Bobcat®

Service Manual



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E10

Compact Excavator

S/N A33P11001 & Above
S/N B4PD11001 & Above
S/N B4K911001 & Above

6986788enUS (12-18) (C)

Printed in U.S.A.

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EU T2 S5 NA T4-K

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MAINTENANCE SAFETY

⚠ WARNING

Training is necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual, Operator's Handbook and signs (stickers) 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.

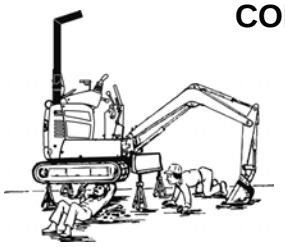
CORRECT



P-90216

Never service the Bobcat Compact Excavator without instructions.

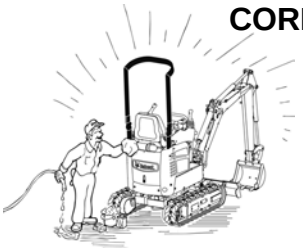
CORRECT



RI075

Use the correct procedure to lift and support the excavator.

CORRECT



RI072

Cleaning and maintenance are required daily.

WRONG



RI076

Have good ventilation when welding or grinding painted parts.

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

WRONG

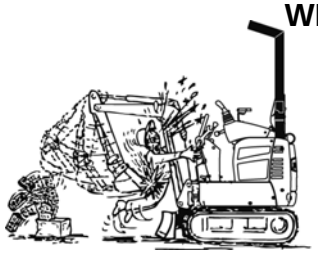


RI073

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

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

WRONG



RI077

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



RI074

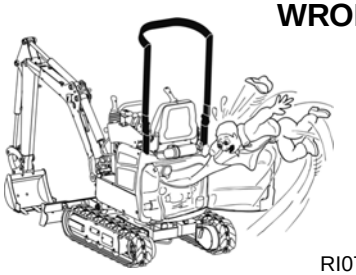
Stop, cool and clean engine of flammable materials before checking fluids.

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



RI071

Keep body, jewellery 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.**

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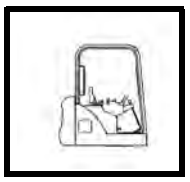
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FOREWORD

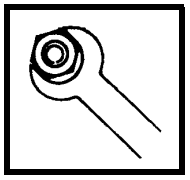
This manual is for the Bobcat excavator mechanic. It provides necessary servicing and adjustment procedures for the Bobcat excavator and its component parts and systems. Refer to the Operation & Maintenance Manual for operating instructions, starting procedure, daily checks, etc.

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

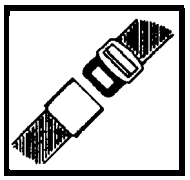
1. Check that the ROPS/TOPS/ FOPS is in good condition and is not modified.



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



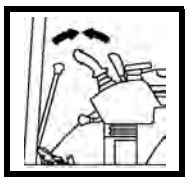
3. The seat belt must be correctly installed, functional and in good condition.



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



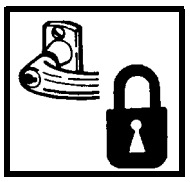
5. Travel levers, control levers and foot pedals must return to neutral. Check that the pedal locks are in working order.



6. Check for correct function of the work lights.



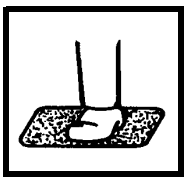
7. Enclosure door latches must open and close freely.



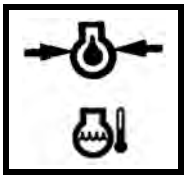
8. Attachment locking pins must function correctly and be in good condition.



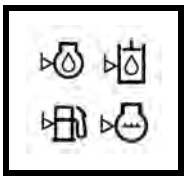
9. Safety treads must be in good condition.



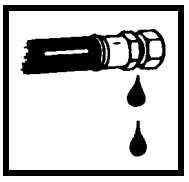
10. Check for correct function of indicator lamps.



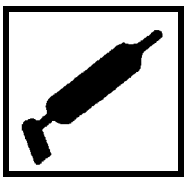
11. Check all machine fluid levels.



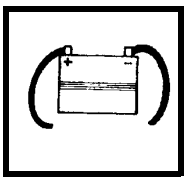
12. Inspect for fuel, oil or hydraulic fluid leaks.



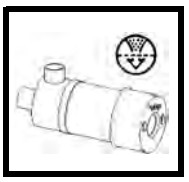
13. Lubricate the excavator.



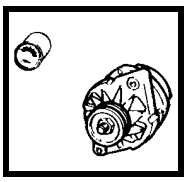
14. Check the condition of the battery and cables.



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



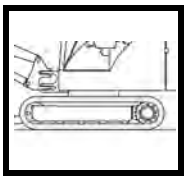
16. Check the electrical charging system.



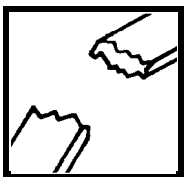
FW EXC-0119 SM

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



18. Inspect for loose or broken parts or connections.



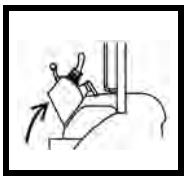
19. Check for any field modification not completed.



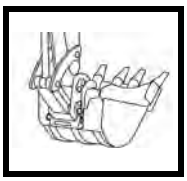
20. Operate the machine and check all functions.



21. Check the control console interlocks for correct function.



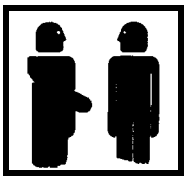
22. Inspect the X-Change™ for wear or damage. Repair or replace damaged parts.



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 INSTRUCTIONS

Safety Alert Symbol

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

WARNING

AVOID INJURY OR DEATH

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

W-2003-0807

IMPORTANT

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

I-2019-0284

DANGER

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

D-1002-1107

WARNING

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

W-2044-1107

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

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

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SI EXC-1016 SM

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



Call Before You Dig

Dial 811 (USA Only)

1-888-258-0808 (USA & Canada)

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



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

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FIRE PREVENTION



Maintenance

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

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

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

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

Operation

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

Electrical



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

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

Hydraulic System

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

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

Fueling



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

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

Starting

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

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

Spark Arrester Exhaust System

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

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

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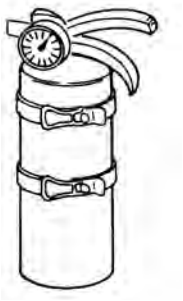
Welding And Grinding

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

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

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

Fire Extinguishers



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

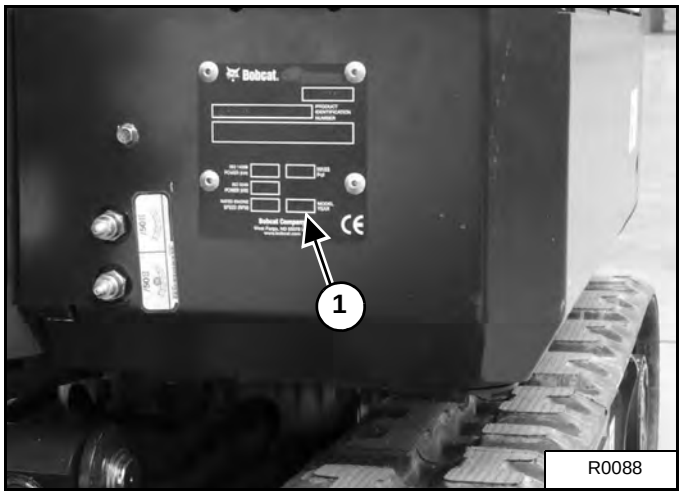
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SERIAL NUMBER LOCATIONS

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

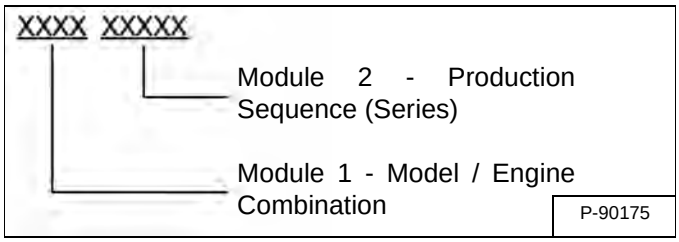
Excavator Serial Number

Figure 1



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

Explanation of excavator Serial Number:

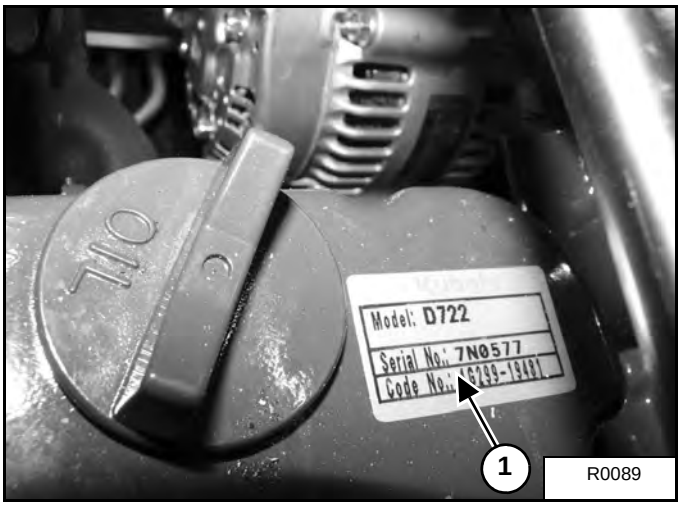


1. The four digit Model / Engine Combination Module number identifies the model number and engine combination.

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

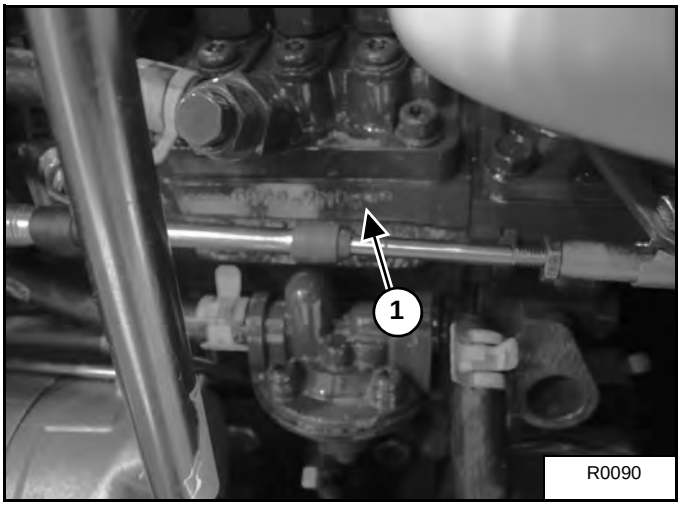
Engine Serial Number

Figure 2



The engine serial number is located as a plate (Item 1) on the top of the engine **[Figure 2]**.

Figure 3

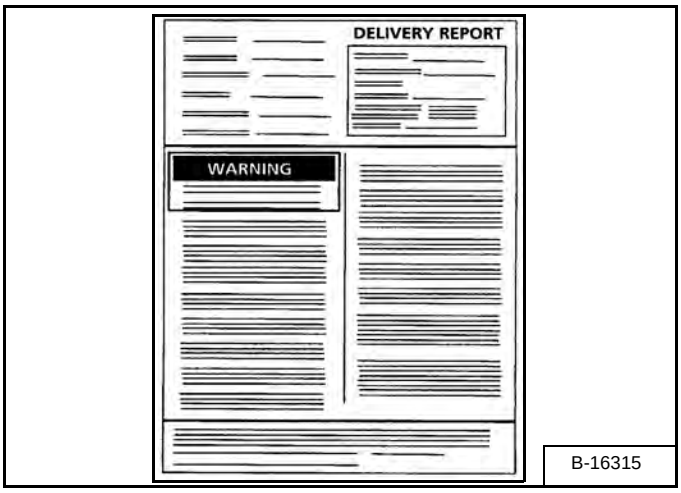


It also appears engraved on the side of the engine (Item 1) **[Figure 3]**.

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DELIVERY REPORT

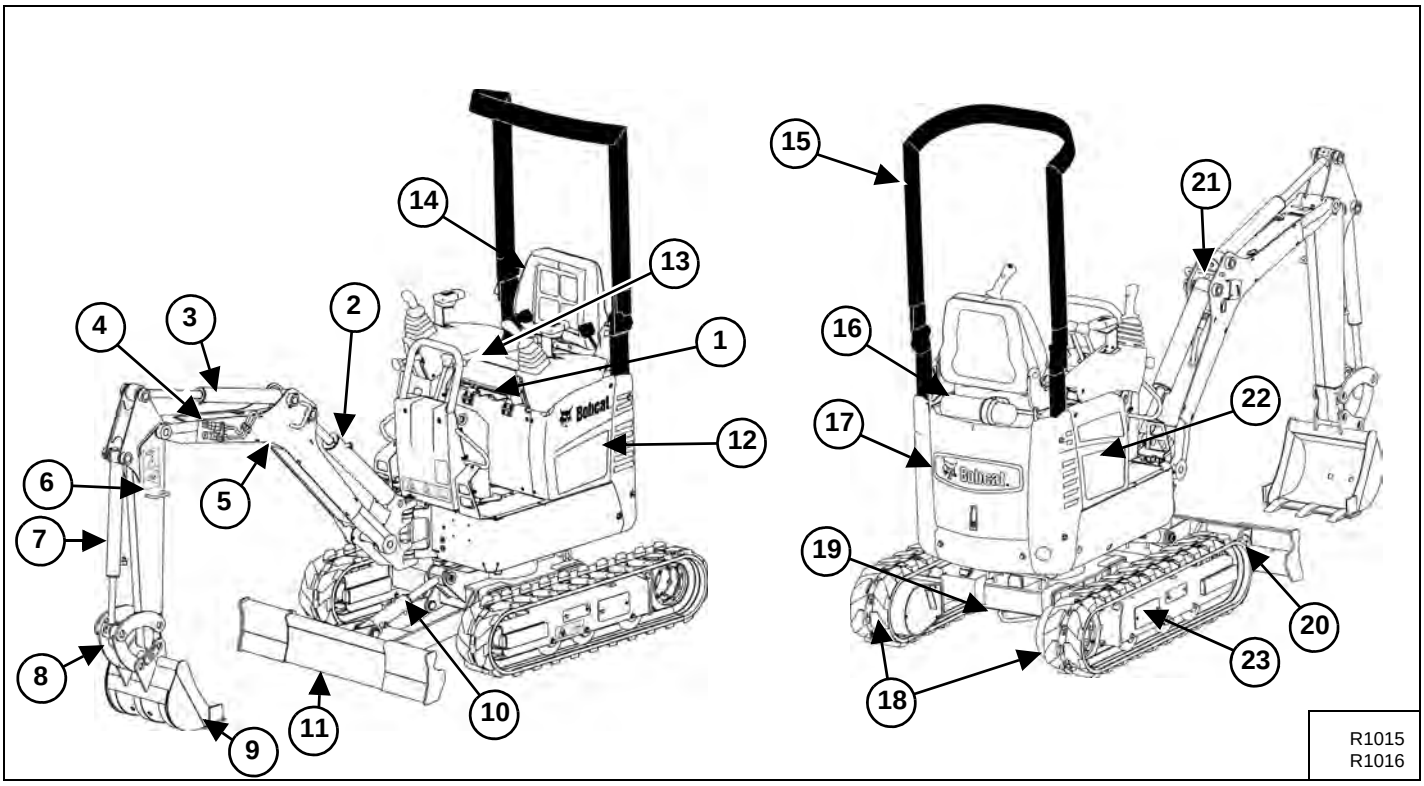
Figure 4



The delivery report **[Figure 4]** contains a list of items that must be explained or shown to the owner or operator by the dealer when the Bobcat excavator is delivered.

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

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ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	Operator's Handbook	**15**	Tip-Over Protective Structure (TOPS)
2	Boom Cylinder	**16**	Operation & Maintenance Manual
3	Arm Cylinder	**17**	Tailgate
4	Auxiliary Quick Couplers	**18**	Tracks
5	Boom	**19**	Tie Downs
6	Arm	**20**	Tie Downs / Lift Point (Both Sides)
7	Bucket Cylinder	**21**	Lift Point
8	Bucket Link / Attachment Coupler (If Equipped)	**22**	Right Side Cover
9	Bucket **[A]**	**23**	Track Frames
10	Blade Cylinder		
11	Blade		
12	Upperstructure		
13	Control Levers (Joysticks)		
14	Operator's Seat with Seat Belt		

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

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SAFETY AND MAINTENANCE

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Procedure 10-10-1

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LIFTING AND BLOCKING THE EXCAVATOR

Procedure

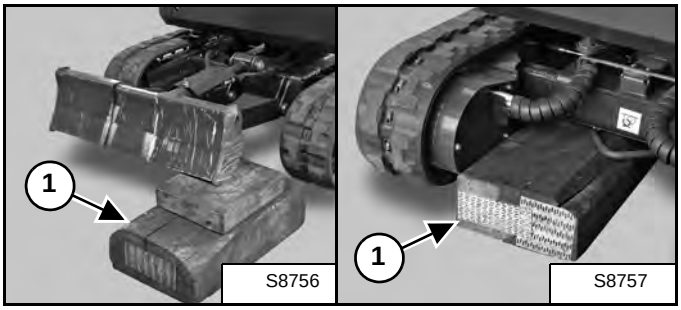
Always park the machine on a level surface.

Figure 10-10-1



Raise one side of the machine (approximately 100 mm [4 in]) using the boom and arm as shown in **[Figure 10-10-1]**.

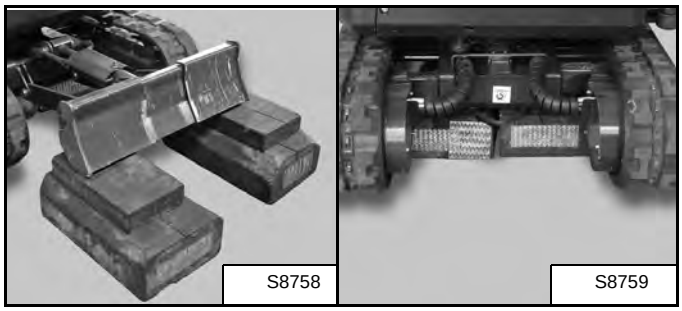
Figure 10-10-2



Raise the blade fully 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 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 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.

W-2143-0189

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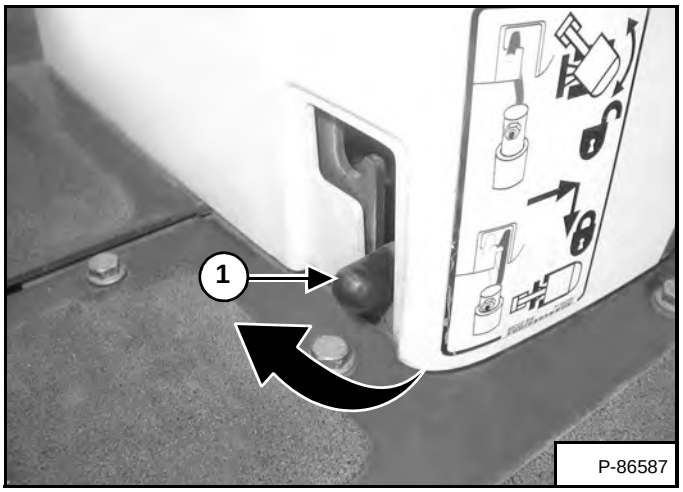


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UPPERSTRUCTURE SLEW LOCK

Operation

Figure 10-20-1



Move the slew lock pin (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.

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

Move the slew lock pin (Item 1) **[Figure 10-20-1]** 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.

W-2197-0904

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LIFTING THE EXCAVATOR

Procedure

Fully extend the cylinders of the bucket, arm and boom.

Raise the blade all the way.

Turn the upperstructure so that the boom is at the opposite end as the blade.

Put all the controls in neutral and engage the swing lock. (See UPPERSTRUCTURE SLEW LOCK on Page 10-20-1.)

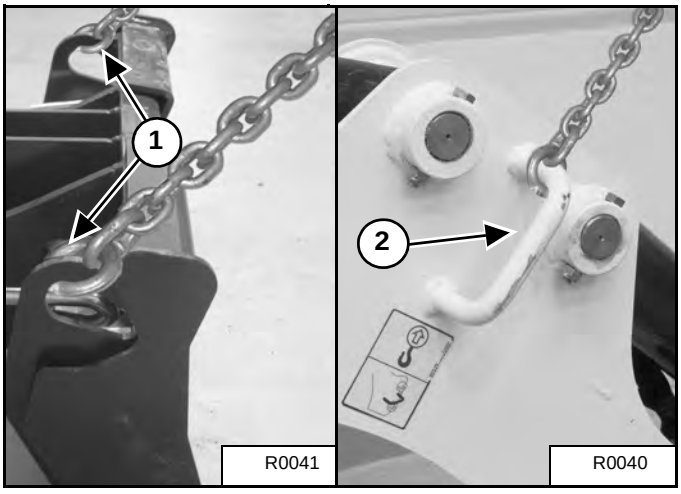
⚠ WARNING

AVOID INJURY OR DEATH

- **Use chains and lifting equipment with sufficient capacity for the weight of the excavator plus any added attachments.**
- **Maintain center of gravity and balance when lifting.**
- **Do not swing boom or upperstructure. Engage the upperstructure slew lock.**
- **Never lift with operator on machine.**
- **Never lift with the blade angled (if equipped).**

W-2580-0607

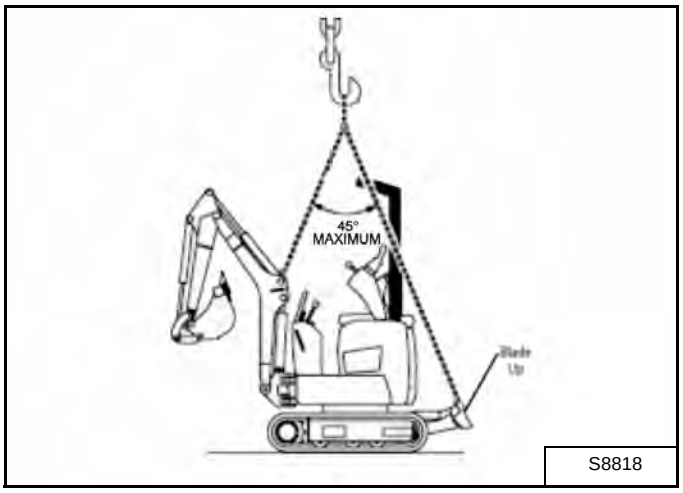
Figure 10-30-1



Fasten the chains to the ends of the blade (Item 1) **[Figure 10-30-1]** and up to a lifting fixture above the canopy.

Fasten a chain in the hook of the boom (Item 2) **[Figure 10-30-1]** and up to the lifting fixture.

Figure 10-30-2



The maximum angle between the front and rear chains must not exceed 45° **[Figure 10-30-2]**.

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TRANSPORTING THE EXCAVATOR ON A TRAILER

Loading And Unloading

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

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

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

Use metal loading ramps with a slip resistant surface.

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

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

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

Figure 10-40-1



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

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

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

Stop the engine and remove the key.

Put blocks under the front and rear of the tracks shoes.

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Fastening

Figure 10-40-2

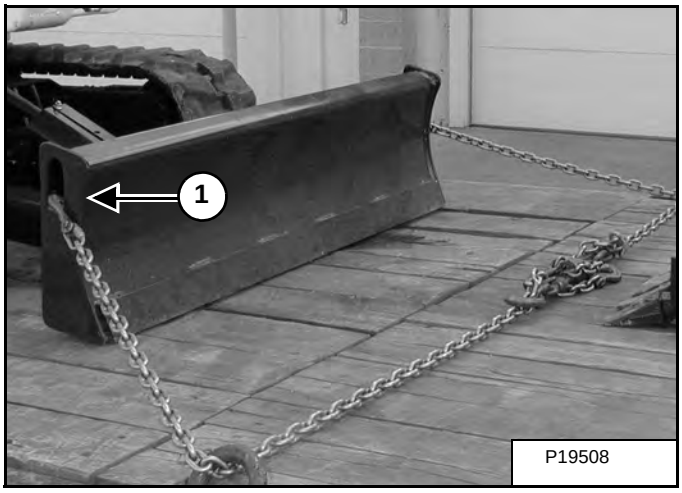


Figure 10-40-3

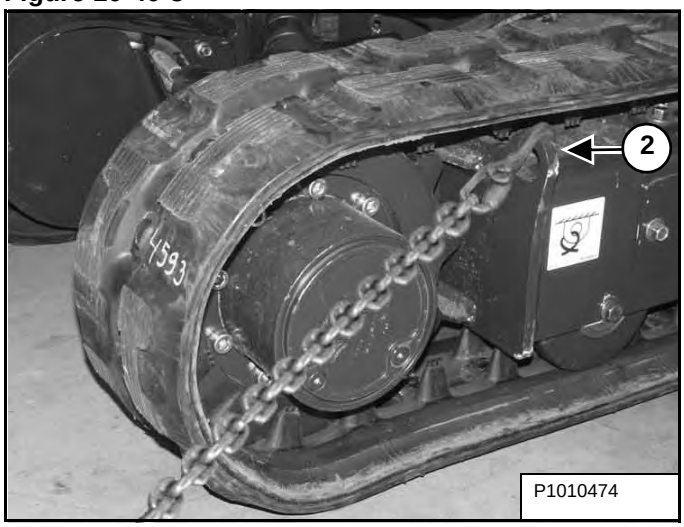
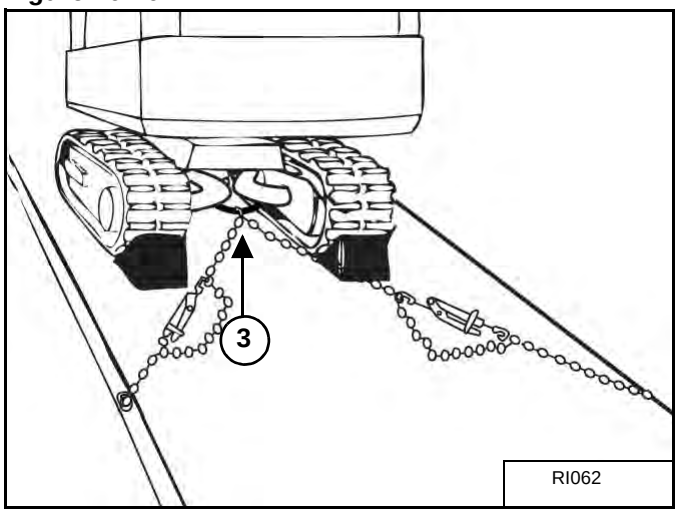


Figure 10-40-4



Fasten chains to the front corners of the blade (Item 1) **[Figure 10-40-2]**, to both sides of the track frame (Item 2) **[Figure 10-40-3]** or to the tie down loop at the rear of the track frame (Item 3) **[Figure 10-40-4]**.

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

⚠ WARNING

AVOID SERIOUS INJURY OR DEATH

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

W-2058-0807

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FOLD-DOWN TOPS

TOPS Position

WARNING

AVOID INJURY OR DEATH

Use the Tip Over Protective Structure (TOPS). TOPS changes not approved by Bobcat Company can cause loss of operator protection and result in injury or death. The TOPS must be in the raised position with the seat belt fastened. There is no tip-over protection when the TOPS is in the lowered position.

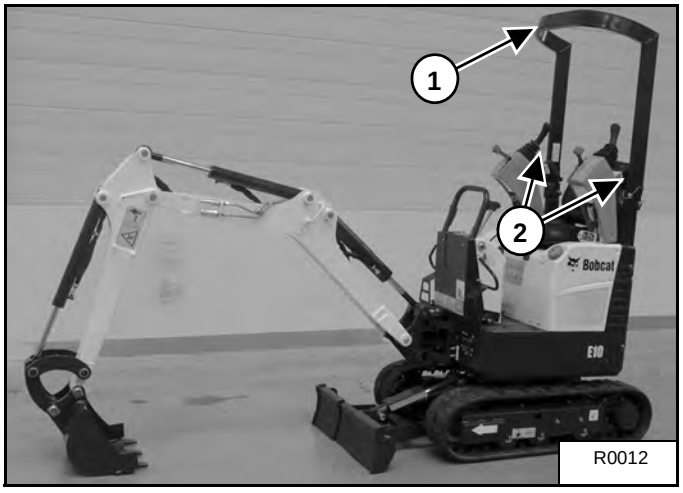
W-2742-0608

The excavator can be operated temporarily with the TOPS lowered for access through height restricted openings. Do not fasten seat belt when the TOPS is in the DOWN position.

Stop the engine, exit the machine and put the TOPS in the UP and LOCKED position after passing through height restricted opening.

TOPS Approved

Figure 10-50-1

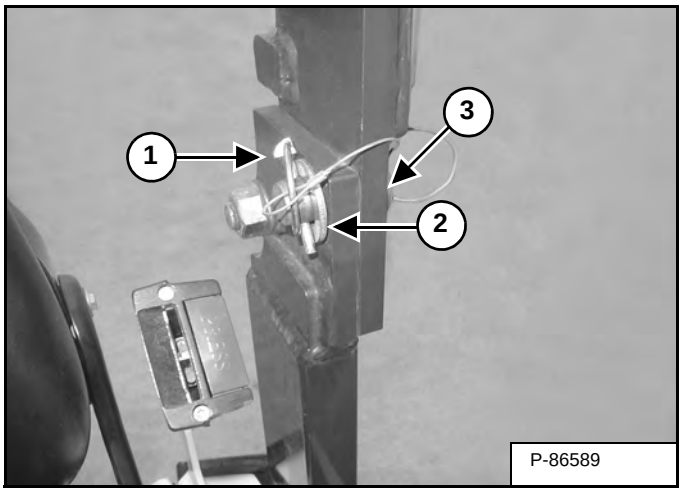


The excavator has an operator canopy (TOPS) (Tip-Over Protective Structure) (Item 1) (meets ISO 12117) as standard equipment **[Figure 10-50-1]**.

The canopy provides operator protection if the excavator tips over. The seat belt must be worn for TOPS protection.

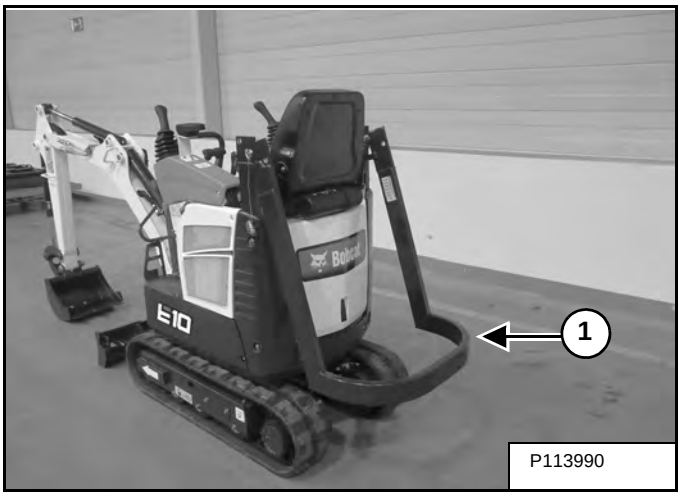
Lowering The Fold Down TOPS

Figure 10-50-2



Remove the retaining clip (Item 1) and washer (Item 2) **[Figure 10-50-2]** (both sides).

Figure 10-50-3



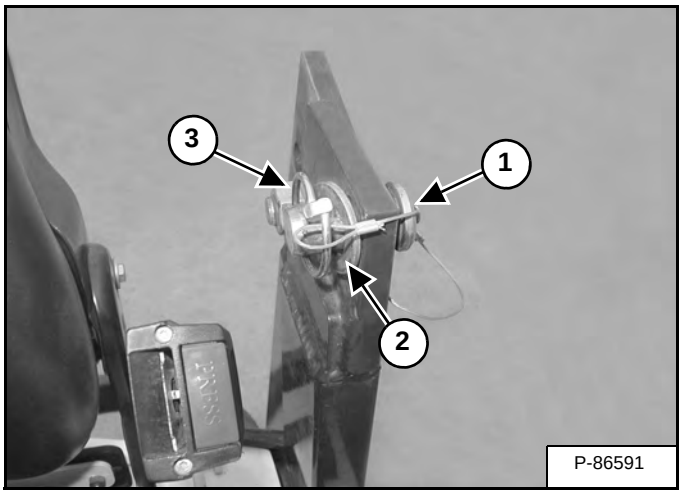
Securely grasp the TOPS (Item 1) **[Figure 10-50-1]** with one hand and remove the pin (Item 3) **[Figure 10-50-2]** (both sides) and lower the TOPS (Item 1) **[Figure 10-50-3]** to the down position.

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FOLD-DOWN TOPS (CONT'D)

Lowering The Fold Down TOPS (Cont'd)

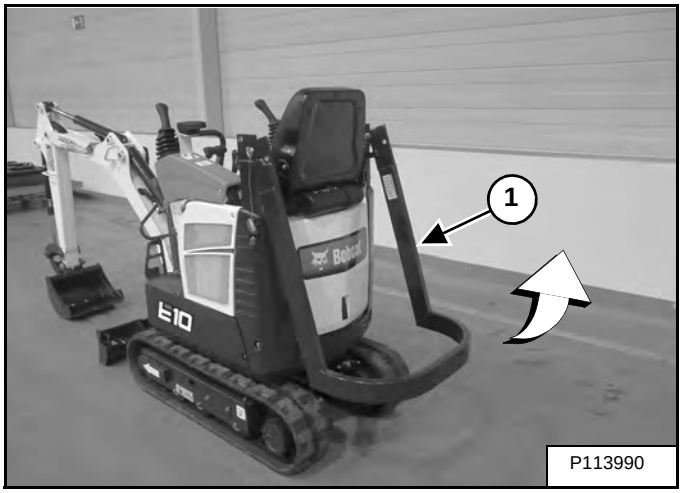
Figure 10-50-4



Reinstall the pin (Item 1) and the washer (Item 2) on the retainer clip (Item 3) **[Figure 10-50-4]** into the TOPS for storage.

Raising The Fold Down TOPS

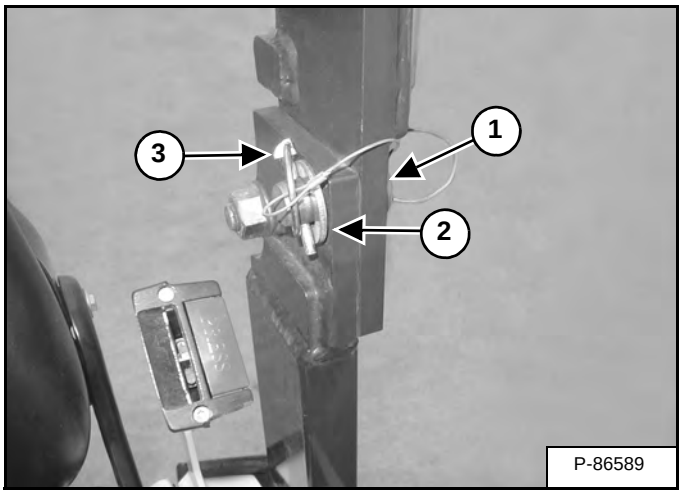
Figure 10-50-5



Remove the retainer clip (Item 3) and the washer (Item 2) from the pin (Item 1) **[Figure 10-50-4]** (both sides).

Securely grasp the TOPS (Item 1) **[Figure 10-50-5]** and raise to the upright position and install the pin (Item 1) **[Figure 10-50-6]** (both sides).

Figure 10-50-6



Reinstall the pin (Item 1) and the washer (Item 2) on the retainer clip (Item 3) **[Figure 10-50-6]** into the TOPS for storage.

⚠ WARNING

AVOID INJURY OR DEATH

The Tip Over Protective Structure (TOPS) must be properly secured in the raised position. Make sure the pins are correctly installed through the mounting frame and the TOPS tube and secured with the retainer pins. Improperly installed fasteners will cause loss of TOPS protection.

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TAILGATE

Opening And Closing The Tailgate

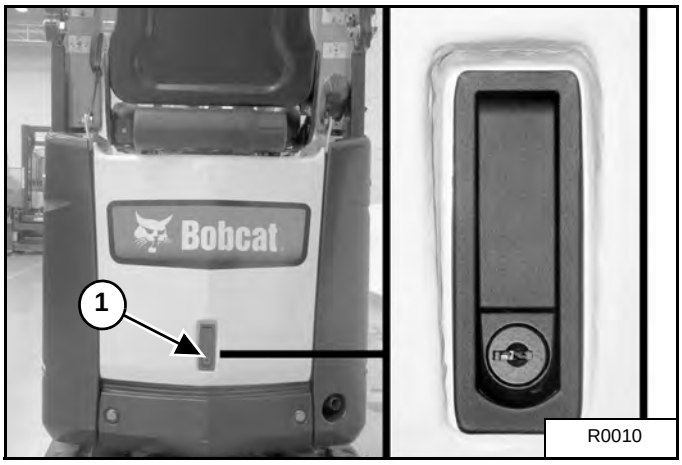
WARNING

AVOID INJURY OR DEATH

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

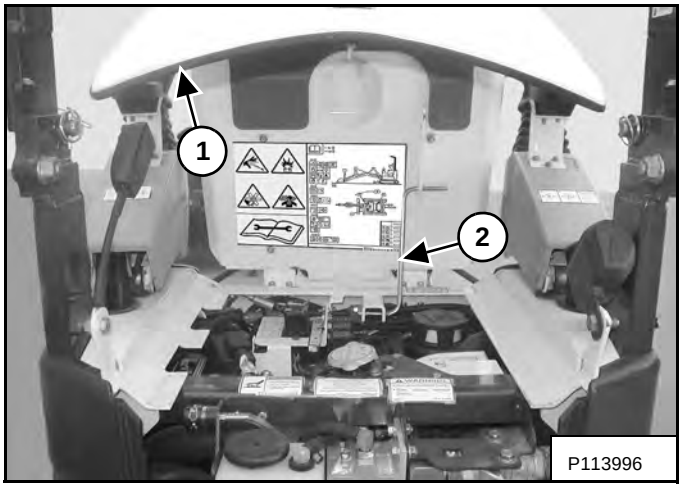
W-2012-0497

Figure 10-60-1



Release the latch (Item 1) **[Figure 10-60-1]** and pull the tailgate open.

Figure 10-60-2



Raise the tailgate (Item 1) until the rod (Item 2) **[Figure 10-60-2]** is in the engaged position.

To close the tailgate, lift up slightly on the tailgate (Item 1) until the rod can be moved to the disengaged position (Item 2) **[Figure 10-60-2]**. Slowly lower the tailgate until it is completely lowered and in the latched position.

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

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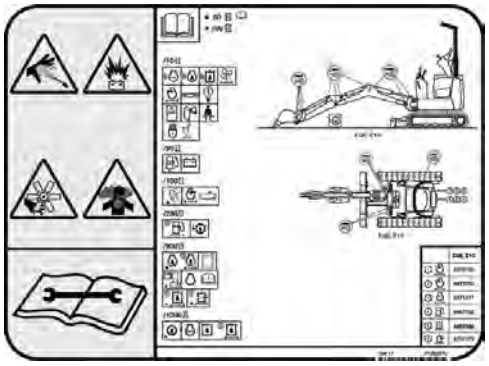
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SERVICE SCHEDULE

Maintenance Intervals

Maintenance work must be done at regular intervals. Failure to do so will result in excessive wear and early failures.

The SERVICE SCHEDULE is a guide for correct maintenance of the Bobcat excavator.



See inside page of the back cover for symbols and identification.

WARNING

AVOID INJURY OR DEATH

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

W-2003-0807

Every 10 Hours (Before Starting The Excavator)

- **Engine Oil** - Check level and add as needed.
- **Engine Air Filters and Air System** - Check the condition indicator. Service only when required. Check for leaks and damaged components.
- **Engine Cooling System** - Clean debris from oil cooler, radiator and grille. Check coolant level COLD and add premixed coolant as needed.
- **Seat Belt, Seat Belt Retractors, Seat Belt Mounting hardware, Control Console Lockout** - Check the condition of seat belt and mounting hardware. Clean or replace seat belt retractors as needed. Check the control console lockout lever for proper operation. Clean dirt and debris from moving parts.
- **Motion Alarm** - Check for proper function (if equipped).
- **TOPS** - Check condition and mounting hardware.
- **Indicators and Lights** - Check for correct operation of all indicators and lights.
- **Safety Signs and Safety Tread** - Check for damaged signs (decals) and safety tread. Replace any signs and safety treads that are damaged.
- **Hydraulic Fluid** - Check fluid level and add as needed.
- **Track Tension** - Check tension and adjust as needed.
- **Pivot Points** - Grease all machinery pivot points.

First 50 Hours

- **Engine Oil and Filter** - Replace oil and filter.
- **Drive Belts (Alternator / Fan)** - Check condition. Replace as needed.

Every 50 Hours

- **Swing Bearing** - Grease swing bearing and swing pinion. Service every 10 hours when operating in water.
- **Battery** - Check cables, connections, and electrolyte level; add distilled water as needed.
- **Fuel Tank** - Drain water and sediment from fuel tank and fuel filter.

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Maintenance Intervals (Cont'd)

First 100 Hours

- **Alternator and Starter** - Check connections.
- **Drive Motors (Final Drive)** - Replace fluid.
- **Hydraulic Filter** - Replace the hydraulic filter.

Every 100 Hours

- **Spark Arrestor Muffler** - Clean spark chamber.
- **Drive Belts (Alternator / Fan)** - Check condition. Replace as needed.

Every 250 Hours Or Every 12 Months

- **Fuel Filter** - Replace filter.
- **Drive Motors (Final Drive)** - Check fluid level and add as needed.

Every 500 Hours Or Every 12 Months

- **Engine Oil and Filter** - Replace oil and filter.
- **Cooling System** - Clean debris from radiator, hydraulic fluid cooler (if equipped).
- **Hydraulic Filter and Hydraulic Reservoir Breather Cap** - Replace the hydraulic filter, and the reservoir breather cap.
- **Alternator and Starter** - Check connections.
- **Engine Valves** - Adjust the engine valve clearance.

Every 1000 Hours Or Every 12 Months

- **Hydraulic Fluid and Filters** - Replace hydraulic fluid and filters.
- **Drive Motors (Final Drive)** - Replace fluid.

Every 24 Months

- **Coolant** - Replace the coolant.

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Contents Of The Inspection Checkbook (Logbook)

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.

The Inspection Checkbook contains the following information:

- Doosan Trading Limited Warranty Conditions
- Protection Plus Extended Warranty Conditions
- General Parts Policy
- General Information
- First Inspection
- Scheduled Services
- Authorised Identification
- Lubricants and Fluids Table
- Service Parts Charts

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

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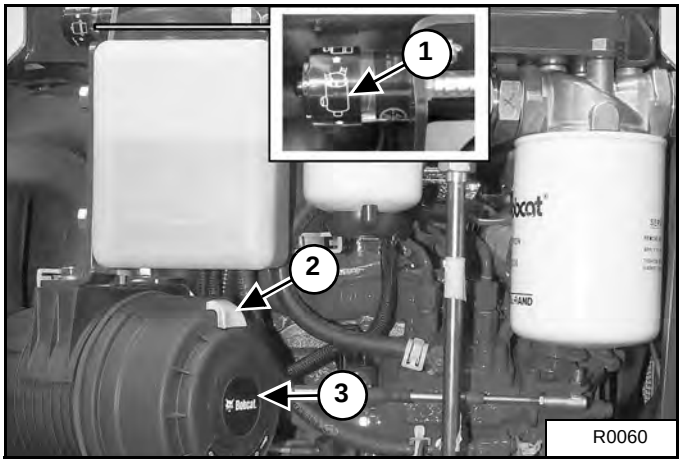
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AIR CLEANER SERVICE

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

Daily Check

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.

Replacing The Filter Elements

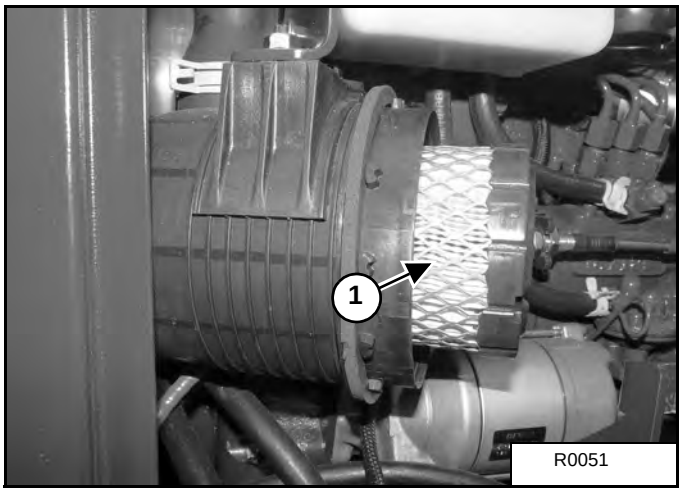
Outer Filter

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

Turn the dust cup (Item 3) **[Figure 10-80-1]** counterclockwise 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.

Install a new outer filter.

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

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

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

After the outer filter has been replaced, press the button (Item 1) **[Figure 10-80-1]** on the end 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.

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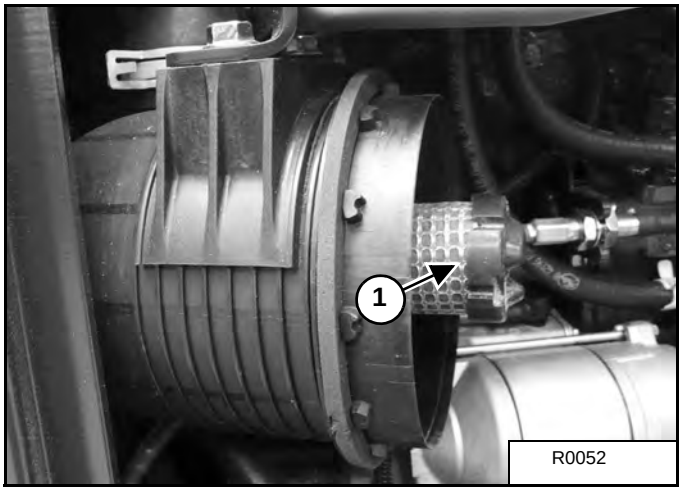
Replacing The Filters (Cont'd)

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 on the top of the condition indicator (Item 1) **[Figure 10-80-1]** and start the engine. Run at full rpm, then reduce engine speed and stop the engine. If the red ring shows in the condition indicator, replace the inner filter.

Figure 10-80-3



Remove the dust cup (Item 3) **[Figure 10-80-1]**, the outer filter (Item 1) **[Figure 10-80-2]** and the inner filter (Item 1) **[Figure 10-80-3]**.

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

Install the new inner filter.

Install the outer filter and the dust cup.

Press the button on the condition indicator to reset the condition indicator (Item 1) **[Figure 10-80-1]** (the red ring will not show anymore).

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ENGINE COOLING SYSTEM

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

Cleaning

Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

Use low 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

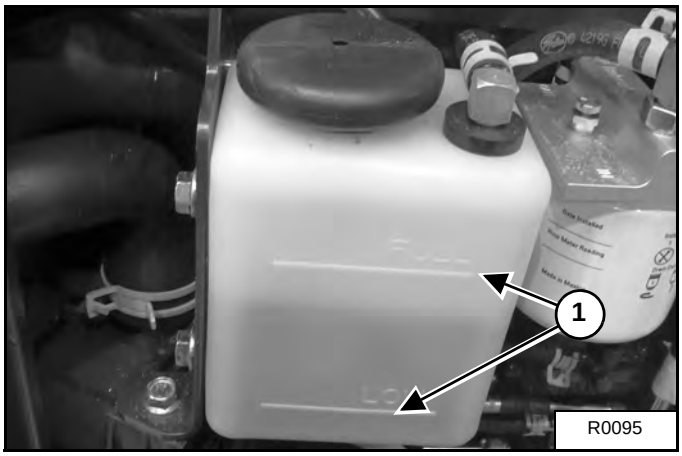
AVOID INJURY OR DEATH

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

Figure 10-90-1



The coolant level must be between the marks (Item 1) **[Figure 10-90-1]** on the coolant recovery tank.

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 The Coolant

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

Stop the engine. Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

⚠ WARNING

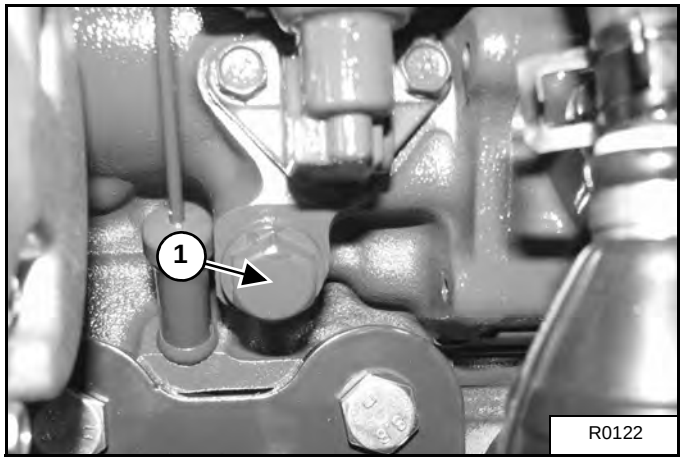
AVOID BURNS

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

W-2070-1203

When the engine is cool, remove the radiator cap.

Figure 10-90-2



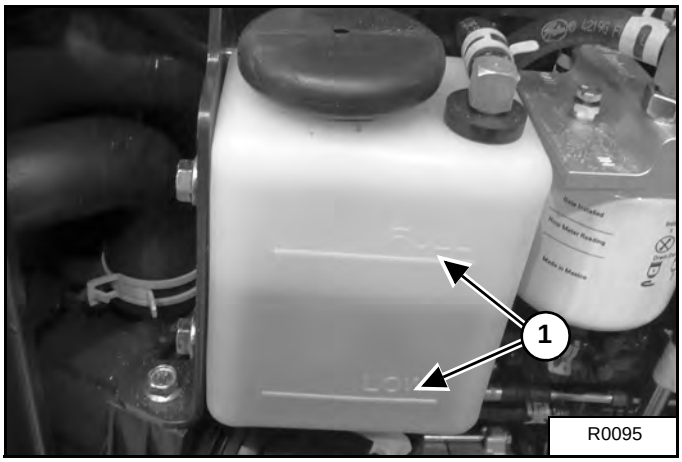
Open the drain valve (Item 1) **[Figure 10-90-2]** on the engine block and drain the coolant into a container.

After all the coolant is removed, close the drain valve.

NOTE: Fluids such as engine oil, hydraulic fluid, coolant, 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, state and federal regulations for correct disposal.

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

Figure 10-90-3



The coolant level must be between the marks (Item 1) **[Figure 10-90-3]** on the coolant recovery tank.

Mix the coolant in a separate container.

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.

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.

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FUEL SYSTEM

Fuel Specifications

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

U.S. Standard (ASTM D975)

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

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

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

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

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

E.U. Standard (EN590)

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

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

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

Biodiesel Blend Fuel

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

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

Apply the following guidelines if biodiesel blend fuel is used:

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

NOTE: Biodiesel blend fuel does not have long term stability and should not be stored for more than 3 months.

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Filling The Fuel Tank

WARNING

AVOID INJURY OR DEATH

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

W-2063-0807

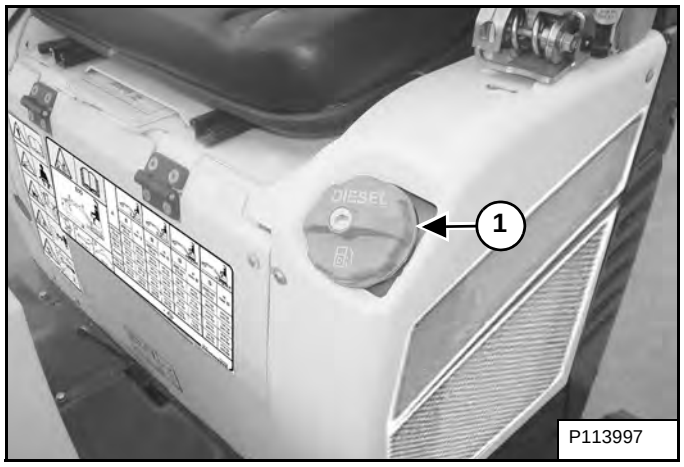
WARNING

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 10-100-1



Remove the fuel fill cap (Item 1) **[Figure 10-100-1]** using the key.

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.

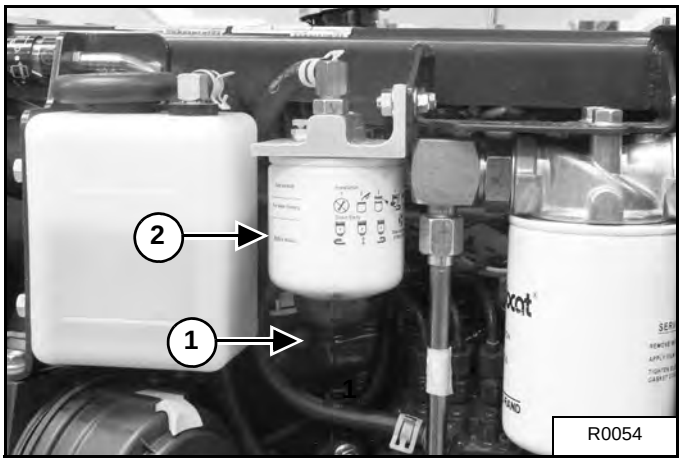
(See SERVICE SCHEDULE on Page 10-70-1.) for the correct service interval.

Fuel Filter

Removing Water

Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

Figure 10-100-2



Loosen the drain (Item 1) **[Figure 10-100-2]** at the bottom of the filter to drain water from the filter.

Replacing The Fuel Filter

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

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

Remove the air from the fuel system. (See Removing Air From The Fuel System on Page 10-100-3.)

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Draining The Fuel Tank

Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

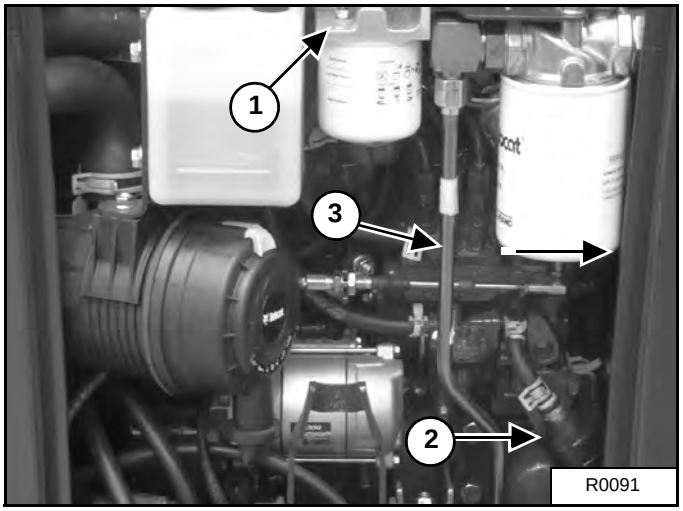
Remove the fuel line at the engine and put the end of the hose in a fuel can. Squeeze the primer bulb (if equipped) and drain the fuel tank that way (siphon action).

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

Removing Air From The Fuel System

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

Figure 10-100-3



Open the fuel filter vent (Item 1) **[Figure 10-100-3]**.

Operate the hand pump (priming bulb) (Item 2) **[Figure 10-100-3]** until the fuel flows from the vent with no air bubbles.

Close the vent (Item 1) **[Figure 10-100-3]** on the fuel filter housing.

Start the engine and let it run at low idle. It can be necessary to open the vent at the fuel injection pump (Item 3) **[Figure 10-100-3]** briefly until the engine runs smoothly.

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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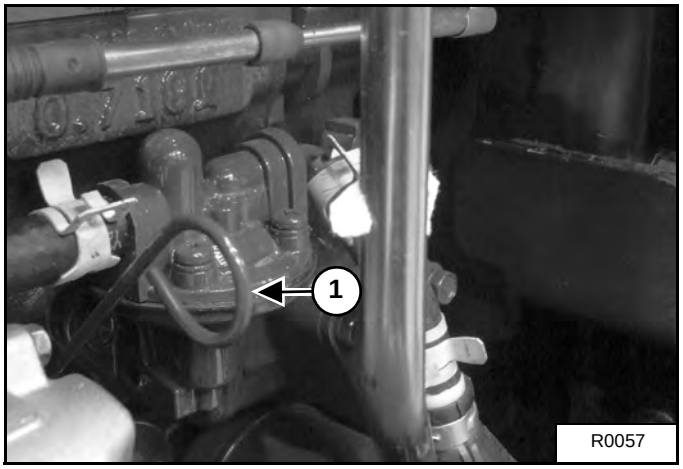
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ENGINE LUBRICATION SYSTEM

Checking And Adding Engine Oil

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

Figure 10-110-1



Open the tailgate and remove the dipstick (Item 1) **[Figure 10-110-1]**.

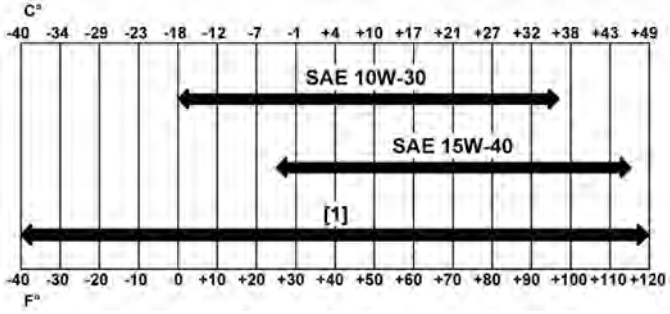
Keep the oil level between the marks on the dipstick.

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

Engine Oil Chart

Figure 10-110-2

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



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

[1] Bobcat Synthetic Oil – 5W-40.

Bobcat engine oils are recommended for use in this machine. If Bobcat engine oil is not available, use a good quality engine oil that meets API Service Classification of CJ-4 or better **[Figure 10-110-2]**.

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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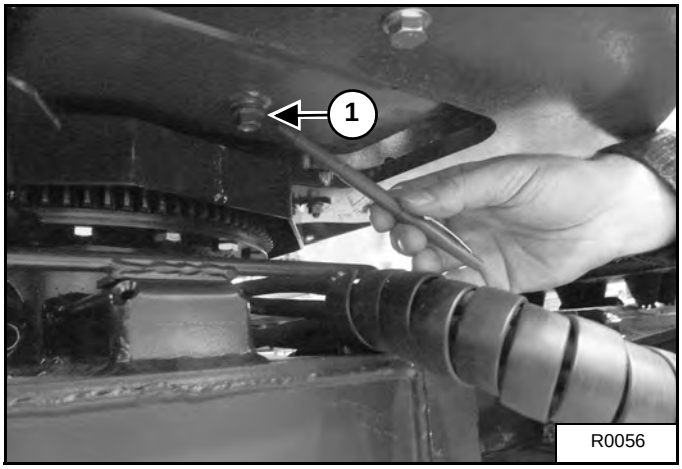
Replacing Oil And Filter

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.

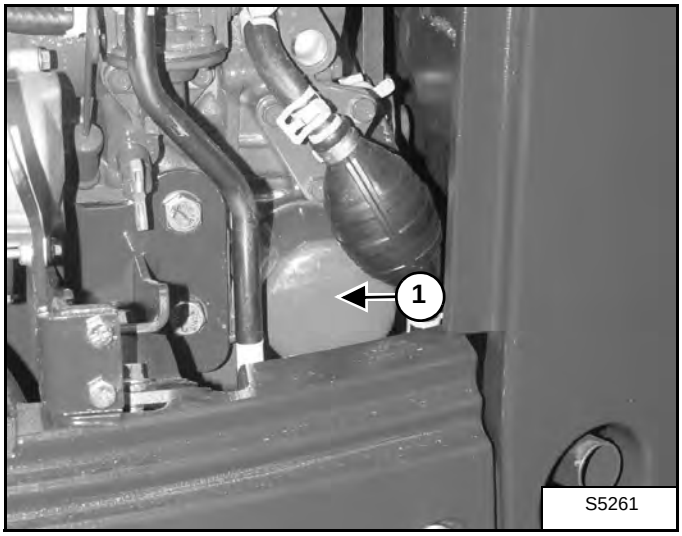
Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

Figure 10-110-3



Remove the drain plug (Item 1) **[Figure 10-110-3]**. Drain the oil into a container and recycle or dispose of used oil in an environmentally safe manner.

Figure 10-110-4



Remove the oil filter (Item 1) **[Figure 10-110-4]** and clean the filter housing surface.

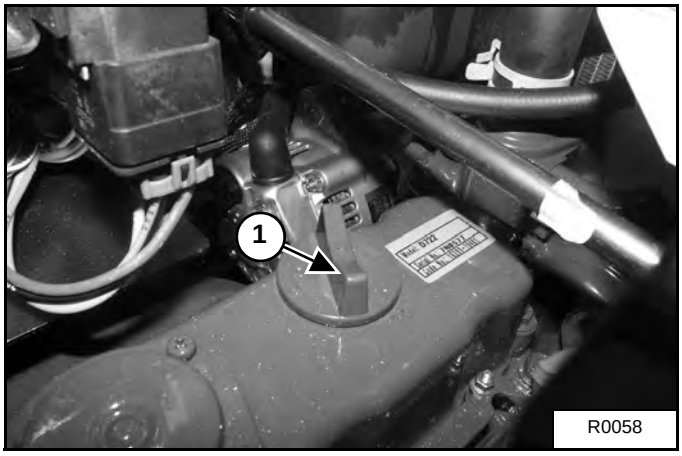
Use a genuine Bobcat filter.

Put clean oil on the filter gasket.

Install the filter and tighten by hand.

Install and tighten the oil drain plug.

Figure 10-110-5



Remove the fill cap (Item 1) **[Figure 10-110-5]**.

Put in 2,8 L (3.0 qt) of oil into the engine.

Use a good quality motor oil that meets the correct API Service Classification **[Figure 10-110-2]**. (See Engine Oil Chart on Page 10-110-1.)

Install the fill cap.

Start the engine and let it run for several minutes.

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

Add oil as needed if it is not at the top mark on the dipstick.

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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HYDRAULIC SYSTEM

Checking And Adding Fluid

Put the machine on a level surface.

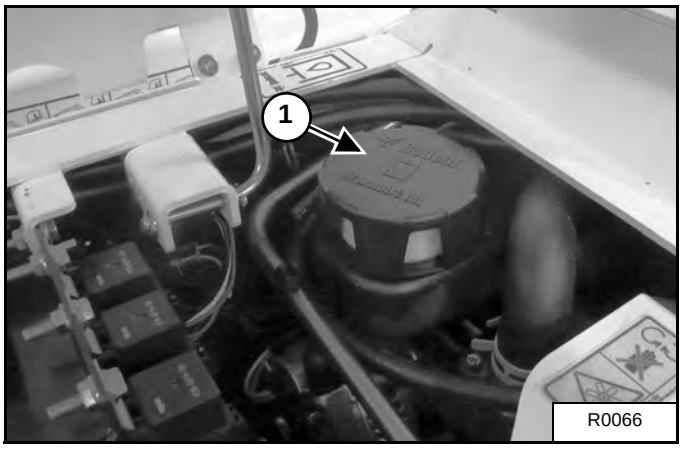
Retract the arm and bucket cylinders, put the bucket on the ground, lower the blade to the ground and retract the tracks. Stop the engine.

Figure 10-120-1



The fluid must be at the center of the sight gauge (Item 1) **[Figure 10-120-1]**.

Figure 10-120-2



Open the tailgate. Remove the oil fill cap (Item 1) **[Figure 10-120-2]**. Check the condition of the screen in the fill neck of the reservoir. The screen must be installed in the fill neck when adding oil.

Add the correct fluid to the reservoir until it is at the center of the sight gauge (Item 1) **[Figure 10-120-1]**.

Install the cap. Close the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

⚠ WARNING

AVOID INJURY OR DEATH

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

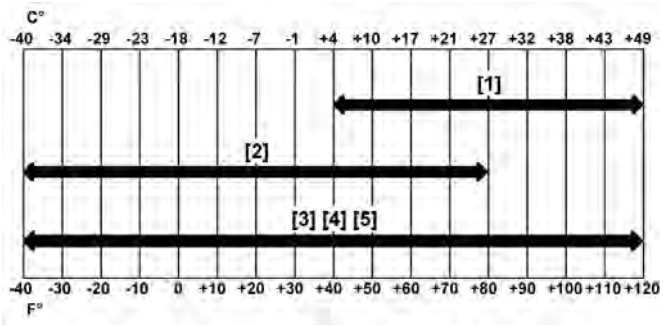
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Hydraulic / Hydrostatic Fluid Chart

Figure 10-120-3

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



TEMPERATURE RANGE ANTICIPATED DURING MACHINE USE

[1] VG 100; Minimum VI 130
[2] VG 46; Minimum VI 150
[3] BOBCAT All-Season Fluid
[4] BOBCAT Synthetic Fluid
[5] BOBCAT Biodegradable Hydraulic / Hydrostatic Fluid (Unlike biodegradable fluids that are vegetable based, Bobcat biodegradable fluid is formulated to prevent oxidation and thermal breakdown at operating temperatures.)

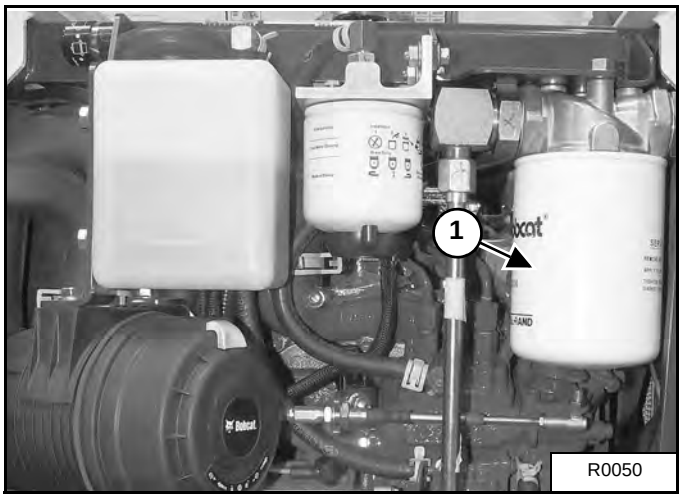
Use only recommended fluid in the hydraulic system **[Figure 10-120-3]**.

Removing And Replacing The Hydraulic Filter

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

Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

Figure 10-120-4



Remove the hydraulic filter (Item 1) **[Figure 10-120-4]**.

Clean the housing where the filter gasket makes contact.

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

Start the engine. Run the excavator through the hydraulic functions. Stop the engine. Check the fluid level at the sight gauge (Item 2) **[Figure 10-120-4]** and add as needed. Check the filter area for leaks.

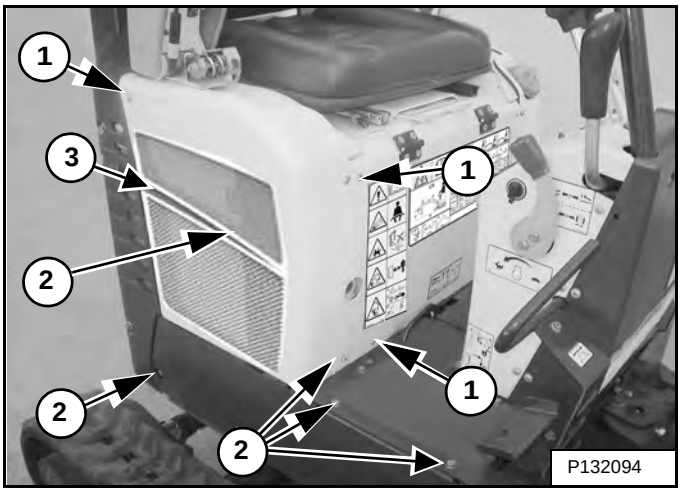
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Removing And Replacing Hydraulic Fluid

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

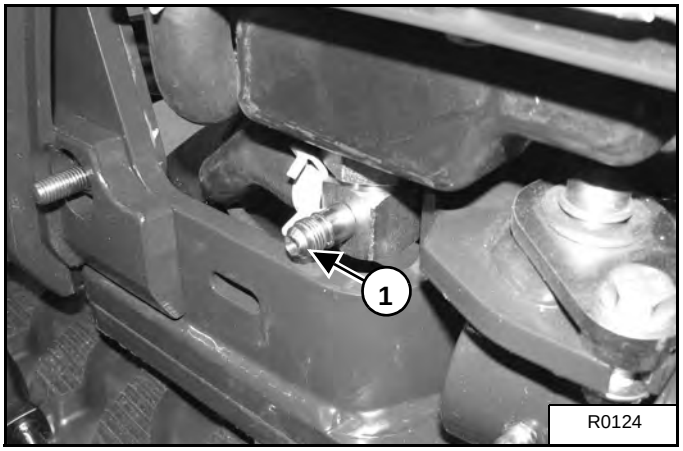
Retract the arm and bucket cylinders, lower the bucket to the ground. Stop the engine.

Figure 10-120-5



To gain access to drain the hydraulic fluid, loosen the three bolts (Item 1) from the cover. Pivot the cover downward. Then remove the black protection on the floor by loosening the bolts (Item 2 **[Figure 10-120-5]**.

Figure 10-120-6



Before removing the cap, place a container under the drain plug (Item 1) **[Figure 10-120-6]** to collect the oil.

Remove the cap and 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

Install the cap again.

Add fluid to the reservoir until it is at the center of the sight gauge (Item 3) **[Figure 10-120-1]**.

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

Replace the black protection and the cover.

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LUBRICATION OF THE EXCAVATOR

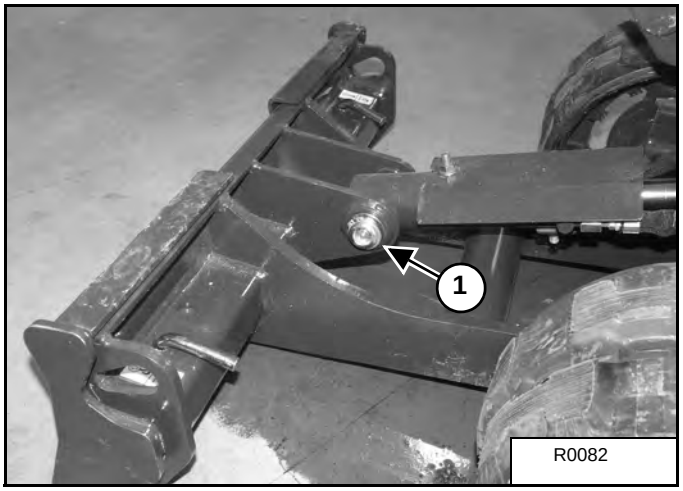
Lubrication Locations

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

Record the operating hours each time you lubricate the Hydraulic Excavator.

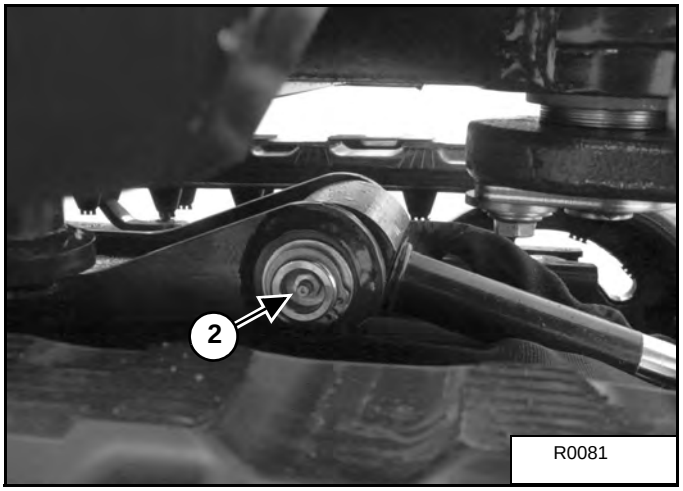
Always use a good quality lithium based multipurpose grease when lubricating the excavator. Apply the lubricant until extra grease shows.

Figure 10-130-1



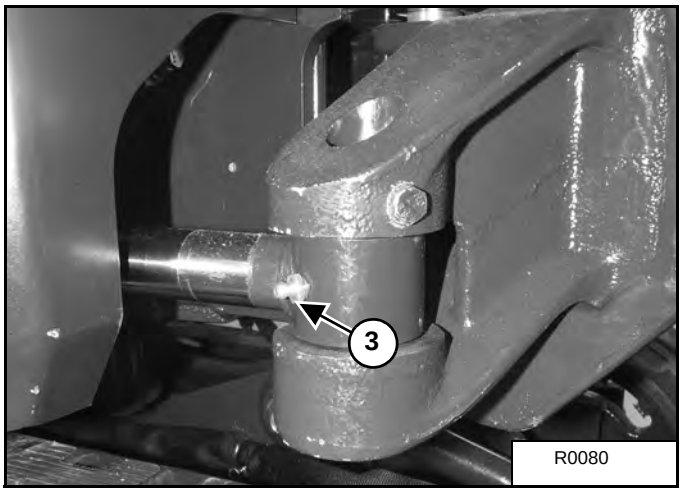
1. Blade Cylinder-Base End, every 8 - 10 hours (Item 1) **[Figure 10-130-1]**.

Figure 10-130-2



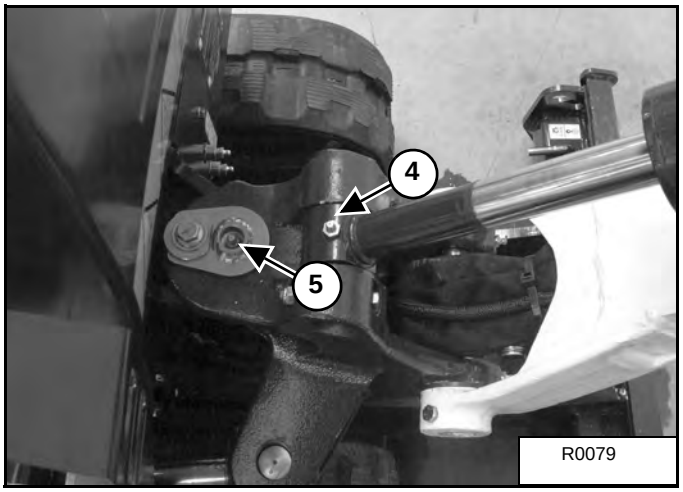
2. Blade Pivots, every 8 - 10 hours (Item 2) **[Figure 10-130-2]**.

Figure 10-130-3



3. Boom Swing Cylinder, Rod End, every 8 - 10 hours (Item 3) **[Figure 10-130-3]**.

Figure 10-130-4



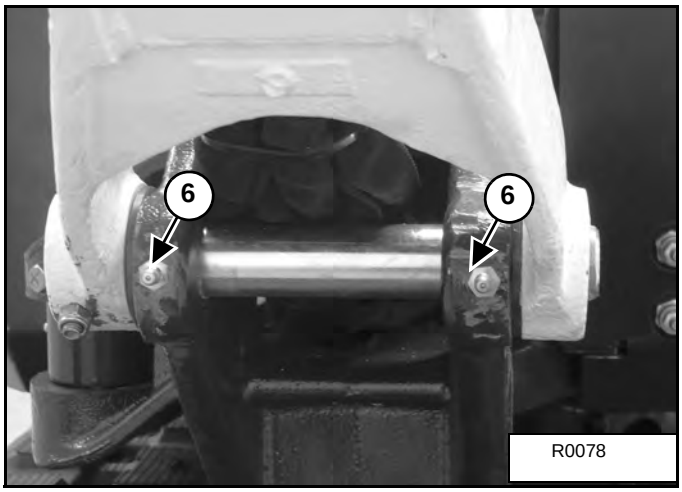
4. Boom Cylinder, Rod End (Item 4) **[Figure 10-130-4]**.

5. Boom Swing Pivot, every 8 - 10 hours (Item 5) **[Figure 10-130-4]**.

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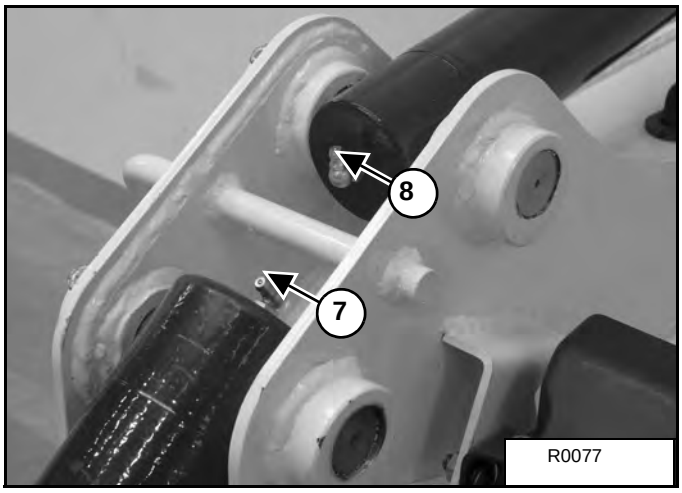
Lubrication Locations (Cont'd)

Figure 10-130-5



6. Boom, Base Pivot, every 8 - 10 hours (Item 6) **[Figure 10-130-5]**.

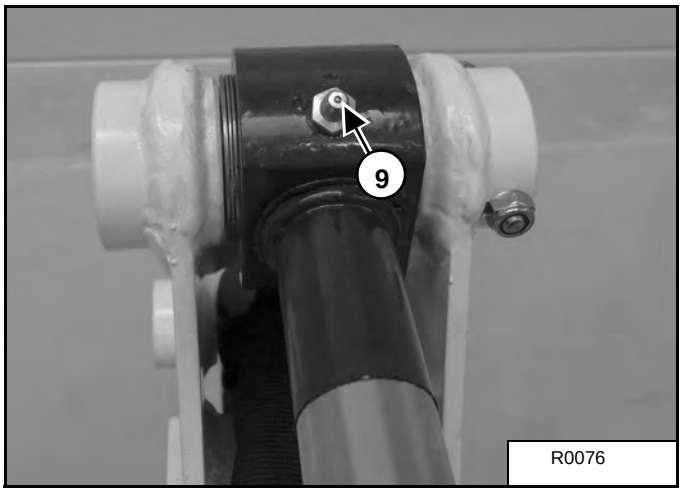
Figure 10-130-6



7. Boom Cylinder, Base End, every 8 - 10 hours (Item 7) **[Figure 10-130-6]**.

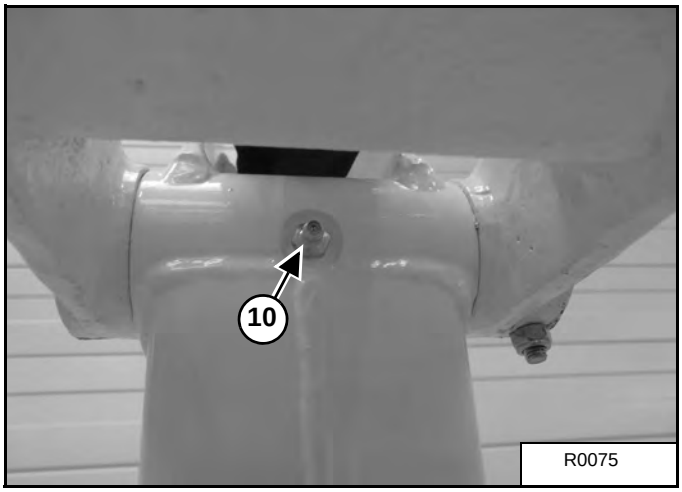
8. Arm Cylinder, Base End, every 8 - 10 hours (Item 8) **[Figure 10-130-6]**.

Figure 10-130-7



9. Arm Cylinder, Rod End, every 8 - 10 hours (Item 9) **[Figure 10-130-7]**.

Figure 10-130-8

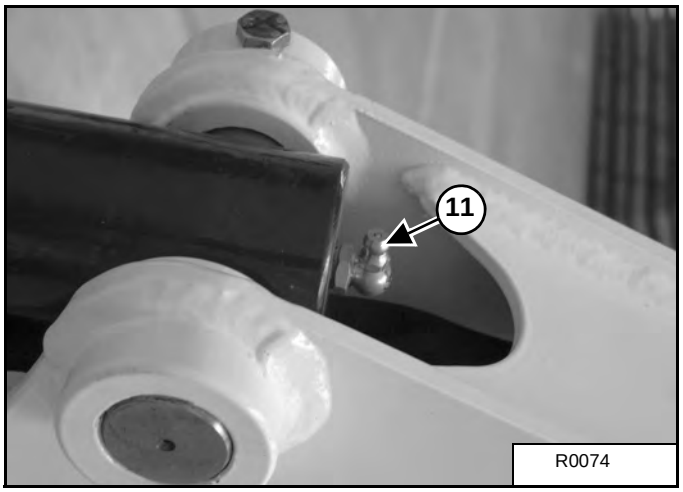


10. Arm Pivot, every 8 - 10 hours (Item 10) **[Figure 10-130-8]**.

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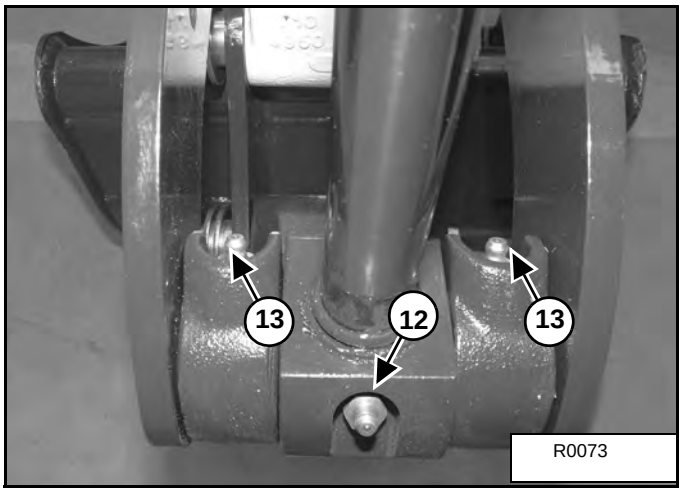
Lubrication Locations (Cont'd)

Figure 10-130-9



11. Bucket Cylinder, Base End, every 8 - 10 hours (Item 11) **[Figure 10-130-9]**.

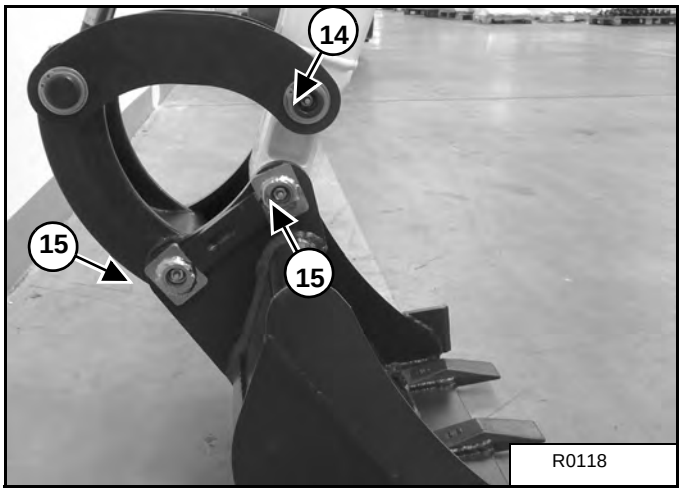
Figure 10-130-10



12. Bucket Cylinder, Rod End, every 8 - 10 hours (Item 12) **[Figure 10-130-10]**.

13. Bucket Link, Bucket Cylinder Pivot, every 8 - 10 hours (Item 13) **[Figure 10-130-10]**.

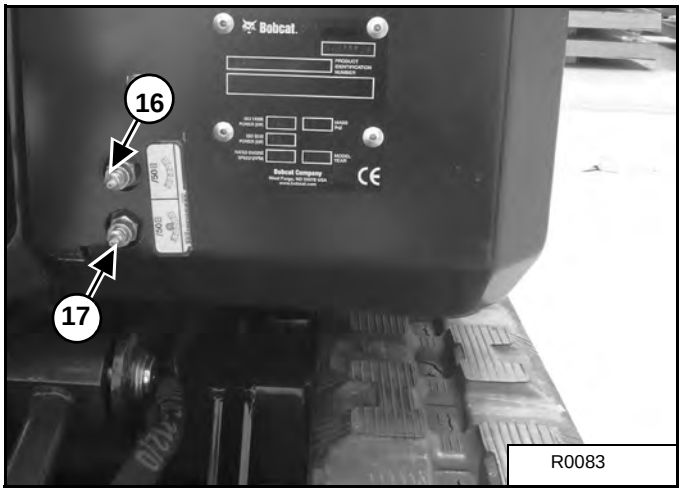
Figure 10-130-11



14. Bucket Link Pivot, every 8 - 10 hours (Item 14) **[Figure 10-130-11]**.

15. Bucket Pivots, every 8 - 10 hours (Item 15) **[Figure 10-130-11]**.

Figure 10-130-12



16. Swing Circle Bearing, every 50 hours (Item 16) **[Figure 10-130-12]**.

17. Swing Circle Pinion (Item 17) **[Figure 10-130-12]**. Pump 4 times with a grease gun. Rotate the upperstructure 180° and repeat.

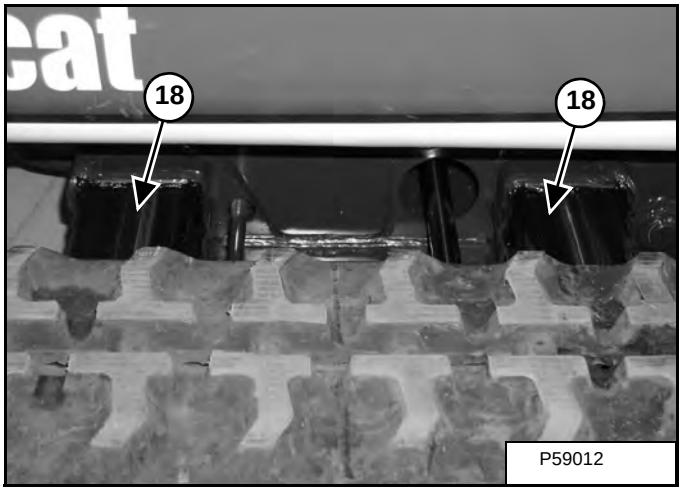
NOTE: Do not over-grease the swing circle; damage to the seal could result. Pump 4 - 5 times with a grease gun. Rotate the upperstructure 90° and repeat three more times.

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Lubrication Locations (Cont'd)

Lubricate the following locations on the hydraulic excavator AS REQUIRED:

Figure 10-130-13



18. Track Expansion Tube (Item 18) **[Figure 10-130-13]**.

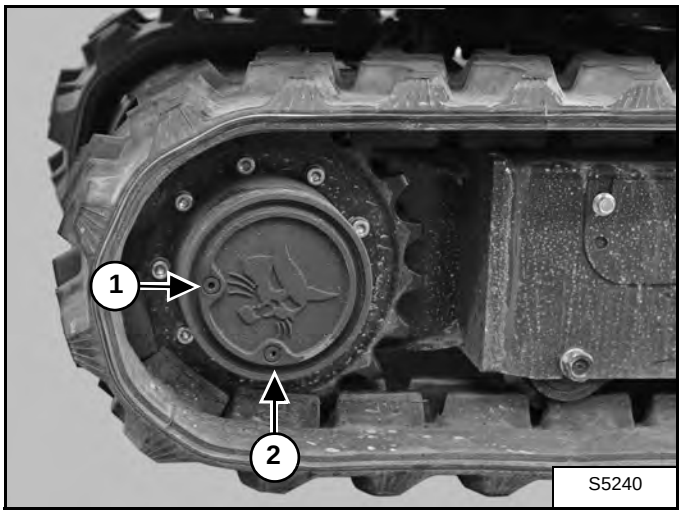
NOTE: Spread lubriplate gearshield extra heavy grease evenly on wear surfaces on both sides of excavator as required.

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TRAVEL MOTOR

Checking And Adding Oil

Figure 10-140-1



Put the machine on a level surface with the plugs positioned as shown (Items 1 and 2) **[Figure 10-140-1]**.

Remove the top plug (Item 1) **[Figure 10-140-1]**. The oil level should be at the bottom edge of the plug hole.

Add gear lube through the plug hole if the oil level is below the hole.

Install and tighten the top plug.

Repeat the procedure for the other side.

Removing And Replacing Oil

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

Put the machine on a level surface with the plugs positioned as shown (Items 1 and 2) **[Figure 10-140-1]**.

Remove the bottom plug (Item 2) and top plug (Item 1) **[Figure 10-140-1]** and drain into a container. Recycle or dispose of the used lubricant in an environmentally safe manner.

After all the gear lube is removed, install the bottom plug (Item 2) **[Figure 10-140-1]**.

Add gear lube to the top plug hole (Item 1) **[Figure 10-140-1]** until the gear lube level is at the bottom edge of the plug hole.

Install and tighten the top plug.

Repeat the procedure for the other side.

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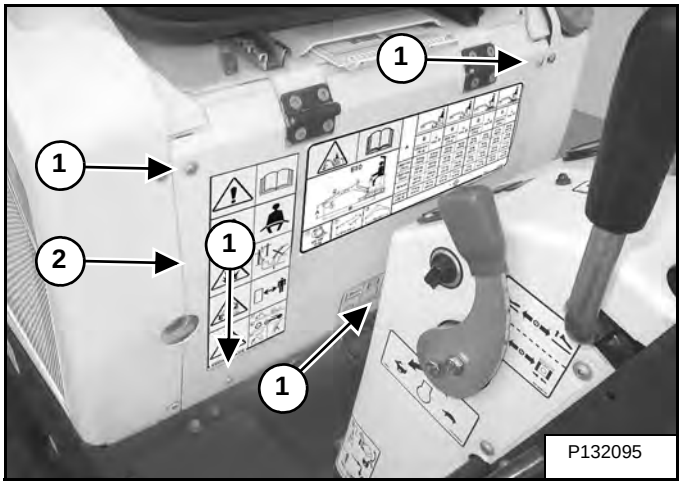


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SPARK ARRESTER MUFFLER

Cleaning Procedure

Figure 10-150-1



Remove the four bolts (Item 1) **[Figure 10-150-1]**.

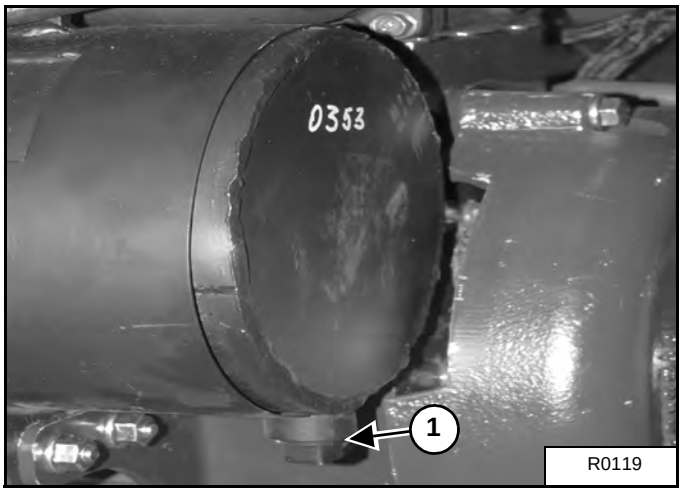
Remove the cover (Item 2) **[Figure 10-150-1]**.

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

Do not operate the excavator with a defective exhaust system.

Stop the engine. Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

Figure 10-150-2



Remove the plug (Item 1) **[Figure 10-150-2]** from the bottom of the muffler.

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

Stop the engine. Install and tighten the plug.

Install the cover (Item 2) **[Figure 10-150-1]**.

tighten the bolts (Item 1) **[Figure 10-150-1]**.

Close the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

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

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

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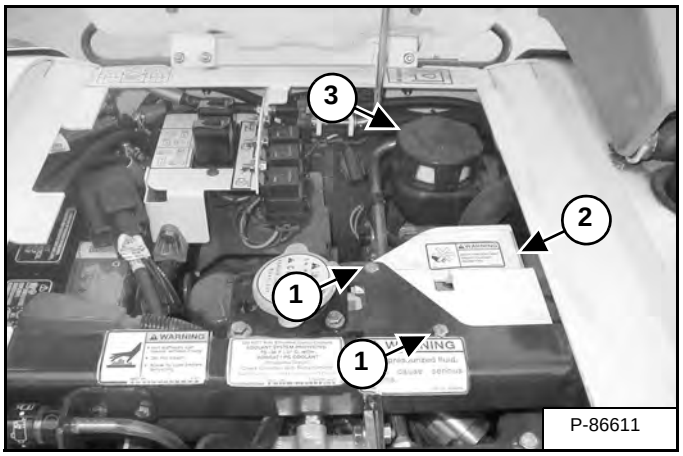
ALTERNATOR BELT

Belt Adjustment

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.

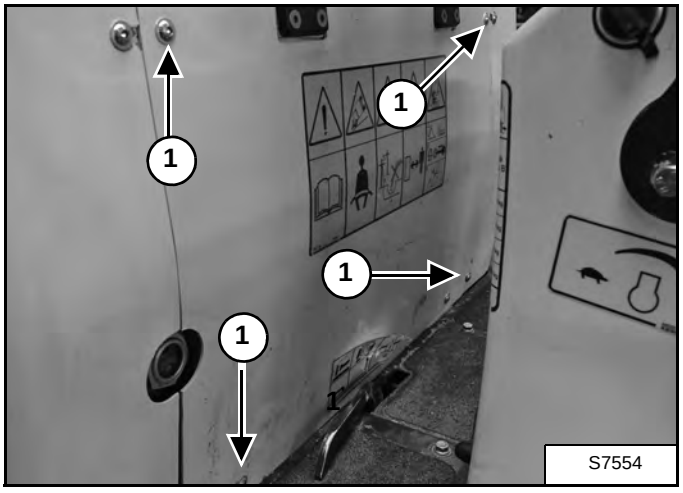
Figure 10-160-1



Remove the two bolts (Item 1) and remove the fan guard (Item 2) **[Figure 10-160-1]**.

Remove the fill cap (Item 3) **[Figure 10-160-1]** from the hydraulic reservoir.

Figure 10-160-2



Remove the four bolts (Item 1) **[Figure 10-160-2]**.

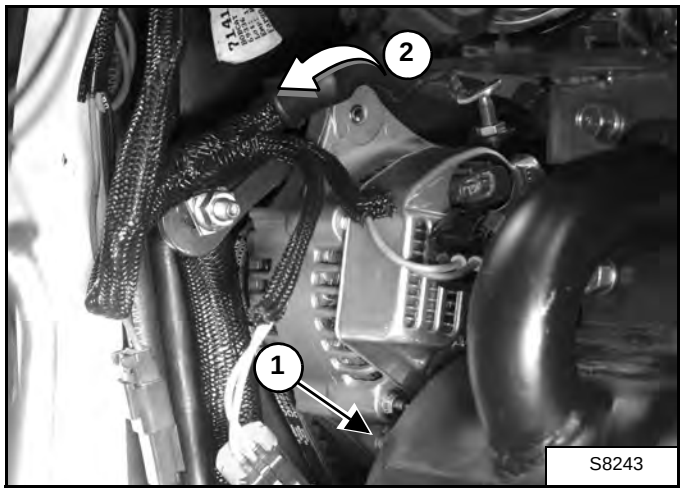
Remove the cover.

Figure 10-160-3



Loosen the upper alternator bolt **[Figure 10-160-3]**.

Figure 10-160-4

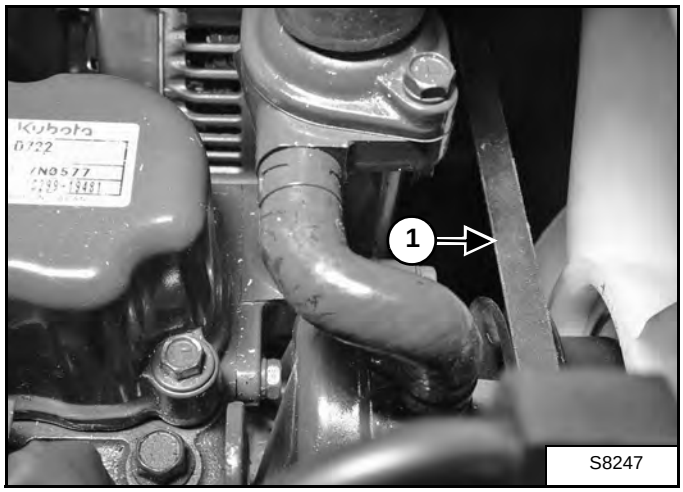


Loosen the lower alternator mounting and adjustment bolt (Item 1) **[Figure 10-160-4]**.

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Belt Adjustment (Cont'd)

Figure 10-160-5



If a belt tension tool is available, move the alternator toward the front of the machine (Item 2) **[Figure 10-160-4]** until the belt (Item 1) **[Figure 10-160-5]** has (New belt = 56 - 60 lbf or Used belt = 48 - 52 lbf) tension.

If a belt tension tool is not available, move the alternator toward the front of the machine (Item 2) **[Figure 10-160-4]** until the belt (Item 1) **[Figure 10-160-5]** has 13 mm (0.50 in) movement at the middle of the belt span with 58 N (13 lb) of force.

Tighten the mounting and adjustment bolts.

Install the cover, fill cap and fan guard.

Belt Replacement

Remove components to access the alternator belt. (See Belt Replacement on Page 10-160-2.)

Loosen the alternator mounting and adjustment bolts (Item 1) **[Figure 10-160-4]** and loosen the belt fully.

Remove the belt and install a new belt.

Adjust the belt. (See Belt Adjustment on Page 10-160-1.)

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SEAT BELT

Inspection And Maintenance

⚠ WARNING

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

W-2466-0703

Check the seat belt daily for correct function.

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

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

The items below are referenced in **[Figure 10-170-1]**.

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.

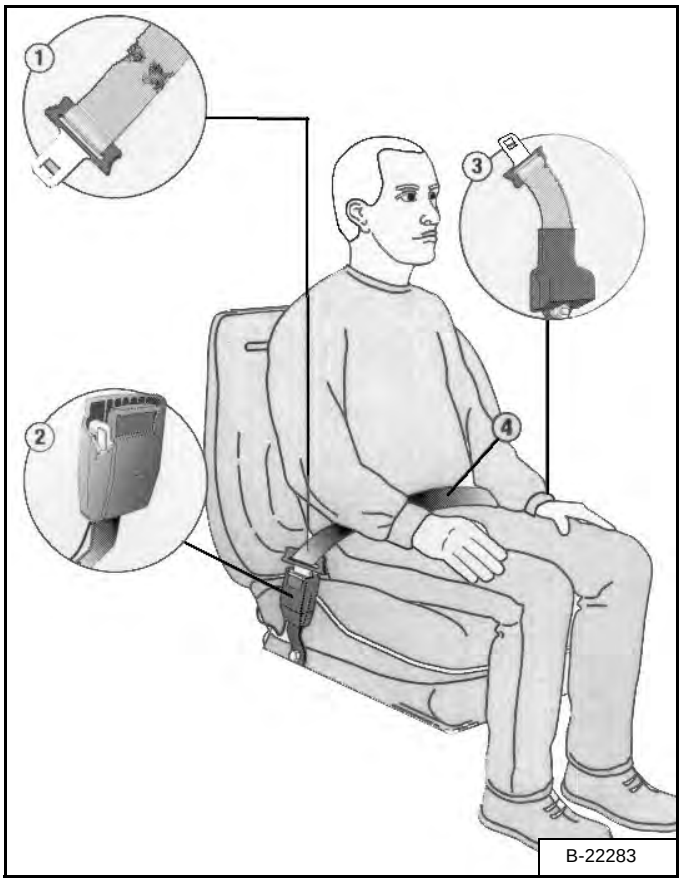
2. Check the buckle and latch for correct operation. Make sure latch plate is not excessively worn, deformed or buckle is not damaged or casing broken.

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 the webbing correctly.

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

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

Figure 10-170-1



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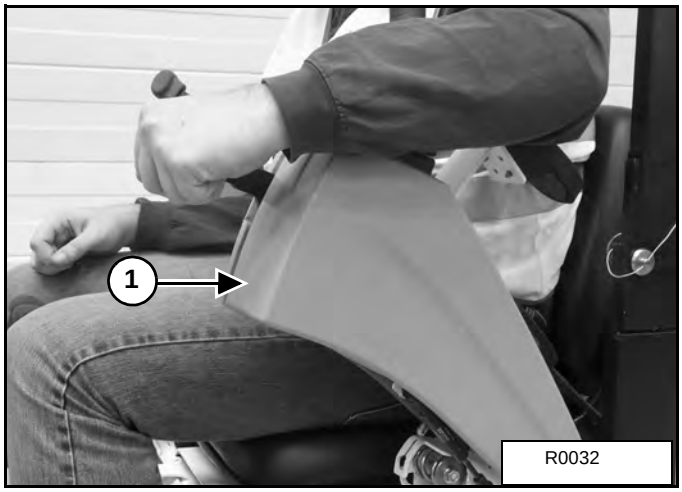


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CONTROL CONSOLE LOCKOUTS

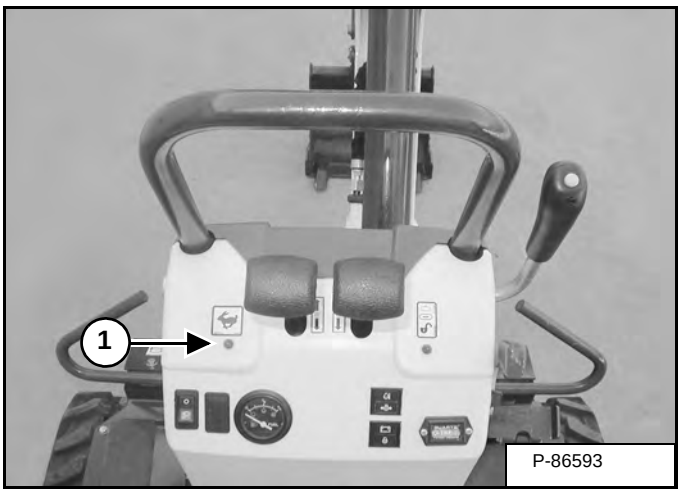
Inspection And Maintenance

Figure 10-180-1



When a console is raised **[Figure 10-180-1]**, the hydraulic control joysticks and traction system must not function.

Figure 10-180-2



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

Raise the right console (Item 1) **[Figure 10-180-1]**. The green light (Item 1) **[Figure 10-180-2]** on the console will turn off.

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

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

Lower the left console. Raise the right console and repeat the inspection procedure.

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

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

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EXCAVATOR STORAGE AND RETURN TO SERVICE

Storage

Sometimes it may 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 oil 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 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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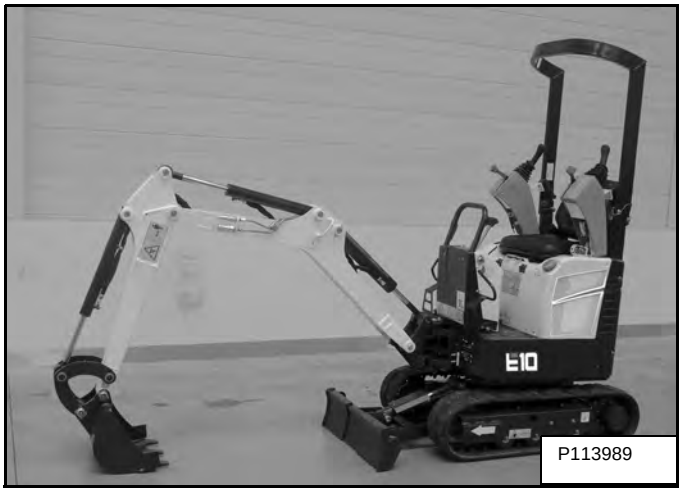


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STOPPING THE ENGINE AND LEAVING THE EXCAVATOR

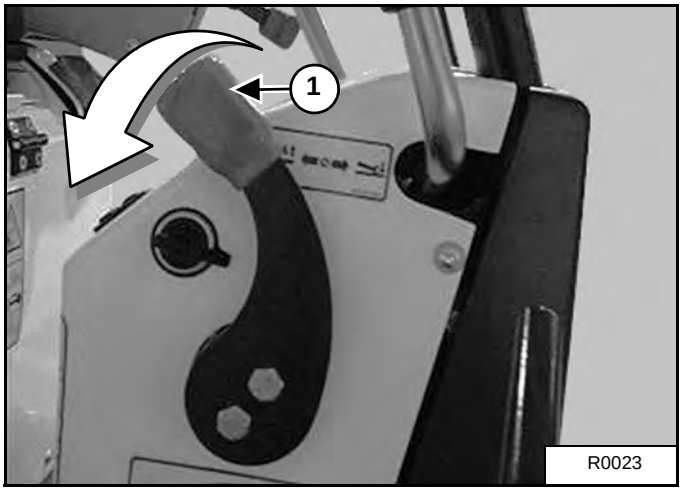
Procedure

Figure 10-200-1



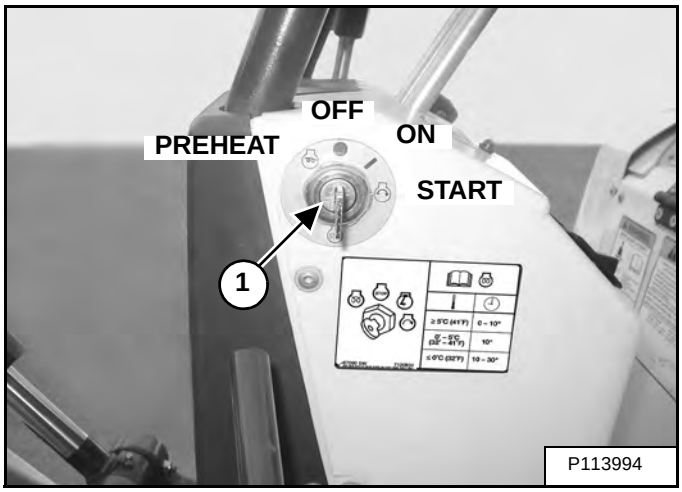
Stop the machine on level ground. Lower the work equipment and the blade to the ground **[Figure 10-200-1]**.

Figure 10-200-2



Move the engine speed control lever (Item 1) **[Figure 10-200-2]** fully down and run the engine at idle speed for about 5 minutes to allow it to cool.

Figure 10-200-3



Turn the key (Item 1) **[Figure 10-200-3]** to the OFF position.

Stop the engine.

Raise the control console(s).

Disconnect the seat belt.

Remove the key from the switch to prevent operation of machine by unauthorized personnel.

Exit machine.

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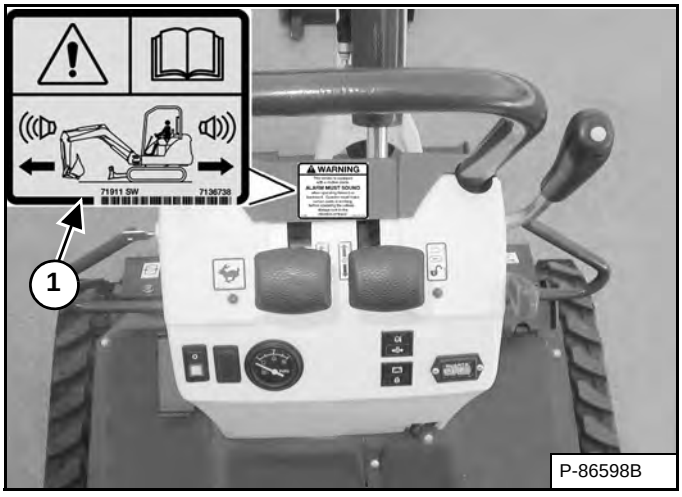
MOTION ALARM

Description

This excavator may be equipped with a motion alarm system. The motion alarm will sound when the operator moves the travel control levers in either the forward or reverse direction. Slight movement of the steering levers in either the forward or reverse direction is required with hydraulic components before the motion alarm will sound.

