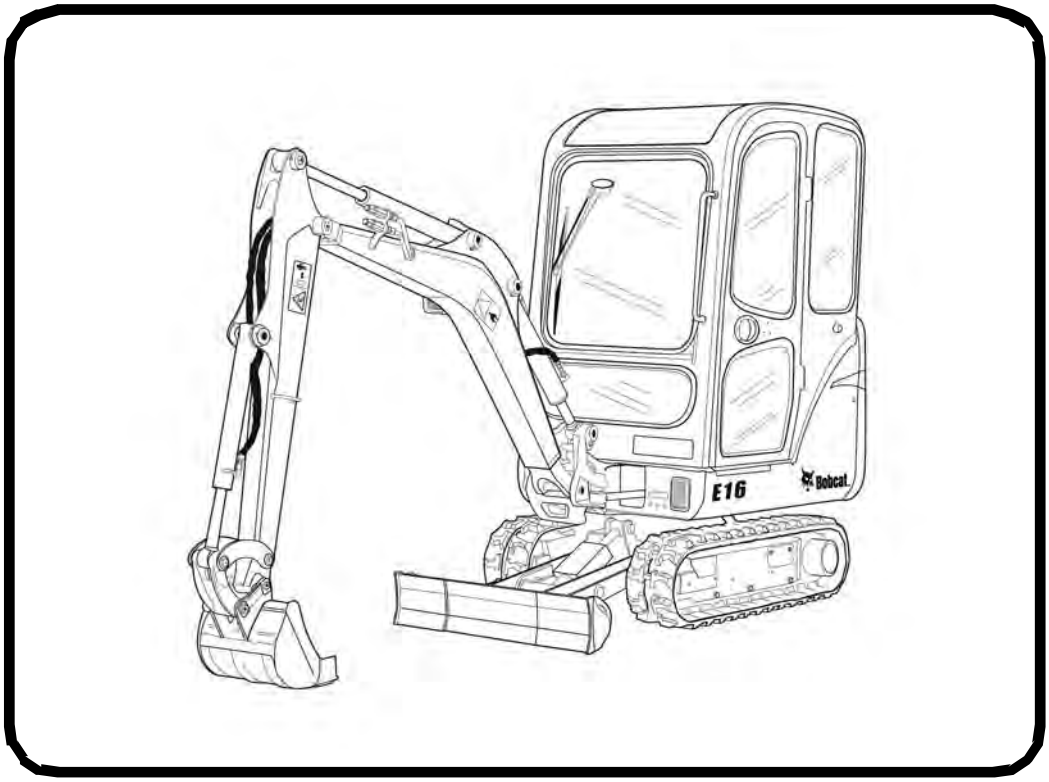
Bobcat

Service Manual
E16 Compact Excavator

S/N AHLL11001 & Above



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Printed in Belgium
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T2-K

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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.

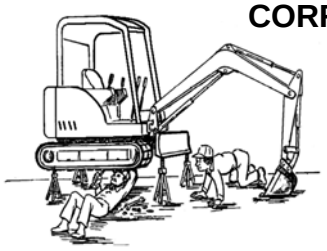
CORRECT



P-90216

Never service the Bobcat excavator without instructions.

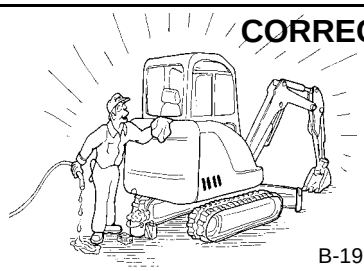
CORRECT



B-19964

Use the correct procedure to lift and support the excavator.

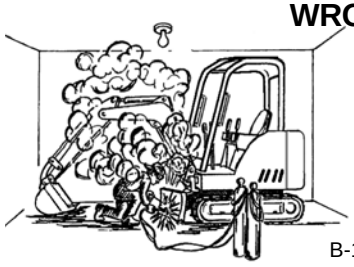
CORRECT



B-19959

Cleaning and maintenance are required daily.

WRONG

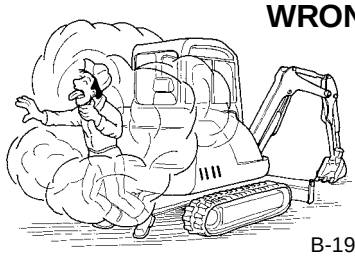


B-19965

Have good ventilation when welding or grinding painted parts.

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

WRONG

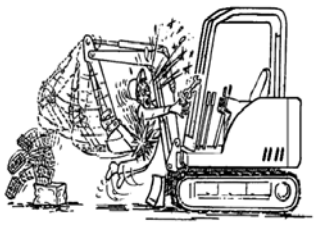


B-19960

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

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

WRONG

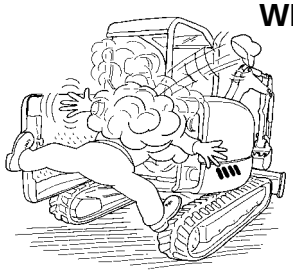


B-19966

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

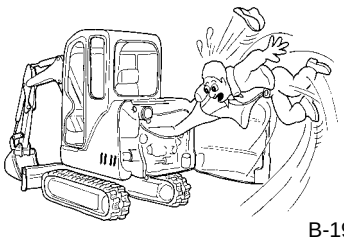
Stop, cool and clean engine of flammable materials before checking fluids.

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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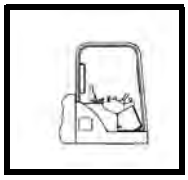
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FOREWORD

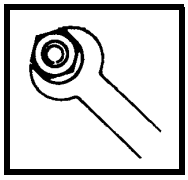
This manual is for the Bobcat excavator mechanic. It provides necessary servicing and adjustment procedures for the Bobcat excavator and its component parts and systems. Refer to the Operation & Maintenance Manual for operating instructions, starting procedure, daily checks, etc.

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

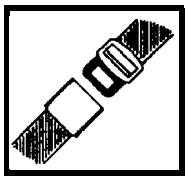
1. Check that the ROPS / TOPS / FOPS is in good condition and is not modified.



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



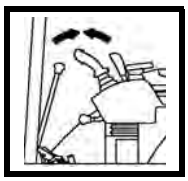
3. The seat belt must be correctly installed, functional and in good condition.



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



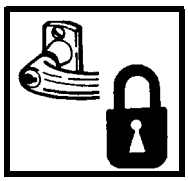
5. Travel levers, control levers and foot pedals must return to neutral. Check that the pedal locks are in working order.



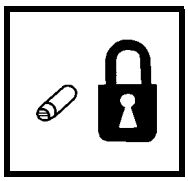
6. Check for correct function of the work lights.



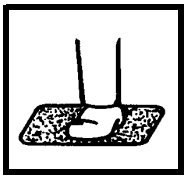
7. Enclosure door latches must open and close freely.



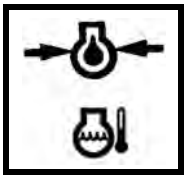
8. Attachment locking pins must function correctly and be in good condition.



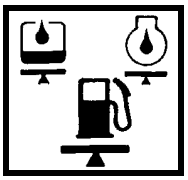
9. Safety treads must be in good condition.



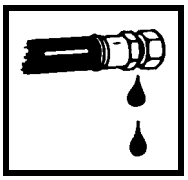
10. Check for correct function of indicator lamps.



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



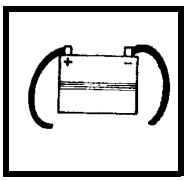
12. Inspect for fuel, oil or hydraulic fluid leaks.



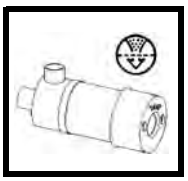
13. Lubricate the excavator.



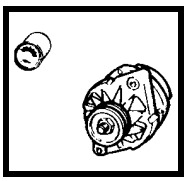
14. Check the condition of the battery and cables.



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



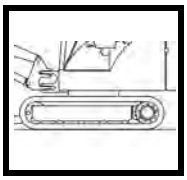
16. Check the electrical charging system.



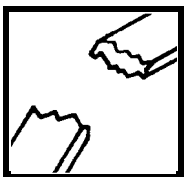
FW EXC-0509 SM

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



18. Inspect for loose or broken parts or connections.



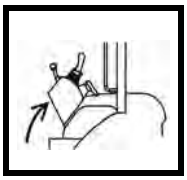
19. Check for any field modification not completed.



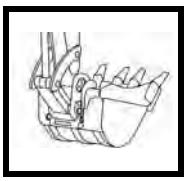
20. Operate the machine and check all functions.



21. Check the control console interlocks for correct function.



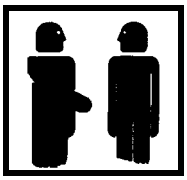
22. Inspect the X-Change™ for wear or damage. Repair or replace damaged parts.



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



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



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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

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**.

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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.



Cutting or drilling concrete containing sand or rock containing quartz can result in exposure to silica dust. Use a respirator, water spray or other means to control dust.

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 (exit, 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.

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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 non-flammable solvents.

Fueling



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

Starting

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

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

Spark 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).

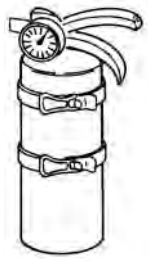
Welding And Grinding

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 non-metallic 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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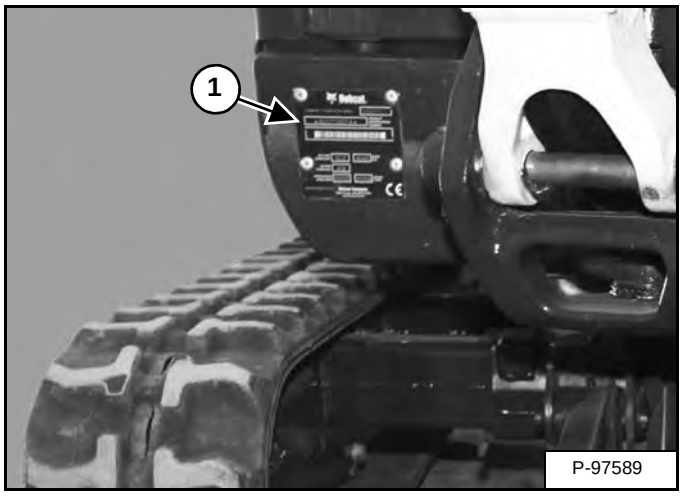
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SERIAL NUMBER LOCATIONS

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) can use different parts, or it can be necessary to use a different procedure in doing a specific service operation.

Excavator Serial Number

Figure 1



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

Explanation of Excavator Serial Number:

XXXX XXXXX

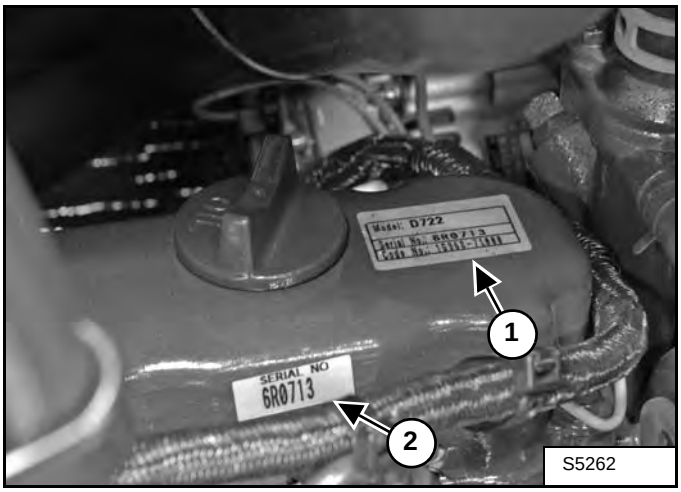
- Module 2. - Production Sequence (Series)
- Module 1. - Model / Engine Combination

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

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

Engine Serial Number

Figure 2

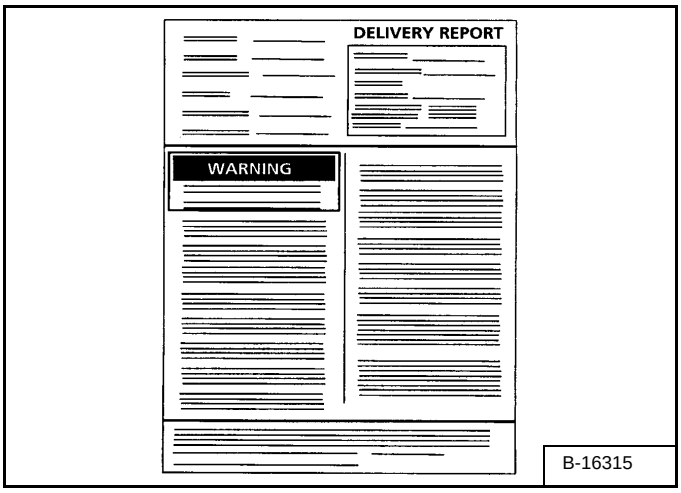


The engine serial number (Item 1) **[Figure 2]** is located on the side of the engine.

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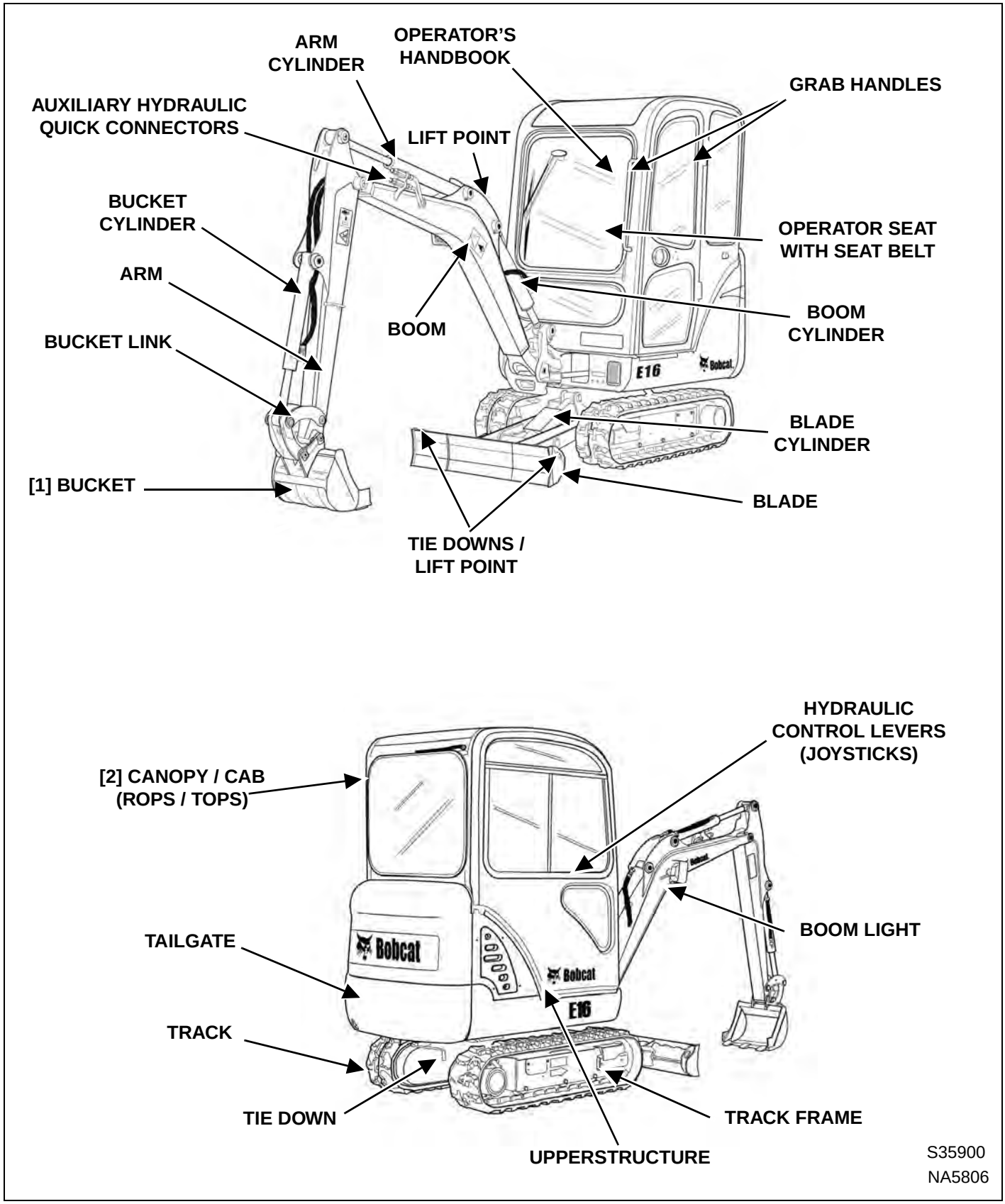
DELIVERY REPORT

Figure 3



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

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[1] BUCKET - Several different buckets and other attachments are available from the Bobcat excavator.

[2] ROPS / TOPS - (Roll-Over Protective Structure / Tip-Over Protective Structure) as standard equipment. The ROPS / TOPS meets ISO 12117-2 and ISO 12117.

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SAFETY AND MAINTENANCE

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LIFTING AND BLOCKING THE EXCAVATOR

Procedure

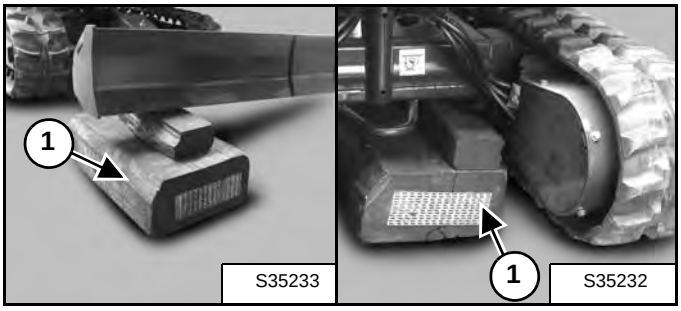
Always park the machine on a level surface.

Figure 10-10-1



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

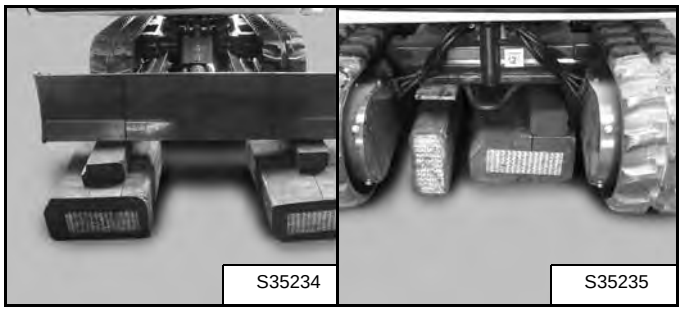
Figure 10-10-2



Fully raise the blade and install wooden blocks (Item 1) **[Figure 10-10-2]** or jackstands under the blade and the track frame. Lower the machine until all machine weight is on the wooden blocks or jackstands.

Rotate the upperstructure 180 degrees and repeat procedure for the other side.

Figure 10-10-3



The machine must be blocked up as shown in **[Figure 10-10-3]**.

Stop the engine.

WARNING

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

W-2218-1195

WARNING

AVOID INJURY

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

W-2142-0903

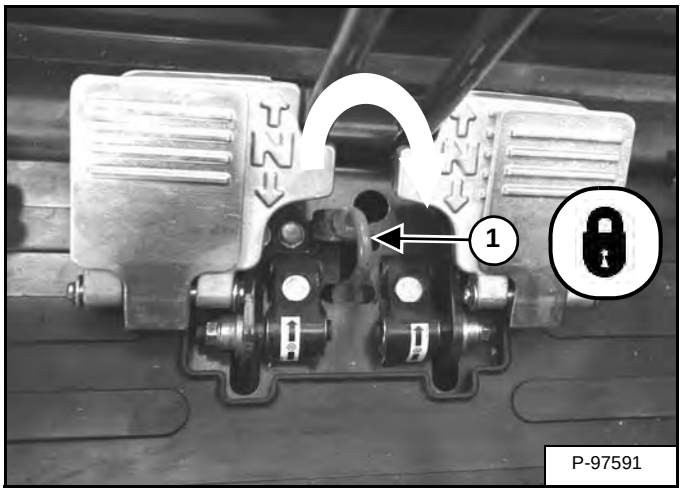
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UPPERSTRUCTURE SLEW LOCK

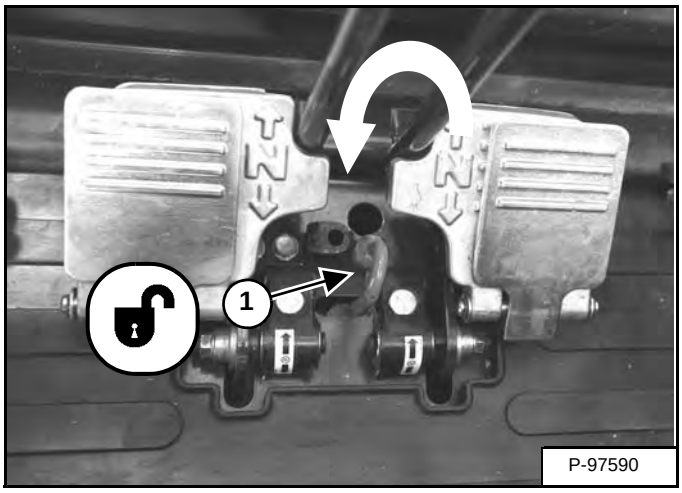
Figure 10-20-1



Move the lever (Item 1) **[Figure 10-20-1]** *to the right and down* to engage the upperstructure slew lock. When the Slew Lock is engaged (locked), the upperstructure of the excavator is locked to the track frame and will not rotate. The upperstructure must be parallel to the track frame to engage the Slew Lock.

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

Figure 10-20-2



Move the lever (Item 1) **[Figure 10-20-2]***up and to the left* to disengage (unlock) the upperstructure from the track frame. Secure the lever in the unlocked position.

⚠ WARNING

AVOID INJURY

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

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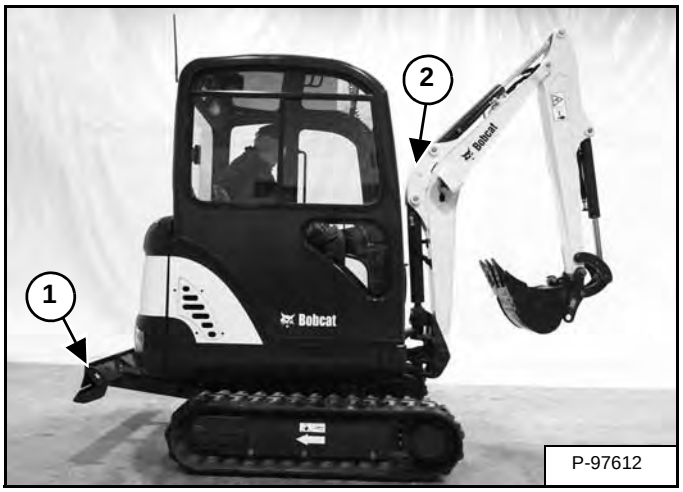


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LIFTING THE EXCAVATOR

Procedure

Figure 10-30-1



Fully extend the cylinders of the bucket and arm, and fully retract boom cylinder so that the excavator is in the position as shown **[Figure 10-30-1]**.

Engage the upperstructure slew lock. (See UPPERSTRUCTURE SLEW LOCK on Page 10-20-1.)

Raise the blade all the way.

Put all the control levers in neutral.

⚠ WARNING

AVOID INJURY OR DEATH

- **Use a lifting fixture with sufficient capacity for the weight of the excavator plus any added attachments.**
- **Maintain centre 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-EN-0909

Figure 10-30-2

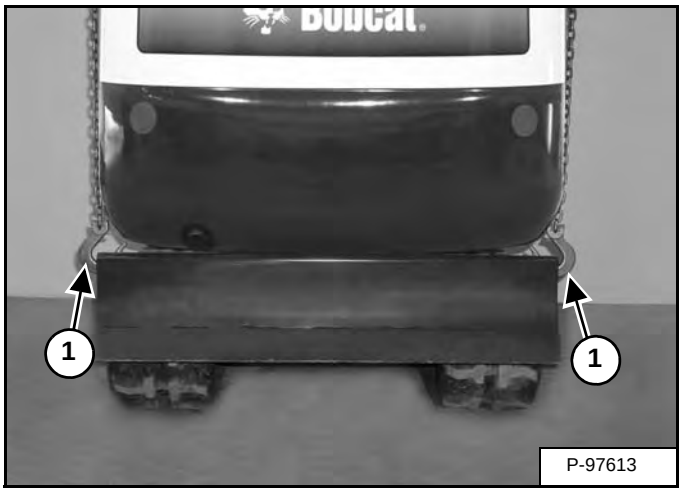
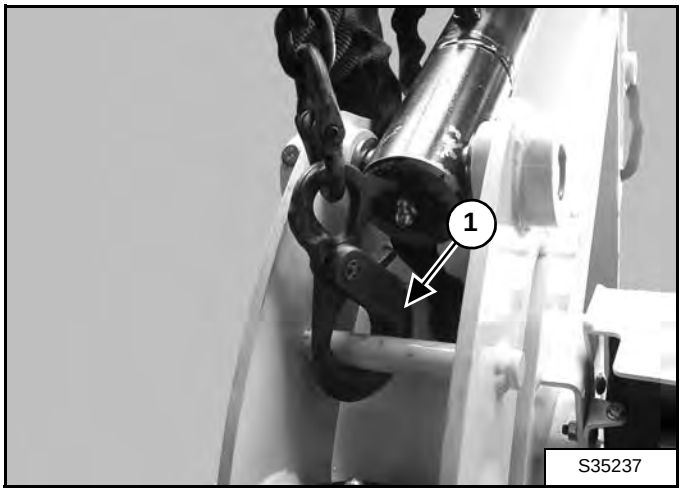


Figure 10-30-3



NOTE: Remove blade extension before connecting chains to blade.

Fasten chains to the ends of the blade (Item 1) **[Figure 10-30-1]** and **[Figure 10-30-2]** and to a lifting fixture above the canopy / cab. The lifting fixture must extend over the sides of the canopy / cab to prevent the chains from hitting the ROPS / TOPS.

Fasten a chain (Item 1) **[Figure 10-30-3]** and (Item 2) **[Figure 10-30-1]** from the rod to the lift fixture.

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OPERATOR CANOPY (ROPS / TOPS)

Description

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

Check the ROPS / TOPS canopy, mounting, and hardware for damage. Never modify the ROPS / TOPS canopy. Replace the canopy and hardware if damaged.

ROPS / TOPS - Roll-Over Protective Structure per ISO 12117-2, and Tip-Over Protective Structure per ISO 12117.

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.

W-2069-0200

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OPERATOR CAB (ROPS / TOPS)

Description

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

Check the ROPS / TOPS cab, mounting, and hardware for damage. Never modify the ROPS / TOPS cab. Replace the cab and hardware if damaged.

ROPS / TOPS - Roll-Over Protective Structure per ISO 12117-2, and Tip-Over Protective Structure per ISO 12117.

⚠ WARNING

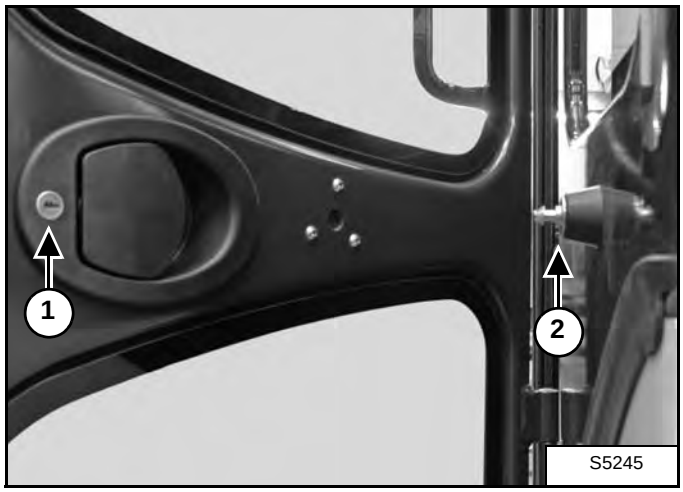
Never modify operator cab by welding, grinding, drilling holes or adding attachments unless instructed to do so by Bobcat Company. Changes to the cab can cause loss of operator protection from rollover and falling objects, and result in injury or death.

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Cab Door

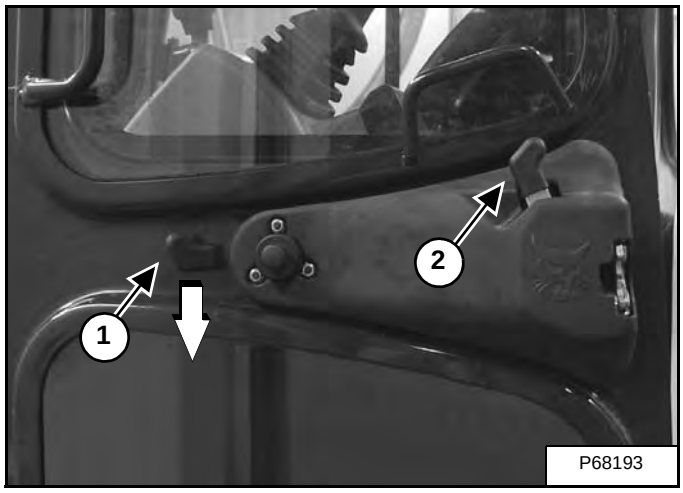
Figure 10-41-1



The cab door can be locked (Item 1) **[Figure 10-41-1]** with the same key as the starter switch.

Push the door all the way open until the latch (Item 2) **[Figure 10-41-1]** engages to hold the door in the open position.

Figure 10-41-2



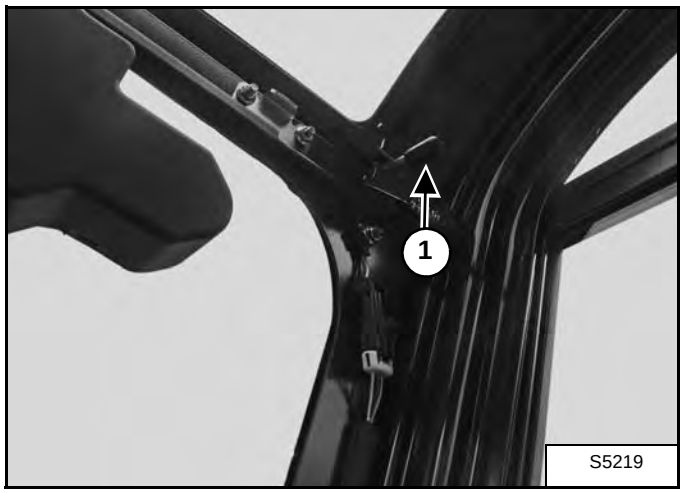
When the door is in the open position, push down on the latch (Item 1) **[Figure 10-41-2]** and close the door.

From inside the cab, open the door using the lever (Item 2) **[Figure 10-41-2]**.

Front Window

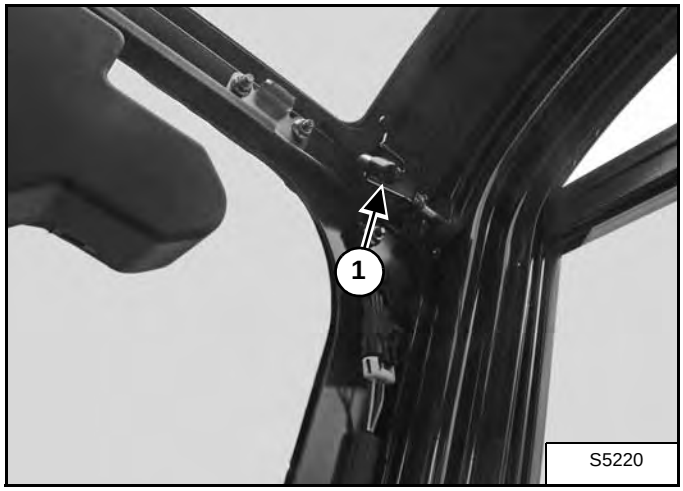
Opening The Front Window

Figure 10-41-3



Pull back the top latch pin (Item 1) **[Figure 10-41-3]** (Both sides).

Figure 10-41-4



Turn the top latch (Item 1) **[Figure 10-41-4]** to the unlocked position (Both sides).

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Front Window (Cont'd)

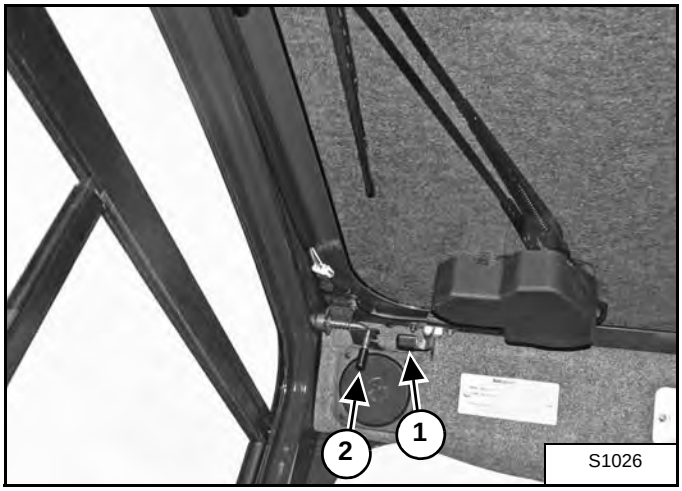
Figure 10-41-5



Use both window grab handles to pull the top of the window in **[Figure 10-41-5]**.

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

Figure 10-41-6



When the window is fully raised, the latch (Item 1) (Both sides) will close on the bracket. Turn the top latch (Item 2) **[Figure 10-41-6]** (Both sides) to the locked position.

Closing The Front Window

Support the window while releasing the latch pin and placing it in the unlocked position (Both sides) **[Figure 10-41-6]**.

Support the window using the left grab handle and pull down on the latch (Item 1) **[Figure 10-41-6]** to release the window.

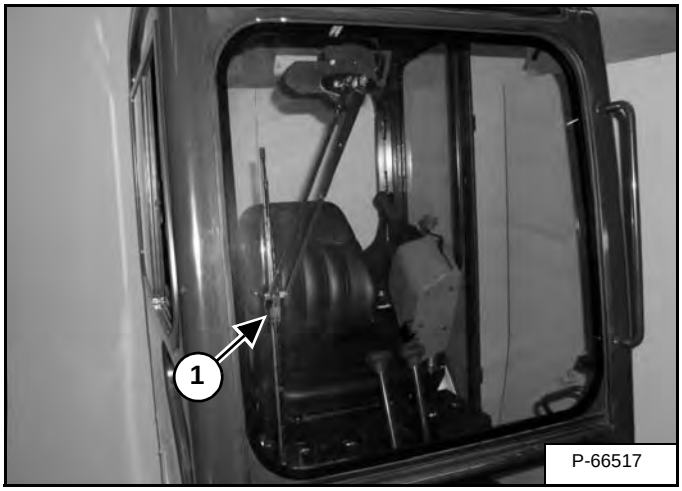
Use both window grab handles to pull the window down **[Figure 10-41-5]**.

Rotate the top latch (Item 1) **[Figure 10-41-4]** to the locked position (Item 1) **[Figure 10-41-3]** (Both sides).

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Front Wiper

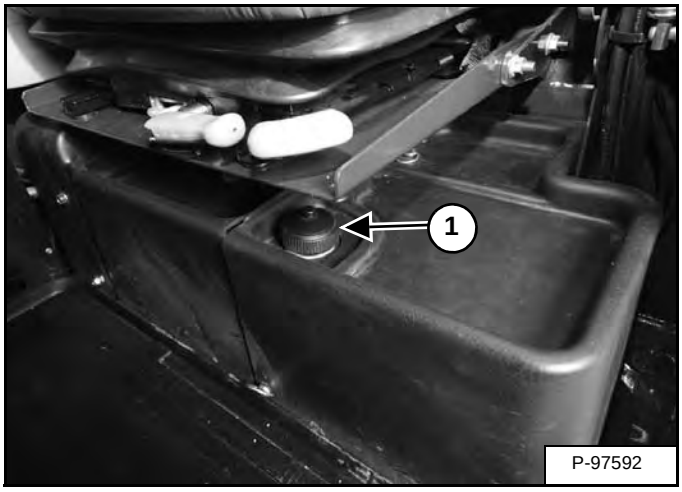
Figure 10-41-7



The front window is equipped with a wiper (Item 1) **[Figure 10-41-7]** and washer.

Window Washer Reservoir

Figure 10-41-8

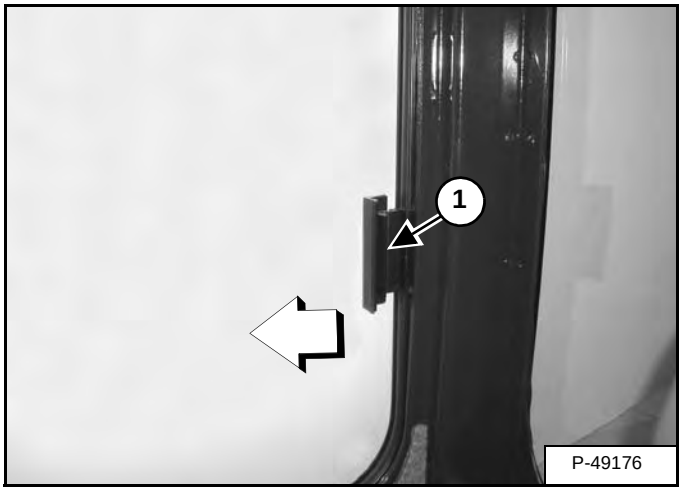


The window washer reservoir (Item 1) **[Figure 10-41-8]** is located under the operator's seat.

Right Side Windows

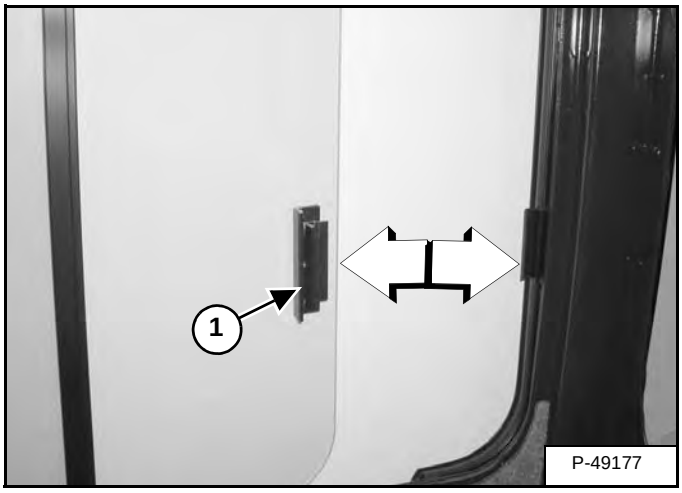
Opening The Right Rear Window

Figure 10-41-9



Pull out the latch (Item 1) **[Figure 10-41-9]**.

Figure 10-41-10



Pull the latch (Item 1) **[Figure 10-41-10]** forward to open the window.

Closing The Right Rear Window

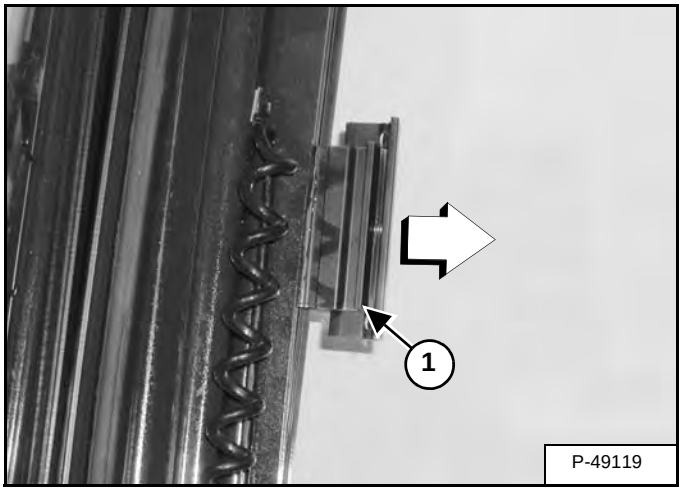
Push the latch back to close the window.

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Right Side Windows

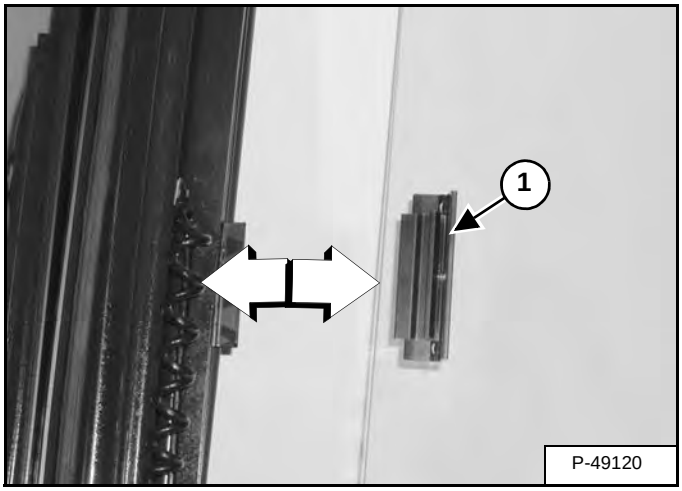
Opening The Right Front Window

Figure 10-41-11



Pull out the latch (Item 1) **[Figure 10-41-11]**.

Figure 10-41-12



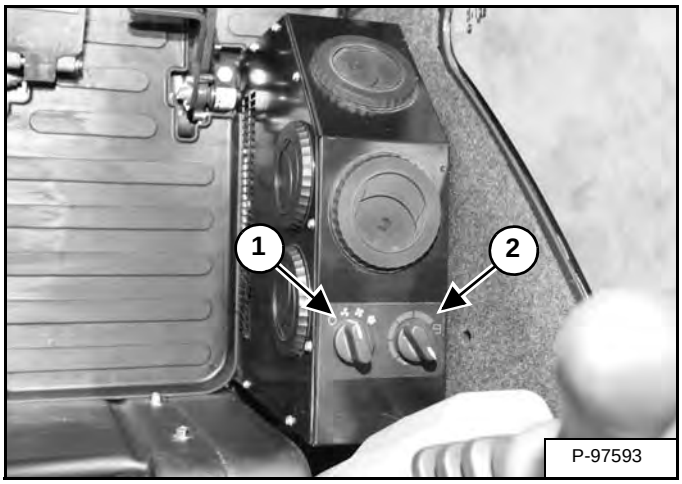
Pull the latch (Item 1) **[Figure 10-41-12]** back to open the window.

Closing The Right Front Window

Push the handle forward to close the window.

Heater

Figure 10-41-13



*Heater***[Figure 10-41-13]**

REF. NO.	DESCRIPTION	FUNCTION / OPERATION
1	Fan Motor Switch	Turn clockwise to increase fan speed; counterclockwise to decrease.
2	Temperature Control	Turn clockwise to increase temperature; counterclockwise to decrease.

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TRANSPORTING THE EXCAVATOR ON A TRAILER

Loading And Unloading

When transporting the machine, observe the rules, motor machine laws, and machine 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.

Retract the track frame if required.

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

Use metal loading ramps with a slip resistant surface.

Use ramps that are of 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). Engage the upperstructure slew lock. (See UPPERSTRUCTURE SLEW LOCK on Page 10-20-1.)

Figure 10-50-1



Move the machine forward onto the transport vehicle **[Figure 10-50-1]**.

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

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

Stop the engine and remove the key.

Put blocks at the front and rear of the tracks.

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Fastening - Track Frame Tie Downs

Figure 10-50-2

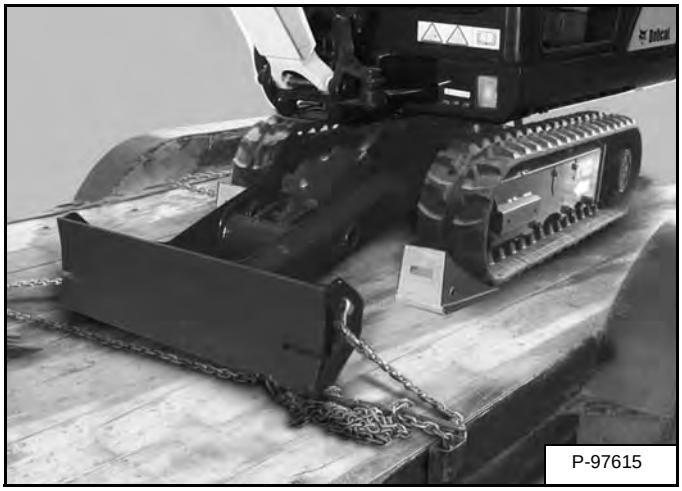
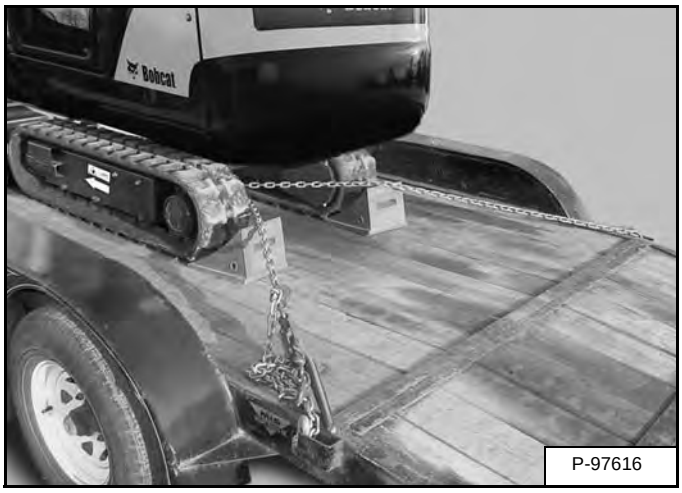


Figure 10-50-3



Fasten chains to the front corners of the blade and to the tie down loop at both sides of the track frame **[Figure 10-50-2]** and **[Figure 10-50-3]** to prevent it from moving when going up or down slopes or during sudden stops.

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

Fastening - Upperstructure Tie Downs (Optional)

Figure 10-50-4

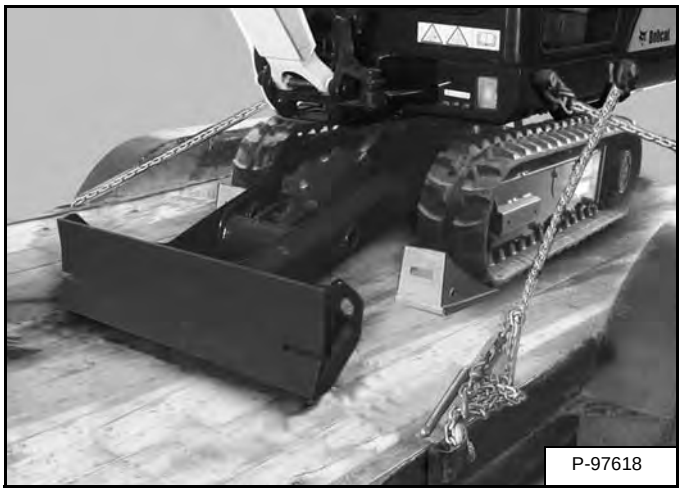
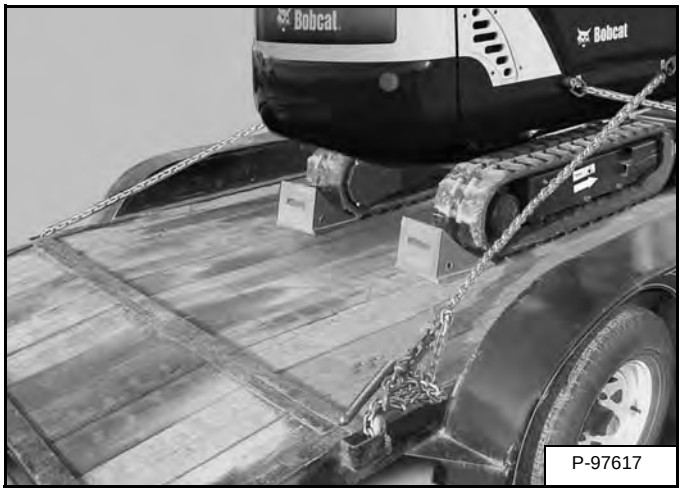


Figure 10-50-5



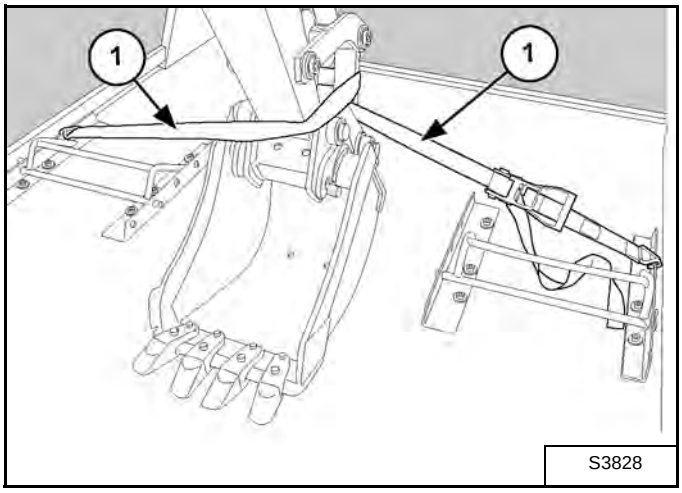
Fasten chains to the four upperstructure tie down links **[Figure 10-50-4]** and **[Figure 10-50-5]** to the prevent the machine from moving when going up or down slopes or during sudden stops.

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

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Fastening Arm - All Models

Figure 10-50-6



- When on the transport vehicle, loop the chains through the holes in the mounting frame.
- Loop the chain (Item 1) **[Figure 10-50-6]** around the bucket link.

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.

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TAILGATE

Opening And Closing

WARNING

AVOID INJURY OR DEATH

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

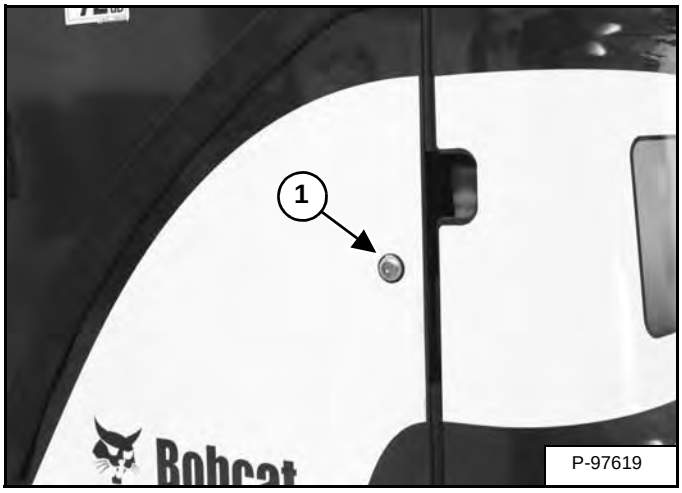
W-2012-0497

WARNING

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

W-2020-1285

Figure 10-40-1



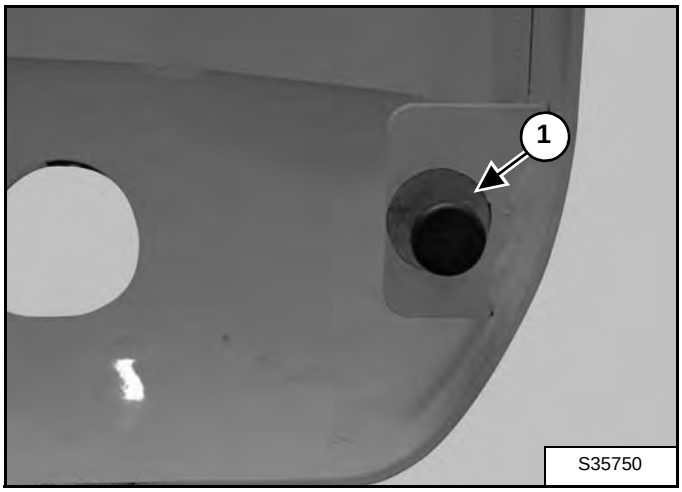
Pull the latch (Item 1) **[Figure 10-40-1]** to open the tailgate.

Push firmly to close the tailgate.

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

Adjusting The Bumper

Figure 10-60-1

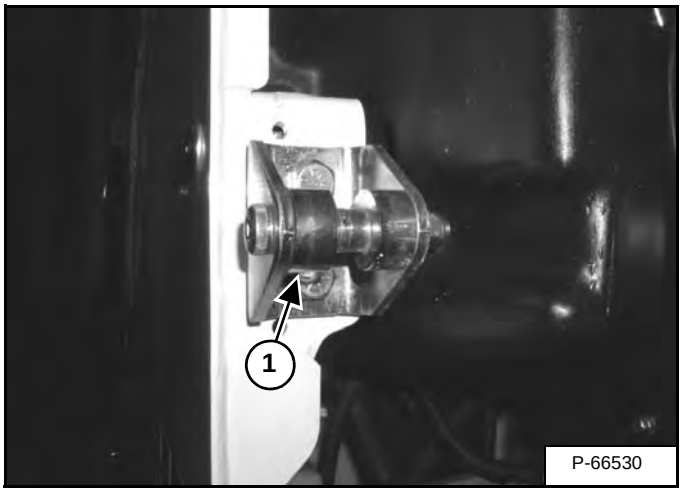


The door bumper (Item 1) **[Figure 10-60-1]** can be adjusted for alignment with the tailgate.

Close the tailgate before operating the excavator.

Adjusting The Latch

Figure 10-60-2



The tailgate latch (Item 1) **[Figure 10-60-2]** can be adjusted by loosening the two bolts, moving the latch, and tightening the two bolts.

Close the tailgate before operating the excavator.

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SERVICE SCHEDULE

Chart

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

⚠ WARNING

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

W-2003-0807

SERVICE SCHEDULE		HOURS					
ITEM	**SERVICE REQUIRED**	**8-10**	**50**	**100**	**250**	**500**	**[5] 1000**
Engine Coolant	Check coolant level. Add premixed coolant as needed.						
Engine Oil	Check the engine oil level and add as needed.						
Hydraulic Fluid, Hoses and Tubelines, Reservoir Breather Cap	Check the hydraulic fluid level and add as needed. Check for damage and leaks. Repair or replace as needed.						
Engine Air Filter and Air System	Check condition indicator and empty dust cup as needed. Check air system for leaks.						
Tracks	Check and adjust track tension as needed.						
Indicators and Lights	Check for correct operation of all indicators and lights.						
Horn	Check for correct operation and repair as needed.						
Operator Canopy/Cab	Check condition. Check mounting hardware.	**[1]**					
Seat Belt	Check condition. Check mounting hardware.						
Safety Signs (Decals)	Check for damaged signs (decals). Replace any signs that are damaged.						
Pivot Points	Grease all machinery pivot points.						
Cab / Heater Air Filters	Clean the filters as needed.	**[1]**					
Console Lockout	Check console lockout for proper operation.						
Swing Circle and Pinion	Grease two fittings		**[2]**				
Fuel Tank & Filter	Drain water and sediment from fuel tank and fuel filter.						
Battery	Check battery, cables, connections and electrolyte level. Add distilled water as needed.						
Alternator / Fan Belt	Check condition of belt and adjust as needed.		**[3]**				
Spark Arrester Muffler	Clean the spark chamber.						
Fuel Filter	Replace fuel filter.						
Travel Motor	Check oil level in both motors.			**[4]**			
Engine Oil and Filter	Replace oil and filter.		**[3]**				
Radiator, Oil Cooler	Clean debris from the radiator fins.						
Hydraulic Filter and Reservoir Breather	Replace the hydraulic filter and reservoir breather.			**[4]**			
Alternator & Starter	Check the alternator and starter connections.			**[4]**			
Engine Valves	Check and adjust the engine valve clearance.						
Travel Motor	Replace the lubricant in both travel motors.						
Hydraulic System	Replace the hydraulic fluid and filters. Clean the reservoir.			**[4]**			
Engine Coolant	Drain and flush the cooling system. Replace the coolant.	Every 2 years					

[1] If Equipped.
[2] Service every 10 hours when operating in water.
[3] Service at the first 50 hours, then as scheduled.
[4] Service at the first 100 hours, then as scheduled.
[5] Or every 12 months.

NOTE: The Inspection Checkbook can be ordered for you by your local dealer. Part number 4420310.

Dealer Copy -- Not for Resale

Inspection Checkbook

Regularly scheduled maintenance is essential to continuous operation and operating safety. The life expectancy of your machine depends on proper and meticulous care.

The Inspection Checkbook contains the following information:

- Doosan Benelux S.A. Warranty Conditions
- Protection Plus Extended Warranty Conditions
- General Parts Policy
- General Information
- First Inspection
- Scheduled Services
- Identification
- Authorized Identification
- Lubricants and Fluids Table
- Service Parts Chart

Your local dealer can order the Inspection Checkbook. Part number: 4420310.

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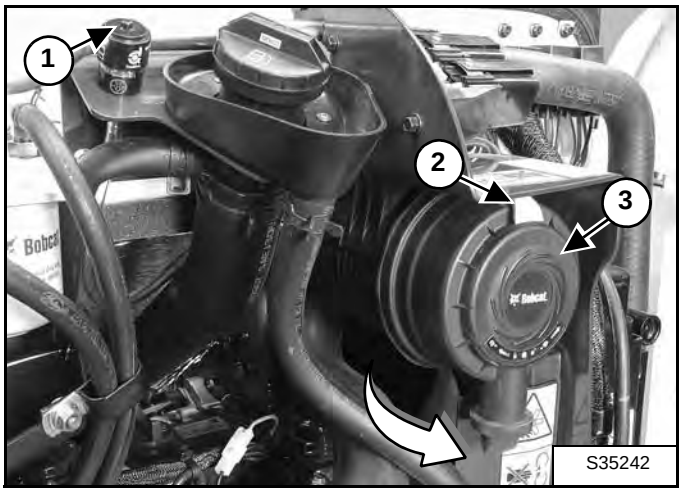
AIR CLEANER SERVICE

See the service schedule for the correct service interval. (See SERVICE SCHEDULE on Page 10-70-1.)

Daily Check

The air cleaner is located in the engine compartment. Open the tailgate to access the air cleaner for service. (See TAILGATE on Page 10-60-1.)

Figure 10-80-1



Check the condition indicator (Item 1) **[Figure 10-80-1]**. If the red ring shows in the condition indicator, the filter needs to be replaced.

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

Replacing The Filter Elements

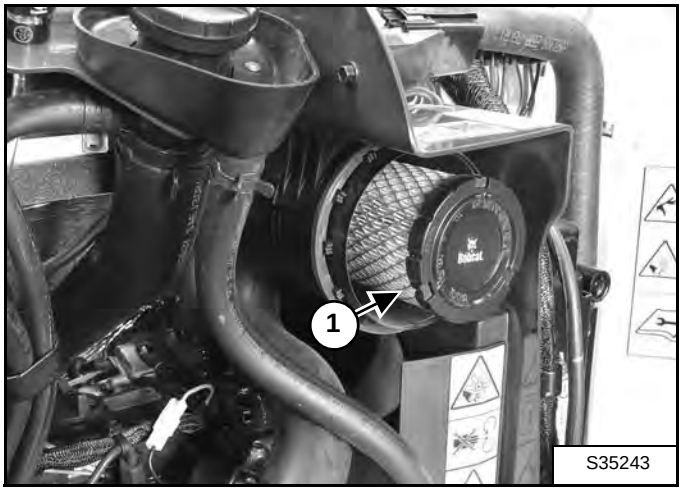
Outer Filter

Pull the locking tab (Item 2) **[Figure 10-80-1]**.

Turn the dust cup (Item 3) **[Figure 10-80-1]** anticlockwise for about 1/8 turn.

Remove and clean the dust cup.

Figure 10-80-2



Pull the outer filter (Item 1) **[Figure 10-80-2]** from the air cleaner housing.

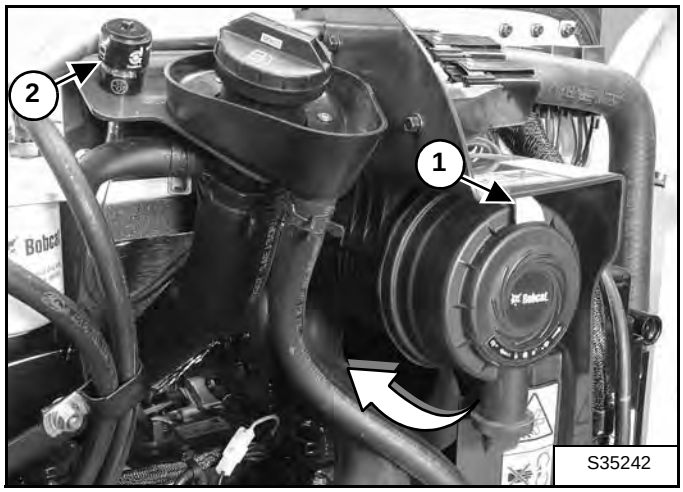
Check the housing for damage.

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

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Replacing The Filter Elements (Cont'd)

Figure 10-80-3



Install the dust cup and turn about 1/8 turn clockwise **[Figure 10-80-3]**.

Push the locking tab in (Item 1) **[Figure 10-80-3]**.

After the outer filter has been replaced, press the button (Item 2) **[Figure 10-80-3]** on the top of the condition indicator and start the engine. Run at full rpm, then reduce engine speed and stop the engine. If the red ring shows in the condition indicator, replace the inner filter.

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

Inner Filter

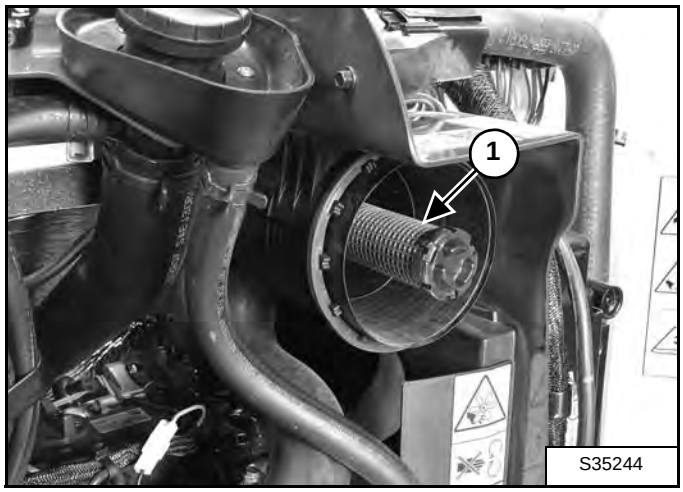
Only replace the inner filter under the following conditions:

- Replace the inner filter every *third* time the outer filter is replaced.
- After the outer filter has been replaced, press the button (Item 2) **[Figure 10-80-3]** on the top of the condition indicator. Start the engine. Run the engine at full rpm, then reduce engine speed. Stop the engine. If the red ring shows in the condition indicator, replace the inner filter.

Remove the dust cup, outer filter and inner filter.

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

Figure 10-80-4



Remove the dust cup, outer filter and inner filter (Item 1) **[Figure 10-80-4]**.

Install the new inner filter (Item 1) **[Figure 10-80-4]**.

Install the outer filter and the dust cup.

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

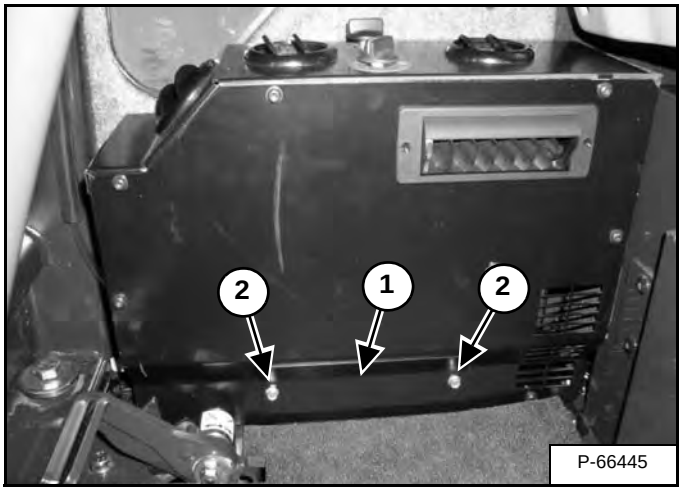
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CAB FILTER

Cleaning And Maintenance (Early Models Only)

The recirculation filter must be cleaned regularly. (See SERVICE SCHEDULE on Page 10-70-1.) The filter is located on the right of the operator seat.

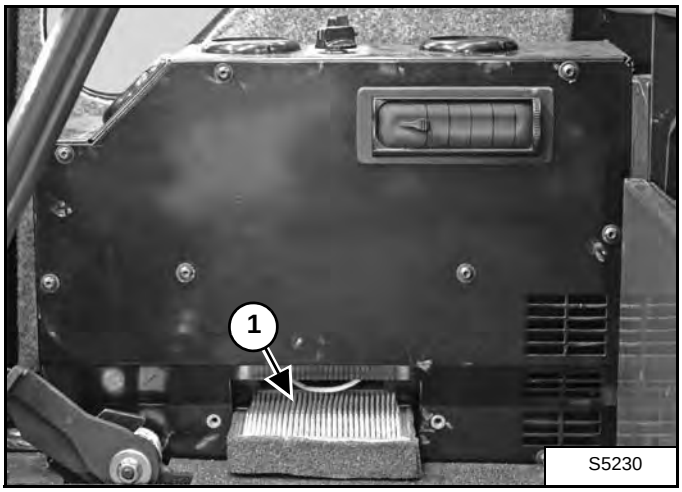
Figure 10-90-1



The cab filter is located on the lower side of the heater panel **[Figure 10-90-1]**.

Remove the two bolts (Item 1) **[Figure 10-90-1]** and remove the panel.

Figure 10-90-2



Remove the filter (Item 1) **[Figure 10-90-2]**. Shake the filter or use low air pressure to remove debris. Replace the filter after three cleanings or if the filter becomes too dirty to clean or damaged.

Reinstall the filter, cover and bolts.

The filter must be cleaned regularly.

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ENGINE COOLING SYSTEM

Check the cooling system every day to prevent overheating, loss of performance or engine damage. (See SERVICE SCHEDULE on Page 10-70-1.)

Cleaning

Open the tailgate. (See TAILGATE on Page 10-60-1.)

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

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

Checking Level

⚠ WARNING

AVOID BURNS

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

W-2070-1203

⚠ WARNING

AVOID INJURY OR DEATH

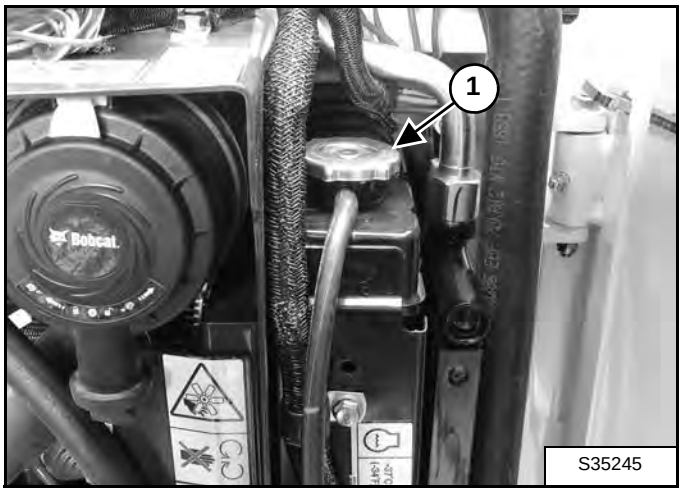
Wear safety glasses to prevent eye injury when any of the following conditions exist:

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

W-2019-0907

Open the tailgate. (See TAILGATE on Page 10-60-1.)

Figure 10-100-1



When the engine is cool, remove the radiator cap (Item 1) **[Figure 10-100-1]**.

The coolant level must be 20 - 25 mm (0.79 - 0.98 in) below the filler neck.

If the coolant level is low, add premixed coolant to the radiator.

IMPORTANT

AVOID ENGINE DAMAGE

Always use the correct ratio of water to antifreeze.

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

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

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

I-2124-0497

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Removing And Replacing Coolant

See the service schedule for correct service intervals. (See SERVICE SCHEDULE on Page 10-70-1.)

Stop the engine. Open the tailgate. (See TAILGATE on Page 10-60-1.)

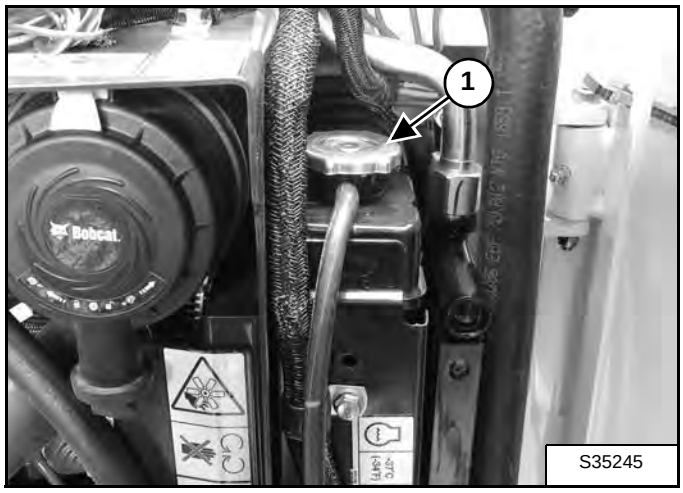
⚠ WARNING

AVOID BURNS

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

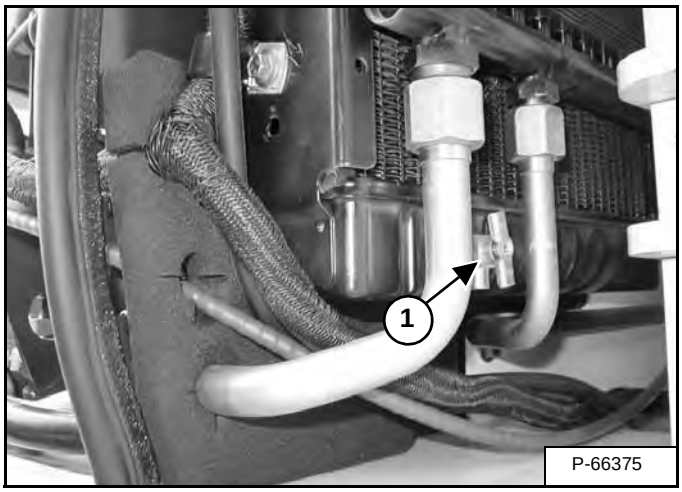
W-2070-1203

Figure 10-100-2



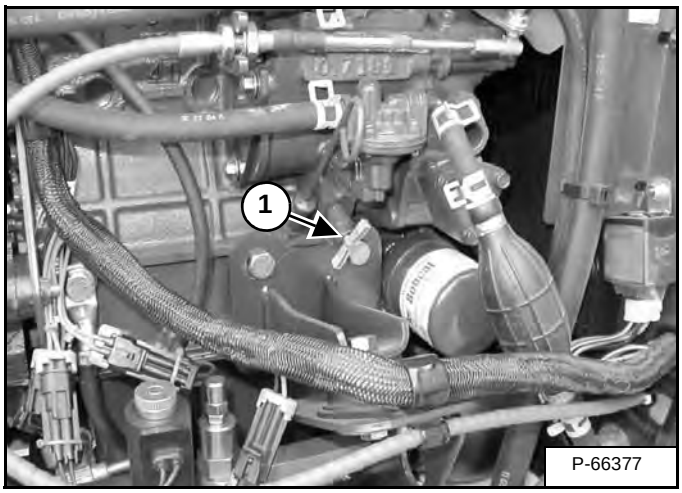
When the engine is cool, loosen and remove the radiator cap (Item 1) **[Figure 10-100-2]**.

Figure 10-100-3



Install a hose on the drain valve at the bottom of the radiator. Open the drain valve (Item 1) **[Figure 10-100-3]** and drain the coolant into a container.

Figure 10-100-4



Put a hose on the drain valve on the engine block. Open the drain valve (Item 1) **[Figure 10-100-4]** and drain the coolant into a container.

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

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

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Removing And Replacing Coolant (Cont'd)

Mix the coolant in a separate container. (See ENGINE COOLING SYSTEM on Page 10-100-1.)and (See Capacities on Page SPEC-10-9.)

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

The correct mixture of coolant to provide a -37°C (-34°F) freeze protection is 5 L propylene glycol mixed with 4,4 L of water **OR** 1 U.S. gal propylene glycol mixed with 3.5 qt of water.

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

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

Add premixed coolant until the level is correct.

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

Add coolant to the recovery tank as needed.

Close the tailgate.

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FUEL SYSTEM

Fuel Specifications

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

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

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

At a minimum, low sulfur diesel fuel must be used in this machine. Low sulfur is defined as 500 mg/kg (500 ppm) sulfur maximum.

The following fuels may also be used in this machine:

- Ultra low sulfur diesel fuel. Ultra low sulfur is defined as 15 mg/kg (15 ppm) sulfur maximum.
- Biodiesel blend fuel - Must contain no more than five percent biodiesel mixed with low sulfur or ultra low sulfur petroleum based diesel. This is commonly marketed as B5 blended diesel fuel.

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2063-0807

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2103-0508

Biodiesel Blend Fuel

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

- Cold weather conditions can lead to plugged fuel system components and hard starting.
- Biodiesel blend fuel is an excellent medium for microbial growth and contamination which can cause corrosion and plugging of fuel system components.
- Use of biodiesel blend fuel can result in premature failure of fuel system components, such as plugged fuel filters and deteriorated fuel lines.
- Shorter maintenance intervals can 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 machine storage; drain the fuel tank, refill with 100% petroleum diesel fuel, add fuel stabilizer and run the engine for at least 30 minutes.

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

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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

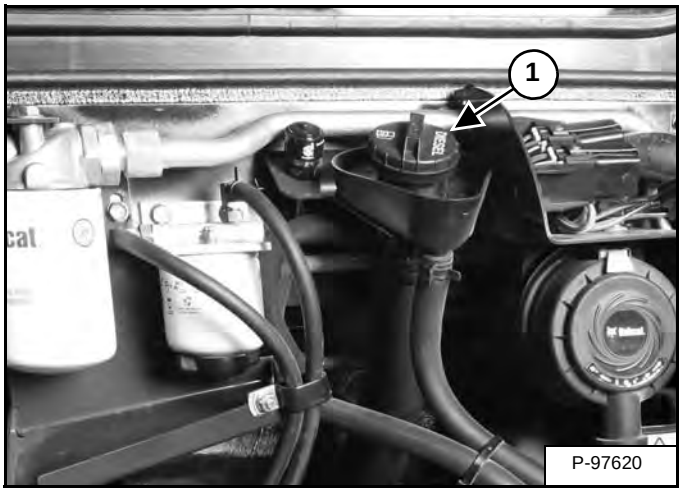
⚠ WARNING

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 10-80-1



The fuel cap is located in the engine compartment.

Open the tailgate. (See TAILGATE on Page 10-60-1.)

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

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

Install and tighten the fuel fill cap.

Clean up any spilled fuel.

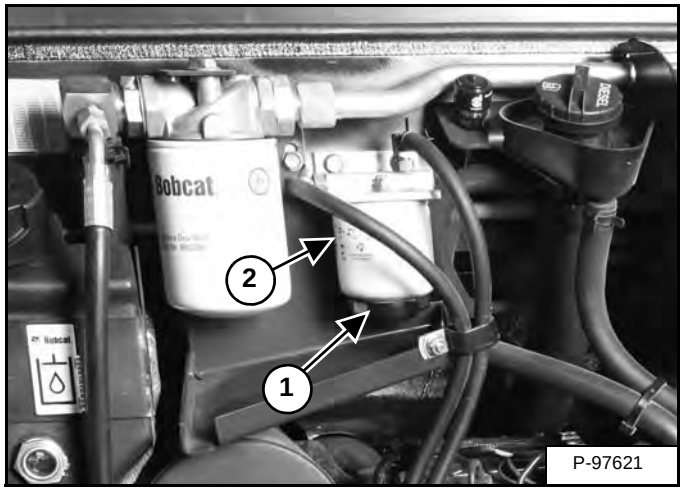
See the service schedule for the service interval when to remove water from or replace the fuel filter. (See SERVICE SCHEDULE on Page 10-70-1.)

Fuel Filters

Removing Water

Open the tailgate. (See TAILGATE on Page 10-60-1.)

Figure 10-110-1



Loosen the drain (Item 1) **[Figure 10-110-1]** at the bottom of the filter to drain water from the filter into a container.

Clean up any spilled fuel.

Replacing Elements

Remove the filter (Item 2) **[Figure 10-110-1]**.

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

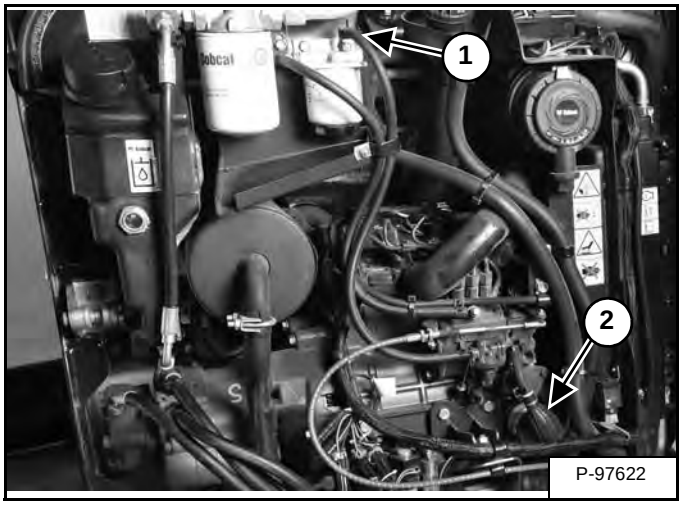
Remove the air from the fuel system. (See Removing Air From The Fuel System on Page 10-110-3.)

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Draining The Fuel Tank

See the service schedule for the correct service interval. (See SERVICE SCHEDULE on Page 10-70-1.)

Figure 10-110-2



Remove the hose (Item 1) **[Figure 10-110-2]** from the engine. Route the hose to a container.

Squeeze the hand pump (priming bulb) (Item 2) **[Figure 10-110-2]** to start the fuel siphoning from the fuel tank.

Drain the fuel into the container.

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

Reinstall the hose (Item 1) **[Figure 10-110-2]** after the fuel is removed from fuel tank.

⚠ 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 doctor familiar with this injury.

W-2072-EN-0909

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.

Open the tailgate. (See TAILGATE on Page 10-60-1.)

Figure 10-110-3

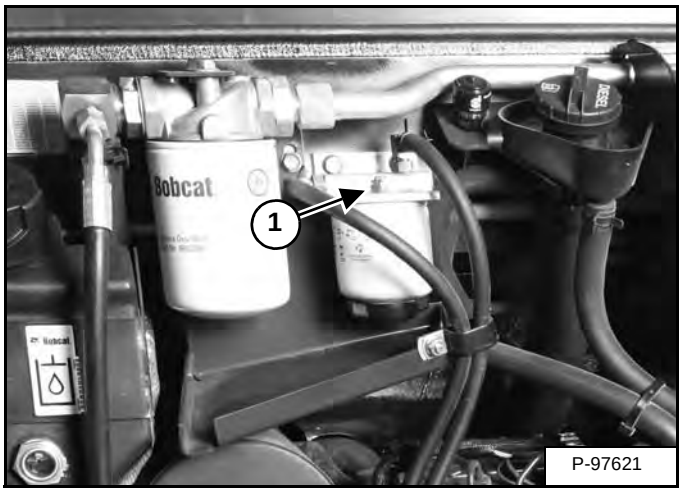
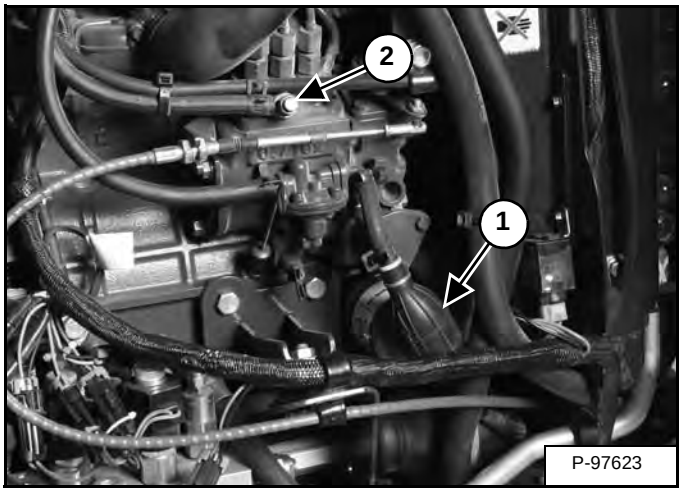


Figure 10-110-4



Open the fuel filter vent (Item 1) **[Figure 10-110-3]** and operate the hand pump (priming bulb) (Item 1) **[Figure 10-110-4]** until the fuel flows from the vent with no air bubbles.

Close the vent (Item 1) **[Figure 10-110-3]**.

Start the engine. It can be necessary to open the vent (Item 2) **[Figure 10-110-4]** (at the fuel injection pump) briefly until the engine runs smoothly.

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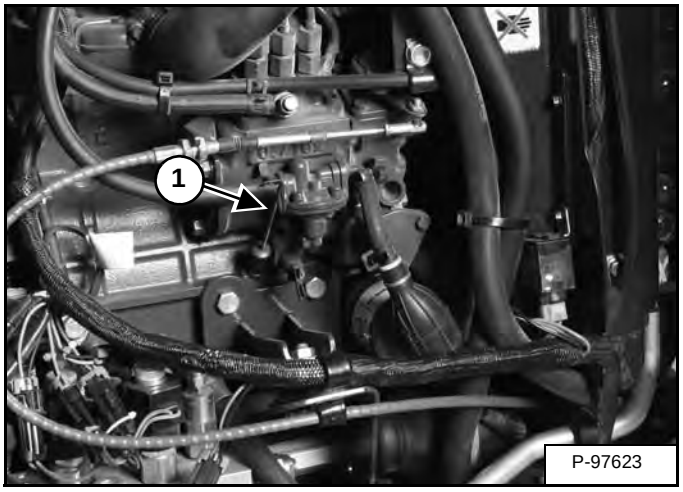
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ENGINE LUBRICATION SYSTEM

Checking And Adding Engine Oil

Check the engine oil after every 8 - 10 hours of operation and before starting the engine. (See SERVICE SCHEDULE on Page 10-70-1.)

Figure 10-120-1



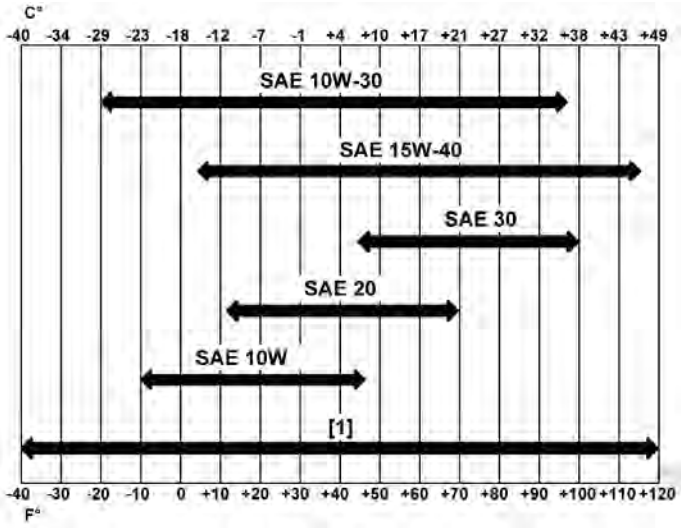
Open the tailgate and remove the dipstick (Item 1) **[Figure 10-120-1]**.

Keep the oil level between the marks on the dipstick.

Engine Oil Chart

Figure 10-120-2

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 CI-4 OR BETTER)

[1] Synthetic Oil - Use recommendation from Synthetic Oil Manufacturer.

Use good quality engine oil that meets API Service Classification of CI-4 or better **[Figure 10-120-2]**.

⚠ 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

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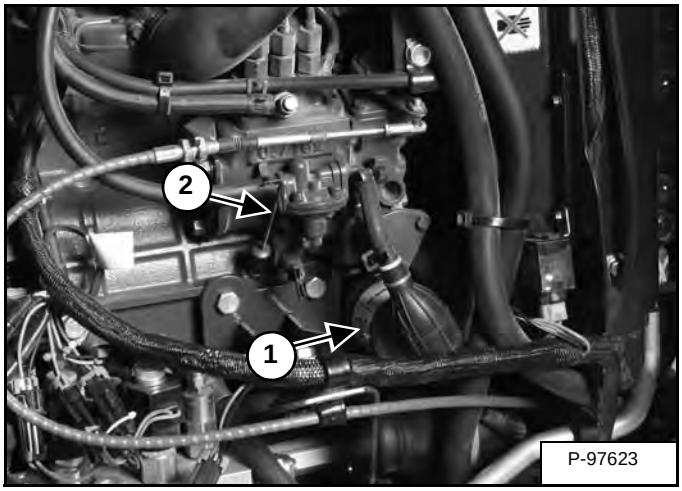
Removing And Replacing Oil And Filter

See the service schedule for the service interval for replacing the engine oil and filter. (See SERVICE SCHEDULE on Page 10-70-1.)

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

Open the tailgate. (See TAILGATE on Page 10-60-1.)

Figure 10-120-3



From below the engine, remove the engine oil drain plug. Drain the oil into a container and recycle or dispose of used oil in an environmentally safe manner.

Remove the oil filter (Item 1) **[Figure 10-120-3]** and clean the filter housing surface.

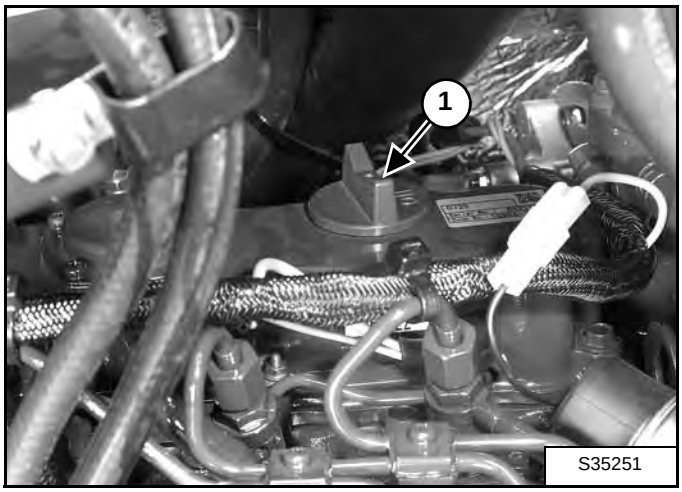
Use a genuine Bobcat filter.

Put clean oil on the filter gasket.

Install the filter and tighten by hand.

Install and tighten the oil drain plug.

Figure 10-120-4



Remove the fill cap (Item 1) **[Figure 10-120-4]**.

Put oil in the engine. (See ENGINE LUBRICATION SYSTEM on Page 10-120-1.)

Install the fill cap (Item 1) **[Figure 10-120-4]**.

Start the engine and let it run for several minutes.

Stop the engine. Check for leaks at the oil filter. Check the oil level.

Add oil as needed if it is not at the top mark on the dipstick (Item 2) **[Figure 10-120-3]**.

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HYDRAULIC SYSTEM

Checking And Adding Hydraulic Fluid

Figure 10-130-1



Put the machine on a flat level surface.

Retract the tracks fully.

Extend the arm and retract the bucket cylinders, lower the boom until the bucket is on the ground and lower the blade as shown **[Figure 10-130-1]**. Stop the engine.

Open the tailgate. (See TAILGATE on Page 10-60-1.)

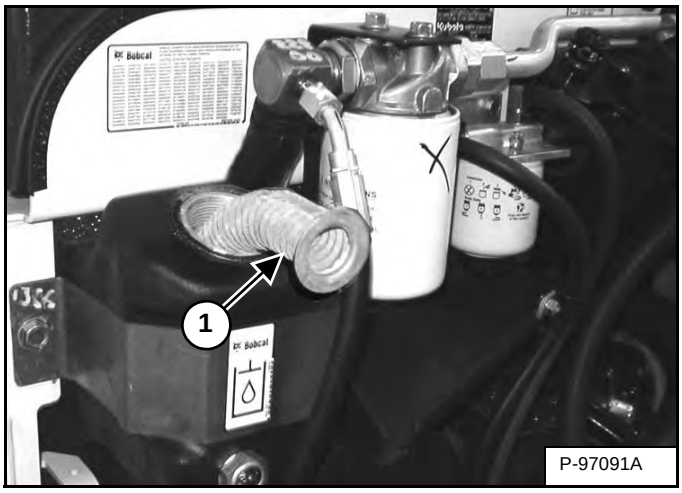
Figure 10-130-2



The fluid must be at the center of the sight gauge (Item 1) **[Figure 10-130-2]**.

Remove the oil fill cap (Item 2) **[Figure 10-130-2]**.

Figure 10-130-3



Check the condition of the screen (Item 1) **[Figure 10-130-3]** in the fill neck of the reservoir. The screen must be installed in fill neck when adding oil.

⚠ 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

Add the correct fluid to the reservoir until it is visible in the sight gauge (Item 1) **[Figure 10-130-2]**.

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

Install the cap.

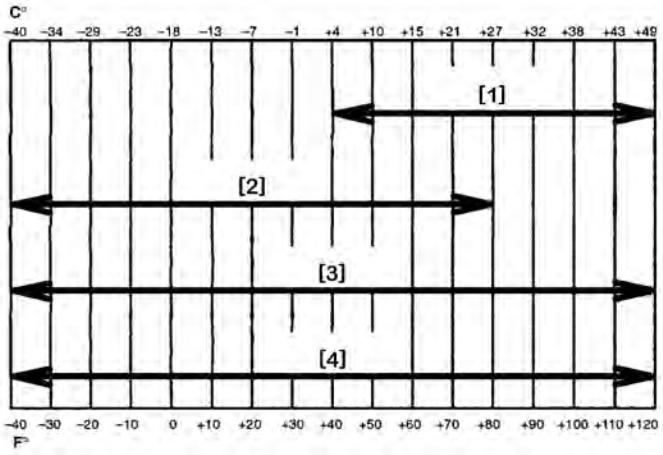
Close the tailgate.

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Hydraulic / Hydrostatic Fluid Chart

Figure 10-130-4

HYDRAULIC / HYDROSTATIC FLUID RECOMMENDED ISO VISCOSITY GRADE (VG) AND VISCOSITY INDEX (VI)



TEMPERATURE RANGE ANTICIPATED DURING MACHINE USE

[1] VG 100; Minimum VI 120
[2] VG 46; Minimum VI 140
[3] Synthetic Fluid; VG 46; Minimum VI 150
[4] BOBCAT Hydraulic / Hydrostatic Fluid

Use only recommended fluid in the hydraulic system **[Figure 10-130-4]**.

Install the oil fill cap.

Removing And Replacing The Hydraulic Filter

WARNING

AVOID INJURY OR DEATH

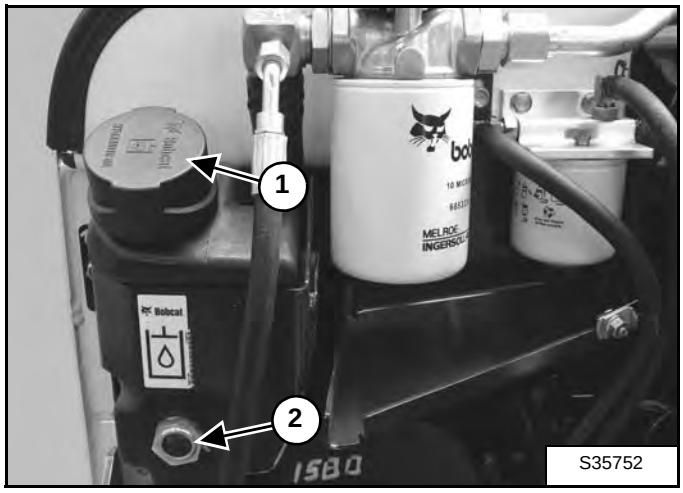
Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

See the service schedule for the correct service interval. (See SERVICE SCHEDULE on Page 10-70-1.)

Open the tailgate. (See TAILGATE on Page 10-60-1.)

Figure 10-130-5



Remove the filter (Item 1) **[Figure 10-130-5]**.

Clean the housing where the filter gasket makes contact.

Put clean hydraulic fluid on the gasket. Install the new filter (Item 1) **[Figure 10-130-5]** and hand tighten.

Start the engine. Run the excavator through the hydraulic functions. Stop the engine. Check the fluid level at the sight gauge (Item 2) **[Figure 10-130-5]** and add as needed. Check the filter area for leaks.

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Removing And Replacing The Hydraulic Fluid

See the service schedule for the correct service interval. (See SERVICE SCHEDULE on Page 10-70-1.)

⚠ 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 doctor familiar with this injury.

W-2072-EN-0909

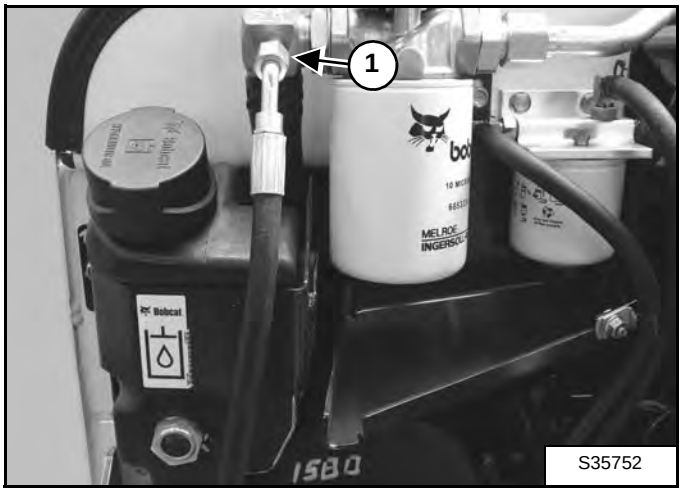
Retract the tracks fully.

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

Open the tailgate. (See TAILGATE on Page 10-60-1.)

Remove and replace the hydraulic filter.

Figure 10-130-6



Loosen the hose (Item 1) **[Figure 10-130-6]** at the top and lead it into a container to drain the hydraulic fluid.

IMPORTANT

Fluid such as engine oil, hydraulic fluid, coolants, grease, etc. must be disposed of in an environmentally safe manner. Some regulations require that certain spills and leaks on the ground must be cleaned in a specific manner. See local regulations for the correct disposal.

I-2067-EN-0711

IMPORTANT

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

I-2045-0788

Reinstall the hose.

Add fluid to the reservoir until it is at the center of the sight gauge (Item 2) **[Figure 10-130-5]**.

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

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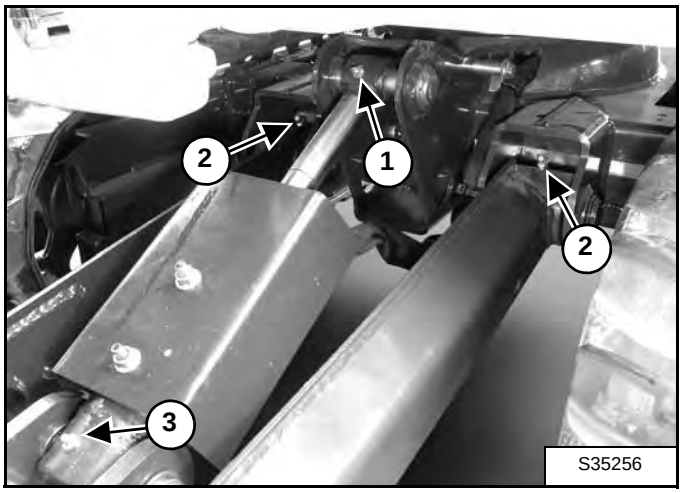
LUBRICATING THE EXCAVATOR

Lubrication Locations

Lubricate the excavator as specified in the SERVICE SCHEDULE for the best performance of the machine. (See SERVICE SCHEDULE on Page 10-70-1.)

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

Figure 10-140-1



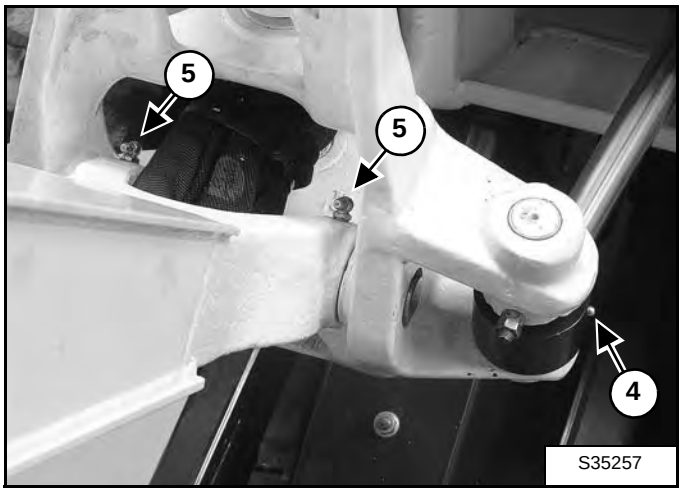
Ref Description (# of Fittings)

1. Blade Cylinder Rod End, every 8 - 10 hours (1) **[Figure 10-140-1]**.

2. Blade Pivots, every 8 - 10 hours (2) **[Figure 10-140-1]**.

3. Blade Cylinder Base End, every 8 - 10 hours (1) **[Figure 10-140-1]**.

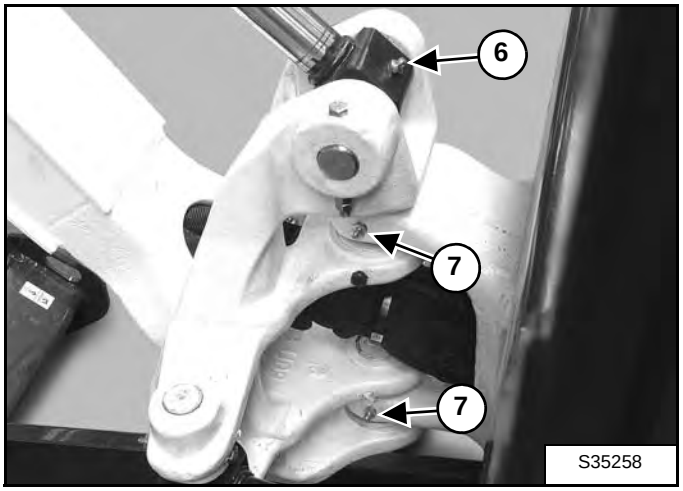
Figure 10-140-2



4. Boom Swing Cylinder Rod End, every 8 - 10 hours (1) **[Figure 10-140-2]**.

5. Boom Base End, every 8 - 10 hours (2) **[Figure 10-140-2]**.

Figure 10-140-3



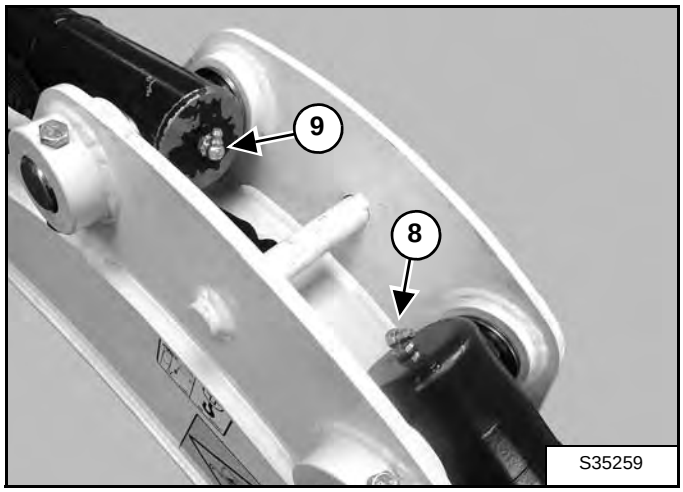
6. Boom Cylinder Base End, every 8 - 10 hours (1) **[Figure 10-140-3]**.

7. Boom Swing Pivot, every 8 - 10 hours (2) **[Figure 10-140-3]**.

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Lubrication Locations (Cont'd)

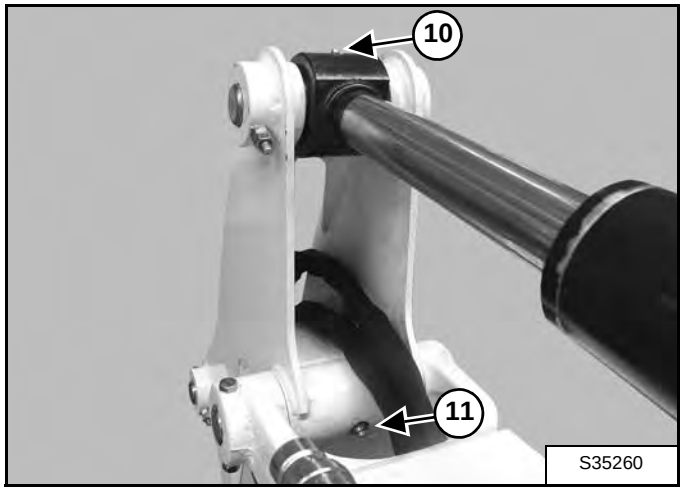
Figure 10-140-4



8. Boom Cylinder Rod End, every 8 - 10 hours (1) **[Figure 10-140-4]**.

9. Arm Cylinder Base End, every 8 - 10 hours (1) **[Figure 10-140-4]**.

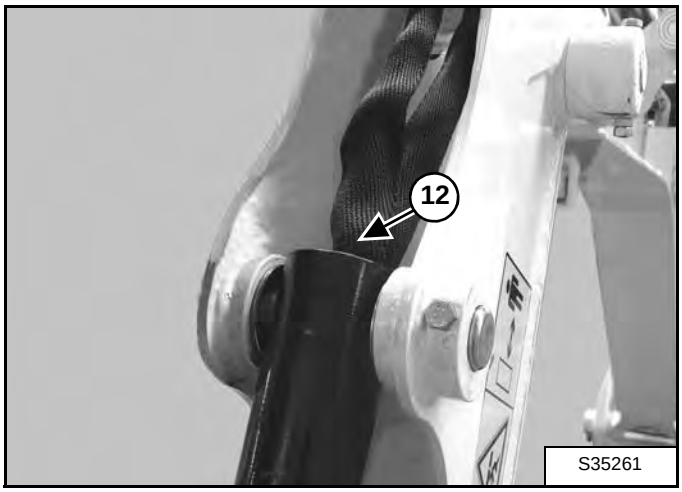
Figure 10-140-5



10. Arm Cylinder Rod End, every 8 - 10 hours (1) **[Figure 10-140-5]**.

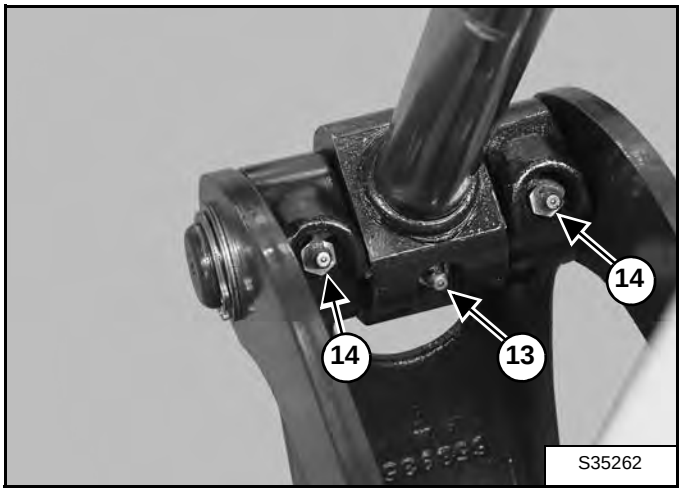
11. Arm Pivot, every 8 - 10 hours (1) **[Figure 10-140-5]**.

Figure 10-140-6



12. Bucket Cylinder Base End, every 8 - 10 hours (1) **[Figure 10-140-6]**.

Figure 10-140-7



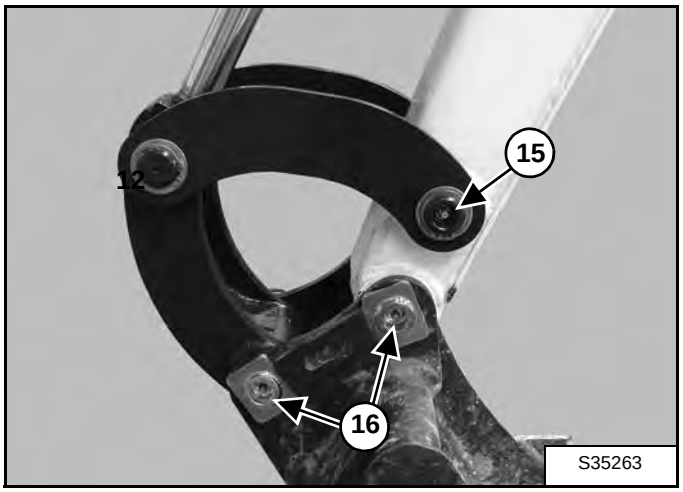
13. Bucket Cylinder Rod End, every 8 - 10 hours (1) **[Figure 10-140-7]**.

14. Bucket Link Pivots, every 8 - 10 hours (2) **[Figure 10-140-7]**.

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Lubrication Locations (Cont'd)

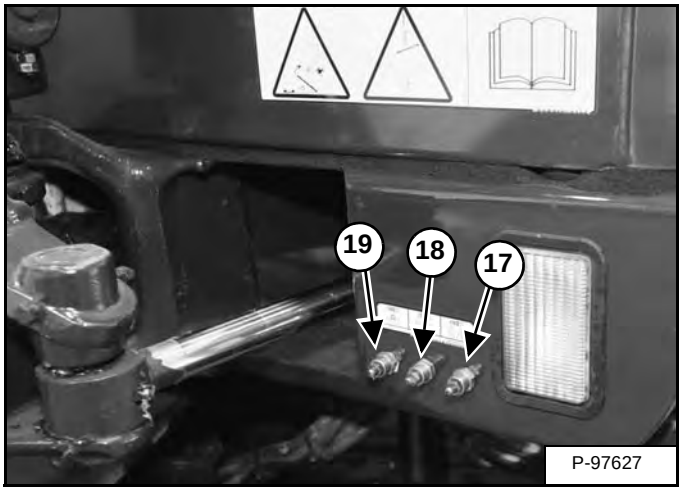
Figure 10-140-8



15. Bucket Link Pivot, every 8 - 10 hours (1) **[Figure 10-140-8]**.

16. Bucket Pivots, every 8 - 10 hours (2) **[Figure 10-140-8]**.

Figure 10-140-9



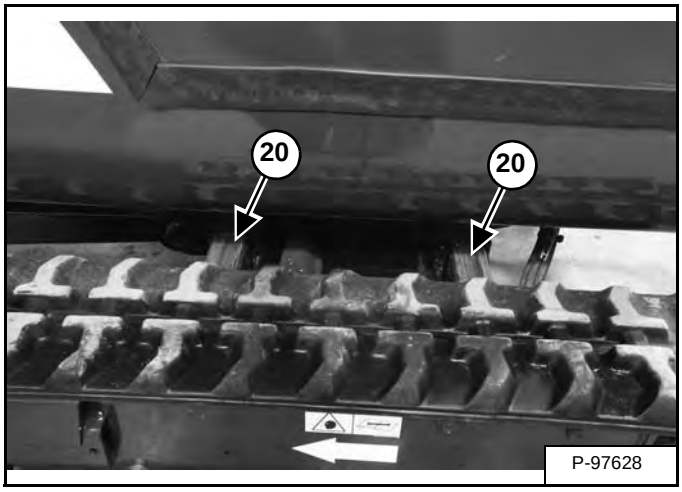
17. Boom Swing Cylinder Base End, every 8 - 10 hours **[Figure 10-140-9]**.

18. Swing Circle Bearing, every 50 hours **[Figure 10-140-9]**.

19. Swing Circle Pinion, every 50 hours. Pump four times with a grease gun. Rotate the upperstructure 180 degrees and repeat **[Figure 10-140-9]**.

NOTE: Do not over-grease the swing circle; damage to the seal could result. Pump four to five times with a grease gun. Rotate the upperstructure 90 degrees and repeat three more times.

Figure 10-140-10



20. Track Expansion Tube, as required **[Figure 10-140-10]**.

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

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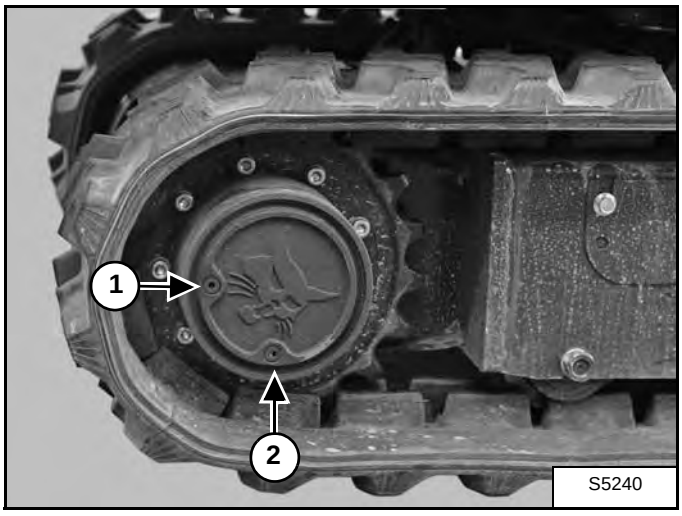


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TRAVEL MOTOR

Checking And Adding Oil

Figure 10-150-1



Put the machine on a level surface with the plugs (Items 1 and 2) **[Figure 10-150-1]** positioned as shown.

Remove the top plug (Item 1) **[Figure 10-150-1]**. The lube level must be at the bottom edge of the plug hole.

Add lubricant (SAE 90W) through the hole if the lube level is low.

Removing And Replacing Oil

(See SERVICE SCHEDULE on Page 10-70-1.) For the correct service interval.

Put the excavator on a level surface with the plugs (Items 1 and 2) **[Figure 10-150-1]** positioned as shown.

Remove the bottom plug (Item 2) and top plug (Item 1) **[Figure 10-150-1]** and drain into a container. Recycle or dispose of the used lubricant in an environmentally safe manner.

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

After all the lubricant is removed, install the bottom plug (Item 2) **[Figure 10-150-1]**.

Add 0,5 L (0.55 qt) of lubricant (SAE 90W) through the top plug hole (Item 1) **[Figure 10-150-1]** until the lubricant level is at the bottom edge of the plug hole.

Install and tighten the top plug (Item 1) **[Figure 10-150-1]**.

Repeat the procedure on the other side.

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SPARK ARRESTER MUFFLER

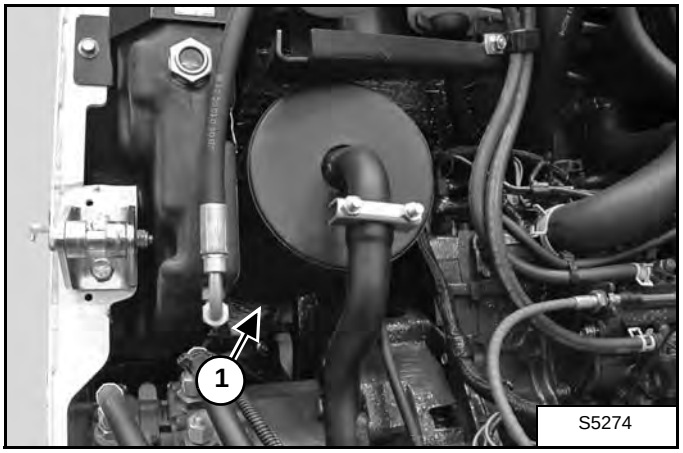
Cleaning Procedure

See the service schedule. (See SERVICE SCHEDULE on Page 10-70-1.) for the correct service interval.

Do not operate the excavator with a defective exhaust system.

Stop the engine and open the tailgate. (See TAILGATE on Page 10-60-1.)

Figure 10-160-1



Remove the plug (Item 1) **[Figure 10-160-1]** from the bottom of the muffler.

Start the engine and let it run for about 10 seconds while a second person, wearing safety glasses, holds a piece of wood over the outlet of the muffler. (The carbon deposits will be forced out of the muffler cleanout hole.)

Stop the engine. Install and tighten the plug.

Close the tailgate.

⚠ WARNING

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

Failure to do so can cause injury or death.

W-2203-0595

⚠ WARNING

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

W-2068-1285

⚠ WARNING

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

W-2011-1285

⚠ WARNING

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.

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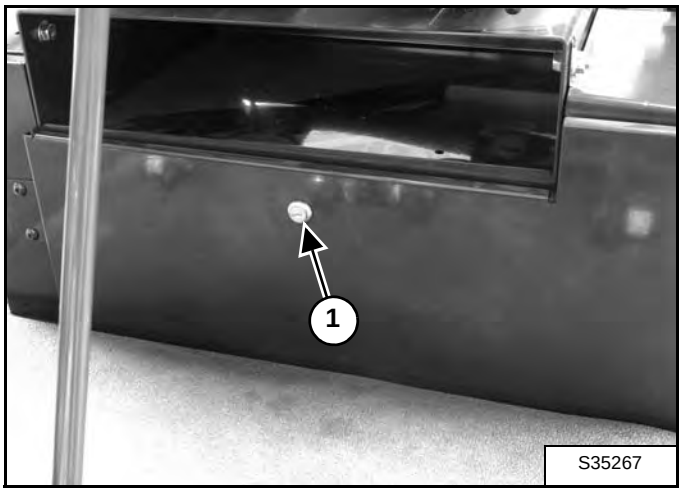
ALTERNATOR BELT

Belt Adjustment (S/N AHLL11001 - AHLL13119)

Replace the belt if it is stretched or has cracks. Replace the pulley if the belt makes contact with the bottom of the groove in the pulley.

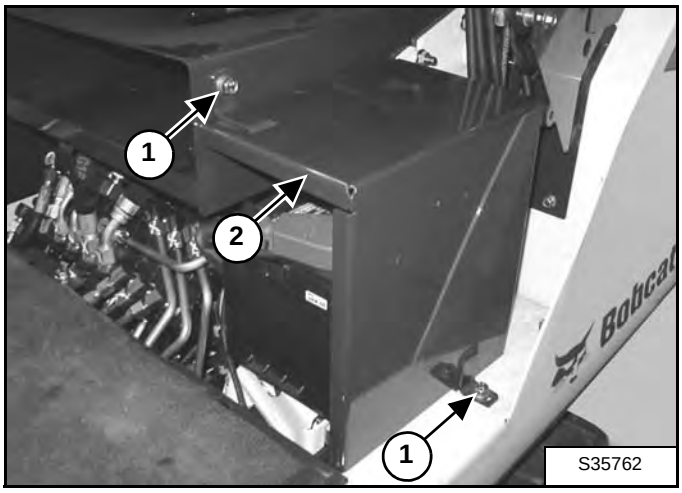
Stop the engine.

Figure 10-170-1



Use the start key to remove the access cover (Item 1) **[Figure 10-170-1]**.

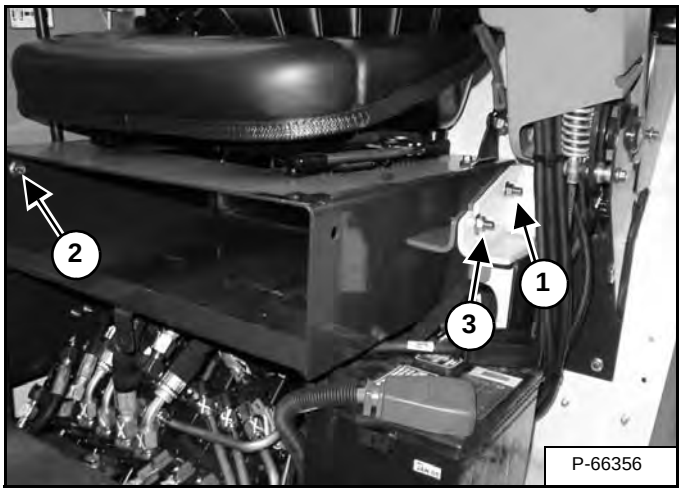
Figure 10-170-2



Remove the two bolts (Item 1) **[Figure 10-170-2]** and brackets from the battery cover.

Remove the cover (Item 2) **[Figure 10-170-2]**.

Figure 10-170-3



Remove the two bolts (Item 1) **[Figure 10-170-3]** and nuts from both sides of the seat mount.

Remove the bolt (Item 2) **[Figure 10-170-3]**, nut and bracket from the right side of the seat mount.

Loosen the two bolts (Item 3) **[Figure 10-170-3]** and nuts from both sides of the seat mount.

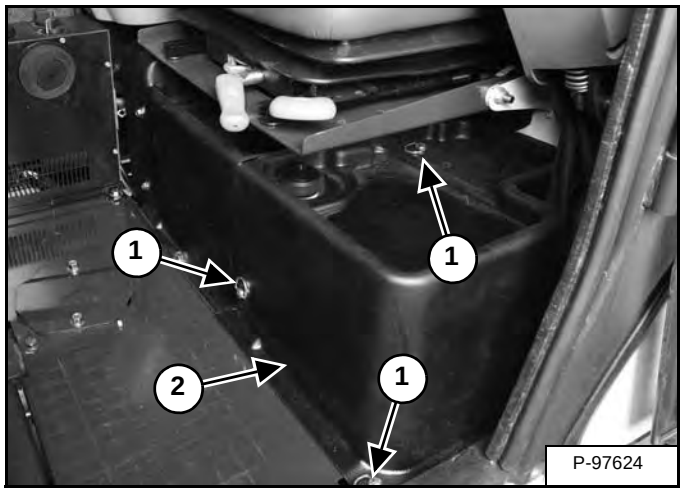
Remove the seat and seat mount.

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ALTERNATOR BELT (CONT'D)

Belt Adjustment (S/N AHLL13120 & Above)

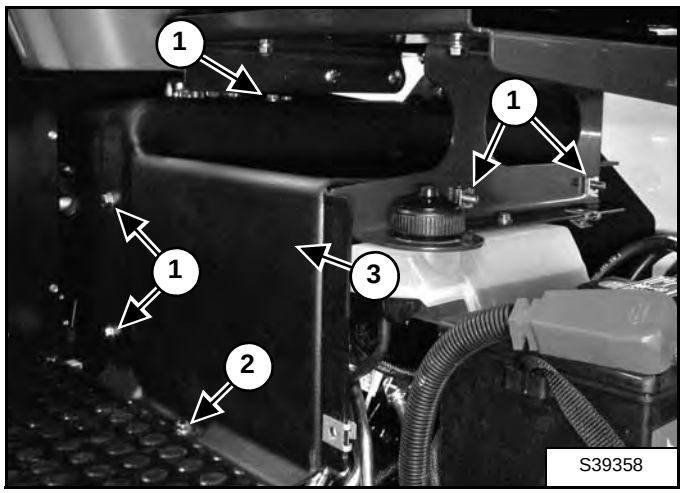
Figure 10-170-4



Turn the three quarter turn fasteners (Item 1) **[Figure 10-170-4]** and remove the battery cover.

Remove the cover (Item 2) **[Figure 10-170-4]**.

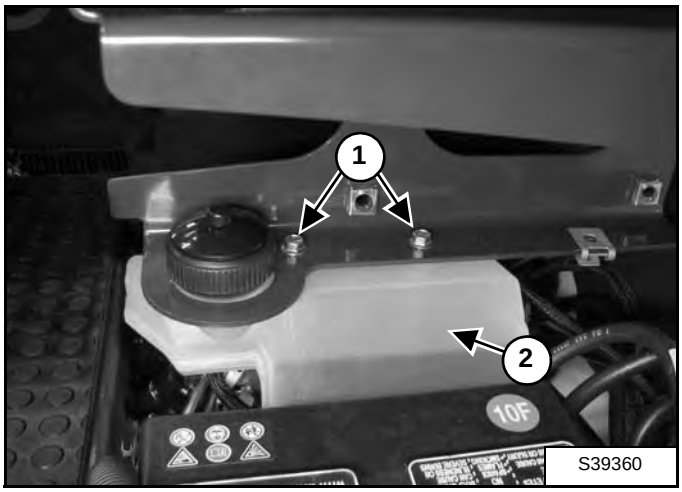
Figure 10-170-5



Remove the six bolts (Item 1 and 2) and remove the access cover (Item 3) **[Figure 10-170-5]**.

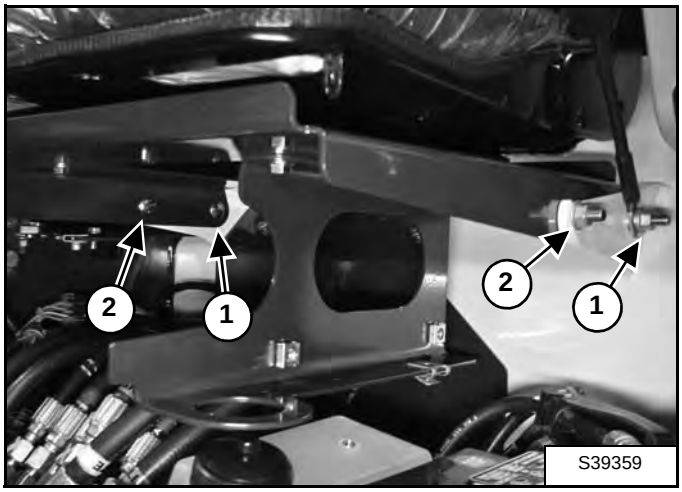
Installation: Tighten bolt (Item 2) **[Figure 10-170-5]** to 8 - 10 N•m (71 - 88 in-lb) torque.

Figure 10-170-6



Remove the two bolts (Item 1) and lower the washer bottle (Item 2) **[Figure 10-170-6]**.

Figure 10-170-7



Remove the two bolts (Item 1) **[Figure 10-170-7]** and nuts from both sides of the seat mount.

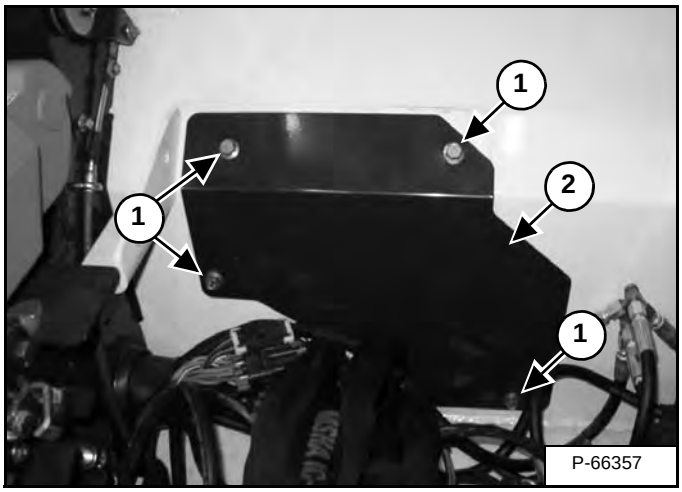
Loosen the two bolts (Item 2) **[Figure 10-170-7]** and nuts from both sides of the seat mount.

Remove the seat and seat mount.

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Belt Adjustment (All Models)

Figure 10-170-8



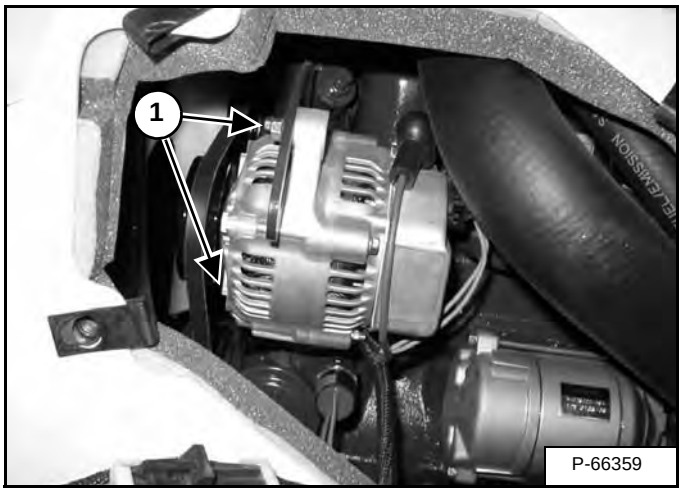
Remove the four bolts (Item 1) and remove the access panel (Item 2) **[Figure 10-170-8]**.

NOTE: There are five bolts (Item 1) [Figure 10-170-8] on later machines (S/N AHLL13120 & Above).

Replace the belt if it has stretched or there are cracks in the belt. Replace the pulley if the belt makes contact with the bottom of the groove in the pulley.

Stop the engine.

Figure 10-170-9



Loosen the alternator mounting and adjustment bolts (Item 1) **[Figure 10-170-9]**.

If a belt tension tool is available, move the alternator towards the front of the machine until the belt has (New belt = 250 - 267 N [56 - 60 lbf] or used belt = 214 - 231 N [48 - 52 lbf]) tension.

If a belt tension tool is not available, move the alternator towards the front of the machine until the belt has 13 mm (0.50 in) movement at the middle of the belt span with 58 N (13 lbf) of force.

Tighten the mounting and adjustment bolts.

Install the access panel, the seat and seat mount, the battery cover and the access cover.

Belt Replacement

Loosen the alternator mounting and adjustment bolts (Item 1) **[Figure 10-170-9]** and loosen the belt fully.

Remove the belt and install a new belt.

Adjust the belt to the specifications shown above.

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SEAT BELT

Inspection And Maintenance

WARNING

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

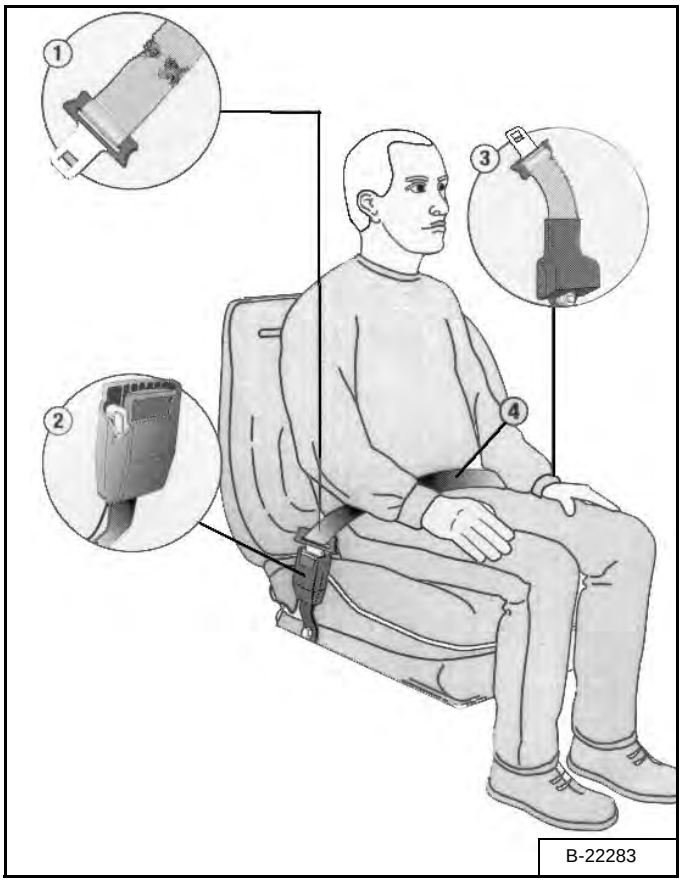
W-2466-0703

Check the seat belt daily for correct function.

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

Any seat belt system that shows cuts, fraying, extreme or unusual wear, significant discolorations due to ultraviolet UV exposure, dusty / dirty conditions, abrasion to the seat belt webbing, or damage to the buckle, latch plate, retractor (if equipped), hardware or any other obvious problem should be replaced immediately.

Figure 10-180-1



The items below are referenced in **[Figure 10-180-1]**.

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

2. Check the buckle and latch for 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 the seat belt 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 can have deteriorated.

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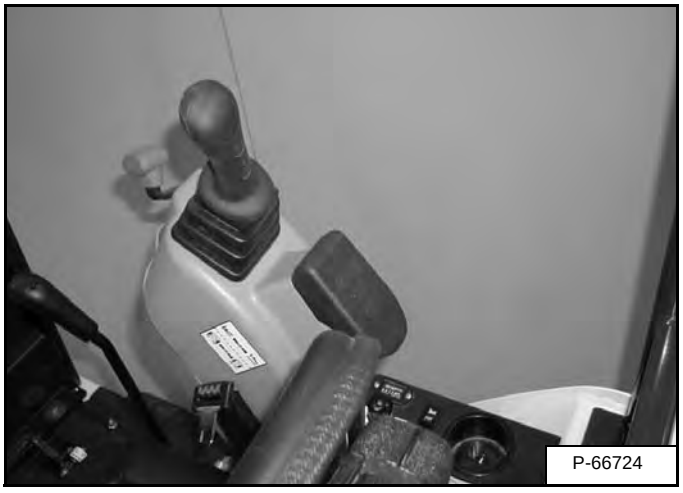
CONTROL CONSOLE LOCKOUTS

Inspection And Maintenance

Figure 10-160-1



Figure 10-160-2



When a console is raised **[Figure 10-160-1]** or **[Figure 10-160-2]**, 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 **[Figure 10-160-1]**. (Green light on the console will go off).

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

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

Lower the left console. Raise the right console **[Figure 10-160-2]** and repeat the inspection procedure.

The joystick control levers and traction system must be deactivated when a console is raised.

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

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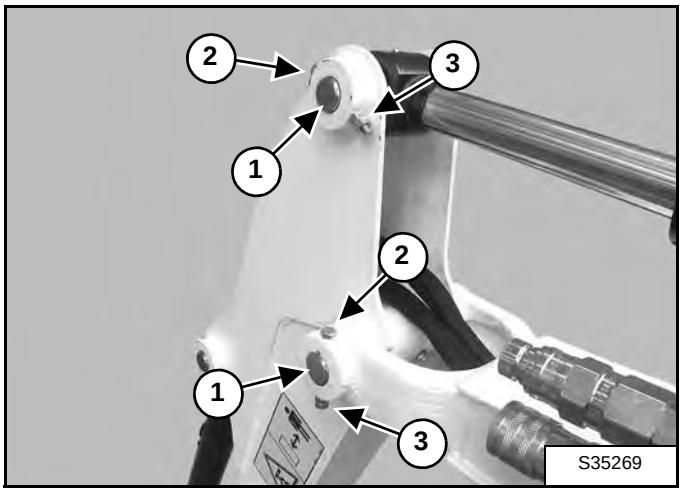


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PIVOT PINS

Inspection And Maintenance

Figure 10-200-1



The pivots and cylinders have a large pin (Item 1) held in position with a bolt (Item 2) and double nuts (Item 3) **[Figure 10-200-1]** securing the pin.

The two nuts (Item 3) are used as jam nuts to hold the bolt (Item 2) without tightening the bolt (Item 2) to the pin boss. After the nuts (Item 3) are tightened together, the bolt (Item 2) **[Figure 10-200-1]** should be free to spin.

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EXCAVATOR STORAGE AND RETURN TO SERVICE

Storage

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

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

Return to Service

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

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

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STOPPING THE ENGINE AND LEAVING THE EXCAVATOR

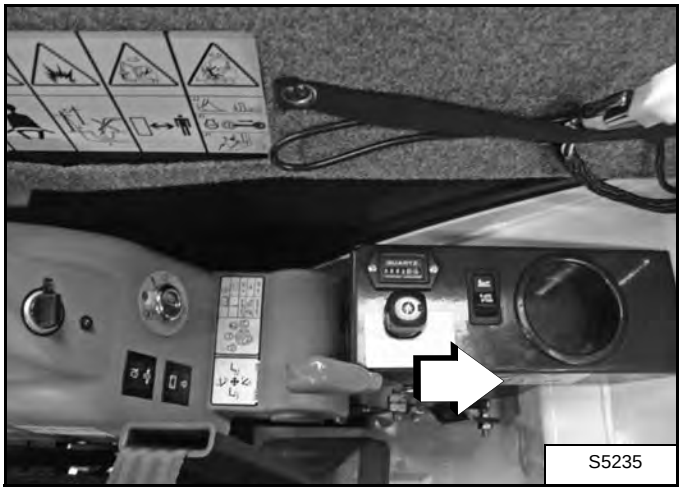
Procedure

Figure 10-220-1



Stop the machine on level ground. Lower the work equipment and the blade to the ground **[Figure 10-220-1]**.

Figure 10-220-2



Move the speed control lever fully backward **[Figure 10-220-2]**.

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

Figure 10-220-3

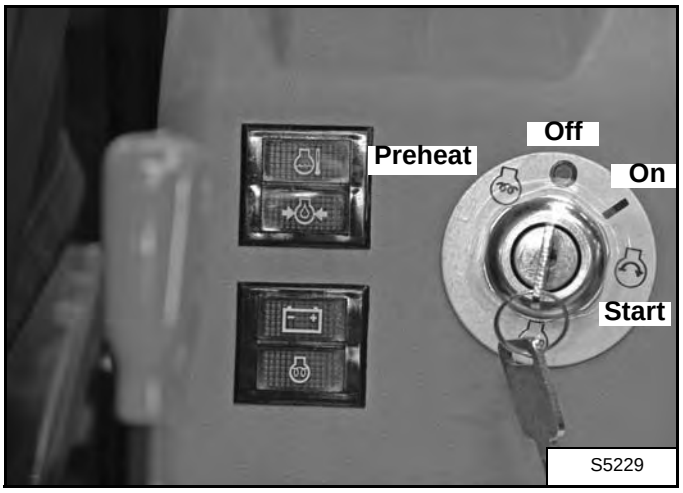
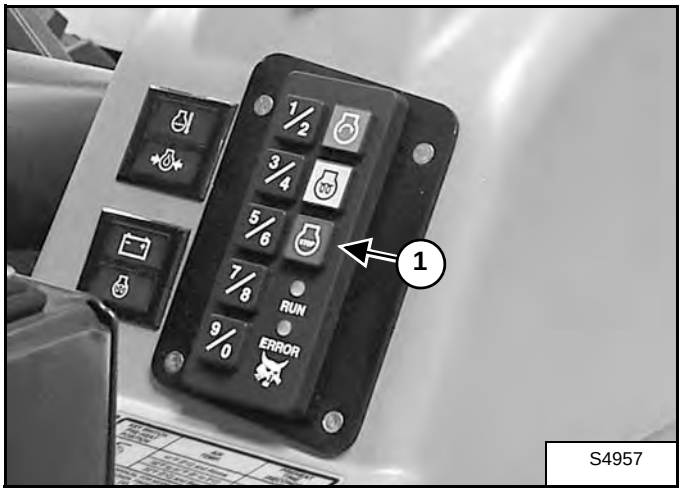


Figure 10-220-4



Turn the key switch OFF **[Figure 10-220-3]** or press the stop button (Item 1) **[Figure 10-220-4]**.

Disconnect the seat belt. Remove the key from the switch to prevent operation of machine by unauthorized personnel. Raise the control console and exit the machine.

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EMERGENCY EXIT

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

Right Side Rear Window

Figure 10-230-1



Slide the right side rear window to the front of the excavator and exit through the side window **[Figure 10-230-1]**.

Front Window

Figure 10-230-2



Open the front window and exit **[Figure 10-230-2]**.

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

Dealer Copy -- Not for Resale



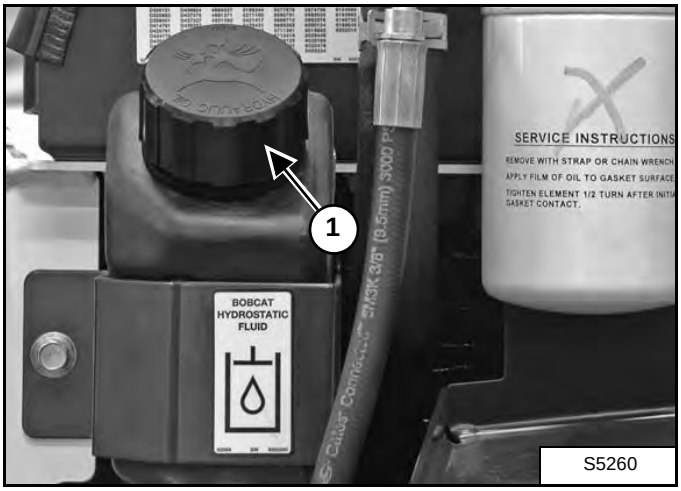
Dealer Copy -- Not for Resale

DE-AERATION

Procedure

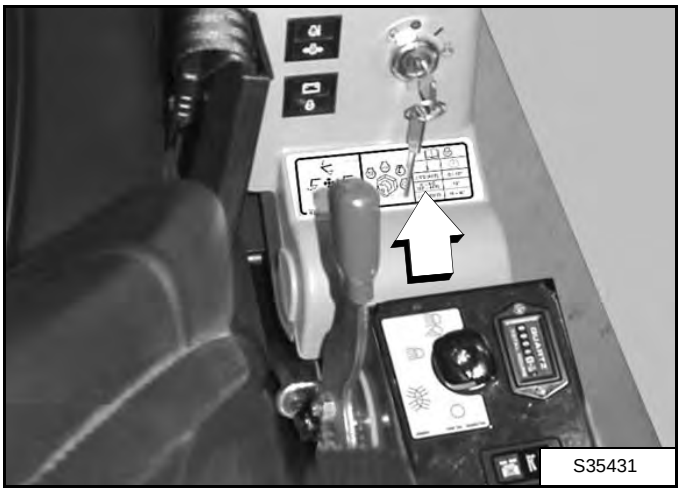
NOTE: Provide a clear track of at least 15 m (49 ft) in front of the excavator before starting the procedure.

Figure 10-240-1



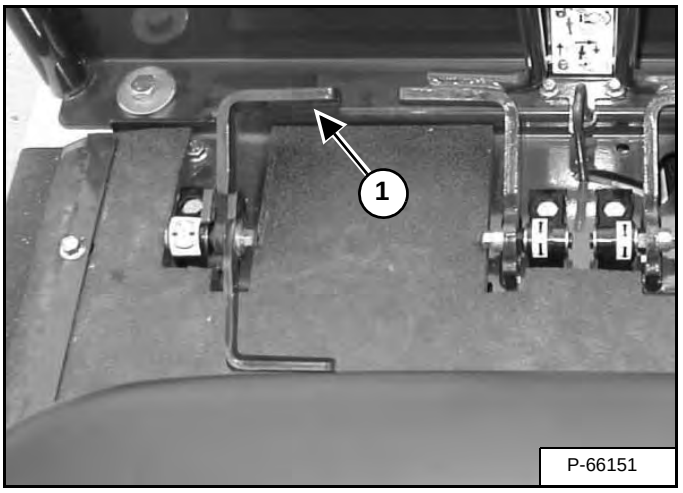
Release the oil fill cap (Item 1) **[Figure 10-240-1]** of the hydraulic tank to avoid overpressure during the procedure.

Figure 10-240-2



Put the engine speed at high engine idle **[Figure 10-240-2]**.

Figure 10-240-3



Warm up the hydraulic fluid of the machine to the operating temperature (approximately 60°C [140°F]) by pushing the auxiliary function pedal (Item 1) **[Figure 10-240-3]** in both directions several times.

Extend all hydraulic cylinders to their maximum position as follows:

- Lower the blade.
- Extend the undercarriage.
- Swing the boom completely to the right.
- Curl the bucket.
- Extend the arm.
- Lower the boom.

NOTE: Avoid contact between the ground and the arm and bucket to avoid damage to the excavator.

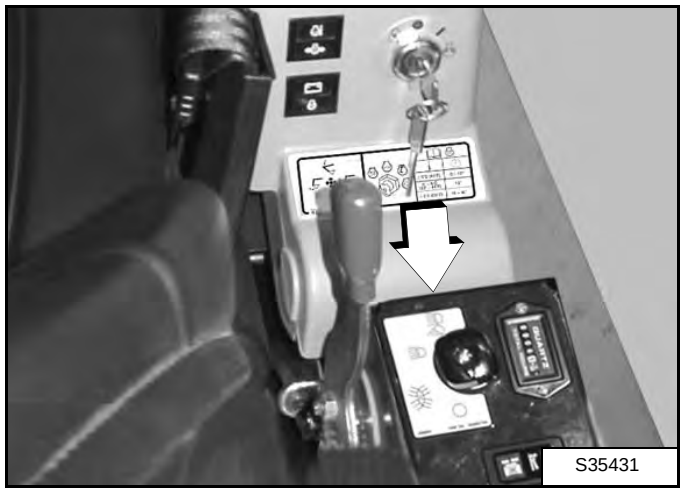
Retract all hydraulic cylinders to their minimum position as follows:

- Raise the boom.
- Retract the arm.
- Open the bucket.
- Swing the boom completely to the left.
- Retract the undercarriage cylinder.
- Raise the blade.

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Procedure (Cont'd)

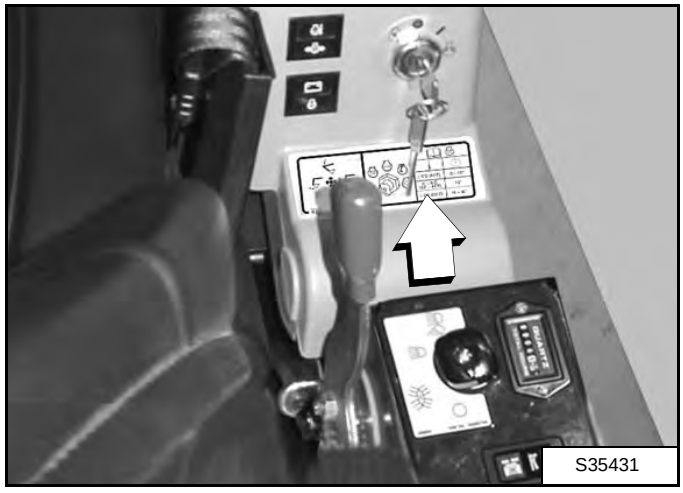
Figure 10-240-4



Put the engine speed at low engine idle **[Figure 10-240-4]**.

Wait one minute.

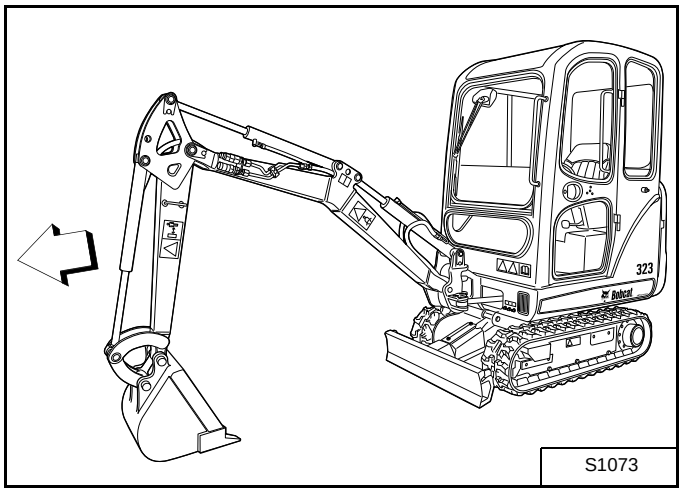
Figure 10-240-5



Put the engine speed at high engine idle **[Figure 10-240-5]**.

Repeat the steps from **[Figure 10-240-3]** through **[Figure 10-240-5]**.

Figure 10-240-6



Return the work group and blade to travel position **[Figure 10-240-6]**.

Drive the machine 15 m (49 ft) forward, switching speed range every 5 m (16.3 ft) **[Figure 10-240-6]**.

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DE-AERATION (CONT'D)

Procedure (Cont'd)

Figure 10-240-7

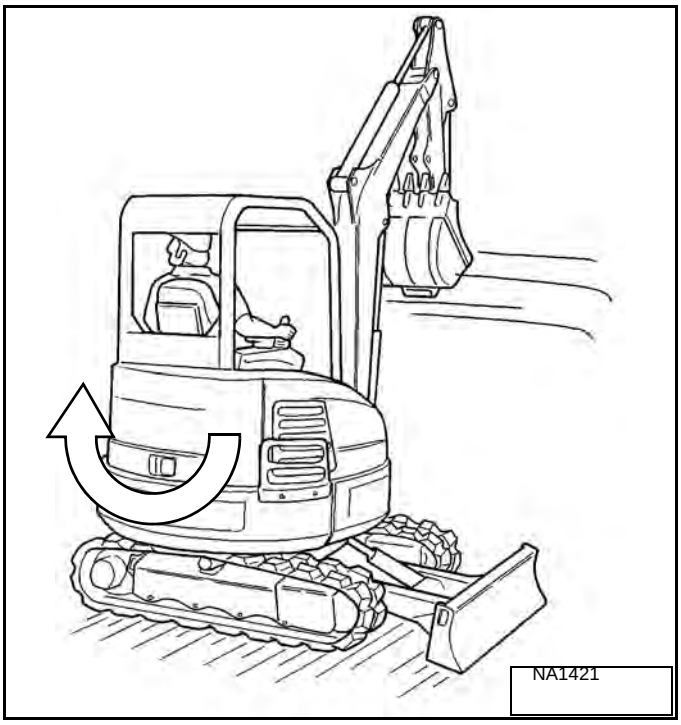
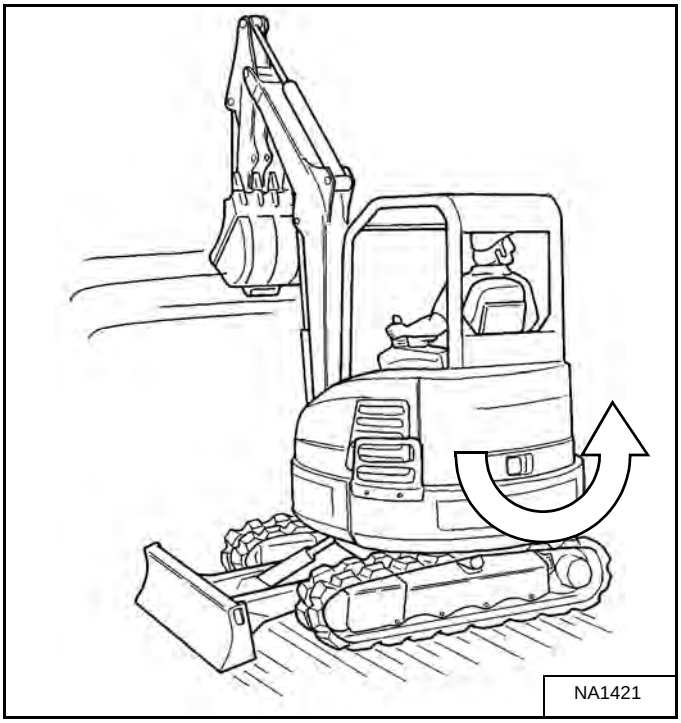
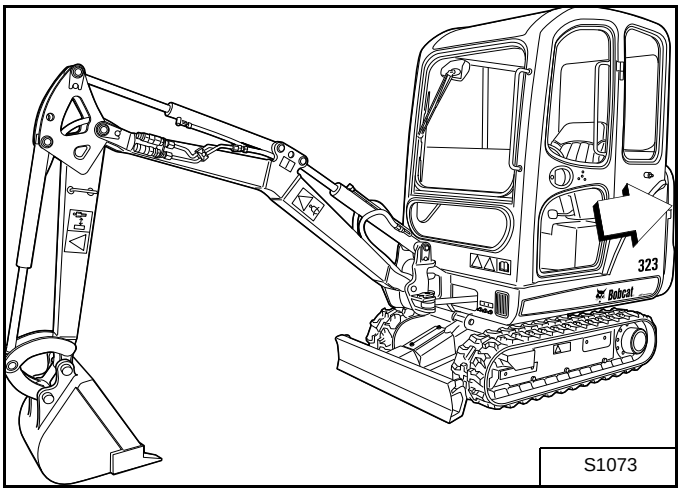


Figure 10-240-8



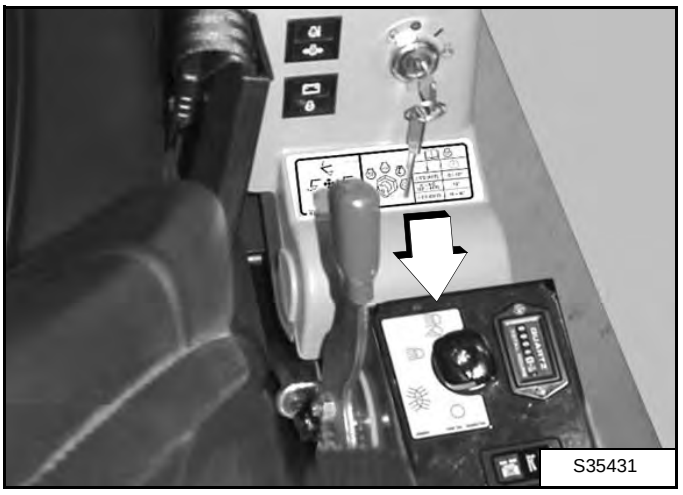
Rotate the upperstructure three times clockwise **[Figure 10-240-7]**, then three times anticlockwise **[Figure 10-240-8]**.

Figure 10-240-9



Drive the machine 15 m (49 ft) backward, switching speed range every 5 m (16.3 ft) **[Figure 10-240-9]**.

Figure 10-240-10



Put the engine speed at low engine idle **[Figure 10-240-10]**.

Wait one minute.

Repeat the steps from **[Figure 10-240-3]** through **[Figure 10-240-9]**.

Put the engine speed at low engine idle **[Figure 10-240-10]**.

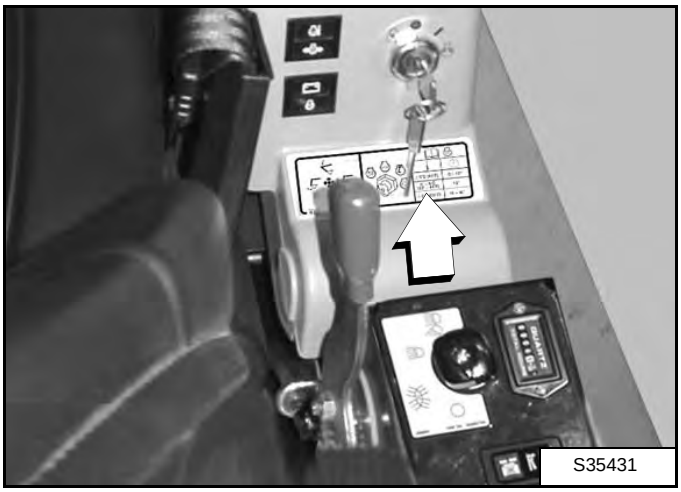
Turn off the machine and wait for 10 minutes.

Dealer Copy -- Not for Resale

DE-AERATION (CONT'D)

Procedure (Cont'd)

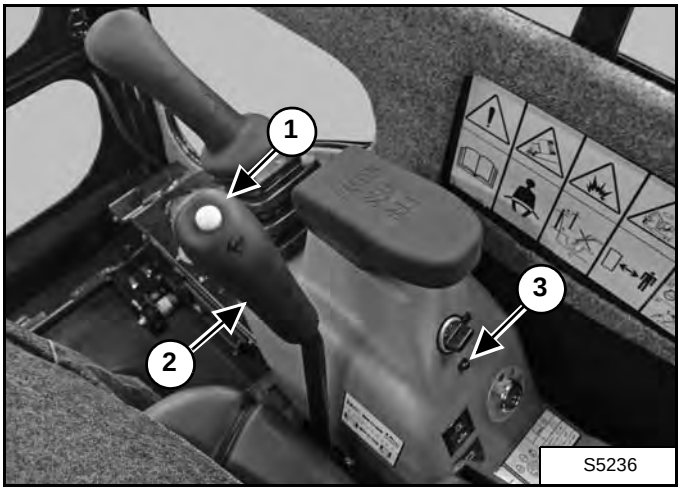
Figure 10-240-11



Start the engine and put the engine speed at high engine idle **[Figure 10-240-11]**.

Repeat the steps from **[Figure 10-240-3]** through **[Figure 10-240-4]**.

Figure 10-240-12



Put the excavator in speed range 1 by pressing the button (Item 1) on the blade / track lever (Item 2). The green light (Item 3) **[Figure 10-240-12]** will be off when speed range 1 is engaged.

Use a stop-watch to record the time it takes for the excavator to drive 15 m (49 ft) forward.

Put the excavator in speed range 2 by pressing the button (Item 1) on the blade / track lever (Item 2). The green light (Item 3) **[Figure 10-240-12]** will be on when speed range 2 is engaged.

Use a stop-watch to record the time it takes for the excavator to drive 15 m (49 ft) forward.

Compare the two recorded times: If the travelling time in the first speed range is less than approximately 25 seconds and the time in the second speed range is less than approximately 16 seconds, the de-aeration of the excavator is complete.

Figure 10-240-13



Tighten the oil fill cap (Item 1) **[Figure 10-240-13]** of the hydraulic tank when the de-aeration is complete.

If the traveling times are more than approximately 25 seconds (speed range 1) and approximately 16 seconds (speed range 2), repeat the complete procedure.

Dealer Copy -- Not for Resale

MOTION ALARM SYSTEM

Description

This excavator can be equipped with a motion alarm system. The motion alarm will sound when the operator moves the travel control levers in 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 back-up alarm will sound.

Inspecting

Figure 10-250-1

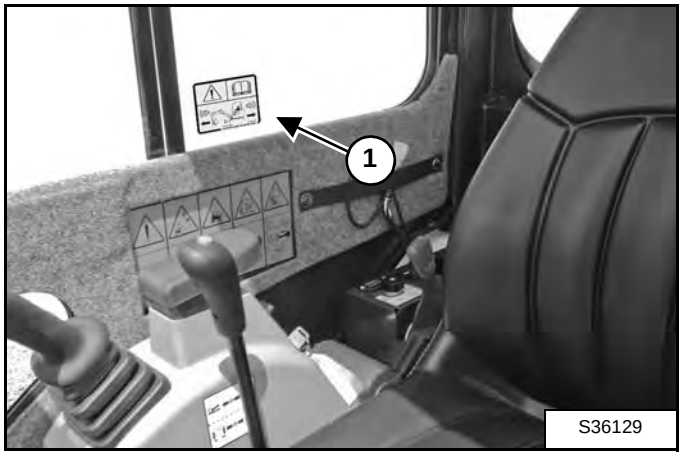
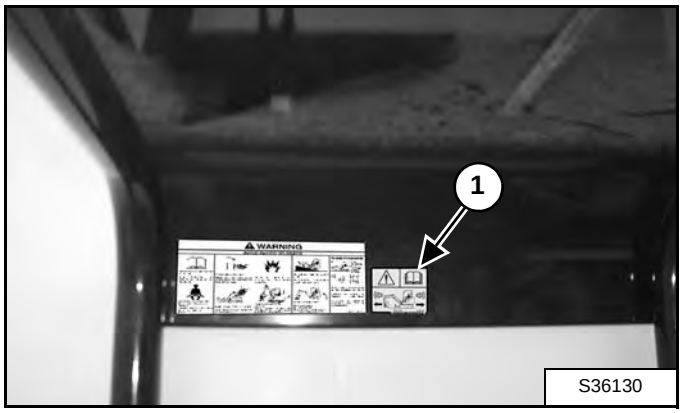


Figure 10-250-2



Inspect for damaged or missing motion alarm decal (Item 1) **[Figure 10-250-1]** (cab machine) or (Item 1) **[Figure 10-250-2]** (canopy machine). 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.

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 and fasten the seat belt. 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.

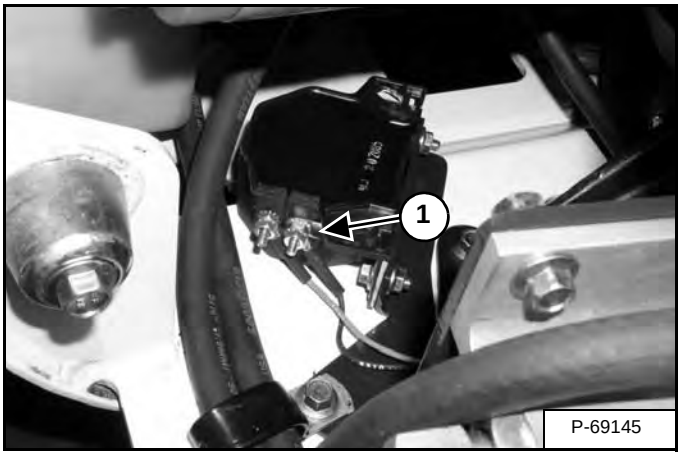
Return both levers to neutral and turn excavator key to OFF position. Exit the excavator.

Dealer Copy -- Not for Resale

Inspecting (Cont'd)

The motion alarm is located inside the rear of the excavator, below the hydraulic pump.

Figure 10-250-3

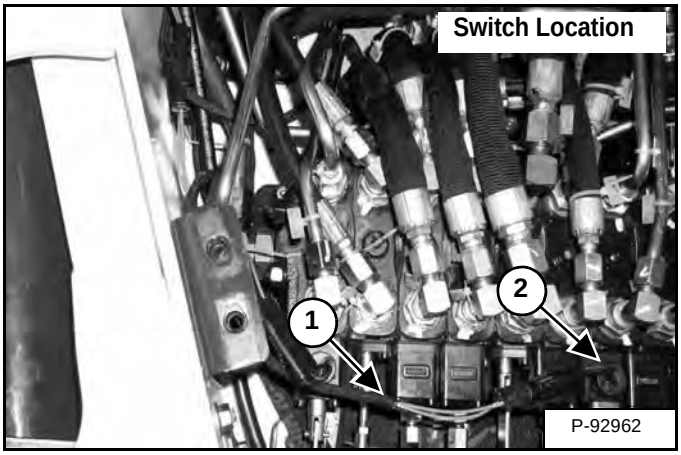


Inspect the motion alarm electrical connections and wire harness (Item 1) **[Figure 10-250-3]**, wire harness (Item 1) **[Figure 10-250-4]** and motion alarm switch (Item 2) **[Figure 10-250-4]** for tightness and damage. Repair or replace any damaged components.

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

Adjusting Switch Position

Figure 10-250-4



The motion alarm switch (Item 2) **[Figure 10-250-4]** is located in the travel control valve located under the floorplate. Remove the floor mat and the floorplate to access the switch.

The switch (Item 2) **[Figure 10-250-4]** is non-adjustable. It must be fully installed into the travel control valve housings and tightened. Tighten the switch to 18 - 20 N•m (13 - 15 ft-lb) torque.

Inspect the motion alarm system for proper function after switch replacement.

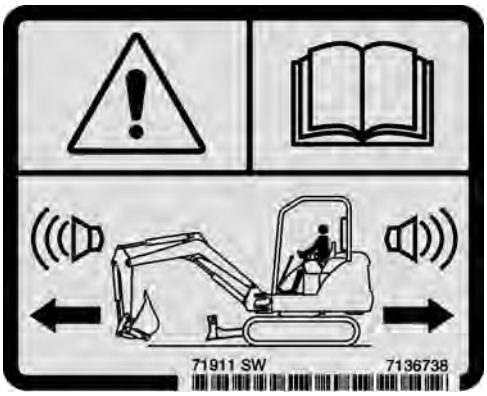
⚠ WARNING

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.

W-2786-0309



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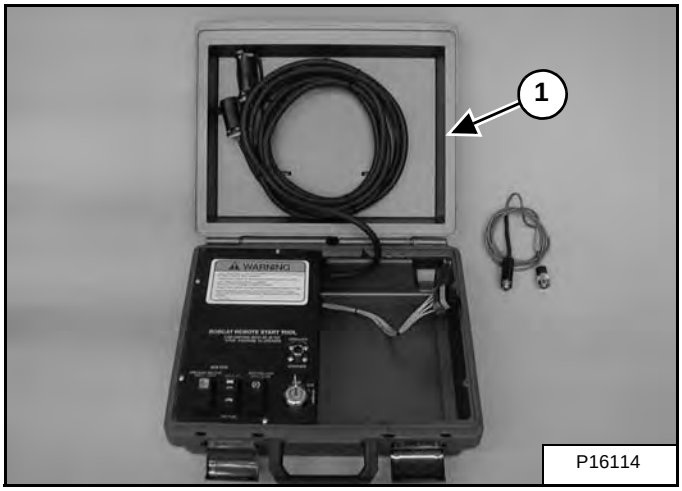
REMOTE START TOOL KIT - MEL1563

Remote Start Tool - MEL1563

Tools that will be needed to complete the following steps are:

MEL1563 - Remote Start Tool
MEL1565 - Service Tool Harness Control
MEL1566 - Service Tool Harness Communicator (Computer Interface)

Figure 10-260-1

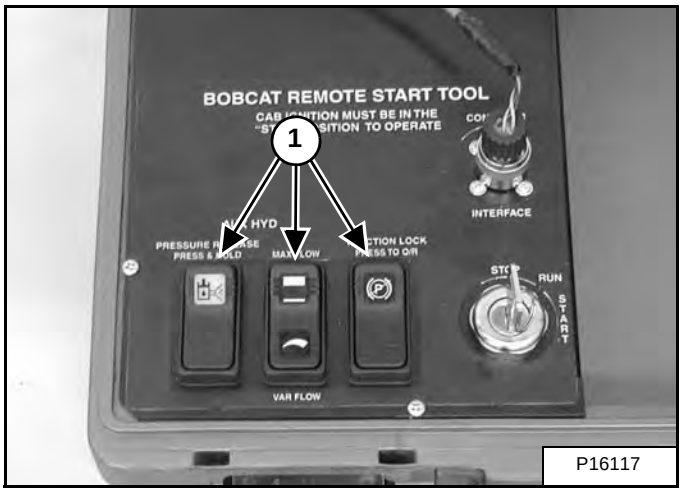


The remote start tool (Item 1) **[Figure 10-260-1]** is used for excavators.

The remote start tool is required when the service technician is checking the service codes.

Remote Start Tool is a link between the excavator and the service computer.

Figure 10-260-2



The three function buttons (Item 1) **[Figure 10-260-2]** are non-functional for excavators.

NOTE: Excavators can not be started by using the remote start tool.

Figure 10-260-3

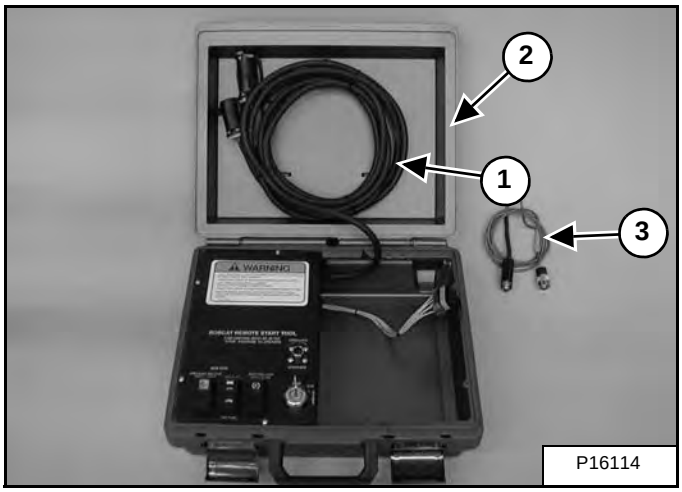


The 10-pin rectangular connector (Item 1) **[Figure 10-260-3]** is not used for an excavator application.

Dealer Copy -- Not for Resale

Service Tool Harness Control - MEL1565

Figure 10-260-4



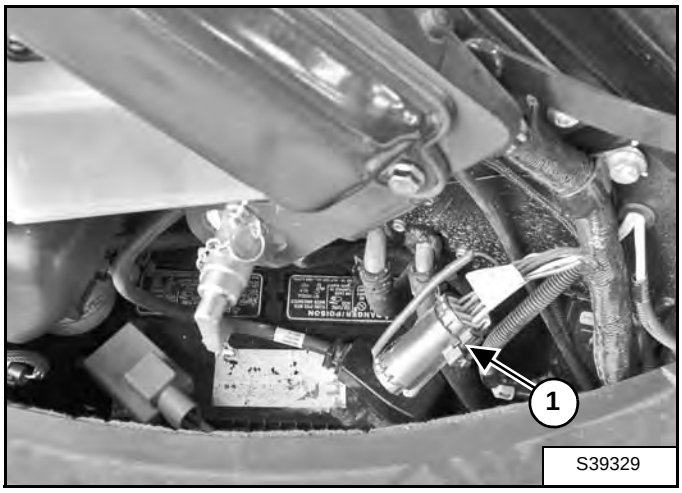
The service tool harness control (Item 1) is used to connect the remote start tool (Item 2) **[Figure 10-260-4]** to the electrical system on the excavator.

The service tool harness communicator (Item 3) **[Figure 10-260-4]** is used to connect the remote start tool to the service computer.

NOTE: Make all connections with the key or keyless panel in the OFF position.

Open the right side cover.

Figure 10-260-5



Remove the plug (Item 1) **[Figure 10-260-5]** from the excavator harness connector.

Connect the service tool harness control (MEL1565) to the excavator harness connector.

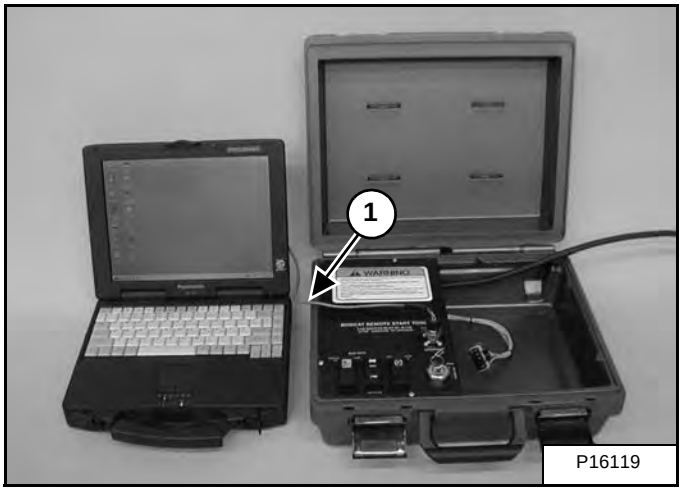
Connect the service tool harness communicator (MEL1566) to the designated serial port on the service computer.

Dealer Copy -- Not for Resale

Service Tool Harness Communicator - MEL1566

NOTE: To monitor, diagnose or load new software the service computer must be connected to the Remote Start Tool.

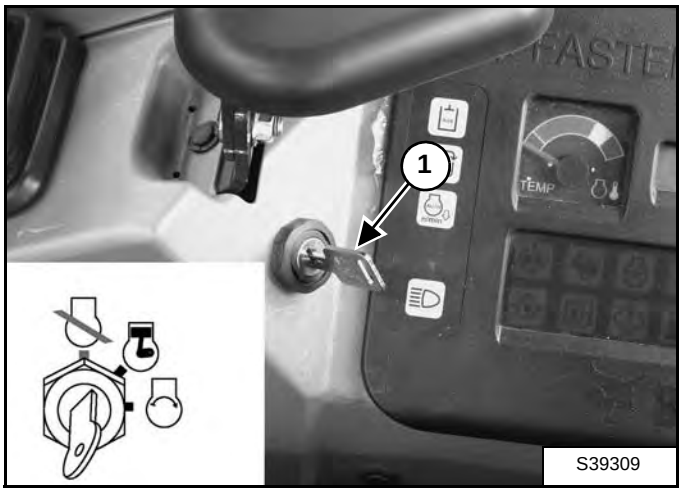
Figure 10-260-6



The service tool harness communicator (Item 1) **[Figure 10-260-6]** is required to connect the service computer to the remote start tool.

Key Switch

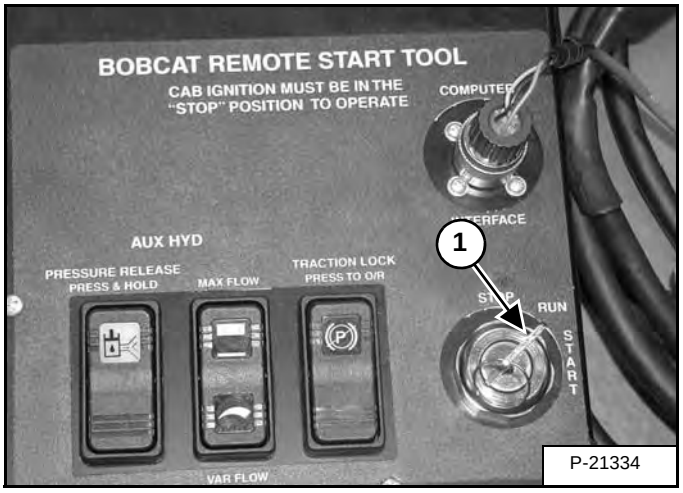
Figure 10-260-7



Turn the key switch (Item 1) **[Figure 10-260-7]** to the RUN position on the excavator.

NOTE: DO NOT start the excavator.

Figure 10-260-8



Turn the key switch (Item 1) **[Figure 10-260-8]** to the RUN position on the remote start tool.

Dealer Copy -- Not for Resale

Service Tool Harness Communicator - MEL1566 (Cont'd)

Keyless Start

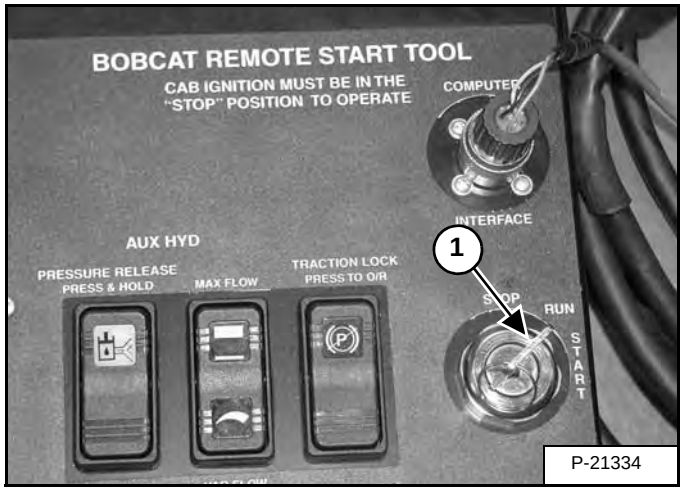
Figure 10-260-9



Press the ENTER CODE button (Item 1) **[Figure 10-260-9]** to turn power on.

NOTE: DO NOT start the excavator.

Figure 10-260-10



Turn the key switch (Item 1) **[Figure 10-260-10]** to the RUN position on the remote start tool.

Dealer Copy -- Not for Resale

REMOTE START TOOL (SERVICE TOOL) KIT - 6689779 / 7003031

Description

The Remote Start Tool (Service Tool) Kit is a replacement tool for MEL1563 Remote Start Tool.

The Remote Start Tool (Service Tool) Kit, P/N 6689779 / 7003031, can be used to service excavators using the supplied harness P/N 6689747.

A computer can be connected to the Remote Start Tool (Service Tool) for diagnostics and software updates using the computer harness P/N 6689746 in conjunction with the excavator harness.

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REMOTE START TOOL (SERVICE TOOL) KIT - 6689779 / 7003031

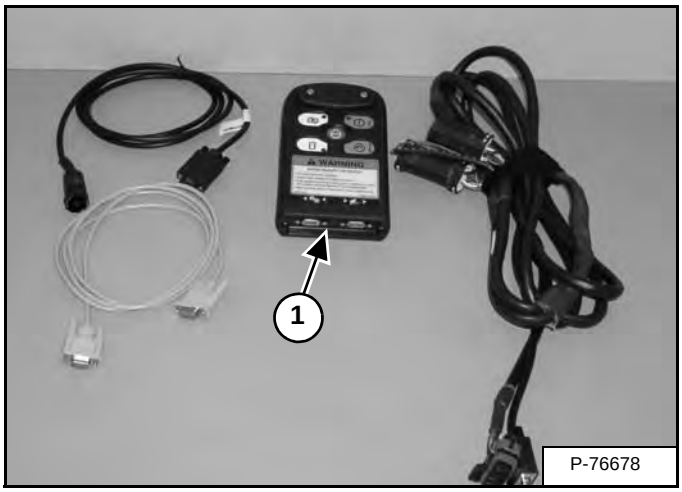
Remote Start Tool (Service Tool) - 6689778 / 7003030

Tools that will be needed to complete the following steps are:

Order from Bobcat Parts P/N: 6689779 / 7003031 - Remote Start Tool (Service Tool) Kit

Kit Includes:
6689778 / 7003030 - Remote Start Tool (Service Tool)
6689747 - Excavator Service Tool Harness
6689746 - Computer Service Tool Harness
6689745 - BOSS® Service Tool Harness

Figure 10-261-1

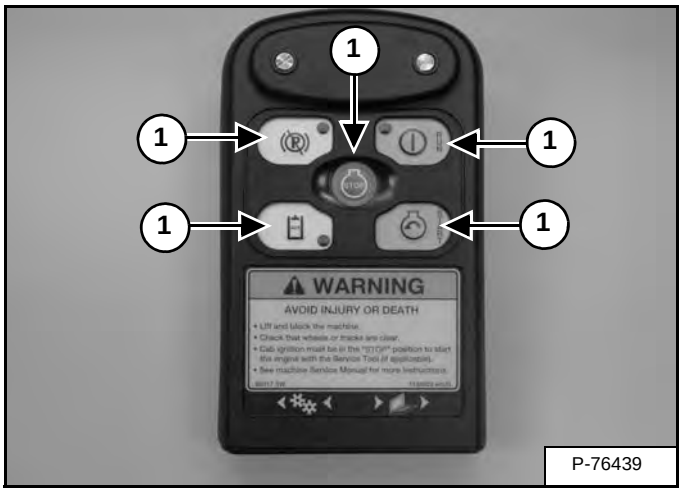


The remote start tool (Item 1) **[Figure 10-261-1]** is used for excavators.

The remote start tool is required when the service technician is checking the service codes.

Remote Start Tool is a link between the excavator and the service computer.

Figure 10-261-2



The five function buttons (Item 1) **[Figure 10-261-2]** are non-functional for excavators.

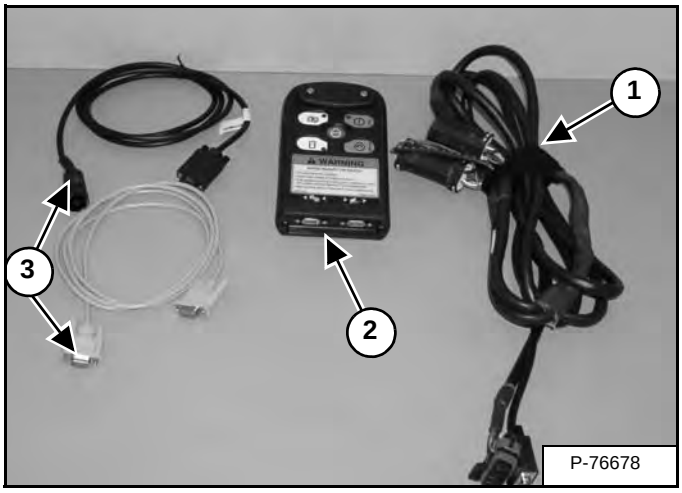
NOTE: Excavators can not be started by using the remote start tool.

Dealer Copy -- Not for Resale

REMOTE START TOOL (SERVICE TOOL) KIT - 6689779 / 7003031 (CONT'D)

Excavator Service Tool Harness - 6689747

Figure 10-261-3



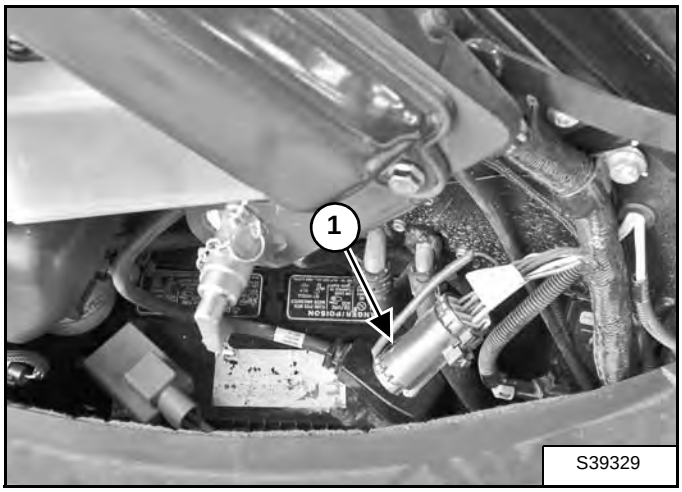
The service tool harness control (Item 1) is used to connect the remote start tool (Item 2) **[Figure 10-261-3]** to the electrical system on the excaavator.

The service tool harness communicator (Item 3) **[Figure 10-261-3]** is used to connect the remote start tool to the service computer.

NOTE: Make all connections with the key or keyless panel in the OFF position.

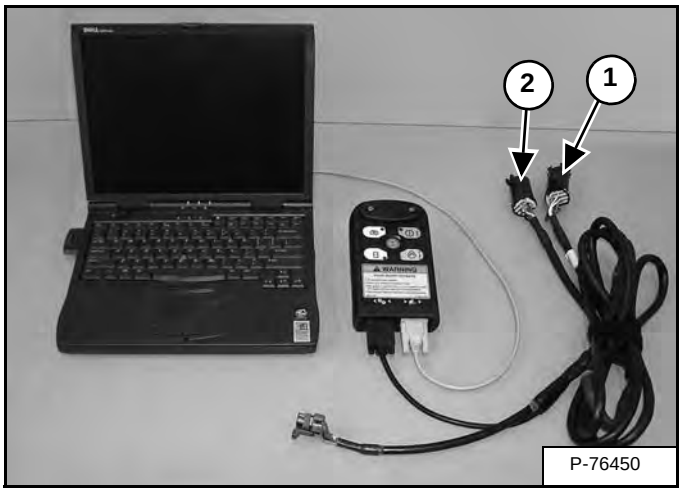
Open the right side cover.

Figure 10-261-4



Remove the plug (Item 1) **[Figure 10-261-4]** from the excavator harness connector.

Figure 10-261-5



NOTE: The Remote Start Tool (Service Tool) connection harness has two connectors (Item 1) and (Item 2). The main connector (Item 1) [Figure 10-261-5] is always used for connection to the excavator harness.

The second connector (Item 2) [Figure 10-261-5] is not used for E26 excavator applications. This connector has a cap attached to it to prevent damage or corrosion when not in use.

Connect the Remote Start Tool (Service Tool) connector (Item 1) **[Figure 10-261-5]** to the excavator harness connector.

NOTE: The Key Switch or Keyless Instrument Panel must be in the run position or the Remote Start Tool (Service Tool) will not operate.

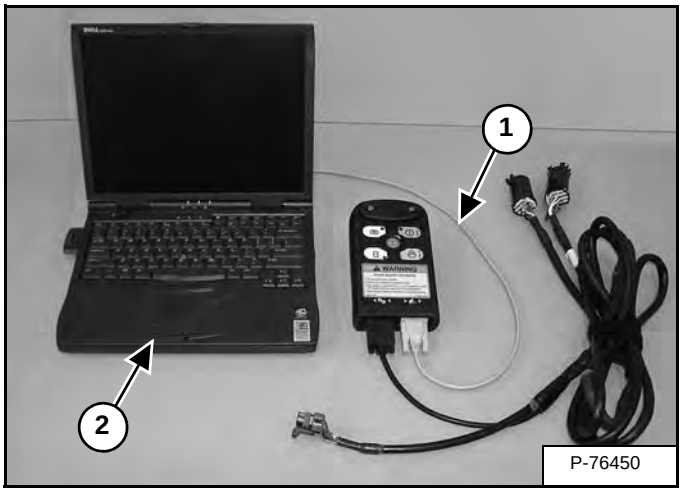
Dealer Copy -- Not for Resale

REMOTE START TOOL (SERVICE TOOL) KIT - 6689779 / 7003031 (CONT'D)

Computer Service Tool Harness - 6689746

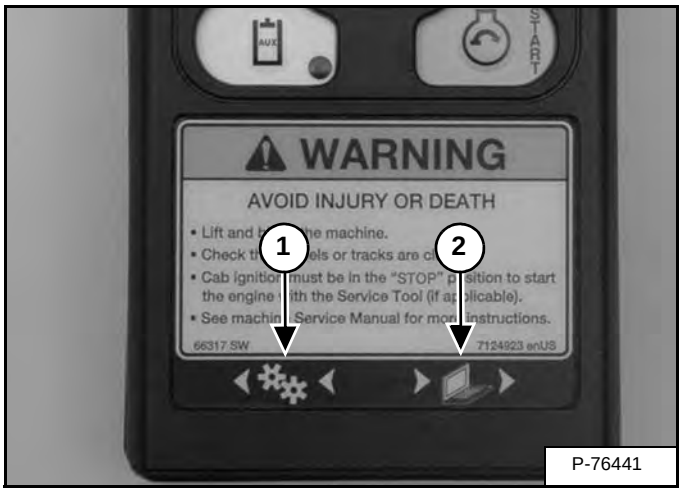
NOTE: To monitor, diagnose or load new software the service computer must be connected to the Remote Start Tool.

Figure 10-261-6



The computer service tool harness (Item 1) **[Figure 10-261-6]** is required to connect remote start tool (service tool) to the service computer (Item 2) **[Figure 10-261-6]**.

Figure 10-261-7



The gear icon with the left facing arrows (Item 1) **[Figure 10-261-7]** will illuminate and blink when the excavator key is in the RUN position or excavator keyless panel is ON and the excavator is communicating with the service tool.

NOTE: DO NOT start the excavator.

The computer icon with the right facing arrows (Item 2) **[Figure 10-261-7]** will illuminate and blink when the Remote Start Tool (Service Tool) is transmitting data to and from the computer.

Dealer Copy -- Not for Resale

HYDRAULIC SYSTEM

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Troubleshooting The Cylinder Circuit 20-10-5
Troubleshooting The Swing (Upperstructure Slew) Circuit 20-10-6
Troubleshooting The Travel Circuit 20-10-7

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HYDRAULIC/HYDROSTATIC SCHEMATIC
E16 (S/N AHLL11001 AND ABOVE)

(PRINTED SEPTEMBER 2012)
V-1366legend

LEGEND

(1) HYDRAULIC RESERVOIR
(PRESSURIZED) with FILL STRAINER
Reservoir Capacity . . . . . 11.8 qt. (11,2 L)
System Capacity . . . . . 24.8 qt. (23,5 L)

(2) PRESSURIZED BREATHER/FILL CAP
with FILTER
6 PSI (0,41 bar) - Outlet
0.6 PSI (0,04 bar) - Inlet

(3) HYDRAULIC FILTER ELEMENT
10 Micron

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

(5) HYDRAULIC PUMP - Dual Piston with
Gear Pump:
Pump Section 1 and 2
3.96 GPM (15,0 L/min.) at High Engine Idle
Pump Sections 3
2.99 GPM (11,25 L/min.) at High Engine Idle

(6) SOLENOID VALVE - SYSTEM BY-PASS

(7) MAIN RELIEF VALVE
3350 PSI (231 bar)

(8) SOLENOID VALVE - TWO SPEED

(9) PRESSURE REDUCING VALVE
435 PSI (30 bar)

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

(11) SOLENOID VALVE - TWO SPEED BOOST

(12) SWING MOTOR CROSS PORT RELIEF
VALVE . . . . . 2465 - 2567 PSI (170 - 177 bar)
When Tested at “G” Port

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

(14) ORIFICE . . . . .0.040 inch (1,02 mm)

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

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

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

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

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

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

(21) ANTI-CAVITATION VALVE

(22) ACCUMULATOR
Nitrogen 165 PSI (11 bar)
non-rechargeable

(23) TRAVEL MOTOR SPOOL

(24) RELIEF VALVE - Travel Motor
3438 PSI (237 bar)

(25) TWO SPEED VALVE - Travel Motor

(26) BUILD UP VALVE - 218 PSI (15 bar)

(27) TEST PORT - (Factory Fill Port)

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

(29) TEST PORT - Pilot Pressure

(30) CHECK VALVE

(31) SOLENOID VALVE – BLADE/TRACK EXPAND
With Relief Valve . . . . . 4205 PSI (290 bar)

(32) PRESSURE REDUCING VALVE - 3000 PSI (207 bar)

(33) PILOT ACTIVATED DIRECTIONAL
CONTROL VALVE – Slew Lock Valve

(34) SHUTTLE VALVE – Swing Lock Valve

(35) CHECK VALVE – Swing Lock Valve (2)

(36) PORT – Air Bleed

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

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E16 HYDRAULIC/HYDROSTATIC SCHEMATIC
S/N AHLL11001 AND ABOVE

(PRINTED SEPTEMBER 2012)
V-1366

RH TRAVEL MOTOR

BLADE CYLINDER

CENTER SWIVEL JOINT

TRACK EXPAND CYLINDER

TRACK EXPAND SOLENOID VALVE

LH TRAVEL MOTOR

BOOM SWING CYLINDER

ARM CYLINDER

BUCKET CYLINDER

FEMALE (PRESSURE)

AUX FLOW

MALE (RETURN)

BOOM CYLINDER

RH TRAVEL

BOOM SWING

ARM

BUCKET

AUX

BOOM

LH TRAVEL

SLEW

BLADE

HYDRAULIC PUMPS

RH JOYSTICK

LH JOYSTICK

SLEW LOCK VALVE

SWING MOTOR

TOP (Slew Right)

BOTTOM (Slew Left)

PRESSURIZED BREATHER

RESERVOIR

COOLER

FILTER W/ BY-PASS

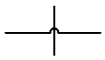
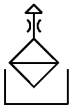
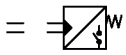
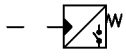
ENCLOSURE
PUMP SUPPLY
WORKING CIRCUITS
PILOT PRESSURE
SYSTEM RETURN LINES

INTERSECTION OF HYDRAULIC LINES INDICATED BY JUNTION DOT

V-1366 (9-6-12)

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)
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)

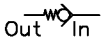
GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

SYMBOL DESCRIPTION

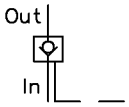
NON–RETURN VALVE, SHUTTLE VALVE: Valve which allows free flow in one direction only



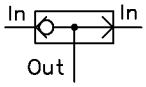
NON–RETURN VALVE (Check Valve) – Used as Replenishing Valve, Load Check Valve or Anticavitation Valve – Opens if the Inlet pressure is higher than the Outlet pressure. Often contains internal spring which has NO significant pressure value



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

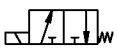


SHUTTLE VALVE – The Inlet port connected to the higher pressure is automatically connected to the Outlet port while the other Inlet port is closed

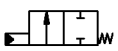
DIRECTIONAL CONTROL VALVE: Valve providing for the opening (fully or restricted) or the closing of one or more flow paths (represented by several squares)



TWO PORTS and CLOSED FLOW PATHS



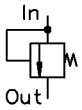
SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (Two Position) – controlled by an electric solenoid (with return spring)



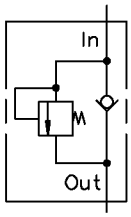
PILOT ACTIVATED DIRECTIONAL CONTROL VALVE (Two Position) – controlled by pressure (with return spring)

SYMBOL DESCRIPTION

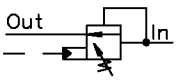
PRESSURE CONTROL VALVE: Valve ensuring the control of pressure



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.

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



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



TOW VALVE – Normally in closed position

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Troubleshooting The Hydraulic Circuit

PROBLEM	CAUSE	CORRECTION
No hydraulic operation at 1 or more circuits.	Hydraulic fluid level low.	Refill with correct fluid.
	Hydraulic pump drive coupling damaged.	Replace.
	Hydraulic pump defective.	Check, repair or replace.
	Main relief valve defective.	Readjust or replace.
Hydraulic power insufficient to 1 or more circuits.	Main relief valve pressure setting incorrect.	Readjust or replace.
Hydraulic speed too slow.	Hydraulic fluid level or viscosity incorrect.	Refill or replace.
	Engine rpm reduced.	Readjust or replace.
	Control valve linkage defective.	Check, repair or replace
	Hydraulic pump volume low.	Check, repair or replace.
Oil temperature too high.	Oil cooler or radiator fins plugged.	Clean oil cooler external surface.
	Hydraulic fluid level low.	Refill or replace.
	Non recommended hydraulic fluid	Replace.
	Relief valve excessively activated.	Use proper operating procedures.
	1 or more relief valves not set correctly.	Test, readjust or replace.
	Extreme operating conditions. High ambient temperature (e.g.: Enclosed structure).	
	Alternator belt loose.	Tighten alternator belt.

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Troubleshooting The Cylinder Circuit

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

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Troubleshooting The Swing (Upperstructure Slew) Circuit

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

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Troubleshooting The Travel Circuit

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

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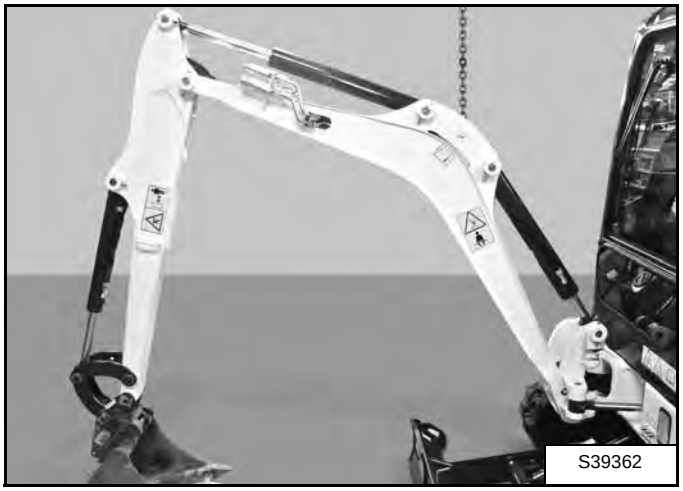
CYLINDER (BOOM)

Testing

Lower the boom / bucket and blade to the ground.

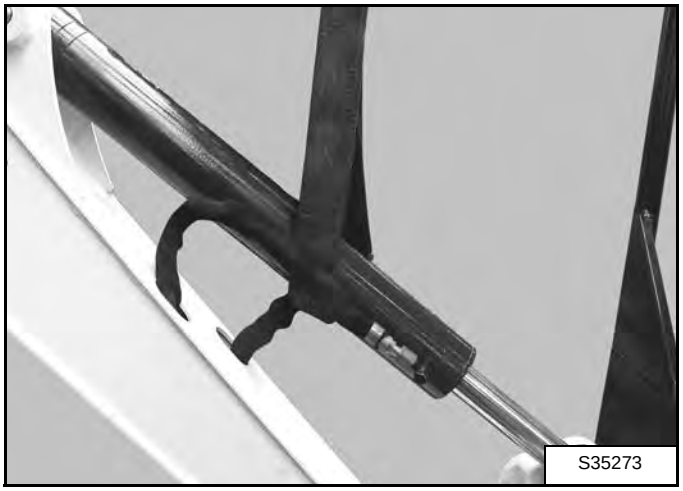
Stop the engine. Raise the control console.

Figure 20-20-1



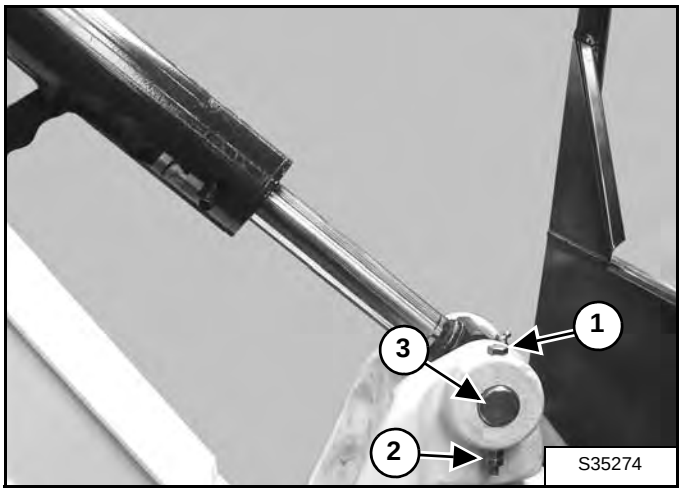
Support the boom using a chain hoist **[Figure 20-20-1]**.

Figure 20-20-2



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

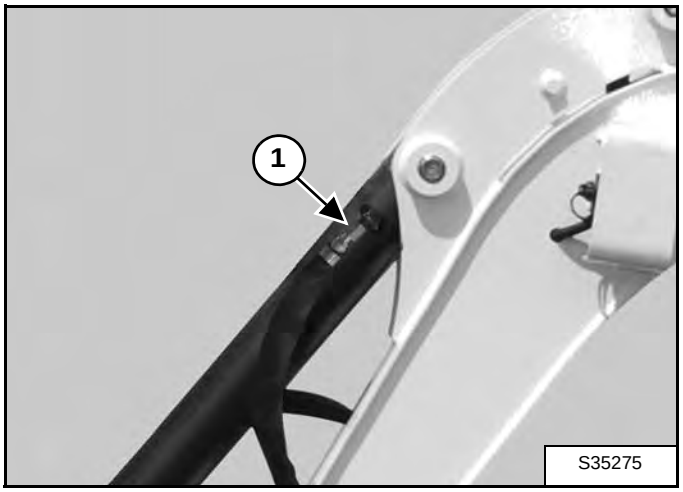
Figure 20-20-3



Remove the bolt (Item 1) and nuts (Item 2) **[Figure 20-20-3]** from the rod end pivot pin.

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

Figure 20-20-4



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

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

Disconnect the boom cylinder base end hose (Item 1) **[Figure 20-20-4]** at the hose tubeline connection.

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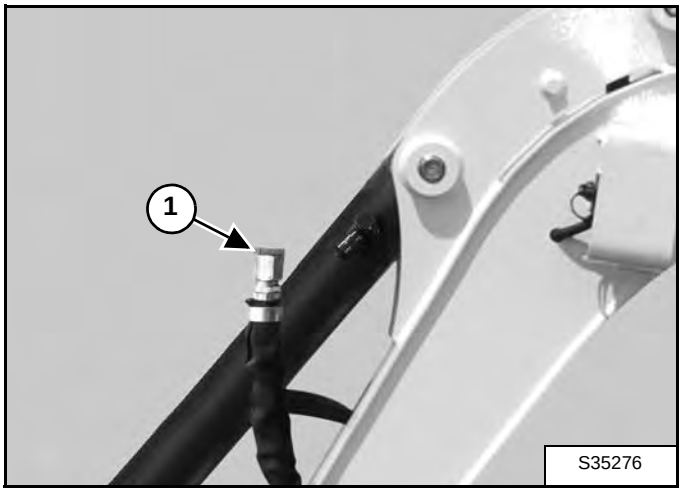
Testing (Cont'd)

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 doctor familiar with this injury is not received immediately.

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Figure 20-20-5



Install a cap (Item 1) **[Figure 20-20-5]** on the hose fitting and tighten.

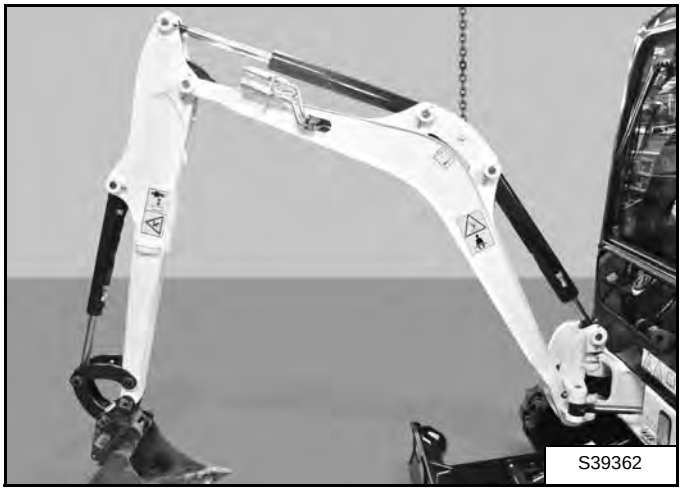
Lower control console and fasten seat belt. Start the engine and retract the boom cylinder.

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

Removal And Installation

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

Figure 20-20-6



Support the boom using a chain hoist **[Figure 20-20-6]**.

With the key in the ON position, move the hydraulic controls to release the hydraulic pressure.

IMPORTANT

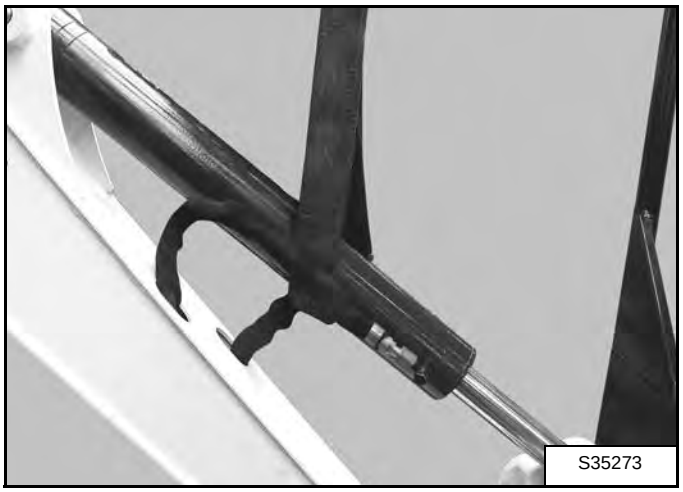
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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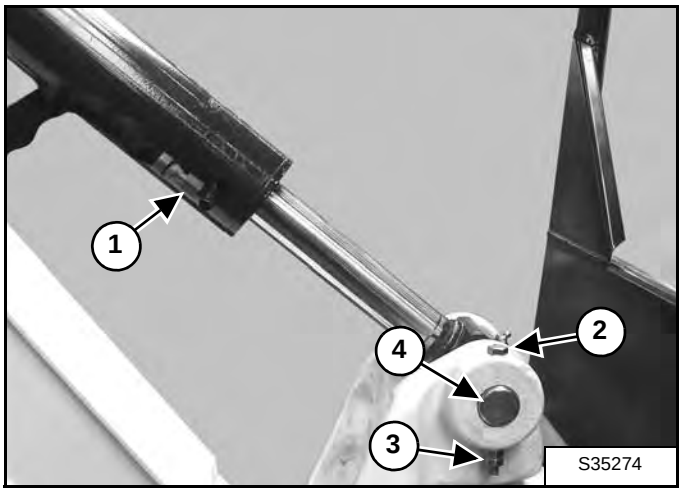
Removal And Installation (Cont'd)

Figure 20-20-7



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

Figure 20-20-8

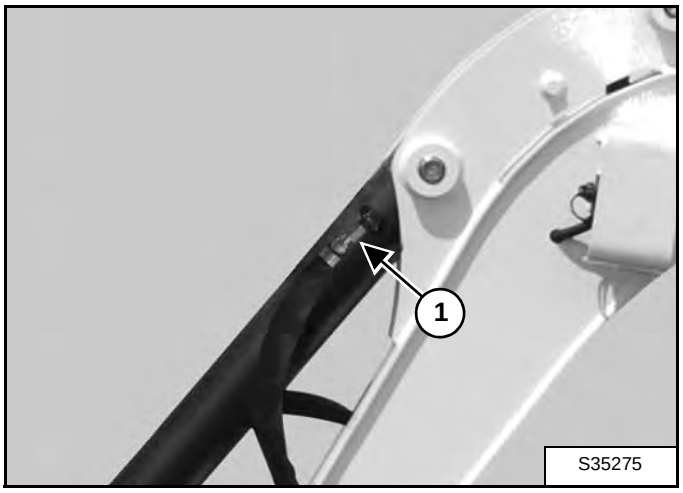


Disconnect and cap the rod end hose (Item 1) **[Figure 20-20-8]**.

Remove the bolt (Item 2) and nuts (Item 3) **[Figure 20-20-8]** from the rod end pivot pin.

Remove the pivot pin (Item 4) **[Figure 20-20-8]**.

Figure 20-20-9



Disconnect and cap the base end hose (Item 1) **[Figure 20-20-9]** from the boom cylinder.

IMPORTANT

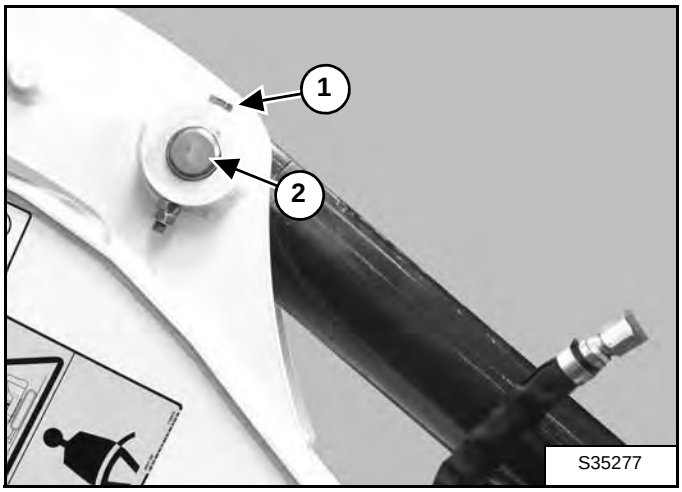
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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Removal And Installation (Cont'd)

Figure 20-20-10



Remove the bolt and nuts (Item 1) **[Figure 20-20-10]** from the boom cylinder base end pin.

Remove the boom cylinder base end pin (Item 2) **[Figure 20-20-10]**.

Remove the boom cylinder.

⚠ WARNING

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

W-2145-EN-0210

⚠ 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.

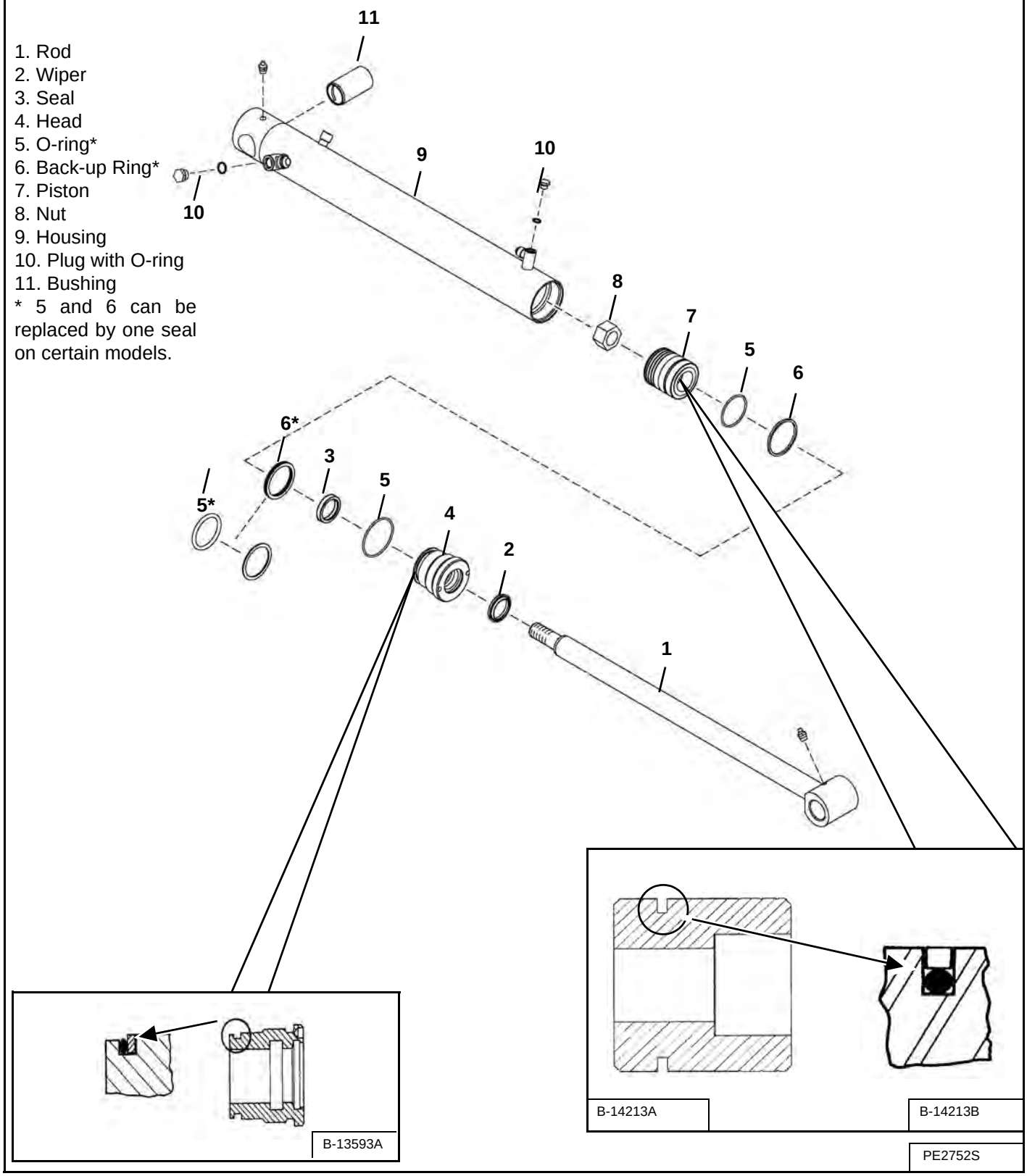
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Parts Identification

1. Rod
2. Wiper
3. Seal
4. Head
5. O-ring*
6. Back-up Ring*
7. Piston
8. Nut
9. Housing
10. Plug with O-ring
11. Bushing

* 5 and 6 can be replaced by one seal on certain models.



Dealer Copy -- Not for Resale

Disassembly

Clean the outside of the boom cylinder before disassembly.

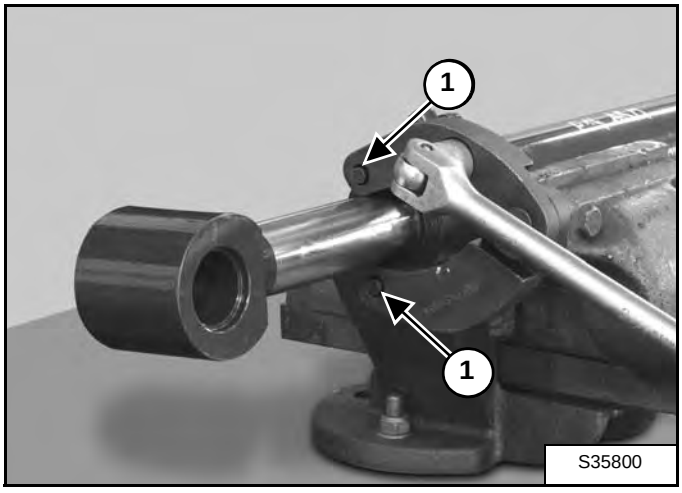
Use the following tools to disassemble the cylinder:

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

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

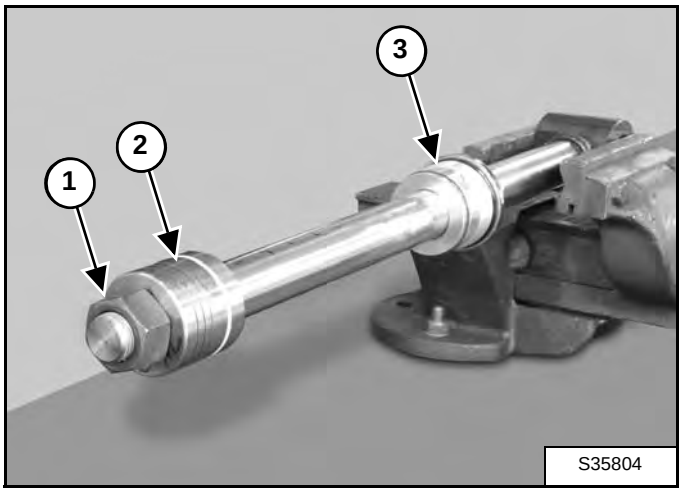
Put the base end of the cylinder in a vise.

Figure 20-20-11



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

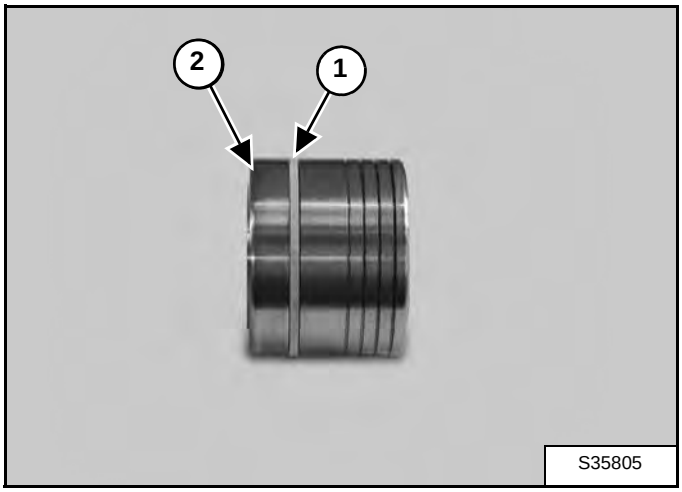
Figure 20-20-12



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

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

Figure 20-20-13

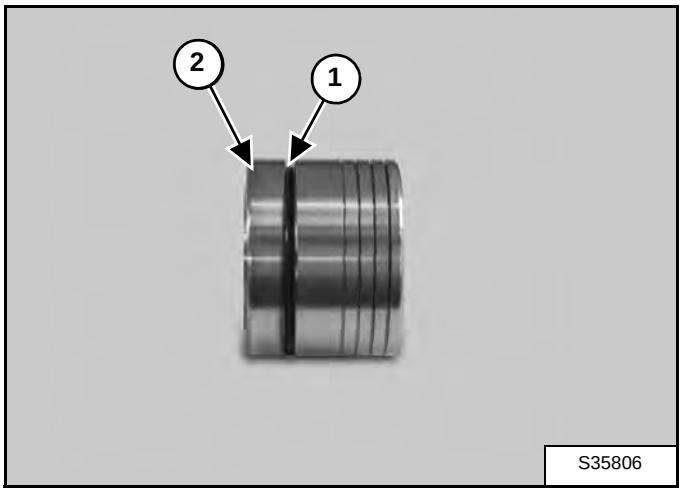


Cushion Piston: Remove the seal (Item 1) from the piston (Item 2) **[Figure 20-20-13]**.

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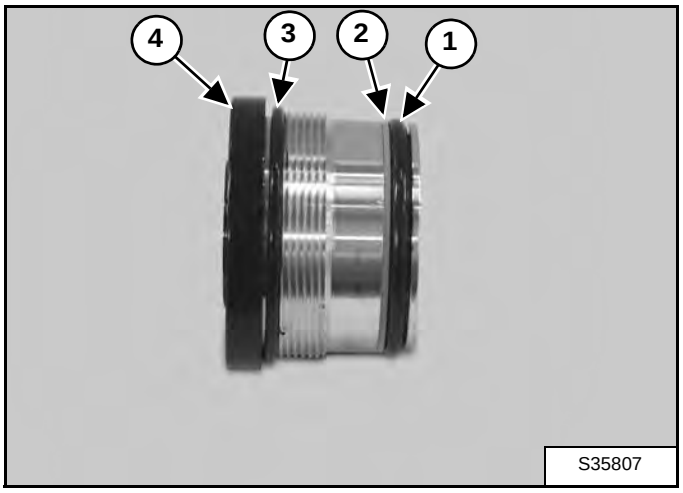
Disassembly (Cont'd)

Figure 20-20-14



Remove the O-ring (Item 1) from the piston (Item 2) **[Figure 20-20-14]**.

Figure 20-20-15

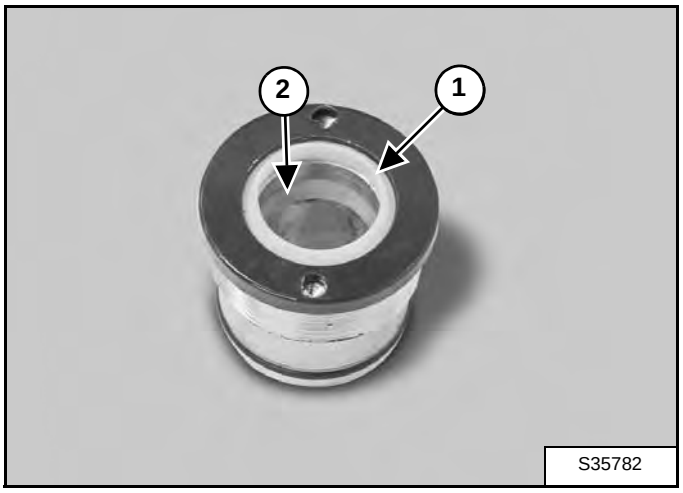


Remove the O-ring (Item 1) and the back-up ring (Item 2) from the head (Item 3) **[Figure 20-20-15]**.

NOTE: O-ring (Item 1) and back-up ring (Item 2) [Figure 20-20-15] were replaced, for a limited time, with a one piece seal. Service replacements may use either seal, as available.

Remove the O-ring (Item 4) **[Figure 20-20-15]**.

Figure 20-20-16



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head **[Figure 20-20-16]**.

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Assembly

Use the following tools to assemble the cylinder:

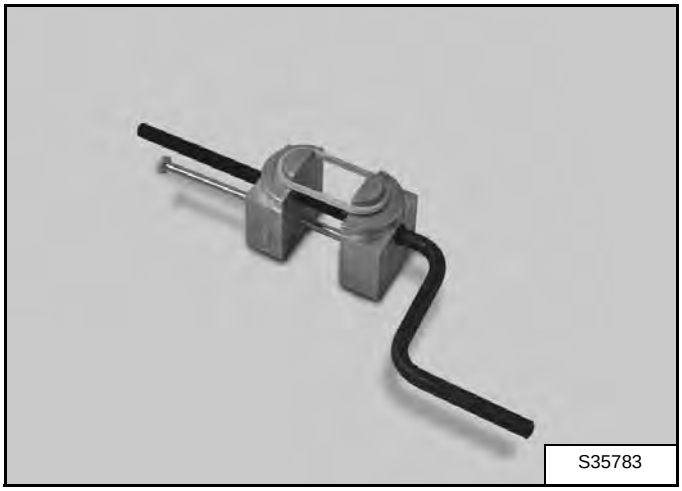
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

Clean all parts in solvent and dry with compressed air.

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

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

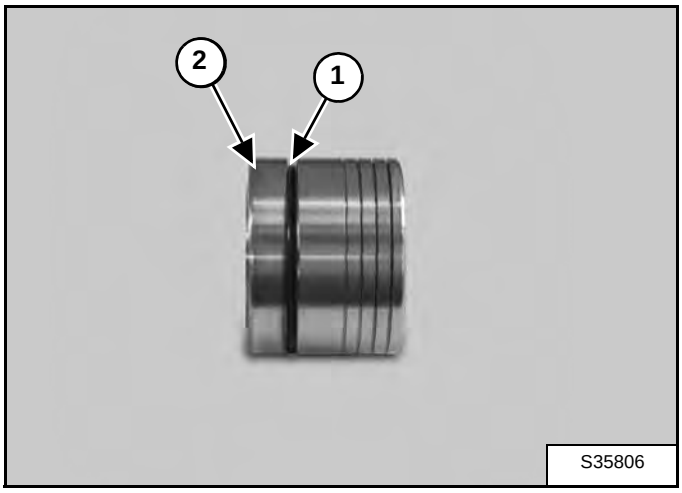
Figure 20-20-17



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

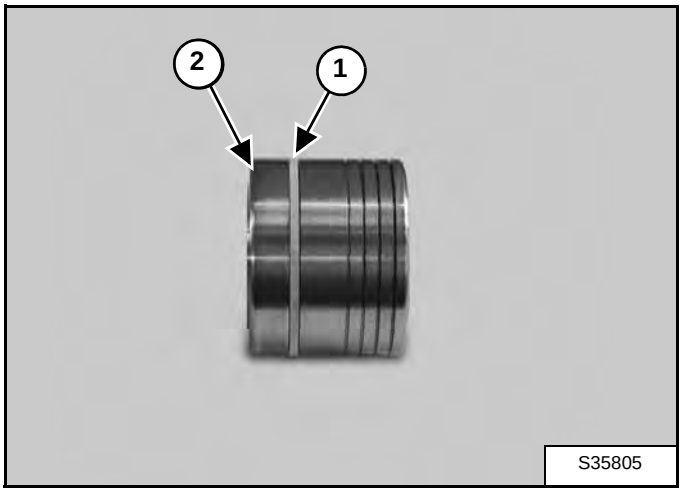
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-20-18



Cushion Piston: Install the O-ring (Item 1) on the piston (Item 2) **[Figure 20-20-18]**.

Figure 20-20-19



Install the seal (Item 1) on the piston (Item 2) **[Figure 20-20-19]**.

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Assembly (Cont'd)

Figure 20-20-20



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

Figure 20-20-21



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

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

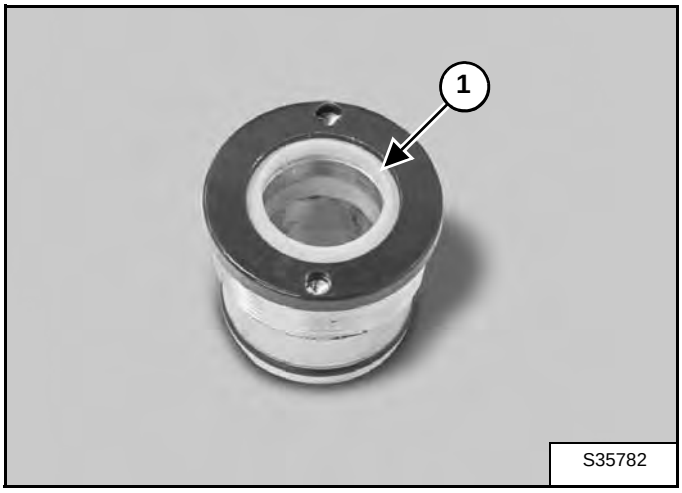
Rotate the handles to collapse the rod seal **[Figure 20-20-21]**.

Figure 20-20-22



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

Figure 20-20-23

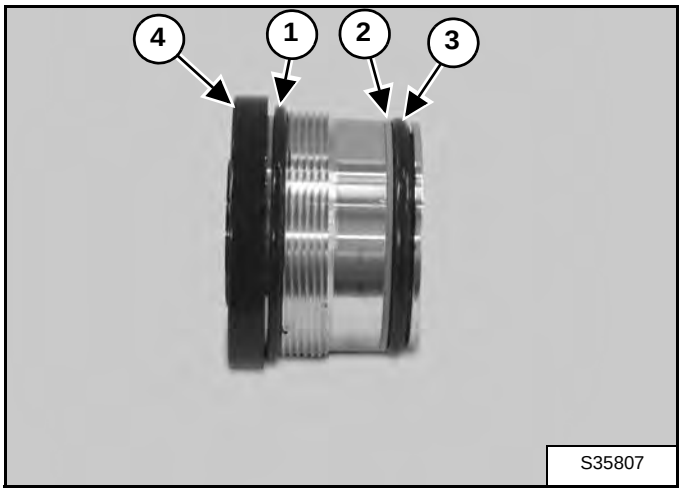


Install the wiper seal with the wiper (Item 1) **[Figure 20-20-23]** toward the outside of the head.

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Assembly (Cont'd)

Figure 20-20-24

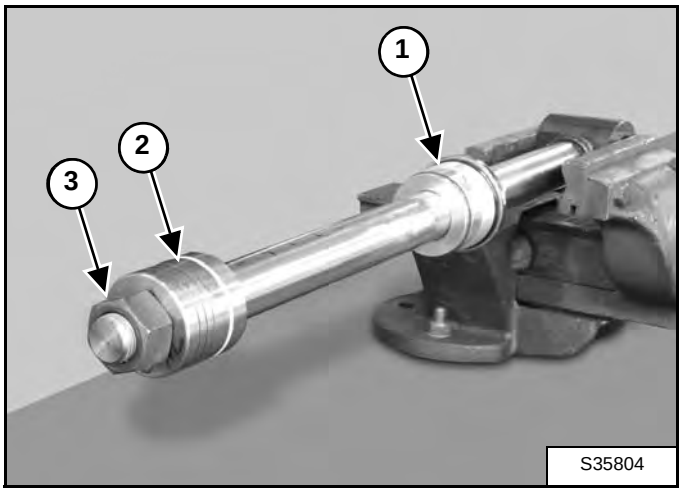


Install the O-ring (Item 1) **[Figure 20-20-24]**.

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

NOTE: O-ring (Item 3) and back-up ring (Item 2) [Figure 20-20-15] were replaced, for a limited time, with a one piece seal. Service replacements may use either seal, as available.

Figure 20-20-25



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

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

Provide an adequate support for the cylinder before tightening.

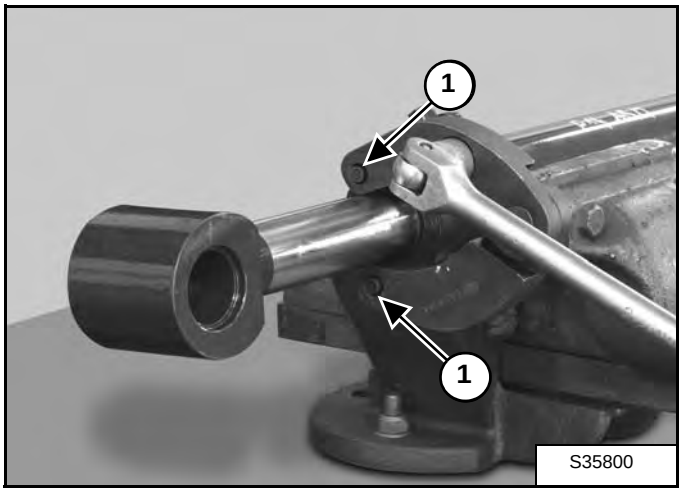
Install the nut (Item 3) **[Figure 20-20-25]**.

NOTE: Clean and dry the rod threads, install a NEW NUT from the kit with preapplied Loctite®.

Tighten the nut to 406 N•m (300 ft-lb) torque.

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

Figure 20-20-26



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-20-26]** to tighten the head. Apply torque to the head until it is flush with the end of the housing.

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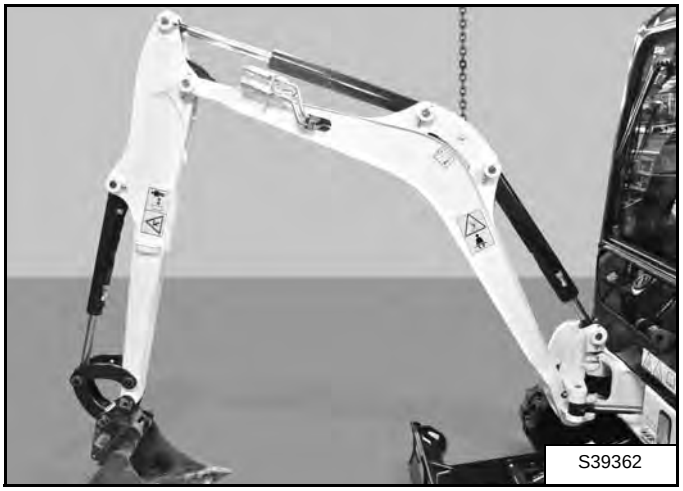
CYLINDER (ARM)

Testing

Lower the boom / bucket and blade to the ground.

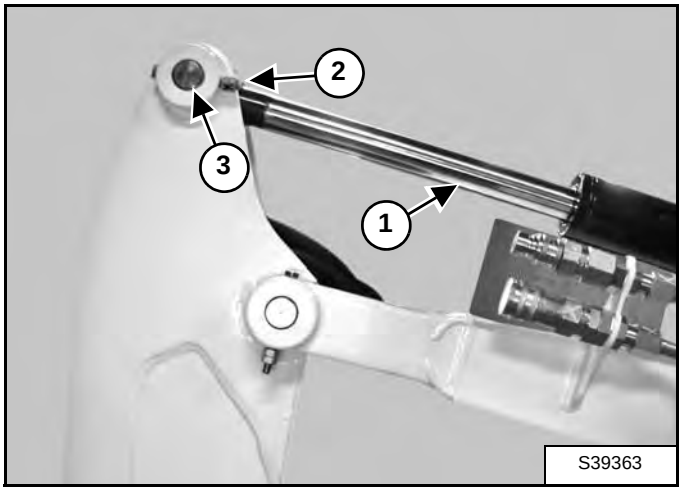
Stop the engine. Raise the control console.

Figure 20-21-1



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

Figure 20-21-2



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

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

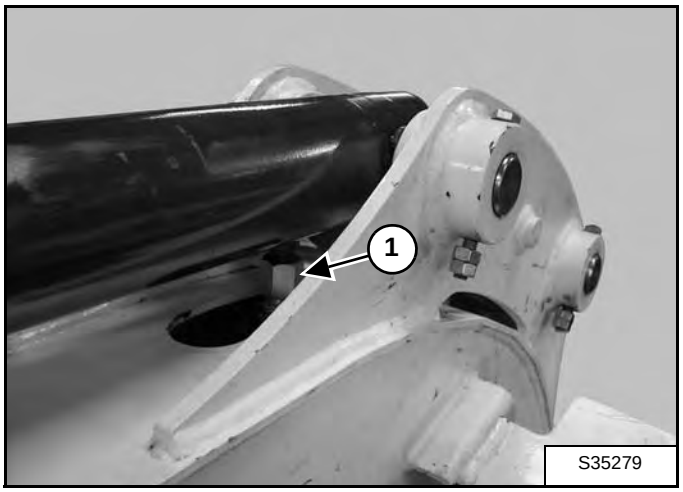
Remove the rod end pivot pin (Item 3) **[Figure 20-21-2]**.

⚠ WARNING

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

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Figure 20-21-3



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

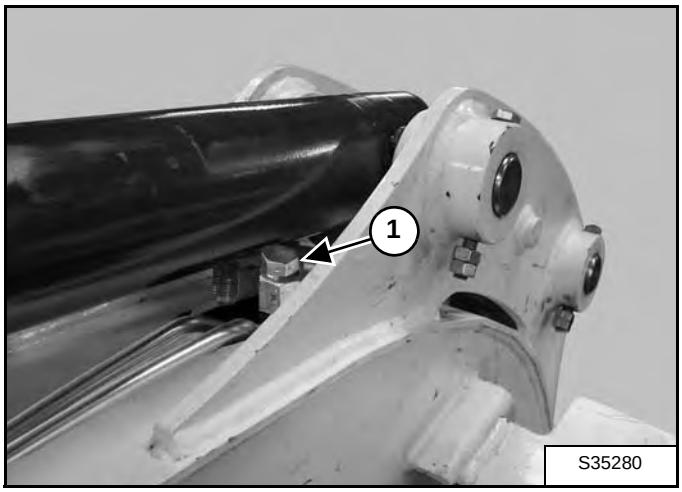
Stop the engine. With the key in the ON position, move the hydraulic controls to release the hydraulic pressure. Raise the control console.

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

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Testing (Cont'd)

Figure 20-21-4



Install a plug (Item 1) **[Figure 20-21-4]** on the tubeline and tighten.

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

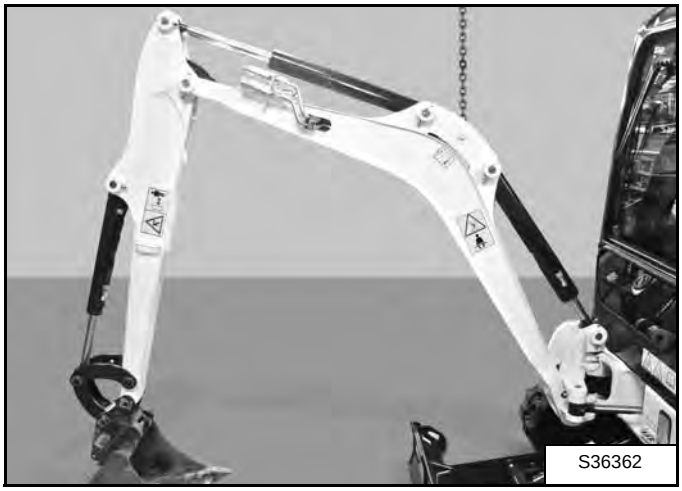
If there is any leakage from the base end hose on the arm cylinder, remove the cylinder for repair or replacement.

Dealer Copy -- Not for Resale

Removal And Installation

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

Figure 20-21-5



Support the boom using a chain hoist **[Figure 20-21-5]**.

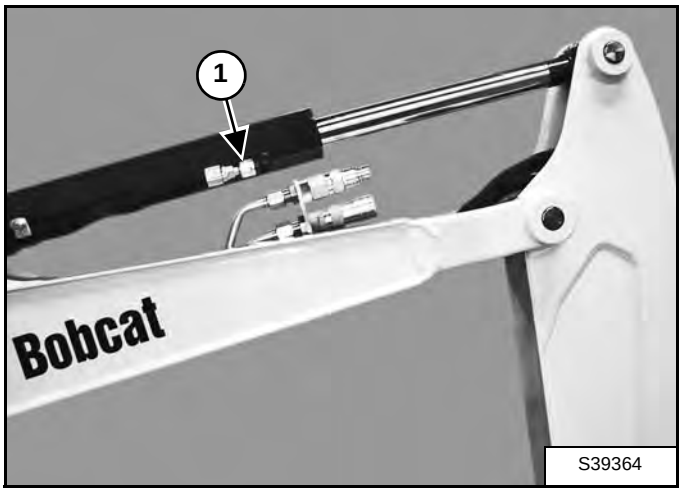
With the key in the ON position, move the hydraulic controls to release the hydraulic pressure.

IMPORTANT

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

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Figure 20-21-6

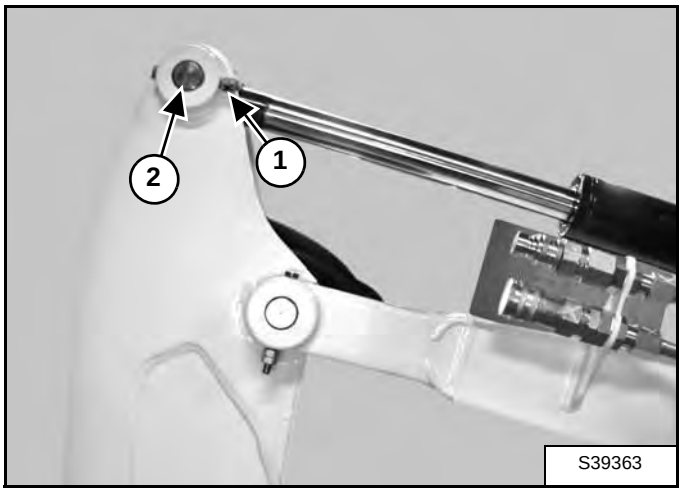


Remove the rod end hose (Item 1) **[Figure 20-21-6]** from the arm cylinder.

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Removal And Installation (Cont'd)

Figure 20-21-7



Remove the bolt and nuts (Item 1) from the arm cylinder rod end pivot pin (Item 2) **[Figure 20-21-7]**.

Remove the arm cylinder rod end pin (Item 2) **[Figure 20-21-7]**.

⚠ WARNING

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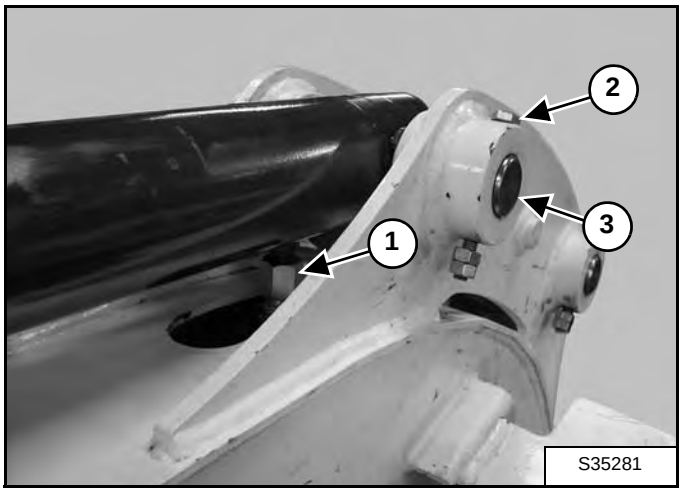
⚠ WARNING

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.

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Figure 20-21-8



Disconnect and cap the base end hose (Item 1) **[Figure 20-21-8]**.

Remove the bolt and nuts (Item 2) **[Figure 20-21-8]** from the cylinder base end pin.

Remove the cylinder base end pin (Item 3) **[Figure 20-21-8]**.

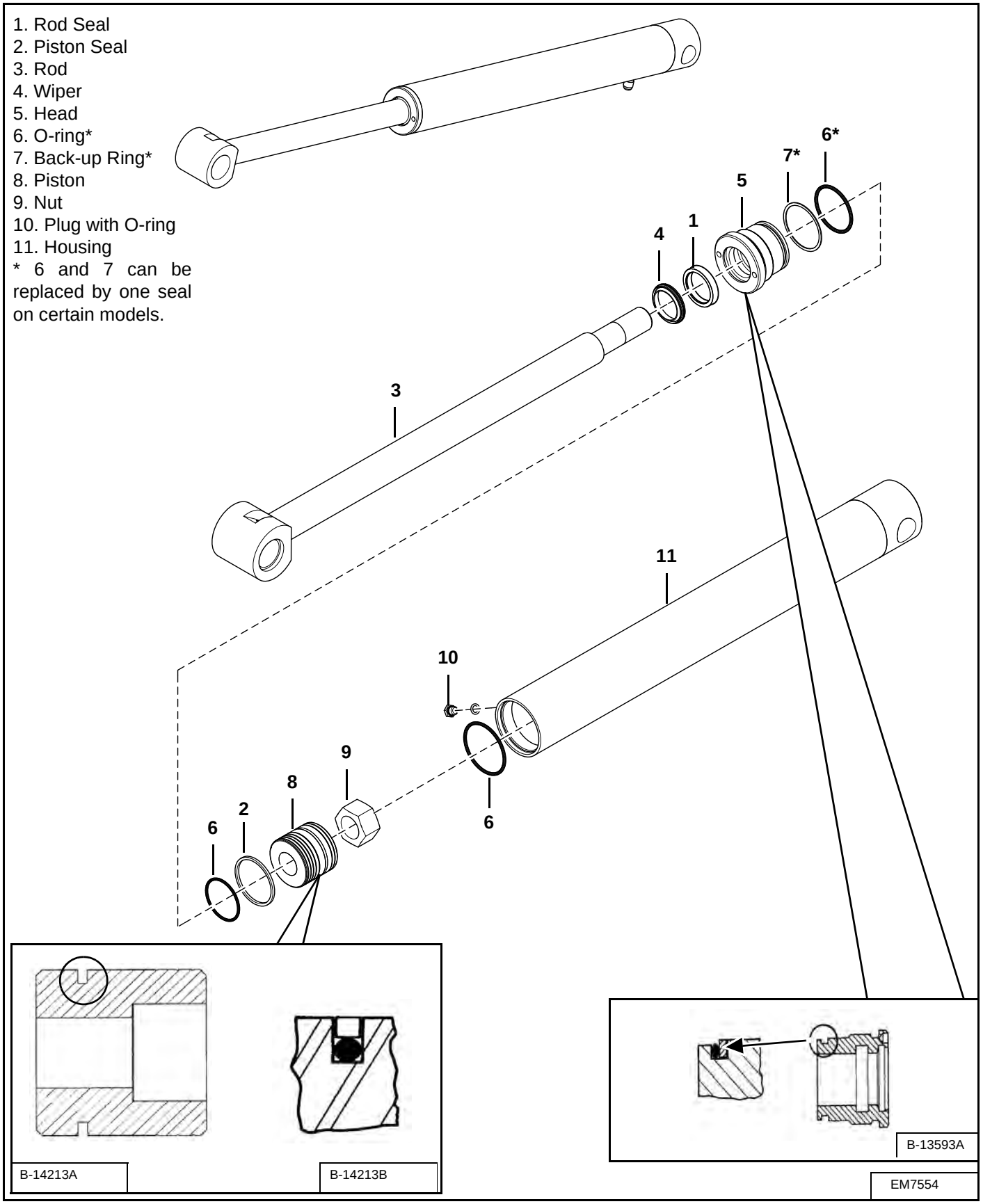
Remove the cylinder from the arm.

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Parts Identification

1. Rod Seal
2. Piston Seal
3. Rod
4. Wiper
5. Head
6. O-ring*
7. Back-up Ring*
8. Piston
9. Nut
10. Plug with O-ring
11. Housing

* 6 and 7 can be replaced by one seal on certain models.



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Disassembly

Clean the outside of the arm cylinder before disassembly.

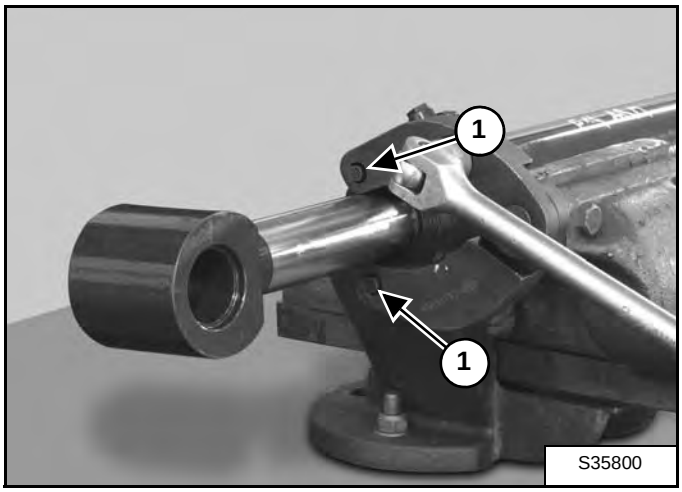
Use the following tools to disassemble the cylinder:

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

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

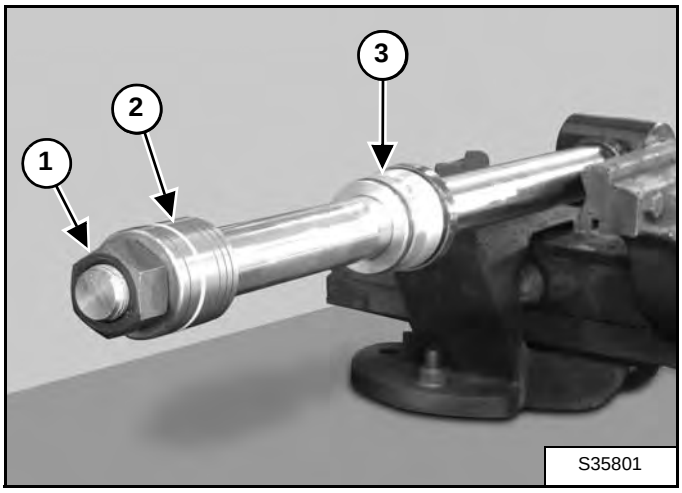
Put the base end of the cylinder in a vise.

Figure 20-21-9



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

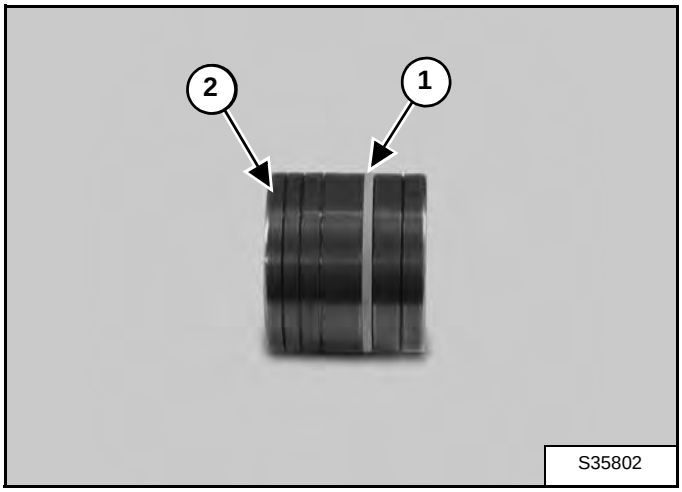
Figure 20-21-10



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

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

Figure 20-21-11

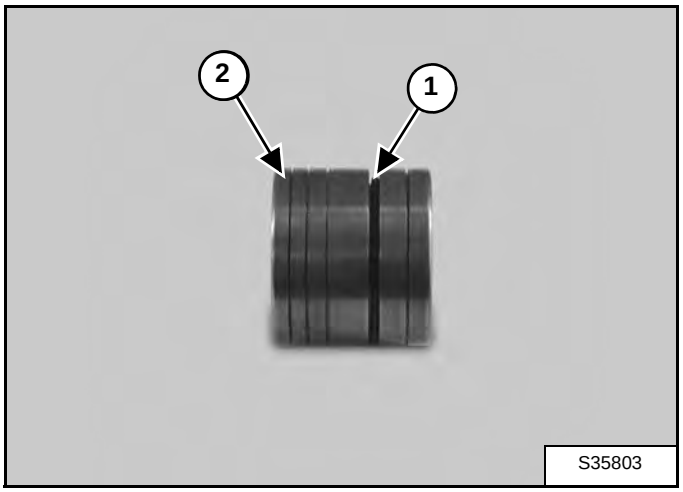


Standard piston: Remove the seal (Item 1) from the piston (Item 2) **[Figure 20-21-11]**.

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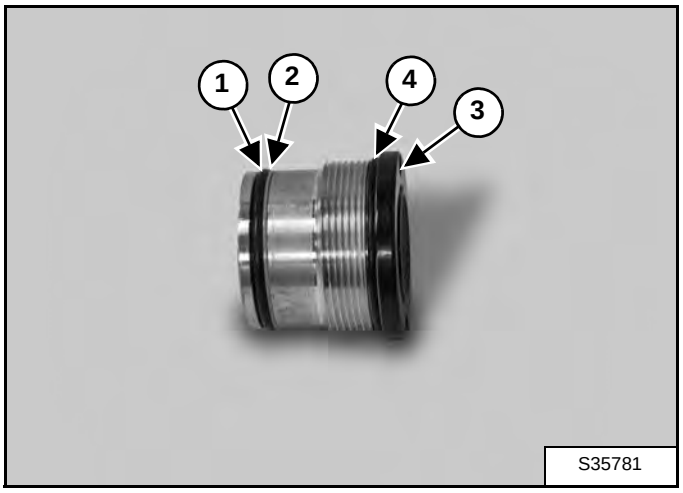
Disassembly (Cont'd)

Figure 20-21-12



Remove the O-ring (Item 1) from the piston (Item 2) **[Figure 20-21-12]**.

Figure 20-21-13

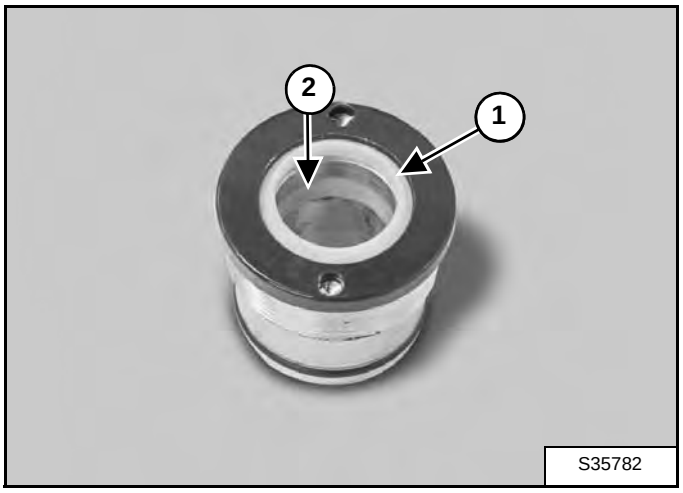


Remove the O-ring (Item 1) and the back-up ring (Item 2) from the head (Item 3) **[Figure 20-21-13]**.

NOTE: O-ring (Item 1) and back-up ring (Item 2) [Figure 20-21-13] were replaced, for a limited time, with a one piece seal. Service replacements may use either seal, as available.

Remove the O-ring (Item 4) **[Figure 20-21-13]**.

Figure 20-21-14



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head **[Figure 20-21-14]**.

Dealer Copy -- Not for Resale

Assembly

Use the following tools to assemble the cylinder:

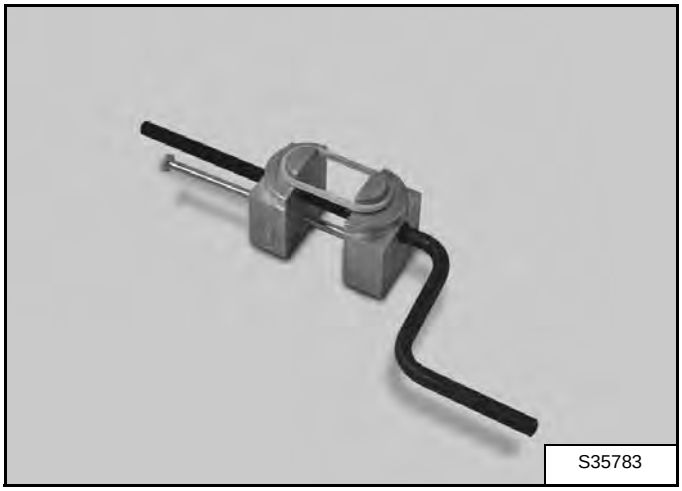
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

Clean all parts in solvent and dry with compressed air.

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

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

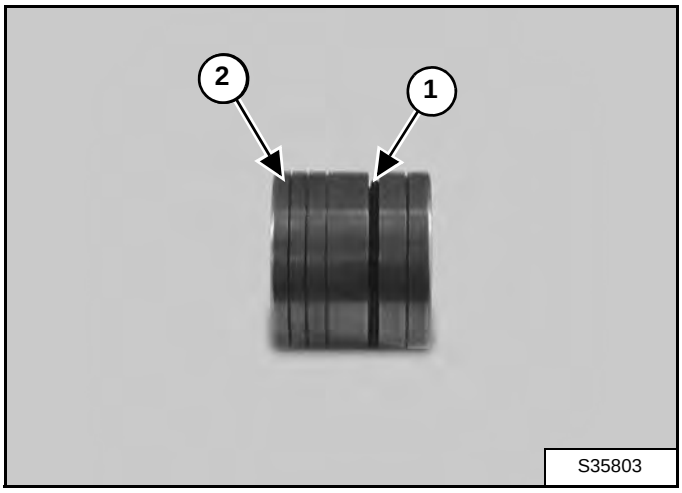
Figure 20-21-15



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-21-15]**.

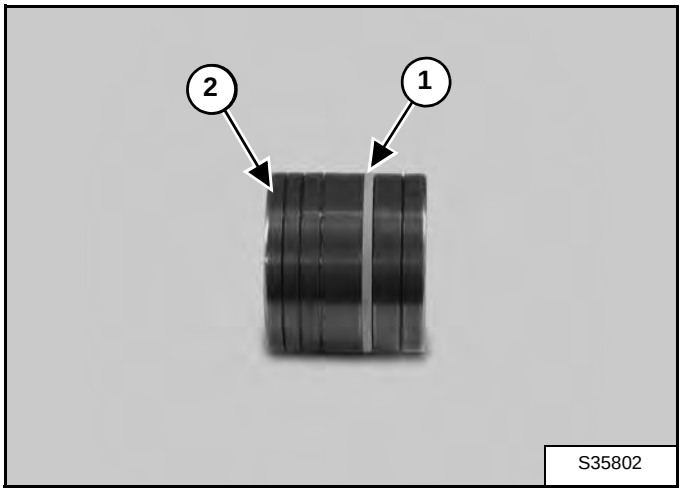
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-21-16



Standard piston: Install the O-ring (Item 1) on the piston (Item 2) **[Figure 20-21-16]**.

Figure 20-21-17



Install the seal (Item 1) on the piston (Item 2) **[Figure 20-21-17]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-21-18



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-21-18]**.

Figure 20-21-19



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

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

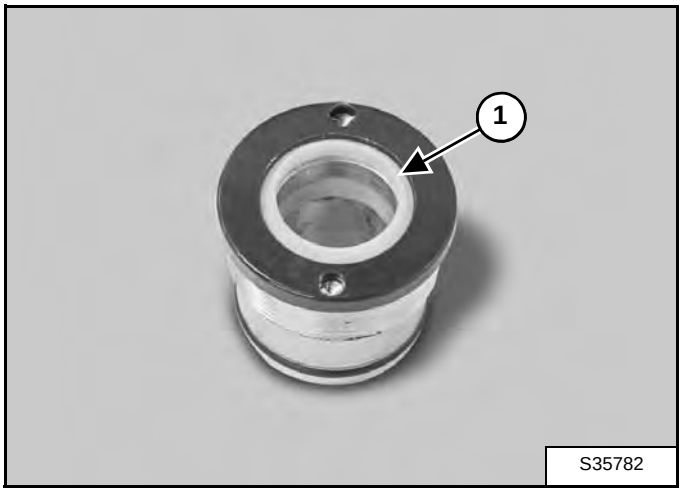
Rotate the handles to collapse the rod seal **[Figure 20-21-19]**.

Figure 20-21-20



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

Figure 20-21-21

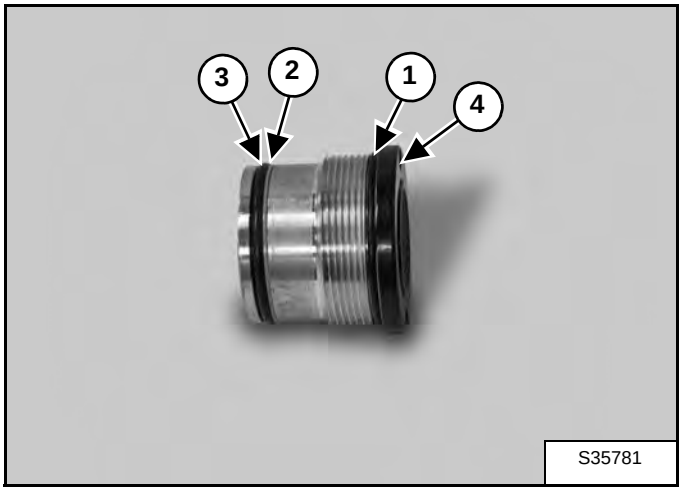


Install the wiper seal with the wiper (Item 1) **[Figure 20-21-21]** toward the outside of the head.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-21-22

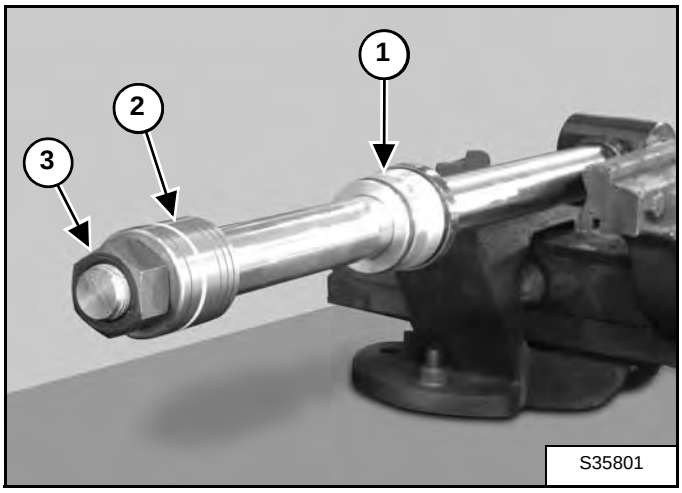


Install the O-ring (Item 1) **[Figure 20-21-22]**.

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

NOTE: O-ring (Item 3) and back-up ring (Item 2) [Figure 20-21-22] were replaced, for a limited time, with a one piece seal. Service replacements may use either seal, as available.

Figure 20-21-23



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

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

Provide an adequate support for the cylinder before tightening.

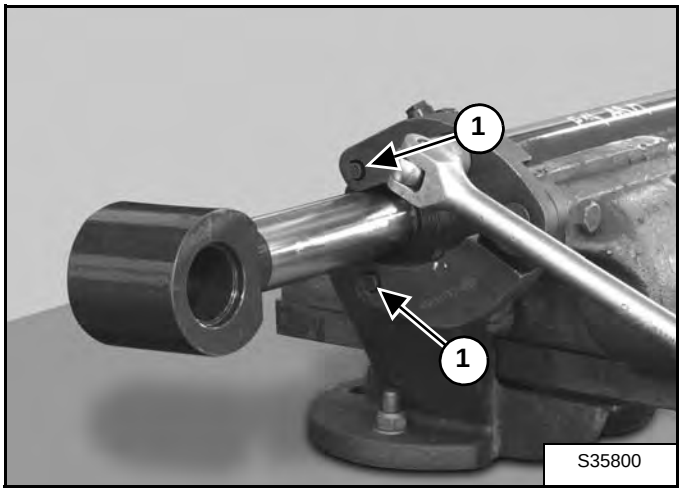
Install the nut (Item 3) **[Figure 20-21-23]**.

NOTE: Clean and dry the rod threads, install a NEW NUT with preapplied Loctite® from the kit. Reclean thread area for Loctite® residue.

Tighten the nut to 410 N•m (300 ft-lb) torque.

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

Figure 20-21-24



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-21-24]** to tighten the head. Apply torque to the head until it is flush with the end of the housing.

Dealer Copy -- Not for Resale

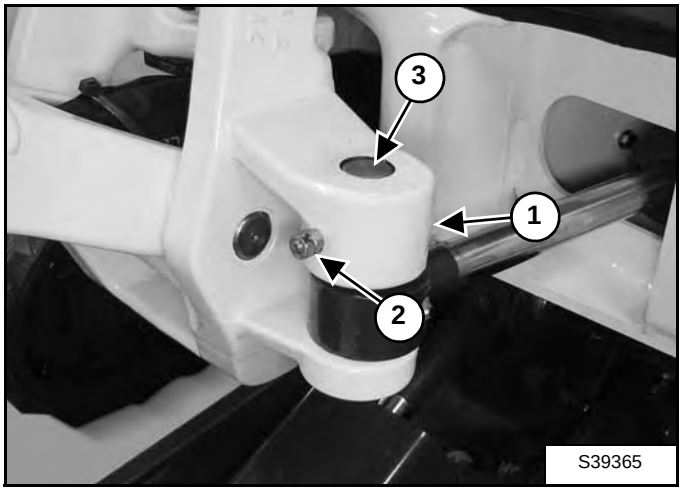
CYLINDER (BOOM SWING)

Testing

Lower the boom / bucket and blade to the ground.

Stop the engine. Raise the control console.

Figure 20-22-1



Remove the bolt (Item 1) and nuts (Item 2) from the rod end pivot pin (Item 3) **[Figure 20-22-1]**.

Remove the pivot pin (Item 3) **[Figure 20-22-1]**.

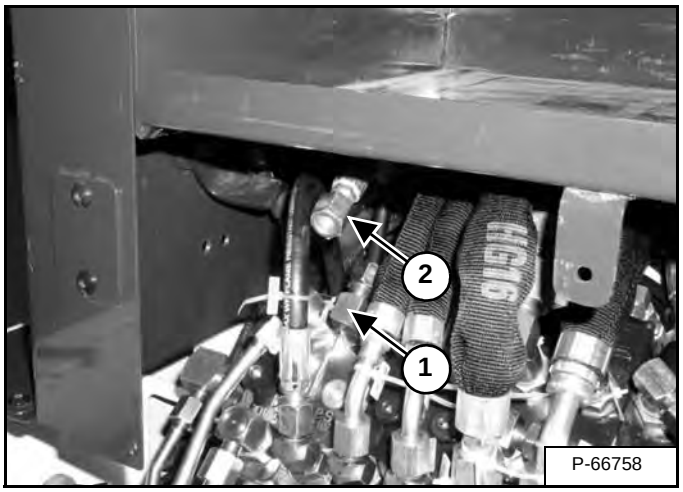
Figure 20-22-2



Lower the control console and fasten the seat belt. Start the engine and retract the swing cylinder **[Figure 20-22-2]**.

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

Figure 20-22-3



Remove the base end hose (Item 1) **[Figure 20-22-3]** at the control valve assembly connection.

Install a cap (Item 1) **[Figure 20-22-3]** on the control valve assembly fitting and tighten.

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

If there is any leakage from the base end hose (Item 2) **[Figure 20-22-3]** on the cylinder, remove the cylinder for repair or replacement.

Dealer Copy -- Not for Resale

Removal And Installation

IMPORTANT

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

I-2003-0888

⚠ WARNING

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

W-2145-EN-0210

⚠ 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

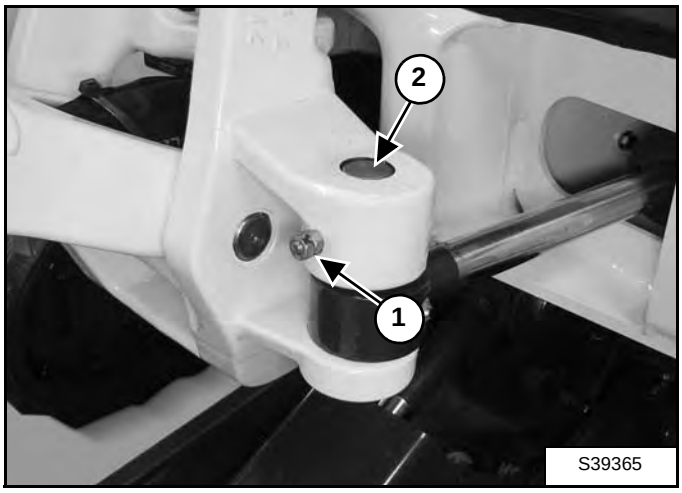
Swing the upperstructure so the pin in the base end of the cylinder is located between the tracks.

Offset the boom slightly for additional working space.

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

Remove the floor mat and floor panels. (See Removal And Installation on Page 40-140-1.)

Figure 20-22-4



Remove the bolt and nuts (Item 1) **[Figure 20-22-4]** from the rod end pin.

Remove the pivot pin (Item 2) **[Figure 20-22-4]**.

Lower the control console and fasten the seat belt.

Figure 20-22-5



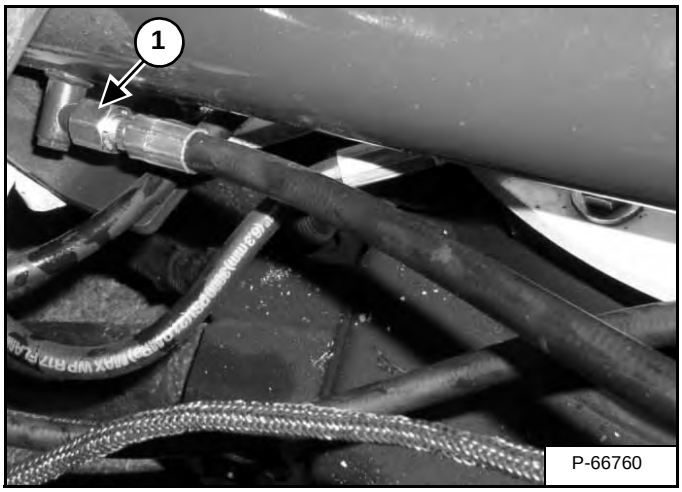
Start the engine and fully retract the cylinder **[Figure 20-22-5]**.

Stop the engine.

Dealer Copy -- Not for Resale

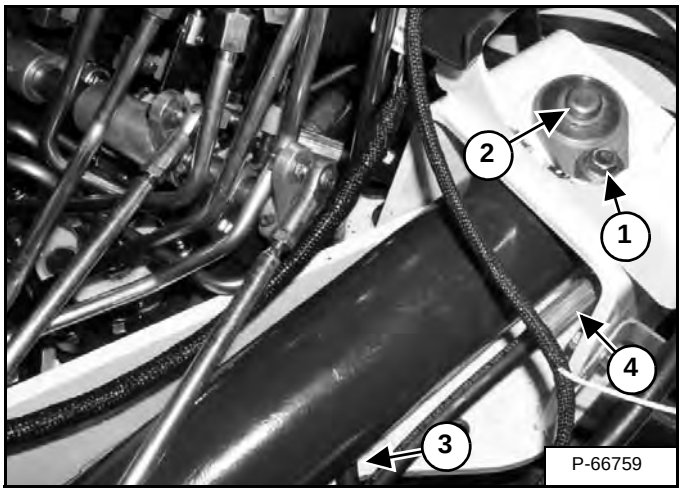
Removal And Installation (Cont'd)

Figure 20-22-6



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

Figure 20-22-7



Remove the base end pin retainer bolt, washer and spacer (Item 1) **[Figure 20-22-7]** from under the upperstructure.

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

Slide the boom swing cylinder forward.

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

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

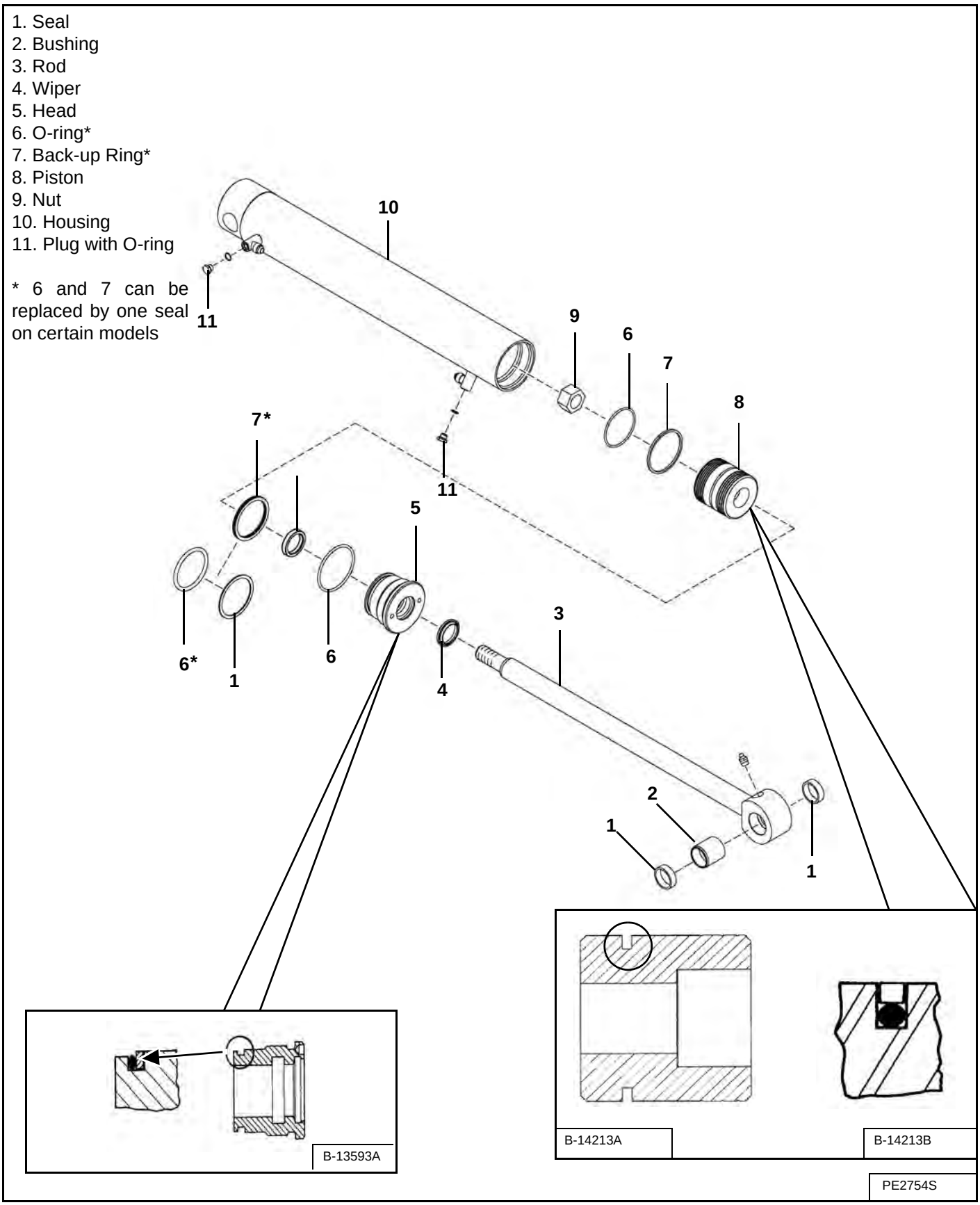
Slide the cylinder out the front of the excavator frame.

Dealer Copy -- Not for Resale

Parts Identification

1. Seal
2. Bushing
3. Rod
4. Wiper
5. Head
6. O-ring*
7. Back-up Ring*
8. Piston
9. Nut
10. Housing
11. Plug with O-ring

* 6 and 7 can be replaced by one seal on certain models



Dealer Copy -- Not for Resale

Disassembly

Clean the outside of the boom swing cylinder before disassembly.

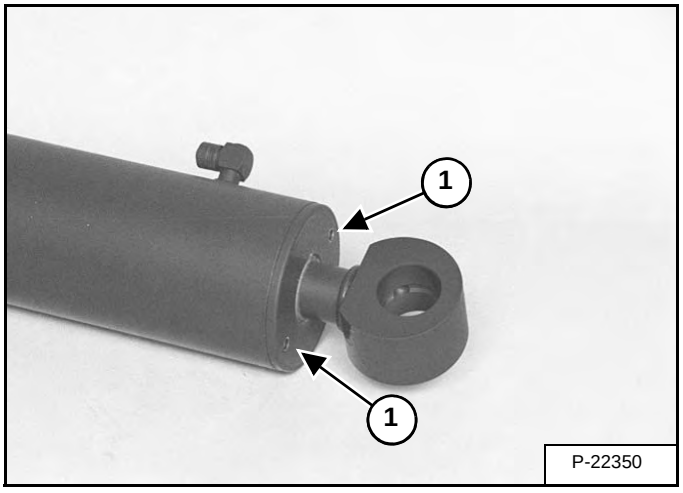
Use the following tools to disassemble the cylinder:

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

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

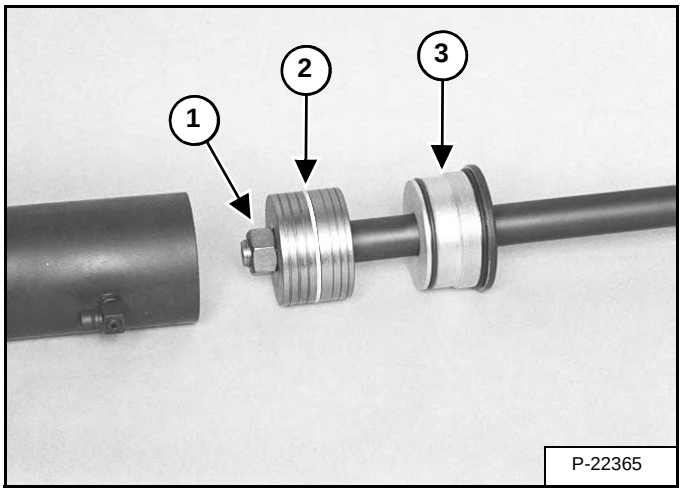
Put the base end of the cylinder in a vise.

Figure 20-22-8



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

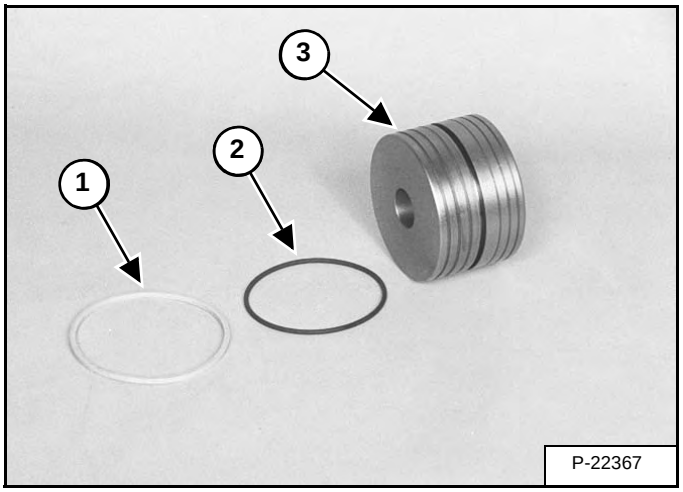
Figure 20-22-9



Remove the head and the rod assembly from the cylinder **[Figure 20-22-9]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-22-9]**.

Figure 20-22-10

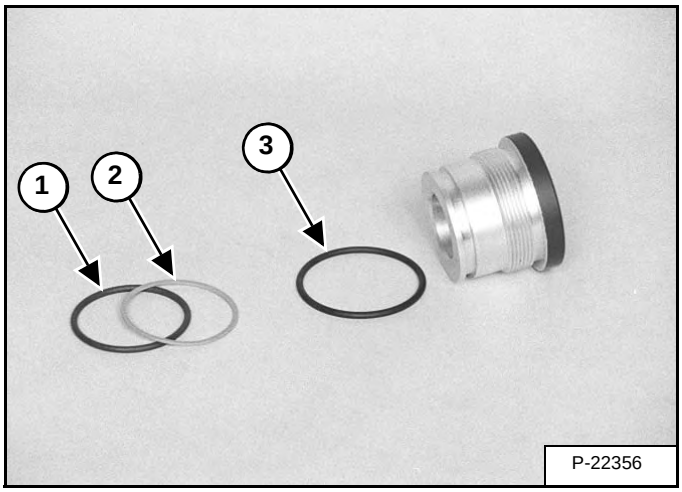


Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-22-10]**.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

Figure 20-22-11

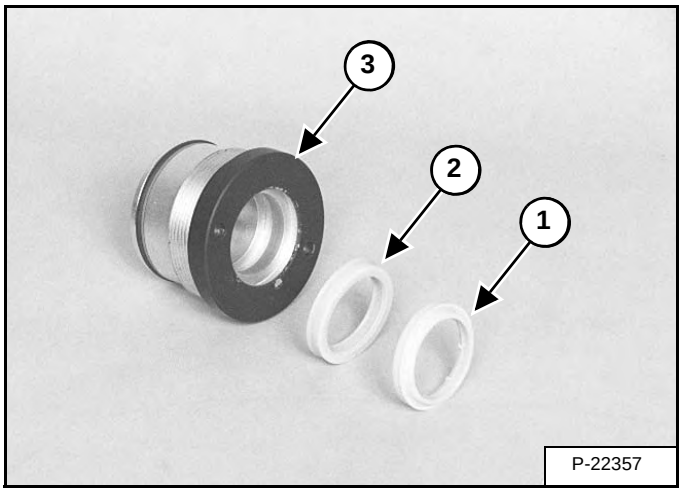


Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-22-11]**.

NOTE: O-ring (Item 1) and back-up ring (Item 2) [Figure 20-22-11] were replaced, for a limited time, with a one piece seal. Service replacements may use either seal, as available.

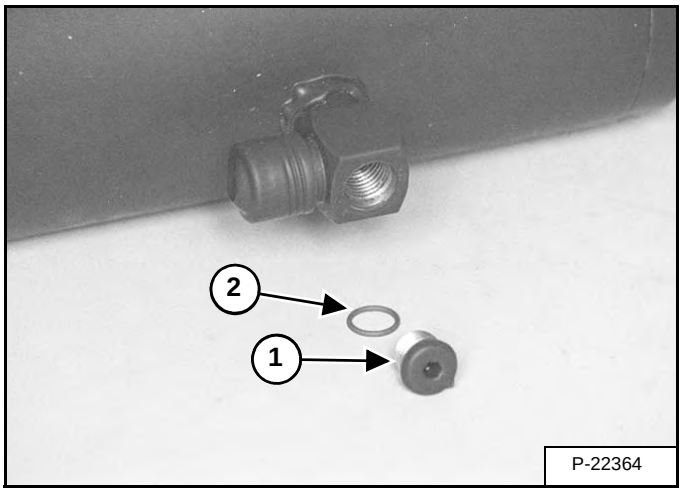
Remove the O-ring (Item 3) **[Figure 20-22-11]**.

Figure 20-22-12



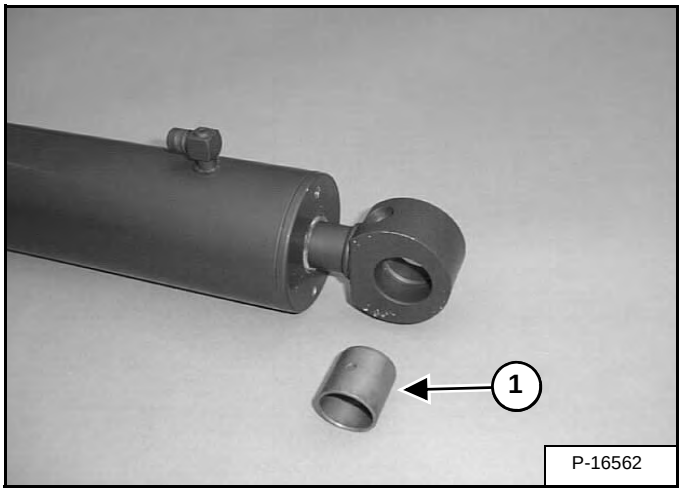
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-22-12]**.

Figure 20-22-13



Remove the plug (Item 1) and O-ring (Item 2) **[Figure 20-22-13]**.

Figure 20-22-14



Remove the bushing (Item 1) **[Figure 20-22-14]**.

Dealer Copy -- Not for Resale

Assembly

Use the following tools to assemble the cylinder:

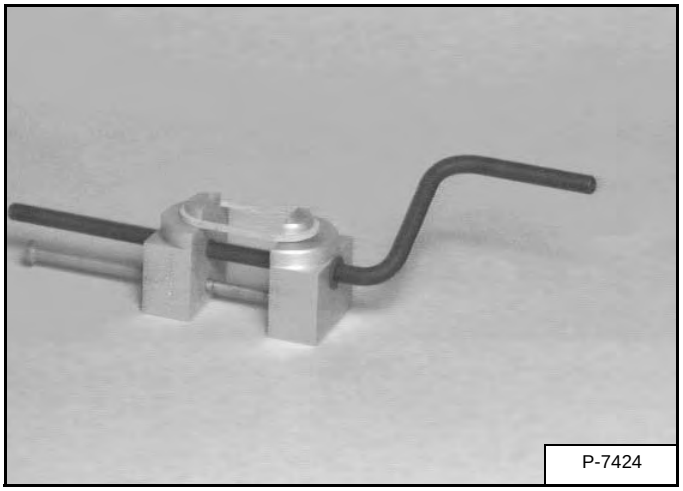
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

Clean all parts in solvent and dry with compressed air.

