Item 1) **[Figure 60-50-14]**.

Figure 60-50-15



Remove the radiator from the excavator **[Figure 60-50-15]**.

Figure 60-50-16



Remove the shims (Item 1) **[Figure 60-50-16]** (if equipped).

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Radiator Disassembly And Assembly

Figure 60-50-17

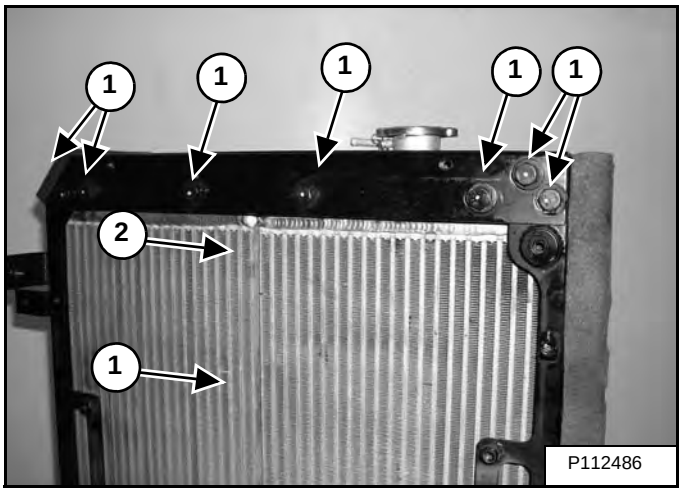
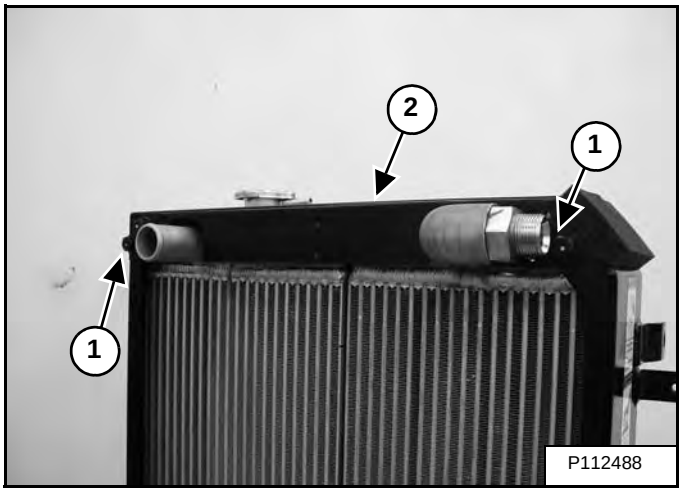
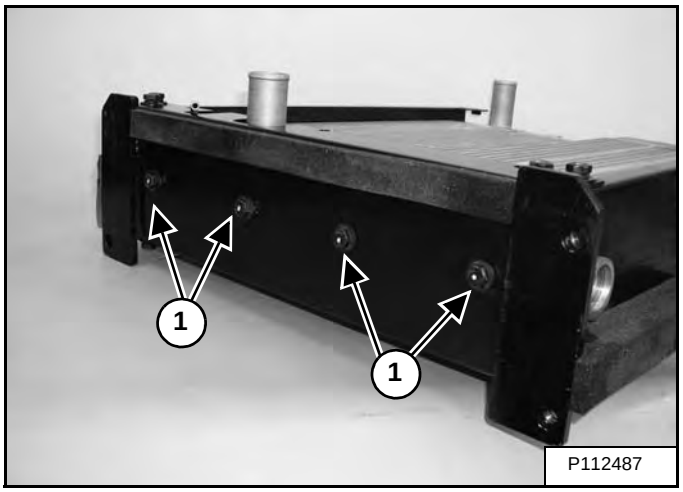


Figure 60-50-18



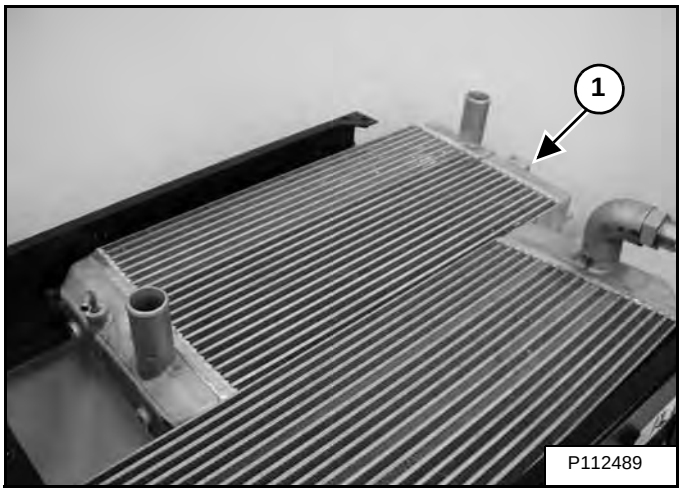
Remove the bolts (Item 1) and top cover (Item 2) **[Figure 60-50-17]** and **[Figure 60-50-18]**.

Figure 60-50-19



Remove the bolts (Item 1) **[Figure 60-50-19]**.

Figure 60-50-20

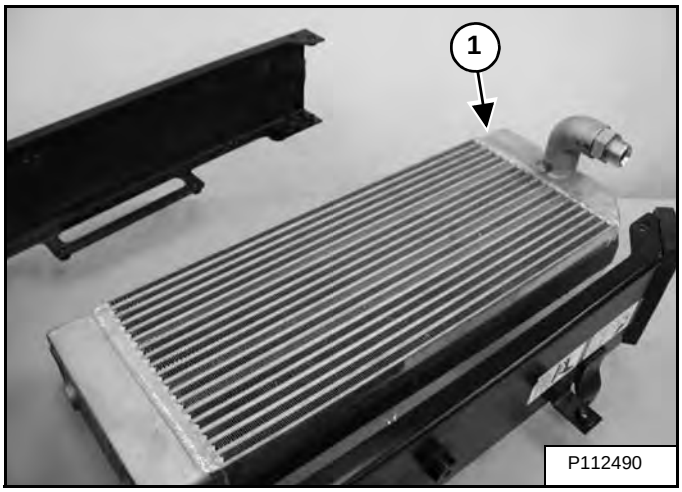


Remove the radiator (Item 1) **[Figure 60-50-20]**.

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Radiator Disassembly And Assembly (Cont'd)

Figure 60-50-21



Remove the oil cooler (Item 1) **[Figure 60-50-21]**.

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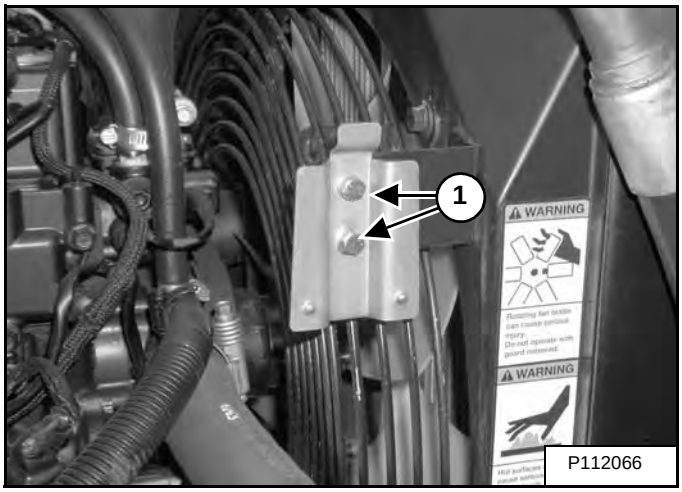
Fan Removal And Installation

Figure 60-50-22



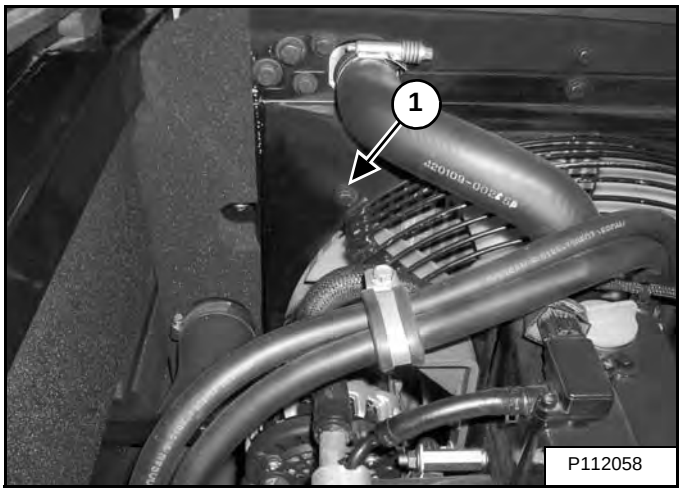
Pull up on and remove the coolant reservoir (Item 1) **[Figure 60-50-22]**.

Figure 60-50-23



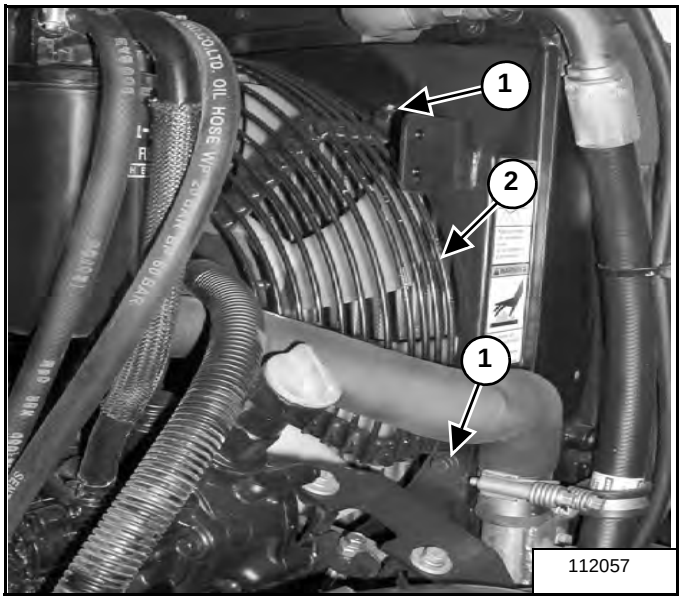
Remove the two bolts (Item 1) **[Figure 60-50-23]** and remove the reservoir bracket.

Figure 60-50-24



Remove the bolt (Item 1) **[Figure 60-50-24]**.

Figure 60-50-25

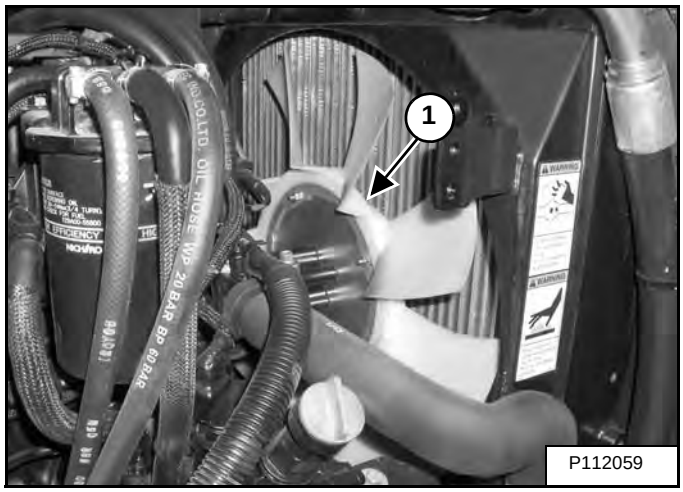


Remove the two bolts (Item 1) and remove the fan guard (Item 2) **[Figure 60-50-25]**.

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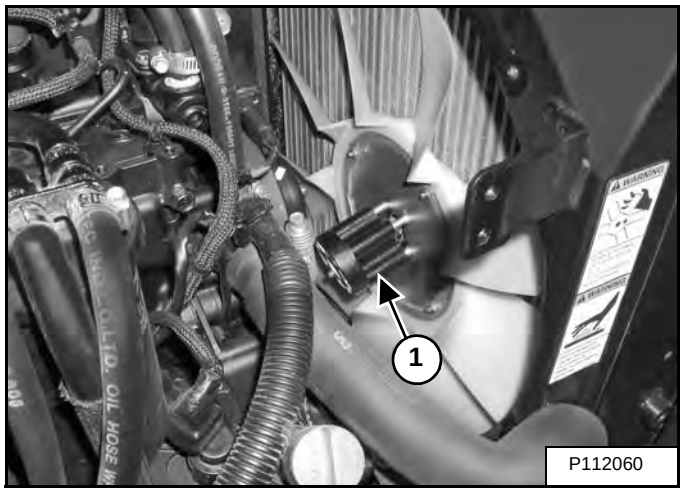
Fan Removal And Installation (Cont'd)

Figure 60-50-26



Remove the four bolts (Item 1) **[Figure 60-50-26]** from the fan.

Figure 60-50-27

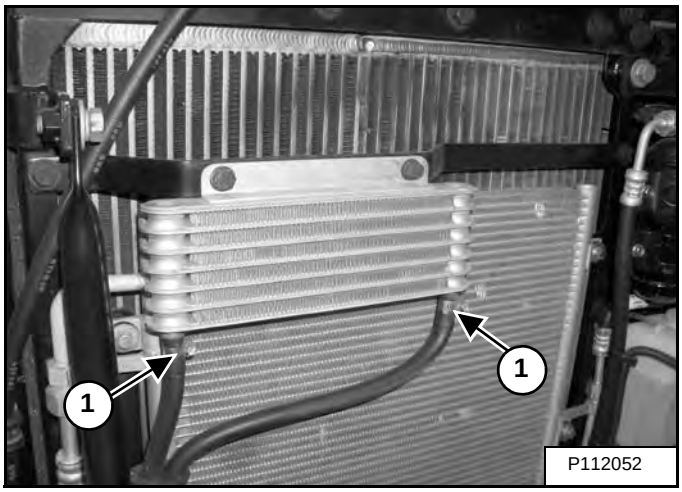


Slide the fan towards the radiator and remove the spacer (Item 1) **[Figure 60-50-27]**.

Remove the fan.

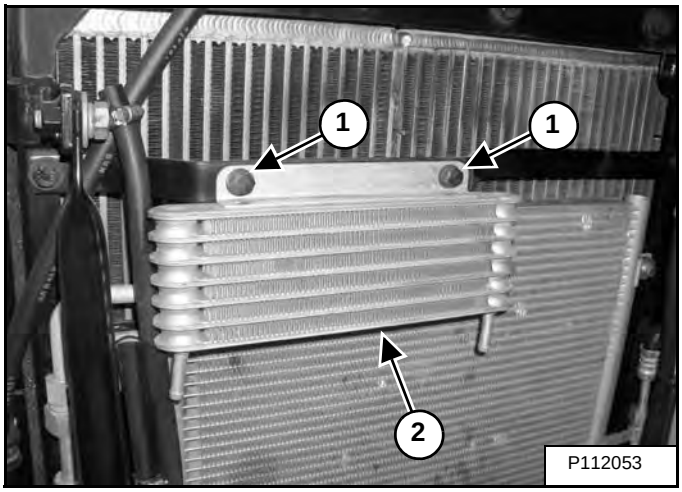
Fuel Cooler Removal And Installation

Figure 60-50-28



Loosen the hose clamps (Item 1) **[Figure 60-50-28]** and remove the hoses.

Figure 60-50-29



Remove the bolts (Item 1) and remove the cooler (Item 2) **[Figure 60-50-29]**.

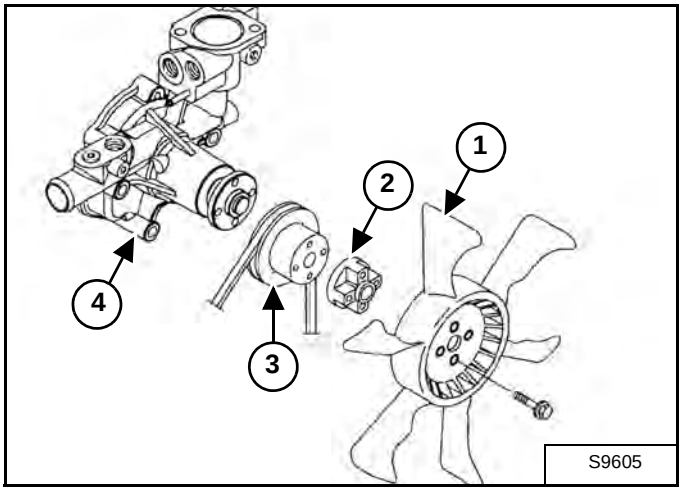
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Water Pump Removal And Installation

NOTE: Replace the engine coolant pump as an assembly only. Do not attempt to repair the engine coolant pump or replace individual components.

Remove the alternator belt. (See Belt Replacement on Page 50-30-1.)

Figure 60-50-30



Remove the fan (Item 1), spacer (Item 2) and pulley (Item 3) **[Figure 60-50-30]**.

Disconnect the coolant hoses and the temperature switch lead wire from the engine coolant pump.

Remove the engine coolant pump (Item 4) **[Figure 60-50-30]**.

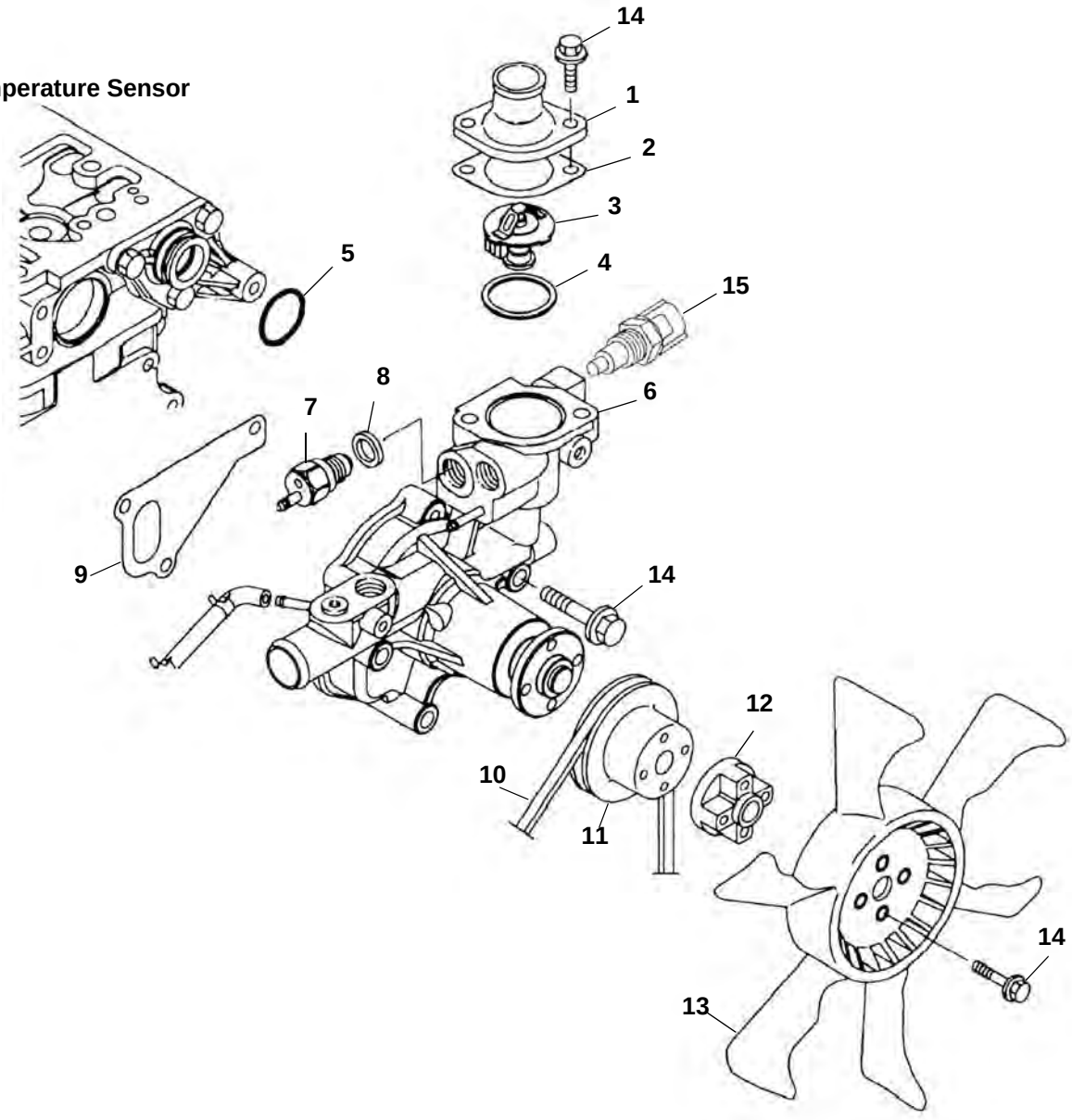
Installation: Install a new O-ring between the engine coolant pump and the joint.

NOTE: The correct O-ring must be used. The O-ring dimensions are the same as a commercially available O-ring, the material is different.

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Water Pump Parts Identification

1. Thermostat Cover
2. Gasket
3. Thermostat
4. O-ring
5. O-ring
6. Water Pump
7. Temperature Switch
8. Gasket
9. Gasket
10. Belt
11. Pulley
12. Spacer
13. Fan
14. Bolt
15. Water Temperature Sensor

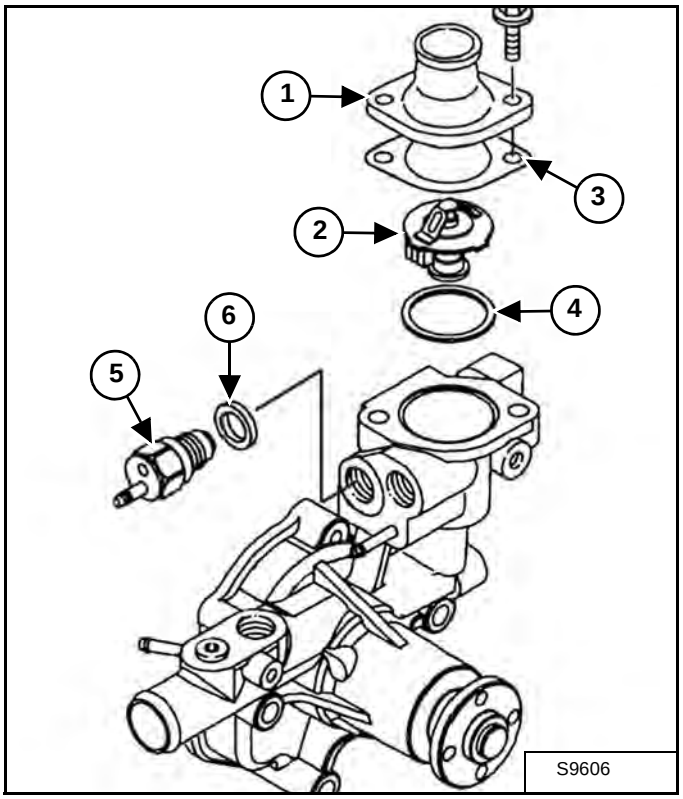


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Thermostat Removal And Installation

Figure 60-50-31



Remove the thermostat cover (Item 1) and the thermostat (Item 2) **[Figure 60-50-31]**.

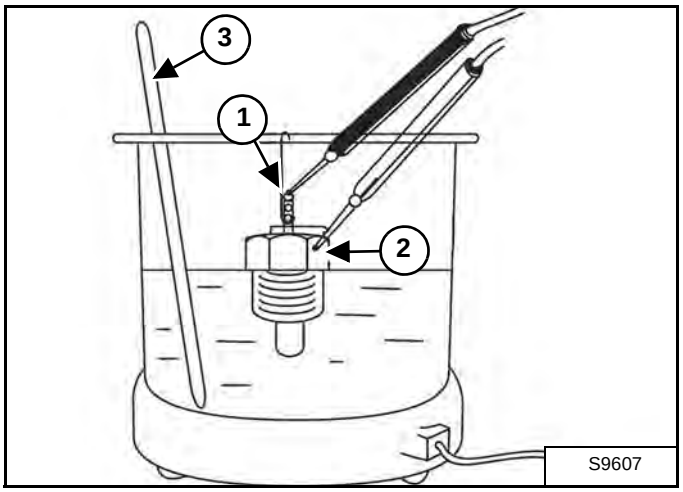
Installation: Use a new gasket (Item 3) and O-ring (Item 4) **[Figure 60-50-31]**.

Remove the temperature switch (Item 5) **[Figure 60-50-31]**.

Installation: Use a new gasket (Item 6) **[Figure 60-50-31]**.

Temperature Switch - Testing

Figure 60-50-32



Connect a continuity light or ohmmeter to the temperature switch. Connect one lead to the terminal of the switch (Item 1) and the other lead to the metal portion of the switch (Item 2) **[Figure 60-50-32]**.

Install the temperature switch and an accurate thermometer (Item 3) **[Figure 60-50-32]** in engine coolant.

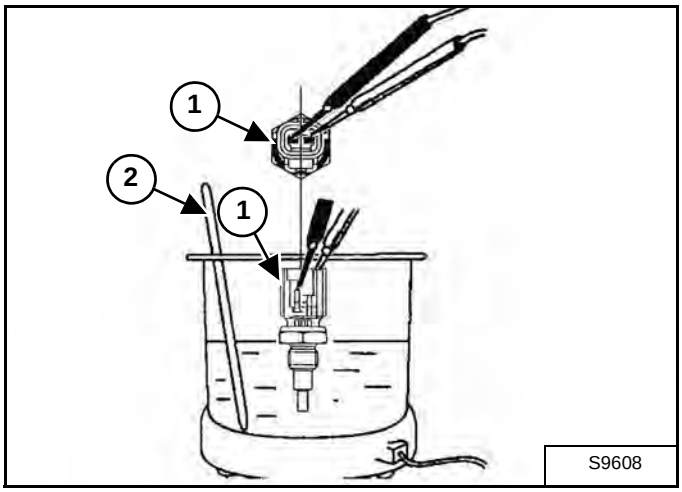
Slowly increase the temperature of the fluid.

The temperature switch is working properly if the continuity light or ohmmeter indicates continuity when the fluid reaches 107 - 113°C (225 - 235°F).

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Temperature Sensor - Testing

Figure 60-50-33



Connect an electric resistor to the coupler of the water temperature sensor (Item 1) **[Figure 60-50-33]**.

Install the temperature switch and an accurate thermometer (Item 2) **[Figure 60-50-33]** in engine coolant.

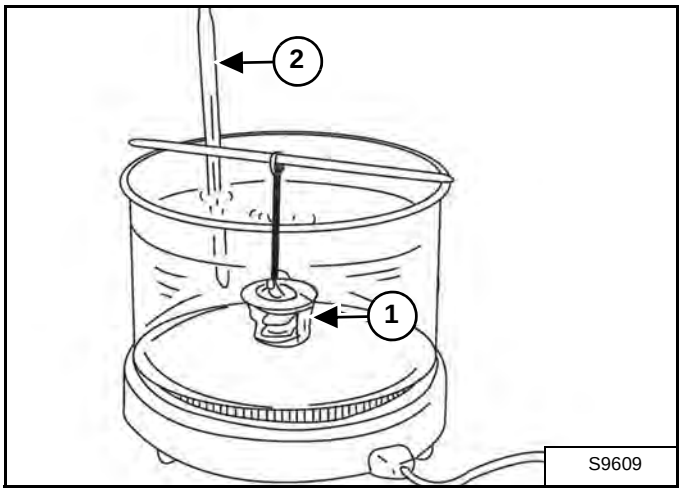
Slowly increase the temperature of the fluid and measure the electric resistance value.

If the resistance value at each of the following temperatures is within the permissible range specified, the water temperature sensor is operating properly.

WATER TEMPERATURE	RESISTANCE (K OHM)
20°C (68°F)	2.45 (+/- 0.13)
80°C (176°F)	0.318 (+/- 0.008)
100°C (212°F)	0.1836

Thermostat - Testing

Figure 60-50-34

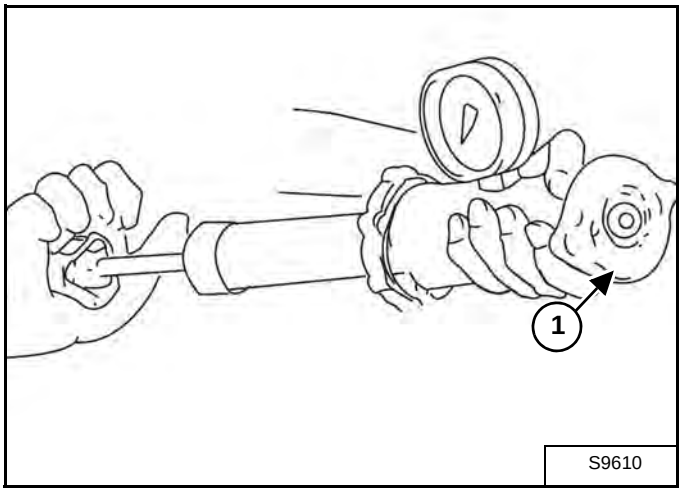


Install the thermostat (Item 1) and an accurate thermometer (Item 2) **[Figure 60-50-34]** in hot water.

Slowly increase the temperature of the fluid.

The thermostat is operating properly if it starts to open at the temperature value stamped on the flange of the thermostat, and fully opens as the temperature of the water is increased.

Figure 60-50-35



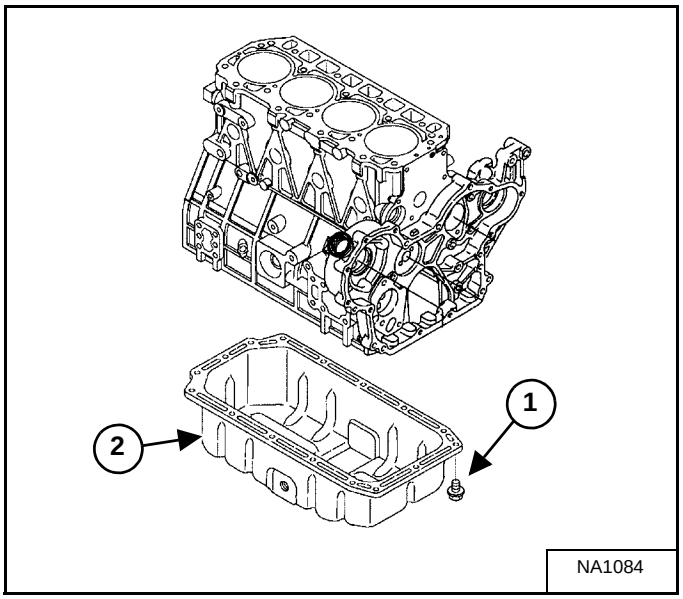
Install the radiator cap (Item 1) **[Figure 60-50-35]** on a cooling system tester.

Apply 75 - 105 kPa (0,75 - 1,05 bar) (10.8 - 14.8 psi) to the radiator cap. The radiator cap relief valve must open within the specified range.

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Oil Pan Removal And Installation

Figure 60-60-1



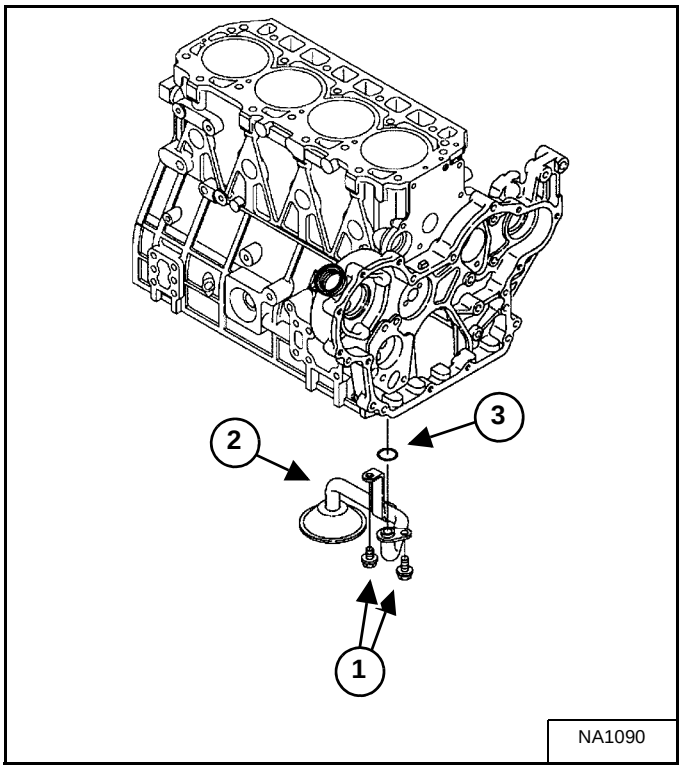
Remove the bolts (Item 1) and remove the oil pan (Item 2) **[Figure 60-60-1]**.

Installation: Apply a continuous bead of liquid gasket to the mounting surface of the oil pan (Item 2).

NOTE: Be sure to circle each bolt hole.

Reinstall the oil pan and tighten the bolts.

Figure 60-60-2



Remove the bolts (Item 1), oil pickup tube (Item 2) and O-ring (Item 3) **[Figure 60-60-2]**.

Installation: Install the oil pickup tube (Item 2) using a new O-ring (Item 3) **[Figure 60-60-2]**.

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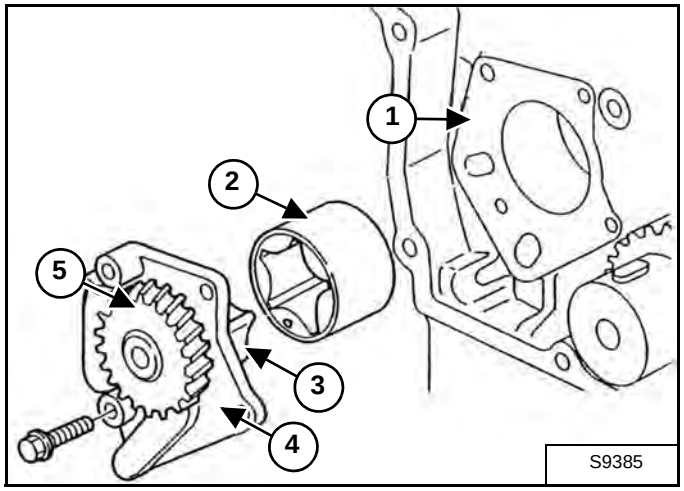
Oil Pump Removal And Installation

NOTE: If the oil pump must be replaced, replace it as an assembly only. Do not replace individual components.

Remove the engine cooling fan (See Fan Removal And Installation on Page 60-50-7.).

The oil pump is located in the front gear case and is driven by the same gear train that drives the camshaft and fuel injection pump. Remove crankshaft pulley and the front gear case cover to gain access to the oil pump (See Timing Gear Case Cover Removal And Installation on Page 60-100-1.).

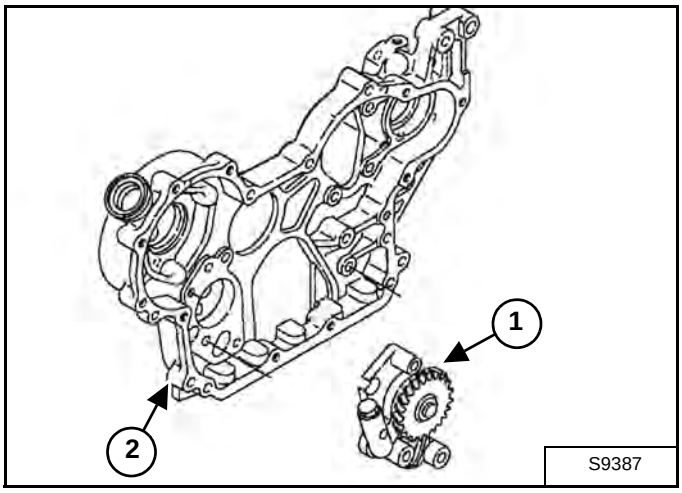
Figure 60-60-3



Gear Case Housing (Item 1)
Outer Rotor (Item 2)
Inner Rotor (Item 3)
Cover Plate (Item 4)
Drive Gear (Item 5) **[Figure 60-60-3]**

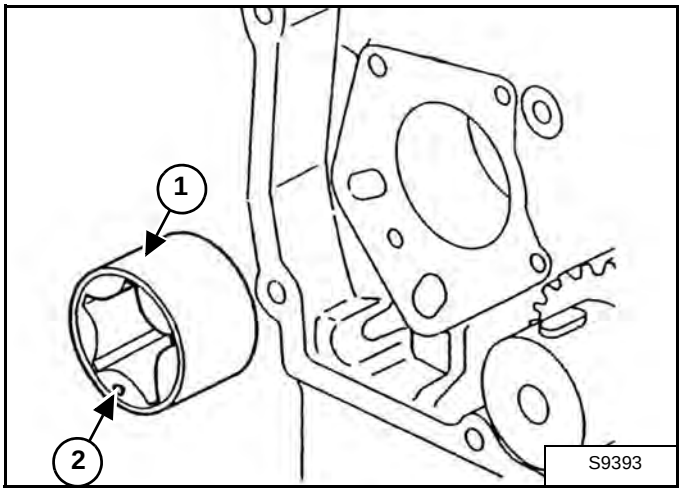
Remove the crankshaft pulley and the gear case cover.

Figure 60-60-4



Remove the oil pump assembly bolts. Remove the oil pump assembly (Item 1) from the gear case housing (Item 2) **[Figure 60-60-4]**.

Figure 60-60-5



Remove the outer rotor (Item 1) **[Figure 60-60-5]** from the gear case housing.

Installation: Lubricate the outer rotor and pump bore in the gear case with clean engine oil. The punch mark (Item 2) **[Figure 60-60-5]** on the end of the outer rotor must face away from the gear case housing

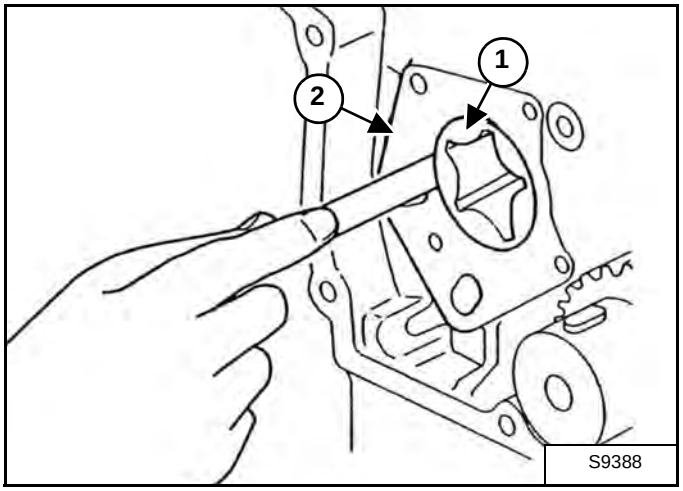
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Oil Pump Inspection

Wash the oil pump, oil pressure regulator and oil pump cavity with clean solvent. Inspect for wear or damage. Replace if necessary.

NOTE: If any oil pump component clearance exceeds its limit, the oil pump must be replaced as an assembly.

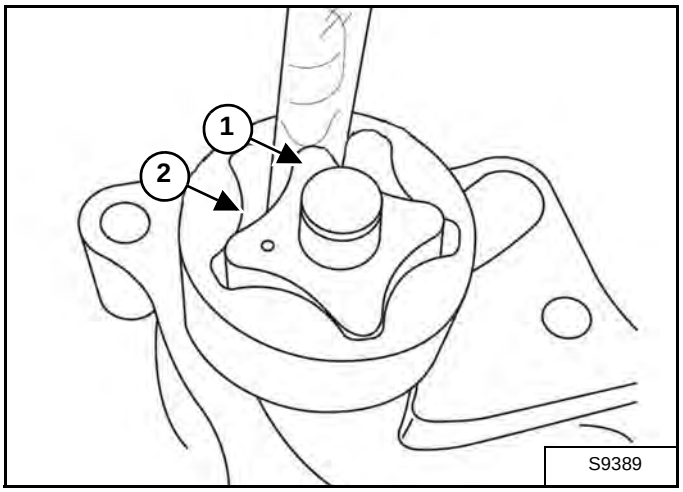
Figure 60-60-6



Measure the clearance between the outer rotor (Item 1) and pump body (Item 2) **[Figure 60-60-6]**.

Clearance	0,1 - 0,155 mm (0.0039 - 0.0061 in)
Allowable Limit	0,25 mm (0.0098 in)

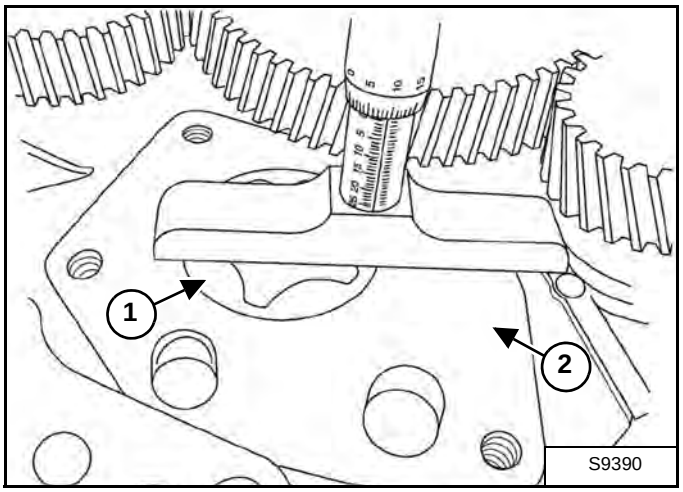
Figure 60-60-7



Measure the clearance between the lobes of the inner rotor (Item 1) and outer rotor (Item 2) **[Figure 60-60-7]**.

Allowable Limit	0,16 mm (0.0063 in)

Figure 60-60-8



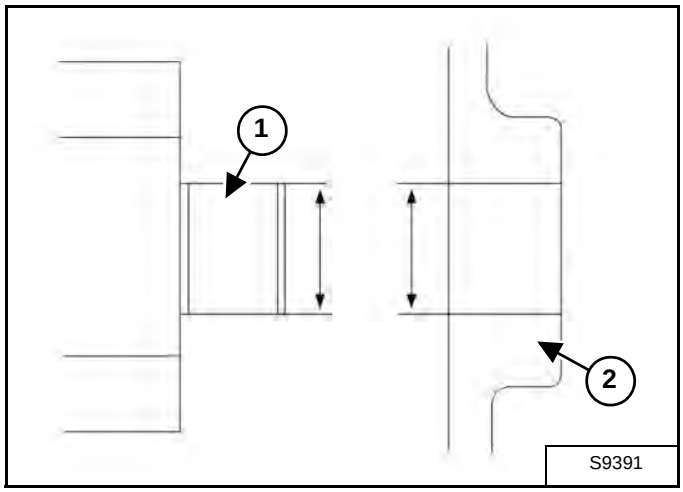
Determine the side clearance of the outer rotor (Item 1) across the pump cavity (Item 2) **[Figure 60-60-8]**. Measure the side clearance using a depth micrometer.

Side Clearance	0,05 - 0,10 mm (0.002 - 0.0039 in)
Allowable Limit	0,15 mm (0.0059 in)

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Oil Pump Inspection (Cont'd)

Figure 60-60-9



Determine the rotor shaft clearance. Measure the outside diameter of the rotor shaft (Item 1) and the bore diameter in the gear case housing (Item 2) **[Figure 60-60-9]**.

Calculate the difference between the two measurements to determine the clearance.

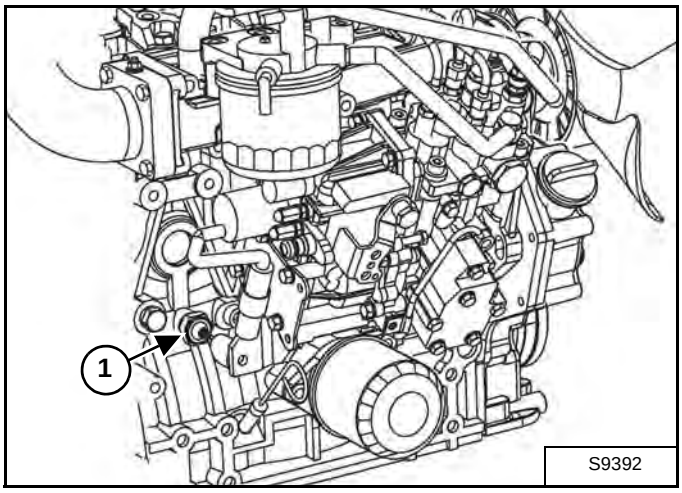
Gear Case Bearing I.D.	12,980 - 13,020 mm (0.5110 - 0.5126 in)
Allowable Limit	13,050 mm (0.5138 in)
Rotor Shaft O.D.	12,955 - 12,965 mm (0.5100 - 0.5104 in)
Allowable Limit	12,945 mm (0.5096 in)
Rotor Clearance	0,015 - 0,065 mm (0.0006 - 0.0026 in)
Allowable Limit	0,105 mm (0.0041 in)

If the clearance exceeds the allowable limit, replace the oil pump.

Engine Oil Pressure - Testing

Perform an engine oil pressure check if there is any indication of low oil pressure such as the oil pressure indicator is on or the oil pressure gauge indicates low oil pressure.

Figure 60-60-10



Disconnect the wire harness from the oil pressure switch (Item 1) **[Figure 60-60-10]**.

Remove the oil pressure switch.

Install a mechanical oil pressure gauge in the oil pressure switch port.

Start the engine:

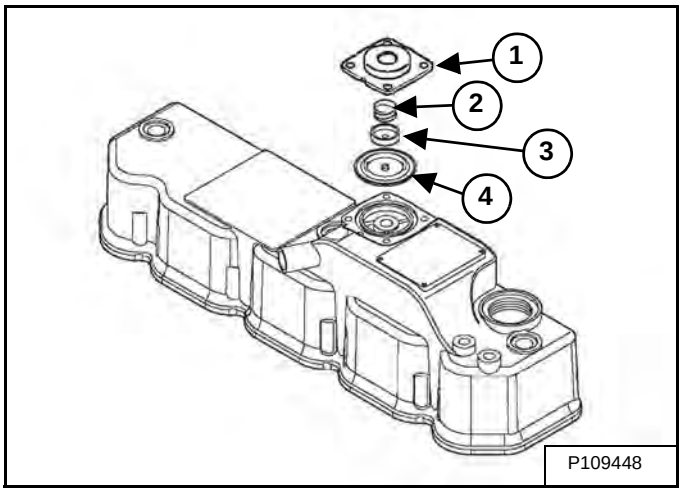
At Idle Speed Allowable Limit	60 kPa (0,6 bar) (8,7 psi) or more
At Rated Speed	290 - 390 kPa (2,90 - 3,90 bar (42,1 - 56,6 psi)

- If the mechanical oil pressure test gauge indicates good oil pressure, replace the faulty oil pressure switch or sending unit, or faulty machine oil pressure gauge in instrument panel.
- If the mechanical oil pressure test gauge indicates low oil pressure, troubleshoot the lubrication system to locate the cause of the low oil pressure.

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Crankcase Ventilation Filter Removal And Installation

Figure 60-60-11



Remove the bolts retaining the diaphragm cover (Item 1). Remove the diaphragm cover, spring (Item 2), diaphragm plate (Item 3) and diaphragm (Item 4) **[Figure 60-60-11]**.

Installation: Install the diaphragm, diaphragm plate, spring and diaphragm cover and tighten the bolts.

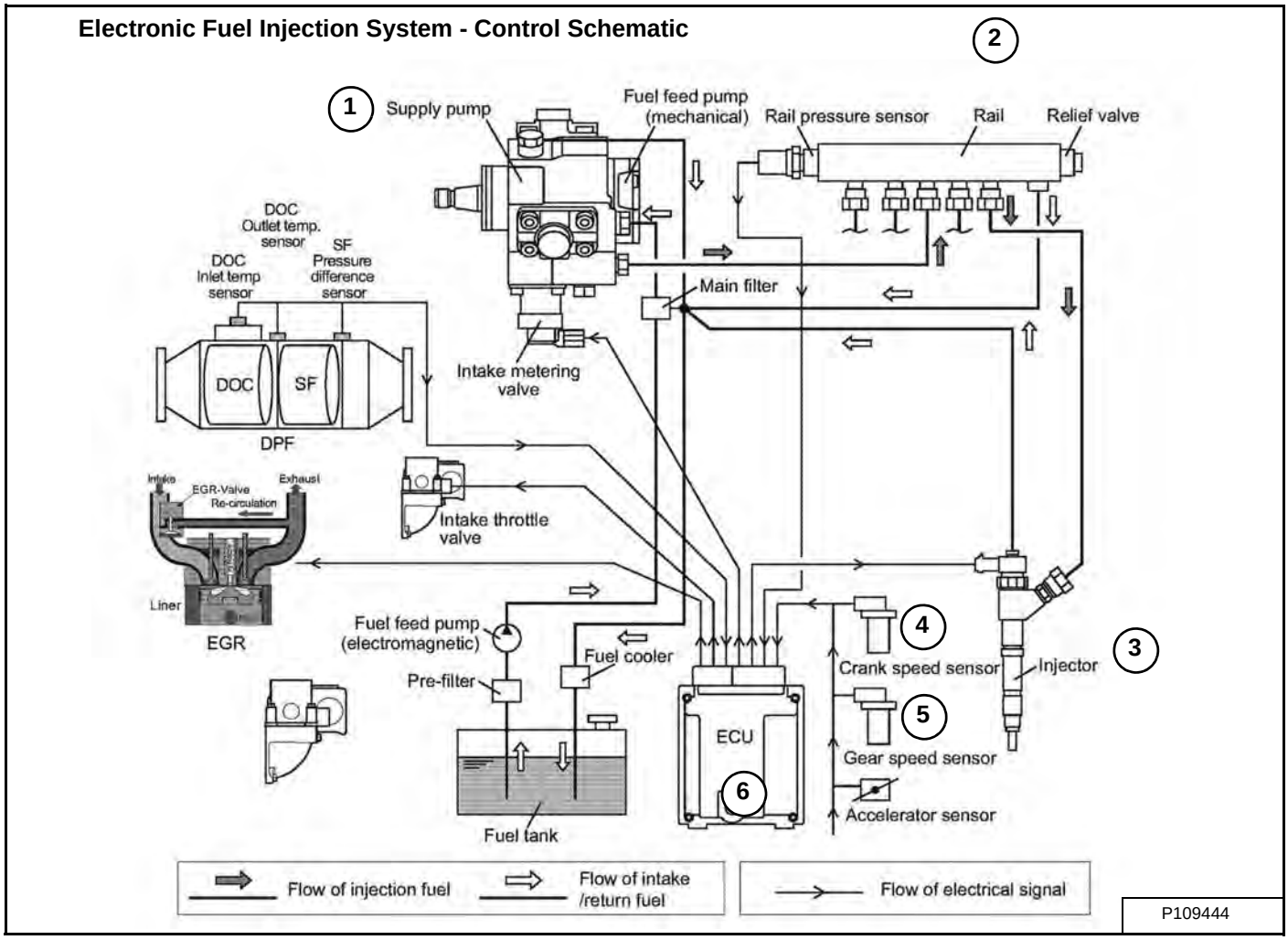
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Electronic Fuel Injection Schematic - Components

Figure 60-70-1



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Supply Pump (Item 1) [Figure 60-70-1]- The fuel passes the pre-filter and is pressure-fed by a fuel feed pump to the main filter, then it arrives at the supply pump. The ECU controls the opening of the intake metering valve and adjusts the fuel intake volume so that the rail pressure is at the target value. The fuel pressurized in the supply pump is fed to the rail.

Rail (Item 2) [Figure 60-70-1] - A pressure of up to 160 MPa is accumulated in the rail. The rail is equipped with a rail pressure sensor and it sends information to the ECU. In the case of an abnormal increase in the rail pressure, the mechanical relief valve opens to prevent the pressure increase.

Injector (Item 3) [Figure 60-70-1] - The ECU controls the injector to maintain optimum injection volume and injection timing and injects the high pressure fuel accumulated in the rail into the cylinder.

Crank Speed Sensor (Item 4) and **Gear Speed Sensor (Item 5) [Figure 60-70-1]** - The crank speed sensor is equipped on the flywheel side and the gear speed sensor is equipped on the gear side. Based on these 2 sensor outputs, the ECU recognizes the engine speed and each piston position.

Electronic Control Unit (ECU) (Item 6) [Figure 60-70-1] - Based on the information from each sensor, ECU determines optimum injection volume, injection timing and rail pressure, and controls the intake metering valve of the supply pump and injector. It also monitors the occurrence of system abnormality at all times. If an abnormality is detected, it notifies the operator and controls the safe running condition of the system.

Fuel Supply Pump Removal And Installation

Remove the air cleaner. (See Housing Removal And Installation on Page 60-40-1.)

Remove the DPF. (See Removal And Installation on Page 60-30-2.)

NOTE: Allow five minutes after the engine is shut down for the fuel pressure to bleed down.

⚠ 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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Figure 60-70-2



Pull up on and reposition the coolant overflow tank (Item 1) **[Figure 60-70-2]**.