Inspecting

Figure 10-210-1



Inspect for damaged or missing motion alarm decal (Item 1) **[Figure 10-210-1]**. Replace if damaged.

Sit in the operator's seat. Turn Start key to ON position but DO NOT start the engine.

⚠ 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.

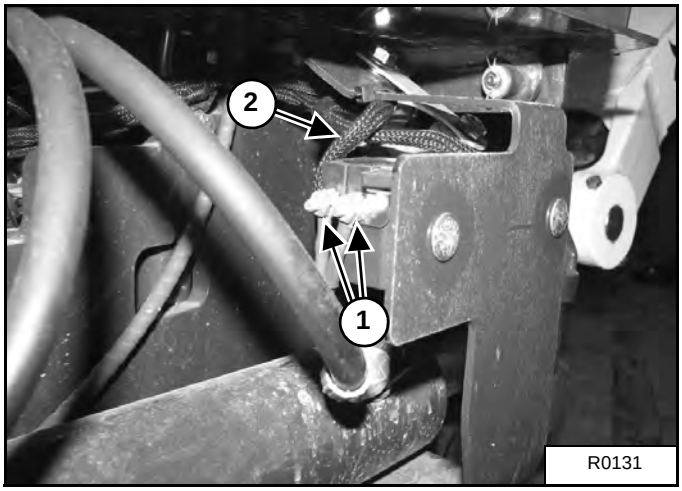
W-2050-0807

Move the travel control levers in the forward direction. The motion alarm must sound. Move the travel control levers in the reverse direction. The motion alarm must sound.

Turn the Start key to the OFF position.

The motion alarm is located on the lower part of the frame, on top of the swing cylinder.

Figure 10-210-2



Inspect the motion alarm connections (Item 1), wire harness (Item 2) **[Figure 10-210-2]** and motion alarm switch (Item 1) **[Figure 10-210-3]** for tightness and damage. Repair or replace any damaged components.

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

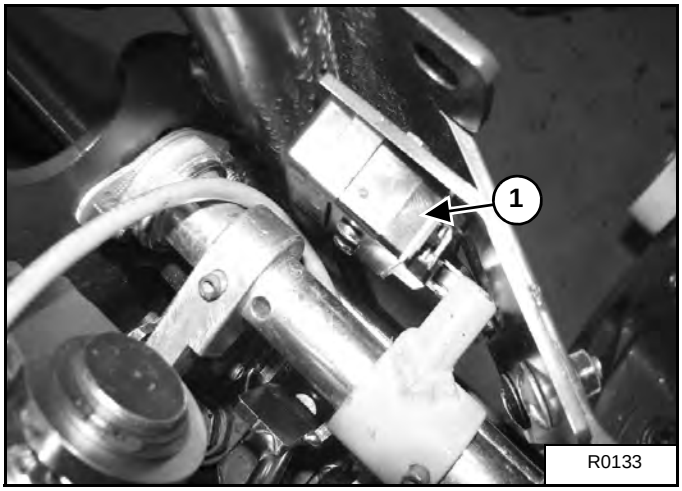
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MOTION ALARM (CONT'D)

Adjusting Switch Position

Stop the engine. Remove the floor mat and floorplate.

Figure 10-210-3



Place the travel control levers in the NEUTRAL position.

Loosen the screws (Item 1) **[Figure 10-210-3]** securing the motion alarm switch.

Position the motion alarm switch roller (Item 2) so that it makes contact with bearing (Item 3) until it opens the switch circuit. (Listen for the click of the switch.) Tighten the screws (Item 1) **[Figure 10-210-3]** securing the switch to the bracket to 1,6 - 2,1 N•m (14 - 19 in-lb).

Inspect the motion alarm system for correct operation after adjustment.

⚠ 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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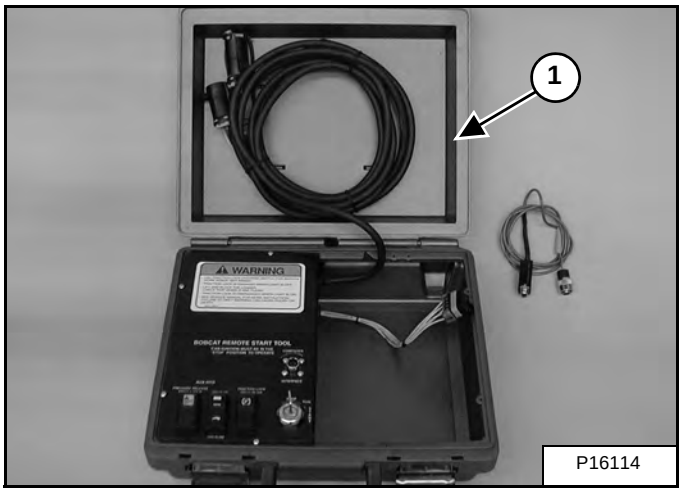
REMOTE START TOOL KIT - MEL1563

Remote Start Tool - MEL1563

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

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

Figure 10-220-1

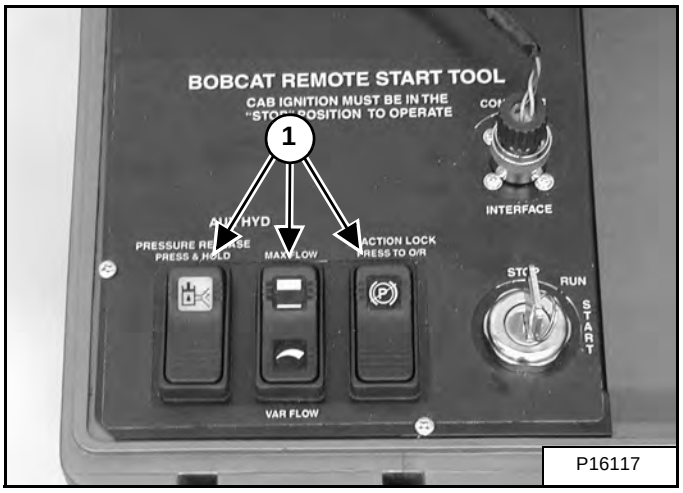


The Remote Start Tool (Item 1) **[Figure 10-220-1]** is used for excavators.

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 PC.

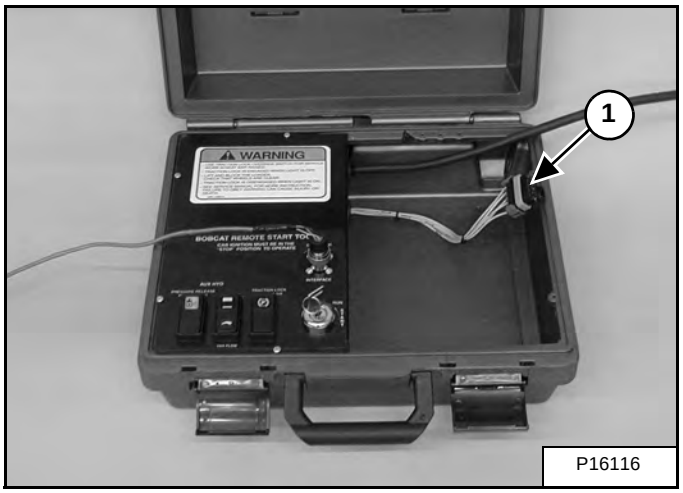
Figure 10-220-2



The three function buttons (Item 1) **[Figure 10-220-2]** are non-functional for excavators.

NOTE: Excavators can not be started by using the Remote Start Tool.

Figure 10-220-3

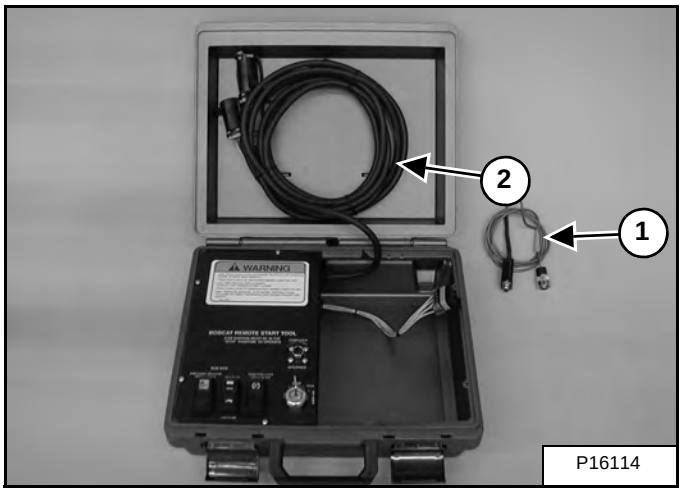


The 10-pin rectangular connector (Item 1) **[Figure 10-220-3]** is not used for an excavator application.

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Remote Start Tool - MEL1563 (Cont'd)

Figure 10-220-4



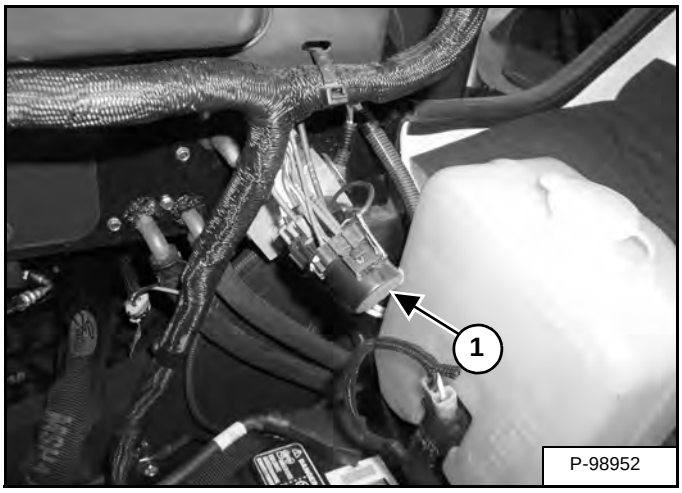
The service tool harness communicator (Item 1) **[Figure 10-220-4]** is used to connect the Remote Start Tool to the Service PC.

Remove the service tool harness (Item 2) **[Figure 10-220-4]** from the cover.

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

Open the right side cover.

Figure 10-220-5



Remove the plug (Item 1) **[Figure 10-220-5]** from the excavator harness connector.

Connect the service tool harness to the excavator harness.

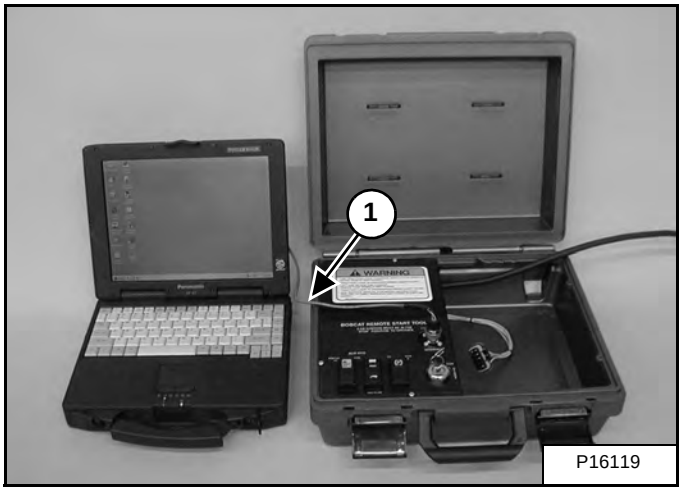
Connect the service tool harness communicator (MEL1566) to the designated serial port on the Service PC.

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Service Tool Harness Communicator - MEL1566

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

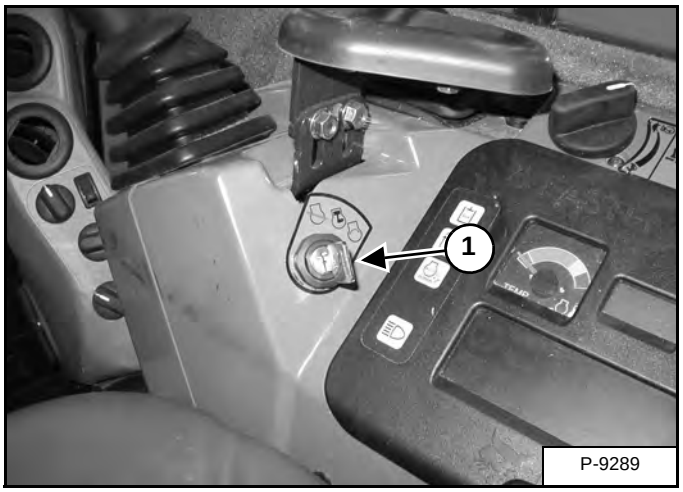
Figure 10-220-6



The Service Tool Harness Communicator (Item 1) **[Figure 10-220-6]** is required to connect the Service PC to the remote start tool.

Key Switch

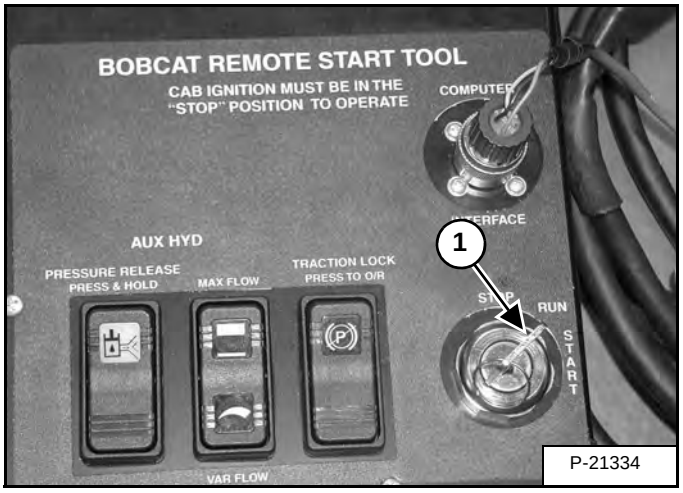
Figure 10-220-7



Turn the key (Item 1) **[Figure 10-220-7]** to the RUN position on the excavator.

NOTE: DO NOT start the excavator.

Figure 10-220-8



Turn the key (Item 1) **[Figure 10-220-8]** to the RUN position on the Remote Start Tool.

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REMOTE START TOOL KIT - MEL1563 (CONT'D)

Service Tool Harness Communicator - MEL1566 (Cont'd)

Keyless Start

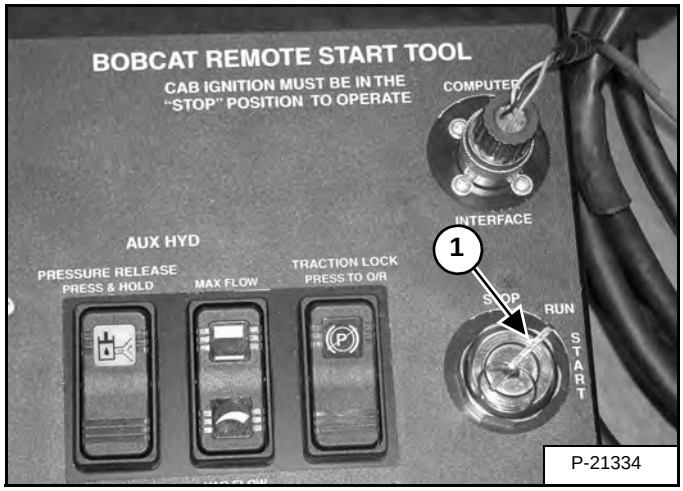
Figure 10-220-9



Press the ENTER CODE button (Item 1) **[Figure 10-220-9]** to turn power on.

NOTE: DO NOT start the excavator.

Figure 10-220-10



Turn the key (Item 1) **[Figure 10-220-10]** to the RUN position on the Remote Start Tool.

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

Remote Start Tool (Service Tool) - 7003030

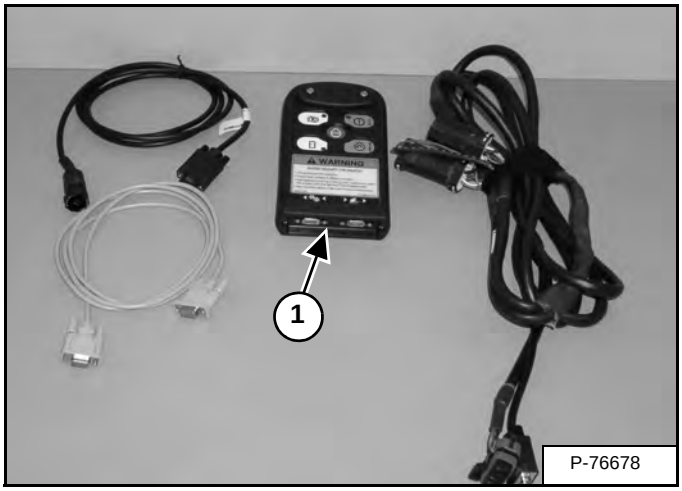
Tools that will be needed to complete the following steps are:

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

Kit Includes:

7003030 - Remote Start Tool (Service Tool)
6689747 - Excavator Service Tool Harness
6689746 - Computer Service Tool Harness

Figure 10-221-1

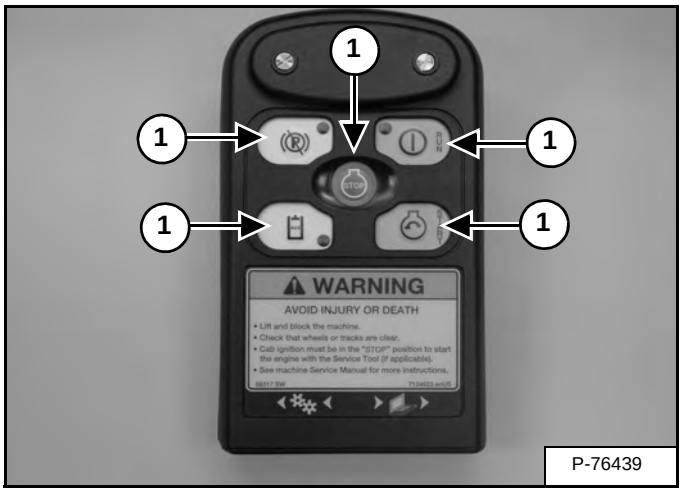


The Remote Start Tool (Item 1) **[Figure 10-221-1]** is used for excavators.

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 PC.

Figure 10-221-2



The five function buttons (Item 1) **[Figure 10-221-2]** are non-functional for excavators.

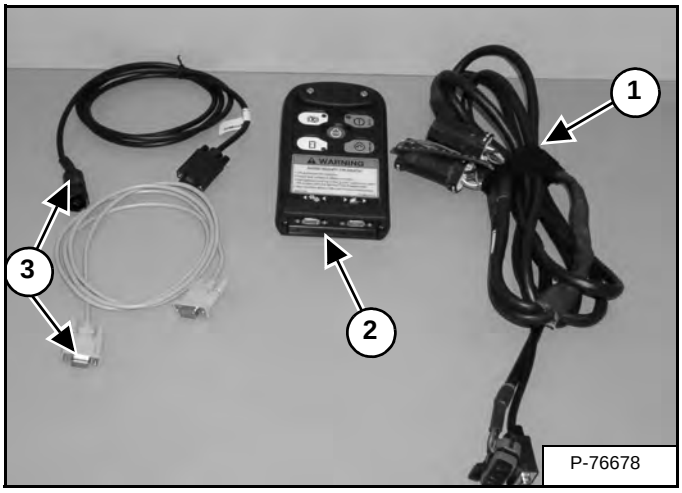
NOTE: Excavators can not be started by using the Remote Start Tool.

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

Excavator Service Tool Harness - 6689747

Figure 10-221-3



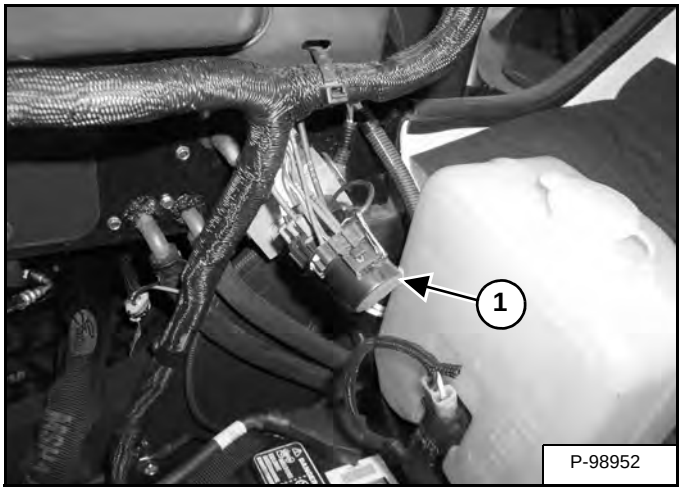
The service tool harness control (Item 1) **[Figure 10-221-3]** is used to connect the Remote Start Tool (Item 2) **[Figure 10-221-3]** to the electrical system on the excavator.

The service tool harness communicator (Item 3) **[Figure 10-221-3]** is used to connect the Remote Start Tool to the Service PC.

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

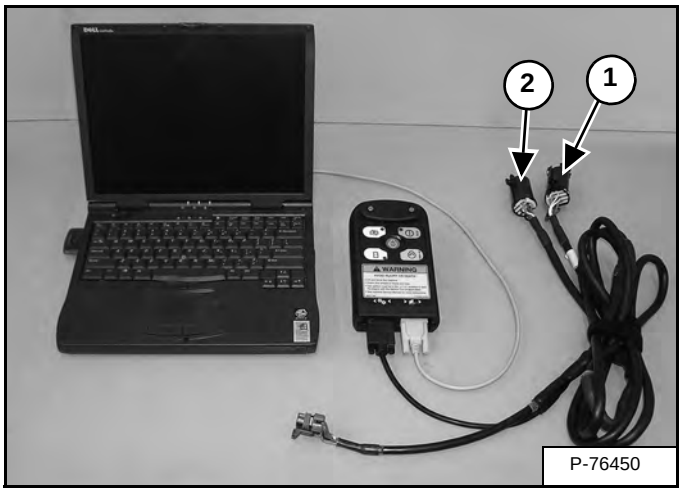
Open the right side cover.

Figure 10-221-4



Remove the plug (Item 1) **[Figure 10-221-4]** from the excavator harness connector.

Figure 10-221-5



NOTE: The Remote Start Tool (Service Tool) connection harness has two connectors (Item 1) and (Item 2). The main connector (Item 1) [Figure 10-221-5] is always used for connection to the excavator harness.

The second connector (Item 2) [Figure 10-221-5] is not used for 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 10-221-5]** 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.

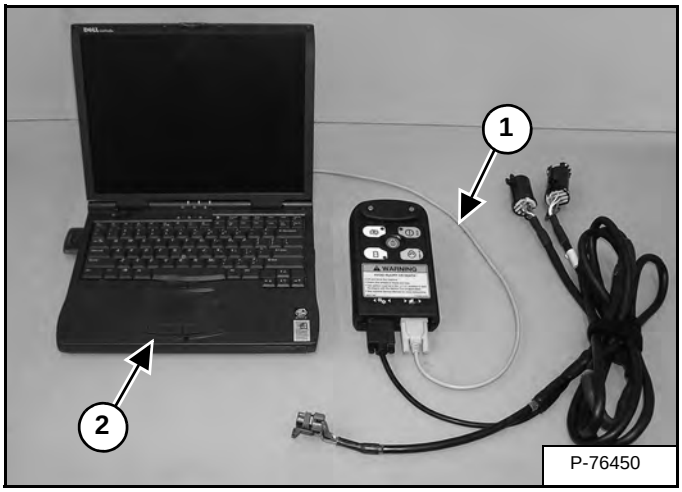
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REMOTE START TOOL (SERVICE TOOL) KIT - 7003031 (CONT'D)

Computer Service Tool Harness - 6689746

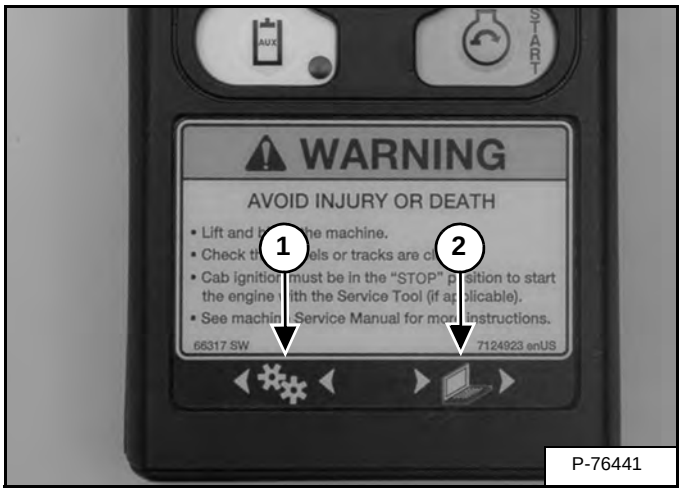
NOTE: To monitor, diagnose or load new software the Service PC must be connected to the Remote Start Tool.

Figure 10-221-6



The Computer Service Tool Harness (Item 1) **[Figure 10-221-6]** is required to connect Remote Start Tool (Service Tool) to the Service PC (Item 2) **[Figure 10-221-6]**.

Figure 10-221-7



The gear icon with the left facing arrows (Item 1) **[Figure 10-221-7]** 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 10-221-7]** will illuminate and blink when the Remote Start Tool (Service Tool) is transmitting data to and from the computer.

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HYDRAULIC/HYDROSTATIC SCHEMATIC
E10 (S/N A33P11001 AND ABOVE)

(PRINTED OCTOBER 2017)
V-1214legend

LEGEND

1. HYDRAULIC RESERVOIR with FILL STRAINER
   Reservoir Capacity: . . . . . 2,6 L (2.75 qt)
   System Capacity to centre of site gauge:
   . . . . . 10,1 L (10.7 qt)
2. BREATHER/FILL CAP with FILTER
3. HYDRAULIC FILTER ELEMENT
   10 Micron
4. FILTER BY-PASS 17200 kPa (1,72 bar) (25 psi)
5. HYDRAULIC PUMP - 2 Section Gear Pump:
   Pump Section 1
   10,0 Lpm (2.6 gpm) at High Engine Idle
   Pump Section 2
   10,0 Lpm (2.6 gpm) at High Engine Idle
6. SOLENOID VALVE - SYSTEM BY-PASS
7. MAIN RELIEF VALVE:
   18400 – 19200 kPa (184 - 192 bar) (2660 - 2770 psi)
8. PRESSURE REDUCING VALVE:
   3000 kPa (30 bar) (435 psi)
9. SOLENOID VALVE - CONSOLE (Joystick)
   LOCK OUT
10. ACCUMULATOR
    Nitrogen . . . . . 1100 kPa (11 bar) (165 psi)
    non-rechargeable
11. TEST PORT - "F" Port - Gauge Test Port
12. TEST PORT - “PS1” Port - Pilot Pressure
    Test Port
13. CHECK VALVE
14. BUILD UP VALVE: 2700 kPa (27 bar) (391 psi)
15. PORT RELIEF / ANTICAVITATION VALVE
    Boom Cylinder (Base End)
    23200 kPa (232 bar) (3365 psi)
16. PORT RELIEF / ANTICAVITATION VALVE
    Arm Cylinder (Base End)
    22500 kPa (225 bar) (3262 psi)
17. SLEW MOTOR - CROSS PORT RELIEF
    VALVE . . . . 8400 kPa (84 bar) (1218 psi)
18. ANTICAVITATION VALVE
    Boom Swing Cylinder (Rod End)
19. ANTICAVITATION VALVE: Arm Cylinder (Rod End)
    – Early Models Only
    PLUGGED PORT – Later Models Only
20. CHECK VALVE
21. ORIFICE . . . . . 1,2 mm (0.047 in)
22. ORIFICE . . . . . 1,1 mm (0.043 in)
23. ORIFICE . . . . . 1,1 mm (0.043 in)
24. TRAVEL MOTOR SPOOL
25. TWO SPEED VALVE - Travel Motor
26. CHECK VALVE (Later Models Only)
27. ORIFICE . . . . . 1,2 mm (0.047 in)
    (Later Models Only)
28. PORT RELIEF / ANTICAVITATION VALVE
    Bucket Cylinder (Base End) – (Later Models Only)
    23200 kPa (232 bar) (3365 psi)

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

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V-1214 (10-25-17)

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HYDRAULIC/HYDROSTATIC SCHEMATIC
E10 S/N A33P11001 AND ABOVE

(PRINTED OCTOBER 2017)
V-1214

R.H. TRAVEL MOTOR

PS
P1
P2
T1

TWO SPEED VALVE

BLADE CYLINDER

EXPAND CYLINDER

CENTER SWIVEL JOINT

BOOM CYLINDER

BUCKET CYLINDER

TRACK EXPAND VALVE

AUXILIARY HYDRAULIC COUPLERS
TWO WAY FLOW **(OPTIONAL)**
MALE (RETURN)
FEMALE (PRESSURE)

AUXILIARY HYDRAULIC COUPLERS
ONE WAY FLOW **(STANDARD)**
MALE (RETURN)
FEMALE (PRESSURE)

BOOM SWING CYLINDER

ARM CYLINDER

SLEW MOTOR
UPPERSTRUCTURE TURNS CCW
UPPERSTRUCTURE TURNS CW

L.H. TRAVEL MOTOR

RH TRAVEL
BOOM
BUCKET
BLADE
AUX
BOOM SWING
ARM
SLEW
LH TRAVEL

P2
P1
T1

PB
CV
T

BUILD-UP VALVE

COOLER (OPTIONAL WITH DEMOLITION KIT)

PS1
PS2
F
V2
V1
PUMP 1
PUMP 2
T

HYDRAULIC PUMP

RH JOYSTICK
P
T

LH JOYSTICK

RESERVOIR

FILTER W/ BY-PASS

ENCLOSURE
PUMP SUPPLY
WORKING CIRCUITS
PILOT PRESSURE
SYSTEM RETURN LINES

INTERSECTION OF HYDRAULIC LINES INDICATED BY JUNTION DOT

V-1214 (10-25-17)

HYDRAULIC/HYDROSTATIC SCHEMATIC
E10 (S/N B4K911001 AND ABOVE)

(PRINTED OCTOBER 2017)
V-1213legend

LEGEND

(1) HYDRAULIC RESERVOIR
(PRESSURIZED) with FILL STRAINER
Reservoir Capacity: . . . . . 2,6 L (2.75 qt)
System Capacity to center of site gauge:
. . . . . 10,1 L (10.7 qt)

(2) BREATHER/FILL CAP - with FILTER

(3) HYDRAULIC FILTER ELEMENT
10 Micron

(4) FILTER BY-PASS: 172 kPa (1,72 bar) (25 psi)

(5) HYDRAULIC PUMP - 2 Section Gear Pump:
Pump Section 1
10,0 Lpm (2.6 U.S. gpm) at High Engine Idle
Pump Section 2
10,0 Lpm (2.6 U.S. gpm) at High Engine Idle

(6) SOLENOID VALVE - SYSTEM BY-PASS

(7) MAIN RELIEF VALVE: 18400 – 19200 kPa
(184 - 192 bar) (2660 - 2770 psi)

(8) PRESSURE REDUCING VALVE
3000 kPa (30 bar) (435 psi)

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

(10) ACCUMULATOR
Nitrogen: 1100 kPa (11 bar) (165 psi)
non-rechargeable

(11) TEST PORT - "F" Port - Gauge Test Port

(12) TEST PORT – “PS1” Port - Pilot Pressure
Test Port

(13) CHECK VALVE

(14) BUILD UP VALVE: 2700 kPa (27 bar) (391 psi)

(15) PORT RELIEF / ANTICAVITATION VALVE
Boom Cylinder (Base End): 33200 kPa
(232 bar) (3365 psi)

(16) PORT RELIEF / ANTICAVITATION VALVE
Arm Cylinder (Base End): 22500 kPa
(225 bar) (3262 psi)

(17) SLEW MOTOR - CROSS PORT RELIEF
VALVE: 8400 kPa (84 bar) (1218 psi)

(18) ANTICAVITATION VALVE
Boom Swing Cylinder (Rod End)

(19) NOT USED ON THIS MODEL

(20) CHECK VALVE

(21) ORIFICE . . . . . 1,2 mm (0.04 in)

(22) ORIFICE . . . . . 1,1 mm (0.043 in)

(23) ORIFICE . . . . . 1,1 mm (0.043 in)

(24) TRAVEL MOTOR SPOOL

(25) TWO SPEED VALVE - Traval Motor

(26) CHECK VALVE (S/N AB4711177 & Above)

(27) ORIFICE . . . . . 1,2 mm (0.047 in)

(28) PORT RELIEF / ANTICAVITATION VALVE
Bucket Cylinder (Base End): 23200 kPa
(232 bar) (3365 psi)

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

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HYDRAULIC/HYDROSTATIC SCHEMATIC
E10 S/N B4K911001 AND ABOVE

(PRINTED OCTOBER 2017)
V-1213

R.H. TRAVEL MOTOR

PS
P1
P2
T1

TWO SPEED VALVE

BOOM CYLINDER

BLADE CYLINDER

BUCKET CYLINDER

TRACK EXPAND VALVE

EXPAND CYLINDER

CENTER SWIVEL JOINT

AUXILIARY HYDRAULIC COUPLERS
TWO WAY FLOW **(OPTIONAL)**
MALE (RETURN)
FEMALE (PRESSURE)

AUXILIARY HYDRAULIC COUPLERS
MALE (RETURN)
FEMALE (PRESSURE)

BOOM SWING CYLINDER

ARM CYLINDER

SLEW MOTOR
UPPERSTRUCTURE TURNS CCW
UPPERSTRUCTURE TURNS CW

L.H. TRAVEL MOTOR

RH TRAVEL
BOOM
BUCKET
BLADE
AUX
BOOM SWING
ARM
SLEW
LH TRAVEL

P2
P1
T1

PB
PS1
PS2
F
V2
V1
T
PUMP 1
PUMP 2
HYDRAULIC PUMP

CV
BUILD-UP VALVE

R3
R1
L1
L3
STD
ISO
FRON
BACK
STD / ISO VALVE

RH JOYSTICK
LH JOYSTICK
P
T

OIL COOLER (OPTIONAL – INSTALL KIT FOR BREAKER APLICATIONS)

FILL CAP
RESERVOIR

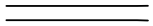
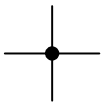
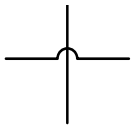
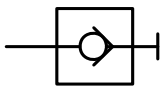
FILTER W/ BY-PASS

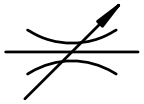
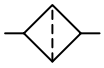
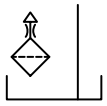
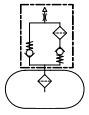
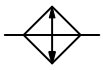
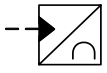
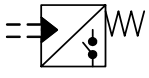
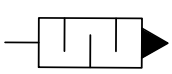
ENCLOSURE
PUMP SUPPLY
WORKING CIRCUITS
PILOT PRESSURE
SYSTEM RETURN LINES

INTERSECTION OF HYDRAULIC LINES INDICATED BY JUNTION DOT

V-1213 (10-25-17)

Glossary Of Hydraulic / Hydrostatic Symbols

SYMBOL	DESCRIPTION
	FLOW LINES and CONNECTIONS
	WORKING CIRCUITS - Continuous, Solid Line - Working (Main) Line, Return Line (line conducting fluid from working devices to the reservoir) and Feed line (main line conductor).
	PILOT PRESSURE - Dashed Line - Pilot Line (Line which conducts control fluid).
	DRAIN CIRCUITS - Dotted Line - Drain Line (drain or bleed line conducting fluid from a component housing to the reservoir.
	COMPONENTS - Long Chain Line - Enclosure outline for several components assembled in one unit.
	MECHANICAL CONNECTIONS - Double Line (Shaft, Lever, Piston Rod).
	CONNECTED JUNCTION OF OIL LINES (Flow Line Connection).
	OIL LINES CROSSING (NOT Connected).
	COUPLER - Quick - Acting Coupling (uncoupled, closed by non-return valve).

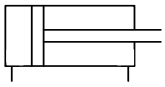
SYMBOL	DESCRIPTION
	BASIC and MISCELLANEOUS SYMBOLS
	RESTRICTION - Line with Fixed Restriction - Affected by Viscosity (property of resistance to flowing fluid).
	VARIABLE ADJUSTMENT RESTRICTION - Regulated or Variable Restriction.
	TEMPERATURE CONTROL - (Indication of temperature).
	TEMPERATURE INDICATOR - (temperature measurement - thermometer).
	FILTER (strainer or screen) - For fluid conditioning.
	VENTED AND FILTERED RESERVOIR (reservoir open to atmosphere).
	PRESSURIZED, VENTED AND FILTERED RESERVOIR (Reservoir uses a pressured cap).
	OIL COOLER (heat exchanger) - The arrows in the diamond indicate the extraction of heat (heat dissipation).
	PRESSURE SENSOR - Varies electric signal with pressure.
	DIFFERENTIAL PRESSURE SWITCH - Switch activates when pressure difference reaches specified level.
	PRESSURE SWITCH - Switch activates when pressure reaches specified level.
	MUFFLER (silencer) - Reduces noise.

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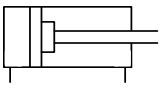
Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

SYMBOL DESCRIPTION

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

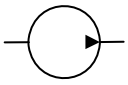


DOUBLE ACTING HYDRAULIC CYLINDER, UNEQUAL DISPLACEMENT - With single piston rod.

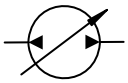


DOUBLE ACTING HYDRAULIC CYLINDER, UNEQUAL DISPLACEMENT and CUSHION ON ONE END - With single piston rod.

PUMP: To convert mechanical energy into hydraulic energy.

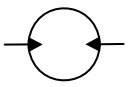


FIXED CAPACITY DISPLACEMENT HYDRAULIC PUMP - With one direction of flow.



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

MOTOR: To convert hydraulic energy into rotary mechanical energy.



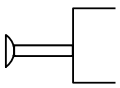
FIXED CAPACITY DISPLACEMENT BIDIRECTIONAL HYDRAULIC MOTOR - With two directions of flow (bidirectional.

SYMBOL DESCRIPTION

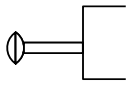
CONTROL MECHANISMS



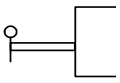
CONTROL VALVE WITH DETENT (Holds Valve in Position) - device for maintaining a given position (mechanical).



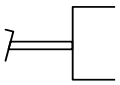
CONTROL VALVE ACTIVATED BY A PULL BUTTON (manual).



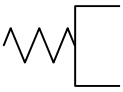
CONTROL VALVE ACTIVATED BY A PUSH-PULL BUTTON (manual).



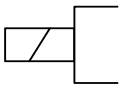
CONTROL VALVE ACTIVATED BY A LEVER (manual).



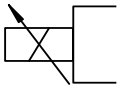
CONTROL VALVE ACTIVATED BY A PEDAL (manual).



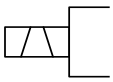
CONTROL VALVE WITH SPRING RETURN (mechanical).



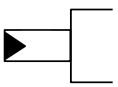
CONTROL VALVE ACTIVATED BY AN ELECTRIC SOLENOID (electrical).



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



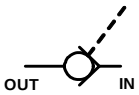
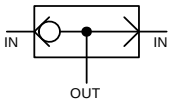
CONTROL VALVE ACTIVATED BY DUAL ELECTRICAL SOLENOID (electrical).

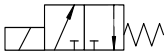
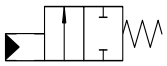
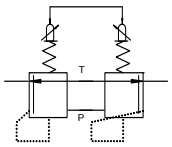
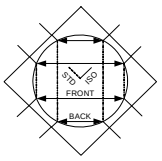
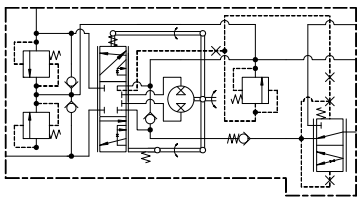
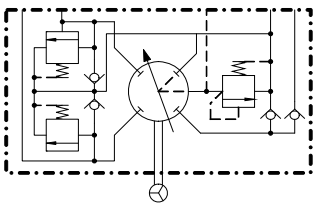
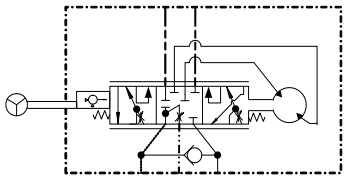


CONTROL VALVE ACTIVATED BY PILOT PRESSURE (indirect control, pilot actuated by application of pressure).

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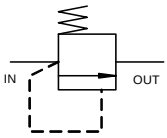
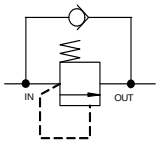
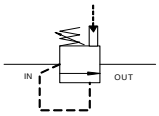
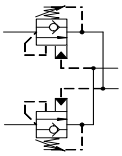
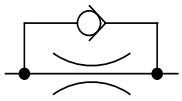
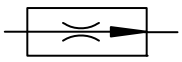
Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

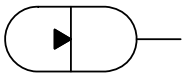
SYMBOL	DESCRIPTION
	NON-RETURN VALVE, SHUTTLE VALVE: Valve which allows free flow in one direction only.
	NON-RETURN VALVE (Check Valve) - Used as Replenishing Valve, Lock Check Valve or Anticavitation Valve - Opens if the Inlet pressure is higher than the Outlet pressure. Often contains internal spring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

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

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Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)

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

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

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Troubleshooting The Hydraulic Circuit

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

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Troubleshooting The Cylinder Circuit

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

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 cross port 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 cross port relief valve set too low.	Repair or replace.
	Swing motor internal leakage excessive.	Repair or replace.

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Troubleshooting The Travel Circuit

TROUBLESHOOTING THE TRAVEL CIRCUIT		
PROBLEM	**CAUSE**	**CORRECTION**
Travel system inoperable.	Lever linkage incorrectly adjusted.	Readjust.
	Track tension too tight.	Readjust.
	Defective pump.	Check, repair or replace.
	Travel motor 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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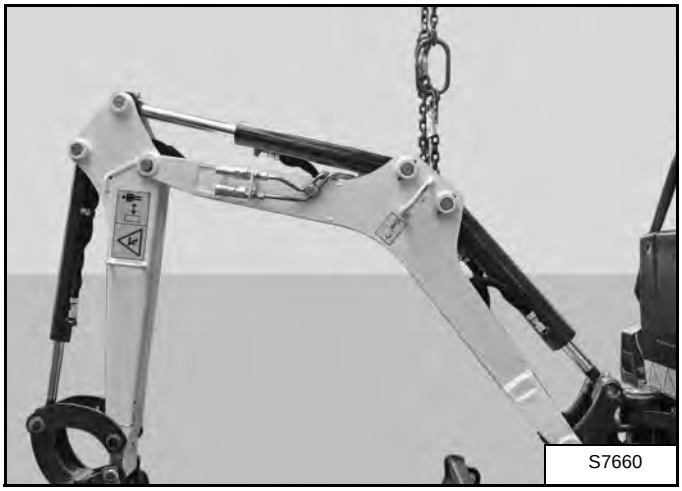
CYLINDER (BOOM)

Testing

Lower the boom / bucket and blade to the ground.

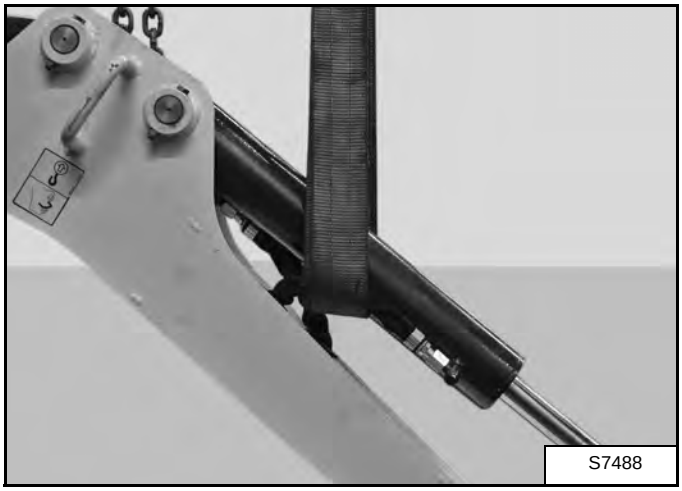
Stop the engine. Raise the control console.

Figure 20-20-1



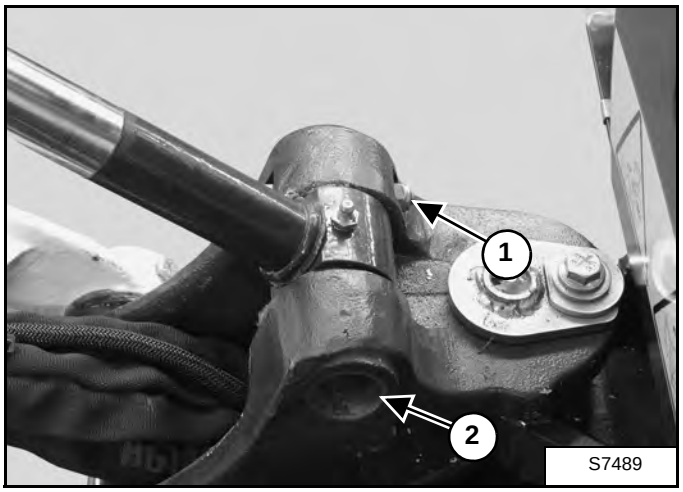
Support the boom using a chain hoist **[Figure 20-20-1]**.

Figure 20-20-2



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

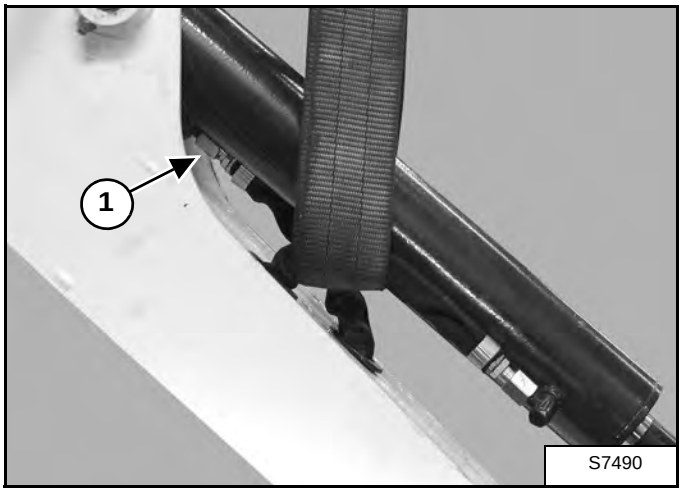
Figure 20-20-3



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

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

Figure 20-20-4



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

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]** from the boom cylinder.

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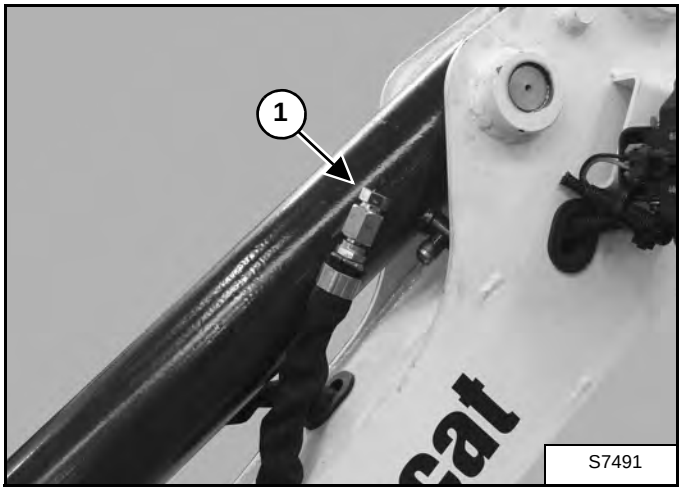
Testing (Cont'd)

WARNING

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

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Figure 20-20-5



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

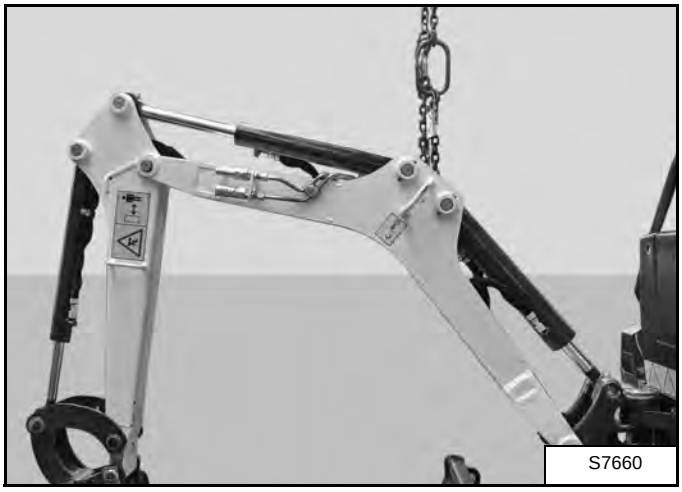
Lower control console and fasten seat belt. Start the engine and retract the boom cylinder.

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

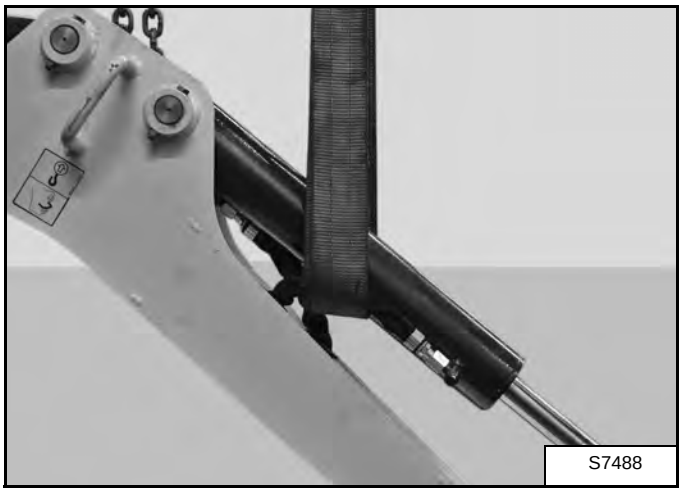
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

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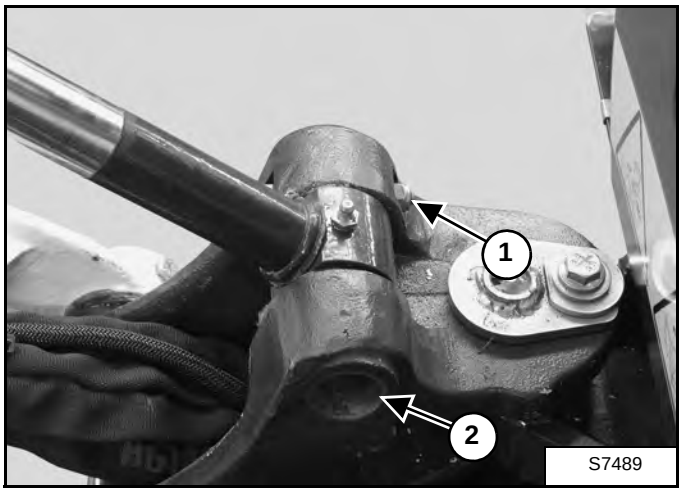
Removal And Installation (Cont'd)

Figure 20-20-7



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

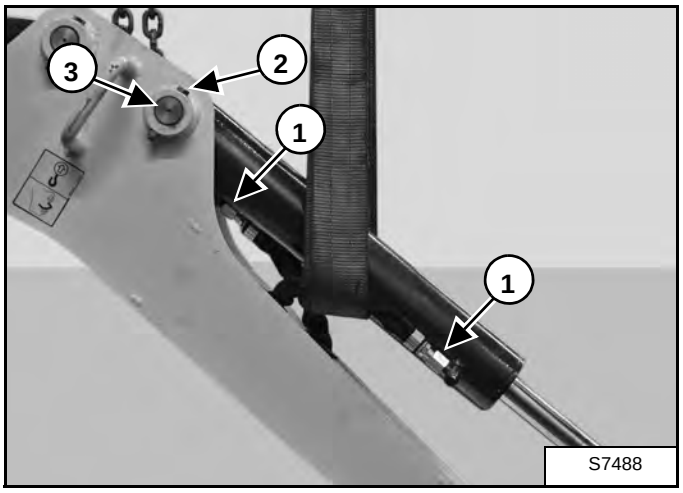
Figure 20-20-8



Remove the bolt and nut (Item 1) **[Figure 20-20-8]** from the rod end pivot pin.

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

Figure 20-20-9



Disconnect and cap the two hoses (Item 1) **[Figure 20-20-9]** from the boom cylinder.

Remove the bolt and nut (Item 2) **[Figure 20-20-9]** from the boom cylinder base end pin.

Remove the boom cylinder base end pin (Item 3) **[Figure 20-20-9]**.

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 physician familiar with this injury is not received immediately.

W-2145-0290

IMPORTANT

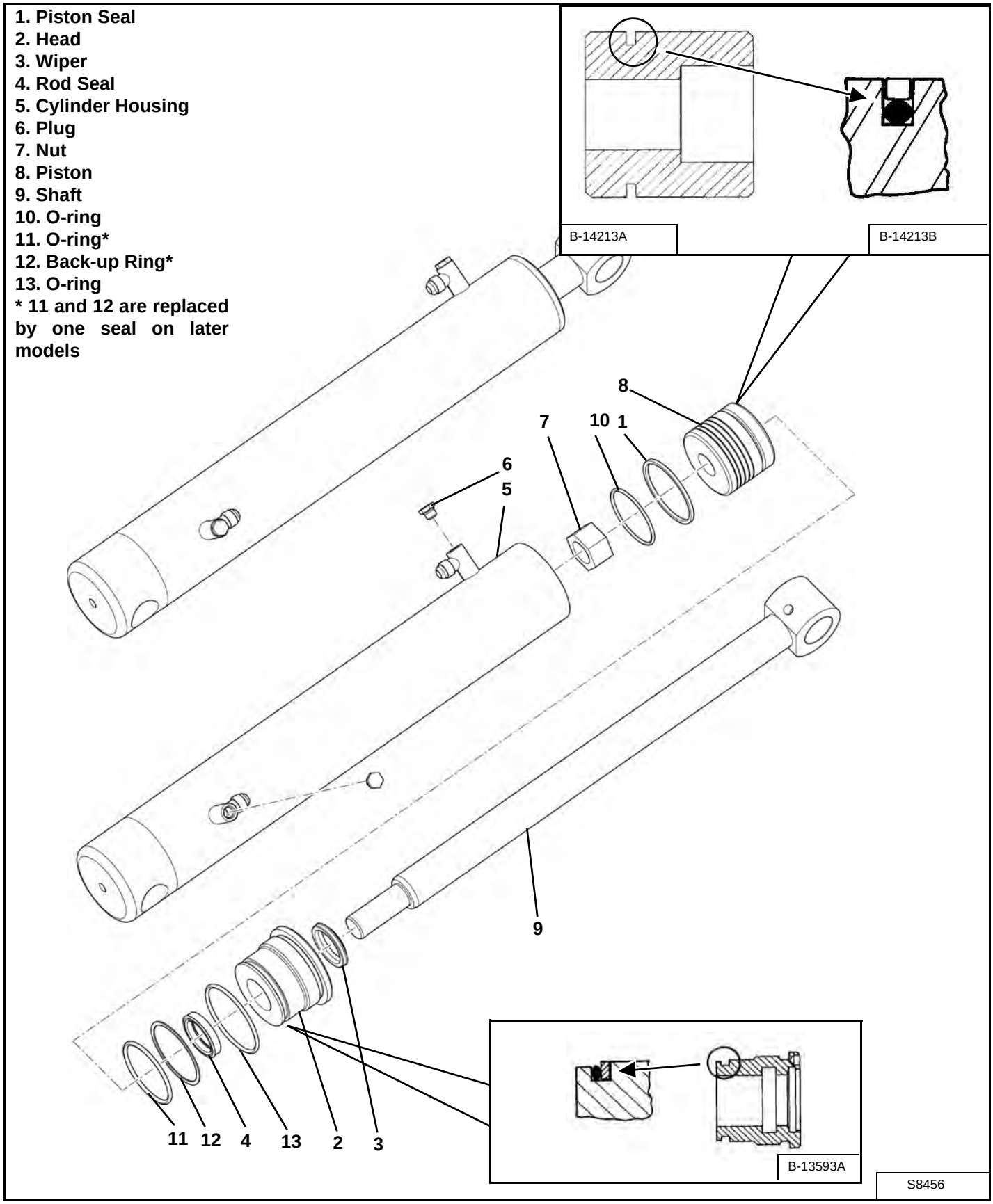
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

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Parts Identification

1. Piston Seal
2. Head
3. Wiper
4. Rod Seal
5. Cylinder Housing
6. Plug
7. Nut
8. Piston
9. Shaft
10. O-ring
11. O-ring*
12. Back-up Ring*
13. O-ring
*** 11 and 12 are replaced by one seal on later models**



Dealer Copy -- Not for Resale

Disassembly

Clean the outside of the boom cylinder before disassembly.

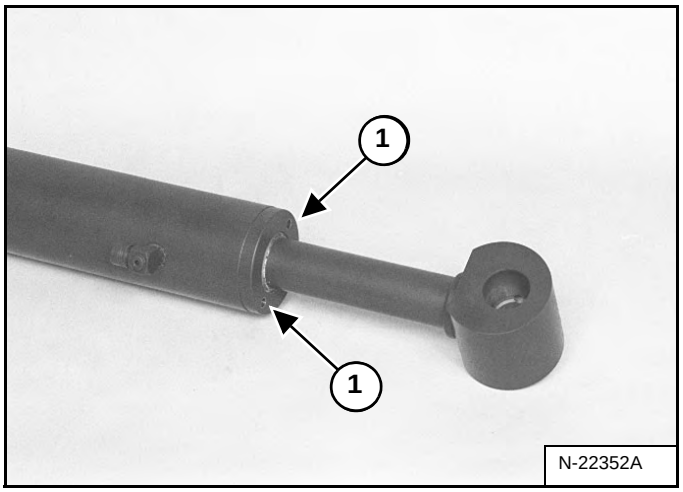
Use the following tools to disassemble the cylinder:

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

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

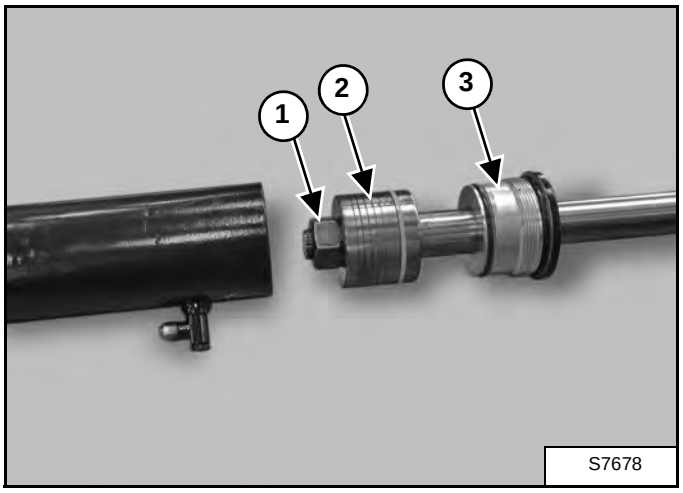
Put the base end of the cylinder in a vise.

Figure 20-20-10



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

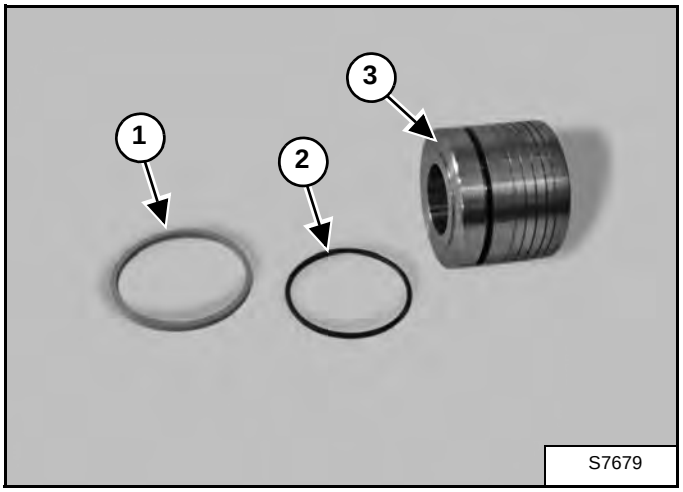
Figure 20-20-11



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

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

Figure 20-20-12

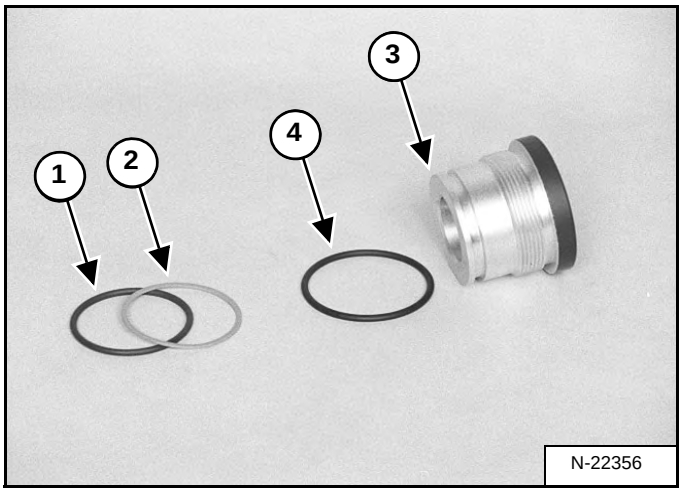


Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-20-12]**.

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Disassembly (Cont'd)

Figure 20-20-13

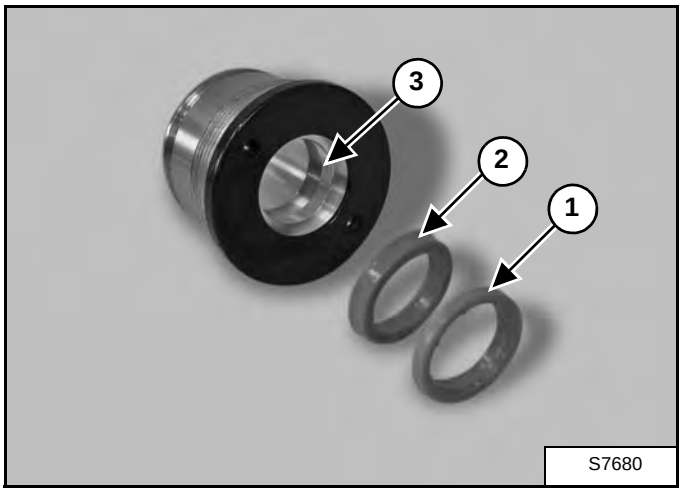


Remove the O-ring (Item 1) and the back-up ring (Item 2) from the groove in the head (Item 3) **[Figure 20-20-13]**.

NOTE: O-ring (Item 1) and back-up ring (Item 2) [Figure 20-20-13] are replaced by one seal on later models.

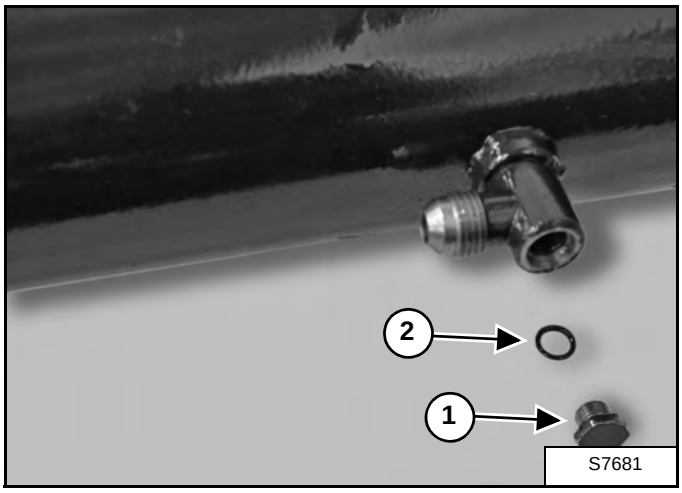
Remove the O-ring (Item 4) **[Figure 20-20-13]**.

Figure 20-20-14



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

Figure 20-20-15



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

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Assembly

Use the following tools to assemble the cylinder:

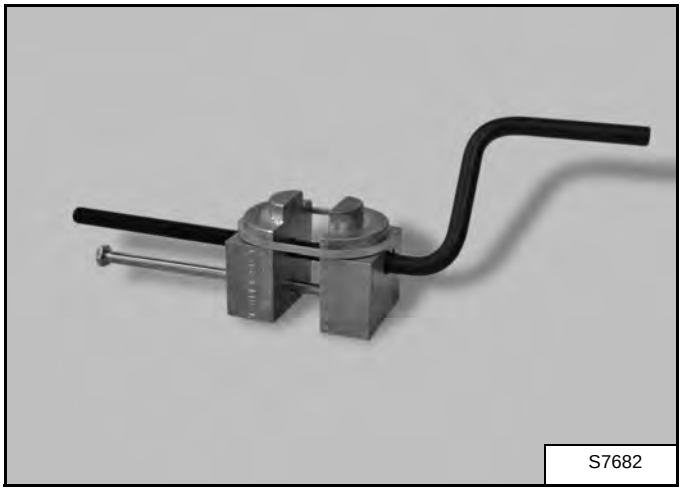
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

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.

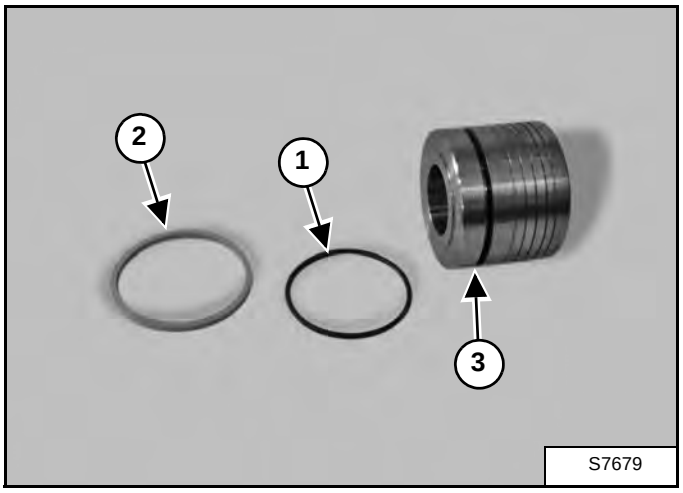
Figure 20-20-16



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

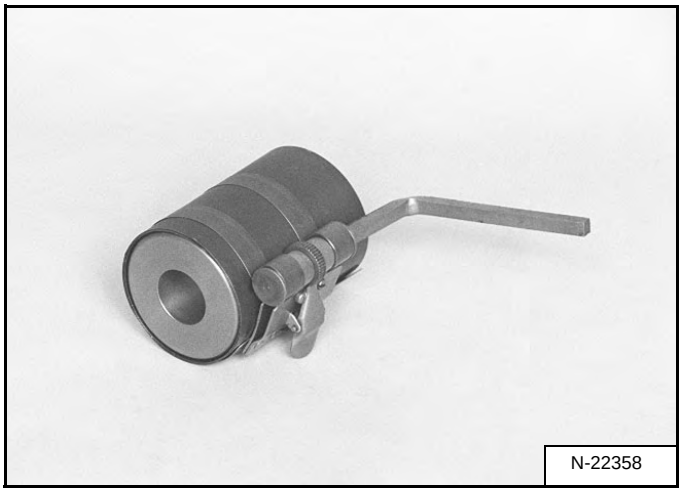
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-20-17



Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-20-17]**.

Figure 20-20-18

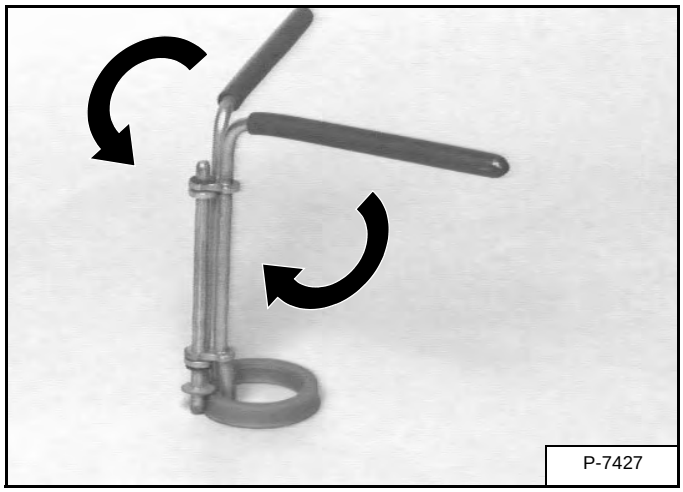


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-20-18]**.

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Assembly (Cont'd)

Figure 20-20-19

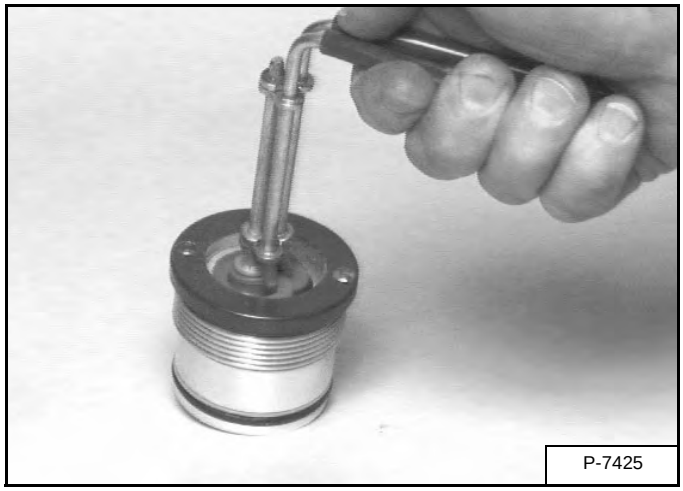


Install the rod seal on the rod seal tool **[Figure 20-20-19]**.

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

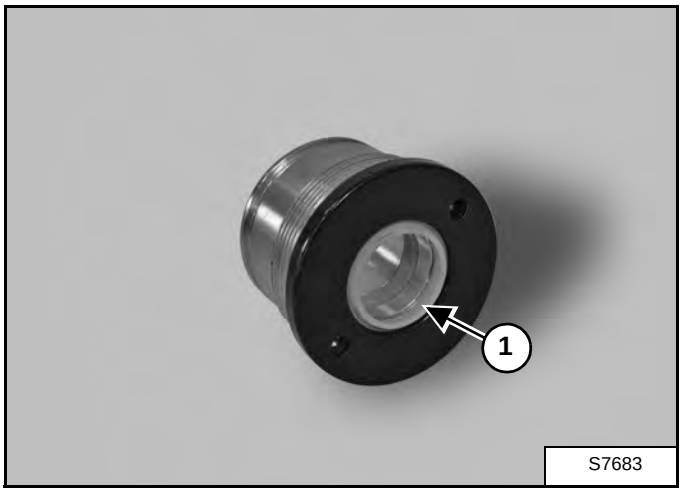
Rotate the handles to collapse the rod seal **[Figure 20-20-19]**.

Figure 20-20-20



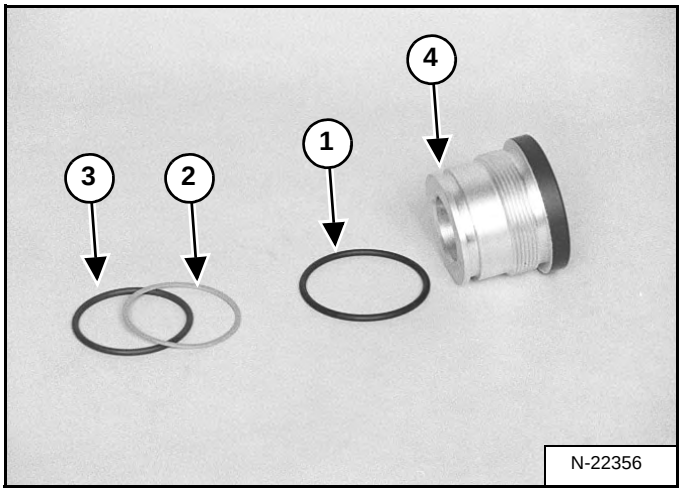
Install the rod seal in the head **[Figure 20-20-20]**.

Figure 20-20-21



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

Figure 20-20-22



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

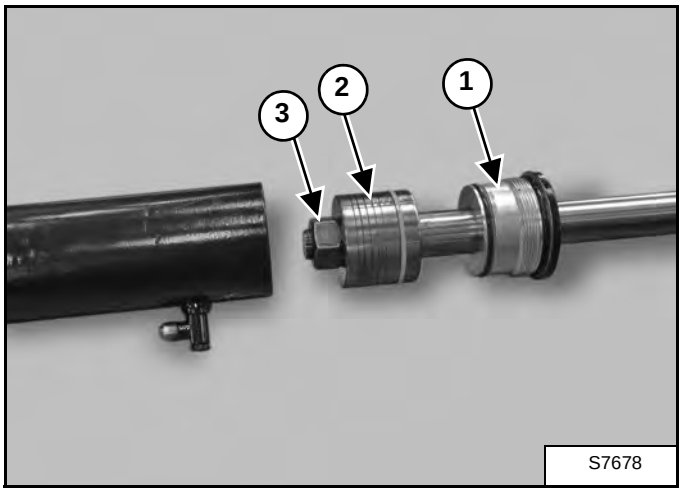
Install the back-up ring (Item 2) and O-ring (Item 3) into the groove on the head (Item 4) **[Figure 20-20-22]**.

NOTE: O-ring (Item 3) and back-up ring (Item 2) [Figure 20-20-22] are replaced by one seal on later models. Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes.

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Assembly (Cont'd)

Figure 20-20-23



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

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

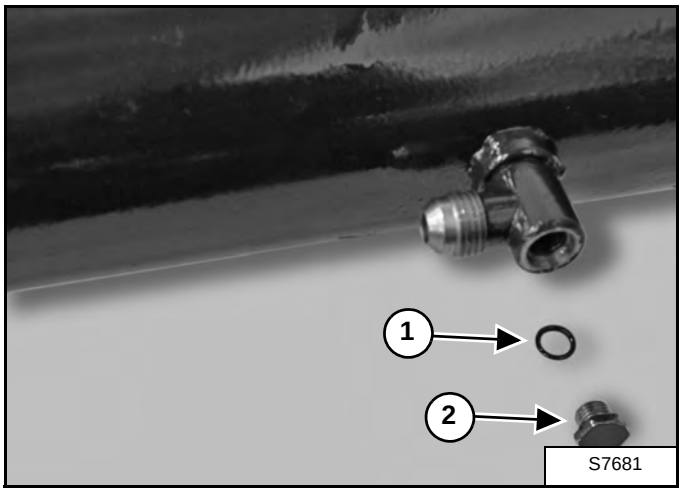
Provide an adequate support for the cylinder before tightening.

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

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

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

Figure 20-20-24



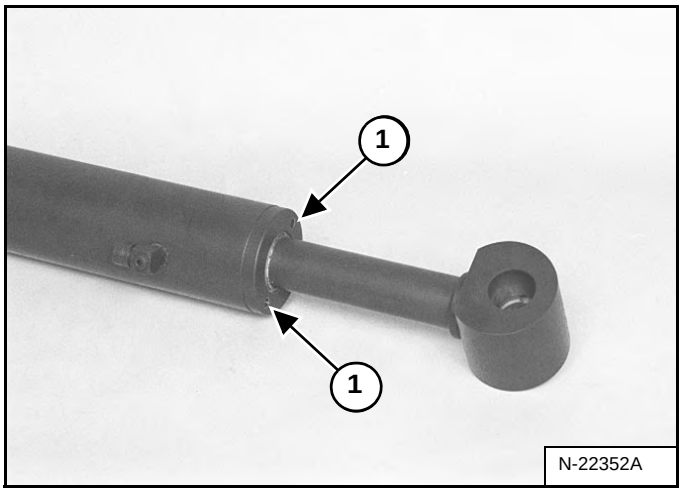
Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-20-24]**.

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

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

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

Figure 20-20-25



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

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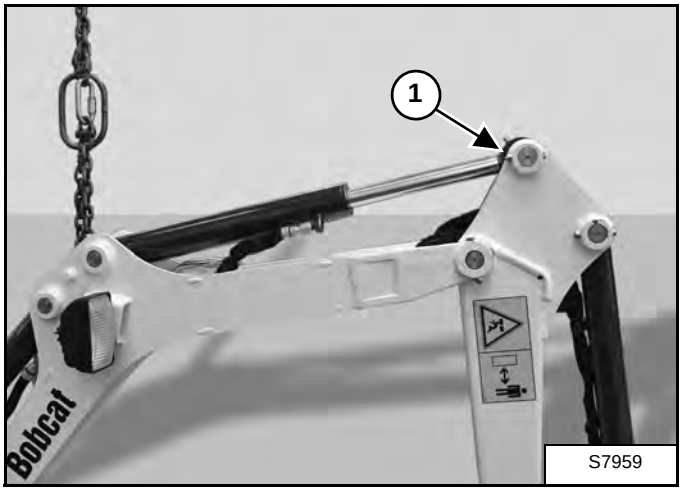
CYLINDER (ARM)

Testing

Lower the boom / bucket and blade to the ground.

Stop the engine. Raise the control console.

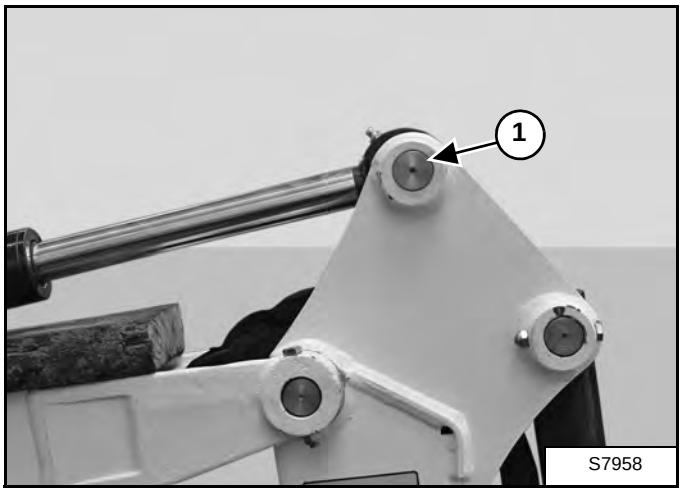
Figure 20-21-1



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

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

Figure 20-21-2



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

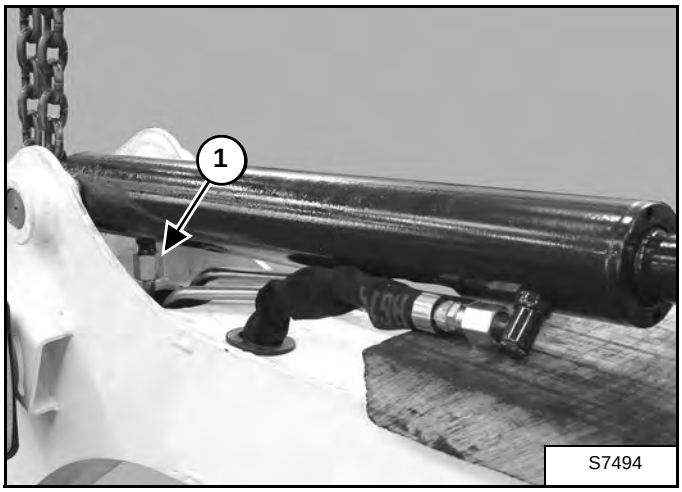
Remove the pivot pin (Item 1) **[Figure 20-21-2]**.

⚠ 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 physician familiar with this injury is not received immediately.

W-2145-0290

Figure 20-21-3



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

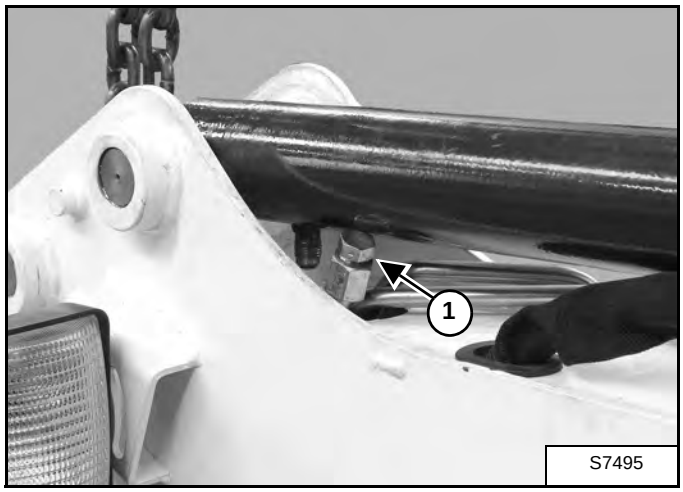
Stop the engine. With the key in the ON position, move the hydraulic controls to release the hydraulic pressure. Raise the control console.

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

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Testing (Cont'd)

Figure 20-21-4



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

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

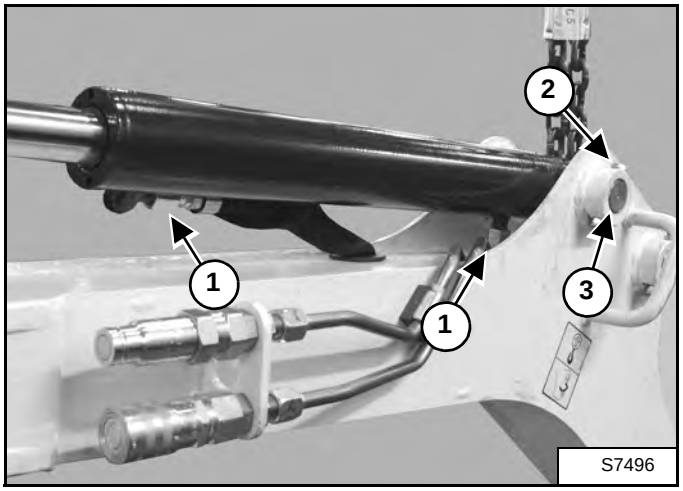
If there is any leakage from the base end fitting on the arm cylinder, remove the cylinder for repair or replacement.

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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.

I-2003-0888

Remove and plug the two hoses (Item 1) **[Figure 20-21-5]** from the arm cylinder.

Remove the bolt and nut (Item 2) **[Figure 20-21-5]** from the arm cylinder base end pin.

Remove the cylinder base end pin (Item 3) **[Figure 20-21-5]**.

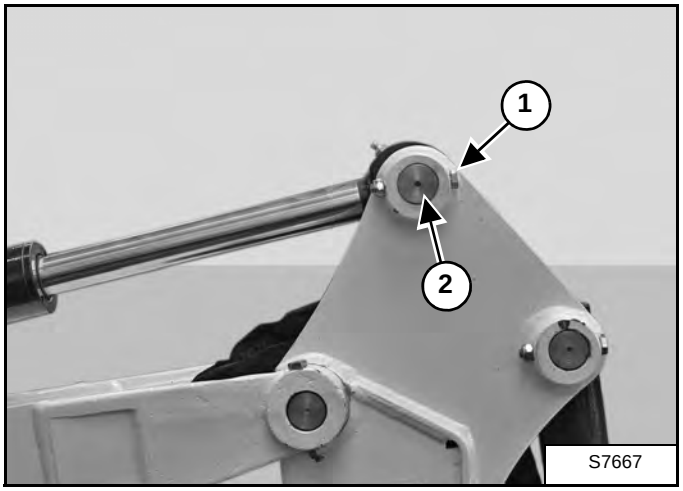
⚠ WARNING

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 20-21-6



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

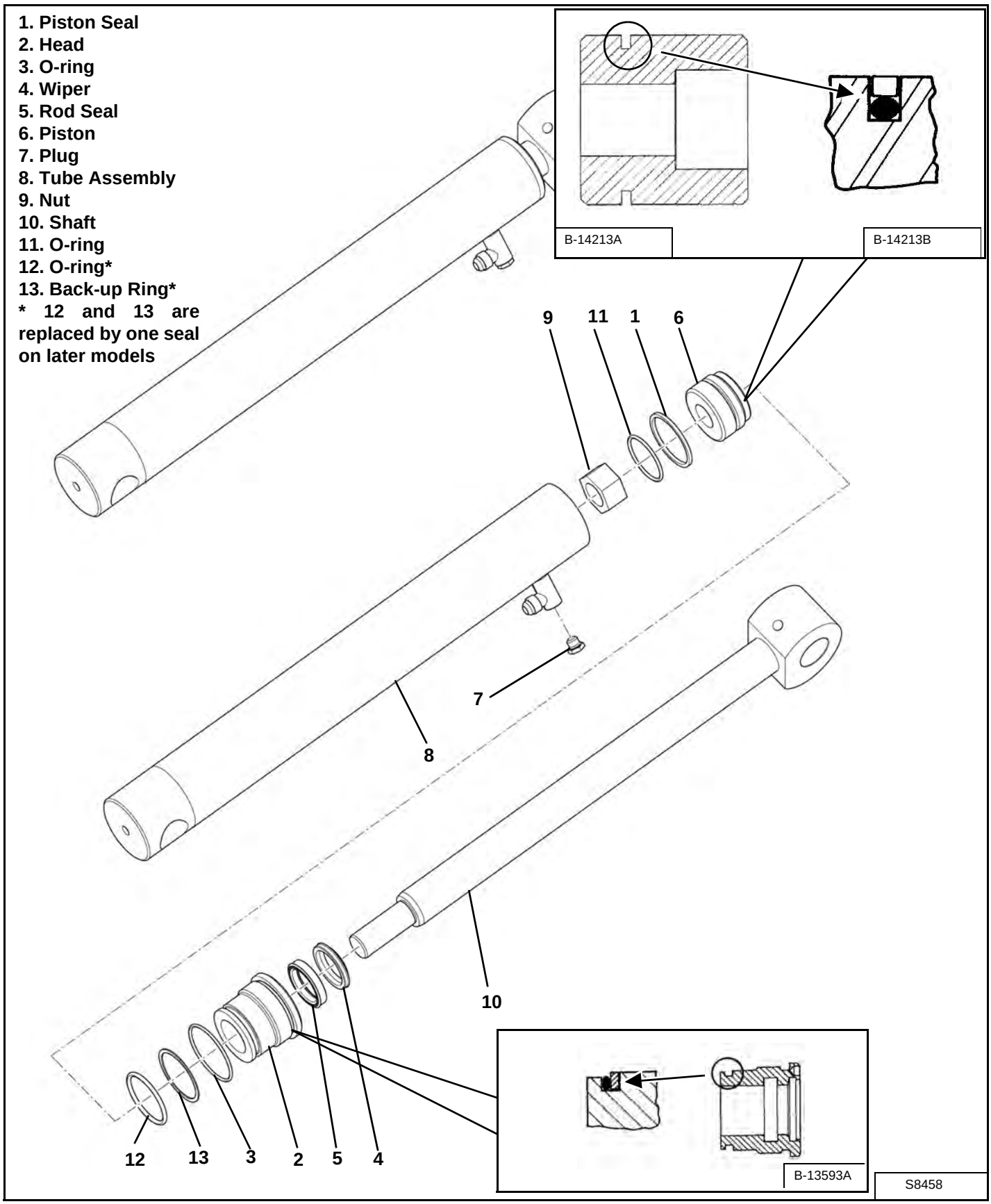
Remove the cylinder rod end pin (Item 2) **[Figure 20-21-6]**.

Remove the arm cylinder.

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CYLINDER (ARM) (CONT'D)

Parts Identification



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Disassembly

Clean the outside of the arm cylinder before disassembly.

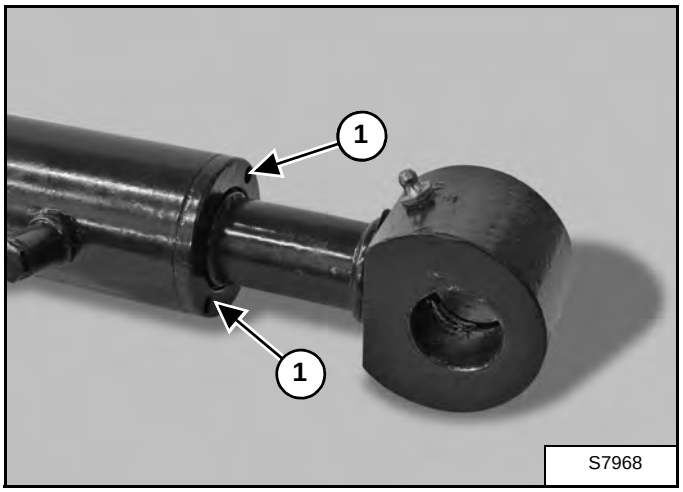
Use the following tools to disassemble the cylinder:

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

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

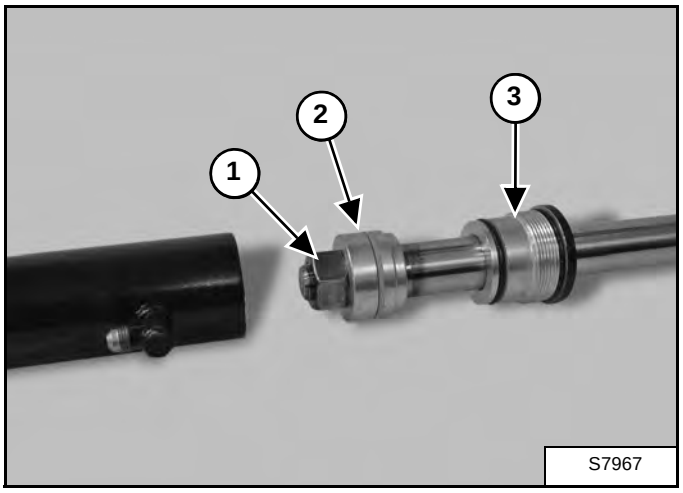
Put the base end of the cylinder in a vise.

Figure 20-21-7



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-21-7]** to loosen the head.

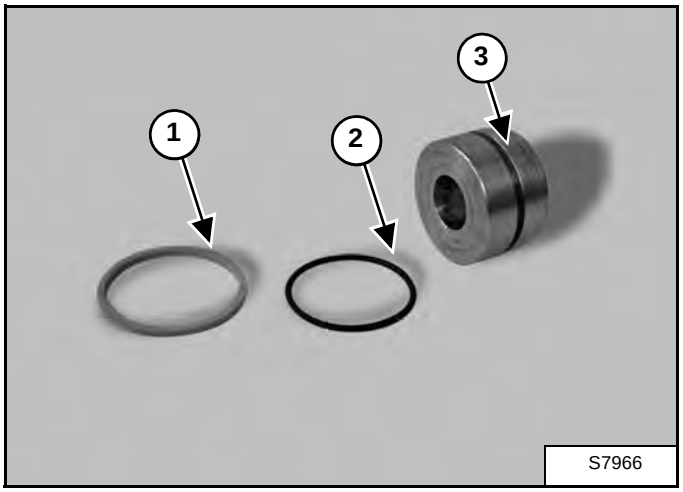
Figure 20-21-8



Remove the head and the rod assembly from the cylinder **[Figure 20-21-8]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2), and head (Item 3) **[Figure 20-21-8]**.

Figure 20-21-9

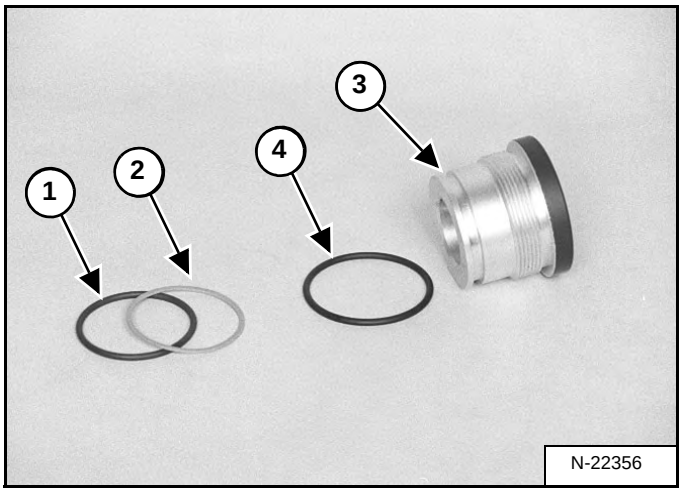


Standard Piston: Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-21-9]**.

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Disassembly (Cont'd)

Figure 20-21-10

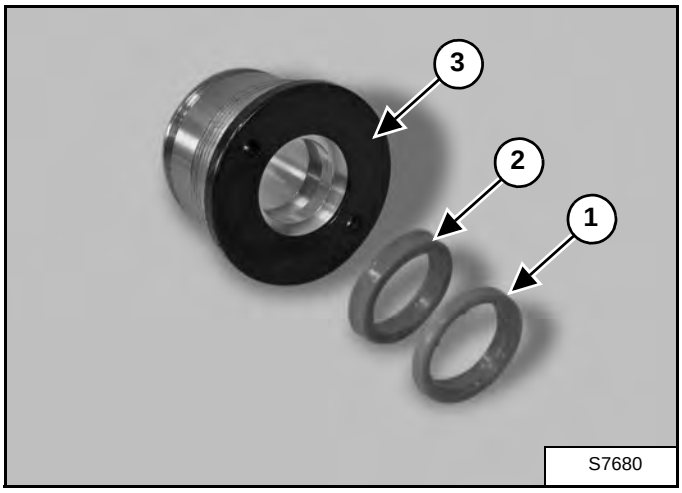


Remove the O-ring (Item 1) and the back-up ring (Item 2) from the groove in the head (Item 3) **[Figure 20-21-10]**.

NOTE: O-ring (Item 1) and back-up ring (Item 2) [Figure 20-21-10] are replaced by one seal on later models.

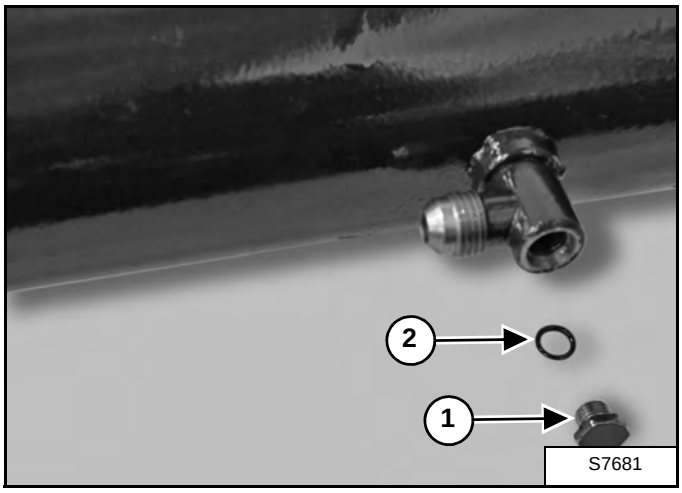
Remove the O-ring (Item 4) **[Figure 20-21-10]**.

Figure 20-21-11



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-21-11]**.

Figure 20-21-12



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-21-12]**.

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Assembly

Use the following tools to assemble the cylinder:

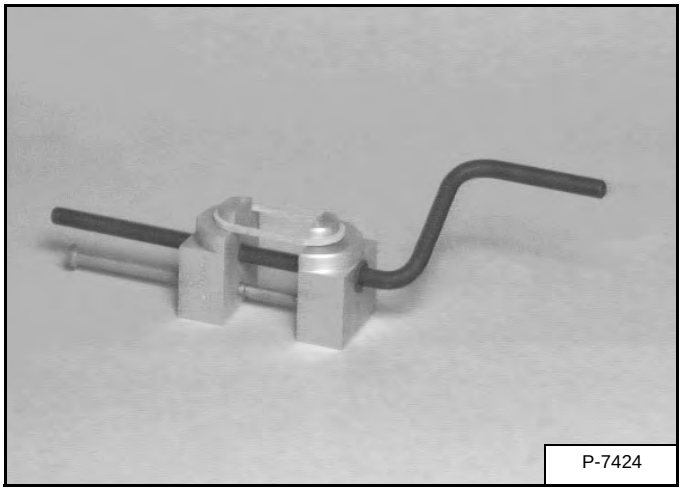
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

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.

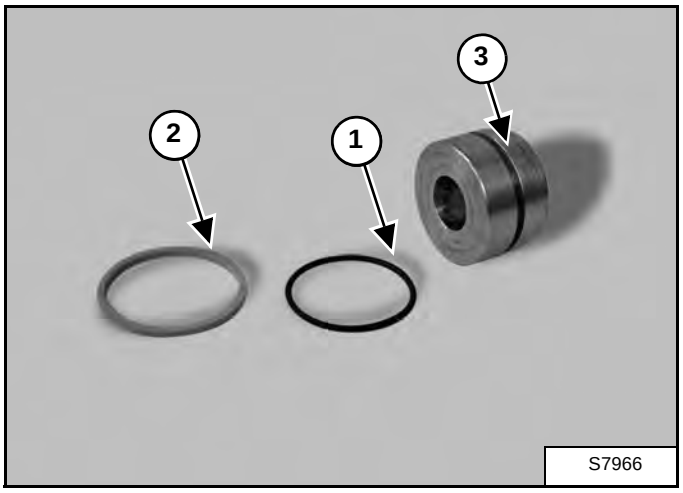
Figure 20-21-13



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-21-13]**.

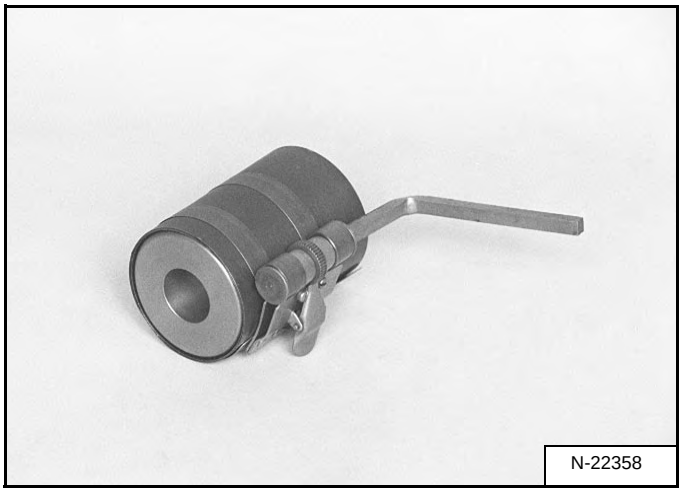
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-21-14



Standard Piston: Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-21-14]**.

Figure 20-21-15

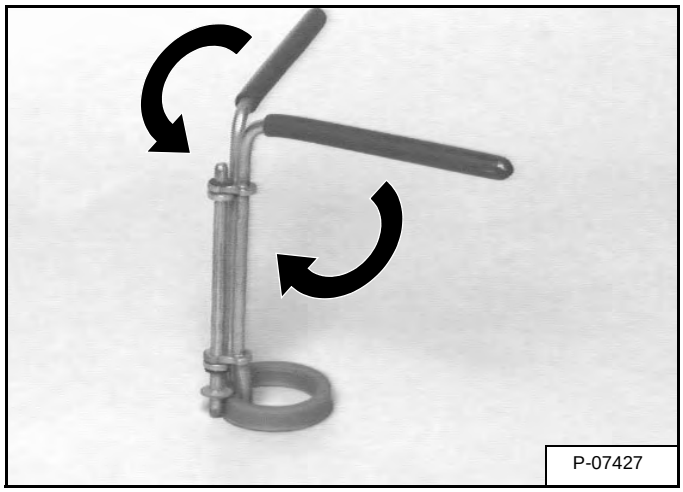


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-21-15]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-21-16

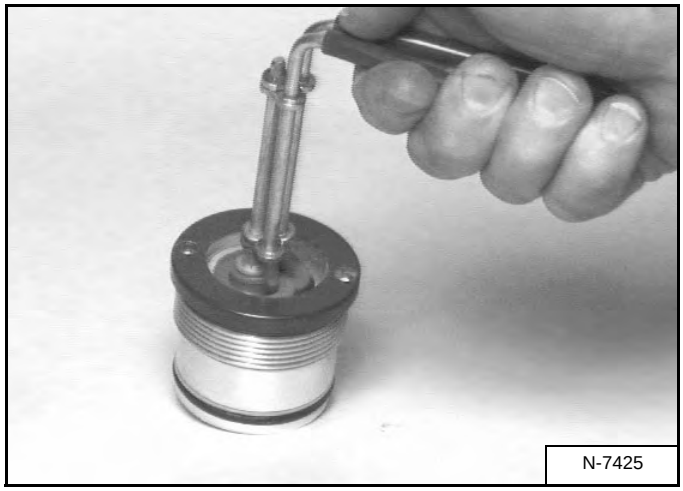


Install the rod seal on the rod seal tool **[Figure 20-21-16]**.

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

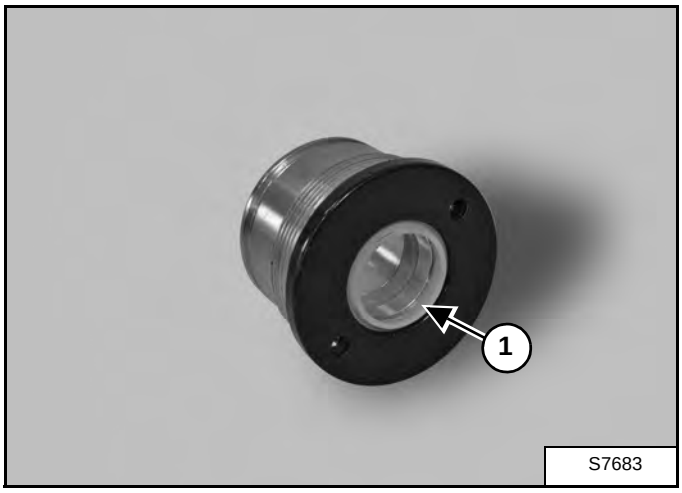
Rotate the handles to collapse the rod seal **[Figure 20-21-16]**.

Figure 20-21-17



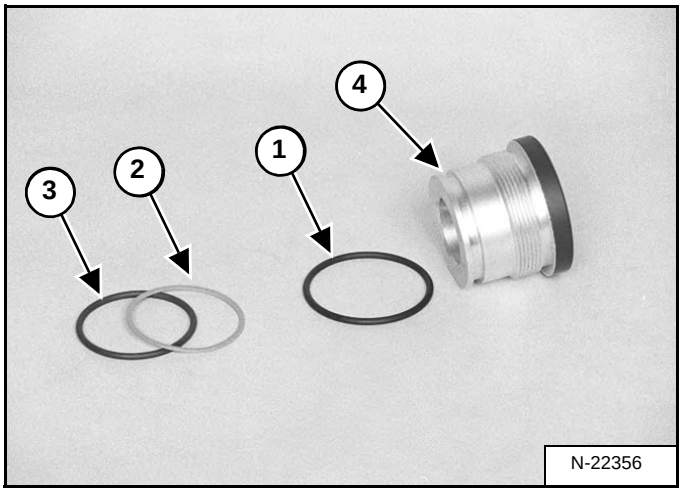
Install the rod seal in the head **[Figure 20-21-17]**.

Figure 20-21-18



Install the wiper seal with the wiper (Item 1) **[Figure 20-21-18]** toward the outside of the head.

Figure 20-21-19



Install the O-ring (Item 1) **[Figure 20-21-19]**.

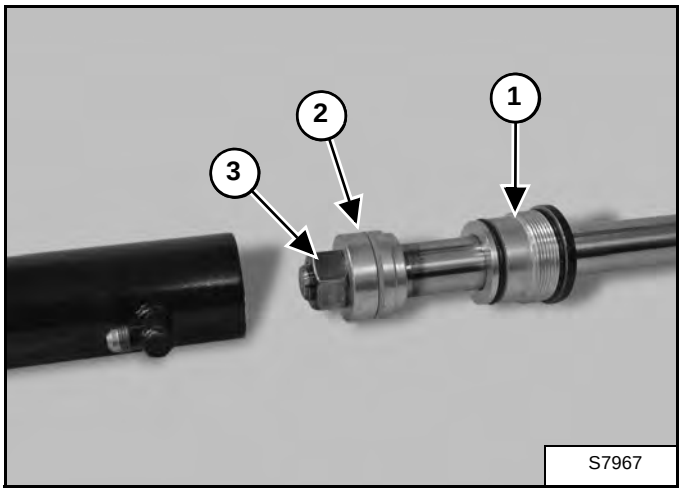
Install the back-up ring (Item 2) and O-ring (Item 3) into the groove on the head (Item 4) **[Figure 20-21-19]**.

NOTE: O-ring (Item 3) and back-up ring (Item 2) [Figure 20-21-19] are replaced by one seal on later models. Use a ring compressor to compress the seal to the correct size. Leave the head in the compressor for about 3 minutes.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-21-20



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

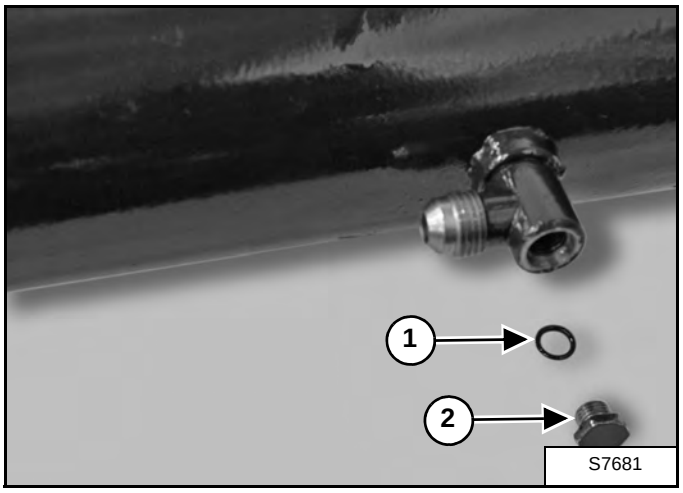
Install the nut (Item 3) **[Figure 20-21-20]**.

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

Reclean thread area for Loctite® residue.

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

Figure 20-21-21

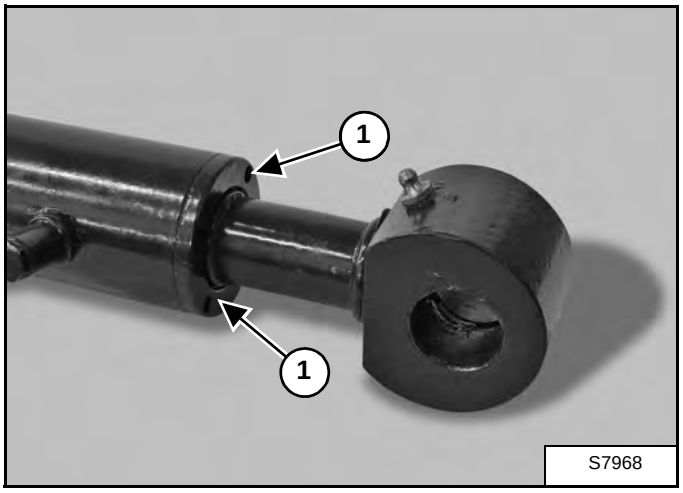


Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-21-21]**.

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

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

Figure 20-21-22



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-21-22]** to tighten the head. Head to be torqued until flush with end of the housing.

Dealer Copy -- Not for Resale



Dealer Copy -- Not for Resale

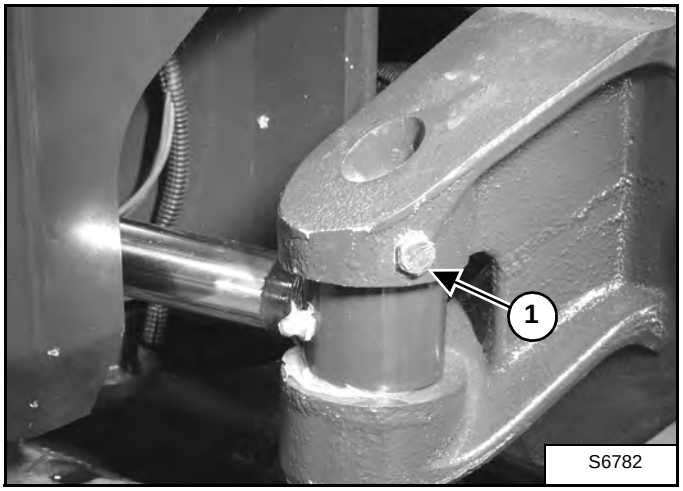
CYLINDER (BOOM SWING)

Testing

Lower the boom / bucket and blade to the ground.