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

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

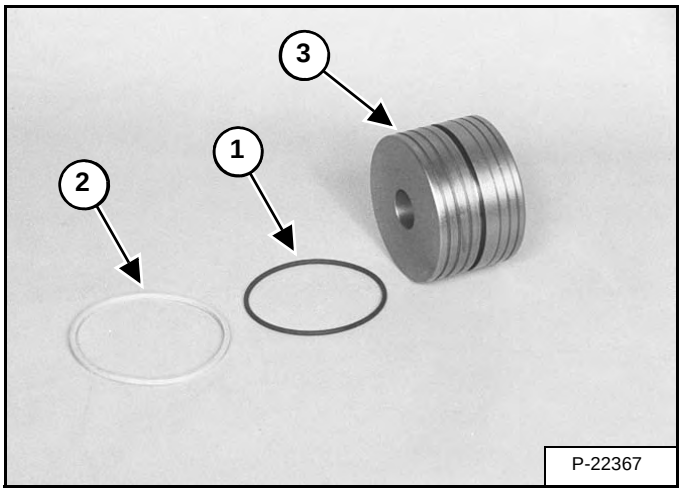
Figure 20-22-15



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

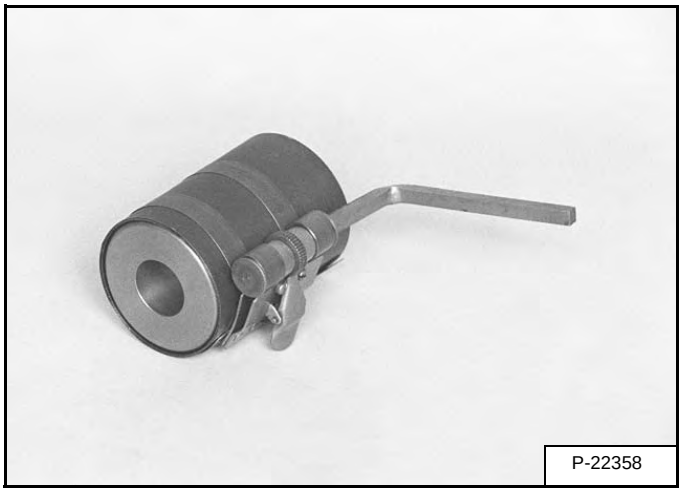
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-22-16



Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-22-16]**.

Figure 20-22-17

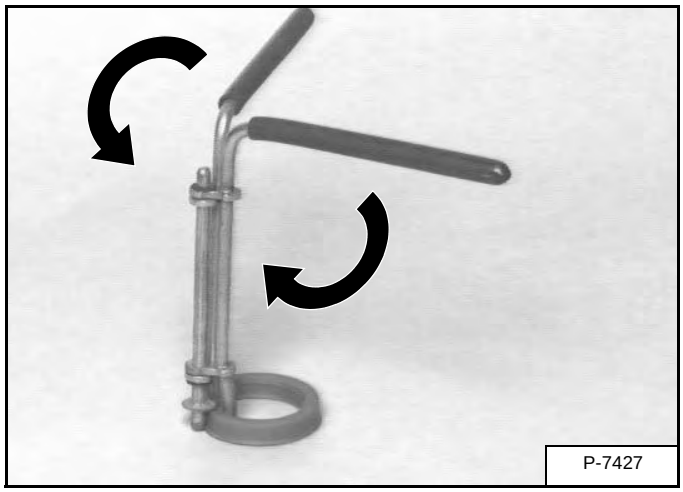


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-22-17]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-22-18

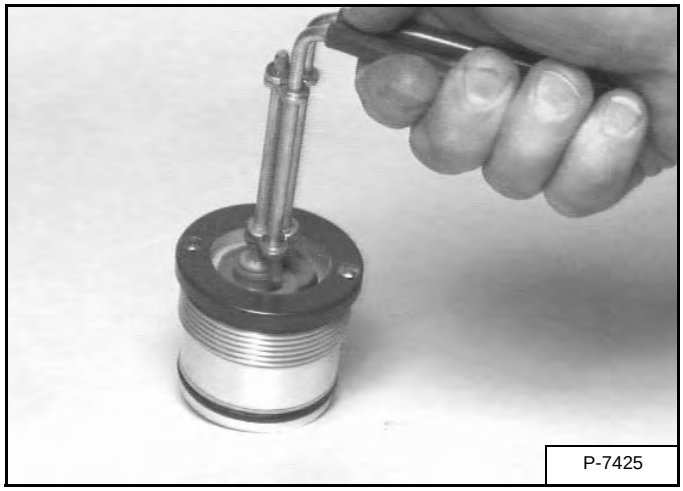


Install the rod seal on the rod seal tool **[Figure 20-22-18]**.

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

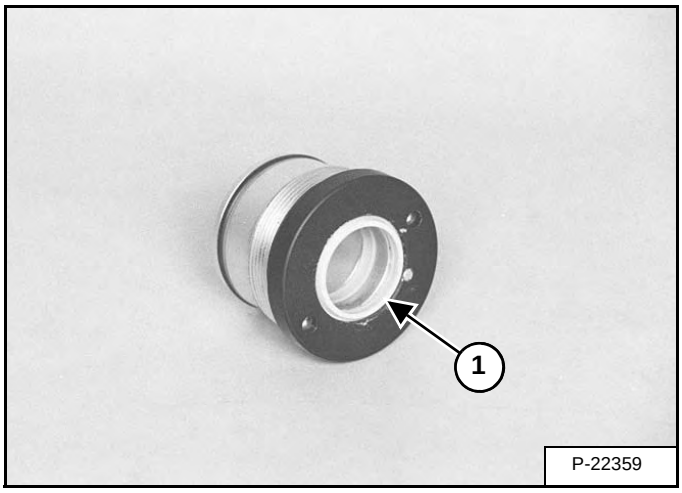
Rotate the handles to collapse the rod seal **[Figure 20-22-18]**.

Figure 20-22-19



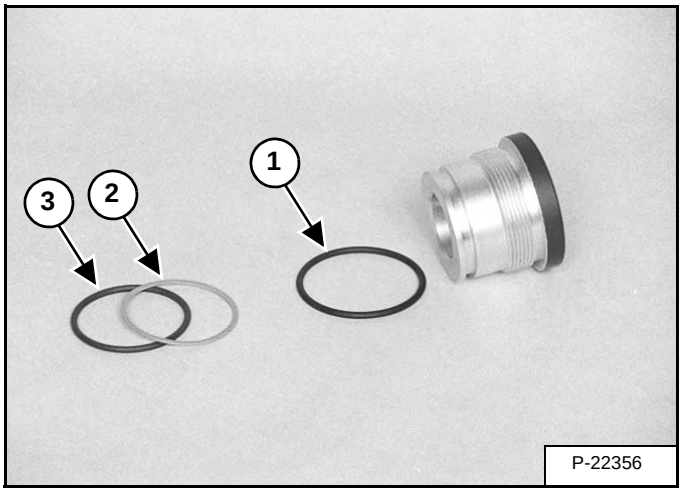
Install the rod seal in the head **[Figure 20-22-19]**.

Figure 20-22-20



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

Figure 20-22-21



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

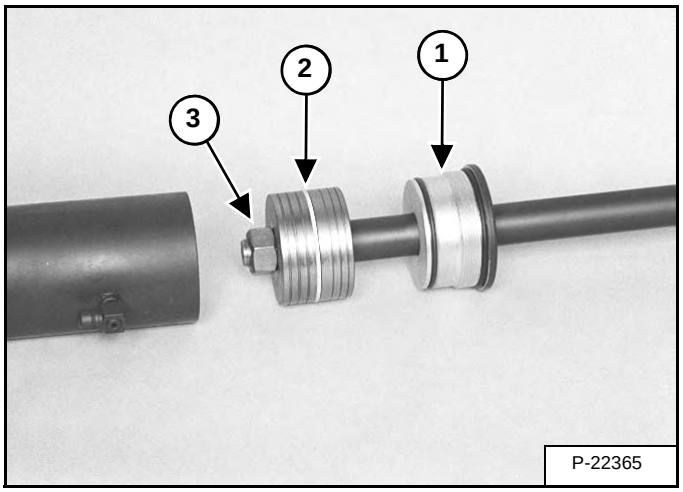
Install the back-up ring (Item 2) and O-ring (Item 3) **[Figure 20-22-21]**.

NOTE: O-ring (Item 2) and back-up ring (Item 3) [Figure 20-22-21] were replaced, for a limited time, with a one piece seal. Service replacements may use either seal, as available.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-22-22



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

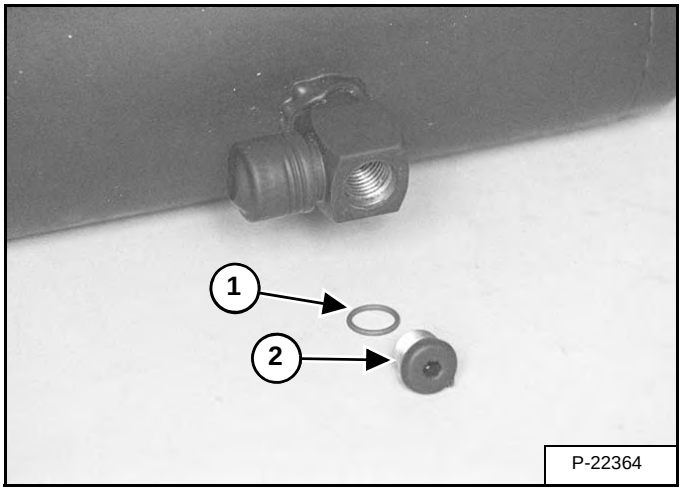
Grease the piston where the nut contacts the piston. Do not get grease on the threads.

Provide an adequate support for the cylinder before tightening.

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

Tighten the nut to 407 N•m (300 ft-lb) torque.

Figure 20-22-23

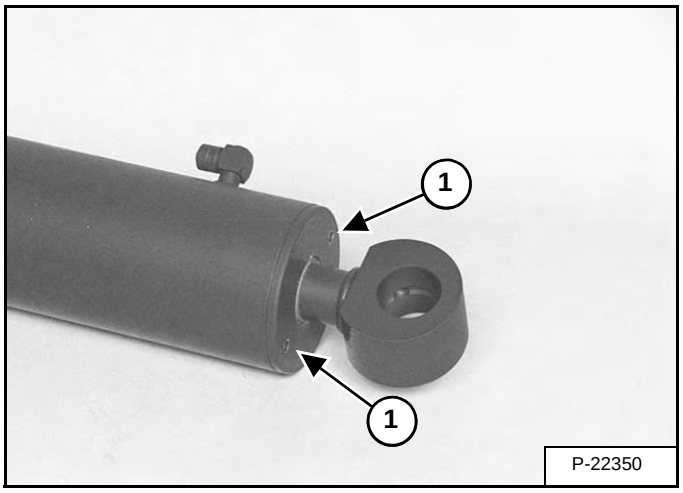


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-22-23]**.

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

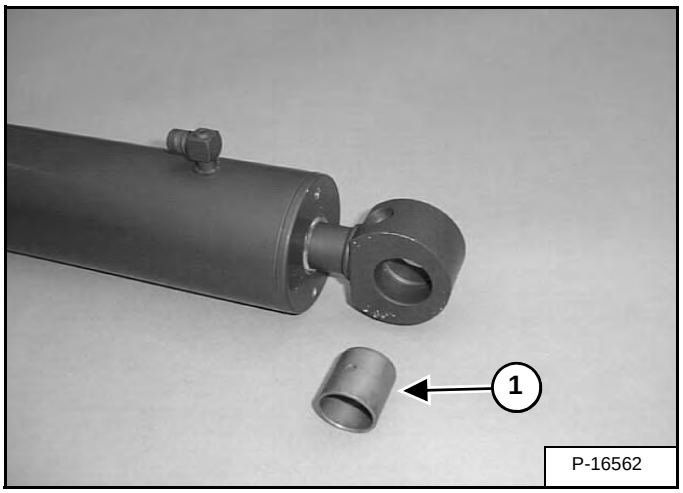
Put the base end of the hydraulic cylinder in a vise.

Figure 20-22-24



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-22-24]**. Tighten the head to 373 N•m (275 lb-ft) torque.

Figure 20-22-25



Install the bushing (Item 1) **[Figure 20-22-25]**. The bushing must be aligned with the grease channel in the rod end of the cylinder.

Dealer Copy -- Not for Resale

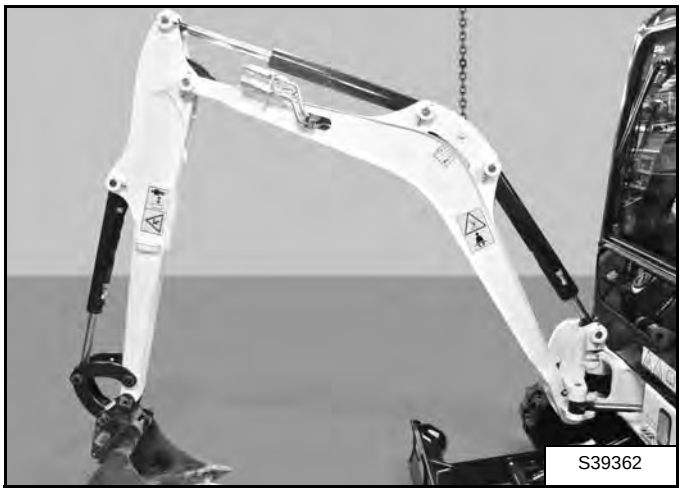


Dealer Copy -- Not for Resale

CYLINDER (BUCKET)

Testing

Figure 20-23-1

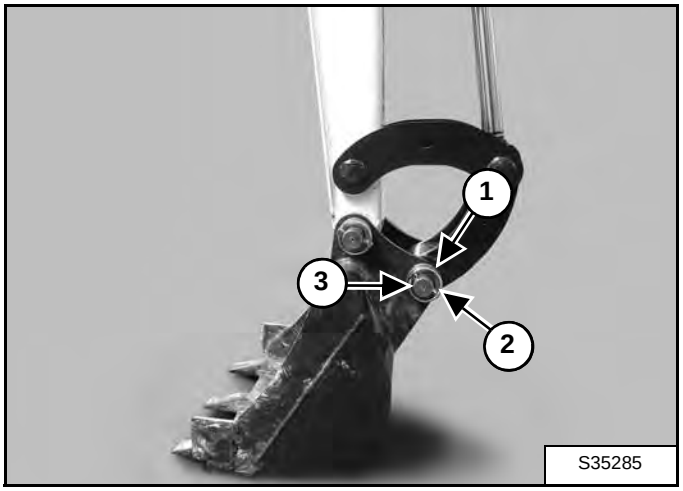


Lower the boom / bucket and blade to the ground **[Figure 20-23-1]**.

Stop the engine. Raise the control console.

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

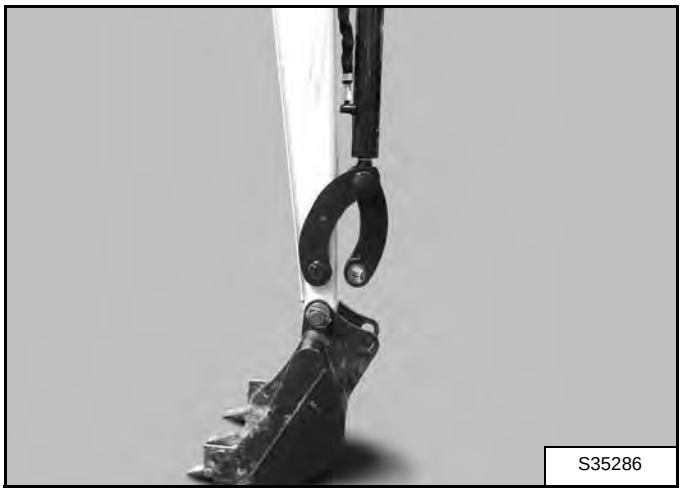
Figure 20-23-2



Remove the retaining pin (Item 1) and washers (Item 2) from the outside pivot pin (Item 3) **[Figure 20-23-2]**.

Remove the pivot pin (Item 3) **[Figure 20-23-2]**.

Figure 20-23-3



Lower control console and fasten the seat belt. Start the engine and retract the bucket cylinder **[Figure 20-23-3]**.

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

⚠ WARNING

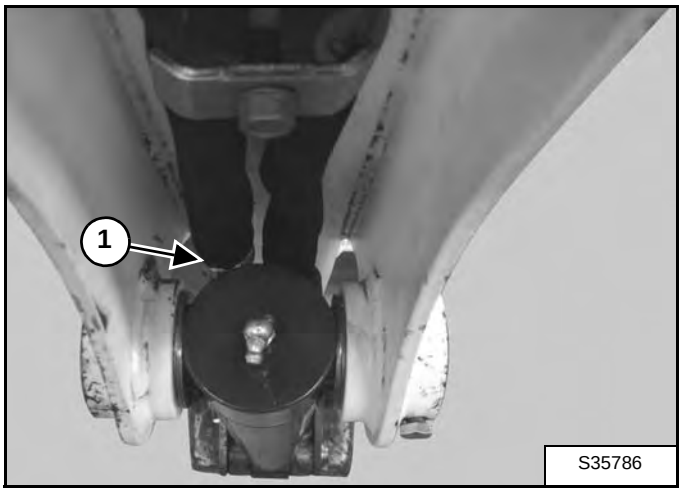
Hydraulic fluid escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. This can cause serious injury and possible death if proper medical treatment by a doctor familiar with this injury is not received immediately.

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Testing (Cont'd)

Figure 20-23-4



Remove the bucket cylinder base end hose (Item 1) **[Figure 20-23-4]**, and install a plug on the hose fitting and tighten.

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

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

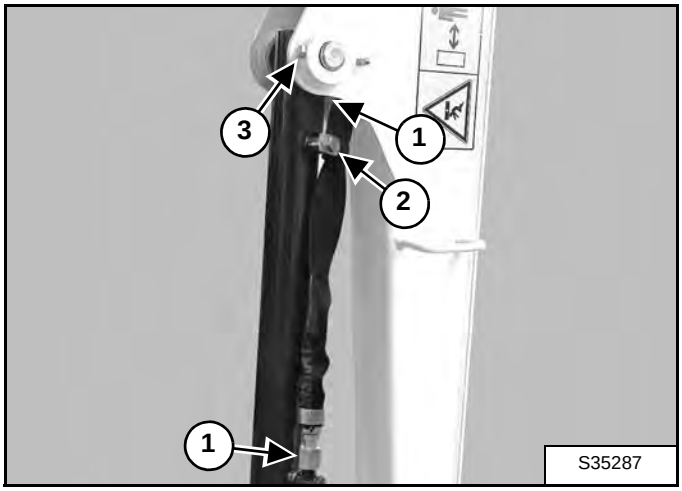
Removal And Installation

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

Support the boom using a chain hoist.

With the key in the ON position, move the hydraulic controls to release the hydraulic pressure.

Figure 20-23-5



Remove and plug the two hoses (Item 1) **[Figure 20-23-5]** from the bucket cylinder.

Remove the hose clamp (Item 2) **[Figure 20-23-5]** on the side of the cylinder.

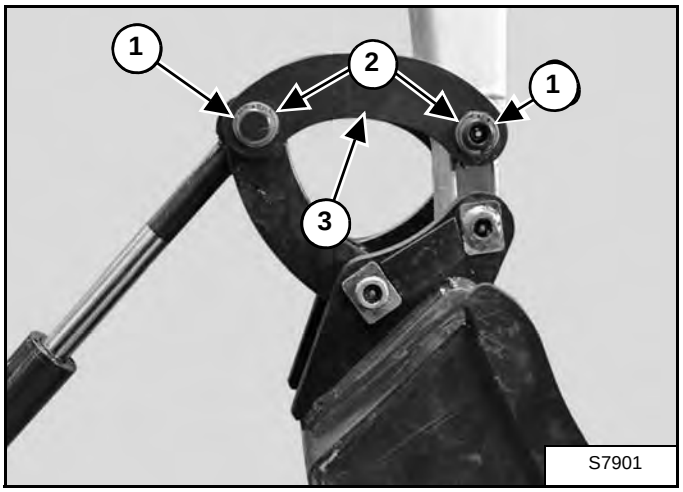
Remove the bolt and nuts (Item 3) **[Figure 20-23-5]** from the cylinder base end pin.

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

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Removal And Installation (Cont'd)

Figure 20-23-6



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

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

Remove the bucket link pins (Item 1) **[Figure 20-23-6]**.

Remove the bucket cylinder.

IMPORTANT

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

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⚠ WARNING

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

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⚠ 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.

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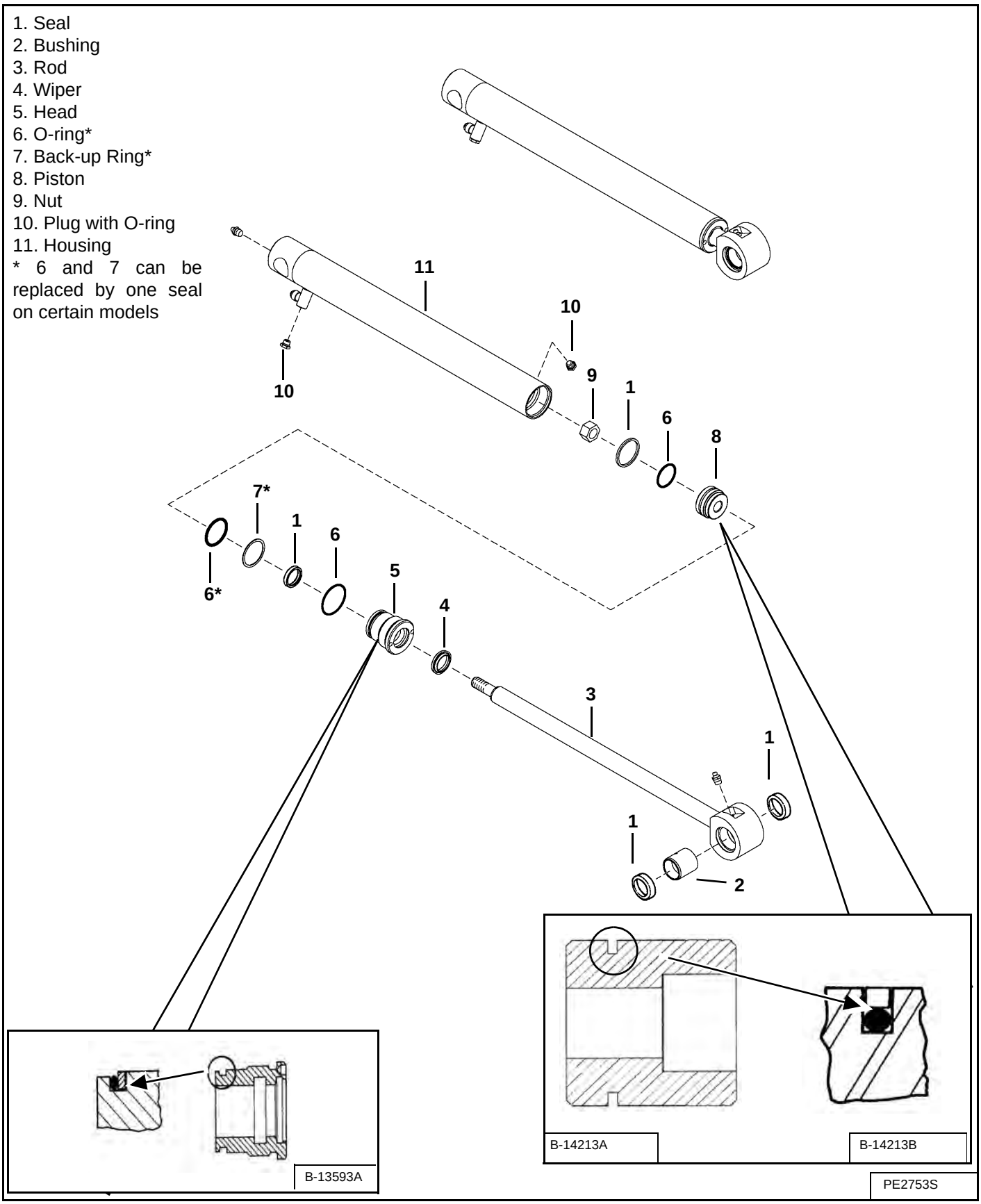
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CYLINDER (BUCKET) (CONT'D)

Parts Identification

1. Seal
2. Bushing
3. Rod
4. Wiper
5. Head
6. O-ring*
7. Back-up Ring*
8. Piston
9. Nut
10. Plug with O-ring
11. Housing

* 6 and 7 can be replaced by one seal on certain models



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Disassembly

Clean the outside of the bucket cylinder before disassembly.

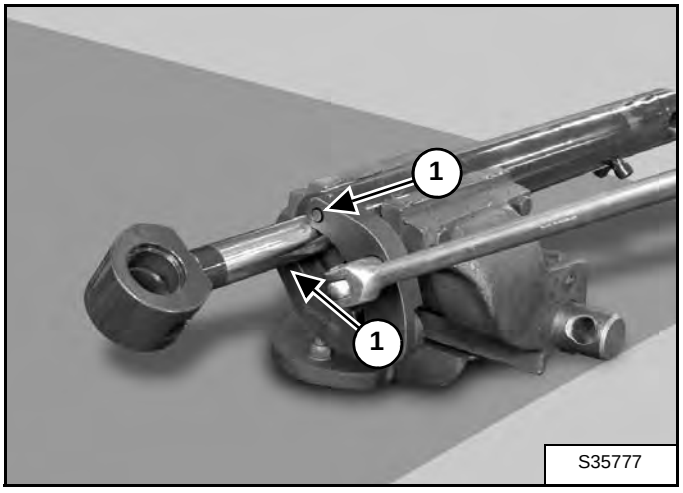
Use the following tools to disassemble the cylinder:

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

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

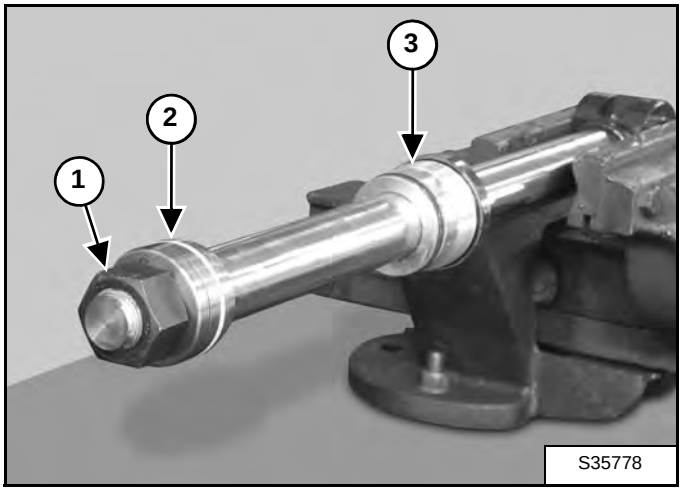
Put the base end of the cylinder in a vise.

Figure 20-23-7



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

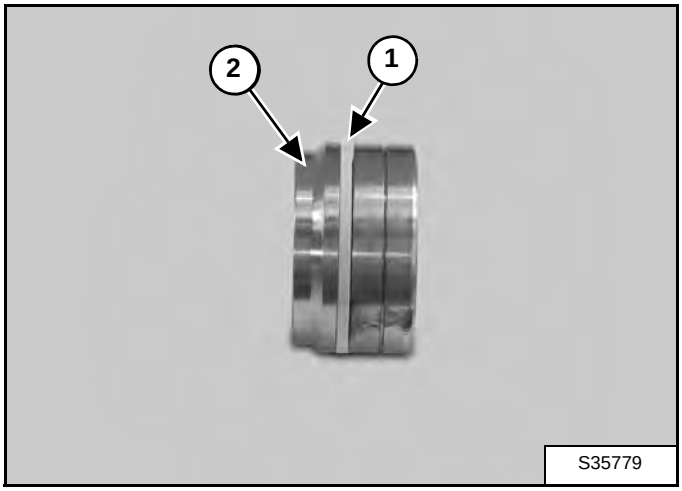
Figure 20-23-8



Remove the head and the rod assembly from the cylinder **[Figure 20-23-8]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-23-8]**.

Figure 20-23-9

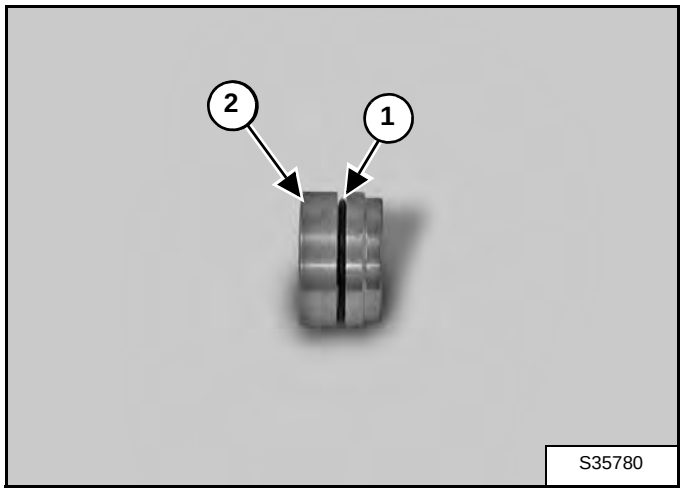


Standard piston: Remove the seal (Item 1) from the piston (Item 2) **[Figure 20-23-9]**.

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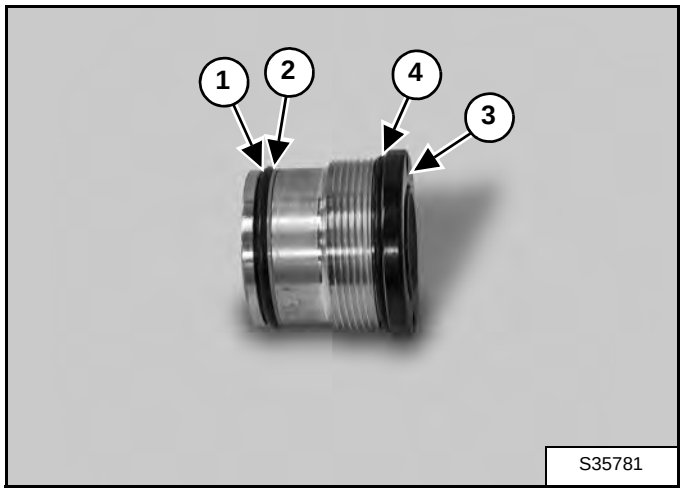
Disassembly (Cont'd)

Figure 20-23-10



Remove the O-ring (Item 1) from the piston (Item 2) **[Figure 20-23-10]**.

Figure 20-23-11

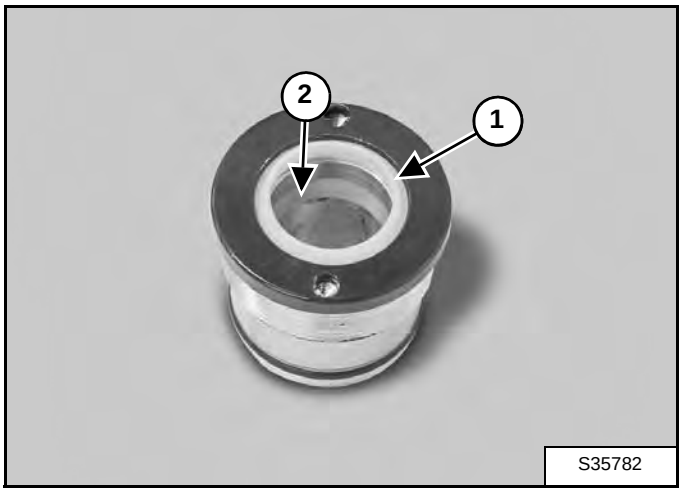


Remove the O-ring (Item 1) and the back-up ring (Item 2) from the groove in the head (Item 3) **[Figure 20-23-11]**.

NOTE: O-ring (Item 1) and back-up ring (Item 2) [Figure 20-23-11] were replaced, for a limited time, with a one piece seal. Service replacements may use either seal, as available.

Remove the O-ring (Item 4) **[Figure 20-23-11]**.

Figure 20-23-12



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head **[Figure 20-23-12]**.

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Assembly

Use the following tools to assemble the cylinder:

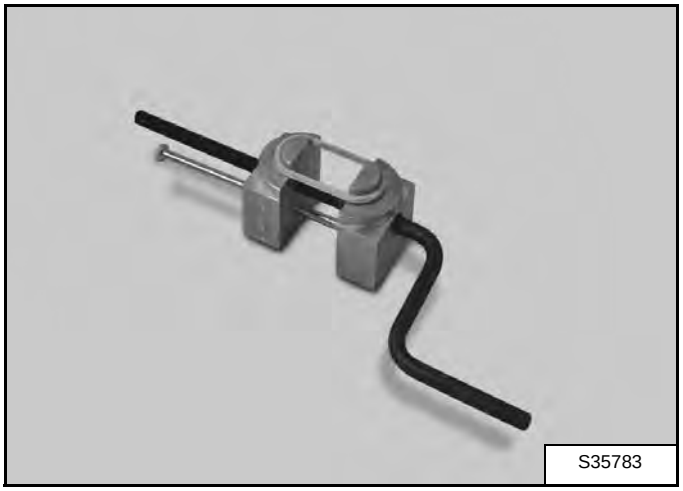
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

Clean all parts in solvent and dry with compressed air.

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

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

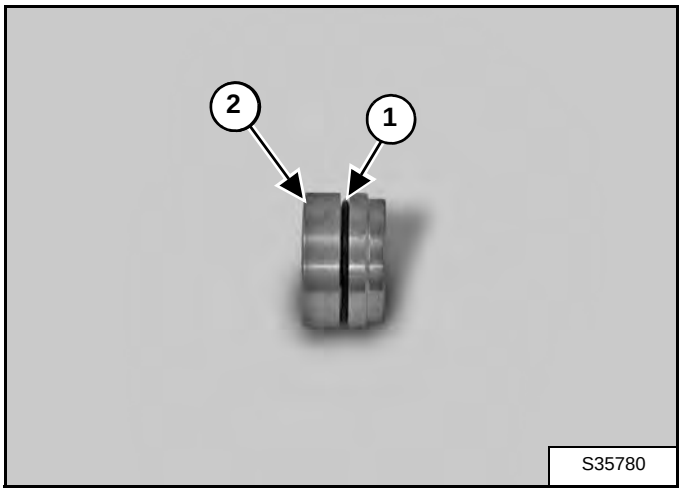
Figure 20-23-13



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-23-13]**.

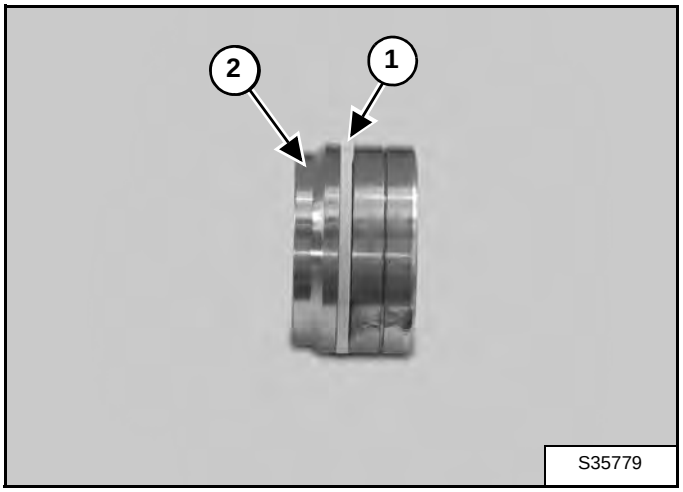
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-23-14



Standard piston: Install the O-ring (Item 1) on the piston (Item 2) **[Figure 20-23-14]**.

Figure 20-23-15



Install the seal (Item 1) on the piston (Item 2) **[Figure 20-23-15]**.

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Assembly (Cont'd)

Figure 20-23-16



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

Figure 20-23-17



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

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

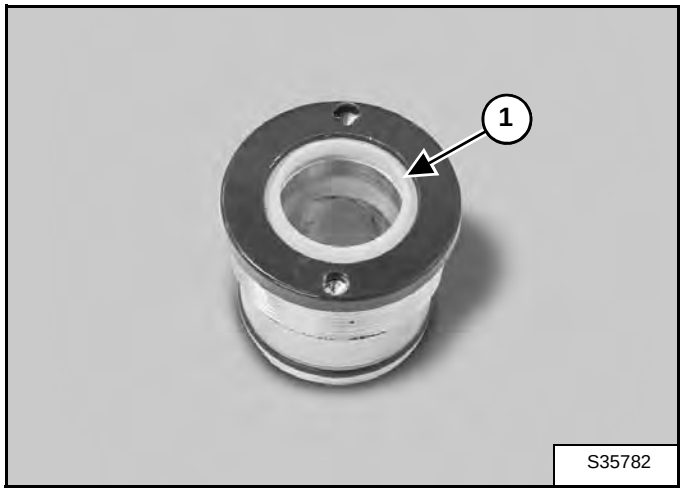
Rotate the handles to collapse the rod seal **[Figure 20-23-17]**.

Figure 20-23-18



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

Figure 20-23-19

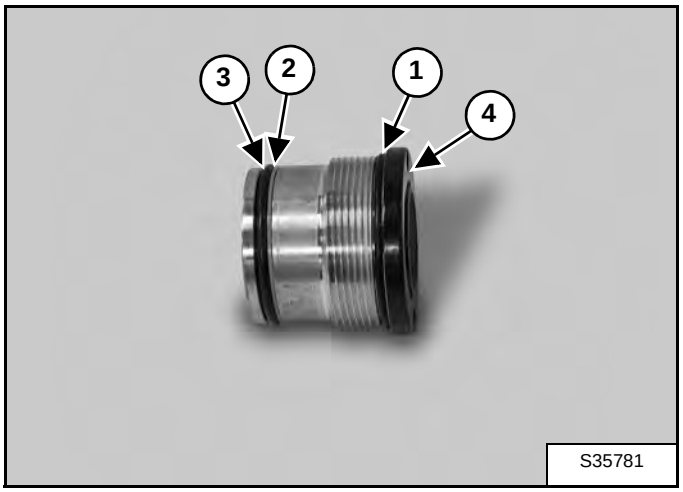


Install the wiper seal with the wiper (Item 1) **[Figure 20-23-19]** toward the outside of the head.

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Assembly (Cont'd)

Figure 20-23-20

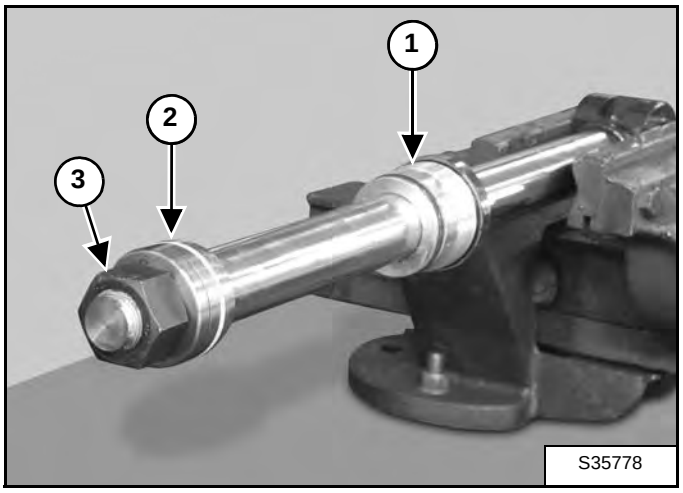


Install the O-ring (Item 1) **[Figure 20-23-20]**.

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

NOTE: O-ring (Item 3) and back-up ring (Item 2) [Figure 20-23-20] were replaced, for a limited time, with a one piece seal. Service replacements may use either seal, as available.

Figure 20-23-21



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

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

Provide an adequate support for the cylinder before tightening.

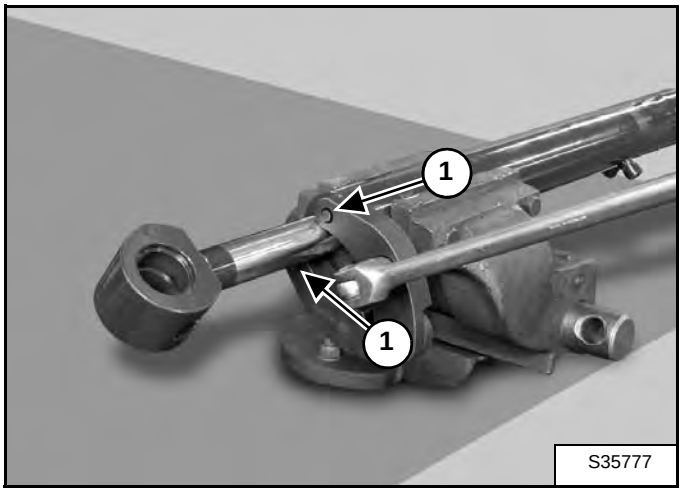
Install the nut (Item 3) **[Figure 20-23-21]**.

Tighten the nut to 122 N•m (90 ft-lb) torque.

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

Be careful no to damage the cylinder tube.

Figure 20-23-22



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-23-22]**. Tighten the head to 271 N•m (200 lb-ft) torque.

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CYLINDER (BLADE)

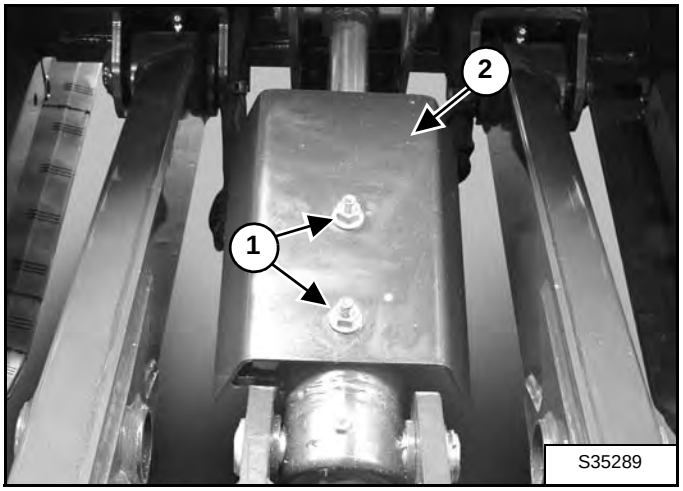
Testing

Swing the upperstructure out of the way. Lower the boom / bucket to the ground. Raise the blade to its highest position.

Stop the engine.

Support the blade. With the key in the ON position, move the blade control to release the hydraulic pressure. Raise the control console.

Figure 20-24-1



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

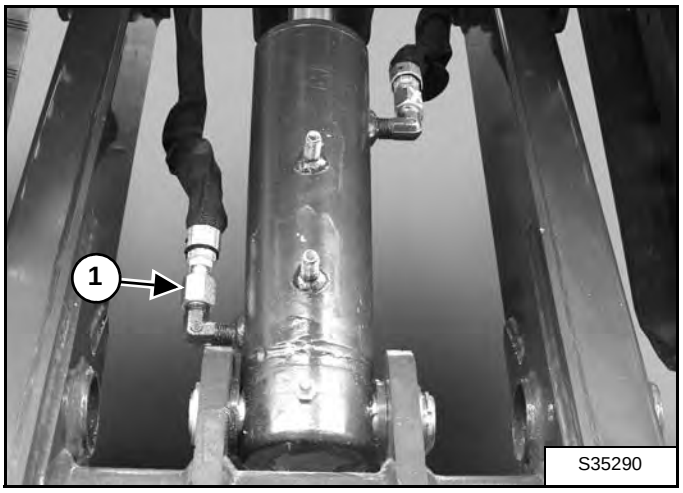
Remove the blade cylinder shield (Item 2) **[Figure 20-24-1]** from the blade cylinder.

⚠ WARNING

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

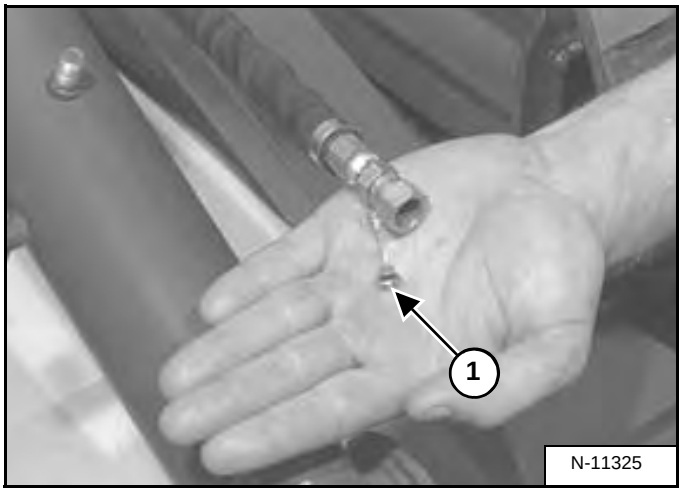
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Figure 20-24-2



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

Figure 20-24-3



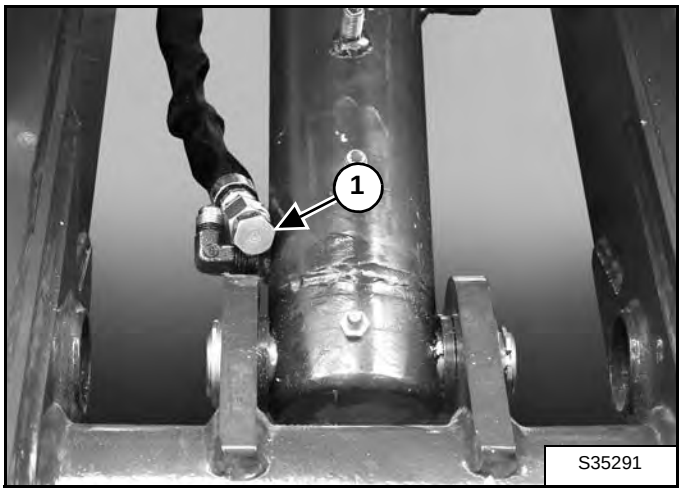
NOTE: Use care not to lose the orifice (Item 1) [Figure 20-24-3] located in the cylinder rod end hose.

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CYLINDER (BLADE) (CONT'D)

Removal And Installation

Figure 20-24-4



Install a plug (Item 1) **[Figure 20-24-4]** on the hose fitting and tighten.

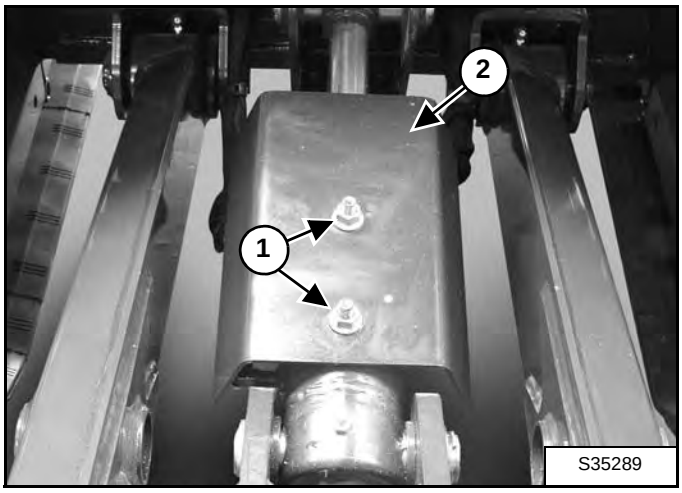
Lower the control console. Start the engine and retract the blade cylinder.

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

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

Support the blade. With the key in the ON position, move the blade control to release the hydraulic pressure. Raise the control console.

Figure 20-24-5



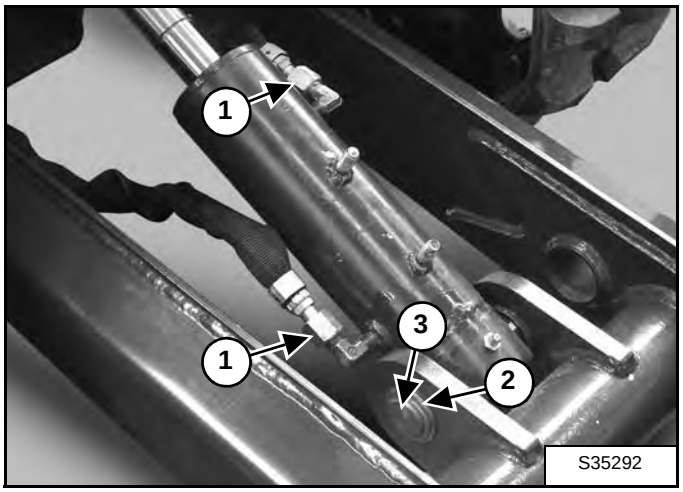
Remove the top two nuts (Item 1) from the shield (Item 2) **[Figure 20-24-5]**.

Remove the blade cylinder shield (Item 2) **[Figure 20-24-5]** from the blade cylinder.

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Removal And Installation (Cont'd)

Figure 20-24-6



Remove and plug the blade cylinder hoses (Item 1) **[Figure 20-24-6]**.

Remove the snap ring and washer (Item 2) **[Figure 20-24-6]** (Both sides) from the cylinder base end.

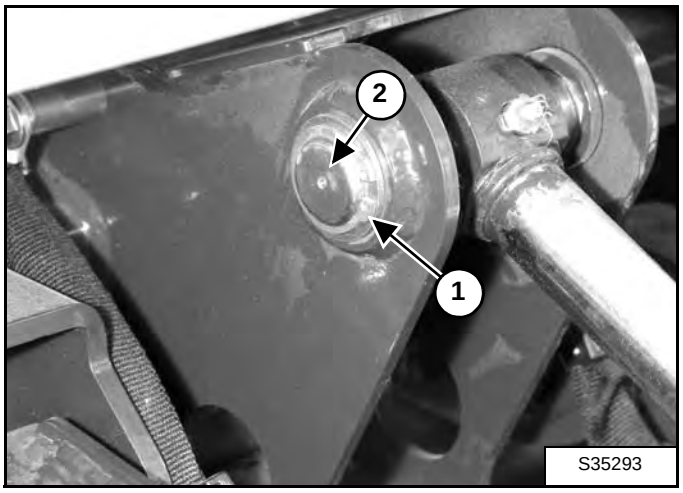
Remove the cylinder base end retaining pin (Item 3) **[Figure 20-24-6]**.

IMPORTANT

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

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Figure 20-24-7



Remove the snap ring and washer (Item 1) **[Figure 20-24-7]** (Both sides) from the cylinder rod end.

Remove the cylinder rod end retaining pin (Item 2) **[Figure 20-24-7]**.

Remove the blade cylinder.

⚠ 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.

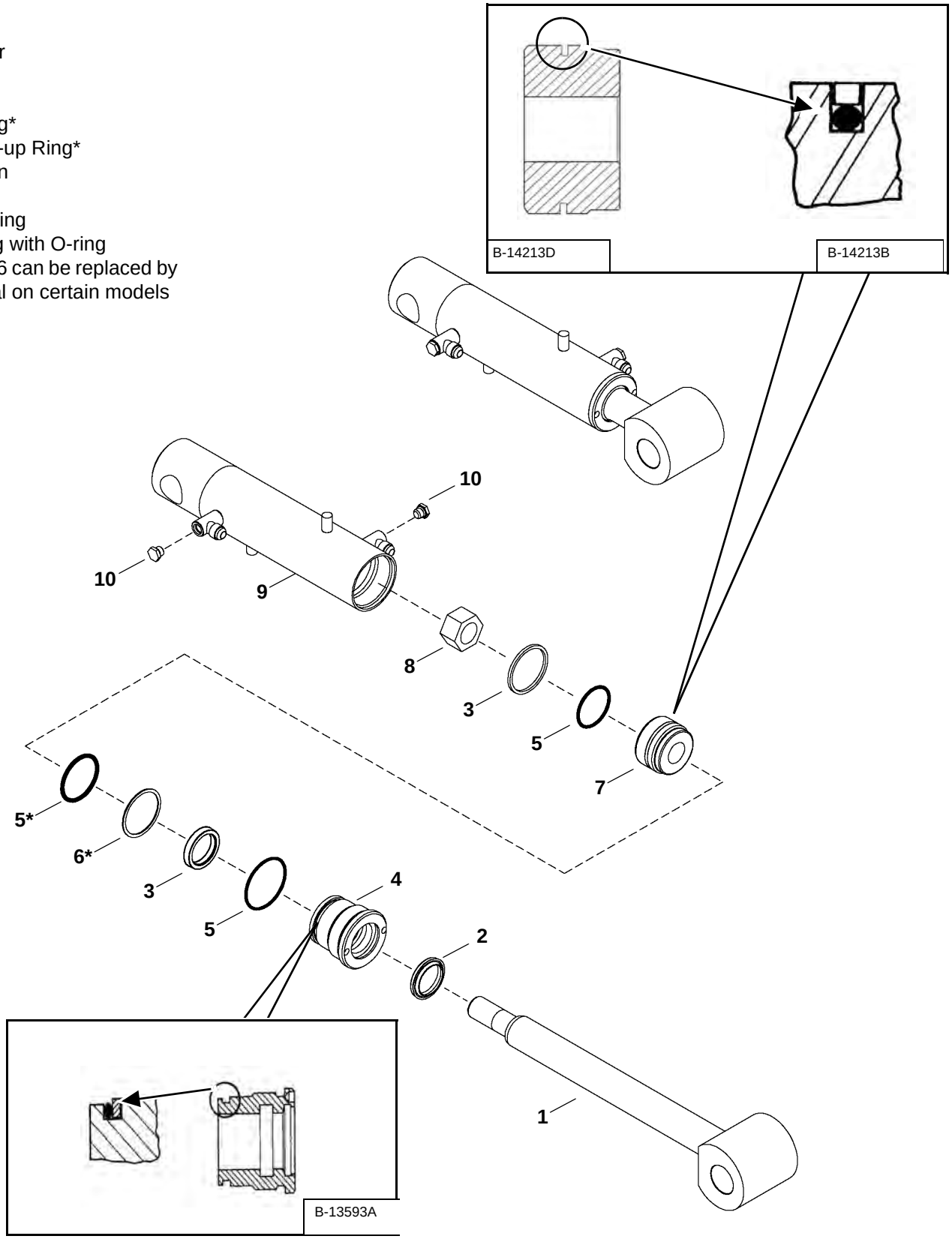
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Parts Identification

1. Rod
2. Wiper
3. Seal
4. Head
5. O-ring*
6. Back-up Ring*
7. Piston
8. Nut
9. Housing
10. Plug with O-ring

* 5 and 6 can be replaced by one seal on certain models



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Disassembly

Clean the outside of the blade cylinder before disassembly.

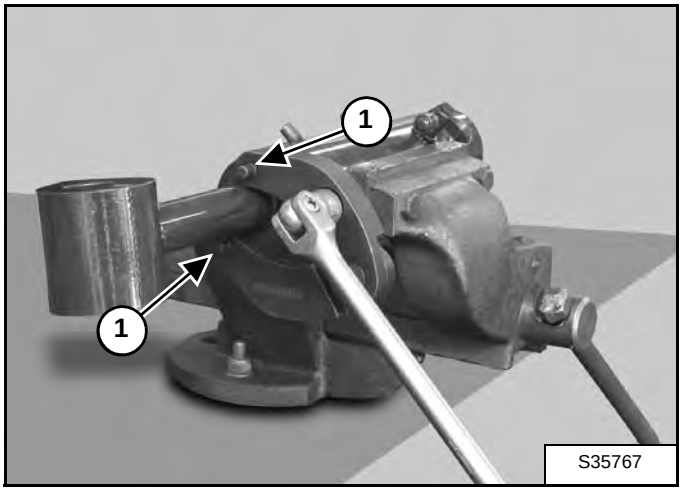
Use the following tools to disassemble the cylinder:

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

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

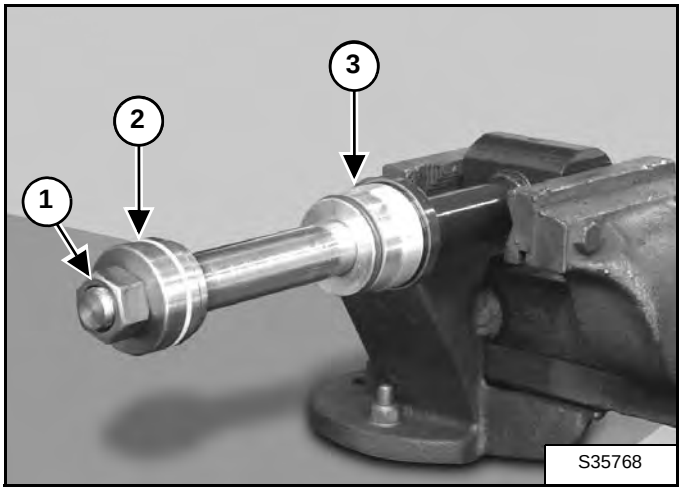
Put the base end of the cylinder in a vise.

Figure 20-24-8



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-24-8]** to loosen the head.

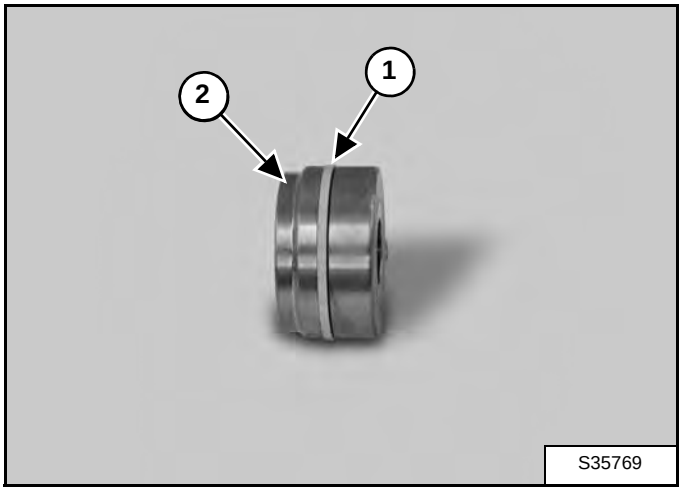
Figure 20-24-9



Remove the head and the rod assembly from the cylinder **[Figure 20-24-9]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-24-9]**.

Figure 20-24-10

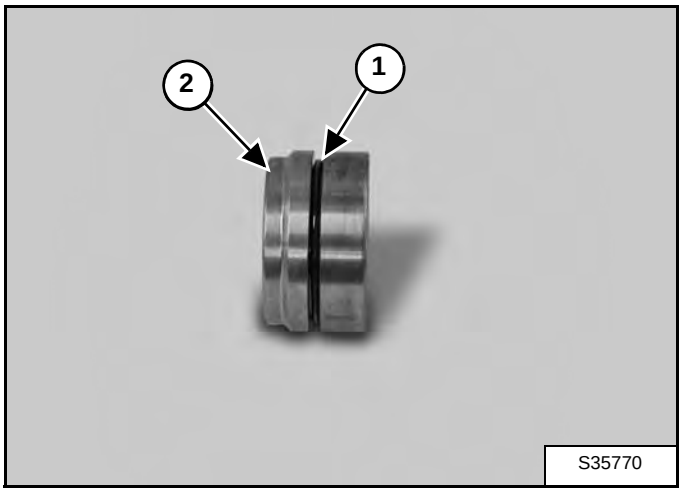


Standard piston: Remove the seal (Item 1) from the piston (Item 2) **[Figure 20-24-10]**.

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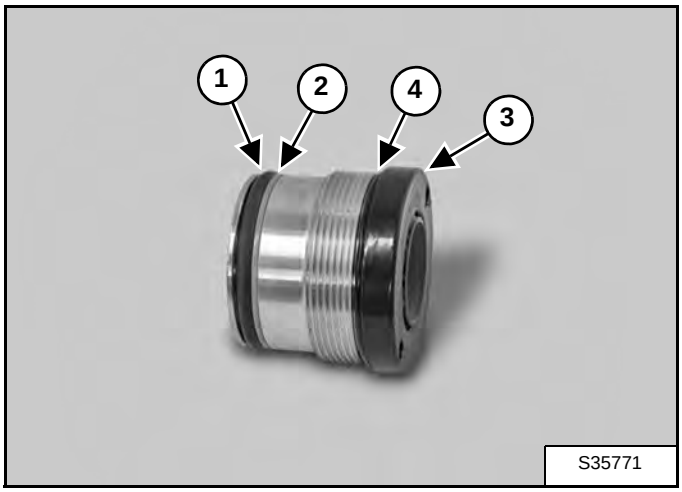
Disassembly (Cont'd)

Figure 20-24-11



Remove the O-ring (Item 1) from the piston (Item 2) **[Figure 20-24-11]**.

Figure 20-24-12

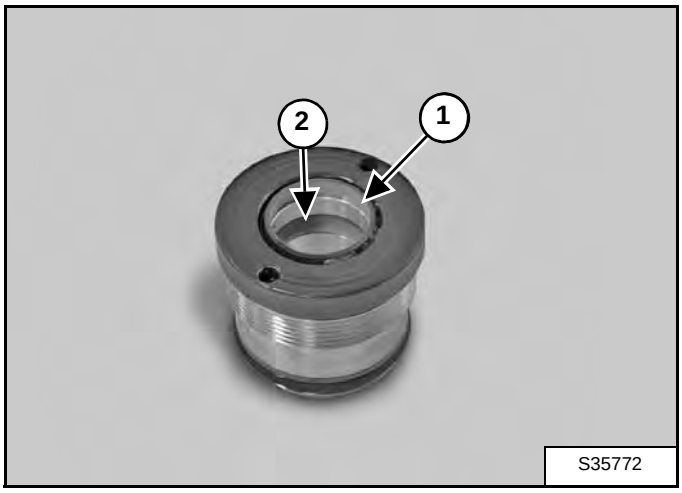


Remove the O-ring (Item 1) and the back-up ring (Item 2) from the cylinder head (Item 3) **[Figure 20-24-12]**.

NOTE: O-ring (Item 1) and back-up ring (Item 2) [Figure 20-24-12] were replaced, for a limited time, with a one piece seal. Service replacements may use either seal, as available.

Remove the O-ring (Item 4) **[Figure 20-24-12]**.

Figure 20-24-13



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head **[Figure 20-24-13]**.

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Assembly

Use the following tools to assemble the cylinder:

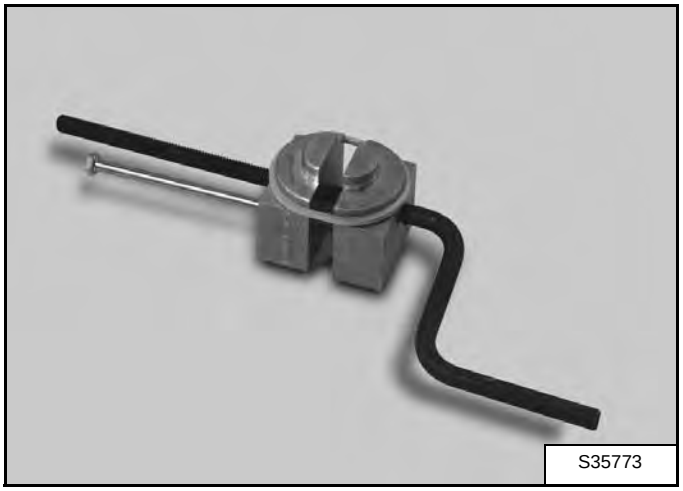
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

Clean all parts in solvent and dry with compressed air.

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

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

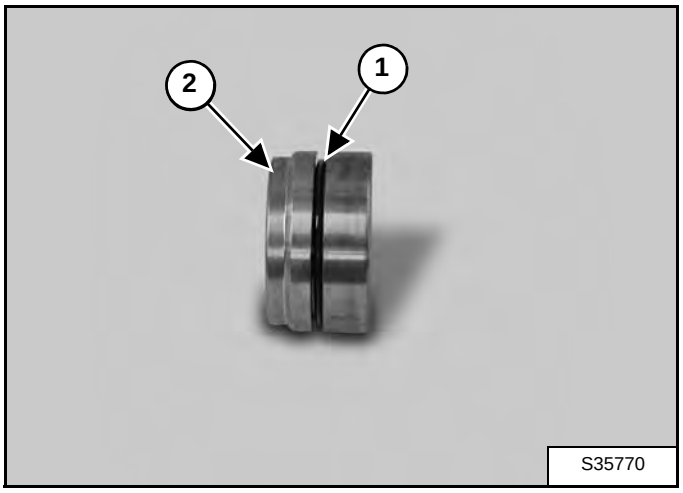
Figure 20-24-14



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-24-14]**.

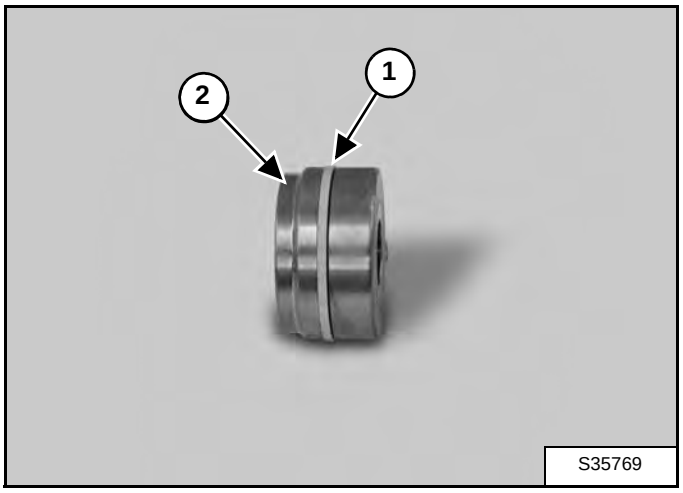
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-24-15



Standard piston: Install the O-ring (Item 1) on the piston (Item 2) **[Figure 20-24-15]**.

Figure 20-24-16



Install the seal (Item 1) on the piston (Item 2) **[Figure 20-24-16]**.

Dealer Copy -- Not for Resale

CYLINDER (BLADE) (CONT'D)

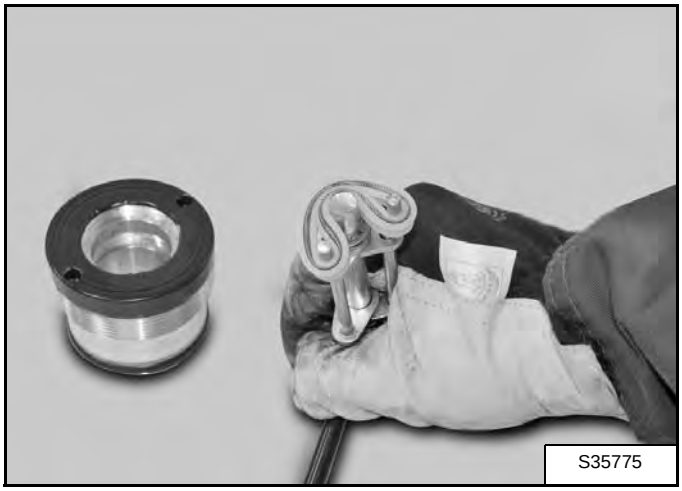
Assembly (Cont'd)

Figure 20-24-17



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-24-17]**.

Figure 20-24-18



Install the rod seal on the rod seal tool **[Figure 20-24-18]**.

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

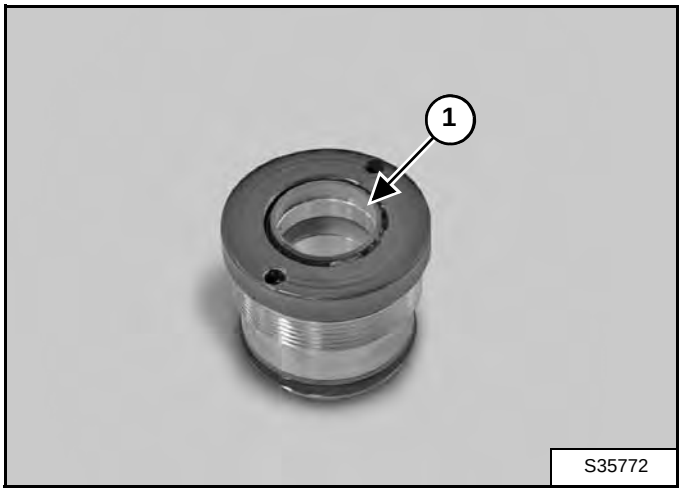
Rotate the handles to collapse the rod seal **[Figure 20-24-18]**.

Figure 20-24-19



Install the rod seal in the head **[Figure 20-24-19]**.

Figure 20-24-20

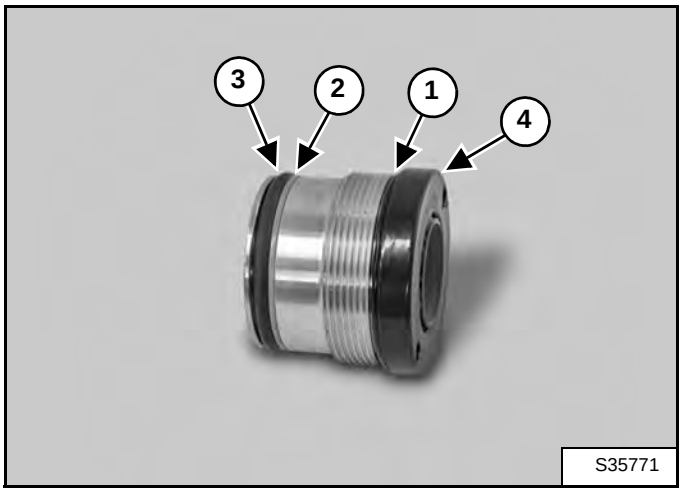


Install the wiper seal with the wiper (Item 1) **[Figure 20-24-20]** toward the outside of the head.

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Assembly (Cont'd)

Figure 20-24-21

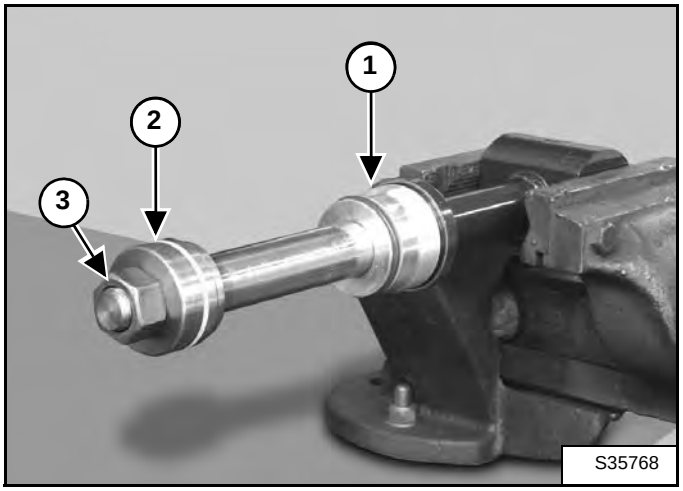


Install the O-ring (Item 1) **[Figure 20-24-21]**.

Install the back-up ring (Item 2) and O-ring (Item 3) into the groove on the head (Item 4) **[Figure 20-24-21]**.

NOTE: O-ring (Item 3) and back-up ring (Item 2) [Figure 20-24-21] were replaced, for a limited time, with a one piece seal. Service replacements may use either seal, as available.

Figure 20-24-22



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

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

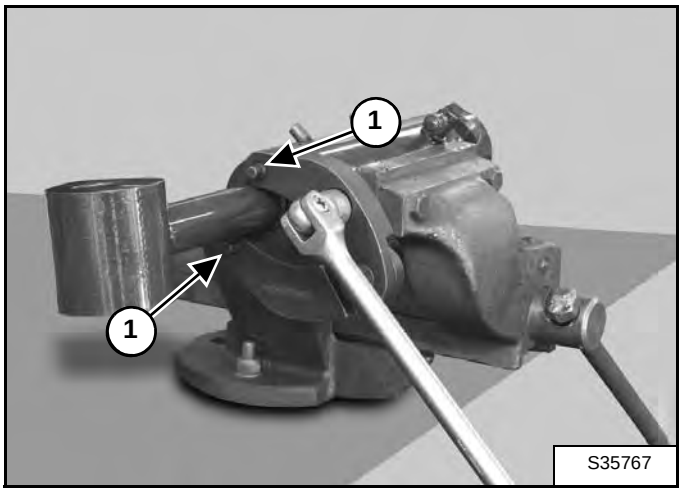
Provide an adequate support for the cylinder before tightening.

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

Tighten the nut (Item 3) **[Figure 20-24-22]** to 339 N•m (250 ft-lb) torque.

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

Figure 20-24-23



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-24-23]**. Tighten the head to 156 N•m (115 ft-lb) torque.

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CYLINDER (TRACK FRAME EXPANSION)

Testing

Retract the track frame fully.

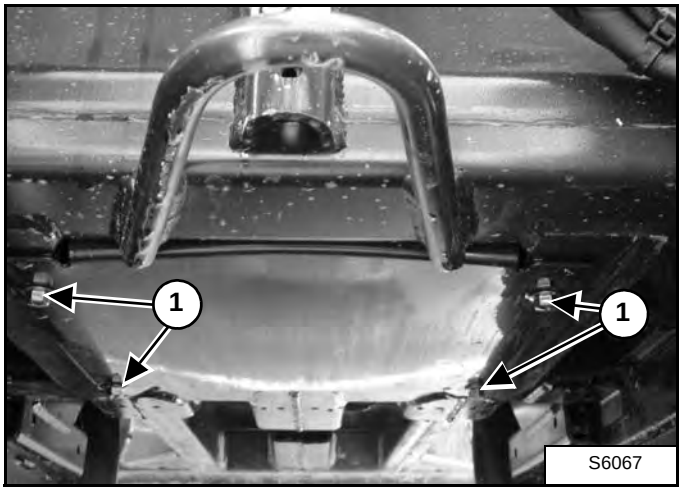
Figure 20-25-1



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

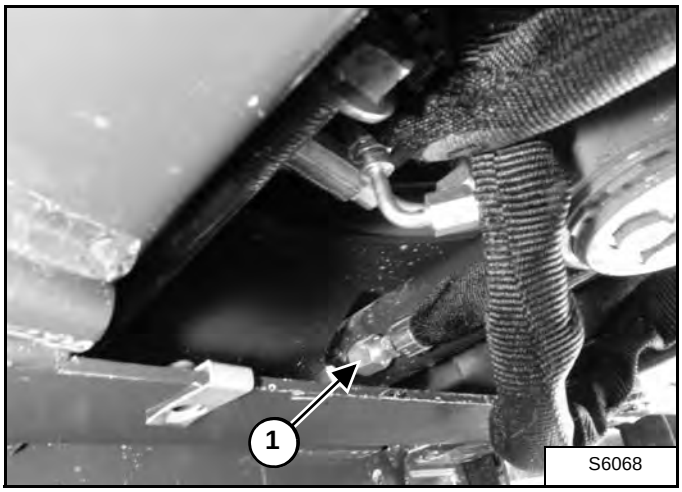
Stop the engine. Raise the control console.

Figure 20-25-2



Remove the four bolts (Item 1) **[Figure 20-25-2]** fastening the cover to the bottom side of the undercarriage. Remove the cover.

Figure 20-25-3



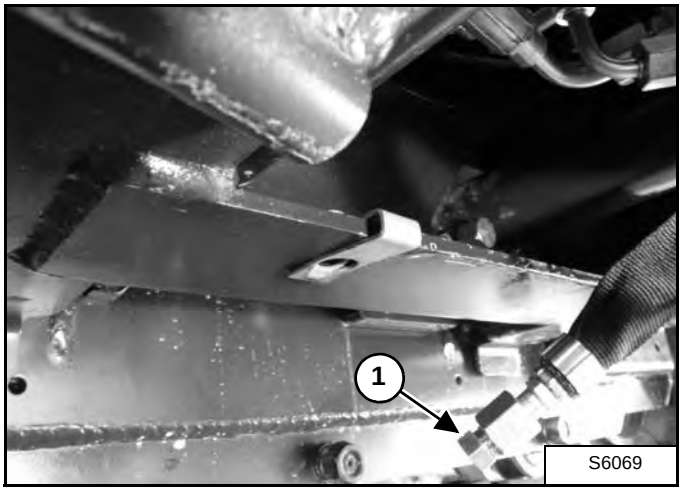
Remove the expansion cylinder base end hose (Item 1) **[Figure 20-25-3]**.

WARNING

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

W-2145-EN-0210

Figure 20-25-4



Install a plug (Item 1) **[Figure 20-25-4]** on the hose fitting and tighten.

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

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Testing (Cont'd)

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

Removal And Installation

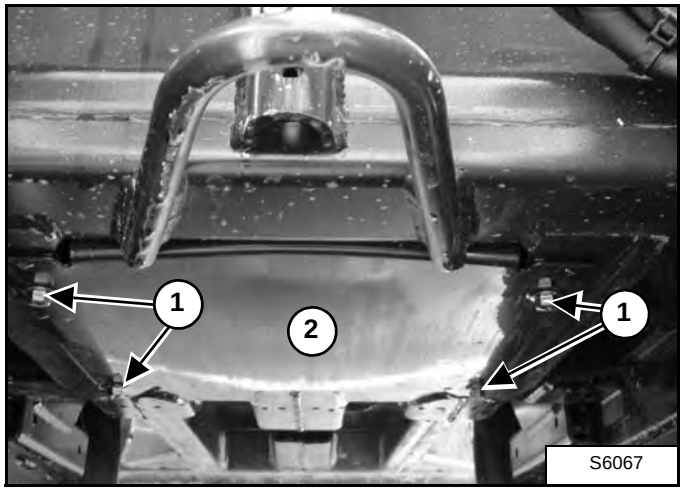
Fully expand the track frame.

Figure 20-25-5



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

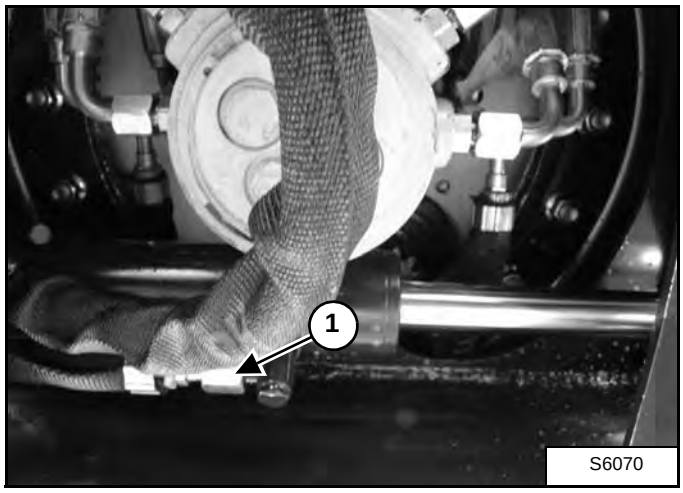
Figure 20-25-6



Remove the four bolts (Item 1) **[Figure 20-25-6]**.

Remove the access plate (Item 2) **[Figure 20-25-6]**.

Figure 20-25-7



Remove the hose (Item 1) **[Figure 20-25-7]** from the cylinder rod end.

IMPORTANT

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

I-2003-0888

⚠ WARNING

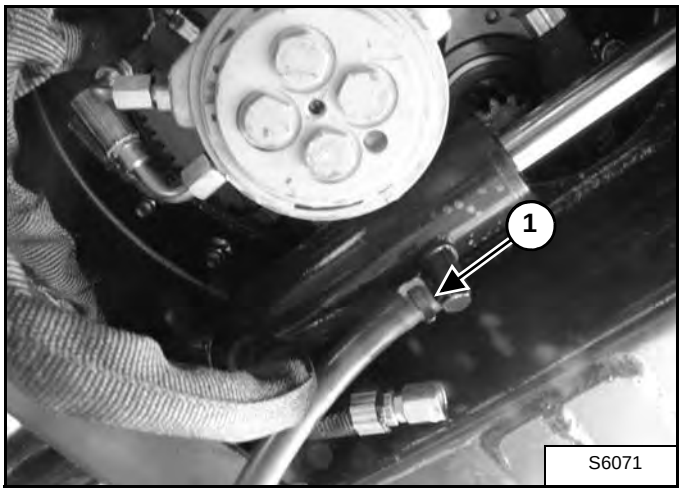
Hydraulic fluid escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. This can cause serious injury and possible death if proper medical treatment by a doctor familiar with this injury is not received immediately.

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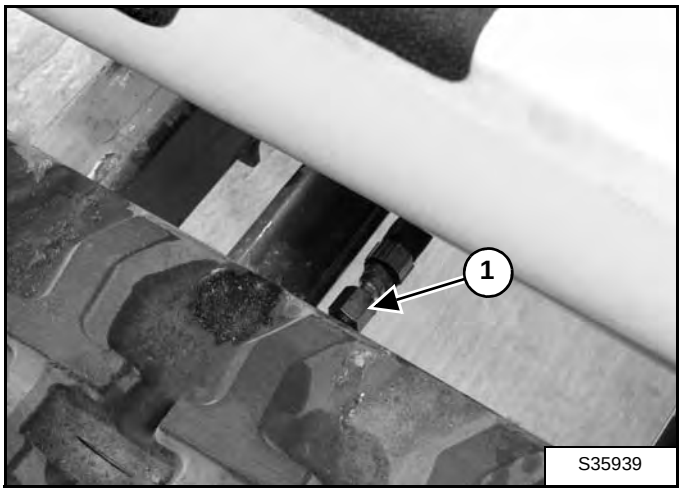
Removal And Installation (Cont'd)

Figure 20-25-8



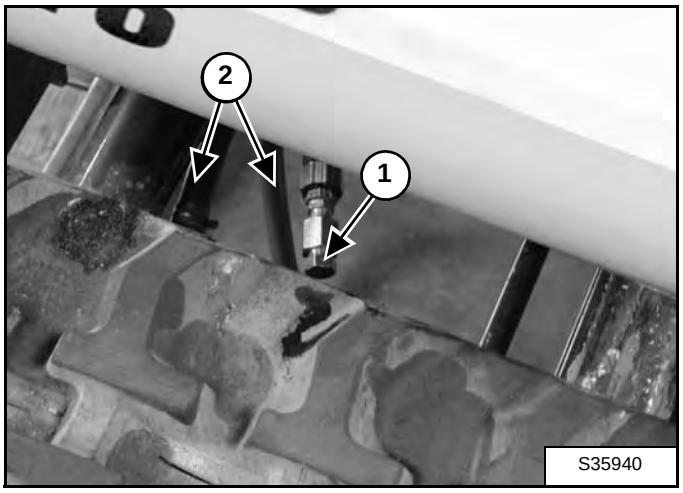
Install a hose (Item 1) **[Figure 20-25-8]** on the cylinder rod end. Place the other end of the hose in a drain pan.

Figure 20-25-9



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

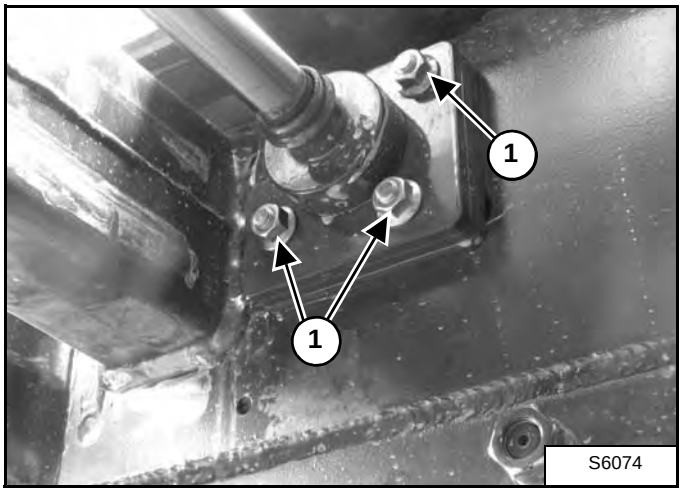
Figure 20-25-10



Plug the base end hose (Item 1) **[Figure 20-25-10]**.

Install a hose (Item 2) **[Figure 20-25-10]** on the cylinder base end. Place the other end of the hose in a drain pan.

Figure 20-25-11



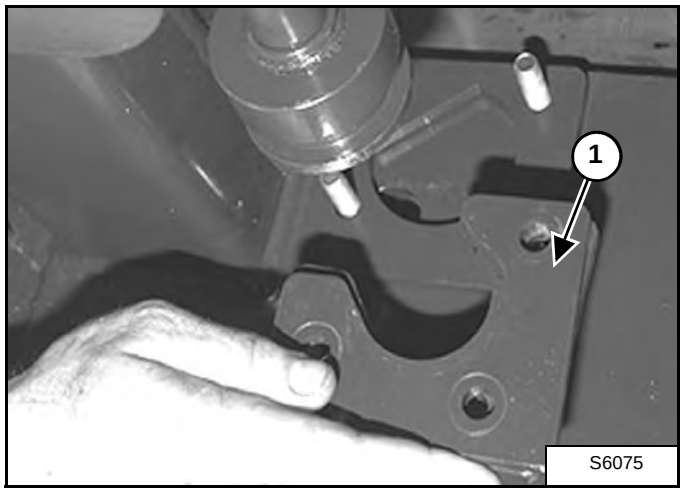
Remove the three nuts (Item 1) **[Figure 20-25-11]** from the rod end of the cylinder.

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

Dealer Copy -- Not for Resale

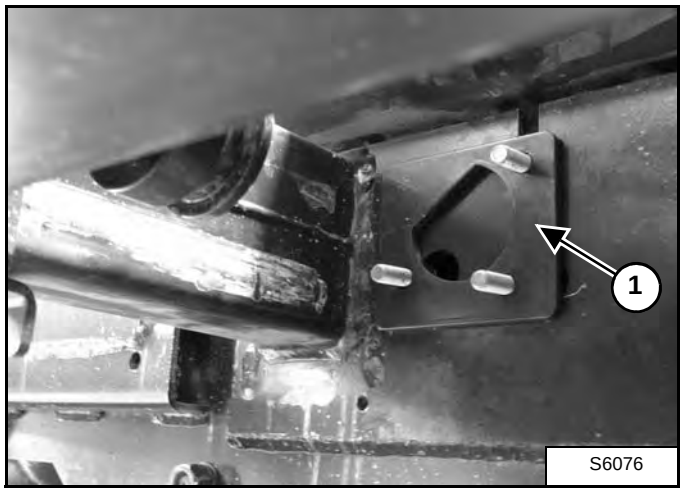
Removal And Installation (Cont'd)

Figure 20-25-12



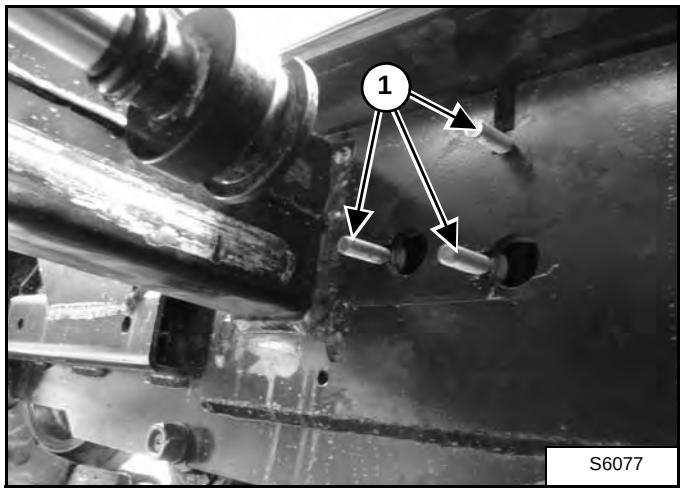
Slightly compress the cylinder. Remove the two plates (Item 1) **[Figure 20-25-12]** from the rod end of the cylinder.

Figure 20-25-13



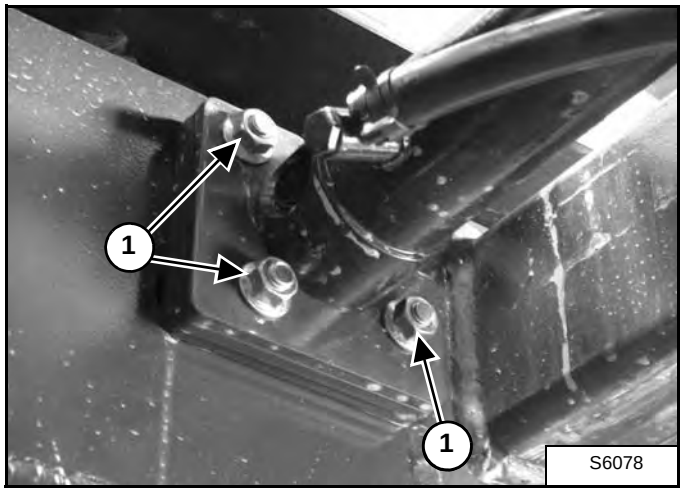
Remove the mount plate (Item 1) **[Figure 20-25-13]** from the track frame.

Figure 20-25-14



Remove the three bolts (Item 1) **[Figure 20-25-14]** and retaining clips from the track frame.

Figure 20-25-15



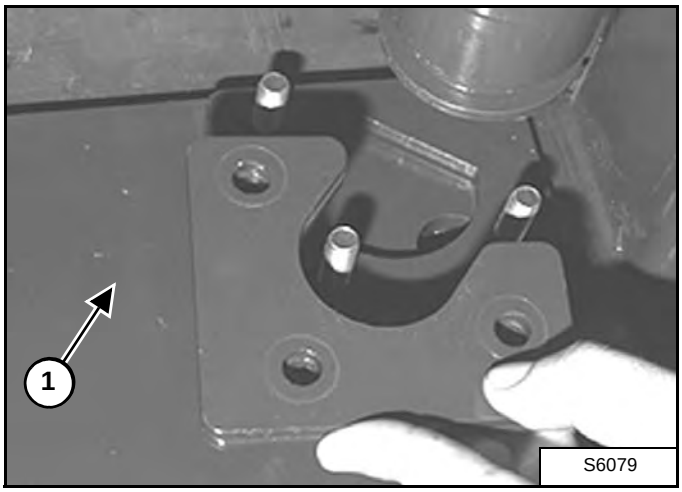
Remove the three nuts (Item 1) **[Figure 20-25-15]** from the base end of the cylinder.

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

Dealer Copy -- Not for Resale

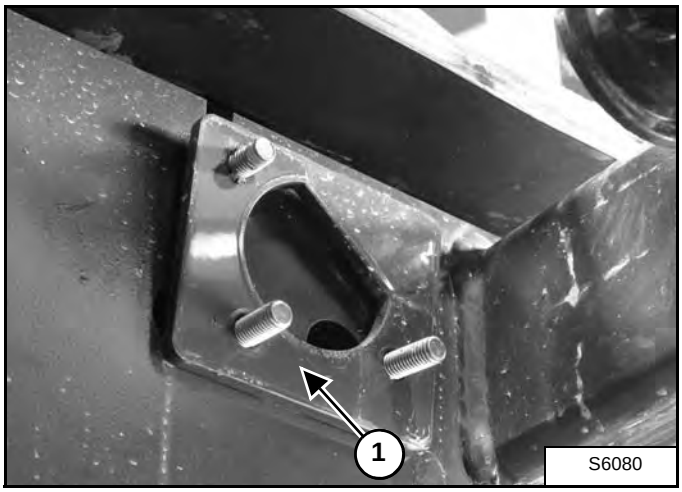
Removal And Installation (Cont'd)

Figure 20-25-16



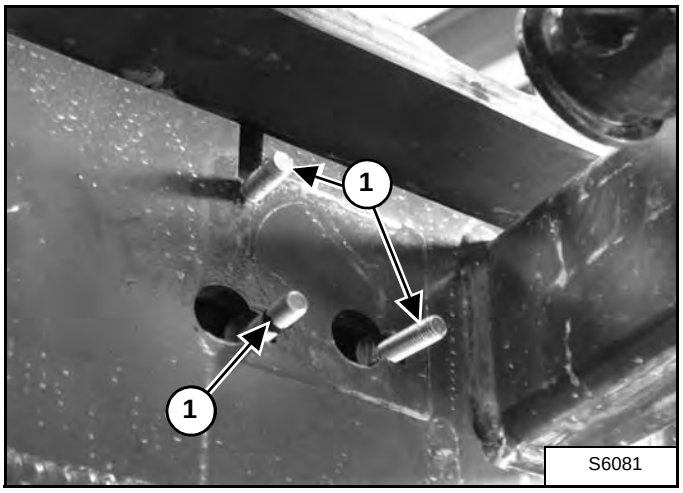
Pull the cylinder out of the mount. Remove the two plates (Item 1) **[Figure 20-25-16]** from the base end of the cylinder.

Figure 20-25-17



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

Figure 20-25-18

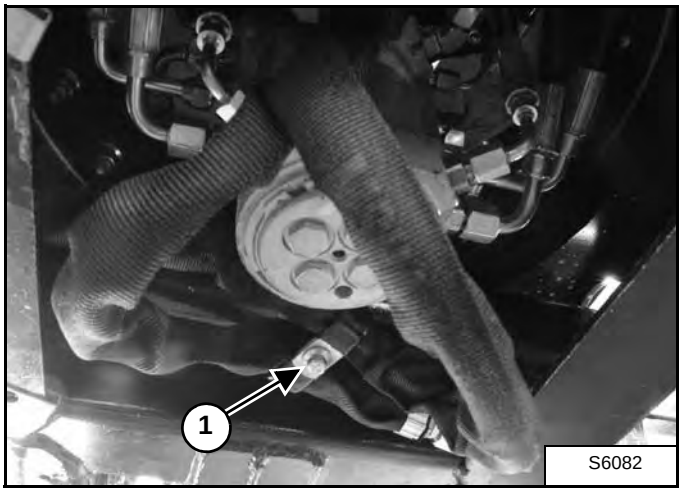


Remove the three bolts (Item 1) **[Figure 20-25-18]** and retaining clips from the track frame.

Compress the cylinder.

Rotate the cylinder until the hose clamp is accessible.

Figure 20-25-19



Remove the bolt (Item 1) **[Figure 20-25-19]**.

Remove the cylinder.

⚠ WARNING

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.

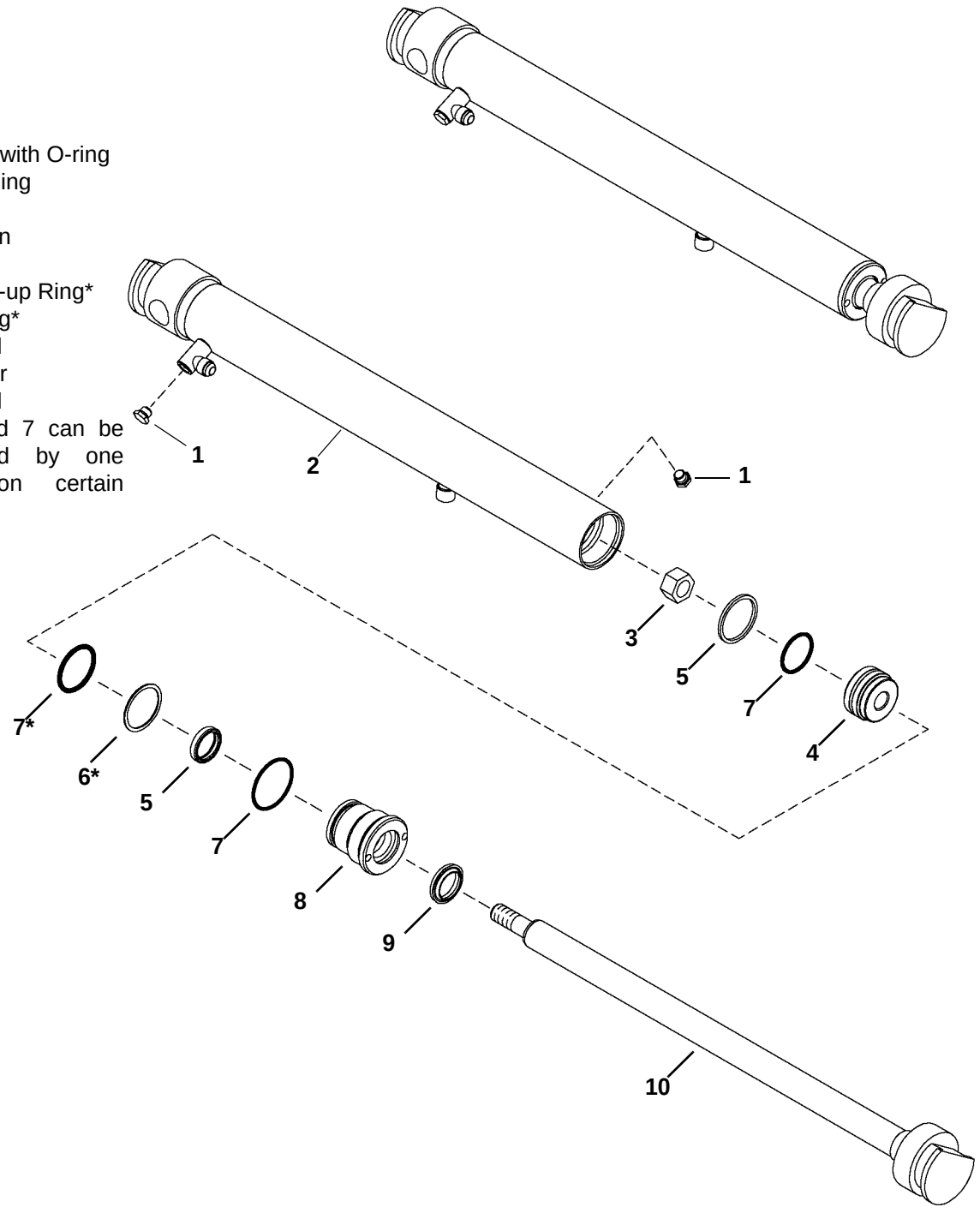
W-2103-0508

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Parts Identification

1. Plug with O-ring
2. Housing
3. Nut
4. Piston
5. Seal
6. Back-up Ring*
7. O-ring*
8. Head
9. Wiper
10. Rod

* 6 and 7 can be replaced by one seal on certain models



PE2755

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Disassembly

Clean the outside of the expansion cylinder before disassembly.

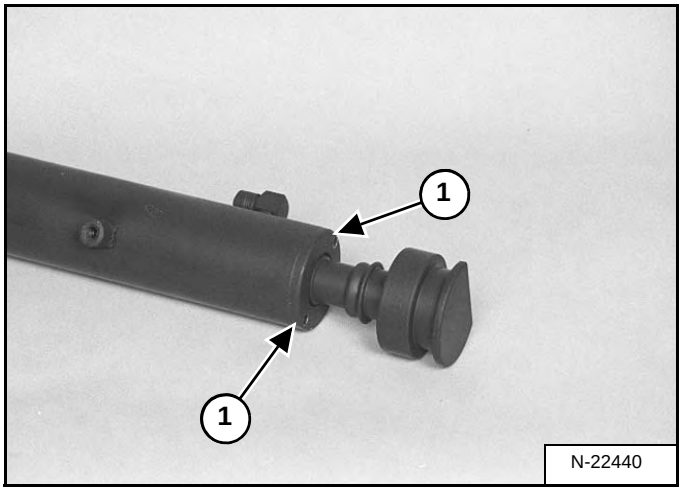
Use the following tools to disassemble the cylinder:

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

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

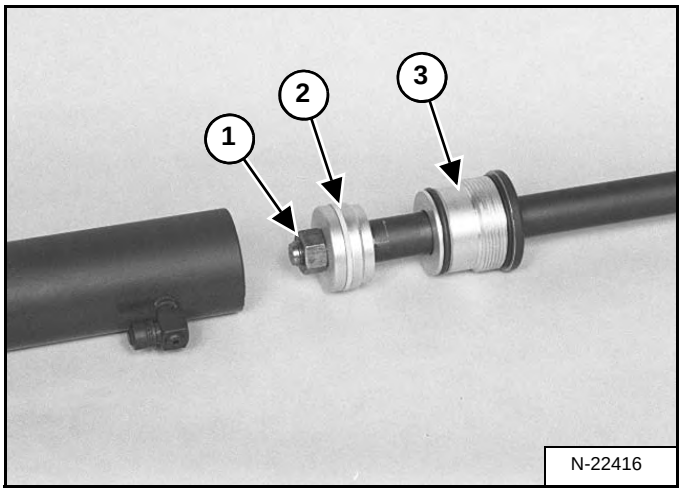
Put the base end of the cylinder in a vise.

Figure 20-25-20



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

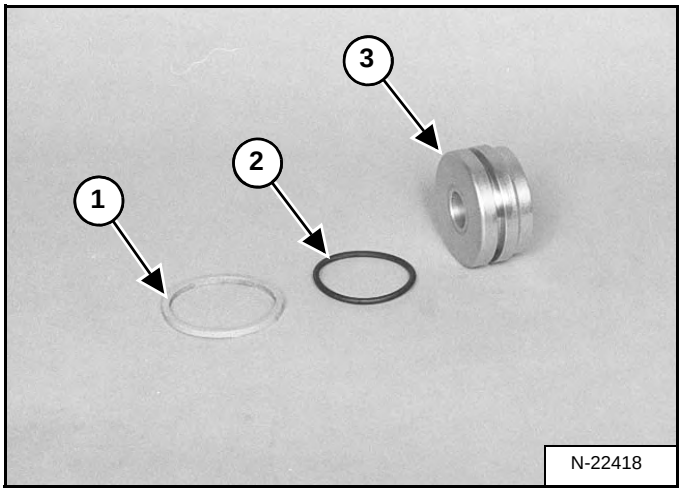
Figure 20-25-21



Remove the head and the rod assembly from the cylinder **[Figure 20-25-21]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-25-21]**.

Figure 20-25-22

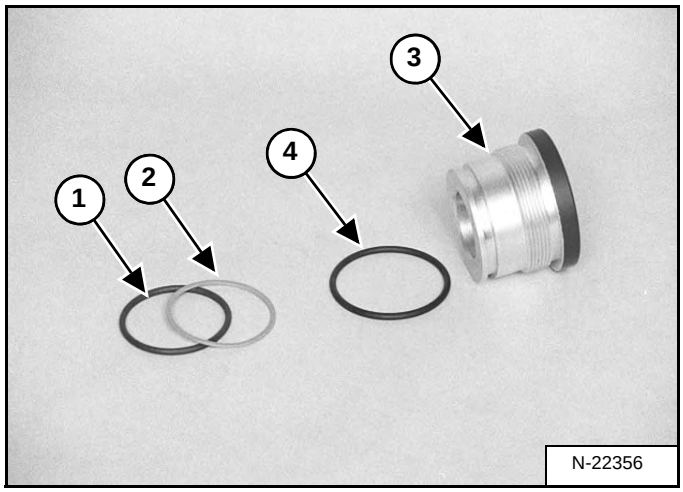


Standard Piston: Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-25-22]**.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

Figure 20-25-23

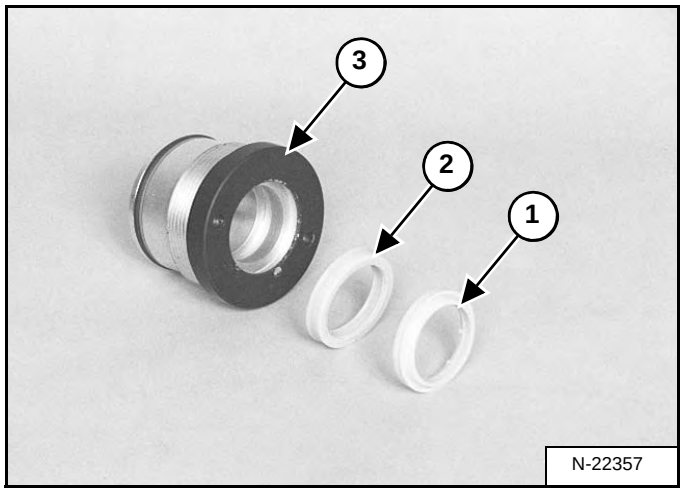


Remove the O-ring (Item 1) and the back-up ring (Item 2) from the groove in the head (Item 3) **[Figure 20-25-23]**.

NOTE: O-ring (Item 1) and back-up ring (Item 2) [Figure 20-25-23] were replaced, for a limited time, with a one piece seal. Service replacements may use either seal, as available.

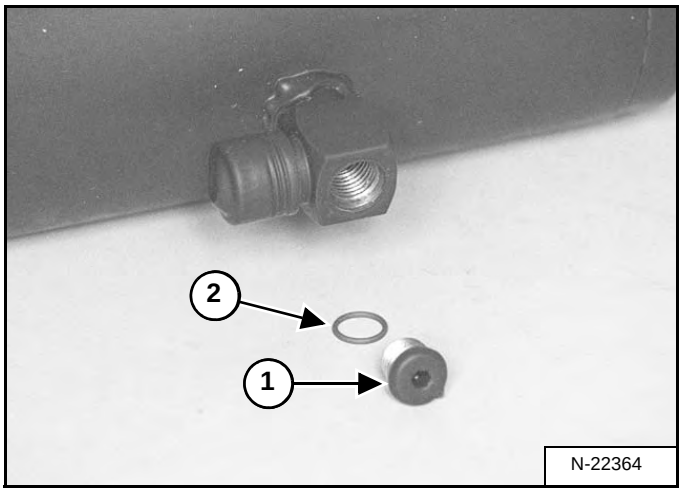
Remove the thin O-ring (Item 4) **[Figure 20-25-23]**.

Figure 20-25-24



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-25-24]**.

Figure 20-25-25



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

Dealer Copy -- Not for Resale

Assembly

Use the following tools to assemble the cylinder:

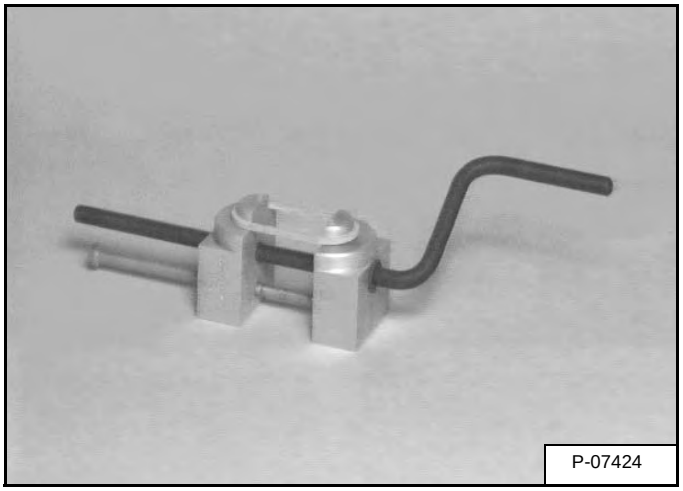
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

Clean all parts in solvent and dry with compressed air.

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

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

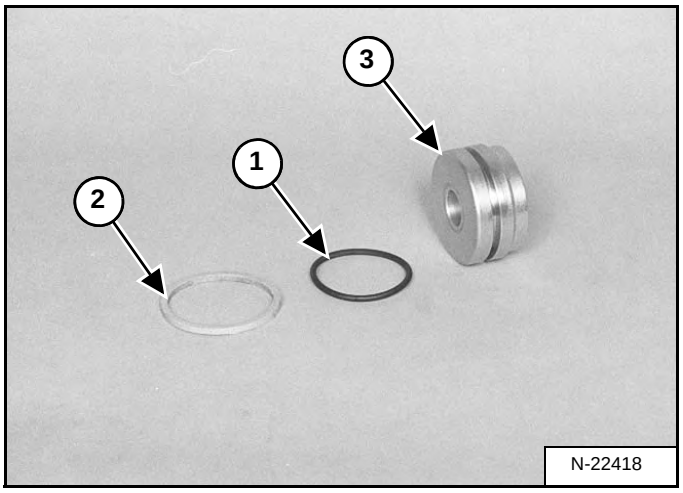
Figure 20-25-26



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

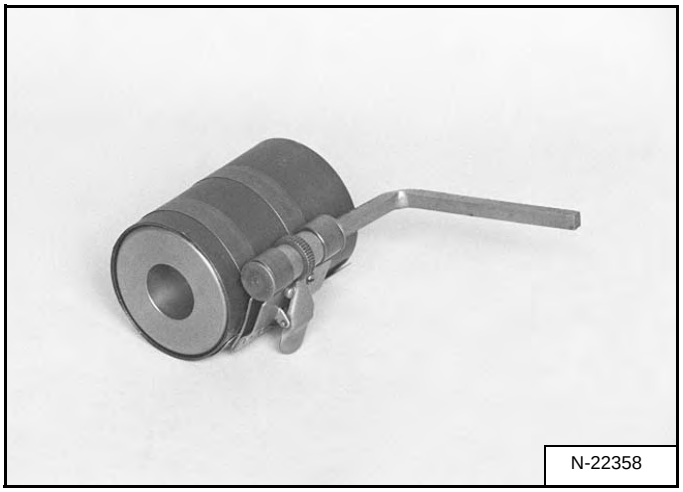
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-25-27



Standard Piston: Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-25-27]**.

Figure 20-25-28

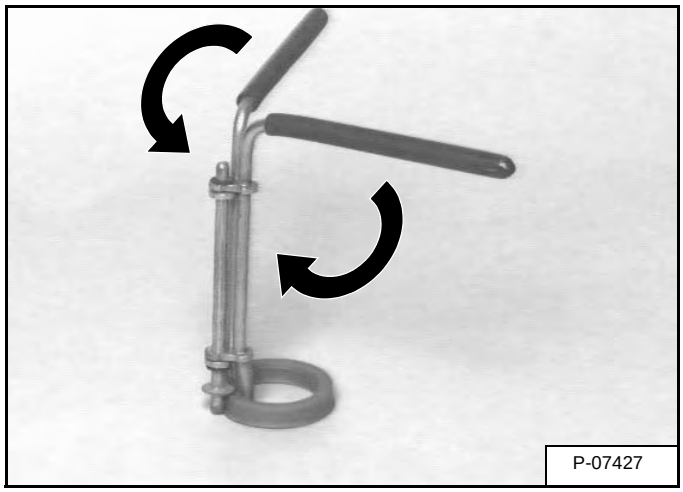


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-25-28]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-25-29

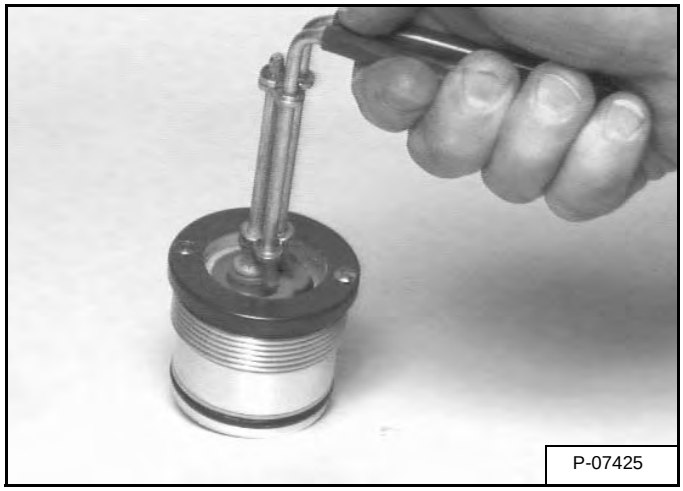


Install the rod seal on the rod seal tool **[Figure 20-25-29]**.

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

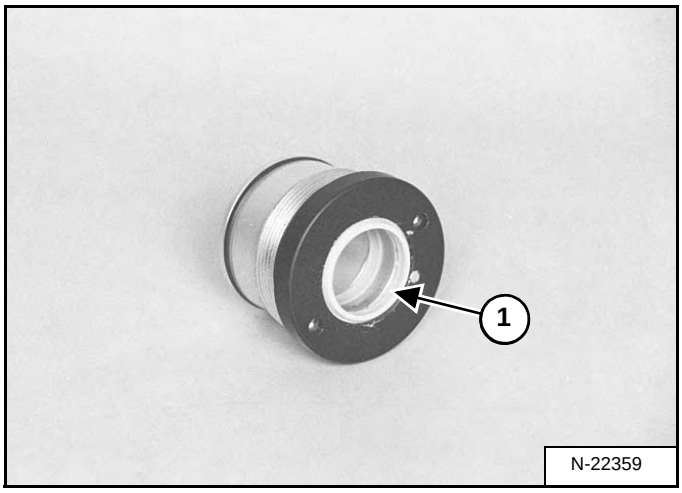
Rotate the handles to collapse the rod seal **[Figure 20-25-29]**.

Figure 20-25-30



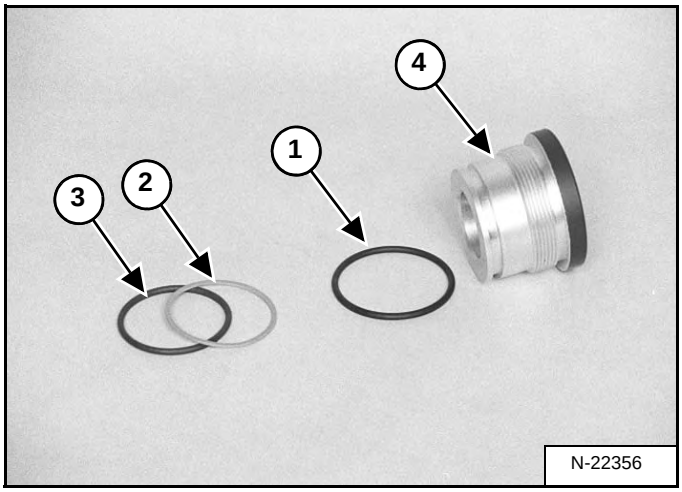
Install the rod seal in the head **[Figure 20-25-30]**.

Figure 20-25-31



Install the wiper seal with the wiper (Item 1) **[Figure 20-25-31]** toward the outside of the head.

Figure 20-25-32



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

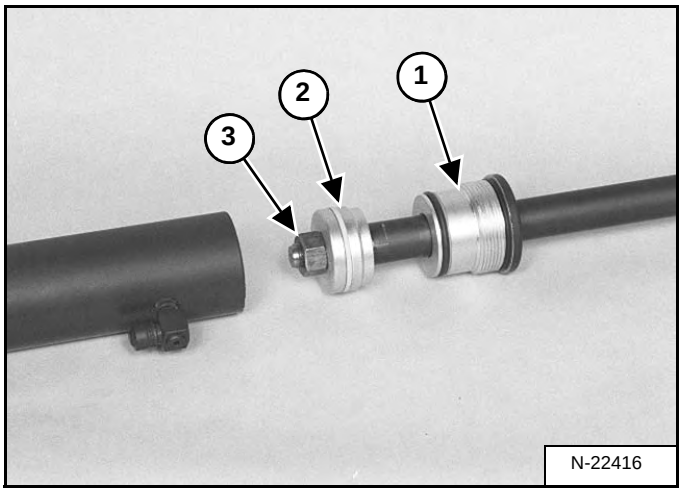
Install the back-up ring (Item 2) and thick O-ring (Item 3) into the groove on the head (Item 4) **[Figure 20-25-32]**.

NOTE: O-ring (Item 3) and back-up ring (Item 2) [Figure 20-25-32] were replaced, for a limited time, with a one piece seal. Service replacements may use either seal, as available.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-25-33



Install the head (Item 1) and the piston (Item 2) **[Figure 20-25-33]** on the rod.

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

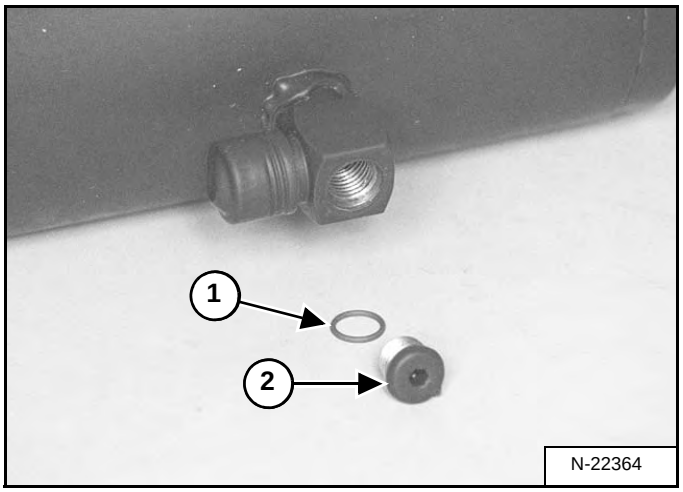
Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-25-33]**.

NOTE: Clean and dry the rod threads, install a NEW NUT with preapplied Loctite® from the kit.

Tighten the nut (Item 3) **[Figure 20-25-33]** to 190 N•m (140 ft-lb) torque.

Figure 20-25-34

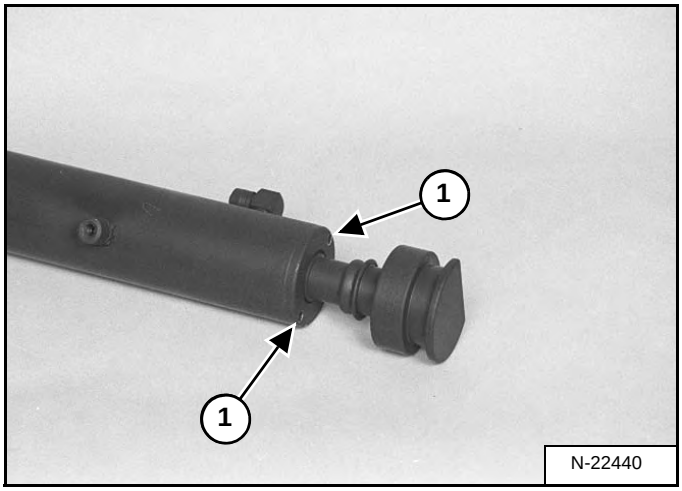


Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-25-34]**.

Tighten the plug (Item 2) **[Figure 20-25-34]** to 11 N•m (97.4 in-lb) torque.

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

Figure 20-25-35



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-25-35]**. Tighten the head to 183 N•m (135 ft-lb) torque.

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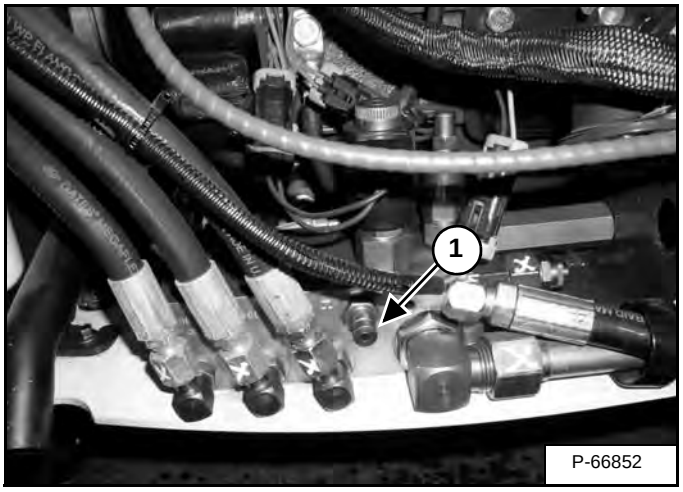
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VALVE (MAIN RELIEF)

Testing And Adjusting

All testing is done with the hydraulic fluid at operating temperature and the engine at high speed setting of 2500 rpm maximum.

Figure 20-30-1



There is one diagnostic coupler (Item 1) **[Figure 20-30-1]** on the manifold assembly for checking each of the pump section pressures.

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

MEL1355 - Test Kit includes the following:
MEL1355-3 - 34,5 MPa (345 bar) (5000 psi) Gauge
MEL1355-12 - Coupler
MEL1355-9 - Thermometer

System Pressures At Gauge Port Specifications

TEST CONDITIONS

1. Engine High Idle Speed

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

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

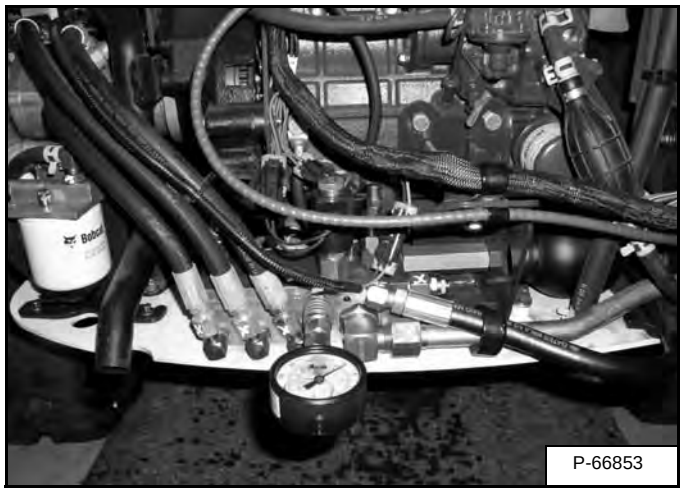
SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURISED	TEST PORT	TARGET MPa (bar) (psi)	ACCEPTABLE RANGE MPa (bar) (psi)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	PSI	3 (30) (435)	2,8 - 3,1 (28-31) (406 - 450)
PRESSURE BUILD - UP VALVE	NONE - CONSOLE DOWN	P1 and P2	G	2.861 (28,61) (415)	2,38 - 3,34 (23,8 - 33,4) (345 - 485)
SYSTEM BY - PASS	NONE - CONSOLE UP	DUMP TO TANK	G	0,79 (7,9) (115)	MAX ALLOWABLE 1,07 (10,7) (155)
MAIN RELIEF ON MANIFOLD BLOCK	BOOM	P2	G	23,1 (231) (3350)	22,4- 23,8 (224 - 238) (3248 - 3451)
MAIN RELIEF ON MANIFOLD BLOCK	AUXILIARY	P1 and P2	G	23,1 (231) (3350)	222,4- 23,8 (224 - 238) (3248 - 3451)
MAIN RELIEF ON MANIFOLD BLOCK	ARM	P1 and P2	G	23,1 (231) (3350)	22,4- 23,8 (224 - 238) (3248 - 3451)
SWING MOTOR - CROSS PORT RELIEF	SLEW RIGHT	P3	G	17,4 (174) (2525)	17- 17,7 (170- 177) (2465 - 2567)
SWING MOTOR - CROSS PORT RELIEF	SLEW LEFT	P3	G	17,4 (174) (2525)	17- 17,7 (170- 177) (2465 - 2567)

* Under seat at Bulkhead

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Testing And Adjusting (Cont'd)

Figure 20-30-2



Connect the test gauge coupler from the test kit to the "G" diagnostic port **[Figure 20-30-2]**.

Lower the control console and fasten the seat belt.

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

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

Operate the following circuits over relief and record the pressure for each circuit.

NOTE: Do not operate the blade circuit.

The main relief valve pressure at "G" diagnostic port **[Figure 20-30-2]** should be as follows:

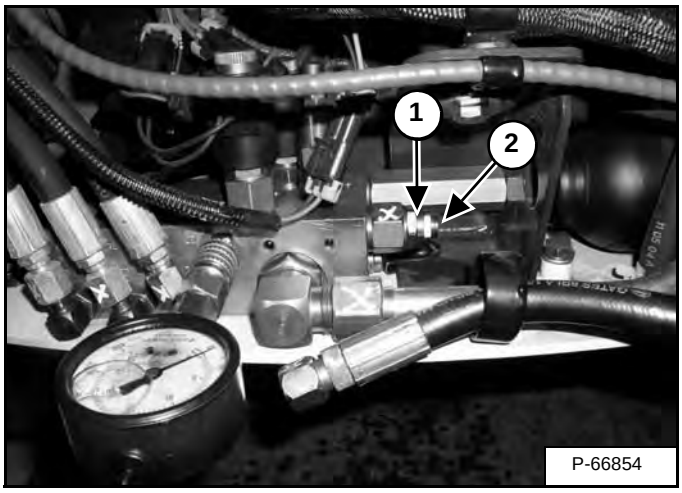
Boom up:
22,2 - 23,6 MPa (222 - 236 bar) (3220 - 3420 psi).

Arm in:
22,2 - 23,6 MPa (222 - 236 bar) (3220 - 3420 psi).

Auxiliary:
22.4 - 23,8 MPa (224 - 238 bar) (3248 - 3451 psi)

Stop the engine.

Figure 20-30-3



If adjustment is needed, loosen the nut (Item 1) **[Figure 20-30-3]**.

Turn the adjustment bolt (Item 2) **[Figure 20-30-3]** clockwise to increase the pressure or anticlockwise to decrease the pressure.

Tighten the nut (Item 1) **[Figure 20-30-3]**.

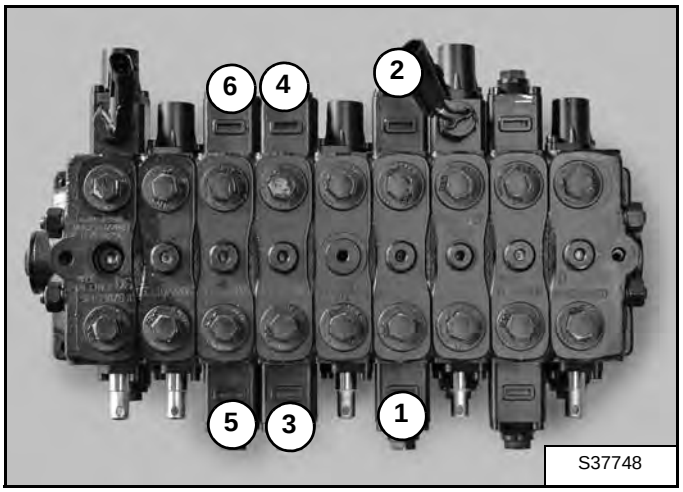
Retest the main relief valve after adjustment.

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VALVE (PORT RELIEF)

Testing And Adjusting

Figure 20-31-1



Boom Port Relief set at:

Rod End (Item 1) **[Figure 20-31-1]**	21 MPa (210 bar) (3045 psi)
Base End (Item 2) **[Figure 20-31-1]**	21 MPa (210 bar) (3045 psi)

Bucket Port Relief set at:

Rod End (Item 3) **[Figure 20-31-1]**	25 MPa (250 bar) (3625 psi)
Base End (Item 4) **[Figure 20-31-1]**	25 MPa (250 bar) (3625 psi)

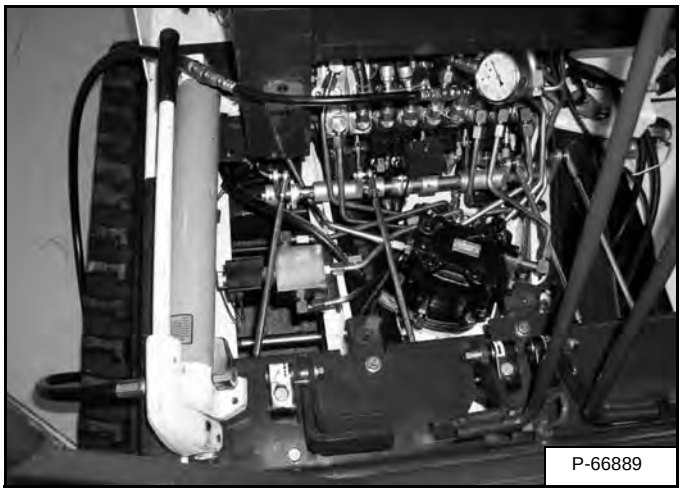
Arm Port Relief set at:

Rod End (Item 5) **[Figure 20-31-1]**	25 MPa (250 bar) (3625 psi)
Base End (Item 6) **[Figure 20-31-1]**	25 MPa (250 bar) (3625 psi)

NOTE: The reliefs are located below the spool covers on the valve sections.

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

Figure 20-31-2



Install the hand pump hose and a pressure gauge (minimum of 34,4 MPa [345 bar] [5000 psi]) into the valve section work port in which the port relief valve is located **[Figure 20-31-2]**. Slowly pressurize this section with the hand pump until the port relief valve opens and make a note of the pressure reading.

NOTE: Pumping the hand pump too fast will alter the pressure readings up to 0,34 MPa (3,4 bar) (50 psi).

If the port relief pressure setting is incorrect, replace the port relief valve.

⚠ WARNING

AVOID INJURY OR DEATH

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

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

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VALVE (CROSSPORT RELIEF)

Testing And Adjusting

The hydraulic system has two crossport relief valves that protect the swing motor from high pressure.

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

MEL1355 - Test Kit includes the following:
MEL1355-3 - 34,5 MPa (345 bar) (5000 psi) Gauge
MEL1355-12 - Coupler
MEL1355-9 - Thermometer

System Pressures At Gauge Port Specifications

TEST CONDITIONS

1. Engine High Idle Speed.

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

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

Open the tailgate. (See TAILGATE on Page 10-60-1.)

Figure 20-32-1

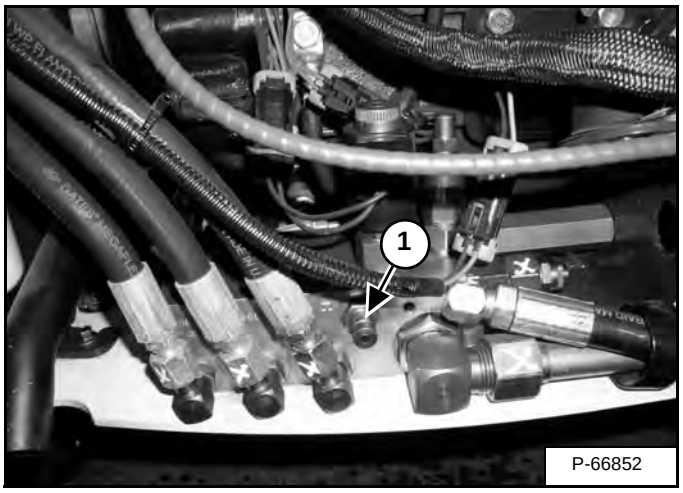
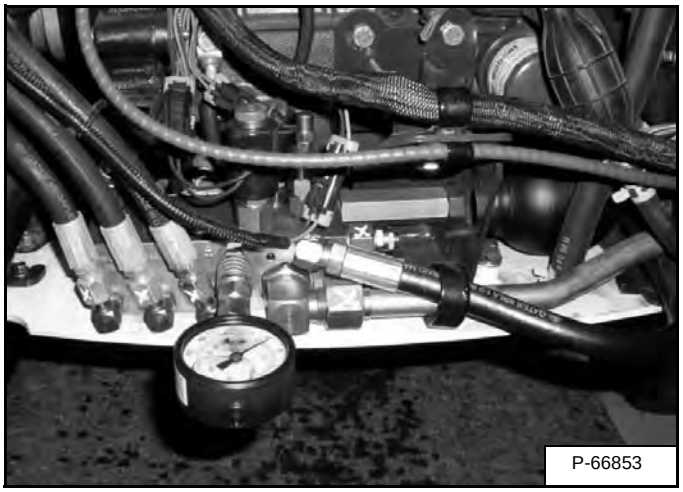


Figure 20-32-2



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

Lower the control console and fasten the seat belt.

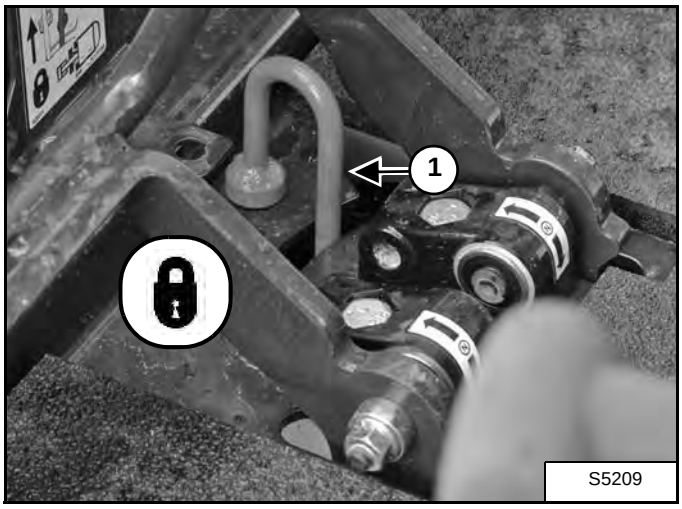
SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURISED	GAUGE LOCATION	TARGET MPa (bar) (psi)	ACCEPTABLE RANGE MPa (bar) (psi)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	PSI	3 (30) (435)	2,8 - 3,1 (28 - 31) (406 - 450)
PRESSURE BUILD - UP VALVE	NONE - CONSOLE DOWN	P1 & P2	G	2.861 (28,61) (415)	2,38 - 3,34 (23,8 - 33,4) (345 - 485)
SYSTEM BY - PASS	NONE - CONSOLE UP	DUMP TO TANK	G	0,79 (7,9) (115)	MAX ALLOWABLE 1,07 (10,7) (155)
MAIN RELIEF ON MANIFOLD BLOCK	BOOM	P2	G	22,89 (229) (3320)	22,2 - 23,58 (222 - 236) (3220 - 3420)
MAIN RELIEF ON MANIFOLD BLOCK	AUXILIARY	P1 & P2	G	18,96 (190) (2750)	18,27 - 19,65 (182,7 - 196,5) (2650 - 2850)
MAIN RELIEF ON MANIFOLD BLOCK	ARM	P1 & P2	G	22,89 (229) (3320)	22,2 - 23,58 (222 - 236) (3220 - 3420)
SWING MOTOR - CROSS PORT RELIEF	SLEW RIGHT	P3	G	16,55 (165) (2400)	16,2 - 16,89 (162 - 169) (2350 - 2450)
SWING MOTOR - CROSS PORT RELIEF	SLEW LEFT	P3	G	16,55 (165) (2400)	16,2 - 16,89 (162 - 169) (2350 - 2450)

* Under seat at Bulkhead

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Testing And Adjusting (Cont'd)

Figure 20-32-3



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

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

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

Move the left control lever (joystick) to engage the swing circuit in the clockwise direction. Record the pressure.

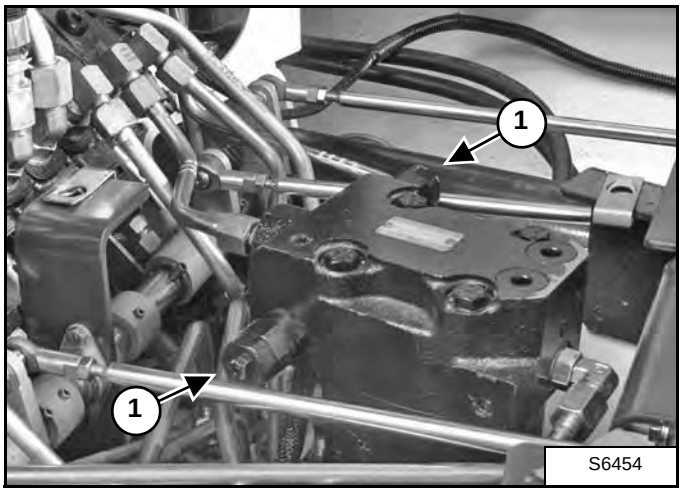
Move the left control lever (joystick) to engage the swing circuit in the clockwise direction. Record the pressure.

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

17 - 17,7 MPa (170 - 177 bar) (2465 - 2567 psi).

Swing (Slew) crossport relief valve is factory set at 200 MPa (138 bar) (2000 psi) at (2.64 U.S. gpm)

Figure 20-32-4



If the pressure is incorrect, remove the two crossport relief valves (Item 1) **[Figure 20-32-4]**.

Clean the two crossport relief valves.

Install the two crossport relief valves and tighten to 98 N•m (72 ft-lb) torque.

Retest the crossport relief valves after cleaning.

If the pressure is still incorrect, replace the crossport relief valves.

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VALVE (PRESSURE REDUCING)

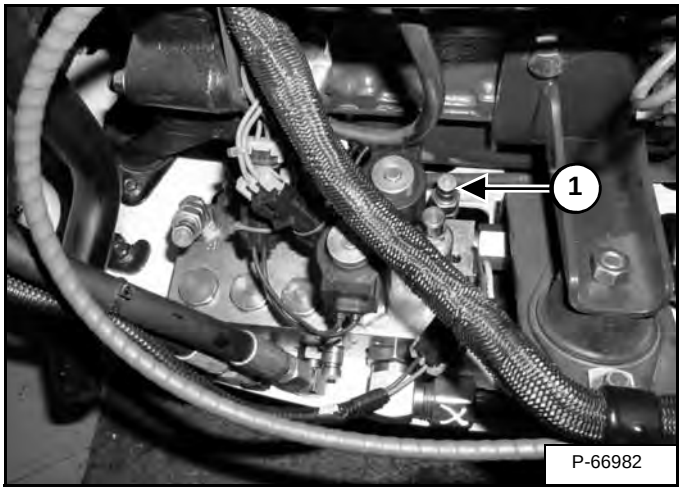
Testing And Adjusting

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

MEL1355 - Test Kit includes the following:
MEL1355-2 - 6,9 MPa (69 bar) (1000 psi) Gauge
MEL1355-9 - Thermometer

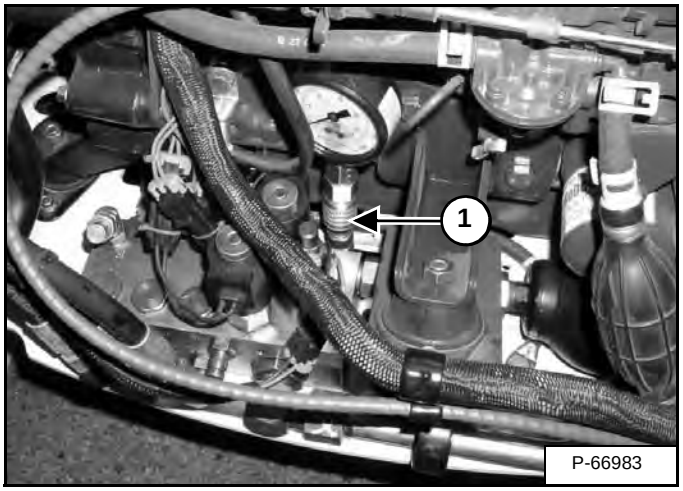
Open the tailgate. (See TAILGATE on Page 10-60-1.)

Figure 20-33-1



Locate the test port (PS1) **[Figure 20-33-1]** on the back side of the manifold.

Figure 20-33-2



Install a 6,9 MPa (69 bar) (1000 psi) gauge (Item 1) **[Figure 20-33-2]** on the test port (PS1).

Lower the control console and fasten seat belt.

Start the engine and warm the hydraulic fluid to operating temperatures 66°C (150°F).

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

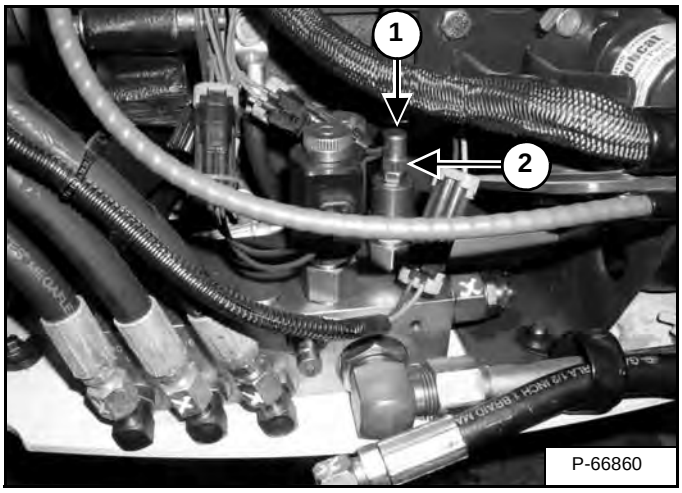
Operate the circuit over relief and record the pressure.

The pressure reducing valve pressure at the test port (PS1) **[Figure 20-33-2]** should be as follows:

3 MPa (30 bar) (435 psi) with an acceptable range of 2,8 - 3,1 MPa (28 - 31 bar) (406 - 450 psi).

Stop the engine.

Figure 20-33-3



If adjustment is needed, remove the cap (Item 1) and loosen the nut (Item 2) **[Figure 20-33-3]**.

Turn the adjustment screw under the cap (Item 1) **[Figure 20-33-3]** clockwise to increase the pressure or anticlockwise to decrease the pressure.

Tighten the nut (Item 2) **[Figure 20-33-3]**.

Retest the pressure reducing valve after adjustment.

If pressure is still incorrect, remove the pressure reducing valve from the manifold assembly and inspect it.

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Testing And Adjusting (Cont'd)

Inspect the port of the pressure reducing valve on the manifold assembly to verify no damage. If damaged replace manifold assembly.

Figure 20-33-4

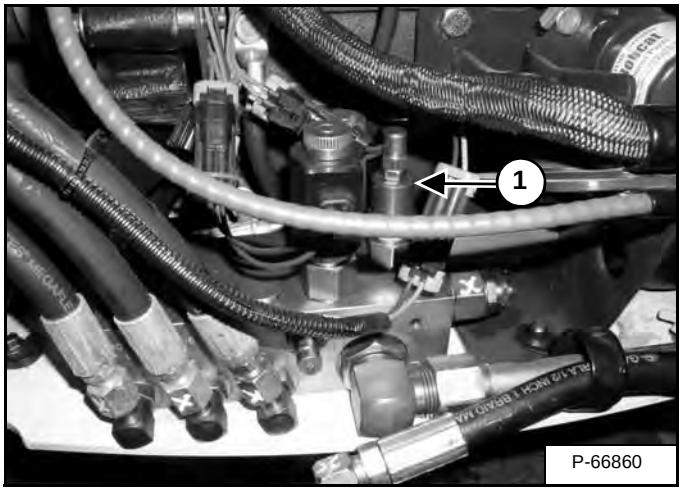
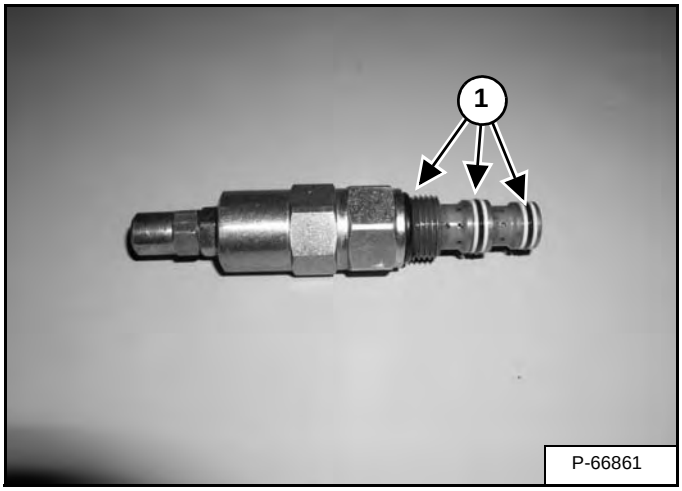


Figure 20-33-5



Inspect the O-rings and back-up rings on the pressure reducing valve (Item 1) **[Figure 20-33-4]** and **[Figure 20-33-5]**. If O-rings and back-up rings are worn or damaged, replace O-rings and back-up rings.

Reinstall the pressure reducing valve in the manifold assembly.

Repeat pressure reducing valve test.

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

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HYDRAULIC CONTROL VALVE

Description

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

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

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

The hydraulic control valve has 25 MPa (250 bar) (3625 psi) work port relief valves for the bucket, arm and boom (rod end) sections. The hydraulic control valve has a 21 MPa (210 bar) (3045 psi) work port relief valve for the boom (base end) section.

The hydraulic control valve has a 20,7 MPa (207 bar) (3000 psi) pressure reducing valve for the slew / blade (P3) flow.

The 1,5 MPa (15 bar) (218 psi) buildup valve is located in the auxiliary section.

Removal And Installation

Lower the boom / bucket and blade to the ground.

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

IMPORTANT

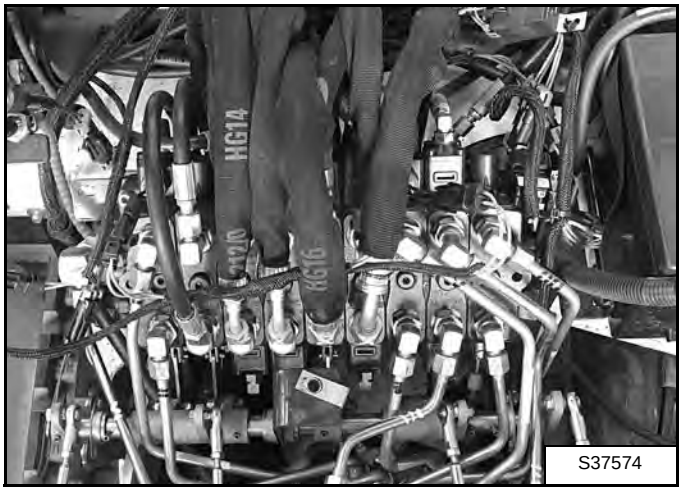
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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Remove the floor mat and floor panels. (See Removal And Installation on Page 40-140-1.)

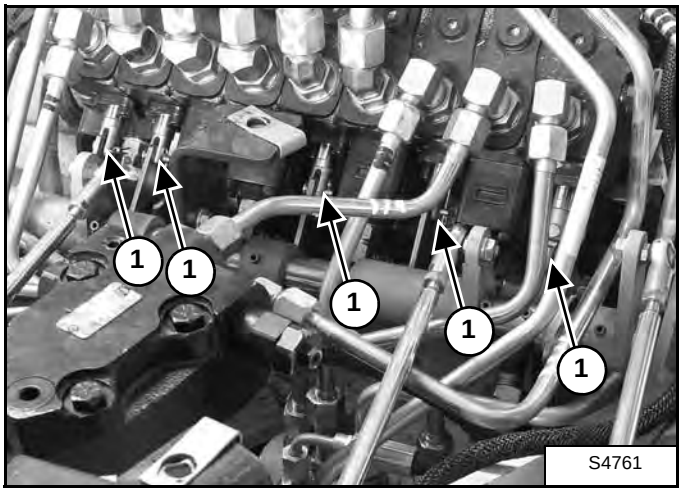
Remove the seat and seat mount. (See Seat Mount Removal And Installation on Page 40-40-1.)

Figure 20-40-1



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

Figure 20-40-2



Remove the clevis pins and cotter pins (Item 1) **[Figure 20-40-2]**.

⚠ WARNING

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

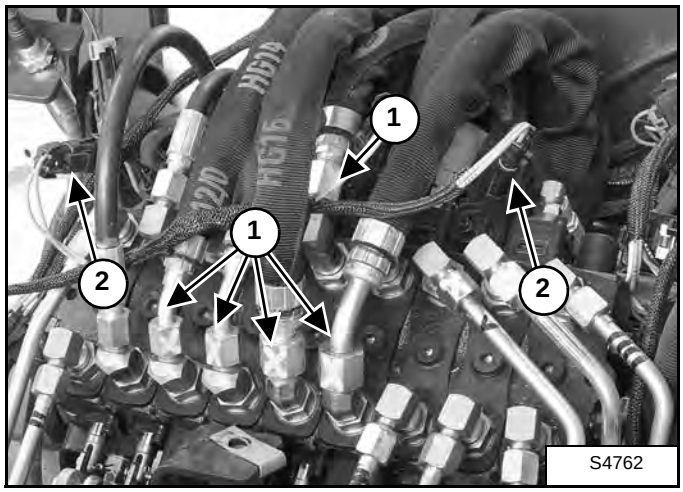
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HYDRAULIC CONTROL VALVE (CONT'D)

Removal And Installation (Cont'd)

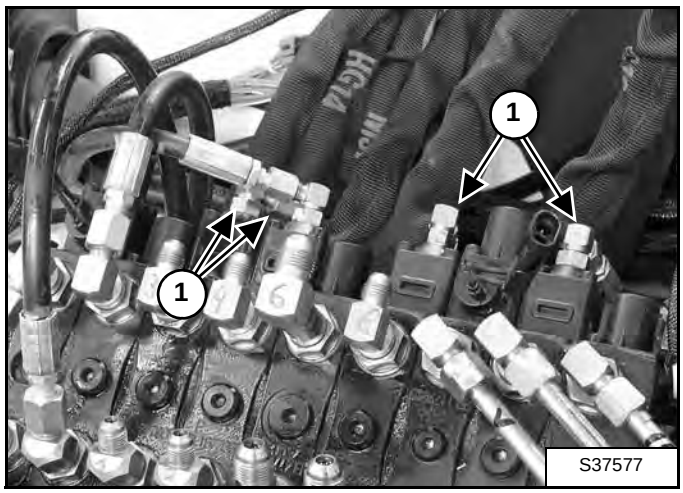
Figure 20-40-3



Remove the hoses (Item 1) **[Figure 20-40-3]** from the top of the control valve.

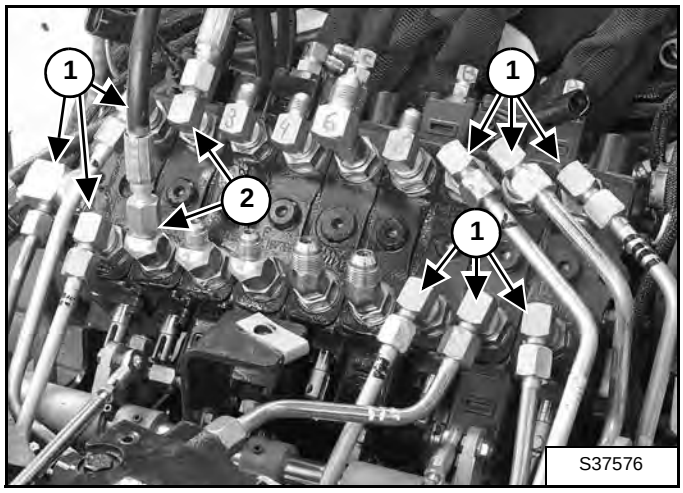
Disconnect the wire harnesses (Item 2) **[Figure 20-40-3]**.

Figure 20-40-4



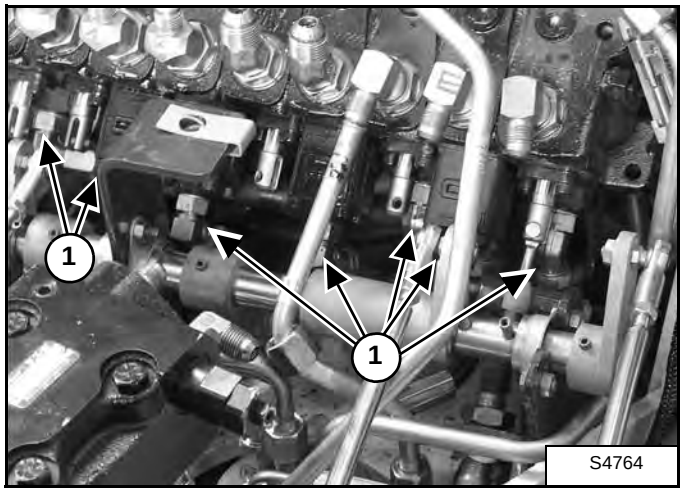
Remove the hoses (Item 1) **[Figure 20-40-4]**.

Figure 20-40-5



Remove the tubelines (Item 1) and hoses (Item 2) **[Figure 20-40-5]**.

Figure 20-40-6

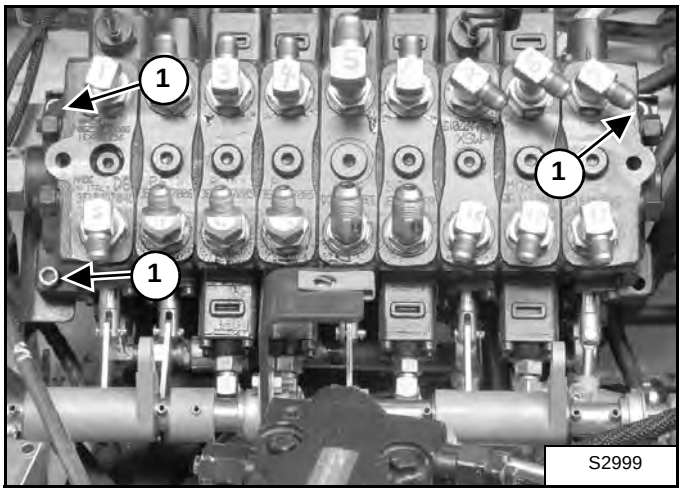


Disconnect the hoses (Item 1) **[Figure 20-40-6]**.

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Removal And Installation (Cont'd)

Figure 20-40-7



Remove the three bolts and nuts (Item 1) **[Figure 20-40-7]**.

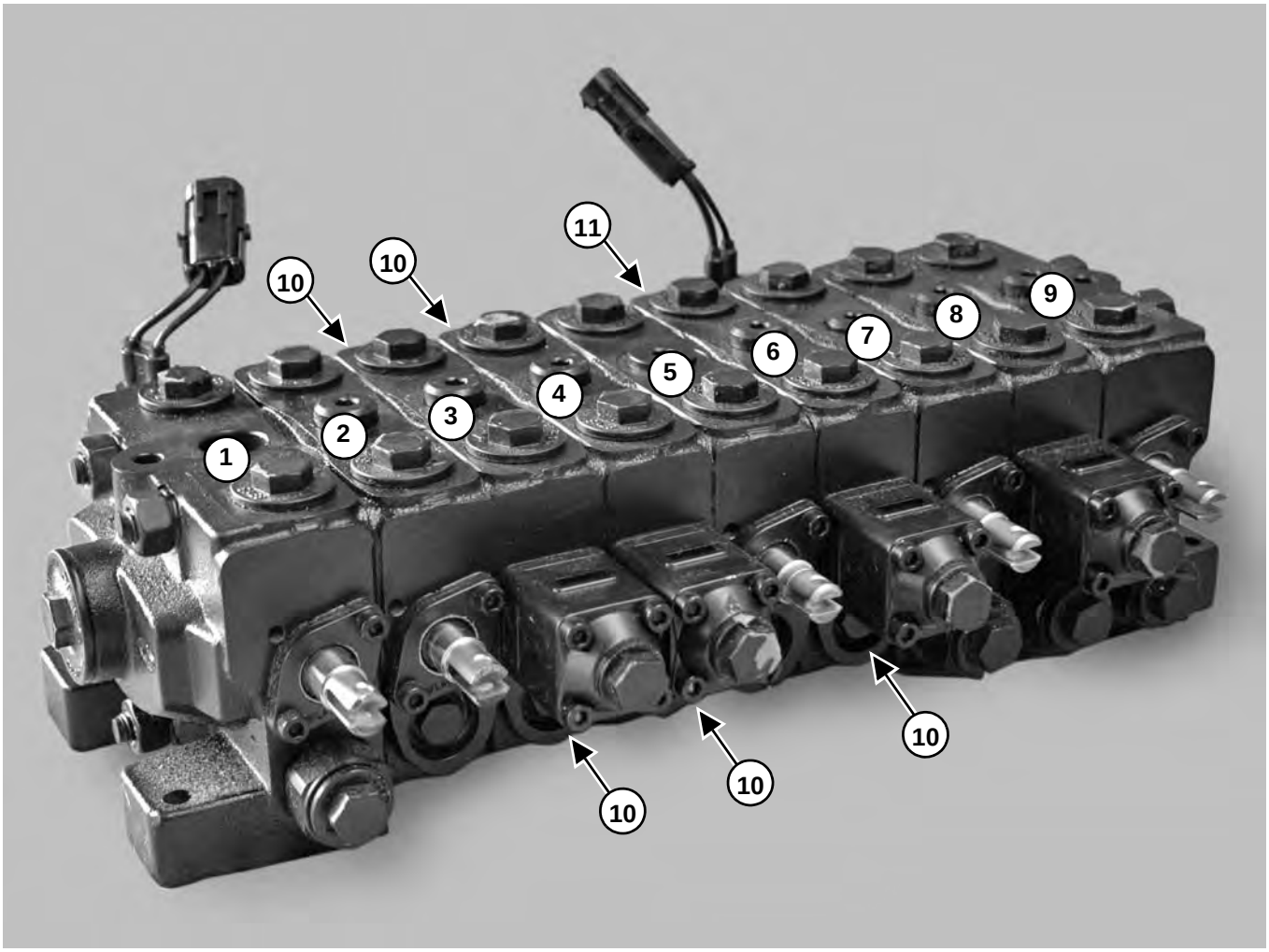
Remove the control valve.

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HYDRAULIC CONTROL VALVE (CONT'D)

Parts Identification

Item Description
1. RIGHT TRAVEL SECTION
2. BOOM SWING SECTION
3. ARM SECTION
4. BUCKET SECTION
5. AUXILIARY SECTION
6. BOOM SECTION
7. LEFT TRAVEL SECTION
8. SWING (SLEW) SECTION
9. BLADE SECTION
10. PORT RELIEF - 25 MPa (250 bar) (3625 psi) (Below Spool Cover)
11. PORT RELIEF - 21 MPa (210 bar) (3045 psi) (Below Spool Cover)



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Disassembly

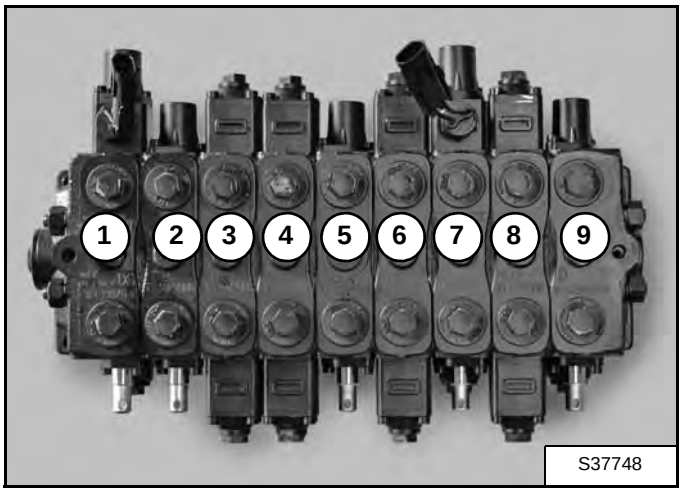
Clean the outside of the hydraulic control valve before disassembly.

IMPORTANT

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

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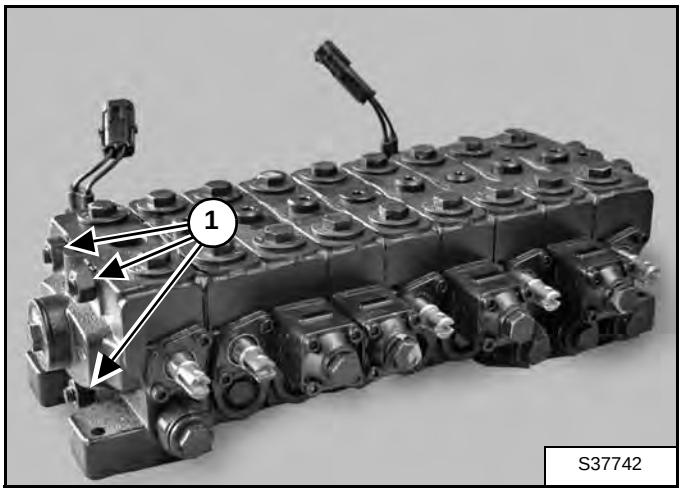
Figure 20-40-8



Mark the valve sections for ease of assembly **[Figure 20-40-8]**.

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

Figure 20-40-9



Remove the tie rod nuts and lock washers (Item 1) **[Figure 20-40-9]**.

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Right Travel Valve Section Disassembly And Assembly

IMPORTANT

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

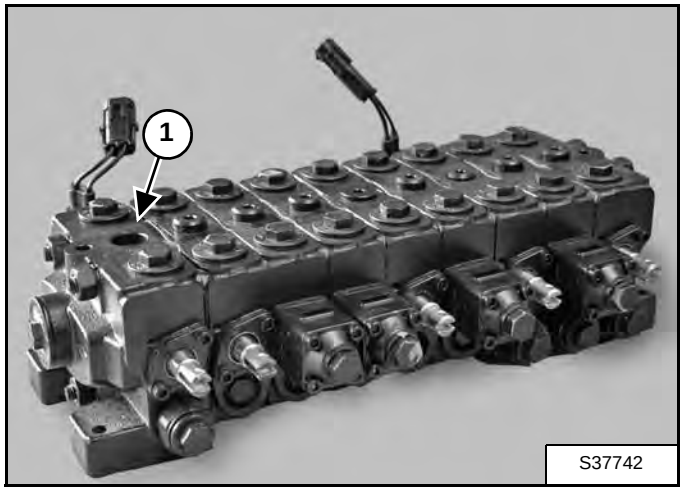
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

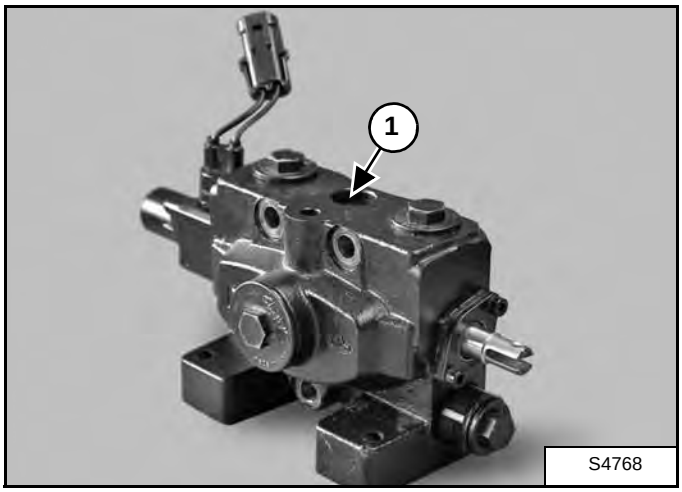
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-10



Remove the right travel valve (Item 1) **[Figure 20-40-10]** from the valve assembly.

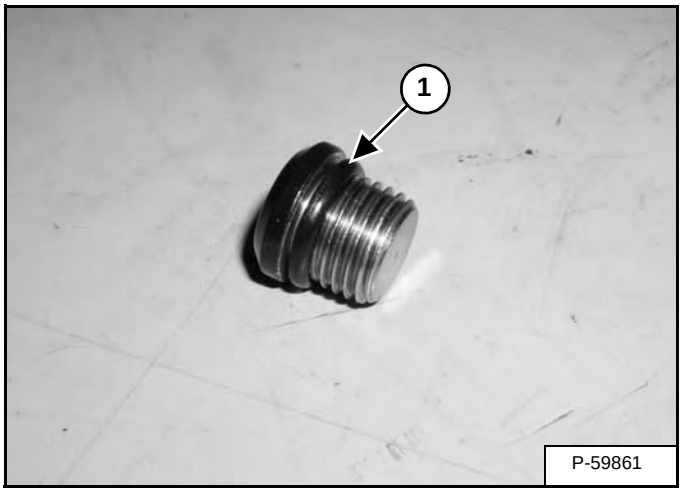
Figure 20-40-11



Remove the plug (Item 1) **[Figure 20-40-11]** from the right travel valve section.

Installation: Tighten the plug (Item 1) **[Figure 20-40-11]** to 24 N•m (18 ft-lb) torque.

Figure 20-40-12

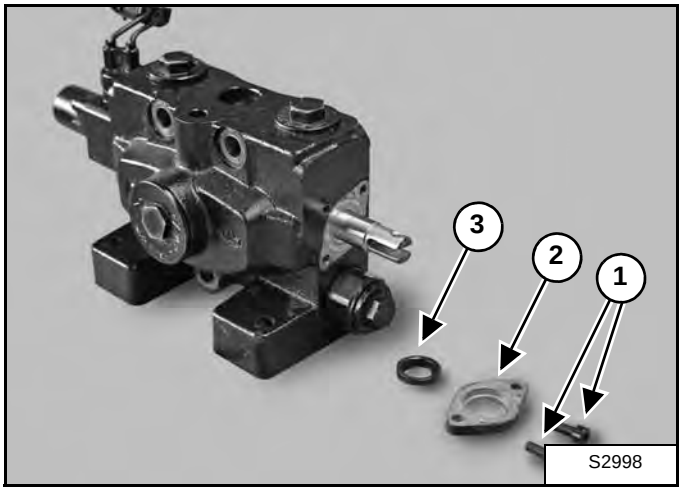


Remove the O-ring (Item 1) **[Figure 20-40-12]** from the plug.

Dealer Copy -- Not for Resale

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

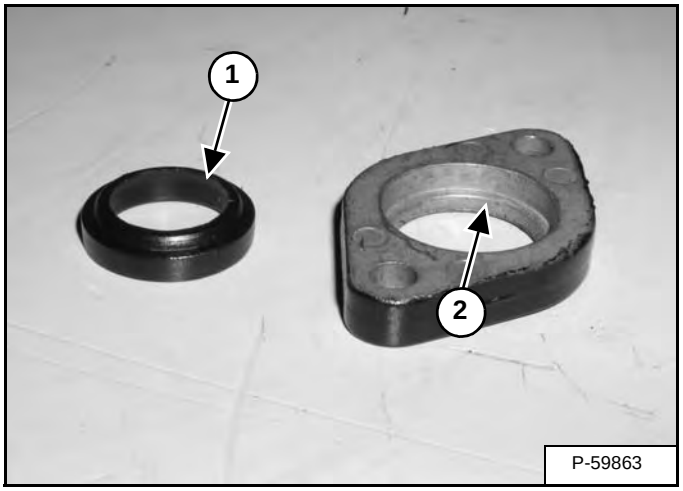
Figure 20-40-13



Remove the bolts (Item 1), retaining plate (Item 2) and seal (Item 3) **[Figure 20-40-13]**.

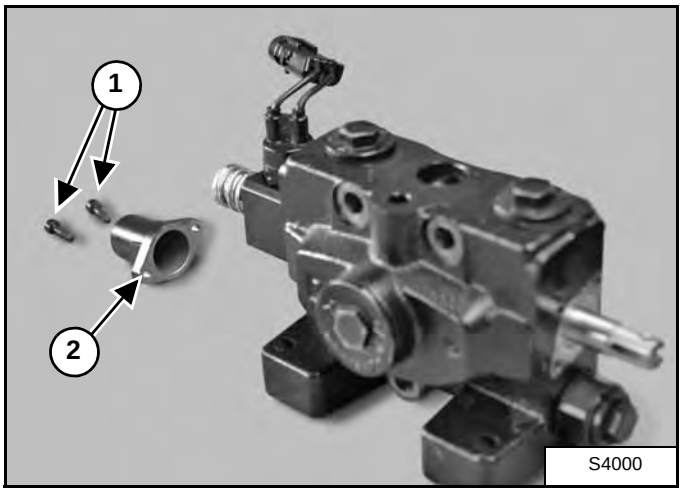
Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-14



Installation: Make sure the lip (Item 1) of the seal fits inside the retaining plate (Item 2) **[Figure 20-40-14]**.

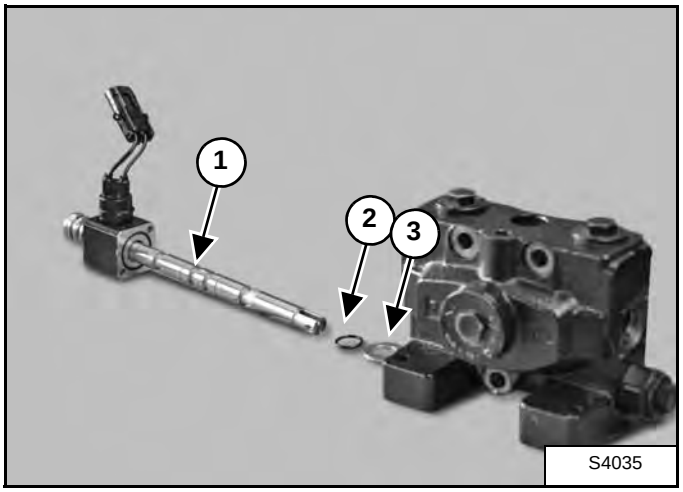
Figure 20-40-15



Remove the bolts (Item 1) and cap (Item 2) **[Figure 20-40-15]**.

Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-16

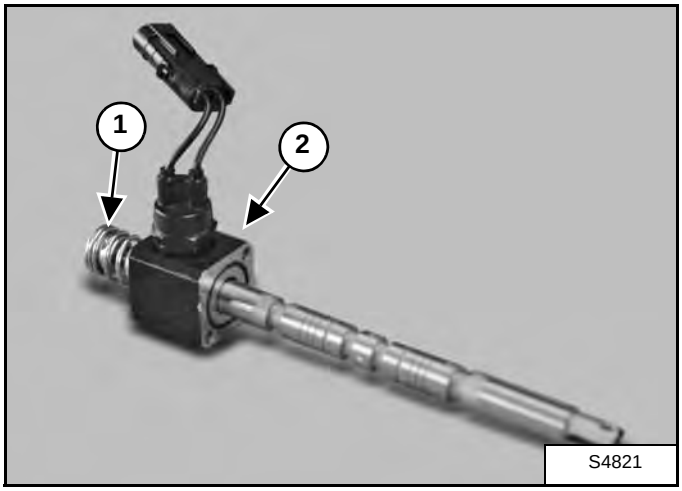


Remove the spool and spool cover assembly (Item 1), O-ring (Item 2) and washer (Item 3) **[Figure 20-40-16]** from the valve.

Dealer Copy -- Not for Resale

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

Figure 20-40-17



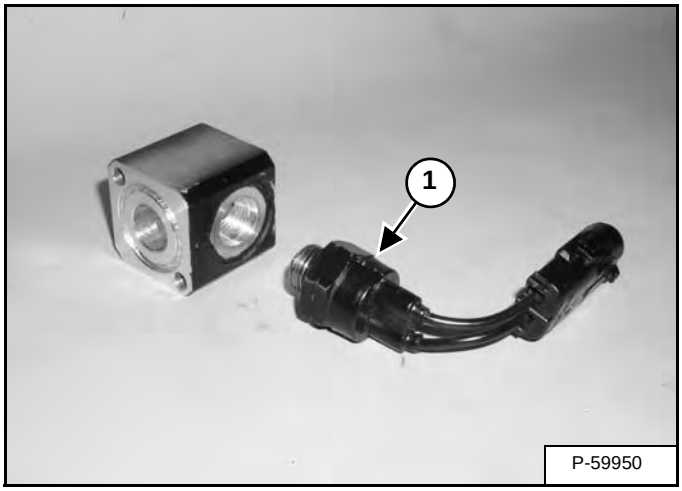
Remove the spring assembly (Item 1) and spool cover (Item 2) **[Figure 20-40-17]** from the spool.

The spool and valve section are not serviced separately.

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

Installation: Tighten the spring assembly retaining screw to 9,8 N•m (86.7 in-lb) torque.

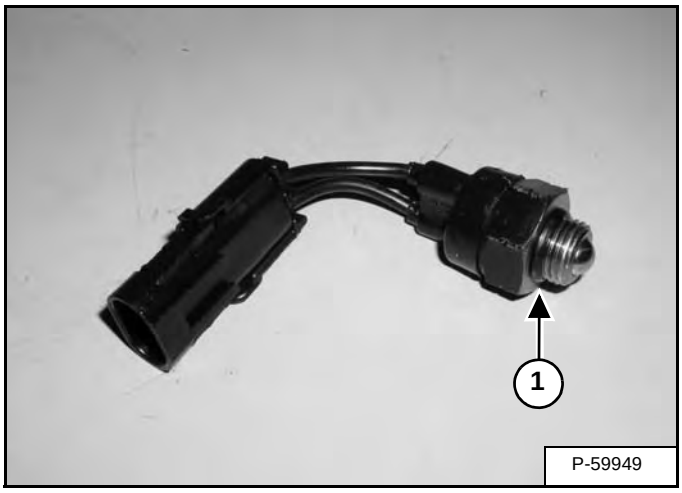
Figure 20-40-18



Remove the switch (Item 1) **[Figure 20-40-18]** from the spool cover.

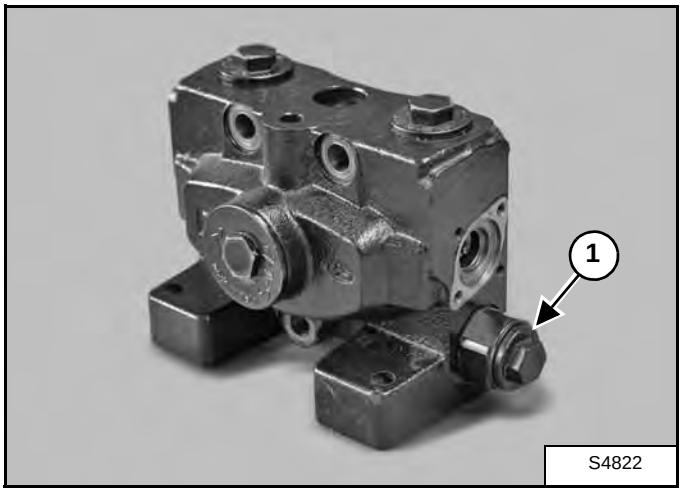
Installation: Tighten the switch to 42 N•m (31 ft-lb) torque.

Figure 20-40-19



Remove the O-ring (Item 1) **[Figure 20-40-19]** from the switch.

Figure 20-40-20



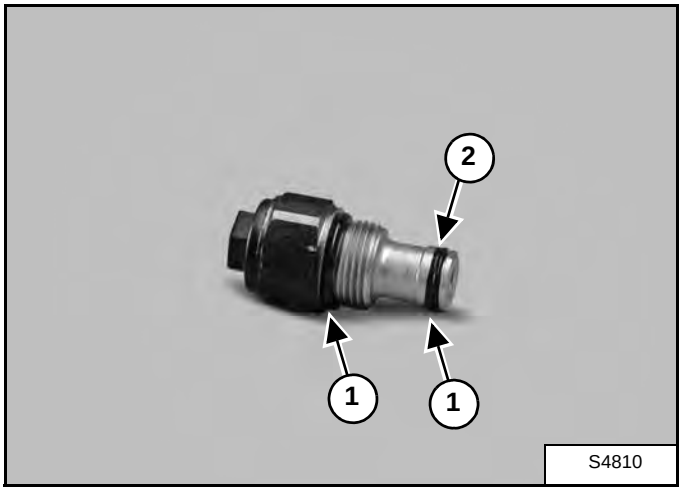
Remove the fitting (Item 1) **[Figure 20-40-20]**.

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

Dealer Copy -- Not for Resale

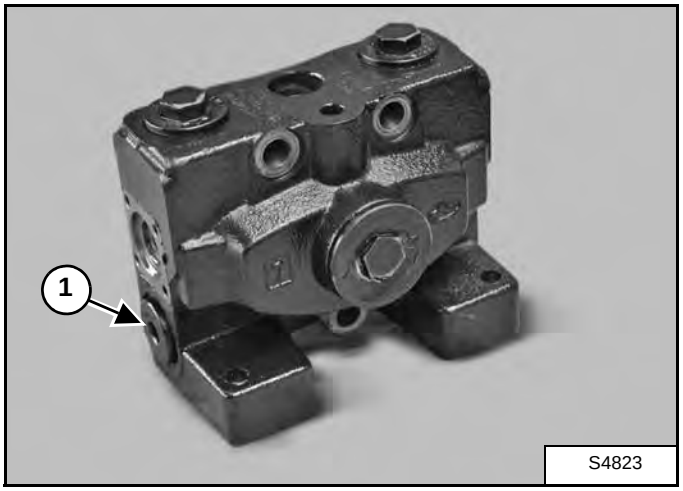
Right Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-21



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-21]** from the fitting.

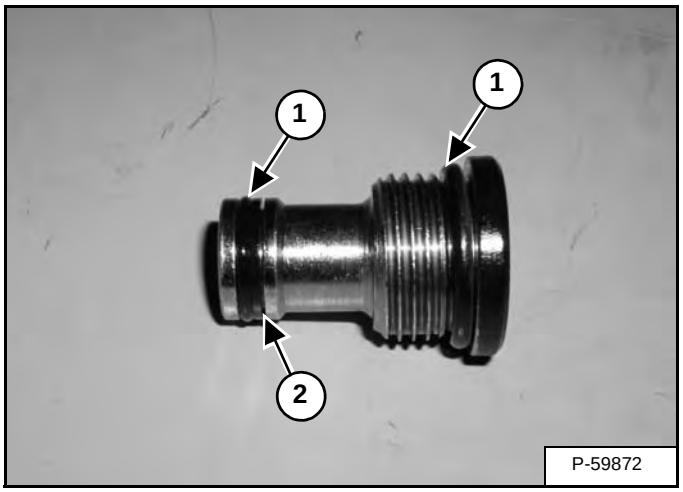
Figure 20-40-22



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

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

Figure 20-40-23



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-23]** from the plug.

Dealer Copy -- Not for Resale

Boom Swing Valve Section Disassembly And Assembly

IMPORTANT

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

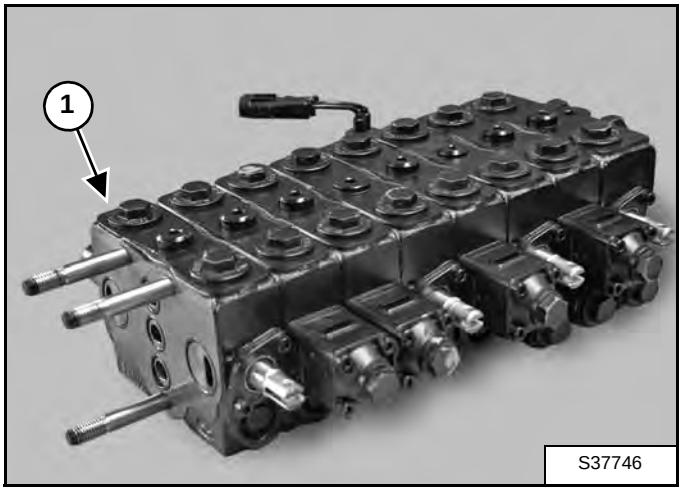
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

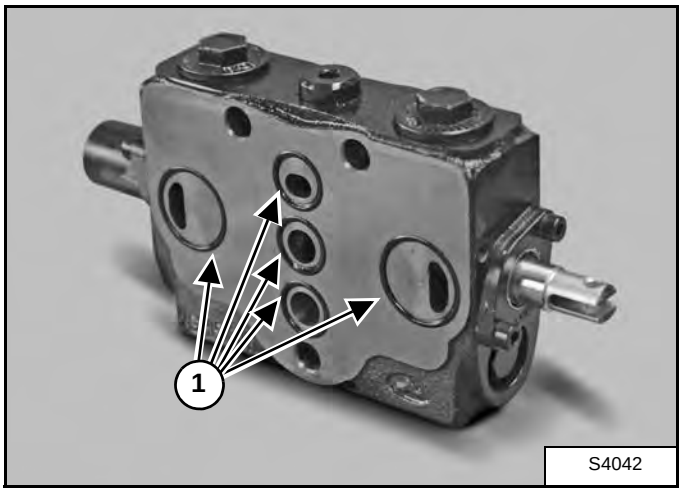
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-24



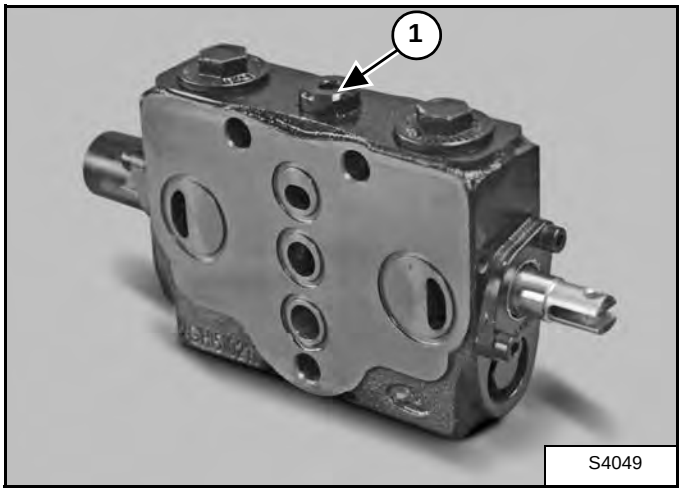
Remove the boom swing valve section (Item 1) **[Figure 20-40-24]** from the valve assembly.

Figure 20-40-25



Remove the O-rings (Item 1) **[Figure 20-40-25]** from the boom swing valve section.

Figure 20-40-26



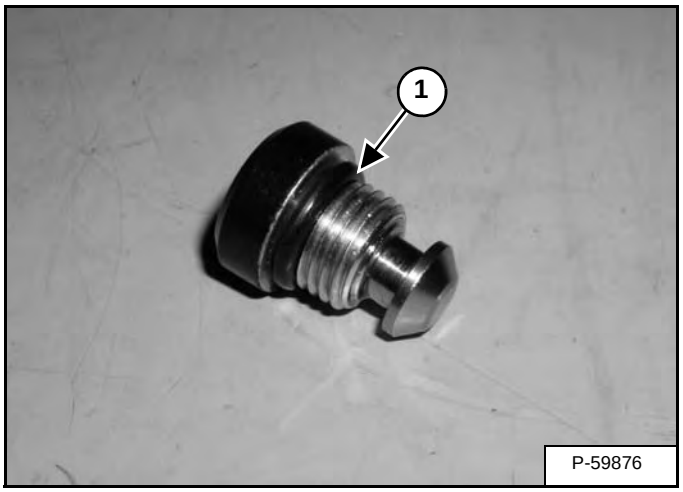
Remove the load check valve (Item 1) **[Figure 20-40-26]**.

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

Dealer Copy -- Not for Resale

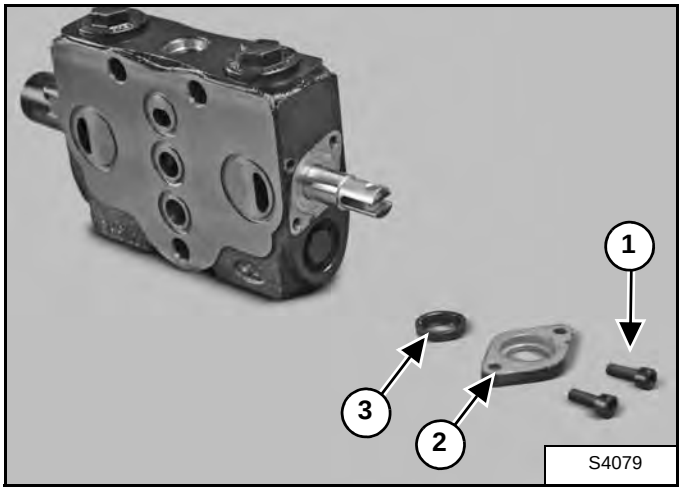
Boom Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-27



Remove the O-ring (Item 1) **[Figure 20-40-27]** from the load check valve.

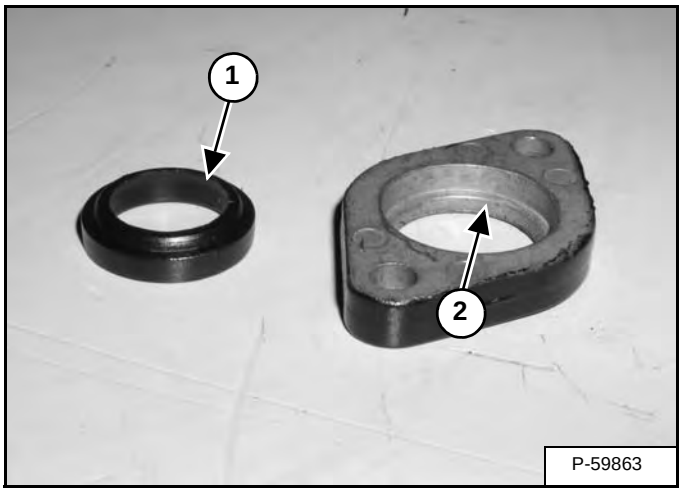
Figure 20-40-28



Remove the bolts (Item 1), retainer (Item 2) and seal (Item 3) **[Figure 20-40-28]**.

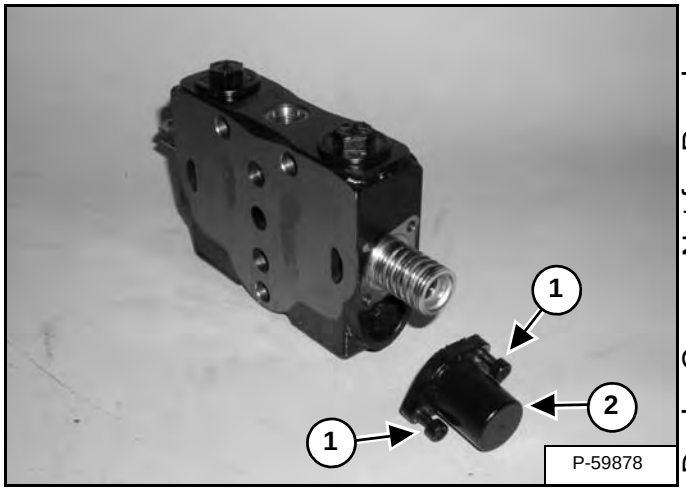
Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-29



Installation: Make sure the lip (Item 1) of the seal fits inside the retaining plate (Item 2) **[Figure 20-40-29]**.

Figure 20-40-30



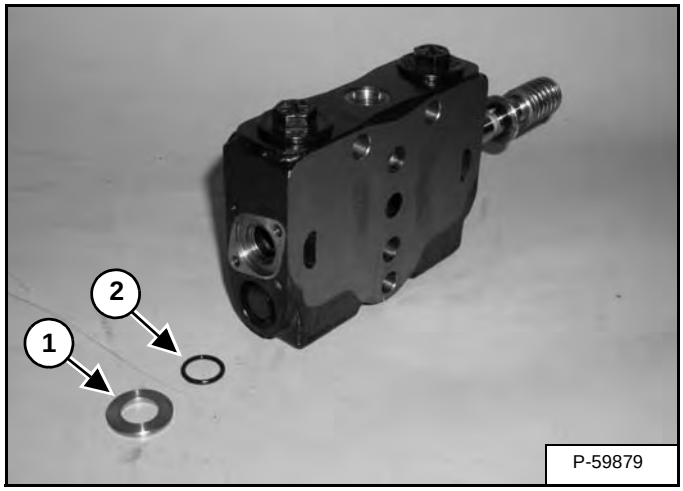
Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-30]**.

Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Dealer Copy -- Not for Resale

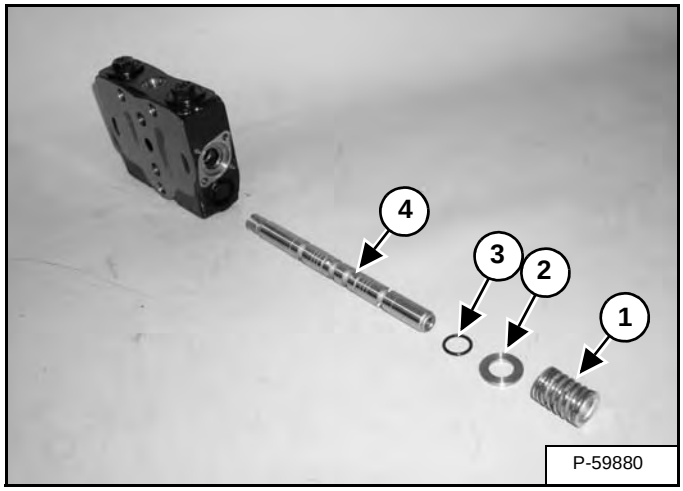
Boom Swing Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-31



Remove the washer (Item 1) and O-ring (Item 2) **[Figure 20-40-31]** from the valve section.

Figure 20-40-32



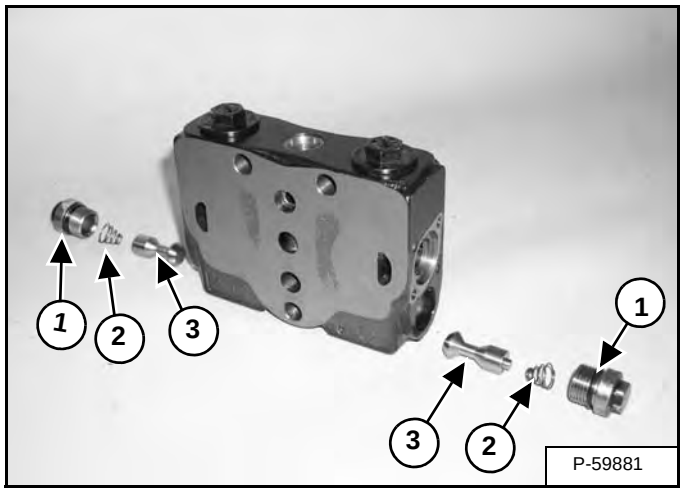
Remove the spring assembly (Item 1), washer (Item 2), O-ring (Item 3) and spool (Item 4) **[Figure 20-40-32]**.

The spool and valve section are not serviced separately.

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

Installation: Tighten the spring retaining screw to 9,8 N•m (86.7 in-lb) torque.

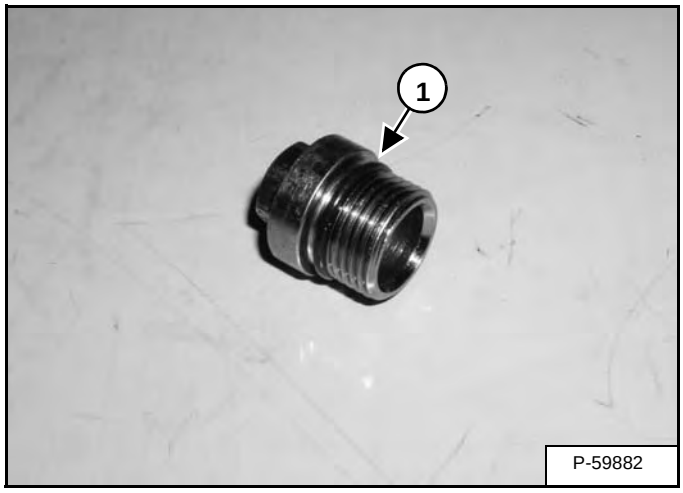
Figure 20-40-33



Remove the plug (Item 1), spring (Item 2) and valve assembly (Item 3) **[Figure 20-40-33]** from both relief valves.

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

Figure 20-40-34



Remove the O-ring (Item 1) **[Figure 20-40-34]** from the plugs.

Dealer Copy -- Not for Resale

Arm Valve Section Disassembly And Assembly

IMPORTANT

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

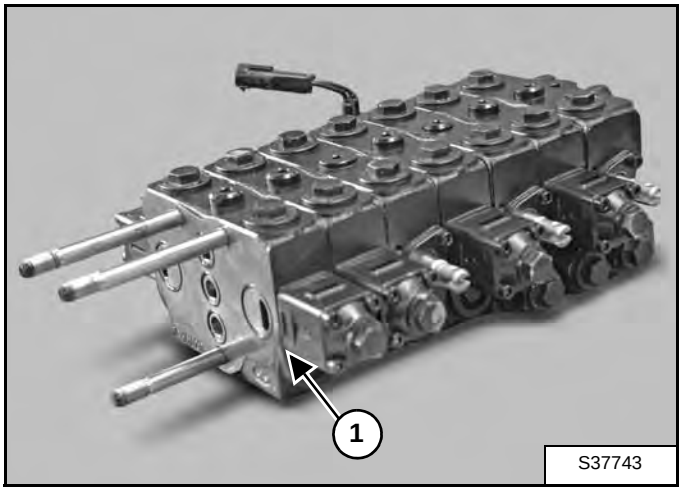
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

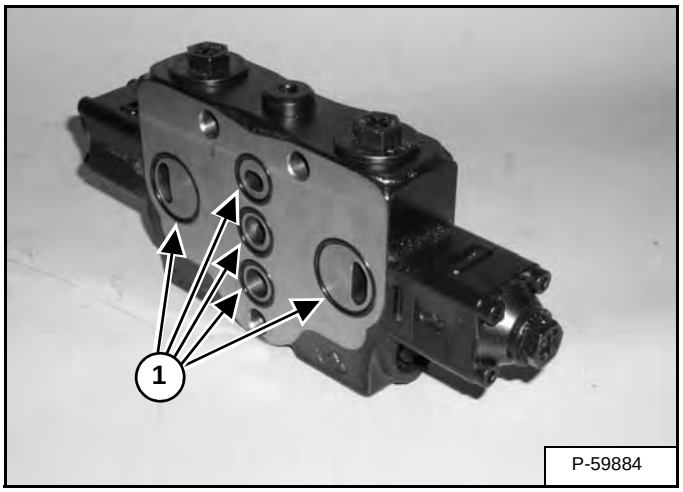
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-35



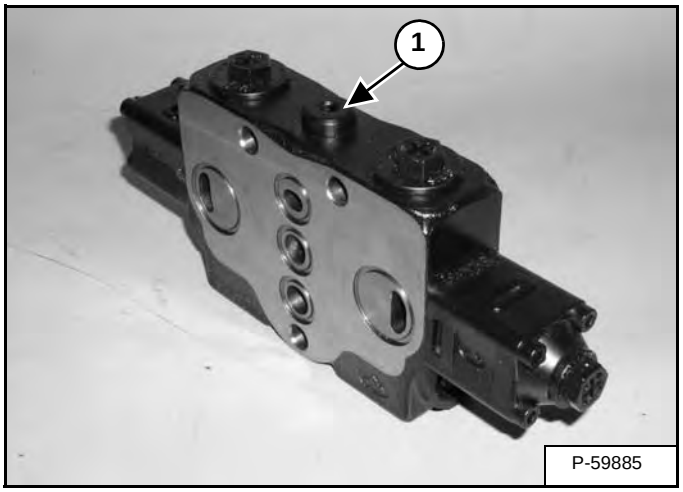
Remove the arm valve section (Item 1) **[Figure 20-40-35]** from the valve assembly.

Figure 20-40-36



Remove the O-rings (Item 1) **[Figure 20-40-36]** from the arm valve section.

Figure 20-40-37



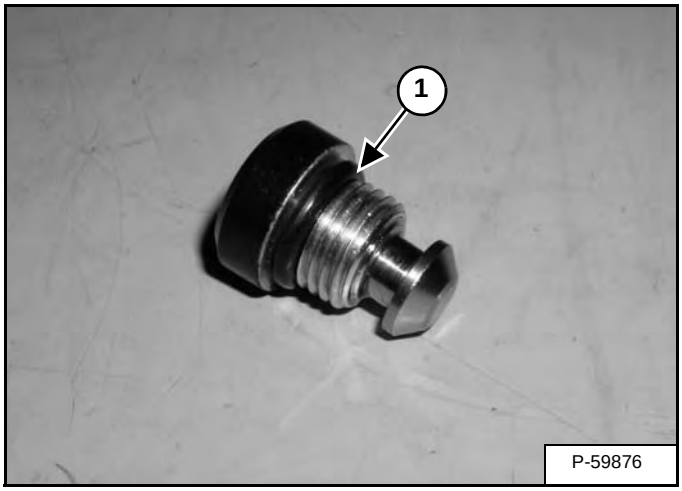
Remove the load check valve (Item 1) **[Figure 20-40-37]**.

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

Dealer Copy -- Not for Resale

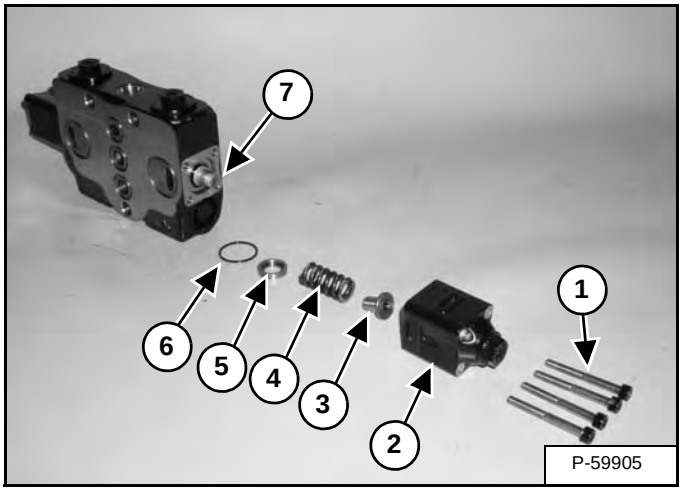
Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-38



Remove the O-ring (Item 1) **[Figure 20-40-38]** from the load check valve.

Figure 20-40-39

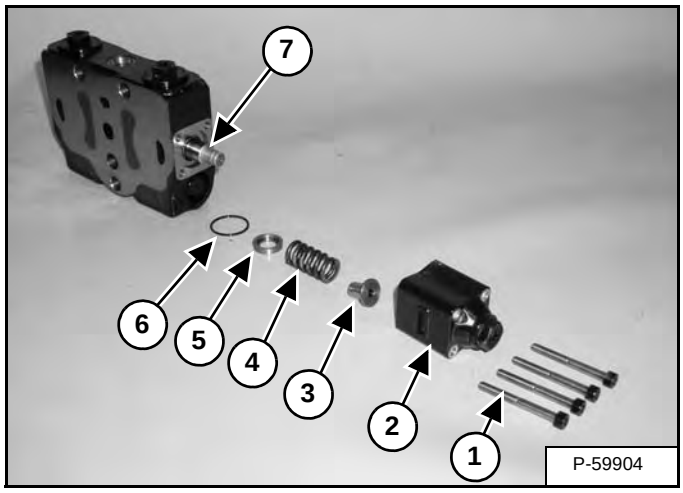


Remove the bolts (Item 1) spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-39]**.

Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 7) **[Figure 20-40-39]**.

Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-40

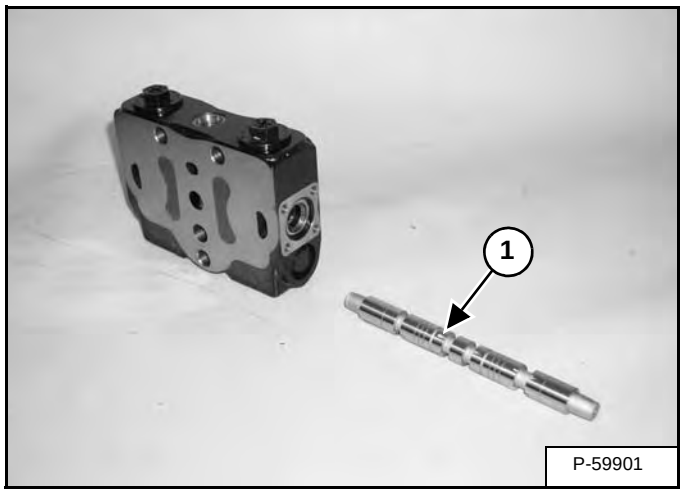


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-40]**.

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

Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-41



Remove the spool (Item 1) **[Figure 20-40-41]**.

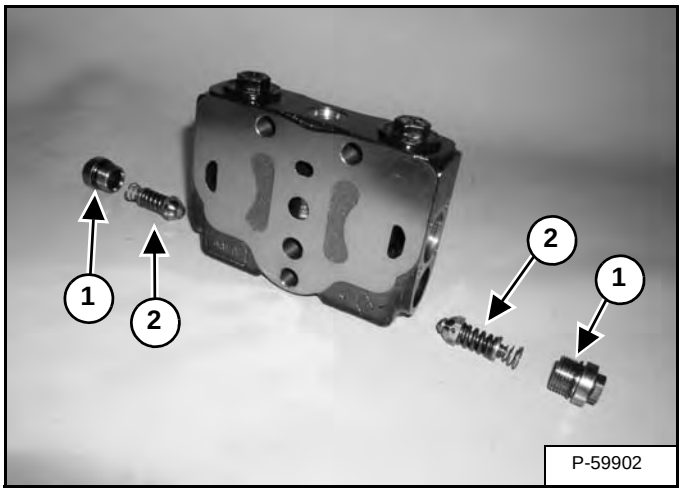
The spool and valve section are not serviced separately.

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

Dealer Copy -- Not for Resale

Arm Valve Section Disassembly And Assembly (Cont'd)

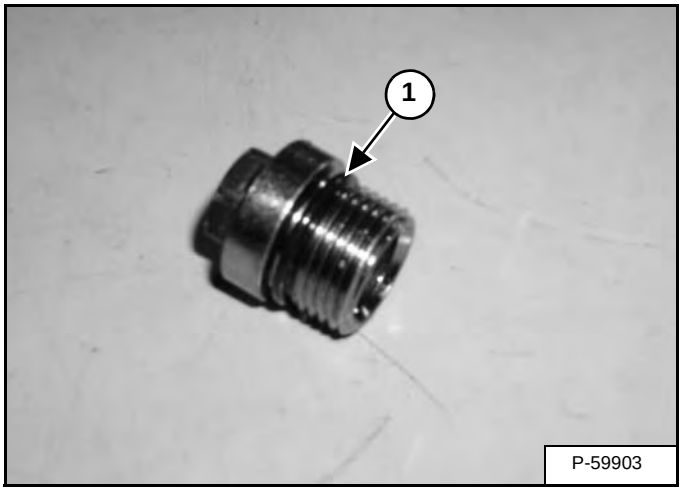
Figure 20-40-42



Remove the plug (Item 1) and relief valve assemblies (Item 2) **[Figure 20-40-42]** from both relief valves.

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

Figure 20-40-43



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

Dealer Copy -- Not for Resale

Bucket Valve Section Disassembly And Assembly

IMPORTANT

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

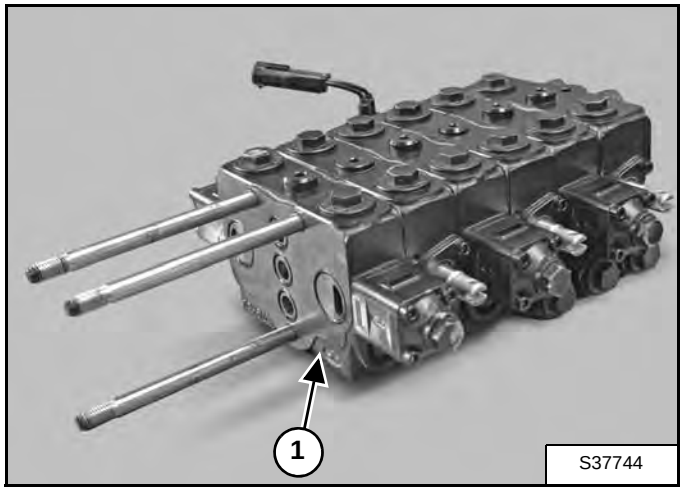
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

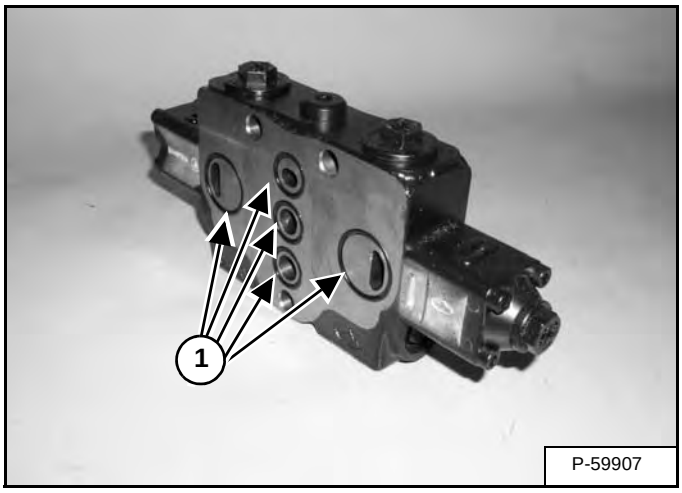
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-44



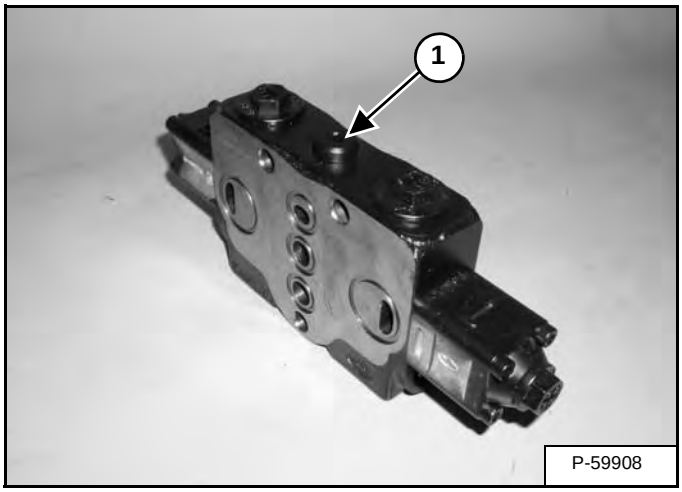
Remove the bucket valve section (Item 1) **[Figure 20-40-44]** from the valve assembly.

Figure 20-40-45



Remove the O-rings (Item 1) **[Figure 20-40-45]** from the side of the bucket valve section.

Figure 20-40-46



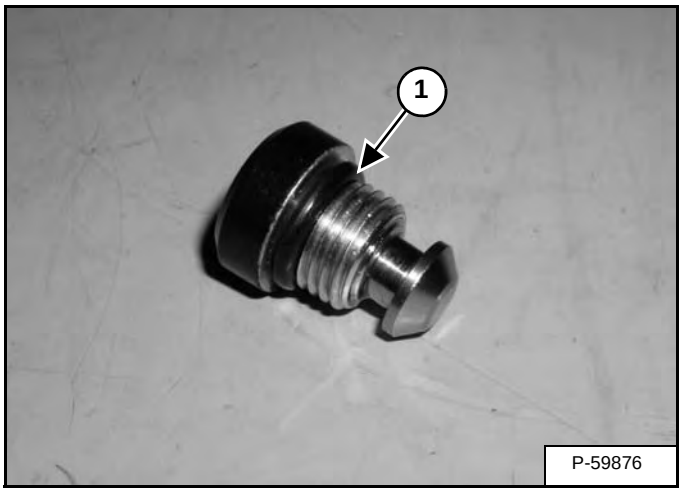
Remove the load check valve (Item 1) **[Figure 20-40-46]**.

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

Dealer Copy -- Not for Resale

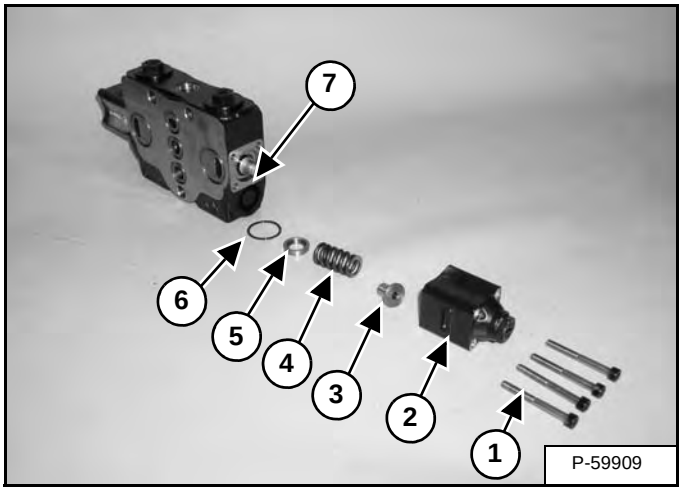
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-47



Remove the O-ring (Item 1) **[Figure 20-40-47]** from the load check valve.

Figure 20-40-48

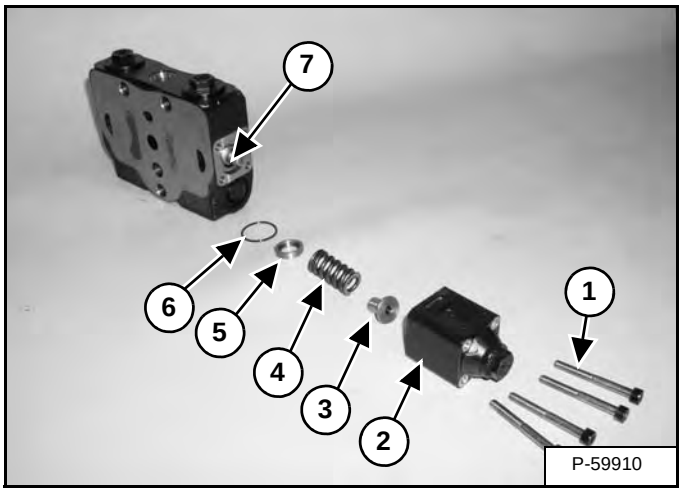


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-48]**.

Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 7) **[Figure 20-40-48]**.

Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-49

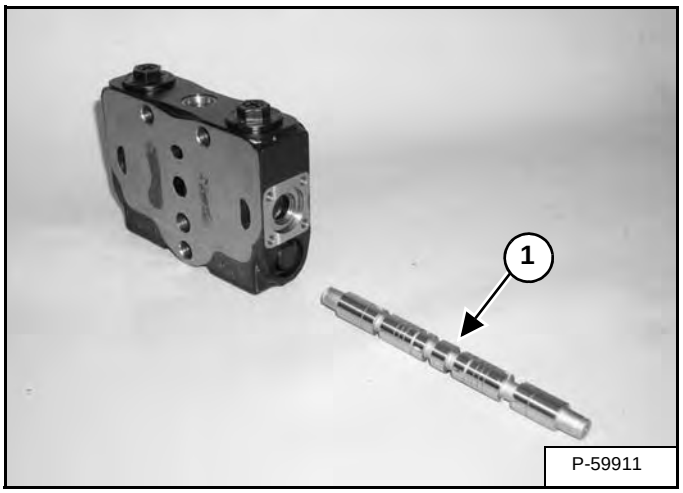


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-49]**.

Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 7) **[Figure 20-40-49]**.

Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-50



Remove the spool (Item 1) **[Figure 20-40-50]**.

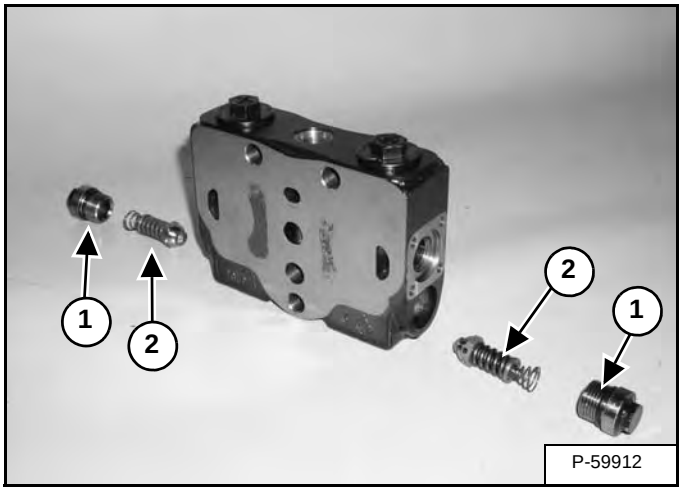
The spool and valve section are not serviced separately.

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

Dealer Copy -- Not for Resale

Bucket Valve Section Disassembly And Assembly (Cont'd)

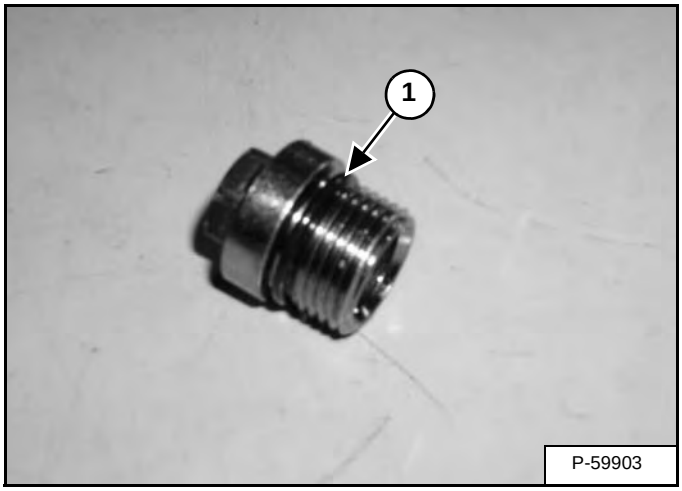
Figure 20-40-51



Remove the plug (Item 1) and valve assembly (Item 2) **[Figure 20-40-51]** from both relief valves.

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

Figure 20-40-52



Remove the O-ring (Item 1) **[Figure 20-40-52]** from both plugs.

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Auxiliary Valve Section Disassembly And Assembly

IMPORTANT

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

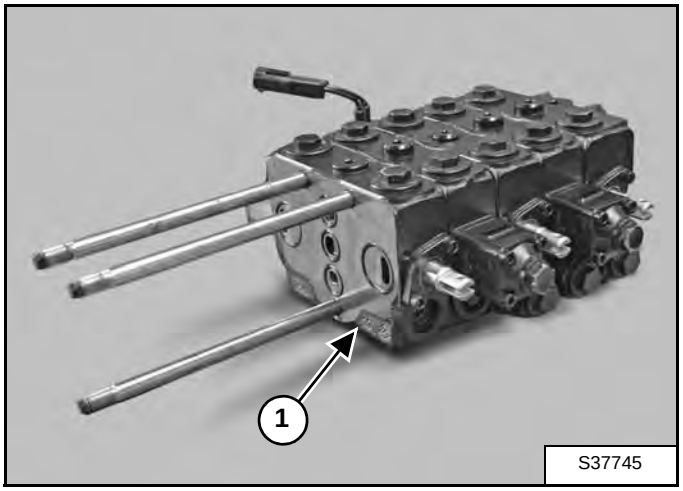
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

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

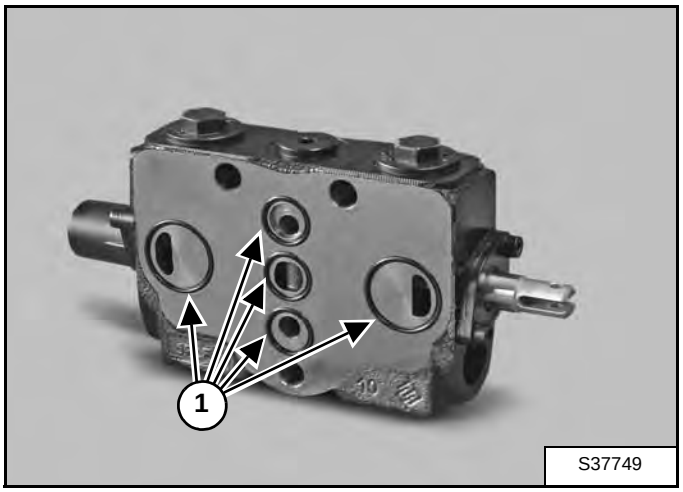
Figure 20-40-53



Remove the auxiliary valve section (Item 1) **[Figure 20-40-53]** from the valve assembly.

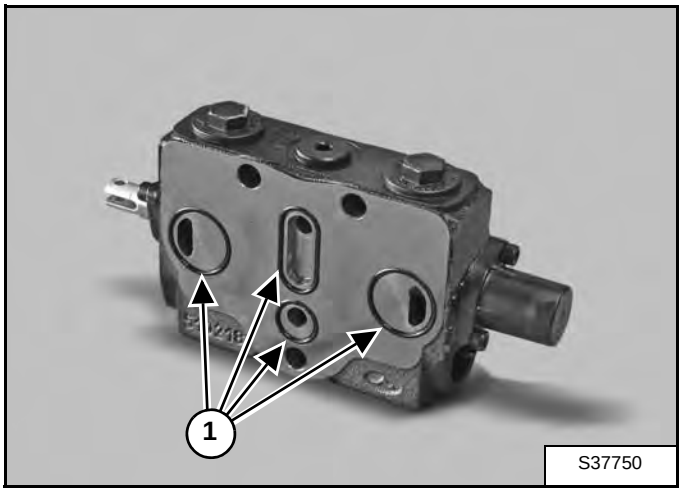
NOTE: Use care while removing the auxiliary valve section. The buildup valve (Item 1) [Figure 20-40-65] is spring loaded.

Figure 20-40-54



Remove the O-rings (Item 1) **[Figure 20-40-54]** from the auxiliary valve section.

Figure 20-40-55

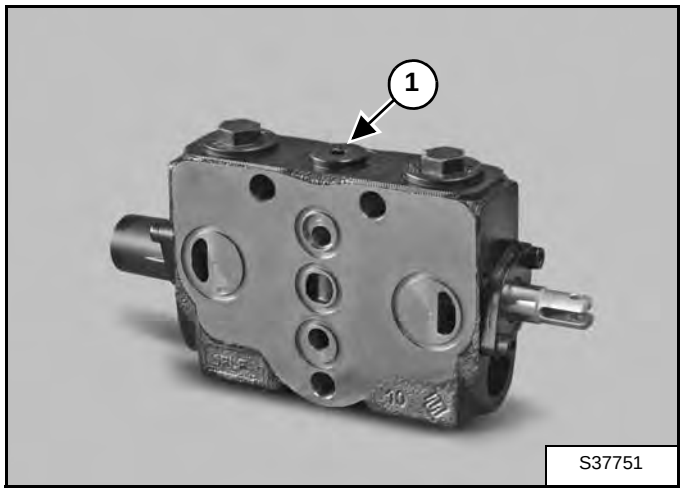


Remove the O-rings (Item 1) **[Figure 20-40-55]** from the auxiliary valve section.

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Auxiliary Valve Section Disassembly And Assembly (Cont'd)

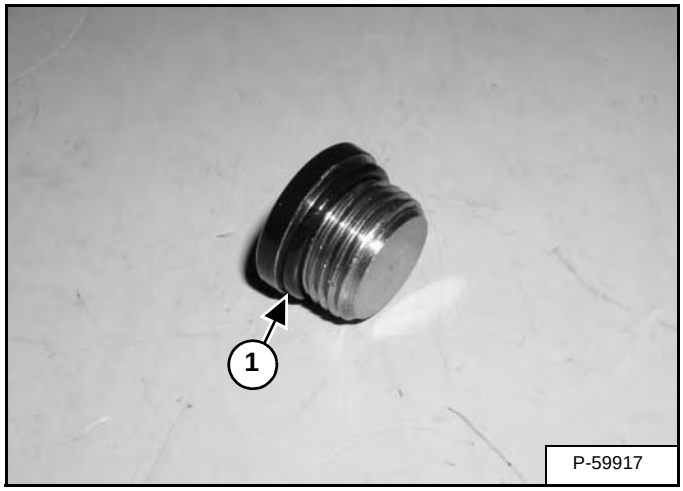
Figure 20-40-56



Remove the load check valve (Item 1) **[Figure 20-40-56]**.

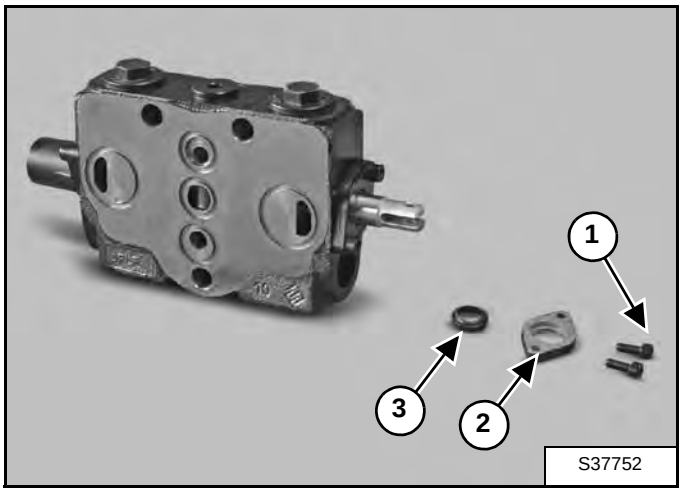
Installation: Tighten the load check valve to 35 N•m (26 ft-lb) torque.

Figure 20-40-57



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

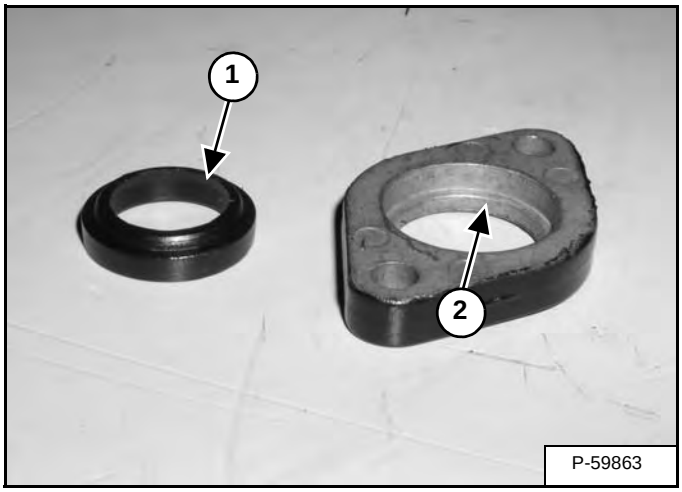
Figure 20-40-58



Remove the bolts (Item 1), retainer (Item 2) and seal (Item 3) **[Figure 20-40-58]**.

Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-59

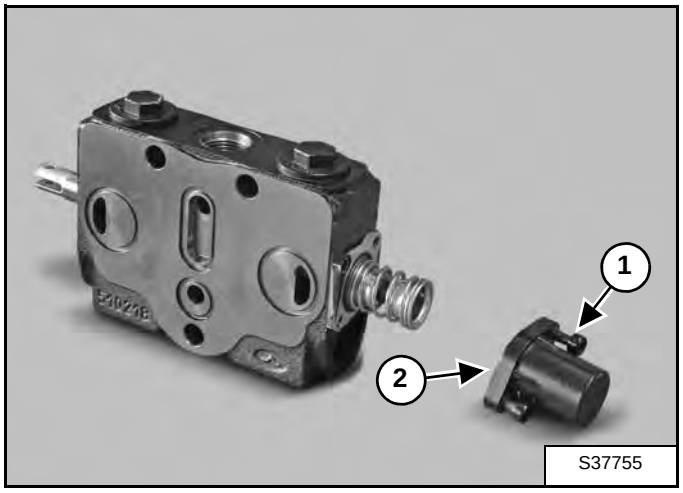


Installation: Make sure the lip (Item 1) of the seal fits inside the retaining plate (Item 2) **[Figure 20-40-59]**.

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Auxiliary Valve Section Disassembly And Assembly (Cont'd)

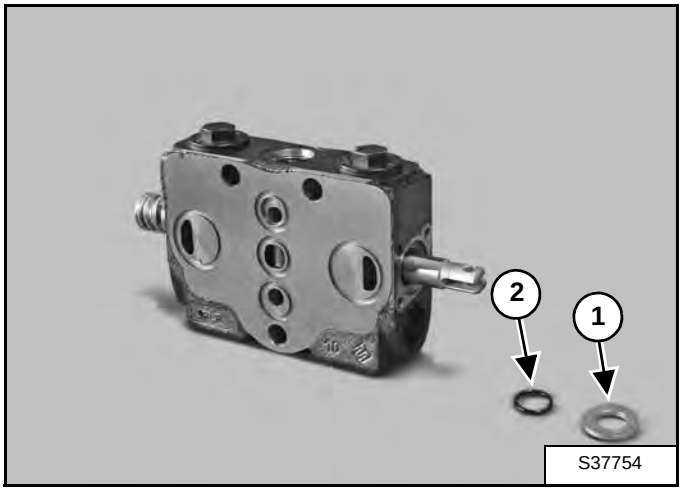
Figure 20-40-60



Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-60]**.

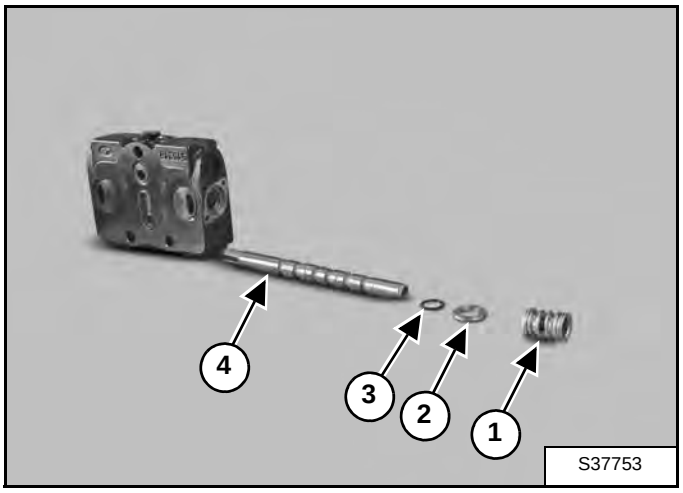
Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-61



Remove the washer (Item 1) and O-ring (Item 2) **[Figure 20-40-61]** from the valve section.

Figure 20-40-62



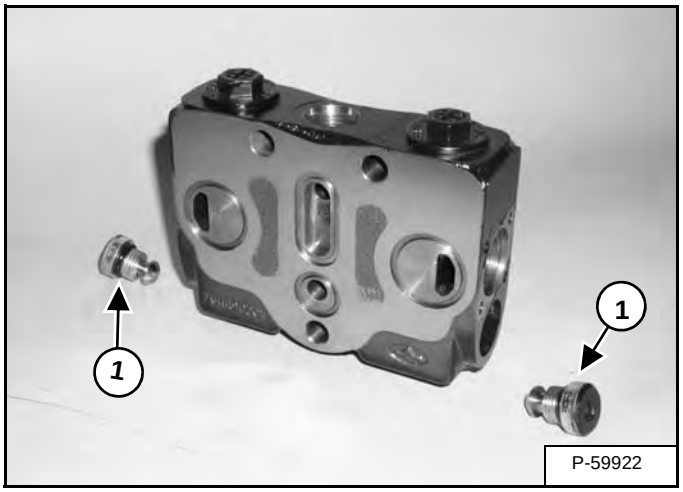
Remove the spring assembly (Item 1), washer (Item 2), O-ring (Item 3) and spool (Item 4) **[Figure 20-40-62]**.

The spool and valve section are not serviced separately.

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

Installation: Tighten the spring retaining screw to 9,8 N•m (86.7 in-lb) torque.

Figure 20-40-63



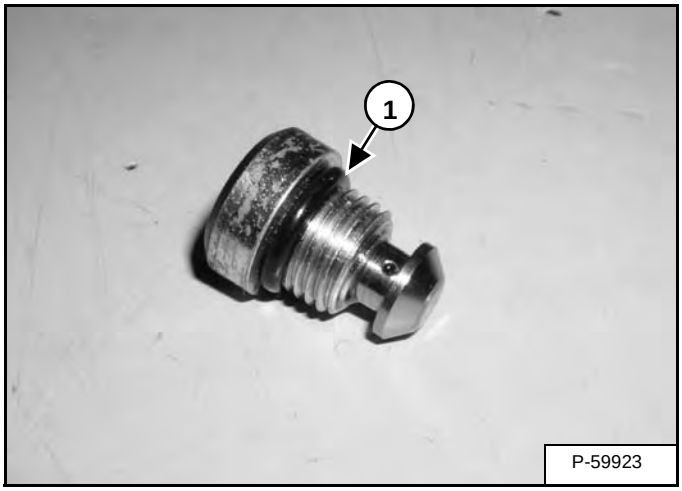
Remove the load checks (Item 1) **[Figure 20-40-63]** from valve section.

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

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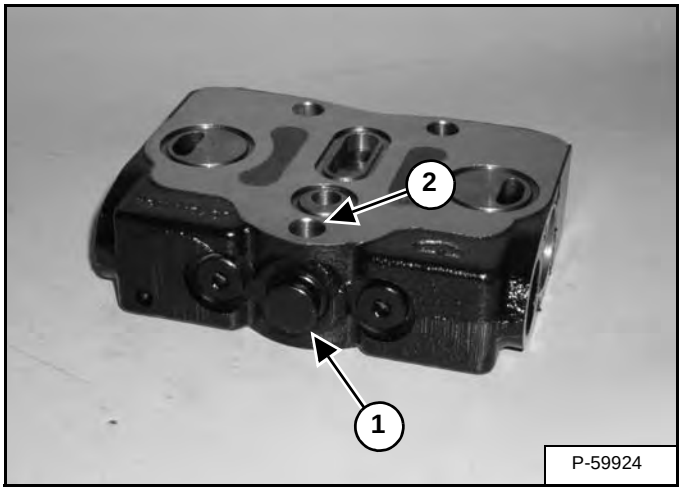
Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-64



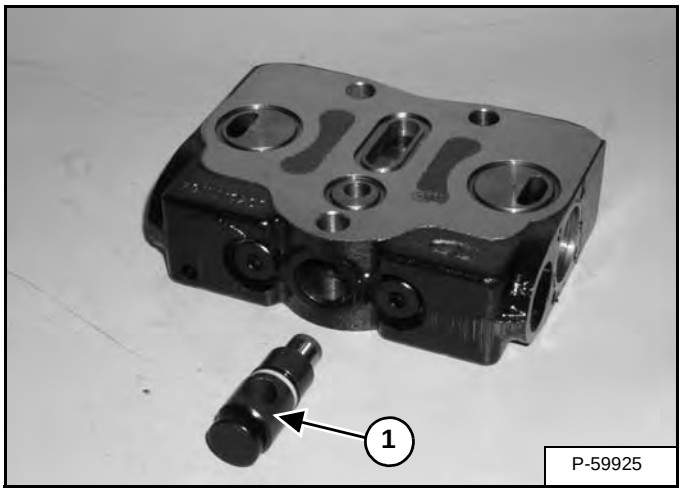
Remove the O-ring (Item 1) **[Figure 20-40-64]** from the load check.

Figure 20-40-65



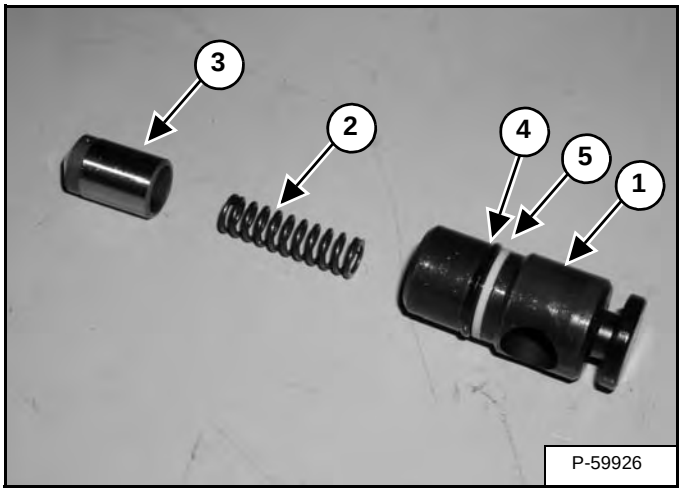
Installation: Align the hole in the buildup valve (Item 1) with the hole (Item 2) **[Figure 20-40-65]** in the auxiliary valve section. Fully depress the buildup valve and slide the auxiliary valve section on the tie rods.

Figure 20-40-66



Remove the buildup valve assembly (Item 1) **[Figure 20-40-65]** and **[Figure 20-40-66]**.

Figure 20-40-67



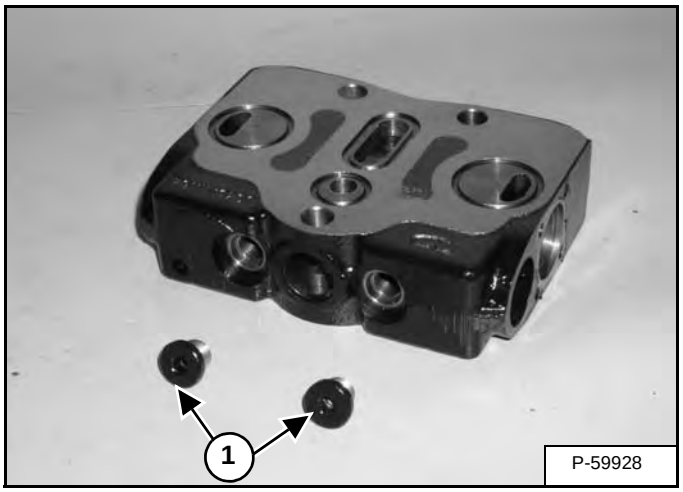
Remove the build-up valve (Item 1), spring (Item 2) and piston (Item 3) **[Figure 20-40-67]**.

Remove the O-ring (Item 4) and back-up seal (Item 5) **[Figure 20-40-67]**.

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Auxiliary Valve Section Disassembly And Assembly (Cont'd)

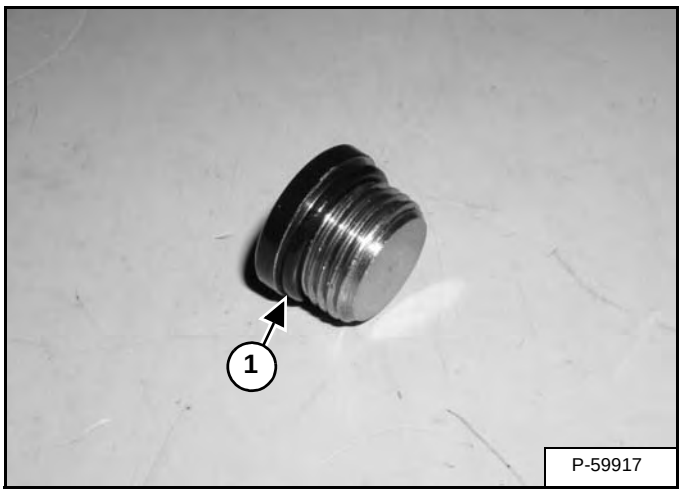
Figure 20-40-68



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

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

Figure 20-40-69



Remove the O-ring (Item 1) **[Figure 20-40-69]** from the plug.

Dealer Copy -- Not for Resale

Boom Valve Section Disassembly And Assembly

IMPORTANT

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

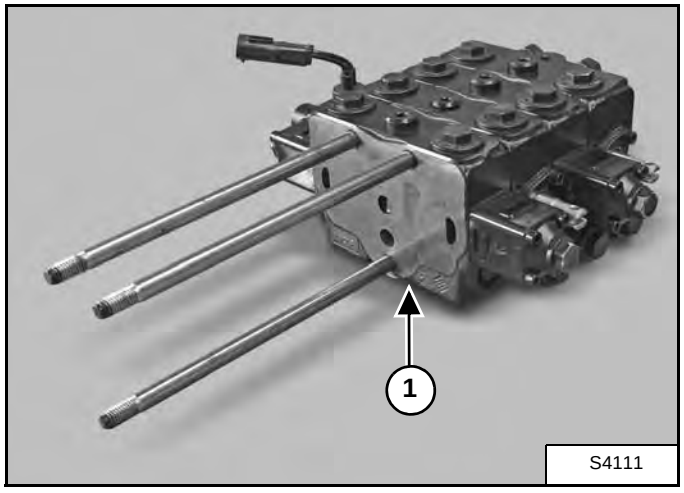
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

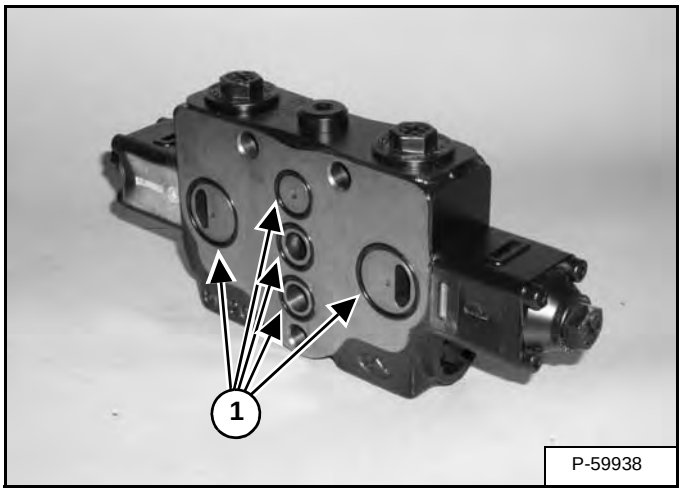
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-70



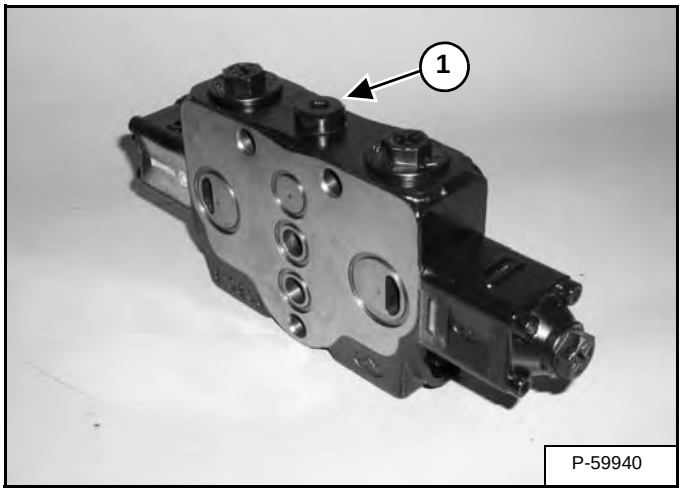
Remove the boom valve section (Item 1) **[Figure 20-40-70]** from the valve assembly.

Figure 20-40-71



Remove the O-rings (Item 1) **[Figure 20-40-71]** from the boom valve section.

Figure 20-40-72



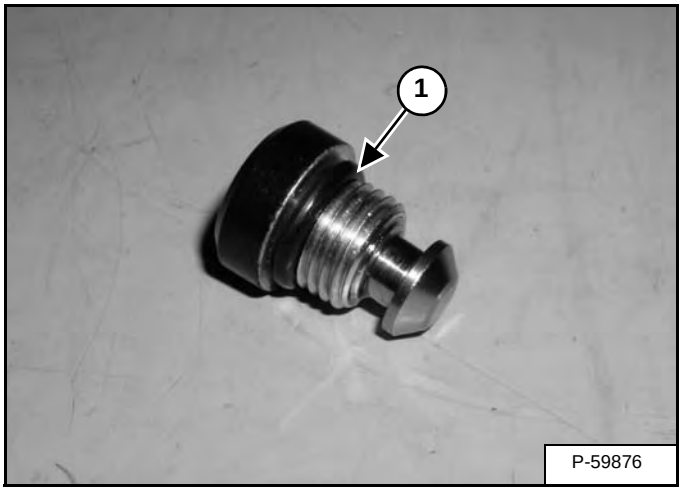
Remove the load check valve (Item 1) **[Figure 20-40-72]**.

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

Dealer Copy -- Not for Resale

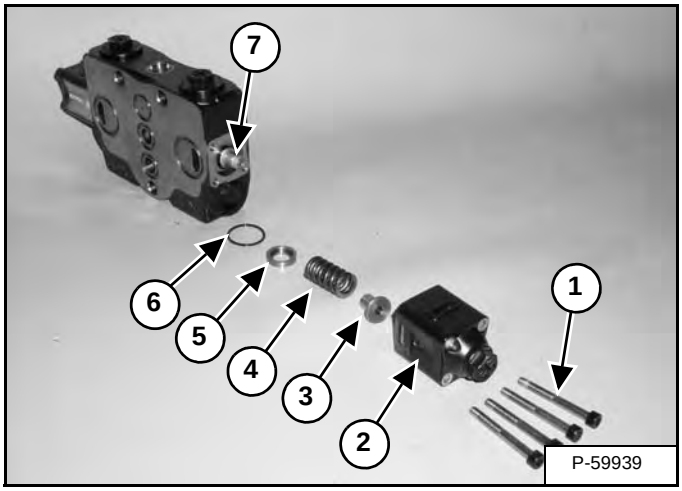
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-73



Remove the O-ring (Item 1) **[Figure 20-40-73]** from the load check valve.

Figure 20-40-74

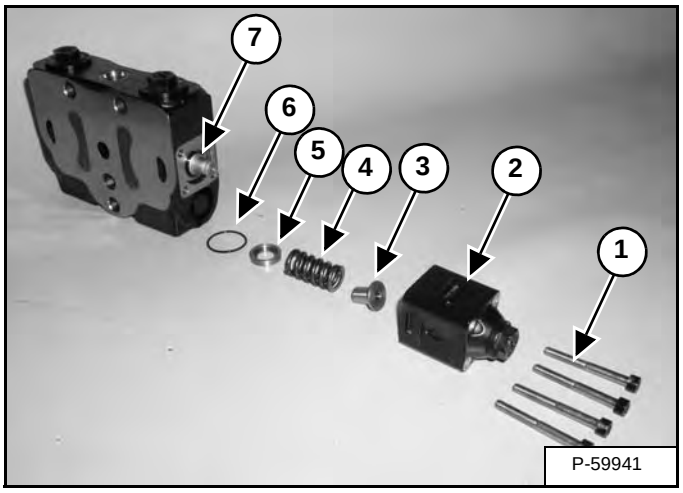


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-74]**.

Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 7) **[Figure 20-40-74]**.

Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-75

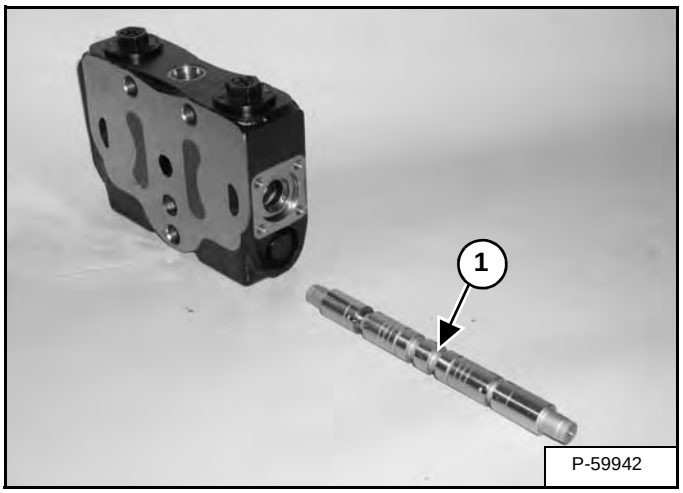


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-75]**.

Installation: Make sure the lip on the spring retainer (Item 5) fits over the spool (Item 7) **[Figure 20-40-75]**.

Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-76



Remove the spool (Item 1) **[Figure 20-40-76]**.

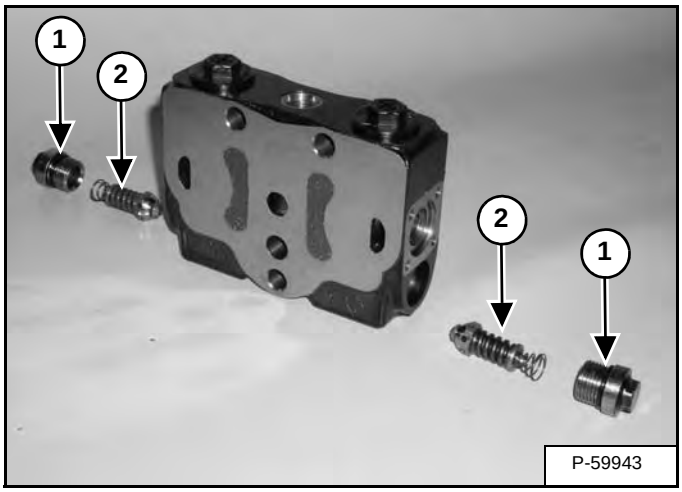
The spool and valve section are not serviced separately.

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

Dealer Copy -- Not for Resale

Boom Valve Section Disassembly And Assembly (Cont'd)

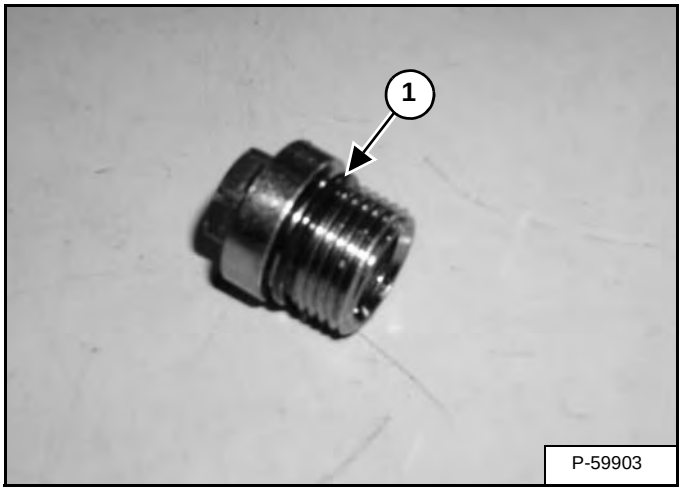
Figure 20-40-77



Remove the plug (Item 1) and valve assembly (Item 2) **[Figure 20-40-77]** from both relief valves.

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

Figure 20-40-78



Remove the O-ring (Item 1) **[Figure 20-40-78]** from both plugs.

Dealer Copy -- Not for Resale

Left Travel Valve Section Disassembly And Assembly

IMPORTANT

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

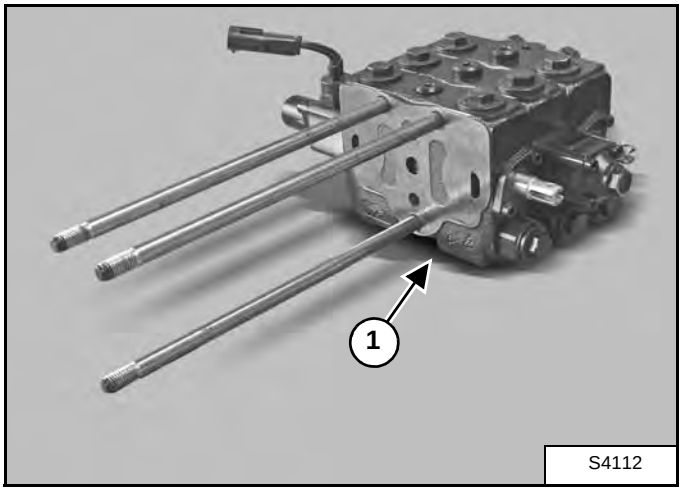
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

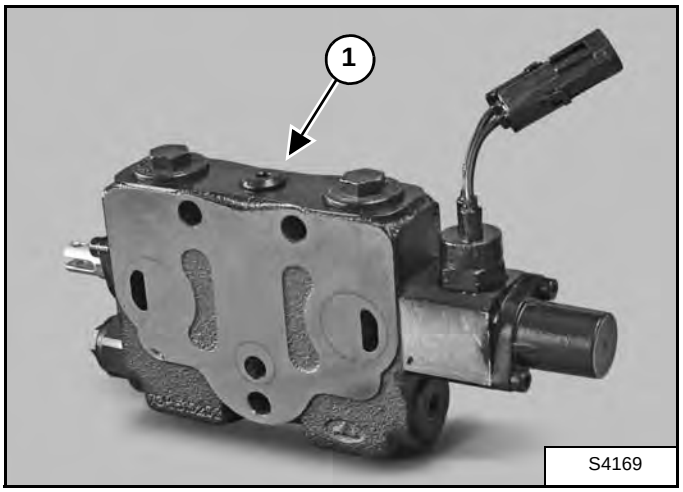
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-79



Remove the left travel valve section (Item 1) **[Figure 20-40-79]** from the valve assembly.

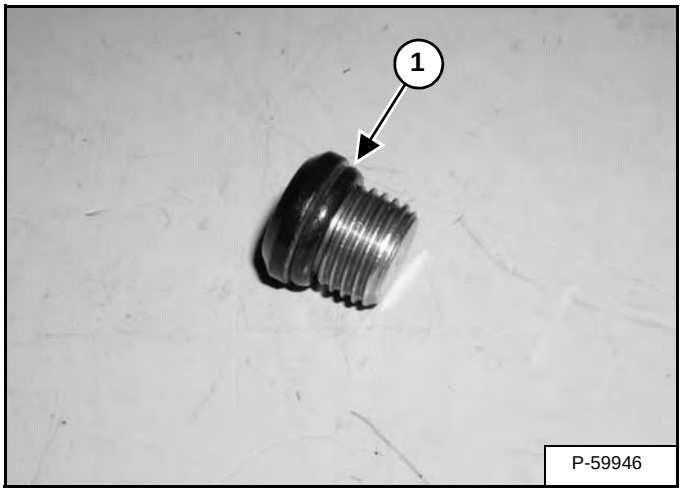
Figure 20-40-80



Remove the plug (Item 1) **[Figure 20-40-80]** from the left travel valve section.

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

Figure 20-40-81

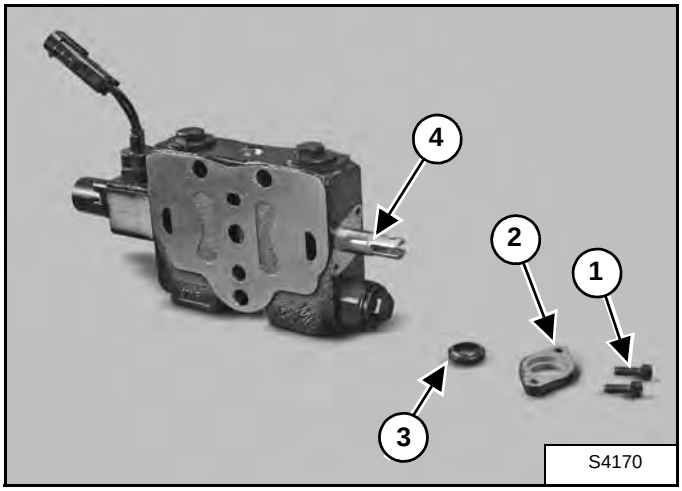


Remove the O-ring (Item 1) **[Figure 20-40-81]** from the plug.

Dealer Copy -- Not for Resale

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

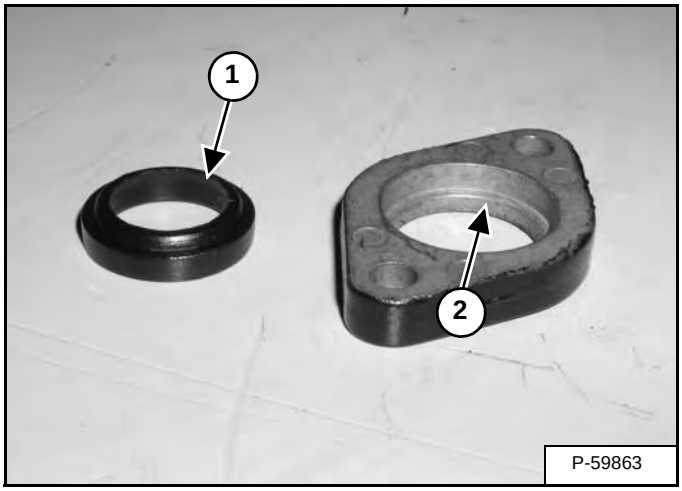
Figure 20-40-82



Remove the bolts (Item 1), retainer (Item 2) and seal (Item 3) from the spool (Item 4) **[Figure 20-40-82]**.

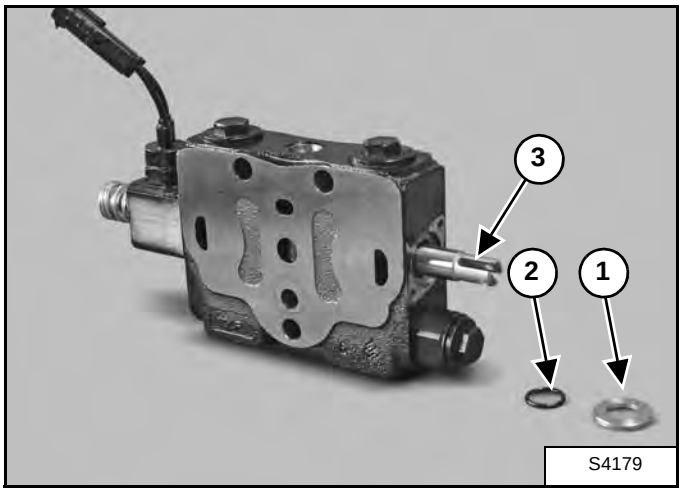
Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-83



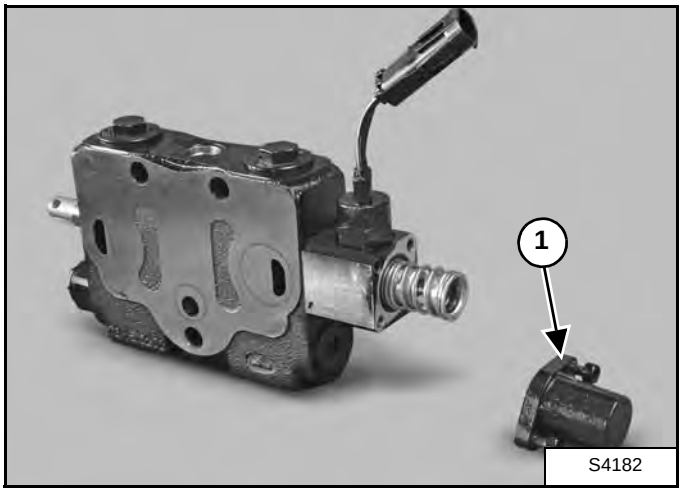
Installation: Make sure the lip (Item 1) of the seal fits inside the retaining plate (Item 2) **[Figure 20-40-83]**.

Figure 20-40-84



Remove the washer (Item 1) and O-ring (Item 2) from the actuating end of the spool (Item 3) **[Figure 20-40-84]**.

Figure 20-40-85



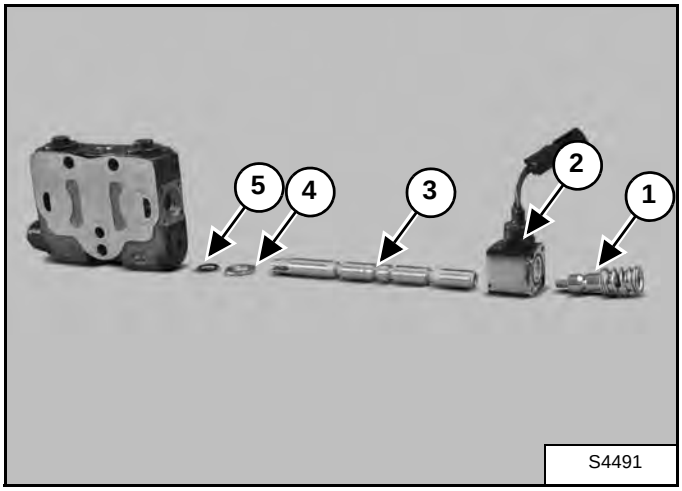
Remove the cap (Item 1) **[Figure 20-40-85]**.

Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Dealer Copy -- Not for Resale

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

Figure 20-40-86



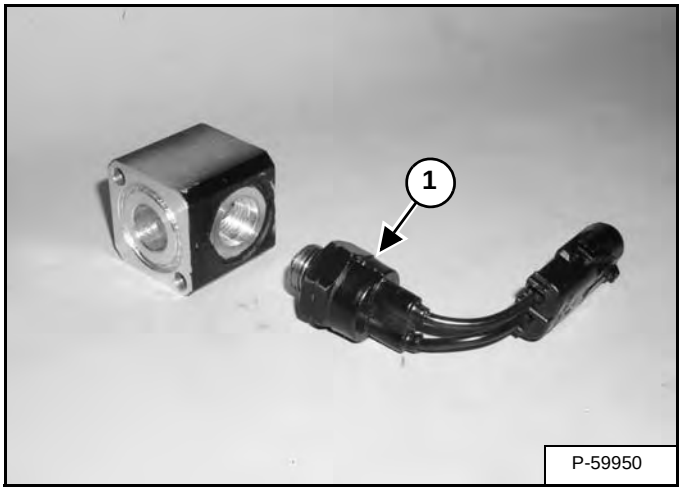
Remove the spring assembly (Item 1), spool cover (Item 2), spool (Item 3), washer (Item 4) and O-ring (Item 5) **[Figure 20-40-86]**.

The spool and valve section are not serviced separately.

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

Installation: Tighten the spring assembly (Item 1) **[Figure 20-40-86]** to 9,8 N•m (86.7 in-lb) torque.

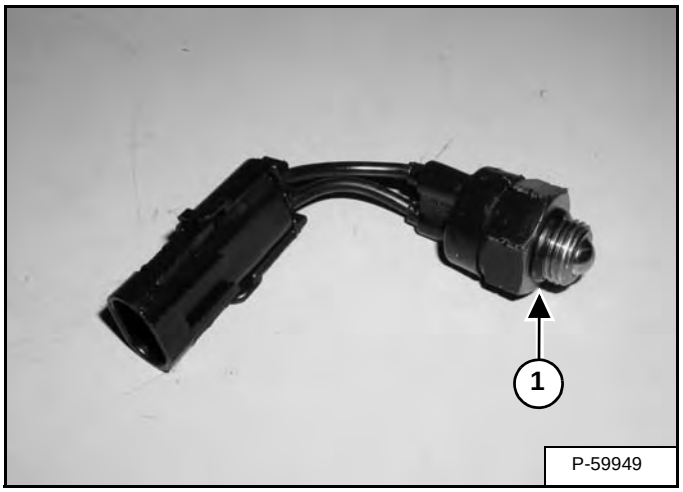
Figure 20-40-87



Remove the switch (Item 1) **[Figure 20-40-87]** from the spool cover.

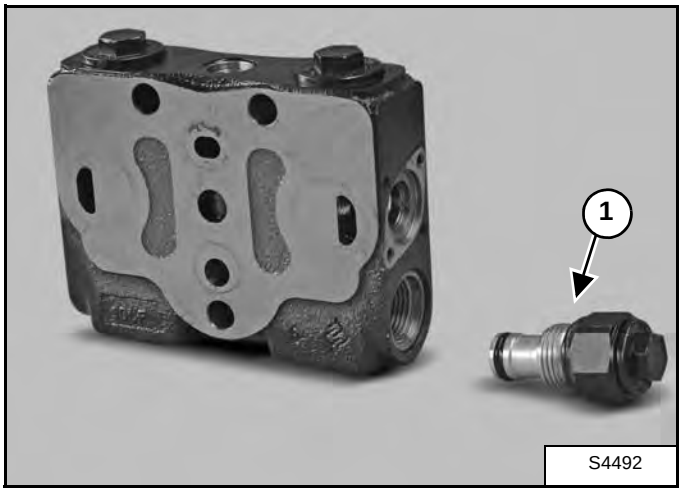
Installation: Tighten the bolts to 42 N•m (31 ft-lb) torque.

Figure 20-40-88



Remove the O-ring (Item 1) **[Figure 20-40-88]** from the switch.

Figure 20-40-89



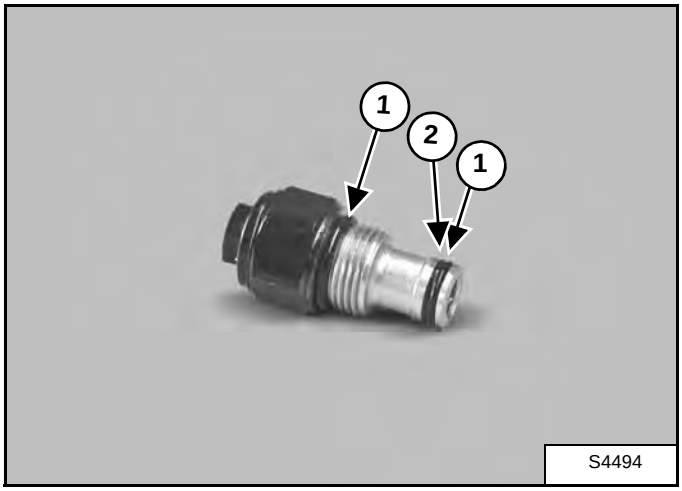
Remove the fitting (Item 1) **[Figure 20-40-89]**.

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

Dealer Copy -- Not for Resale

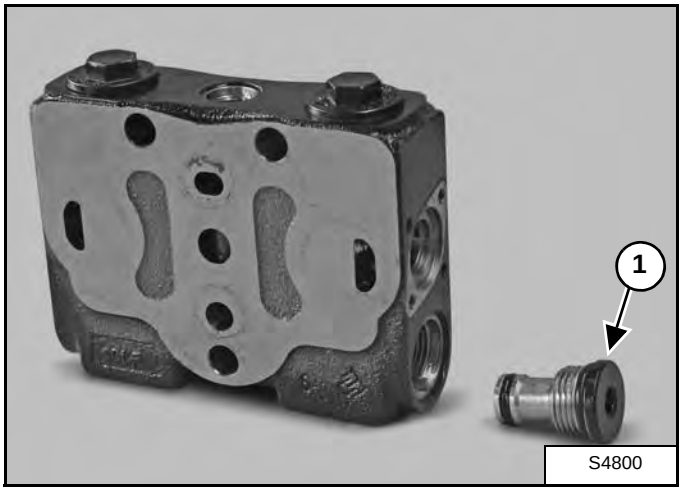
Left Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-90



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-90]** from the fitting.

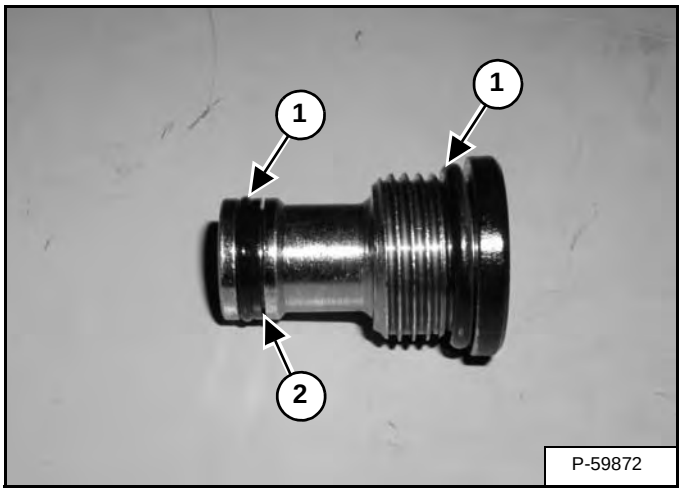
Figure 20-40-91



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

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

Figure 20-40-92



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-92]** from the plug.

Dealer Copy -- Not for Resale

Swing (Slew) Valve Section Disassembly And Assembly

IMPORTANT

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

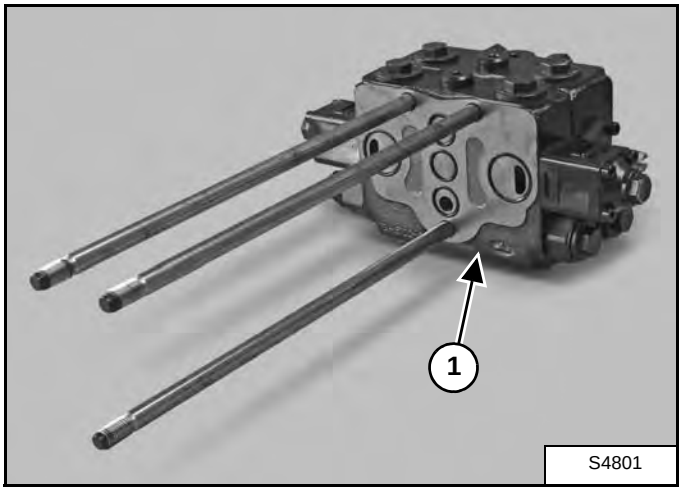
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

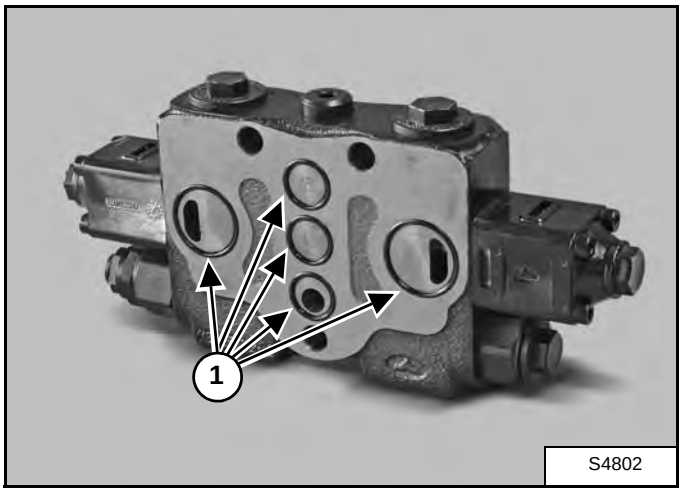
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-93



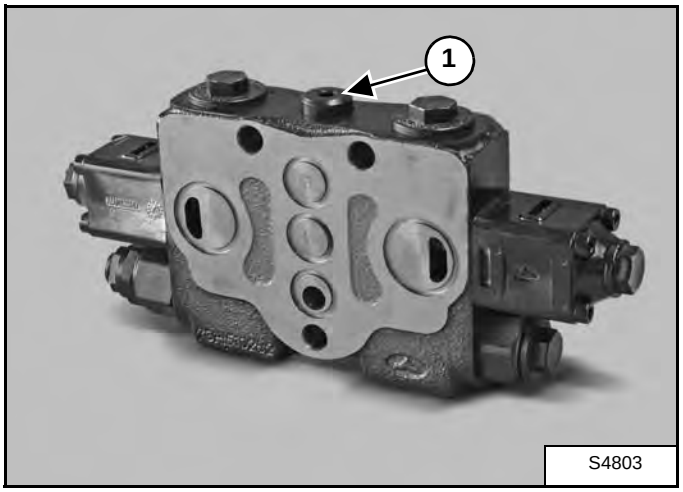
Remove the swing (slew) valve section (Item 1) **[Figure 20-40-93]** from the valve assembly.

Figure 20-40-94



Remove the O-rings (Item 1) **[Figure 20-40-94]** from the swing (slew) valve section.

Figure 20-40-95



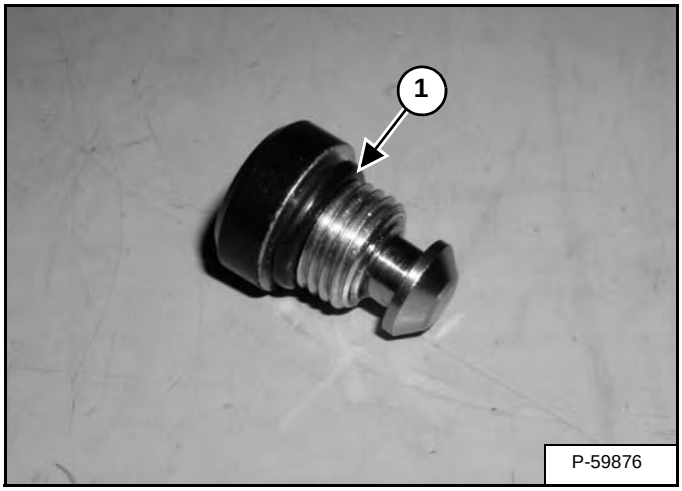
Remove the load check valve (Item 1) **[Figure 20-40-95]**.

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

Dealer Copy -- Not for Resale

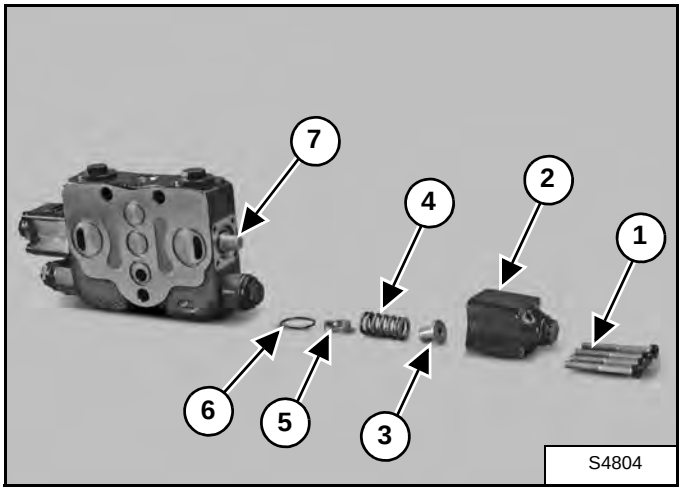
Swing (Slew) Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-96



Remove the O-ring (Item 1) **[Figure 20-40-96]** from the load check valve.

Figure 20-40-97

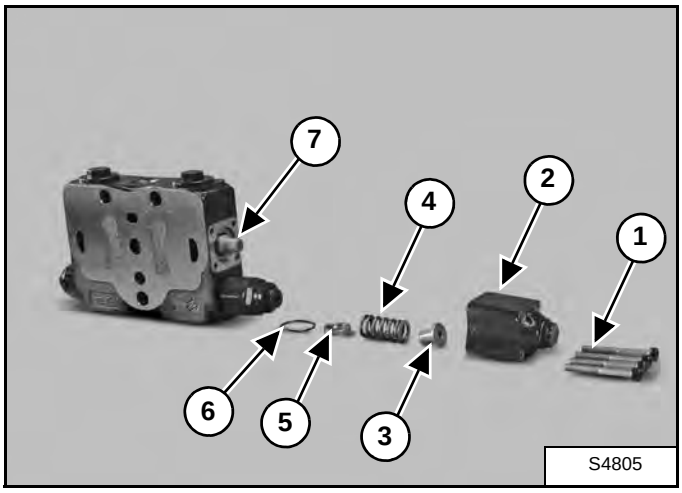


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-97]**.

Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 7) **[Figure 20-40-97]**.

Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-98

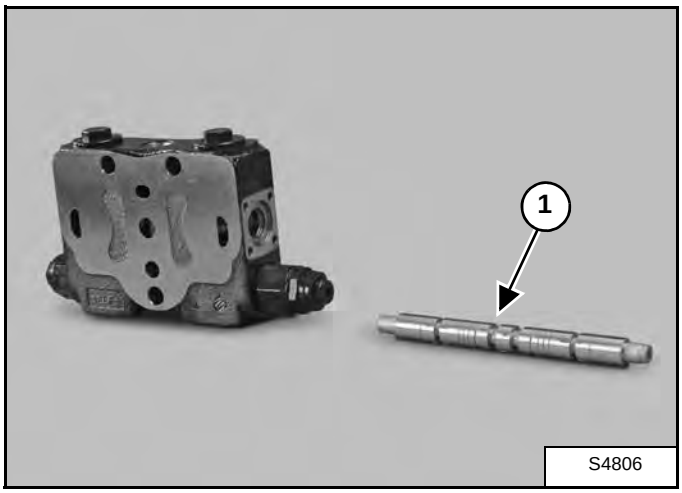


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-98]**.

Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 7) **[Figure 20-40-98]**.

Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-99



Remove the spool (Item 1) **[Figure 20-40-99]**.

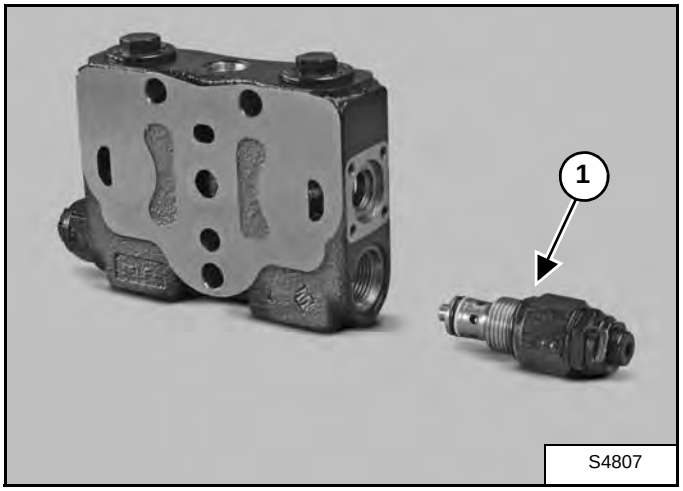
The spool and valve section are not serviced separately.

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

Dealer Copy -- Not for Resale

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

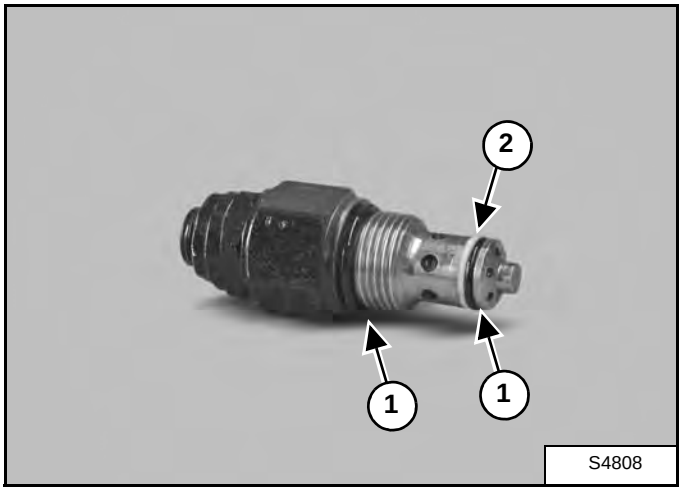
Figure 20-40-100



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

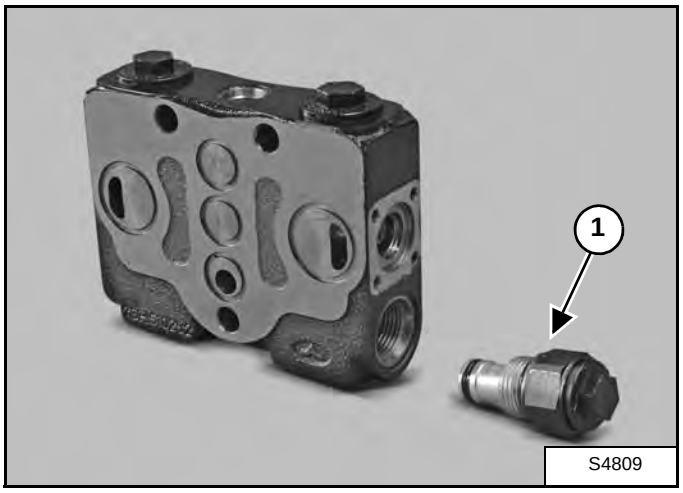
Installation: Tighten the to 42 N•m (31 ft-lb) torque.

Figure 20-40-101



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-101]** from the relief valve.

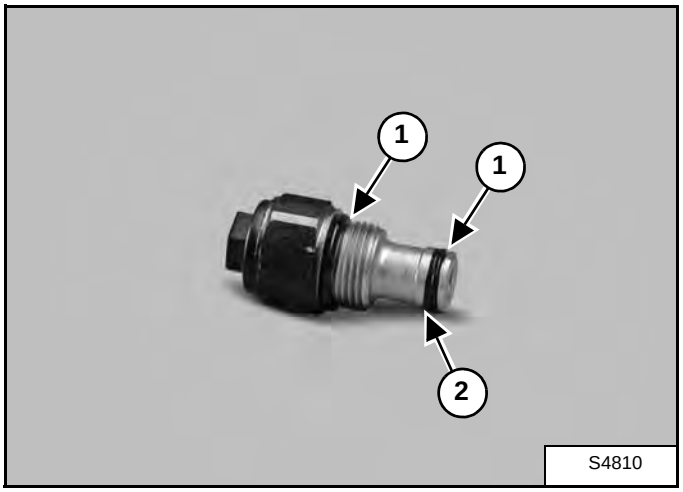
Figure 20-40-102



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

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

Figure 20-40-103



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-103]** from the fitting.