Figure 60-70-3

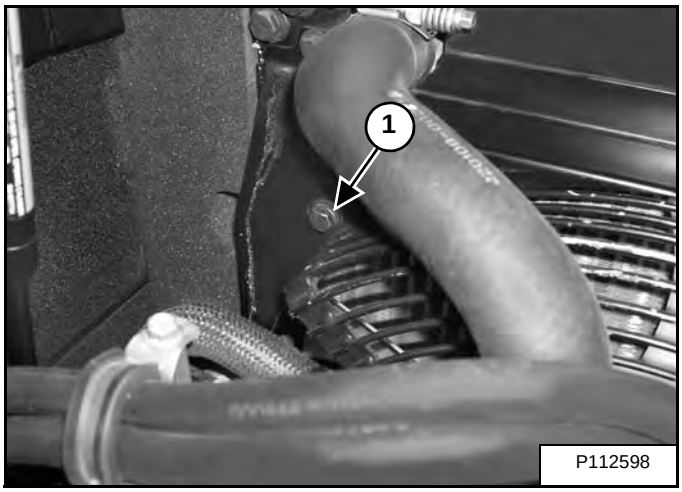
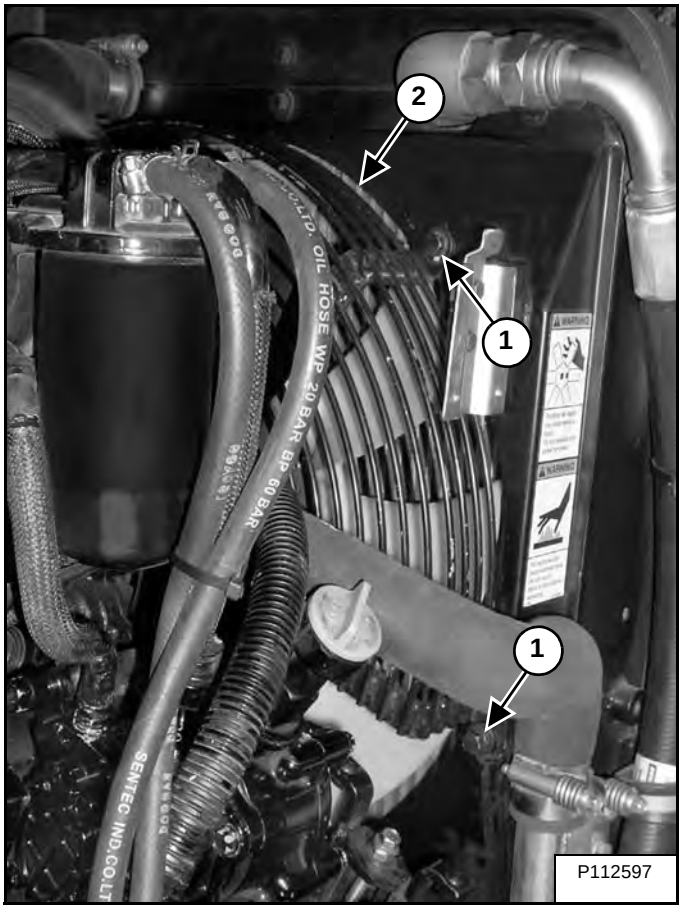


Figure 60-70-4



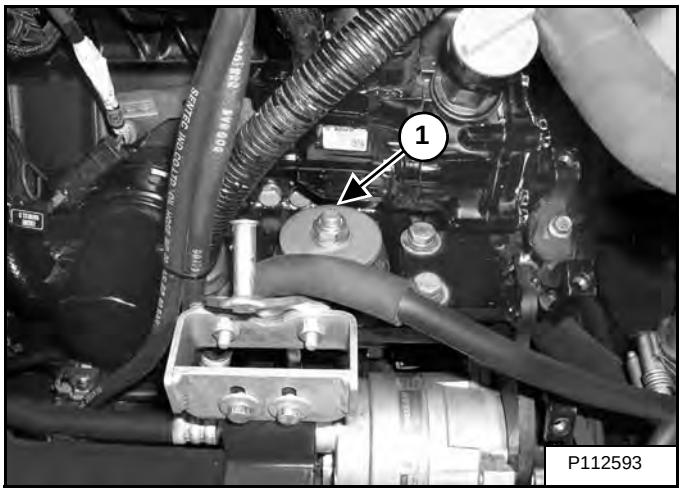
Remove the bolts (Item 1) **[Figure 60-70-3]** and **[Figure 60-70-4]**.

Reposition the fan guard (Item 2) **[Figure 60-70-4]**.

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Fuel Supply Pump Removal And Installation (Cont'd)

Figure 60-70-5



Remove the nut (Item 1) **[Figure 60-70-5]** bolt, washer and top engine mount.

Figure 60-70-6

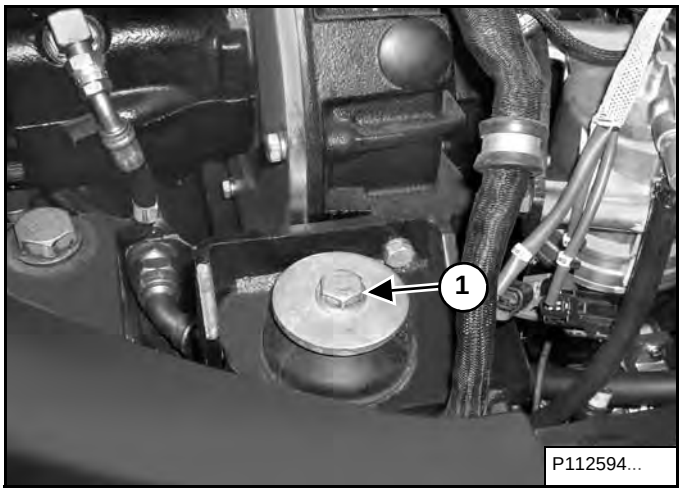


Figure 60-70-7

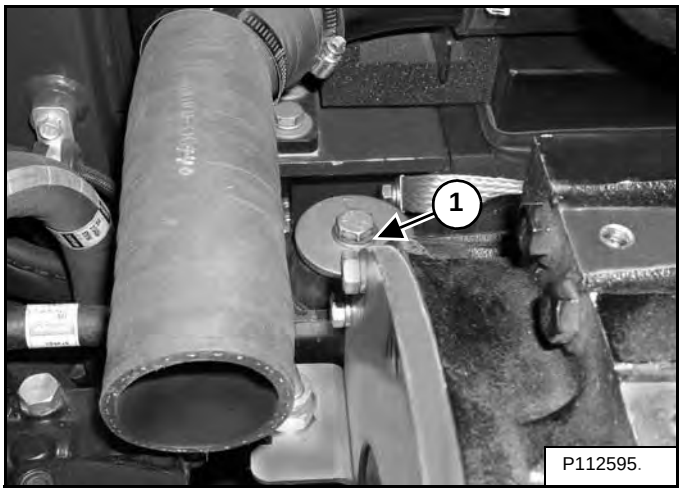
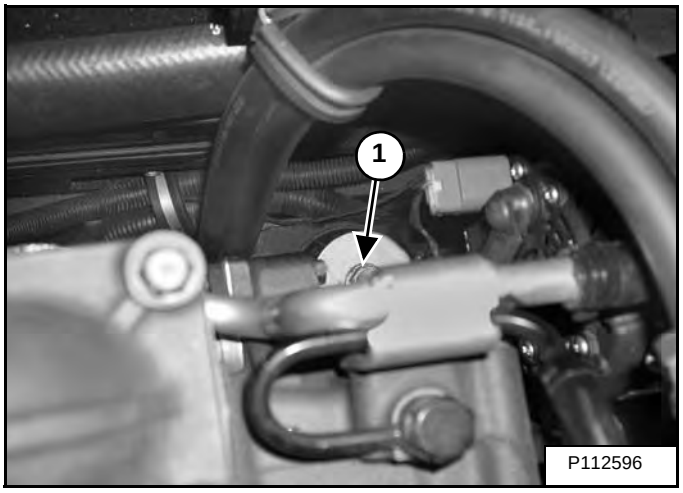


Figure 60-70-8

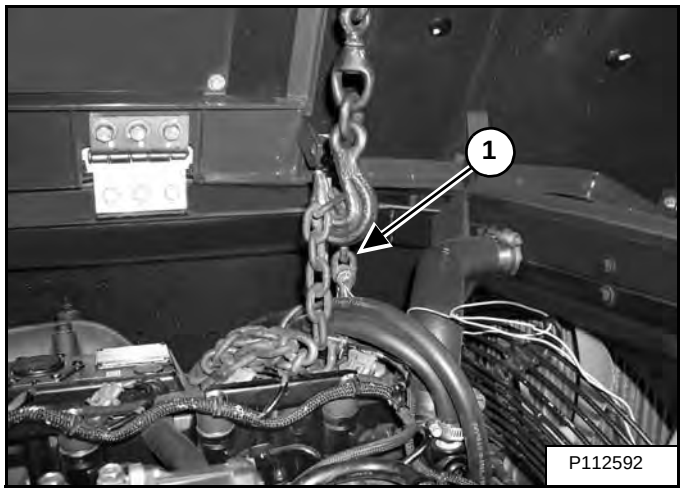


Loosen the remaining three engine mount bolts (Item 1) **[Figure 60-70-6]**, **[Figure 60-70-7]** and **[Figure 60-70-8]**.

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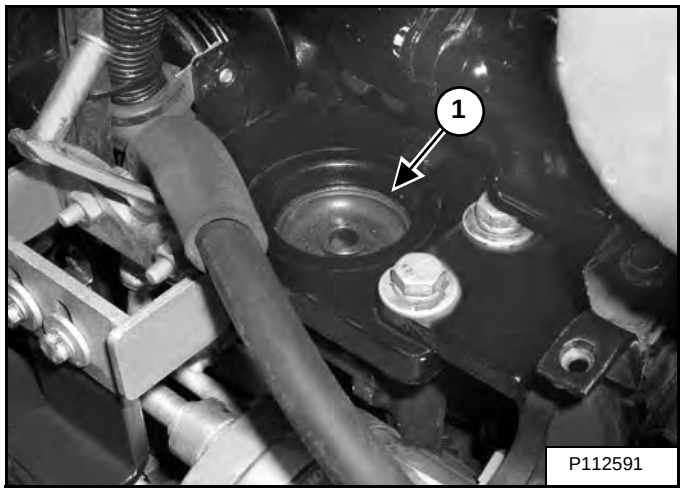
Fuel Supply Pump Removal And Installation (Cont'd)

Figure 60-70-9



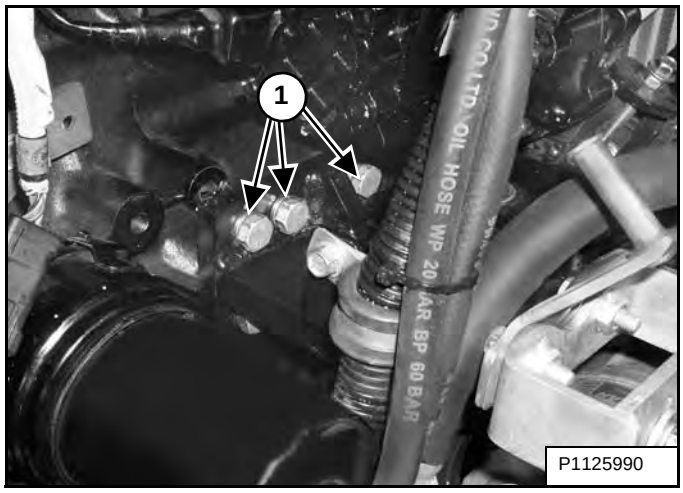
Install a hoist (Item 1) **[Figure 60-70-9]** on the front engine lifting bracket.

Figure 60-70-10



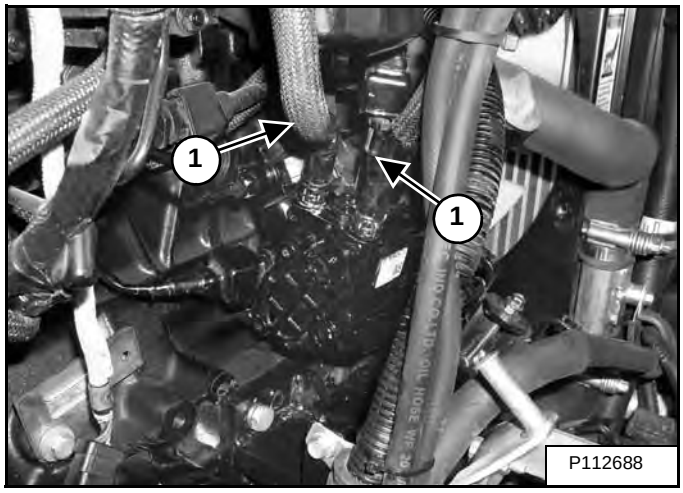
Raise the hoist enough to remove the bottom engine mount (Item 1) **[Figure 60-70-10]**.

Figure 60-70-11



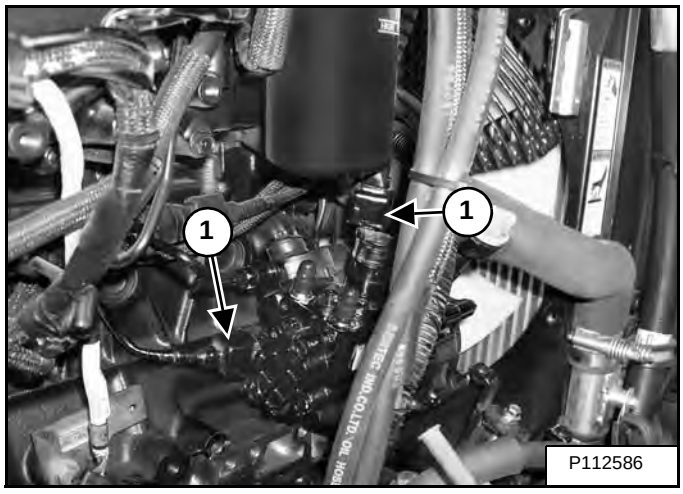
Remove the six bolts (Item 1) **[Figure 60-70-11]** and lower the mount to the excavator frame.

Figure 60-70-12



Remove the fuel lines (Item 1) **[Figure 60-70-12]**.

Figure 60-70-13

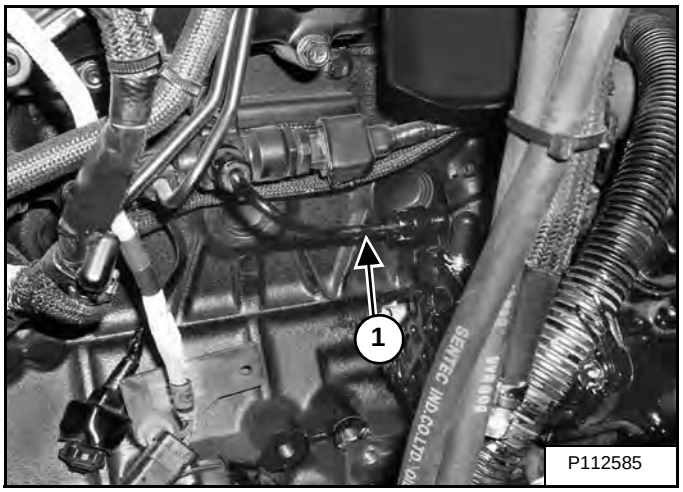


Disconnect the wire harness (Item 1) **[Figure 60-70-13]**.

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Fuel Supply Pump Removal And Installation (Cont'd)

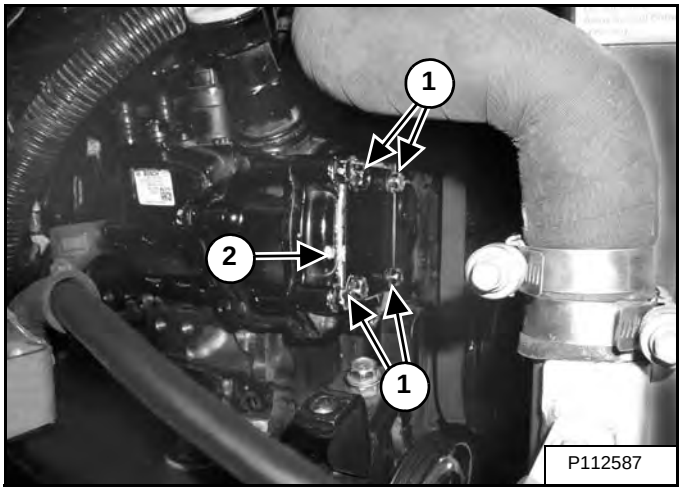
Figure 60-70-14



Remove the fuel line (Item 1) **[Figure 60-70-24]** from the supply pump to the fuel rail.

Installation: Tighten the fuel line to 29,4 - 34,3 N•m (21.7 - 25.3 ft-lb) torque.

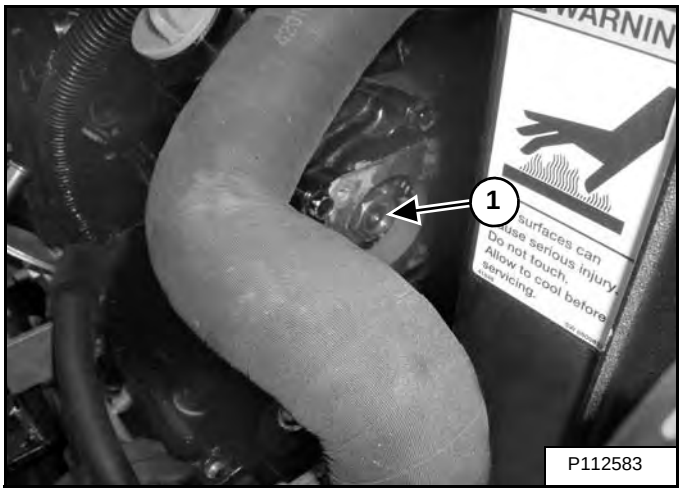
Figure 60-70-15



Remove the bolts (Item 1) and plate (Item 2) **[Figure 60-70-15]**.

Installation: Apply a thin continuous bead of silicone sealant around the outer edge of the plate. Tighten the bolts to 22,6 - 28,4 N•m (16.6 - 20.9 ft-lb) torque.

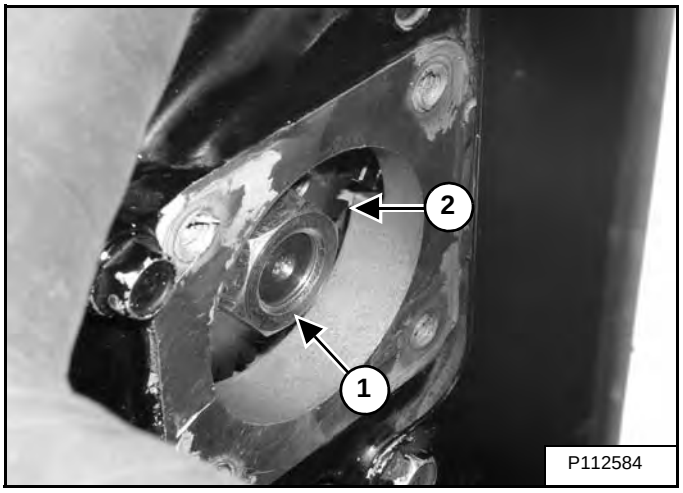
Figure 60-70-16



Remove the nut (Item 1) **[Figure 60-70-16]** and lock washer.

Installation: Tighten the nut to 75 - 85 N•m (55 - 63 ft-lb) torque.

Figure 60-70-17



Install the nut (Item 1) on the shaft three turns. Do not contact the face of the gear with the face of the nut. Make an alignment mark (Item 2) **[Figure 60-70-17]** between the supply pump gear and the idler gear.

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Fuel Supply Pump Removal And Installation (Cont'd)

Figure 60-70-18

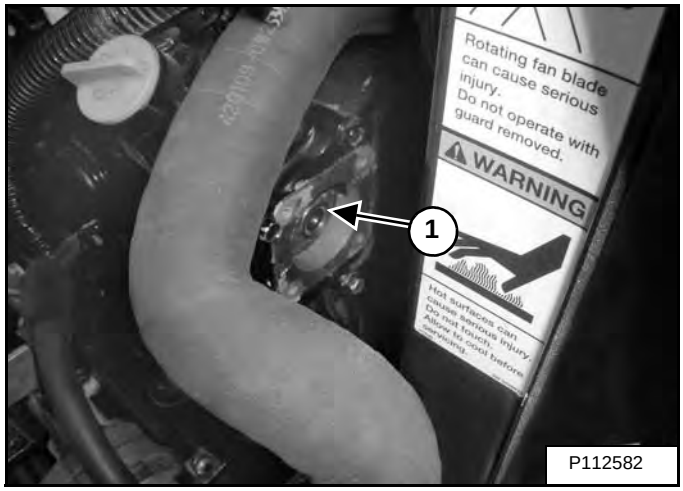


Install the puller on the gear **[Figure 60-70-18]**.

Remove the gear from the pump shaft.

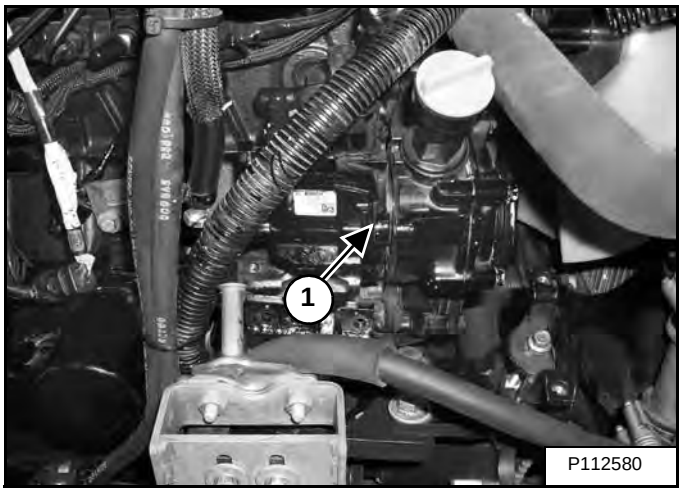
NOTE: The gear will stay in the timing case after it is removed from the pump shaft.

Figure 60-70-19



Remove the puller and remove the nut (Item 1) **[Figure 60-70-19]**.

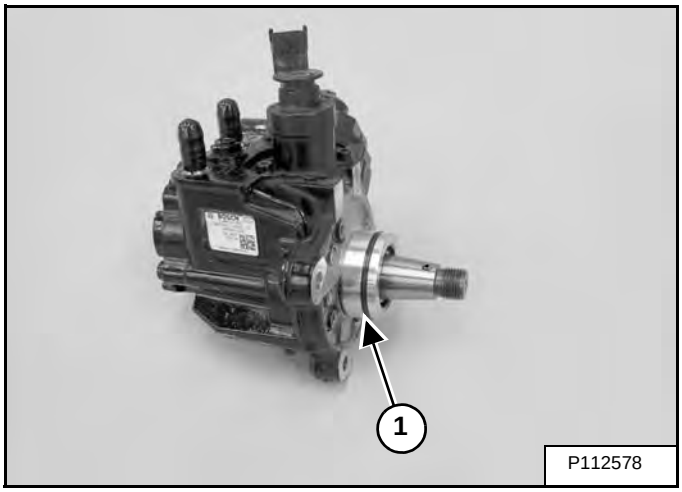
Figure 60-70-20



Remove the three bolts (Item 1) **[Figure 60-70-20]** and remove the pump.

I***nstallation:*** Tighten the bolts to 22,6 - 28,4 N•m (16.6 - 20.9 ft-lb) torque.

Figure 60-70-21



Remove the O-ring (Item 1) **[Figure 60-70-21]**.

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Fuel Rail Assembly Removal And Installation

⚠ 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.

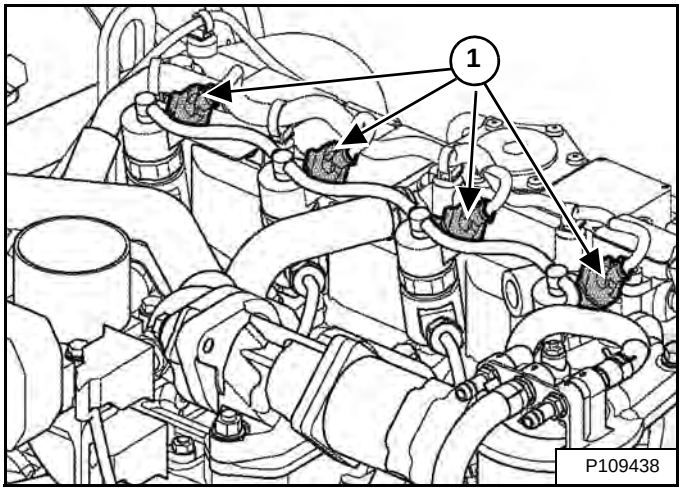
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NOTE: Allow 5 minutes after the engine is shut down for the fuel pressure to bleed down.

Remove the EGR valve. (See Removal And Installation on Page 60-110-2.)

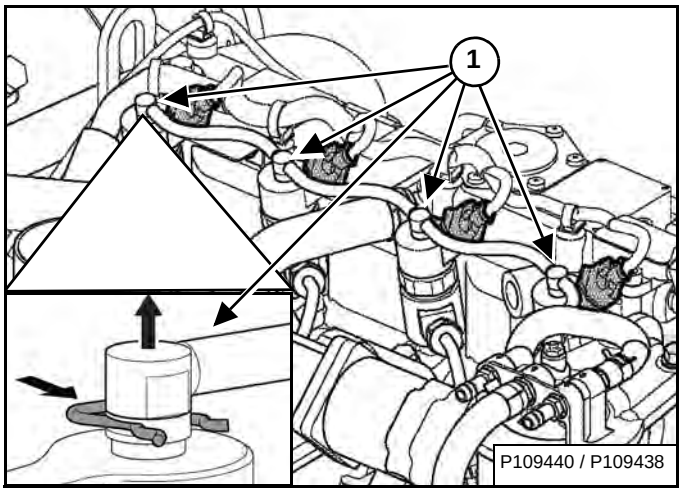
Remove the air cleaner flange, intake throttle valve and intake air heater from the engine. (See Housing Removal And Installation on Page 60-40-1.)

Figure 60-70-22



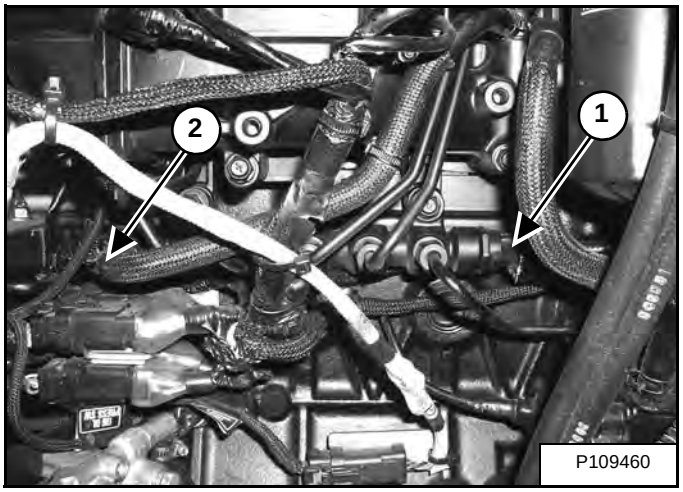
Disconnect the injector wires (Item 1) **[Figure 60-70-22]**.

Figure 60-70-23



Disconnect the injector fuel return line assembly (Item 1) **[Figure 60-70-23]** from the injectors.

Figure 60-70-24

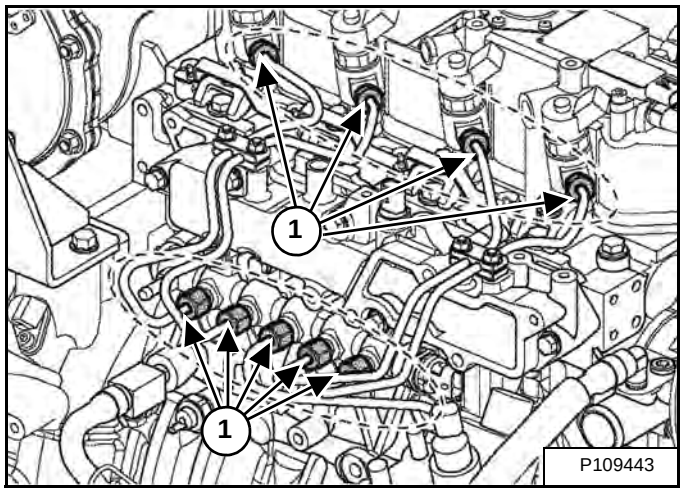


Disconnect the fuel pressure sensor (Item 1) and the fuel pressure relief line (Item 2) **[Figure 60-70-24]**.

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Fuel Rail Assembly Removal And Installation (Cont'd)

Figure 60-70-25



Clean around the high pressure fuel fittings (Item 1) **[Figure 60-70-25]** and remove the fuel lines from the common rail and injectors. Install caps and plugs.

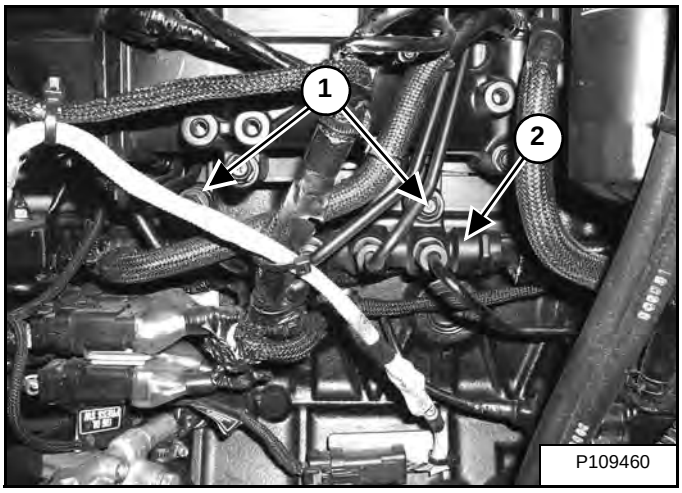
Installation: Tighten the high pressure fuel line nuts: (Injector Side) to 26,5 - 31,4 N•m (19.5 - 23.1 ft-lb) torque and (Fuel Rail Side) to 29,4 - 34,3 N•m (21.7 - 25.3 ft-lb) torque.

IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

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Figure 60-70-26



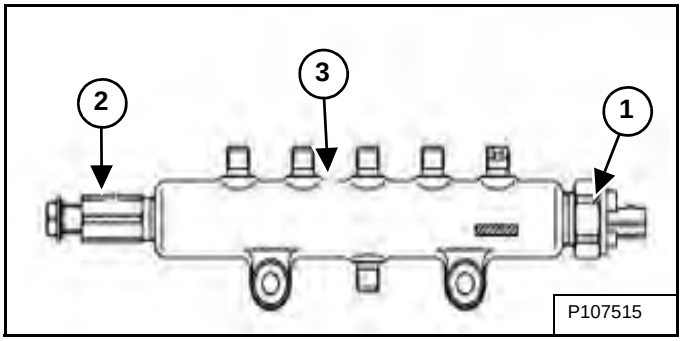
Remove the fuel rail assembly bolts (Item 1) and the fuel rail assembly (Item 2) **[Figure 60-70-26]**.

Installation: Tighten the bolts to 22,6 - 28,4 N•m (16.7 - 21.0 ft-lb) torque.

NOTE: When removing the fuel rail assembly do not hold it by the fuel rail pressure limiter or fuel rail pressure sensor.

Cap and store the fuel rail assembly and injector pipes to protect against dust and other contaminants.

Figure 60-70-27



Do not disassemble the fuel rail assembly. The fuel rail pressure sensor (Item 1), fuel rail pressure relief (Item 2) and the fuel rail (Item 3) **[Figure 60-70-27]** are not serviceable parts. Fuel rail assembly must be replaced as a single unit.

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Fuel Injector Removal And Installation

⚠ 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.

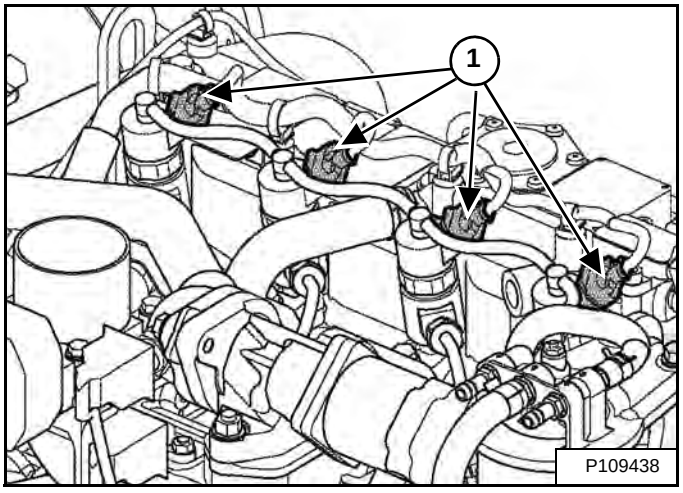
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NOTE: Allow 5 minutes after the engine is shut down for the fuel pressure to bleed down.

Remove the EGR valve. (See Removal And Installation on Page 60-110-2.)

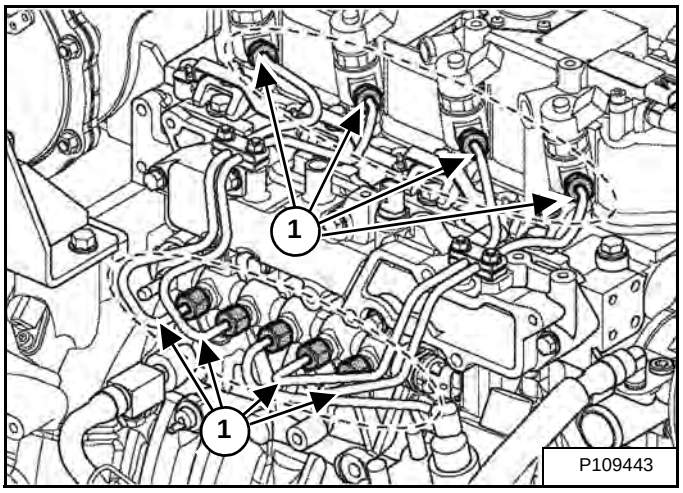
Remove the air cleaner flange, intake throttle valve and intake air heater from the engine. (See Housing Removal And Installation on Page 60-40-1.)

Figure 60-70-28



Disconnect the injector wires (Item 1) **[Figure 60-70-28]**.

Figure 60-70-29



Remove the high pressure fuel lines (Item 1) from the common rail and injectors **[Figure 60-70-29]**. Install caps and plugs.

Installation: Tighten the high pressure fuel line nuts (Injector Side) to 26,5 - 31,4 N•m (19.5 - 23.1 ft-lb) torque and (Fuel Rail Side) to 29,4 - 34,3 N•m (21.7 - 25.3 ft-lb) torque.

IMPORTANT

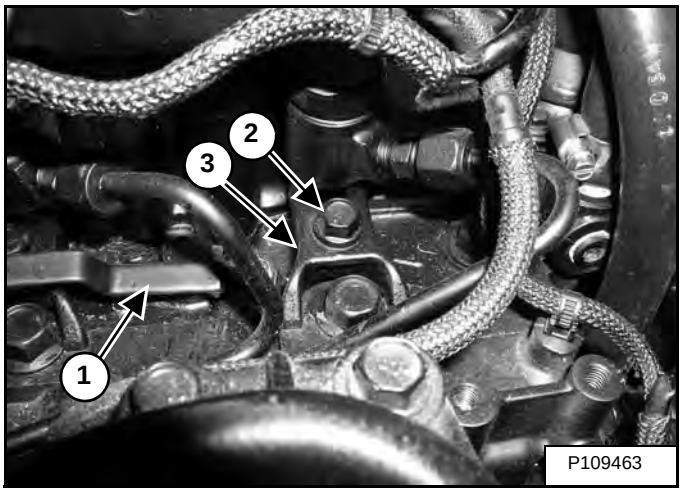
Do not bend the high pressure fuel injection tubes when removing or installing them.

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Fuel Injector Removal And Installation (Cont'd)

Figure 60-70-30



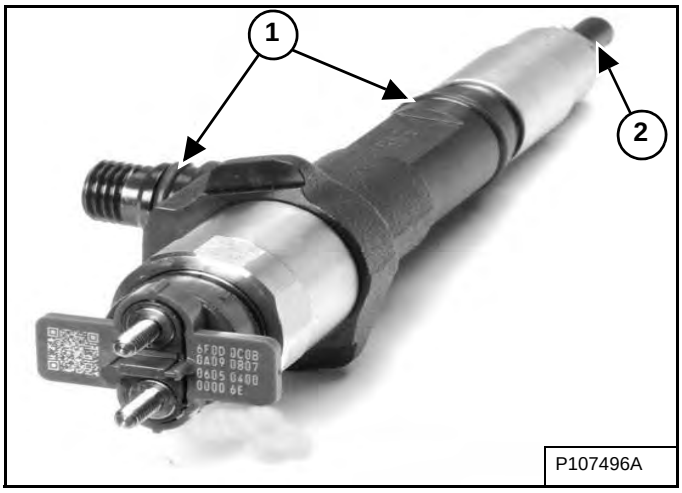
Remove the glow plug strip (Item 1) for access to the injection nozzle bolts. Remove the injector bolts (Item 2) and clamps (Item 3) **[Figure 60-70-30]**.

Remove the injector nozzle assembly and gasket (Item 3) **[Figure 60-70-30]**.

Installation: Tighten the injection nozzle assembly bolt to 24,4 - 28,4 N•m (18 - 21 ft-lb) torque.

NOTE: Do not disassemble the injector. Do not remove or damage the injector QR code tag. Do not get the injectors out of order. If the injectors get out of order or need replacing, it is necessary to perform injector correction. (See Fuel Injector Removal And Installation on Page 60-70-9.)

Figure 60-70-31



Remove and replace the injection nozzle assembly O-rings (Item 1) and nozzle gasket (Item 2) **[Figure 60-70-31]** before installation.

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CYLINDER HEAD

Valve Clearance Adjustment

NOTE: Valve clearance must be inspected and adjusted when engine is cold.

Remove the valve cover.

Installation: Install the valve cover and tighten the nuts to 12 - 15 N•m (8.9 - 11 ft-lb) torque.

Rotate the crankshaft clockwise as seen from the coolant pump end, to bring No. 1 piston to top dead center (TDC) on the compression stroke while watching the rocker arm motion and the timing grid on the flywheel. (Position where both the intake and exhaust valves are closed.)

With the number 1 cylinder (flywheel end) at TDC, adjust the following valves.

Cylinder No.	**1**		**2**		**3**		**4**	
Valve	Intake	Exhaust	Intake	Exhaust	Intake	Exhaust	Intake	Exhaust
No. 1 Cylinder at TDC Compression	**X**	**X**	**X**			**X**		

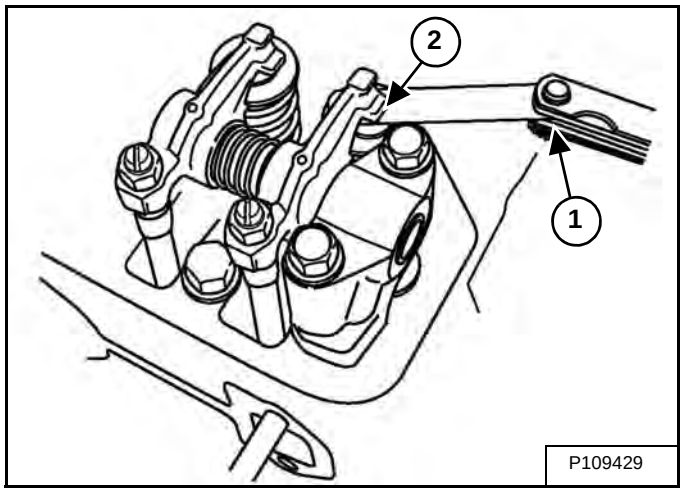
Rotate the crankshaft until the number 4 cylinder (radiator end) is at TDC. Adjust the following valves.

Cylinder No.	**1**		**2**		**3**		**4**	
Valve	Intake	Exhaust	Intake	Exhaust	Intake	Exhaust	Intake	Exhaust
No. 4 Cylinder at TDC Compression				**X**	**X**		**X**	**X**

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Valve Clearance Adjustment (Cont'd)

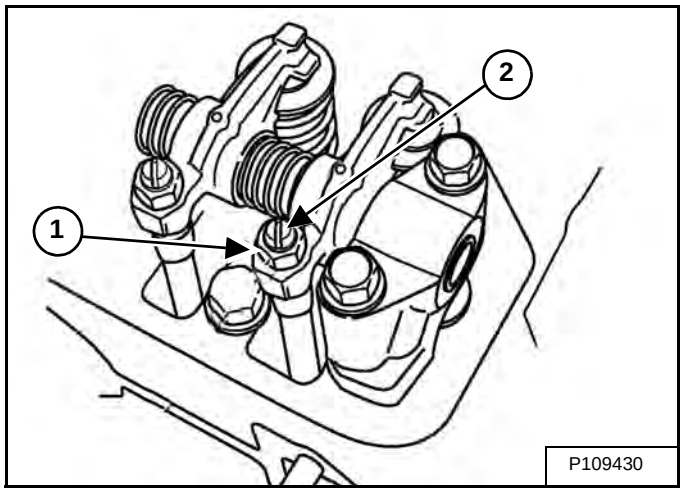
Figure 60-80-1



Insert a feeler gauge (Item 1) between the rocker arm and valve cap (Item 2) **[Figure 60-80-1]**, and record the measured valve clearance. (Use the data for estimating the wear.)

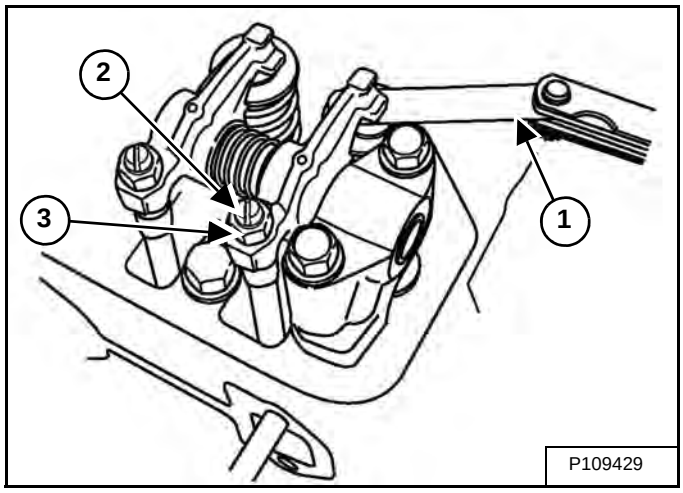
If adjustment is required, proceed to the next step. If no adjustment is required, inspect the rest of the valves and adjust as required.

Figure 60-80-2



Loosen the valve adjusting screw lock nut (Item 1) **[Figure 60-80-2]** and valve adjusting screw (Item 2) on the rocker arm and check the valve for inclination of the valve cap, entrance of dirt, or wear.

Figure 60-80-3



Insert a feeler gauge of the correct thickness (Item 1) (See table below) between the rocker arm and valve cap. Turn the valve adjustment screw (Item 2) **[Figure 60-80-3]** to adjust the valve clearance so there is a slight drag on the feeler gauge when sliding it between the rocker arm and the valve cap.

Hold the adjusting screw while tightening the valve adjusting screw lock nut (Item 3) **[Figure 60-80-3]**.

Valve clearance	Factory spec.	0,15 - 0,25 mm (0.006 - 0.010 in)

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Cylinder Head Removal And Installation

Drain the coolant from the engine into a suitable container. (See Removing And Replacing Coolant on Page 10-110-2.)

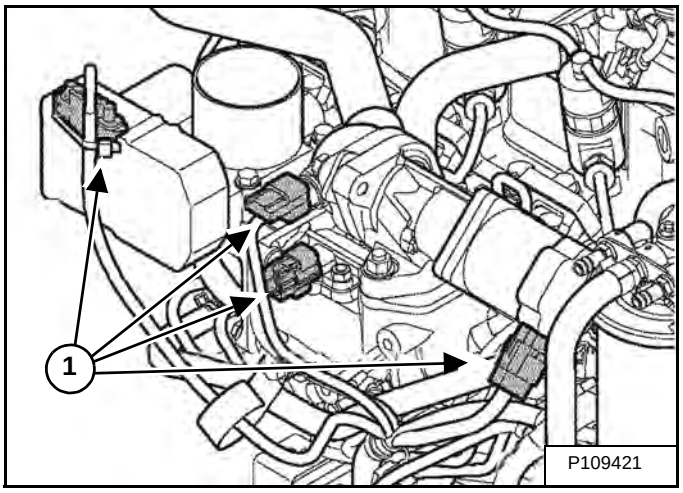
Remove the diesel particulate filter from the engine. (See Removal And Installation on Page 60-30-2.)

Remove the coolant pump. (See Water Pump Removal And Installation on Page 60-50-9.)

Remove the high-pressure fuel lines and injectors from the cylinder head. (See Fuel Injector Removal And Installation on Page 60-70-9.)

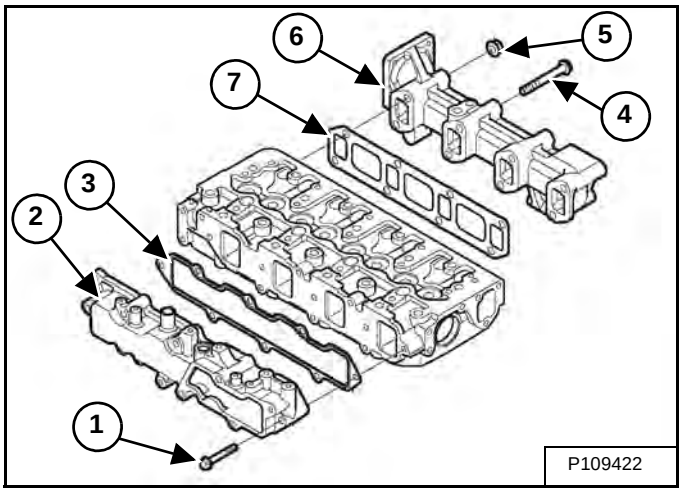
Remove the fuel rail and return fuel lines from the cylinder head. (See Fuel Rail Assembly Removal And Installation on Page 60-70-7.)

Figure 60-80-4



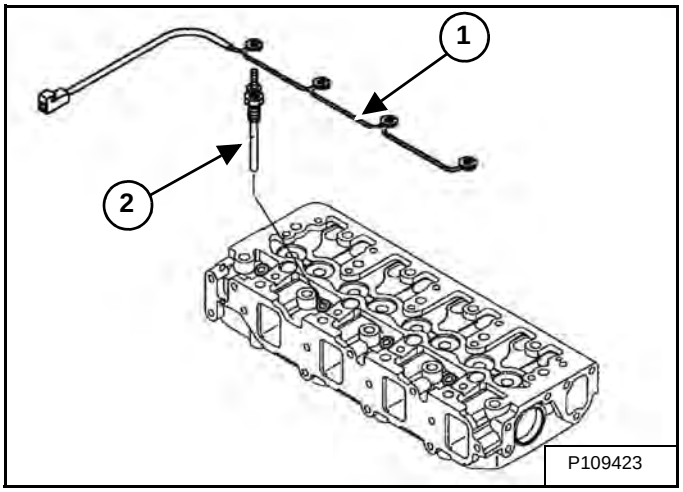
Disconnect the electrical wires from the glow plug, injector, intake throttle, EGR valve and sensors (Item 1) **[Figure 60-80-4]**.

Figure 60-80-5



Remove the intake manifold bolts (Item 1). Remove the intake manifold (Item 2). Discard the intake manifold gasket (Item 3). Remove the exhaust manifold bolts (Item 4) and nuts (Item 5). Remove the exhaust manifold (Item 6) and the exhaust manifold gasket (Item 7) **[Figure 60-80-5]**. Discard and replace of the original gaskets with new gaskets.

Figure 60-80-6



Remove the glow plug harness (Item 1) from each glow plug (Item 2) **[Figure 60-80-6]**. Remove the glow plug from the cylinder head.

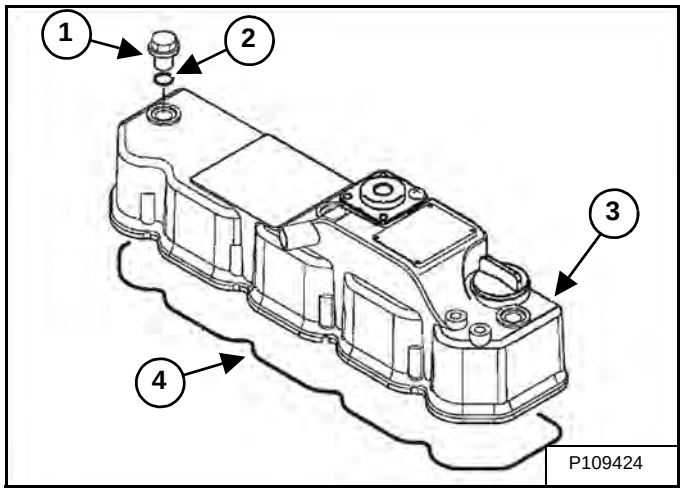
NOTE: Remove the glow plugs in advance to avoid damaging to the tips protruding below the cylinder head combustion chamber surface.

Installation: Install the glow plugs and tighten to 15 - 20 N•m (133 - 177 in-lb) torque. Install the harness and tighten the nuts to 1,0 - 1,5 N•m (9 - 13 in-lb) torque.

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Cylinder Head Removal And Installation (Cont'd)

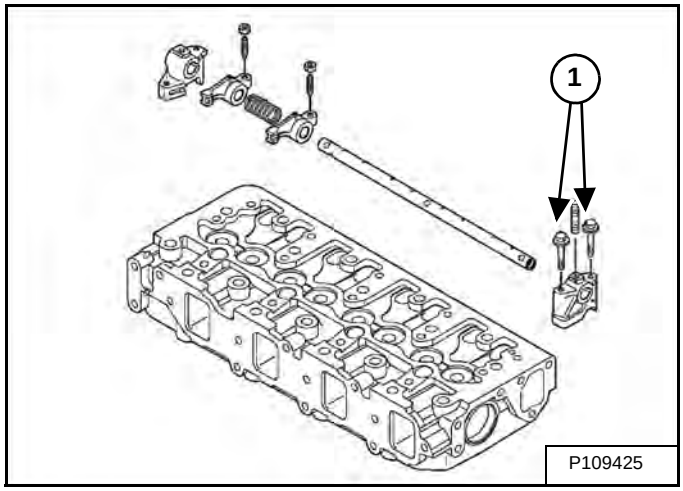
Figure 60-80-7



Remove the valve cover bolts (Item 1) and O-rings (Item 2). Remove the valve cover (Item 3) and valve cover gasket (Item 4) **[Figure 60-80-7]**.

Installation: Install the valve cover and tighten the nuts to 12 - 15 N•m (8.9 - 11 ft-lb) torque.

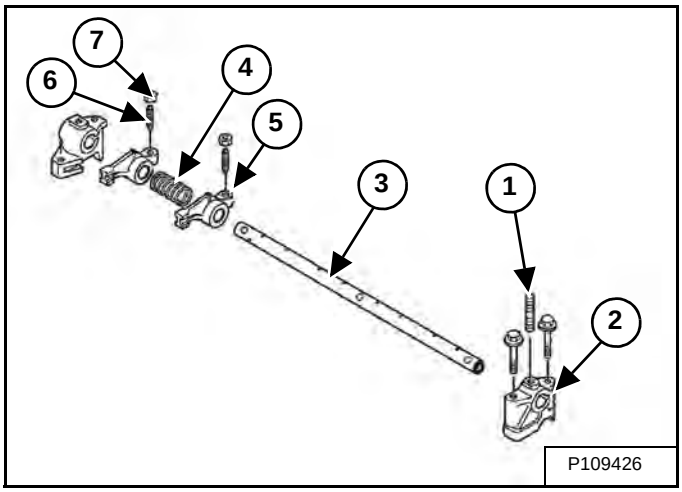
Figure 60-80-8



Remove the bolts (Item 1) that retain the rocker arm shaft supports. Remove the rocker arm shaft assembly from the cylinder head. Remove the push rods (not shown) **[Figure 60-80-8]**.

NOTE: Mark the push rods and rocker arms so the parts are reinstalled in their original positions.

Figure 60-80-9

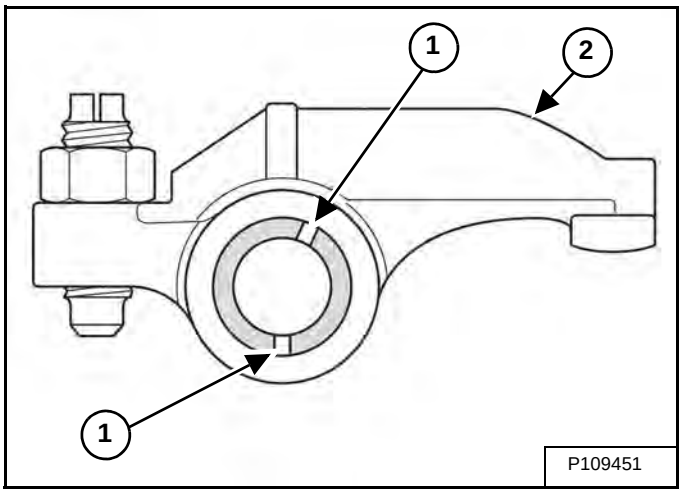


Remove the rocker arm shaft alignment stud (Item 1) from support (Item 2) **[Figure 60-80-9]**.

NOTE: Clamp the support in a padded vise. Twist and pull out on the rocker arm shaft to remove.

Slide the rocker arm shaft (Item 3) out of the rocker arm supports (Item 2), springs (Item 4), and rocker arms (Item 5). Remove the valve adjusting screw (Item 6) and the lock nut (Item 7) **[Figure 60-80-9]** from the rocker arms.