Stop the engine. Raise the control console.

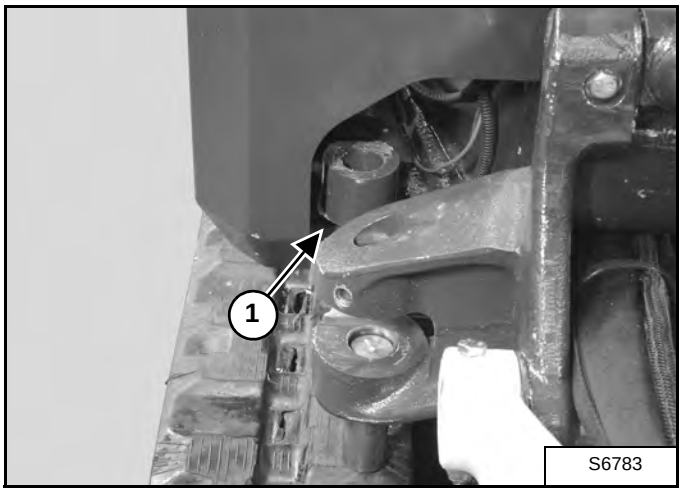
Figure 20-22-1



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

Remove the pivot pin from the rod end of the cylinder.

Figure 20-22-2

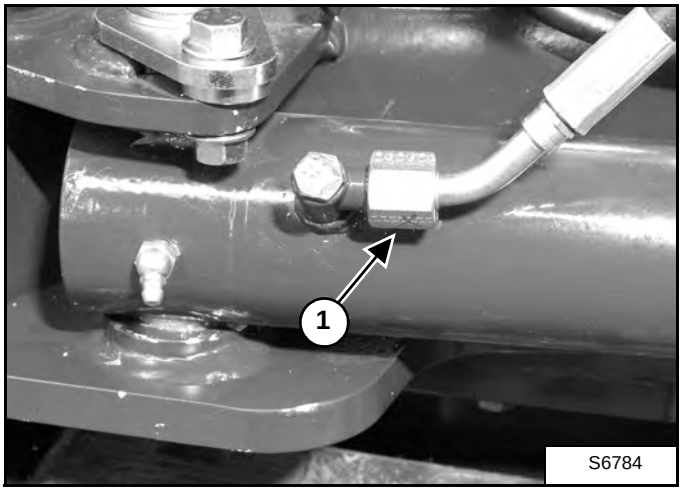


Lower the control console and fasten the seat belt. Start the engine and retract the boom swing cylinder (Item 1) **[Figure 20-22-2]**.

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

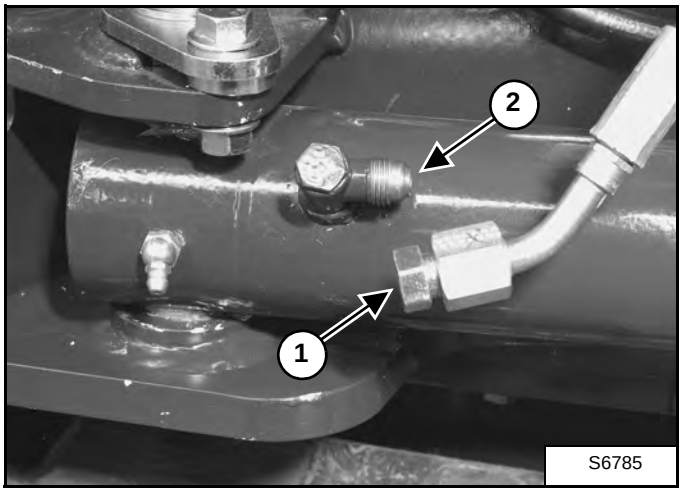
Remove the lower right hand side cover. (See Lower Right Side Cover Removal And Installation on Page 40-210-3.)

Figure 20-22-3



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

Figure 20-22-4



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

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

If there is any leakage from the base end fitting (Item 2) **[Figure 20-22-4]** on the cylinder, remove the boom swing 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 physician familiar with this injury is not received immediately.

W-2145-0290

⚠ WARNING

AVOID INJURY OR DEATH

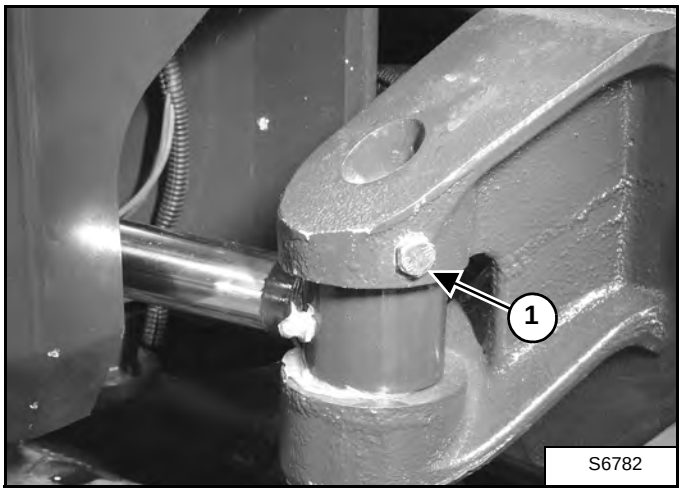
Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

W-2103-0508

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

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

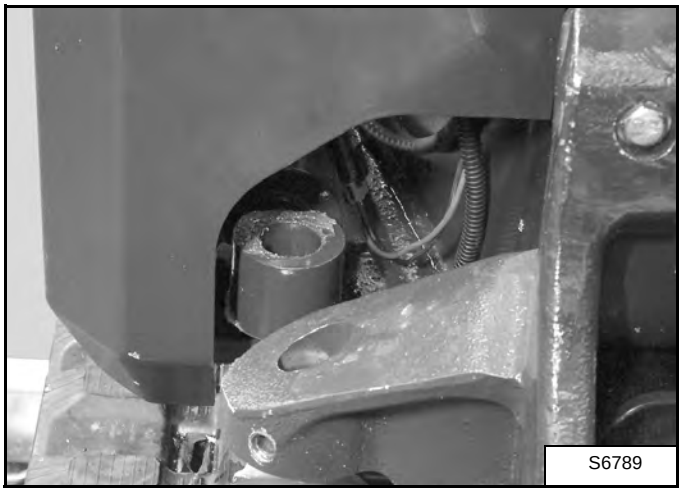
Figure 20-22-5



Remove the bolt and nut (Item 1) **[Figure 20-22-5]** from the rod end pivot pin.

Remove the pivot pin from the rod end of the cylinder.

Figure 20-22-6



Lower the control console and fasten the seat belt.

Start the excavator and fully retract the boom swing cylinder **[Figure 20-22-6]**.

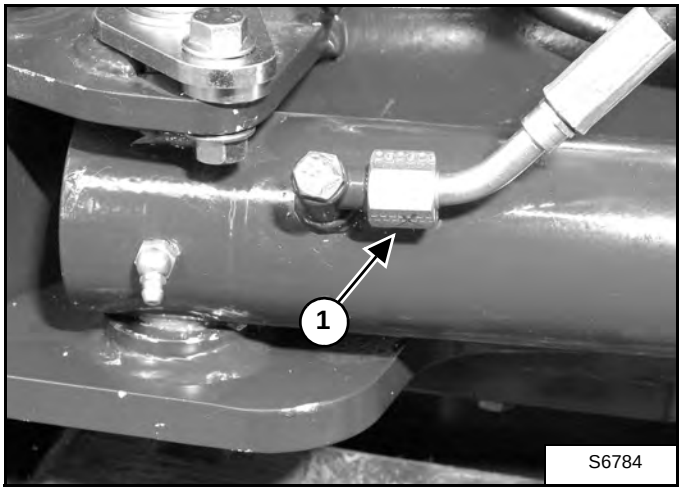
Stop the engine.

Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

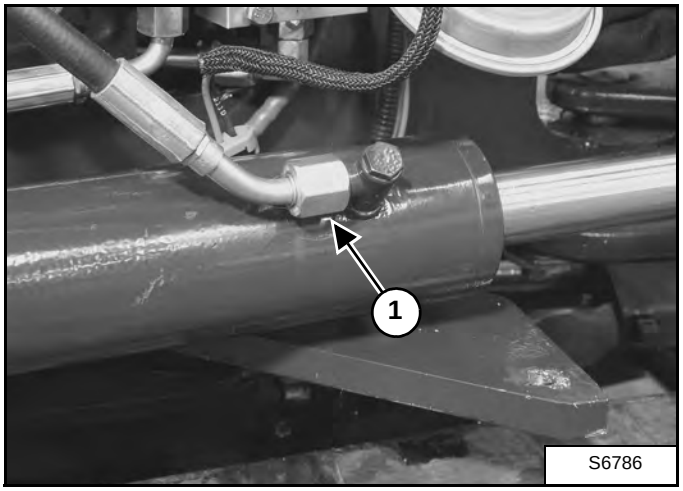
Remove the lower right hand side cover. (See Lower Right Side Cover Removal And Installation on page 40-210-3)

Figure 20-22-7



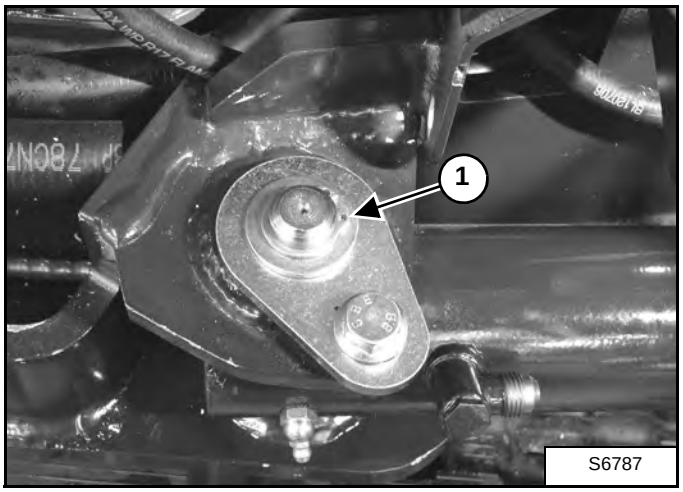
Remove the base end hose (Item 1) **[Figure 20-22-7]** from the boom swing cylinder.

Figure 20-22-8



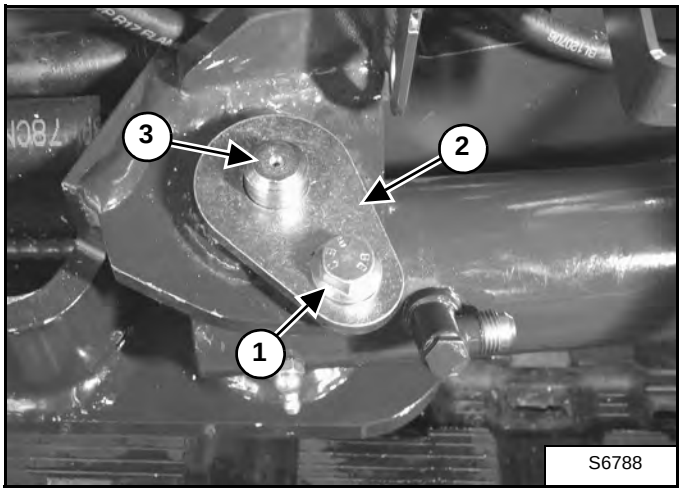
Remove the rod end hose (Item 1) **[Figure 20-22-8]** from the boom swing cylinder.

Figure 20-22-9



Remove the snap ring and washer (Item 1) **[Figure 20-22-9]**.

Figure 20-22-10



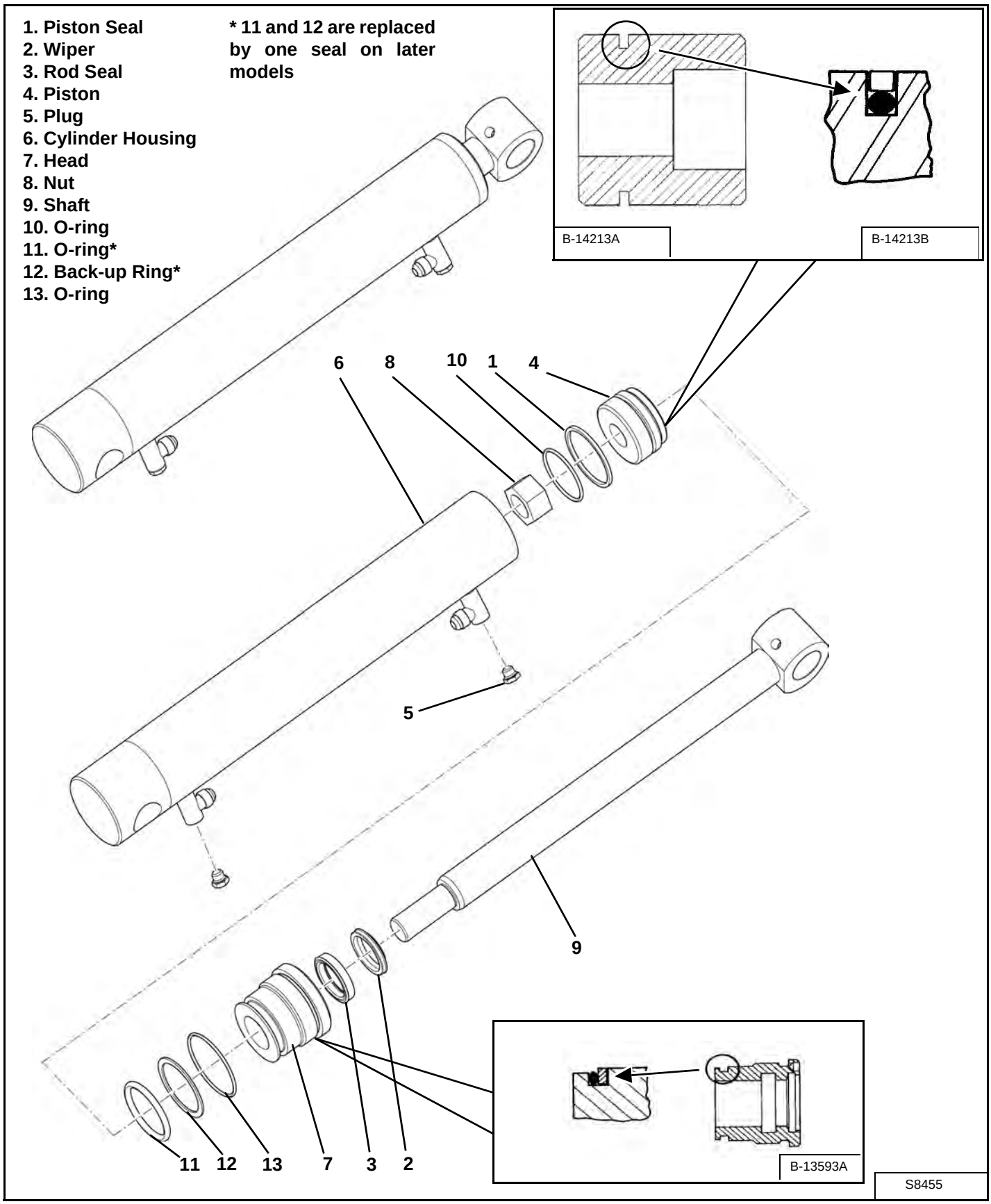
Remove the bolt (Item 1) and the retaining plate (Item 2) **[Figure 20-22-10]**.

Remove the pivot pin (Item 3) **[Figure 20-22-10]** from the base end of the boom swing cylinder.

Remove the boom swing cylinder from the excavator.

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Parts Identification



Dealer Copy -- Not for Resale

Disassembly

Clean the outside of the boom swing cylinder before disassembly.

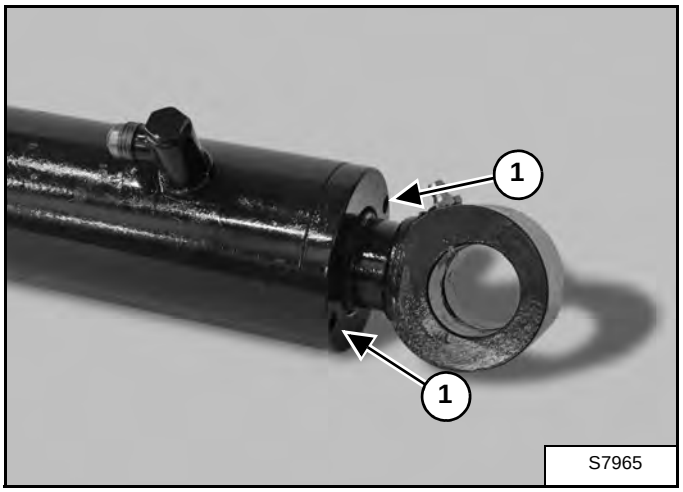
Use the following tools to disassemble the cylinder:

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

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

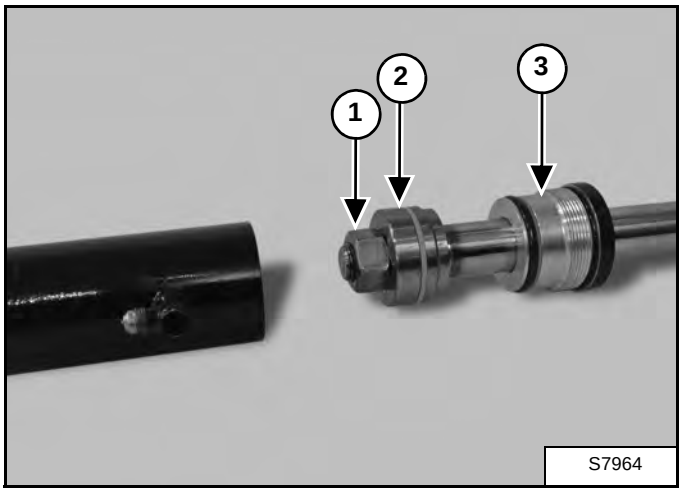
Put the base end of the cylinder in a vise.

Figure 20-22-11



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

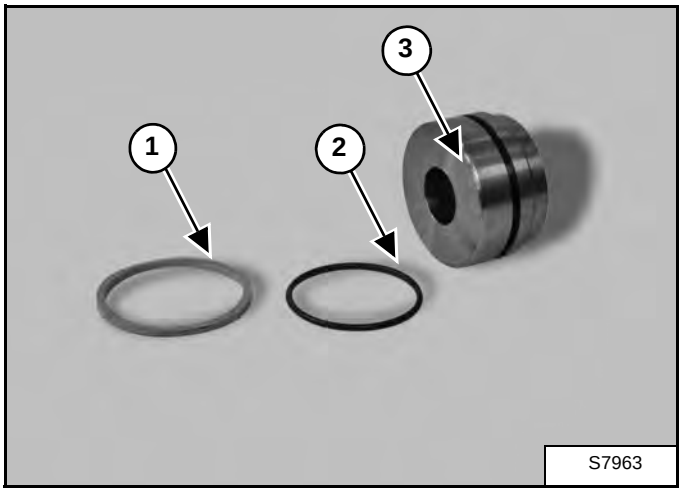
Figure 20-22-12



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

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

Figure 20-22-13

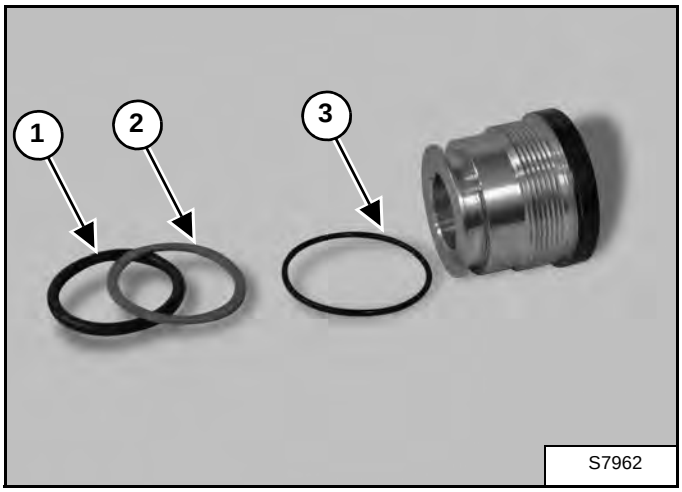


Standard piston: Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-22-13]**.

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Disassembly (Cont'd)

Figure 20-22-14

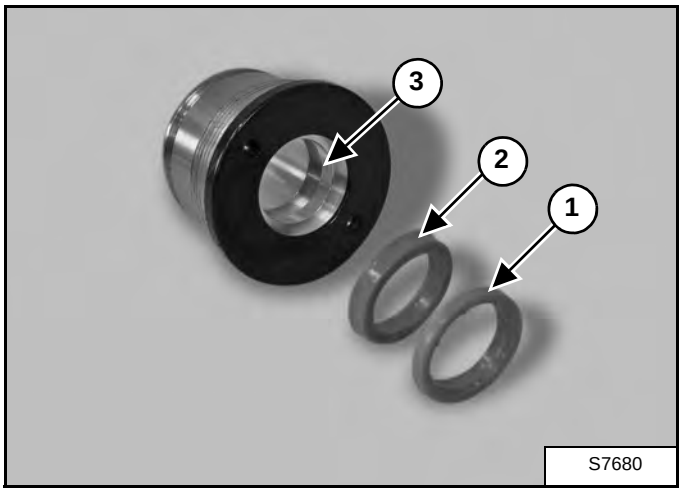


Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-22-14]**.

NOTE: O-ring (Item 1) and back-up ring (Item 2) [Figure 20-22-14] are replaced by one seal on later models.

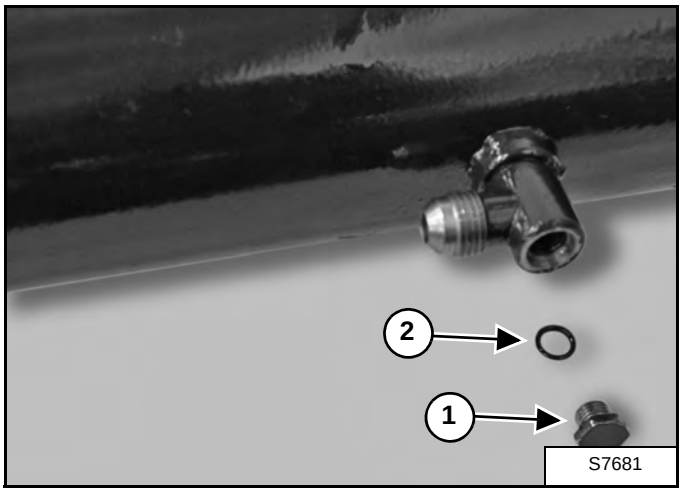
Remove the O-ring (Item 3) **[Figure 20-22-14]**.

Figure 20-22-15



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

Figure 20-22-16



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

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Assembly

Use the following tools to assemble the cylinder:

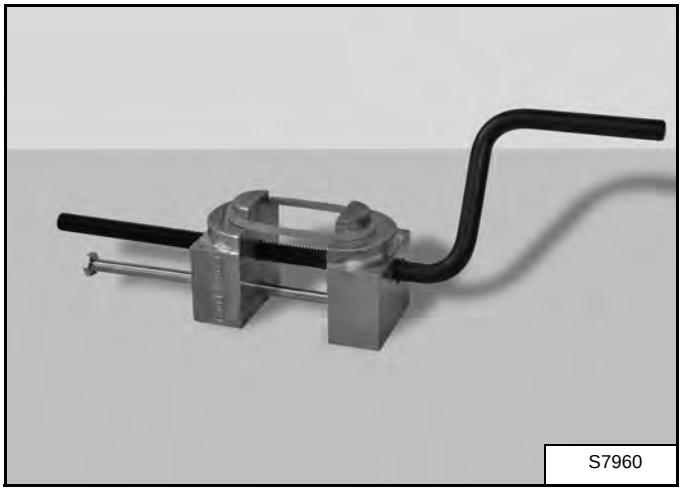
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

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.

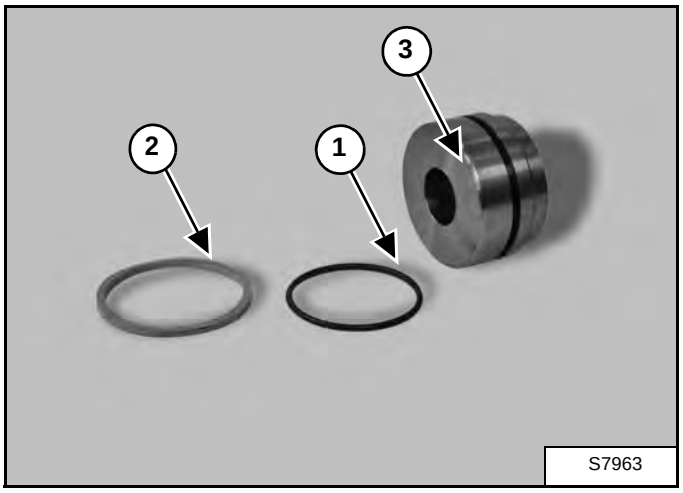
Figure 20-22-17



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

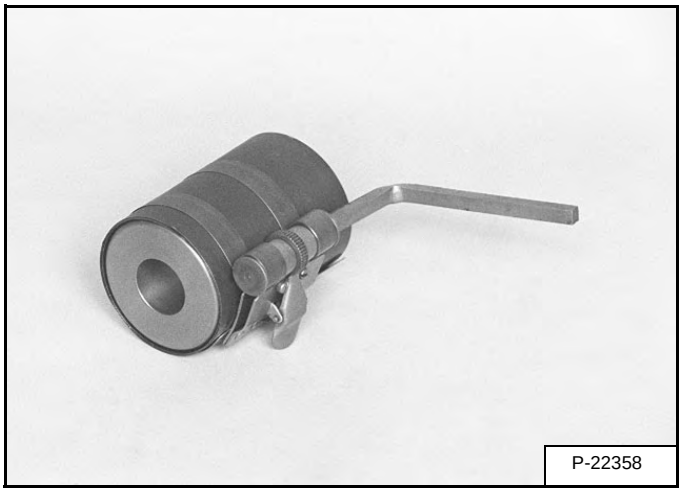
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-22-18



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

Figure 20-22-19

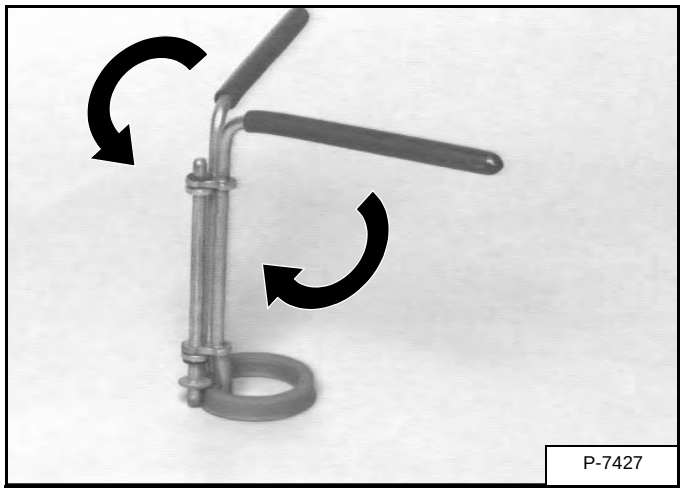


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-22-19]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-22-20

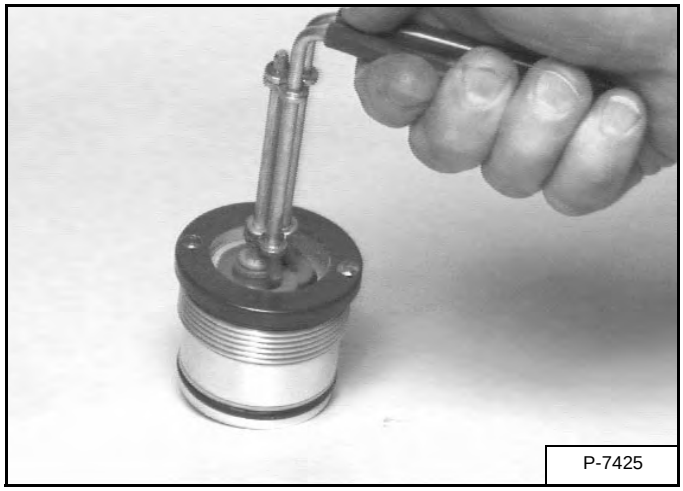


Install the rod seal on the rod seal tool **[Figure 20-22-20]**.

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

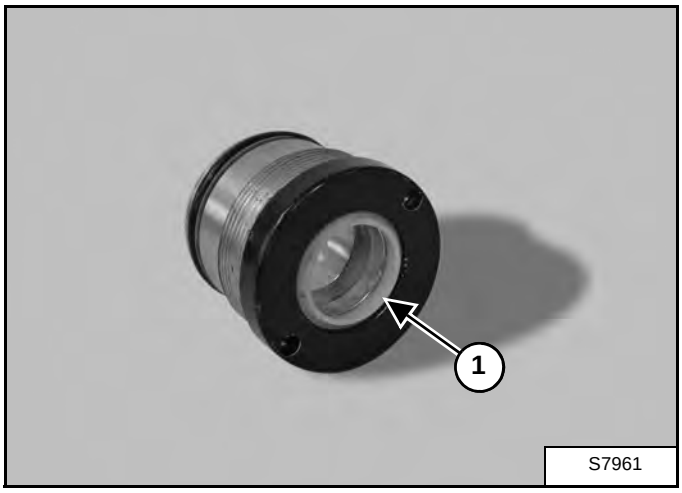
Rotate the handles to collapse the rod seal **[Figure 20-22-20]**.

Figure 20-22-21



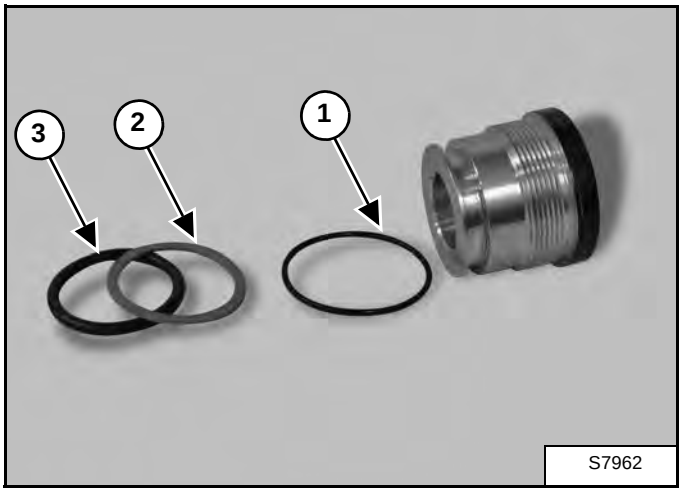
Install the rod seal in the head **[Figure 20-22-21]**.

Figure 20-22-22



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

Figure 20-22-23



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

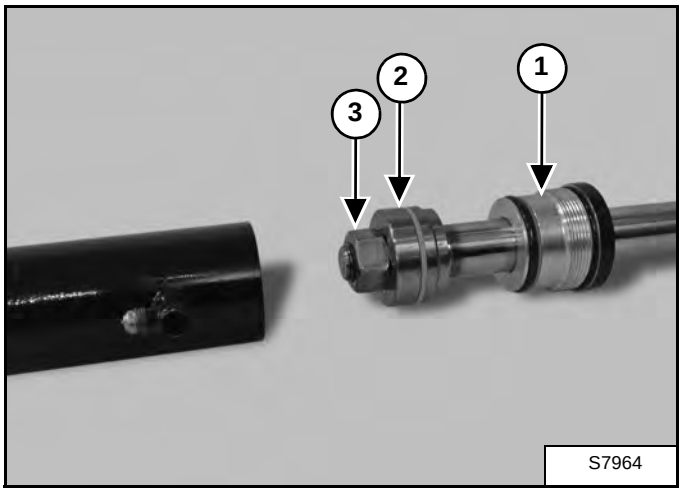
Install the back-up ring (Item 2) and O-ring (Item 3) **[Figure 20-22-23]**.

NOTE: O-ring (Item 3) and back-up ring (Item 2) [Figure 20-22-23] are replaced by one seal on later models. Use a ring compressor to compress the seal to the correct size. Leave the head in the compressor for about 3 minutes.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-22-24



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

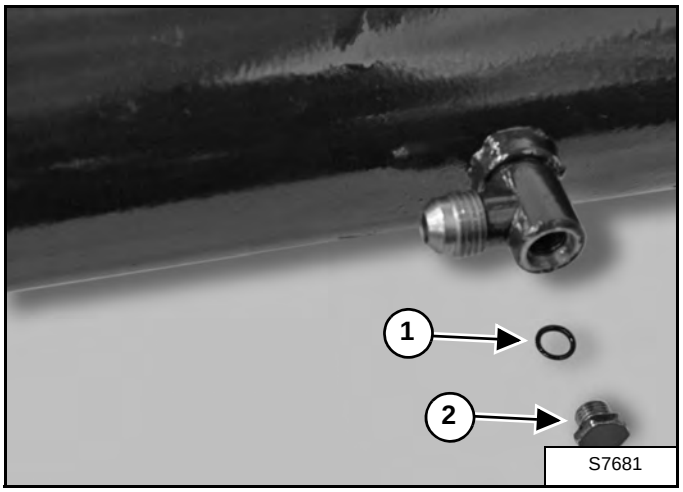
Install the nut (Item 3) **[Figure 20-22-24]**.

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

Reclean thread area for Loctite® residue.

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

Figure 20-22-25

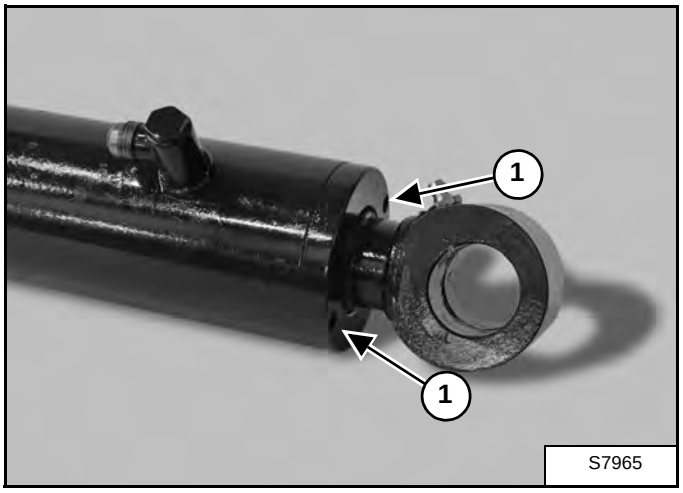


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-22-25]**.

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

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

Figure 20-22-26



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

Dealer Copy -- Not for Resale



Dealer Copy -- Not for Resale

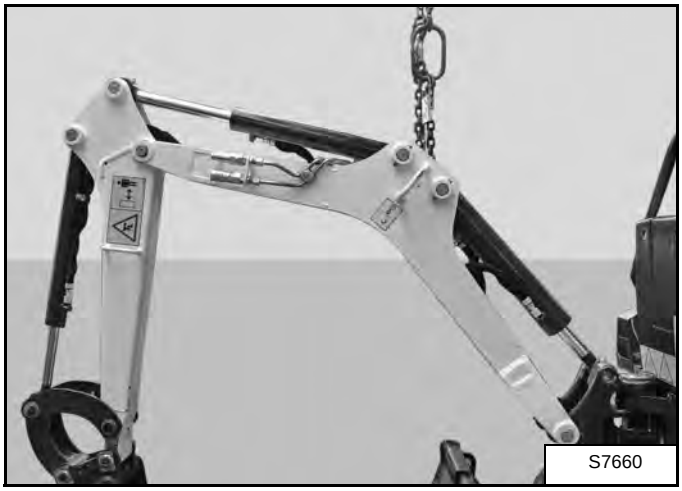
CYLINDER (BUCKET)

Testing

Lower the boom / bucket and blade to the ground.

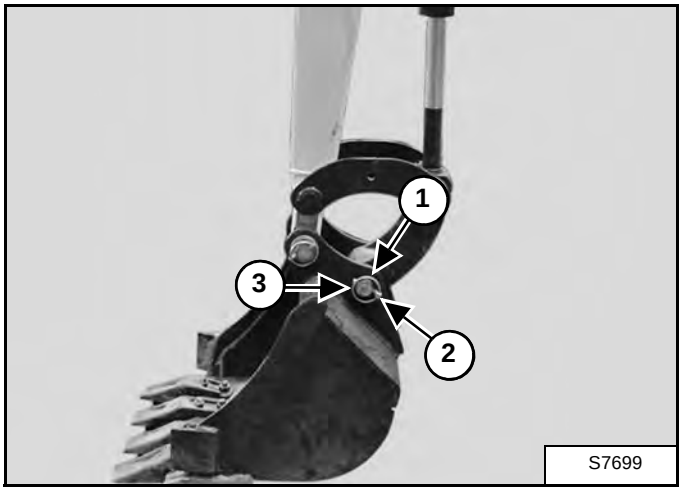
Stop the engine. Raise the control console.

Figure 20-23-1



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

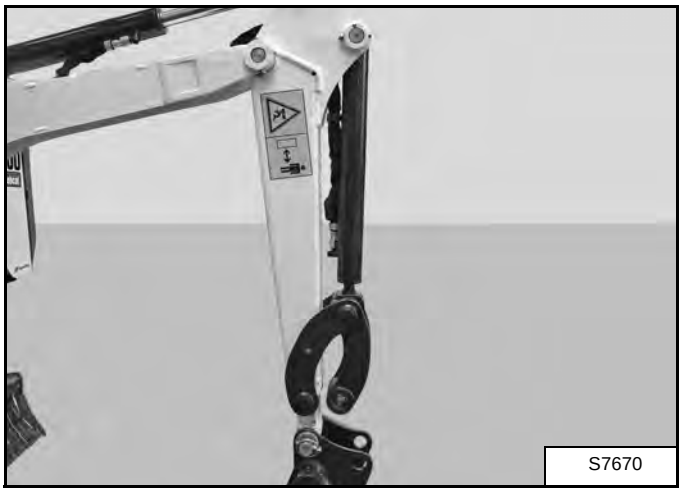
Figure 20-23-2



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

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

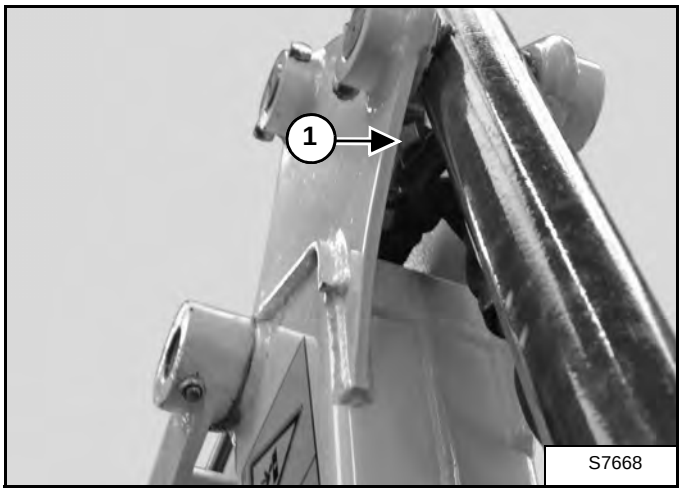
Hydraulic fluid escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. This can cause serious injury and possible death if proper medical treatment by a physician familiar with this injury is not received immediately.

W-2145-0290

Dealer Copy -- Not for Resale

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 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.

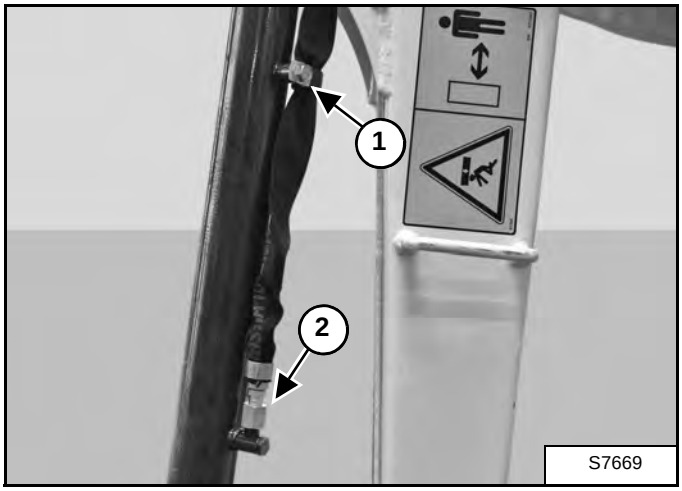
Removal And Installation

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.

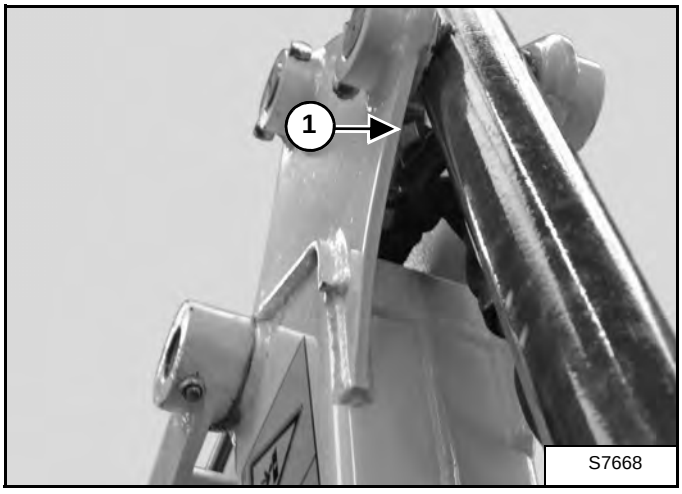
Figure 20-23-5



Remove the hose clamp (Item 1) **[Figure 20-23-5]** from the bucket cylinder.

Remove and plug the bucket cylinder rod end hose (Item 2) **[Figure 20-23-5]**.

Figure 20-23-6

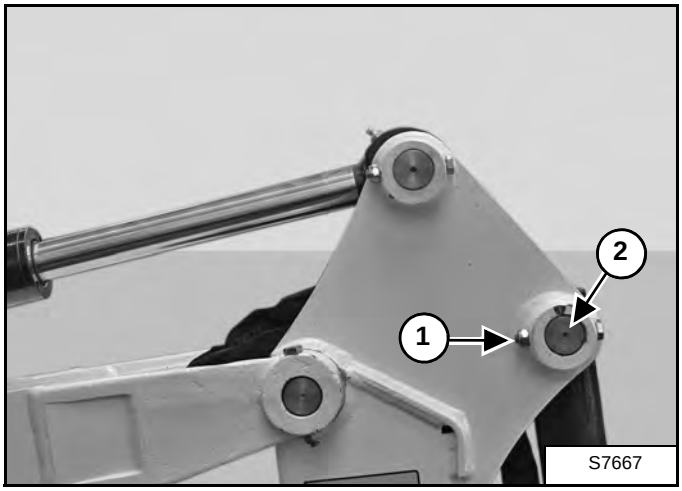


Remove and plug the bucket cylinder base end hose (Item 1) **[Figure 20-23-6]**.

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Removal And Installation (Cont'd)

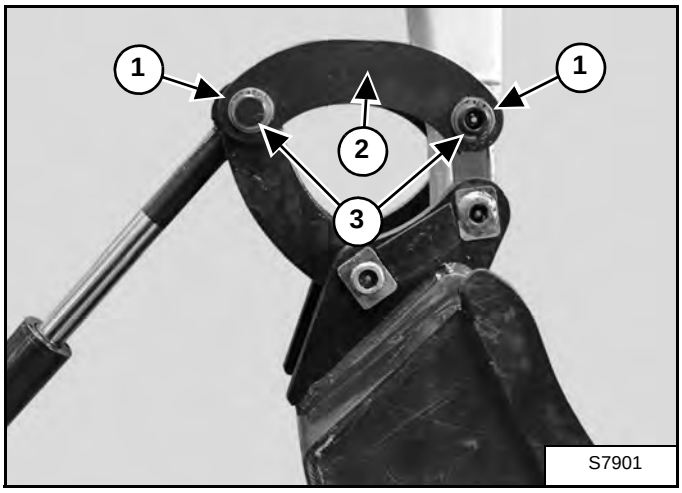
Figure 20-23-7



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

Remove the base end pivot pin (Item 2) **[Figure 20-23-7]** and lower the base end of the cylinder to the floor.

Figure 20-23-8



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

Remove the bucket link (Item 2) **[Figure 20-23-8]**.

Remove the bucket link pins (Item 3) **[Figure 20-23-8]**.

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.

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 physician familiar with this injury is not received immediately.

W-2145-0290

⚠ 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

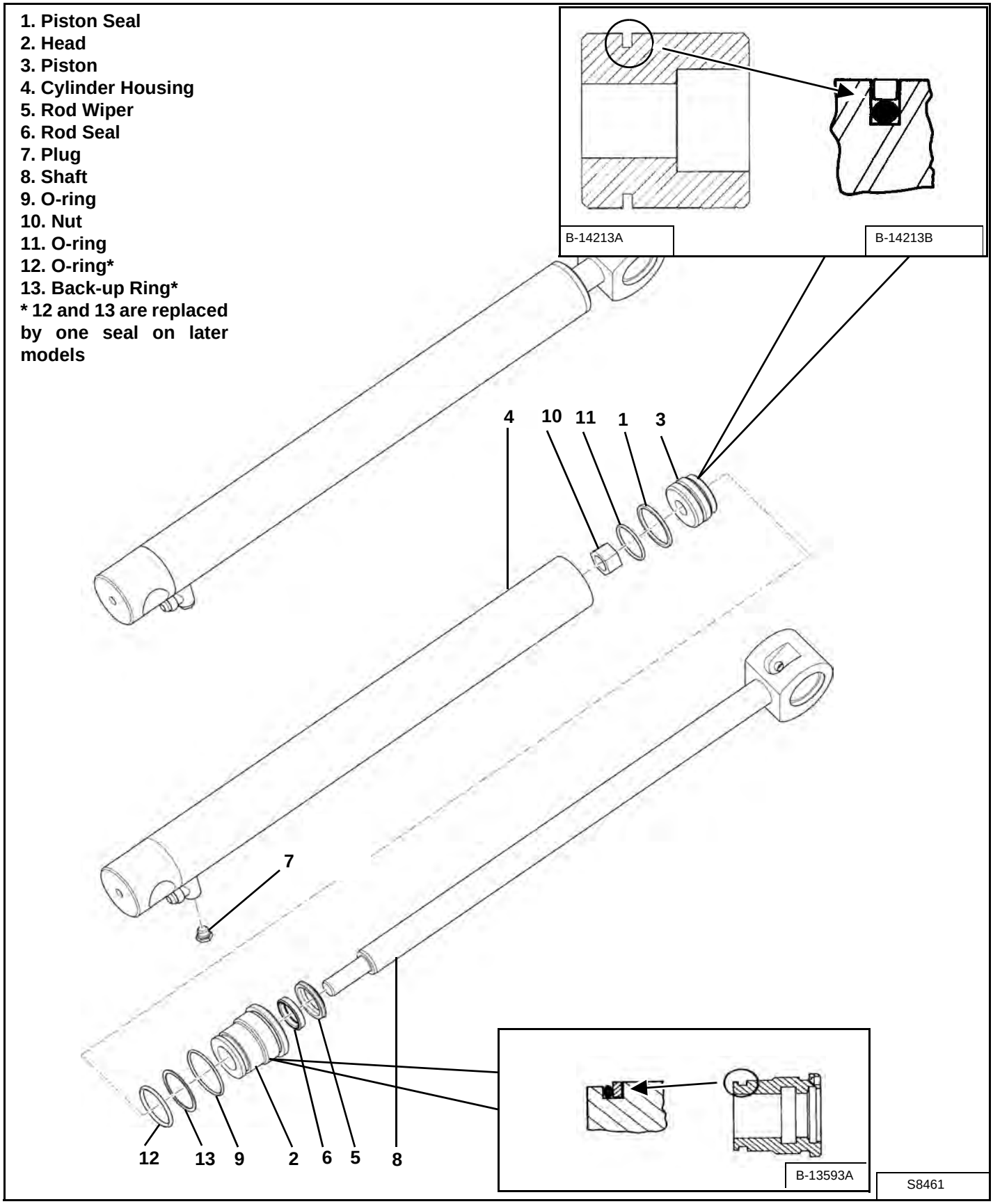
Dealer Copy -- Not for Resale

CYLINDER (BUCKET) (CONT'D)

Parts Identification

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

* 12 and 13 are replaced by one seal on later models



Dealer Copy -- Not for Resale

Disassembly

Clean the outside of the bucket cylinder before disassembly.

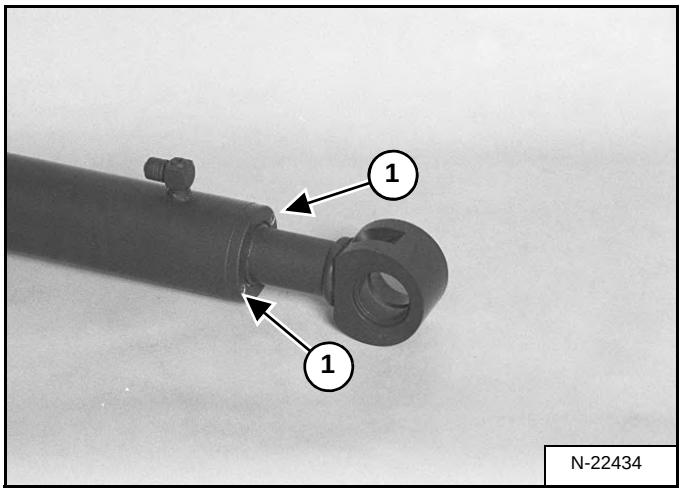
Use the following tools to disassemble the cylinder:

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

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

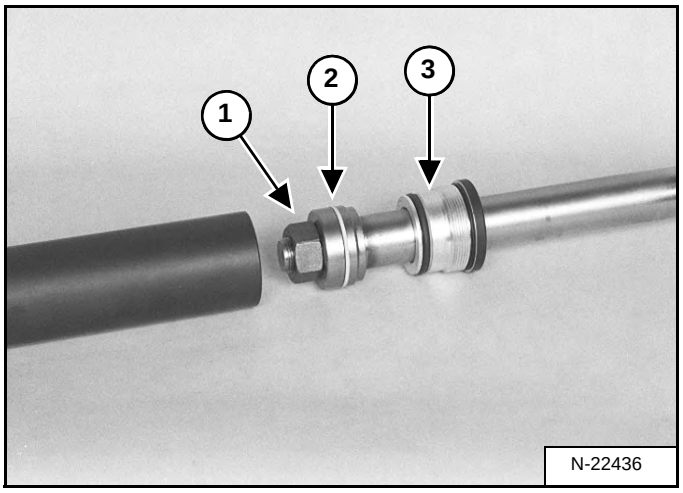
Put the base end of the cylinder in a vise.

Figure 20-23-9



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-23-9]** to loosen the head.

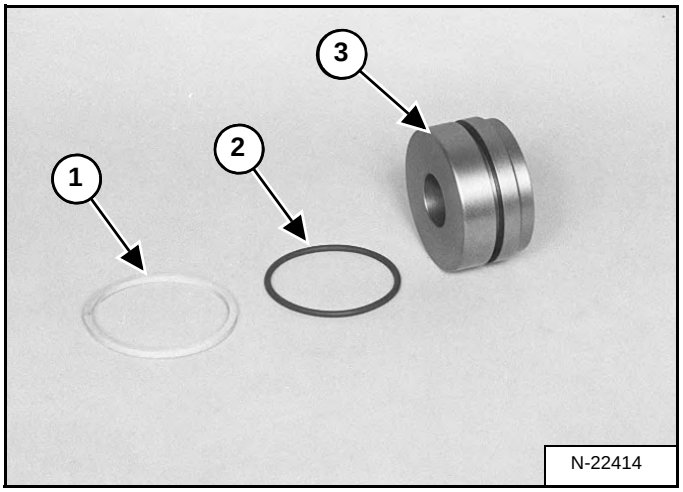
Figure 20-23-10



Remove the head and the rod assembly from the cylinder **[Figure 20-23-10]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2), and head (Item 3) **[Figure 20-23-10]**.

Figure 20-23-11

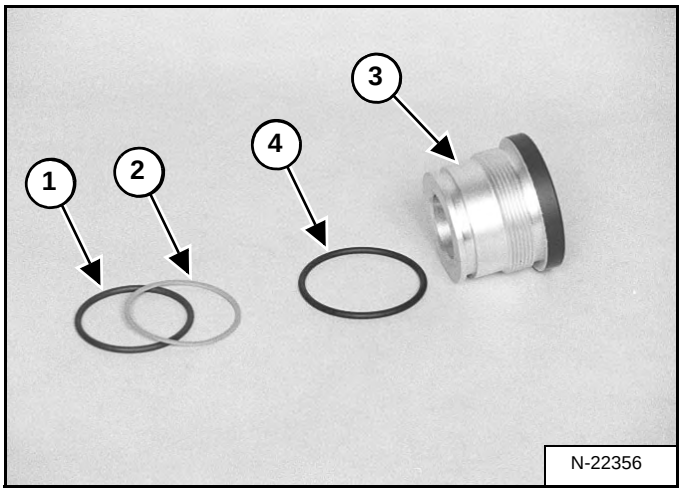


Standard Piston: Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-23-11]**.

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Disassembly (Cont'd)

Figure 20-23-12

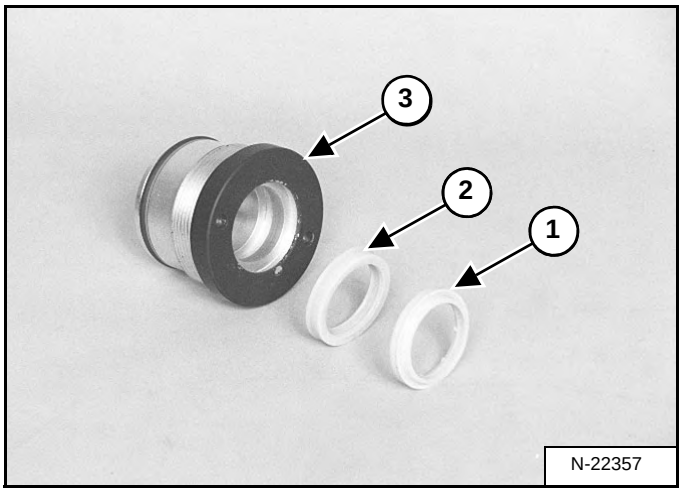


Remove the O-ring (Item 1) and the back-up ring (Item 2) from the groove in the head (Item 3) **[Figure 20-23-12]**.

NOTE: O-ring (Item 1) and back-up ring (Item 2) [Figure 20-23-12] are replaced by one seal on later models.

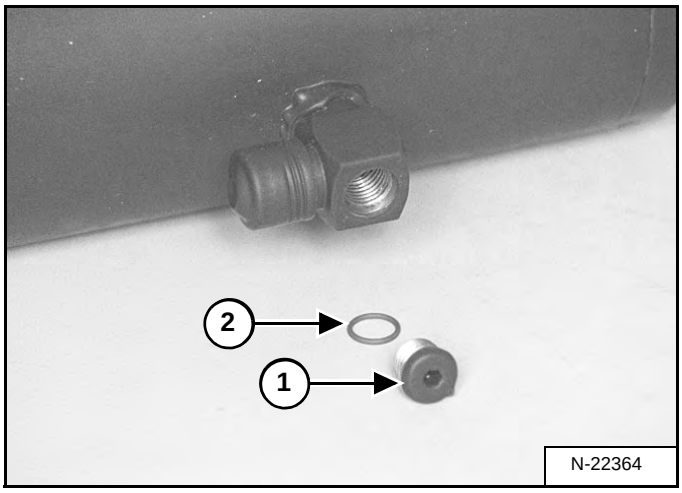
Remove the O-ring (Item 4) **[Figure 20-23-12]**.

Figure 20-23-13



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-23-13]**.

Figure 20-23-14



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-23-14]**.

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Assembly

Use the following tools to assemble the cylinder:

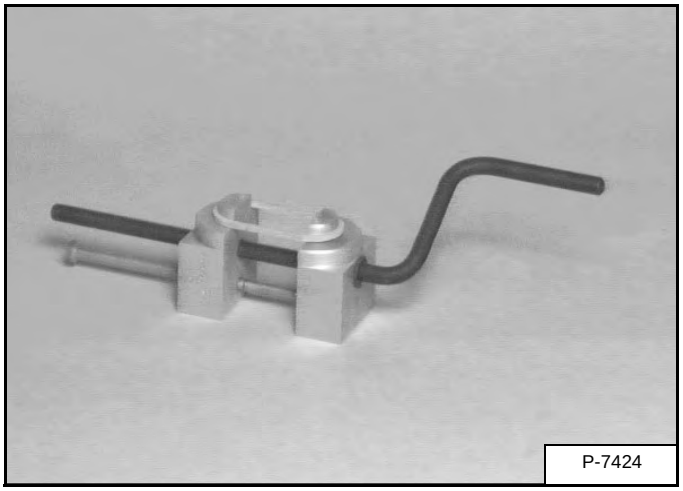
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

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.

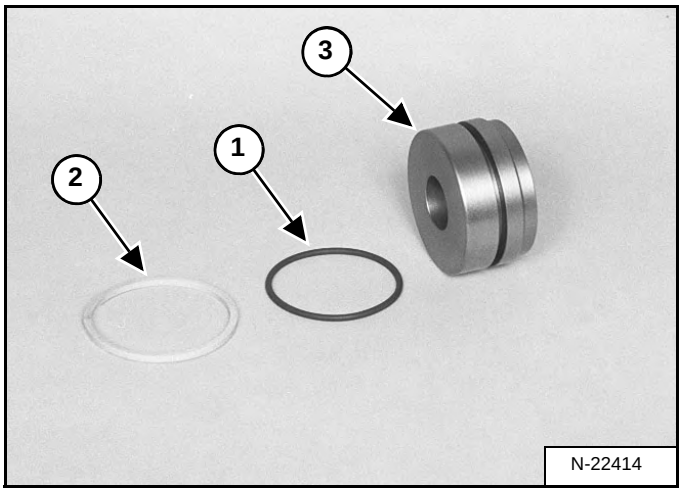
Figure 20-23-15



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-23-15]**.

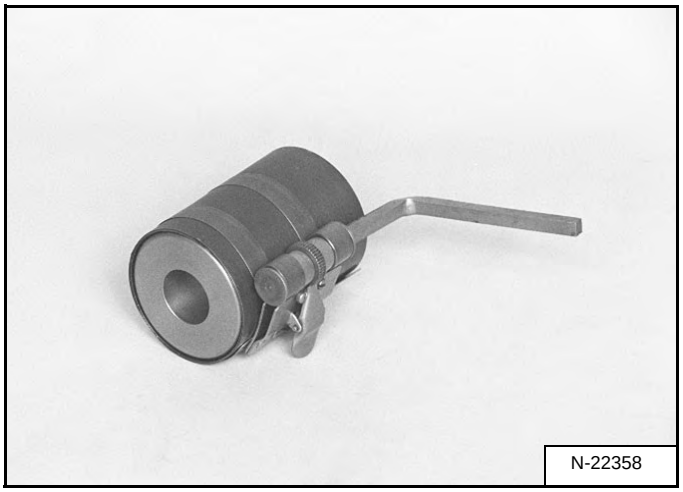
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-23-16



Standard Piston: Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-23-16]**.

Figure 20-23-17

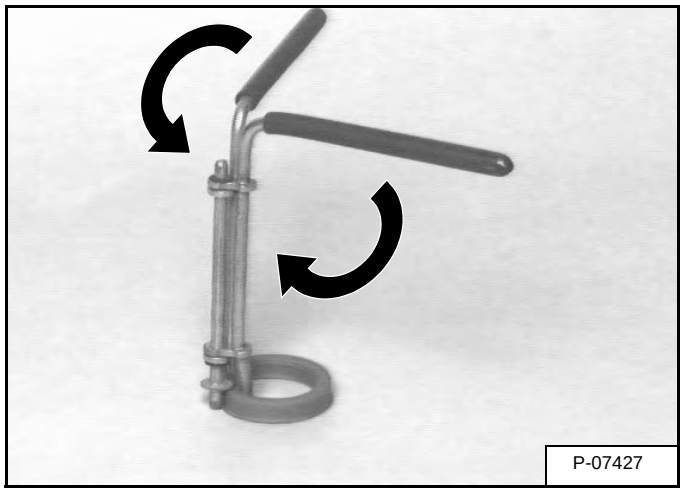


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-23-17]**.

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Assembly (Cont'd)

Figure 20-23-18

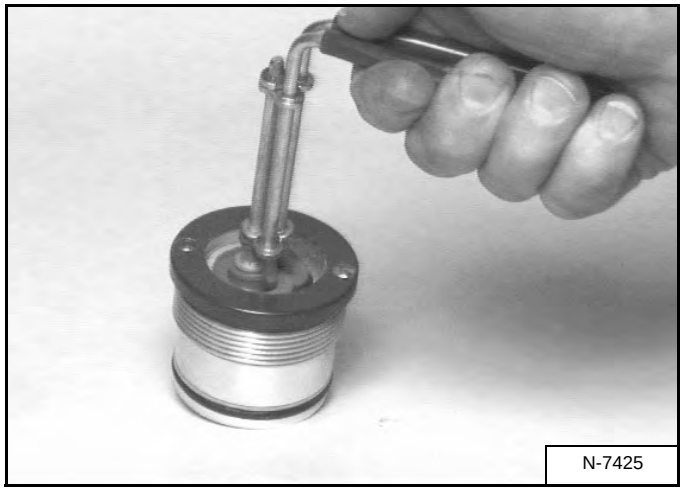


Install the rod seal on the rod seal tool **[Figure 20-23-18]**.

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

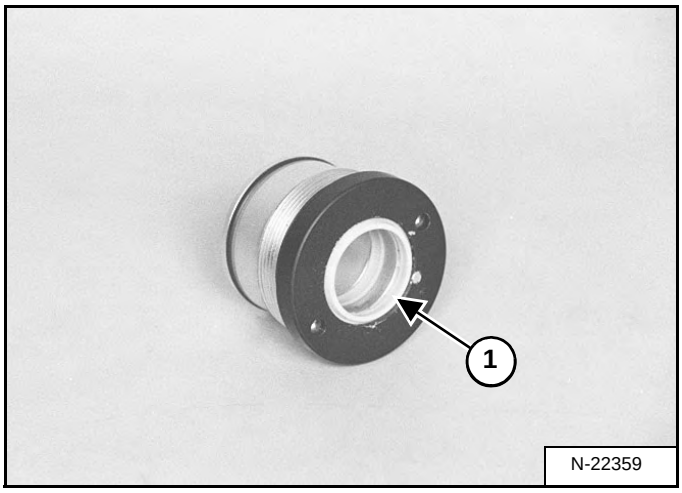
Rotate the handles to collapse the rod seal **[Figure 20-23-18]**.

Figure 20-23-19



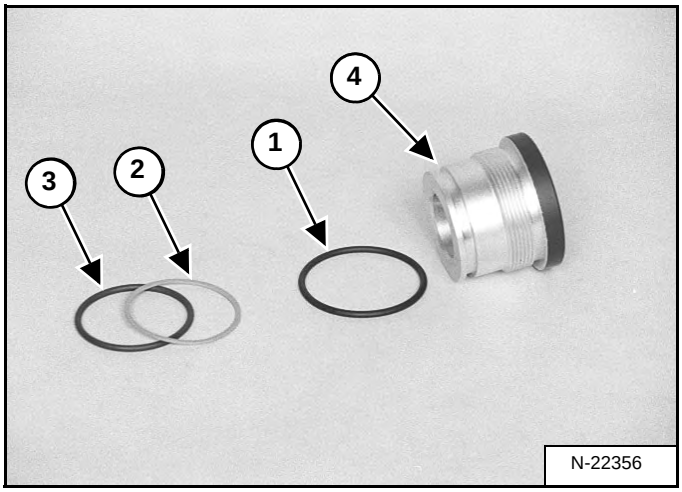
Install the rod seal in the head **[Figure 20-23-19]**.

Figure 20-23-20



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

Figure 20-23-21



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

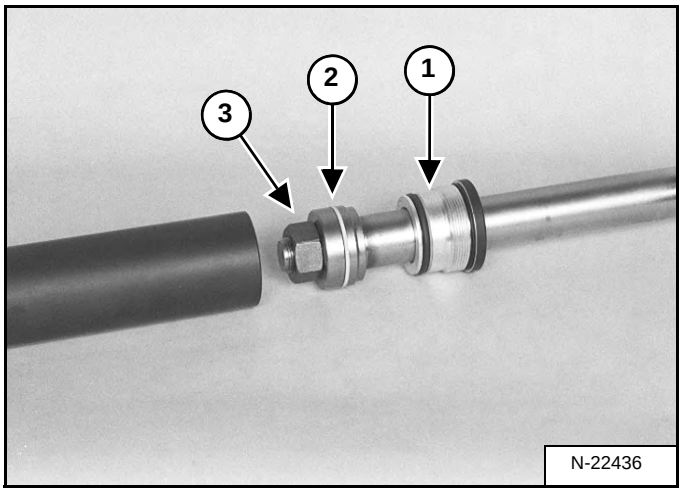
Install the back-up ring (Item 2) and O-ring (Item 3) into the groove on the head (Item 4) **[Figure 20-23-21]**.

NOTE: O-ring (Item 3) and back-up ring (Item 2) [Figure 20-23-21] are replaced by one seal on later models. Use a ring compressor to compress the seal to the correct size. Leave the head in the compressor for about 3 minutes.

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Assembly (Cont'd)

Figure 20-23-22



Install the head (Item 1) and the piston (Item 2) **[Figure 20-23-22]** 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.

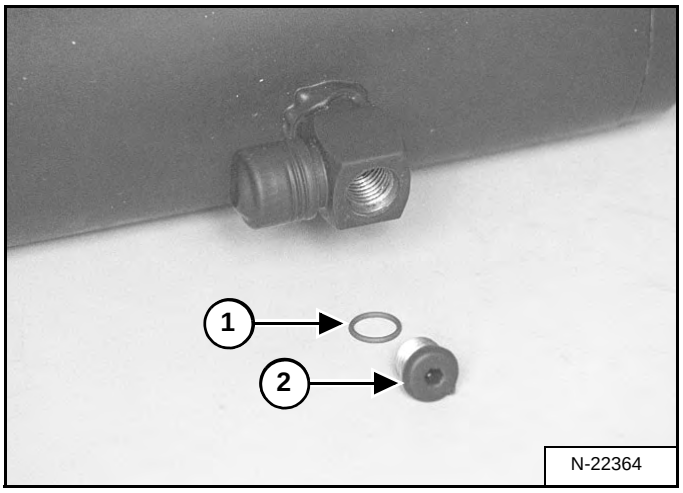
Install the nut (Item 3) **[Figure 20-23-22]**.

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

Reclean thread area for Loctite® residue.

Tighten the nut to 190 N•m (140 ft-lb) torque.

Figure 20-23-23



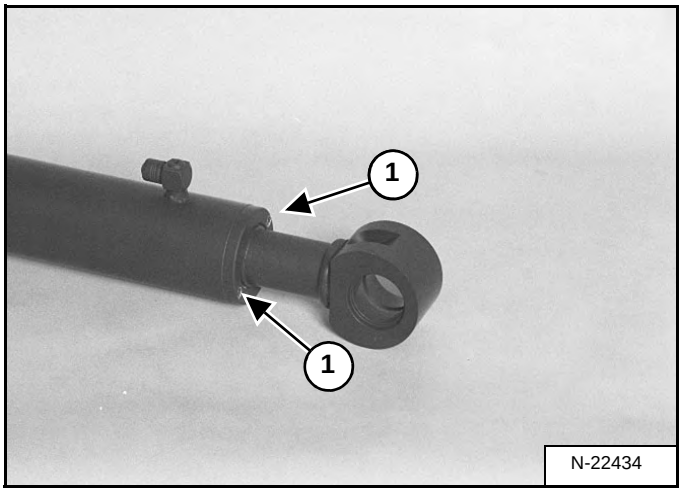
Install O-ring (Item 1) and plug (Item 2) **[Figure 20-23-23]**.

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

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

Be careful no to damage the cylinder tube.

Figure 20-23-24



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-23-24]** to tighten the head. Head to be torqued until flush with end of cylinder housing.

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Dealer Copy -- Not for Resale

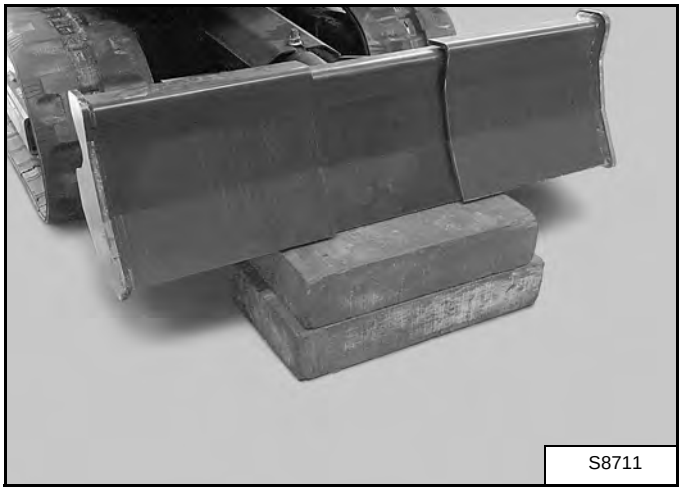
CYLINDER (BLADE)

Testing

Swing the upperstructure out of the way. Lower the boom / bucket to the ground. Raise the blade up until it stops.

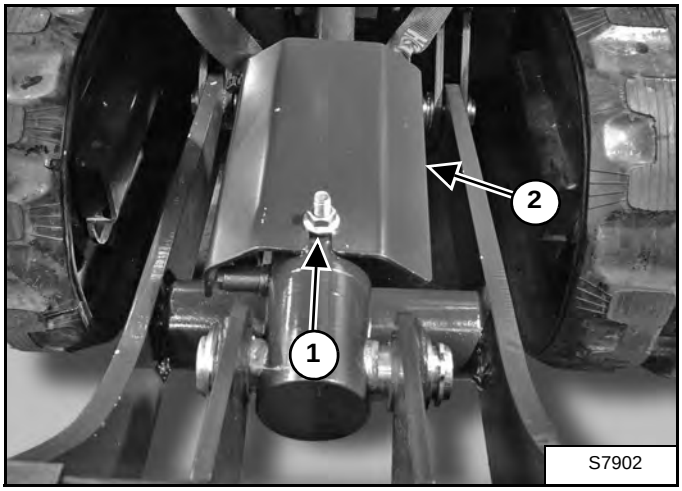
Stop the engine.

Figure 20-24-1



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

Figure 20-24-2



Loosen the top nut (Item 1) and the bottom nut (Item 2) **[Figure 20-24-2]** fastening the shield to the blade cylinder.

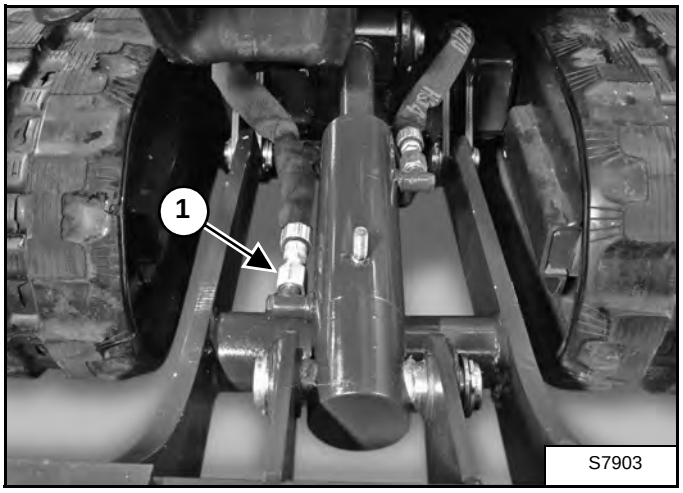
Remove the blade cylinder shield from the blade cylinder.

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 physician familiar with this injury is not received immediately.

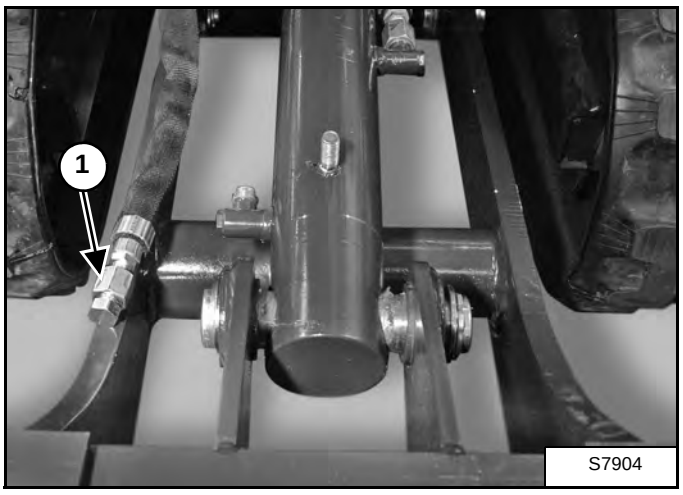
W-2145-0290

Figure 20-24-3



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

Figure 20-24-4



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

Lower 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.

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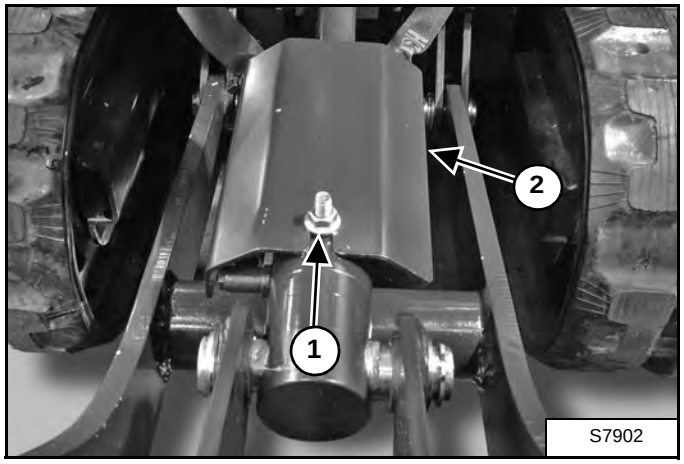
CYLINDER (BLADE) (CONT'D)

Removal And Installation

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

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

Figure 20-24-5



Loosen the top nut (Item 1) and the bottom nut (Item 2) **[Figure 20-24-5]** fastening the shield to the blade cylinder.

Remove the blade cylinder shield from the blade cylinder.

IMPORTANT

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

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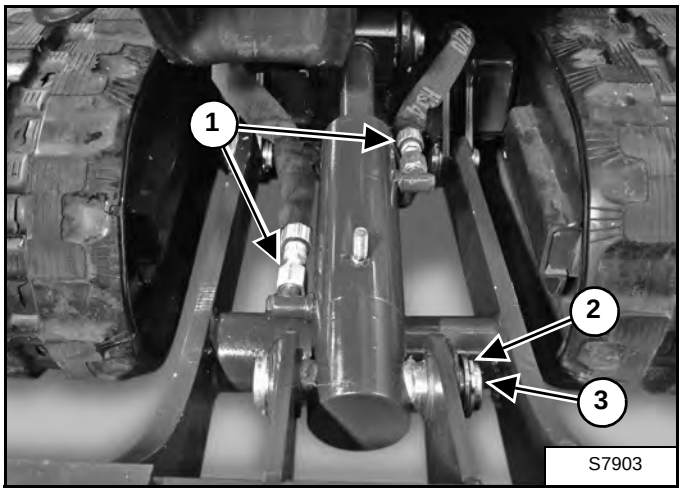
⚠ WARNING

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 20-24-6

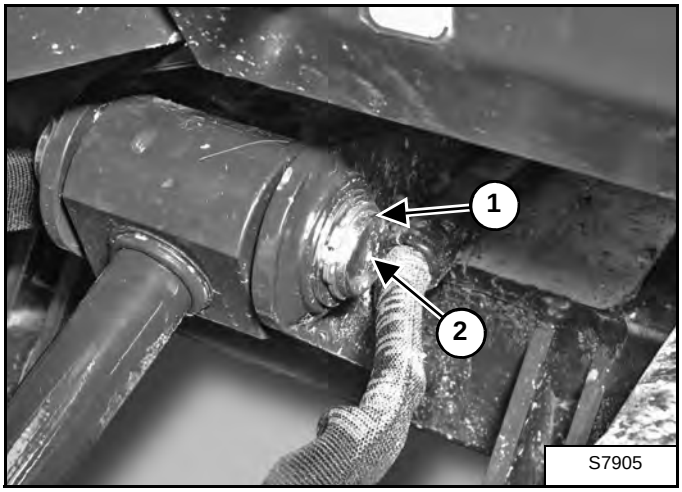


Remove and plug the blade cylinder hoses (Item 1) **[Figure 20-24-6]**.

Remove the snap ring and washers (Item 2) **[Figure 20-24-6]** from the blade cylinder base end pin.

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

Figure 20-24-7



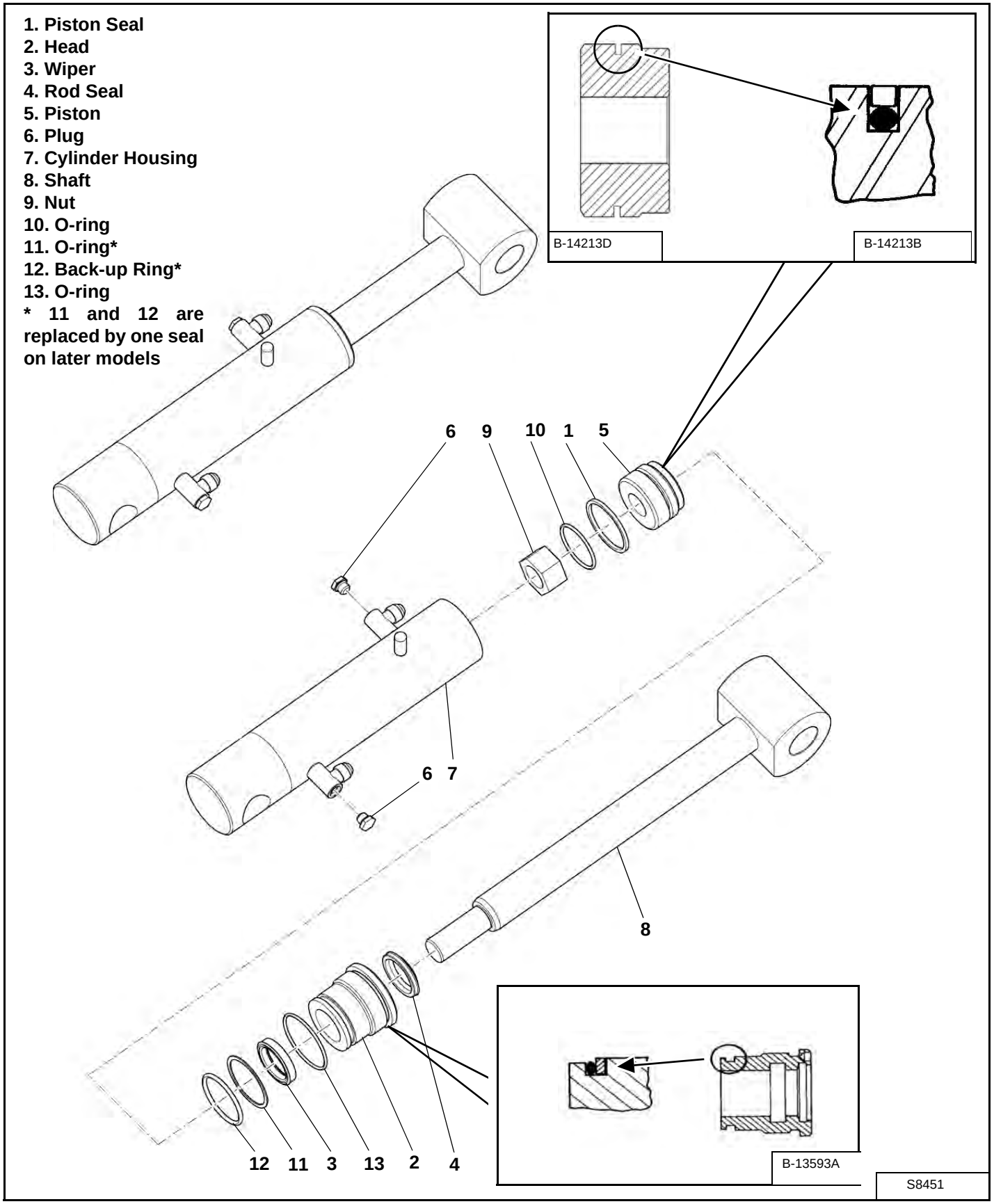
Remove the snap ring and washer (Item 1) **[Figure 20-24-7]** from the blade cylinder rod end.

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

Remove the blade cylinder.

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Parts Identification



Dealer Copy -- Not for Resale

Disassembly

Clean the outside of the blade cylinder before disassembly.

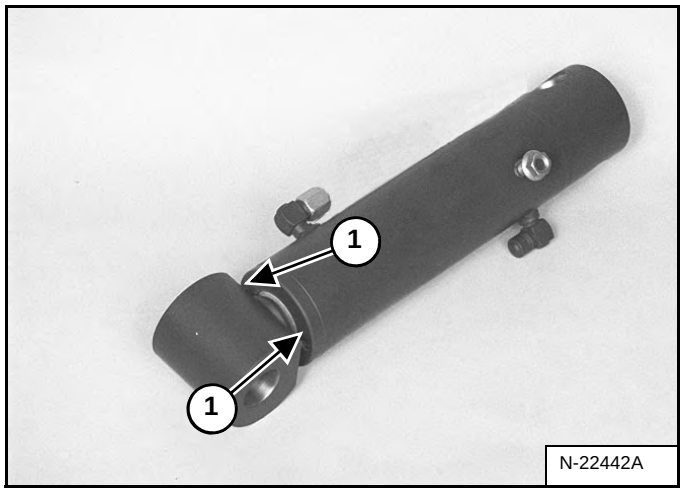
Use the following tools to disassemble the cylinder:

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

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

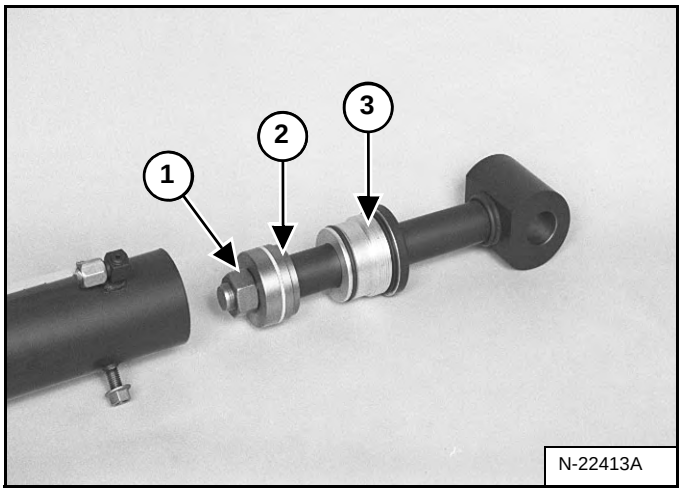
Put the base end of the cylinder in a vise.

Figure 20-24-8



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

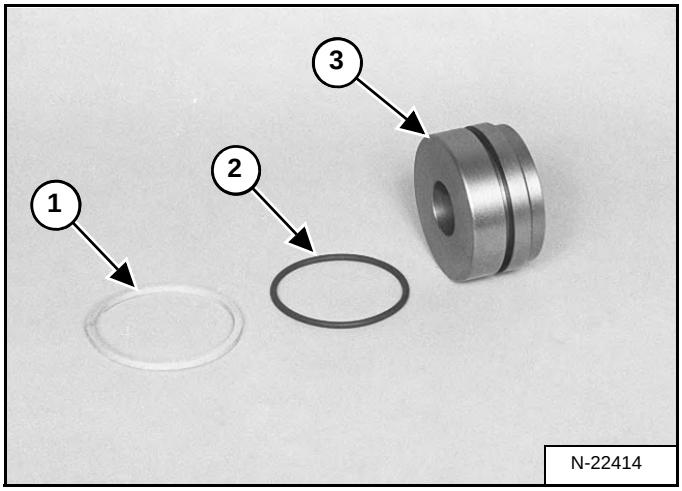
Figure 20-24-9



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

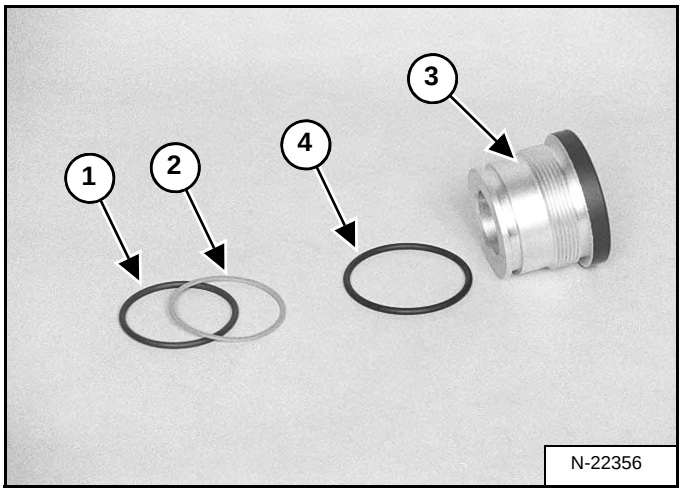


Standard Piston: Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-24-10]**.

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Disassembly (Cont'd)

Figure 20-24-11

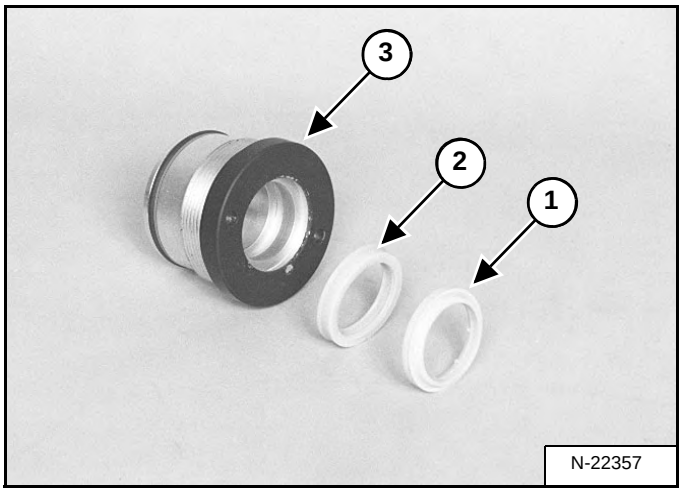


Remove the O-ring (Item 1) and the back-up ring (Item 2) from the groove in the head (Item 3) **[Figure 20-24-11]**.

NOTE: O-ring (Item 1) and back-up ring (Item 2) [Figure 20-24-11] are replaced by one seal on later models.

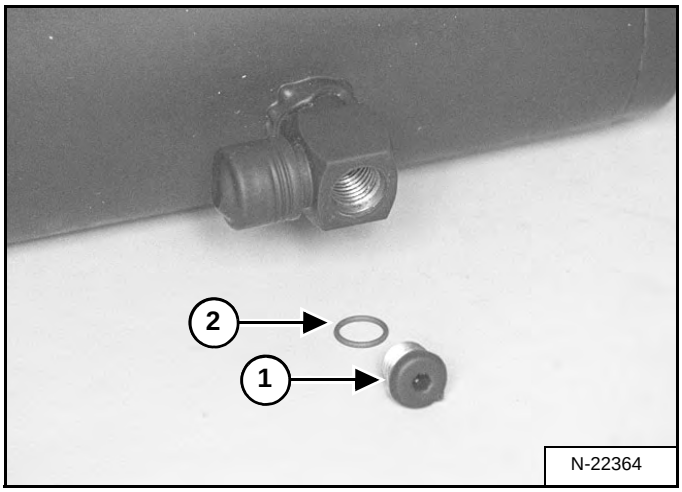
Remove the O-ring (Item 4) **[Figure 20-24-11]**.

Figure 20-24-12



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-24-12]**.

Figure 20-24-13



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-24-13]**.

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Assembly

Use the following tools to assemble the cylinder:

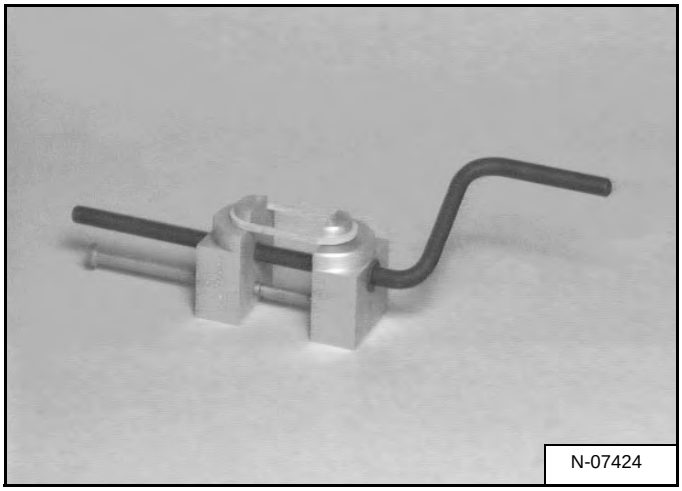
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

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.

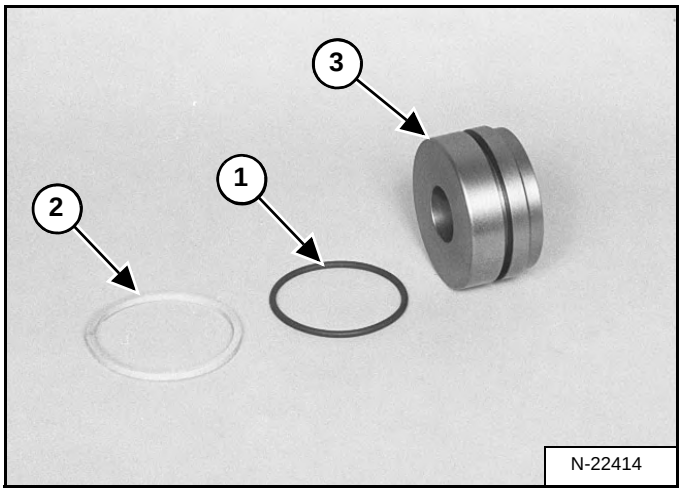
Figure 20-24-14



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

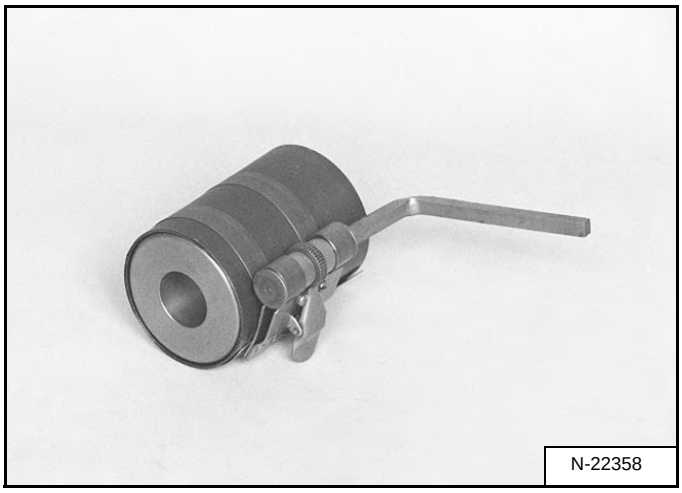
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-24-15



Standard Piston: Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-24-15]**.

Figure 20-24-16

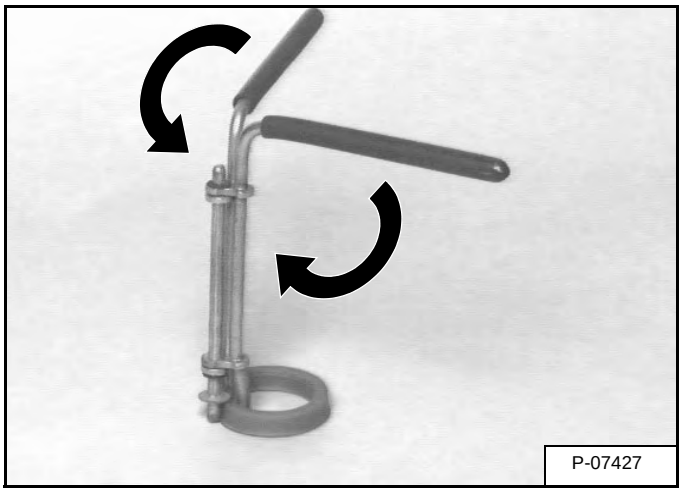


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-24-16]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-24-17

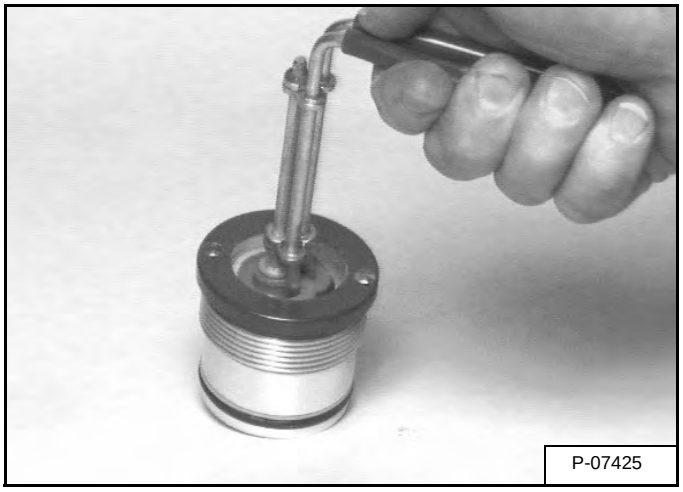


Install the rod seal on the rod seal tool **[Figure 20-24-17]**.

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

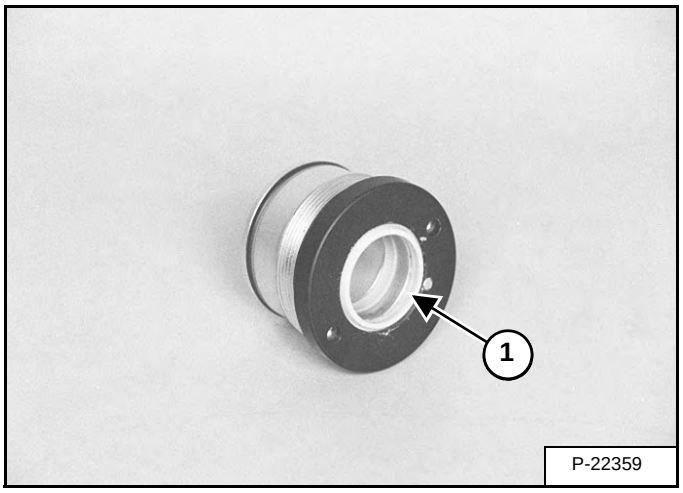
Rotate the handles to collapse the rod seal **[Figure 20-24-17]**.

Figure 20-24-18



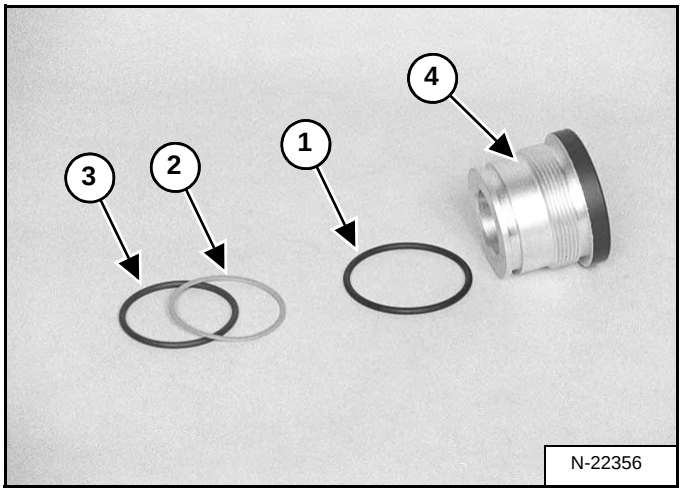
Install the rod seal in the head **[Figure 20-24-18]**.

Figure 20-24-19



Install the wiper seal with the wiper (Item 1) **[Figure 20-24-19]** toward the outside of the head.

Figure 20-24-20



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

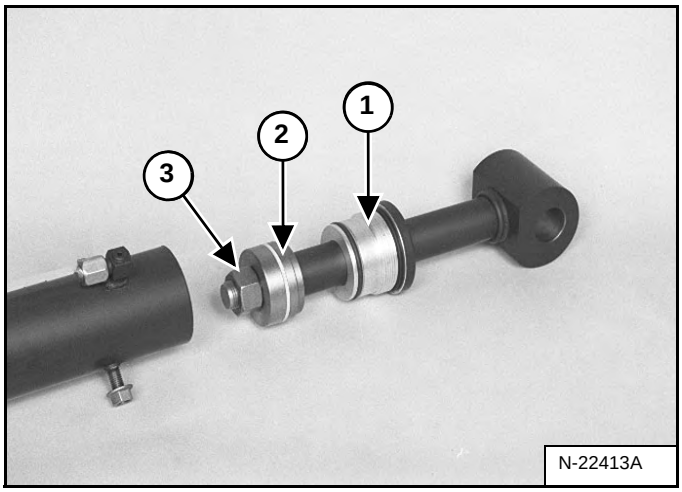
Install the back-up ring (Item 2) and O-ring (Item 3) into the groove on the head (Item 4) **[Figure 20-24-20]**.

NOTE: O-ring (Item 3) and back-up ring (Item 2) [Figure 20-24-20] are replaced by one seal on later models. Use a ring compressor to compress the seal to the correct size. Leave the head in the compressor for about 3 minutes.

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Assembly (Cont'd)

Figure 20-24-21



Install the head (Item 1) and piston (Item 2) **[Figure 20-24-21]** 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.

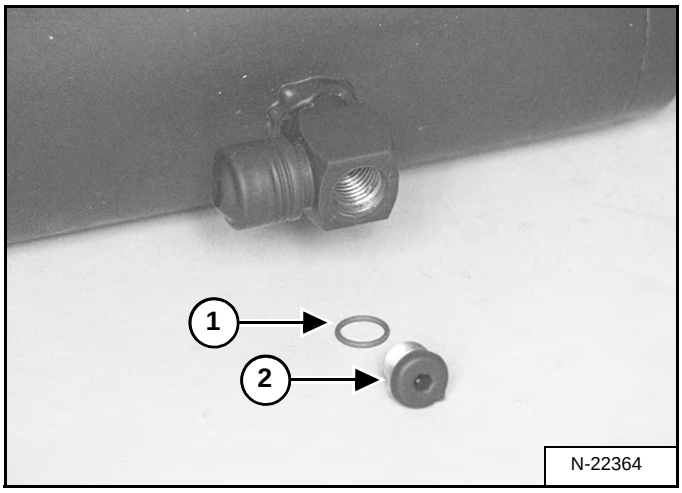
Install the nut (Item 3) **[Figure 20-24-21]**.

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

Reclean thread area for Loctite® residue.

Tighten the nut to 339 N•m (250 ft-lb) torque.

Figure 20-24-22

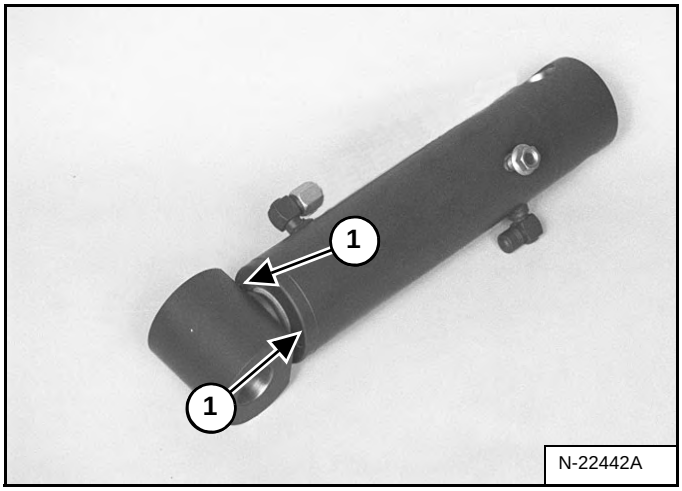


Install O-ring (Item 1) and plug (Item 2) **[Figure 20-24-22]**.

Tighten the plug to 20 N•m (15 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]** to tighten the head. Head to be torqued until flush with end of the housing.

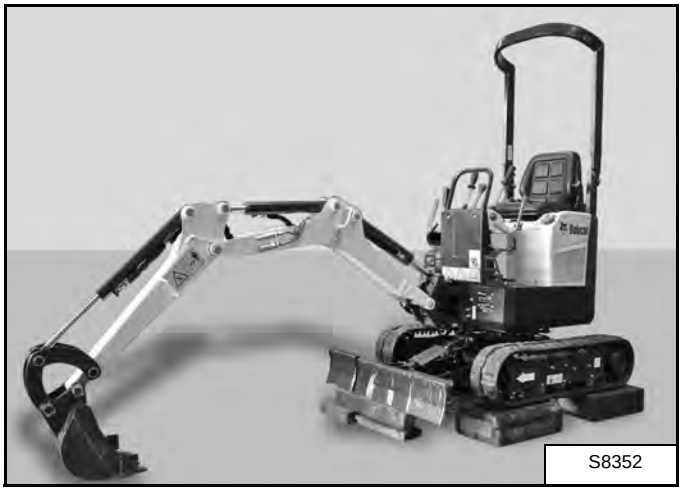
Dealer Copy -- Not for Resale

CYLINDER (TRACK FRAME EXPANSION)

Testing

Retract the track frame fully.

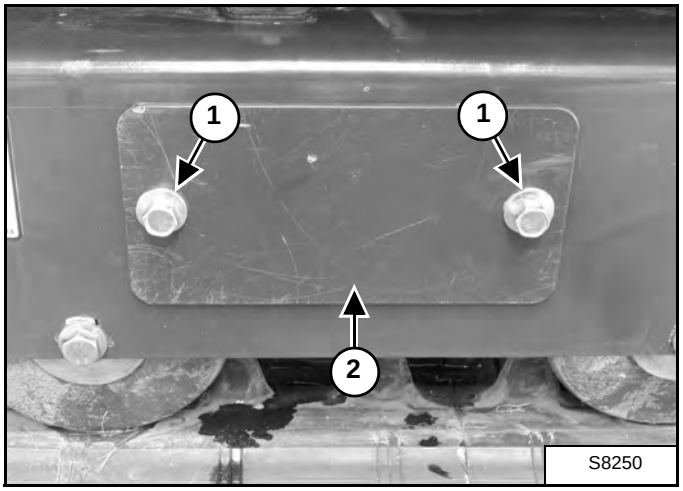
Figure 20-25-1



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

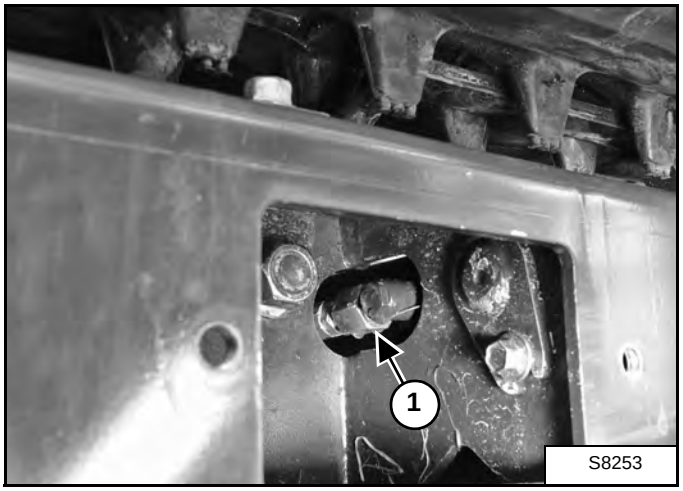
Stop the engine. Raise the control console.

Figure 20-25-2



Remove the two bolts (Item 1) and access plate (Item 2) **[Figure 20-25-2]** on the right side of the undercarriage.

Figure 20-25-3



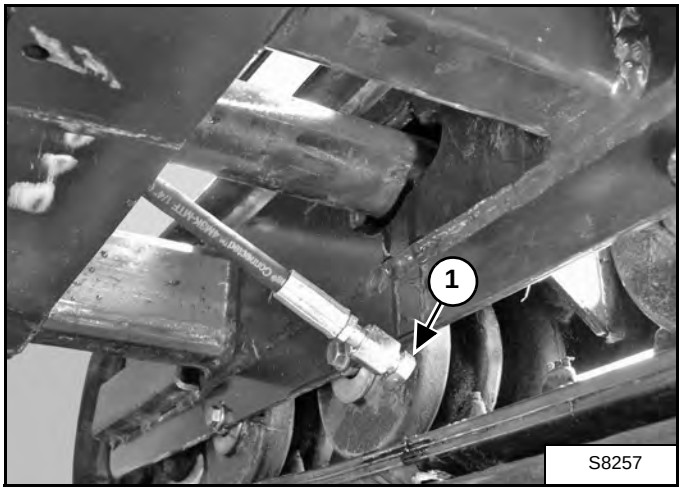
Remove the expansion cylinder base end hose (Item 1) **[Figure 20-25-3]**.

⚠ 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 physician familiar with this injury is not received immediately.

W-2145-0290

Figure 20-25-4



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

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

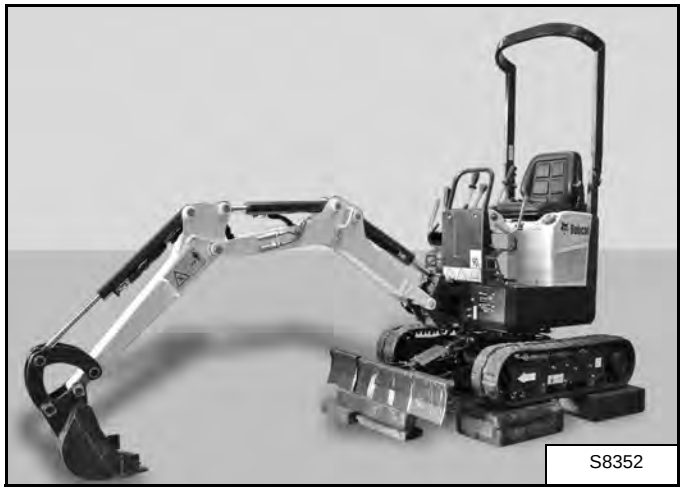
If there is any leakage from the base end fitting on the expansion cylinder, remove the cylinder for repair or replacement.

Dealer Copy -- Not for Resale

Removal And Installation

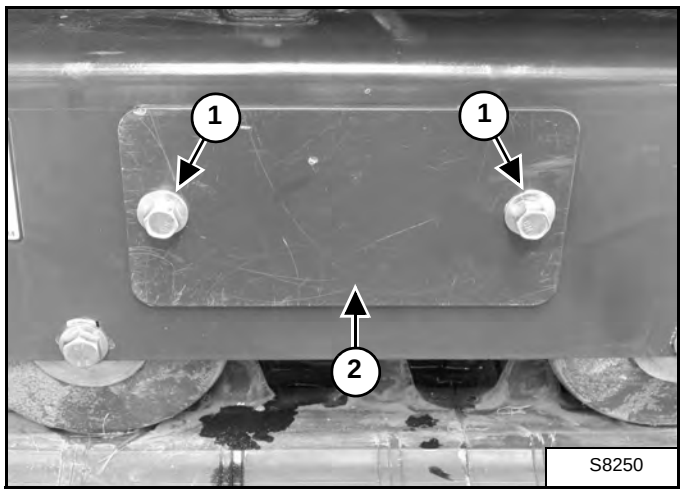
Expand the track frame fully.