Dealer Copy -- Not for Resale

Blade Valve Section Disassembly And Assembly

IMPORTANT

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

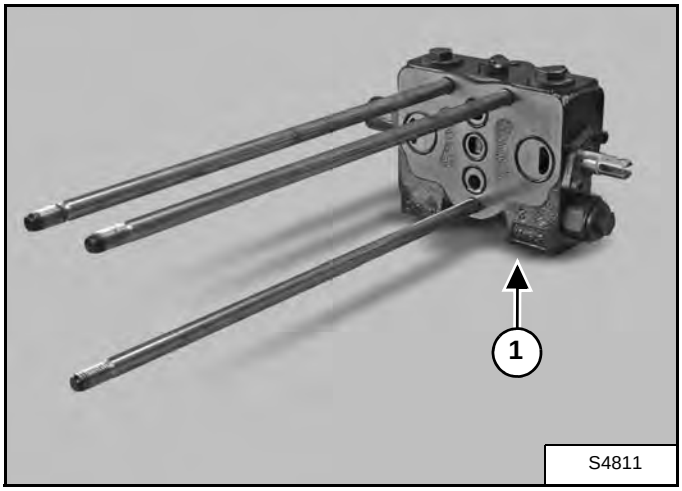
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

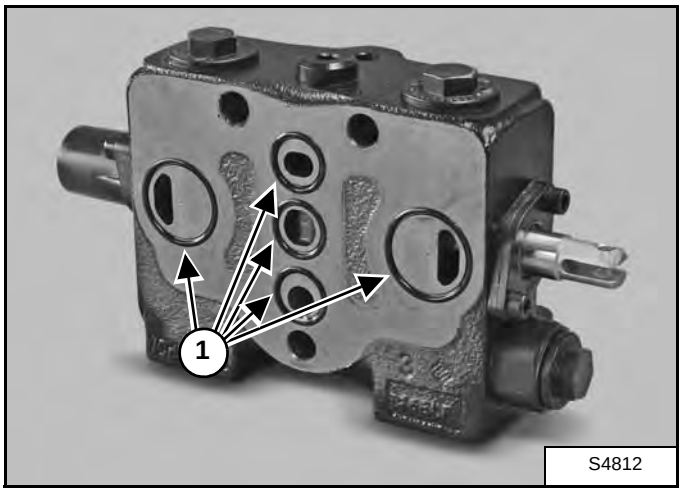
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-104



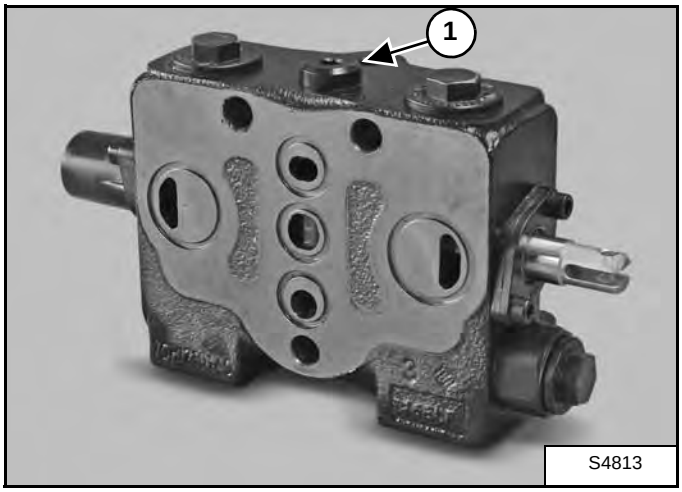
Remove the blade valve section (Item 1) **[Figure 20-40-104]** from the tie rods.

Figure 20-40-105



Remove the O-rings (Item 1) **[Figure 20-40-105]** from the blade valve section.

Figure 20-40-106



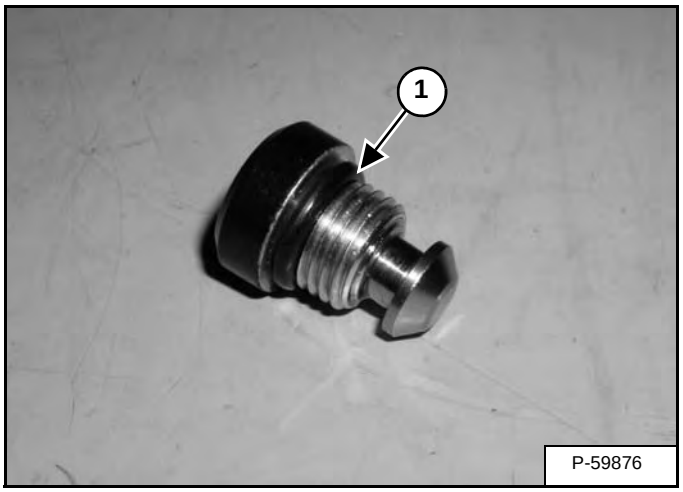
Remove the load check valve (Item 1) **[Figure 20-40-106]**.

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

Dealer Copy -- Not for Resale

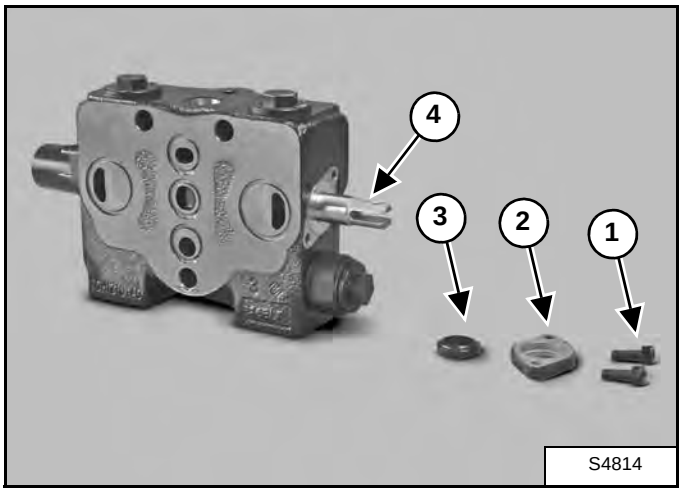
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-107



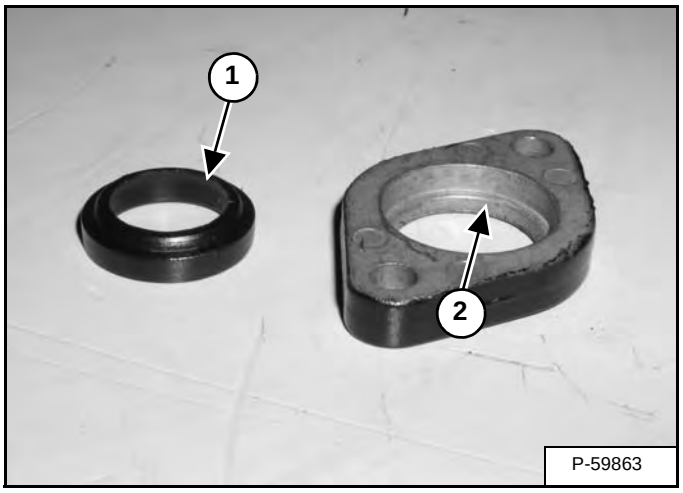
Remove the O-ring (Item 1) **[Figure 20-40-107]** from the load check valve.

Figure 20-40-108



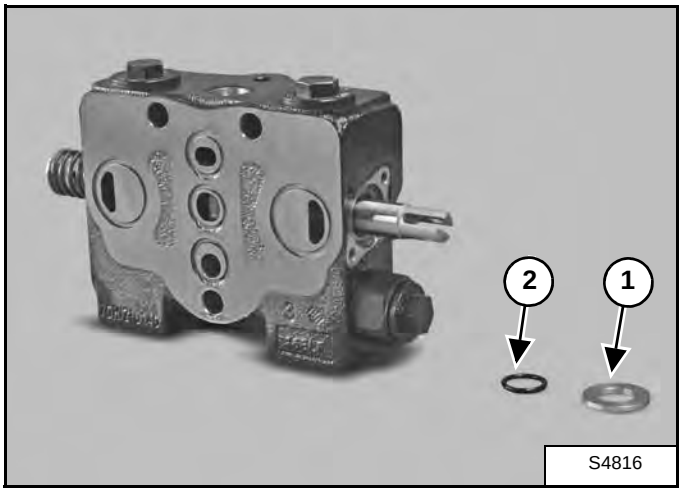
Remove the bolts (Item 1), spool retainer (Item 2) and seal (Item 3) from the actuating end of the spool (Item 4) **[Figure 20-40-108]**.

Figure 20-40-109



Installation: Make sure the lip (Item 1) of the seal fits inside the retaining plate (Item 2) **[Figure 20-40-109]**.

Figure 20-40-110

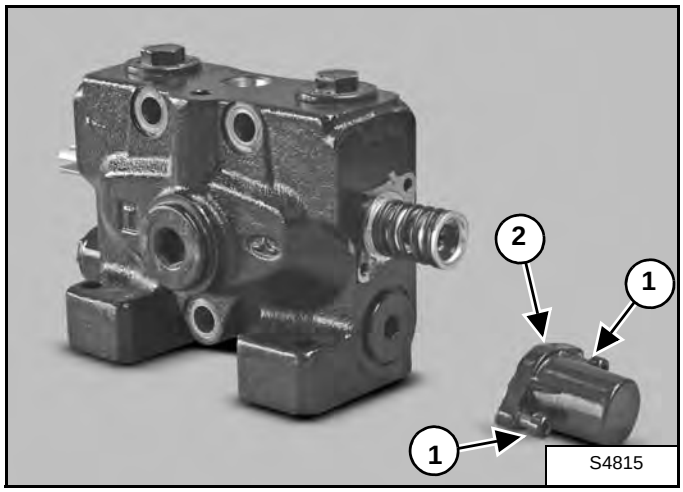


Remove the washer (Item 1) and O-ring (Item 2) **[Figure 20-40-110]**.

Dealer Copy -- Not for Resale

Blade Valve Section Disassembly And Assembly (Cont'd)

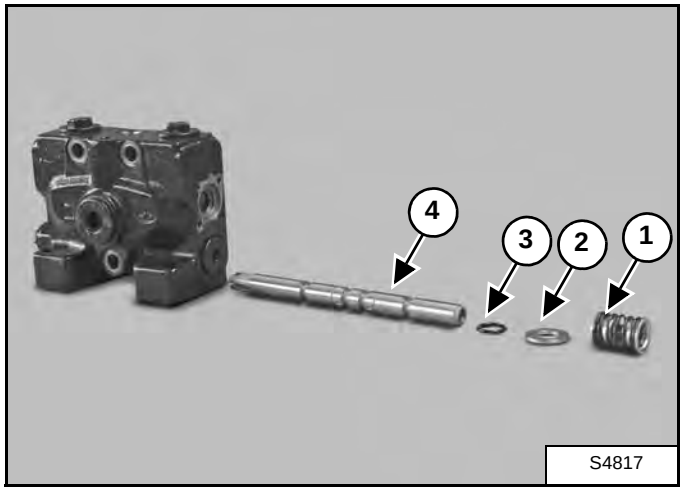
Figure 20-40-111



Loosen the bolts (Item 1) and remove the cap and screw assembly (Item 2) **[Figure 20-40-111]**.

Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-112



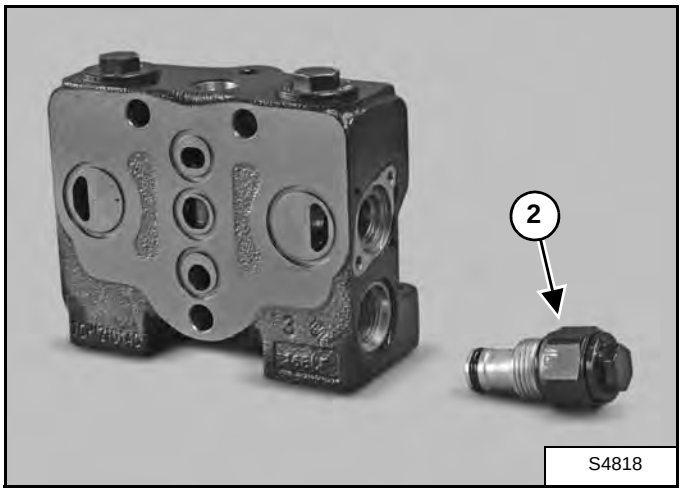
Remove the spring assembly (Item 1), washer (Item 2), O-ring (Item 3) and spool (Item 4) **[Figure 20-40-112]**.

The spool and valve section are not serviced separately.

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

Installation: Tighten the spring retaining bolt to 9,8 N•m (86.7 in-lb) torque.

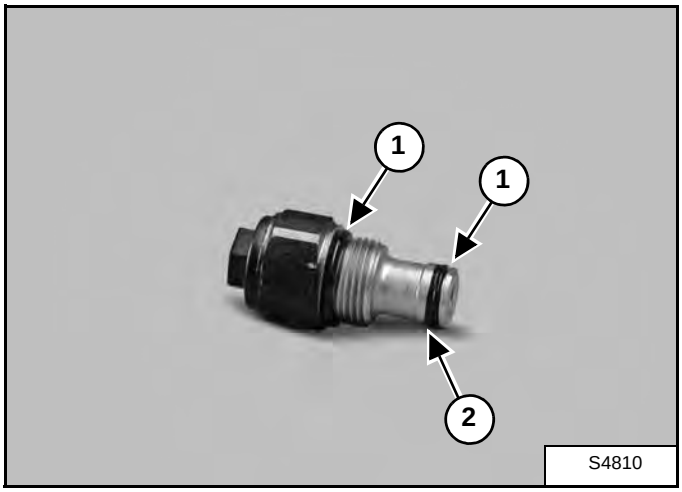
Figure 20-40-113



Remove the fitting (Item 1) **[Figure 20-40-113]**

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

Figure 20-40-114

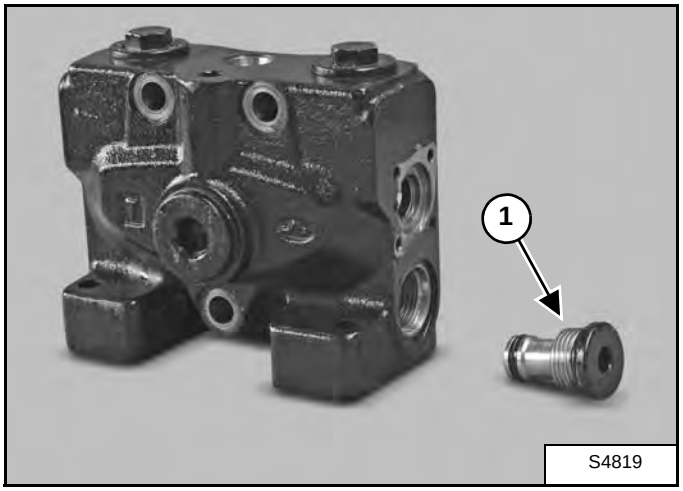


Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-114]** from the fitting.

Dealer Copy -- Not for Resale

Blade Valve Section Disassembly And Assembly (Cont'd)

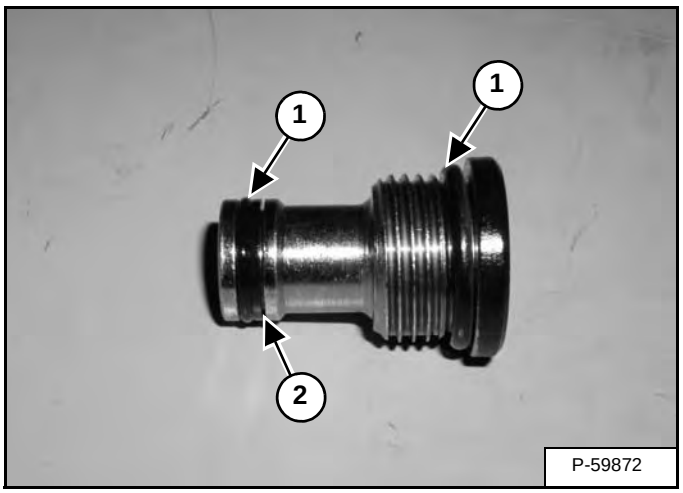
Figure 20-40-115



Remove the plug (Item 1) **[Figure 20-40-115]**.

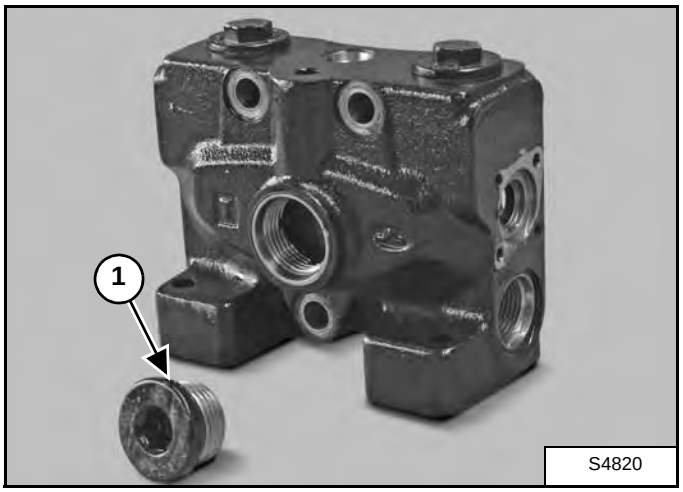
Installation: Tighten the plug to 42 N•m (31 ft-lb) torque.

Figure 20-40-116



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-116]** from the plug.

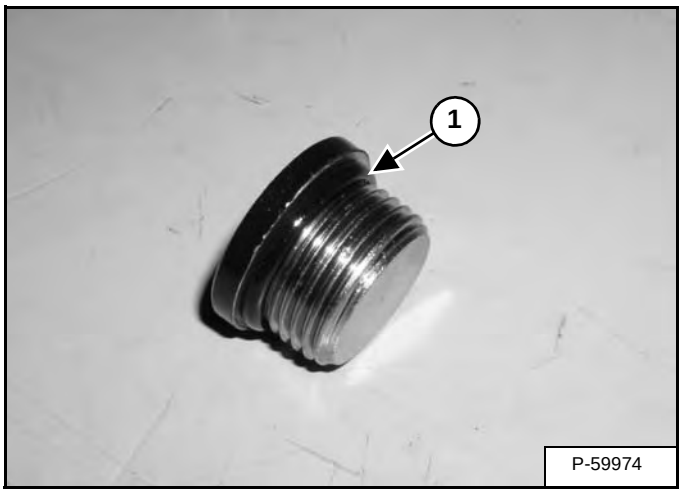
Figure 20-40-117



Remove the plug (Item 1) **[Figure 20-40-117]**.

Installation: Tighten the plug to 35 N•m (26 ft-lb) torque.

Figure 20-40-118



Remove the O-ring (Item 1) **[Figure 20-40-118]** from the plug.

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.

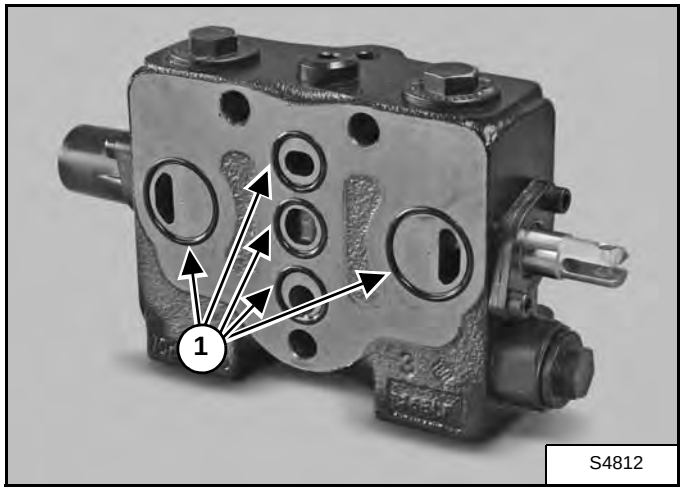
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

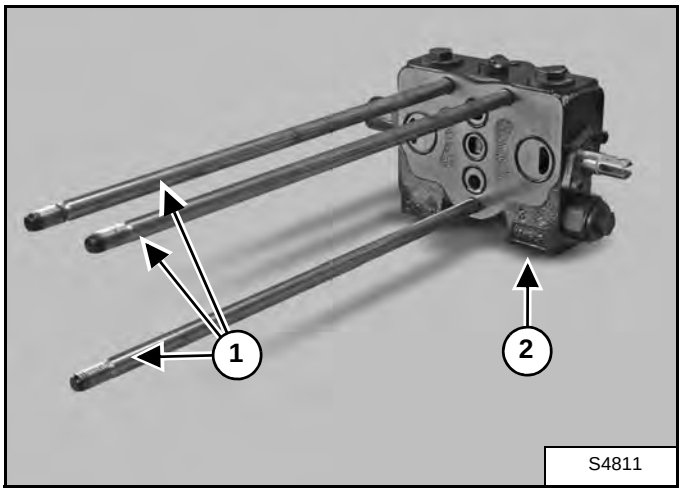
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-119



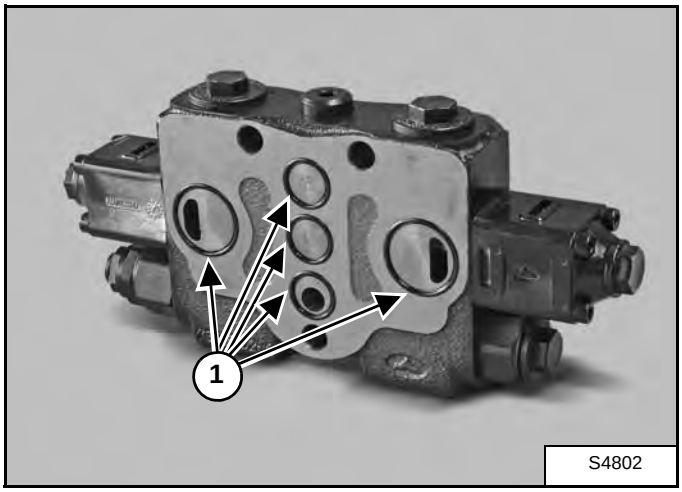
Install the O-rings (Item 1) **[Figure 20-40-119]** on the blade valve section.

Figure 20-40-120



Install the tie rods (Item 1) on the blade valve section (Item 2) **[Figure 20-40-120]**.

Figure 20-40-121

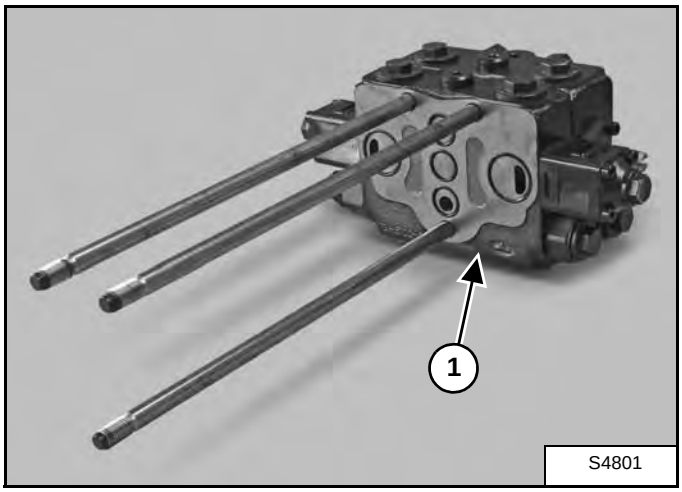


Install the O-rings (Item 1) **[Figure 20-40-121]** on the swing (slew) valve section.

Dealer Copy -- Not for Resale

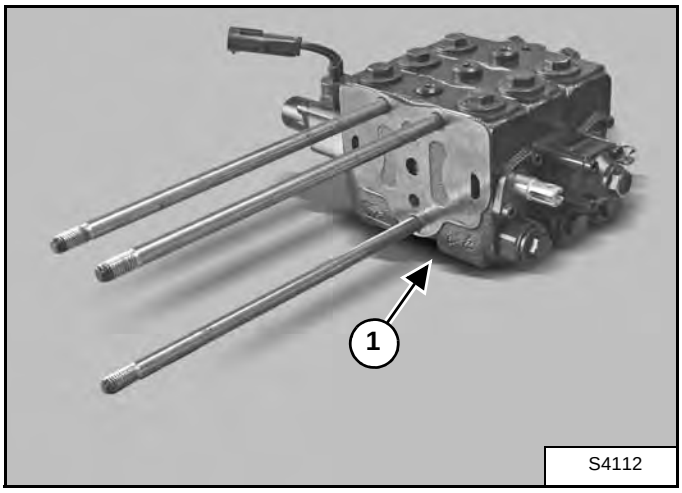
Assembly (Cont'd)

Figure 20-40-122



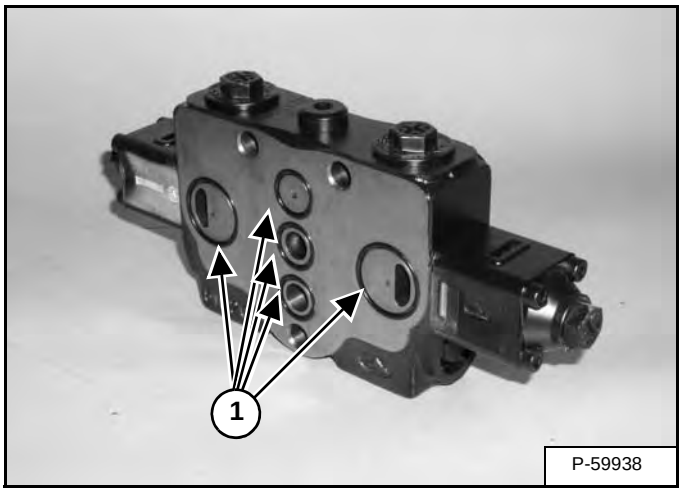
Install the swing (slew) valve section (Item 1) **[Figure 20-40-122]** on the tie rods.

Figure 20-40-123



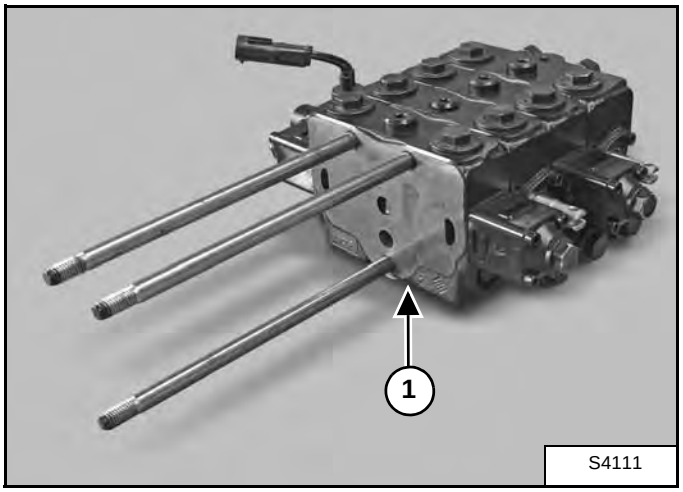
Install the left travel valve section (Item 1) **[Figure 20-40-123]** on the tie rods.

Figure 20-40-124



Install the O-rings (Item 1) **[Figure 20-40-124]** on the boom valve section.

Figure 20-40-125

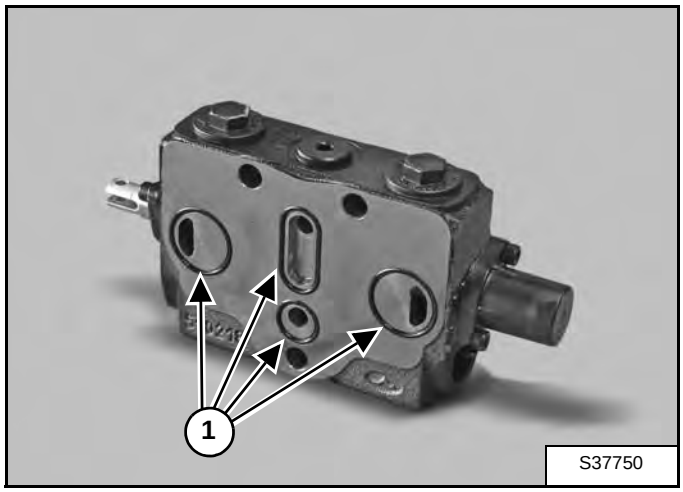


Install the boom valve section (Item 1) **[Figure 20-40-125]** on the tie rods.

Dealer Copy -- Not for Resale

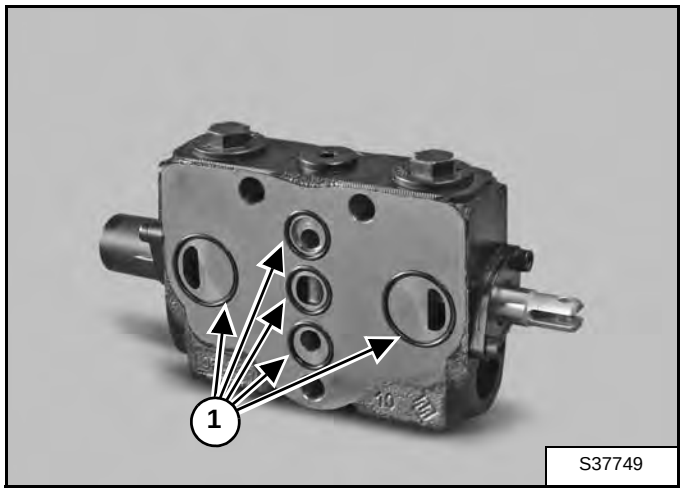
Assembly (Cont'd)

Figure 20-40-126



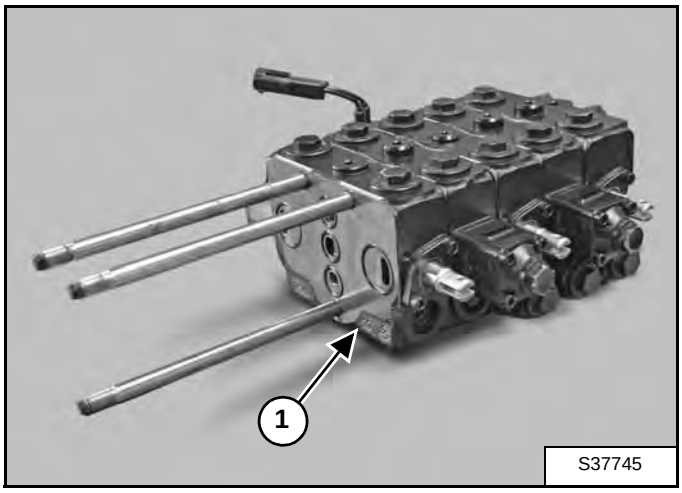
Install the O-rings (Item 1) **[Figure 20-40-126]** on the auxiliary valve section.

Figure 20-40-127



Install the O-rings (Item 1) **[Figure 20-40-127]** on the auxiliary valve section.

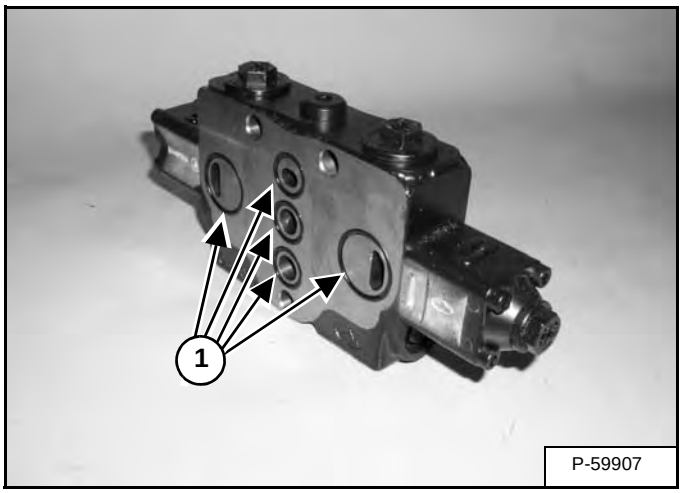
Figure 20-40-128



Install the auxiliary valve section (Item 1) **[Figure 20-40-128]** on the tie rods.

NOTE: Use care while installing the auxiliary valve section. The buildup valve is spring loaded and the hole in the buildup valve must be aligned with the hole in the auxiliary valve section (Item 2) [Figure 20-40-128] before installing the bottom tie rod.

Figure 20-40-129

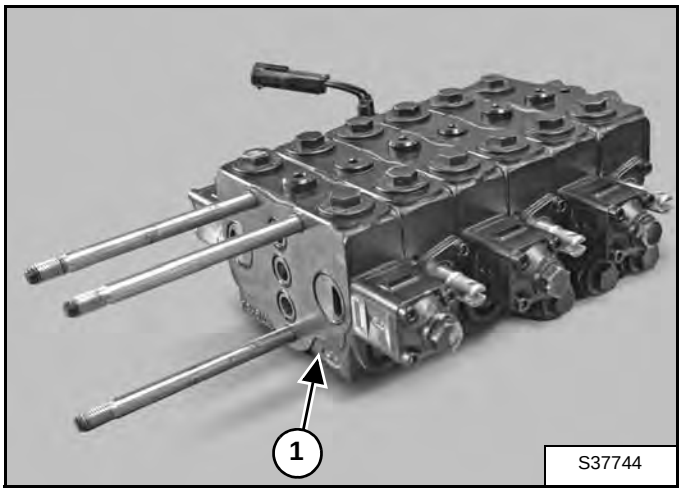


Install the O-rings (Item 1) **[Figure 20-40-129]** on the side of the bucket valve section.

Dealer Copy -- Not for Resale

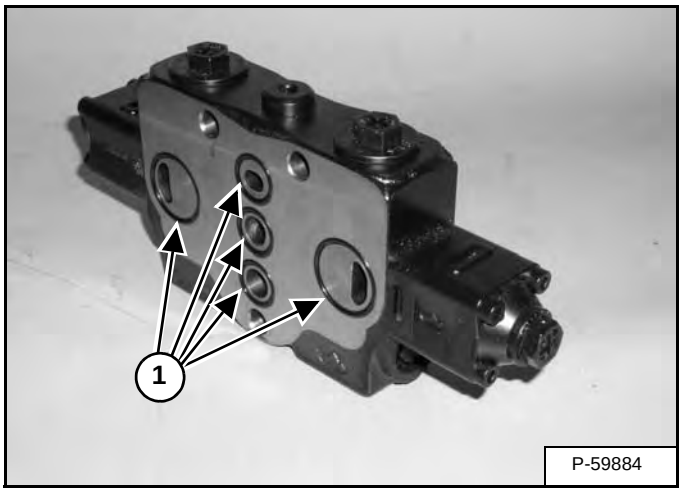
Assembly (Cont'd)

Figure 20-40-130



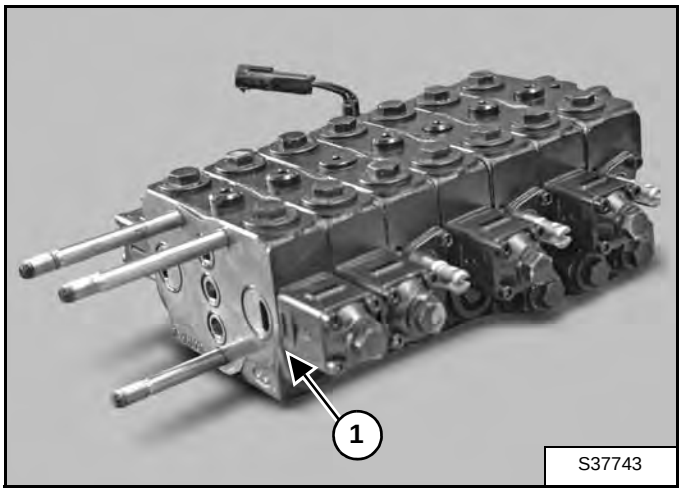
Install the bucket valve section (Item 1) **[Figure 20-40-130]** on the tie rods.

Figure 20-40-131



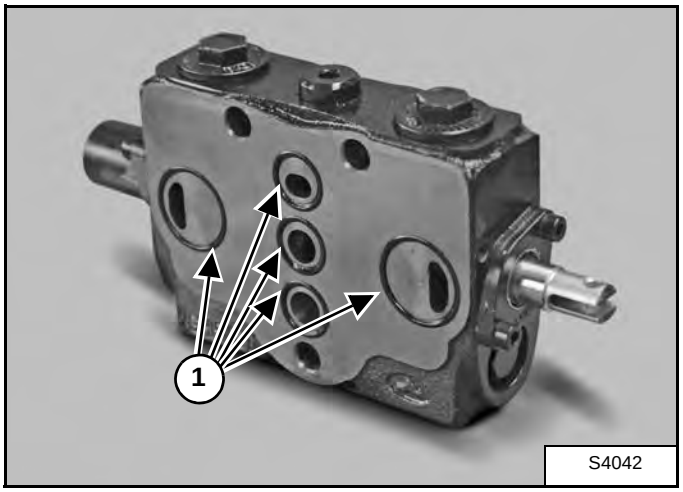
Install the O-rings (Item 1) **[Figure 20-40-131]** on the arm valve section.

Figure 20-40-132



Install the arm valve section (Item 1) **[Figure 20-40-132]** on the tie rods.

Figure 20-40-133

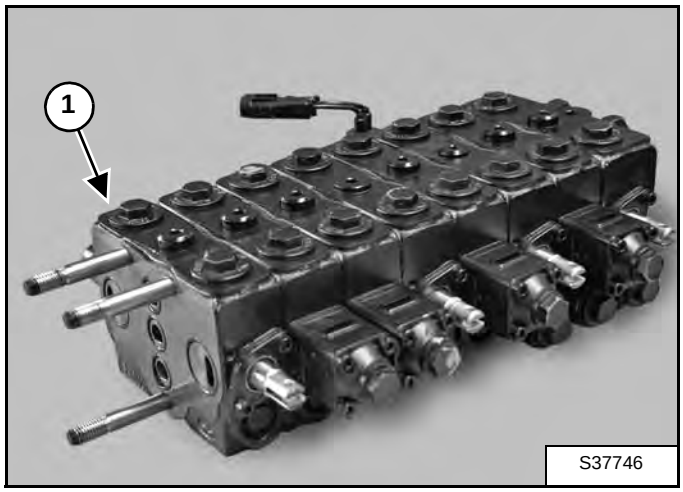


Install the O-rings (Item 1) **[Figure 20-40-133]** on the boom swing (slew) valve section.

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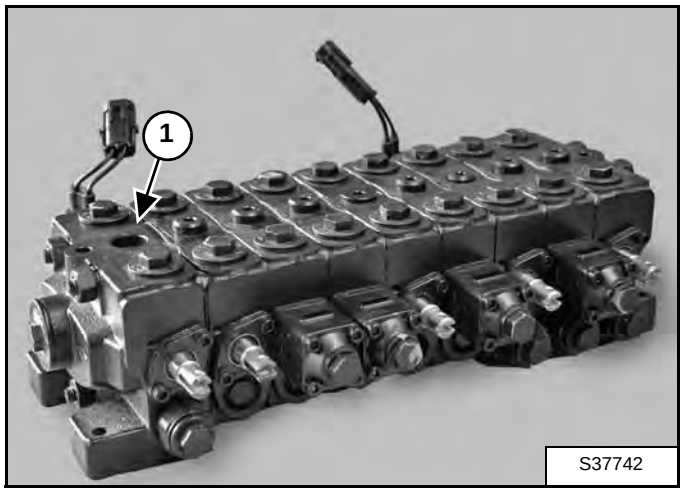
Assembly (Cont'd)

Figure 20-40-134



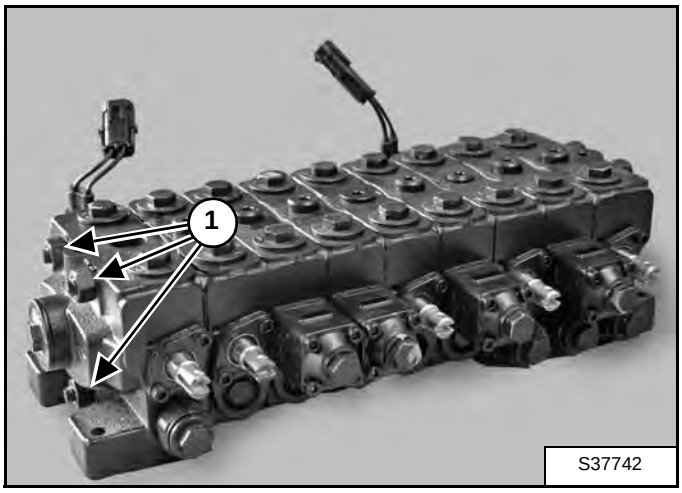
Install the boom swing valve section (Item 1) **[Figure 20-40-134]** on the tie rods.

Figure 20-40-135



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

Figure 20-40-136



Install the washers and nuts (Item 1) **[Figure 20-40-136]** on the tie rods, finger tight.

Be sure the valve assembly does not rock on a flat surface.

Initially tighten the tie rod nuts (Item 1) **[Figure 20-40-136]** to 13 N•m (10 ft-lb) torque in a crisscross manner.

Final tighten the tie rod nuts (Item 1) **[Figure 20-40-136]** to 35 N•m (26 ft-lb) torque.

The valve assembly must not have any spacing between the valve sections and the spools must be free when pushed in and released.

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

Recheck the control valve assembly for level settings.

Install the hoses and fittings.

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HYDRAULIC PUMP

Description

IMPORTANT

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

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Figure 20-50-1

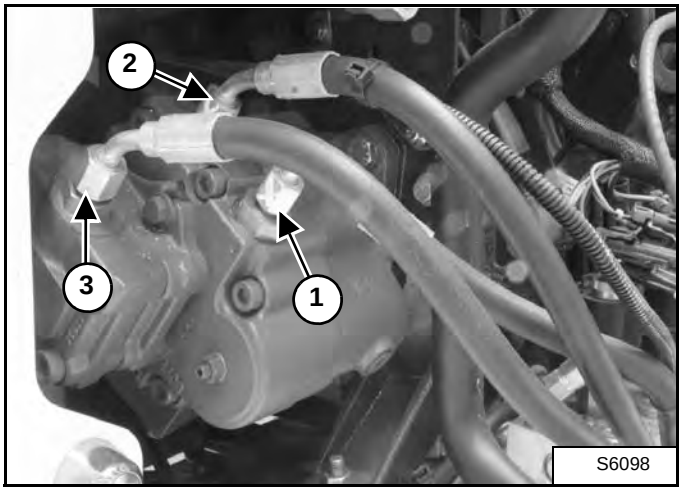
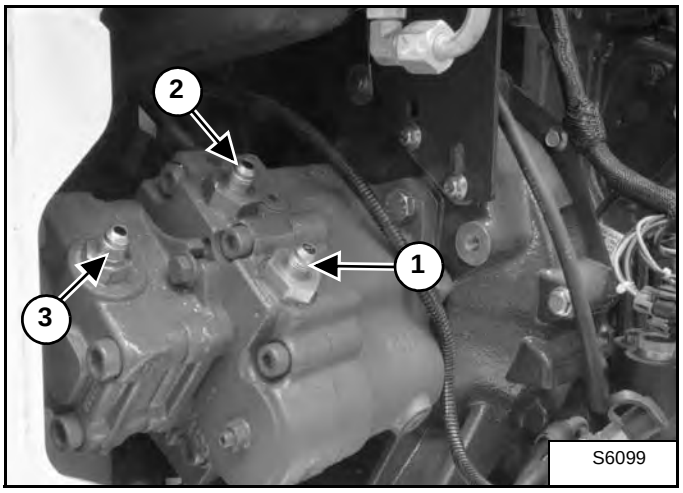


Figure 20-50-2



Pump outlet one (Item 1) **[Figure 20-50-1]** and **[Figure 20-50-3]** provides hydraulic fluid to the right hand travel, boom swing, arm, bucket and auxiliary valve sections.

Pump outlet two (Item 2) **[Figure 20-50-1]** and **[Figure 20-50-3]** provides hydraulic fluid flow to the left hand travel and boom valve sections.

Pump outlet three (gear pump) (Item 3) **[Figure 20-50-1]** and **[Figure 20-50-3]** provides hydraulic fluid flow to the upperstructure swing and blade valve sections.

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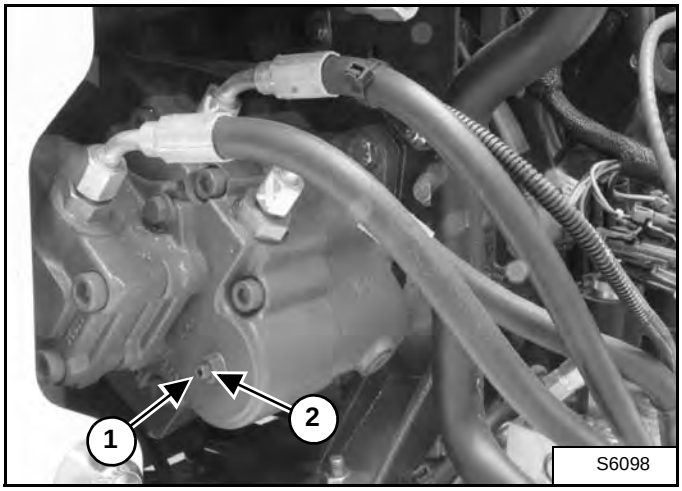
HYDRAULIC PUMP (CONT'D)

Torque Adjustment

Prior to making any torque adjustment, insure all piston and gear pump tests have been completed and they are to rated specifications. (See the following pages for pump tests.)

Prior to making any torque adjustment, make sure the no load engine rpm is correct.

Figure 20-50-3



The adjustment screw (Item 1) **[Figure 20-50-3]** is used to match the maximum hydraulic horsepower of the pump to the maximum rated engine horsepower.

Remove any auxiliary hydraulic attachments from the excavator.

Engage the swing lock.

Start the engine and move the speed control to the high rpm position.

Engage the following hydraulic functions, and continue to engage the functions.

Engage the auxiliary hydraulics.
Extend the bucket cylinder.
Extend the arm cylinder.
Extend the boom cylinder.
Extend the boom swing cylinder.
Engage the upperstructure swing.

With all the above hydraulic functions engaged, the engine speed must maintain 2500 rpm.

To adjust the hydraulic pump torque, loosen the lock nut (Item 2) **[Figure 20-50-3]** and turn the adjustment screw clockwise to increase pump torque. anticlockwise to decrease pump torque.

Tighten the locknut and retest the pump.

Increase or decrease pump torque until correct engine rpm is maintained.

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Testing The Piston Pump

All pump testing is done with the hydraulic fluid at operating temperature and with the engine high speed setting.

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

MEL10003 - Hydraulic Tester

Stop the engine.

Open the tailgate. (See TAILGATE on Page 10-60-1.)

Figure 20-50-4

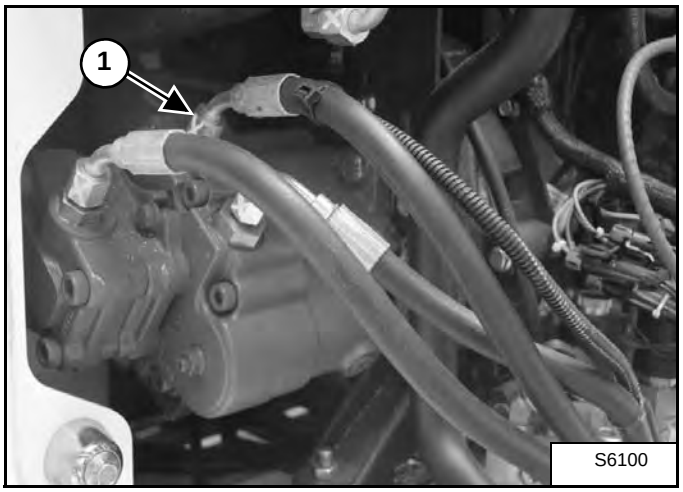
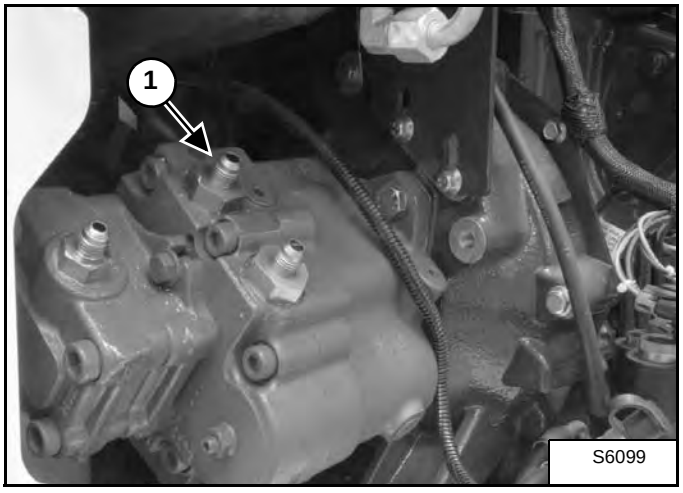
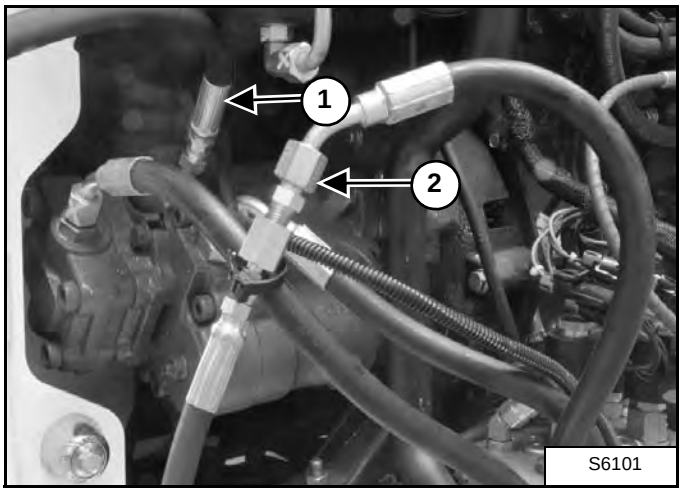


Figure 20-50-5



Remove the outlet hose (Item 1) **[Figure 20-50-4]** and **[Figure 20-50-5]** from the hydraulic pump being tested.

Figure 20-50-6



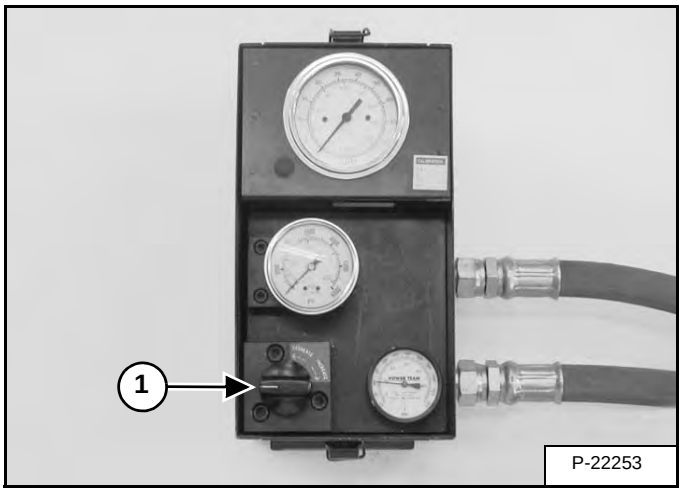
Connect the inlet (Item 1) **[Figure 20-50-6]** of the tester to the pump.

Connect the outlet of the tester to the hose (Item 2) **[Figure 20-50-6]** that was removed from the pump.

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Testing The Piston Pump (Cont'd)

Figure 20-50-7



NOTE: Open the flow control knob (Item 1) [Figure 20-50-7] fully to prevent pump damage. This is a direct pump test. There is no relief valve in the system.

Start the engine and run at low rpm. Make sure the tester is connected correctly. If no flow is indicated at the tester, the hoses are connected wrong.

Increase the engine speed to full rpm. Warm the hydraulic fluid to 66°C (150°F) by turning the restrictor valve until the gauge reads about 6,9 MPa (69 bar) (1000 psi). Do not exceed system pressure.

After the temperature is correct, open the restrictor valve fully.

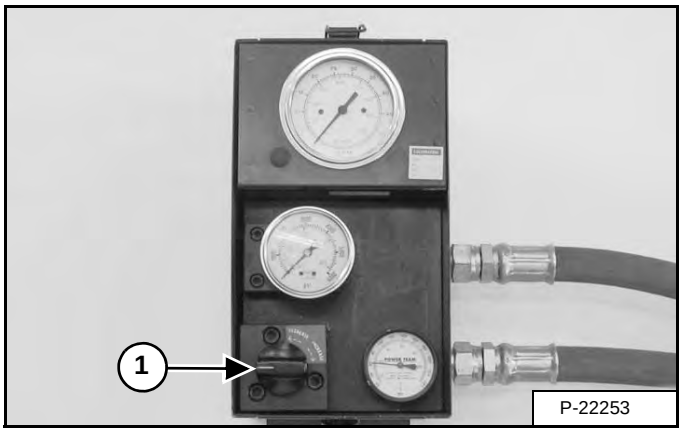
Record the pump free flow L/min (U.S. gpm).

Pump flow on a new piston pump is 15,0 L/min (3.96 U.S. gpm) @ 2500 rpm.

Repeat the procedure for pump outlet two.

The pump flow must be equal between outlet one and two.

Figure 20-50-8



Close the flow control knob (Item 1) **[Figure 20-50-8]** slowly to 0,689 MPa (6.89 bar) (100 psi) below the relief valve setting 23,1 MPa (231 bar) (3350 psi).

Record the pump high pressure flow L/min (U.S. gpm).

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

$$\% = \frac{\text{HIGH PRESSURE FLOW (U.S. gpm)}}{\text{FREE FLOW (U.S. gpm)}} \text{ x100}$$

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

Repeat the procedure for pump outlet two.

The pump flow must be equal between outlet one and two.

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Testing The Gear Pump

All pump testing is done with the hydraulic fluid at operating temperature and with the engine high speed setting.

Figure 20-50-9

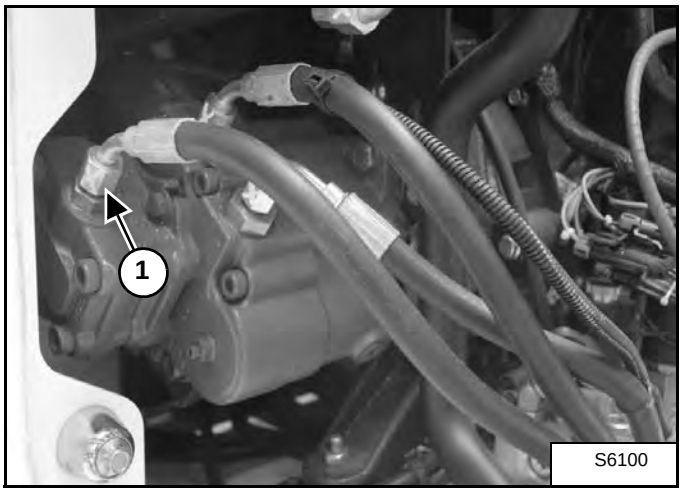
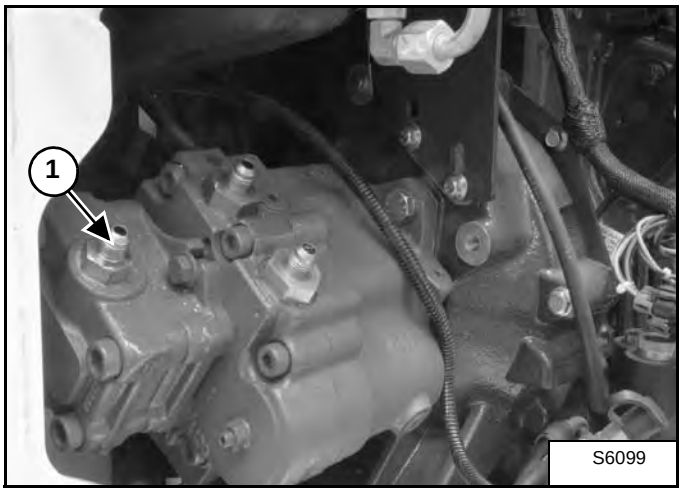
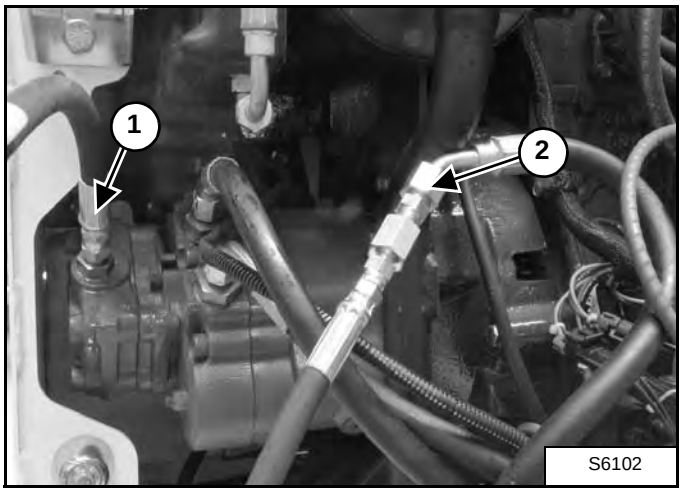


Figure 20-50-10



Remove the outlet hose (Item 1) **[Figure 20-50-9]** and **[Figure 20-50-10]** from the hydraulic pump section being tested.

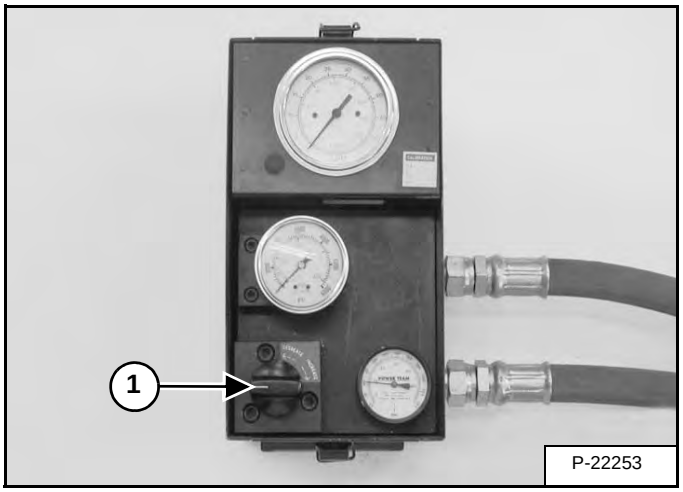
Figure 20-50-11



Connect the inlet (Item 1) **[Figure 20-50-11]** of the tester to the pump.

Connect the outlet of the tester to the hose (Item 2) **[Figure 20-50-11]** that was removed from the pump.

Figure 20-50-12



NOTE: Open the flow control knob (Item 1) [Figure 20-50-12] fully to prevent pump damage. This is a direct pump test. There is no relief valve in the system.

Start the engine and run at low rpm. Make sure the tester is connected correctly. If no flow is indicated at the tester, the hoses are connected wrong.

Increase the engine speed to full rpm. Warm the hydraulic fluid to 66°C (150°F) by turning the restrictor valve until the gauge reads about 6,9 MPa (69 bar) (1000 psi). Do not exceed system pressure.

After the temperature is correct, open the restrictor valve fully.

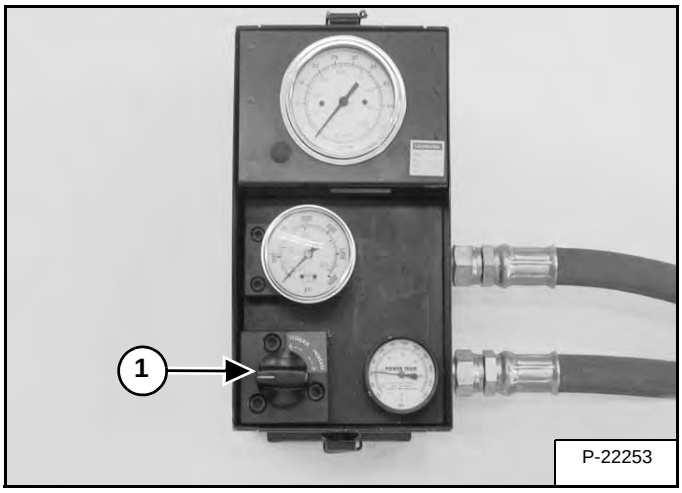
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Testing The Gear Pump (Cont'd)

Record the pump free flow L/min (U.S. gpm).

Pump flow on a new gear pump is 11,25 L/min (2.99 U.S. gpm) @ 2500 rpm.

Figure 20-50-13



Close the flow control knob (Item 1) **[Figure 20-50-13]** slowly to 689,4 kPa (6.89 bar) (100 psi) below the relief valve setting 23,1 MPa (231 bar) (3350 psi).

Record the pump high pressure flow L/min (U.S. gpm).

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

$$\% = \frac{\text{HIGH PRESSURE FLOW (U.S. gpm)}}{\text{FREE FLOW (U.S. gpm)}} \text{ x100}$$

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

Testing Auxiliary Hydraulic Flow

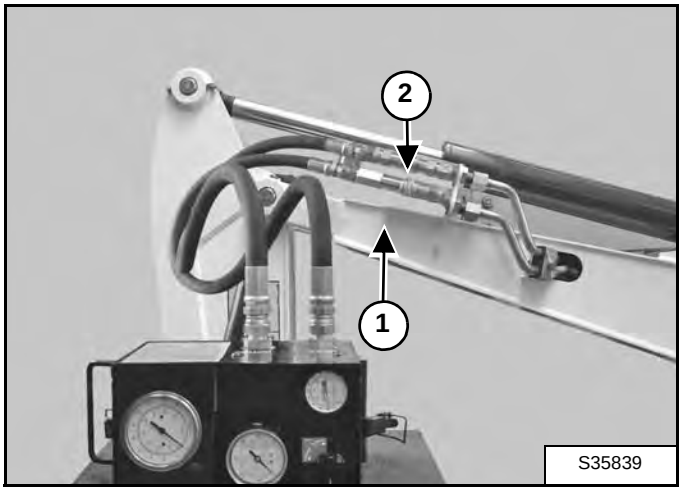
All testing is done with the hydraulic fluid at operating temperature and the engine high speed setting.

The following tool will be needed for the auxiliary hydraulic flow test:

MEL10003-Hydraulic Tester.

Stop the engine.

Figure 20-50-14

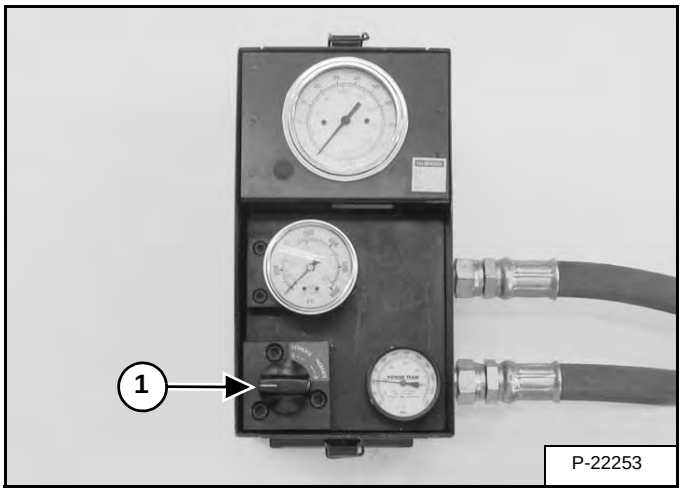


Connect the inlet side of the tester to the female coupler (Item 1) **[Figure 20-50-14]**. Connect the outlet side of the tester to the male coupler (Item 2) **[Figure 20-50-14]**.

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Testing The Auxiliary Hydraulic Flow (Cont'd)

Figure 20-50-15



NOTE: Open the flow control knob (Item 1) [Figure 20-50-15] fully.

Start the engine, and run at low rpm. Engage the auxiliary hydraulic circuit.

NOTE: When engaging the auxiliary hydraulic circuit, make sure the female coupler is pressure and the male coupler is return.

Make sure the tester is connected correctly. If no flow is indicated at the tester, the hoses are connected wrong.

Increase the engine speed to full rpm. Warm the hydraulic fluid to 66°C (150°F) by turning the restrictor valve until the gauge reads about 6,9 MPa (69 bar) (1000 psi). Do not exceed system pressure.

After the temperature is correct, open the restrictor valve fully.

Record the auxiliary hydraulic free flow. This should be 30,0 L/min (7.93 U.S. gpm).

Removal And Installation

Lower the boom / bucket and blade to the ground.

Relieve hydraulic pressure.

Drain the hydraulic reservoir. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

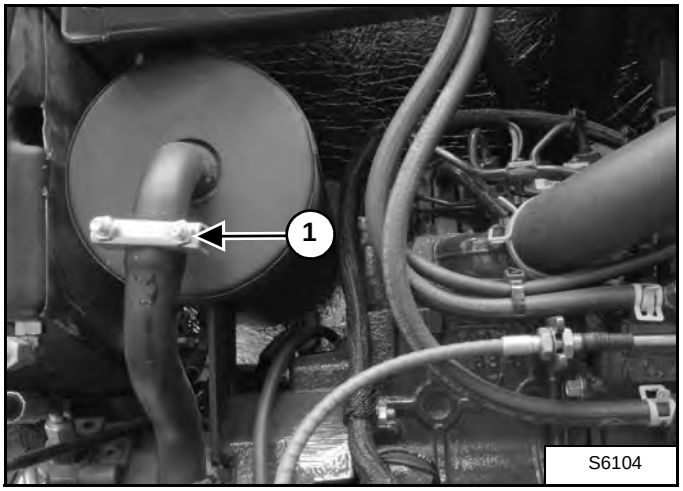
Drain the pump.

IMPORTANT

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

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Figure 20-50-16



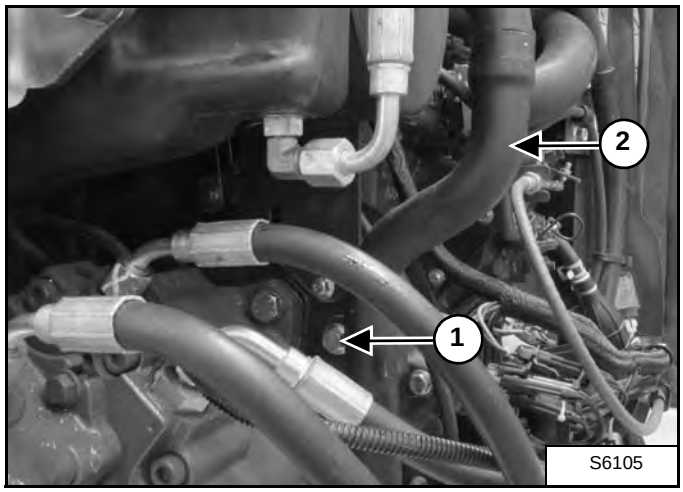
Loosen the exhaust extension clamp (Item 1) **[Figure 20-50-16]**.

Installation: Tighten clamp to 8 - 10 N•m (70.8 - 88.5 in-lb) torque.

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Removal And Installation (Cont'd)

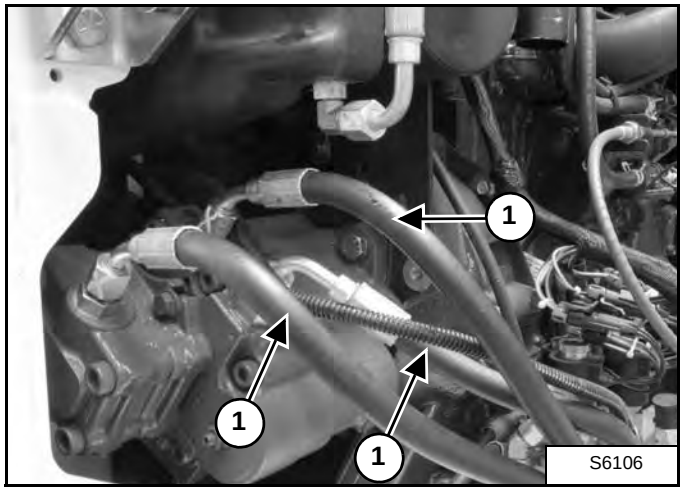
Figure 20-50-17



Remove the bolt (Item 1) **[Figure 20-50-17]** from the exhaust extension mounting bracket.

Slide exhaust extension (Item 2) **[Figure 20-50-17]** off the muffler and remove from excavator.

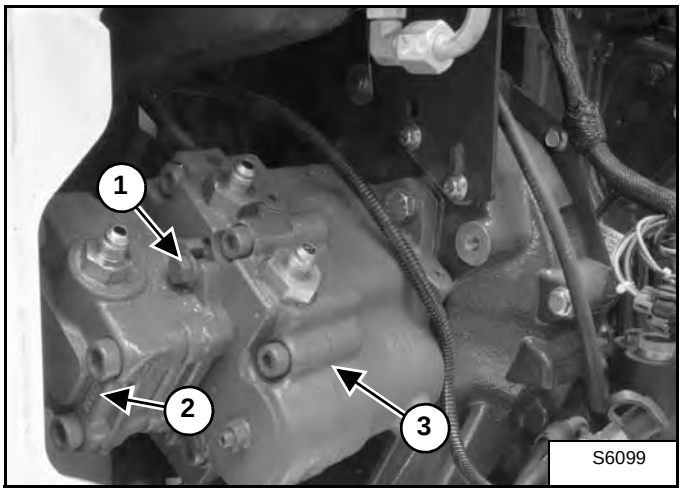
Figure 20-50-18



Mark and remove the three pressure hoses (Item 1) **[Figure 20-50-18]**.

Cap and plug the hoses and fittings.

Figure 20-50-19

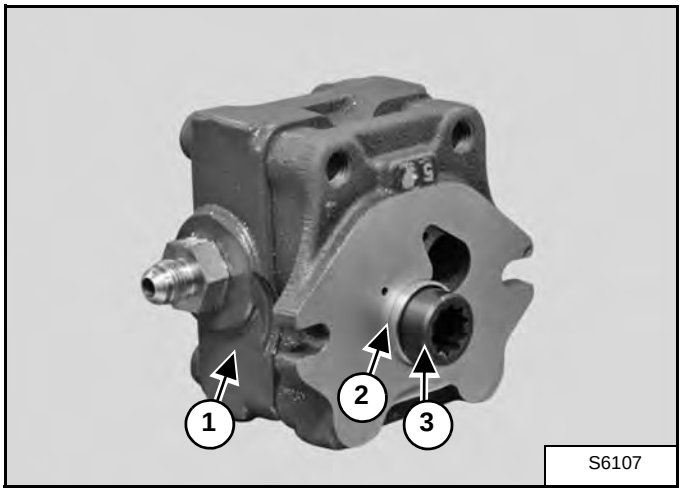


Remove the two bolts (Item 1) **[Figure 20-50-19]** from the gear pump.

Installation: Tighten bolts to 20,6 - 24,5 N•m (15.2 - 18.1 ft-lb) torque.

Remove the gear pump (Item 2) from the end of the piston pump (Item 3) **[Figure 20-50-19]**.

Figure 20-50-20



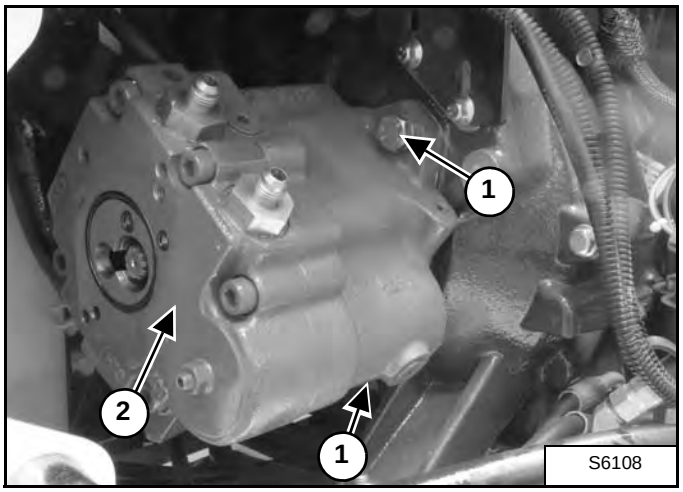
Once the gear pump (Item 1) has been removed, there is a set collar (Item 2), coupling (Item 3) **[Figure 20-50-20]** and O-rings (Item 4) **[Figure 20-50-22]** on the piston pump.

NOTE: The seals for the gear pump (Item 1) [Figure 20-50-20] are the only serviceable parts in the gear pump. Order new gear pump seals from Bobcat Parts.

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Removal And Installation (Cont'd)

Figure 20-50-21

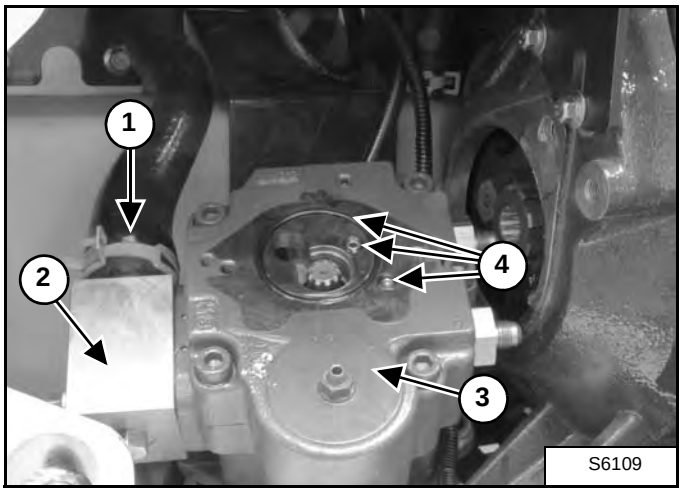


Remove the hydraulic pump mounting bolts and washers (Item 1) **[Figure 20-50-21]**.

Remove the piston pump (Item 2) **[Figure 20-50-21]** from the side of the flywheel housing.

Installation: Tighten bolts to 105 - 115 N•m (85 - 78 ft-lb) torque.

Figure 20-50-22

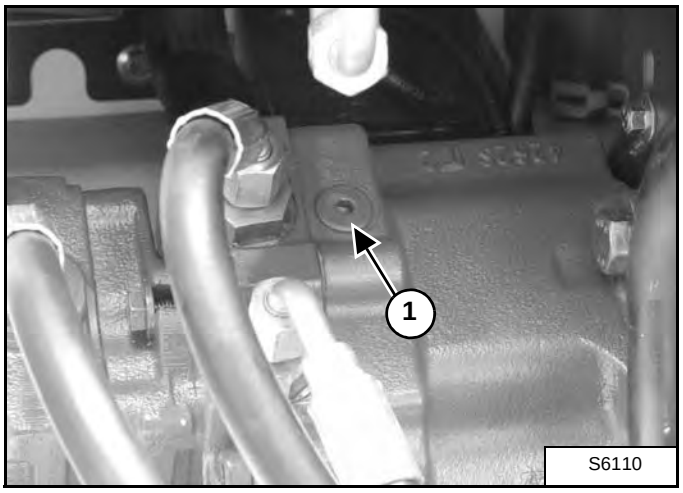


Remove the pump inlet hose (Item 1) from the pump block (Item 2) **[Figure 20-50-22]**.

Remove the piston pump (Item 3) **[Figure 20-50-22]** from the excavator.

Installation: Whenever the hydraulic system has been drained and refilled, the hydraulic pump must be purged of air.

Figure 20-50-23



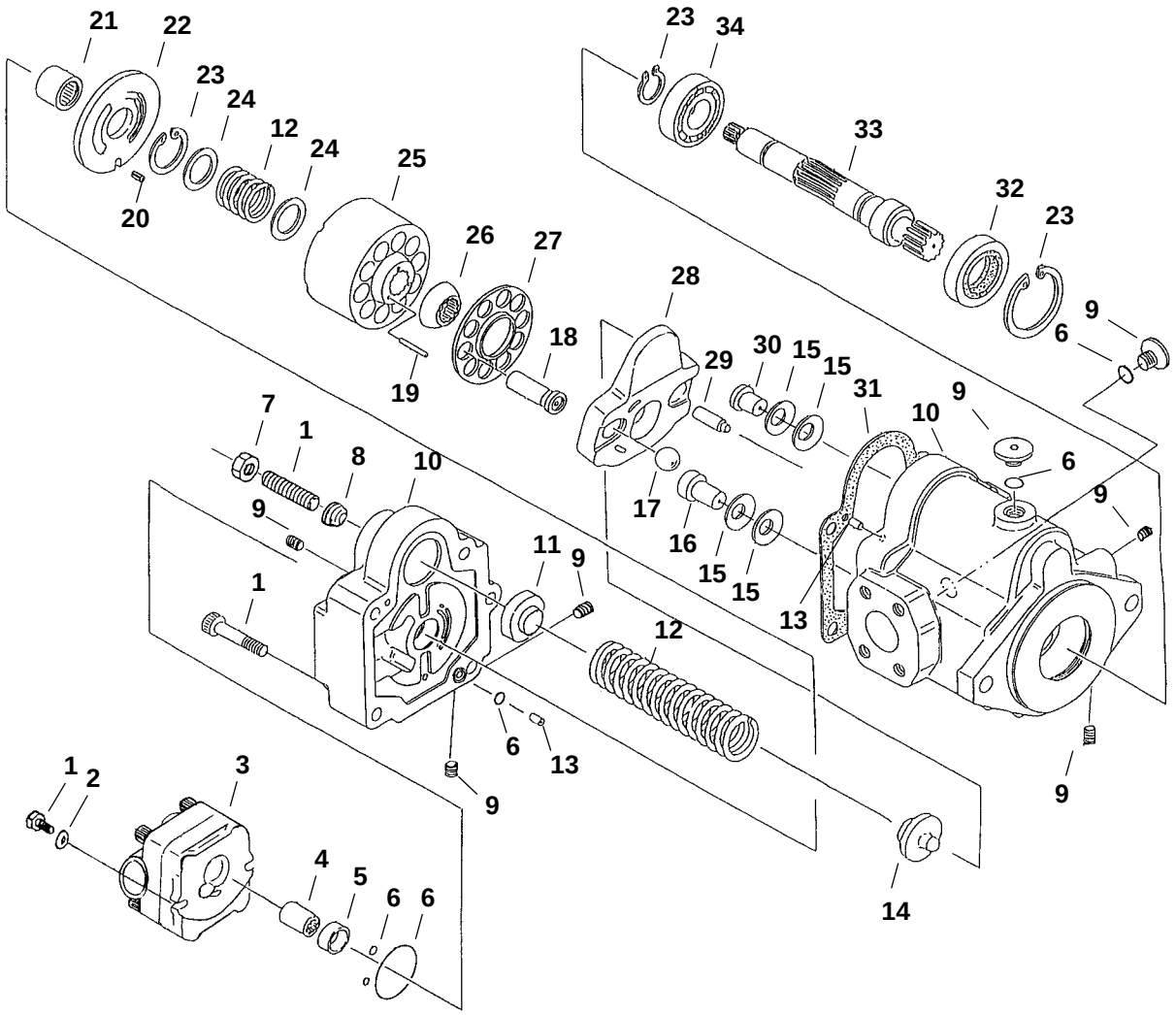
Installation: Remove the oil supply plug (Item 1) **[Figure 20-50-23]** on the hydraulic pump. Install the oil supply plug after a steady stream of hydraulic fluid free of any air drains from the hydraulic pump.

Installation: Tighten plug to 29,4 - 34,3 N•m (21.7 - 25.3 ft-lb) torque.

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Parts Identification

1. Screw
2. Washer
3. Gear Pump
4. Coupler
5. Collar
6. O-ring
7. Nut
8. Seal Washer
9. Plug
10. Pump Housing
11. Spring Guide
12. Spring
13. Pin
14. Spring Holder
15. Dish Washer
16. Stopper Pin B
17. Ball
18. Piston / Shoe
19. Needle
20. Spring Pin
21. Needle Bearing
22. Valve Plate
23. Snap Ring
24. Retainer
25. Cylinder Barrel
26. Barrel Holder
27. Shoe Holder
28. Swash Plate
29. Rod
30. Stopper Pin A
31. Packing
32. Oil Seal
33. Shaft
34. Bearing



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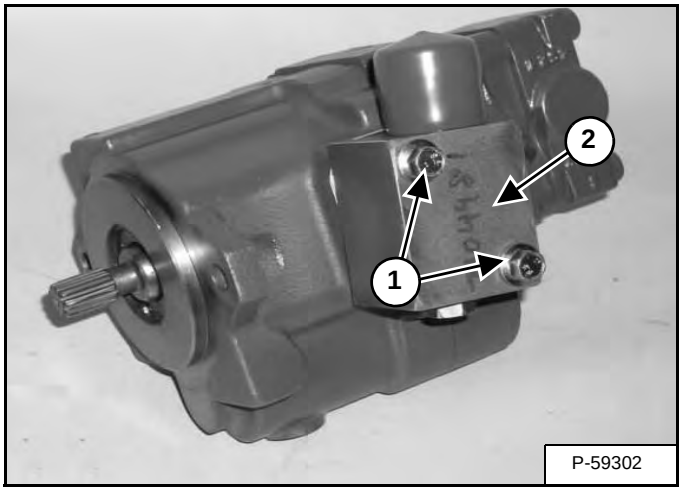
Disassembly

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.

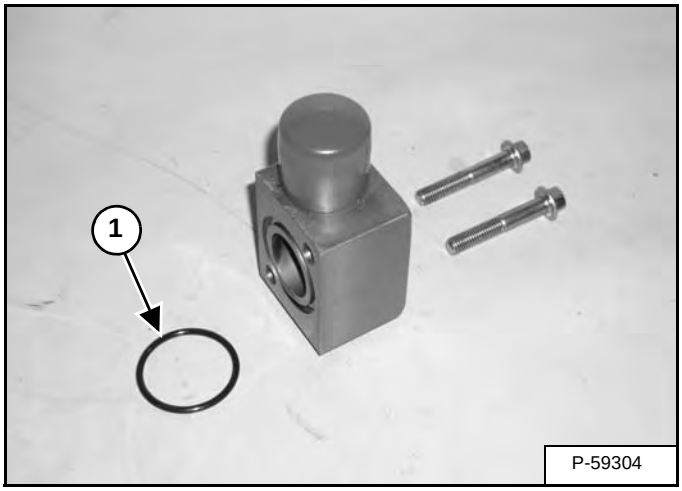
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Figure 20-50-24



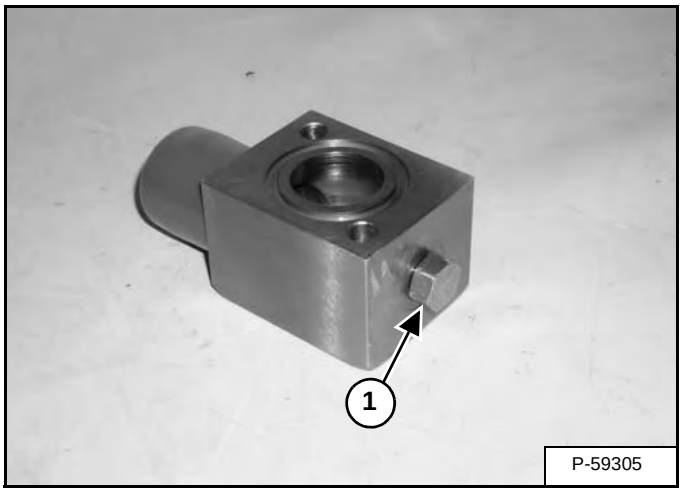
Remove the two bolts (Item 1) and pump block (Item 2) **[Figure 20-50-24]** from the back of the piston pump.

Figure 20-50-25



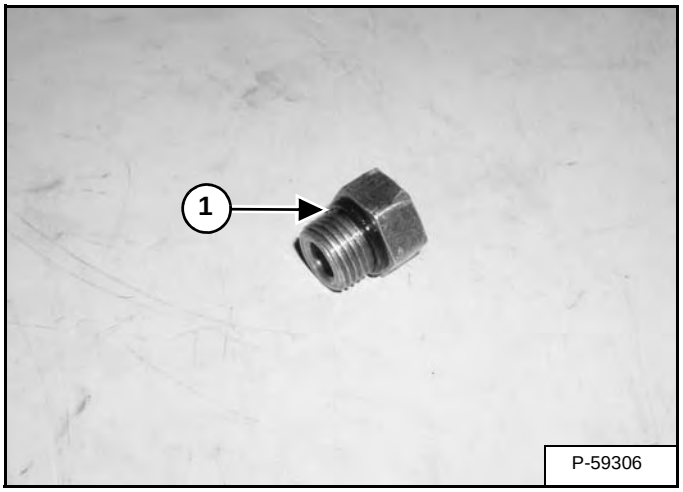
Remove the O-ring (Item 1) **[Figure 20-50-25]** from the pump block.

Figure 20-50-26



Remove the plug (Item 1) **[Figure 20-50-26]** from the pump block.

Figure 20-50-27



Remove the O-ring (Item 1) **[Figure 20-50-27]** from the plug.

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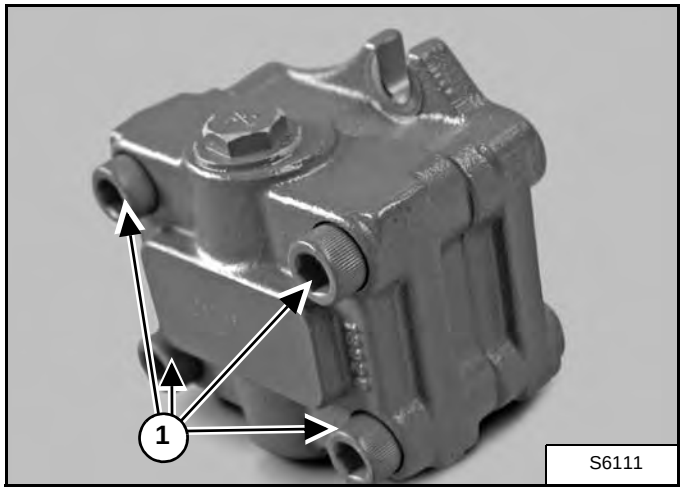
Gear Pump Disassembly

IMPORTANT

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

I-2003-0888

Figure 20-50-28



Mark the halves of the gear pump to aid in the assembly process.

Remove the four bolts (Item 1) **[Figure 20-50-28]** from the gear pump.

Figure 20-50-29

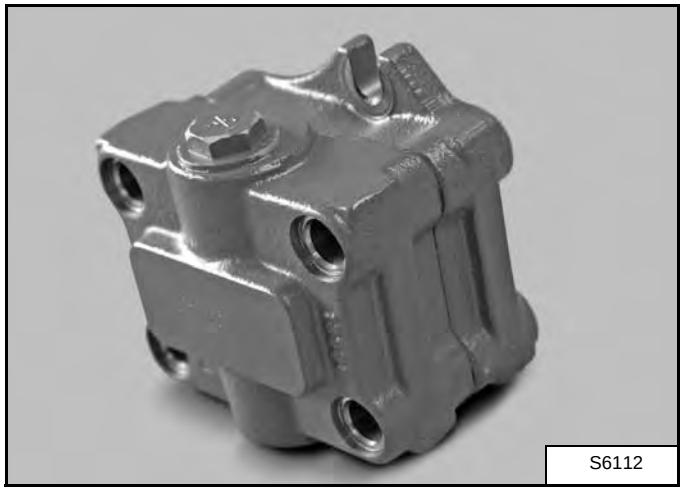
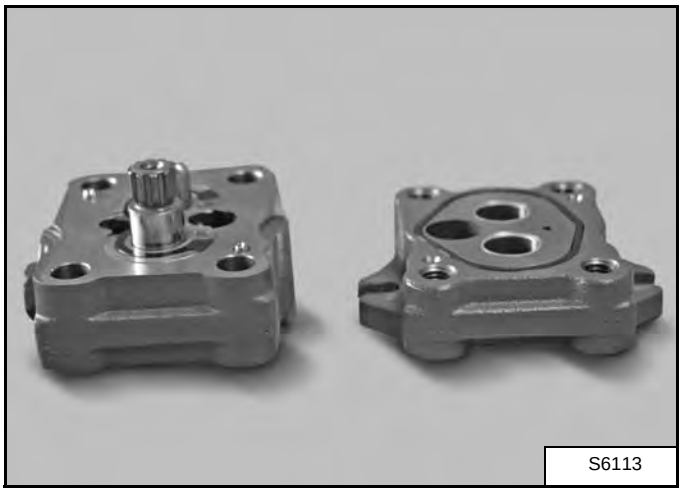
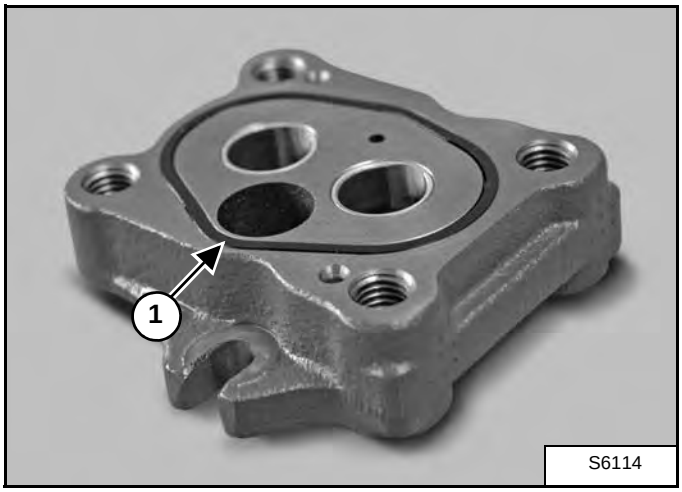


Figure 20-50-30



Separate the two halves of the gear pump **[Figure 20-50-29]** and **[Figure 20-50-30]**.

Figure 20-50-31

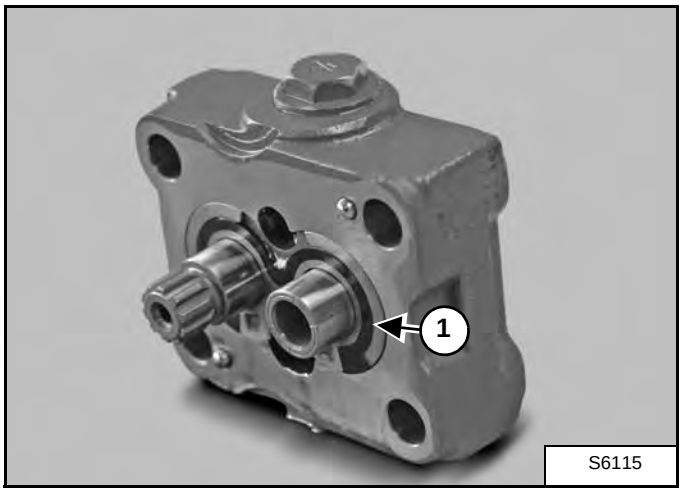


Remove the seal (Item 1) **[Figure 20-50-31]**.

Dealer Copy -- Not for Resale

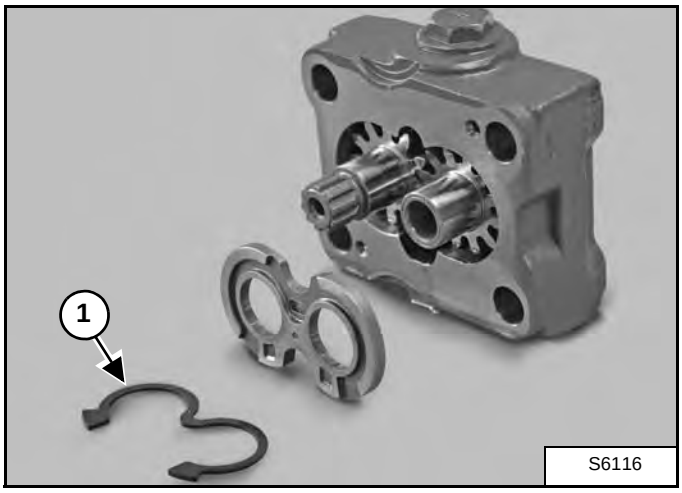
Gear Pump Disassembly (Cont'd)

Figure 20-50-32



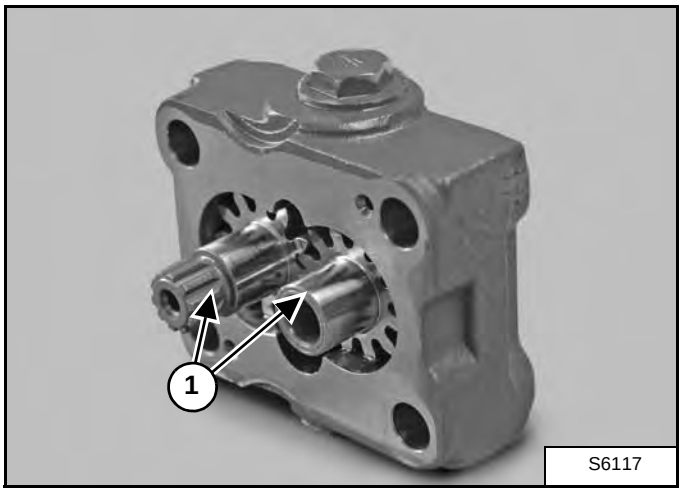
Remove the bearing (Item 1) **[Figure 20-50-32]**.

Figure 20-50-33



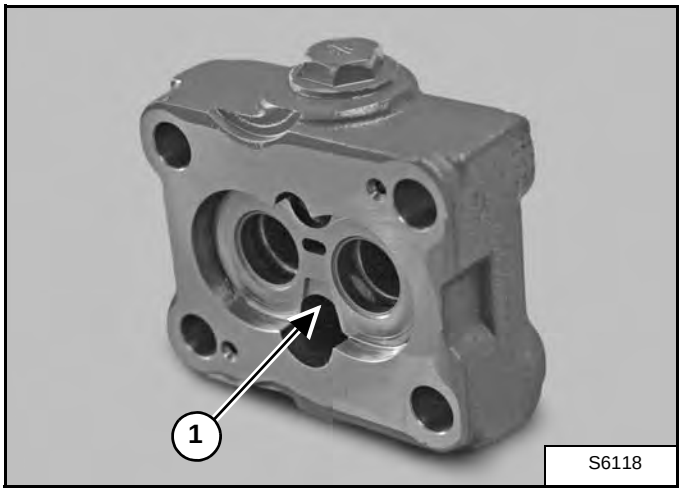
Remove the seal (Item 1) **[Figure 20-50-33]**.

Figure 20-50-34



Remove the drive and idler gears (Item 1) **[Figure 20-50-34]**.

Figure 20-50-35

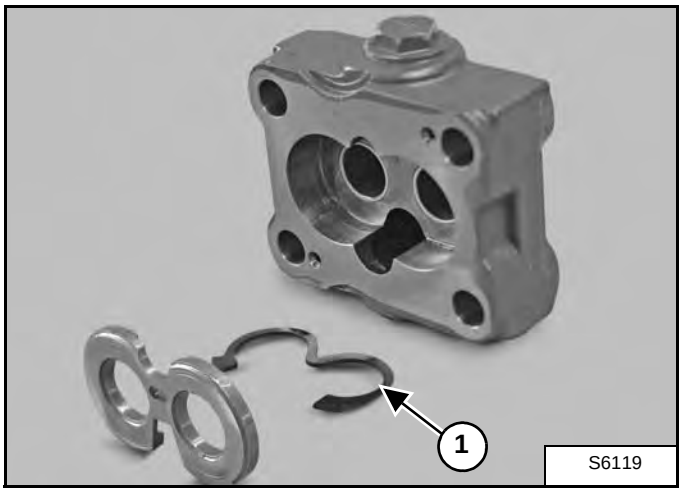


Remove the bearing (Item 1) **[Figure 20-50-35]**.

Dealer Copy -- Not for Resale

Gear Pump Disassembly (Cont'd)

Figure 20-50-36

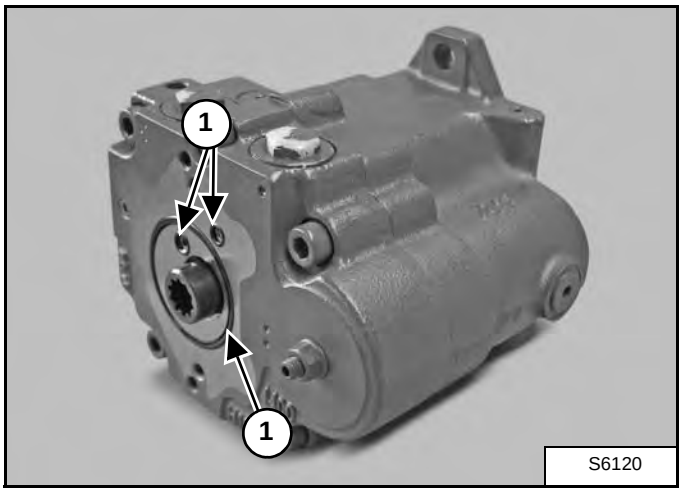


Remove the seal (Item 1) **[Figure 20-50-36]**.

NOTE: The gear housing, two bearings, drive and idler gears are not serviced separately. If any part is damaged, the entire gear pump assembly must be replaced.

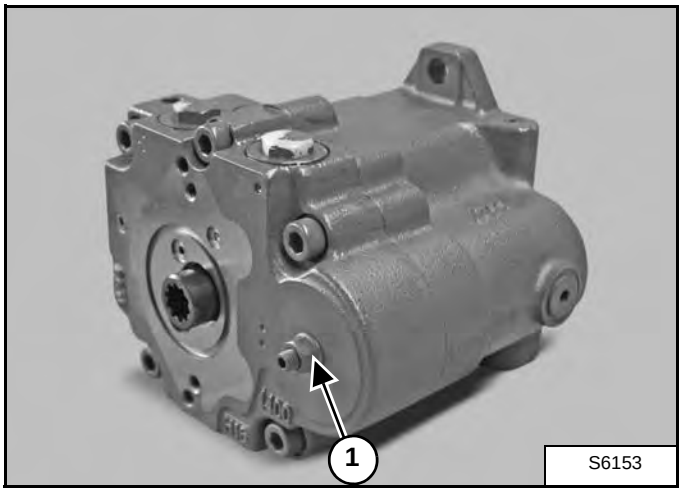
Piston Pump Disassembly

Figure 20-50-37



Remove the three O-rings (Item 1) **[Figure 20-50-37]** from the pump housing.

Figure 20-50-38

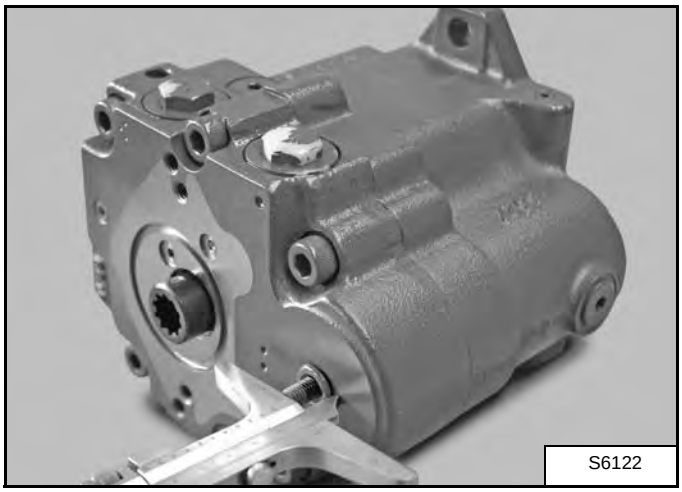


Remove the pressure adjustment nut (Item 1) **[Figure 20-50-38]** from the pump housing.

Dealer Copy -- Not for Resale

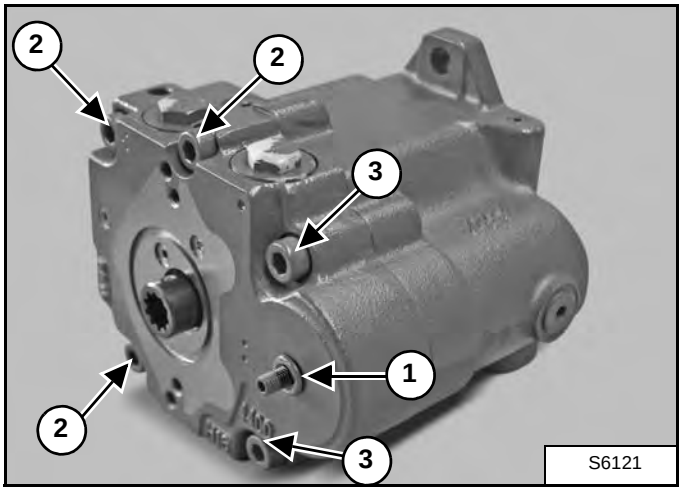
Piston Pump Disassembly (Cont'd)

Figure 20-50-39



Measure the outside length of the pressure adjustment screw **[Figure 20-50-39]** for aid in adjustment after re-assembly

Figure 20-50-40

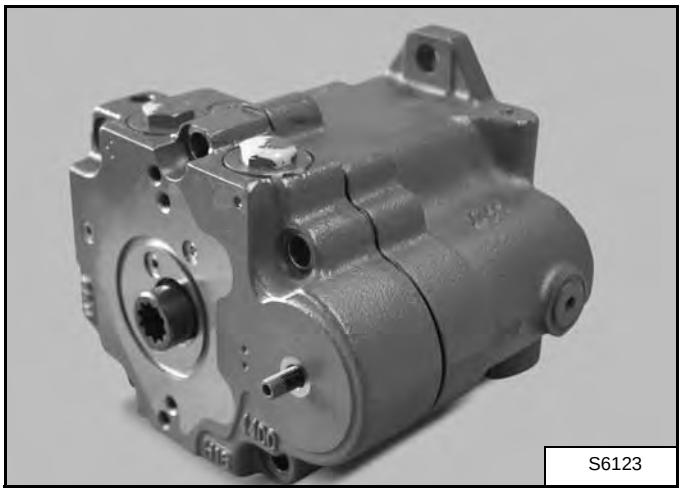


Remove the seal washer (Item 1) **[Figure 20-50-40]** from the pump housing.

Remove the three bolts (Item 2) **[Figure 20-50-40]** from the pump housing.

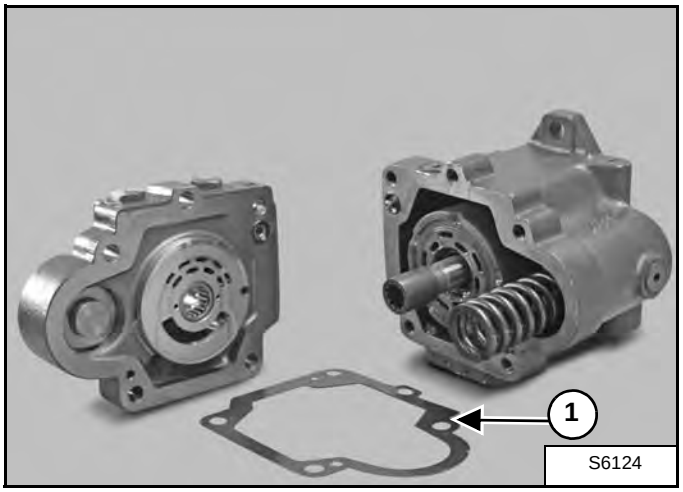
Remove the two bolts (Item 3) **[Figure 20-50-40]** from either side of the pressure adjusting spring in the pump housing.

Figure 20-50-41



Separate the two halves of pump housings **[Figure 20-50-41]**.

Figure 20-50-42

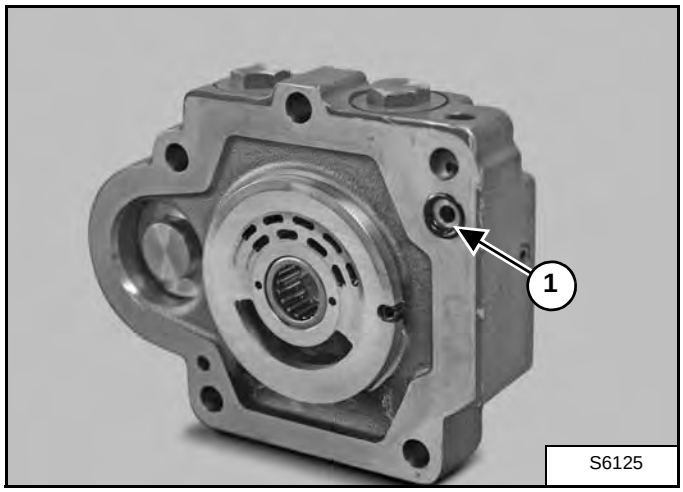


Remove the packing (Item 1) **[Figure 20-50-42]** from between the pump housings.

Dealer Copy -- Not for Resale

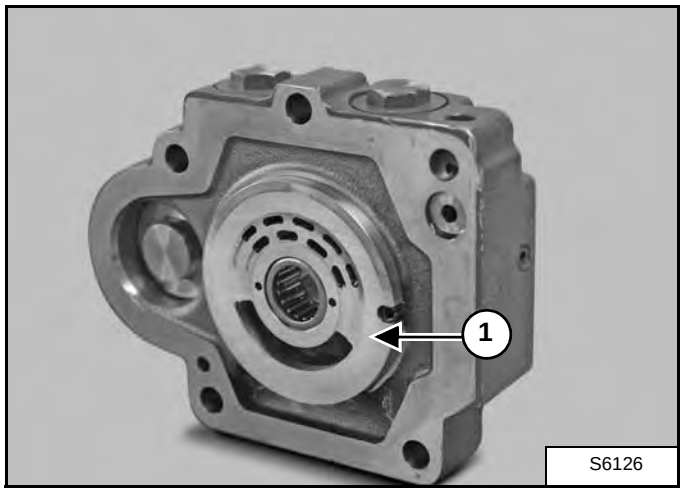
Piston Pump Disassembly (Cont'd)

Figure 20-50-43



Remove the O-ring (Item 1) **[Figure 20-50-43]** from the pump housing.

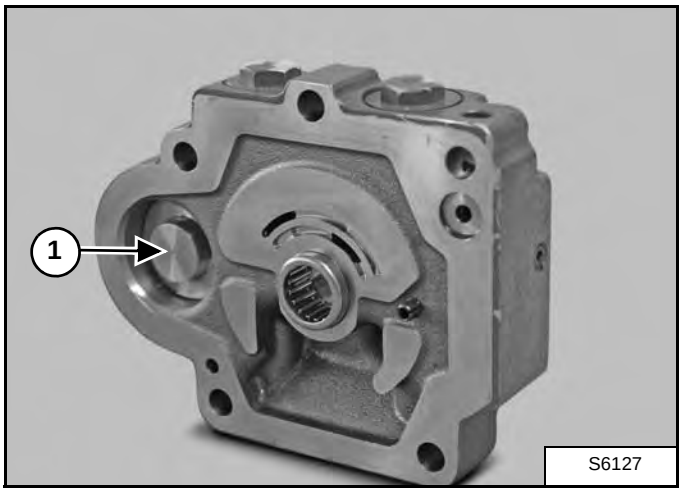
Figure 20-50-44



Remove the valve plate (Item 1) **[Figure 20-50-44]** from the pump housing.

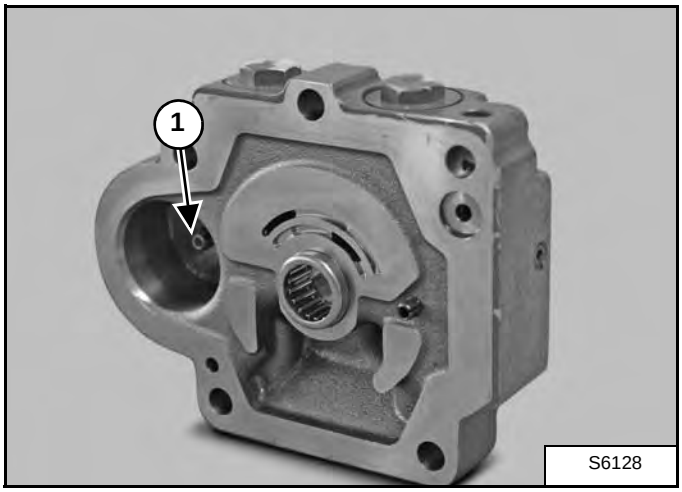
NOTE: Visually inspect valve plate for scratches, abnormal wear or damage.

Figure 20-50-45



Remove the spring guide (Item 1) **[Figure 20-50-45]** from the pump housing.

Figure 20-50-46

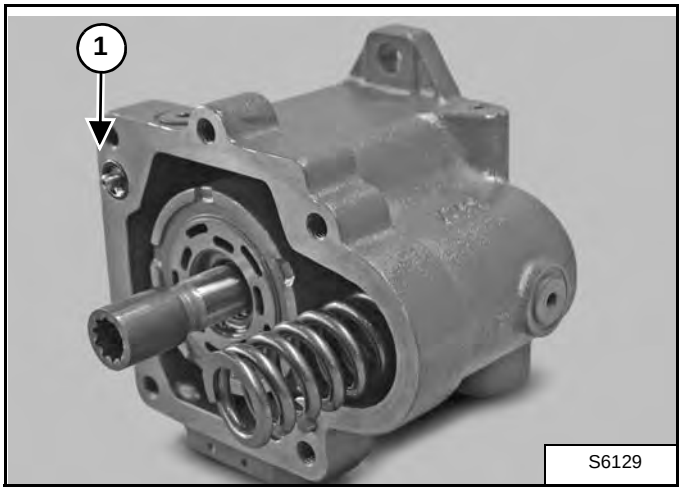


Remove the screw (Item 1) **[Figure 20-50-46]** from the pump housing.

Dealer Copy -- Not for Resale

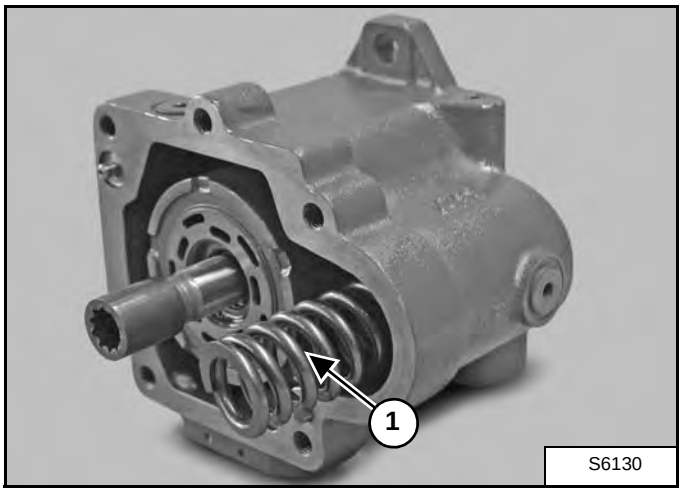
Piston Pump Disassembly (Cont'd)

Figure 20-50-47



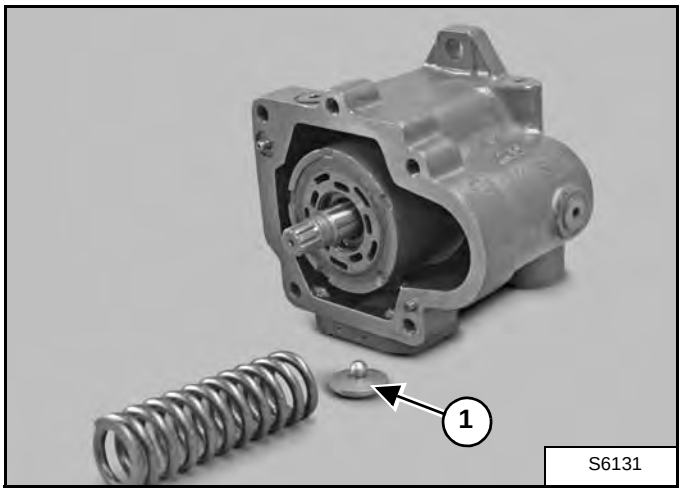
Remove the O-ring (Item 1) **[Figure 20-50-47]**.

Figure 20-50-48



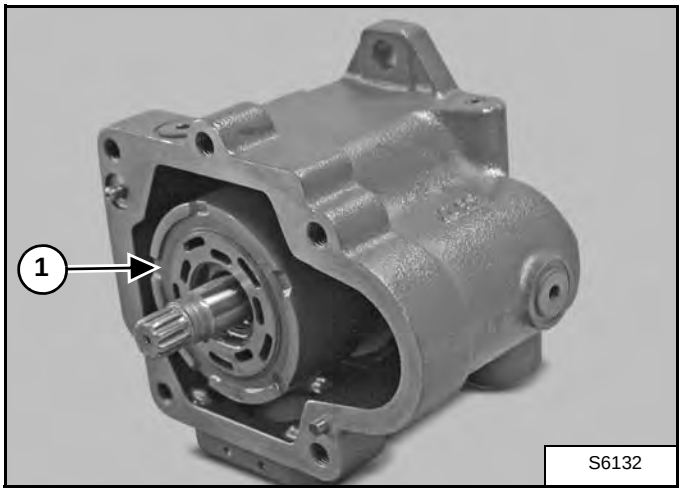
Remove the spring (Item 1) **[Figure 20-50-48]** from the pump housing.

Figure 20-50-49



Remove the spring seat (Item 1) **[Figure 20-50-49]** from the pump housing.

Figure 20-50-50



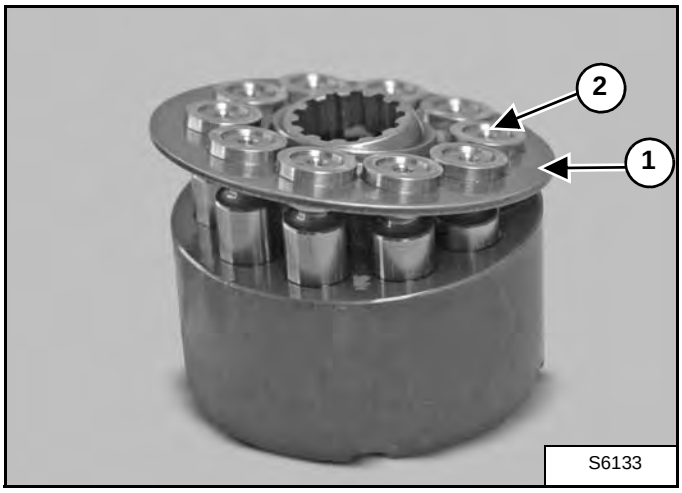
Remove the cylinder barrel assembly (Item 1) **[Figure 20-50-50]** from the pump housing.

Dealer Copy -- Not for Resale

Piston Pump Disassembly (Cont'd)

NOTE: The following procedure shown is to disassemble the rotating group for inspection only. The rotating group parts cannot be ordered separately and must be ordered as an assembly.

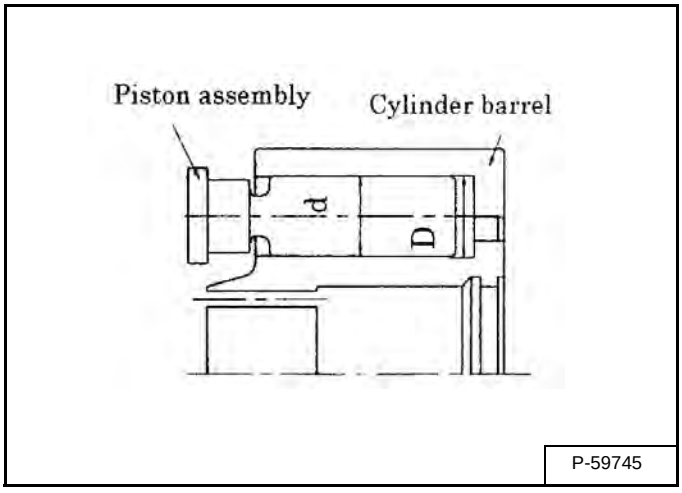
Figure 20-50-51



Remove the shoe holder (Item 1) and piston assemblies (Item 2) **[Figure 20-50-51]** from the cylinder barrel.

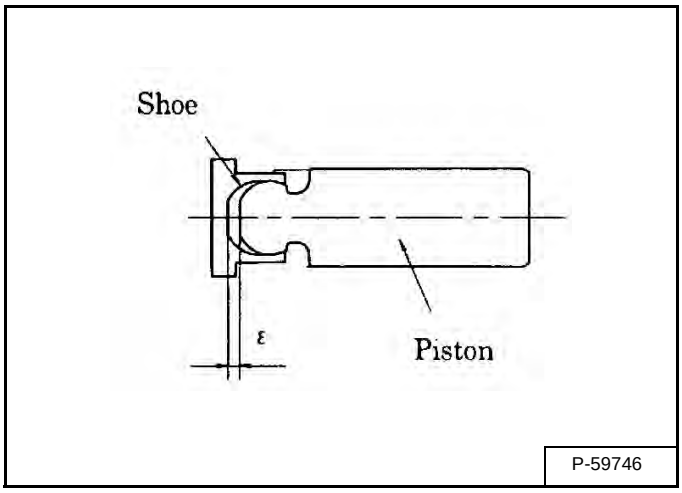
NOTE: Visually inspect piston assemblies and cylinder barrel for scratches, abnormal wear or damage.

Figure 20-50-52



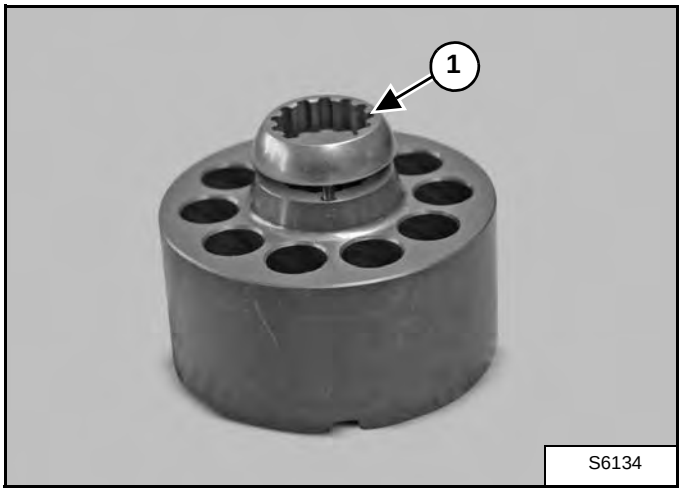
Inspect the difference between the inner diameter of cylinder barrel (D) and the outer diameter of piston (d) **[Figure 20-50-52]**. The difference should be less than 0,05 mm (0.002 in).

Figure 20-50-53



The clearance between the piston and shoe **[Figure 20-50-53]** should be less than 0,2 mm (0.008 in).

Figure 20-50-54

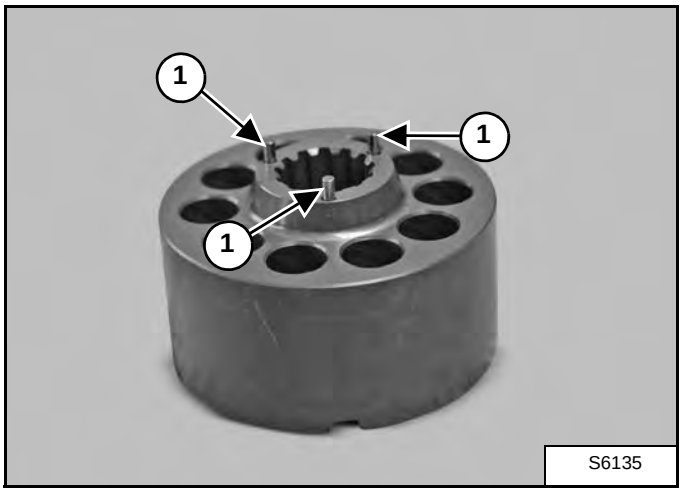


Remove the barrel holder (Item 1) **[Figure 20-50-54]**.

Dealer Copy -- Not for Resale

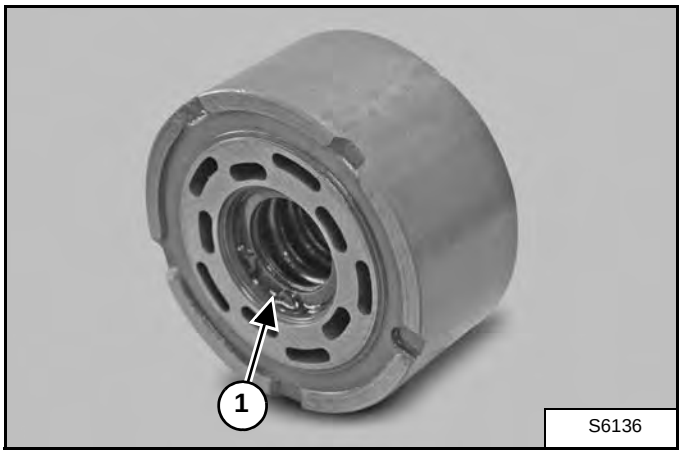
Piston Pump Disassembly (Cont'd)

Figure 20-50-55



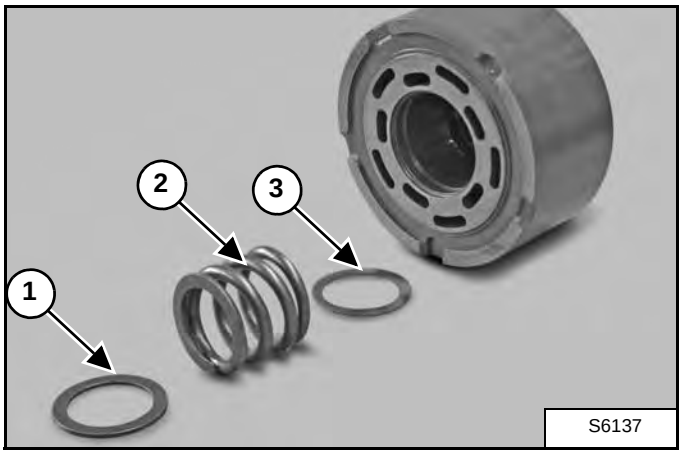
Remove the three needles (Item 1) **[Figure 20-50-55]**.

Figure 20-50-56



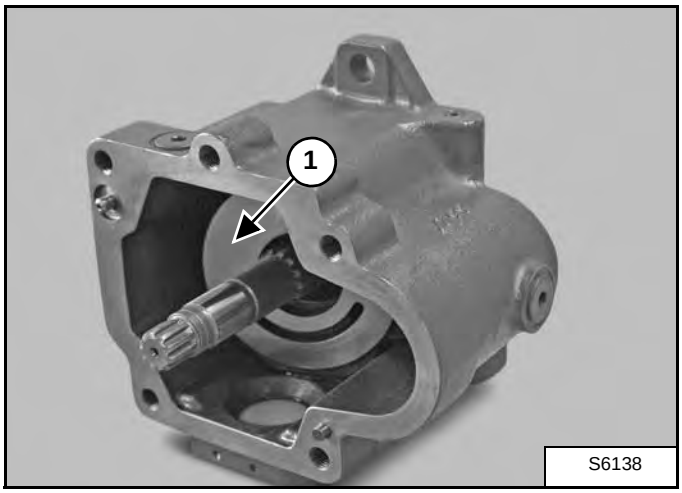
Remove the snap ring (Item 1) **[Figure 20-50-56]** in the cylinder barrel.

Figure 20-50-57



Remove the retainer (Item 1), spring (Item 2) and retainer (Item 3) **[Figure 20-50-57]**.

Figure 20-50-58

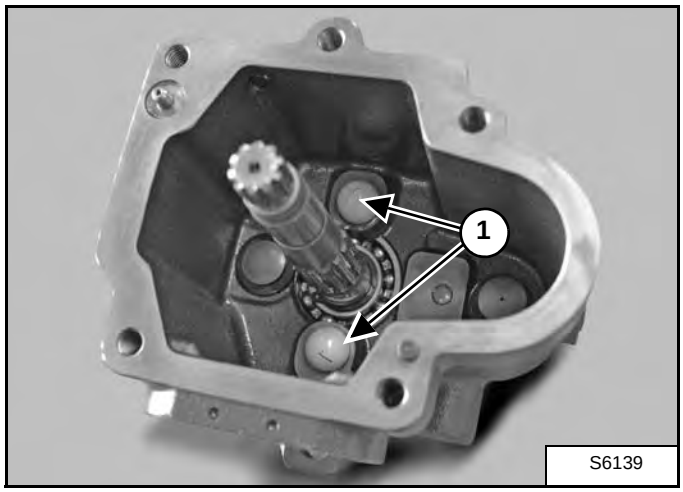


Remove the swash plate (Item 1) **[Figure 20-50-58]** from the pump housing.

Dealer Copy -- Not for Resale

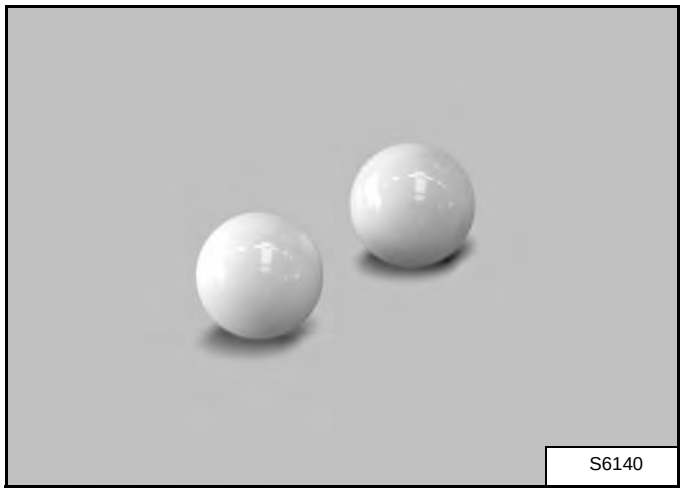
Piston Pump Disassembly (Cont'd)

Figure 20-50-59



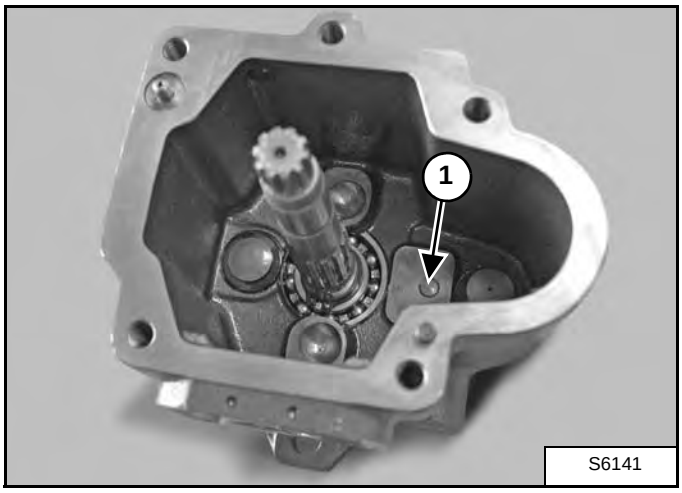
Remove the balls (Item 1) **[Figure 20-50-59]** from the pump housing.

Figure 20-50-60



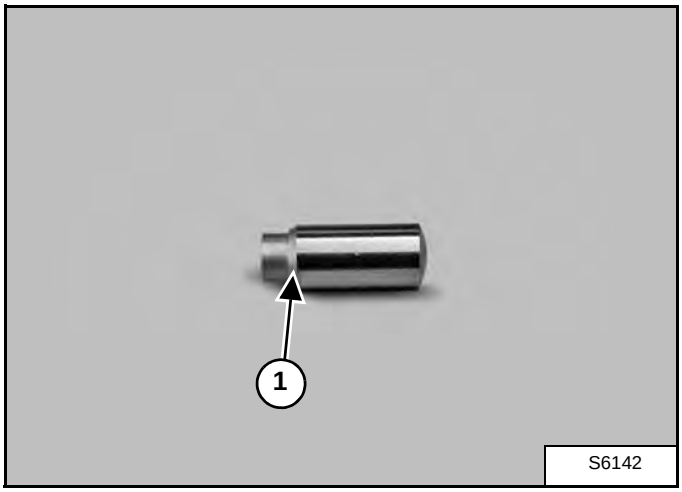
Visually inspect the balls for scratches, abnormal wear or damage **[Figure 20-50-60]**.

Figure 20-50-61



Remove the rod (Item 1) **[Figure 20-50-61]** from the pump housing.

Figure 20-50-62



The step in the rod (Item 1) **[Figure 20-50-62]** must be inserted into the pump housing first.

Dealer Copy -- Not for Resale

Piston Pump Disassembly (Cont'd)

Figure 20-50-63

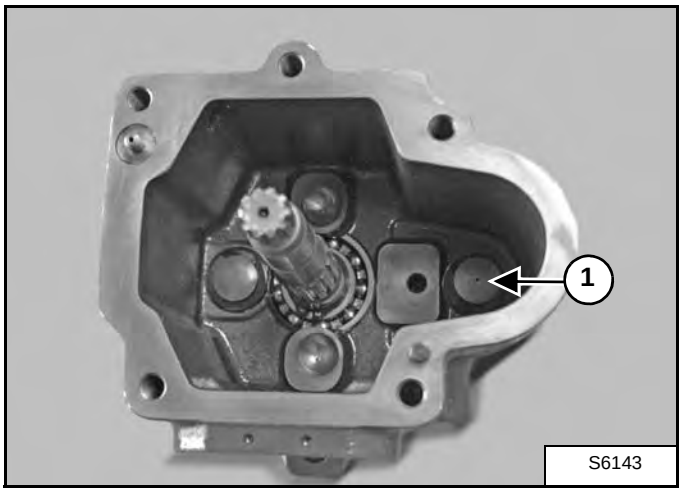
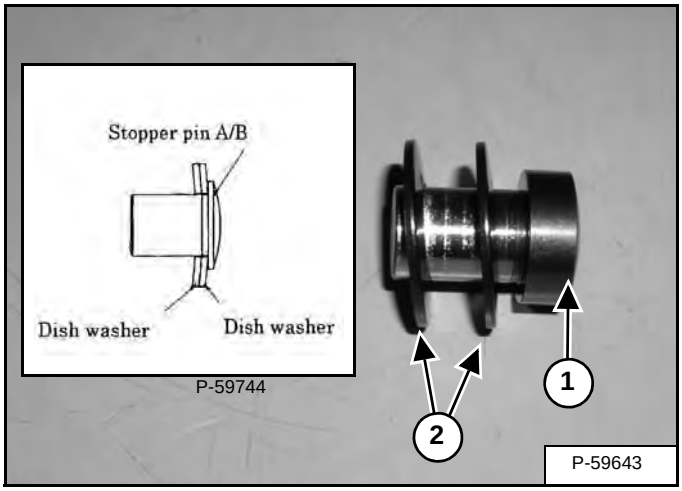


Figure 20-50-64



Remove the stopper pin A (Item 1) **[Figure 20-50-63]** and **[Figure 20-50-64]** and the two dish washers (Item 2) **[Figure 20-50-64]** from the pump housing.

Figure 20-50-65

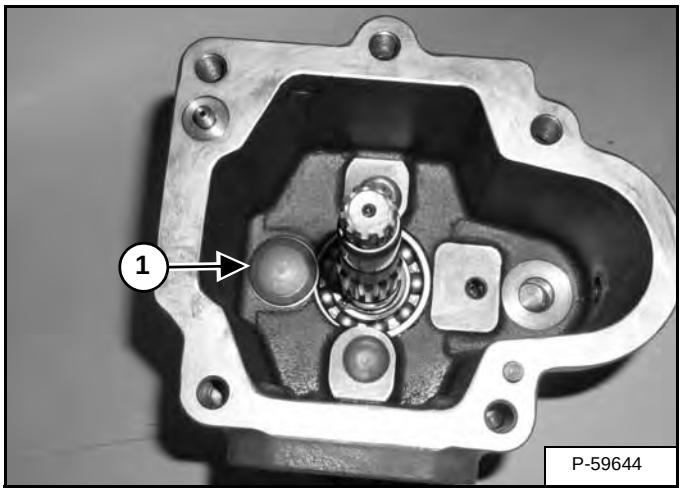
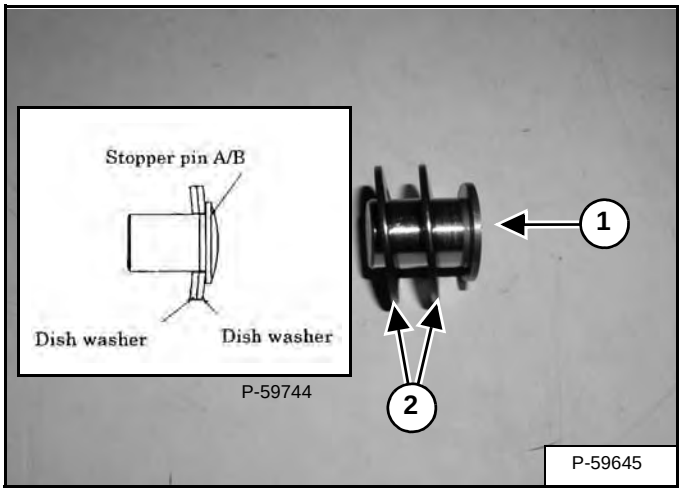


Figure 20-50-66

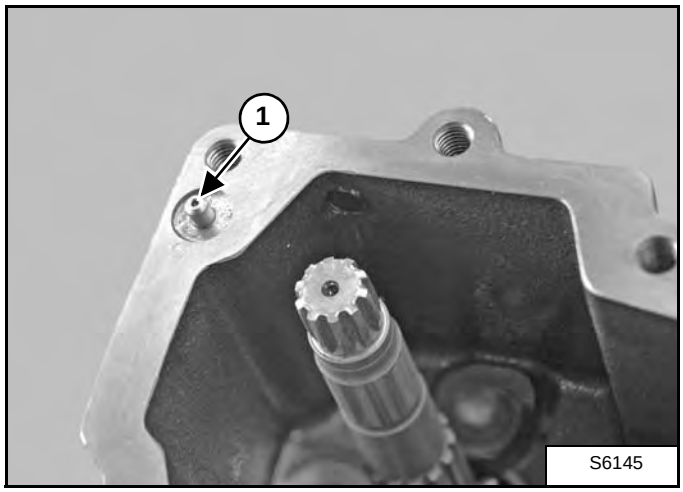


Remove the stopper pin B (Item 1) **[Figure 20-50-65]** and **[Figure 20-50-66]** and the two dish washers (Item 2) **[Figure 20-50-66]** from the pump housing.

Dealer Copy -- Not for Resale

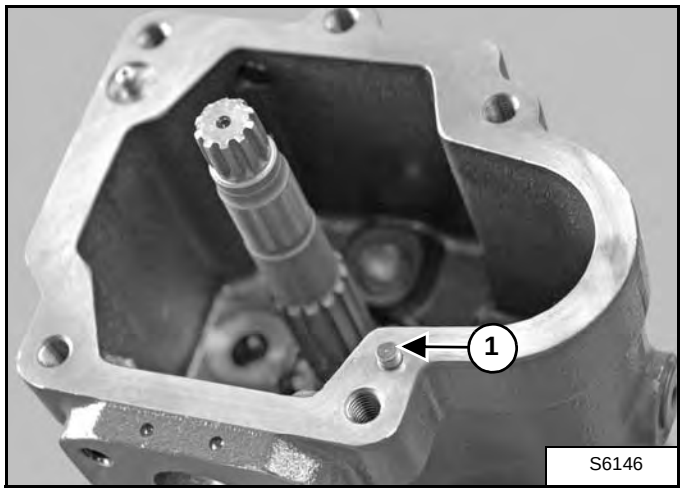
Piston Pump Disassembly (Cont'd)

Figure 20-50-67



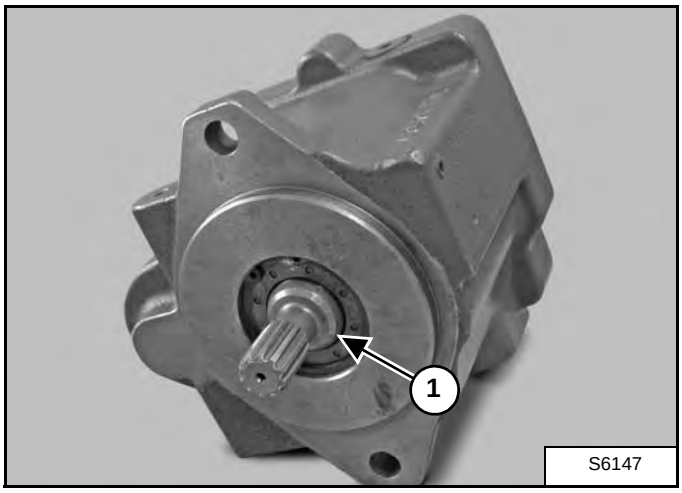
Remove the pin (Item 1) **[Figure 20-50-67]** from the pump housing.

Figure 20-50-68



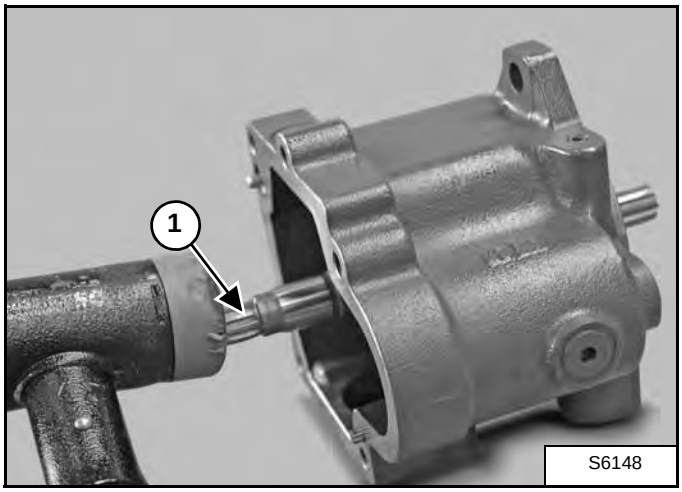
Remove the pin (Item 1) **[Figure 20-50-68]** from the pump housing.

Figure 20-50-69



Remove the snap ring (Item 1) **[Figure 20-50-69]** from the pump housing.

Figure 20-50-70

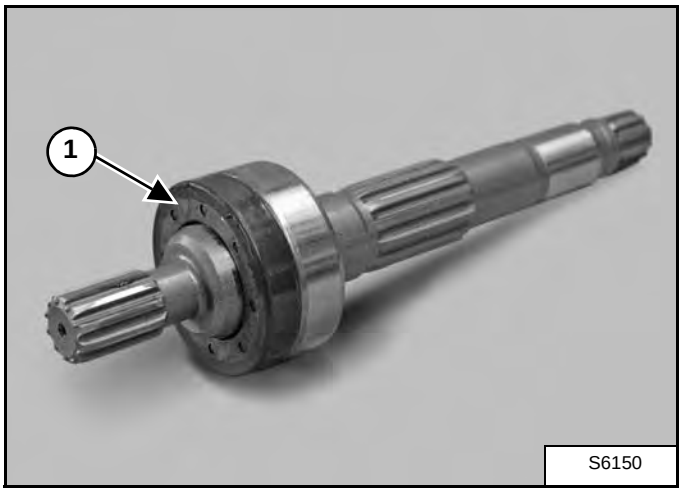


Remove the shaft and bearing assembly (Item 1) **[Figure 20-50-70]** from the pump housing by tapping the other end of the shaft.

Dealer Copy -- Not for Resale

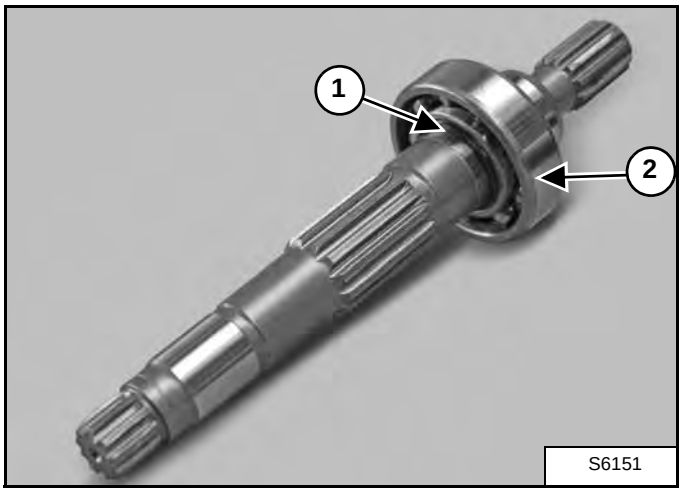
Piston Pump Disassembly (Cont'd)

Figure 20-50-71



Remove the oil seal (Item 1) **[Figure 20-50-71]** from the shaft.

Figure 20-50-72



Remove the snap ring (Item 1) **[Figure 20-50-72]** from the shaft.

Remove the bearing (Item 2) **[Figure 20-50-72]** from the shaft.

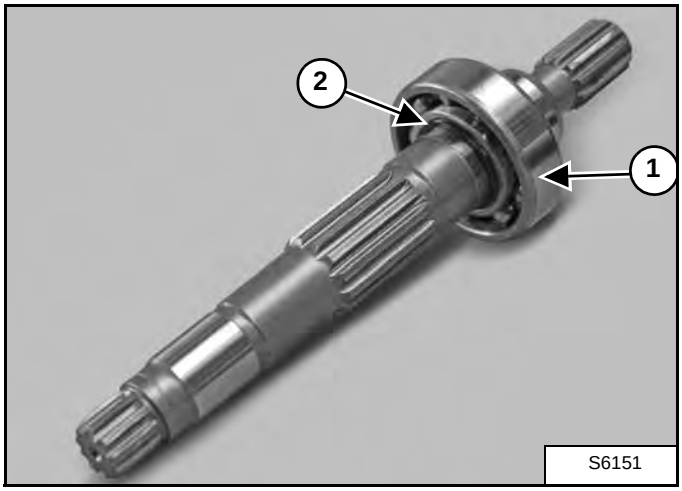
Piston Pump Assembly

Clean all parts in solvent and dry with compressed air. Do not use compressed air to dry the bearings.

Always install new seals and O-rings.

Apply a thin coat of hydraulic fluid to all components before assembly.

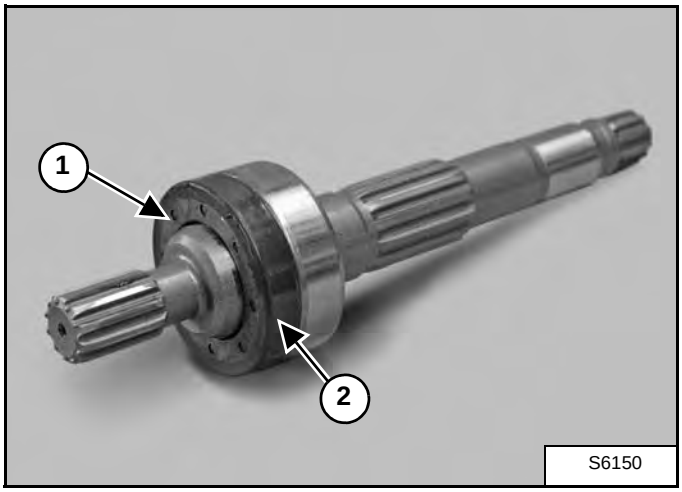
Figure 20-50-73



Install the bearing (Item 1) **[Figure 20-50-73]** on the shaft.

Install the snap ring (Item 2) **[Figure 20-50-73]** on the shaft.

Figure 20-50-74



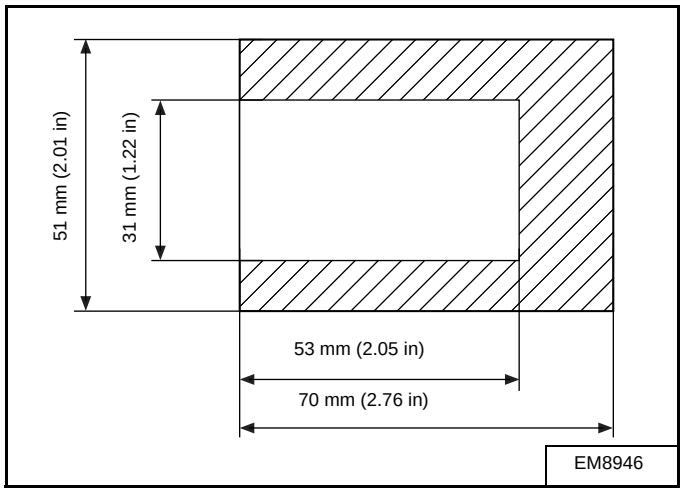
Install the oil seal (Item 1) **[Figure 20-50-74]** on the shaft.

Apply a small quantity of grease to the perimeter of the oil seal lip (Item 2) **[Figure 20-50-74]**.

Dealer Copy -- Not for Resale

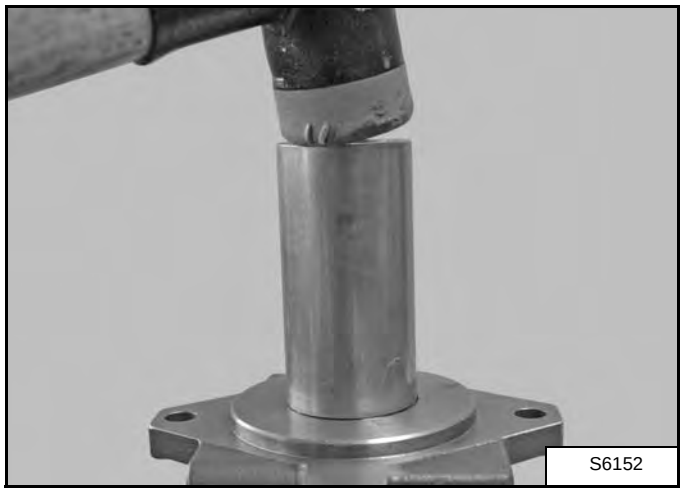
Piston Pump Assembly (Cont'd)

Figure 20-50-75



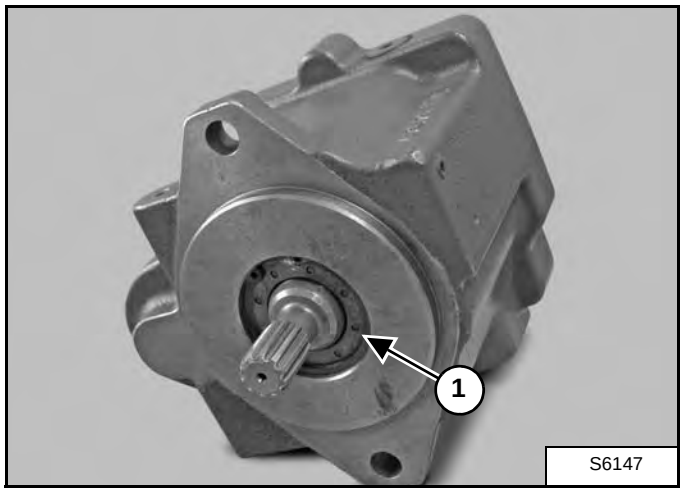
Manufacture the special tool **[Figure 20-50-75]** needed to install the oil seal into the pump housing.

Figure 20-50-76



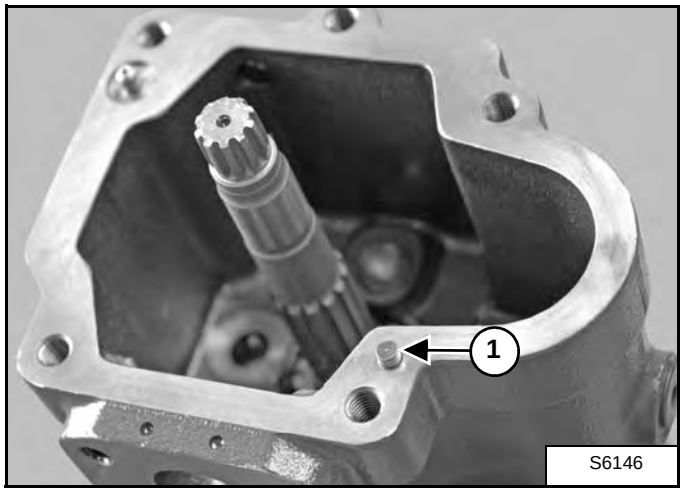
Install the shaft, bearing, and oil seal assembly **[Figure 20-50-74]** into the pump housing by using the special tooling **[Figure 20-50-75]**.

Figure 20-50-77



Install the snap ring (Item 1) **[Figure 20-50-77]** in the pump housing.

Figure 20-50-78

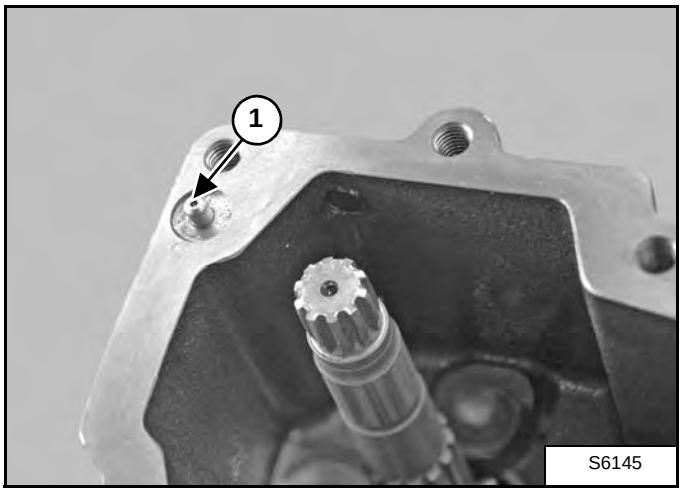


Install the pin (Item 1) **[Figure 20-50-78]** in the pump housing.

Dealer Copy -- Not for Resale

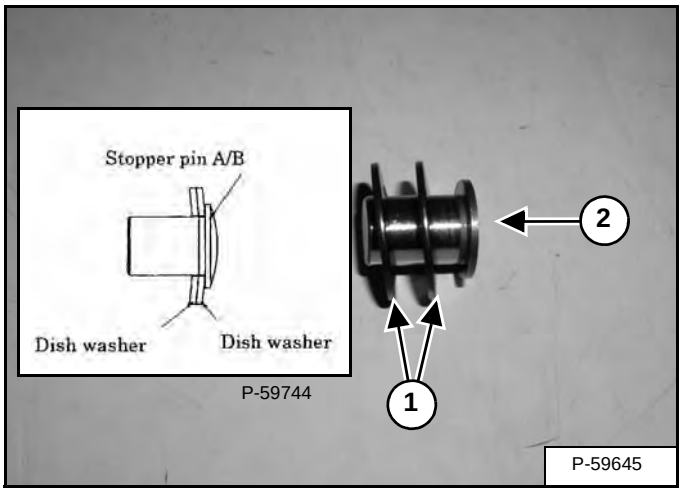
Piston Pump Assembly (Cont'd)

Figure 20-50-79



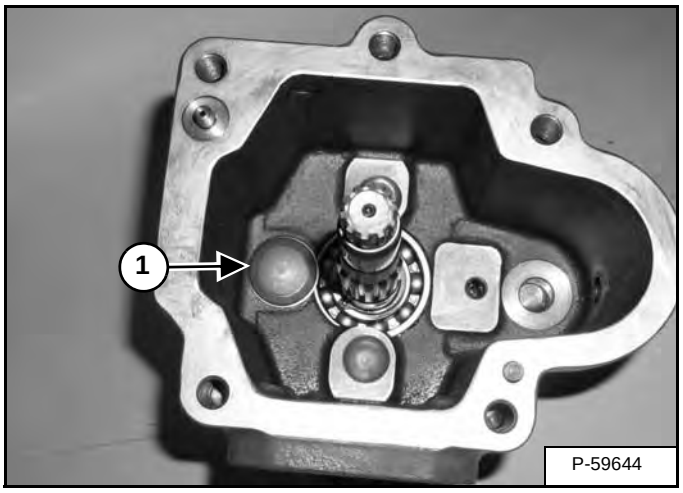
Install the pin (Item 1) **[Figure 20-50-79]** in the pump housing.

Figure 20-50-80



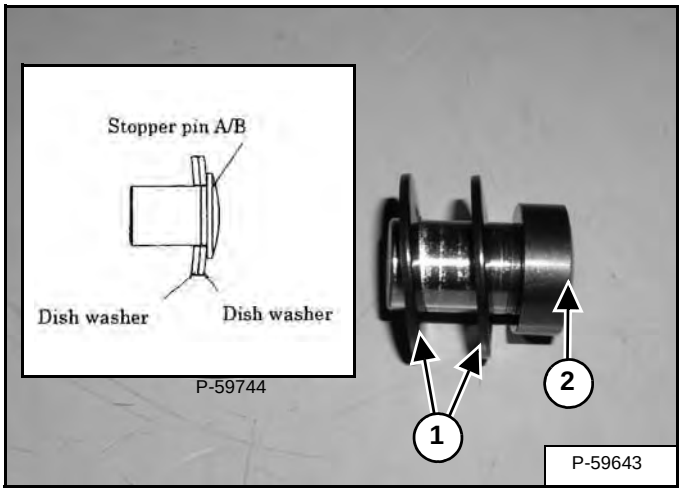
Install the two dish washers (Item 1) on the stopper pin B (Item 2) **[Figure 20-50-80]**.

Figure 20-50-81



Install stopper pin B and washers (Item 1) **[Figure 20-50-81]** into pump housing.

Figure 20-50-82

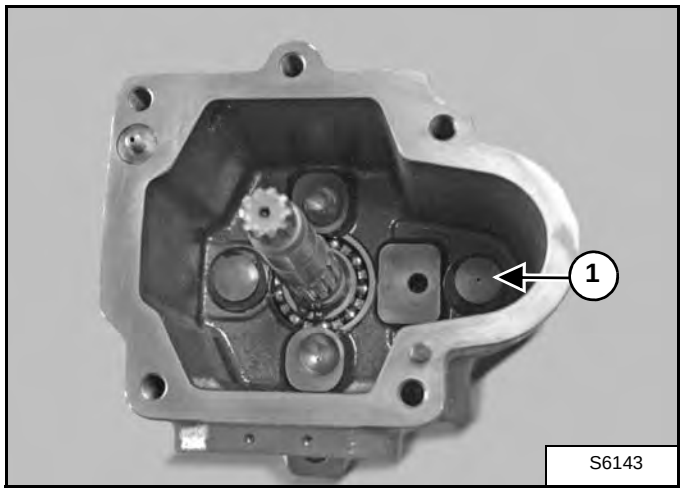


Install the two dish washers (Item 1) on the stopper pin A (Item 2) **[Figure 20-50-82]**.

Dealer Copy -- Not for Resale

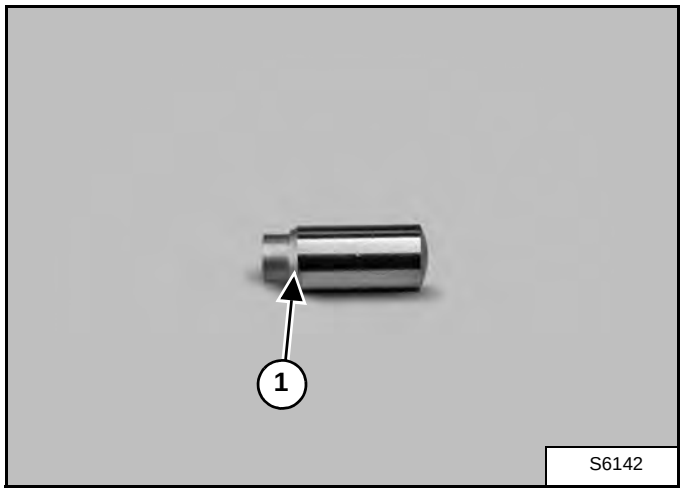
Piston Pump Assembly (Cont'd)

Figure 20-50-83



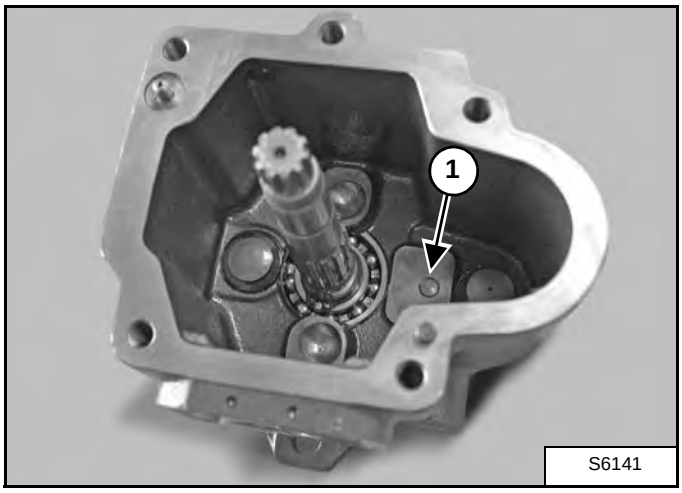
Install stopper pin A and washers (Item 1) **[Figure 20-50-83]** into pump housing.

Figure 20-50-84



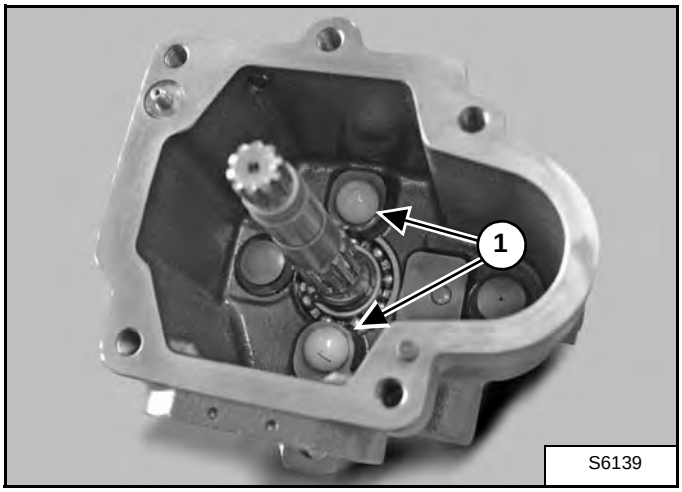
The step in the rod (Item 1) **[Figure 20-50-84]** must be inserted into the pump housing first.

Figure 20-50-85



Install the rod (Item 1) **[Figure 20-50-85]** in the pump housing.

Figure 20-50-86

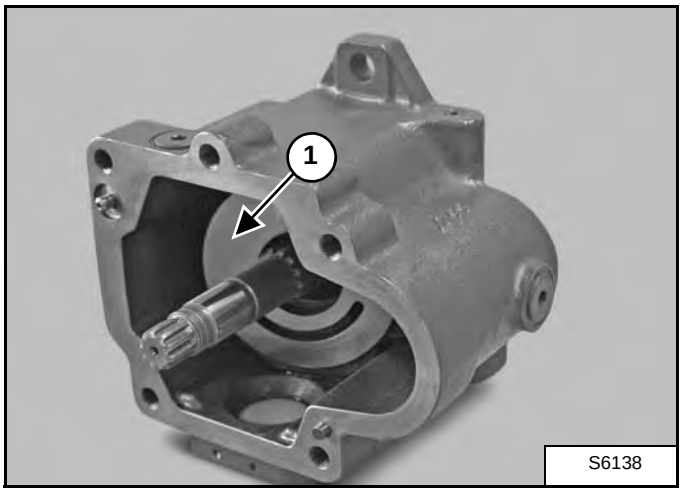


Install the balls (Item 1) **[Figure 20-50-86]** in the pump housing.

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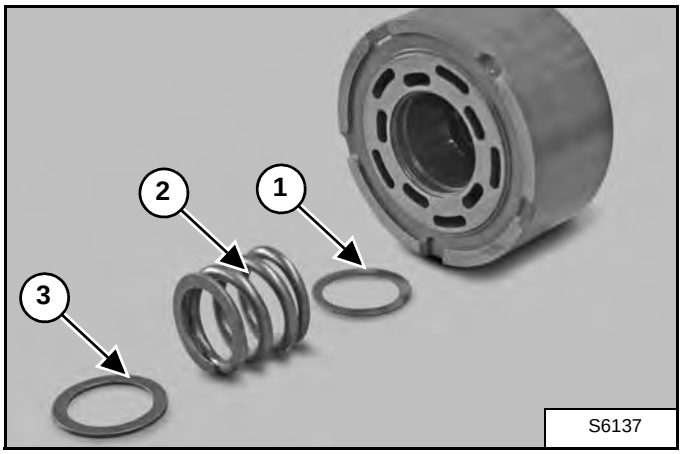
Piston Pump Assembly (Cont'd)

Figure 20-50-87



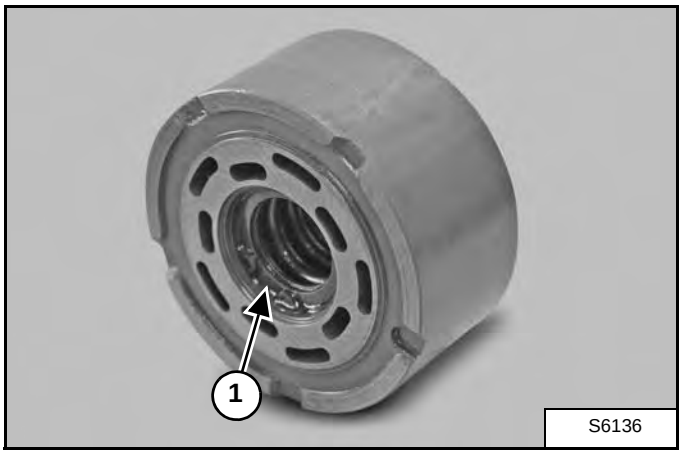
Install the swash plate (Item 1) **[Figure 20-50-87]** in the pump housing.

Figure 20-50-88



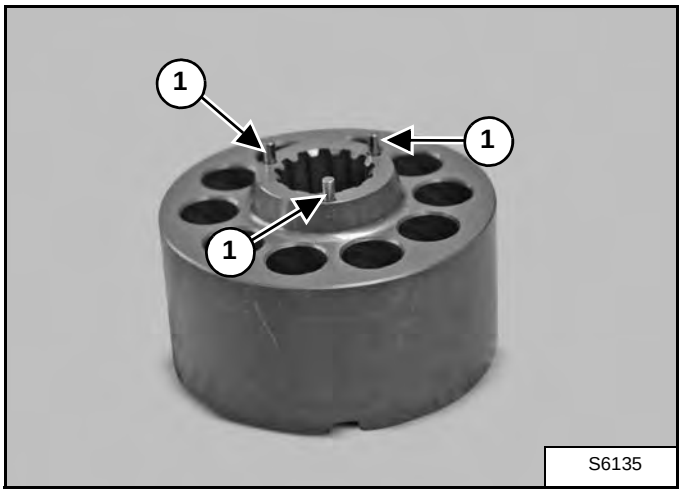
Install the retainer (Item 1), spring (Item 2) and retainer (Item 3) **[Figure 20-50-88]**.

Figure 20-50-89



Install the snap ring (Item 1) **[Figure 20-50-89]** in the cylinder barrel.

Figure 20-50-90

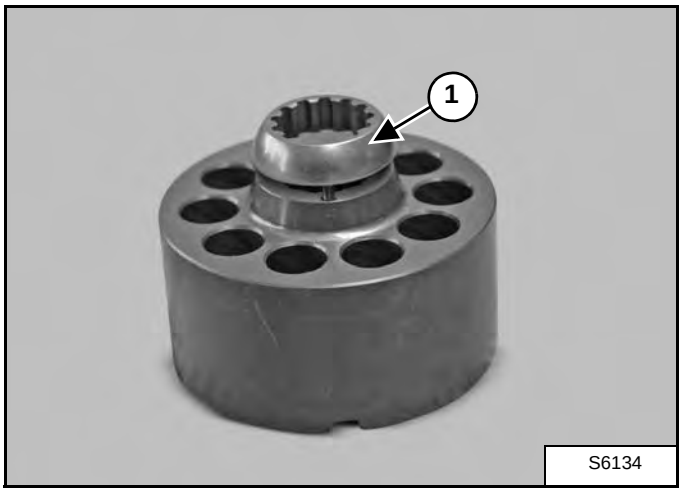


Install the three needles (Item 1) **[Figure 20-50-90]**.

Dealer Copy -- Not for Resale

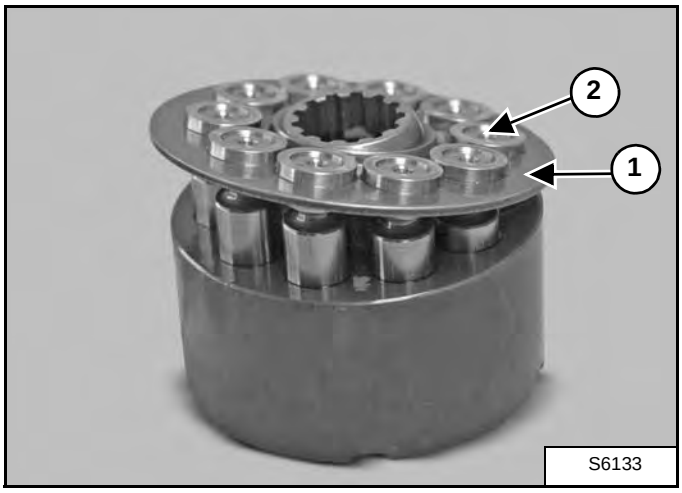
Piston Pump Assembly (Cont'd)

Figure 20-50-91



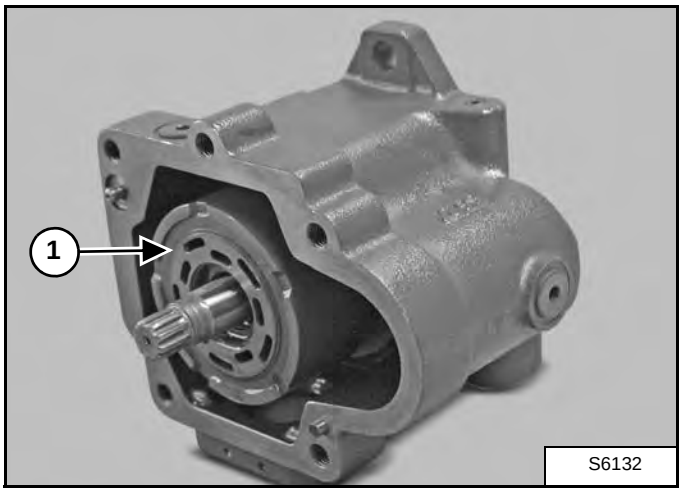
Install the barrel holder (Item 1) **[Figure 20-50-91]**.

Figure 20-50-92



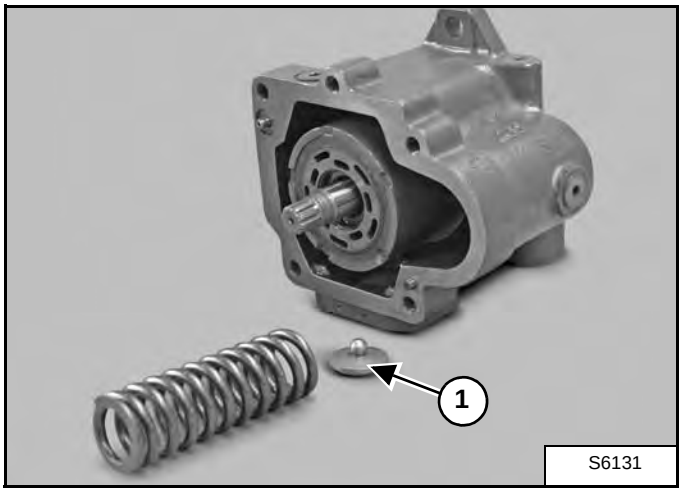
Install the shoe holder (Item 1) and piston assemblies (Item 2) **[Figure 20-50-92]** into the cylinder barrel.

Figure 20-50-93



Install the cylinder barrel assembly (Item 1) **[Figure 20-50-93]** in the pump housing.

Figure 20-50-94

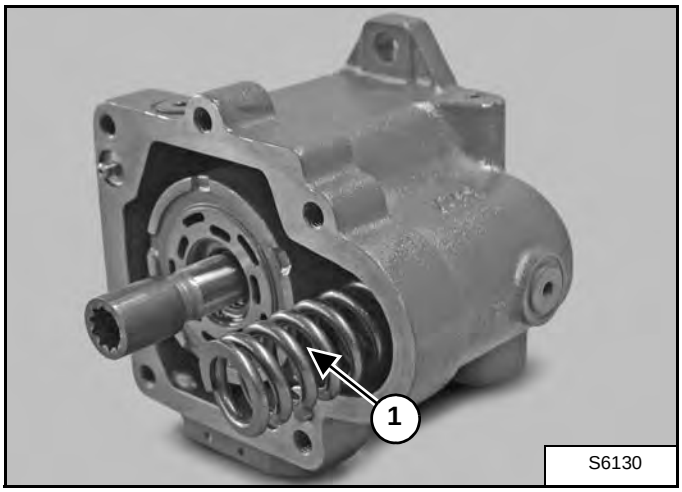


Install the spring seat (Item 1) **[Figure 20-50-94]** into the pump housing.

Dealer Copy -- Not for Resale

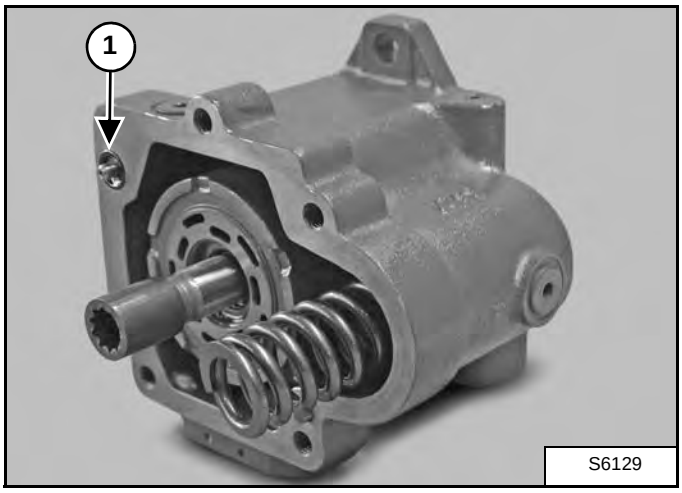
Piston Pump Assembly (Cont'd)

Figure 20-50-95



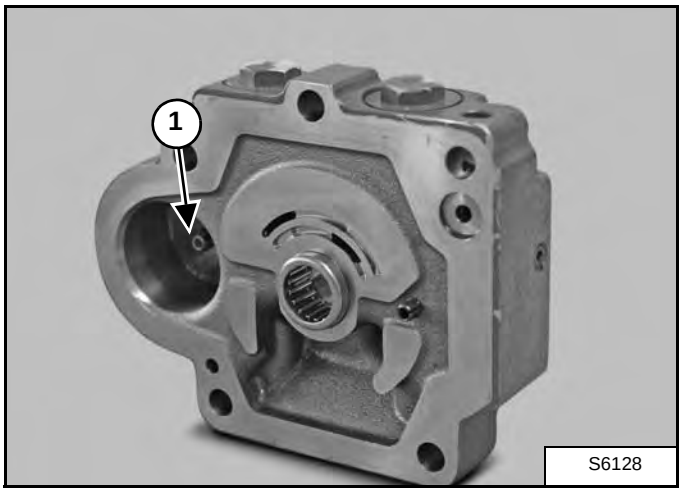
Install the spring (Item 1) **[Figure 20-50-95]** into the pump housing.

Figure 20-50-96



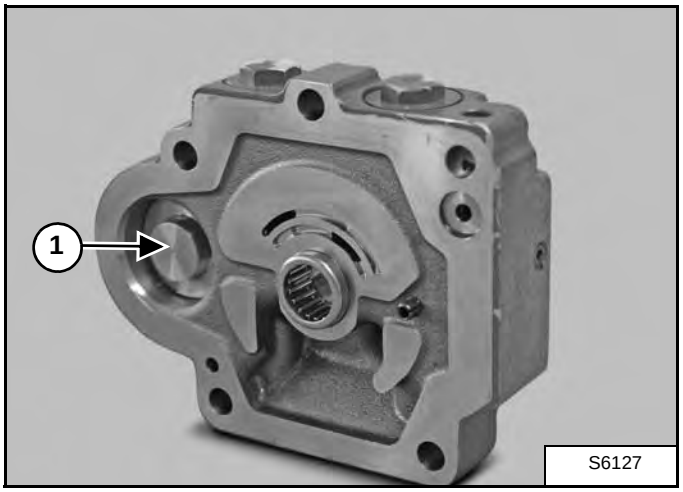
Install the O-ring (Item 1) **[Figure 20-50-96]**.

Figure 20-50-97



Install the screw (Item 1) **[Figure 20-50-97]** in the pump housing.

Figure 20-50-98

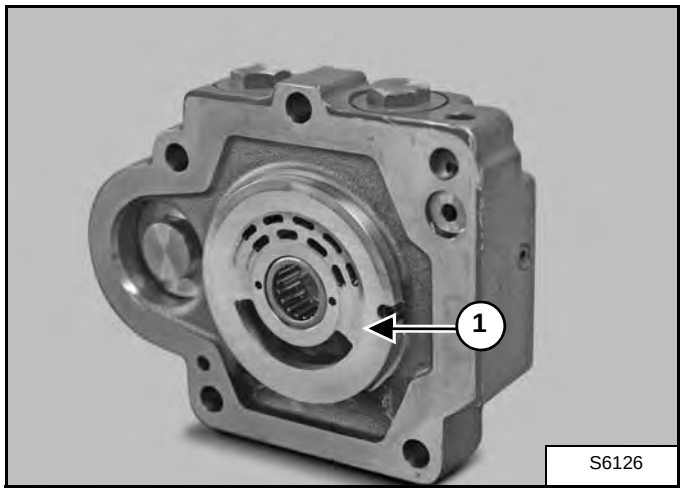


Install the spring guide (Item 1) **[Figure 20-50-98]** in the pump housing.

Dealer Copy -- Not for Resale

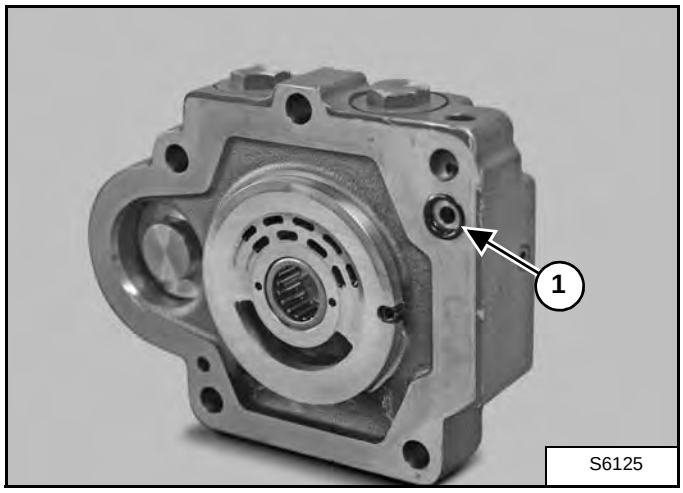
Piston Pump Assembly (Cont'd)

Figure 20-50-99



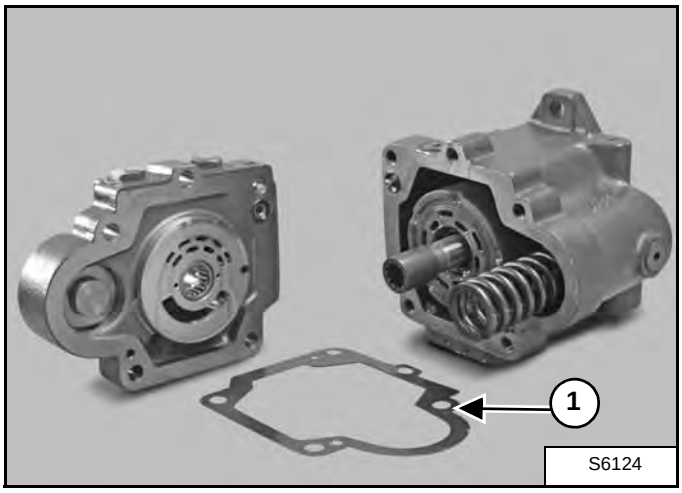
Install the valve plate (Item 1) **[Figure 20-50-99]** in the pump housing.

Figure 20-50-100



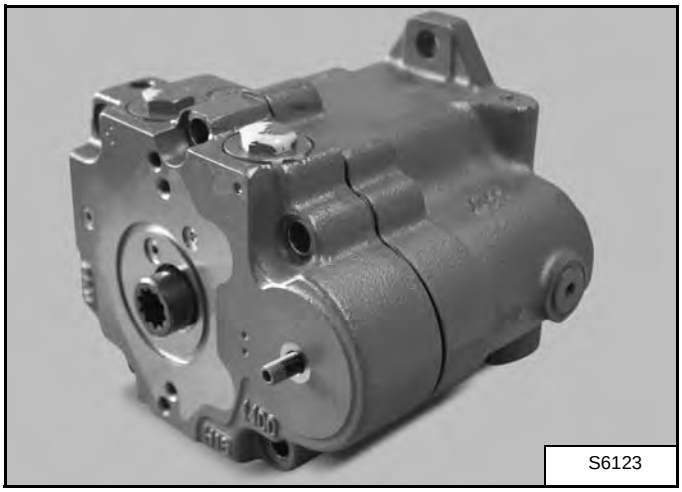
Install the O-ring (Item 1) **[Figure 20-50-100]** in the pump housing.

Figure 20-50-101



Install the packing (Item 1) **[Figure 20-50-101]** in between the pump housings.

Figure 20-50-102

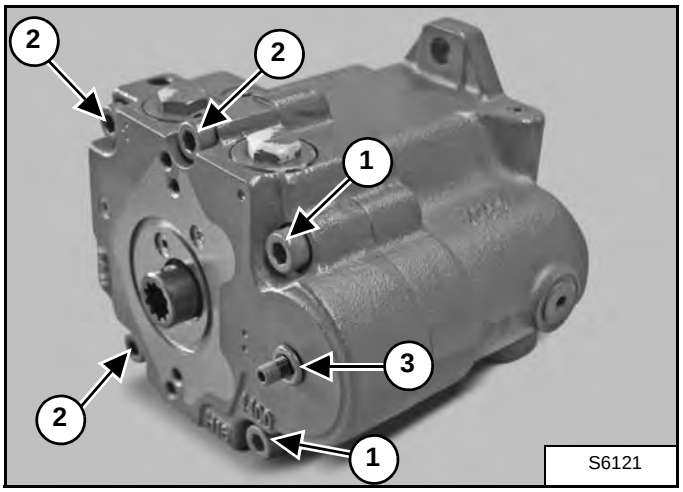


Install the two halves of pump housings **[Figure 20-50-102]** together.

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Piston Pump Assembly (Cont'd)

Figure 20-50-103



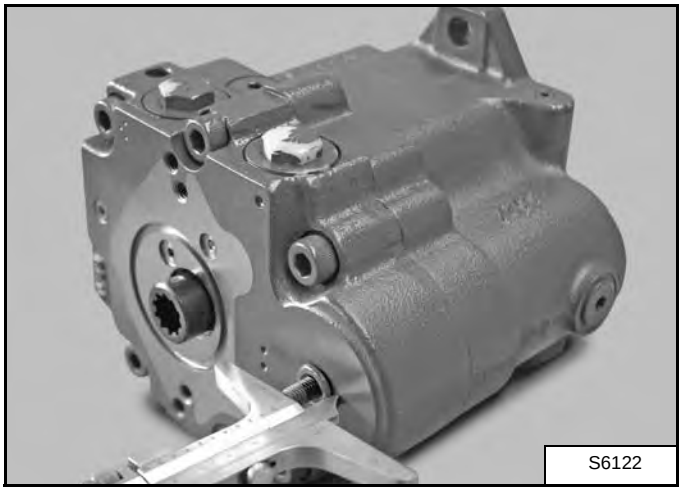
Install the two bolts (Item 1) **[Figure 20-50-103]** on either side of the pressure adjusting spring in the pump housing. Alternate tightening each bolt until both pump housings are assembled.

Install the remaining three bolts (Item 2) **[Figure 20-50-103]** in the pump housing.

Installation: Tighten bolts to 54 - 63,7 N•m (39.8 - 47.0 ft-lb) torque.

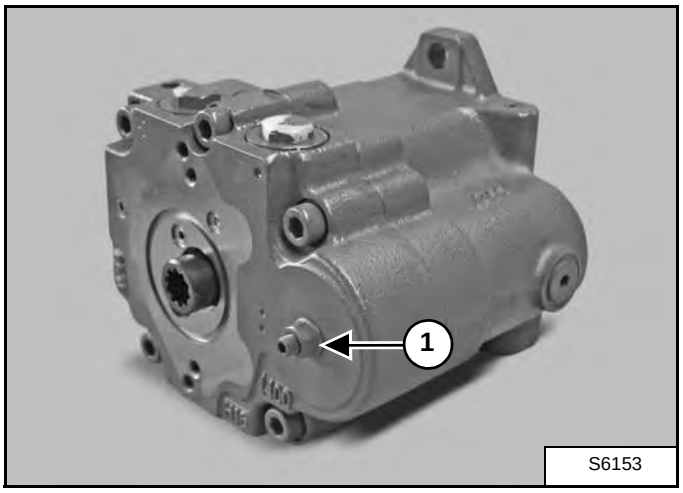
Install the seal washer (Item 3) **[Figure 20-50-103]** on the pump housing.

Figure 20-50-104



Set the measurement of the outside length of the pressure adjustment screw **[Figure 20-50-104]** taken before disassembly. Final adjustment can need to be made after installation in excavator.

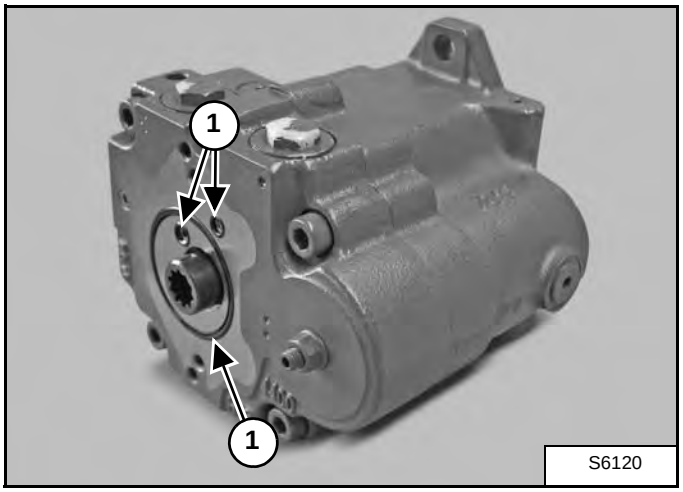
Figure 20-50-105



Install the pressure adjustment nut (Item 1) **[Figure 20-50-105]** on the pump housing.

Installation: Tighten the nut to 14,8 - 19,7 N•m (10.9 - 14.5 ft-lb) torque.

Figure 20-50-106

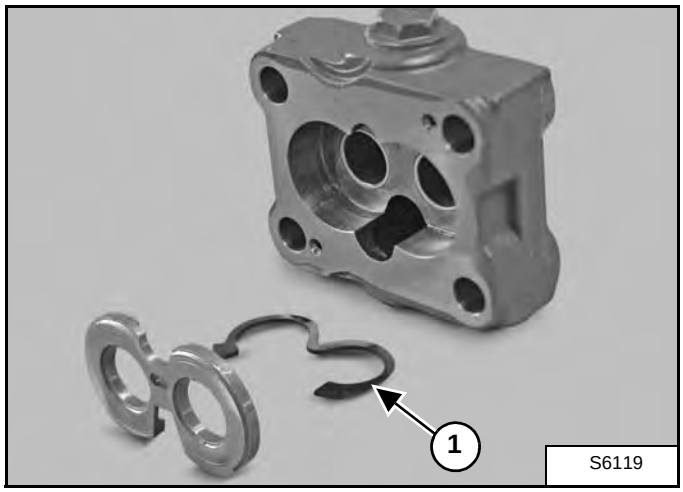


Install the three O-rings (Item 1) **[Figure 20-50-106]** on the pump housing.

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Gear Pump Assembly

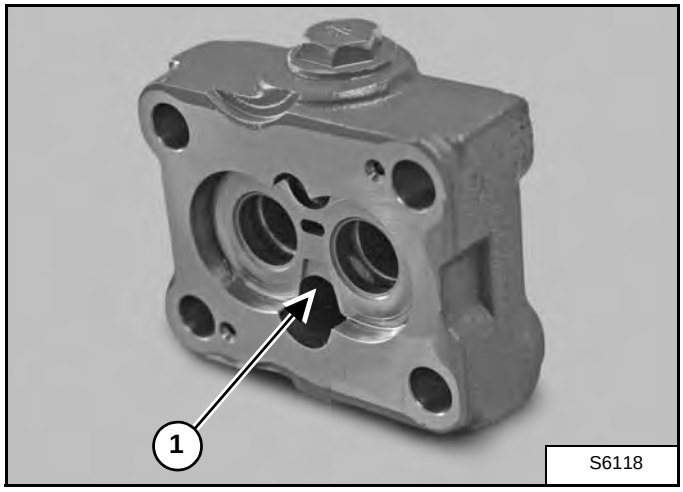
Figure 20-50-107



Install the seal (Item 1) **[Figure 20-50-107]** on the bearing.

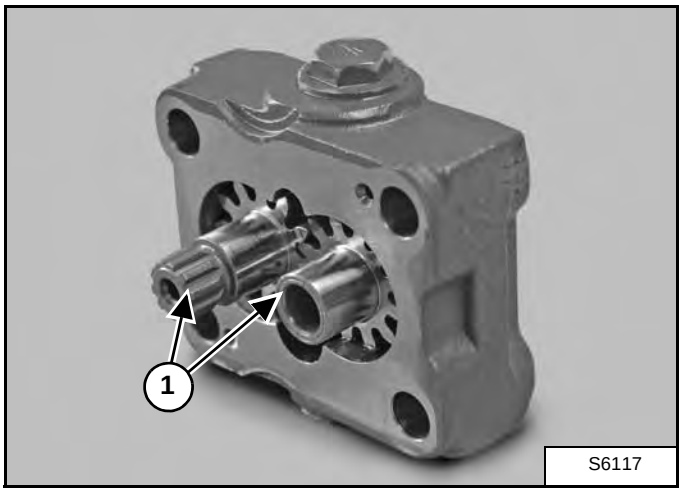
NOTE: The gear housing, two bearings, drive and idler gears are not serviced separately. If any part is damaged, the entire gear pump assembly must be replaced.

Figure 20-50-108



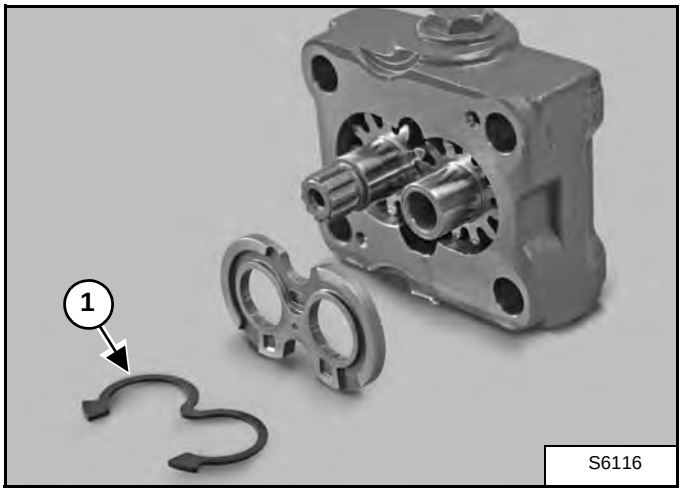
Install the bearing (Item 1) **[Figure 20-50-108]**.

Figure 20-50-109



Install the drive and idler gears (Item 1) **[Figure 20-50-109]**.

Figure 20-50-110

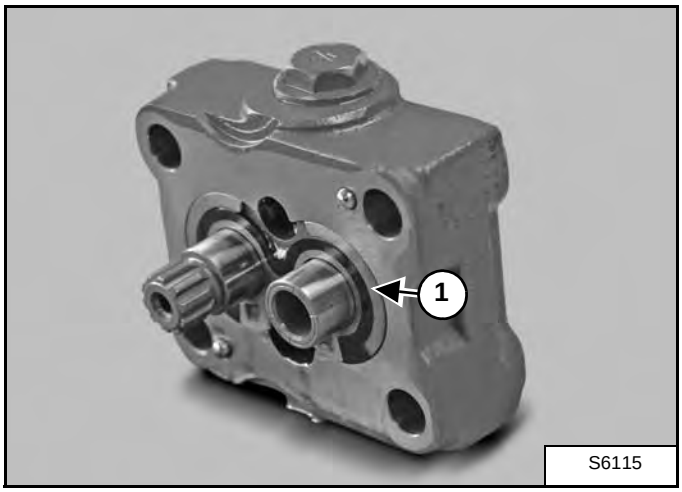


Install the seal (Item 1) **[Figure 20-50-110]** on the bearing.

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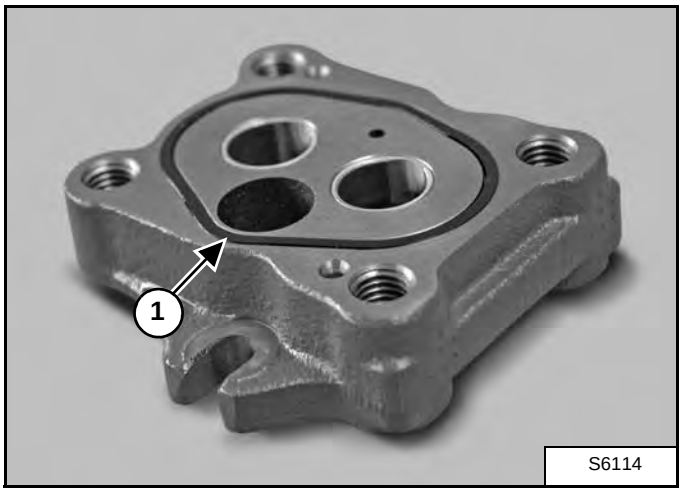
Gear Pump Assembly (Cont'd)

Figure 20-50-111



Install the bearing (Item 1) **[Figure 20-50-111]**.

Figure 20-50-112



Install the seal (Item 1) **[Figure 20-50-112]**.

Figure 20-50-113

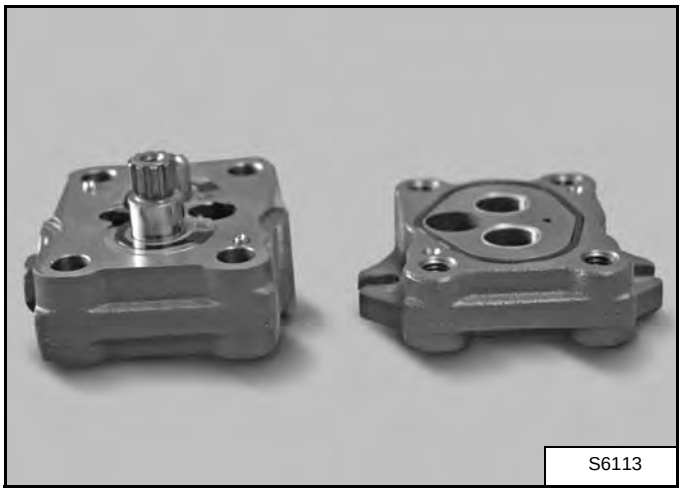
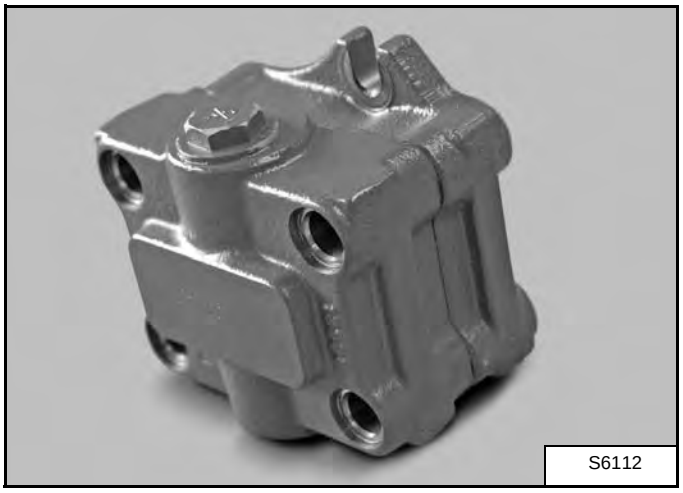


Figure 20-50-114

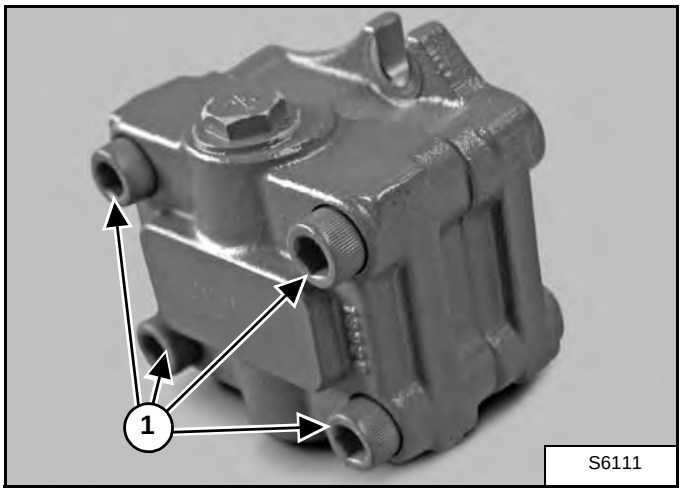


Assemble the two halves of the gear pump **[Figure 20-50-113]** and **[Figure 20-50-114]**.

Dealer Copy -- Not for Resale

Gear Pump Assembly (Cont'd)

Figure 20-50-115

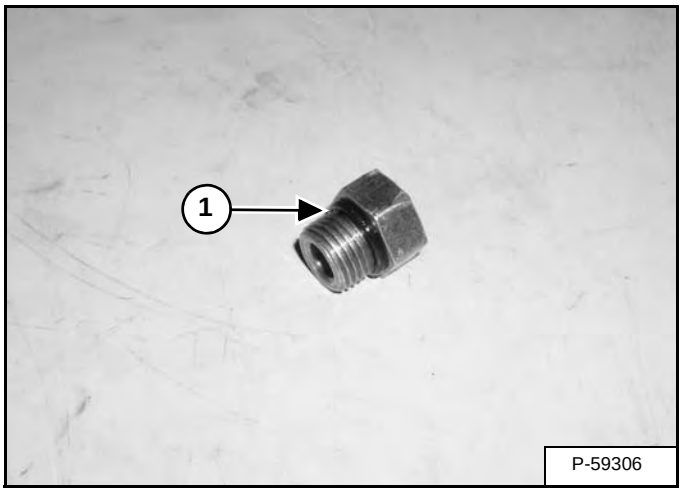


Install the four bolts (Item 1) **[Figure 20-50-115]** in the gear pump.

Tighten the bolts to 88,3 - 93,1 N•m (65.1 - 68.7 ft-lb) torque.

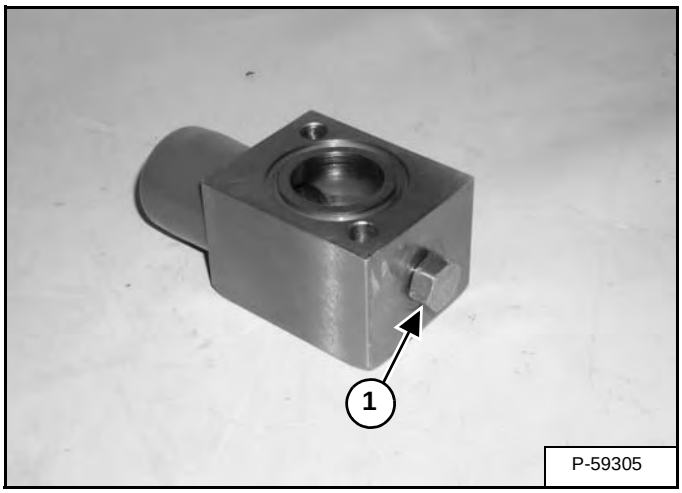
Assembly

Figure 20-50-116



Install the O-ring (Item 1) **[Figure 20-50-116]** on the plug.

Figure 20-50-117

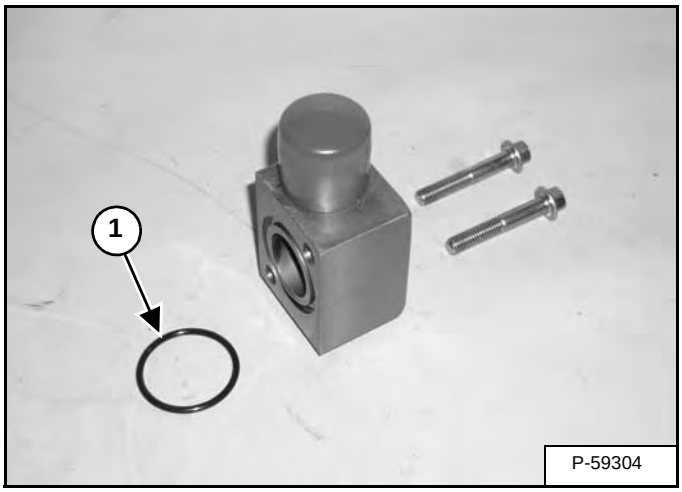


Install the plug (Item 1) **[Figure 20-50-117]** in the pump block.

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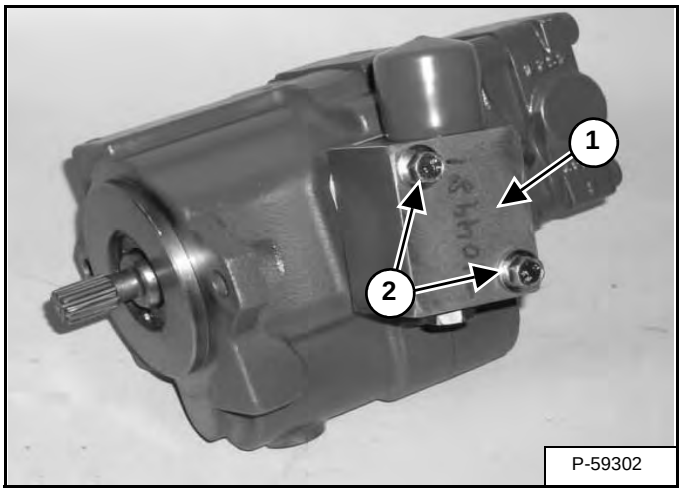
Assembly (Cont'd)

Figure 20-50-118



Install the O-ring (Item 1) **[Figure 20-50-118]** on the pump block.

Figure 20-50-119



Install pump block (Item 1) and the two bolts (Item 2) **[Figure 20-50-119]**.

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Dealer Copy -- Not for Resale

MANIFOLD ASSEMBLY / ACCUMULATOR

Description

The manifold body contains a two speed solenoid valve, a two speed boost solenoid valve, a system bypass valve, a console (joystick) lockout solenoid valve, a pressure reducing valve and a safety relief valve.

The body is connected to the accumulator.

The manifold supplies 3 MPa (30 bar) (435 psi) to the joysticks to activate the control valve spools.

The accumulator provides short term reserve pressure for joystick function with the engine off and the key in the ON position.

Removal And Installation

Lower the boom / bucket and blade to the ground.

⚠ 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 doctor familiar with this injury is not received immediately.

W-2145-EN-0210

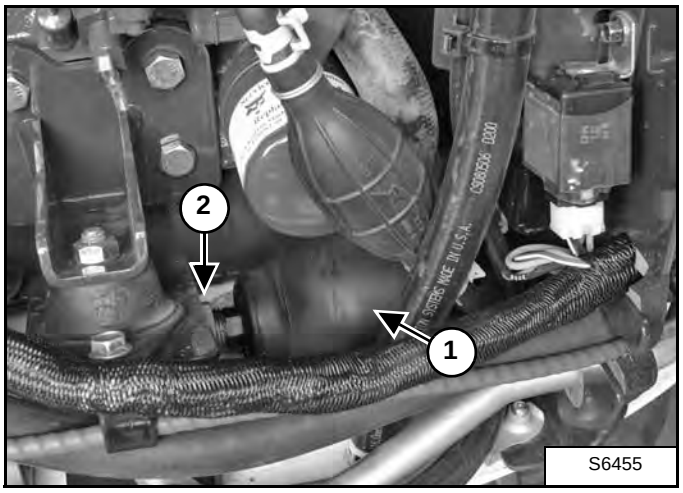
IMPORTANT

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

I-2003-0888

From the operator's seat, drain the residual pressure from the accumulator by stroking a function with the engine off and the key in the run position.

Figure 20-60-1



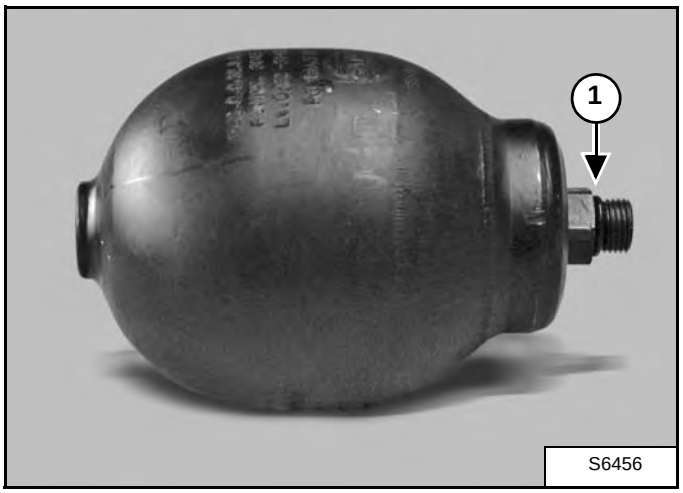
Open the tailgate. (See TAILGATE on Page 10-40-1.)

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

Installation: Tighten the accumulator and O-ring to 29 - 33 N•m (22 - 24 ft-lb) torque.

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

Figure 20-60-2



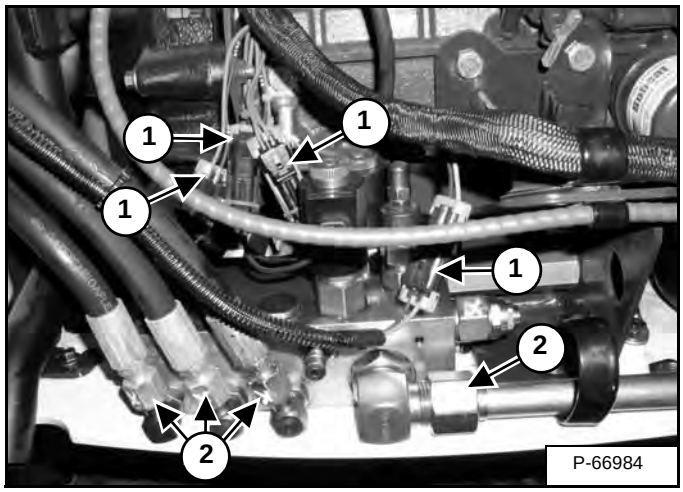
Remove the O-ring (Item 1) **[Figure 20-60-2]** from the accumulator.

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MANIFOLD ASSEMBLY / ACCUMULATOR (CONT'D)

Removal And Installation (Cont'd)

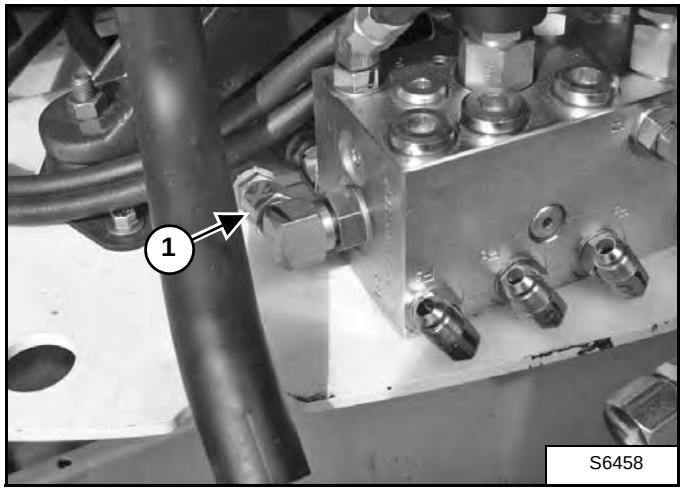
Figure 20-60-3



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

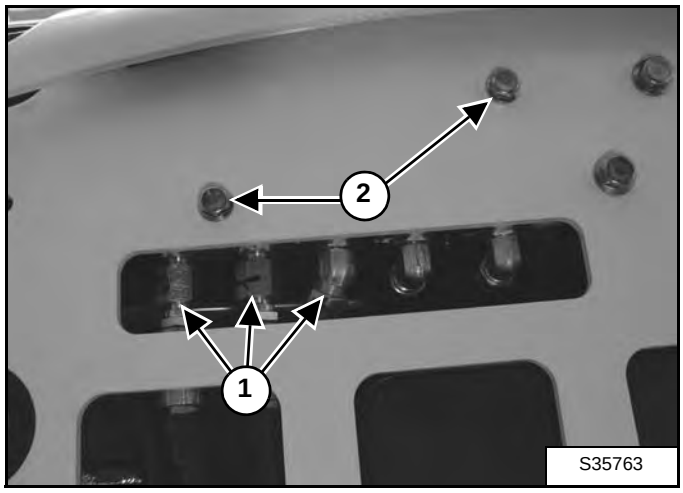
Mark and remove the hoses and tubelines (Item 2) **[Figure 20-60-3]** from the manifold.

Figure 20-60-4



Mark and remove the hose (Item 1) **[Figure 20-60-4]** from the manifold.

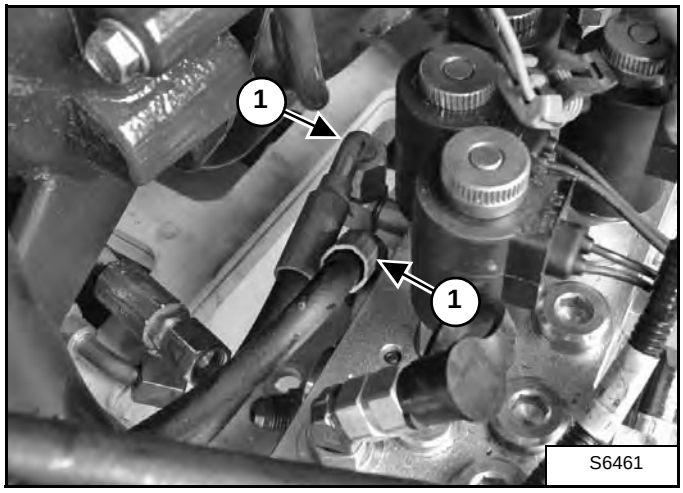
Figure 20-60-5



Mark and remove the hoses (Item 1) **[Figure 20-60-5]** from under the upperstructure.

Remove the bolts (Item 2) **[Figure 20-60-5]** from under the upperstructure.

Figure 20-60-6



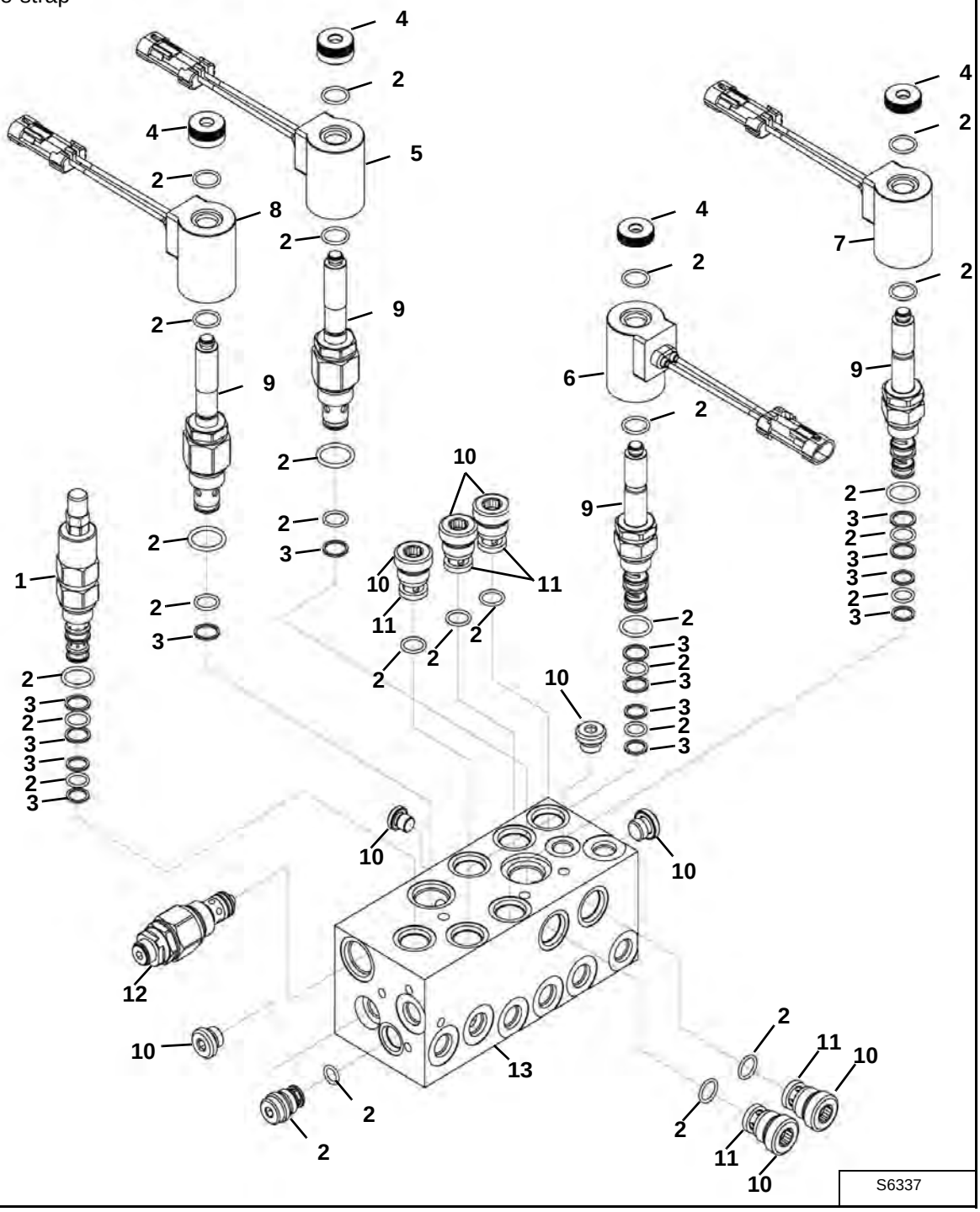
Slide the manifold assembly toward the tailgate to expose the hoses. Mark and remove the hoses (Item 1) **[Figure 20-60-6]** from the manifold.

Remove the manifold.

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Parts Identification

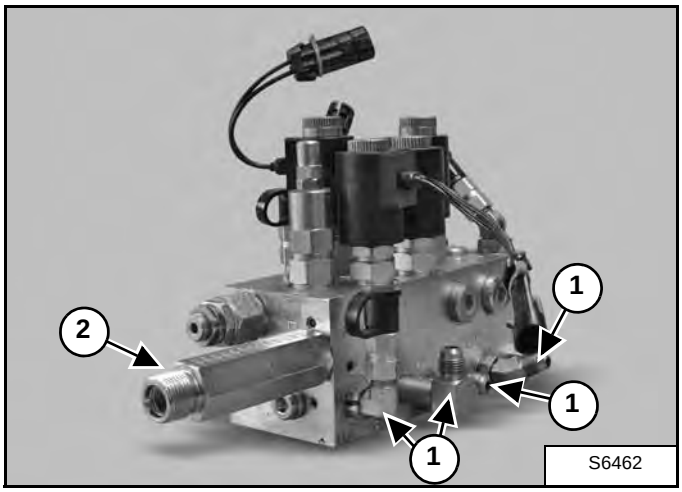
1. Pressure Reducing Valve
2. O-ring
3. Back-up Ring
4. Nut
5. Coil without tie-strap
6. Coil with green tie-strap
7. Coil with yellow tie-strap
8. Coil with orange tie-strap
9. Solenoid Stem
10. Plug
11. Seat
12. Relief Valve
13. Valve Body



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Disassembly

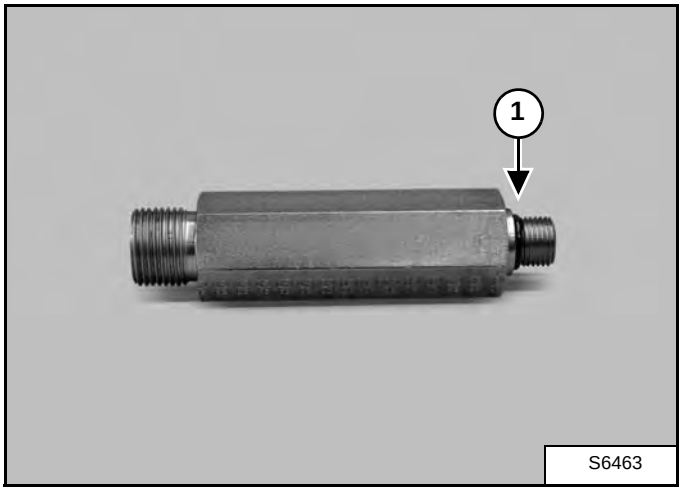
Figure 20-60-7



Remove the twelve fittings (Item 1) **[Figure 20-60-7]** from the manifold.

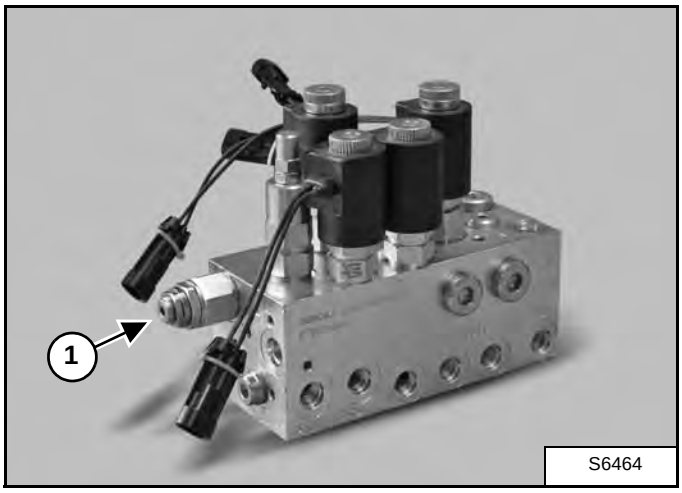
Remove the accumulator extension (Item 2) **[Figure 20-60-7]** from the manifold.

Figure 20-60-8



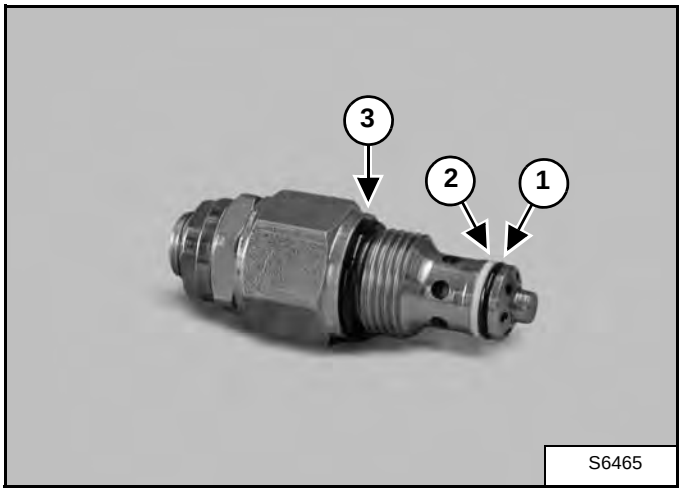
Remove the O-ring (Item 1) **[Figure 20-60-8]** from the accumulator extension.

Figure 20-60-9



Remove the relief valve (Item 1) **[Figure 20-60-9]** from the manifold.

Figure 20-60-10



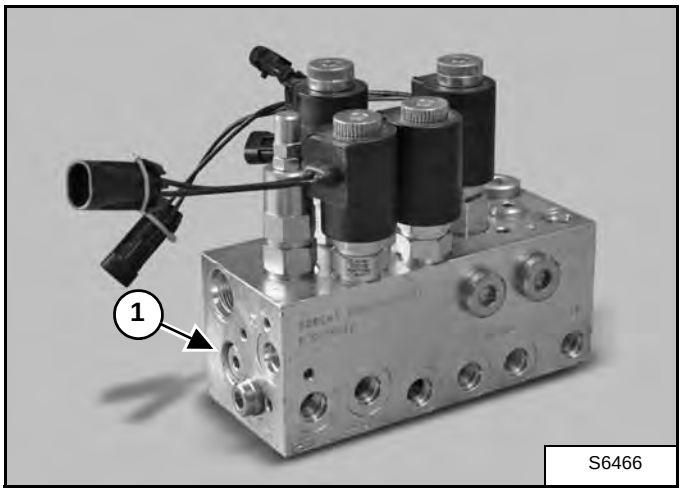
Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-60-10]** from the relief valve.

Remove the O-ring (Item 3) **[Figure 20-60-10]** from the relief valve.

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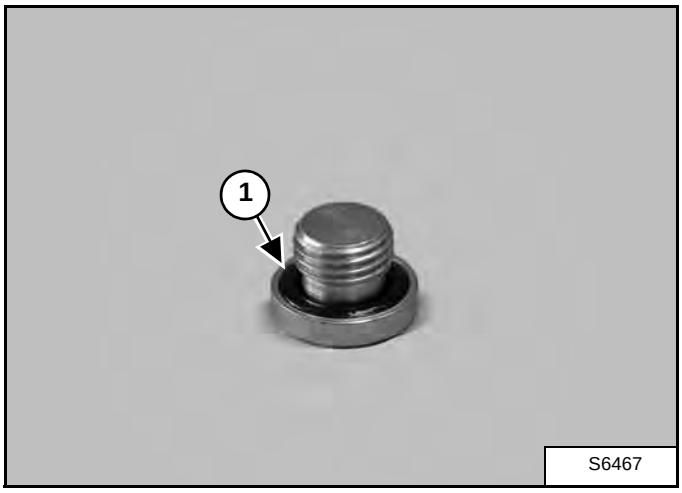
Disassembly (Cont'd)

Figure 20-60-11



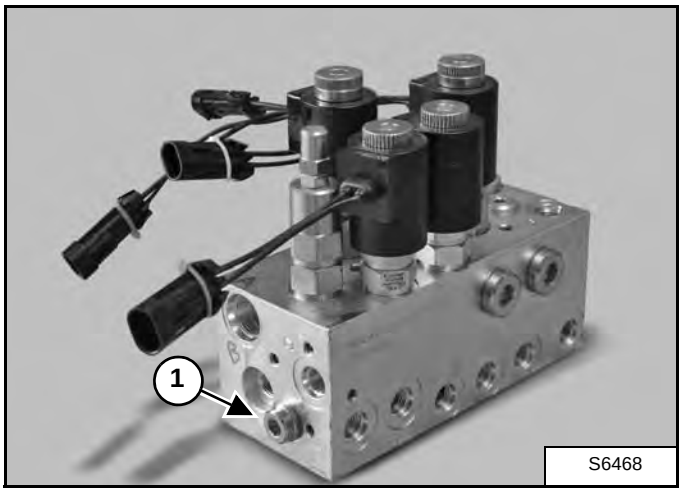
Remove the plug (Item 1) **[Figure 20-60-11]** from the manifold.

Figure 20-60-12



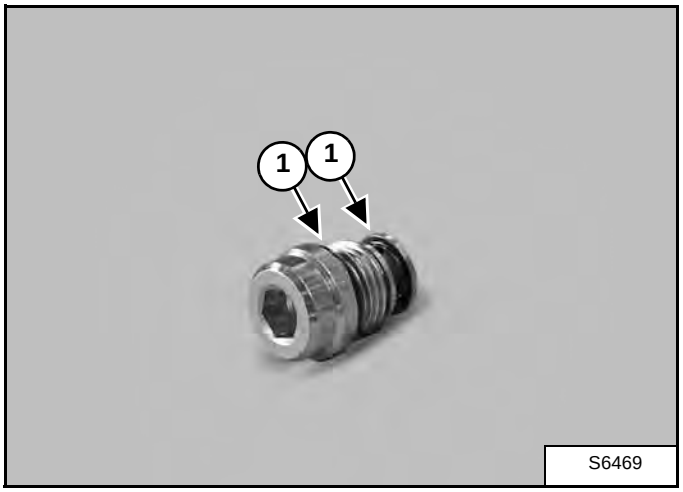
Remove the O-ring (Item 1) **[Figure 20-60-12]** from the plug.

Figure 20-60-13



Remove the plug (Item 1) **[Figure 20-60-13]** from the manifold.

Figure 20-60-14

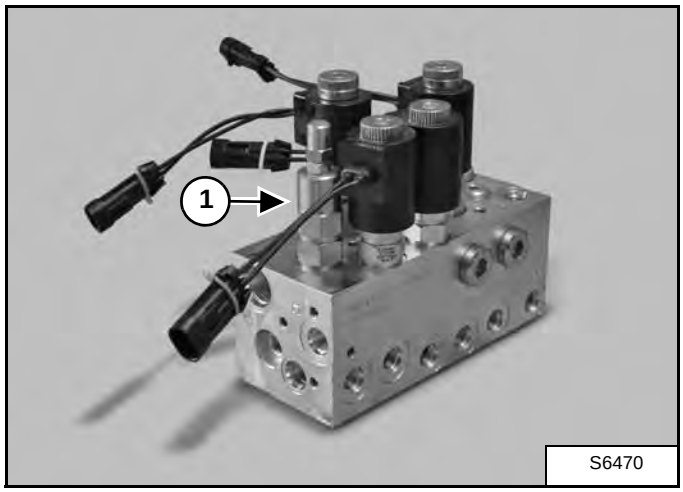


Remove the two O-rings (Item 1) **[Figure 20-60-14]** from the plug.

Dealer Copy -- Not for Resale

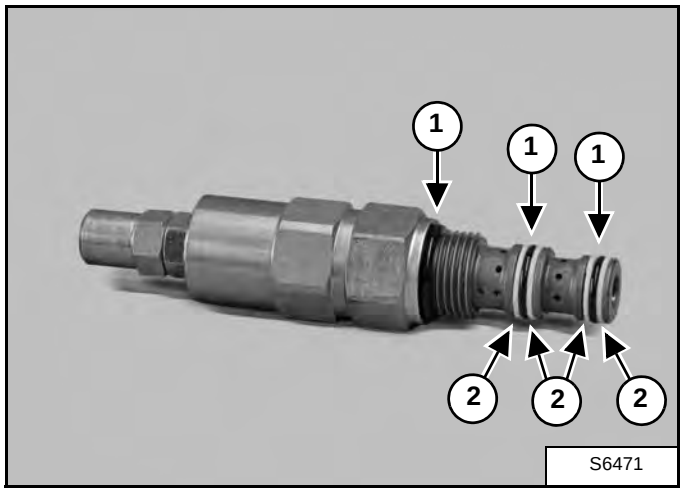
Disassembly (Cont'd)

Figure 20-60-15



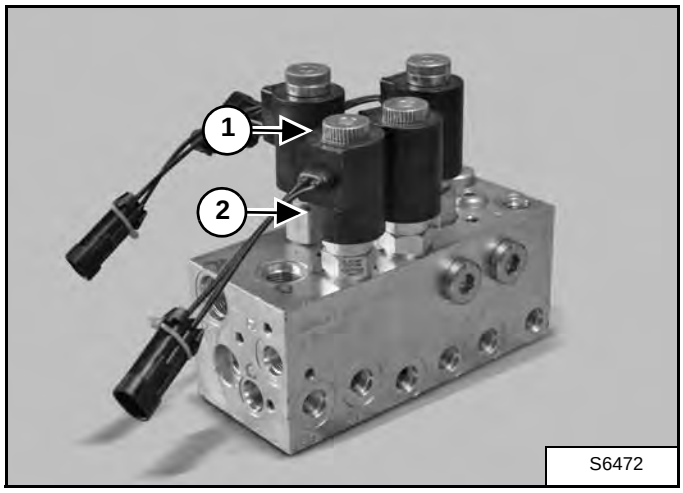
Remove the pressure reducing valve (Item 1) **[Figure 20-60-15]** from the manifold.

Figure 20-60-16



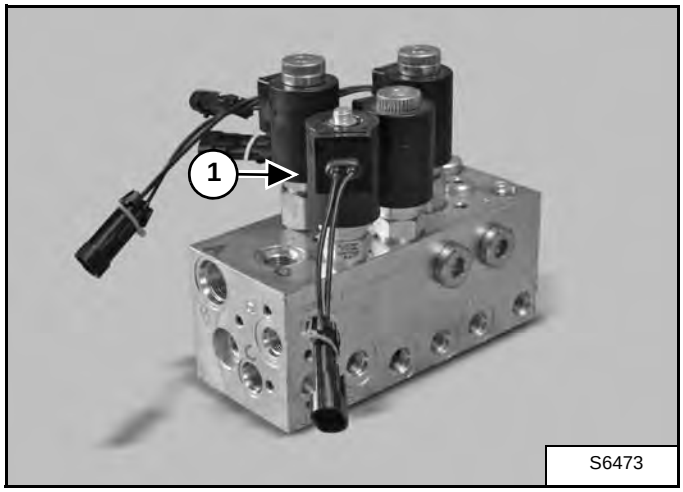
Remove the three O-rings (Item 1) and the four back-up rings (Item 2) **[Figure 20-60-16]** from the pressure reducing valve.

Figure 20-60-17



Remove the nut (Item 1) from the console (joystick) lockout solenoid (Item 2) **[Figure 20-60-17]**.

Figure 20-60-18

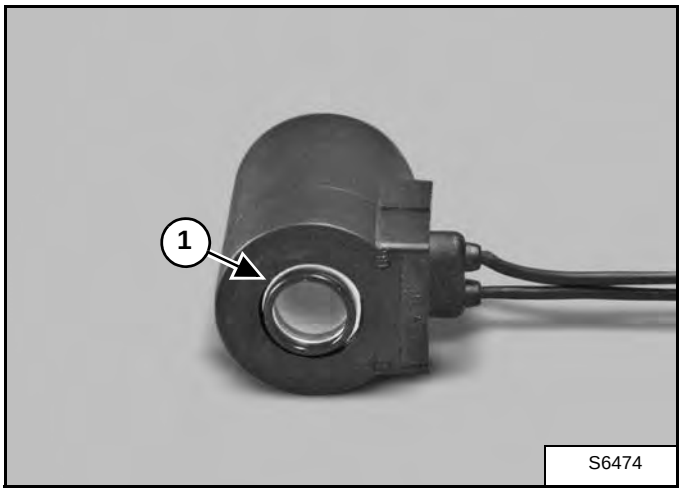


Remove the coil with the green tie-strap (Item 1) **[Figure 20-60-18]** from the solenoid stem.

Dealer Copy -- Not for Resale

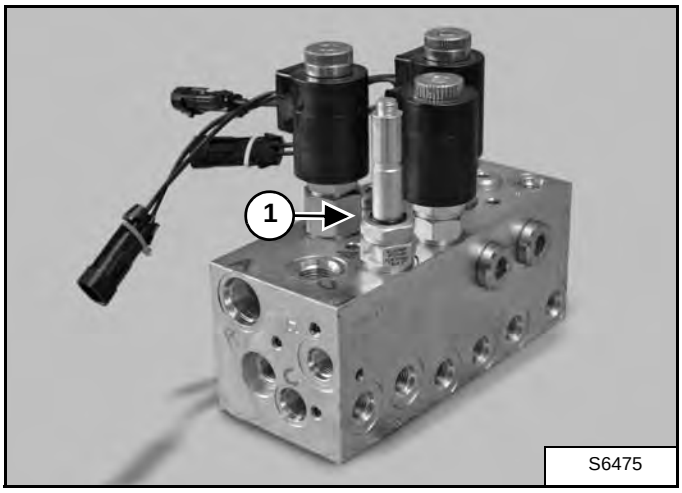
Disassembly (Cont'd)

Figure 20-60-19



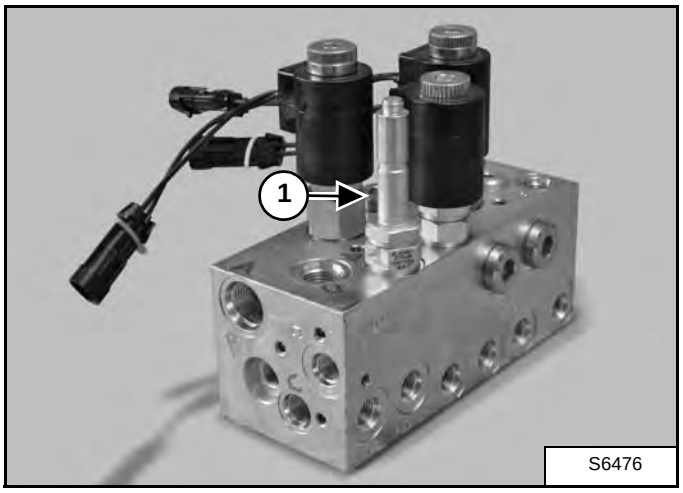
Remove the O-ring (Item 1) **[Figure 20-60-19]** from the coil.

Figure 20-60-20



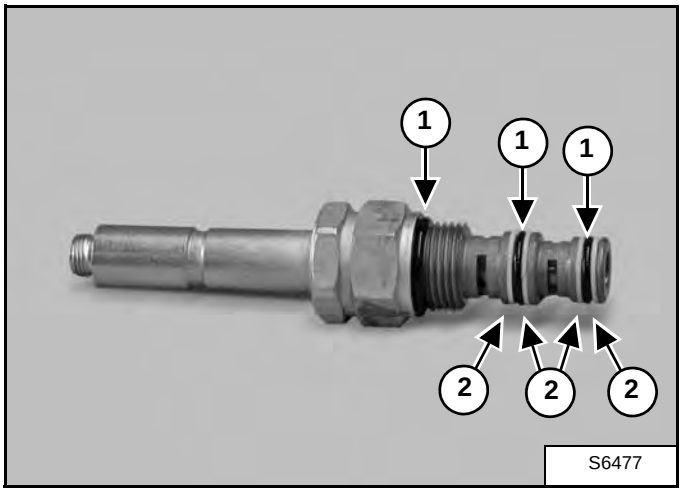
Remove the O-ring (Item 1) **[Figure 20-60-20]** from the solenoid stem.

Figure 20-60-21



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

Figure 20-60-22

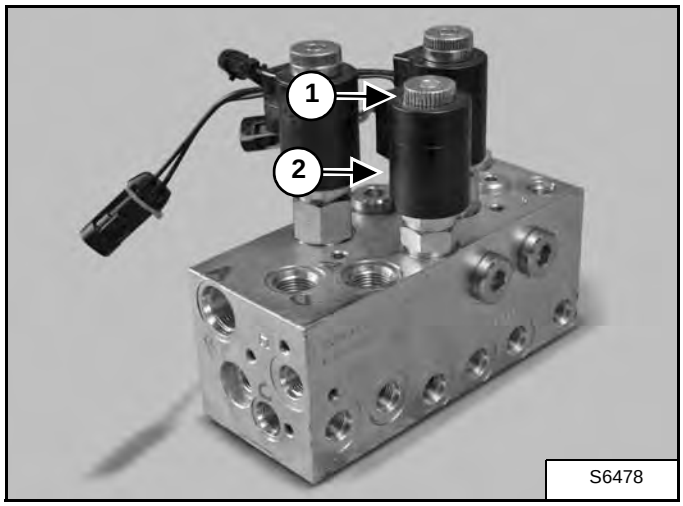


Remove the three O-rings (Item 1) and the four back-up rings (Item 2) **[Figure 20-60-22]** from the solenoid stem.

Dealer Copy -- Not for Resale

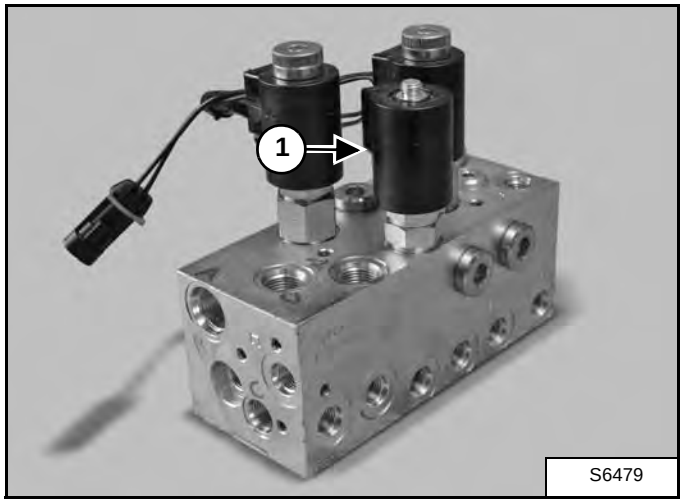
Disassembly (Cont'd)

Figure 20-60-23



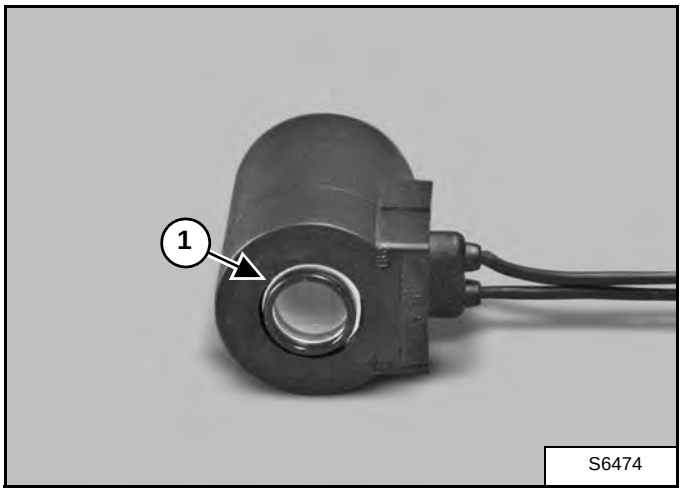
Remove the nut (Item 1) from the two speed boost solenoid (Item 2) **[Figure 20-60-23]**.

Figure 20-60-24



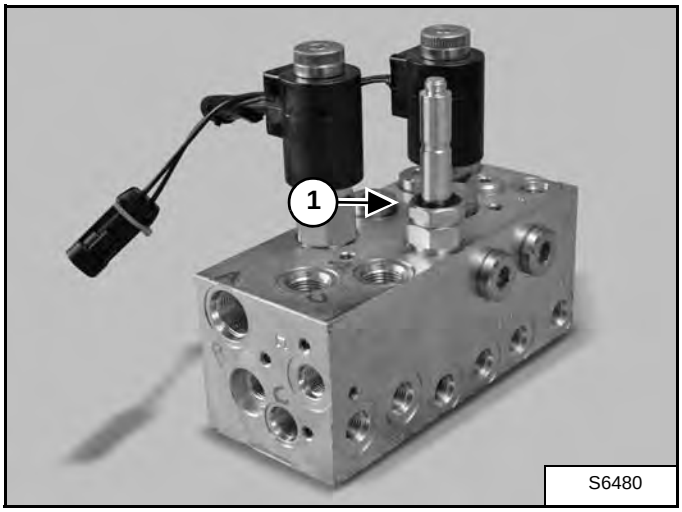
Remove the coil with yellow tie-strap (Item 1) **[Figure 20-60-24]** from the solenoid stem.

Figure 20-60-25



Remove the O-ring (Item 1) **[Figure 20-60-25]** from the coil.

Figure 20-60-26

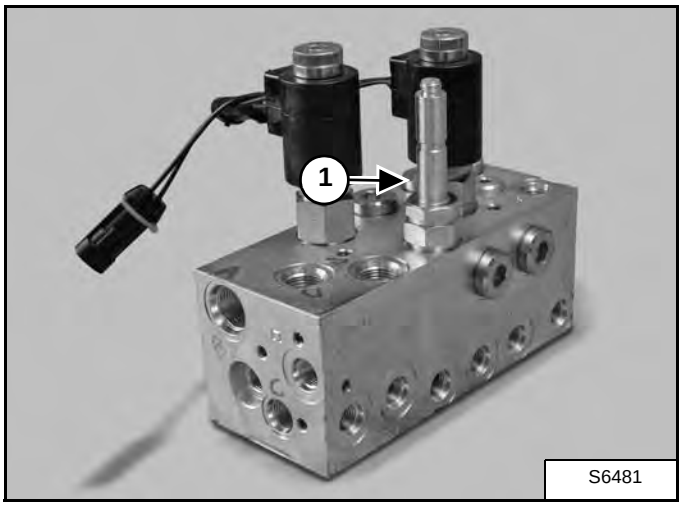


Remove the O-ring (Item 1) **[Figure 20-60-26]** from the solenoid stem.

Dealer Copy -- Not for Resale

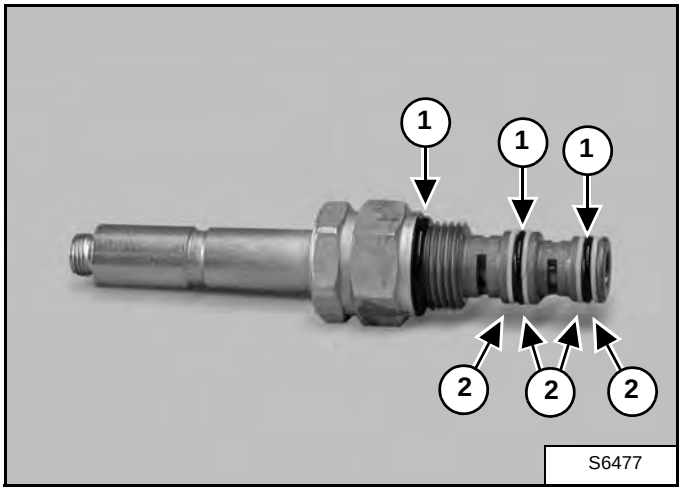
Disassembly (Cont'd)

Figure 20-60-27



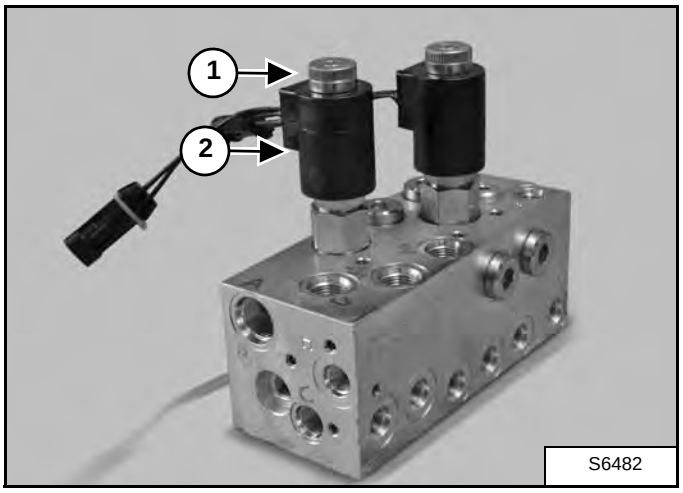
Remove the solenoid stem (Item 1) **[Figure 20-60-27]**.

Figure 20-60-28



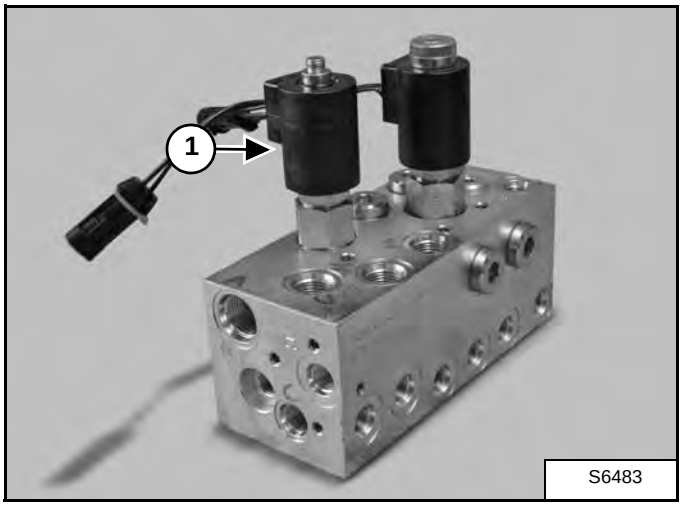
Remove the three O-rings (Item 1) and the four back-up rings (Item 2) **[Figure 20-60-28]** from the solenoid stem.

Figure 20-60-29



Remove the nut (Item 1) from the system bypass solenoid (Item 2) **[Figure 20-60-29]**.

Figure 20-60-30

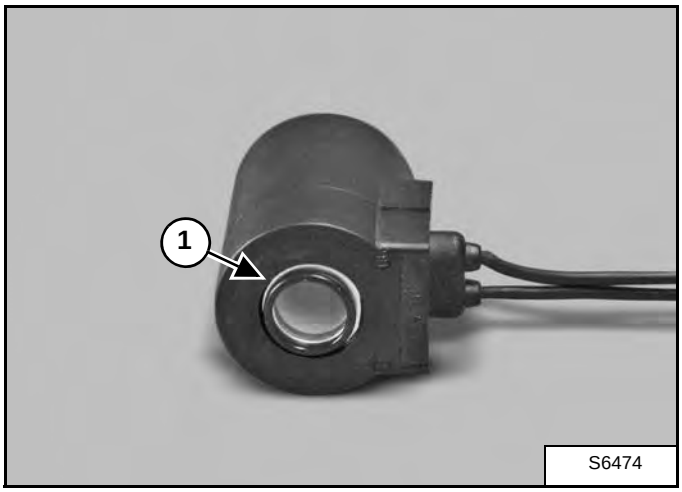


Remove the coil with orange strap (Item 1) **[Figure 20-60-30]** from the solenoid stem.

Dealer Copy -- Not for Resale

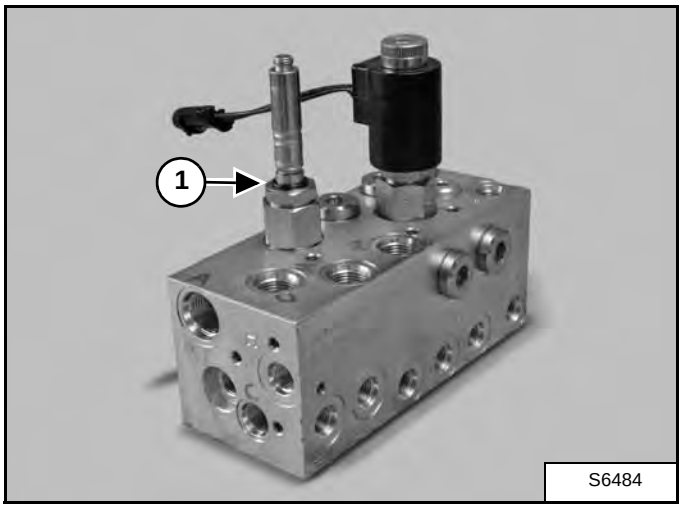
Disassembly (Cont'd)

Figure 20-60-31



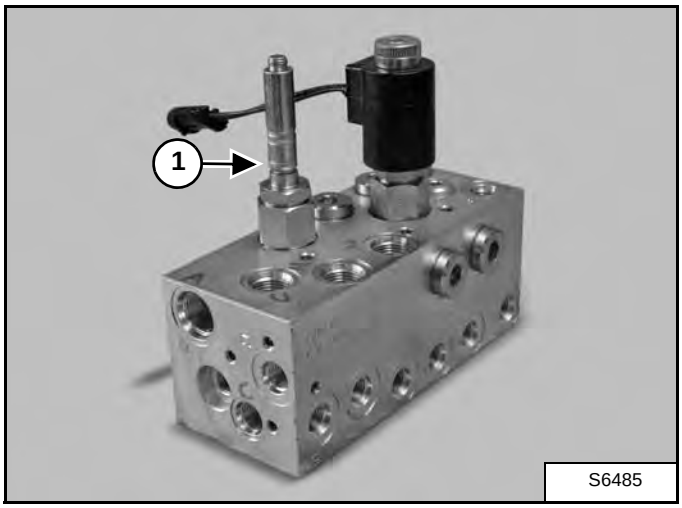
Remove the O-ring (Item 1) **[Figure 20-60-31]** from the coil.

Figure 20-60-32



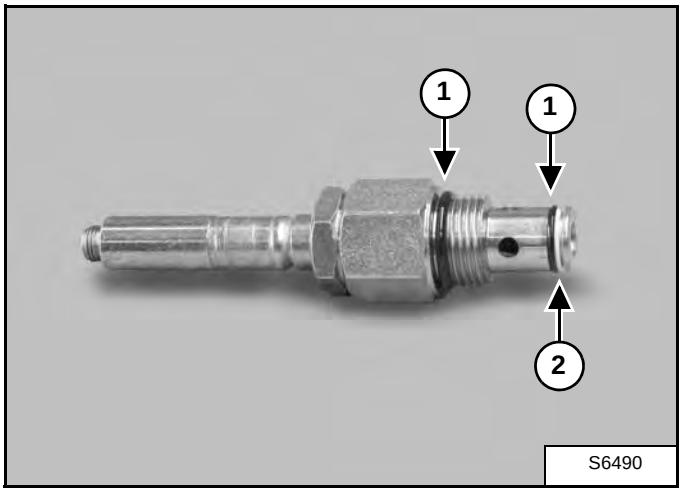
Remove the O-ring (Item 1) **[Figure 20-60-32]** from the solenoid stem.

Figure 20-60-33



Remove the solenoid stem (Item 1) **[Figure 20-60-33]**.

Figure 20-60-34

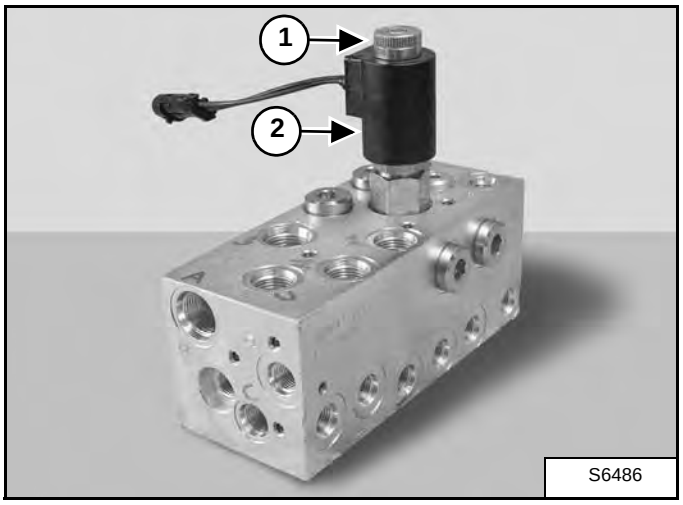


Remove the two O-rings (Item 1) and the back-up ring (Item 2) **[Figure 20-60-34]** from the solenoid stem.

Dealer Copy -- Not for Resale

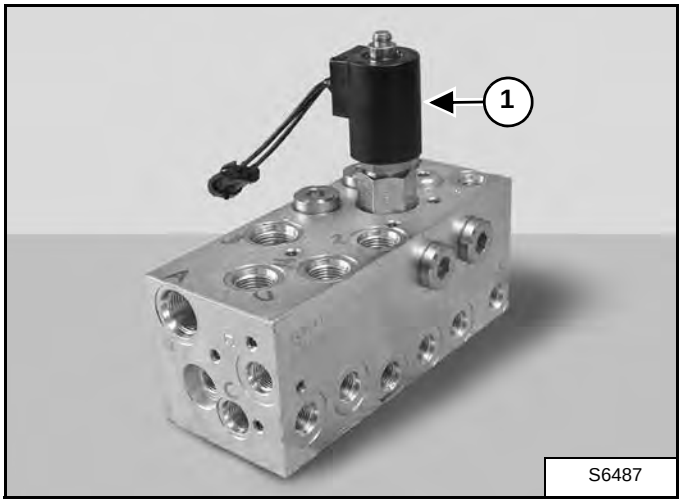
Disassembly (Cont'd)

Figure 20-60-35



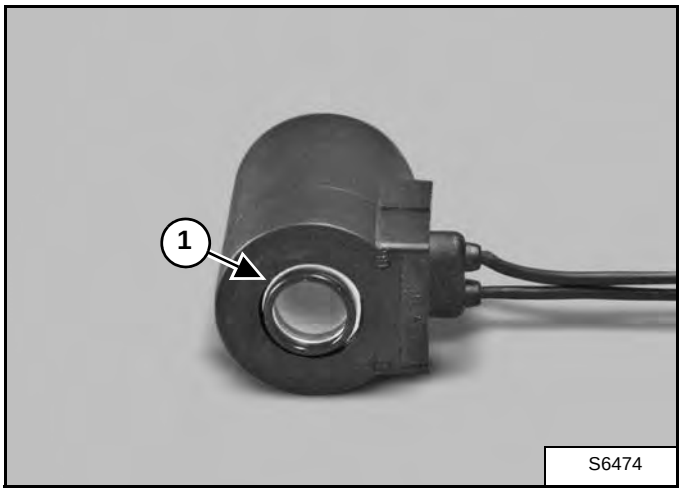
Remove the nut (Item 1) from the two speed solenoid (Item 2) **[Figure 20-60-35]**.

Figure 20-60-36



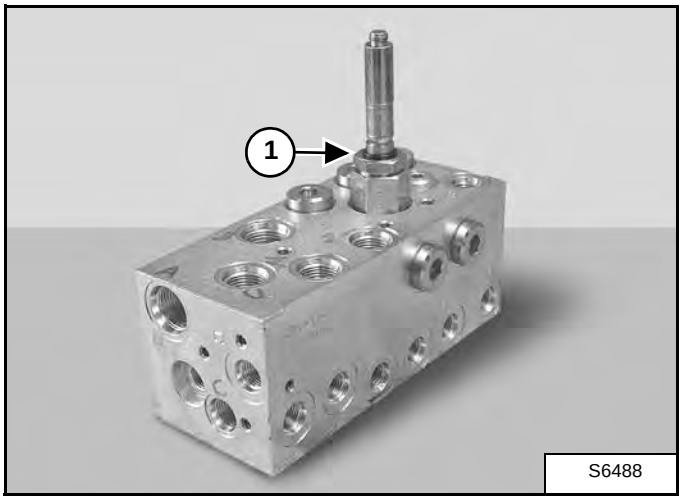
Remove the coil with no strap (Item 1) **[Figure 20-60-36]** from the solenoid stem.

Figure 20-60-37



Remove the O-ring (Item 1) **[Figure 20-60-37]** from the coil.

Figure 20-60-38

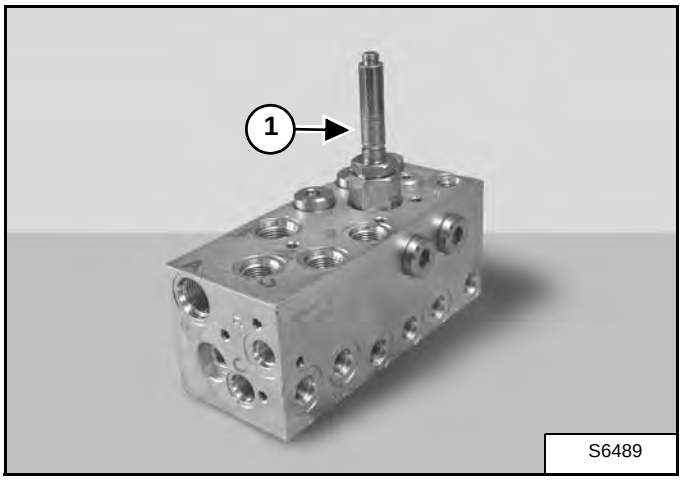


Remove the O-ring (Item 1) **[Figure 20-60-38]** from the solenoid stem.

Dealer Copy -- Not for Resale

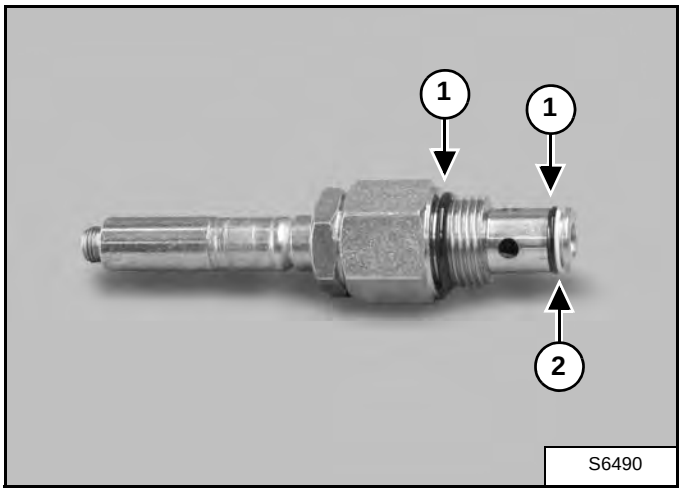
Disassembly (Cont'd)

Figure 20-60-39



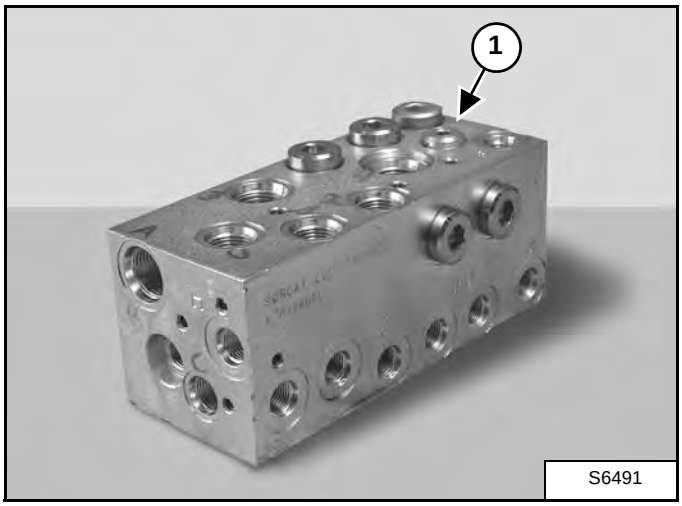
Remove the solenoid stem (Item 1) **[Figure 20-60-39]**.

Figure 20-60-40



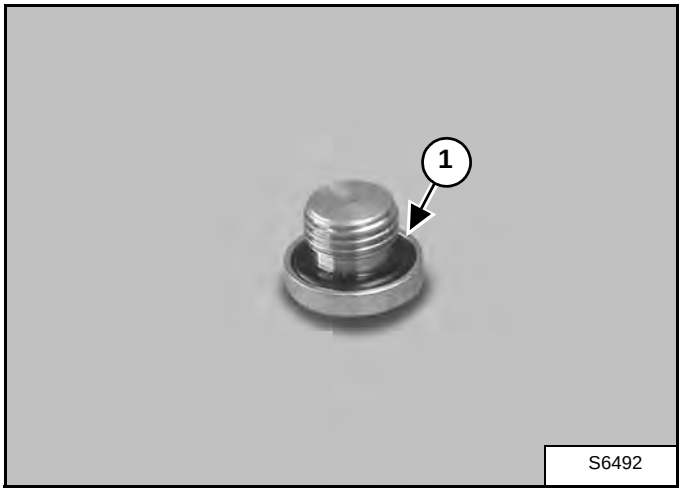
Remove the two O-rings (Item 1) and the back-up ring (Item 2) **[Figure 20-60-40]** from the solenoid stem.

Figure 20-60-41



Remove the plug (Item 1) **[Figure 20-60-41]** from the top of the manifold.

Figure 20-60-42

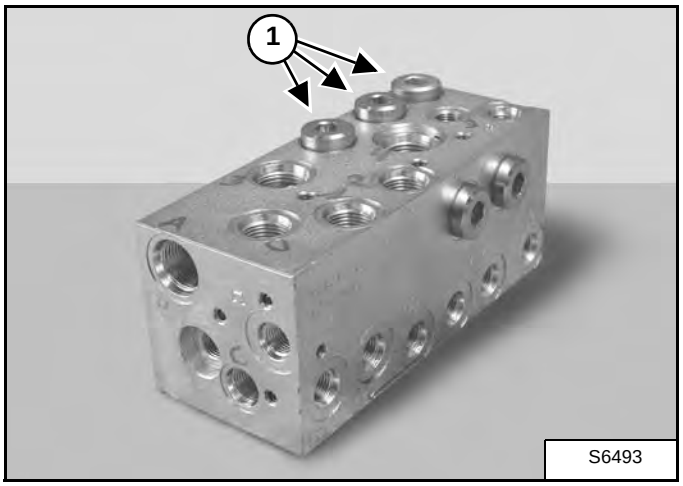


Remove the O-ring (Item 1) **[Figure 20-60-42]** from the plug.

Dealer Copy -- Not for Resale

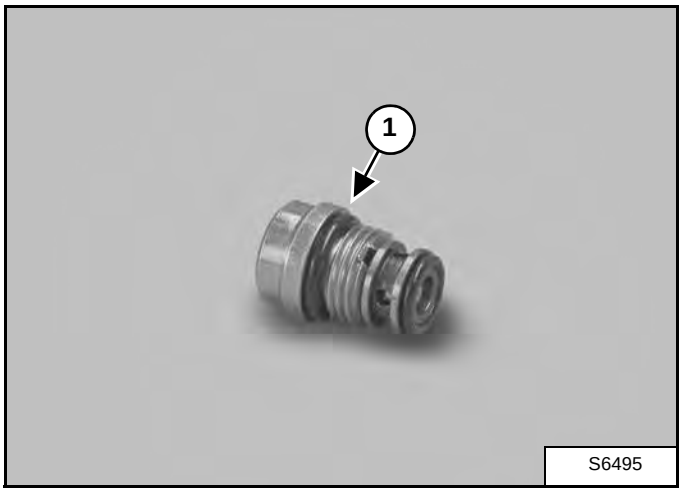
Disassembly (Cont'd)

Figure 20-60-43



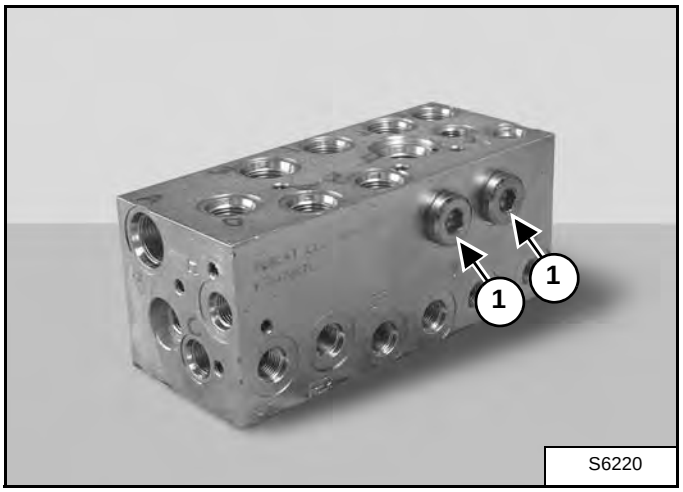
Remove the three plugs (Item 1) **[Figure 20-60-43]** from the top of the manifold.

Figure 20-60-44



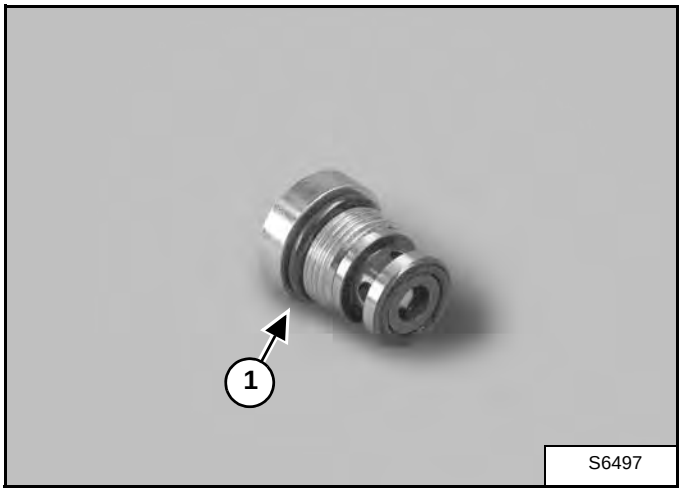
Remove the O-ring (Item 1) **[Figure 20-60-44]** from the plugs.

Figure 20-60-45



Remove the two plugs (Item 1) **[Figure 20-60-45]** from the side of the manifold.

Figure 20-60-46

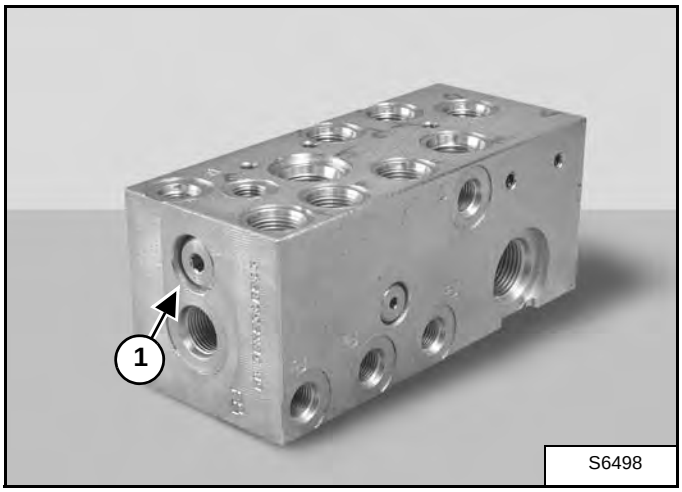


Remove the O-ring (Item 1) **[Figure 20-60-46]** from the plugs.

Dealer Copy -- Not for Resale

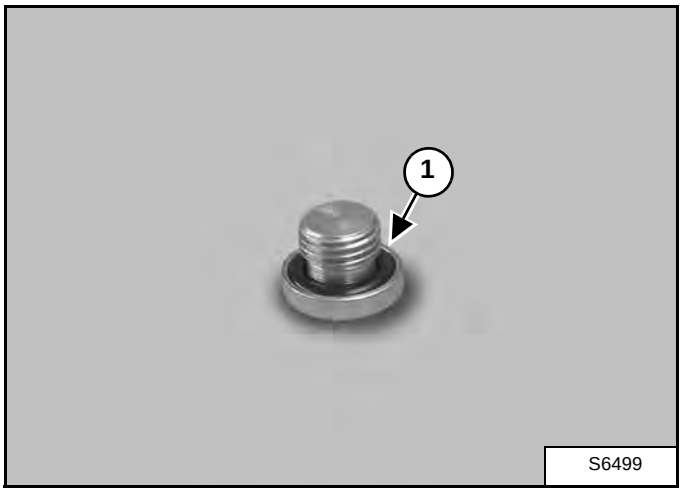
Disassembly (Cont'd)

Figure 20-60-47



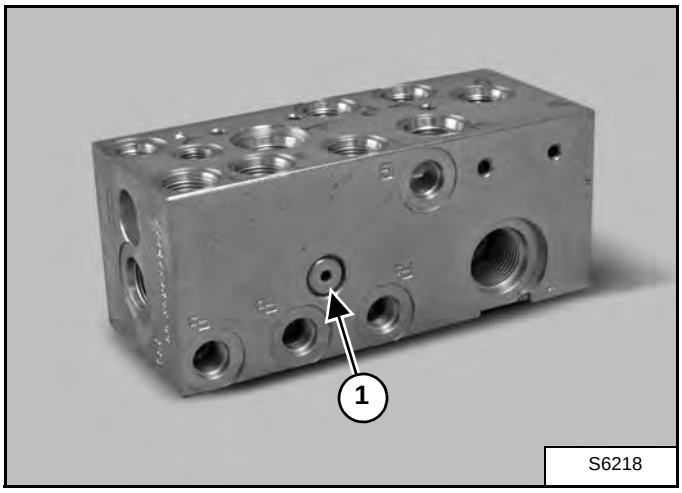
Remove the plug (Item 1) **[Figure 20-60-47]**.

Figure 20-60-48



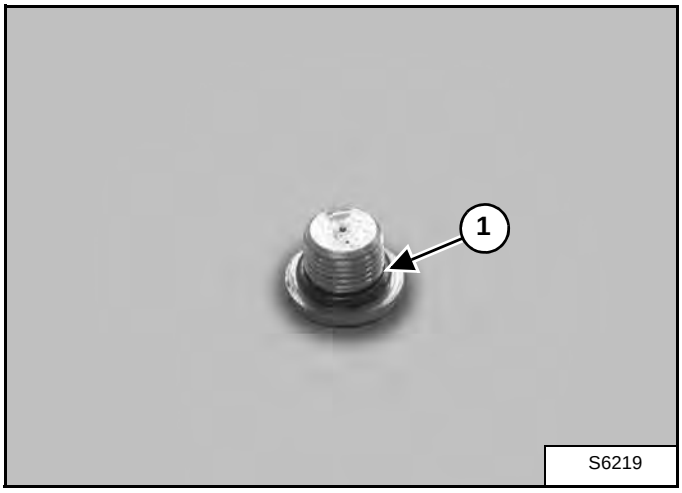
Remove the O-ring (Item 1) **[Figure 20-60-48]** from the plug.

Figure 20-60-49



Remove the plug (Item 1) **[Figure 20-60-49]**.

Figure 20-60-50



Remove the O-ring (Item 1) **[Figure 20-60-50]** from the plug.

Dealer Copy -- Not for Resale

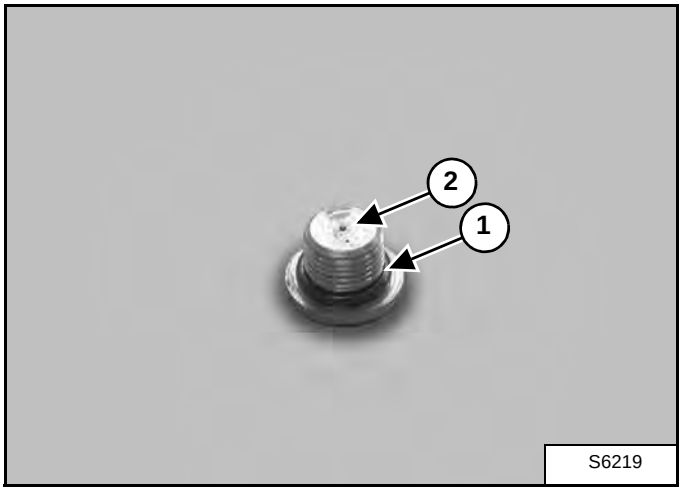
Assembly

Clean all parts in solvent and dry with compressed air.

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

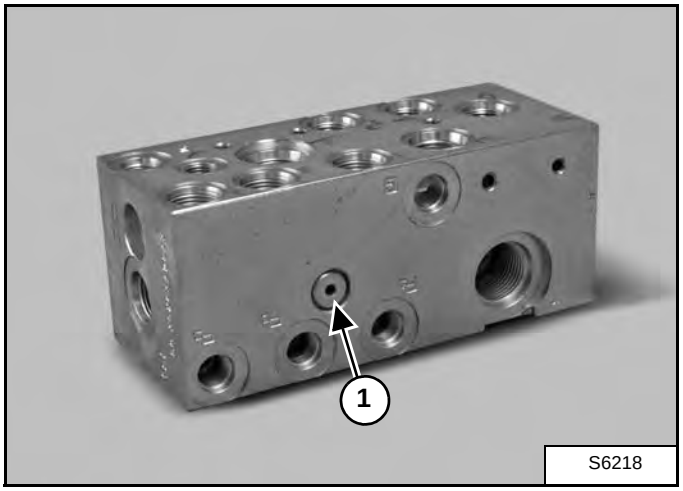
Always install new back-up rings and O-rings. Lubricate all back-up rings and O-rings with clean hydraulic fluid before installation.

Figure 20-60-51



Install the O-ring (Item 1) on the plug (Item 2) **[Figure 20-60-51]**.

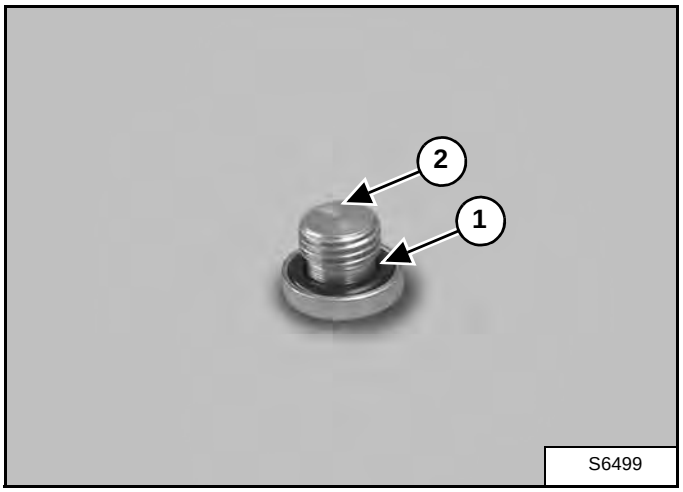
Figure 20-60-52



Install the plug (Item 1) **[Figure 20-60-52]**.

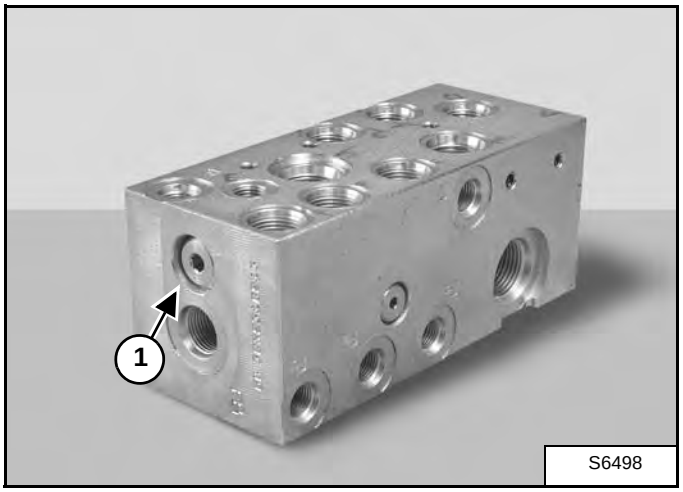
Tighten the plug to 15 N•m (11 ft-lb) torque.

Figure 20-60-53



Install the O-ring (Item 1) on the plug (Item 2) **[Figure 20-60-53]**.

Figure 20-60-54



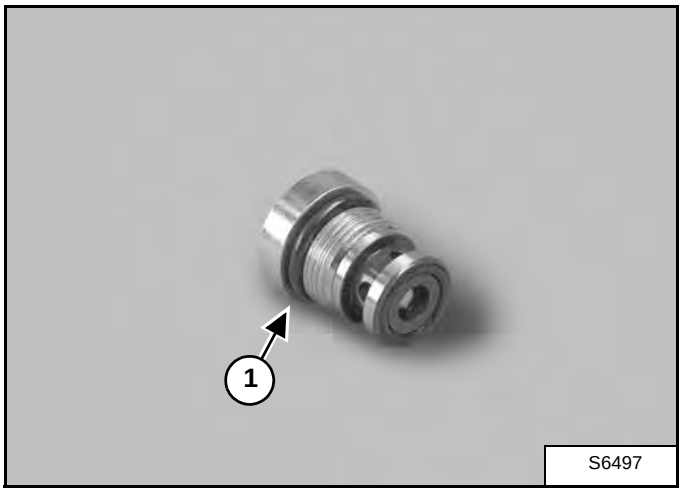
Install the plug (Item 1) **[Figure 20-60-54]**.

Tighten the plug to 30 N•m (22 ft-lb) torque.

Dealer Copy -- Not for Resale

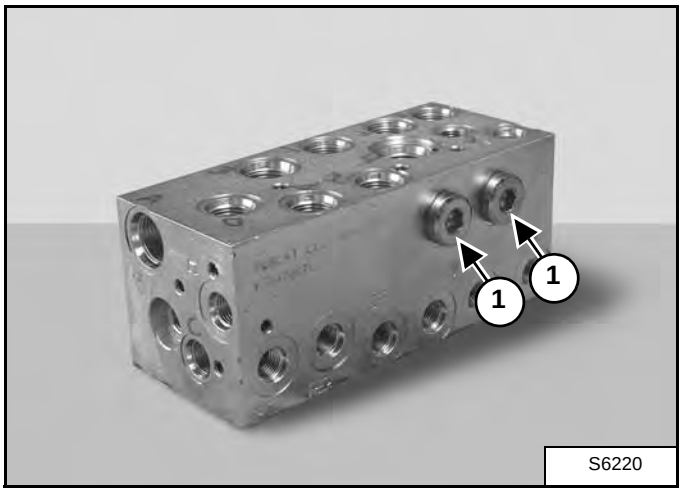
Assembly (Cont'd)

Figure 20-60-55



Install the O-rings (Item 1) **[Figure 20-60-55]** on the two plugs.

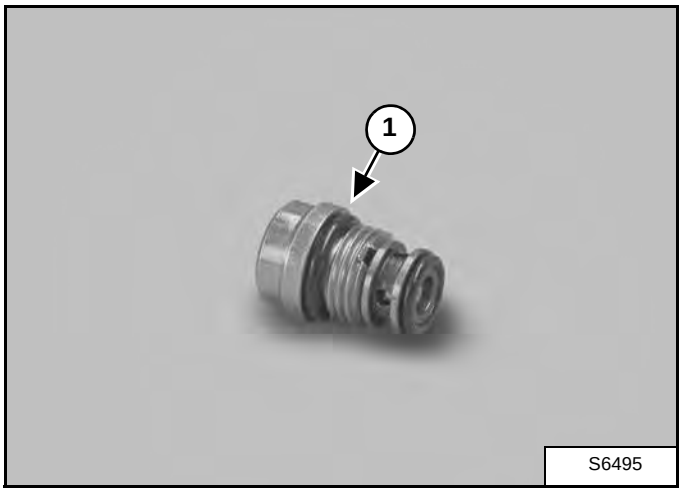
Figure 20-60-56



Install the two plugs (Item 1) **[Figure 20-60-56]** in the side of the manifold.