Figure 60-80-10

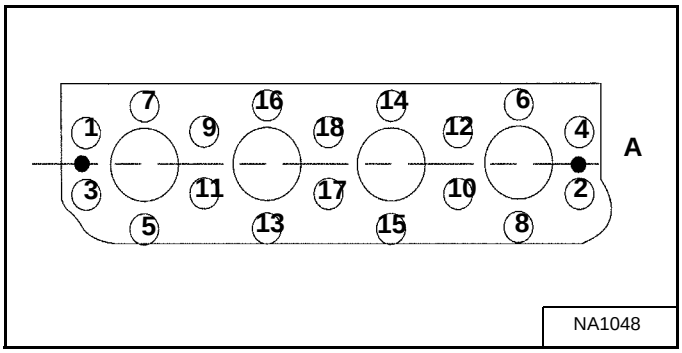


Installation: The lubrication holes (Item 1) in the rocker arm shaft must be oriented correctly with respect to the rocker arms (Item 2) **[Figure 60-80-10]**. Align the push rods with their respective rocker arms. Adjust the valve clearance.

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Cylinder Head Removal And Installation (Cont'd)

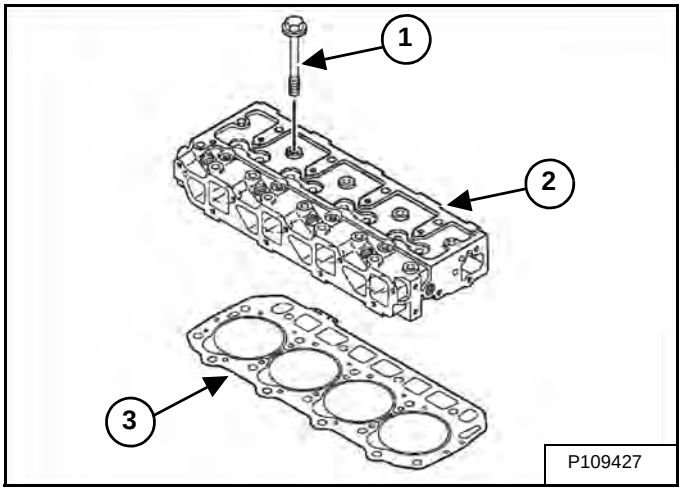
Figure 60-80-11



Loosen the cylinder head bolts in the sequence shown **[Figure 60-80-11]**.

NOTE: A is the cooling fan end.

Figure 60-80-12



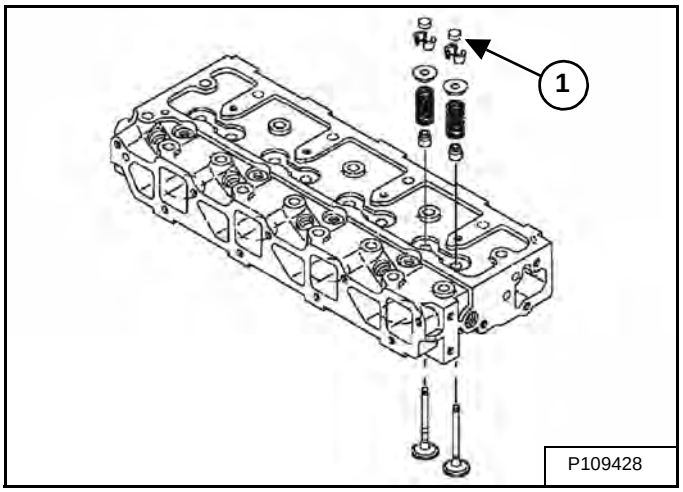
Remove the bolts (Item 1). Remove the cylinder head (Item 2) and remove and discard the gasket (Item 3) **[Figure 60-80-12]**.

NOTE: Place the cylinder head on a flat surface to avoid damage to the combustion surface.

Installation: Apply a light film of oil to the bolt threads. Tighten the bolts in the correct sequence of #18 to #1, to 103 - 113 N•m (76 - 83 ft-lb) torque **[Figure 60-80-11]**.

Cylinder Head Disassembly And Assembly

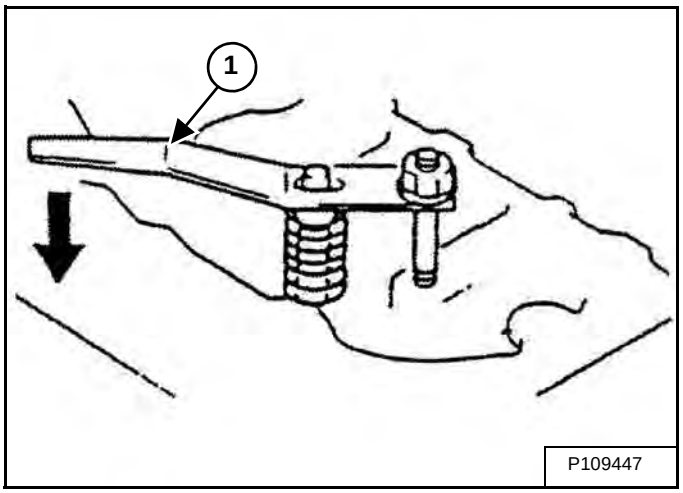
Figure 60-80-13



Place the cylinder head on a work bench with the combustion side down. Remove the valve cap (Item 1) **[Figure 60-80-13]**.

NOTE: If the valves are to be reused, identify the valves and the caps so they can be reinstalled in their original locations.

Figure 60-80-14

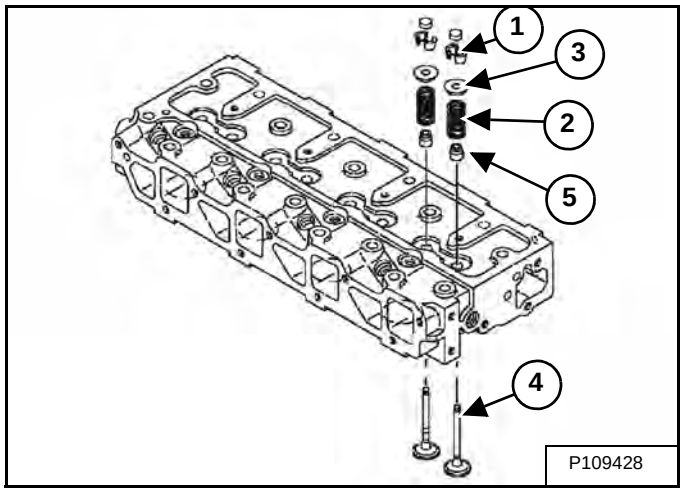


Use a valve spring compressor tool (Item 1) **[Figure 60-80-14]** to compress the valve spring.

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Cylinder Head Disassembly And Assembly (Cont'd)

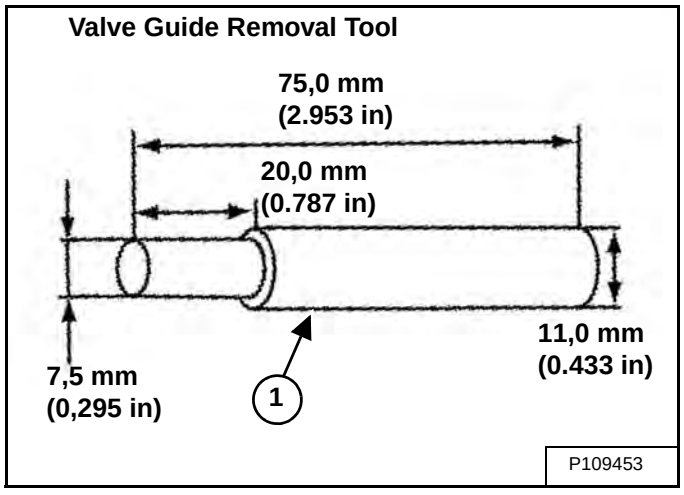
Figure 60-80-15



Remove the valve keepers (Item 1). Slowly release the tension on the valve spring (Item 2). Remove the spring retainer (Item 3) **[Figure 60-80-15]** and valve spring. Repeat the procedure with the remaining valves.

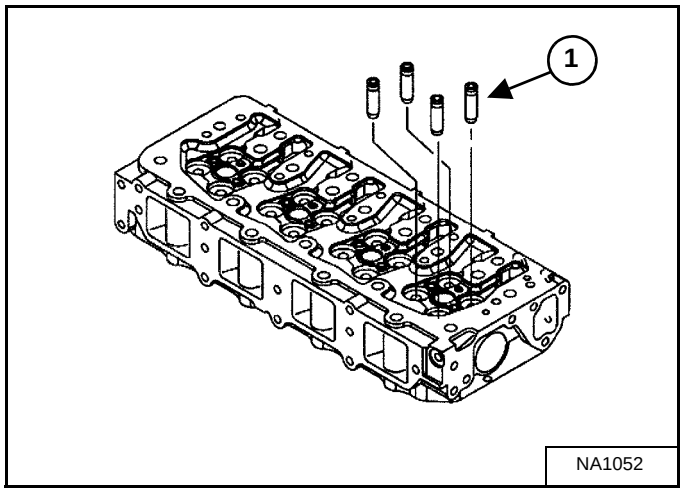
Turn the cylinder head so the exhaust port side faces down. Remove the valves (Item 4) **[Figure 60-80-15]** and the valve stem seals (Item 5).

Figure 60-80-16



The tool (Item 1) **[Figure 60-80-16]** above is not provided. The tool is used for ***removing*** the valve guides. Use the dimensions shown to make this tool.

Figure 60-80-17

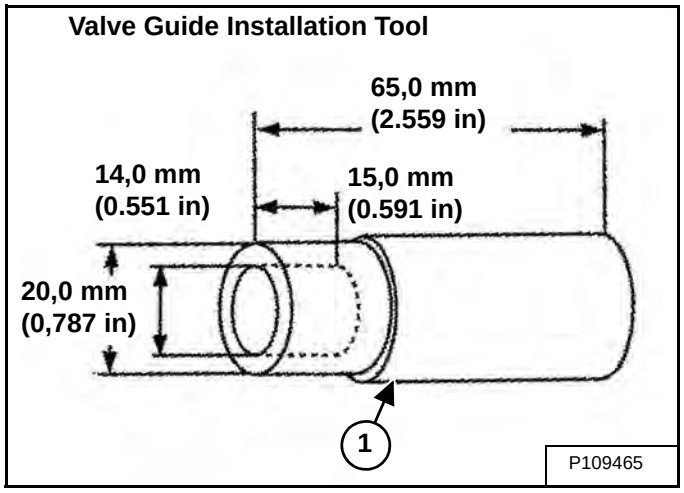


Use the valve guide tool or other appropriate tool to drive the valve guides (Item 1) **[Figure 60-80-17]** out of the head.

NOTE: Do not remove the valve guides until the inspection and measurement procedures have been performed (See Valve Guide - Inspection on Page 60-80-8.).

Installation: The valve guides have a tight press fit. Before installing, place the valve guides in a freezer for at least twenty minutes. Immediately after removing the valve guides from the freezer, insert the valve guides (Item 1) **[Figure 60-80-17]** in their proper positions.

Figure 60-80-18

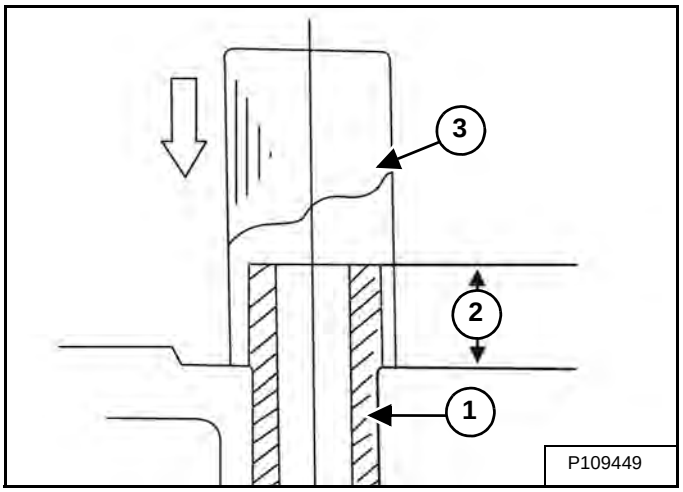


The tool (Item 1) **[Figure 60-80-18]** above is not provided. The tool is used for ***installing*** the valve guides. Use the dimensions shown to make this tool.

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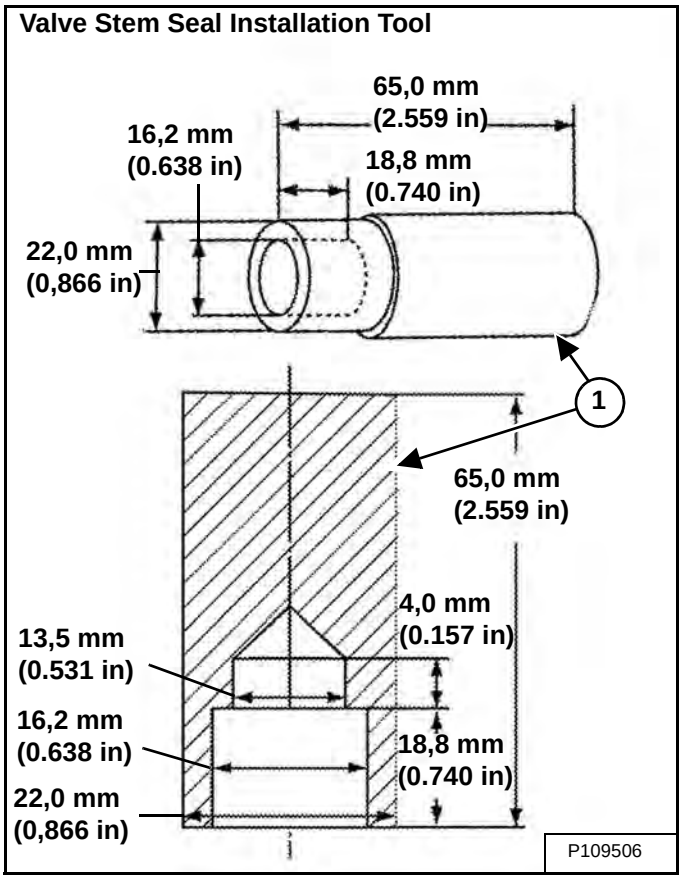
Cylinder Head Disassembly And Assembly (Cont'd)

Figure 60-80-19



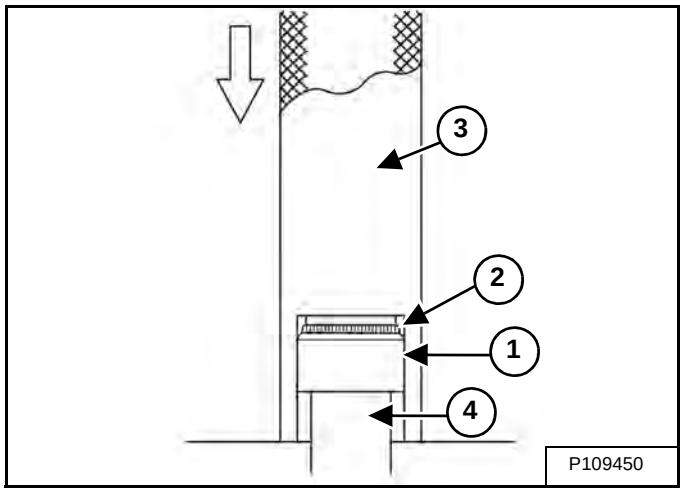
Finish installing the valve guides (Item 1) into the cylinder head to the proper height (Item 2) using the valve guide installation tool (Item 3) **[Figure 60-80-19]**.

Figure 60-80-20



The tool (Item 1) **[Figure 60-80-20]** above is not provided. The tool is used for ***installing*** the valve stem seals. Use the dimensions shown to make this tool.

Figure 60-80-21

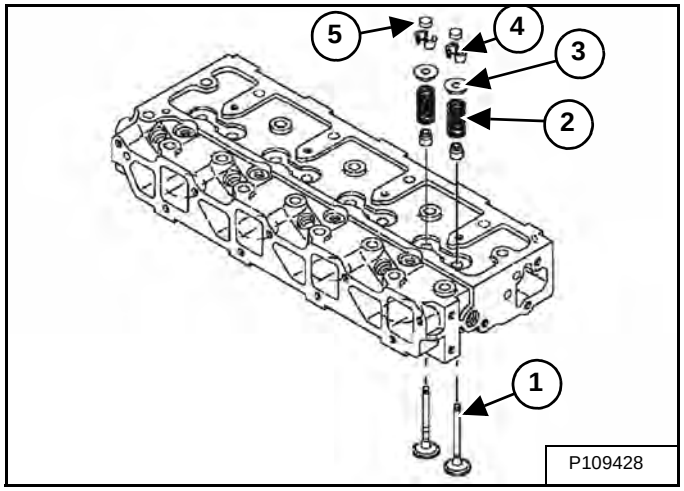


Install new valve stem seals (Item 1) **[Figure 60-80-21]** in the correct locations.

NOTE: The exhaust and intake valve stem seals are different and can be identified by either paint marks on the outside of the seals or by the seal spring (Item 2) [Figure 60-80-21] color.

Apply oil to the lip of the valve stem seal (Item 1). Use the valve stem seal installation tool (Item 3), to install a new valve stem seal on each of the valve guides (Item 4) **[Figure 60-80-21]**.

Figure 60-80-22



Turn the cylinder head so the exhaust port side faces down. Install all the valves (Item 1) **[Figure 60-80-22]** in their proper location in the cylinder head.

Turn the cylinder head so the combustion side faces down. Install the valve spring (Item 2) and spring retainer (Item 3) **[Figure 60-80-22]**.

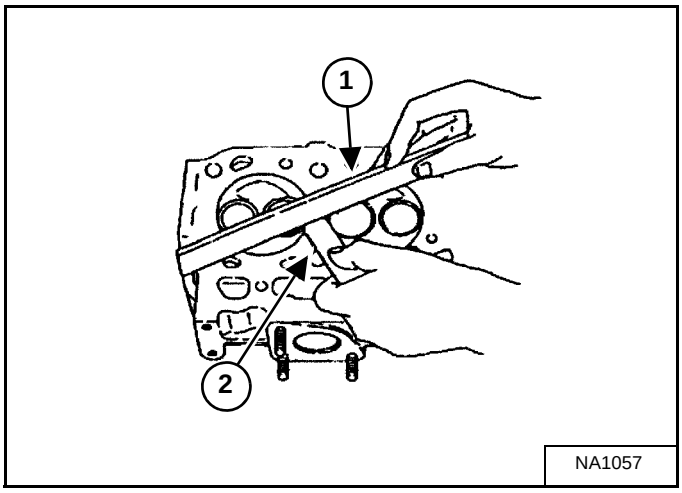
Using the valve spring compressor tool, compress the valve spring. Insert the valve keepers (Item 4) and slowly release the tension in the valve spring. Install the valve cap (Item 5) **[Figure 60-80-22]**. Repeat the procedure on all the remaining valves.

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Cylinder Head - Servicing

Thoroughly clean the surface of the cylinder head and all components using a non-metallic brush and an appropriate solvent. Each part must be free of carbon, metal filings and other debris.

Figure 60-80-23

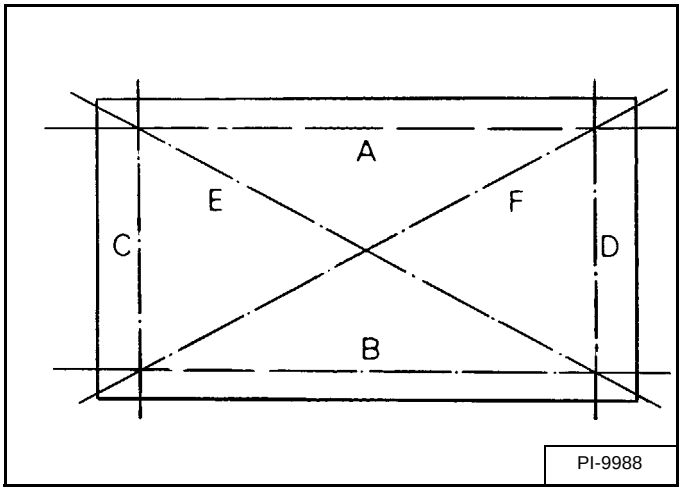


Put a straight edge (Item 1) **[Figure 60-80-23]** on the cylinder head.

NOTE: Do not put the straight edge across combustion chambers.

Put a feeler gauge (Item 2) **[Figure 60-80-23]** between the straight edge and the surface of the cylinder head.

Figure 60-80-24



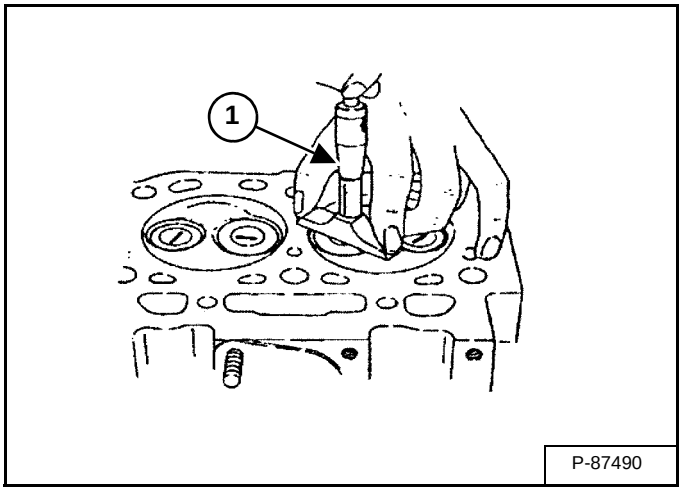
Put the straight edge on the cylinder head's four sides and on the two diagonals as shown **[Figure 60-80-24]**.

The maximum distortion of the head surface is ± 0,15 mm (± 0.0059 in). If the measurement exceeds the specification, replace the cylinder head.

Valve Guide - Inspection

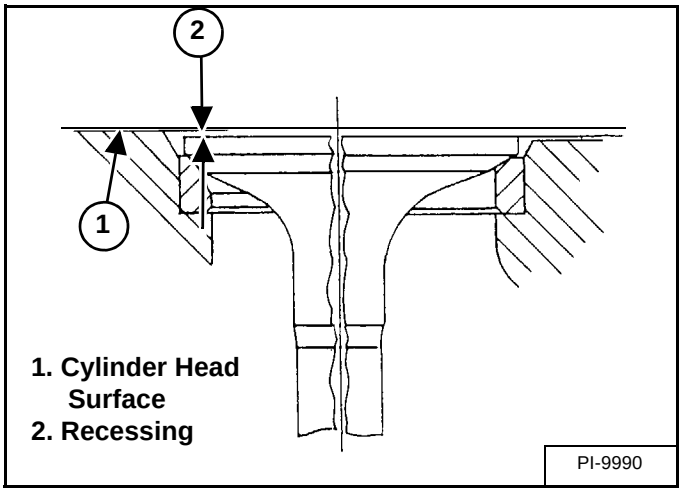
Clean the valve seat and combustion chamber.

Figure 60-80-25



Install the valve into the guide in their original locations. Measure the valve recessing with a depth gauge (Item 1) **[Figure 60-80-25]**.

Figure 60-80-26



If the measurement exceeds the allowable limit, replace the valve or cylinder head **[Figure 60-80-26]**.

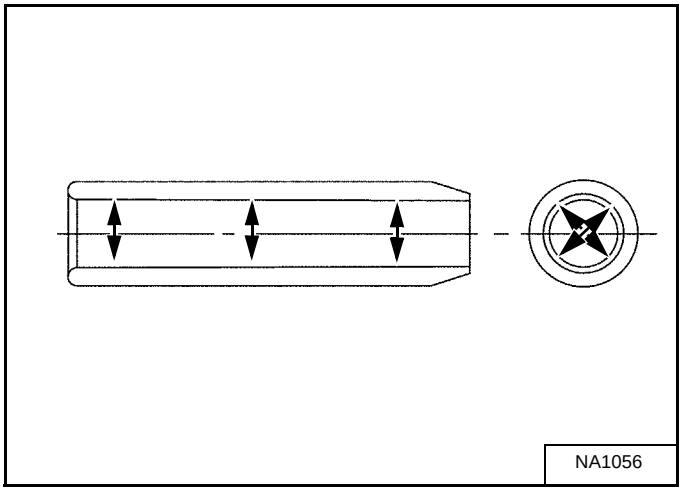
Recessing (Intake)	0,36 - 0,56 mm (0.0142 - 0.0220 in)
Recessing (Exhaust)	0,35 - 0,55 mm (0.0138 - 0.0217 in)
Allowable Limit (Intake, Exhaust)	0,8 mm (0.0315 in)

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Valve Guide - Inspection (Cont'd)

Inspect the valve guides for wear or other damage and replace as required.

Figure 60-80-27



Measure the valve guide I.D. at three different depths and 90° apart **[Figure 60-80-27]**.

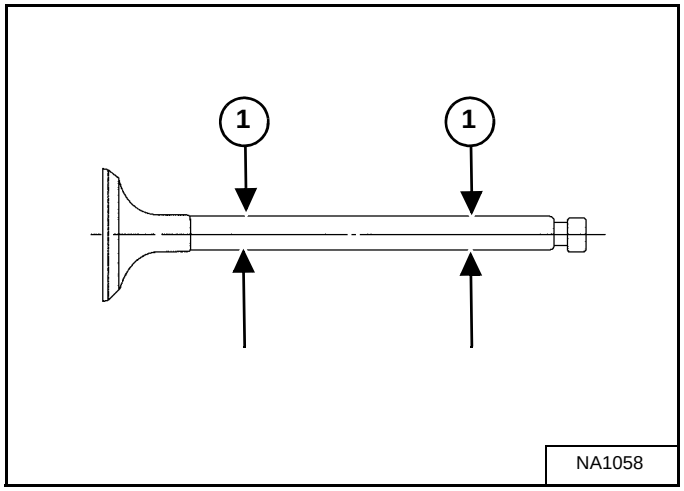
NOTE: Measure the valve guides while they are still installed in the cylinder head.

Valve Guide I.D.	7,0 - 7,015 mm (0.2756 - 0.2762 in)
Allowable Limit	7,08 mm (0.2787 in)
Valve Guide Projection From Cylinder Head	14,7 - 15,0 mm (0.5791 - 0.5905 in)

Intake And Exhaust Valve - Inspection

Inspect the intake and exhaust valves. Replace any valves that are obviously discolored, heavily pitted or otherwise damaged.

Figure 60-80-28



Measure the valve stem diameter (Item 1) **[Figure 60-80-28]** where shown.

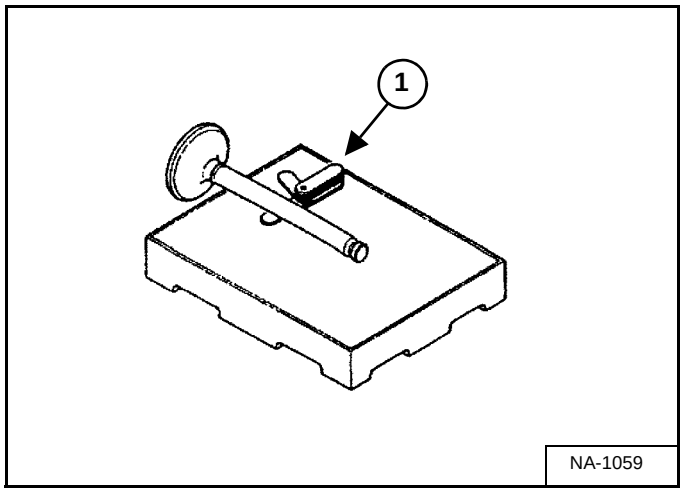
Intake Valve Stem O.D.	6,945 - 6,960 mm (0.2734 - 0.2740 in)
Allowable Limit (Intake, Exhaust)	6,90 mm (0.2717 in)

Exhaust Valve Stem O.D.	6,940 - 6,955 mm (0.2732 - 0.2738 in)
Allowable Limit (Intake, Exhaust)	6,90 mm (0.2717 in)

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Valve Stem Bend - Inspection

Figure 60-80-29



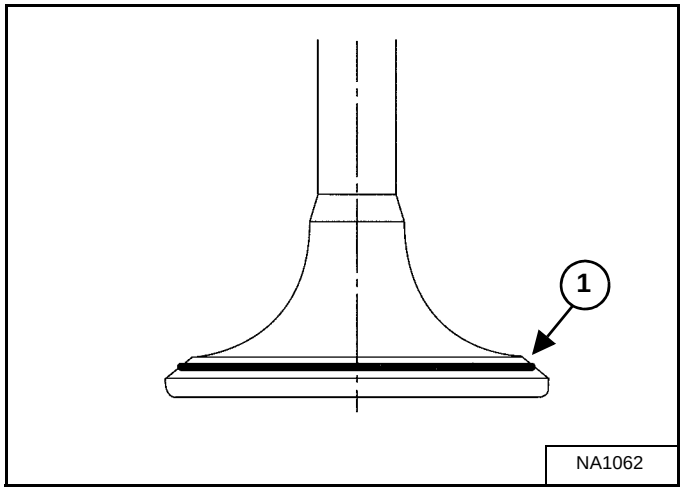
Place the valve stem on an inspection block. Roll the valve until a gap can be observed between a portion of the valve stem and the surface of the block or bed. Use a feeler gauge (Item 1) **[Figure 60-80-29]** to measure the gap.

Intake Valve Stem Bend	0,040 - 0,070 mm (0.0016 - 0.0028 in)
Exhaust Valve Stem Bend	0,045 - 0,075 mm (0.0018 - 0.0030 in)
Allowable Limit	0,17 mm (0.0067 in)

Valve Face And Seat

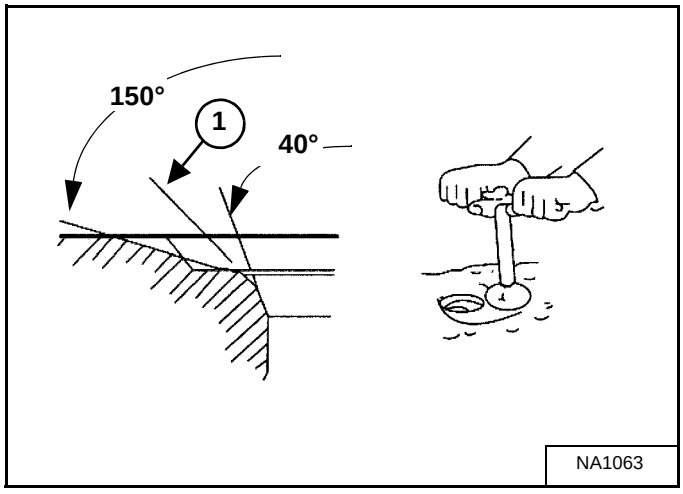
Inspect the seating surfaces of each valve and valve seat for wear, damage or evidence of overheating. Severely worn or damaged components will require replacement.

Figure 60-80-30



Coat the valve seat with a thin coat of bluing compound. Install the valve and rotate to distribute bluing onto the valve face. The contact pattern on the valve face (Item 1) **[Figure 60-80-30]** should be approximately centered and even in width.

Figure 60-80-31



The valve seat diameter (Item 1) **[Figure 60-80-31]** can be adjusted by top grinding with a 150° stone to make the seat diameter smaller, and bottom grinding using a 40° stone to make the seat diameter larger.

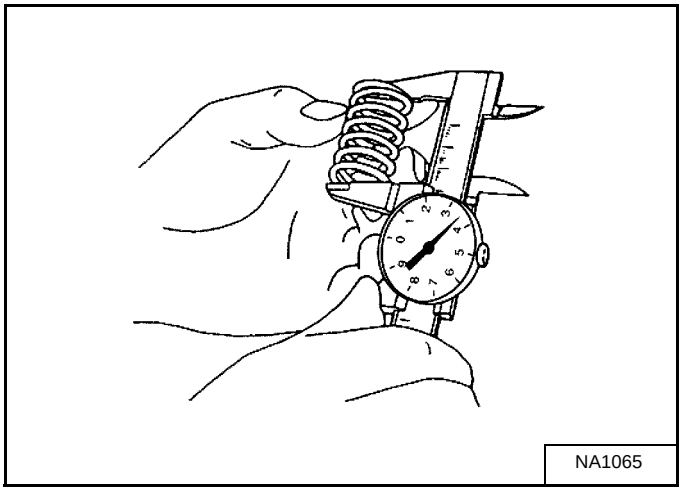
Seat Angle	Intake 120°
	Exhaust 90°

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Valve Spring - Inspection

Inspect the valve springs. If damage or corrosion is seen, or if measurements exceed the specified limits, replace the springs.

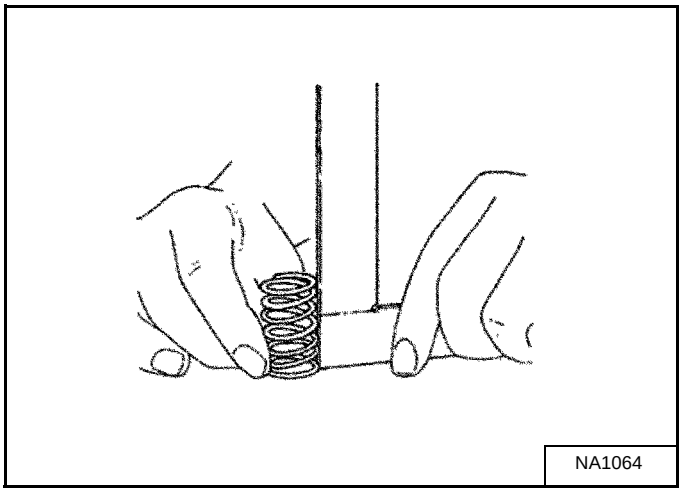
Figure 60-80-32



Measure the valve spring free length **[Figure 60-80-32]**.

Free Length	47,5 mm (1.8701 in)
Allowable Limit	47,0 mm (1.8504 in)

Figure 60-80-33

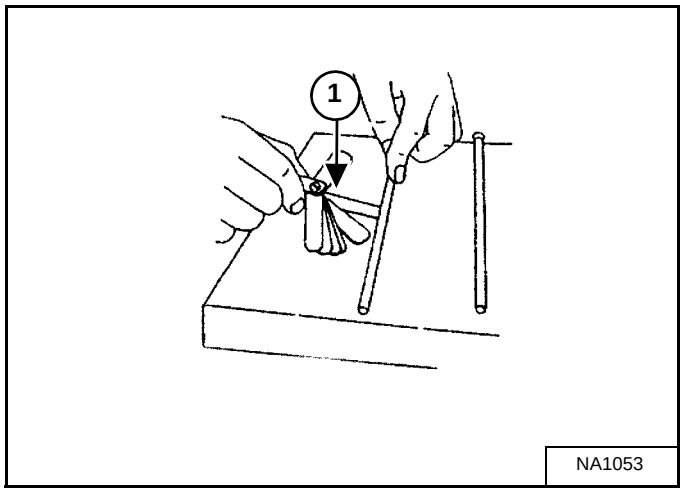


Use a flat surface and square to check the springs for squareness **[Figure 60-80-33]**.

Squareness Allowable Limit	1,2 mm (0.0472 in)

Push Rod - Inspection

Figure 60-80-34



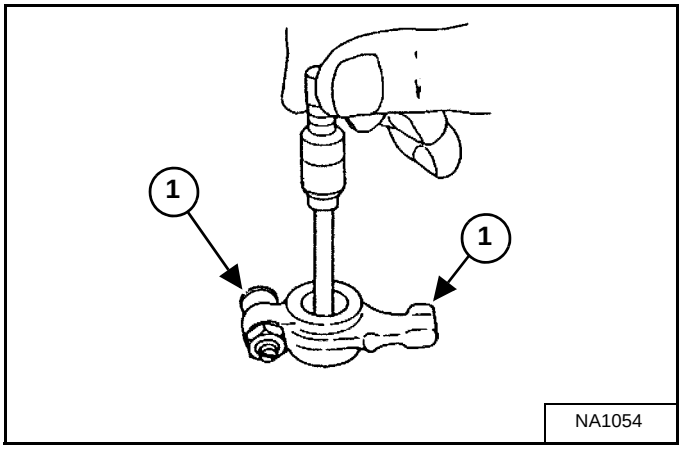
Place the push rod on an inspection block. Roll the push rods until a gap can be observed between a portion of the push rod and the surface of the block. Use a feeler gauge (Item 1) **[Figure 60-80-34]** to measure the gap.

Push Rod Bend	Less than 0,03 mm (0.0012 in)
Allowable Limit	0,03 mm (0.0012 in)

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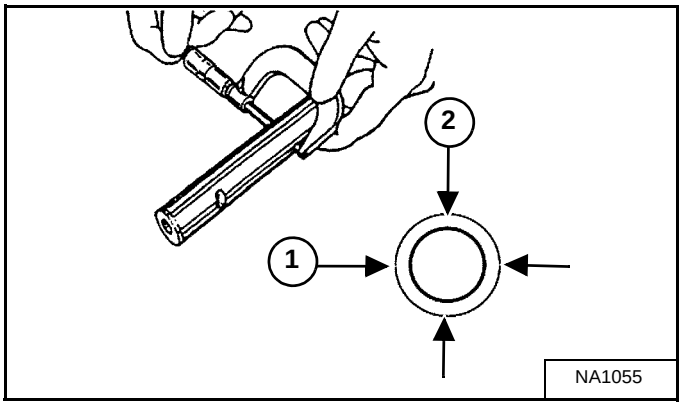
Rocker Arm - Inspection

Figure 60-80-35



Inspect the rocker arm contact areas (Item 1) **[Figure 60-80-35]** for wear or damage and replace as required. Measure the inside diameter (I.D.) of the rocker arm bore.

Figure 60-80-36



Measure the outside diameter (O.D.) of the rocker arm shaft at two points 90° apart (Item 1) and (Item 2) **[Figure 60-80-36]**.

Calculate the oil clearance (difference) between the shaft O.D. and rocker arm bore I.D.

Rocker Arm Bore I.D.	18,5 - 18,52 mm (0.7283 - 0.7291 in)
Allowable Limit	18,57 mm (0.7311 in)
Shaft O.D.	18,47 - 18,49 mm (0.7272 - 0.7280 in)
Allowable Limit	18,44 mm (0.7260 in)
Oil Clearance	0,010 - 0,050 mm (0.004 - 0.0020 in)
Allowable Limit	0,13 mm (0.0051 in)

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CRANKSHAFT AND PISTONS

Piston And Connecting Rod Removal And Installation

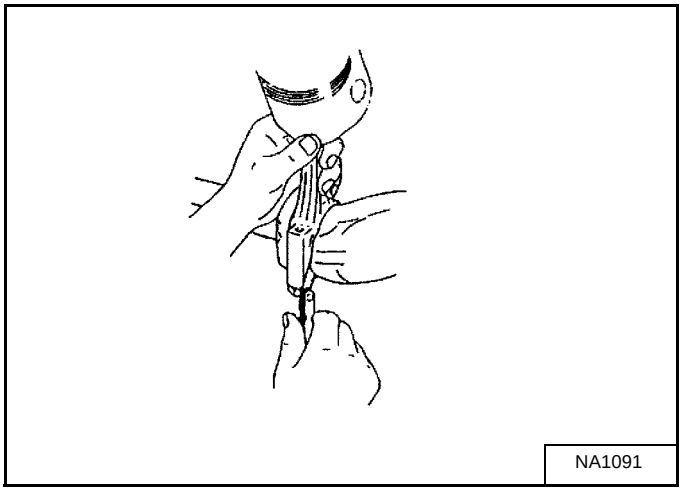
Remove the oil pan. (See Oil Pan Removal And Installation on Page 60-60-1.)

Remove the cylinder head. (See Cylinder Head Removal And Installation on Page 60-80-3.)

NOTE: Keep the piston pin parts, piston assemblies, and connecting rod assemblies together to be returned to the location and same position during the reassembly process. Mark the parts using an appropriate method.

NOTE: Remove the top ridge from the cylinder bore with a ridge reamer before removing the pistons.

Figure 60-90-1



Using a feeler gauge, measure the connecting rod side clearance **[Figure 60-90-1]**. If the measurement is out of specification, replace the crankshaft, connecting rod, or both.

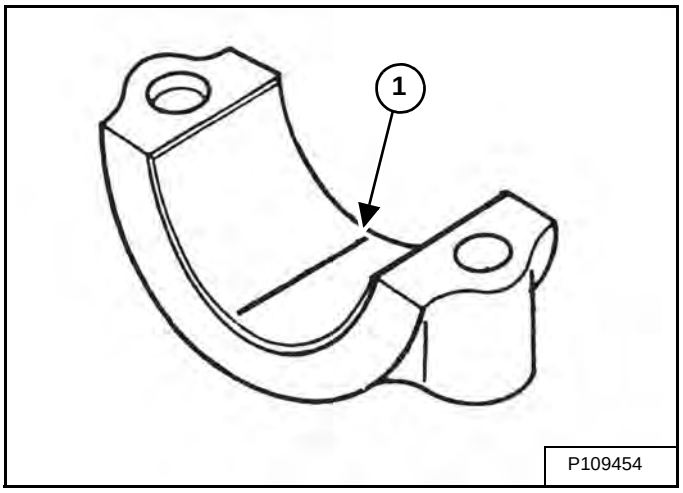
Connecting Rod Side Clearance	0,20 - 0,40 mm (0.0079 - 0.0157 in)

Remove the bearing cap to measure the bearing oil clearance. Do this before removing the pistons and connecting rods to determine the extent of bearing wear.

NOTE: Do not remove the bearing inserts at this time.

Wipe oil from the bearing insert and crankshaft journal surfaces.

Figure 60-90-2

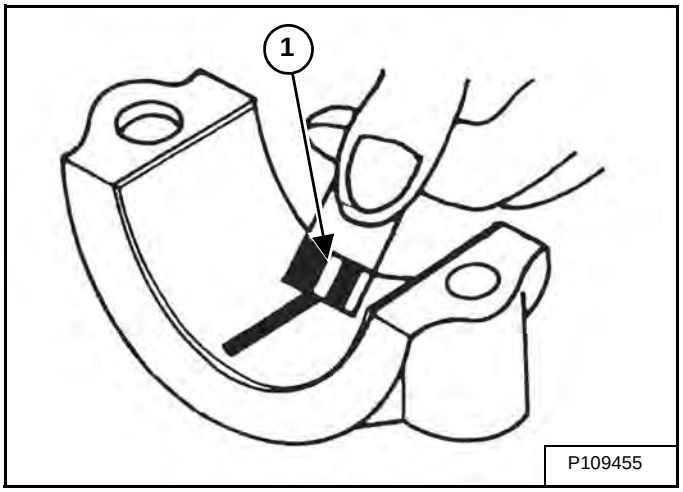


Place a piece of PLASTIGAGE (Item 1) **[Figure 60-90-2]** along the full width of the bearing insert.

NOTE: Do not rotate the crankshaft when using the PLASTIGAGE. A false reading may result.

Reinstall bearing cap and tighten to specification. Remove bearing cap.

Figure 60-90-3



Compare the width of the flattened PLASTIGAGE to the graduation marks on the package (Item 1) **[Figure 60-90-3]**. The mark that most closely matches the width of the flattened PLASTIGAGE will indicate the oil clearance.

Oil Clearance	0,025 - 0,051 mm (0.0010 - 0.0020 in)
Oil Clearance Allowable Limit	0,109 mm (0.0043 in)

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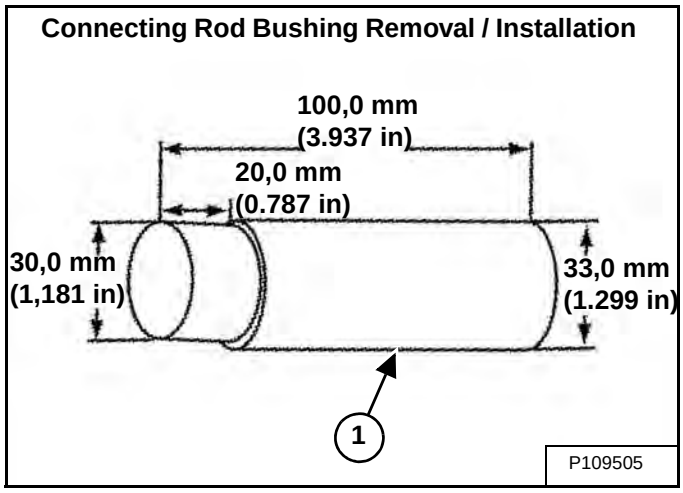
Piston And Connecting Rod Removal And Installation (Cont'd)

To remove the cylinders, use a wooden dowel against the connecting rod and tap the piston / connecting rod assembly out of the cylinder.

NOTE: To avoid damage to the bearing journal, do NOT allow the connecting rod to contact the crankshaft journal.

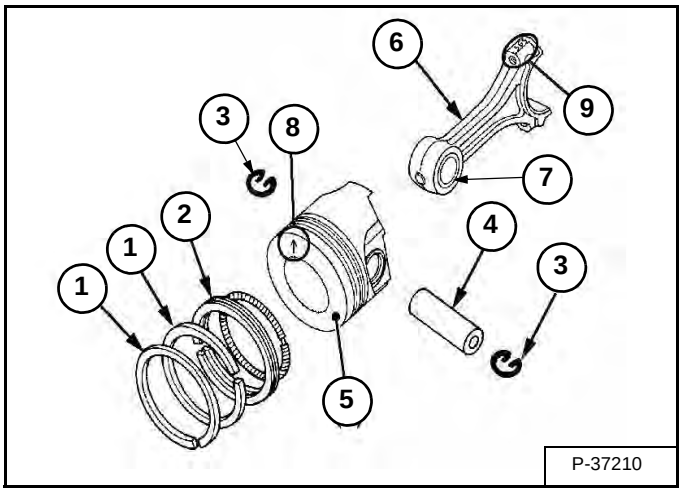
NOTE: Mark the cylinder number on the piston and connecting rod for reassembly.

Figure 60-90-4



The tool (Item 1) **[Figure 60-90-4]** above is not provided. The tool is used for ***removing and installing*** the connecting rod bushings. Use the dimensions shown to make this tool.

Figure 60-90-5



Remove the compression rings (Item 1), oil ring (Item 2), circlips (Item 3) and wrist pin (Item 4) from the piston (Item 5) **[Figure 60-90-5]**.

Remove the connecting rod (Item 6) and bearing (Item 7) **[Figure 60-90-5]**.

NOTE: When using the existing crank bearings, put marks on the crank pin bearing and the connecting rod in order to keep their position.

Repeat the procedure until all pistons are removed and disassembled.

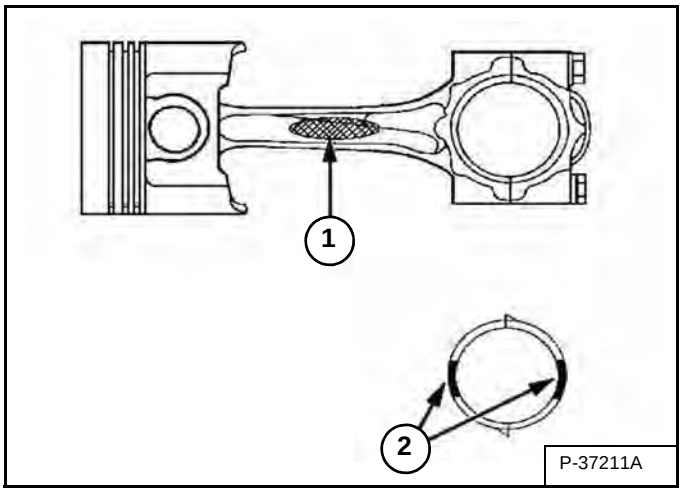
Installation: When installing the piston pin, immerse the piston in 80° C (176° F) oil for 10 to 15 minutes and insert the piston pin to the piston.

Assemble the piston to the connecting rod with the ↑ mark (Item 8) and the connecting rod numbering mark (Item 9) **[Figure 60-90-5]** facing same side.

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Piston And Connecting Rod Removal And Installation (Cont'd)

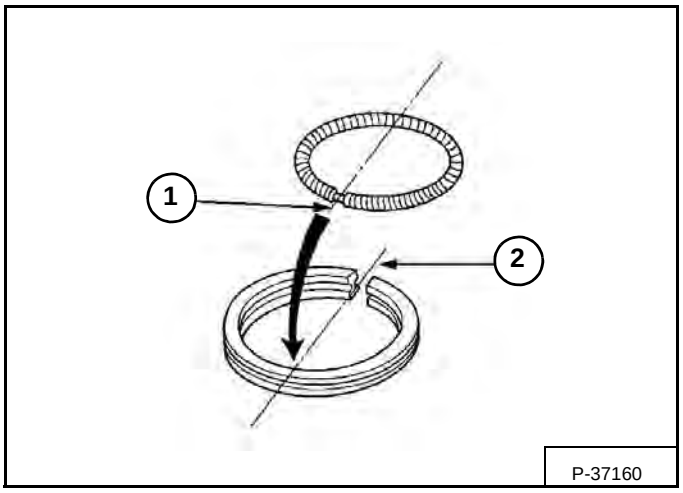
Figure 60-90-6



Be sure the crank pin bearing and the connecting rod are the same I.D. colors (Items 1 and 2) **[Figure 60-90-6]**.

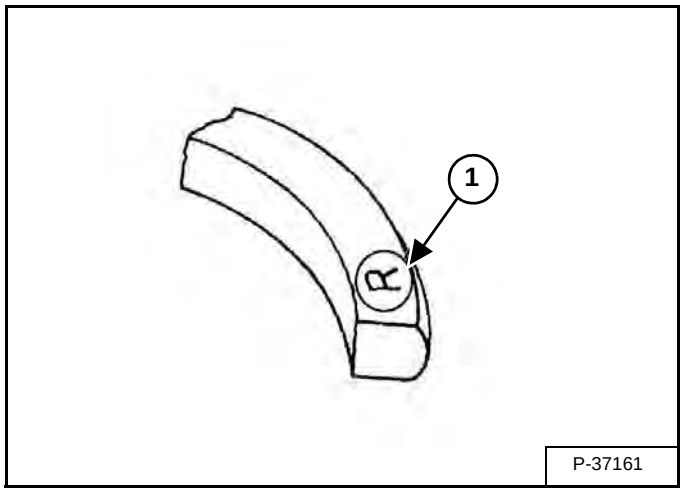
NOTE: The connecting rod is drilled for oil passage to pin bushing. Make sure to line up pin bushing to avoid oil starvation to piston pin.

Figure 60-90-7



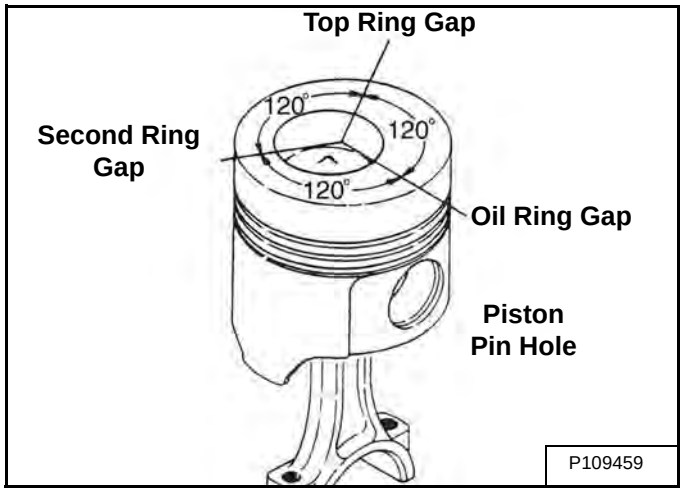
When installing the oil ring onto the piston, place the expander joint (Item 1) on the opposite side of the oil ring gap (Item 2) **[Figure 60-90-7]**.

Figure 60-90-8



When installing the ring, assemble the rings so that the manufacturer's mark (Item 1) **[Figure 60-90-8]** near the gap faces the top of the piston.

Figure 60-90-9



The piston ring gaps must be located a 120° intervals **[Figure 60-90-9]**.

NOTE: Do not position the top piston ring end gap in line with the piston pin holes.

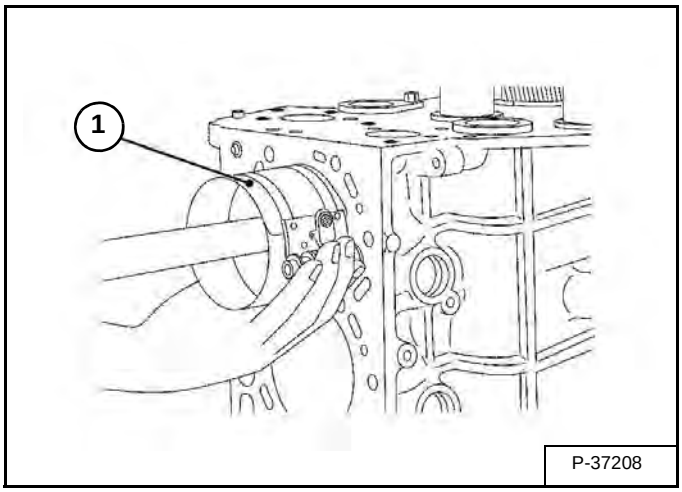
Before installing the piston into the cylinder, apply engine oil to the cylinder to aid in reassembly and initial startup.

NOTE: Locate each piston and cylinder combination by the markings made earlier.

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Piston And Connecting Rod Removal And Installation (Cont'd)

Figure 60-90-10

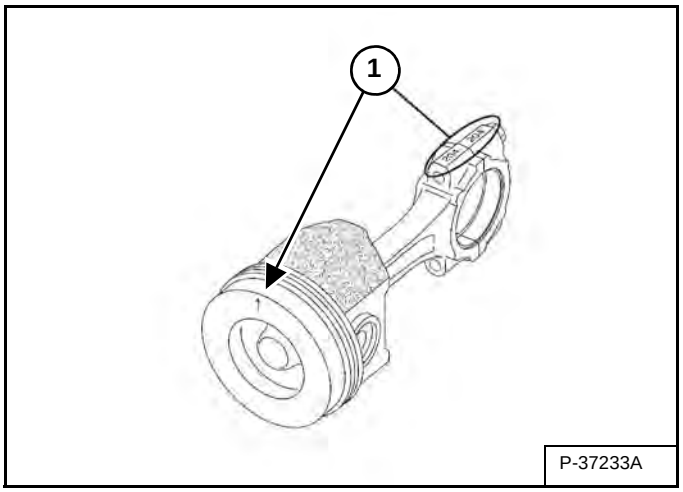


Install the pistons using a piston ring compressor (Item 1) **[Figure 60-90-10]**.