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

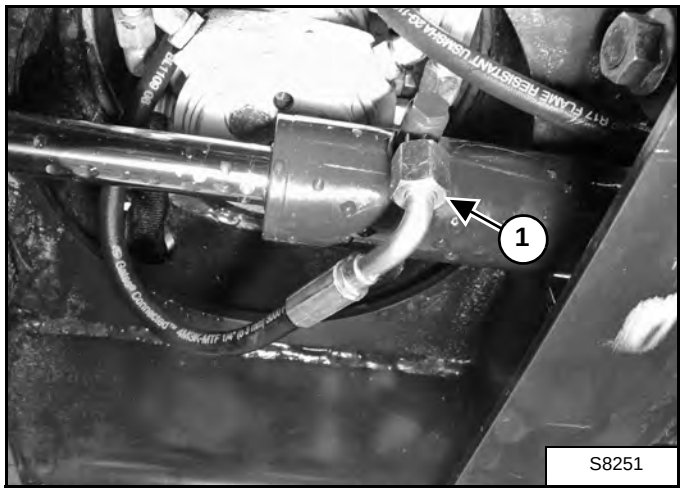


Remove the bolts (Item 1) **[Figure 20-25-6]**.

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

NOTE: Remove the access plates on both sides of the undercarriage.

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

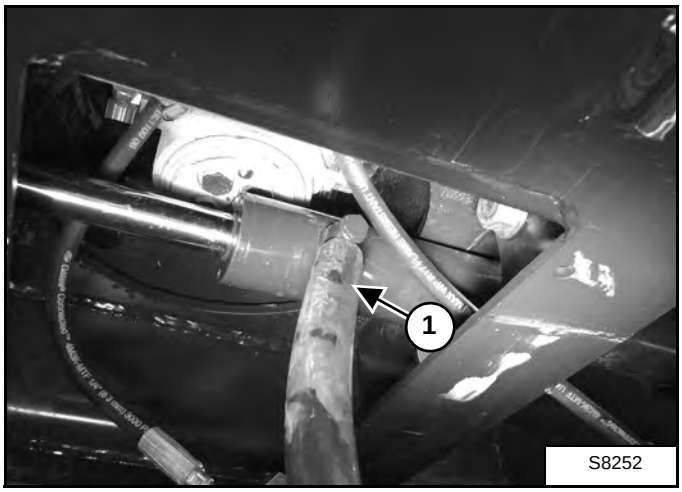
Hydraulic fluid escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. This can cause serious injury and possible death if proper medical treatment by a physician familiar with this injury is not received immediately.

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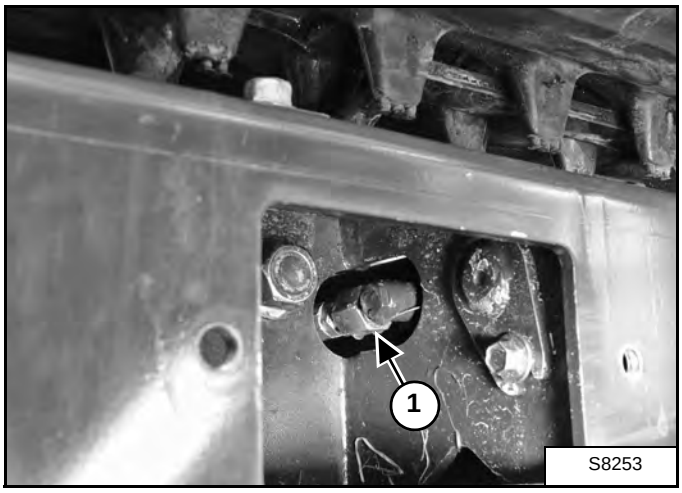
Removal And Installation (Cont'd)

Figure 20-25-8



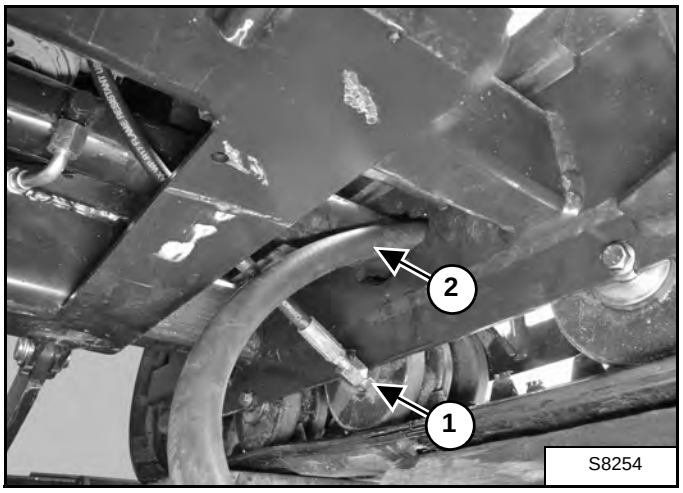
Install a hose (Item 1) **[Figure 20-25-8]** on the cylinder rod end. Place the other end of the hose in a drain pan.

Figure 20-25-9



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

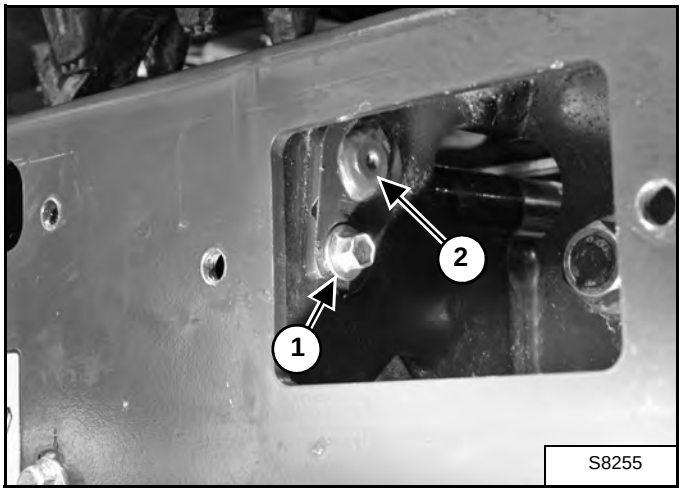
Figure 20-25-10



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 bolt (Item 1) **[Figure 20-25-11]**.

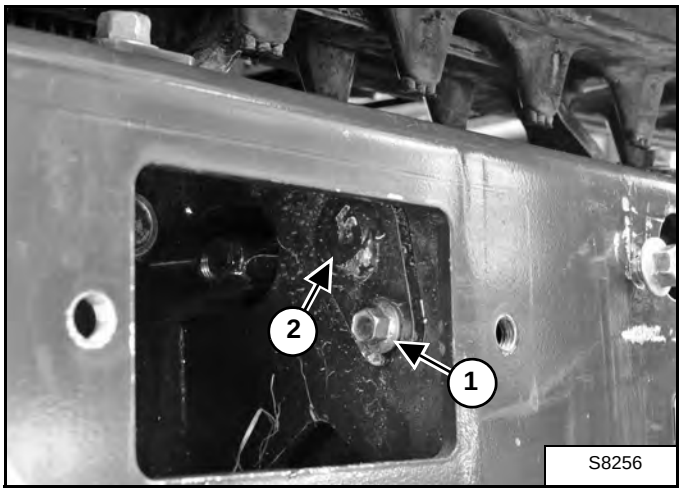
Remove the rod end pivot pin (Item 2) **[Figure 20-25-11]**.

Remove the rod end of the cylinder from the undercarriage.

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Removal And Installation (Cont'd)

Figure 20-25-12

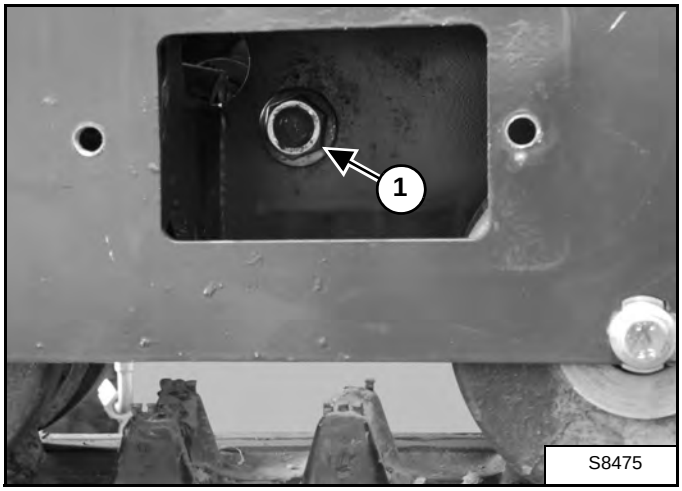


Remove the bolt (Item 1) **[Figure 20-25-12]**.

Remove the base end pivot pin (Item 2) **[Figure 20-25-12]**.

Remove the base end of the cylinder from the undercarriage.

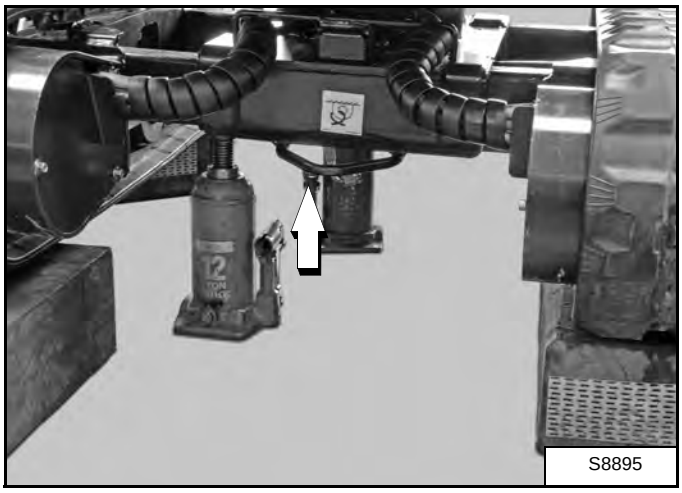
Figure 20-25-13



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

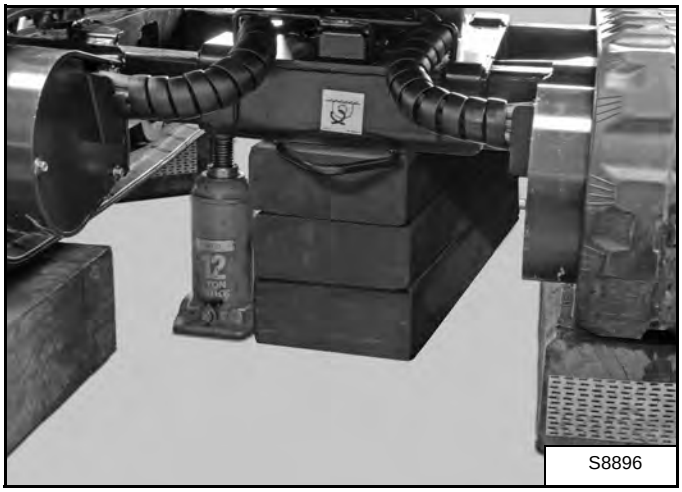
Installation: Tighten the nut to 305 N•m (225 ft-lb) torque.

Figure 20-25-14



Gently lift one side of the undercarriage until the excavator tracks are free of the blocks **[Figure 20-25-14]**.

Figure 20-25-15



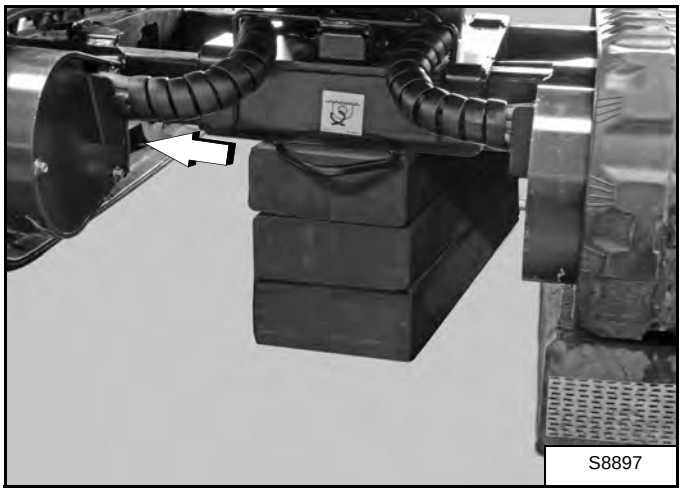
Place blocks under the undercarriage **[Figure 20-25-15]**.

Gently lower the excavator onto the blocks, then remove the jacks.

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Removal And Installation (Cont'd)

Figure 20-25-16



Move the tracks frame towards the outside of the excavator to provide extra clearance for track frame expansion cylinder removal **[Figure 20-25-16]**.

Remove the track frame expansion cylinder from the side by using the opening between undercarriage and track frame.

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.

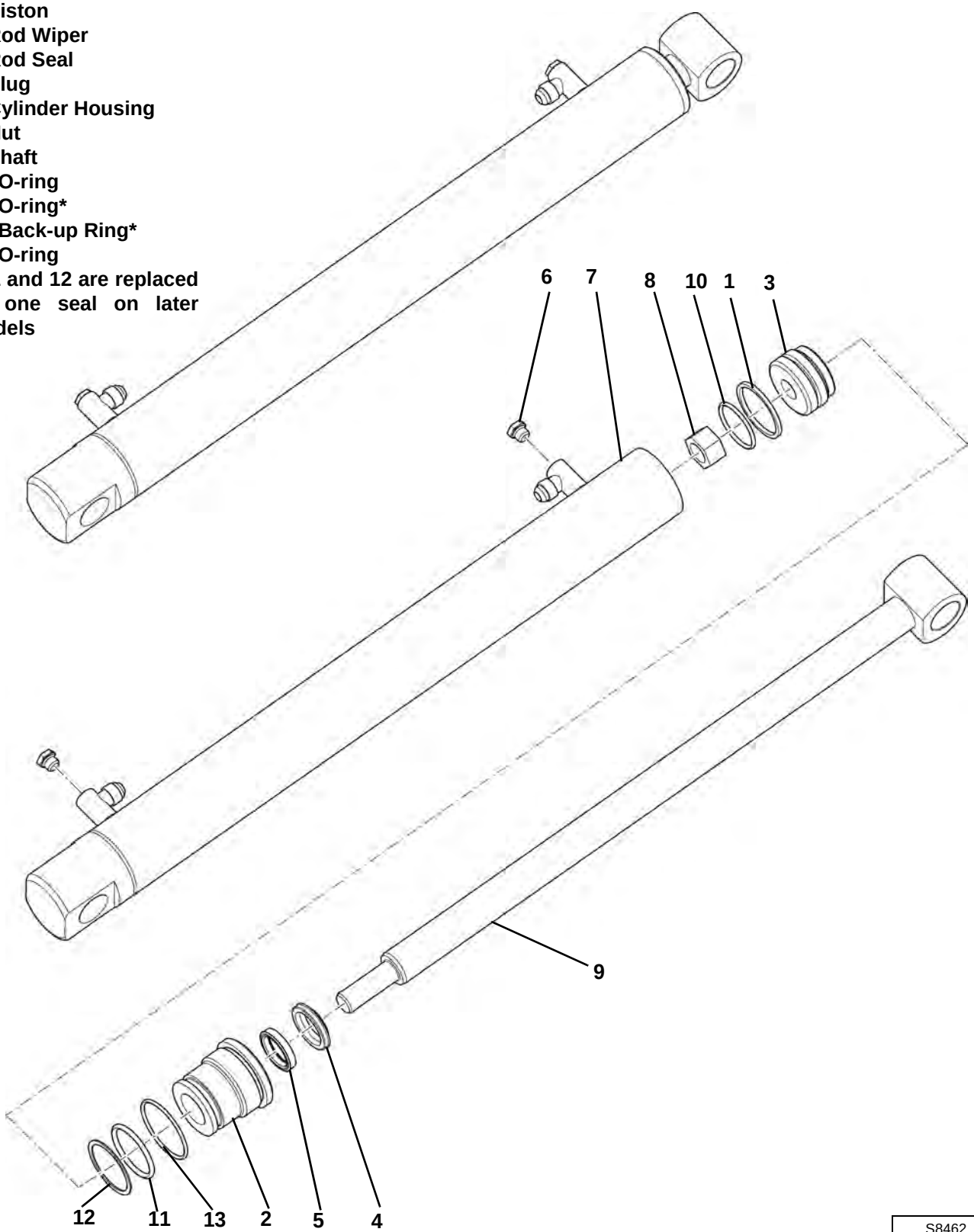
W-2103-0508

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Parts Identification

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

* 11 and 12 are replaced by one seal on later models



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Disassembly

Clean the outside of the expansion cylinder before disassembly.

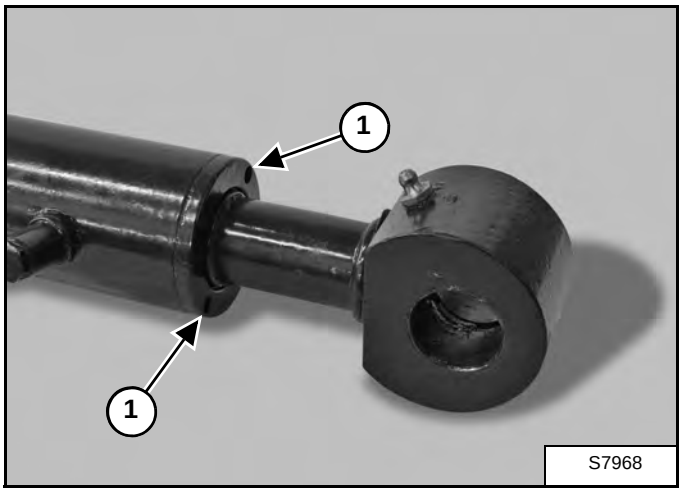
Use the following tools to disassemble the cylinder:

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

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

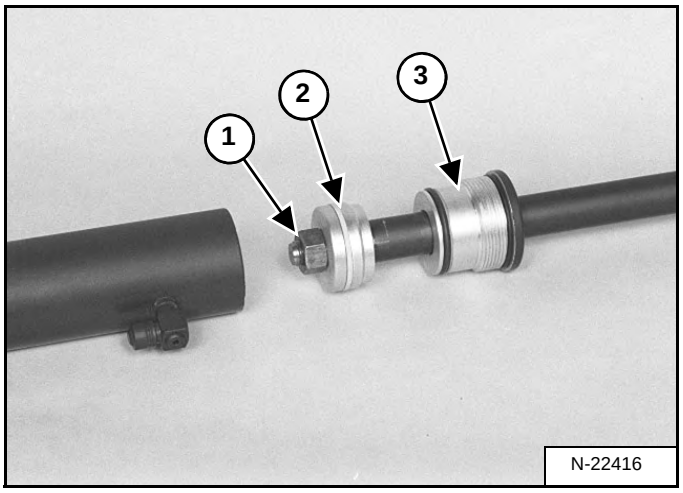
Put the base end of the cylinder in a vise.

Figure 20-25-17



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-25-17]** to loosen the head.

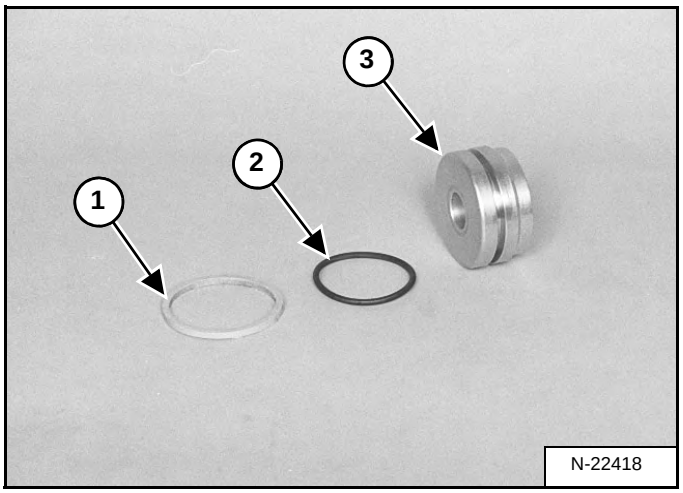
Figure 20-25-18



Remove the head and the rod assembly from the cylinder **[Figure 20-25-18]**. Put the rod end in a vise.

Remove the nut (Item 1), piston (Item 2), and head (Item 3) **[Figure 20-25-18]**.

Figure 20-25-19

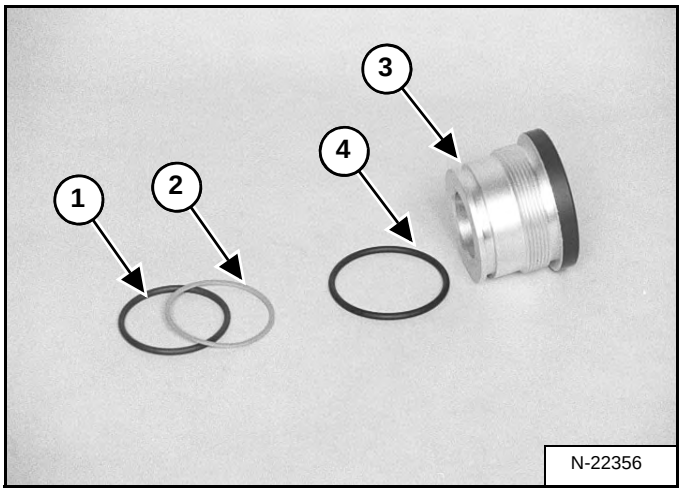


Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-25-19]**.

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Disassembly (Cont'd)

Figure 20-25-20

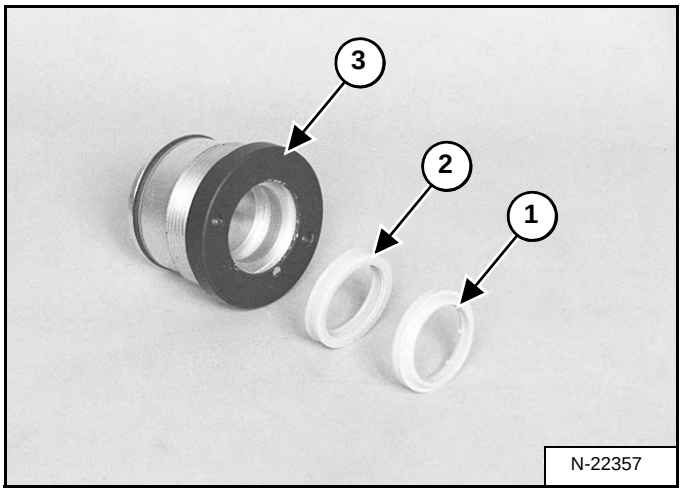


Remove the O-ring (Item 1) and the back-up ring (Item 2) from the groove in the head (Item 3) **[Figure 20-25-20]**.

NOTE: O-ring (Item 1) and back-up ring (Item 2) [Figure 20-25-20] are replaced by one seal on later models.

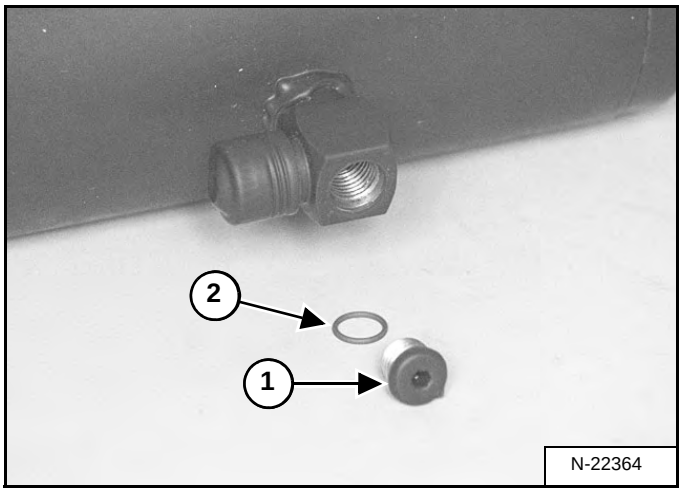
Remove the thin O-ring (Item 4) **[Figure 20-25-20]**.

Figure 20-25-21



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-25-21]**.

Figure 20-25-22



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

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Assembly

Use the following tools to assemble the cylinder:

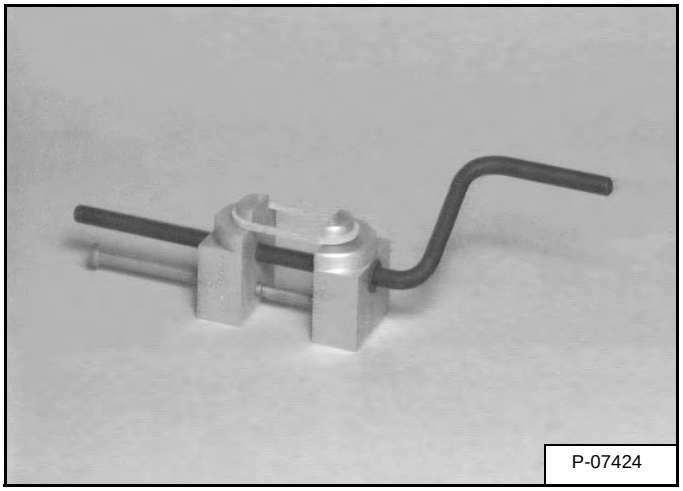
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

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.

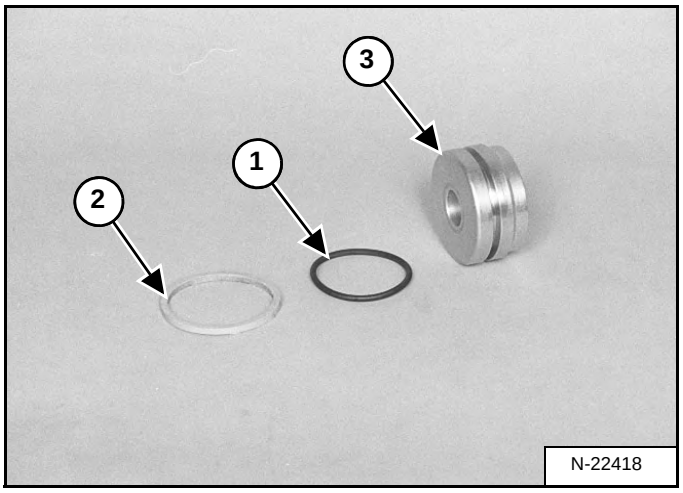
Figure 20-25-23



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-25-23]**.

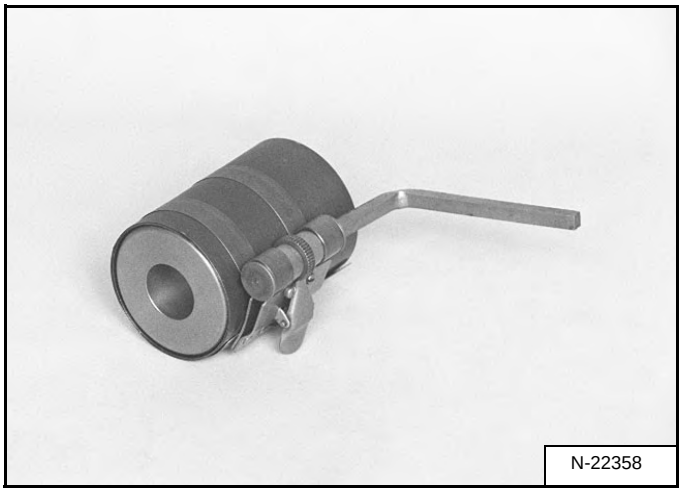
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-25-24



Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-25-24]**.

Figure 20-25-25

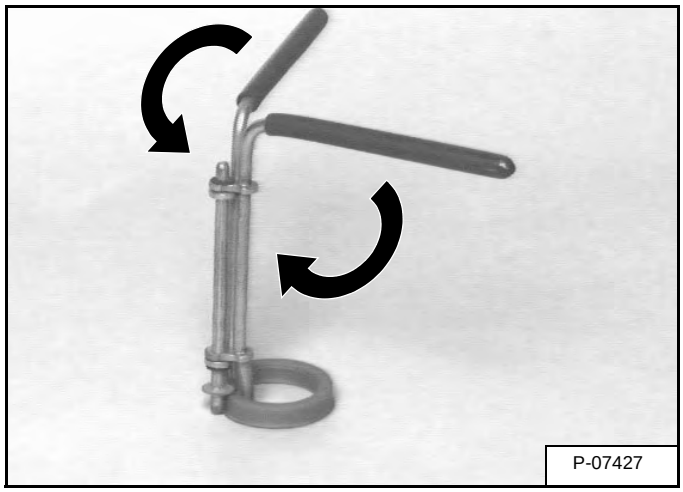


Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-25-25]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-25-26

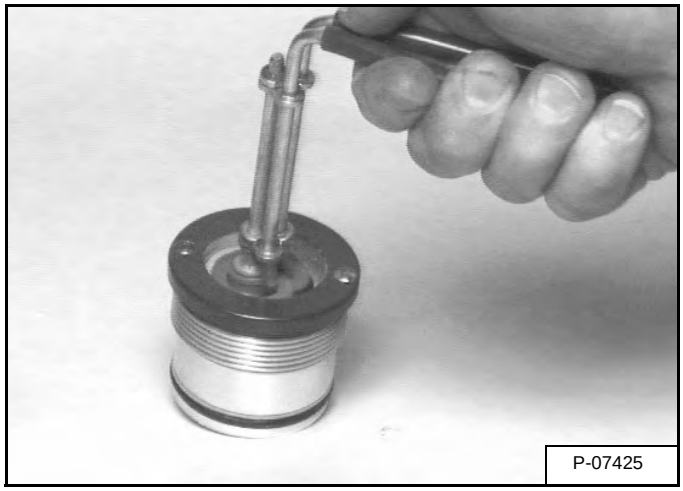


Install the rod seal on the rod seal tool **[Figure 20-25-26]**.

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

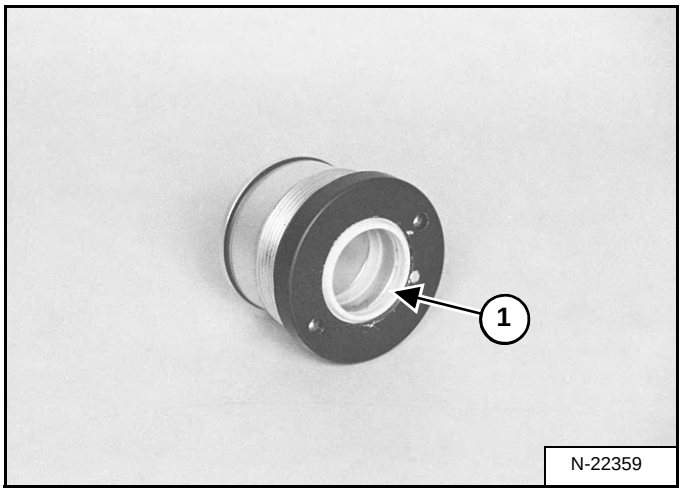
Rotate the handles to collapse the rod seal **[Figure 20-25-26]**.

Figure 20-25-27



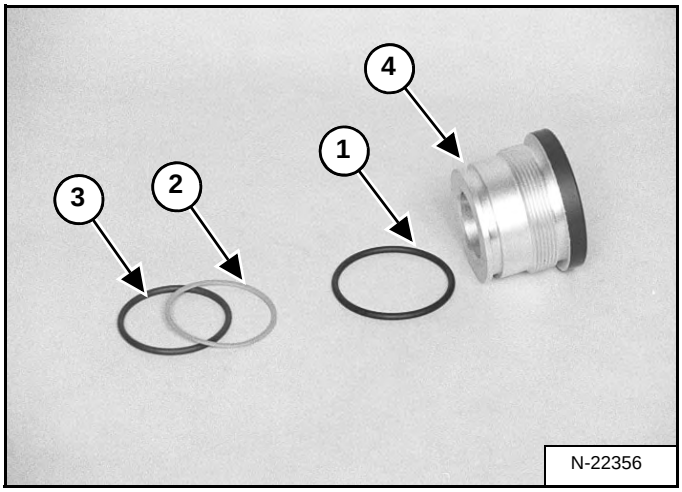
Install the rod seal in the head **[Figure 20-25-27]**.

Figure 20-25-28



Install the wiper seal with the wiper (Item 1) **[Figure 20-25-28]** toward the outside of the head.

Figure 20-25-29



Install the O-ring (Item 1) **[Figure 20-25-29]**.

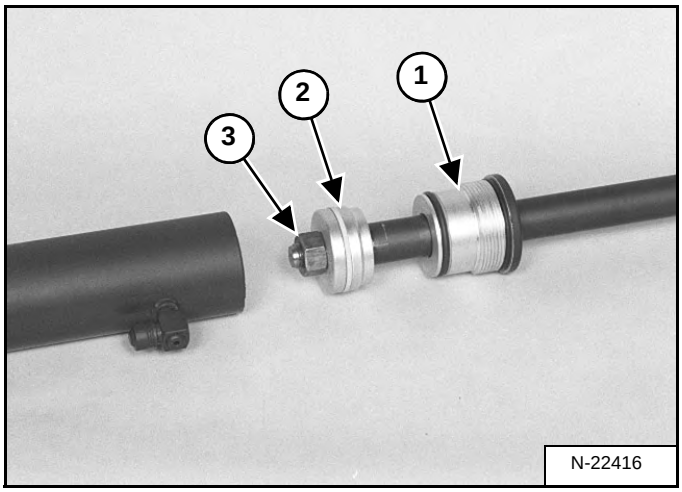
Install the back-up ring (Item 2) and thick O-ring (Item 3) into the groove on the head (Item 4) **[Figure 20-25-29]**.

NOTE: O-ring (Item 3) and back-up ring (Item 2) [Figure 20-25-29] are replaced by one seal on later models. Use a ring compressor to compress the seal to the correct size. Leave the head in the compressor for about 3 minutes.

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Assembly (Cont'd)

Figure 20-25-30



Install the head (Item 1) and the piston (Item 2) **[Figure 20-25-30]** on the rod.

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

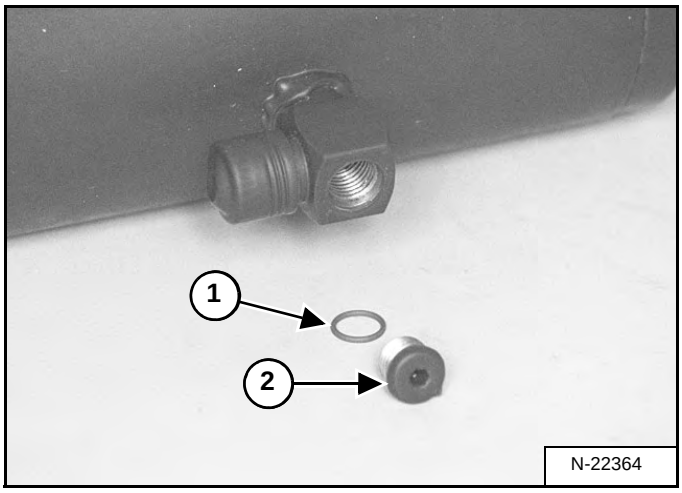
Provide an adequate support for the cylinder before tightening.

Install the nut (Item 3) **[Figure 20-25-30]**.

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

Tighten the nut to 190 N•m (140 ft-lb) torque.

Figure 20-25-31

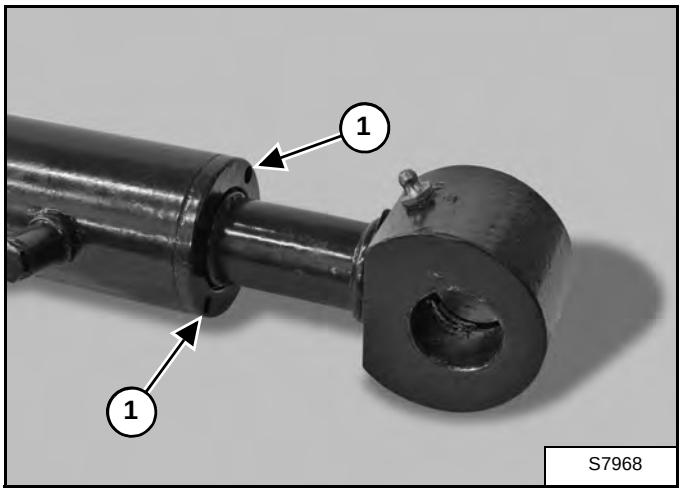


Install the O-ring (Item 1) and plug (Item 2) **[Figure 20-25-31]**.

Tighten the plug to 11 N•m (8 ft-lb) torque.

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

Figure 20-25-32



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-25-32]** to tighten the head. Head to be torqued until flush with end of the housing.

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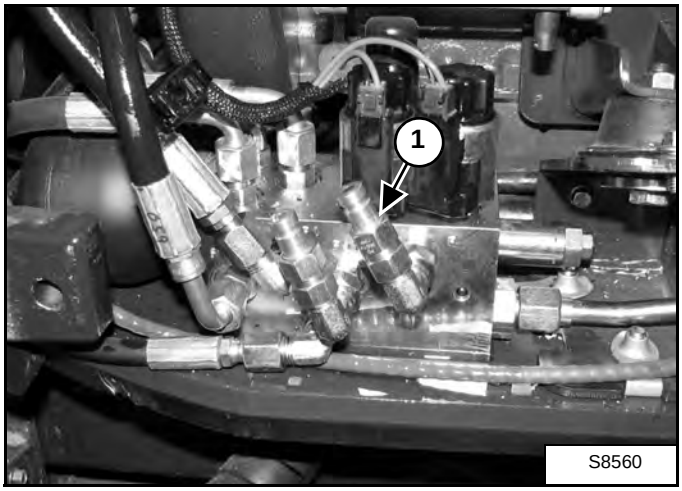
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VALVE (MAIN RELIEF)

Testing And Adjusting

All testing is done with the hydraulic oil 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]** (F port) on the manifold assembly for checking each of the pump section pressure.

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

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

System Pressures At Gauge Port Specifications

TEST CONDITIONS

1. Engine High Idle Speed

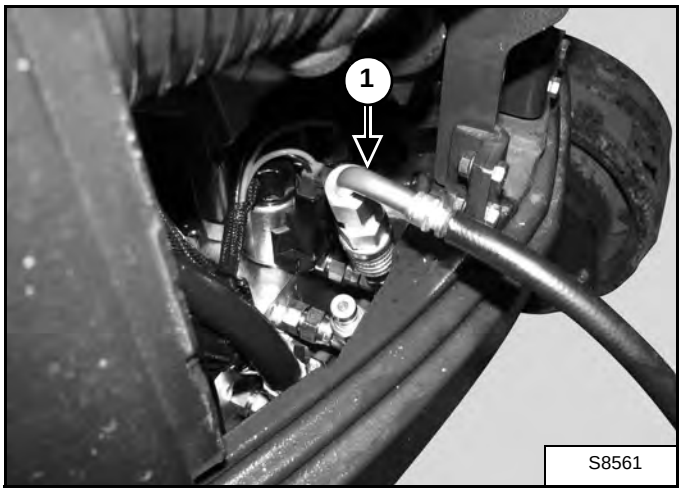
2. Warm oil over relief function to minimum 66°C (150°F). Cycle all functions during warm up procedure.
   Warm oil until the pressure build-up valve stabilizes near its target pressure.

SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET kPa (bar) (psi)	ACCEPTABLE RANGE kPa (bar) (psi)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	PS1	299,9 (30) (45)	2799,3 - 3102,6 (28 - 31) (406 - 450)
SYSTEM BYPASS	NONE - CONSOLE UP	DUMP TO TANK	F	284,2 (2,5) (36)	MAXIMUM ALLOWED 448,2 (4,5) (65)
MAIN RELIEF ON MANIFOLD BLOCK	BUCKET	P2	F	18202,1 (182) (2640)	17698,7 - 18698,6 (177 - 187) (2567 - 2712)
MAIN RELIEF ON MANIFOLD BLOCK	AUXILIARY	P1 and P2	F	19002 (190) (2756)	18498,6 - 19498,8 (185 - 195) (2683 - 2828)
MAIN RELIEF ON MANIFOLD BLOCK	ARM	P1	F	18202,2 (182) (2640)	17698,8 - 18698,6 (177 - 187) (2567 - 2712)
SWING MOTOR - PORT RELIEF	SLEW RIGHT	P1	F	8397,8 (84) (1218)	7997,9 - 8797,7 (80 - 88) (1160 - 1276)
SWING MOTOR - PORT RELIEF	SLEW LEFT	P1	F	8397,8 (84) (1218)	7997,9 - 8797,7 (80 - 88) (1160 - 1276)

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

Figure 20-30-2



Connect the test gauge coupler from the test kit (Item 1) **[Figure 20-30-2]** to the "F" diagnostic port.

Lower the control console and fasten 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 due to a bypass orifice in spool.

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

Boom up:
17,7 - 18,7 MPa (177 - 187 bar) (2567 - 2712 psi)

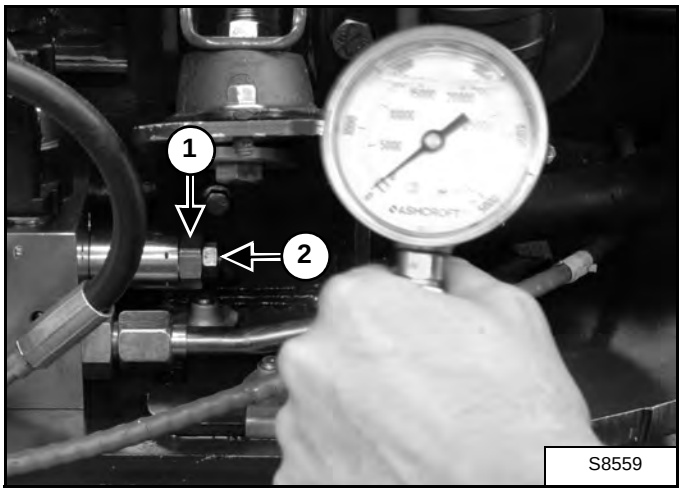
Bucket in:
17,7 - 18,7 MPa (177 - 187 bar) (2567 - 2712 psi)

Arm in:
17,7 - 18,7 MPa (177 - 187 bar) (2567 - 2712 psi)

Auxiliary:
18,5 - 19,5 MPa (185 - 195 bar) (2683 - 2828 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 counterclockwise to decrease the pressure.

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

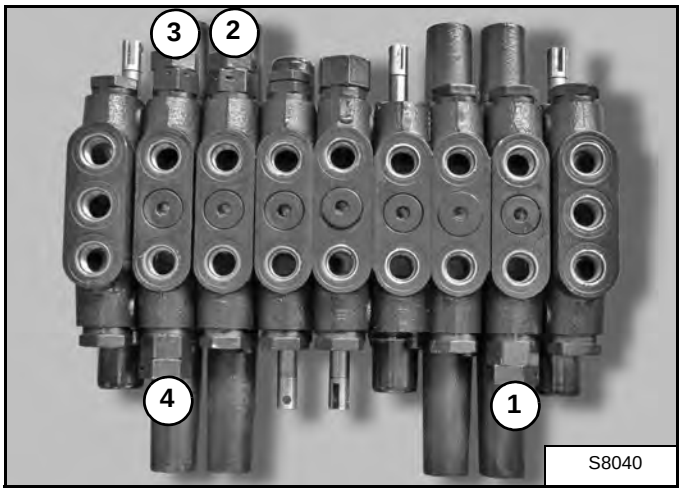
Retest the main relief valve after adjustment.

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VALVE (PORT RELIEF)

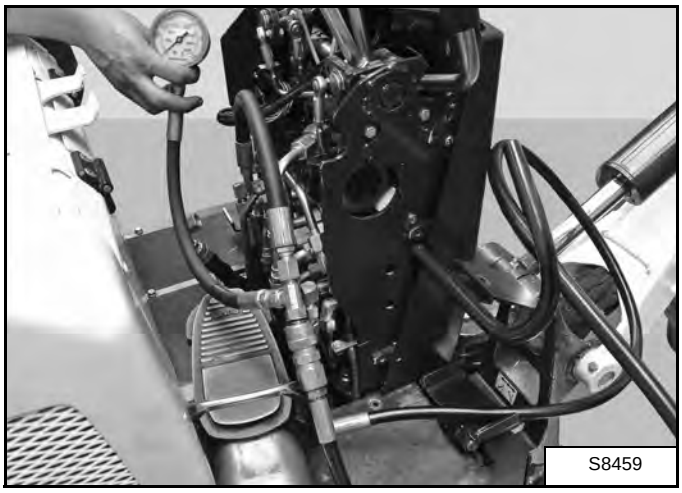
Testing And Adjusting

Figure 20-31-1



Boom Port Relief set at:	
Base End (Item 1) **[Figure 20-31-1]**	23,2 MPa (232 bar) (3365 psi)
Arm Port Relief set at:	
Base End (Item 2) **[Figure 20-31-1]**	22,5 MPa (225 bar) (3263 psi)
Slew Port Relief set at:	
CW (Item 3) **[Figure 20-31-1]**	8,4 MPa (84 bar) (1160 psi)
CCW (Item 4) **[Figure 20-31-1]**	8,4 MPa (84 bar) (1218 psi)

Figure 20-31-2



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

Install the hand pump hose and a pressure gauge (minimum of 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 344,7 kPa (3,4 bar) (50 psi).

If the port relief pressure setting is incorrect, replace the port relief valve.

WARNING

AVOID INJURY OR DEATH

Traction and Chain Drives must be adjusted so that neutral is at the location of the Neutral Start Switch. Trencher or Chain can move suddenly when engine starts if neutral adjustments are not correct. Start trencher only from operator position.

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VALVE (PRESSURE REDUCING)

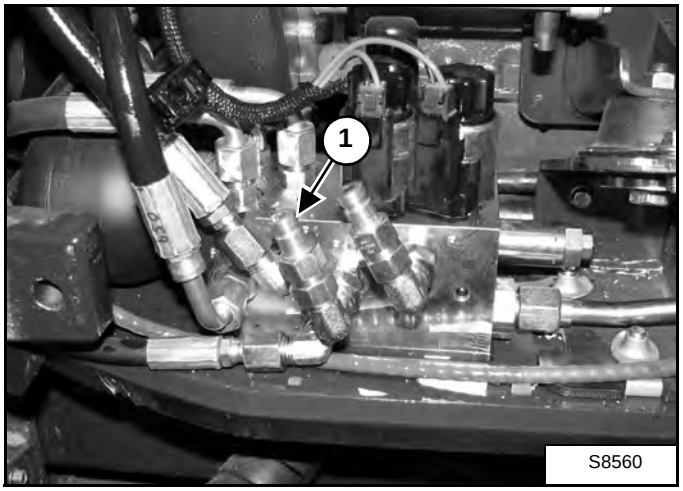
Testing And Adjusting

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

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

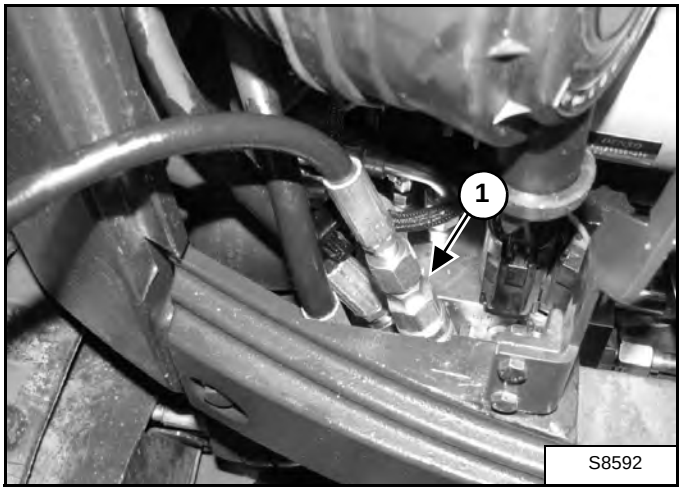
Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

Figure 20-32-1



Locate the test port (Item 1) **[Figure 20-32-1]** (PS1) on the front side of the manifold.

Figure 20-32-2



Install a 6,9 MPa (69 bar) (1000 psi) gauge on the test port (Item 1) **[Figure 20-32-2]** (PS1).

Lower 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.

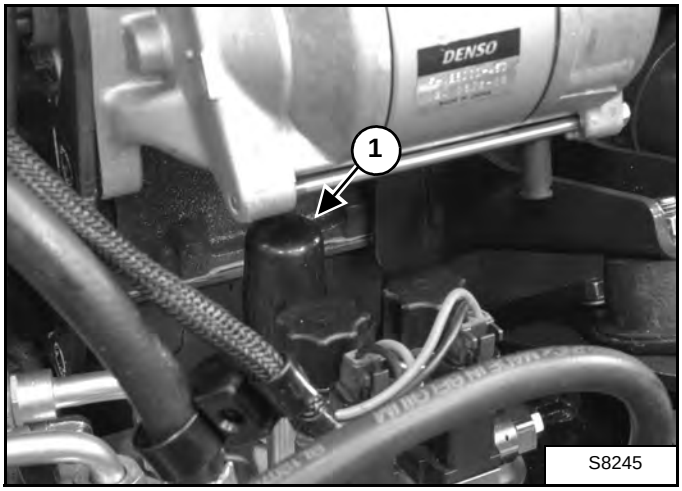
Operate the circuit over relief and record the pressure.

The pressure reducing valve pressure at the test port (Item 1) **[Figure 20-32-2]** (PS1) should be as follows:

3,0 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 20-32-3

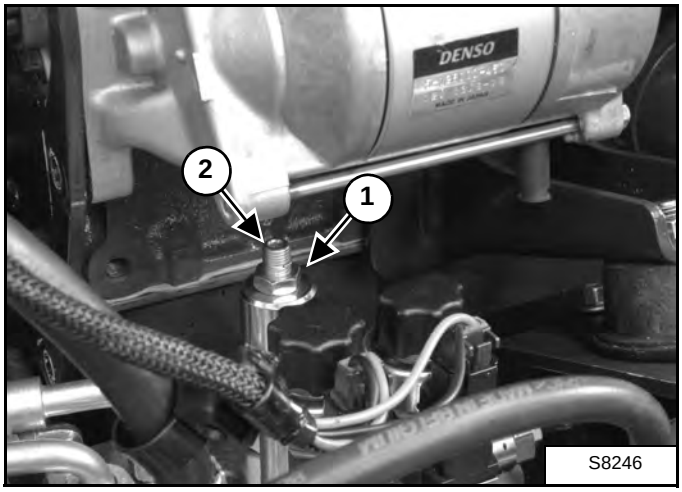


If adjustment is needed, remove the cap (Item 1) **[Figure 20-32-3]** from the pressure reducing valve.

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

Figure 20-32-4



Loosen the nut (Item 1) **[Figure 20-32-4]** on the pressure reducing valve.

Turn the adjustment screw (Item 2) **[Figure 20-32-4]** clockwise to increase the pressure or counterclockwise to decrease the pressure.

Tighten the nut (Item 1) **[Figure 20-32-4]**.

Retest the pressure reducing valve after adjustment.

If pressure is still incorrect, remove the pressure reducing valve from the manifold assembly and inspect.

Inspect the port of the pressure reducing valve on the manifold assembly to verify no damage. If damaged replace manifold assembly.

Figure 20-32-5

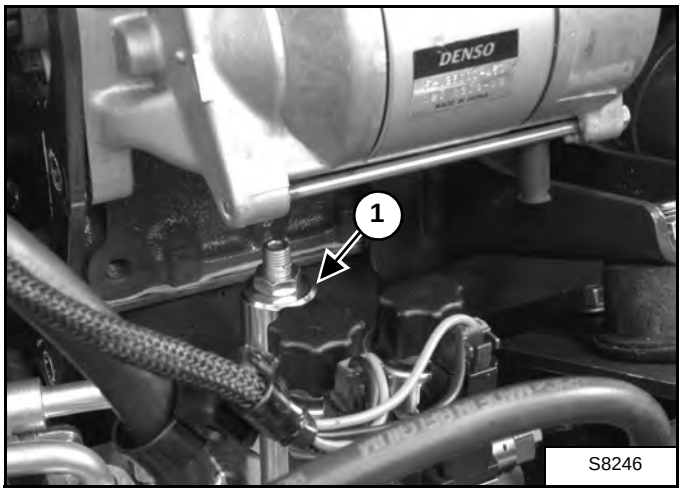
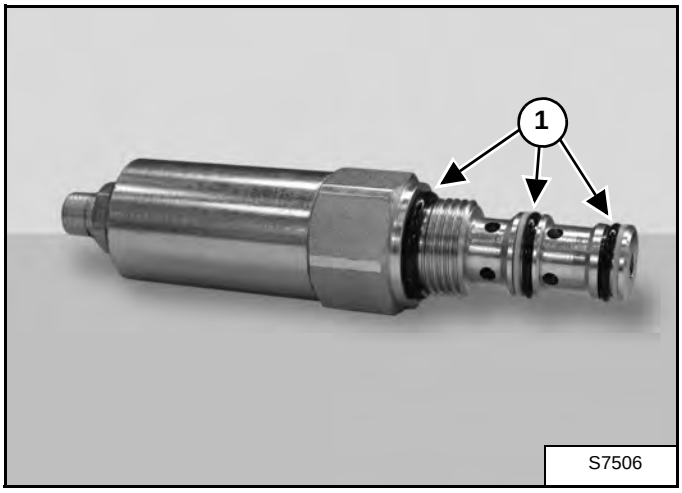


Figure 20-32-6



Inspect the O-rings and back-up rings on the pressure reducing valve (Item 1) **[Figure 20-32-5]** and **[Figure 20-32-6]**. 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 test port could not be achieved, replace pressure reducing valve.

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HYDRAULIC CONTROL VALVE

Description

The hydraulic control valve has a 23,2 MPa (232 bar) (3365 psi) work port relief valve for the boom (base end) section. The hydraulic control valve has a 22,5 MPa (225 bar) (3263 psi) work port relief valve for the arm (base end) section. The hydraulic control valve has two 8,4 MPa (84 bar) (1218 psi) work port relief valves for the slew 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 the 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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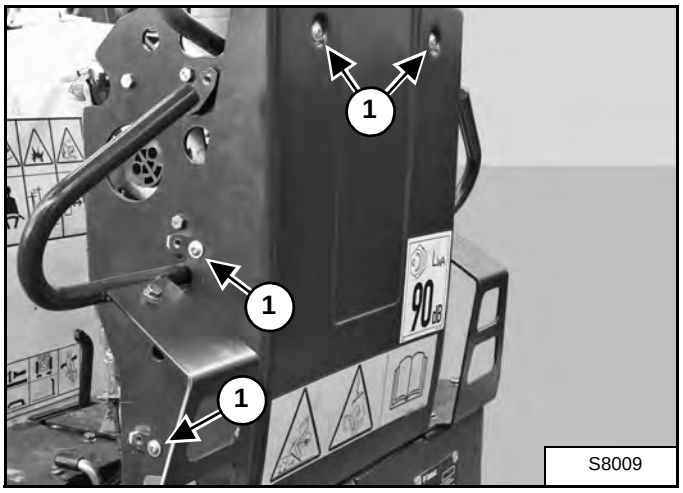
Remove the instrument panel. (See Removal And Installation on Page 40-220-1.)

⚠ 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 physician familiar with this injury is not received immediately.

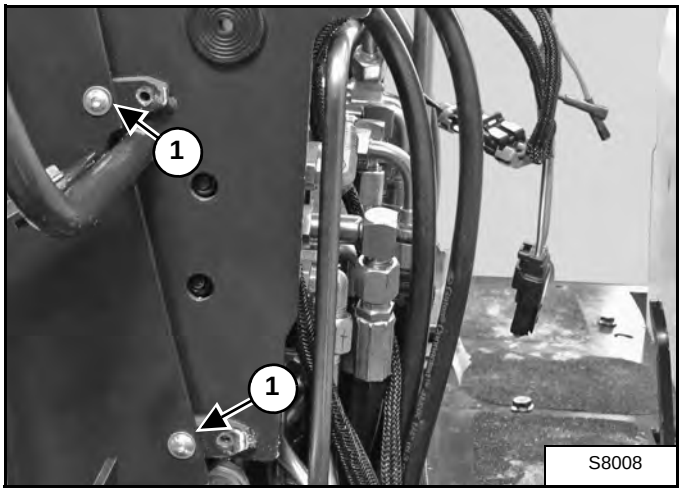
W-2145-0290

Figure 20-40-1



Remove the four bolts (Item 1) **[Figure 20-40-1]** from the cover.

Figure 20-40-2



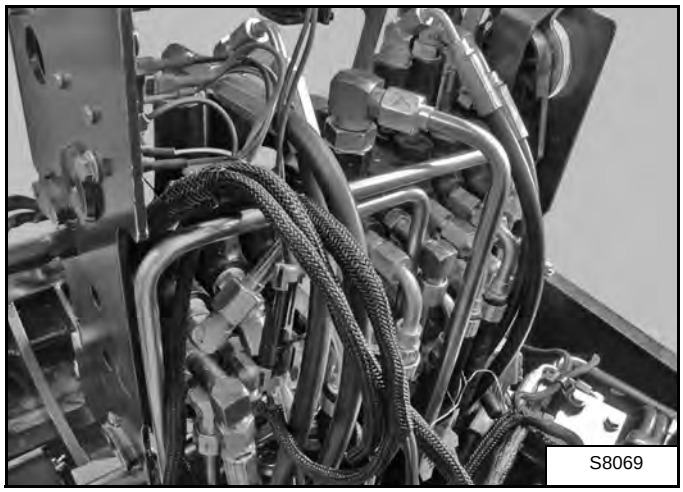
Remove the bolts (Item 1) **[Figure 20-40-2]** and remove the cover.

Remove the floor panels. (See FLOOR PANELS on Page 40-120-1.)

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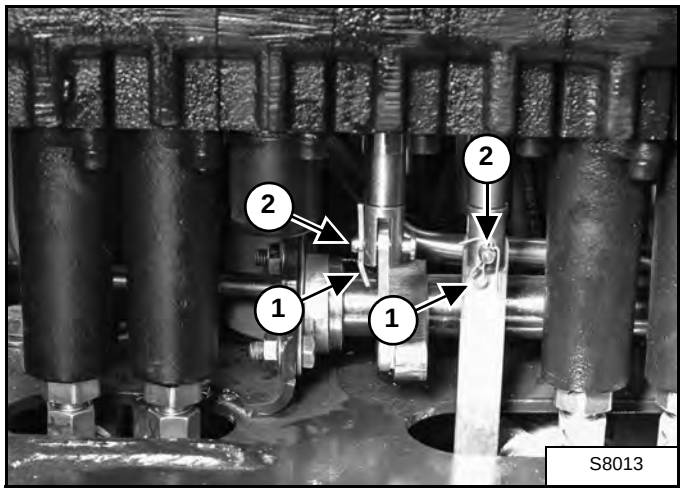
Removal And Installation (Cont'd)

Figure 20-40-3



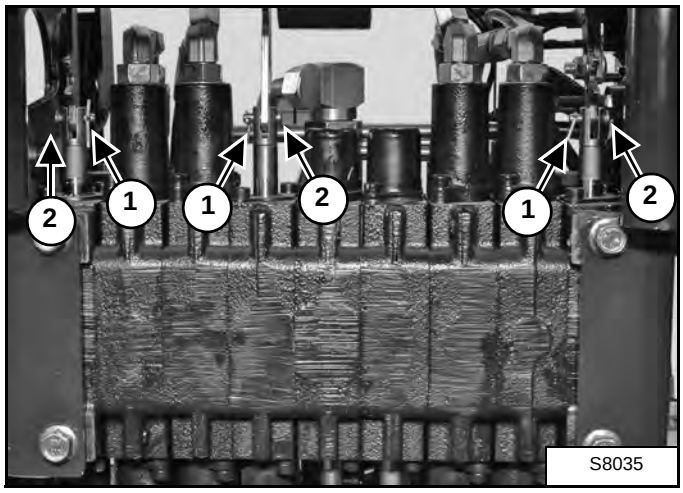
Mark all tubes and hoses for ease of assembly **[Figure 20-40-3]**.

Figure 20-40-4



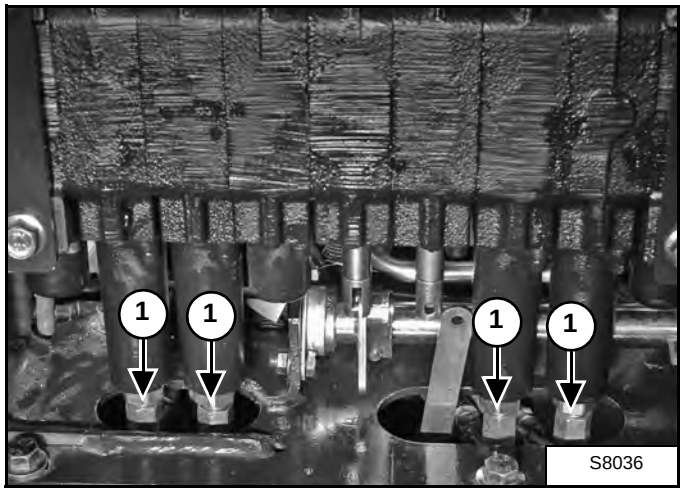
Remove the cotter pins (Item 1) and the pins (Item 2) **[Figure 20-40-4]**.

Figure 20-40-5



Remove the cotter pins (Item 1) and the pins (Item 2) **[Figure 20-40-5]**.

Figure 20-40-6

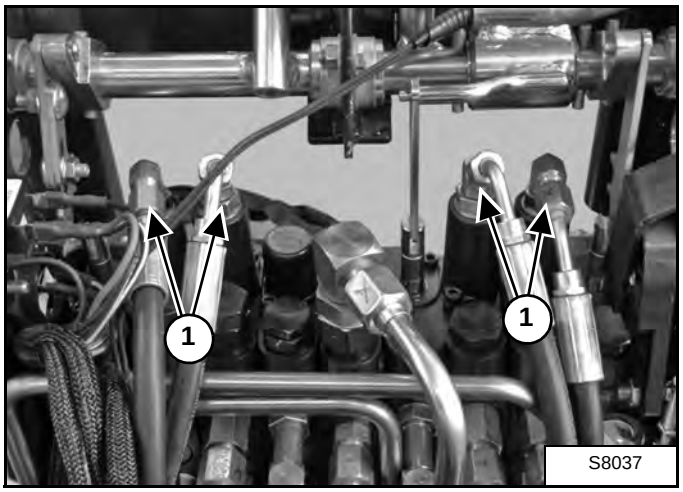


Remove the hoses (Item 1) **[Figure 20-40-6]**.

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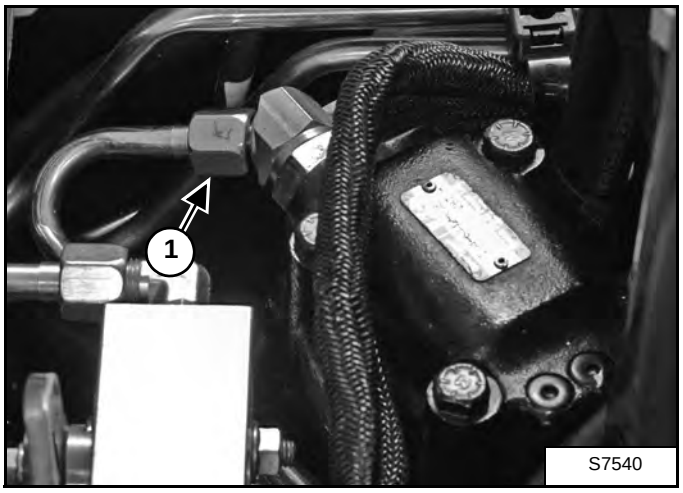
Removal And Installation (Cont'd)

Figure 20-40-7



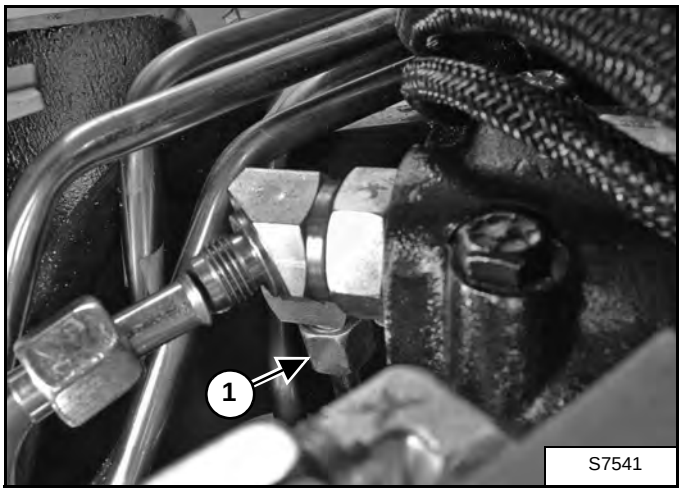
Remove the hoses (Item 1) **[Figure 20-40-7]**.

Figure 20-40-8



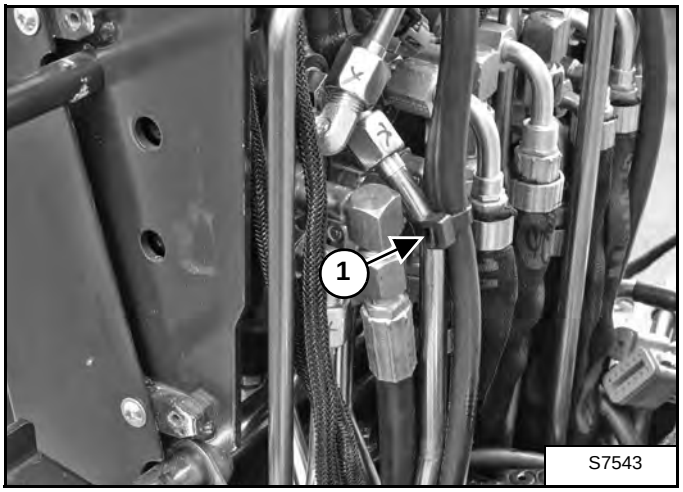
Disconnect the tubeline (Item 1) **[Figure 20-40-8]** from the slew motor.

Figure 20-40-9



Disconnect the tubeline (Item 1) **[Figure 20-40-9]** from the slew motor.

Figure 20-40-10

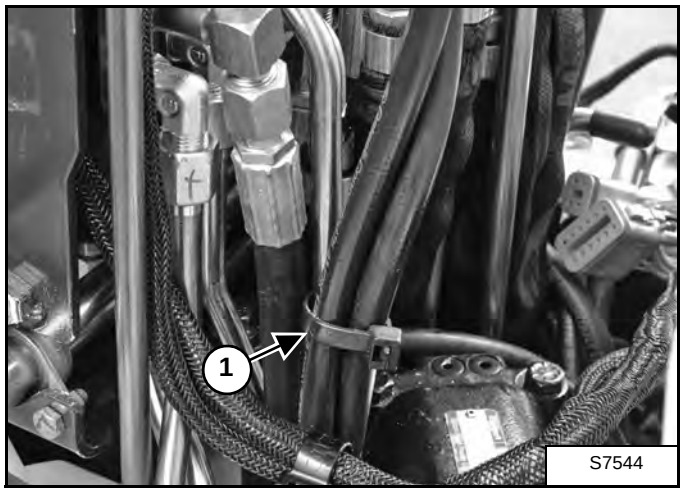


Cut the tie-strap (Item 1) **[Figure 20-40-10]**.

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Removal And Installation (Cont'd)

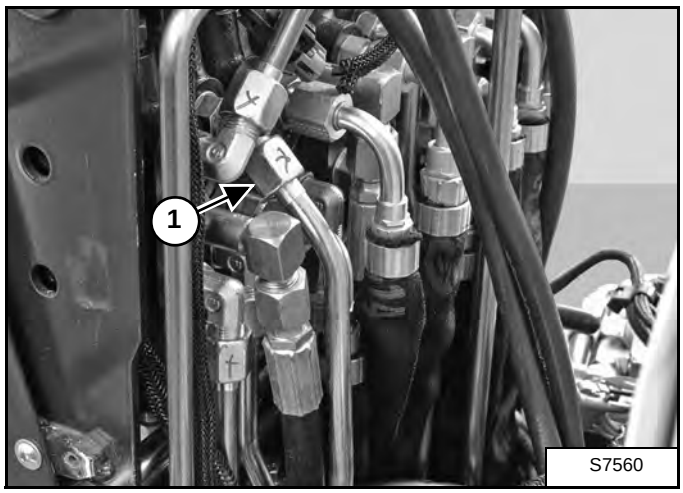
Figure 20-40-11



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

Push the hoses aside.

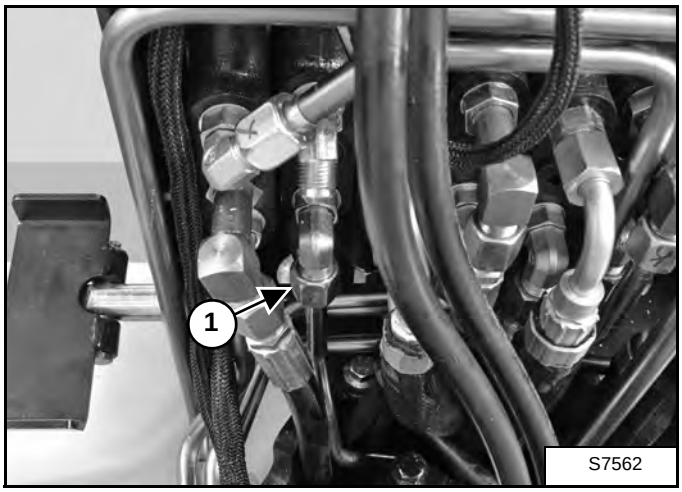
Figure 20-40-12



Disconnect the tubeline (Item 1) **[Figure 20-40-12]** from the control valve.

Remove the tubeline from the excavator for easy access to other tubelines and hoses.

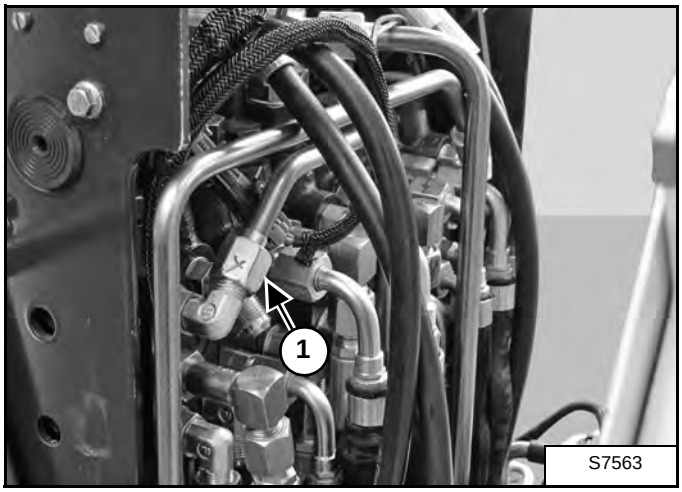
Figure 20-40-13



Disconnect the tubeline (Item 1) **[Figure 20-40-13]** from the control valve.

Remove the tubeline from the excavator for easy access to other tubelines and hoses.

Figure 20-40-14

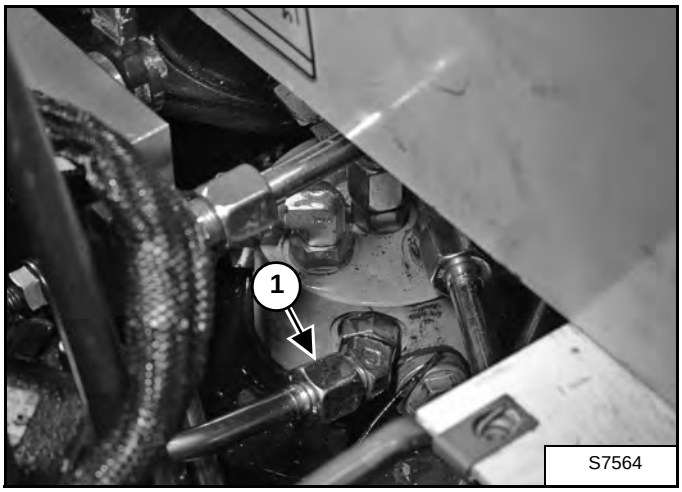


Disconnect the tubeline (Item 1) **[Figure 20-40-14]** from the control valve.

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Removal And Installation (Cont'd)

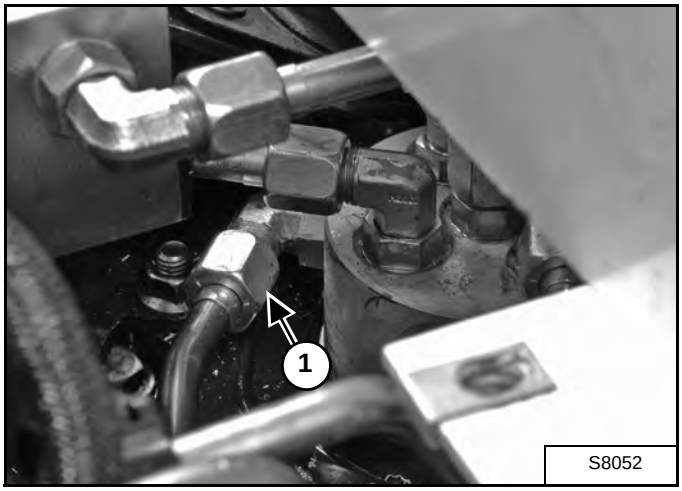
Figure 20-40-15



Disconnect the tubeline (Item 1) **[Figure 20-40-15]** from the swivel joint.

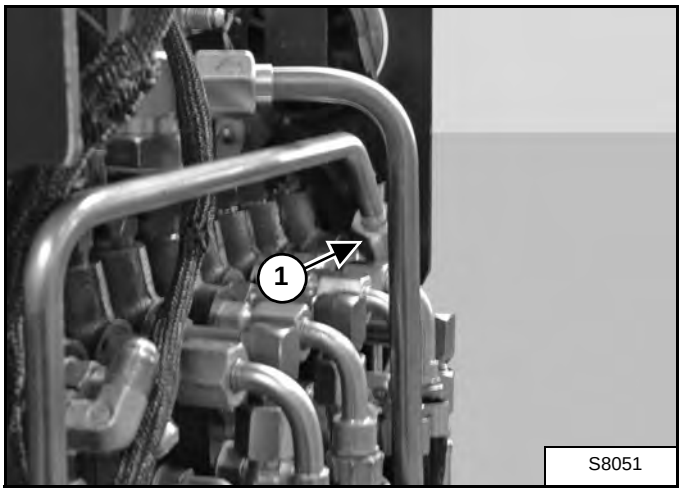
Remove the tubeline from the excavator for easy access to other tubelines and hoses.

Figure 20-40-16



Disconnect the tubeline (Item 1) **[Figure 20-40-16]** from the swivel joint.

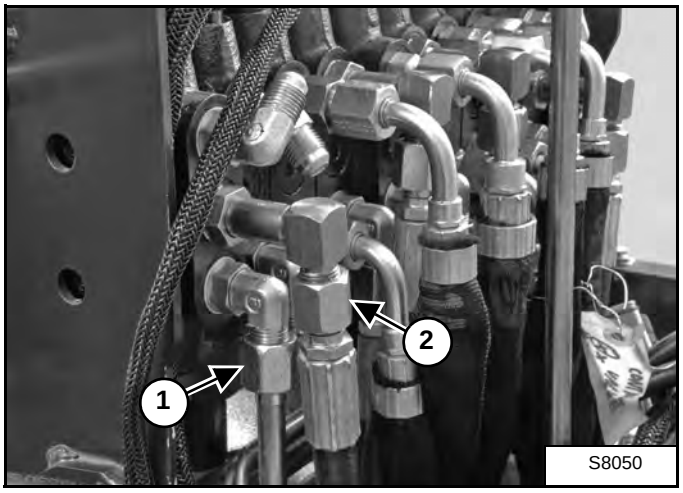
Figure 20-40-17



Disconnect the tubeline (Item 1) **[Figure 20-40-17]** from the control valve.

Remove the tubeline from the excavator for easy access to other tubelines and hoses.

Figure 20-40-18

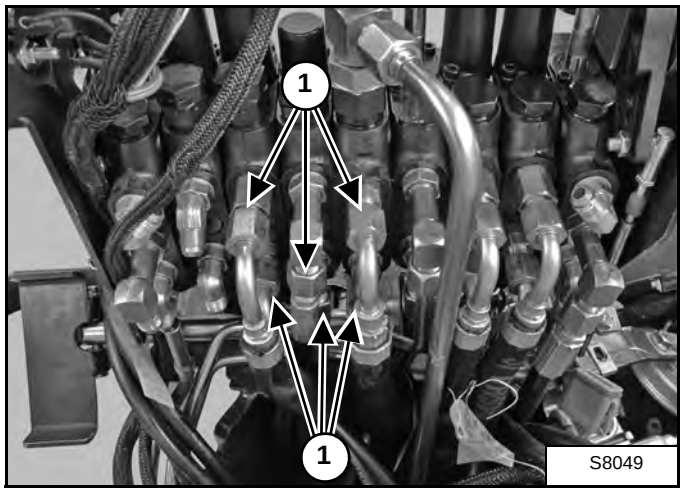


Disconnect the tubeline (Item 1) and hose (Item 2) **[Figure 20-40-18]** from the control valve.

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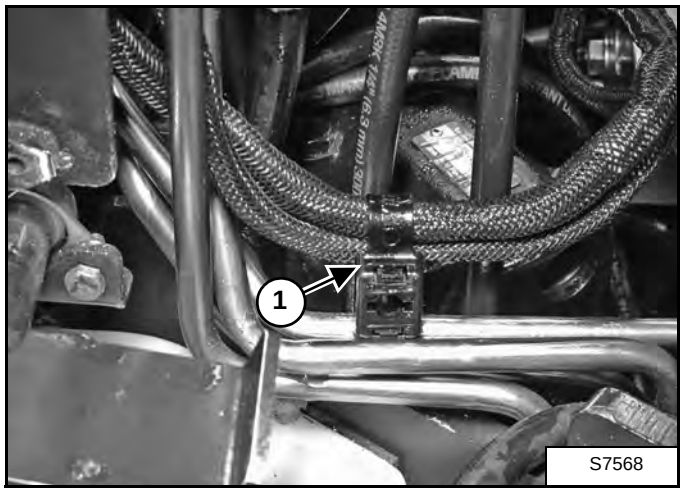
Removal And Installation (Cont'd)

Figure 20-40-19



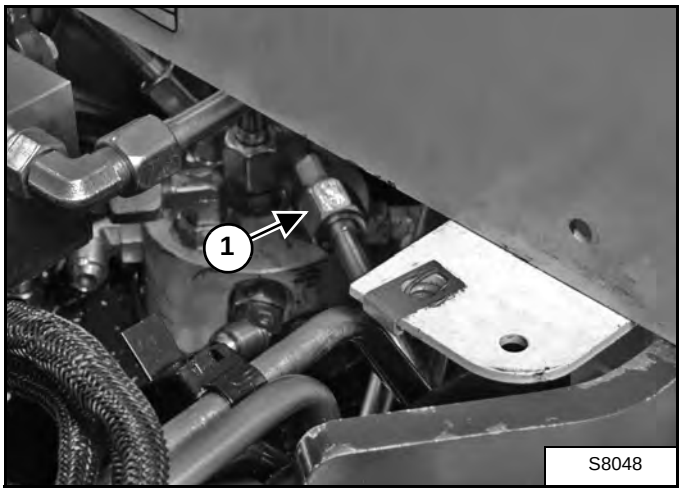
Disconnect the six hoses (Item 1) **[Figure 20-40-19]** from the control valve.

Figure 20-40-20



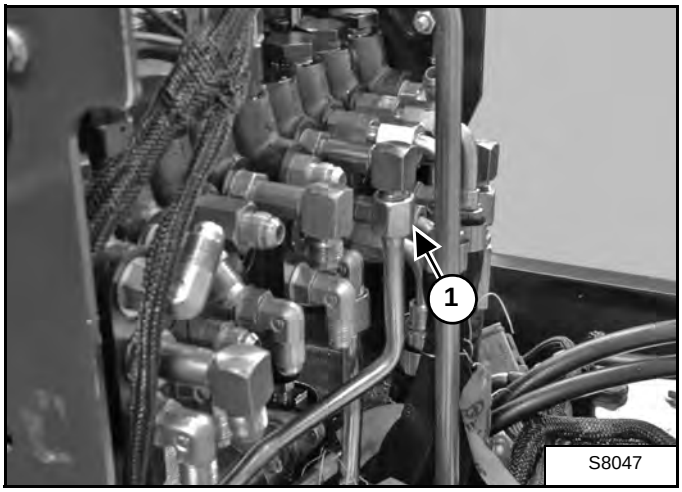
Remove the clamp (Item 1) **[Figure 20-40-20]** from the tubeline.

Figure 20-40-21



Disconnect the tubeline (Item 1) **[Figure 20-40-21]** from the swivel joint.

Figure 20-40-22



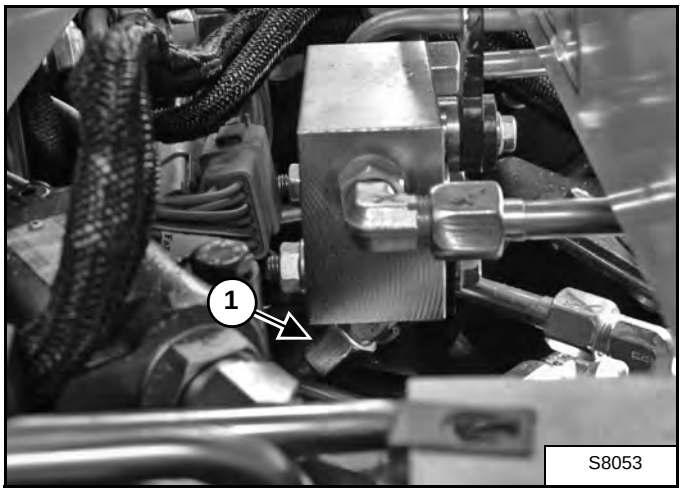
Disconnect the tubeline (Item 1) **[Figure 20-40-22]** from the control valve.

Remove the tubeline from the excavator for easy access to other tubelines and hoses.

Dealer Copy -- Not for Resale

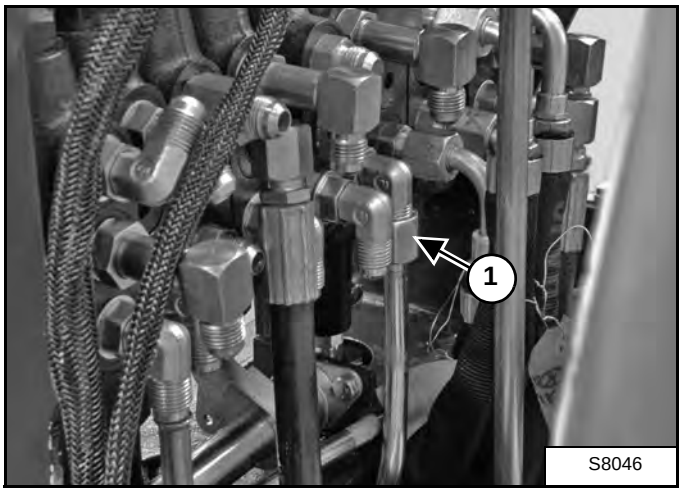
Removal And Installation (Cont'd)

Figure 20-40-23



Disconnect the tubeline (Item 1) **[Figure 20-40-23]** from the track expand valve.

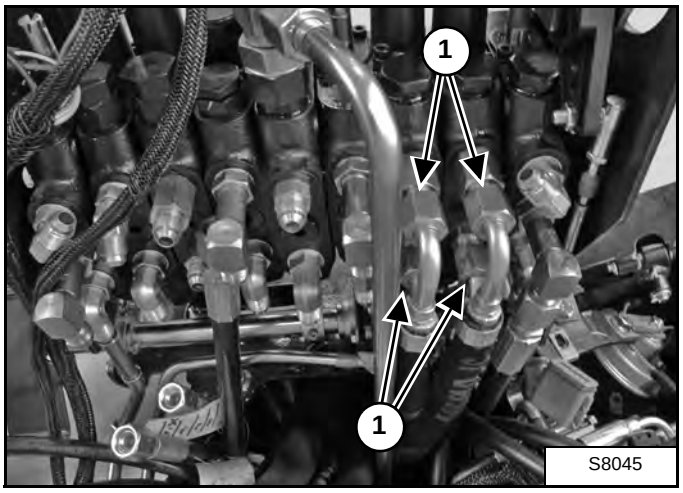
Figure 20-40-24



Disconnect the tubeline (Item 1) **[Figure 20-40-24]** from the control valve.

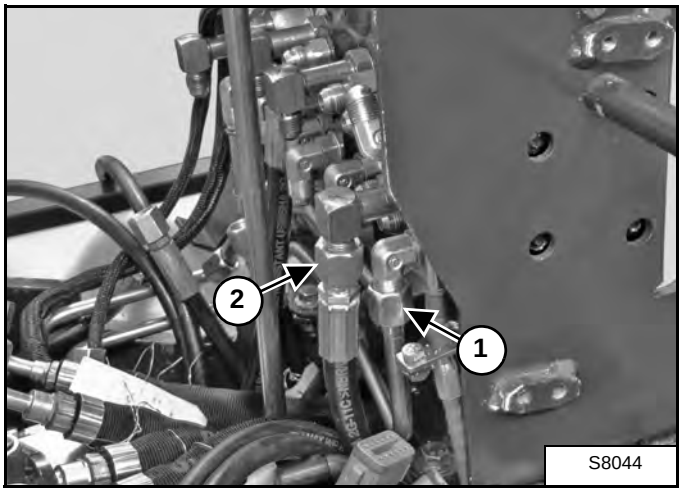
Remove the tubeline from the excavator for easy access to other tubelines and hoses.

Figure 20-40-25



Disconnect the four hoses (Item 1) **[Figure 20-40-25]** from the control valve.

Figure 20-40-26

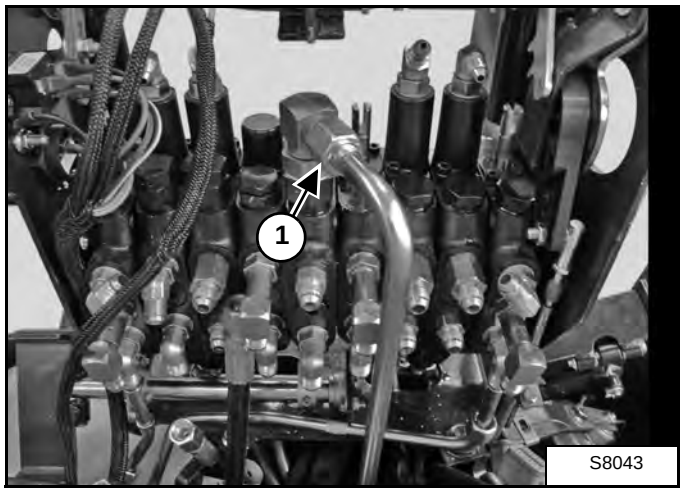


Disconnect the tubeline (Item 1) and hose (Item 2) **[Figure 20-40-26]** from the control valve.

Dealer Copy -- Not for Resale

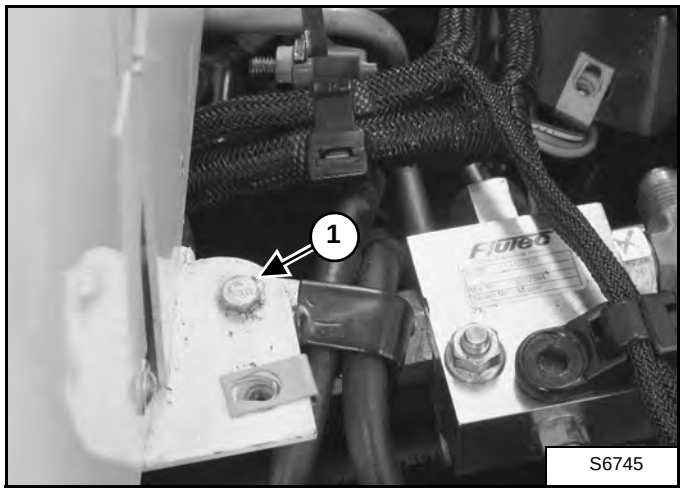
Removal And Installation (Cont'd)

Figure 20-40-27



Disconnect the tubeline (Item 1) **[Figure 20-40-27]** from the control valve.

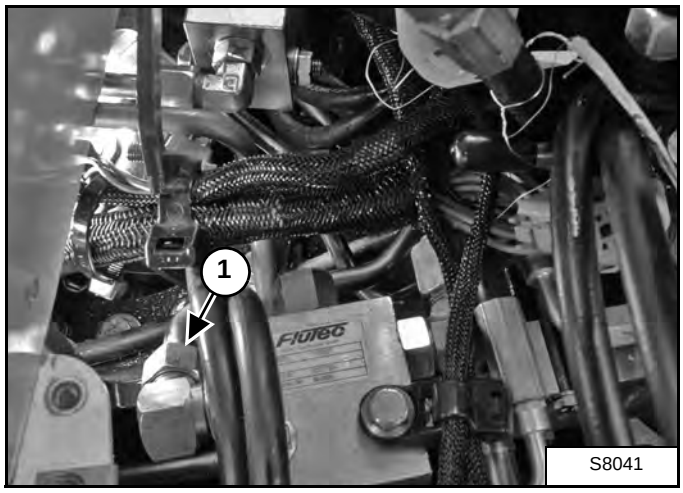
Figure 20-40-28



Remove the nut and bolt (Item 1) **[Figure 20-40-28]** from the hose bracket.

Push the boom swing hoses aside.

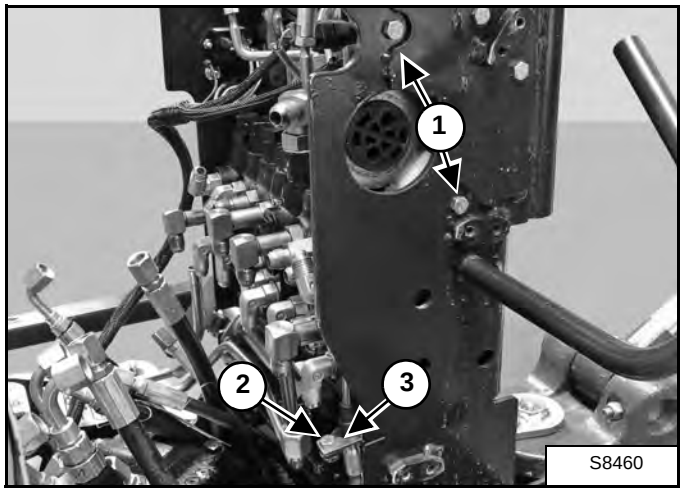
Figure 20-40-29



Disconnect the tubeline (Item 1) **[Figure 20-40-29]** from the build-up valve.

Remove the tubeline from the excavator for easy access to other tubelines and hoses.

Figure 20-40-30



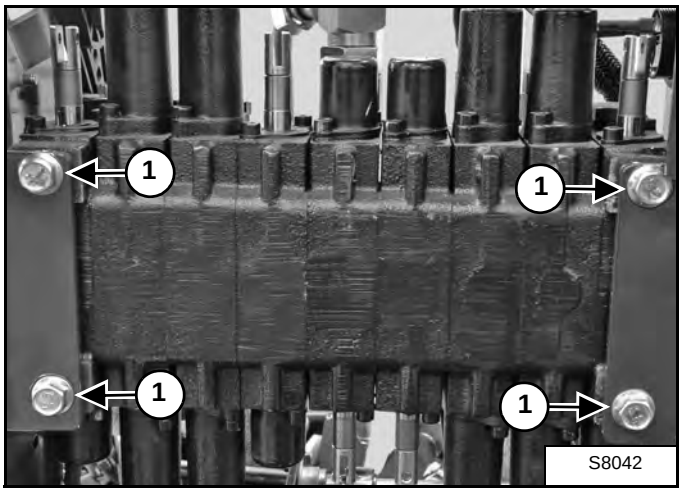
Remove the two bolts (Item 1) **[Figure 20-40-30]**.

Remove the bolt and nut (Item 2) from the mounting bracket (Item 3) **[Figure 20-40-30]** and push the speed control cable aside.

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Removal And Installation (Cont'd)

Figure 20-40-31



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

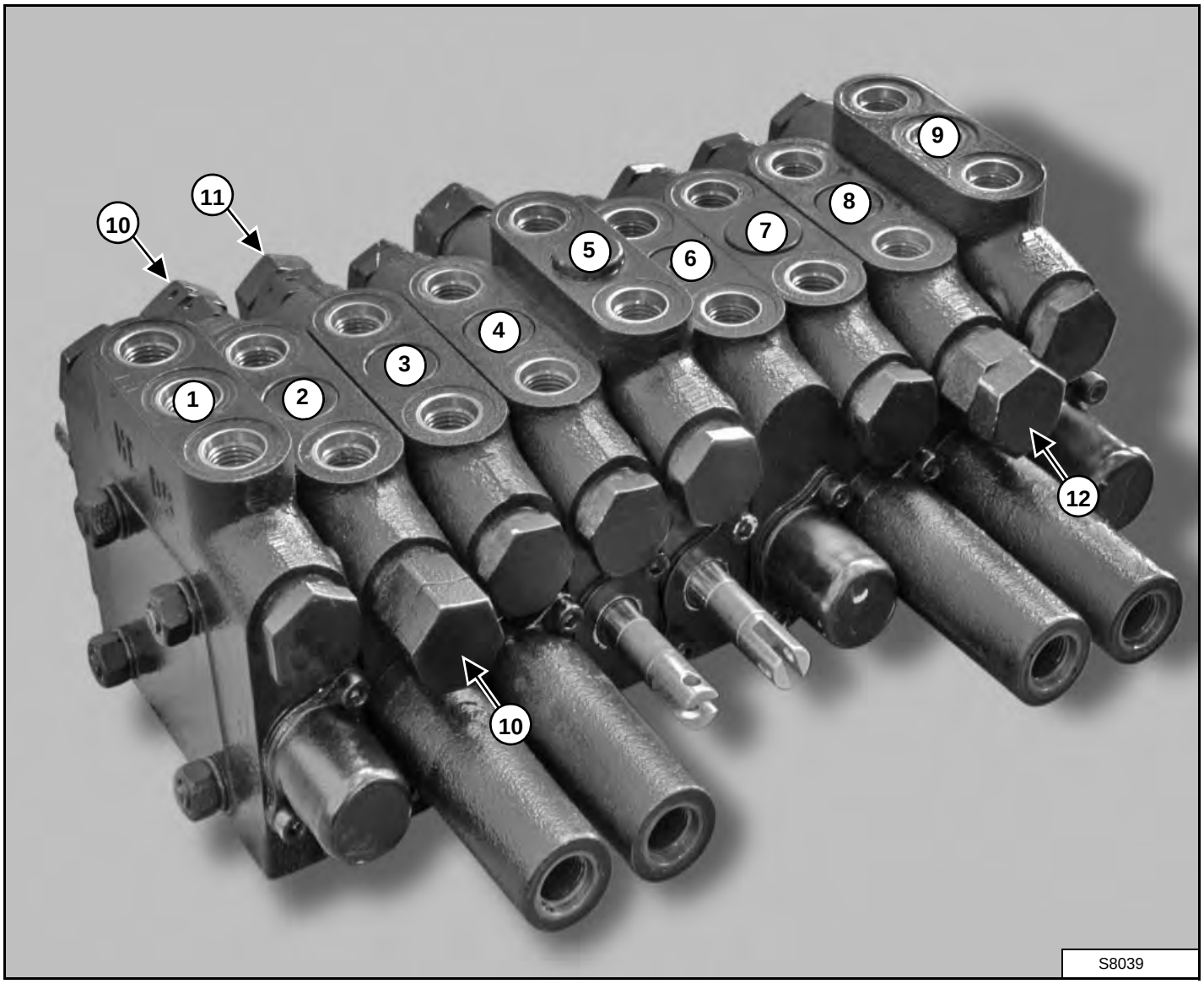
Remove the control valve from the excavator.

Dealer Copy -- Not for Resale

HYDRAULIC CONTROL VALVE (CONT'D)

Parts Identification

Item	Description
1.	Left Travel Section
2.	Slew Section
3.	Arm Section
4.	Boom Swing Section
5.	Auxiliary Section
6.	Blade Section
7.	Bucket Section
8.	Boom Section
9.	Right Travel Section
10.	Port Relief - 8,4 MPa (84 bar) (1218 psi)
11.	Port Relief - 22,5 MPa (225 bar) (3263 psi)
12.	Port Relief - 23,2 MPa (232 bar) (3365 psi)



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Disassembly

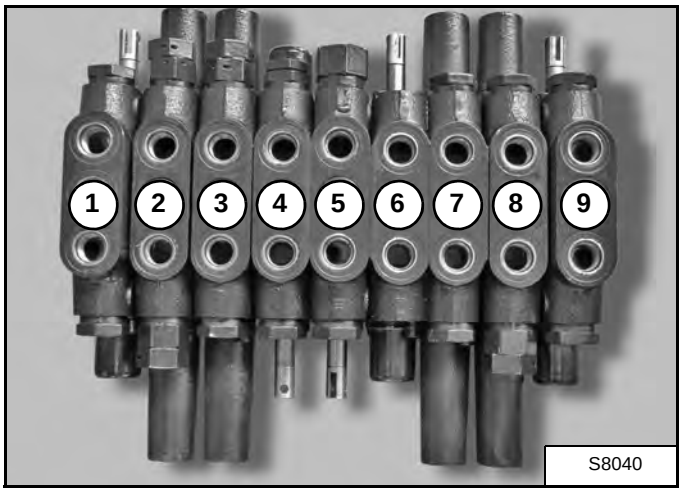
Clean the outside of the hydraulic control valve before disassembly.

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.

I-2003-0888

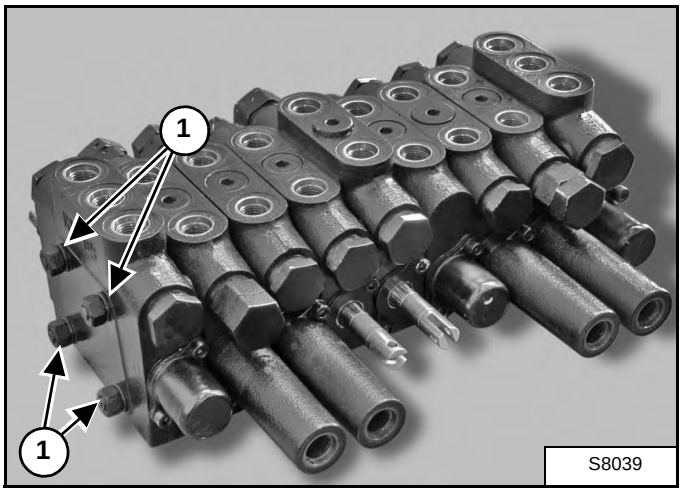
Figure 20-40-32



Remove all the fittings from the control valve. Mark the valve sections for ease of assembly **[Figure 20-40-32]**.

1. Left Travel Valve
2. Slew Valve
3. Arm Valve
4. Boom Swing Valve
5. Auxiliary Valve
6. Blade Valve
7. Bucket Valve
8. Boom Valve
9. Right Travel Valve

Figure 20-40-33



Remove the tie rod nuts and lock washers (Item 1) **[Figure 20-40-33]**.

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.

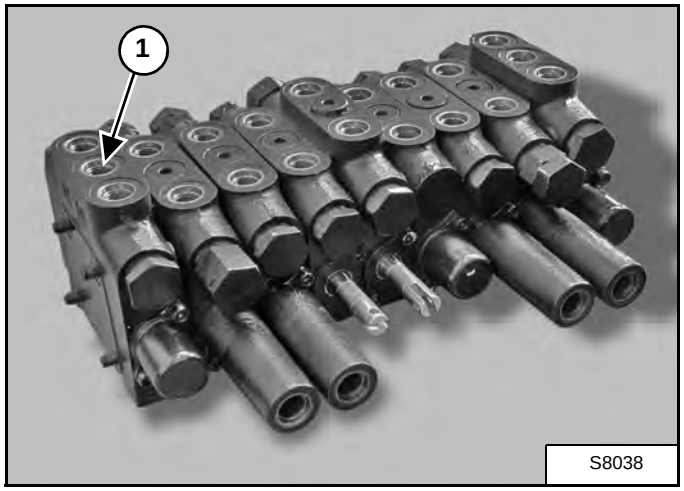
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

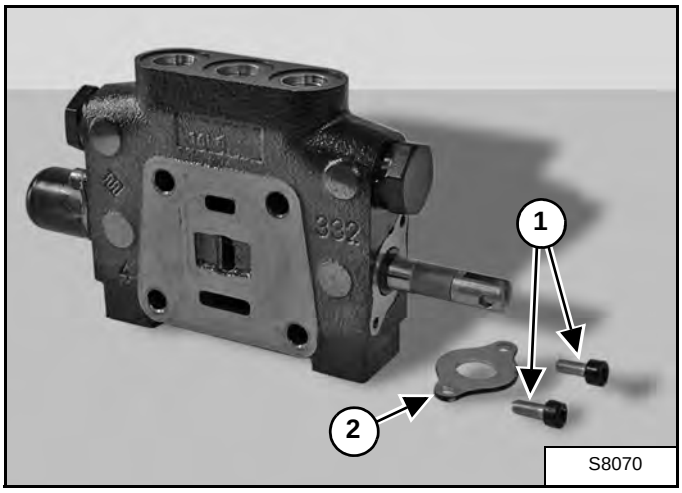
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-34



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

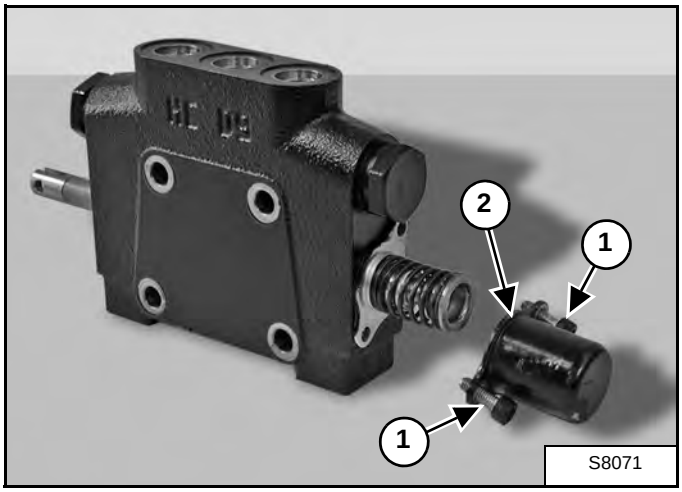
Figure 20-40-35



Remove the bolts (Item 1) and retaining plate (Item 2) **[Figure 20-40-35]**.

Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

Figure 20-40-36



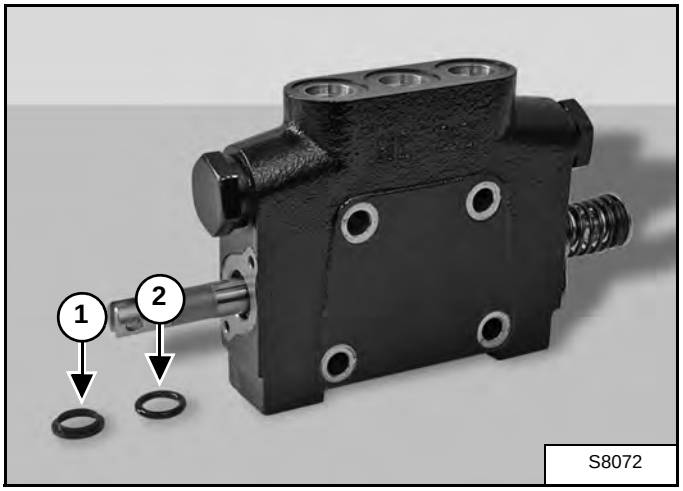
Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-36]**.

Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

Dealer Copy -- Not for Resale

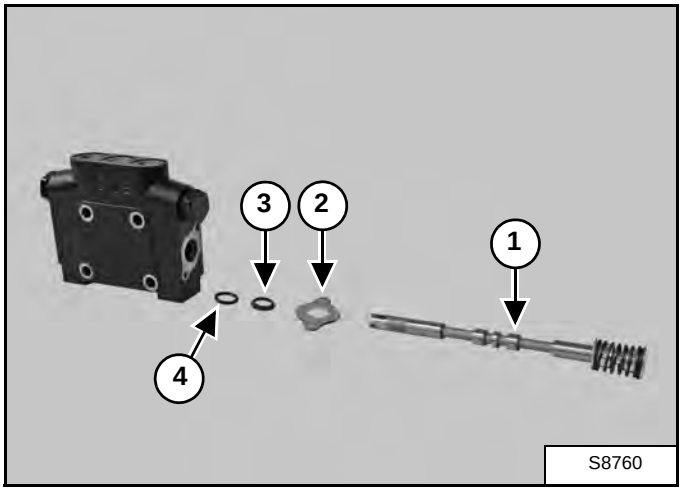
Left Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-37



Remove the seal (Item 1) and O-ring (Item 2) **[Figure 20-40-37]**.

Figure 20-40-38

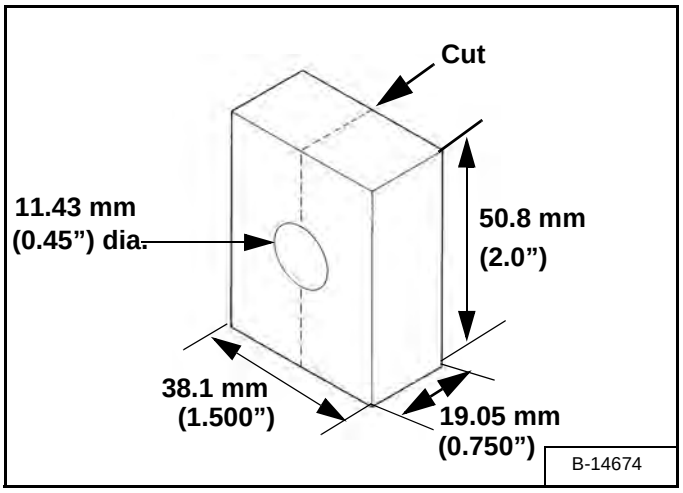


Remove the spool and spring assembly (Item 1), retaining plate (Item 2), seal (Item 3), O-ring (Item 4) **[Figure 20-40-38]**.

The spool and valve section are not serviced separately.

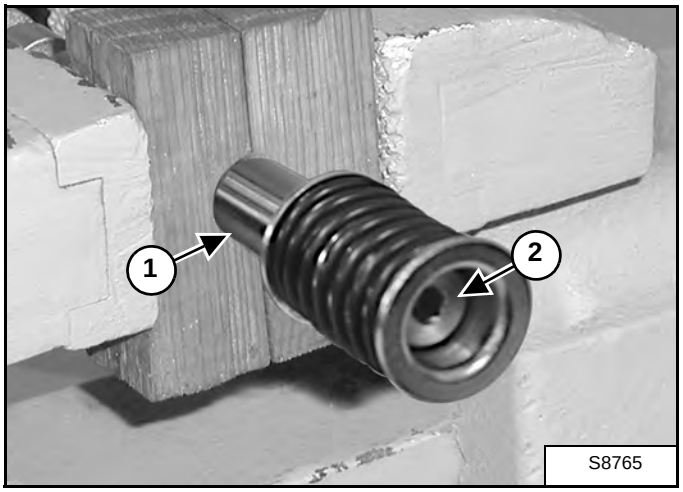
NOTE: When the spool is removed, use care not to scratch the spool surface. Do not interchange spools and valve sections.