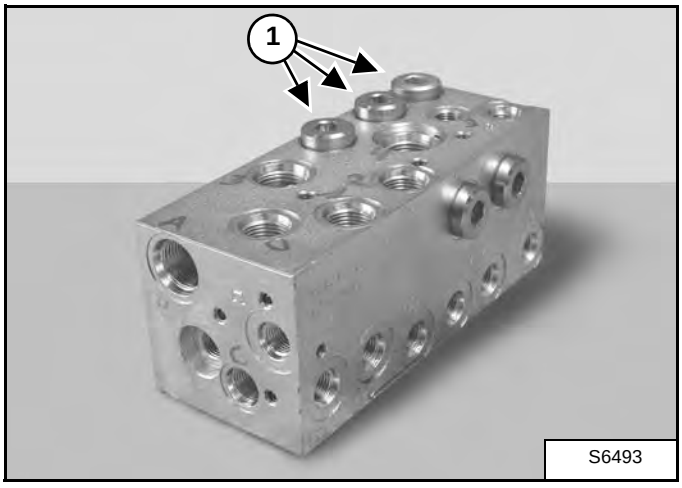
Tighten the plugs to 60 N•m (44 ft-lb) torque.

Figure 20-60-57



Install the O-rings (Item 1) **[Figure 20-60-57]** on the three plugs.

Figure 20-60-58



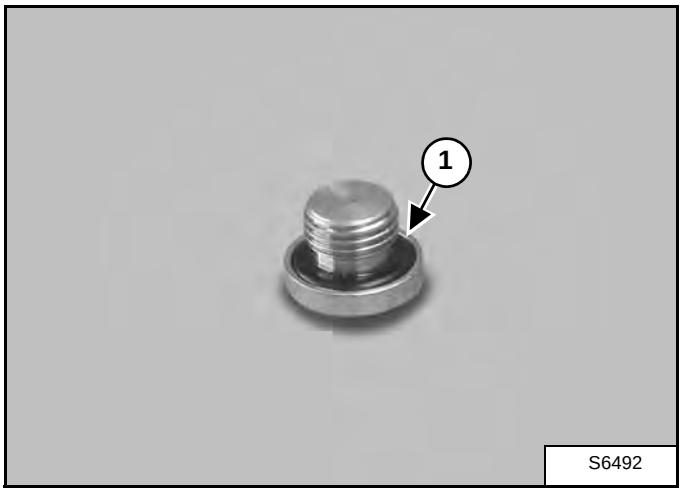
Install the three plugs (Item 1) **[Figure 20-60-58]**.

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

Dealer Copy -- Not for Resale

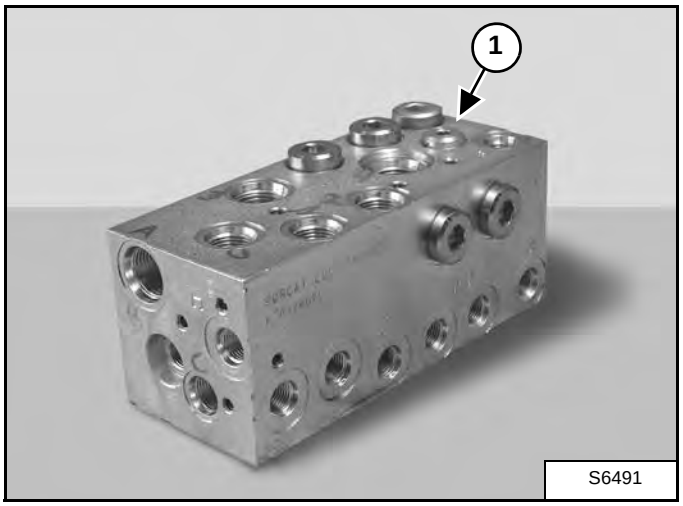
Assembly (Cont'd)

Figure 20-60-59



Install the O-ring (Item 1) **[Figure 20-60-59]** on the plug.

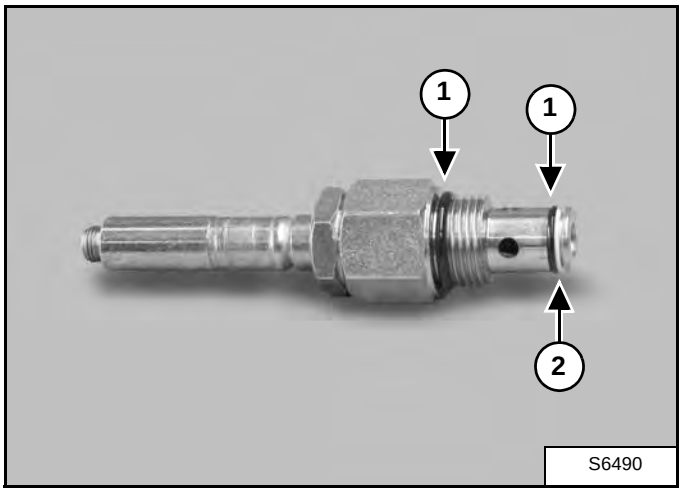
Figure 20-60-60



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

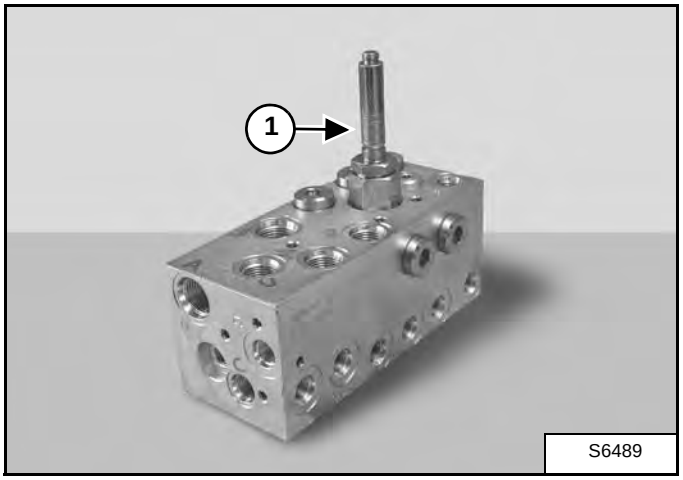
Tighten the plug to 30 N•m (22 ft-lb) torque.

Figure 20-60-61



Install the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-60-61]**.

Figure 20-60-62



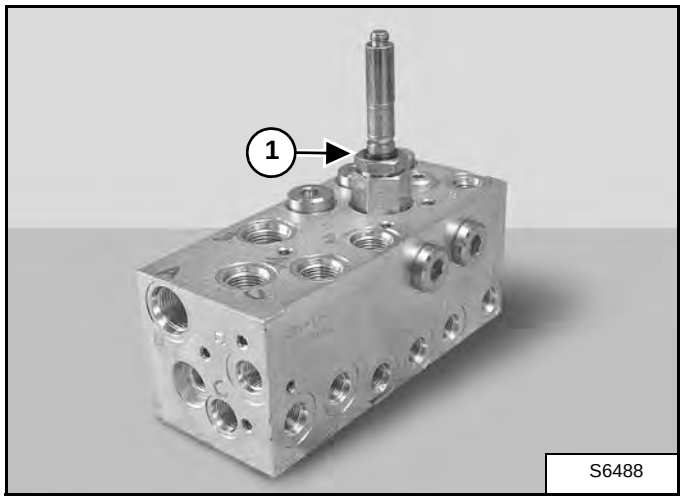
Install the solenoid stem (Item 1) **[Figure 20-60-62]**.

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

Dealer Copy -- Not for Resale

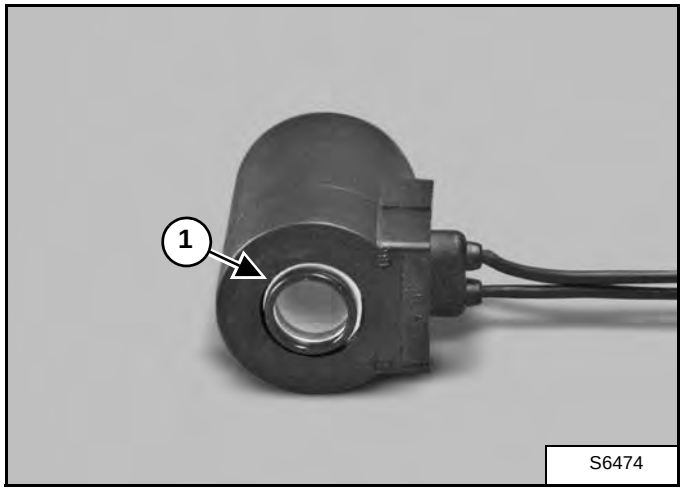
Assembly (Cont'd)

Figure 20-60-63



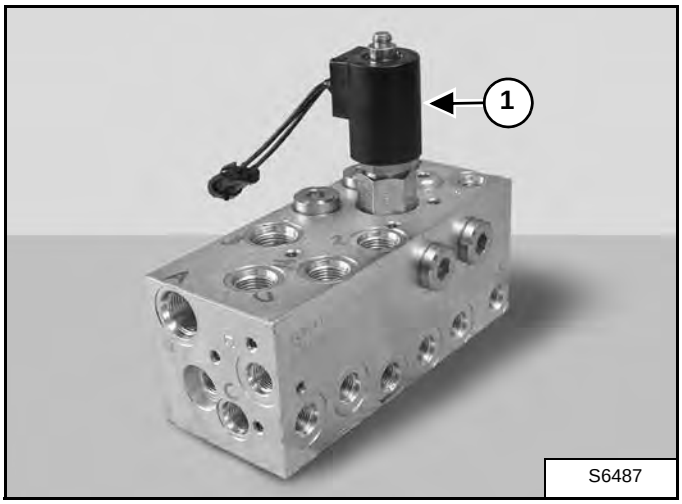
Install the O-ring (Item 1) **[Figure 20-60-63]** on the solenoid stem.

Figure 20-60-64



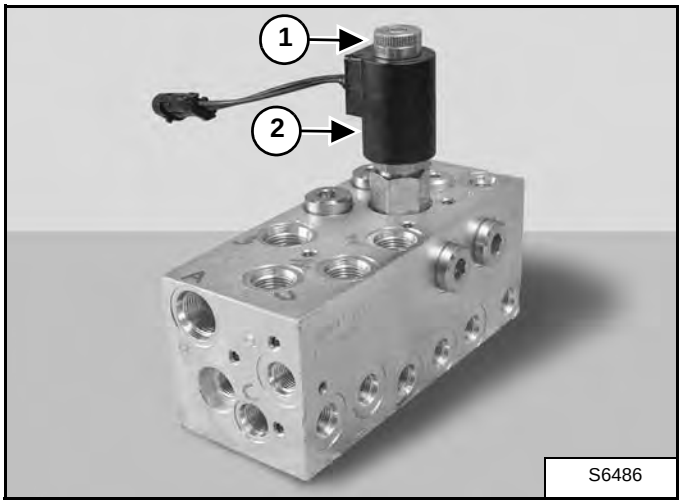
Install the O-ring (Item 1) **[Figure 20-60-64]** on the coil.

Figure 20-60-65



Install the coil with no strap (Item 1) **[Figure 20-60-65]** on the solenoid stem.

Figure 20-60-66



Install the nut (Item 1) on the two speed solenoid (Item 2) **[Figure 20-60-66]**.

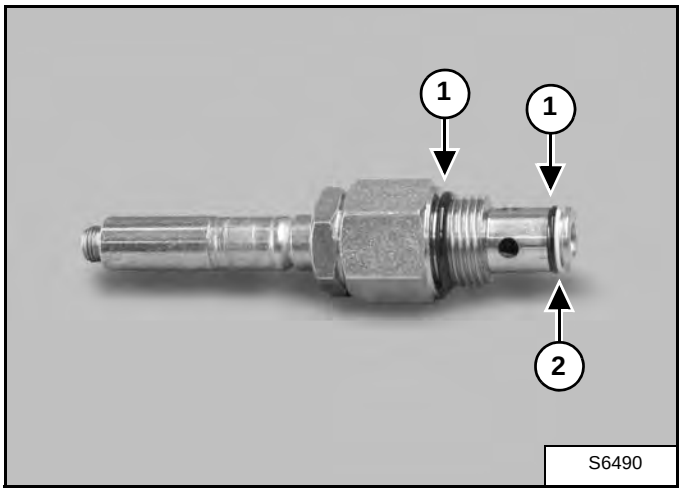
Tighten the nuts to 6 N•m (53 in-lb) torque.

NOTE: Overtightening the nut (Item 1) [Figure 20-60-66] can cause solenoid or coil failure.

Dealer Copy -- Not for Resale

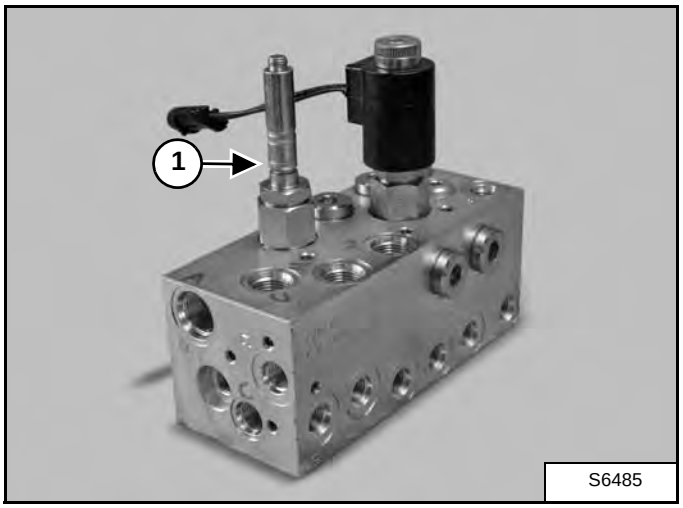
Assembly (Cont'd)

Figure 20-60-67



Install the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-60-67]**.

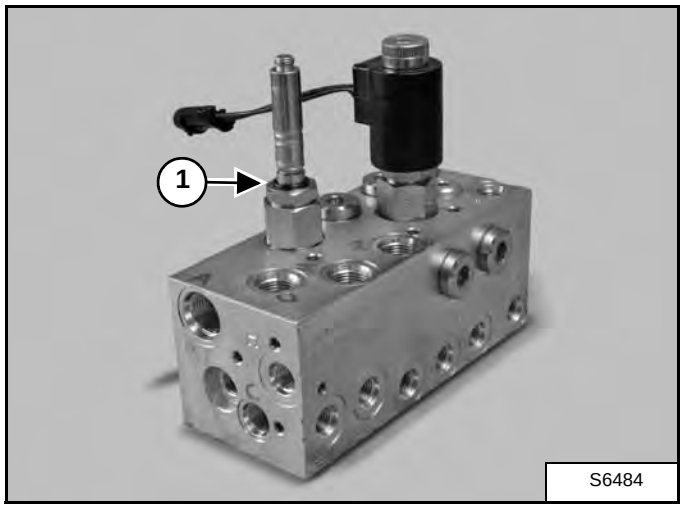
Figure 20-60-68



Install the solenoid stem (Item 1) **[Figure 20-60-68]**.

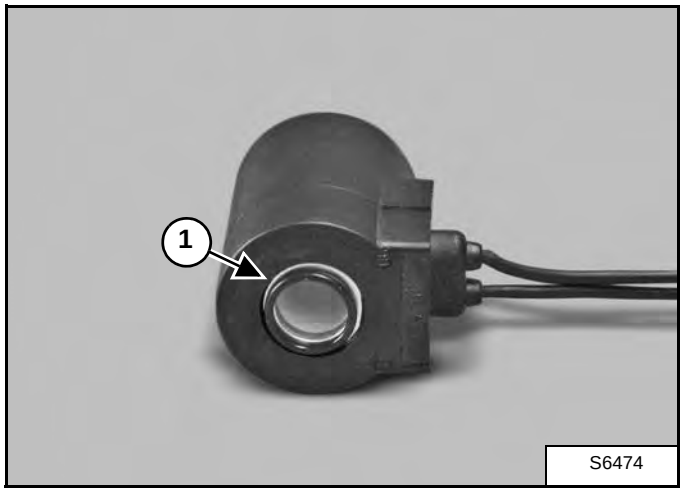
Tighten the solenoid stem to 50 N•m (37 ft-lb) torque.

Figure 20-60-69



Install the O-ring (Item 1) **[Figure 20-60-69]** on the solenoid stem.

Figure 20-60-70

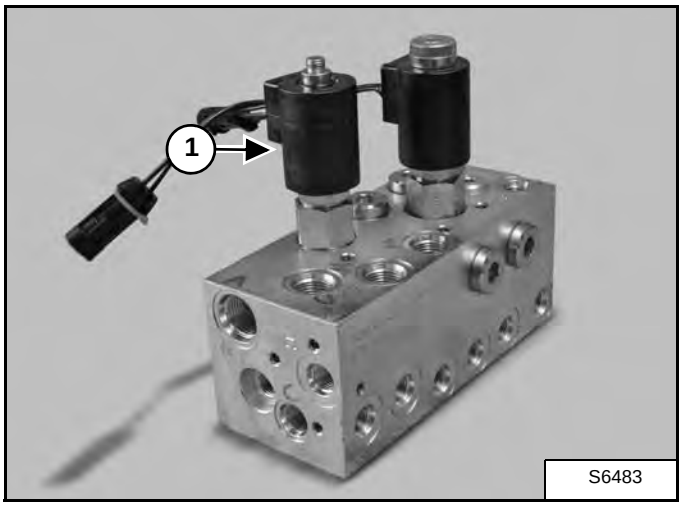


Install the O-ring (Item 1) **[Figure 20-60-70]** on the coil.

Dealer Copy -- Not for Resale

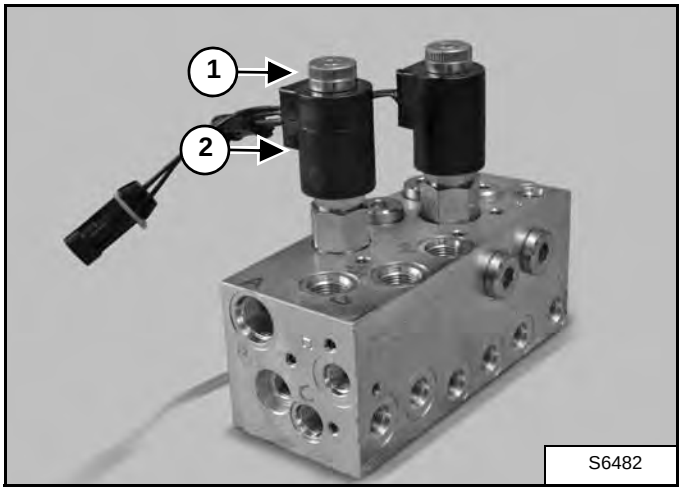
Assembly (Cont'd)

Figure 20-60-71



Install the coil with the orange tie-strap (Item 1) **[Figure 20-60-71]** on the system bypass solenoid stem.

Figure 20-60-72

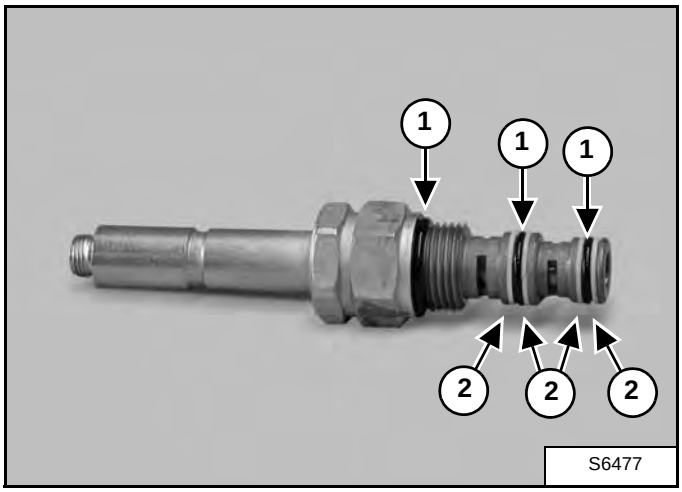


Install the nut (Item 1) on the system bypass solenoid (Item 2) **[Figure 20-60-72]**.

Tighten the nuts to 6 N•m (53 in-lb) torque.

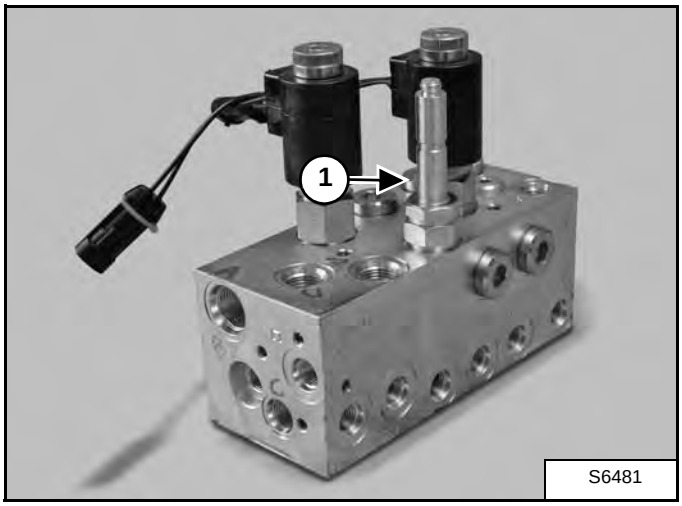
NOTE: Overtightening the nut (Item 1) [Figure 20-60-72] can cause solenoid or coil failure.

Figure 20-60-73



Install the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-60-73]**.

Figure 20-60-74



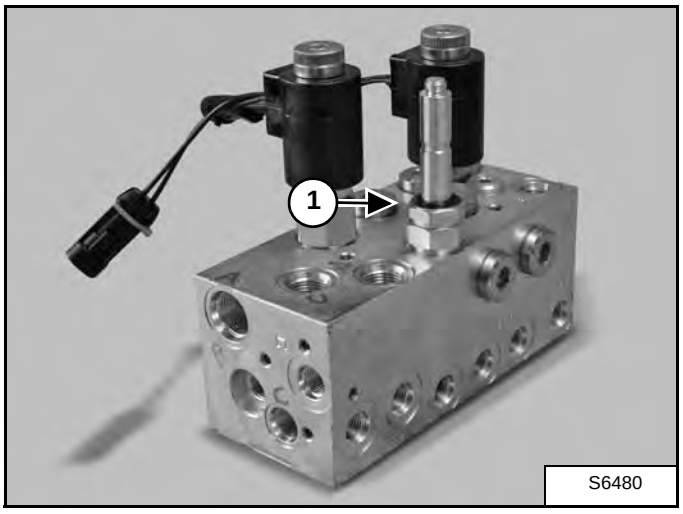
Install the solenoid stem (Item 1) **[Figure 20-60-74]**.

Tighten the solenoid stem to 30 N•m (22 ft-lb) torque.

Dealer Copy -- Not for Resale

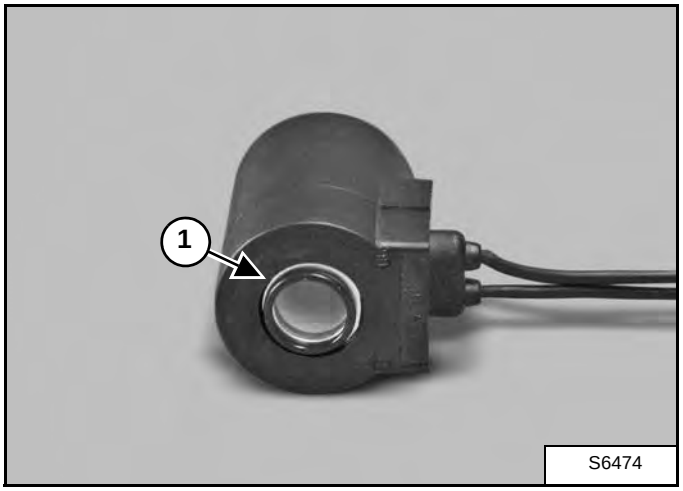
Assembly (Cont'd)

Figure 20-60-75



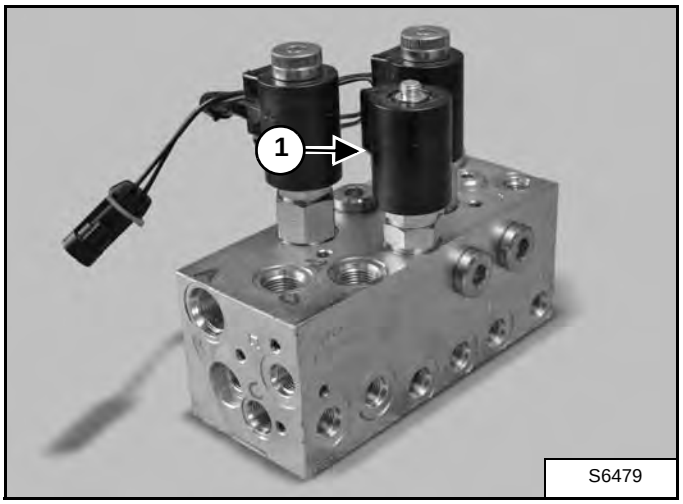
Install the O-ring (Item 1) **[Figure 20-60-75]** on the solenoid stem.

Figure 20-60-76



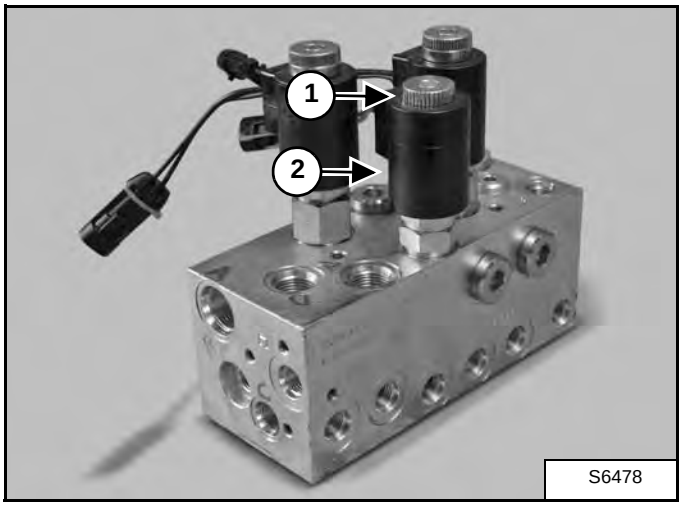
Install the O-ring (Item 1) **[Figure 20-60-76]** on the coil.

Figure 20-60-77



Install the coil with yellow tie-strap (Item 1) **[Figure 20-60-77]** on the two speed boost solenoid stem.

Figure 20-60-78



Install the nut (Item 1) on the two speed boost solenoid (Item 2) **[Figure 20-60-78]**.

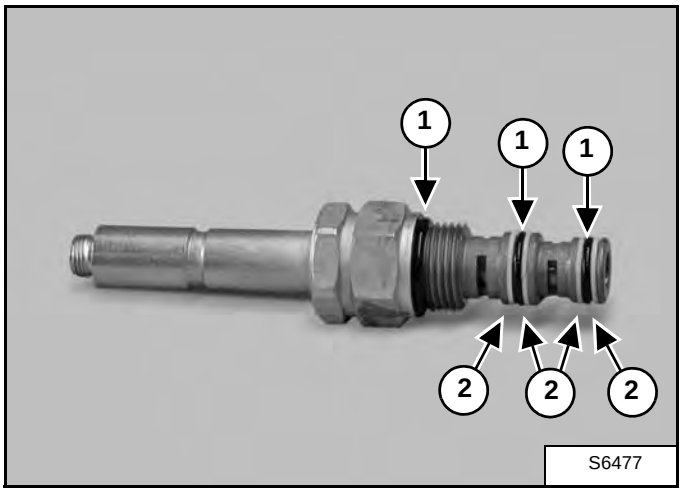
Tighten the nuts to 6 N•m (53 in-lb) torque.

NOTE: Overtightening the nut (Item 1) [Figure 20-60-78] can cause solenoid or coil failure.

Dealer Copy -- Not for Resale

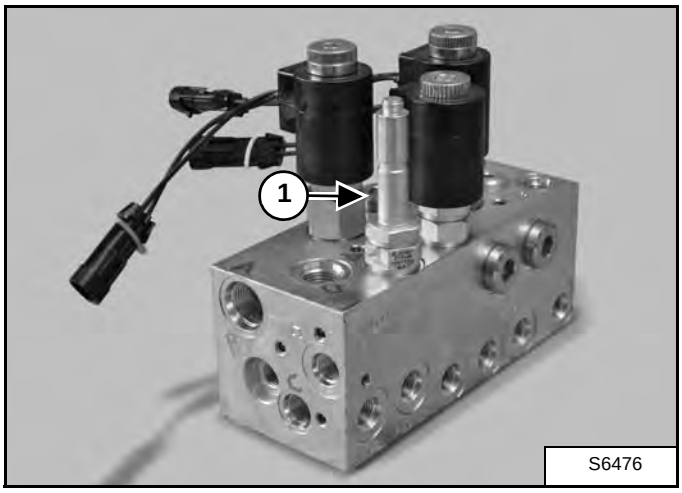
Assembly (Cont'd)

Figure 20-60-79



Install the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-60-79]**.

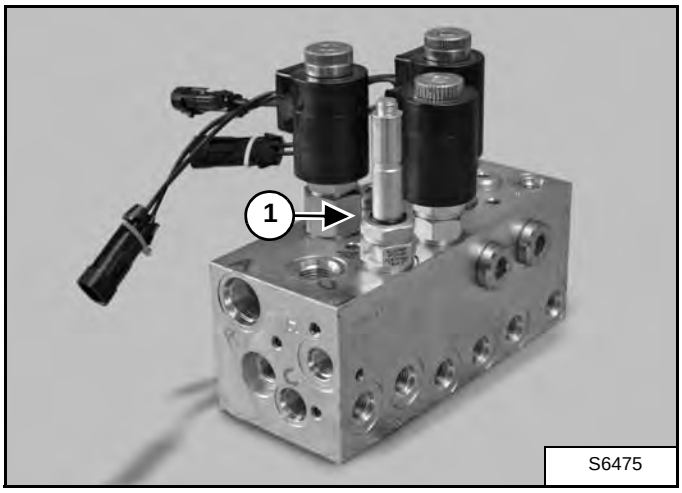
Figure 20-60-80



Install the solenoid stem (Item 1) **[Figure 20-60-80]**.

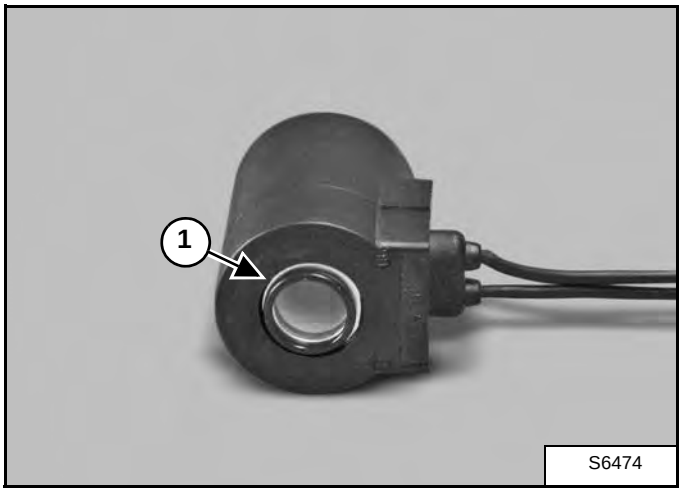
Tighten the solenoid stem to 30 N•m (22 ft-lb) torque.

Figure 20-60-81



Install the O-ring (Item 1) **[Figure 20-60-81]** on the solenoid stem.

Figure 20-60-82

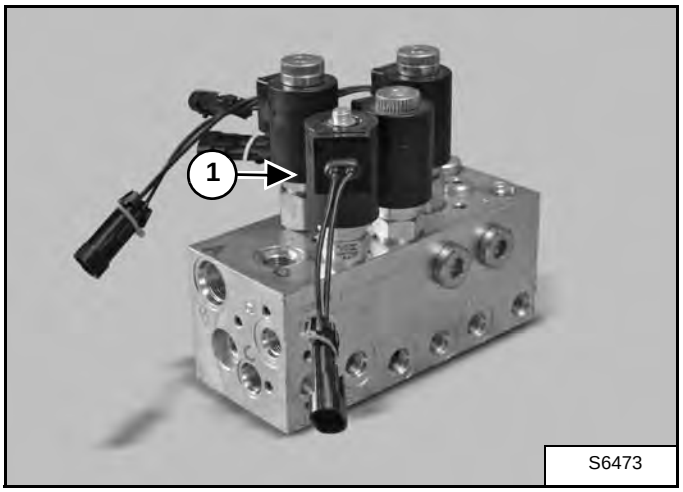


Install the O-ring (Item 1) **[Figure 20-60-82]** on the coil.

Dealer Copy -- Not for Resale

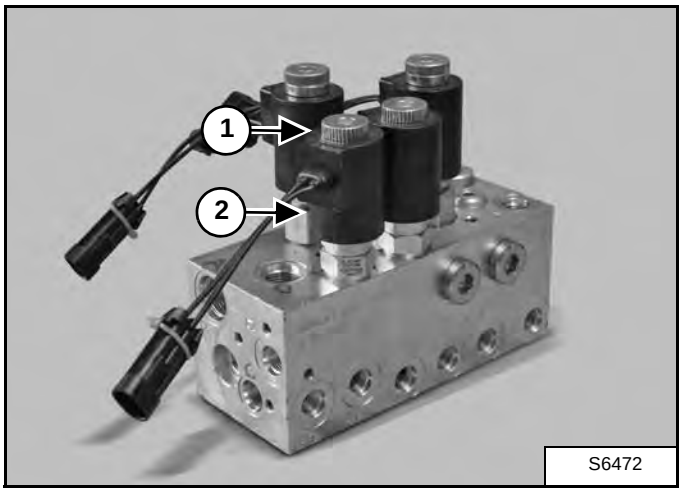
Assembly (Cont'd)

Figure 20-60-83



Install the coil with the green tie-strap (Item 1) **[Figure 20-60-83]** on the console (joystick) lockout solenoid stem.

Figure 20-60-84

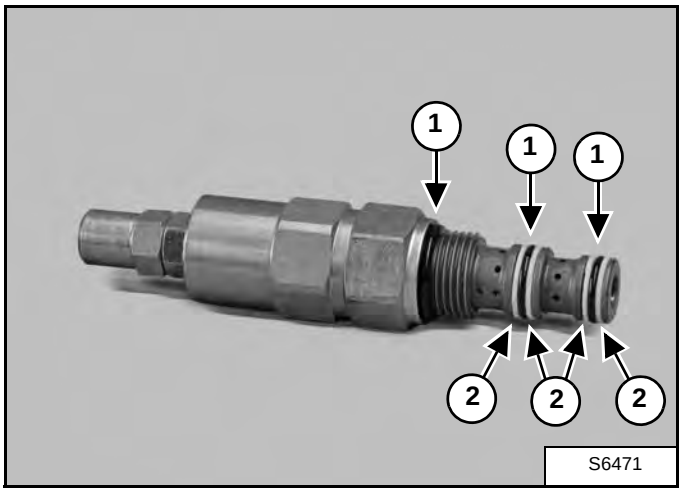


Install the nut (Item 1) on the console (joystick) lockout solenoid (Item 2) **[Figure 20-60-84]**.

Tighten the nuts to 6 N•m (53 in-lb) torque.

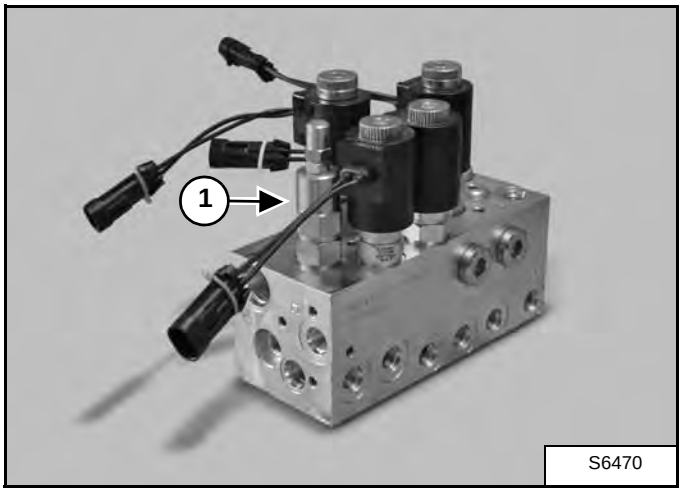
NOTE: Overtightening the nut (Item 1) [Figure 20-60-84] can cause solenoid or coil failure.

Figure 20-60-85



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-60-85]**.

Figure 20-60-86



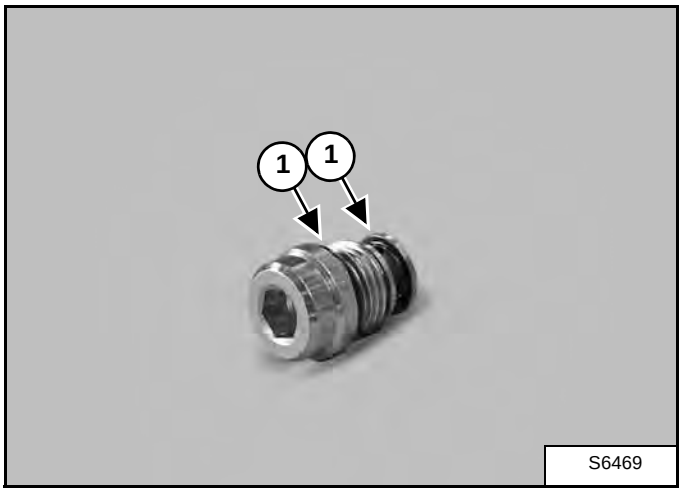
Install the pressure reducing valve (Item 1) **[Figure 20-60-86]** from the manifold.

Tighten the valve to 30 N•m (22 ft-lb) torque.

Dealer Copy -- Not for Resale

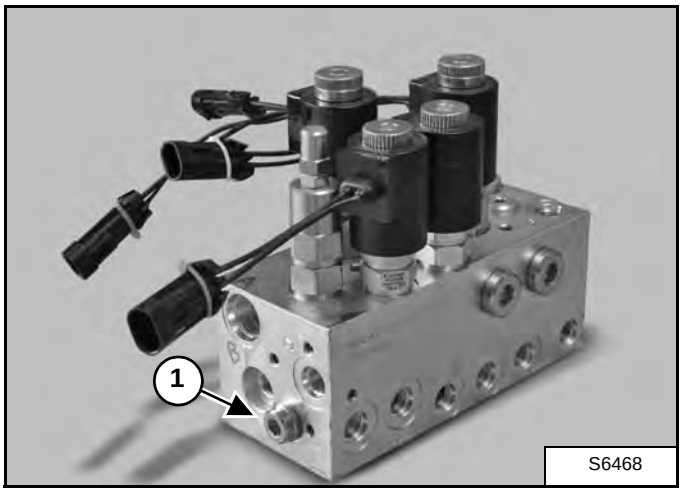
Assembly (Cont'd)

Figure 20-60-87



Install the two O-rings (Item 1) **[Figure 20-60-87]** on the plug.

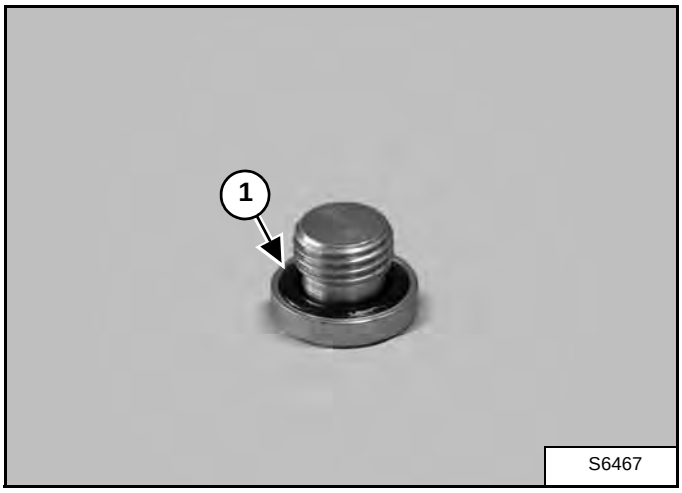
Figure 20-60-88



Install the plug (Item 1) **[Figure 20-60-88]** in the manifold.

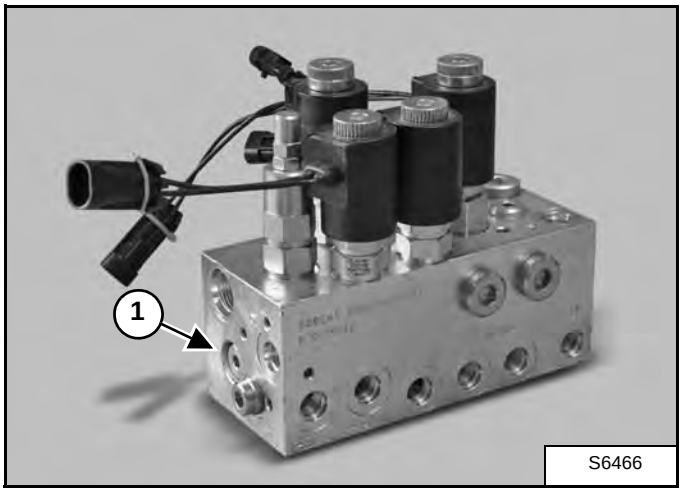
Tighten the plug to 40 N•m (30 ft-lb) torque.

Figure 20-60-89



Install the O-ring (Item 1) **[Figure 20-60-89]** on the plug.

Figure 20-60-90



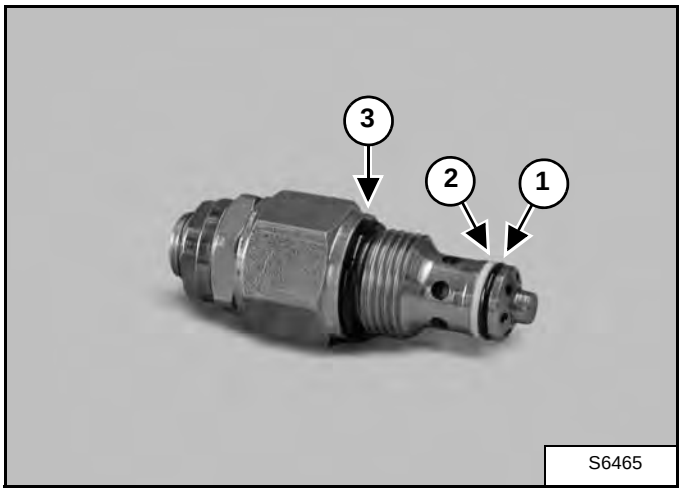
Install the plug (Item 1) **[Figure 20-60-90]** in the manifold.

Tighten the plug to 30 N•m (22 ft-lb) torque.

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Assembly (Cont'd)

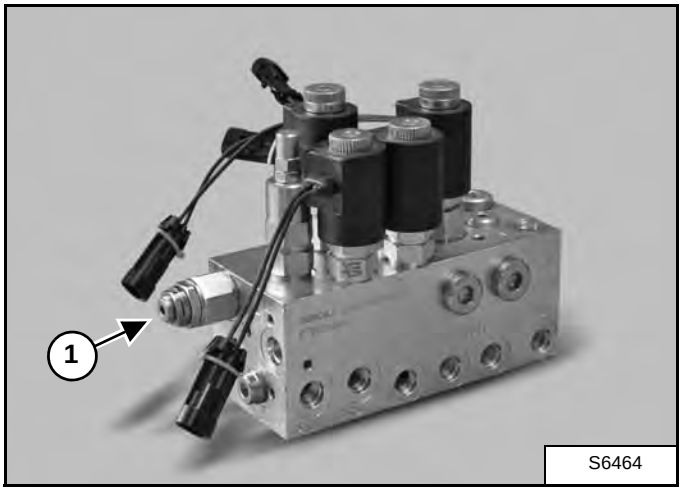
Figure 20-60-91



Install the back-up ring (Item 1) O-ring (Item 2) **[Figure 20-60-91]** on the relief valve.

Install the O-ring (Item 3) **[Figure 20-60-91]** on the relief valve.

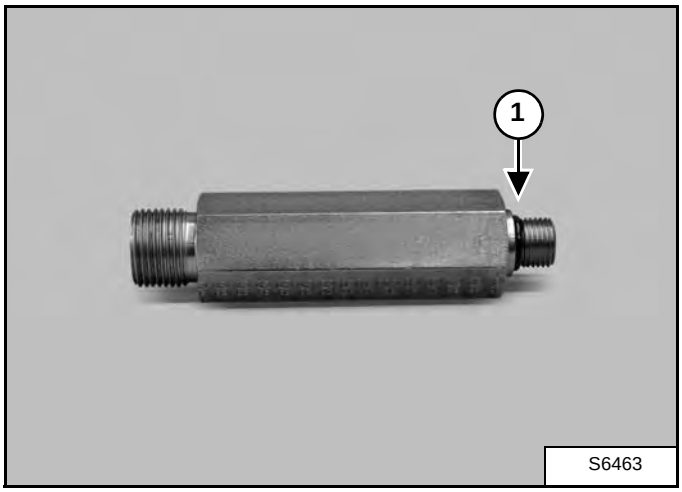
Figure 20-60-92



Install the relief valve (Item 1) **[Figure 20-60-92]** in the manifold.

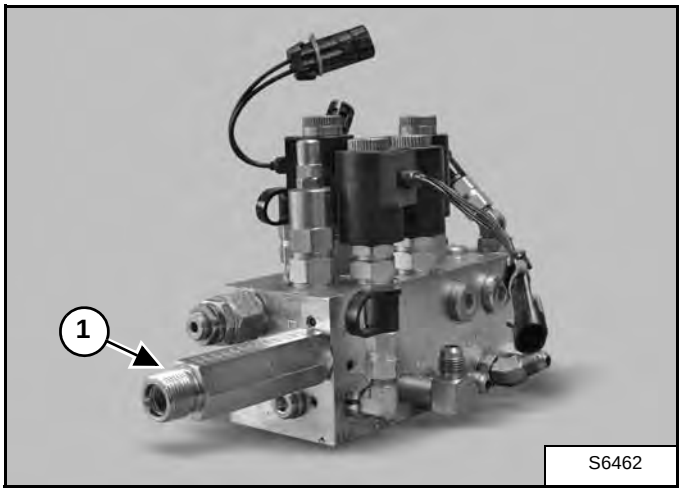
Tighten the valve to 60 N•m (44 ft-lb) torque.

Figure 20-60-93



Install the O-ring (Item 1) **[Figure 20-60-93]** on the accumulator extension.

Figure 20-60-94



Install the accumulator extension (Item 1) **[Figure 20-60-94]** on the manifold.

Tighten the extension to 29 - 33 N•m (21 - 24 ft-lb) torque.

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TRAVEL MOTOR

Description

The travel motor is a hydraulic motor which receives hydraulic fluid from the hydraulic pump through the hydraulic control valve. The speed at which the travel motor rotates, is related to the amount of hydraulic fluid it receives. This travel motor is equipped with two-speed.

Removal And Installation

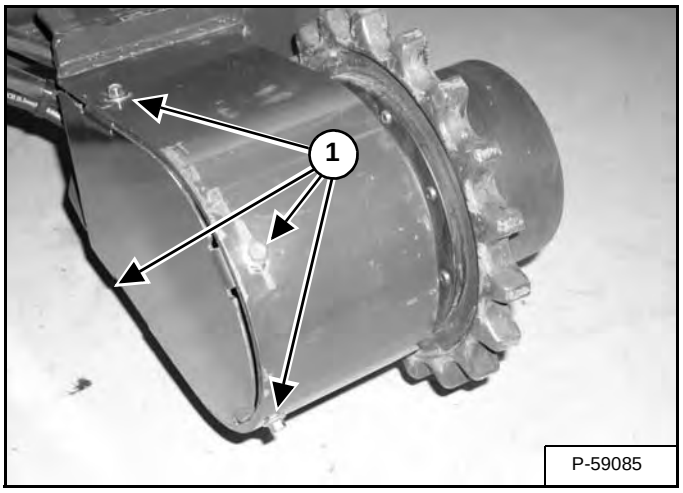
Remove the track. (See Track Removal And Installation on Page 30-20-3.)

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 20-70-1



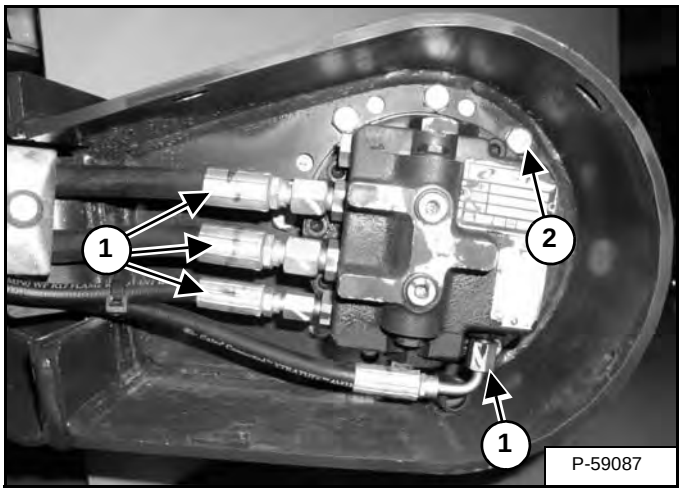
Remove the bolts (Item 1) **[Figure 20-70-1]** from the track frame cover.

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

Remove the cover.

Mark the hoses for correct installation.

Figure 20-70-2



Remove the hoses (Item 1) **[Figure 20-70-2]** from the travel motor.

Remove the travel motor mounting bolts (Item 2) **[Figure 20-70-2]**.

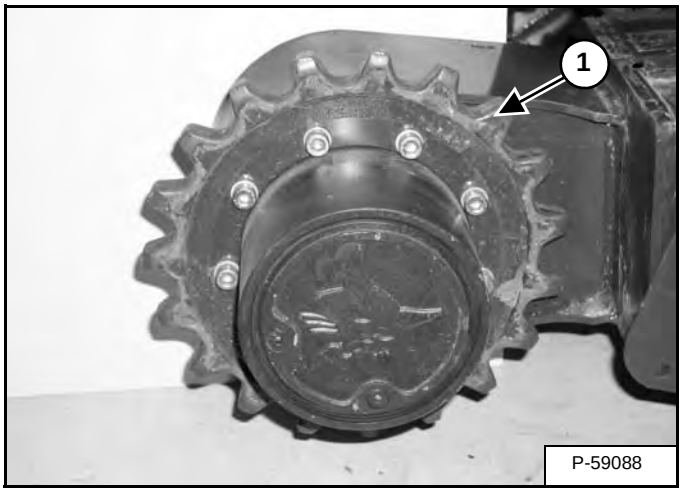
Installation: Tighten the bolts to 40 - 50 N•m (29 - 37 ft-lb) torque.

Remove the travel motor.

The drive sprocket can be removed without removing the travel motor.

If removing the sprocket from a travel motor that has been removed from the track frame, clamp the motor in a vise.

Figure 20-70-3



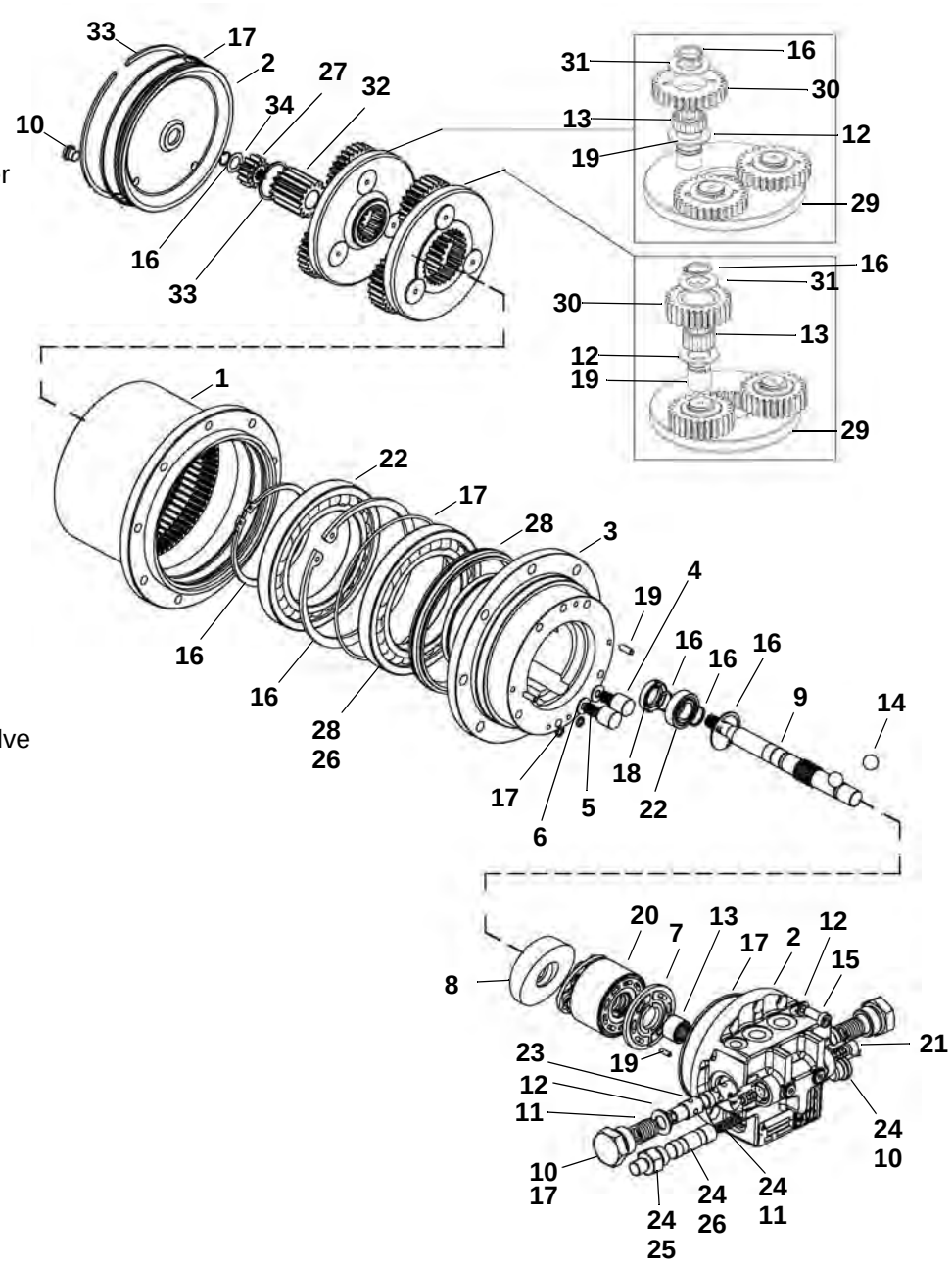
Remove the sprocket bolts. Remove the sprocket (Item 1) **[Figure 20-70-3]**.

Installation: Tighten the bolts to 65 - 75 N•m (48 - 55 ft-lb) torque.

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Parts Identification

1. Housing
2. Cover
3. Hub
4. Change Disposition Piston
5. Change Disposition Spring
6. Change Disposition Washer
7. Distributor
8. Swash Plate
9. Motor Shaft
10. Plug
11. Spring
12. Washer
13. Needle Bearing
14. Sphere
15. Screw
16. Retaining Ring
17. O-ring
18. Seal
19. Pin
20. Rotating Pump Assy
21. Shockproof Valve
22. Ball Bearing
23. Counterbalance Valve
24. Change Displacement Valve
25. Fitting
26. Valve Piston
27. Gear
28. Bearing and Seal
29. Planetary Carrier
30. Planet Gear
31. Anti-Rotation Washer
32. Sun Gear
33. Snap Ring
34. Shim



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Disassembly

IMPORTANT

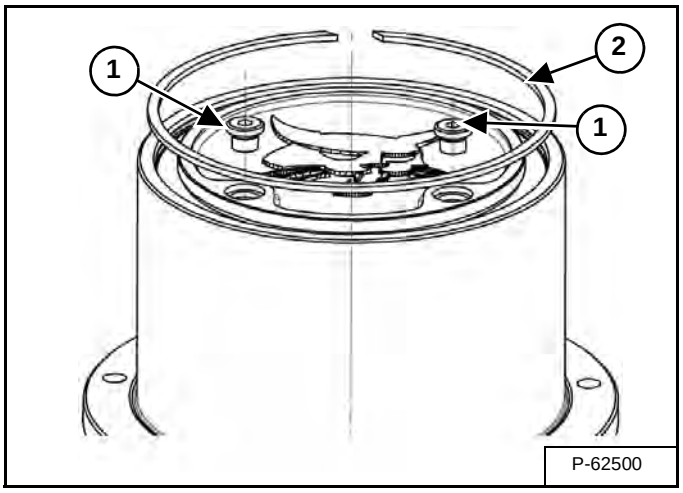
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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Clean the outside of the travel motor before disassembly.

Drain the lubricant from the travel motor.

Figure 20-70-4



Remove the drain plugs (Item 1) and snap ring (Item 2) **[Figure 20-70-4]** securing the reduction gear cover.

Drain the excess oil into a container.

Figure 20-70-5

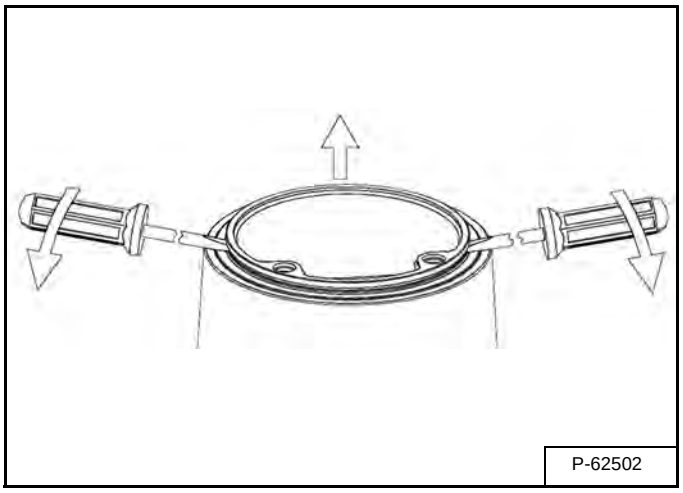
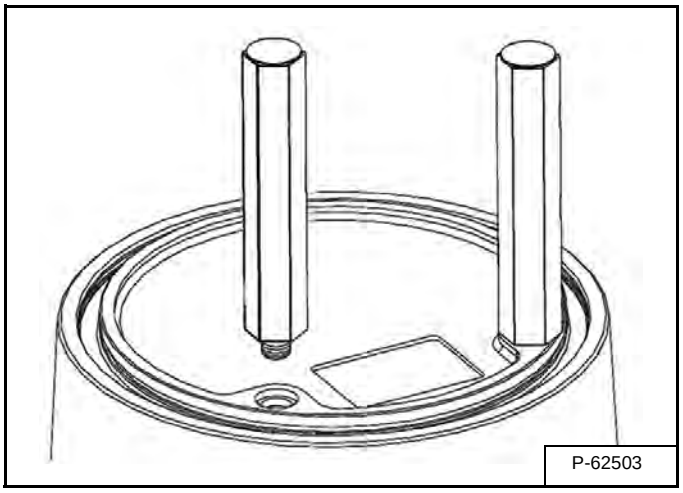


Figure 20-70-6

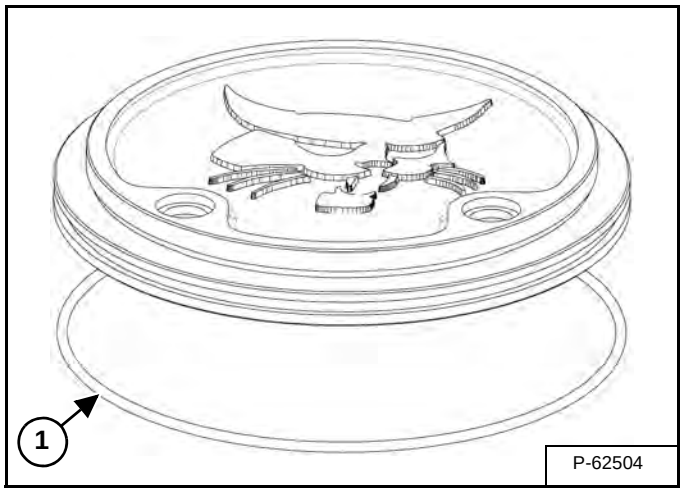


To remove the cover, lift the cover up using screwdrivers in the upper groove **[Figure 20-70-5]**, or install two threaded pins in the drain holes and lift the cover off **[Figure 20-70-6]**.

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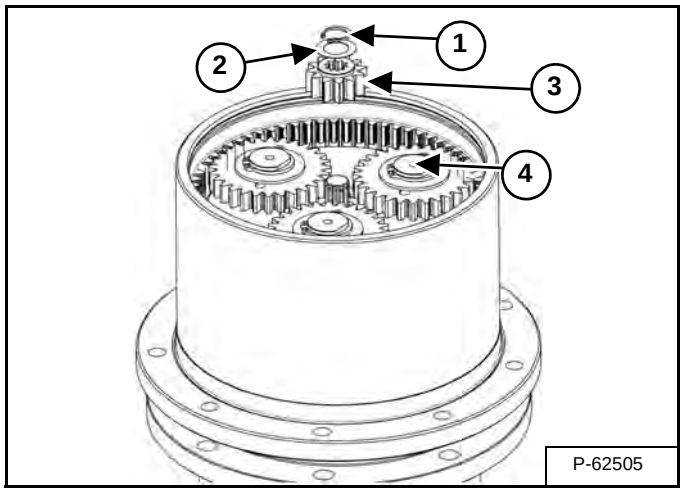
Disassembly (Cont'd)

Figure 20-70-7



Remove the O-ring (Item 1) **[Figure 20-70-7]** from the cover.

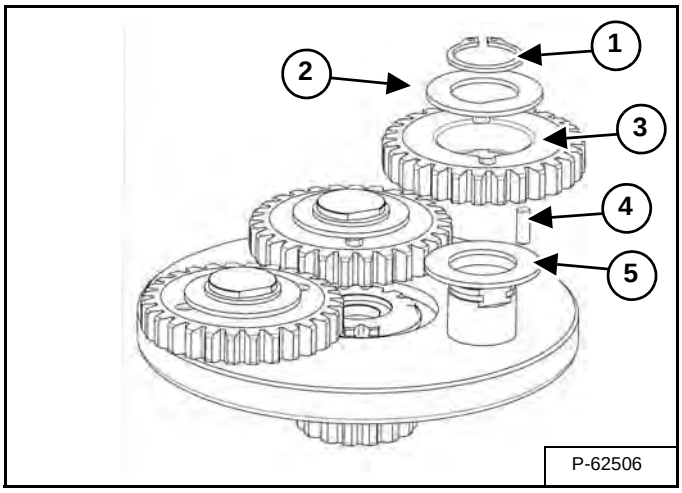
Figure 20-70-8



Remove the retaining ring (Item 1), shims (Item 2) and sun gear (Item 3) **[Figure 20-70-8]**.

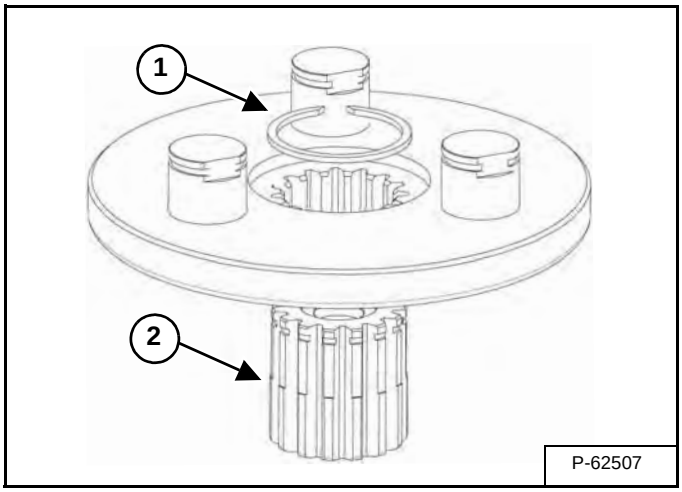
Remove the first stage planetary carrier (Item 4) **[Figure 20-70-8]** using your hands.

Figure 20-70-9



Remove the retaining rings (Item 1), anti-rotation washer (Item 2), planetary gears (Item 3), needle bearings (Item 4) and thrust washer (Item 5) **[Figure 20-70-9]** from the first stage planetary carrier assembly.

Figure 20-70-10

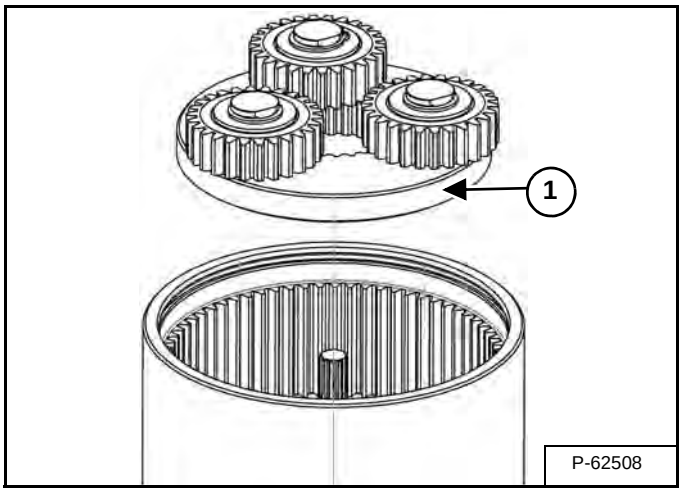


Remove the retaining ring (Item 1) from the second reduction sun gear (Item 2) **[Figure 20-70-10]** and push the gear down to remove it from the planetary carrier.

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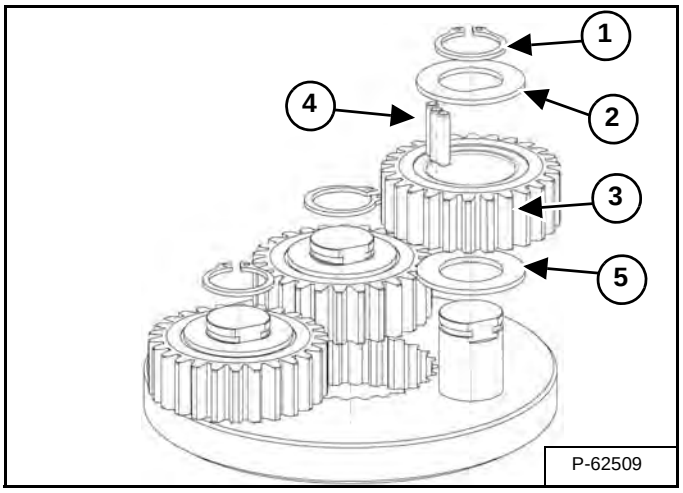
Disassembly (Cont'd)

Figure 20-70-11



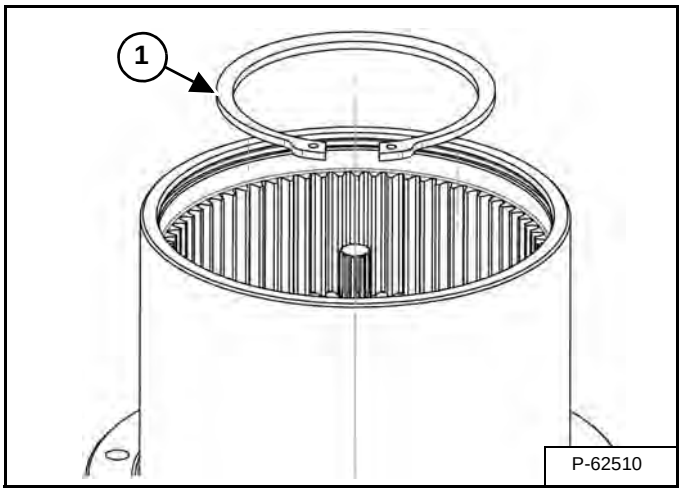
Remove the second stage planetary carrier (Item 1) **[Figure 20-70-11]** using your hands.

Figure 20-70-12



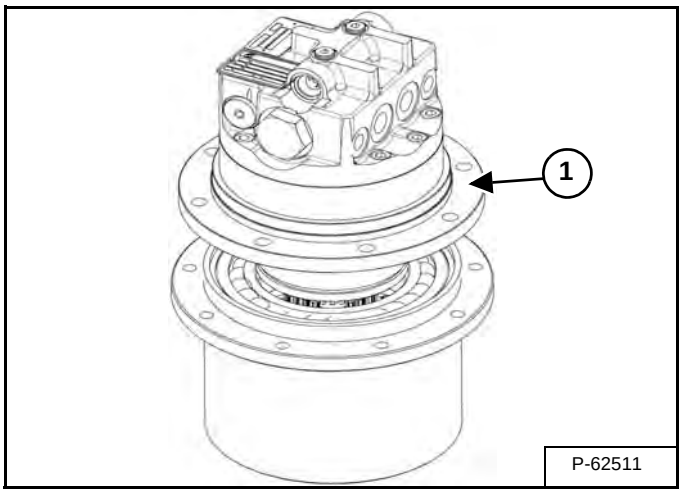
Remove the retaining rings (Item 1), anti-rotation washer (Item 2), planetary gears (Item 3), needle bearings (Item 4) and thrust washer (Item 5) **[Figure 20-70-12]** from the first stage planetary carrier assembly.

Figure 20-70-13



Remove the retaining ring (Item 1) **[Figure 20-70-13]** from the hub to free the two bearings, ring gear and motor.

Figure 20-70-14

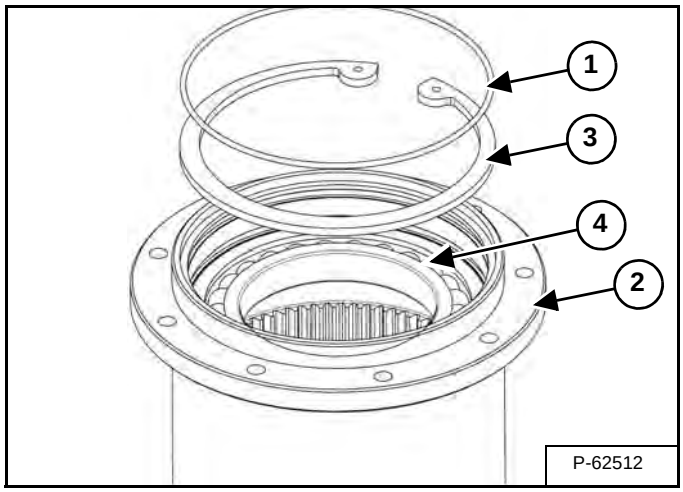


Remove the hub (Item 1) **[Figure 20-70-14]** from the ring gear.

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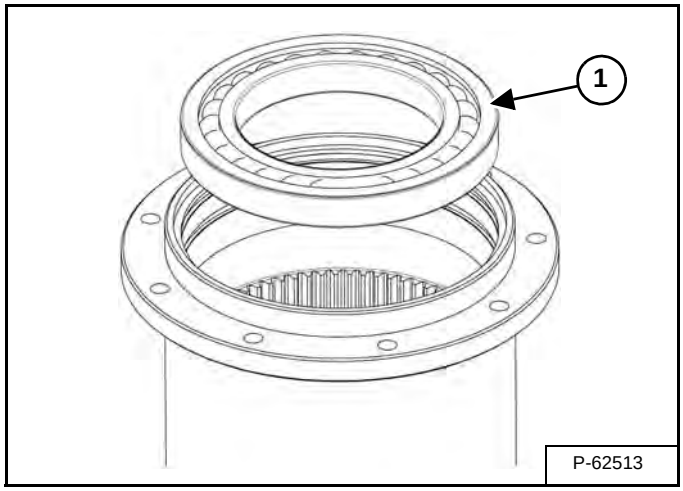
Disassembly (Cont'd)

Figure 20-70-15



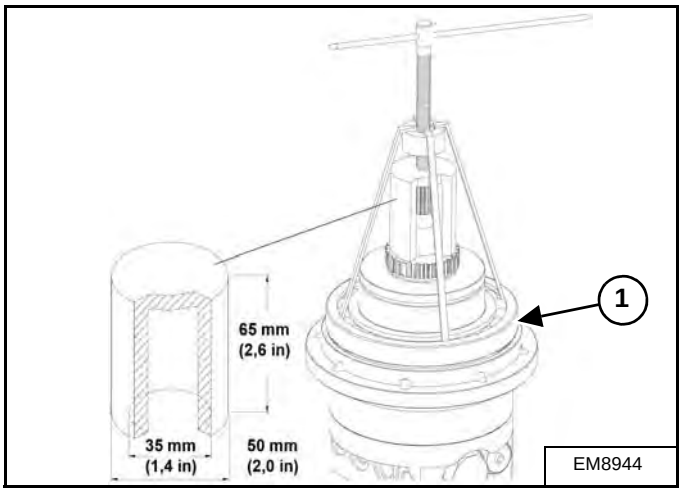
Remove the O-ring (Item 1) from the ring gear (Item 2) and the retaining ring (Item 3) securing the bearing (Item 4) **[Figure 20-70-15]**.

Figure 20-70-16



Remove the ball bearing (Item 1) **[Figure 20-70-16]** by pushing from underneath.

Figure 20-70-17

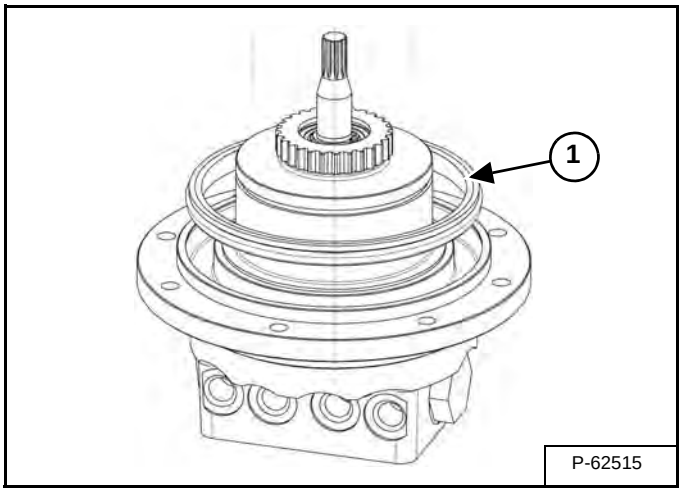


Remove the lapped bearing / front seal (Item 1) **[Figure 20-70-17]**.

NOTE: Be careful not to damage the bottom polished / lapped surface of the bearing [Figure 20-70-17].

NOTE: A commercial bearing extractor and supporting cap, as shown, will be required for bearing removal [Figure 20-70-17]. Be careful not to damage the bottom polished / lapped surface of the bearing.

Figure 20-70-18

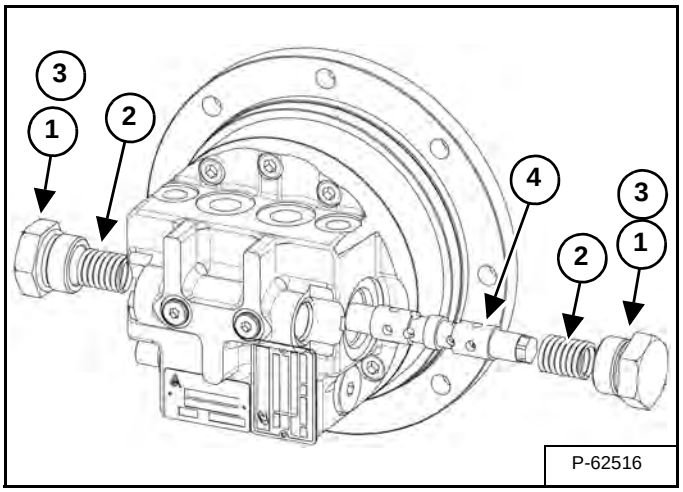


Remove the front seal ring (Item 1) **[Figure 20-70-18]**.

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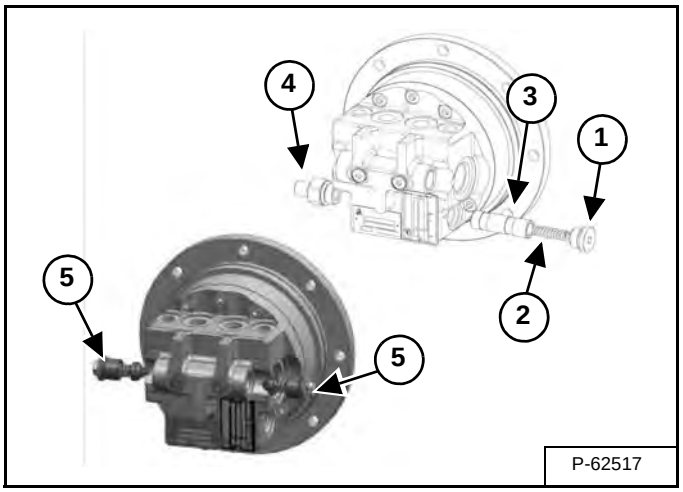
Disassembly (Cont'd)

Figure 20-70-19



Remove the plugs (Item 1), springs (Item 2), washers (Item 3) and counterbalance valve (Item 4) **[Figure 20-70-19]**.

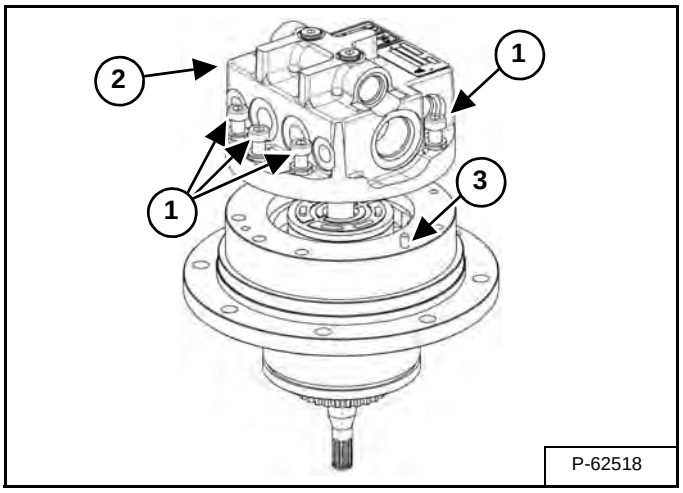
Figure 20-70-20



Remove the plug (Item 1), springs (Item 2), piston valve (Item 3) and plug (Item 4) **[Figure 20-70-20]**.

Remove the valves (Item 5) **[Figure 20-70-20]** from the motor cover.

Figure 20-70-21

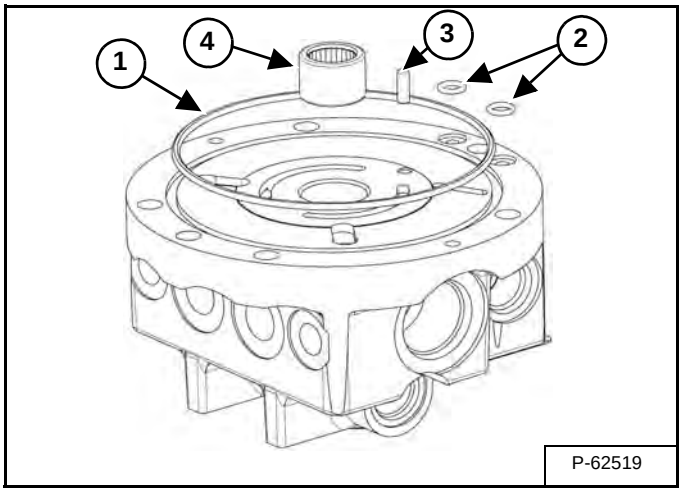


Remove the six screws and washers (Item 1) **[Figure 20-70-21]**.

Remove the cover (Item 2) **[Figure 20-70-21]**.

NOTE: Removal of pin (Item 3) [Figure 20-70-21] is optional.

Figure 20-70-22



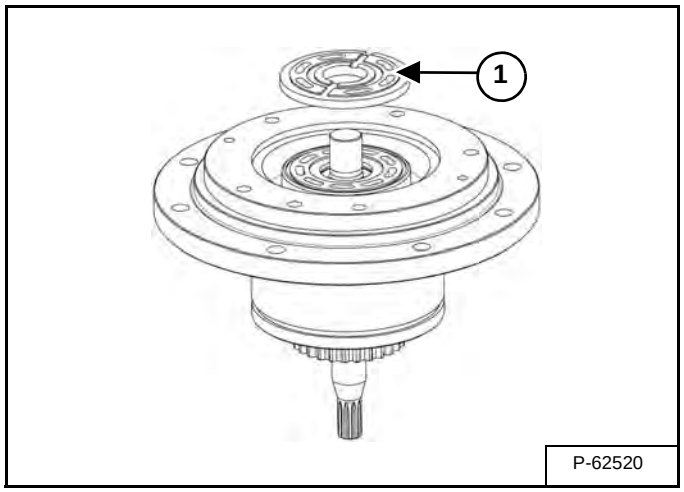
Remove large O-ring (Item 1), small O-rings (Item 2), pin (Item 3) and needle bearing (Item 4) **[Figure 20-70-22]** from the cover.

NOTE: Removal of pin (Item 3) [Figure 20-70-22] is optional.

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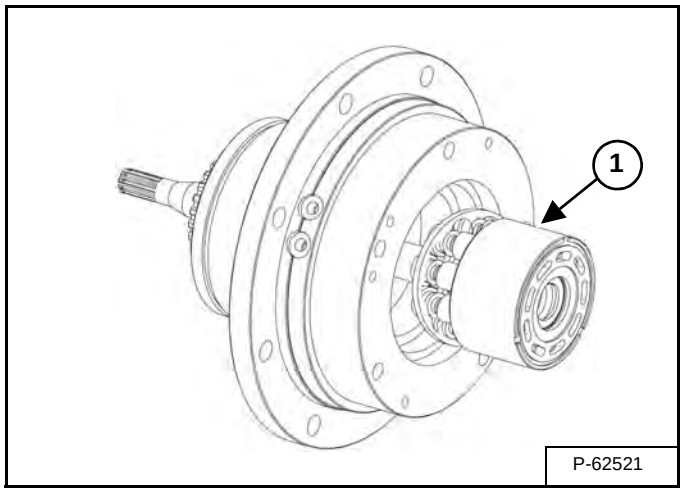
Disassembly (Cont'd)

Figure 20-70-23



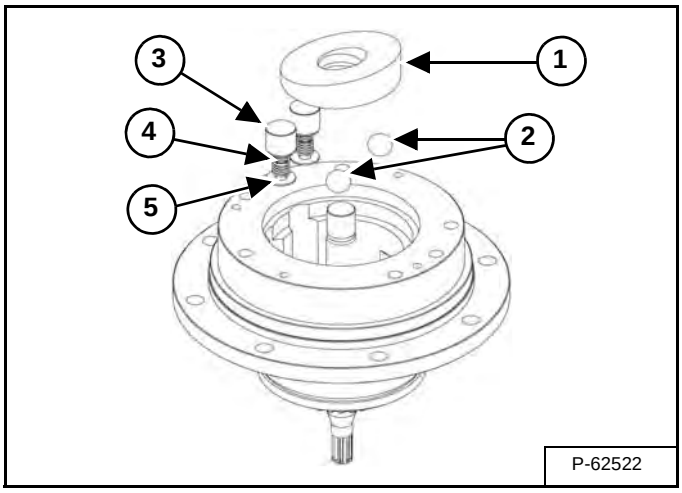
Remove the valve plate (Item 1) **[Figure 20-70-23]**.

Figure 20-70-24



Remove the rotating pump assembly (Item 1) **[Figure 20-70-24]**.

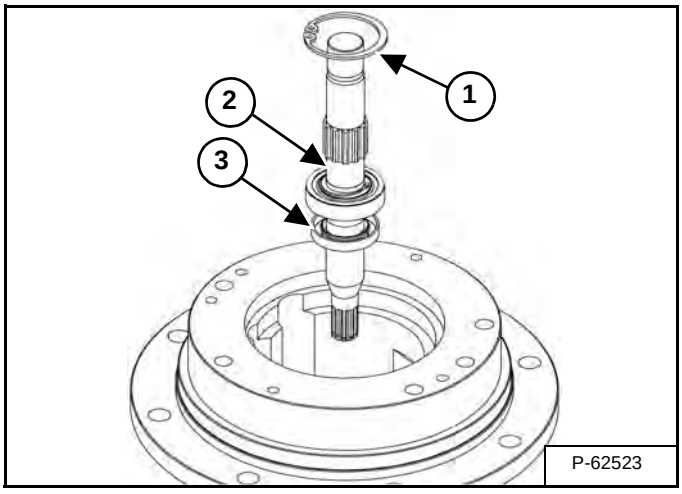
Figure 20-70-25



Remove the swash plate (Item 1) **[Figure 20-70-25]**.

Remove the sphere (Item 2), pistons (Item 3), springs (Item 4) and washers (Item 5) **[Figure 20-70-25]**.

Figure 20-70-26



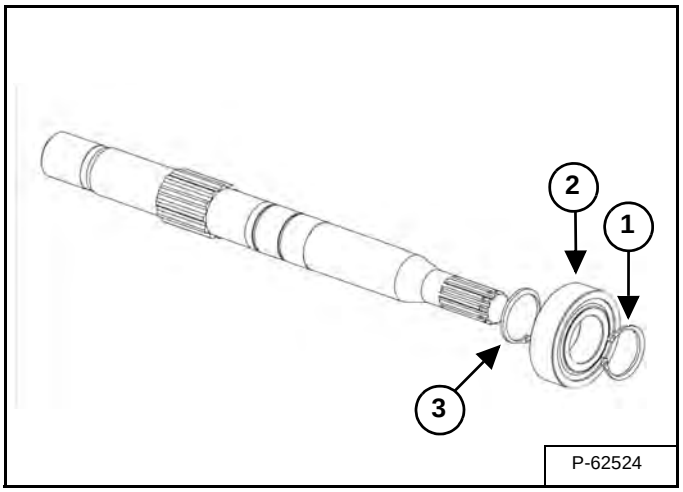
Remove the retaining ring (Item 1) and bearing / drive shaft assembly (Item 2) **[Figure 20-70-26]**.

Remove the oil seal (Item 3) **[Figure 20-70-26]**.

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Disassembly (Cont'd)

Figure 20-70-27



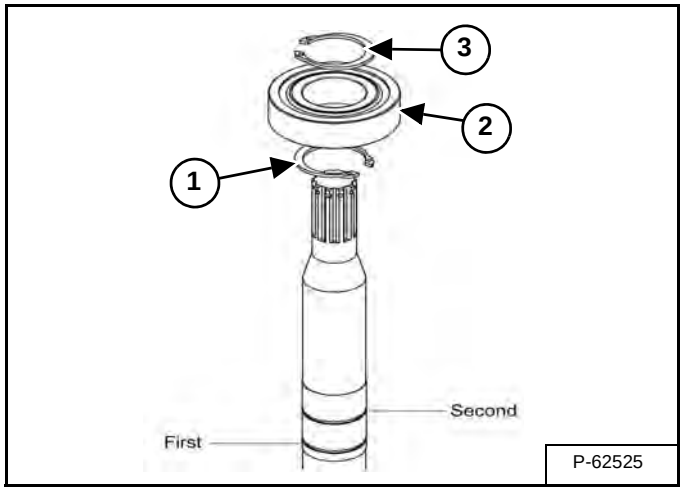
Remove the retaining ring (Item 1), ball bearing (Item 2) and the second retaining ring (Item 3) **[Figure 20-70-27]**.

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Assembly

Clean all parts in solvent and dry with compressed air. Inspect all parts and replace any that are damaged. If any of the planetary gears (first or second) are damaged, replace the damaged planetary stage assembly (first or second) complete with the sun gear that the damaged gear is from. One damaged gear can cause microscopic fatigue cracks in mating gear teeth and cause premature failure after servicing. Apply oil to all O-rings and light grease to the ball and roller bearings before installation.

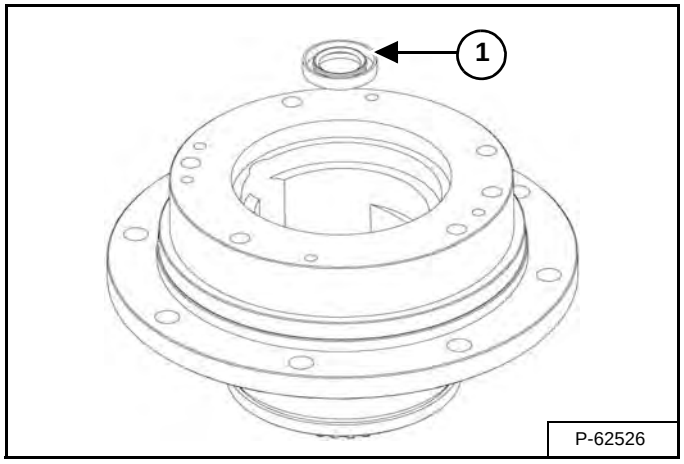
Figure 20-70-28



Install the retaining ring (Item 1) **[Figure 20-70-28]** on the drive shaft.

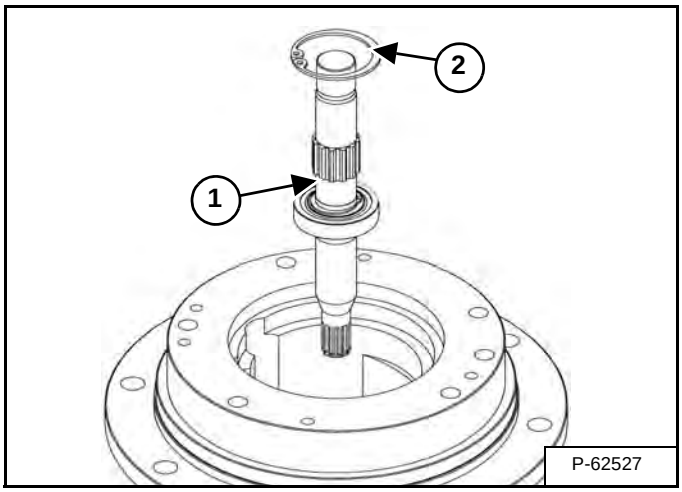
Install the ball bearing (Item 2) and the retaining ring (Item 3) **[Figure 20-70-28]**.

Figure 20-70-29



Install the oil seal (Item 1) **[Figure 20-70-29]** in the hub.

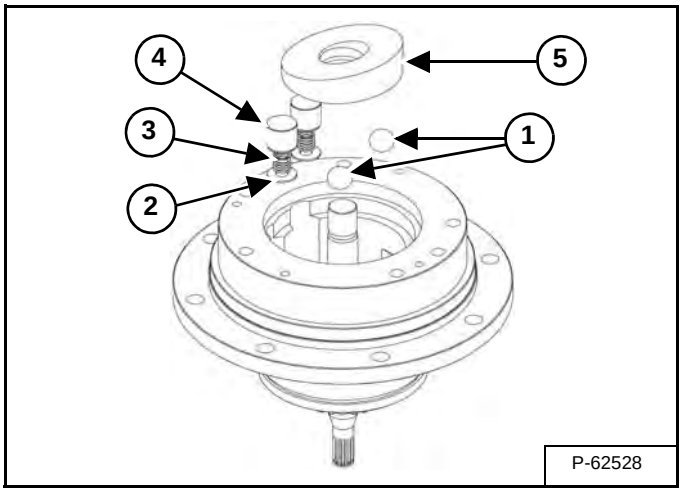
Figure 20-70-30



Install the bearing / drive shaft assembly (Item 1) **[Figure 20-70-30]**.

Install the retaining ring (Item 2) **[Figure 20-70-30]**.

Figure 20-70-31



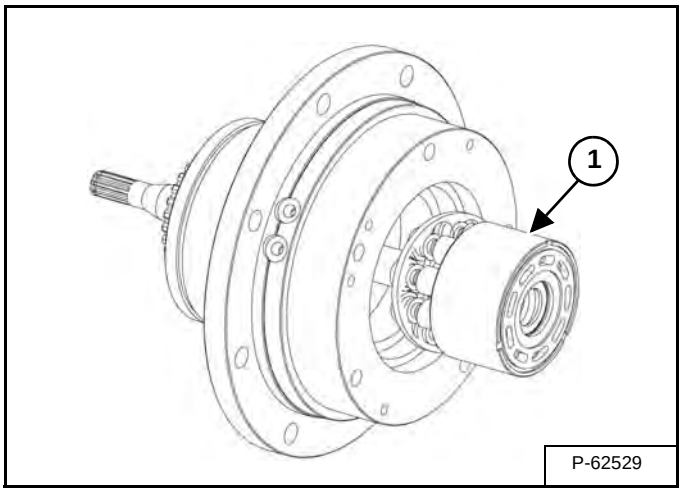
Install the sphere (Item 1), washers (Item 2), springs (Item 3) and pistons (Item 4) **[Figure 20-70-31]**.

Install the swash plate (Item 5) **[Figure 20-70-31]**.

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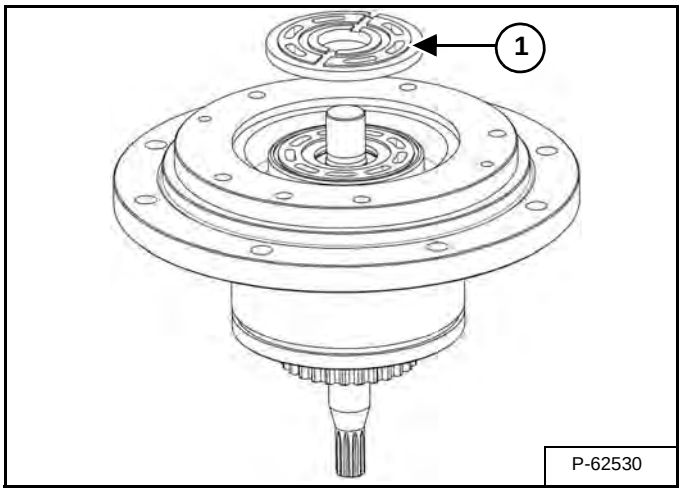
Assembly (Cont'd)

Figure 20-70-32



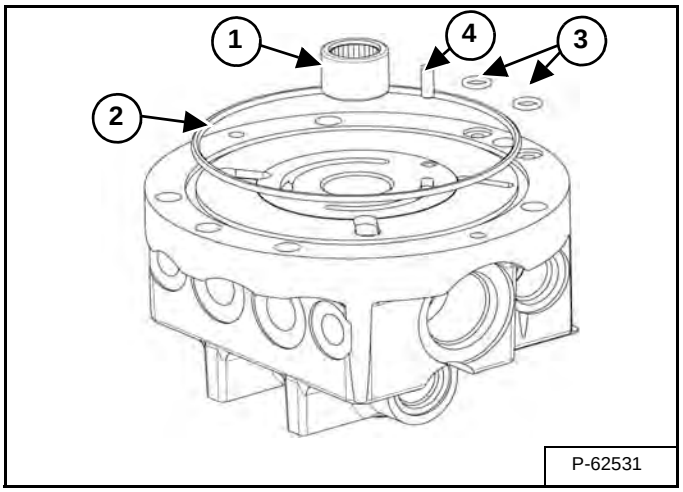
Install the rotating pump assembly (Item 1) **[Figure 20-70-32]**.

Figure 20-70-33



Install the valve plate (Item 1) **[Figure 20-70-33]**.

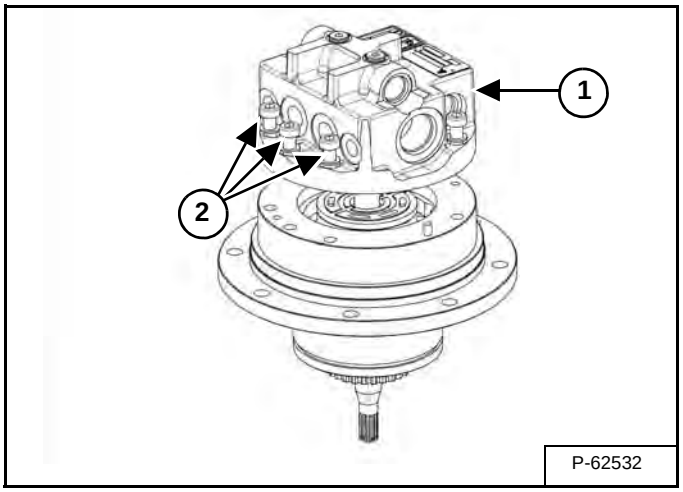
Figure 20-70-34



Install the needle bearing (Item 1) **[Figure 20-70-34]** in the cover so the bearing edge extends from the face of the cover 2,5 - 2,8 mm (0.98 - 0.110 in).

Install the large O-ring (Item 2), small O-rings (Item 3) and pin (Item 4) **[Figure 20-70-34]** in the cover.

Figure 20-70-35



Install the cover (Item 1) **[Figure 20-70-35]**.

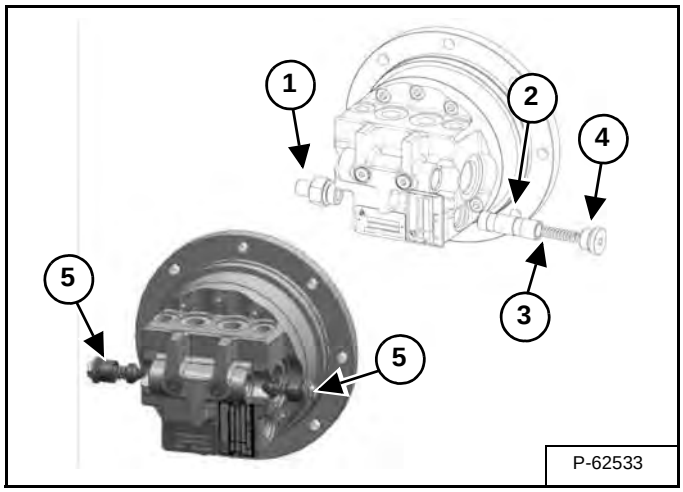
Install the six screws and washers (Item 2) **[Figure 20-70-35]**.

Tighten the screws in a crisscross manner to 40 - 50 N•m (30 - 37 ft-lb) torque.

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Assembly (Cont'd)

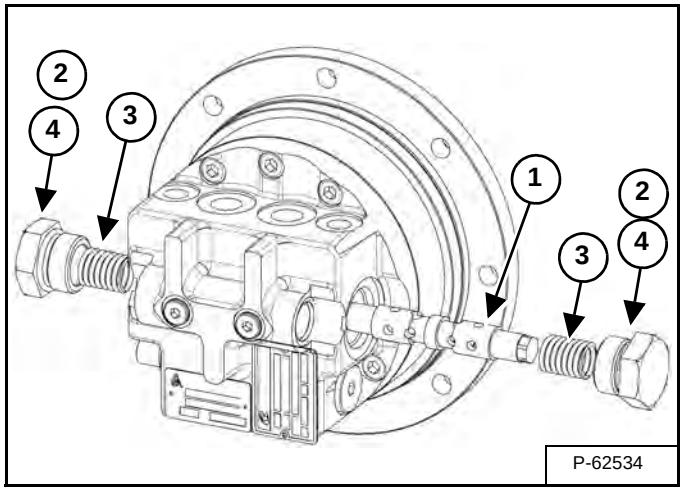
Figure 20-70-36



Install the plug (Item 1), piston valve (Item 2), springs (Item 3) and plug (Item 4) **[Figure 20-70-36]**.

Install the valves (Item 5) **[Figure 20-70-36]** in the motor cover.

Figure 20-70-37



Install the counterbalance valve (Item 1), washers (Item 2), springs (Item 3) and plugs (Item 4) **[Figure 20-70-37]**.

Figure 20-70-38

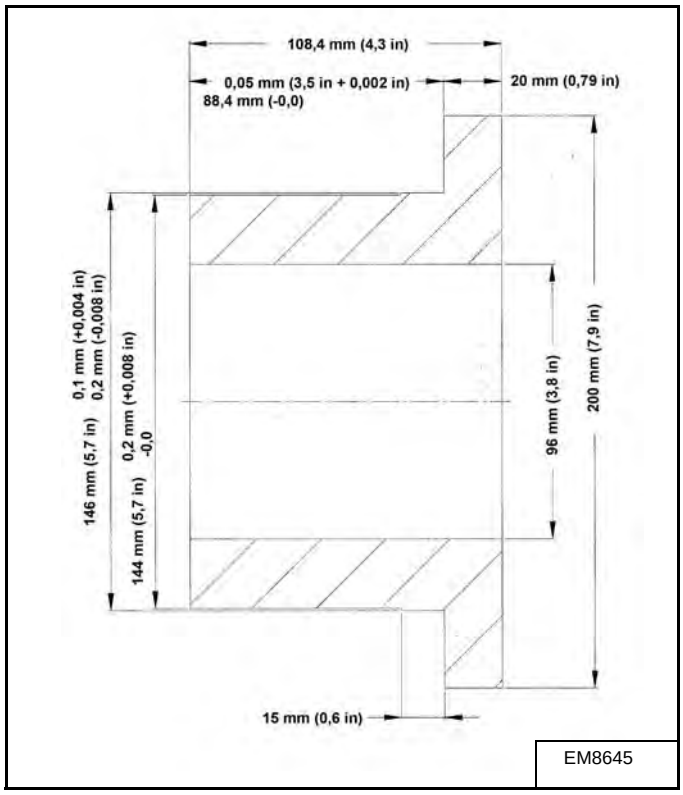
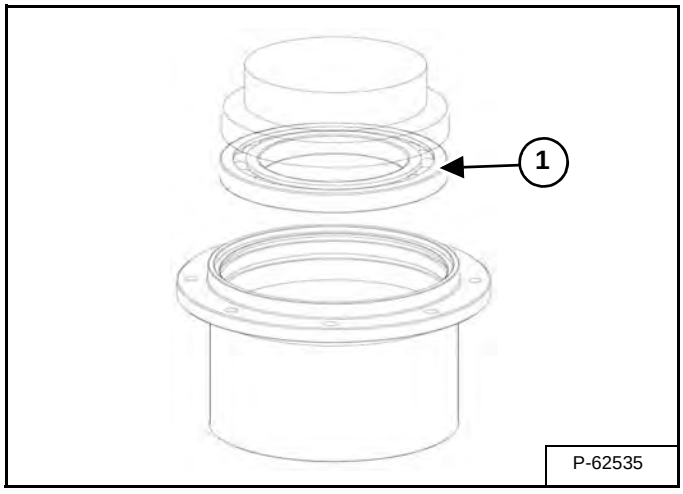


Figure 20-70-39

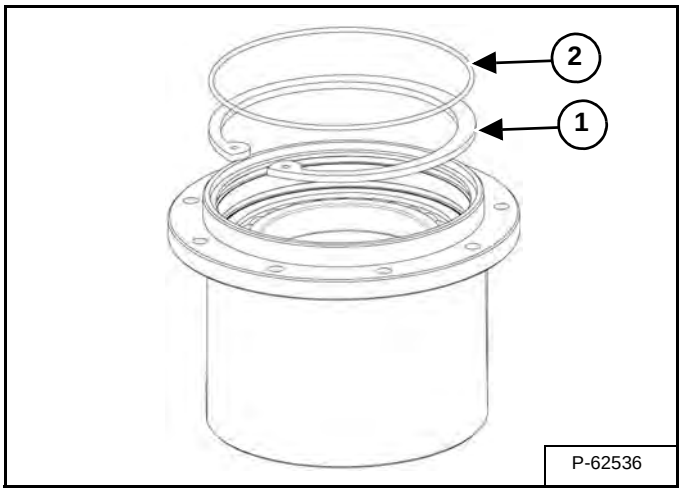


Install the ball bearing (Item 1) **[Figure 20-70-39]** using the bearing installation tool **[Figure 20-70-38]**.

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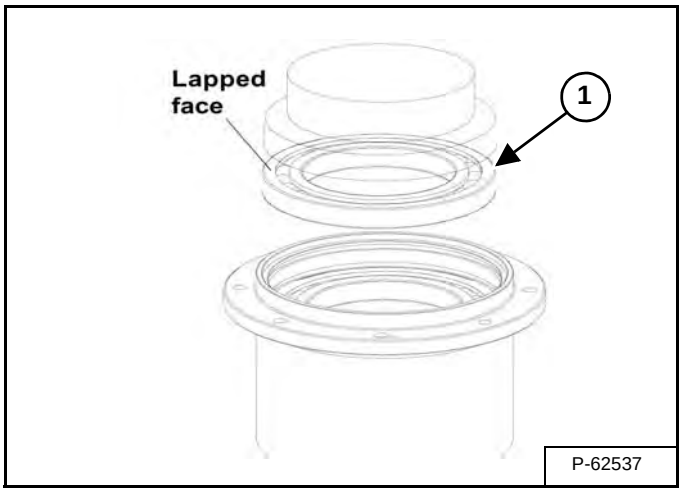
Assembly (Cont'd)

Figure 20-70-40



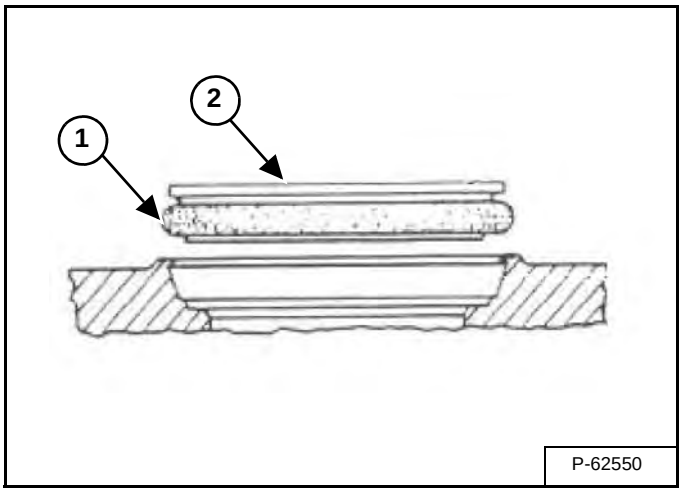
Install the retaining ring (Item 1) and O-ring (Item 2) **[Figure 20-70-40]**.

Figure 20-70-41



Using the bearing installation tool **[Figure 20-70-38]**, install the second bearing (Item 1) **[Figure 20-70-41]** keeping the lapped face up. Use extreme care not to damage the lapped face of the bearing.

Figure 20-70-42

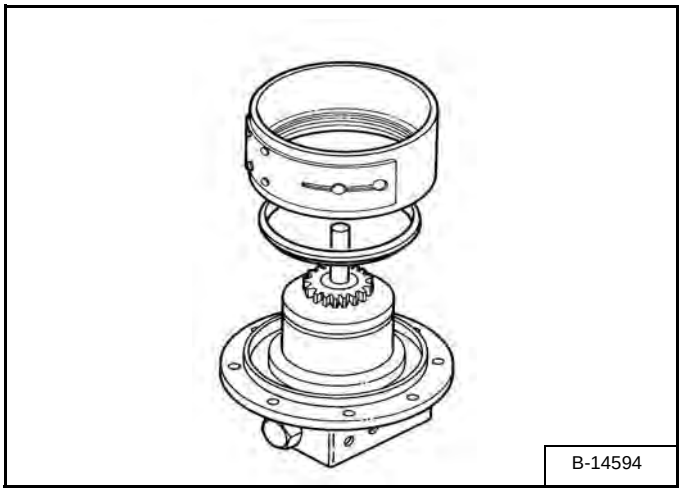


Install the O-ring (Item 1) on the seal ring (Item 2) **[Figure 20-70-42]**.

NOTE: Inspect the seal ring for burrs before installing the O-ring. Install the seal ring making sure it is not twisted. To remove any twists, gently pull a section of the O-ring and let it snap back.

The O-ring, seal ring and motor assembly must be clean and free of any dust, oil film or foreign matter.

Figure 20-70-43

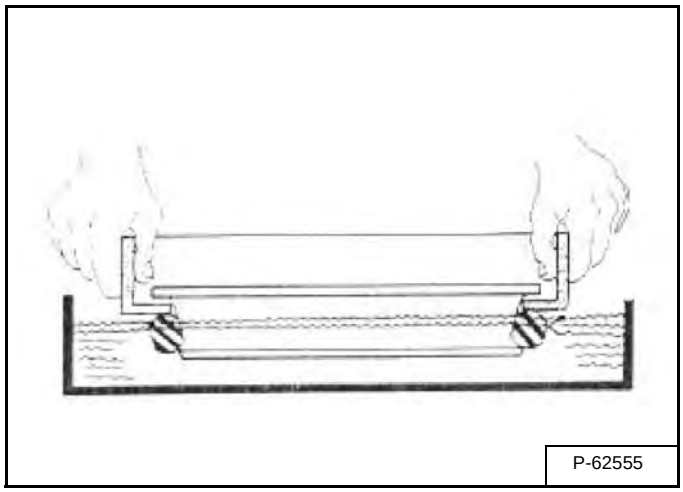


Install the seal seating tool (MEL1468) on the seal ring **[Figure 20-70-43]**.

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Assembly (Cont'd)

Figure 20-70-44



The seal ring assembly **[Figure 20-70-44]** must be lubricated with alcohol, so the O-ring will slip past the housing retaining ring and seal uniform in the motor housing radius.

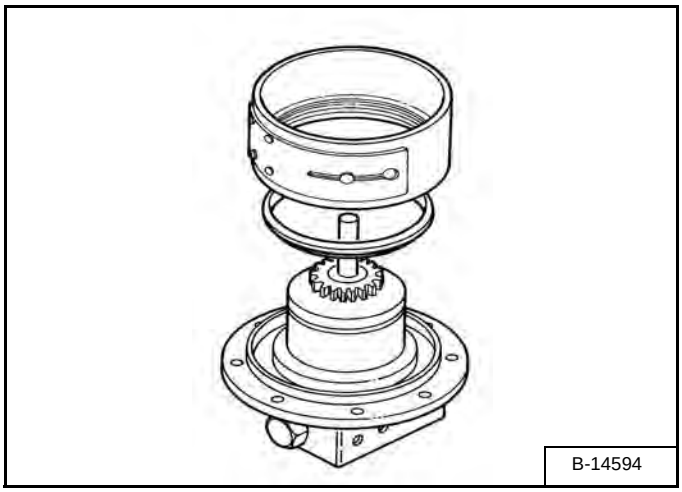
The O-ring **[Figure 20-70-44]** on the seal ring assembly must be lubricated with alcohol.

This will allow the O-ring to slide on the motor housing sealing surface without twisting.

Dip the O-ring **[Figure 20-70-44]** and seal ring assembly in a pan of alcohol.

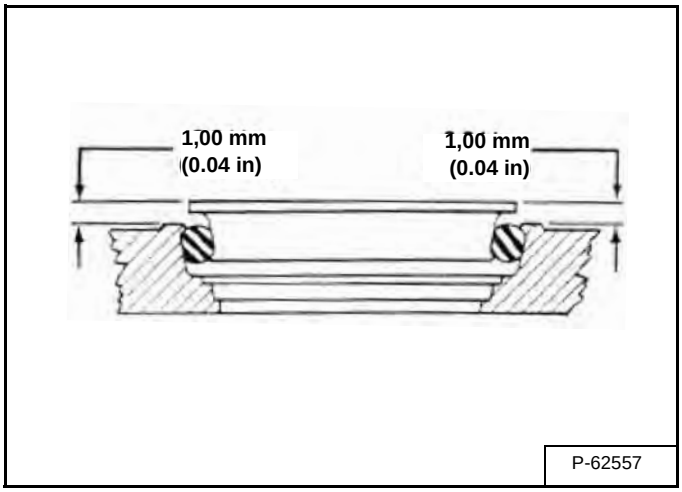
Shake off the excess alcohol and install the seal ring assembly on the motor **[Figure 20-70-44]**.

Figure 20-70-45



Use firm even pressure on the installation tool (MEL1468) to pop the O-ring into the motor housing **[Figure 20-70-45]**.

Figure 20-70-46



After the seal ring is installed, check the stand out height **[Figure 20-70-46]** in four places, 90° apart.

The stand out height is 1,00 mm (0.04 in).

NOTE: If the seal ring does not meet the height specifications inspect the torque ring for twists or obvious bulges.

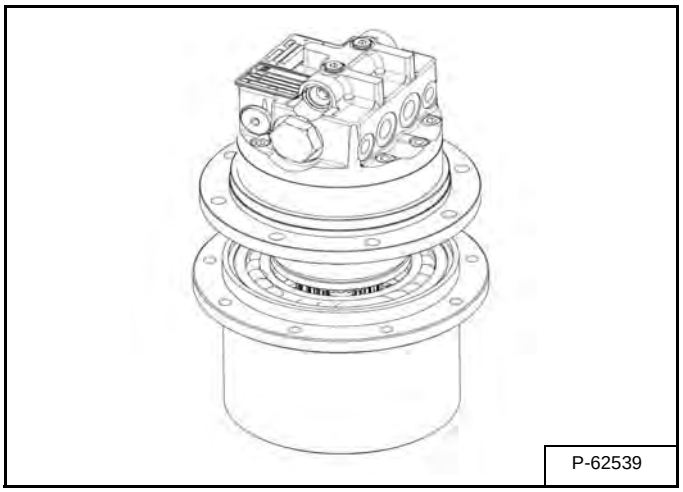
Apply a light film of oil to the seal ring and lapped face of the bearing.

NOTE: Do not get any oil on the O-ring.

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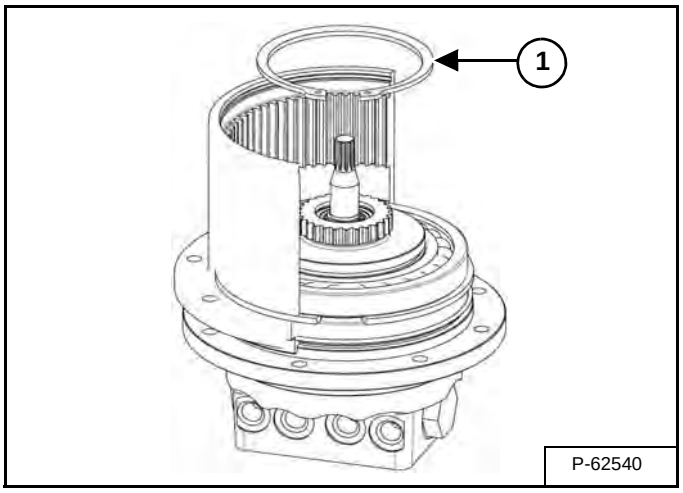
Assembly (Cont'd)

Figure 20-70-47



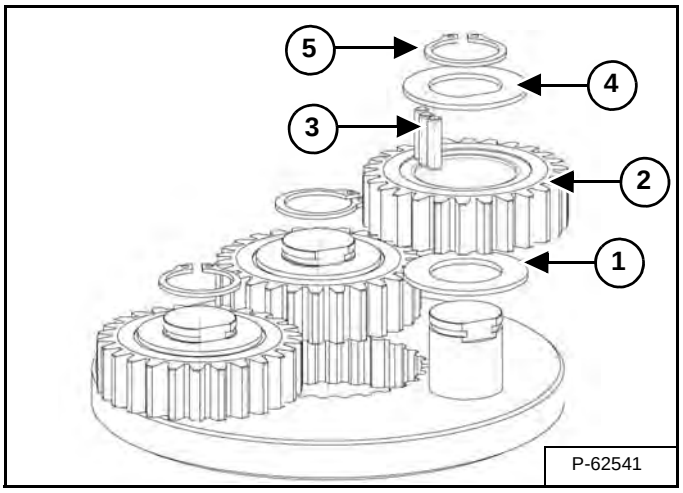
Press the reduction unit and motor assembly into the seat of the bearings **[Figure 20-70-47]**.

Figure 20-70-48



Install the external snap ring (Item 1) **[Figure 20-70-48]** in the motor reduction unit.

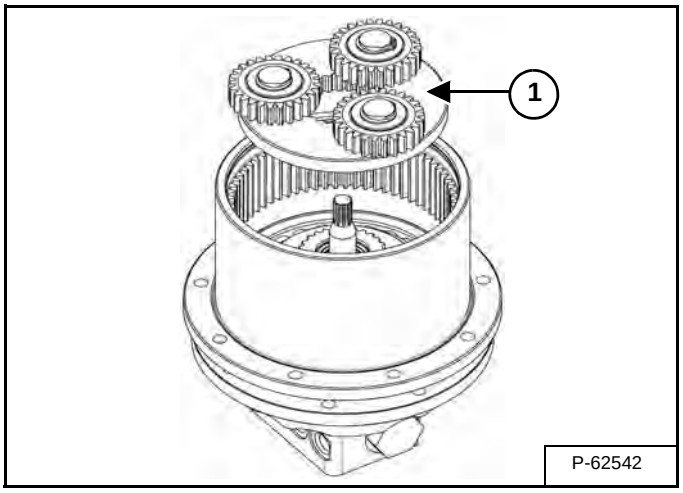
Figure 20-70-49



Install the thrust washers (Item 1), planetary gears (Item 2), needle bearing (Item 3), anti-rotation washers (Item 4) and external snap rings (Item 5) **[Figure 20-70-49]**.

NOTE: Install the snap rings so the opening of the snap ring is toward the outside.

Figure 20-70-50

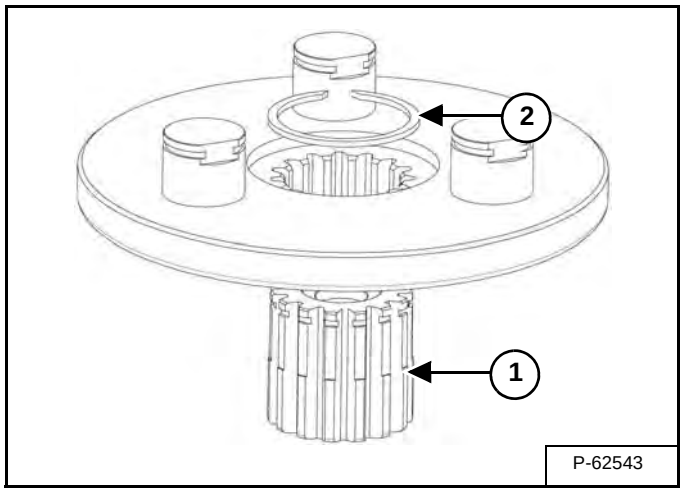


Install the planetary assembly (Item 1) **[Figure 20-70-50]**.

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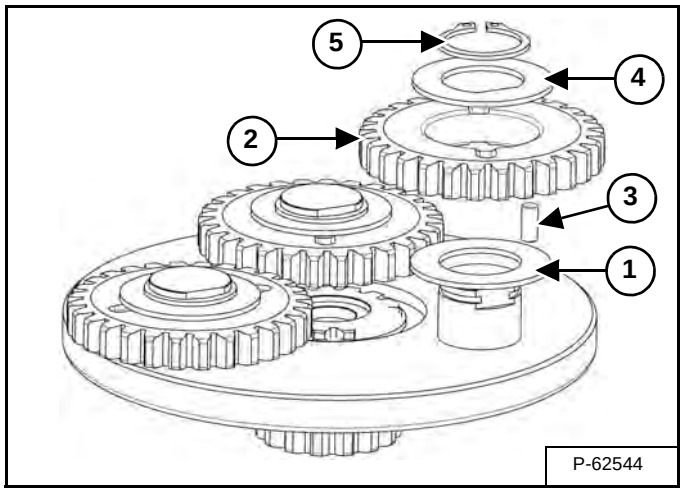
Assembly (Cont'd)

Figure 20-70-51



Install the sun gear (Item 1) into the planetary carrier and lock with the retaining ring (Item 2) **[Figure 20-70-51]**.

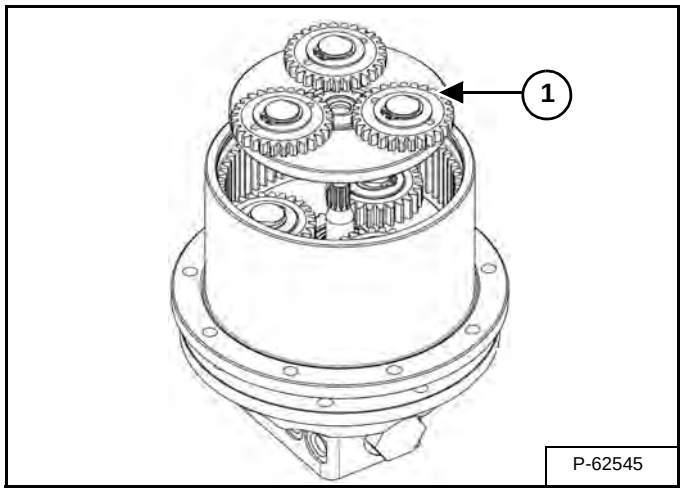
Figure 20-70-52



Install the thrust washers (Item 1), planetary gears (Item 2), needle bearings (Item 3), anti-rotation washers (Item 4) and external snap rings (Item 5) **[Figure 20-70-52]**.

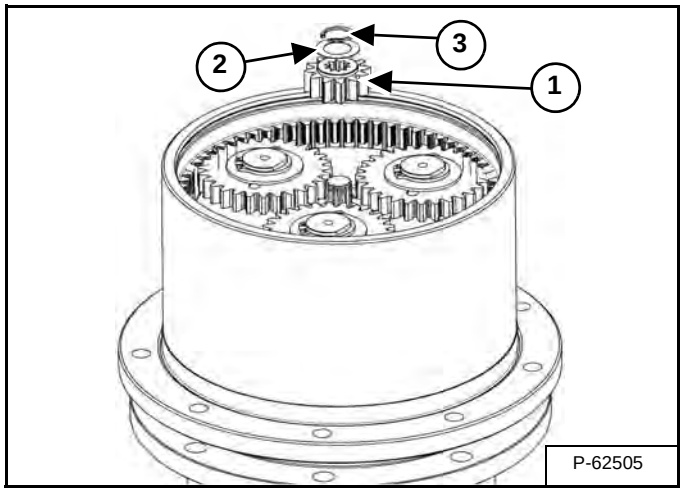
NOTE: Install the snap rings so the opening of the snap ring is toward the outside.

Figure 20-70-53



Install the outer planetary assembly (Item 1) **[Figure 20-70-53]**.

Figure 20-70-54

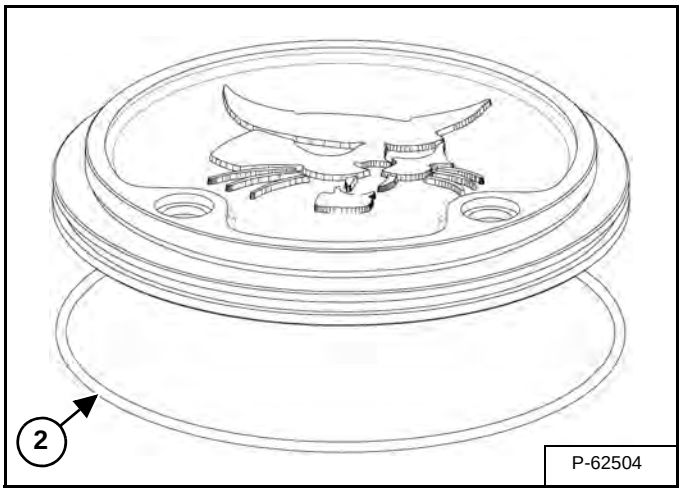


Install the sun gear (Item 1), shims (theoretical shimming 0,5 mm (0.02 in) (Item 2) and retaining ring (Item 3) **[Figure 20-70-54]**.

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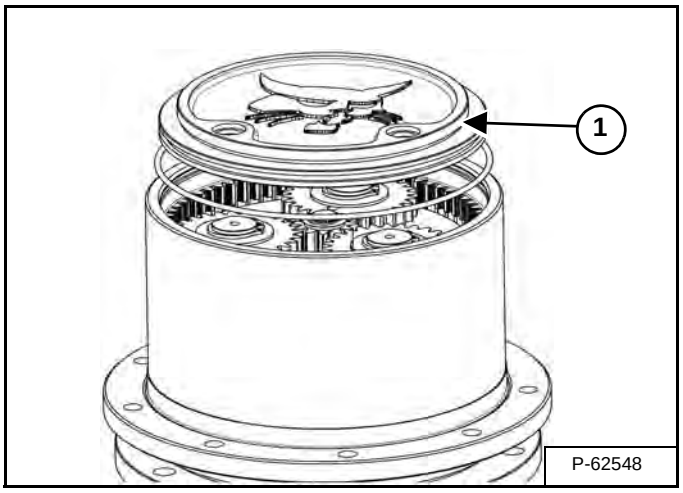
Assembly (Cont'd)

Figure 20-70-55



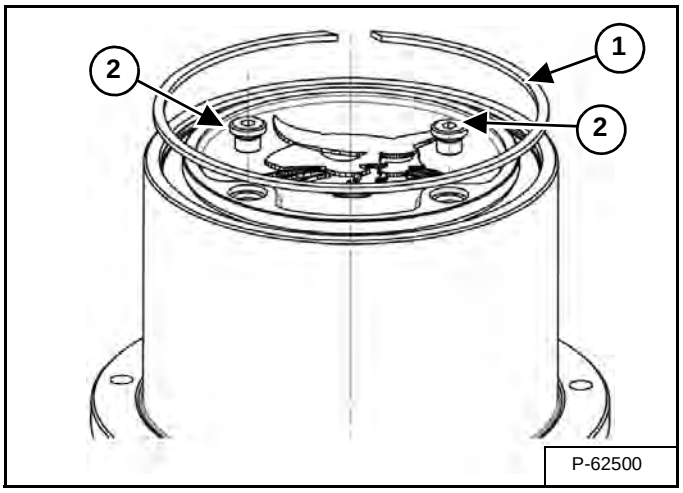
Install the O-ring (Item 1) **[Figure 20-70-55]** on the cover.

Figure 20-70-56



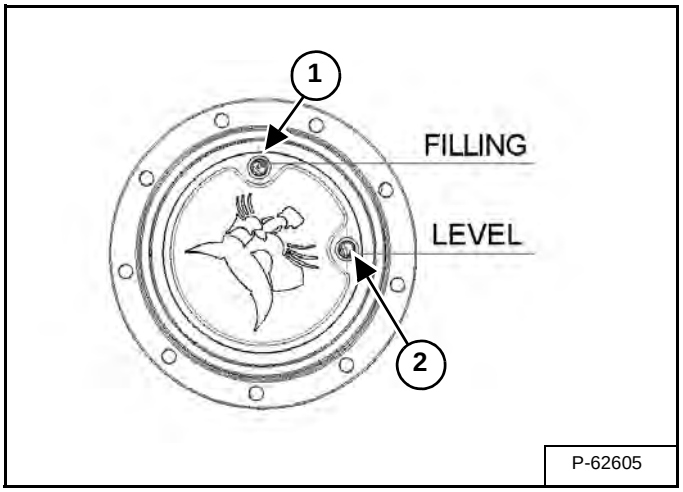
Install the cover (Item 1) **[Figure 20-70-56]** in the housing.

Figure 20-70-57



Install the snap ring (Item 1) **[Figure 20-70-57]** securing the reduction gear cover.

Figure 20-70-58



Add 0,4 L (0.422 qt) of gear lube 90W to the top plug hole (Item 1) until the gear lube is at the bottom of the plug hole (Item 2) **[Figure 20-70-58]**.

Install and tighten the two plugs (Item 2) **[Figure 20-70-57]**.

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SWIVEL JOINT

Description

The swivel joint is located under the floor panels and mounted to the upperstructure. The swivel joint directs hydraulic fluid to the undercarriage components while allowing the upperstructure to rotate.

Removal And Installation

Fully expand the track frame.

Figure 20-80-1



Place blocks under the excavator tracks **[Figure 20-80-1]**.

Lower the boom / bucket and blade to the ground.

Relieve hydraulic pressure.

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

Remove the floor mat and floor panels. (See Removal And Installation on Page 40-140-1.)

Drain the hydraulic reservoir. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

WARNING

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

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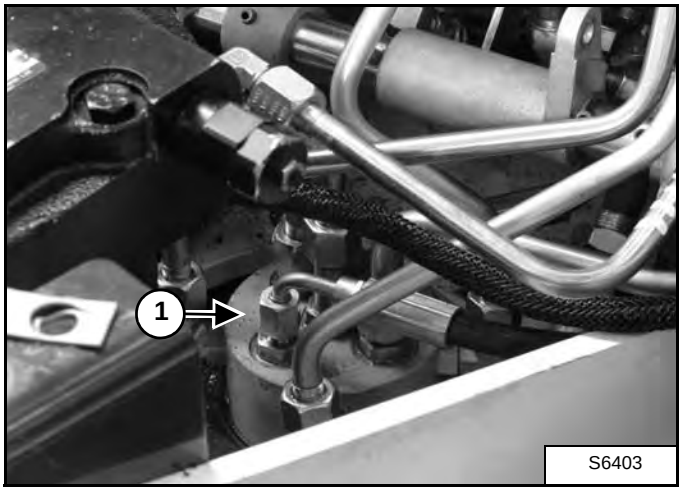
IMPORTANT

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

I-2003-0888

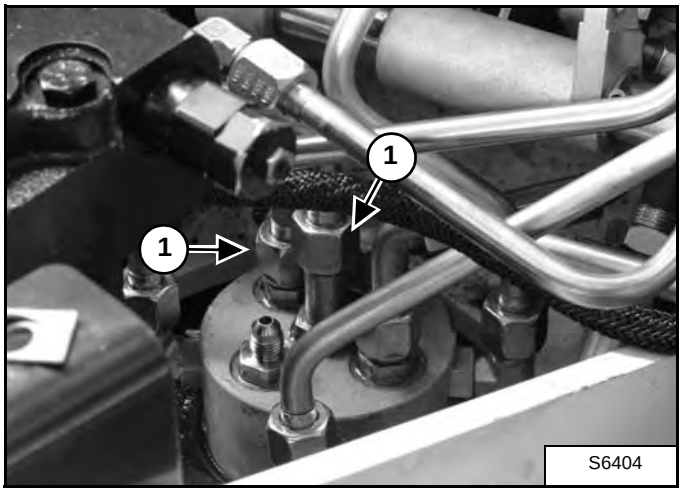
Mark all hoses and tubelines for ease of assembly.

Figure 20-80-2



Remove the hose (Item 1) **[Figure 20-80-2]** from the top of the swivel joint.

Figure 20-80-3

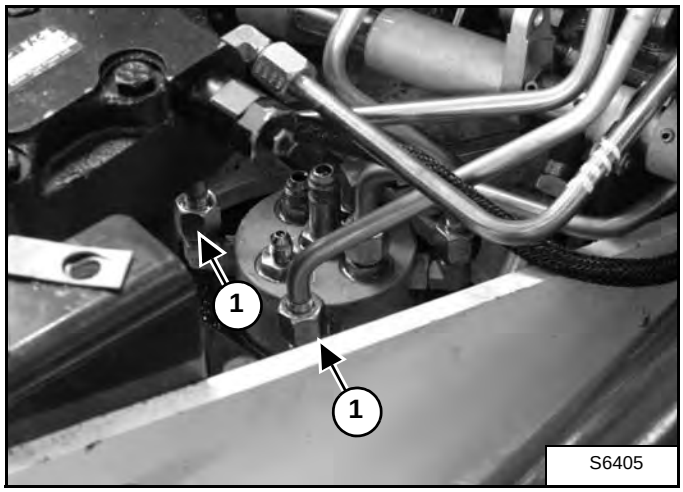


Remove the tubelines (Item 1) **[Figure 20-80-3]** from the top of the swivel joint and blade / track expansion solenoid block.

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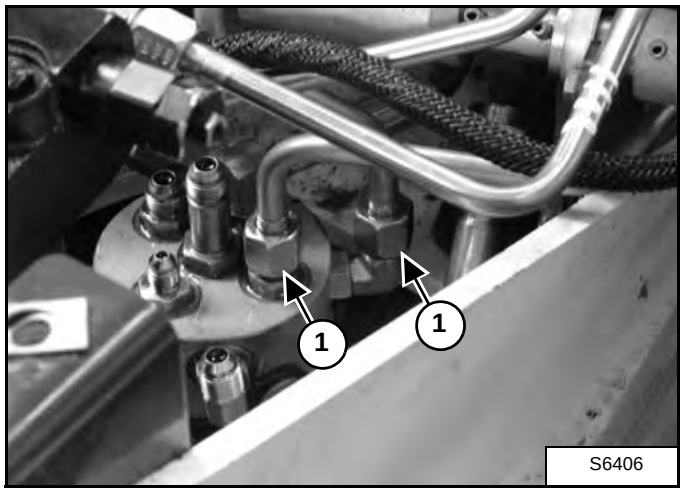
Removal And Installation (Cont'd)

Figure 20-80-4



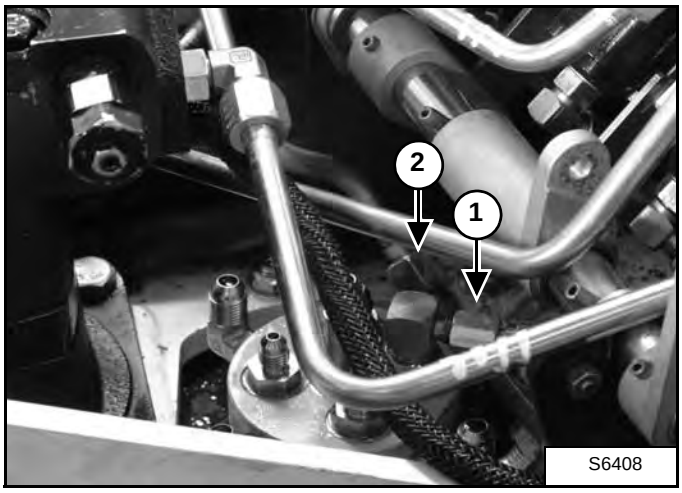
Remove the tubelines (Item 1) **[Figure 20-80-4]** from the swivel joint and valve assembly.

Figure 20-80-5



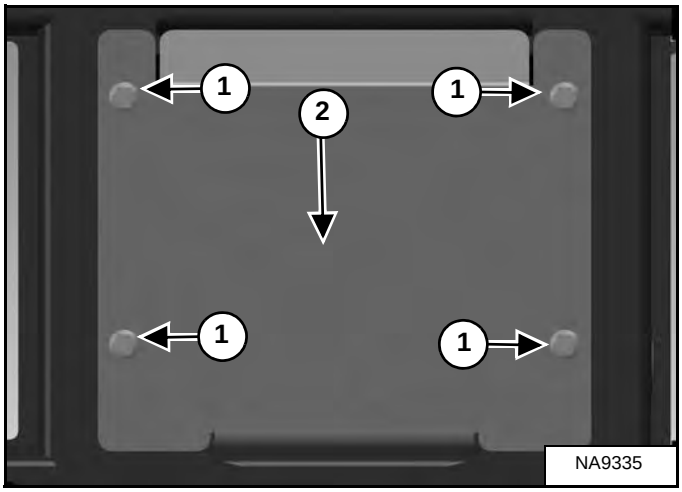
Remove the tubelines (Item 1) **[Figure 20-80-5]** from the swivel joint and valve assembly.

Figure 20-80-6



Remove the hose (Item 1) and tubeline (Item 2) **[Figure 20-80-6]**.

Figure 20-80-7

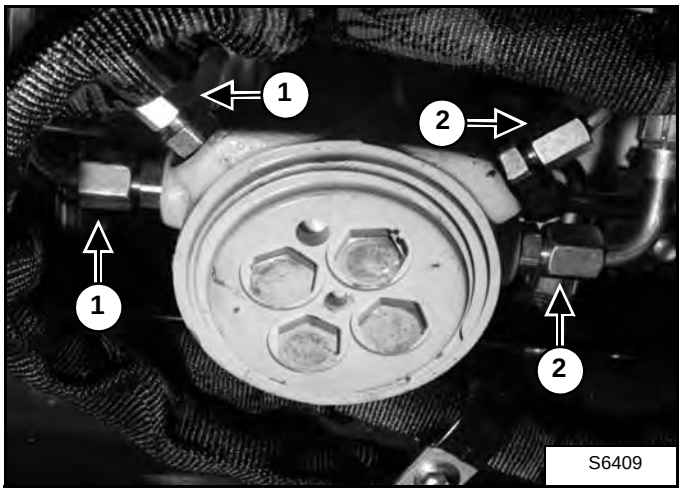


Remove the bolts (Item 1) and the access plate (Item 2) **[Figure 20-80-7]** from the bottom side of the excavator.

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Removal And Installation (Cont'd)

Figure 20-80-8

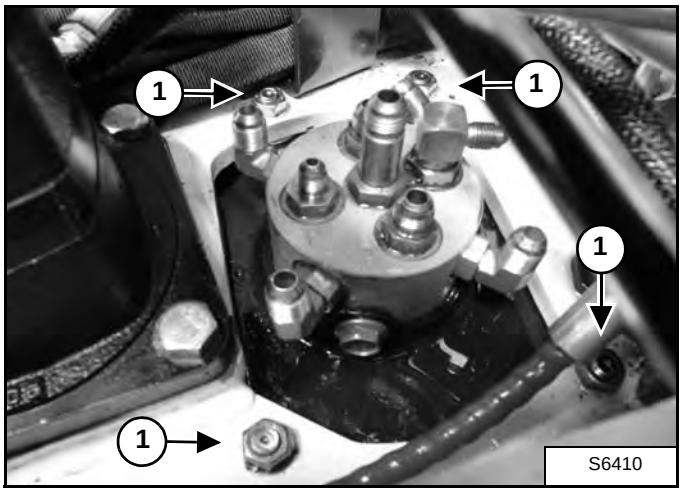


Remove the six hoses (Item 1) **[Figure 20-80-8]** from the left side of the swivel joint.

Remove the six hoses (Item 2) **[Figure 20-80-8]** from the right side of the swivel joint.

NOTE: Support the swivel joint on the bottom side of the excavator to prevent the swivel joint from falling when the four nuts are being removed.

Figure 20-80-9

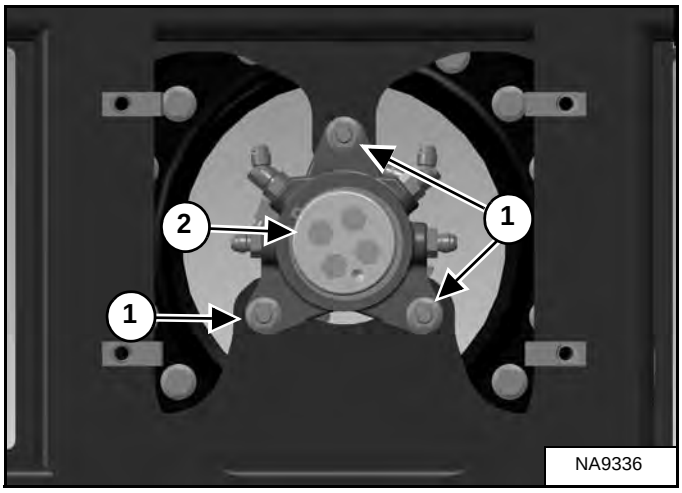


Remove the four nuts (Item 1) **[Figure 20-80-9]** and slide the swivel joint out through the bottom of the excavator.

S/N AHLL12204 & Above

NOTE: Support the swivel joint on the bottom side of the excavator to prevent the swivel joint from falling when the three nuts are being removed.

Figure 20-80-10



Remove the nuts (Item 1) **[Figure 20-80-10]** and bolts.

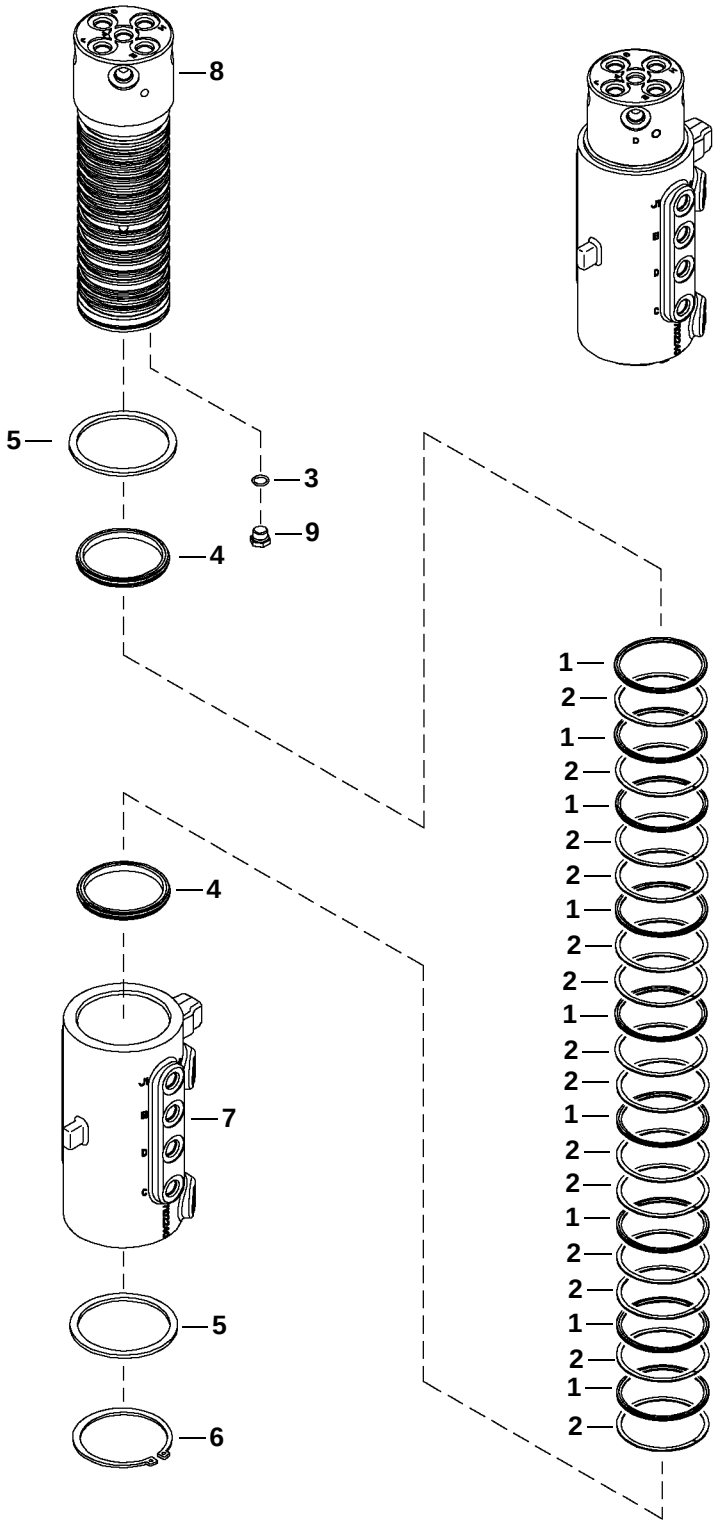
Remove the swivel joint (Item 2) **[Figure 20-80-10]**.

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SWIVEL JOINT (CONT'D)

Parts Identification (S/N AHll11001 to AHLL22003)

1. Seal and O-ring
2. Back-up Seal
3. O-ring
4. Inner / Outer Seals
5. Washer
6. Snap Ring
7. Housing
8. Rotor
9. Plug

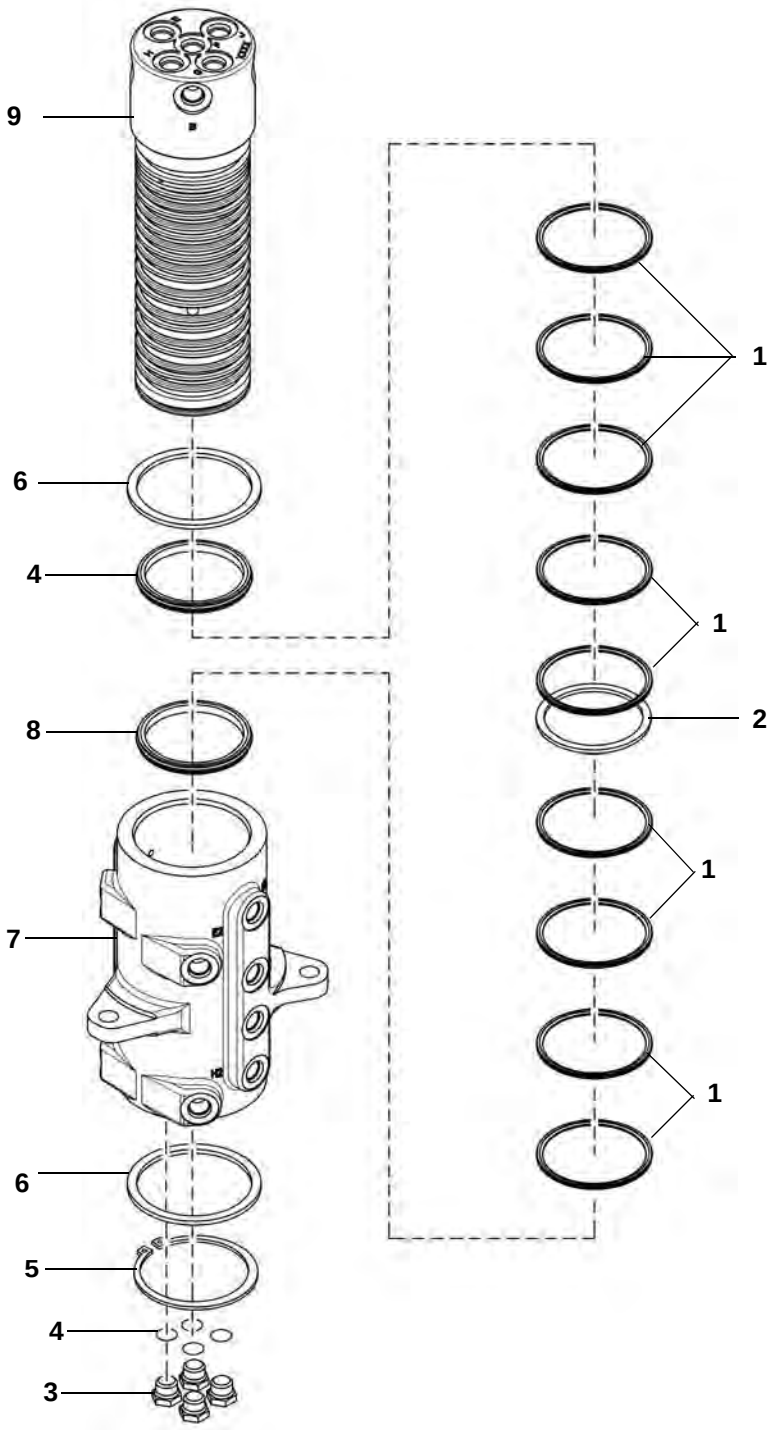


MS-2041

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Parts Identification (AHLL22003 & Above)

1. Seal
2. Backup Ring
3. Plug
4. O-ring
5. Snap Ring
6. Washer
7.Housing
8. Backup Ring
9. Rotor



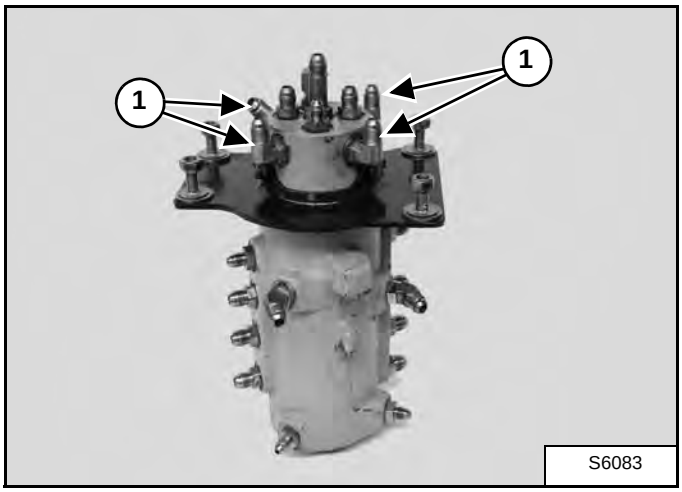
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SWIVEL JOINT (CONT'D)

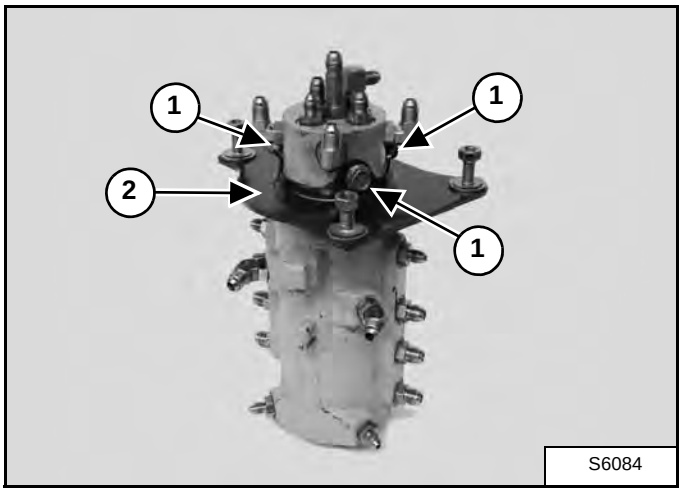
Disassembly

Figure 20-80-11



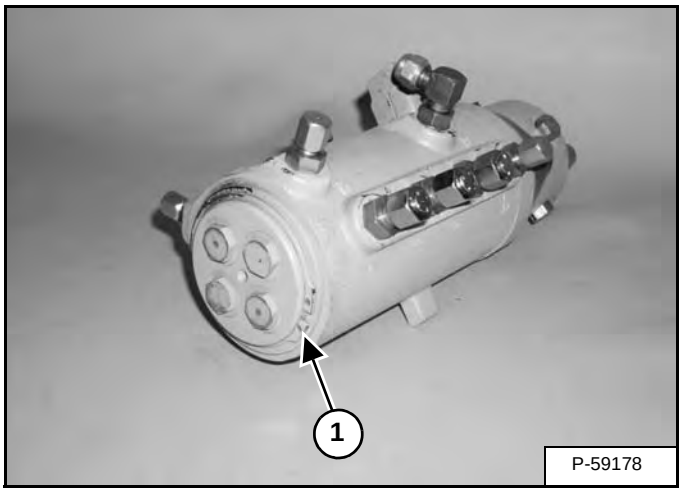
Mark fitting orientation. Remove the fittings (Item 1) **[Figure 20-80-11]**.

Figure 20-80-12



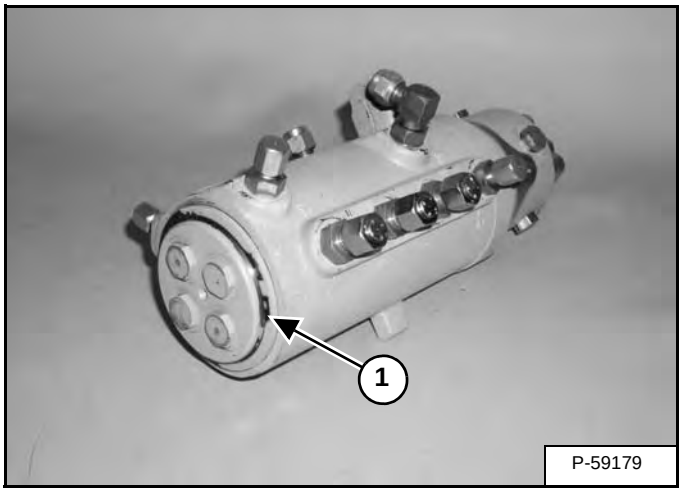
Remove the three bolts (Item 1). Remove the mount (Item 2) **[Figure 20-80-12]**.

Figure 20-80-13



Remove the snap ring (Item 1) **[Figure 20-80-13]** from the bottom of the swivel joint.

Figure 20-80-14

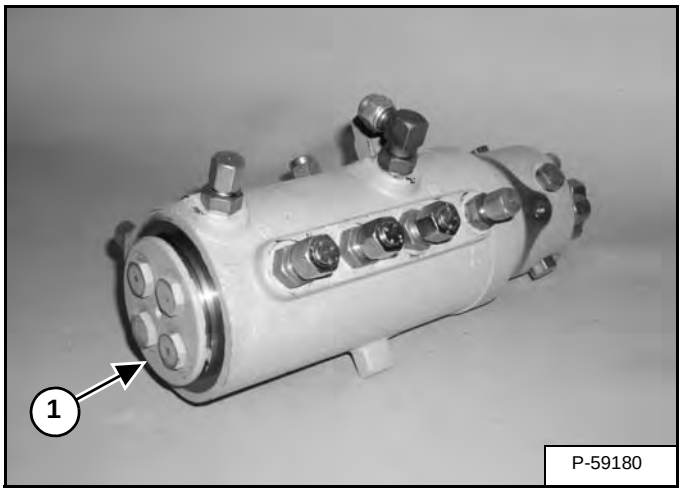


Remove the nylon washer (Item 1) **[Figure 20-80-14]**.

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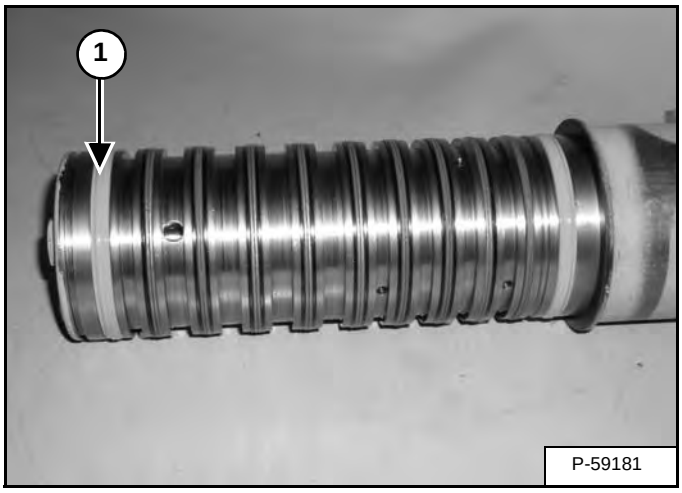
Disassembly (Cont'd)

Figure 20-80-15



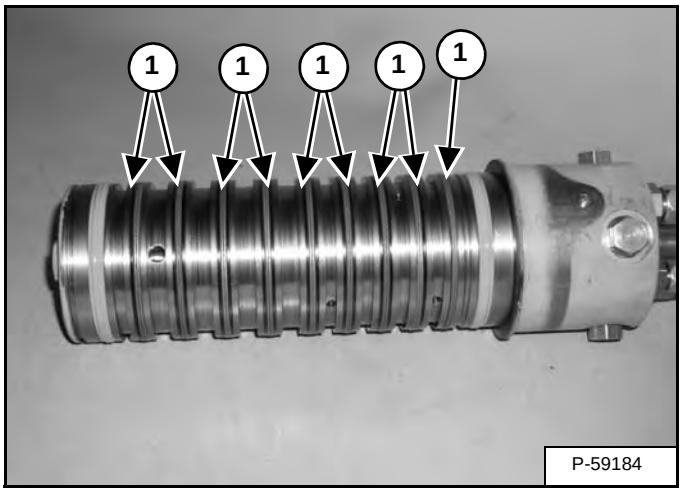
Tap the end of the rotor (Item 1) **[Figure 20-80-15]** with a rubber mallet to drive the rotor out of the housing.

Figure 20-80-16



Remove the outer and inner seals (Item 1) **[Figure 20-80-16]**.

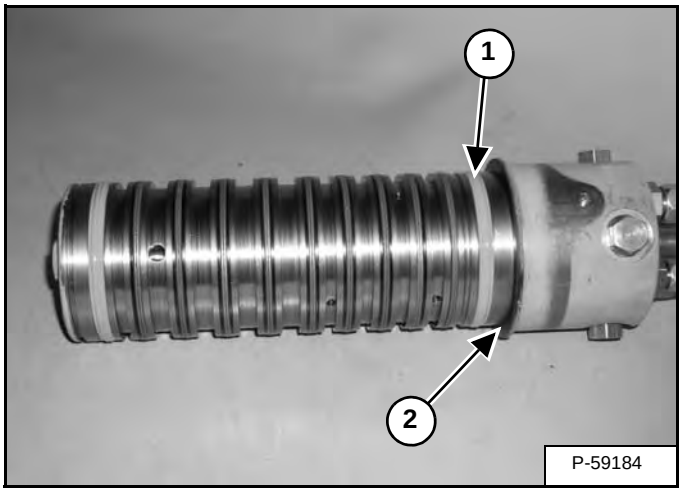
Figure 20-80-17



Remove the seals, back-up seals and O-rings (Item 1) **[Figure 20-80-17]**.

NOTE: For S/N AHLL22004 & Above, there is a back-up ring and seal in the fifth groove only. All other grooves have just the seal.

Figure 20-80-18



Remove the outer and inner seals (Item 1). Remove the nylon washer (Item 2) **[Figure 20-80-18]**.

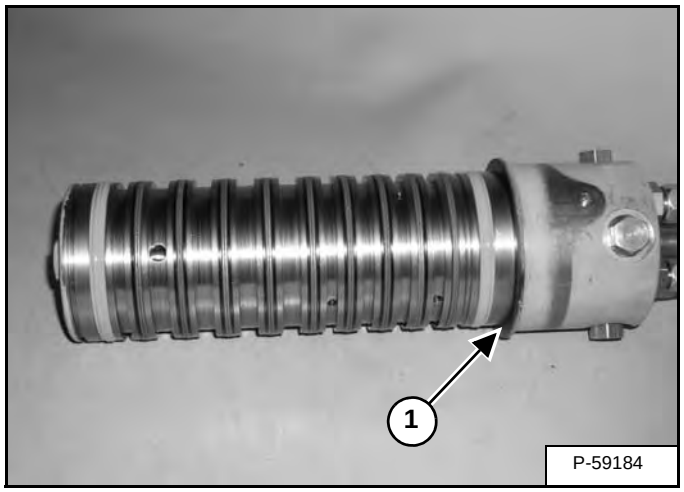
Dealer Copy -- Not for Resale

Assembly

Clean all parts in solvent and dry with compressed air.

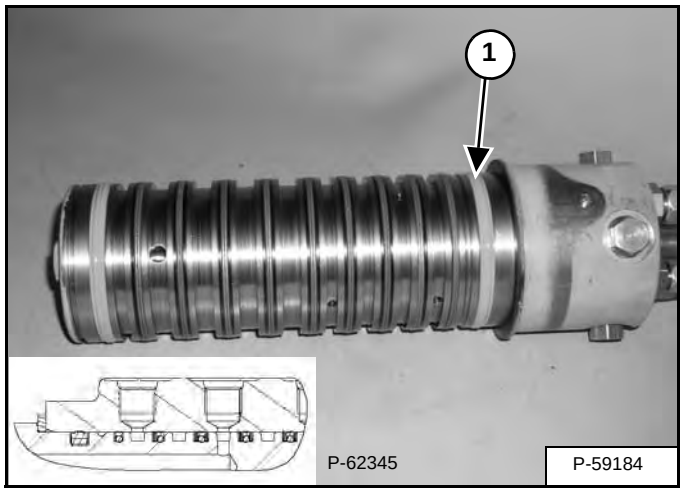
Inspect the rotor and housing for scratches or wear that could cause internal leakage. Always install new seals and back-up seals. Lubricate all seals and back-up seals with clean hydraulic fluid before installation.

Figure 20-80-19



Install the nylon washer (Item 1) **[Figure 20-80-19]**.

Figure 20-80-20

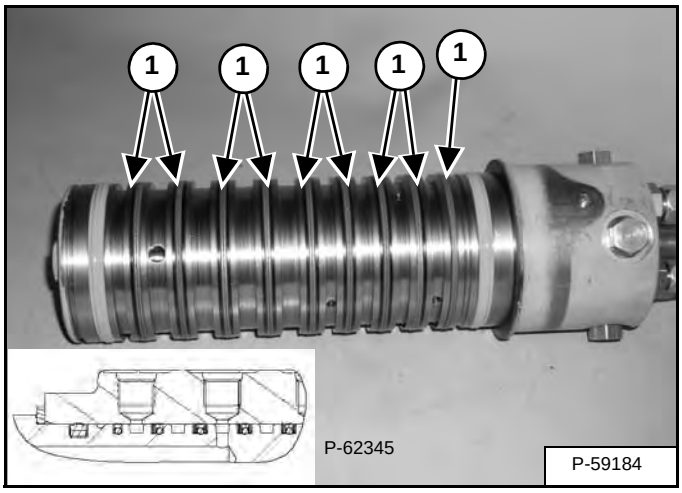


0Heat the seals in hydraulic fluid for 3 minutes at 54°C (130°F).

Install the inner and outer seals (Item 1) **[Figure 20-80-20]**.

NOTE: The inner and outer seal are serviceable as one part number.

Figure 20-80-21



Install the O-rings under the seals (Item 1) **[Figure 20-80-21]**.

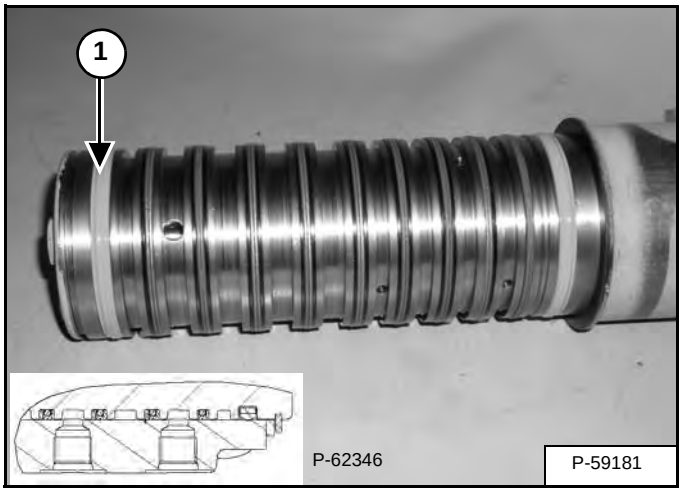
Heat the seals in hydraulic fluid for 3 minutes at 54°C (130°F).

Install the seals and back-up seals (Item 1) **[Figure 20-80-21]**.

NOTE: The seal and O-ring are serviceable as one part number.

NOTE: For S/N AHLL22004 & Above, there is a back-up ring and seal in the fifth groove only. All other grooves have just the seal.

Figure 20-80-22



Heat the seals in hydraulic fluid for 3 minutes at 54°C (130°F).

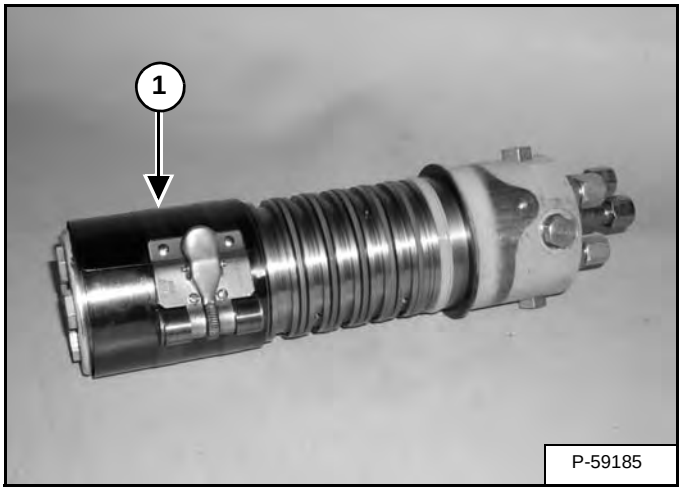
Install the inner and outer seals (Item 1) **[Figure 20-80-22]**.

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Assembly (Cont'd)

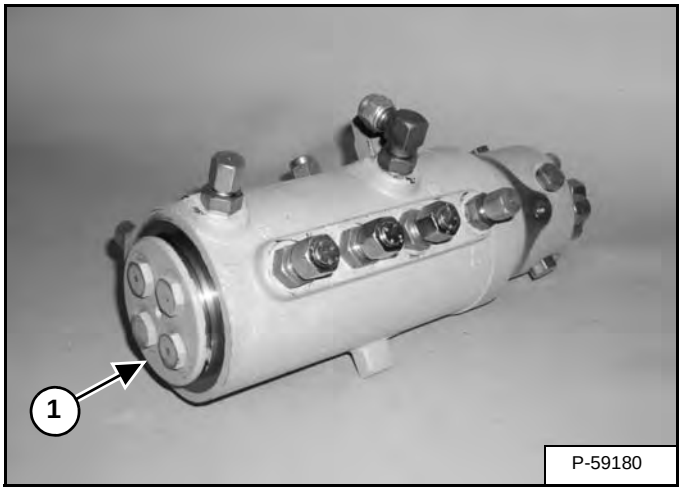
NOTE: The inner and outer seal are serviceable as one part number.

Figure 20-80-23



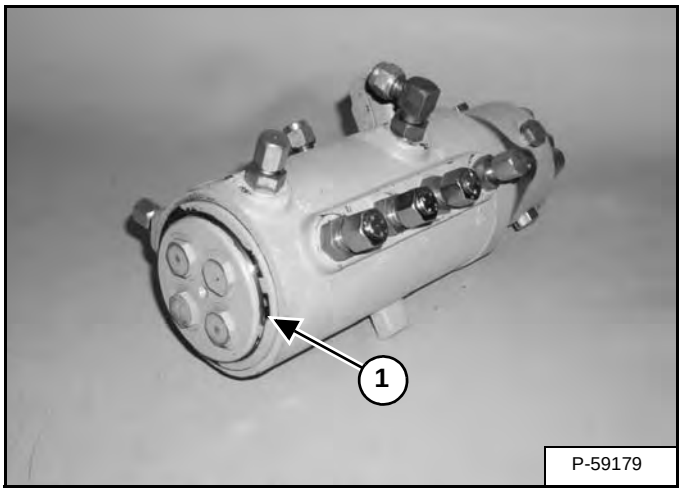
NOTE: A ring compressor (Item 1) [Figure 20-80-23] can be used to fit the seals into the seal grove. Compress the seals for 3 minutes.

Figure 20-80-24



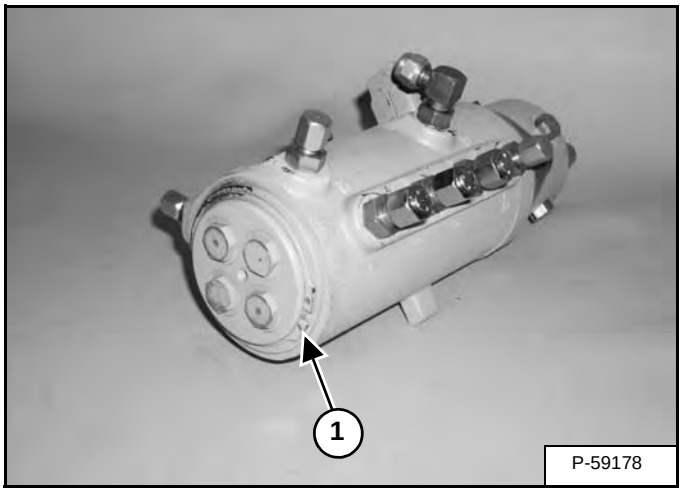
Apply hydraulic fluid to the rotor (Item 1) **[Figure 20-80-24]**. Install the rotor in the housing.

Figure 20-80-25



Install the nylon washer (Item 1) **[Figure 20-80-25]**.

Figure 20-80-26

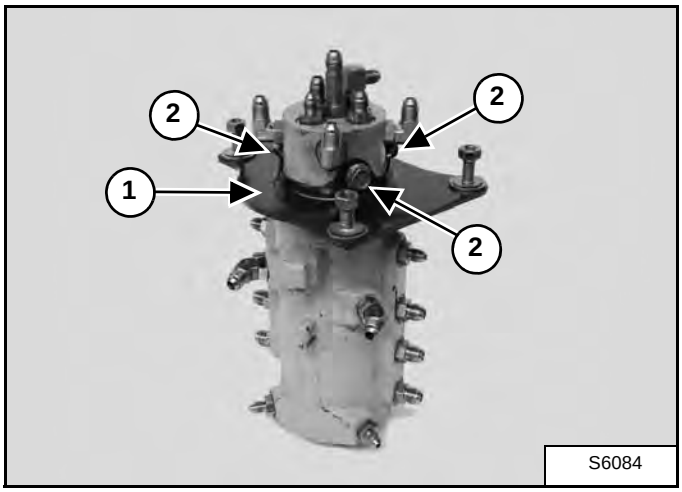


Remove the snap ring (Item 1) **[Figure 20-80-26]** from the bottom of the swivel joint.

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Assembly (Cont'd)

Figure 20-80-27

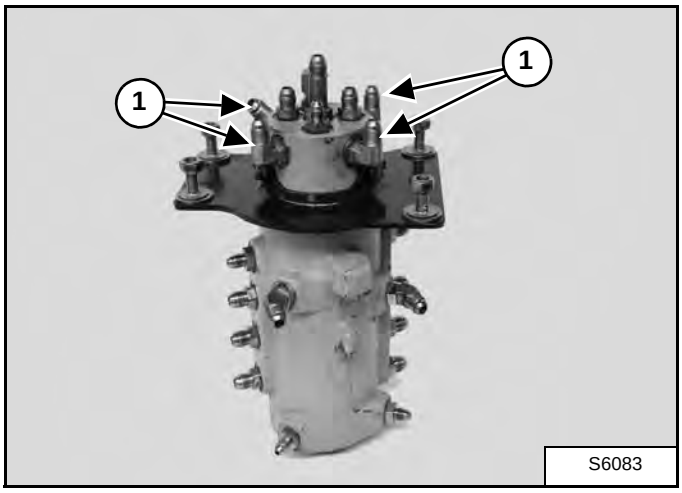


Install the mount (Item 1) **[Figure 20-80-27]** on the swivel joint.

Apply Loctite® 242 to each bolt (Item 2) **[Figure 20-80-27]**.

Install the bolts (Item 2) **[Figure 20-80-27]**. Tighten the bolts to 43 - 47 N•m (32 - 35 ft-lb) torque.

Figure 20-80-28



Install the fittings (Item 1) **[Figure 20-80-28]** and orientate accordingly.

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SWING MOTOR

Description

The swing motor is a hydraulic motor that receives hydraulic fluid from the gear pump through the control valve to swing the upperstructure left or right. The speed that the swing motor rotates is related to the amount of hydraulic fluid it receives.

Removal And Installation

IMPORTANT

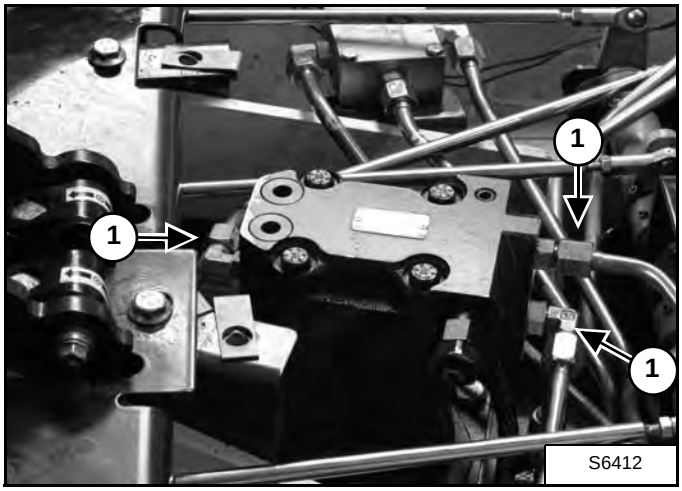
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

Remove the floor mat and floorplate. (See Removal And Installation on Page 40-140-1.)

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

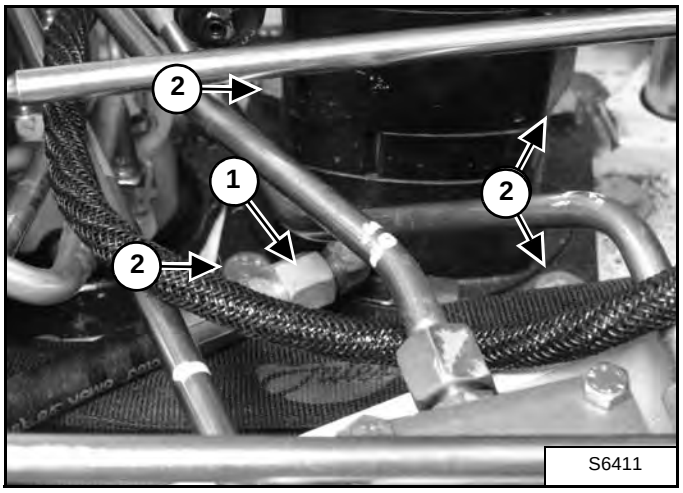
Figure 20-90-1



Mark the tubelines (Item 1) **[Figure 20-90-1]** for ease of assembly.

Remove the tubelines (Item 1) **[Figure 20-90-1]**.

Figure 20-90-2



Remove hose (Item 1) **[Figure 20-90-2]**.

Remove the four bolts (Item 2) **[Figure 20-90-2]** from the swing motor.

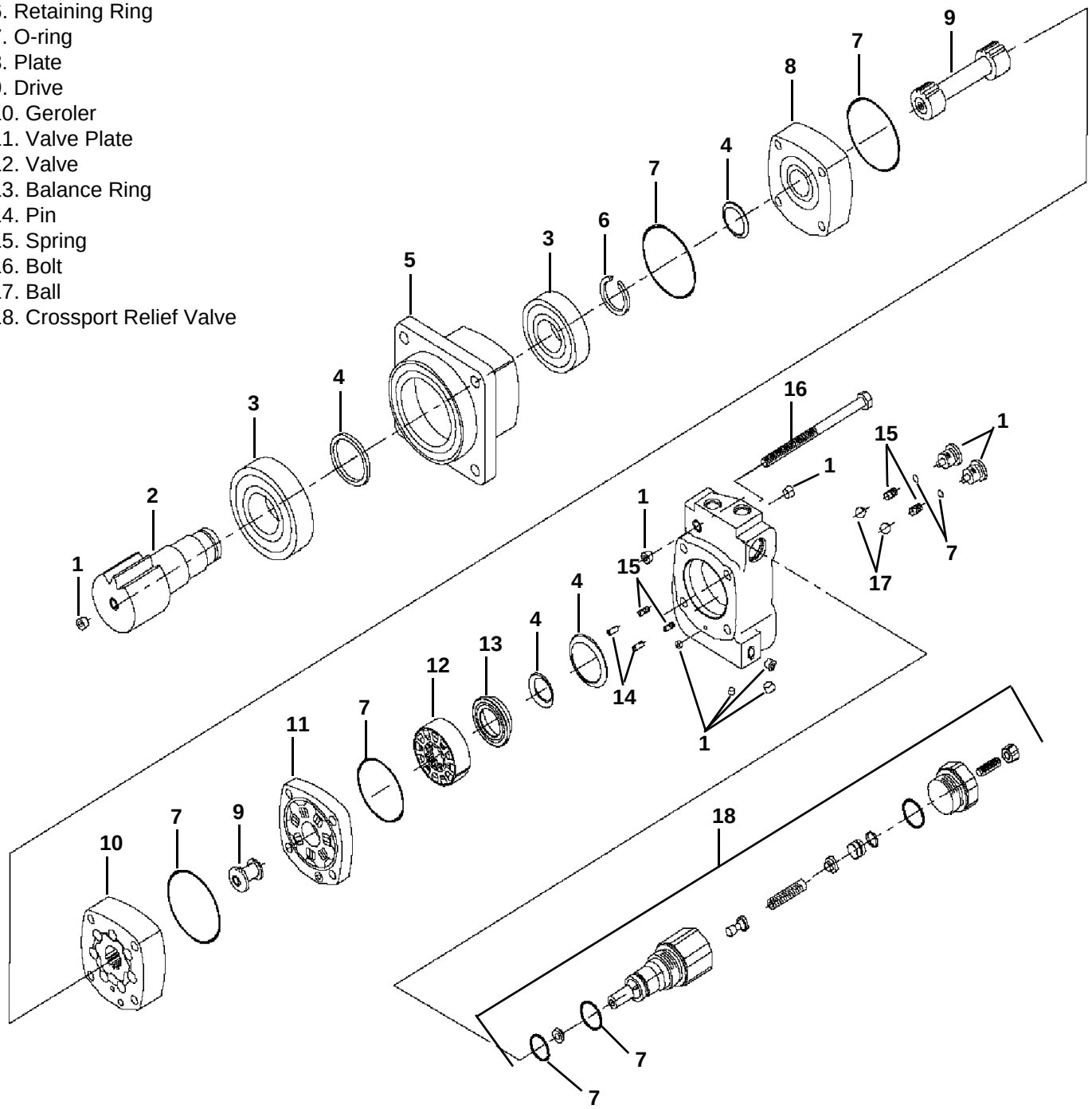
Installation: Tighten the bolts to 105 - 115 N•m (75 - 85 ft-lb) torque.

Remove the swing motor from the excavator.

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Parts Identification

1. Plug
2. Shaft
3. Bearing
4. Seal
5. Housing
6. Retaining Ring
7. O-ring
8. Plate
9. Drive
10. Geroler
11. Valve Plate
12. Valve
13. Balance Ring
14. Pin
15. Spring
16. Bolt
17. Ball
18. Crossport Relief Valve



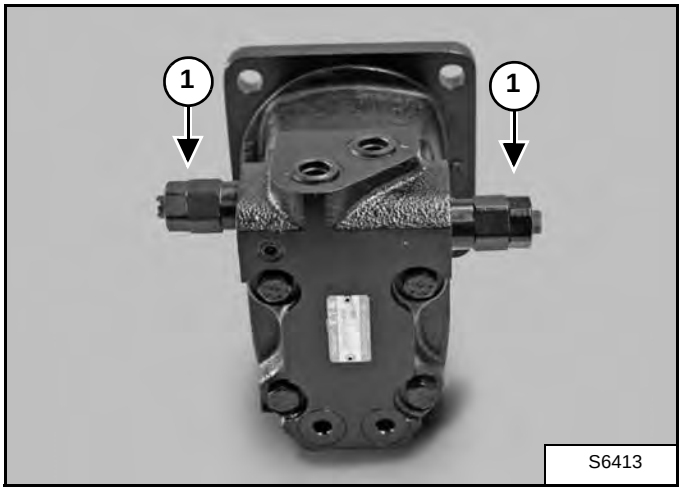
Dealer Copy -- Not for Resale

Disassembly

Clean the outside of the swing motor before disassembly.

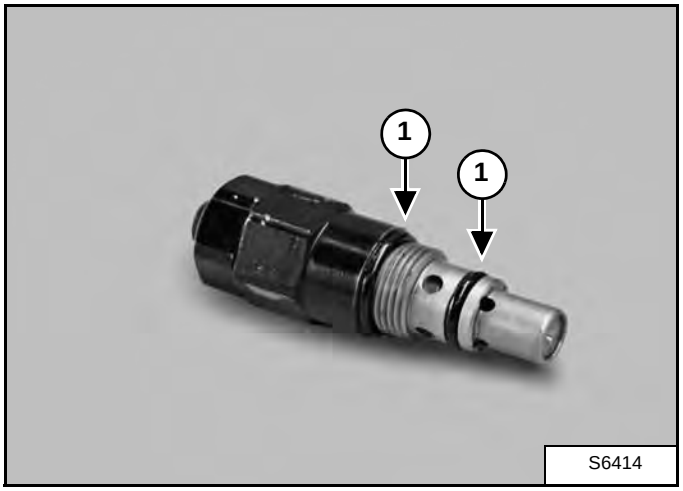
Mark the outside of the swing motor for ease of assembly.

Figure 20-90-3



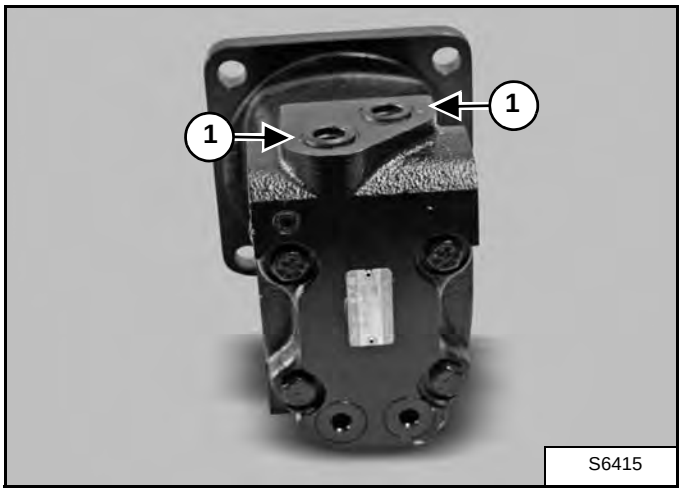
Remove the crossport relief valves (Item 1) **[Figure 20-90-3]**.

Figure 20-90-4



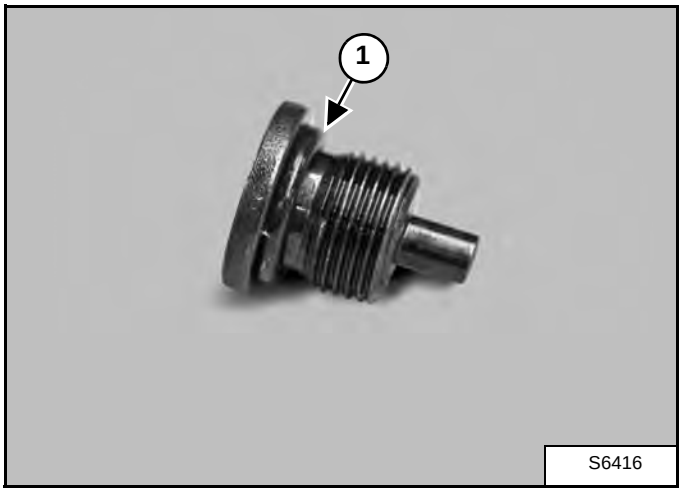
Remove the O-rings (Item 1) **[Figure 20-90-4]** from the crossport relief valves.

Figure 20-90-5



Remove the plugs (Item 1) **[Figure 20-90-5]** from the swing motor.

Figure 20-90-6

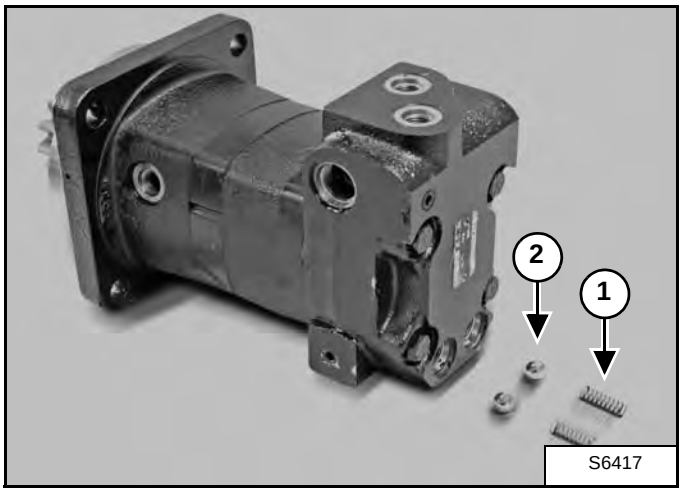


Remove the O-ring (Item 1) **[Figure 20-90-6]** from the plug.

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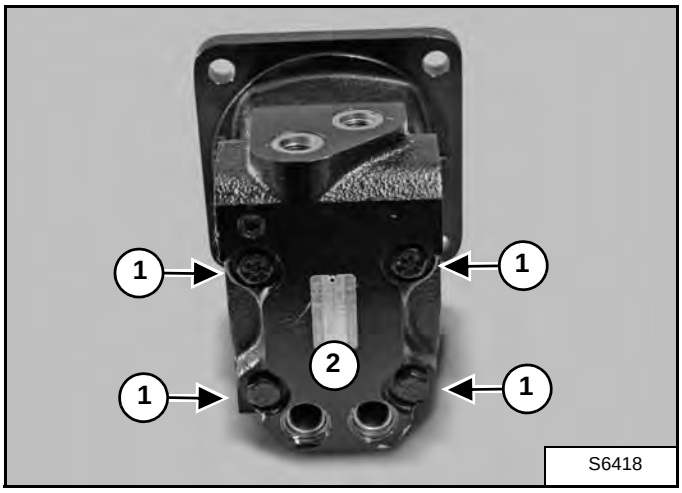
Disassembly (Cont'd)

Figure 20-90-7



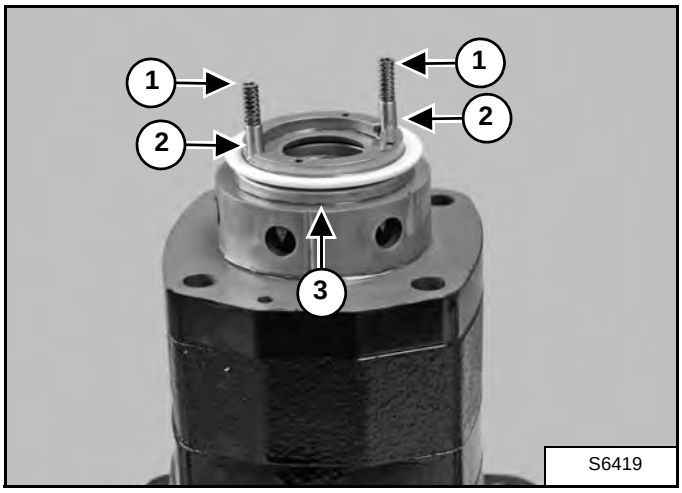
Remove the springs (Item 1) and balls (Item 2) **[Figure 20-90-7]**.

Figure 20-90-8



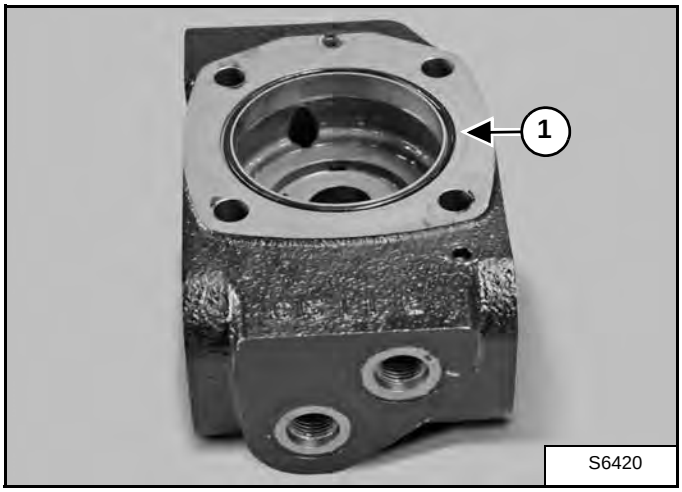
Remove the bolts (Item 1) **[Figure 20-90-8]**.

Figure 20-90-9



Remove the top of the motor (Item 2) **[Figure 20-90-9]** by lifting it straight up. If done carefully, the springs (Item 1), pins (Item 2) and balance ring assembly (Item 3) **[Figure 20-90-9]** will remain on the valve for easy removal.

Figure 20-90-10

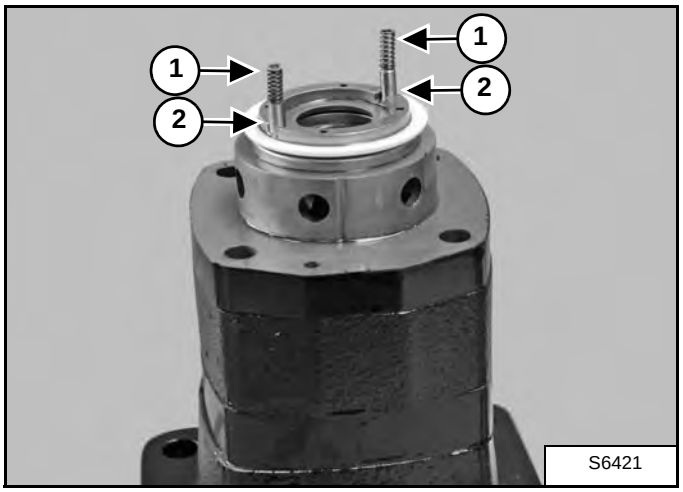


Remove the O-ring (Item 1) **[Figure 20-90-10]**.

Dealer Copy -- Not for Resale

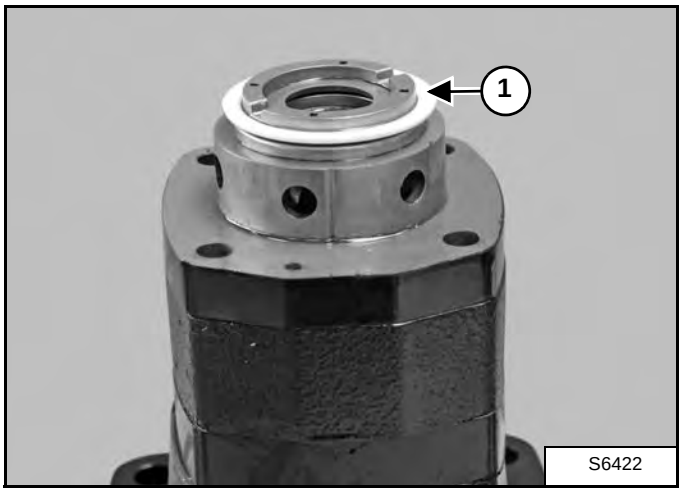
Disassembly (Cont'd)

Figure 20-90-11



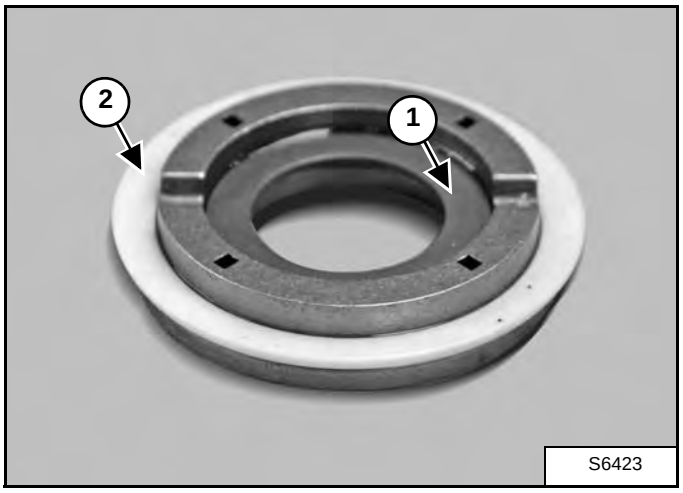
Remove the springs (Item 1) and pins (Item 2) **[Figure 20-90-11]**.

Figure 20-90-12



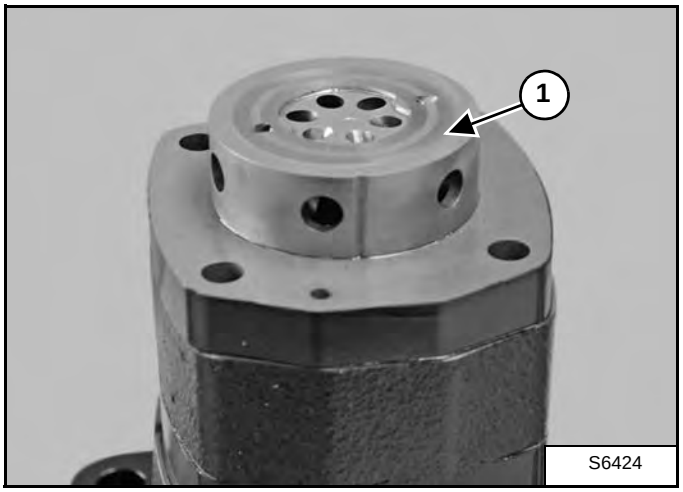
Remove the balance ring (Item 1) **[Figure 20-90-12]**.

Figure 20-90-13



Remove the inner seal (Item 1) and outer seal (Item 2) **[Figure 20-90-13]**.

Figure 20-90-14

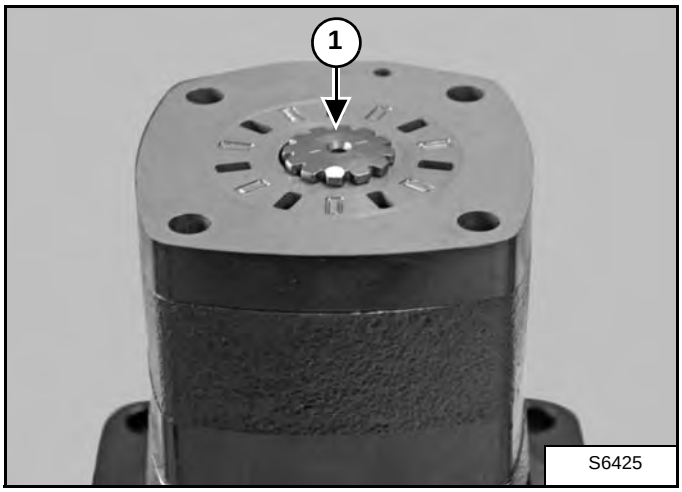


Remove the valve (Item 1) **[Figure 20-90-14]**.

Dealer Copy -- Not for Resale

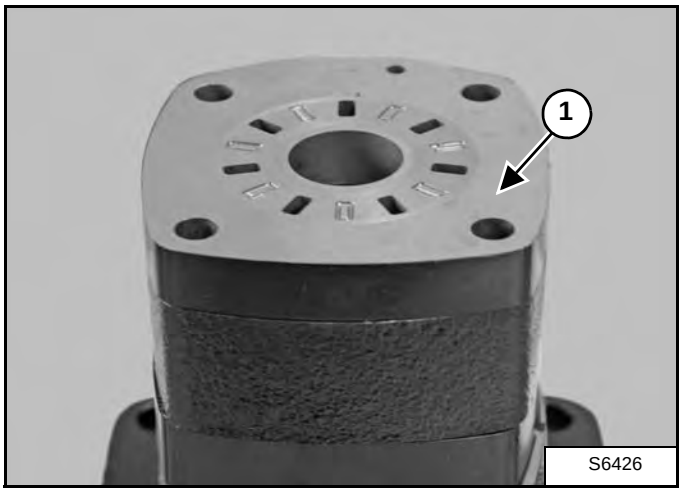
Disassembly (Cont'd)

Figure 20-90-15



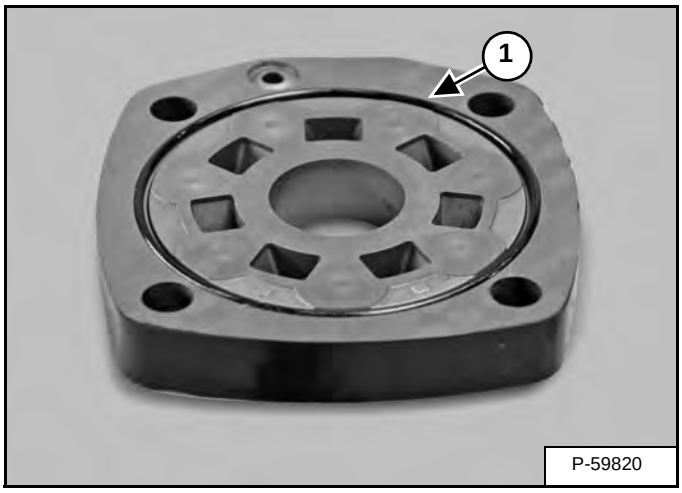
Remove the drive (Item 1) **[Figure 20-90-15]**.

Figure 20-90-16



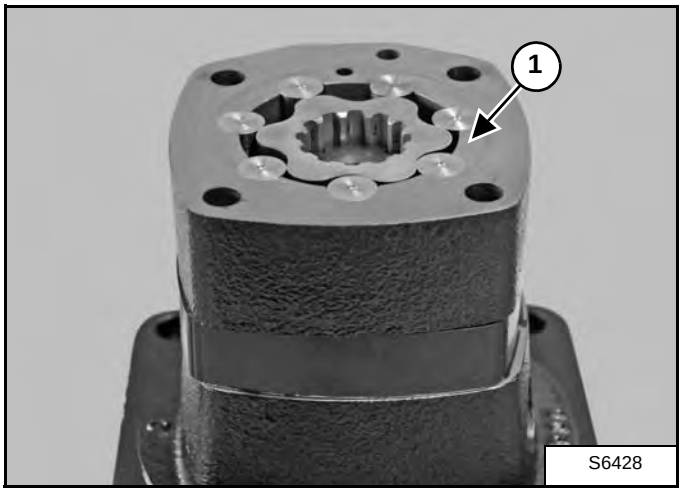
Remove the valve plate (Item 1) **[Figure 20-90-16]**.

Figure 20-90-17



Remove the O-ring (Item 1) **[Figure 20-90-17]** from the valve plate.

Figure 20-90-18



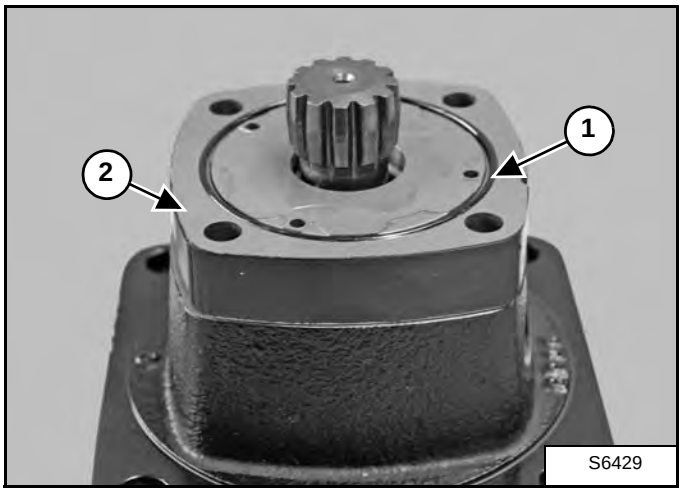
Remove the Geroler® (Item 1) **[Figure 20-90-18]**.

NOTE: Do not disassemble the Geroler®.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

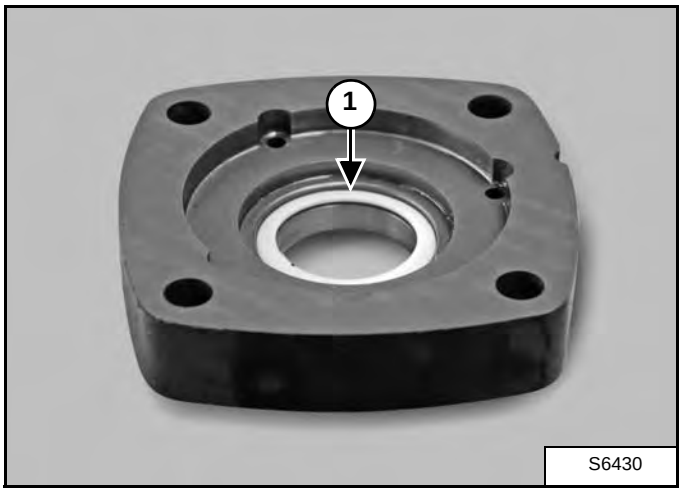
Figure 20-90-19



Remove the O-ring (Item 1) **[Figure 20-90-19]**.

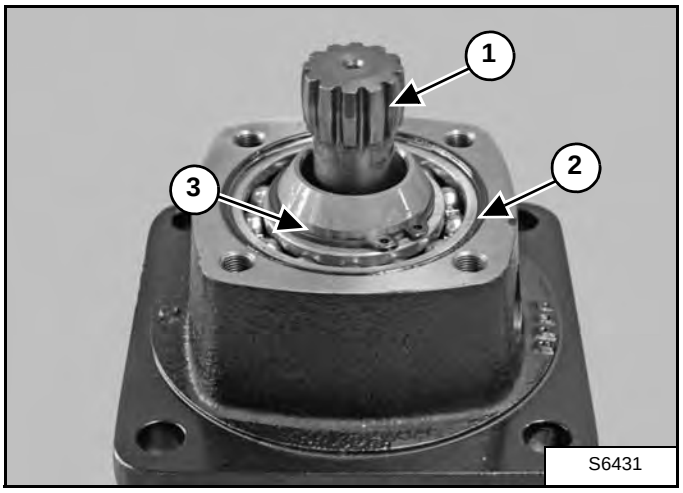
Remove the valve plate (Item 2) **[Figure 20-90-19]**.

Figure 20-90-20



Remove the seal (Item 1) **[Figure 20-90-20]** from the valve plate.

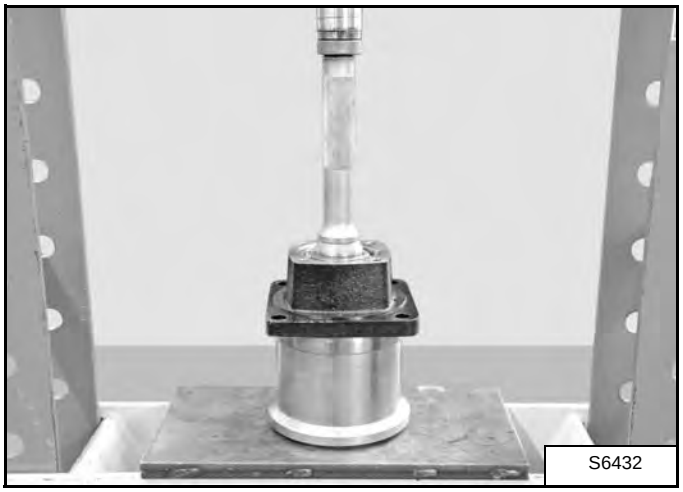
Figure 20-90-21



Remove the drive (Item 1) and O-ring (Item 2) **[Figure 20-90-21]**.

Remove the retaining ring (Item 3) **[Figure 20-90-21]**.

Figure 20-90-22

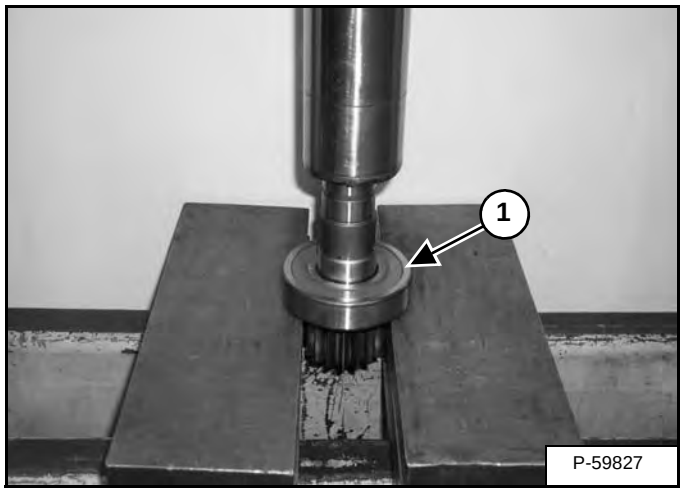


Press the shaft out of the housing **[Figure 20-90-22]**.

Dealer Copy -- Not for Resale

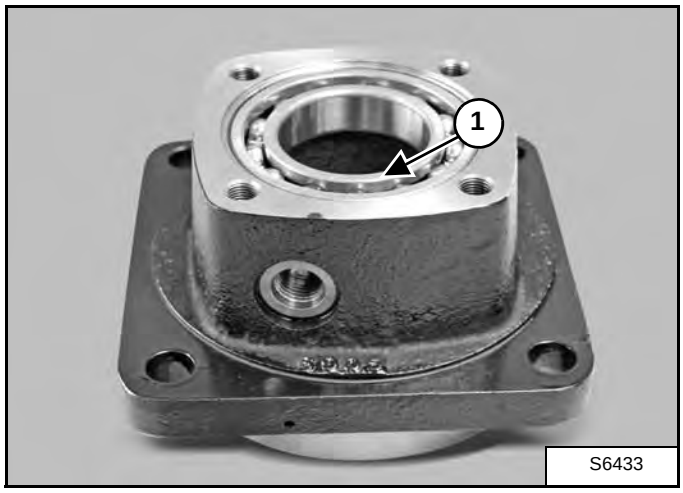
Disassembly (Cont'd)

Figure 20-90-23



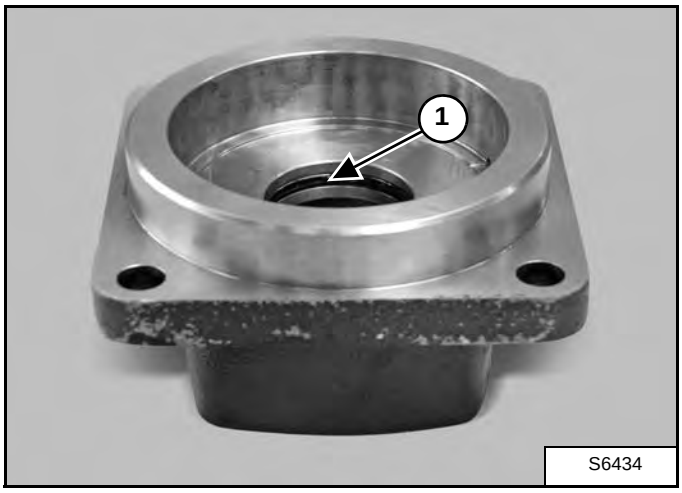
Press the bearing (Item 1) **[Figure 20-90-23]** off of the shaft.

Figure 20-90-24



Remove the bearing (Item 1) **[Figure 20-90-24]** from the housing.

Figure 20-90-25



Remove the seal (Item 1) **[Figure 20-90-25]** from the housing.

Dealer Copy -- Not for Resale

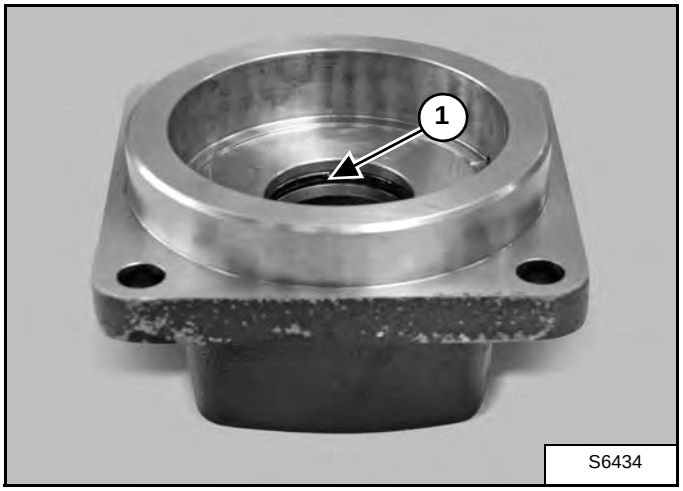
Assembly

Clean all parts in solvent and dry with compressed air.

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

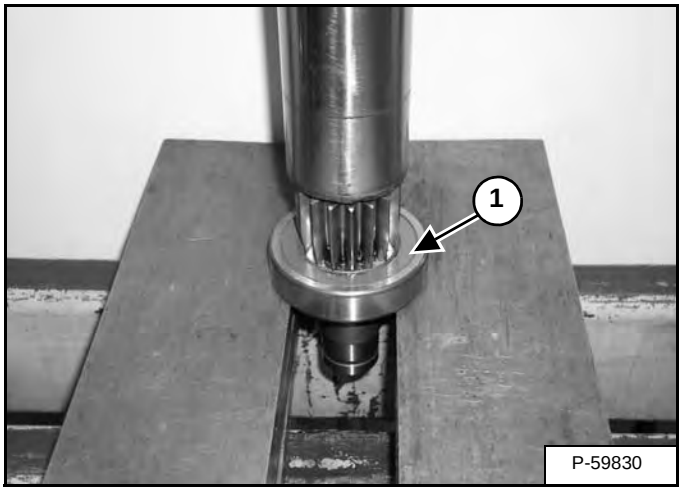
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-90-26



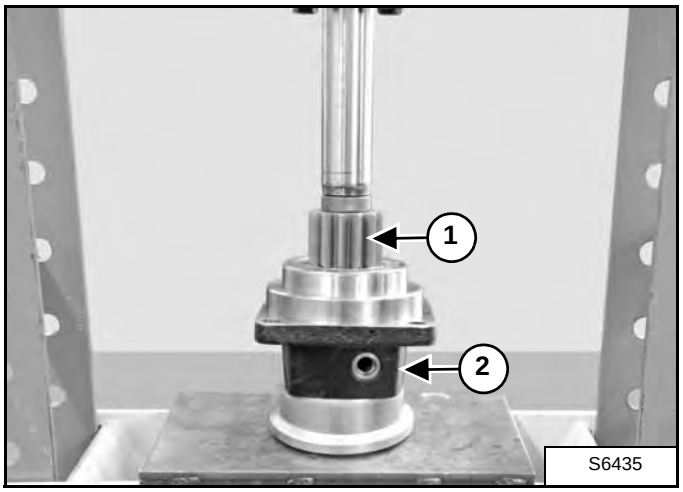
Install the seal (Item 1) **[Figure 20-90-26]** in the housing.

Figure 20-90-27



Press the bearing (Item 1) **[Figure 20-90-27]** on the shaft.

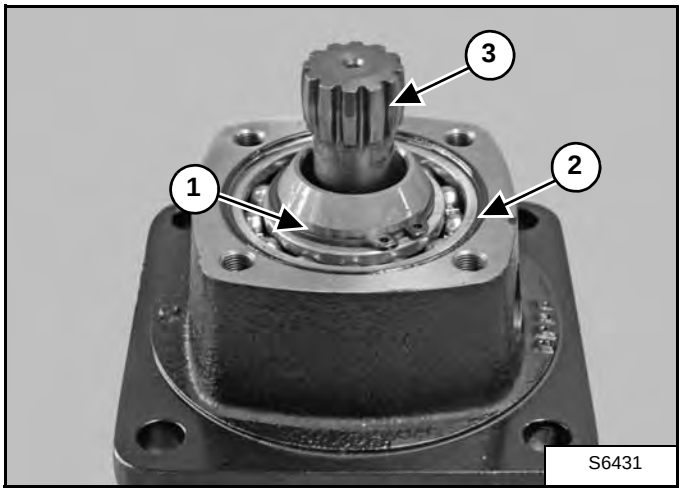
Figure 20-90-28



Press the shaft (Item 1) **[Figure 20-90-28]** in the housing.

Apply assembly lube to the bearing and press the bearing (Item 2) **[Figure 20-90-28]** in the housing.

Figure 20-90-29



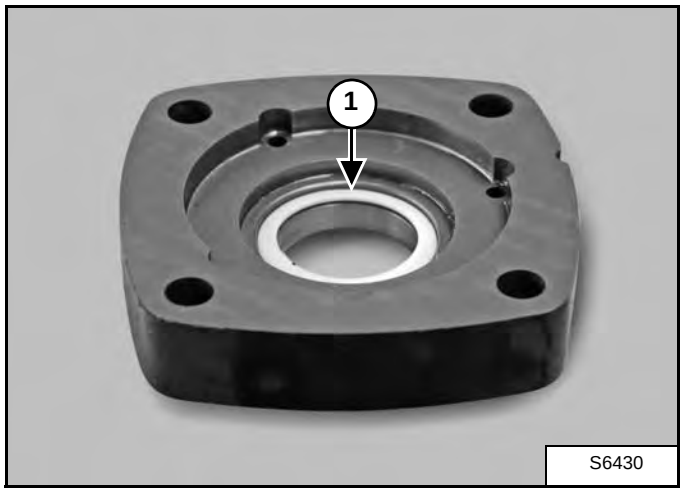
Install the retaining ring (Item 1) and O-ring (Item 2) **[Figure 20-90-29]**.

Install the drive (Item 3) **[Figure 20-90-29]**.

Dealer Copy -- Not for Resale

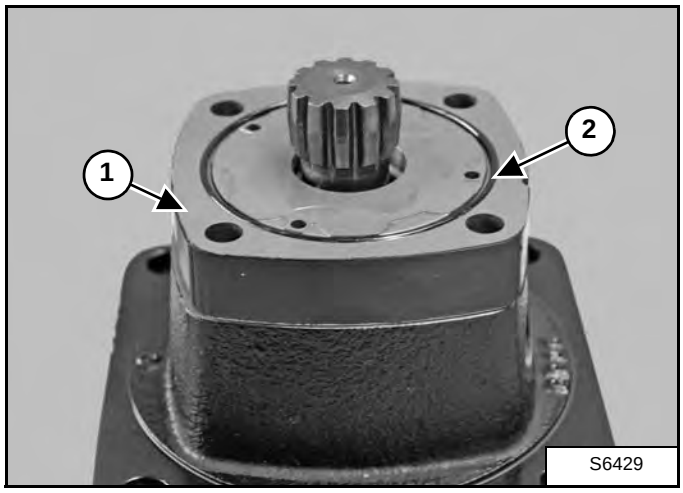
Assembly (Cont'd)

Figure 20-90-30



Install the seal (Item 1) **[Figure 20-90-30]** in the valve plate.

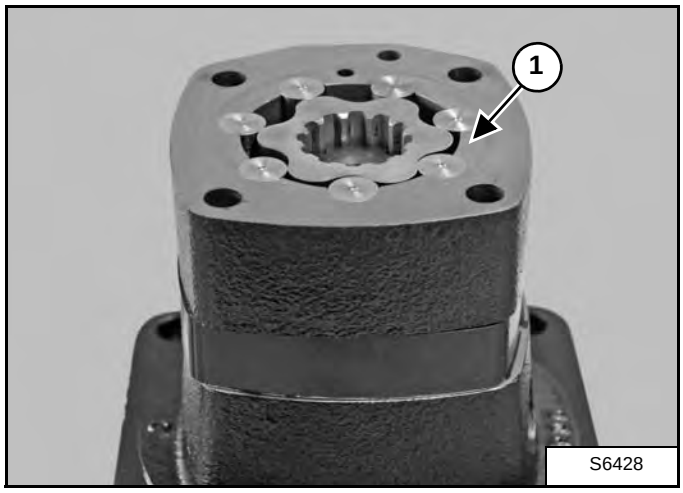
Figure 20-90-31



Install the valve plate (Item 1) **[Figure 20-90-31]**.

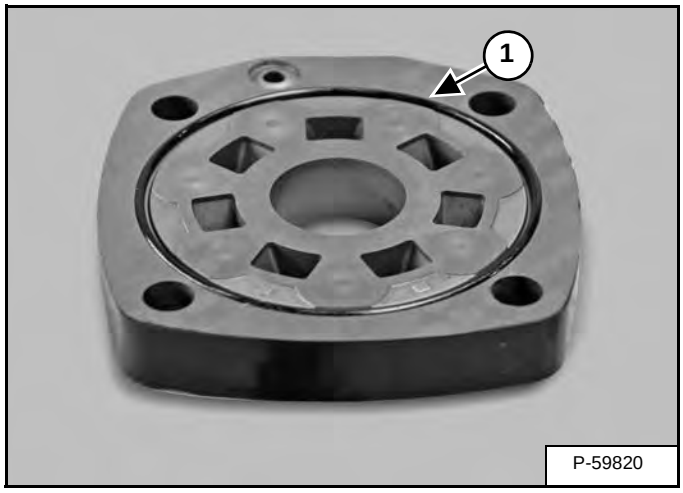
Install the O-ring (Item 2) **[Figure 20-90-31]**.

Figure 20-90-32



Install the Geroler® (Item 1) **[Figure 20-90-32]**.

Figure 20-90-33



Install the O-ring (Item 1) **[Figure 20-90-33]** on the valve plate.

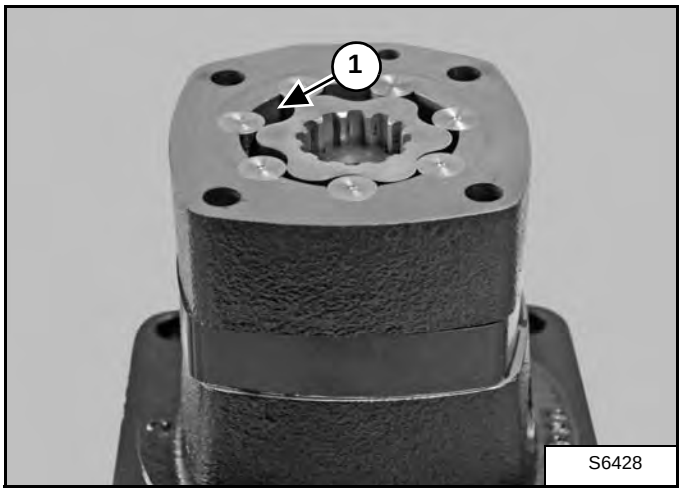
Dealer Copy -- Not for Resale

Assembly (Cont'd)

Motor Timing

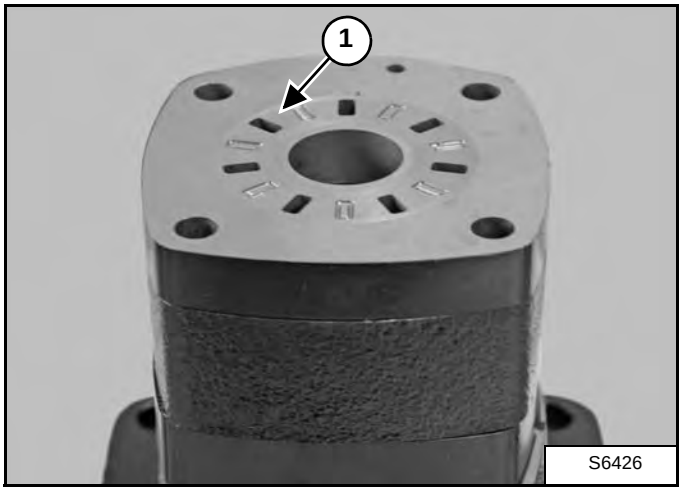
The direction that the output shaft rotates is determined by timing. Time the motor as follows:

Figure 20-90-34



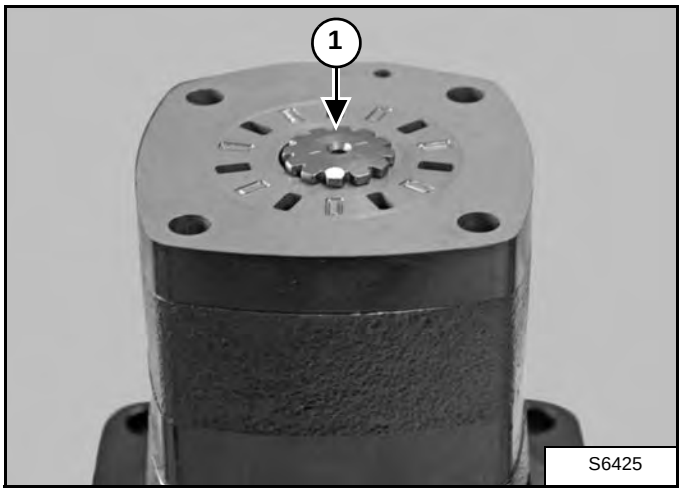
Locate the largest open pocket in the Geroler® (Item 1) **[Figure 20-90-34]**.

Figure 20-90-35



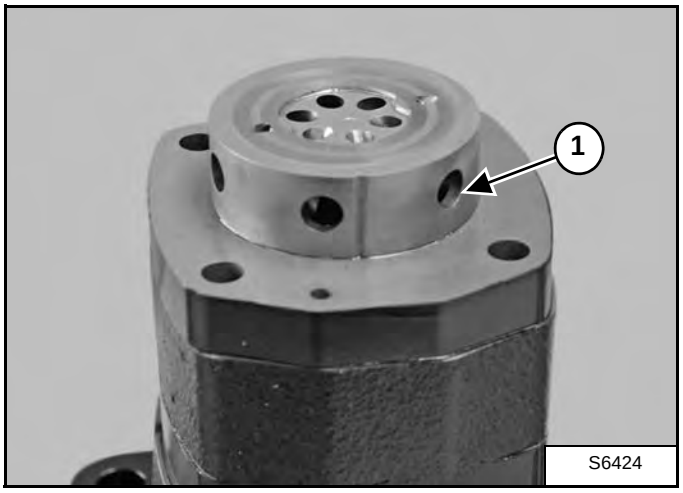
Install the valve plate and locate the open slot (Item 1) **[Figure 20-90-35]** that is over the largest open Geroler® pocket.

Figure 20-90-36



Install the drive (Item 1) **[Figure 20-90-36]**.

Figure 20-90-37



NOTE: Picture position has changed 180°.

Align one of the side openings (Item 1) **[Figure 20-90-37]** in the valve with the valve plate slot that is over the largest open Geroler® pocket.

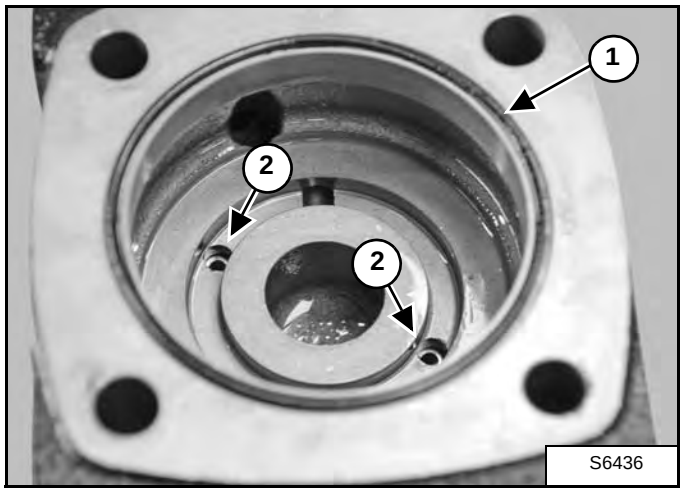
Engage the valve with the valve drive by rotating it 15° clockwise until the spline teeth mesh.

NOTE: If the valve is turned clockwise the motor will rotate in the opposite direction.

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Assembly (Cont'd)

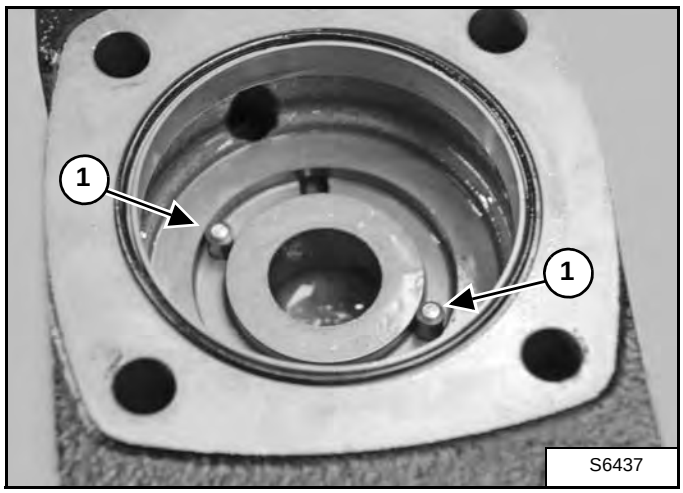
Figure 20-90-38



Install the O-ring (Item 1) **[Figure 20-90-38]**.

Apply assembly lube to the springs, and install the springs (Item 2) **[Figure 20-90-38]**.

Figure 20-90-39



Install the pins (Item 1) **[Figure 20-90-39]**.

Figure 20-90-40

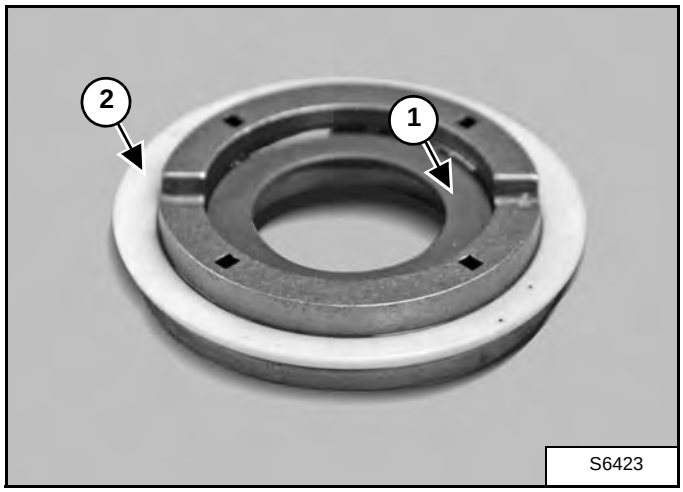
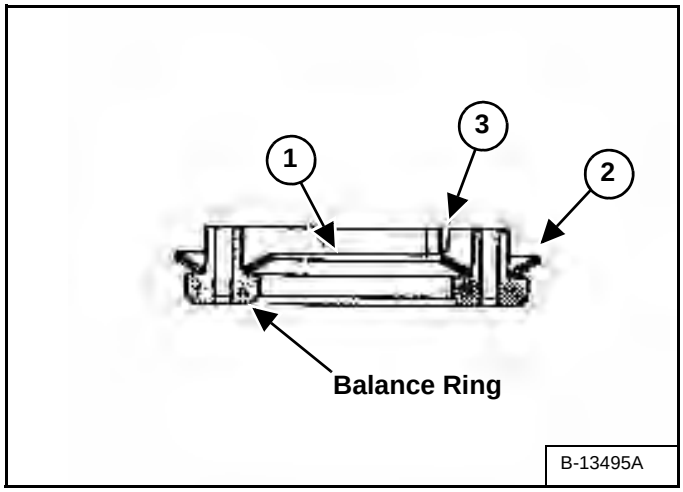


Figure 20-90-41

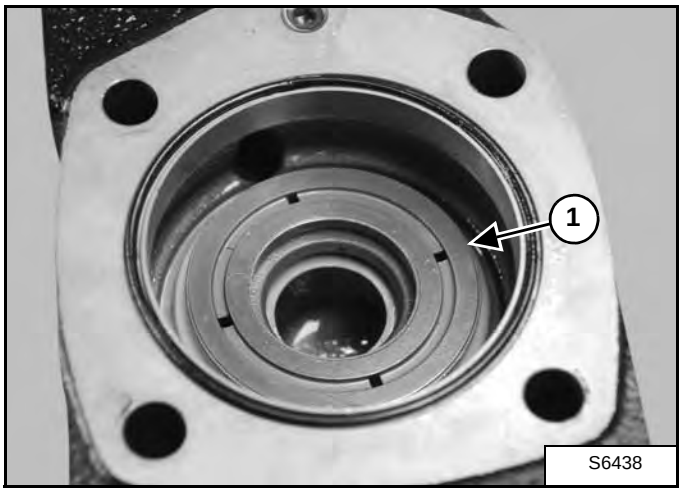


Install the inner (Item 1) and outer (Item 2) **[Figure 20-90-40]** and **[Figure 20-90-41]** face seals on the balance ring as shown.

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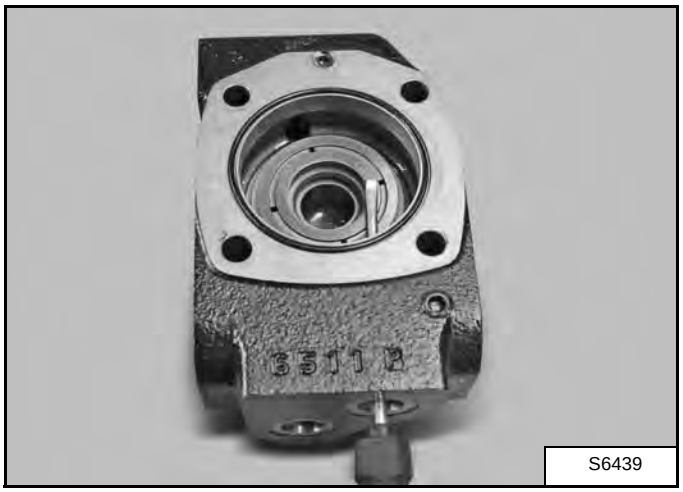
Assembly (Cont'd)

Figure 20-90-42



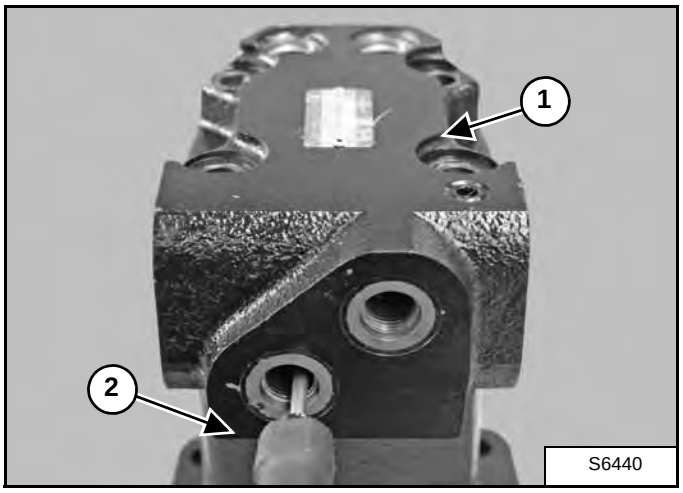
Install the balance ring (Item 1) **[Figure 20-90-42]**. Make sure the pins engage the pin notches (Item 3) **[Figure 20-90-41]** in the balance ring.

Figure 20-90-43



Insert a small screw driver through the port in the housing. Apply pressure to the side of the balance ring assembly until the valve housing is in place **[Figure 20-90-43]**.

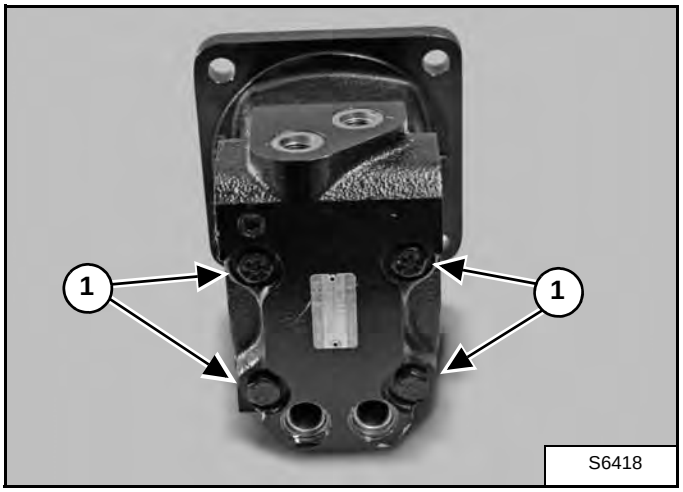
Figure 20-90-44



Install the housing (Item 1) **[Figure 20-90-44]** on the motor.

Remove the screwdriver (Item 2) **[Figure 20-90-44]**.

Figure 20-90-45



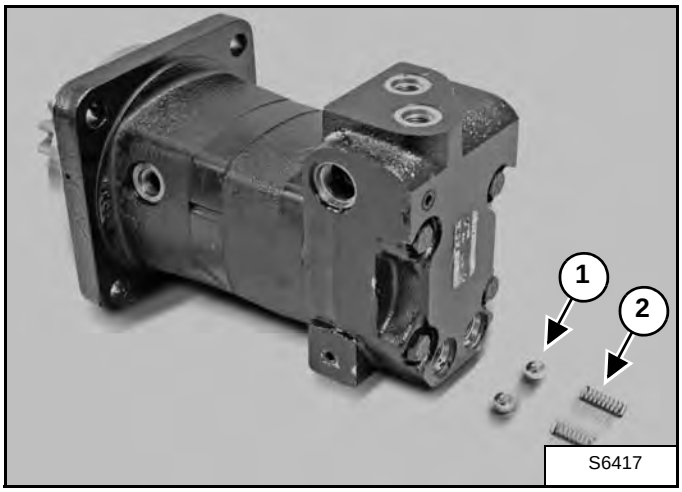
Install the bolts (Item 1) **[Figure 20-90-45]**. Tighten the bolts to 50 N•m (37 ft-lb) torque in a crisscross pattern.

Installation: Tighten the bolts to 53 N•m (39.1 ft-lb) torque.

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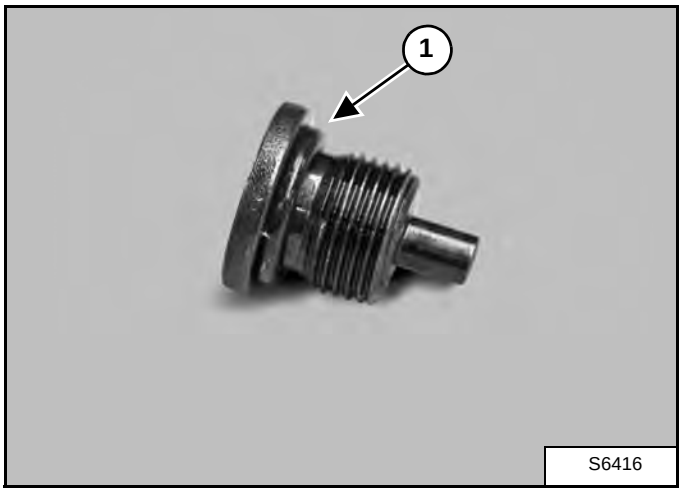
Assembly (Cont'd)

Figure 20-90-46



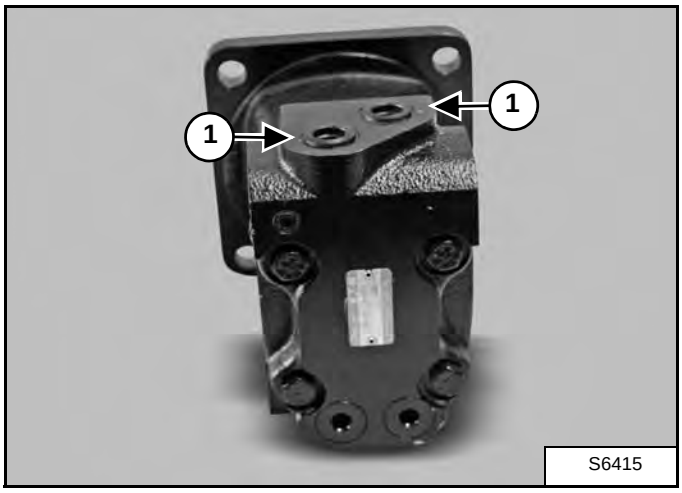
Install the balls (Item 1) and springs (Item 2) **[Figure 20-90-46]**.

Figure 20-90-47



Install the O-ring (Item 1) **[Figure 20-90-47]** on the plugs.

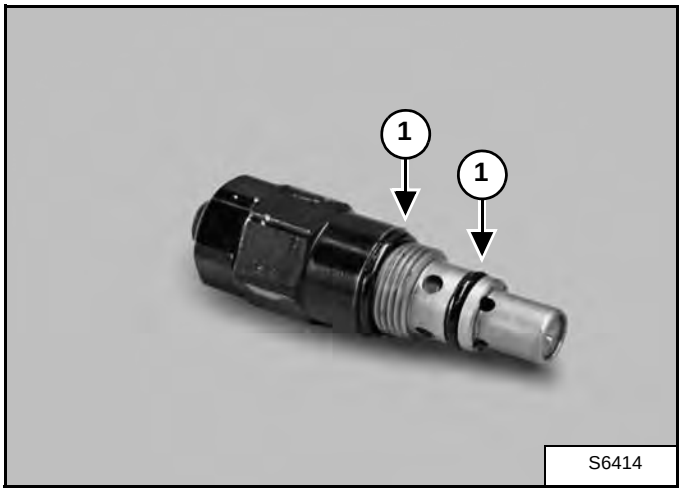
Figure 20-90-48



Install the plugs (Item 1) **[Figure 20-90-48]**.

Installation: Tighten the bolts to 59 N•m (43.5 ft-lb) torque.

Figure 20-90-49

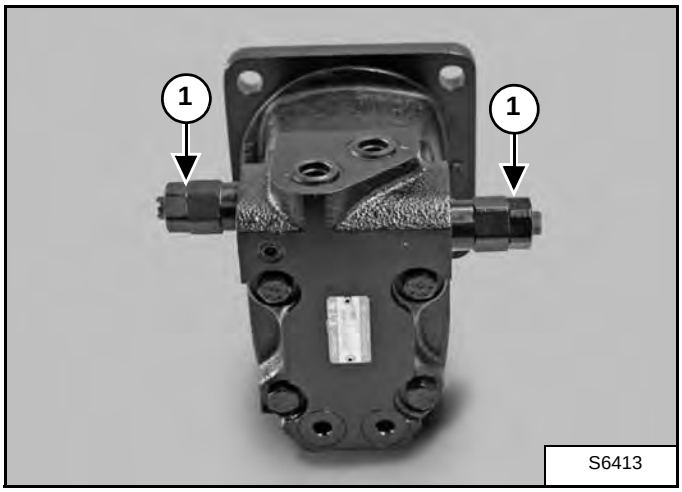


Install the O-rings (Item 1) **[Figure 20-90-49]** on the crossport relief valves.

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Assembly (Cont'd)

Figure 20-90-50

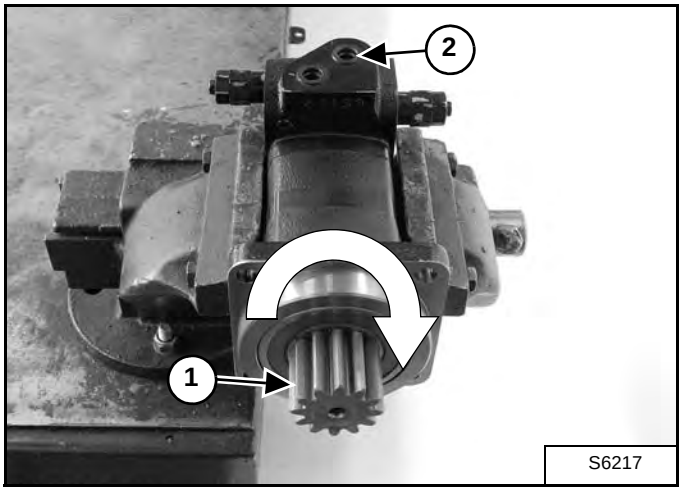


Install the crossport relief valves (Item 1) **[Figure 20-90-50]**.

Installation: Tighten the bolts to 98 N•m (72 ft-lb) torque.

Clamp the motor in a vise.

Figure 20-90-51



Turn the shaft (Item 1) **[Figure 20-90-51]** in a clockwise direction.

If the motor is correctly timed, there will be suction at the top port (Item 2) **[Figure 20-90-51]**.

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CONTROL LEVER (JOYSTICK) (RIGHT)

Description

The right control lever (joystick) operates using pilot pressure to move the boom and / or bucket spools in the control valve. The right control lever (joystick) will be locked in the down position in a cab equipped excavator and moveable in a canopy equipped excavator. The right control lever (joystick), in a canopy equipped excavator, has a microswitch that will lockout the hydraulic functions in the raised position and enable the hydraulic functions in the down (locked) position.

Testing

Check the pressure reducing valve for the correct pressure. (See Testing And Adjusting on Page 20-33-1.)

The following tools will be needed to perform the procedure:

MEL1355 - Hydraulic Test Kit

Lower the boom / bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

Remove the bottom half of the right console cover.

IMPORTANT

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

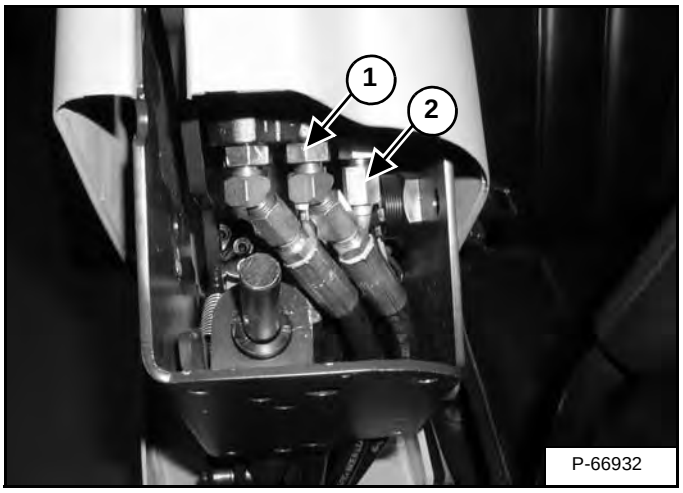
I-2003-0888

⚠ WARNING

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

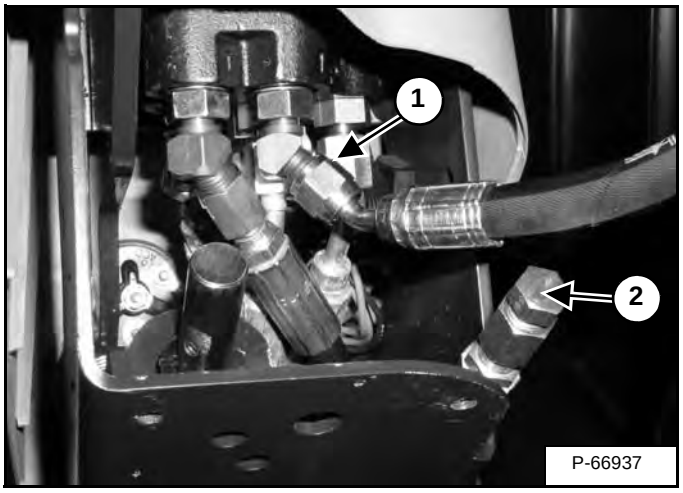
W-2145-EN-0210

Figure 20-100-1



At the bottom of the right control lever (joystick), find the pilot hose connected to Port 1 (Item 1) and Port 4 (Item 2) **[Figure 20-100-1]** labeled on the side of the right control lever (joystick) casting. Port 1 is the pilot pressure for the Boom function and Port 4 is the pilot pressure for the Bucket function.

Figure 20-100-1



Remove the pilot hose **[Figure 20-100-1]** from the bottom of the control lever (joystick) that is to be checked.

Install a fitting and gauge hose (Item 1) **[Figure 20-100-1]** from the test kit on the control lever (joystick) fitting.

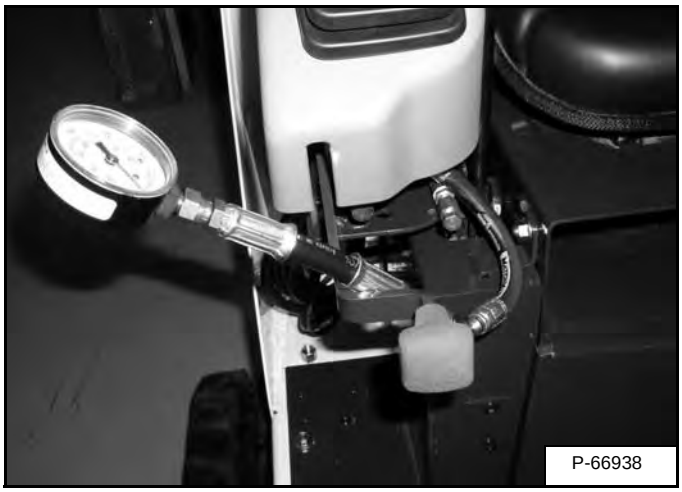
Cap the pilot hose (Item 2) **[Figure 20-100-1]**.

Dealer Copy -- Not for Resale

CONTROL LEVER (JOYSTICK) (RIGHT) (CONT'D)

Testing (Cont'd)

Figure 20-100-2



Install a 6,9 MPa (69 bar) (1000 psi) gauge on the hose **[Figure 20-100-2]**.

Lower the right console to the locked position **[Figure 20-100-2]**. Also lower the left console to the locked position if it is in the vertical position.

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

Check the gauge with the control levers (joystick) in neutral. The hydraulic pressure should be 0 kPa (0 bar) (0 psi).

Engage the to be tested circuit. Record the operating pressure.

The operating pressure should be as follows:

3 MPa (30 bar) (435 psi) with an acceptable range of 2,8 - 3,1MPa (28 - 31 bar) (406 - 450 psi).

If the operating pressure is correct, check the valve section spool for proper operation.

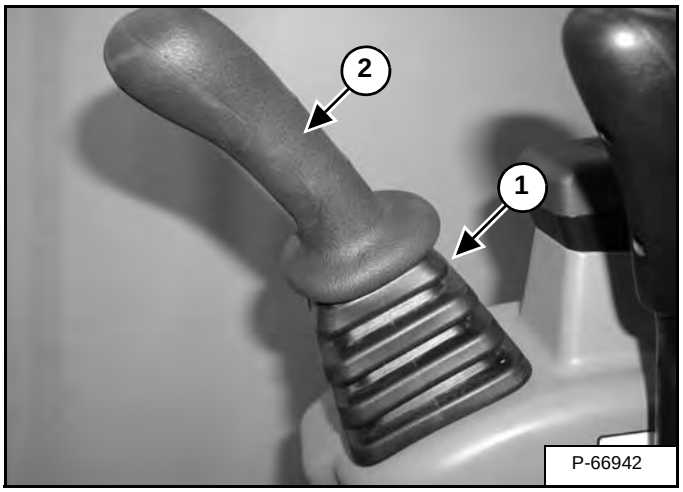
If the operating pressure is incorrect, remove the pressure reducing valve, clean, install and retest. (See Testing And Adjusting on Page 20-33-1.)

If the pressure is still incorrect replace the pressure reducing valve. (See Testing And Adjusting on Page 20-33-1.)

Dealer Copy -- Not for Resale

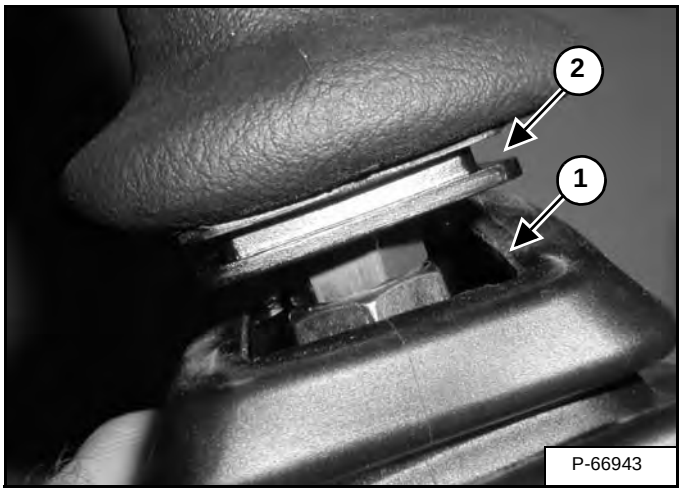
Handle Removal And Installation

Figure 20-100-3



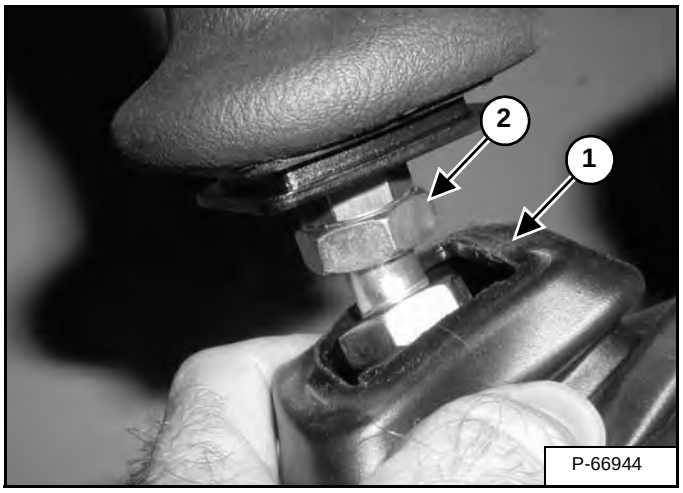
Remove the dust boot (Item 1) from the handle (Item 2) **[Figure 20-100-3]**.

Figure 20-100-4



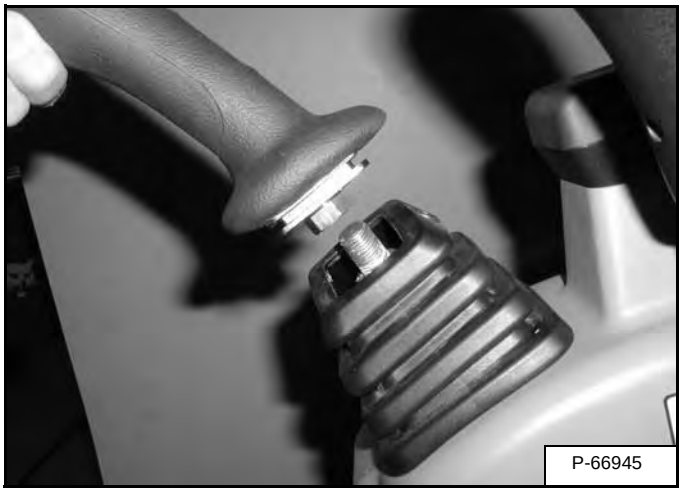
Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-100-4]** in the control handle.

Figure 20-100-5



Hold the dust boot (Item 1) down and loosen the jam nut (Item 2) **[Figure 20-100-5]**.

Figure 20-100-6



Remove the handle **[Figure 20-100-6]**.

Dealer Copy -- Not for Resale

CONTROL LEVER (JOYSTICK) (RIGHT) (CONT'D)

Removal And Installation

Lower the boom / bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

Remove the console cover. (See Right Rear Console Cover Removal And Installation on Page 40-50-10.)

IMPORTANT

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

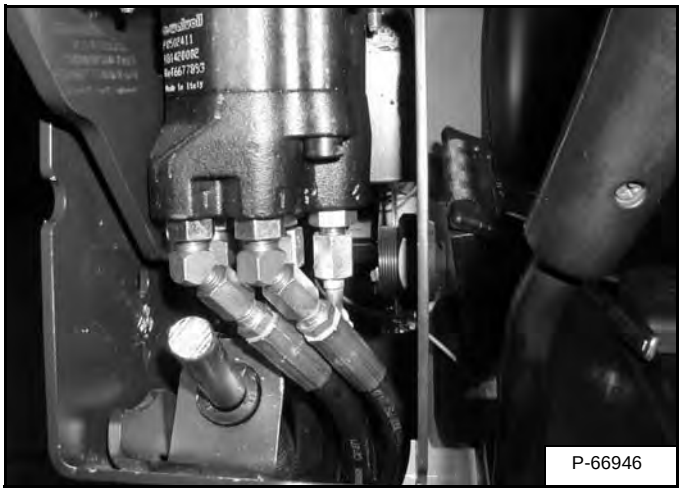
I-2003-0888

⚠ WARNING

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

W-2145-EN-0210

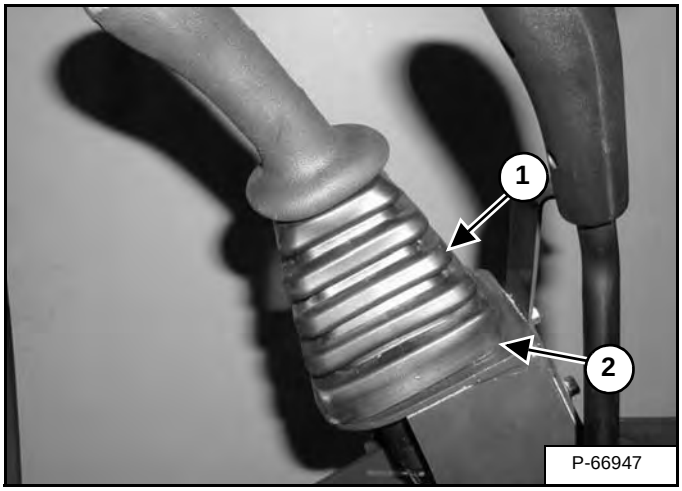
Figure 20-100-7



Mark the hoses for ease of assembly **[Figure 20-100-7]**.

Remove the hoses while the control lever (joystick) is bolted to the console **[Figure 20-100-7]**.

Figure 20-100-8

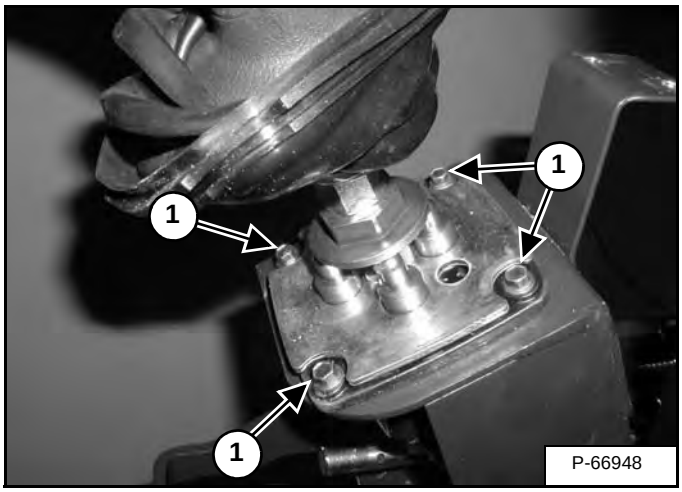


Raise the dust boot (Item 1) up from the mounting plate (Item 2) **[Figure 20-100-8]**.

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Removal And Installation (Cont'd)

Figure 20-100-9



Remove the bolts (Item 1) **[Figure 20-100-9]** from the control lever (joystick) mounting plate.

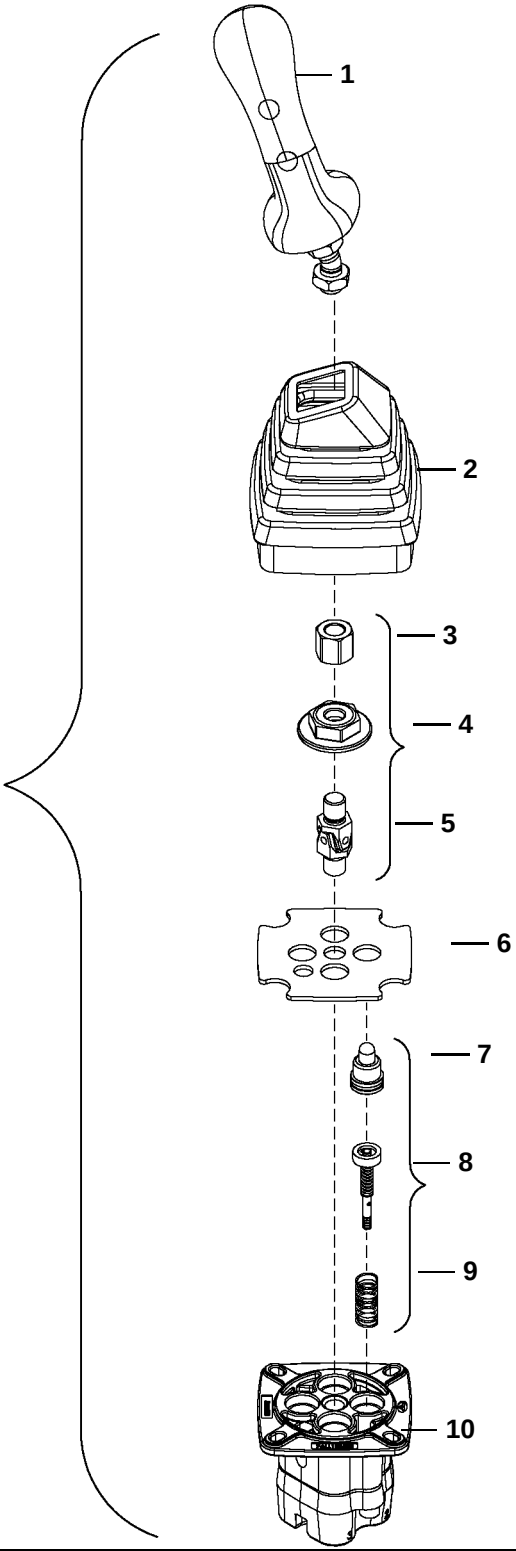
Remove the control lever (joystick) from the console frame.

Dealer Copy -- Not for Resale

CONTROL LEVER (JOYSTICK) (RIGHT) (CONT'D)

Parts Identification

1. Handle
2. Dust Boot
3. Coupler
4. Actuator Control Plate
5. U-Joint
6. Plate
7. Plunger Assembly
8. Spool
9. Spring
10. Housing



MS1353

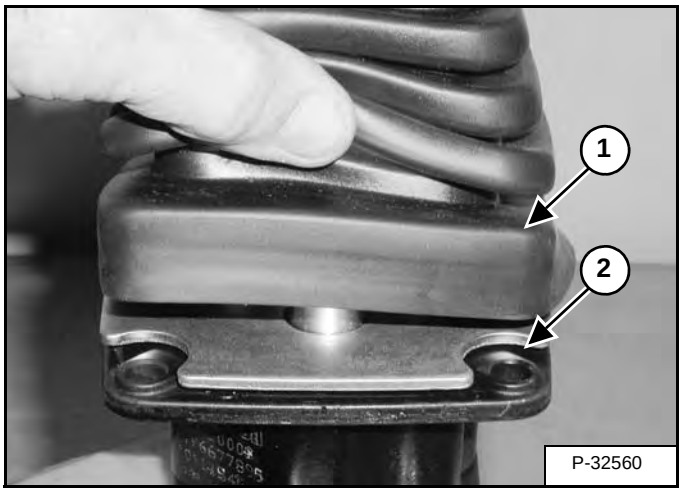
Dealer Copy -- Not for Resale

Disassembly

Remove the right handle. (See Handle Removal And Installation on Page 20-100-3.)

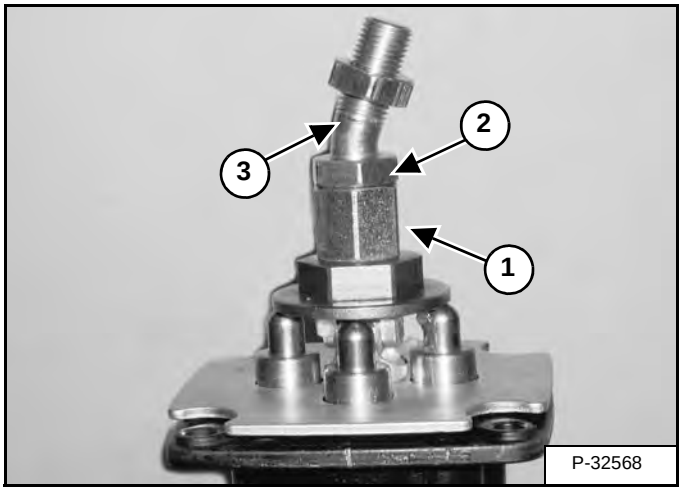
Clean the outside of the control lever before disassembly.

Figure 20-100-10



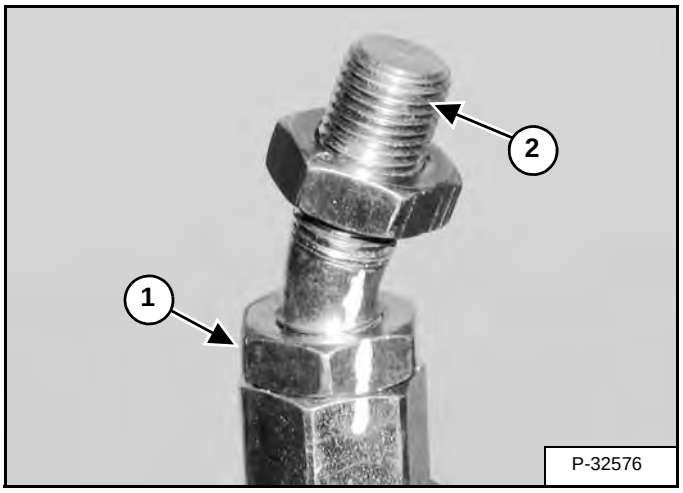
Remove the boot (Item 1) from the control lever (joystick) (Item 2) **[Figure 20-100-10]**.

Figure 20-100-11



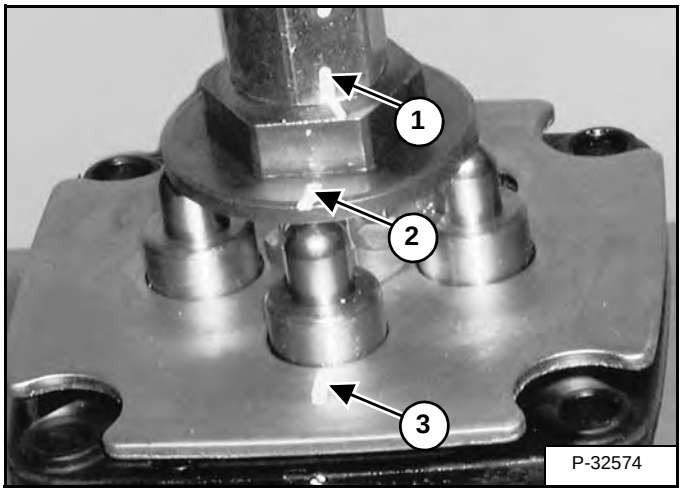
Mark the coupler (Item 1), nut (Item 2) and connector (Item 3) **[Figure 20-100-11]** for correct assembly.

Figure 20-100-12



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-100-12]**.

Figure 20-100-13

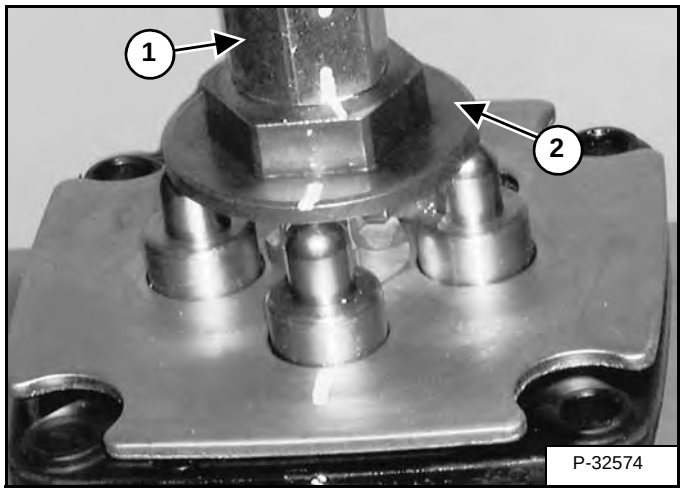


Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-100-13]** for correct installation.

Dealer Copy -- Not for Resale

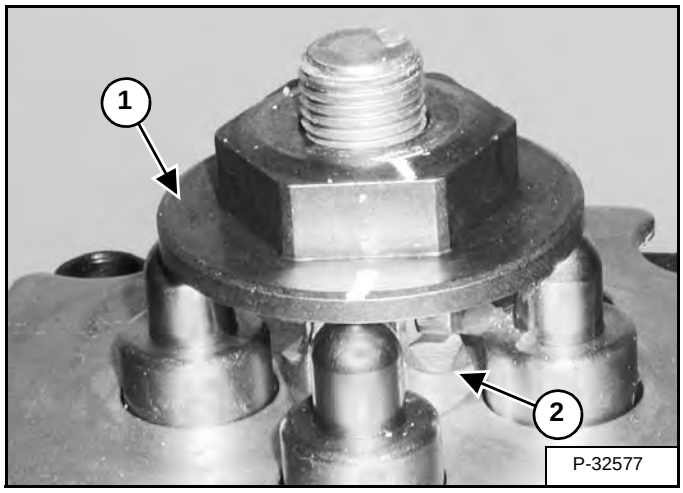
Disassembly (Cont'd)

Figure 20-100-14



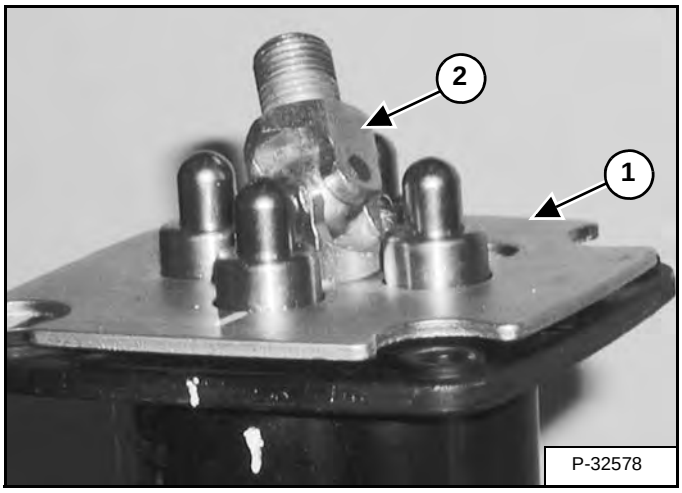
Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-100-14]**.

Figure 20-100-15



Remove the control plate (Item 1) from the U-Joint (Item 2) **[Figure 20-100-15]**.

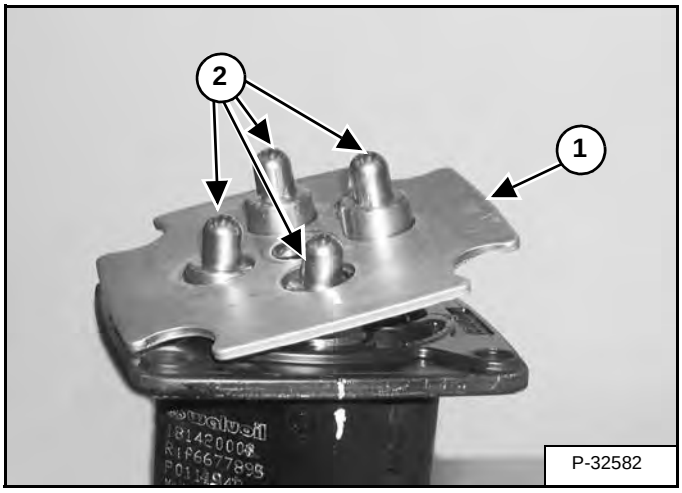
Figure 20-100-16



Mark the plate (Item 1) and housing for correct installation. Remove the U-joint (Item 2) **[Figure 20-100-16]**.

NOTE: The plate (Item 1) is spring loaded and will come up as the U-joint (Item 2) [Figure 20-100-16] is removed.

Figure 20-100-17



Remove the plate (Item 1) **[Figure 20-100-17]**.

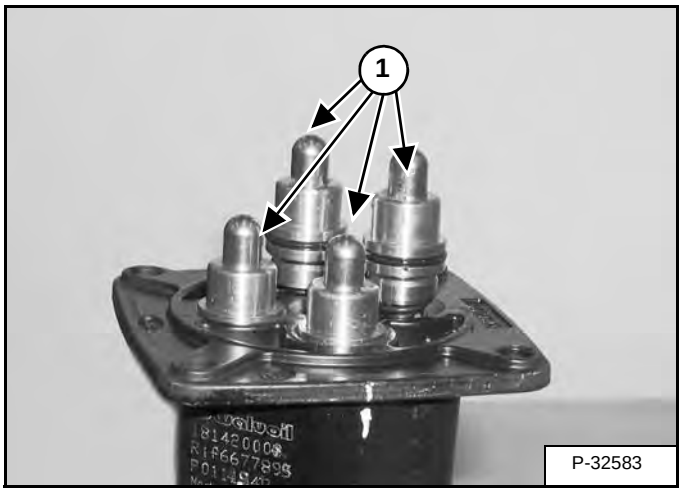
NOTE: Use care while removing the plate. The plungers (Item 2) [Figure 20-100-17] are spring loaded.

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CONTROL LEVER (JOYSTICK) (RIGHT) (CONT'D)

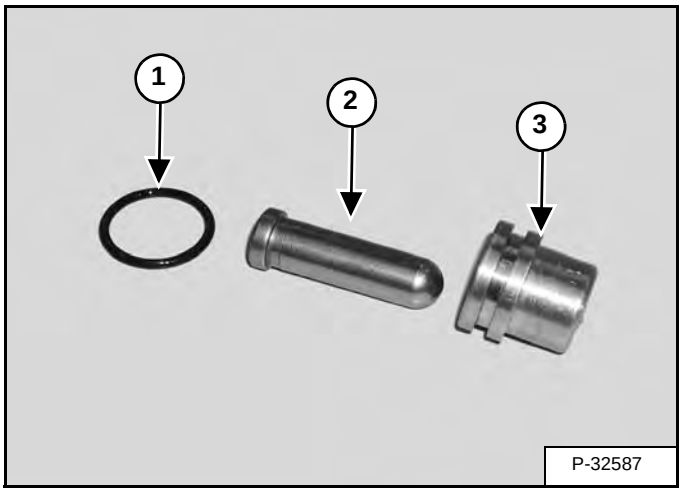
Disassembly (Cont'd)

Figure 20-100-18



Remove the plunger assemblies (Item 1) **[Figure 20-100-18]**.

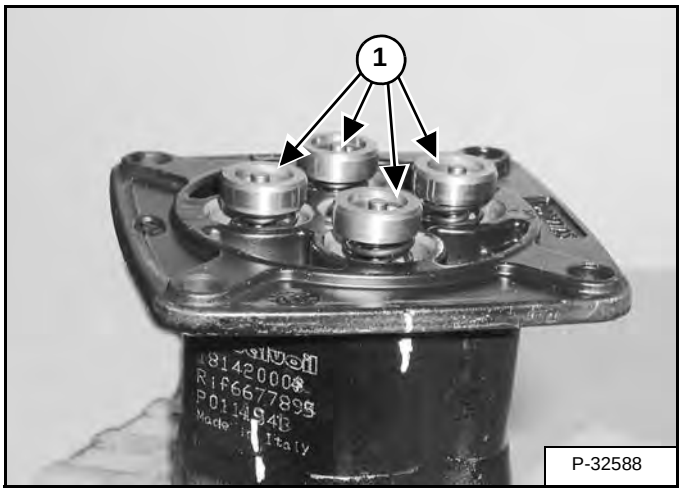
Figure 20-100-19



Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-100-19]**.

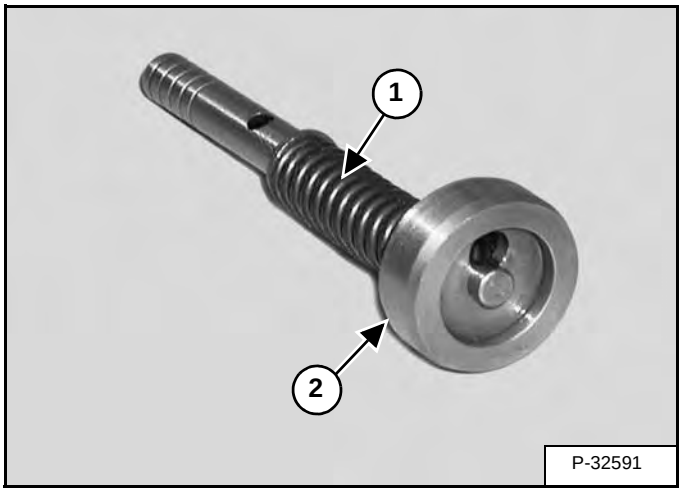
NOTE: Mark the spool assemblies for installation in their original location.

Figure 20-100-20



Remove the spool assemblies (Item 1) **[Figure 20-100-20]**.

Figure 20-100-21

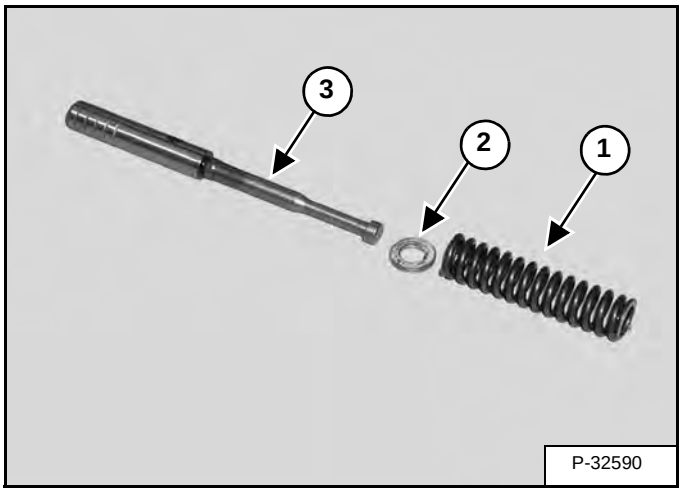


Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-100-21]**.

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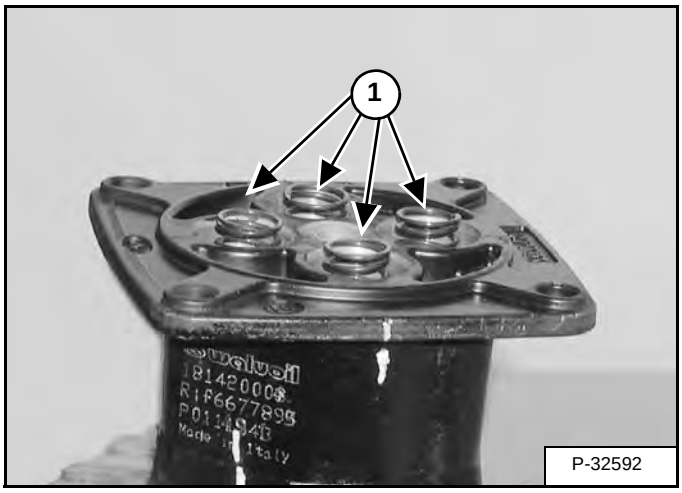
Disassembly (Cont'd)

Figure 20-100-22



Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-100-22]**.

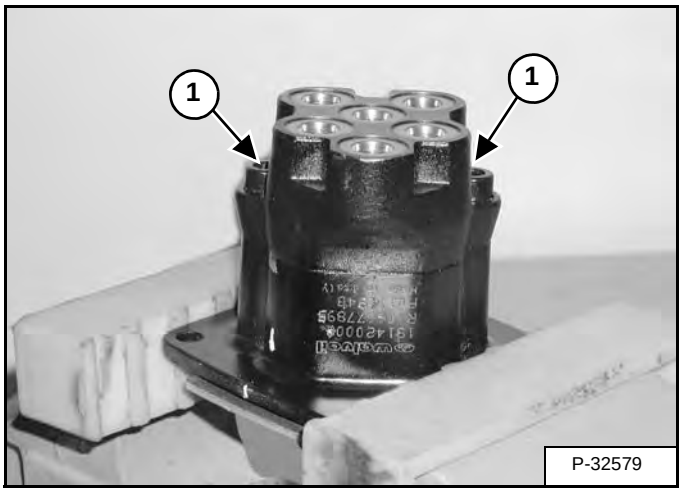
Figure 20-100-23



Remove the springs (Item 1) **[Figure 20-100-23]** from the housing.

Clamp the housing in a vise that is equipped with padded jaws.