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Piston And Connecting Rod - Servicing

Figure 60-90-11



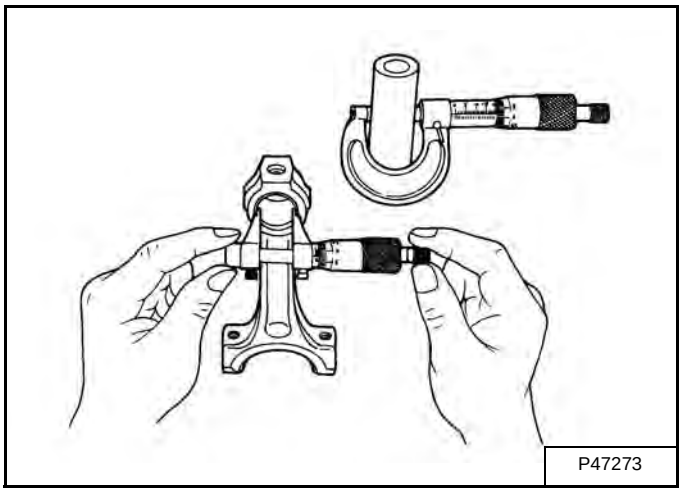
When installing the piston into the cylinder, face the marks (Item 1) **[Figure 60-90-11]** on the connecting rod and top of piston toward the injection pump side of the engine.

Install the bearing inserts in the connecting rod and cap. Apply a liberal coat of clean engine oil to the bearing inserts and crankshaft journal.

Apply engine oil to the connecting rod bolts and lightly thread in by hand, then tighten to the specified torque.
If the connecting rod bolts do not thread together smoothly, clean the threads. If the connecting rod bolt is still hard to thread in, replace it.

Tightening torque	Connecting rod bolt	53,9 - 58,8 N•m (40 - 43 ft-lb)

Figure 60-90-12



Measure the O.D. of the piston pin where it contacts the bushing with an outside micrometer **[Figure 60-90-12]**.

Measure the I.D. of the piston pin bushing at the connecting rod small end with a cylinder gauge **[Figure 60-90-12]**.

If the clearance (difference) exceeds the allowable limit, replace the bushing. If it still exceeds the allowable limit, replace the piston pin.

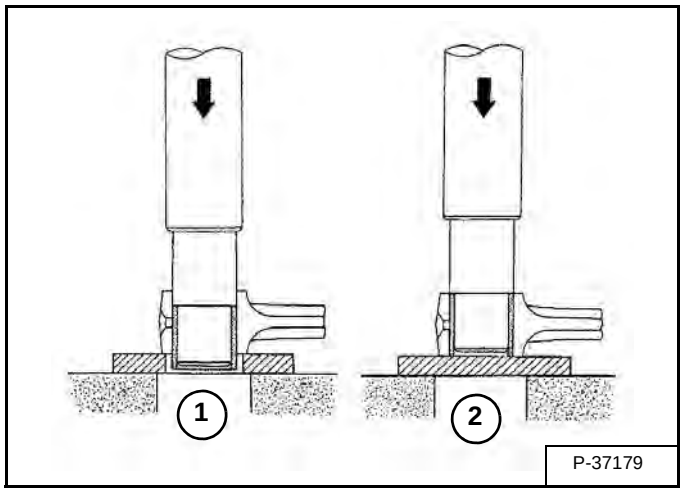
Oil clearance between piston pin and small end bushing	Factory spec.	0,025 - 0,51 mm (0.0010 - 0.0020 in)
	Allowable limit	0,109 mm (0.0043 in)

Piston pin O.D.	Factory spec.	29,987 - 30,0 mm (1.1806 - 1.1811 in)
Small end bushing I.D.	Factory spec.	30,025 - 30,038 mm (1.1821 - 1.1826 in)

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Piston And Connecting Rod - Servicing (Cont'd)

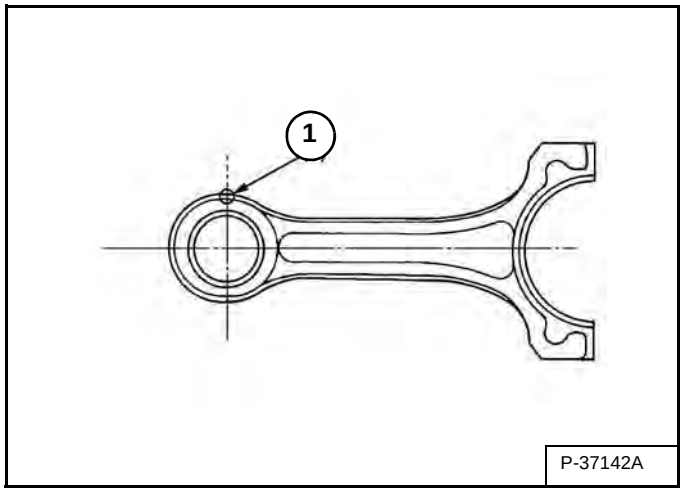
Figure 60-90-13



Press out the used bushing using a small end bushing replacing tool (Item 1) **[Figure 60-90-13]**.

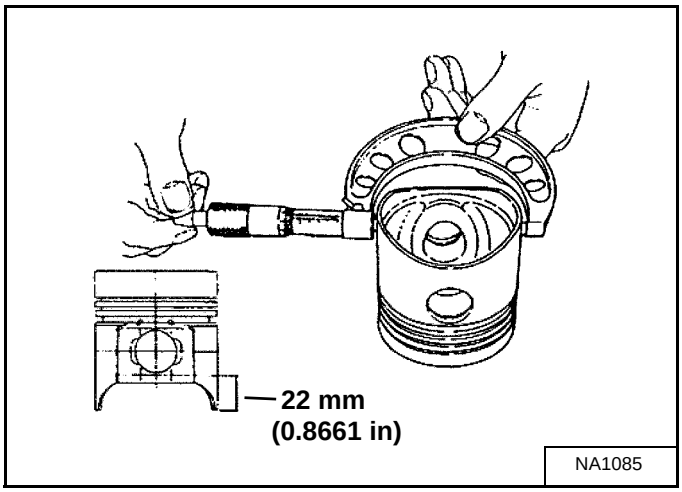
Clean a replacement small end bushing and connecting rod bore, and apply engine oil to aid in assembly.

Figure 60-90-14



Place the bushing onto the tool and press-fit it with a press (Item 2) **[Figure 60-90-13]** so that the seam (Item 1) **[Figure 60-90-14]** of the bushing is flush with the connecting rod.

Figure 60-90-15

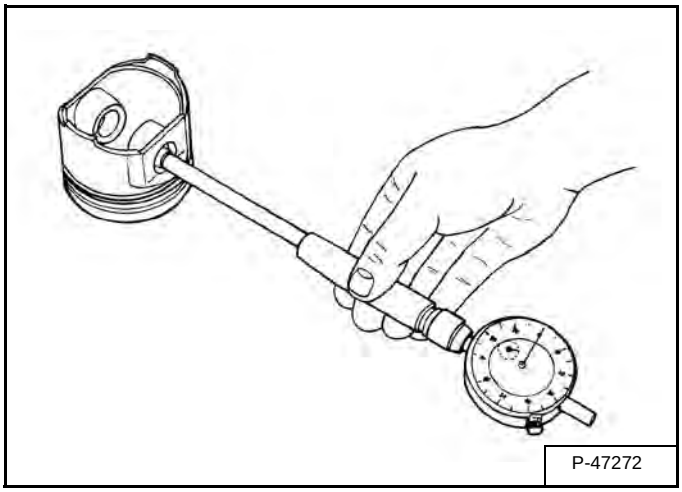


Measure 22 mm (0.8661 in) upwards from the bottom of the piston skirt at 90° from the wrist pin bore **[Figure 60-90-15]**.

Piston OD	97,940 - 97,950 mm (3.8559 - 3.8563 in)
Allowable Limit	97,905 mm (3.8545 in)

If the measurement is below the allowable limit, replace the piston.

Figure 60-90-16



Measure the piston pin bore I.D. in both the horizontal and vertical directions with a cylinder gauge **[Figure 60-90-16]**.

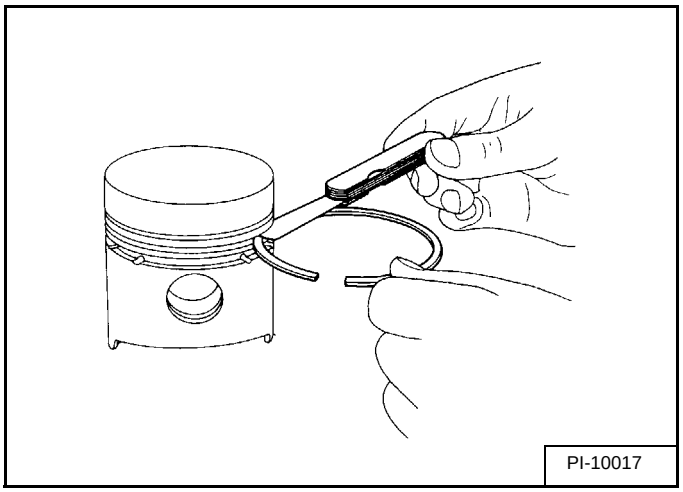
If the pin bore measurement exceeds the allowable limit, replace the piston.

Wrist Pin Bore ID	30,0 - 30,009 mm (1.1811 - 1.1815 in)
Allowable Limit	30,039 mm (1.1826 in)

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Piston And Connecting Rod - Servicing (Cont'd)

Figure 60-90-17

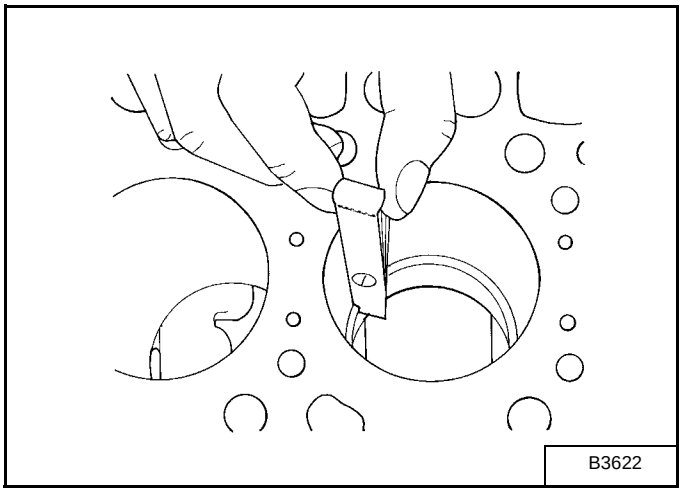


Remove the carbon from the ring grooves. Measure the clearance between the ring and groove with a feeler gauge **[Figure 60-90-17]**.

If the clearance exceeds the allowable limit, replace the ring. If the clearance still exceeds the allowable limit, replace the piston.

Top Ring Side Clearance	0,08 - 0,12 mm (0.0031 - 0.0047 in)
Second Ring Side Clearance	0,09 - 0,125 mm (0.0035 - 0.0049 in)
Oil Ring Side Clearance	0,025 - 0,060 mm (0.0010 - 0.0024 in)

Figure 60-90-18



Install a piston ring into the lower part of the cylinder bore. Measure the ring gap with a feeler gauge **[Figure 60-90-18]**.

If the gap exceeds the allowable limit, replace the ring.

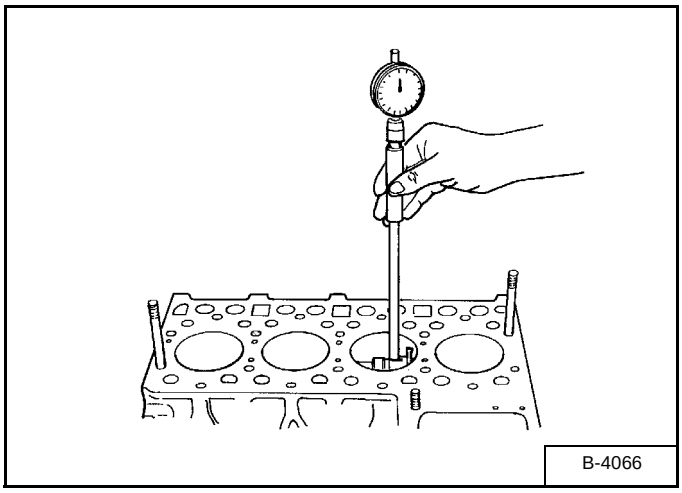
Top Ring End Gap	0,250 - 0,450 mm (0.0098 - 0.0177 in)
Allowable Limit	0,540 mm (0.0213 in)
Second Ring End Gap	0,450 - 0,650 mm (0.017 - 0.0256 in)
Allowable Limit	0,730 mm (0.0287 in)
Oil Ring End Gap	0,250 - 0,450 mm (0.0098 - 0.0177 in)
Allowable Limit	0,550 mm (0.0217 in)

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Cylinder Bore - Inspection

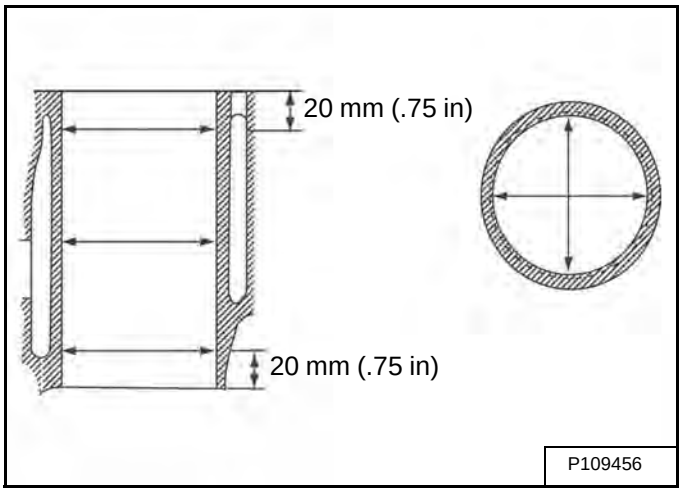
The oil passages must be clear and unobstructed. Inspect for discoloration or evidence of cracks. If a crack is suspected, use the color check method or the Magnaflux method to determine if the cylinder block is cracked.

Figure 60-90-19



Use a gauge to measure the inside of the cylinder bore **[Figure 60-90-19]**.

Figure 60-90-20



To find the maximum wear, check the inside diameter in six different locations **[Figure 60-90-20]**.

If the cylinder bore is not within specifications, bore and hone the cylinder for an oversize piston. Replace the piston and piston rings with oversize (0,5 mm) ones.

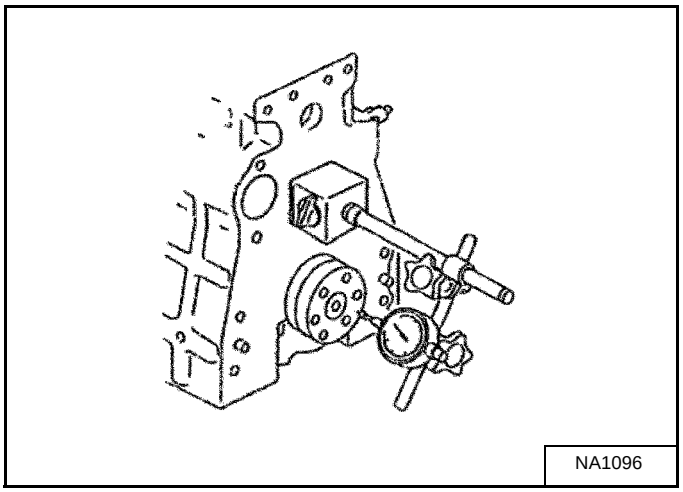
Cylinder ID	98,0 - 98,03 mm (3.8583 - 3.8594 in)
Allowable Limit	98,13 mm (3.8634 in)
Cylinder Bore Taper - Roundness	0,01 mm (0.0004 in)
Allowable Limit	0,03 mm (0.0012 in)

NOTE: When the oversize cylinder is worn beyond the allowable limit, replace the cylinder block with a new one.

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Crankshaft End Play

Figure 60-90-21



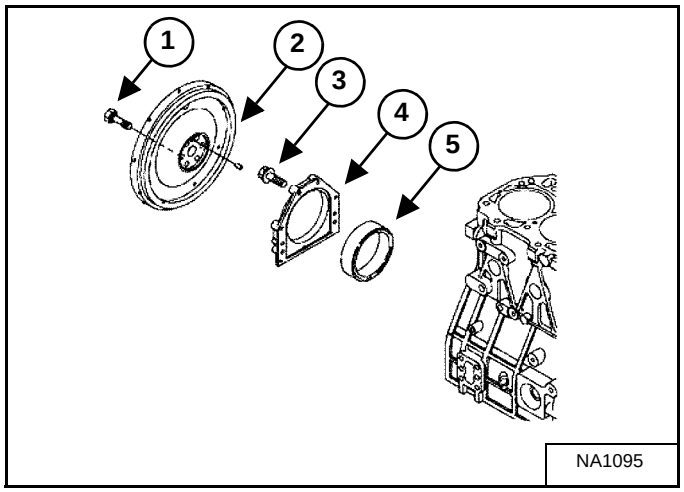
Install a dial indicator on the cylinder block with the tip on the end of the crankshaft **[Figure 60-90-21]**. Measure the end play by moving the crankshaft to the front and rear.

Crankshaft End Play	0,13 - 0,23 mm (0.0051 - 0.0091 in)
Allowable Limit	0,28 mm (0.0110 in)

If the measurement exceeds the allowable limit, replace the thrust bearings.

Crankshaft And Bearings Removal And Installation

Figure 60-90-22



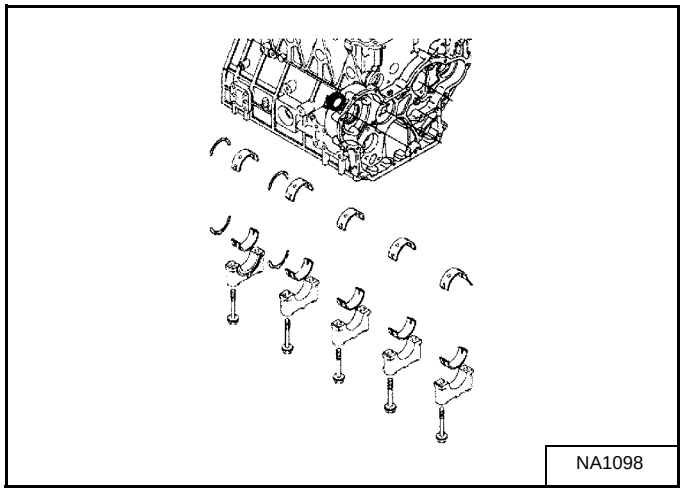
Remove the bolts (Item 1) and flywheel (Item 2) **[Figure 60-90-22]**.

Installation: Tighten the bolts to 186 - 206 N•m (137 - 152 ft-lb) torque.

Remove the oil seal retainer bolts (Item 3), oil seal retainer (Item 4) and seal (Item 5) **[Figure 60-90-22]**.

NOTE: Before removing the main bearing caps, measure the crankshaft end play. (See Crankshaft End Play on Page 60-90-9.)

Figure 60-90-23



Mark for assembly and remove the rod bearing caps, rod bearings, bearing caps and main bearings **[Figure 60-90-23]**.

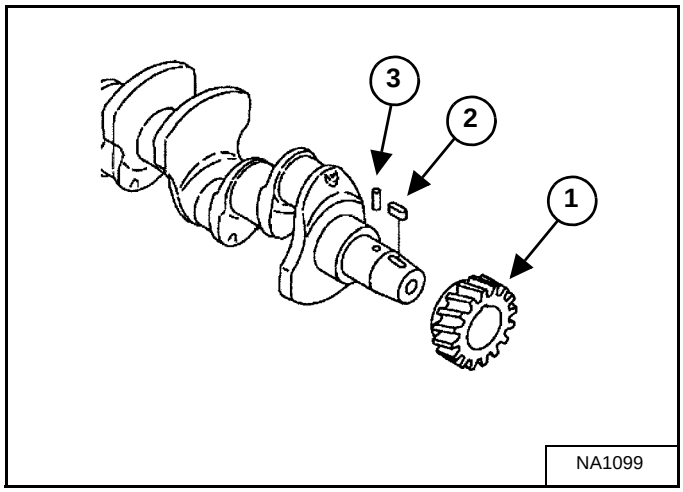
NOTE: The arrows on the main bearing caps point to the flywheel end of the engine.

Remove the crankshaft from the block.

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Crankshaft And Bearings Removal And Installation (Cont'd)

Figure 60-90-24



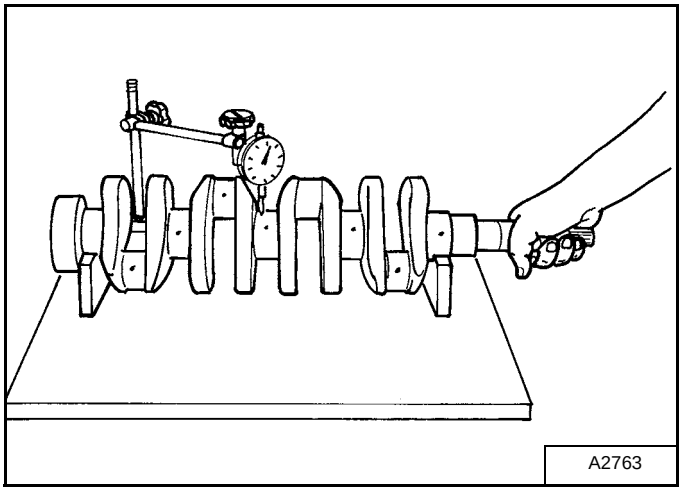
Do not remove the crankshaft gear (Item 1), key (Item 2) and parallel pin (Item 3) **[Figure 60-90-24]** unless worn or damaged.

NOTE: If it is necessary remove the crankshaft gear using a gear puller, use care not to damage the threads in the end of the crankshaft.

Crankshaft And Bearings - Servicing

Use the color check method or Magnaflux® to inspect the crankshaft for cracks. Replace the crankshaft if evidence of cracks are found.

Figure 60-90-25



Put the crankshaft end journals on V-blocks. Install a dial indicator on the center journal **[Figure 60-90-25]**.

Turn the crankshaft at a slow rate to obtain the misalignment (one half of the alignment measurement).

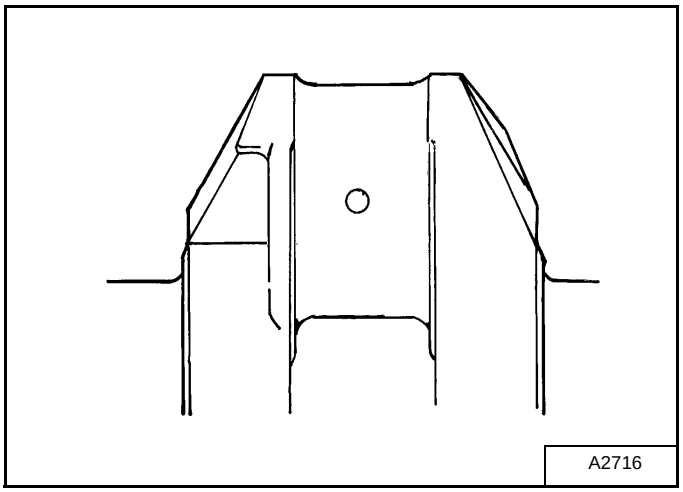
If the misalignment exceeds the allowable limit, replace the crankshaft.

Alignment	0,02 mm (0.0008 in)

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Crankshaft And Bearings - Servicing (Cont'd)

Figure 60-90-26



Measure the main bearing journals and connecting rod journals **[Figure 60-90-26]**.

Connecting Rod Journal	Journal OD	57,952 - 57,962 mm (2.2816 - 2.2827 in)
	Allowable Limit	57,902 mm (2.2796 in)
	Bearing ID	58,0 - 58,026 mm (2.2835 - 2.2845 in)
	Bearing Insert Thickness	1,492 - 1,50 mm (0.0587 - 0.0591 in)
	Oil Clearance	0,038 - 0,074 mm (0.0015 - 0.0029 in)
	Allowable Limit	0,150 mm (0.0059 in)
Main Bearing Journal	Journal OD	64,952 - 64,962 mm (2.5572 - 2.5576 in)
	Allowable Limit	64,902 mm (2.5552 in)
	Bearing ID	65,0 - 65,020 mm (2.559 - 2.5598 in)
	Bearing Insert Thickness	1,995 - 2,010 mm (0.0785 - 0.0791in)
	Oil Clearance	0,038 - 0,068 mm (0.0015 - 0.0027 in)
	Allowable Limit	0,150 mm (0.0059 in)

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CAMSHAFT AND TIMING GEARS

Timing Gear Case Cover Removal And Installation

Remove the bolt and washer from the crankshaft pulley.

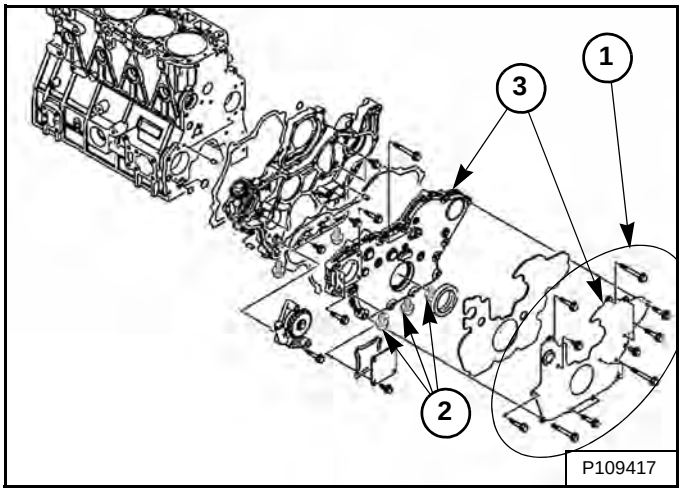
Remove the crankshaft pulley using a gear puller.

NOTE: Use care not to damage the threads in the end of the crankshaft when removing the crankshaft pulley.

Installation: Apply engine oil to the bolt threads and tighten the crankshaft pulley bolt to 108 - 128 N•m (80 - 94 ft-lb) torque.

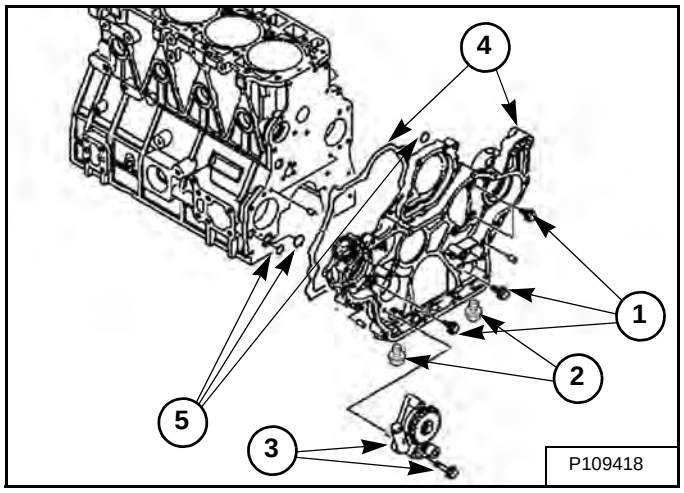
NOTE: Clean the crankshaft bolt and the drive pulley sleeve surface thoroughly.

Figure 60-100-1



Remove the gear case cover bolts mounting to the gear case (Item 1) and oil pan (Item 2) **[Figure 60-100-4]**. Remove the gear case covers (Item 3).

Figure 60-100-2

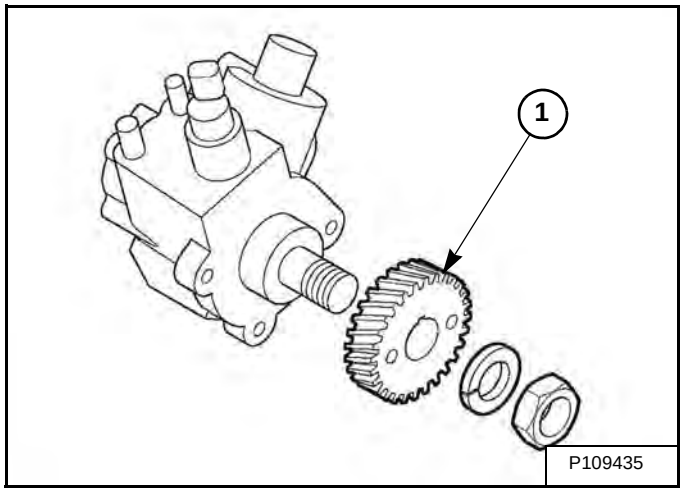


Remove the timing gear case bolts mounting to the cylinder block (Item 1) and oil pan (Item 2). Remove the oil pump and mounting bolt (Item 3) (See Oil Pump Removal And Installation on Page 60-60-2.). Remove the gear case and gasket (Item 4). Clean all of the old sealant off the cylinder block and timing gear case. Remove and discard the O-rings (Item 5) **[Figure 60-100-2]**.

Installation: Confirm that the liquid gasket coating surface is free of water, dust and oil in order to maintain sealing effect.

NOTE: Apply a liquid gasket evenly to the gearcase cover. Assemble the adhesive-applied parts within the manufacture's specified cure time.

Figure 60-100-3



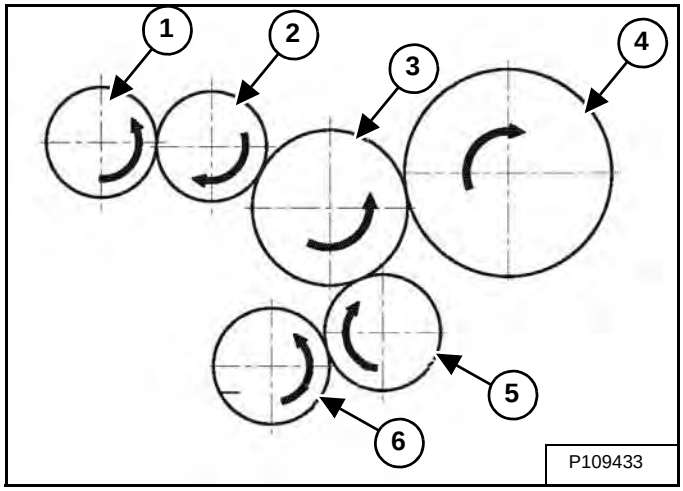
Remove the oil pump (See Oil Pump Removal And Installation on Page 60-60-2.). Remove the oil pump drive gear (Item 1) **[Figure 60-100-3]** using a puller.

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Timing Gear Backlash - Inspection

Before removing the timing gears, measure the gear backlash and determine the gear wear.

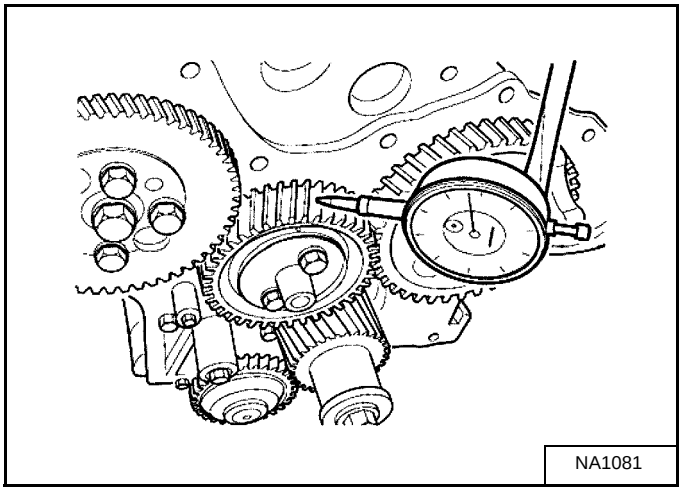
Figure 60-100-4



(Item 1) Fuel injection pump drive gear
(Item 2) Idler gear (B)
(Item 3) Idler gear (A)
(Item 4) Camshaft drive gear
(Item 5) Crankshaft drive gear
(Item 6) **[Figure 60-100-4]** Oil pump drive gear.

Fuel Injection Pump Gear	0,08 - 0,14 mm (0.0031 - 0.0055 in)
Idler Gear (B)	0,08 - 0,14 mm (0.0031 - 0.0055 in)
Idler Gear (A)	0,08 - 0,14 mm (0.0031 - 0.0055 in)
Camshaft Gear	0,08 - 0,14 mm (0.0031 - 0.0055 in)
Crank Shaft Gear	0,08 - 0,14 mm (0.0031 - 0.0055 in)
Allowable Limit	0,16 mm (0.0063 in)
Oil Pump Gear	0,09 - 0,15 mm (0.0035 - 0.0059 in)
Allowable Limit	0,17 mm (0.0067 in)

Figure 60-100-5



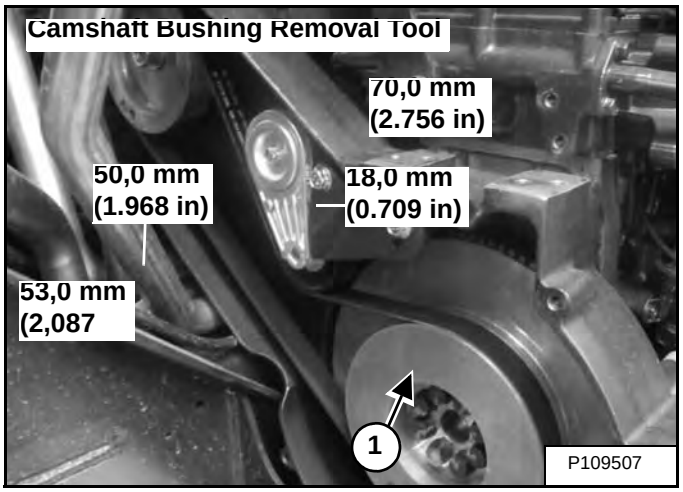
Install a dial indicator and rotate the idler gear back and forth to check the idler gear to crankshaft backlash **[Figure 60-100-5]**. Check the remainder of the gears using the above procedure.

NOTE: Do not allow the gear being checked to move axially as excess end play could cause a false reading.

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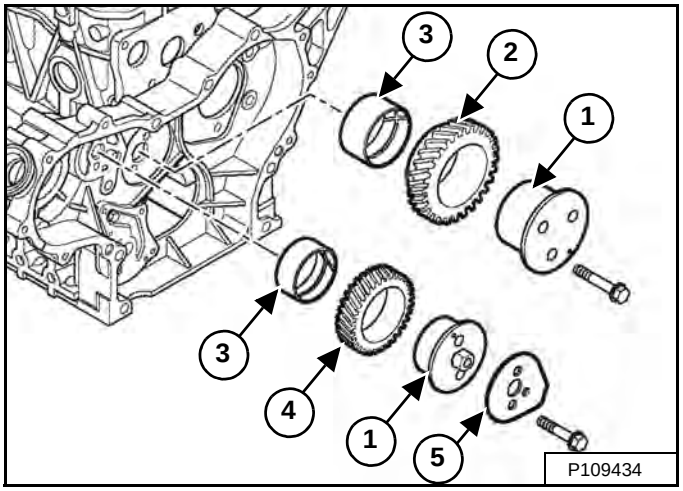
Idler Gear And Camshaft Removal And Installation

Figure 60-100-6



The tool (Item 1) **[Figure 60-100-6]** above is not provided. The tool is used for ***removing*** the camshaft bushings. Use the dimensions shown to make this tool.

Figure 60-100-7



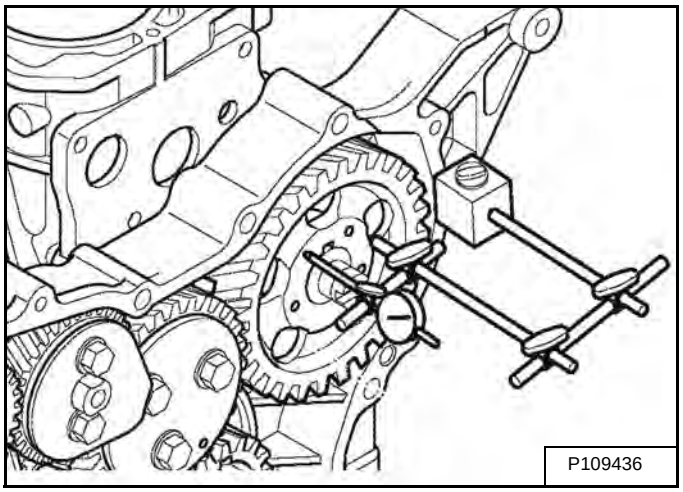
Remove the bolts from the idler gear shafts (Item 1). Remove the idler gear 'B' (Item 2), shaft and bushing (Item 3). Remove the idler gear 'A' (Item 4), shaft, bushing and plate (Item 5) **[Figure 60-100-7]**.

Do not remove the crankshaft gear unless it requires replacement. If it must be removed, use a gear puller.

Do not remove the camshaft gear unless it or the camshaft requires replacement. To remove the camshaft gear, remove the camshaft from the engine, heat to 356° - 392°F (180° - 200°C) and use a knife-edge puller and a press.

NOTE: Before removing the camshaft, check the camshaft end play.

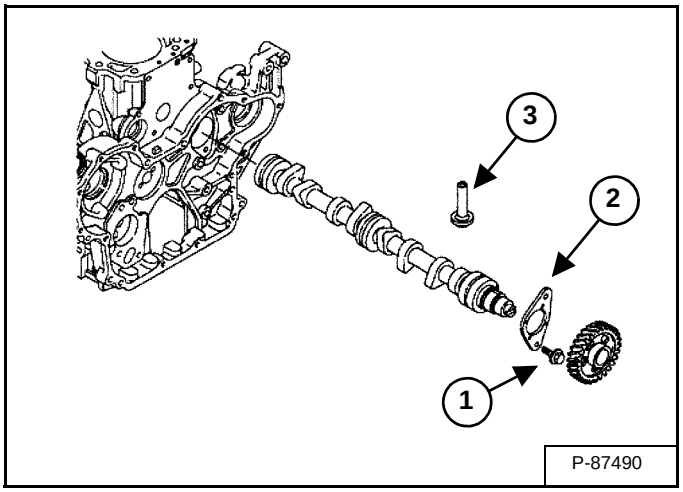
Figure 60-100-8



Install a dial indicator on the cylinder block. Move the camshaft back and forth to measure end play **[Figure 60-100-8]**.

Camshaft End Play	0,05 - 0,20 mm (0.0020 - 0.0079 in)
Allowable Limit	0,030 mm (0.0118 in)

Figure 60-100-9



Remove the two bolts (Item 1) from the retaining plate (Item 2). Rotate the engine on the engine stand so that gravity causes the tappets (Item 3) **[Figure 60-100-9]** to drop away from the camshaft lobes.

NOTE: If the engine is not installed on an engine stand, stand the engine upright on the flywheel end mounting flange. Rotate the camshaft at least two turns to bump the tappets out of the way.

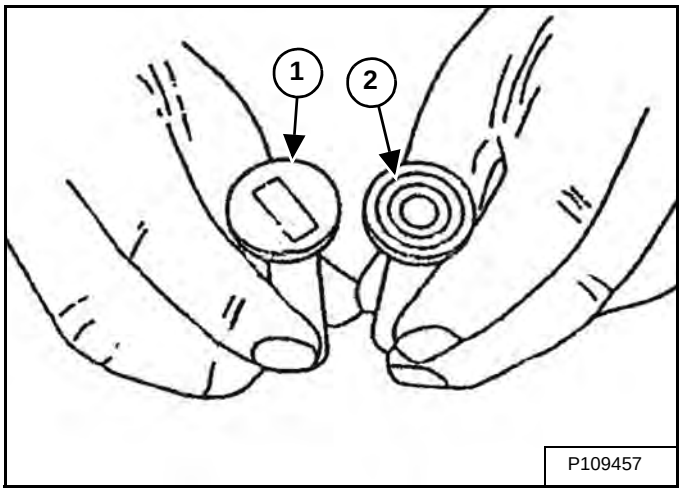
NOTE: Use care to not damage the front camshaft bearing.

Mark and remove the tappets (Item 3) **[Figure 60-100-9]**.

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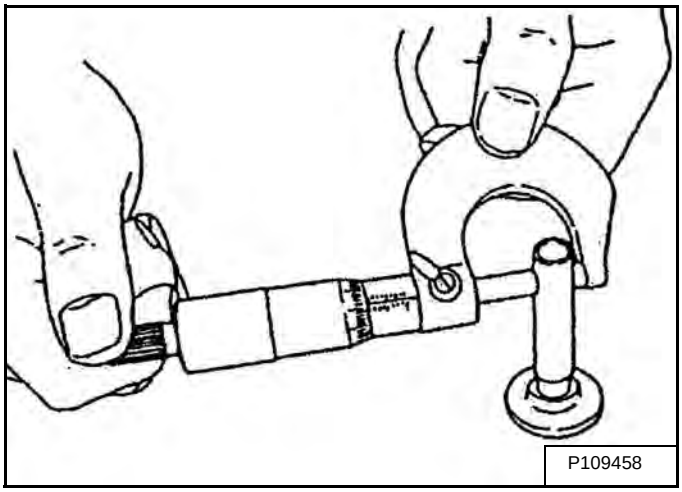
Valve Tappet - Servicing

Figure 60-100-10



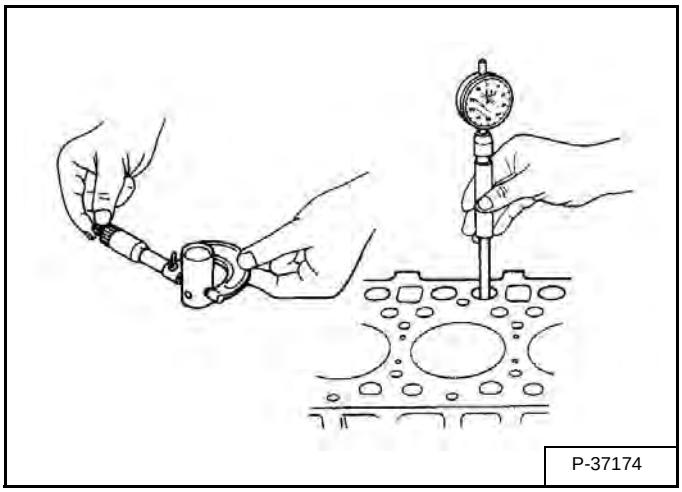
Inspect the tappet contact surfaces for abnormal wear (Item 1). Normal wear will be even as shown in (Item 2) **[Figure 60-100-10]**. Slight surface defects can be corrected using an oilstone.

Figure 60-100-11



Measure the tappet O.D. with an outside micrometer **[Figure 60-100-11]**.

Figure 60-100-12



Measure the I.D. of the tappet bore with a cylinder gauge, and calculate the oil clearance **[Figure 60-100-12]**.

Tappet O.D.	Factory spec.	11,975 - 11,990 mm (0.4715 - 0.4720 in)
	Allowable limit	11,955 mm (0.4707 in)
Tappet Bore I.D.	Factory spec.	12,000 - 12,018 mm (0.4724 - 0.4731 in)
	Allowable limit	12,038 mm (0.4739 in)

Oil clearance between tappet and guide	Factory spec.	0,010 - 0,043 mm (0.0004 - 0.0017 in)
	Allowable limit	0,083 mm (0.0033 in)

If the oil clearance exceeds the allowable limit or the tappet is damaged, replace the tappet.

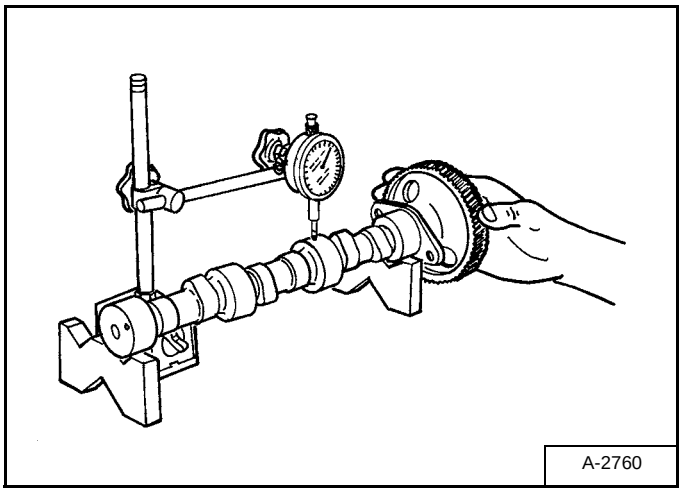
Before installing the tappets, apply engine oil to aid in assembly and initial startup.

NOTE: Use the cylinder number markings on the tappets to prevent interchanging.

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Camshaft - Servicing

Figure 60-100-13

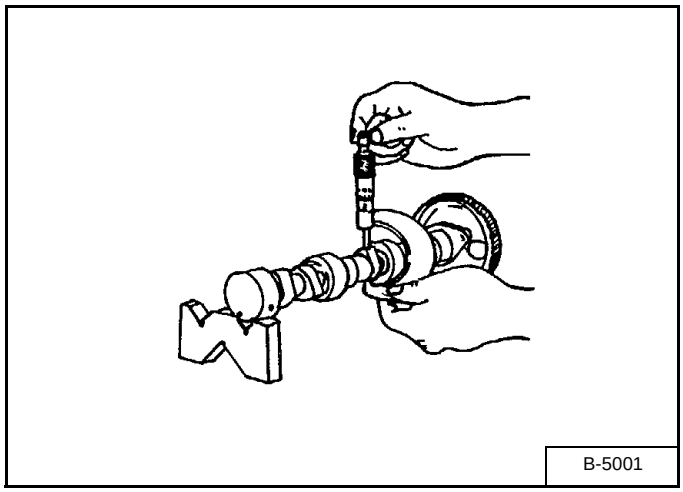


Put the camshaft in V-blocks. Install a dial indicator **[Figure 60-100-13]**.

Turn the camshaft at a slow rate. If the misalignment exceeds the allowable limit, replace the camshaft.

Camshaft Alignment	0,02 mm (0.0008 in)
Allowable Limit	0,05 mm (0.002 in)

Figure 60-100-14



Measure the cam lobes at their highest point **[Figure 60-100-14]**.

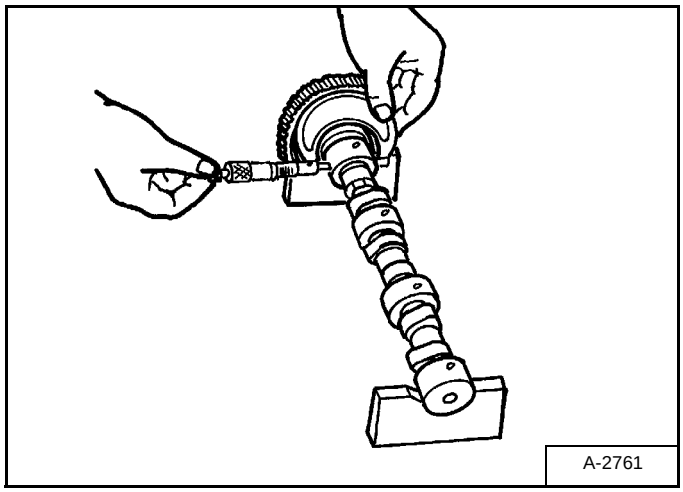
If the measurement is less than the allowable limit, replace the camshaft.

Cam Lobe Height	42,435 - 42,565 mm (1.6707 - 1.6758 in)
Allowable Limit	42,185 mm (1.6608 in)

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Camshaft - Servicing (Cont'd)

Figure 60-100-15



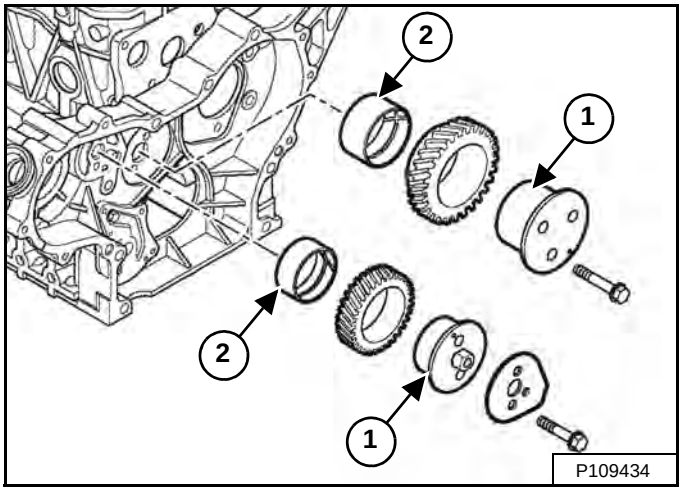
Measure the camshaft journal **[Figure 60-100-15]**.

Calculate the oil clearance. If the clearance exceeds the allowable limit, replace the camshaft.

Gear End Journal	Bushing ID	49,99 - 50,06 mm (1.9681 - 1.9707 in)
	Allowable Limit	50,130 mm (1.9736 in)
	Camshaft OD	49,925 - 49,950 mm (1.9655 - 1.9665 in)
	Allowable Limit	49,89 mm (1.9642 in)
	Oil Clearance	0,04 - 0,13 mm (0.0016 - 0.0051 in)
	Allowable Limit	0,240 mm (0.0094 in)
Intermediate Journal	Bore ID	50,0 - 50,025 mm (1.9685 - 1.9695 in)
	Allowable Limit	50,1 mm (1.9724 in)
	Camshaft OD	49,91 - 49,935 mm (1.9650 - 1.9659 in)
	Allowable Limit	49,875 mm (1.9636 in)
	Oil Clearance	0,065 - 0,115 mm (0.0026 - 0.0045 in)
	Allowable Limit	0,225 mm (0.0089 in)
Flywheel And Journal	Bore ID	50,0 - 50,025 mm (1.9685 - 1.9695 in)
	Allowable Limit	50,1 mm (1.9724 in)
	Camshaft OD	49,925 - 49,95 mm (1.9655 - 1.9665 in)
	Allowable Limit	49,89 mm (1.7673 in)
	Oil Clearance	0,05 - 0,1 mm (0.0020 - 0.0039 in)
	Allowable Limit	0,210 mm (0.0083 in)

Idler Gear And Shaft - Servicing

Figure 60-100-16



Measure the OD of the idler gear shafts (Item 1) and the ID of the bushing (Item 2) **[Figure 60-100-16]** and calculate the oil clearance.

Shaft OD	45,95 - 45,975 mm (1.8091 - 1.8100 in)
Allowable Limit	45,9 mm (1.8071 in)
Bushing ID	46,0 - 46,025 mm (1.8110 - 1.8120 in)
Allowable Limit	46,075 mm (1.8140 in)
Oil Clearance	0,025 - 0,075 mm (0.001 - 0.003 in)
Allowable Limit	0,175 mm (0.0069 in)

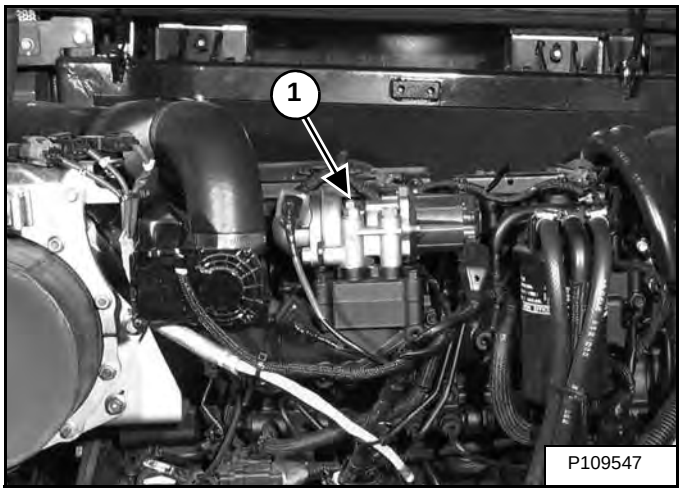
If the oil clearance exceeds the allowable limit, replace the bushing.

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EXHAUST GAS RECIRCULATION (EGR) VALVE

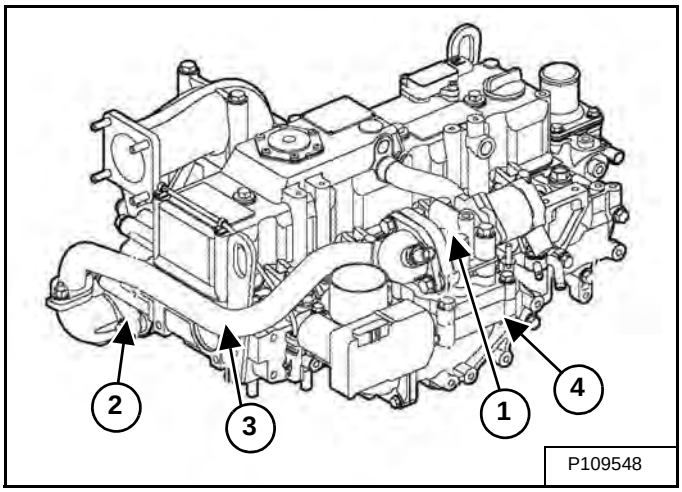
Description

Figure 60-110-1



The EGR valve (Item 1) **[Figure 60-110-1]** controls the exhaust gas recirculation flow rate depending on the engine speed / load signals from the E-ECU.

Figure 60-110-2



The EGR valve (Item 1) is connected to the EGR cooler (Item 2) with an EGR pipe (Item 3) and on top of the intake manifold (Item 4) **[Figure 60-110-2]**.