Figure 20-40-39



To remove the spring assembly from the spool a holding fixture will have to be made from a 19 mm thick x 38 mm wide x 51 mm long (0.750 in thick x 1.500 in wide x 2.0 in long) piece of hardwood. Drill a 11,5 mm (0.45 in) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-39]**.

Figure 20-40-40



Using the wood blocks clamp the spool and spring assembly (Item 1) **[Figure 20-40-40]** in a vise.

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

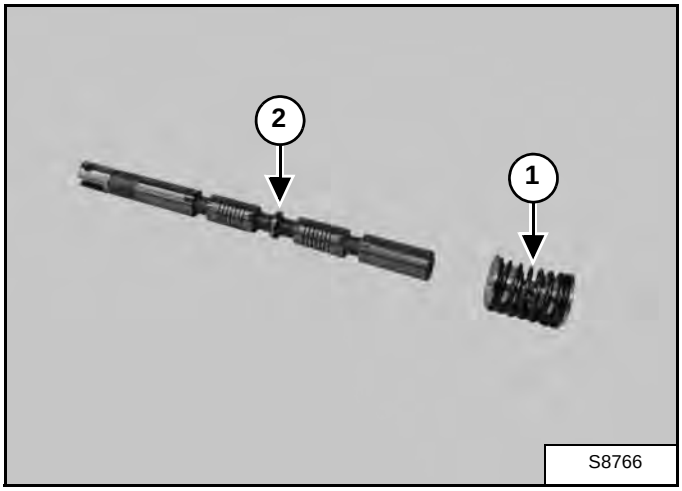
Loosen the bolt (Item 2) **[Figure 20-40-40]**.

Installation: Apply Loctite® 243 or equivalent and tighten the bolt to 6 N•m (53 in-lb) torque.

Dealer Copy -- Not for Resale

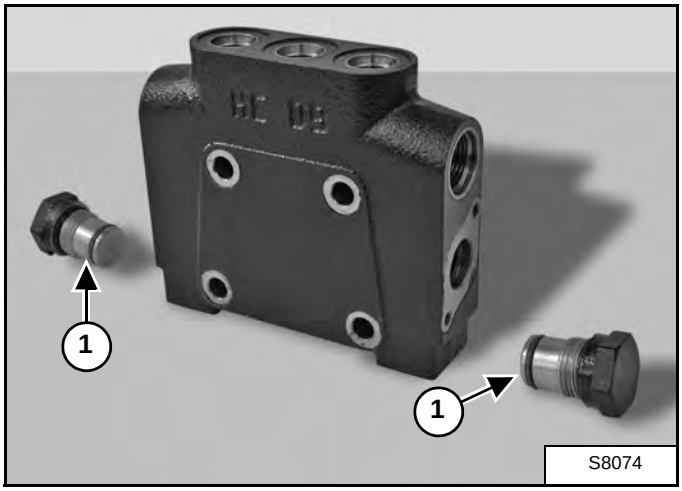
Left Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-41



Remove the spring assembly (Item 1) from the spool (Item 2) **[Figure 20-40-41]**.

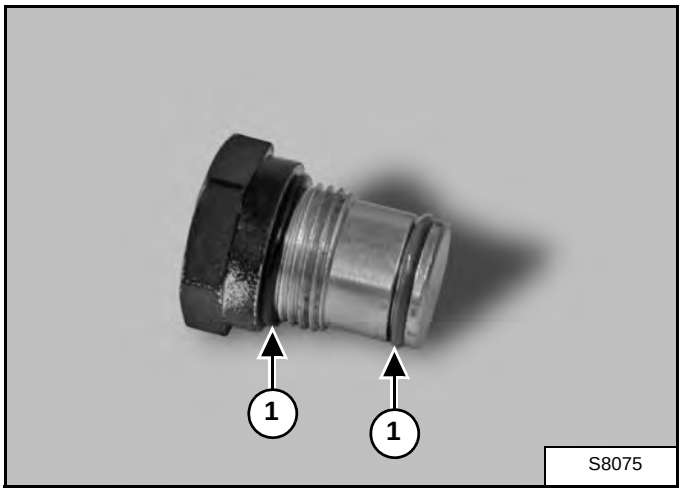
Figure 20-40-42



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

Installation: Tighten the plugs to 40 - 45 N•m (29 - 33 ft-lb) torque.

Figure 20-40-43



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

Dealer Copy -- Not for Resale

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.

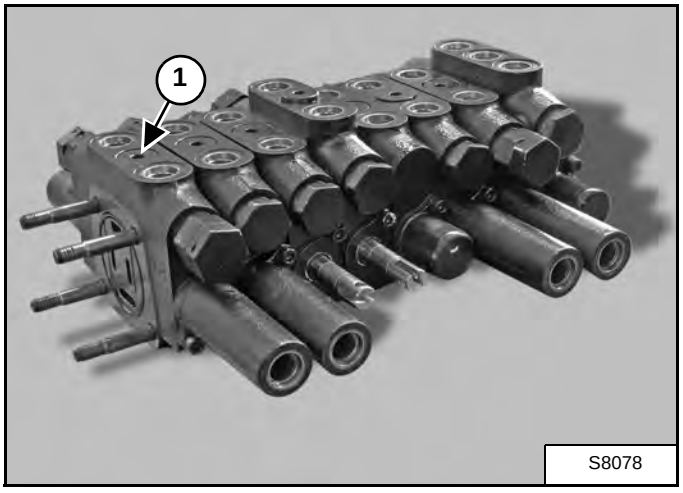
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

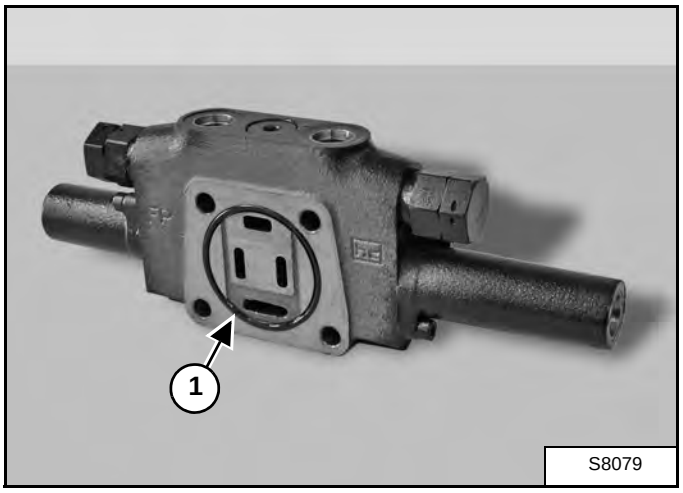
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-44



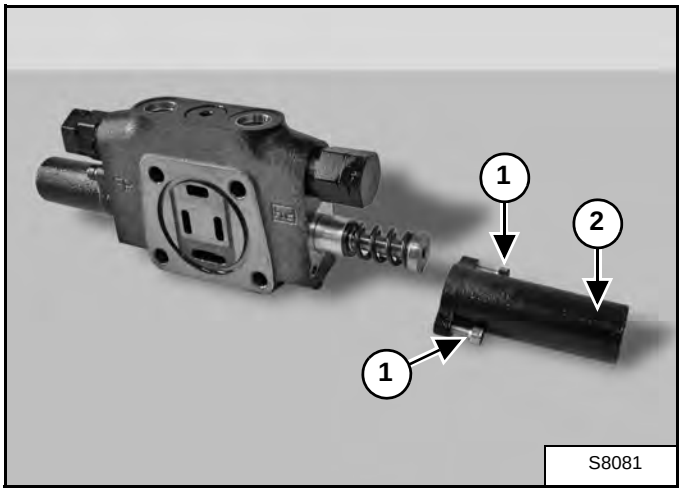
Remove the slew valve section (Item 1) **[Figure 20-40-44]** from the valve assembly.

Figure 20-40-45



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

Figure 20-40-46



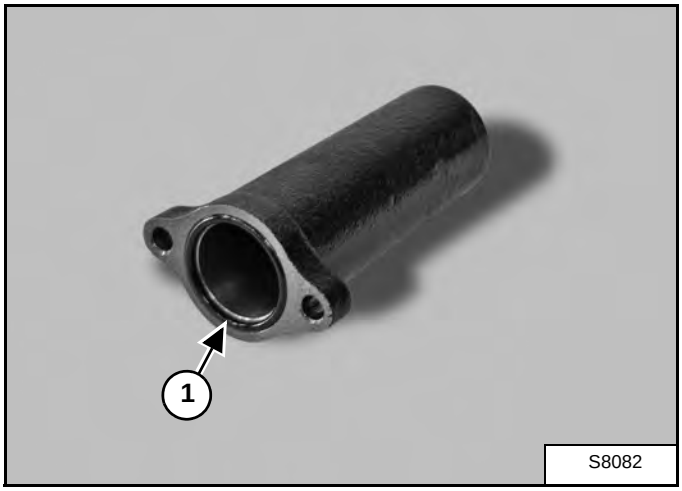
Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-46]**.

Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

Dealer Copy -- Not for Resale

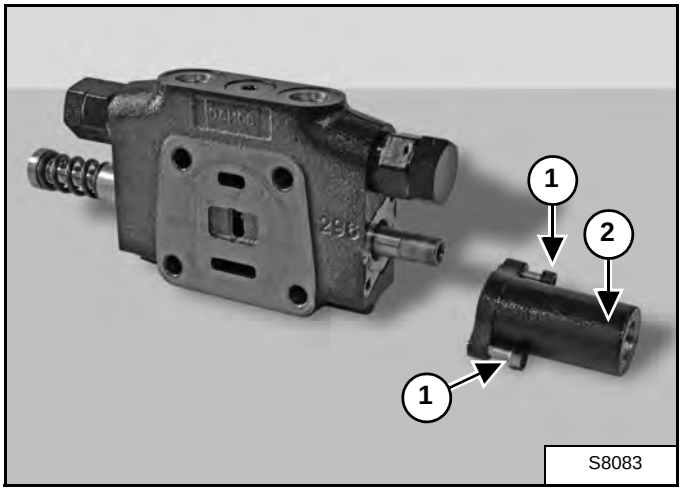
Slew Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-47



Remove the O-ring (Item 1) **[Figure 20-40-47]** from the cap.

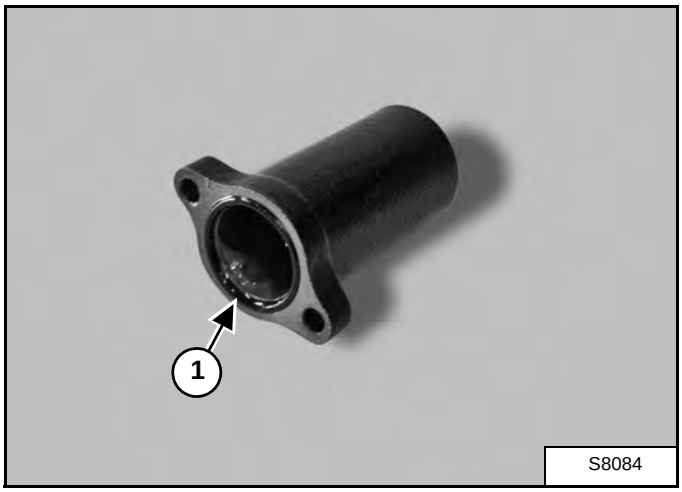
Figure 20-40-48



Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-48]**.

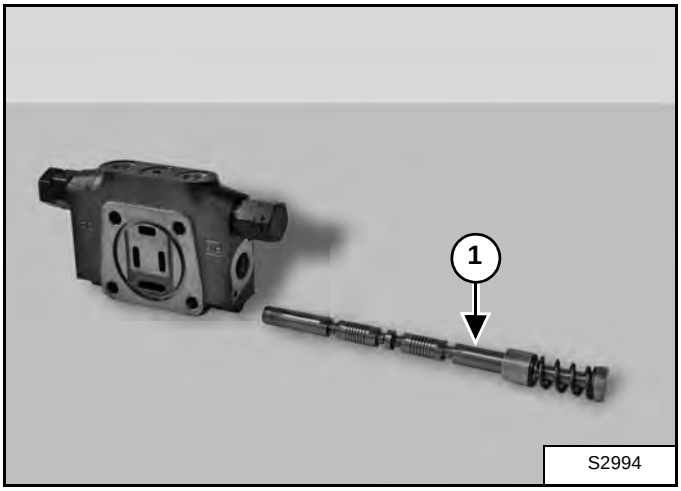
Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

Figure 20-40-49



Remove the O-ring (Item 1) **[Figure 20-40-49]** from the cap.

Figure 20-40-50



Remove the spool and spring assembly (Item 1) **[Figure 20-40-50]** from the valve section.

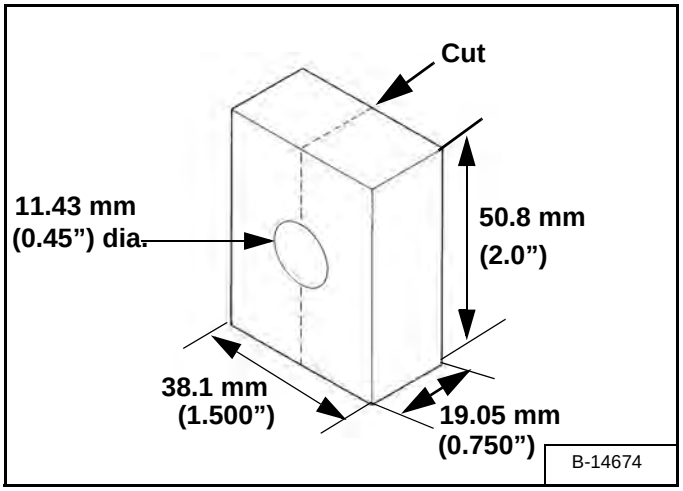
The spool and valve section are not serviced separately.

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

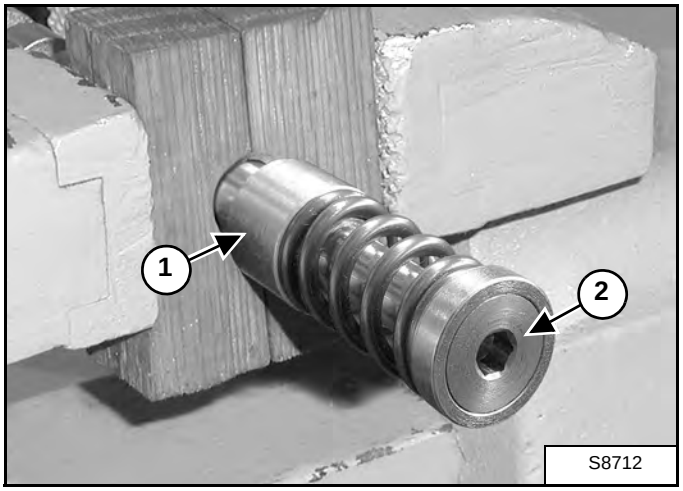
Slew Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-51



To remove the spring assembly from the spool a holding fixture will have to be made from a 19 mm thick x 38 mm wide x 51 mm long (0.750 in thick x 1.500 in wide x 2.0 in long) piece of hardwood. Drill a 11,5 mm (0.45 in) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-51]**.

Figure 20-40-52



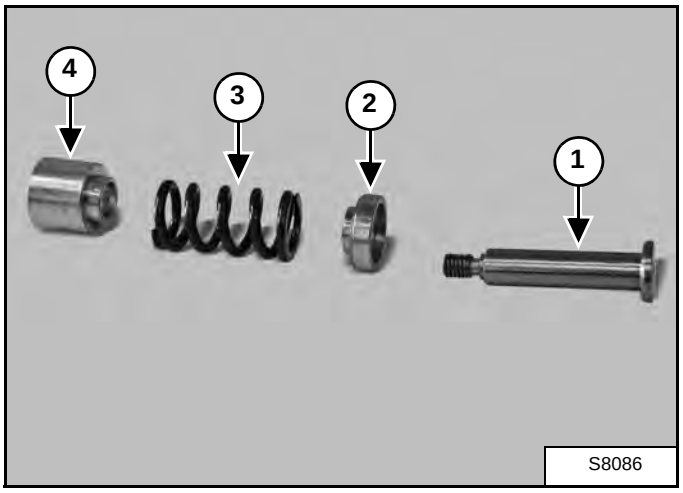
Using the wood blocks clamp the spool and spring assembly (Item 1) **[Figure 20-40-52]** in a vise.

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

Loosen the bolt (Item 2) **[Figure 20-40-52]**.

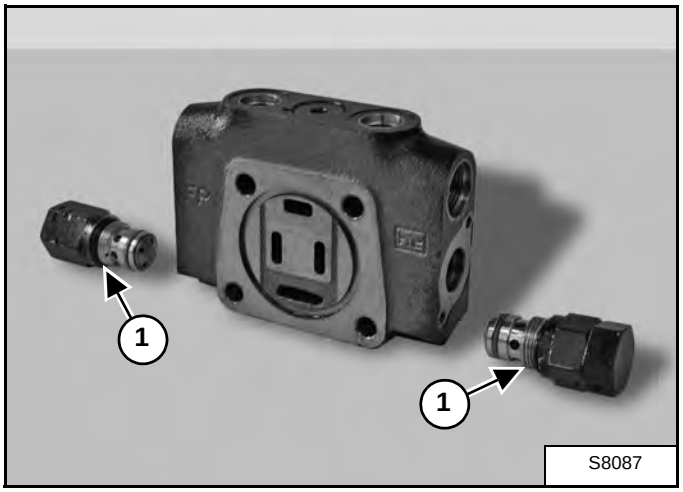
Installation: Apply Loctite® 243 or equivalent and tighten the bolt to 6 N•m (53 in-lb) torque.

Figure 20-40-53



Remove the bolt (Item 1), spring seat (Item 2), spring (Item 3) and spring retainer (Item 4) **[Figure 20-40-53]**.

Figure 20-40-54



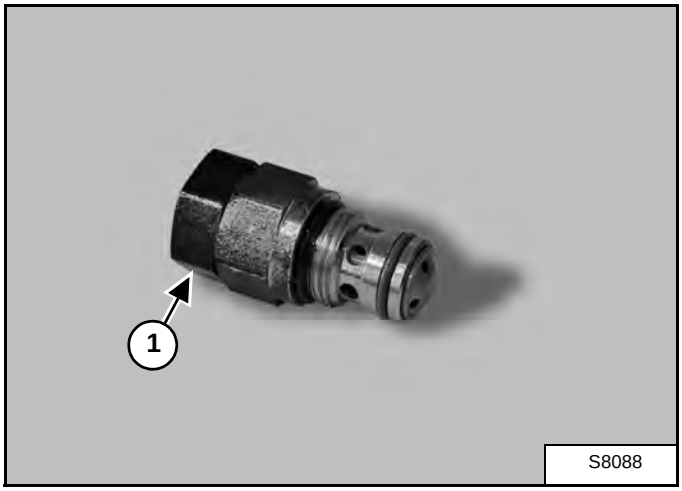
Remove the relief valve assemblies (Item 1) **[Figure 20-40-54]**.

Installation: Tighten the relief valve assemblies to 40 - 45 N•m (29 - 33 ft-lb) torque.

Dealer Copy -- Not for Resale

Slew Valve Section Disassembly And Assembly (Cont'd)

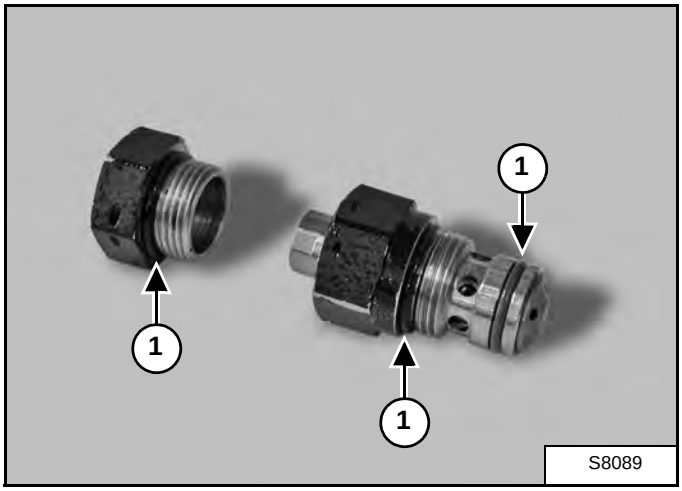
Figure 20-40-55



Remove the plug (Item 1) **[Figure 20-40-55]** from both relief valves.

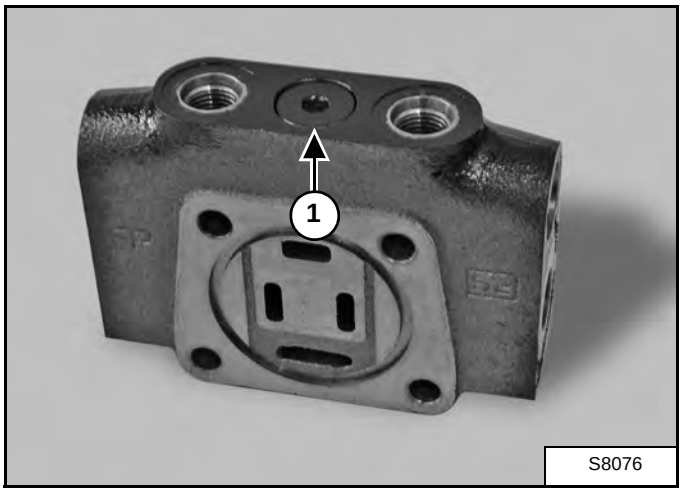
Installation: Tighten the plugs to 25 N•m (18 ft-lb) torque.

Figure 20-40-56



Remove the O-rings (Item 1) **[Figure 20-40-56]**.

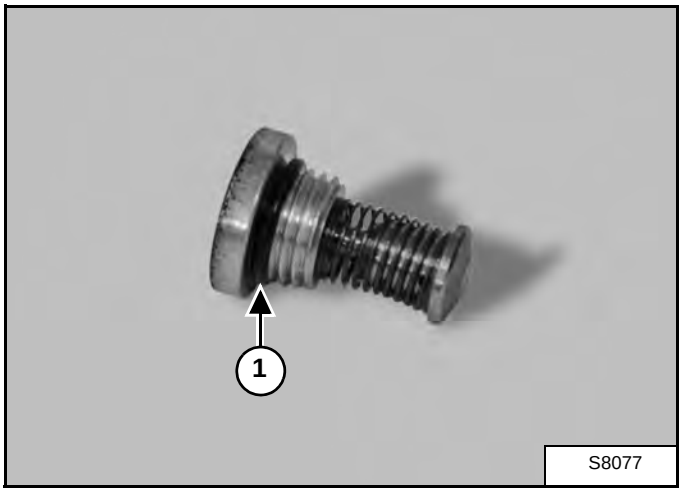
Figure 20-40-57



Remove the check valve (Item 1) **[Figure 20-40-57]**.

Installation: Tighten the check valve to 20 N•m (15 ft-lb) torque.

Figure 20-40-58



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

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.

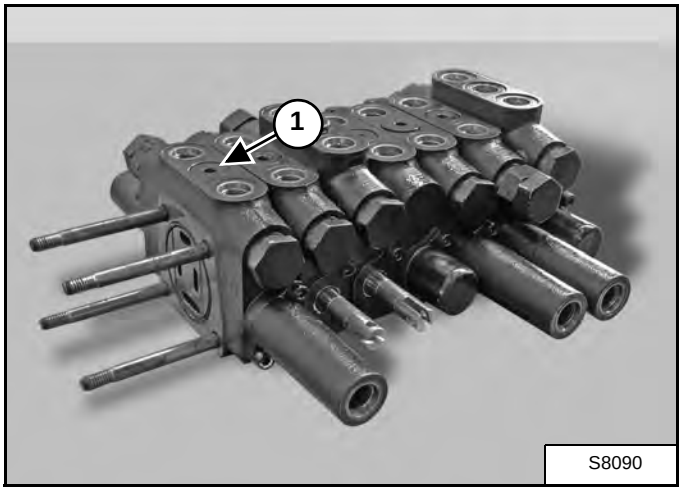
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Clean all parts in solvent and dry with compressed air.

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

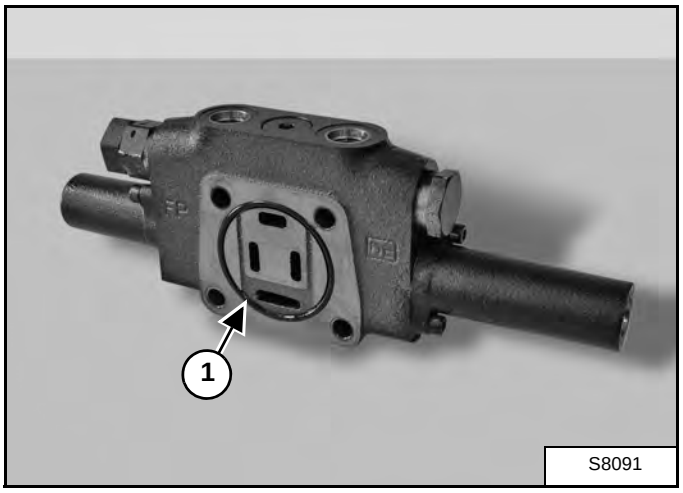
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-59



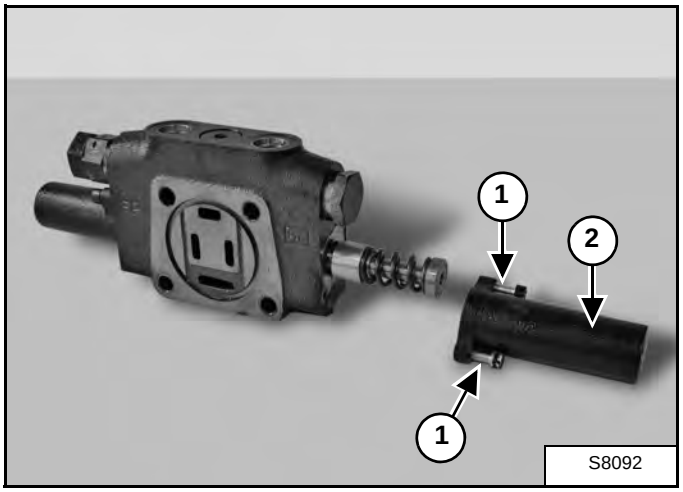
Remove the arm valve section (Item 1) **[Figure 20-40-59]** from the valve assembly.

Figure 20-40-60



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

Figure 20-40-61



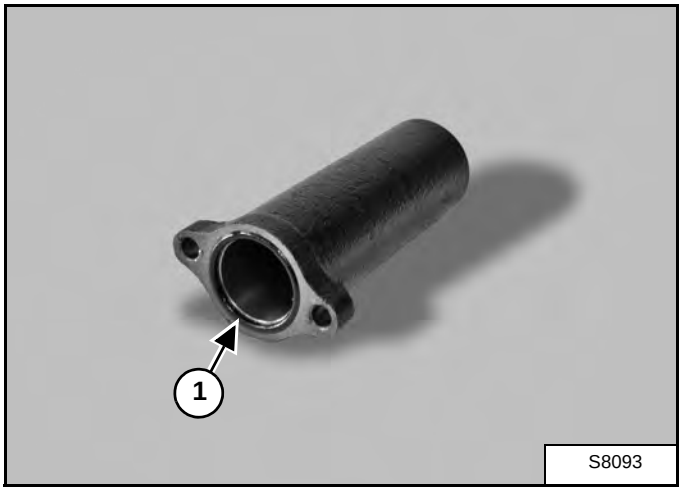
Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-61]**.

Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

Dealer Copy -- Not for Resale

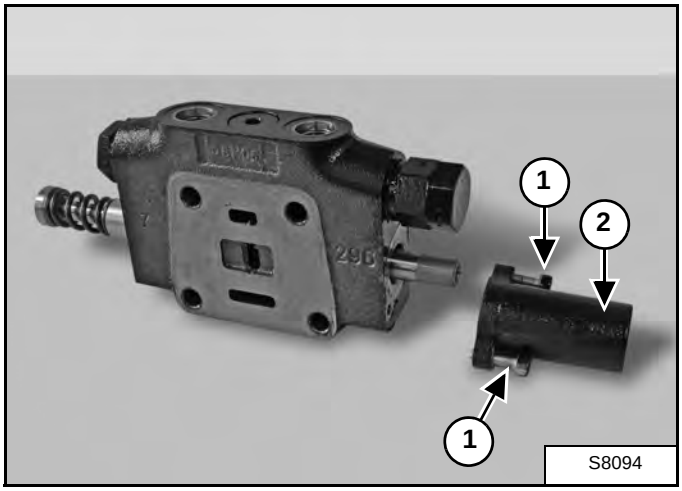
Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-62



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

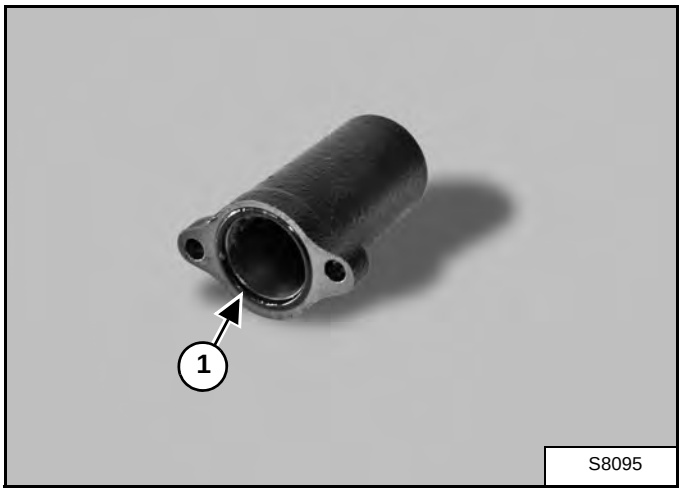
Figure 20-40-63



Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-63]**.

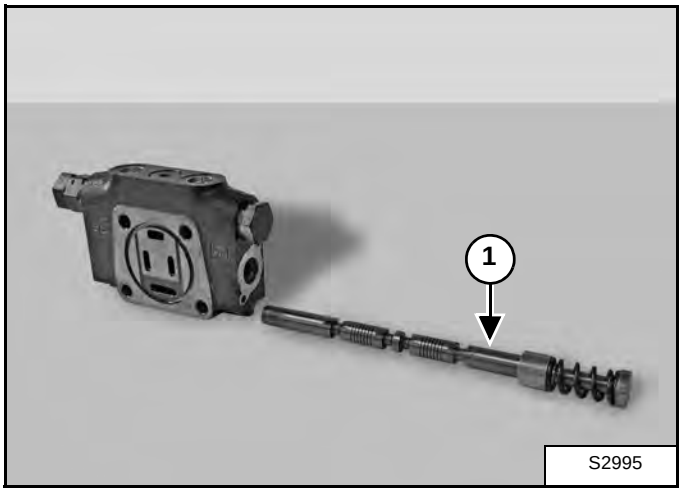
Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

Figure 20-40-64



Remove the O-ring (Item 1) **[Figure 20-40-64]** from the cap.

Figure 20-40-65



Remove the spool and spring assembly (Item 1) **[Figure 20-40-65]** from the valve section.

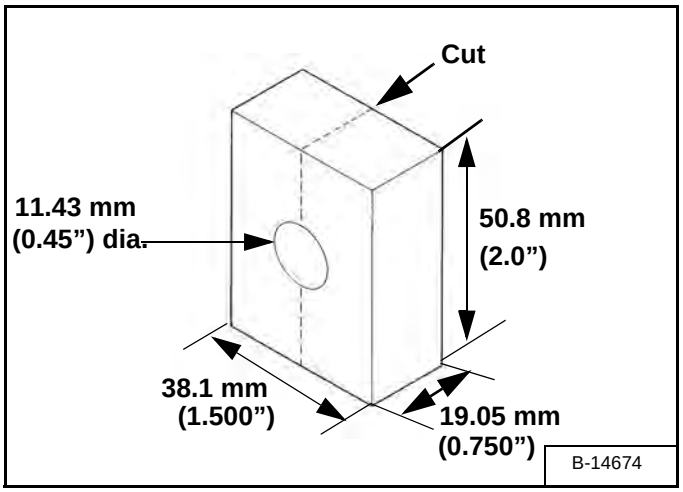
The spool and valve section are not serviced separately.

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

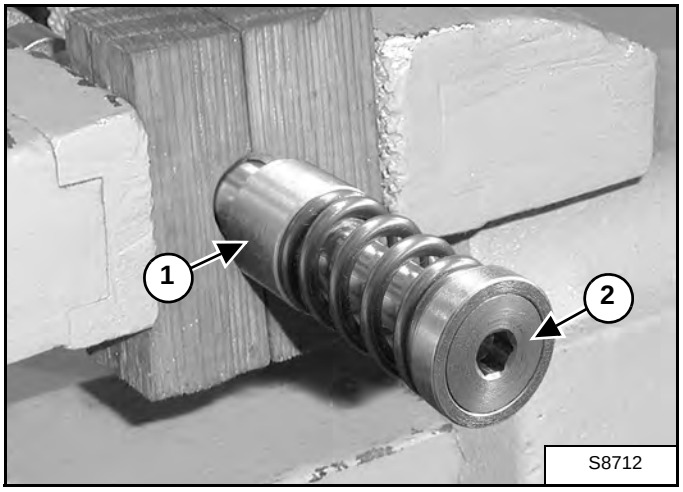
Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-66



To remove the spring assembly from the spool a holding fixture will have to be made from a 19 mm thick x 38 mm wide x 51 mm long (0.750 in thick x 1.500 in wide x 2.0 in long) piece of hardwood. Drill a 11,5 mm (0.45 in) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-66]**.

Figure 20-40-67



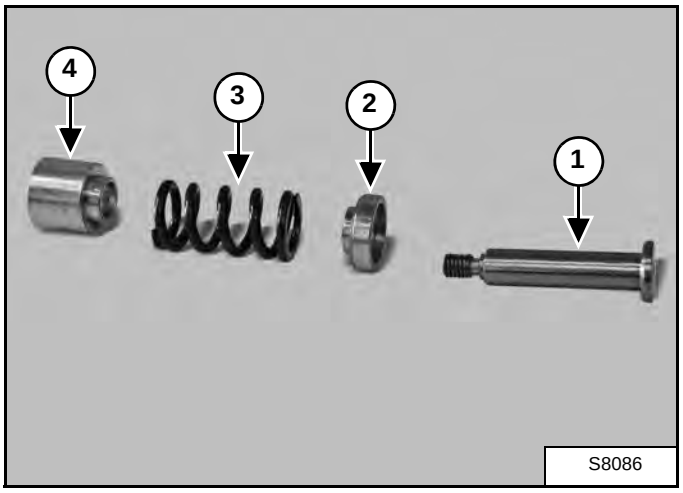
Using the wood blocks clamp the spool and spring assembly (Item 1) **[Figure 20-40-67]** in a vise.

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

Loosen the bolt (Item 2) **[Figure 20-40-67]**.

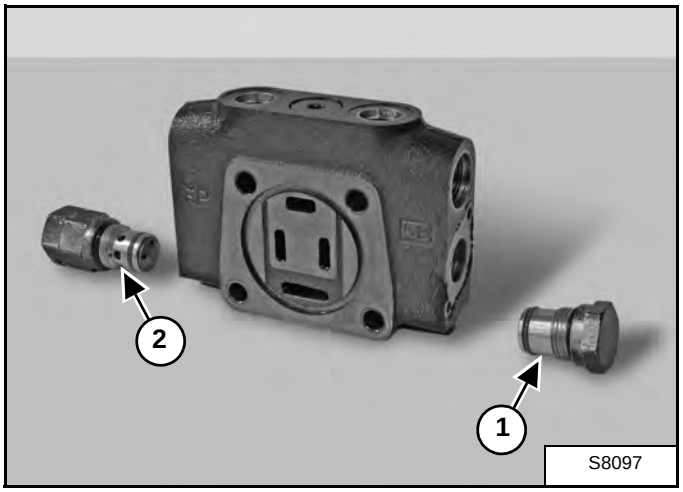
Installation: Apply Loctite® 243 or equivalent and tighten the bolt to 6 N•m (53 in-lb) torque.

Figure 20-40-68



Remove the bolt (Item 1), spring seat (Item 2), spring (Item 3) and spring retainer (Item 4) **[Figure 20-40-68]**.

Figure 20-40-69



Remove the plug (Item 1) and port relief valve (Item 2) **[Figure 20-40-69]**.

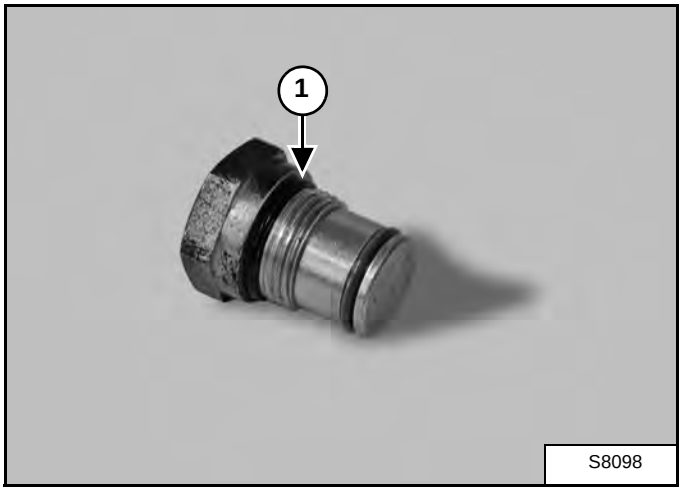
Installation: Tighten the plug to 40 - 45 N•m (29 - 33 ft-lb) torque.

Installation: Tighten the port relief valve to 40 - 45 N•m (29 - 33 ft-lb) torque.

Dealer Copy -- Not for Resale

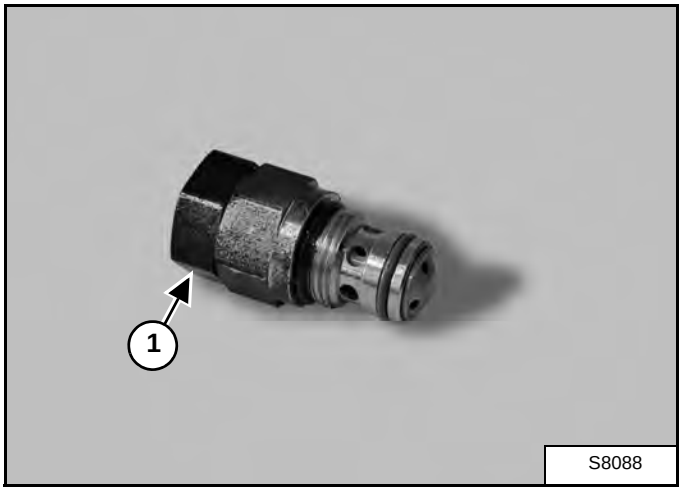
Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-70



Remove the O-ring (Item 1) **[Figure 20-40-70]** from the plug.

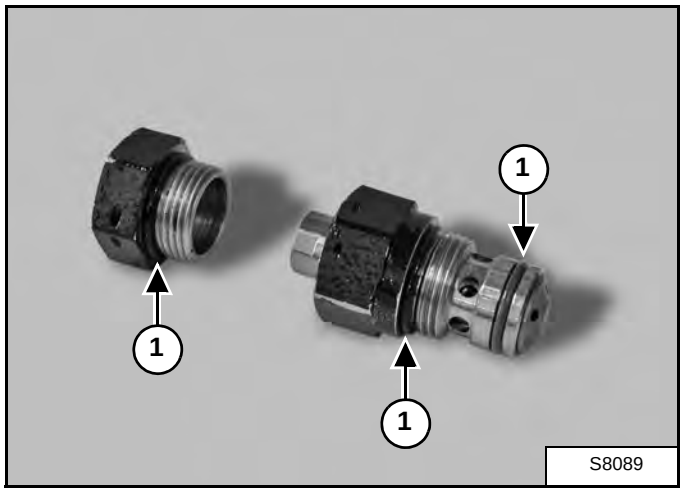
Figure 20-40-71



Remove the plug (Item 1) **[Figure 20-40-71]** from the port relief valve.

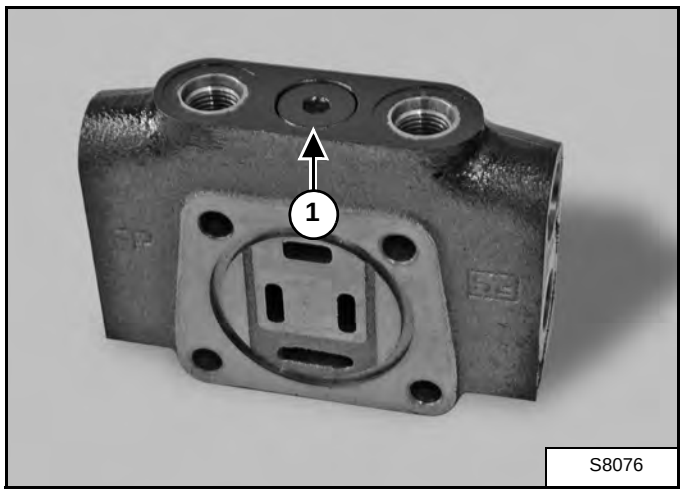
Installation: Tighten the plug to 25 N•m (18 ft-lb) torque.

Figure 20-40-72



Remove the O-rings (Item 1) **[Figure 20-40-72]**.

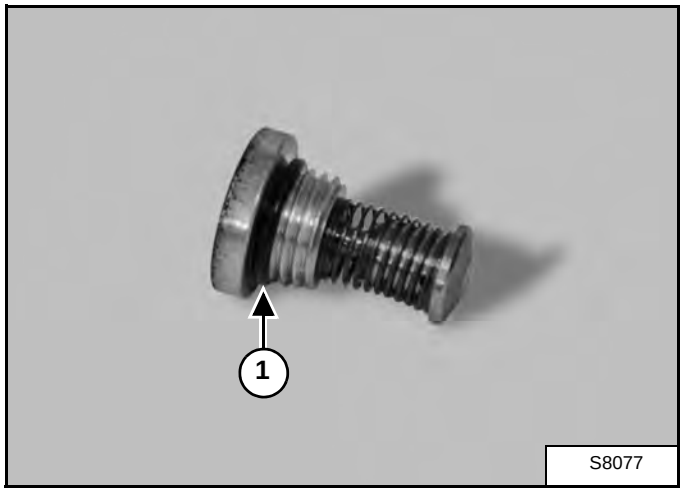
Figure 20-40-73



Remove the check valve (Item 1) **[Figure 20-40-73]**.

Installation: Tighten the check valve to 20 N•m (15 ft-lb) torque.

Figure 20-40-74



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

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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.

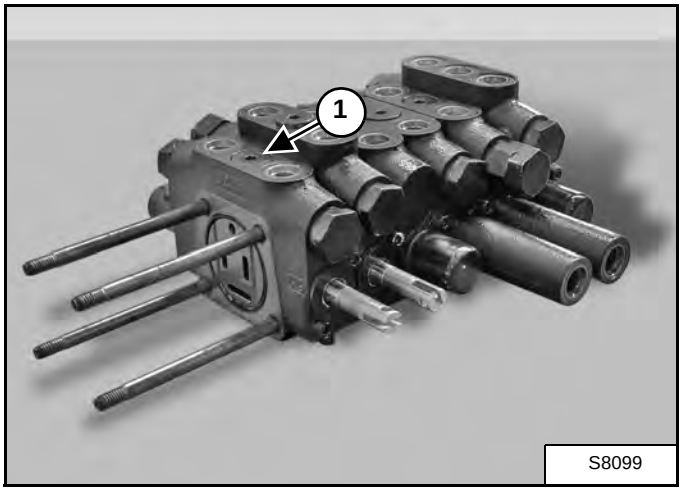
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

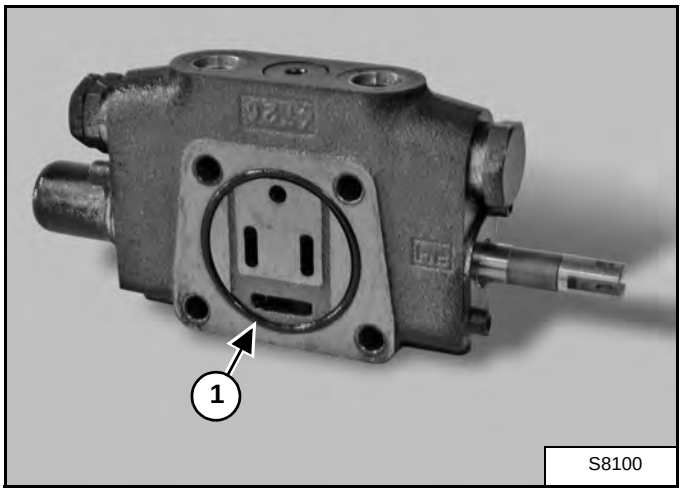
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-75



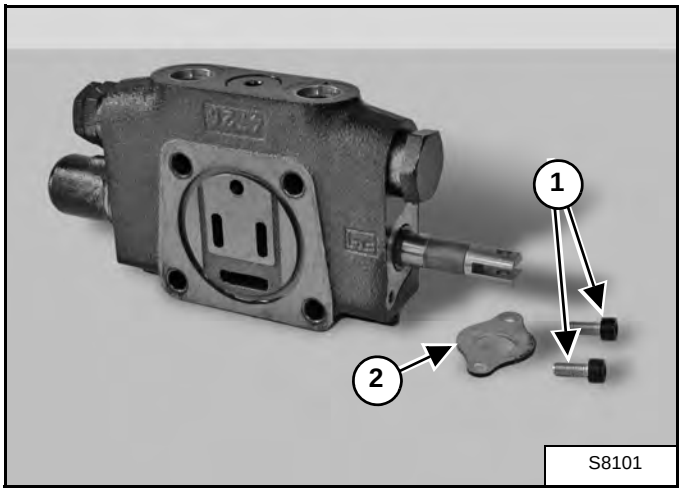
Remove the boom swing valve section (Item 1) **[Figure 20-40-75]** from the valve assembly.

Figure 20-40-76



Remove the O-ring (Item 1) **[Figure 20-40-76]** from the side of the boom swing valve section.

Figure 20-40-77



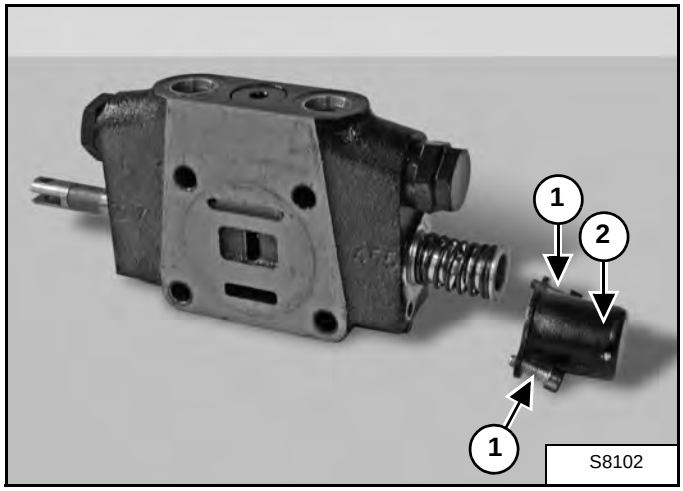
Remove the bolts (Item 1) and retaining plate (Item 2) **[Figure 20-40-77]**.

Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

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

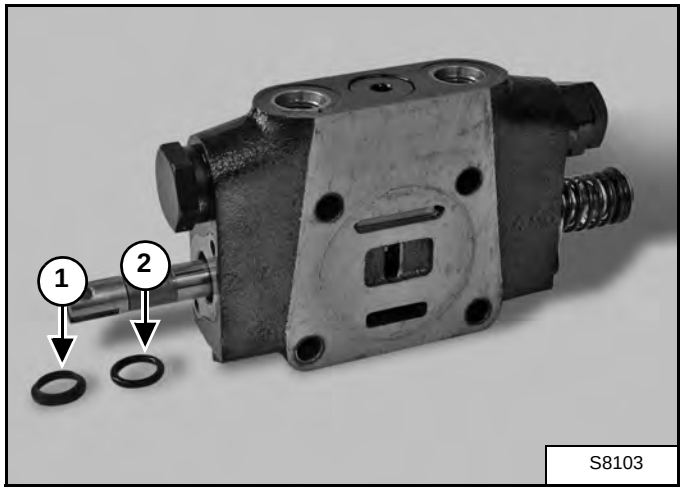
Figure 20-40-78



Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-78]**.

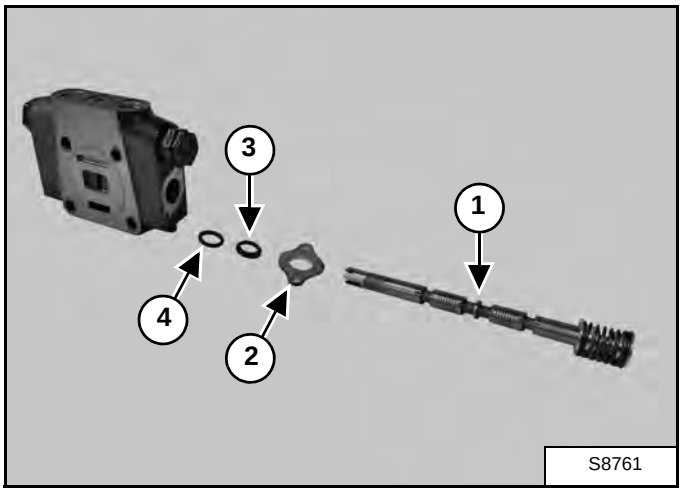
Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

Figure 20-40-79



Remove the seal (Item 1) and O-ring (Item 2) **[Figure 20-40-79]**.

Figure 20-40-80

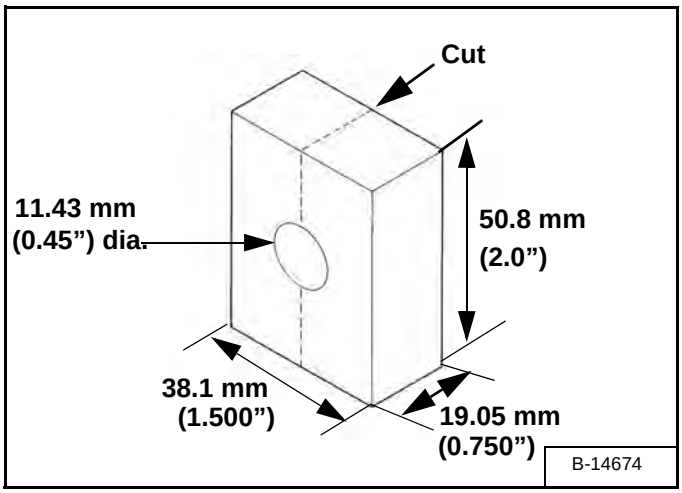


Remove the spool and spring assembly (Item 1), retaining plate (Item 2), seal (Item 3) and O-ring (Item 4) **[Figure 20-40-80]**.

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.

Figure 20-40-81

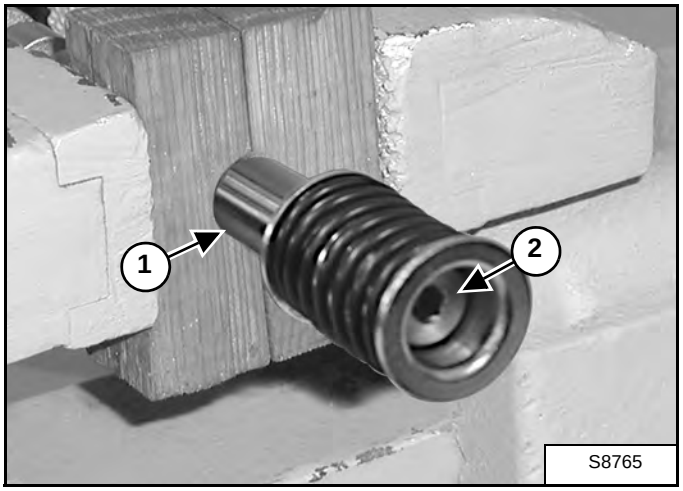


To remove the spring assembly from the spool a holding fixture will have to be made from a 19 mm thick x 38 mm wide x 51 mm long (0.750 in thick x 1.500 in wide x 2.0 in long) piece of hardwood. Drill a 11,5 mm (0.45 in) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-81]**.

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

Figure 20-40-82



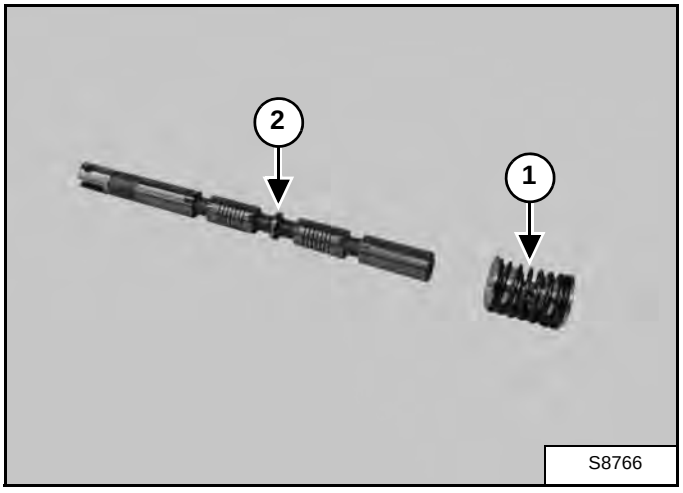
Using the wood blocks clamp the spool and spring assembly (Item 1) **[Figure 20-40-82]** in a vise.

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

Loosen the bolt (Item 2) **[Figure 20-40-82]**.

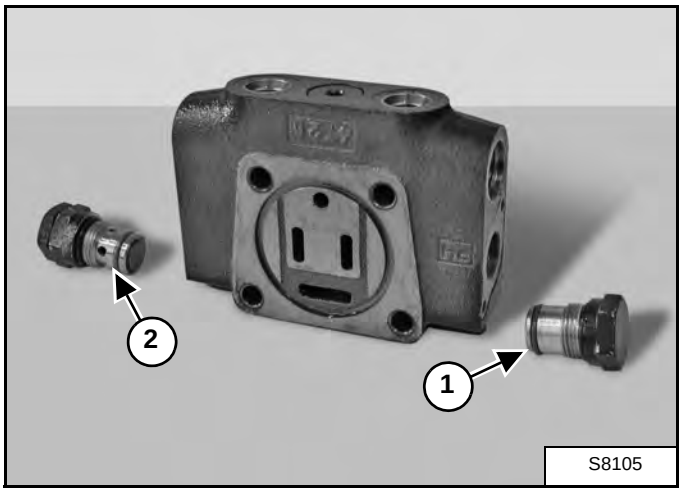
Installation: Apply Loctite® 243 or equivalent and tighten the bolt to 6 N•m (53 in-lb) torque.

Figure 20-40-83



Remove the spring assembly (Item 1) from the spool (Item 2) **[Figure 20-40-83]**.

Figure 20-40-84

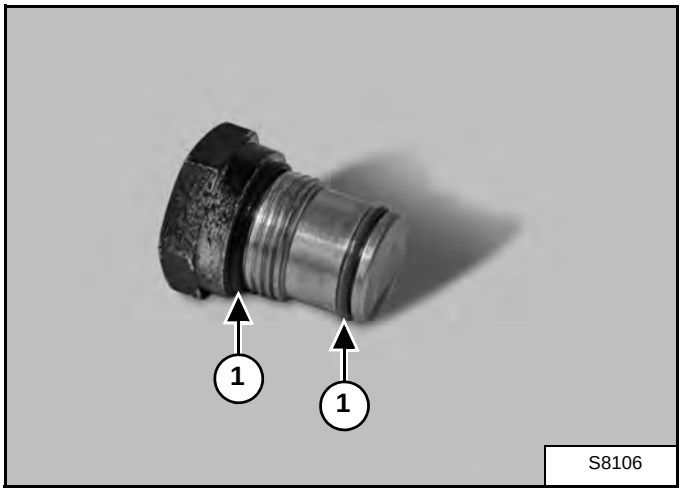


Remove the plug (Item 1) and valve assembly (Item 2) **[Figure 20-40-84]**.

Installation: Tighten the plug to 40 - 45 N•m (29 - 33 ft-lb) torque.

Installation: Tighten the valve assembly to 40 - 45 N•m (29-33 ft-lb) torque.

Figure 20-40-85

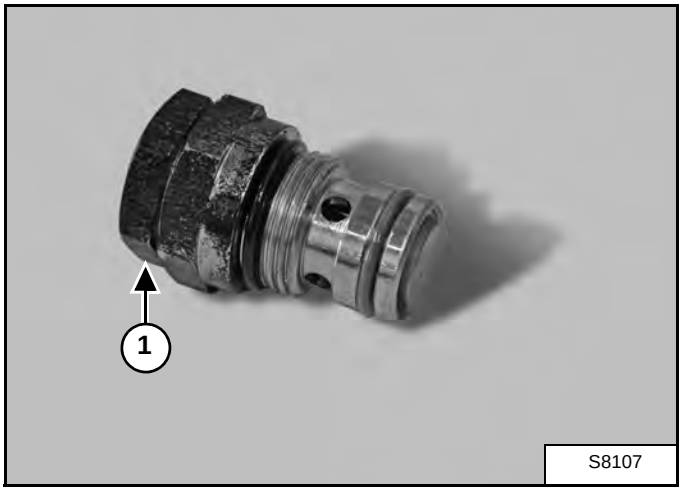


Remove the O-rings (Item 1) **[Figure 20-40-85]**.

Dealer Copy -- Not for Resale

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

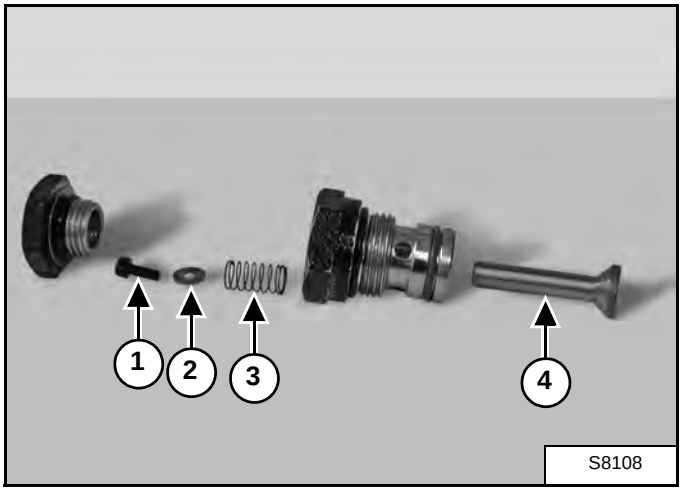
Figure 20-40-86



Remove the plug (Item 1) **[Figure 20-40-86]** from the valve assembly.

Installation: Tighten the plug to 25 N•m (18 ft-lb) torque.

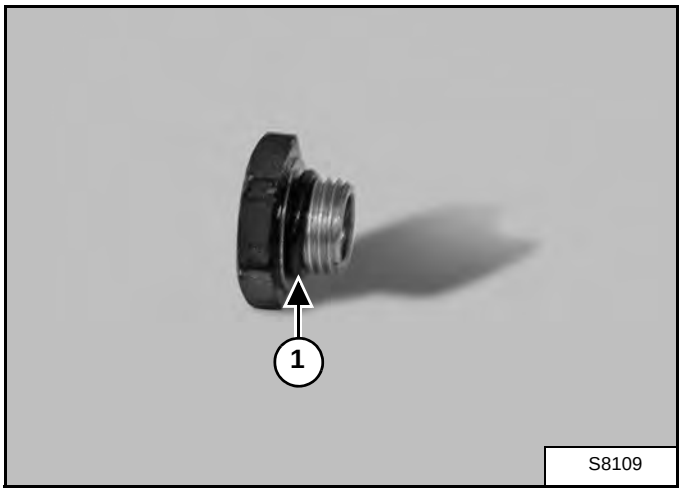
Figure 20-40-87



Remove the bolt (Item 1), washer (Item 2), spring (Item 3) and valve (Item 4) **[Figure 20-40-87]**.

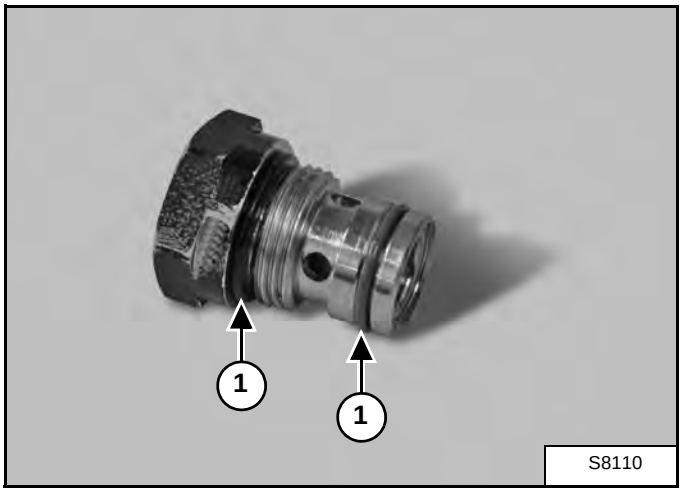
Installation: Tighten the bolt to 1,5 N•m (13 in-lb) torque.

Figure 20-40-88



Remove the O-ring (Item 1) **[Figure 20-40-88]**.

Figure 20-40-89

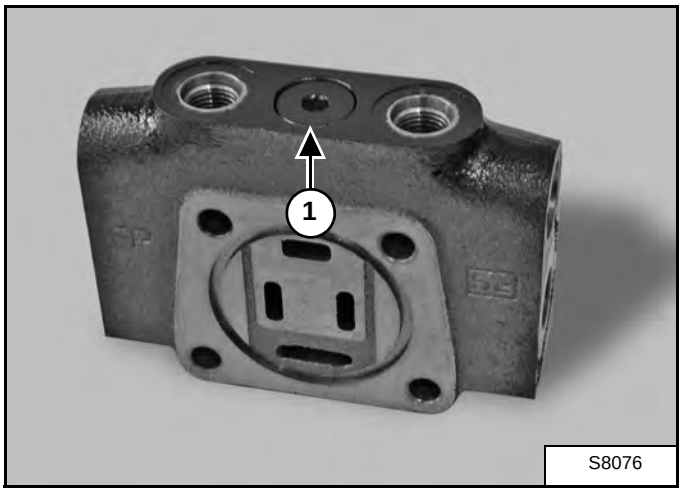


Remove the O-rings (Item 1) **[Figure 20-40-89]**.

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

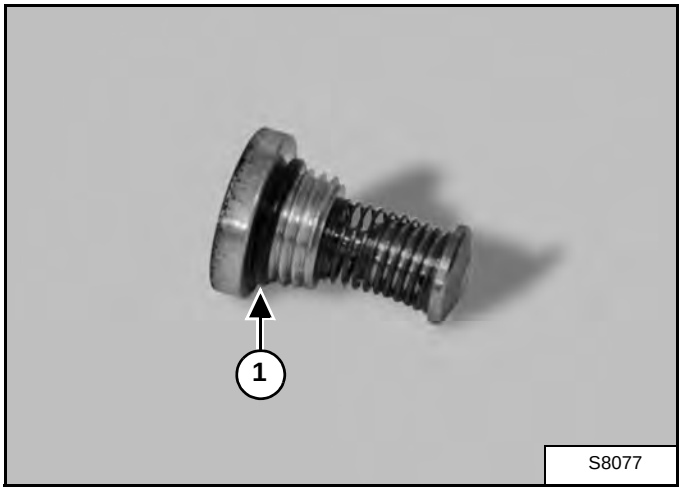
Figure 20-40-90



Remove the check valve (Item 1) **[Figure 20-40-90]**.

Installation: Tighten the check valve to 20 N•m (15 ft-lb) torque.

Figure 20-40-91



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

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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.

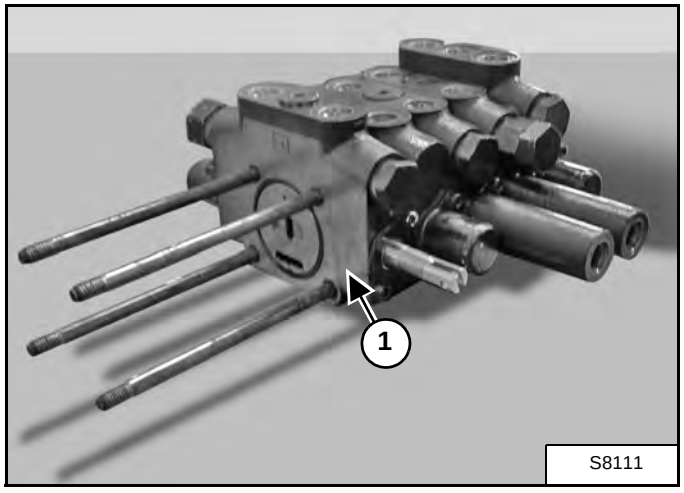
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

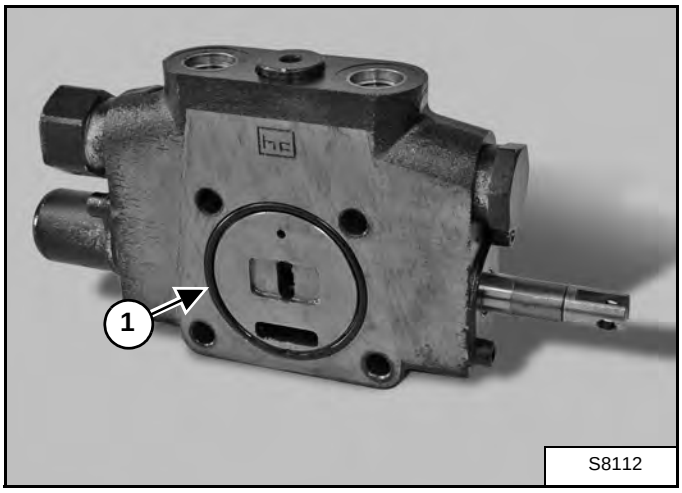
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-92



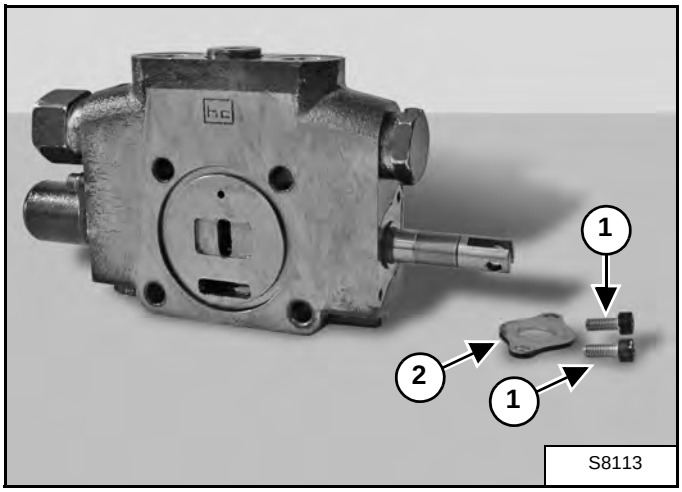
Remove the auxiliary valve section (Item 1) **[Figure 20-40-92]** from the valve assembly.

Figure 20-40-93



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

Figure 20-40-94



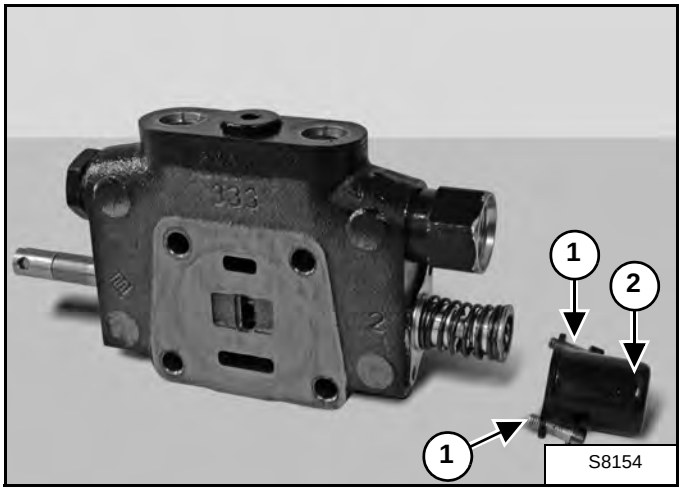
Remove the bolts (Item 1) and retaining plate (Item 2) **[Figure 20-40-94]**.

Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

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Auxiliary Valve Section Disassembly And Assembly (Cont'd)

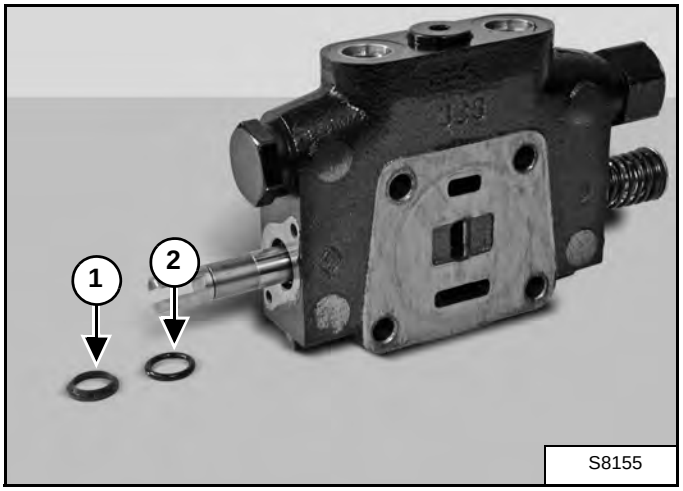
Figure 20-40-95



Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-95]**.

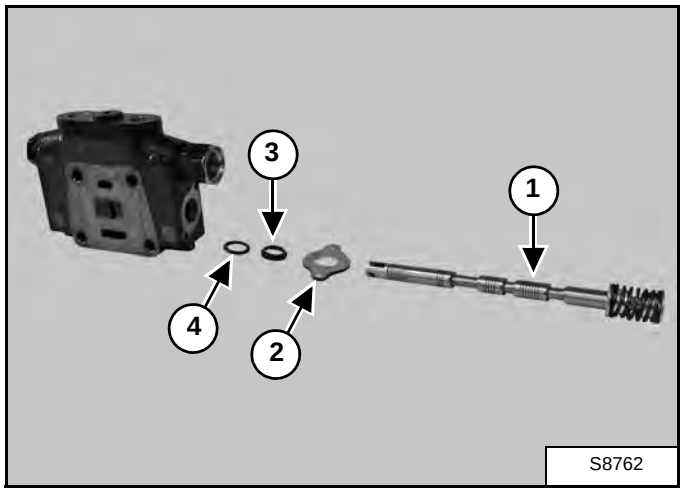
Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

Figure 20-40-96



Remove the seal (Item 1) and O-ring (Item 2) **[Figure 20-40-96]**.

Figure 20-40-97

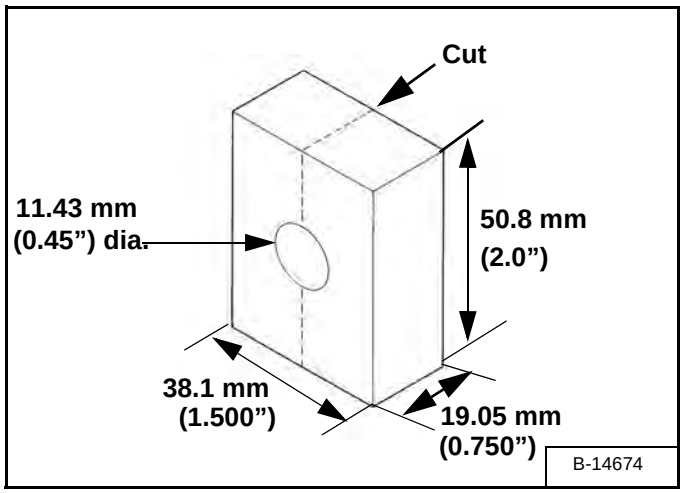


Remove the spool and spring assembly (Item 1), retaining plate (Item 2), seal (Item 3), and O-ring (Item 4) **[Figure 20-40-97]**.

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.

Figure 20-40-98

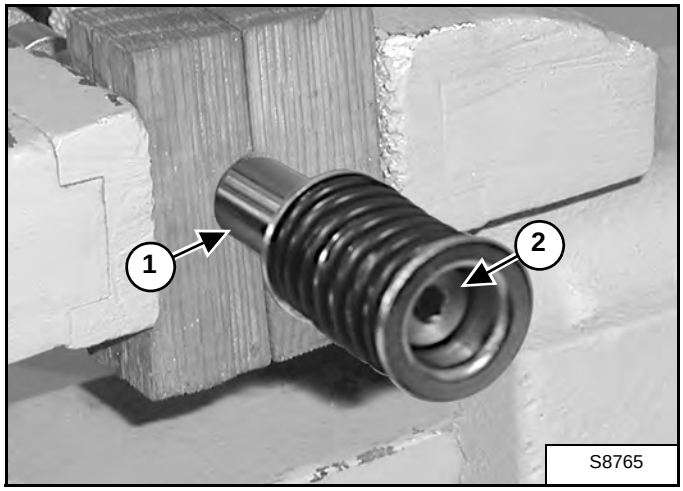


To remove the spring assembly from the spool a holding fixture will have to be made from a 19 mm thick x 38 mm wide x 51 mm long (0.750 in thick x 1.500 in wide x 2.0 in long) piece of hardwood. Drill a 11,5 mm (0.45 in) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-98]**.

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Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-99



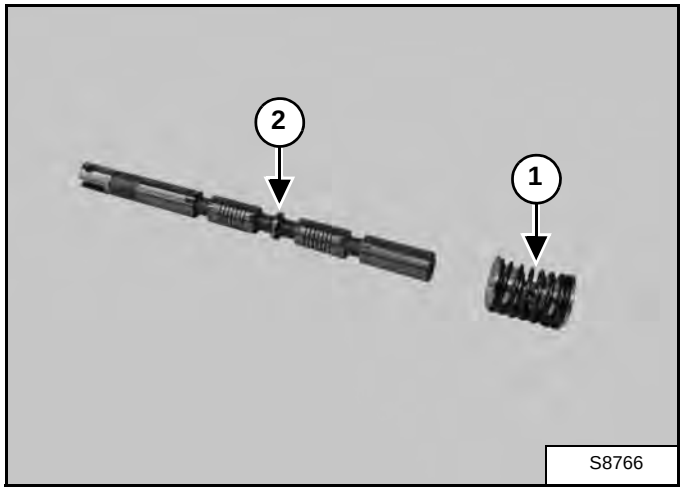
Using the wood blocks, clamp the spool and spring assembly (Item 1) **[Figure 20-40-99]** in a vise.

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

Loosen the bolt (Item 2) **[Figure 20-40-99]**.

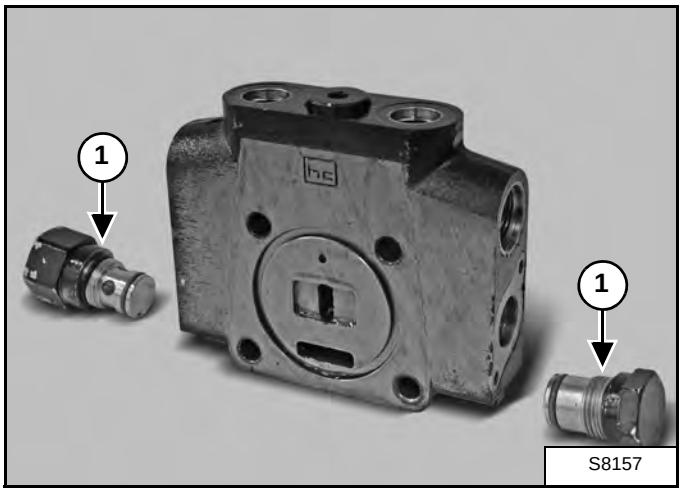
Installation: Apply Loctite® 243 or equivalent and tighten the bolt to 6 N•m (53 in-lb) torque.

Figure 20-40-100



Remove the spring assembly (Item 1) from the spool (Item 2) **[Figure 20-40-100]**.

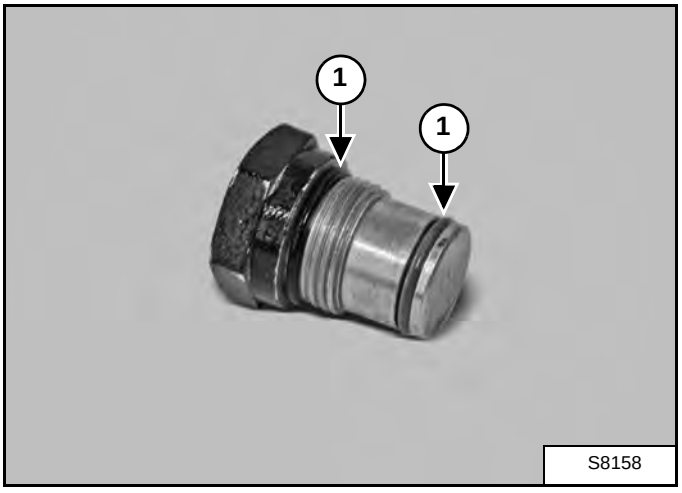
Figure 20-40-101



Remove the two plugs (Item 1) **[Figure 20-40-101]**.

Installation: Tighten the plugs to 40 - 45 N•m (29 - 33 ft-lb) torque.

Figure 20-40-102

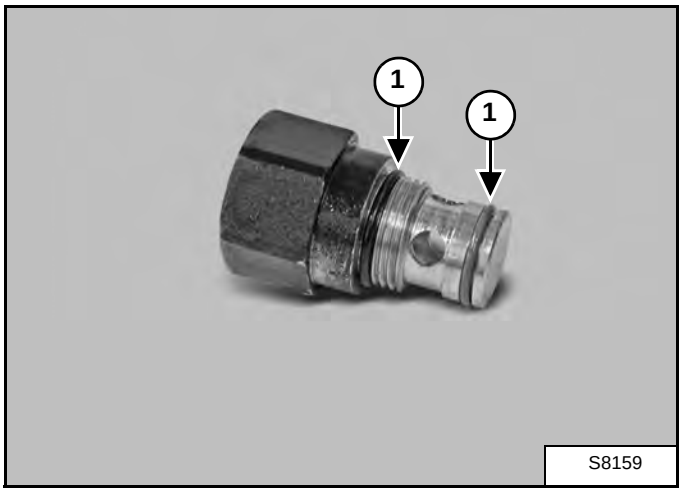


Remove the O-rings (Item 1) **[Figure 20-40-102]**.

Dealer Copy -- Not for Resale

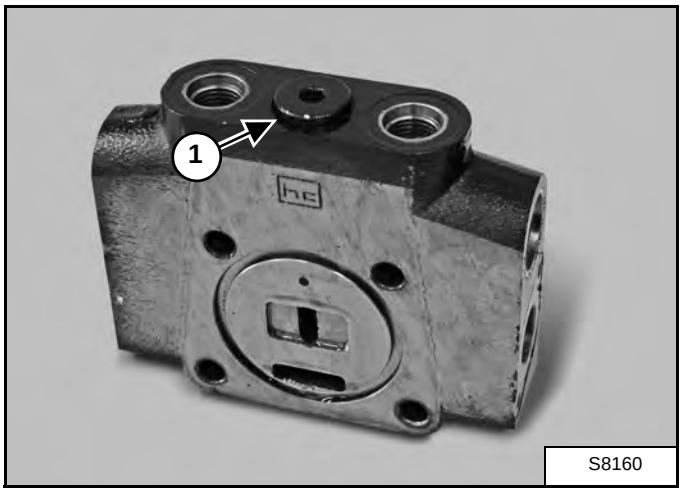
Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-103



Remove the O-rings (Item 1) **[Figure 20-40-103]**.

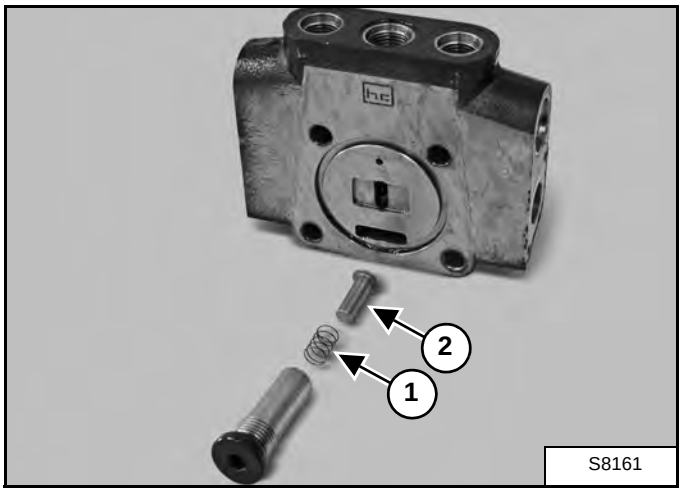
Figure 20-40-104



Remove the check valve (Item 1) **[Figure 20-40-104]**.

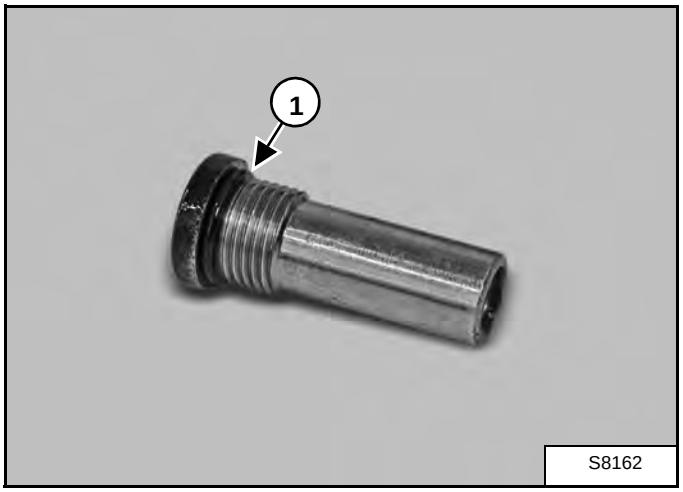
Installation: Tighten the check valve to 20 N•m (15 ft-lb) torque.

Figure 20-40-105



Remove the spring (Item 1) and spring seat (Item 2) **[Figure 20-40-105]**.

Figure 20-40-106



Remove the O-ring (Item 1) **[Figure 20-40-106]**.

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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.

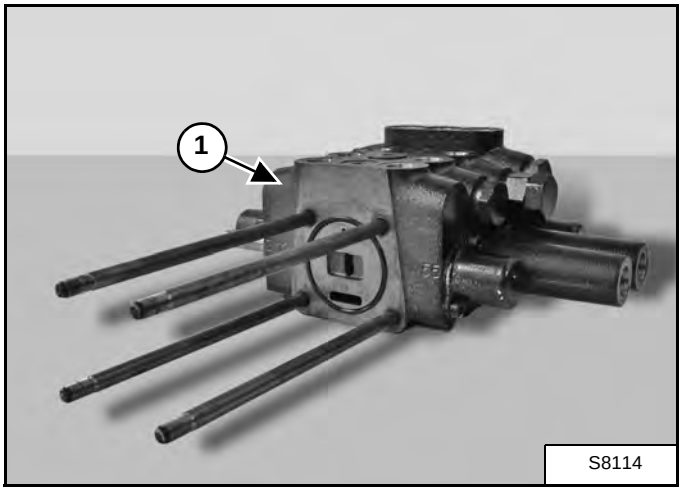
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

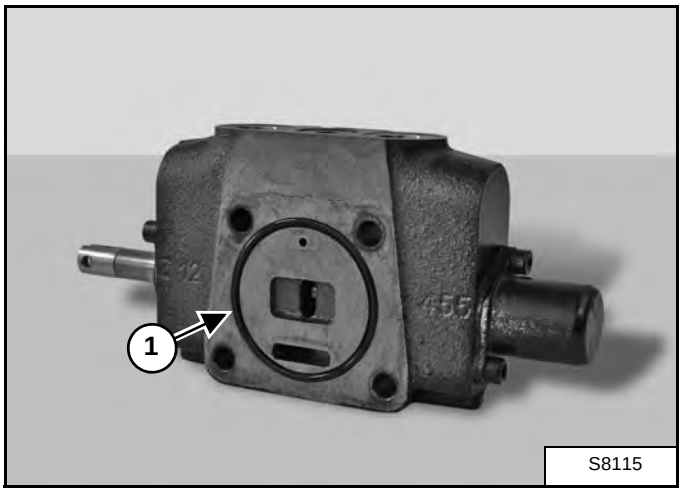
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-107



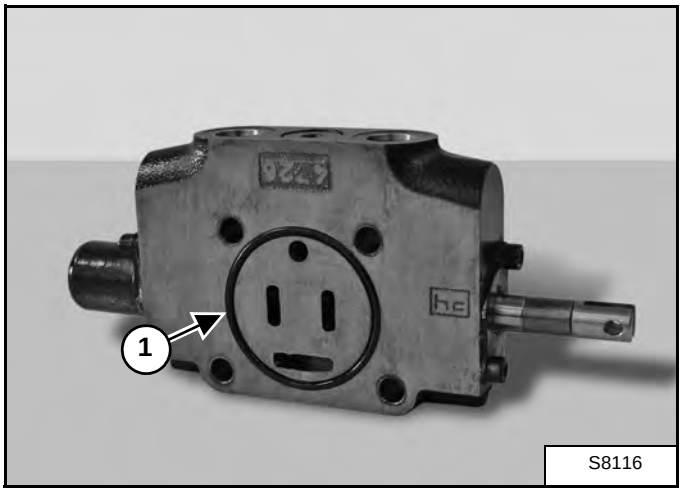
Remove the blade valve section (Item 1) **[Figure 20-40-107]** from the valve assembly.

Figure 20-40-108



Remove the O-ring (Item 1) **[Figure 20-40-108]** from the blade valve section.

Figure 20-40-109

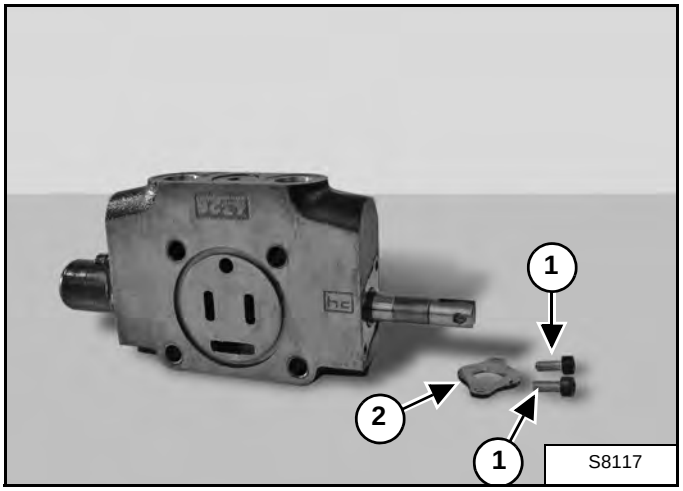


Remove the O-ring (Item 1) **[Figure 20-40-109]** from the blade valve section.

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Blade Valve Section Disassembly And Assembly (Cont'd)

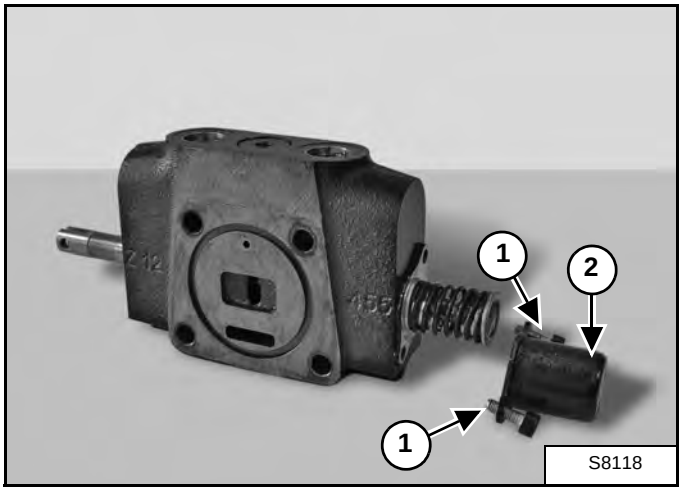
Figure 20-40-110



Remove the bolts (Item 1) and retaining plate (Item 2) **[Figure 20-40-110]**.

Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

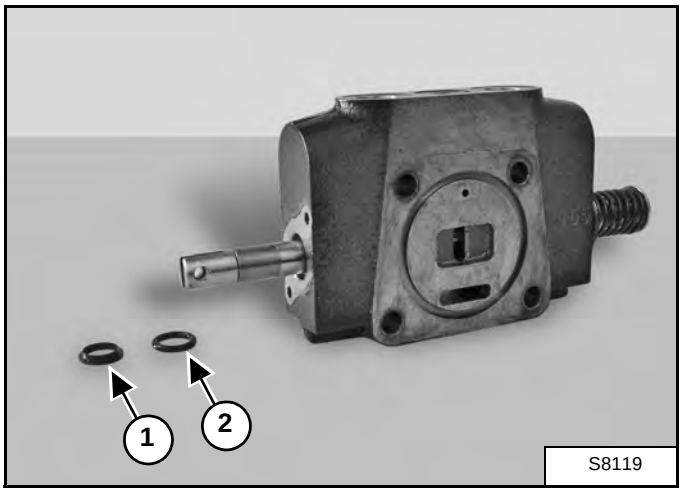
Figure 20-40-111



Loosen the bolts (Item 1) and remove cap and screw assembly **[Figure 20-40-111]**.

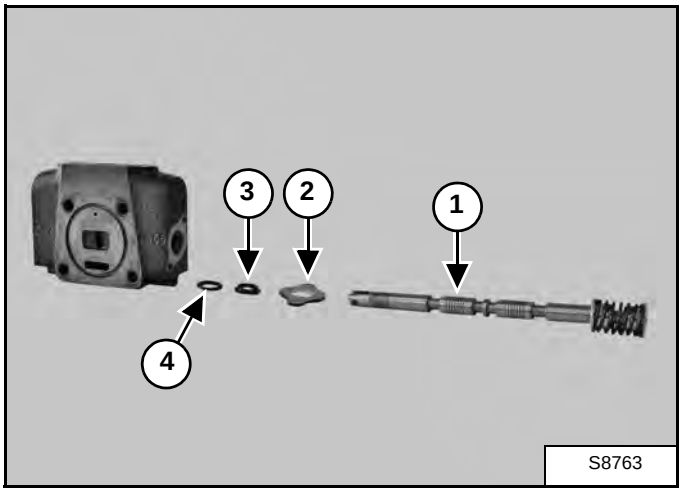
Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

Figure 20-40-112



Remove the seal (Item 1) and O-ring (Item 2) **[Figure 20-40-112]**.

Figure 20-40-113



Remove the spool and spring assembly (Item 1), retaining plate (Item 2), seal (Item 3), and O-ring (Item 4) **[Figure 20-40-113]**.

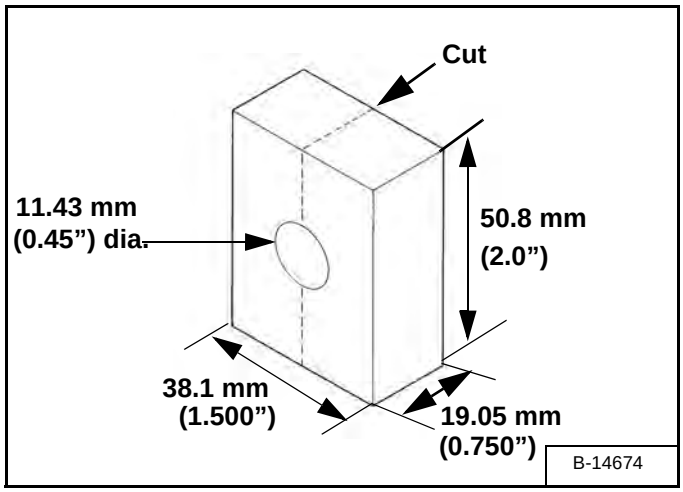
The spool and valve section are not serviced separately.

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

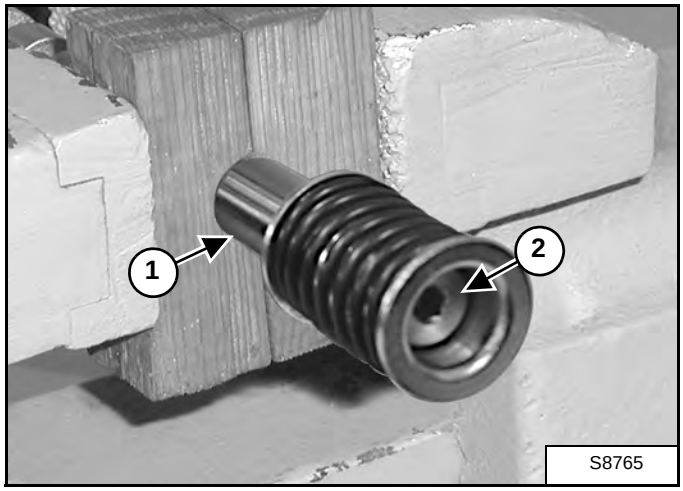
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-114



To remove the spring assembly from the spool a holding fixture will have to be made from a 19 mm thick x 38 mm wide x 51 mm long (0.750 in thick x 1.500 in wide x 2.0 in long) piece of hardwood. Drill a 11,5 mm (0.45 in) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-114]**.

Figure 20-40-115



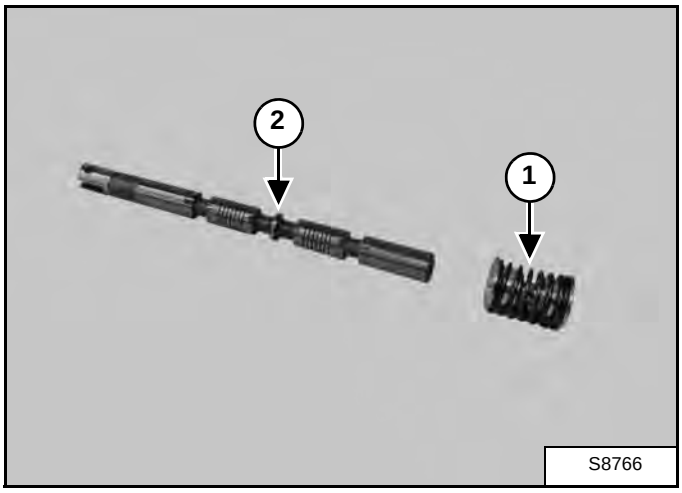
Using the wood blocks clamp the spool and spring assembly (Item 1) **[Figure 20-40-115]** in a vise.

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

Loosen the bolt (Item 2) **[Figure 20-40-115]**.

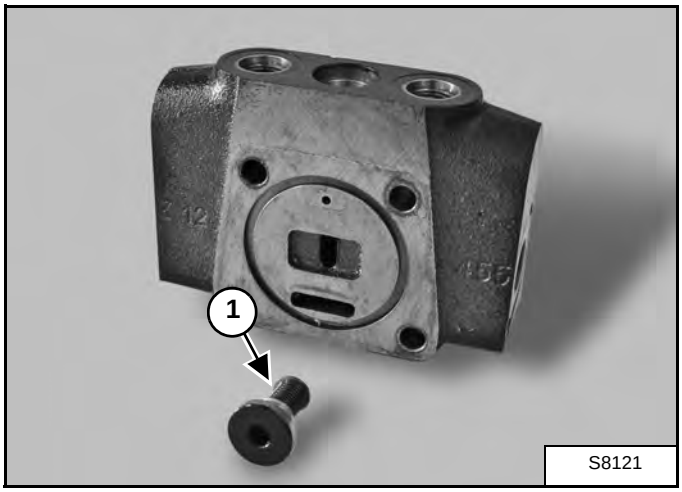
Installation: Apply Loctite® 243 or equivalent and tighten the bolt to 6 N•m (53 in-lb) torque.

Figure 20-40-116



Remove the spring assembly (Item 1) from the spool (Item 2) **[Figure 20-40-116]**.

Figure 20-40-117



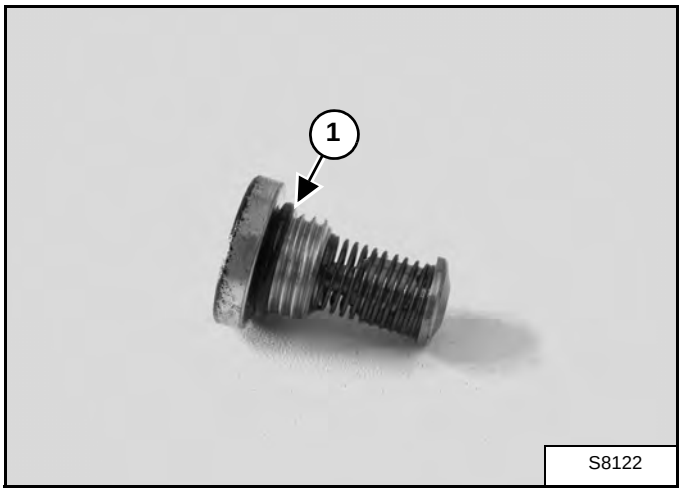
Remove the check valve (Item 1) **[Figure 20-40-117]**.

Installation: Tighten the check valve to 20 N•m (15 ft-lb) torque.

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Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-118



Remove the O-ring (Item 1) **[Figure 20-40-118]** from the check valve.

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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.

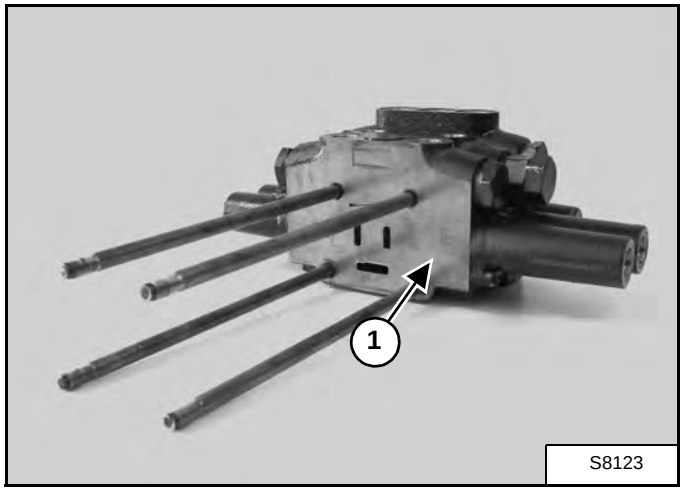
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

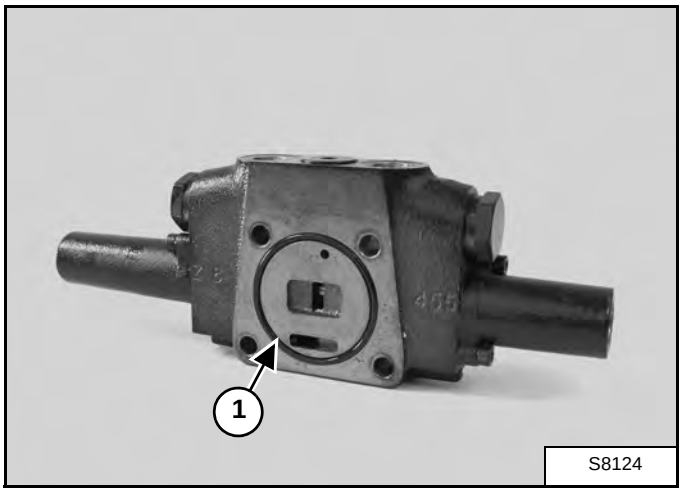
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-119



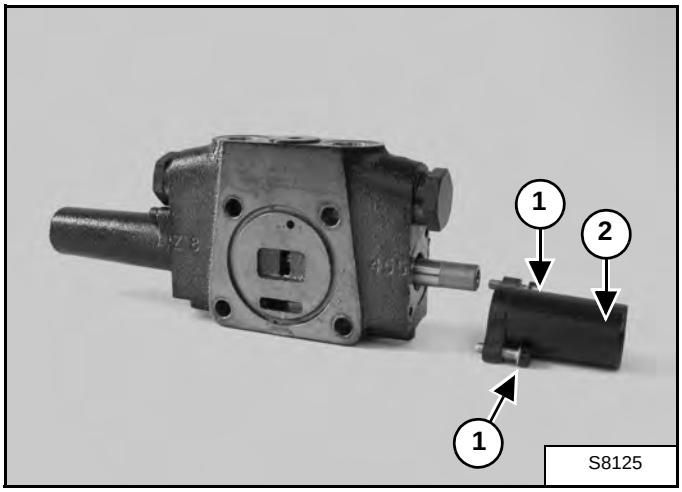
Remove the bucket valve section (Item 1) **[Figure 20-40-119]** from the valve assembly.

Figure 20-40-120



Remove the O-ring (Item 1) **[Figure 20-40-120]** from the bucket valve section.

Figure 20-40-121



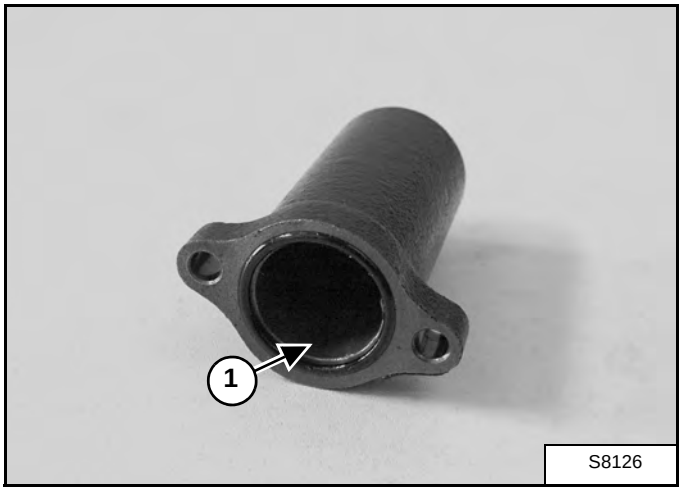
Loosen the bolts (Item 1) and remove cap and screw assembly **[Figure 20-40-121]**.

Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

Dealer Copy -- Not for Resale

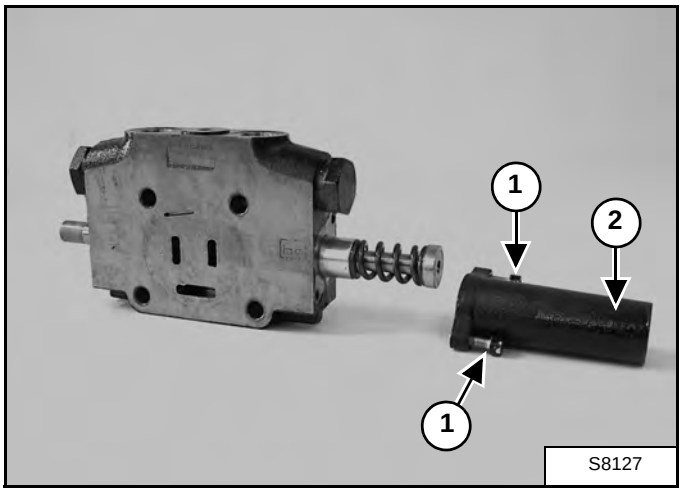
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-122



Remove the O-ring (Item 1) **[Figure 20-40-122]**.

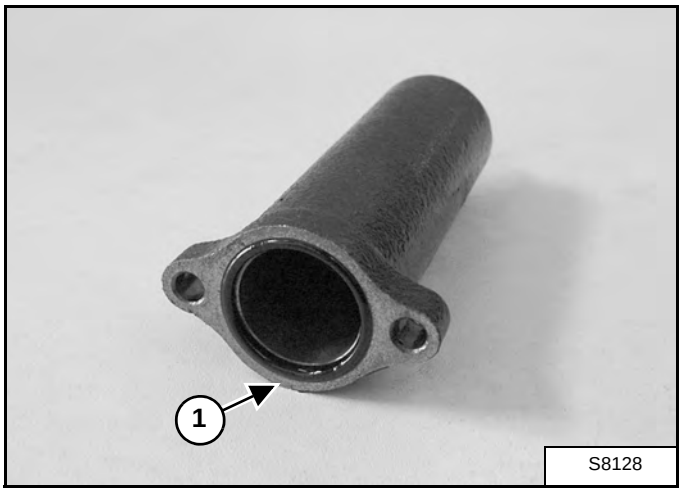
Figure 20-40-123



Loosen the bolts (Item 1) and remove cap and screw assembly **[Figure 20-40-123]**.

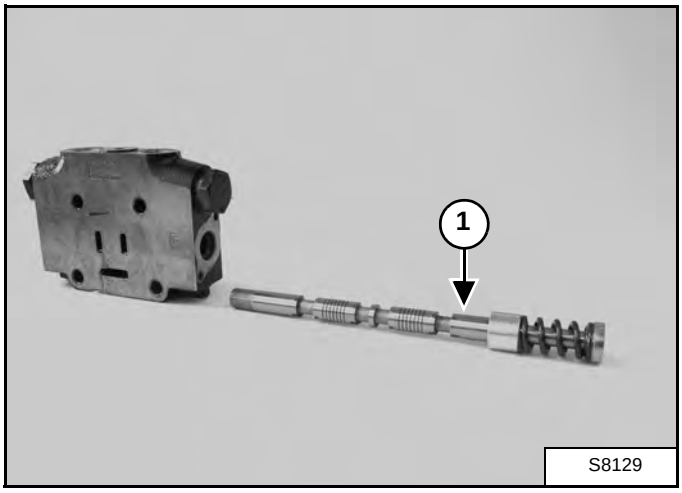
Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

Figure 20-40-124



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

Figure 20-40-125



Remove the spool and spring assembly (Item 1) **[Figure 20-40-125]** from the valve section.

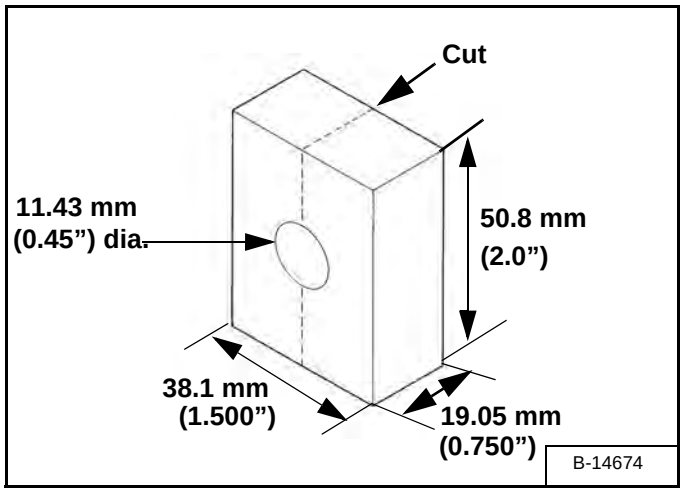
The spool and valve section are not serviced separately.

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

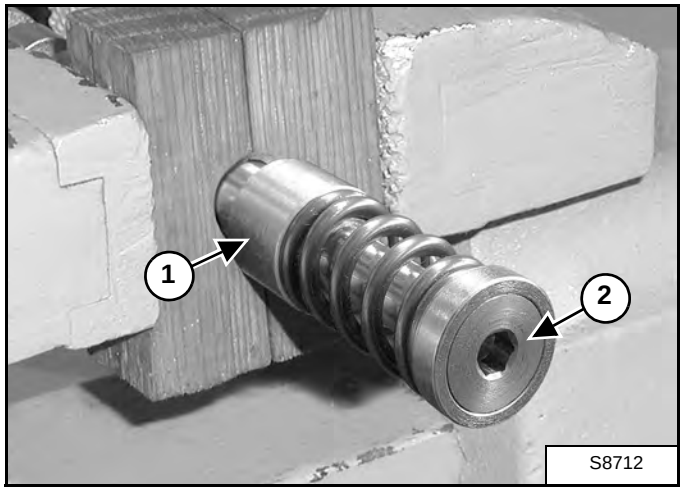
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-126



To remove the spring assembly from the spool a holding fixture will have to be made from a 19 mm thick x 38 mm wide x 51 mm long (0.750 in thick x 1.500 in wide x 2.0 in long) piece of hardwood. Drill a 11,5 mm (0.45 in) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-126]**.