Figure 20-100-24

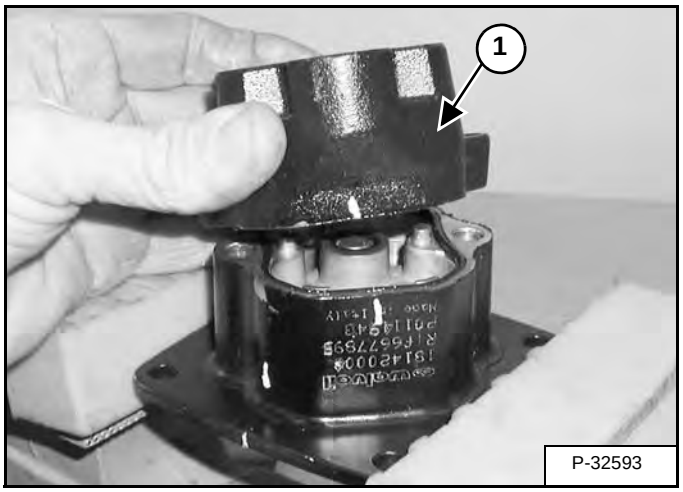


Remove the bolts (Item 1) **[Figure 20-100-24]**.

Dealer Copy -- Not for Resale

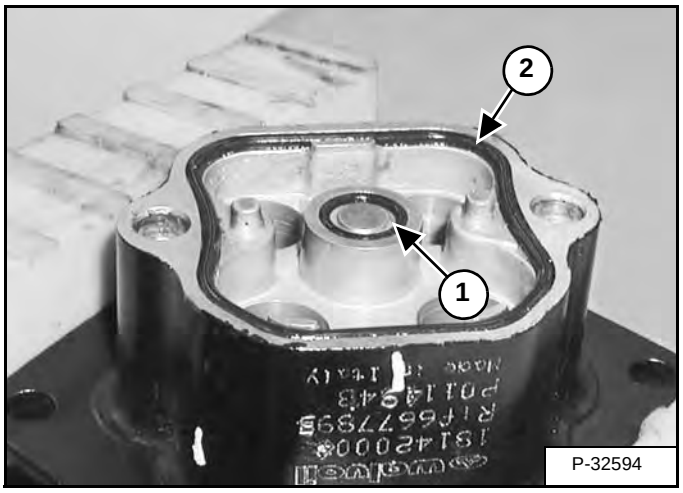
Disassembly (Cont'd)

Figure 20-100-25



Remove the end cap (Item 1) **[Figure 20-100-25]**.

Figure 20-100-26



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-100-26]**.

Dealer Copy -- Not for Resale

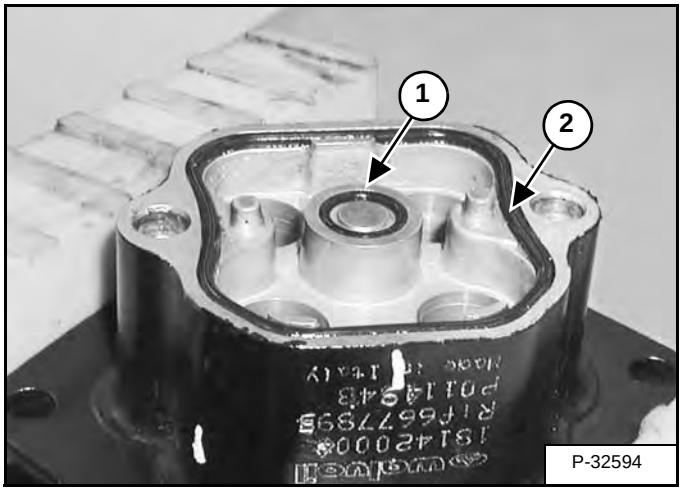
Assembly

Clean all parts in solvent and dry with compressed air.

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

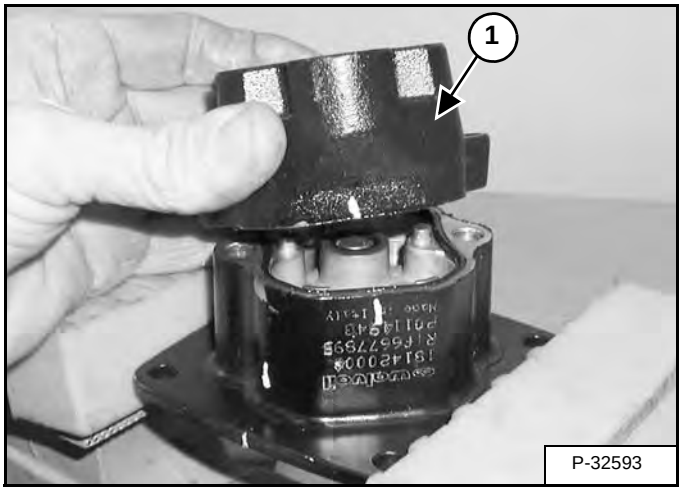
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-100-27



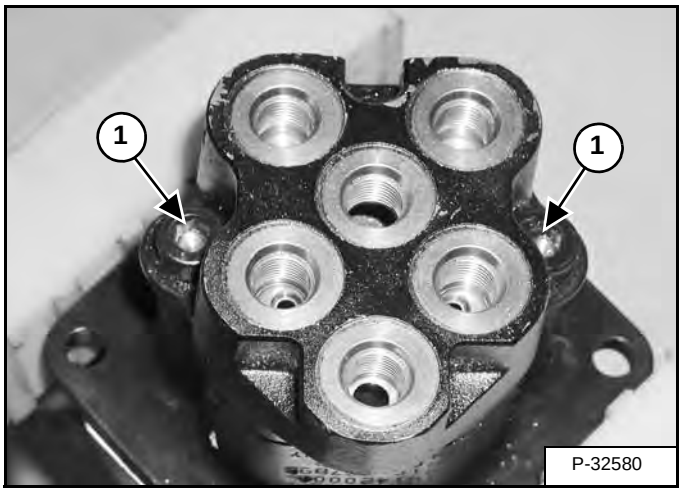
Clamp the housing in a vise equipped with padded jaws. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-100-27]**.

Figure 20-100-28



Install the end cap (Item 1) **[Figure 20-100-28]**.

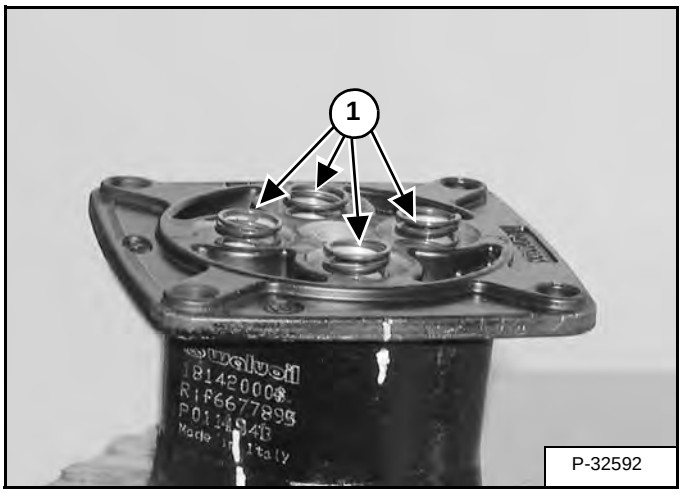
Figure 20-100-29



Install the bolts (Item 1) **[Figure 20-100-29]**.

Turn the housing over.

Figure 20-100-30

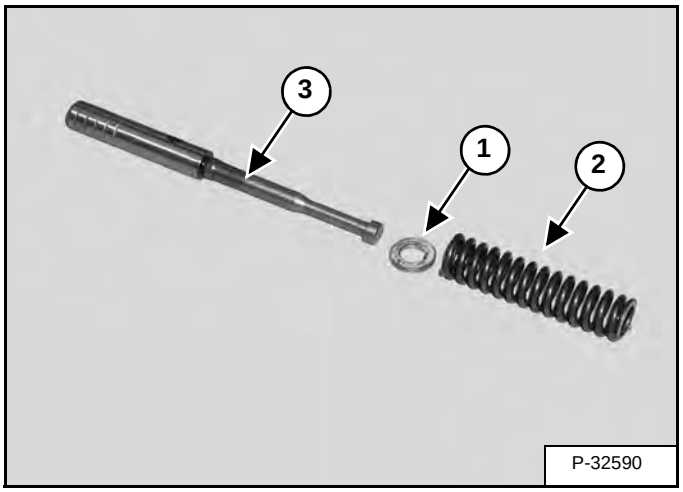


Install the springs (Item 1) **[Figure 20-100-30]**.

Dealer Copy -- Not for Resale

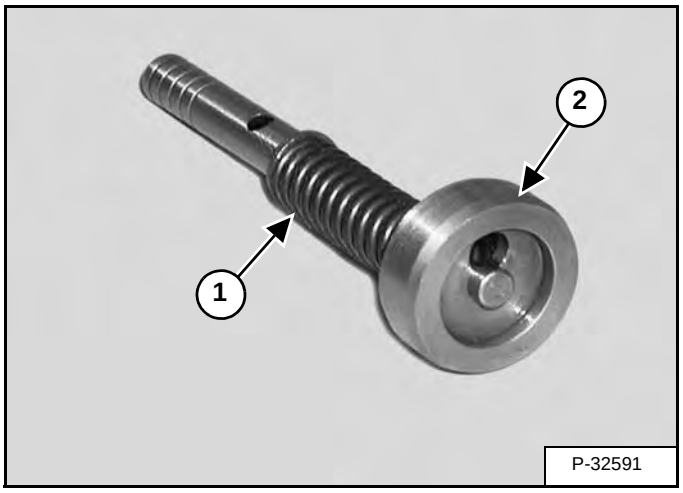
Assembly (Cont'd)

Figure 20-100-31



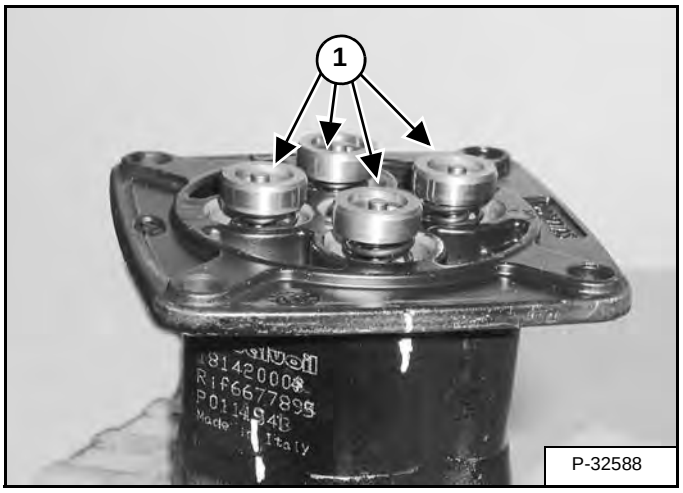
Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-100-31]**.

Figure 20-100-32



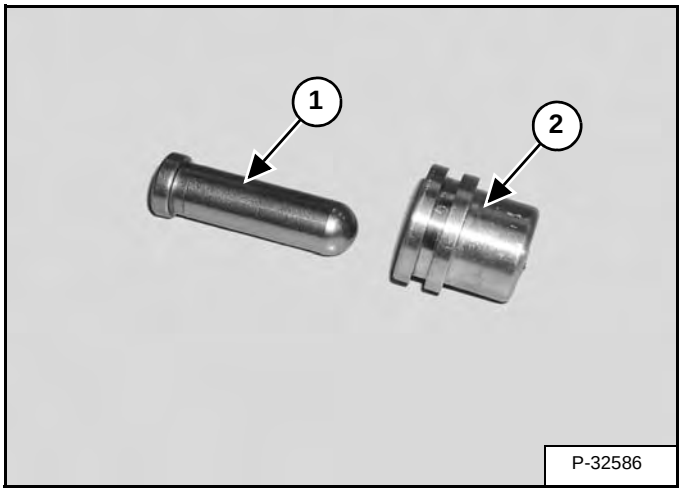
Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-100-32]**.

Figure 20-100-33



Install the spool assemblies (Item 1) **[Figure 20-100-33]** into the housing.

Figure 20-100-34

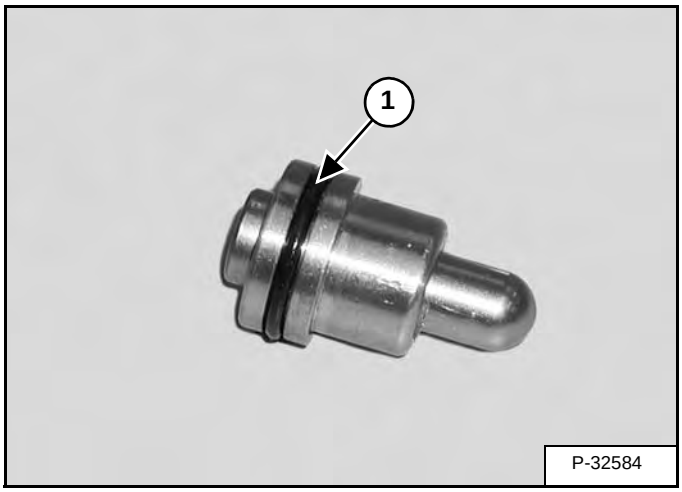


Install the plunger (Item 1) into the bushing (Item 2) **[Figure 20-100-34]**.

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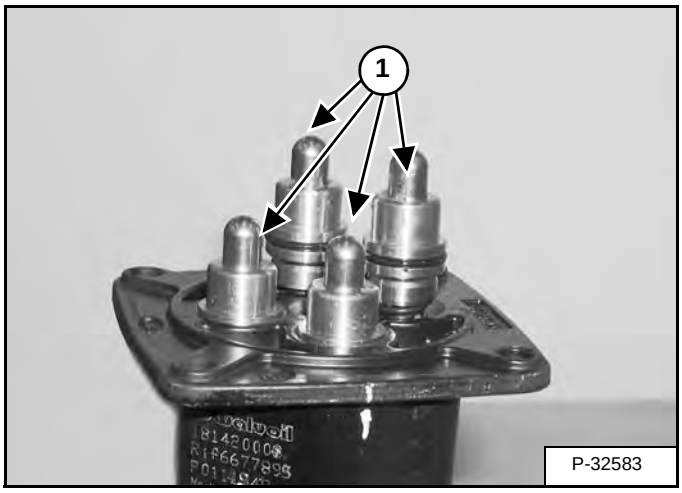
Assembly (Cont'd)

Figure 20-100-35



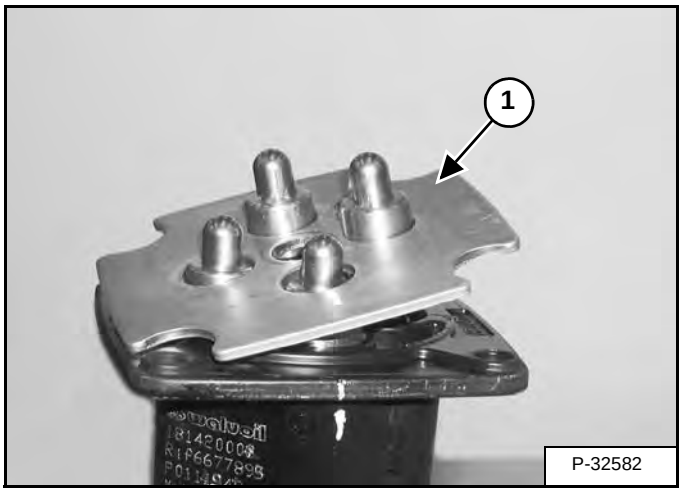
Install the O-ring (Item 1) **[Figure 20-100-35]** on the bushing.

Figure 20-100-36



Install the plunger assemblies (Item 1) **[Figure 20-100-36]** into the housing.

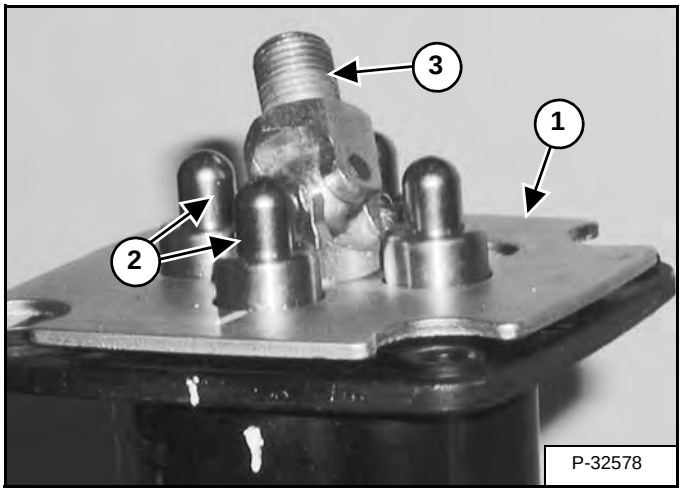
Figure 20-100-37



Install the plate (Item 1) **[Figure 20-100-37]**.

NOTE: Spring pressure can dislodge the plunger assemblies until the plate (Item 1) [Figure 20-100-37] is secured in place.

Figure 20-100-38

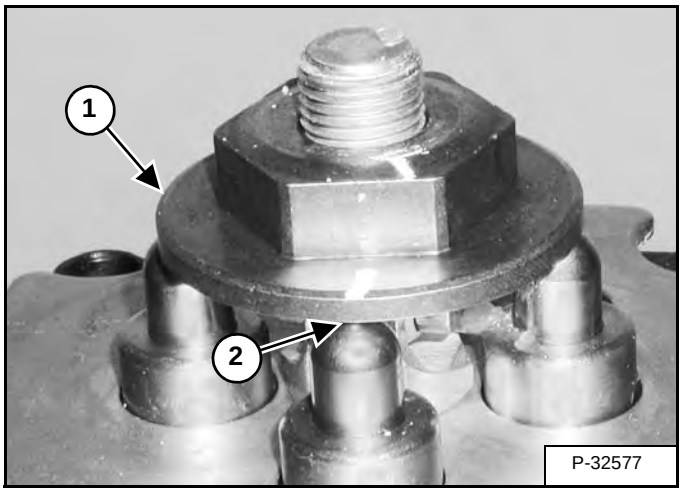


Press down on the plate (Item 1) to seat the plunger assemblies (Item 2). Install the U-joint (Item 3) **[Figure 20-100-38]**.

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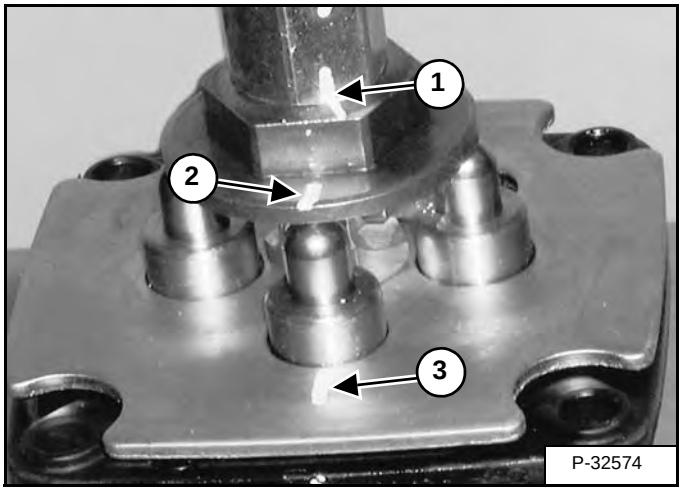
Assembly (Cont'd)

Figure 20-100-39



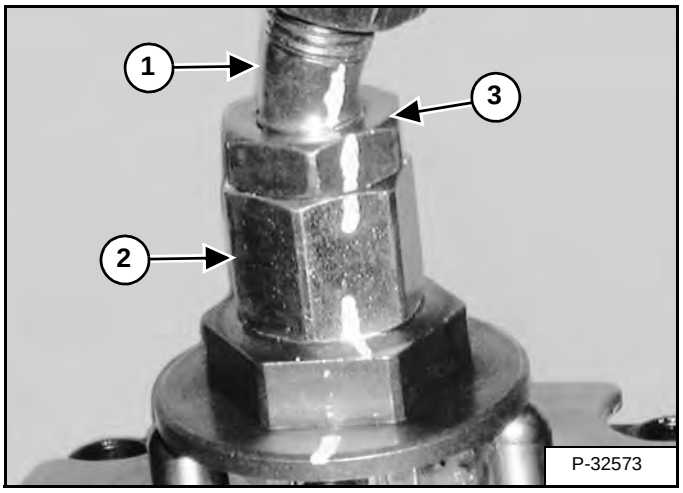
Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-100-39]**.

Figure 20-100-40



Align the coupler (Item 1) with the control plate (Item 2) and plate (Item 3) **[Figure 20-100-40]**. Tighten the coupler.

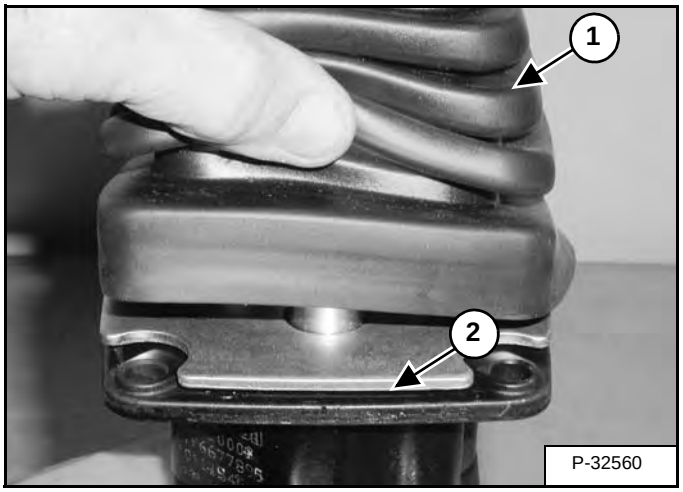
Figure 20-100-41



Install the connector (Item 1) **[Figure 20-100-41]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-100-41]**.

Figure 20-100-42



Install the tabs of the boot (Item 1) in between the joystick flange and mounting plate (Item 2) **[Figure 20-100-42]**.

Install the handle. (See Handle Removal And Installation on Page 20-100-3.)

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CONTROL LEVER (JOYSTICK) (LEFT)

Description

The left control lever (joystick) operates using pilot pressure to move the arm and / or slew spools in the control valve. The left control lever (joystick) will be moveable in a canopy or cab equipped excavator. The left control lever (joystick) has a microswitch which will lockout the hydraulic functions in the raised position and enable the hydraulic functions in the down (locked) position.

Testing

Check the pressure reducing valve for the correct pressure. (See Testing And Adjusting on Page 20-33-1.)

The following tools will be needed to perform the procedure:

MEL1355 - Hydraulic Test Kit

Lower the boom / bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

Remove the bottom half of the right console cover.

IMPORTANT

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

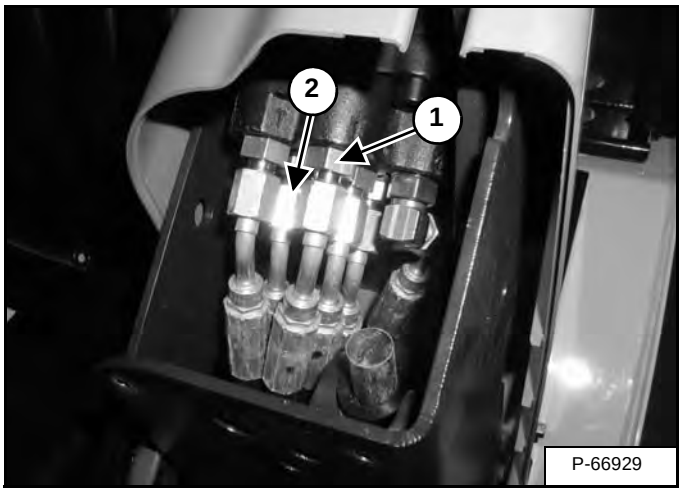
I-2003-0888

⚠ WARNING

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

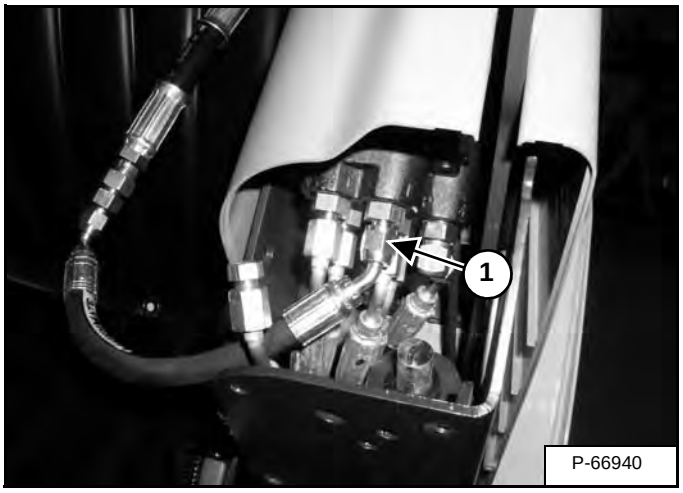
W-2145-EN-0210

Figure 20-101-1



At the bottom of the left control lever (joystick), find the pilot hose connected to Port 1 (Item 1) and Port 2 (Item 2) **[Figure 20-101-1]** labeled on the side of the left control lever (joystick) casting. Port 1 is the pilot pressure for the Arm function and Port 2 is the pilot pressure for the Swing (Slew) function.

Figure 20-101-1



Remove the pilot hose **[Figure 20-101-1]** from the bottom of the control lever (joystick) that is to be checked.

From the test kit, install a fitting and gauge hose (Item 1) **[Figure 20-101-1]** to the control lever (joystick) fitting.

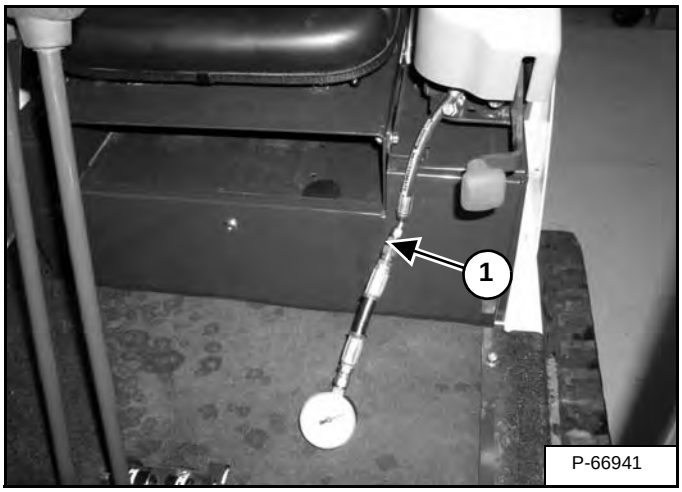
Cap the pilot hose (Item 2) **[Figure 20-101-1]**.

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CONTROL LEVER (JOYSTICK) (LEFT) (CONT'D)

Testing (Cont'd)

Figure 20-101-2



Install a 6,9 MPa (69 bar) (1000 psi) gauge on the hose **[Figure 20-101-2]**.

Lower the left console to the locked position **[Figure 20-101-2]**. Also lower the right console to the locked position if it is in the vertical position.

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

Check the gauge with the control levers (joystick) in neutral. The hydraulic pressure should be 0 MPa (0 bar) (0 psi).

Engage the to be tested circuit. Record the operating pressure.

The operating pressure should be as follows:

30 MPa (300 bar) (435 psi) with an acceptable range of 2,8 - 3,1 MPa (28 - 31 bar) (406 - 450 psi).

If the operating pressure is correct, check the valve section spool for proper operation.

If the operating pressure is incorrect, remove the pressure reducing valve, clean, install and retest. (See Testing And Adjusting on Page 20-33-1.)

If the pressure is still incorrect replace the pressure reducing valve. (See Testing And Adjusting on Page 20-33-1.)

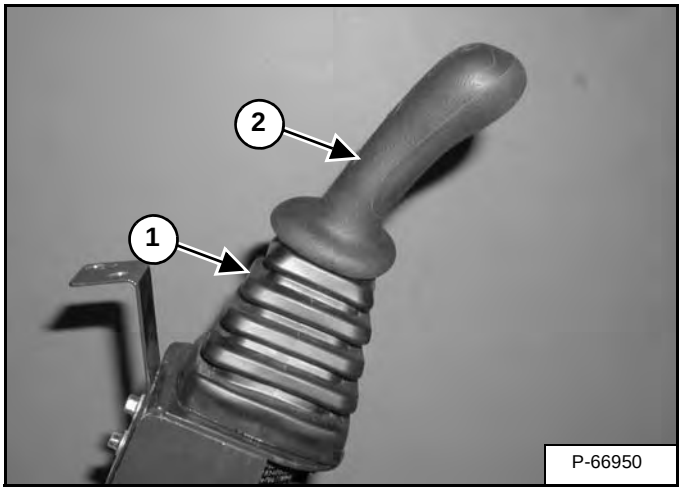
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CONTROL LEVER (JOYSTICK) (LEFT) (CONT'D)

Handle Removal And Installation

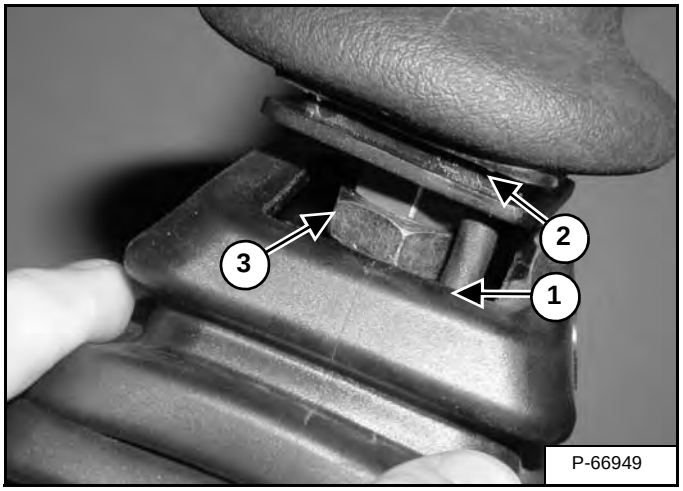
Remove the console cover. (See Left Rear Console Cover Removal And Installation on Page 40-60-8.)

Figure 20-101-3



Remove the dust boot (Item 1) from the handle (Item 2) **[Figure 20-101-3]**.

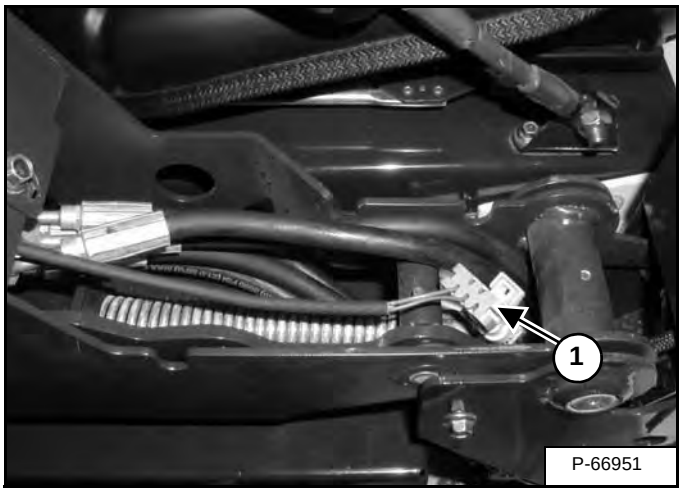
Figure 20-101-4



Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-101-4]**.

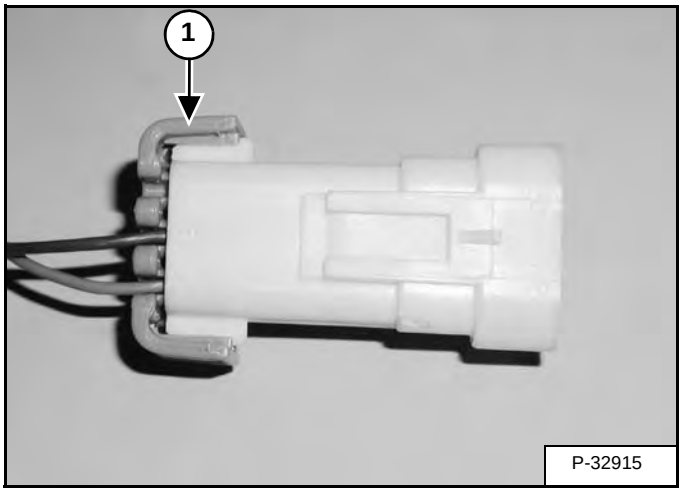
Hold the dust boot (Item 1) down and loosen the nut (Item 3) **[Figure 20-101-4]**.

Figure 20-101-5



Disconnect the wire harness (Item 1) **[Figure 20-101-5]**.

Figure 20-101-6

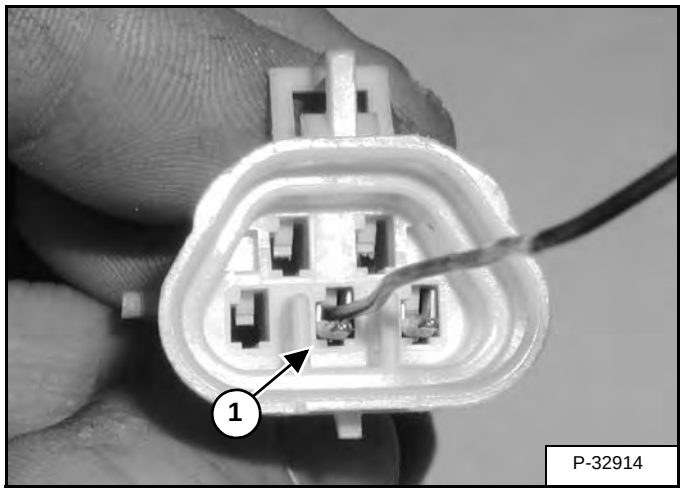


Remove the lock (Item 1) **[Figure 20-101-6]** from the electrical connector.

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Handle Removal And Installation (Cont'd)

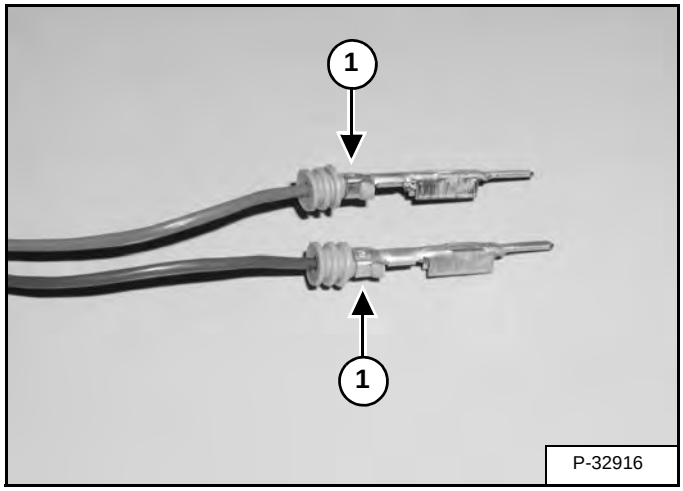
Figure 20-101-7



With a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 20-101-7]**.

Remove the individual wires from the back of the electrical connector.

Figure 20-101-8



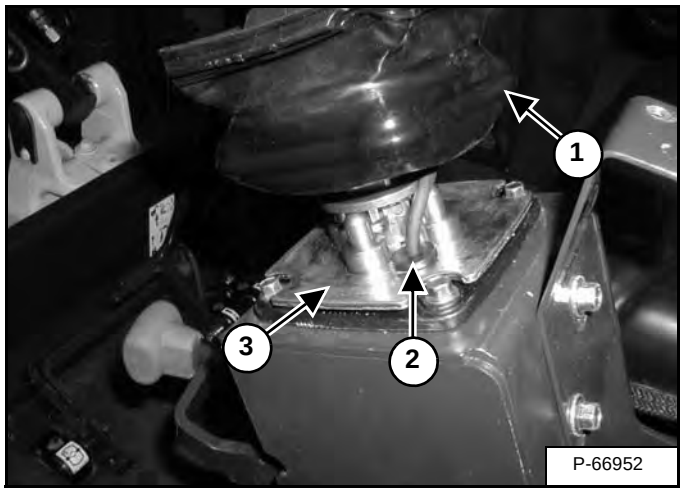
Installation: Use a small piece of wire and rebend the tabs (Item 1) **[Figure 20-101-8]** on each wire before installing them in the electrical connector.

Installation: The wires must be installed in the proper locations in the wire connector, listed below.

C Red
D Black

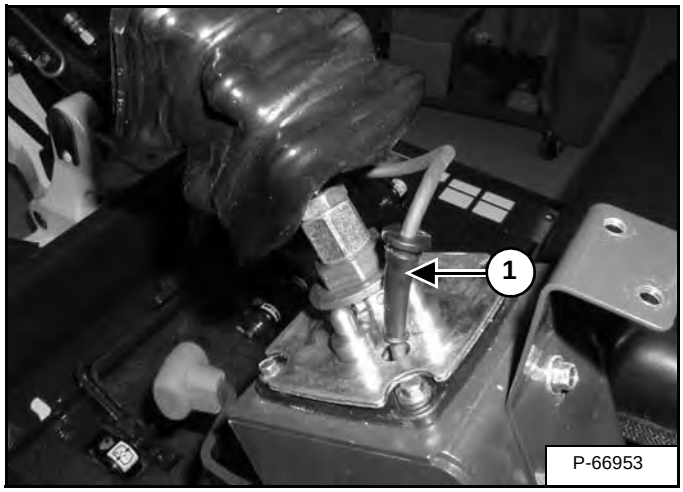
Check each wire to be certain the tab locks into position.

Figure 20-101-9



Raise the dust boot (Item 1) and pull the grommet (Item 2) up through the plate (Item 3) **[Figure 20-101-9]**.

Figure 20-101-10



Remove the grommet and wire (Item 1) **[Figure 20-101-10]** from the mount plate.

Remove the handle from the control lever.

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CONTROL LEVER (JOYSTICK) (LEFT) (CONT'D)

Removal And Installation

Lower the boom / bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

Remove the console cover. (See Left Rear Console Cover Removal And Installation on Page 40-60-8.)

IMPORTANT

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

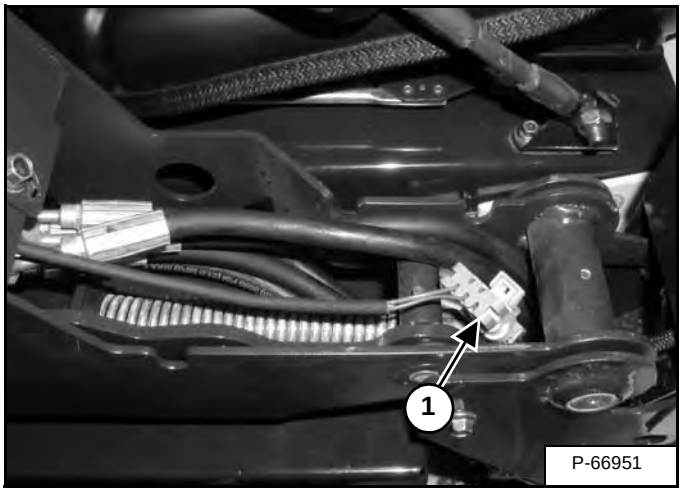
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⚠ WARNING

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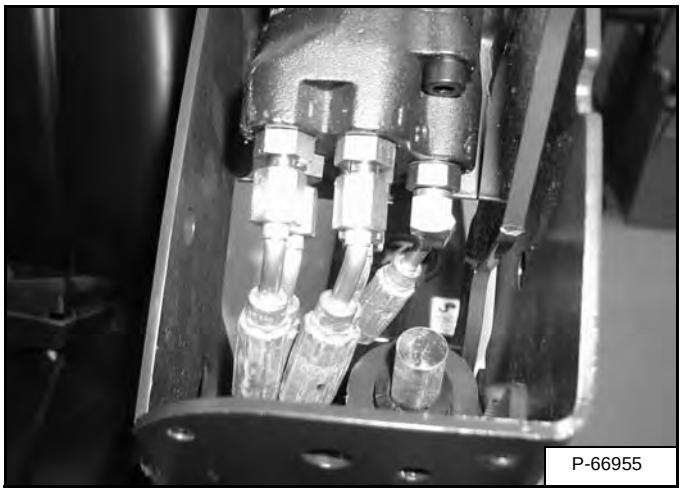
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Figure 20-101-11



Disconnect the wire connector (Item 1) **[Figure 20-101-11]**.

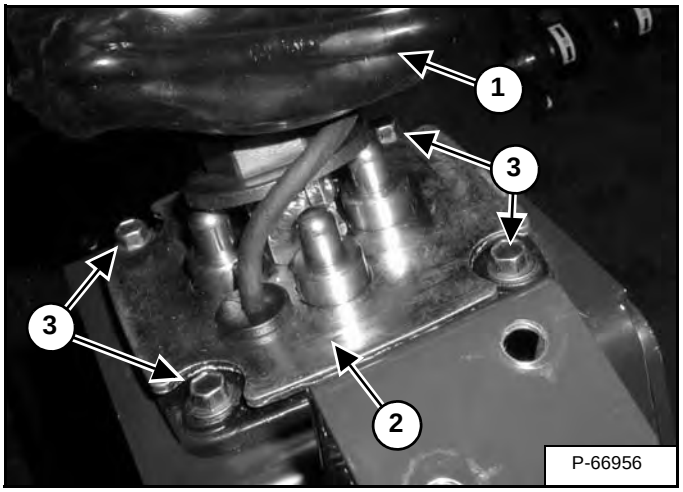
Figure 20-101-12



Mark the hoses for ease of assembly **[Figure 20-101-12]**.

Remove the hoses while the control lever (joystick) is bolted to the console **[Figure 20-101-12]**.

Figure 20-101-13



Raise the dust boot (Item 1) up from the plate (Item 2) **[Figure 20-101-13]**.

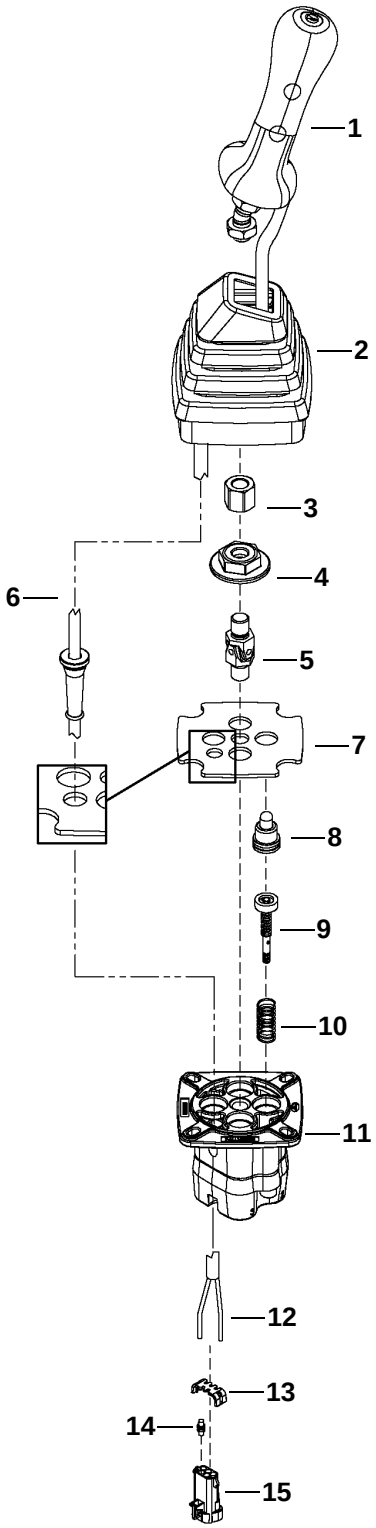
Remove the bolts (Item 3) **[Figure 20-101-13]** from the joystick plate.

Remove the joystick.

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Parts Identification

1. Handle
2. Dust Boot
3. Coupler
4. Actuator Control Plate
5. U-Joint
6. Grommet
7. Plate
8. Plunger Assembly
9. Spool
10. Spring
11. Housing
12. Wire Harness
13. Lock
14. Pin
15. Connector



MS-1354

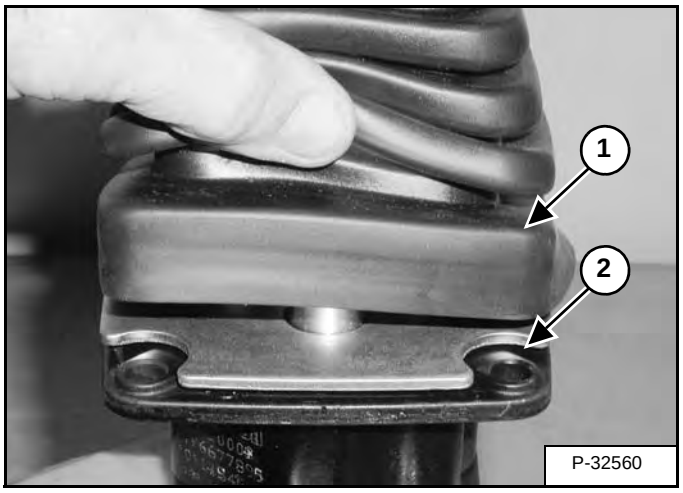
Dealer Copy -- Not for Resale

Disassembly

Remove the left handle. (See Handle Removal And Installation on Page 20-101-3.)

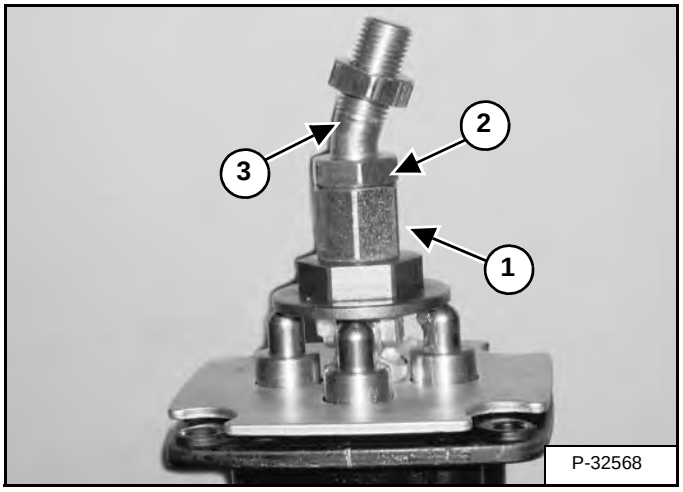
Clean the outside of the control lever before disassembly.

Figure 20-101-14



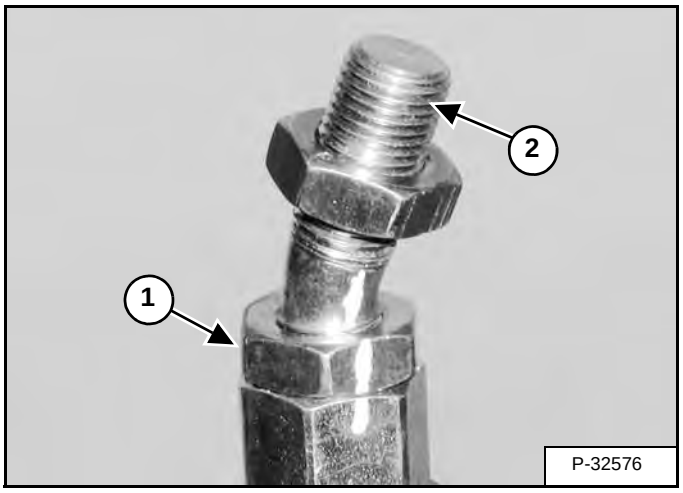
Remove the boot (Item 1) from the control lever (joystick) (Item 2) **[Figure 20-101-14]**.

Figure 20-101-15



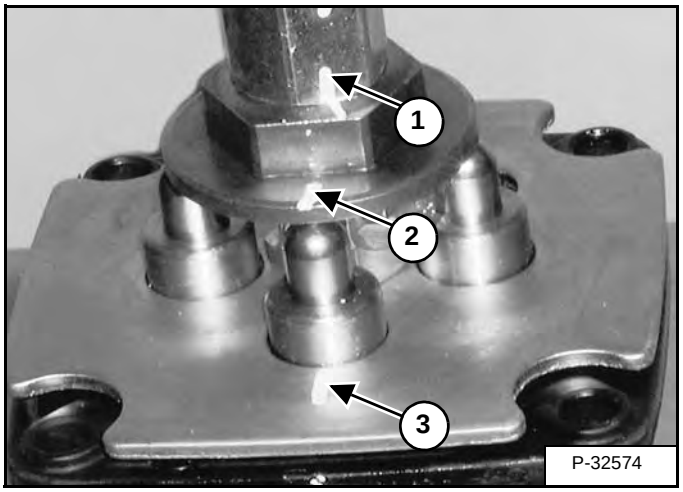
Mark the coupler (Item 1), nut (Item 2) and connector (Item 3) **[Figure 20-101-15]** for correct assembly.

Figure 20-101-16



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-101-16]**.

Figure 20-101-17

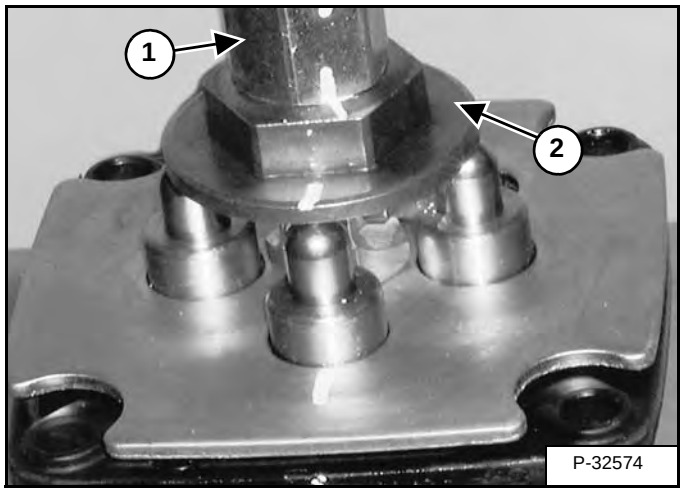


Mark the coupler (Item 1), control plate (Item 2) and plate (Item 3) **[Figure 20-101-17]** for correct installation.

Dealer Copy -- Not for Resale

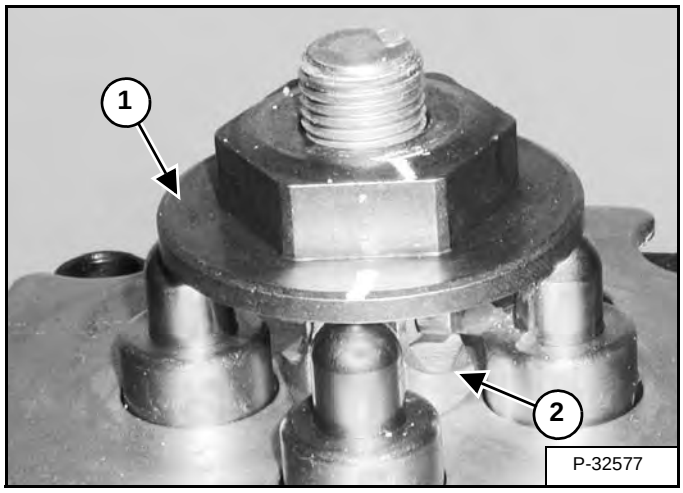
Disassembly (Cont'd)

Figure 20-101-18



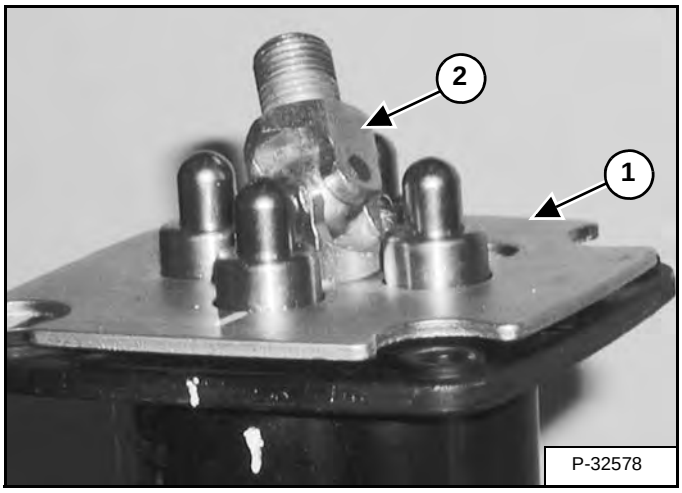
Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-101-18]**.

Figure 20-101-19



Remove the control plate (Item 1) from the U-Joint (Item 2) **[Figure 20-101-19]**.

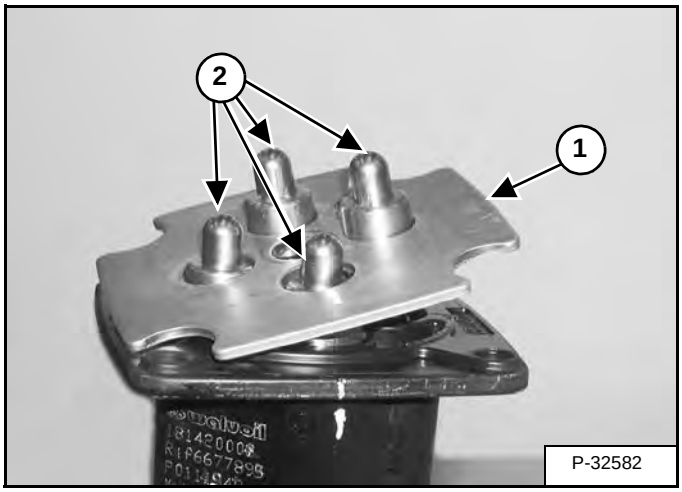
Figure 20-101-20



Mark the plate (Item 1) and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-101-20]**.

NOTE: The plate (Item 1) is spring loaded and will come up as the U-joint (Item 2) [Figure 20-101-20] is removed.

Figure 20-101-21



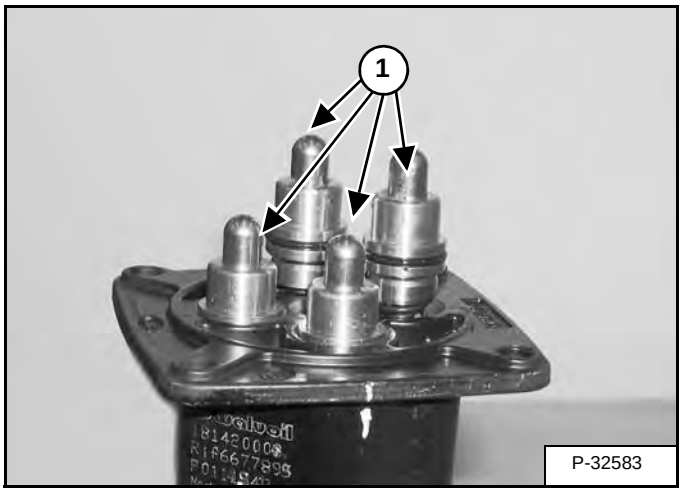
Remove the plate (Item 1) **[Figure 20-101-21]**.

NOTE: Use care while removing the plate (Item 1). The plungers (Item 2) [Figure 20-101-21] are spring loaded.

Dealer Copy -- Not for Resale

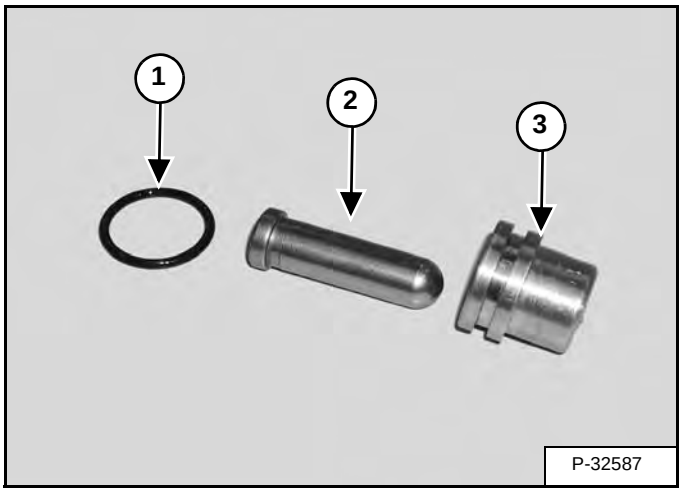
Disassembly (Cont'd)

Figure 20-101-22



Remove the plunger assemblies (Item 1) **[Figure 20-101-22]**.

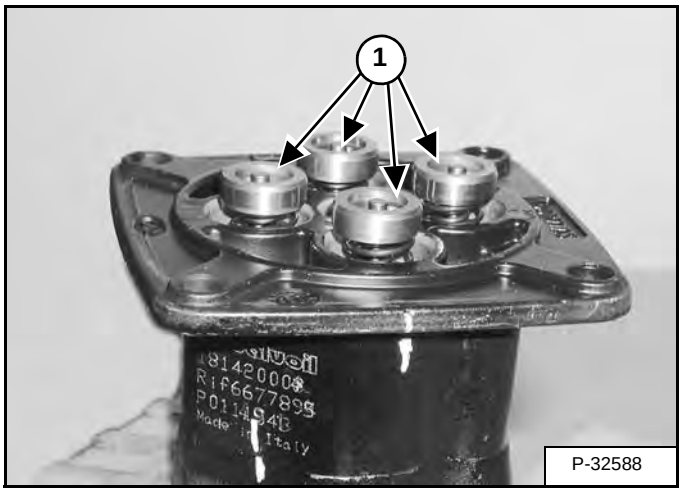
Figure 20-101-23



Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-101-23]**.

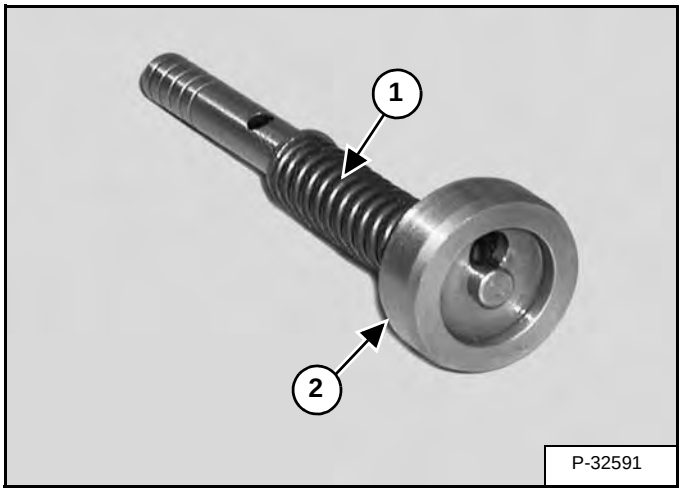
NOTE: Mark the spool assemblies for installation in their original location.

Figure 20-101-24



Remove the spool assemblies (Item 1) **[Figure 20-101-24]**.

Figure 20-101-25

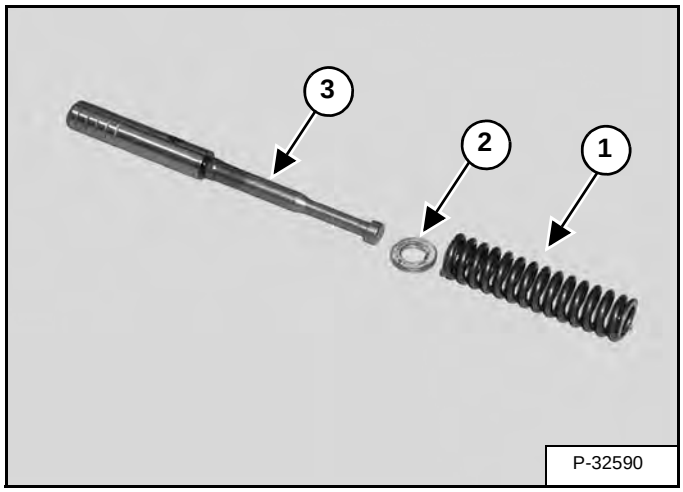


Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-101-25]**.

Dealer Copy -- Not for Resale

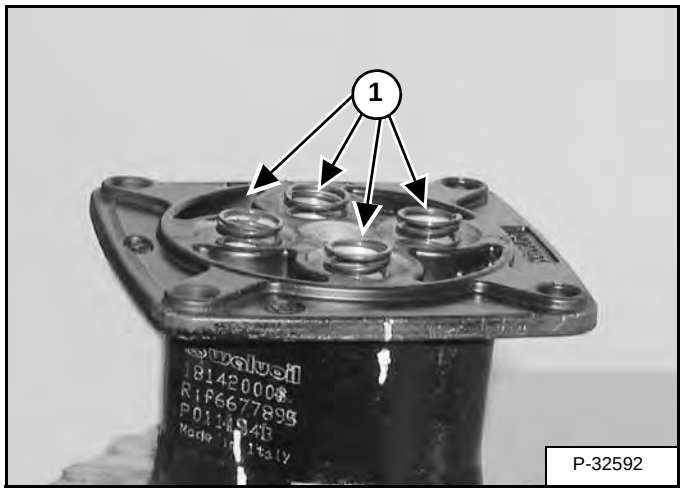
Disassembly (Cont'd)

Figure 20-101-26



Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-101-26]**.

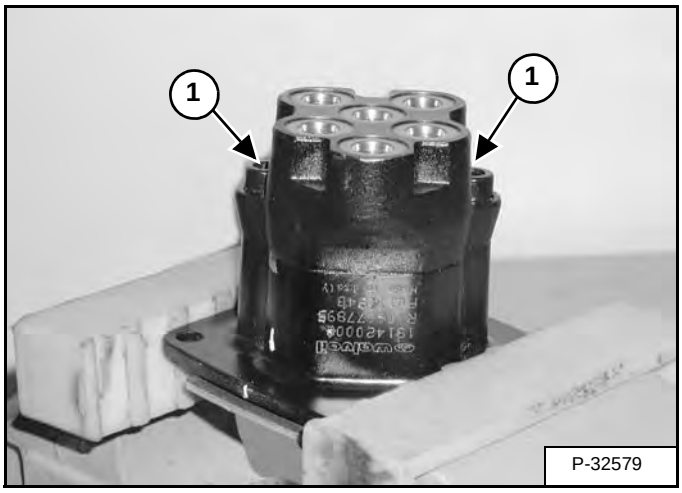
Figure 20-101-27



Remove the springs (Item 1) **[Figure 20-101-27]** from the housing.

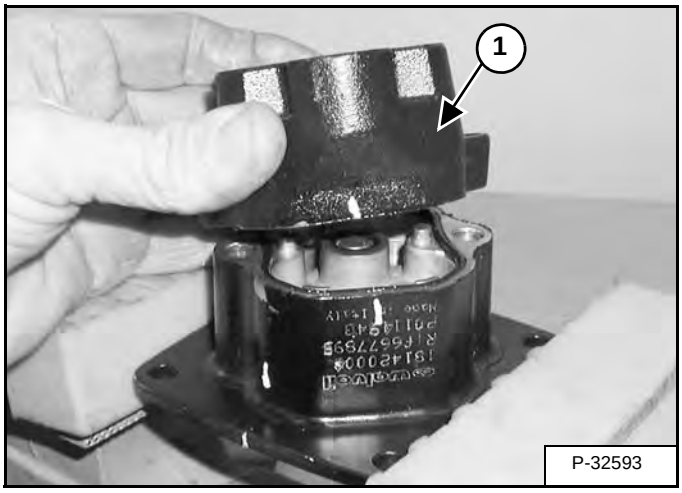
Clamp the housing in a vise that is equipped with padded jaws.

Figure 20-101-28



Remove the bolts (Item 1) **[Figure 20-101-28]**.

Figure 20-101-29

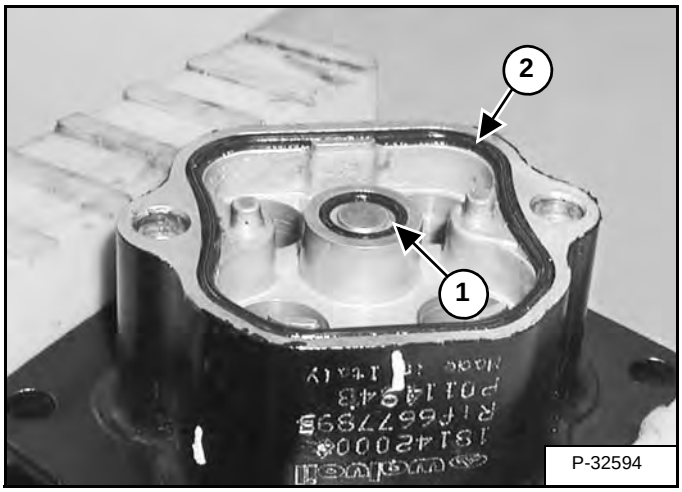


Remove the end cap (Item 1) **[Figure 20-101-29]**.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

Figure 20-101-30



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-101-30]**.

Dealer Copy -- Not for Resale

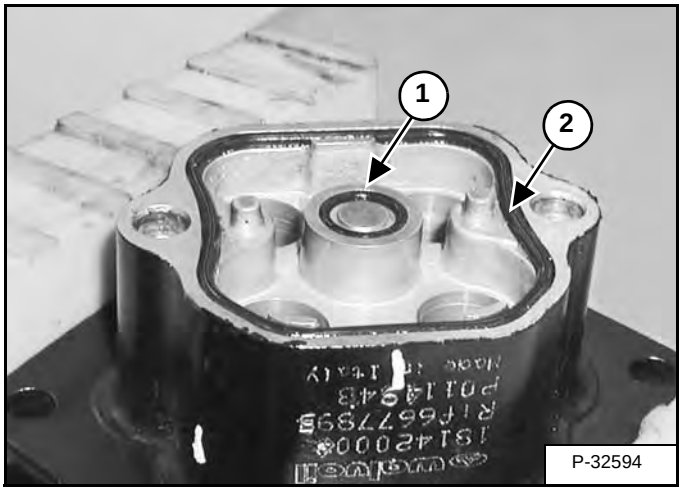
Assembly

Clean all parts in solvent and dry with compressed air.

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

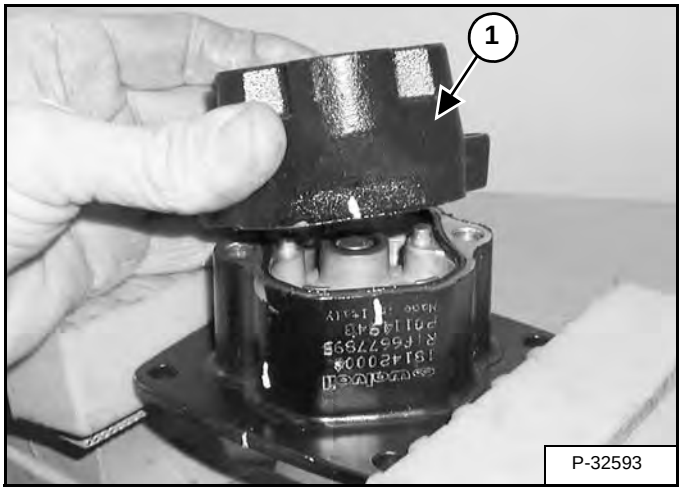
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-101-31



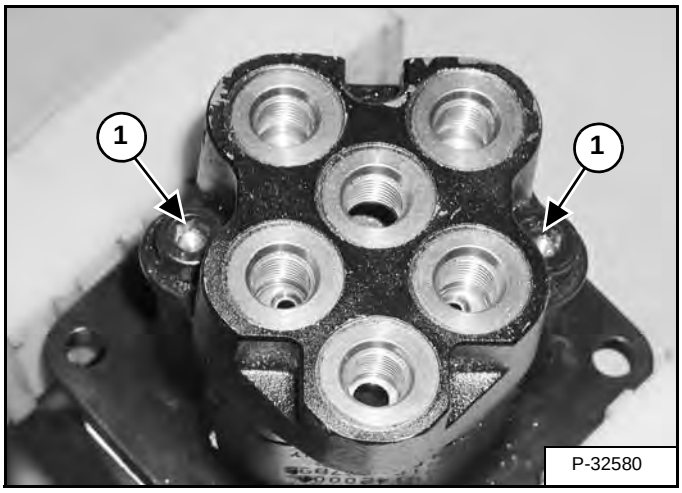
Clamp the housing in a vise equipped with padded jaws. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-101-31]**.

Figure 20-101-32



Install the end cap (Item 1) **[Figure 20-101-32]**.

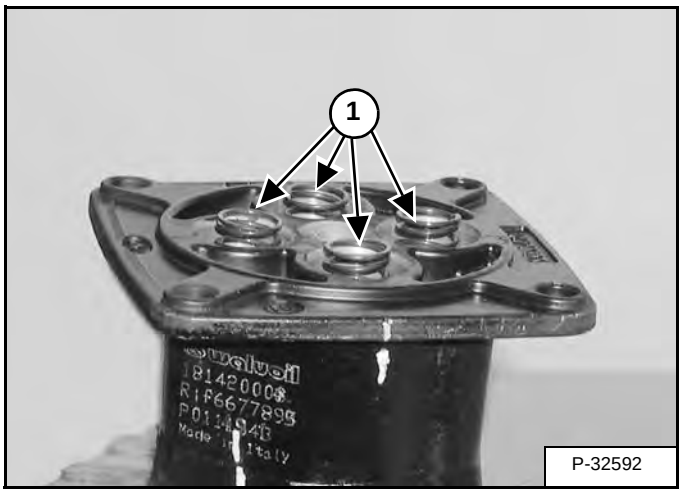
Figure 20-101-33



Install the bolts (Item 1) **[Figure 20-101-33]**.

Turn the housing over.

Figure 20-101-34

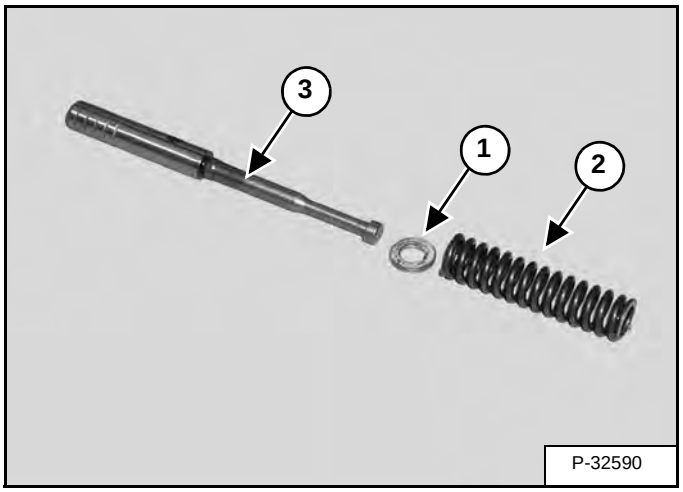


Install the springs (Item 1) **[Figure 20-101-34]**.

Dealer Copy -- Not for Resale

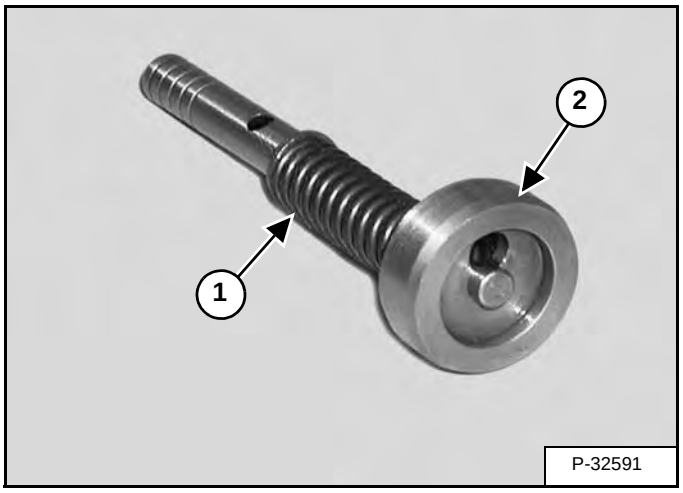
Assembly (Cont'd)

Figure 20-101-35



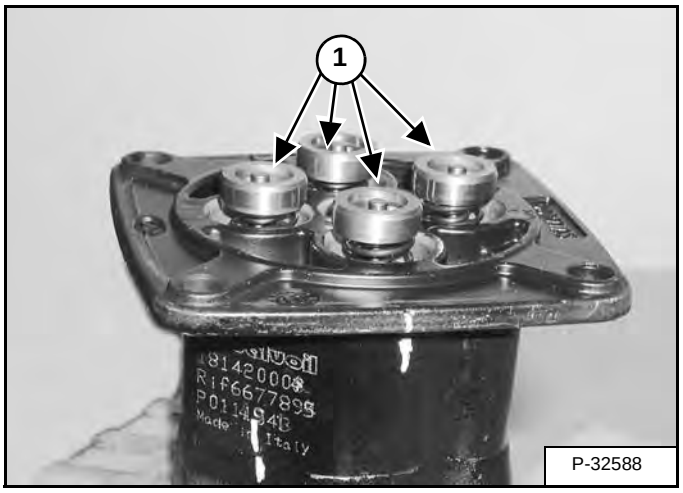
Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-101-35]**.

Figure 20-101-36



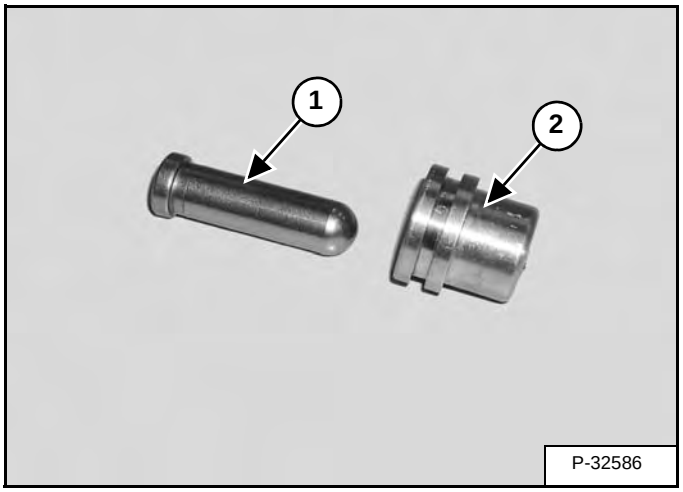
Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-101-36]**.

Figure 20-101-37



Install the spool assemblies (Item 1) **[Figure 20-101-37]** into the housing.

Figure 20-101-38

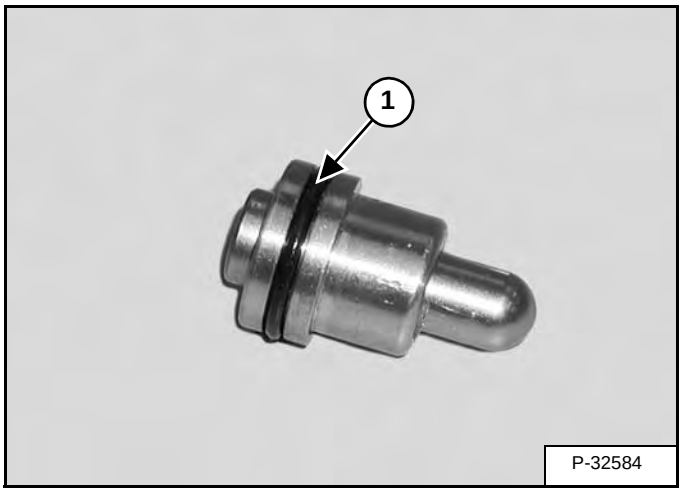


Install the plunger (Item 1) into the bushing (Item 2) **[Figure 20-101-38]**.

Dealer Copy -- Not for Resale

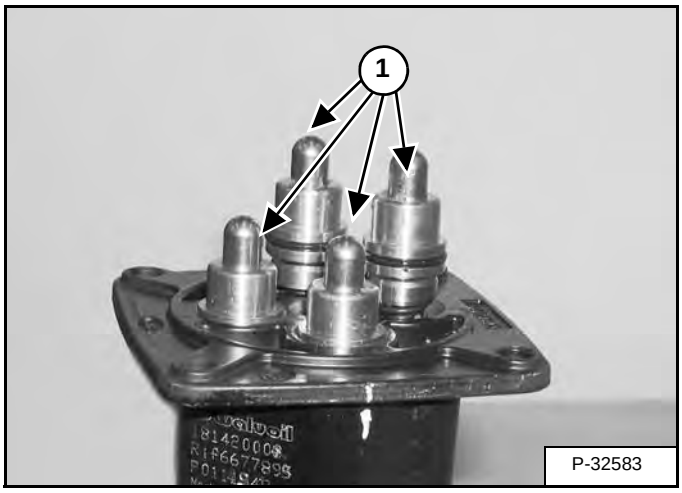
Assembly (Cont'd)

Figure 20-101-39



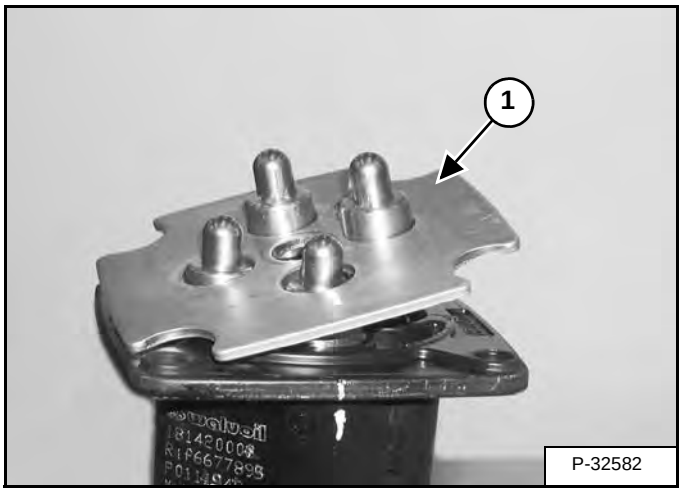
Install the O-ring (Item 1) **[Figure 20-101-39]** on the bushing.

Figure 20-101-40



Install the plunger assemblies (Item 1) **[Figure 20-101-40]** into the housing.

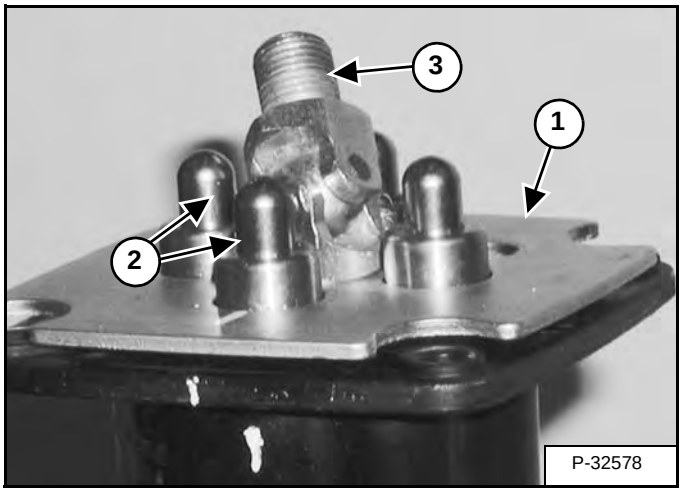
Figure 20-101-41



Install the plate (Item 1) **[Figure 20-101-41]**.

NOTE: Spring pressure can dislodge the plunger assemblies until the plate (Item 1) [Figure 20-101-41] is secured in place.

Figure 20-101-42

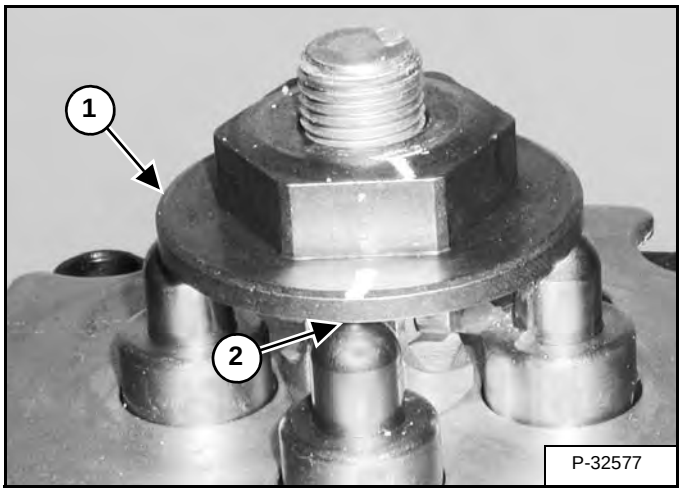


Press down on the plate (Item 1) to seat the plunger assemblies (Item 2). Install the U-joint (Item 3) **[Figure 20-101-42]**.

Dealer Copy -- Not for Resale

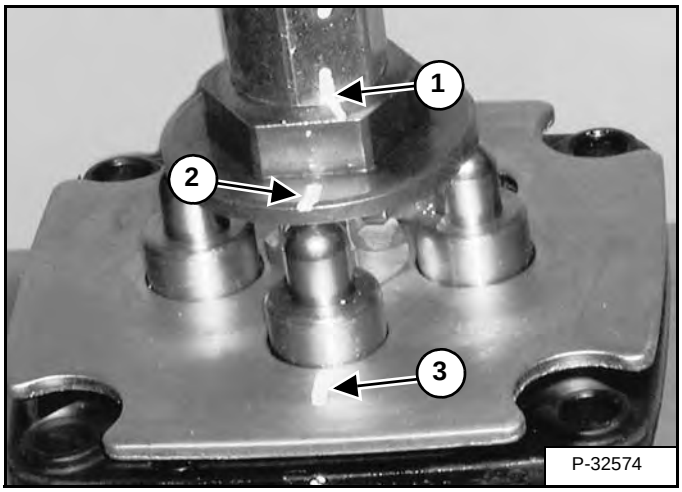
Assembly (Cont'd)

Figure 20-101-43



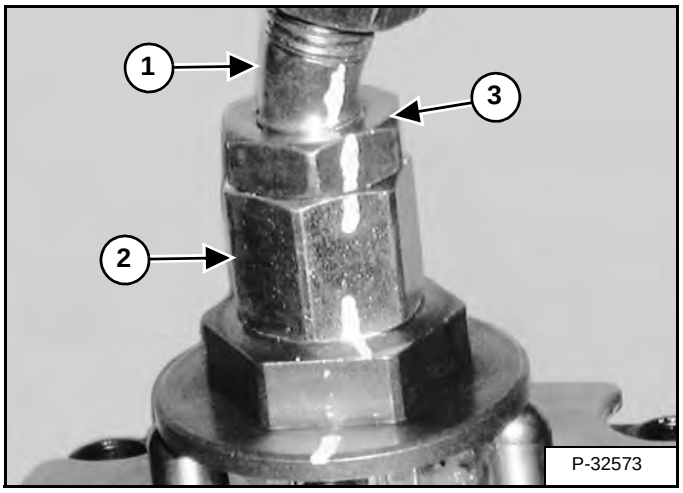
Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-101-43]**.

Figure 20-101-44



Align the coupler (Item 1) with the control plate (Item 2) and plate (Item 3) **[Figure 20-101-44]**. Tighten the coupler.

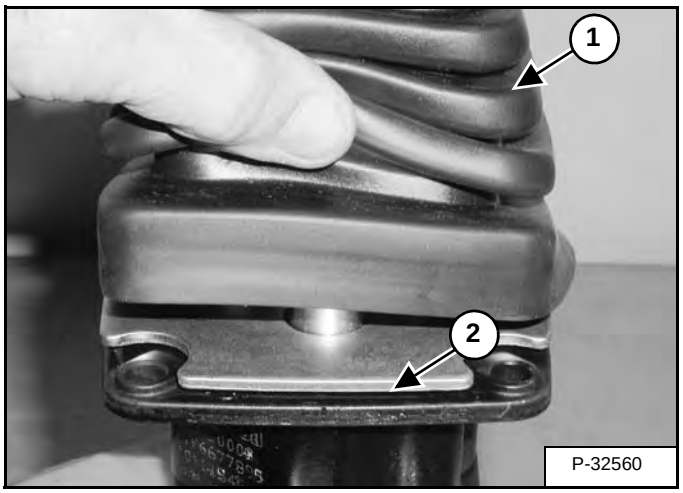
Figure 20-101-45



Install the connector (Item 1) **[Figure 20-101-45]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-101-45]**.

Figure 20-101-46



Install the tabs of the boot (Item 1) in between the joystick flange and mounting plate (Item 2) **[Figure 20-101-46]**.

Install the handle. (See Handle Removal And Installation on Page 20-101-3.)

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Dealer Copy -- Not for Resale

HYDRAULIC FILTER MOUNT

Description

The hydraulic filter removes contaminants from the hydraulic fluid when the hydraulic systems are operating.

The hydraulic filter system consists of one main hydraulic filter located behind the tailgate and removes the contaminants after the oil cooler.

Removal And Installation

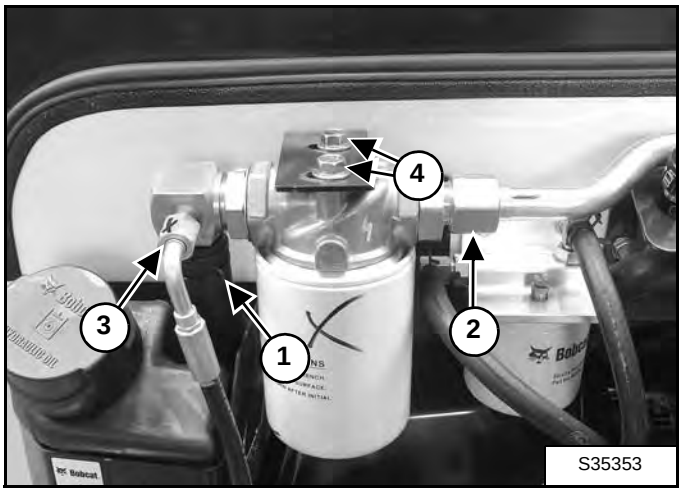
IMPORTANT

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

I-2003-0888

Open the tailgate. (See TAILGATE on Page 10-60-1.)

Figure 20-110-1



Loosen the hose clamp (Item 1) **[Figure 20-110-1]** and remove the hose.

NOTE: Support the hose in approximately the same position as when attached to the filter mount to avoid any hydraulic fluid from draining out of the hydraulic reservoir.

Remove the tubeline (Item 2) **[Figure 20-110-1]**.

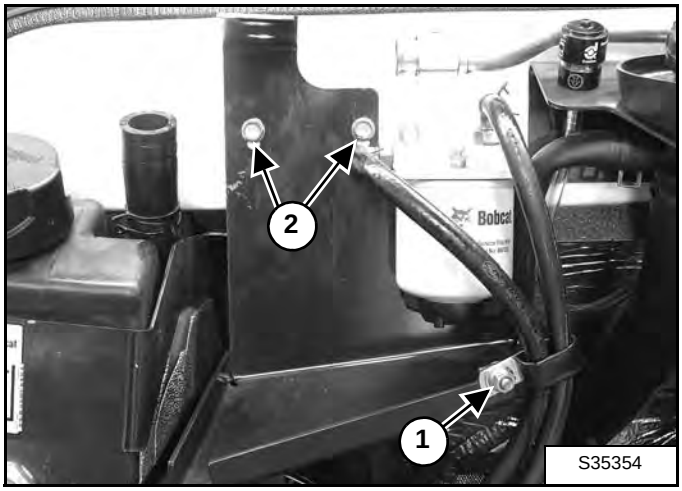
Remove the hose (Item 3) **[Figure 20-110-1]**.

Remove the bolts (Item 4) **[Figure 20-110-1]**.

Remove the filter and filter mount.

Installation: Tighten the bolts to 38 N•m (28 ft-lb) torque.

Figure 20-110-2



Remove the two hoses from the filter mount by removing the bolt and nut (Item 1) **[Figure 20-110-2]**.

Remove the screws (Item 2) **[Figure 20-110-2]** from the filter mount bracket.

Remove the bracket.

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Dealer Copy -- Not for Resale

HYDRAULIC RESERVOIR

Description

The hydraulic reservoir is a storage container for the excavators hydraulic fluid. The reservoir contains a vented fill cap with a fluid screen to prevent contaminants from entering the reservoir while adding fluid.

The hydraulic reservoir is located behind the tailgate on the left side of the excavator.

Removal And Installation

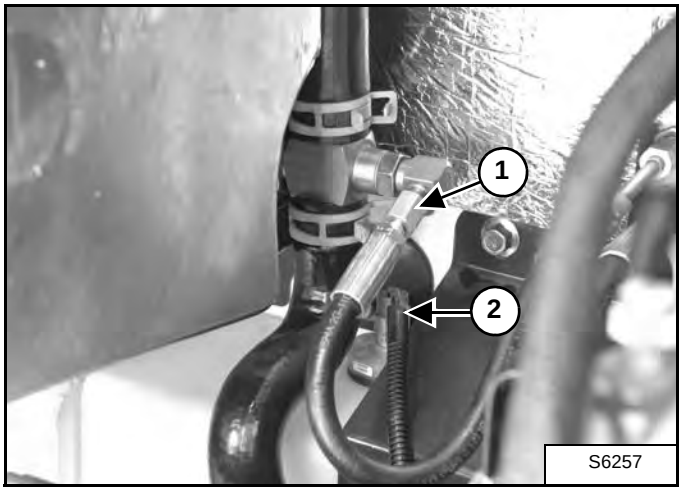
Open tailgate.

Drain hydraulic reservoir. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

Remove the muffler and extension. (See Removal And Installation on Page 60-20-1.)

Remove the hydraulic filter mount. (See Removal And Installation on Page 20-110-1.)

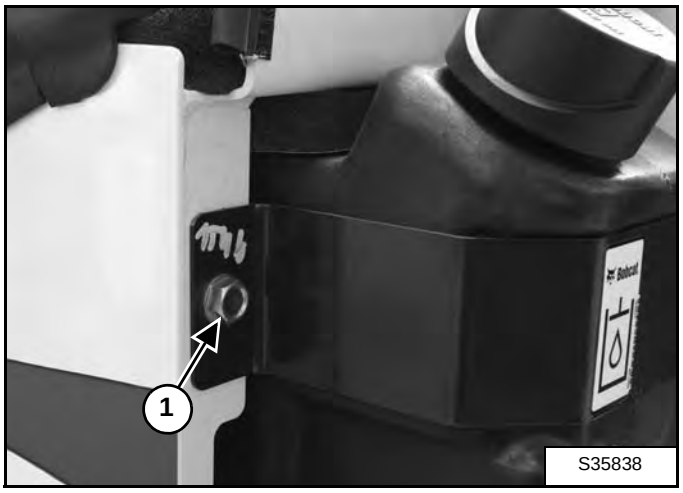
Figure 20-120-1



Remove the hose (Item 1) **[Figure 20-120-1]** from the hydraulic reservoir tee fitting.

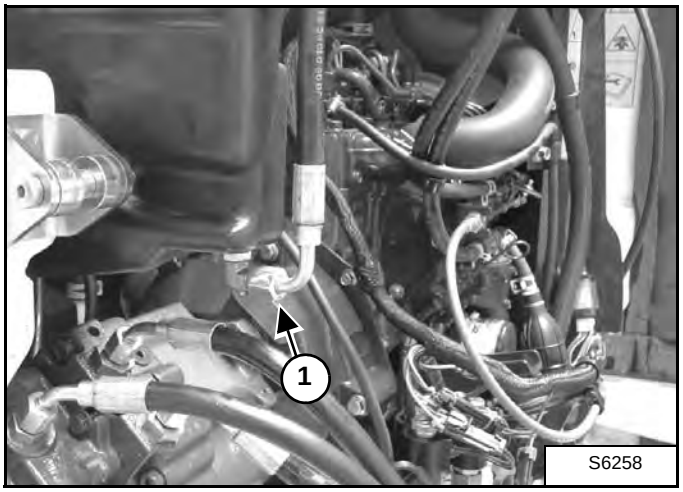
Disconnect the fuel level sender harness (Item 2) **[Figure 20-120-1]** from the fuel level sender.

Figure 20-120-2



Remove the two bolts (Item 1) **[Figure 20-120-2]** (Both sides) from the hydraulic reservoir bracket.

Figure 20-120-3

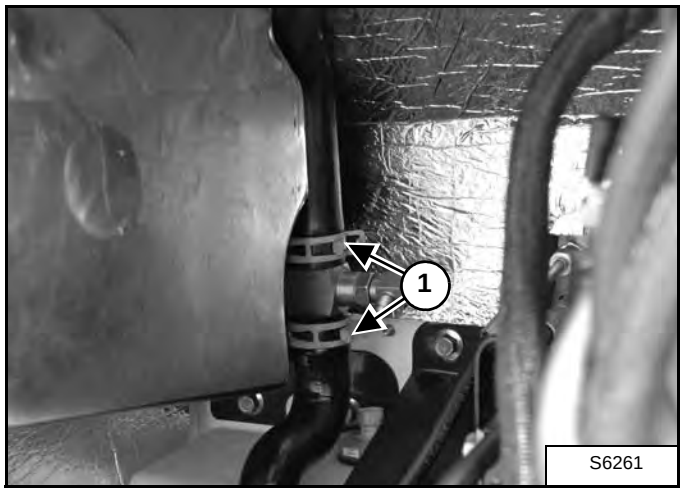


Remove the hose (Item 1) **[Figure 20-120-3]** from the hydraulic reservoir.

Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

Figure 20-120-4



Release the hose clamps (Item 1) **[Figure 20-120-4]** and remove hoses from tee fitting on reservoir.

Tilt hydraulic reservoir towards engine and slide reservoir out **[Figure 20-120-4]**.

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OIL COOLER

Description

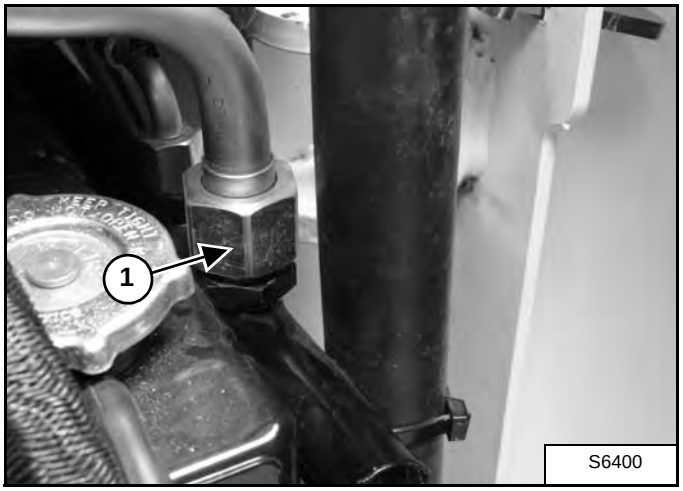
The oil cooler is used to cool the excavators hydraulic fluid. Oil passages are coiled into a heat exchanger. The air is forced around these passages cooling the oil.

Removal And Installation

Open the tailgate. (See TAILGATE on Page 10-60-1.)

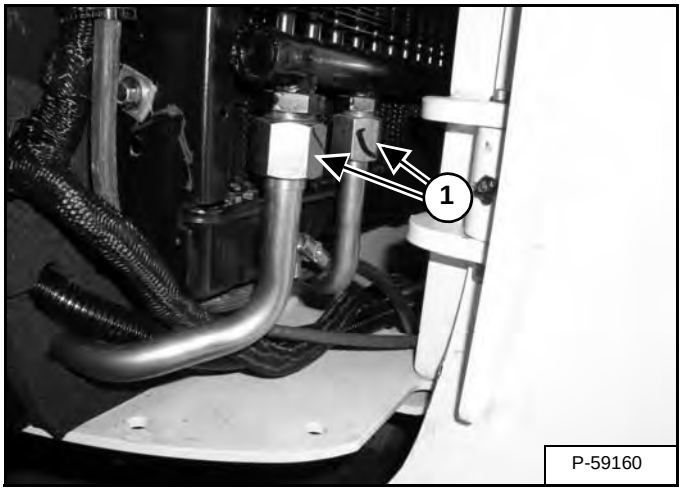
Drain hydraulic reservoir. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

Figure 20-130-1



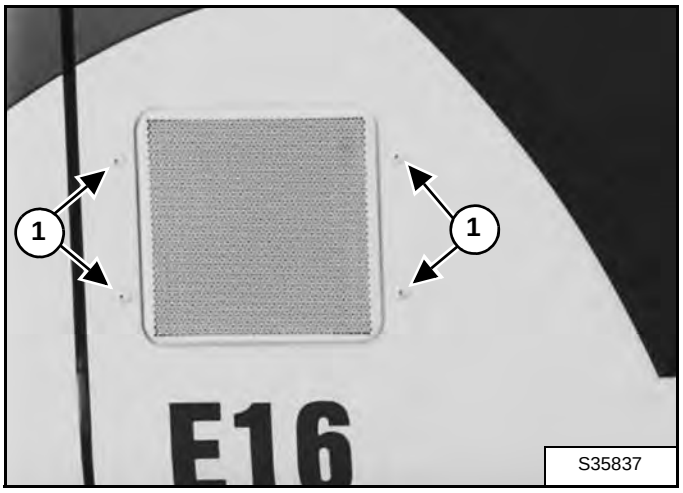
Remove the tubeline (Item 1) **[Figure 20-130-1]** from the top of the oil cooler.

Figure 20-130-2



Remove the tubelines (Item 1) **[Figure 20-130-2]** from the bottom of the oil cooler.

Figure 20-130-3



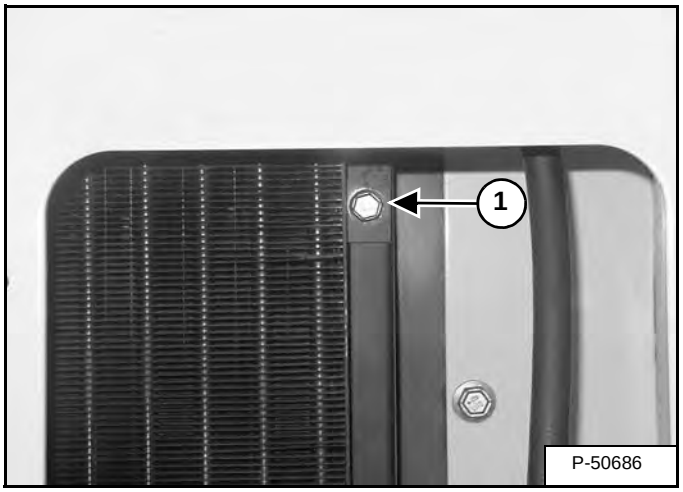
Remove the four bolts (Item 1) **[Figure 20-130-3]** that hold the grille to the side frame.

Push the grille in and slide the grille out the back of the excavator.

NOTE: Use a magnet or hook pick to prevent the grille from dropping and being scratched or damaged.

NOTE: Support the oil cooler before removing the mounting bolts (Item 1) [Figure 20-130-3].

Figure 20-130-4

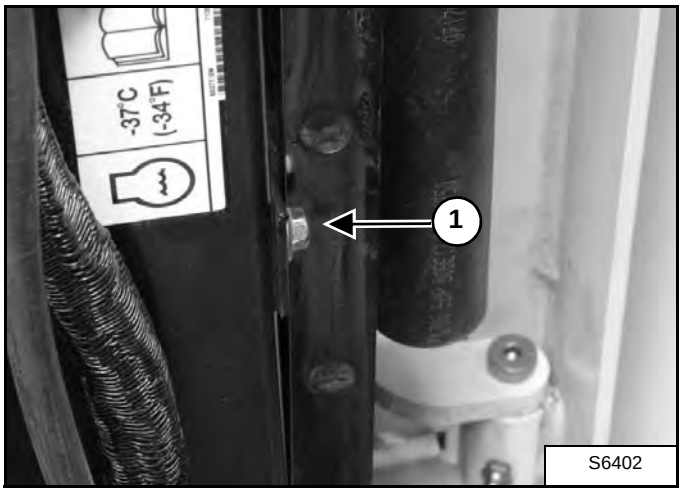


Remove the bolt (Item 1) **[Figure 20-130-4]** mounting the oil cooler to the radiator.

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Removal And Installation (Cont'd)

Figure 20-130-5



Remove the bolt (Item 1) **[Figure 20-130-5]** mounting the oil cooler to the radiator.

Remove the oil cooler from rear of excavator.

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BLADE / TRACK EXPANSION SOLENOID BLOCK (FOR MODEL E16 S/N AHLL11001 - 13119)

Description

The blade / track expansion solenoid block diverts hydraulic fluid to either the blade or track expansion function with the switch on the right hand console.

The blade / track expansion solenoid block is located under the floor mat and floor panels on the right side of the excavator.

The blade / track expansion solenoid block has a 29 MPa (290 bar) (4205 psi) relief valve to protect the blade function from overpressure.

Block Removal And Installation

Lower the boom / bucket and blade to the ground.

With the engine off, turn the start key to the ON position and move 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.

I-2003-0888

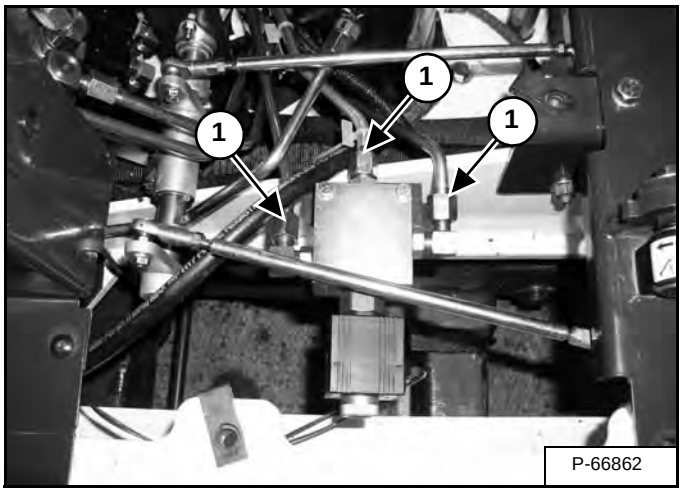
Remove the floor mat and floor panel. (See Removal And Installation on Page 40-140-1.)

⚠ WARNING

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

W-2145-EN-0210

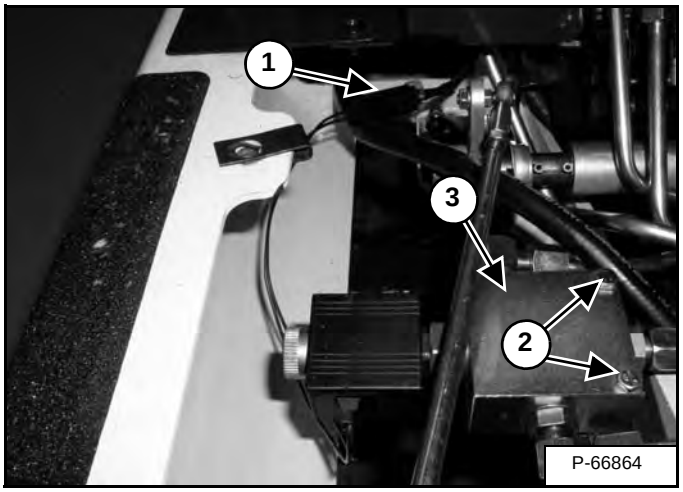
Figure 20-140-1



Mark all tubelines (Item 1) **[Figure 20-140-1]** for ease of assembly.

Disconnect the tubelines (Item 1) **[Figure 20-140-1]** from the block.

Figure 20-140-2



Disconnect the wire harness (Item 1) **[Figure 20-140-2]** from the excavator harness.

Remove the bolts (Item 2) **[Figure 20-140-2]**.

Remove the blade / track expansion solenoid block (Item 3) **[Figure 20-140-2]** from the excavator.

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BLADE / TRACK EXPANSION SOLENOID BLOCK (FOR MODEL E16 S/N AHLL11001 - 13119) (CONT'D)

Solenoid Removal And Installation

Lower the boom / bucket and blade to the ground.

With the engine off, turn the start key to the ON position and move 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.

I-2003-0888

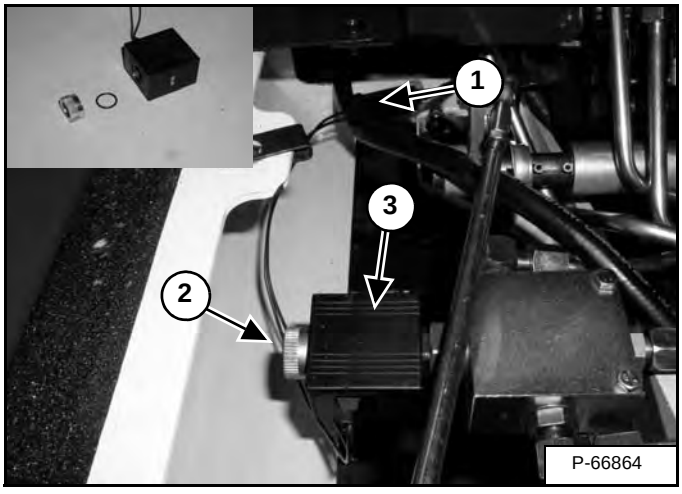
Remove the floor mat and floor panel. (See Removal And Installation on Page 40-140-1.)

⚠ WARNING

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

W-2145-EN-0210

Figure 20-140-3

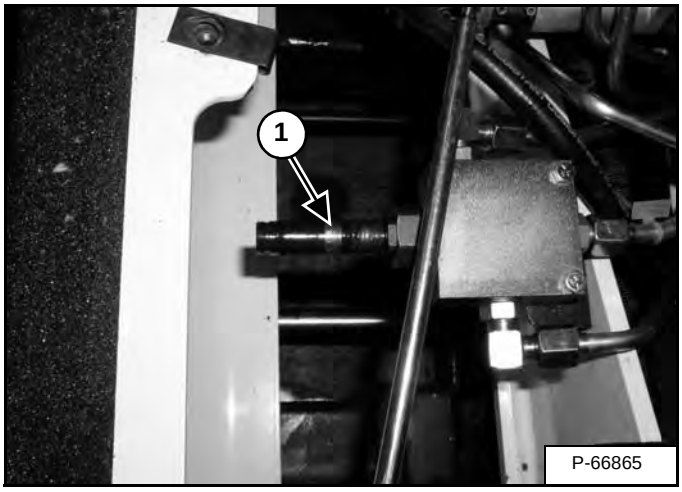


Disconnect the wire harness (Item 1) **[Figure 20-140-3]** from the excavator harness.

Remove the solenoid nut (Item 2) **[Figure 20-140-3]**.

Remove the O-ring and coil (Item 3) **[Figure 20-140-3]** from the solenoid stem.

Figure 20-140-4



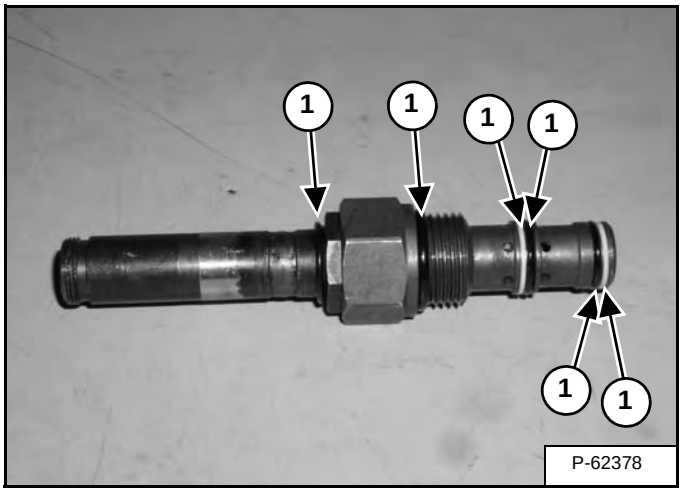
Remove the solenoid stem (Item 1) **[Figure 20-140-4]**.

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

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Solenoid Removal And Installation (Cont'd)

Figure 20-140-5



Remove the O-rings and back-up rings (Item 1) **[Figure 20-140-5]** from the solenoid stem.

Block Disassembly And Assembly

IMPORTANT

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

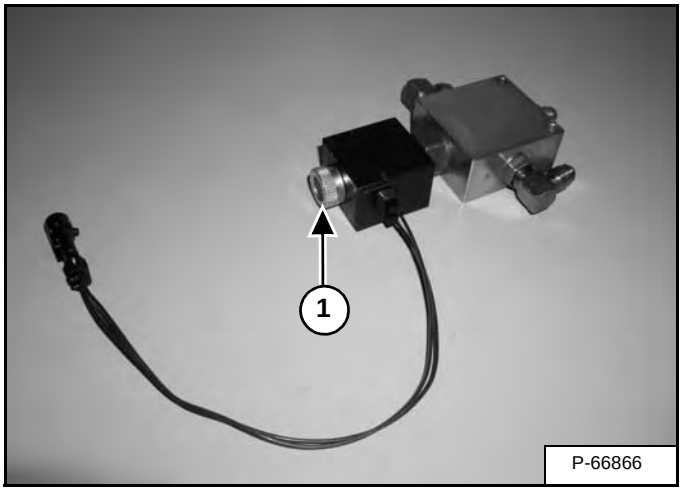
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

Always install O-rings back-up rings. Lubricate all O-rings and back-up rings with clean hydraulic fluid before installation.

Figure 20-140-6

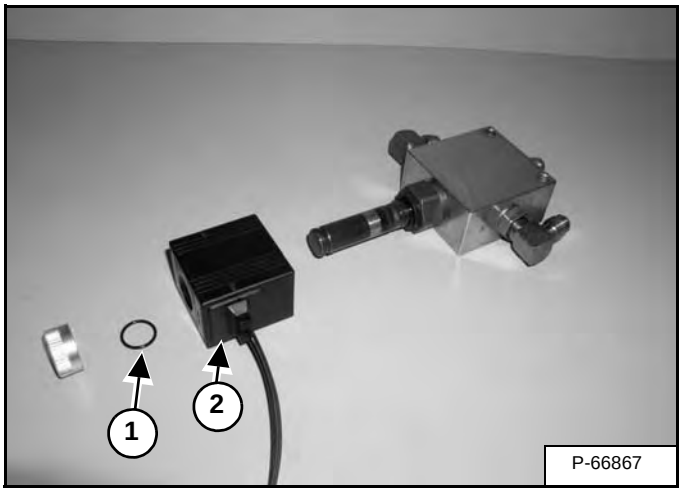


Remove the nut (Item 1) **[Figure 20-140-6]** from the solenoid.

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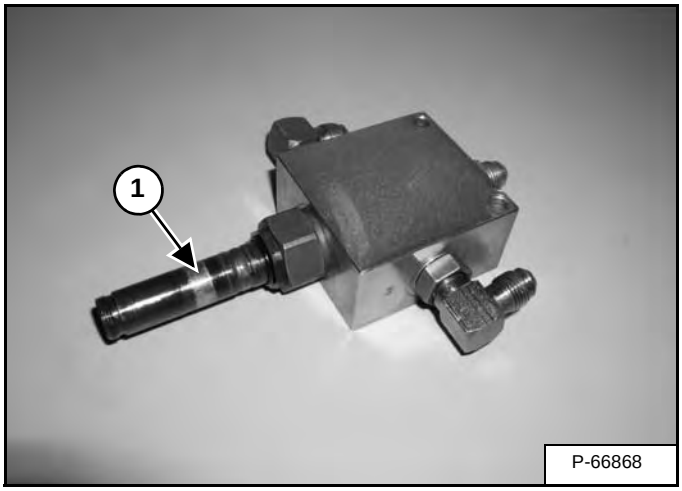
Block Disassembly And Assembly (Cont'd)

Figure 20-140-7



Remove the O-ring (Item 1) and solenoid (Item 2) **[Figure 20-140-7]**.

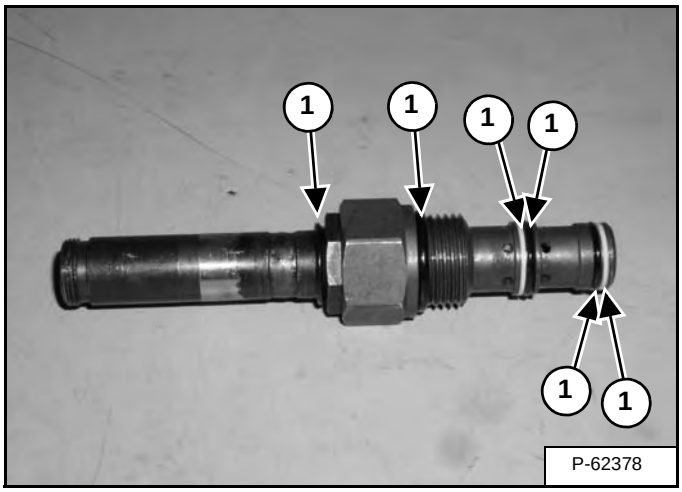
Figure 20-140-8



Remove the solenoid stem (Item 1) **[Figure 20-140-8]**.

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

Figure 20-140-9



Remove the O-rings and back-up rings (Item 1) **[Figure 20-140-9]** from the solenoid stem.

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BLADE / TRACK EXPANSION SOLENOID BLOCK (FOR MODEL E16 S/N AHLL13120 & ABOVE)

Description

The blade / track expansion solenoid block diverts hydraulic fluid to either the blade or track expansion function with the switch on the right hand console.

The blade / track expansion solenoid block is located under the floor mat and floor panels on the right side of the excavator.

The blade / track expansion solenoid block has a 29 MPa (290 bar) (4205 psi) relief valve to protect the blade function from overpressure.

Block Removal And Installation

Lower the boom / bucket and blade to the ground.

With the engine off, turn the start key to the ON position and move 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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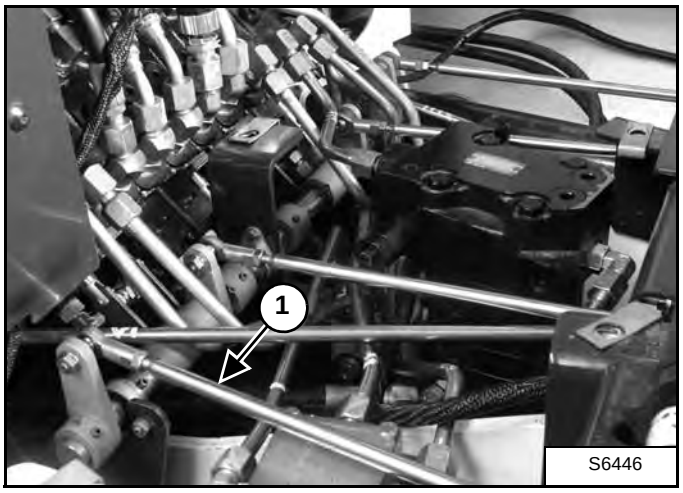
Remove the floor mat and floor panel. (See Removal And Installation on Page 40-140-1.)

⚠ WARNING

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

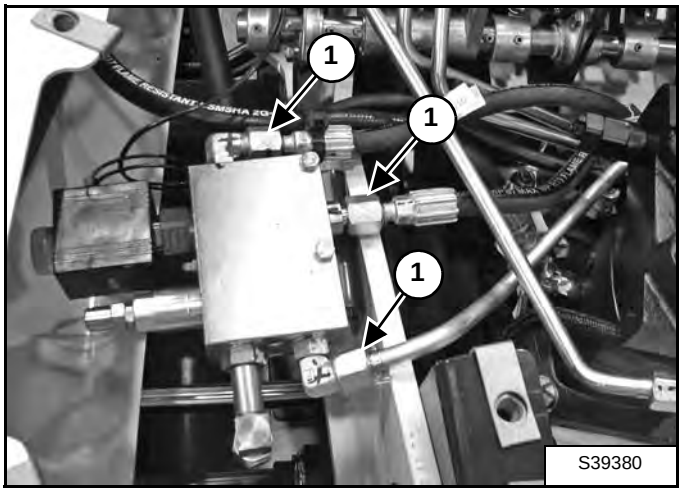
W-2145-EN-0210

Figure 20-141-1



Remove the right linkage rod (Item 1) **[Figure 20-141-1]** from the control linkage assembly.

Figure 20-141-1



Mark all tubelines (Item 1) **[Figure 20-141-1]** for ease of assembly.

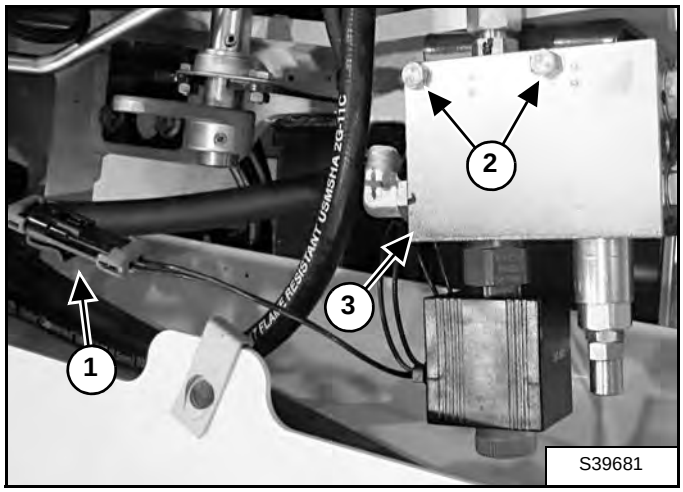
Disconnect the tubelines (Item 1) **[Figure 20-141-1]** from the block.

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BLADE / TRACK EXPANSION SOLENOID BLOCK (FOR MODEL E16 S/N AHLL13120 & ABOVE) (CONT'D)

Block Removal And Installation (Cont'd)

Figure 20-141-2



Disconnect the wire harness (Item 1) **[Figure 20-141-2]** from the excavator harness.

Remove the bolts (Item 2) **[Figure 20-141-2]**.

Remove the blade / track expansion solenoid block (Item 3) **[Figure 20-141-2]** from the excavator.

⚠ WARNING

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

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Solenoid Removal And Installation

Lower the boom / bucket and blade to the ground.

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

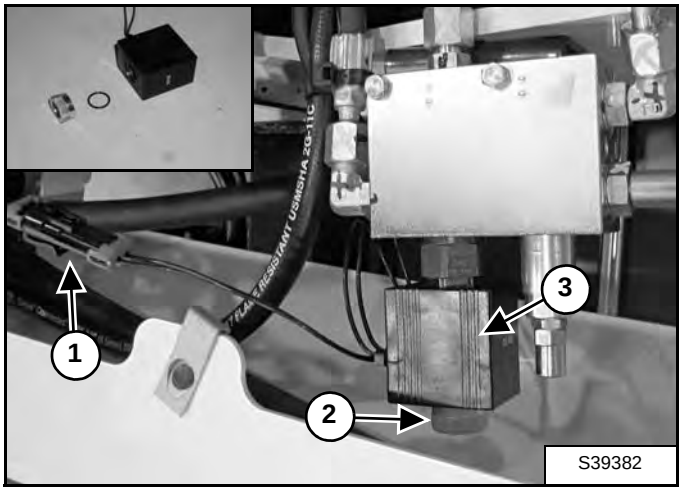
IMPORTANT

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.

I-2003-0888

Remove the floor mat and floor panel. (See Removal And Installation on Page 40-140-1.)

Figure 20-141-3



Disconnect the wire harness (Item 1) **[Figure 20-141-3]** from the excavator harness.

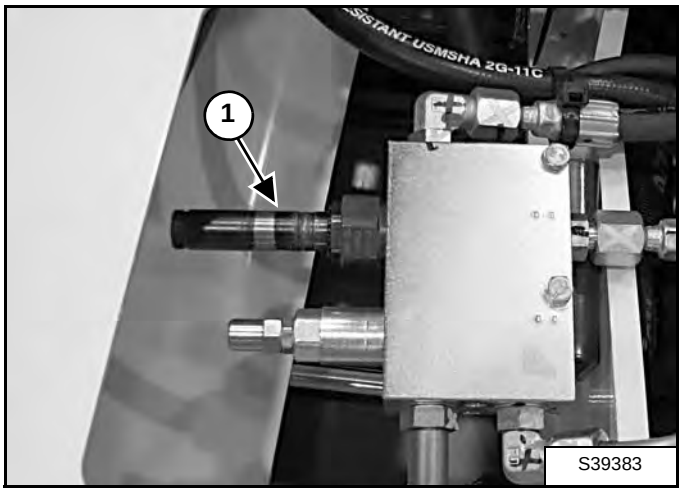
Remove the solenoid nut (Item 2) **[Figure 20-141-3]**.

Remove the O-ring and coil (Item 3) **[Figure 20-141-3]** from the solenoid stem.

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Solenoid Removal And Installation (Cont'd)

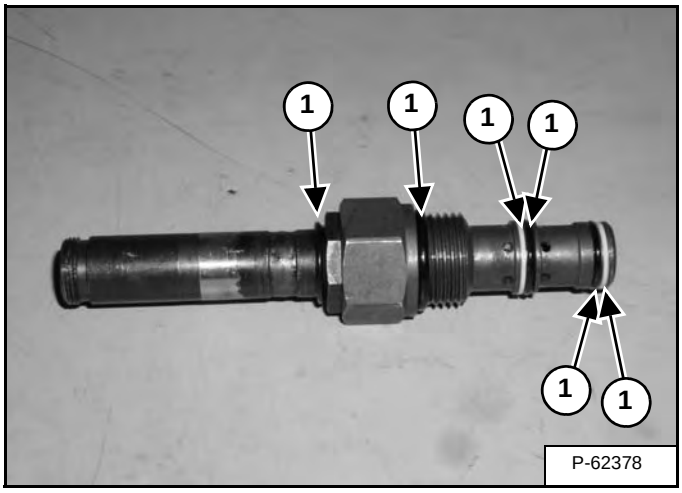
Figure 20-141-4



Remove the solenoid stem (Item 1) **[Figure 20-141-4]**.

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

Figure 20-141-5



Remove the O-rings and back-up rings (Item 1) **[Figure 20-141-5]** from the solenoid stem.

Block Disassembly And Assembly

IMPORTANT

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

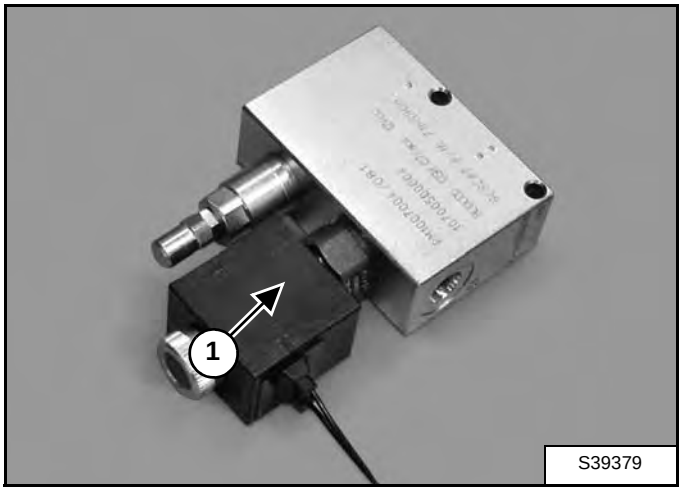
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

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

Figure 20-141-6



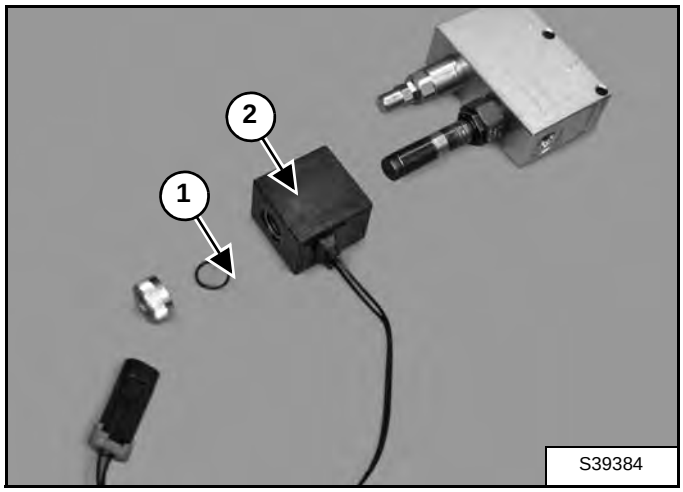
Remove the nut (Item 1) **[Figure 20-141-6]** from the solenoid.

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BLADE / TRACK EXPANSION SOLENOID BLOCK (FOR MODEL E16 S/N AHLL13120 & ABOVE) (CONT'D)

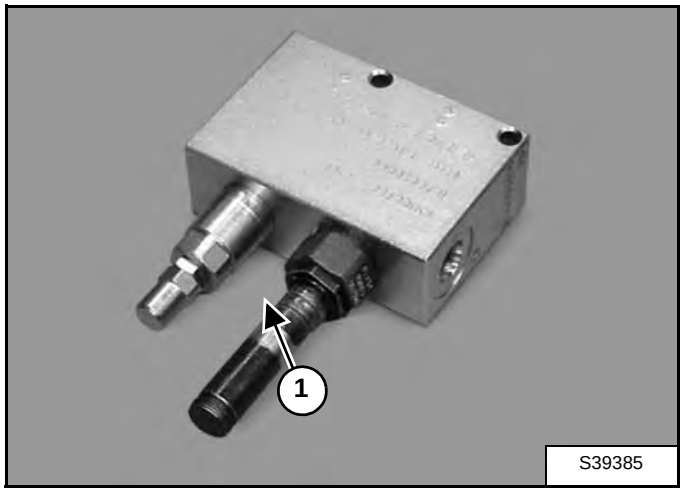
Block Disassembly And Assembly (Cont'd)

Figure 20-141-7



Remove the O-ring (Item 1) and solenoid (Item 2) **[Figure 20-141-7]**.

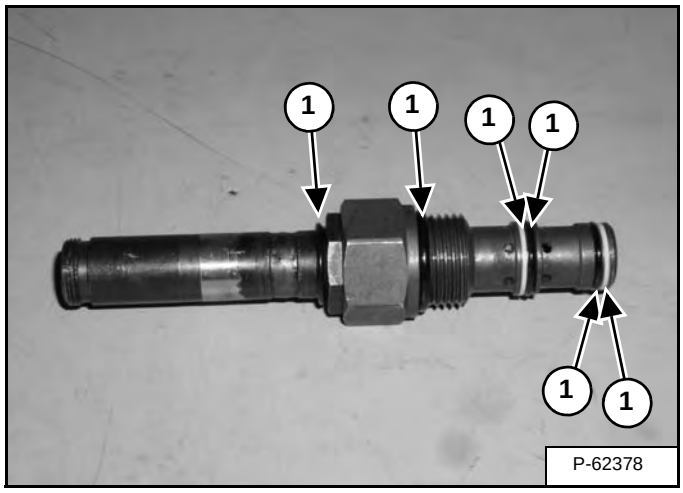
Figure 20-141-8



Remove the solenoid stem (Item 1) **[Figure 20-141-8]**.

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

Figure 20-141-9



Remove the O-rings and back-up rings (Item 1) **[Figure 20-141-9]** from the solenoid stem.

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SLEW LOCK VALVE

Description

The slew lock valve uses two pilot operated check valves to restrict hydraulic flow between the control valve and the slew motor.

When the joystick is moved to swing the upperstructure, hydraulic pressure opens the slew lock check valves and allows hydraulic flow to the swing motor to rotate the upperstructure. When the joystick is in neutral, the check valves close, restricting hydraulic flow to the swing motor.

Removal And Installation

Lower the work equipment to the ground.

With the engine off, turn the key switch to the ON position and move the hydraulic control levers to 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 doctor familiar with this injury is not received immediately.

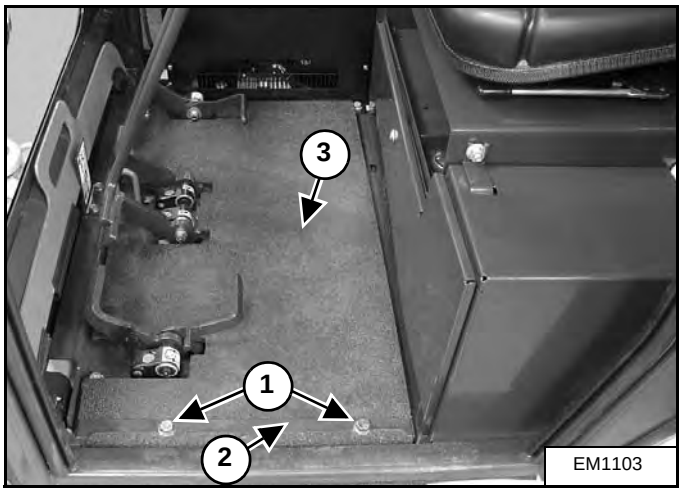
W-2145-EN-0210

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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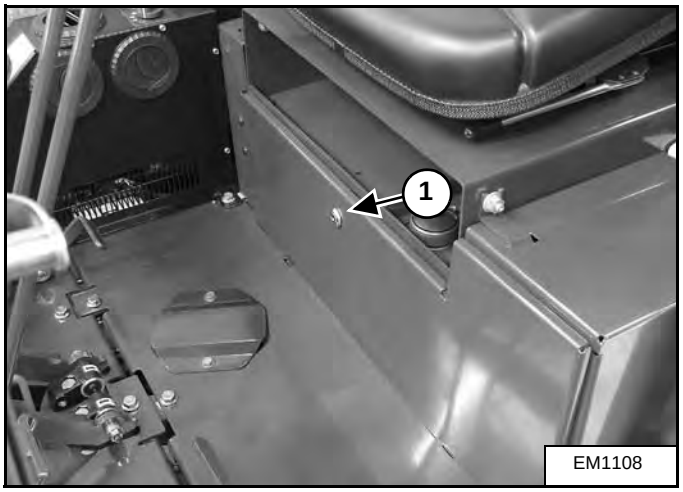
Figure 20-150-1



Remove the two bolts and remove the plate (Item 2) **[Figure 20-150-1]**.

Remove the floor mat (Item 3) **[Figure 20-150-1]**.

Figure 20-150-2



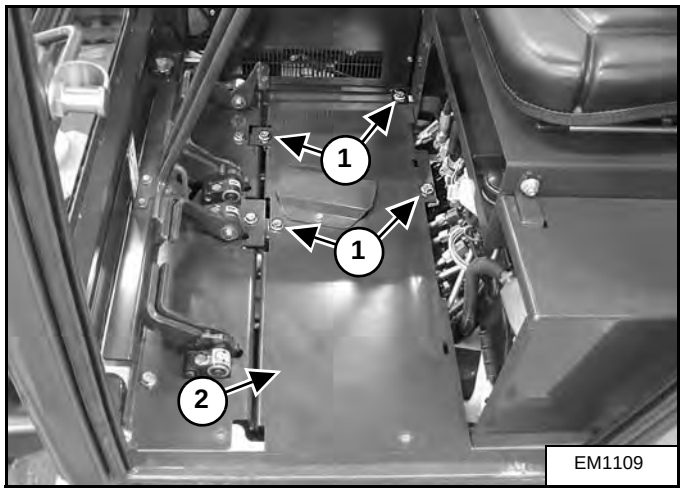
Remove the cover plate, using the contact key (Item 1) **[Figure 20-150-2]**.

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SLEW LOCK VALVE (CONT'D)

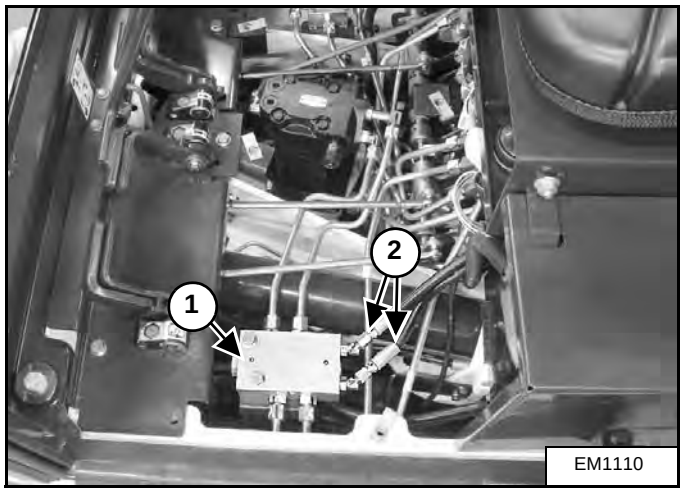
Removal And Installation (Cont'd)

Figure 20-150-3



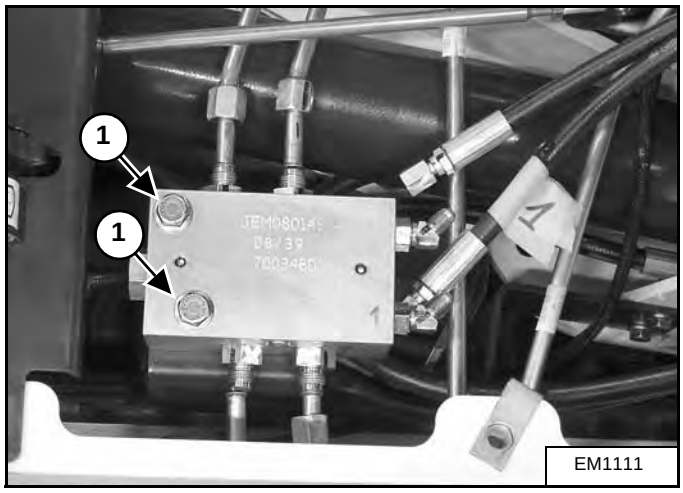
Remove the four remaining bolts (Item 1) and remove the bottom plate (Item 2) **[Figure 20-150-3]**.

Figure 20-150-4



Locate the slew lock valve (Item 1), and mark the two hoses (Item 2) **[Figure 20-150-4]** prior to disassembly.

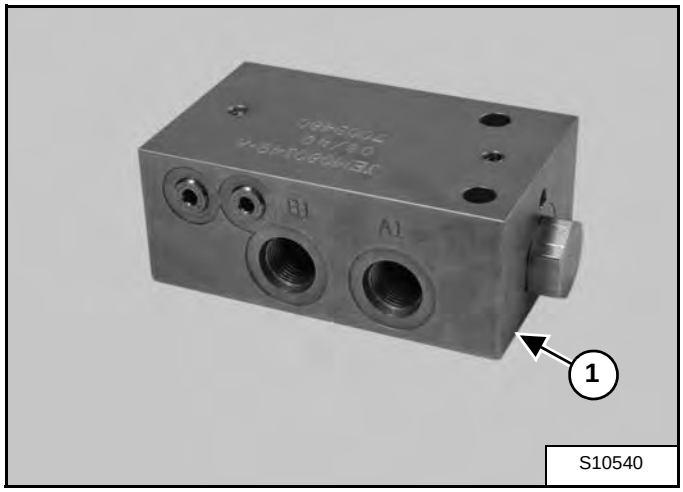
Figure 20-150-5



Remove the six hydraulic connections from the slew lock valve.

Remove the two bolts (Item 1) **[Figure 20-150-5]** from the slew lock valve.

Figure 20-150-6

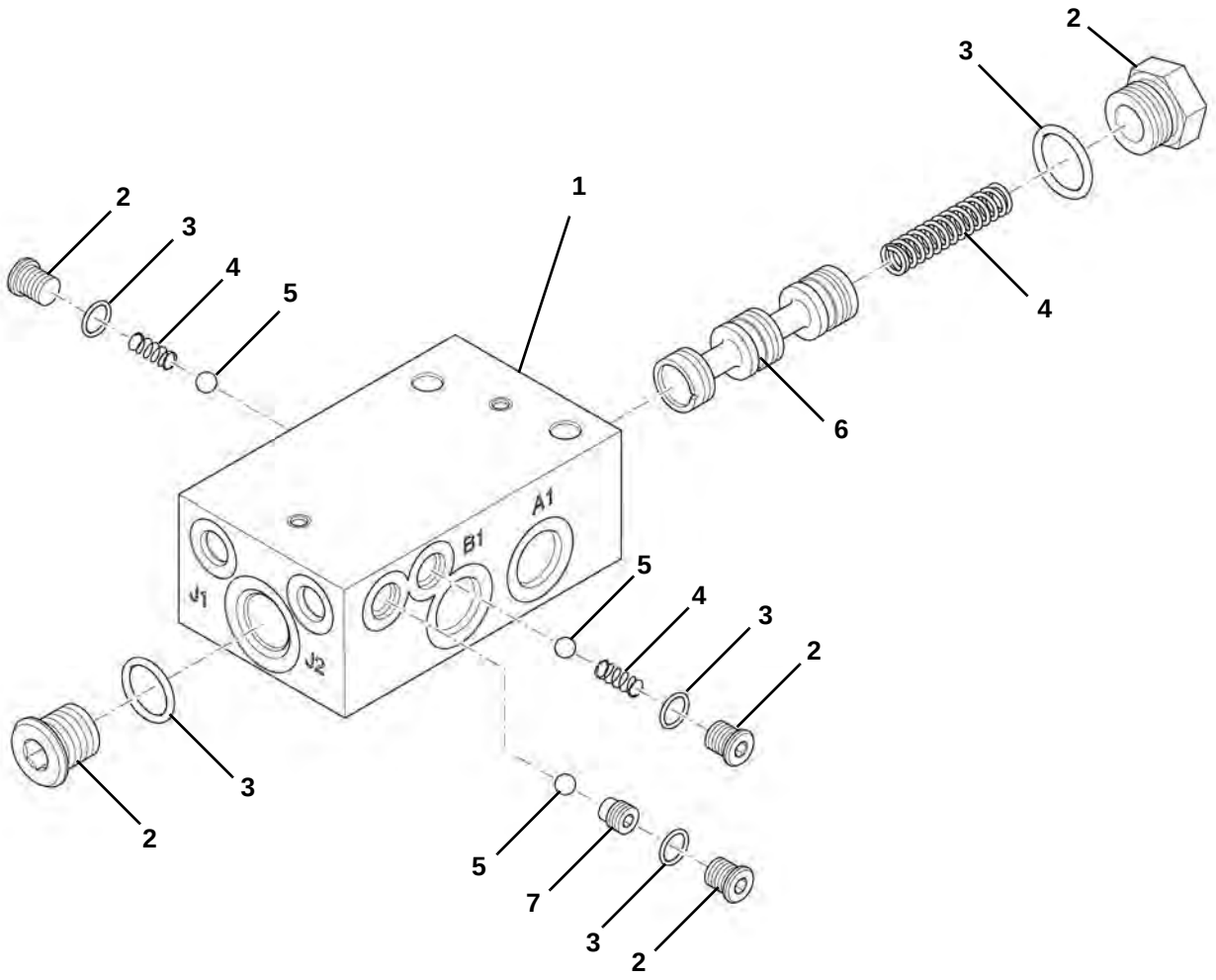


Remove the slew lock valve (Item 1) **[Figure 20-150-6]** from the excavator.

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Parts Identification

1. Valve
2. Plug
3. O-ring
4. Spring
5. Ball
6. Spool
7. Shuttle seat



EM1112

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SLEW LOCK VALVE (CONT'D)

Disassembly And Assembly

Clean all parts in solvent and dry with compressed air.

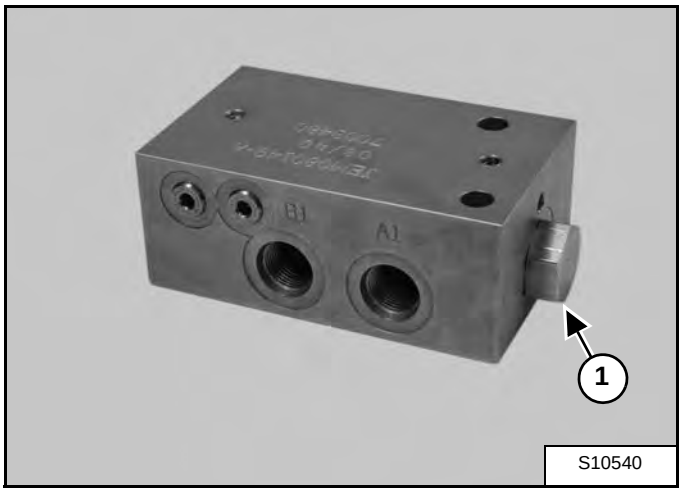
Inspect all parts for wear or damage. Replace any worn or damaged parts.

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

Mark the locations and orientation of the six fittings.

Remove the six fittings from the manifold.

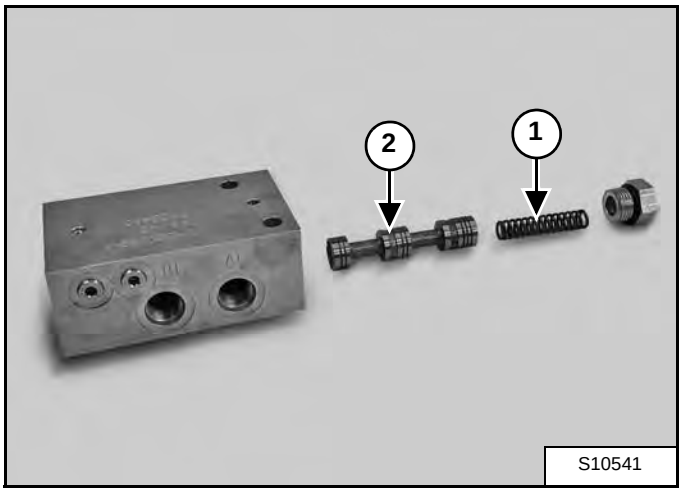
Figure 20-150-7



Remove the plug (Item 1) **[Figure 20-150-7]**.

Installation: Tighten the plug to 68 N•m (50 ft-lb) torque.

Figure 20-150-8



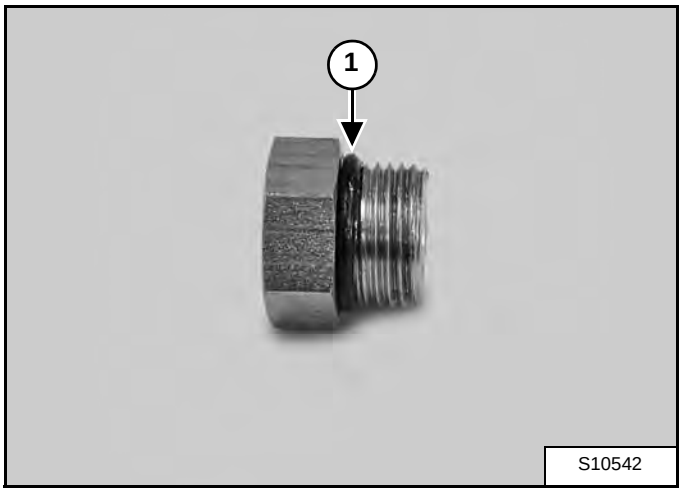
Remove the spring (Item 1) and spool (Item 2) **[Figure 20-150-8]**.

IMPORTANT

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

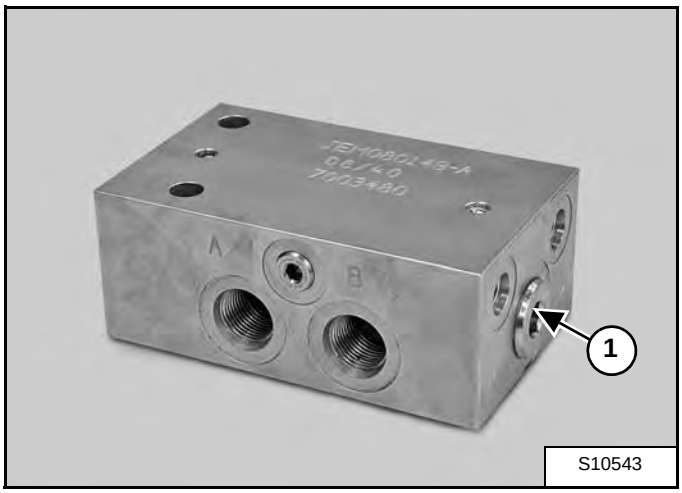
I-2003-0888

Figure 20-150-9



Remove the O-ring (Item 1) **[Figure 20-150-9]** from the plug.

Figure 20-150-10



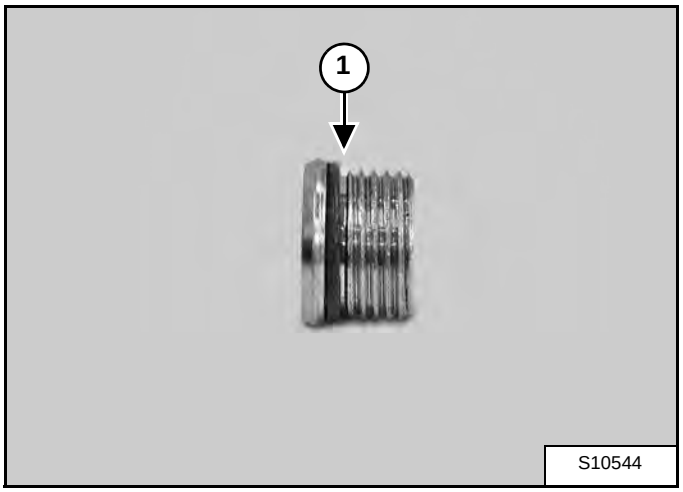
Remove the plug (Item 1) **[Figure 20-150-10]**.

Installation: Tighten the plug to 102 N•m (75 ft-lb) torque.

Dealer Copy -- Not for Resale

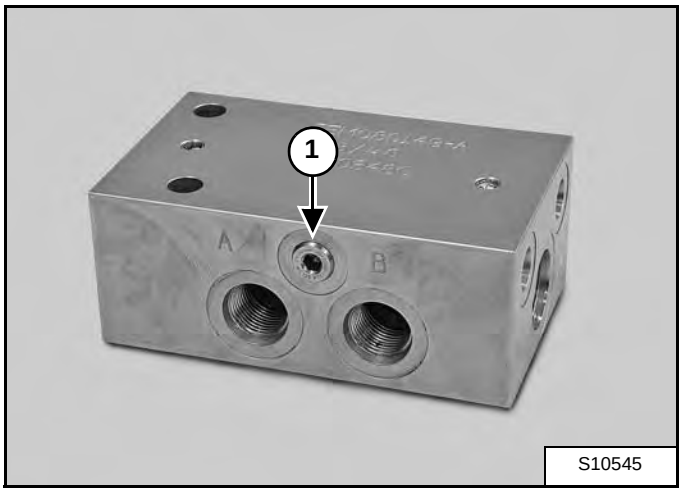
Disassembly And Assembly (Cont'd)

Figure 20-150-11



Remove the O-ring (Item 1) **[Figure 20-150-11]** from the plug.

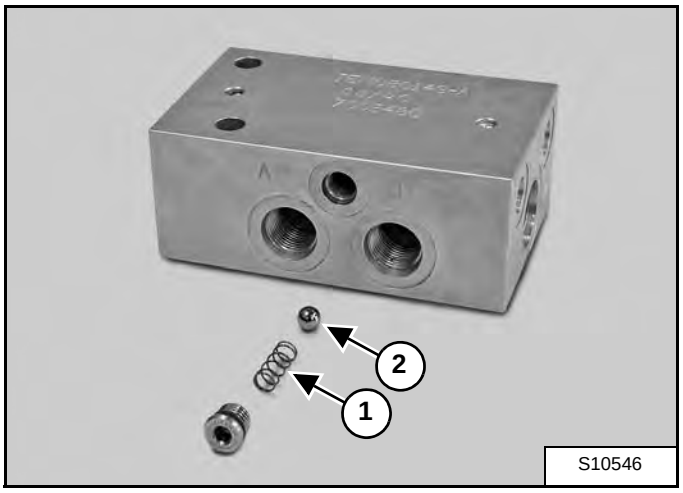
Figure 20-150-12



Remove the plug (Item 1) **[Figure 20-150-12]**.

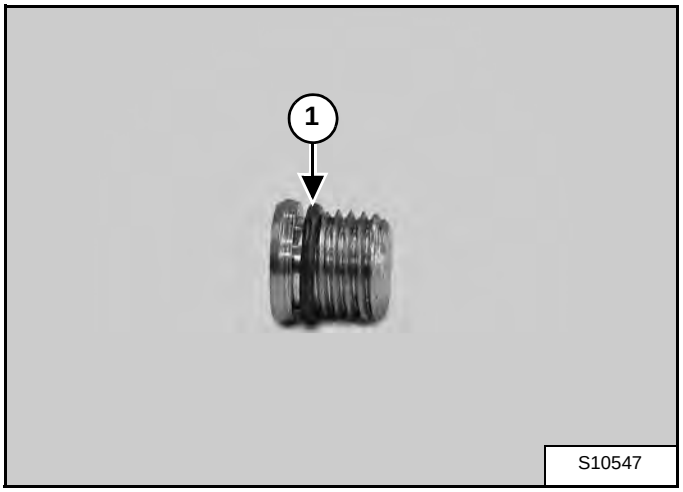
Installation: Tighten the plug to 27 N•m (20 ft-lb) torque.

Figure 20-150-13



Remove the spring (Item 1) and ball (Item 2) **[Figure 20-150-13]**.

Figure 20-150-14

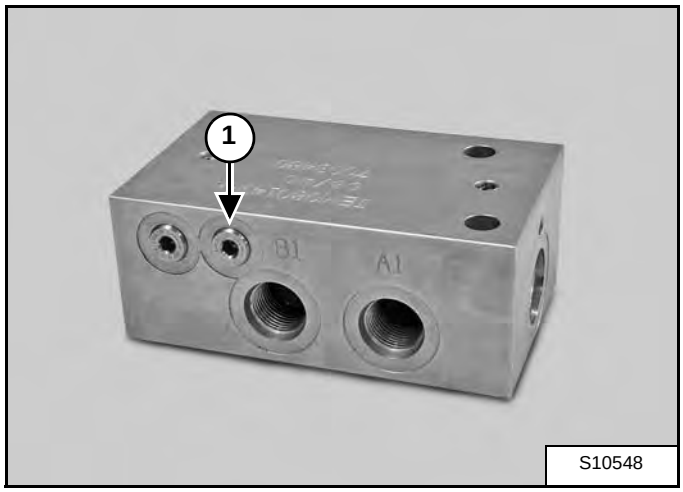


Remove the O-ring (Item 1) **[Figure 20-150-14]** from the plug.

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Disassembly And Assembly (Cont'd)

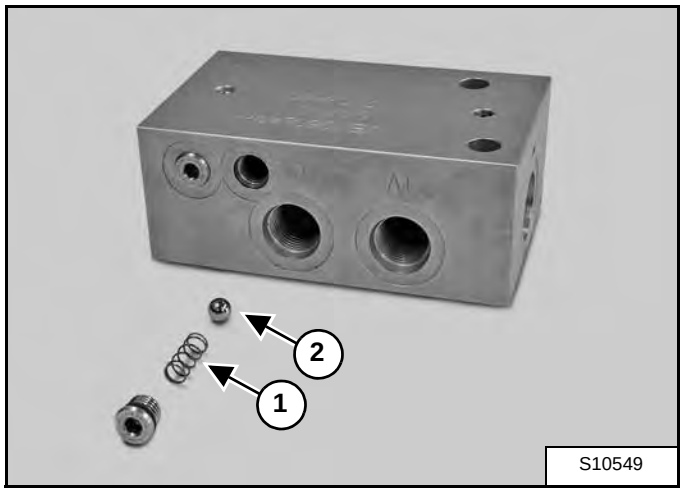
Figure 20-150-15



Remove the plug (Item 1) **[Figure 20-150-15]**.

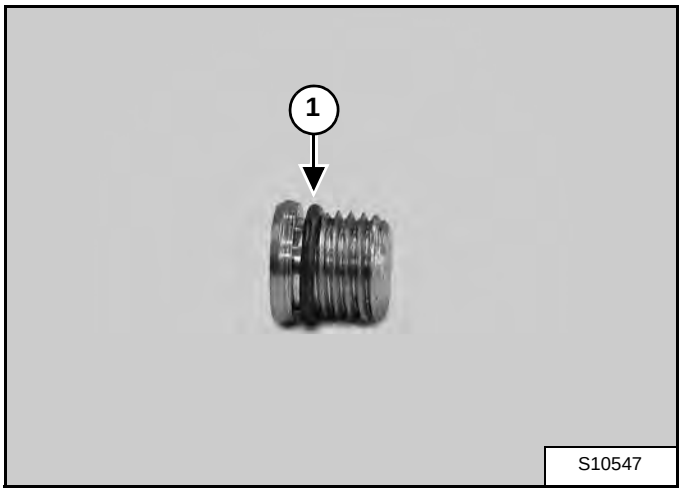
Installation: Tighten the plug to 27 N•m (20 ft-lb) torque.

Figure 20-150-16



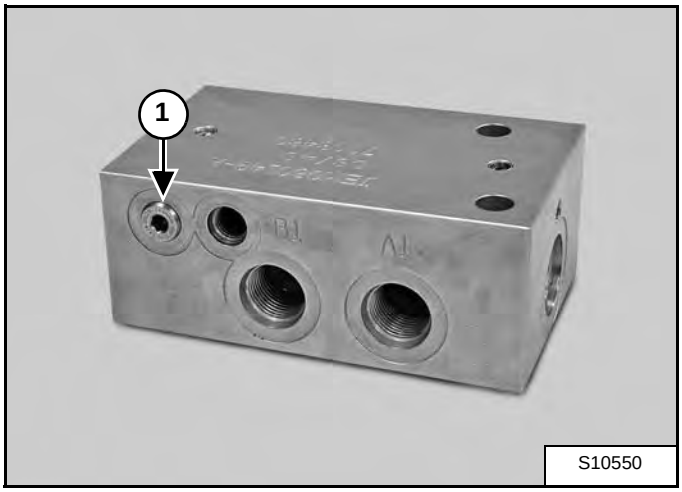
Remove the spring (Item 1) and ball (Item 2) **[Figure 20-150-16]**.

Figure 20-150-17



Remove the O-ring (Item 1) **[Figure 20-150-17]** from the plug.

Figure 20-150-18



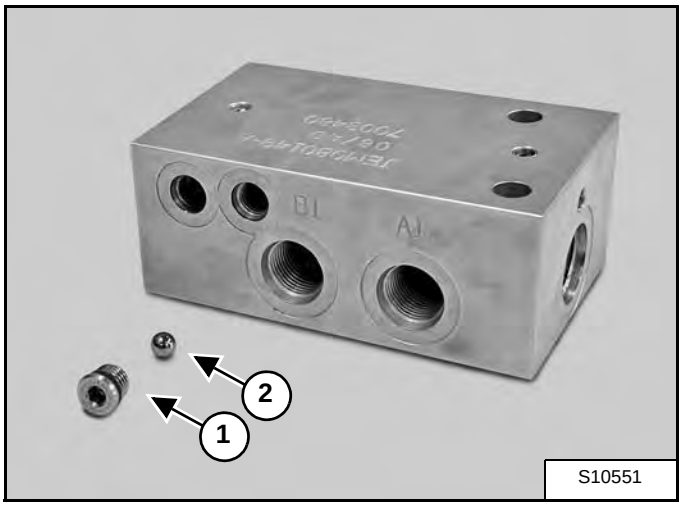
Remove the plug (Item 1) **[Figure 20-150-18]**.

Installation: Tighten the plug to 27 N•m (20 ft-lb) torque.

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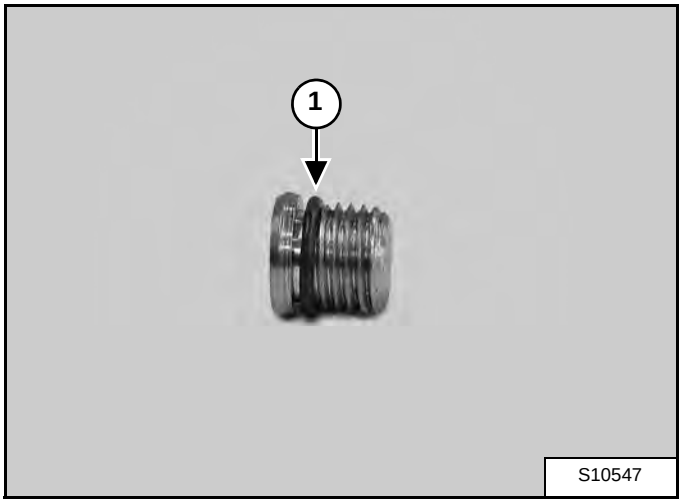
Disassembly And Assembly (Cont'd)

Figure 20-150-19



Remove the shuttle seat (Item 1) and ball (Item 2) **[Figure 20-150-19]**.

Figure 20-150-20



Remove the O-ring (Item 1) **[Figure 20-150-20]** from the plug.

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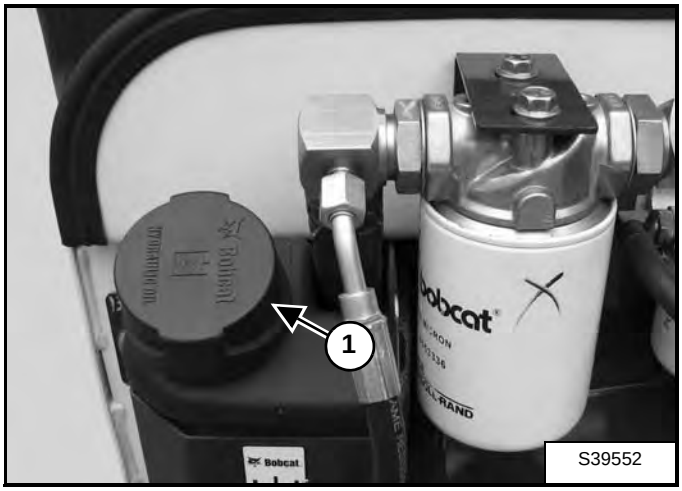
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REMOVING AIR FROM THE HYDRAULIC SYSTEM

Procedure

Open the tailgate.

Figure 20-160-1



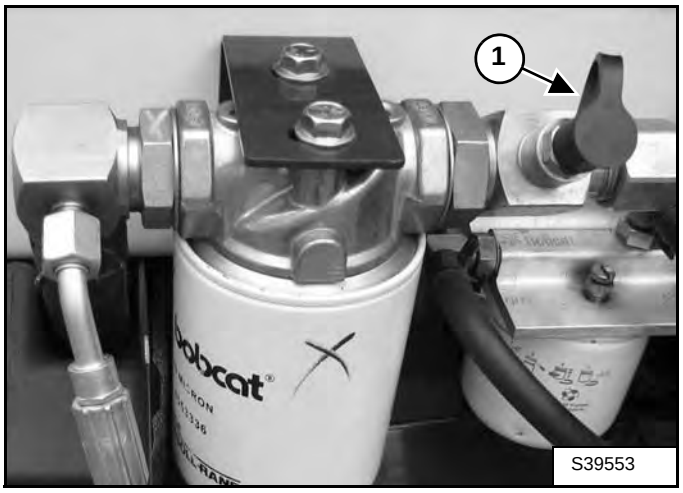
Remove the oil fill cap (Item 1) **[Figure 20-160-1]** from the hydraulic reservoir.

Figure 20-160-2



Remove the fill strainer screen (Item 1) **[Figure 20-160-2]** from the hydraulic reservoir.

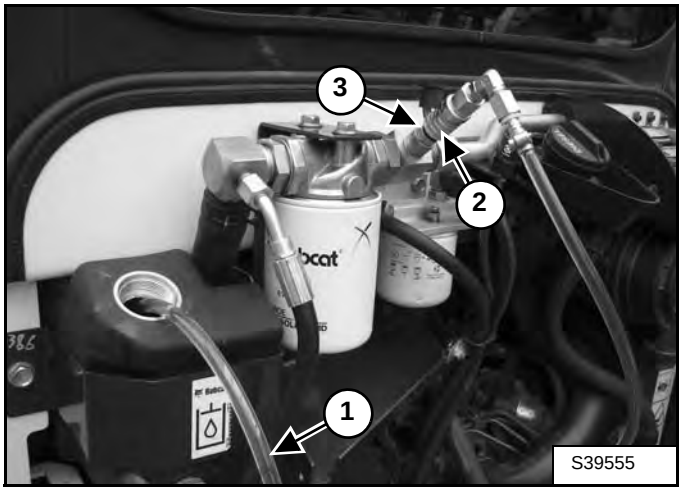
Figure 20-160-3



Remove the cap (Item 1) **[Figure 20-160-3]** from the male diagnostic coupler on the filter inlet.

Clean the male diagnostic coupler and the surrounding area.

Figure 20-160-4



Install the tubeline end of the oil hose (Item 1) **[Figure 20-160-4]** into the hydraulic reservoir.

Install the female diagnostic coupler (Item 2) on the male diagnostic coupler (Item 3) **[Figure 20-160-4]**.

NOTE: Be sure the hydraulic system is filled with oil before starting the excavator to prevent damage to the system.

Start the excavator.

If additional air has gotten into some of the circuits (motors or cylinders), the excavator can be operated with the bleed tool in place.

NOTE: When the excavator is operated with bleed hose in place, the reservoir cap is removed. The hydraulic system must be protected from contamination and spill.

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UNDERCARRIAGE

BLADE 30-10-1
Description 30-10-1
Extension Removal And Installation 30-10-1
Blade Removal And Installation 30-10-2

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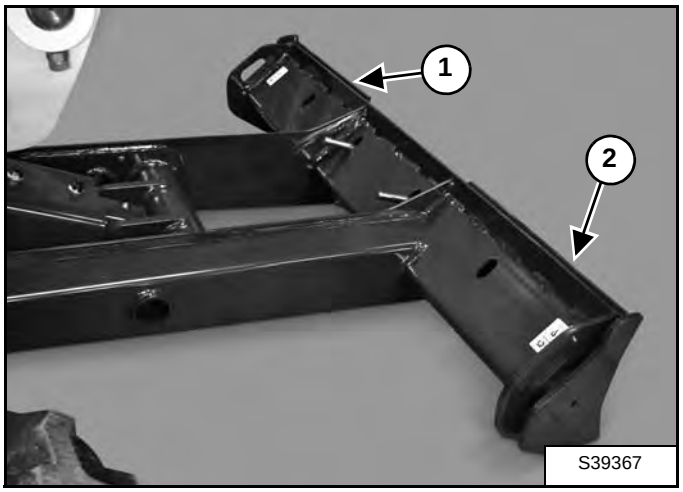
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BLADE

Description

The blade extensions are used to match the blade width to the track width. Secure the blade extensions in the retracted position when transporting the excavator or when narrow operating width is needed. Under normal operating conditions, the blade width should match the track width.

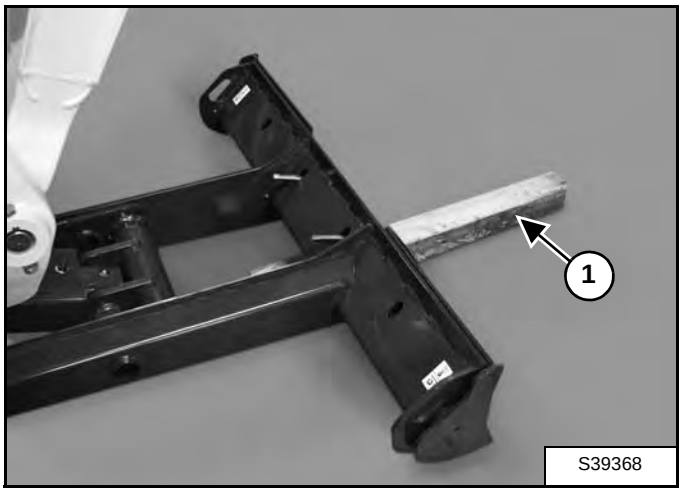
Figure 30-10-1



The blade extensions (Items 1 and 2) **[Figure 30-10-1]** are located on the blade.

Extension Removal And Installation

Figure 30-10-2

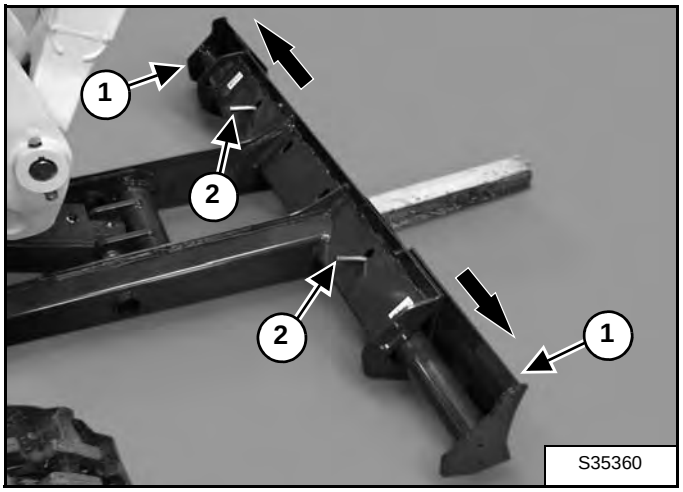


Put a block (Item 1) **[Figure 30-10-2]** under the blade.

Fully lower the blade on the block.

Stop the engine.

Figure 30-10-3



Remove the two pins (Item 1) **[Figure 30-10-3]** from the blade extensions.

Remove the blade extensions (Item 1) **[Figure 30-10-3]** from the blade.

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BLADE (CONT'D)

Extension Removal And Installation (C0nt'd)

Expand the tracks. (See the Operation & Maintenance Manual for the correct procedure.)

Blade Removal And Installation

Lower the blade to the ground.

Remove the blade cylinder. (See Removal And Installation on Page 20-24-2.)

Figure 30-10-4

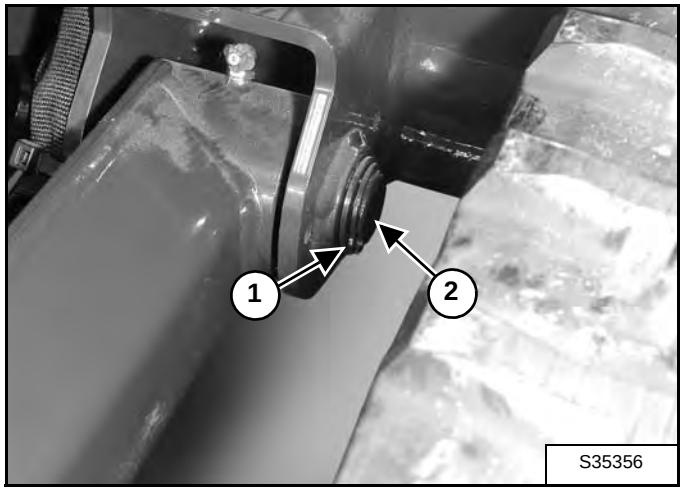
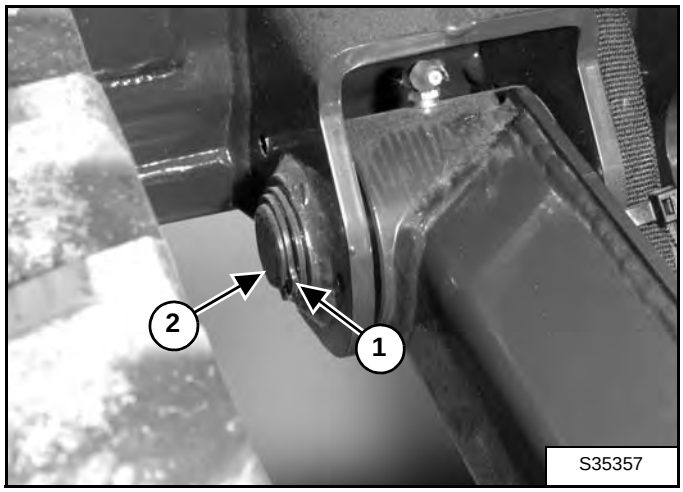


Figure 30-10-5



Remove the snap ring (Item 1) **[Figure 30-10-4]** and **[Figure 30-10-5]** and washer from the blade arm pivot pins (Both sides).

Remove the blade arm pivot pins (Item 2) **[Figure 30-10-4]** and **[Figure 30-10-5]**.

Remove the blade from the excavator.

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TRACK UNDERCARRIAGE COMPONENTS

Description

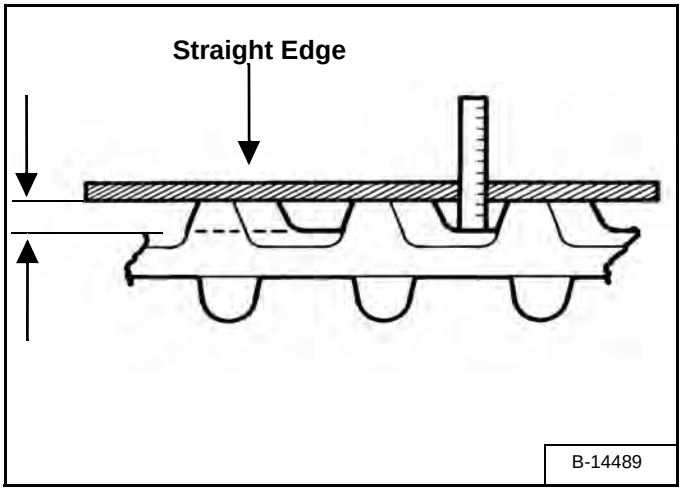
The track undercarriage components consist of the front idler, rollers, drive motor and track frame.

Track Lug Height

Rubber Track

The lug height of a new rubber track is 25,0 mm (0.984 in).

Figure 30-20-1



To find the percentage of wear on an excavator track, measure the height of the lug by placing a straight edge across the top of three lugs and measure the distance from the base of the track to the bottom of the straight edge **[Figure 30-20-1]**.

Divide this measurement by the new track height and multiply by 100. This will give the percentage of track lug left.

Example: lug height 20,0 mm (0.787 in)

$$\frac{0.787}{0.984} \times 100 = 80$$

Checking Tension

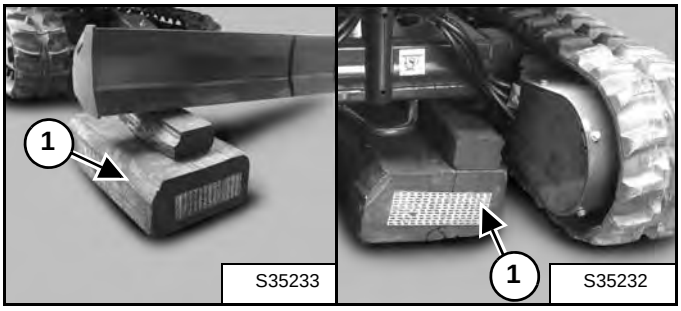
NOTE: The wear of undercarriage parts varies with the working conditions and the soil types. Maintain the correct track tension by inspecting regularly. (See SERVICE SCHEDULE on Page 10-70-1.)

Figure 30-20-2



Raise one side of the machine (approximately 102 mm [4 in]) using the boom and arm as shown in **[Figure 30-20-2]**.

Figure 30-20-3



Fully raise the blade and install wooden blocks (Item 1) **[Figure 30-20-3]** or jackstands under the blade and the track frame. Lower the machine until all machine weight is on the wooden blocks or jackstands.

Stop the engine.

WARNING

AVOID INJURY

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

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Checking Tension (Cont'd)

Figure 30-20-4

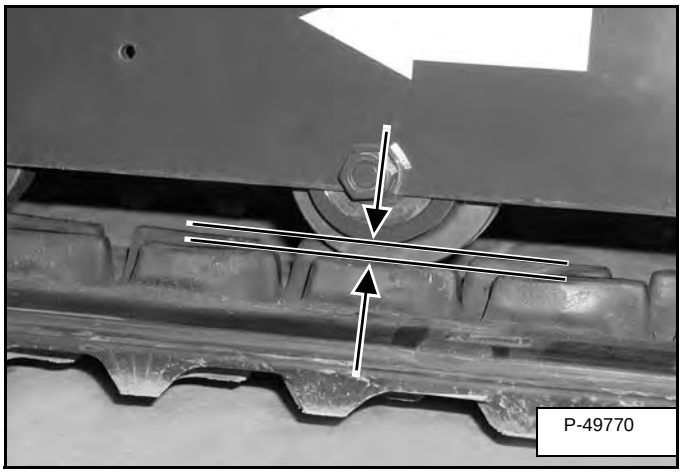
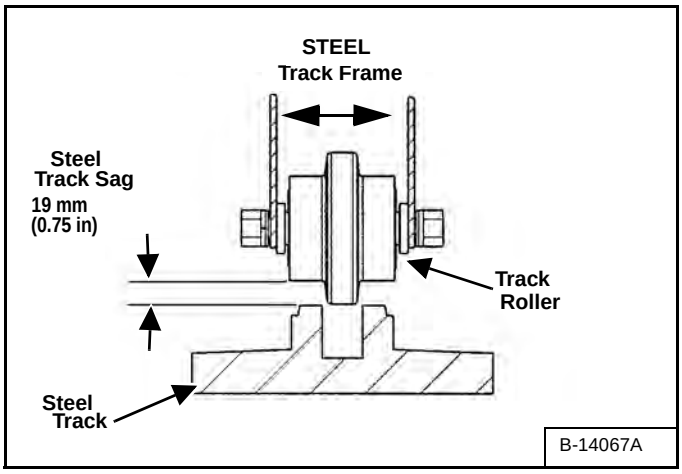


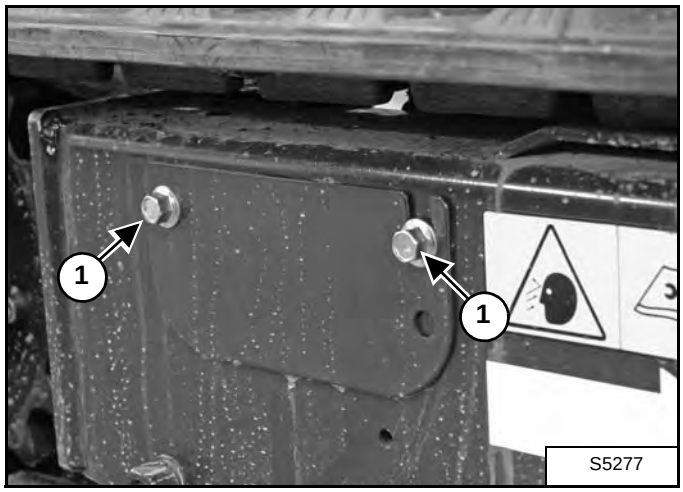
Figure 30-20-5



Measure the rubber or steel track sag at the middle track roller **[Figure 30-20-4]**. Do not get your fingers into pinch points between the track and the track roller. Use material of appropriate size to check the gap between the contact edge of the roller and top edge of the track guide lug **[Figure 30-20-4]** and **[Figure 30-20-5]**.

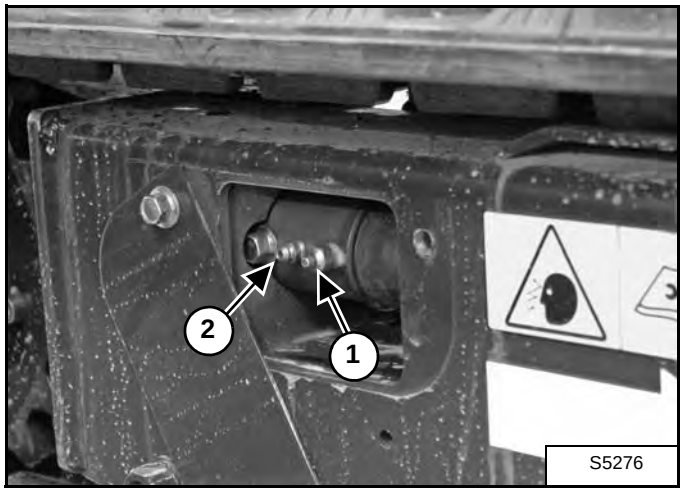
Adjusting Tension

Figure 30-20-6



Loosen the two bolts (Item 1) **[Figure 30-20-6]** on the cover. Pivot the cover downward.

Figure 30-20-7



Add grease to the fitting (Item 1) **[Figure 30-20-7]** until the track tension is correct.

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Adjusting Tension (Cont'd)

Use tool MEL1560 to loosen the bleed fitting (Item 2) **[Figure 30-20-7]** (one turn maximum) to release tension from the track.

Repeat the procedure for the other side.

If the track tension is still loose after adjusting to the mentioned limit, it indicates the track is worn.

⚠ WARNING

AVOID INJURY OR DEATH

Do not loosen the grease fitting more than one complete rotation. Also, be careful not to loosen any part other than the grease fitting. If the grease fitting or any part is loosened too much, it can fly off under high pressure. If the grease does not ooze smoothly, try moving the machine back and forth for a short distance.

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⚠ WARNING

HIGH PRESSURE GREASE CAN CAUSE SERIOUS INJURY

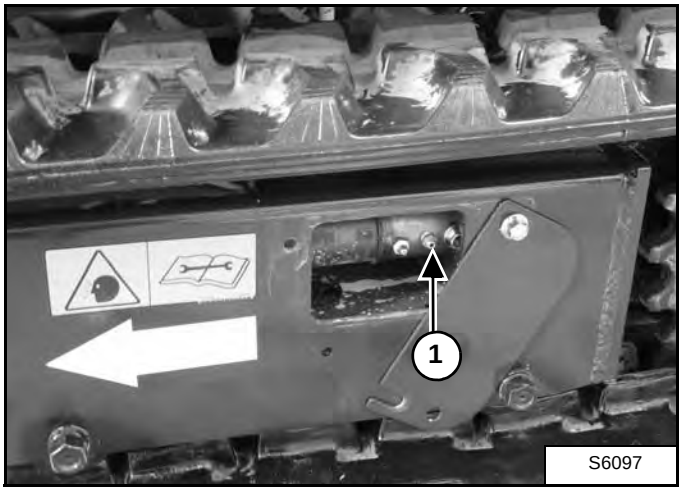
- **Do not loosen grease fitting.**
- **Do not loosen bleed fitting more than 1 - 1/2 turns.**

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Track Removal And Installation

Lift and block the side of the machine where the track will be removed. (See Procedure on Page 10-10-1.)

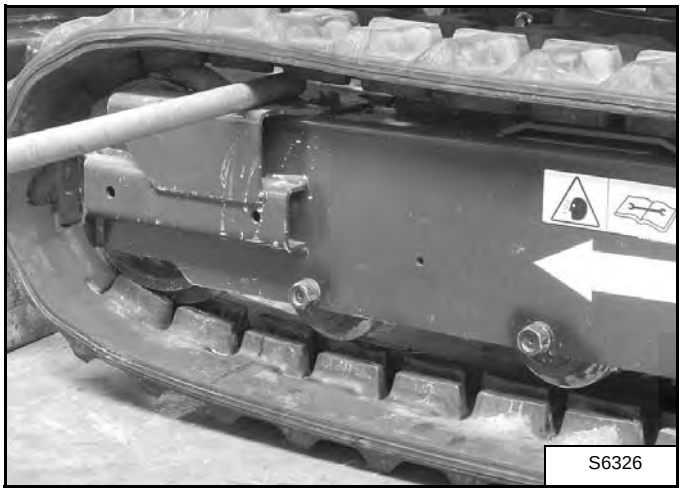
Figure 30-20-8



Slowly loosen the bleed screw fitting (Item 1) **[Figure 30-20-8]** (one turn maximum) to remove track tension.

NOTE: Apply additional pressure to the track by standing on the lower track span so all the tension is released from the grease cylinder for easier removal of the track.

Figure 30-20-9

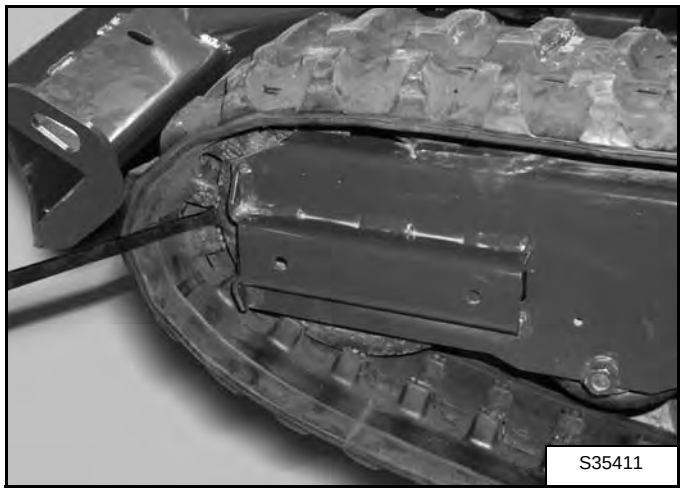


Install a round bar (Approximately 1,25 in [30 mm] diameter) between the drive lugs **[Figure 30-20-9]**.

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Track Removal And Installation (Cont'd)

Figure 30-20-10



Turn the track until the bar contacts the frame **[Figure 30-20-10]**.

Pry the track off the idler wheel.

Remove the track from the drive sprocket.

To install the rubber track:

Put the track over the rear drive sprocket lugs.

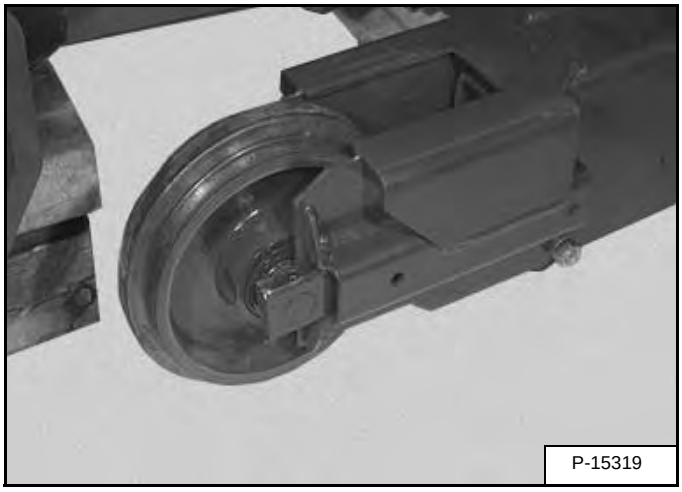
Put the front of the track onto the front idler wheel.

(See Checking Tension on Page 30-20-1.) For adding grease to the grease spring and for checking track tension.

Idler Removal And Installation

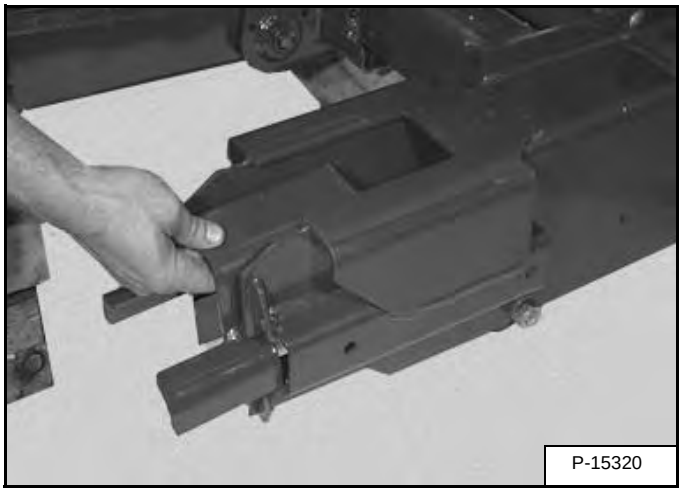
Remove the track. (See Track Removal And Installation on Page 30-20-3.)

Figure 30-20-11



Slide the front track idler out of the track frame to remove it **[Figure 30-20-11]**.

Figure 30-20-12

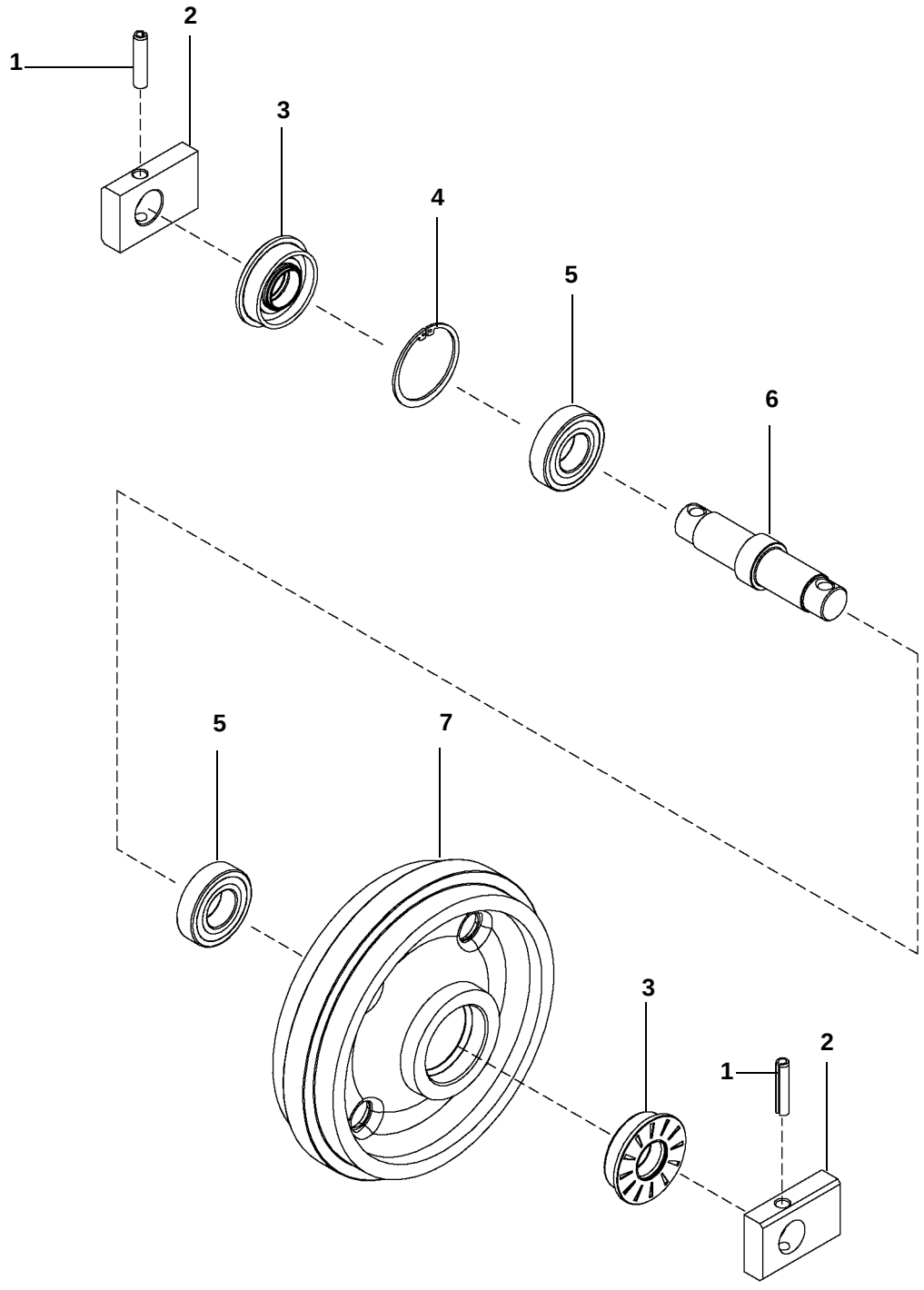


Remove the sliding plate **[Figure 30-20-12]**.

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Idler Parts Identification

1. Roll Pin
2. Block
3. Seal
4. Snap Ring
5. Bearing
6. Shaft
7. Idler



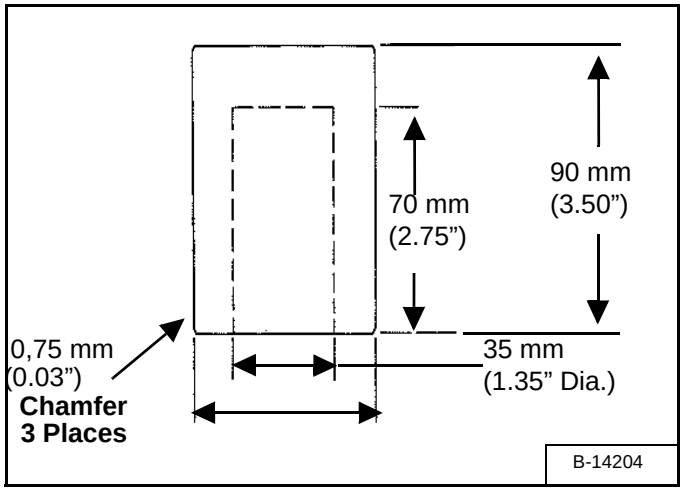
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Idler Disassembly

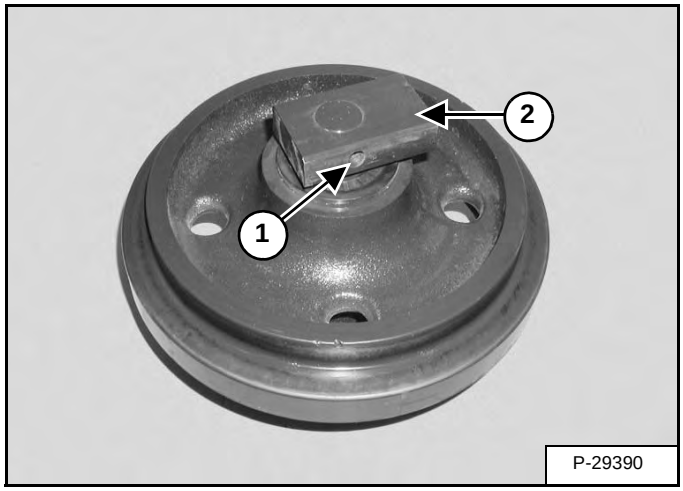
The following tools must be fabricated for this procedure:

Figure 30-20-13



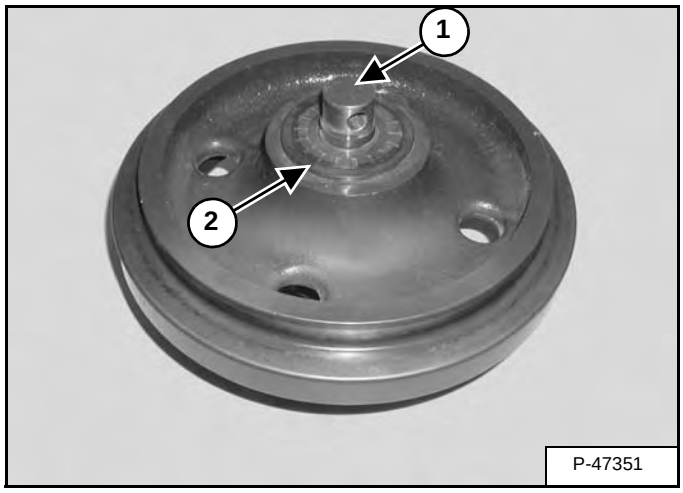
1. Support Fixture - Tube, 76,2 mm I.D. x 6,35 mm wall x 152,4 mm long (3.0 in I.D. x 0.250 in wall x 6.0 in long).

Figure 30-20-14



Remove the roll pin (Item 1) and block (Item 2) **[Figure 30-20-14]** from each end of the shaft.

Figure 30-20-15

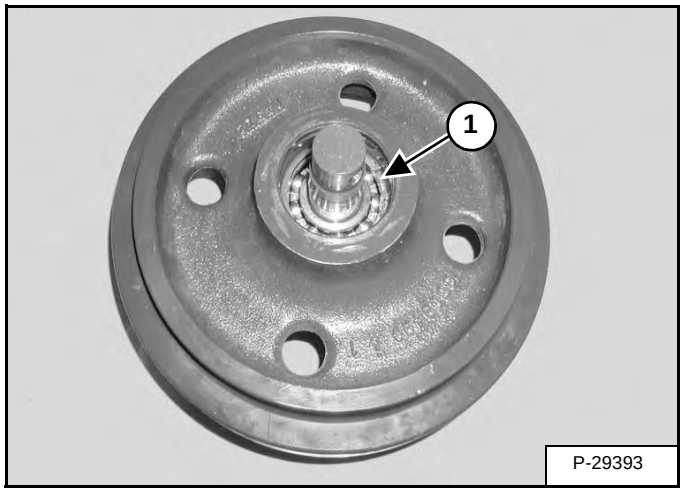


Remove any corrosion or paint from both ends of the exposed shaft (Item 1) **[Figure 30-20-15]** that could affect seal removal or damage the new seal during installation.

Apply penetrating oil to both ends of the exposed shaft (Item 1) to ease removal of the seal (Item 2) **[Figure 30-20-15]**.

Remove the seal (Item 2) **[Figure 30-20-15]** from both sides of the idler.

Figure 30-20-16



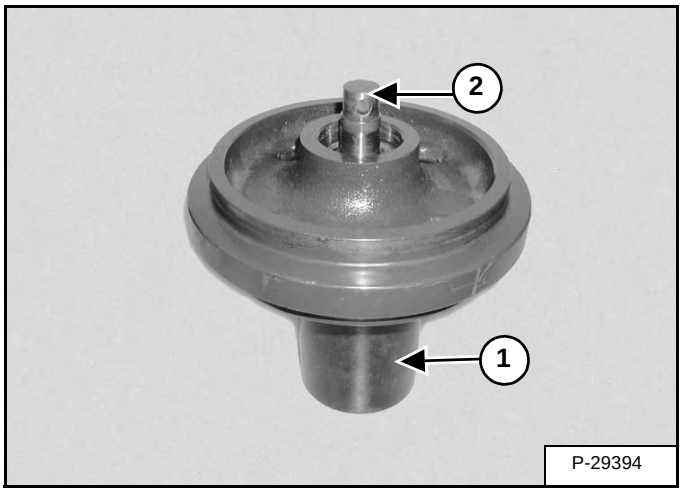
Remove the snap ring (Item 1) **[Figure 30-20-16]**.

NOTE: The snap ring is installed on one side of the idler. The other side is stepped to retain the bearing.

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Idler Disassembly (Cont'd)

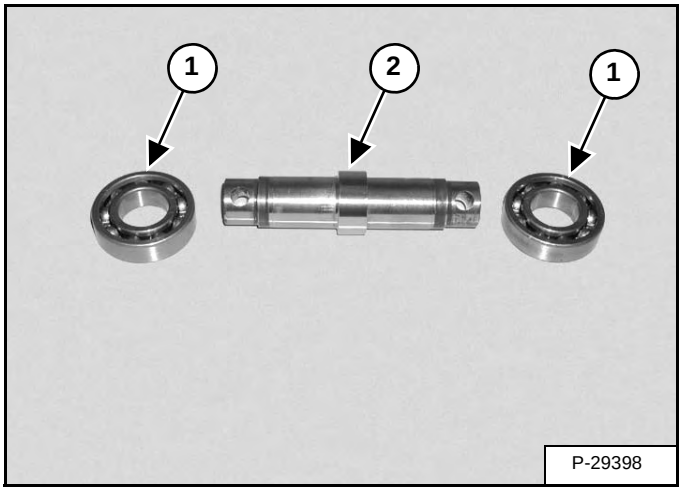
Figure 30-20-17



Place the idler on the support fixture (Item 1) **[Figure 30-20-17]**.

Using a soft faced hammer, tap the shaft (Item 2) **[Figure 30-20-17]** and bearing out the bottom of the idler.

Figure 30-20-18

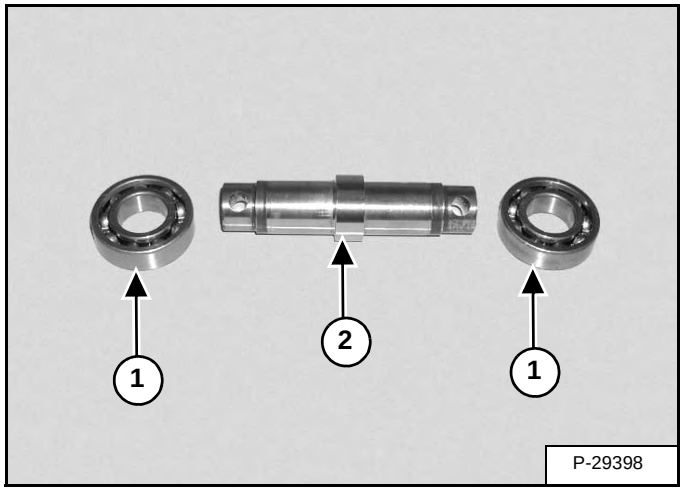


Slide the bearings (Item 1) off of the shaft (Item 2) **[Figure 30-20-18]**.

Idler Assembly

Clean all parts in solvent and dry with compressed air.

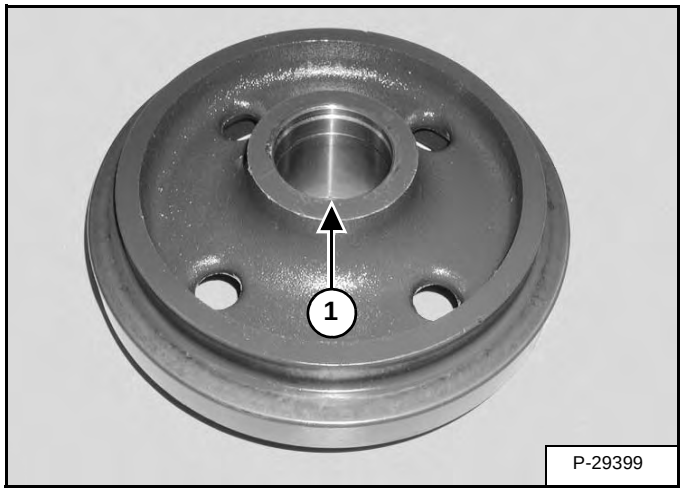
Figure 30-20-19



Inspect the bearings (Item 1) and shaft (Item 2) **[Figure 30-20-19]** for wear or damage. Replace any worn or damaged parts.

The bearings are sealed. If the bearings do not roll smoothly, or if the seals are damaged, replace the bearings.

Figure 30-20-20

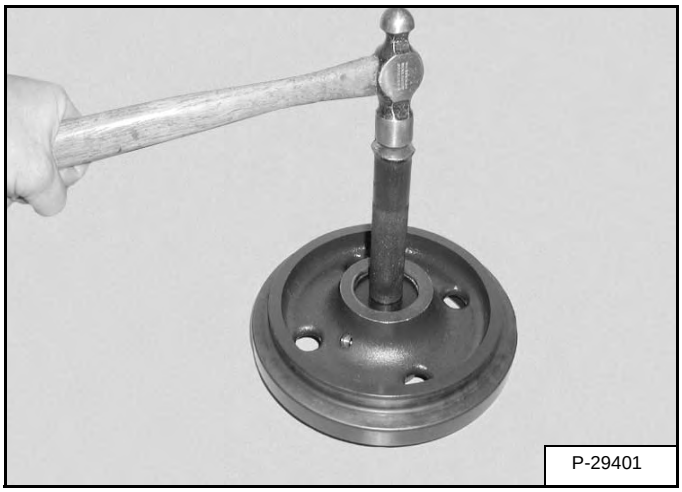


Remove all paint and corrosion from the seal surface (Item 1) **[Figure 30-20-20]** on both sides of the idler.

Dealer Copy -- Not for Resale

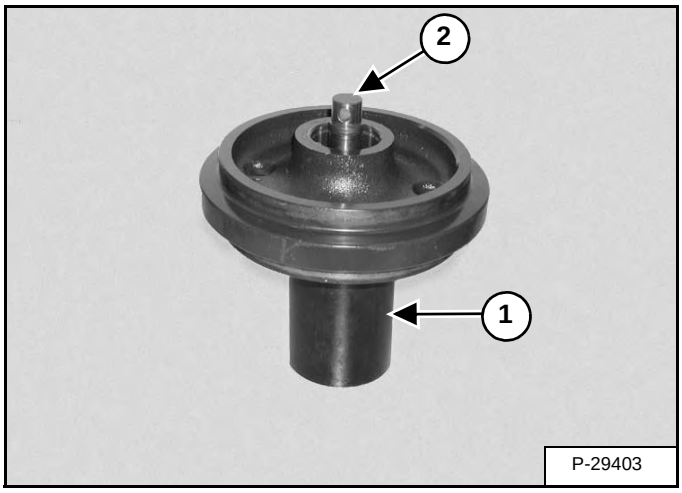
Idler Assembly (Cont'd)

Figure 30-20-21



Using a bearing driver, install the bearing in the idler **[Figure 30-20-21]**.

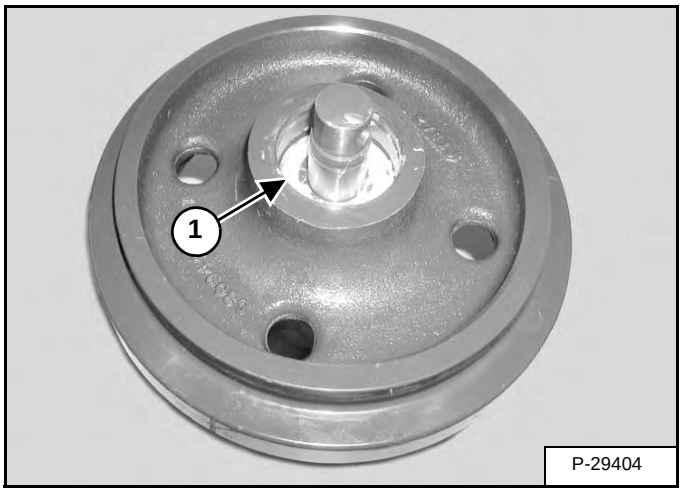
Figure 30-20-22



Place the idler on the support fixture (Item 1) **[Figure 30-20-22]**.

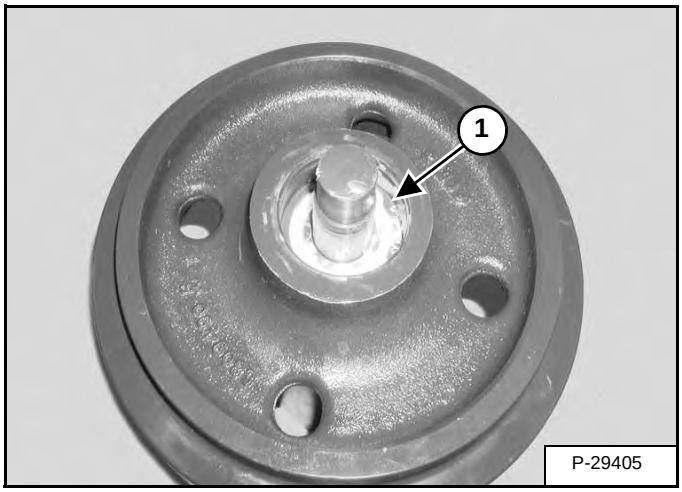
Install the shaft (Item 2) **[Figure 30-20-22]**.

Figure 30-20-23



Install the bearing (Item 1) **[Figure 30-20-23]**. Use a brass drift to seat the bearing.

Figure 30-20-24

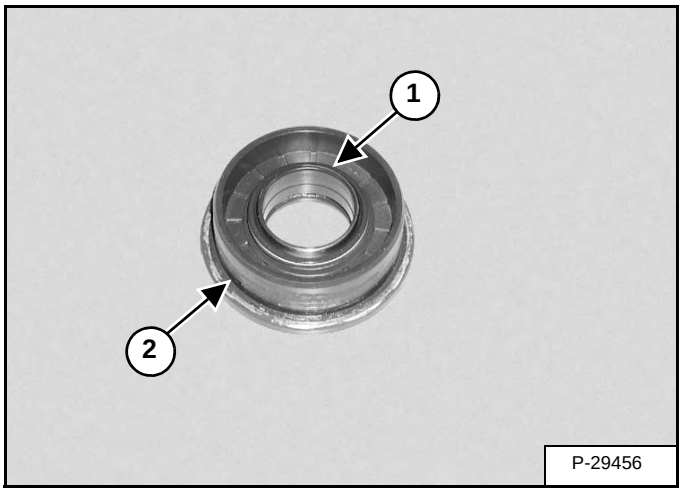


Install the snap ring (Item 1) **[Figure 30-20-24]**.

Dealer Copy -- Not for Resale

Idler Assembly (Cont'd)

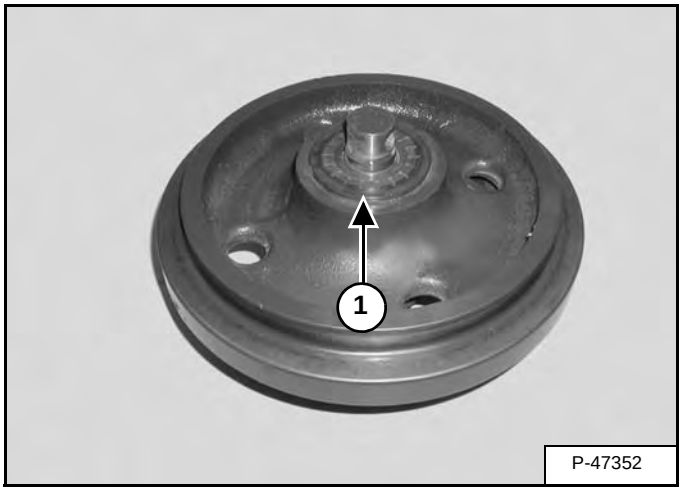
Figure 30-20-25



Apply assembly lube to the inside diameter (Item 1) **[Figure 30-20-25]** of the seal.

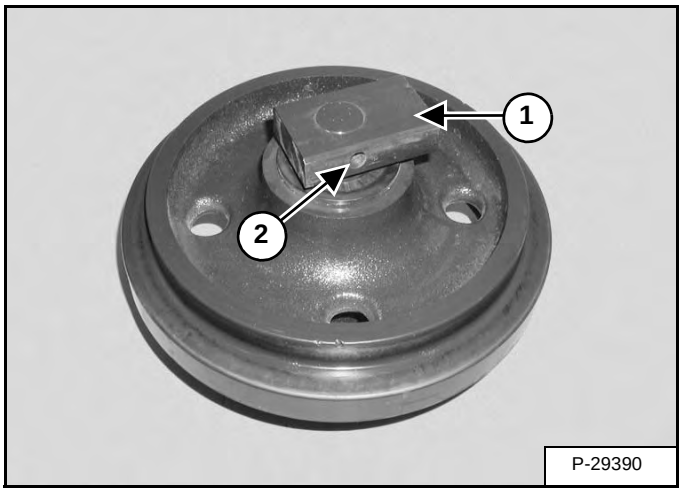
Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-20-25]** of the seal.

Figure 30-20-26



Using the driving tool, install the seal (Item 1) **[Figure 30-20-26]** on both sides of the idler.

Figure 30-20-27

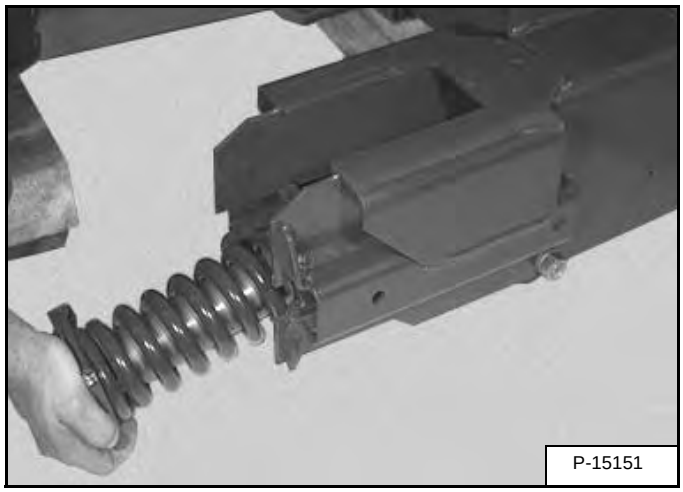


Install the block (Item 1) and roll pin (Item 2) **[Figure 30-20-27]** on both sides of the shaft.

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Track Tensioner Removal And Installation

Figure 30-20-28



Slide the recoil spring cylinder forward and remove it from the track frame **[Figure 30-20-28]**.

DO NOT DISASSEMBLE OR REPAIR THE COIL SPRING ASSEMBLY (Item 2) [Figure 30-20-29]

⚠ WARNING



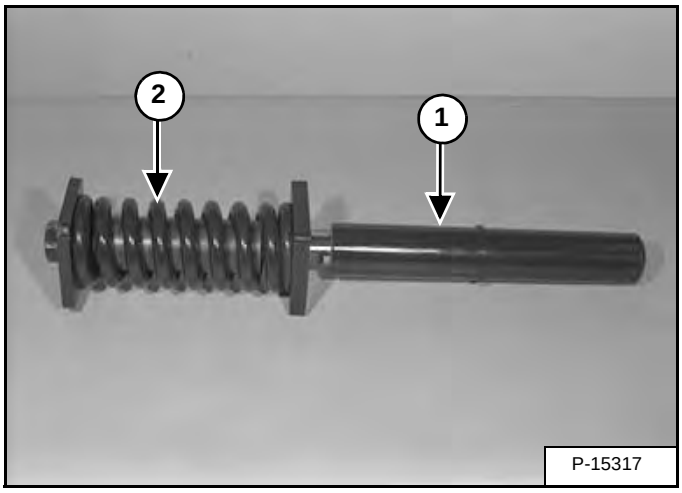
P-62574

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

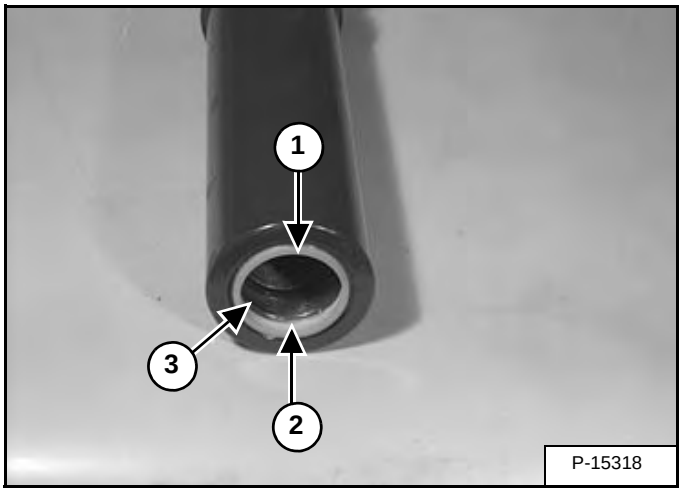
Figure 30-20-29



Remove the cylinder (Item 1) from the coil spring assembly (Item 2) **[Figure 30-20-29]**.

Track Tensioner Assembly Disassembly And Assembly

Figure 30-20-30

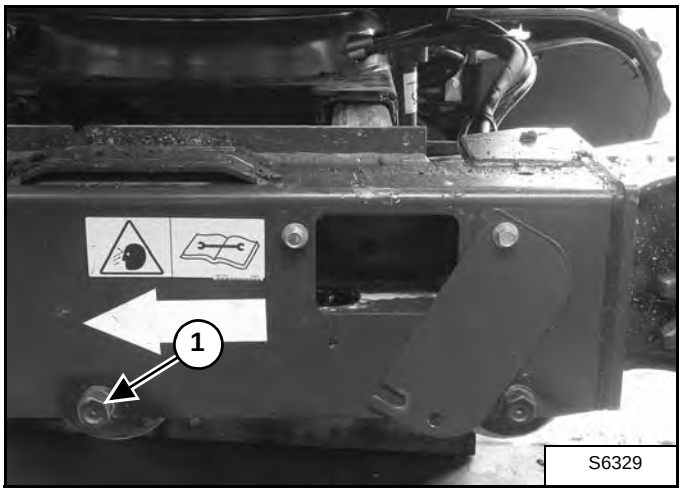


Remove the seal (Item 1), back-up ring (Item 2) and O-ring (Item 3) **[Figure 30-20-30]** from the cylinder.

Dealer Copy -- Not for Resale

Roller Removal And Installation

Figure 30-20-31

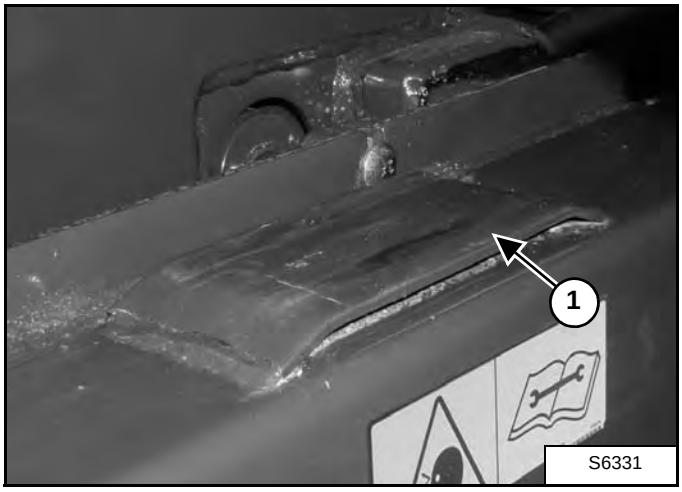


Loosen the nuts from the track roller on both sides of the track frame **[Figure 30-20-31]**.

Installation: Tighten the nuts to 170 - 190 N•m (125 - 140 ft-lb) torque.

Remove the track roller (Item 1) **[Figure 30-20-31]**.

Figure 30-20-32

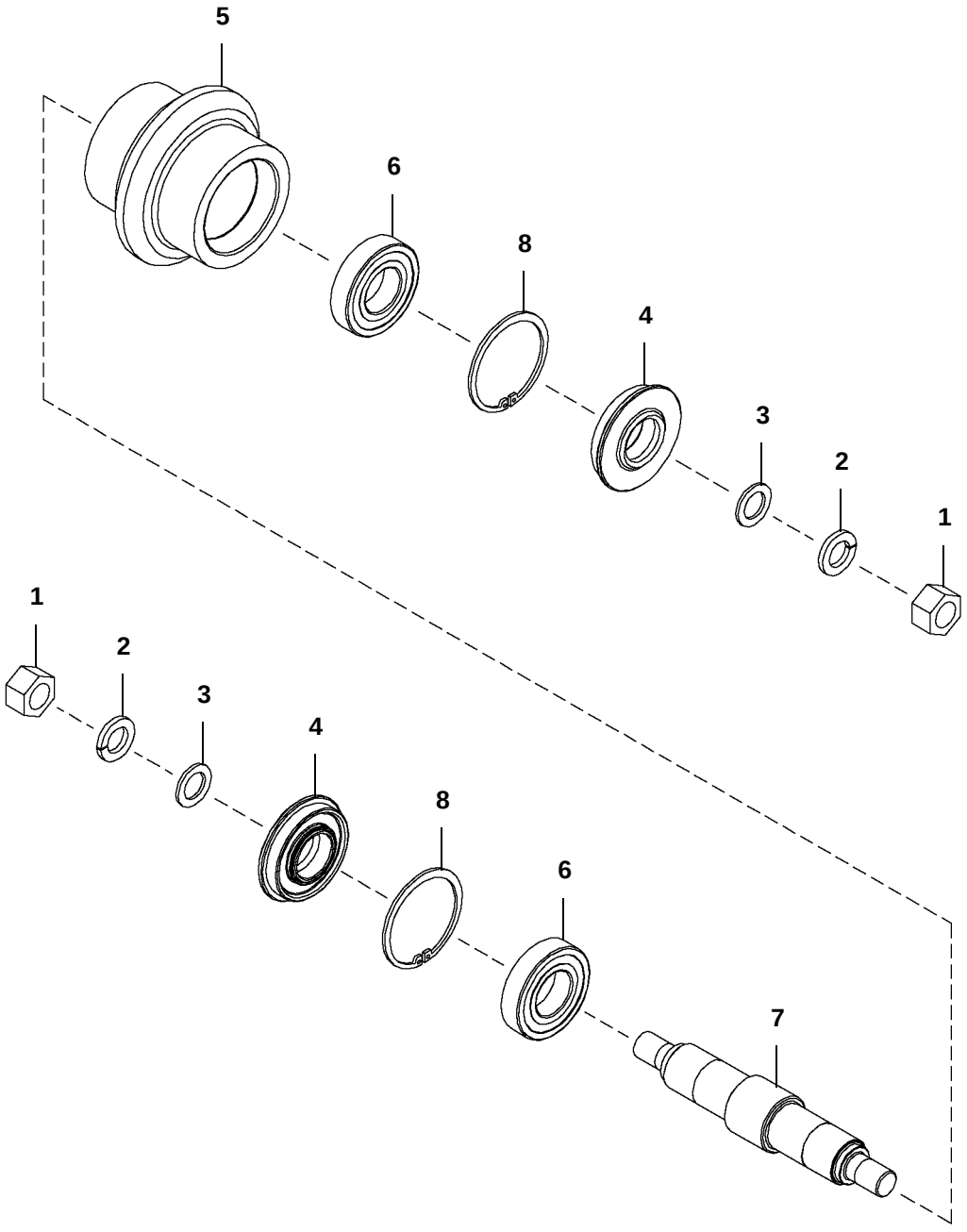


Inspect the track guide (Item 1) **[Figure 30-20-32]** for wear or damage.

Dealer Copy -- Not for Resale

Roller Parts Identification

1. Nut
2. Lockwasher
3. Washer
4. Seal
5. Roller
6. Bearing
7. Shaft
8. Snap Ring



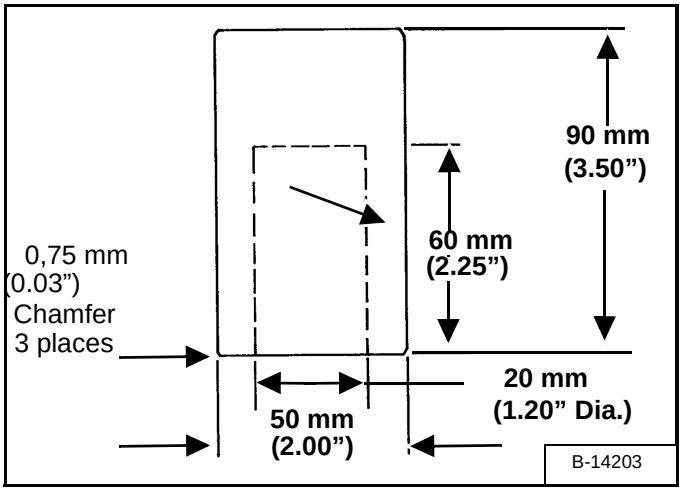
PE1914S

Dealer Copy -- Not for Resale

Disassembly

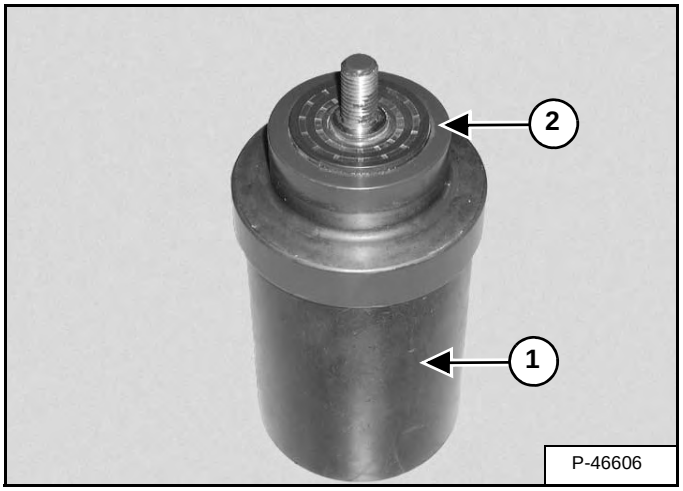
The following tools must be fabricated for this procedure:

Figure 30-20-33



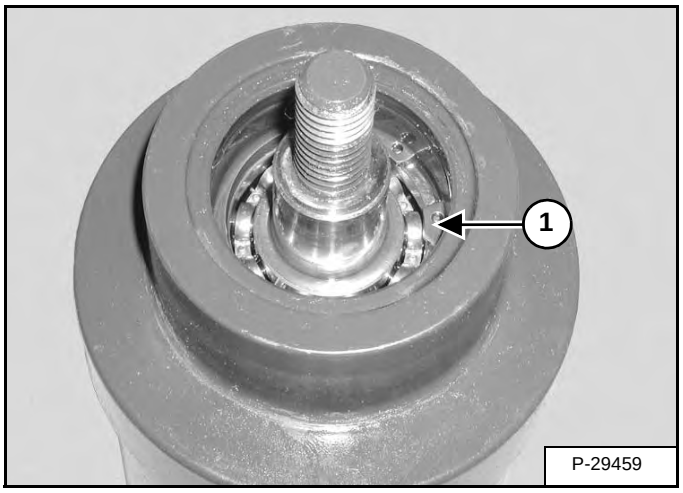
1. Driver Tool - see **[Figure 30-20-33]**.
2. Support Fixture - Tube, 76,2 mm I.D. x 6,35 mm wall x 152,4 mm long (3.0 in I.D. x 0.250 in wall x 6.0 in long).

Figure 30-20-34



Support the roller in the support fixture (Item 1). Remove the seal (Item 2) **[Figure 30-20-34]** from both sides of the roller.

Figure 30-20-35



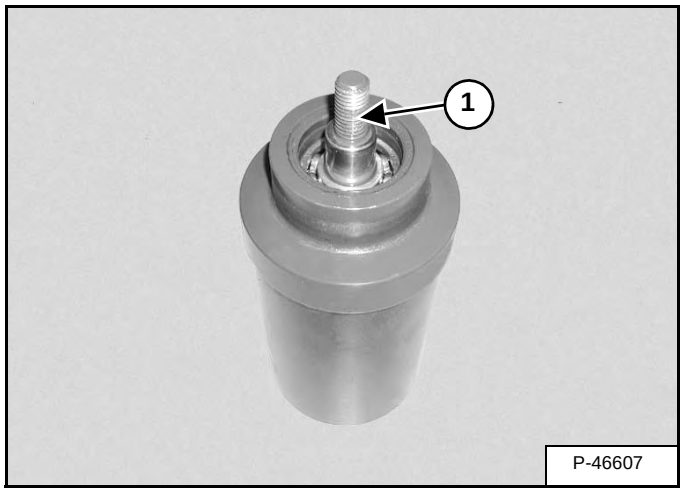
Remove the snap ring (Item 1) **[Figure 30-20-35]**.

NOTE: The snap ring is installed on one side of the roller. The other side is stepped to retain the bearing.

Dealer Copy -- Not for Resale

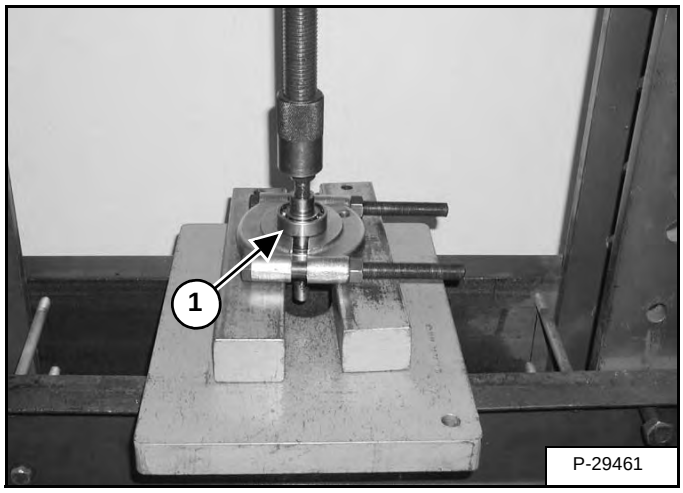
Disassembly (Cont'd)

Figure 30-20-36



Turn the roller over and tap the shaft (Item 1) **[Figure 30-20-36]** and bearings out the bottom of the roller.

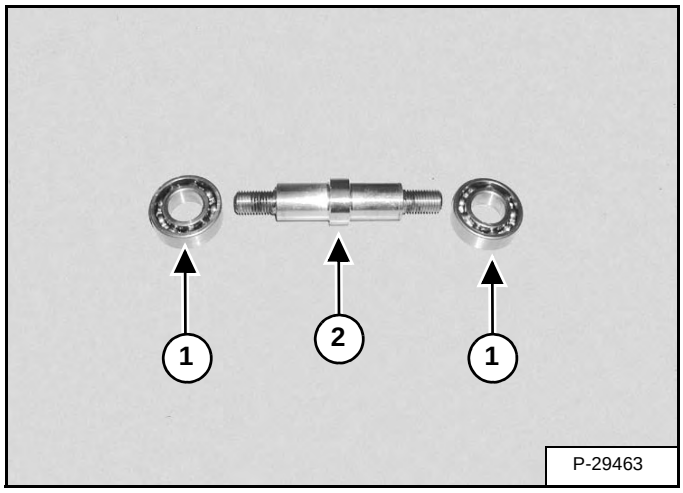
Figure 30-20-37



Press the bearings (Item 1) **[Figure 30-20-37]** off the shaft.

Clean all parts in solvent and dry with compressed air.

Figure 30-20-38

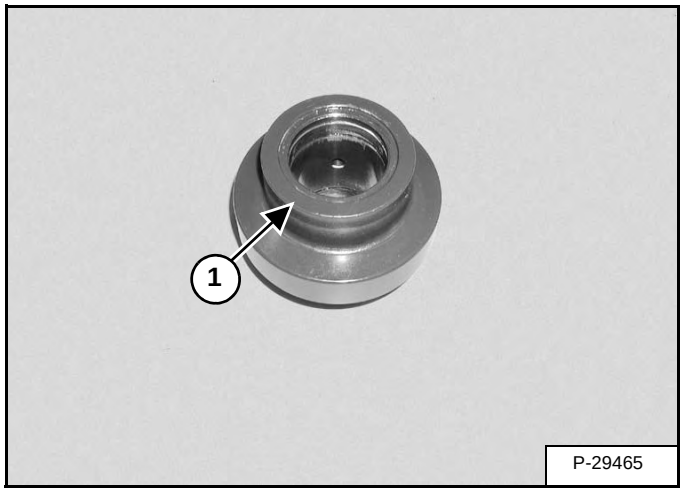


Inspect the bearings (Item 1) and shaft (Item 2) **[Figure 30-20-38]** for wear or damage.

The bearings are sealed. If the bearings do not roll smoothly or if the seals are damaged, replace the bearings.

Replace any worn or damaged parts.

Figure 30-20-39

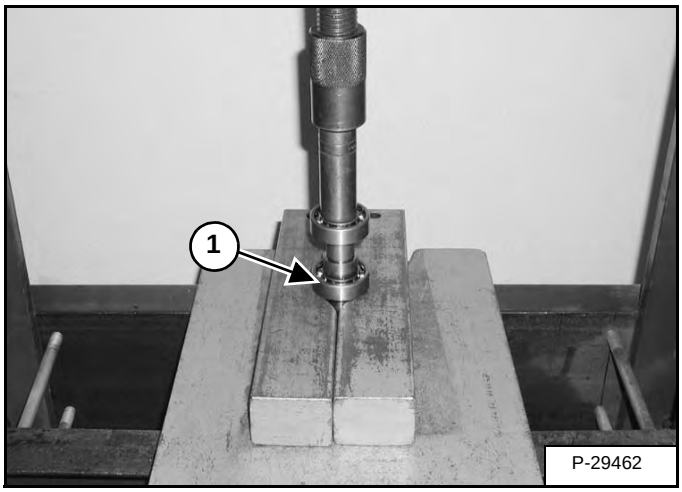


Remove all paint and corrosion from the seal surface (Item 1) **[Figure 30-20-39]** on both sides of the roller.

Dealer Copy -- Not for Resale

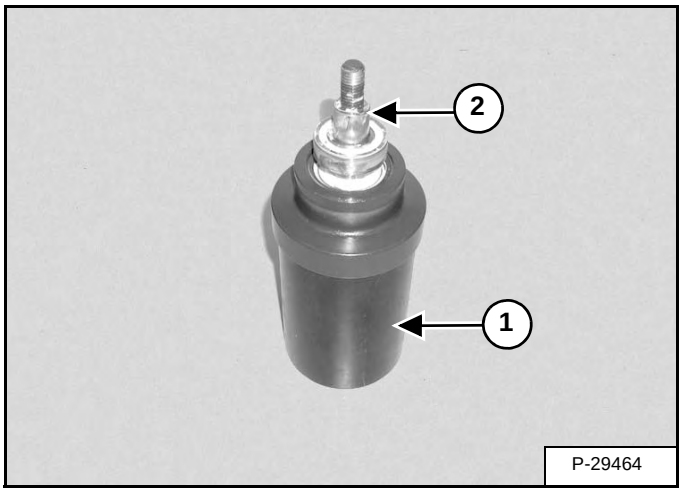
Assembly

Figure 30-20-40



Press the bearings (Item 1) **[Figure 30-20-40]** on the shaft.

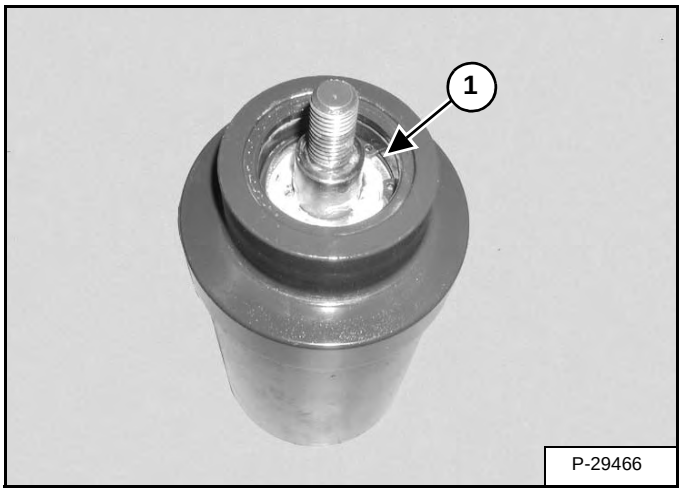
Figure 30-20-41



Place the roller on the support fixture (Item 1) **[Figure 30-20-41]**.

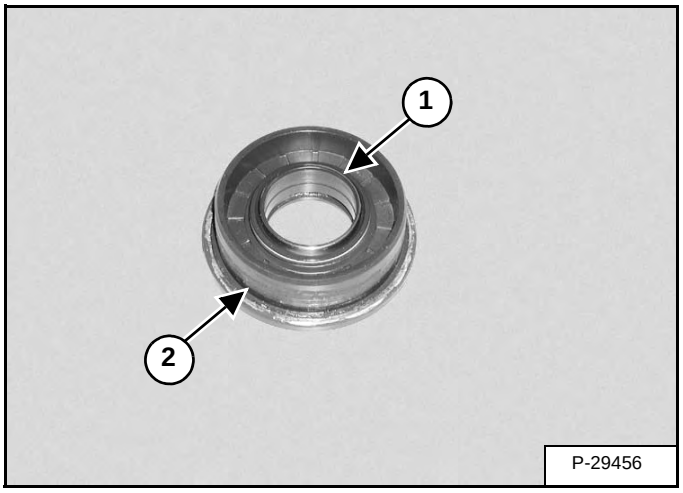
Tap the shaft and bearing assembly (Item 2) **[Figure 30-20-41]** into the roller.

Figure 30-20-42



Install the snap ring (Item 1) **[Figure 30-20-42]**.

Figure 30-20-43



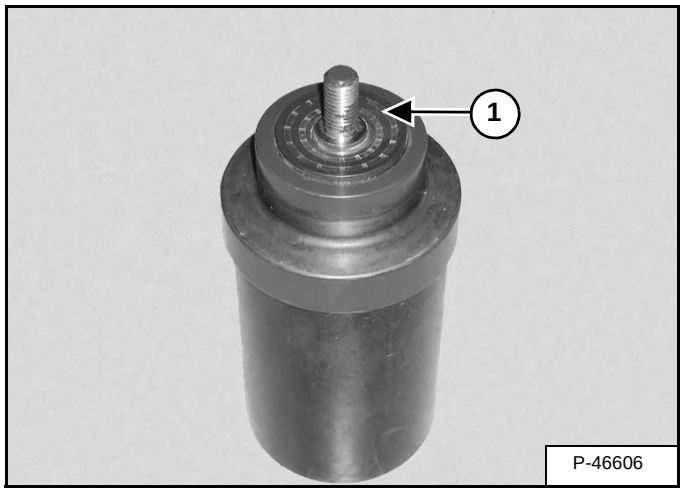
Apply assembly lube to the inside diameter (Item 1) **[Figure 30-20-43]** of the seal.

Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-20-43]** of the seal.

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Assembly (Cont'd)

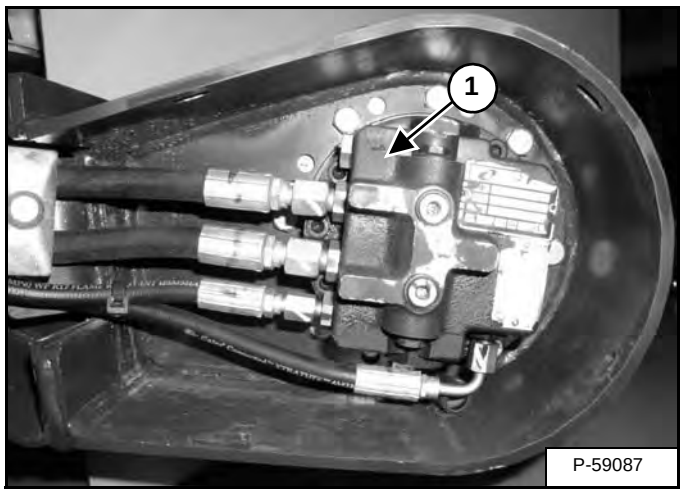
Figure 30-20-44



Using the driving tool, install the seal (Item 1) **[Figure 30-20-44]** on both sides of the roller.

Removal And Installation of Expandable Track Frame

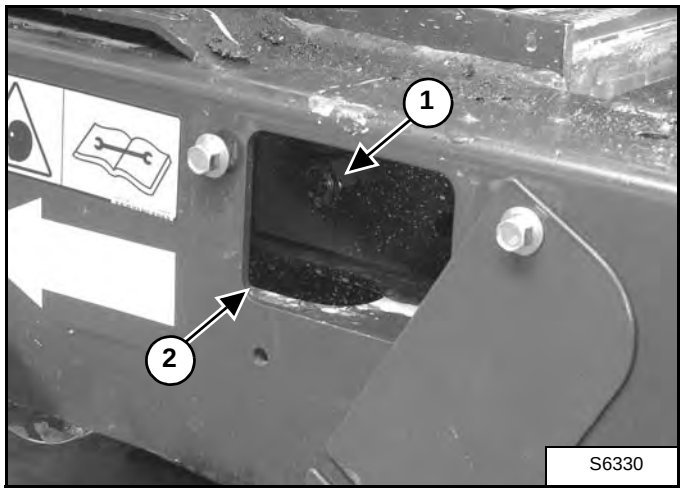
Figure 30-20-45



Remove the travel motor cover. Remove the hose (Item 1) **[Figure 30-20-45]** from the travel motor.

Remove the hose clamp (Item 2) **[Figure 30-20-45]** from the track frame

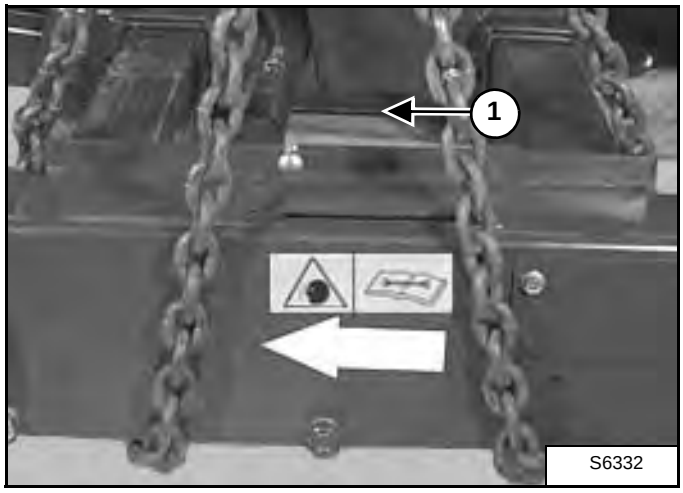
Figure 30-20-46



Remove the nut (Item 1) **[Figure 30-20-46]** from the track expansion stop rod.

Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-20-46]** of the seal.

Figure 30-20-47



Install a chain hoist on the track frame **[Figure 30-20-47]**. Lift the frame a small amount while pulling the frame away from the excavator.

Using a 10 x 1,5 mm (10 x 0.06 in) tap, clean the track frame bolt holes to remove the old thread locking compound.

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TRACK MAINTENANCE

Track Damage Identification

Cutting Of The Steel Cords

Damage:

Figure 30-30-1

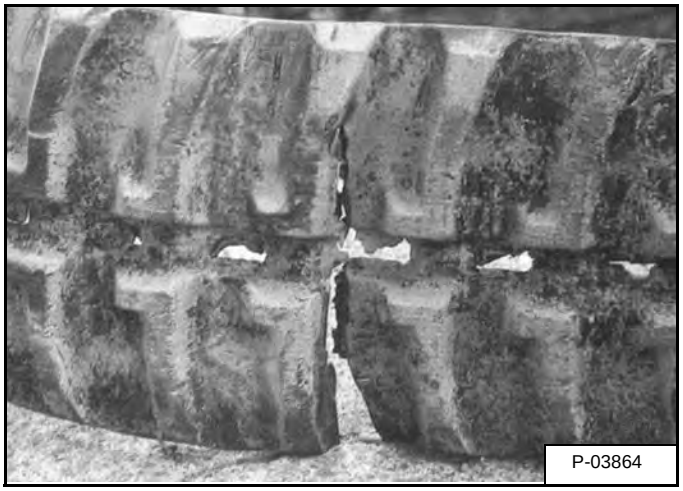
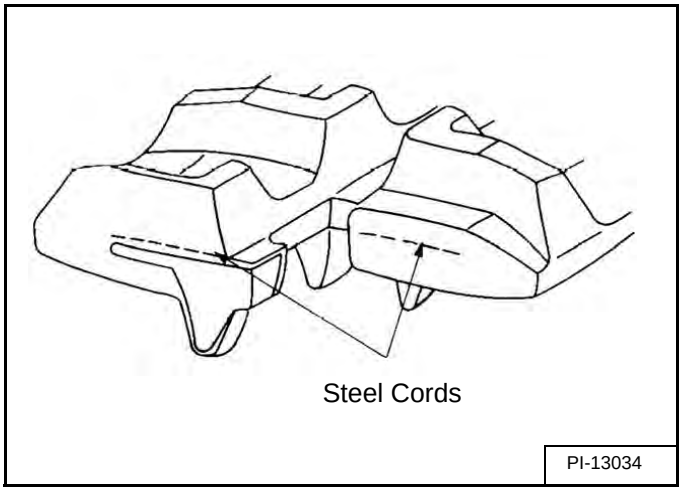


Figure 30-30-2



Embedded steel cords are cut off **[Figure 30-30-1]** and **[Figure 30-30-2]**.

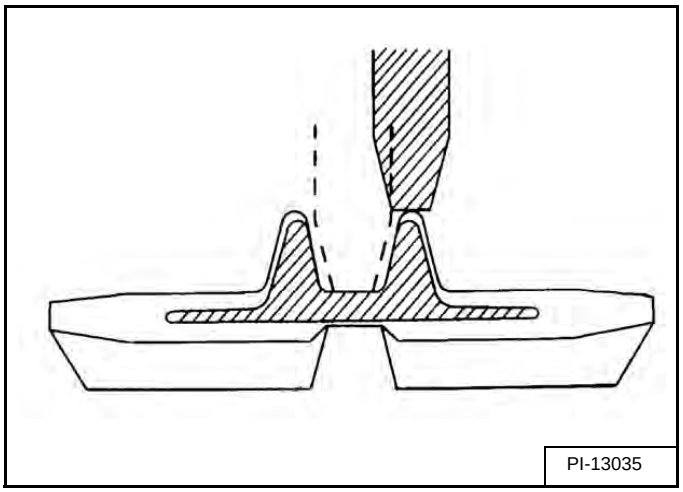
Replacement:

Replacement is required **[Figure 30-30-1]** and **[Figure 30-30-2]**.

Causes Of The Damage:

When applied to rubber tracks under the following circumstances, tension in excess of the breaking strength of the embedded steel cords causes steel cords to be cut:

Figure 30-30-3



When the rubber track is detracking, 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 penetrates through a cut on the lug side rubber surface, the embedded steel cords will corrode. The deterioration of the design strength can lead to the breaking off of the steel cords.

Prevention:

The following preventions should be taken to minimize the risk of this damage:

Periodically check on site, recommended track tension. (See Checking Tension on Page 30-20-1.)

Avoid quick turns on bumpy and rocky fields.

Drive carefully to avoid having stones and other articles clog the rubber tracks.

Avoid driving over sharp objects. If this is impossible, do not make turns while driving over sharp objects.

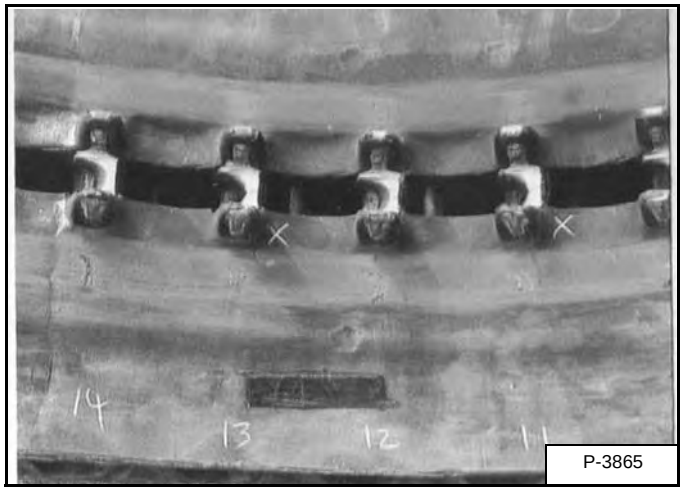
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Track Damage Identification (Cont'd)

Abrasion Of Embedded Metals

Damage:

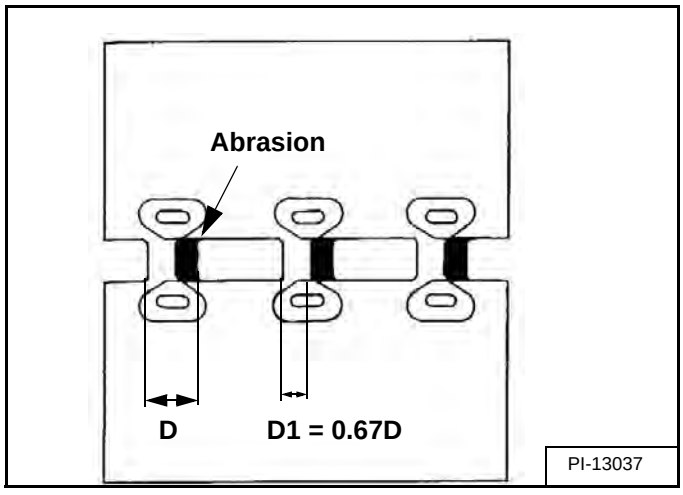
Figure 30-30-4



In proportion to the service time, embedded metals will gradually wear away by friction **[Figure 30-30-4]**.

Replacement:

Figure 30-30-5



Replacement is required when the width of the embedded metals (D1) becomes 67% of their 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 rubber track 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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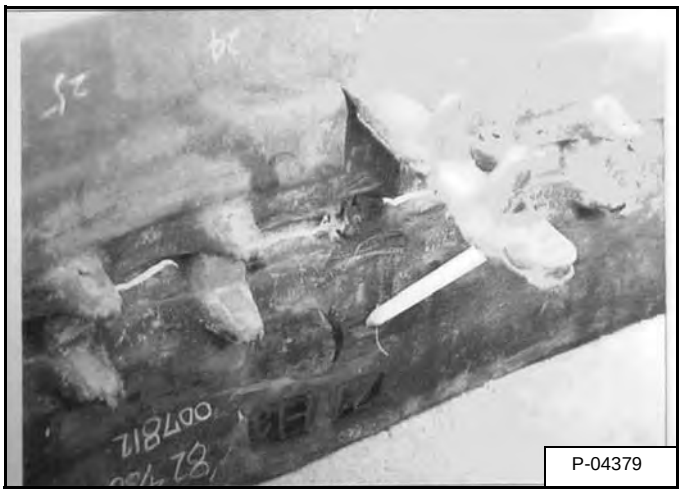
TRACK MAINTENANCE (CONT'D)

Track Damage Identification (Cont'd)

Separation Of Embedded Metals

Damage:

Figure 30-30-6



Extraordinary outer forces applied to embedded metals cause their separation from the rubber track's body **[Figure 30-30-6]**.

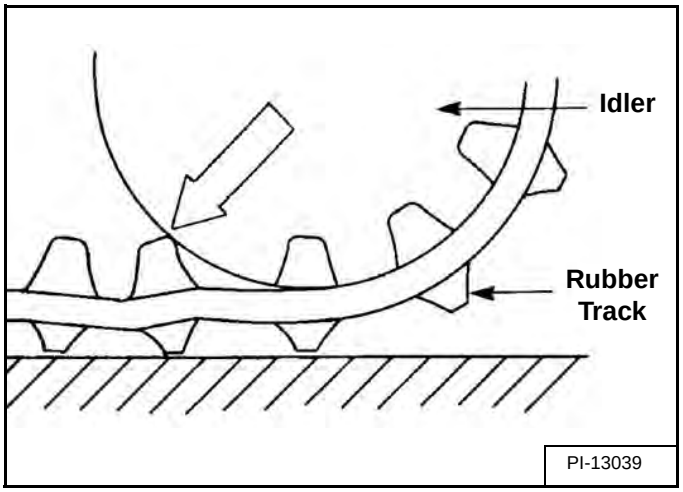
Replacement:

Even a partial separation of embedded metals requires replacement of the track.

Causes Of The Damage:

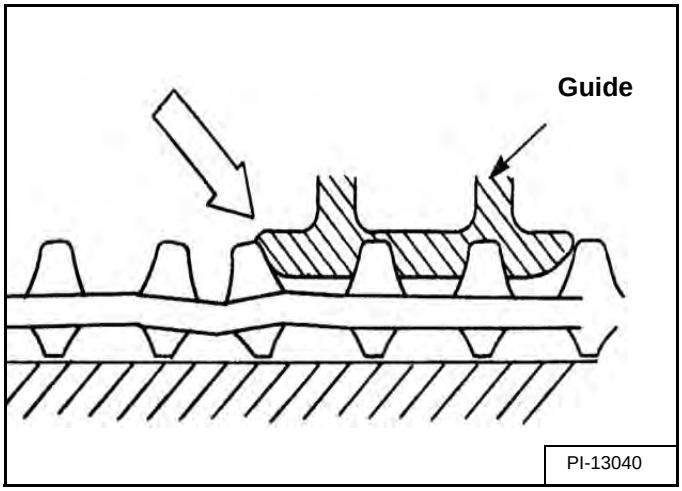
Embedded metals adhere between the steel cords and the rubber body. The following cases generate external forces greater than the adhesion strength, causing separation of the embedded metals:

Figure 30-30-7



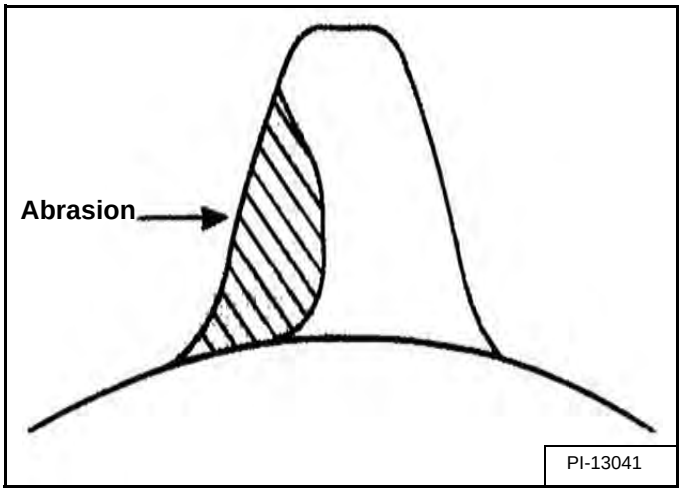
When the idler continually rides on the projections of embedded metals, the embedded metals will eventually peel off **[Figure 30-30-7]**.

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]**.

Figure 30-30-9



Abnormally worn sprockets as shown will pull embedded metals out **[Figure 30-30-9]**.

Prevention:

Similar to the prevention against the cutting of the steel cords:

Periodically check on site, recommended track tension. (See Checking Tension on Page 30-20-1.)

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Track Damage Identification (Cont'd)

Separation Of Embedded Metals (Cont'd)

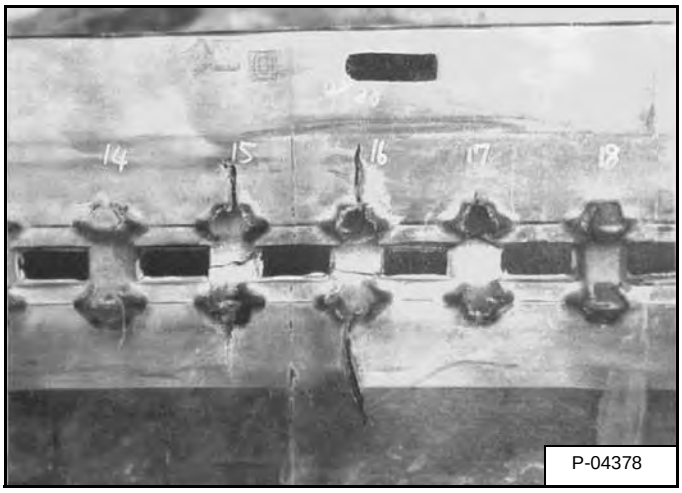
Quick turns on bumpy and rocky fields should be avoided.

If abnormal wear of sprockets is observed, they should be immediately replaced.

Separation Of Embedded Metals Due To Corrosion

Damage:

Figure 30-30-10



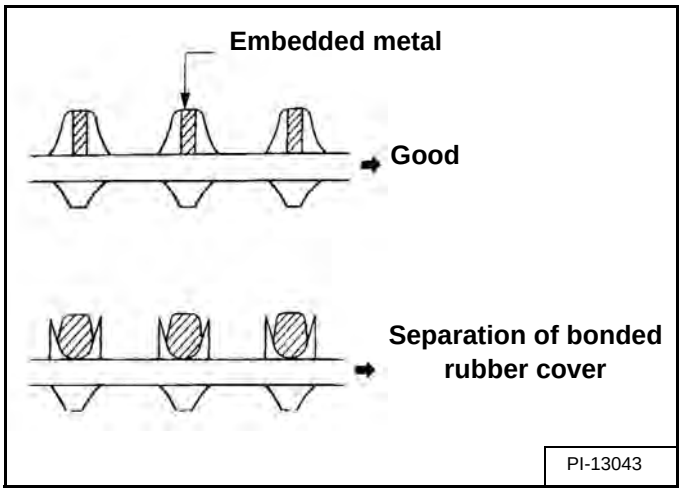
Due to corrosion of embedded metals, the adhesion to the rubber body deteriorates, resulting in complete separation **[Figure 30-30-10]**.

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 track roller side, causing exposure of the embedded metals. Consequently the embedded metals will corrode resulting in their separation from the rubber body.

Prevention:

If rubber tracks are used under such field conditions as described under (Causes Of The Damage), they should be washed with plenty of water. After being completely dried, they should be stored correctly.

When the bonded rubber cover is separated from the embedded metal projections and the metals in the rubber body become loose, it is time to consider replacement of the rubber track.

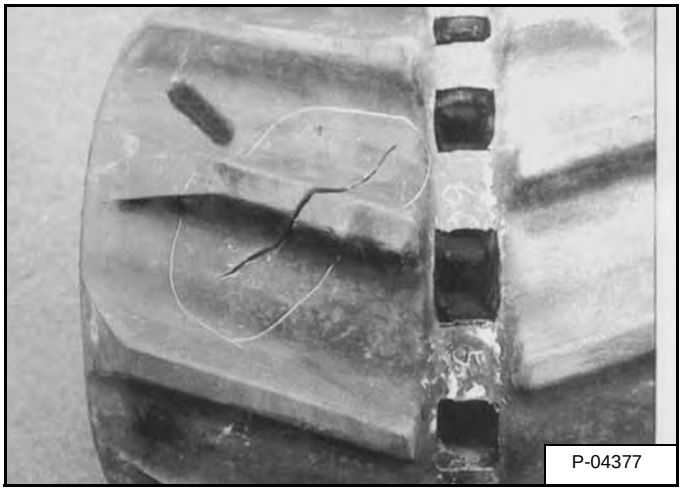
Dealer Copy -- Not for Resale

Track Damage Identification (Cont'd)

Cuts On The Lug Side Rubber

Damage:

Figure 30-30-12



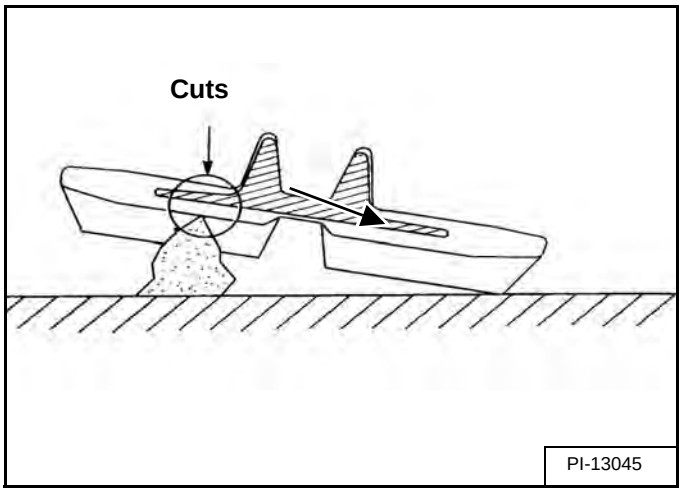
Cuts on the lug side rubber often occur as one of the most typical failure modes **[Figure 30-30-12]**.

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 breakage of steel cords due to 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 should drive with great attention to the ground 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, quick high speed turns and overloading should be avoided.

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Track Damage Identification (Cont'd)

Cracks On The Lug Side Rubber Due To Fatigue

Damage:

Figure 30-30-14

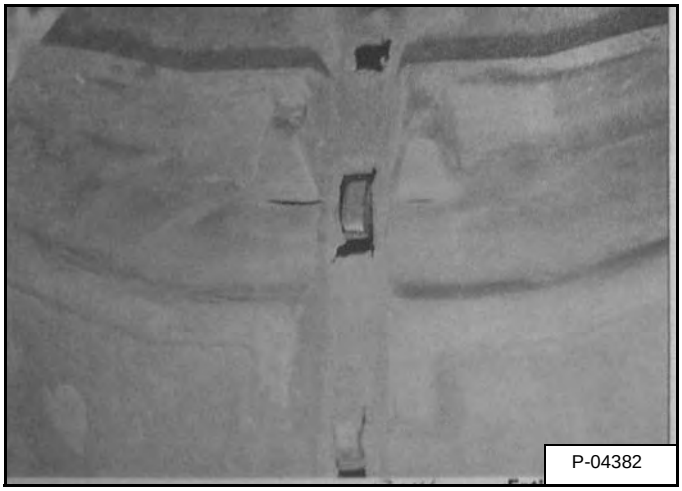
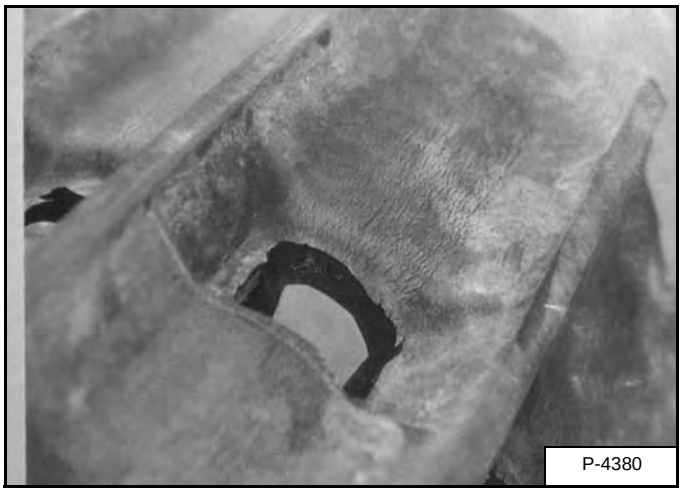


Figure 30-30-15



Small cracks around the root of the lug are a result from operation fatigue **[Figure 30-30-14]** and **[Figure 30-30-15]**

Replacement:

When the cracks become deep enough to expose the steel cords, track replacement is required.

Causes Of The Damage:

Because of wound stress applied to rubber tracks around the undercarriage parts during operation, the fatigue especially causes cracks on the lug side rubber surface. Once the cracks occur, they gradually deteriorate with even small external cracks.

Also when operating near seashores or under cold temperatures, rubber tracks are more likely to suffer from ozone cracks.

Prevention:

Rubber tracks are designed with special rubber compounds to prevent cracks due to fatigue. However, external damage on the lug side rubber, increases the possibility of cracking. Machine operators should observe soil conditions when driving, to prevent external damage to the lug side rubber. In order to minimize the occurrence of ozone cracks, follow these maintenance instructions:

Avoid exposing stored tracks to direct sun light.

Avoid exposing stored tracks to direct rain and snowfall.

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

Damage:

Figure 30-30-16

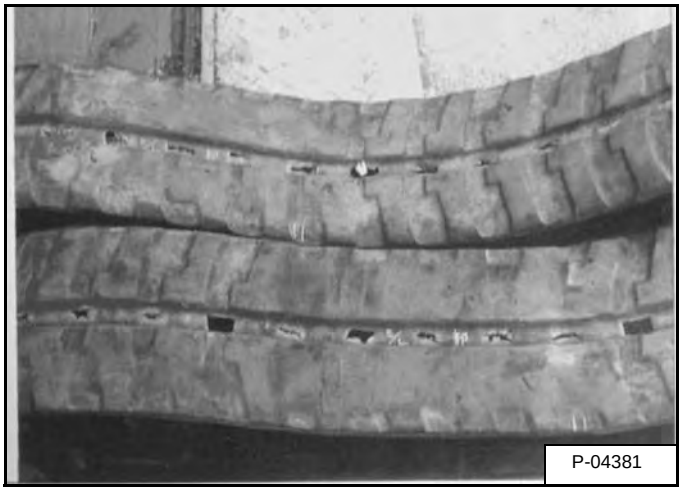
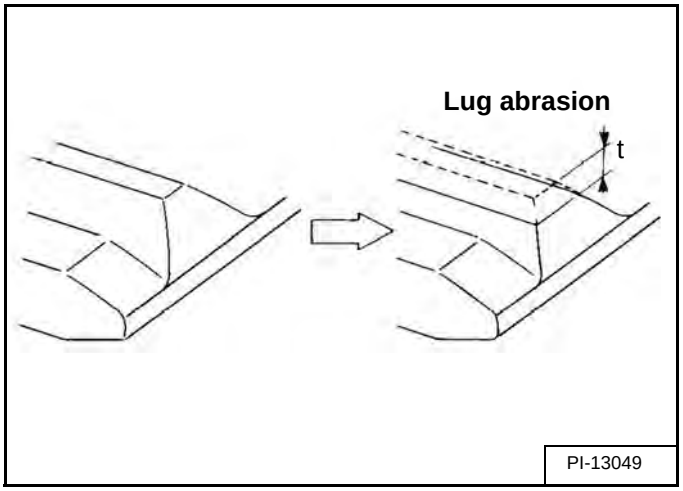


Figure 30-30-17



As operation time increases, the lug side undergoes abrasion **[Figure 30-30-16]** and **[Figure 30-30-17]**.

Replacement:

No replacement is required.

Causes Of The Damage:

Lug abrasion will occur as operation time increases. Even as lug abrasion increases, the rubber track can be used. However, as the traction performance deteriorates, it is highly recommended to replace the abraded tracks with new ones when the lug height becomes less than 5 mm.

Prevention:

In order to prevent the rubber track from abnormal or premature abrasion, the 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.

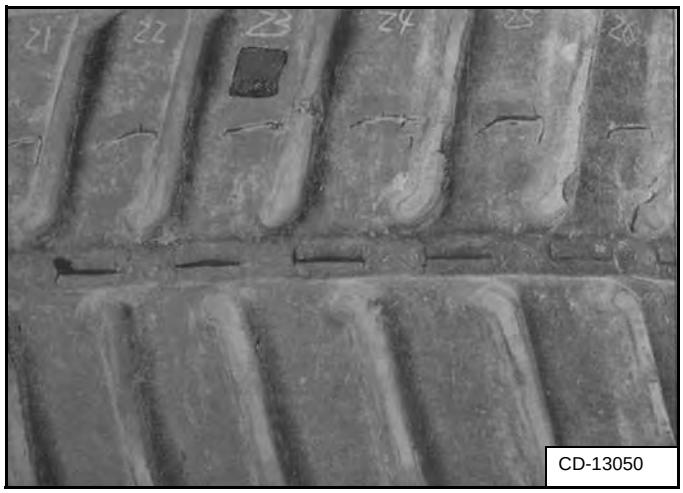
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Track Damage Identification (Cont'd)

Cracks And Cuts On The Lug Side Rubber

Damage:

Figure 30-30-18



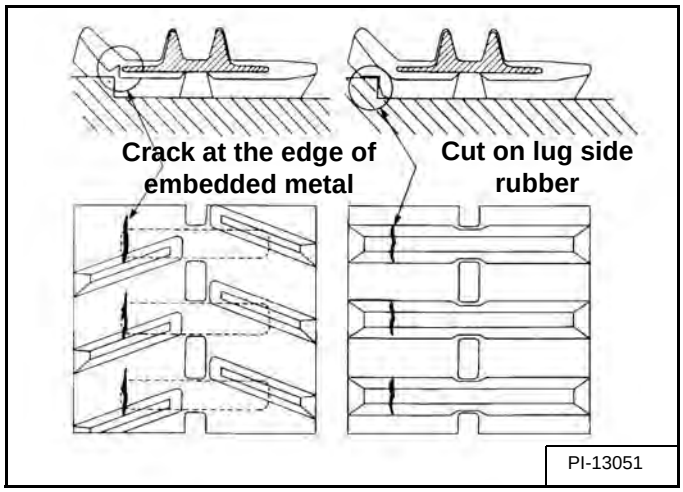
Sometimes cracks and cuts on the lug side rubber at the edges of the embedded metals can be observed **[Figure 30-30-18]**.

Replacement:

Basically, no replacement is required unless the cuts on the lug side rubber are discovered all around the edges of the embedded metals, as this will result in a complete cut off.

Causes Of The Damage:

Figure 30-30-19



When rubber tracks drive over sharp projections, intensive stress is applied to the lug side rubber surface, especially at the edges of embedded metals, causing cracks and cuts in the area around the embedded metals **[Figure 30-30-19]**.

Prevention:

To avoid extensive stress applied to the lug root where metals are embedded, machine operators should avoid driving over stumps and ridges.

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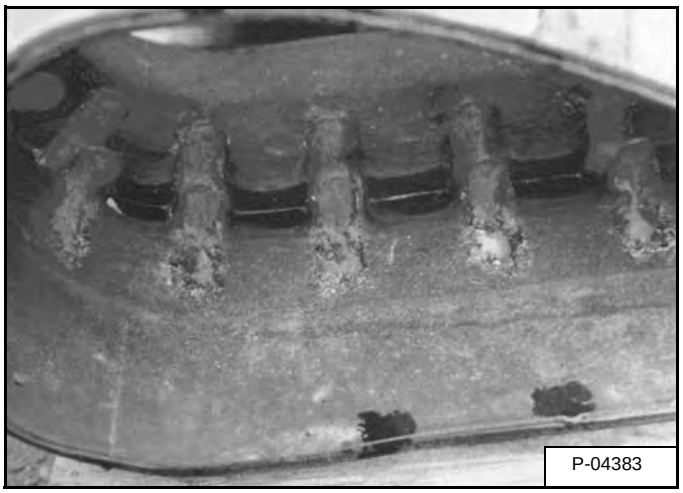
TRACK MAINTENANCE (CONT'D)

Track Damage Identification (Cont'd)

Abrasion Of The Track Roller Side

Damage:

Figure 30-30-20



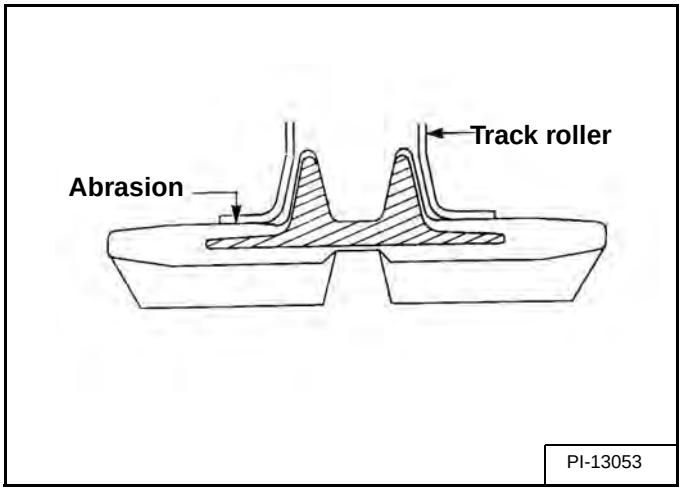
The rubber surface on which track rollers run is gradually abraded. It will result in the exposure of the embedded metals **[Figure 30-30-20]**.

Replacement:

It is recommended to replace the rubber track when more than half of the embedded metals are completely exposed.

Causes Of The Damage:

Figure 30-30-21



The abrasion of the track roller side rubber surface occurs because of sand and gravel being clogged between the rubber and the outside surface of the track rollers. The stress pushes the sand and gravel against the side of the rubber track causing 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 to the track rollers completely. When operating on gravel paths and stony grounds, machines should be driven slowly and the turning radius should be big enough to prevent stones and gravel from getting stuck to the track roller side rubber.

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Track Damage Identification (Cont'd)

Cuts On The Edges Of The Track Roller Side

Damage:

Figure 30-30-22

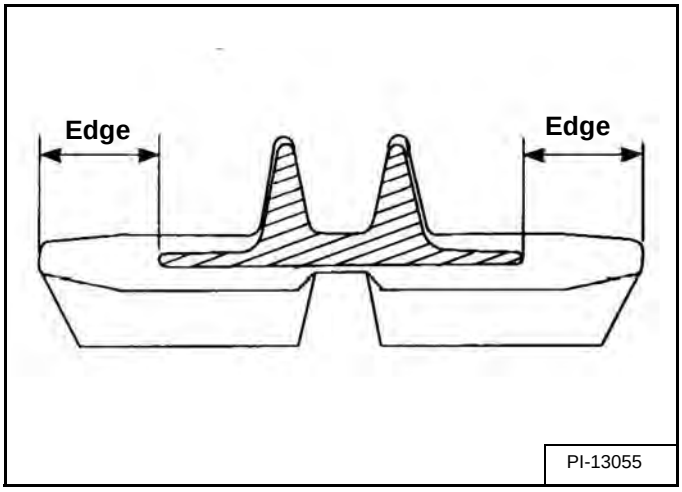


Figure 30-30-23

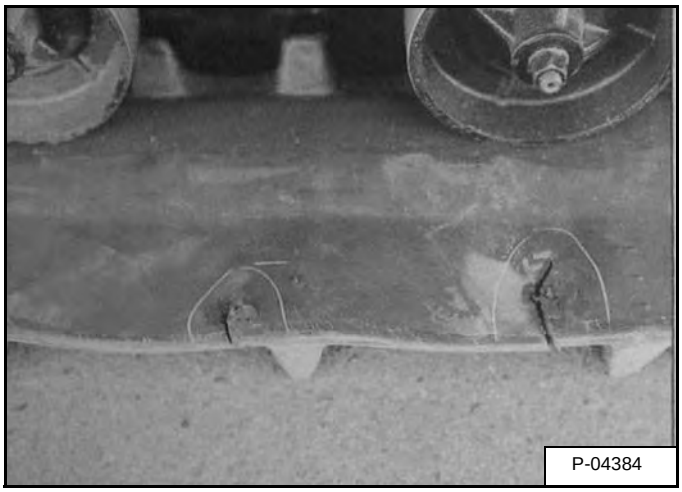
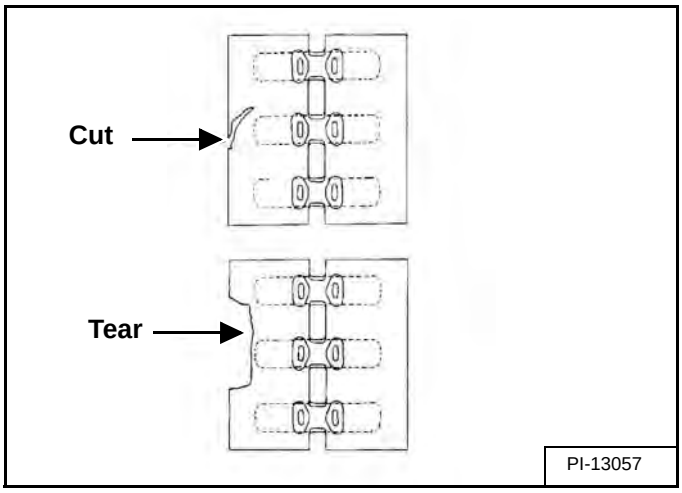


Figure 30-30-24



Both edges of a rubber track **[Figure 30-30-22]** have no special reinforcement. During operation the edges can become cut or torn off **[Figure 30-30-23]** and **[Figure 30-30-24]**.

Replacement:

In such cases, the rubber track does not have to be replaced.

Causes Of The Damage:

This damage is caused by objects on the ground or by interference with the machine frame.

In case of damage by objects on the operating ground:

The edges of rubber track are often deformed largely due to a bumpy ground surface, stones and other objects. This causes extensive stress on the edges resulting in the damage.

When driving a machine over concrete ridges, this type of damage easily occurs.

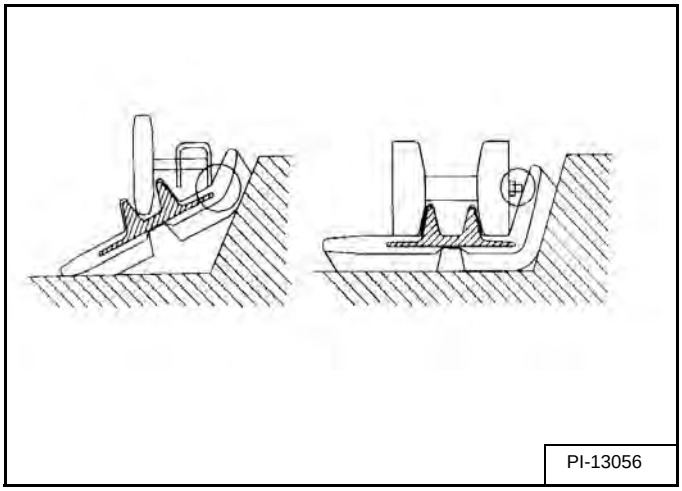
In case of damage by interference with the machine frame.

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Track Damage Identification (Cont'd)

Cuts On The Edges Of The Track Roller Side (Cont'd)

Figure 30-30-25



If a machine continues operating with rubber tracks being detracked, the rubber tracks can get caught up in the machine frame or undercarriage parts resulting in damage. Furthermore, when a machine travels along side slopes, the rubber tracks are deformed so much that they come into contact with the machine frame and undercarriage parts, which causes cutting, gouging and rubbing of rubber tracks in the end **[Figure 30-30-25]**.

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

Removal And Installation

Remove the upperstructure from the swing circle gear. (See Removal on Page 40-10-1.)

Figure 30-40-1

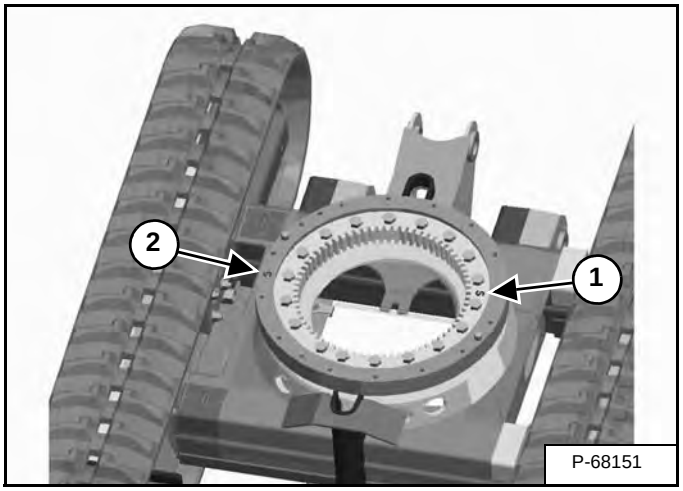
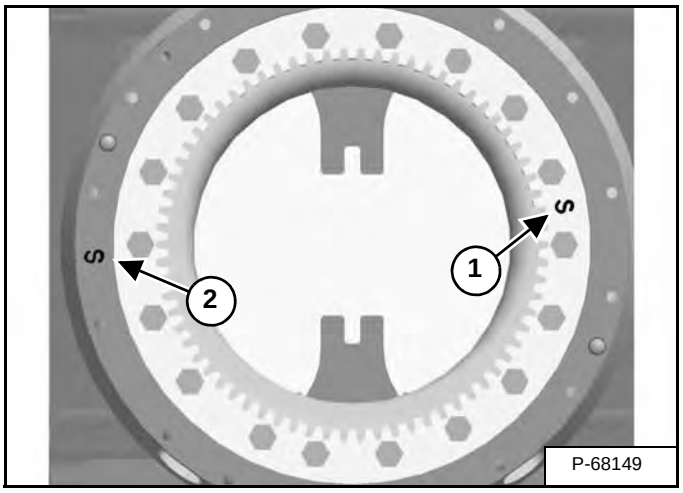


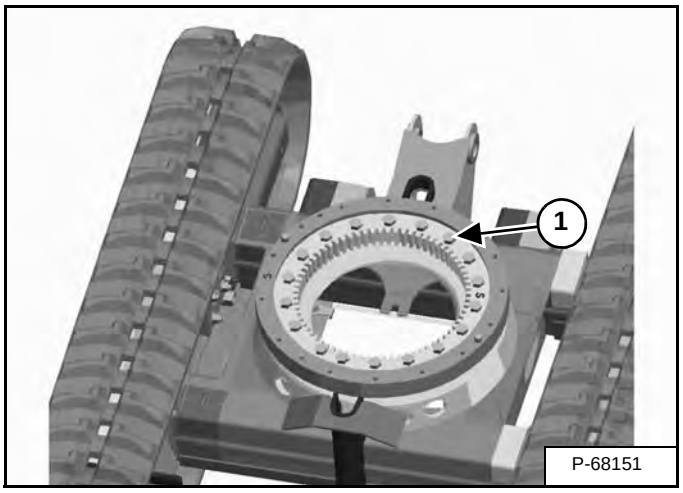
Figure 30-40-2



The swing gear and outer ring both have a soft zone. The swing gear soft zone is identified with an S (Item 1) stamped in the swing gear. The outer ring soft zone is identified with an S (Item 2) **[Figure 30-40-1]** and **[Figure 30-40-2]** stamped in the outer ring.

The soft zones of both the swing gear and outer ring must be positioned 180° of each other.

Figure 30-40-3



Remove the bolts (Item 1) **[Figure 30-40-3]** and nuts from the swing circle gear.