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EXHAUST GAS RECIRCULATION (EGR) VALVE (CONT'D)

Removal And Installation

WARNING

AVOID INJURY OR DEATH

When the engine is running during service, the steering levers or joysticks must be in neutral and the parking brake engaged.

W-2717-0208

WARNING

MACHINE FALLING OR MOVING CAN CAUSE SERIOUS INJURY OR DEATH

Put jackstands under the front and rear of the machine before running engine for service.

W-2718-0208

WARNING

AVOID INJURY OR DEATH

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

W-2050-0807

WARNING

AVOID BURNS

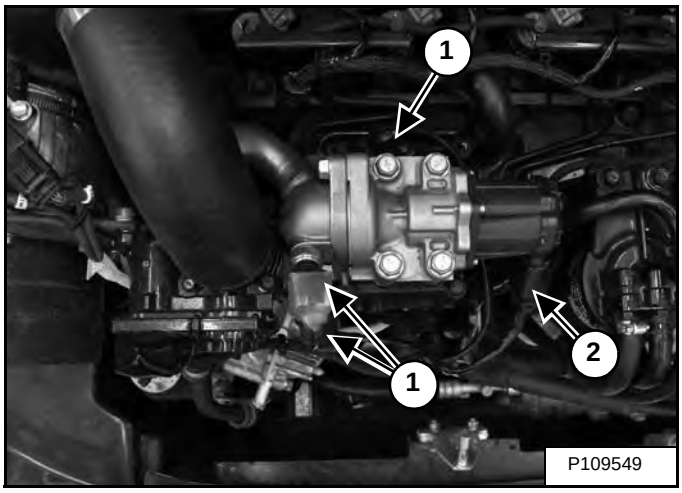
Some surfaces of the Exhaust Gas Recirculation system can be hot. Use caution when conducting diagnostic tests.

Allow the engine to cool before servicing.

W-2716-0208

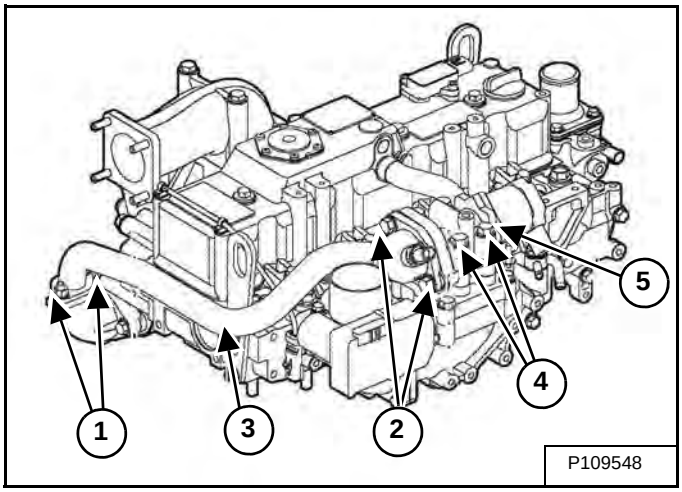
Remove the battery cable from the negative (-) battery terminal.

Figure 60-110-3



Remove the EGR valve electrical connectors for the three temperature sensors (Item 1) and the one motor control (Item 2) **[Figure 60-110-3]**.

Figure 60-110-4



Remove the nuts (Item 1) in the coupling flanges of the EGR cooler and the EGR pipe. Remove the bolts (Item 2) in the coupling flanges of the EGR pipe and EGR valve, and remove the EGR pipe (Item 3). Remove the four EGR mounting bolts (Item 4) and the EGR valve and motor assembly (Item 5) **[Figure 60-110-4]**.

NOTE: The EGR system uses steel gaskets at the joints between its components / parts. These steel gaskets are specific to the respective joints. When you remove the system's components / parts and reinstall them, replace the steel gaskets between them with new correct ones.

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EGR Valve Testing And Cleaning

When the key is first turned to the run position, the ECU checks valve operation by opening and shutting the valve.

The EGR valves and pipes must be cleaned every 3,000 hours to prevent deterioration of the EGR ratio. To remove deposited carbon, use compressed air (0.19 MPa, [1,9 bar] [27 psi] or lower). If the valves are heavily fouled, use carbon cleaner, kerosene, or some other liquid capable of removing carbon as well as a soft brush to clean the valves, taking care not to damage their parts.

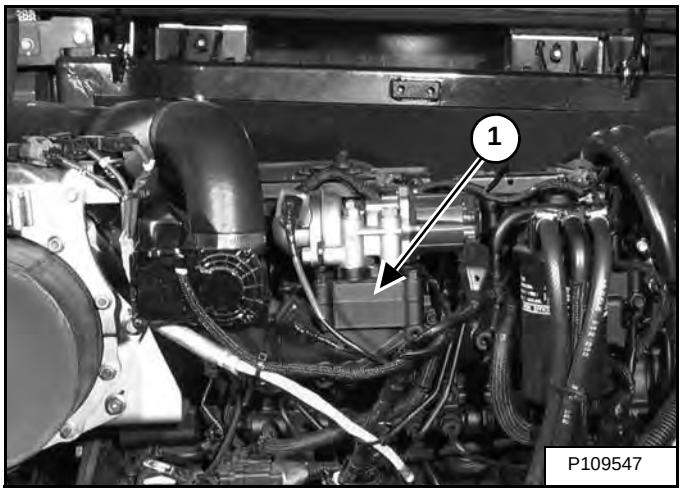
NOTE: When cleaning the valves, take extreme care to prevent water, solvent, cleaner, and other liquid from entering into the motor and coupler terminals or failure may result.

If the EGR valve continues to operate poorly, replace the valve.

NOTE: When it is necessary to replace an EGR valve, be sure to replace the entire EGR valve assembly. Do NOT attempt to disassemble and repair the EGR valve, or replace its individual components.

Lead (Reed) Valve Cleaning

Figure 60-110-5

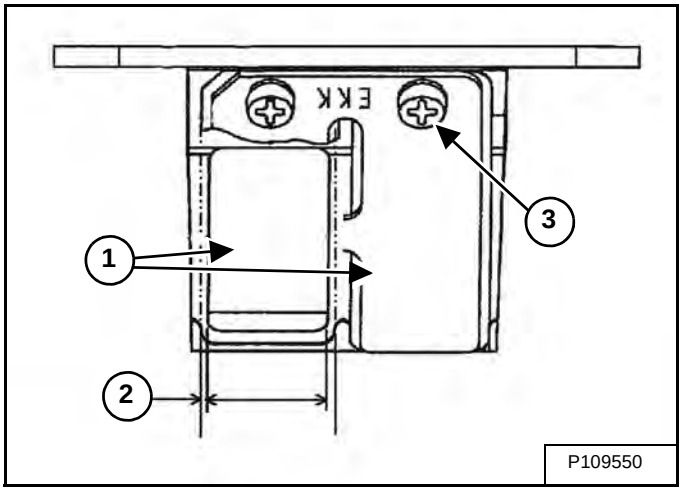


The reed valve (Item 1) **[Figure 60-110-5]** located between the EGR valve and the intake manifold prevents fresh air from flowing into the EGR system.

To remove deposited carbon inside the lead valves, disassemble and clean them. Use carbon cleaner, kerosene, or some other liquid capable of removing carbon as well as a soft brush to clean the valves, taking care not to damage their parts. Make sure that the case, valve and stopper are free of foreign matter and liquids and then reinstall.

Installation

Figure 60-110-6



Install the valve and stopper (Item 1) so that they are located on the left-hand side of the valve and evenly positioned inside the case window (Item 2) **[Figure 60-110-6]**.

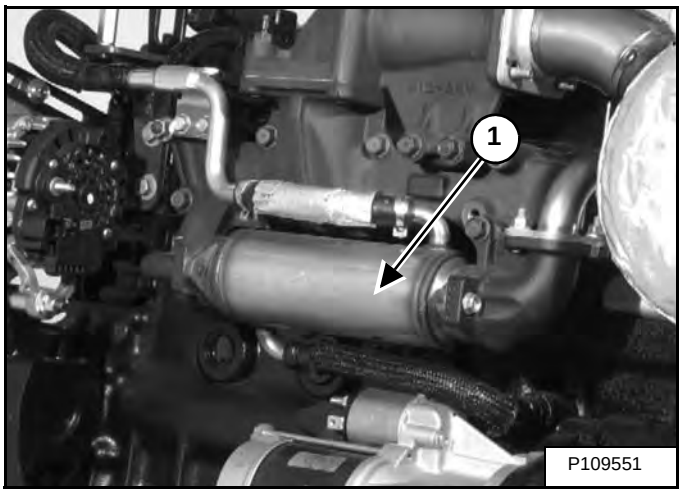
Tighten the screws (Item 3) **[Figure 60-110-6]** to 1.4 N•m (12.4 in-lb) torque. After tightening, mark the screw.

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EGR Cooler Cleaning

Drain the radiator. (See Removing And Replacing Coolant on Page 10-110-2.)

Figure 60-110-7

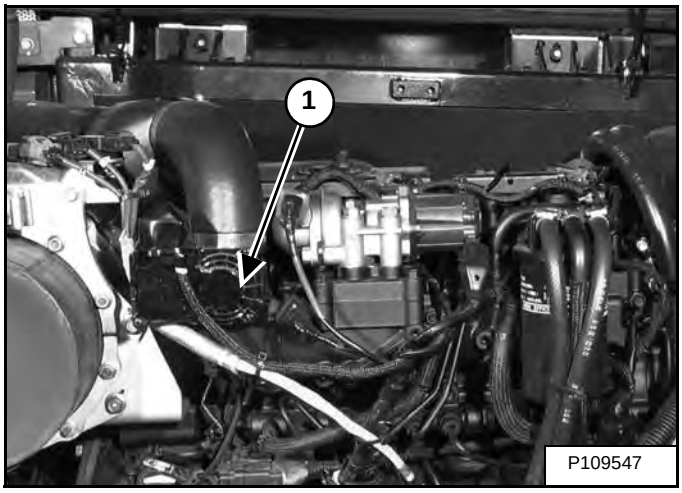


Remove the EGR cooler (Item 1) **[Figure 60-110-1]**. To remove deposited carbon inside the exhaust section of the cooler, disassemble and clean using carbon cleaner or kerosene. Rinse the coolant section with a descaler solution.

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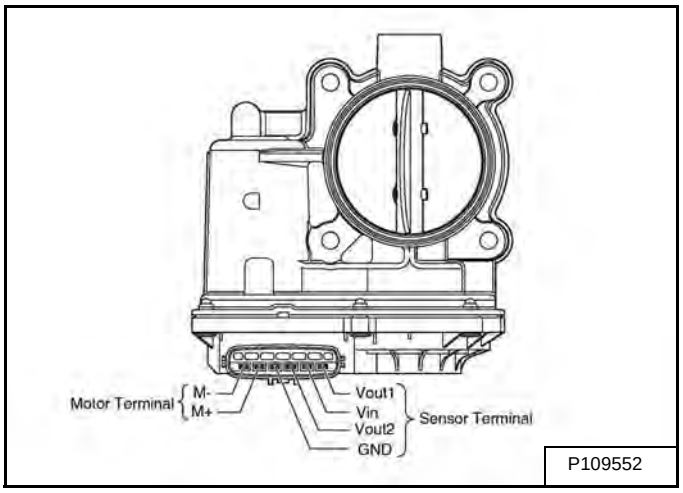
Intake Throttle

Figure 60-110-8



The intake throttle (Item 1) **[Figure 60-110-8]** controls the amount of the engine air intake. The intake throttle is used for the combustion of soot collected inside the DPF.

Figure 60-110-9



The intake throttle valve **[Figure 60-110-9]** is motor driven. The ECU controls the appropriate degree of opening of the throttle depending on the engine speed and load conditions.

Intake Throttle Handling Precautions:

- To avoid injury, do not touch the throttle valve when the throttle is energized.
- To avoid damage, do not operate the valve with the installation surface pointing down, as the valve protrudes below the installation surface.
- Do not apply excessive impact or load to the throttle. Replace a throttle if it has been dropped, due to possible internal damage.
- Prevent any foreign matter including oil, dust, and water droplets from entering the air passage and the connector.
- Prevent static electric charge of the human body when handling the throttle. Do not touch the sensor cover terminal directly.
- Do not remove the sensor cover installation rivet.
- Do not adjust the stop screw.

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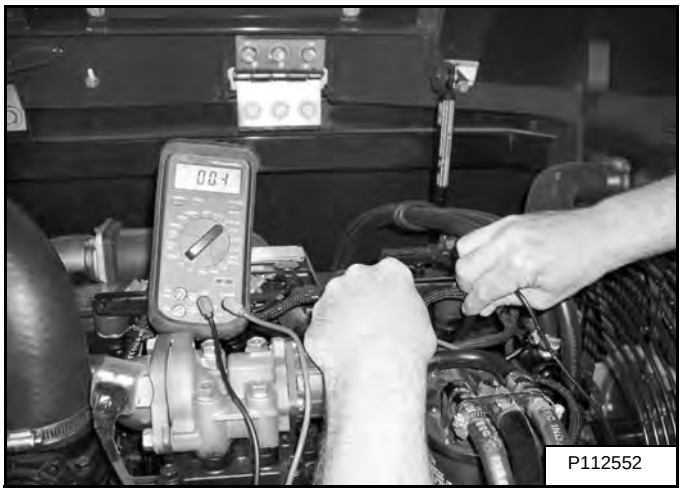


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GLOW PLUGS

Testing

Figure 60-120-1



Connect a test meter to the end of the glow plug. Connect the second lead of the meter to the glow plug body **[Figure 60-120-1]**.

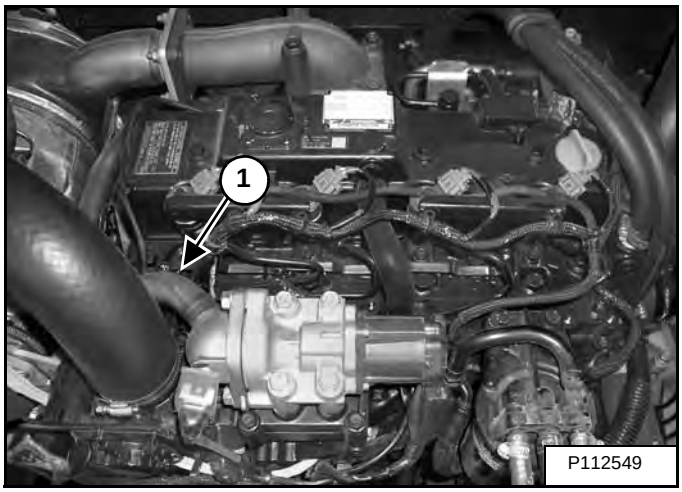
The reading should be approximately 0.5 ohm. If the resistance is infinite or zero, the glow plug is defective and must be replaced.

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GLOW PLUGS (CONT'D)

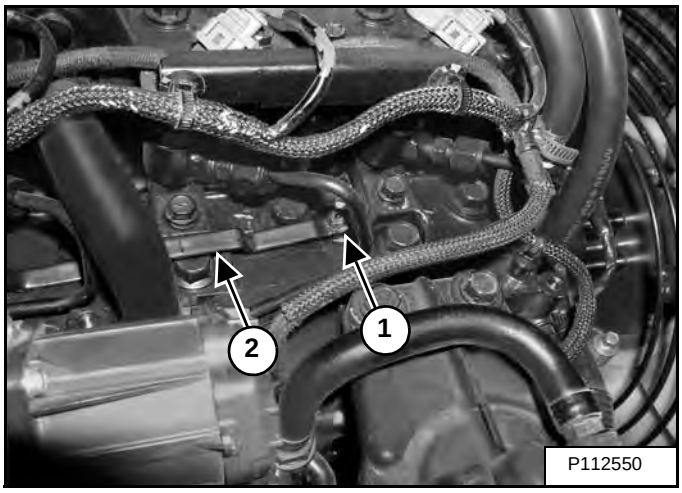
Removal And Installation

Figure 60-120-2



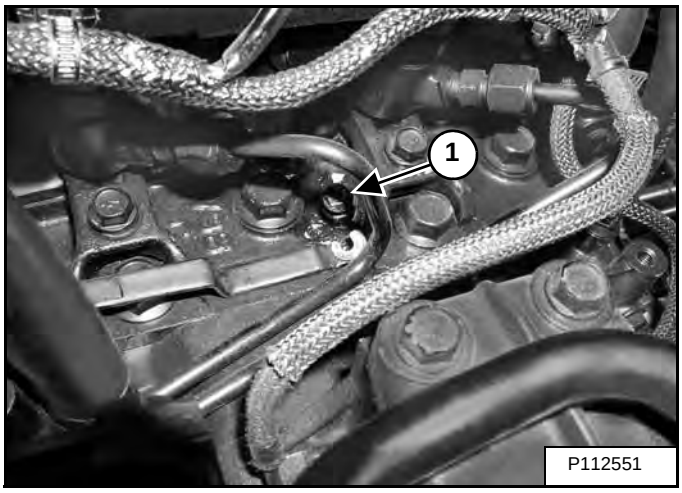
Remove the nut (Item 1) **[Figure 60-120-2]** and wire from the glow plug.

Figure 60-120-3



Loosen the nuts (Item 1) on the three glow plugs and reposition the glow plug strap (Item 2) **[Figure 60-120-3]**.

Figure 60-120-4



Remove the glow plugs (Item 1) **[Figure 60-120-4]**.

Installation: Tighten the glow plug to 15 - 20 N•m (133 - 177 in-lb)

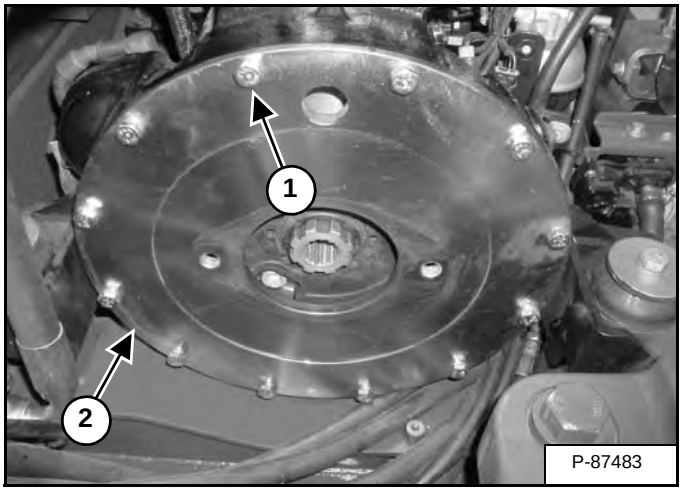
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ENGINE FLYWHEEL

Hydraulic Pump Coupler Removal And Installation

Remove the hydraulic piston pump. (See Removal And Installation on Page 20-50-13.)

Figure 60-130-1

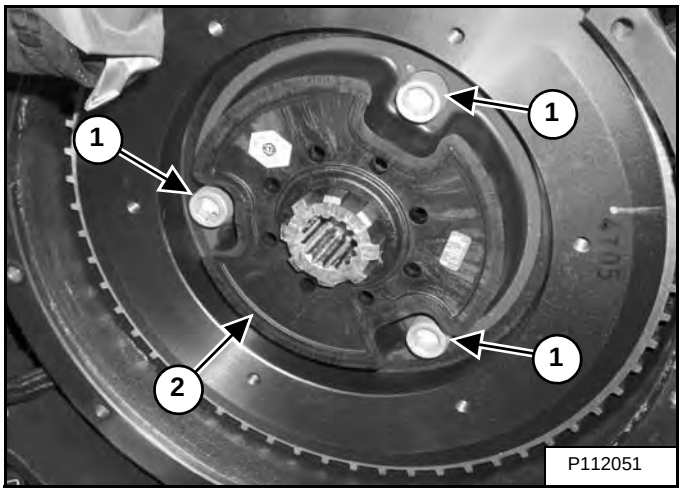


Remove the twelve bolts (Item 1) and plate (Item 2) **[Figure 60-130-1]**.

Installation: Apply thread adhesive (Loctite® 242) to the bolt threads before installation.

Tighten the bolts to 61 N•m (45 ft-lb) torque.

Figure 60-130-2

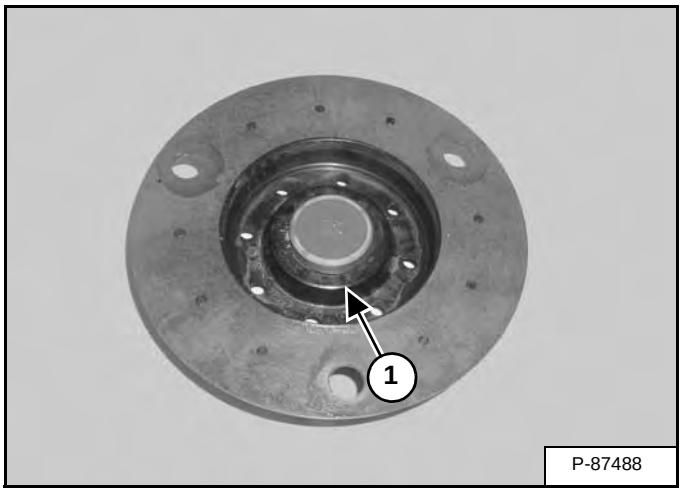


Remove the bolts (Item 1) and coupler (Item 2) **[Figure 60-130-2]**.

NOTE: The bolts may need to be heated to melt the thread adhesive before removal.

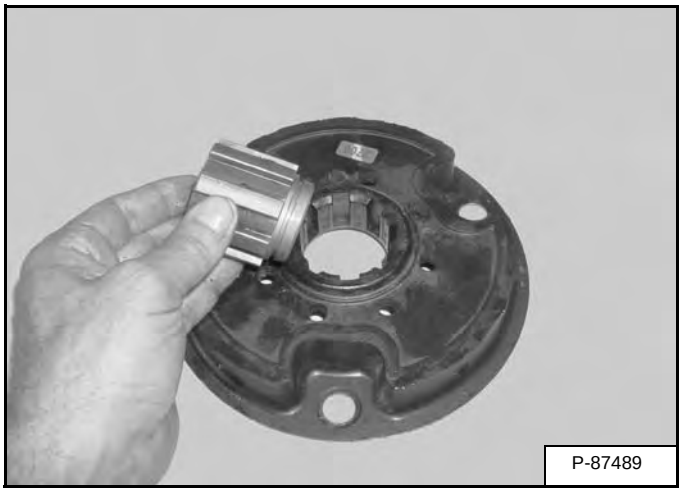
Installation: Apply thread adhesive (Loctite® 271) to the bolt threads before assembly.

Figure 60-130-3



Remove the snap ring (Item 1) **[Figure 60-130-3]**.

Figure 60-130-4

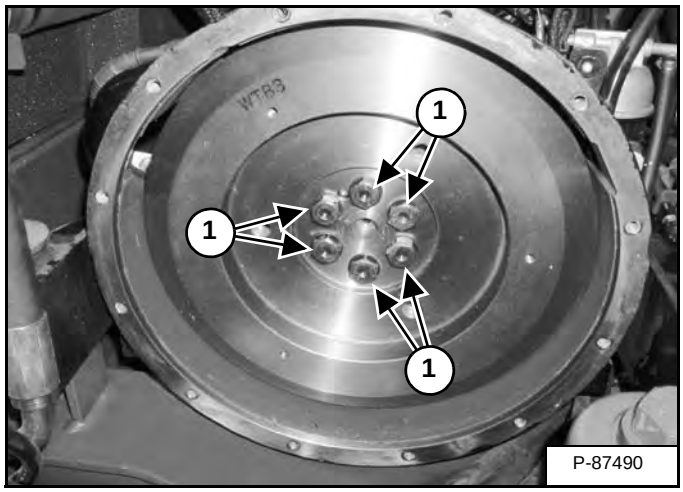


Turn the coupler over and remove the center of the coupler **[Figure 60-130-4]**.

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Flywheel Removal And Installation

Figure 60-130-5



Remove the six bolts (Item 1) **[Figure 60-130-5]** from the flywheel.

Installation: Tighten the bolts 186 - 206 N•m (137 - 152 ft-lb) torque.

Remove the flywheel.

Flywheel Ring Gear Removal And Installation

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 232 - 260°C (450 - 500°F)

Fit the ring gear over the flywheel. Make sure the gear is seated correctly.

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HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

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HVAC CONTROLLER 70-130-1
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AIR CONDITIONING SYSTEM FLOW

Description

In an air conditioning system the refrigerant is circulated under pressure through five major components in a closed circuit. At these five points in the system the refrigerant goes through pressure and temperature changes.

The compressor (Item 1) (See Chart on Page 70-10-2.) takes in heated, low pressure refrigerant gas through the suction valve (low pressure side) and as the name indicates, pressurizes the heated refrigerant and forces it through the discharge valve (high pressure side) on the condenser (Item 2) (See Chart on Page 70-10-2.).

Ambient air passing through the condenser removes the heat from the refrigerant, resulting in a physical state change in the refrigerant from a gas to a liquid.

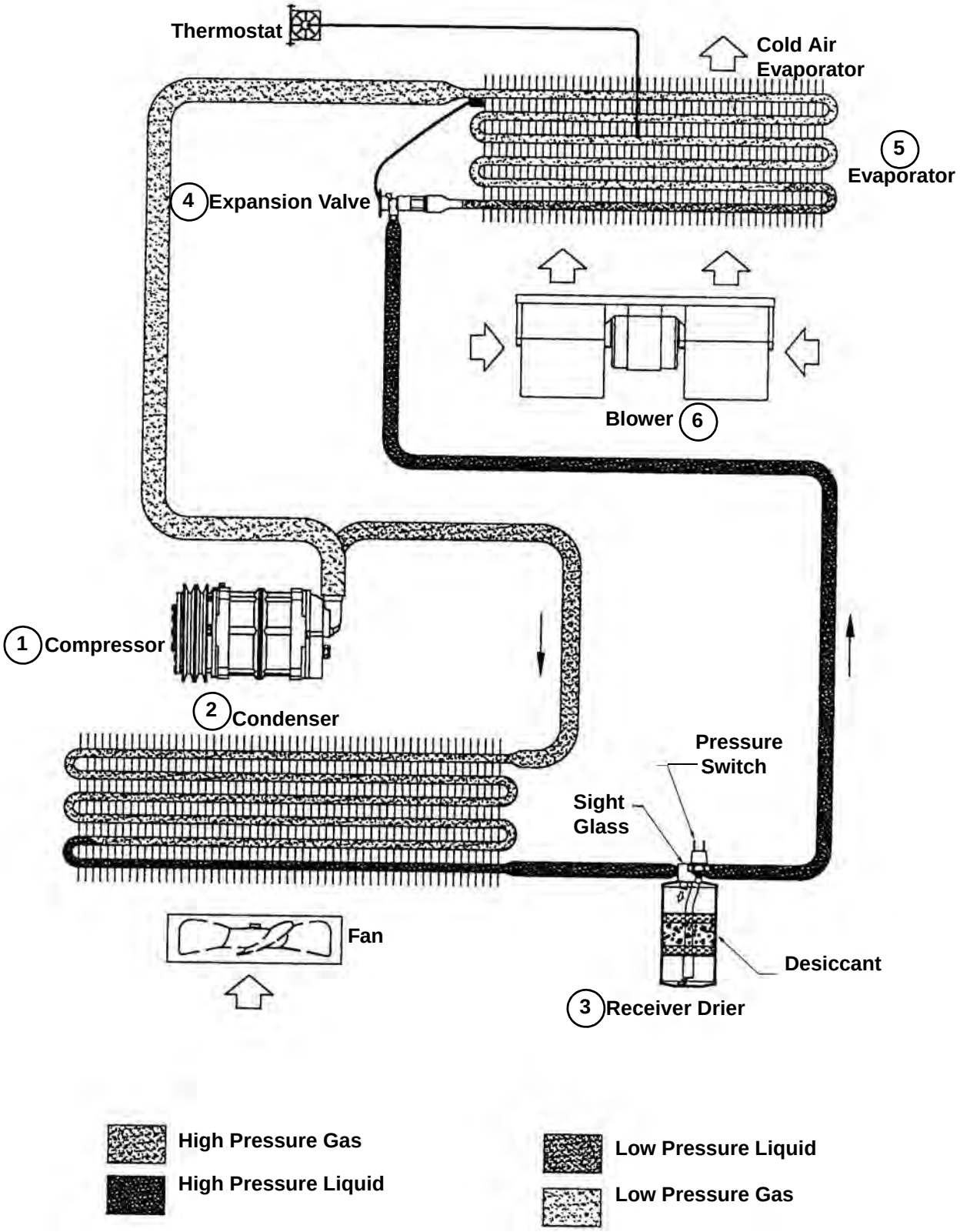
The liquid refrigerant moves on to the receiver / drier (Item 3) (See Chart on Page 70-10-2.) where impurities such as moisture and dirt are filtered out. The receiver / drier also serves as the storage tank for the liquid refrigerant. The liquid refrigerant (still under high pressure) flows to the expansion valve (Item 4) Page (See Chart on Page 70-10-2.).

The expansion valve meters the amount of refrigerant into the evaporator coil (Item 5) (See Chart on Page 70-10-2.). As the refrigerant passes through the expansion valve, it again changes its physical state. It becomes a low temperature, low-pressure liquid and saturated vapor. The low pressure liquid immediately starts to boil and vaporize as it enters the evaporator. The hot humid air of the machine's cab is drawn through or blown into the evaporator by the evaporator fan (Item 6) (See Chart on Page 70-10-2.). Since the refrigerant is colder than the air, it absorbs the heat from the air and produces cooled air, which is pushed into the cab by the fan. The moisture in the air condenses on the evaporator coil and drips into the drain pan, which directs the water out of the cab.

The refrigerant cycle is completed when the heated low pressure gas is again drawn into the compressor.

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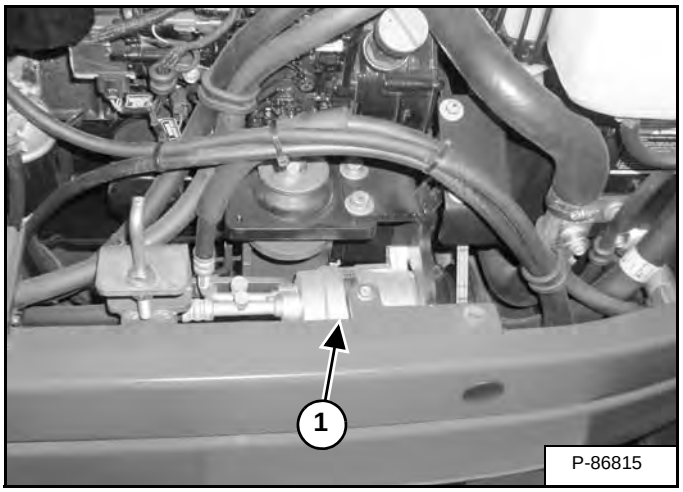
Chart



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Components

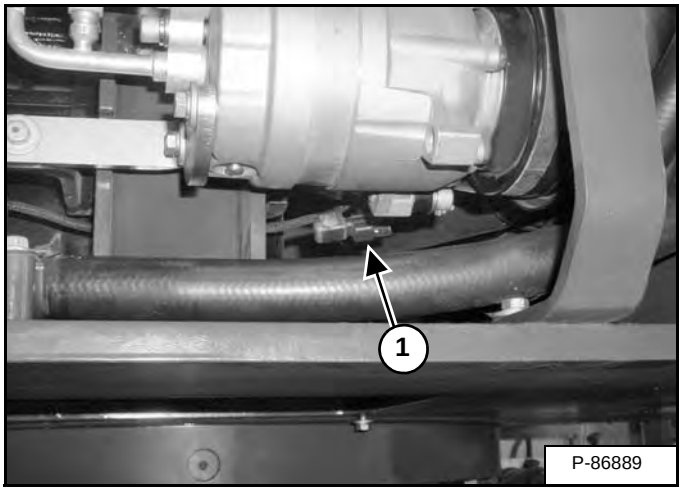
Figure 70-10-1



Compressor: The compressor (Item 1) **[Figure 70-10-1]** is the pump that circulates the refrigerant through the system. It raises the pressure of the refrigerant for heat transfer through the condenser and evaporator.

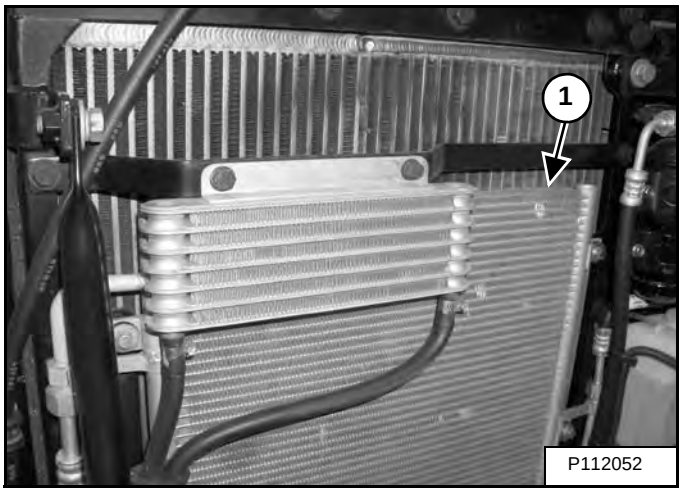
NOTE: The A/C system (Compressor) is recommended to be turned on for at least five minutes weekly through the year to lubricate the internal components.

Figure 70-10-2



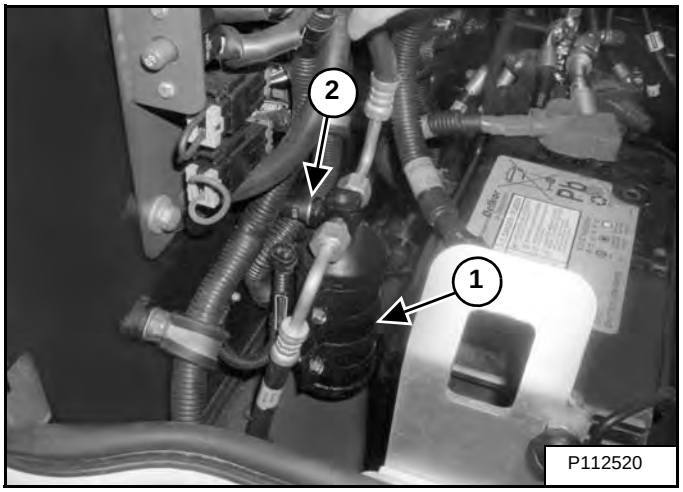
Compressor Diode: The compressor diode is located under the compressor **[Figure 70-10-2]**.

Figure 70-10-3



Condenser: The condenser (Item 1) **[Figure 70-10-3]** is the unit that receives the high pressure, high temperature refrigerant vapor from the compressor and condenses it into a high temperature liquid.

Figure 70-10-4



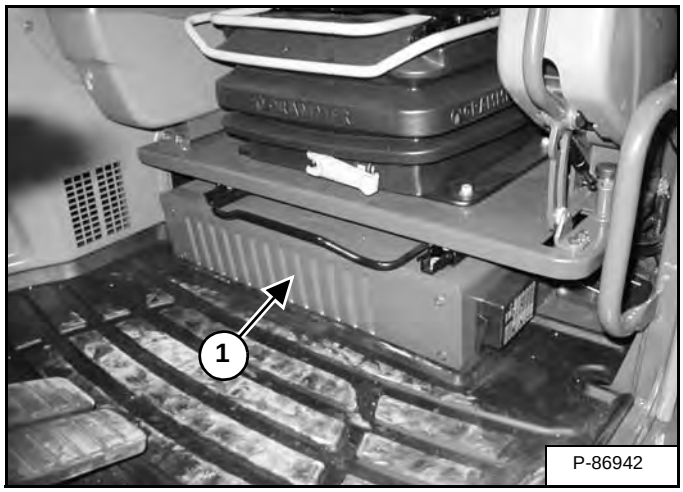
Receiver / Drier: The receiver / drier (Item 1) **[Figure 70-10-4]** is the unit that receives the liquid refrigerant from the condenser and removes moisture and foreign matter from the system. It also serves as a storage tank for the extra liquid refrigerant until it is needed by the evaporator.

Pressure Switch: The pressure switch (Item 2) **[Figure 70-10-4]** will disengage the compressor clutch at high pressure readings on the high side, or at very low pressure on the high side, which indicates loss of refrigerant.

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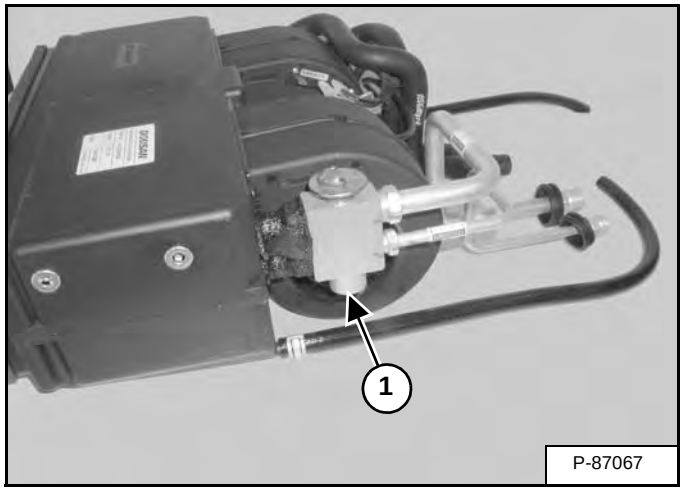
Components (Cont'd)

Figure 70-10-5



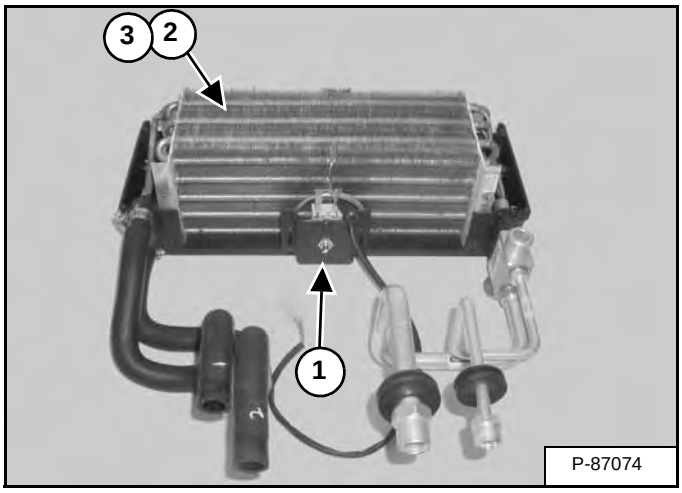
Evaporator / Heater Unit: The evaporator / heater unit (Item 1) **[Figure 70-10-5]** is located under the operator seat in the excavator cab. The unit delivers cold air for the A/C and warm air for heat into the cab. The unit contains the blower, heater coil, evaporator coil, thermostat, and expansion valve.

Figure 70-10-6



Expansion Valve: The expansion valve (Item 1) **[Figure 70-10-6]** controls the amount of refrigerant entering the evaporator coil.

Figure 70-10-7

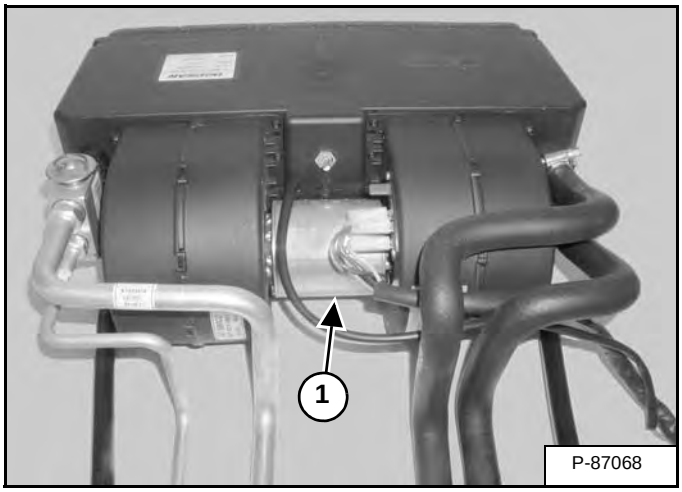


Thermostat: The thermostat (Item 1) **[Figure 70-10-7]** controls the temperature of the evaporator coil.

Heater Coil: The heater coil (Item 2) **[Figure 70-10-7]** supplies the warm air into the cab by passing air through the coil.

Evaporator Coil: The evaporator coil (Item 3) **[Figure 70-10-7]** cools and dehumidifies the air before it enters the cab.

Figure 70-10-8

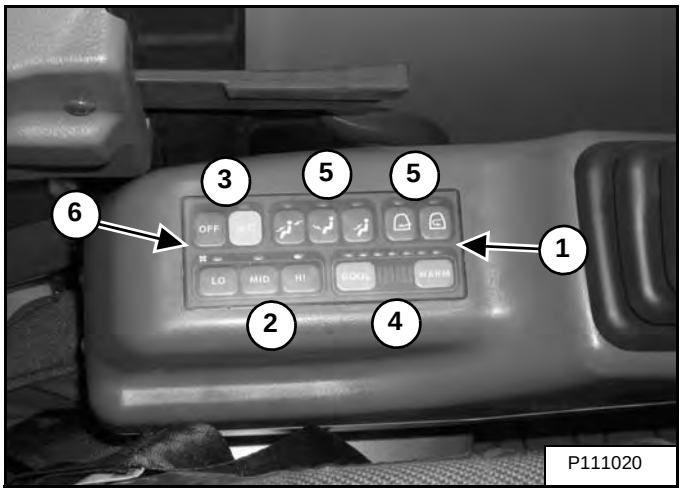


Heater / Evaporator Blower: The blower (Item 1) **[Figure 70-10-8]** pushes air through the heater and evaporator coils and into the cab.

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Components (Cont'd)

Figure 70-10-9



Control Panel: The panel (Item 1) **[Figure 70-10-9]** has three separate components.

Fan Switch: This is a three position switch (Item 2) **[Figure 70-10-9]**. When the fan switch is in the off position the A/C will not engage.

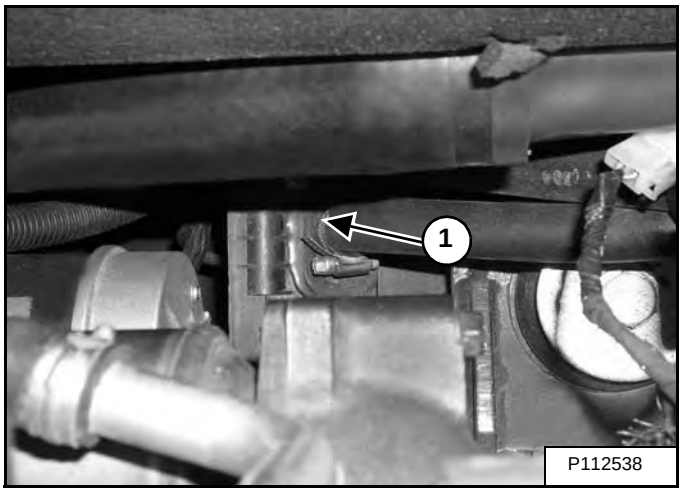
A/C Switch: The switch (Item 3) **[Figure 70-10-9]** will be illuminated when the A/C is engaged.

Temperature Control: The temperature control (Item 4) **[Figure 70-10-9]** controls the cooling / heating air temperature.

Directional Switches: The switches (Item 5) **[Figure 70-10-9]** control the direction of the air flow.

Off Switch: The off switch (Item 6) **[Figure 70-10-9]** shuts the HVAC system off.

Figure 70-10-10



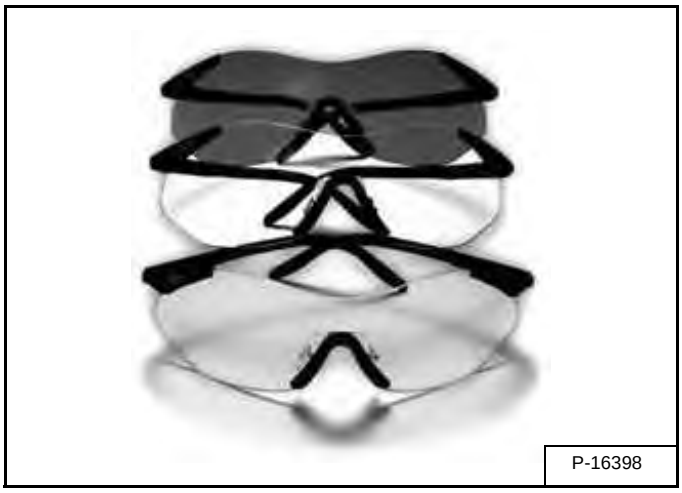
Heater Valve: The heater valve (Item 1) **[Figure 70-10-10]** is used to control the amount of engine coolant that flows to the heater coil.

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Safety Equipment

In servicing A/C and heater systems you will be exposed to high pressures, temperatures and several chemical hazards. Moving belts and pulleys are normal shop hazards.

Figure 70-10-11



In addition to exercising caution in your work, **DO WEAR SAFETY GLASSES OR A FACE SHIELD** when you are using R-134a or a leak detector, adjusting service valves or the manifold gage set connectors. Safety glasses or a transparent face shield are practical safety items and one or the other is absolutely required **[Figure 70-10-11]**.

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

W-2371-0611

Figure 70-10-12



R-134a inside a canister or in an A/C system is a liquid under pressure. When it escapes or releases into the air, **ITS TEMPERATURE DROPS TO -5.8°C (21.6°F) "INSTANTLY".**

If it spills on your skin or in your eyes you should flood the area with cool water and **SEEK MEDICAL ATTENTION FAST!** It is a good idea to wear gloves to prevent frost bite if you should get refrigerant on your hands **[Figure 70-10-12]**.

⚠ WARNING

HFC R-134a refrigerant can be dangerous if not properly handled. Liquid R-134a may cause blindness if it contacts the eyes and may cause serious frostbite if it contacts the skin.

- **Gaseous R-134a becomes lethal (phosgene) gas when it contacts open flame or very hot substances.**
- **NEVER SMOKE when there is the possibility of even small amounts of R-134a in the air.**

Any servicing work that involves release or addition of R-134a to the system must be done by a competent refrigeration dealer who has the proper equipment, knowledge, and experience to service refrigeration equipment.

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Filters

Remove the Heat / A/C filter. (See Cleaning And Maintenance on Page 10-100-1.)

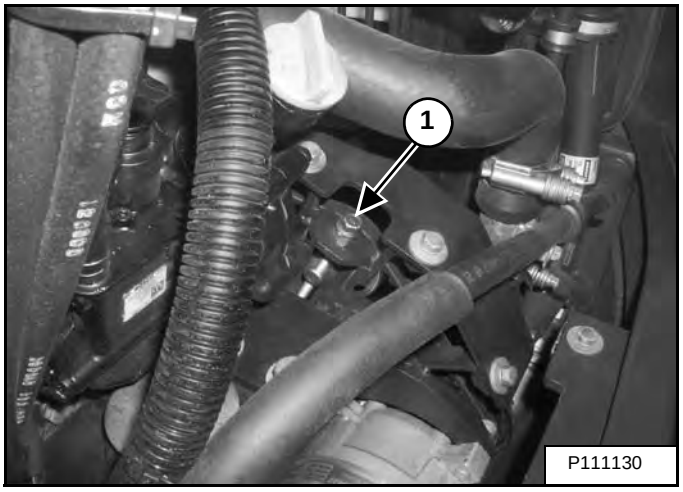
Clean the filter by shaking it or using low air pressure.

Belt Adjustment

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 10-80-1.)

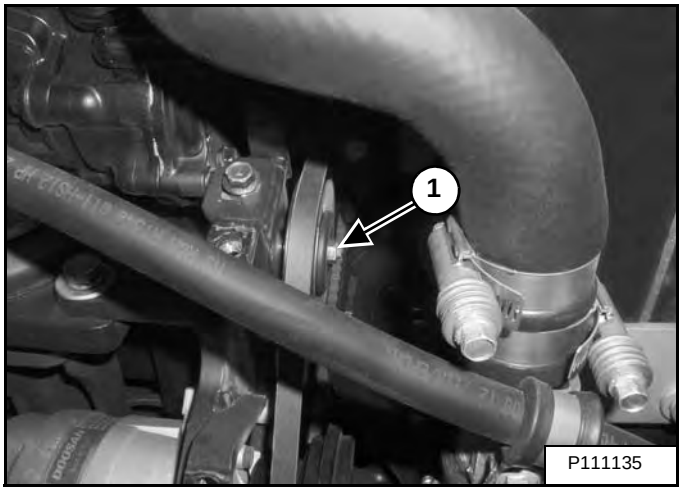
Open the right side cover. (See Opening And Closing on Page 10-50-1.)

Figure 70-20-1



The air conditioning belt will be adjusted by using the bolt (Item 1) **[Figure 70-20-1]**.

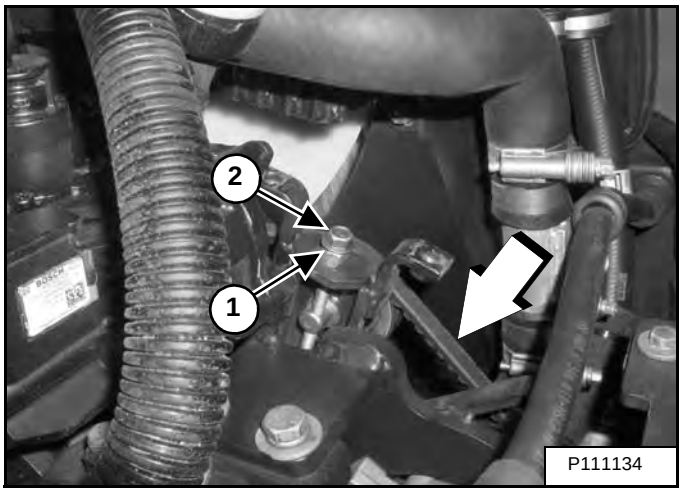
Figure 70-20-2



NOTE: The belt shield is removed for photo clarity in the following two photos.

Loosen the belt idler mounting bolt (Item 1) **[Figure 70-20-2]**.

Figure 70-20-3



Press down on the belt midway between the crankshaft pulley and the compressor pulley. The correct tension should allow the belt to deflect 10 mm (0.375 in) **[Figure 70-20-3]**.

Loosen the lock nut (Item 1) and adjust the bolt (Item 2) **[Figure 70-20-3]** until the belt tension is correct.

When the belt tension is correct, tighten the lock nut (Item 1) **[Figure 70-20-3]**.

Tighten the belt idler mounting bolt (Item 1) **[Figure 70-20-2]**.

Reinstall the shield (Item 2) and the two bolts and washers (Item 1) **[Figure 70-20-1]**.

⚠ WARNING

AVOID INJURY OR DEATH

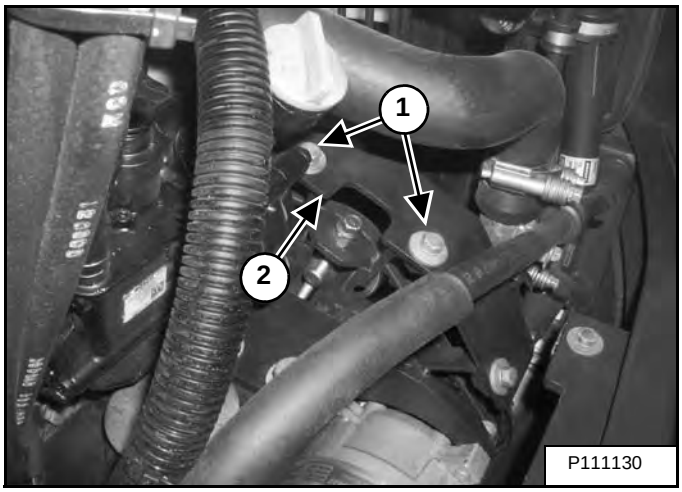
- **Do Not Operate with damaged or missing screens, shields or rubber deflectors.**
- **Stop engine before cleaning or servicing.**
- **Contact with moving parts or flying objects can cause injury or death.**

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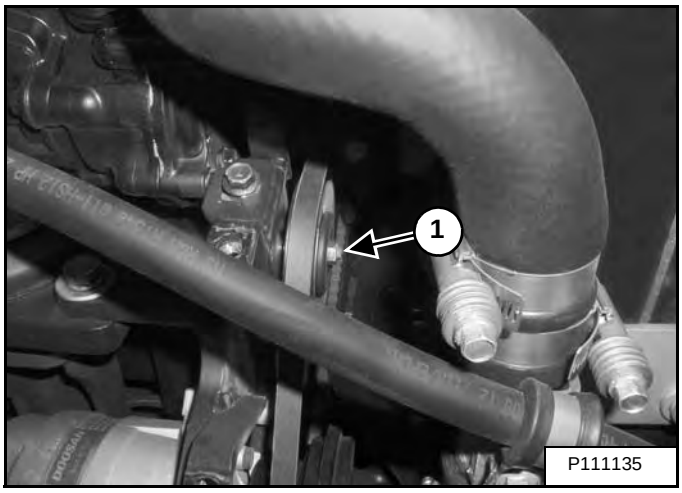
Belt Replacement

Figure 70-20-4



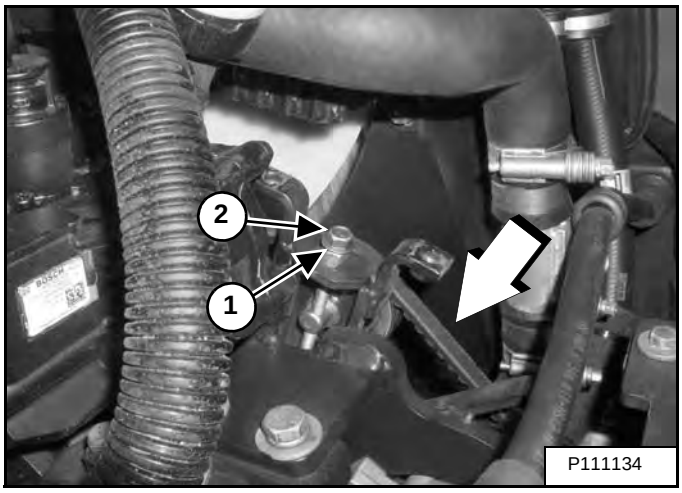
Remove the two bolts and washers (Item 1) and remove the shield (Item 2) **[Figure 70-20-4]**.