Figure 20-40-127



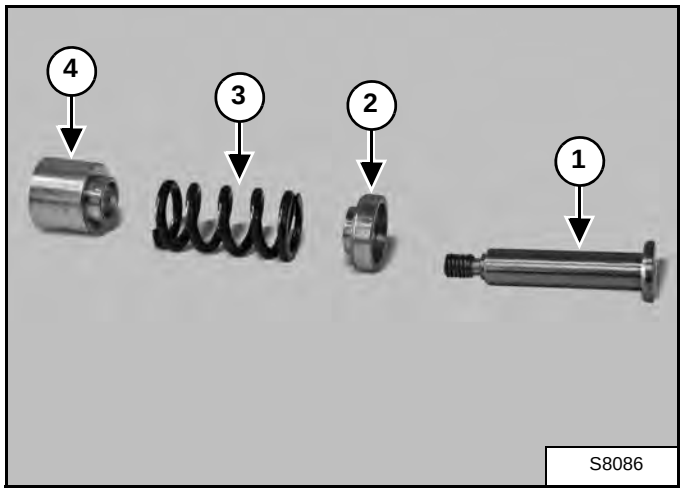
Using the wood blocks clamp the spool and spring assembly (Item 1) **[Figure 20-40-127]** in a vise.

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

Loosen the bolt (Item 2) **[Figure 20-40-127]**.

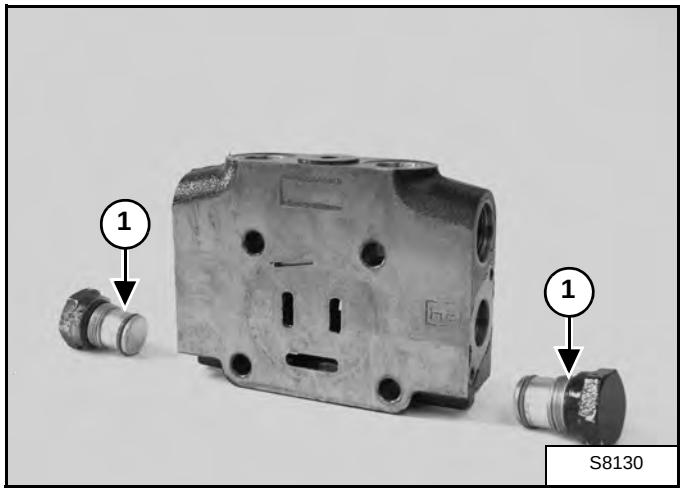
Installation: Apply Loctite® 243 or equivalent and tighten the bolt to 6 N•m (53 in-lb) torque.

Figure 20-40-128



Remove the bolt (Item 1), spring seat (Item 2), spring (Item 3), spring retainer (Item 4) **[Figure 20-40-128]**.

Figure 20-40-129



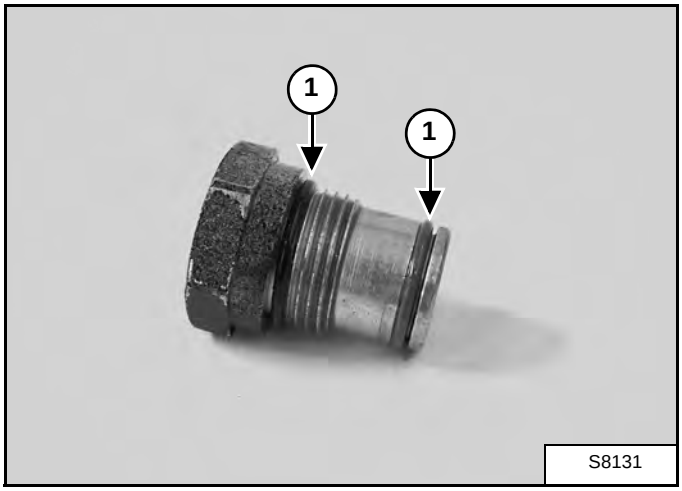
Remove the plugs (Item 1) **[Figure 20-40-129]**.

Installation: Tighten the plugs to 40 - 45 N•m (29 - 33 ft-lb) torque.

Dealer Copy -- Not for Resale

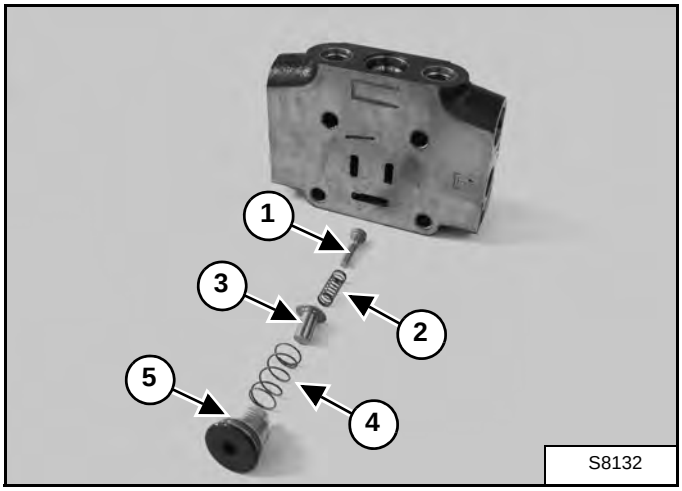
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-130



Remove the O-rings (Item 1) **[Figure 20-40-130]** from the plugs.

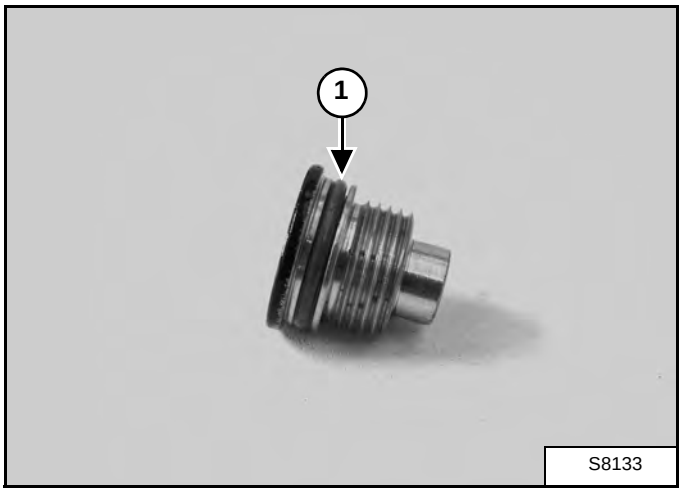
Figure 20-40-131



Remove the spring seat (Item 1), spring (Item 2), spring seat (Item 3), spring (Item 4), and plug (Item 5) **[Figure 20-40-131]**.

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

Figure 20-40-132



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

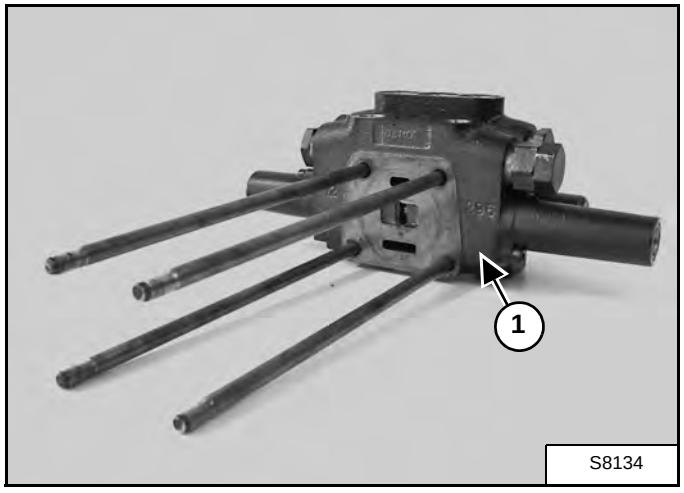
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

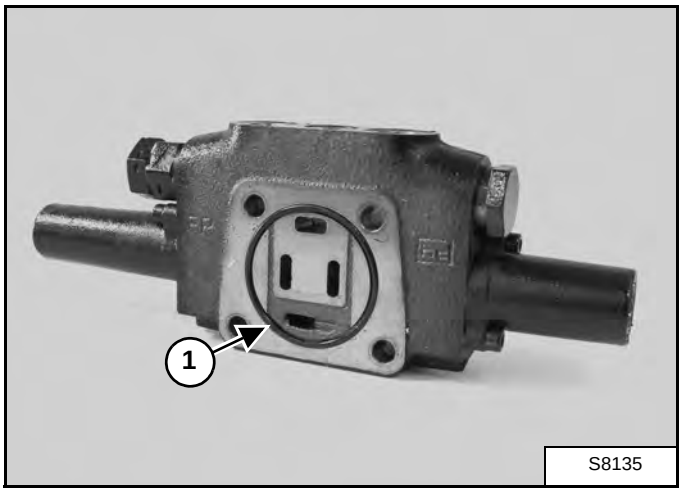
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-133



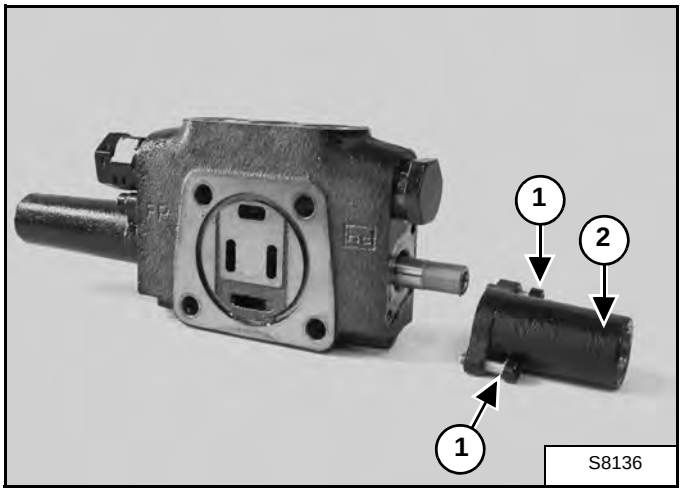
Remove the boom valve section (Item 1) **[Figure 20-40-133]** from the valve assembly.

Figure 20-40-134



Remove the O-ring (Item 1) **[Figure 20-40-134]** from the boom valve section.

Figure 20-40-135



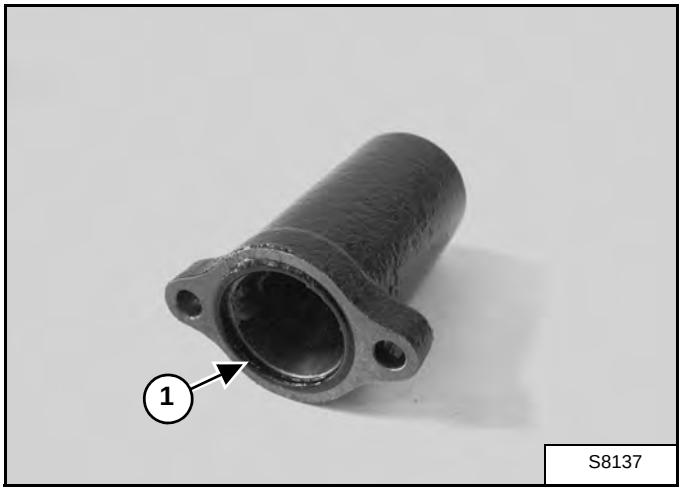
Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-135]**.

Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

Dealer Copy -- Not for Resale

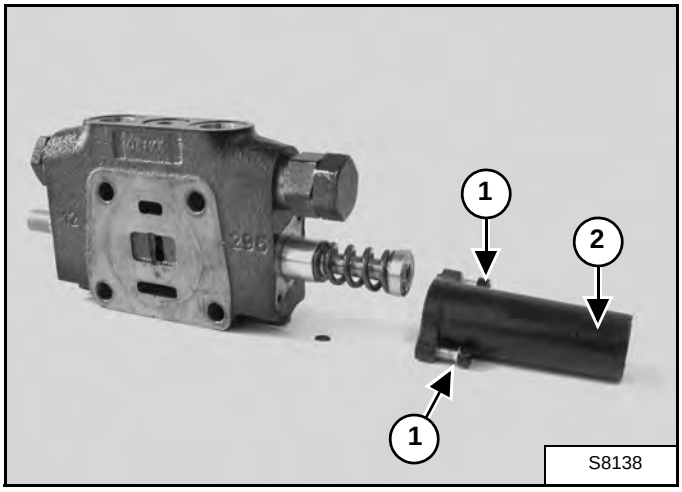
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-136



Remove the O-ring (Item 1) **[Figure 20-40-136]**.

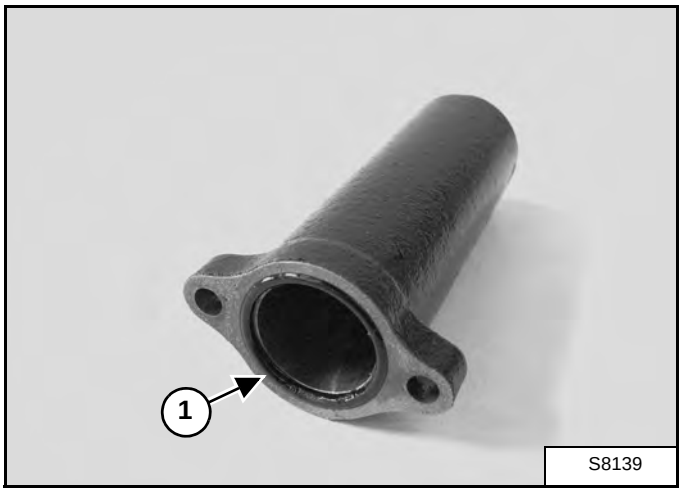
Figure 20-40-137



Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-137]**.

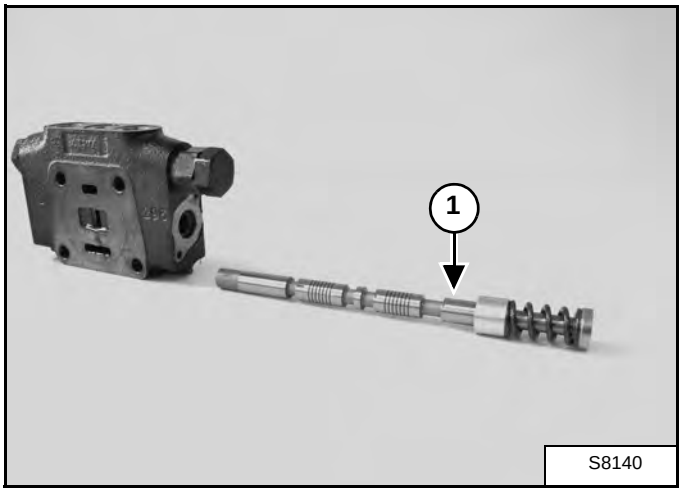
Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

Figure 20-40-138



Remove the O-ring (Item 1) **[Figure 20-40-138]**.

Figure 20-40-139



Remove the spool and spring assembly (Item 1) **[Figure 20-40-139]** from the valve section.

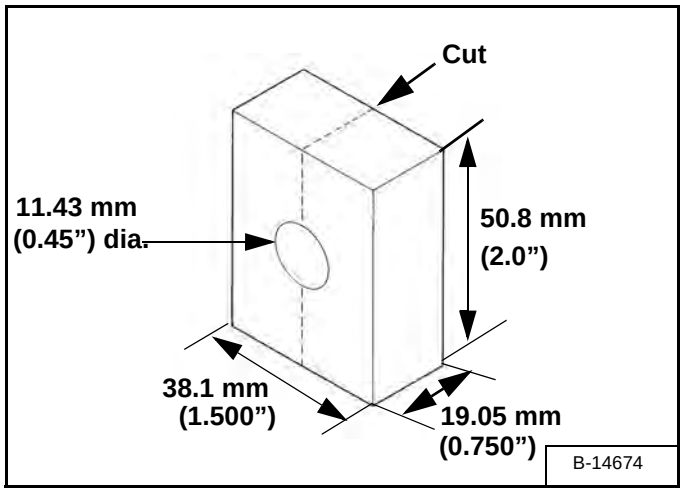
The spool and valve section are not serviced separately.

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

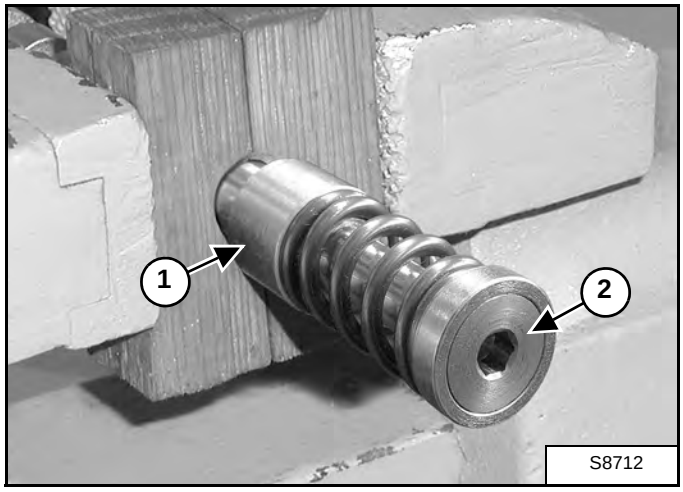
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-140



To remove the spring assembly from the spool a holding fixture will have to be made from a 19 mm thick x 38 mm wide x 51 mm long (0.750 in thick x 1.500 in wide x 2.0 in long) piece of hardwood. Drill a 11,5 mm (0.45 in) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-140]**.

Figure 20-40-141



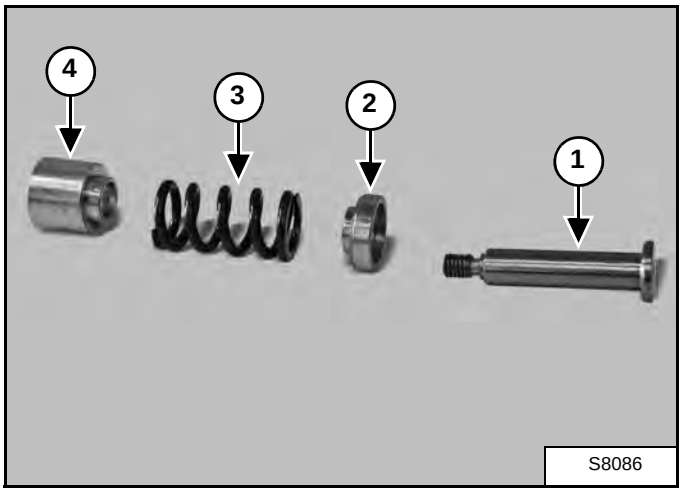
Using the wood blocks clamp the spool and spring assembly (Item 1) **[Figure 20-40-141]** in a vise.

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

Loosen the bolt (Item 2) **[Figure 20-40-141]**.

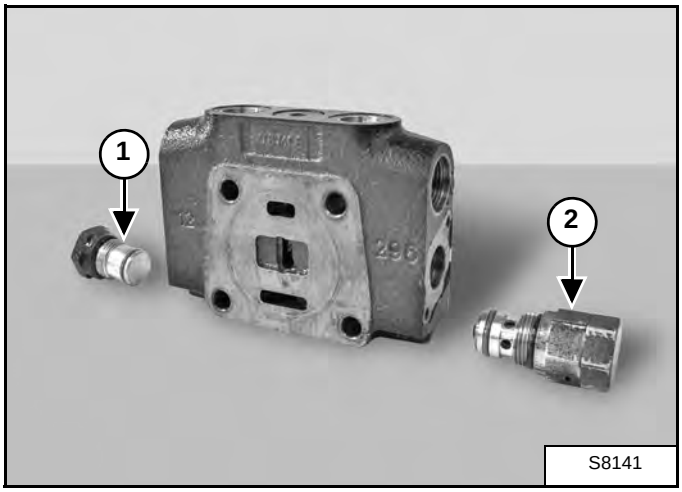
Installation: Apply Loctite® 243 or equivalent and tighten the bolt to 6 N•m (53 in-lb) torque.

Figure 20-40-142



Remove the bolt (Item 1), spring seat (Item 2), spring (Item 3), spring retainer (Item 4) **[Figure 20-40-142]**.

Figure 20-40-143



Remove the plug (Item 1) and relief valve (Item 2) **[Figure 20-40-143]**.

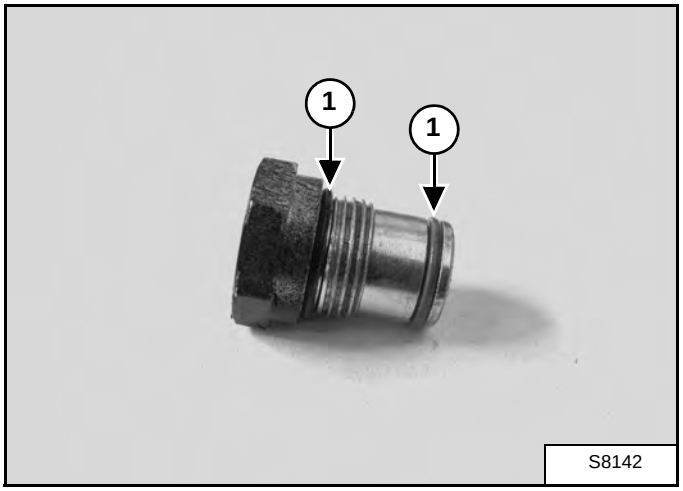
Installation: Tighten the plug to 40 - 45 N•m (29 - 33 ft-lb) torque.

Installation: Tighten the relief valve to 40 - 45 N•m (29 - 33 ft-lb) torque.

Dealer Copy -- Not for Resale

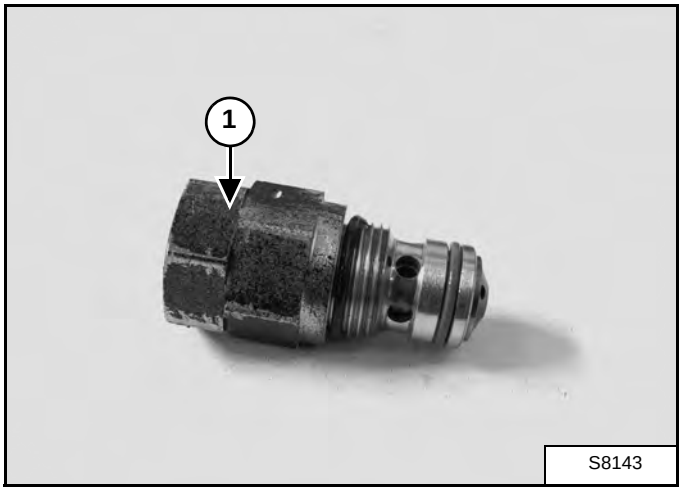
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-144



Remove the O-rings (Item 1) **[Figure 20-40-144]**.

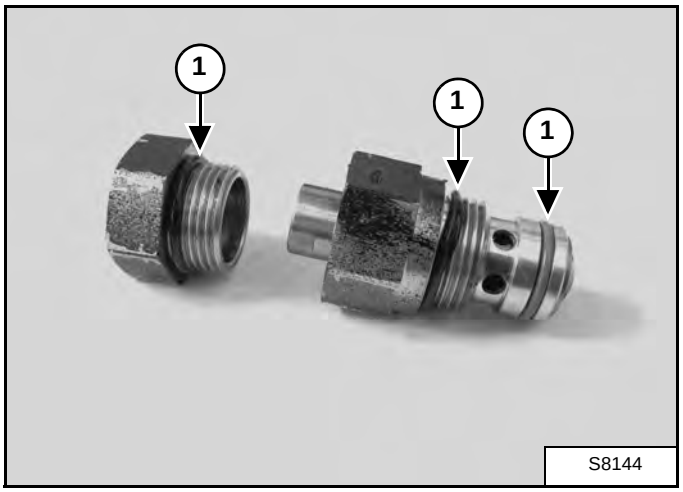
Figure 20-40-145



Remove the plug (Item 1) **[Figure 20-40-145]** from the relief valve.

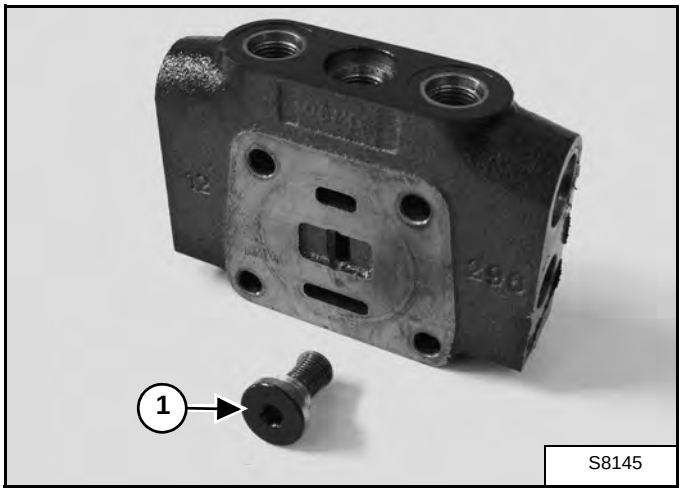
Installation: Tighten the plug to 25 N•m (18 ft-lb) torque.

Figure 20-40-146



Remove the O-rings (Item 1) **[Figure 20-40-146]**.

Figure 20-40-147



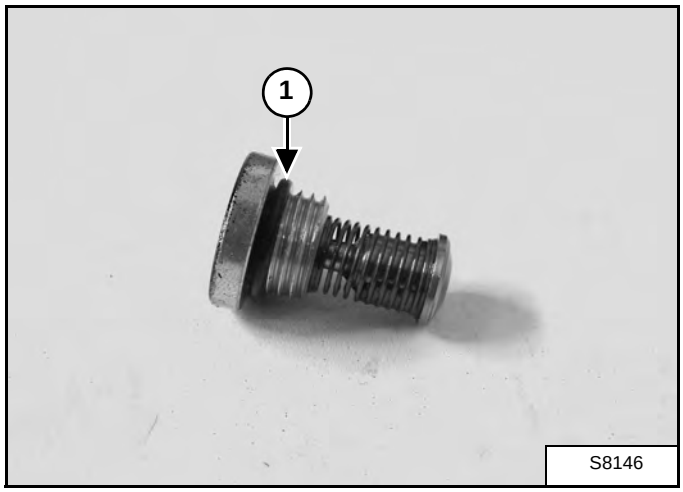
Remove the check valve (Item 1) **[Figure 20-40-147]**.

Installation: Tighten the check valve to 20 N•m (15 ft-lb) torque.

Dealer Copy -- Not for Resale

Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-148



Remove the O-ring (Item 1) **[Figure 20-40-148]** from the check valve.

Dealer Copy -- Not for Resale

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.

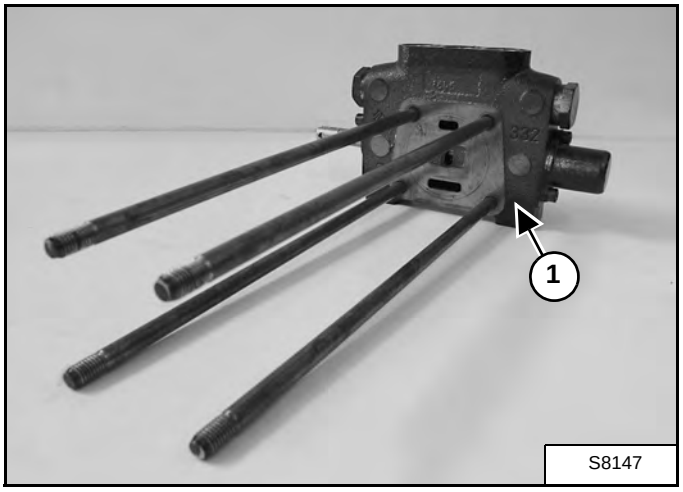
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

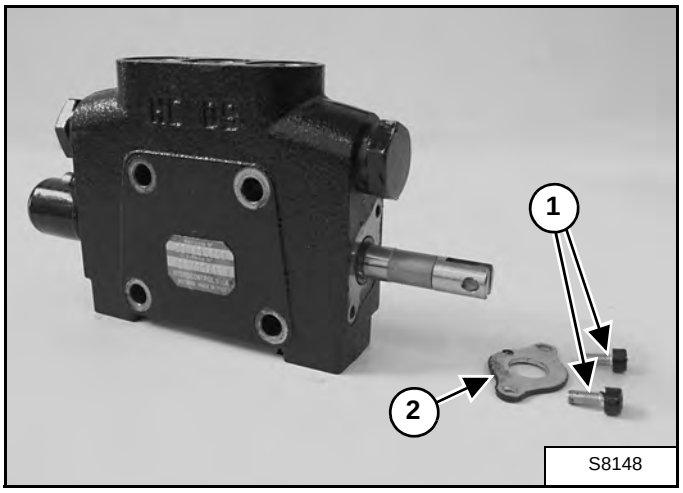
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-149



Remove the right travel valve section (Item 1) **[Figure 20-40-149]** from the tie rods.

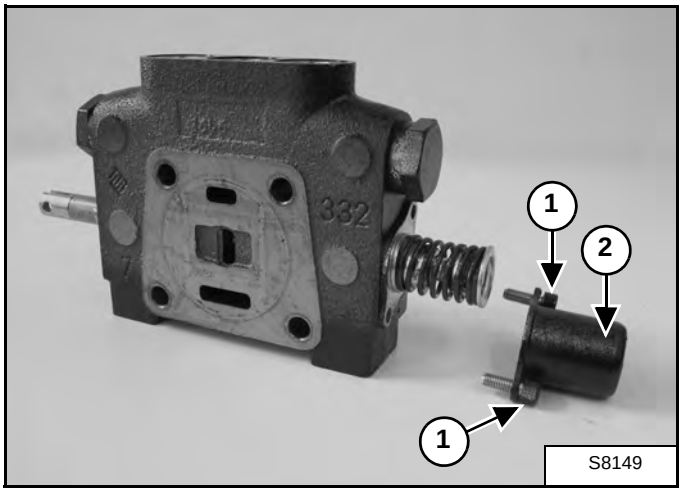
Figure 20-40-150



Remove the bolts (Item 1) and retaining plate (Item 2) **[Figure 20-40-150]**.

Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

Figure 20-40-151



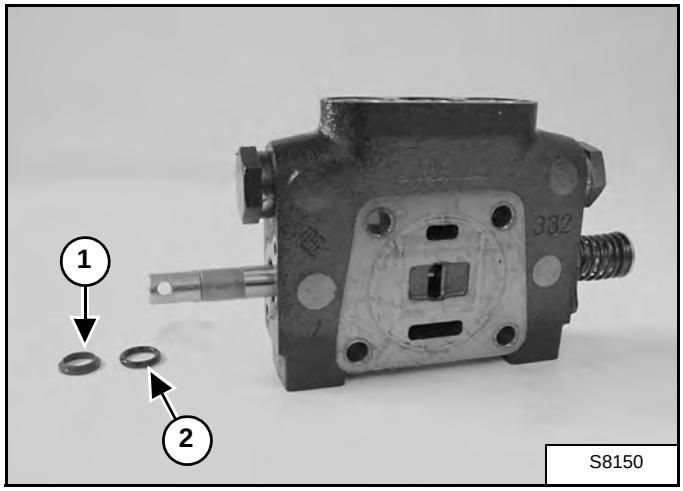
Loosen the bolts (Item 1) and remove cap and screw assembly (Item 2) **[Figure 20-40-151]**.

Installation: Tighten the bolts to 6,5 N•m (58 in-lb) torque.

Dealer Copy -- Not for Resale

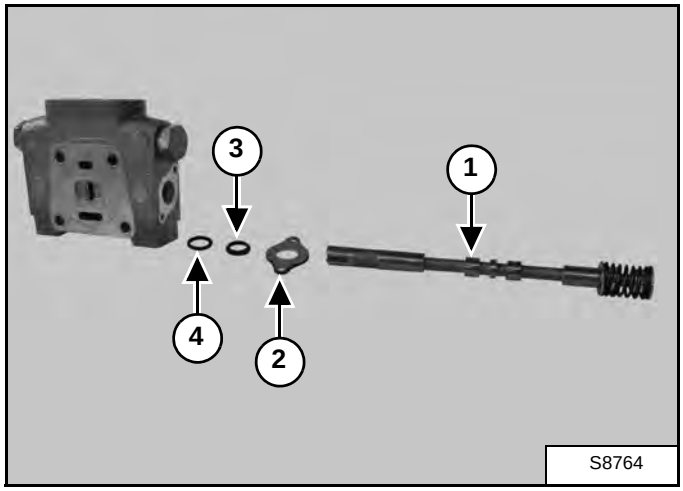
Right Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-152



Remove the seal (Item 1) and O-ring (Item 2) **[Figure 20-40-152]**.

Figure 20-40-153

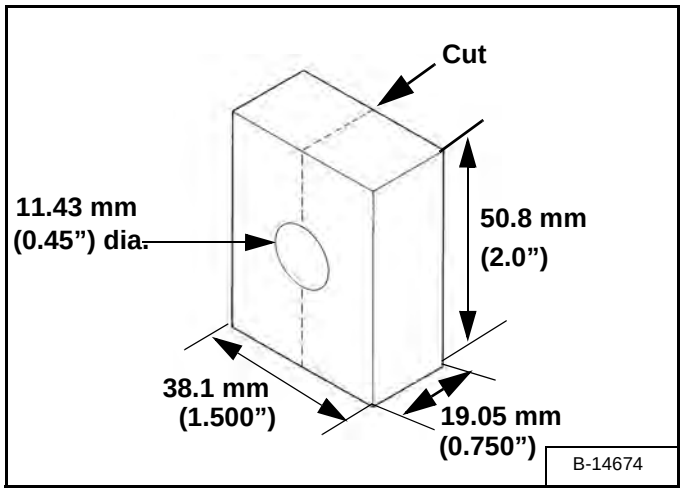


Remove the spool and spring assembly (Item 1), retaining plate (Item 2), seal (Item 3) and O-ring (Item 4) **[Figure 20-40-153]**.

The spool and valve section are not serviced separately.

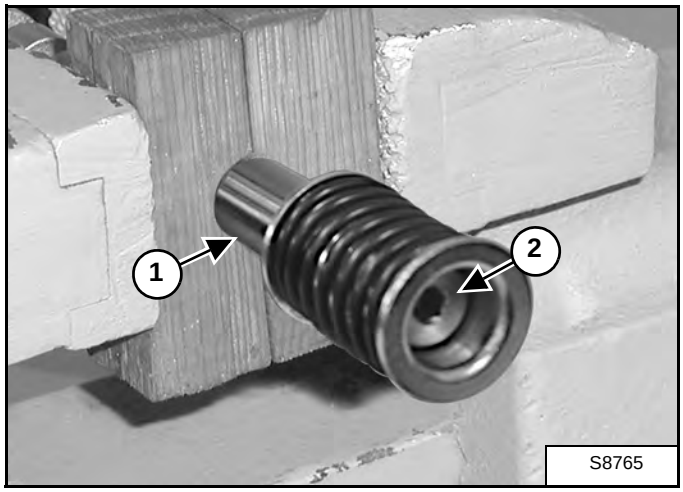
NOTE: When the spool is removed, use care not to scratch the spool surface. Do not interchange spools and valve sections.

Figure 20-40-154



To remove the spring assembly from the spool a holding fixture will have to be made from a 19 mm thick x 38 mm wide x 51 mm long (0.750 in thick x 1.500 in wide x 2.0 in long) piece of hardwood. Drill a 11,5 mm (0.45 in) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-154]**.

Figure 20-40-155



Using the wood blocks clamp the spool and spring assembly (Item 1) **[Figure 20-40-155]** in a vise.

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

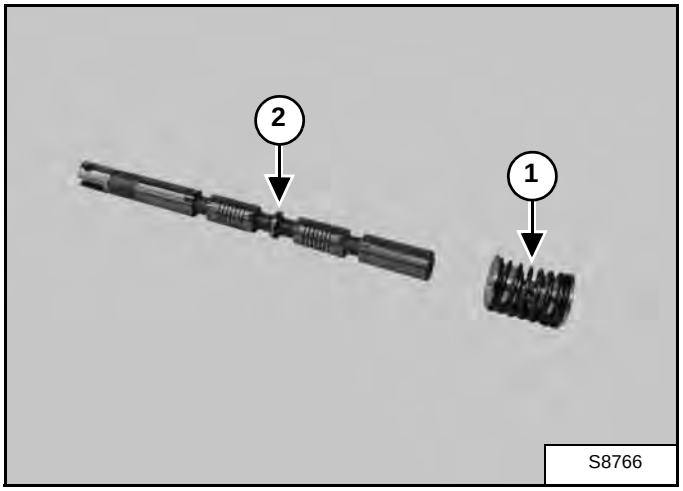
Loosen the bolt (Item 2) **[Figure 20-40-155]**.

Installation: Apply Loctite® 243 or equivalent and tighten the bolt to 6 N•m (53.1 in-lb) torque.

Dealer Copy -- Not for Resale

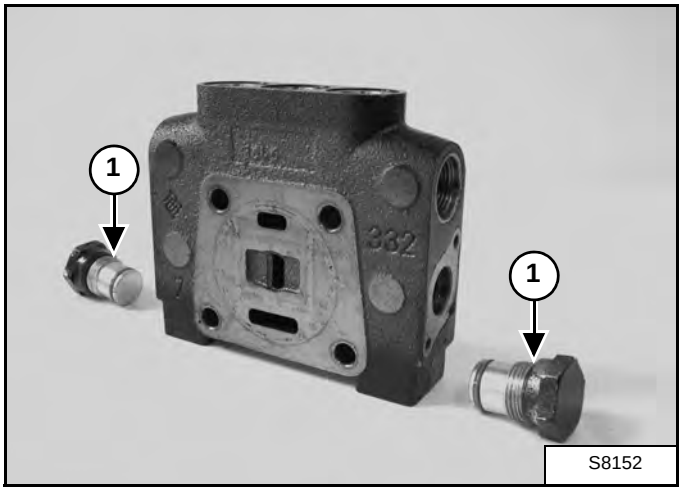
Right Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-156



Remove the spring assembly (Item 1) from the spool (Item 2) **[Figure 20-40-156]**.

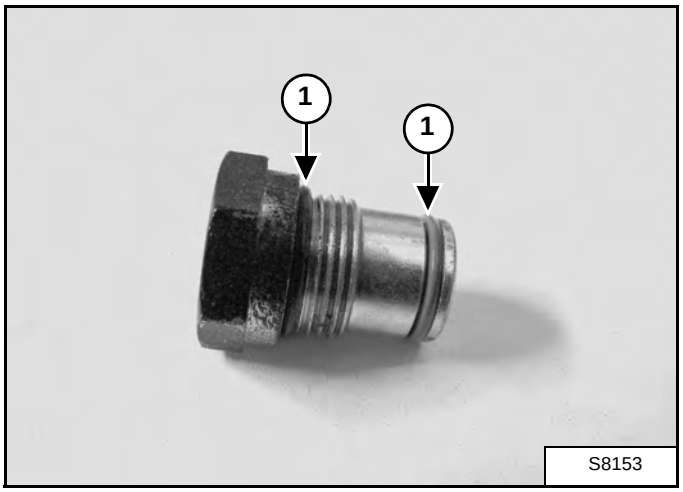
Figure 20-40-157



Remove the plugs (Item 1) **[Figure 20-40-157]**.

Installation: Tighten the plugs to 40 - 45 N•m (29 - 33 ft-lb) torque.

Figure 20-40-158



Remove the O-rings (Item 1) **[Figure 20-40-158]** from the plugs.

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.

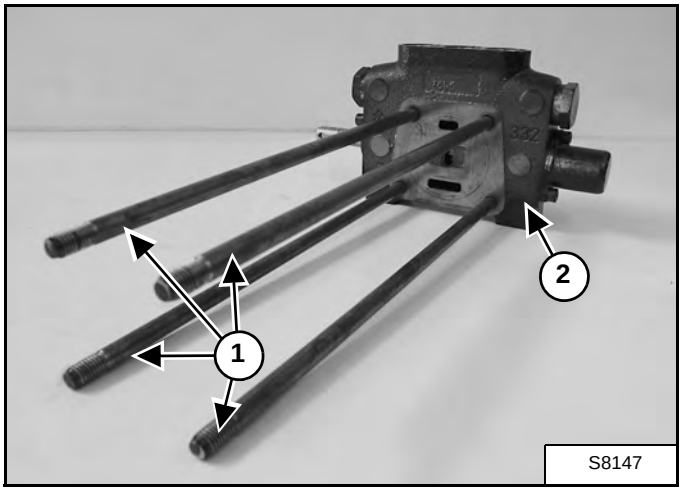
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

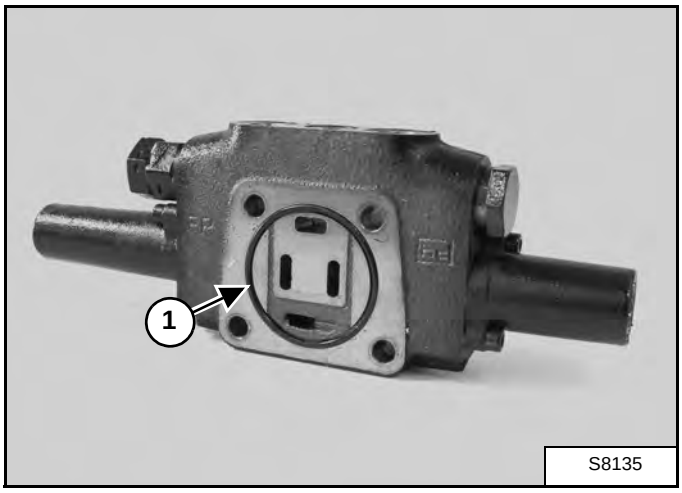
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-159



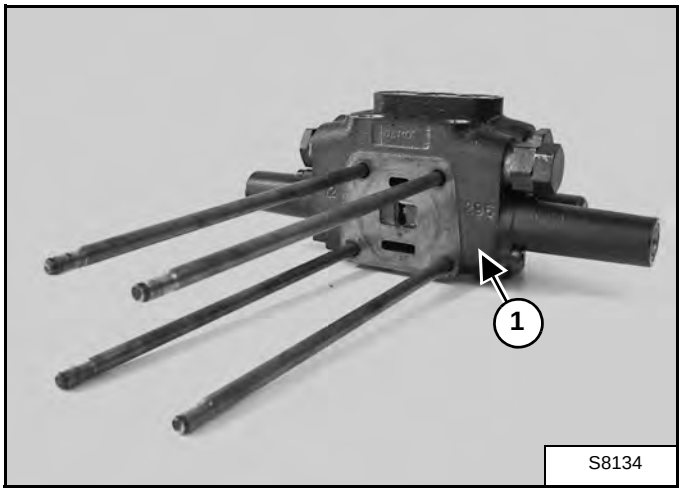
Install the tie rods (Item 1) on the right travel valve section (Item 2) **[Figure 20-40-159]**.

Figure 20-40-160



Install the O-ring (Item 1) **[Figure 20-40-160]** on the boom valve section.

Figure 20-40-161

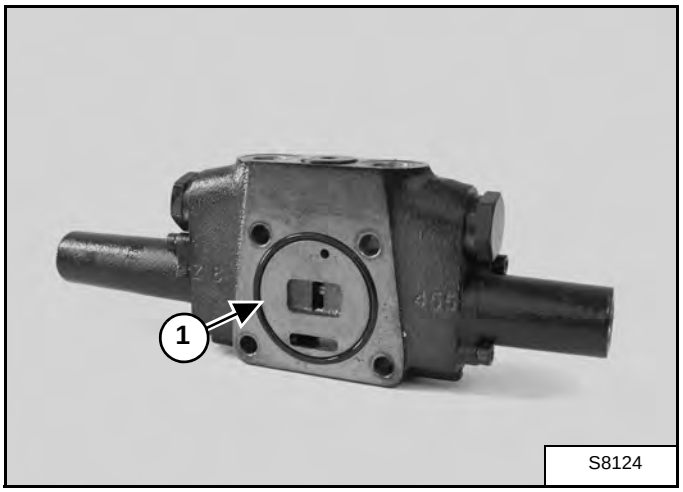


Install the boom valve section (Item 1) **[Figure 20-40-161]** on the tie rods.

Dealer Copy -- Not for Resale

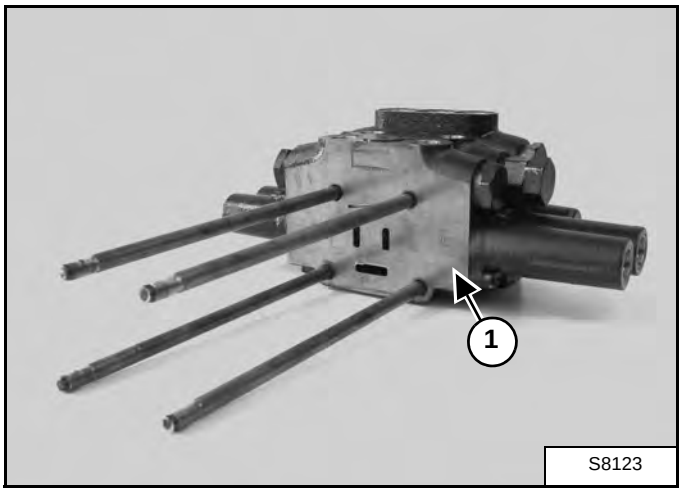
Assembly (Cont'd)

Figure 20-40-162



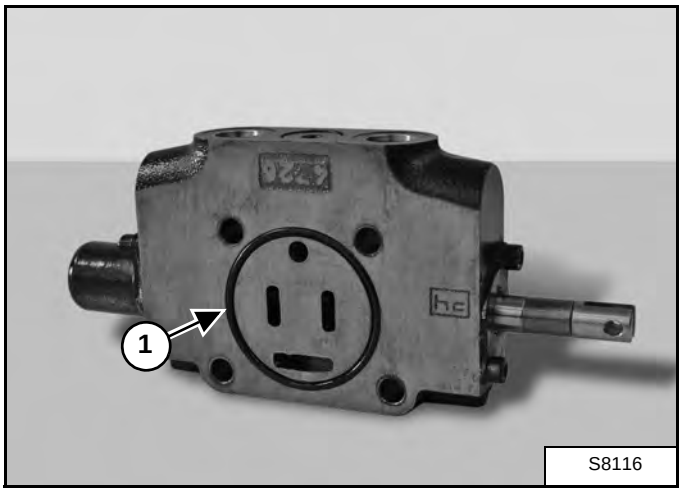
Install the O-ring (Item 1) **[Figure 20-40-162]** on the bucket valve section.

Figure 20-40-163



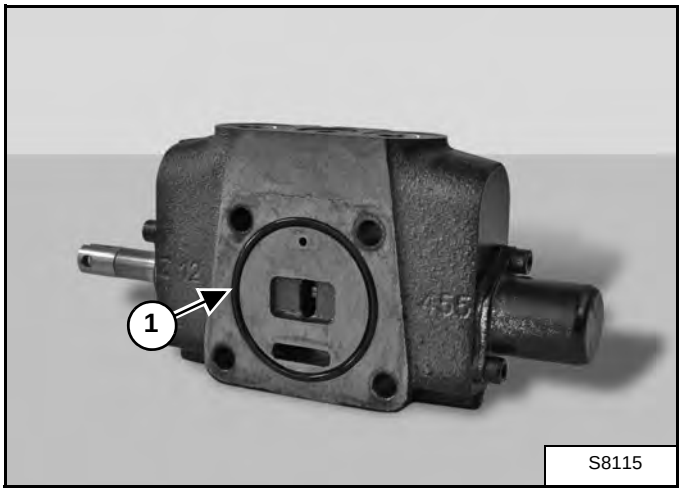
Install the bucket valve section (Item 1) **[Figure 20-40-163]** on the tie rods.

Figure 20-40-164



Install the O-ring (Item 1) **[Figure 20-40-164]** on the blade valve section.

Figure 20-40-165

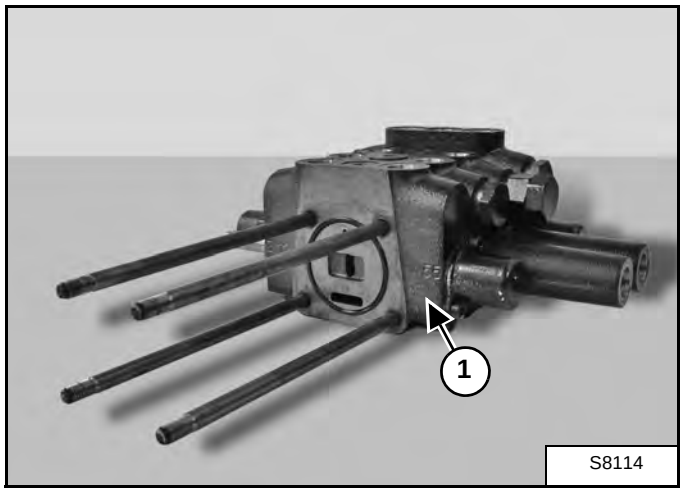


Install the O-ring (Item 1) **[Figure 20-40-165]** on the blade valve section.

Dealer Copy -- Not for Resale

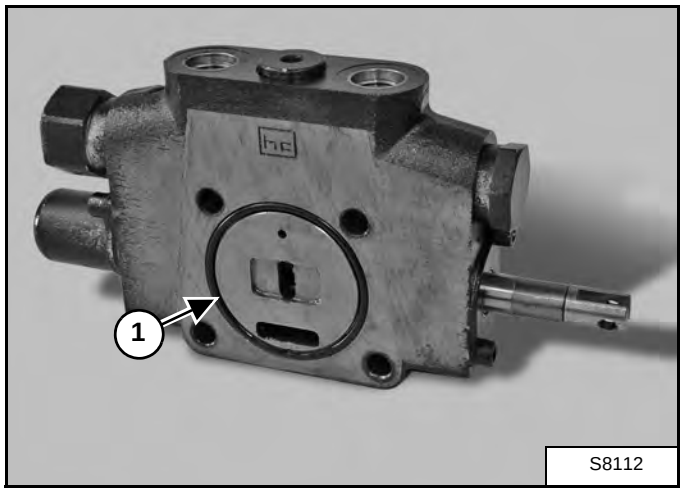
Assembly (Cont'd)

Figure 20-40-166



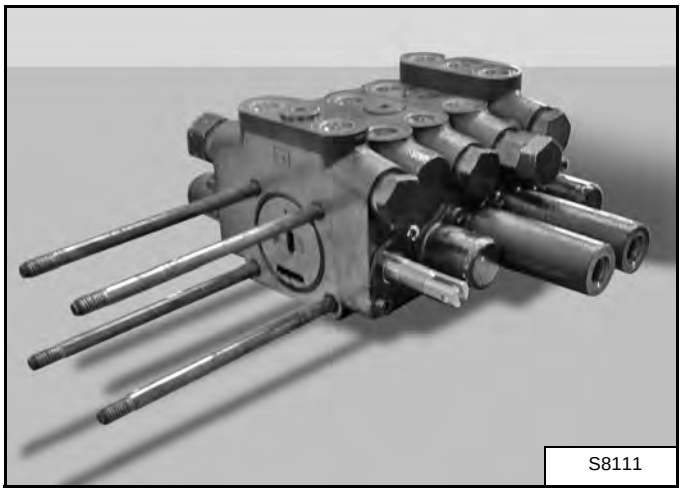
Install the blade valve section (Item 1) **[Figure 20-40-166]** on the tie rods.

Figure 20-40-167



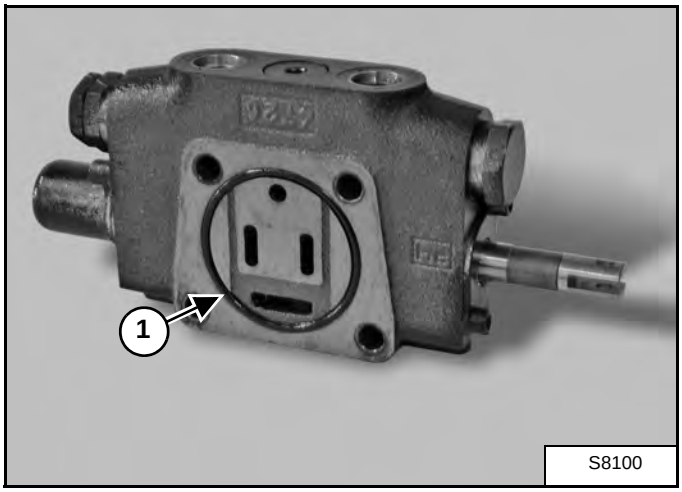
Install the O-ring (Item 1) **[Figure 20-40-167]** on the auxiliary valve section.

Figure 20-40-168



Install the auxiliary valve section (Item 1) **[Figure 20-40-168]** on the tie rods.

Figure 20-40-169

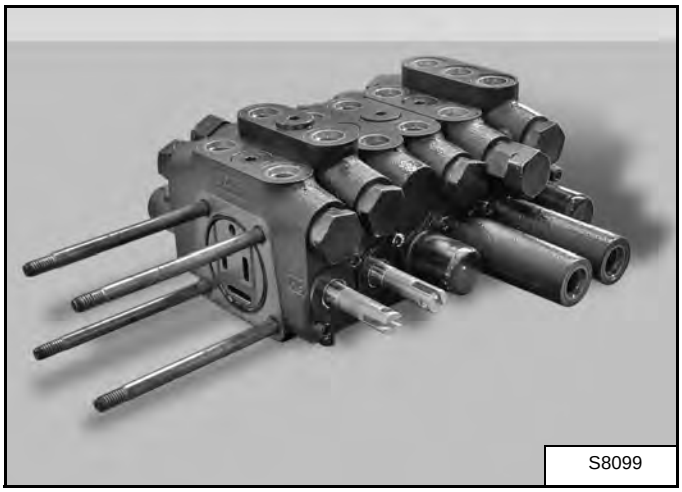


Install the O-ring (Item 1) **[Figure 20-40-169]** on the boom swing valve section.

Dealer Copy -- Not for Resale

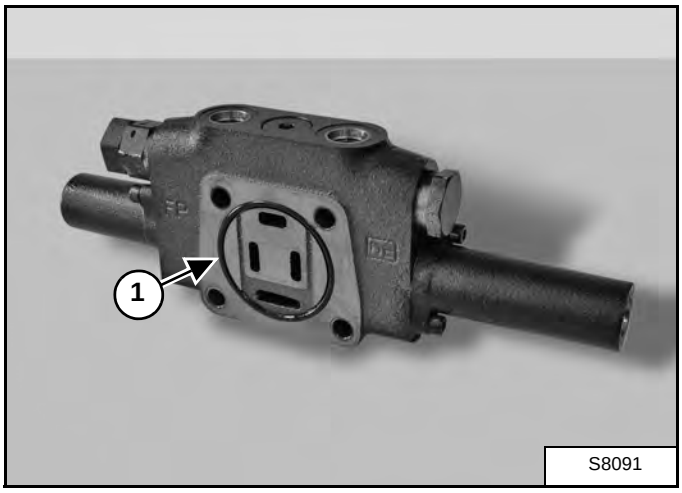
Assembly (Cont'd)

Figure 20-40-170



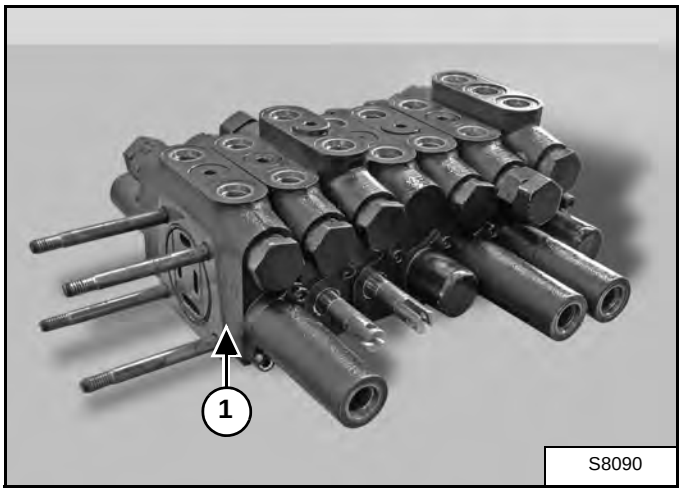
Install the boom swing valve section (Item 1) **[Figure 20-40-170]** on the tie rods.

Figure 20-40-171



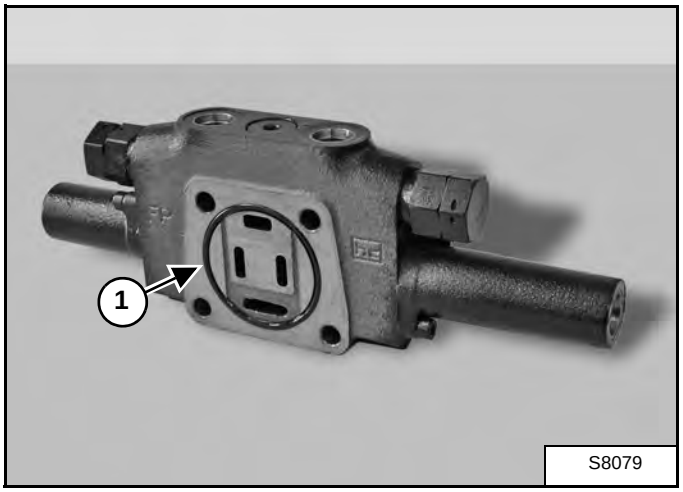
Install the O-ring (Item 1) **[Figure 20-40-171]** on the arm valve section.

Figure 20-40-172



Install the arm valve section (Item 1) **[Figure 20-40-172]** on the tie rods.

Figure 20-40-173

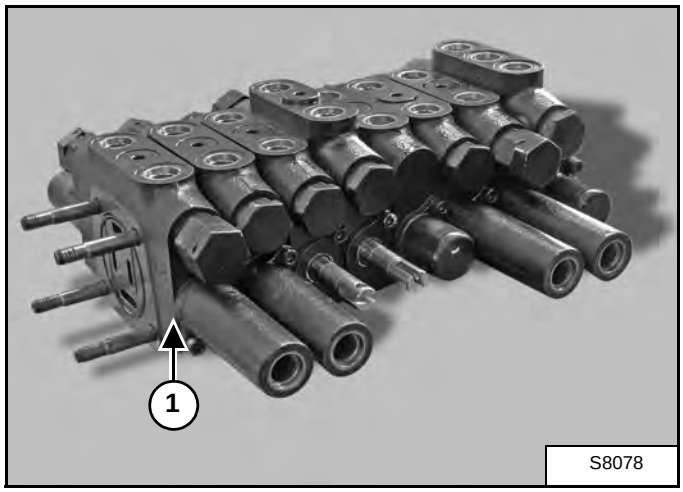


Install the O-ring (Item 1) **[Figure 20-40-173]** on the slew valve section.

Dealer Copy -- Not for Resale

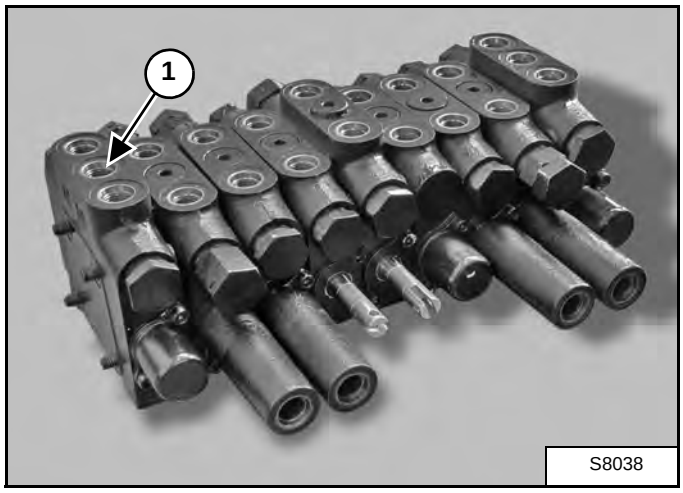
Assembly (Cont'd)

Figure 20-40-174



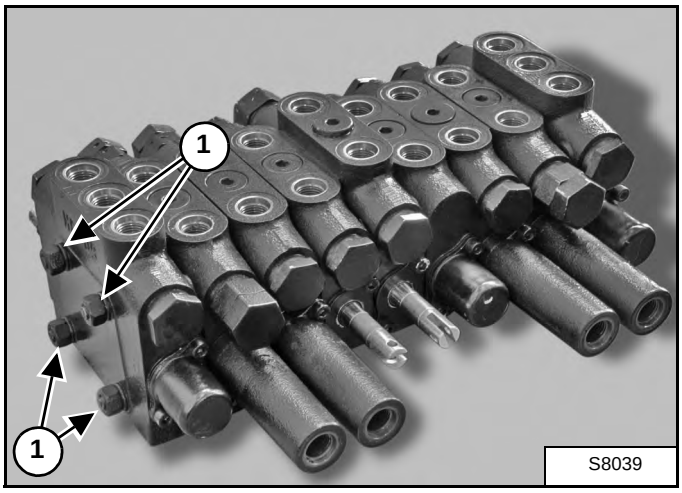
Install the slew valve section (Item 1) **[Figure 20-40-174]** on the tie rods.

Figure 20-40-175



Install the left travel valve section (Item 1) **[Figure 20-40-175]** on the tie rods.

Figure 20-40-176



Install the washers and nuts (Item 1) **[Figure 20-40-176]** 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 20-40-176]** to 13 N•m (10 ft-lb) torque in a crisscross manner.

Final tighten the tie rod nuts (Item 1) **[Figure 20-40-176]** to 25 N•m (18 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.

Dealer Copy -- Not for Resale

HYDRAULIC PUMP

Description

The hydraulic gear pump is attached to the end of the engine flywheel at the left side of the motor.

The hydraulic gear pump is a double gear pump that provides hydraulic flow to the hydraulic systems. The first gear pump section, located nearest the engine, provides flow to the right travel, boom, bucket, blade and auxiliary functions. The second gear pump section provides flow to the auxiliary, boom swing, arm, slew and left hand travel functions.

Testing The Hydraulic Pump

The hydraulic pump flow is 10 L/min (2.64 U.S. gpm) for both pump sections at 2370 rpm.

NOTE: Pump Section 1 is closest to the engine.

The following tool will be needed for the hydraulic pump test:

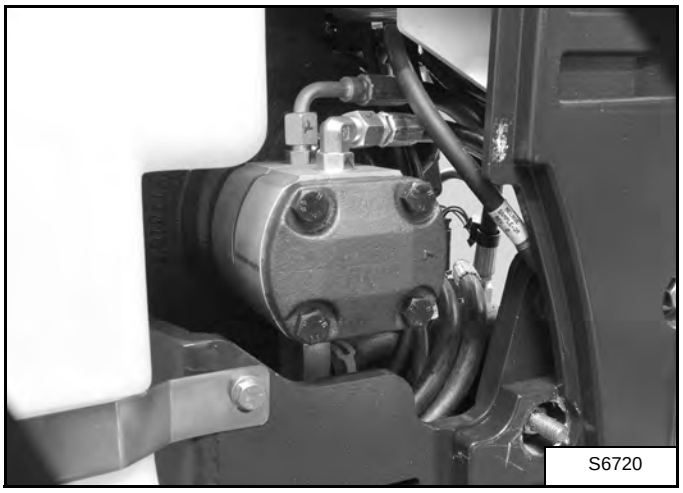
MEL10003 - Hydraulic Tester

Stop the engine.

Remove the upper left hand side cover. (See Upper Left Side Cover Removal And Installation on Page 40-210-1.)

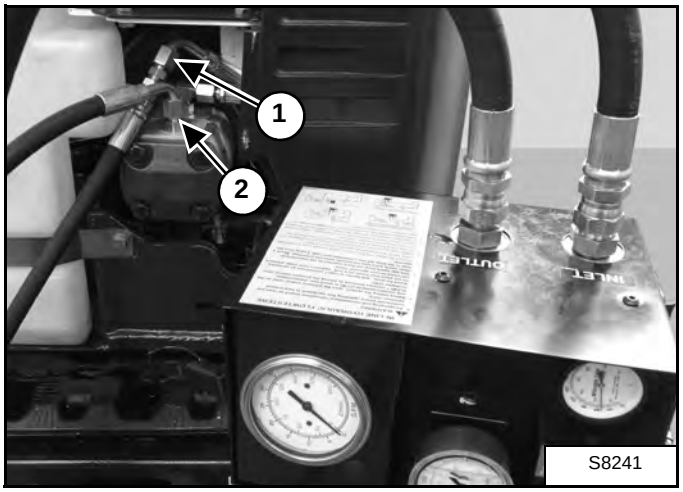
Remove the lower left hand side cover. (See Lower Left Side Cover Removal And Installation on Page 40-210-2.)

Figure 20-50-1



Remove the outlet hose, of the section to be tested, from the hydraulic pump section for testing **[Figure 20-50-1]**.

Figure 20-50-2



Connect the hose removed from the pump (Item 1) **[Figure 20-50-2]** to the outlet of the tester.

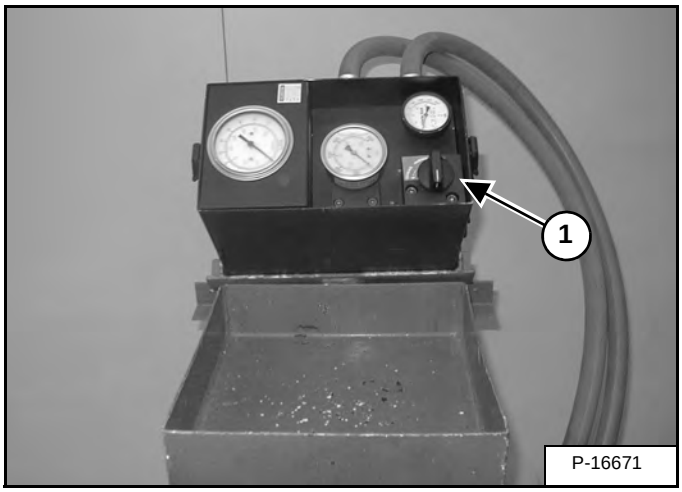
Connect the inlet hose of the tester to the fitting on the pump (Item 2) **[Figure 20-50-2]**.

NOTE: The tester connections will be the same for each pump section.

Dealer Copy -- Not for Resale

Testing The Hydraulic Pump (Cont'd)

Figure 20-50-3



NOTE: Open the flow control knob on the hydraulic tester (Item 1) [Figure 20-50-3] fully to prevent pump damage.

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

Record the pump free flow L/min (U.S. gpm).

Close the flow control knob (Item 1) **[Figure 20-50-3]** slowly to approximately 700 kPa (7,0 bar) (100 psi) below the relief valve setting which is 18,4 - 19,2 MPa (184 - 192 bar) (2669 - 2785 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.

$$\%= \frac{\text{HIGH PRESSURE FLOW (L/MIN)}}{\text{FREE FLOW (L/MIN)}} \times 100$$

If the high pressure flow is less than 80% of free flow, remove the hydraulic pump for repair or replacement.

Repeat the testing procedure for each pump section.

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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 Filter 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

⚠ WARNING

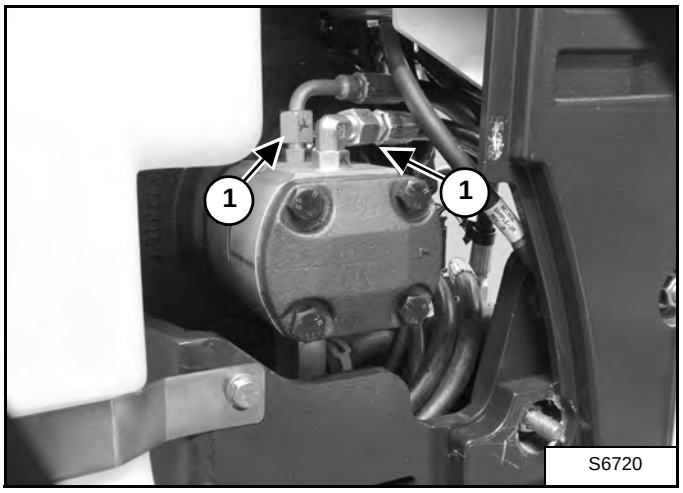
Hydraulic fluid escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. This can cause serious injury and possible death if proper medical treatment by a physician familiar with this injury is not received immediately.

W-2145-0290

Remove the upper left hand side cover. (See Upper Left Side Cover Removal And Installation on Page 40-210-1.)

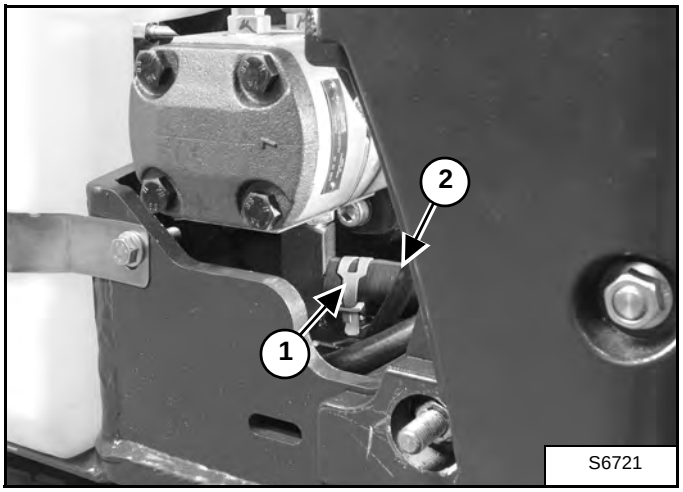
Remove the lower left hand side cover. (See Lower Left Side Cover Removal And Installation on Page 40-210-2.)

Figure 20-50-4



Remove the two pressure hoses (Item 1) **[Figure 20-50-4]**. Cap and plug the hoses and fittings.

Figure 20-50-5

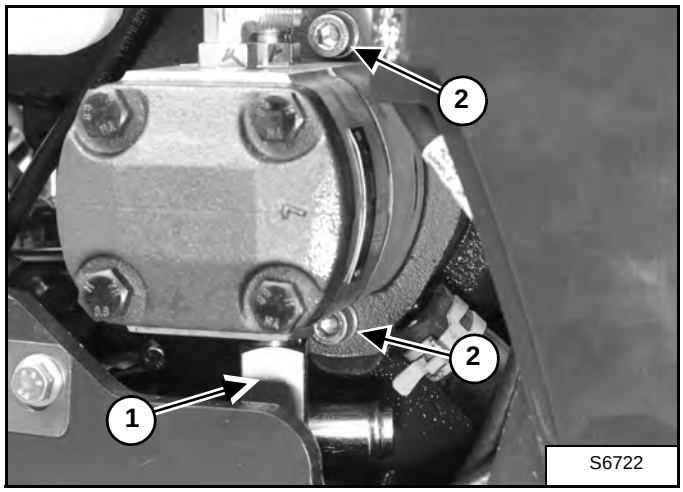


Remove the hose clamp (Item 1) and inlet hose (Item 2) **[Figure 20-50-5]**.

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Removal And Installation (Cont'd)

Figure 20-50-6



Remove the fitting (Item 1) **[Figure 20-50-6]** from the pump.

Remove the bolts (Item 2) **[Figure 20-50-6]** from the pump flange.

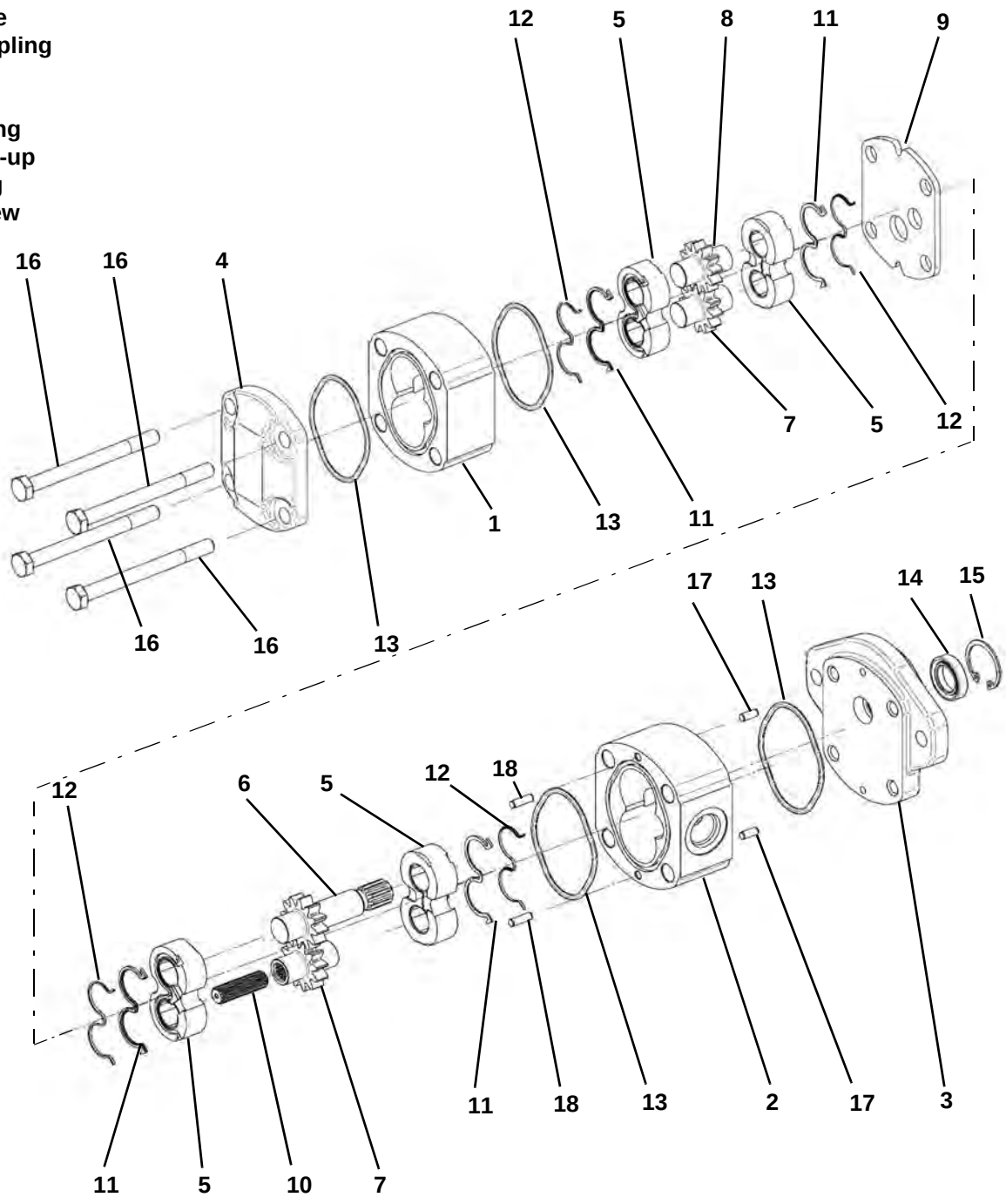
Installation: Tighten the bolts to 71 - 79 N•m (52 - 58 ft-lb) torque.

Remove the hydraulic pump from the excavator.

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Parts Identification

1. Body
2. Body
3. Flange
4. Cover
5. Block
6. Gear
7. Gear
8. Gear
9. Plate
10. Coupling
11. Seal
12. Seal
13. O-ring
14. Seal-up
15. Ring
16. Screw
17. Pin
18. Pin



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Disassembly

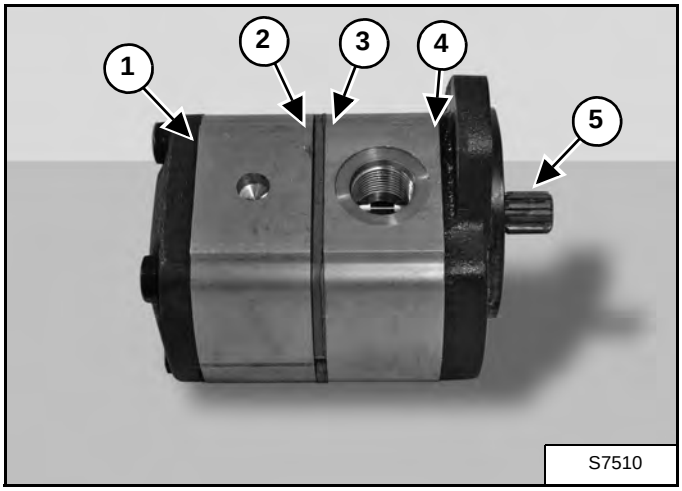
Clean the outside of the gear pump before disassembly.

IMPORTANT

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

I-2003-0888

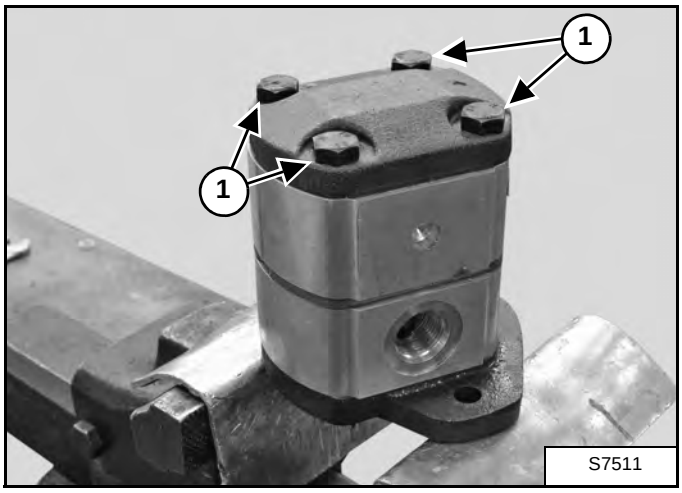
Figure 20-50-7



Mark both sides of each separation point (Items 1-4) **[Figure 20-50-7]** on the inlet side of the pump, as shown, with the corresponding separation point number.

Tape the shaft splines (Item 5) **[Figure 20-50-7]** to make sure that the splines will not damage the oil seal when the shaft is removed.

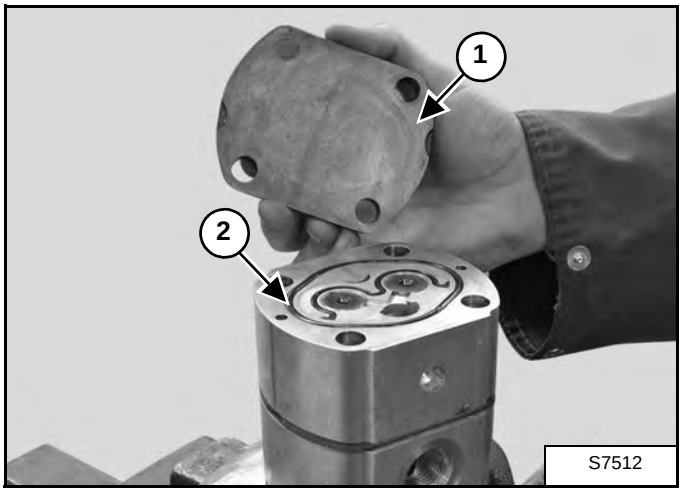
Figure 20-50-8



Put the pump, mounting flange down, in a protected jaw vise. Remove the four assembly bolts (Item 1) **[Figure 20-50-8]**.

NOTE: The pump has only one inlet port. The pump section with the inlet port is located closest to the input shaft.

Figure 20-50-9



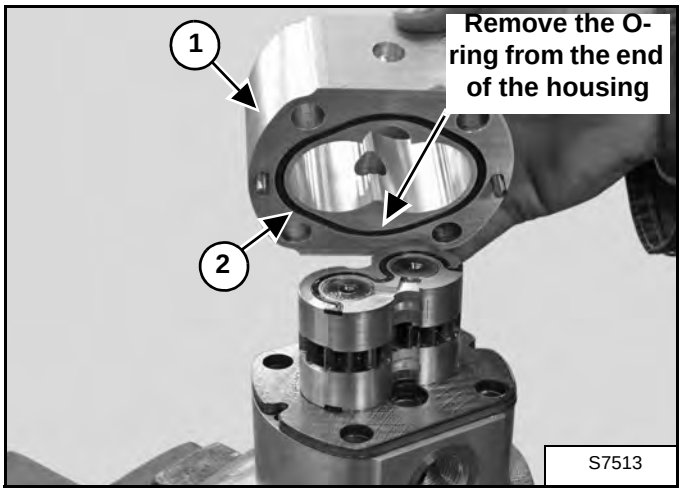
Remove the end cap (or separating plate) (Item 1) **[Figure 20-50-9]**.

Remove the O-ring (Item 2) **[Figure 20-50-9]** from the top of the gear housing.

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Disassembly (Cont'd)

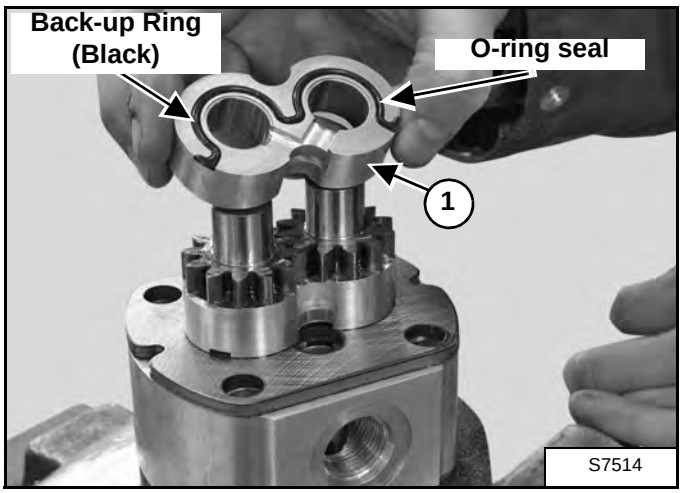
Figure 20-50-10



Remove the gear housing (Item 1) **[Figure 20-50-10]**.

Remove the O-ring (Item 2) **[Figure 20-50-10]** from the end of the gear housing.

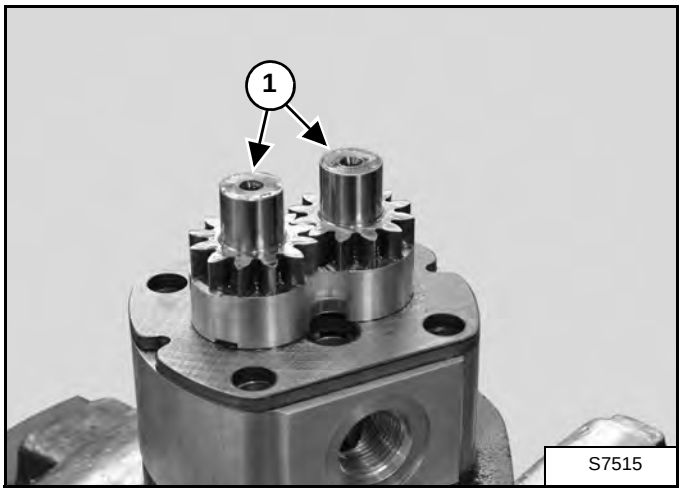
Figure 20-50-11



Remove the upper bearing (Item 1) **[Figure 20-50-11]**.

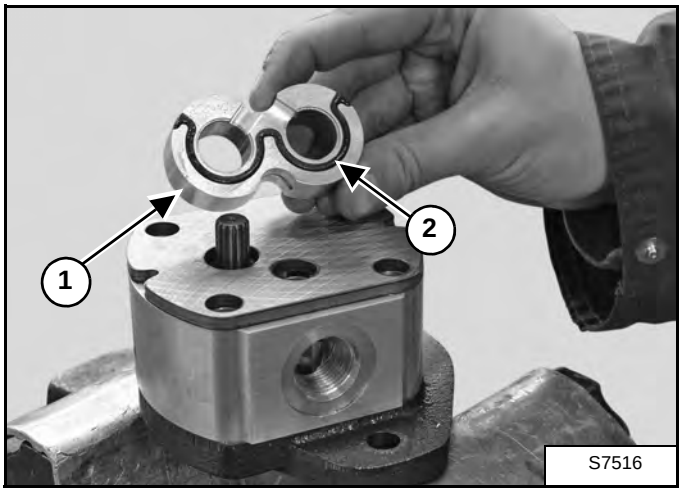
Remove the back-up ring and O-ring seal from the bearing.

Figure 20-50-12



Remove the drive and idler gears (Item 1) **[Figure 20-50-12]**.

Figure 20-50-13



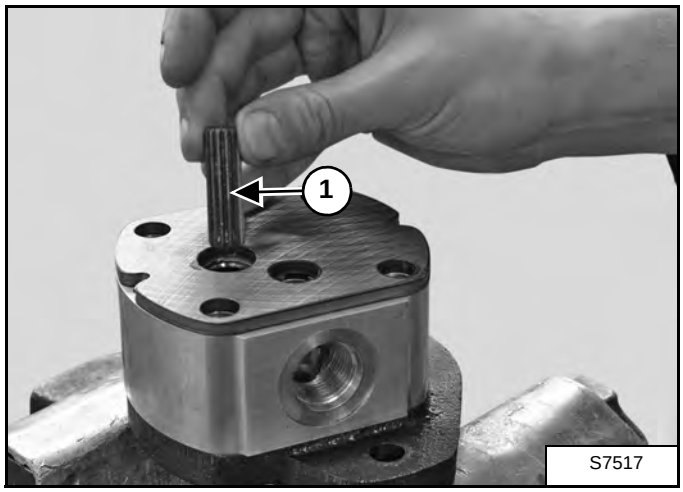
Remove the lower bearing (Item 1) **[Figure 20-50-13]**.

Remove the back-up ring and O-ring seal (Item 2) **[Figure 20-50-13]** from the bearing.

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Disassembly (Cont'd)

Figure 20-50-14

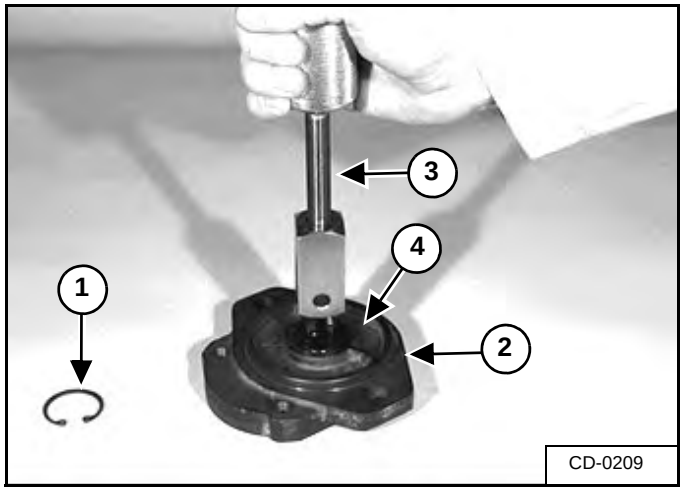


Remove the coupling (Item 1) **[Figure 20-50-14]**.

Repeat step **[Figure 20-50-9 on Page 6]** through step **[Figure 20-50-14]** to disassemble the second pump section. Keep the parts from each section separate from the other section.

NOTE: The gear housing, two bearings, drive gear and idler gear in each pump section are not serviced separately. These parts are matched sets which are run in at the factory. If any part is damaged, the entire section must be replaced.

Figure 20-50-15



Remove the snap ring (Item 1) from the mounting flange, (Item 2). Using a seal puller (Item 3), remove the oil seal (Item 4) **[Figure 20-50-15]**.

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Assembly

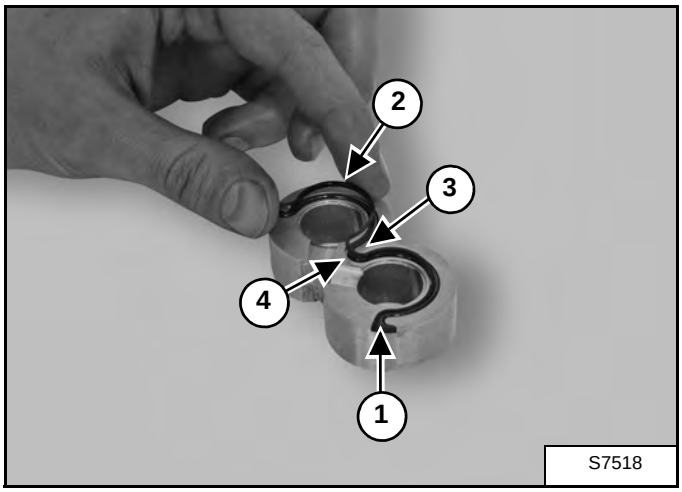
Clean all parts in solvent and dry with compressed air.

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

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

Use the correct size driver and install the oil seal (seal lips to the inside of the pump) (Item 4) into the mounting flange (Item 2). Install the snap ring (Item 1) **[Figure 20-50-15]**.

Figure 20-50-16

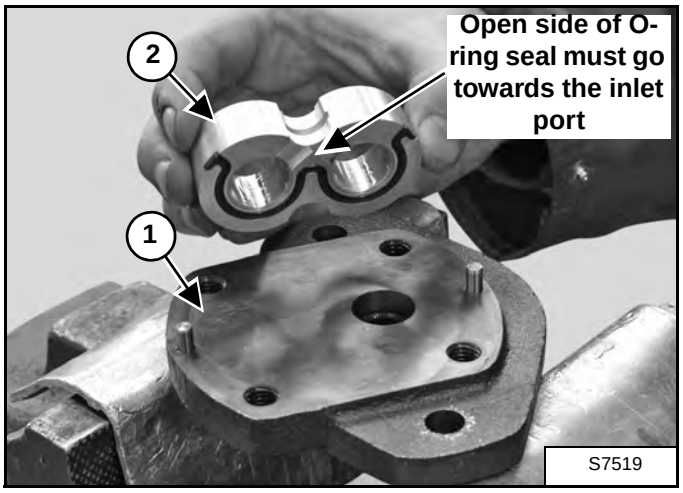


Install an O-ring seal (Item 1) **[Figure 20-50-16]** stepped side up, into each O-ring seal groove. Push each O-ring seal down into the groove.

Install the back-up ring (Item 2) **[Figure 20-50-16]** into the groove made by the O-ring seal and bearing. Push the back-up ring down flush with the O-ring seal.

NOTE: There is a notch (Items 3 and 4) [Figure 20-50-16] in the center of the back-up ring and O-ring seal. When installing the back-up ring, make sure that these notches are aligned. If the back-up ring or O-ring seal are not installed correctly the back-up ring will not sit flush with the O-ring seal.

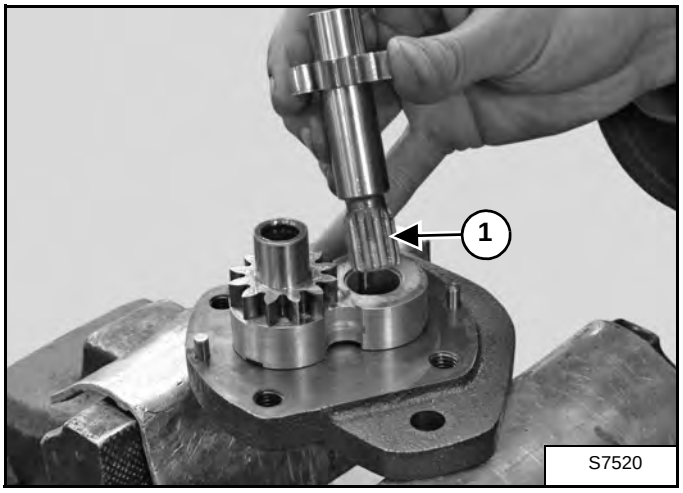
Figure 20-50-17



Put the mounting flange, oil seal side down (Item 1) **[Figure 20-50-17]** in a protected jaw vise.

Install the lower bearing (Item 2) **[Figure 20-50-17]**, seal side down, on the mounting flange (or separating plate). The open side of the O-ring seal must point toward the inlet port side (marked side) of the pump.

Figure 20-50-18



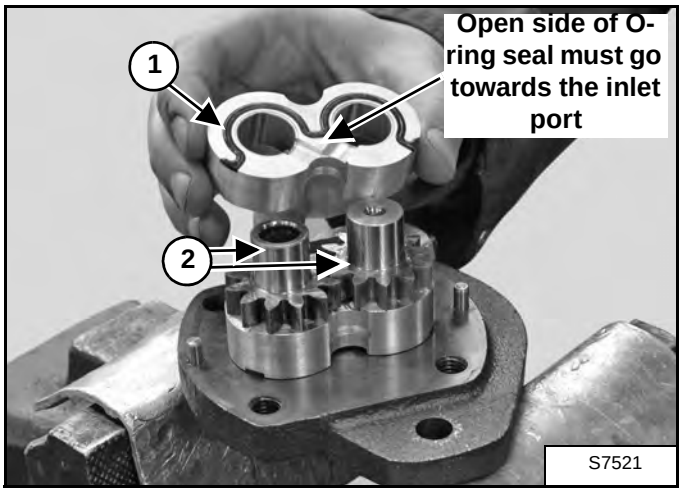
Tape the splined end (Item 1) **[Figure 20-50-18]** of the drive gear to make sure that the splines will not damage the oil seal during installation.

Apply oil to the drive gear and idler gear and to the side faces of the gears. Install the gears into the lower bearing **[Figure 20-50-18]**.

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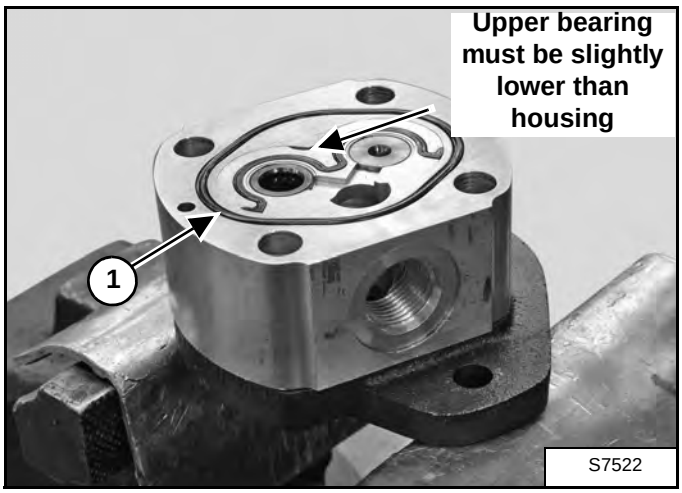
Assembly (Cont'd)

Figure 20-50-19



Install the upper bearing (Item 1), seal side up, on the drive and idler gears (Item 2) **[Figure 20-50-19]**. The open side of the O-ring seal must point toward the inlet port side (marked side) of the pump.

Figure 20-50-20

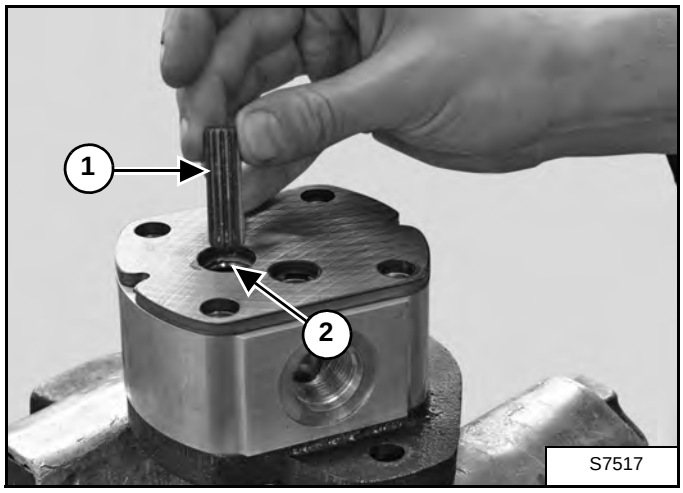


Install O-rings (Item 1) **[Figure 20-50-20]** on each end of the gear housing.

Align the marks made during disassembly on the gear housing and mounting flange (or separating plate). Carefully install the gear housing over the bearings and gears **[Figure 20-50-20]**.

NOTE: The upper bearing must be slightly lower than the gear housing. If the bearing is higher than the housing, disassemble the pump section to verify that the O-ring seal, back-up ring, or O-ring have not moved out of position.

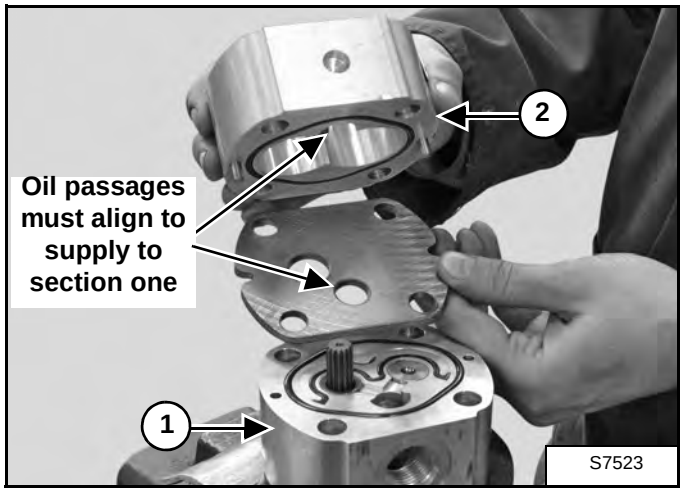
Figure 20-50-21



Apply oil to the coupling (Item 1) **[Figure 20-50-21]**.

Install the coupling into the drive gear (Item 2) **[Figure 20-50-21]**.

Figure 20-50-22

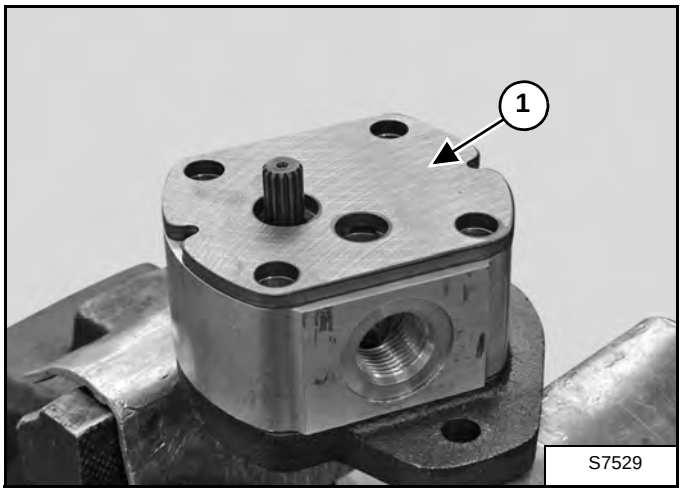


NOTE: When installing the first section gear housing (Item 1) (with inlet port), make sure that the oil passage in the housing and the separation plate align. Section two gear housing (Item 2) [Figure 20-50-22] must receive oil flow through this passage from section one gear housing.

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Assembly (Cont'd)

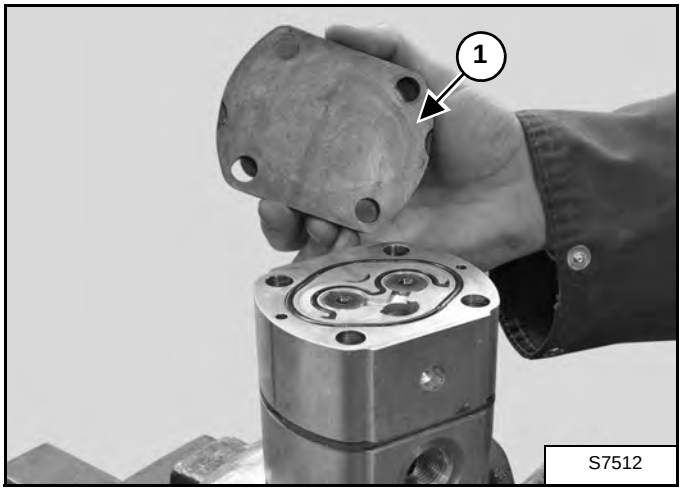
Figure 20-50-23



Align the marks made during disassembly on the separating plate and gear housing. Install the separating plate (Item 1) **[Figure 20-50-23]**.

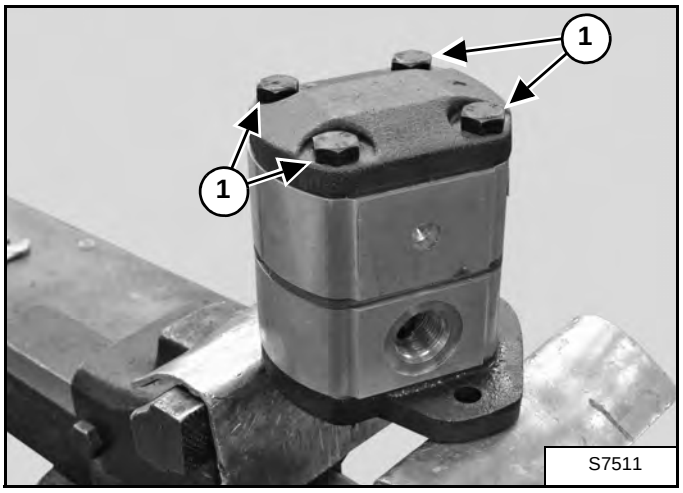
Repeat step **[Figure 20-50-16 on Page 9]** through step **[Figure 20-50-20 on Page 10]** to assemble pump section 2.

Figure 20-50-24



Align the marks made during disassembly on the end cap and gear housing. Install the end cap (Item 1) **[Figure 20-50-24]**.

Figure 20-50-25



Install the four assembly bolts (Item 1) **[Figure 20-50-25]**.

Evenly tighten the bolts to a final torque of 52 - 58 N•m (38 - 43 ft-lb).

Rotate the input shaft periodically while tightening the bolts to make sure the pump is assembled correctly.

Using a locking plier, rotate the pump shaft to be sure there is no binding.

NOTE: Use care not to damage the pump shaft.

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MANIFOLD ASSEMBLY / ACCUMULATOR

Description

The manifold body contains a system bypass solenoid 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 3,0 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 physician 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.

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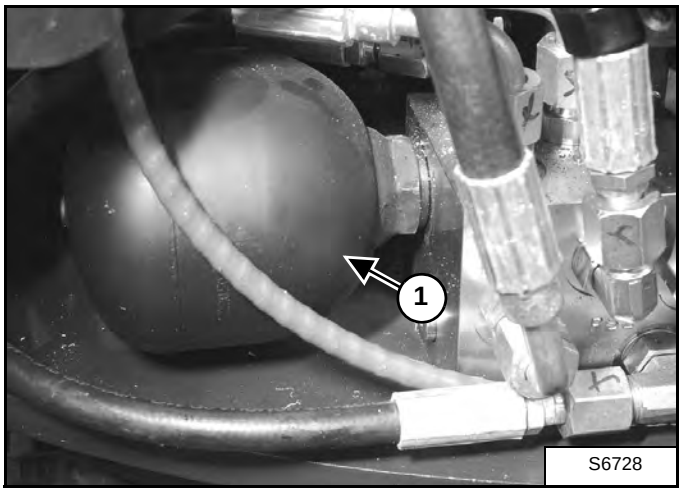
From the operator's seat, drain the residual pressure from the accumulator by stroking a function with the engine off and the key in the run position.

Open the tailgate.

Remove the rear counterweight. (See Rear Counterweight Removal And Installation on Page 40-200-1.)

NOTE: All counterweights are removed for photo clarity!

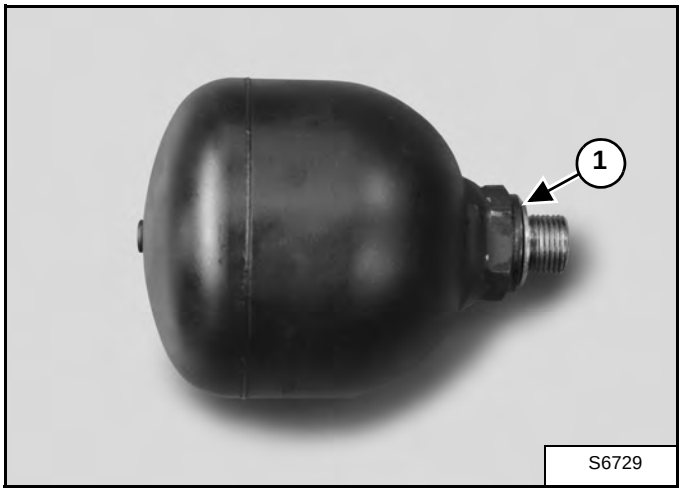
Figure 20-60-1



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.

Figure 20-60-2



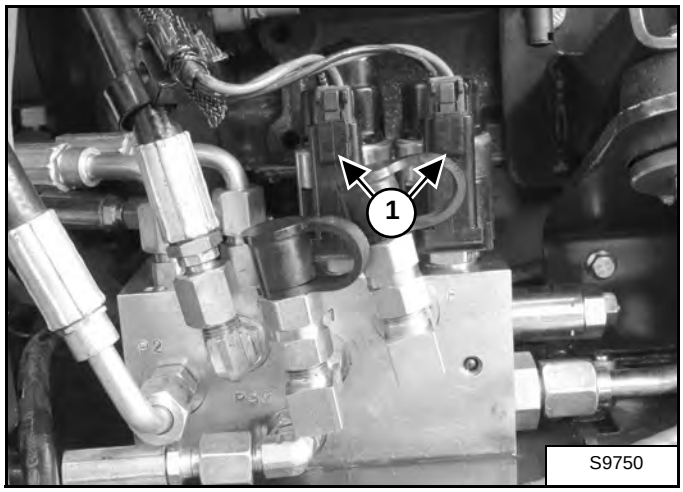
Remove the O-ring (Item 1) **[Figure 20-60-2]** from the accumulator.

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MANIFOLD ASSEMBLY / ACCUMULATOR (CONT'D)

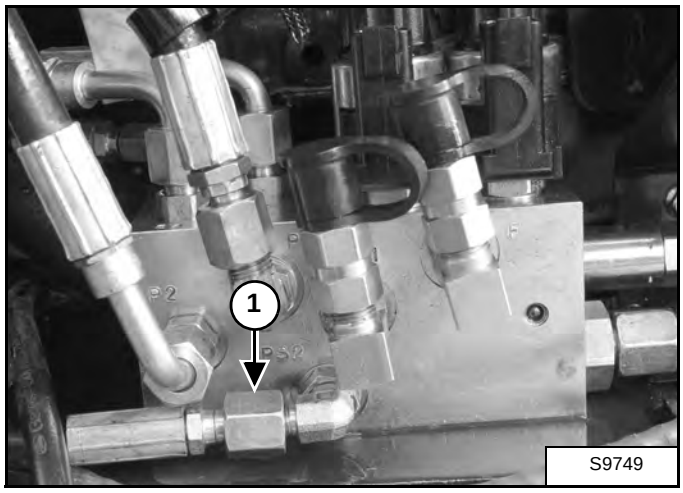
Removal And Installation (Cont'd)

Figure 20-60-3



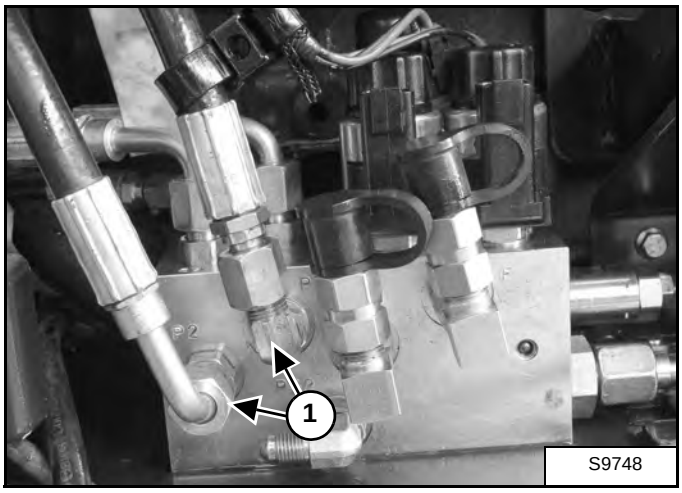
Mark and disconnect the wire harnesses (Item 1) **[Figure 20-60-3]** from the coils.