Installation: Tighten the bolts (Item 1) **[Figure 30-40-3]** and nuts to 105 - 115 N•m (78 - 85 ft-lb) torque.

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UPPERSTRUCTURE AND SWING SECTION

UPPERSTRUCTURE 40-10-1
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Installation 40-10-3

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SEAT AND SEAT MOUNT (FOR MODEL E16 S/N AHLL11001 - 13119) 40-40-1
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Compression Spring Removal And Installation (Canopy Only) 40-50-4
Compression Spring Disassembly And Assembly (Canopy Only) 40-50-5
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Right Rear Console Cover Removal And Installation 40-50-10
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LEFT CONSOLE 40-60-1
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Joystick Console Cover (Top) Removal And Installation 40-60-2
Compression Spring Removal And Installation 40-60-3
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Joystick Console Frame Removal And Installation 40-60-7
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CONTROL LINKAGE ASSEMBLY 40-130-1
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Bracket Of Control Linkage Disassembly And Assembly 40-130-8

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SWING FRAME 40-170-1
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Swing Frame Bushing Removal 40-170-3
Swing Frame Bushing Installation 40-170-4
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Boom Pivot Bushing Installation 40-170-6

BOOM 40-180-1
Description 40-180-1
Removal And Installation 40-180-1
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Description 40-190-1
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BUCKET 40-200-1
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TAILGATE 40-210-1
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Latch Removal And Installation 40-210-2

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UPPERSTRUCTURE

Description

The upperstructure includes all the components in or attached to the frame and connects to the slew bearing. The slew bearing divides the upperstructure from the undercarriage, which includes the track frame components.

Removal

Fully extend the cylinders of the bucket and arm. Fully retract the cylinder of the boom.

Lower the blade to the ground.

Remove the battery. (See Removal And Installation on Page 50-20-2.)

Remove the cab or canopy. (See Removal And Installation on Page 40-30-1.) or (See Removal And Installation on Page 40-20-1.)

Drain the hydraulic reservoir. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

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

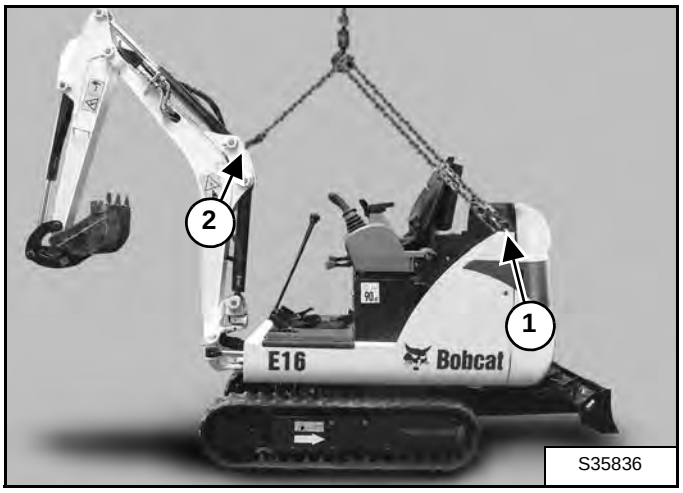
Remove the floor mat and floor panels. (See Removal And Installation on Page 40-140-1.)

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

Remove the hydraulic control valve. (See Removal And Installation on Page 20-40-1.)

Remove the swing motor. (See Removal And Installation on Page 20-90-1.)

Figure 40-10-1



Install eye bolts (Item 1) **[Figure 40-10-1]** in the rear cab / canopy mounts.

Fasten chains to the eyebolts and the chain hoist.

Install a 0,25 mm (1 in) bolt (Grade 5) (Item 2) **[Figure 40-10-1]** through the hole at the top of the boom. Fasten a chain from the bolt to the chain hoist.

WARNING

AVOID INJURY OR DEATH

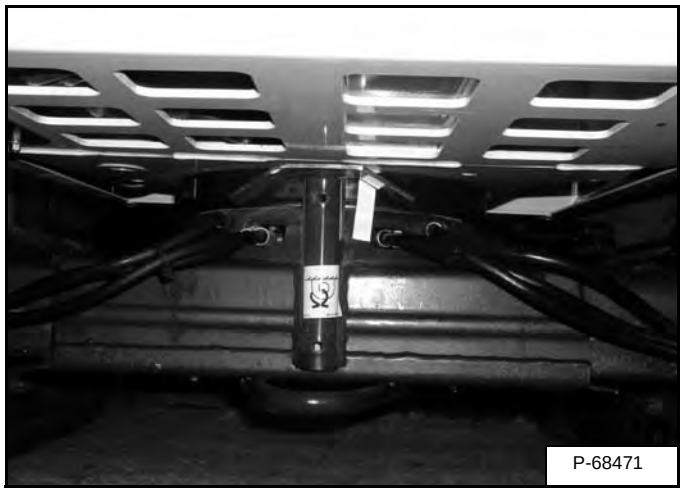
- **Use a lifting fixture with sufficient capacity for the weight of the excavator plus any added attachments.**
- **Maintain centre of gravity and balance when lifting.**
- **Do not swing boom or upperstructure. Engage the upperstructure slew lock.**
- **Never lift with operator on machine.**

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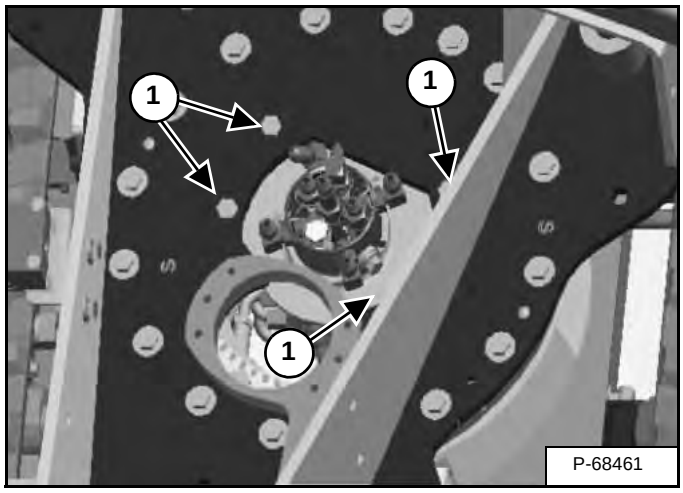
Removal (Cont'd)

Figure 40-10-2



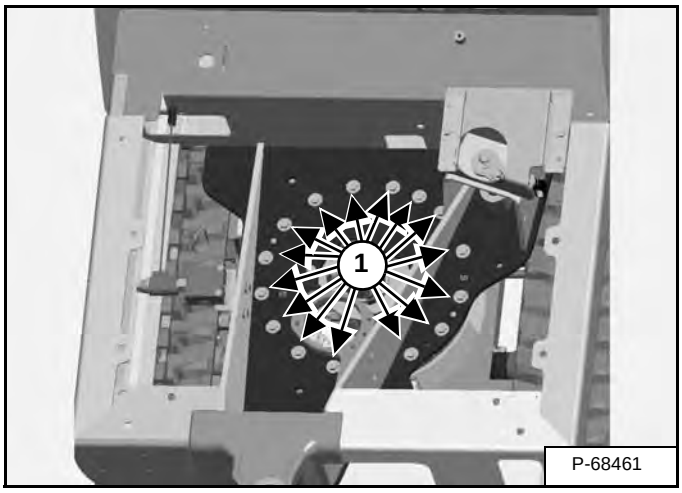
Mark the upperstructure to the swing bearing and to the track frame for ease of assembly **[Figure 40-10-2]**.

Figure 40-10-3



Remove the swivel joint nuts (Item 1) **[Figure 40-10-3]**.

Figure 40-10-4



Remove the 16 bolts (Item 1) **[Figure 40-10-4]** from the upperstructure.

Lift the upperstructure off the swing bearing. Position the upperstructure onto supporting stands or blocks.

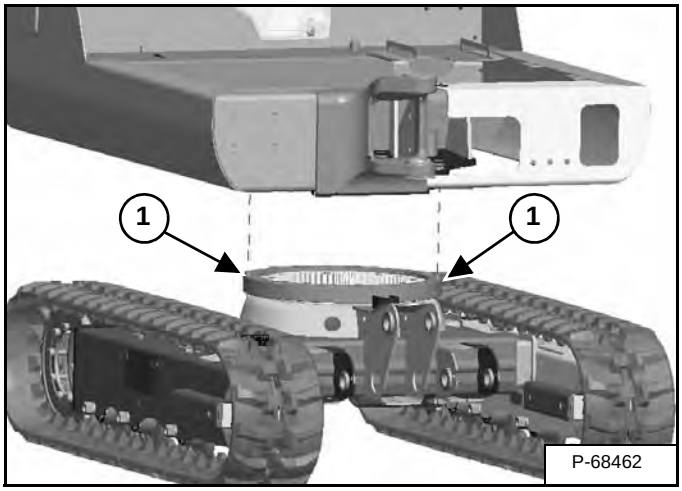
NOTE: Keep tension on the chain hoist to support the boom and arm when the upperstructure is supported on stands or blocks.

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Installation

NOTE: Clean out the old excess Loctite® from all the 16 threaded holes in the slew bearing prior to installing the upperstructure.

Figure 40-10-5



Lower the upperstructure frame onto the swing bearing aligning the two pins (Item 1) **[Figure 40-10-5]**. Maintain a slight amount of weight on the hoist.

Install the 16 bolts and washers through the upperstructure frame and into the swing bearing.

Tighten the bolts to 57 - 63 N•m (42 - 46.5 ft-lb) torque.

Install the swing motor. (See Removal And Installation on Page 20-90-1.)

Install the hydraulic control valve. (See Removal And Installation on Page 20-40-1.)

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

Install the floor mat and floor panels. (See Removal And Installation on Page 40-140-1.)

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

Fill the hydraulic reservoir. (See Checking And Adding Hydraulic Fluid on Page 10-130-1.)

Install the battery. (See Removal And Installation on Page 50-20-2.)

Install the cab or canopy.(See Removal And Installation on Page 40-30-1.) or (See Removal And Installation on Page 40-30-1.)

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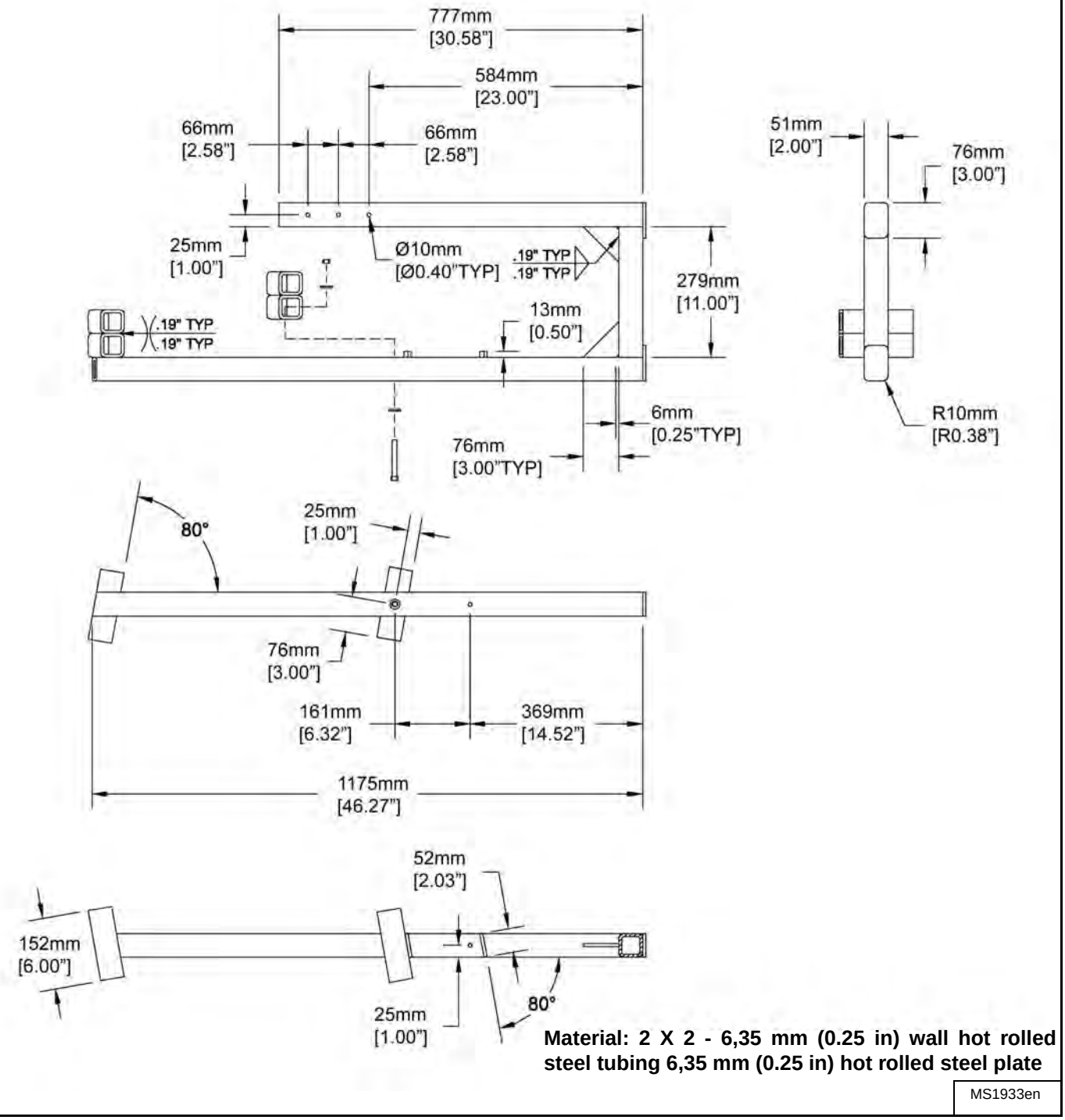
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ROPS CANOPY

Removal And Installation

Build the service lifting bracket used to remove and install the ROPS canopy. Use the dimensions shown in **[Figure 40-20-1]** to build the service lifting bracket.

Figure 40-20-1



Material: 2 X 2 - 6,35 mm (0.25 in) wall hot rolled steel tubing 6,35 mm (0.25 in) hot rolled steel plate

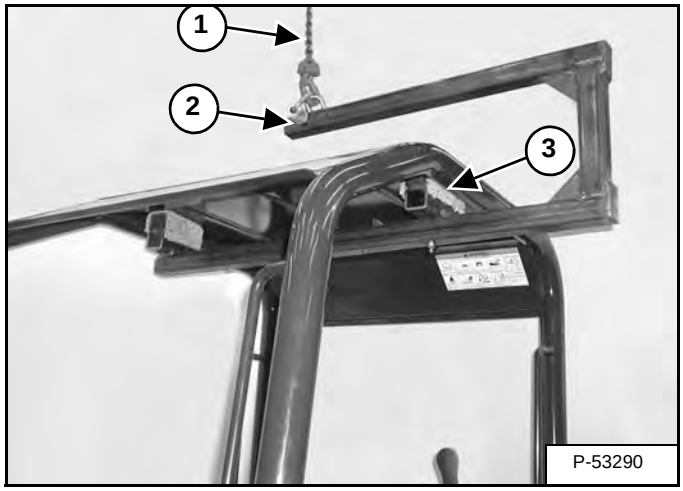
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Removal And Installation (Cont'd)

Remove the upperstructure light. (See Upperstructure Light Removal And Installation on Page 50-50-1.)

Figure 40-20-2



Install the chain hoist (Item 1) in the end hole of the lifting bracket (Item 2) **[Figure 40-20-2]**.

Install the cab / canopy service lifting bracket (Item 2) **[Figure 40-20-2]** on the cab.

NOTE: Use a lifting device of sufficient capacity.

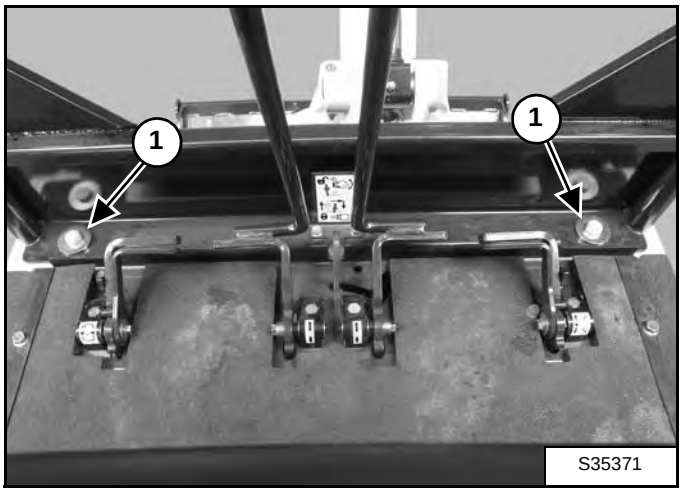
Adjust the lifting bracket to the proper width by moving the bracket (Item 3) **[Figure 40-20-2]**.

⚠ WARNING

Never use the cab / canopy service lifting bracket to lift the excavator. The bracket is not strong enough and can fail causing serious injury or death.

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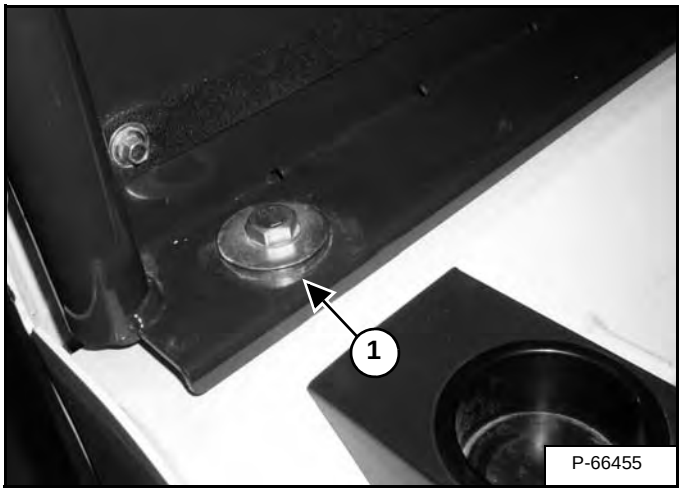
Figure 40-20-3



Remove the bolts, nuts and washers (Item 1) **[Figure 40-20-3]** from the front of the canopy.

Installation: Tighten the bolts to 160 - 180 N•m (118 - 133 ft-lb) torque.

Figure 40-20-4



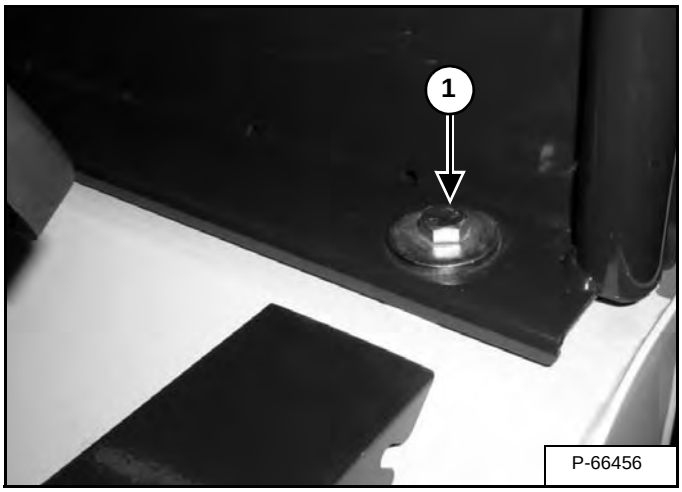
Remove the bolt and washer (Item 1) **[Figure 40-20-4]** from the right rear of the canopy.

Installation: Tighten the bolt to 160 - 180 N•m (118 - 133 ft-lb) torque.

Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

Figure 40-20-5



Remove the bolt and washer (Item 1) **[Figure 40-20-5]** from the left rear of the canopy.

Installation: Tighten the bolt to 160 - 180 N•m (118 - 133 ft-lb) torque.

Remove the canopy from the upperstructure.

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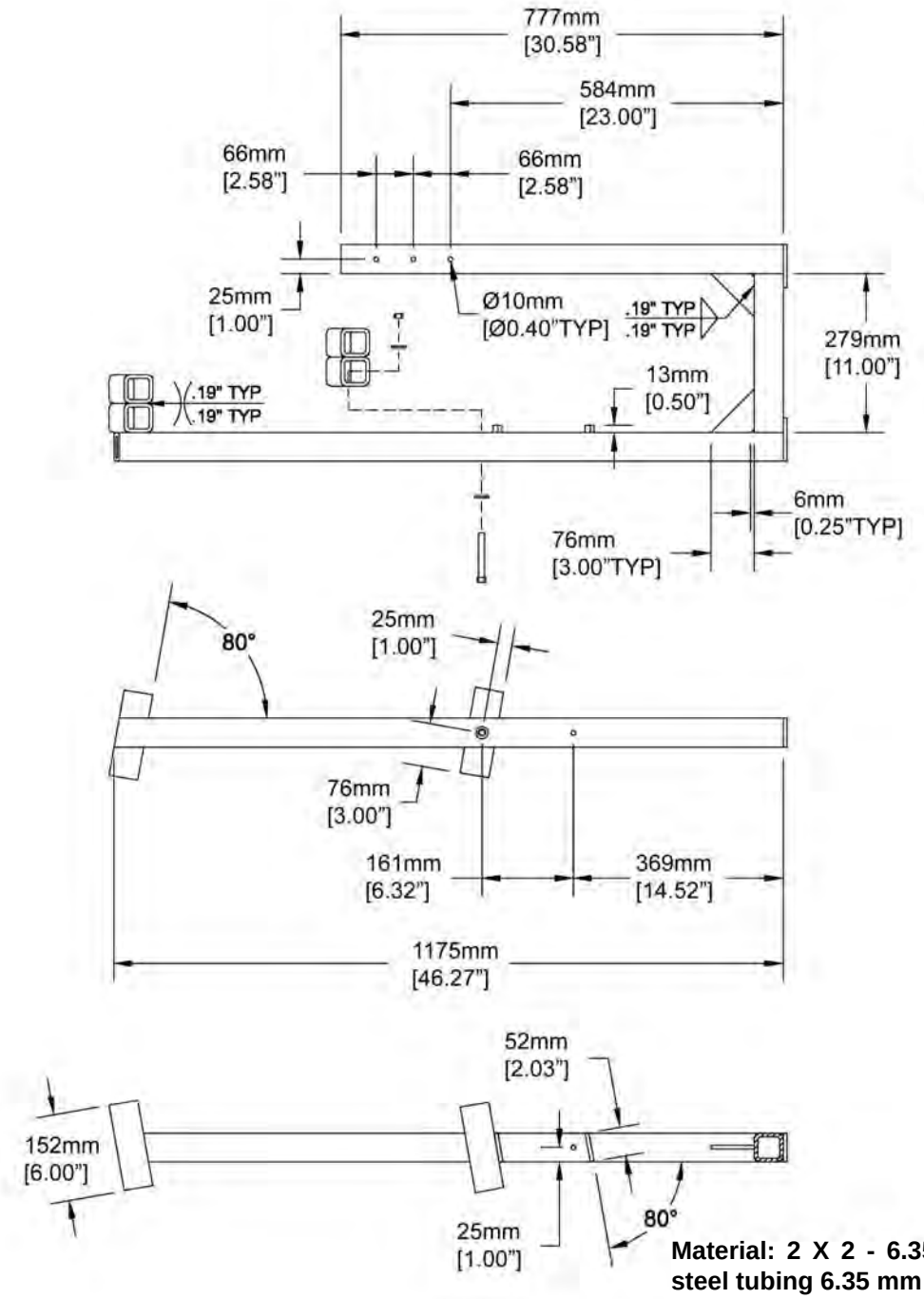


Dealer Copy -- Not for Resale

Removal And Installation

Build the service lifting bracket used to remove and install the cab. Use the dimensions shown in **[Figure 40-30-1]** to build the service lifting bracket.

Figure 40-30-1



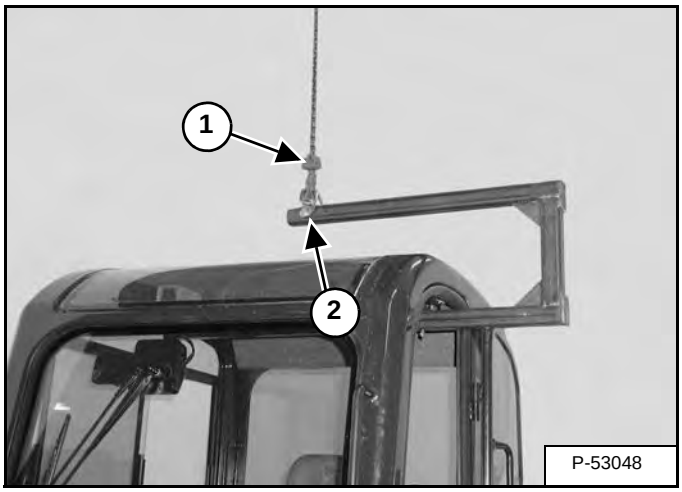
Material: 2 X 2 - 6.35 mm (0.25 in) wall hot rolled steel tubing 6.35 mm (0.25 in) hot rolled steel plate

MS1933EN

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Removal And Installation (Cont'd)

Figure 40-30-2



Install the chain hoist (Item 1) in the end hole of the lifting bracket (Item 2) **[Figure 40-30-2]**.

Install the cab / canopy service lifting bracket on the cab **[Figure 40-30-2]**.

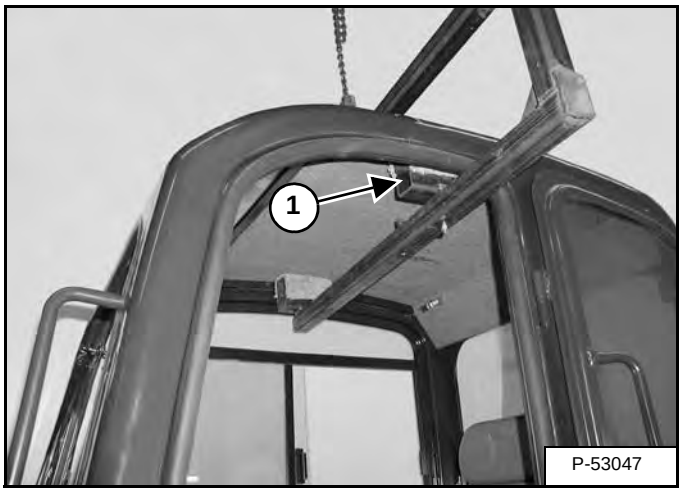
NOTE: Use a chain hoist of sufficient capacity.

⚠ WARNING

Never use the cab / canopy service lifting bracket to lift the excavator. The bracket is not strong enough and can fail causing serious injury or death.

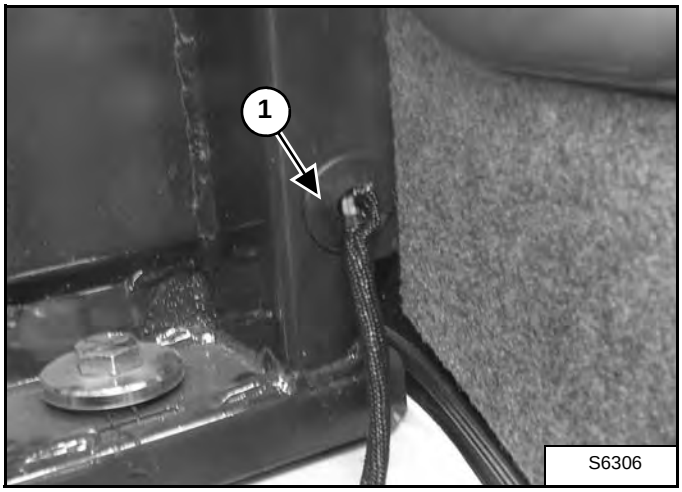
W-2384-1000

Figure 40-30-3



Adjust the lifting bracket to the proper width by moving the bracket (Item 1) **[Figure 40-30-3]**.

Figure 40-30-4

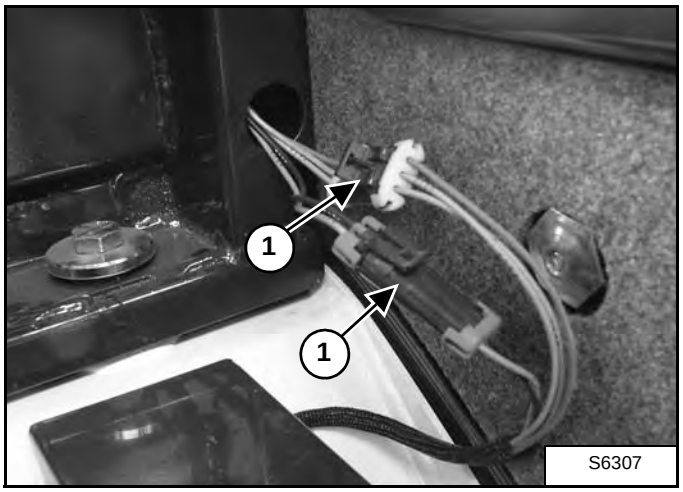


Remove the grommet (Item 1) **[Figure 40-30-4]** located in the left rear corner of the cab.

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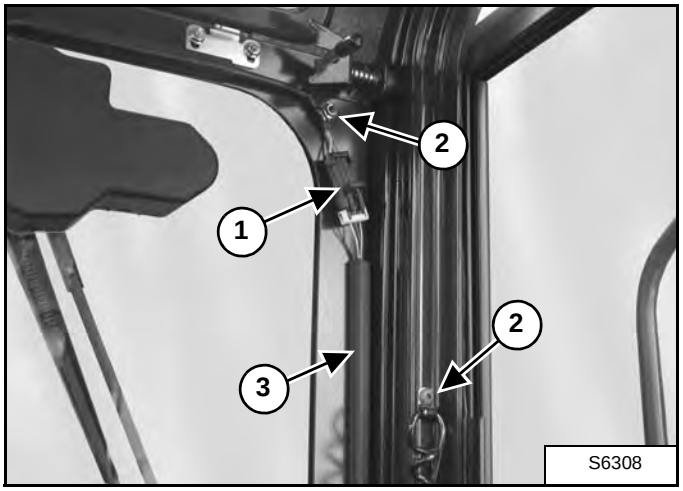
Removal And Installation (Cont'd)

Figure 40-30-5



Remove the wire harness from the cab frame and disconnect the wire connectors (Item 1) **[Figure 40-30-5]**.

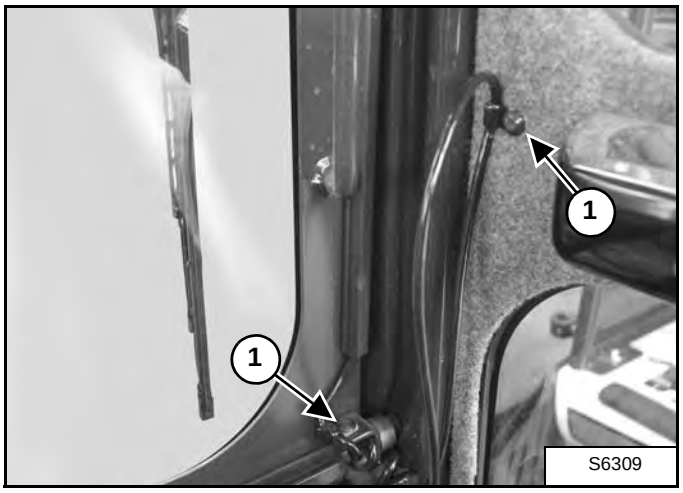
Figure 40-30-6



Disconnect the wire harness (Item 1) and remove the screws (Item 2) **[Figure 40-30-6]**.

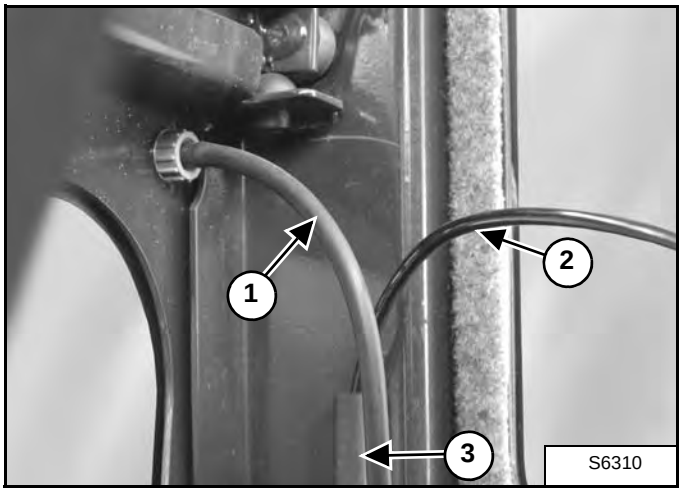
Remove the wire harness from the channel (Item 3) **[Figure 40-30-6]**.

Figure 40-30-7



Remove the screws (Item 1) **[Figure 40-30-7]**.

Figure 40-30-8



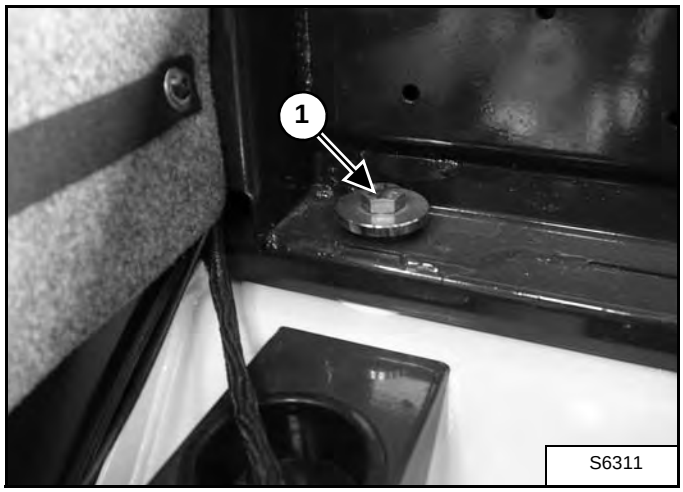
Remove the windshield washer hose (Item 1) **[Figure 40-30-8]** from the nozzle.

Remove the wire harness (Item 2) and washer hose from the channel (Item 3) **[Figure 40-30-8]**.

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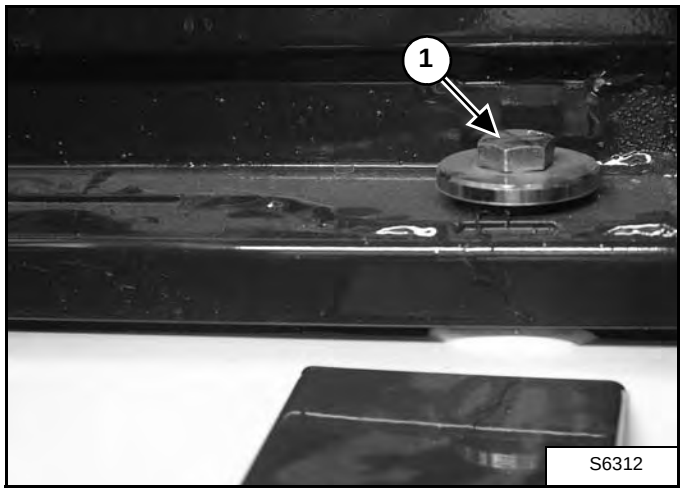
Removal And Installation (Cont'd)

Figure 40-30-9



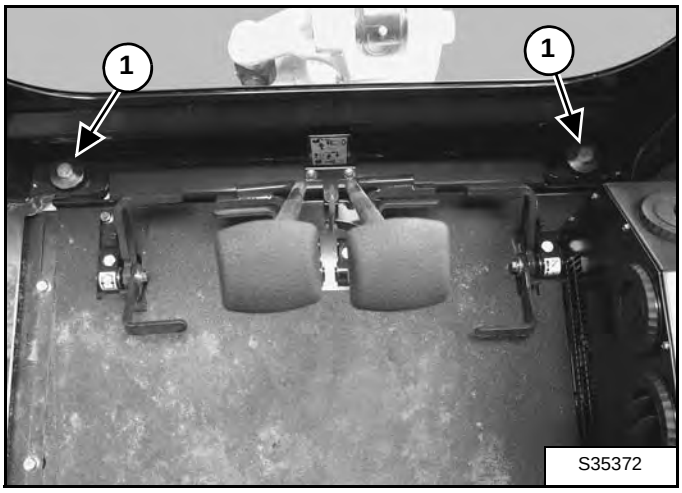
Remove the bolt and washer (Item 1) **[Figure 40-30-9]** from the right rear of the cab.

Figure 40-30-10



Remove the bolt and washer (Item 1) **[Figure 40-30-10]** from the left rear of the cab.

Figure 40-30-11

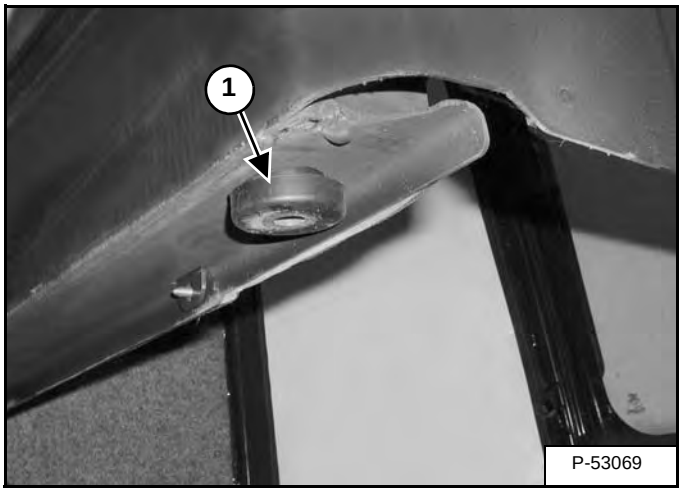


Remove the bolts, nuts and washers (Item 1) **[Figure 40-30-11]** from the front of the cab.

Installation: Tighten the bolts to 160 - 180 N•m (118 - 133 ft-lb) torque.

Raise the hoist and remove the cab.

Figure 40-30-12

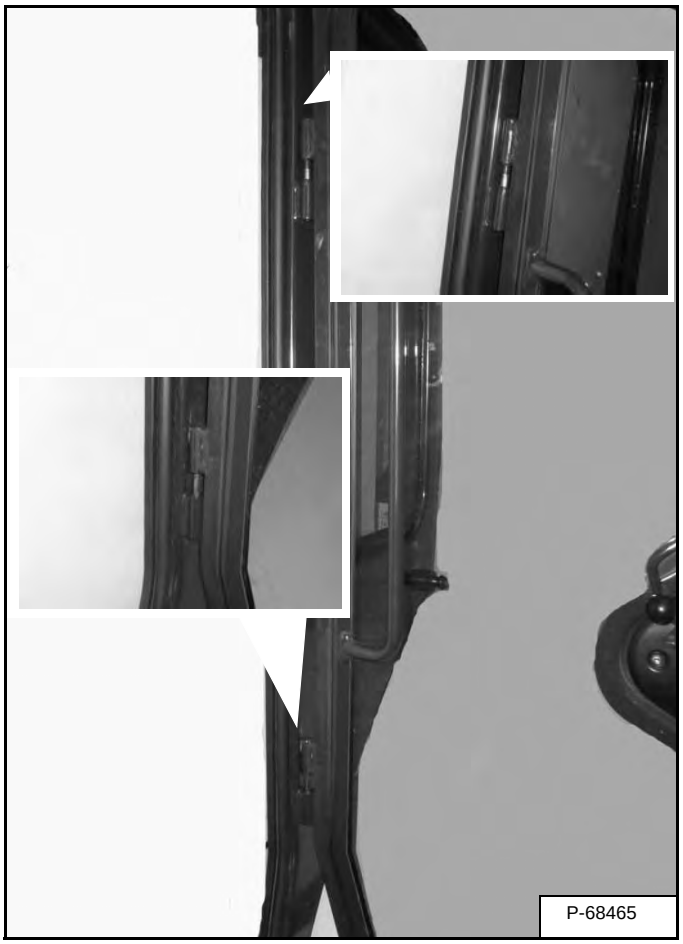


Installation: Install the cab mounts (Item 1) **[Figure 40-30-12]** on the four corners of the cab.

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Door Removal And Installation

Figure 40-30-13



The door can be removed from the cab by slowly swinging the door back and forth while lifting up on the door **[Figure 40-30-13]**.

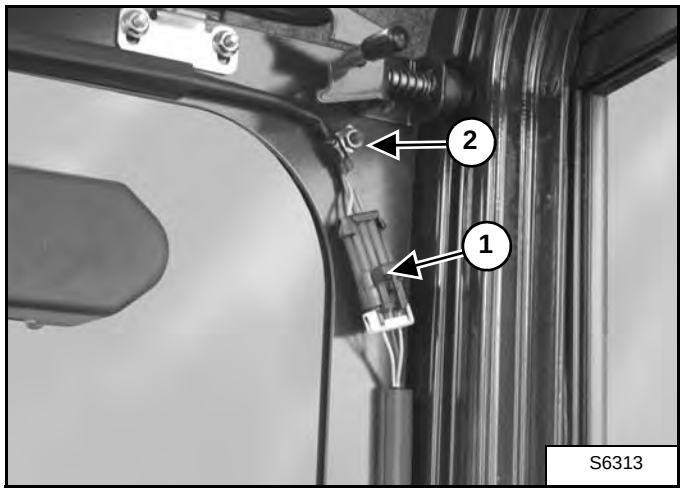
Installation: Align the hinges and swing the door back and forth until the door weight settles the hinges to full engagement.

NOTE: Early style door with one piece glass is shown. Later model doors have two pieces of glass. The procedure is the same for both styles of doors.

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Front Window Removal And Installation

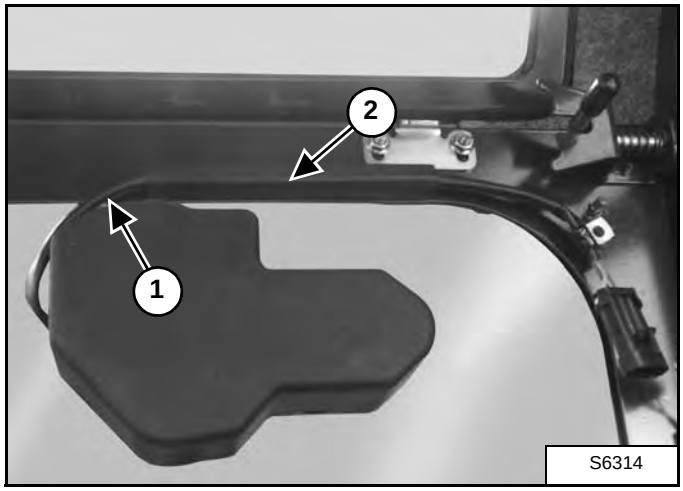
Figure 40-30-14



Disconnect the wire harness (Item 1) **[Figure 40-30-14]**.

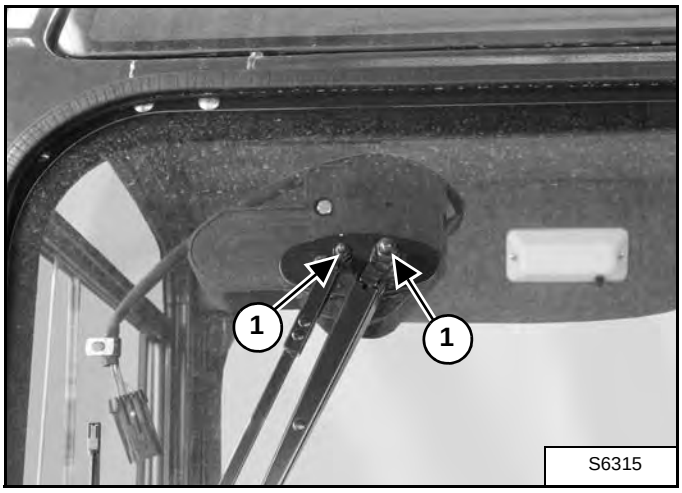
Remove the nut (Item 2) **[Figure 40-30-14]**.

Figure 40-30-15



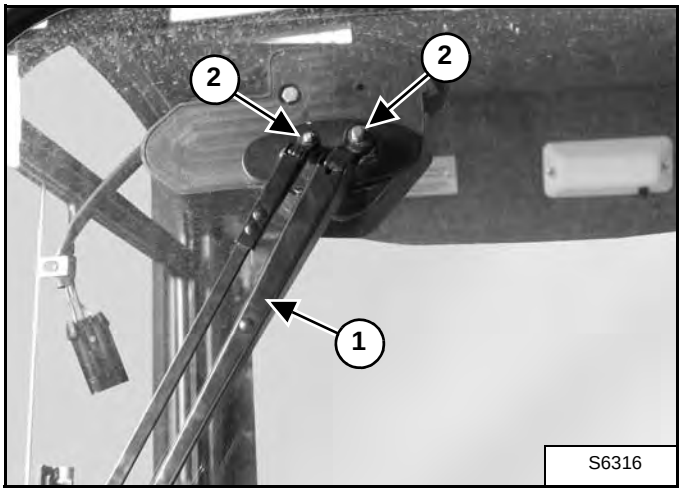
Remove the wire harness (Item 1) from the channel (Item 2) **[Figure 40-30-15]**.

Figure 40-30-16



Remove the nuts (Item 1) **[Figure 40-30-16]**.

Figure 40-30-17

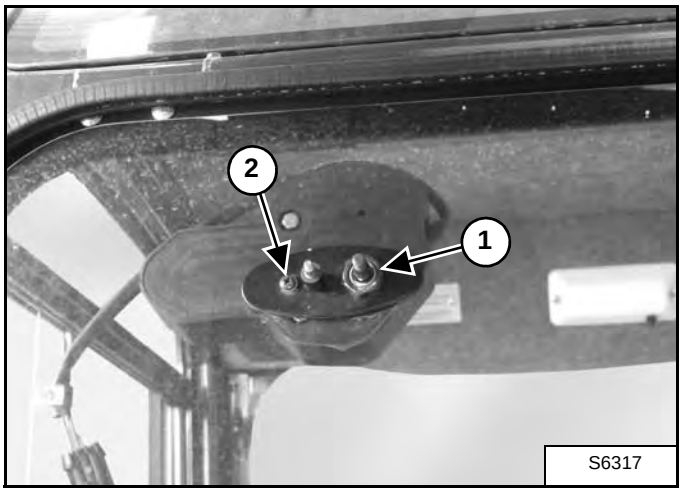


Remove the wiper assembly (Item 1) from the pivot mounts (Item 2) **[Figure 40-30-17]**.

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Front Window Removal And Installation (Cont'd)

Figure 40-30-18

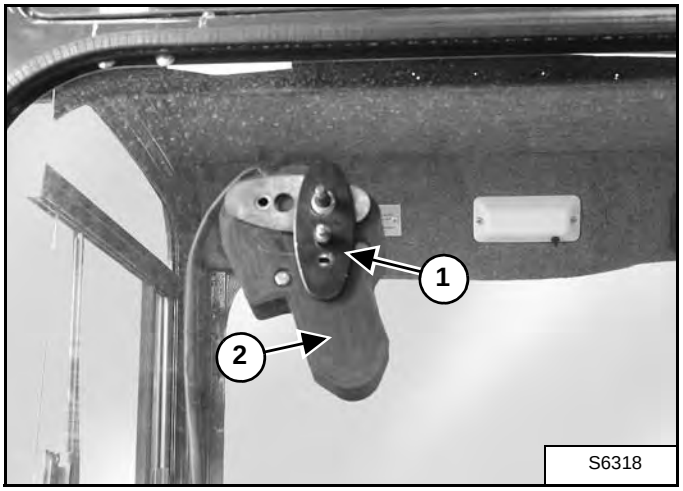


Remove the nut and washer (Item 1) **[Figure 40-30-18]**.

Remove the bolt (Item 2) **[Figure 40-30-18]**.

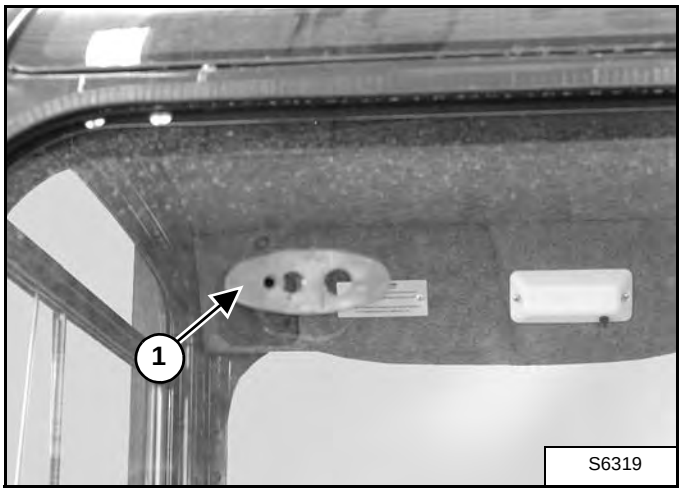
NOTE: Support the wiper motor before removing the bolts.

Figure 40-30-19



Remove the plate (Item 1) and wiper motor (Item 2) **[Figure 40-30-19]**.

Figure 40-30-20

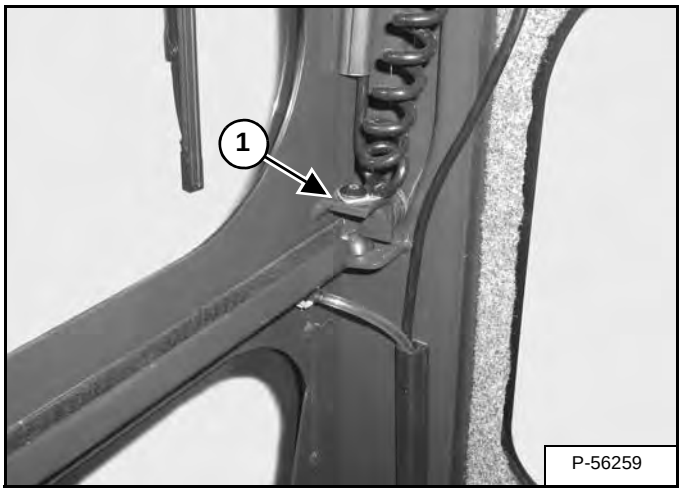


Remove the seal (Item 1) **[Figure 40-30-20]**.

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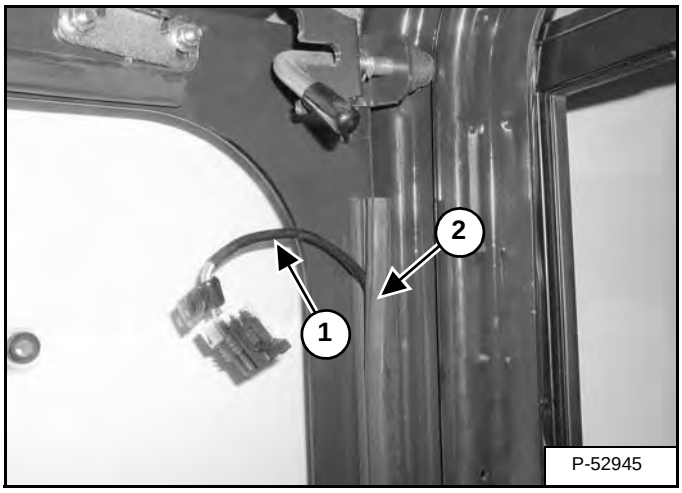
Front Window Removal And Installation (Cont'd)

Figure 40-30-21



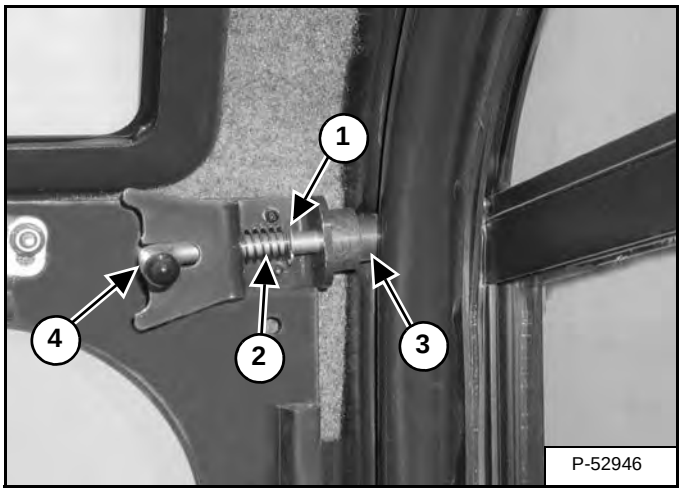
Remove the screw (Item 1) **[Figure 40-30-21]** holding the wire harness clamp to the bottom of the front window.

Figure 40-30-22



Remove the wire harness (Item 1) from the channel (Item 2) **[Figure 40-30-22]**.

Figure 40-30-23



With the help of a second person holding the front window, remove the retainer (Item 1), spring (Item 2), roller (Item 3), and handle (Item 4) **[Figure 40-30-23]** from both sides of the front window.

Figure 40-30-24



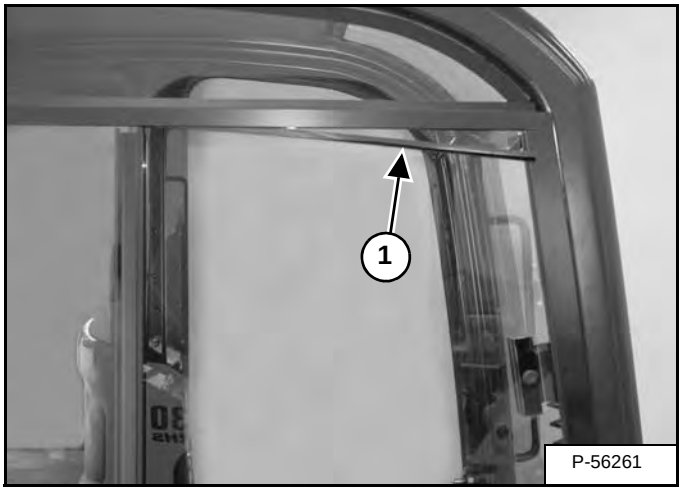
Tilt the front window (Item 1) **[Figure 40-30-24]**. Remove the front window from the cab.

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Right Side Rear Sliding Window Removal And Installation

Close and latch the front and rear sliding windows.

Figure 40-30-25



Use a pick to pull the felt (Item 1) **[Figure 40-30-25]** from the top window channel.

Unlatch the rear sliding window and slide the window open until it stops.

Figure 40-30-26



Lift the window up into the top channel and tilt the bottom edge out **[Figure 40-30-26]**. Remove the window from the cab.

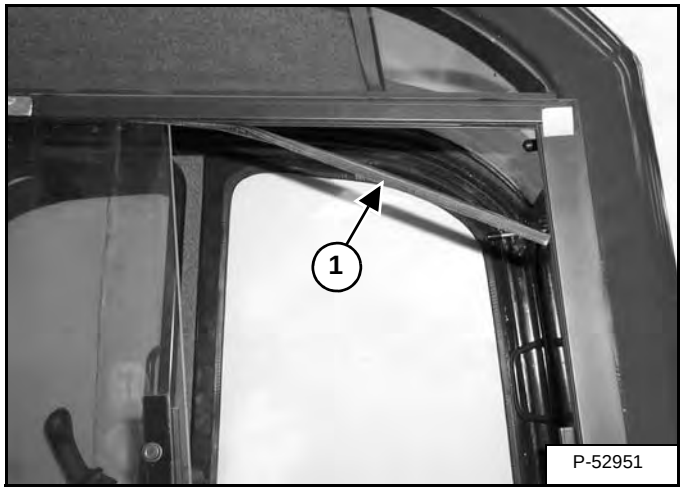
Dealer Copy -- Not for Resale

Right Side Front Sliding Window Removal And Installation

NOTE: The rear sliding window must be removed before the front sliding window can be removed.

Unlatch the front sliding window and slide the window open until it stops.

Figure 40-30-27



Use a pick to pull the felt (Item 1) **[Figure 40-30-27]** from the inside top window channel.

Figure 40-30-28

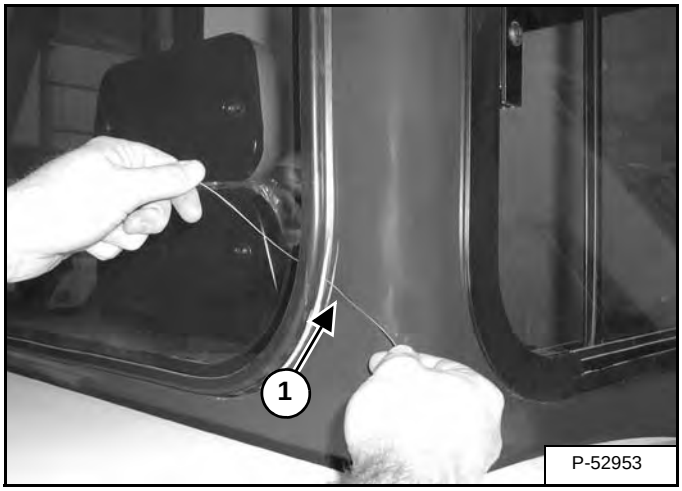


Lift the window up into the channel and tilt the bottom edge out **[Figure 40-30-28]**. Remove the window from the cab.

Glass Removal

Use the following procedure to remove the glass from the rear of the cab and right side window assembly.

Figure 40-30-29



Push a small diameter wire (Item 1) **[Figure 40-30-29]** through the adhesive. Pull the wire around the perimeter of the glass to cut the adhesive.

Remove the glass.

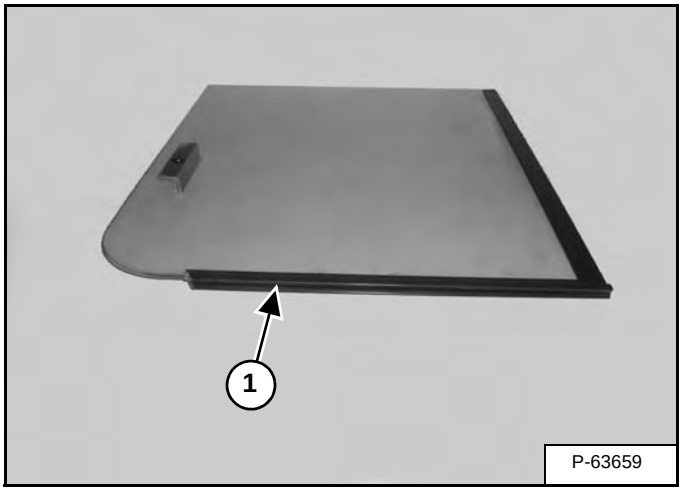
NOTE: The right side window frame is aluminum and will be destroyed when removed.

Dealer Copy -- Not for Resale

Right Side Front And Rear Sliding Window Weather Strip Removal And Installation

Remove the window.

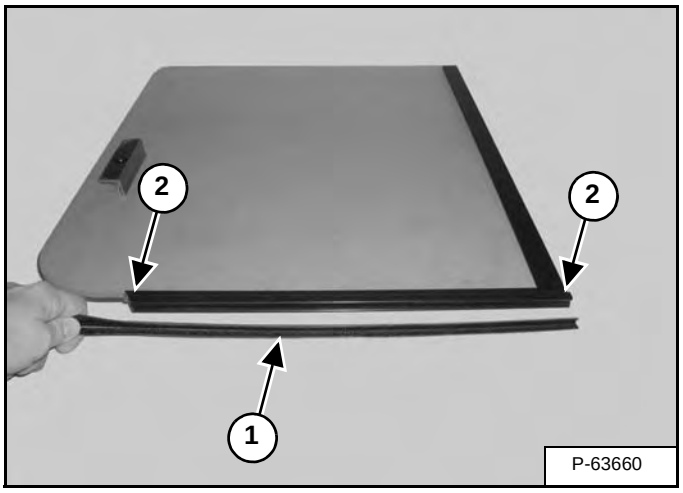
Figure 40-30-30



Remove the weather strip (Item 1) **[Figure 40-30-30]** from the bottom channel of the window.

Installation: Clean the bottom channel. Apply a bead of adhesive in the channel.

Figure 40-30-31

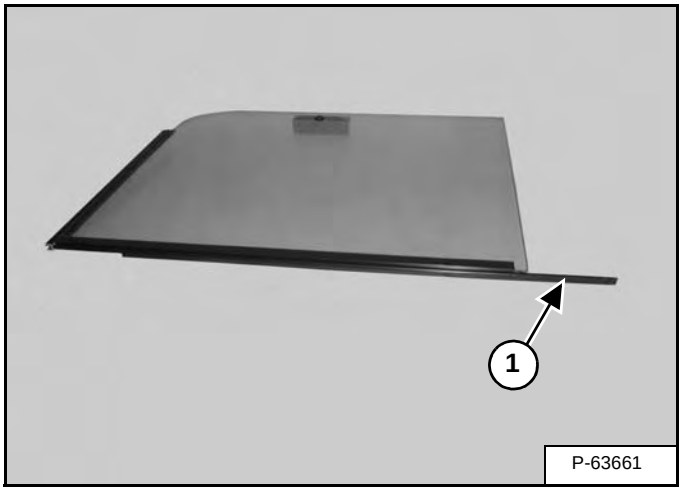


Install the new weather strip (Item 1). Cut the weather strip flush with the ends of the window channel (Item 2) **[Figure 40-30-31]**.

Right Side Front And Rear Sliding Window Wiper Strip Removal And Installation

Remove the window.

Figure 40-30-32



Remove the wiper strip (Item 1) **[Figure 40-30-32]** from the window channel.

Dealer Copy -- Not for Resale

CAB (CONT'D)

Glass Installation

Rear And Front Lower Glass

Remove the majority of the old urethane adhesive from the perimeter of the cab.

NOTE: Leave a thin film of the old urethane on the cab frame, fresh urethane will bond to the remaining film.

Prime and paint any bare metal or scratches.

Clean the metal surfaces with general purposes adhesive cleaner. Clean the glass surface with glass cleaner.

Figure 40-30-33

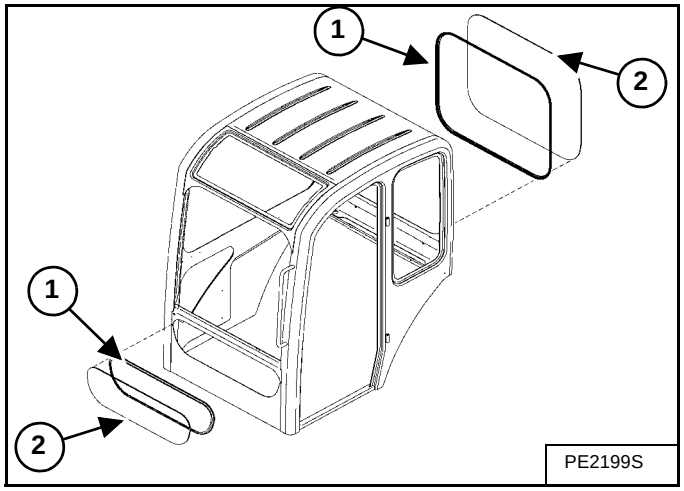
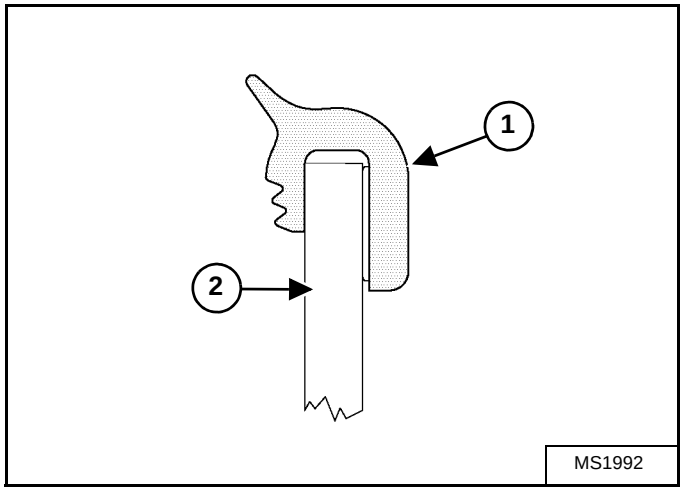


Figure 40-30-34



Install the seal (Item 1) on the glass (Item 2) **[Figure 40-30-33]** and **[Figure 40-30-34]**.

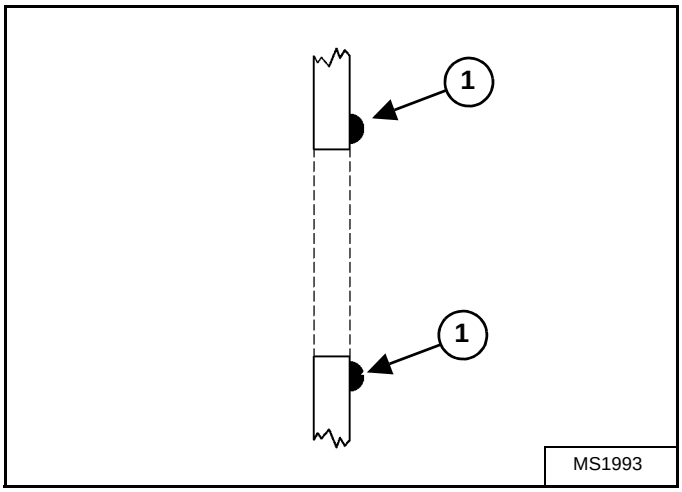
Shake the combo primer for 1 minute.

Apply the combo primer to the perimeter of the cab and glass (Item 2) **[Figure 40-30-34]**. Apply the primer in one direction only, using a dauber. Do not dip the dauber in the primer more than once. Use multiple daubers if needed.

Allow the combo primer to dry for 5 minutes. Dry time doubles if the primer is applied in two coats.

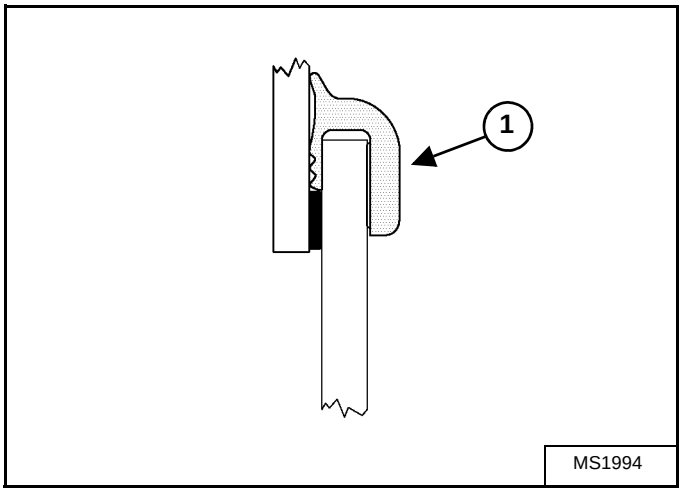
Cut the tip of the adhesive tube to the desired shape and size to provide a bead height sufficient to give good contact with the glass around the entire perimeter.

Figure 40-30-35



Apply a 7,62 x 6,35 mm (0.3 x 0.25 in) bead of urethane adhesive (Item 1) **[Figure 40-30-35]** to the perimeter of the cab.

Figure 40-30-36



Install the glass and seal assembly (Item 1) **[Figure 40-30-36]**. Press the glass into the cab to make complete contact with the adhesive. Tape the glass in place.

Dealer Copy -- Not for Resale

Glass Installation (Cont'd)

Allow 2 hours for curing at normal conditions (65°C [65°F], 75% relative humidity).

Remove the tape after the adhesive is cured.

Top, Right Side And Left Side Glass

Remove the majority of the old urethane adhesive from the perimeter of the cab.

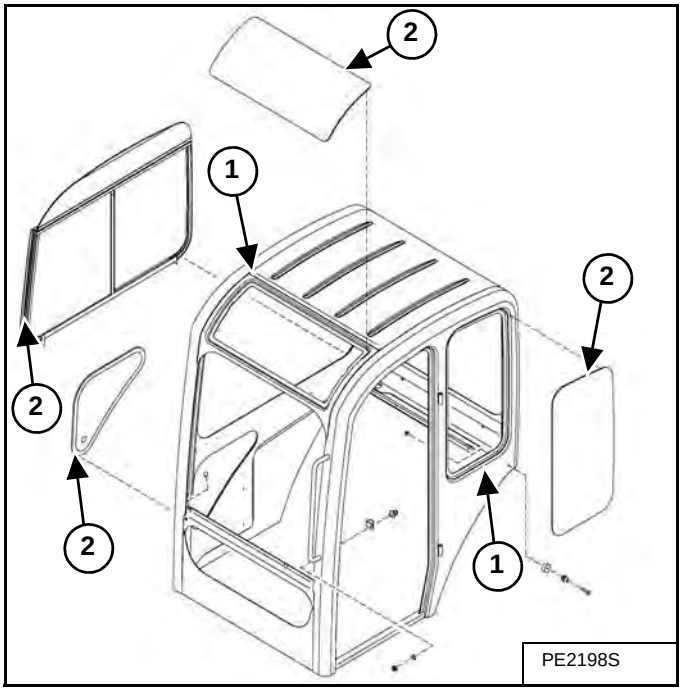
NOTE: Leave a thin film of the old urethane on the cab frame, fresh urethane will bond to the remaining film.

Prime and paint any bare metal or scratches.

Clean the metal surfaces with general purposes adhesive cleaner. Clean the glass surface with glass cleaner.

Shake the combo primer for 1 minute.

Figure 40-30-37

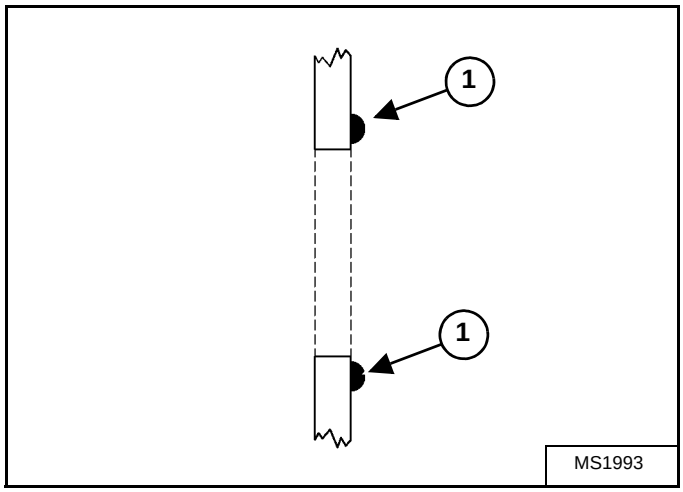


Apply combo primer to the perimeter of the cab (Item 1) and glass (Item 2) **[Figure 40-30-37]**. Apply the primer in one direction only, using a dauber. Do not dip the dauber in the primer more than once. Use multiple daubers if needed.

Allow the combo primer to dry for 5 minutes. Dry time doubles if the primer is applied in two coats.

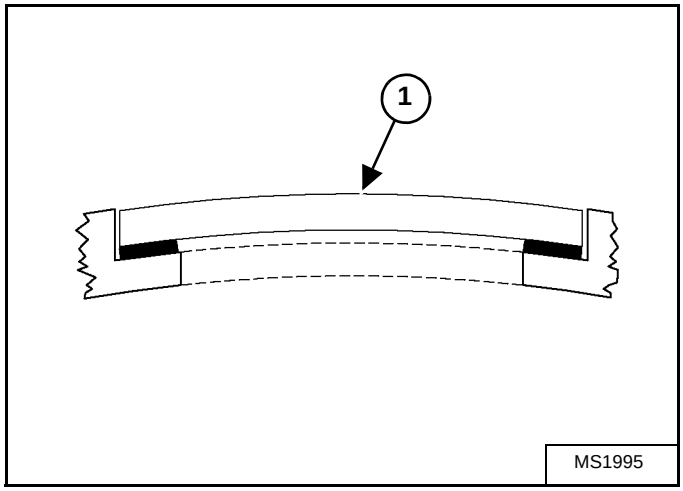
Cut the tip of the adhesive tube to the desired shape and size to provide a bead height sufficient to give good contact with the glass around the entire perimeter.

Figure 40-30-38



Apply a 7,62 x 6,35 mm (0.3 x 0.25 in) bead of urethane adhesive (Item 1) **[Figure 40-30-38]** to the perimeter of the cab.

Figure 40-30-39



Install the glass (Item 1) **[Figure 40-30-39]**. Press the glass into the cab to make complete contact with the adhesive. Tape the glass in place.

Allow 2 hours for curing at normal conditions (65°C [65°F], 75% relative humidity).

Remove the tape after the adhesive is cured.

Door And Front Window Glass

The door and front window glass are not available separately.

Order and install the door or front window frame and glass assembly.

Dealer Copy -- Not for Resale

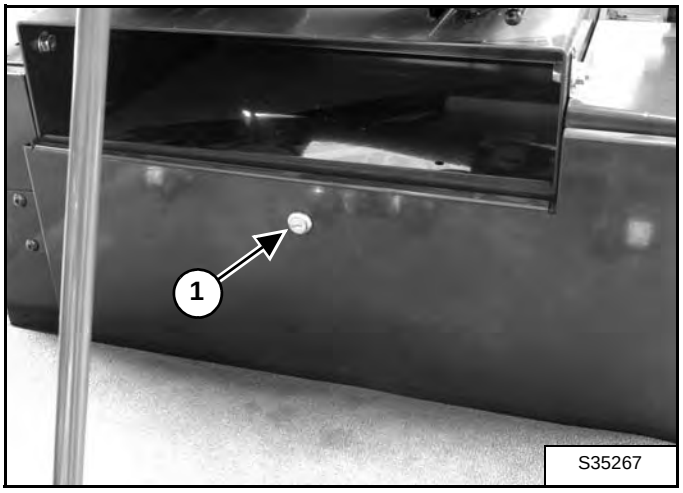


Dealer Copy -- Not for Resale

SEAT AND SEAT MOUNT (FOR MODEL E16 S/N AHLL11001 - 13119)

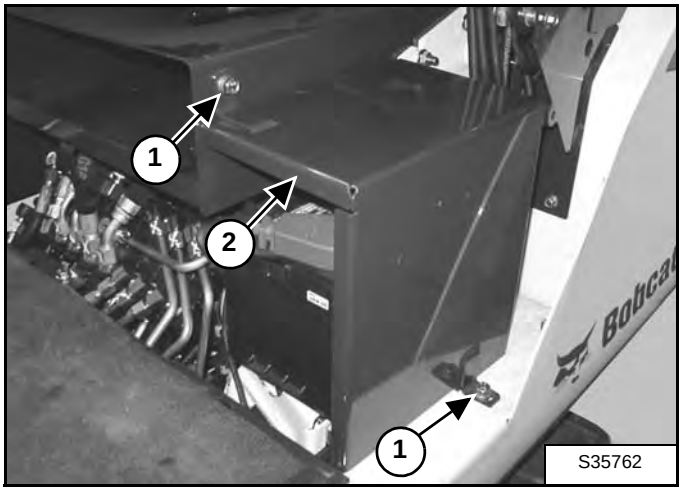
Seat Mount Removal And Installation

Figure 40-40-1



Use the start key to remove the access cover (Item 1) **[Figure 40-40-1]**.

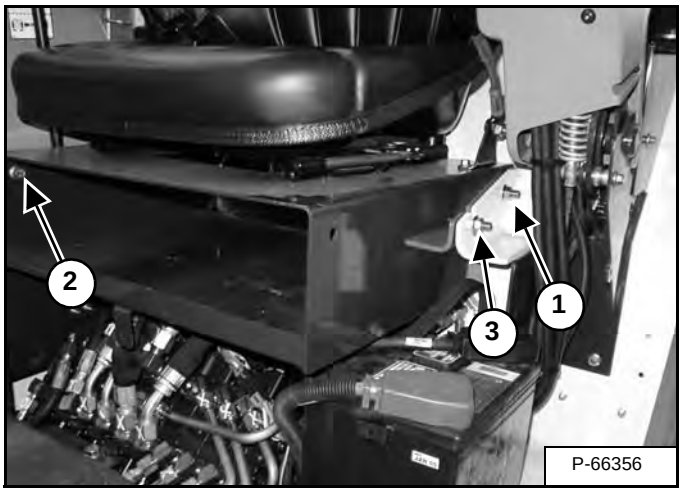
Figure 40-40-2



Remove the two bolts (Item 1) **[Figure 40-40-2]** and brackets from the battery cover.

Remove the battery cover (Item 2) **[Figure 40-40-2]**.

Figure 40-40-3



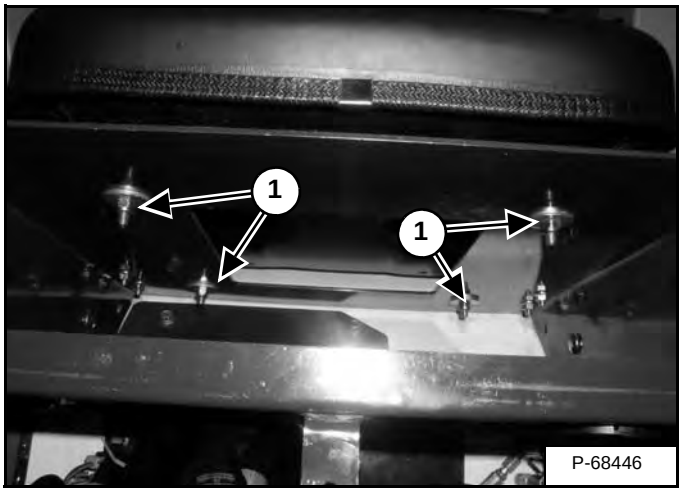
Remove the two bolts (Item 1) **[Figure 40-40-3]** and nuts from both sides of the seat mount.

Remove the bolt (Item 2) **[Figure 40-40-3]**, nut and bracket from the right side of the seat mount.

Loosen the two bolts (Item 3) **[Figure 40-40-3]** and nuts from both sides of the seat mount.

Remove the seat and seat mount.

Figure 40-40-4



Remove the four nuts and washers (Item 1) **[Figure 40-40-4]** from the seat bolts and remove seat and rail assembly.

NOTE: The lower seat rails do not separate from the seat rails and are attached to the bottom of the seat as an assembly.

Dealer Copy -- Not for Resale

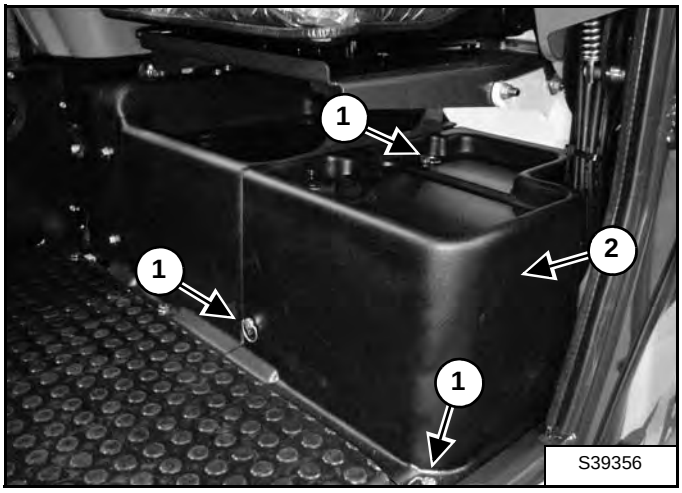


Dealer Copy -- Not for Resale

SEAT AND SEAT MOUNT (FOR MODEL E16 S/N AHLL13120 & ABOVE)

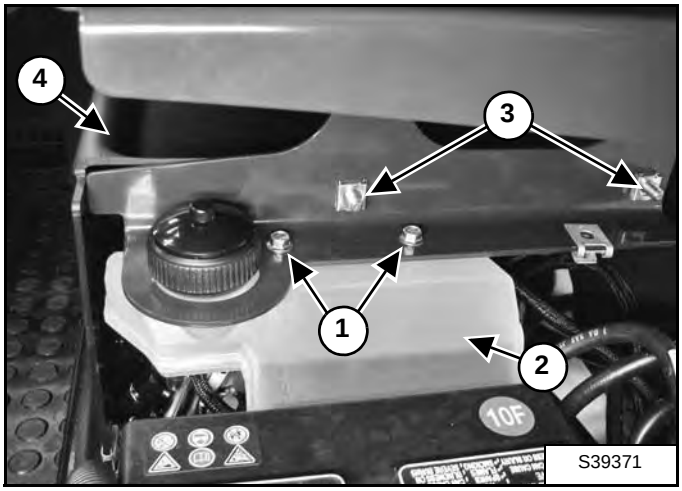
Seat Mount Removal And Installation

Figure 40-41-1



Loosen the three screws (Item 1) and remove the battery cover (Item 2) **[Figure 40-41-1]**.

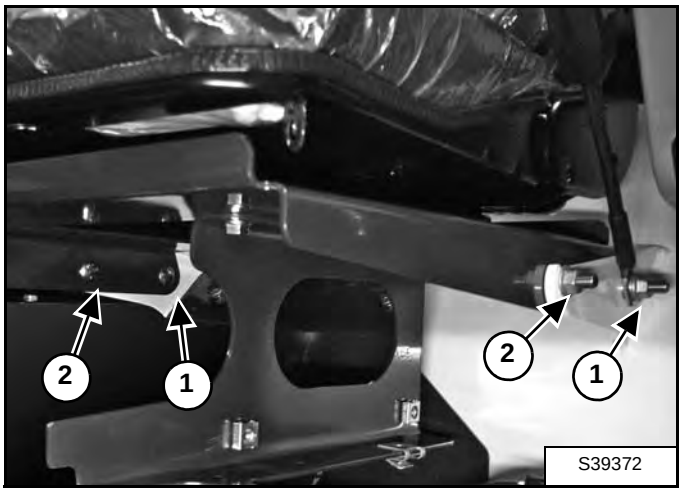
Figure 40-41-2



Remove the two bolts (Item 1) and lower the windscreen washer bottle (Item 2) **[Figure 40-41-2]**.

Remove the two bolts (Item 3) from the access cover (Item 4) **[Figure 40-41-2]**.

Figure 40-41-3

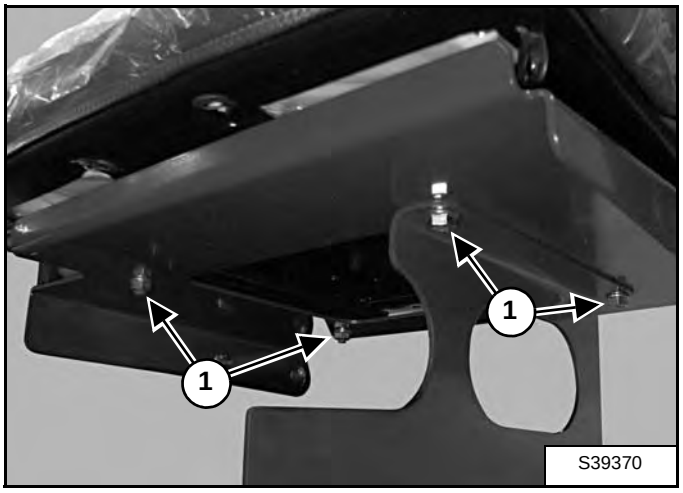


Remove the two bolts (Item 1) **[Figure 40-41-3]** and nuts from both sides of the seat mount.

Loosen the two bolts (Item 2) **[Figure 40-41-3]** and nuts from both sides of the seat mount.

Remove the seat and seat mount.

Figure 40-41-4



Remove the four nuts and washers (Item 1) **[Figure 40-41-4]** from the seat bolts and remove seat and rail assembly.

NOTE: The lower seat rails do not separate from the seat rails and are attached to the bottom of the seat as an assembly.

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Dealer Copy -- Not for Resale

RIGHT CONSOLE

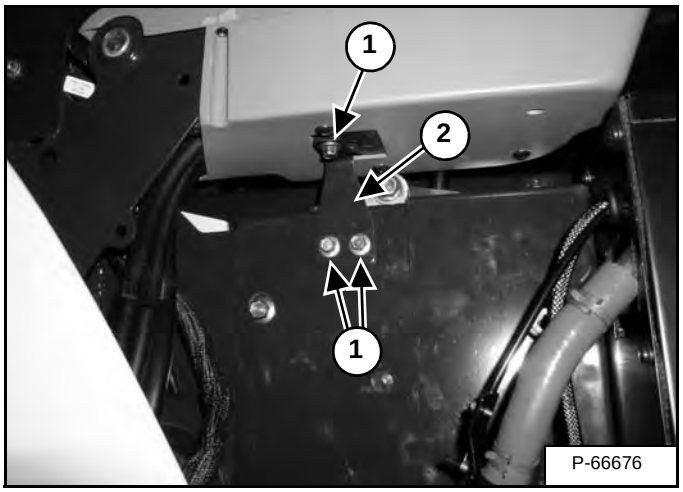
Description

On an excavator equipped with a canopy, the right console contains a movable joystick console and a rear console containing the throttle lever, hourmeter, light switch, track expansion / blade switch and cup holder.

On an excavator equipped with a cab, the right joystick console is bolted in the down position and a rear console containing the throttle lever, hourmeter, light switch, track expansion / blade switch and cup holder.

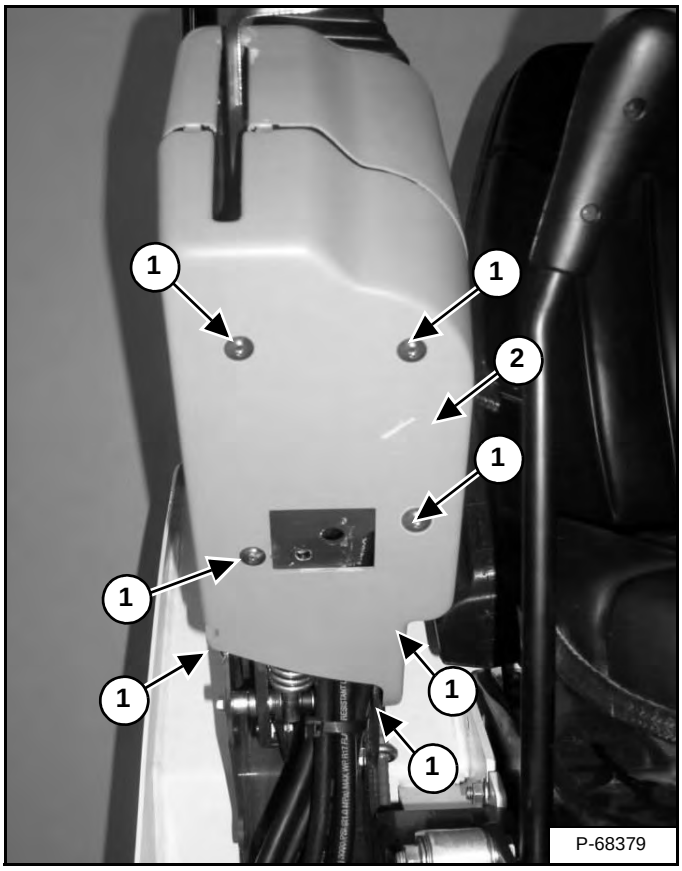
Joystick Console Cover (Bottom) Removal And Installation

Figure 40-50-1



Cab Option Only: Remove the three bolts (Item 1) and bracket (Item 2) **[Figure 40-50-1]**.

Figure 40-50-2



Remove the seven screws (Item 1) **[Figure 40-50-2]** from the lower half of the joystick console cover.

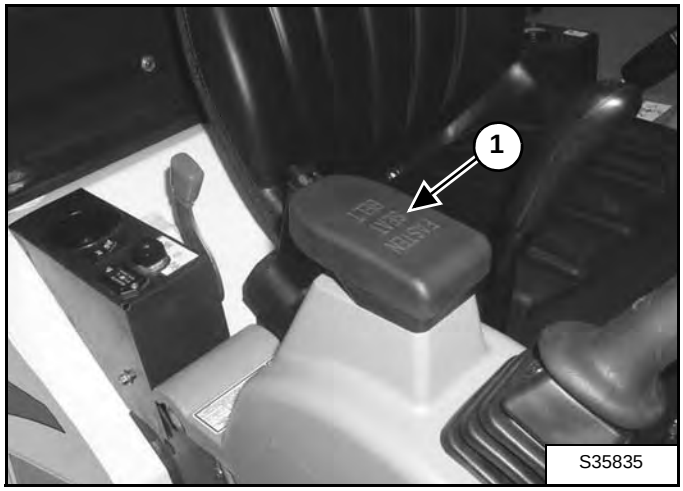
Remove the lower half of the joystick console cover (Item 2) **[Figure 40-50-2]**.

Lower the right console.

Dealer Copy -- Not for Resale

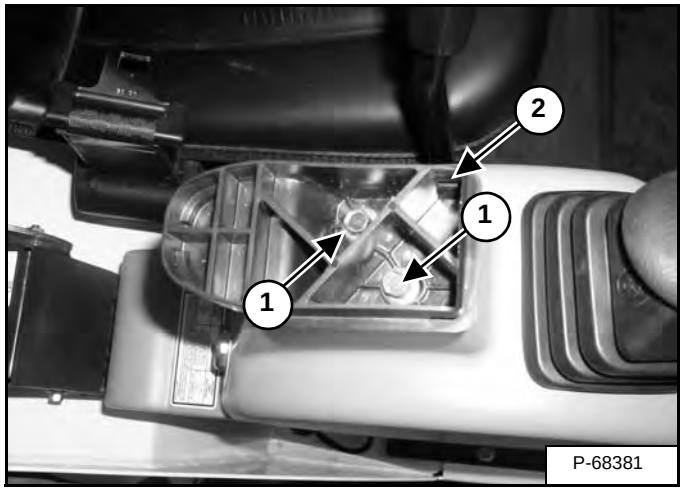
Joystick Console Cover (Top) Removal And Installation

Figure 40-50-3



Remove the cover (Item 1) **[Figure 40-50-3]** from the armrest.

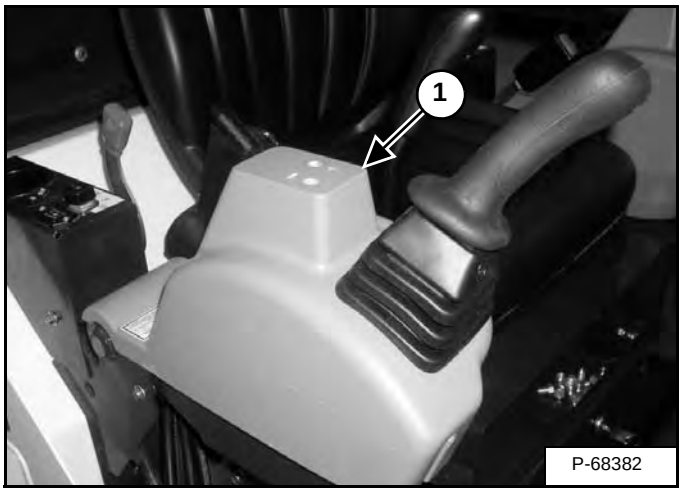
Figure 40-50-4



Remove the bolts (Item 1) from the armrest (Item 2) **[Figure 40-50-4]**.

Remove the armrest (Item 2) **[Figure 40-50-4]**.

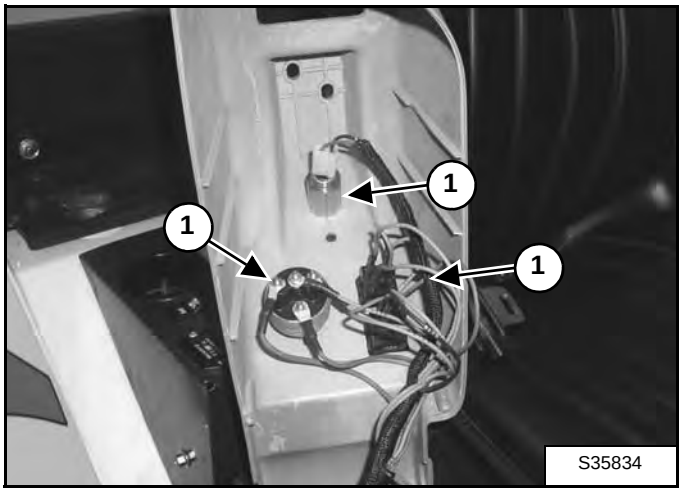
Figure 40-50-5



Remove the upper half of the joystick console cover (Item 1) **[Figure 40-50-5]** over the joystick.

Mark the wires for ease of assembly.

Figure 40-50-6



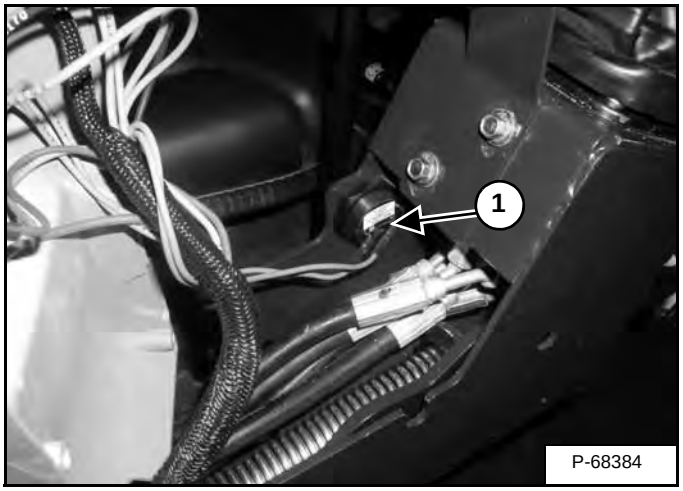
Disconnect the electrical connector and wires (Item 1) **[Figure 40-50-6]** from the key switch, indicator lights and accessory plug.

Dealer Copy -- Not for Resale

Joystick Console Cover (Top) Removal And Installation (Cont'd)

Mark the wires for ease of assembly.

Figure 40-50-7



Disconnect the electrical wires (Item 1) **[Figure 40-50-7]** from the buzzer.

Remove the joystick console cover.

Joystick Console Cover (Top) Disassembly And Assembly

Mark the wires for ease of assembly.

Figure 40-50-8

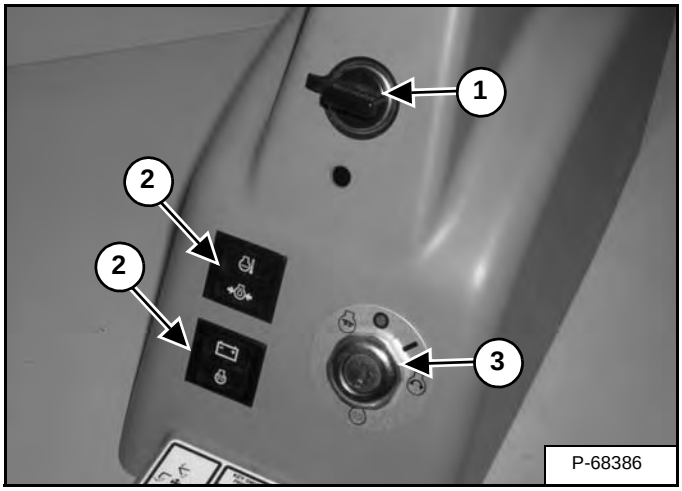
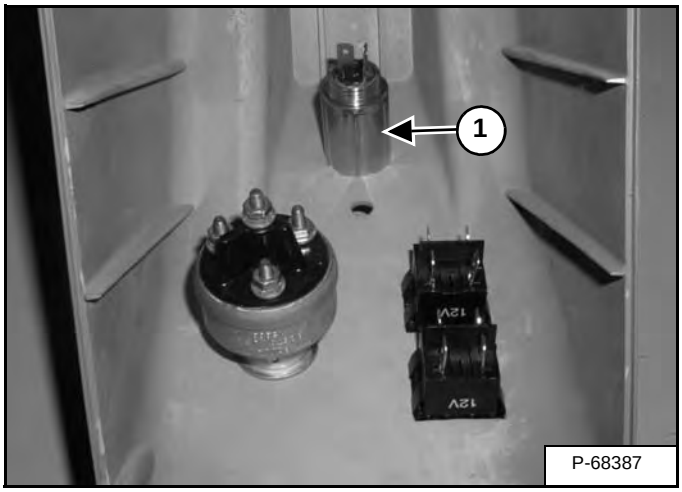


Figure 40-50-9



Remove the back (Item 1) **[Figure 40-50-9]** and **[Figure 40-50-8]** from the accessory plug and remove from the front of the cover.

Remove the indicator lights (Item 2) **[Figure 40-50-8]** in the top of the compression spring rod.

Remove the nut (Item 3) **[Figure 40-50-8]** from the front of the key switch and remove from the back of the cover.

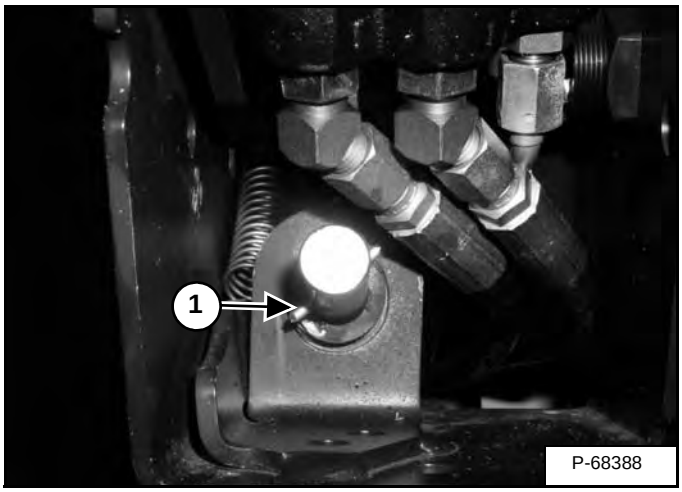
Dealer Copy -- Not for Resale

Compression Spring Removal And Installation (Canopy Only)

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

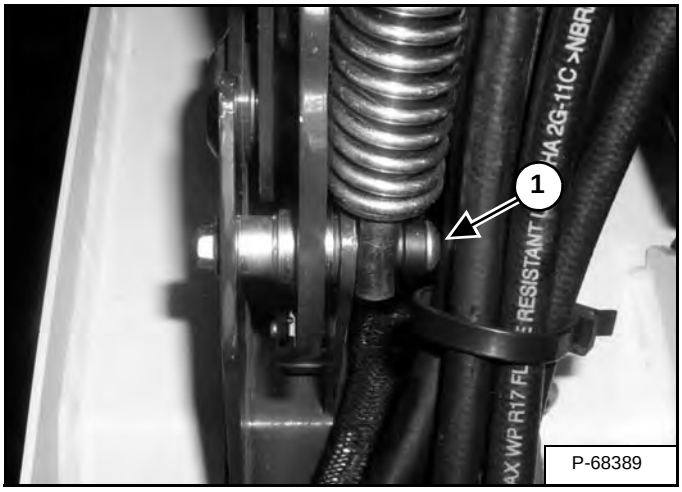
Lower the console.

Figure 40-50-10



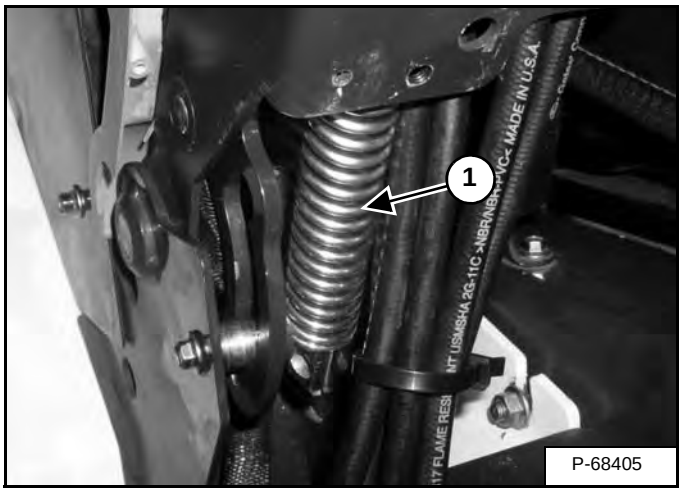
Install a pin (Item 1) **[Figure 40-50-10]** in the top of the compression spring rod.

Figure 40-50-11



Support the console in the raised position. Remove the bolt (Item 1) **[Figure 40-50-11]**.

Figure 40-50-12

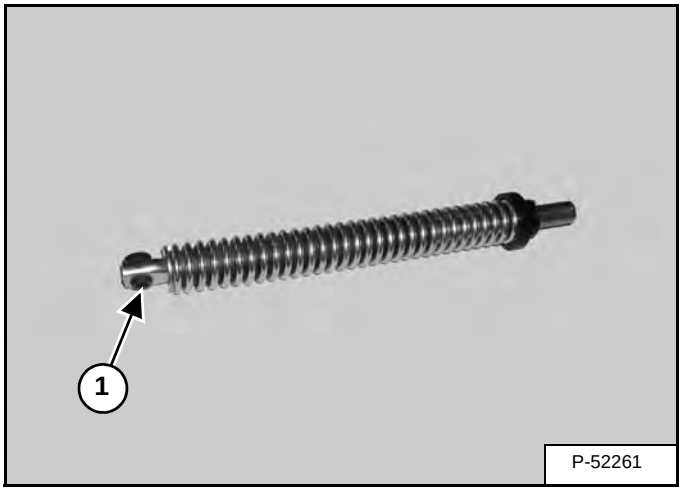


Remove the spring assembly (Item 1) **[Figure 40-50-12]** from the bottom of the console.

Dealer Copy -- Not for Resale

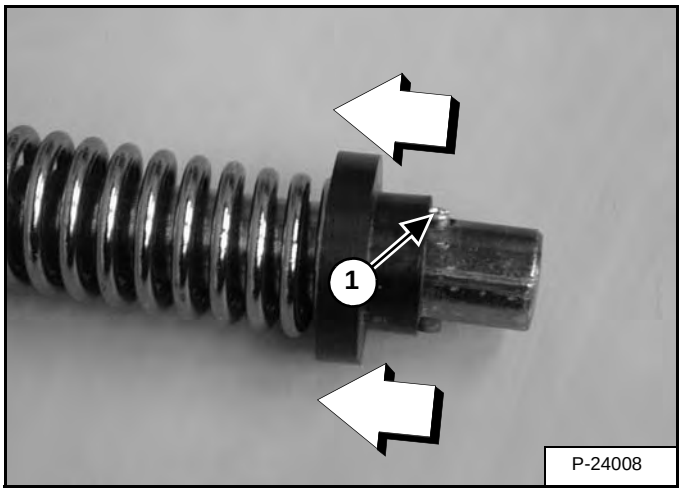
Compression Spring Disassembly And Assembly (Canopy Only)

Figure 40-50-13



Remove the bushing (Item 1) **[Figure 40-50-13]**.

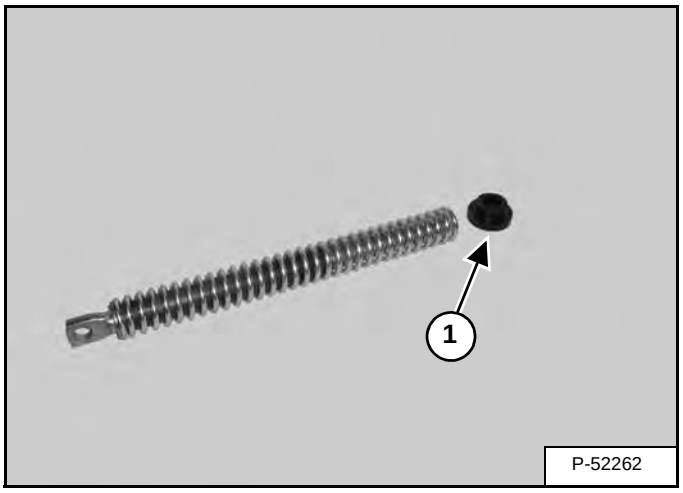
Figure 40-50-14



Apply pressure against the spring, and remove the pin (Item 1) **[Figure 40-50-14]** from the shaft.

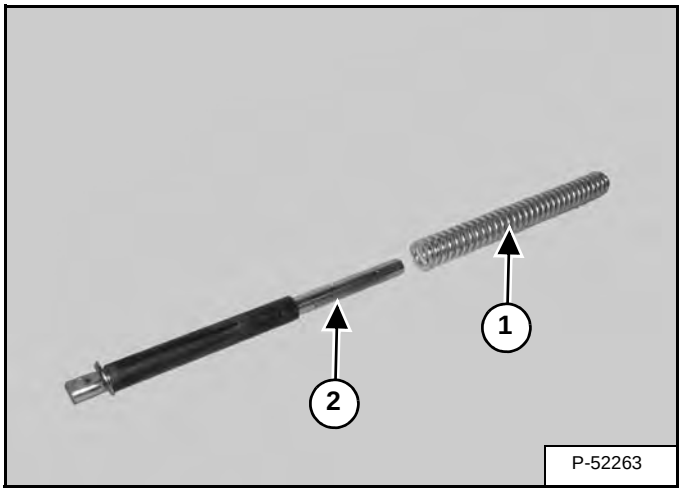
Release the pressure from the spring.

Figure 40-50-15



Remove the bushing (Item 1) **[Figure 40-50-15]**.

Figure 40-50-16

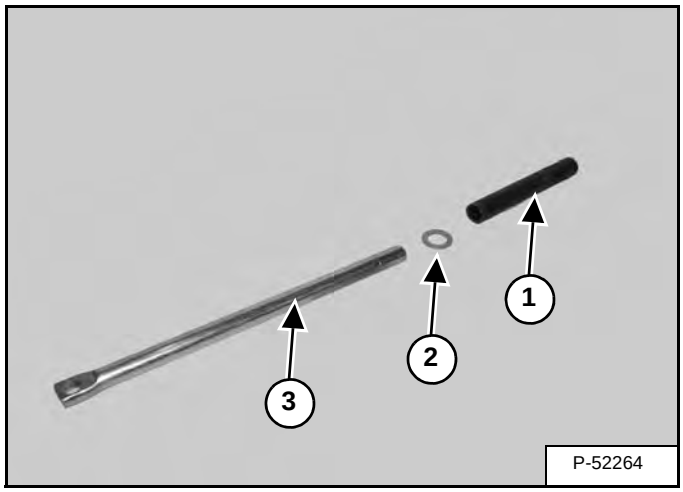


Remove the spring (Item 1) from the shaft (Item 2) **[Figure 40-50-16]**.

Dealer Copy -- Not for Resale

Compression Spring Disassembly And Assembly (Canopy Only) (Cont'd)

Figure 40-50-17



Remove the sleeve (Item 1) and washer (Item 2) from the shaft (Item 3) **[Figure 40-50-17]**.

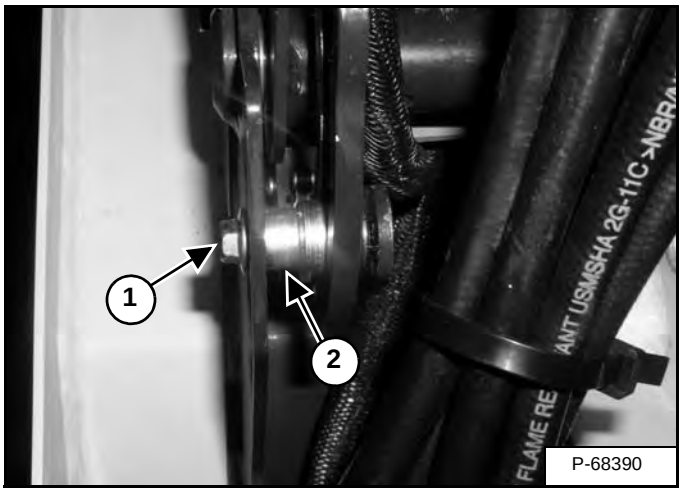
Lever Removal And Installation (Canopy Only)

Remove the joystick console bottom cover. (See Joystick Console Cover (Bottom) Removal And Installation on Page 40-50-1.)

Remove the joystick console top cover. (See Joystick Console Cover (Top) Removal And Installation on Page 40-50-2.)

Remove the compression spring. (See Compression Spring Removal And Installation (Canopy Only) on Page 40-50-4.)

Figure 40-50-18



Remove the bolt (Item 1) from the lever bearing (Item 2) **[Figure 40-50-18]**.

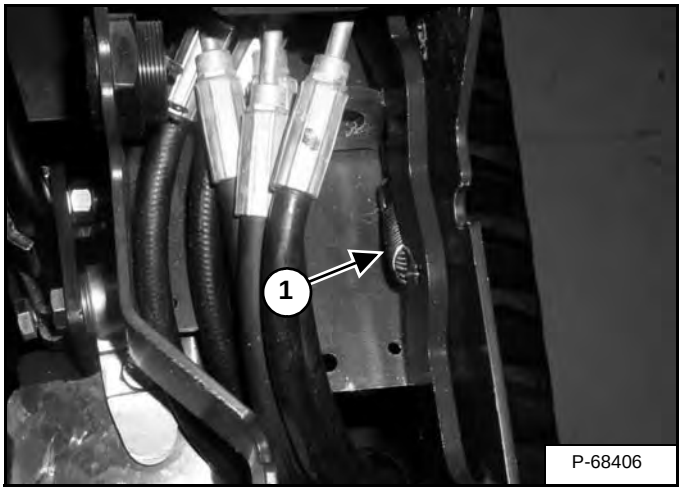
Remove the lever bearing (Item 2) **[Figure 40-50-18]**.

Lower the console.

Dealer Copy -- Not for Resale

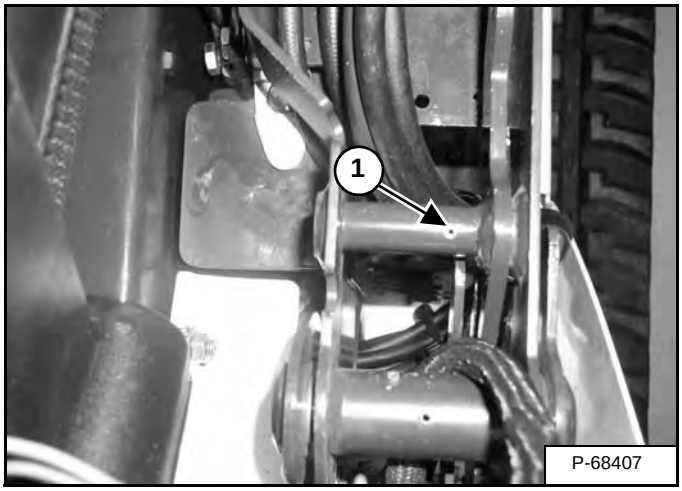
Lever Removal And Installation (Canopy Only) (Cont'd)

Figure 40-50-19



Remove the spring (Item 1) **[Figure 40-50-19]** from the console and lever.

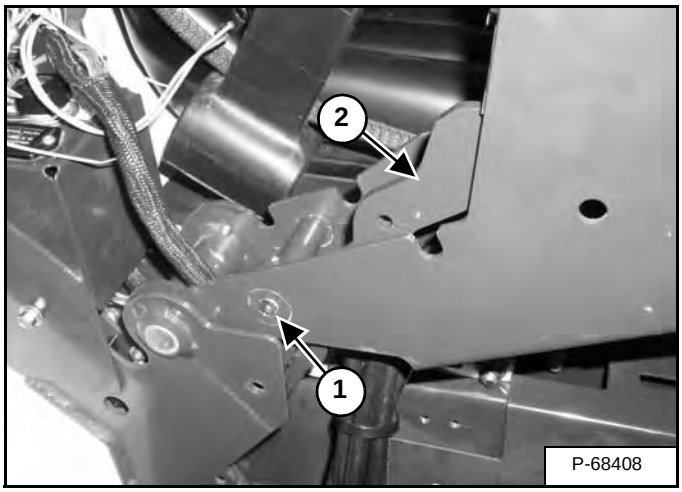
Figure 40-50-20



Remove the roll pin (Item 1) **[Figure 40-50-20]** from the lever pivot pin.

Raise and support the console.

Figure 40-50-21



Remove the pivot pin (Item 1) **[Figure 40-50-21]** from the lever.

Remove the lever (Item 2) **[Figure 40-50-21]** from the console.

Dealer Copy -- Not for Resale

Joystick Console Frame Removal And Installation

Remove the joystick console bottom cover. (See Joystick Console Cover (Bottom) Removal And Installation on Page 40-50-1.)

Remove the joystick console top cover. (See Joystick Console Cover (Top) Removal And Installation on Page 40-50-2.)

Remove the compression spring. (See Compression Spring Removal And Installation (Canopy Only) on Page 40-50-4.)

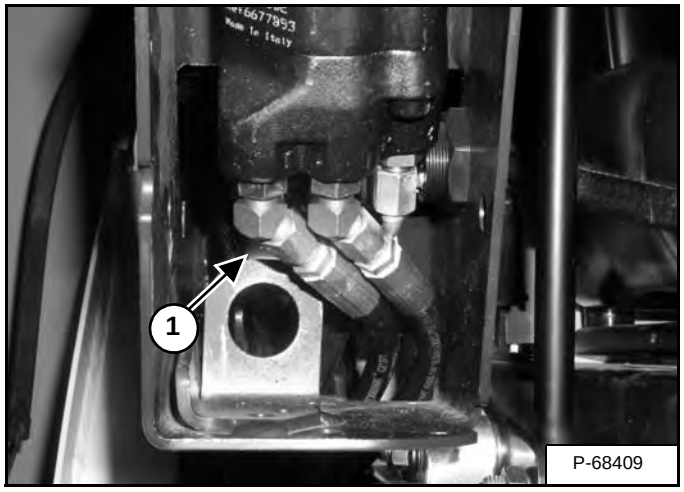
Remove the lever. (See Lever Removal And Installation (Canopy Only) on Page 40-50-6.)

IMPORTANT

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

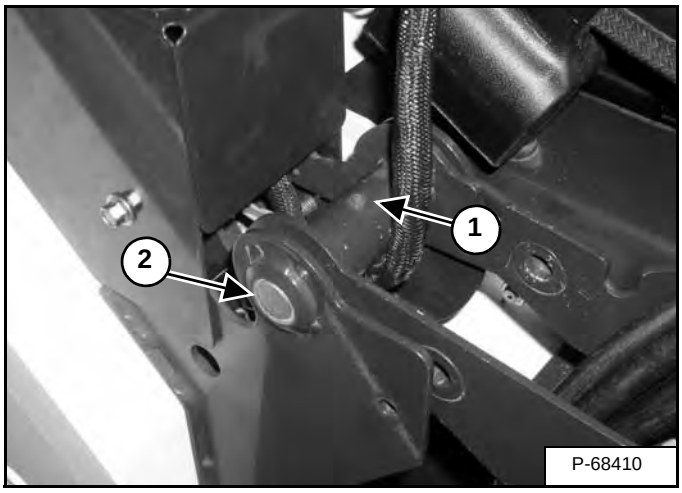
I-2003-0888

Figure 40-50-22



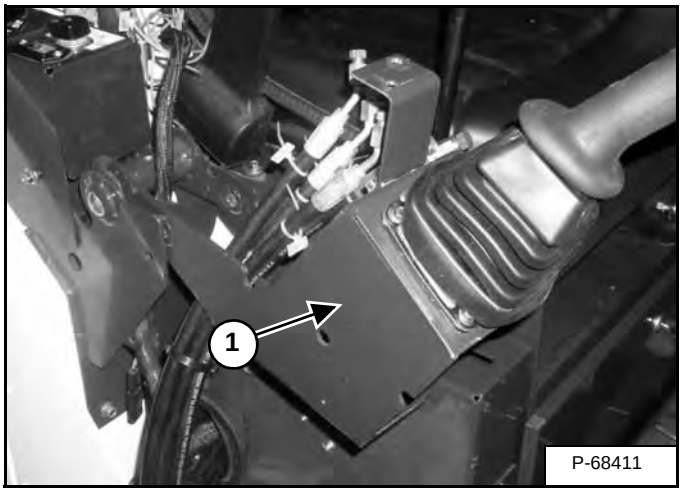
Mark the hoses for ease of assembly. Remove and cap the six hoses (Item 1) **[Figure 40-50-22]** from the joystick.

Figure 40-50-23



Remove the roll pin (Item 1) and the pivot pin (Item 2) **[Figure 40-50-23]**.

Figure 40-50-24

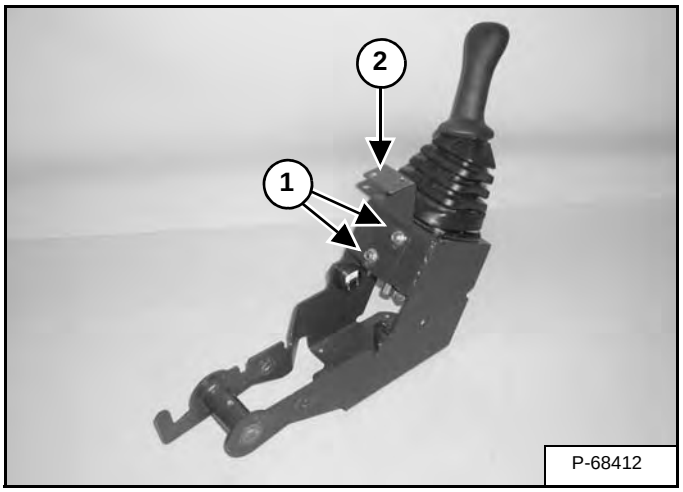


Remove the joystick console frame (Item 1) **[Figure 40-50-24]** from the excavator.

Dealer Copy -- Not for Resale

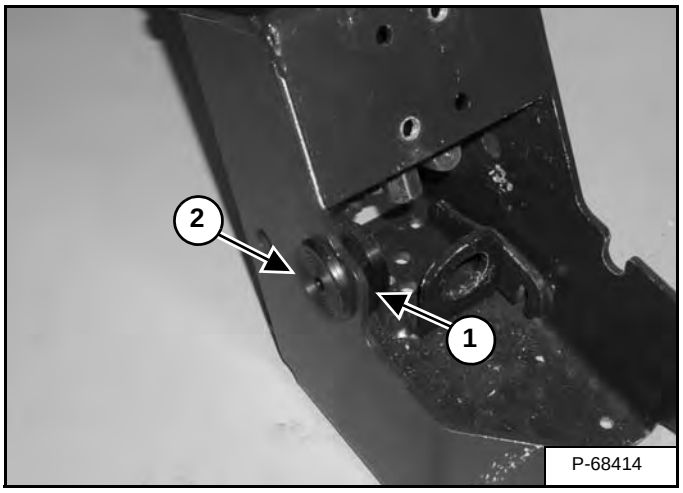
Joystick Console Frame Disassembly And Assembly

Figure 40-50-25



Remove the screws (Item 1) and bracket (Item 2) **[Figure 40-50-25]**.

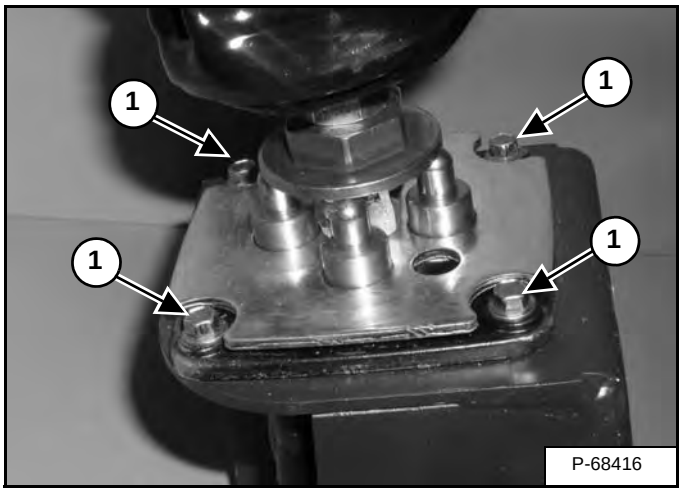
Figure 40-50-26



Remove the nut (Item 1) from the buzzer (Item 2) **[Figure 40-50-26]**.

Remove the buzzer (Item 2) **[Figure 40-50-26]**.

Figure 40-50-27



Lift the joystick boot.

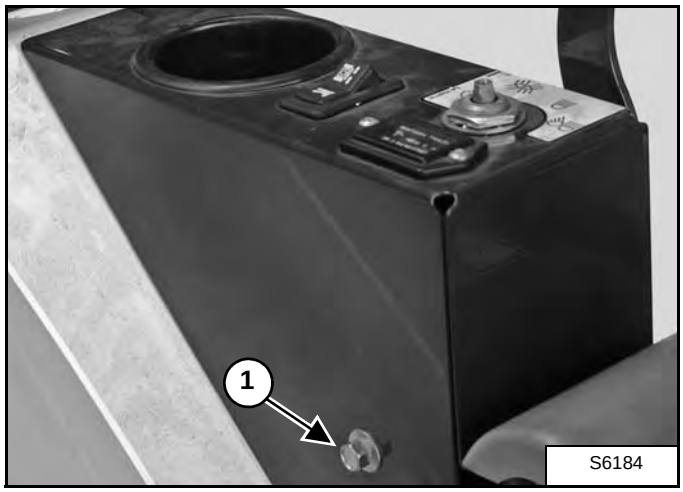
Remove the screws (Item 1) **[Figure 40-50-27]** from the joystick bracket.

Remove the joystick from the console frame.

Dealer Copy -- Not for Resale

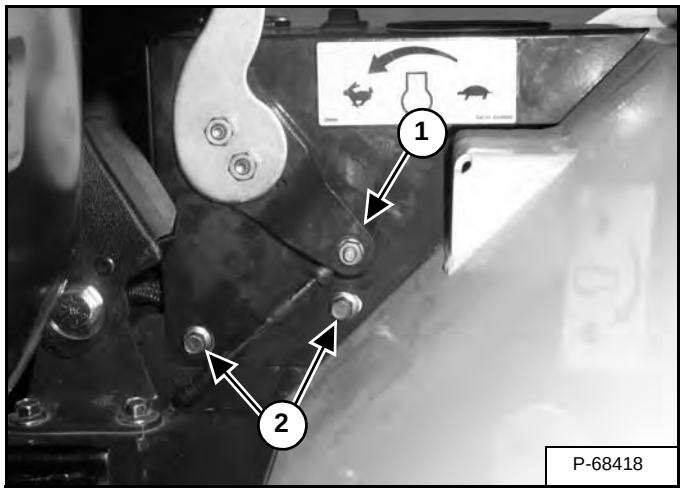
Right Rear Console Cover Removal And Installation

Figure 40-50-28



Remove the console cover screw (Item 1) **[Figure 40-50-28]**.

Figure 40-50-29

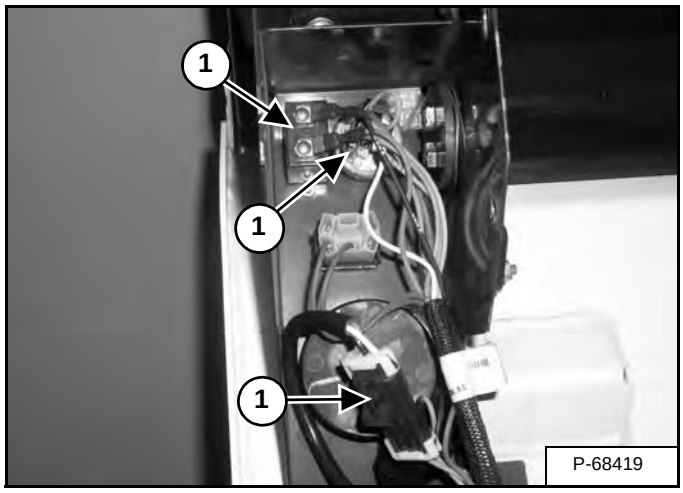


Remove the throttle linkage from the ball on the back side of the lever (Item 1) **[Figure 40-50-29]**.

Remove the console cover screws (Item 2) **[Figure 40-50-29]**.

Lift the console cover.

Figure 40-50-30



Lift the right rear console cover and mark the wires for ease of assembly.

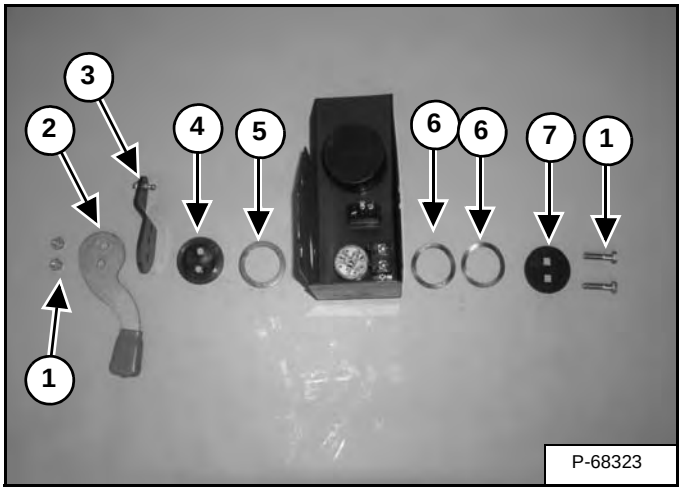
Disconnect the wires and connectors (Item 1) **[Figure 40-50-30]** from the hourmeter, light switch, track expansion / blade switch, and microswitch.

Remove the right rear console cover from the excavator.

Dealer Copy -- Not for Resale

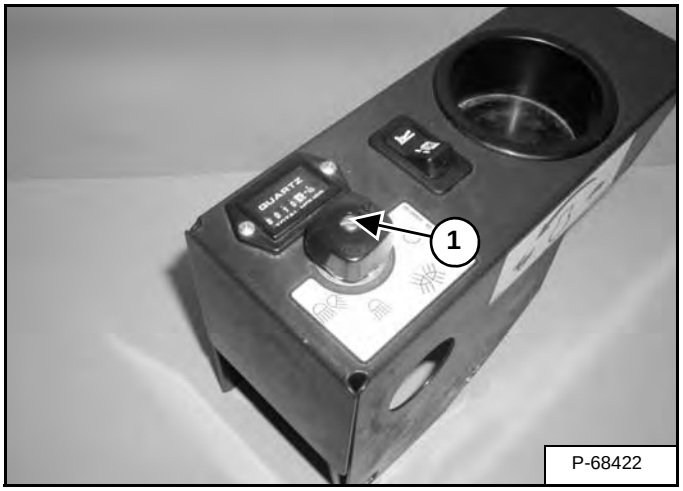
Right Rear Console Cover Disassembly And Assembly

Figure 40-50-31



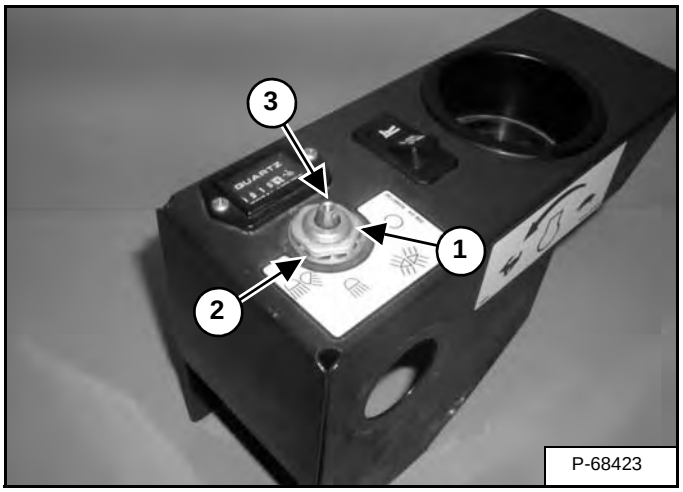
Remove the bolts and nuts (Item 1), lever (Item 2), the bracket (Item 3), the nylon spacer (Item 4), friction washer (Item 5), the two wave washers (Item 6), and the spacer (Item 7) **[Figure 40-50-31]**.

Figure 40-50-32



Remove the knob (Item 1) **[Figure 40-50-32]** from the light switch.

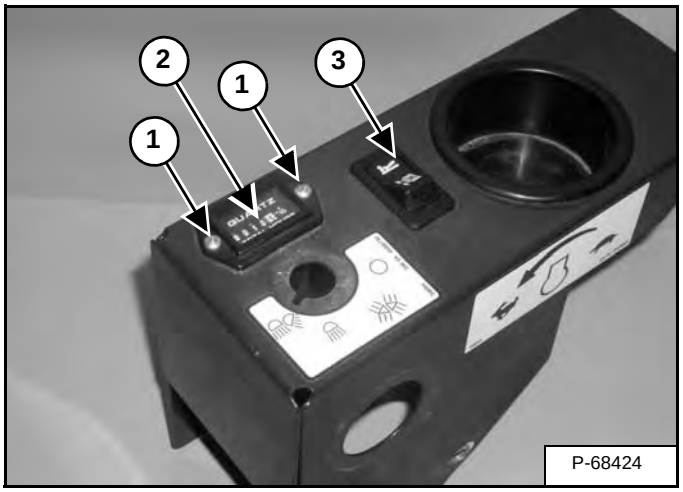
Figure 40-50-33



Remove the nut (Item 1) and lock washer (Item 2) from the light switch (Item 3) **[Figure 40-50-33]**.

Remove the light switch (Item 3) **[Figure 40-50-33]**.

Figure 40-50-34



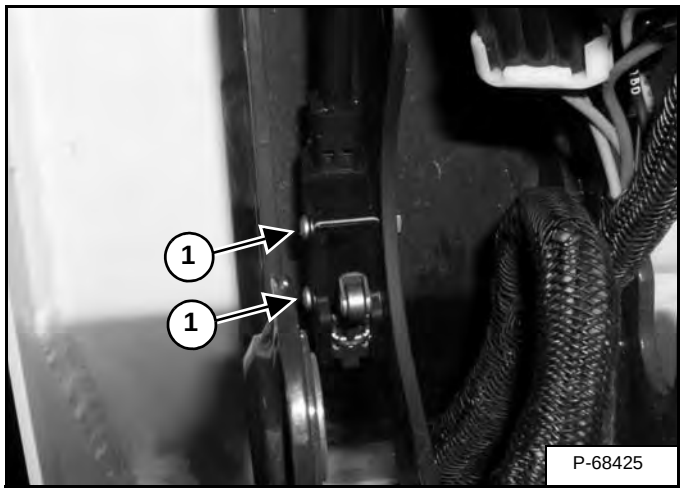
Remove the two screws and nuts (Item 1) from the hourmeter. Remove the hourmeter (Item 2) **[Figure 40-50-34]**.

Remove the track expansion / blade switch (Item 3) **[Figure 40-50-34]** from the right rear console cover.

Dealer Copy -- Not for Resale

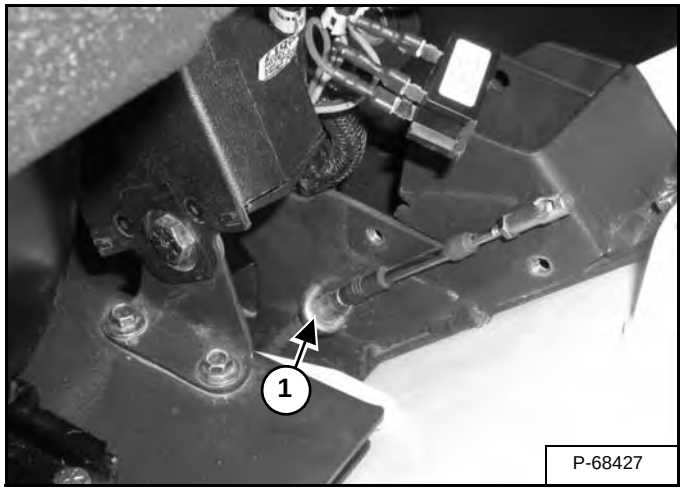
Right Rear Console Frame Removal And Installation

Figure 40-50-35



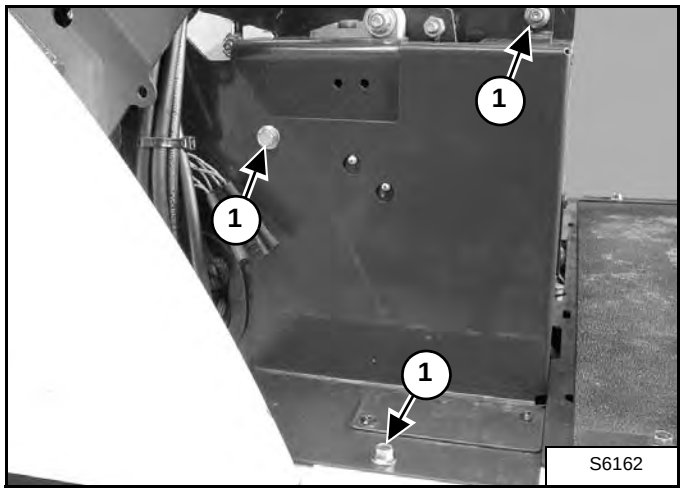
Remove the two screws and nuts (Item 1) **[Figure 40-50-35]** from the right rear console microswitch. Remove the microswitch.

Figure 40-50-36



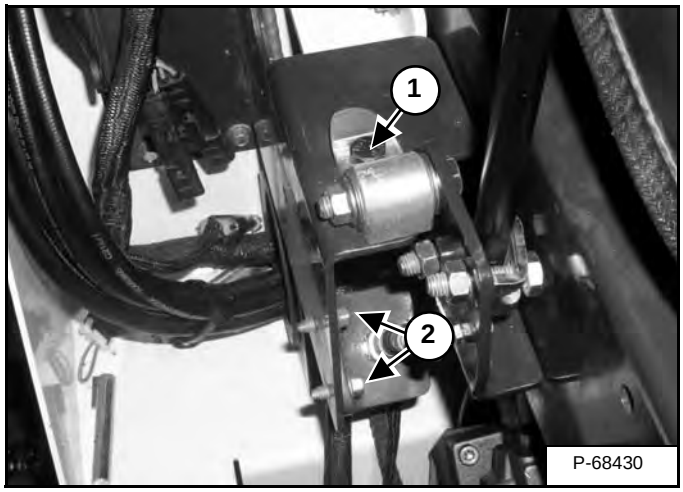
Remove the throttle cable clamp (Item 1) **[Figure 40-50-36]**.

Figure 40-50-37



Remove the three screws (Item 1) **[Figure 40-50-37]** from the right side cover. Remove the right side cover.

Figure 40-50-38



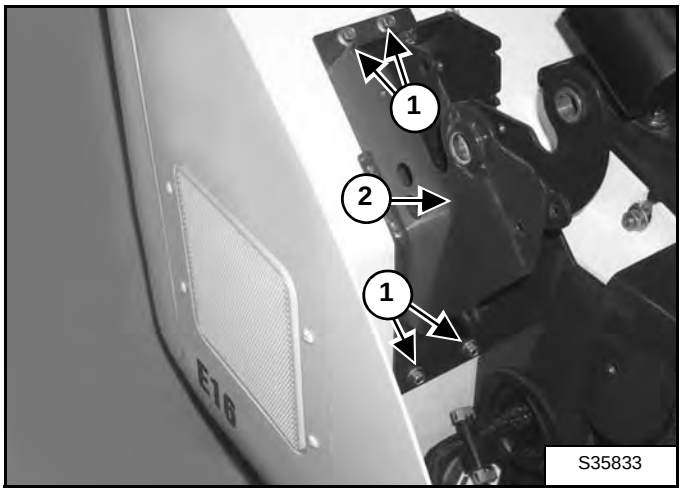
Remove the bolt and nut (Item 1) **[Figure 40-50-38]** from the blade lever bearing block.

Remove the two screws (Item 2) **[Figure 40-50-38]** from the blade lever cable bracket.

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Right Rear Console Frame Removal And Installation (Cont'd)

Figure 40-50-39



Remove the four bolts (Item 1) **[Figure 40-50-39]**.

Remove the right rear console frame (Item 2) **[Figure 40-50-39]**. The joystick pilot hoses will slide through the rubber as the console frame is removed.

Dealer Copy -- Not for Resale



Dealer Copy -- Not for Resale

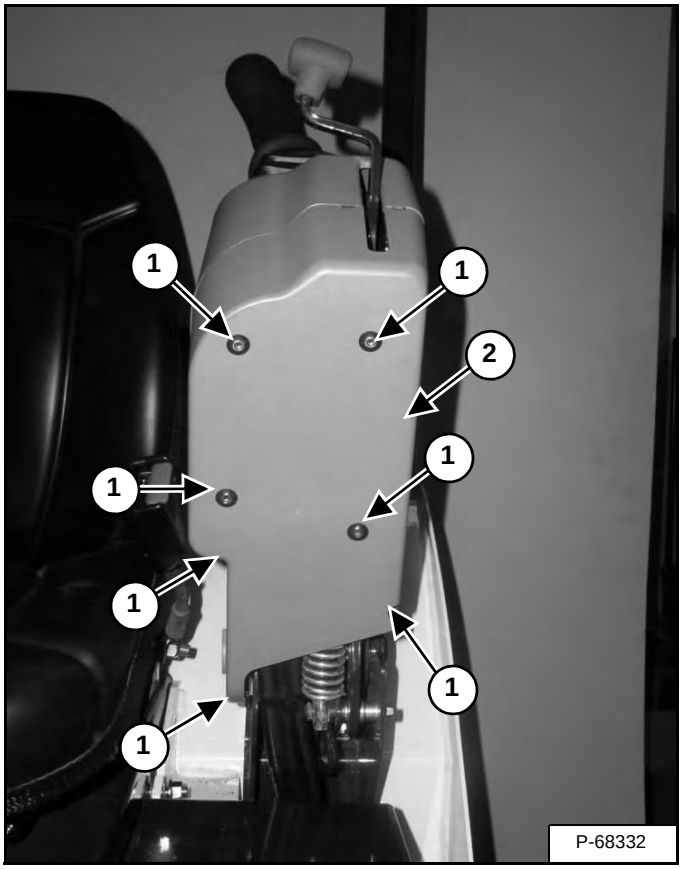
LEFT CONSOLE

Description

On an excavator equipped with a canopy or cab, the left console contains a movable joystick console and the rear console contains the fuel gauge and hydraulic lockout LED.

Joystick Console Cover (Bottom) Removal And Installation

Figure 40-60-1



Remove the seven screws (Item 1) from the lower half of the joystick console cover (Item 2) **[Figure 40-60-1]**.

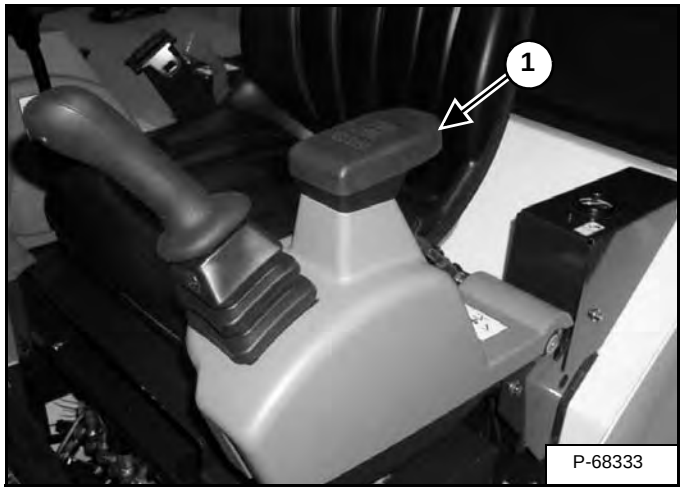
Remove the lower half of the joystick console cover (Item 2) **[Figure 40-60-1]**.

Lower the left console.

Dealer Copy -- Not for Resale

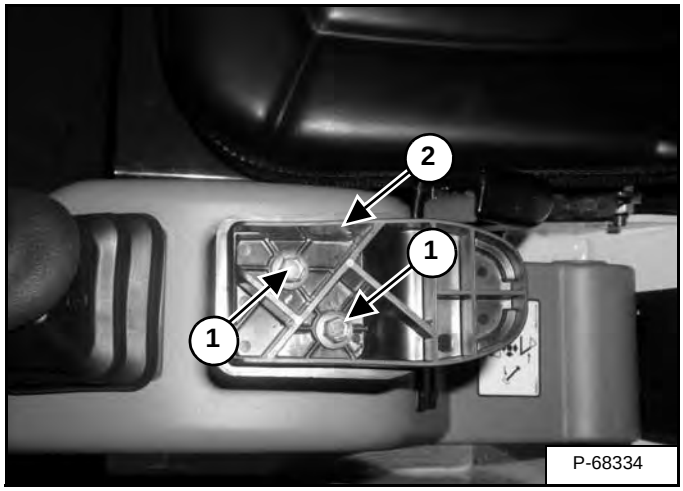
Joystick Console Cover (Top) Removal And Installation

Figure 40-60-2



Remove the cover (Item 1) **[Figure 40-60-2]** from the armrest.

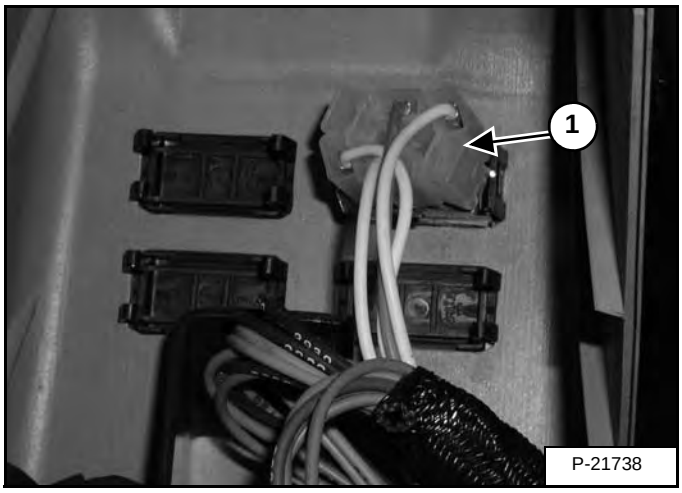
Figure 40-60-3



Remove the bolts (Item 1) from the armrest (Item 2) **[Figure 40-60-3]**.

Remove the armrest (Item 2) **[Figure 40-60-3]**.

Figure 40-60-4

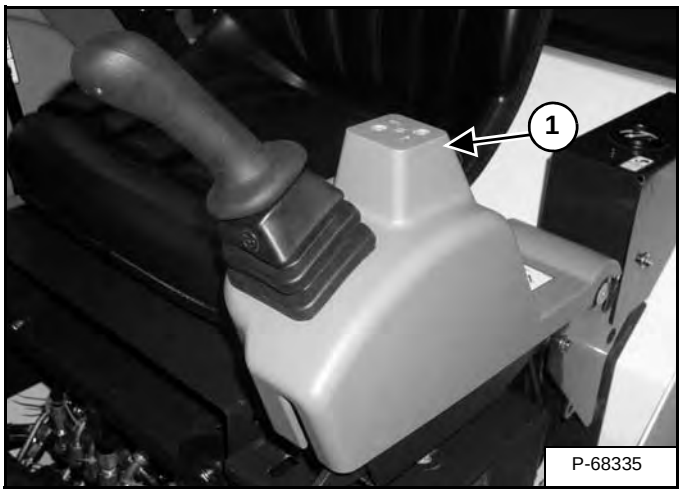


Raise the upper half of the joystick console cover to expose the electrical connectors if accessories are installed.

Disconnect the electrical connector(s) (Item 1) **[Figure 40-60-4]** if installed.

NOTE: These connectors are keyed so they can be plugged in only one way.

Figure 40-60-5



Remove the upper half of the joystick console cover (Item 1) **[Figure 40-60-5]** over the joystick.

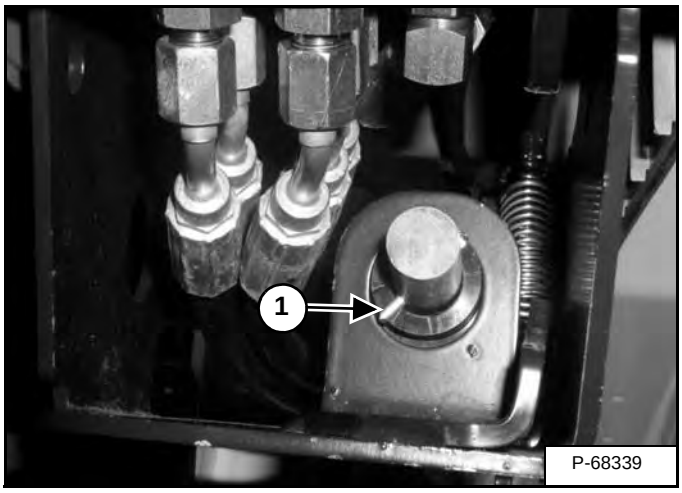
Dealer Copy -- Not for Resale

Compression Spring Removal And Installation

Remove the lower console cover. (See Joystick Console Cover (Bottom) Removal And Installation on Page 40-60-1.)

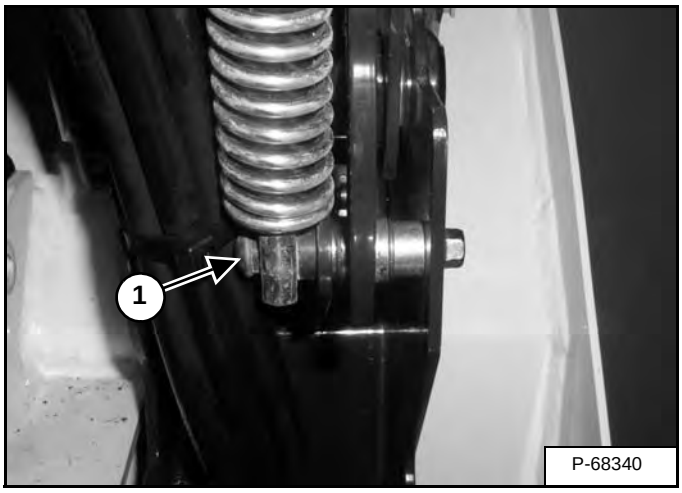
Lower the console.

Figure 40-60-6



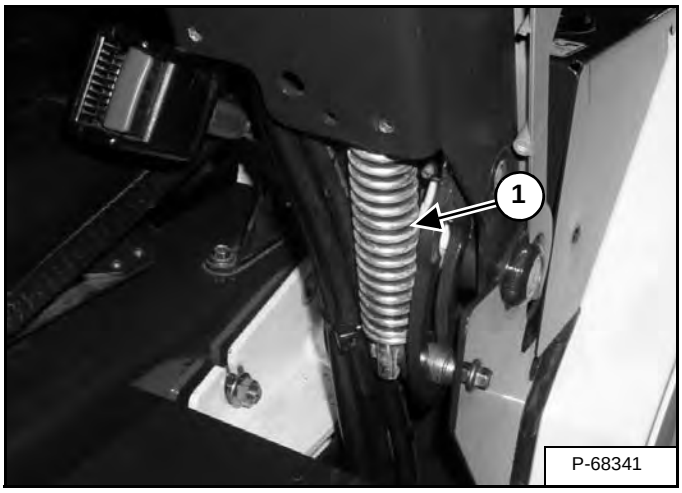
Install a pin (Item 1) **[Figure 40-60-6]** in the top of the compression spring rod.

Figure 40-60-7



Support the console in the raised position. Remove the bolt (Item 1) **[Figure 40-60-7]**.

Figure 40-60-8

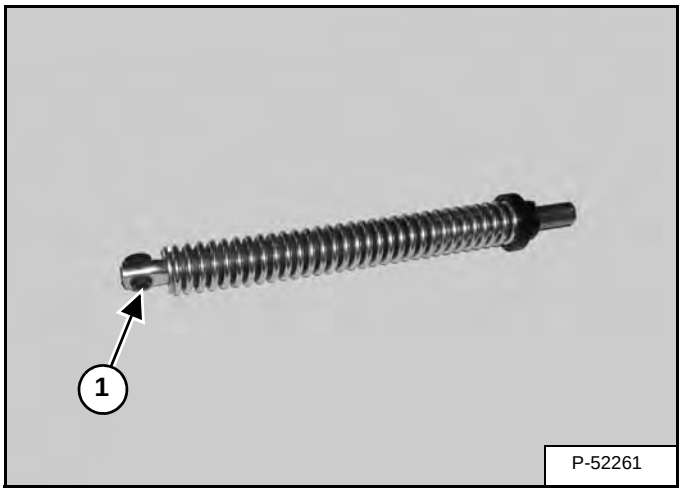


Remove the spring assembly (Item 1) **[Figure 40-60-8]** from the bottom of the console.

Dealer Copy -- Not for Resale

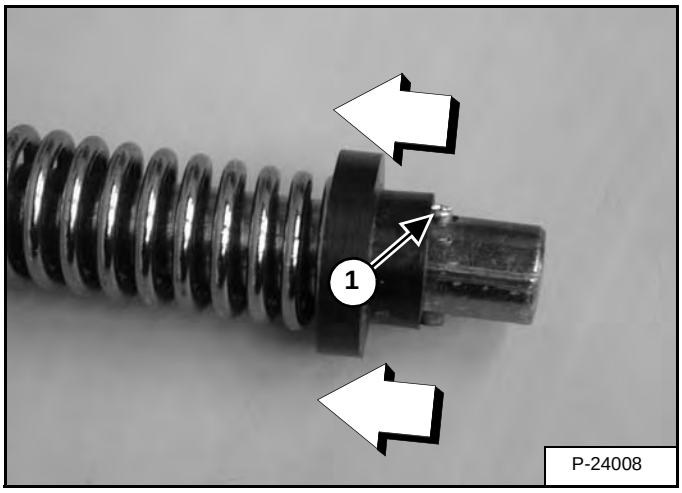
Compression Spring Disassembly And Assembly

Figure 40-60-9



Remove the bushing (Item 1) **[Figure 40-60-9]**.

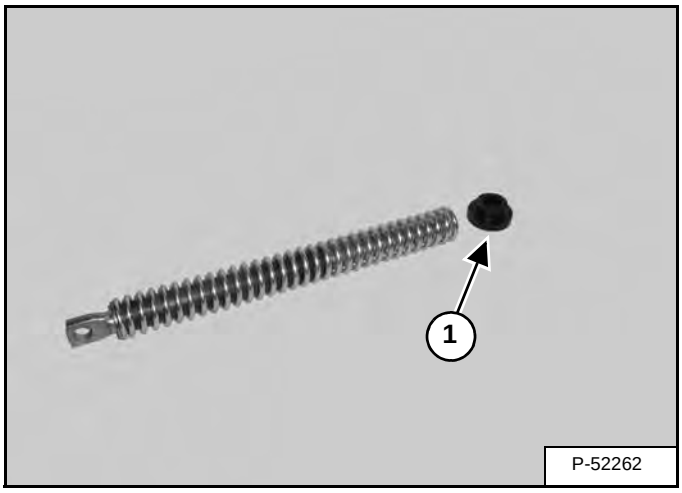
Figure 40-60-10



Apply pressure against the spring, and remove the pin (Item 1) **[Figure 40-60-10]** from the shaft.

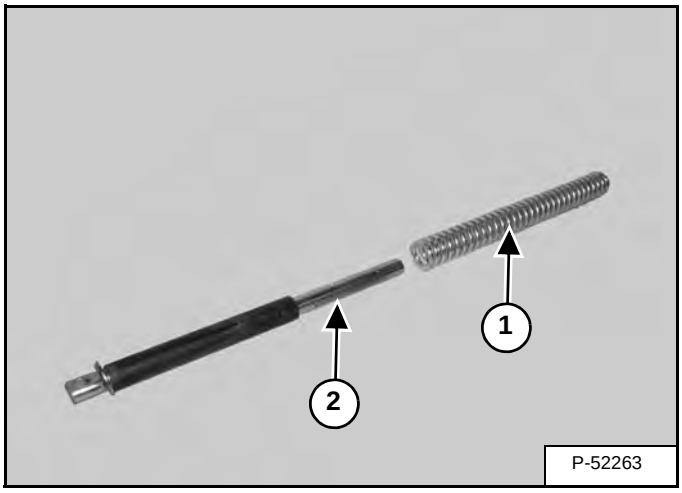
Release the pressure from the spring.

Figure 40-60-11



Remove the bushing (Item 1) **[Figure 40-60-11]**.

Figure 40-60-12

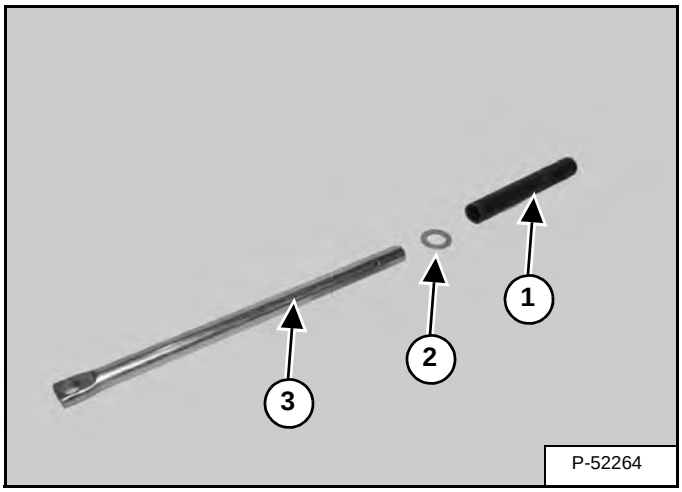


Remove the spring (Item 1) from the shaft (Item 2) **[Figure 40-60-12]**.

Dealer Copy -- Not for Resale

Compression Spring Disassembly And Assembly (Cont'd)

Figure 40-60-13



Remove the sleeve (Item 1) and washer (Item 2) from the shaft (Item 3) **[Figure 40-60-13]**.

Dealer Copy -- Not for Resale

LEFT CONSOLE (CONT'D)

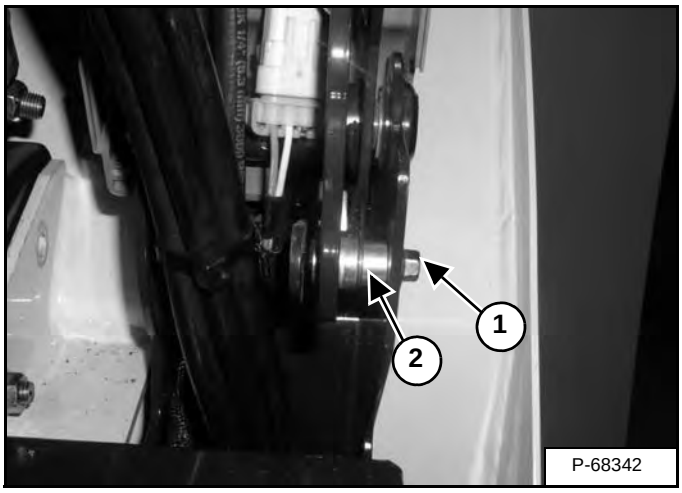
Lever Removal And Installation

Remove the joystick console cover (bottom) cover. (See Joystick Console Cover (Bottom) Removal And Installation on Page 40-60-1.)

Remove the joystick console cover (top) cover. (See Joystick Console Cover (Top) Removal And Installation on Page 40-60-2.)

Remove the compression spring. (See Compression Spring Removal And Installation on Page 40-60-3.)

Figure 40-60-14

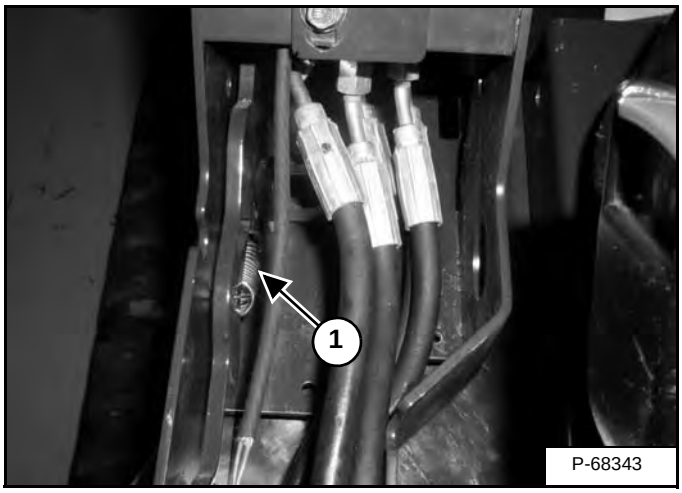


Remove the bolt (Item 1) from the lever bearing (Item 2) **[Figure 40-60-14]**.

Remove the lever bearing (Item 2) **[Figure 40-60-14]**.

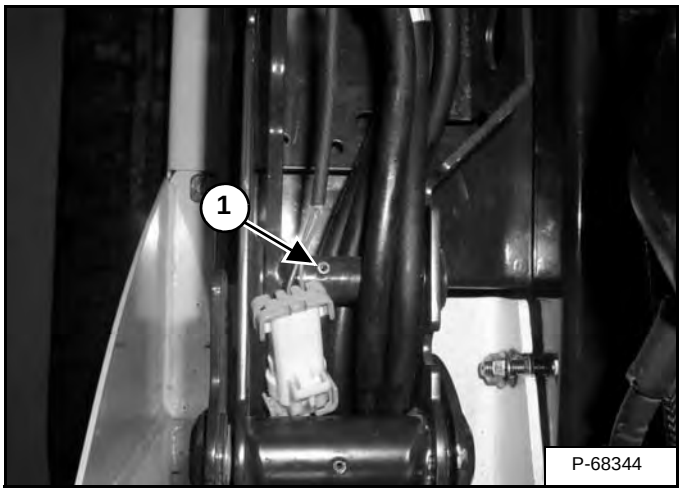
Lower the console.

Figure 40-60-15



Remove the spring (Item 1) **[Figure 40-60-15]** from the console and lever.

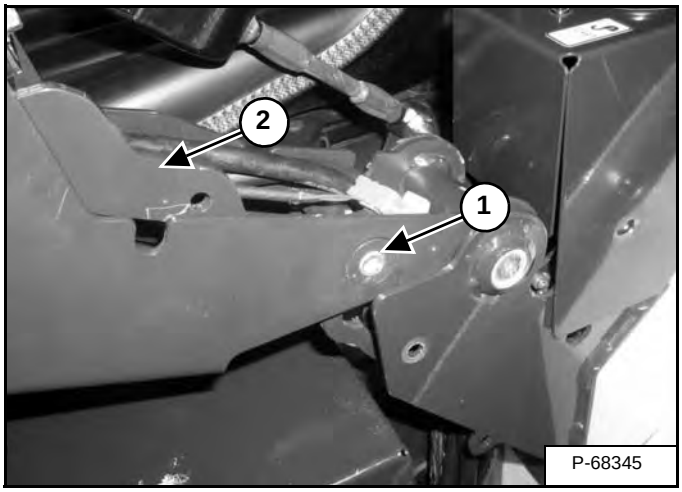
Figure 40-60-16



Remove the roll pin (Item 1) **[Figure 40-60-16]** from the lever pivot pin.

Raise and support the console.

Figure 40-60-17



Remove the pivot pin (Item 1) **[Figure 40-60-17]** from the lever.

Remove the lever (Item 2) **[Figure 40-60-17]** from the console.

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Joystick Console Frame Removal And Installation

Remove the joystick console cover (bottom) cover. (See Joystick Console Cover (Bottom) Removal And Installation on Page 40-60-1.)

Remove the joystick console cover (top) cover. (See Joystick Console Cover (Top) Removal And Installation on Page 40-60-2.)

Remove the compression spring. (See Compression Spring Removal And Installation on Page 40-60-3.)

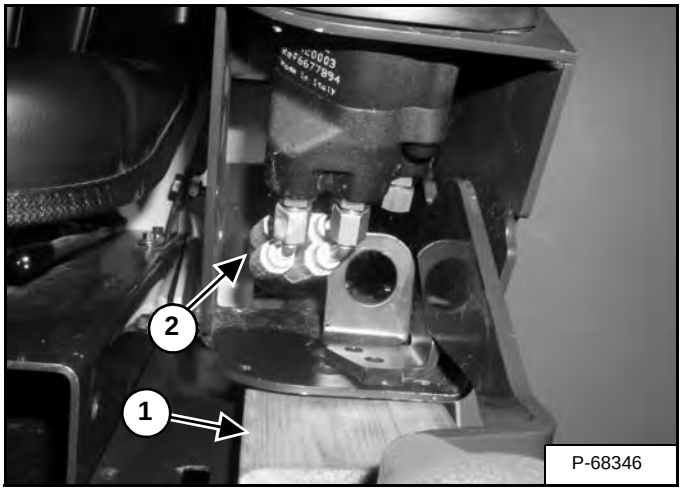
Remove the lever. (See Lever Removal And Installation on Page 40-60-6.)

IMPORTANT

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

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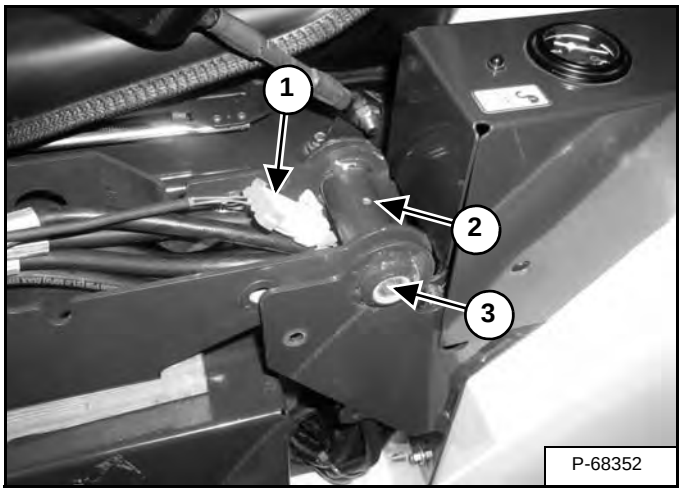
Figure 40-60-18



Lower the console on a support (Item 1) **[Figure 40-60-18]** to avoid damage to the microswitch if the console drops below the locked position.

Mark the hoses for ease of assembly. Remove and cap the six hoses (Item 2) **[Figure 40-60-18]** from the joystick.

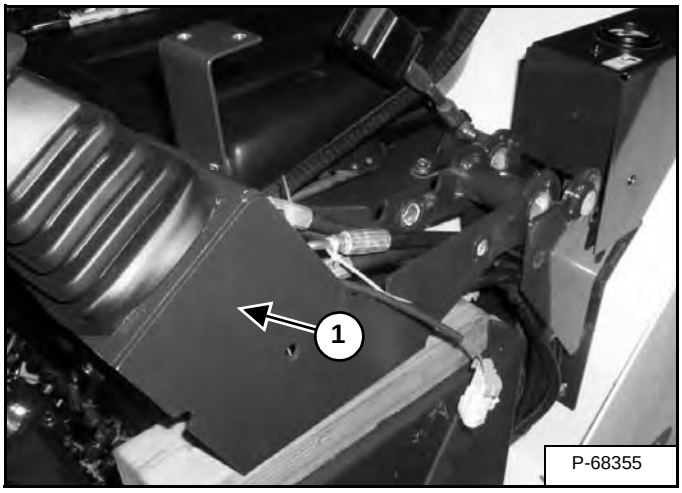
Figure 40-60-19



Lower the console on a support to avoid damage to the microswitch if the console drops below the locked position. Disconnect the joystick wire harness (Item 1) **[Figure 40-60-19]**.

Remove the roll pin (Item 2) and the pivot pin (Item 3) **[Figure 40-60-19]**.

Figure 40-60-20

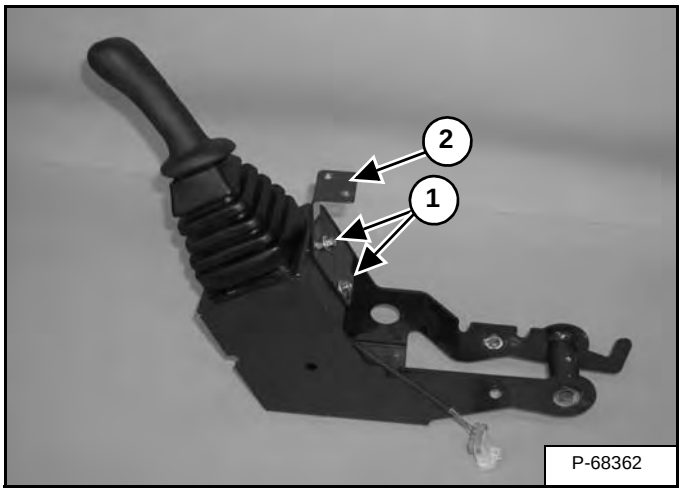


Remove the joystick console frame (Item 1) **[Figure 40-60-20]** from the excavator.

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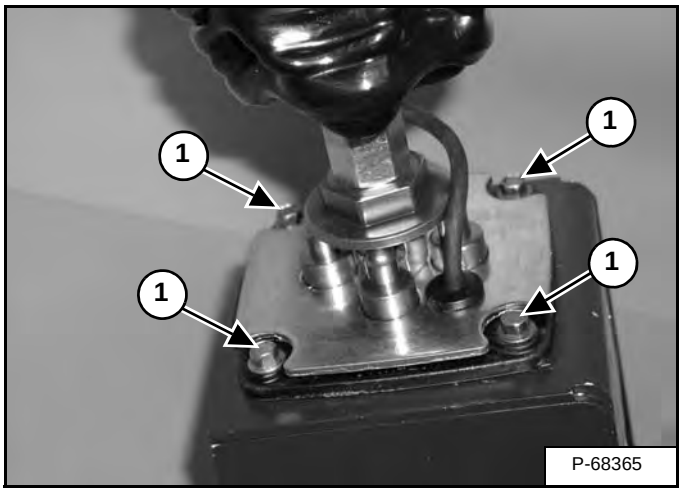
Joystick Console Frame Disassembly And Assembly

Figure 40-60-21



Remove the screws (Item 1) and bracket (Item 2) **[Figure 40-60-21]**.

Figure 40-60-22



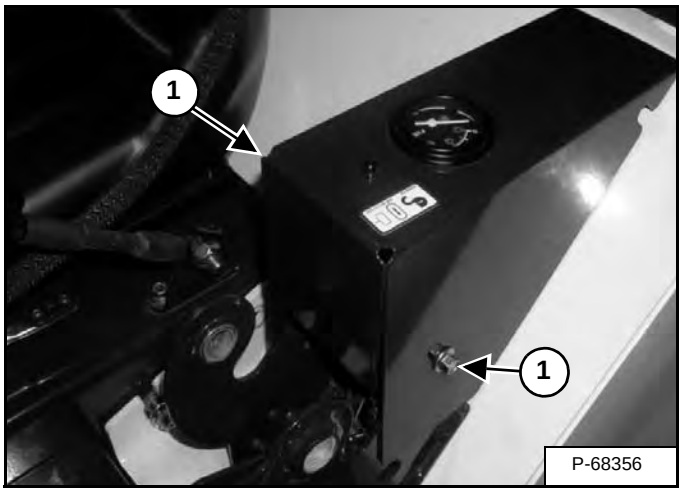
Lift the joystick boot.

Remove the screws (Item 1) **[Figure 40-60-22]** from the joystick bracket.

Remove the joystick from the console frame.

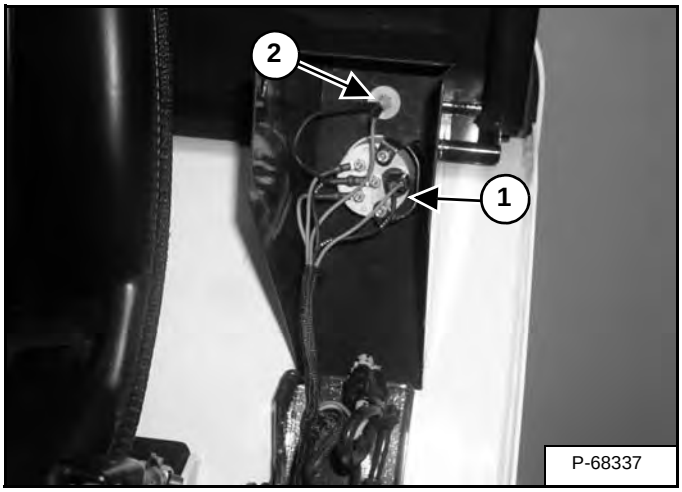
Left Rear Console Cover Removal And Installation

Figure 40-60-23



Remove the two console cover screws (Item 1) **[Figure 40-60-23]**.

Figure 40-60-24



Lift the left rear console cover and mark the wires for ease of assembly.

Disconnect the wires and bulb from the fuel gauge (Item 1) **[Figure 40-60-24]**.

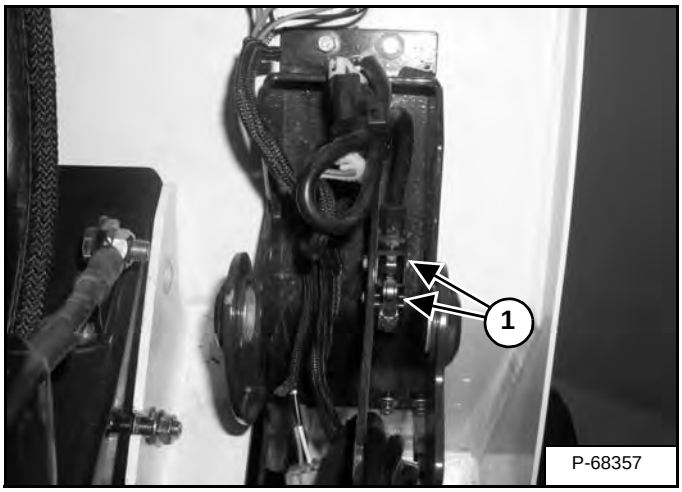
Disconnect the wires from the LED indicator (Item 2) **[Figure 40-60-24]**.

Remove the left rear console cover from the excavator.

Dealer Copy -- Not for Resale

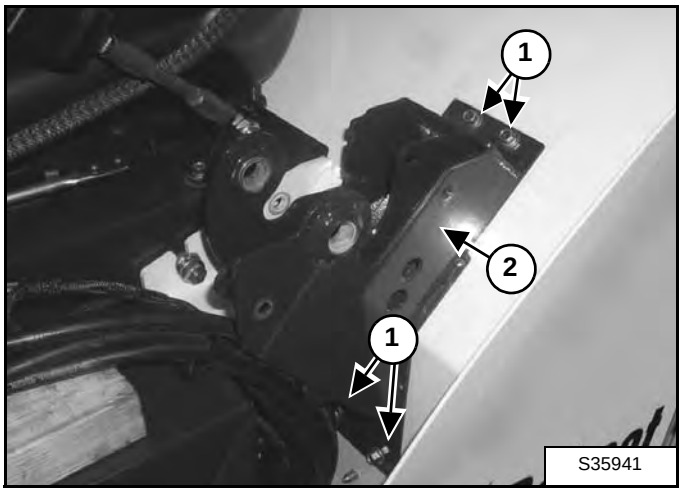
Left Rear Console Frame Removal And Installation

Figure 40-60-25



Remove the two screws (Item 1) **[Figure 40-60-25]** from the left rear console microswitch. Remove the microswitch.

Figure 40-60-26



Remove the four bolts (Item 1) **[Figure 40-60-26]**.

Remove the left rear console frame (Item 2) **[Figure 40-60-26]**. The joystick pilot hoses will slide through the rubber as the console frame is removed.

Dealer Copy -- Not for Resale

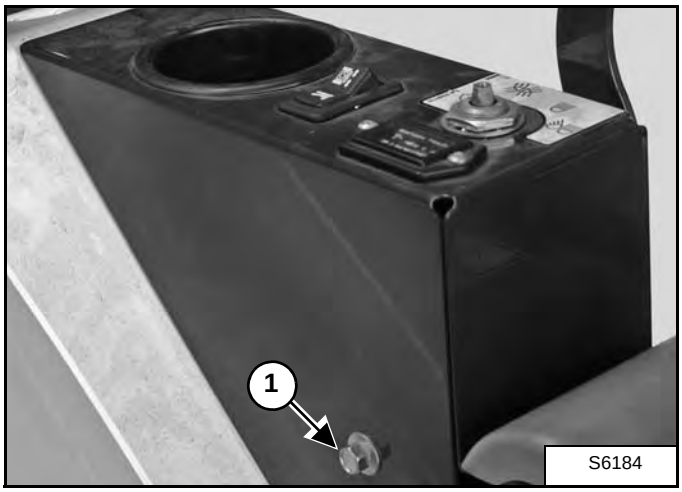


Dealer Copy -- Not for Resale

ENGINE SPEED CONTROL

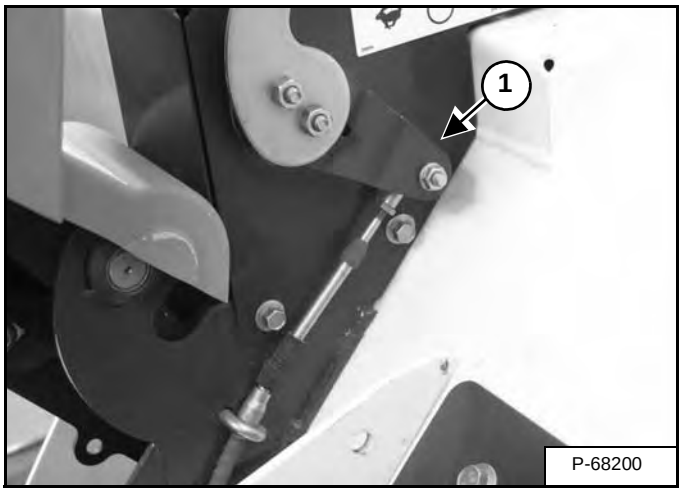
Removal And Installation

Figure 40-70-1



Remove the bolt (Item 1) **[Figure 40-70-1]** from the right side of the instrument console.

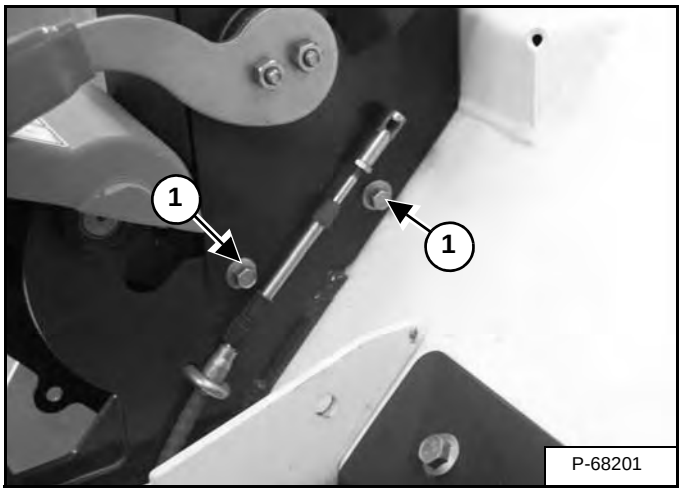
Figure 40-70-2



Remove the throttle linkage from the ball joint on the back side of the lever (Item 1) **[Figure 40-70-2]**.

NOTE: The seat is removed [Figure 40-70-2] from the excavator to show a clear view of the throttle linkage and bolts to be removed.

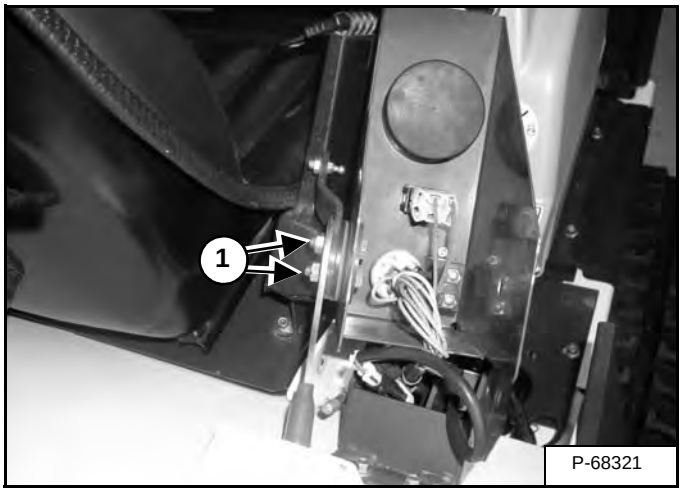
Figure 40-70-3



Remove the two bolts (Item 1) **[Figure 40-70-3]** from the left side of the instrument console.

Lift the instrument console from the console mounting bracket and turn over to view the inside of the instrument console.

Figure 40-70-4

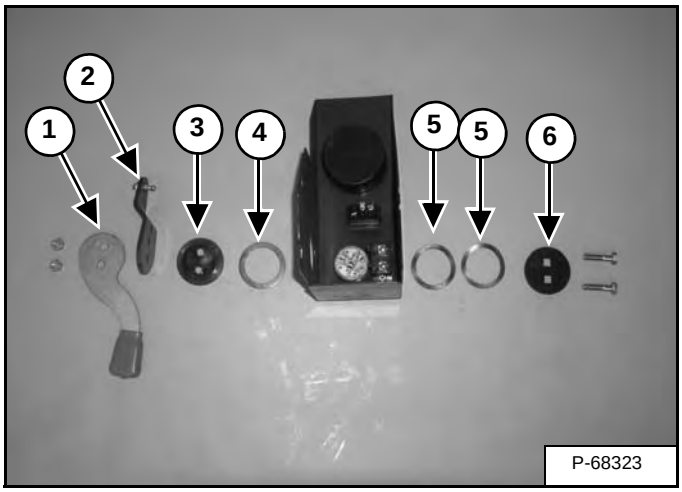


Remove the bolts and nuts (Item 1) **[Figure 40-70-4]** from the throttle lever.

Dealer Copy -- Not for Resale

Removal And Installation

Figure 40-70-5

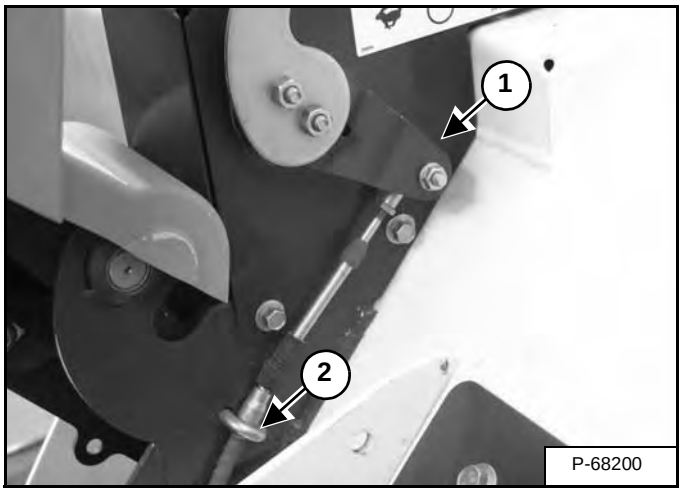


NOTE: Photograph is shown on the bench for component clarity. The instrument console does not need to be removed from the excavator [Figure 40-70-5].

Remove the lever (Item 1), the bracket (Item 2), the nylon spacer (Item 3), friction washer (Item 4), the TWO wave washers (Item 5), and the spacer (Item 6) **[Figure 40-70-5]**.

Cable Removal And Installation

Figure 40-70-6

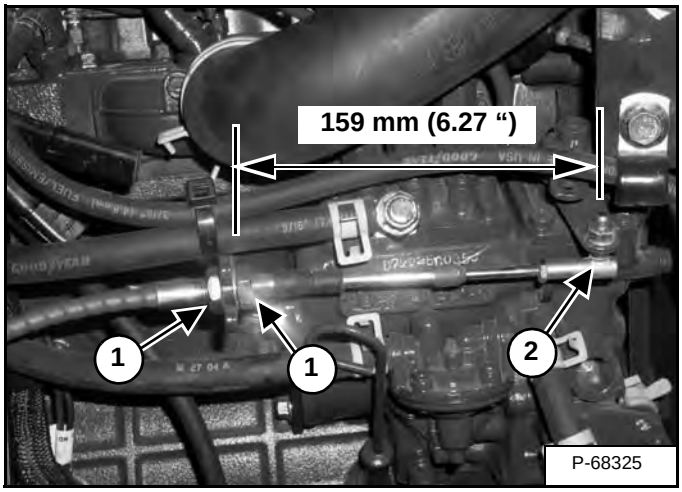


Remove the throttle linkage from the ball joint on the back side of the lever (Item 1) **[Figure 40-70-6]**.

Remove the U-clamp (Item 2) **[Figure 40-70-6]** fastening the cable to the side of the instrument console.

NOTE: The seat is removed in [Figure 40-70-6] from the excavator to show a clear view of the throttle linkage and bolts to be removed.

Figure 40-70-7



Loosen the nuts (Item 1) **[Figure 40-70-7]** fastening the cable to the bracket.

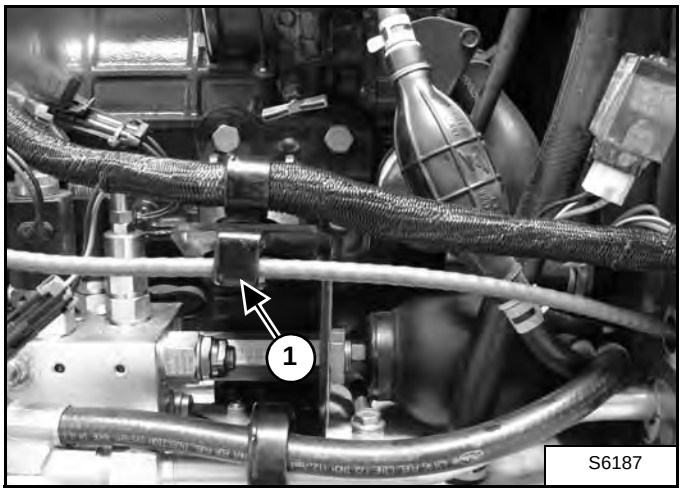
Disconnect the linkage (Item 2) **[Figure 40-70-7]** from the bracket.

Installation: The cable linkage measurement from bracket to the center of the ball joint is 159 mm (6.27 in).

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Cable Removal And Installation (Cont'd)

Figure 40-70-8



Remove the nut and clamp (Item 1) **[Figure 40-70-8]**.

Move the cable away from the engine.

Pull the cable down from the right console and out the back of the excavator.

Dealer Copy -- Not for Resale

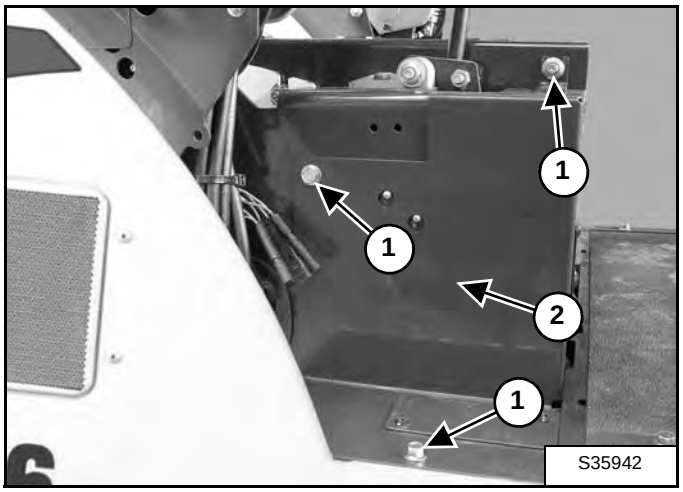


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BLADE CONTROL

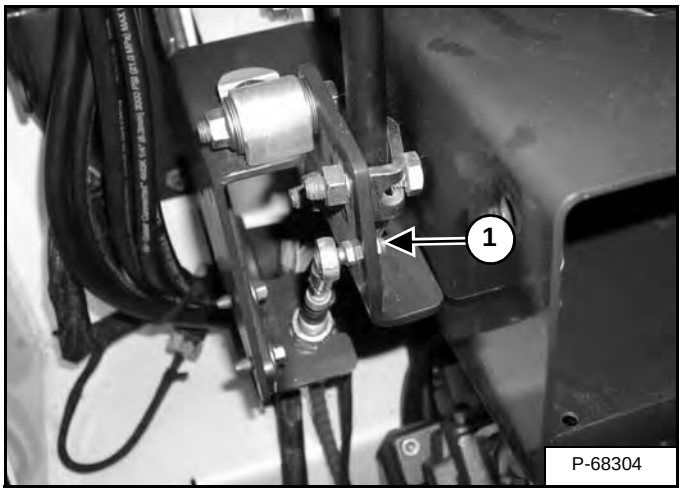
Removal And Installation

Figure 40-80-1



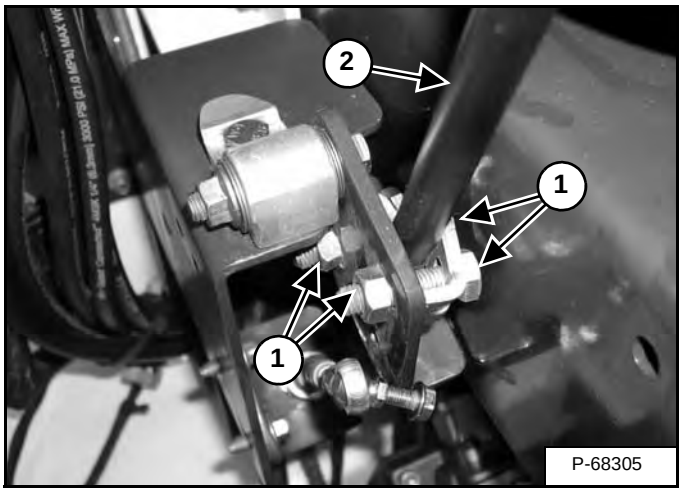
Remove the three bolts (Item 1) and remove the right side cover (Item 2) **[Figure 40-80-1]**.

Figure 40-80-2



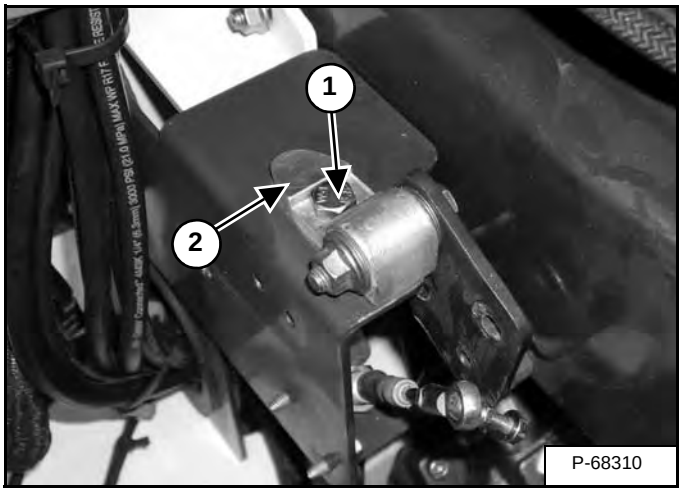
Remove the nut holding the ball joint of the blade / track expansion cable (Item 1) **[Figure 40-80-2]**.

Figure 40-80-3



Remove the bolts and nuts (Item 1). Remove the blade / track expansion lever (Item 2) **[Figure 40-80-3]**.

Figure 40-80-4



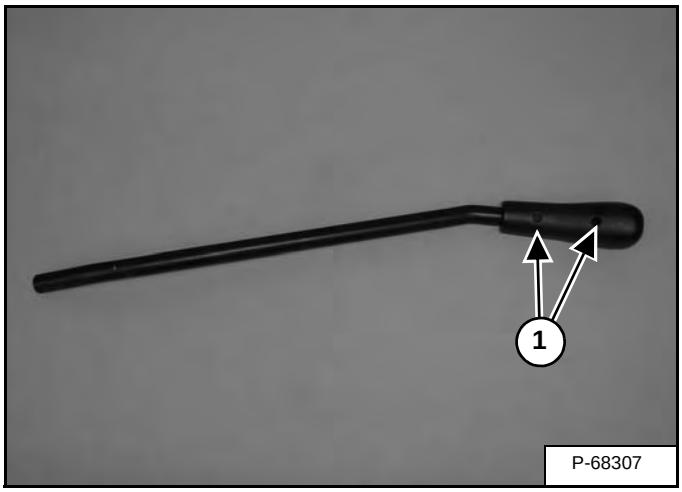
Remove the nut and bolt (Item 1) **[Figure 40-80-4]**.

Remove the bellcrank and pivot mount (Item 2) **[Figure 40-80-4]**.

Dealer Copy -- Not for Resale

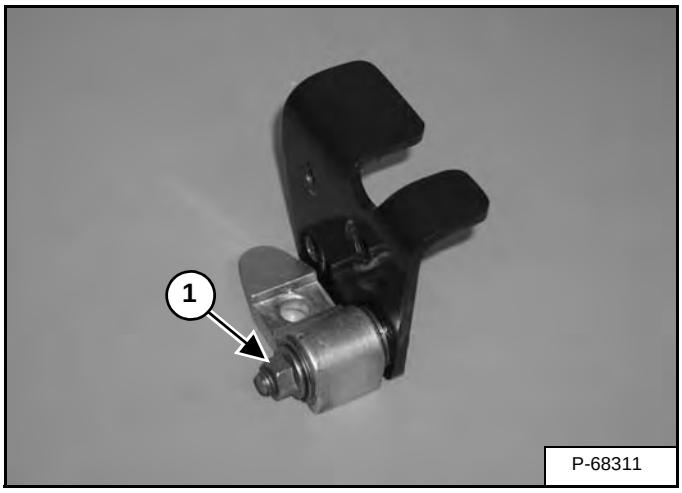
Disassembly And Assembly

Figure 40-80-5



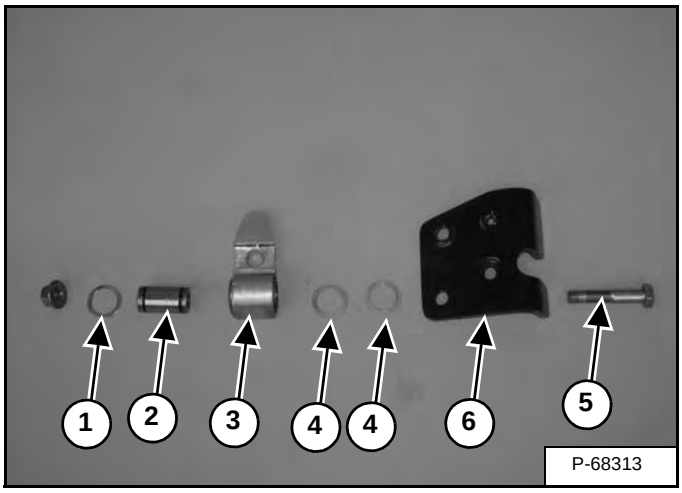
Remove the screws (Item 1) **[Figure 40-80-5]** and plastic handle halves.

Figure 40-80-6



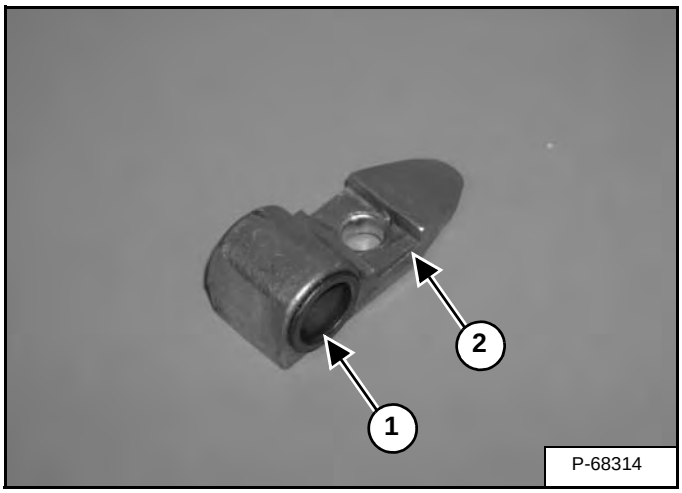
Remove the nut (Item 1) **[Figure 40-80-6]**.

Figure 40-80-7



Remove the washer (Item 1), sleeve (Item 2), bellcrank (Item 3), washers (Item 4) and bolt (Item 5) from the pivot mount (Item 6) **[Figure 40-80-7]**.

Figure 40-80-8

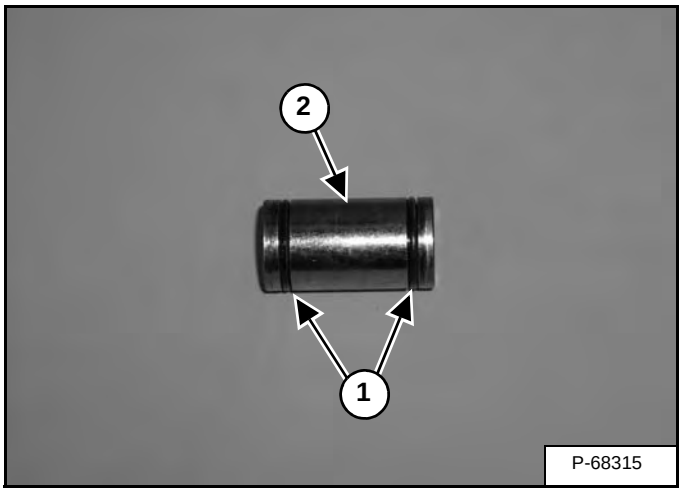


Remove the bushing (Item 1) from the bellcrank (Item 2) **[Figure 40-80-8]** (Both Sides).

Dealer Copy -- Not for Resale

Disassembly And Assembly (Cont'd)

Figure 40-80-9



Remove the O-rings (Item 1) from the sleeve (Item 2) **[Figure 40-80-9]**.

Dealer Copy -- Not for Resale

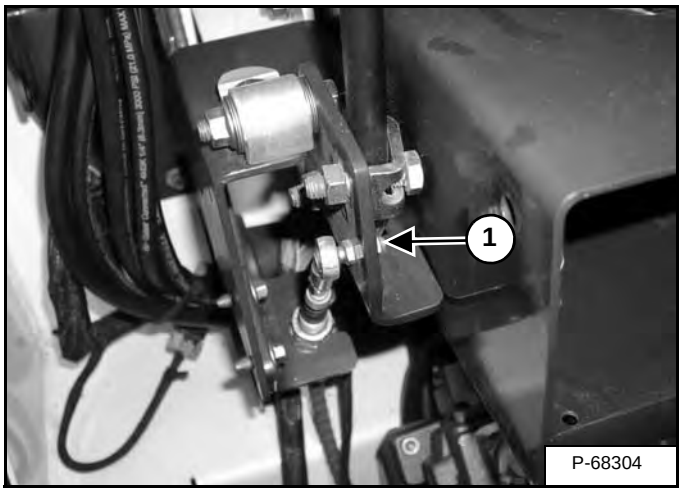
BLADE CONTROL (CONT'D)

Cable Removal And Installation

Remove the floor mat and floor panels. (See Removal And Installation on Page 40-140-1.)

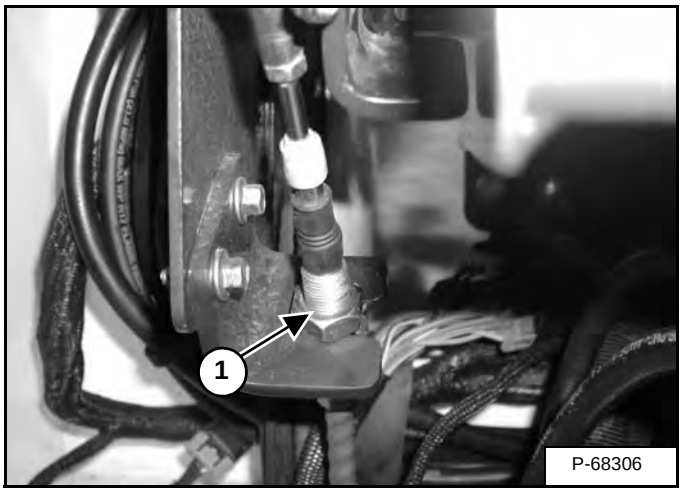
Remove the control linkage assembly. (See Removal And Installation on Page 40-90-1.)

Figure 40-80-10



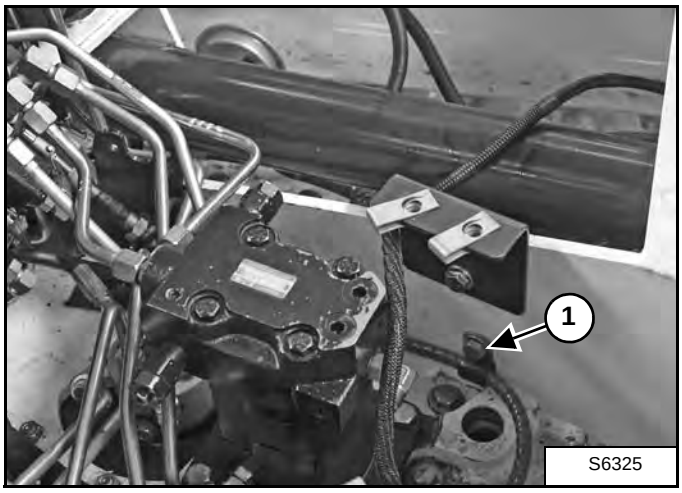
Remove the nut holding the ball joint of the blade / track expansion cable (Item 1) **[Figure 40-80-10]**.

Figure 40-80-11



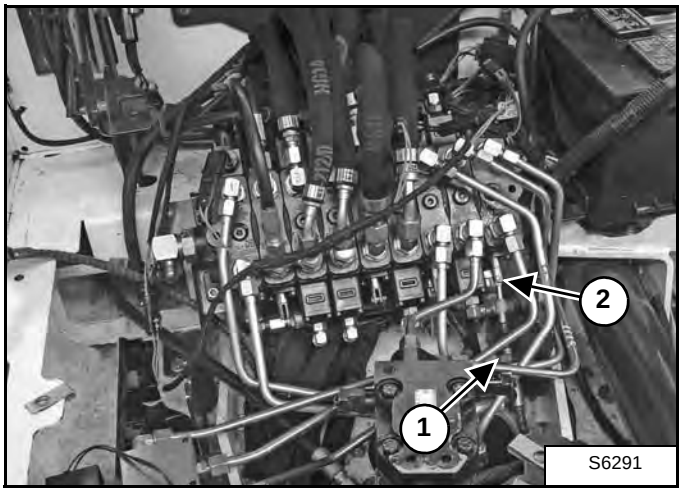
Loosen the nut (Item 1) **[Figure 40-80-11]** and slide the cable assembly out of the bracket.

Figure 40-80-12



Remove the cable clamp from the frame by removing the bolt (Item 1) **[Figure 40-80-12]**.

Figure 40-80-13



Loosen the nut (Item 1) and remove the clevis pin and cotter pin (Item 2) **[Figure 40-80-13]**.

Remove the cable.

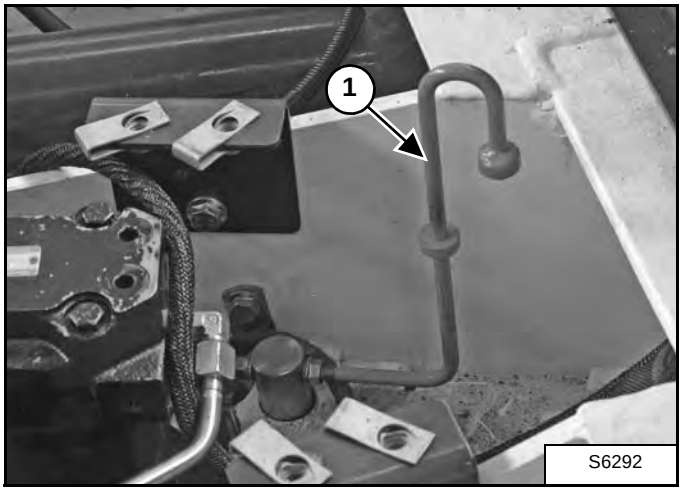
Dealer Copy -- Not for Resale

UPPERSTRUCTURE SLEW LOCK

Removal And Installation

Remove the floor mat and floor panels. (See Removal And Installation on Page 40-140-1.)

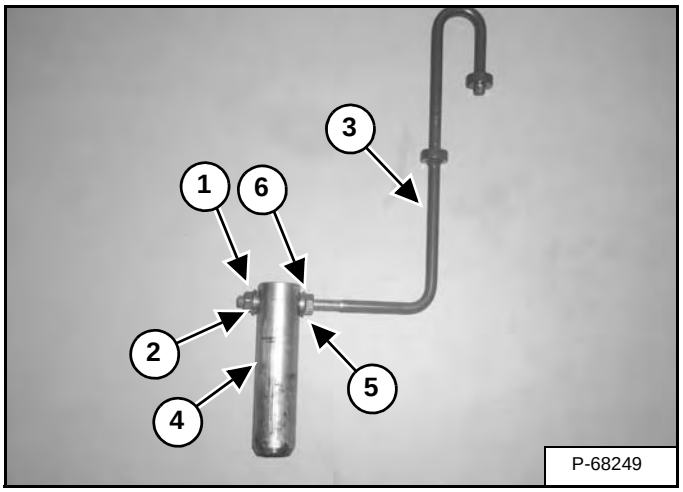
Figure 40-90-1



Remove the upperstructure slew lock lever (Item 1) **[Figure 40-90-1]** from the upperstructure.

Disassembly And Assembly

Figure 40-90-2



Remove the nut (Item 1) and washer (Item 2) from the swing lock lever (Item 3). Remove the pin (Item 4), washer (Item 5) and the nut (Item 6) **[Figure 40-90-2]**.

Dealer Copy -- Not for Resale

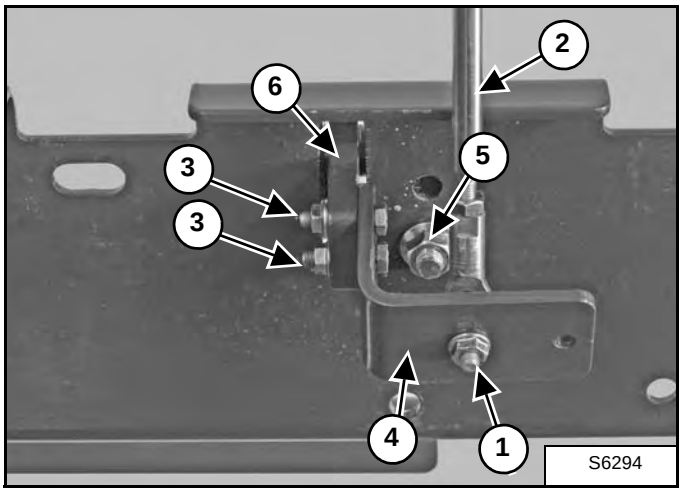


Dealer Copy -- Not for Resale

RIGHT PEDAL

Removal And Installation

Figure 40-100-1



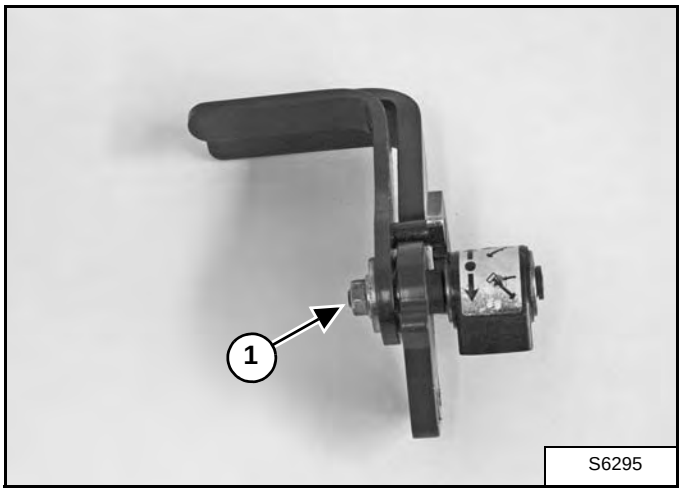
Remove the nut (Item 1) and linkage rod (Item 2) **[Figure 40-100-1]**.

Remove the two bolts and nuts (Item 3) and remove the bracket (Item 4) **[Figure 40-100-1]**.

Remove the nut and bolt (Item 5) and remove the boom swing pedal assembly (Item 6) **[Figure 40-100-1]**.

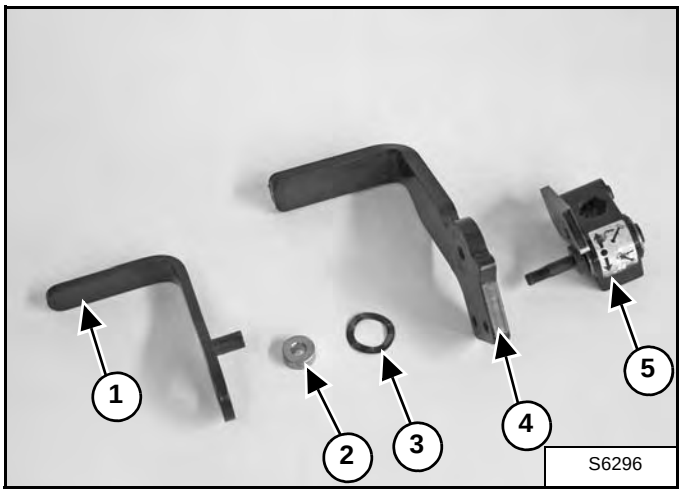
Disassembly And Assembly

Figure 40-100-2



Remove the nut and washer (Item 1) **[Figure 40-100-2]**.

Figure 40-100-3

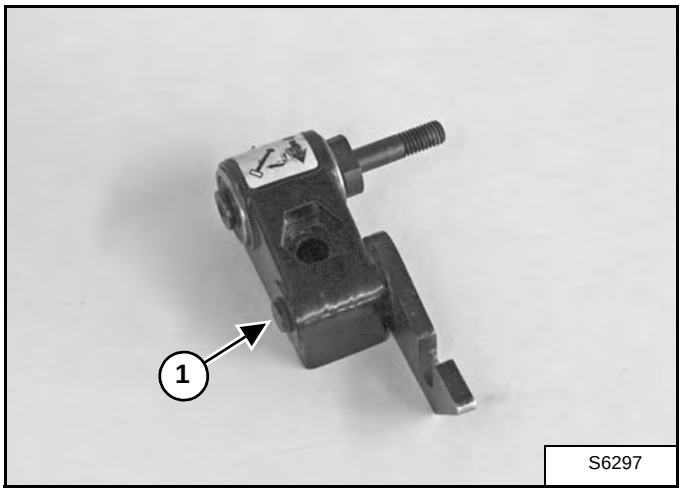


Remove the rear pedal (Item 1), bushing (Item 2), wave washer (Item 3) and front pedal (Item 4) from the mount (Item 5) **[Figure 40-100-3]**.

Dealer Copy -- Not for Resale

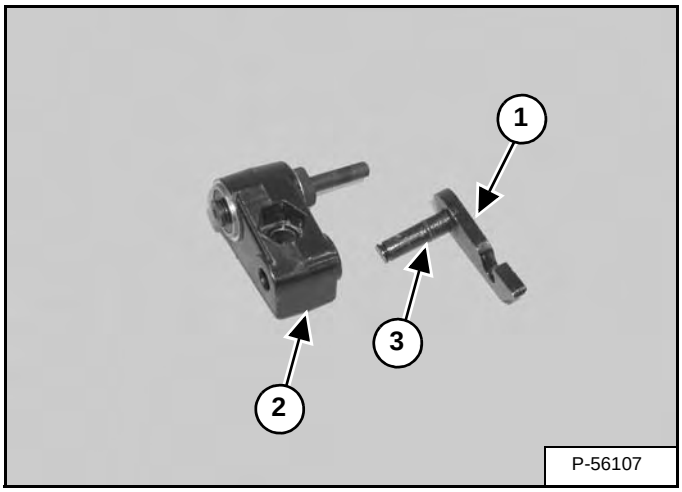
Disassembly And Assembly (Cont'd)

Figure 40-100-4



Remove the O-ring (Item 1) **[Figure 40-100-4]** from the shaft.

Figure 40-100-5



Remove the lock (Item 1) from the mount (Item 2) **[Figure 40-100-5]**.

Remove the O-ring (Item 3) **[Figure 40-100-5]** from the shaft.

NOTE: Do not lubricate the O-ring (Item 3) with grease during installation. The O-ring works as a friction lock to prevent the lock (Item 1) [Figure 40-100-5] from pivoting freely.

Dealer Copy -- Not for Resale

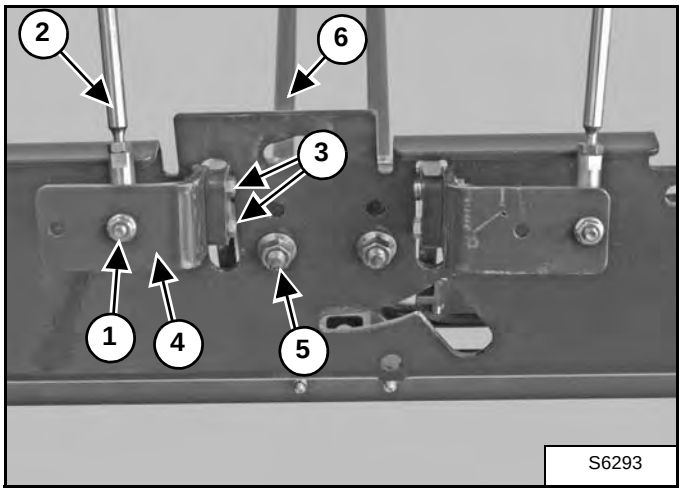
TRAVEL CONTROLS

Removal And Installation

Remove the floor mat and floor panels. (See Removal And Installation on Page 40-140-1.)

NOTE: The procedure is the same for both travel controls. The left travel control is shown.

Figure 40-110-1



Remove the nut (Item 1) and linkage rod (Item 2) **[Figure 40-110-1]**.

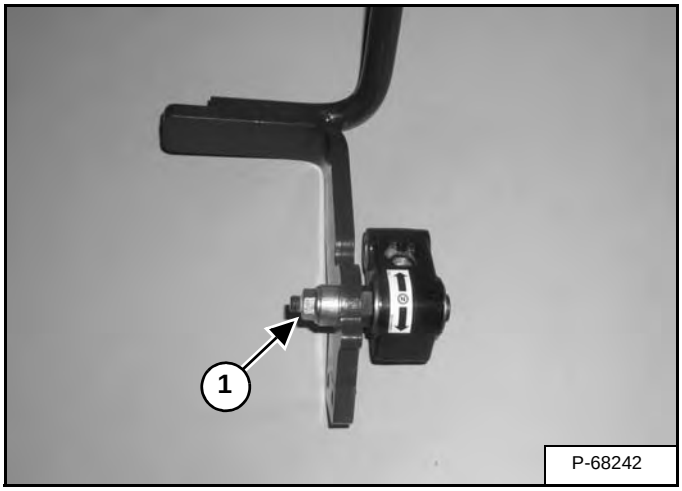
Remove the two bolts and nuts (Item 3) and remove the bracket (Item 4) **[Figure 40-110-1]**.

Remove the nut and bolt (Item 5) and remove the left travel lever (Item 6) **[Figure 40-110-1]**.

Disassembly And Assembly

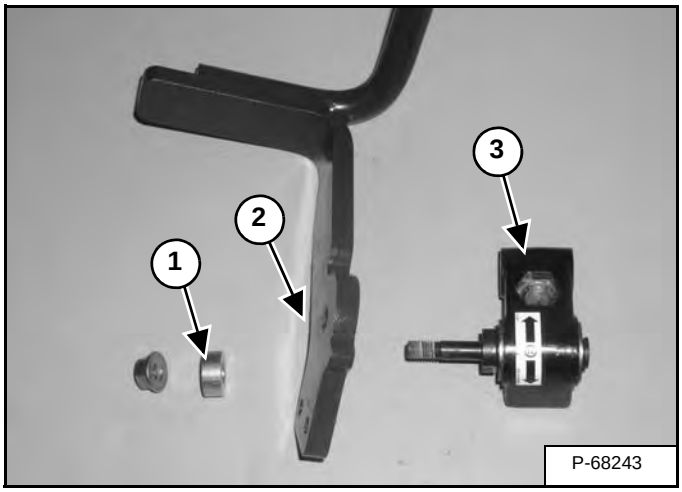
NOTE: The procedure is the same for both left and right travel controls. The left travel control is shown.

Figure 40-110-2



Remove the nut (Item 1) **[Figure 40-110-2]**.

Figure 40-110-3



Remove the bushing (Item 1) and rear pedal (Item 2) from the mount (Item 3) **[Figure 40-110-3]**.

Dealer Copy -- Not for Resale



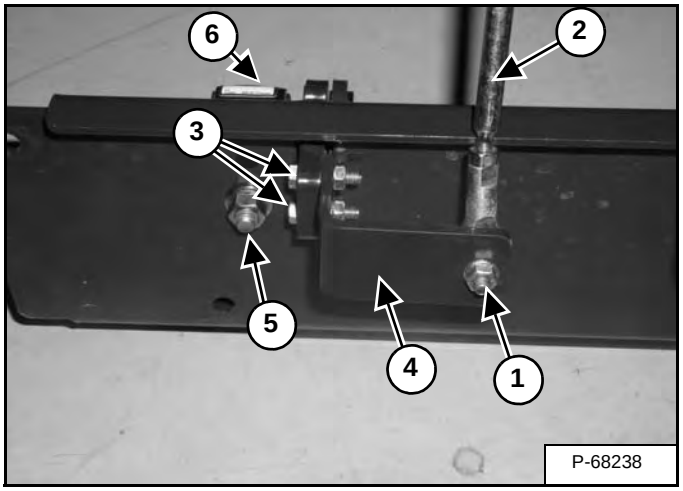
Dealer Copy -- Not for Resale

LEFT PEDAL

Removal And Installation

Remove the floor mat and floor panels. (See Removal And Installation on Page 40-140-1.)

Figure 40-120-1



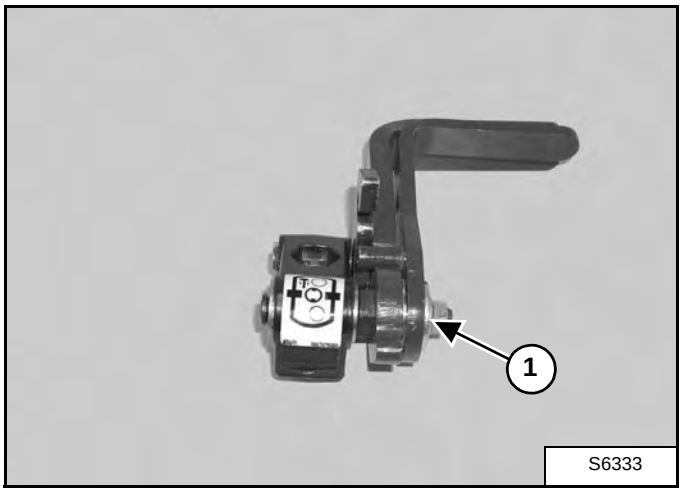
Remove the nut (Item 1) and linkage rod (Item 2) **[Figure 40-120-1]**.

Remove the two bolts and nuts (Item 3) and remove the bracket (Item 4) **[Figure 40-120-1]**.

Remove the nut and bolt (Item 5) and remove the boom swing pedal assembly (Item 6) **[Figure 40-120-1]**.

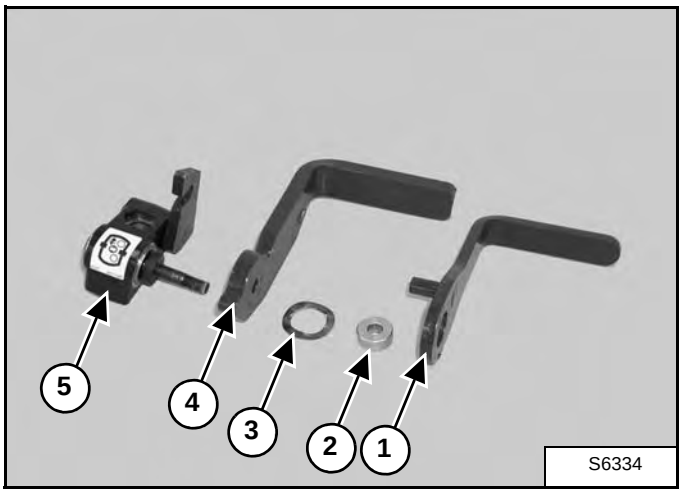
Disassembly And Assembly

Figure 40-120-2



Remove the nut and washer (Item 1) **[Figure 40-120-2]**.

Figure 40-120-3

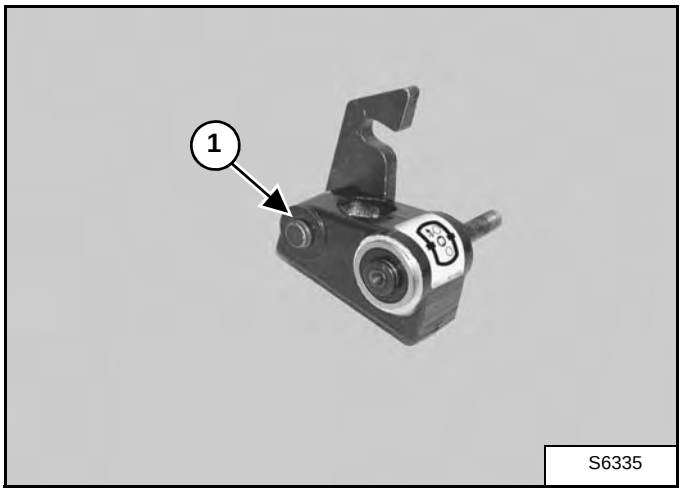


Remove the rear pedal (Item 1), bushing (Item 2), wave washer (Item 3), and front pedal (Item 4) from the mount (Item 5) **[Figure 40-120-3]**.

Dealer Copy -- Not for Resale

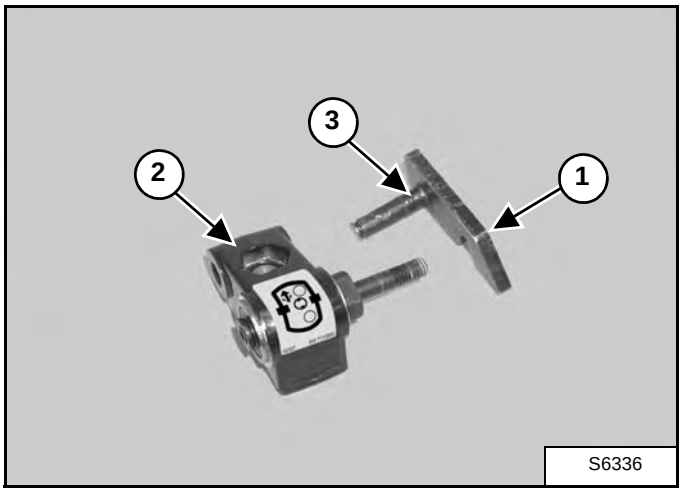
Disassembly And Assembly (Cont'd)

Figure 40-120-4



Remove the O-ring (Item 1) **[Figure 40-120-4]** from the shaft.

Figure 40-120-5



Remove the lock (Item 1) from the mount (Item 2) **[Figure 40-120-5]**.

Remove the O-ring (Item 3) **[Figure 40-120-5]** from the shaft.

NOTE: Do not lubricate the O-ring (Item 3) with grease during installation. The O-ring works as a friction lock to prevent the lock (Item 1) [Figure 40-120-5] from pivoting freely.

Dealer Copy -- Not for Resale

CONTROL LINKAGE ASSEMBLY

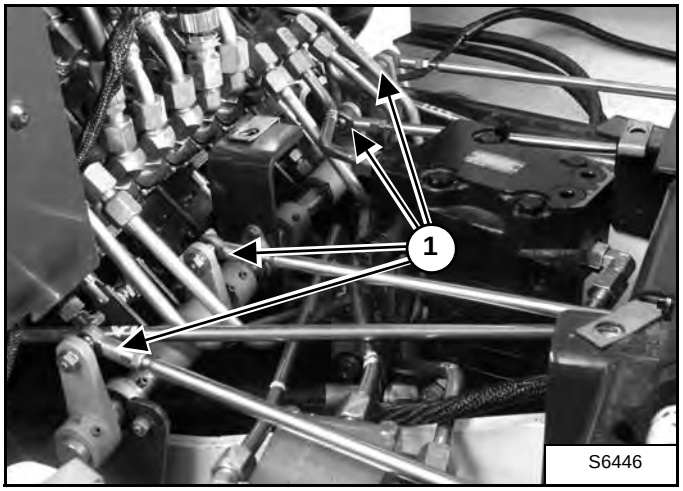
Description

The control linkage assembly is the linkage that connects the pedals and travel levers to the control valve section for the left and right travel, boom swing (offset) and the auxiliary functions. The control linkage is a two piece shaft supported on each end with a bearing.

Removal And Installation

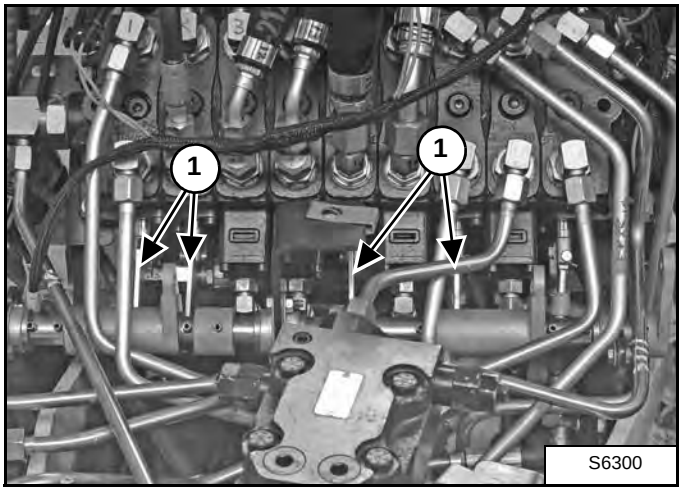
Remove the floor mat and floor panels. (See Removal And Installation on Page 40-140-1.)

Figure 40-130-1



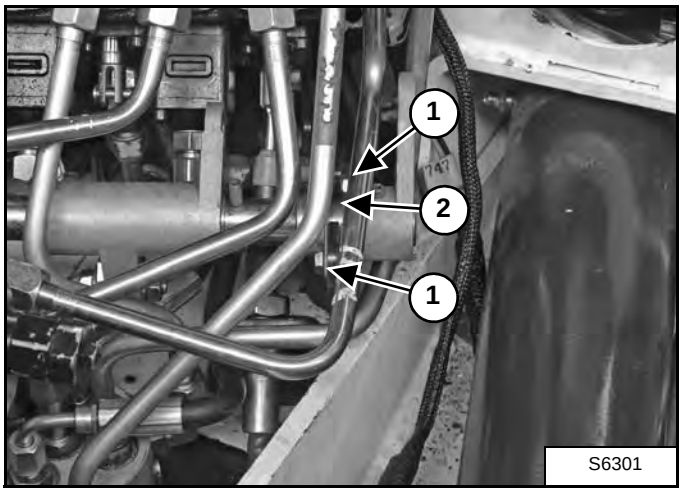
Remove the linkage rods (Item 1) **[Figure 40-130-1]** from the control linkage assembly.

Figure 40-130-2



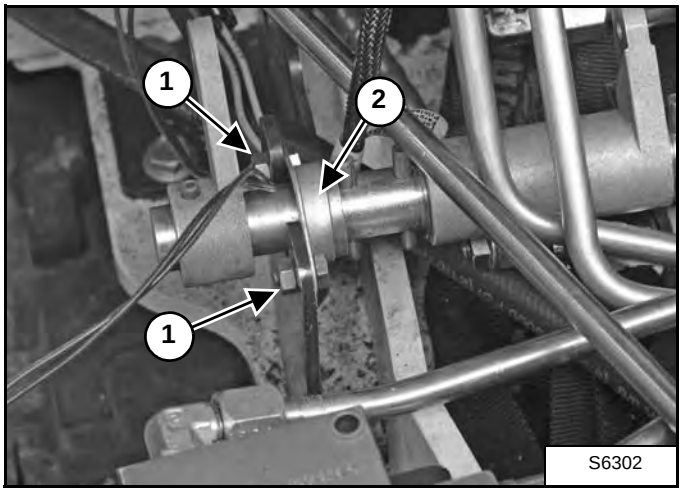
Remove the cotter pins and clevis pins (Item 1) **[Figure 40-130-2]** from the control valve.

Figure 40-130-3



Remove the bolts and nuts (Item 1) from the bearing block (Item 2) **[Figure 40-130-3]**.

Figure 40-130-4

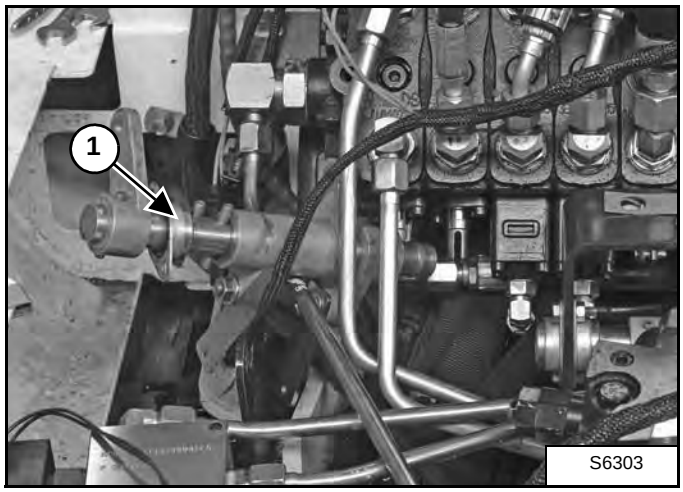


Remove the bolts and nuts (Item 1) from the bearing block (Item 2) **[Figure 40-130-4]**.

Dealer Copy -- Not for Resale

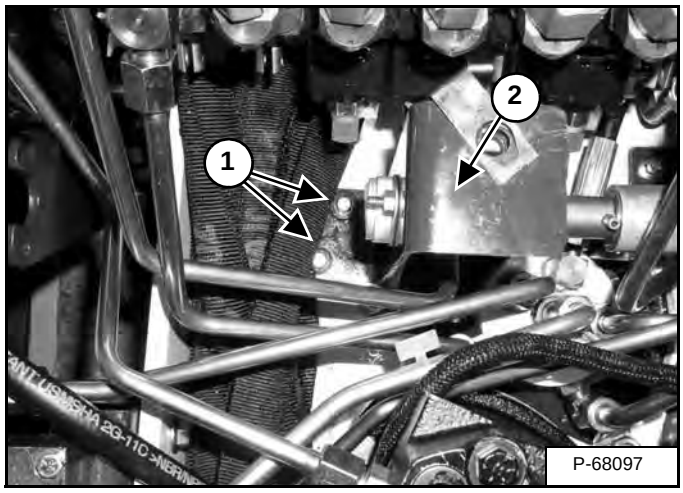
Removal And Installation (Cont'd)

Figure 40-130-5



Remove the right half of the control linkage assembly (Item 1) **[Figure 40-130-5]** from the excavator.

Figure 40-130-6



Remove the two bolts (Item 1) and remove the middle support bracket (Item 2) **[Figure 40-130-6]** with bearings attached.

Figure 40-130-7

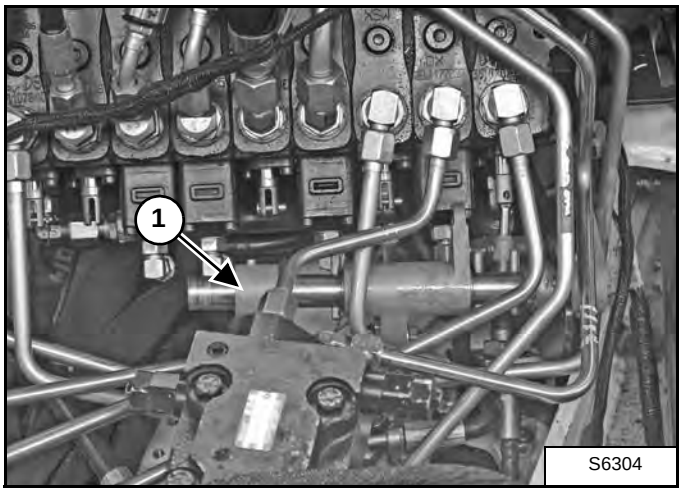
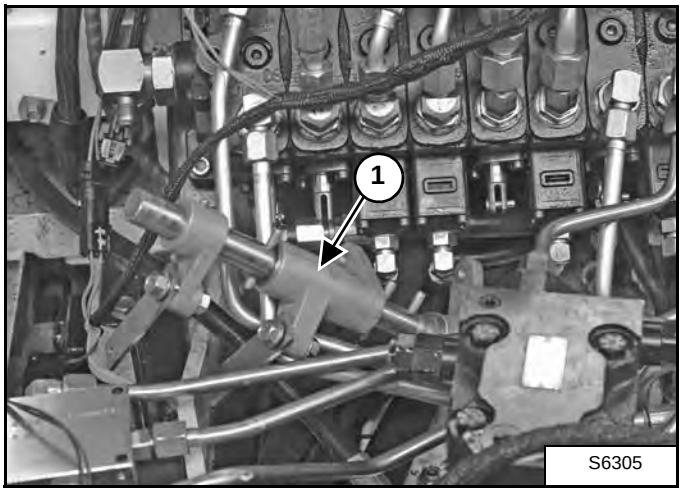


Figure 40-130-8



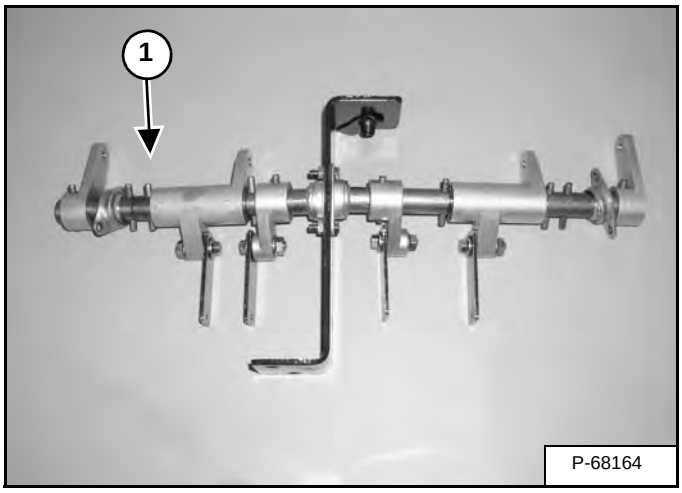
Remove the left half of the control linkage assembly (Item 1) **[Figure 40-130-7]** and **[Figure 40-130-8]** from the excavator.

Dealer Copy -- Not for Resale

Right Half Of Control Linkage Disassembly And Assembly

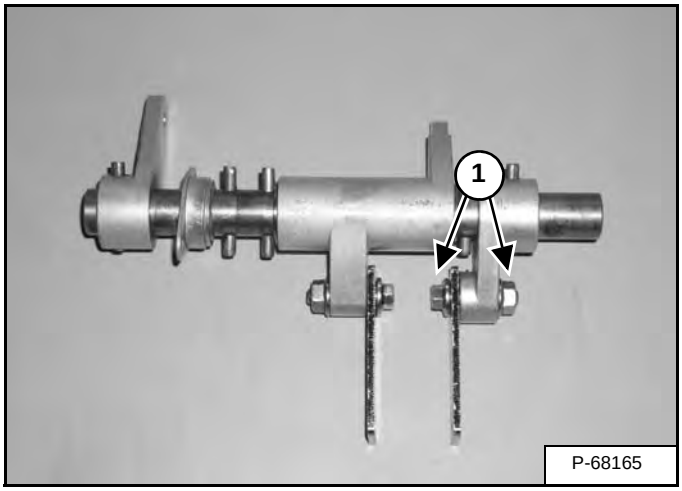
Mark the linkage rods and their orientation on the bellcranks. Mark bellcrank assemblies location and orientation on the shaft for ease of assembly.

Figure 40-130-9



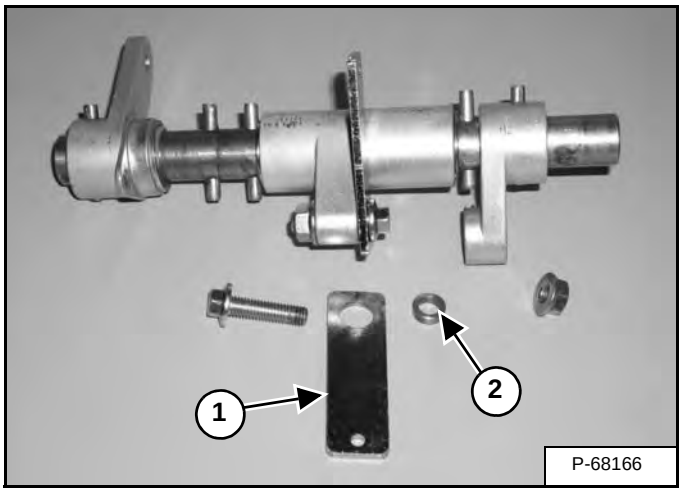
Remove the right half of the control linkage (Item 1) **[Figure 40-130-9]** from the control linkage assembly.

Figure 40-130-10



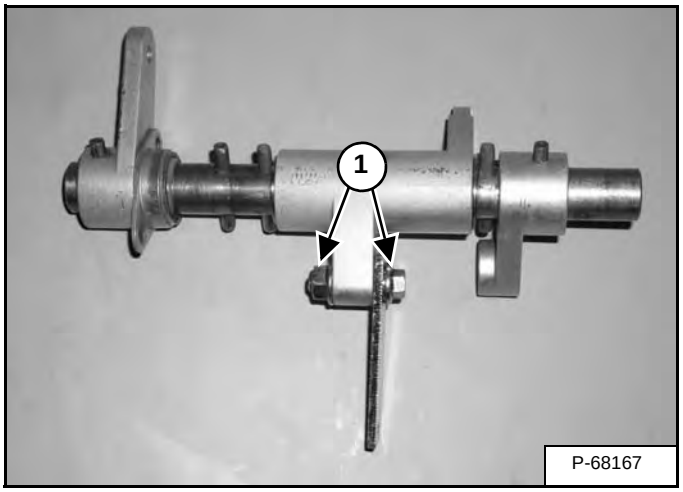
Remove the bolt and nut (Item 1) **[Figure 40-130-10]** from the bellcrank.

Figure 40-130-11



Remove the linkage plate (Item 1) and spacer (Item 2) **[Figure 40-130-11]** from the bellcrank.

Figure 40-130-12

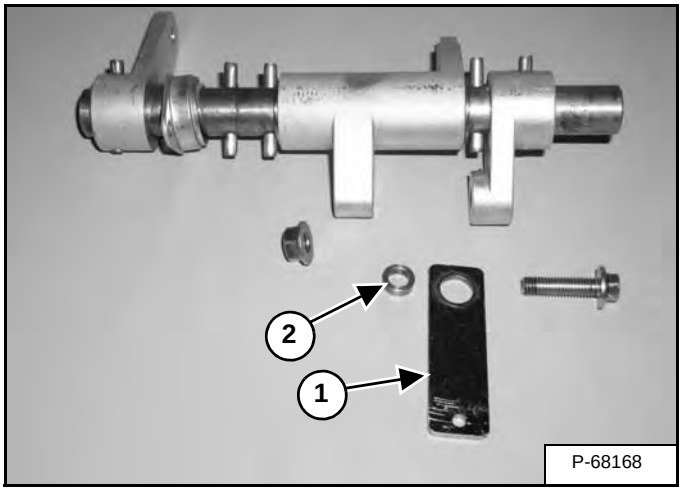


Remove the bolt and nut (Item 1) **[Figure 40-130-12]** from the bellcrank.

Dealer Copy -- Not for Resale

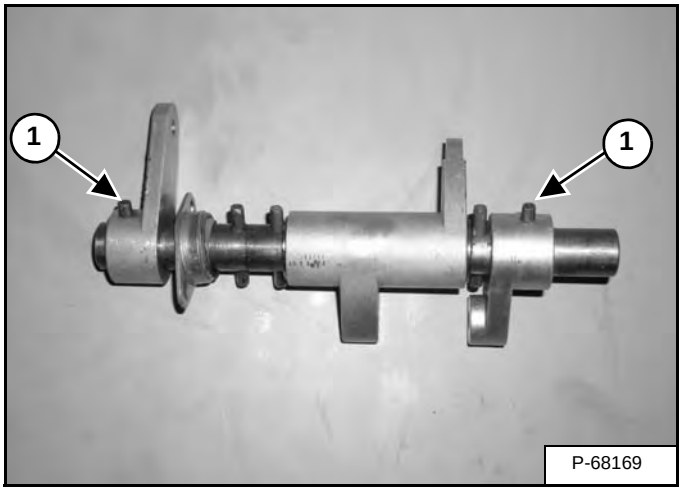
Right Half Of Control Linkage Disassembly And Assembly (Cont'd)

Figure 40-130-13



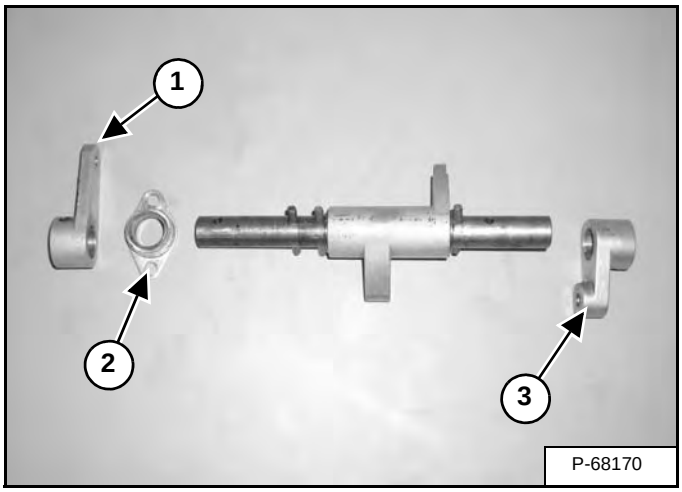
Remove the linkage plate (Item 1) and spacer (Item 2) **[Figure 40-130-13]** from the bellcrank.

Figure 40-130-14



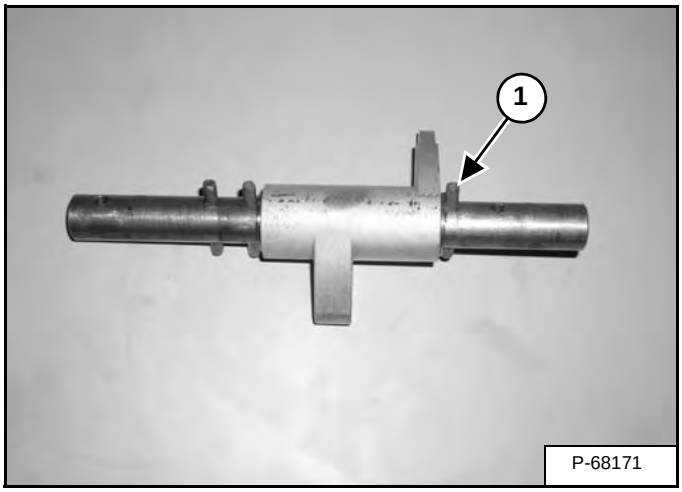
Remove the roll pins (Item 1) **[Figure 40-130-14]** from the bellcranks.

Figure 40-130-15



Remove the bellcrank (Item 1), bearing (Item 2) and bellcrank (Item 3) **[Figure 40-130-15]** from the shaft.

Figure 40-130-16

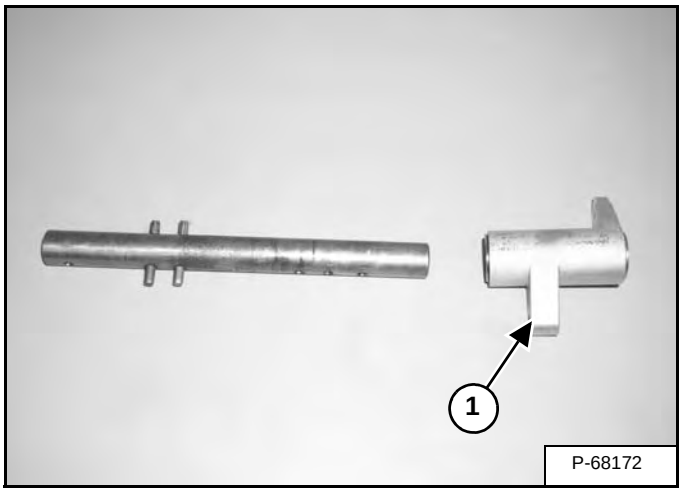


Remove the roll pin (Item 1) **[Figure 40-130-16]** from the shaft.

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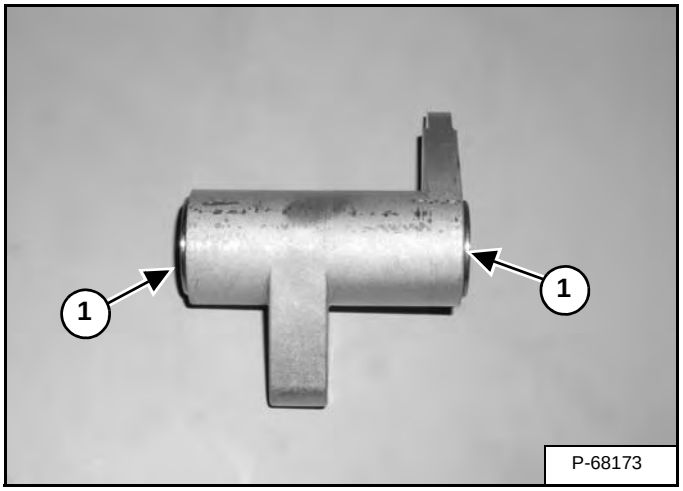
Right Half Of Control Linkage Disassembly And Assembly (Cont'd)

Figure 40-130-17



Remove the bellcrank (Item 1) **[Figure 40-130-17]** from the shaft.

Figure 40-130-18

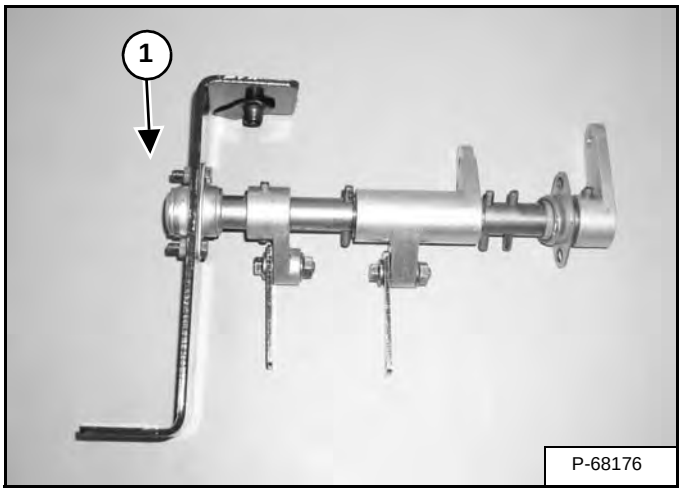


Remove the bushings (Item 1) **[Figure 40-130-18]** from the bellcrank.

Left Half Of Control Linkage Disassembly And Assembly

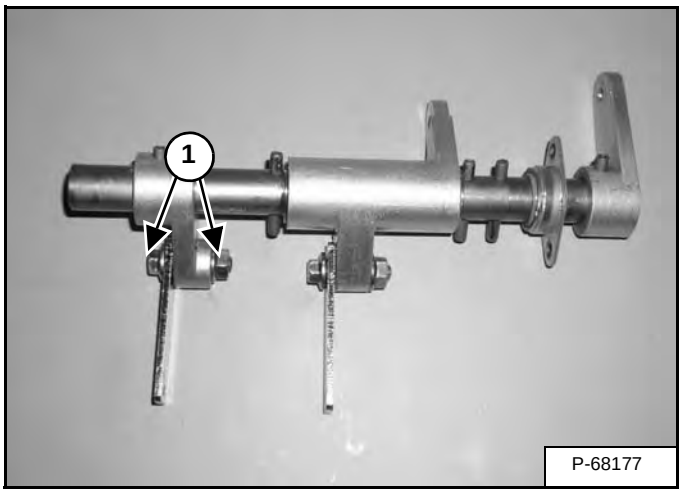
Mark the linkage rods and their orientation on the bellcranks. Mark bellcrank assemblies location and orientation on the shaft for ease of assembly.

Figure 40-130-19



Remove the left half of the control linkage (Item 1) **[Figure 40-130-19]** from the mount bracket bearing.

Figure 40-130-20

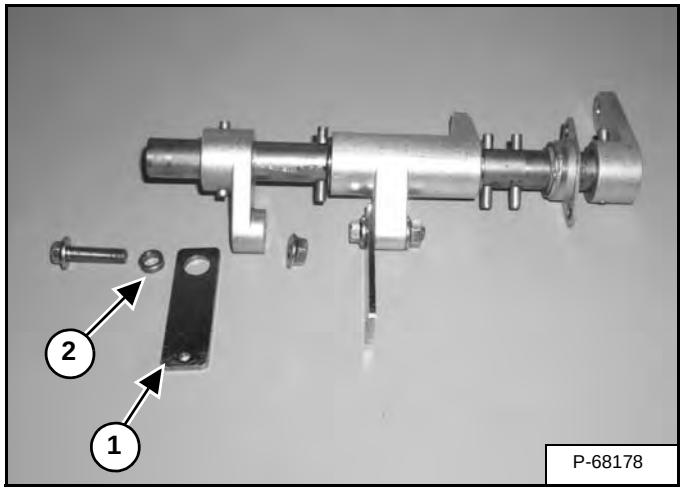


Remove the bolt and nut (Item 1) **[Figure 40-130-20]** from the bellcrank.

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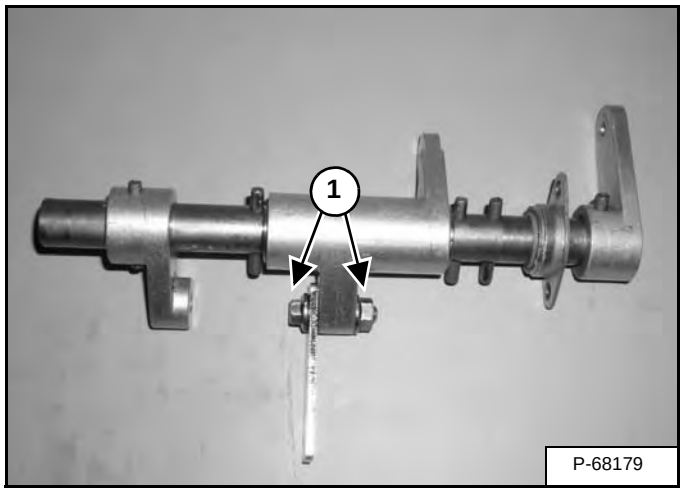
Left Half Of Control Linkage Disassembly And Assembly (Cont'd)

Figure 40-130-21



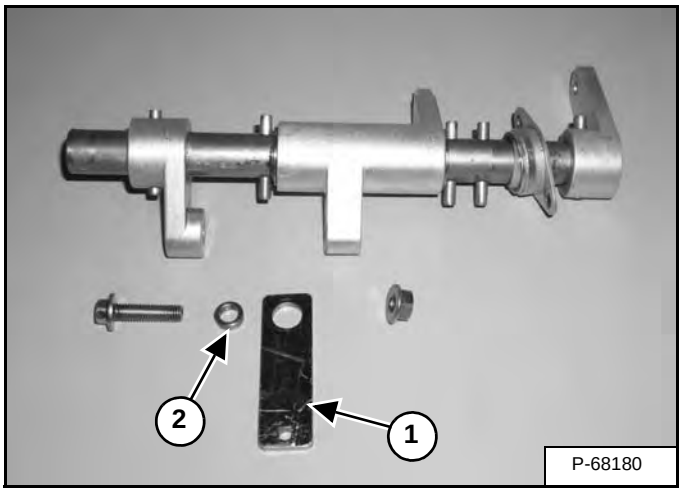
Remove the linkage plate (Item 1) and spacer (Item 2) **[Figure 40-130-21]** from the bellcrank.

Figure 40-130-22



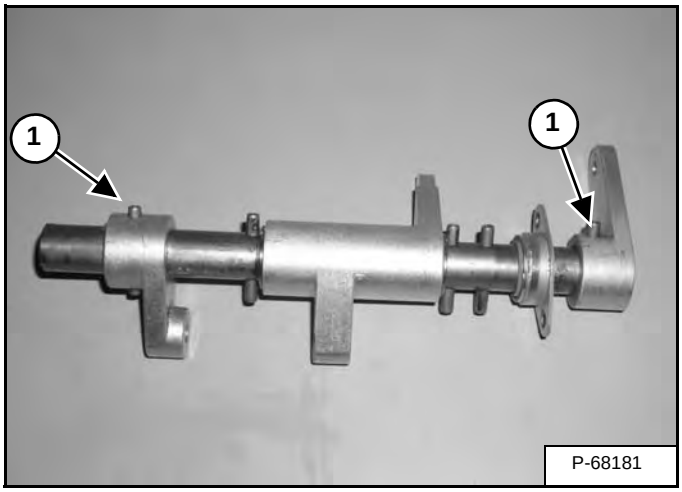
Remove the bolt and nut (Item 1) **[Figure 40-130-22]** from the bellcrank.

Figure 40-130-23



Remove the linkage plate (Item 1) and spacer (Item 2) **[Figure 40-130-23]** from the bellcrank.

Figure 40-130-24

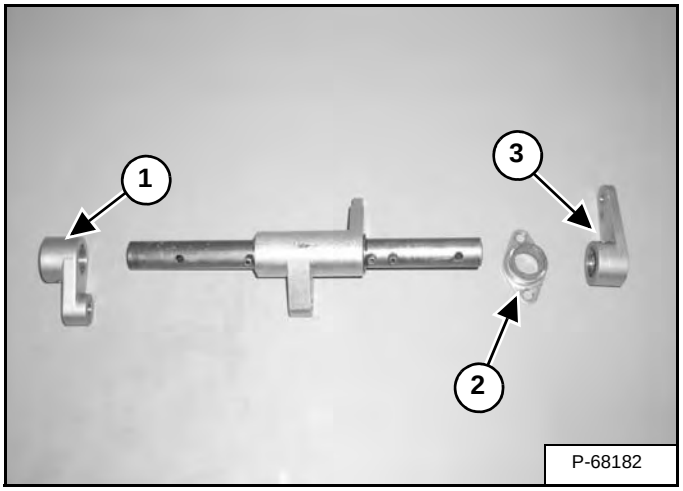


Remove the roll pins (Item 1) **[Figure 40-130-24]** from the bellcranks.

Dealer Copy -- Not for Resale

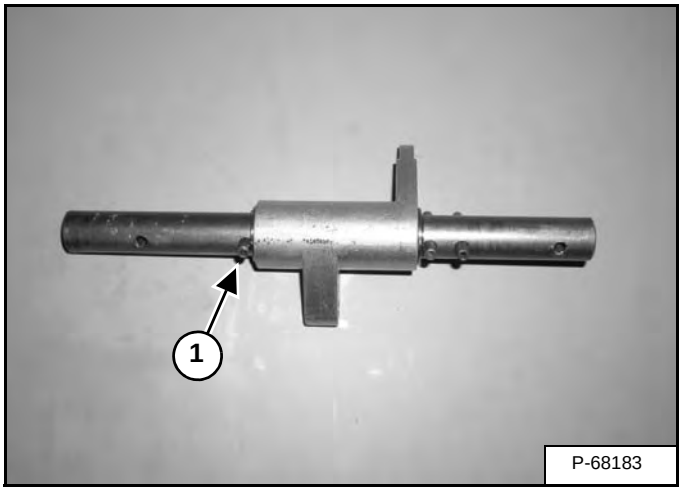
Left Half Of Control Linkage Disassembly And Assembly (Cont'd)

Figure 40-130-25



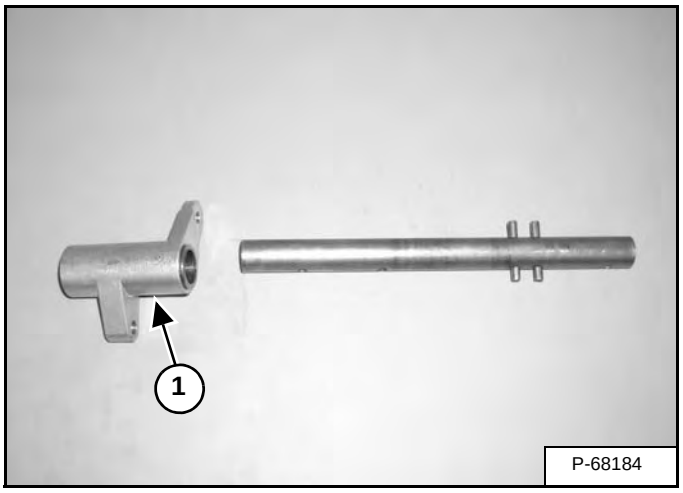
Remove the bellcrank (Item 1), bearing (Item 2) and bellcrank (Item 3) **[Figure 40-130-25]** from the shaft.

Figure 40-130-26



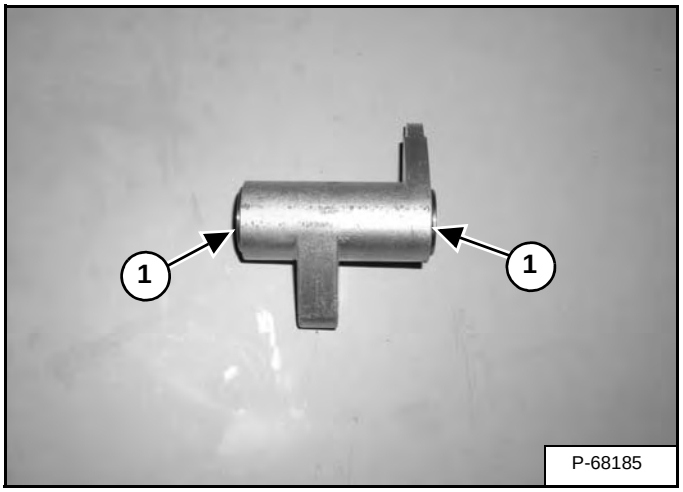
Remove the roll pin (Item 1) **[Figure 40-130-26]** from the shaft.

Figure 40-130-27



Remove the bellcrank (Item 1) **[Figure 40-130-27]** from the shaft.

Figure 40-130-28

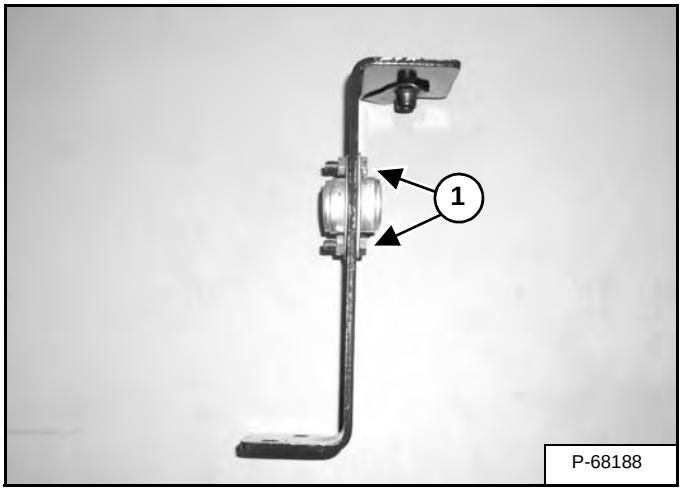


Remove the bushings (Item 1) **[Figure 40-130-28]** from the bellcrank.

Dealer Copy -- Not for Resale

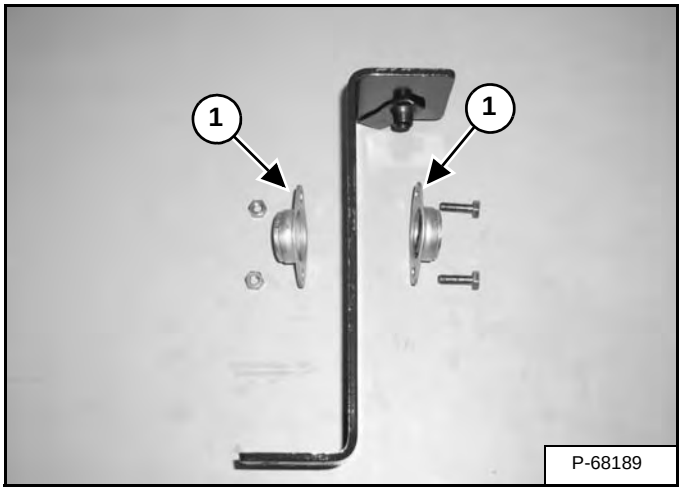
Bracket Of Control Linkage Disassembly And Assembly

Figure 40-130-29



Remove the bolts and nuts (Item 1) **[Figure 40-130-29]** from the bearings.

Figure 40-130-30



Remove the bearings (Item 1) **[Figure 40-130-30]** from the bracket.

Dealer Copy -- Not for Resale

FLOOR MAT AND FLOOR PANELS

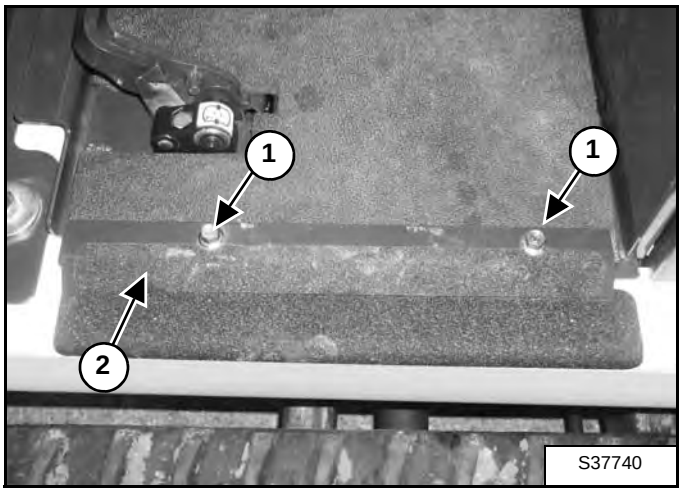
Description

The floor of the excavator (cab or canopy) is divided into two floor panels covered by a mat. The rear floor panel provides accessibility to the hydraulic components and the front panel consists of the travel levers and foot pedals.

The rear floor panel is the only floor panel that needs to be removed when servicing the hydraulic components. The front floor panel only needs to be removed when the travel levers, pedals and upperstructure slew lock need servicing.

Removal And Installation

Figure 40-140-1

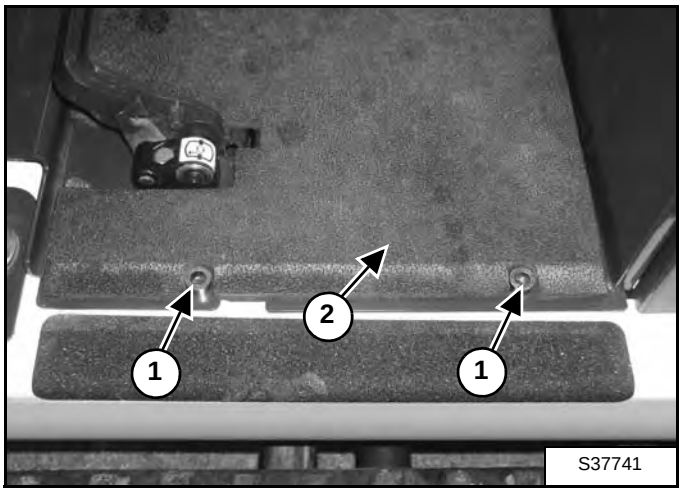


Remove the bolts (Item 1) **[Figure 40-140-1]** in both floor mat retaining plates.

Remove the floor mat retaining plate (Item 2) **[Figure 40-140-1]** from both sides.

NOTE: Excavators that are equipped with a cab only have a floor mat retainer plate on the door side.

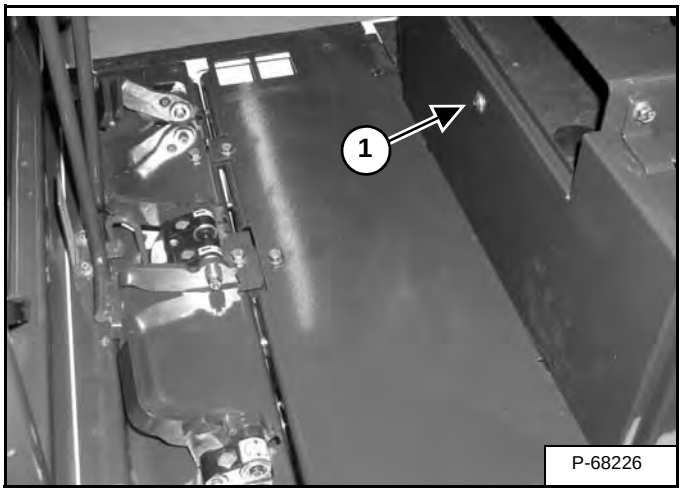
Figure 40-140-2



Remove the spacers (Item 1) from both sides of the floor mat (Item 2) **[Figure 40-140-2]**.

Remove the floor mat (Item 2) **[Figure 40-140-2]**.

Figure 40-140-3

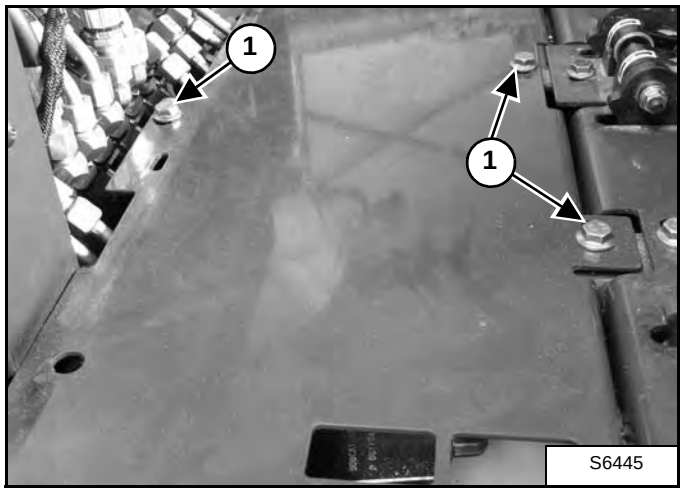


Use the key to remove the access panel (Item 1) **[Figure 40-140-3]**.

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Removal And Installation (Cont'd)

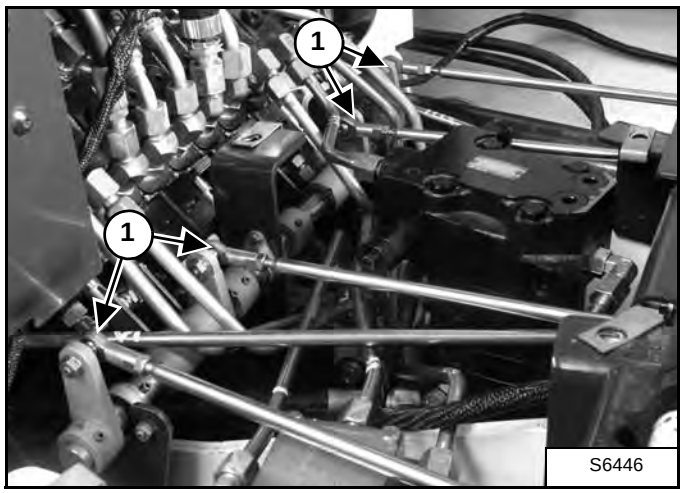
Figure 40-140-4



Remove the bolts (Item 1) **[Figure 40-140-4]** from the rear floor panel.

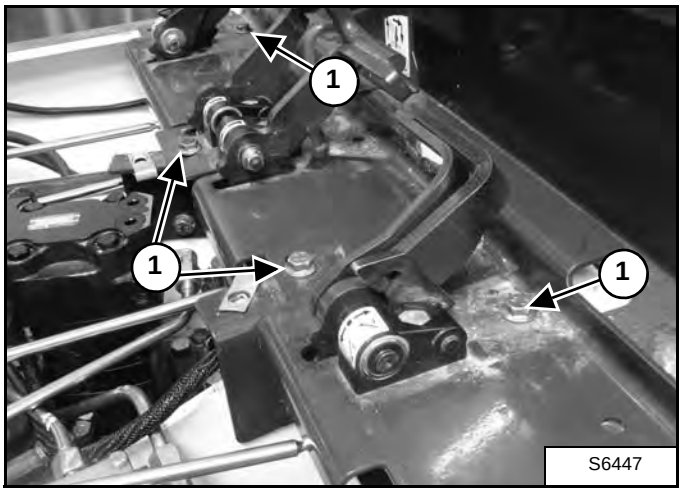
Remove the rear floor panel.

Figure 40-140-5



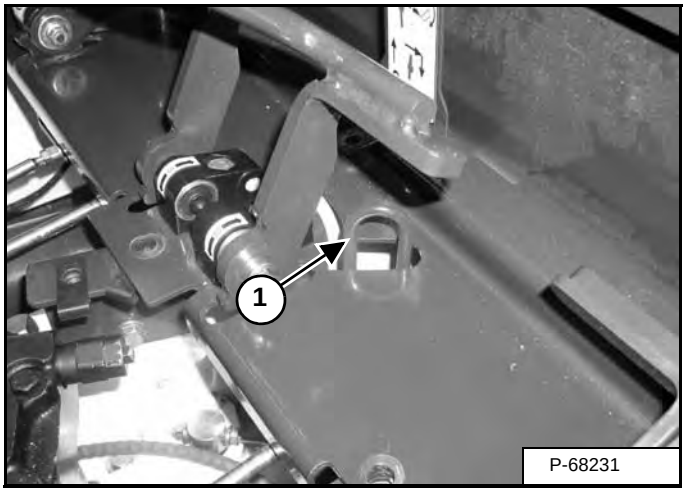
Remove the nuts (Item 1) **[Figure 40-140-5]** from the control valve linkages and remove the linkages from the bellcranks.

Figure 40-140-6



Remove the four bolts (Item 1) **[Figure 40-140-6]** from the front floor panel.

Figure 40-140-7



Lift the upperstructure slew lock (Item 1) **[Figure 40-140-7]** from the stored (locked) position into the slot in the front floor panel. The front floor panel can now be removed while leaving the upperstructure slew lock in place.

Remove the front floor panel.

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FUEL TANK

Removal And Installation

Open the tailgate. (See TAILGATE on Page 10-60-1.)

Remove the muffler. (See Removal And Installation on Page 60-30-1.)

Remove the hydraulic reservoir. (See Removal And Installation on Page 20-120-1.)

Remove the hydraulic filter bracket assembly. (See Removal And Installation on Page 20-120-1.)

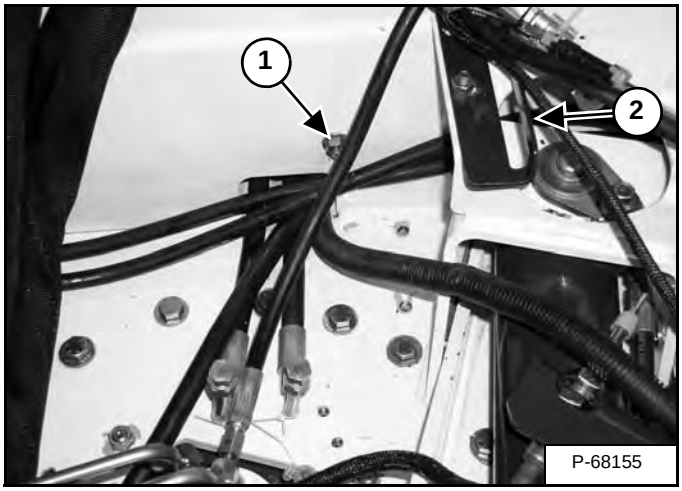
Remove the engine. (See Engine Removal And Installation on Page 60-10-8.)

Remove the floor mat and floor panels. (See Removal And Installation on Page 40-140-1.)

Remove the battery. (See Removal And Installation on Page 50-20-2.)

Remove the seat and seat mount. (See Seat Mount Removal And Installation on Page 40-40-1.) or (See Seat Mount Removal And Installation on Page 40-41-1.)

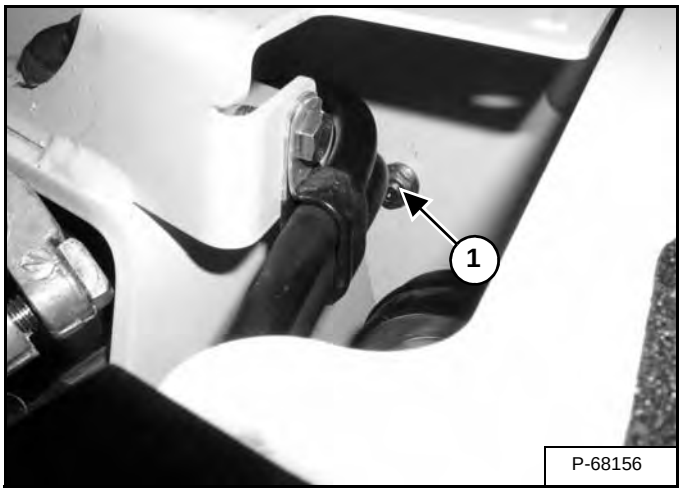
Figure 40-150-1



Remove the nut (Item 1) **[Figure 40-150-1]** from the fuel tank mounting bolt behind the control valve.

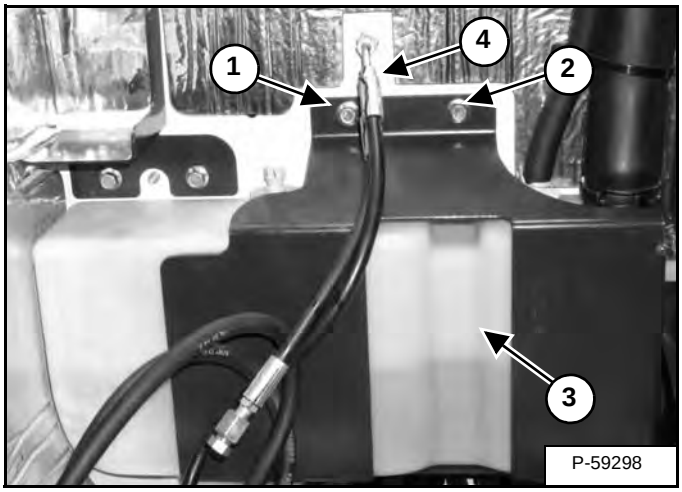
NOTE: The control valve assembly has been removed for picture clarity. The nut can be accessed through the clearance hole for the base end boom swing cylinder mounting (Item 2) [Figure 40-150-1].

Figure 40-150-2



Remove the nut (Item 1) **[Figure 40-150-2]** from the fuel tank mounting bolt under the battery.

Figure 40-150-3



Remove the short bolt (Item 1) and the long bolt (Item 2) **[Figure 40-150-3]** from the fuel tank mounting bracket.

Remove the fuel tank (Item 3) **[Figure 40-150-3]** from the back of the excavator.

NOTE: The bulk head hoses (Item 4) [Figure 40-150-3] can need to be loosened and rotated away from the fuel tank bracket.

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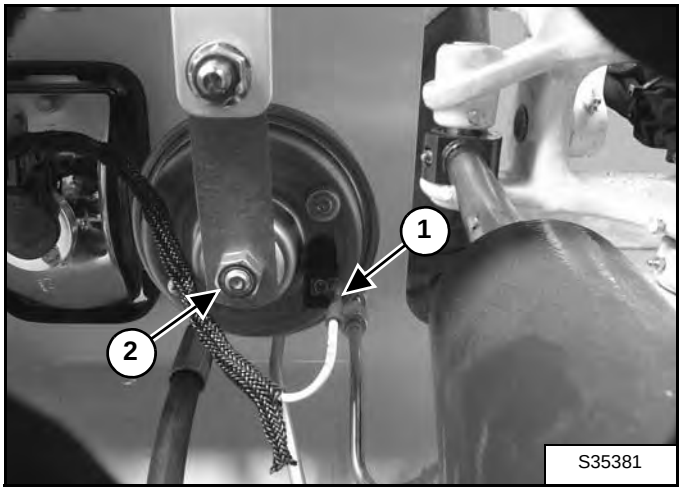
Dealer Copy -- Not for Resale

HORN

Removal And Installation

Remove the floor mat and floor panels. (See Removal And Installation on Page 40-140-1.)

Figure 40-160-1



Remove the wire (Item 1) **[Figure 40-160-1]** from the horn.

Remove the nut (Item 2) **[Figure 40-160-1]**.

Remove the horn.

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Dealer Copy -- Not for Resale

SWING FRAME

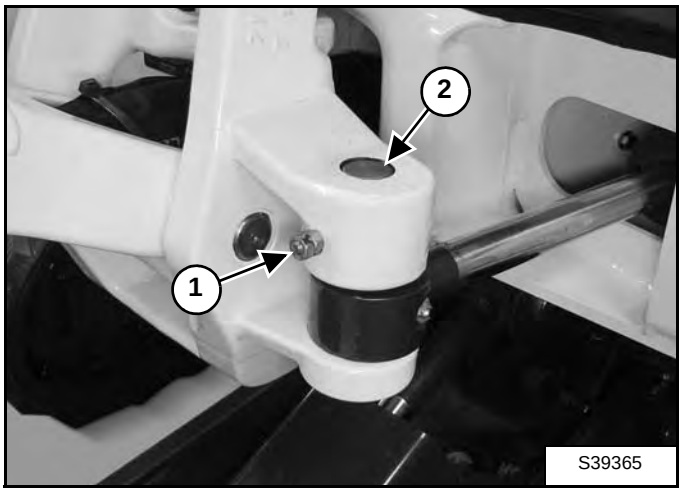
Description

The swing frame is the casting connected to the boom swing cylinder and the boom with top mounted boom cylinder. The swing casting provides the pivot point for the boom in the offset function and the up down motion of the boom. The swing frame is connected to the upperstructure by a top and bottom pivot pin.

Removal And Installation

Remove the boom. (See Removal And Installation on Page 40-180-1.)

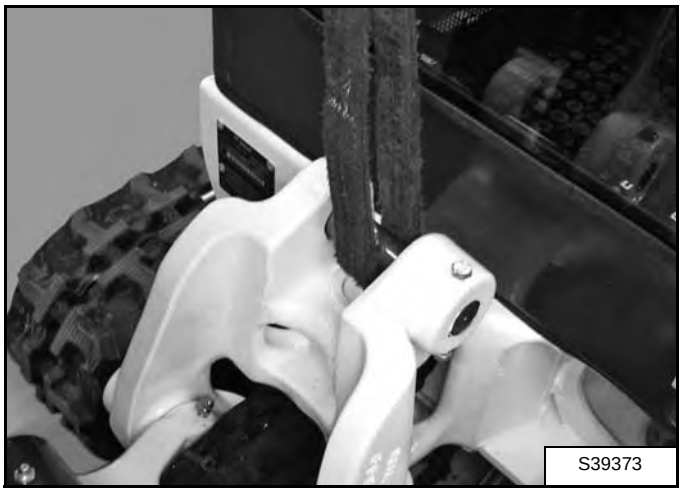
Figure 40-170-1



Remove the bolt and nuts (Item 1) **[Figure 40-170-1]** from the cylinder pivot pin.