Figure 70-20-5



Loosen the belt idler nut (Item 1) **[Figure 70-20-5]**.

Figure 70-20-6



Loosen the lock nut (Item 1) and the bolt (Item 2) **[Figure 70-20-6]** until the belt can be removed.

Install a new belt.

Adjust the bolt (Item 2) until the belt tension is correct. Tighten the lock nut (Item 1) **[Figure 70-20-6]**.

Tighten the belt idler mounting bolt (Item 1) **[Figure 70-20-5]**.

Reinstall the shield (Item 2) and the two bolts and washers (Item 1) **[Figure 70-20-4]**.

⚠ WARNING

AVOID INJURY OR DEATH

- **Do Not Operate with damaged or missing screens, shields or rubber deflectors.**
- **Stop engine before cleaning or servicing.**
- **Contact with moving parts or flying objects can cause injury or death.**

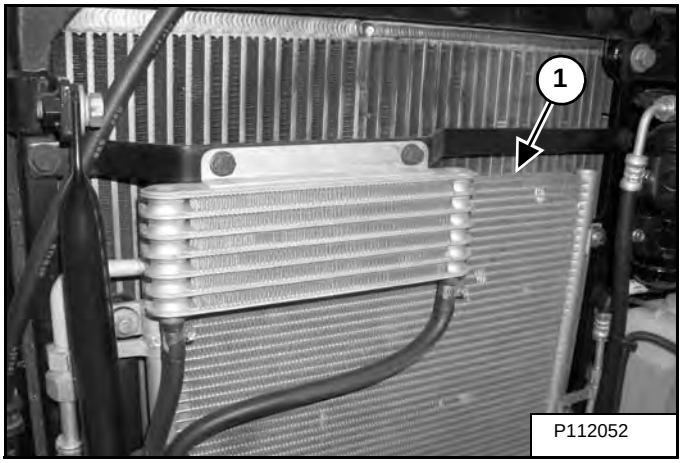
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Condenser

Open the right side cover.

Figure 70-20-7



Check the condenser (Item 1) **[Figure 70-20-7]** for mud or dirt.

The condenser can be cleaned with low water or air pressure.

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Air Conditioning Service Chart

Service Company Name / Phone Number:			
Date:			
Machine Model:			Machine Dealer:
Machine Serial Number:			Customer:
Machine Hours:			
Pre Service Conditions	15 Minutes	30 Minutes	Notes
Ambient Temperature:			
Louver Temperature:			
Cab Temperature At Head Position:			
Temperature Into Condenser:			
High Side Pressure:			
Low Side Pressure:			
Ambient Humidity:			
Observations:			
Explain services required:			
Post Service Conditions	15 Minutes	30 Minutes	Notes
Ambient Temperature:			
Louver Temperature:			
Cab Temperature At Head Position:			
Temperature Into Condenser:			
High Side Pressure:			
Low Side Pressure:			
Ambient Humidity:			
Observations:			

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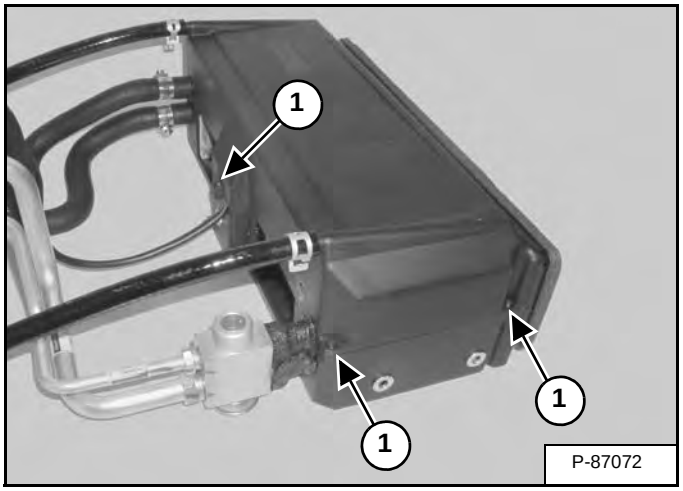
Evaporator / Heater Coil

NOTE: The following procedure is shown for cleaning the evaporator / heater coil. The unit is not serviceable separately.

Remove the evaporator / heater unit. (See Removal And Installation on Page 70-80-1.)

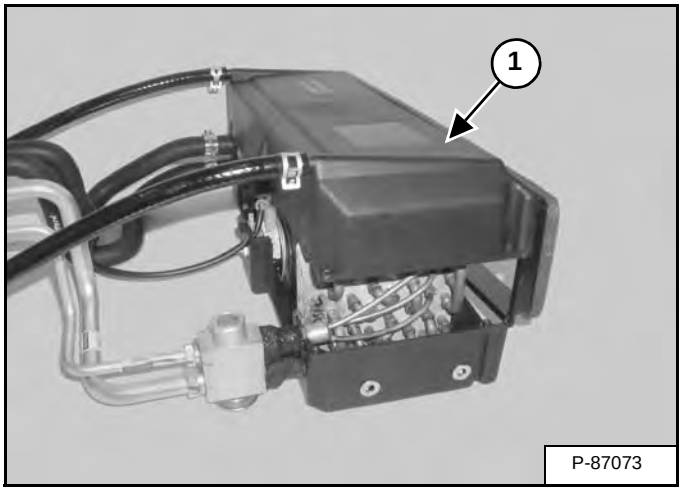
Remove the blower fan. (See Removal And Installation on Page 70-110-1.)

Figure 70-20-8



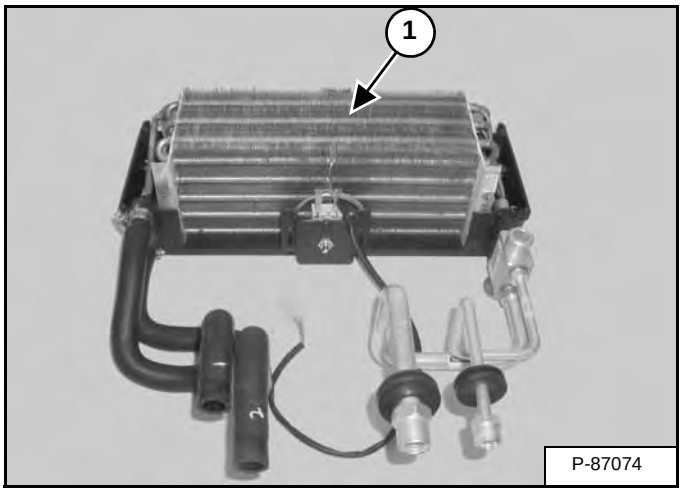
Remove the five screws (Item 1) **[Figure 70-20-8]**.

Figure 70-20-9



Remove the cover (Item 1) **[Figure 70-20-9]**.

Figure 70-20-10



Clean and inspect the evaporator / heater coil (Item 1) **[Figure 70-20-10]**.

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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 the obstruction and clean evaporator fins with air or water
2. Air leak	Check to make sure air hoses are properly hooked to Louvers and air ducts	Repair or adjust
3. Defective thermo switch (frozen evaporator)	Check thermostat using a circuit tester	Replace thermostat

Insufficient Cooling Although Air Flow And Compressor Operation Are Normal

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. System low on refrigerant	The high side pressure will be low and bubbles may be present in sight glass on receiver / drier	Repair any leaks and recharge the refrigerant to the correct level
2. Excessive Refrigerant	The high pressure side will be high	Use refrigerant recovery equipment to capture excess refrigerant. Charge to the correct refrigerant level

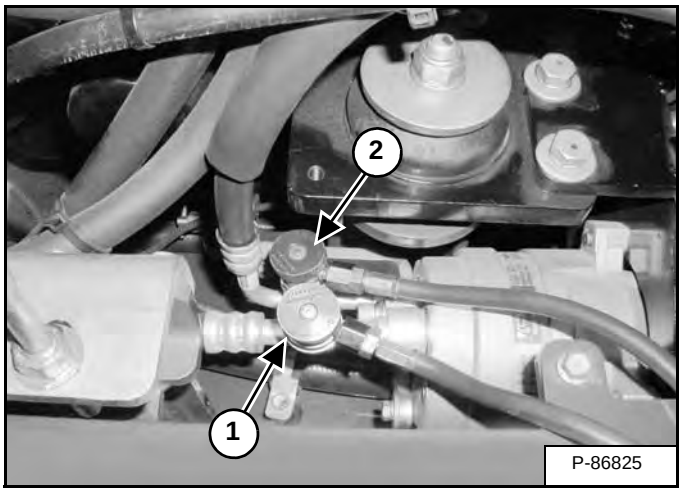
The Compressor Operates Improperly Or Not At All

POSSIBLE CAUSE	INSPECTION	SOLUTION
1. Loose drive belt	The belt is vibrating or oscillating	Adjust tension
2. Internal compressor malfunction	The compressor is locked up and the belt slips	Replace compressor
	MAGNETIC CLUTCH RELATED	
3. Low battery voltage	Clutch slips	Recharge the battery
4. Faulty coil	Clutch slips	Replace the magnetic clutch
5. Oil on the clutch surface	Clutch slips	Replace or clean the clutch surface
6. Open oil	Clutch does not engage and there is not reading when a circuit tester is connected between the coil and terminals	Replace clutch
7. Broken wiring or poor ground	Clutch will not engage. Inspect the ground and connections.	Repair
8. Wiring harness components	Test the conductance of the pressure switch, thermostat, relay, etc.	Check operation

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Gauge Pressure Related Troubleshooting

Figure 70-30-1



Install the gauge set on the low pressure port (Item 1) and the high pressure port (Item 2) **[Figure 70-30-1]**.

Open all windows and doors.

Start the engine and run at 1800 - 2000 rpm.

Check the high / low pressure of refrigerant.

High Pressure 790 - 980 kPa (7,9 - 9,8 bar) (114 - 142 psi)
Low Pressure 90 kPa (0,9 bar) (14 psi)

POSSIBLE CAUSE	INSPECTION	SOLUTION
Low refrigerant level	Inspect connections for traces of refrigerant oil	Reassemble fittings
	Use leak detection device to check for leakage at all major components and connections	Repair / replace leaking component

High Pressure Over 2260 kPa (22,6 bar) (327 psi)
Low Pressure Approximately 240 -290 kPa (2,4 - 2,9 bar) (35 - 42 psi)

POSSIBLE CAUSE	INSPECTION	SOLUTION
Overcharge, frost on condenser	High system pressure	Recover refrigerant and recharge to correct pressure
Condenser tube and / or fin damage	Inspect condenser for damaged tubes or cooling fins.	Repair / replace condenser

High Pressure 1970 - 2450 kPa (19,7 - 24,5 bar) (285 - 355 psi)
Low Pressure 240 - 340 kPa (2,4 - 3,4 bar) (35 - 50 psi)

POSSIBLE CAUSE	SOLUTION
Air in system	Recover refrigerant, replace receiver / dryer and recharge system

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Gauge Pressure Related Troubleshooting (Cont'd)

High Pressure Over 590 kPa (5,9 bar) (85 psi) Low Pressure Approximately 760 mm HG (29.9 In HG) (Negative Pressure)
Turn on air conditioning, set blower switch to high, turn air conditioner OFF and wait 10 minutes. Recheck High / Low pressure readings. High Pressure 1280 - 1860 kPa (12,8 - 18,6 bar) (185 - 270 psi) Low Pressure 140 - 320 kPa (1,4 - 3,2 bar) (21 - 47 psi)

POSSIBLE CAUSE	SOLUTION
Moisture in system	Recover refrigerant and replace receiver dryer
Contaminated system	Recover refrigerant and replace evaporator core assembly

High Pressure 590 - 1770 kPa (5,9 - 17,7 bar) (85 - 256 psi) Low Pressure 500 mm Hg (19.7 in Hg) (Negative Pressure)

POSSIBLE CAUSE	SOLUTION
Moisture in the system has iced up the expansion valve	Recover refrigerant, replace receiver / dryer, vacuum and recharge the system

High Pressure Over 2120 - 2260 kPa (21,2 - 22,6 bar) (313 - 327 psi) Low Pressure 250 kPa (2,5 bar) (36 psi)

POSSIBLE CAUSE	INSPECTION	SOLUTION
Refrigerant pressure problem due to defective expansion valve or temperature sensor	Inspect whether the temperature sensor is installed correctly	Install temperature sensor correctly, replace expansion valve.

High Pressure over 690 - 1080 kPa (6,9 - 10,8 bar) (100 - 156 psi) Low Pressure 390 - 590 kPa (3,9 - 5,9 bar) (57 - 85 psi)

POSSIBLE CAUSE	SOLUTION
Low pressure due to poor compressor performance	Inspect and replace compressor if necessary

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Temperature / Pressure Chart

NORMAL EVAPORATOR RANGE		NORMAL CONDENSER RANGE	
TEMP C (F)	kPag (barg) (psig)	TEMP C (F)	kPag (barg) (psig)
-9 (16)	108 (1,08) (15.69)	34 (93)	760 (7,60) (110.20)
-8 (18)	118 (1,18) (17.04)	34 (94)	773 (7,73) (112.10)
-7 (20)	127 (1,27) (18.43)	35 (95)	787 (7,87) (114.10)
-6 (22)	137 (1,37) (19.87)	38 (100)	857 (8,57) (124.30)
-4 (24)	147 (1,47) (21.35)	39 (102)	886 (8,86) (128.50)
-3 (26)	158 (1,58) (22.88)	40 (104)	916 (9,16) (132.90)
-2 (28)	169 (1,69) (24.47)	41 (106)	947 (9,47) (137.30)
-1 (30)	179 (1,79) (26.10)	42 (108)	978 (9,78) (141.90)
0 (32)	192 (1,92) (27.79)	43 (110)	1010 (10,10) (146.50)
1 (34)	204 (2,04) (29.52)	44 (112)	1043 (10,43) (151.30)
2 (36)	216 (2,16) (31.32)	46 (114)	1076 (10,76) (156.10)
3 (38)	229 (2,29) (33.17)	47 (116)	1111 (11,11) (161.10)
4 (40)	242 (2,42) (35.07)	48 (118)	1145 (11,45) (166.10)
6 (42)	255 (2,55) (37.03)	49 (120)	1181 (11,81) (171.30)
7 (44)	269 (2,69) (39.05)	50 (122)	1218 (12,18) (176.60)
7 (45)	276 (2,76) (40.09)	51 (124)	1255 (12,55) (182.00)
10 (50)	314 (3,14) (45.48)	52 (126)	1293 (12,93) (187.50)
13 (55)	353 (3,53) (51.27)	53 (128)	1331 (13,31) (193.10)
16 (60)	396 (3,96) (57.47)	54 (130)	1371 (13,71) (198.90)
18 (65)	442 (4,42) (64.10)	57 (135)	1473 (14,73) (213.70)
21 (70)	491 (4,91) (71.19)	60 (140)	1582 (15,82) (229.40)
24 (75)	543 (5,43) (78.75)	63 (145)	1695 (16,95) (245.80)
27 (80)	598 (5,98) (86.80)	66 (150)	1813 (18,13) (263.00)
29 (85)	658 (6,58) (95.40)	68 (155)	1938 (19,38) (281.10)
32 (90)	720 (7,20) (104.40)	71 (160)	2069 (20,69) (300.10)
33 (91)	733 (7,33) (106.30)	74 (165)	2207 (22,07) (320.10)
33 (92)	746 (7,46) (108.20)	77 (170)	2350 (23,50) (340.80)

Evaporator

Pressures represent gas temperatures inside the coil, not the coil surface. For an estimate of the temperature of the air coming off the coil add -12.5 ± -0.5°C (9 ± 1°F) to the temperature on the chart.

Condenser

Temperatures are not ambient temperatures but condensing temperatures. Add 4°C (40°F) to the ambient temperature to get the condensing temperature and then refer to the pressure chart to see appropriate pressure for ambient temperature.

Example: Ambient Temperature = 32°C (90°F)

32°C (90°F)
+ 4°C (40°F)
54°C (130°F) condenser temperature = 1379 kPa (14 bar) (200 psig)

Conditions and pressures will vary from system to system.

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Poor A/C Performance

Start the excavator. Engage the A/C system with the blower fan on high. Run the excavator at full rpm for approximately 15 minutes, with the cab door closed.

Figure 70-30-2

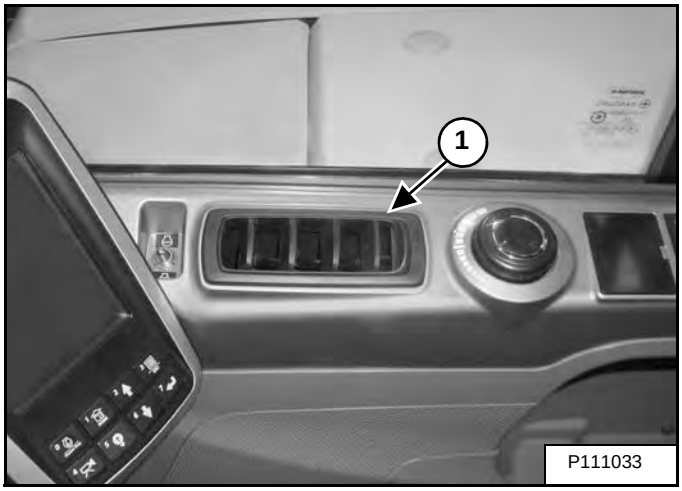


Figure 70-30-3

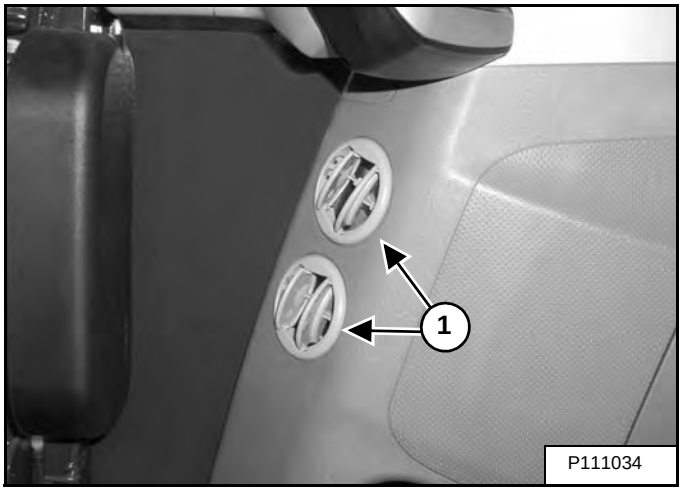


Figure 70-30-4

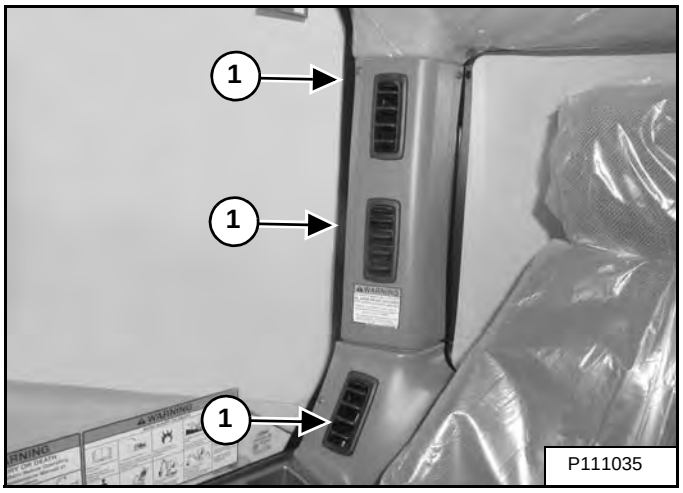
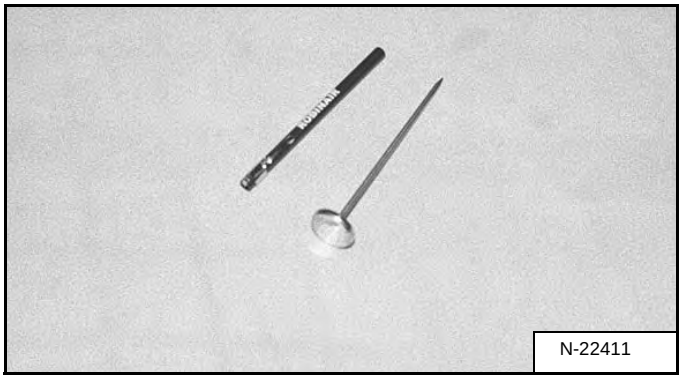


Figure 70-30-5



Check the temperature at the louvers (Item 1) **[Figure 70-30-2]**, **[Figure 70-30-3]** and **[Figure 70-30-4]** with a thermometer **[Figure 70-30-5]**.

The louver temperature should be between 2,2 - 11,6° C (36 - 53° F) depending on the amount of humidity in the air.

If louver temperature is too high see the System Troubleshooting Chart. (See Gauge Pressure Related Troubleshooting on Page 70-30-2.)

Check the fan for proper operation or noise, and replace if necessary. (See Removal And Installation on Page 70-110-1.)

Check the air conditioning belt tension. (See Belt Adjustment on Page 70-20-1.)

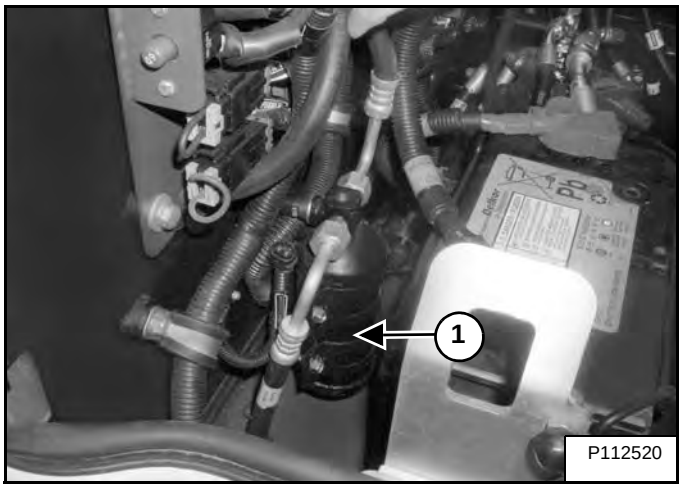
Check the A/C evaporator coil for dirt or mud, and clean if necessary. (See Evaporator / Heater Coil on Page 70-20-5.)

Inspect the sight glass located on the receiver / drier for air bubbles. (See Insufficient Cooling Although Air Flow And Compressor Operation Are Normal on Page 70-30-1.)

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HVAC Repair And Leaks

Figure 70-30-6



Whenever the A/C system is opened to the atmosphere or there has been a leak in the system, the receiver / drier (Item 1) **[Figure 70-30-6]** must be changed.

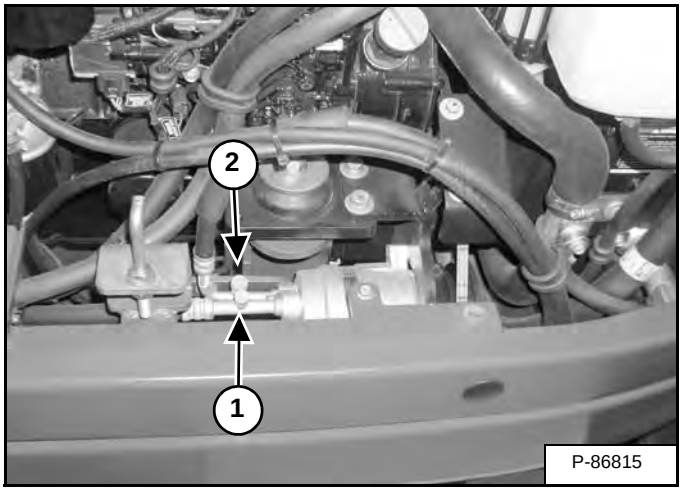
Never leave hose fittings, compressor fittings or components uncapped while working on the A/C system.

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SYSTEM CHARGING AND RECLAMATION

Reclamation And Charging With Recovery / Charging Unit

Figure 70-40-1



Open the right side cover and locate the low pressure port (Item 1) and high pressure port (Item 2) **[Figure 70-40-1]**.

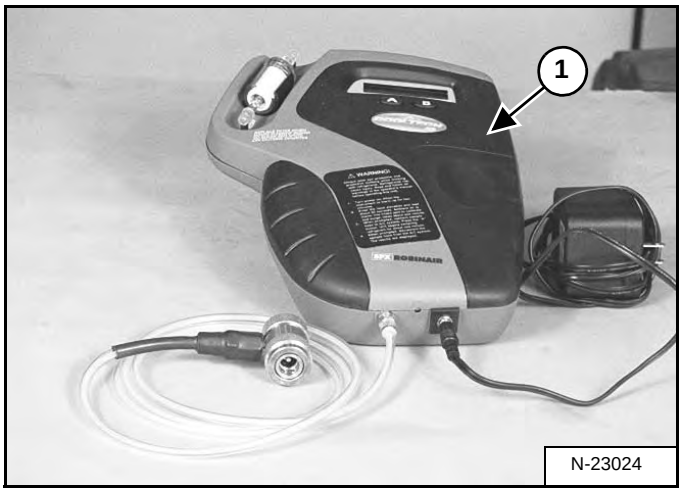
⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

W-2371-0611

NOTE: This procedure is run with the excavator engine OFF, and the A/C switch in the OFF position.

Figure 70-40-2

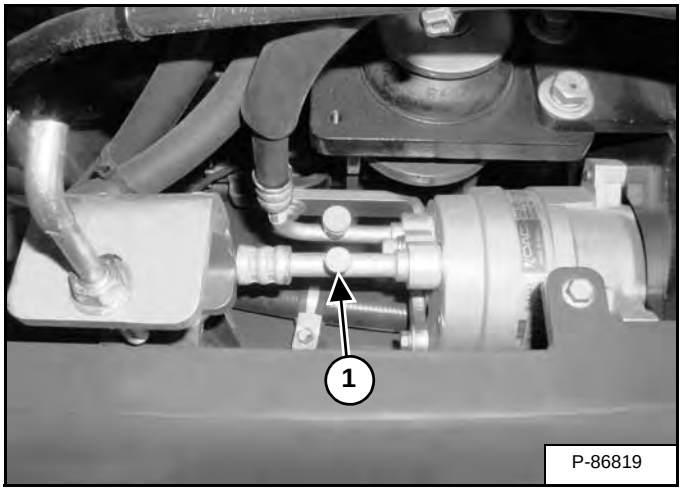


NOTE: Before reclaiming a refrigeration system, it is recommended to identify the type of refrigerant that is in the A/C system and whether it is pure enough to use or not. The tool MEL1592, Refrigerant Identifier (Item 1) [Figure 70-40-2] will determine the kind of refrigerant and any possible harmful or dangerous substances that may be present in the system. Thus preventing mixing of dangerous material with your reclaimed R-134a in your reclaimer, and further contamination to other A/C systems that are reclaimed and charged from your MEL1581 Recovery / Recycling / Recharging Machine.

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Reclamation And Charging With Recovery / Charging Unit (Cont'd)

Figure 70-40-3



Remove the protective cap and connect the Refrigerant Identifier to the low pressure hose (Item 1) **[Figure 70-40-3]**.

Connect the refrigerant identifier to a power source.

Follow the steps displayed on the refrigerant identifier screen.

Allow two minutes for the refrigerant identifier to display the type of refrigerant and air content. If potentially flammable hydrocarbons are present an alarm will sound and the visual display will indicate it.

Disconnect the refrigerant identifier from the excavator A/C.

If the refrigerant is dangerous or flammable, it must be evacuated from the A/C system into a separate container and properly and safely disposed of.

If R-134a is found, evacuate the system.

⚠ WARNING

HFC R-134a refrigerant can be dangerous if not properly handled. Liquid R-134a may cause blindness if it contacts the eyes and may cause serious frostbite if it contacts the skin.

- **Gaseous R-134a becomes lethal (phosgene) gas when it contacts open flame or very hot substances.**
- **NEVER SMOKE when there is the possibility of even small amounts of R-134a in the air.**

Any servicing work that involves release or addition of R-134a to the system must be done by a competent refrigeration dealer who has the proper equipment, knowledge, and experience to service refrigeration equipment.

W-2373-0611

Figure 70-40-4



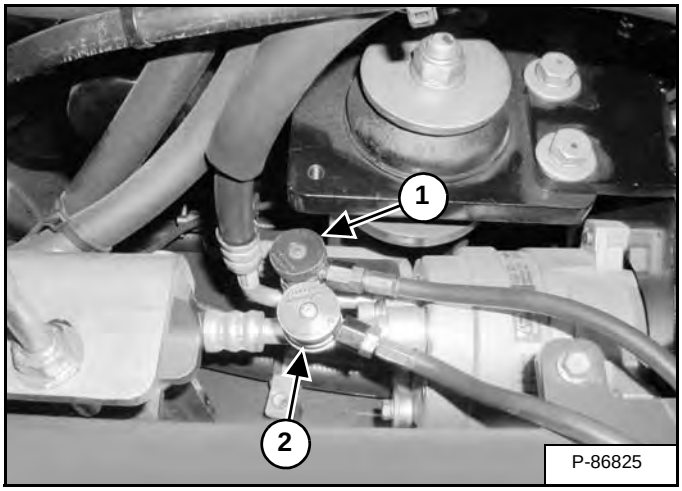
Use an approved recover / charging unit **[Figure 70-40-4]** to evacuate the system.

Connect the reclaimer to the excavator A/C charge ports.

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Reclamation And Charging With Recovery / Charging Unit (Cont'd)

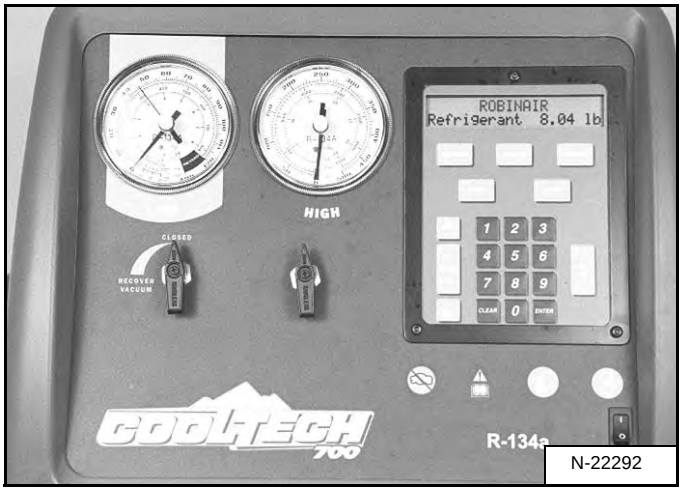
Figure 70-40-5



Connect the Red hose (Item 1) **[Figure 70-40-5]** to the high pressure port and open the valve.

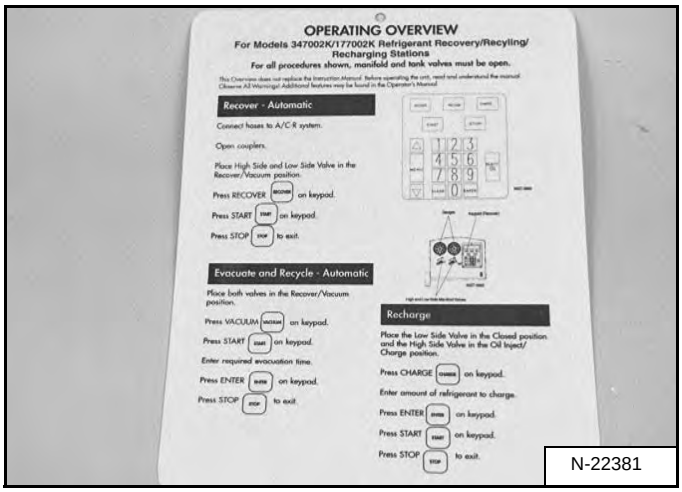
Connect the Blue hose (Item 2) **[Figure 70-40-5]** to the low pressure port and open the valve.

Figure 70-40-6



Turn the reclaimer unit to the ON position and follow the on screen instructions **[Figure 70-40-6]**.

Figure 70-40-7



NOTE: The reclaimer unit has a complete step by step set of instructions [Figure 70-40-7] to follow for reclamation and recharging of the A/C system. A trained technician should follow these instructions as they may very slightly depend on the model and brand of reclaimer used.

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Charging With A Manifold Gauge Set

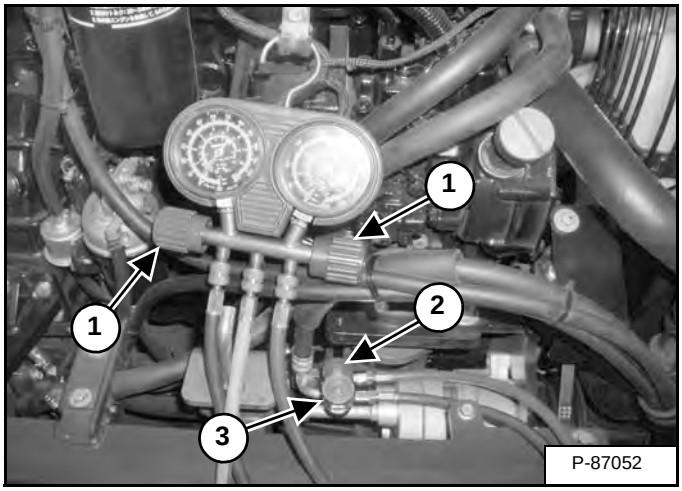
Open the right side cover.

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

W-2371-0611

Figure 70-40-8



Check to see that the hand valves (Item 1) **[Figure 70-40-8]** are closed on the manifold gauge set.

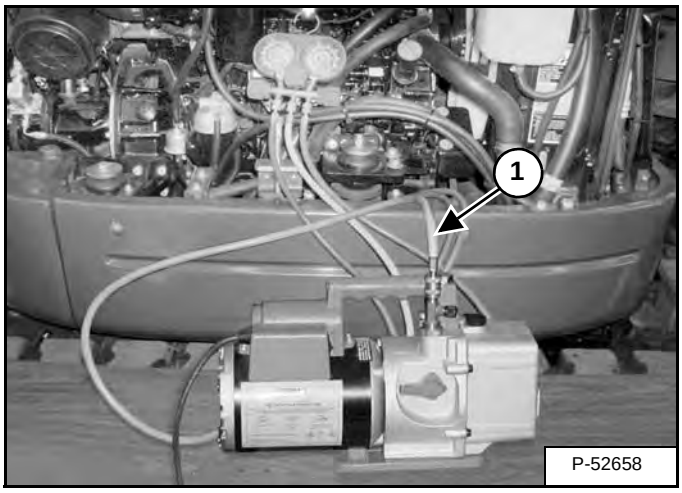
If there is any refrigerant in the A/C system, it must be recovered by an approved A/C reclamation procedure. (See Reclamation And Charging With Recovery / Charging Unit on Page 70-40-1.)

Connect the gauge to the excavator A/C charge ports.

Connect the Red hose (Item 2) **[Figure 70-40-8]** to the high pressure port and open the valve.

Connect the Blue hose (Item 3) **[Figure 70-40-8]** to the low pressure port and open the valve.

Figure 70-40-9

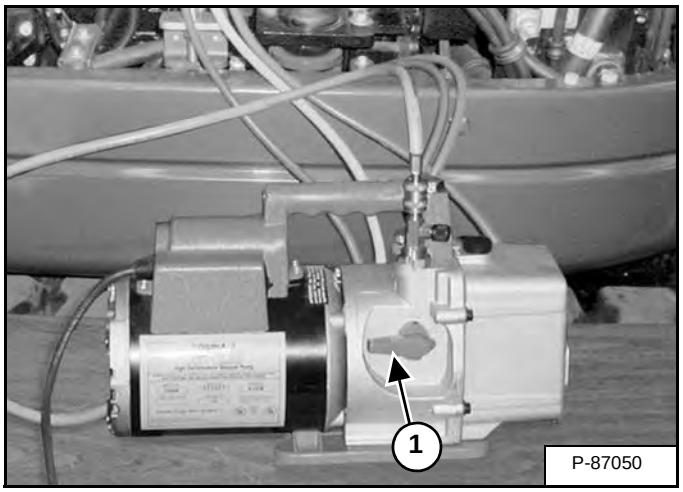


Connect the Yellow hose (Item 1) **[Figure 70-40-9]** to the vacuum pump.

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Charging With A Manifold Gauge Set (Cont'd)

Figure 70-40-10

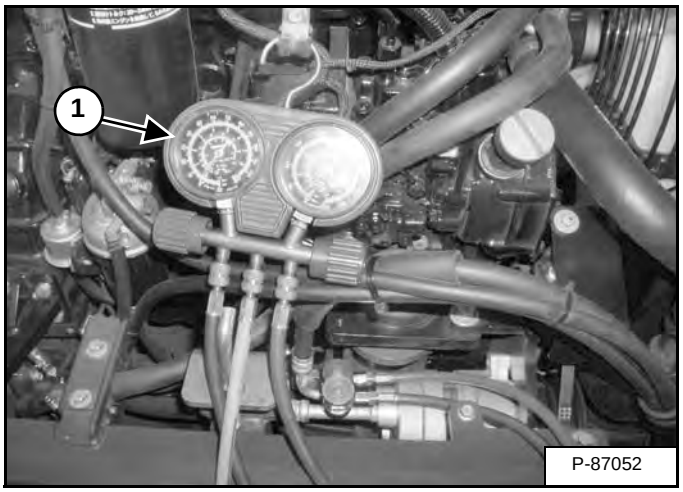


Start the vacuum pump and open the ISO-valve (Item 1) **[Figure 70-40-10]** on the vacuum pump.

Run the vacuum pump for at least 5 - 10 minutes to make sure that a vacuum has been pulled on the system.

Close the ISO-valve (Item 1) **[Figure 70-40-10]** (which isolates the vacuum pump from the A/C system) and turn OFF the vacuum pump.

Figure 70-40-11

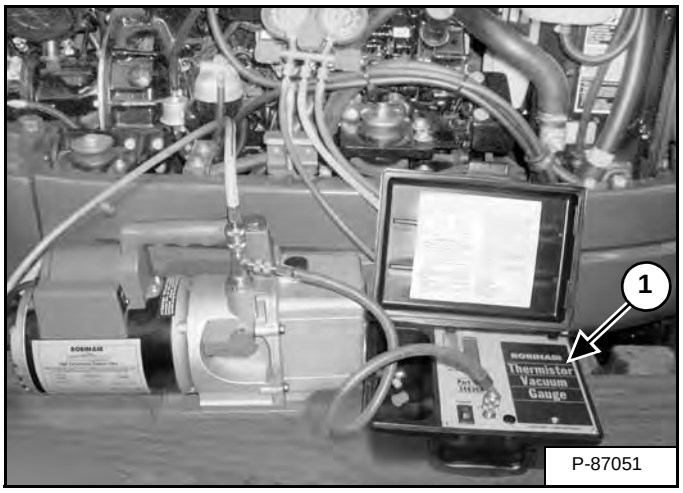


Note the vacuum pressure indicated on the low pressure (Blue) gauge (Item 1) **[Figure 70-40-11]**. Let stand for 5-10 minutes and recheck the pressure for changes.

If the pressure drops, this may be an indication of a leak in the A/C system.

Determine the problem with the A/C system and repair it.

Figure 70-40-12



A thermistor vacuum gauge (Item 1) **[Figure 70-40-12]** can be used to determine the critical vacuum level during evacuation. It is a solid state instrument that constantly monitors and visually indicates the vacuum level.

The thermistor vacuum gauge is used with the vacuum pump **[Figure 70-40-12]**.

Start the vacuum pump and open the ISO-valve on the vacuum pump.

Make sure that both hand valves, and both charge port valves are open.

Run the vacuum pump for at least 45 minutes to insure that all the moisture is boiled out of the system.

Stop the vacuum pump and close the ISO-valve on the vacuum pump.

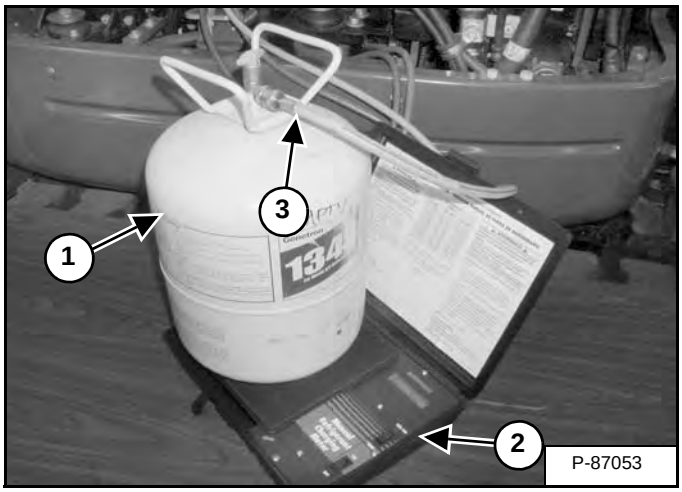
Close both hand valves on the manifold gauge set and remove the yellow hose from the vacuum pump that goes to the manifold gauge set.

Remove the vacuum pump and thermistor vacuum gauge.

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Charging With A Manifold Gauge Set (Cont'd)

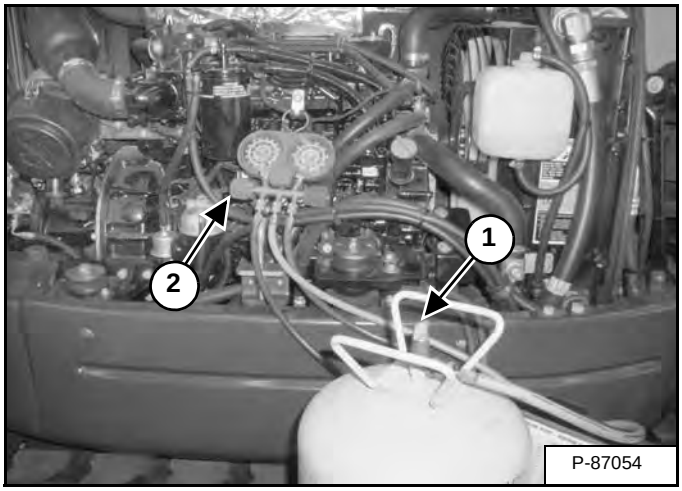
Figure 70-40-13



Place a refrigerant container with R-134a (Item 1) on a charging scale (Item 2) **[Figure 70-40-13]** and zero out the scale.

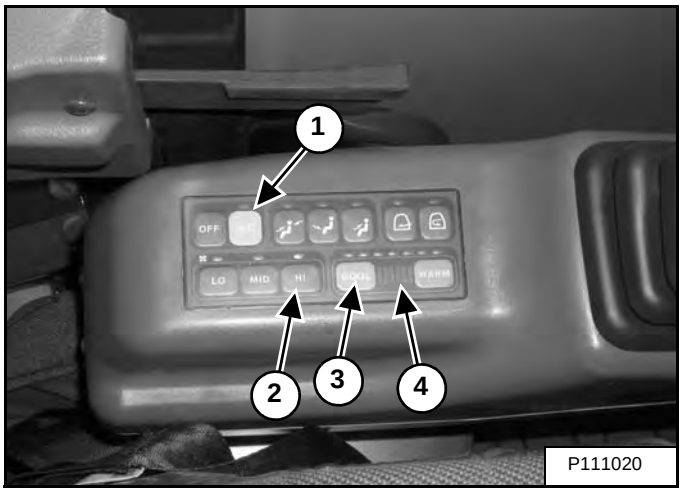
Connect the yellow hose (Item 3) **[Figure 70-40-13]** from the manifold gauge set to the valve on the refrigerant tank.

Figure 70-40-14



Open the valve on the refrigerant container (Item 1) and open the low pressure hand valve (Blue) (Item 2) **[Figure 70-40-14]** on the manifold gauge set. Allow the vacuum to pull in the refrigerant until the pressure stabilizes.

Figure 70-40-15



Press the A/C (Item 1) **[Figure 70-40-15]** switch to ON position.

Press the fan switch (Item 2) **[Figure 70-40-15]** to HIGH position.

Press the cool switch (Item 3) until all the indicator lights (Item 4) **[Figure 70-40-15]** are green.

Start the engine, with the left console in the raised position, and run at medium speed.

Watch the scale and run the system until the predetermined amount of refrigerant is added to the A/C system.

The A/C system holds 0,63 - 0,67 kg (1.38 - 1.48 lb) of refrigerant.

Turn OFF the valve on the refrigerant container, and the hand valves on the manifold gauge set.

Turn OFF the engine, and remove the A/C charging equipment from the excavator.

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COMPRESSOR

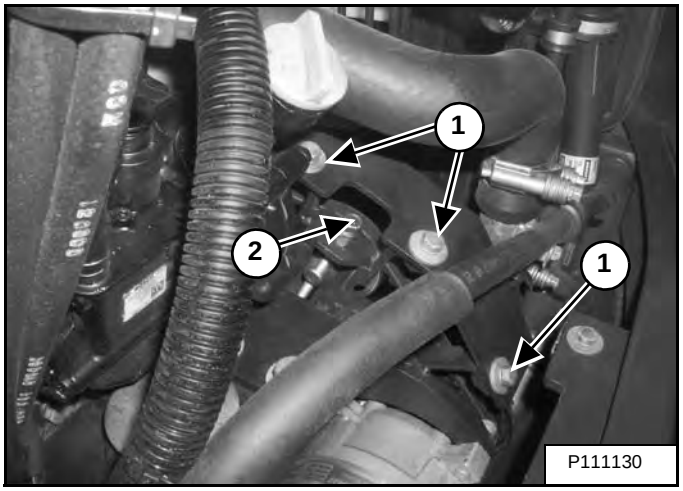
Removal And Installation

Open the right side cover.

Remove the right upperstructure side cover. (See Removal And Installation on Page 40-21-1.)

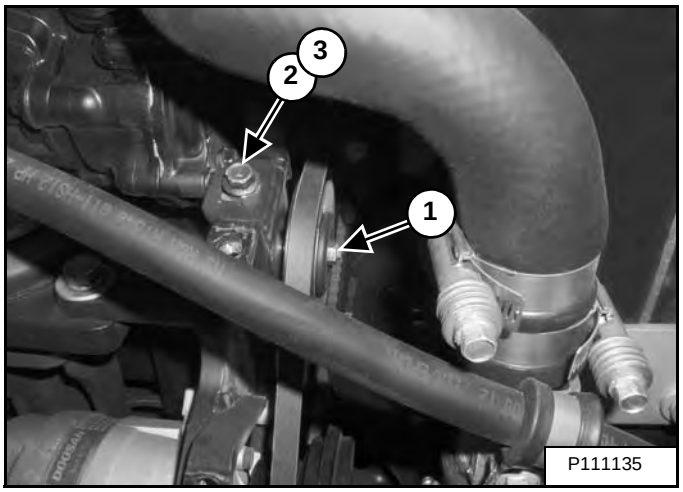
Evacuate the A/C system. (See SYSTEM CHARGING AND RECLAMATION on Page 70-40-1.)

Figure 70-50-1



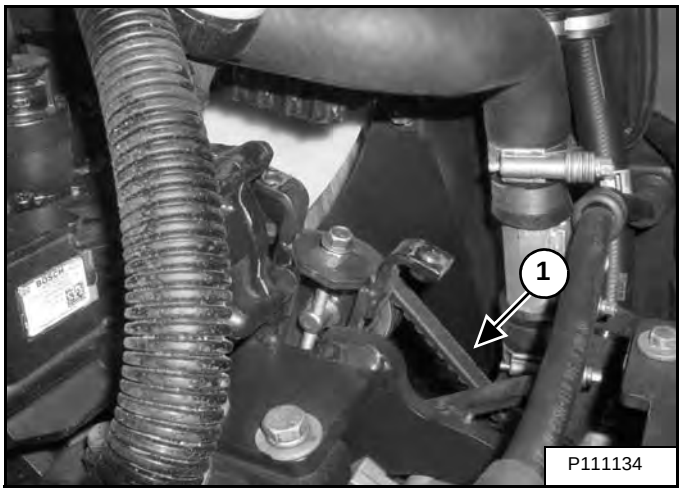
Remove the three bolts (Item 1) and washers. Remove the belt shield (Item 2) **[Figure 70-50-1]**.

Figure 70-50-2



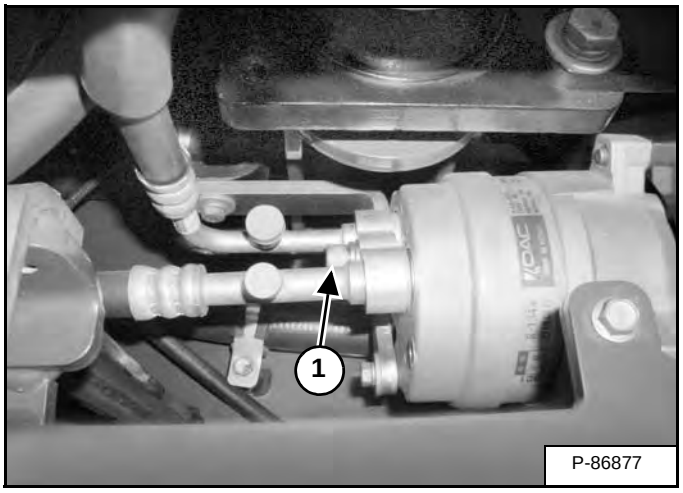
Loosen the nut (Item 1) on the pulley. Loosen the lock nut (Item 2) and adjustment bolt (Item 3) **[Figure 70-50-2]**.

Figure 70-50-3



Remove the belt (Item 1) **[Figure 70-50-3]**.

Figure 70-50-4

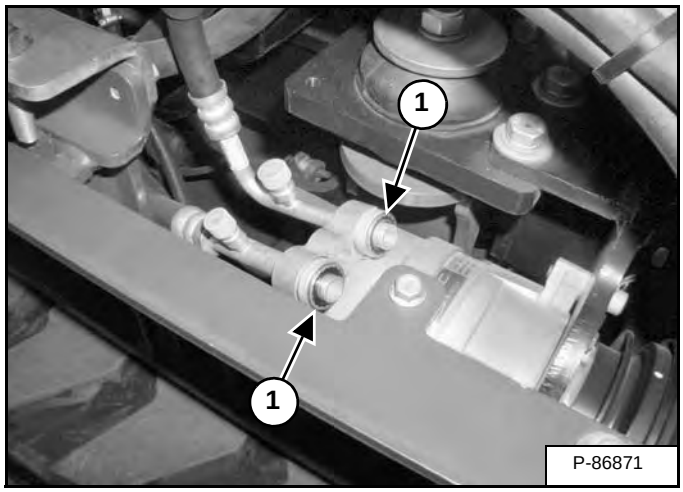


Remove the bolt (Item 1) **[Figure 70-50-4]** and the hoses from the compressor.

Dealer Copy -- Not for Resale

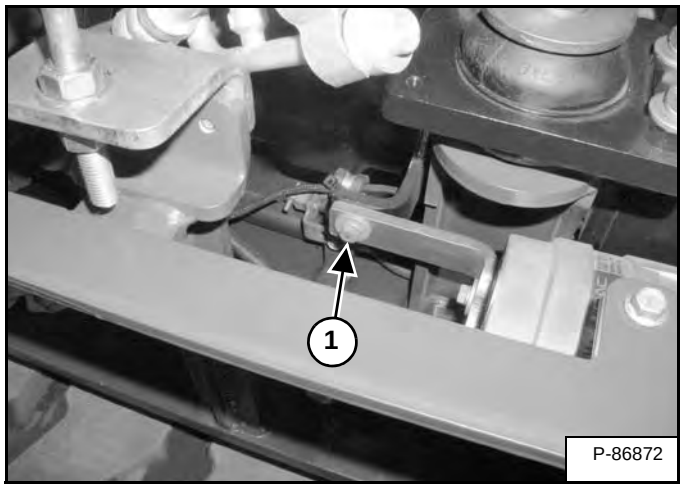
Removal And Installation (Cont'd)

Figure 70-50-5



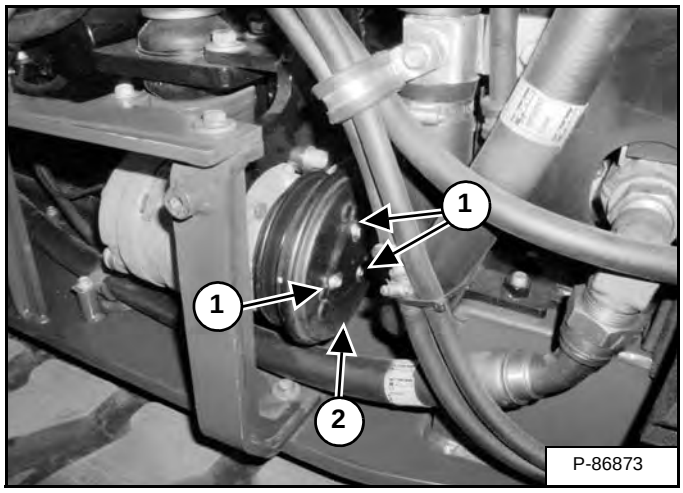
Remove the seal washers (Item 1) **[Figure 70-50-5]** from the tubelines.