Figure 20-60-4



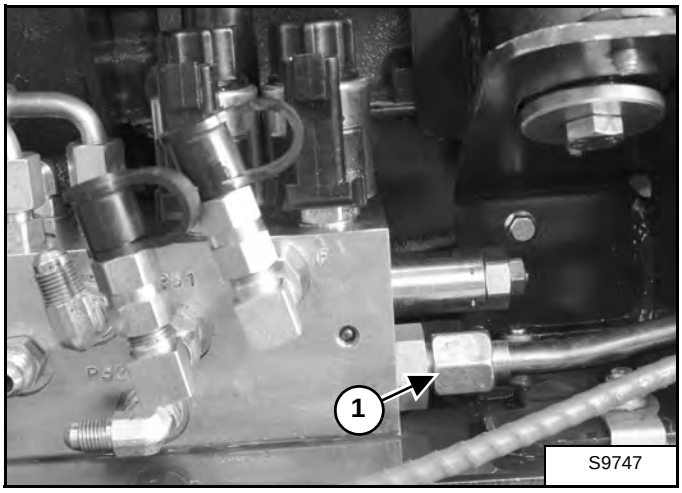
Mark and remove the hose (Item 1) **[Figure 20-60-4]**.

Figure 20-60-5



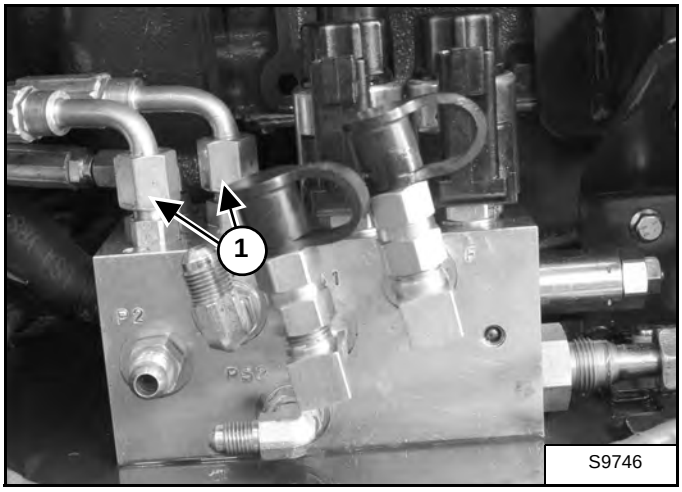
Mark and remove the hoses (Item 1) **[Figure 20-60-5]**.

Figure 20-60-6



Mark and remove the tubeline (Item 1) **[Figure 20-60-6]**.

Figure 20-60-7

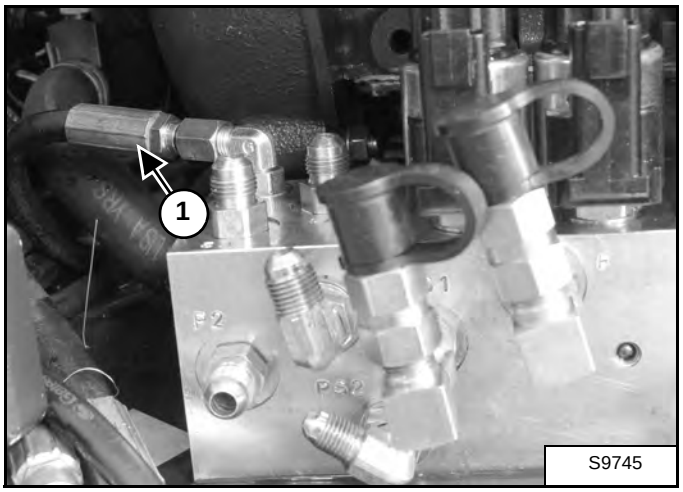


Mark and remove the hoses (Item 1) **[Figure 20-60-7]**.

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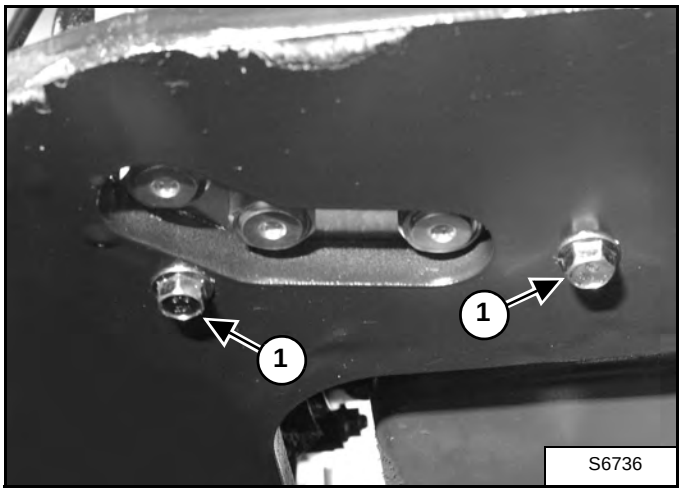
Removal And Installation (Cont'd)

Figure 20-60-8



Mark and remove the hose (Item 1) **[Figure 20-60-8]**.

Figure 20-60-9



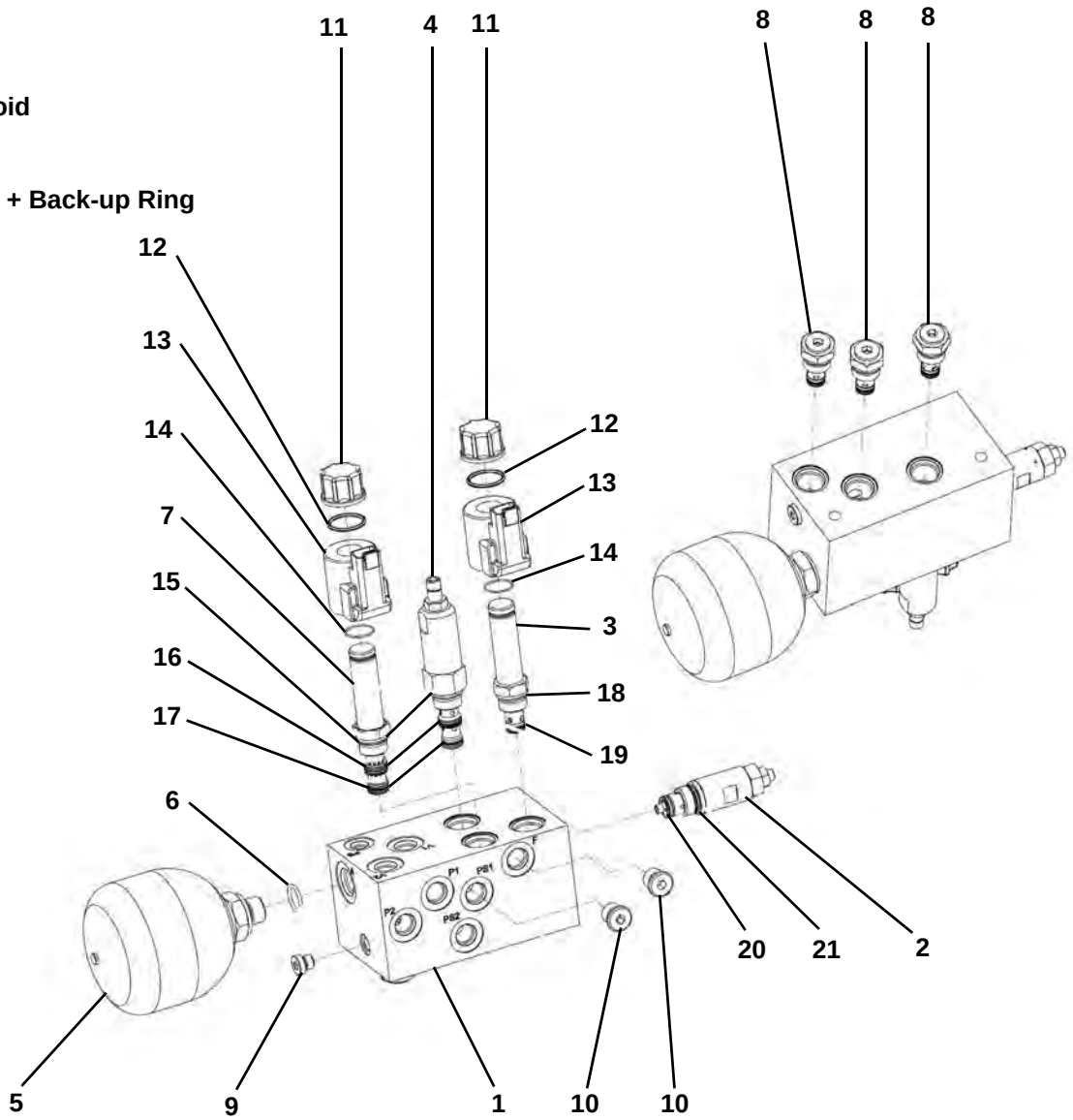
Remove the bolts (Item 1) **[Figure 20-60-9]** from the undercarriage.

Remove the manifold.

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Parts Identification

1. Block
2. Valve
3. Valve
4. Valve
5. Accumulator
6. O-ring
7. Valve
8. Valve
9. Plug
10. Plug
11. Nut
12. O-ring
13. Solenoid
14. O-ring
15. O-ring
16. O-ring + Back-up Ring
17. O-ring + Back-up Ring
18. O-ring
19. O-ring + Back-up Ring
20. O-ring + Back-up Ring
21. O-ring

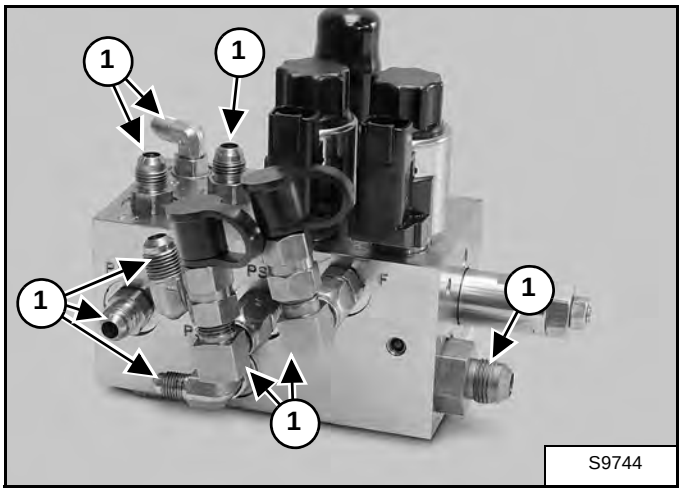


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Disassembly

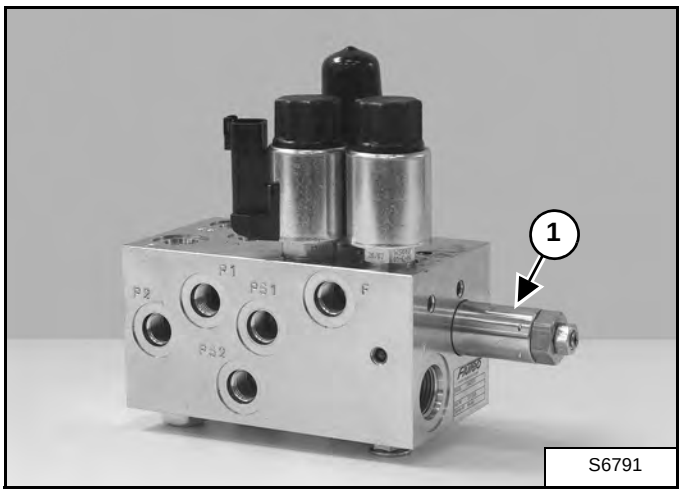
Figure 20-60-10



Mark the locations and orientation of the nine fittings.

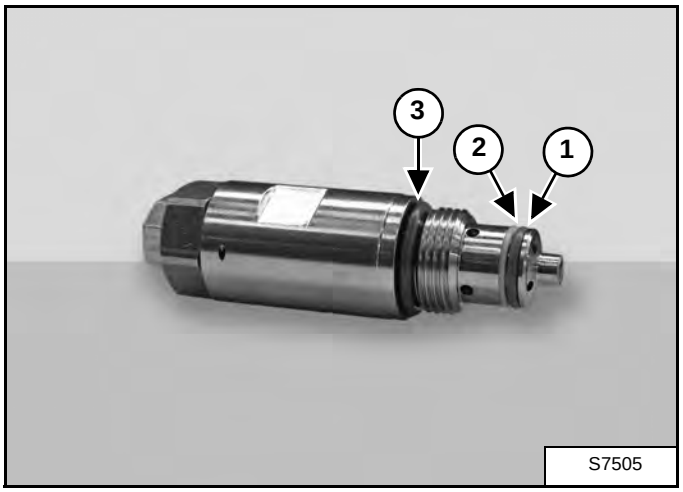
Remove the nine fittings (Item 1) **[Figure 20-60-10]** from the manifold.

Figure 20-60-11



Remove the main relief valve (Item 1) **[Figure 20-60-11]** from the manifold.

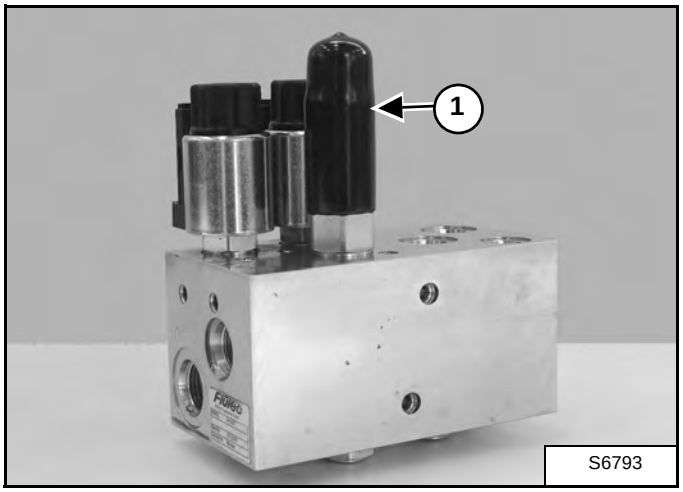
Figure 20-60-12



Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-60-12]** from the main relief valve.

Remove the O-ring (Item 3) **[Figure 20-60-12]** from the main relief valve.

Figure 20-60-13

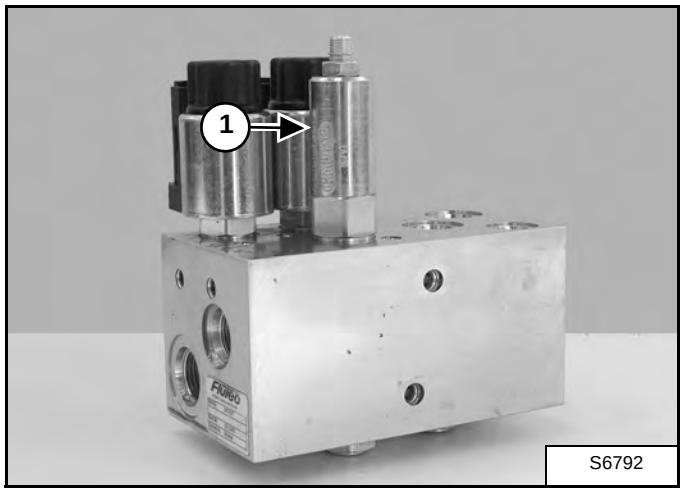


Remove the protective cover (Item 1) **[Figure 20-60-13]** from the pressure reducing valve.

Dealer Copy -- Not for Resale

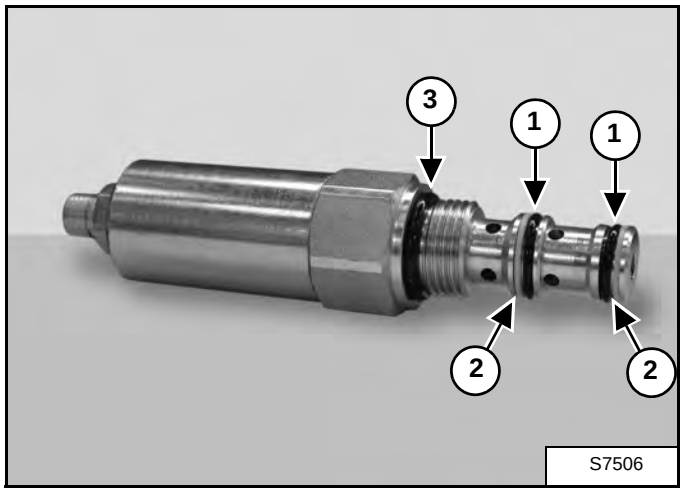
Disassembly (Cont'd)

Figure 20-60-14



Remove the pressure reducing valve (Item 1) **[Figure 20-60-14]** from the manifold.

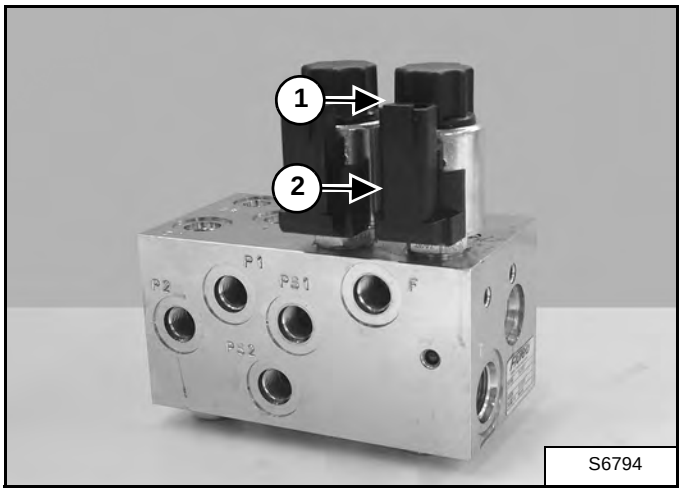
Figure 20-60-15



Remove the two O-rings (Item 1) and the two back-up rings (Item 2) **[Figure 20-60-15]** from the pressure reducing valve.

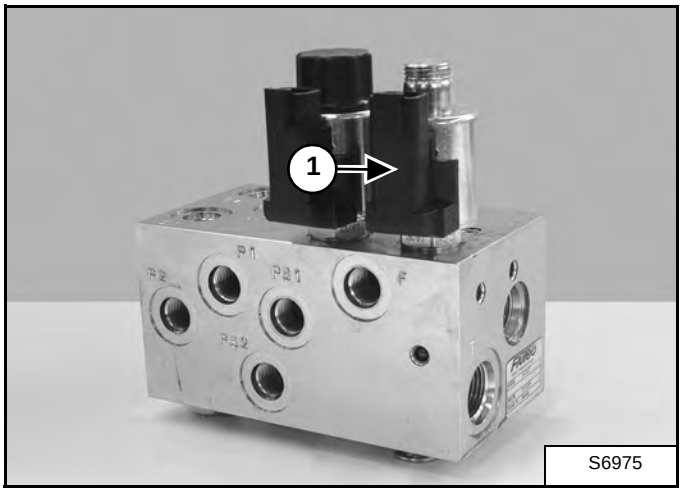
Remove the O-ring (Item 3) **[Figure 20-60-15]** from the pressure reducing valve.

Figure 20-60-16



Remove the plastic nut (Item 1) from the console (joystick) lockout solenoid (Item 2) **[Figure 20-60-16]**.

Figure 20-60-17

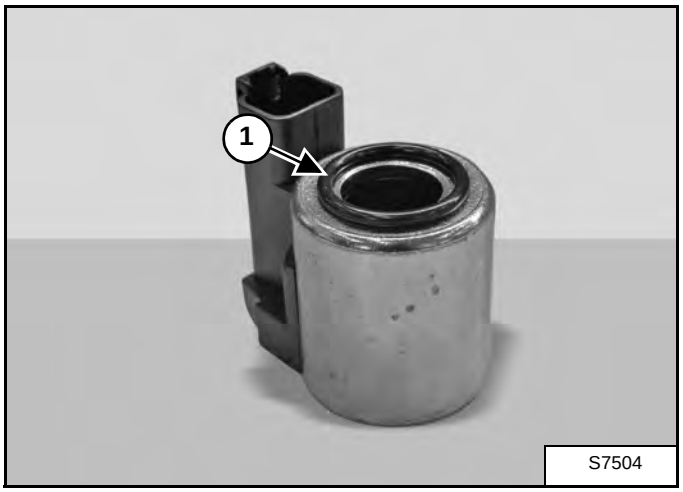


Remove the coil (Item 1) **[Figure 20-60-17]** from the solenoid stem.

Dealer Copy -- Not for Resale

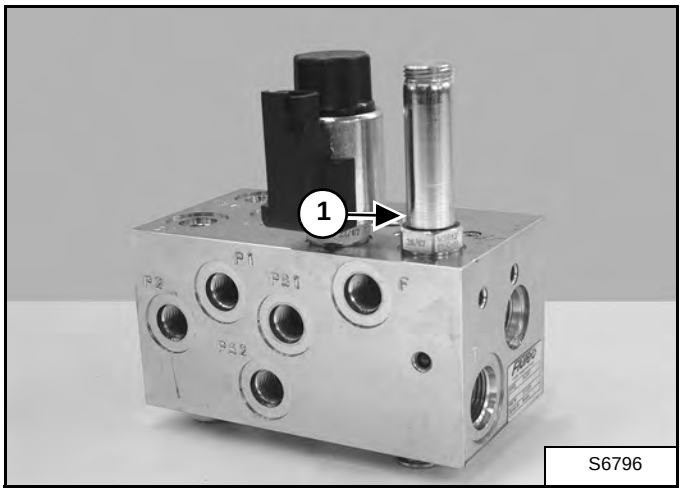
Disassembly (Cont'd)

Figure 20-60-18



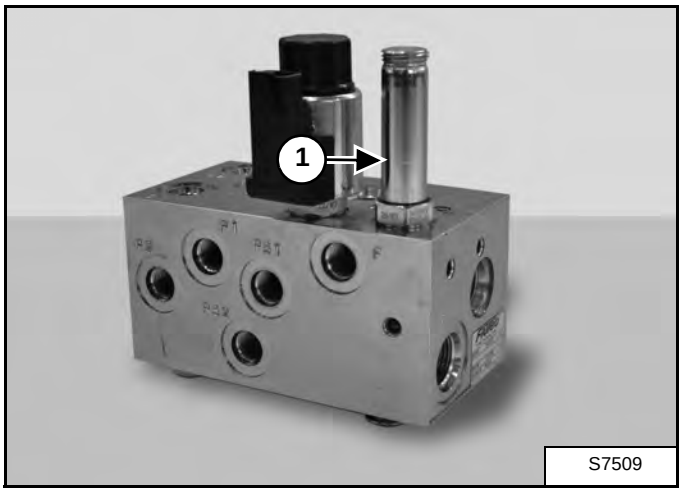
Remove the O-ring (Item 1) **[Figure 20-60-18]** from the coil.

Figure 20-60-19



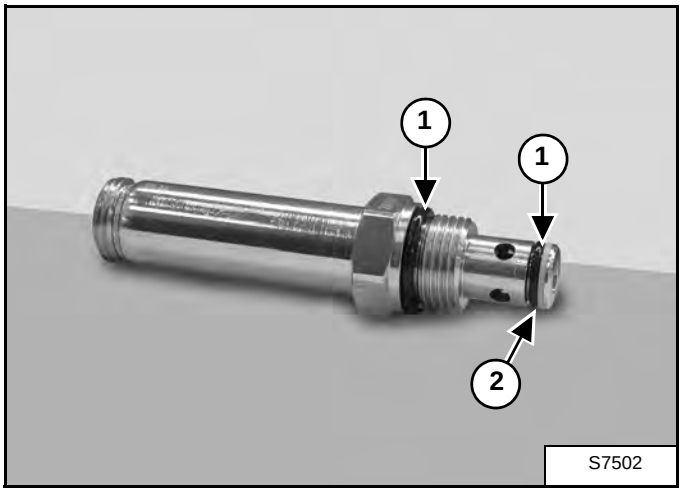
Remove the O-ring (Item 1) **[Figure 20-60-19]** from the solenoid stem.

Figure 20-60-20



Remove the solenoid stem (Item 1) **[Figure 20-60-20]**.

Figure 20-60-21

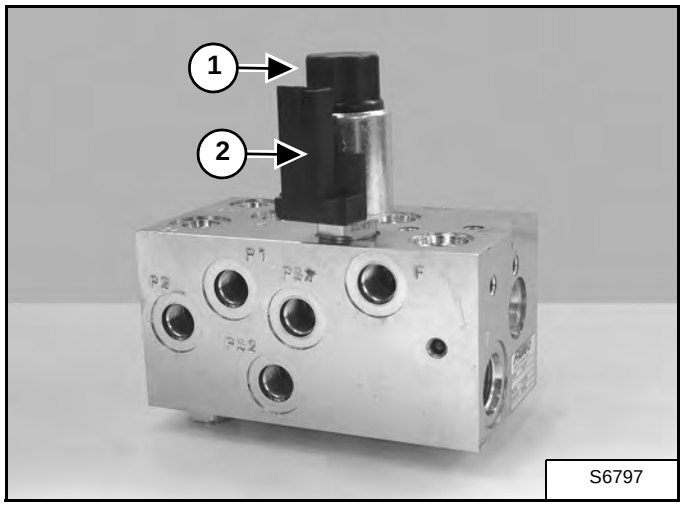


Remove the two O-rings (Item 1) and the back-up ring (Item 2) **[Figure 20-60-21]** from the solenoid stem.

Dealer Copy -- Not for Resale

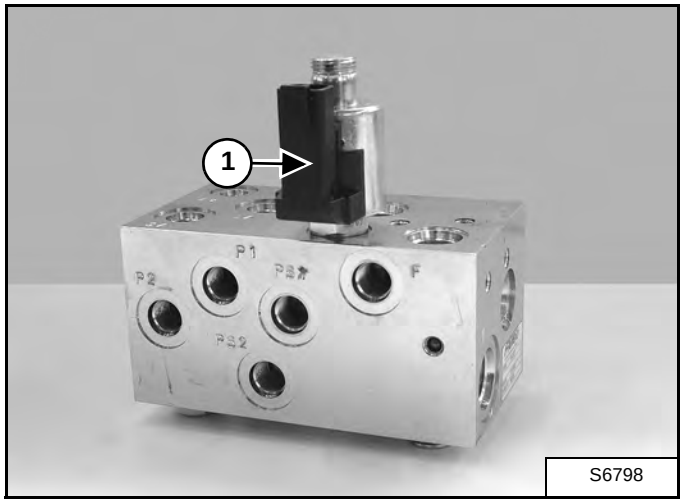
Disassembly (Cont'd)

Figure 20-60-22



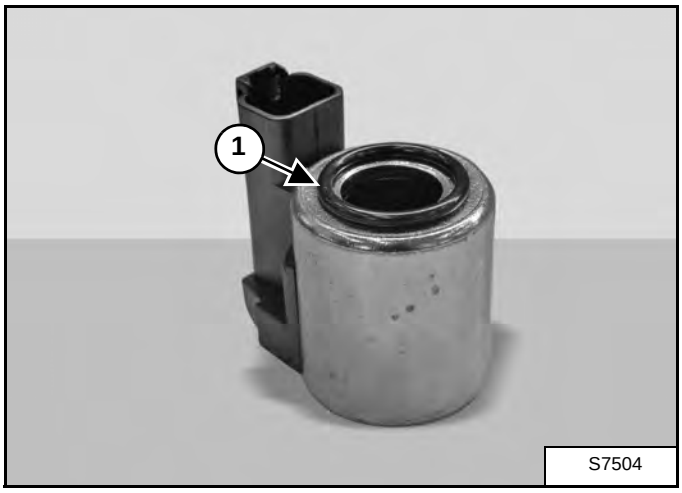
Remove the plastic nut (Item 1) from the system bypass solenoid (Item 2) **[Figure 20-60-22]**.

Figure 20-60-23



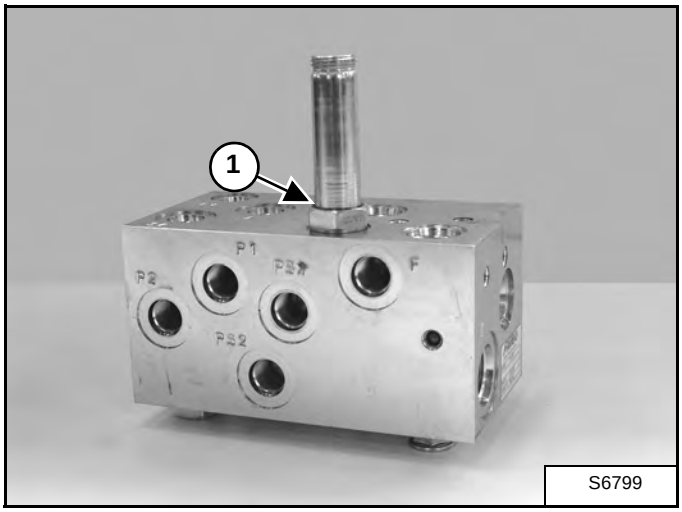
Remove the coil (Item 1) **[Figure 20-60-23]** from the solenoid stem.

Figure 20-60-24



Remove the O-ring (Item 1) **[Figure 20-60-24]** from the coil.

Figure 20-60-25

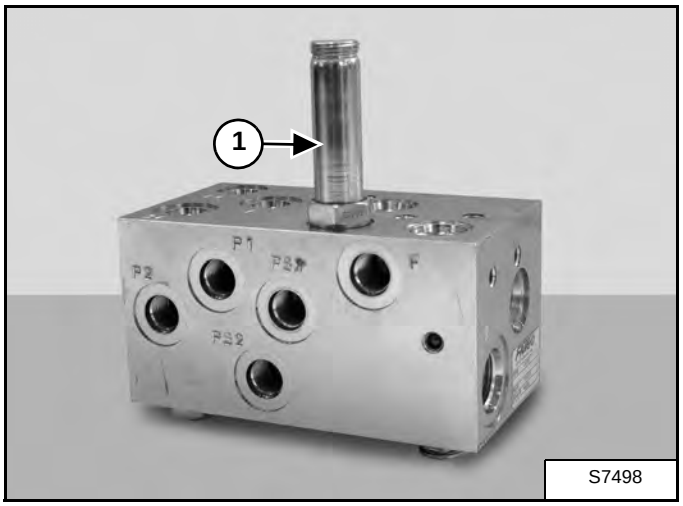


Remove the O-ring (Item 1) **[Figure 20-60-25]** from the solenoid stem.

Dealer Copy -- Not for Resale

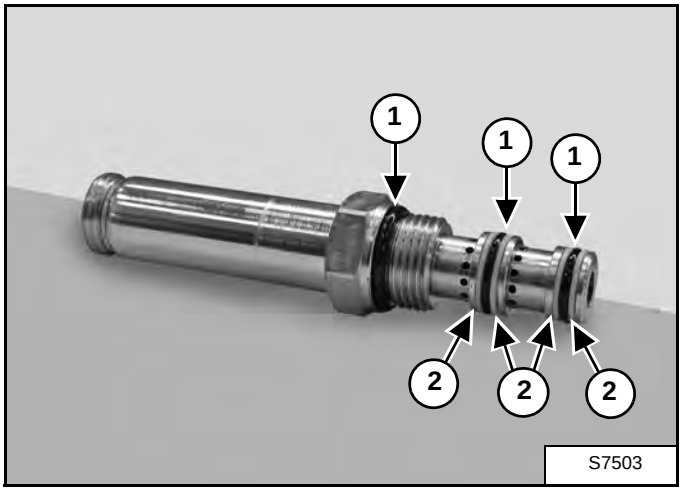
Disassembly (Cont'd)

Figure 20-60-26



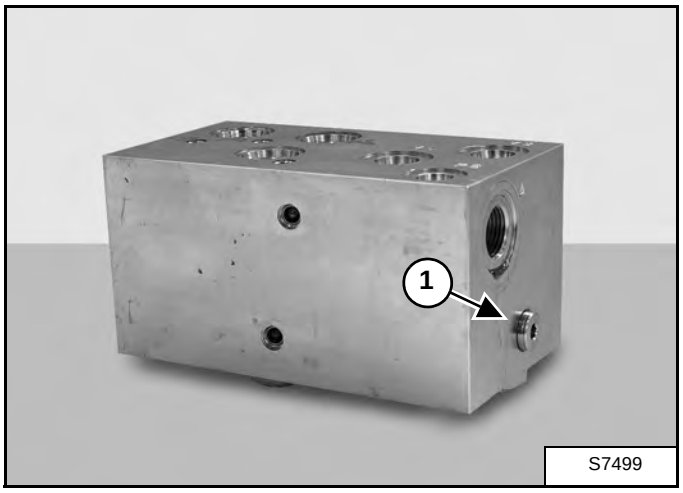
Remove the solenoid stem (Item 1) **[Figure 20-60-26]**.

Figure 20-60-27



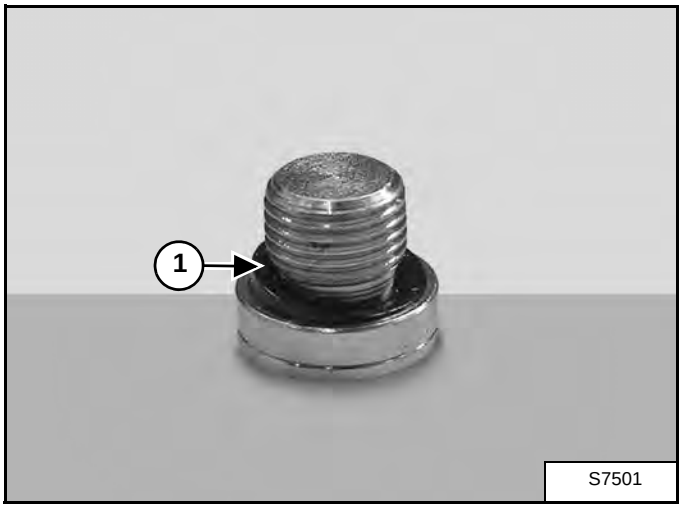
Remove the three O-rings (Item 1) and the four back-up rings (Item 2) **[Figure 20-60-27]** from the solenoid stem.

Figure 20-60-28



Remove the plug (Item 1) **[Figure 20-60-28]** from the manifold.

Figure 20-60-29

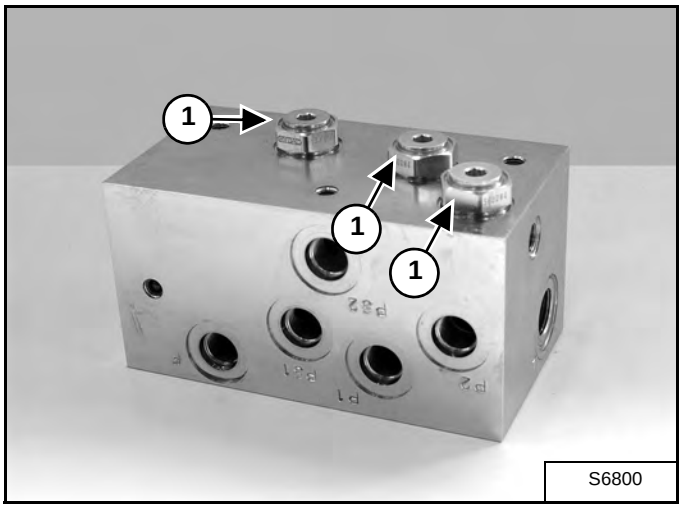


Remove the O-ring (Item 1) **[Figure 20-60-29]** from the plug.

Dealer Copy -- Not for Resale

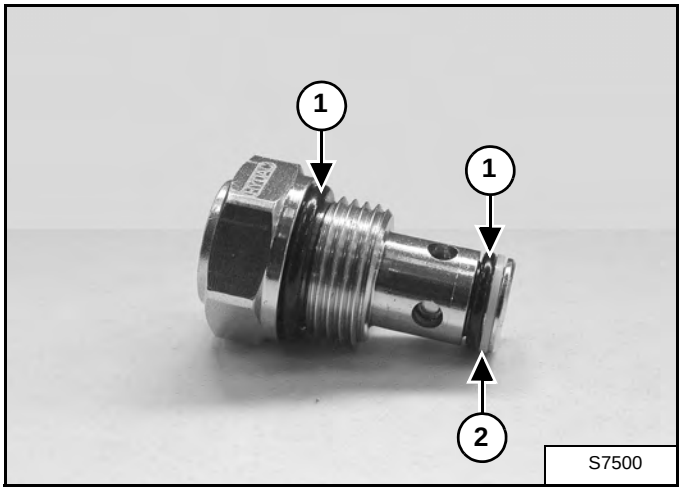
Disassembly (Cont'd)

Figure 20-60-30



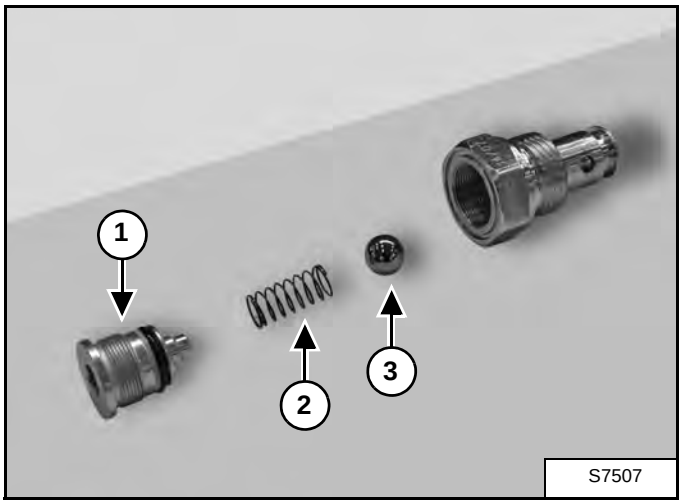
Remove the three valves (Item 1) **[Figure 20-60-30]** from the manifold.

Figure 20-60-31



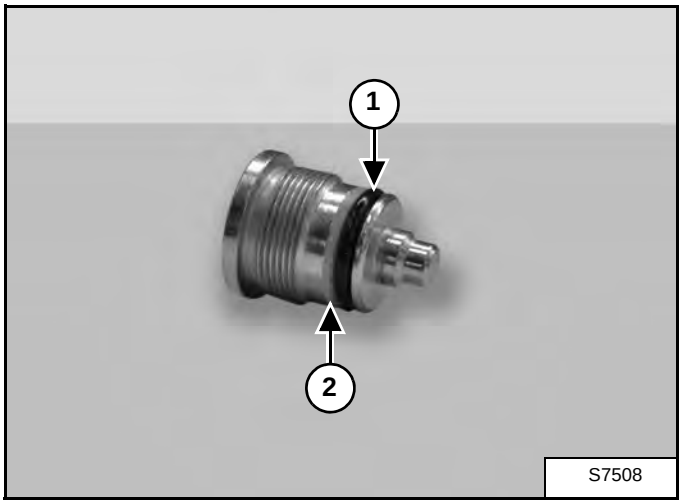
Remove the two O-rings (Item 1) and the back-up ring (Item 2) **[Figure 20-60-31]** from the valves.

Figure 20-60-32



Remove the plug (Item 1), spring (Item 2) and the ball (Item 3) **[Figure 20-60-32]** from the valves.

Figure 20-60-33



Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-60-33]** from the plugs.

Dealer Copy -- Not for Resale

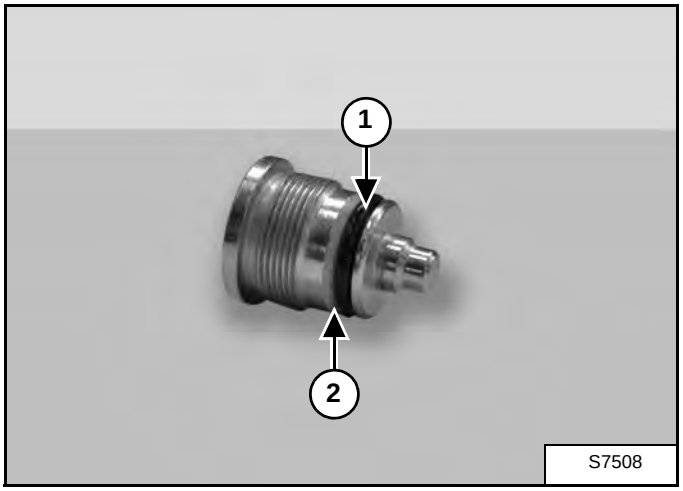
Assembly

Clean all parts in solvent and dry with compressed air.

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

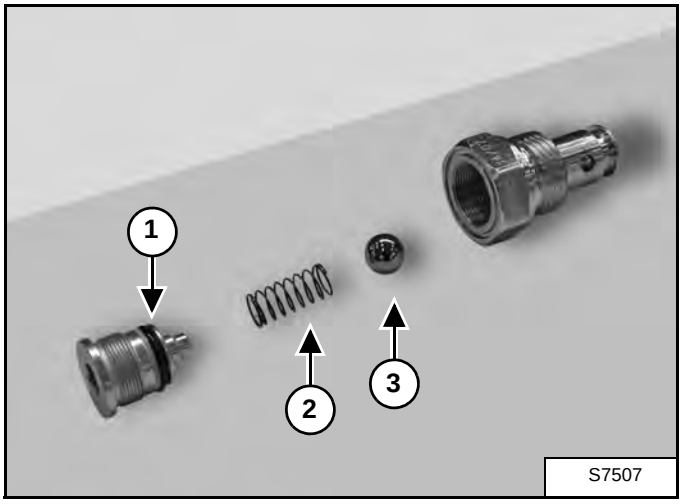
Always install new back-up rings and O-rings. Lubricate all back-up rings and O-rings with clean hydraulic fluid before installation.

Figure 20-60-34



Install the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-60-34]** on the plugs.

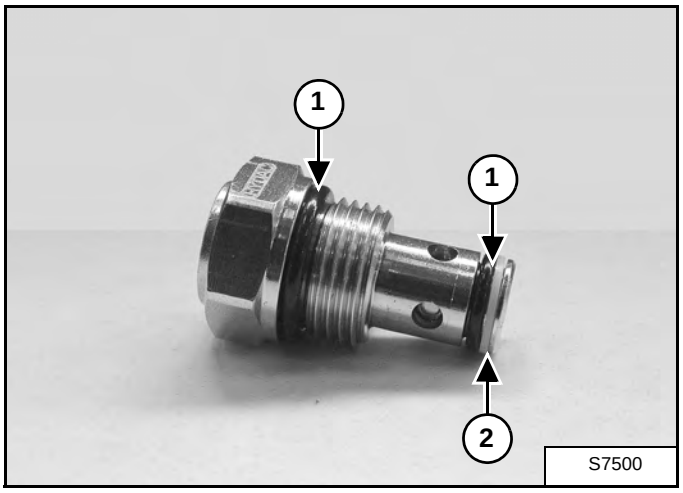
Figure 20-60-35



Install the ball (Item 1), spring (Item 2) and plug (Item 3) **[Figure 20-60-35]** in the valves.

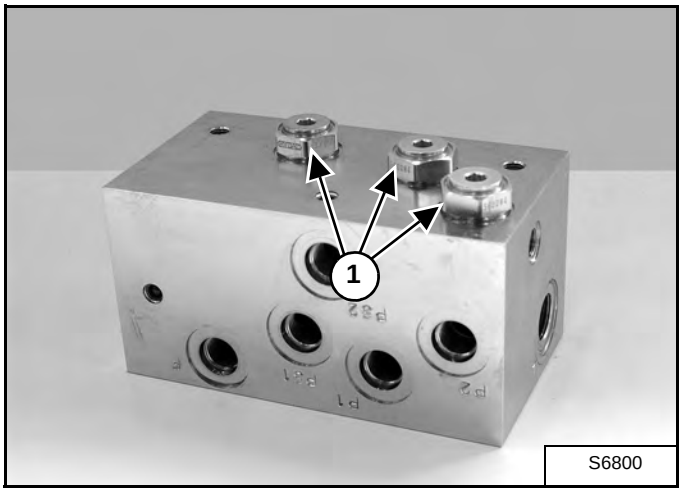
Tighten the plug to 60 N•m (44 ft-lb) torque.

Figure 20-60-36



Install the two O-rings (Item 1) and the back-up ring (Item 2) **[Figure 20-60-36]** on the valves.

Figure 20-60-37



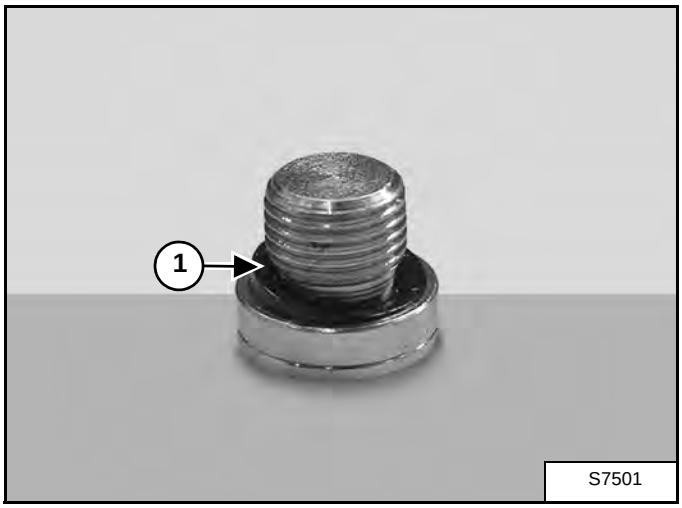
Install the three valves (Item 1) **[Figure 20-60-37]**.

Tighten the valves to 60 N•m (44 ft-lb) torque.

Dealer Copy -- Not for Resale

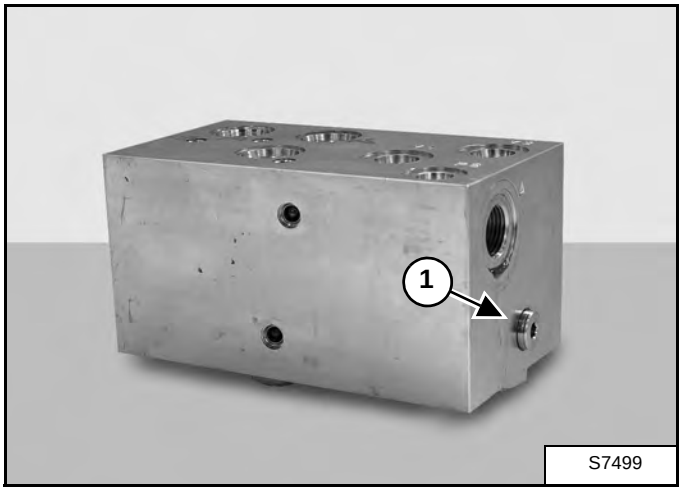
Assembly (Cont'd)

Figure 20-60-38



Install the O-ring on the plug (Item 1) **[Figure 20-60-38]**.

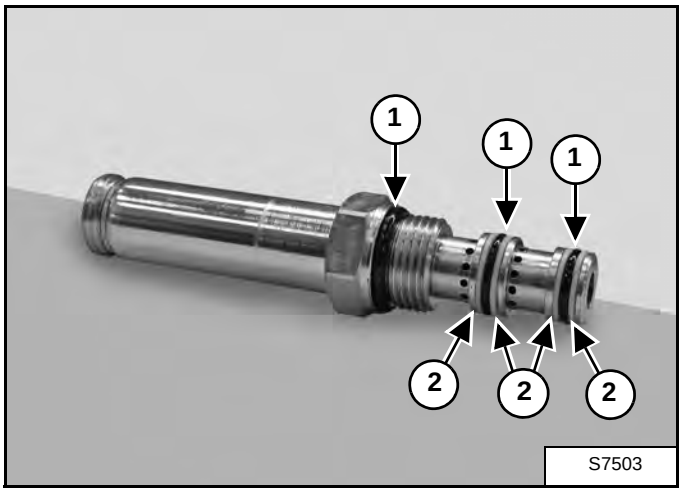
Figure 20-60-39



Install the plug (Item 1) **[Figure 20-60-39]** on the side of the manifold.

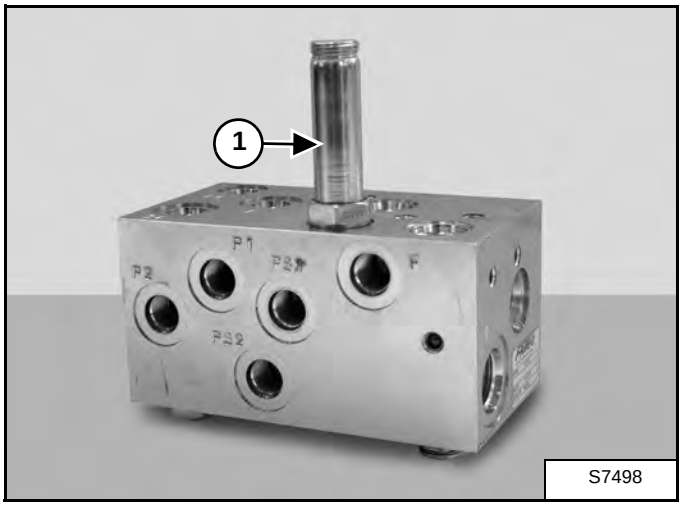
Tighten the plug to 30 N•m (22 ft-lb) torque.

Figure 20-60-40



Install the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-60-40]** on the solenoid stem.

Figure 20-60-41



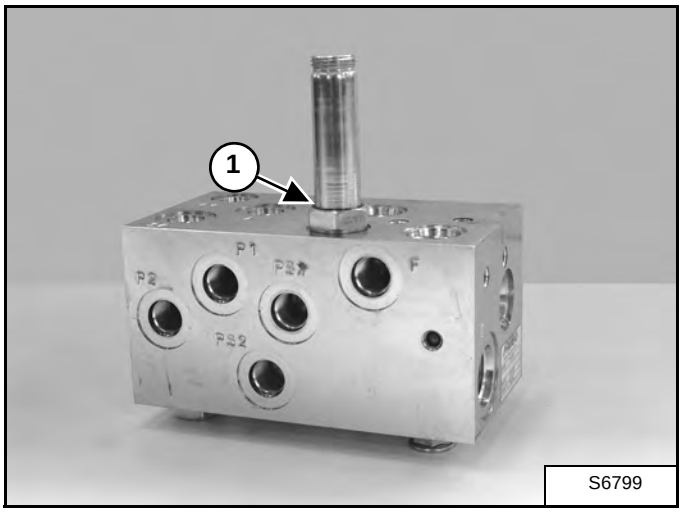
Install the solenoid stem (Item 1) **[Figure 20-60-41]**.

Tighten the solenoid stem to 30 N•m (22 ft-lb) torque.

Dealer Copy -- Not for Resale

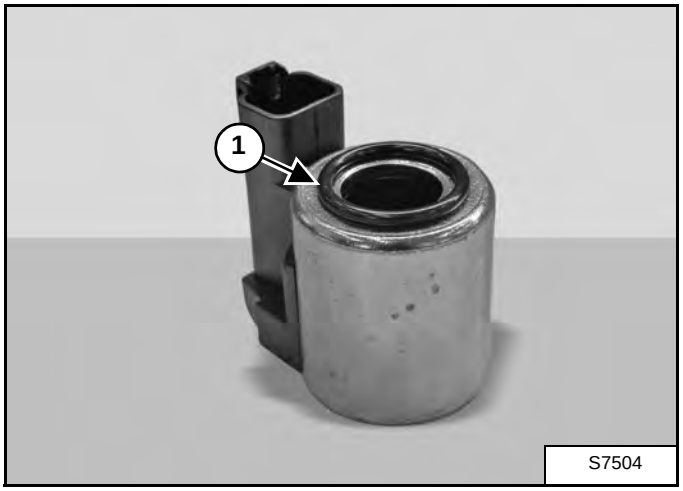
Assembly (Cont'd)

Figure 20-60-42



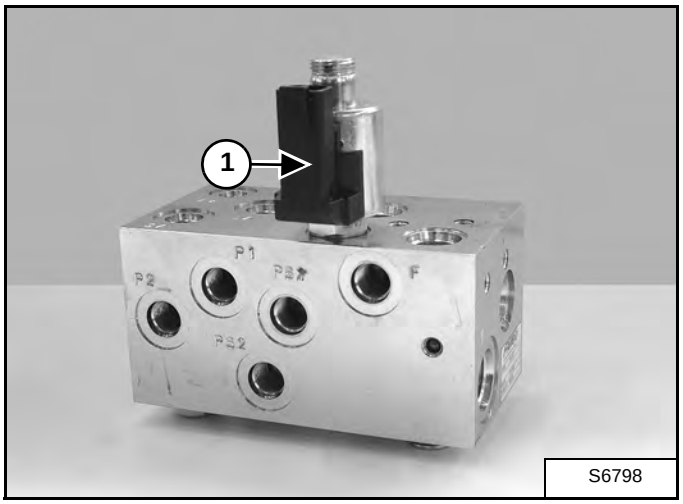
Install the O-ring (Item 1) **[Figure 20-60-42]** on the solenoid stem.

Figure 20-60-43



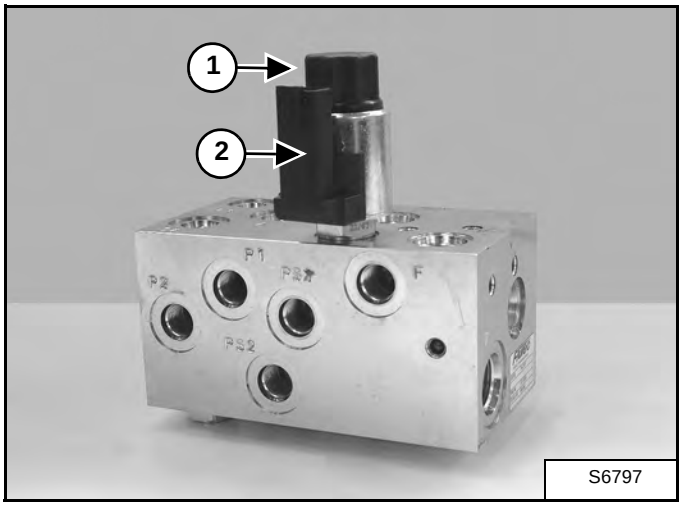
Install the O-ring (Item 1) **[Figure 20-60-43]** on the coil.

Figure 20-60-44



Install the coil (Item 1) **[Figure 20-60-44]** on the solenoid stem.

Figure 20-60-45



Install the plastic nut (Item 1) on the system bypass solenoid (Item 2) **[Figure 20-60-45]**.

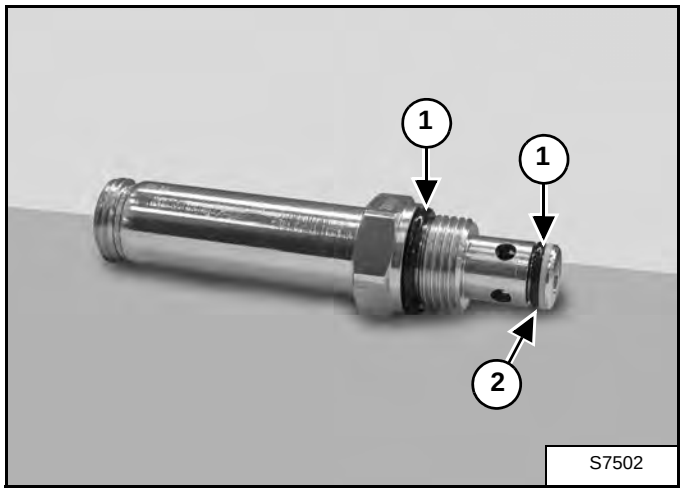
Tighten the nut to 6 N•m (53.1 in-lb) torque.

NOTE: Overtightening the nut (Item 1) [Figure 20-60-45] may cause solenoid or coil failure.

Dealer Copy -- Not for Resale

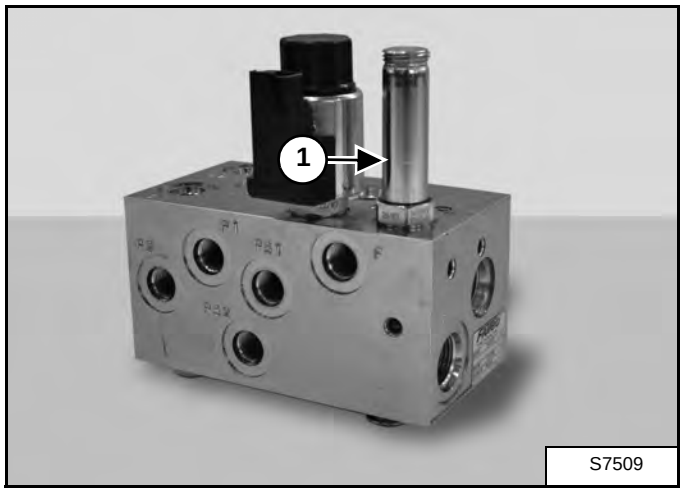
Assembly (Cont'd)

Figure 20-60-46



Install the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-60-46]** on the solenoid stem.

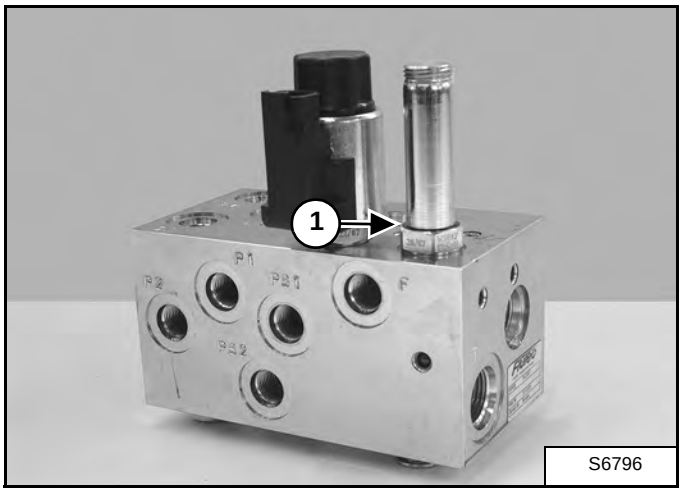
Figure 20-60-47



Install the solenoid stem (Item 1) **[Figure 20-60-47]**.

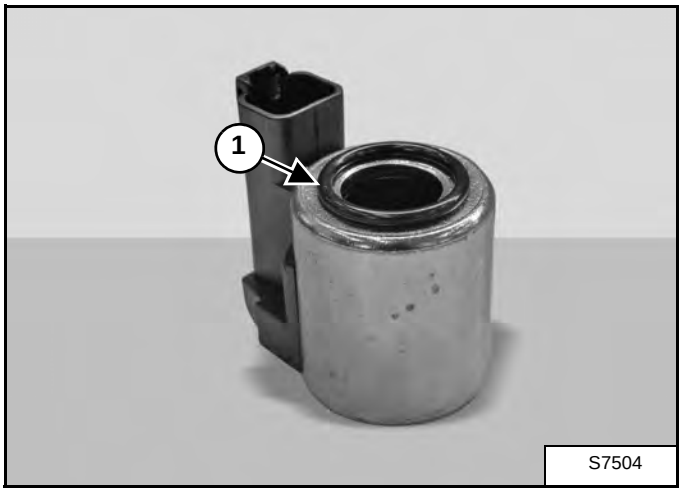
Tighten the solenoid stem to 50 N•m (37 ft-lb) torque.

Figure 20-60-48



Install the O-ring (Item 1) **[Figure 20-60-48]** on the solenoid stem.

Figure 20-60-49

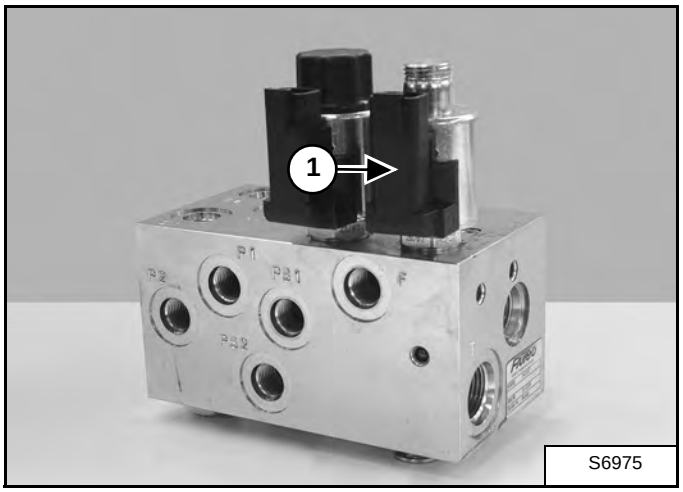


Install the O-ring (Item 1) **[Figure 20-60-49]** on the coil.

Dealer Copy -- Not for Resale

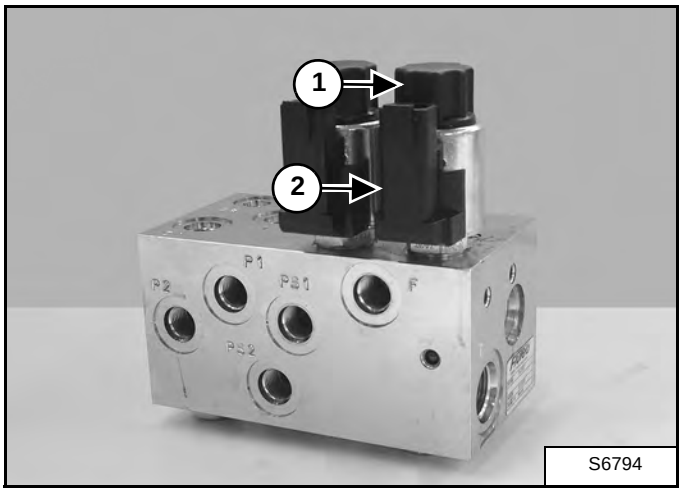
Assembly (Cont'd)

Figure 20-60-50



Install the coil (Item 1) **[Figure 20-60-50]** on the solenoid stem.

Figure 20-60-51

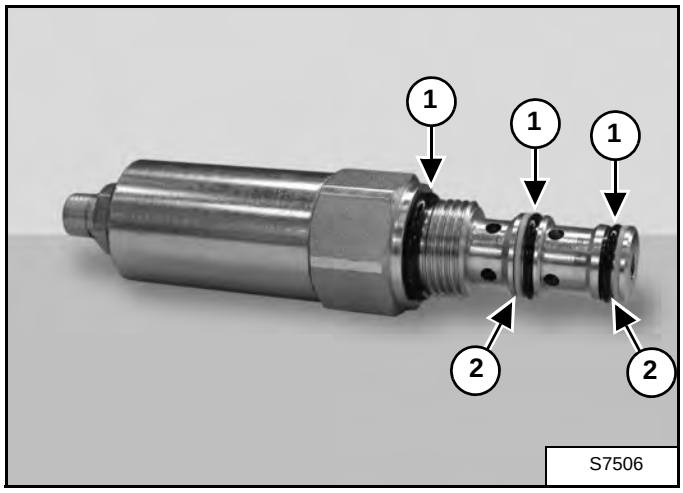


Install the plastic nut (Item 1) on the console (joystick) lockout solenoid (Item 2) **[Figure 20-60-51]**.

Tighten the nut to 6 N•m (53.1 in-lb) torque.

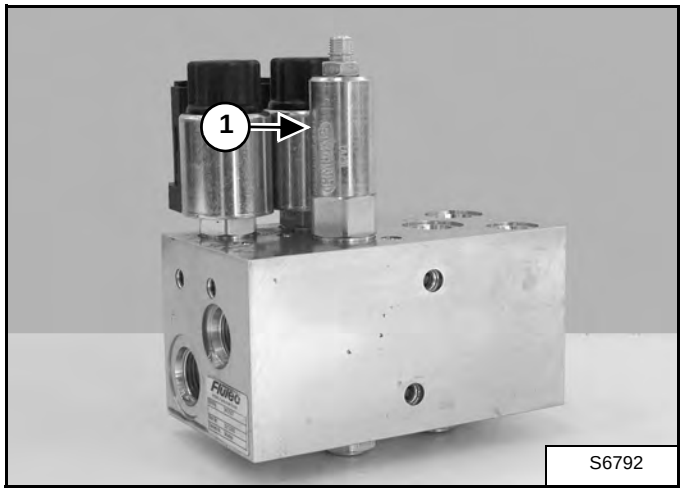
NOTE: Overtightening the nut (Item 1) [Figure 20-60-51] may cause solenoid or coil failure.

Figure 20-60-52



Install the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-60-52]** on the pressure reducing valve.

Figure 20-60-53



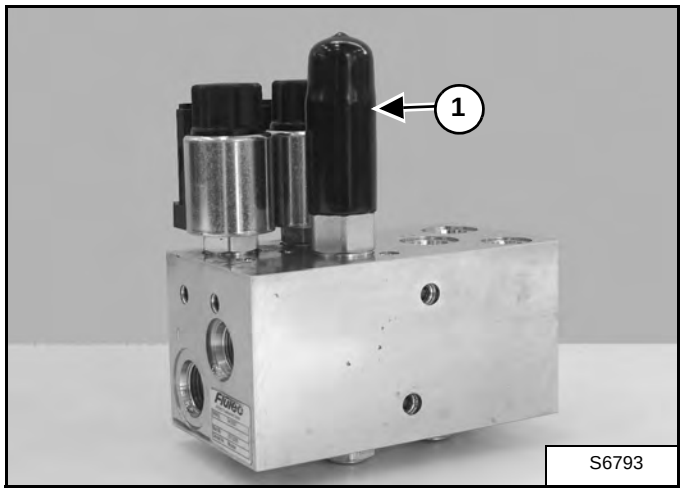
Install the pressure reducing valve (Item 1) **[Figure 20-60-53]** on the manifold.

Tighten the valve to 25 - 30 N•m (18.4 - 22.1 ft-lb) torque.

Dealer Copy -- Not for Resale

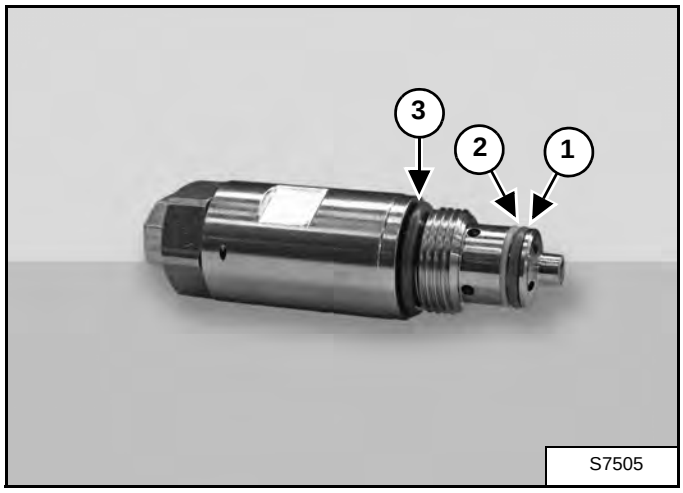
Assembly (Cont'd)

Figure 20-60-54



Put the protective cover (Item 1) **[Figure 20-60-54]** over the pressure reducing valve.

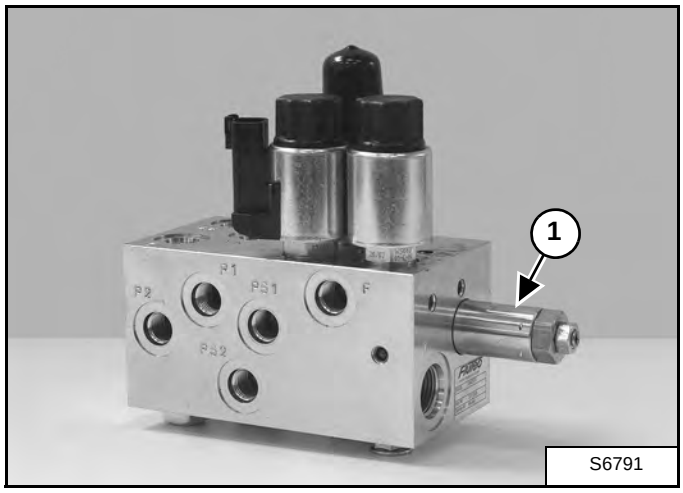
Figure 20-60-55



Install the O-ring (Item 1) and back-up ring (Item 2) **[Figure 20-60-55]** on the main relief valve.

Install the O-ring (Item 3) **[Figure 20-60-55]** on the main relief valve.

Figure 20-60-56



Install the main relief valve (Item 1) **[Figure 20-60-56]** on the manifold.

Tighten the valve to 60 N•m (44 ft-lb) torque.

Dealer Copy -- Not for Resale

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 that the travel motor rotates is related to the amount of hydraulic fluid it receives. This travel motor is equipped with two-speed section.

The traditional bench mark for the drift is less than 3,0 m (10 ft) of “drift” in 30,5 m (100 ft) of travel.

Removal And Installation

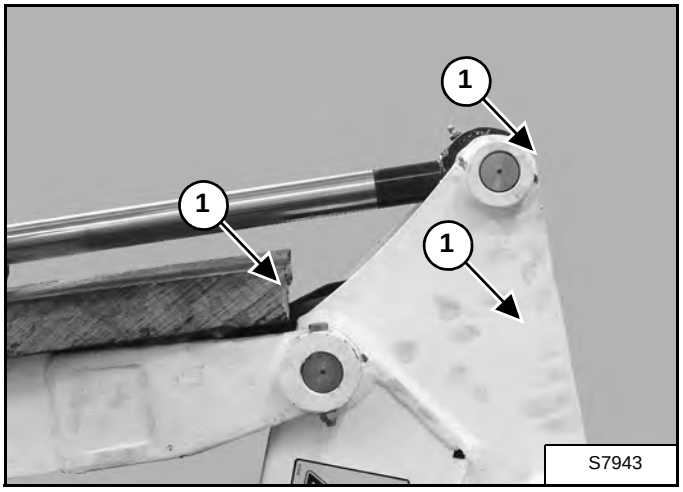
Remove the track. (See Track Removal And Installation on Page 30-20-4.)

IMPORTANT

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

I-2003-0888

Figure 20-70-1



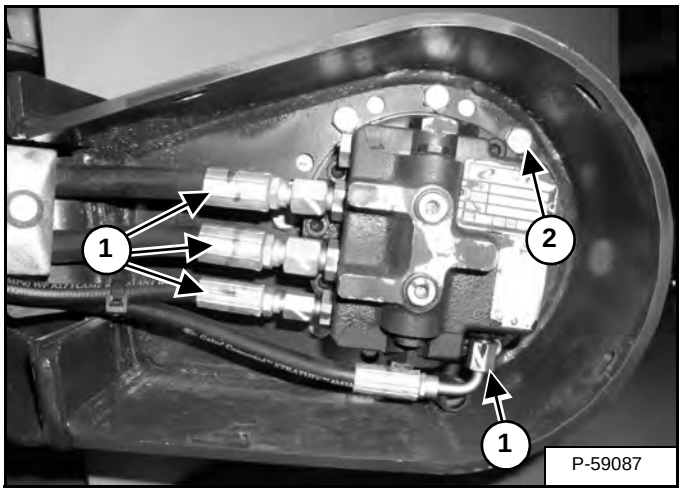
Remove the bolts (Item 1) **[Figure 20-70-1]** from the track frame cover.

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]**.

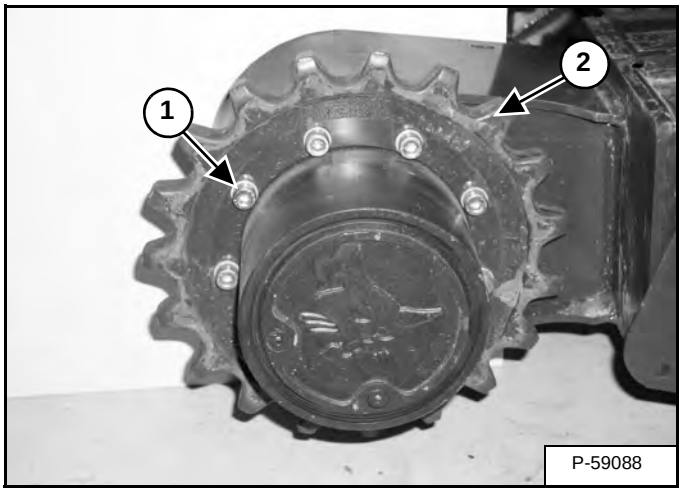
Installation: Tighten the bolts to 40 - 50 N•m (29 - 37 ft-lb) torque.

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



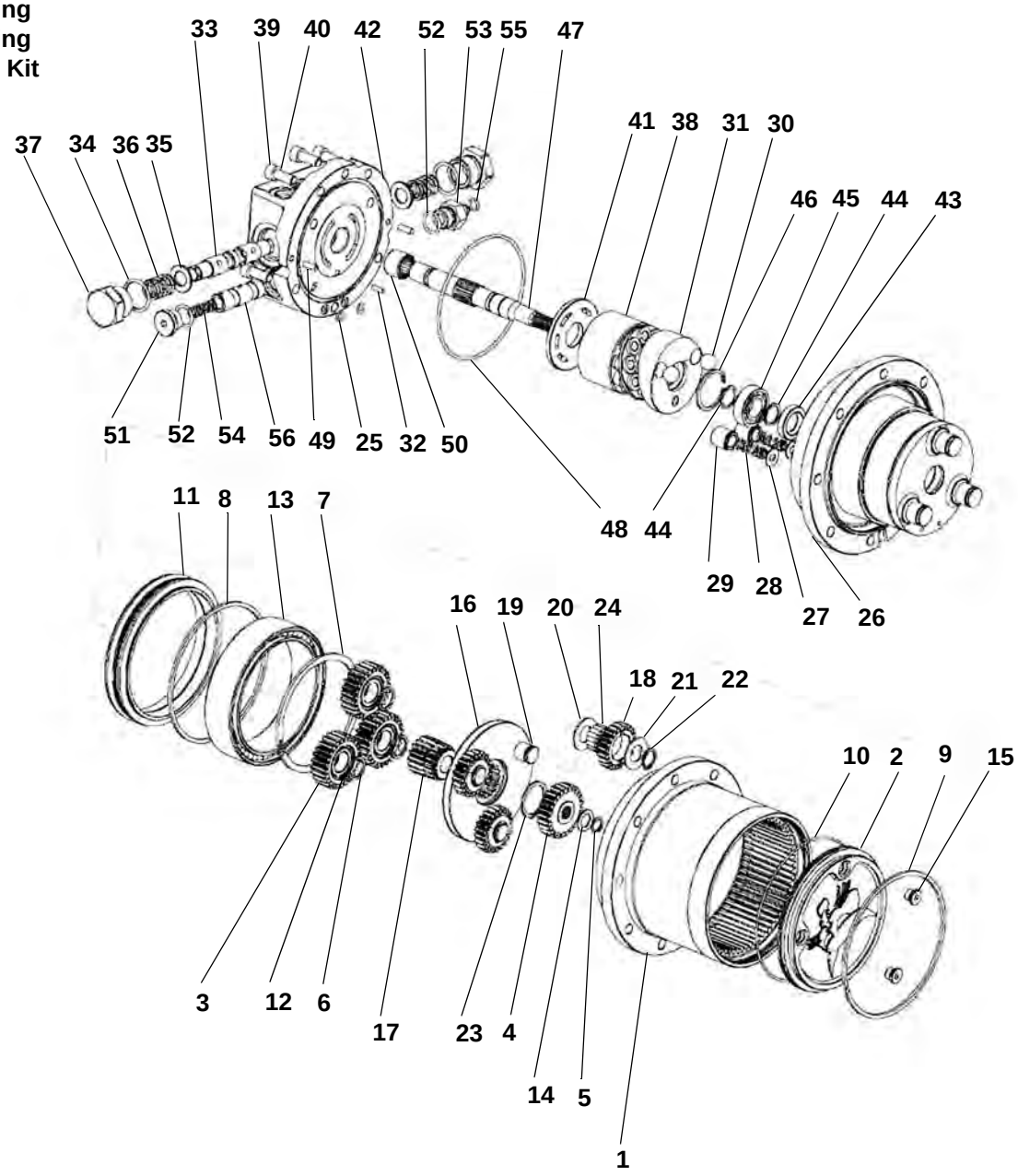
Remove the sprocket bolts (Item 1) and the sprocket (Item 2) **[Figure 20-70-3]**.

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. Gear
4. Gear
5. Ring
6. Ring
7. Ring
8. Ring
9. Ring
10. O-ring
11. Seal
12. Bearing
13. Bearing
14. Shim Kit
15. Plug
16. Carrier
17. Gear
18. Gear
19. Pin
20. Washer
21. Washer
23. Ring
24. Roller
25. O-ring
26. Hub
27. Washer
28. Spring
29. Piston
30. Ball
31. Swash plate
32. Pin
33. Valve kit Assembly
34. O-ring
35. Washer
36. Spring
37. Plug
38. Plumbing Kit
39. Bolt
40. Washer
41. Distributor
42. Cover
43. Seal
44. Ring
45. Bearing
46. Ring
47. Shaft
48. O-ring
49. Pin
50. Bearing
51. Plug
52. O-ring
53. Fitting
54. Spring
55. O-ring
56. Piston



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Disassembly

IMPORTANT

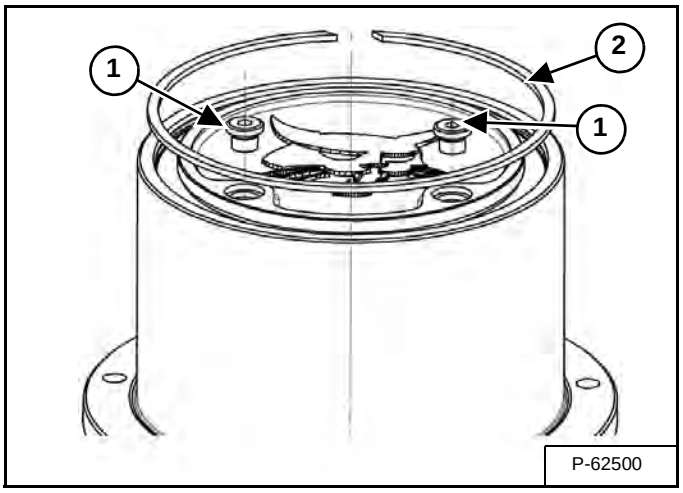
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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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

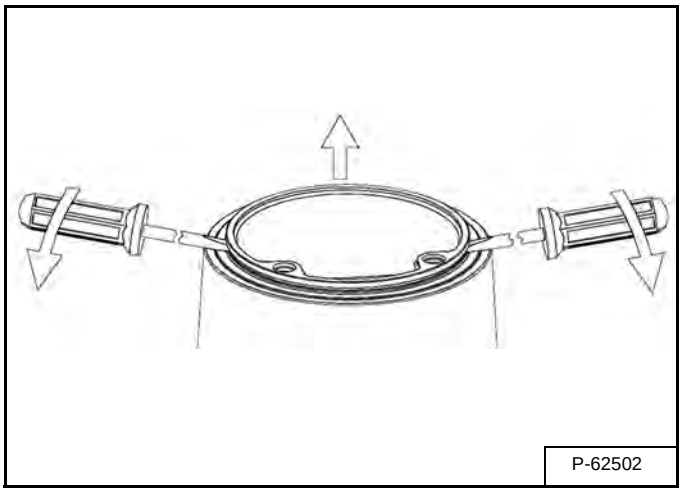
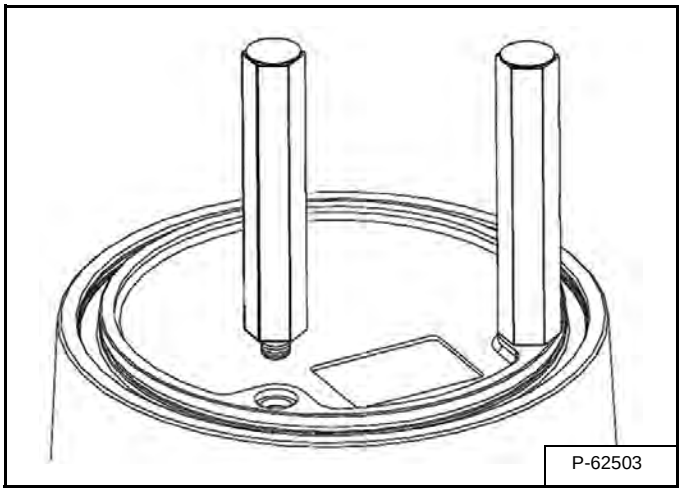


Figure 20-70-6

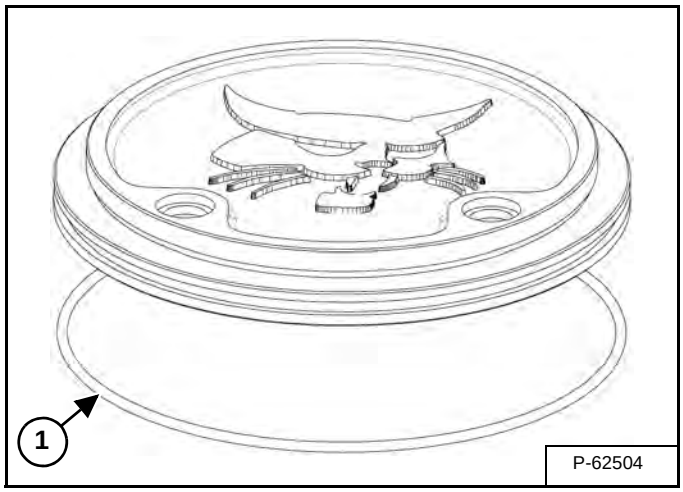


To remove the cover, lift the cover up using screwdrivers in the upper groove **[Figure 20-70-5]** or install two threaded pins in the drain holes and lift the cover off **[Figure 20-70-6]**.

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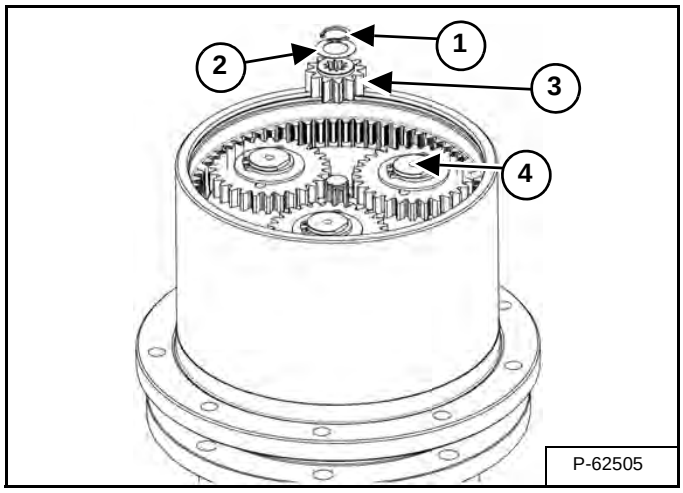
Disassembly (Cont'd)

Figure 20-70-7



Remove the O-ring (Item 1) **[Figure 20-70-7]** from the cover.

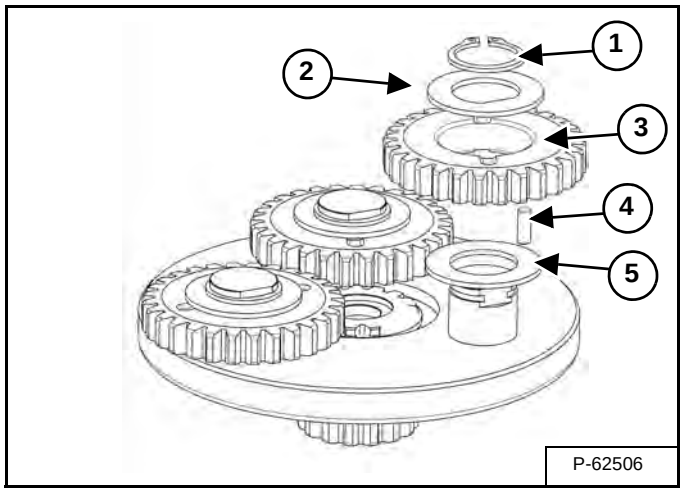
Figure 20-70-8



Remove the retaining ring (Item 1), shims (Item 2) and sun gear (Item 3) **[Figure 20-70-8]**.

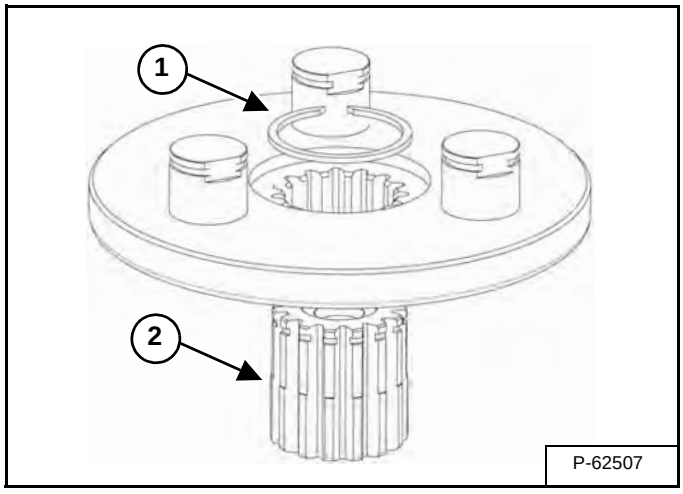
Remove the first stage planetary carrier (Item 4) **[Figure 20-70-8]** using your hands.

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

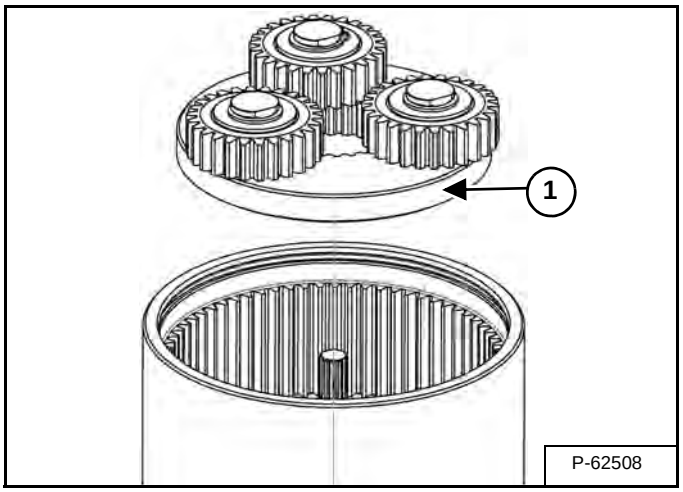


Remove the retaining ring (Item 1) from the second reduction sun gear (Item 2) **[Figure 20-70-10]** and push the gear down to remove from planetary carrier.

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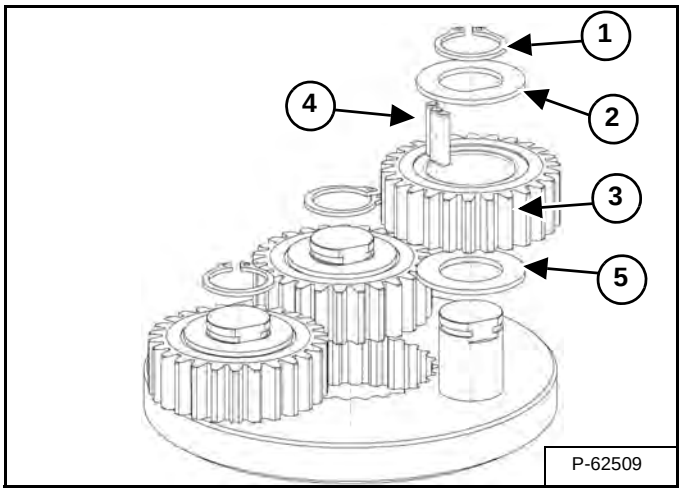
Disassembly (Cont'd)

Figure 20-70-11



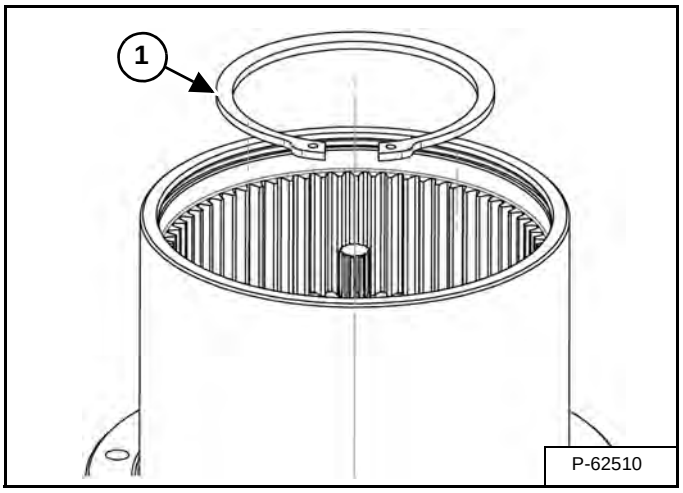
Remove the second stage planetary carrier (Item 1) **[Figure 20-70-11]** using your hands.

Figure 20-70-12



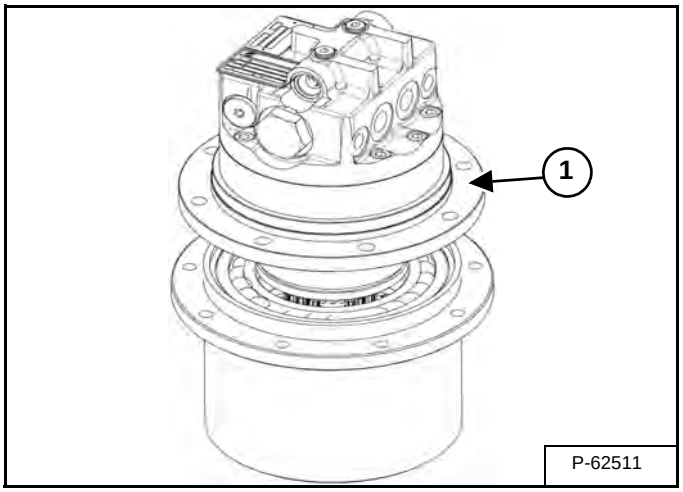
Remove the retaining rings (Item 1), anti-rotation washer (Item 2), planetary gears (Item 3), needle bearings (Item 4) and thrust washer (Item 5) **[Figure 20-70-12]** from the first stage planetary carrier assembly.

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

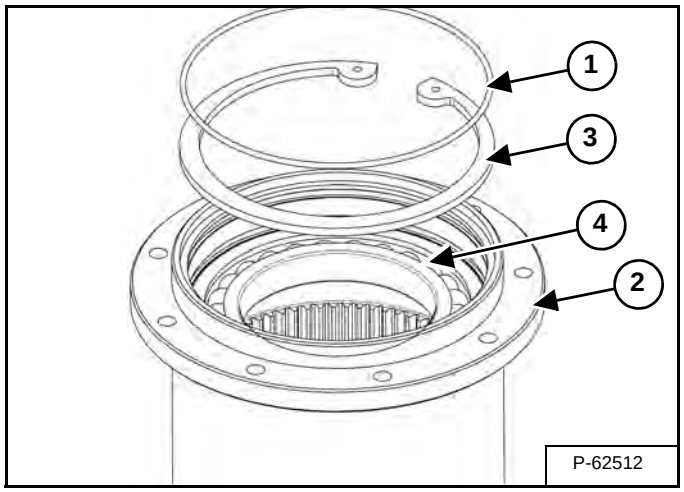


Remove the hub (Item 1) **[Figure 20-70-14]** from the ring gear.

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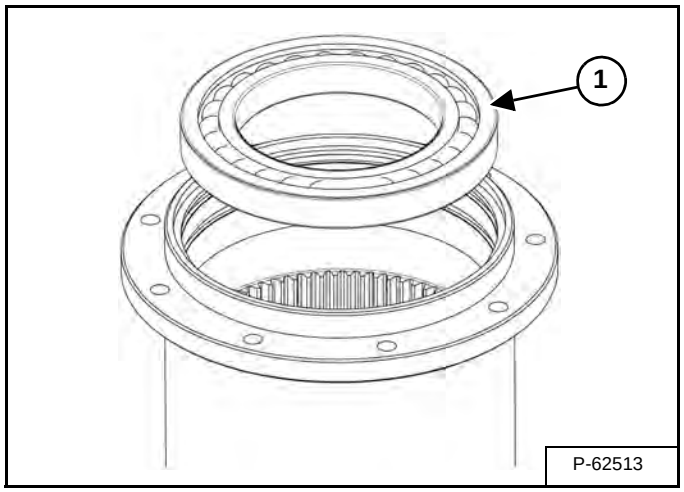
Disassembly (Cont'd)

Figure 20-70-15



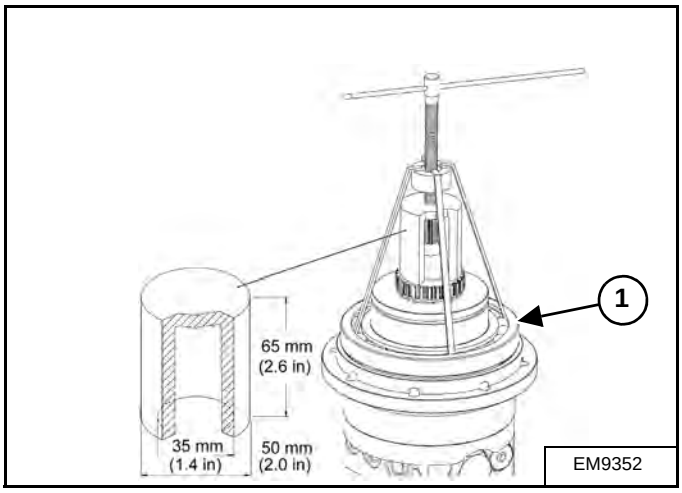
Remove the O-ring (Item 1) from the ring gear (Item 2) and the retaining ring (Item 3) securing the bearing (Item 4) **[Figure 20-70-15]**.

Figure 20-70-16



Remove the ball bearing (Item 1) **[Figure 20-70-16]** by pushing from underneath.

Figure 20-70-17

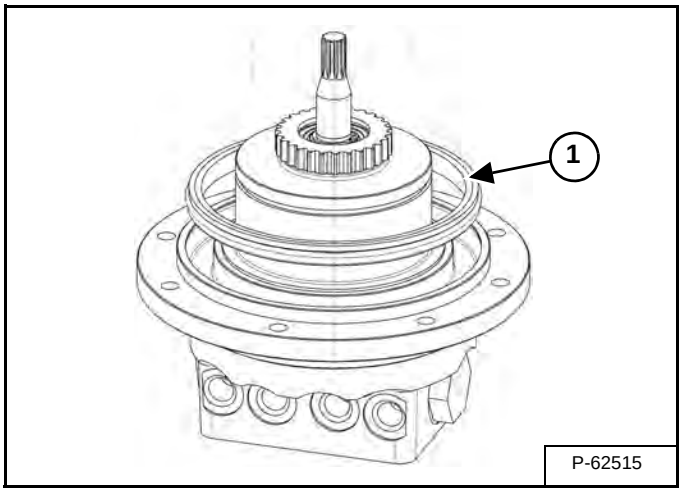


Remove the lapped bearing / front seal (Item 1) **[Figure 20-70-17]**.

NOTE: Be careful not to damage the bottom polished / lapped surface of the bearing [Figure 20-70-17].

NOTE: A bearing puller 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

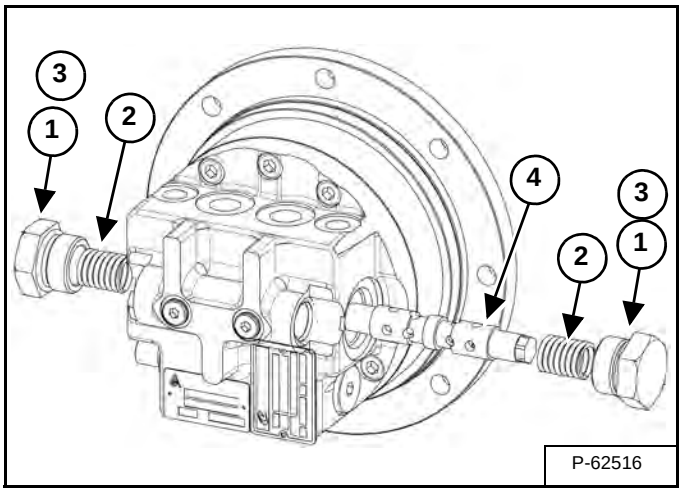


Remove the front seal ring (Item 1) **[Figure 20-70-18]**.

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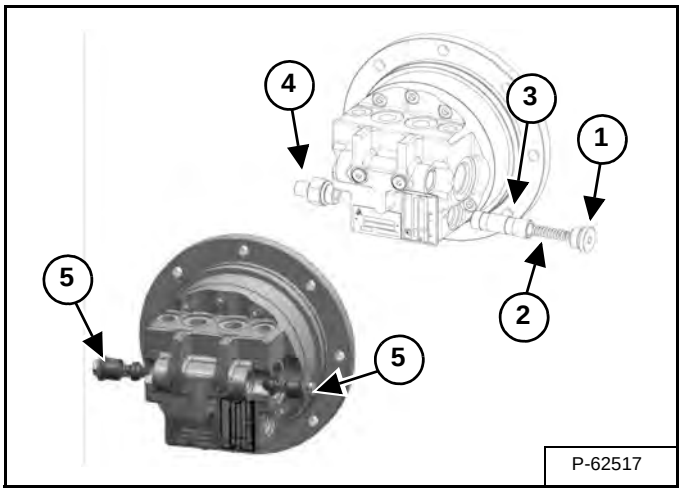
Disassembly (Cont'd)

Figure 20-70-19



Remove the plugs (Item 1), springs (Item 2), washers (Item 3) and counterbalance valve (Item 4) **[Figure 20-70-19]**.

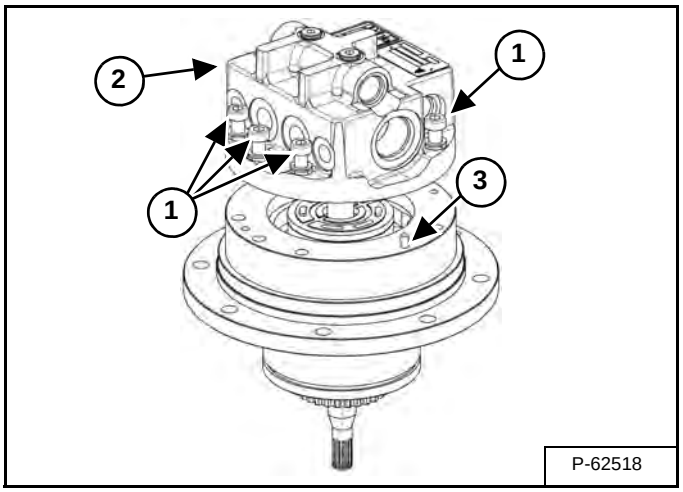
Figure 20-70-20



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

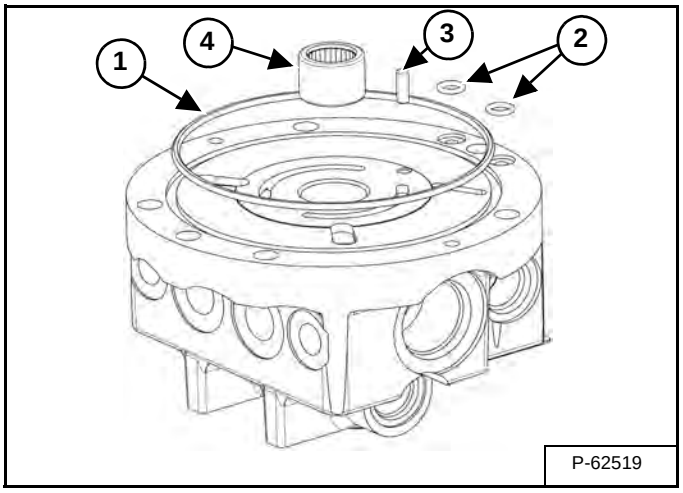


Remove the six screws and washers (Item 1) **[Figure 20-70-21]**.

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



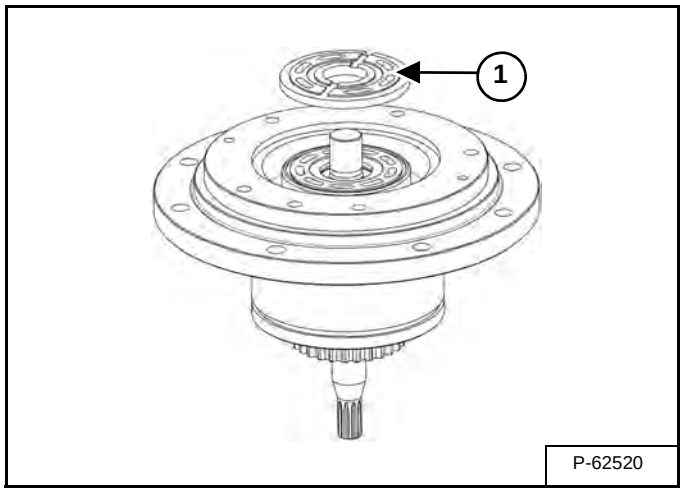
Remove large O-ring (Item 1), small O-rings (Item 2), pin (Item 3), and needle bearing (Item 4) **[Figure 20-70-22]** from the cover.

NOTE: Removal of pin (Item 3) [Figure 20-70-22] is optional.

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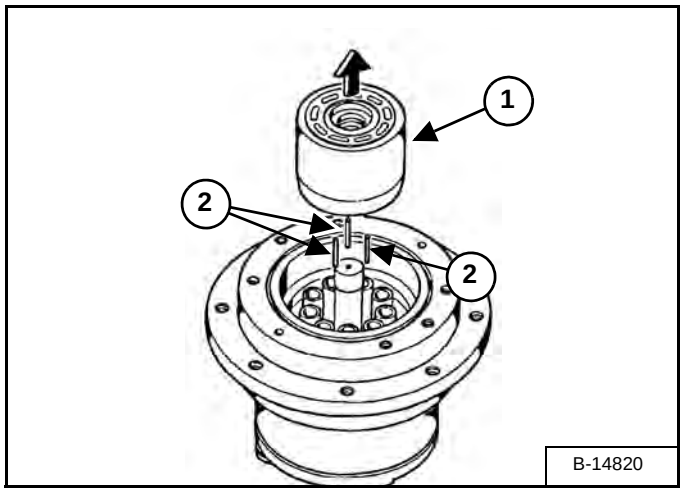
Disassembly (Cont'd)

Figure 20-70-23



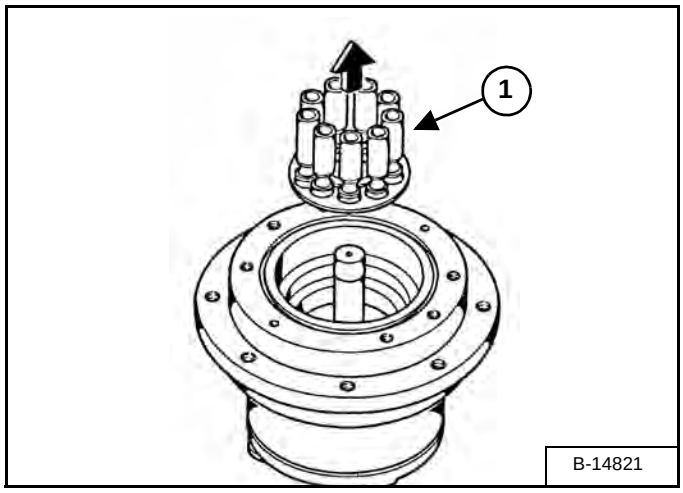
Remove the valve plate (Item 1) **[Figure 20-70-23]**.

Figure 20-70-24



Remove the rotating block (Item 1) and the three dowel pins (Item 2) **[Figure 20-70-24]**.

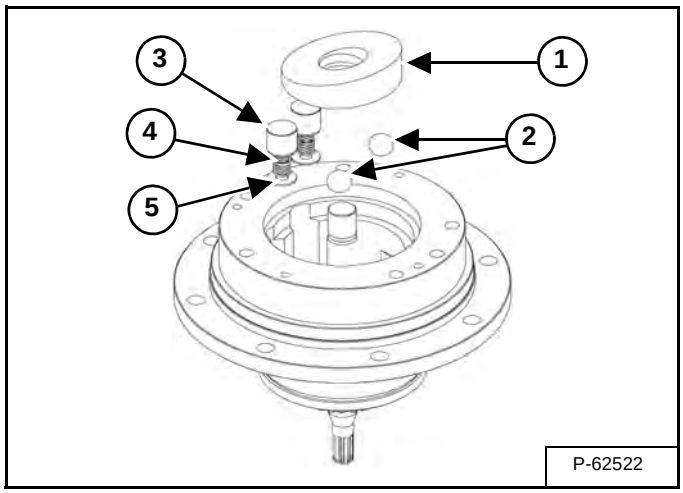
Figure 20-70-25



Remove the piston assembly (Item 1) **[Figure 20-70-25]**.

NOTE: The rotating group components are not available separately. Service as a complete assembly only.

Figure 20-70-26



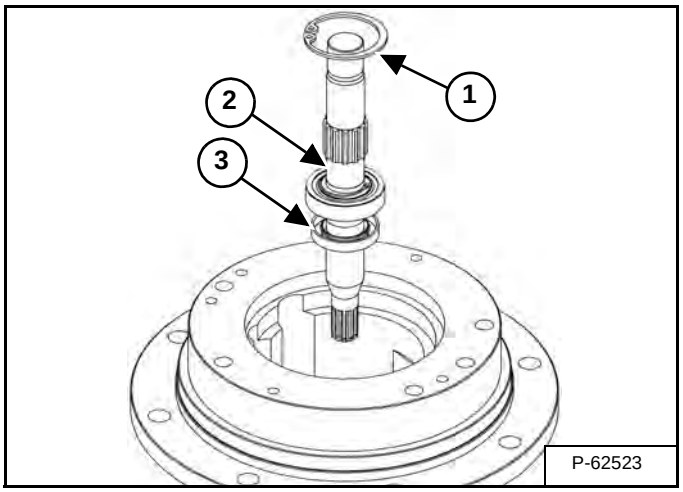
Remove the swash plate (Item 1) **[Figure 20-70-26]**.

Remove the two balls (Item 2), pistons (Item 3), springs (Item 4), and washers (Item 5) **[Figure 20-70-26]**.

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Disassembly (Cont'd)

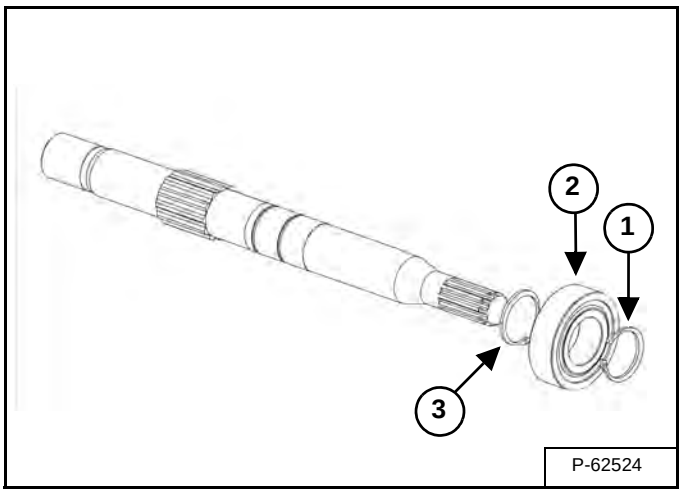
Figure 20-70-27



Remove the retaining ring (Item 1) and bearing / drive shaft assembly (Item 2) **[Figure 20-70-27]**.