Remove the pivot pin (Item 2) **[Figure 40-170-1]**.

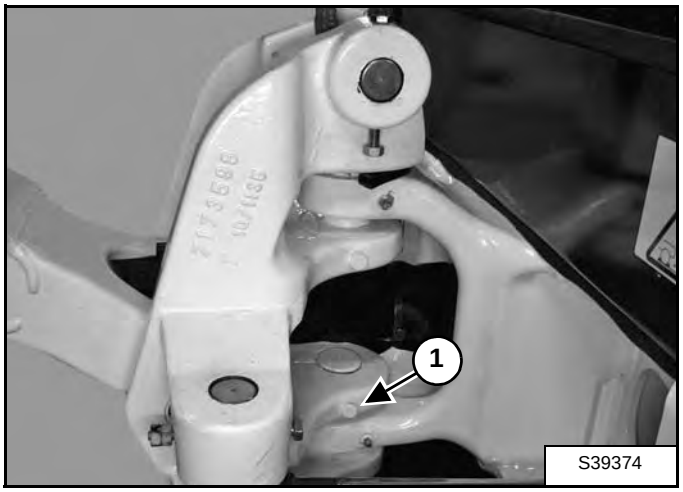
Figure 40-170-2



Install the pivot pin, bolt and nuts **[Figure 40-170-2]**.

Install a chain hoist on the swing frame **[Figure 40-170-2]**.

Figure 40-170-3

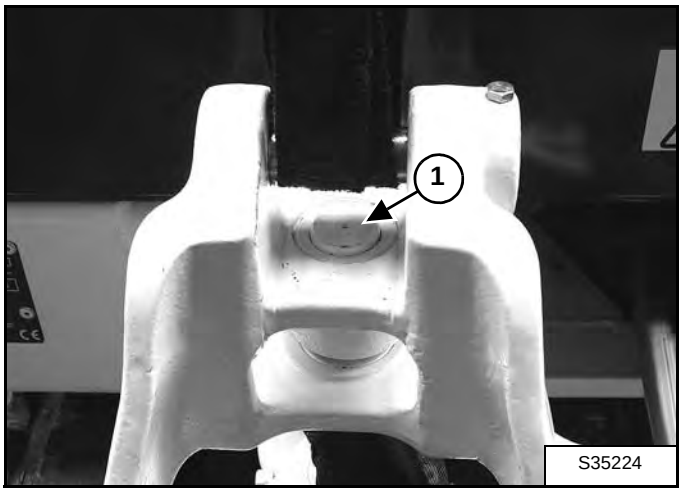


Remove the bolt and nuts (Item 1) **[Figure 40-170-3]** from the top pivot pin.

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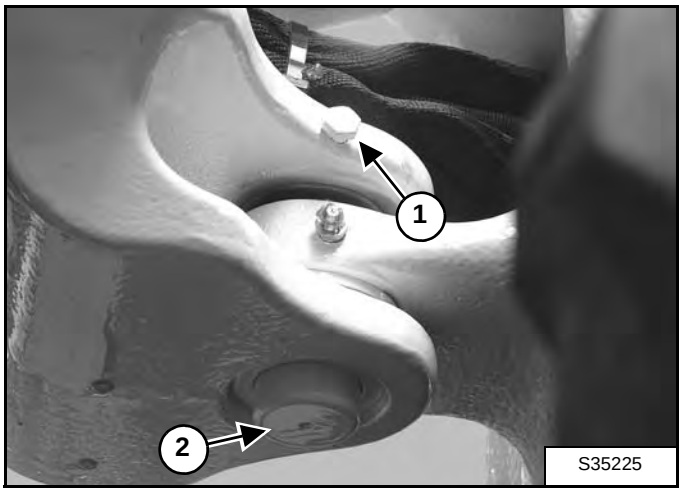
Removal And Installation (Cont'd)

Figure 40-170-4



Remove the top pivot pin (Item 1) **[Figure 40-170-4]** from the swing frame.

Figure 40-170-5



Remove the bolt and nuts (Item 1) from the bottom pivot pin (Item 2) **[Figure 40-170-5]**.

Remove the bottom pivot pin (Item 2) **[Figure 40-170-5]** from the swing frame.

Figure 40-170-6

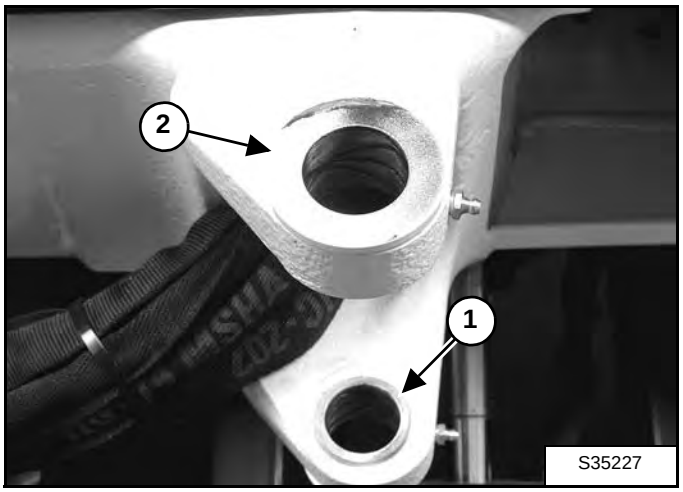


Remove the swing frame from the excavator **[Figure 40-170-6]**.

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Bushing Removal And Installation

Figure 40-170-7



Remove the bottom bushing (Item 1) **[Figure 40-170-7]** from the upperstructure by driving the bushing down through the casting.

Remove the top bushing (Item 2) **[Figure 40-170-7]** from the upperstructure by driving the bushing up through the casting.

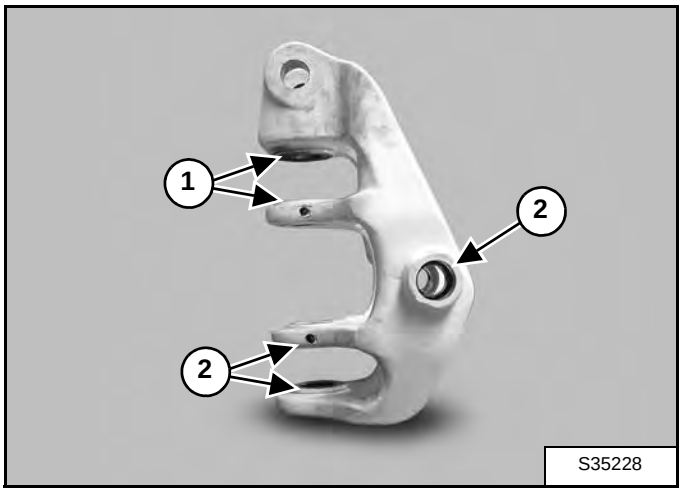
During installation, center the bushing on the casting hole.

NOTE: Make sure the bushing is centered in the casting hole and is started in the hole evenly and square.

Install the bushing so the flanged edge of bushing is seated in the casting. The flanged edge of the bushings must be installed from the top and bottom of the upperstructure casting.

Swing Frame Bushing Removal

Figure 40-170-8



Remove the top pivot bushings (Item 1) and the bottom pivot bushings (Item 2) **[Figure 40-170-8]**. The bushings will need to be pressed in toward each other to be removed from the swing frame casting.

The following parts will be needed for removal and installation of the swing frame bushings:

Bolt - 15,88 x 114,3 mm long (0.625 x 4.5 in long)

Nut - 15,875 mm (0.625 in)

Washer -
(15,875 mm I.D. x 58,7 mm O.D. x 6,35 mm thick)
(0.625 in I.D. x 2.312 in O.D. x 0.25 in thick)

Washer -
(15,875 mm I.D. x 88,9 mm O.D. x 6,35 mm thick)
(0.625 in I.D. x 3.5 in O.D. x 0.25 in thick)

Spacer -
(73 mm I.D. x 85,7 mm O.D. x 38,1 mm thick)
(2.875 in I.D. x 3.375 in O.D. x 1.5 in thick)

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Swing Frame Bushing Removal (Cont'd)

Figure 40-170-9

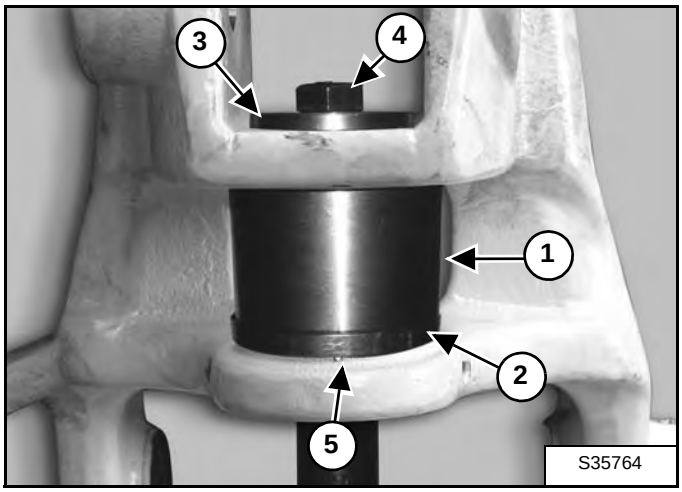
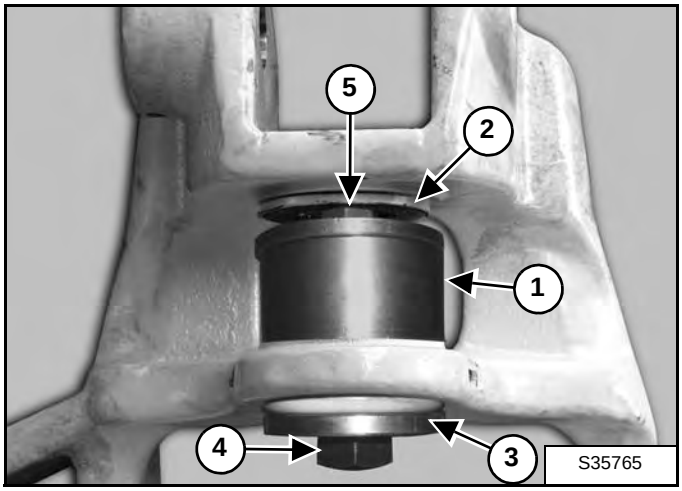


Figure 40-170-10



Install the spacer (Item 1) and washer (Item 2) **[Figure 40-170-9]** and **[Figure 40-170-10]** over the flanged end of the bushing.

The spacer (Item 1) **[Figure 40-170-9]** and **[Figure 40-170-10]** must be centered over the bushing to avoid contact between the bushing and the spacer during removal.

Install the washer (Item 3) **[Figure 40-170-9]** and **[Figure 40-170-10]** on the opposite end of the bushing. The washer must be centered on the bushing and must not contact the casting.

Install the bolt (Item 4) and the nut (Item 5) **[Figure 40-170-9]** and **[Figure 40-170-10]** through the washers and spacer.

Tighten the bolt and nut to remove the bushing from the casting.

Swing Frame Bushing Installation

Apply a film of grease to the outer diameter of the bushing and the inner diameter of the casting.

Centre the bushing on the casting hole.

NOTE: Make sure the bushing is centered in the casting hole and is started in the hole evenly and square.

Put the washer (Item 3) over the flanged end of the bushing. Put the washer (Item 2) **[Figure 40-170-10]** over the bushing hole casting, center the washer over the bushing hole.

Install the bolt (Item 4) through the washers and the bushing and install the nut (Item 5) **[Figure 40-170-10]**.

Tighten the bolt and nut until the bushing is seated in the casting.

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Boom Pivot Bushing Removal

The following parts will be needed for removal and installation of the boom pivot bushings.

Bolt - 15,88 x 114,3 mm long (0.625 x 4.5 in long)

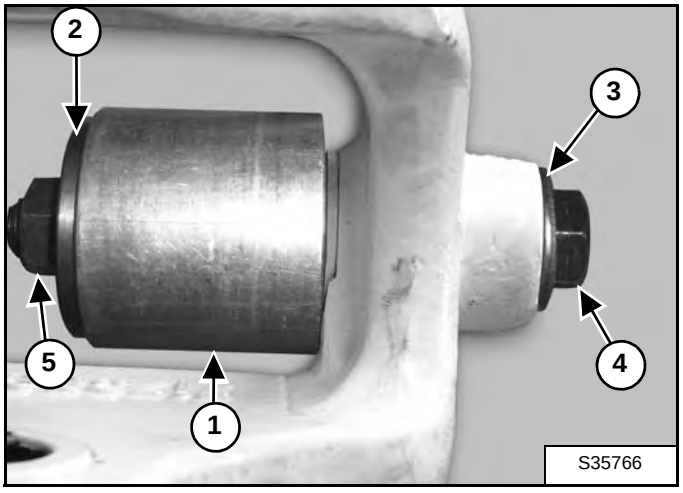
Nut - 15,875 mm (0.625 in)

Washer -
(15,875 mm I.D. x 34,9 mm O.D. x 6,35 mm thick)
(0.625 in I.D. x 1.375 in O.D. x 0.25 in thick)

Washer -
(15,875 mm I.D. x 66,7 mm O.D. x 6,35 mm thick)
(0.625 in I.D. x 2.625 in O.D. x 0.25 in thick)

Spacer -
(57,15 mm I.D. x 66,7 mm O.D. x 38,1 mm thick)
(2.250 in I.D. x 2.625 in O.D. x 1.5 in thick)

Figure 40-170-11



Install the spacer (Item 1) and washer (Item 2) **[Figure 40-170-11]** over the flanged end of the bushing.

The spacer (Item 1) **[Figure 40-170-11]** must be centered over the bushing to avoid contact between the bushing and the spacer during removal.

Install the washer (Item 3) **[Figure 40-170-11]** on the opposite end of the bushing. This washer must be centered on the bushing and must not contact the casting.

Install the bolt (Item 4) and the nut (Item 5) **[Figure 40-170-11]** through the washers and spacer.

Boom Pivot Bushing Installation

Tighten the bolt and nut to remove the bushing from the casting.

Apply a film of grease to the outer diameter of the bushing and the inner diameter of the casting.

Centre the bushing in the casting hole.

NOTE: Make sure the bushing is centered into the casting hole and is started in the hole evenly and square.

Put the washer (Item 3) over the flanged end of the bushing. Put the washer (Item 2) **[Figure 40-170-11]** over the bushing hole casting, center the washer over the bushing hole.

Install the bolt (Item 4) through the washers and the bushing and install the nut (Item 5) **[Figure 40-170-11]**.

Tighten the bolt and nut until the bushing is seated in the casting.

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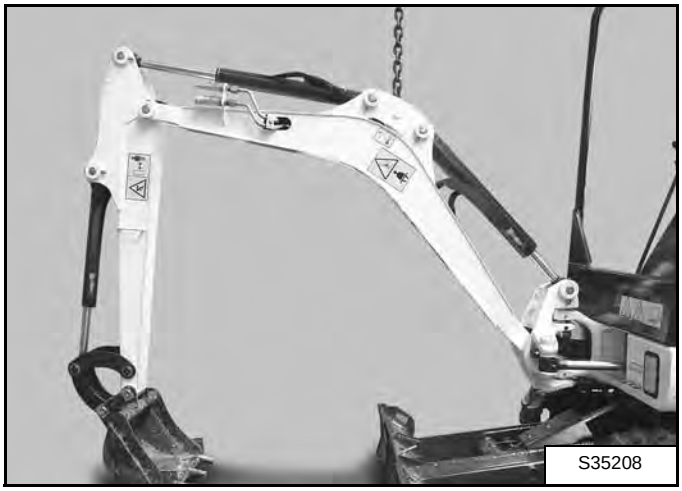
BOOM

Description

The boom is the section that is connected to the swing frame and the arm. The boom has the boom and arm cylinders mounted on the top of the boom.

Removal And Installation

Figure 40-180-1



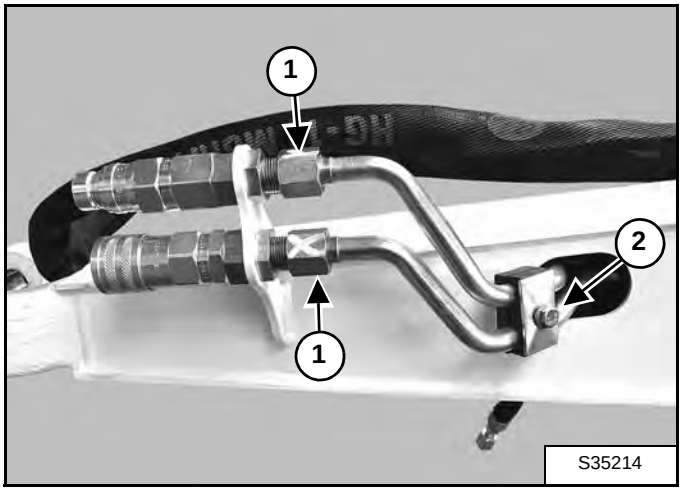
Install a chain hoist on the boom **[Figure 40-180-1]**.

Remove the arm. (See Removal And Installation on Page 40-190-1.)

Remove the arm cylinder. (See Removal And Installation on Page 20-21-3.)

Remove the boom cylinder. (See Removal And Installation on Page 20-20-2.)

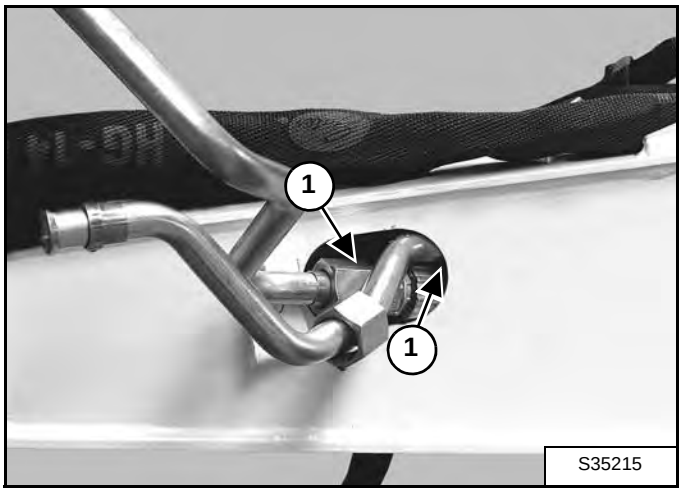
Figure 40-180-2



Disconnect the tubelines (Item 1) **[Figure 40-180-2]** from the hydraulic quick couplers.

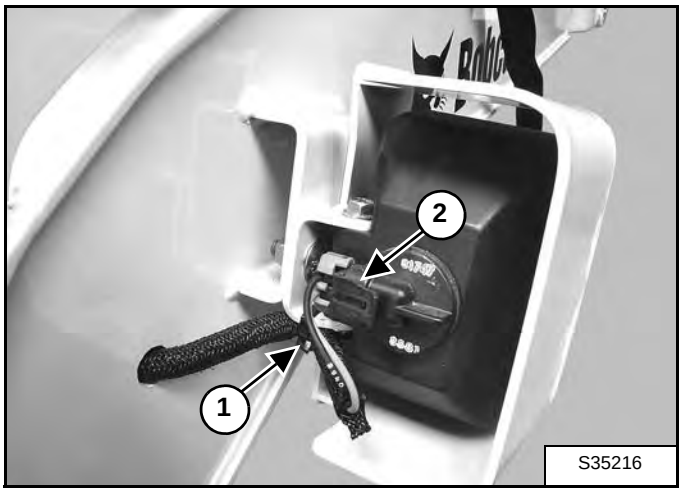
Remove the bolt and nut (Item 2) **[Figure 40-180-2]** from the bracket.

Figure 40-180-3



Pull the tubelines out of the boom and disconnect them from the hydraulic hoses (Item 1) **[Figure 40-180-3]**.

Figure 40-180-4

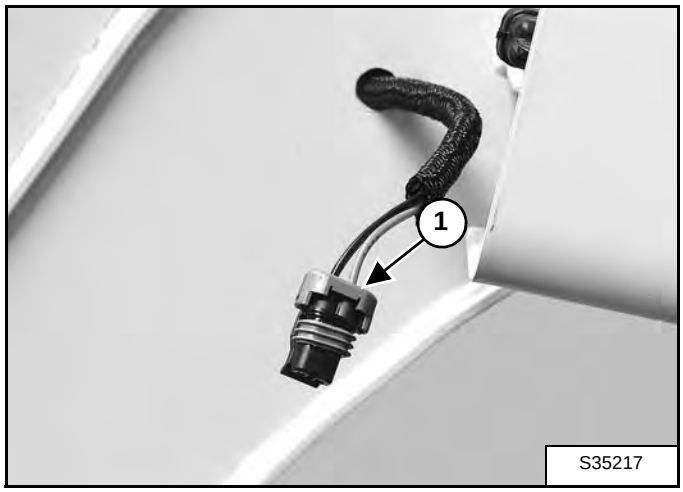


Remove the tie-strap (Item 1) on the light wire harness (Item 2) **[Figure 40-180-4]**. Disconnect the harness.

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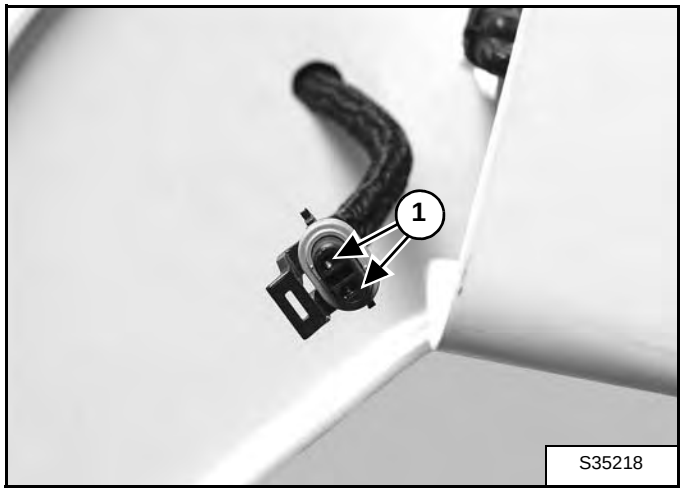
Removal And Installation (Cont'd)

Figure 40-180-5



Remove the lock (Item 1) **[Figure 40-180-5]** from the electrical connector.

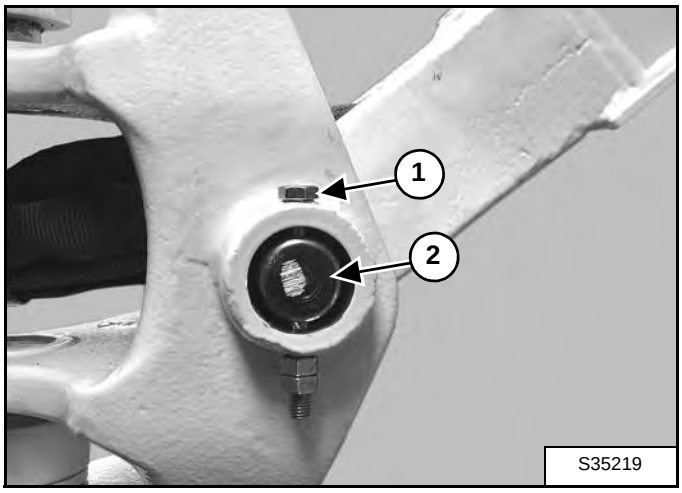
Figure 40-180-6



With a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 40-180-6]**.

Mark and remove the individual wires from the back of the electrical connector.

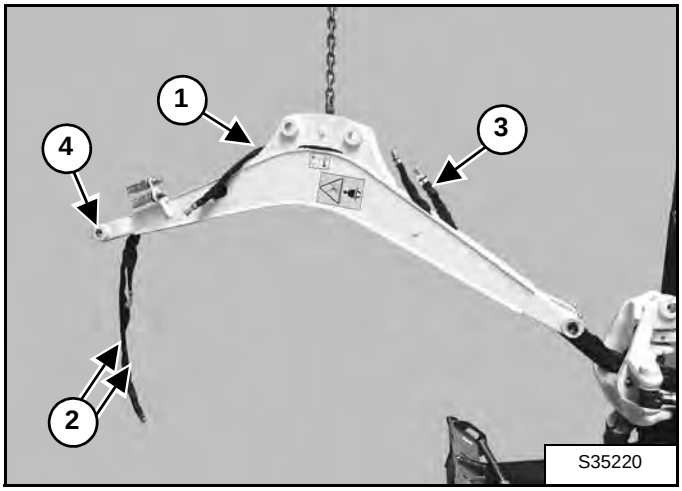
Figure 40-180-7



Remove the bolt and nuts (Item 1) from the pivot pin (Item 2) **[Figure 40-180-7]**.

Remove the pivot pin (Item 2) **[Figure 40-180-7]**.

Figure 40-180-8



Lift the boom from the swing frame **[Figure 40-180-8]**.

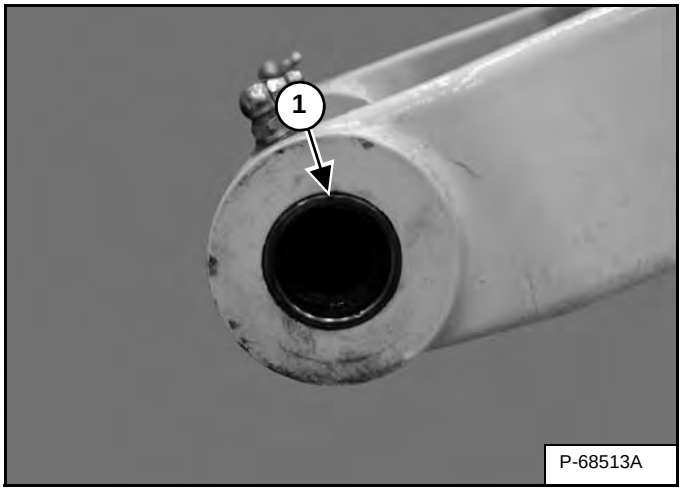
Installation: Feed the two arm cylinder hoses and the two auxiliary hoses (Item 1) through the inside of the boom and to the base pivot of the arm cylinder. Continue feeding the two bucket cylinder hoses (Item 2) and the boom cylinder hoses (Item 3) through the end of the boom (Item 4) **[Figure 40-180-8]**.

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Boom Bushing Removal And Installation

Remove the boom. (See Removal And Installation on Page 40-180-1.)

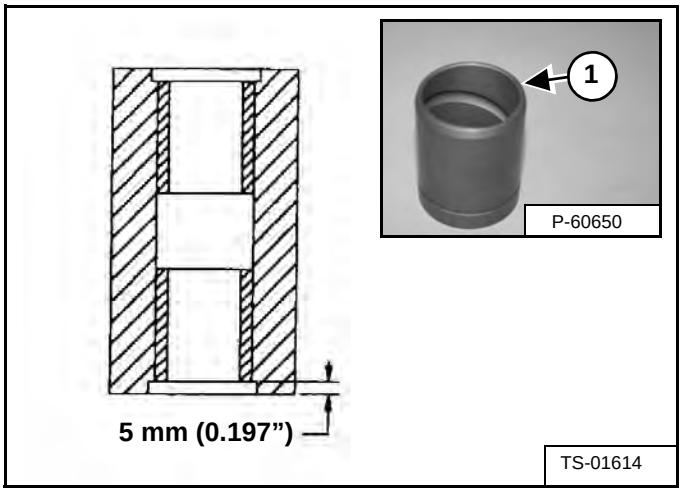
Figure 40-180-9



Remove the bushings (Item 1) **[Figure 40-180-9]** from both sides of the boom.

Install the new bushings in the boom.

Figure 40-180-10



Install the bushings until they are seated 5 mm (0.197 in) in the pin boss **[Figure 40-180-10]**.

NOTE: Install the new bushings with the tapered end first (Item 1) [Figure 40-180-10].

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ARM

Description

The arm is the section that is connected to the end of the boom section and the bucket link. The excavator comes with a standard length but has an optional long arm.

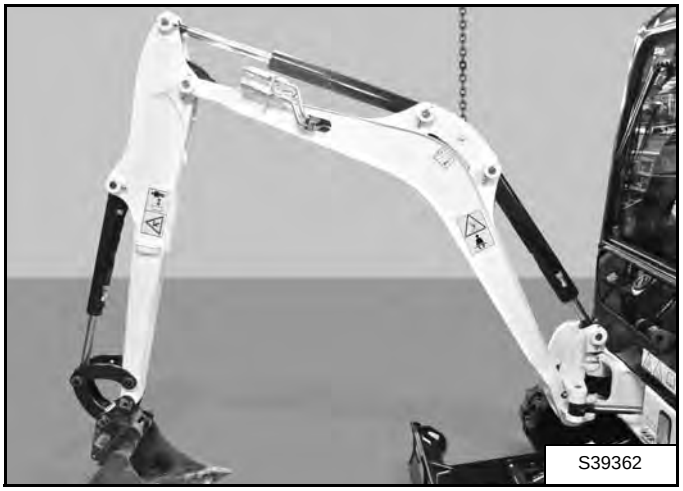
Removal And Installation

IMPORTANT

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

I-2003-0888

Figure 40-190-1

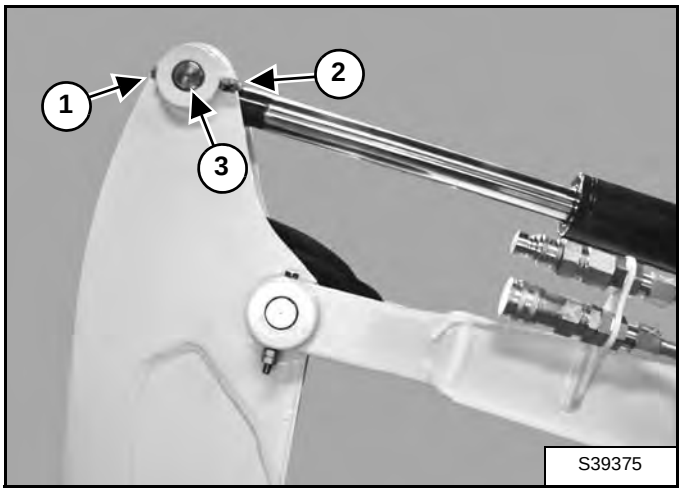


Support the boom with a chain hoist **[Figure 40-190-1]**.

Remove the bucket. (See Removal And Installation on Page 40-200-1.)

Remove the bucket cylinder. (See Removal And Installation on Page 20-23-2.)

Figure 40-190-2

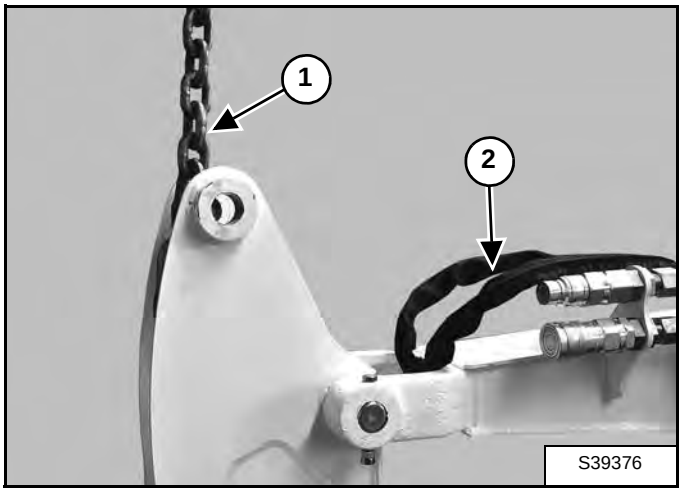


Remove the bolt (Item 1) and nuts (Item 2) **[Figure 40-190-2]** from the rod end pivot pin.

Remove the pivot pin (Item 3) **[Figure 40-190-2]**.

Remove the rod end of the cylinder from the arm.

Figure 40-190-3



Install a chain (Item 1) **[Figure 40-190-3]** to support the arm.

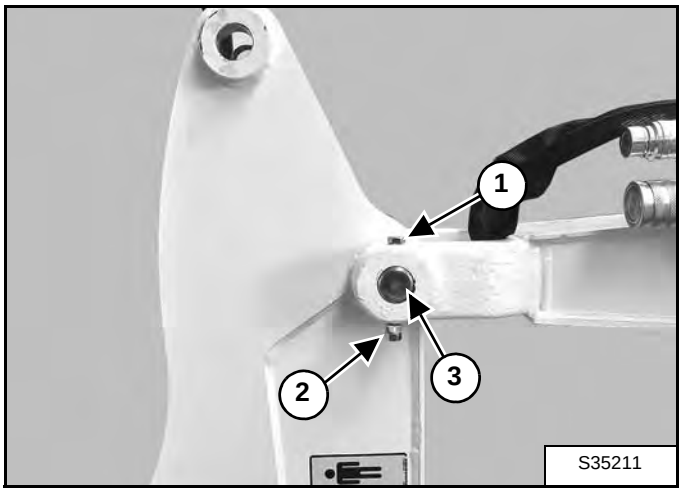
Move the bucket cylinder hoses (Item 2) **[Figure 40-190-3]** away from the arm.

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ARM (CONT'D)

Removal And Installation (Cont'd)

Figure 40-190-4



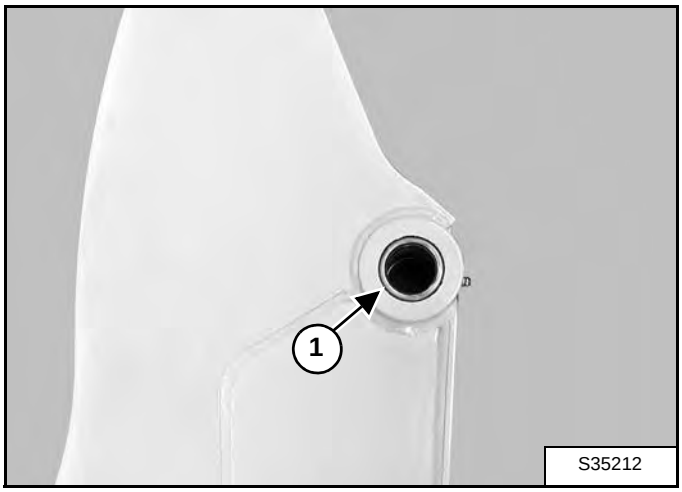
Remove the bolt (Item 1) and nuts (Item 2) **[Figure 40-190-4]** from the arm pivot pin.

Remove the pivot pin (Item 3) **[Figure 40-190-4]**.

Remove the arm.

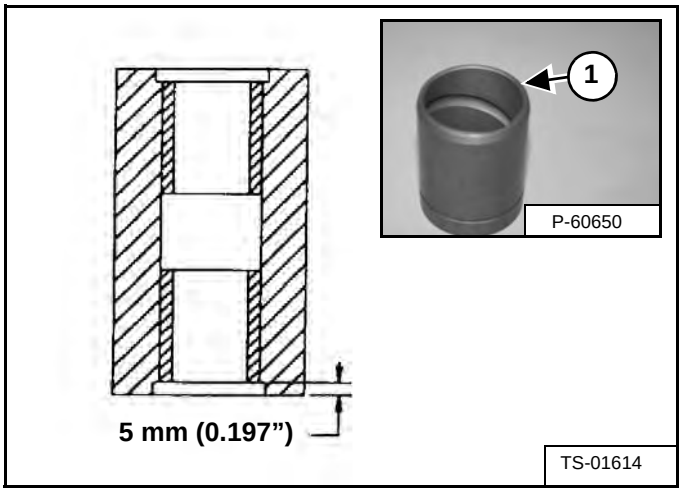
Arm To Boom Bushing Removal And Installation

Figure 40-190-5



Remove the dust seals and bushings (Item 1) **[Figure 40-190-5]** from both sides of the arm.

Figure 40-190-6



Install the new bushings until they are seated 5 mm (0.197 in) in the pin boss **[Figure 40-190-6]**.

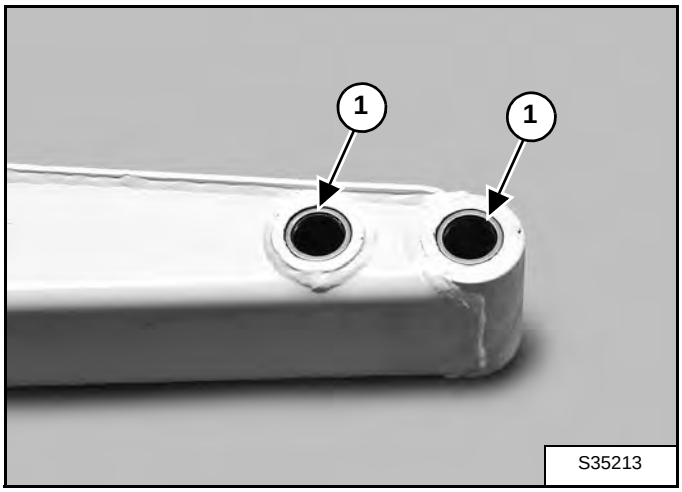
NOTE: Install the new bushings with the tapered end first (Item 1) [Figure 40-190-6].

Install new dust seals with the lip facing out.

Dealer Copy -- Not for Resale

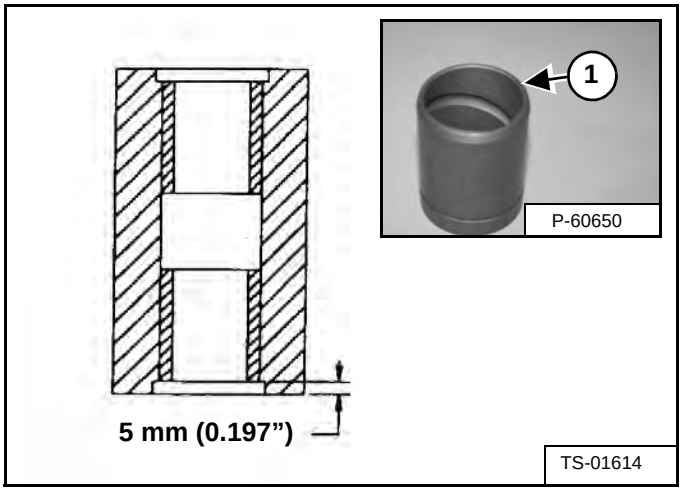
Arm To Bucket And Bucket Link Bushing Removal And Installation

Figure 40-190-7



Remove the dust seals and bushings (Item 1) **[Figure 40-190-7]** from both sides of the arm.

Figure 40-190-8



Install the bushings until they are seated 5 mm (0.197 in) in the pin boss **[Figure 40-190-8]**.

NOTE: Install the new bushings with the tapered end first (Item 1) [Figure 40-190-8].

Install new dust seals with the lip facing out.

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BUCKET

Removal And Installation

WARNING

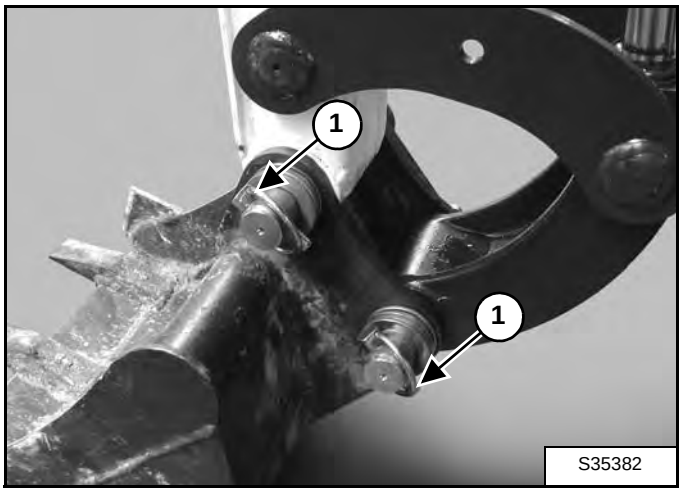
AVOID INJURY OR DEATH

Stop the machine on a firm flat surface. When removing or installing attachments (such as a bucket), always have a second person in the operator's seat, give clear signals and work carefully.

W-2140-0189

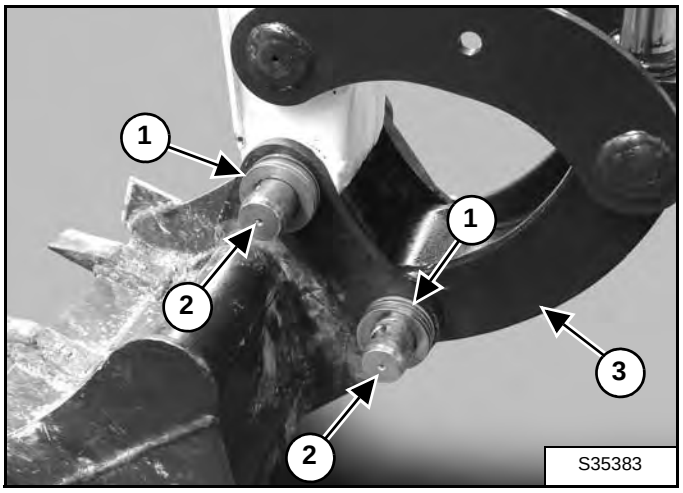
Park the excavator on a flat surface and put the bucket on the ground.

Figure 40-200-1



Remove the fasteners (Item 1) **[Figure 40-200-1]**.

Figure 40-200-2



Remove the washers (Item 1) and the pivot pins (Item 2) **[Figure 40-200-2]**.

Keep the pins clean. Do not damage the dust seals in the arm when removing the bucket.

Install the arm into the bucket, align the hole, install the pivot pin (Item 2) and washer (Item 1) **[Figure 40-200-2]**.

Install the link (Item 3) into the bucket, align the hole, install the pivot pin and washer (Item 2) **[Figure 40-200-2]**.

Install the fasteners (Item 1) **[Figure 40-200-1]**. Add grease to the pivot.

WARNING

AVOID INJURY OR DEATH

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

W-2052-0907

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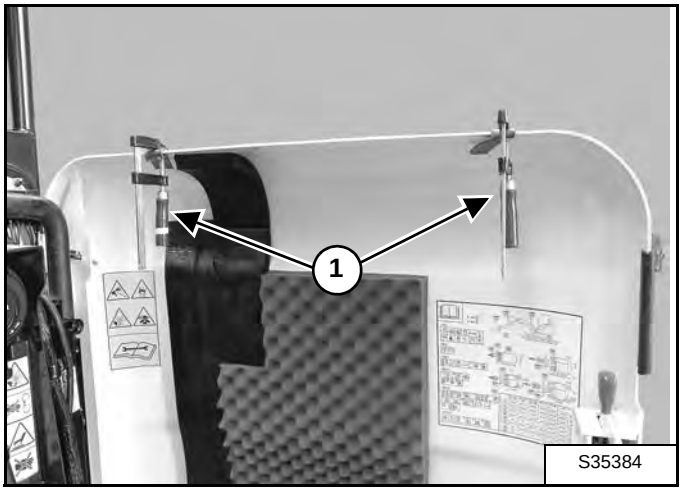
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TAILGATE

Removal And Installation

Open the tailgate. (See TAILGATE on Page 10-60-1.)

Figure 40-210-1



Install and tighten two C-clamps (Item 1) **[Figure 40-210-1]** equally spaced from the sides on the top of the tailgate.

NOTE: To prevent paint damage use rubber pads on the C-clamps.

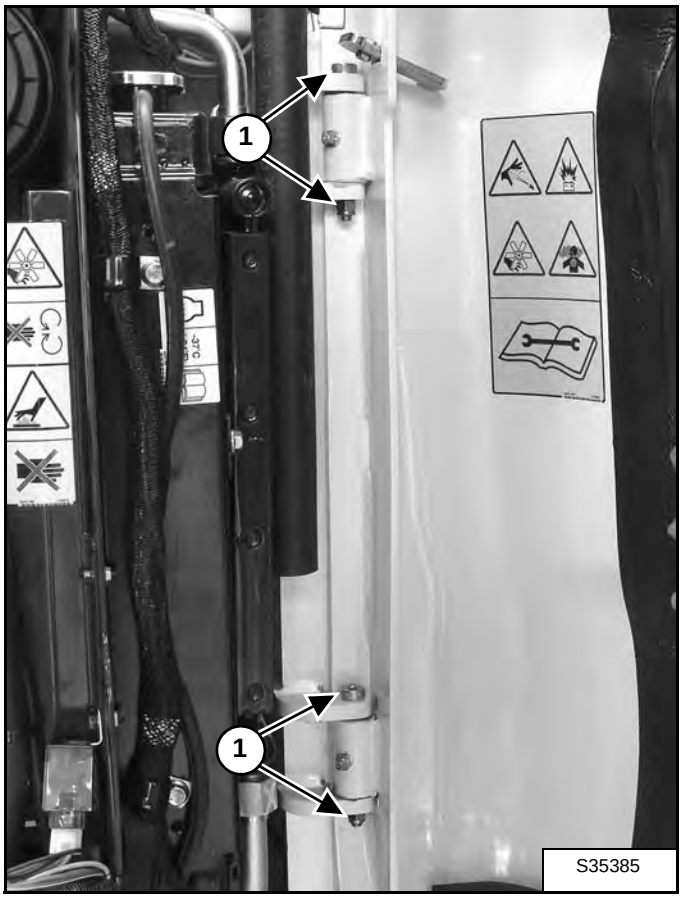
Figure 40-210-2



Install chains to the C-clamps and on the chain hoist **[Figure 40-210-2]**.

NOTE: Use a lifting device of sufficient capacity. Approximate weight of the tailgate is 55 kg (120 lb).

Figure 40-210-3



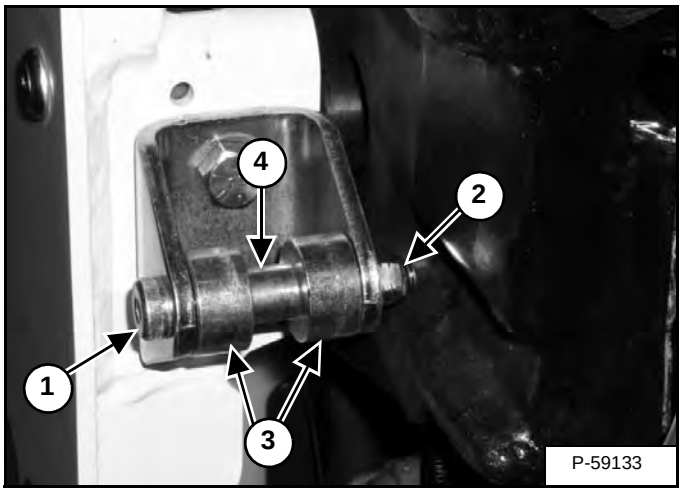
Remove the nuts and bolts (Item 1) **[Figure 40-210-3]** from the hinges.

Remove the tailgate from the excavator.

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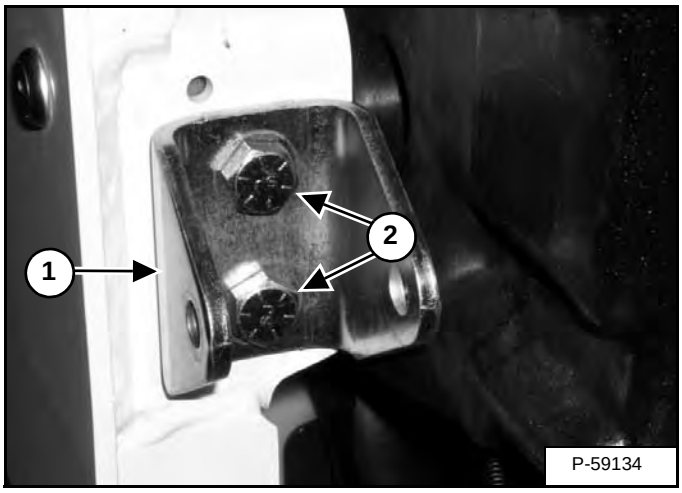
Latch Removal And Installation

Figure 40-210-4



Remove the bolt (Item 1), nut (Item 2), outer rollers (Item 3) and inner roller (Item 4) **[Figure 40-210-4]**.

Figure 40-210-5



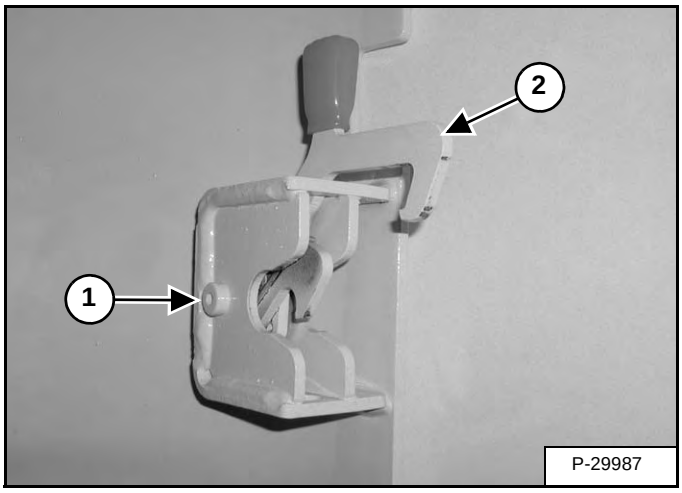
For ease of assembly, mark around the outside edge (Item 1) **[Figure 40-210-5]** of the latch bracket.

Remove the two bolts (Item 2) **[Figure 40-210-5]**, washer and nuts.

See latch adjustment. (See Adjusting The Latch on Page 10-60-1.)

Remove the bracket (Item 1) **[Figure 40-210-5]**.

Figure 40-210-6



Remove the bolt (Item 1). Remove the latch assembly (Item 2) **[Figure 40-210-6]** from the tailgate.

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WIRING SCHEMATIC

E16 (S/N AHLL11001 AND ABOVE)
(PRINTED SEPTEMBER 2012)
V-1368

ENGINE OIL PRESSURE LAMP
ENGINE WATER TEMERATURE LAMP
ALTERNATOR LAMP
SYSTEM WARNING BUZZER
TIMER
DIODE
GLOW PLUG LAMP
EXPANDABLE UNDERCARRIAGE SWITCH (OPTIONAL)
AUXILIARY POWER SOCKET
RIGHT HAND CONSOLE
HARNESS 7135651
GLOW PLUG
OFF
RUN
START
IGNITION SWITCH
HEATER GRD 2340
BOOM LIGHT GRD 2280
TWO SPD MODULE GRD 2260
EXP UNDERCARRIAGE SOL GRD 2200
TWO SPEED INDICATOR GRD 2270
WASHER GRD 2190
POWER PLUG GRD 2180
GLOW PLUG LIGHT GRD 2170
TIMER GRD 2160
HORN GRD 2210
HOUSE LIGHT GRD 2220
2 SPD RELAY GRD 2140
2000 RIGHT CONSOLE
HARNESS 7188467
TRAVEL SWITCH
TRAVEL SWITCH
(SWITCHES ON CONTROL VALVE)
HOUSE LIGHT
C169
LIGHT SWITCH
BOOM LIGHT
C167
BOOM LIGHT (OPTIONAL)
HARNESS 7135895
C168
TWO SPEED RELAY
TWO SPEED INDICATOR
TWO SPEED MODULE
OUT
SW
GND
PWR
HEATER
TWO SPEED SWITCH
RIGHT CONSOLE LOCKOUT SWITCH
(THIS SWITCH ONLY USED ON MODELS WITH ROPS CANOPY)
C164
HOURMETER
HORN
WASHER
C408
CAB
HARNESS 7112902
(IF EQUIPPED)
REAR CAB GRD 2950
CAB GRD 2190
WASHER GRD 2820
2960 WIPER GRD
C609
C410
C409
C608
C610
C166
C151
C152
C153
C154
ENGINE
HARNESS 7105065
SWITCHED ACCESSORY
20A
RESTRAINT
10A
15A
CAB
IGNITION SWITCH
NON-SWITCHED POWER
15A
NON-SWITCHED TIMER
FUSE BLOCK
FUSE 1 - 10A
FUSE 5 - 15A
FUSE 4 - 15A
FUSE 3 - 20A
FUSE 6 - 15A
FUSE 2 - 20A
FUSE 7 - 15A
C151-A
C152-A
LIGHTS RELAY
KEYLESS HARNESS
(IF EQUIPPED)
HARNESS 7128577
C151-B
C152-B
C171
C174
C172
C173
BEACON
DOME LIGHT
WIPER SWITCH
PARK
WIPER
WASHER
WIPER MOTOR
WIPER HARNESS 7100772
LEFT HAND WORK LIGHTS (OPTIONAL)
RIGHT HAND WORK LIGHTS (OPTIONAL)
LIGHT GRD 2860
BEACON GRD 2870
DOME LIGHT GRD 2880
2950 CAB GRD
2975 RADIO GRD
RADIO C220
LH SPEAKER
RH SPEAKER
CAB AND WIPER WIRING (IF EQUIPPED)
HARNESS 7102834
LEFT HAND CONSOLE
HARNESS 7105067
HORN SWITCH
LEFT CONSOLE LOCKOUT SWITCH
C175
CONSOLE DOWN INDICATOR
FUEL GAUGE
FUEL GAUGE BACKLIGHT
BACKLIGHT GRD 2130
FUEL GAUGE GRD 2140
2080 LEFT CONSOLE GRD
ENGINE COOLANT TEMPERATURE SWITCH
EXPANDABLE UNDERCARRIAGE SOLENOID (OPTIONAL)
FOR OPTIONS
C163
20A FUSED ACCESSORY
OIL PRESSURE SWITCH
SWITCHED POWER RELAY
STOP TIMER MODULE
FUEL SOLENOID
GLOW PLUGS
MOTION ALARM (IF EQUIPPED)
HARNESS 7122059
TO RIGHT TRAVEL SWITCH
C124-A
C155
20A SWITCHED ACCESSORY
C125-A
ALARM
TO LEFT TRAVEL SWITCH
(TO SWITCHES ON CONTROL VALVE)
MOTION ALARM RELAY
C122-A
TO TWO SPEED
STARTER
PREHEAT RELAY
STARTER RELAY
DIODE
C156
C157
C158
FUEL SENDER HARNESS 6587177
FUEL LEVEL SENSOR
C159
C160
C161
C162
GREEN TIE STRAP
ORANGE TIE STRAP
YELLOW TIE STRAP
CONSOLE (JOYSTICK) LOCKOUT SOLENOID
SYSTEM BY-PASS VALVE SOLENOID
TWO SPEED BOOST SOLENOID
TWO SPEED SOLENOID
ALTERNATOR
BATTERY
FRAME GROUND
STARTER RELAY GRD 2020
GLOW PLUG RELAY GRD 2030
SWITCHED PWR RELAY GRD 2040
FUEL SOLENOID TIMER GRD 2050
SWITCHED ACCESSORY GRD 2120
2010
PB SOLENOID GRD 2110
FUEL SENSOR GRD 2070
RIGHT CONSOLE GRD 2000
LEFT CONSOLE GRD 2080
TWO SPEED SOLENOID GRD 2150
2060
CONSOLE (JOYSTICK) LOCKOUT SOLENOID GRD 2130
SYSTEM BY-PASS VALVE SOLENOID GRD 2140
2100

WIRES CONNECT BY LETTER ACROSS CONNECTORS

SOME CONNECTOR BODIES NOT SHOWN FOR DRAWING CLARITY

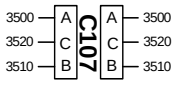
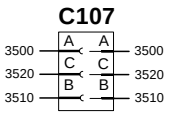
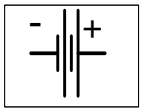
BATTERY FEED 1000-1999 RED, RED/WHT, RNG
GROUND 2000-2999 BLK
MONITORING 3000-3999 LBL
HYDRAULIC 4000-4999 LGN
ATTACHMENT CONTROLS 5000-5999 YEL
LIGHTS 6000-6999 PNK
ACCESSORIES 7000-7999 WHT
ENGINE 8000-8999 TAN
COMMUNICATION 9000-9999 PUR

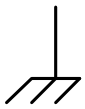
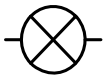
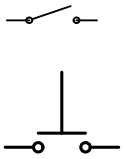
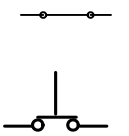
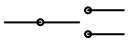
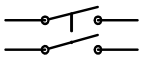
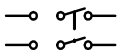
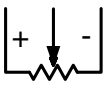
RED = RED
RNG = ORANGE
BLK = BLACK
LBL = LIGHT BLUE
DBL = DARK BLUE
LGN = LIGHT GREEN
DGN = DARK GREEN
YEL = YELLOW
PNK = PINK
WHT = WHITE
BRN = BROWN
TAN = TAN
PUR = PURPLE
GRY = GRAY

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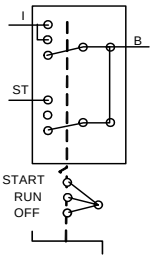
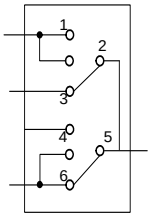
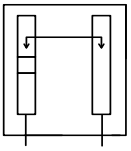
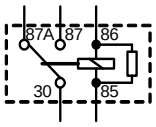
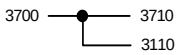
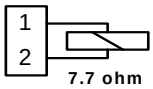
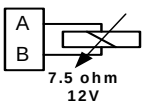
Glossary Of Electrical Symbols

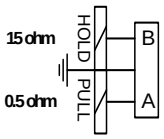
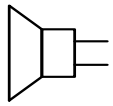
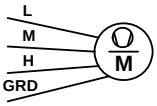
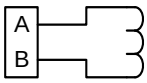
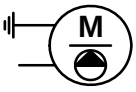
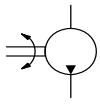
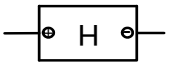
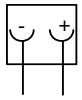
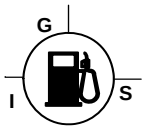
SYMBOL	DESCRIPTION
	CONNECTIONS
	CONNECTOR - Harness - Used for connecting 2 harnesses together or a harness to a component. The connector can vary from a single pin to any number of pins (Example: 3 pin connectors shown). The connector pins can be numbered alphabetical (shown) or numerical (1, 2, 3 etc.). The harness wires numbers are called out next to the connector (Example: 3500).
	The connector number is called out next to the connector (Example: C107). These connector numbers are used for schematic identification only and do not appear on the harness or connector.
	COMPONENTS
	BATTERY - Used for supplying and storing electrical power for the machine.
	POSITIVE ELECTRICAL CIRCUIT - Indicates positive battery circuit.
	NEGATIVE ELECTRICAL CIRCUIT - Indicates battery earth circuit.
	ALTERNATOR - Used to create the electrical current to supply voltage to the battery and components.
	STARTER - Uses battery current to start the machine engine.
	EARTH - Used to represent an external earth connection.

SYMBOL	DESCRIPTION
	COMPONENTS
	EARTH - Frame - Used to represent an component that is internally earthed.
	LIGHT -
	SWITCH - Single Pole - Single Throw (ON-OFF) Normally Open
	SWITCH - Single Pole - Single Throw (ON-OFF) Normally Closed.
	SWITCH - Single Pole - Double Throw (ON-OFF-ON) - This switch can be in any of three positions. (Some switches are spring activated to return them to a certain position when released.)
	SWITCH - Double Pole - Single Throw (ON-OFF) Open and Closed positions will be specified depending on switch application.)
	SWITCH - Double Pole - Double Throw (ON-OFF) Open and Closed positions will be specified depending on switch application.
	POTENTIOMETER - Variable resistance - Provides variable resistance.

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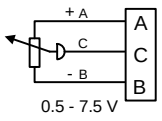
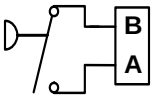
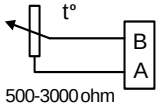
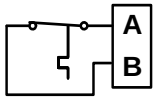
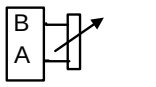
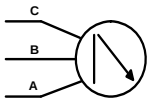
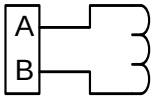
Glossary Of Electrical Symbols (Cont'd)

SYMBOL	DESCRIPTION
	COMPONENTS
	SWITCH - Ignition - Multi position switch to activate various start functions at different positions.
	SWITCH - Light - Multi position switch to activate various lights at different positions.
	ROTARY CONTROL - Provides variable voltage proportional to position.
	RELAY - Uses a low amp switch to control a high amp component.
	FUSE - Used to protect the wire harness from an overloaded circuit. (The fuse rating is listed next to the fuse.)
	SPLICE (•) - Used to show when multiple wires are connected together on the schematic.
	SOLENOID - ON / OFF - Electrically activated coil that controls movement magnetically. (The ohm rating of the solenoid coil is listed next to the component [if available]).
	SOLENOID - VARIABLE - Electrically activated coil that controls movement magnetically. (The ohm rating and voltage of the solenoid coil is listed next to the component [if available]).

SYMBOL	DESCRIPTION
	SOLENOID - Fuel and Traction Lock - Dual solenoids. (The ohm rating of the solenoid coils are listed next to the component [if available]). The pull solenoid is energized for a short time.
	HORN - Audible alarm. Sound is activated manually by a switch to warn personnel.
	BUZZER - Audible alarm. Sounds at a predetermined setting to warn the operator of a component condition.
	RESISTOR - Limits current flow.
	DIODE - Allows electrical current to flow in 1 direction only.
	MOTOR - HVAC - Multi speed motor.
	MOTOR - Wiper - Single or multi speed motor.
	MOTOR - Washer - Single speed.
	PUMP - FUEL
	HOURMETER - Records the time the engine is running.
	POWER PLUG - Supplies 12 volt power for customer supplied accessories.
	GAUGE - Instrument - Indicates certain engine or other component conditions. (The different types of gauge are marked with a icon that represents what function the gauge is monitoring. Example: the gauge shown is for fuel.)

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Glossary Of Electrical Symbols (Cont'd)

SYMBOL	DESCRIPTION
	SENDERS AND SENSORS
	PRESSURE SENDER - Provides a variable voltage proportional to pressure. (Sender voltage rating is listed to show volts at high and low setting.)
	PRESSURE SWITCH - Switch opens or closes at a predetermined pressure to active a function or to turn on a warning light. (Switch is shown in the open position.)
	TEMPERATURE SENDER - Provides a variable resistance (ohm) signal proportional to temperature. (Sender ohm rating is listed to show ohms at high and low setting.)
	TEMPERATURE SWITCH - The switch opens or closes at a predetermined temperature to active a function or to turn on a warning light. (Switch is shown in the closed position.)
	FUEL SENDER - Provides a variable resistance, based on the fuel level in the tank. (Sender ohm rating is listed to show ohms at full and empty setting.)
	HALL EFFECT SENSOR - Detects linear or rotary position and provides a proportional variable voltage.
	SPEED SENSOR - magnetic pickup - detects rpm.

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Troubleshooting

The following troubleshooting chart is provided for assistance in locating and correcting problems which are most common. Many of the recommended procedures must be done by authorized Bobcat Service personnel only.

⚠ WARNING

AVOID INJURY OR DEATH

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

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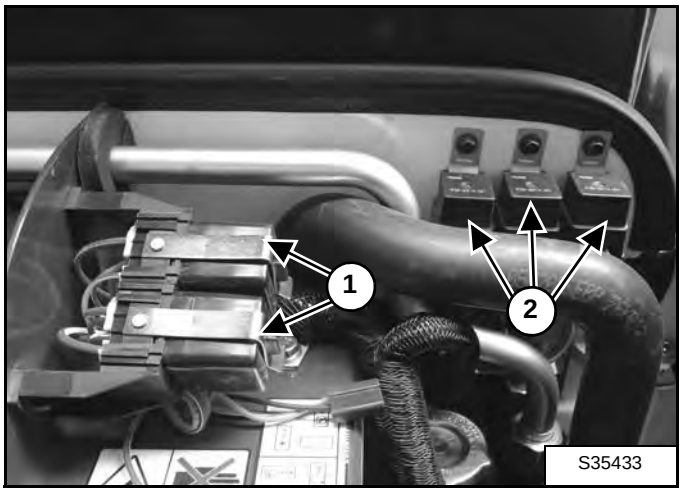
PROBLEM	CAUSE
Battery will not take charge.	1, 2, 3, 4, 5
Alternator will not charge.	1, 2, 5
Starter will not turn engine.	2, 3, 4, 6, 7, 8, 9

KEY TO CORRECT THE CAUSE
1. Engine accessory drive belt is loose or damaged.
2. Battery connections are dirty or loose.
3. Battery is damaged.
4. The earth 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

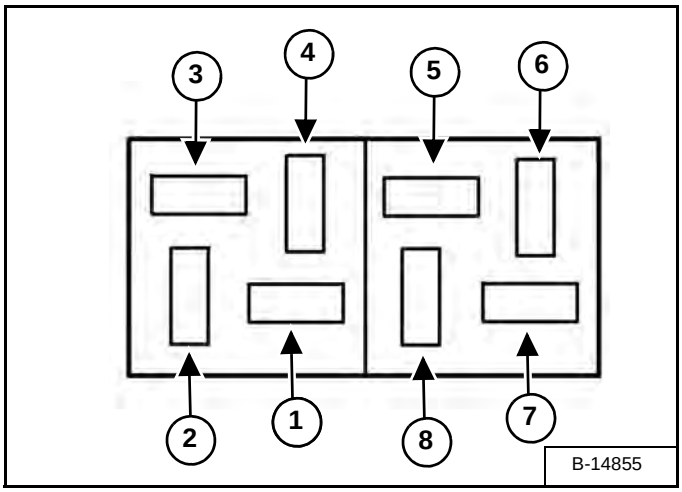
Figure 50-10-1



The excavator has a 12 volt, negative earth electrical system. The electrical system is controlled by fuses and relays located in the right side of the engine compartment (Items 1 and 2) **[Figure 50-10-1]**. The fuses will protect the electrical system when there is an electrical overload. The reason for the overload must be found before starting the engine again.

Fuse And Relay Location / Identification

Figure 50-10-2



1. **Instrument** - 10A (SW) Hourmeter, Warning Buzzer and Fuel Gauge Back Light
2. **Accessory** - 20A (SW) Accessory Connector, Heater and Horn
3. **Start** - 20A (SW) Key Switch, Unswitched Accessory Connector
4. **Cab** - 15A (SW) Cab Power, Lights, Wiper and Dome Light
5. **Power** - 15A (UNSW) Appliance Socket
6. **Timer Power** - 15A (UNSW) Stop Timer Module
7. **Power -** 15A (SW) Stop Timer Module
8. **Open** - Not Used **[Figure 50-10-2]**

Always replace fuses using the same type and capacity.

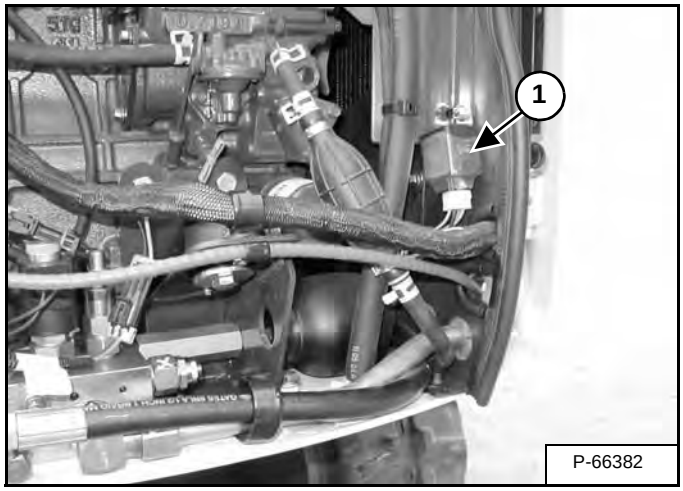
The three electrical relays (Item 2) **[Figure 50-10-1]** are located in the engine compartment to the right of the fuel fill. The three relays control the starter, glow plugs and switched power circuits.

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Fuel Timer And Diode Location / Identification

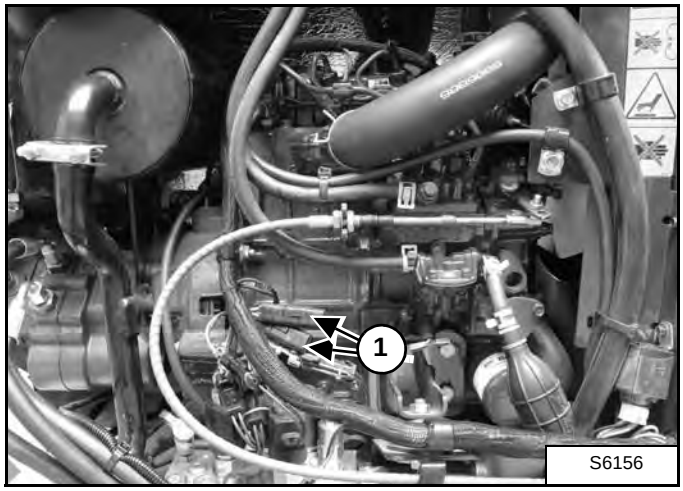
Open the tailgate.

Figure 50-10-3



The fuel shutoff timer (Item 1) **[Figure 50-10-3]** is located on the right side of the engine compartment.

Figure 50-10-4



There are two diodes (Item 1) **[Figure 50-10-4]** in the harness to the left of the intake manifold. They are for alternator feedback protection and the glow plug during start function.

Figure 50-10-5



There are three diodes (Item 1) **[Figure 50-10-5]** in the harness in the right console. They are used for activating the warning buzzer if the engine oil pressure is low or the coolant temperature is high.

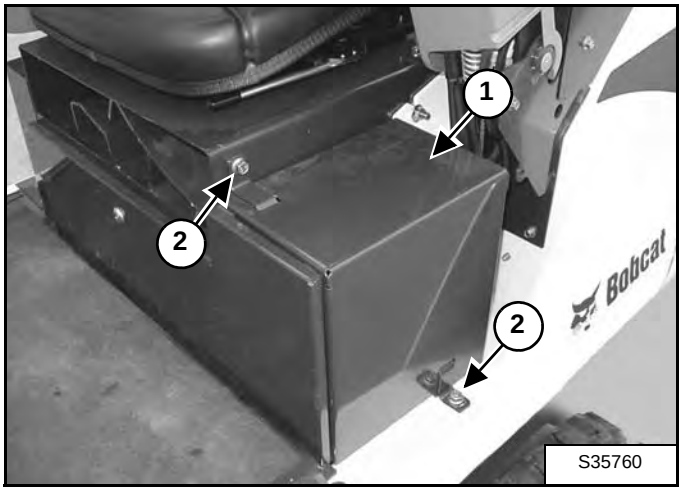
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BATTERY

Maintenance

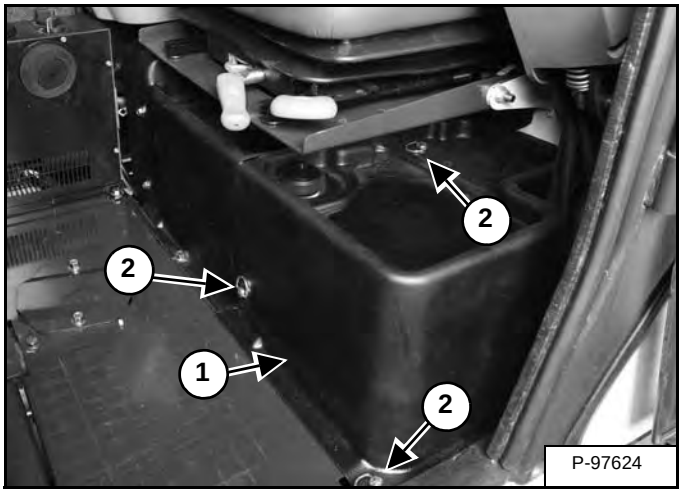
The battery is located under the cover (Item 1) **[Figure 50-20-1]** or **[Figure 50-20-2]** next to the operator's seat.

Figure 50-20-1



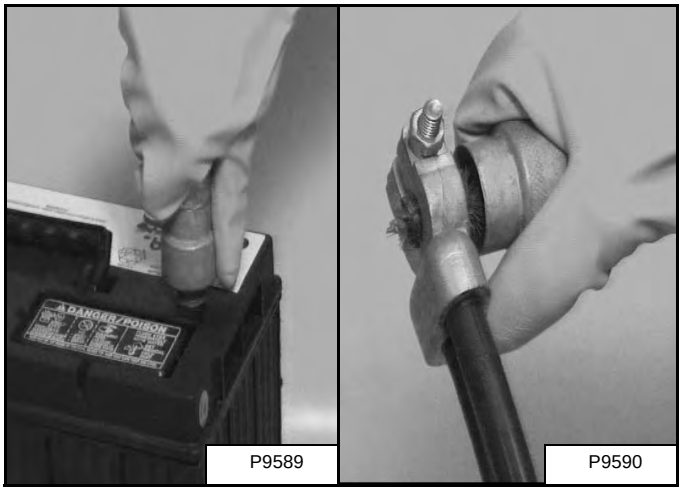
For S/N AHLL11001 - 13119: Remove the two bolts (Item 2) **[Figure 50-20-1]** and brackets to open the cover.

Figure 50-20-2



For S/N AHLL13120 And Above: Turn the three quarter turn fasteners (Item 2) **[Figure 50-20-2]** and remove the cover.

Figure 50-20-3



The battery cables must be clean and tight **[Figure 50-20-3]**. 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.

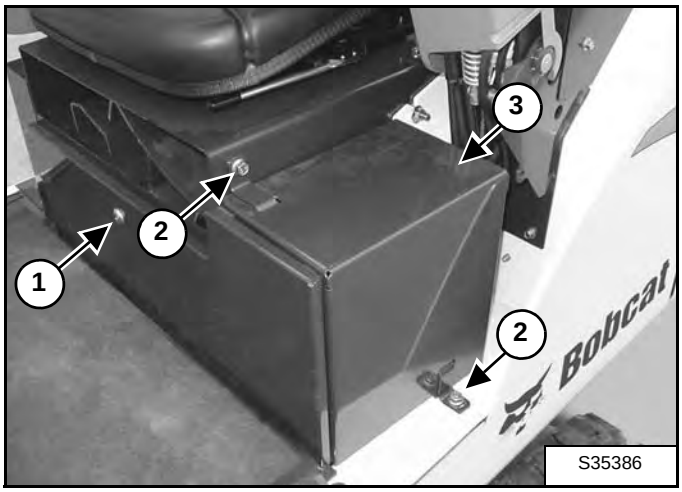
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BATTERY (CONT'D)

Removal And Installation

Figure 50-20-4

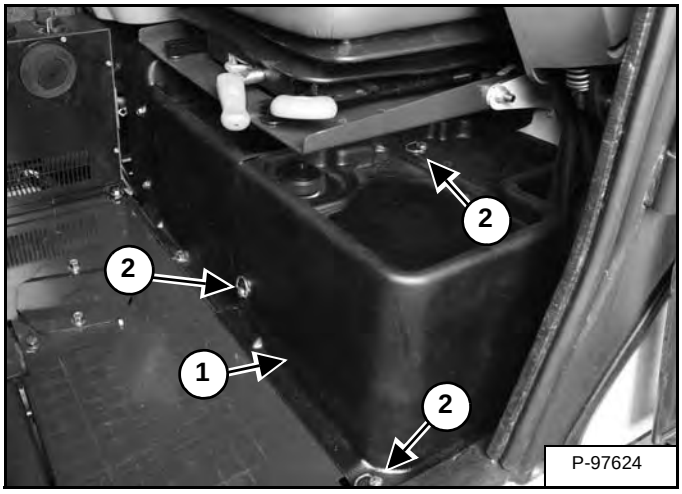


For S/N AHLL11001 - 13119:

Remove the front access cover (Item 1) **[Figure 50-20-4]** using the start key.

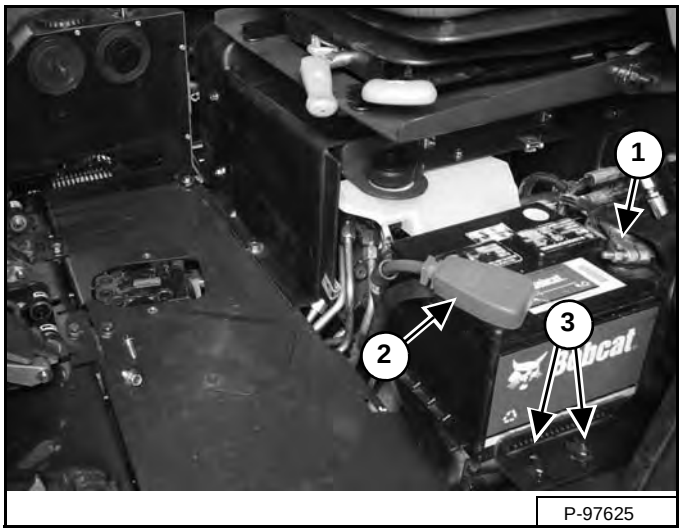
Remove the two bolts (Item 2) and brackets and remove the battery cover (Item 3) **[Figure 50-20-4]**.

Figure 50-20-5



For S/N AHLL13120 And Above: Turn the three quarter turn fasteners (Item 2) **[Figure 50-20-5]** and remove the cover.

Figure 50-20-6



Disconnect the negative (-) cable (Item 1) **[Figure 50-20-6]** first.

Disconnect the positive (+) cable (Item 2) **[Figure 50-20-6]**.

Remove the two bolts (Item 3) **[Figure 50-20-6]** from the holddown clamp and remove the clamp.

Remove the battery.

Always clean the terminals and the cable ends, even when installing a new battery.

Install the battery. Install the holddown clamp and tighten the bolts.

Connect the battery cables. Connect the negative (-) cable (Item 1) **[Figure 50-20-6]** last to prevent sparks.

⚠ WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

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Using A Booster Battery (Jump Starting)

IMPORTANT

If jump starting the excavator from a second machine:

When jump starting the excavator from a battery installed in a second machine, make sure the engine is NOT running while using the glow plugs. High voltage spikes from a running machine can burn out the glow plugs.

I-2060-0906

If it is necessary to use a booster battery to start the engine. BE CAREFUL! There must be one person in the operator's seat and one person to connect and disconnect the battery cables.

Engage the upperstructure slew lock. (See UPPERSTRUCTURE SLEW LOCK on Page 10-20-1.) Be sure the key switch is OFF. The booster battery must be 12 volt.

Figure 50-20-7

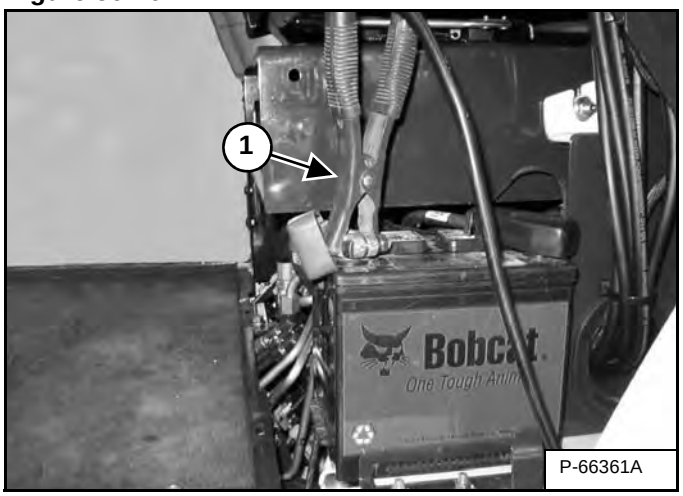
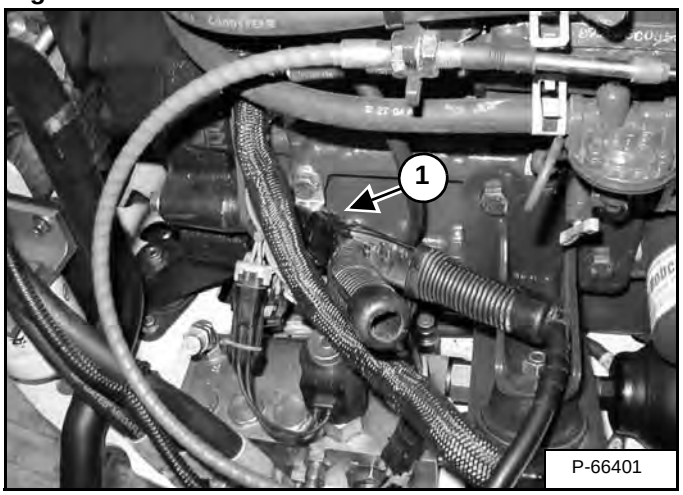


Figure 50-20-8



Open the tailgate. (See TAILGATE on Page 10-60-1.)

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 50-20-7]** of the excavator starter.

Connect one end of the second cable to the negative (-) terminal of the booster battery. Connect the other end of the same cable to the starter mounting bolt (Item 1) **[Figure 50-20-8]**.

Start the engine. After the engine has started, remove the ground (-) cable first (Item 1) **[Figure 50-20-8]**.

Disconnect the cable from the excavator starter (Item 1) **[Figure 50-20-7]**.

NOTE: For cold temperature starting, see the Operation & Maintenance Manual for the correct procedure.

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Using A Booster Battery (Jump Starting) (Cont'd)

IMPORTANT

Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the excavator. (Remove both cables from the battery.)**
- **Extra battery cables (booster cables) are connected wrong.**

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⚠ WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

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ALTERNATOR

Description

Figure 50-30-1

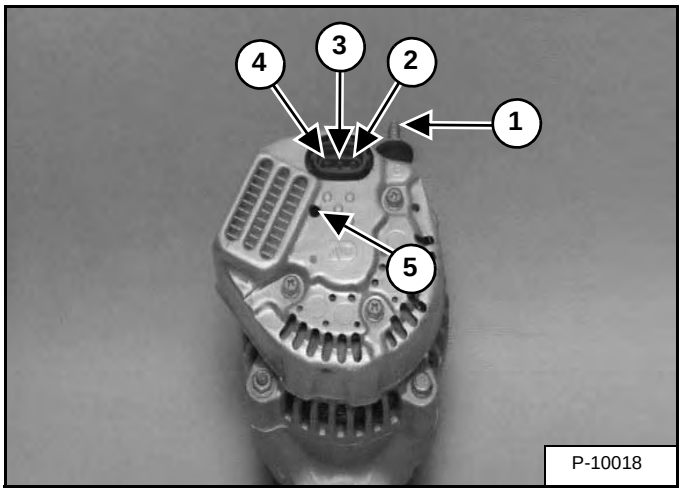
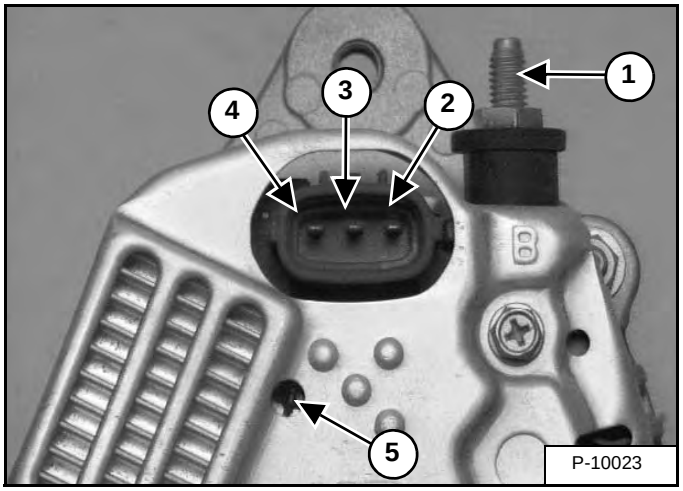


Figure 50-30-2



The output terminal (Item 1) **[Figure 50-30-1]** and **[Figure 50-30-2]**.

The battery or power sensing terminal (Item 2) **[Figure 50-30-1]** and **[Figure 50-30-2]**.

The ignition terminal (Item 3) **[Figure 50-30-1]** and **[Figure 50-30-2]**.

Open terminal not used in the excavator harness (Item 4) **[Figure 50-30-1]** and **[Figure 50-30-2]**.

Access hole for full field test (Item 5) **[Figure 50-30-1]** and **[Figure 50-30-2]**.

Tests

Perform the following alternator tests in this order:

Alternator Output Test: Tests the alternator and regulator output.

Full Field Test: Tests the maximum amperage output of the alternator.

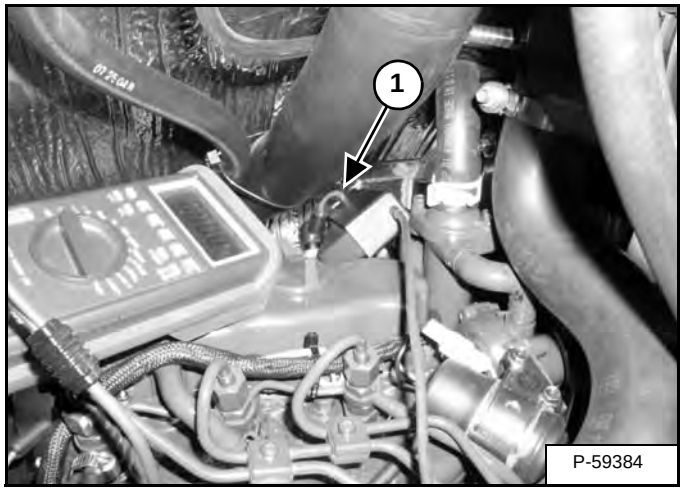
Alternator Regulator Test: Tests the regulator voltage output.

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Alternator Output Test

Check the battery and battery connections. (See Removal And Installation on Page 50-20-2.)

Figure 50-30-3



Use an induction meter and loop around the positive (+) wire (Item 1) **[Figure 50-30-3]** at the alternator.

Start the engine and run at full rpm.

The ammeter reading should be between 35 and 40 amp.

If the ammeter reading is less than 35 amp do the full field test.

⚠ WARNING

AVOID INJURY OR DEATH

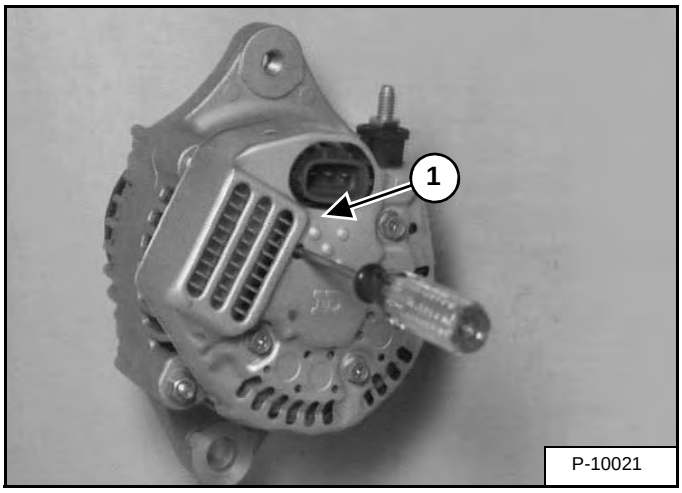
When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

W-2050-0807

Full Field Test

Start the engine and run at full rpm.

Figure 50-30-4



Place a small screw driver in the test port (Item 1) **[Figure 50-30-4]** to provide an earth to the alternator case. This will give maximum amperage output from the alternator.

NOTE: The Full Field Test should only last long enough to get ammeter reading to prevent damage to the alternator.

The ammeter reading should be above 35 amp.

If the ammeter reading is low, repair or replace the alternator.

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2050-0807

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Alternator Regulator Test

Disconnect the fuel stop solenoid connector.

Turn the lights on (if equipped) and crank the engine for 30 seconds to discharge the battery.

Connect the fuel stop solenoid connector.

Start the engine and run at full rpm.

The ammeter reading should be around 35 amp and slowly decrease with alternator output.

If ammeter reading is low or does not decrease with time, replace the alternator's regulator.

Disconnect the negative (-) cable from the battery.

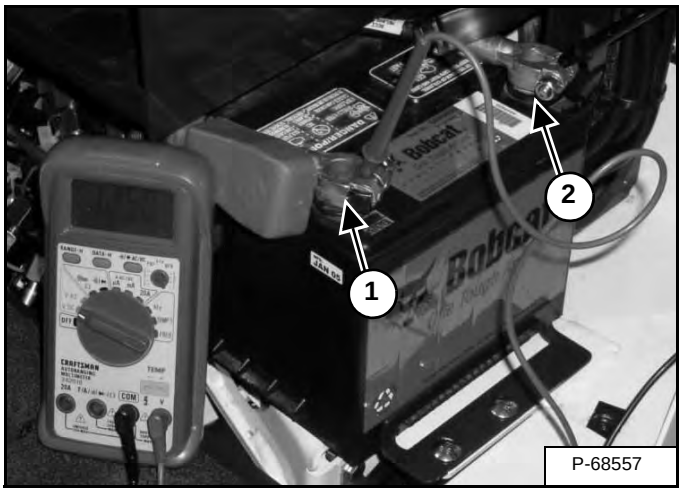
Connect the alternator wires.

Connect the negative (-) cable on the battery.

NOTE: The alternator regulator test can also be run using a voltmeter.

Alternator Regulator Test With Voltmeter

Figure 50-30-5



Connect the positive (+) voltmeter lead to the positive (+) battery terminal (Item 1) **[Figure 50-30-5]**.

Connect the negative (-) voltmeter lead to the negative (-) battery terminal (Item 2) **[Figure 50-30-5]**.

Start the engine and run at full rpm.

The voltmeter should read between 13.9 and 14.7 volt.

If the voltmeter reading is not within this range, replace the alternator's regulator.

IMPORTANT

Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the loader. (Remove both cables from the battery.)**
- **Extra battery cables (booster cables) are connected wrong.**

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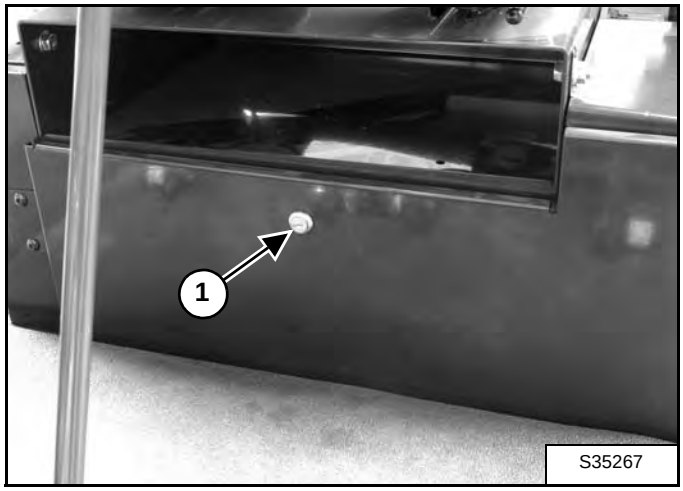
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ALTERNATOR (CONT'D)

Removal And Installation

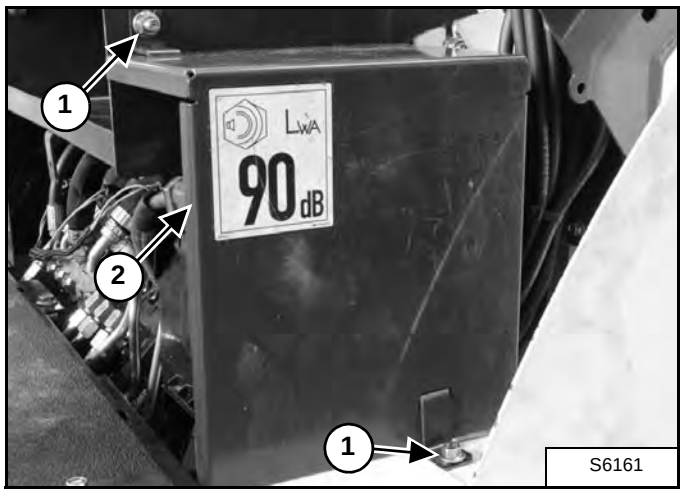
For Model E16 S/N AHLL11001 - 13119:

Figure 50-30-6



Use the start key to remove the access cover (Item 1) **[Figure 50-30-6]**.

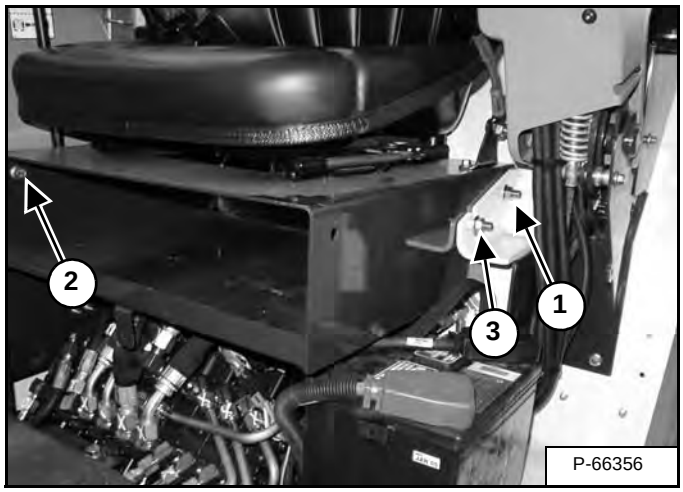
Figure 50-30-7



Remove the two bolts (Item 1) and brackets from the battery cover (Item 2) **[Figure 50-30-7]**.

Remove the cover (Item 2) **[Figure 50-30-7]**.

Figure 50-30-8



Remove the two bolts (Item 1) **[Figure 50-30-8]** and nuts from both sides of the seat mount.

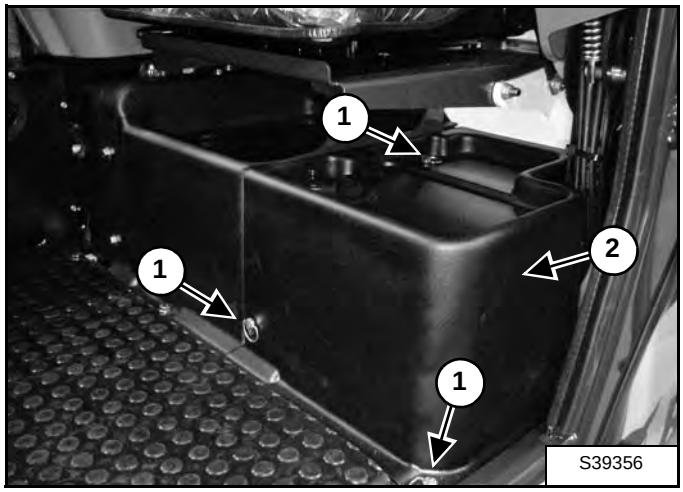
Remove the bolt (Item 2) **[Figure 50-30-8]**, nut and bracket from the right side of the seat mount.

Loosen the two bolts (Item 3) **[Figure 50-30-8]** and nuts from both sides of the seat mount.

Remove the seat and seat mount.

For Model E16 S/N AHLL13120 & Above:

Figure 50-30-9

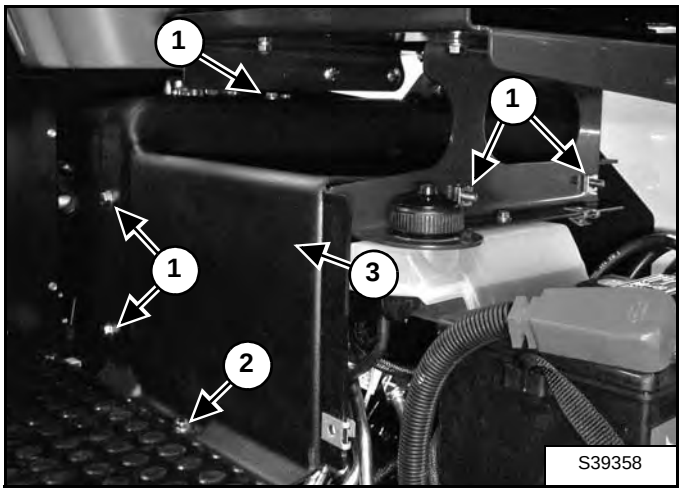


Loosen the three screws (Item 1) and remove the battery cover (Item 2) **[Figure 50-30-9]**.

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Removal And Installation (Cont'd)

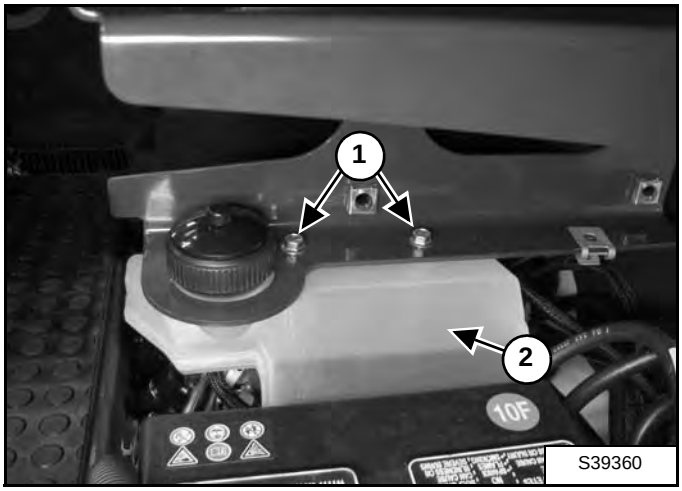
Figure 50-30-10



Remove the six bolts (Item 1 and 2) and remove the access cover (Item 3) **[Figure 50-30-10]**.

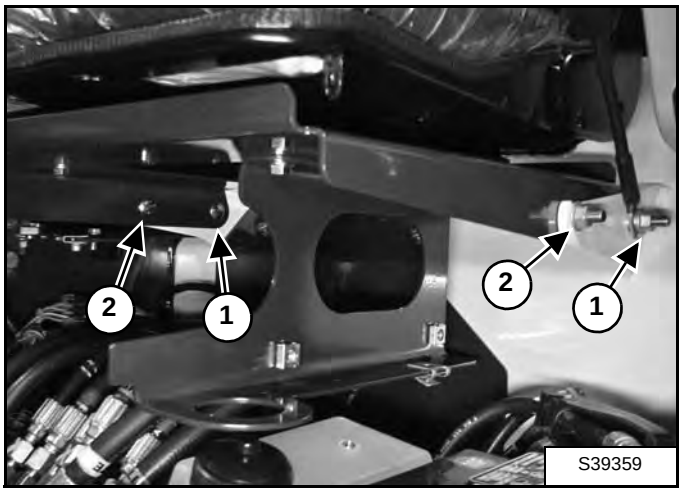
Installation: Tighten bolt (Item 2) **[Figure 50-30-10]** to 8 - 10 N•m (70.8 - 88.5 in-lb) torque.

Figure 50-30-11



Remove the two bolts (Item 1) and lower the windscreen washer bottle (Item 2) **[Figure 50-30-11]**.

Figure 50-30-12



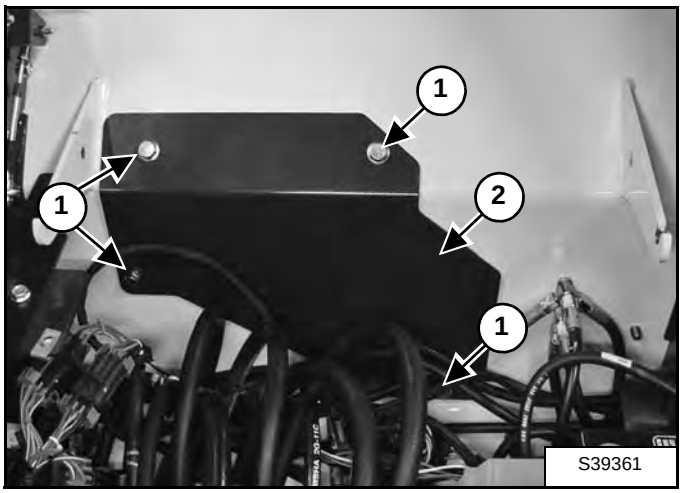
Remove the two bolts (Item 1) **[Figure 50-30-12]** and nuts from both sides of the seat mount.

Loosen the two bolts (Item 2) **[Figure 50-30-12]** and nuts from both sides of the seat mount.

Remove the seat and seat mount.

For All Models:

Figure 50-30-13

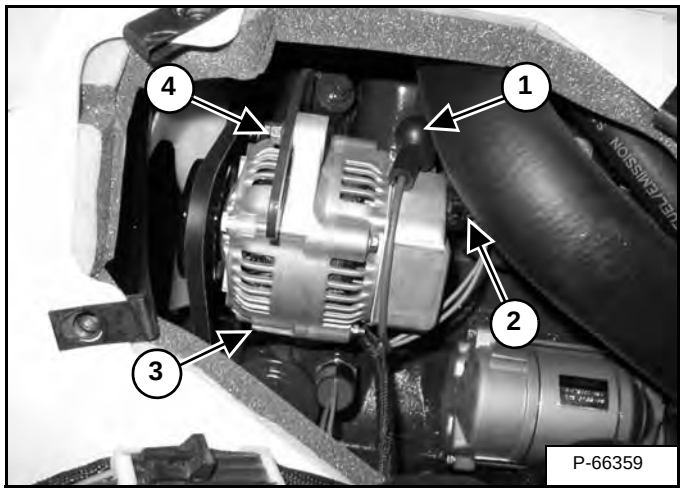


Remove the four bolts (Item 1) and remove the access panel (Item 2) **[Figure 50-30-13]**.

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Removal And Installation (Cont'd)

Figure 50-30-14



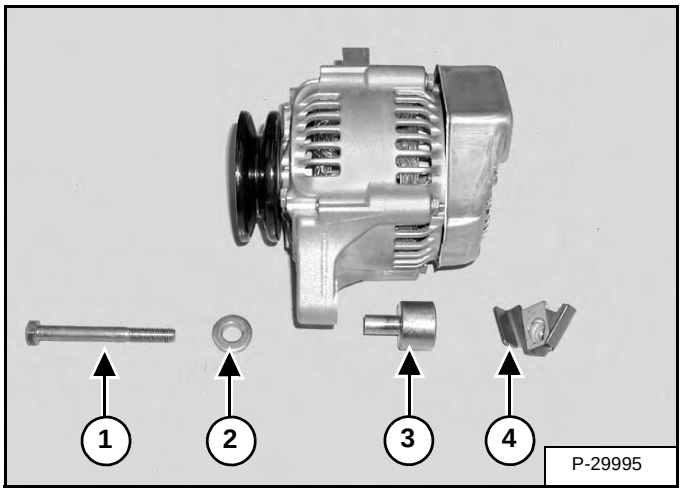
Disconnect the red wire (Item 1) **[Figure 50-30-14]**.

Disconnect the wire harness connector (Item 2) **[Figure 50-30-14]**.

Remove the bottom mount bolt (Item 3) **[Figure 50-30-14]**.

Remove alternator adjustment bolt (Item 4) **[Figure 50-30-14]**.

Figure 50-30-15



NOTE: Alternator will fall if not supported while removing adjustment bolt.

Remove belt from the alternator pulley.

Remove alternator.

NOTE: The lower alternator mounting bolt (Item 1) is assembled with a washer (Item 2), spacer (Item 3) and retaining bracket with nut (Item 4) [Figure 50-30-15] which will fall during disassembly.

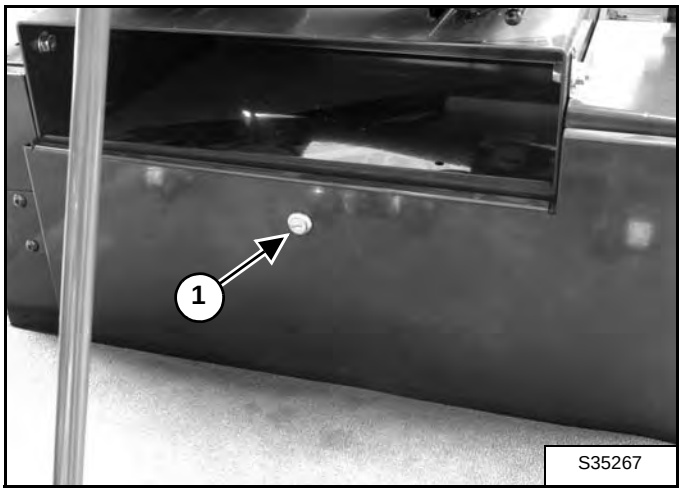
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Belt Adjustment (S/N AHLL11001 - AHLL13119)

Replace the belt if it has stretched or there are cracks in the belt. Replace the pulley if the belt makes contact with the bottom of the groove in the pulley.

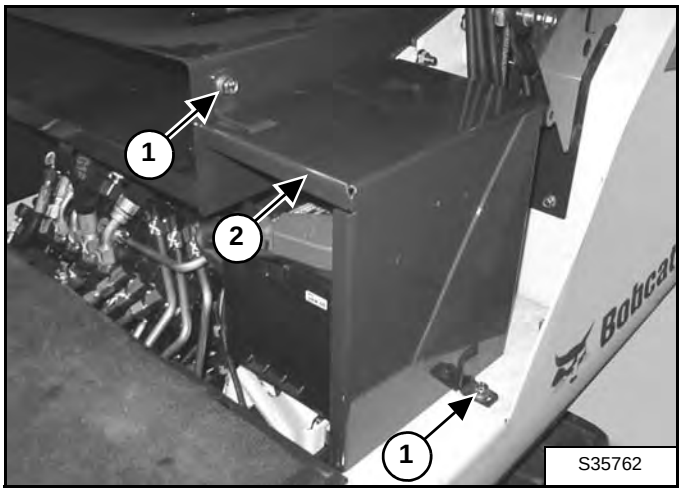
Stop the engine.

Figure 50-30-16



Use the start key to remove the access cover (Item 1) **[Figure 50-30-16]**.

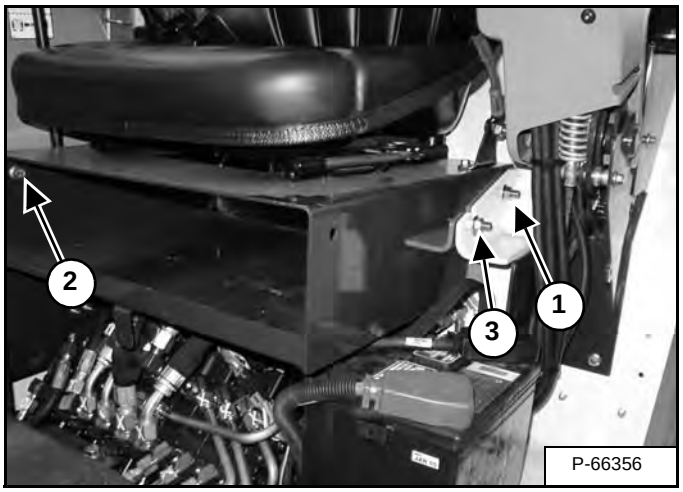
Figure 50-30-17



Remove the two bolts (Item 1) **[Figure 50-30-17]** and brackets from the battery cover.

Remove the cover (Item 2) **[Figure 50-30-17]**.

Figure 50-30-18



Remove the two bolts (Item 1) **[Figure 50-30-18]** and nuts from both sides of the seat mount.

Remove the bolt (Item 2) **[Figure 50-30-18]**, nut and bracket from the right side of the seat mount.

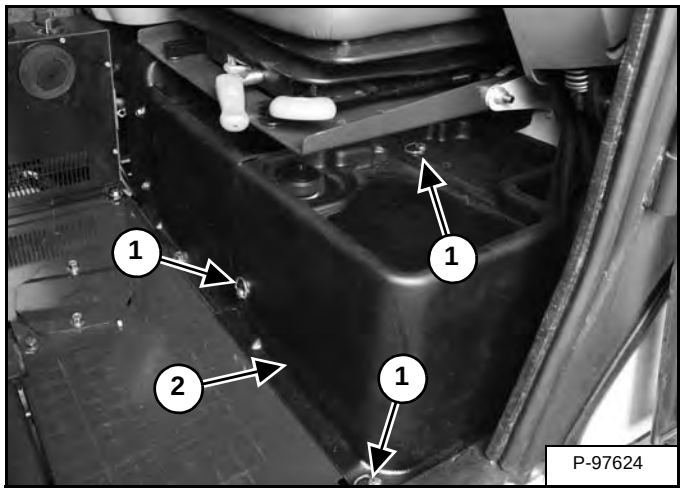
Loosen the two bolts (Item 3) **[Figure 50-30-18]** and nuts from both sides of the seat mount.

Remove the seat and seat mount.

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Belt Adjustment (S/N AHLL13120 & Above)

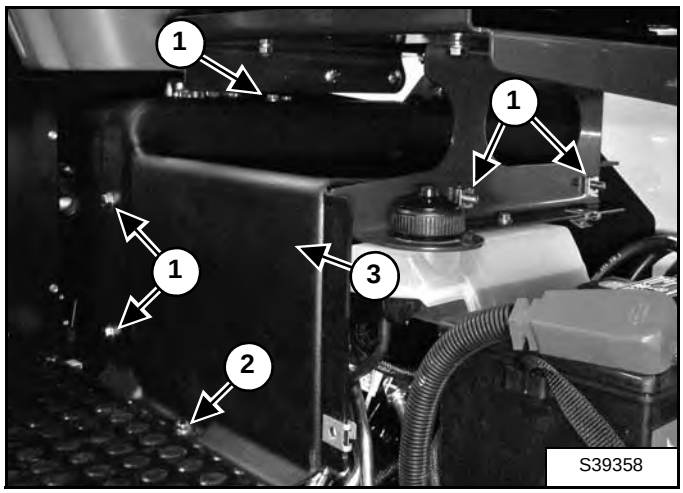
Figure 50-30-19



Turn the three quarter turn fasteners (Item 1) **[Figure 50-30-19]** and remove the battery cover.

Remove the cover (Item 2) **[Figure 50-30-19]**.

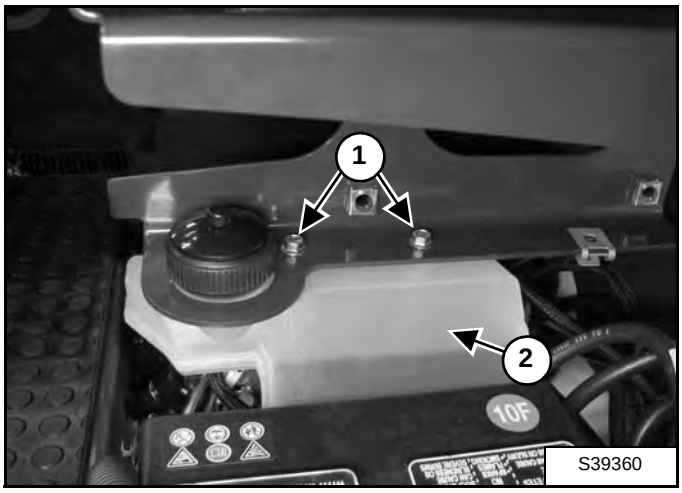
Figure 50-30-20



Remove the six bolts (Item 1 and 2) and remove the access cover (Item 3) **[Figure 50-30-20]**.

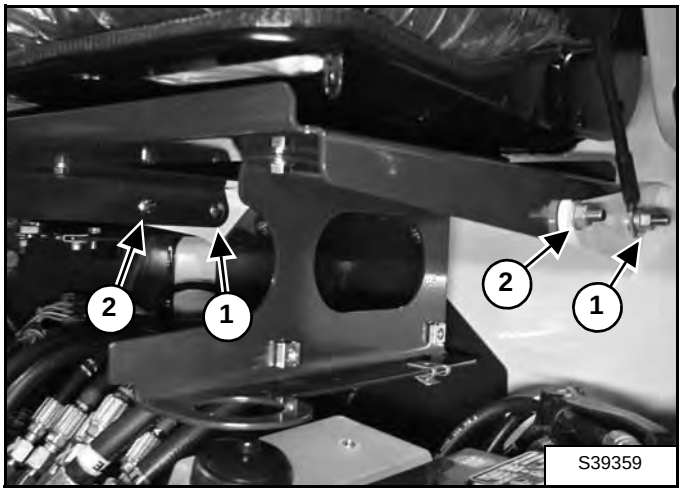
Installation: Tighten bolt (Item 2) **[Figure 50-30-20]** to 8 - 10 N•m (71 - 88 in-lb) torque.

Figure 50-30-21



Remove the two bolts (Item 1) and lower the washer bottle (Item 2) **[Figure 50-30-21]**.

Figure 50-30-22



Remove the two bolts (Item 1) **[Figure 50-30-22]** and nuts from both sides of the seat mount.

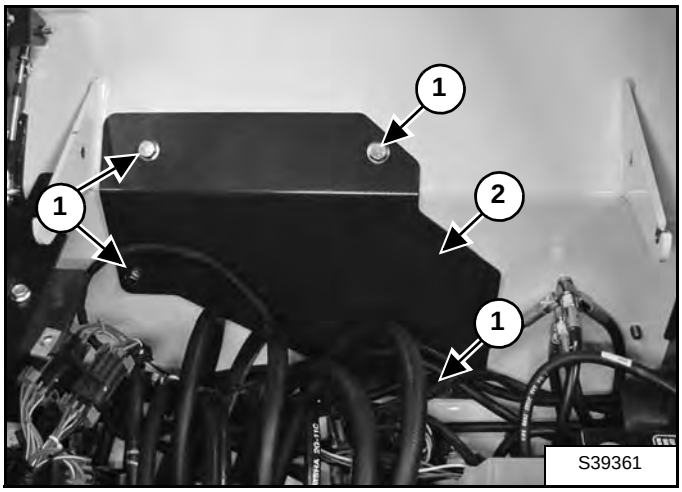
Loosen the two bolts (Item 2) **[Figure 50-30-22]** and nuts from both sides of the seat mount.

Remove the seat and seat mount.

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Belt Adjustment (All Models)

Figure 50-30-23



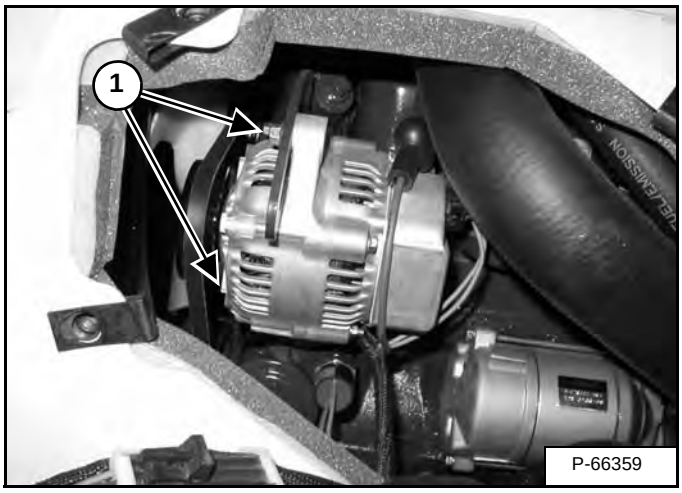
Remove the four bolts (Item 1) and remove the access panel (Item 2) **[Figure 50-30-23]**.

NOTE: There are five bolts (Item 1) [Figure 50-30-23] on later machines (S/N AHLL13120 & Above).

Replace the belt if it has stretched or there are cracks in the belt. Replace the pulley if the belt makes contact with the bottom of the groove in the pulley.

Stop the engine.

Figure 50-30-24



Loosen the alternator mounting and adjustment bolts (Item 1) **[Figure 50-30-24]**.

If a belt tension tool is available, move the alternator toward the front of the machine **[Figure 50-30-24]** until the belt has (New belt = 249 - 267 N [56 - 60 lbf] or Used belt = 213,5 - 231,3 N [48 - 52 lbf]) tension.

If a belt tension tool is not available, move the alternator toward the front of the machine **[Figure 50-30-24]** until the belt has 13 mm (0.50 in) movement at the middle of the belt span with 58 N (13 lbf) of force.

Tighten the mounting and adjustment bolts.

Install the access panel, the seat and seat mount, the battery cover and the access cover.

Belt Replacement

Loosen the alternator mounting and adjustment bolts (Item 1) **[Figure 50-30-24]** and loosen the belt fully.

Remove the belt and install a new belt.

Adjust the belt to the specifications shown above.

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Charging System Inspection

WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

W-2065-0807

WARNING

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

If the charging system malfunctions check the following:

Check the condition and tension of the alternator belt. (See Belt Adjustment (All Models) on Page 50-30-9.) Replace the belt if it is worn or deteriorated.

Inspect the alternator wiring harness and the connectors at the alternator. Harness and connectors must be clean and tight.

Check the fuse for the alternator in the fuse panel. If fuse is burned, find the cause and repair / replace. If fuse is in doubt, remove it and check for continuity.

Check the electrolyte level in the battery. Add distilled water as needed. (Does not apply to maintenance free batteries.)

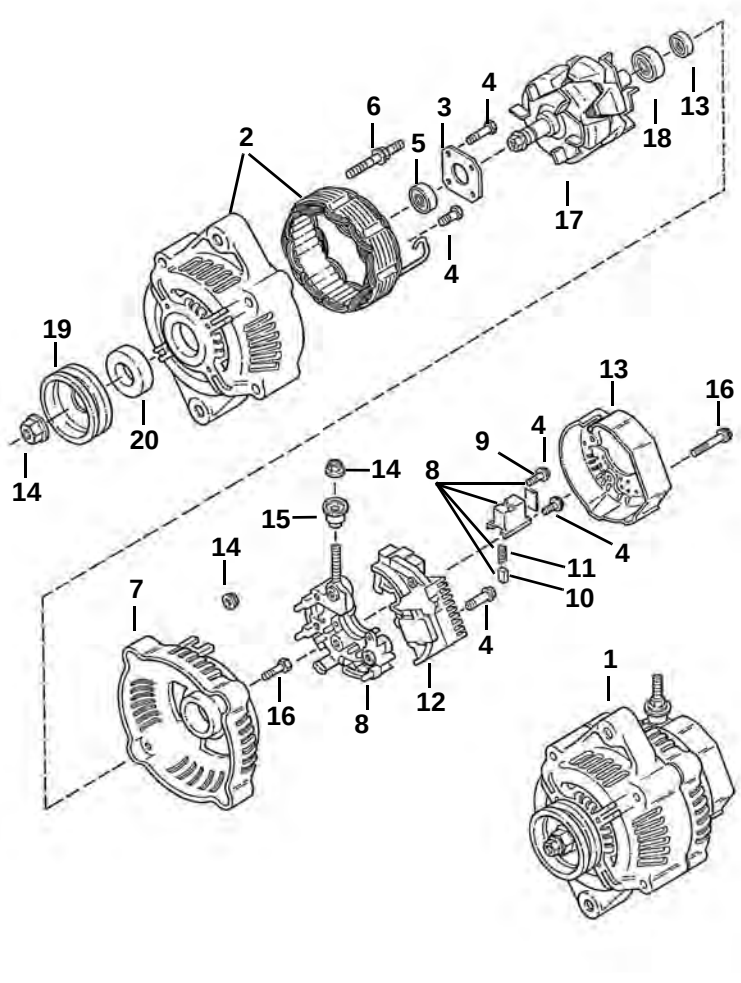
Verify the charge of the battery. Make sure battery is fully charged.

Disconnect the battery cables (negative first, then positive). Inspect the cable clamps and battery posts for corrosion. Remove acid or corrosion from the battery and cables with a sodium bicarbonate and water solution. Put grease on the cable ends and battery terminals to prevent corrosion. Connect the cable to the positive terminal.

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Parts Identification

1. Alternator
2. Frame Assy.
3. Plate
4. Screw
5. Bearing
6. Stud
7. Frame End
8. Holder
9. Seal
10. Brush
11. Spring
12. Regulator
13. Cover
14. Nut
15. Insulator
16. Bolt
17. Rotor Assy.
18. Bearing
19. Pulley
20. Spacer



C-3456

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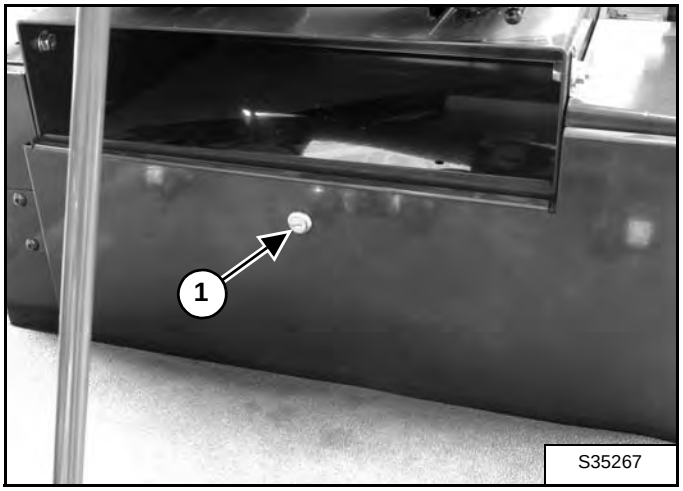
STARTER

Removal And Installation

Stop the engine.

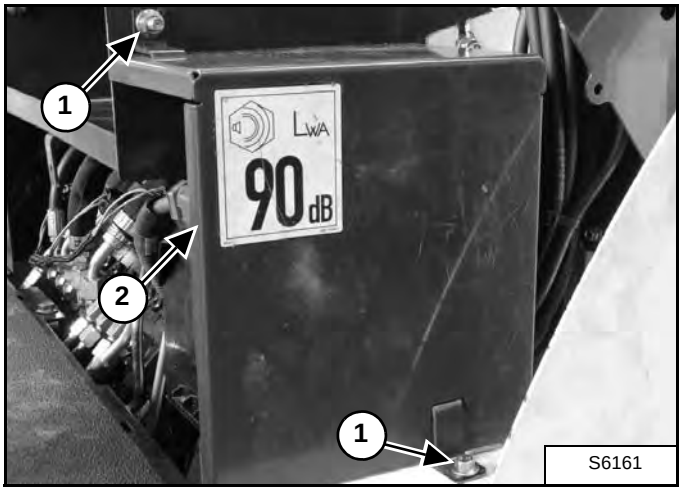
For Model E16 S/N AHLL11001 - 13119:

Figure 50-40-1



Use the start key to remove the access cover (Item 1) **[Figure 50-40-1]**.

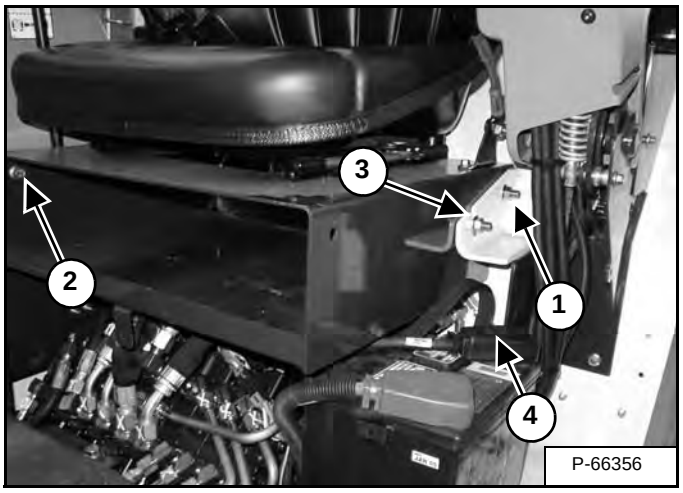
Figure 50-40-2



Remove the two bolts (Item 1) and brackets from the battery cover (Item 2) **[Figure 50-40-2]**.

Remove the cover (Item 2) **[Figure 50-40-2]**.

Figure 50-40-3



Remove the two bolts (Item 1) **[Figure 50-40-3]** and nuts from both sides of the seat mount.

Remove the bolt (Item 2) **[Figure 50-40-3]**, nut and bracket from the right side of the seat mount.

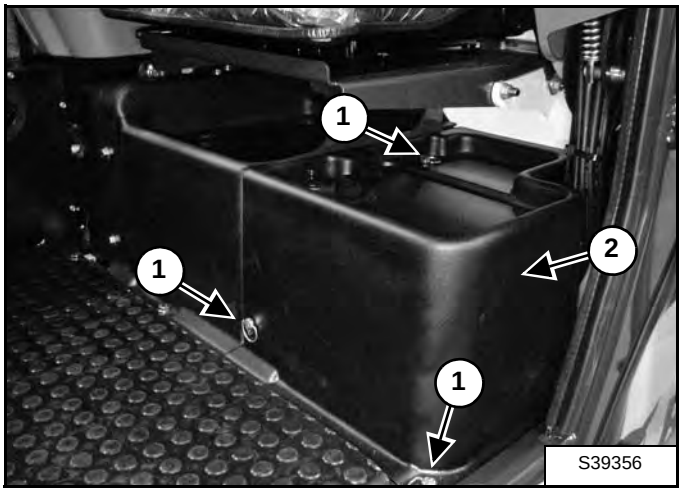
Loosen the two bolts (Item 3) **[Figure 50-40-3]** and nuts from both sides of the seat mount.

Remove the seat and seat mount.

Disconnect the negative (-) cable (Item 4) **[Figure 50-40-3]** from the battery.

For Model E16 S/N AHLL13120 & Above:

Figure 50-40-4

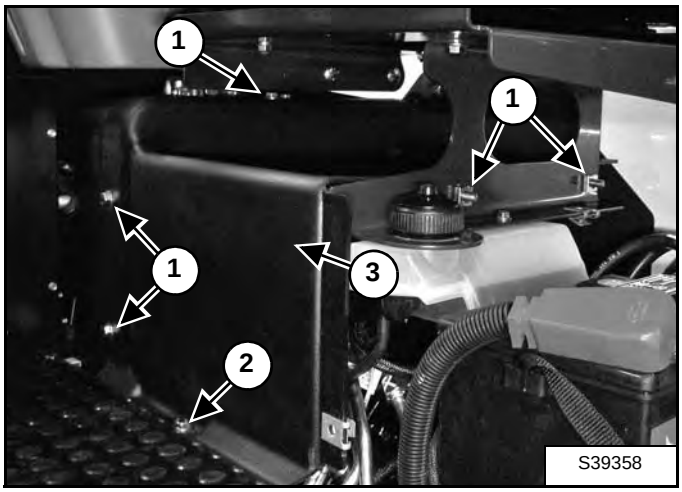


Loosen the three screws (Item 1) and remove the battery cover (Item 2) **[Figure 50-40-4]**.

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Removal And Installation (Cont'd)

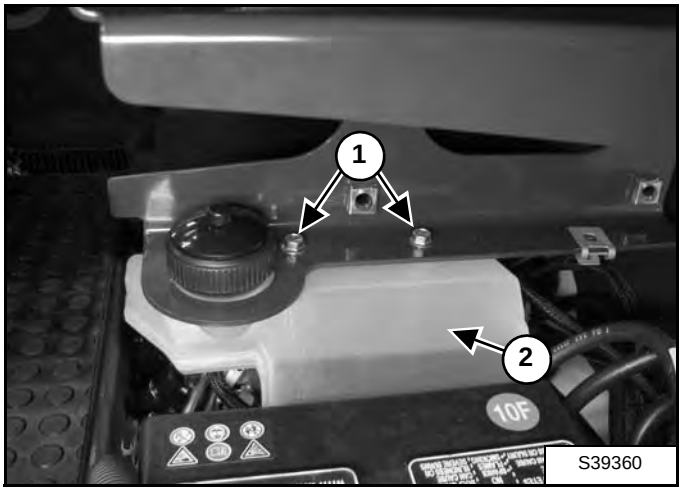
Figure 50-40-5



Remove the six bolts (Item 1 and 2) and remove the access cover (Item 3) **[Figure 50-40-5]**.

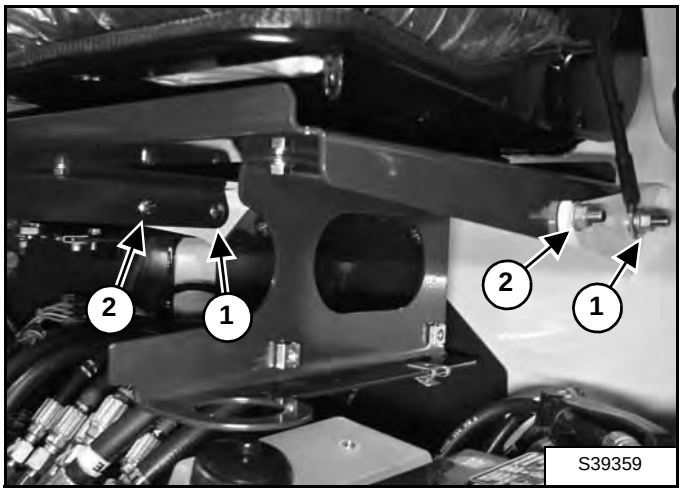
Installation: Tighten bolt (Item 2) **[Figure 50-40-5]** to 8 - 10 N•m (70.8 - 88.5 in-lb) torque.

Figure 50-40-6



Remove the two bolts (Item 1) and lower the windscreen washer bottle (Item 2) **[Figure 50-40-6]**.

Figure 50-40-7

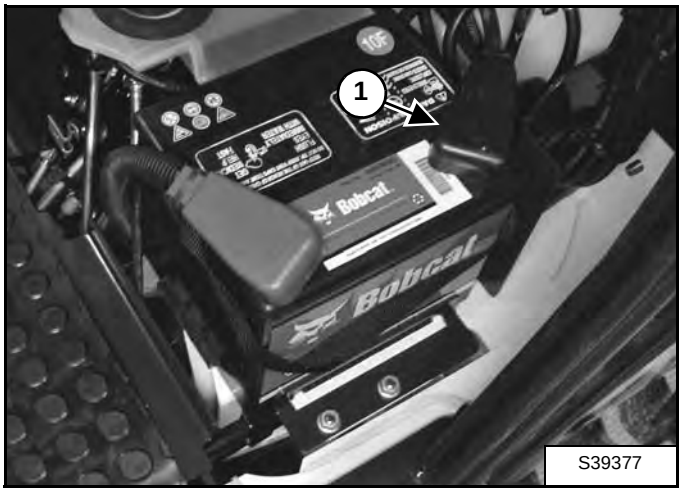


Remove the two bolts (Item 1) **[Figure 50-40-7]** and nuts from both sides of the seat mount.

Loosen the two bolts (Item 2) **[Figure 50-40-7]** and nuts from both sides of the seat mount.

Remove the seat and seat mount.

Figure 50-40-8



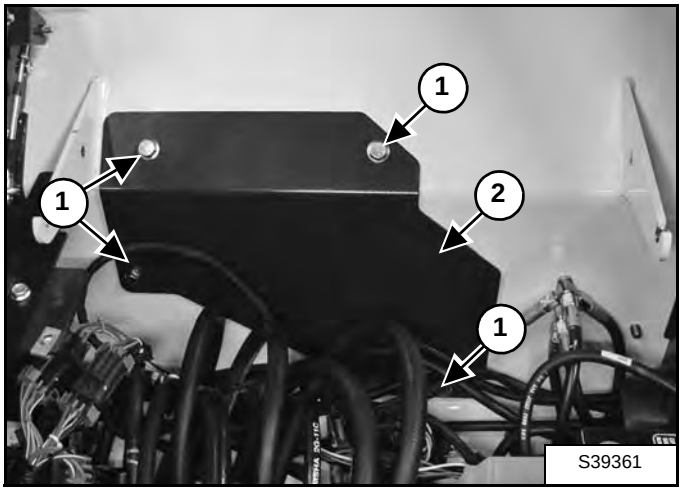
Disconnect the negative (-) cable (Item 1) **[Figure 50-40-8]** from the battery.

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Removal And Installation (Cont'd)

For All Models:

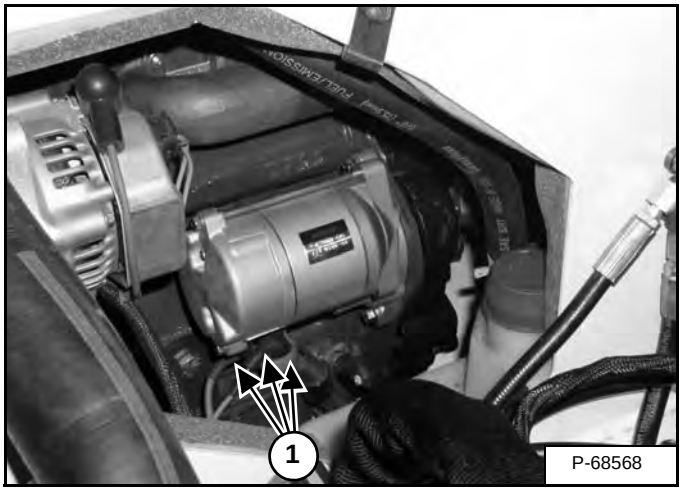
Figure 50-40-9



Remove the four bolts (Item 1) and remove the access panel (Item 2) **[Figure 50-40-9]**.

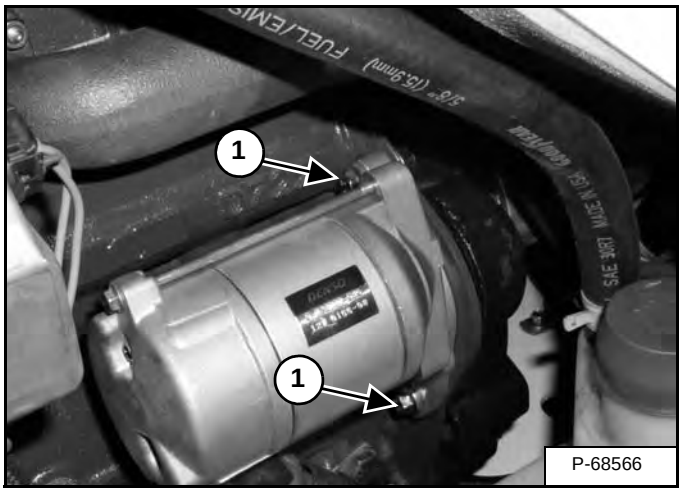
Mark the starter wires for ease of assembly.

Figure 50-40-10



Disconnect the wires (Item 1) **[Figure 50-40-10]** from the starter.

Figure 50-40-11



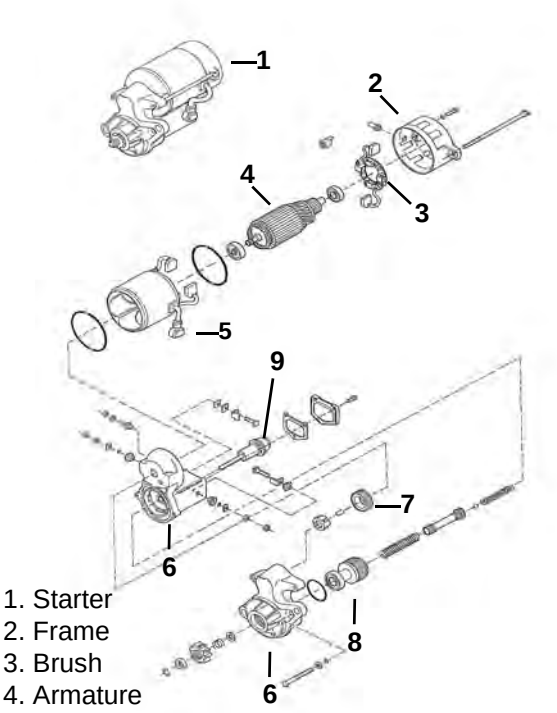
Remove the mounting bolts (Item 1) **[Figure 50-40-11]** from the starter.

Remove the starter from the bell housing.

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Parts Identification

Figure 50-40-12



1. Starter
2. Frame
3. Brush
4. Armature
5. Yoke
6. Housing
7. Pinion
8. Clutch
9. Plunger

B-19162

Cleaning And Inspection

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

Use a brush and air pressure to clean the drive, field coils, armature and starter housing.

NOTE: Do not use solvent to clean the drive assembly. The solvent will remove the lubricant and the drive will slip.

Check the following items:

Armature

Broken or burned insulation.
Loose connections at commutator.
Open or earthed circuits.
Worn shaft or bearings.
Rough commutator.

Field Coils

Broken or burned insulation.
Electrical continuity.
Brush connections.

Drive Gear

Worn teeth.
Tooth engagement (drive gear must engage ring gear by half the depth of the ring gear tooth).

Brush Holders

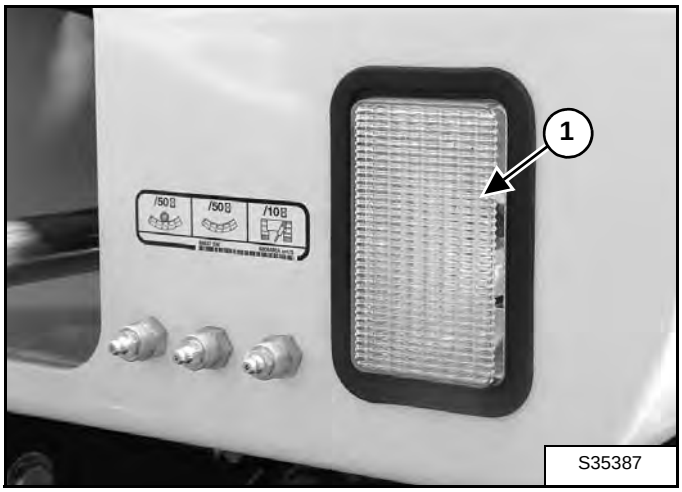
Broken springs.
Broken insulation.
Spring tension.

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LIGHTS

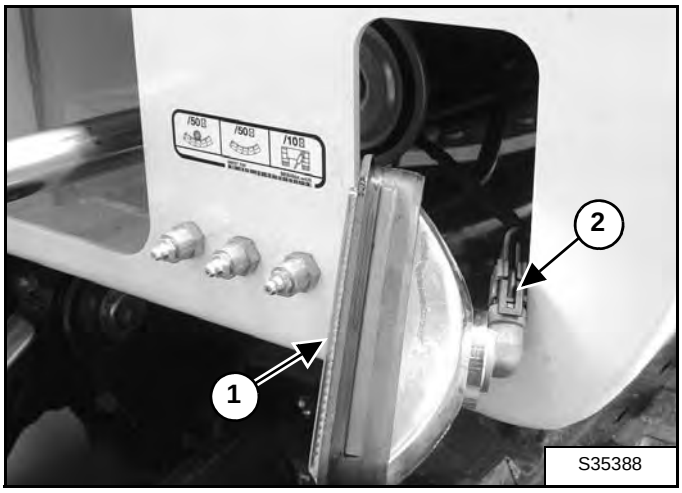
Upperstructure Light Removal And Installation

Figure 50-50-1



Push out on the light housing (Item 1) **[Figure 50-50-1]** until the light is outside the upperstructure.

Figure 50-50-2



Pull the light (Item 1) **[Figure 50-50-2]** out of the upperstructure.

Disconnect the wire harness (Item 2) **[Figure 50-50-2]**.

Upperstructure Light Disassembly And Assembly

Figure 50-50-3

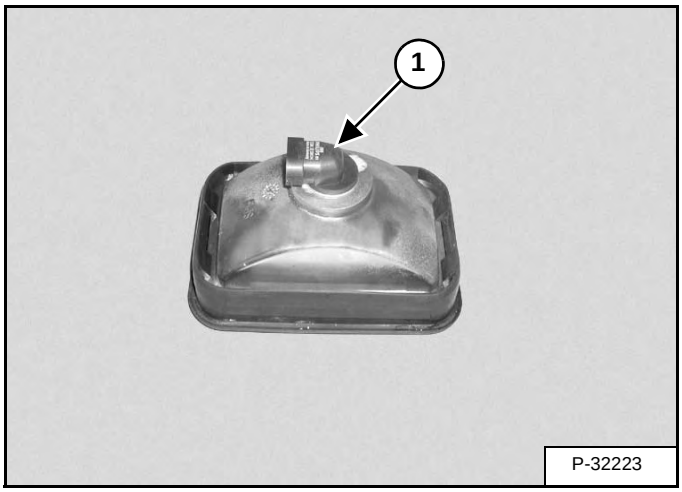
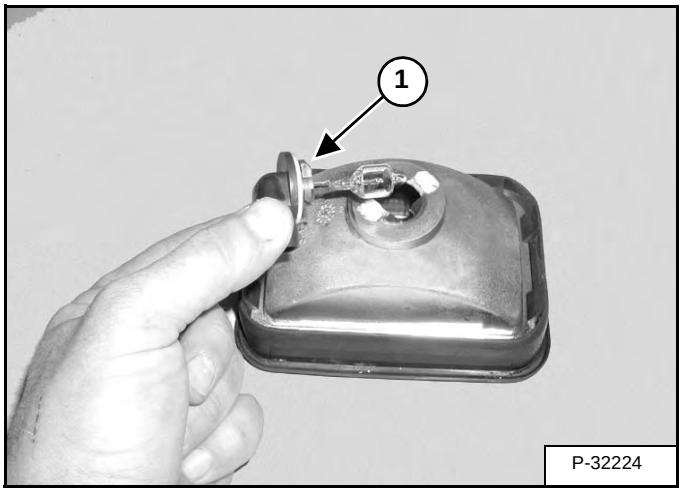


Figure 50-50-4

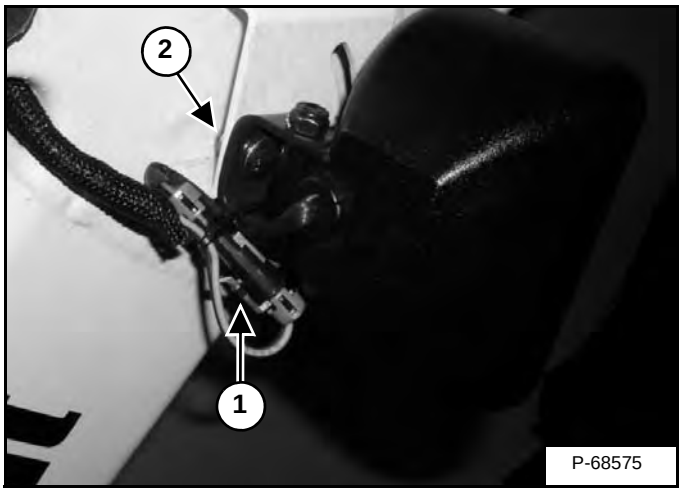


Remove the light bulb assembly (Item 1) **[Figure 50-50-3]** and **[Figure 50-50-4]** from the lens.

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Boom Light Removal And Installation

Figure 50-50-5

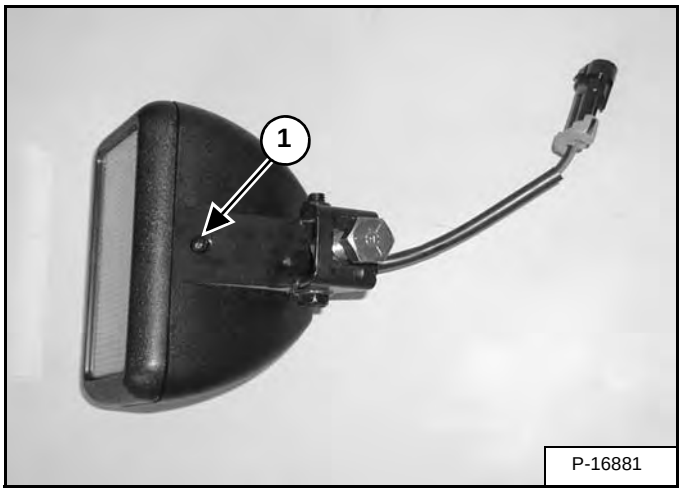


Disconnect the wire harness (Item 1) **[Figure 50-50-5]**.

Remove the nut and bolt (Item 2) **[Figure 50-50-5]**.

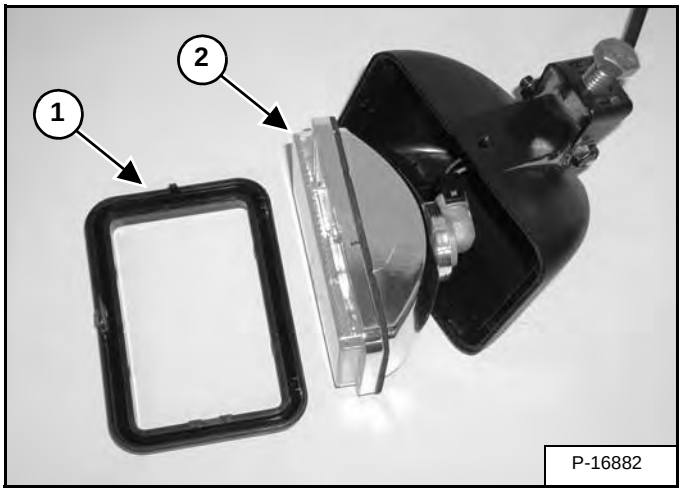
Boom Light Disassembly And Assembly

Figure 50-50-6



Remove the screw (Item 1) **[Figure 50-50-6]** from the side of the light.

Figure 50-50-7

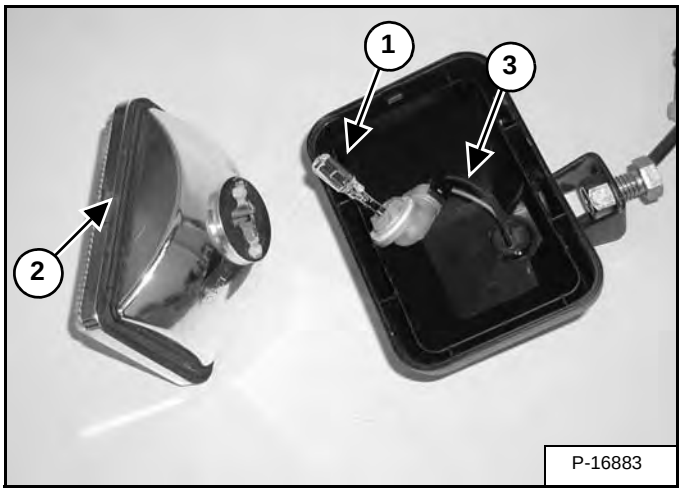


Remove the cover (Item 1) and lens assembly (Item 2) **[Figure 50-50-7]**.

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Boom Light Disassembly And Assembly (Cont'd)

Figure 50-50-8

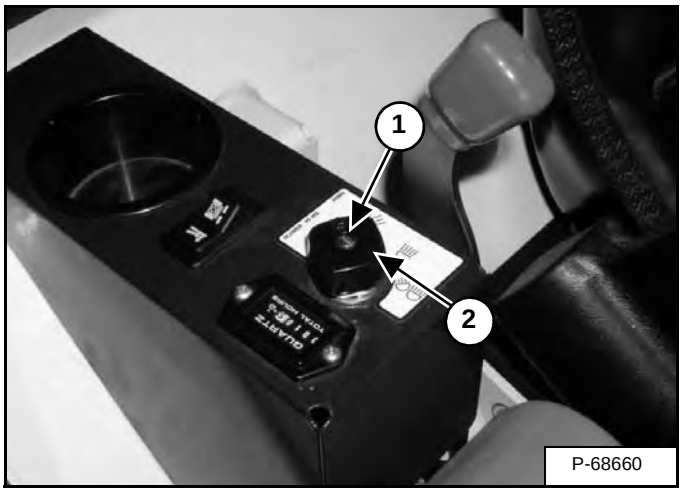


Remove the light bulb assembly (Item 1) from the lens assembly (Item 2) **[Figure 50-50-8]**.

Disconnect the wire connector (Item 3) **[Figure 50-50-8]** from the light bulb assembly.

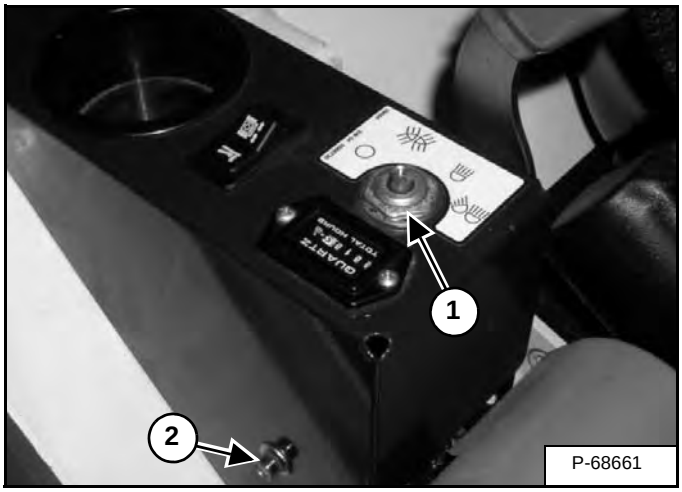
Light Switch Removal And Installation

Figure 50-50-9



Remove the screw (Item 1) and knob (Item 2) **[Figure 50-50-9]** from the switch.

Figure 50-50-10



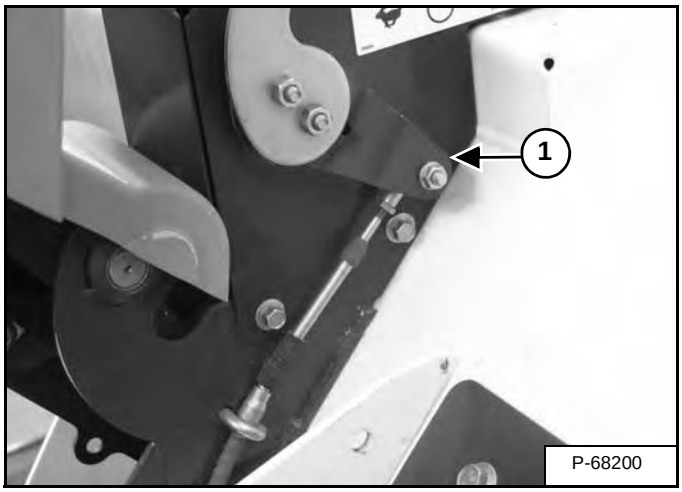
Remove the nut and lockwasher (Item 1) **[Figure 50-50-10]** from the switch.

Remove the screw (Item 2) **[Figure 50-50-10]** from the instrument console.

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Light Switch Removal And Installation (Cont'd)

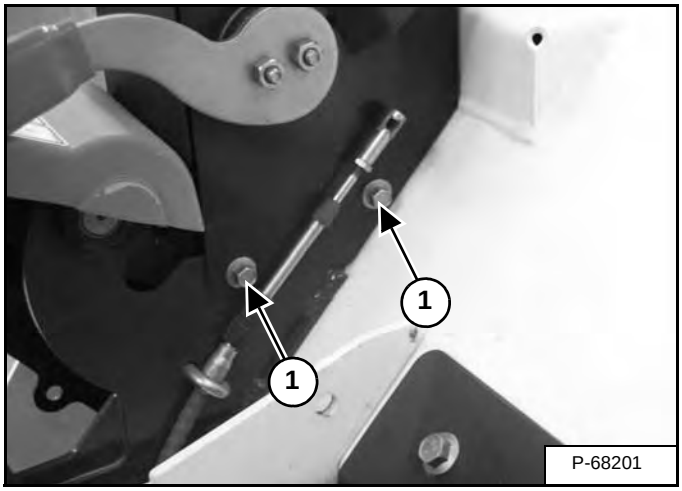
Figure 50-50-11



Remove the throttle linkage from the ball on the back side of the lever (Item 1) **[Figure 50-50-11]**.

NOTE: The seat is removed [Figure 50-50-11] from the excavator to show a clear view of the throttle linkage and bolts to be removed.

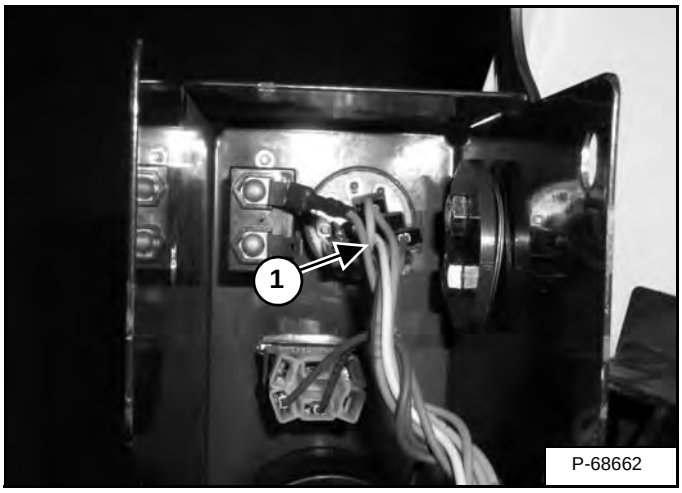
Figure 50-50-12



Remove the two bolts (Item 1) **[Figure 50-50-12]** from the left side of the instrument console.

Lift the instrument console from the console mounting bracket.

Figure 50-50-13



Disconnect the wire harness (Item 1) **[Figure 50-50-13]** from the switch.

Remove the switch from the bottom of the panel.

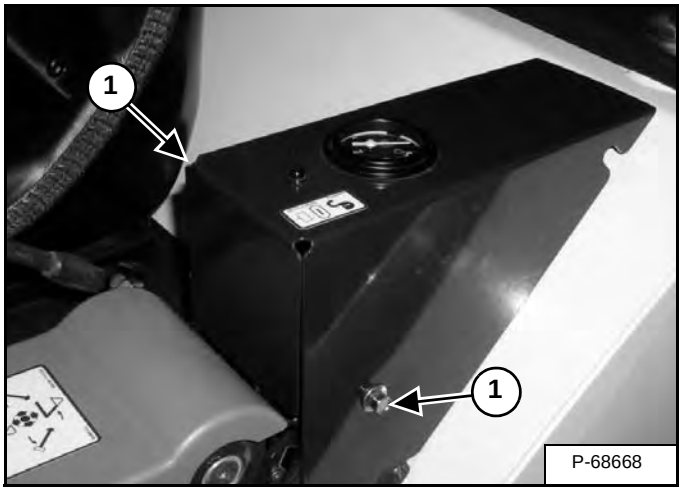
Dealer Copy -- Not for Resale

MICROSWITCH

Testing Left Console Microswitch

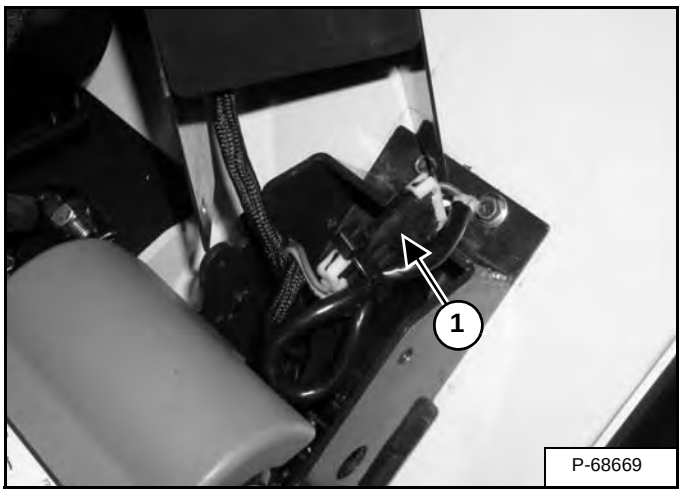
Lower the control console.

Figure 50-60-1



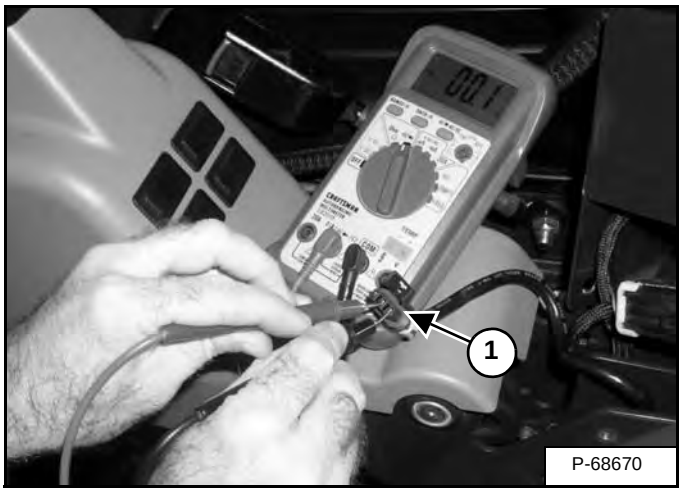
Remove the two bolts (Item 1) **[Figure 50-60-1]**, on both sides, and lift the left instrument console off to the side.

Figure 50-60-2



Remove the tie-strap and disconnect the microswitch harness (Item 1) **[Figure 50-60-2]** from the control harness.

Figure 50-60-3



Use a continuity tester to check the microswitch prior to removal. Test the continuity between the black and white wire pins (Item 1) **[Figure 50-60-3]**.

The microswitch is normally open.

With the console raised the gauge reading should show no current.

By pushing the actuator on the microswitch, the gauge reading should show a completed circuit. If not, the microswitch is faulty and must be replaced.

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Left Console Microswitch Removal And Installation

Figure 50-60-4

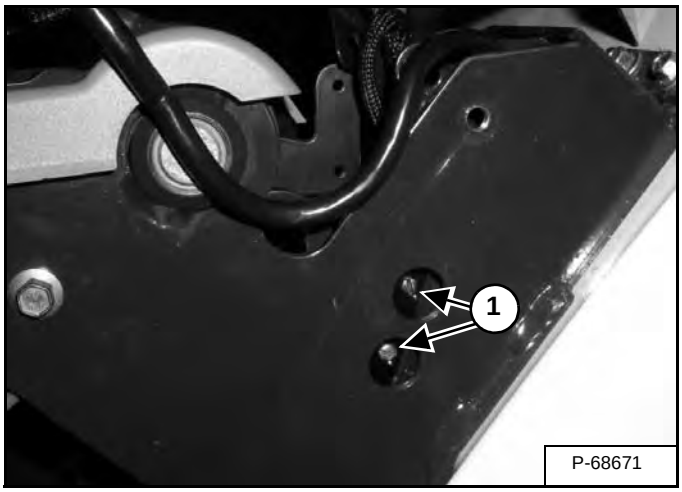
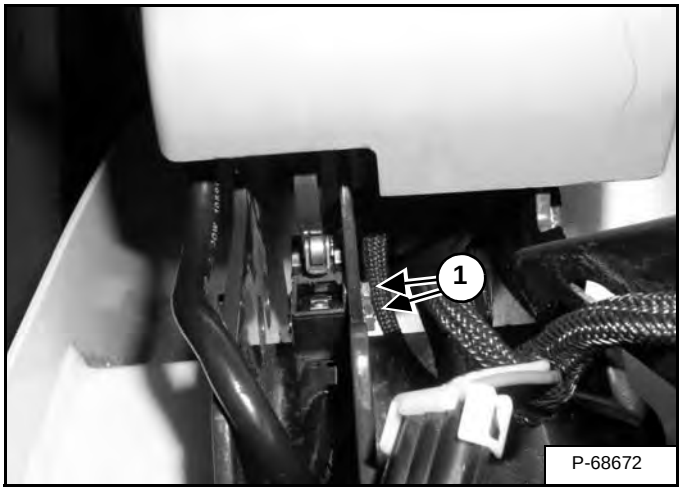


Figure 50-60-5



Remove the nuts, lockwashers and bolts (Item 1) **[Figure 50-60-4]** and **[Figure 50-60-5]** fastening the microswitch.

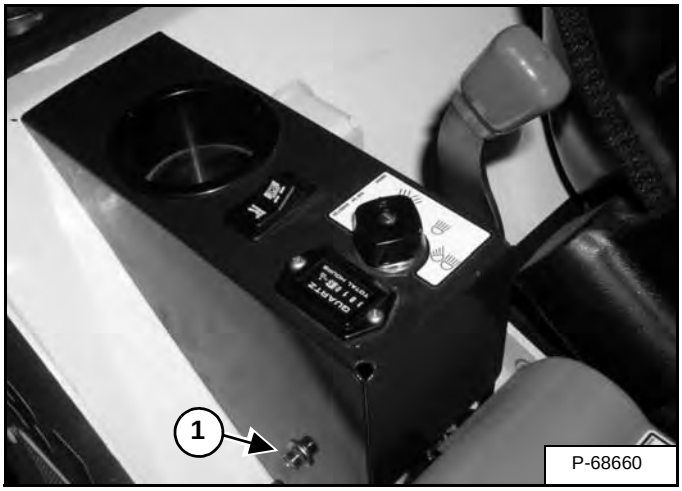
Remove the microswitch.

NOTE: The microswitch does not have an adjustment procedure. The microswitch is mounted on the frame on a fixed location.

Testing Right Console Microswitch

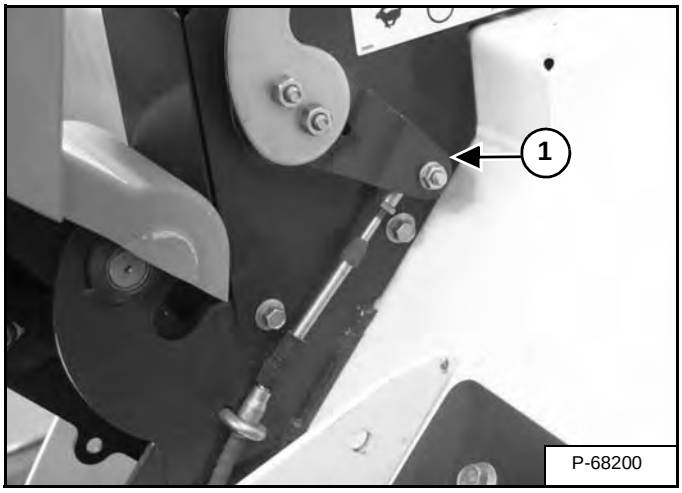
Lower the control console.

Figure 50-60-6



Remove the screw (Item 1) **[Figure 50-60-6]** from the instrument console.

Figure 50-60-7



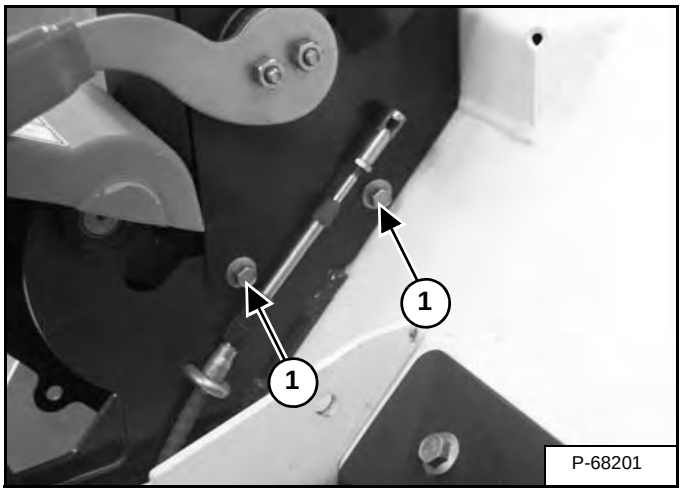
Remove the throttle linkage from the ball on the back side of the lever (Item 1) **[Figure 50-60-7]**.

NOTE: The seat is removed [Figure 50-60-7] from the excavator to show a clear view of the throttle linkage and bolts to be removed.

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Testing Right Console Microswitch (Cont'd)

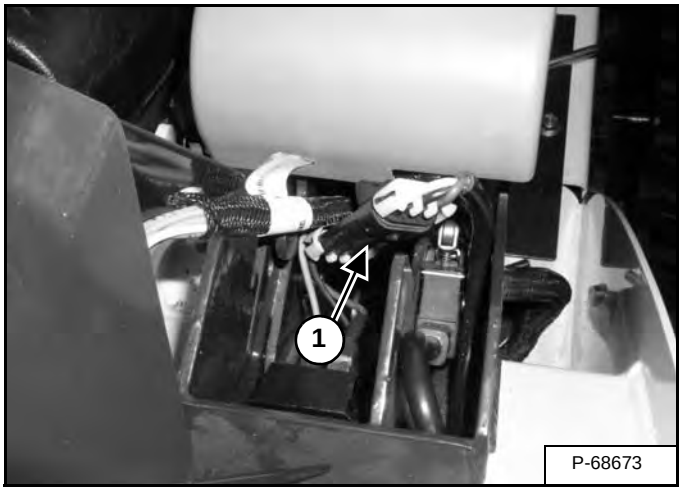
Figure 50-60-8



Remove the two bolts (Item 1) **[Figure 50-60-8]** from the left side of the instrument console.

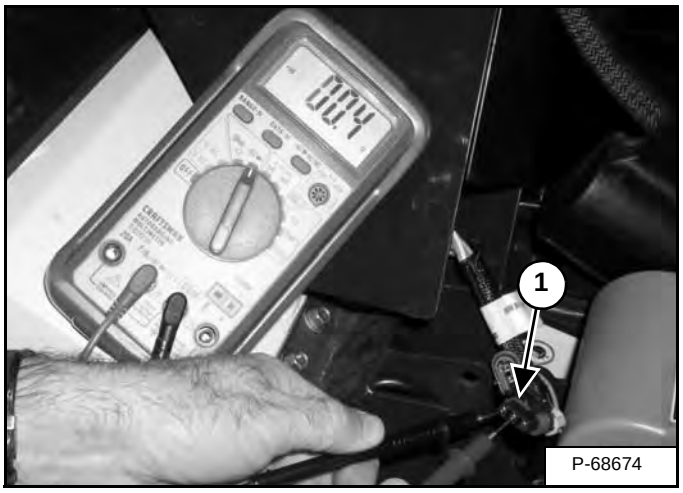
Lift the instrument console from the console mounting bracket.

Figure 50-60-9



Disconnect the microswitch harness (Item 1) **[Figure 50-60-9]** from the control harness.

Figure 50-60-10



Use a continuity tester to check the microswitch prior to removal. Test the continuity between the black and white wire pins (Item 1) **[Figure 50-60-10]**.

The microswitch is normally open.

With the console raised, the gauge reading should show no current.

By pushing the actuator on the microswitch, the gauge reading should show a completed circuit. If not, the microswitch is faulty and must be replaced.

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MICROSWITCH (CONT'D)

Right Console Microswitch Removal And Installation

Figure 50-60-11

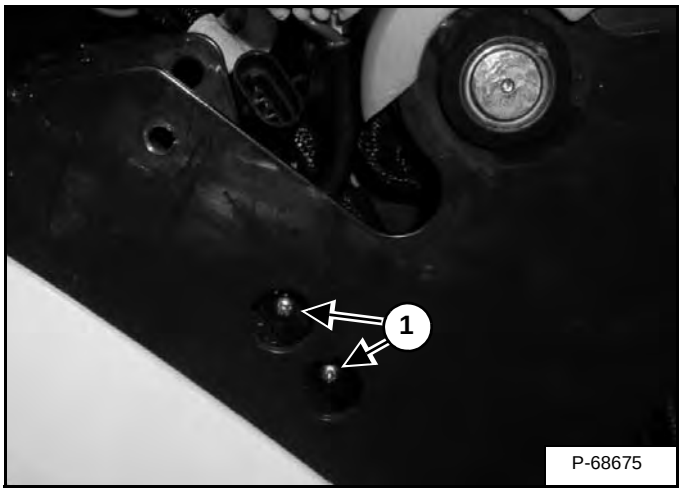
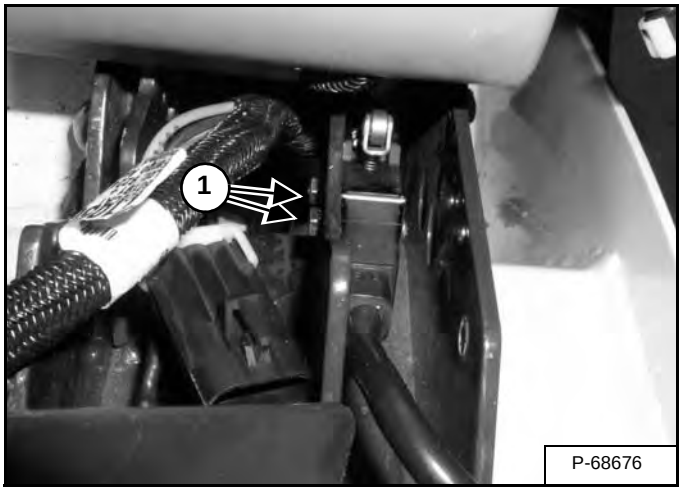


Figure 50-60-12



Remove the nuts, lockwashers and bolts (Item 1) **[Figure 50-60-11]** and **[Figure 50-60-12]** fastening the microswitch.

Remove the microswitch.

NOTE: The microswitch does not have an adjustment procedure. The microswitch is mounted to the frame in a fixed location.

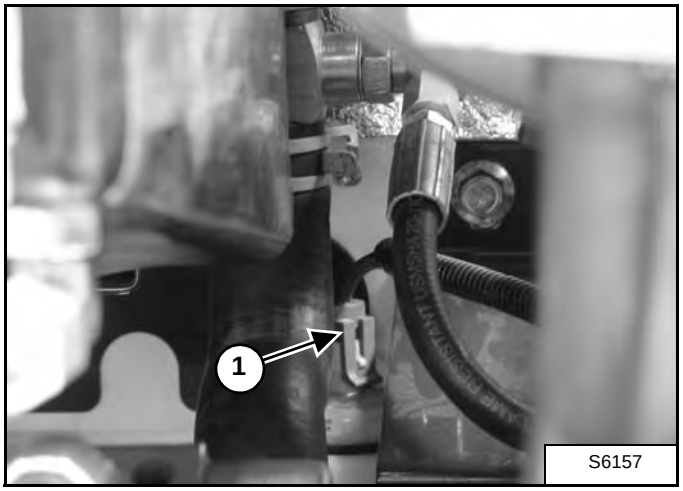
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FUEL LEVEL SENDER

Removal And Installation

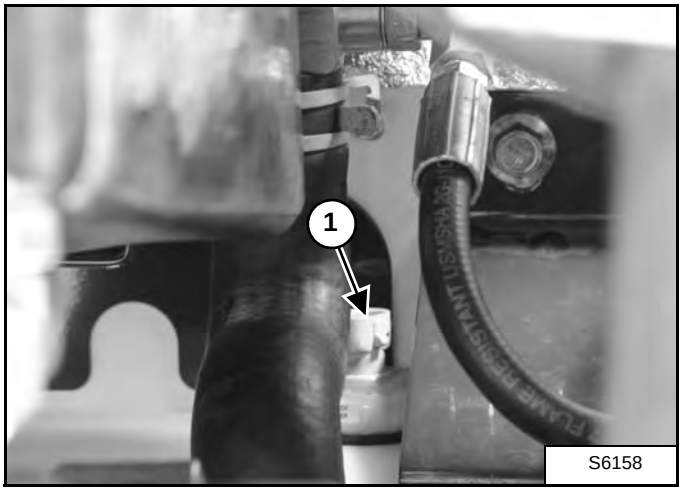
Open the tailgate. (See TAILGATE on Page 10-60-1.)

Figure 50-70-1



Disconnect the wire harness (Item 1) **[Figure 50-70-1]** from the fuel level sender.

Figure 50-70-2

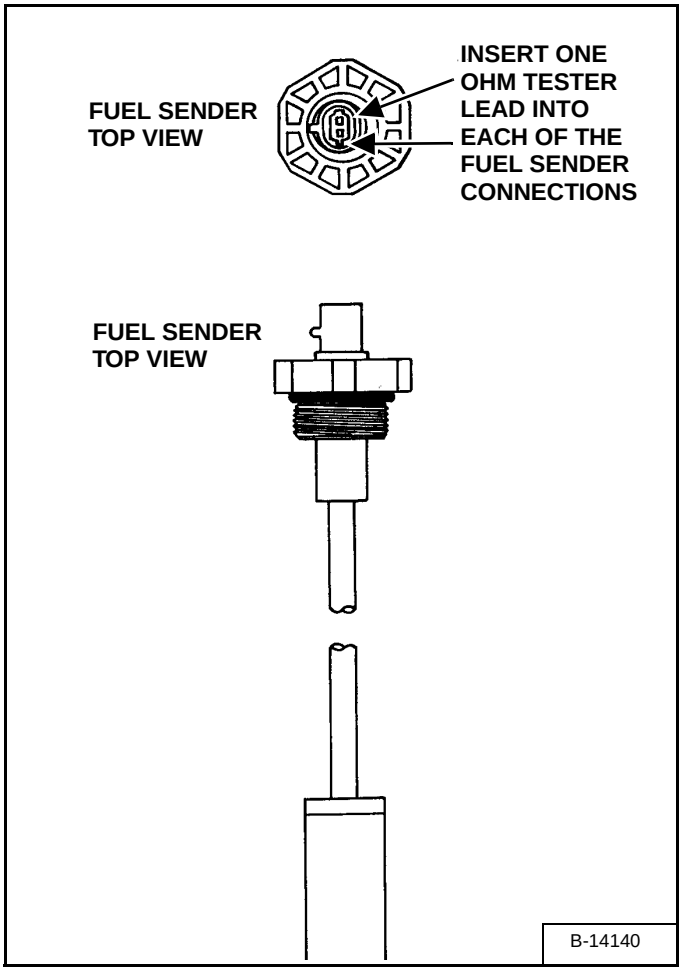


Remove the sender (Item 1) **[Figure 50-70-2]** from the fuel tank.

Testing

Use an ohmmeter to check the resistance of the fuel level sender.

Figure 50-70-3



Insert one of the ohm tester leads into each of the fuel sender electrical connectors at the end of the fuel sender **[Figure 50-70-3]**.

With the fuel sender in the position shown **[Figure 50-70-3]**, read the ohms in the empty position. Slide the float upwards and the ohm reading will decrease. See resistance chart below.

The approximate resistance should read as follows:

FULL: 15 - 35 ohm
HALF: 120 - 145 ohm
EMPTY: 230 - 250 ohm

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Fuel Camshaft Governor 60-06-7
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ENGINE INFORMATION

Description

The E16 Bobcat excavator has a Kubota direct injected D722-E2B diesel engine with a displacement of 0,719 L (43.88 in^3). The engine is rated at 9,9 KW (13.3 hp) and has an open crankcase ventilation system.

The engine has three cylinders and the rotation is anticlockwise (viewed from the flywheel side). Engine block heaters are also available from Bobcat Parts.

The engine serial number is stamped on the engine and is located near the injection pump. The model number is located on the valve cover. Use these numbers to obtain the correct service parts.

The engine is liquid cooled with a propylene glycol / water mixture. The cooling fan is belt driven. The speed of the fan is determined by the engine speed.

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Specifications

Engine

Compression (At Operating Temperature)	2,8 - 3,2 MPa (28 - 32 bar) (412 - 469 psi)
Limit Permitted	2,3 MPa (23 bar) (327 psi)

Fuel Injector Nozzles

Opening Pressure	13,7 - 14,7 MPa (137 - 147 bar) (1991 - 2134 psi)
Fuel Tightness Nozzle Seat	12,7 MPa (127 bar) (1849 psi)

Fuel Injection Pump

Fuel Tightness of Pump Element	13,7 MPa (137 bar) (1991 psi)
Fuel Tightness of Delivery Valve (factory spec)	10 s Initial Pressure Drop From 13,7 - 14,7 MPa (137 - 127 bar) (1991 - 1849 psi)
Fuel Tightness of Delivery Valve Limit Permitted	5 s Initial Pressure Drop From 13,7 - 14,7 MPa (137 - 147 bar) (1991 - 2134 psi)
Injection Timing @ 3600 rpm	19 - 21 degrees B.T.D.C.

Cylinder Head

Cylinder Head Distortion Limit	0,05 mm (0.002 in)
Thickness of Gasket Free	1,15 - 1,30 mm (0.0415 - 0.0512 in)
Thickness of Gasket Tightened	1,05 - 1,15 mm (0.0413 - 0.0453 in)
Top Clearance	0,50 - 0,70 mm (0.0197 - 0.0276 in)

Valves

Valve Seat Angle	45 degrees
Valve Seat Width	2,12 mm (0.084 in)
O.D. of Valve Stem	5,968 - 5,980 mm (0.2350 - 0.2354 in)
I.D. of Valve Guide	6,01 - 6,025 mm (0.2366 - 0.2372 in)
Clearance between Valve Stem and Guide	0,03 - 0,057 mm (0.0012 - 0.0022 in)
Limit Permitted	0,1 mm (0.004 in)
Depth of Valve	-0,10 - 0,10 mm (-0.004 - 0.004 in)
Limit Permitted	0,30 mm (0.0118 in)
Valve Clearance (Cold) (Intake and Exhaust)	0,145 - 0,185 mm (0.006 - 0.007 in)

Valve Springs

Free Length	31,3 - 31,8 mm (1.232 - 1.252 in)
Limit Permitted	28,4 mm (1.118 in)
Fitted Length	27 mm (1.063 in)
Load to Compress to Fitted Length	6,6 kg (14.6 lb)
Limited Permitted	5,6 kg (12.3 lb)
Limited Permitted for Spring Tilt	1,2 mm (0.047 in)

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Specifications (Cont'd)

Rocker Arms

O.D. of Rocker Arm Shaft	10,47 - 10,48 mm (0.4123 - 0.4128 in)
I.D. of Rocker Arm Bushing	10,5 - 10,52 mm (0.4134 - 0.4141 in)
Clearance between Rocker Arm Shaft and Bushing	0,016 - 0,045 mm (0.0006 - 0.0018 in)
Limit Permitted	0,15 mm (0.006 in)

Camshaft

O.D. of Camshaft Bearing Journal	32,93 - 32,95 mm (1.2966 - 1.2972 in)
I.D. of Camshaft Bearing	33,00 - 33,025 mm (1.2992 - 1.3002 in)
Clearance between Camshaft Bearing and Journal	0,05 - 0,91 mm (0.002 - 0.004 in)
Limit Permitted	0,15 mm (0.006 in)
Alignment of the Camshaft Limit Permitted	0,01 mm (0.0004 in)
Cam Lobe Height	26,88 mm (1.0583 in)
Limit Permitted	26,83 mm (1.0563 in)
Idle Gear to Cam Gear Backlash	0,041 - 0,123 mm (0.002 - 0.005 in)
Limit Permitted	0,15 mm (0.006 in)

Cylinders

I.D. of Cylinder Liner	67,000 - 67,019 mm (2.6378 - 2.6385 in)
Limit Permitted	67,169 mm (2.6445 in)
Rebore Size for Oversize Piston	67,250 - 67,269 mm (2.6476 - 2.6484 in)

Piston Rings

Ring Gap, Top and Oil	0,15 - 0,30 mm (0.0059 - 0.0118 in)
Ring Gap, 2nd	0,30 - 0,45 mm (0.0118 - 0.0177 in)
Limit Permitted	1,20 mm (0.0472 in)
Side Clearance of Ring in Groove;	
Top Ring	Because of top ring design, measurement does not apply
2nd Ring	0,085 - 0,12 mm (0.0033 - 0.0045 in)
Oil Ring	0,02 - 0,06 mm (0.0016 - 0.0031 in)
Limit Permitted	0,15 mm (0.006 in)

Pistons

I.D. of Piston Pin Bore	20,00 - 20,013 mm (0.7874 - 0.7879 in)
Limit Permitted	20,05 mm (0.7894 in)
O.D. of Piston Pin	20,002 - 20,011mm (0.7875 - 0.7878 in)

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Specifications (Cont'd)

Connecting Rods

I.D. of Connecting Rod Bushing (Small End, Fitted)	20,03 - 20,04 mm (0.7884 - 0.7890 in)
Clearance between Piston Pin and Bushing	0,014 - 0,038 mm (0.0006 - 0.0015 in)
Clearance between Piston Pin and Bushing Limit Permitted	0,10 mm (0.004 in)
Connecting Rod Alignment Limit Permitted	0,05 mm (0.002 in)

Crankshaft

Crankshaft Alignment Limit Permitted	0,02 mm (0.0008 in)
O.D. of Crankshaft Journal No. 1 (Water Pump Side)	39,93 - 39,95 mm (1.5722 - 1.5728 in)
I.D. of Crankshaft Bearing No. 1	39,98 - 40,04 mm (1.5715 - 1.5764 in)
Clearance between No. 1 Crankshaft Journal and Bearing	0,03 - 0,11 mm (0.0013 - 0.0042 in)
Limit Permitted	0,20 mm (0.008 in)
O.D. of Crankshaft Journal No. 2 (Flywheel Side)	43,93 - 43,95 mm (1.7297 - 1.7303 in)
I.D. of Crankshaft Bearing No. 2	43,98 - 44,03 mm (1.7317 - 1.7333 in)
Clearance between No. 2 Crankshaft Journal and Bearing	0,03 - 0,05 mm (0.0011 - 0.0020 in)
Limit Permitted	0,20 mm (0.008 in)
O.D. of Crankshaft Journal No. 3 (Intermediate)	39,93 - 39,95 mm (1.5722 - 1.5728 in)
I.D. of Crankshaft Bearing No. 3	39,98 - 40,03 mm (1.5742 - 1.5758 in)
Clearance between No. 3 Crankshaft Journal and Bearing	0,03 - 0,05 mm (0.0011 - 0.0020 in)
Limit Permitted	0,20 mm (0.008 in)
O.D. of Connecting Rod Journals	33,96 - 33,98 mm (1.3370 - 1.3376 in)
I.D. of Connecting Rod Bearings	33,99 - 34,01 mm (1.3389 - 1.3390 in)
Clearance between Connecting Rod Journal and Bearing	0,02 - 0,051 mm (0.0008 - 0.0020 in)
Limit Permitted	0,15 mm (0.006 in)
Crankshaft End Play	0,15 - 0,31 mm (0.006 - 0.012 in)
Limit Permitted	0,50 mm (0.020 in)

Oil Pump

Oil Pressure @ Rated rpm	0,2 - 0,4 MPa (2 - 4 bar) (28 - 64 psi)
Limit Permitted	0,1 MPa (1 bar) (21 psi)
Oil Pressure @ Idle Speed	50 kPa (0,5 bar) (7 psi)
Clearance between Outer Rotor and Pump Body	0,07 - 0,15 mm (0.003 - 0.006 in)
End Clearance between Inner Rotor and Cover	0,08 - 0,14 mm (0.003 - 0.005 in)
Clearance between Inner Rotor and Outer Rotor	0,03 - 0,14 mm (0.0012 - 0.006 in)

Thermostat

Opening Temperature	
Starting	70 - 73°C (157 - 163°F)
Full Open	85°C (185°F)

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Torque Values

Kubota Metric Engine Bolts

Thread Size (Dia. x Pitch)	Material		
	Head Mark 4	Head Mark 7	Head Mark 10
M5 x 0.8		4 - 5 N•m (3 - 4 ft-lb)	
M6 x 1.0		8 - 9 N•m (6 - 7 ft-lb)	8 - 12 N•m (6 - 9 ft-lb)
M8 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)
M10 x 1.25	18 - 24 N•m (13 - 18 ft-lb)	30 - 41 N•m (22 - 30 ft-lb)	49 - 68 N•m (36 - 50 ft-lb)
M12 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)
M14 x 1.5	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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Torque Values (Cont'd)

Tightening Torques For General Use Screws, Bolts And Nuts

Grade / Nominal Unit Diameter	**Standard Screw and Bolt** (4)		**Special Screw and Bolt** (7)	
	N•m	**ft-lb**	**N•m**	**ft-lb**
M6	7,9 - 9,3	5.8 - 6.9	9,8 - 11,3	7.23 - 8.32
M8	17,7 - 20,6	13.0 - 15.2	23,5 - 27,5	17.4 - 20.3
M10	39,2 - 45,1	28.9 - 33.3	49,0 - 55,9	36.2 - 41.2
M12	62,8 - 72,6	46.3 - 53.5	77,5 - 90,2	57.1 - 66.5

Screw and bolt material grades are shown by numbers punched on the screw and bolt heads. Prior to tightening, be sure to check out the numbers as shown below.

Punched number	Screw and bolt material grade
None or 4	Standard screw and bolt SS400, S20C
7	Special screw and bolt S43C, S48C (Refined)

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Troubleshooting

The following troubleshooting chart is provided for assistance in locating and correcting problems which are most common. Many of the recommended procedures must be done by authorized Bobcat Service personnel only.

PROBLEM	CAUSE
Slow cranking speed	1, 2, 3, 4
Engine will not start	2, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 19, 27, 28, 29
Difficult to start	5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 25, 27, 28, 29
No power from engine	8, 9, 10, 11, 12, 13, 15, 16, 17, 21, 22, 24, 25, 26, 28, 29
Engine is mis-firing	8, 9, 11, 12, 13, 15, 16, 17, 21, 22, 24, 25, 26, 28
Too much fuel consumption	10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29
Black exhaust	10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29
Blue / white exhaust	4, 10, 15, 16, 17, 21, 23, 27, 29, 30, 50
Low oil pressure	4, 31, 32, 33, 34, 35, 37, 38, 39, 52
Engine knocking	13, 15, 16, 19, 22, 24, 25, 27, 29, 31, 40, 41, 53
Engine running rough	7, 8, 9, 10, 11, 12, 13, 17, 18, 22, 24, 25, 26, 29, 40, 53
Vibration	12, 13, 17, 21, 22, 25, 26, 29, 40, 42, 43
High oil pressure	4, 33, 36
Overheating	10, 12, 13, 15, 16, 20, 21, 40, 44, 45, 46, 47, 48, 51
Too much crankcase pressure	22, 27, 29, 30, 40, 49
Poor compression	10, 16, 21, 24, 25, 27, 28, 29, 30, 41, 53
Start and stop	9, 10, 11

KEY TO CORRECT THE CAUSE	
1. Battery capacity low	28. Worn valves and seat
2. Bad electrical connections	29. Broken or worn piston rings
3. Faulty starter motor	30. Worn valve stems or guides
4. Incorrect grade of oil	31. Worn or damaged bearings
5. Low cranking speed	32. Not enough oil in the oil pan
6. Fuel tank empty	33. Switch is defective
7. Faulty stop control operation	34. Oil pump worn
8. Plugged fuel line	35. Relief valve is stuck open
9. Plugged fuel filter	36. Relief valve is stuck closed
10. Restriction in the air cleaner	37. Broken relief valve spring
11. Air in the fuel system	38. Faulty suction pipe
12. Faulty fuel injection pump	39. Plugged oil filter
13. Faulty fuel injectors	40. Piston seizure
14. Broken injection pump drive	41. Incorrect piston height
15. Incorrect injection pump timing	42. Faulty engine mounting
16. Incorrect valve timing	43. Incorrect alignment of flywheel
17. Poor compression	44. Faulty thermostat
18. Plugged fuel tank vent	45. Restriction in water jacket
19. Incorrect grade of fuel	46. Loose alternator belt
20. Exhaust pipe restriction	47. Plugged radiator
21. Cylinder head gasket leaking	48. Plugged breather pipe
22. Over heating	49. Plugged breather pipe
23. Cold running	50. Damaged valve stem oil deflectors
24. Incorrect tappet adjustment	51. Coolant level too low
25. Sticking valves	52. Plugged oil pump pipe strainer
26. Incorrect high pressure fuel lines	53. Broken valve spring
27. Worn cylinder bores	

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Engine Removal And Installation

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

Remove the muffler. (See Removal And Installation on Page 60-30-1.)

Drain and remove the hydraulic reservoir. (See Removal And Installation on Page 20-120-1.)

Remove the hydraulic filter housing assembly. (See Removal And Installation on Page 20-110-1.)

Remove the hydraulic pump. (See Removal And Installation on Page 20-50-7.)

Drain the cooling system. (See Removing And Replacing Coolant on Page 10-100-2.)

IMPORTANT

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

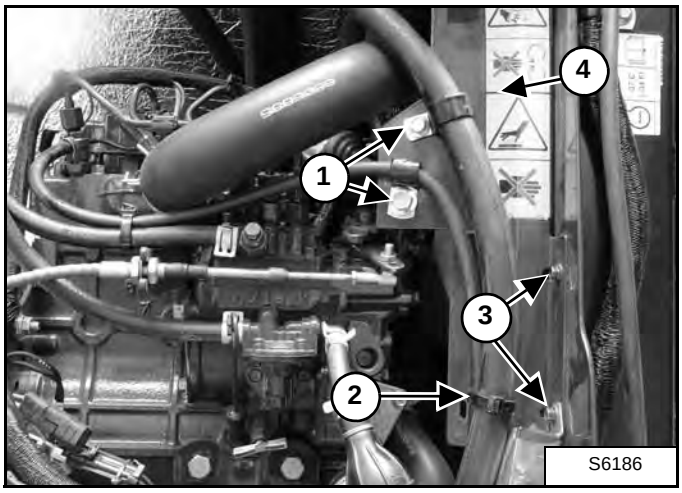
I-2003-0888

IMPORTANT

Fluid such as engine oil, hydraulic fluid, coolants, grease, etc. must be disposed of in an environmentally safe manner. Some regulations require that certain spills and leaks on the ground must be cleaned in a specific manner. See local regulations for the correct disposal.

I-2067-EN-0711

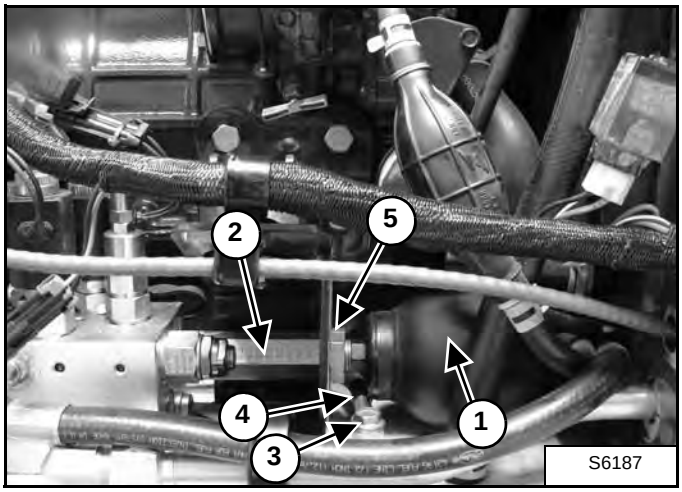
Figure 60-10-1



Remove the two bolts (Item 1) and tie-strap (Item 2) **[Figure 60-10-1]** from the fan guard.

Remove the nuts (Item 3) and remove the fan guard (Item 4) **[Figure 60-10-1]**.

Figure 60-10-2



Remove the accumulator (Item 1). Do not remove the accumulator extension tube (Item 2) **[Figure 60-10-2]** from the motor mount and manifold assembly.

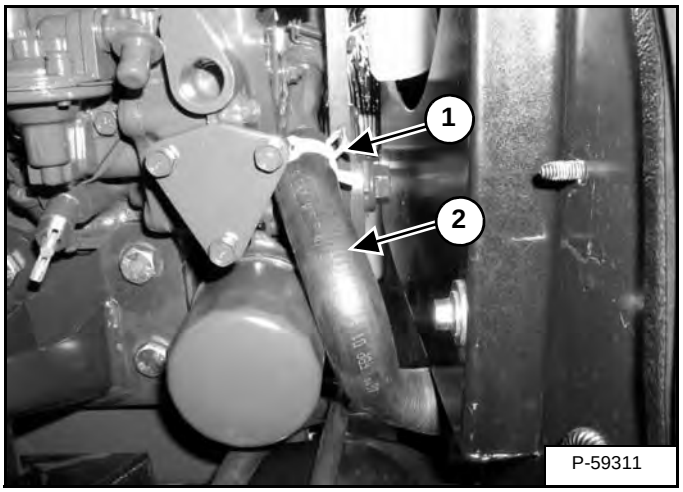
Remove the bolt (Item 3) from the engine earth wire (Item 4) **[Figure 60-10-2]**.

Remove the nut (Item 5) from the accumulator extension tube (Item 2) **[Figure 60-10-2]**.

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Engine Removal And Installation (Cont'd)

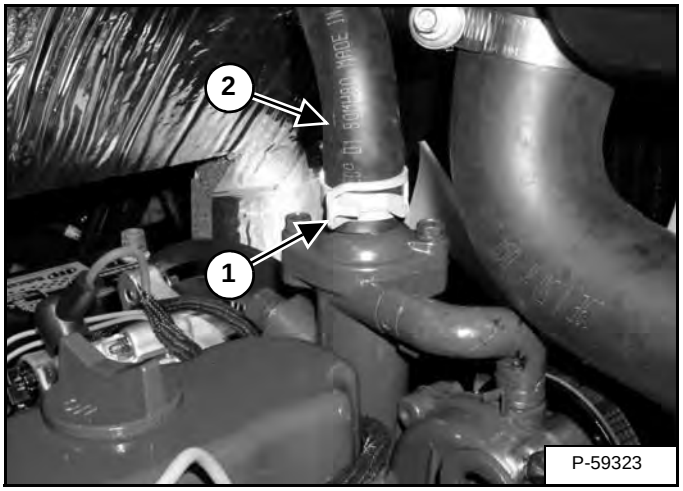
Figure 60-10-3



Slide the hose clamp (Item 1) **[Figure 60-10-3]** away from the end of the lower radiator hose.

Remove the lower radiator hose (Item 2) **[Figure 60-10-3]** and cap.

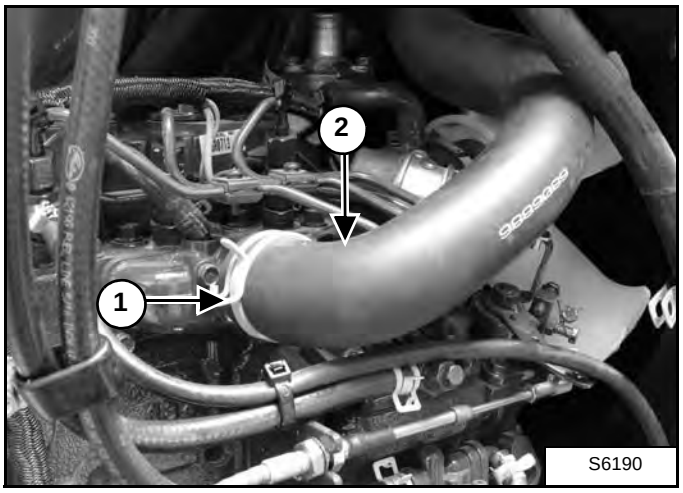
Figure 60-10-4



Slide the hose clamp (Item 1) **[Figure 60-10-4]** away from the end of the upper radiator hose.

Remove the upper radiator hose (Item 2) **[Figure 60-10-4]** and cap.

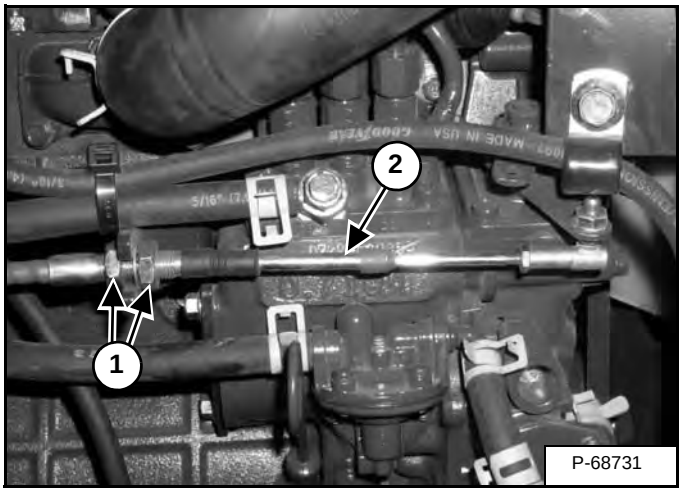
Figure 60-10-5



Slide the hose clamp (Item 1) **[Figure 60-10-5]** away from the end of the air in-take hose.

Remove the air in-take hose (Item 2) **[Figure 60-10-5]** and cap.

Figure 60-10-6



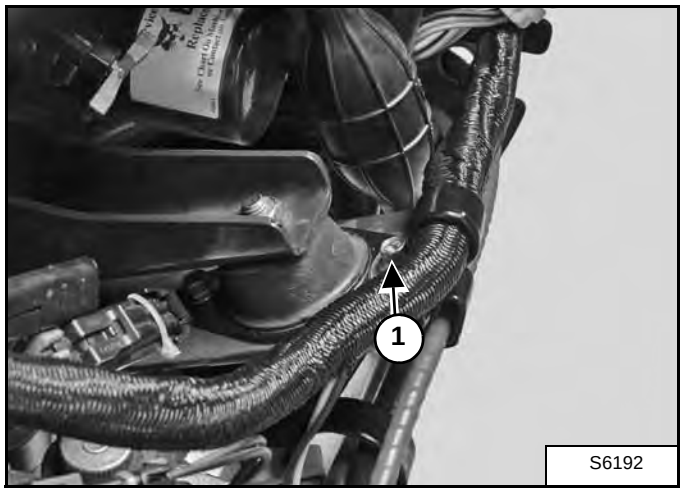
Loosen the nuts (Item 1) **[Figure 60-10-6]** fastening the throttle cable to the bracket.

Disconnect the throttle linkage (Item 2) **[Figure 60-10-6]** from the throttle bracket.

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Engine Removal And Installation (Cont'd)

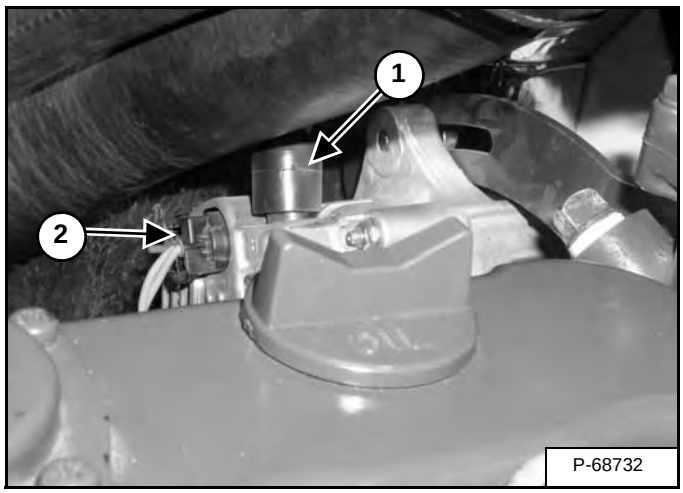
Figure 60-10-7



Remove the nut and cable clamp (Item 1) **[Figure 60-10-7]** from engine mount bracket.

Move the throttle cable out of the way of the engine.

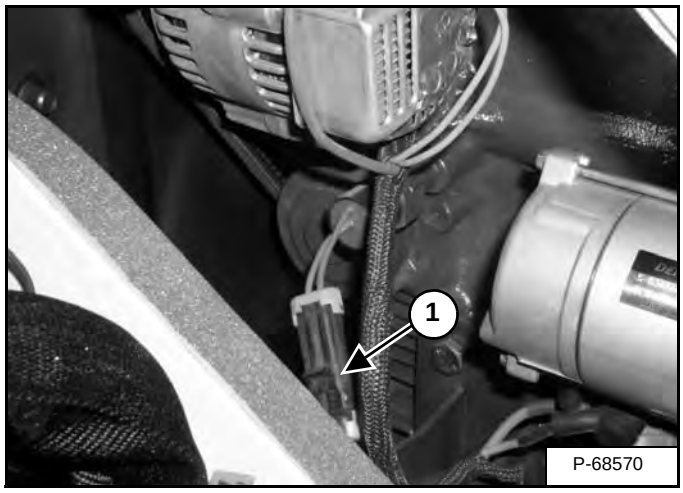
Figure 60-10-8



Disconnect the red wire (Item 1) **[Figure 60-10-8]** from the alternator.

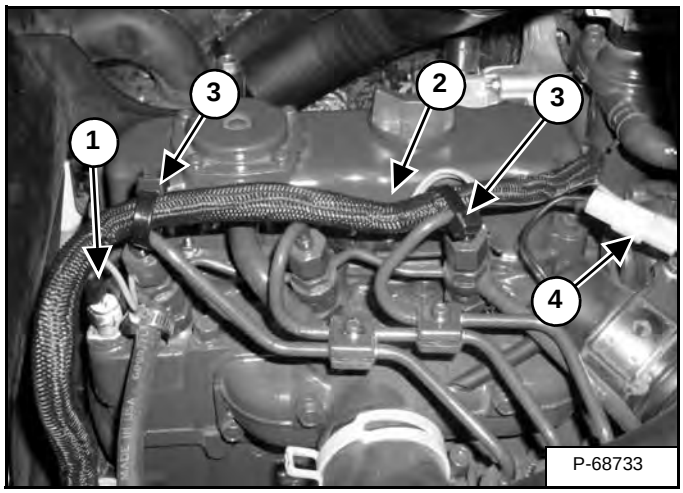
Disconnect the wire harness connector (Item 2) **[Figure 60-10-8]** from the alternator.

Figure 60-10-9



Disconnect the wire connector (Item 1) **[Figure 60-10-9]** from the oil pressure sending unit on the back side of the engine.

Figure 60-10-10



Remove the wire harness from the water temperature sending unit (Item 1) and the glow plugs (Item 2) **[Figure 60-10-10]**.

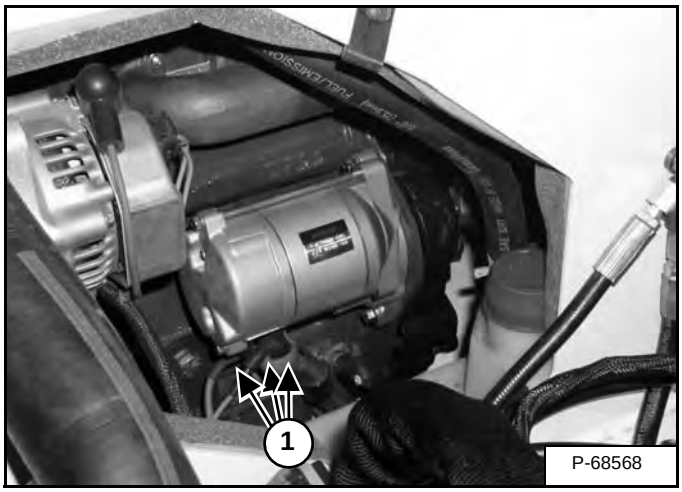
Remove the tie-straps (Item 3) **[Figure 60-10-10]**.

Disconnect the wire connector (Item 4) **[Figure 60-10-10]** from the fuel shutoff.

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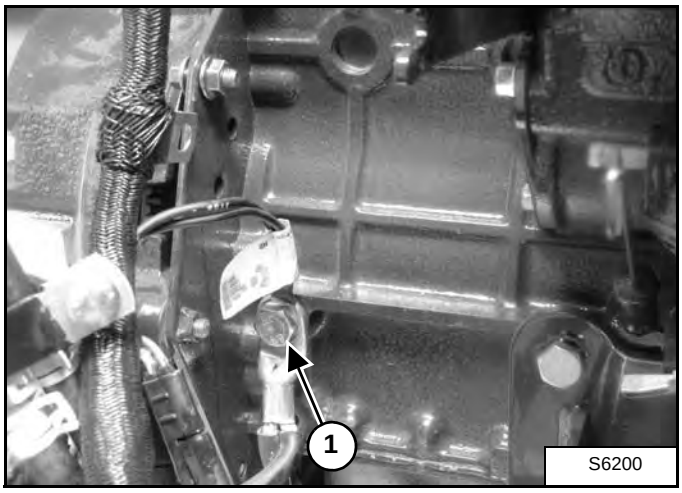
Engine Removal And Installation (Cont'd)

Figure 60-10-11



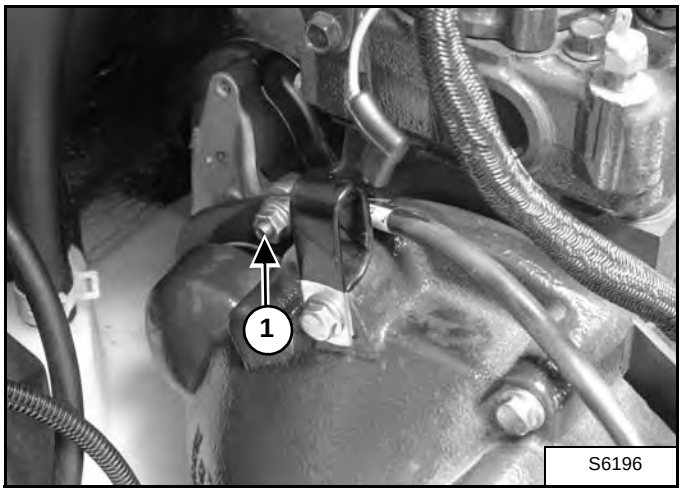
Disconnect the positive wires from the starter (Item 1) **[Figure 60-10-11]**.

Figure 60-10-12



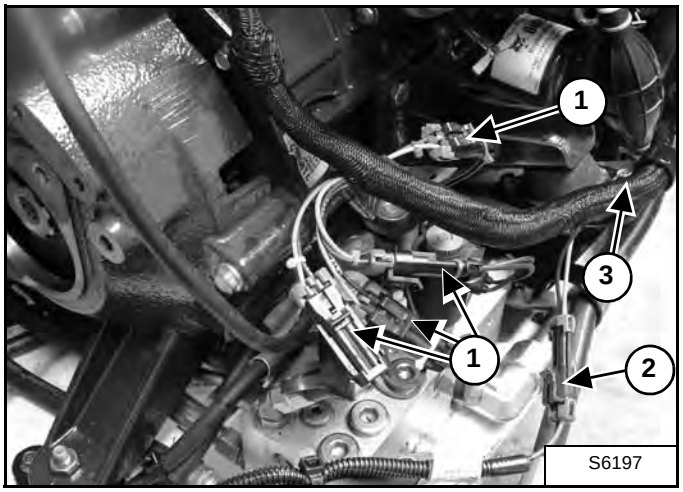
Disconnect the earthing wire (Item 1) **[Figure 60-10-12]** from the engine earth bolt.

Figure 60-10-13



Disconnect the earthing wire (Item 1) **[Figure 60-10-13]** from the starter mounting bolt.

Figure 60-10-14



Disconnect the wire connectors (Item 1) **[Figure 60-10-14]** from the two solenoids.

Disconnect the wire connector (Item 2) **[Figure 60-10-14]** from the fuel level sender wire harness.

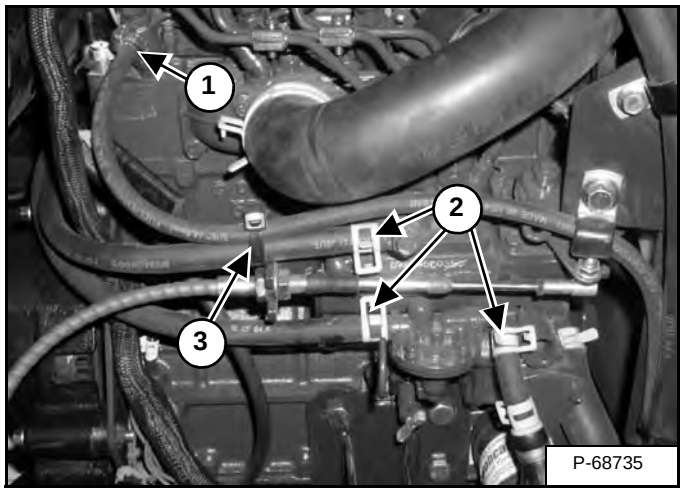
Remove the bolt (Item 3) **[Figure 60-10-14]** fastening the wire harness clamp to the engine mount.

Move the wire harness out of the way of the engine.

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Engine Removal And Installation (Cont'd)

Figure 60-10-15

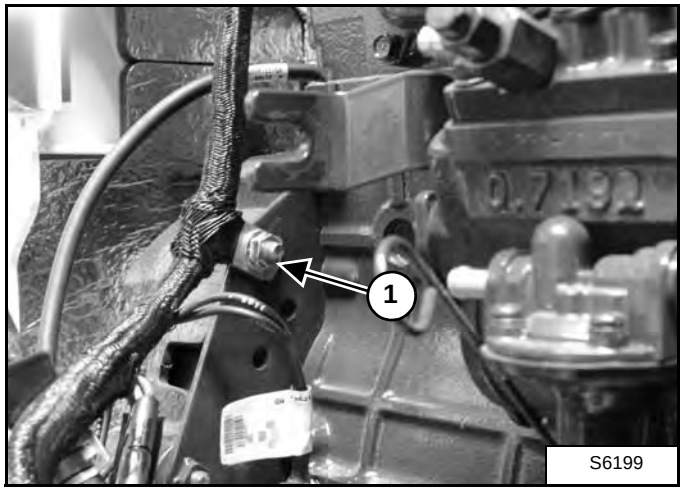


Remove and cap the return fuel line (Item 1) **[Figure 60-10-15]**.

Remove and cap the fuel lines (Item 2) **[Figure 60-10-15]**.

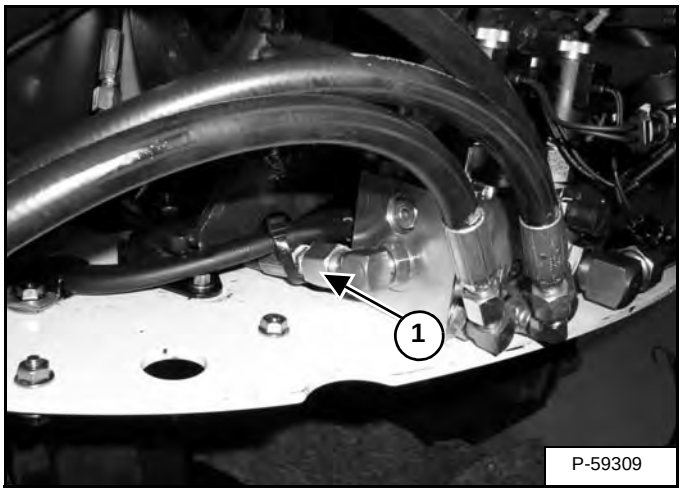
Remove tie-strap (Item 3) **[Figure 60-10-15]**.

Figure 60-10-16



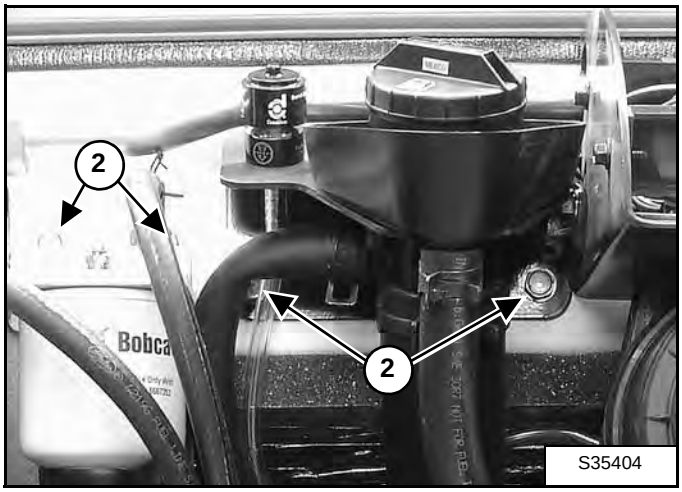
Remove the bolt (Item 1) **[Figure 60-10-16]** from the fuel line clamp.

Figure 60-10-17



Disconnect and cap the hose (Item 1) **[Figure 60-10-17]** on the side of the manifold assembly.

Figure 60-10-18



Remove the two bolts (Item 1) **[Figure 60-10-18]** from the fuel filter bracket.

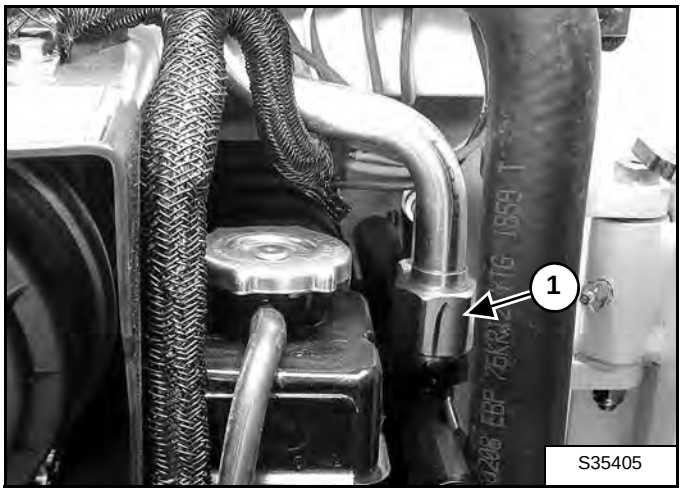
Remove the fuel filter assembly with fuel lines from the engine compartment.

Remove the two bolts (Item 2) **[Figure 60-10-18]** and move the fuel filler assembly out of the way.

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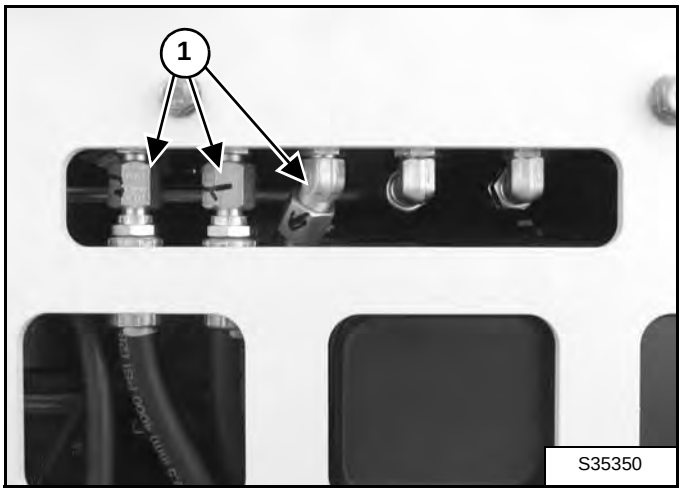
Engine Removal And Installation (Cont'd)

Figure 60-10-19



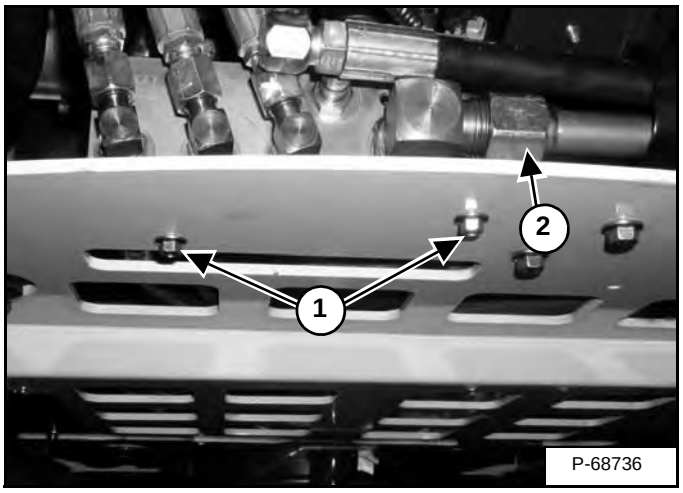
Disconnect and remove the tubeline (Item 1) **[Figure 60-10-19]**.

Figure 60-10-20



Mark and disconnect the three hoses (Item 1) **[Figure 60-10-20]** on the backside of the manifold assembly. Disconnect and cap the three hoses from the underside of the upperstructure.

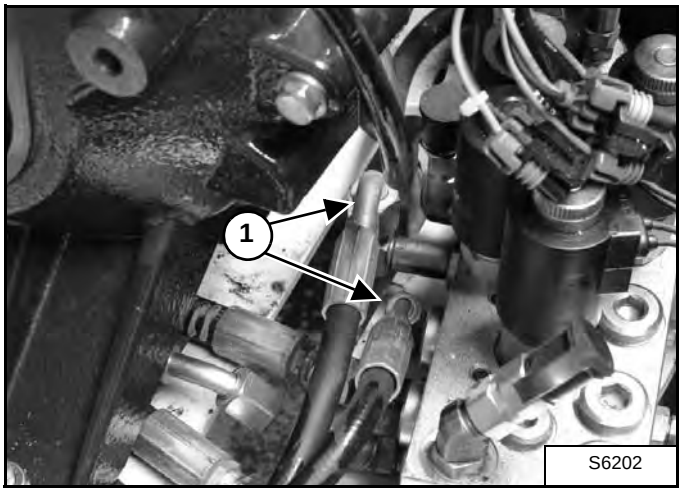
Figure 60-10-21



Remove the two bolts (Item 1) **[Figure 60-10-21]** fastening the manifold assembly to the upperstructure.

Disconnect and cap the tubeline (Item 2) **[Figure 60-10-21]** from the manifold assembly.

Figure 60-10-22



Slide the manifold assembly toward the rear of the excavator. Disconnect and cap the two hoses (Item 1) **[Figure 60-10-22]** on the backside of the manifold assembly.

Remove the manifold assembly from the excavator.

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Engine Removal And Installation (Cont'd)

Figure 60-10-23

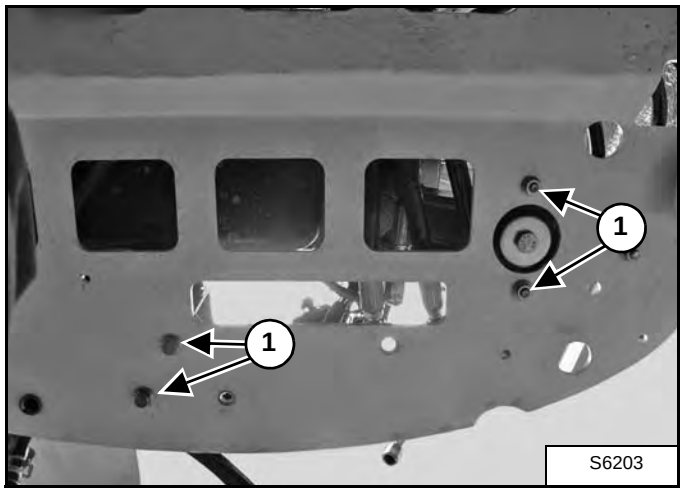
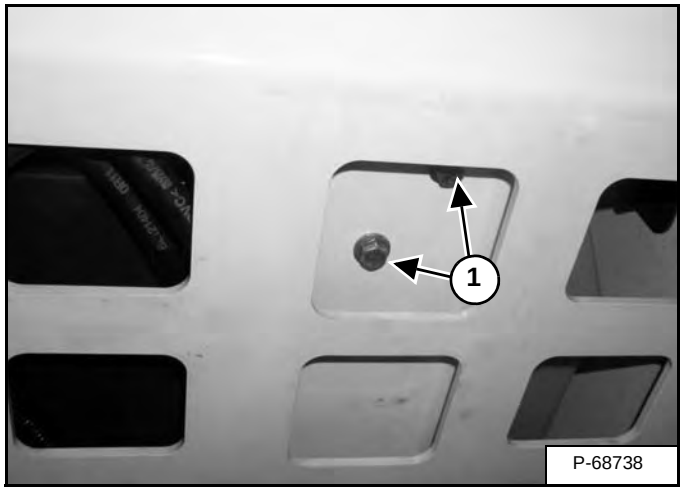


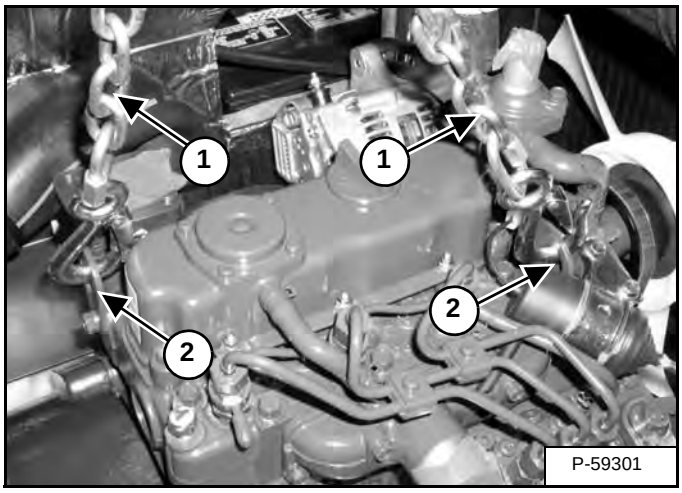
Figure 60-10-24



Remove the six engine mount bolts (Item 1) **[Figure 60-10-23]** and **[Figure 60-10-24]**.

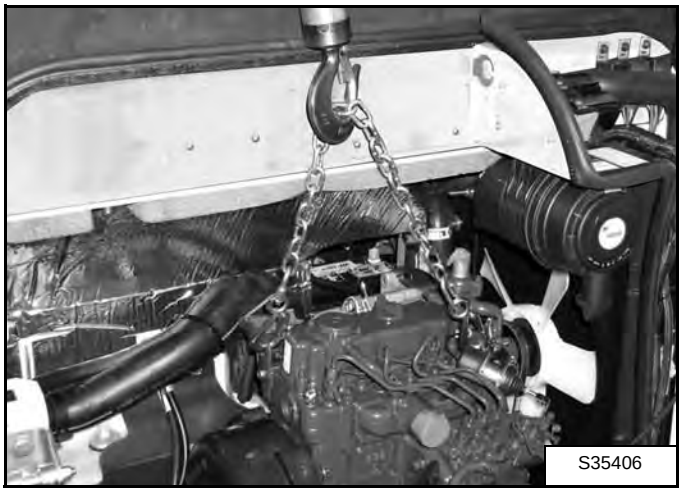
NOTE: The engine mounts are left assembled to the engine and will be removed with the engine.

Figure 60-10-25



Connect a chain (Item 1) to the two engine lifting brackets (Item 2) **[Figure 60-10-25]**.

Figure 60-10-26



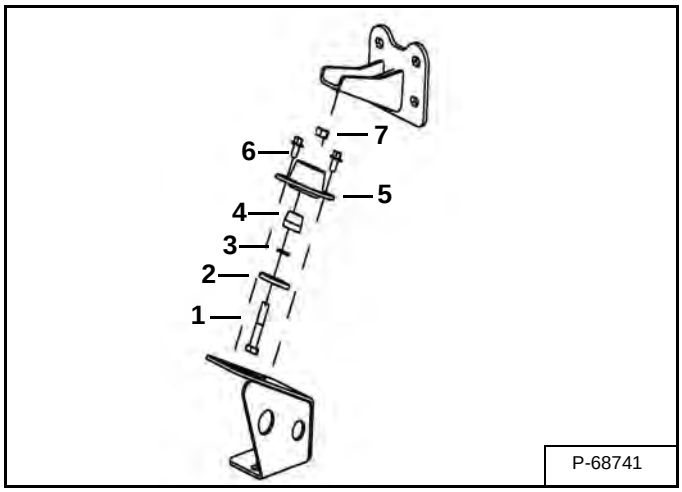
Lift and slide the engine out while turning the engine to provide clearance during engine removal **[Figure 60-10-26]**.

NOTE: Protect the back of the excavator canopy / cab from lifting chain damage during engine removal.

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Engine Mount Replacement

Figure 60-10-27



Use the following procedure to install new front and rear engine mounts:

Remove the existing mount from the engine. Refer to engine removal and installation for engine mount locations.

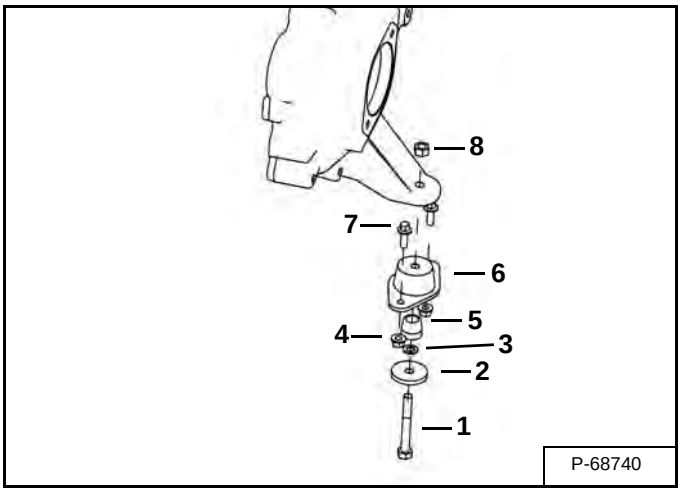
Replace the two front and rear engine mounts.

Use the parts shown to install the new engine mounts for the front and rear engine mounts **[Figure 60-10-27]**.

Item 1 - Mounting Bolt
Item 2 - Mount Washer
Item 3 - Flatwasher
Item 4 - Spacer
Item 5 - Mount
Item 6 - Screw
Item 7 - Nut

Tighten the mounting bolts to 43 - 47 N•m (32 - 35 ft-lb) torque.

Figure 60-10-28



Use the following procedure to install new side engine mounts:

Remove the existing side mount from the engine. Refer to engine removal and installation for engine mount locations.

Use the parts shown to install the new engine mount for the side engine mount **[Figure 60-10-28]**.

Item 1 - Mounting Bolt
Item 2 - Mount Washer
Item 3 - Flatwasher
Item 4 - Nut
Item 5 - Spacer
Item 6 - Mount
Item 7 - Screw
Item 8 - Nut

Tighten the mounting bolt to 43 - 47 N•m (32 - 35 ft-lb) torque.

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Compression - Checking

The tool listed will be needed to do the following procedure:

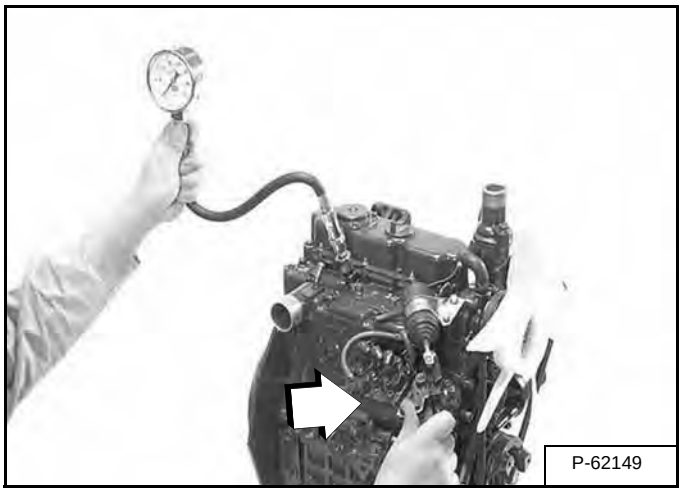
MEL10630 - Engine Compression Test Kit
Warm the engine.

Remove the glow plugs, muffler and air cleaner from the engine. (If testing through glow plug hole.)

Remove the air cleaner, muffler and all injector nozzles. (If testing through injector nozzle hole.)

Install the compression adapter in the cylinder head.

Figure 60-10-29



Connect the compression gauge to the adapter **[Figure 60-10-29]**.

Ensure the speed control lever is set at the low idle setting.

Hold fuel shut off lever to no fuel (shutoff). See arrow, **[Figure 60-10-29]**. Shut off solenoid does not need to be removed.

Turn the engine with the starter at 200 to 300 rpm. Run the test for each cylinder more than twice for 5 to 10 seconds each time and take the average reading. Make sure you are using a fully charged battery.

The correct compression for the engine is 2,8 to 3,2 MPa (28 - 32 bar) (412 - 469 psi) with no more than 10% difference between the cylinders.

If the pressures are not within 10% of each other, apply a small amount of oil in the cylinders and retest.

If the pressures increase after applying oil, check cylinder walls and piston rings.

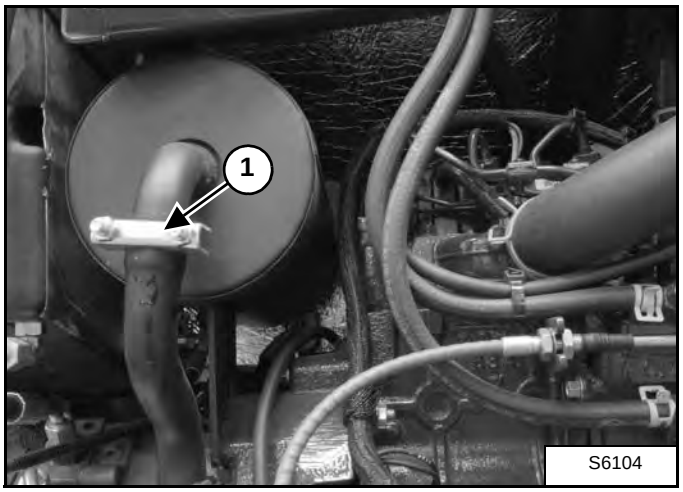
If the pressures do not increase after applying oil, check top clearance, valve clearance and cylinder head.

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SPARK ARRESTER MUFFLER

Removal And Installation

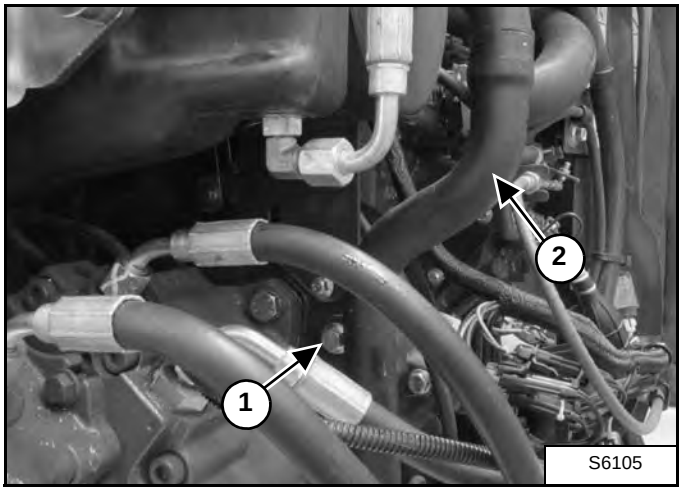
Figure 60-20-1



Loosen the exhaust extension clamp (Item 1) **[Figure 60-20-1]**.

Installation: Tighten clamp to 8 - 10 N•m (71 - 88.5 in-lb) torque.

Figure 60-20-2



Remove the bolt (Item 1) **[Figure 60-20-2]** from the exhaust extension mounting bracket.

Slide exhaust extension (Item 2) **[Figure 60-20-2]** off muffler and remove from the excavator.

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

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

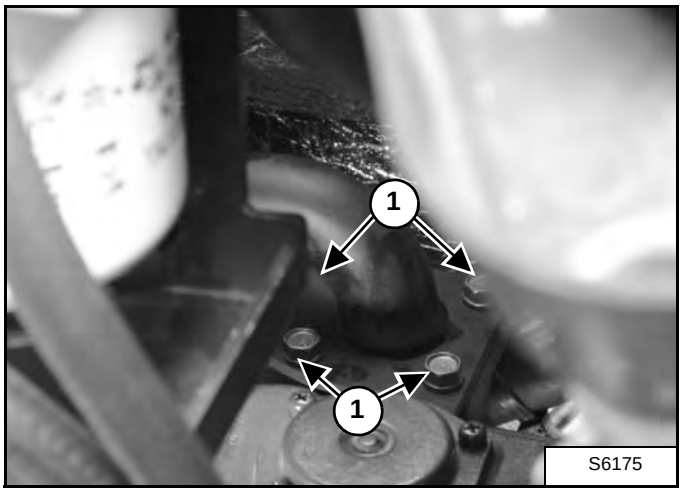
W-2011-1285

WARNING

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

W-2068-1285

Figure 60-20-3

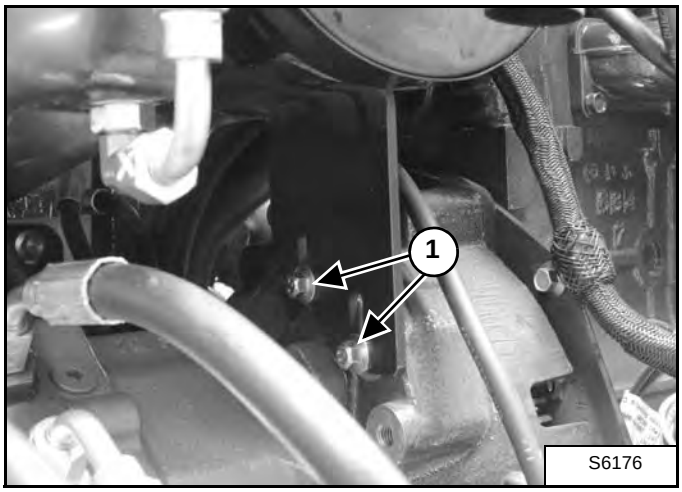


Remove the four bolts (Item 1) **[Figure 60-20-3]** from the muffler mount flange.

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Removal And Installation (Cont'd)

Figure 60-20-4



Loosen the two bolts (Item 1) **[Figure 60-20-4]**.

Remove the muffler.

NOTE: Plug the exhaust manifold hole after muffler removal so no contamination can get into the engine.

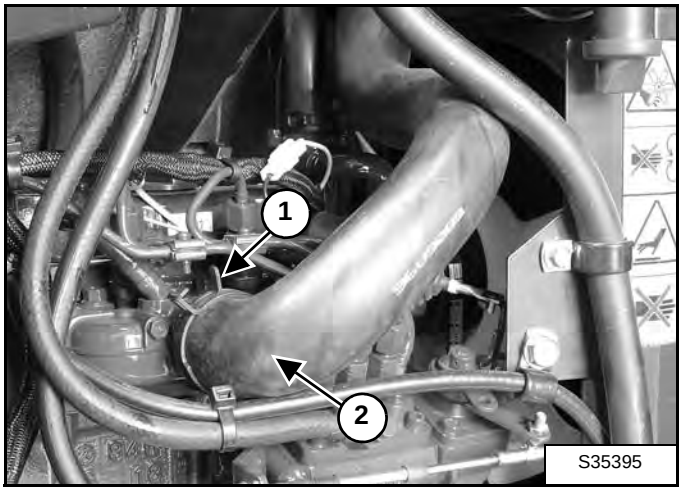
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AIR CLEANER

Removal And Installation

Open the tailgate. (See TAILGATE on Page 10-60-1.)

Figure 60-30-1

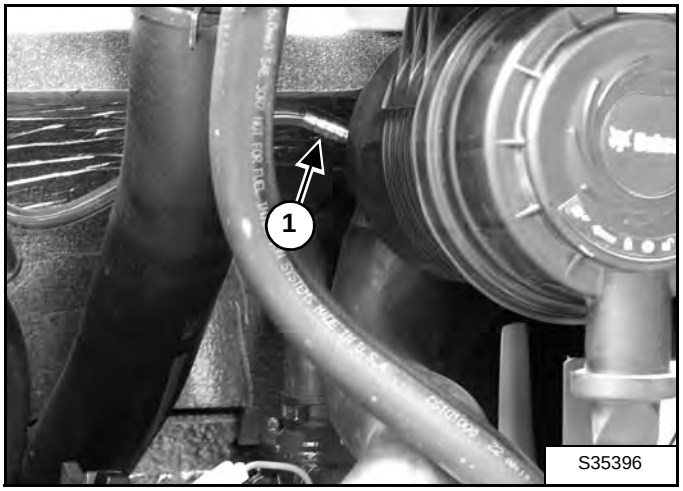


Loosen the hose clamp (Item 1) **[Figure 60-30-1]** on the air intake hose.

Remove the hose (Item 2) **[Figure 60-30-1]**.

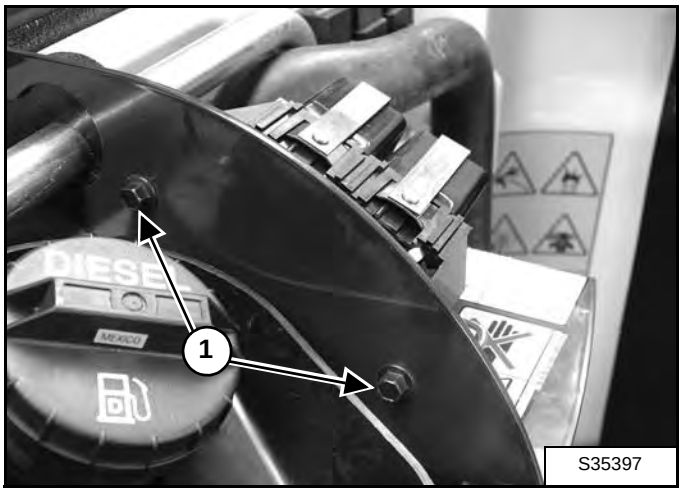
NOTE: Plug the intake manifold hole to prevent any contamination from getting into the engine.

Figure 60-30-2



Remove the hose (Item 1) **[Figure 60-30-2]** from the back of the air cleaner.

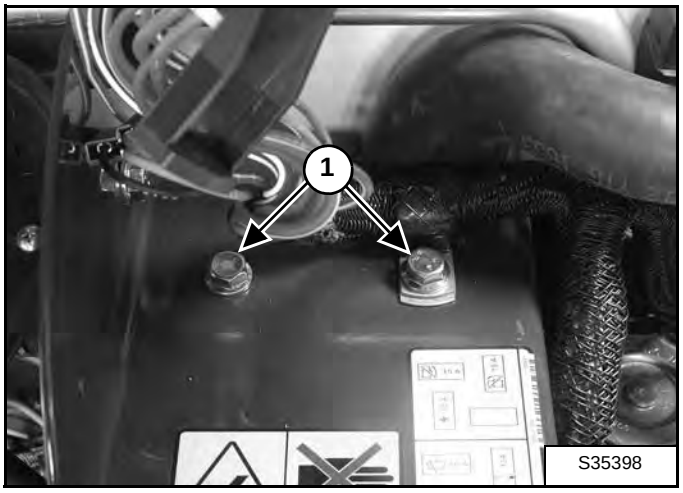
Figure 60-30-3



Remove the two bolts (Item 1) **[Figure 60-30-3]** fastening the fuse bracket to the excavator.

Move the fuse assembly aside to expose the two air cleaner mounting bolts.

Figure 60-30-4

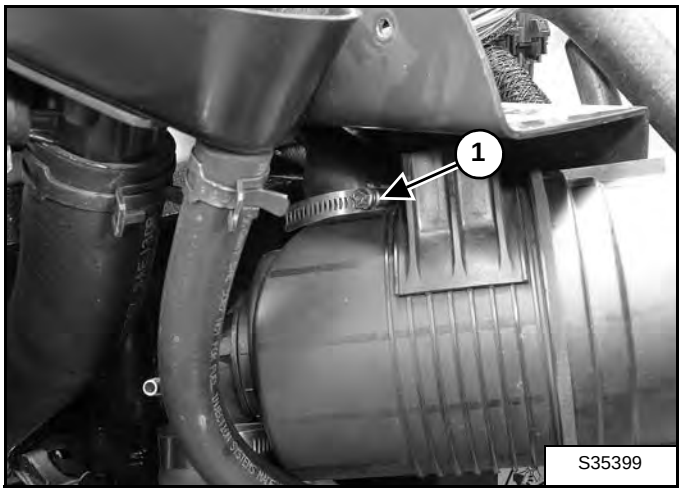


Remove the two bolts (Item 1) **[Figure 60-30-4]**.

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Removal And Installation (Cont'd)

Figure 60-30-5



Loosen the hose clamp (Item 1) **[Figure 60-30-5]** and remove hose from the top of the air cleaner.

Remove the air cleaner and intake hose assembly from the excavator.

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Radiator Removal And Installation

Open the tailgate. (See TAILGATE on Page 10-60-1.)

WARNING

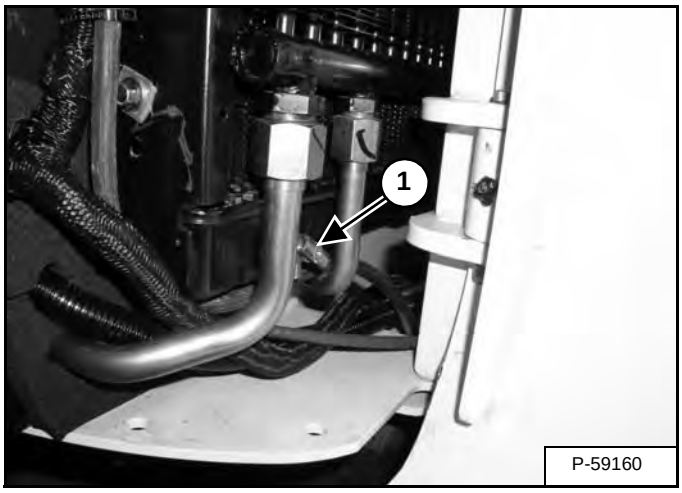
AVOID BURNS

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

W-2070-1203

Drain the hydraulic reservoir. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

Figure 60-40-1

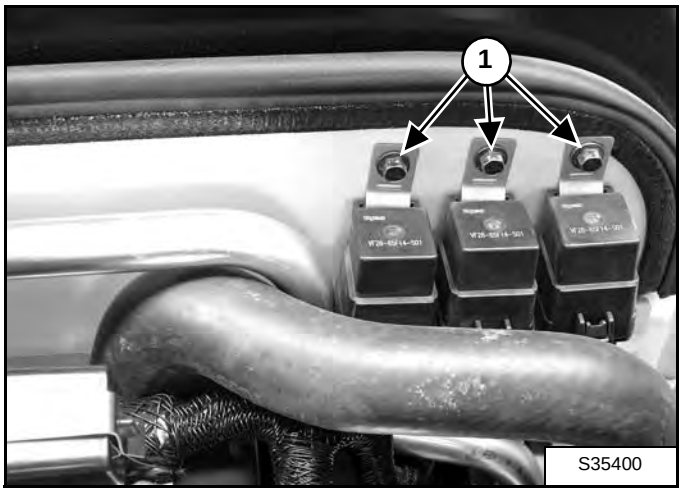


Open the radiator drain valve (Item 1) **[Figure 60-40-1]** and drain the coolant into a container.

Loosen the radiator cap from the radiator fill neck.

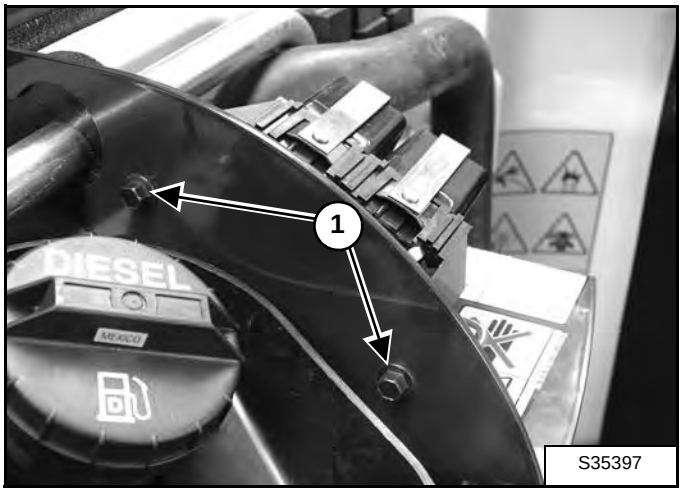
Mark the three electrical relays for ease of assembly.

Figure 60-40-2



Remove the bolts (Item 1) **[Figure 60-40-2]** fastening the relays to the frame.

Figure 60-40-3

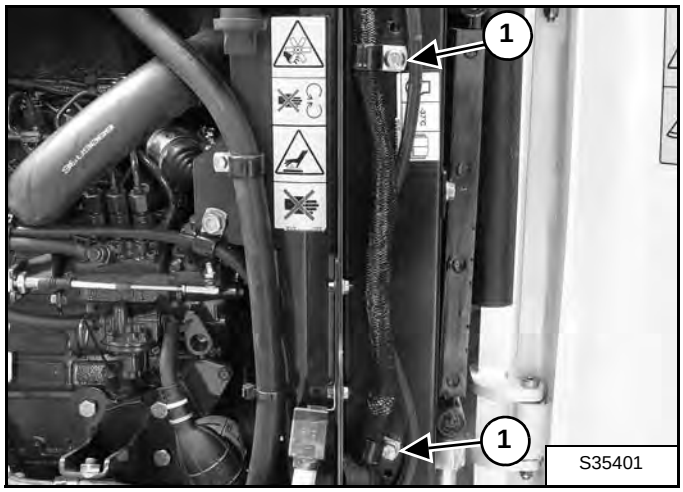


Remove the bolts (Item 1) **[Figure 60-40-3]** fastening the fuse bracket assembly to the frame.

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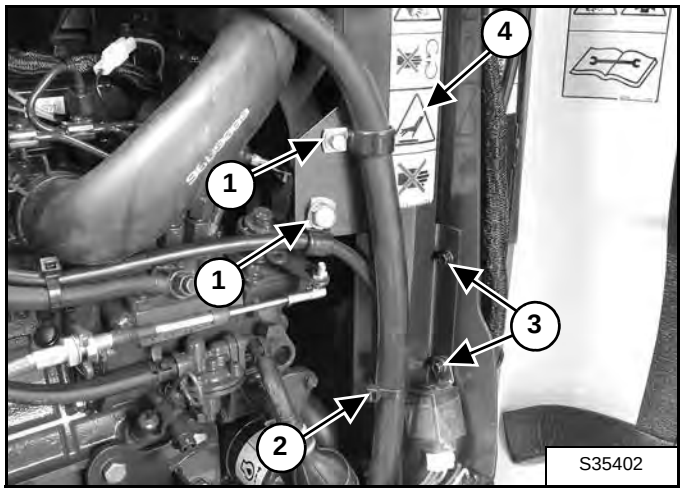
Radiator Removal And Installation (Cont'd)

Figure 60-40-4



Remove the two bolts (Item 1) **[Figure 60-40-4]** fastening the wire harness to the radiator.

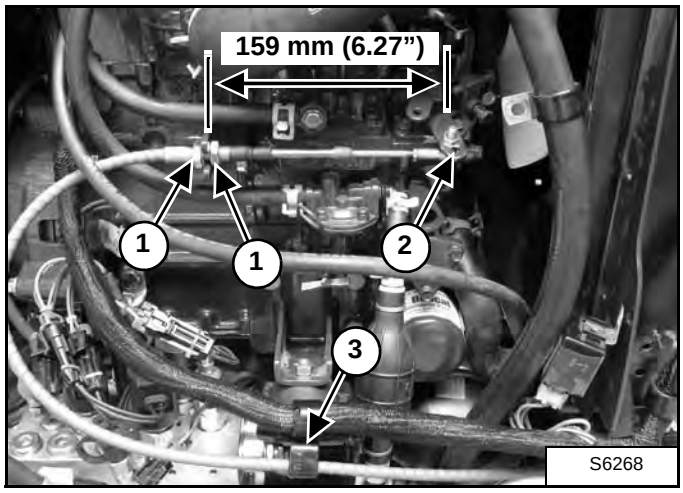
Figure 60-40-5



Remove the bolts (Item 1) and tie-strap (Item 2) **[Figure 60-40-5]** on the fan guard.

Remove the nuts (Item 3) and remove the fan guard (Item 4) **[Figure 60-40-5]**.

Figure 60-40-6



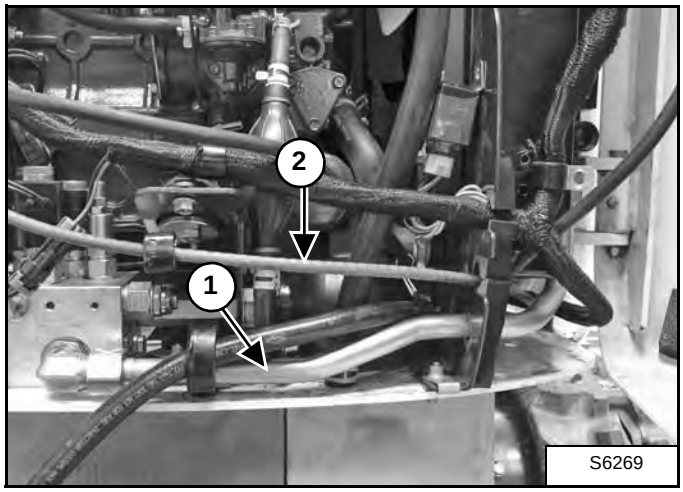
Loosen the nuts (Item 1) **[Figure 60-40-6]** fastening the cable to the bracket.

Disconnect the linkage (Item 2) **[Figure 60-40-6]** from the bracket.

Remove the nut and cable clamp (Item 3) **[Figure 60-40-6]** from the engine mount.

Installation: The linkage measurement from bracket to the center of the ball joint is 159 mm (6.27 in).

Figure 60-40-7



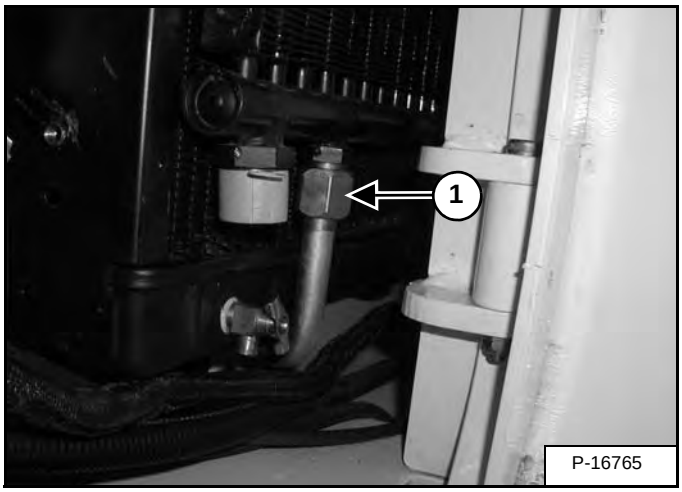
Remove the tubeline (Item 1) **[Figure 60-40-7]** from the manifold assembly to the oil cooler. Remove the tubeline by pulling the tubeline through the radiator bracket from the engine side of the radiator.

Push the engine speed control cable (Item 2) **[Figure 60-40-7]** through the radiator bracket toward the tailgate. Move the cable to the side.

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Radiator Removal And Installation (Cont'd)

Figure 60-40-8



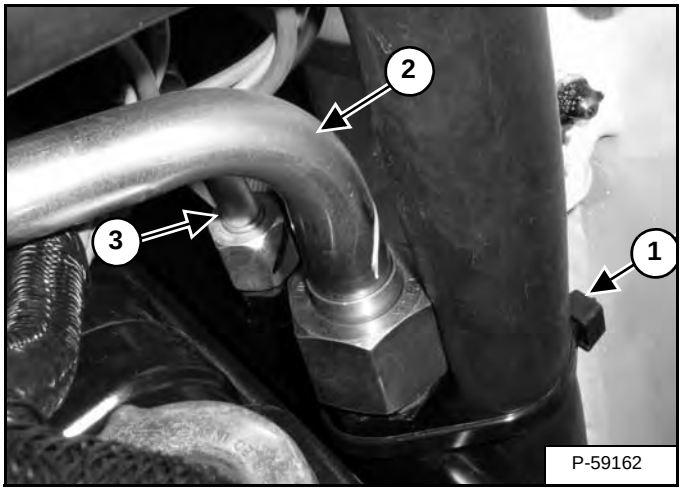
Remove the tubeline (Item 1) **[Figure 60-40-8]** from the oil cooler to the control valve assembly.

IMPORTANT

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

I-2003-0888

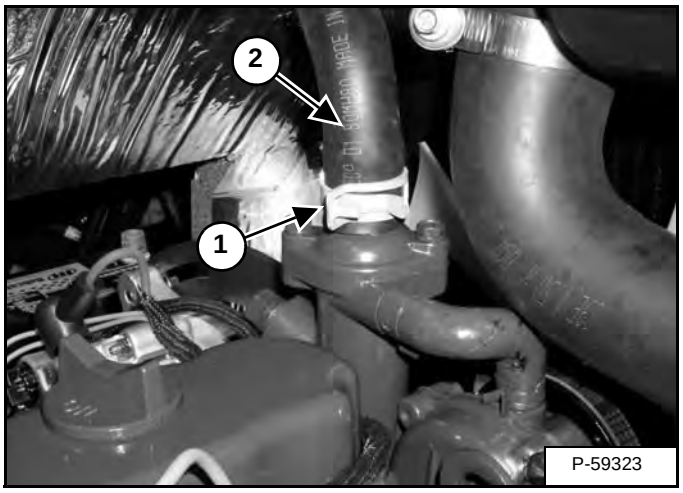
Figure 60-40-9



Remove the tie-strap (Item 1) **[Figure 60-40-9]**.

Remove the tubeline (Item 2) and hose (Item 3) **[Figure 60-40-9]** from the top of the oil cooler.

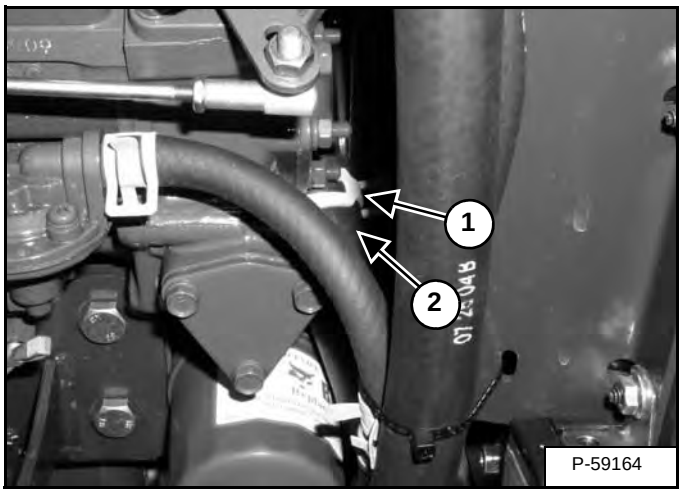
Figure 60-40-10



Slide the hose clamp (Item 1) away from the end of the upper radiator hose (Item 2) **[Figure 60-40-10]**.

Remove the upper radiator hose (Item 2) **[Figure 60-40-10]**.

Figure 60-40-11



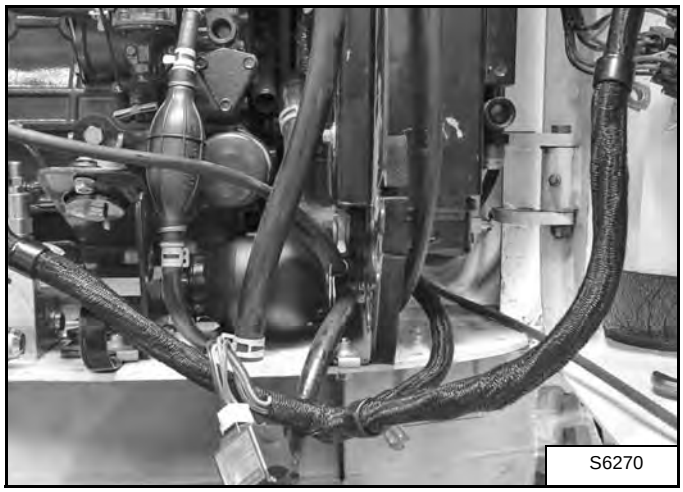
Slide the hose clamp (Item 1) **[Figure 60-40-11]** away from the end of the lower radiator hose.

Remove the lower radiator hose (Item 2) **[Figure 60-40-11]**.

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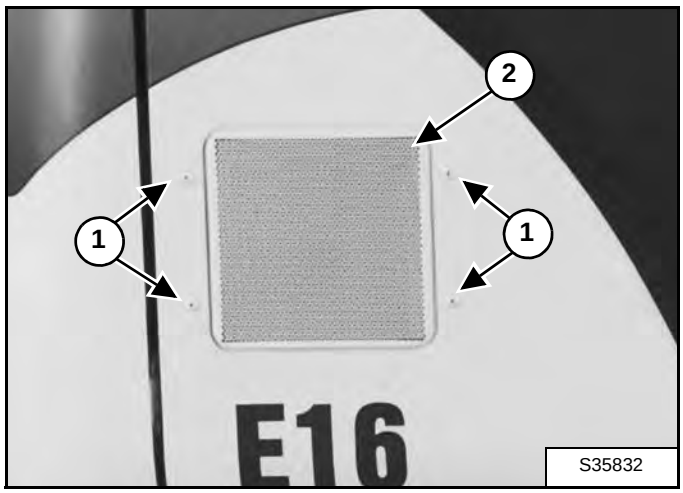
Radiator Removal And Installation (Cont'd)

Figure 60-40-12



Move the wire harness and battery cable down below the radiator bracket. This allows the radiator and oil cooler assembly to pass over the harness and cable during removal **[Figure 60-40-12]**.

Figure 60-40-13

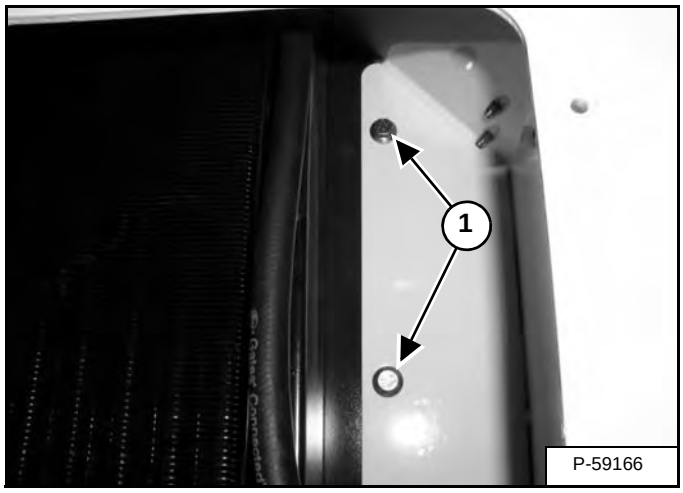


Remove the screws (Item 1) and grille (Item 2) **[Figure 60-40-13]**.

Remove the grille (Item 2) **[Figure 60-40-13]**.

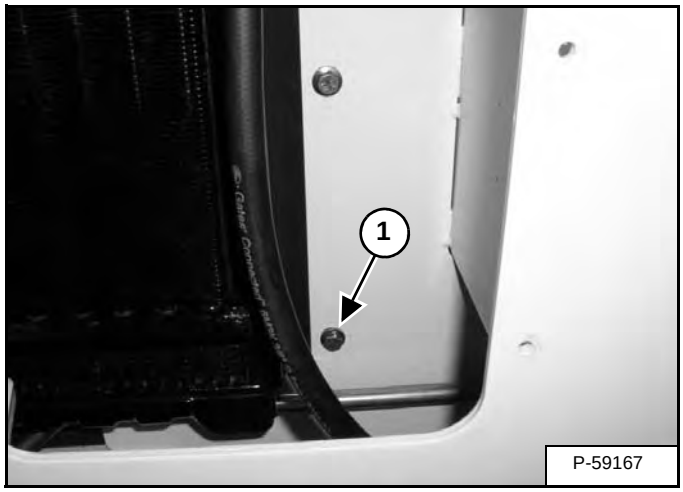
NOTE: Use a magnet or pick to prevent the grille (Item 2) [Figure 60-40-13] from dropping and being scratched or damaged.

Figure 60-40-14



Remove the top bolts (Item 1) **[Figure 60-40-14]** mounting the radiator to the frame.

Figure 60-40-15

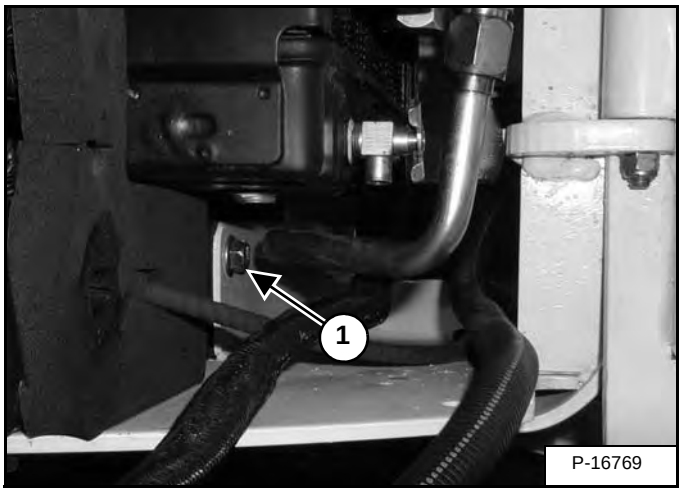


Remove the bottom bolt (Item 1) **[Figure 60-40-15]** mounting the radiator to the frame.

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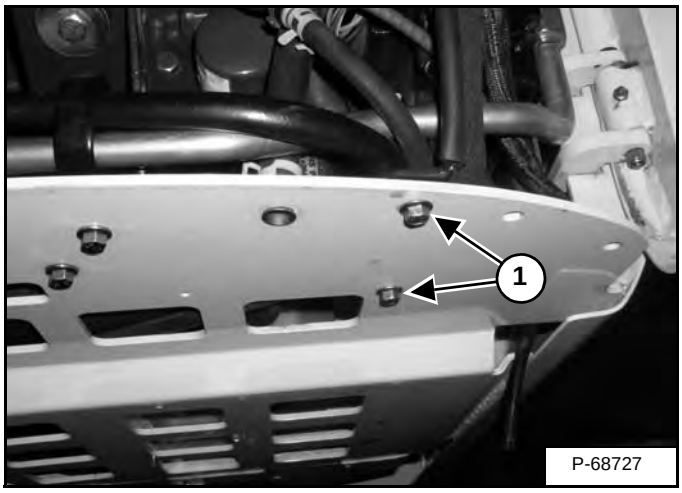
Radiator Removal And Installation (Cont'd)

Figure 60-40-16



Remove the bottom bolt (Item 1) **[Figure 60-40-16]** mounting the radiator to the frame.

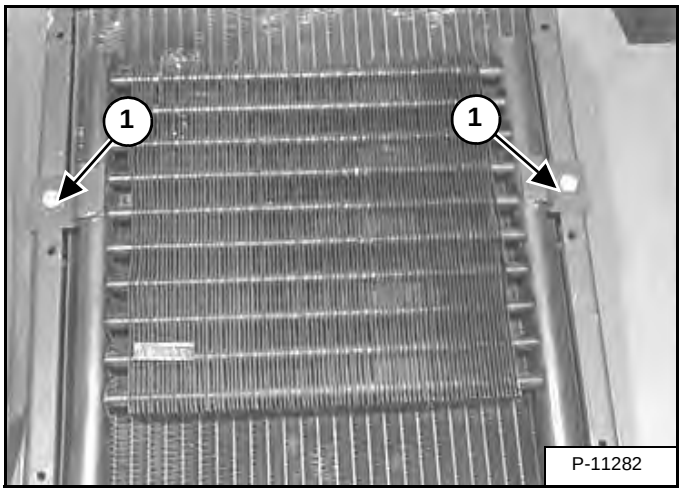
Figure 60-40-17



Remove the bolts (Item 1) **[Figure 60-40-17]** on the underside of the upperstructure.

Slide the radiator and oil cooler assembly out the back of the excavator.

Figure 60-40-18



Remove the bolts (Item 1) **[Figure 60-40-18]** from the oil cooler.

Remove the oil cooler from the radiator.

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Water Pump Removal And Installation

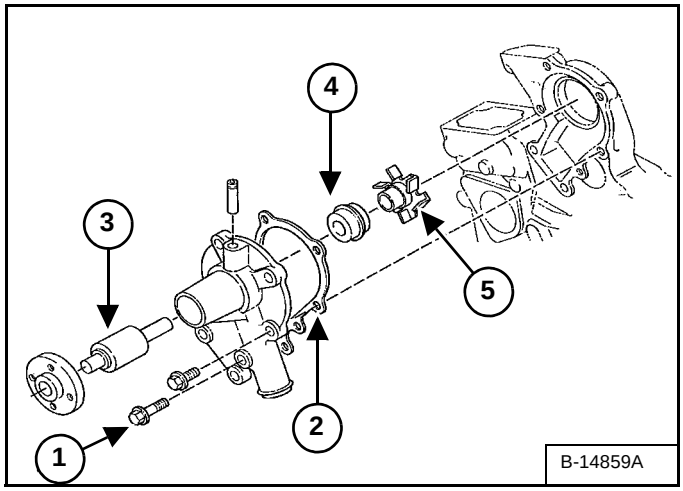
Drain the cooling system.

Remove the radiator. (See Radiator Removal And Installation on Page 60-40-1.)

Remove the alternator belt.

Remove the fan.

Figure 60-40-19



Remove the water pump bolts (Item 1) **[Figure 60-40-19]**.

Remove the water pump.

Installation: Always use a new gasket (Item 2) **[Figure 60-40-19]** when installing the water pump and apply Liquid-Type Gasket (Three Bond 1215 or equivalent) to both sides of new gasket.

Water Pump Disassembly And Assembly

Put the water pump in a vise.

Remove the pulley.

Press the shaft (Item 3) **[Figure 60-40-19]** out of the pulley side of the water pump. Press out the shaft with the impeller on it.

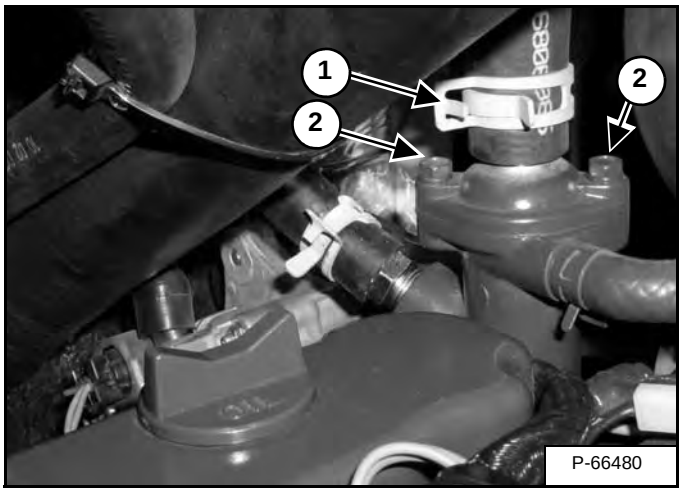
Remove the seal (Item 4) and impeller (Item 5) **[Figure 60-40-19]**.

Install a new seal when assembling the water pump.

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Thermostat Removal And Installation

Figure 60-40-20



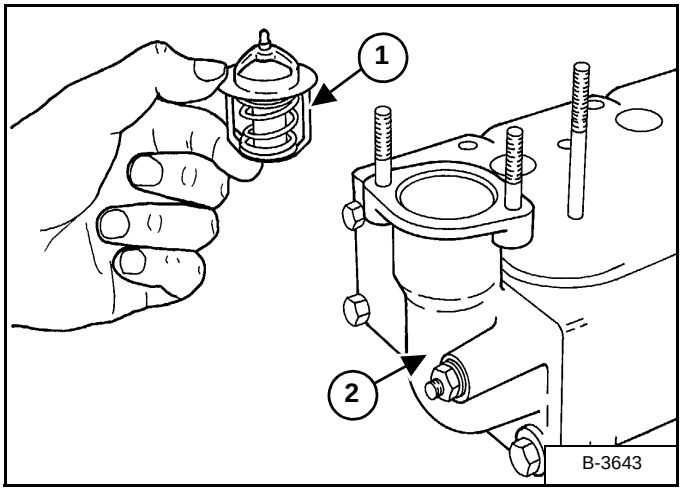
Drain the engine coolant until it is below the thermostat level.

Remove the hose clamp (Item 1) **[Figure 60-40-20]**.

Remove the bolts (Item 2) **[Figure 60-40-20]** and thermostat housing.

Installation: Make sure all gasket surfaces are clean. Replace the gasket before installing the thermostat housing. Install liquid gasket to thermostat housing.

Figure 60-40-21



Remove the housing and thermostat (Item 1) **[Figure 60-40-21]**.

Remove the four mounting bolts at the coolant housing (Item 2) **[Figure 60-40-21]**.

Remove coolant housing from the engine block.

Thermostat - Checking

Hang the thermostats in a suitable container filled with coolant.

Heat the coolant gradually. Use a thermometer to check the temperature when it starts to open and when it's fully open.

If the thermostats do not operate correctly they must be replaced.

NOTE: See specifications on the thermostat (See Thermostat on Page 60-10-4.)

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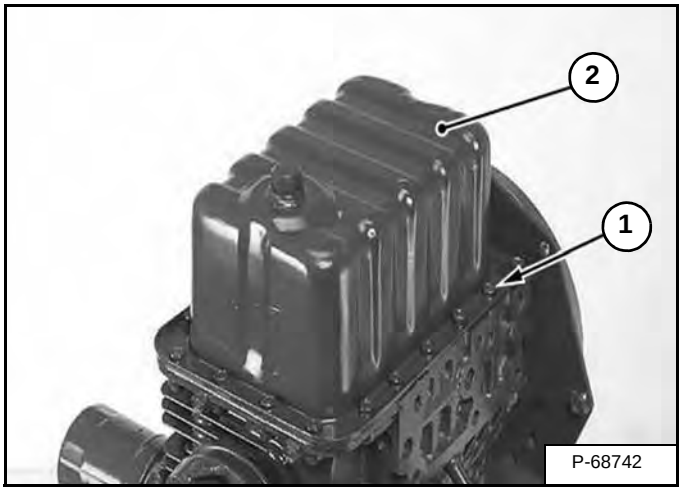


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Oil Pan Removal And Installation

Remove the engine from the excavator (See Engine Removal And Installation on Page 60-10-8.)

Figure 60-50-1



Unscrew the oil pan mounting screws (Item 1) and remove the oil pan (Item 2) **[Figure 60-50-1]**.

Figure 60-50-2

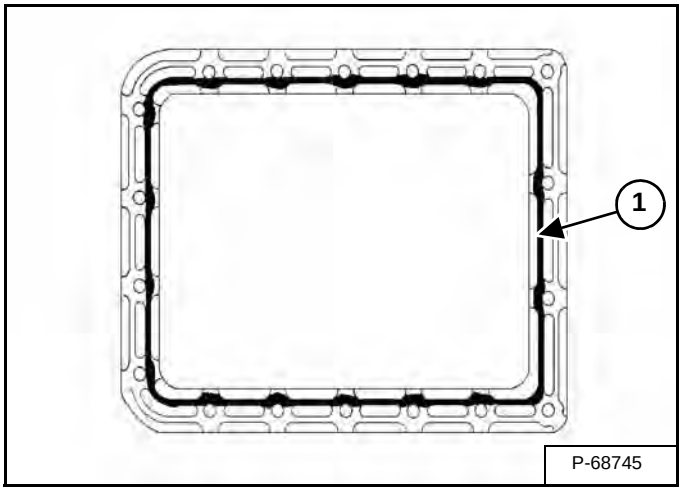
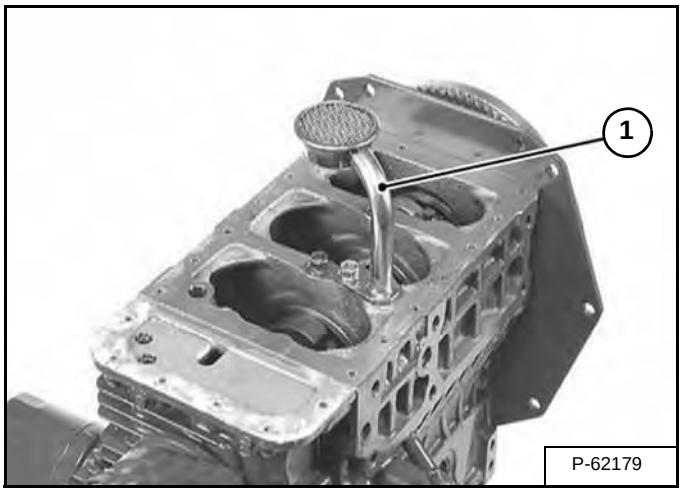
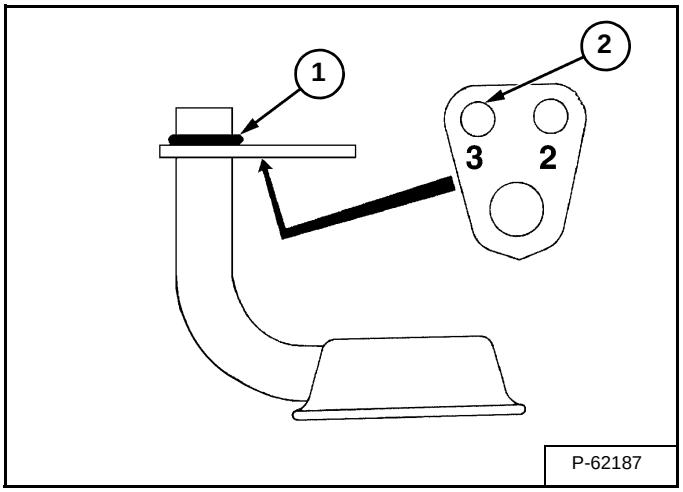


Figure 60-50-3



Remove the oil pump strainer (Item 1) **[Figure 60-50-3]**.

Figure 60-50-4



Installation: Check O-ring (Item 1) on strainer and use hole 3 (Item 2) **[Figure 60-50-4]** when installing strainer. Install the oil strainer, using care not to damage the O-ring.

Apply liquid gasket to the oil pan (Item 1) **[Figure 60-50-2]**.

Confirm that the liquid gasket coating surface is free of water, dust and oil in order to maintain sealing effect.

Carefully apply the adhesive evenly.

NOTE: When mounting the adhesive-applied parts, take care to fit them to the mating parts. Assemble the adhesive-applied parts within 10 minutes. To avoid uneven tightening, tighten mounting screws in diagonal order from the center.After cleaning the oil strainer, install it. Attach the oil pan with its central drain plug facing toward the air suction side.

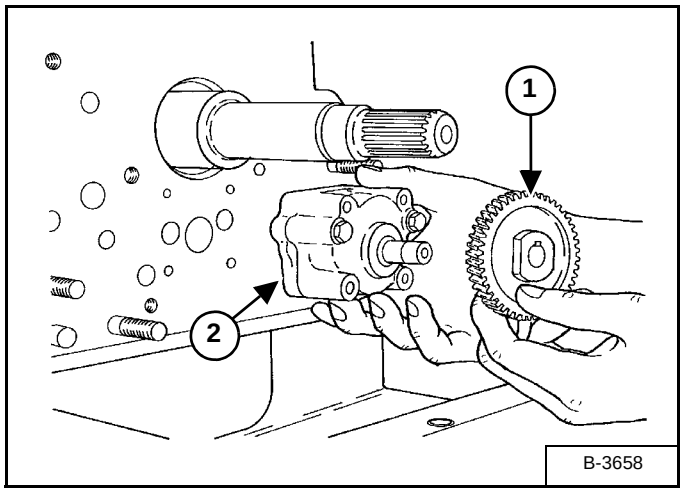
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Oil Pump Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-90-1.)

Remove the crankshaft gear. (See Crankshaft Gear Removal And Installation on Page 60-80-6.)