Figure 70-50-6



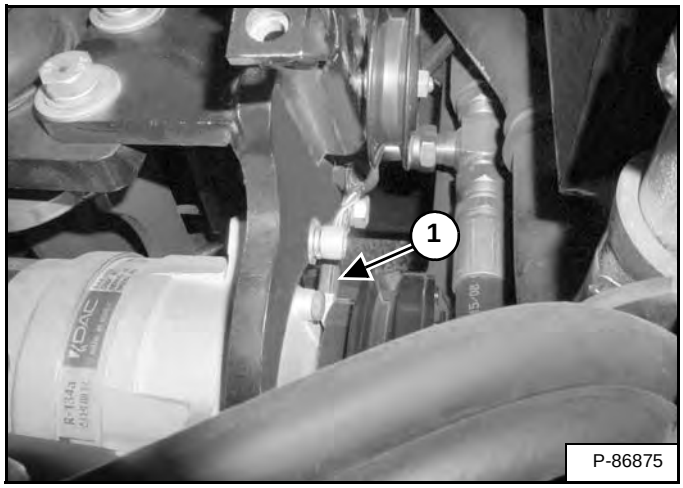
Remove the rear bolt (Item 1) **[Figure 70-50-6]** and washer.

Figure 70-50-7



Remove the three screws (Item 1) and remove the dust cover (Item 2) **[Figure 70-50-7]**.

Figure 70-50-8

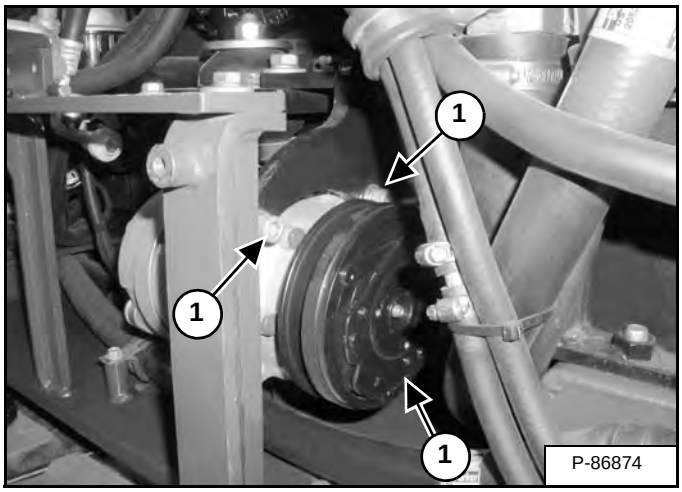


Disconnect the wire harness (Item 1) **[Figure 70-50-8]**.

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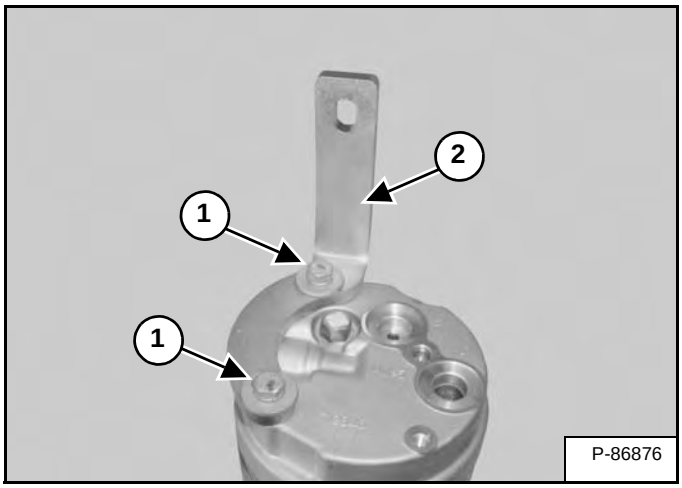
Removal And Installation (Cont'd)

Figure 70-50-9



Remove the three bolts (Item 1) **[Figure 70-50-9]** and the compressor from the excavator.

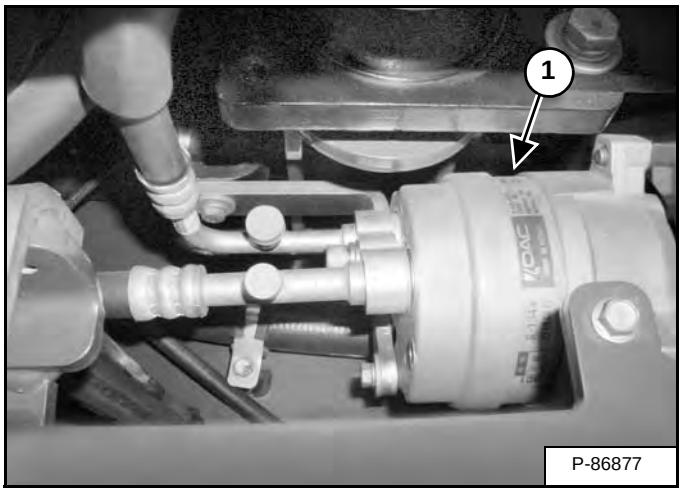
Figure 70-50-10



Remove the two bolts (Item 1) and washers. Remove the bracket (Item 2) **[Figure 70-50-10]**.

Oil

Figure 70-50-11



The compressor (Item 1) **[Figure 70-50-11]** is factory filled with 0,266 L (9.0 U.S. fl oz) of PAG oil.

It is necessary to check, replenish or replace the compressor oil in the following cases:

1. When the evaporator, condenser or receiver-drier is replaced.
2. When refrigerant has leaked from the system.
3. When refrigerant is suddenly released from the cooling cycle.
4. When any oil related problems occur in the cooling cycle.

When one of the components (the evaporator, condenser or receiver-drier) is replaced, 0,029 L (1.0 U.S. fl oz) of PAG oil should be added for each component replaced.

If the A/C compressor is changed, no oil should be added to the system, the compressor comes factory filled with oil.

NOTE: Only PAG oil should be used. Never mix R-12 and R-134a Oils.

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Oil Check

The compressor oil should be checked as follows when oil is being added to an in service excavator.

There is a close affinity between oil and refrigerant. During normal operation, part of the oil circulates with the refrigerant in the system. When checking the amount of oil in the system or replacing any system component, the compressor must be run in advance to insure return of oil to the compressor.

If the amount of refrigerant in the system has decreased, charge the system. (See SYSTEM CHARGING AND RECLAMATION on Page 70-40-1.)

Open the cab door and windows.

Run the blower at maximum speed.

Run the compressor for at least 20 minutes at 800 - 1200 rpm.

Remove the compressor from the excavator. (See Removal And Installation on Page 70-50-1.)

Figure 70-50-12

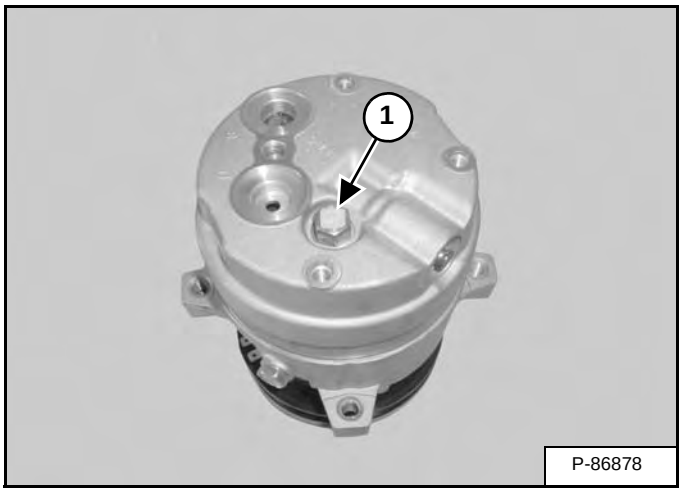
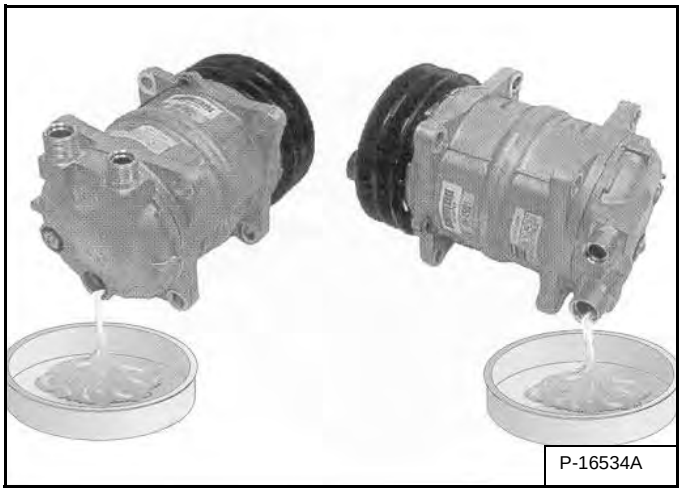


Figure 70-50-13



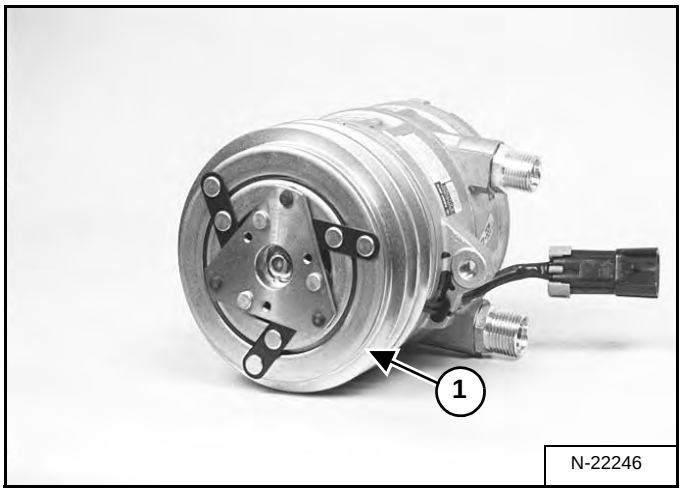
Remove the oil drain plug (Item 1) **[Figure 70-50-12]** and drain the oil through the connectors and the oil drain hole **[Figure 70-50-13]**.

Installation: Tighten the oil drain plug to 13 - 15 N•m (9.4 - 10.8 ft-lb) torque.

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Oil Check (Cont'd)

Figure 70-50-14



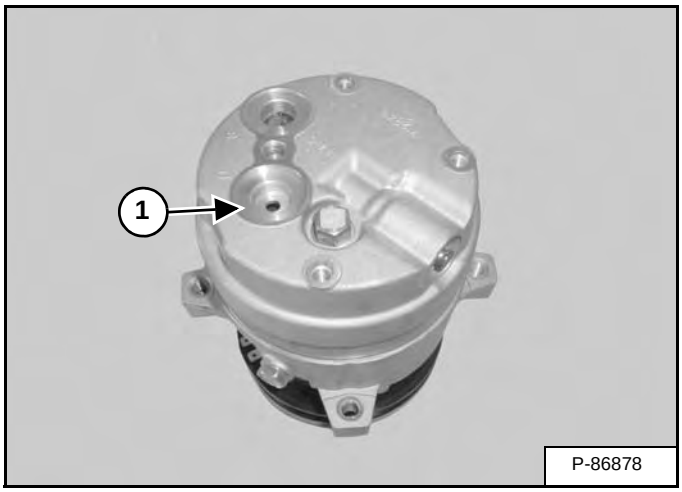
NOTE: After draining the oil through the drain hole and the connectors, extract the remaining oil through the discharge-side connector by rotating the drive pulley (Item 1) [Figure 70-50-14] several times by hand.

Measure the drained oil in a measuring cylinder.

Check the oil for contamination, dirt, metal shavings, or varnish color. Discard the oil if contaminated.

NOTE: If metal shavings are found in the compressor oil, replace the complete compressor assembly.

Figure 70-50-15



Add new compressor oil through the suction side connector (Item 1) **[Figure 70-50-15]**.

Installation: Add 0,266 L (9.0 U.S. fl oz) of PAG oil.

NOTE: The suction port on the compressor is marked with an S and is the larger port on the compressor.

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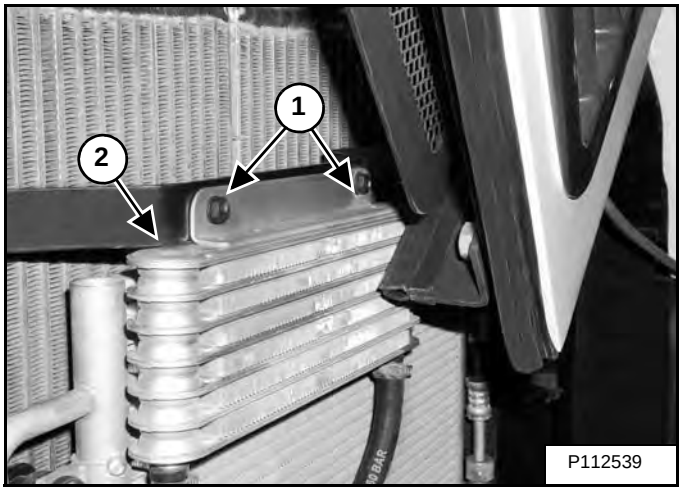
Dealer Copy -- Not for Resale

CONDENSER

Removal And Installation

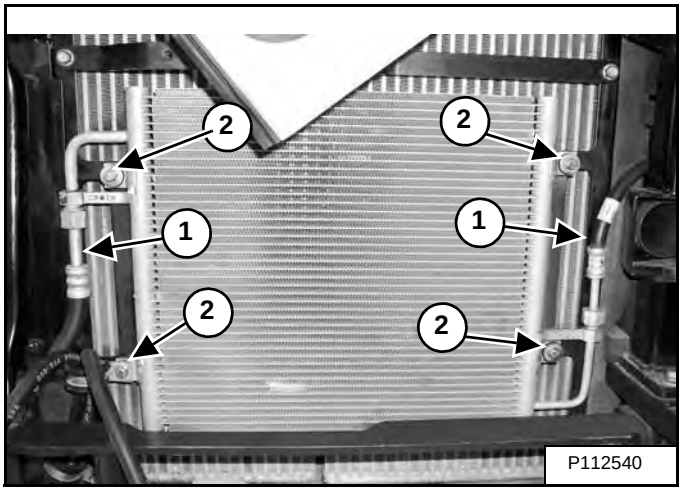
Evacuate the A/C system. (See SYSTEM CHARGING AND RECLAMATION on Page 70-40-1.)

Figure 70-60-1



Remove the bolts (Item 1) and reposition the fuel cooler (Item 2) **[Figure 70-60-1]**.

Figure 70-60-2



Remove the hoses (Item 1) **[Figure 70-60-2]** from the condenser.

⚠ WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

W-2371-0611

Remove the bolts (Item 2) **[Figure 70-60-2]** and remove the condenser from the evacuator.

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Dealer Copy -- Not for Resale

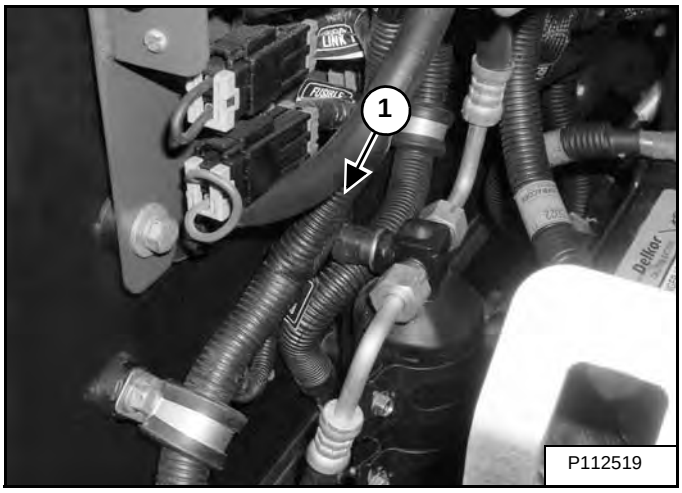
RECEIVER / DRIER

Receiver / Drier Removal And Installation

Evacuate the A/C system. (See SYSTEM CHARGING AND RECLAMATION on Page 70-40-1.)

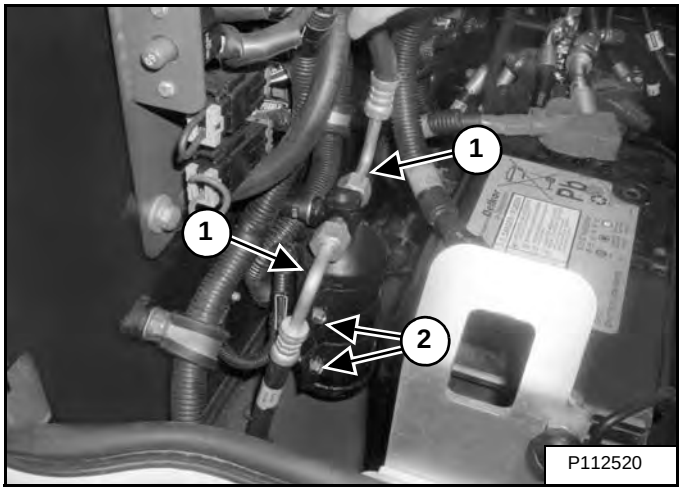
Open the center cover. (See Opening And Closing on Page 10-70-1.)

Figure 70-70-1



Disconnect the wire harness (Item 1) **[Figure 70-70-1]**.

Figure 70-70-2



Remove the A/C hoses (Item 1) **[Figure 70-70-2]** from the receiver / drier.

Cap and plug the hoses and the receiver / drier fittings with the proper A/C caps and plugs.

Note the flow direction on the drier for proper installation.

WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

W-2371-0611

Remove the two bolts (Item 2) **[Figure 70-70-2]** and remove the receiver / drier from the excavator.

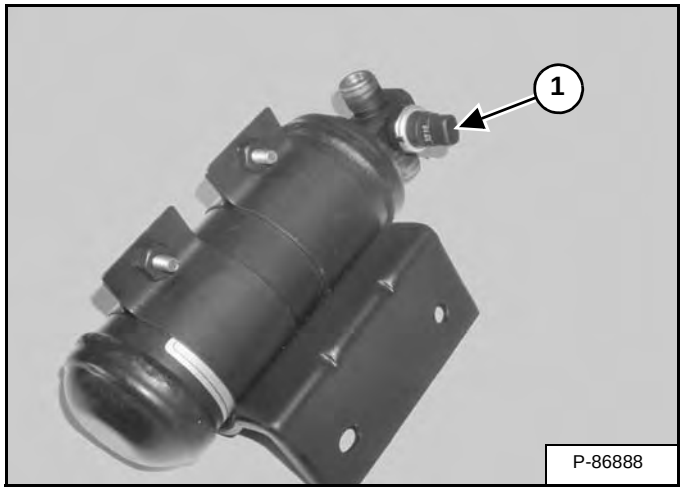
NOTE: When replacing a receiver / drier, 0,029 L (1.0 U.S. fl oz) of PAG oil must be added to the system when recharging.

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Pressure Switch Removal And Installation

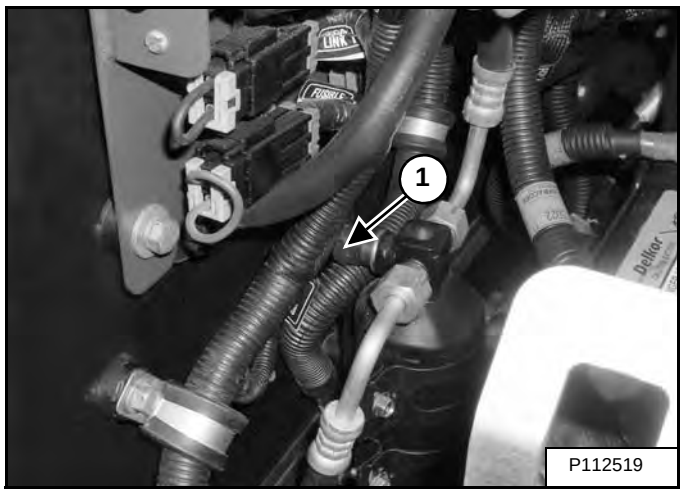
Open the center cover.

Figure 70-70-3



The pressure switch (Item 1) **[Figure 70-70-3]** is located on the receiver / drier.

Figure 70-70-4



Disconnect the wire harness (Item 1) **[Figure 70-70-4]** from the pressure switch.

NOTE: The pressure switch can be changed without evacuating the A/C system.

Remove the pressure switch from the receiver / drier.

WARNING

In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

W-2371-0611

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EVAPORATOR / HEATER UNIT

Removal And Installation

Evacuate the A/C system. (See SYSTEM CHARGING AND RECLAMATION on Page 70-40-1.)

⚠ WARNING

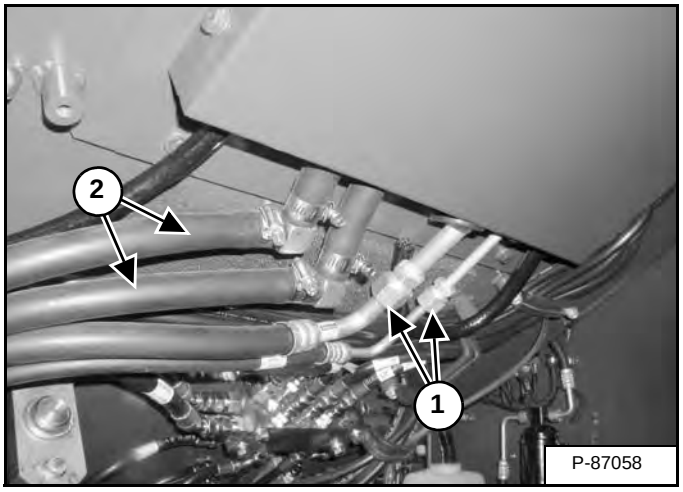
In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.

W-2371-0611

Tilt the cab. (See Raising And Lowering on Page 10-210-1.)

Drain the radiator. (See Removing And Replacing Coolant on Page 10-110-2.)

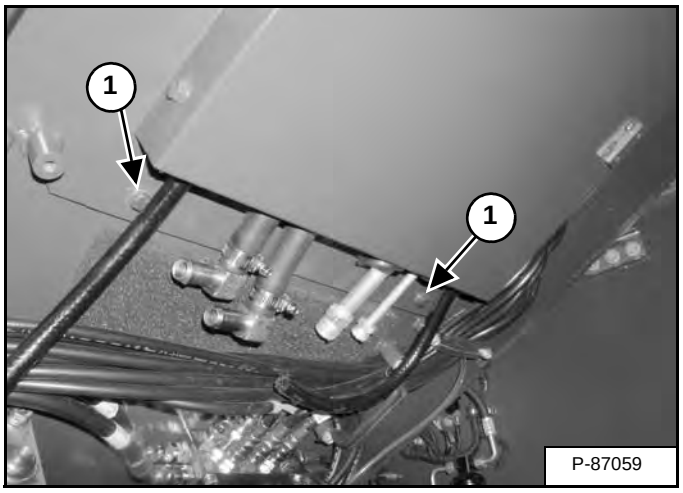
Figure 70-80-1



Disconnect the A/C lines (Item 1). Loosen the hose clamps and remove the heater hoses (Item 2) **[Figure 70-80-1]**.

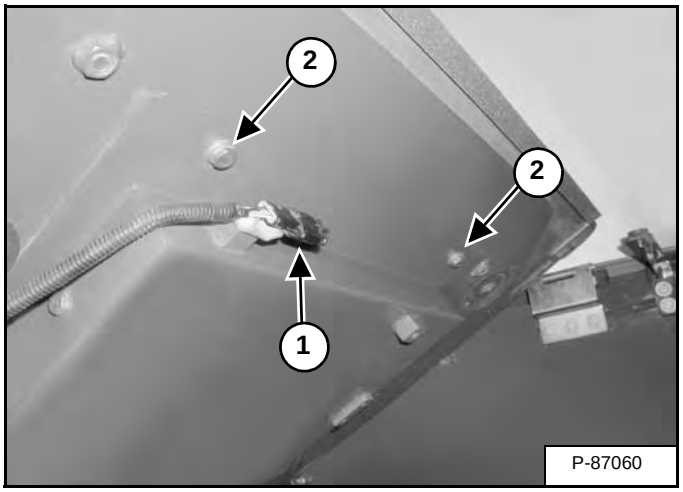
NOTE: Mark the hoses before removal for correct installation.

Figure 70-80-2



Remove the two bolts (Item 1) **[Figure 70-80-2]** and washers.

Figure 70-80-3



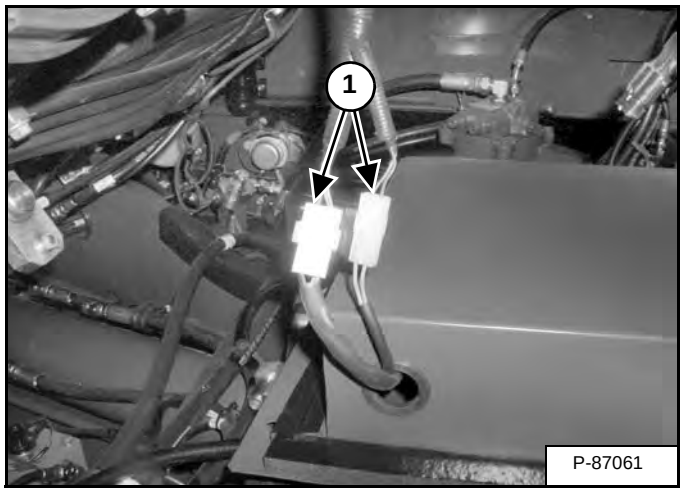
Remove the wire harness (Item 1) from the mount. Support the housing and remove the two bolts (Item 2) **[Figure 70-80-3]** and washers.

Lower the housing.

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Removal And Installation (Cont'd)

Figure 70-80-4



Disconnect the wire harness (Item 1) **[Figure 70-80-4]**.

Remove the unit from the machine.

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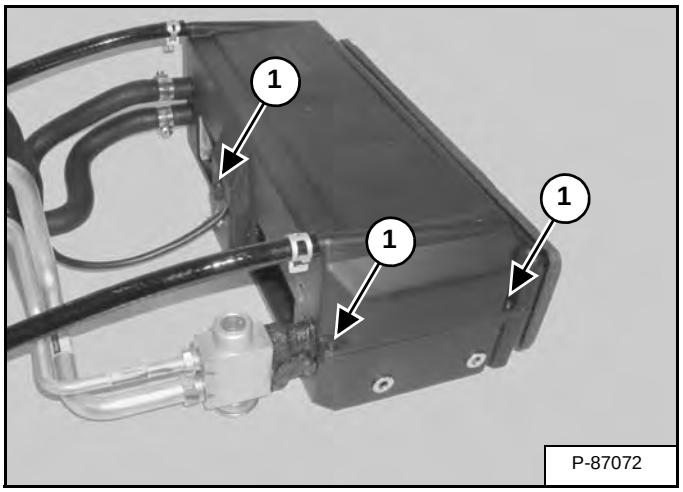
THERMOSTAT

Inspection

NOTE: The thermostat is not serviceable separately. The procedure shown is for inspection purposes.

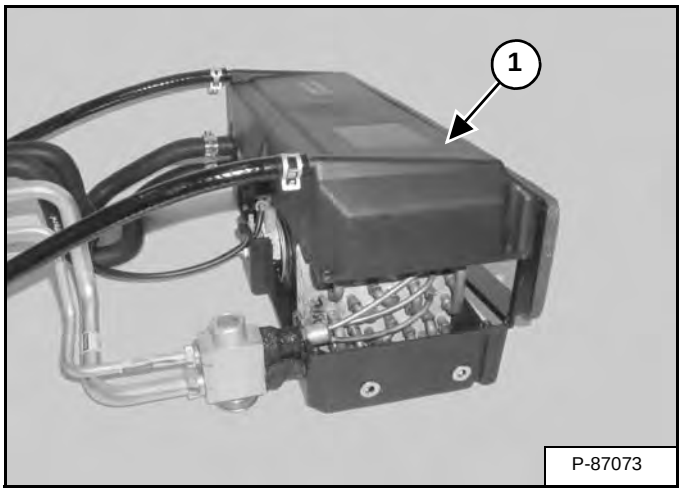
Remove the blower fan. (See Removal And Installation on Page 70-110-1.)

Figure 70-90-1



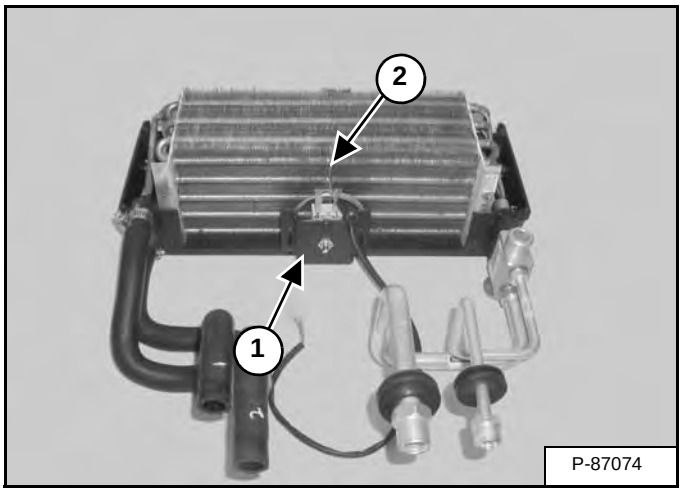
Remove the five screws (Item 1) **[Figure 70-90-1]**.

Figure 70-90-2



Remove the cover (Item 1) **[Figure 70-90-2]**.

Figure 70-90-3



Inspect the thermostat (Item 1) for damage. Inspect the thermostat probe (Item 2) **[Figure 70-90-3]** for correct placement.

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Dealer Copy -- Not for Resale

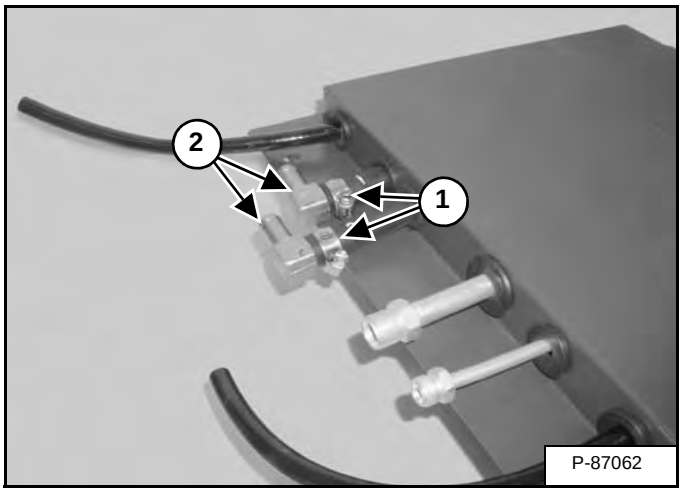
EXPANSION VALVE

Removal And Installation

NOTE: The expansion valve is not serviceable separately. The procedure shown is for inspection purposes.

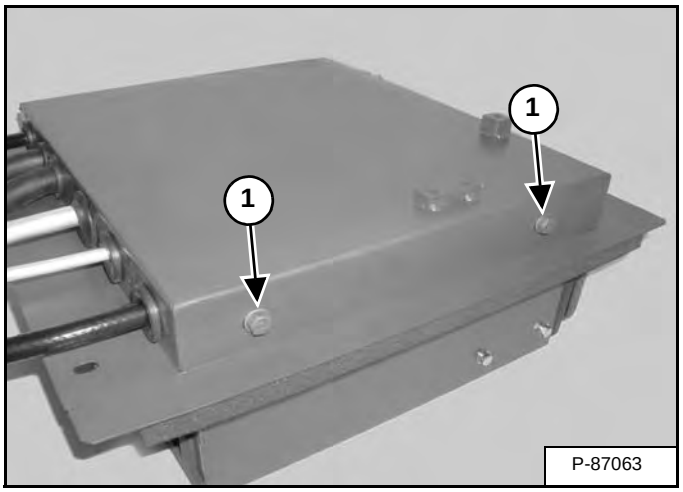
Remove the evaporator / heater unit. (See Removal And Installation on Page 70-80-1.)

Figure 70-100-1



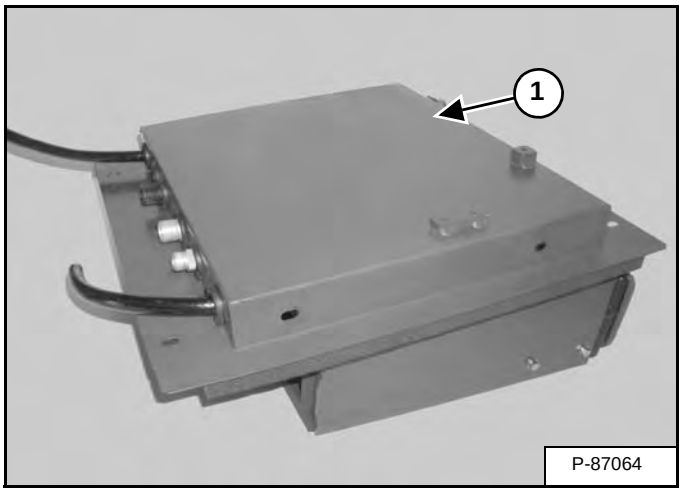
Loosen the clamps (Item 1) and remove the fittings (Item 2) **[Figure 70-100-1]**.

Figure 70-100-2



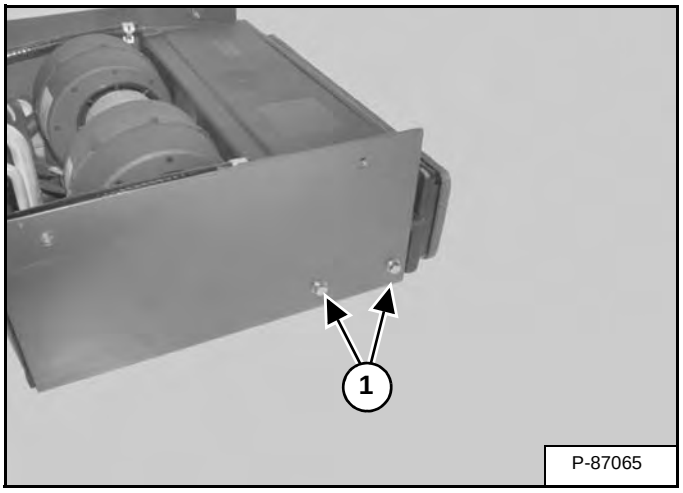
Remove the two bolts (Item 1) **[Figure 70-100-2]** and washers from both sides.

Figure 70-100-3



Remove the bottom cover (Item 1) **[Figure 70-100-3]**.

Figure 70-100-4



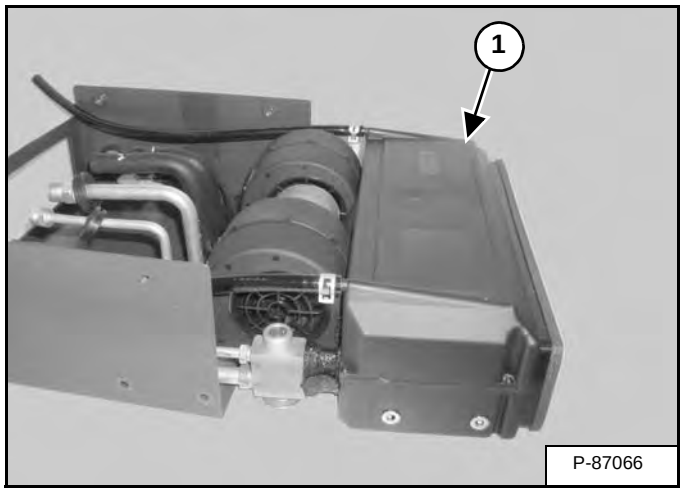
Remove the bolts (Item 1) **[Figure 70-100-4]** and washers from both sides.

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EXPANSION VALVE (CONT'D)

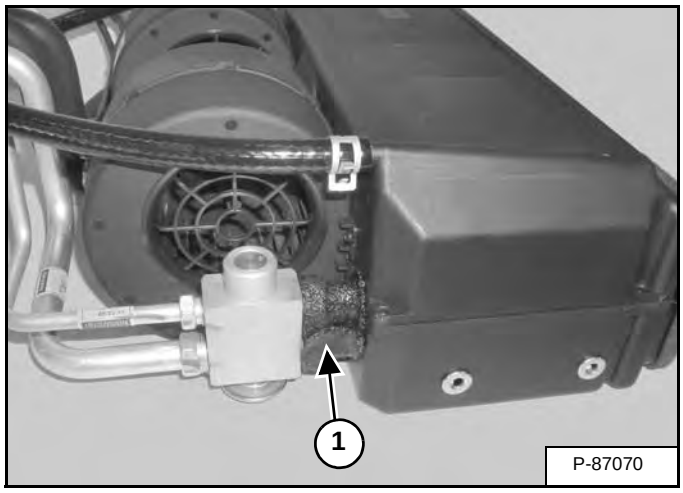
Removal And Installation (Cont'd)

Figure 70-100-5



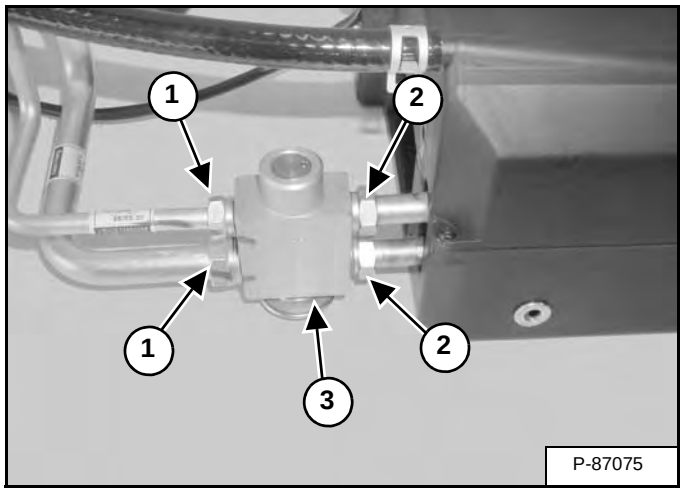
Remove the heater core / evaporator (Item 1) **[Figure 70-100-5]** from the top cover.

Figure 70-100-6



Remove the tape (Item 1) **[Figure 70-100-6]**.

Figure 70-100-7



Remove the tubelines (Item 1). Loosen the tubeline nuts (Item 2) and remove the expansion valve (Item 3) **[Figure 70-100-7]**.

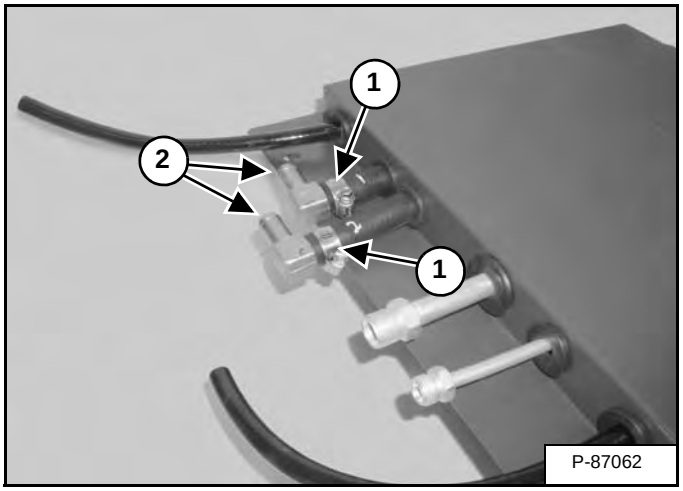
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BLOWER FAN

Removal And Installation

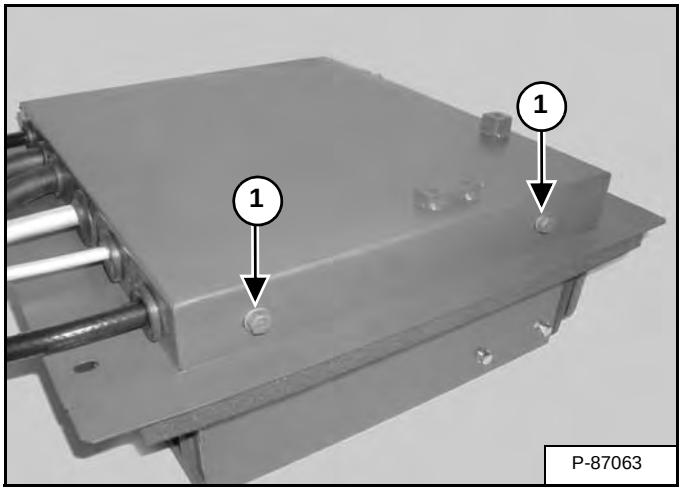
Remove the evaporator / heater unit. (See Removal And Installation on Page 70-80-1.)

Figure 70-110-1



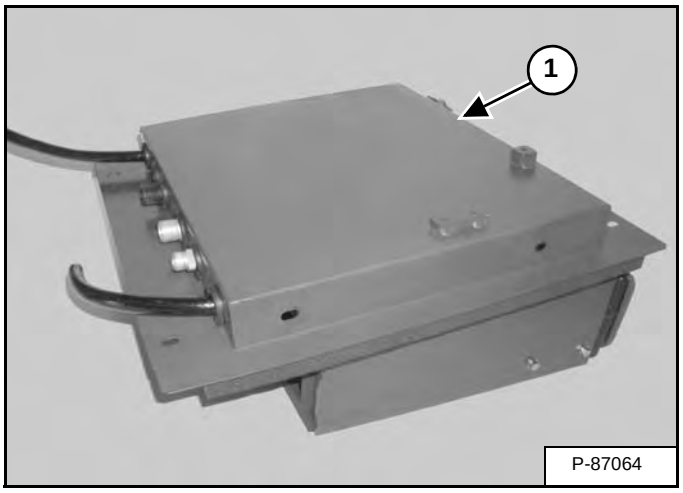
Loosen the clamps (Item 1) and remove the fittings (Item 2) **[Figure 70-110-1]**.

Figure 70-110-2



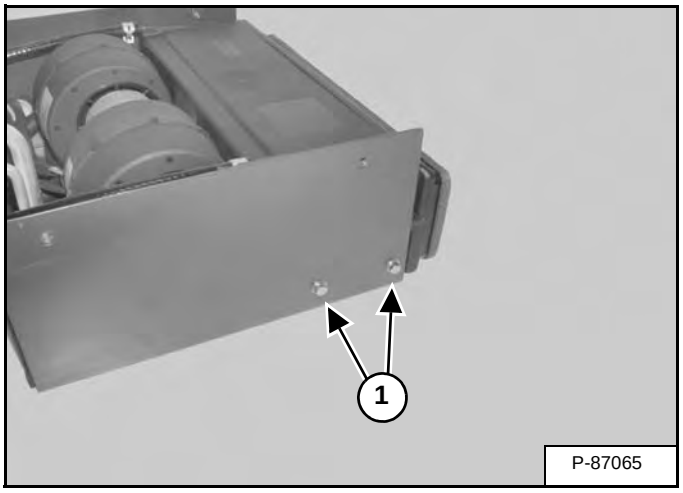
Remove the two bolts (Item 1) **[Figure 70-110-2]** and washers from both sides.

Figure 70-110-3



Remove the bottom cover (Item 1) **[Figure 70-110-3]**.

Figure 70-110-4



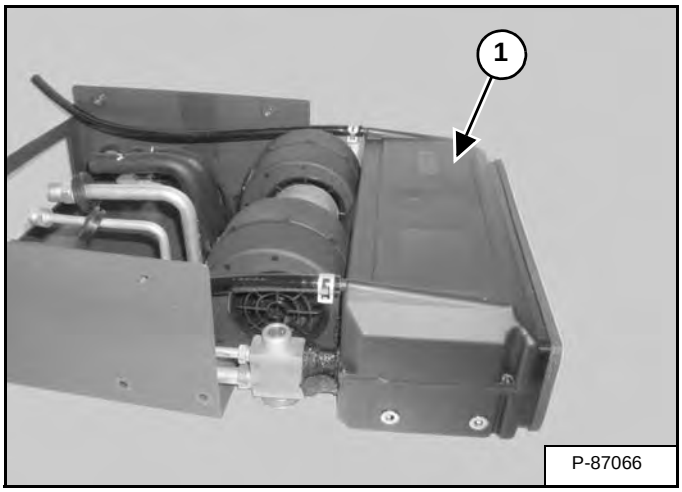
Remove the two bolts (Item 1) **[Figure 70-110-4]** and washers from both sides.

Dealer Copy -- Not for Resale

BLOWER FAN (CONT'D)

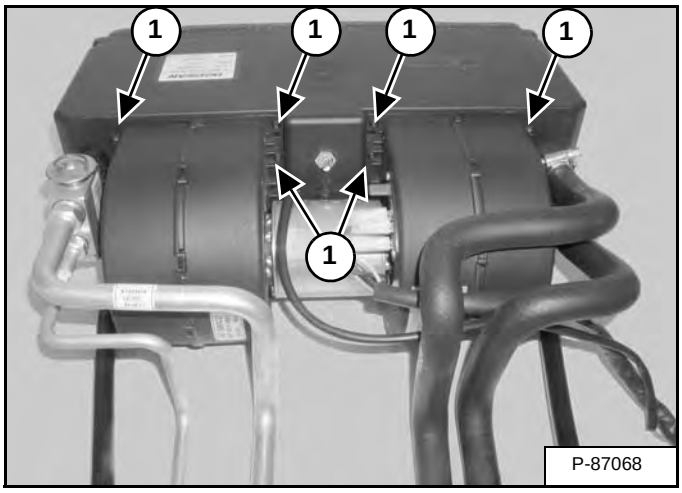
Removal And Installation (Cont'd)

Figure 70-110-5



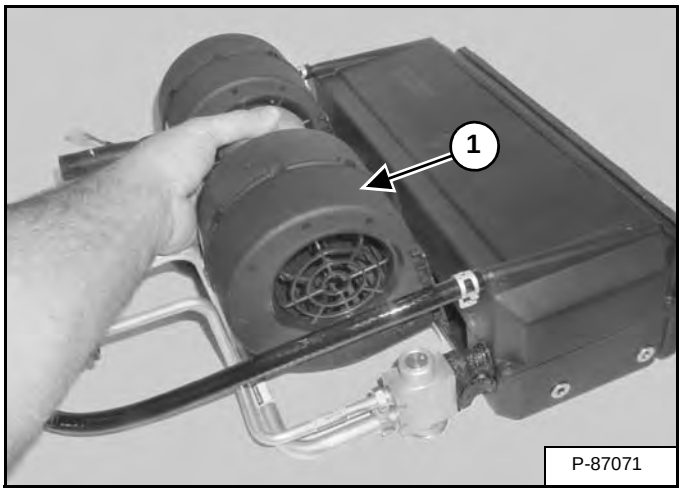
Remove the heater core / evaporator (Item 1) **[Figure 70-110-5]** from the top cover.

Figure 70-110-6



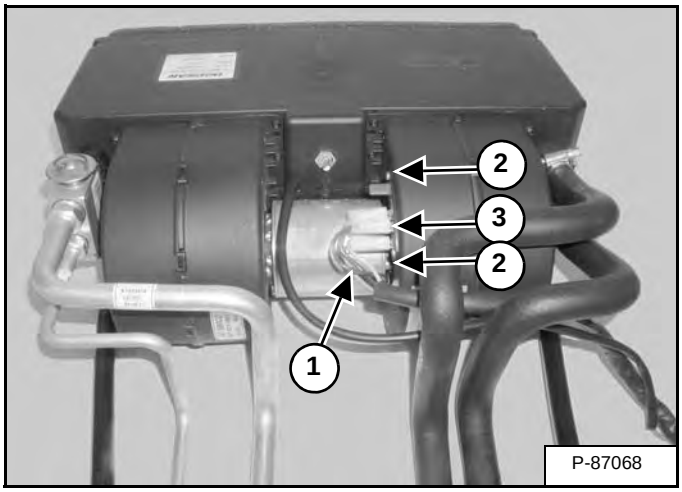
Remove the eight screws (Item 1) **[Figure 70-110-6]**.

Figure 70-110-7



Remove the motor / fan assembly (Item 1) **[Figure 70-110-7]**.

Figure 70-110-8



Disconnect the wire harness (Item 1) **[Figure 70-110-8]**.

Remove the two screws (Item 2) **[Figure 70-110-8]**.

Remove the resistor block (Item 3) **[Figure 70-110-8]**.

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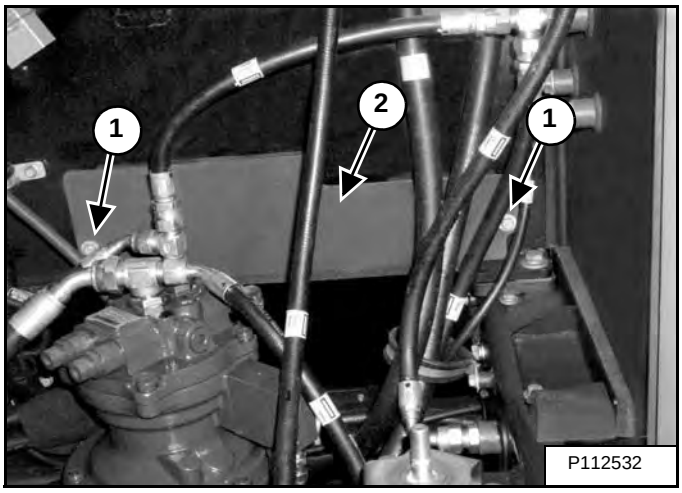
HEATER VALVE

Removal And Installation

Drain the radiator. (See Removing And Replacing Coolant on Page 10-110-2.)

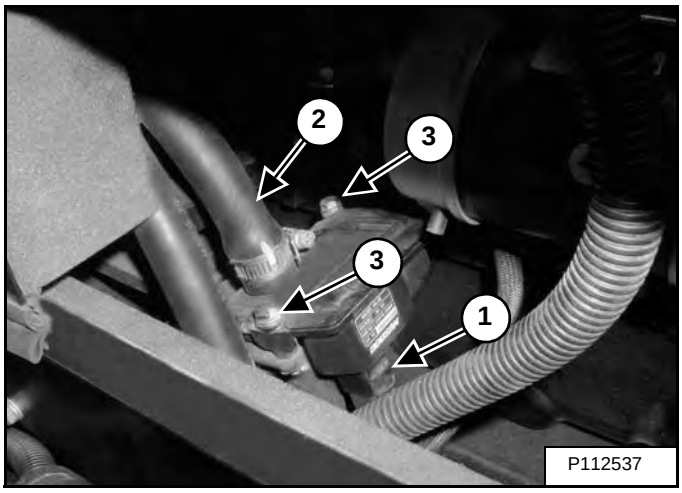
Tilt the cab. (See Raising And Lowering on Page 10-210-1.)

Figure 70-120-1



Remove the bolts (Item 1) and remove the cover (Item 2) **[Figure 70-120-1]**.

Figure 70-120-2



Disconnect the wire harness (Item 1), loosen the clamps and remove the top (Item 2) **[Figure 70-120-2]** and bottom hose.

Remove the bolts (Item 3) **[Figure 70-120-2]**. Remove the valve assembly from the machine.

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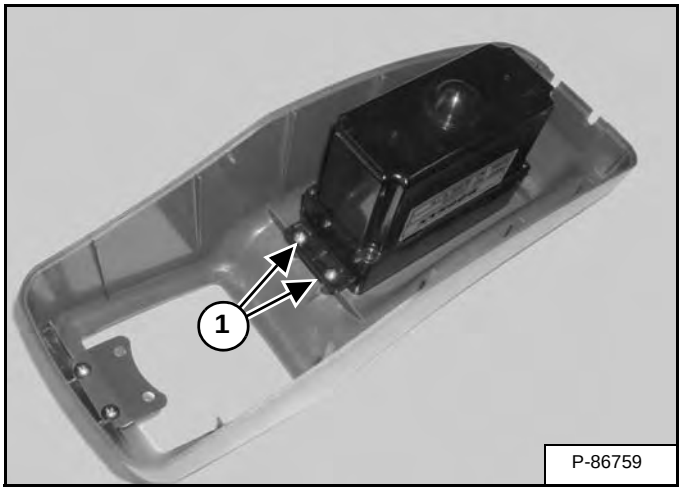
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HVAC CONTROLLER

Removal And Installation

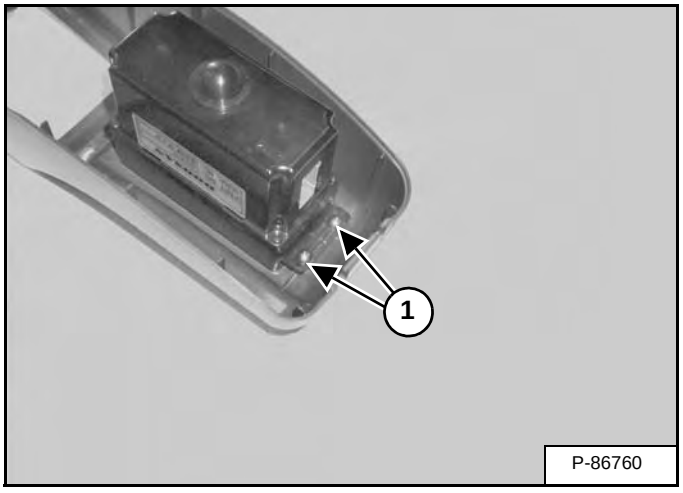
Remove the upper left console cover. (See Upper Console Cover Removal And Installation on Page 40-60-2.)