Figure 60-50-5



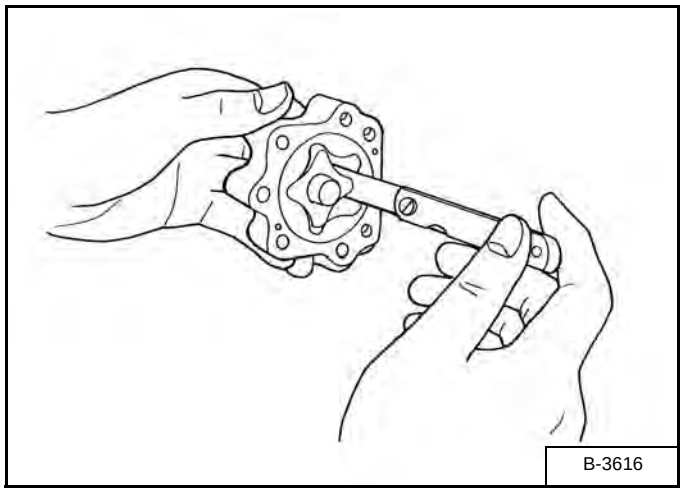
Remove the nut from the oil pump shaft. Use a puller to remove the oil pump gear (Item 1) **[Figure 60-50-5]**.

Remove the oil pump mounting bolts. Remove the oil pump (Item 2) **[Figure 60-50-5]**.

Installation: Tighten the oil pump mounting bolts to 6,9 - 8,1 N•m (60 - 72 in-lb) torque.

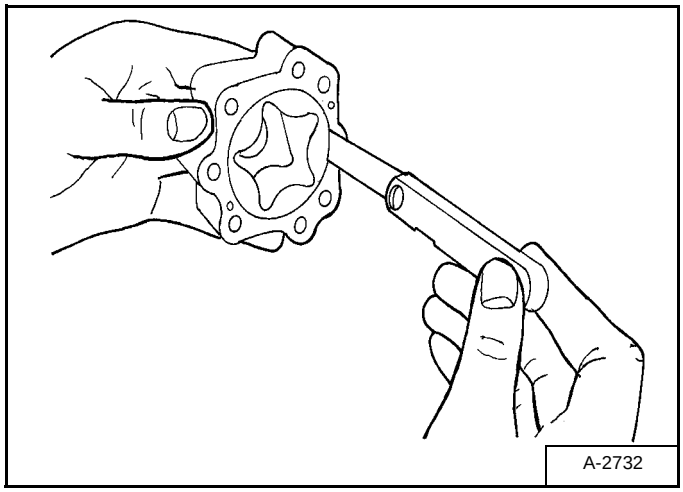
Oil Pump - Service

Figure 60-50-6



Measure the clearance between the lobes of the inner rotor and outer rotor with a feeler gauge **[Figure 60-50-6]**.

Figure 60-50-7



Measure the clearance between the outer rotor and pump body with a feeler gauge **[Figure 60-50-7]**.

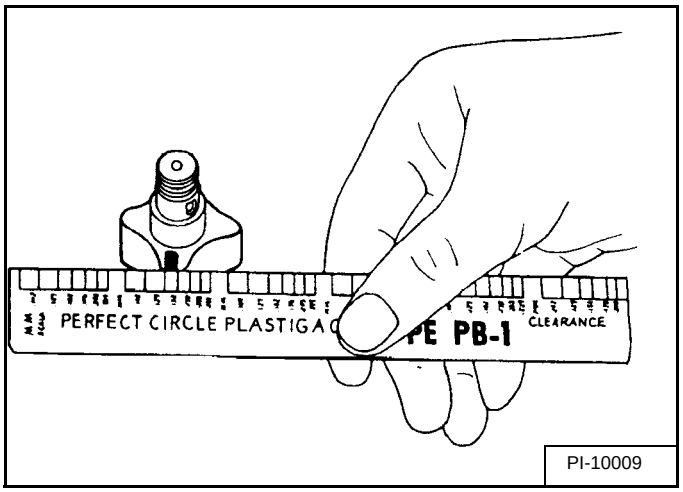
If the clearance exceeds the factory limit, replace the oil pump rotor assembly.

Clearance Between Inner and Outer Rotor	
	0,03 - 0,14 mm (0.001 - 0.006 in)
Clearance Between Outer Rotor and Body	
	0,07 - 0,15 mm (0.003 - 0.006 in)

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Oil Pump - Service (Cont'd)

Figure 60-50-8



Put a piece of press gauge on the rotor face **[Figure 60-50-8]**.

Install the cover and tighten the bolts.

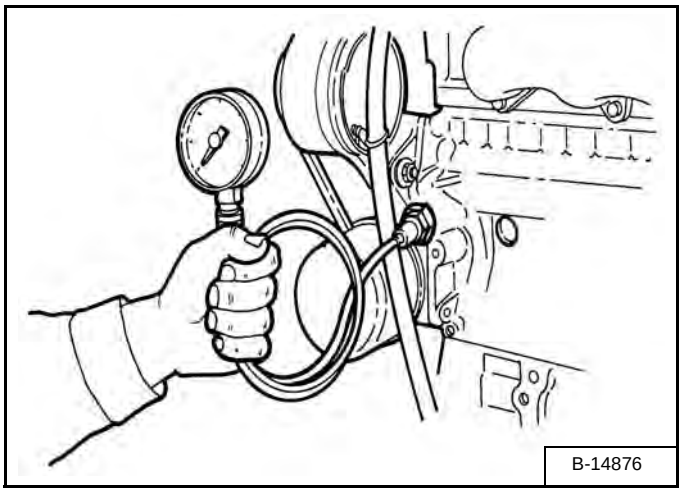
Remove the cover carefully. Measure the width of the press gauge **[Figure 60-50-8]**.

If the clearance exceeds the factory limit replace the oil pump rotor assembly.

End Clearance	0,08 - 0,14 mm (0.003 - 0.005 in)

Engine Oil Pressure - Testing

Figure 60-50-9



Remove the oil pressure sensor.

Install a pressure gauge **[Figure 60-50-9]**.

Start the engine and let it run until it is at operating temperature.

Measure oil pressure at both idling and rated speeds.

If the oil pressure is less than the allowable limit, check the following item:

- Engine Oil Insufficient
- Oil Pump Defective
- Oil Galley Plugged
- Oil Strainer Plugged
- Excessive Oil Clearance
- Foreign Matter in Relief Valve
- Oil Filer Cartridge plugged

At Idle Speed Allowable Limit	4,8 MPa (0,48 bar) (7 psi)
At Rated Speed	0,2 - 0,4 MPa (2 - 4 bar) (28 - 64 psi)
Allowable Limit	0,1 MPa (1 bar) (21 psi)

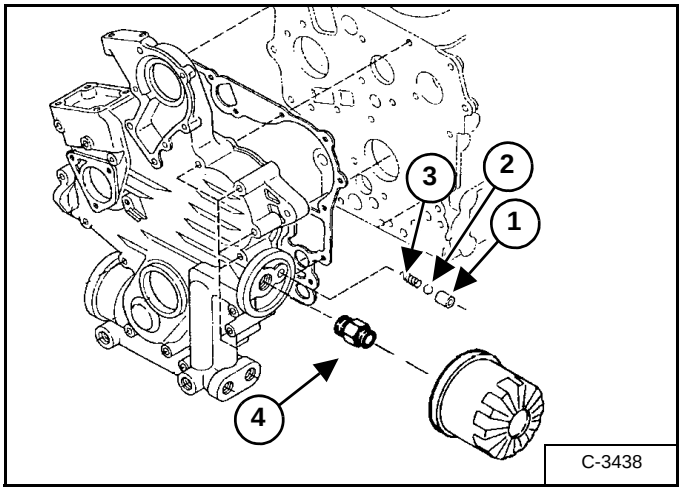
Installation: After checking engine oil pressure, tighten oil pressure sensor to 15 - 20 N•m (11 - 15 ft-lb) torque.

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Relief Valve

The relief valve prevents damage of the lubricating system due to high pressure. This relief valve is a ball type.

Figure 60-50-10



Remove the valve seat (Item 1), ball (Item 2) and spring (Item 3) **[Figure 60-50-10]**.

Check the parts for wear or damage and replace as needed.

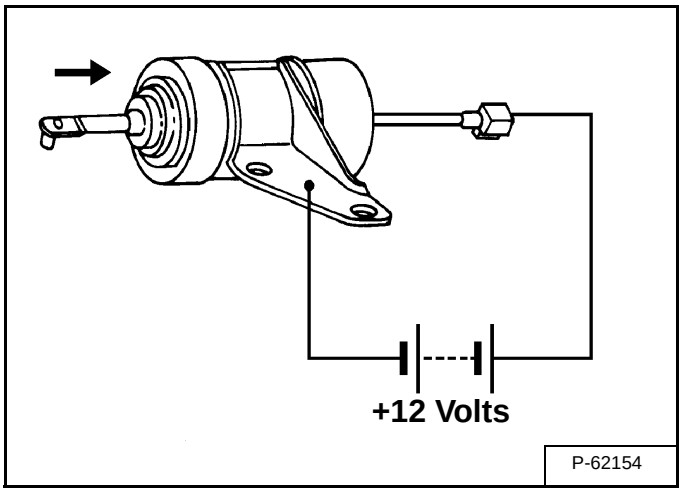
Spring Free Length	
Factory Spec	32 mm (1.26 in)
Allowable Limit	28 mm (1.10 in)

Installation: Tighten the oil fitter adapter (Item 4) **[Figure 60-50-10]** to 39 - 49 N•m (29 - 36 ft-lb) torque.

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Fuel Shutoff Solenoid - Checking

Figure 60-60-1



The solenoid does not have 12 volts applied to it while the engine is running **[Figure 60-60-1]**.

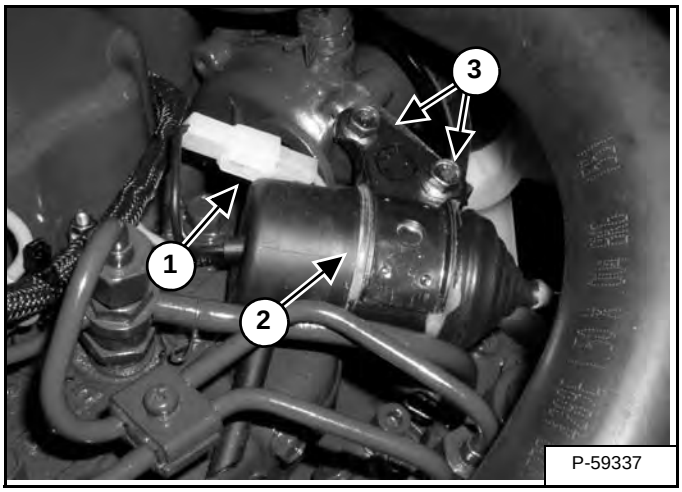
The solenoid is energized for a brief period with 12 volt when the ignition key is turned off.

The length of time 12 volts is applied is controlled by a timer in the electrical harness.

To test the solenoid, directly apply 12 volt to the electrical lead of the solenoid. The solenoid arm should pull back into the solenoid housing until the 12 volt power supply is removed.

Fuel Shutoff Solenoid Removal And Installation

Figure 60-60-2



Disconnect the wire (Item 1) from the solenoid (Item 2) **[Figure 60-60-2]**.

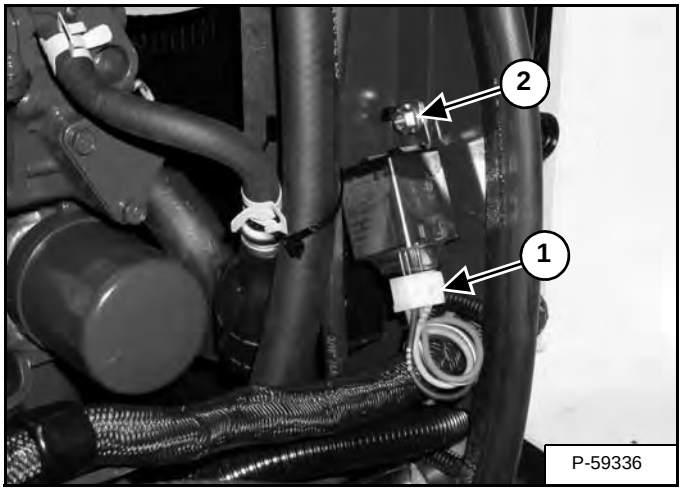
Remove the solenoid mounting bolts (Item 3) **[Figure 60-60-2]**.

Remove the solenoid (Item 2) **[Figure 60-60-2]**.

Fuel Shutoff Timer Removal And Installation

The fuel shutoff timers function is to provide pull in current to the fuel solenoid for only a short duration. This provides longer fuel solenoid service life and also allows for more starter cranking power.

Figure 60-60-3



Disconnect the wire harness (Item 1) **[Figure 60-60-3]** from the timer module.

Remove the nut (Item 2) **[Figure 60-60-3]**.

Remove the fuel shutoff timer.

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Fuel Injection Pump - Checking

NOTE: Never try to disassemble the injection pump assembly. For repairs, you should contact a Kubota-authorized pump service shop.

Remove the air cleaner. (See Removal And Installation on Page 60-30-1.)

Remove the engine stop solenoid.

The tools listed will be needed to do the following procedure:

MEL1237 - Adapter Fuel Line
MEL1173-1 - Pressure Gauge

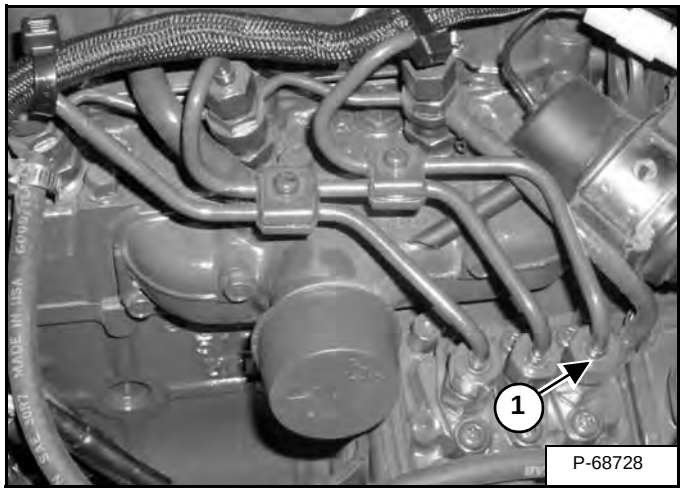
⚠ WARNING

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 doctor familiar with this injury.

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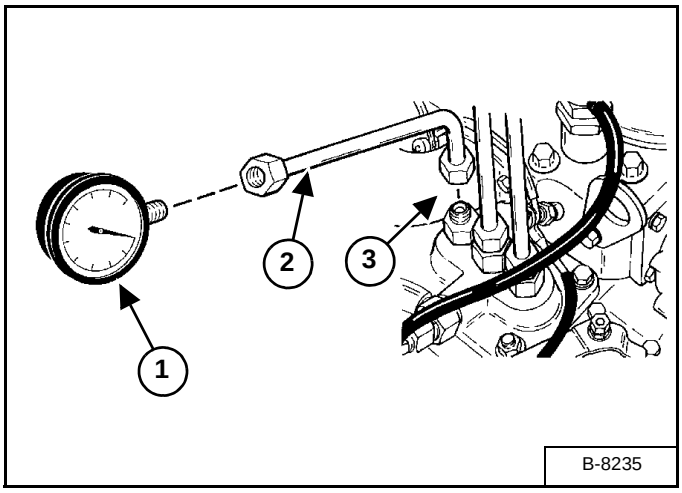
Figure 60-60-4



To check the initial discharge pressure, remove a high pressure tubeline (Item 1) **[Figure 60-60-4]** from the fuel injection pump.

Loosen the other end of the tubeline at the injector, so that the tubeline can be turned away from the fitting.

Figure 60-60-5



Connect a pressure gauge (Item 1) to the long leg of the test tubeline (Item 2) **[Figure 60-60-5]** and tighten.

Connect the short leg of the tubeline to the fitting at the fuel injection pump (Item 3) **[Figure 60-60-5]**.

Set the speed control lever to the maximum engine speed position to allow full fuel delivery.

Fuel Tightness of Pump Element

With the starter, rotate the engine to increase the pressure to 13,7 MPa (137 bar) (1991 psi).

If the pressure cannot be reached, replace the pump with a new one or send to a Kubota-authorized pump service shop.

Fuel Tightness of Delivery Valve

Manually turn the flywheel to raise the pressure to approx. 13,7 MPa (137 bar) (1991 psi). Now turn the flywheel back about 1,5 turn (to keep the plunger free), and clock the time taken for the pressure to drop from 13,7 to 12,7 MPa (137 - 127 bar) (1991 - 1849 psi).

The pressure should hold at 13,7 MPa (137 bar) (1991 psi), for at least 5 seconds or more.

If the time is less than the allowable limit, replace the pump with a new one, or send to a Kubota-authorized pump service shop.

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Fuel Injection Pump Removal And Installation

IMPORTANT

Do not attempt to maintain or adjust unless you are trained and have the correct equipment.

I-2028-0289

Clean the injection pump and area around it with a cleaning solvent or steam cleaning.

IMPORTANT

Never steam clean or put cold water on an injection pump while the engine is running or while it is hot. If you do it will cause serious damage to the injection pump.

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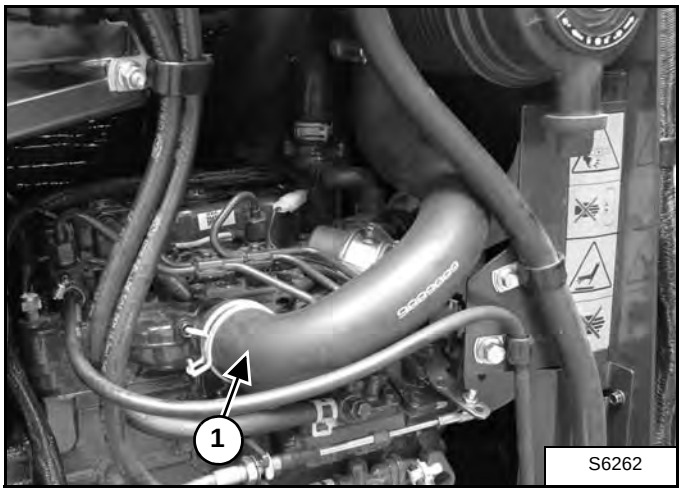
IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

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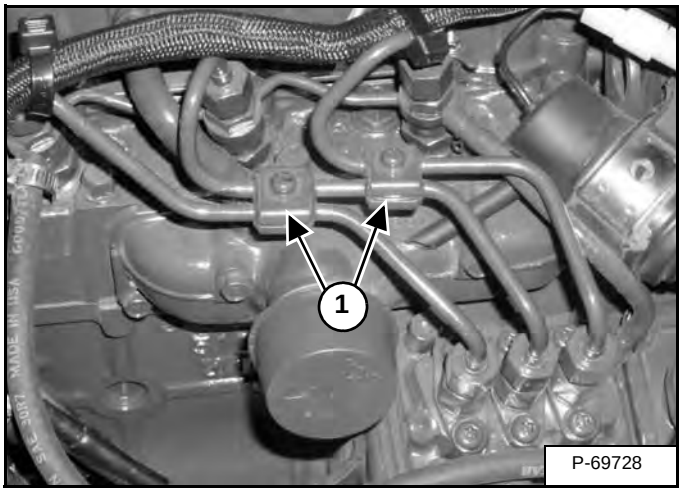
Clean around the injection pump.

Figure 60-60-6



Remove the air intake hose (Item 1) **[Figure 60-60-6]** and cap.

Figure 60-60-7

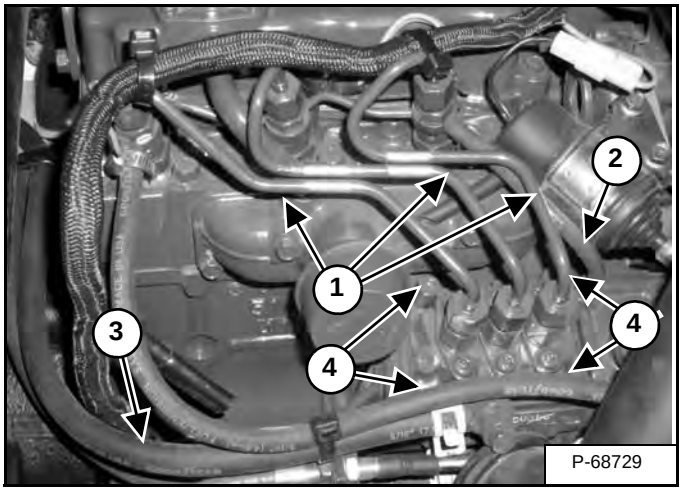


Remove the fuel line clamps (Item 1) **[Figure 60-60-7]**.

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Fuel Injection Pump Removal And Installation (Cont'd)

Figure 60-60-8



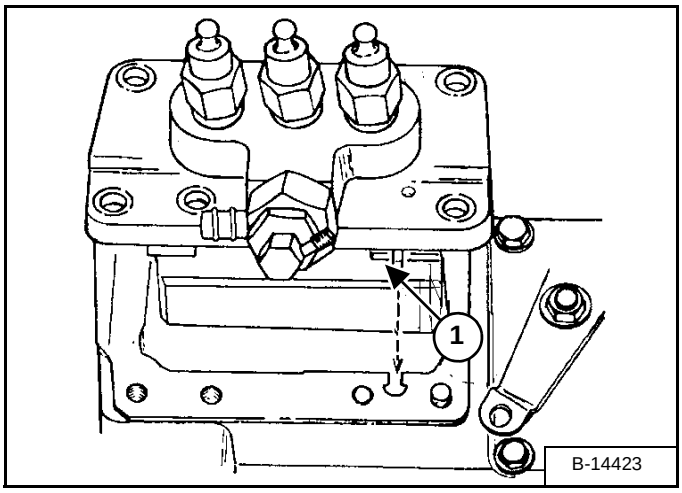
Disconnect the high pressure lines (Item 1) **[Figure 60-60-8]** from the fuel injector and fuel injection pump.

Disconnect the fuel return hose (Item 2) and the fuel feed hose (Item 3) **[Figure 60-60-8]**.

Remove the four injection pump mounting bolts (Item 4) **[Figure 60-60-8]**.

Installation: Tighten the pipe retaining nuts to 25 - 34 N•m (18 - 25 ft-lb) torque.

Figure 60-60-9



Align the pin (Item 1) **[Figure 60-60-9]** in the control rack with the slot in the engine block.

Remove the injection pump.

Installation: When the injection pump is installed, make sure the pin (Item 1) **[Figure 60-60-9]** on the control rack is correctly installed on the fork lever. If the slot is not installed correctly, the engine will run over maximum speed and serious damage can result.

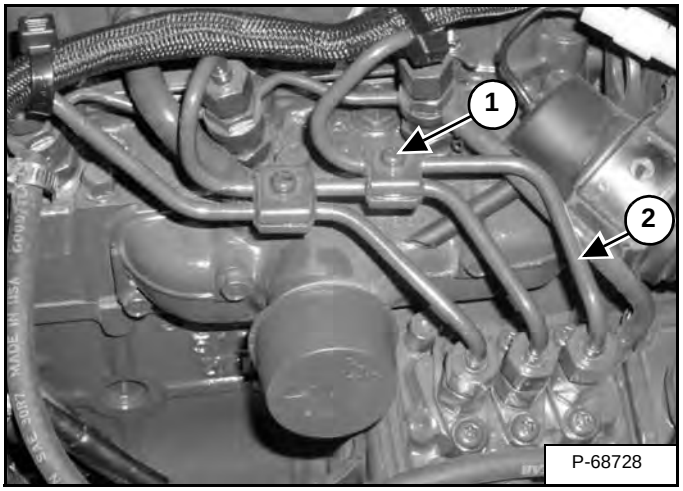
NOTE: Make sure the same number shims are installed under the injection pump. The shims are used for engine timing.

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Fuel Injection Pump - Timing

Timing the injection pump is done by changing the number of shims between the injection pump and the injection pump mounting surface.

Figure 60-60-10



Remove the fuel line clamp (Item 1) **[Figure 60-60-10]**.

Remove the number one cylinder high pressure line (Item 2) **[Figure 60-60-10]** from the injection pump.

IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

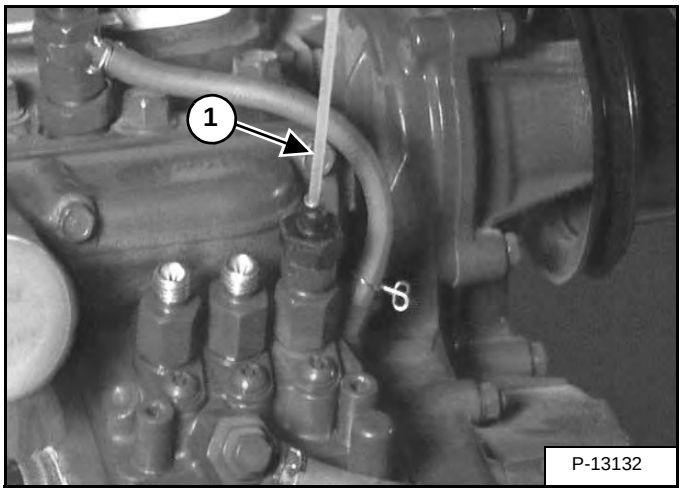
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IMPORTANT

Do not attempt to maintain or adjust unless you are trained and have the correct equipment.

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Figure 60-60-11



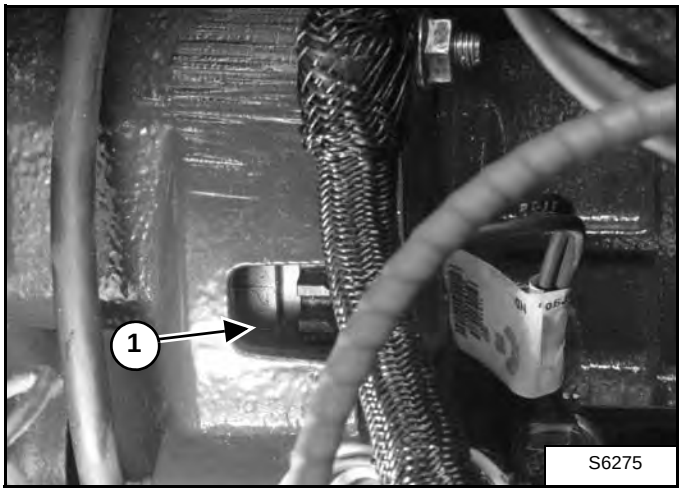
Install a short plastic tube (Item 1) **[Figure 60-60-11]** in the number one cylinder port of the injection pump. The tube should fit tight in the port and point upward.

NOTE: The fuel must be in the tube before attempting timing.

Move the fuel lever on the injection pump to full fuel position (or full throttle).

Turn the flywheel anticlockwise (facing the flywheel) slowly until the start of fuel rise in the plastic tube (Item 1) **[Figure 60-60-11]**.

Figure 60-60-12

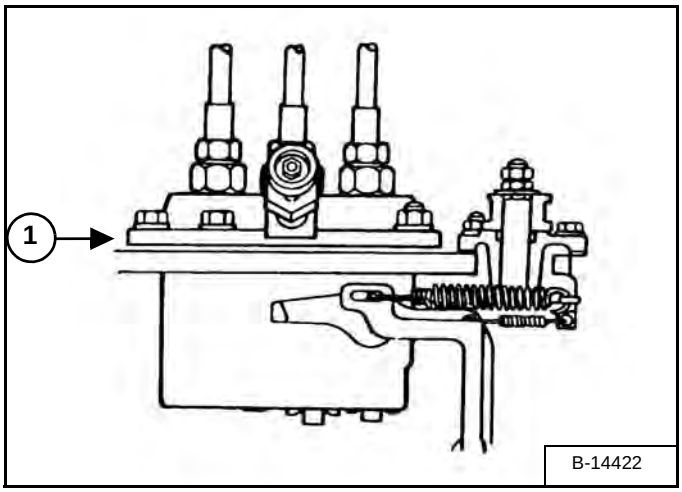


At this point look at the timing mark (located on the flywheel) for proper alignment (Item 1) **[Figure 60-60-12]**. When the timing mark is aligned as shown the timing is correct for the injection pump, which is 19 - 21° B.T.D.C.

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Fuel Injection Pump Timing (Cont'd)

Figure 60-60-13



The correct engine timing for all Kubota D722-E2B engines is 19 - 21° B.T.D.C. Add or subtract shims (Item 1) **[Figure 60-60-13]** to time the engine to 19 - 21° B.T.D.C. The engine is correctly timed when the 19 - 21° B.T.D.C. mark on the flywheel is aligned with the notch in the timing hole.

NOTE: Adding or reducing the shim thickness by 0,05 mm (0.002 in) retards or advances the injection timing by approximately 0,5°.

Some problems caused by faulty injector nozzles:

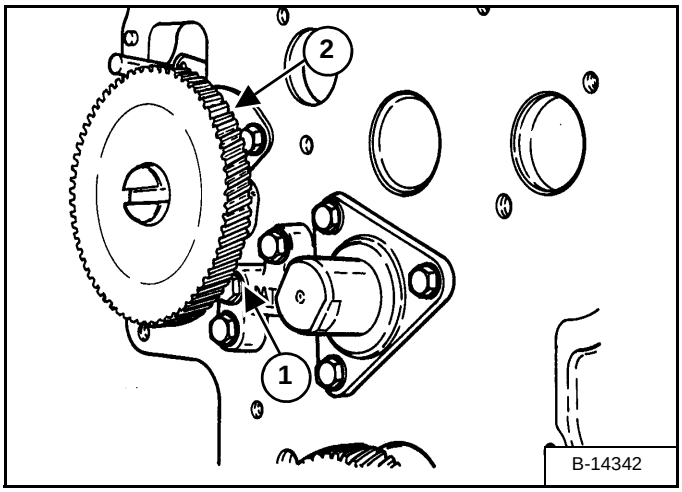
- The engine is hard to start or will not start.
- Rough engine operation at idle.
- The engine will not have full power.
- The engine exhaust smoke is black, white or blue.

Fuel Camshaft Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-90-1.)

Remove the idler gear. (See Cylinder Head Removal And Installation on Page 60-70-3.)

Figure 60-60-14



Remove the bolt (Item 1) from the retainer plate (Item 2) **[Figure 60-60-14]**.

Installation: Tighten the bolt to 6,8 - 8,1 N•m (60 - 72 in-lb) torque.

Remove the fuel camshaft retainer plate (Item 2) **[Figure 60-60-14]**.

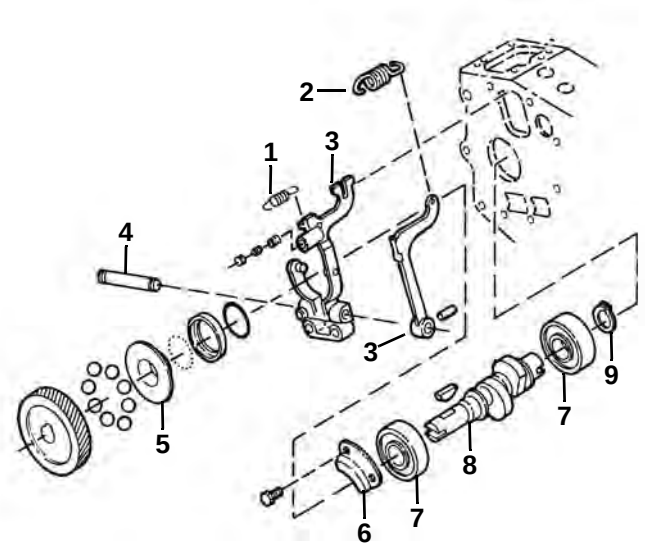
Remove the fuel camshaft and fork lever assembly at the same time.

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Fuel Camshaft Governor

The governor serves to keep the engine speed constant by automatically adjusting the amount of fuel supplied to the engine according to changes in the load.

Figure 60-60-15



1. Start Spring
2. Governor Spring
3. Fork Lever
4. Fork Lever Shaft
5. Governor Sleeve
6. Retaining Plate
7. Bearing
8. Fuel Camshaft
9. Snap Ring

B-14875

Disassemble and assemble the governor and fuel camshaft as shown **[Figure 60-60-15]**.

Check all the parts for wear or damage and replace as needed.

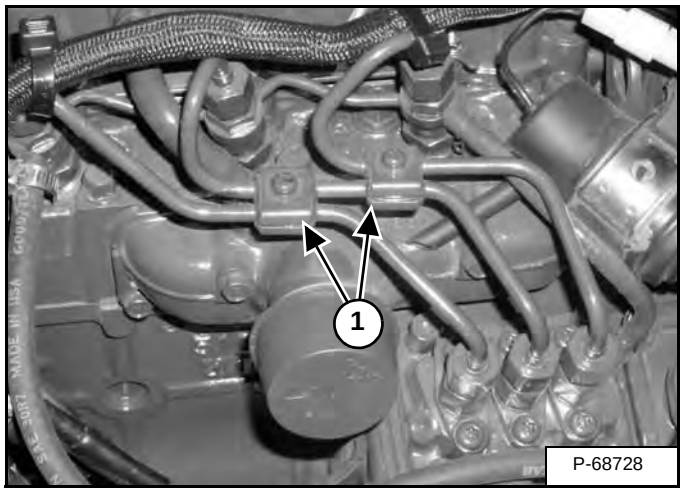
Fuel Injector Removal And Installation

IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

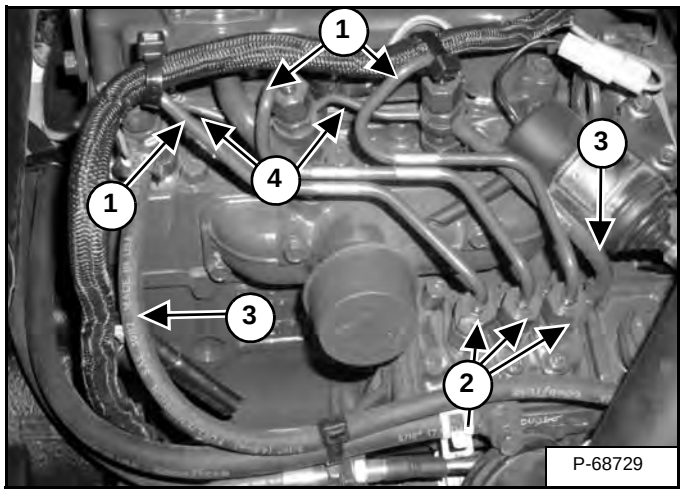
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Figure 60-60-16



Remove the high pressure fuel line clamps (Item 1) **[Figure 60-60-16]**.

Figure 60-60-17



Disconnect the high pressure fuel lines from the fuel injectors (Item 1) **[Figure 60-60-17]**.

Disconnect the fuel lines (Item 2) **[Figure 60-60-17]** from the injection pump.

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Fuel Injector Removal And Installation (Cont'd)

Remove the high pressure fuel lines.

Disconnect the return fuel hoses (Item 3) **[Figure 60-60-17]**.

Remove the retainer nut from the top of the fuel injectors.

Remove the fuel return pipe (Item 4) **[Figure 60-60-17]**.

Loosen the injector nozzle.

Installation: Tighten the injector nozzle to 49 - 69 N•m (36 - 51 ft-lb) torque.

Remove the injector nozzle from the cylinder head.

NOTE: Be sure to replace the copper washer and nozzle cap anytime new or reconditioned fuel injectors are installed.

⚠ WARNING

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 doctor familiar with this injury.

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Fuel Injector Nozzle Pressure - Checking

IMPORTANT

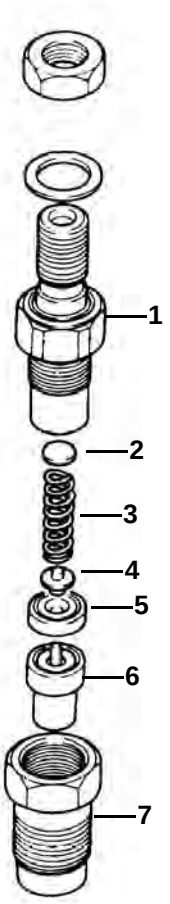
Do not disassemble or test the fuel injector nozzles unless you have the correct service and testing tools.

I-2027-0284

The tool listed will be needed to do the following procedure:

OEM1064 - Injector Nozzle Tester

Figure 60-60-18



(1) Nozzle Holder
(2) Adjusting Washer
(3) Nozzle Spring
(4) Push Rod
(5) Distance Piece
(6) Nozzle Piece
(7) Nozzle Retaining Nut

PI-9981

The nozzle release pressure can be adjusted by adding or removing washer(s) (Item 2) from the top of the nozzle spring (Item 3) **[Figure 60-60-18]**.

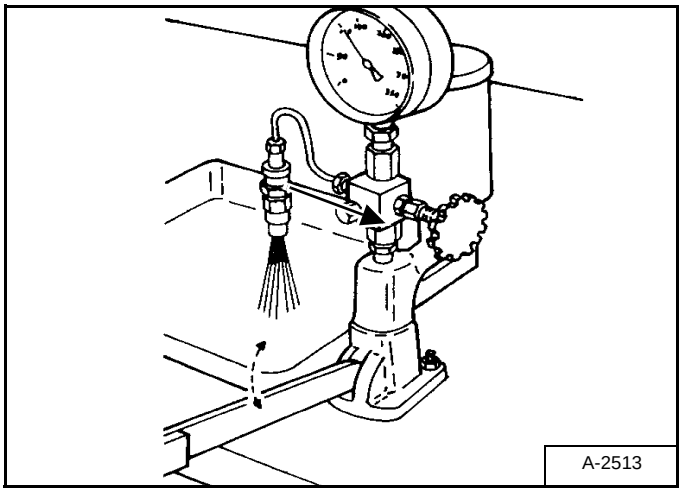
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Fuel Injector Nozzle Pressure - Checking (Cont'd)

Each spacer will change the release pressure by about 230 kPa (2.3 bar) (34 psi).

Fuel Injection Pressure	13,7 - 14,7 MPa (137 - 147 bar) (1991 - 2134psi)

Figure 60-60-19



Assemble the injector nozzle. Connect the nozzle to the tester with the nozzle down **[Figure 60-60-19]**.

Operate the hand lever at a slow rate and record the opening pressure. If the pressure is not correct, disassemble the nozzle and add or remove the spacer (Item 2) **[Figure 60-60-18]** as needed.

NOTE: When assembling the injector nozzle, tighten the retainer nut (Item 1) [Figure 60-60-18] to 25,3 - 28,9 N•m (23.5 - 28.9 ft-lb) torque. Any higher torque will cause slow action of the valve.

When the injector nozzle is assembled, tighten the nozzle body to 49 - 69 N•m (36 - 51 ft-lb) torque.

Check for inside leakage. Operate the hand lever until the pressure 12,7 MPa (127 bar) (1849 psi). Keep the nozzle under this pressure for 10 seconds, check to see if fuel leaks from the nozzle. If fuel leaks, replace the nozzle.

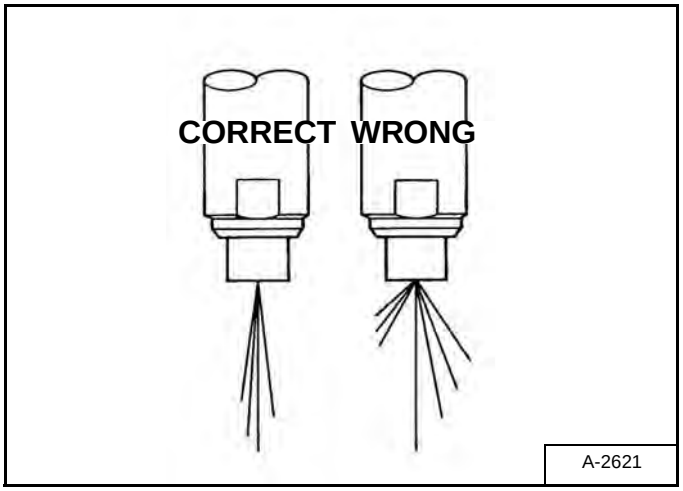
⚠ WARNING

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 doctor familiar with this injury.

W-2072-EN-0909

Figure 60-60-20



Check that the spray pattern is correct **[Figure 60-60-20]**:

1. Fuel does not come out the side of the nozzle.
2. Drops of fuel are not present at the nozzle.
3. The injector has an even flow coming from the nozzle.

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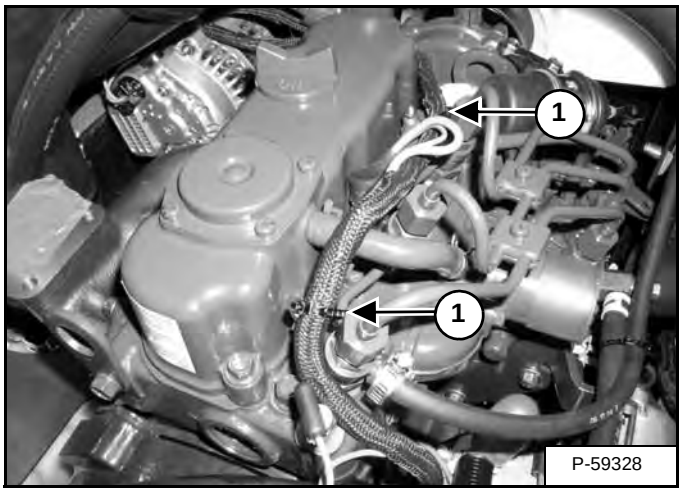
Glow Plug Removal And Installation

IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

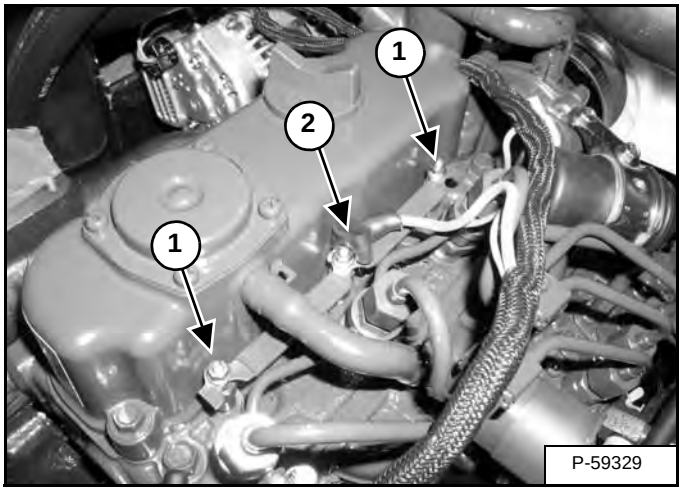
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Figure 60-70-1



Remove the tie-straps (Item 1) **[Figure 60-70-1]**.

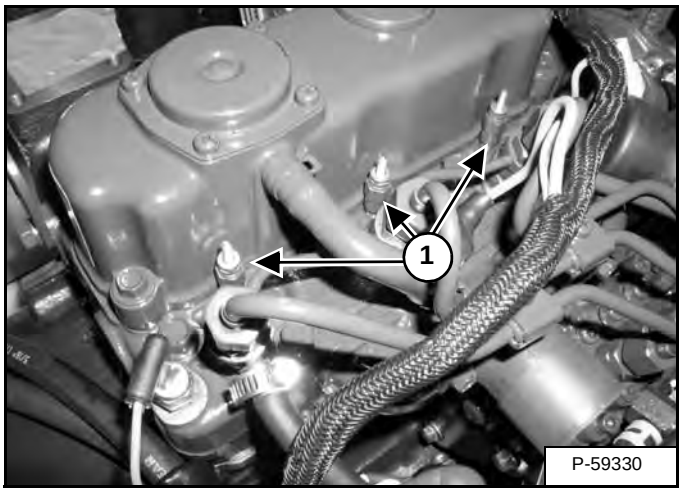
Figure 60-70-2



Remove the nuts (Item 1) **[Figure 60-70-2]**.

Remove the glow plug lead (Item 2) **[Figure 60-70-2]** and nut.

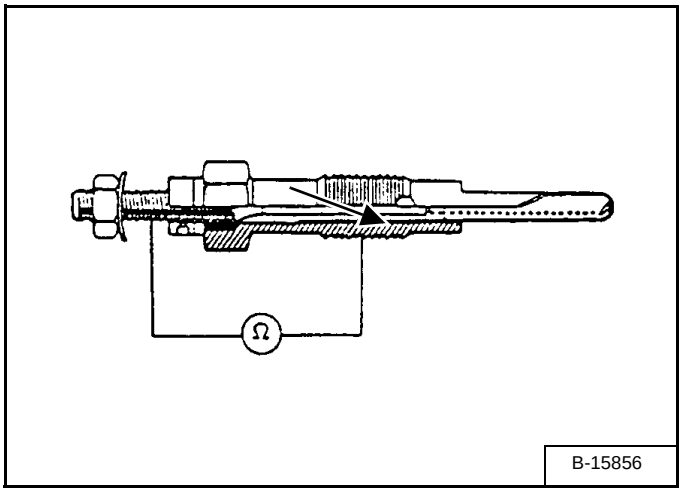
Figure 60-70-3



Remove the glow plugs (Item 1) **[Figure 60-70-3]** from the cylinder head.

Installation: Tighten the glow plugs to 8 - 15 N•m (6 - 11 ft-lb) torque.

Figure 60-70-4



Connect an ohmmeter to the terminal end of the glow plug, touch the other lead from the ohmmeter to the heating end of the glow plug **[Figure 60-70-4]**.

The reading will be approximately 0.9 ohm If the resistance is zero ohm, the glow plug has a short circuit. If the resistance is infinite, the coil of the glow plug is broken.

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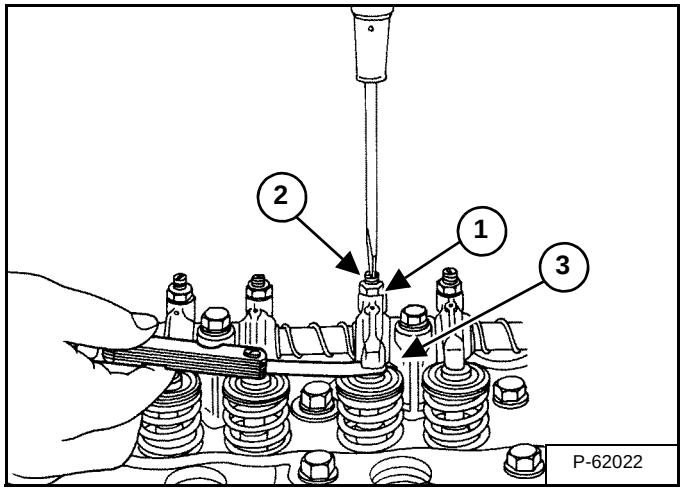
Valve Clearance Adjustment

NOTE: The valve clearance must be checked and adjusted when the engine is cold.

Remove the cylinder head cover and the glow plugs.

Adjust the valve clearance as follows:

Figure 60-70-5



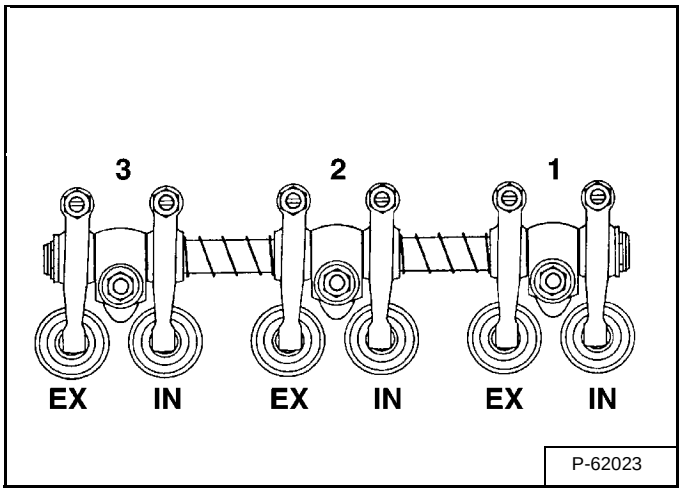
Loosen the lock nut (Item 1) **[Figure 60-70-5]**.

Turn the adjustment screw (Item 2) **[Figure 60-70-5]** until the correct clearance is obtained.

NOTE: The clearance is measured between the rocker arm and valve stem tip (Item 3) [Figure 60-70-5].

If adjustments are necessary, tighten lock nut before moving on to the next rocker arm.

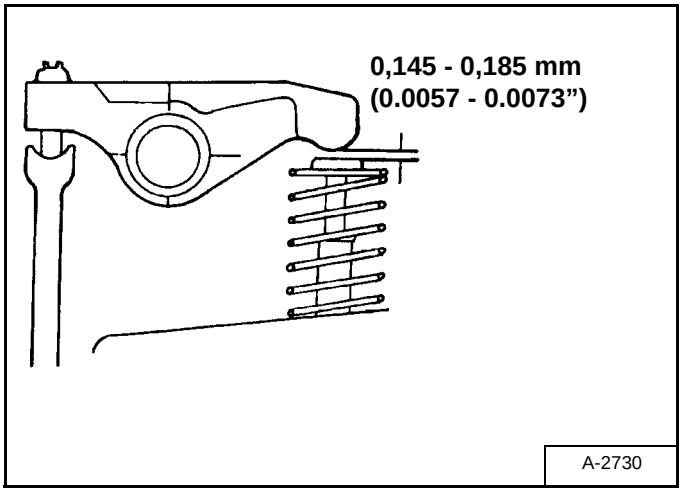
Figure 60-70-6



With No. 1 piston at TDC (compression) both the intake and exhaust valves are up. Set both No. 1 valves, No. 2 exhaust valve and No. 3 intake valve. **[Figure 60-70-6]**.

Rotate the flywheel 360°, No. 1 (overlap position). Set No. 2 intake valve and No. 3 exhaust valve. **[Figure 60-70-6]**.

Figure 60-70-7



Make sure the piston is at TDC when adjusting the clearance at the valves. The correct clearance is 0,145 - 0,185 mm (0.0057 - 0.0073 in) cold clearance **[Figure 60-70-7]**.

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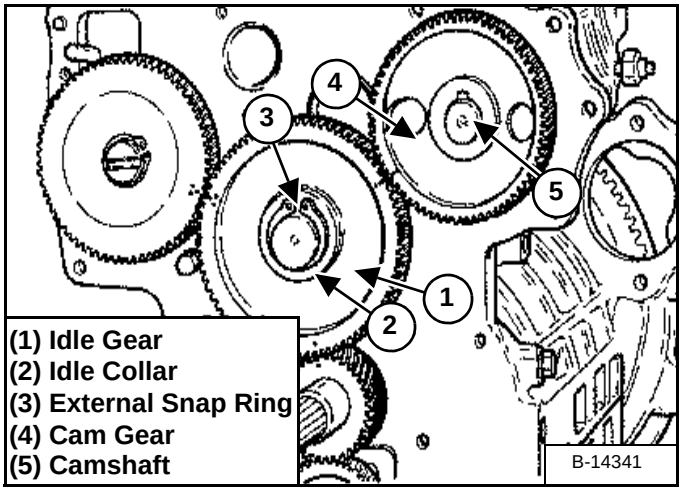
Valve Timing - Checking

Stop the engine and open the rear door.

Remove the engine. (See Engine Removal And Installation on Page 60-10-8.)

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-90-1.)

Figure 60-70-8

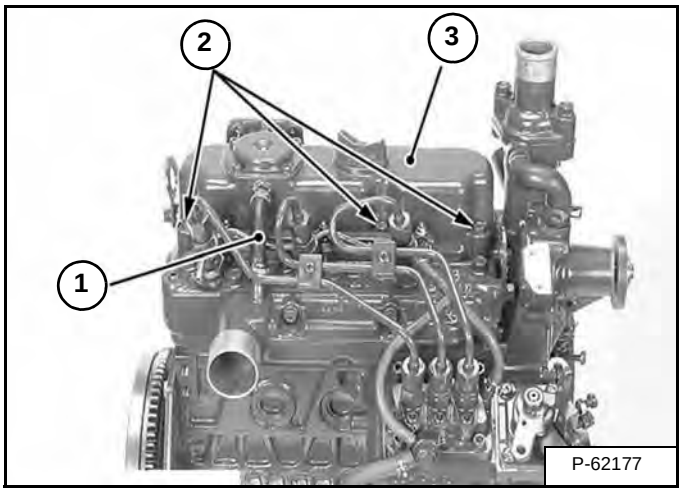


(1) Idle Gear
(2) Idle Collar
(3) External Snap Ring
(4) Cam Gear
(5) Camshaft

Make sure the timing marks are in correct alignment **[Figure 60-70-8]**.

Cylinder Head Removal And Installation

Figure 60-70-9



Remove the breather hose (Item 1) **[Figure 60-70-9]**.

Remove the bolts (Item 2) from the valve cover and remove the valve cover and gasket (Item 3) **[Figure 60-70-9]**.

Installation: Tighten the bolts to 7 - 11 N•m (62 - 97.4 in-lb) torque. Gradually tighten center bolts before the end bolts to avoid cracking valve cover.

Remove the fuel injector nozzles. (See Fuel Injector Removal And Installation on Page 60-60-7.)

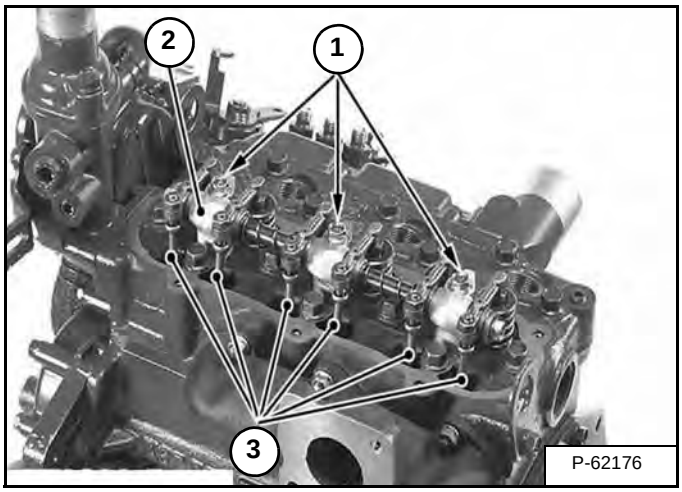
Remove the glow plugs. (See Glow Plug Removal And Installation on Page 60-70-1.)

Remove the alternator. (See Removal And Installation on Page 50-30-4.)

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Cylinder Head Removal And Installation (Cont'd)

Figure 60-70-10



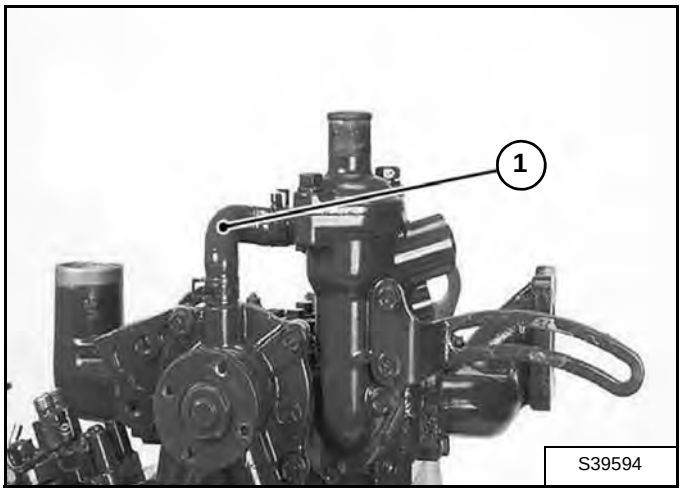
Remove the rocker arm bracket screws (Item 1) and shaft assembly (Item 2) **[Figure 60-70-10]**.

Installation: Tighten the nuts to 9,8 - 11,3 N•m (86.7 - 100 in-lb) torque.

Remove the pushrods (Item 3) **[Figure 60-70-10]**.

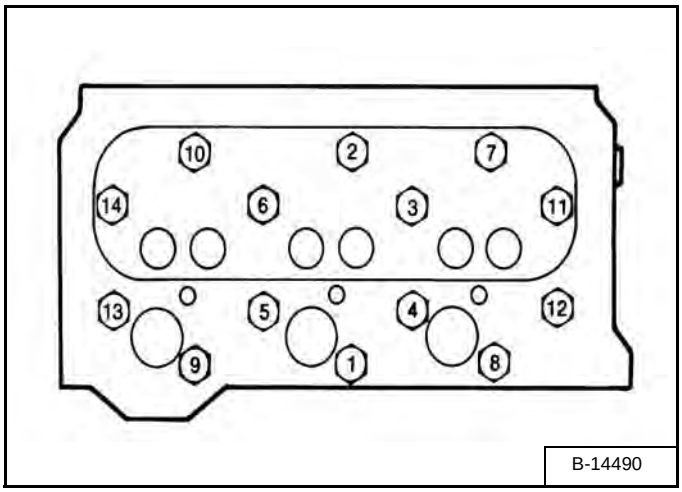
Remove the intake and exhaust manifolds.

Figure 60-70-11



Remove the water return hose (Item 1) **[Figure 60-70-11]**.

Figure 60-70-12



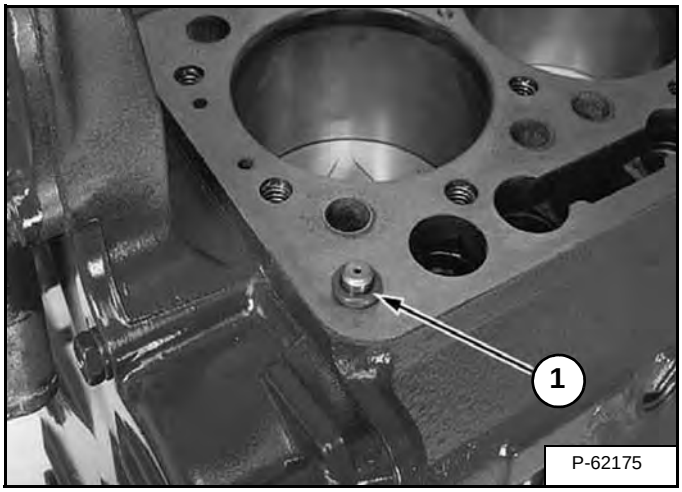
Remove the cylinder head bolts in order of #14 to #1 **[Figure 60-70-12]**.

Installation: Put oil on the bolt threads. Tighten the bolts in the correct sequence of #1 to #14 to 38 - 42 N•m (28 - 31 ft-lb) torque.

NOTE: Re-tighten the cylinder head bolts in the correct sequence after the engine has been run for 30 minutes.

Remove the cylinder head from the engine block.

Figure 60-70-13

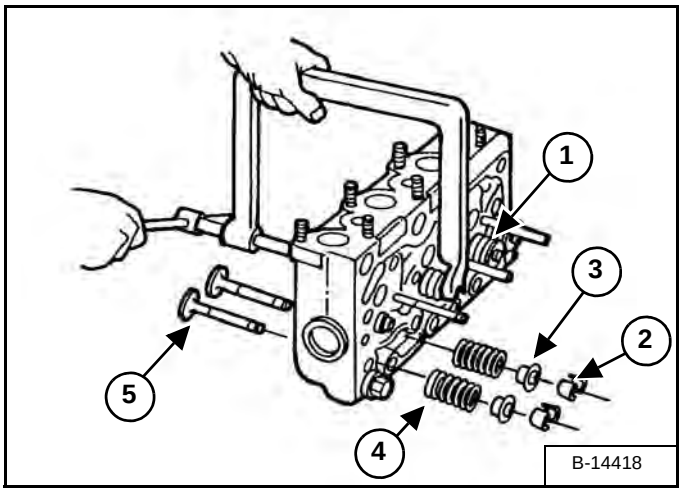


Installation: Always use a new head gasket and new O-ring. Make sure the O-ring (Item 1) **[Figure 60-70-13]** is seated over the dowel.

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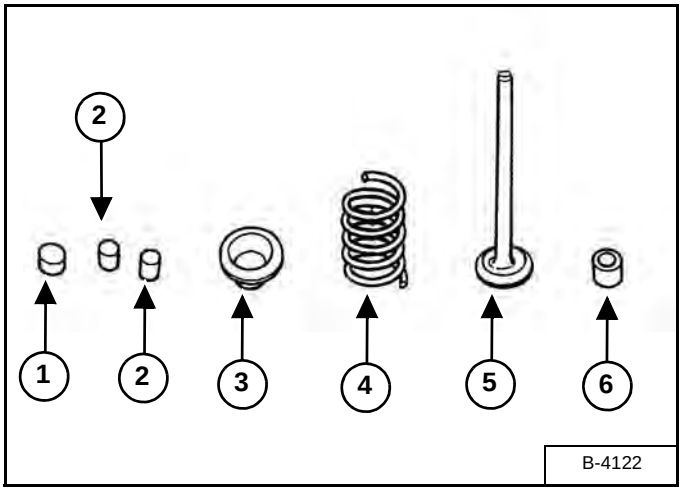
Cylinder Head Disassembly And Assembly

Figure 60-70-14



Use a valve spring compressor to compress the valve spring **[Figure 60-70-14]**.

Figure 60-70-15



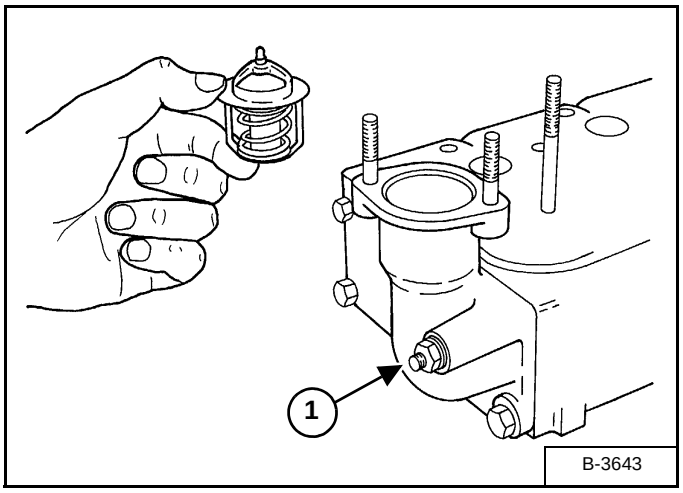
Remove the valve cap (Item 1) **[Figure 60-70-15]** and valve spring collet (Item 2) **[Figure 60-70-14]** and **[Figure 60-70-15]**.

Remove the valve spring retainer (Item 3) **[Figure 60-70-14]** and **[Figure 60-70-15]** and the spring (Item 4) **[Figure 60-70-14]** and **[Figure 60-70-15]**.

Remove the valve (Item 5) **[Figure 60-70-14]** and **[Figure 60-70-15]**.

Remove the seal (Item 6) **[Figure 60-70-15]**.

Figure 60-70-16



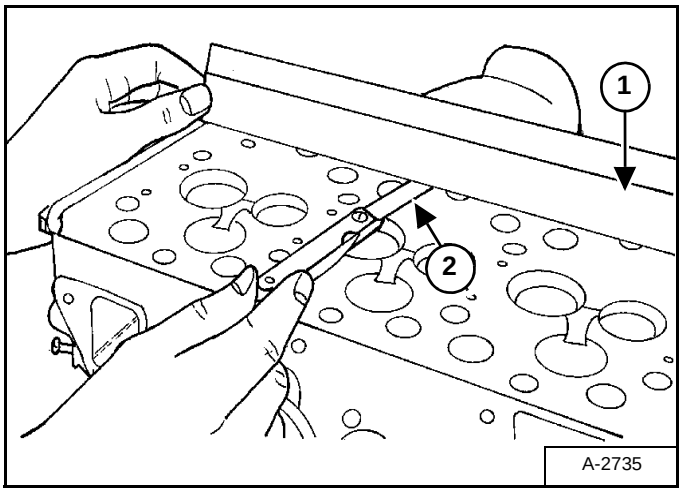
Remove the thermostat cover and thermostat from the cylinder head. Remove the thermostat housing (Item 1) **[Figure 60-70-16]**.

Installation: Apply Liquid-Type Gasket (Three Bond 1215 or equivalent) to both sides of the new thermostat cover gasket and new thermostat housing gasket.

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Cylinder Head - Servicing

Figure 60-70-17



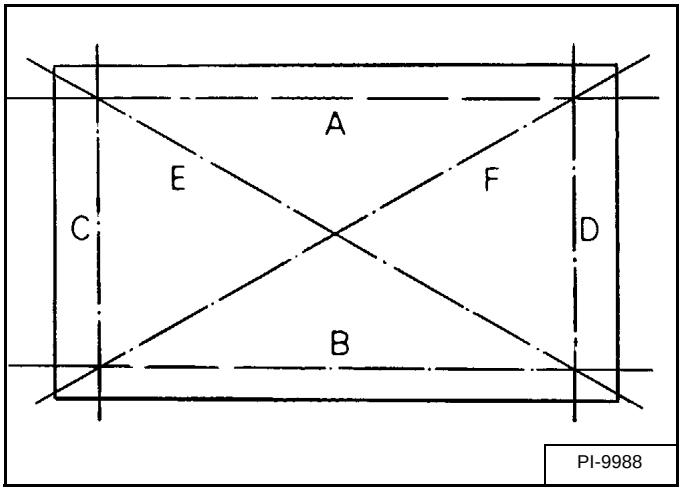
Clean the surface of the cylinder head.

Put a straight edge (Item 1) **[Figure 60-70-17]** on the cylinder head.

NOTE: Do not put the straight edge across combustion chambers.

Put a feeler gauge (Item 2) **[Figure 60-70-17]** between the straight edge and the surface of the cylinder head.

Figure 60-70-18

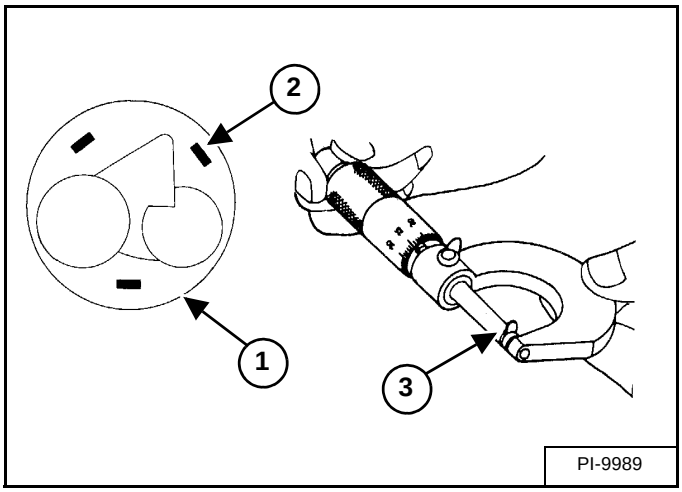


Put the straight edge on the cylinder head's four sides and two diagonals as shown in figure **[Figure 60-70-18]**.

The maximum distortion of the head surface is ± 0,05 mm (± 0.002 in). If the measurement is more than the specification, remove the combustion chambers, then grind the cylinder head. Grind the same amount of material from the bottom of the combustion chambers as was removed from the head.

Cylinder Head Top Clearance

Figure 60-70-19



Install the cylinder head gasket. Put the piston (Item 1) **[Figure 60-70-19]** being checked at T.D.C.

Put three pieces of 1,5 mm (0.06 in) diameter solder (Item 2) **[Figure 60-70-19]** on the top piston. Use grease to hold them in position.

NOTE: Position the solder so that they do not touch the valves.

Turn the piston to bottom dead center.

Install the cylinder head and tighten to the correct torque in the correct sequence. (See Cylinder Head Removal And Installation on Page 60-70-3.)

Turn the crankshaft until the piston exceeds T.D.C. Remove the cylinder head.

Remove the solder wire (Item 3) **[Figure 60-70-19]** and measure it.

If the measurement exceeds the specifications, check the oil clearance of the crank pin journal or the piston pin.

Top clearance	0,50 - 0,70 mm (0.0197 - 0.0276 in)

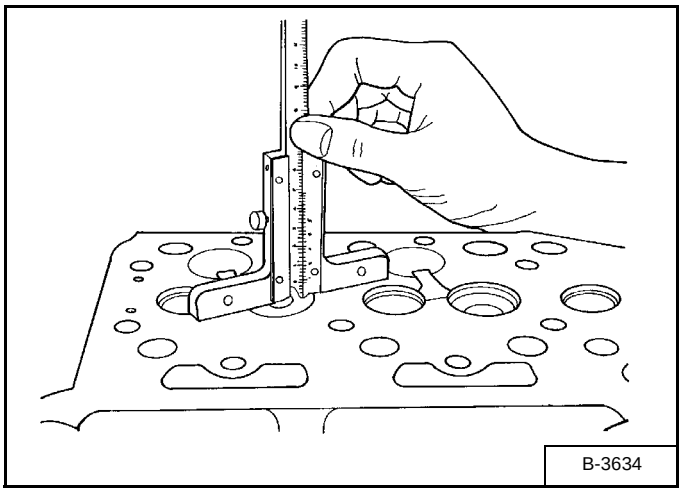
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Valve Guide - Checking

Remove the valve and spring from the cylinder head. (See Cylinder Head Removal And Installation on Page 60-70-3.)

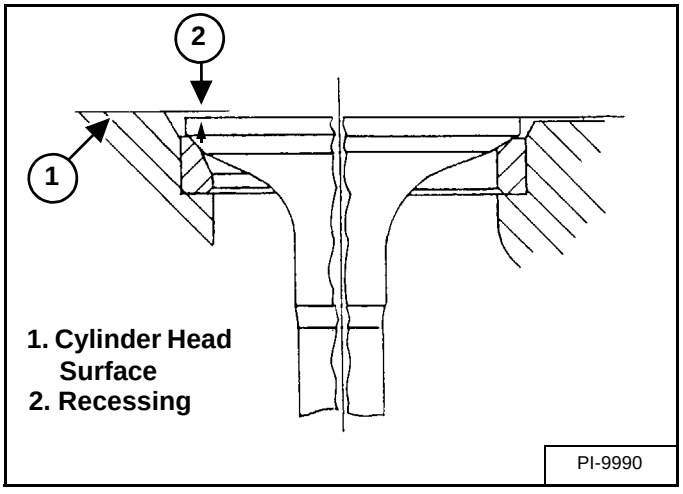
Clean the valve seat and combustion chamber.

Figure 60-70-20



Install the valve into the guide. Measure the valve recessing with a depth gauge **[Figure 60-70-20]**.

Figure 60-70-21

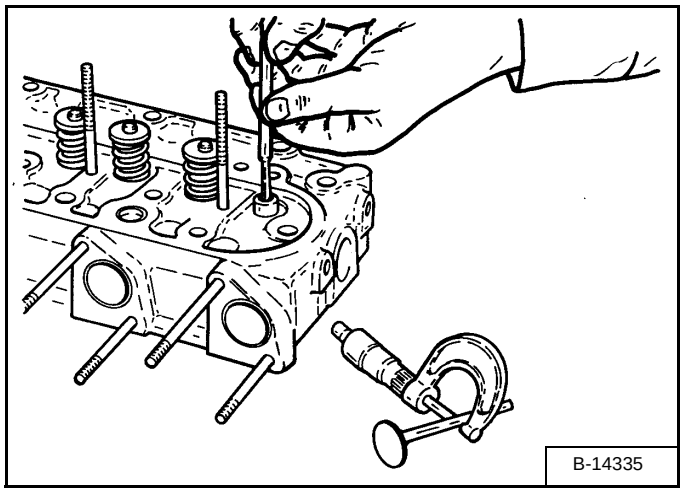


If the measurement exceeds the allowable limit, replace the valve or cylinder head **[Figure 60-70-21]**.

Recessing	0,10 mm (0.004 in)
Allowable Limit (Recessing)	0,30 mm (0.012 in)

Remove the carbon from the valve guide.

Figure 60-70-22



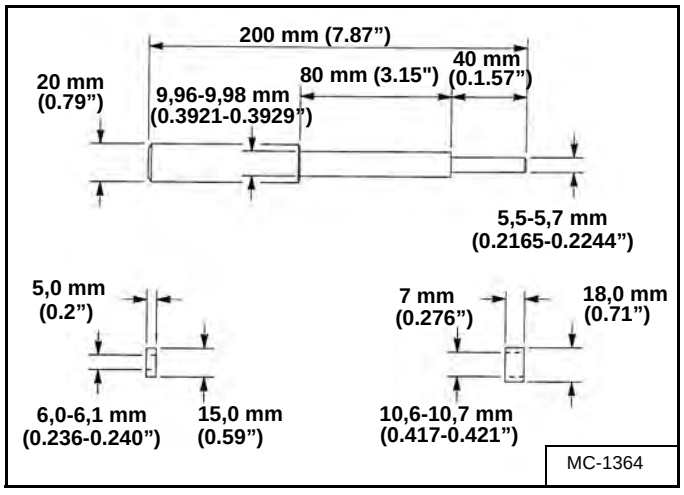
Measure the valve stem O.D. **[Figure 60-70-22]**.

Measure the valve guide I.D. **[Figure 60-70-22]**.

Calculate the clearance. If the clearance exceeds the allowable limit, replace the valve and / or valve guide.

Valve Guide I.D	6,01 - 6,025 mm (0.2366 - 0.2372 in)
Valve Stem O.D	5,968 - 5,980 mm (0.2350 - 0.2354 in)
Clearance Between Valve Stem and Guide	
	0,03 - 0,057 mm (0.0012 - 0.0022 in)
Allowable Limit	0,10 mm (0.0039 in)

Figure 60-70-23

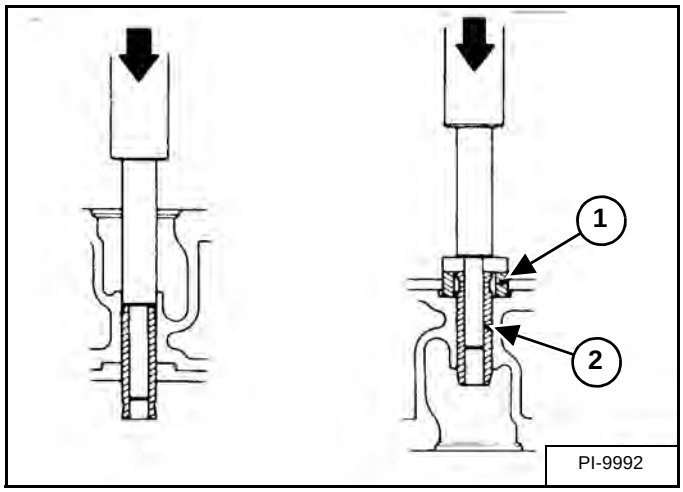


To remove and replace the valve guide, make the driver tools as shown in figure **[Figure 60-70-23]**.

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Valve Guide - Checking (Cont'd)

Figure 60-70-24



Press the used valve guide out of the cylinder head using the special driver tool **[Figure 60-70-24]**. (See previous page for tool dimensions.)

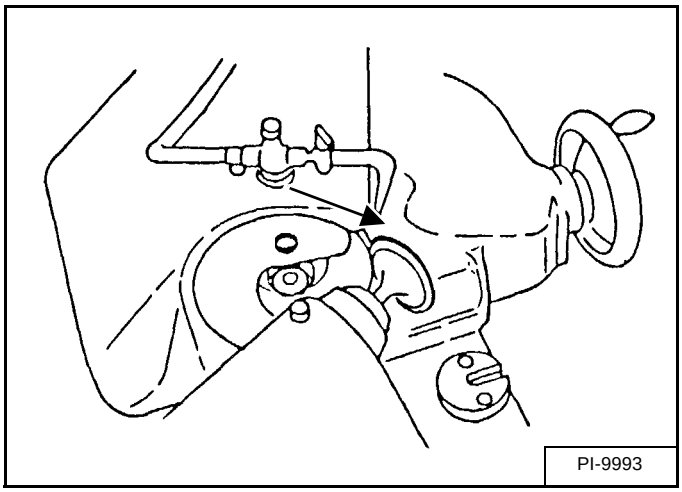
Put oil on the outside diameter of the new valve guide. Press the new valve guide into the cylinder head from the top side. Use the special driver tools (Items 1 and 2) **[Figure 60-70-24]**, press the new guide until the tools contact the cylinder head.

Ream the valve guide to the correct specifications.

NOTE: Valve guide I.D. (Intake and Exhaust) factory specification is 6,01 - 6,025 mm (0.2366 - 0.2372 in).

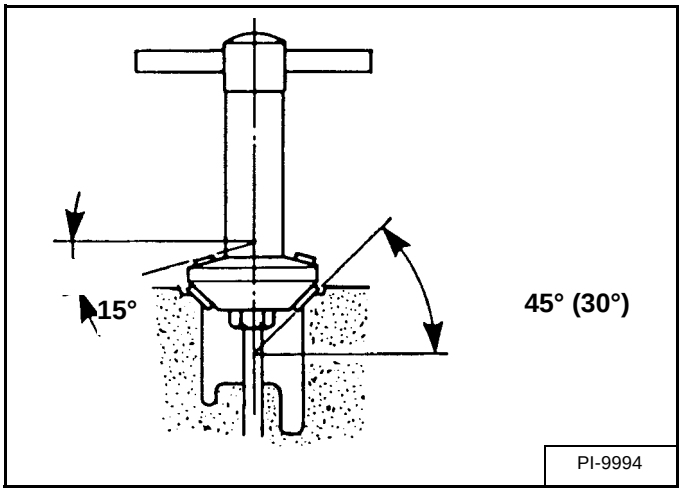
Valve And Valve Seat Reconditioning

Figure 60-70-25



Grind the valve face to the correct angle using a valve refacer **[Figure 60-70-25]** and **[Figure 60-70-27]**.

Figure 60-70-26

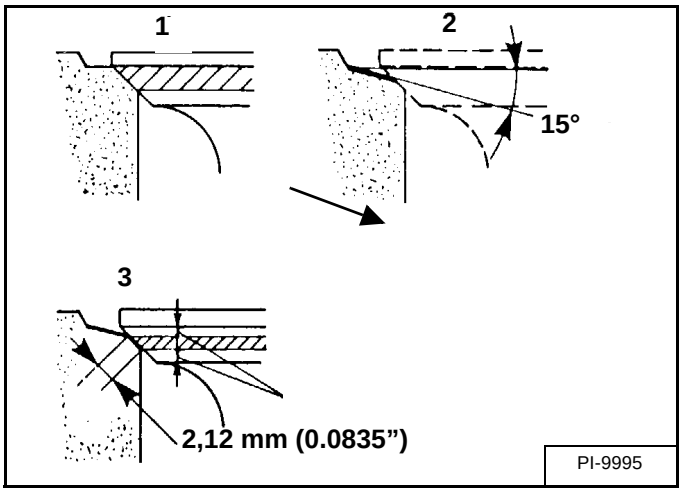


Grind the valve surface in the cylinder head to the correct angle **[Figure 60-70-26]**.

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Valve And Valve Seat Reconditioning (Cont'd)

Figure 60-70-27



Check the seat surface and valve face (Item 1) **[Figure 60-70-27]**.

If the seat surface is too wide, use a 15 degree cutter (Item 2) to get the correct width (Item 3) **[Figure 60-70-27]**.

Valve Seat Width

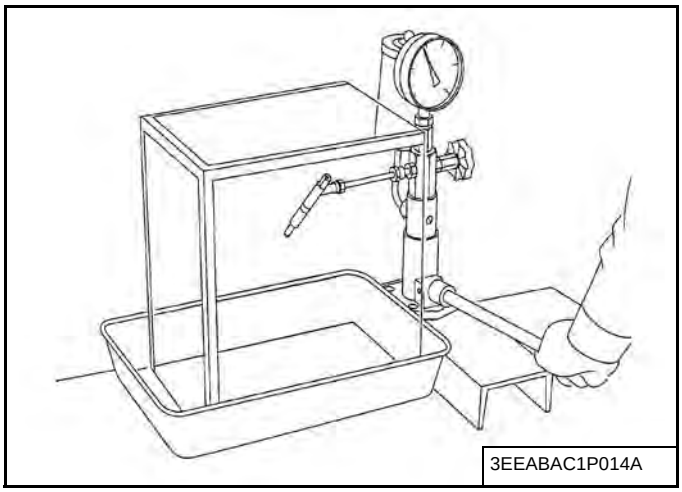
Intake	2,12 mm (0.0835 in)
Exhaust	2,12 mm (0.0835 in)

Valve Seat and Face Angle

Intake	45°
Exhaust	45°

Valve Seat Tightness

Figure 60-70-28



Set the injection nozzle to a nozzle tester (Code No. 07909-31361) **[Figure 60-70-28]**.

Raise the fuel pressure, and keep at 12,75 MPa (127,5 bar) (1849 psi) for 10 seconds.

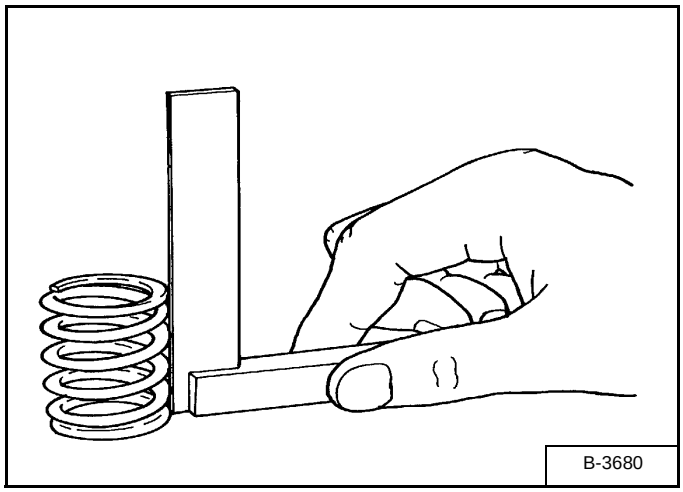
If any fuel leak is found, replace the injection nozzle assembly or repair at Denso service Shop.

Valve seat tightness	Factory spec.	No fuel leak at 12,75 MPa (127,5 bar) (1849 psi)

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Valve Spring

Figure 60-70-29



Measure the length of the valve spring. If the measurement is less than the allowable limit, replace the spring **[Figure 60-70-29]**.

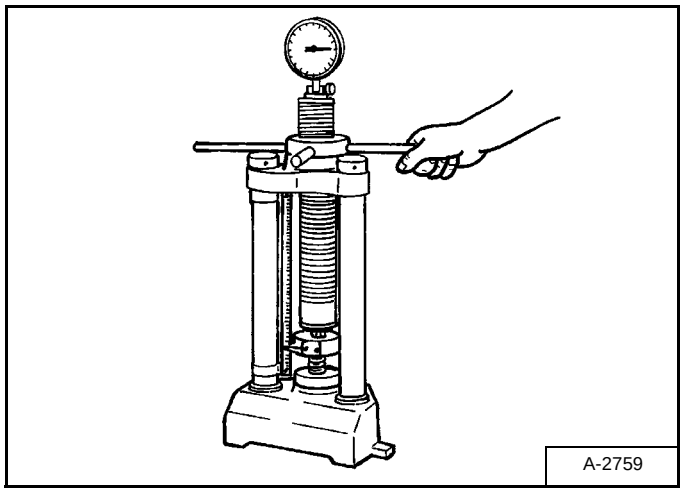
Free Length	31,3 - 31,8 mm (1.232 - 1.252 in)
Allowable Limit	28,4 mm (1.118 in)

Put the spring on a flat surface, place a square on the side of the spring **[Figure 60-70-29]**.

Rotate the spring and measure the maximum tilt. If the measurement is in excess of the allowable limit, replace the spring.

Tilt	1,2 mm (0.047 in)

Figure 60-70-30



Put the spring on a tester and compress to specified length **[Figure 60-70-30]**.

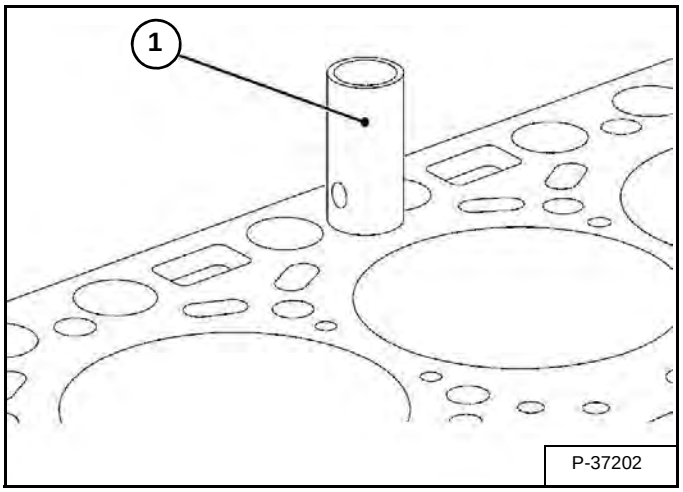
Read the compressed load on the gauge. If the measurement exceeds allowable limit, replace the spring.

Setting Length	27 mm (1.063 in)
Setting Load	64,7 N (14.6 lbf)
Allowable Limit (setting load)	
	54,9 N (12.3 lbf)

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Valve Tappets

Figure 60-70-31



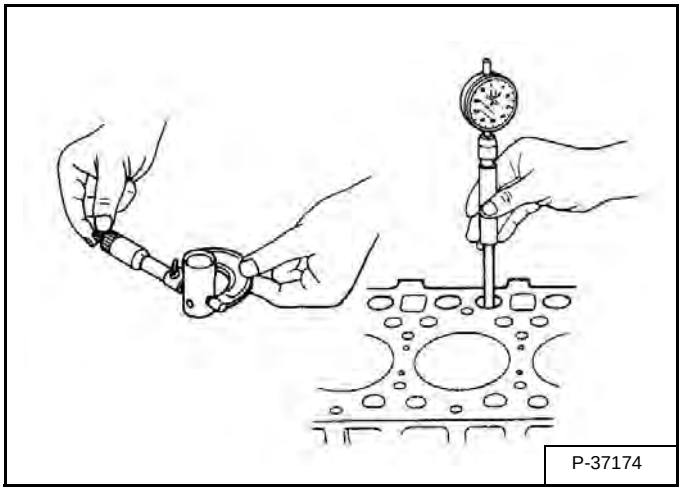
Remove the tappets (Item 1) **[Figure 60-70-31]** from the crankcase.

When reassembling replace the head gasket with a new one.

Before installing the tappets (Item 1) **[Figure 60-70-31]**, apply engine oil thinly around them.

NOTE: Mark the cylinder number on the tappets (Item 1) [Figure 60-70-31] to prevent interchanging.

Figure 60-70-32



Measure the tappet O.D. with an outside micrometer **[Figure 60-70-32]**.

Measure the I.D. of the tappet guide bore with a cylinder gauge, and calculate the oil clearance **[Figure 60-70-32]**.

If the oil clearance exceeds the allowable limit or the tappet is damaged, replace the tappet.

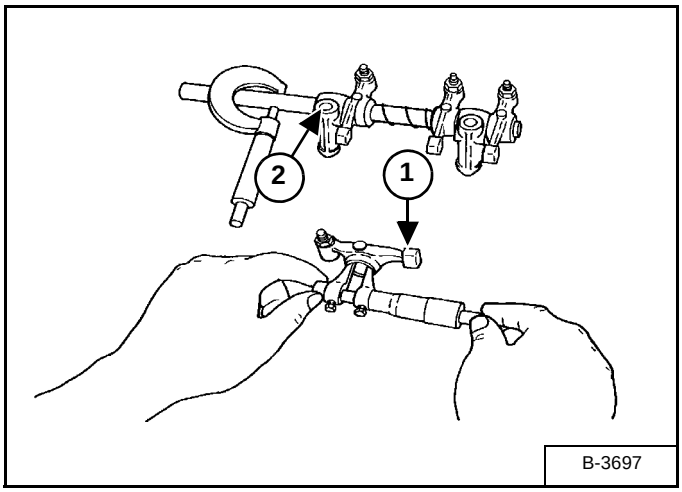
Oil clearance between tappet and guide	Factory spec.	0,016 - 0,052 mm (0.00063 - 0.00205 in)
	Allowable limit	0.10 mm (0.0039 in)

Tappet O.D.	Factory spec.	17.966 - 17.984 mm (0.70732 - 0.70803 in)
Tappet guide I.D.	Factory spec.	18.000 - 18.018 mm (0.70866 - 0.70937 in)

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Rocker Arm And Shaft - Checking

Figure 60-70-33



Measure the rocker arm I.D. (Item 1) **[Figure 60-70-33]** with an inside micrometer.

Measure the rocker shaft O.D. (Item 2) **[Figure 60-70-33]** with an outside micrometer.

If the clearance exceeds the allowable limit, replace the rocker arm and measure the clearance again.

If the clearance still exceeds the allowable limit after the rocker arm is replaced, replace the rocker arm shaft.

Oil Clearance Between Rocker Arm and Shaft	
	0,016 - 0,045 mm (0.0006 - 0.0018 in)
Allowable Limit	0,15 mm (0.0059 in)
Rocker Arm Shaft	10,47 - 10,48 mm (0.4123 - 0.4128 in)
Rocker Arm I.D.	10,5 - 10,52 mm (0.4134 - 0.4141 in)

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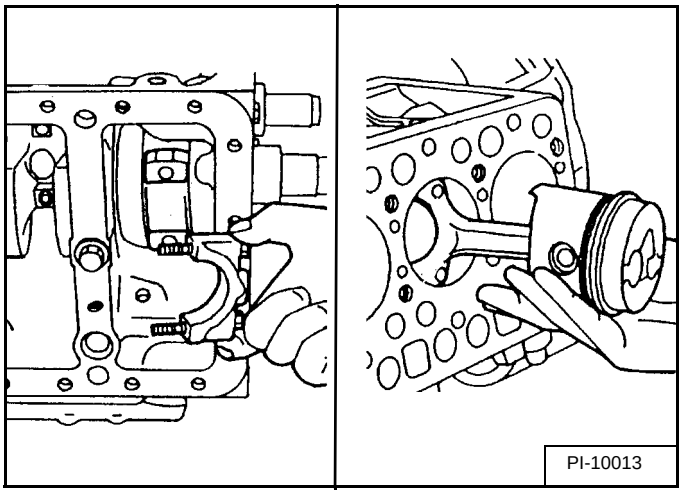
CRANKSHAFT AND PISTONS

Piston And Connecting Rod Removal And Installation

Remove the cylinder head. (See Cylinder Head Removal And Installation on Page 60-70-3.)

Remove the top edge from the cylinder bore with a ridge reamer.

Figure 60-80-1

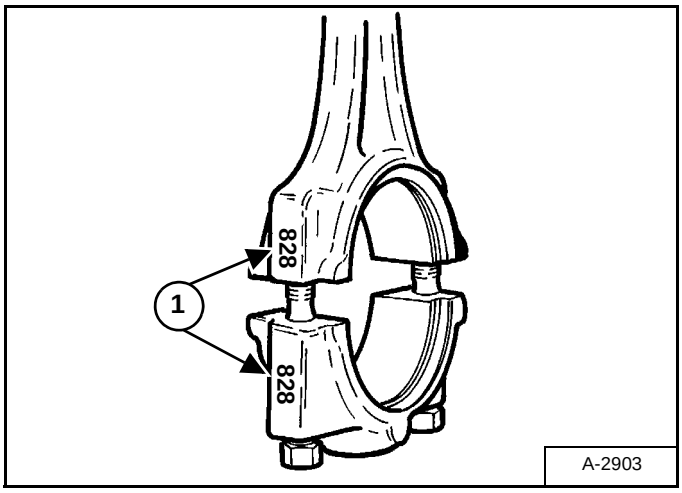


Remove the rod cap and bearing **[Figure 60-80-1]**.

Use a hammer handle to push the piston connecting rod assembly out of the cylinder bore **[Figure 60-80-1]**.

NOTE: Make sure the pistons are marked so they will be reinstalled in the same cylinder bore.

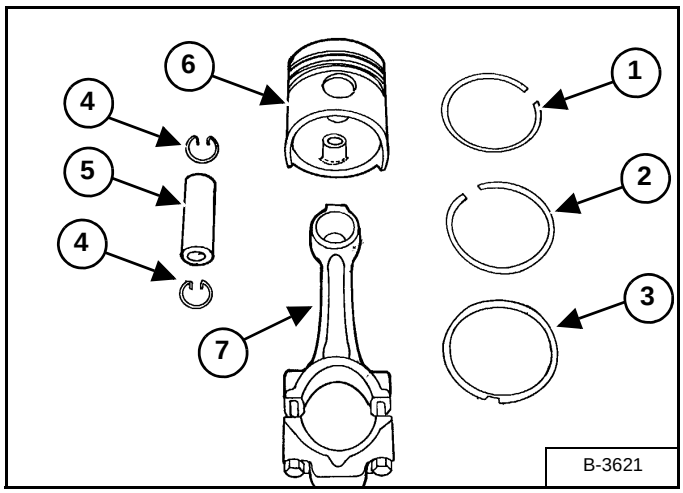
Figure 60-80-2



Installation: Make sure the marks (Item 1) on the connecting rod and bearing are aligned when installing the bearing cap **[Figure 60-80-2]**.

Repeat the procedure to remove the other piston / connecting rod assemblies from the engine block.

Figure 60-80-3



Remove the first compression ring (Item 1) **[Figure 60-80-3]**.

Remove the second compression ring (Item 2) **[Figure 60-80-3]**.

Remove the oil ring (Item 3) **[Figure 60-80-3]**.

Remove the snap ring (Item 4) and piston pin (Item 5) **[Figure 60-80-3]**.

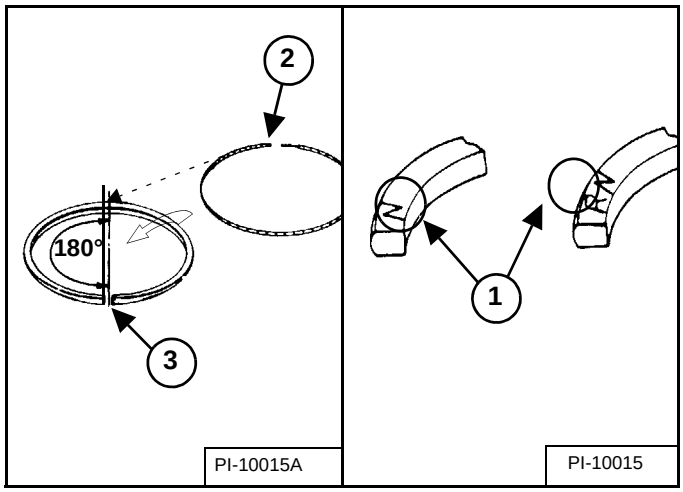
Separate the piston (Item 6) from the connecting rod (Item 7) **[Figure 60-80-3]**.

NOTE: Make sure the piston and rod assembly is marked so as not to change the piston rod assembly with another piston or connecting rod.

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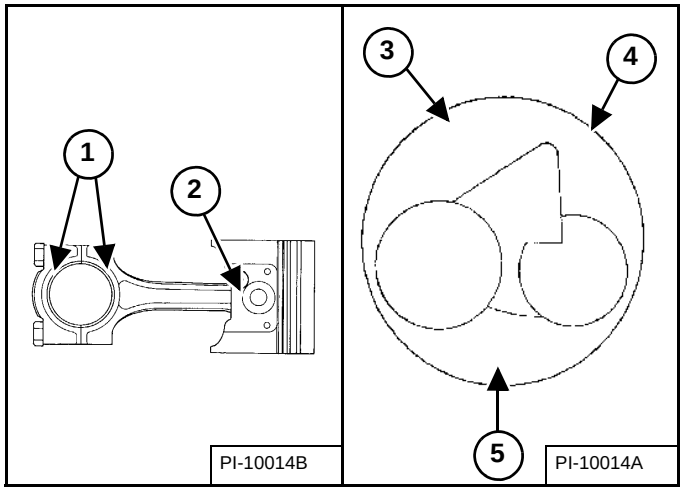
Piston And Connecting Rod Removal And Installation (Cont'd)

Figure 60-80-4



Installation: When installing new rings, assemble the ring so the mark (Item 1) near the gap faces the top of the piston. When installing the oil ring, place the expander joint (Item 2) on the opposite side of the oil ring gap (Item 3) **[Figure 60-80-4]**.

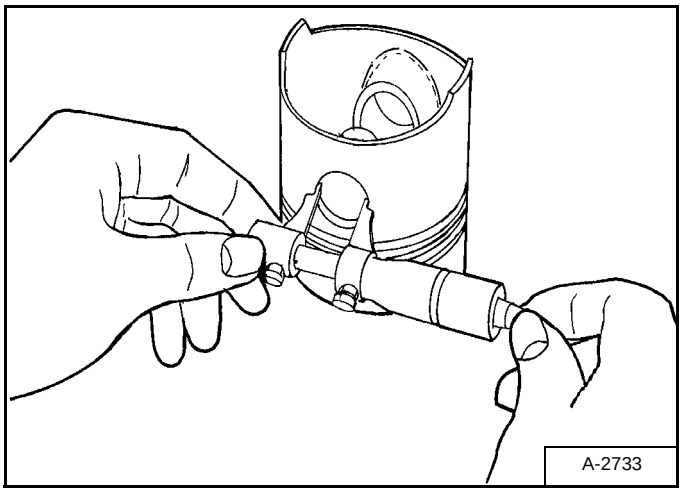
Figure 60-80-5



Installation: When reassembling, align the marks (Item 1) on the connecting rod and piston (Item 2). Heat the piston in oil to 80°C (176°F) for 10 to 15 minutes and tap the piston pin into position. Place the piston rings so that there are gaps every 120° (Items 3, 4 and 5) **[Figure 60-80-5]** with no gap facing the piston pin in the cylinder.

Piston And Connecting Rod - Servicing

Figure 60-80-6



Measure the I.D. of the piston pin bore in both horizontal and vertical direction **[Figure 60-80-6]**.

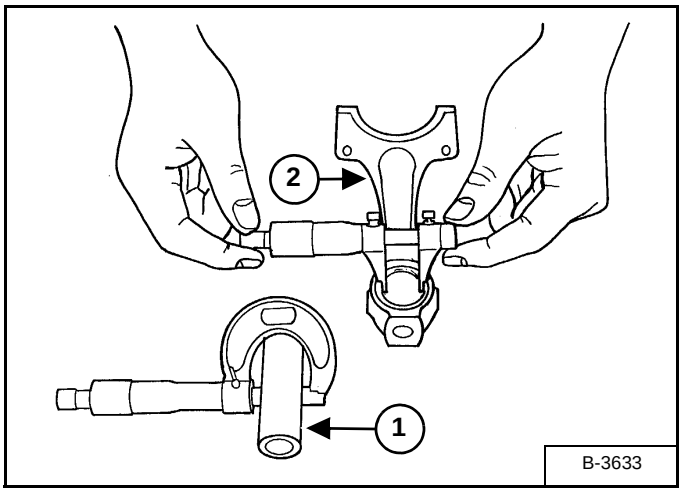
If the measurement exceeds the allowable limit, replace the piston.

Piston Pin Bore I.D.	20,00 - 20,013 mm (0.7874 - 0.7879 in)
Allowable Limit	20,05 mm (0.789 in)

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Piston And Connecting Rod - Servicing (Cont'd)

Figure 60-80-7



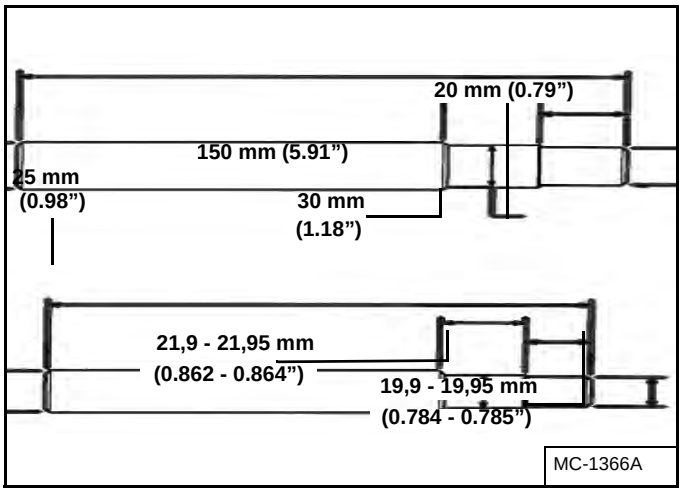
Measure the O.D. of the piston pin (Item 1) **[Figure 60-80-7]**.

Measure the I.D. of the connecting rod small end (Item 2) **[Figure 60-80-7]**.

Calculate the oil clearance. If the clearance exceeds the allowable limit, replace the bushing. If it still exceeds the specifications, replace the piston pin.

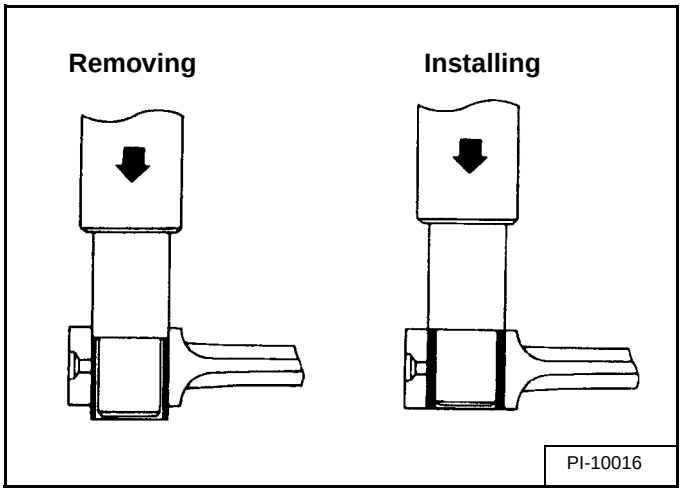
Piston Pin O.D.	20,002 - 20,011 mm (0.7875 - 0.7878 in)
Bushing I.D.	20,025 - 20,04 mm (0.7884 - 0.7890 in)
Oil Clearance between Piston Pin and Bushing	
	0,014 - 0,038 mm (0.0006 - 0.0015 in)
Allowable Limit	0,10 mm (0.004 in)

Figure 60-80-8



To replace the connecting rod small end bushing, make a driver tool as shown in figure **[Figure 60-80-8]**.

Figure 60-80-9



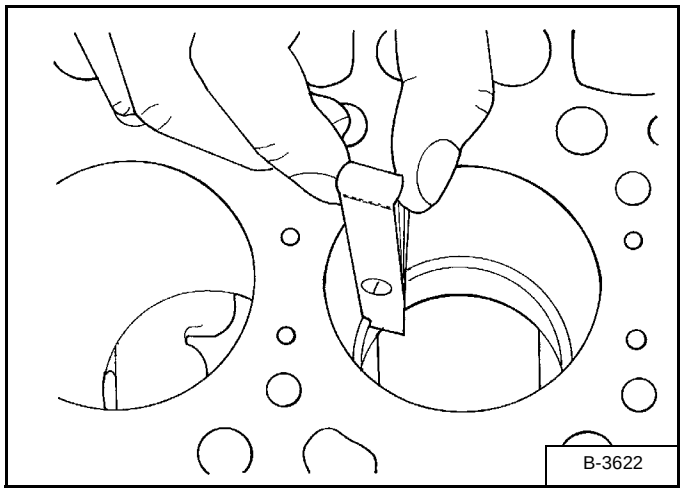
Use a press and special driver tool to remove the small end bushing **[Figure 60-80-9]**.

Installation: Clean the small end bushing and bore. Put oil on the bushing and press into the connecting rod until it is flush **[Figure 60-80-9]**.

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Piston And Connecting Rod - Servicing (Cont'd)

Figure 60-80-10

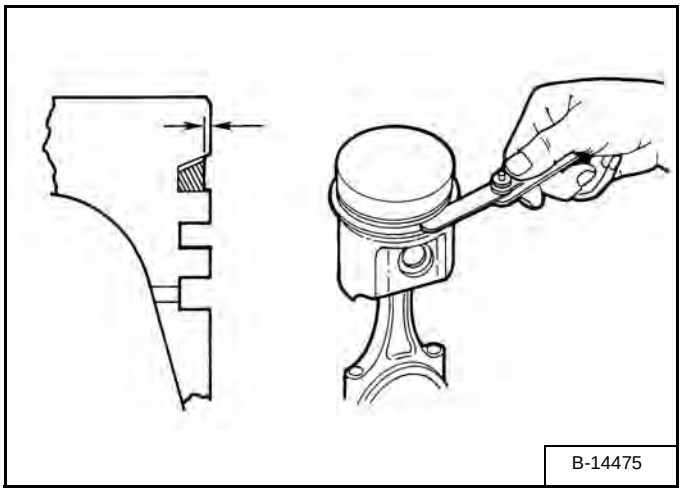


Install a new piston ring into the lower part of the cylinder bore. Measure the ring gap with a feeler gauge **[Figure 60-80-10]**.

If the gap exceeds the allowable limit, replace the piston ring.

Top Compression Ring and Oil Ring	
	0,15 - 0,30 mm (0.006 - 0.012 in)
Second Compression Ring	
	0,30 - 0,45 mm (0.012 - 0.018 in)
Allowable Limit	1,2 mm (0.047 in)

Figure 60-80-11



Remove the carbon from the ring grooves. Measure the clearance between the ring and groove with a feeler gauge **[Figure 60-80-11]**.

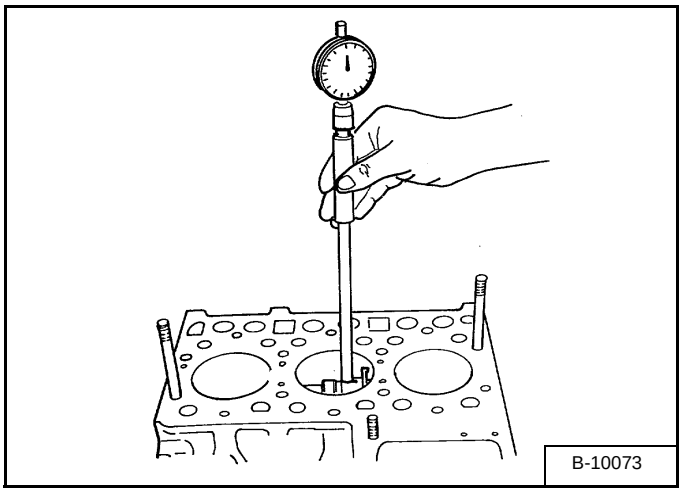
Second ring	0,09 - 0,12 mm (0.0033 - 0.0045 in)
Oil ring	0,04 - 0,08 mm (0.0016 - 0.0031 in)
Allowable limit second ring	
	0,15 mm (0.0059 in)
Allowable limit oil ring	
	0,15 mm (0.0059 in)

If the clearance exceeds the allowable limit, replace the piston.

Dealer Copy -- Not for Resale

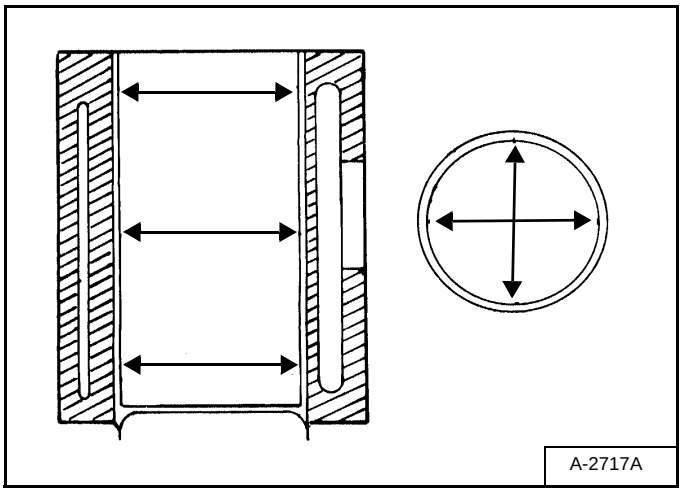
Cylinder Bore - Checking

Figure 60-80-12



Check the inside diameter of the cylinder line **[Figure 60-80-12]**.

Figure 60-80-13



To find the maximum wear check the inside diameter in six different locations **[Figure 60-80-13]**.

When the cylinder bore is not within specifications, bore and hone the cylinder for an oversize piston.

Cylinder Bore I.D.	67,0 - 67,02 mm (2.638 - 2.639 in)
Allowable Limit	67,17 mm (2.644 in)

NOTE: Make sure you use the correct oversize pistons and rings.

Connecting Rod Alignment

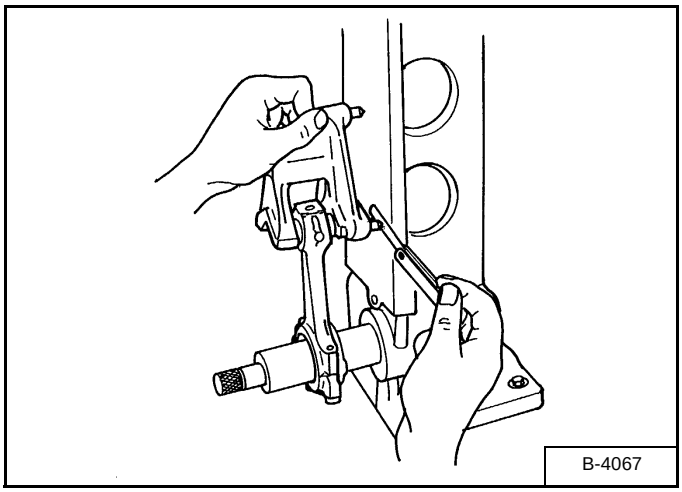
NOTE: The small end bushing is the basis of this check, check the bushing for wear before doing this check.

Install the piston pin into the connecting rod.

Install the connecting rod on an alignment tool.

Put the gauge over the piston pin and move it against the face plate.

Figure 60-80-14



If the gauge does not fit squarely against the face place, measure the space between the gauge and face plate **[Figure 60-80-14]**.

If the measurement exceeds the allowable limit, replace the connecting rod.

Rod Alignment Allowable Limit	
	0,05 mm (0.002 in)

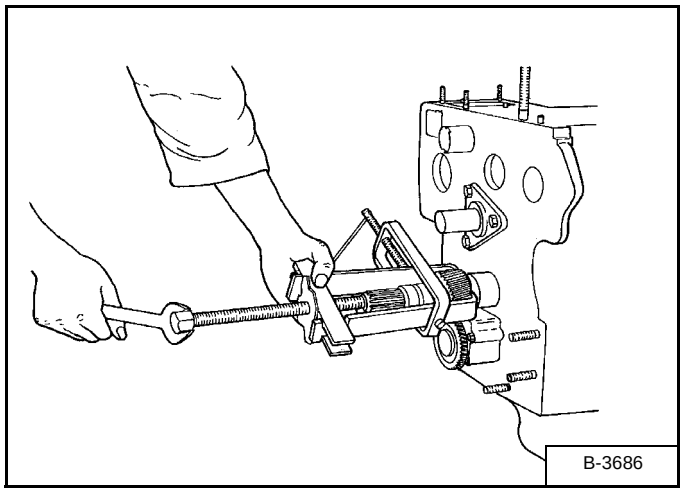
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Crankshaft Gear Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-90-1.)

Remove the idler gear. (See Idler Gear And Camshaft Removal And Installation on Page 60-90-3.)

Figure 60-80-15



Remove the crankshaft gear with a puller **[Figure 60-80-15]**.

Remove the crankshaft key.

Crankshaft And Bearings Removal And Installation

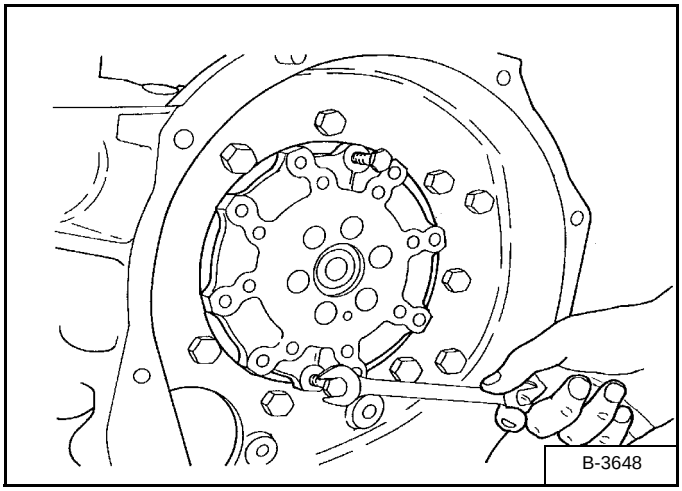
Remove the piston and connecting rod assemblies. (See Piston And Connecting Rod Removal And Installation on Page 60-80-1.)

Remove the engine flywheel. (See Flywheel Removal on Page 60-100-2.)

Remove the bolts which fasten the bearing case cover to the block.

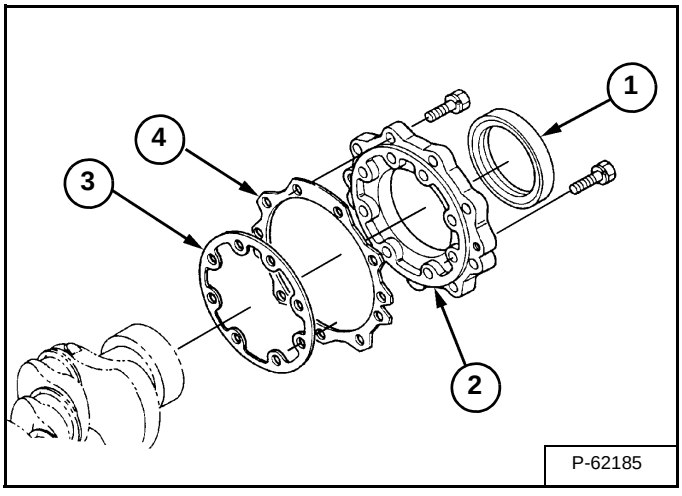
Installation: Tighten the bearing case cover bolts to 10 - 11 N•m (88.5 - 97.4 in-lb) torque. Tighten bolts with even force on the diagonal line.

Figure 60-80-16



Install two bolts into the bearing case cover and pull the cover out **[Figure 60-80-16]**.

Figure 60-80-17

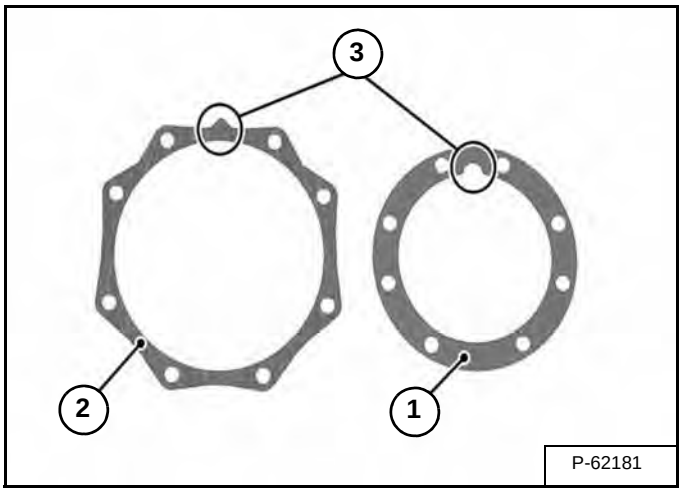


Installation: When installing the cover (Item 1), make sure the casting mark is in the up position. Lightly oil inside lip of oil seal (Item 2) **[Figure 60-80-17]**.

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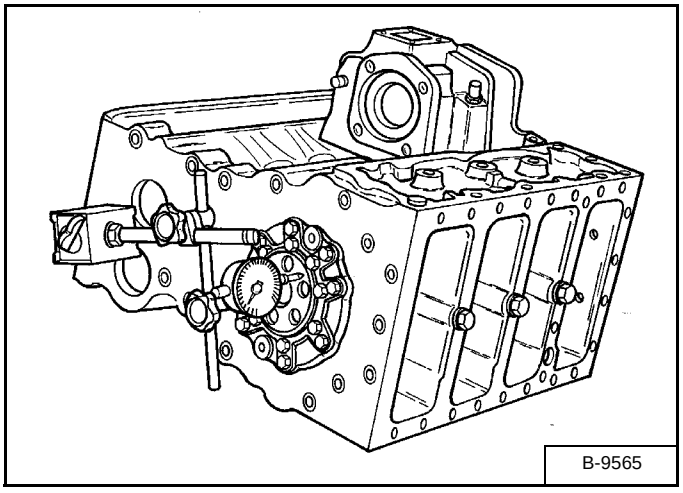
Crankshaft And Bearings Removal And Installation (Cont'd)

Figure 60-80-18



Installation: When installing the bearing case gasket (Item 3) **[Figure 60-80-17]** and (Item 1) **[Figure 60-80-18]**, and the bearing case cover gasket (Item 4) **[Figure 60-80-17]** and (Item 2) **[Figure 60-80-18]** make sure the mark (Item 3) **[Figure 60-80-18]** is in the up position.

Figure 60-80-19

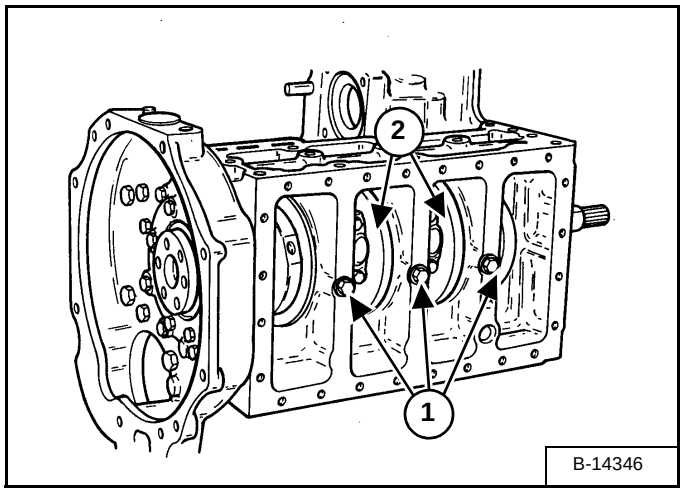


Before removing the crankshaft / mainbearings, check the end play. Install a dial indicator. Measure the end play by moving the crankshaft back and forth **[Figure 60-80-19]**.

If the measurement exceeds the allowable limit, replace the thrust washers.

End Play	0,15 - 0,31 mm (0.006 - 0.012 in)
Allowable Limit	0,5 mm (0.020 in)

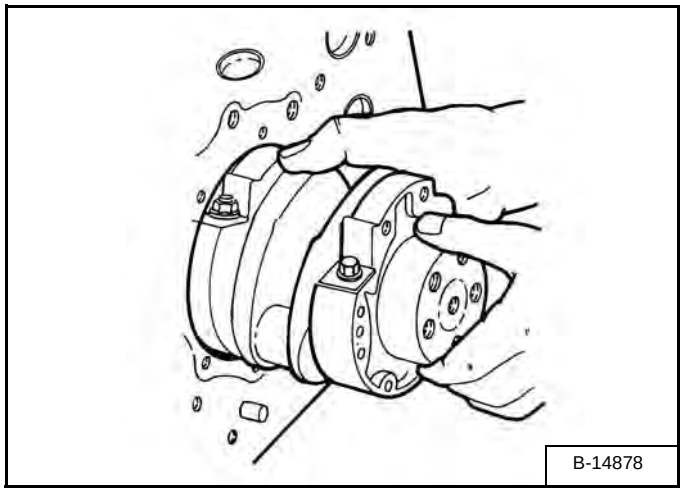
Figure 60-80-20



Remove the mainbearing case bolt (Item 1) **[Figure 60-80-20]**.

Installation: Align the bearing case hole (Item 2) **[Figure 60-80-20]** with the hole in the block. Put oil on the bolt threads and tighten to 27 - 30 N•m (20 - 22 ft-lb) torque.

Figure 60-80-21



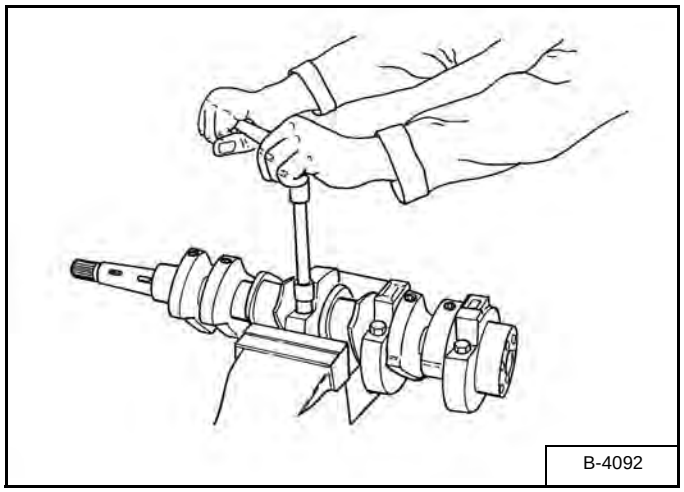
Remove the crankshaft / mainbearing assembly from the engine block **[Figure 60-80-21]**.

Mark the bearing case halves for correct installation.

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Crankshaft And Bearings Removal And Installation (Cont'd)

Figure 60-80-22

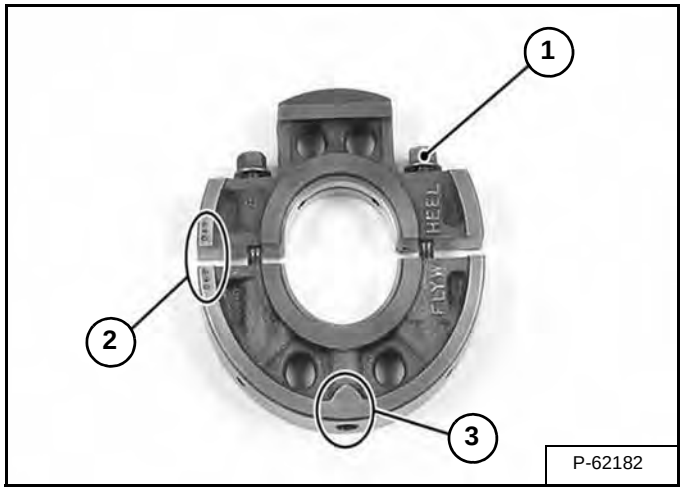


Remove the two bearing case bolts **[Figure 60-80-22]**.

Remove the bearing case and bearing.

Installation: Tighten the bearing case bolts (Item 1) **[Figure 60-80-23]** to 13 - 16 N•m (9 - 12 ft-lb) torque.

Figure 60-80-23

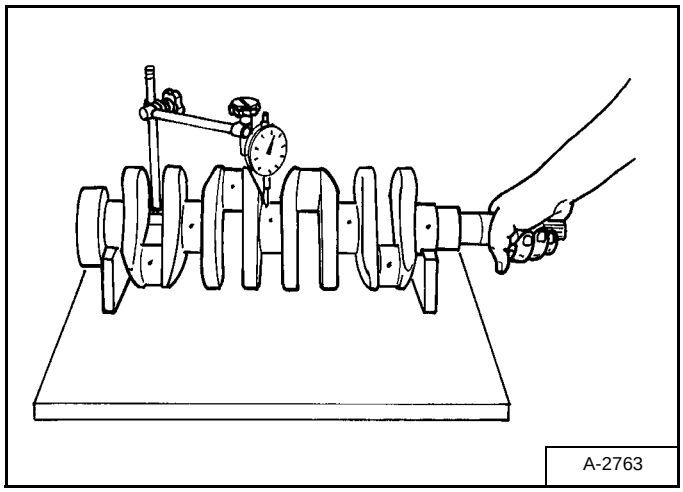


Installation: When installing the mainbearing case assemblies, face the mark FLYWHEEL to the flywheel side of the engine block **[Figure 60-80-23]**. Be sure the thrust washer with its oil grooves faces outward.

Identification marks on the mainbearing case assemblies are the alignment number (Item 2) and the marking "1" or "2" (Item 3) **[Figure 60-80-23]** can be found on the mainbearing case assemblies to ensure proper assembly.

Crankshaft And Bearings - Servicing

Figure 60-80-24



Put the crankshaft on V-blocks. Install a dial indicator on the center journal **[Figure 60-80-24]**.

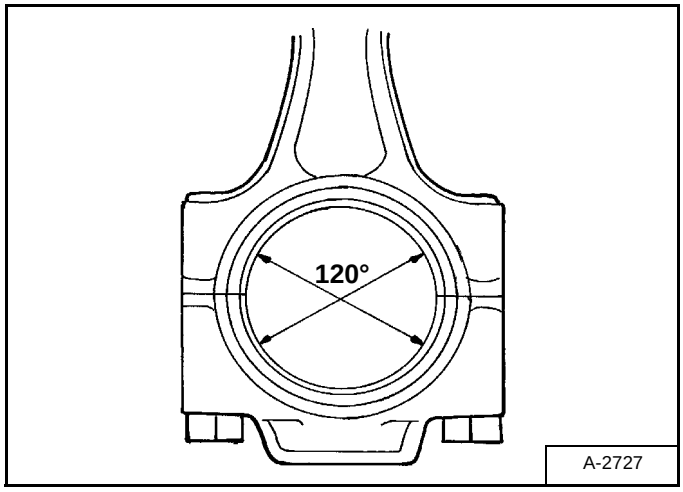
Turn the crankshaft at a slow rate.

If the misalignment exceeds the allowable limit, replace the crankshaft.

Alignment	0,02 mm (0.0008 in)

Tighten the connecting rod cap bolts 27 - 30 N•m (20 - 22 ft-lb) torque.

Figure 60-80-25

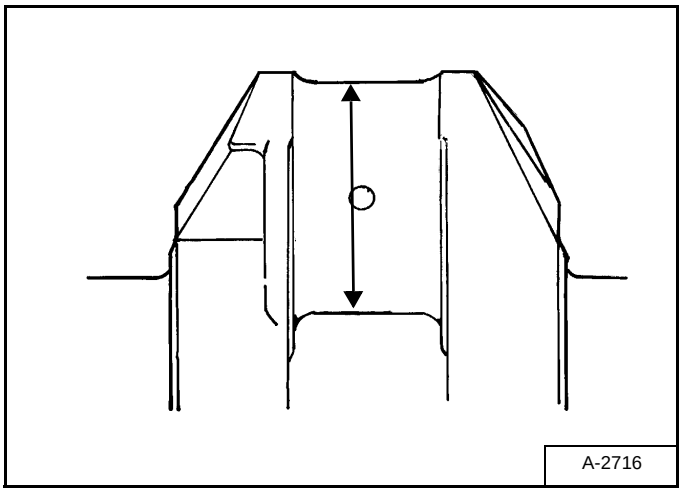


Measure the crankpin bearing I.D. **[Figure 60-80-25]**.

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Crankshaft And Bearings - Servicing (Cont'd)

Figure 60-80-26



Measure the crankpin O.D. **[Figure 60-80-26]**.

Calculate the oil clearance.

Crankpin Bearing I.D.	
	33,99 - 34,01 mm (1.3389 - 1.3390 in)
Crankpin O.D.	33,96 - 33,98 mm (1.3370 - 1.3376 in)
Oil Clearance	0,020 - 0,051 mm (0.0008 - 0.0020 in)
Allowable limit	0,15 mm (0.0059 in)

Figure 60-80-27

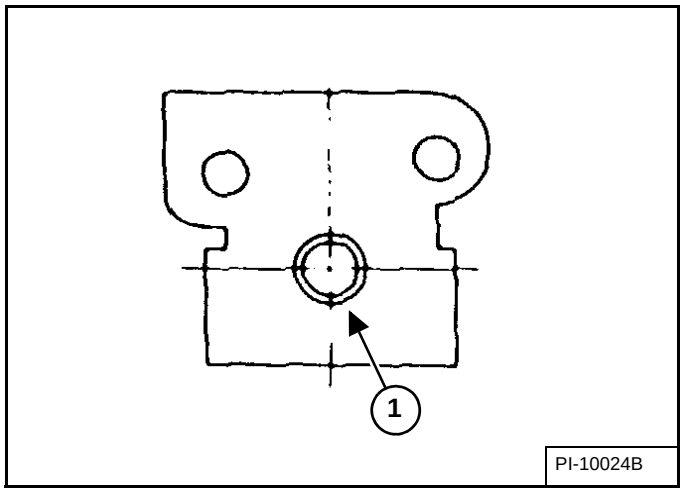
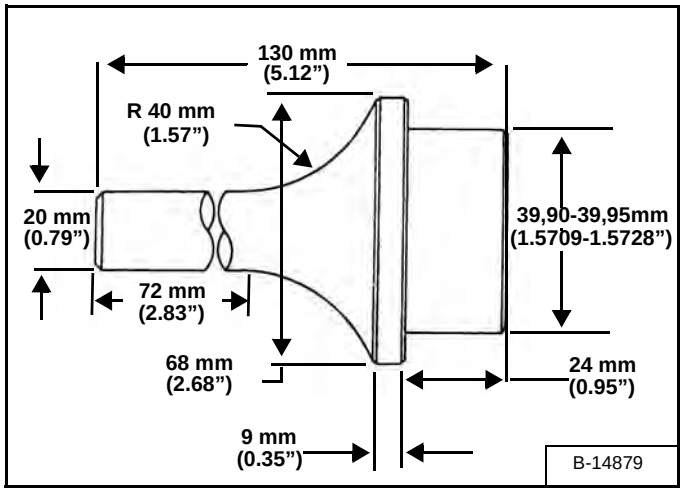


Figure 60-80-28



Remove the bearing (Item 1) **[Figure 60-80-27]** from the front of the engine block with the removal tool shown in **[Figure 60-80-28]**.

Installation: Clean the new bearing and bore and apply oil to them. Install the new bearing with the installation driver tool **[Figure 60-80-27]**.

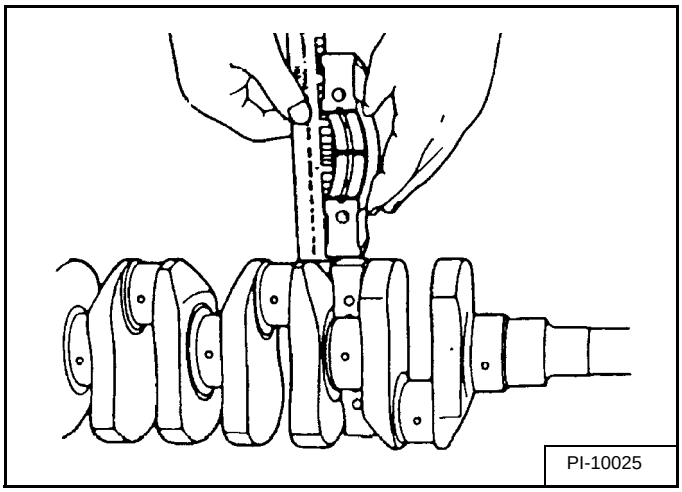
Clean the crankshaft journal and bearing. Put a strip of press gauge on the center journal.

Install the mainbearing case halves and tighten the bolts to 12,7 - 15,7 N•m (9 - 12 ft-lb) torque. Remove the bearing case halves.

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Crankshaft And Bearings - Servicing (Cont'd)

Figure 60-80-29



Measure the flattened press gauge **[Figure 60-80-29]**.

If the clearance exceeds the allowable limit, replace the crankshaft bearing.

Crankshaft Journal O.D. (Flywheel side)	
	43,93 - 43,95 mm (1.7297 - 1.7303 in)
Bearing I.D.	43,98 - 44,03 mm (1.7317 - 1.7333 in)
Crankshaft Journal O.D. (Middle)	
	39,93 - 39,95 mm (1.5722 - 1.5728 in)
Bearing I.D.	39,98 - 40,03 mm (1.5742 - 1.5758 in)
Crankshaft journal O.D. (Front)	
	39,93 - 39,95 mm (1.5722 - 1.5728 in)
Bearing I.D.	39,98 - 40,04 mm (1.5714 - 1.5764 in)
Oil Clearance	0,034 - 0,106 mm (0.0013 - 0.0042 in)
Allowable Limit	0,2 mm (0.008 in)

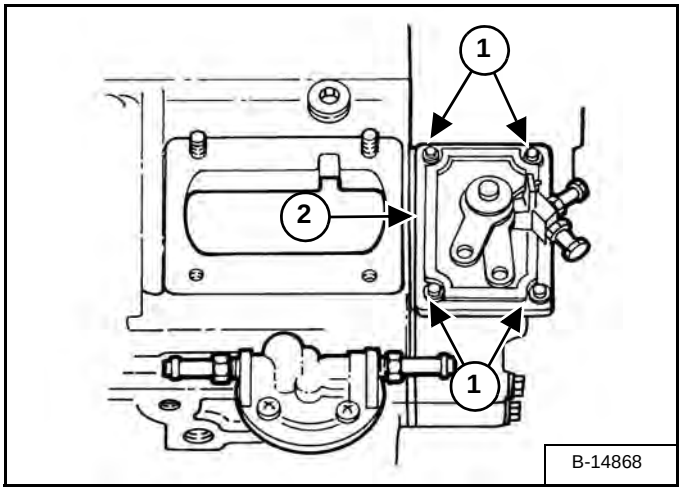
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CAMSHAFT AND TIMING GEARS

Timing Gearcase Cover Removal And Installation

Remove the fuel injection pump. (See Fuel Injection Pump Removal And Installation on Page 60-60-3.)

Figure 60-90-1

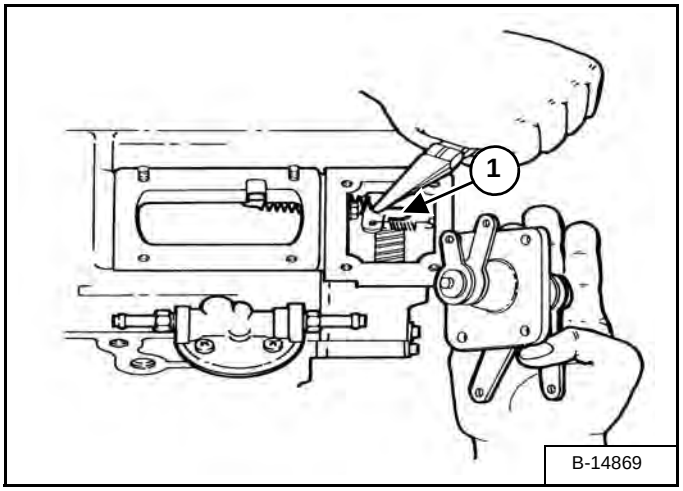


Remove the cylinder head, rocker arms and push rods. (See Cylinder Head Removal And Installation on Page 60-70-3.)

Remove the screws (Item 1) from the speed control plate (Item 2) **[Figure 60-90-1]**.

NOTE: Take care not to damage the spring.

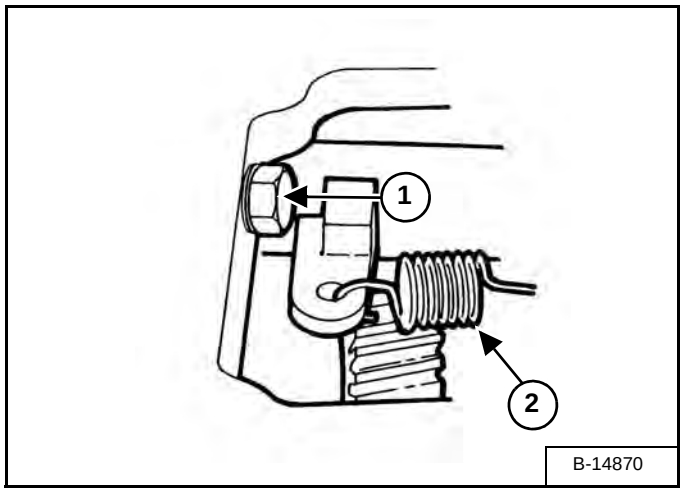
Figure 60-90-2



Separate the speed control plate from the engine and remove the spring (Item 1) **[Figure 60-90-2]**.

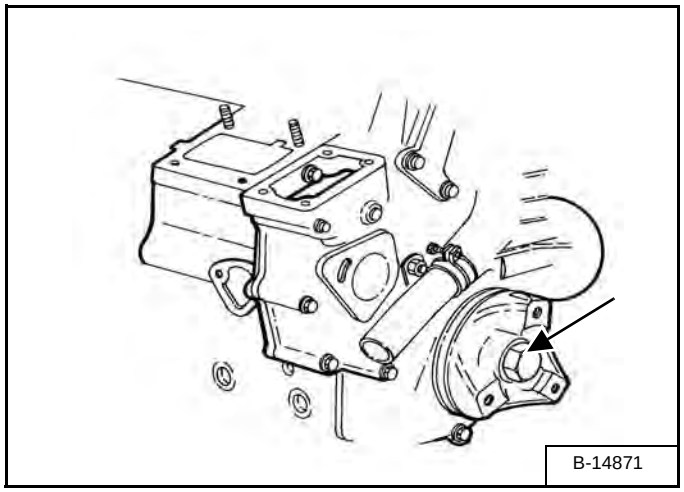
Remove the speed control plate.

Figure 60-90-3



Remove the bolt (Item 1) and disconnect the shaft spring (Item 2) **[Figure 60-90-3]**.

Figure 60-90-4



Remove the crankshaft pulley bolt.

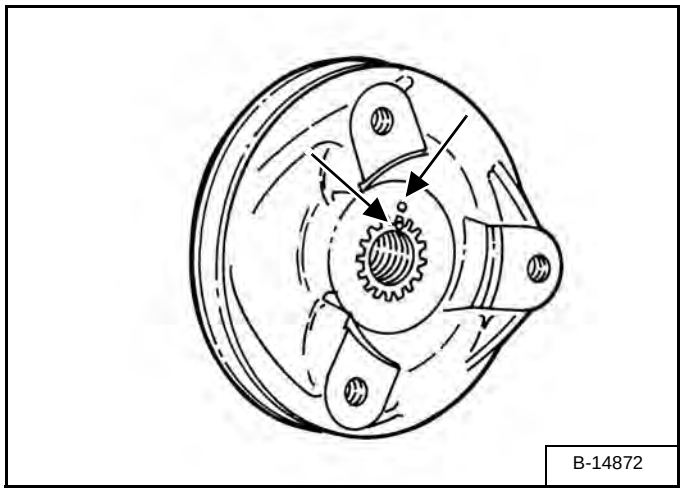
Installation: Tighten the bolt to 98 - 108 N•m (72 - 80 ft-lb) torque.

Use a puller and remove the crankshaft pulley **[Figure 60-90-4]**.

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Timing Gearcase Cover Removal And Installation (Cont'd)

Figure 60-90-5

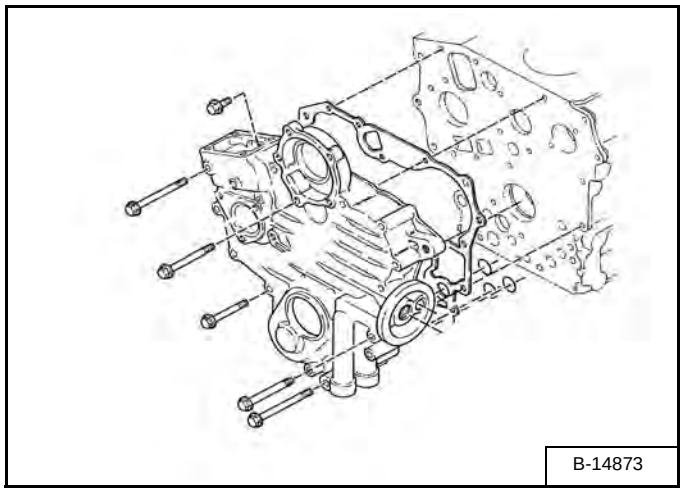


When installing the crank shaft pulley, make sure the alignment marks are aligned **[Figure 60-90-5]**.

Remove the timing gearcase cover bolts.

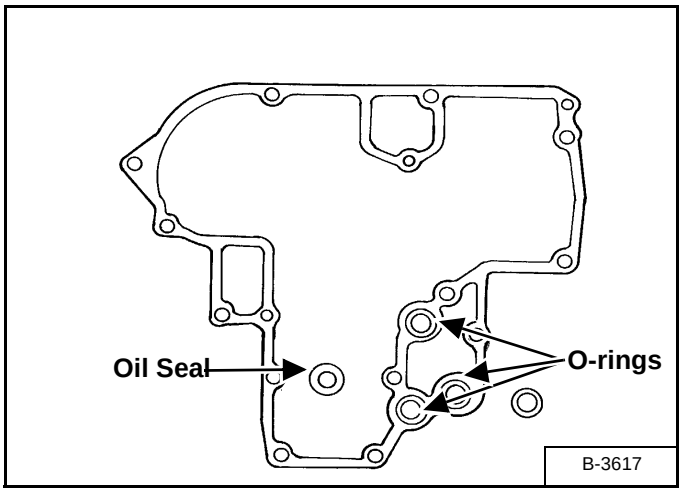
Installation: Tighten the bolts to 10 - 11 N•m (88.5 - 97.4 in-lb) torque.

Figure 60-90-6



Remove the timing gearcase **[Figure 60-90-6]**.

Figure 60-90-7

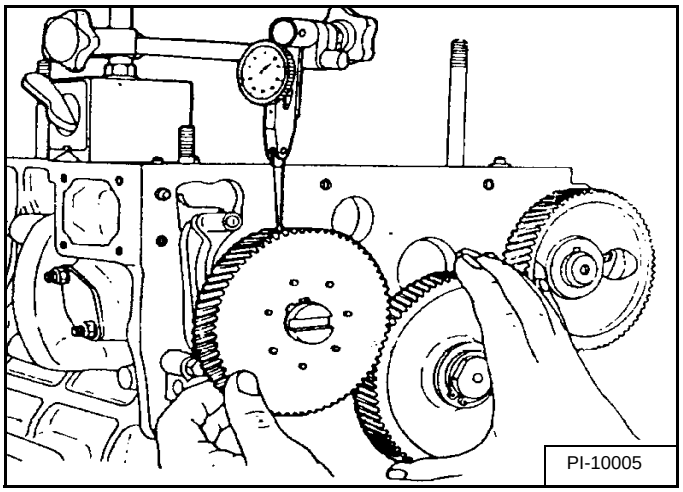


Installation: Install three new O-rings and the oil seal into the timing gearcase cover **[Figure 60-90-7]**.

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Timing Gears Checking Backlash

Figure 60-90-8



When the gears are installed, check the backlash of the gears.

Install a dial indicator with its tip on a gear tooth **[Figure 60-90-8]**.

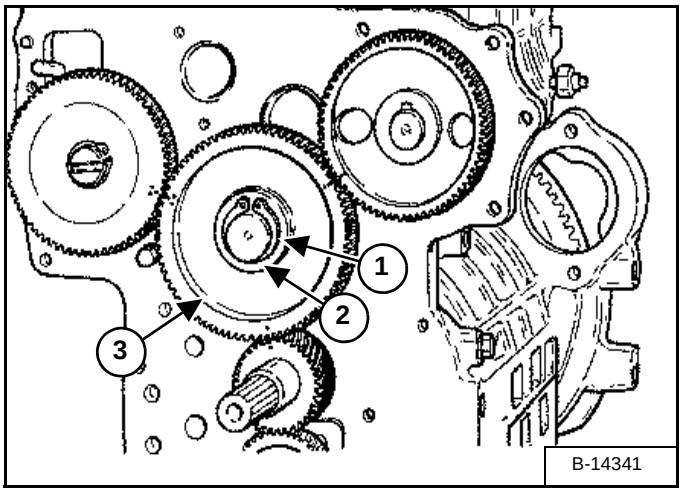
Hold one gear while turning the other gear **[Figure 60-90-8]**.

If the backlash exceeds the allowable limit, check the oil clearance of the shaft and gear. If the oil clearance is correct, replace the gears.

Crank Gear and Idler Gear	
	0,043 - 0,124 mm (0.002 - 0.005 in)
Allowable Limit	0,15 mm (0.006 in)
Cam Gear and Idler Gear	
	0,047 - 0,12 mm (0.002 - 0.005 in)
Allowable Limit	0,15 mm (0.006 in)
Injection Pump Gear and Idler Gear	
	0,046 - 0,124 mm (0.002 - 0.005 in)
Allowable Limit	0,15 mm (0.006 in)
Oil Pump Gear and Crankshaft Cover	
	0,041 - 0,123 mm (0.002 - 0.005 in)
Allowable Limit	0,15 mm (0.006 in)

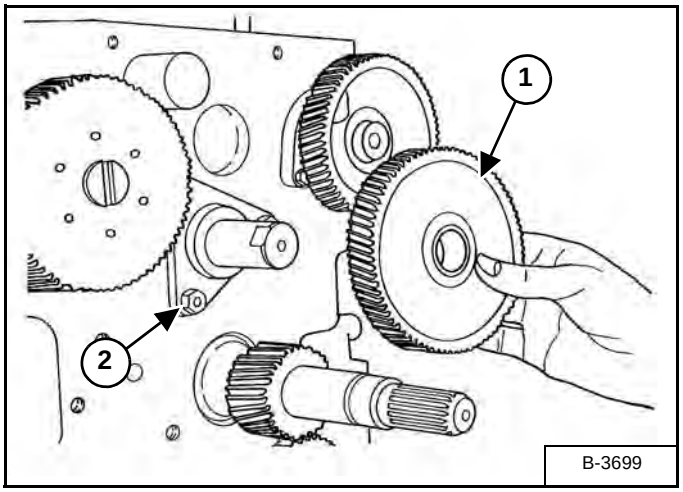
Idler Gear And Camshaft Removal And Installation

Figure 60-90-9



Remove the snap ring (Item 1) and collar (Item 2) from the idler gear shaft (Item 3) **[Figure 60-90-9]**.

Figure 60-90-10



Remove the idler gear (Item 1) **[Figure 60-90-10]**.

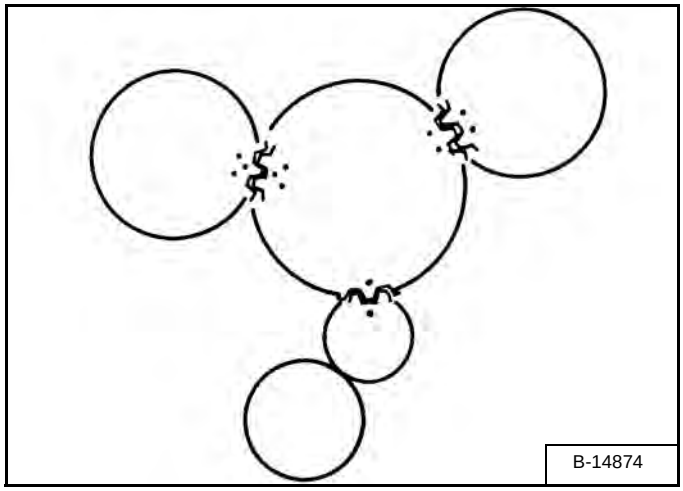
Remove idler gear mounting screws (Item 2) **[Figure 60-90-10]**.

Installation: Tighten screws (Item 2) **[Figure 60-90-10]** to 10 - 11 N•m (88.5 - 97.4 in-lb) torque.

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Idler Gear And Camshaft Removal And Installation (Cont'd)

Figure 60-90-11

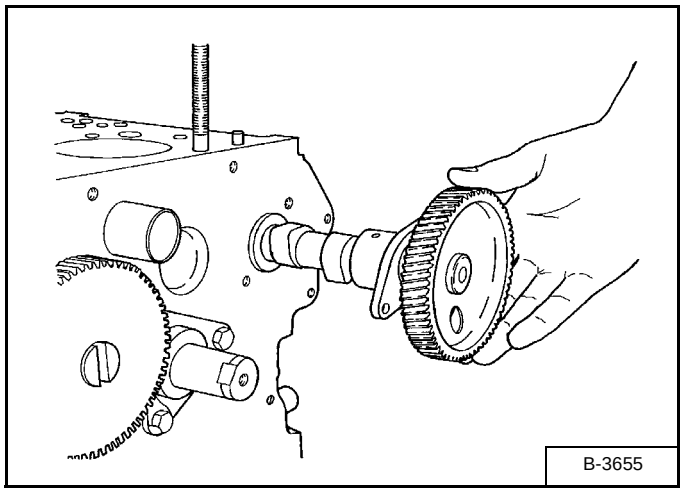


Installation: Make sure the timing marks are in correct alignment when installing the timing gears **[Figure 60-90-11]**.

Align the holes on the camshaft gear with the camshaft retainer plate bolts.

Remove the bolts.

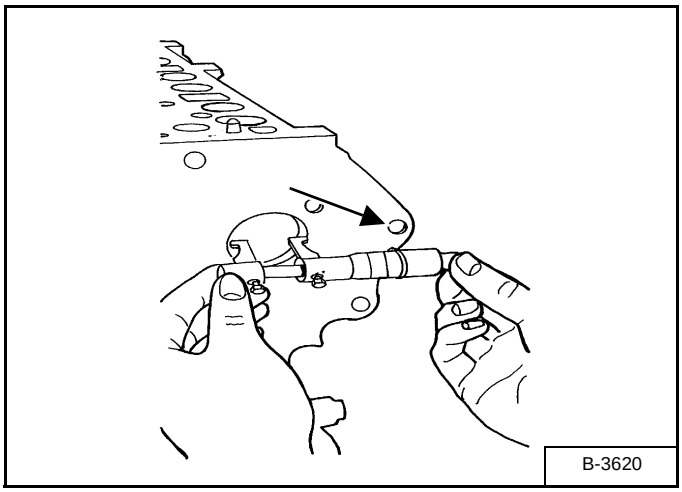
Figure 60-90-12



Remove the camshaft from the engine block **[Figure 60-90-12]**.

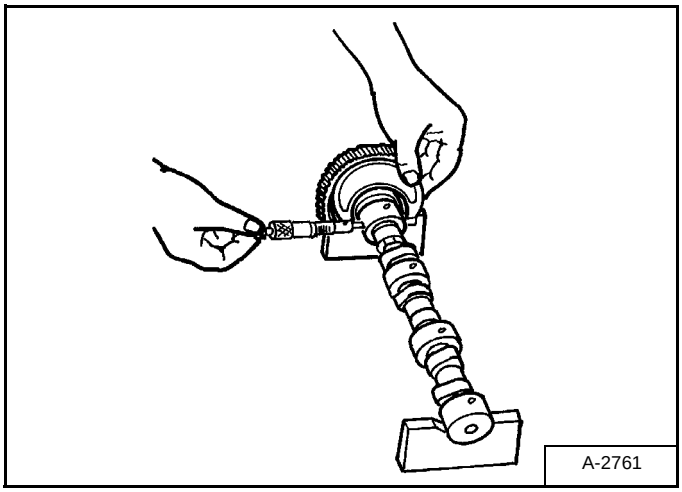
Installation: Tighten the camshaft retainer bolts to 18 - 21 N•m (14 - 15 ft-lb) torque.

Figure 60-90-13



Measure the camshaft bearing in the engine block **[Figure 60-90-13]**.

Figure 60-90-14



Measure the camshaft journal **[Figure 60-90-14]**.

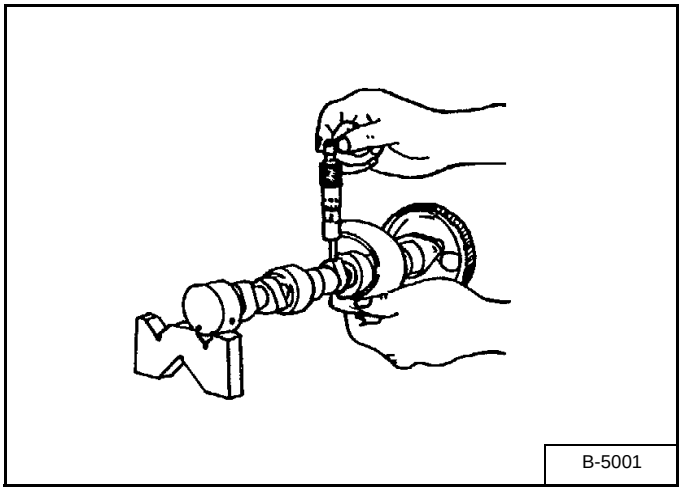
Calculate the oil clearance. If the clearance exceeds the allowable limit, replace the camshaft.

Bearing I.D.	33,00 - 33,03 mm (1.299 - 1.300 in)
Journal O.D.	32,93 - 32,95 mm (1.2966 - 1.2972 in)
Clearance of Camshaft Journal	
	0,05 - 0,09 mm (0.002 - 0.004 in)
Allowable Limit	0,15 mm (0.006 in)

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Idler Gear And Camshaft Removal And Installation (Cont'd)

Figure 60-90-15

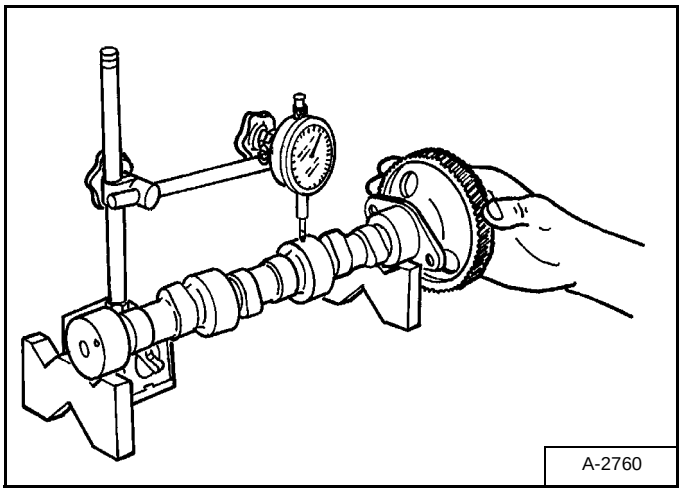


Measure the cam lobes at their highest point **[Figure 60-90-15]**.

If the measurement is less than the allowable limit, replace the camshaft.

Cam Lob Height	26,88 mm (1.058 in)
Allowable Limit	26,83 mm (1.056 in)

Figure 60-90-16



Put the camshaft in V-blocks. Install a dial indicator **[Figure 60-90-16]**.

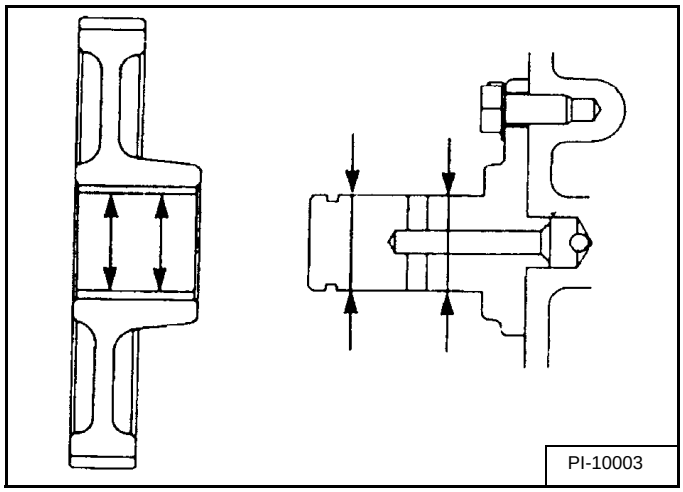
Turn the camshaft at a slow rate. If the misalignment exceeds the allowable limit, replace the camshaft.

Camshaft Alignment Allowable Limit	
	0,01 mm (0.0004 in)

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Idler Gear And Shaft - Servicing

Figure 60-90-17



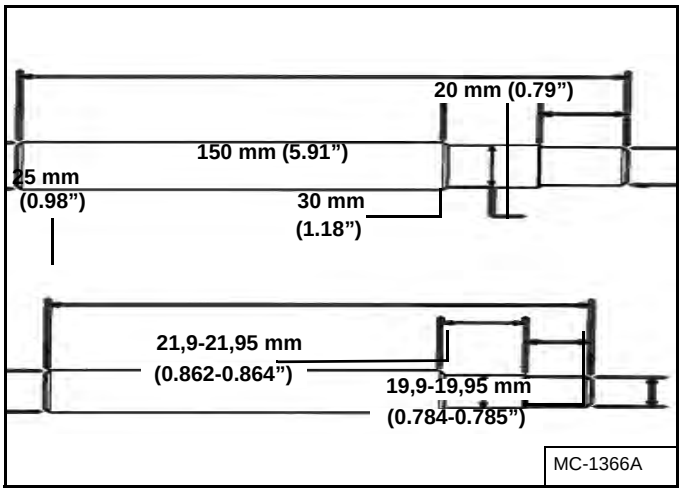
Measure the O.D. of the idler gear shaft **[Figure 60-90-17]**.

Measure the I.D. of the idler gear bushing **[Figure 60-90-17]**.

If the clearance exceeds the allowable limit, replace the bushing.

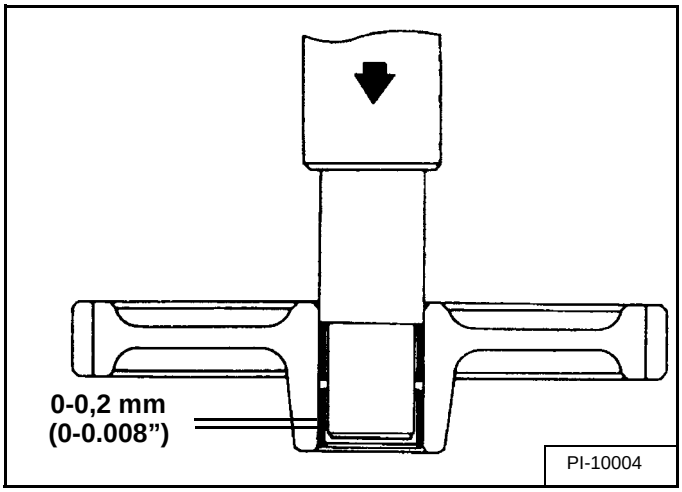
Idler Gear Shaft O.D.	19,97 - 19,98 mm (0.786 - 0.787 in)
Idler Gear Shaft I.D.	20,00 - 20,05 mm (0.787 - 0.789 in)
Oil Clearance between Idler Shaft and Gear Bushing	
	0,020 - 0,084 mm (0.0008 - 0.0033 in)
Allowable Limit	0,10 mm (0.004 in)

Figure 60-90-18



To replace the idler gear bushing, make a driver tool as shown in figure **[Figure 60-90-18]**.

Figure 60-90-19



Use a press and special driver tool, to remove the old bushing and install the new bushing **[Figure 60-90-19]**.

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FLYWHEEL AND HOUSING

Flywheel Housing Removal And Installation

Drain the hydraulic reservoir. (See Removing And Replacing The Hydraulic Fluid on Page 10-130-3.)

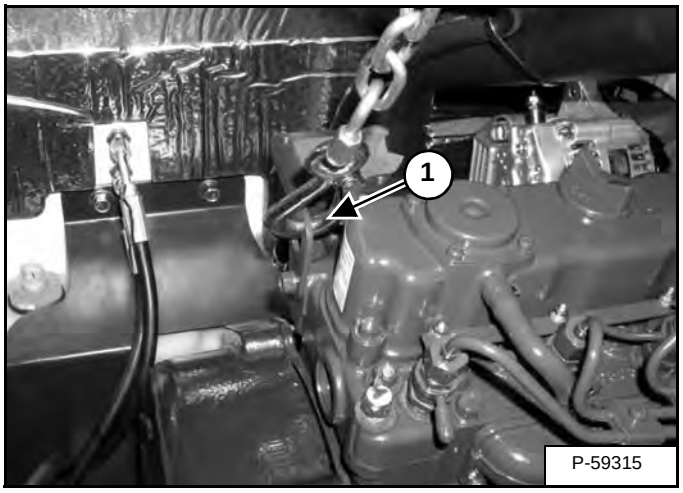
Remove the hydraulic pump. (See Removal And Installation on Page 20-50-7.)

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

Remove the spark arrester muffler. (See Removal And Installation on Page 60-30-1.)

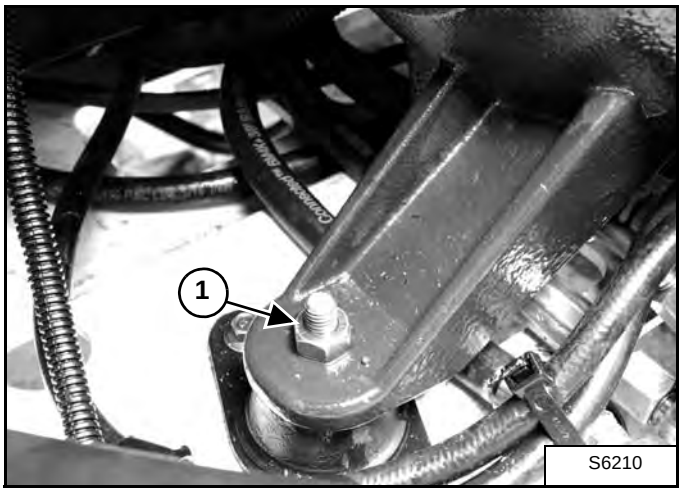
Remove the hydraulic filter housing assembly. (See Removal And Installation on Page 20-110-1.)

Figure 60-100-1



Install a chain hoist to the engine lifting eye to support the engine (Item 1) **[Figure 60-100-1]**.

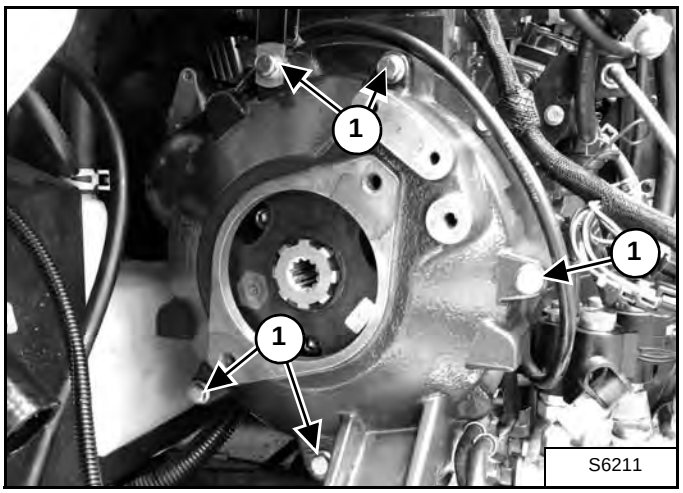
Figure 60-100-2



Remove the mount bolt and nut (Item 1) **[Figure 60-100-2]** from the engine mount.

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

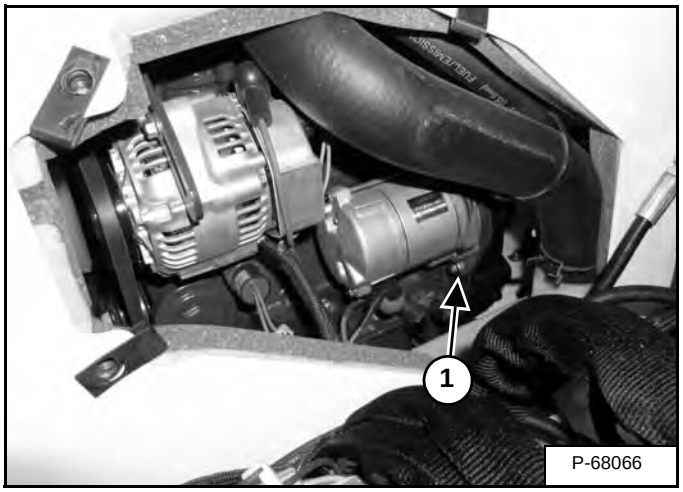
Figure 60-100-3



Remove the five flywheel housing bolts (Item 1) **[Figure 60-100-3]**.

Installation: Tighten the bolts to 24 - 26 N•m (18 - 19 ft-lb) torque.

Figure 60-100-4



Remove the access panel.

Remove the one bolt (Item 1) **[Figure 60-100-4]** from the bottom starter mounting bolt.

Installation: Tighten the bolts to 24 - 26 N•m (18 - 19 ft-lb) torque.

Remove the flywheel housing.

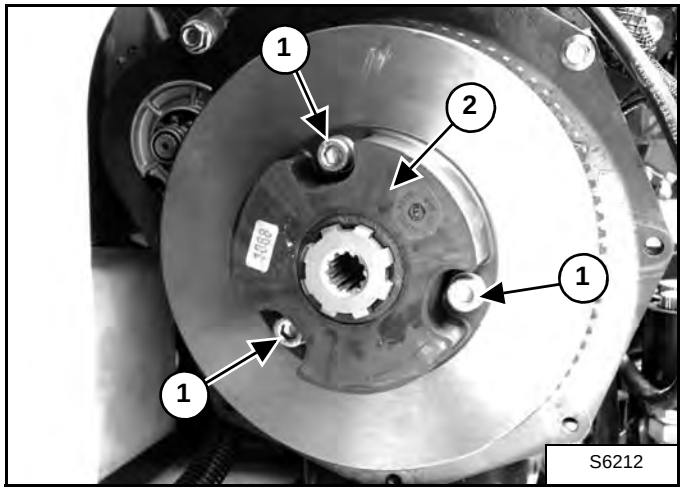
NOTE: Check that the alignment dowel pins are installed in the flywheel housing for assembly.

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Hydraulic Pump Coupler Removal And Installation

Remove the flywheel housing. (See Flywheel Housing Removal And Installation on Page 60-100-1.)

Figure 60-100-5



Remove the three bolts (Item 1) **[Figure 60-100-5]** from the hydraulic pump coupler.

Installation: Apply Loctite® 242 (Blue) to bolts and tighten the bolts to 71 - 79 N•m (52.5 - 58.5 ft-lb) torque. Also lubricate the bolt heads prior to installation.

NOTE: Apply anti-seize compound on spline teeth prior to pump installation.

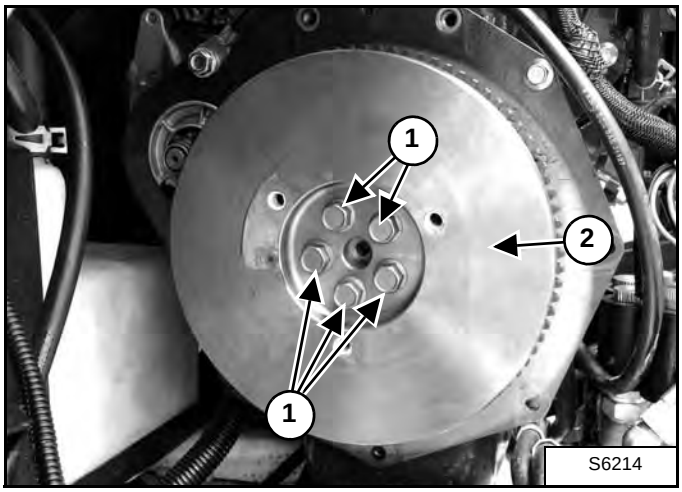
Remove the hydraulic pump coupler (Item 2) **[Figure 60-100-5]**.

Flywheel Removal

Remove the flywheel housing. (See Flywheel Housing Removal And Installation on Page 60-100-1.)

Remove the hydraulic pump coupler. (See Hydraulic Pump Coupler Removal And Installation on Page 60-100-2.)

Figure 60-100-6



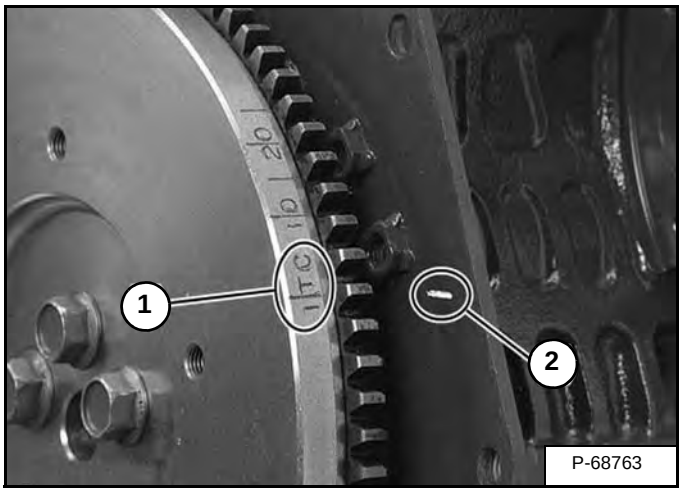
Remove the five bolts (Item 1) **[Figure 60-100-6]** from the flywheel.

Remove the flywheel (Item 2) **[Figure 60-100-6]**.

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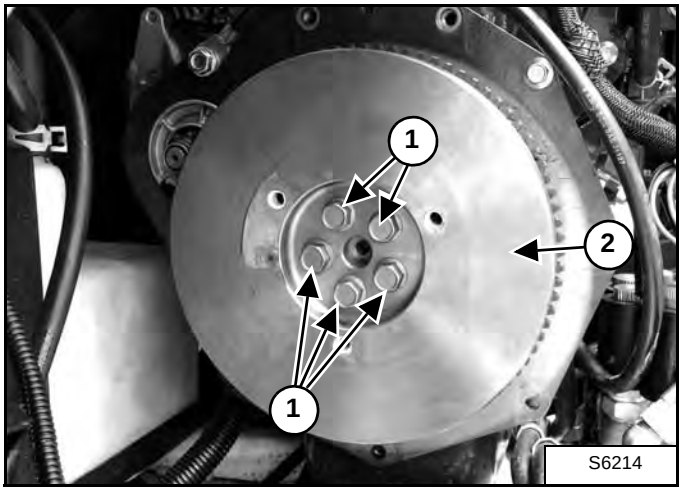
Flywheel Installation

Figure 60-100-7



Align the "1TC" (Item 1) on the outer surface of the flywheel with the alignment mark (Item 2) **[Figure 60-100-7]** on the rear end plate.

Figure 60-100-8



Apply engine oil to the five bolt threads and the underside of bolt heads before installation.

Install the five bolts (Item 1) **[Figure 60-100-8]** on the flywheel.

Tighten the bolts to 53,9 - 58,8 N•m (39.8 - 43.4 ft-lb) torque.

Rear End Plate Removal And Installation

Remove the flywheel housing. (See Flywheel Housing Removal And Installation on Page 60-100-1.)

Remove the hydraulic pump coupler. (See Hydraulic Pump Coupler Removal And Installation on Page 60-100-2.)

Remove the flywheel. (See Flywheel Removal on Page 60-100-2.)

Figure 60-100-9

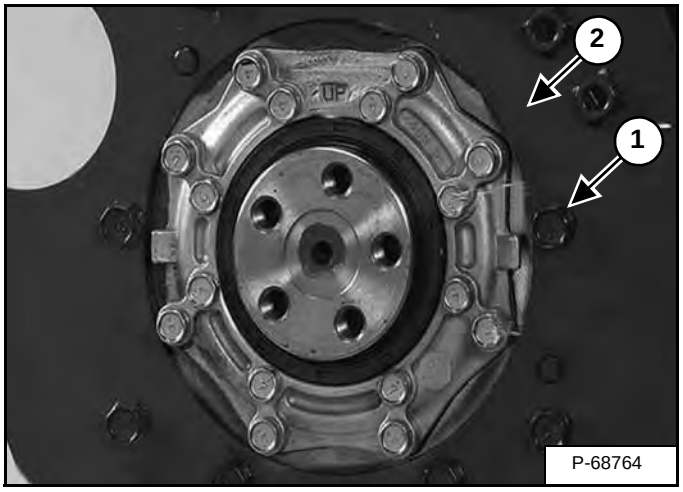
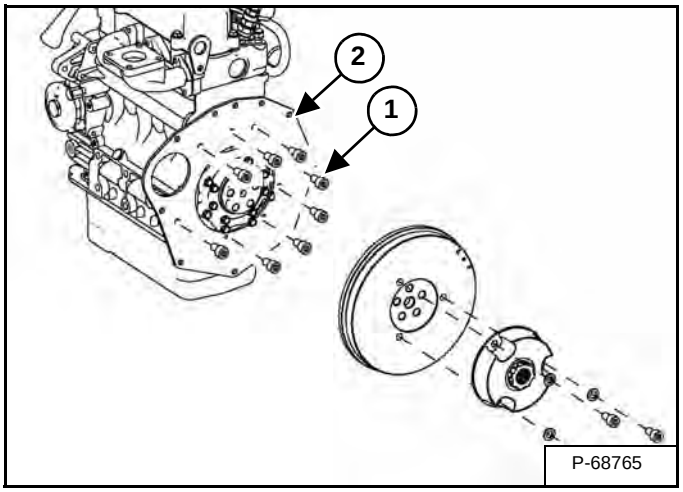


Figure 60-100-10



Remove the bolts (Item 1) from the rear end plate (Item 2) **[Figure 60-100-9]** and **[Figure 60-100-10]**. Remove the end plate from the side of the engine.

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HEATER

HEATER SYSTEM 70-10-1
Description 70-10-1
Components 70-10-1

REGULAR MAINTENANCE 70-20-1
Filter Element Removal And Installation 70-20-1
Heater Coil 70-20-1

HEATER UNIT 70-30-1
Removal And Installation 70-30-1
Louver Removal And Installation 70-30-2
Threaded Insert Removal And Installation 70-30-2

HEATER COIL 70-40-1
Removal And Installation 70-40-1

HEATER FAN 70-50-1
Removal And Installation 70-50-1

HEATER VALVE 70-60-1
Removal And Installation 70-60-1

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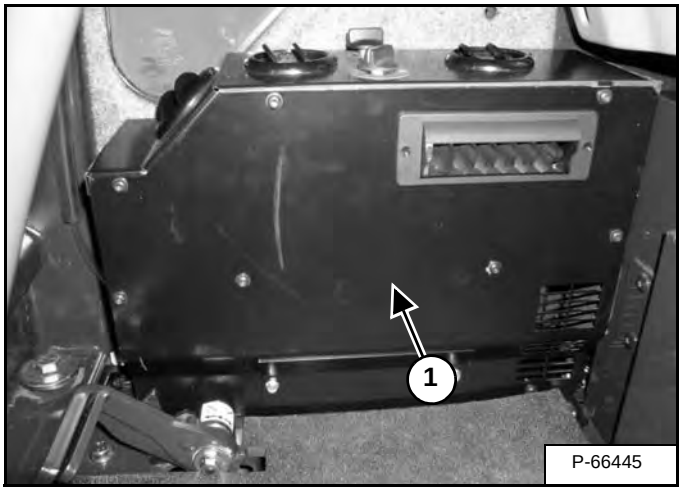
HEATER SYSTEM

Description

The heater system includes the heater unit which is located on the floor on the right side of the excavator cab. The heater unit includes the heater coil, fan motor, blower cages, a temperature switch, fan switch, filter and louvers.

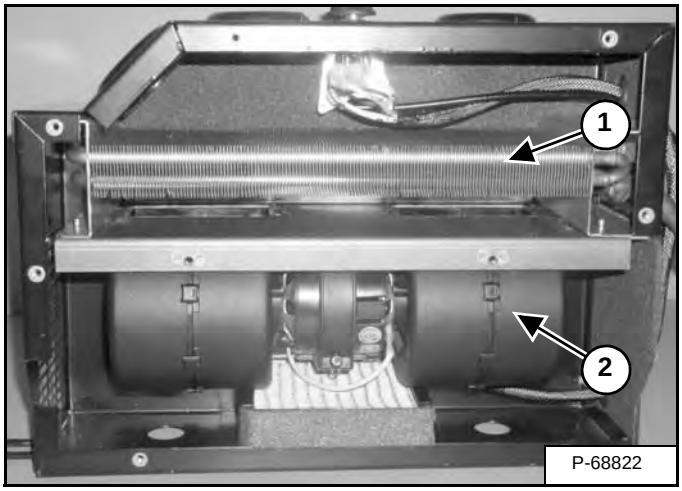
Components

Figure 70-10-1



Heater Unit: The heater unit (Item 1) **[Figure 70-10-1]** is located on the floor on the ride side of the excavator cab. The unit delivers the warm air for heat into the cab.

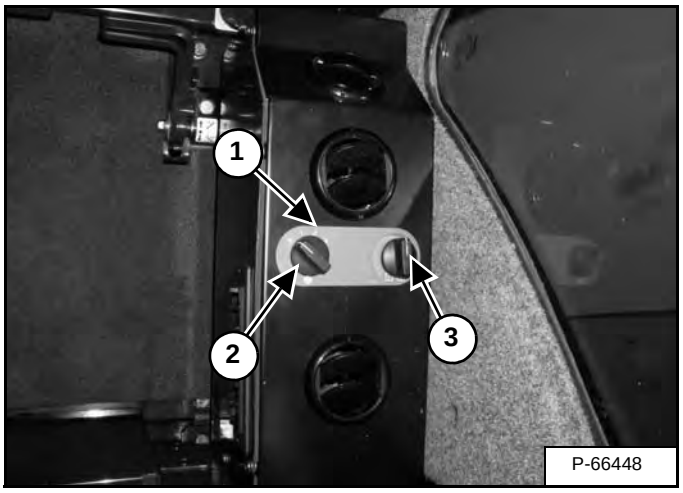
Figure 70-10-2



Heater Coil: The heater coil (Item 1) **[Figure 70-10-2]** supplies the warm air into the cab by passing air through the coil.

Heater Fan: The fan (Item 2) **[Figure 70-10-2]** is used to push air through the heater coil and into the cab.

Figure 70-10-3

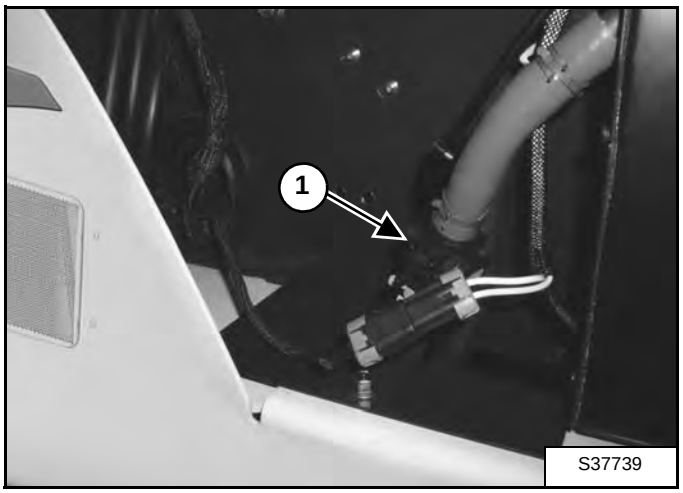


Control Panel: The panel (Item 1) **[Figure 70-10-3]** has three separate components:

Fan Switch: This is a four position rotary switch (Item 2) **[Figure 70-10-3]**.

Temperature Switch: The temperature switch (Item 3) **[Figure 70-10-3]** controls the Heat Valve from fully Off to fully On.

Figure 70-10-4



Heater Valve: The heater valve (Item 1) **[Figure 70-10-4]** manually controls the amount of engine coolant that flows to the heater coil.

Dealer Copy -- Not for Resale



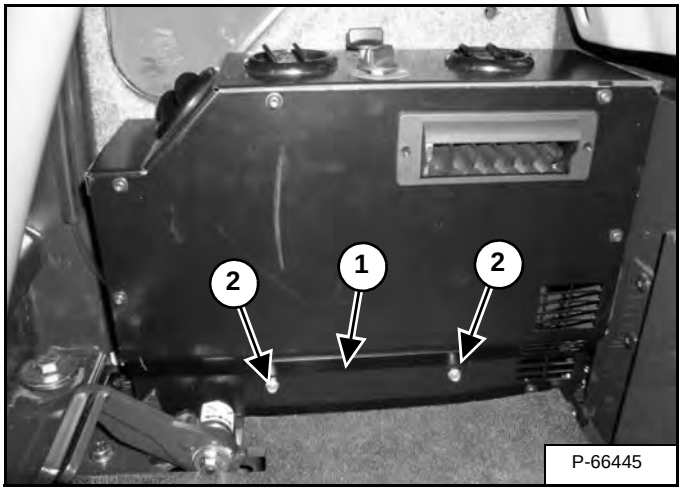
Dealer Copy -- Not for Resale

REGULAR MAINTENANCE

Filter Element Removal And Installation

The recirculation filter must be cleaned regularly. The filter is located on the right of the operator seat.

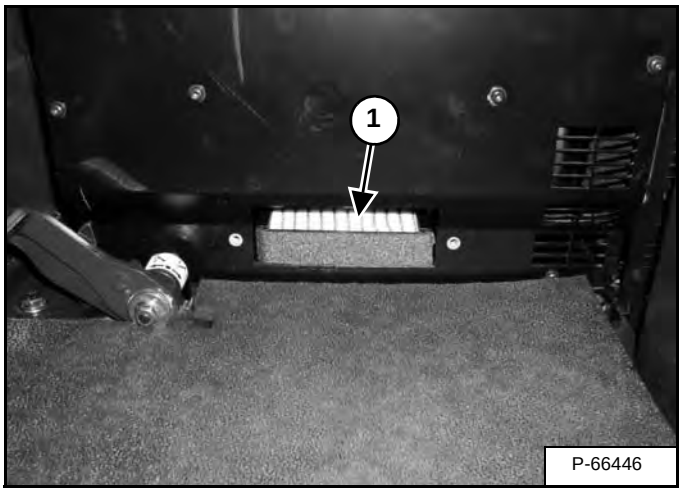
Figure 70-20-1



The cab filter is located on the lower side of the heater panel (Item 1) **[Figure 70-20-1]**.

Remove the two bolts (Item 2) **[Figure 70-20-1]** and remove the panel.

Figure 70-20-2

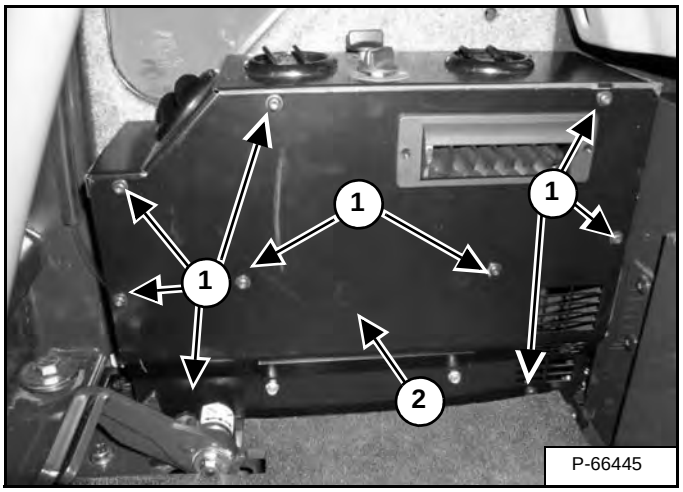


Remove the filter (Item 1) **[Figure 70-20-2]**. Shake the filter or use low air pressure to remove debris. Replace the filter after three cleanings or if the filter becomes to dirty to clean or damaged.

Reinstall the filter, cover and bolts.

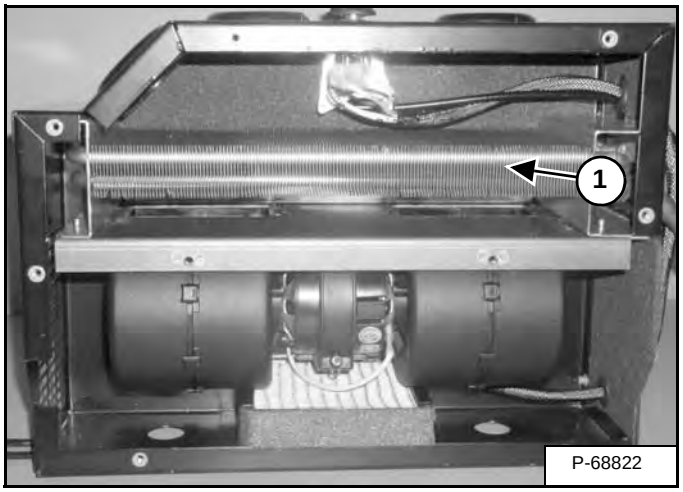
Heater Coil

Figure 70-20-3



Remove the nine bolts and washers (Item 1) and remove the panel (Item 2) **[Figure 70-20-3]**.

Figure 70-20-4



The heater coil (Item 1) **[Figure 70-20-4]** can now be cleaned with low pressure water or air. High pressure can damage the fins of the heater coil.

Dealer Copy -- Not for Resale



Dealer Copy -- Not for Resale

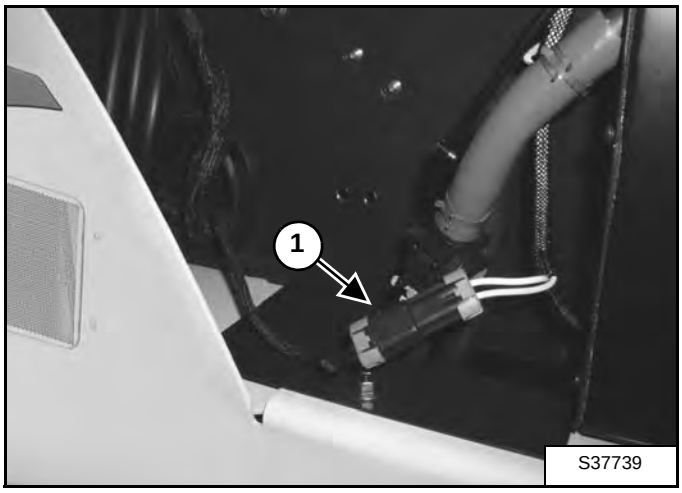
HEATER UNIT

Removal And Installation

Drain the engine coolant. (See Removing And Replacing Coolant on Page 10-100-2.)

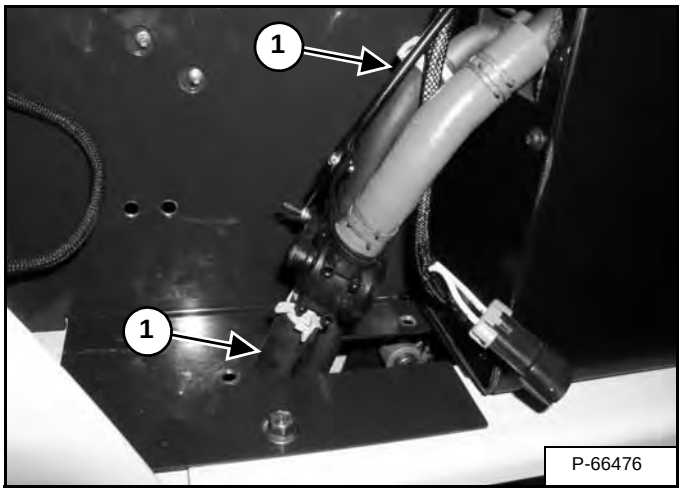
Remove the cab. (See Removal And Installation on Page 40-30-1.)

Figure 70-30-1



Disconnect the heater wire harness (Item 1) **[Figure 70-30-1]**.

Figure 70-30-2

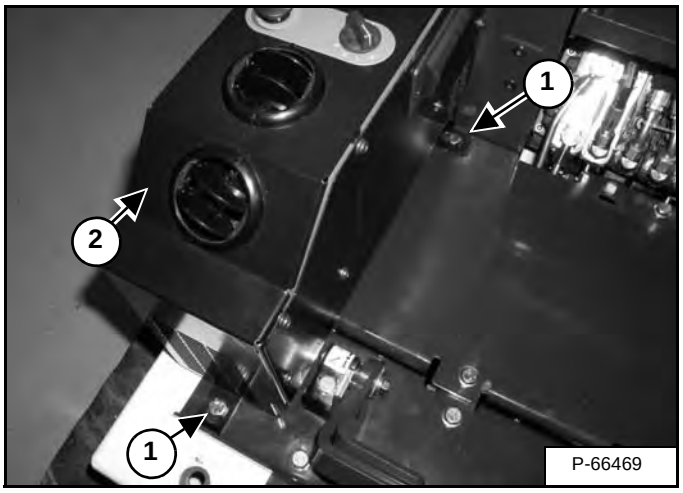


Mark the two hoses (Item 1) **[Figure 70-30-2]** for ease of assembly.

Disconnect and cap the two hoses (Item 1) **[Figure 70-30-2]**.

Cap the heater fittings once the hoses are removed.

Figure 70-30-3



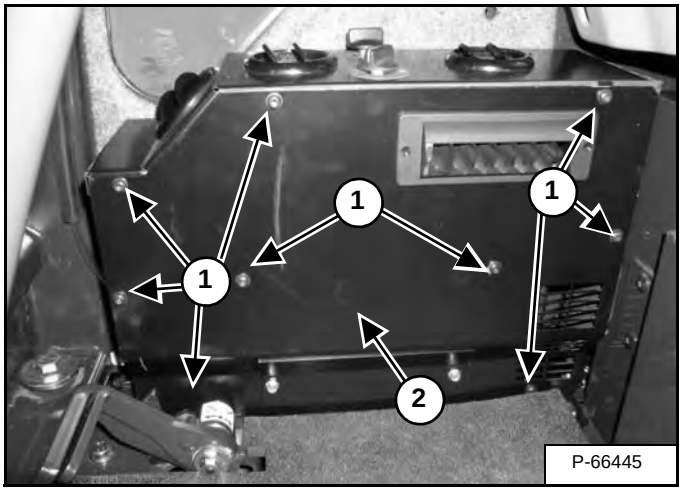
Remove the two screws (Item 1) **[Figure 70-30-3]** mounting the heater to the floor panels.

Remove heater assembly (Item 2) **[Figure 70-30-3]** from the excavator.

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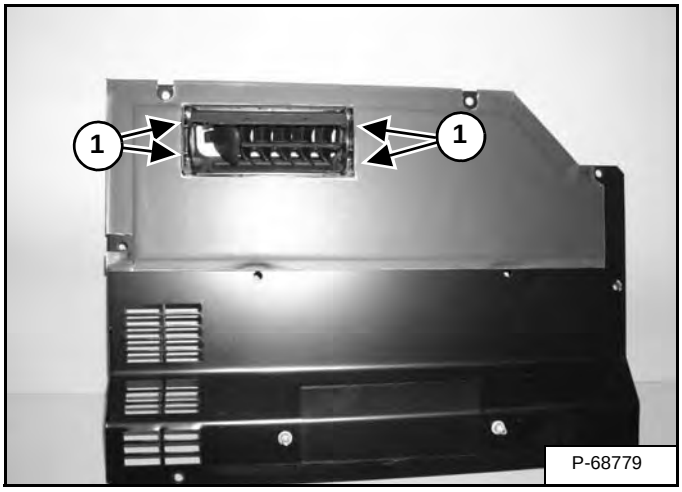
Louver Removal And Installation

Figure 70-30-4



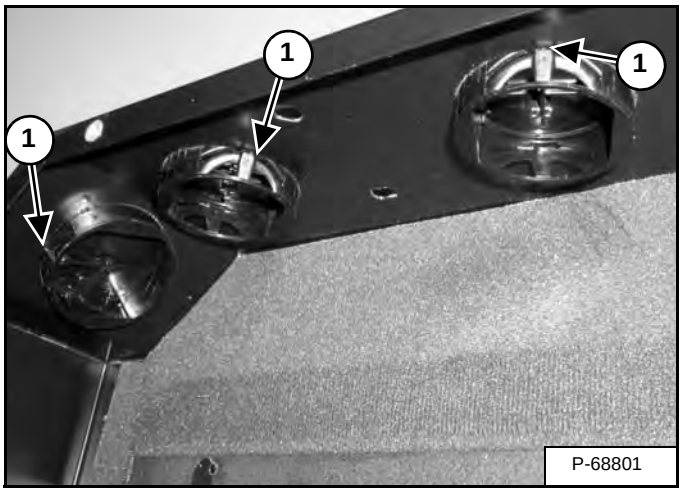
Remove the nine bolts and washers (Item 1) and remove the panel (Item 2) **[Figure 70-30-4]**.

Figure 70-30-5



Push in on the two clips (Item 1) **[Figure 70-30-5]** on each side of the louver and push the louver from the panel.

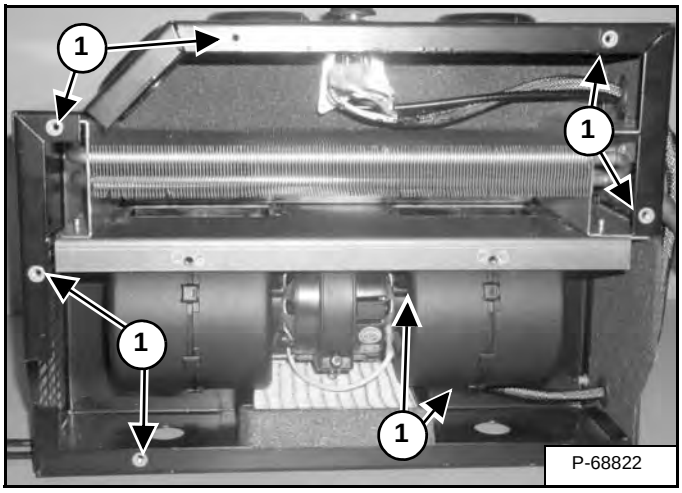
Figure 70-30-6



Push in on the two clips (Item 1) **[Figure 70-30-6]** on each side of each louver and push each louver from the heater box.

Threaded Insert Removal And Installation

Figure 70-30-7



If the threaded insert is damaged, remove and replace the threaded insert (Item 1) **[Figure 70-30-7]** from the heater box.

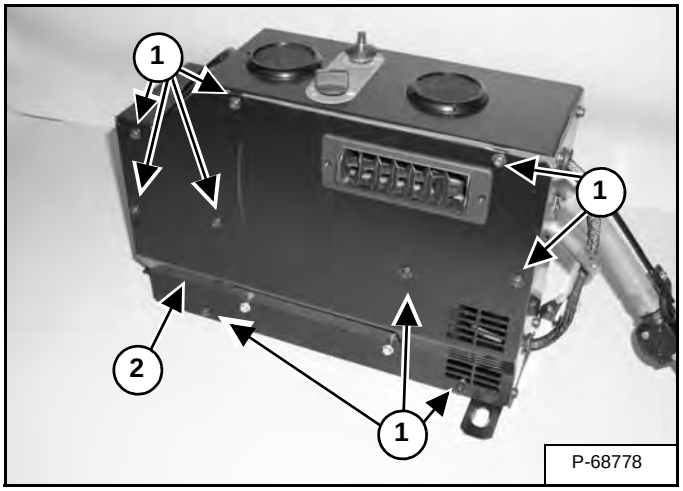
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HEATER COIL

Removal And Installation

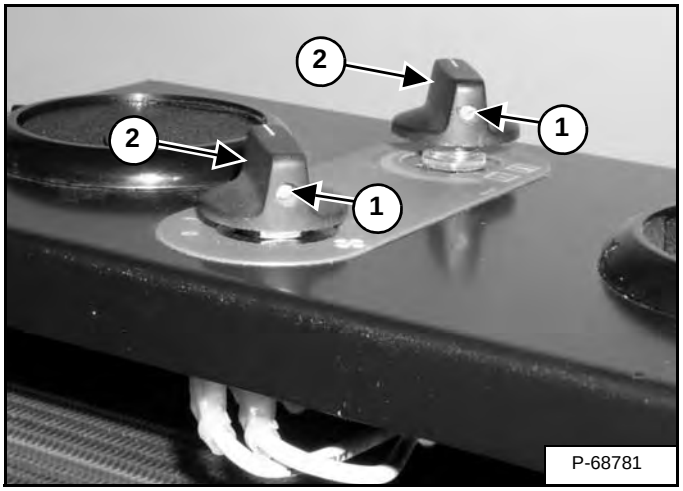
Remove the heater unit. (See Removal And Installation on Page 70-30-1.)

Figure 70-40-1



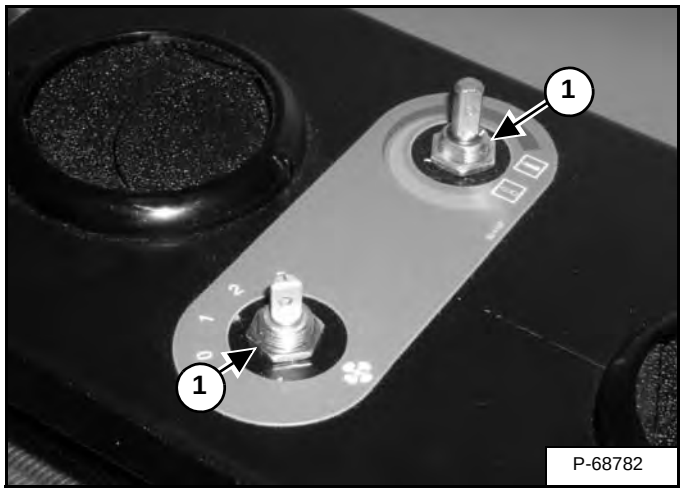
Remove the nine bolts and washers (Item 1) and remove the panel (Item 2) **[Figure 70-40-1]**.

Figure 70-40-2



Loosen the set screws (Item 1) and remove the knobs (Item 2) **[Figure 70-40-2]**.

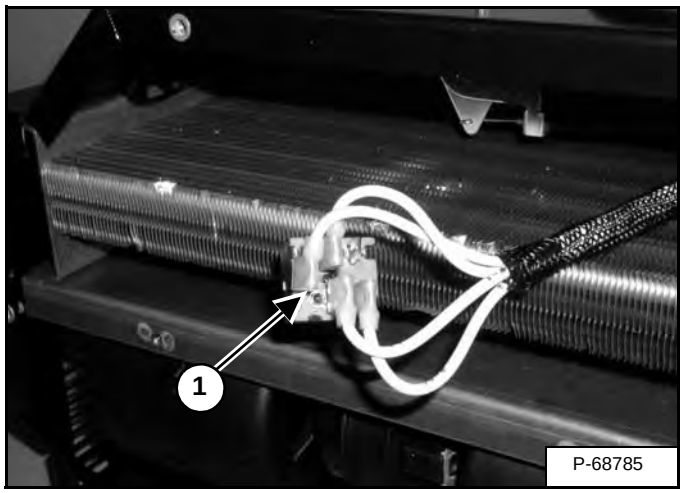
Figure 70-40-3



Remove the two nuts (Item 1) **[Figure 70-40-3]** from the switches.

Push the two switches down into the heater unit.

Figure 70-40-4



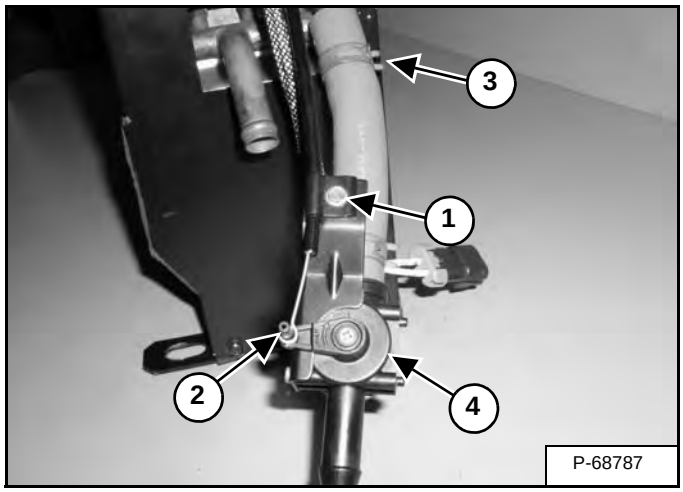
Mark and remove the wires (Item 1) **[Figure 70-40-4]** from the fan switch.

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HEATER COIL (CONT'D)

Removal And Installation (Cont'd)

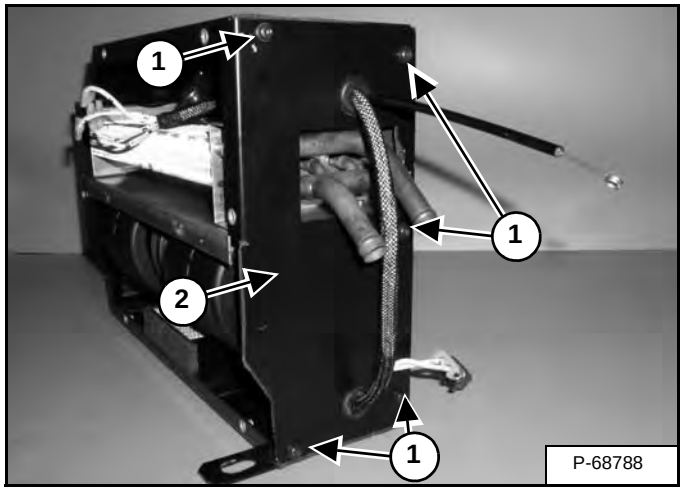
Figure 70-40-5



Loosen the screw (Item 1) on the cable clamp. Slip the cable off the heater valve pin (Item 2) **[Figure 70-40-5]**.

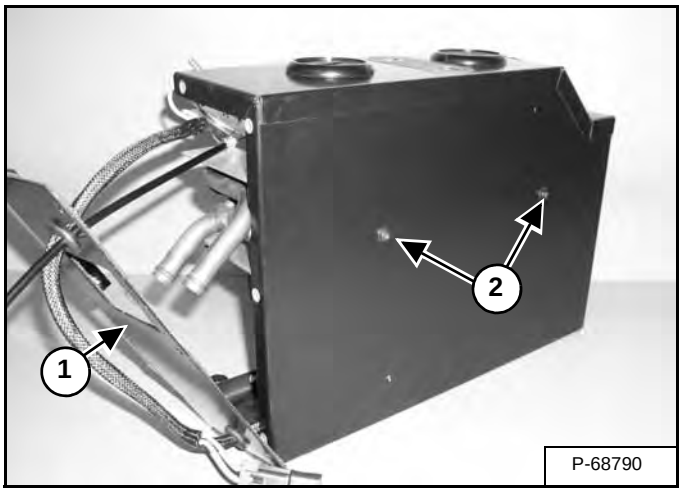
Remove the hose clamp (Item 3) and remove the heater valve assembly (Item 4) **[Figure 70-40-5]** from the heater coil.

Figure 70-40-6



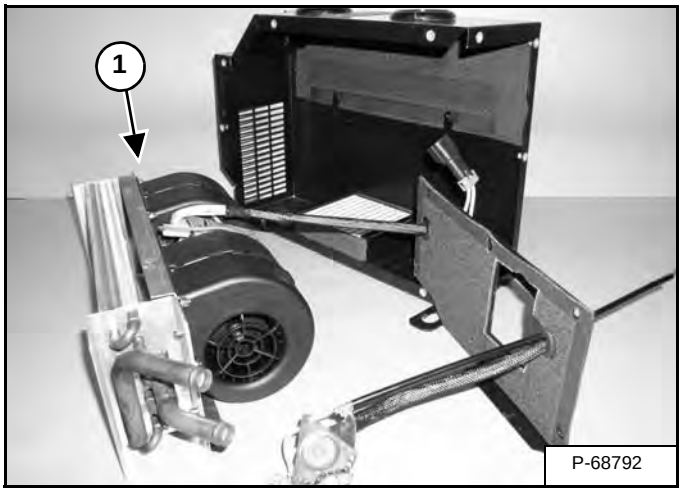
Remove the five bolts and washers (Item 1) and remove the panel (Item 2) **[Figure 70-40-6]**.

Figure 70-40-7



Tilt the panel (Item 1) back and remove the two screws (Item 2) **[Figure 70-40-7]** from the side panel.

Figure 70-40-8

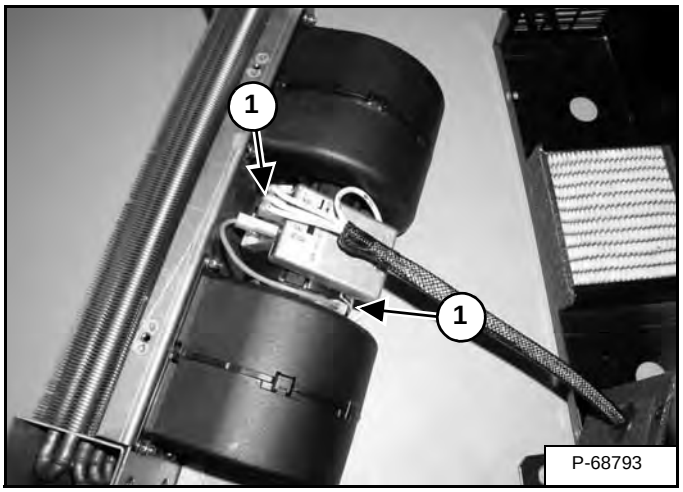


Remove the heater coil and heater fan assembly (Item 1) **[Figure 70-40-8]** from the heater unit.

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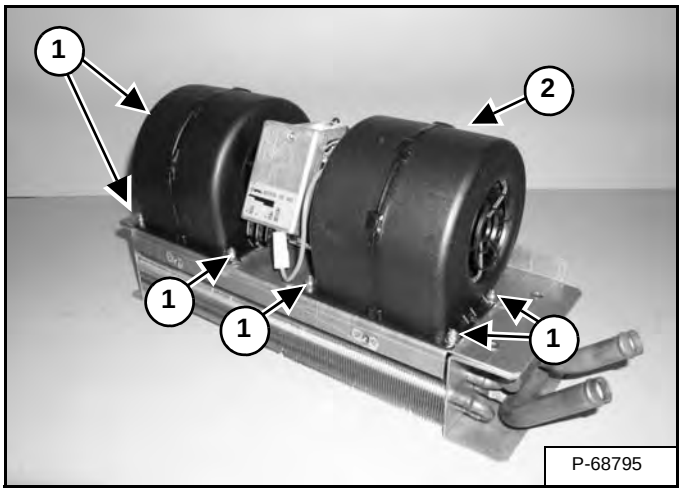
Removal And Installation (Cont'd)

Figure 70-40-9



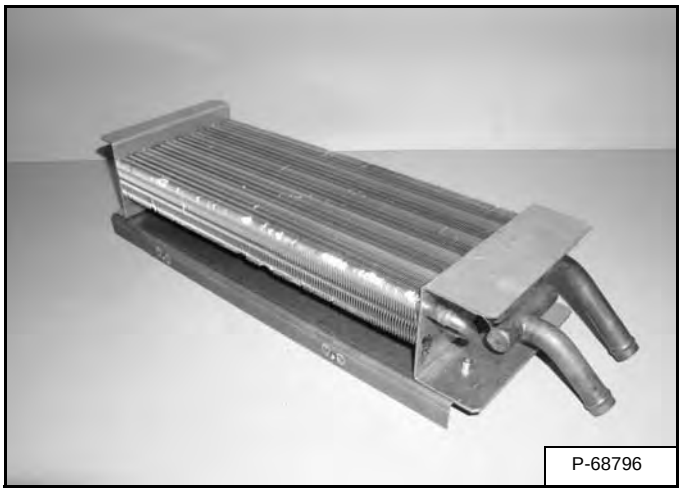
Mark and remove the four wires (Item 1) **[Figure 70-40-9]** from the heater fan motor.

Figure 70-40-10



Remove the six nuts and washers (Item 1) and remove the heater fan assembly (Item 2) **[Figure 70-40-10]**. Remove the heater fan assembly from the heater coil. Heater coil can be repaired or replaced.

Figure 70-40-11



The heater coil **[Figure 70-40-11]** can be cleaned with low air or water pressure.

If the heater coil needs replacement it must be replaced as a complete unit.

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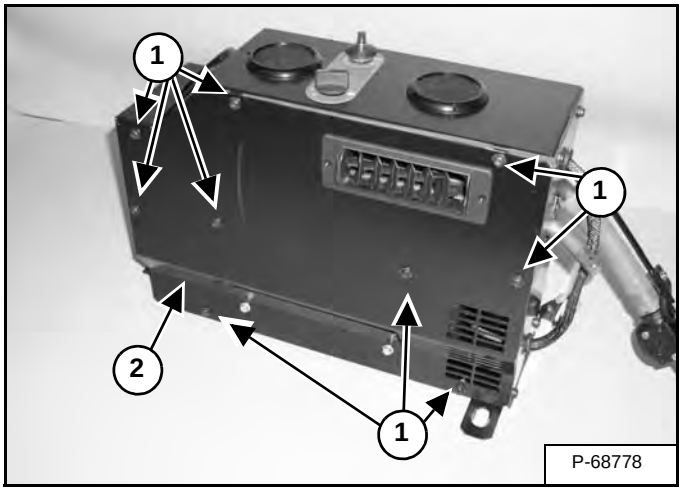
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HEATER FAN

Removal And Installation

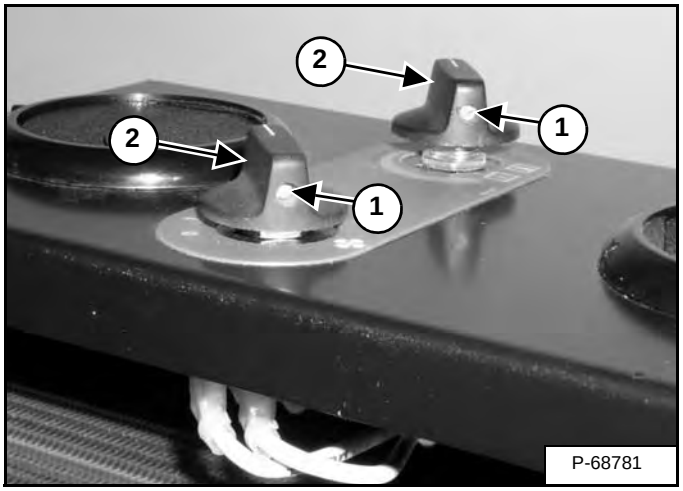
Remove the heater unit. (See Removal And Installation on Page 70-30-1.)

Figure 70-50-1



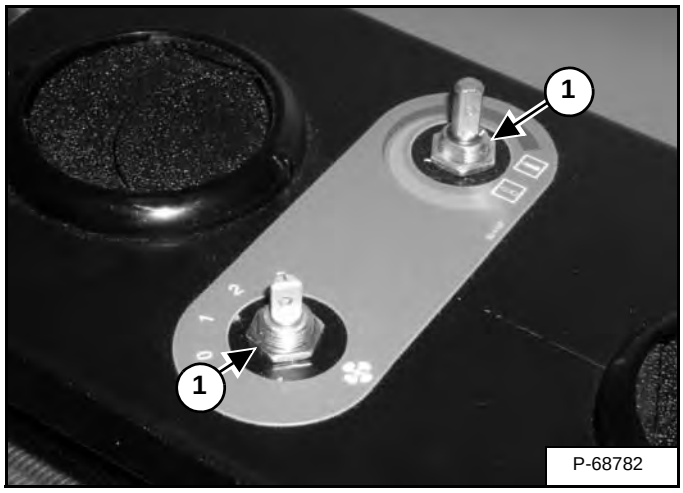
Remove the nine bolts and washers (Item 1) and remove the panel (Item 2) **[Figure 70-50-1]**.

Figure 70-50-2



Loosen the set screws (Item 1) and remove the knobs (Item 2) **[Figure 70-50-2]**.

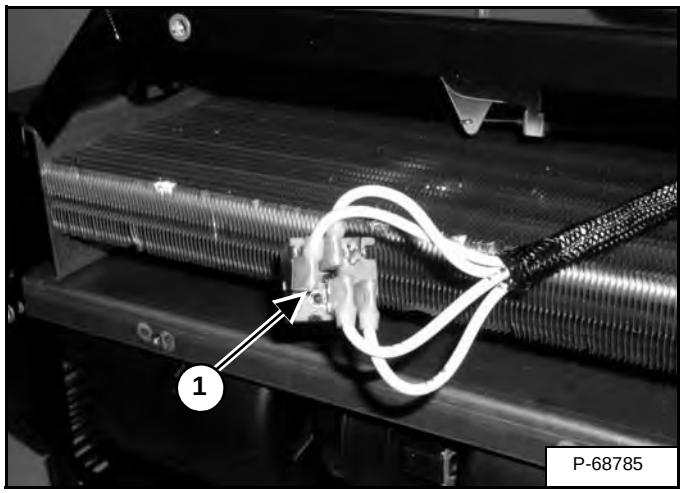
Figure 70-50-3



Remove the two nuts (Item 1) **[Figure 70-50-3]** from the switches.

Push the two switches down into the heater unit.

Figure 70-50-4

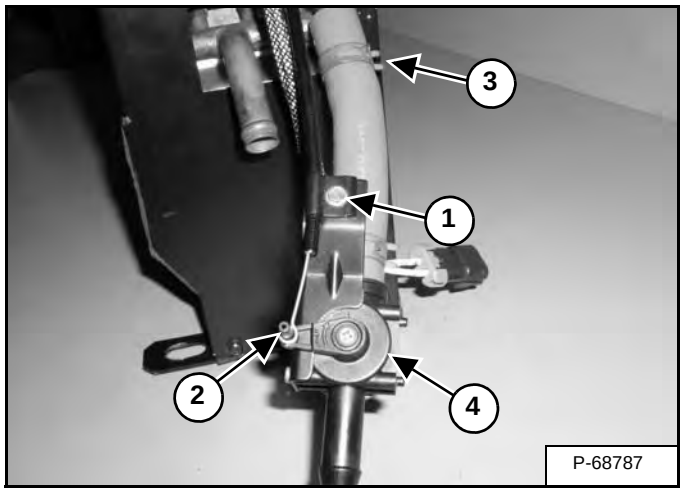


Mark and remove the wires (Item 1) **[Figure 70-50-4]** from the fan switch.

Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

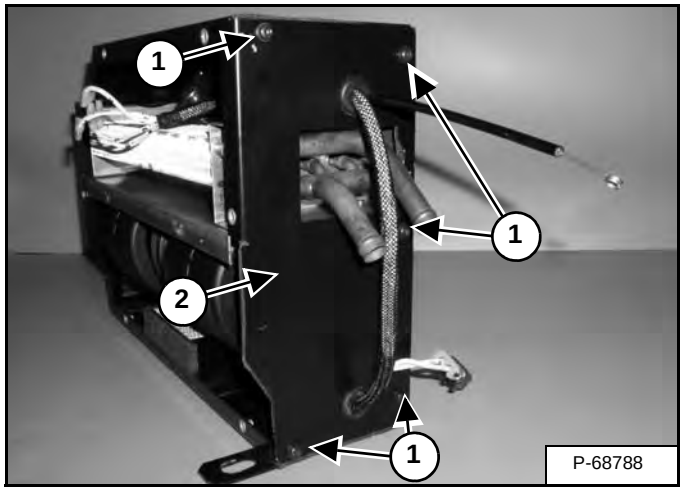
Figure 70-50-5



Loosen the screw (Item 1) on the cable clamp. Slip the cable off the heater valve pin (Item 2) **[Figure 70-50-5]**.

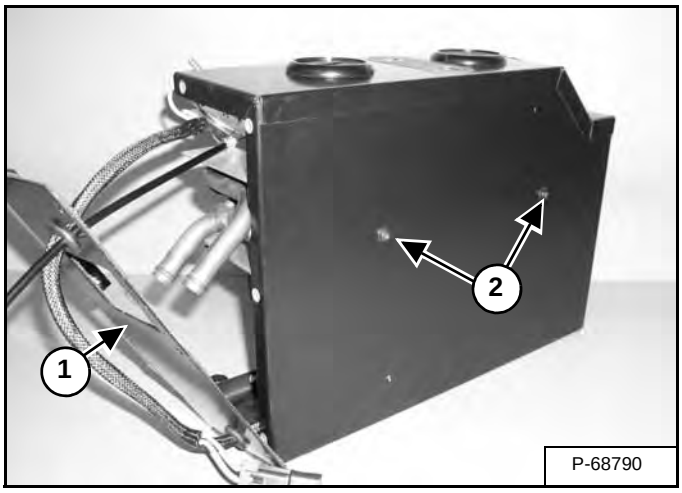
Remove the hose clamp (Item 3) and remove the heater valve assembly (Item 4) **[Figure 70-50-5]** from the heater coil.

Figure 70-50-6



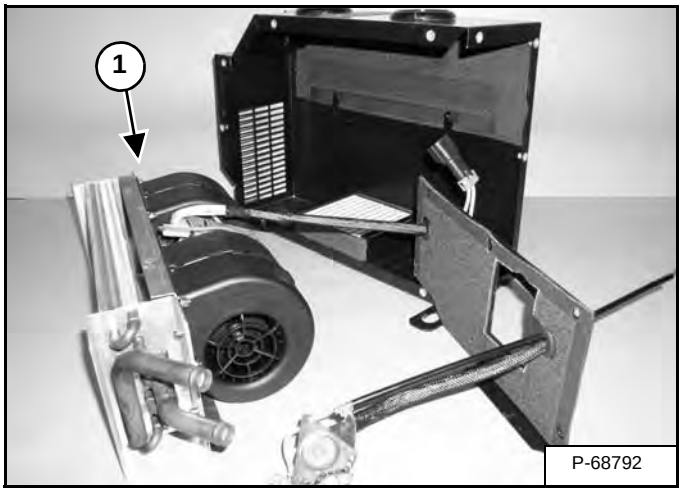
Remove the five bolts and washers (Item 1) and remove the panel (Item 2) **[Figure 70-50-6]**.

Figure 70-50-7



Tilt the panel (Item 1) back and remove the two screws (Item 2) **[Figure 70-50-7]** from the side panel.

Figure 70-50-8

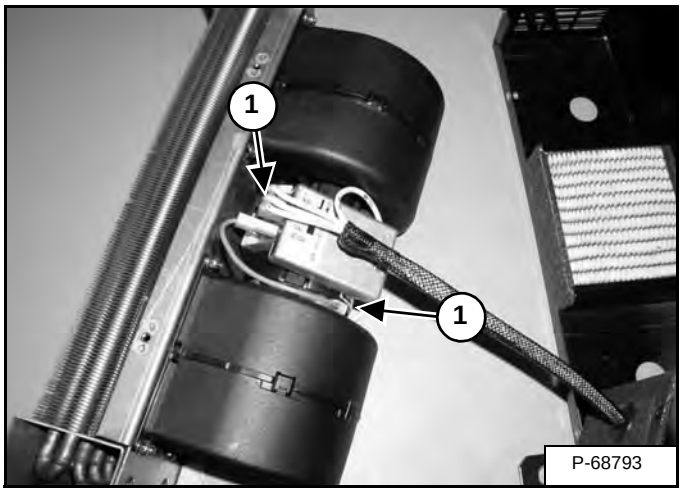


Remove the heater coil and heater fan assembly (Item 1) **[Figure 70-50-8]** from the heater unit.

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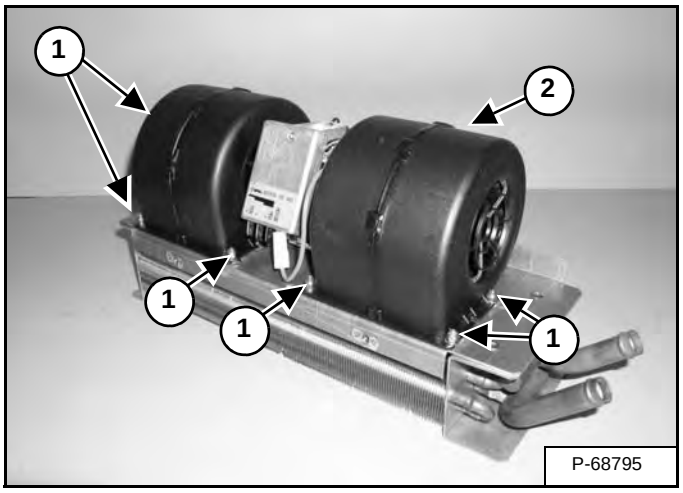
Removal And Installation (Cont'd)

Figure 70-50-9



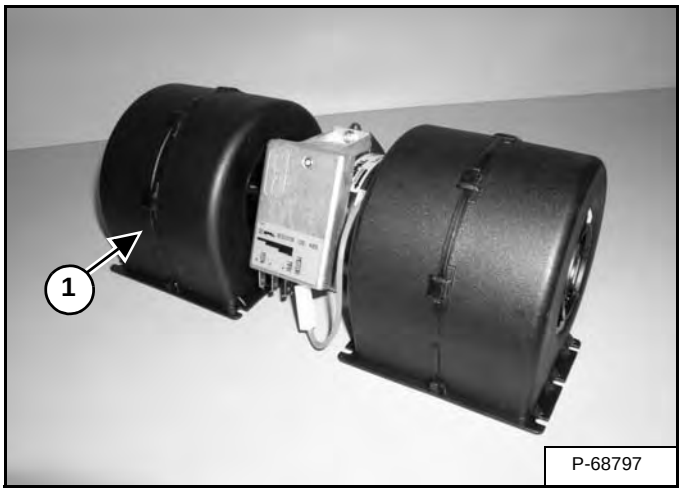
Mark and remove the four wires (Item 1) **[Figure 70-50-9]** from the heater fan motor.

Figure 70-50-10



Remove the six nuts and washers (Item 1) and remove the heater fan assembly (Item 2) **[Figure 70-50-10]**. Remove the heater fan assembly from the heater coil.

Figure 70-50-11



The heater fan assembly (Item 1) **[Figure 70-50-11]** is not repairable. Order complete assembly from Bobcat Parts.

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Dealer Copy -- Not for Resale

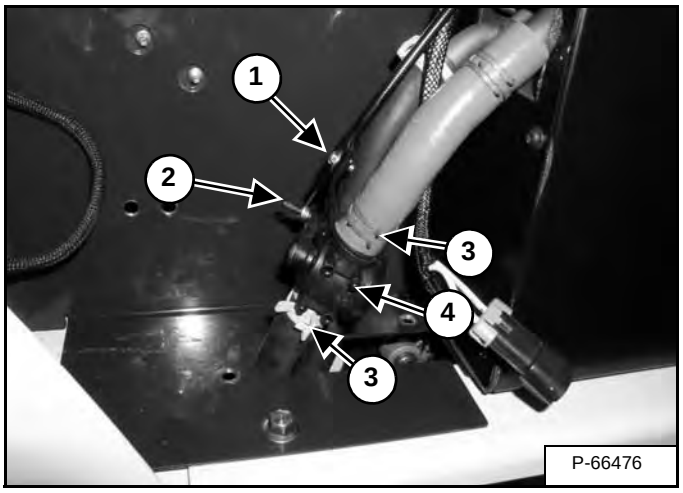
HEATER VALVE

Removal And Installation

Drain the engine coolant. (See Removing And Replacing Coolant on Page 10-100-2.)

Remove the cab. (See Removal And Installation on Page 40-30-1.)

Figure 70-60-1



Loosen the screw and cable clamp (Item 1) **[Figure 70-60-1]**.

Slide the cable off the heater valve pin (Item 2) **[Figure 70-60-1]**.

Disconnect and cap the two hoses (Item 3) from the heater valve (Item 4) **[Figure 70-60-1]**.

Remove the heater valve.

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SPECIFICATIONS

(E16) SPECIFICATIONS SPEC-10-1
Machine Dimensions SPEC-10-1
Machine Dimensions - Standard Arm SPEC-10-2
Machine Dimensions - Long Arm SPEC-10-3
Lift Capacity (Standard Arm) SPEC-10-4
Lift Capacity (Long Arm) SPEC-10-5
Performance SPEC-10-6
Controls SPEC-10-6
Engine SPEC-10-7
Hydraulic System SPEC-10-7
Hydraulic Cylinders SPEC-10-8
Hydraulic Cycle Times SPEC-10-8
Electrical SPEC-10-8
Drive System SPEC-10-8
Slew System SPEC-10-8
Undercarriage SPEC-10-9
Tracks SPEC-10-9
Ground Pressure SPEC-10-9
Capacities SPEC-10-9
Fuel Consumption SPEC-10-9

TECHNICAL SERVICE GUIDE SPECIFICATIONS SPEC-20-1
Engine SPEC-20-1
Engine Torques SPEC-20-1
Cooling System SPEC-20-1
Excavator Torques SPEC-20-1

TORQUE SPECIFICATIONS FOR BOLTS SPEC-30-1
Torque For General SAE Bolts SPEC-30-1
Torque For General Metric Bolts SPEC-30-2

HYDRAULIC CONNECTION SPECIFICATIONS SPEC-40-1
O-ring Face Seal Connection SPEC-40-1
Straight Thread O-ring Fitting SPEC-40-2
Tubelines And Hoses SPEC-40-2
Flare Fitting SPEC-40-3
Port Seal Fittings SPEC-40-4

HYDRAULIC FLUID SPECIFICATIONS SPEC-50-1
Specifications SPEC-50-1

CONVERSIONS SPEC-60-1
Decimal And Millimeter Equivalents SPEC-60-1
U.S. To Metric Conversion Chart SPEC-60-1

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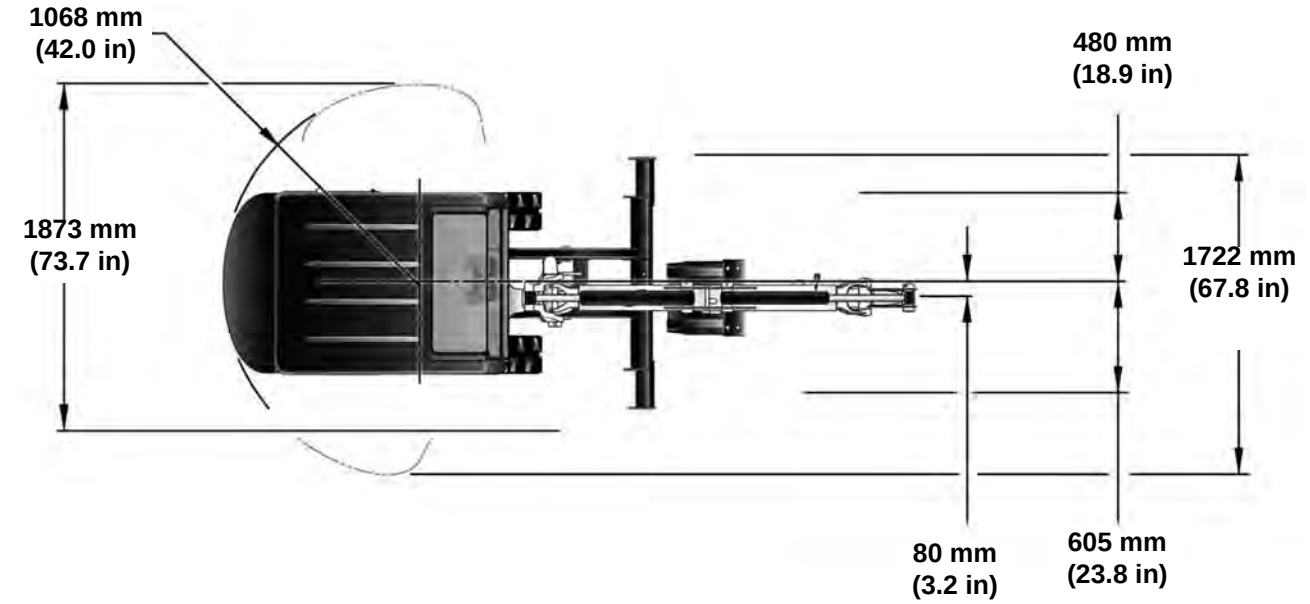
SERVICE TOOLS REQUIRED SPEC-70-1
Remote Start Tools SPEC-70-1
Hydraulic Tools SPEC-70-2
Engine Tools SPEC-70-4
HVAC Tools SPEC-70-6

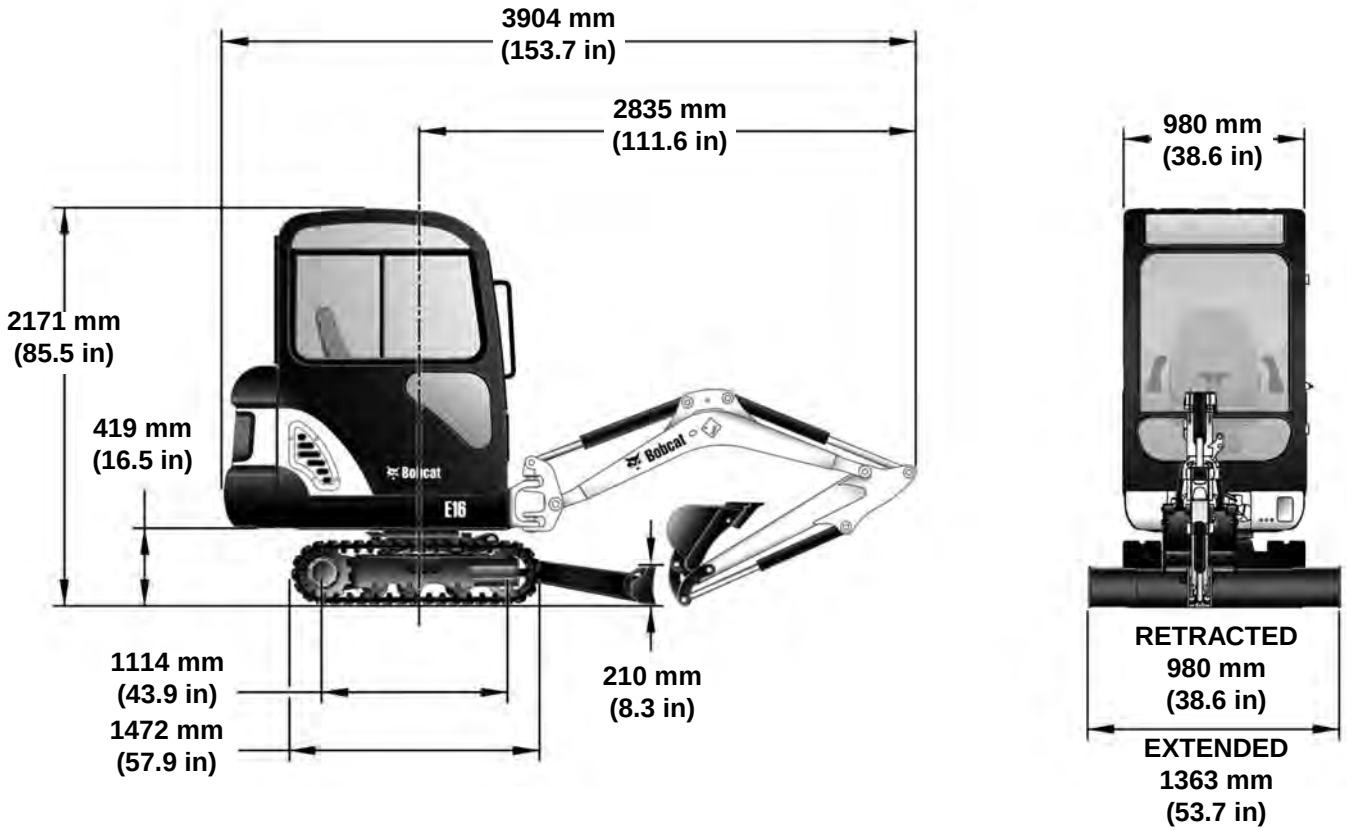
Dealer Copy -- Not for Resale

(E16) SPECIFICATIONS

Machine Dimensions

- All dimensions are shown in metric. Respective imperial dimensions are given in inches enclosed by parentheses.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.





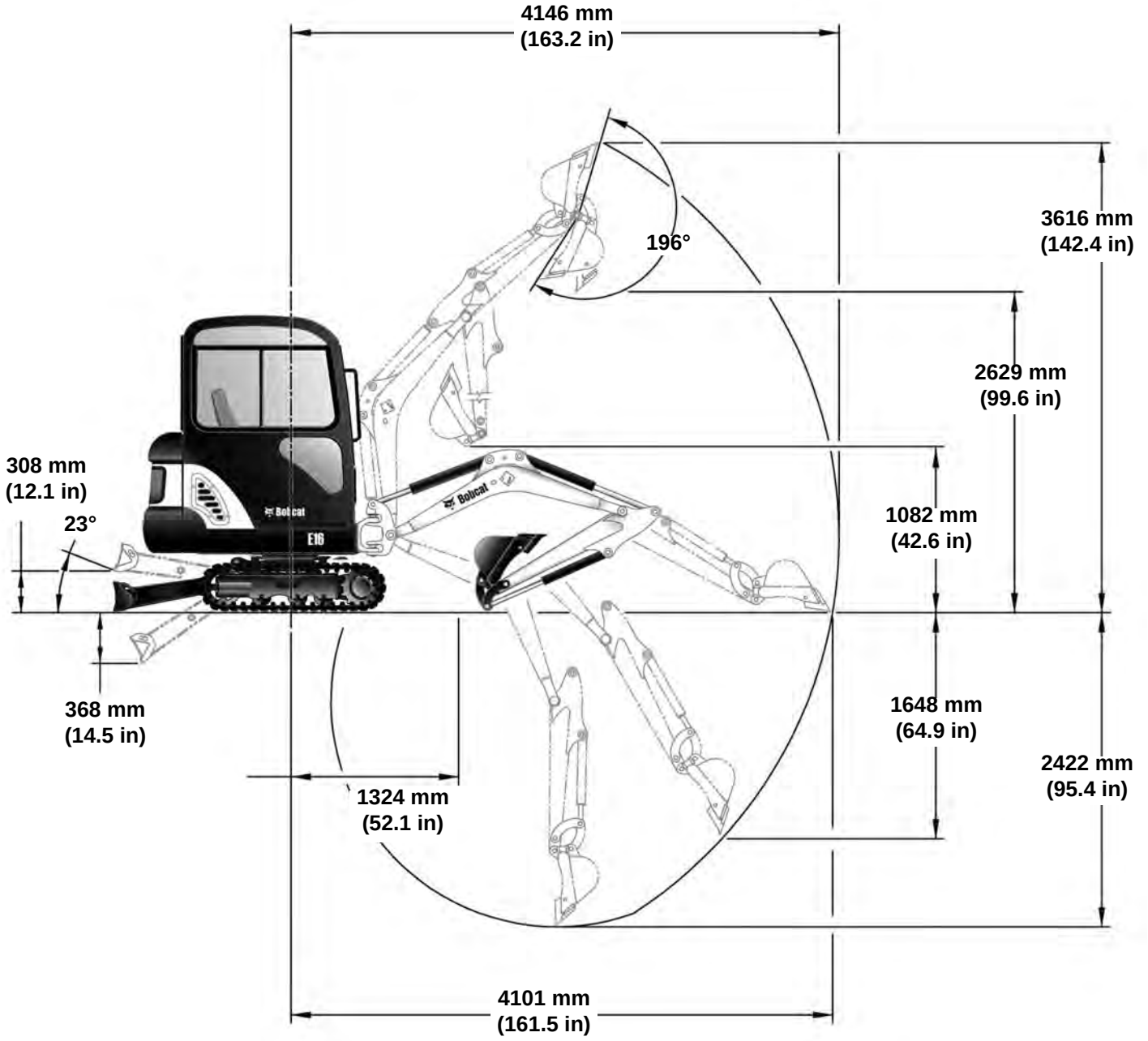
NA5812

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(E16) SPECIFICATIONS (CONT'D)

Machine Dimensions - Standard Arm

- All dimensions are shown in metric. Respective imperial dimensions are given in inches enclosed by parentheses.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.

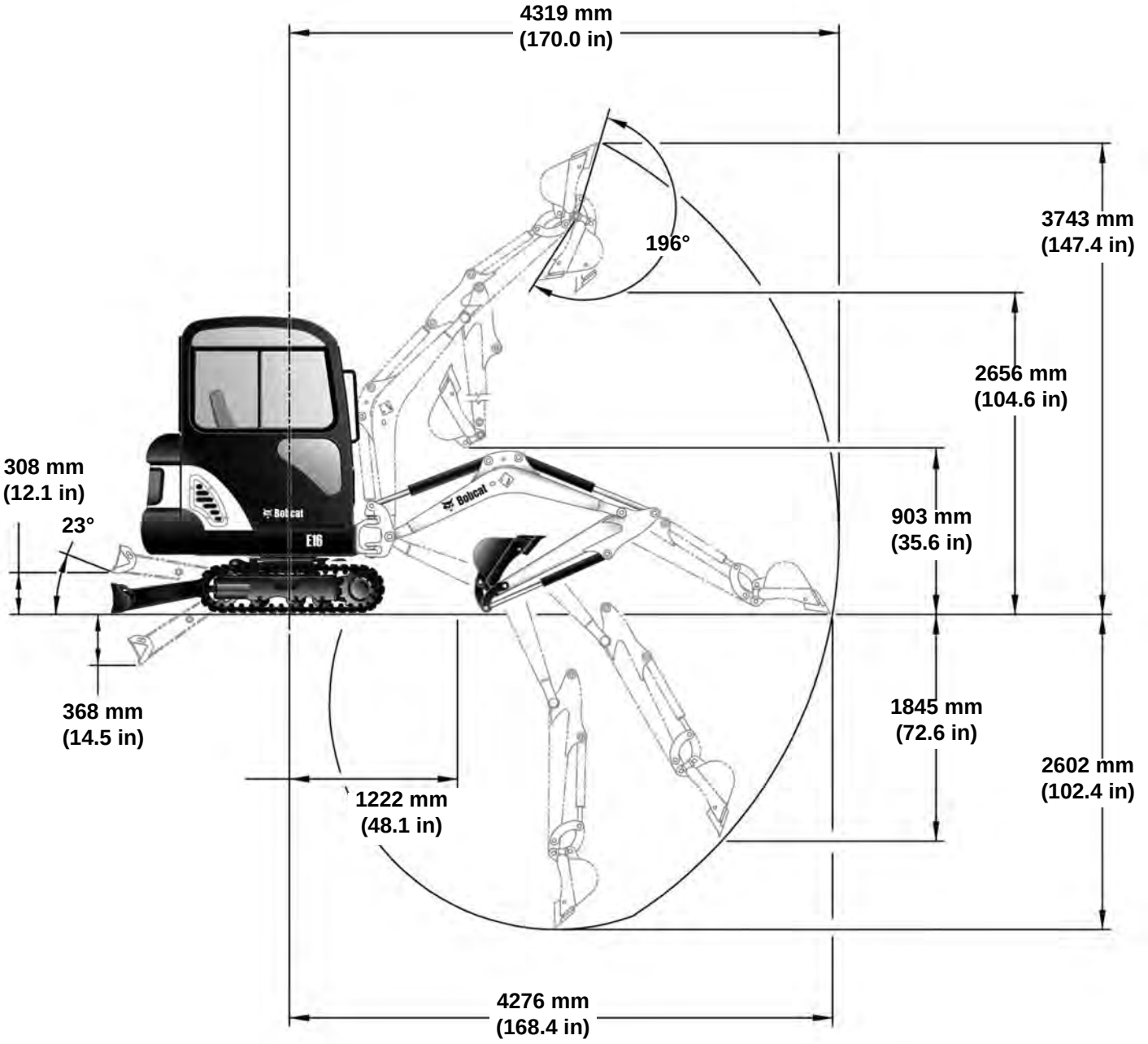


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Machine Dimensions - Long Arm

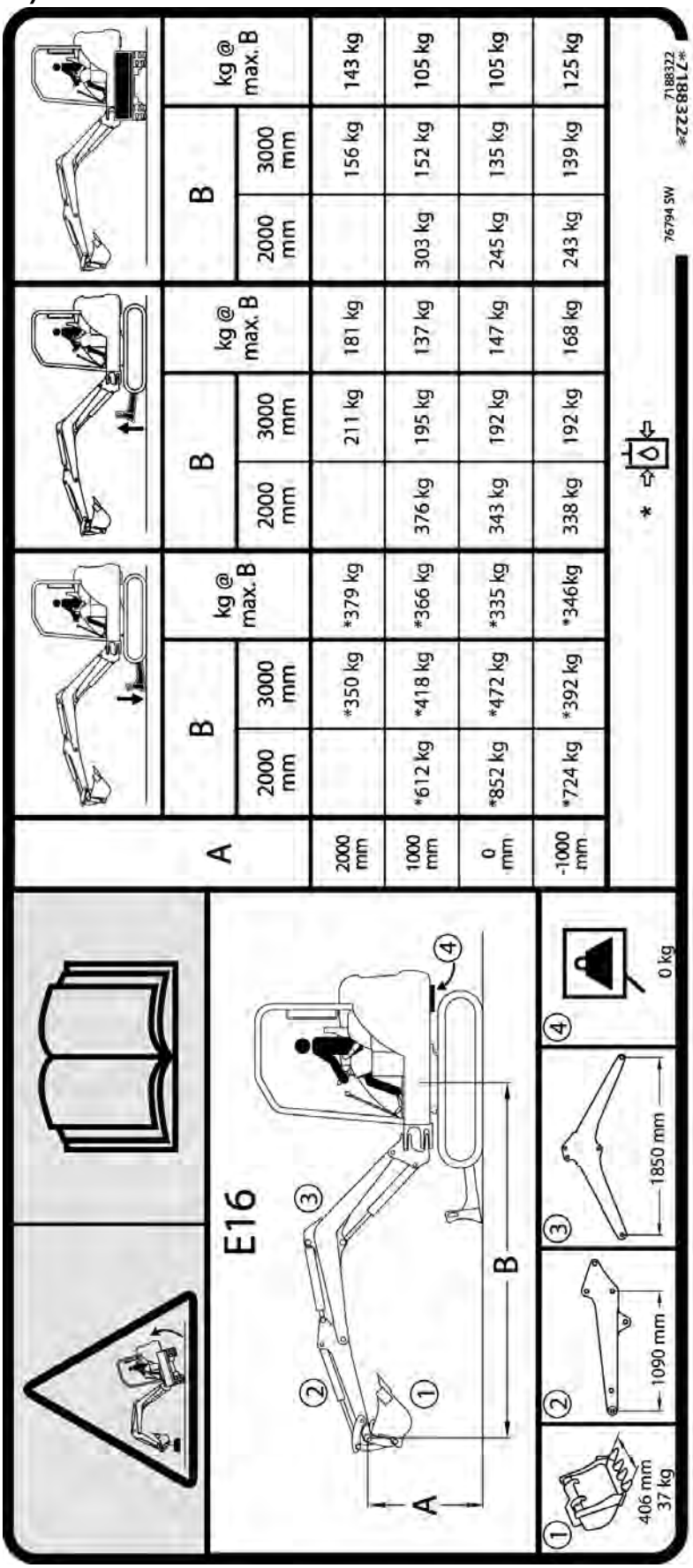
- All dimensions are shown in metric. Respective imperial dimensions are given in inches enclosed by parentheses.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



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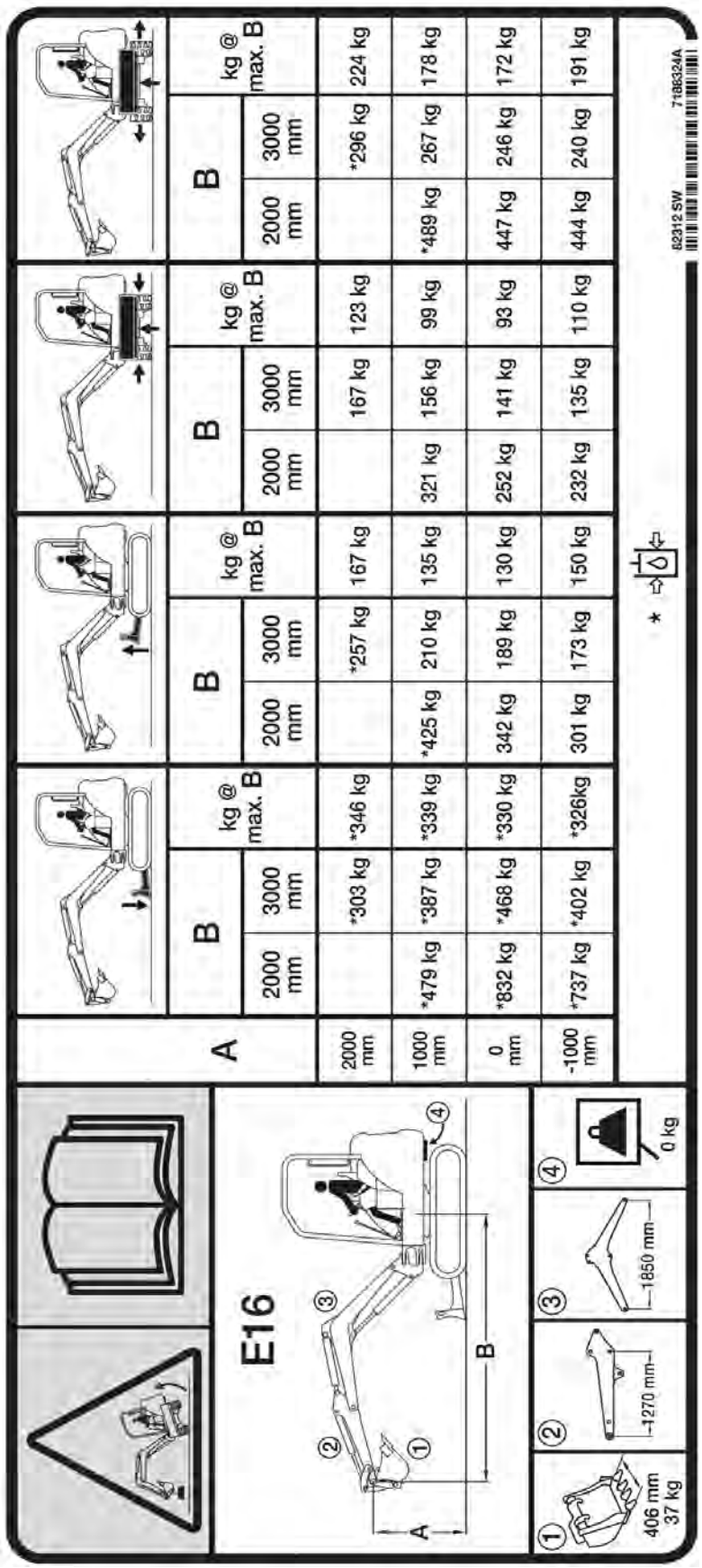
Lift Capacity (Standard Arm)



A	B		kg @ max. B		B		kg @ max. B		B		kg @ max. B
	2000 mm	3000 mm			2000 mm	3000 mm			2000 mm	3000 mm	
2000 mm		*350 kg	*379 kg			211 kg	181 kg			156 kg	143 kg
1000 mm	*612 kg	*418 kg	*366 kg		376 kg	195 kg	137 kg		303 kg	152 kg	105 kg
0 mm	*852 kg	*472 kg	*335 kg		343 kg	192 kg	147 kg		245 kg	135 kg	105 kg
-1000 mm	*724 kg	*392 kg	*346kg		338 kg	192 kg	168 kg		243 kg	139 kg	125 kg

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Lift Capacity (Long Arm)



A	B											
	2000 mm	3000 mm	kg @ max. B	2000 mm	3000 mm	kg @ max. B	2000 mm	3000 mm	kg @ max. B	2000 mm	3000 mm	kg @ max. B
2000 mm		*303 kg	*346 kg		*257 kg	167 kg		167 kg	123 kg		*296 kg	224 kg
1000 mm	*479 kg	*387 kg	*339 kg	*425 kg	210 kg	135 kg	321 kg	156 kg	99 kg	*489 kg	267 kg	178 kg
0 mm	*832 kg	*468 kg	*330 kg	342 kg	189 kg	130 kg	252 kg	141 kg	93 kg	447 kg	246 kg	172 kg
-1000 mm	*737 kg	*402 kg	*326kg	301 kg	173 kg	150 kg	232 kg	135 kg	110 kg	444 kg	240 kg	191 kg

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Performance

Operating weight (canopy w/ rubber tracks, and 406 mm (16 in) bucket)	1580 kg (3483 lb)
If equipped with the following, add:	Steel tracks, add: 53 kg (117 lb); Cab w/ Heater, add: 129 kg (284 lb); Long Arm, add: 5 kg (11 lb); Expandable Undercarriage, add: 35 kg (77 lb)
Travel Speed (Low / High)	2.48 km/h / 4.0 km/h (1.54 mph / 2.48 mph)
Drawbar Pull (theoretical at 90% efficiency)	20029 N (4503 lbf)
Digging Force (per ISO 6015)	
With Standard Arm	Arm - 9966 N (2240 lbf) Bucket 19447 N (4372 lbf)
With Long Arm	Arm - 8934 N (2008 lbf) Bucket 19447 N (4372 lbf)

Controls

Steering	Two hand levers (optional foot pedals)
Hydraulics	Two hand operated levers (joysticks) control boom, bucket, arm and upperstructure slew
Blade	Hand lever
Two Speed (If Equipped)	Switch on blade lever
Boom Swing	Right foot pedal
Auxiliary Hydraulics	Left foot pedal
Auxiliary Pressure Release	Left foot pedal
Engine	Hand lever on right-hand side, key type start switch
Starting Aid	Glow Plugs - activated by key switch
Brakes Travel Service & Parking Swing Service Holding	 Hydraulic lock in motor circuit Hydraulic lock in motor circuit Pin lock

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Engine

Make / Model	Kubota D722-E2B-BC-5-SI
Fuel / Cooling	Diesel / Liquid
Horsepower @ 2500 RPM (ISO 9249)	9,9 kW Kw (13.3 hp)
Torque @ 2000 RPM (SAE Net)	42,2 N•m (31.1 ft-lb)
Number Of Cylinders	3
Displacement	0,72 L (43.9 ci)
Bore / Stroke	67 x 68 mm (2.64 x 2.68 in)
Lubrication	Pressure System with Filter
Crankcase Ventilation	Closed Breathing
Air Cleaner	Dry replaceable paper dual cartridge
Ignition	Diesel-Compression
Low Idle Speed	1125 rpm - 1225 rpm
High Idle Speed	2635 - 2665 rpm
Engine Coolant	Propylene Glycol / water mixture (53% PG / 47% water)

Hydraulic System

Pump Type	Engine drive dual piston pump with gear pump
Pump Capacity Piston Pump (2) Gear Pump - Pilot	 15,0 L/min (3.96 U.S. gpm) 11,25L/min (2.90 U.S. gpm)
Auxiliary Flow	30,0 L/min (7.9 U.S. gpm)
Hydraulic Filter	Full flow replaceable
Control Valve	9 spool closed center individually compensated
System Relief Pressure: (Boom, Arm, Auxiliary) (Blade) Slew Circuit Joystick Control Pressure	 23100 kPa (231 bar) (3350 psi) 20680 kPa (207 bar) (3000 psi) 17400 kPa (174 bar) (2524 psi) 3000 kPa (30 bar) (435 psi)
Auxiliary Relief	20680 kPa (207 bar) (3000 psi)
Arm Port Relief Base And Rod End	24994 kPa (250 bar) (3625 psi)
Boom Port Relief: Base End Boom Port Relief: Rod End	20995 kPa (210 bar) (3045 psi) 24994 kPa (250 bar) (3625 psi)
Bucket Port Relief Base End And Rod End	 24994 kPa (250 bar) (3625 psi)
Blade Port Relief Base End	29000 kPa (290 bar) (4205psi)
Hydraulic Filter Bypass	172 kPa (1,7 bar) (25 psi)

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Hydraulic Cylinders

Cylinder	Bore	Rod	Stroke
Boom (cushion up)	69,9 mm (2.75 in)	41,3 mm (1.625 in)	445 mm (17.52 in)
Arm	60,3 mm (2.38 in)	38,1 mm (1.50 in)	425 mm (16.73 in)
Bucket	57,2 mm (2.25 in)	38,1 mm (1.50 in)	385 mm (15.16 in)
Boom Swing (cushion left and right)	69,9 mm (2.75 in)	31,8 mm (1.25 in)	459,9 mm (16.19 in)
Blade	63,5 mm (2.50 in)	34,9 mm (1.38 in)	108 mm (4.25 in)
Undercarriage	44,5 mm (1.75 in)	25,4 mm (1.00 in)	385 mm (15.16 in)

Hydraulic Cycle Times

Bucket Curl	1.2 Seconds
Bucket Dump	2.0 Seconds
Arm Retract	2.4 Seconds
Arm Extend	2.0 Seconds
Boom Raise	4.4 Seconds
Boom Lower	3.8 Seconds
Boom Swing Left	2.7 Seconds
Boom Swing Right	3.1 Seconds
Blade Raise	2.6 Seconds
Blade Lower	2.6 Seconds
Undercarriage Expand	4.1 Seconds
Undercarriage Retract	3.5 Seconds

Electrical

Starting Aid	Intake air heater
Alternator	12 volt, 40 Amp open frame w/ internal regulator
Battery	12 volts - 530 CCA @ -18°C (0°F)
Starter	12 volts; gear reduction 1.4 kw (1.9 hp)
Instrumentation	Fuel gauge, audible alarm, visual warning for engine functions and hourmeter
Lights	37.5 watt (2)

Drive System

Final Drive	Each track is driven by hydrostatic axial piston motor
Type of Reduction	30.3:1 two stage planetary

Slew System

Slew Motor	Axial piston
Slew Circle	Single row shear type ball bearing with internal gear
Slew Speed	8.1 rpm

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Undercarriage

Crawler Track Design	Sealed track rollers with boxed section track roller frame, grease type track adjuster with shock absorbing recoil spring
Width of crawler	980 mm (38.6 in)

Tracks

Type	Rubber	Steel
Width	230 mm (9.0 in)	230 mm (9.0 in)
Number Of Shoes	Single Assembly	34
Number of Track Rollers (per side)	3	3

Ground Pressure

Rubber Tracks	28,6 kPa (0,286 bar) (4.15 psi)
Steel Tracks	29,5 kPa (0,295 bar) (4.28 psi)

Capacities

Fuel Tank	23,7 L (6.3 U.S. gal)
Hydraulic Reservoir Only (Centre of Sight Glass)	Tank Cap. 11,2 L (3 U.S. gal)
Hydraulic System (with Reservoir)	21,5 L (5.7 U.S. gal)
Cooling System	5.7 L (1.5 U.S. gal)
Engine Oil and Filter	3,5 L (3.75 qt)
Final Drive (each)	0,5 L (0.55 qt)

Fuel Consumption

Fuel Consumption	4,7 L/hr (1.24 gph)
NOTE: The engine fuel consumption chart is to be used as a guideline only. The actual results may vary. Estimated fuel consumption is based on testing by Bobcat Company in high duty cycle digging applications.	

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TECHNICAL SERVICE GUIDE SPECIFICATIONS

Engine

Engine Oil Pressure at Low Idle	50 kPa (0,50 bar) (7 psi)
Engine Oil Pressure at High Idle	197 - 441 kPa (1,97 - 4,41 bar) (43 - 64 psi)
Firing Order	1-2-3-4
Location of Number 1 Cylinder	Closest to water pump
Injection Timing	6.2° - 8.2° BTDC
Crankshaft Rotation (Facing Crankshaft Pulley)	Clockwise
Valve Clearance (Cold) Intake	0,145 - 0,185 mm (0.00571 - 0.00728 in)
Valve Clearance (Cold) Exhaust	0,145 - 0,185 mm (0.00571 - 0.00728 in)

NOTE: For additional engine specifications, (SeeSpecifications on Page 60-10-2.)

Engine Torques

Engine Oil Drain Cap	33 - 37 N•m (24 - 27 ft-lb)
Fuel Injection Tubeline Nuts	25 - 34 N•m (18 - 25 ft-lb)
Glow Plugs	8 - 15 N•m (6 - 11 ft-lb)
Injection Pump Mounting Bolts/Nuts	22 - 27 N•m (16 - 20 ft-lb)
Valve Cover Bolts	10 - 11 N•m (7 - 8 ft-lb)
Head Bolts	93,2 - 98,0 N•m (68.8 - 72.3 ft-lb)

NOTE: For additional engine torques, (SeeTorque Values on Page 60-10-6.)

Cooling System

Coolant Type and Mix	50% Water and 50% Propylene Glycol
Radiator Cap Pressure	97 kPa (1 bar) (14 psi)
Thermostat	Fully Open at 85°C (185°F)

NOTE: For additional engine cooling, (SeeENGINE COOLING SYSTEM on Page 60-40-1.)

Excavator Torques

Drive Motor To Frame Bolt	140 - 50 N•m (29 - 37 ft-lb)
Sprocket To Drive Motor	65 - 70 N•m (48 - 55 ft-lb)
Swing Bearing To Frame Bolt	105 - 115 N•m (78 - 85 ft-lb)
Swing Bearing To Upperstructure Bolt	57 - 63 N•m (42 - 47 ft-lb)
Swing Motor Drive Carrier	105 - 115 N•m (78 - 85 ft-lb)

NOTE: Additional excavator torques can be found in the relevant section of this manual.

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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 (in-lb)	0.250	9 - 10 (80 - 90)	13 - 14 (110 - 120)
	0.3125	21 - 23 (180 - 200)	24-27 (215-240)
N•m (ft-lb)	0.375	34 - 38 (25 - 28)	48 - 54 (35 - 40)
	0.4375	54 - 61 (40 - 45)	82 - 88 (60 - 65)
	0.500	88 - 95 (65 - 70)	125 - 135 (90 - 100)
	0.5625	125 - 135 (90 - 100)	170 - 190 (125 - 140)
	0.625	170 - 190 (125 - 140)	240 - 190 (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)	7450 - 8300 (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.)	MATERIAL		
	8.8	10.9	12.9
M4	2,5 - 3,5 N•m (2.0 - 2.5 ft-lb)	3,8 - 4,2 N•m (2.8 - 3.1 ft-lb)	4,7 - 5,3 N•m (3.5 - 3.9 ft-lb)
M5	5,5 - 6,5 N•m (4.0 - 5.0 ft-lb)	8,4 - 7,6 N•m (5.6 - 6.2 ft-lb)	8,5 - 9,5 N•m (6.2 - 7.0 ft-lb)
M6	9,5 - 10,5 N•m (7.0 - 7.5 ft-lb)	12,2 - 13,7 N•m (9.1 - 10.1 ft-lb)	14,2 - 15,8 N•m (10.4 - 11.6 ft-lb)
M7	15 - 17 N•m (11.0 - 12.5 ft-lb)	20 - 22 N•m (16.2 - 14.7 ft-lb)	23,7 - 26,3 N•m (17.5 - 19.5 ft-lb)
M8	24 - 26 N•m (18 - 19 ft-lb)	29,4 - 32,6 N•m (21.7 - 24.0 ft-lb)	35 - 39 N•m (25.5 - 28.5 ft-lb)
M10	43 - 47 N•m (32 - 35 ft-lb)	57 - 63 N•m (42.0 - 46.5 ft-lb)	71 - 79 N•m (52.5 - 58.5 ft-lb)
M12	75 - 85 N•m (55 - 60 ft-lb)	105 - 115 N•m (78 - 85 ft-lb)	91 - 110 N•m (91 - 110 ft-lb)
M14	125 - 140 N•m (100 - 90 ft-lb)	118 - 133 N•m (118 - 133 ft-lb)	140 - 155 N•m (140 - 155 ft-lb)
M16	190 - 210 N•m (140 - 155 ft-lb)	255 - 285 N•m (188 - 210 ft-lb)	300 - 330 N•m (225 - 245 ft-lb)
M18	260 - 290 N•m (190 - 215 ft-lb)	345 - 385 N•m (255 - 285 ft-lb)	420 - 460 N•m (210 - 340 ft-lb)
M20	370 - 410 N•m (275 - 300 ft-lb)	490 - 550 N•m (360 - 405 ft-lb)	590 - 650 N•m (440 - 490 ft-lb)
M22	500 - 550 N•m (370 - 400 ft-lb)	740 - 760 N•m (554 - 560 ft-lb)	800 - 880 N•m (590 - 650 ft-lb)
M24	640 - 700 N•m (470 - 520 ft-lb)	850 - 950 N•m (625 - 700 ft-lb)	1000 - 1120 N•m (730 - 830 ft-lb)
M27	930 - 1030 N•m (680 - 760 ft-lb)	1230 - 1370 N•m (900 - 1000 ft-lb)	1470 - 1630 N•m (1100 - 1200 ft-lb)
M30	1260 - 1400 N•m (930 - 1030 ft-lb)	1700 - 1900 N•m (1250 - 1400 ft-lb)	2000 - 2200 N•m (1500 - 1600 ft-lb)
M33	1720 - 1900 N•m (1270 - 1400 ft-lb)	2300 - 2500 N•m (2300 - 2500 ft-lb)	2700 - 3100 N•m (2000 - 2300 ft-lb)
M36	200 - 2450 N•m (1620 - 1800 ft-lb)	2900 - 3200 N•m (2200 - 2400 ft-lb)	3500 - 3900 N•m (2600 - 2900 ft-lb)

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HYDRAULIC CONNECTION SPECIFICATIONS

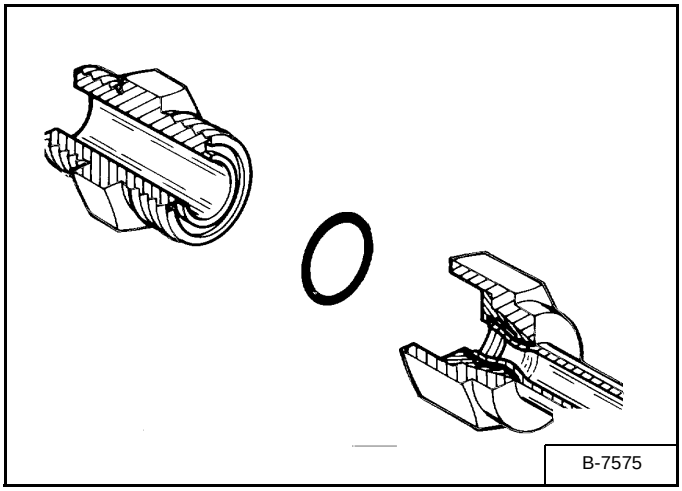
O-ring Face Seal Connection

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]**.

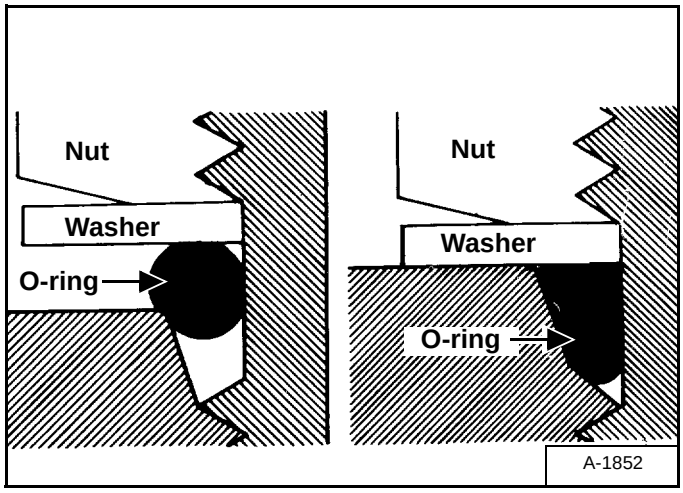
Figure SPEC-40- 2

O-RING FACE SEAL TIGHTENING TORQUE		
TUBELINE OUTSIDE DIAMETER	**X X THREAD SIZE**	**TORQUE N•M (FT-LB)**
6,36 mm (1/4 in)	9/16” - 18	18 (13)
9,52 mm (3/8 in)	11/16” - 16	30 (22)
12,7 mm (1/2 in)	13/16” - 16	54 (40)
15,9 mm (5/8 in)	1” - 14	81 (60)
19 mm (3/4 in)	1-3/16” - 12	114 (84)
22,2 mm (7/8 in)	1-3/16” - 12	133 (98)
25,4 mm (1 in)	1-7/16” - 12	160 (118)
31,75 mm (1-1/4 in)	1-11/16” - 12	209 (154)
38,10 mm (1-1/2 in)	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 4**[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.

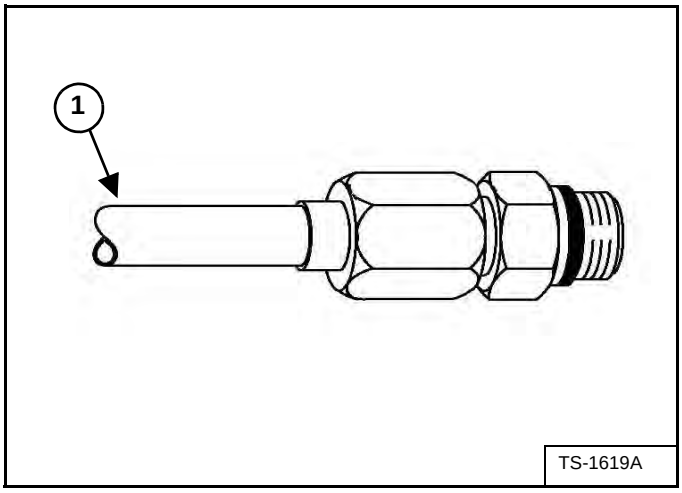
Replace hoses which show signs of wear, damage or weather cracked rubber.

Always use two wrenches when loosening and tightening hose or tubeline fittings.

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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]**

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.

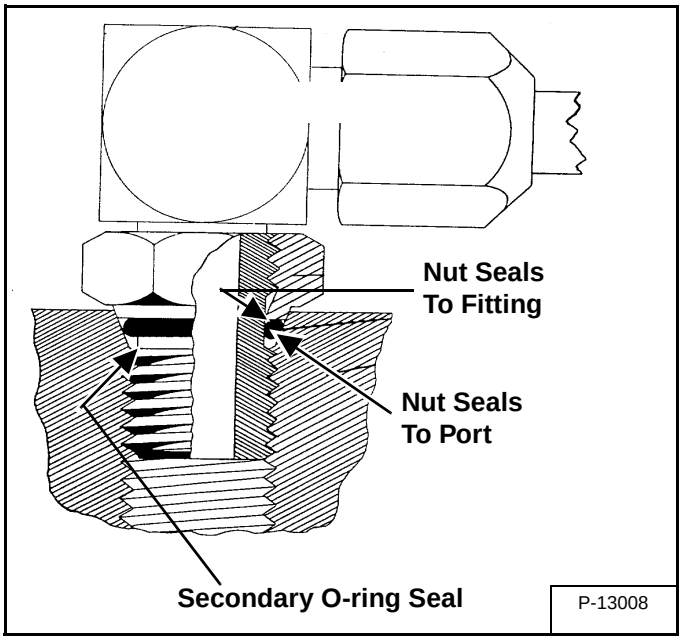
Figure SPEC-40-5

Flare Fitting Tightening Torque		
Tubeline Outside Diameter	x x Thread Size	TORQUE N•m (ft-lb)
6,36 mm (1/4 in)	7/16" - 20	18 (13)
7,94 mm (5/16 in)	1/2" - 20	23 (17)
9,53 mm (3/8 in)	9/16" - 18	30 (22)
12,7 (1/2 in)	3/4" - 16	54 (40)
15,9 (5/8 in)	7/8" - 14	81 (60)
19,05 mm (3/4 in)	1-1/16" - 12	114 (84)
22,23 mm (7/8 in)	1-3/16" - 12	133 (98)
25,4 mm (1 in)	1-5/16" - 12	160 (118)
31,75 mm (1-1/4 in)	1-5/8" - 12	209 (154)
38,10 mm (1-1/2 in)	1-7/8" - 12	221 (163)
50,8 mm (2 in)	2-1/2" - 12	342 (252)

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Port Seal Fittings

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	
X X THREAD SIZE	**TORQUE N•M (FT-LB)**
7/16” - 20	18 (13)
9/16” - 18	30 (22)
3/4” -16	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 following procedure to tighten the port seal fitting:

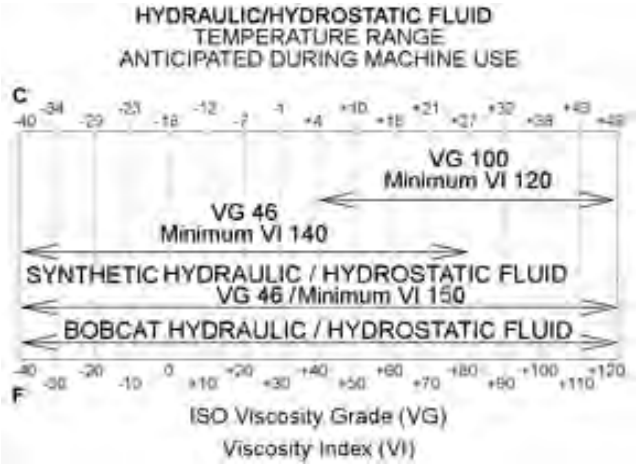
Port seal and nut, washer and O-ring (O-ring Boss) fittings use the same tightening torque valve chart.

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HYDRAULIC FLUID SPECIFICATIONS

Specifications

Use Bobcat hydraulic fluid (P/N 6903117 - 2, 2 1/2 U.S. gal), (P/N 6903118 - 5 U.S. gal), (P/N 6903119 - 55 U.S. gal).



DO NOT use automatic transmission fluids in the excavator or permanent damage to the hydraulic system will result.

⚠ 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 doctor familiar with this injury.

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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 can cause 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.

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CONVERSIONS

Decimal And Millimeter Equivalents

FRACTIONS	DECIMALS	MM
1/64	0.015625	0.397
1/32	0.03125	0.794
3/64	0.046875	1.191
1/16	0.0625	1.588
5/64	0.078125	1.984
3/32	0.09375	2.381
7/64	0.109375	2.778
1/8	0.1250	3.175
9/64	0.140625	3.572
5/32	0.15625	3.969
11/64	0.171875	4.366
3/16	0.1876	4.762
13/64	0.203125	5.159
7/32	0.21875	5.556
15/64	0.234375	5.953
1/4	0.2500	6.350
17/64	0.265625	6.747
9/32	0.28125	7.144
19/64	0.296875	7.541
5/16	0.3125	7.938
21/64	0.328125	8.334
11/32	0.34375	8.731
23/64	0.359375	9.128
3/8	0.3750	9.525
25/64	0.390625	9.922
13/32	0.40625	10.319
27/64	0.421875	10.716
7/16	0.4375	11.112
29/64	0.453125	11.509
15/32	0.46875	11.906
31/64	0.484375	12.303
1/2	0.5000	12.700

1 mm = 0.03937”

FRACTIONS	DECIMALS	MM
33/64	0.515625	13.097
17/32	0.53125	13.494
35/64	0.546875	13.891
9/16	0.5625	14.288
37/64	0.578125	14.684
19/32	0.59375	15.081
39/64	0.609375	15.478
5/8	0.6250	15.875
41/64	0.640625	16.272
21/32	0.65625	16.669
43/64	0.671875	17.066
11/16	0.6875	17.462
45/64	0.703125	17.859
23/32	0.71875	18.256
47/64	0.734375	18.653
3/4	0.7500	19.050
49/64	0.765625	19.447
25/32	0.78125	19.844
51/64	0.796875	20.241
13/16	0.8125	20.638
53/64	0.828125	21.034
27/32	0.84375	21.431
55/64	0.859375	21.828
7/8	0.8750	22.225
57/64	0.890625	22.622
29/32	0.90625	23.019
59/64	0.921875	23.416
15/16	0.9375	23.812
61/64	0.953125	24.209
31/32	0.96875	24.606
63/64	0.984375	25.003
1	1.000	25.400

0.001 = 0.0254 mm

U.S. To Metric Conversion Chart

	TO CONVERT	INTO	MULTIPLY BY
LINEAR MEASUREMENT	Miles	Kilometers	1.609
	Yards	Meters	0.9144
	Feet	Meters	0.3048
	Feet	Centimeters	30.48
	Inches	Meters	0.0254
	Inches	Centimeters	2.54
	Inches	Millimeters	25.4
AREA	Square Miles	Square Kilometers	2.59
	Square Feet	Square Meters	0.0929
	Square Inches	Square Centimeters	6.452
	Acre	Hectare	0.4047
VOLUME	Cubic Yards	Cubic Meters	0.7646
	Cubic Feet	Cubic Meters	0.02832
	Cubic Inches	Cubic Centimeters	16.39
WEIGHT	Tons (Short)	Metric Tons	0.9078
	Pounds	Kilograms	0.4536
	Ounces (Avdp.)	Grams	28.3495
PRESSURE	Pounds/Sq. In.	Kilopascal	6.895
WORK	Foot–Pounds	Newton–Meter	1.356
LIQUID VOLUME	Quarts	Liters	0.9463
	Gallons	Liters	3.785
LIQUID FLOW	Gallons/Minute	Liters/Minute	3.785
TEMPERATURE	Fahrenheit	Celsius	1.Subtract 32° 2. Multiply by 5/9

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SERVICE 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	E26 - 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	E26 - 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.	

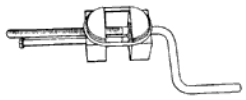
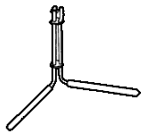
See BobcatNET for parts ordering information. (For Europe dealers, see the Bobcat Special Tools Catalogue for additional information and part numbers.)

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SERVICE TOOLS REQUIRED (CONT'D)

Hydraulic Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL10003	Hydraulic Tester (Flow Meter)	E26 - E80	Either hydraulic tester, MEL10003 or TWX-RFIK200-S-6 can be used for hydraulic testing.	
TWX-RFIK200-S-6 NEED MEL #	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 Comppressor			
MEL1033	Rod Seal Installation Tool			
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			

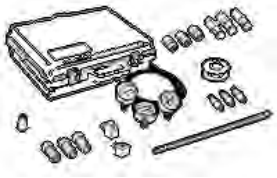
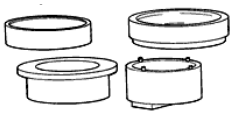
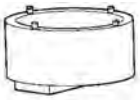
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SERVICE TOOLS REQUIRED (CONT'D)

Hydraulic Tools (Cont'd)

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1355	Hydraulic Test Kit	E26 - E80	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	
MEL1560	Grease Spring Tool (Grease Release)	E26 - E55		
MEL1713	Hydraulic Test Kit	E60, E80	This test kit includes various adapters that are used when testing hydraulic functions. MEL1355 Includes: MEL1713-1 thru MEL1713-5	

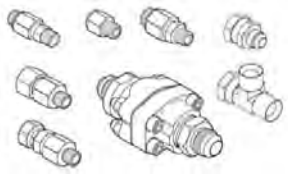
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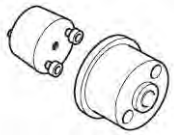
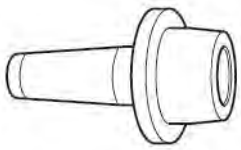
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SERVICE TOOLS REQUIRED (CONT'D)

Hydraulic Tools (Cont'd)

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
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
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	
7031371	Valve Spring Compressor	T4 Bobcat Engine Applications	Used for compressing valve springs	

See BobcatNET for parts ordering information. (For Europe dealers, see the Bobcat Special Tools Catalogue for additional information and part numbers.)

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SERVICE TOOLS REQUIRED (CONT'D)

Engine Tools (Cont'd)

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL10630	Engine Compression Test Kit	E26 - 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	
MEL1237	Fuel Line Adapter	E26 - 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			

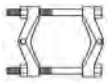
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SERVICE TOOLS REQUIRED (CONT'D)

HVAC Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1581	HVAC Recover, Recycling, Recharging Machine	E26 - E80		
MEL1735	Deluxe HVAC Recover, Recycling, Recharging Machine			
MEL1736	Standard HVAC Recover, Recycling, Recharging Machine			
MEL1592	HVAC Refrigerant Identification Tool			
MEL1595	AC Compressor Pulley Puller	E26 - E55		

See BobcatNET for parts ordering information. (For Europe dealers, see the Bobcat Special Tools Catalogue for additional information and part numbers.)

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