Figure 70-130-1



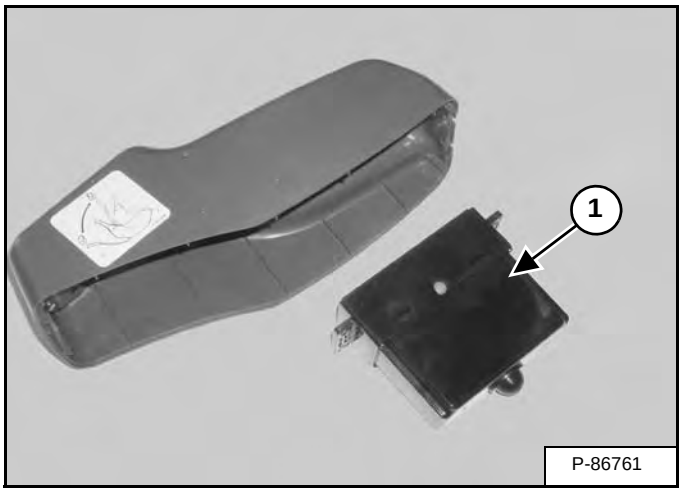
Remove the screws (Item 1) **[Figure 70-130-1]**.

Figure 70-130-2



Remove the screws (Item 1) **[Figure 70-130-2]**.

Figure 70-130-3



Remove the controller (Item 1) **[Figure 70-130-3]** from the upper console cover.

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- Dimensions - Long Arm SPEC-10-4
- Dimensions - Articulated Boom SPEC-10-5
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Hydraulic Tools SPEC-70-2
Engine Tools SPEC-70-4
Electrical Tools SPEC-70-6
HVAC Tools SPEC-70-6

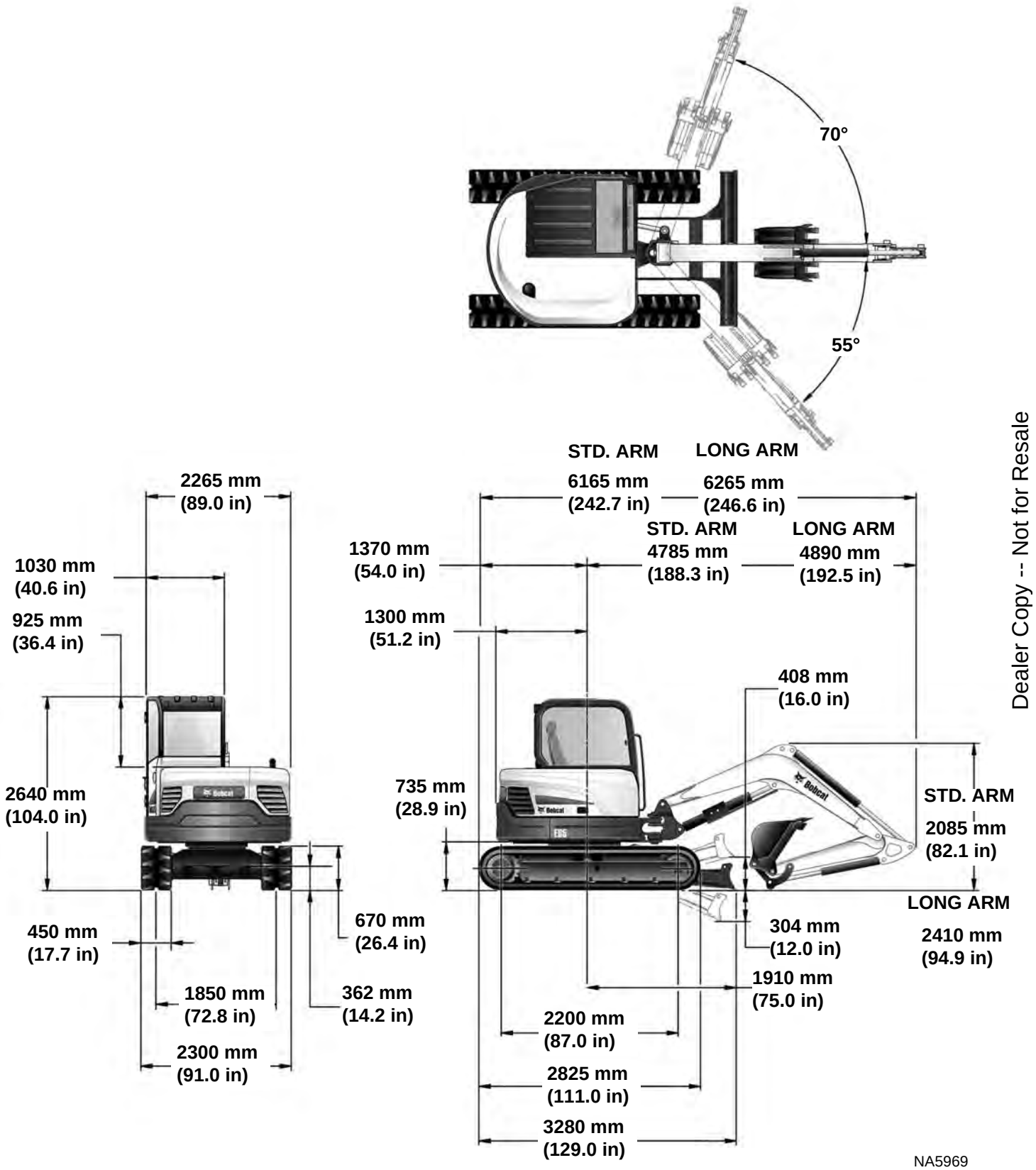
Certain specification(s) are based on engineering calculations and are not actual measurements. Specification(s) are provided for comparison purposes only and are subject to change without notice. Specification(s) for your individual Bobcat equipment will vary based on normal variations in design, manufacturing, operating conditions, and other factors.

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EXCAVATOR SPECIFICATIONS

Dimensions

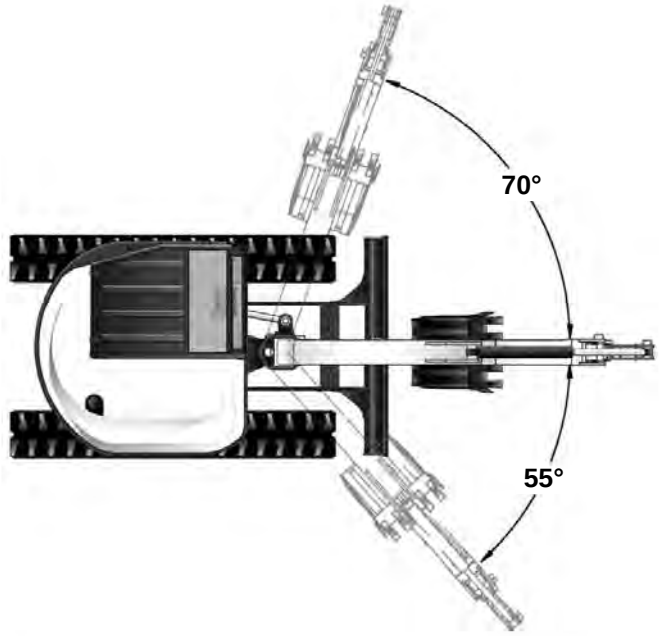
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.

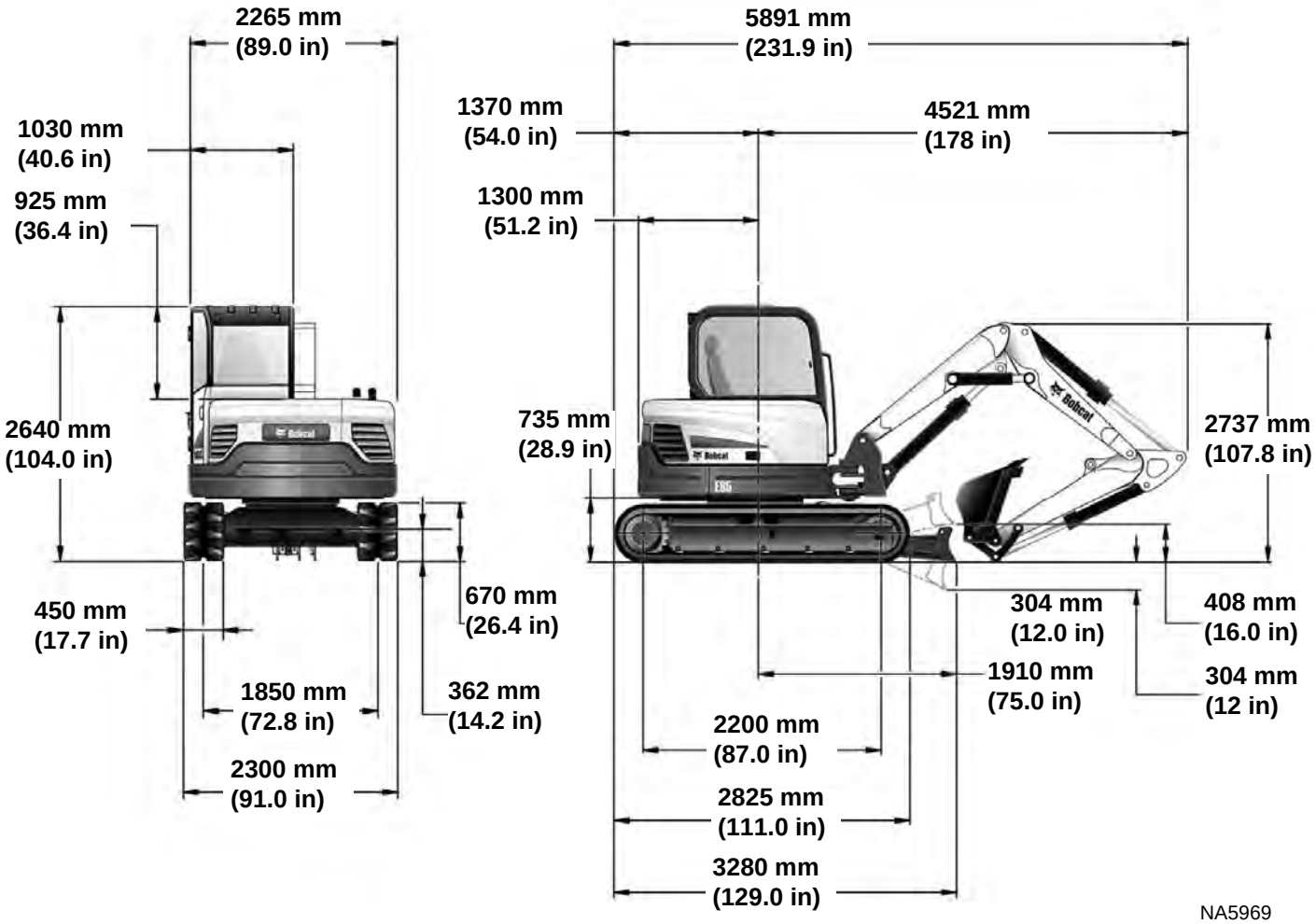


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Dimensions (Cont'd)

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.

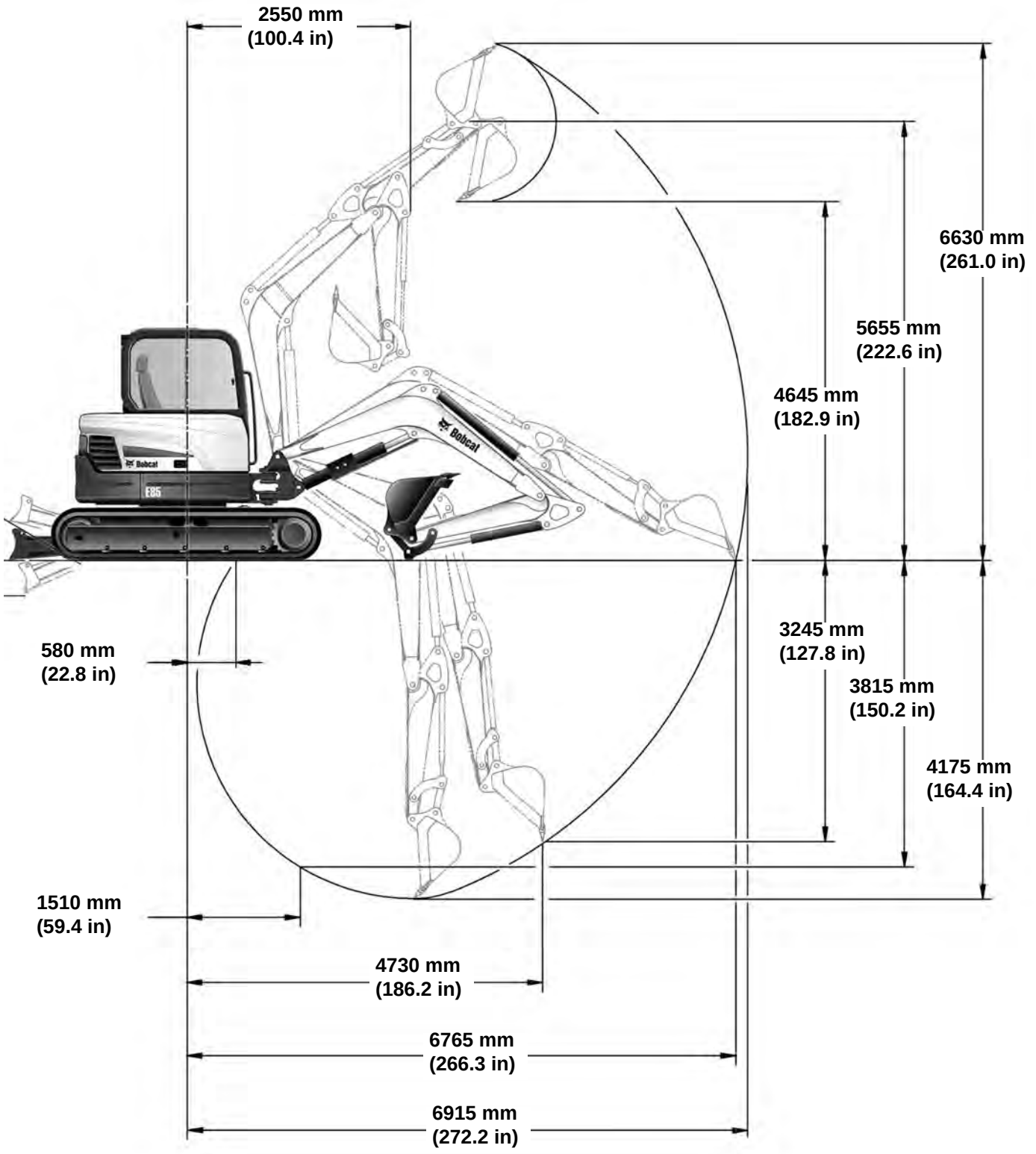




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Dimensions - Standard Arm

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



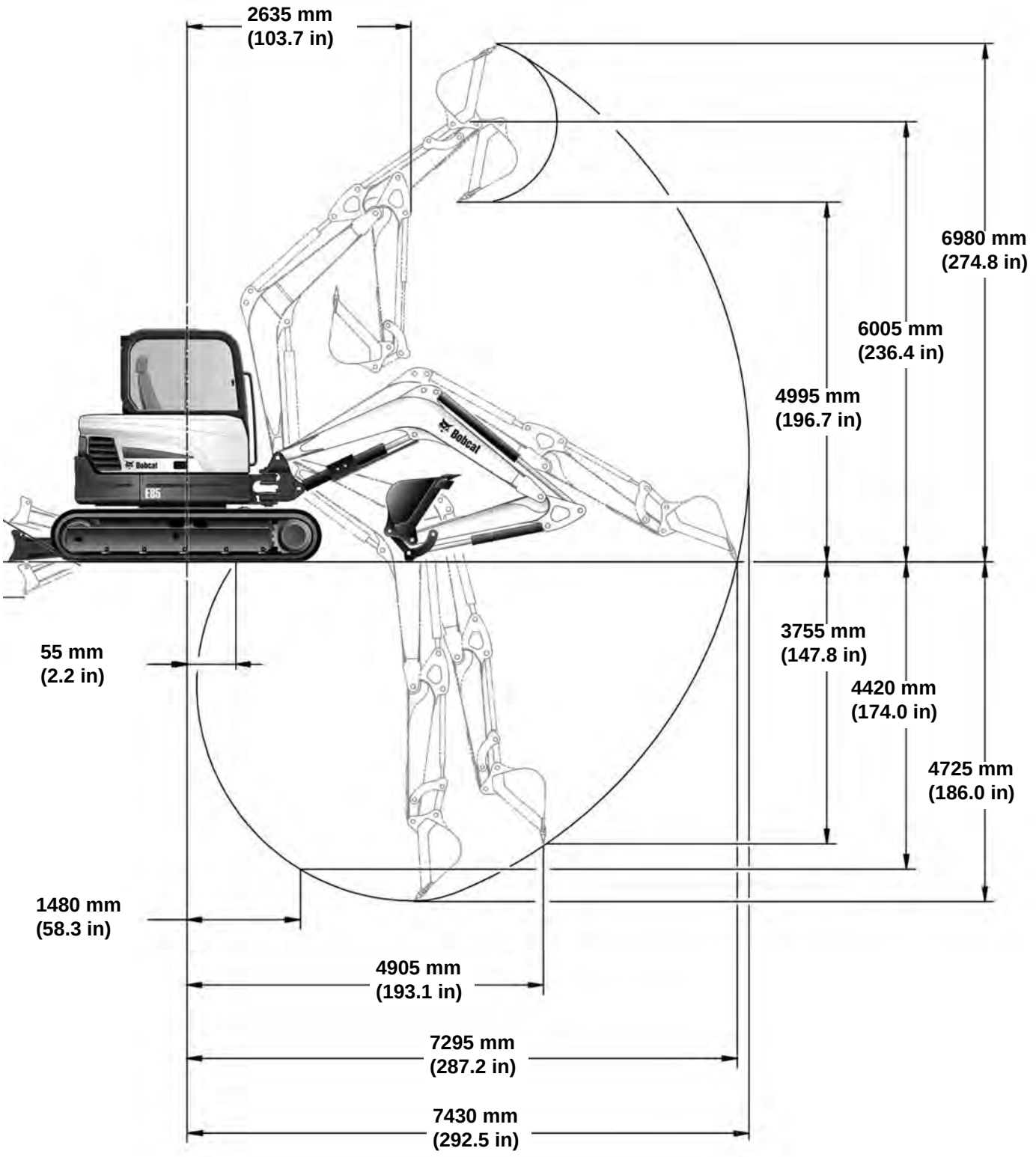
MS2792A

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EXCAVATOR SPECIFICATIONS (CONT'D)

Dimensions - Long Arm

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.

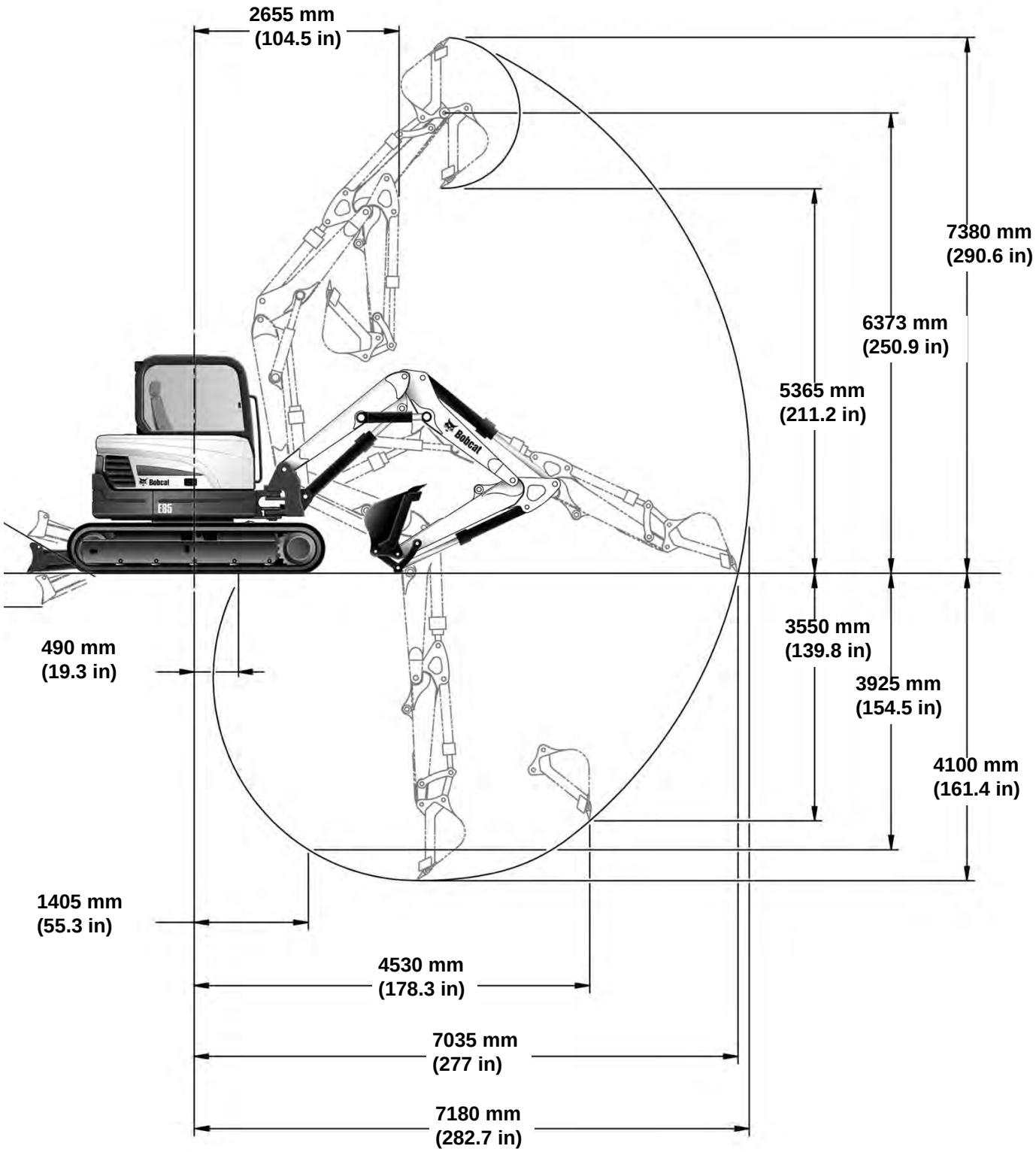


MS2792A

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Dimensions - Articulated Boom

- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



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EXCAVATOR SPECIFICATIONS (CONT'D)

Performance

Operating Weight w/ Cab. HVAC, Rubber Tracks and 610 mm (24 in) Bucket	8600 kg (18960 lb)
If Equipped with Steel Tracks (Optional) add: If Equipped with Long Arm (Optional) add: If Equipped with Articulated Boom (Optional) add:	30 kg (66 lb) 60 kg (132 lb) 495 kg (1091 lb)
Travel Speed	Low Range 2,7 km/h (1.7 mph) High Range 4,7 km/h (2.9 mph)
Digging Force (Per ISO 6015) Arm (Standard) Arm (Long Arm) (Optional) Arm (Articulated Boom) (Optional) Bucket (Standard and Long Arm) Bucket (Articulated Boom)	 43800 N (9847 lbf) 36500 N (8206 lbf) 43800 N (9847 lbf) 65600 N (14747 lbf) 58500 N (13151 lbf)
Boom Swing (Offset)	Left 70° Right 55°

Controls

Steering	Two hand levers or foot pedals.
Hydraulics	Two hand operated levers (joysticks) control boom, bucket, arm and upperstructure slew. Blade is controlled by a separate lever. Left pedal controls articulated boom (optional).
Auxiliary Hydraulics	Thumb swatches in joystick control auxiliary hydraulics and boom swing.
Auxiliary Pressure Release	Electric switches in joystick
Engine	Engine speed control dial with auto-idle feature, key type start switch
Starting Aid	Air Intake Heater - activated by key switch
Brakes Travel Service & Parking Swing Service Holding	 Hydraulic lock in motor Hydraulic lock in motor Hydraulic lock in motor Automatically applied slew brake integrated in slew motor

Engine

Make / Model E85 w/ S/N B34T11001 & Above	Yanmar 4TNV98C Tier 4 Final / Stage IIIB
E85 w/ S/N B34S11001 & Above	Yanmar 4TNV98C Stage IIIB
Fuel / Cooling	Diesel / Liquid (Antifreeze mixture)
Horsepower (SAE Gross)	44,3 kW (59.4 hp) @ 2100 rpm
Torque	241 N•m (179.8 ft-lb) @ 1365 rpm
Number Of Cylinders	4
Displacement	3,3 L (203 in^3)
Bore / Stroke	98 x 110 mm (3.85 x 4.33 in)
Lubrication	Pressure System with Filter
Crankcase Ventilation	Closed Breather
Air Cleaner	Dual dry replaceable paper cartridges
Ignition	Diesel Compression
Low Idle	1050 rpm
High Idle	2150 rpm
Engine Coolant	Ethylene Glycol / water mixture (50% EG / 50% water)

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Hydraulic System

Pump Type	Engine driven, variable displacement piston pump with pressure compensating, load sensing and torque limiter controls and gear pump.
Piston Pump Capacity	151 Lpm (39,8 U.S. gpm)
Gear Pump Capacity	23,1 Lpm (6.1 U.S. gpm)
Auxiliary Hydraulics (Continuous Flow, Auxiliary Hydraulic Flow and Secondary Auxiliary Flow)	95 Lpm (25.1 U.S. gpm)
Auxiliary Hydraulics (Secondary Auxiliary Flow)	50 Lpm (13.2 U.S. gpm)
Control Valve	12 spool closed centre
Fluid Type	Bobcat Fluid, Hydraulic / Hydrostatic 6903117 - (2.5 U.S. gal) 6903118 - (5 U.S. gal) 6903119 - (55 U.S. gal)
System Relief Pressure	
Travel Circuits	27503 kPa (275 bar) (3989 psi)
Slew Circuit	21601 kPa (216 bar) (3133 psi)
Boom, Arm, Bucket, Boom Swing, Blade, Auxiliary Hydraulics	29503 kPa (295 bar) (4279 psi)
Joystick Control Pressure	3200 kPa (32 bar) (464 psi)
Arm Port Relief, Base And Rod End	30999 kPa (310 bar) (4496 psi)
Boom Port Relief, Base End And Rod End	30999 kPa (310 bar) (4496 psi)
Articulated Boom Port Relief, Base End And Rod End (Optional)	30999 kPa (310 bar) (4496 psi)
Bucket Port Relief, Base End Rod End	30999 kPa (310 bar) (4496 psi)
Primary Auxiliary Port Relief	21001 kPa (210 bar) (3046 psi)
Secondary Auxiliary Port Relief (If Equipped)	25000 kPa (250 bar) (3626 psi)
Swing Motor Cross Port Relief Valves	21994 kPa (220 bar) (3190 psi)
Hydraulic Filter Bypass	250 kPa (2,5 bar) (36 psi)
Hydraulic Pilot Filter Bypass	145 kPa (1,5 bar) (21 psi)

Hydraulic Cylinders

Cylinder	Bore	Rod	Stroke
Boom (Cushion Up)	115 mm (4.52 in)	75 mm (2.95 in)	775 mm (30.51 in)
Articulated Boom (Cushion Extend / Retract) (Optional)	100 mm (3.94 in)	55 mm (2.17 in)	370 mm (14.57 in)
Arm	100 mm (3.94 in)	65 mm (2.56 in)	866 mm (34.88 in)
Bucket (Cushion Extend / Retract)	85 mm (3.35 in)	55 mm (2.17 in)	690 mm (27.17 in)
Boom Swing (Cushion Left/ Right)	110 mm (4.33 in)	60 mm (2.36 in)	738 mm (29.05 in)
Blade	100 mm (3.94 in)	60 mm (2.36 in)	149 mm (5.87 in)

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Hydraulic Cycle Times

Boom	Raise 3.2 Seconds	Lower 3.0 Seconds
Articulated Boom (Optional)	Raise 5.9 Seconds	Lower 5.5 Seconds
Arm	Retract 3.8 Seconds	Extend 2.9 Seconds
Bucket	Curl 3.3 Seconds	Dump 2.1 Seconds
Blade	Raise 2.4 Seconds	Lower 2.9 Seconds
Boom Swing	Left 6.9 Seconds	Right 8.6 Seconds

Electrical

Starting Aid	Glow Plugs (automatic)
Alternator	12 volt, 80 Amp open frame w/ internal regulator
Battery	12 volt - 900 CCA @ -18°C (0°F)
Starter	12 volt gear reduction 3.0 kW (4.0 hp)
Instrumentation	Fuel gauge with low fuel indicator, Engine temperature gauge with audible alarm, Engine oil pressure light with audible alarm, Engine check light, Air filter restriction indicator, Auto idle indicator, Auxiliary flow mode indicator, Clock - day and time, Engine preheat indicator, Two speed travel indicator, DPF status indicator and Hourmeter

Drive System

Final Drive	Each track is independently driven by an axial piston motor
Type of Reduction	Three-stage planetary gear reduction

Slew System

Slew Motor	Axial Piston Motor
Slew Circle	Single row shear type ball bearing with internal gear
Slew Speed	9.5 rpm

Undercarriage

Crawler Track Design	Sealed track rollers with boxed section track, Roller frame, Grease type track adjuster

Capacities

Fuel Tank	110 L (29.1 U.S. gal)
Hydraulic Reservoir Only (Centre of Sight Glass)	87 L (23.0 U.S. gal)
Hydraulic System (With Reservoir)	148 L (39.1 U.S. gal)
Cooling System	10,0 L (10.6 qt)
Engine Oil And Filter	10,8 L (10.2 qt)
Final Drive (Each)	1,5 L (1.6 qt) 80W90 gear lube
Swing Motor Reduction Drive	1,5 L (16 qt) 80W90 gear lube

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Track

Type	Rubber	Steel
Width	450 mm (17.7 in)	450 mm (17.7 in)
Number Of Shoes	Single Assembly	39
Number of Track Rollers (Per Side)	5	5

Ground Pressure

Ground Pressure	
Rubber Tracks	38,3 kPa (0,383 bar) (5.5 psi)
Steel Tracks	38,3 kPa (0,383 bar) (5.5 psi)

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TECHNICAL SERVICE GUIDE SPECIFICATIONS

Engine

Allowable Engine Oil Pressure at Low Idle	60 kPa (0,6 bar) (9 psi)
Engine Oil Pressure at High Idle	290 - 390 kPa (2,9 - 3,9 bar) (42 - 57 psi)
Location of Number 1 Cylinder	Closest to water pump
Crankshaft Rotation (Facing Crankshaft Pulley)	Clockwise
Valve Clearance (Cold) Intake	0,15 - 0,25 mm (.006 - 010 in)
Valve Clearance (Cold) Exhaust	0,15 - 0,25 mm (.006 - 010 in)

NOTE: For additional engine specifications, (See Specifications on Page 60-10-2.)

Engine Torques

Fuel Injection Tubeline Nuts (Fuel Rail)	29,4 - 34, 3 N•m (21.7 - 25.3 ft-lb)
Fuel Injection Tubeline Nuts (Injector	26,5 - 31,4 N•m (19.5 - 23.1 ft-lb)
Glow Plugs	15 - 20 N•m (11 - 14.8 ft-lb)
Injection Pump Mounting Bolts	22,6 - 28,4 N•m (16.6 - 20.9 ft-lb)
Valve Cover Nut	12 - 15 N•m (8.9 - 11 ft-lb)
Head Bolts	101,1 - 112,9 N•m (76 - 83 ft-lb)

NOTE: For additional engine torques, (See Engine Removal And Installation on Page 60-10-11.)

Cooling System

Coolant Type and Mix	50% Water and 50% Ethylene Glycol
Radiator Cap Pressure	75 - 105 kPa (0,75 - 1,05 bar) (10.8 - 14.8 psi)

NOTE: For additional cooling system information, (See ENGINE COOLING SYSTEM on Page 60-50-1.)

Excavator Torques

Travel Motor To Frame Bolt	265 N•m (195 ft-lb)
Sprocket To Travel Motor	160 - 180 N•m (118 - 133 ft-lb)
Swing Bearing To Frame Bolt	392 N•m (289 ft-lb)
Swing Bearing To Upperstructure Bolt	392 N•m (289 ft-lb)
Swing Motor Mounting Bolts	85,7 - 117,7 N•m (63 - 87 ft-lb)

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TORQUE SPECIFICATIONS FOR BOLTS

Torque For General SAE Bolts

The following table shows standard torque specifications for bolts with zinc phosphate coating. Bolts purchased from Bobcat that have zinc phosphate coating are specified by the letter H following the part number.

THREAD SIZE		SAE GRADE 5	SAE GRADE 8
N•m (ft-lb)	0.250	9,0 - 10,2 (80 - 90)	12,4 - 13,6 (110 - 120)
	0.3125	20,3 - 22,6 (180 - 200)	24,2 - 27,1 (215 - 240)
N•m (ft-lb)	0.375	34 - 38 (25 - 28)	47 - 54 (35 - 40)
	0.4375	54 - 61 (40 - 45)	81 - 88 (60 - 65)
	0.500	88 - 95 (65 - 70)	122 - 136 (90 - 100)
	0.5625	122 - 136 (90 - 100)	170 - 190 (125 - 140)
	0.625	170 - 190 (125 - 140)	240 - 260 (175 - 190)
	0.750	300 - 330 (220 - 245)	410 - 450 (300 - 330)
	0.875	450 - 490 (330 - 360)	645 - 710 (475 - 525)
	1.000	645 - 710 (475 - 525)	985 - 1085 (725 - 800)
	1.125	880 - 975 (650 - 720)	1425 - 1600 (1050 - 1175)
	1.250	1200 - 1360 (900 - 1000)	2000 - 2200 (1475 - 1625)
	1.375	1630 - 1830 (1200 - 1350)	2720 - 2980 (2000 - 2200)
	1.500	2040 - 2240 (1500 - 1650)	3530 - 3870 (2600 - 2850)
	1.625	2720 - 2980 (2000 - 2800)	4680 - 5150 (3450 - 3800)
	1.750	3390 - 3730 (2500 - 2750)	5830 - 6500 (4300 - 4800)
	1.875	4270 - 4750 (3150 - 3500)	5830 - 6500 (5500 - 6100)
	2.000	5150 - 5700 (3800 - 4200)	8800 - 9800 (6500 - 7200)

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TORQUE SPECIFICATIONS FOR BOLTS (CONT'D)

Torque For General Metric Bolts

THREAD SIZE (DIA. X PITCH)	MATERIAL		
	HEAD MARK 4	HEAD MARK 7	HEAD MARK 10
M 5 x 0.8		4 - 5 N•m (3 - 4 ft-lb)	
M 6 x 1.0		8 - 9 N•m (6 - 7 ft-lb)	8 - 12 N•m (6 - 9 ft-lb)
M 8 x 1.25	8 - 12 N•m (6 - 9 ft-lb)	15 - 22 N•m (11 - 16 ft-lb)	24 - 34 N•m (18 - 25 ft-lb)
M 10 x 1.25	18 - 24 N•m (13 - 18 f.-lb)	30 - 41 N•m (22 - 30 ft-lb)	49 - 68 N•m (36 - 50 ft-lb)
M 12 x 1.25	30 - 41 N•m (22 - 30 ft-lb)	54 - 73 N•m (40 - 54 ft-lb.	94 - 118 N•m (69 - 87 ft-lb)
M 14 x 1.25	49 - 68 N•m (36 - 50 ft-lb)	79 - 108 N•m (58 - 80 ft-lb)	157 - 186 N•m (116 - 137 ft-lb)

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HYDRAULIC CONNECTION SPECIFICATIONS

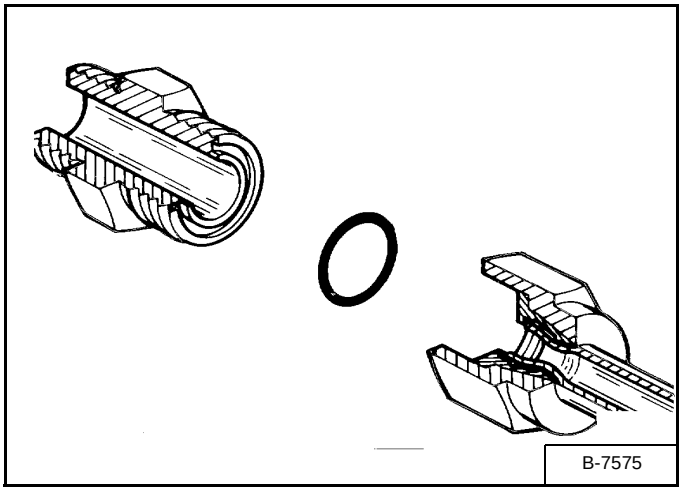
O-Ring Face Seal Connection

IMPORTANT

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

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Figure SPEC-40-1



When the fitting is tightened, you can feel when the fitting is tight to eliminate leakage caused by under or over torqued fittings. Use petroleum jelly to hold the O-ring in position until the fittings are assembled **[Figure SPEC-40-1]**.

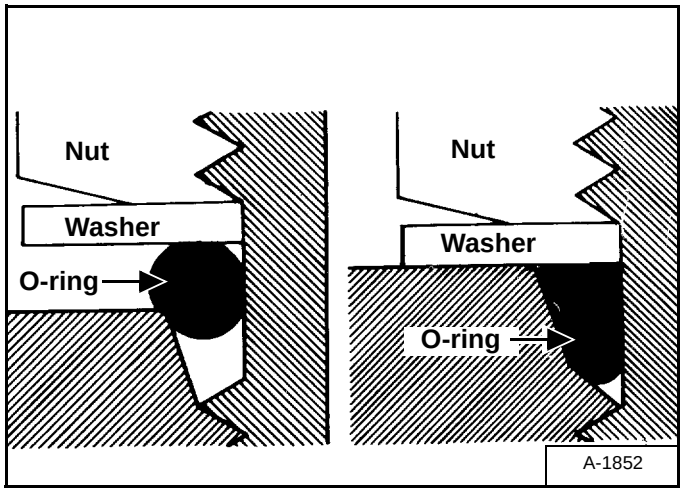
Figure SPEC-40-2

O-ring Face Seal Tightening Torque		
Tubeline Outside Diameter	**Thread Size**	**TORQUE N•m (ft-lb)**
1/4”	9/16” - 18	18 (13)
3/8”	11/16” - 16	30 (22)
1/2”	13/16” - 16	54 (40)
5/8”	1” - 14	81 (60)
3/4”	1-3/16” - 12	114 (84)
7/8”	1-3/16” - 12	133 (98)
1”	1-7/16” - 12	160 (118)
1-1/4”	1-11/16” - 12	209 (154)
1-1/2”	2” - 12	221 (163)

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Straight Thread O-Ring Fitting

Figure SPEC-40-3



Lubricate the O-ring before installing the fitting. Loosen the jam nut and install the fitting. Tighten the jam nut until the washer is tight against the surface **[Figure SPEC-40-3]**.

Tubelines And Hoses

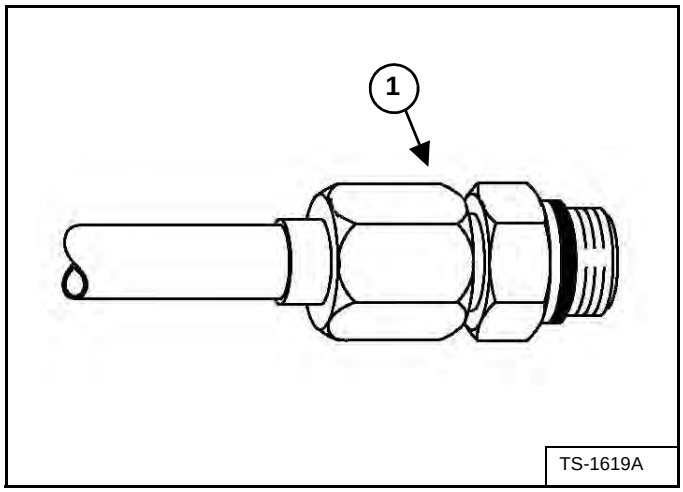
Replace any tubelines that are bent or flattened. They will restrict flow, which will slow hydraulic action and cause heat.

Replace hoses which show signs of wear, damage or weather cracked rubber.

Always use two wrenches when loosening and tightening hose or tubeline fittings.

Flare Fitting

Figure SPEC-40-4



Use the following procedure to tighten the flare fitting:

Tighten the nut until it makes contact with the seat. Make a mark across the flats of both the male and female parts of the connection (Item 1) **[Figure SPEC-40-4]**.

Figure SPEC-40-5

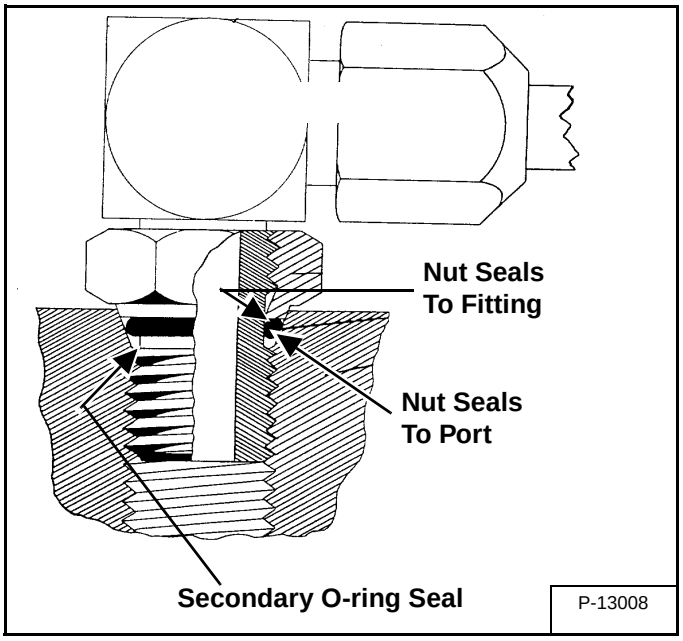
Flare Fitting Tightening Torque		
Tubeline Outside Diameter	**Thread Size**	**TORQUE N•m (ft-lb)**
1/4”	7/16” - 20	18 (13)
5/16”	1/2” - 20	23 (17)
3/8”	9/16” - 18	30 (22)
1/2”	3/4” - 16	54 (40)
5/8”	7/8” - 14	81 (60)
3/4”	1-1/16” - 12	114 (84)
7/8”	1-3/16” - 12	133 (98)
1”	1-5/16” - 12	160 (118)
1-1/4”	1-5/8” - 12	209 (154)
1-1/2”	1-7/8” - 12	221 (163)
2”	2-1/2” - 12	342 (252)

Use the chart **[Figure SPEC-40-5]** to find the correct tightness needed. If the fitting leaks after tightening, disconnect it and inspect the seat area for damage.

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Port Seal Fitting

Figure SPEC-40-6



The nut is the primary seal, the O-ring is the secondary seal and helps absorb vibration and pressure pulses at the connection **[Figure SPEC-40-6]**.

The hex portion of the nut does not contact the surface of the component when the nut is tight.

Figure SPEC-40-7

Port Seal and O-ring Boss Tightening Torque	
Thread Size	**TORQUE N•m (ft-lb)**
7/16" - 20	18 (13)
9/16" - 18	30 (22)
3/4" -1 6	54 (40)
7/8" - 14	81 (60)
1-1/16" - 12	114 (84)
1-3/16" - 12	133 (98)
1-5/16" - 12	160 (118)
1-7/16" - 12	209 (154)
1-5/8" - 12	221 (163)

Use the chart **[Figure SPEC-40-7]** to tighten the port seal fitting.

Port seal and nut, washer and O-ring (O-ring Boss) fittings use the same tightening torque valve chart.

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HYDRAULIC FLUID SPECIFICATIONS

Specifications

Use 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:

- 9.5 L (2.5 U.S. gal) qty 2 (P/N 6903117)
- 18.9 L (5 U.S. gal) (P/N 6903118)
- 208 L (55 U.S. gal) (P/N 6903119)

⚠ 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

When temperatures below -18°C (0°F) are common, the excavator must be kept in a warm building. Extra warm-up time must be used each time the excavator is started during cold temperature conditions. Cold fluid will not flow easily and it makes action of the hydraulic function slower. Loss of fluid flow to the hydraulic system (Indicated by hydraulic temp / pressure lights on) can cause system damage in less than 60 seconds.

⚠ WARNING

During cold weather (0°C [32°F] and below), do not operate machine until the engine has run for at least 5 minutes at less than half throttle. This warm-up period is necessary for foot pedal operation and safe stopping. Do not operate controls during warm-up period.

When temperatures are below -30°C (-20°F), 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 -18°C (0°F) if possible.

W-2027-0311

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CONVERSIONS

Decimal And Millimeter Equivalent Chart

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

U.S. To Metric Conversion Chart

	TO CONVERT	INTO	MULTIPLY BY
LINEAR MEASUREMENT	Miles	Kilometers	1.609
	Yards	Meters	0.9144
	Feet	Meters	0.3048
	Feet	Centimeters	30.48
	Inches	Meters	0.0254
	Inches	Centimeters	2.54
	Inches	Millimeters	25.4
AREA	Square Miles	Square Kilometers	2.59
	Square Feet	Square Meters	0.0929
	Square Inches	Square Centimeters	6.452
	Acre	Hectare	0.4047
VOLUME	Cubic Yards	Cubic Meters	0.7646
	Cubic Feet	Cubic Meters	0.02832
	Cubic Inches	Cubic Centimeters	16.39
WEIGHT	Tons (Short)	Metric Tons	0.9078
	Pounds	Kilograms	0.4536
	Ounces (Avdp.)	Grams	28.3495
PRESSURE	Pounds/Sq. In.	Kilopascal	6.895
WORK	Foot–Pounds	Newton–Meter	1.356
LIQUID VOLUME	Quarts	Liters	0.9463
	Gallons	Liters	3.785
LIQUID FLOW	Gallons/Minute	Liters/Minute	3.785
TEMPERATURE	Fahrenheit	Celsius	1.Subtract 32° 2. Multiply by 5/9

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SERVICE TOOLS REQUIRED

The following is a list of service tools required for servicing excavators.

Remote Start Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1563	Remote Start Tool	E20 - E55	This tool has been replaced by the new remote start tool 7003031, see below. MEL1563 includes: MEL1565 and MEL1566.	
MEL1565	Service Tool Harness		Used with MEL1563 to connect remote start tool to machine	
MEL1566	Service Tool Harness Communicator		Used with MEL1563 to connect remote start tool to PC	
7217666 (Was 7003031) (Was 6689779)	Remote Start Tool Kit	E20 - E55	This tool replaced the original remote start tool kit MEL1563 and 7003031. Kit 7217666 includes: 7022042, 6689747, 6689746 and 6689745.	
7022042 (Was 7003030) (Was 6689778)	Remote Start Tool		This tool replaces remote start tool 6689778 and 7003030.	
6689747	Remote Start Tool Harness		Used with 7003030 to connect remote start tool to excavator.	
6689746	Remote Start Tool Harness		Used with 7003030 to connect Service PC to remote start tool.	

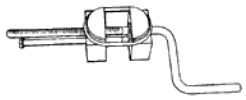
See www.BobcatDealerNET.com for parts ordering information. (For EMEA dealers see the Bobcat Special Tools Catalogue and Doosan Shop for parts ordering information.)

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SERVICE TOOLS REQUIRED (CONT'D)

Hydraulic Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1744	Hydraulic Tester (Flow Meter)	E08 - E85	Hydraulic tester MEL1744, MEL10003 or TWX-RFIK200-S-6 can be used for hydraulic testing.	
MEL10003	Hydraulic Tester (Flow Meter)		MEL10003 and TWX-RFIK22-S-6 are no longer available, order MEL1744.	
TWX-RFIK200-S-6	Hydraulic Tester (Flow Meter)			
MEL1074	O-Ring Seal Hook			
MEL1075	Adjustable Gland Nut Wrench		Includes MEL1075-1 and MEL1075-2	
MEL1075-1	Standard Pins		These are replaceable pins that insert into MEL1075-1 for disassembling various cylinders	No Image Available
MEL1075-2	Offset Pins		These are replaceable pins that insert into MEL1075-1 for disassembling various cylinders	No Image Available
MEL1396-1	Universal Seal Expander		MEL1396 includes: MEL1396-1 and MEL1396-2	
MEL1396-2	Piston Ring Compressor			
MEL1418	Cylinder Hone = 2.00 in			
OEM6275	Cylinder Hone = 2.75 - 3.00 in			
OEM6270	Cylinder Hone = 3.00 - 3.50 in			
OEM6271	Cylinder Hone = 3.50 - 4.00 in			

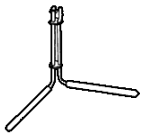
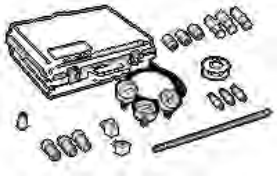
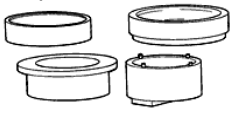
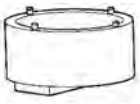
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SERVICE TOOLS REQUIRED (CONT'D)

Hydraulic Tools (Cont'd)

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1033	Rod Seal Installation Tool	E08 - E85		
MEL1355	Hydraulic Test Kit		This test kit includes various gauges, adapters, couplers and hoses that are used when testing hydraulic functions. MEL1355 Includes: MEL1355-1 thru MEL1355-12	
MEL1355-2	1000 psi gauge			
MEL1355-3	5000 psi gauge			
MEL1355-12	Coupler			
MEL1412	Seal Installation Tool	E32, E35	Used for installing Travel Motor Seal	
MEL1413	Seal Installation Tool	E26	Used for installing Travel Motor Seal	
MEL1553	Travel Motor Tool Kit	E42 - E55	MEL1553 Includes: MEL1553-1 thru MEL1553-4	
MEL1553-1	Motor Seal Installation Tool		Included with MEL1553	
MEL1553-2	Motor Seal Installation Tool		Included with MEL1553	
MEL1553-3	Motor Seal Installation Tool		Included with MEL1553	
MEL1553-4	Motor Seal Installation Tool		Included with MEL1553	
6675936 (MEL1560)	Grease Spring Tool (Grease Release)	E08 - E55	Machines with two track tension fittings.	

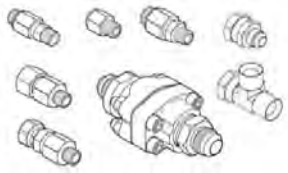
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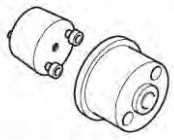
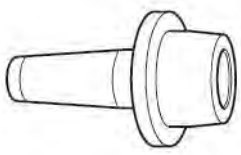
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SERVICE TOOLS REQUIRED (CONT'D)

Hydraulic Tools (Cont'd)

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
7277225 (MEL1745)	Grease Spring Tool (Grease Release)	E08 - E55	Machines with one track tension fitting.	
MEL1713	Hydraulic Fitting Kit	E60, E63, E80, E85	This test kit includes various adapters and couplers that are used when testing hydraulic functions. MEL1713 Includes: MEL1713-1 thru MEL1713-12	
MEL1727	Spanner Wrench	E60, E63	Used for removing and installing bearing nut used in the Travel Motor	
MEL1728	Seal Installation Tool	E60, E63	Used for installing Travel Motor Seal	

Engine Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
7009358	Bobcat Diagnostic Interface Box	E63, E85	Interface for using Yanmar SA-D SmartAssist-Direct diagnostic service software.	No Image Available
7031222	Bobcat Engine Analyzer Diagnostic Tool Kit	T4 Bobcat Engine Applications	Includes: Diagnostic Service Tool (7031223), Vehicle Cable 6 pin (7031398), Vehicle Cable 14 pin (7031356), USB Cable (7031357)	
7031370	Rear Main Seal Installer	T4 Bobcat Engine Applications	Used for installing rear main seal	
7031369	Front Seal Installer	T4 Bobcat Engine Applications	Used for installing front seal	

See www.BobcatDealerNET.com for parts ordering information. (For EMEA dealers see the Bobcat Special Tools Catalogue and Doosan Shop for parts ordering information.)

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SERVICE TOOLS REQUIRED (CONT'D)

Engine Tools (Cont'd)

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
7031371	Valve Spring Compressor	T4 Bobcat Engine Applications	Used for compressing valve springs	
MEL10630	Engine Compression Test Kit	E08 - E55	Includes: MEL1352, MEL1433, MEL1489, MEL1546, MEL1551, MEL1594, MEL1594, MEL10630-1 - MEL10630-11 and MEL10630-14	
MEL1352	Compression Adapter	E26, E42 - E55	Used in glow plug port for testing compression - Included with MEL10630	
MEL1631	Compression Adapter	E32, E35	Used in glow plug port for testing compression, NOT included with MEL10630	
MEL1743	Compression Adapter	E63, E85	Used in glow plug port for testing compression, NOT included with MEL10630	
MEL1237	Fuel Line Adapter	E25 - E55	Adapter used to test delivery valve at the injection pump (Used with pressure gauge MEL1173-1)	
MEL1173-1	Pressure Gauge 10000 psi			
4200	Injector Nozzle Tester			
7268212	Valve Lash Adjusting Wrench	All Bobcat Engine Models		
7255632	Valve Stem Seal Tool			

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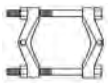
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SERVICE TOOLS REQUIRED (CONT'D)

Electrical Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
7292829	Injector Signal Tester	Excavators equipped with Bobcat engines	Used to test injector signal on Bobcat 1.8L and 2.4L engines.	

HVAC Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1581	HVAC Recover, Recycling, Recharging Machine	E25 - E85	MEL1581 is no longer available, order MEL1735 or MEL1736	
MEL1735	Deluxe HVAC Recover, Recycling, Recharging Machine			
MEL1736	Standard HVAC Recover, Recycling, Recharging Machine			
MEL1592	HVAC Refrigerant Identification Tool			
MEL1595	AC Compressor Pulley Puller			

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VALVE (PRESSURE REDUCING RELIEF) 20-32-1
VALVES (PORT RELIEF) 20-31-1
VALVES (RELIEF) 20-30-1
VEHICLE CONTROL UNIT (VCU) 50-180-1
WIPER MOTOR 50-130-1

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