Remove the oil seal (Item 3) **[Figure 20-70-27]**.

Figure 20-70-28



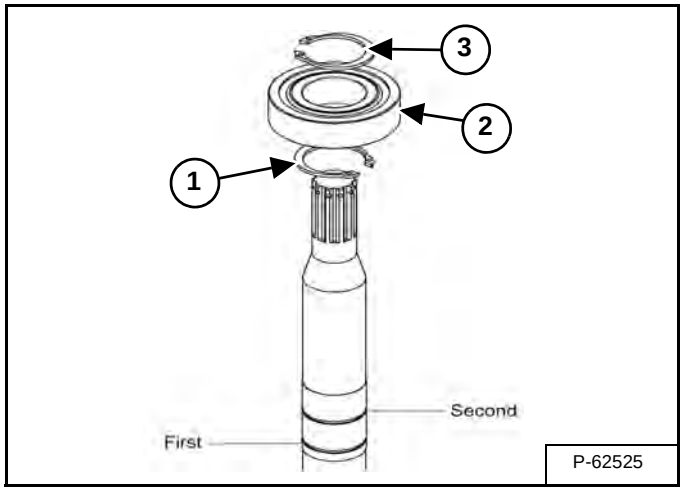
Remove the retaining ring (Item 1), ball bearing (Item 2) and the second retaining ring (Item 3) **[Figure 20-70-28]**.

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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.

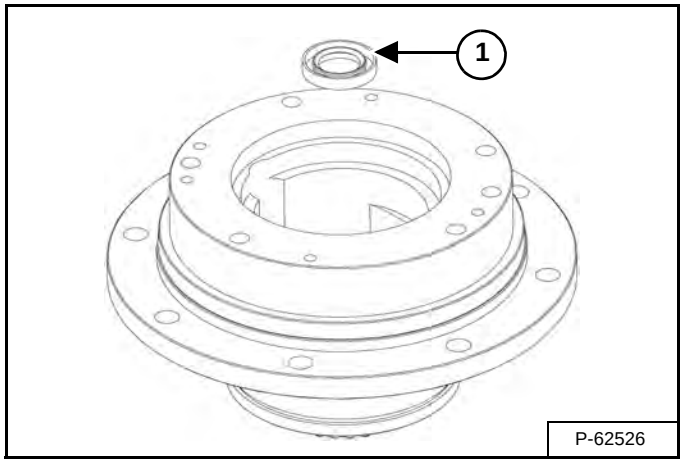
Figure 20-70-29



Install the retaining ring (Item 1) **[Figure 20-70-29]** on the drive shaft.

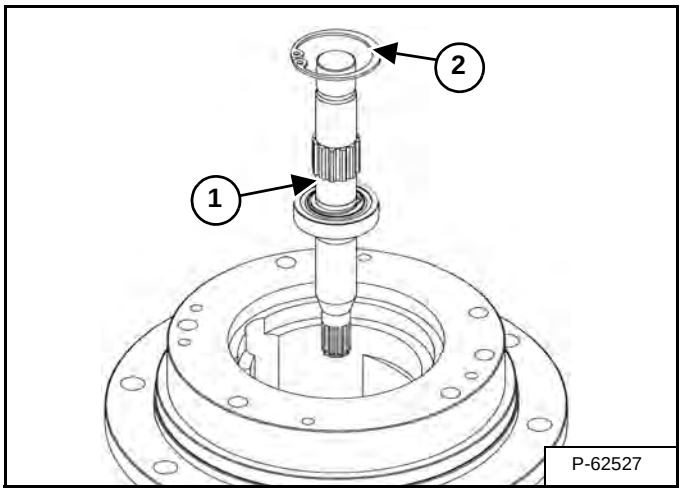
Install the ball bearing (Item 2) and the retaining ring (Item 3) **[Figure 20-70-29]**.

Figure 20-70-30



Install the oil seal (Item 1) **[Figure 20-70-30]** in the hub.

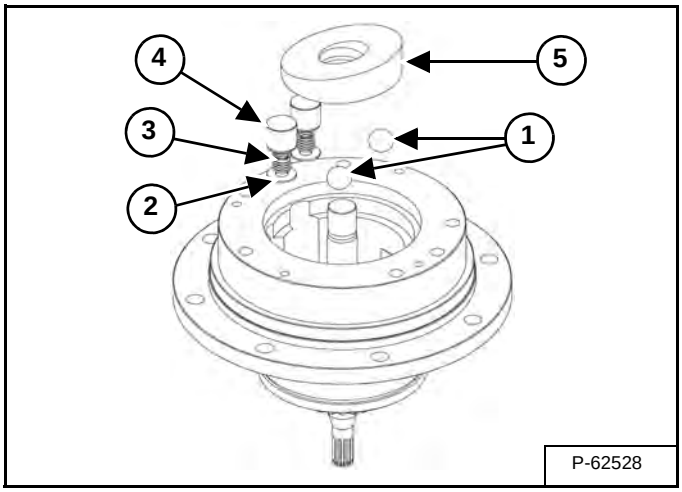
Figure 20-70-31



Install the bearing / drive shaft assembly (Item 1) **[Figure 20-70-31]**.

Install the retaining ring (Item 2) **[Figure 20-70-31]**.

Figure 20-70-32



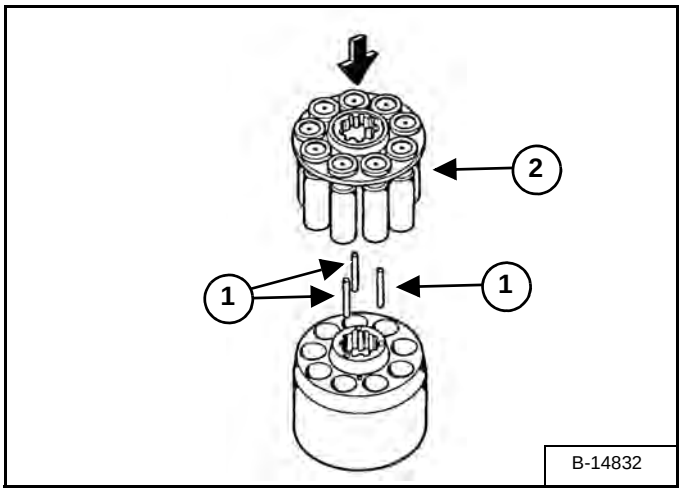
Install the two balls (Item 1), washers (Item 2), springs (Item 3) and pistons (Item 4) **[Figure 20-70-32]**.

Install the swash plate (Item 5) **[Figure 20-70-32]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

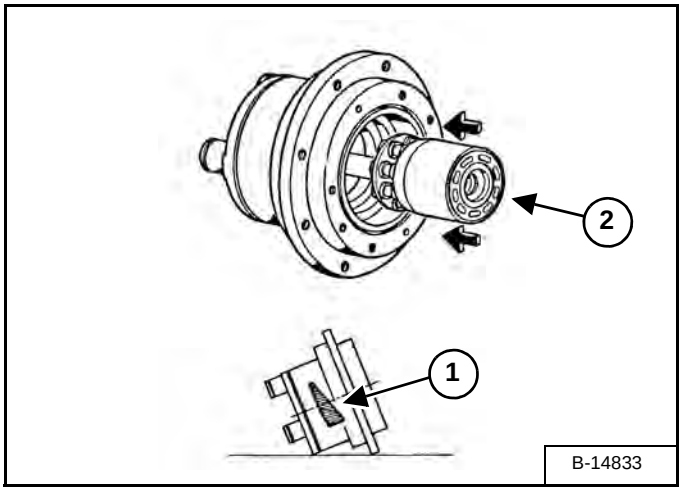
Figure 20-70-33



Install the dowel pins (Item 1) **[Figure 20-70-33]** in the rotating block.

Apply oil to the piston assembly (Item 2) **[Figure 20-70-33]** and install the piston assembly in the rotating block.

Figure 20-70-34

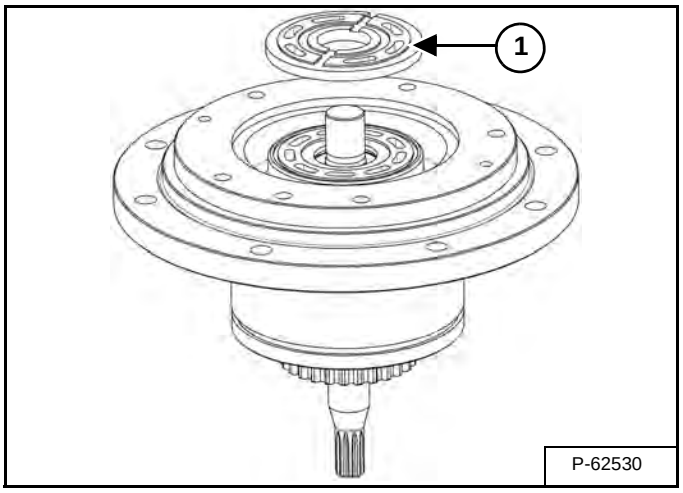


Tip the motor housing on its side. Make sure the thick side of the swash plate (Item 1) **[Figure 20-70-34]** is towards the bottom.

Install the rotating block assembly (Item 2) **[Figure 20-70-34]** in the hub.

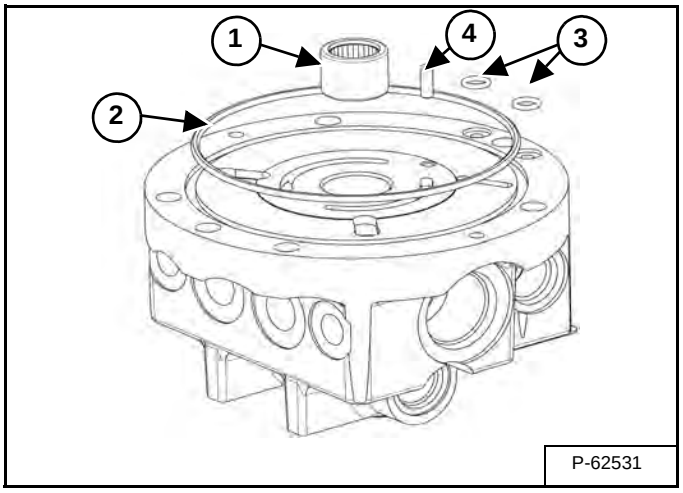
NOTE: The rotating group components are not available separately. Service as a complete assembly only.

Figure 20-70-35



Install the valve plate (Item 1) **[Figure 20-70-35]**.

Figure 20-70-36



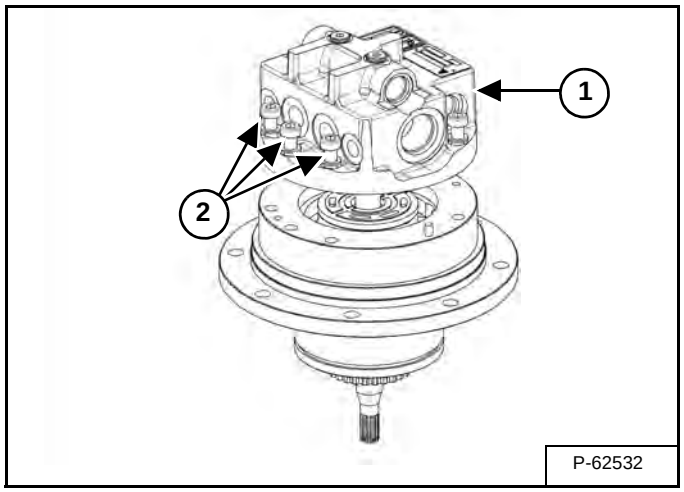
Install the needle bearing (Item 1) **[Figure 20-70-36]** in the cover so the bearing edge extends from the face of the cover 2,5 - 2,8 mm (0.98 - 0.110 in).

Install the large O-ring (Item 2), small O-rings (Item 3) and pin (Item 4) **[Figure 20-70-36]** in the cover.

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Assembly (Cont'd)

Figure 20-70-37

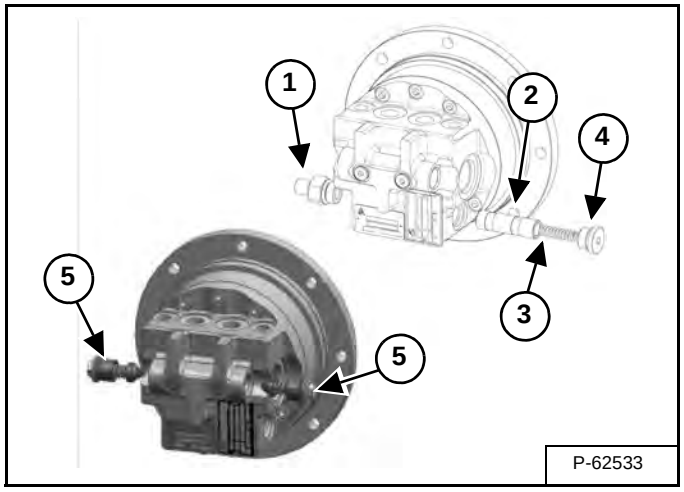


Install the cover (Item 1) **[Figure 20-70-37]**.

Install the six screws and washers (Item 2) **[Figure 20-70-37]**.

Tighten the screws in a crisscross manner to 40 - 50 N•m (30 - 37 ft-lb) torque.

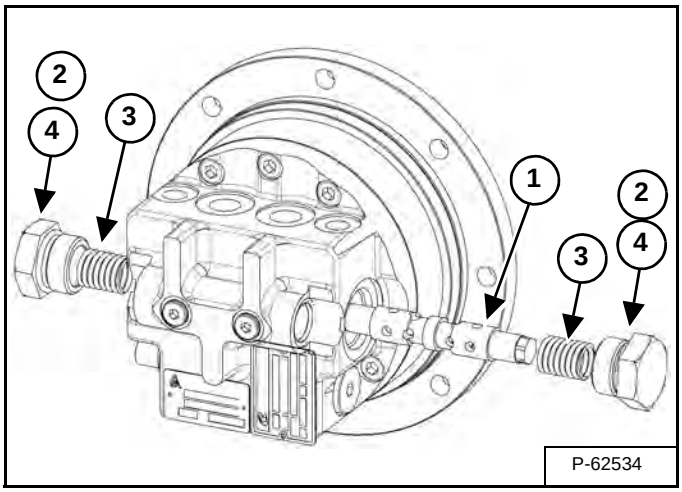
Figure 20-70-38



Install the plug (Item 1), piston valve (Item 2), springs (Item 3) and plug (Item 4) **[Figure 20-70-38]**.

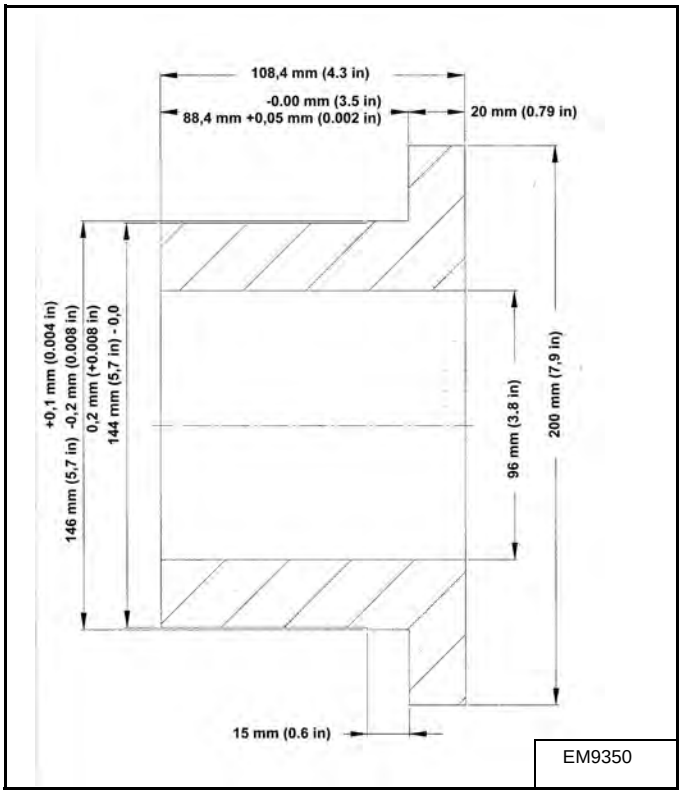
Install the valves (Item 5) **[Figure 20-70-38]** in the motor cover.

Figure 20-70-39



Install the counterbalance valve (Item 1), washers (Item 2), springs (Item 3) and plugs (Item 4) **[Figure 20-70-39]**.

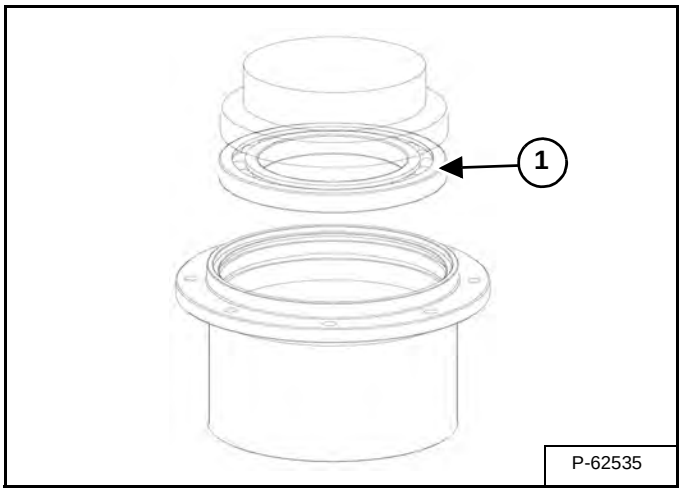
Figure 20-70-40



Dealer Copy -- Not for Resale

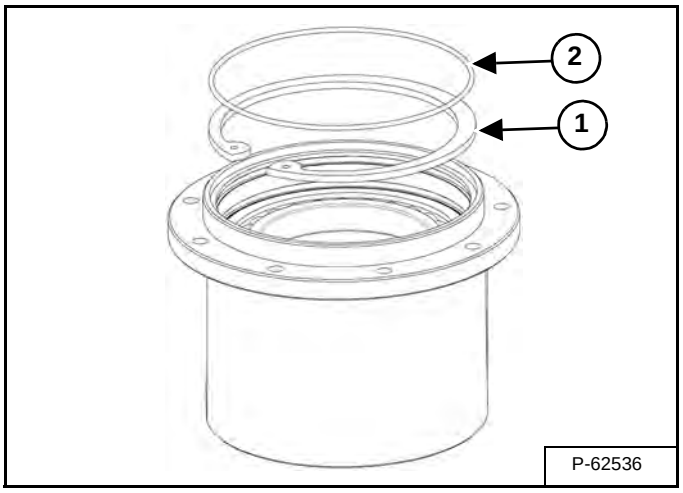
Assembly (Cont'd)

Figure 20-70-41



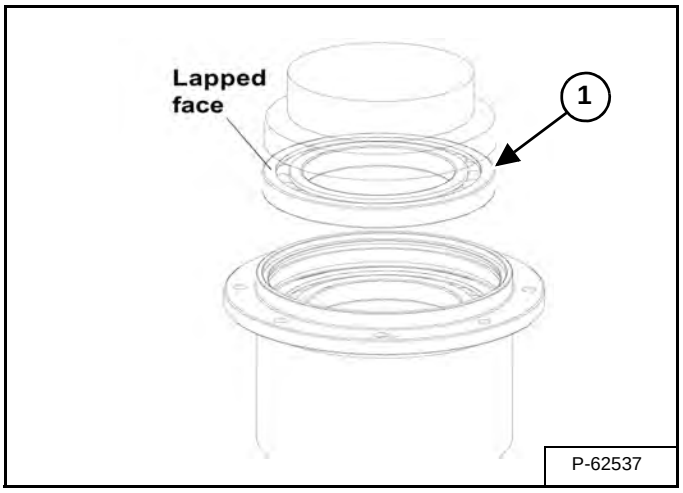
Install the ball bearing (Item 1) **[Figure 20-70-41]** using the bearing installation tool **[Figure 20-70-40]**.

Figure 20-70-42



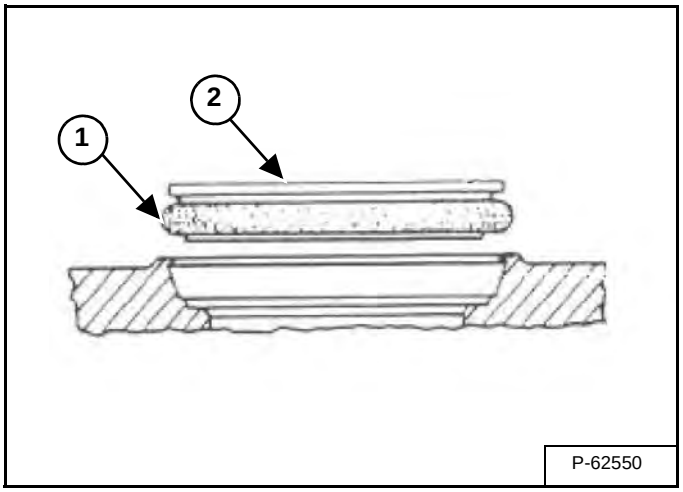
Install the retaining ring (Item 1) and O-ring (Item 2) **[Figure 20-70-42]**.

Figure 20-70-43



Using the bearing installation tool **[Figure 20-70-40]**, install the second bearing (Item 1) **[Figure 20-70-43]** keeping the lapped face up. Use extreme care not to damage the lapped face of the bearing.

Figure 20-70-44



Install the O-ring (Item 1) **[Figure 20-70-44]** on the seal ring (Item 2) **[Figure 20-70-44]**.

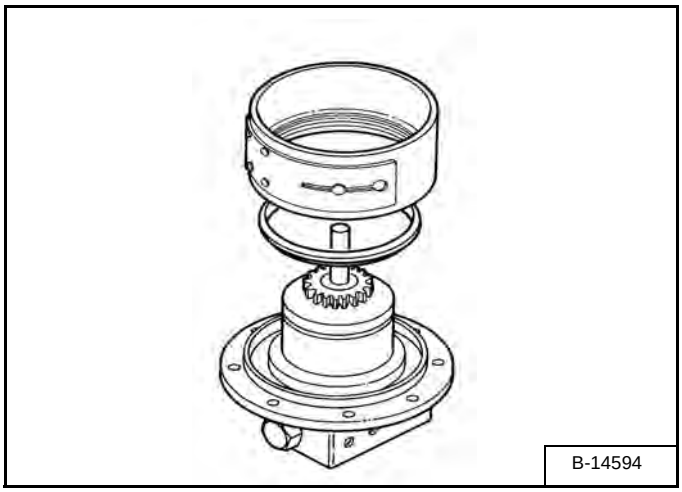
NOTE: Inspect the seal ring for burrs before installing the O-ring. Install the seal ring making sure it is not twisted. To remove any twists, gently pull a section of the O-ring and let it snap back.

The O-ring, seal ring and motor assembly must be clean and free of any dust, oil film or foreign matter.

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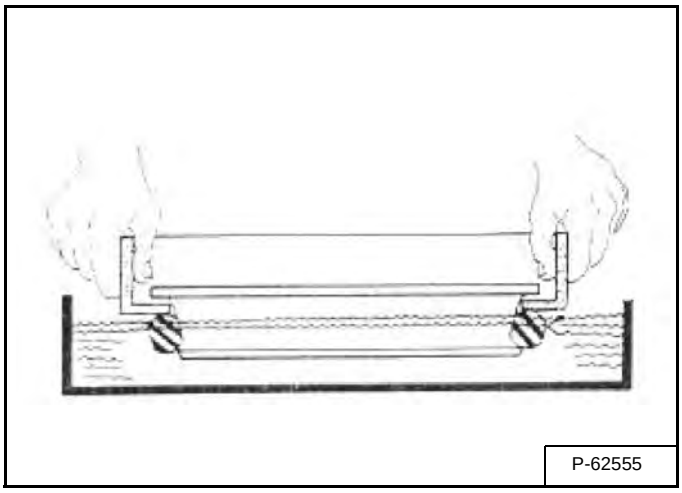
Assembly (Cont'd)

Figure 20-70-45



Install the seal seating tool (MEL1468) on the seal ring **[Figure 20-70-45]**.

Figure 20-70-46



The seal ring assembly **[Figure 20-70-46]** must be lubricated with alcohol, so the O-ring will slip past the housing retaining ring and seal uniform in the motor housing radius.

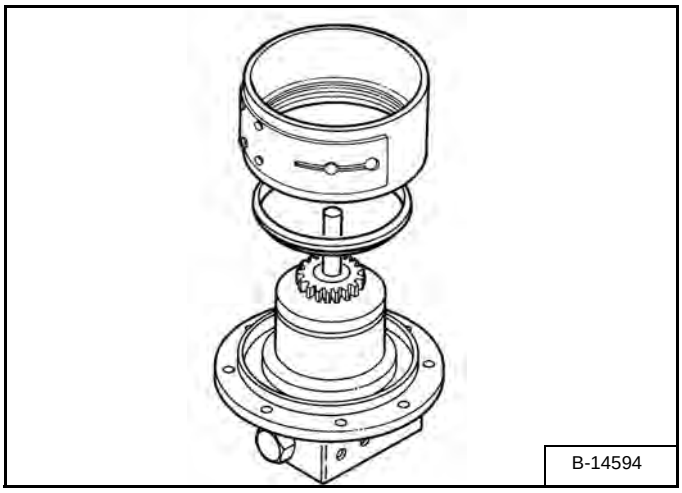
The O-ring **[Figure 20-70-46]** on the seal ring assembly must be lubricated with alcohol.

This will allow the O-ring to slide on the motor housing sealing surface without twisting.

Dip the O-ring **[Figure 20-70-46]** and seal ring assembly in a pan of alcohol.

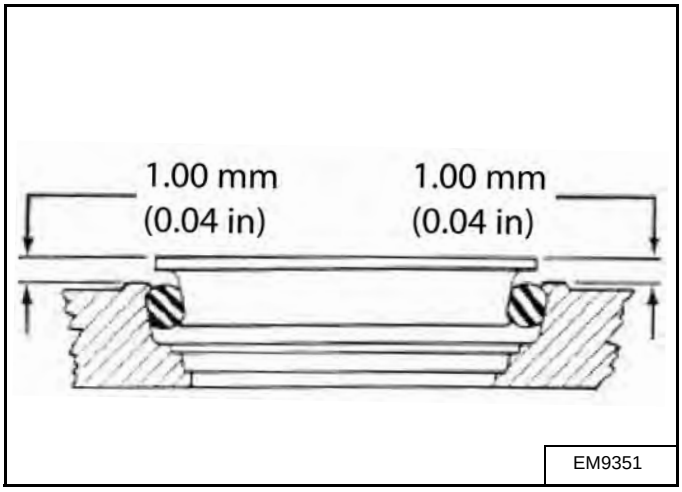
Shake off the excess alcohol and install the seal ring assembly on the motor **[Figure 20-70-46]**.

Figure 20-70-47



Use firm even pressure on the installation tool (MEL1468) to pop the O-ring into the motor housing **[Figure 20-70-47]**.

Figure 20-70-48



After the seal ring is installed, check the stand out height **[Figure 20-70-48]** 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.

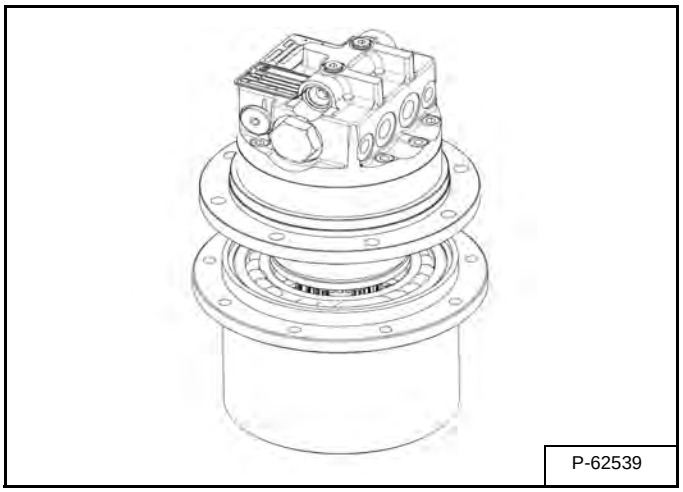
Apply a light film of oil to the seal ring and lapped face of the bearing.

NOTE: Do not get any oil on the O-ring.

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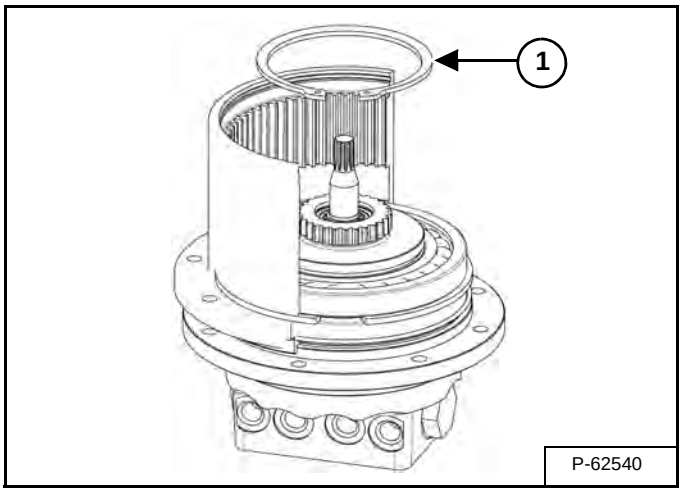
Assembly (Cont'd)

Figure 20-70-49



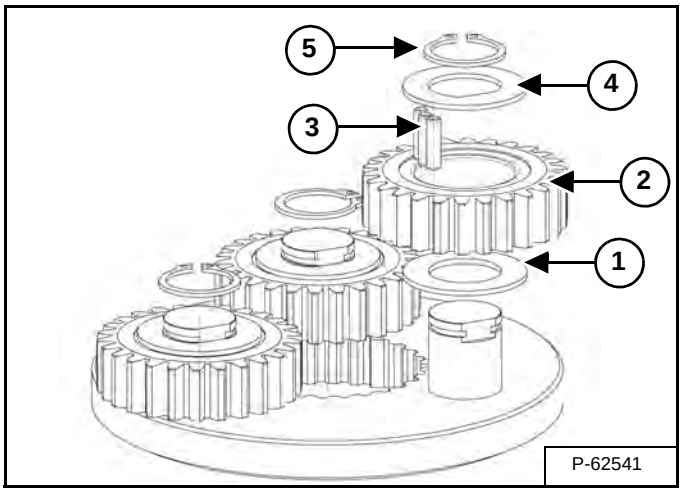
Press the reduction unit and motor assembly into the seat of the bearings **[Figure 20-70-49]**.

Figure 20-70-50



Install the external snap ring (Item 1) **[Figure 20-70-50]** in the motor reduction unit.

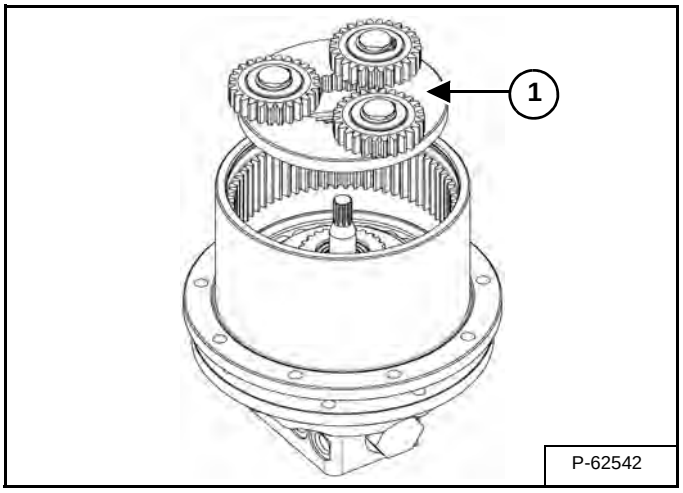
Figure 20-70-51



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 20-70-51]**.

NOTE: Install the snap rings so the opening of the snap ring is towards the outside.

Figure 20-70-52

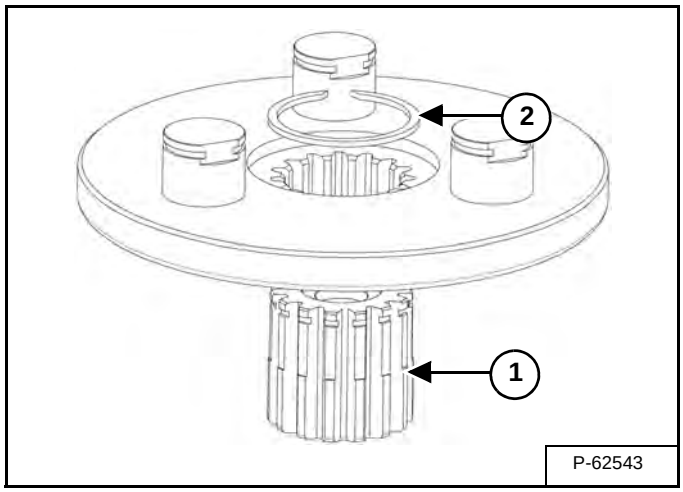


Install the planetary assembly (Item 1) **[Figure 20-70-52]**.

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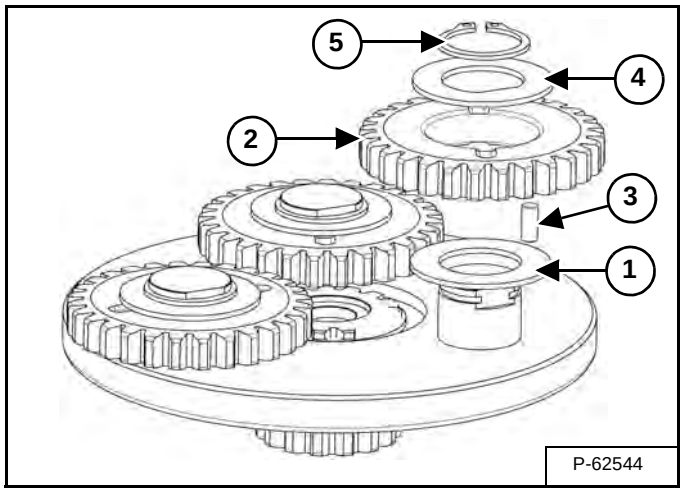
Assembly (Cont'd)

Figure 20-70-53



Install the sun gear (Item 1) into the planetary carrier and lock with the retaining ring (Item 2) **[Figure 20-70-53]**.

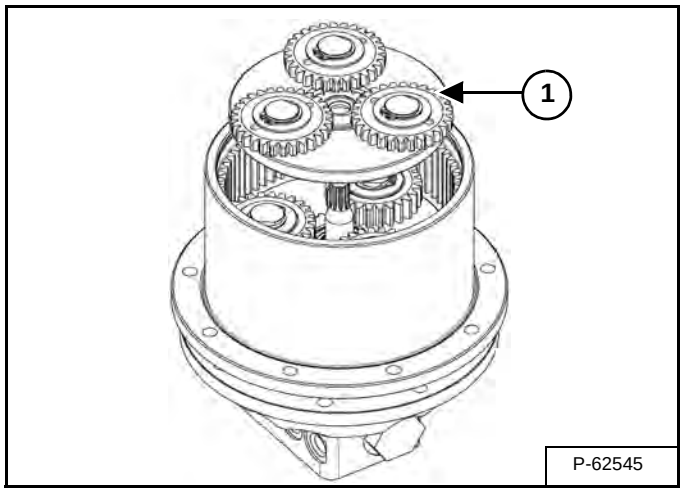
Figure 20-70-54



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 20-70-54]**.

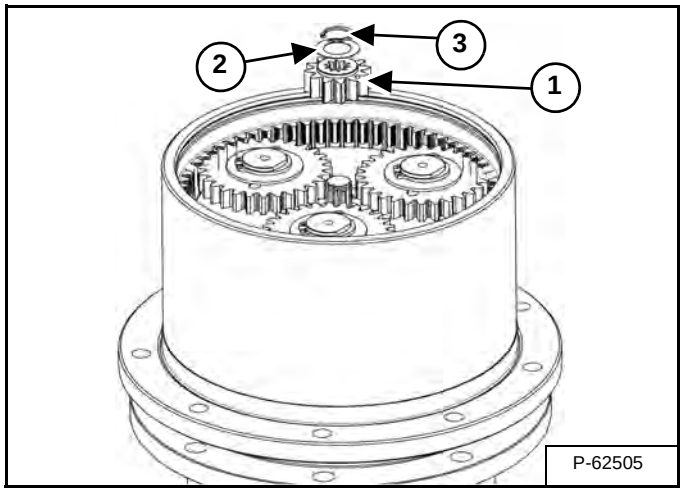
NOTE: Install the snap rings so the opening of the snap ring is towards the outside.

Figure 20-70-55



Install the outer planetary assembly (Item 1) **[Figure 20-70-55]**.

Figure 20-70-56

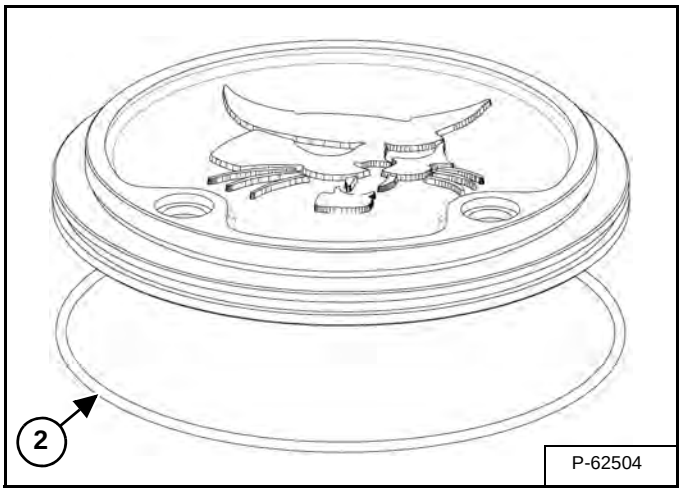


Install the sun gear (Item 1), shims (theoretical shimming 0,5 mm [0.02 in]) (Item 2), and retaining ring (Item 3) **[Figure 20-70-56]**.

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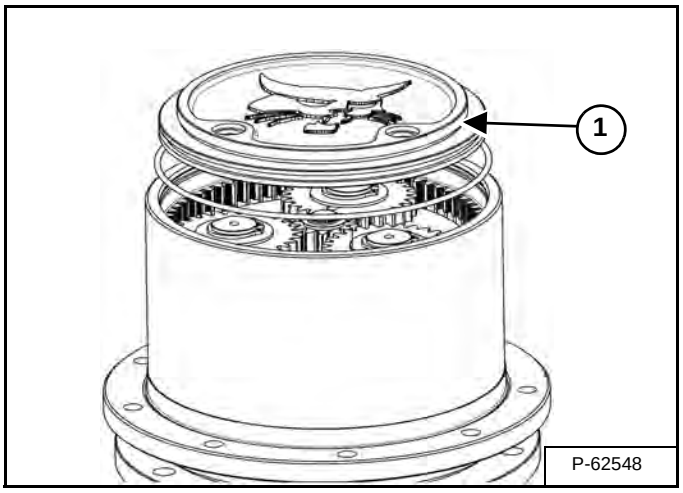
Assembly (Cont'd)

Figure 20-70-57



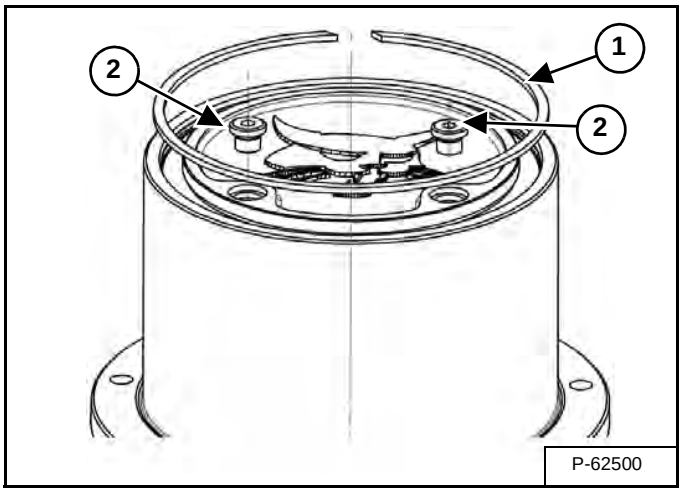
Install the O-ring (Item 1) **[Figure 20-70-57]** on the cover.

Figure 20-70-58



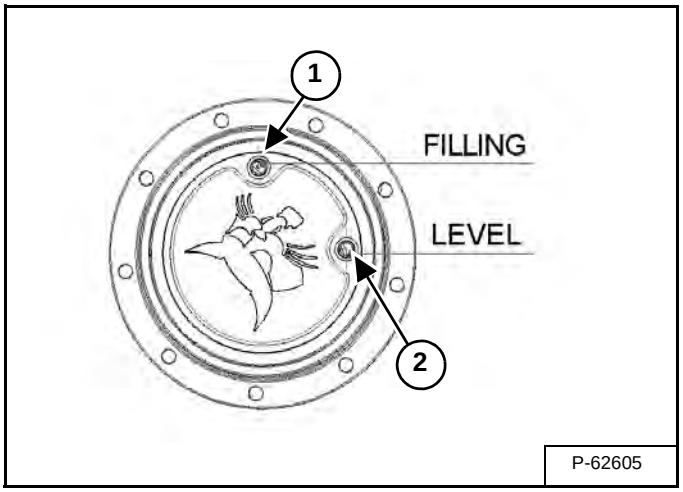
Install the cover (Item 1) **[Figure 20-70-58]** in the housing.

Figure 20-70-59



Install the snap ring (Item 1) **[Figure 20-70-59]** securing the reduction gear cover.

Figure 20-70-60



Add 0,4 L (0.42 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 20-70-60]**.

Install and tighten the two plugs (Item 2) **[Figure 20-70-59]**.

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SWIVEL JOINT (S/N 133P14286 & ABOVE, B4K911001 & ABOVE AND B4PD11001 & ABOVE)

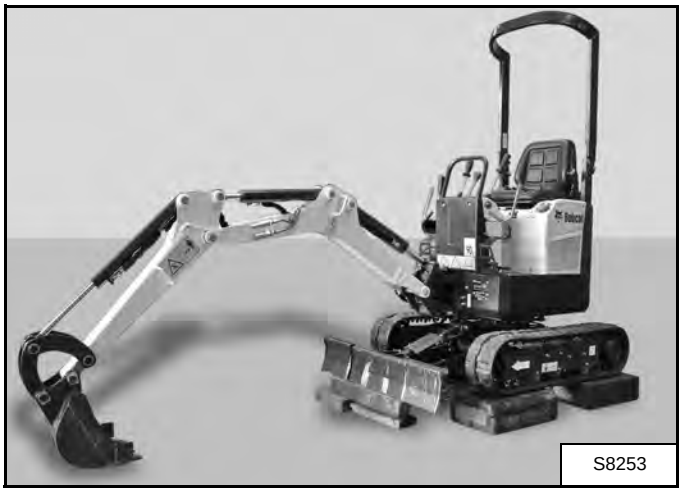
Description

The swivel joint is located under the floor panels and mounted to the upperstructure or undercarriage. The swivel joint directs hydraulic fluid to the undercarriage components while allowing the upperstructure to rotate.

Removal And Installation

Expand the track frame fully.

Figure 20-80-1



Place blocks under the excavator tracks and blade **[Figure 20-80-1]**.

Lower the boom / bucket to the ground.

Relieve hydraulic pressure.

Remove the muffler. (See Removal And Installation on Page 60-20-1.)

Remove the floor panels. (See FLOOR PANELS on Page 40-120-1.)

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-3.)

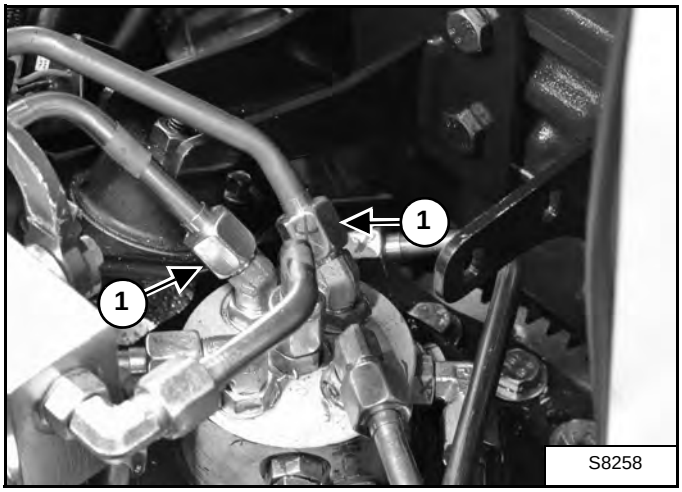
WARNING

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 physician familiar with this injury is not received immediately.

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Mark all hoses and tubelines for ease of assembly.

Figure 20-80-2



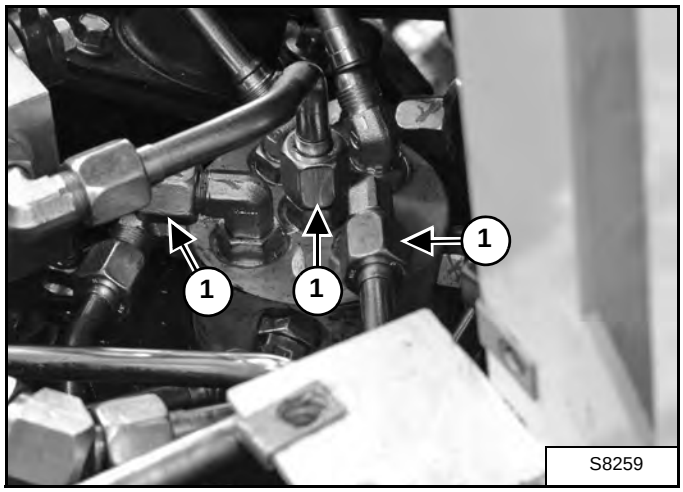
Remove the two tubelines (Item 1) **[Figure 20-80-2]** from the top of the swivel joint.

Dealer Copy -- Not for Resale

SWIVEL JOINT (S/N 133P14286 & ABOVE, B4K911001 & ABOVE AND B4PD11001 & ABOVE) (CONT'D)

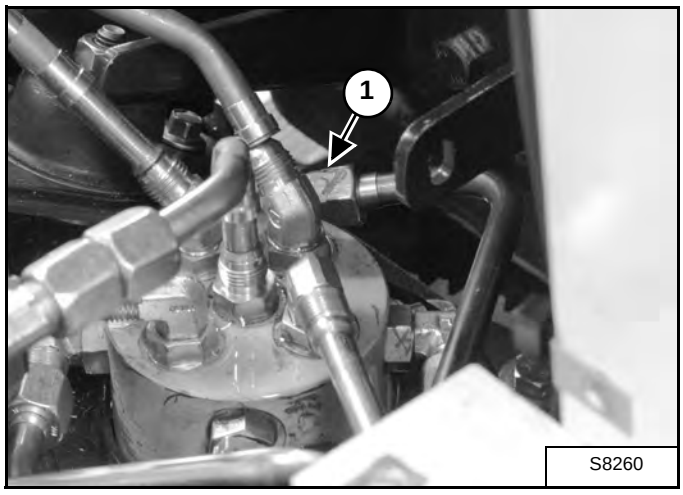
Removal And Installation (Cont'd)

Figure 20-80-3



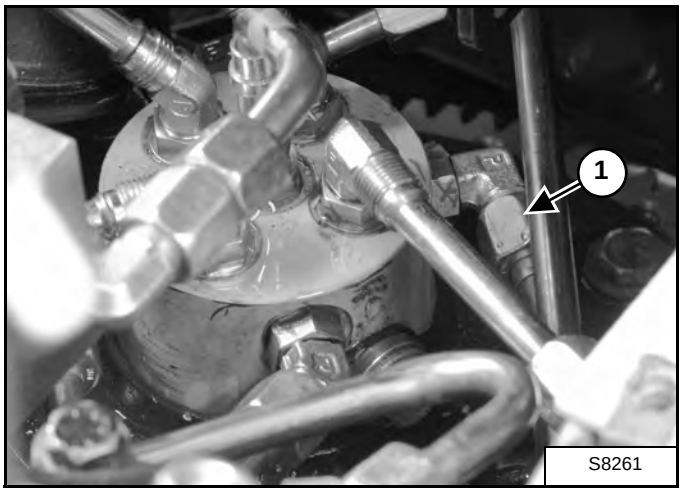
Remove the three tubelines (Item 1) **[Figure 20-80-3]** from the top of the swivel joint.

Figure 20-80-4



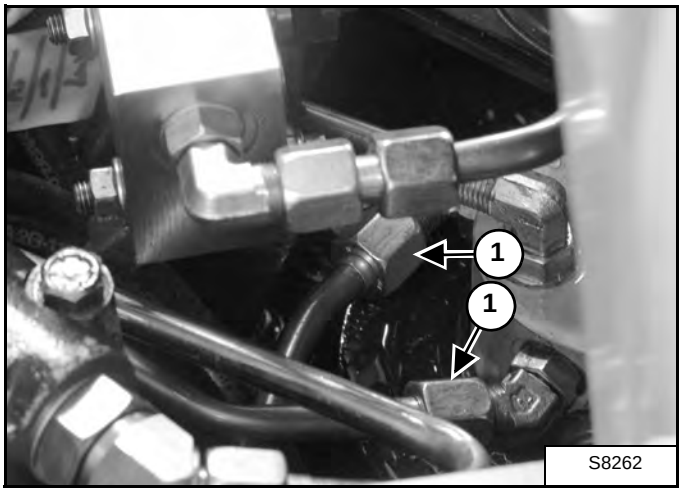
Remove the tubeline (Item 1) **[Figure 20-80-4]** from the side of the swivel joint.

Figure 20-80-5



Remove the tubeline (Item 1) **[Figure 20-80-5]** from the side of the swivel joint.

Figure 20-80-6



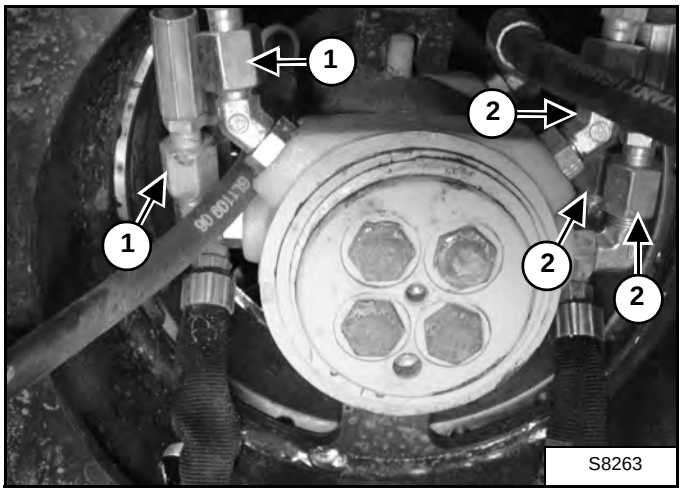
Remove the two tubelines (Item 1) **[Figure 20-80-6]** from the side of the swivel joint.

Remove the track frame expansion cylinder. (See Block Removal And Installation on Page 20-150-1.)

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Removal And Installation (Cont'd)

Figure 20-80-7

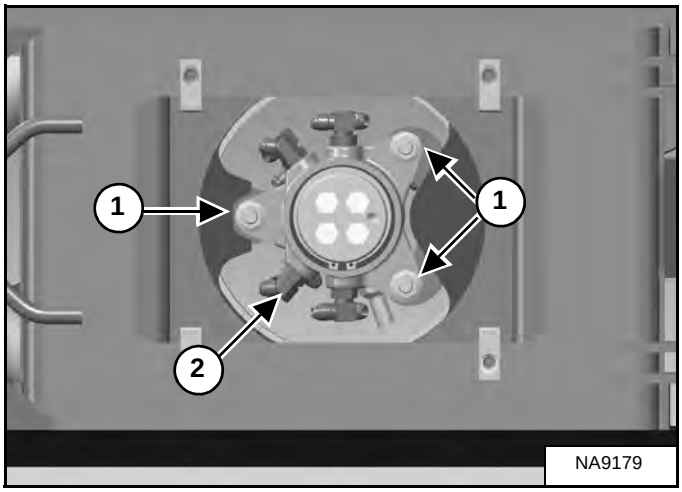


Remove the six hoses (Item 1) **[Figure 20-80-7]** from the left side of the swivel joint.

Remove the six hoses (Item 2) **[Figure 20-80-7]** 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 three nuts are being removed.

Figure 20-80-8



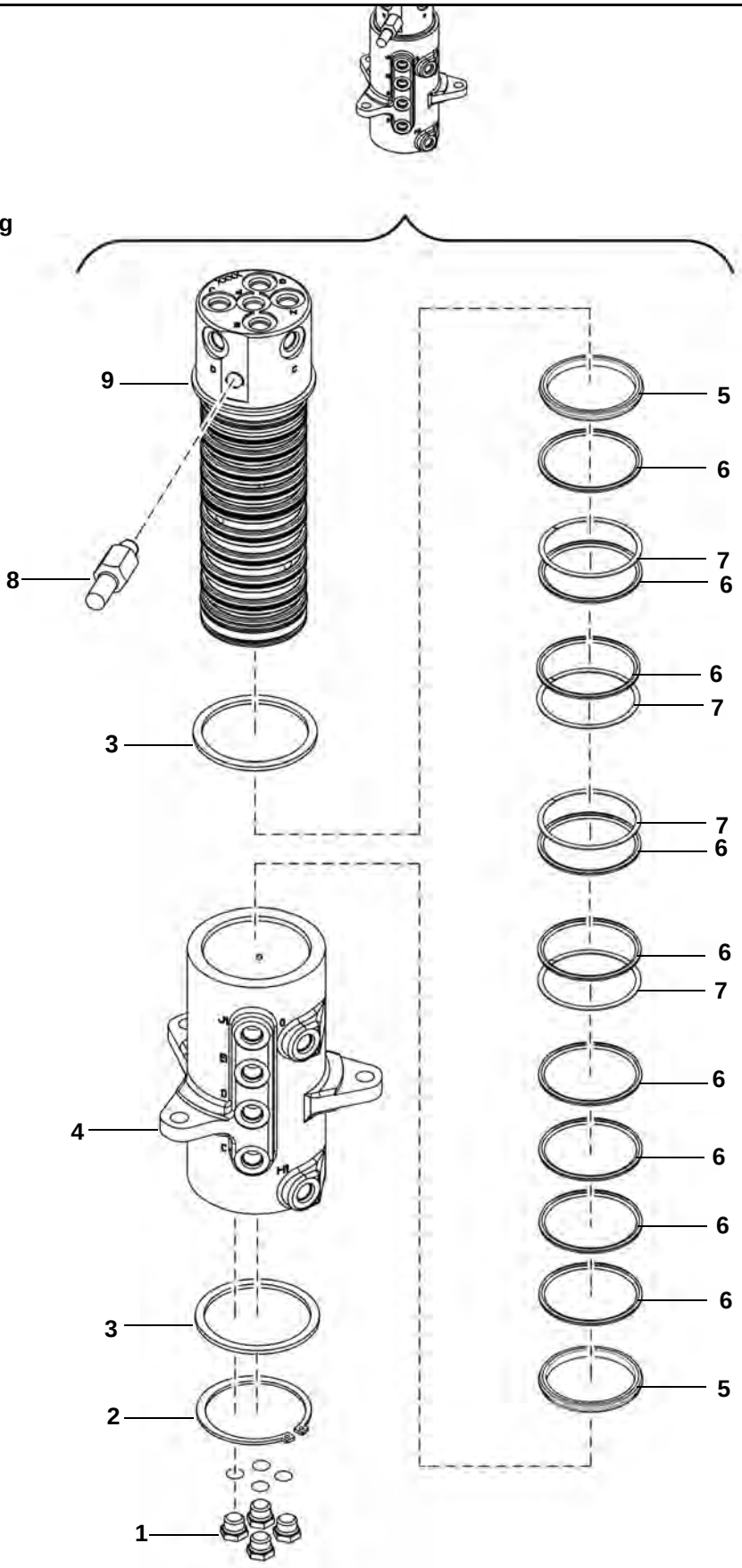
While supporting the swivel joint, remove the nuts (Item 1) **[Figure 20-80-8]**.

Remove the swivel joint Item 2) **[Figure 20-80-8]** out through the bottom of the excavator.

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Parts Identification

1. Plug
2. Snap Ring
3. Washer
4. Housing
5. Seal
6. Seal
7. Back-up Ring
8. Stop
9. Spool

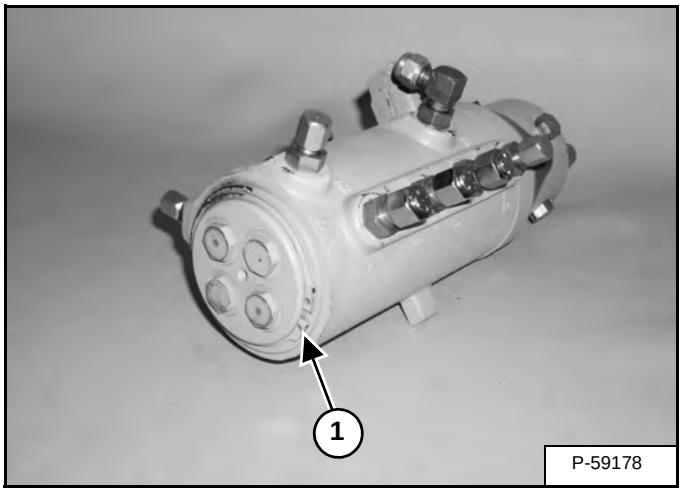


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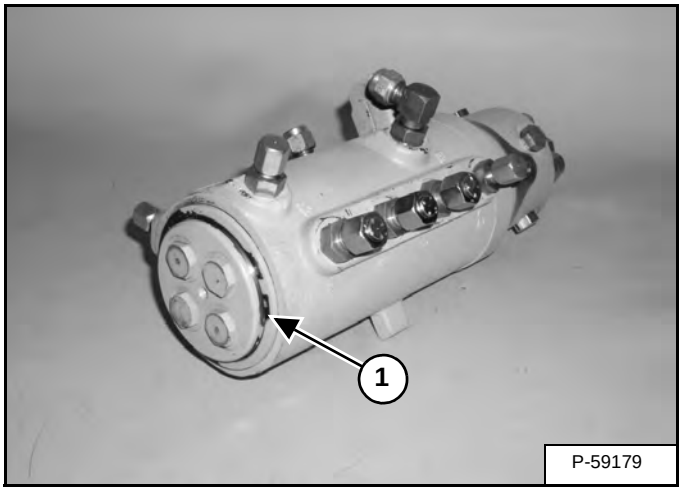
Disassembly

Figure 20-80-9



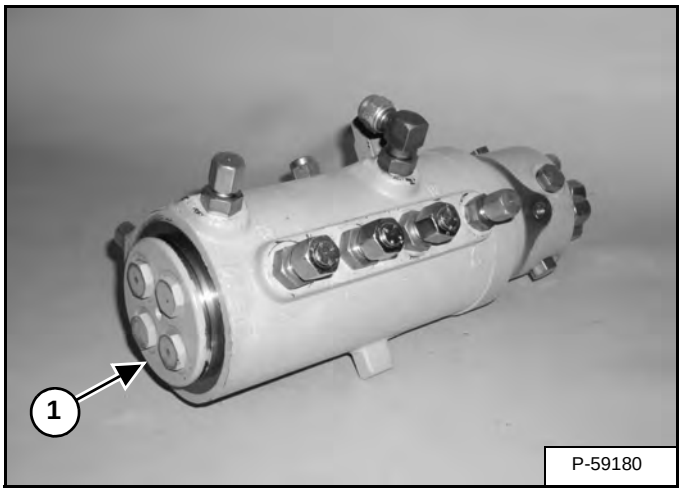
Remove the snap ring (Item 1) **[Figure 20-80-9]** from the bottom of the swivel joint.

Figure 20-80-10



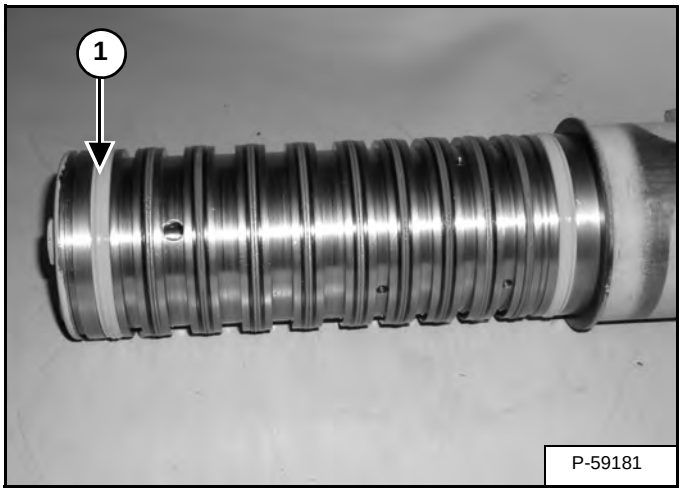
Remove the nylon washer (Item 1) **[Figure 20-80-10]**.

Figure 20-80-11



Tap the end of the rotor (Item 1) **[Figure 20-80-11]** with a rubber mallet to drive the rotor out of the housing.

Figure 20-80-12

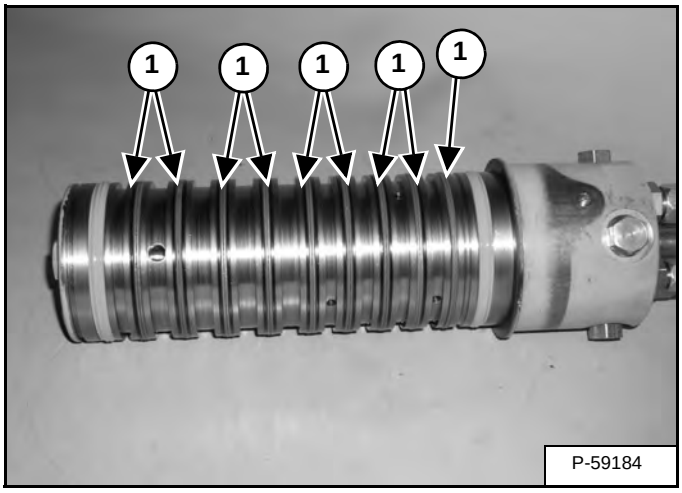


Remove the outer and inner seals (Item 1) **[Figure 20-80-12]**.

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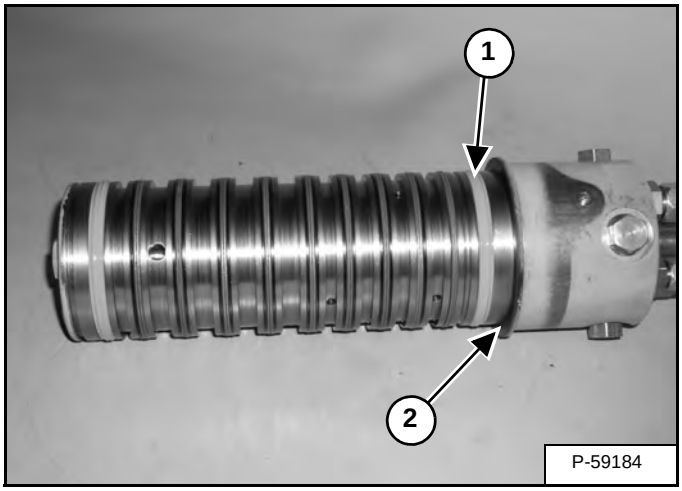
Disassembly (Cont'd)

Figure 20-80-13



Remove the seals, back-up seals and O-rings (Item 1) **[Figure 20-80-13]**.

Figure 20-80-14



Remove the outer and inner seals (Item 1). Remove the nylon washer (Item 2) **[Figure 20-80-14]**.

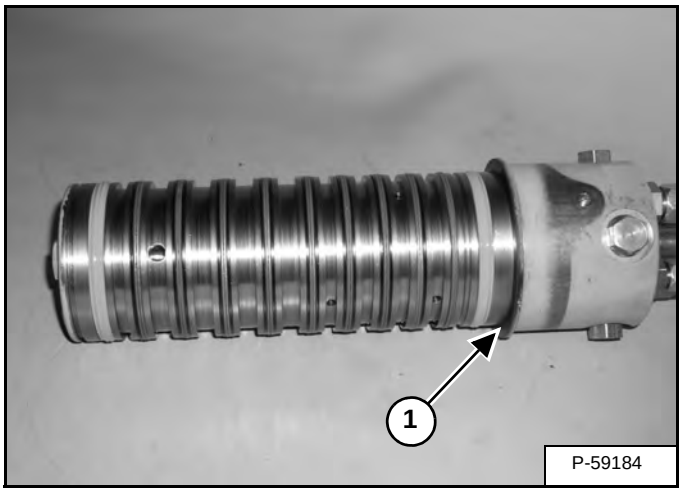
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Assembly

Clean all parts in solvent and dry with compressed air.

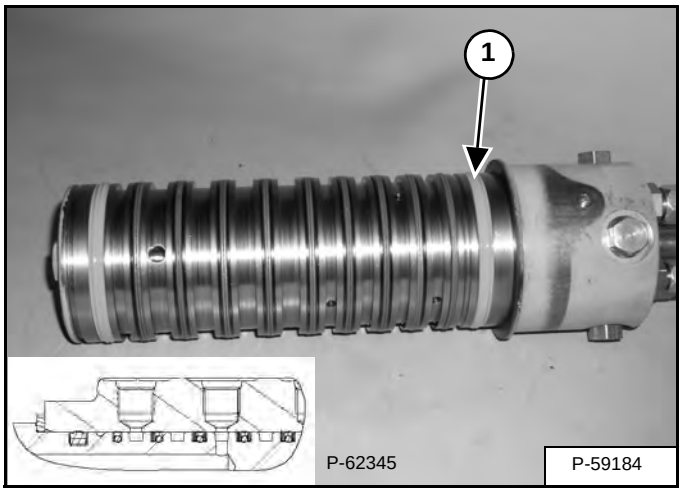
Inspect the rotor and housing for scratches or wear that could cause internal leakage. Always install new seals and back-up seals. Lubricate all seals and back-up seals with clean hydraulic fluid before installation.

Figure 20-80-15



Install the nylon washer (Item 1) **[Figure 20-80-15]**.

Figure 20-80-16

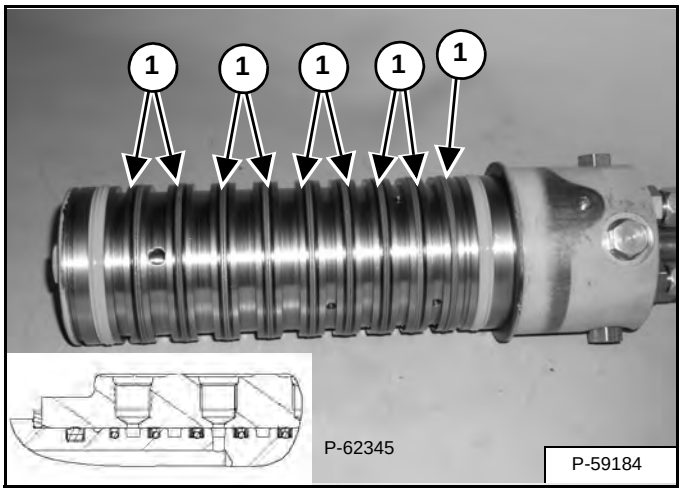


Heat the seals in hydraulic fluid for 3 minutes at 54°C (130°F).

Install the inner and outer seals (Item 1) **[Figure 20-80-16]**.

NOTE: The inner and outer seal are serviceable as one part number.

Figure 20-80-17



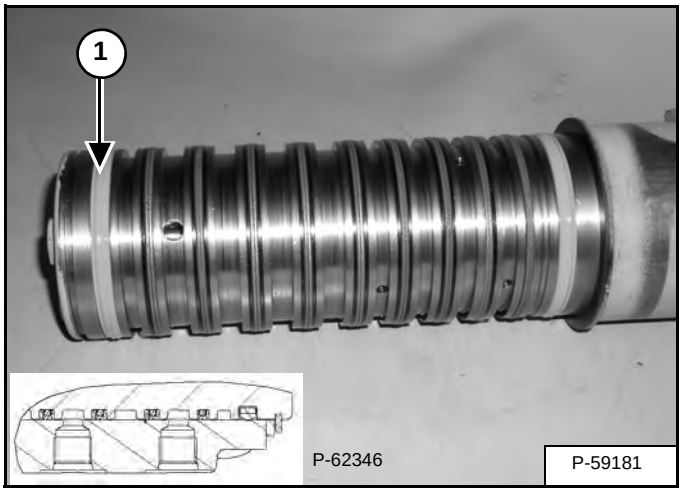
Install the O-rings under the seals (Item 1) **[Figure 20-80-17]**.

Heat the seals in hydraulic fluid for 3 minutes at 54°C (130°F).

Install the seals and back-up seals (Item 1) **[Figure 20-80-17]**.

NOTE: The seal and O-ring are serviceable as one part number.

Figure 20-80-18



Heat the seals in hydraulic fluid for 3 minutes at 54°C (130°F).

Install the inner and outer seals (Item 1) **[Figure 20-80-18]**.

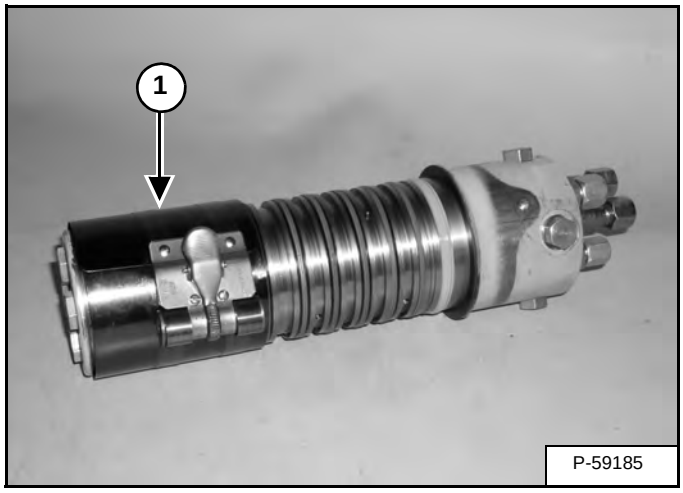
NOTE: The inner and outer seal are serviceable as one part number.

Dealer Copy -- Not for Resale

SWIVEL JOINT (S/N A33P14286 & ABOVE AND B4K911001 & ABOVE) (CONT'D)

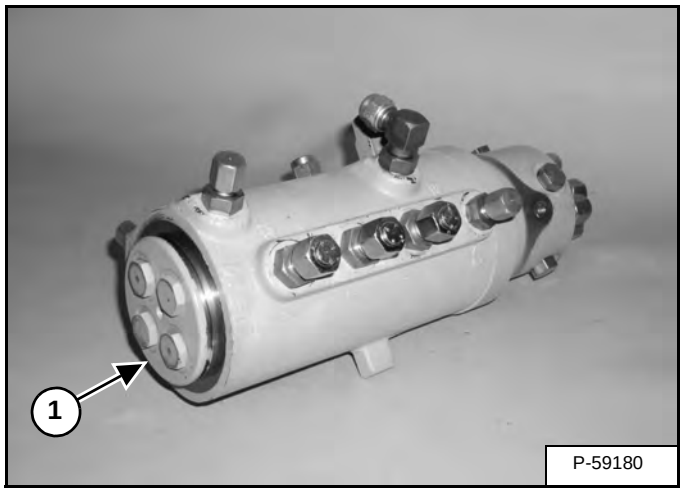
Assembly (Cont'd)

Figure 20-80-19



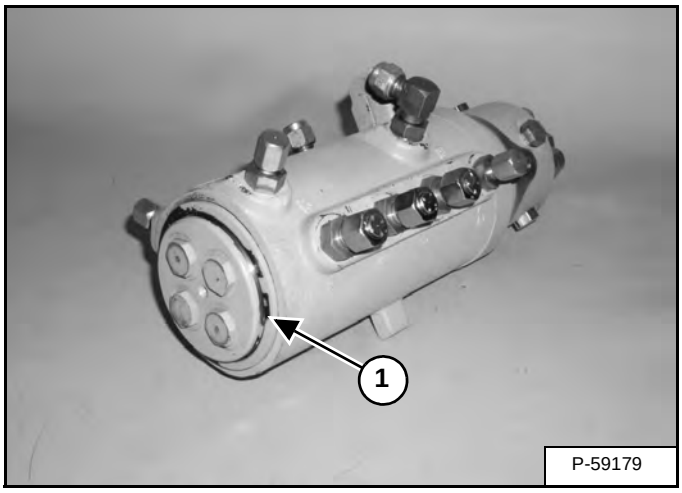
NOTE: A ring compressor (Item 1) [Figure 20-80-19] may be used to install the seals into the seal grove. Compress the seals for 3 minutes.

Figure 20-80-20



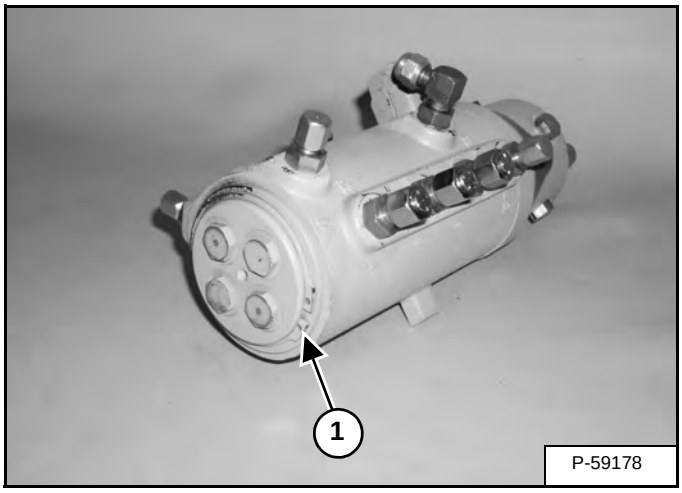
Apply hydraulic fluid to the rotor. Install the rotor (Item 1) **[Figure 20-80-20]** in the housing.

Figure 20-80-21



Install the nylon washer (Item 1) **[Figure 20-80-21]**.

Figure 20-80-22



Install the snap ring (Item 1) **[Figure 20-80-22]** from the bottom of the swivel joint.

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SWIVEL JOINT (S/N A33P13634 - A33P14285)

Description

The swivel joint is located under the floor panels and mounted to the upperstructure or undercarriage. The swivel joint directs hydraulic fluid to the undercarriage components while allowing the upperstructure to rotate.

Removal And Installation

Expand the track frame fully.

Figure 20-81-1



Place blocks under the excavator tracks and blade **[Figure 20-81-1]**.

Lower the boom / bucket to the ground.

Relieve hydraulic pressure.

Remove the muffler. (See Removal And Installation on Page 60-20-1.)

Remove the floor panels. (See FLOOR PANELS on Page 40-120-1.)

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-3.)

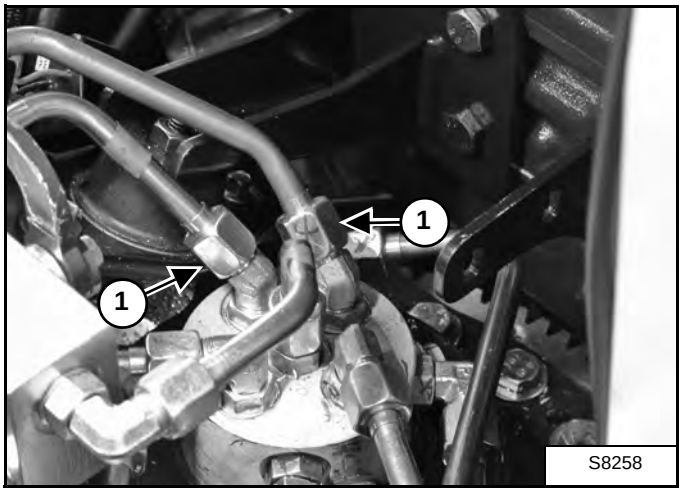
WARNING

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 physician familiar with this injury is not received immediately.

W-2145-0290

Mark all hoses and tubelines for ease of assembly.

Figure 20-81-2



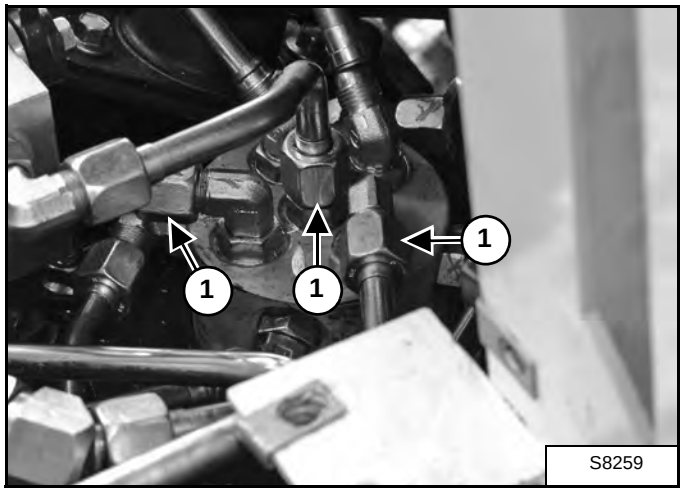
Remove the two tubelines (Item 1) **[Figure 20-81-2]** from the top of the swivel joint.

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SWIVEL JOINT (S/N A33P13634 - A33P14285) (CONT'D)

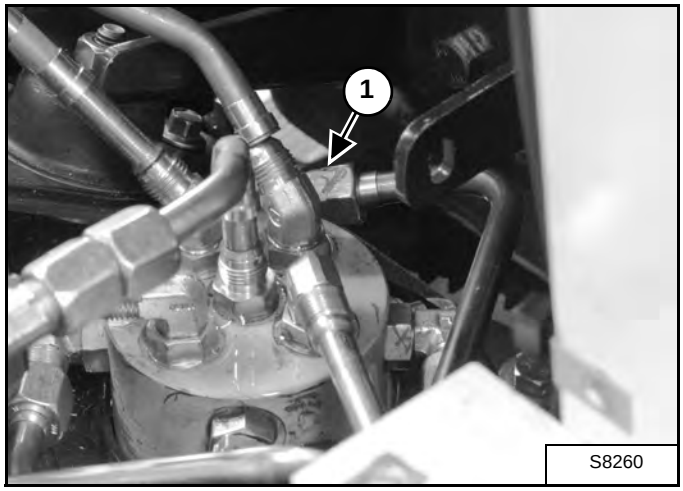
Removal And Installation (Cont'd)

Figure 20-81-3



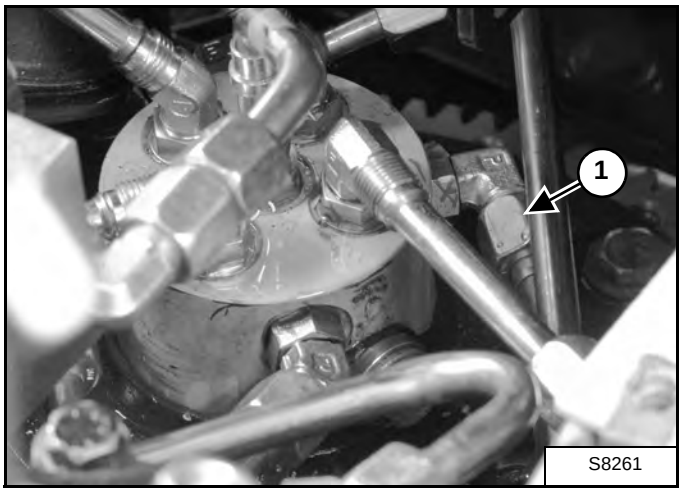
Remove the three tubelines (Item 1) **[Figure 20-81-3]** from the top of the swivel joint.

Figure 20-81-4



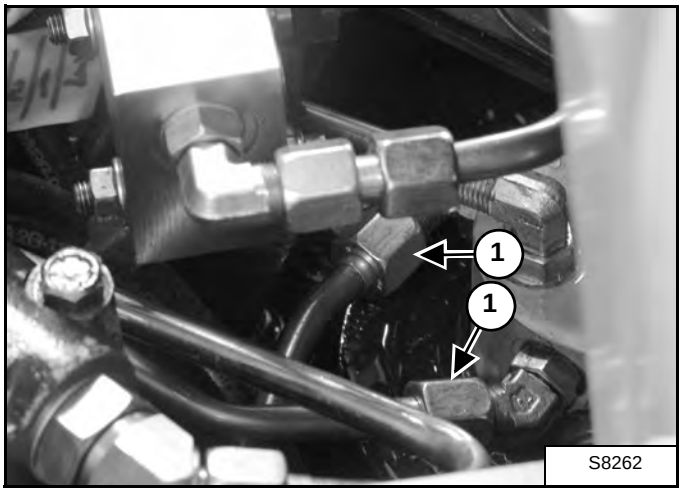
Remove the tubeline (Item 1) **[Figure 20-81-4]** from the side of the swivel joint.

Figure 20-81-5



Remove the tubeline (Item 1) **[Figure 20-81-5]** from the side of the swivel joint.

Figure 20-81-6



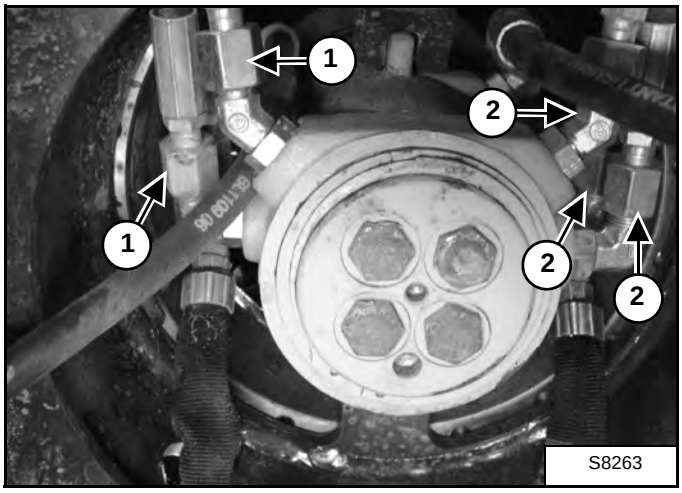
Remove the two tubelines (Item 1) **[Figure 20-81-6]** from the side of the swivel joint.

Remove the track frame expansion cylinder. (See Block Removal And Installation on Page 20-150-1.)

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Removal And Installation (Cont'd)

Figure 20-81-7

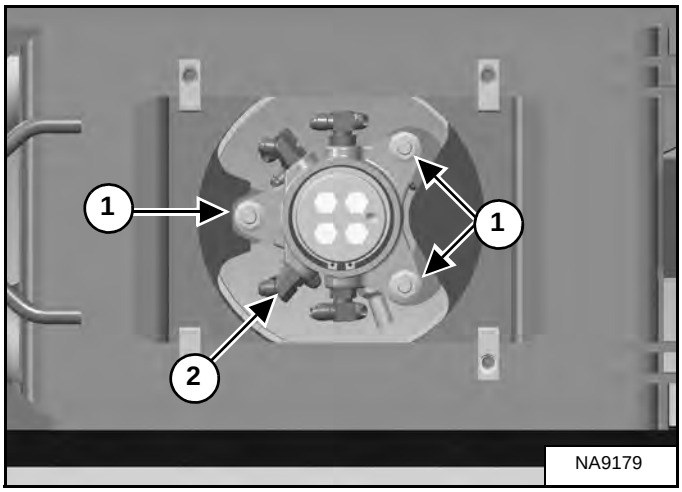


Remove the six hoses (Item 1) **[Figure 20-81-7]** from the left side of the swivel joint.

Remove the six hoses (Item 2) **[Figure 20-81-7]** 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 three nuts are being removed.

Figure 20-81-8



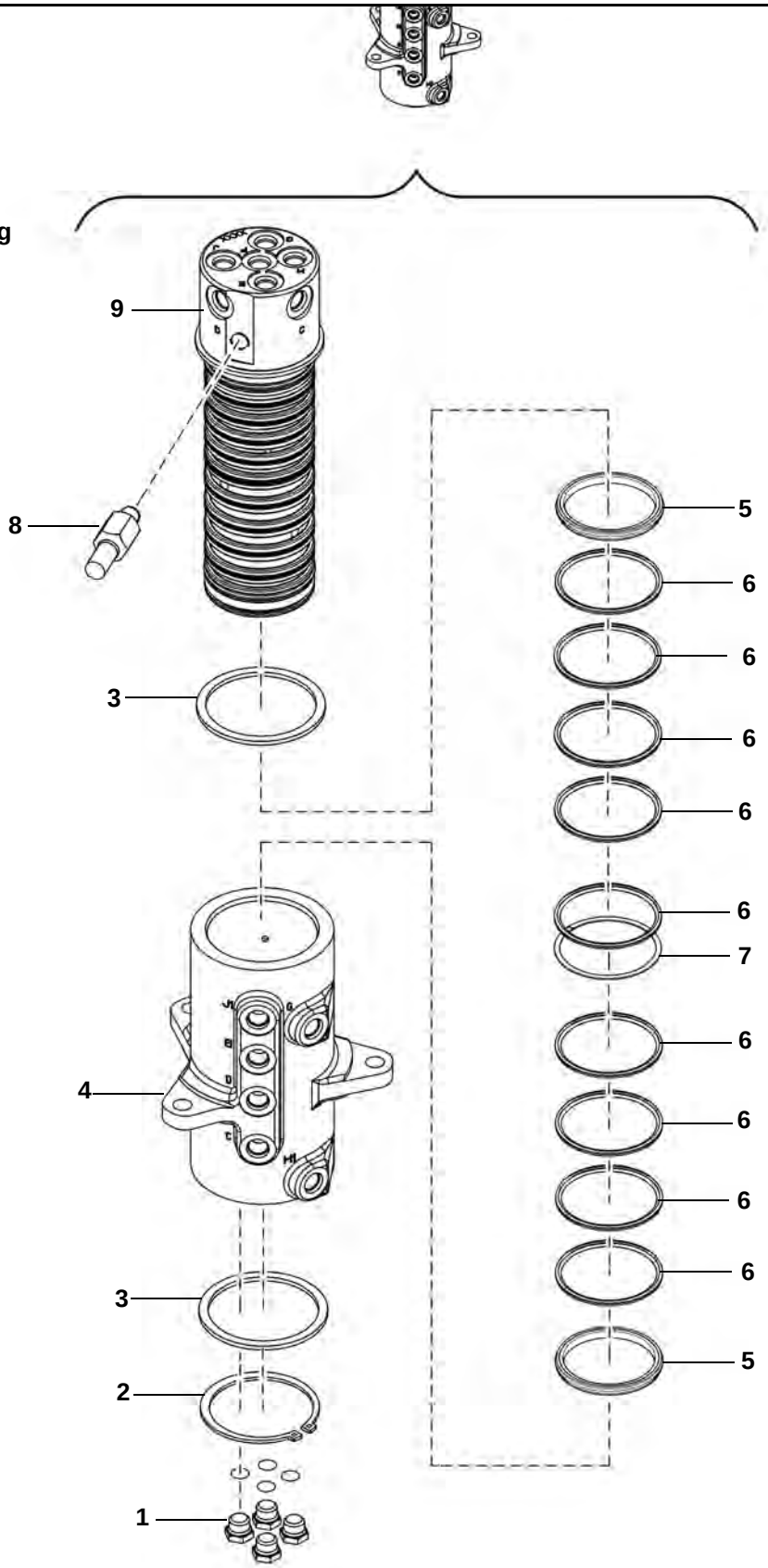
While supporting the swivel joint, remove th nuts (Item 1) **[Figure 20-81-8]**.

Slide the swivel joint out through the bottom of the excavator.

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Parts Identification

1. Plug
2. Snap Ring
3. Washer
4. Housing
5. Seal
6. Seal
7. Back-up Ring
8. Stop
9. Spool



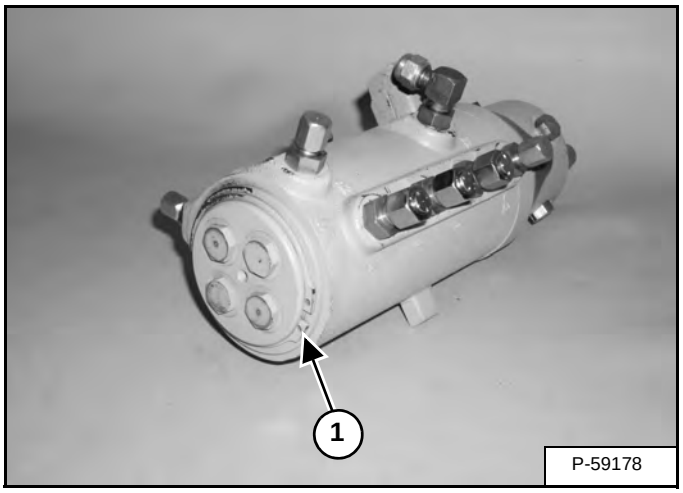
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Dealer Copy -- Not for Resale

SWIVEL JOINT (S/N A33P13634 - A33P14285) (CONT'D)

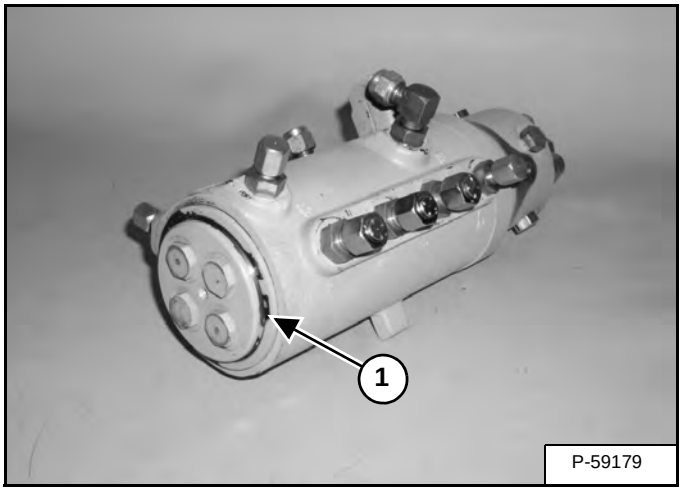
Disassembly

Figure 20-81-9



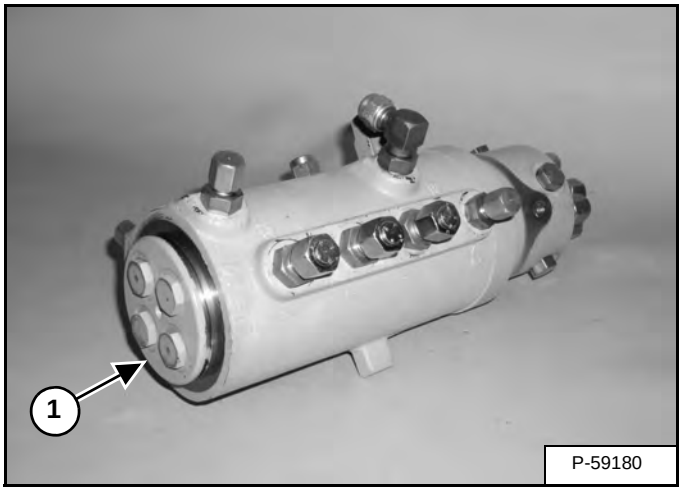
Remove the snap ring (Item 1) **[Figure 20-81-9]** from the bottom of the swivel joint.

Figure 20-81-10



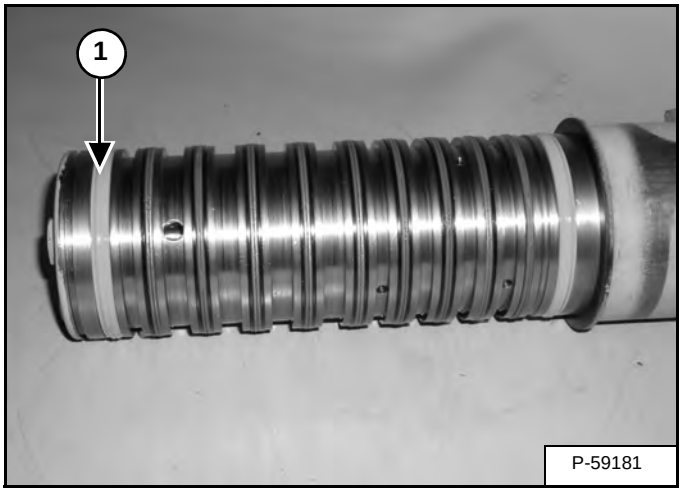
Remove the nylon washer (Item 1) **[Figure 20-81-10]**.

Figure 20-81-11



Tap the end of the rotor (Item 1) **[Figure 20-81-11]** with a rubber mallet to drive the rotor out of the housing.

Figure 20-81-12

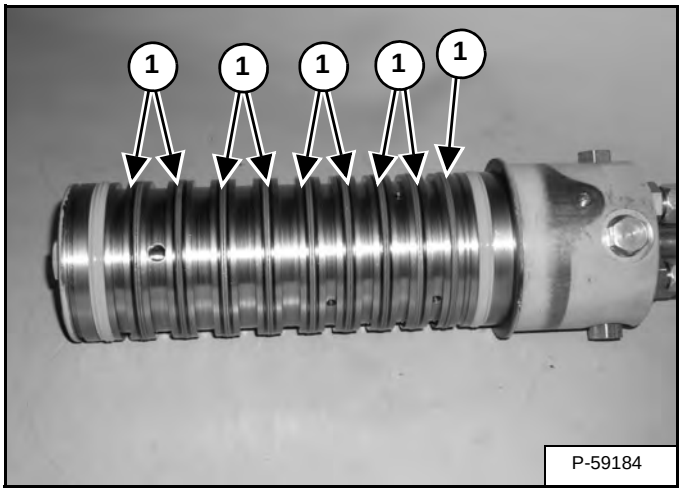


Remove the outer and inner seals (Item 1) **[Figure 20-81-12]**.

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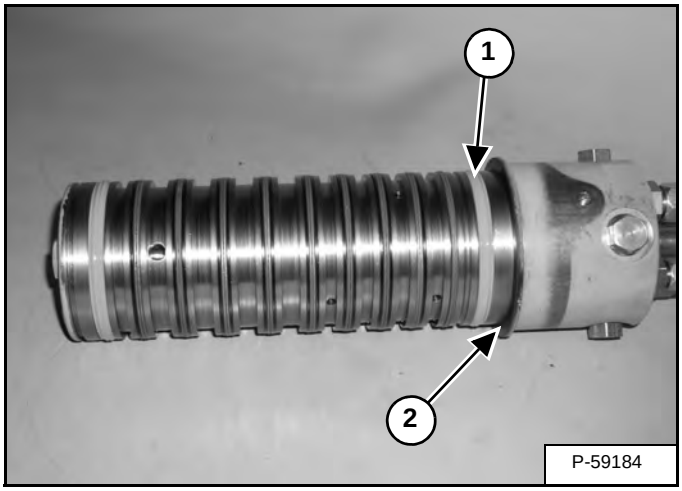
Disassembly (Cont'd)

Figure 20-81-13



Remove the seals, back-up seals and O-rings (Item 1) **[Figure 20-81-13]**.

Figure 20-81-14



Remove the outer and inner seals (Item 1). Remove the nylon washer (Item 2) **[Figure 20-81-14]**.

Dealer Copy -- Not for Resale

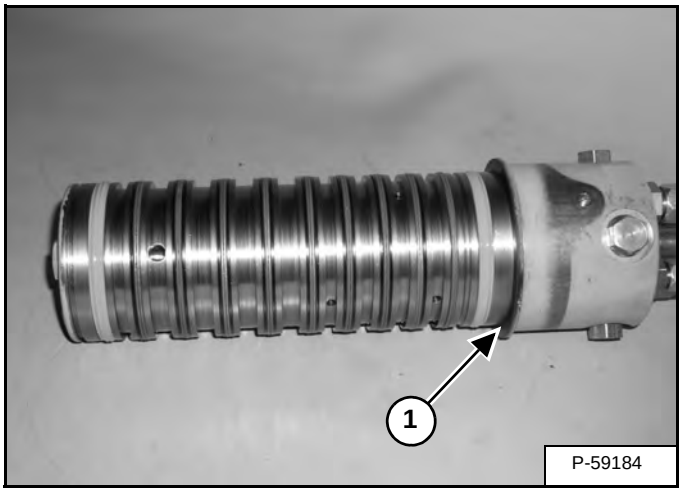
SWIVEL JOINT (S/N A33P13634 - A33P14285) (CONT'D)

Assembly

Clean all parts in solvent and dry with compressed air.

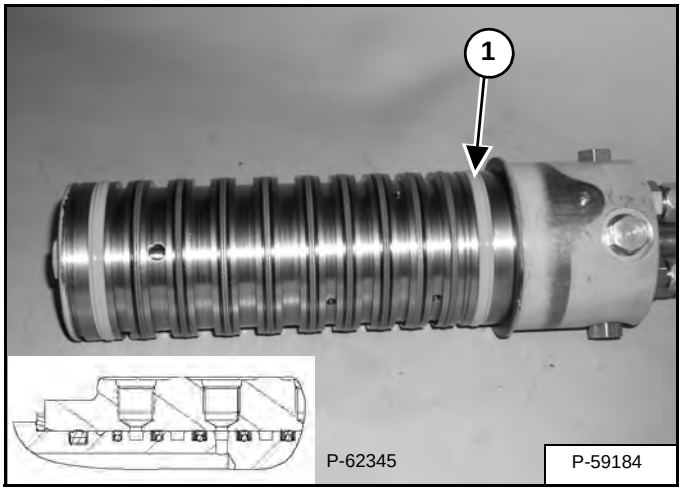
Inspect the rotor and housing for scratches or wear that could cause internal leakage. Always install new seals and back-up seals. Lubricate all seals and back-up seals with clean hydraulic fluid before installation.

Figure 20-81-15



Install the nylon washer (Item 1) **[Figure 20-81-15]**.

Figure 20-81-16

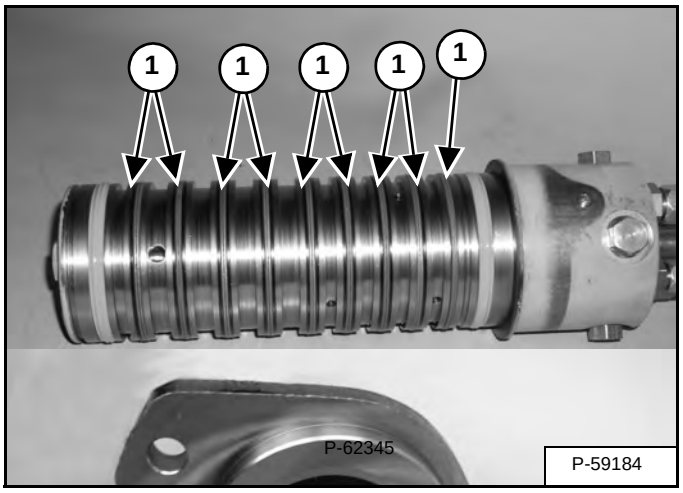


Heat the seals in hydraulic fluid for 3 minutes at 54°C (130°F).

Install the inner and outer seals (Item 1) **[Figure 20-81-16]**.

NOTE: The inner and outer seal are serviceable as one part number.

Figure 20-81-17



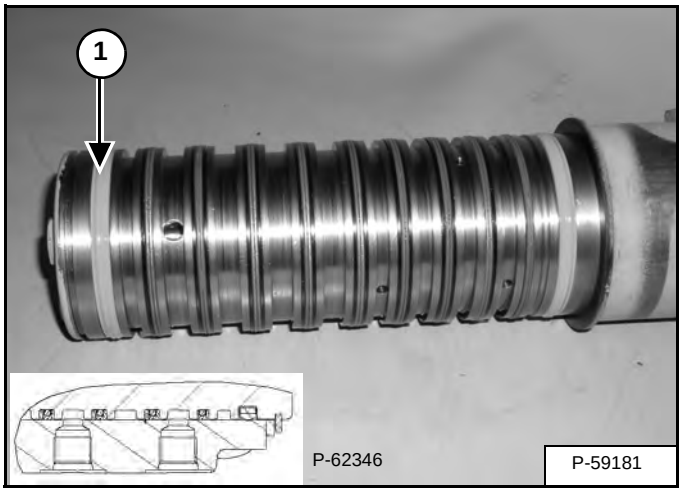
Install the O-rings under the seals (Item 1) **[Figure 20-81-17]**.

Heat the seals in hydraulic fluid for 3 minutes at 54°C (130°F).

Install the seals and back-up seals (Item 1) **[Figure 20-81-17]**.

NOTE: The seal and O-ring are serviceable as one part number.

Figure 20-81-18



Heat the seals in hydraulic fluid for 3 minutes at 54°C (130°F).

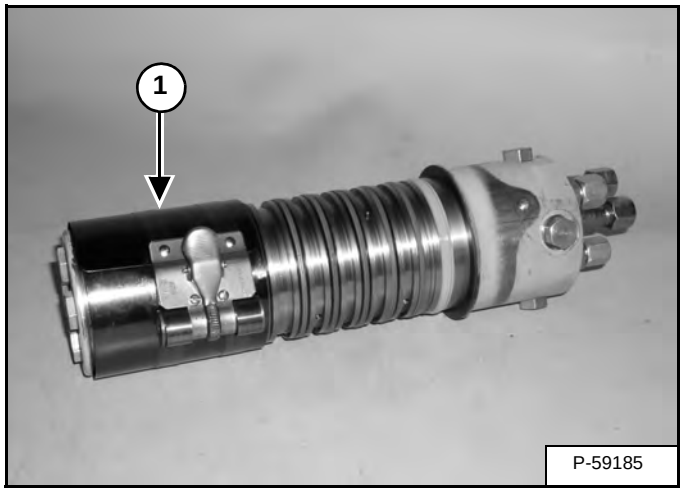
Install the inner and outer seals (Item 1) **[Figure 20-81-18]**.

NOTE: The inner and outer seal are serviceable as one part number.

Dealer Copy -- Not for Resale

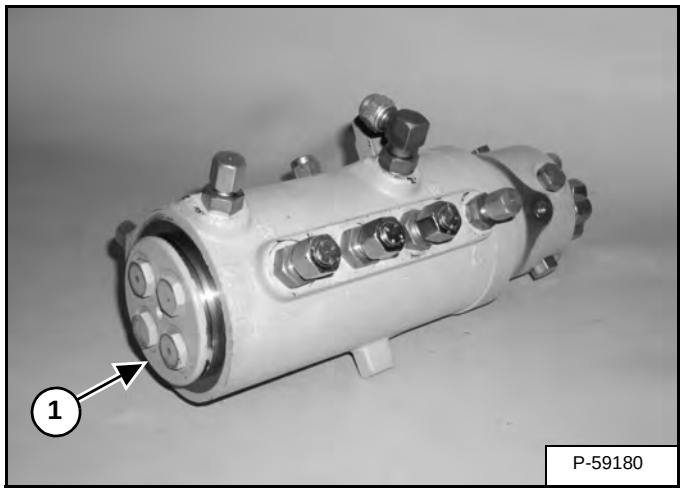
Assembly (Cont'd)

Figure 20-81-19



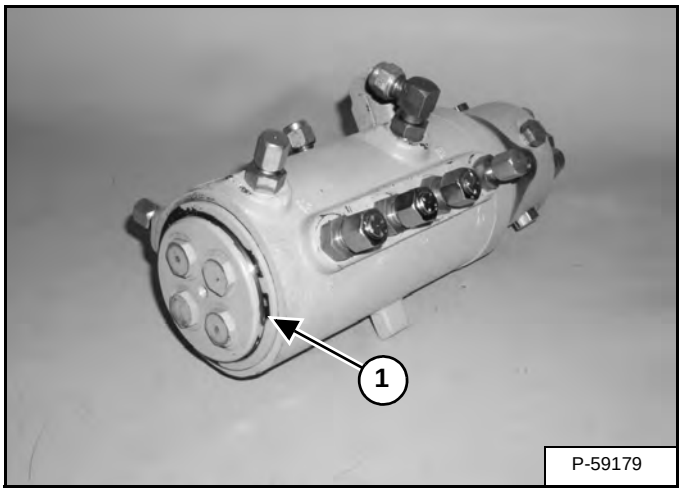
NOTE: A ring compressor (Item 1) [Figure 20-81-19] may be used to install the seals into the seal grove. Compress the seals for 3 minutes.

Figure 20-81-20



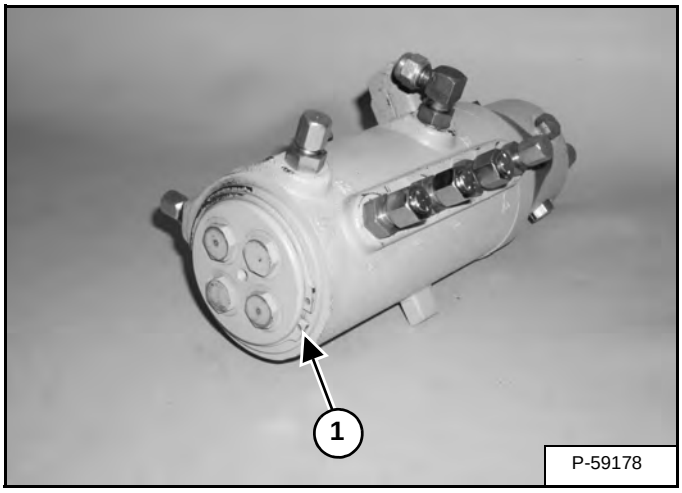
Apply hydraulic fluid to the rotor. Install the rotor (Item 1) **[Figure 20-81-20]** in the housing.

Figure 20-81-21



Install the nylon washer (Item 1) **[Figure 20-81-21]**.

Figure 20-81-22



Remove the snap ring (Item 1) **[Figure 20-81-22]** from the bottom of the swivel joint.

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SWIVEL JOINT (S/N A33P12838 - A33P13633)

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

Expand the track frame fully.

Figure 20-82-1



Place blocks under the excavator tracks and blade **[Figure 20-82-1]**.

Lower the boom / bucket to the ground.

Relieve hydraulic pressure.

Remove the muffler. (See Removal And Installation on Page 60-20-1.)

Remove the floor panels. (See FLOOR PANELS on Page 40-120-1.)

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-3.)

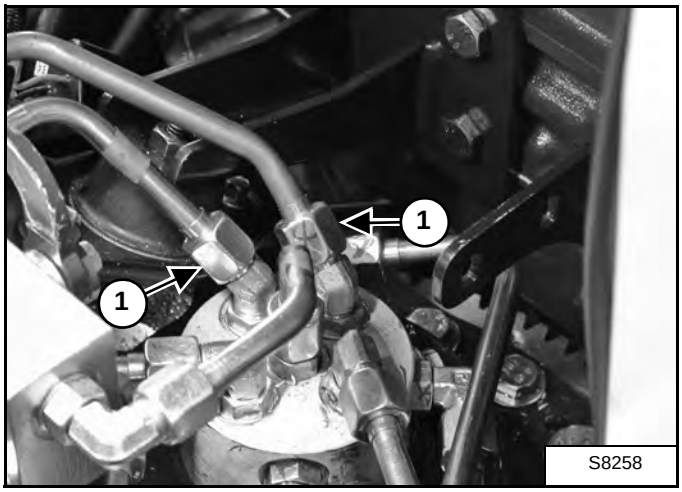
WARNING

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 physician familiar with this injury is not received immediately.

W-2145-0290

Mark all hoses and tubelines for ease of assembly.

Figure 20-82-2



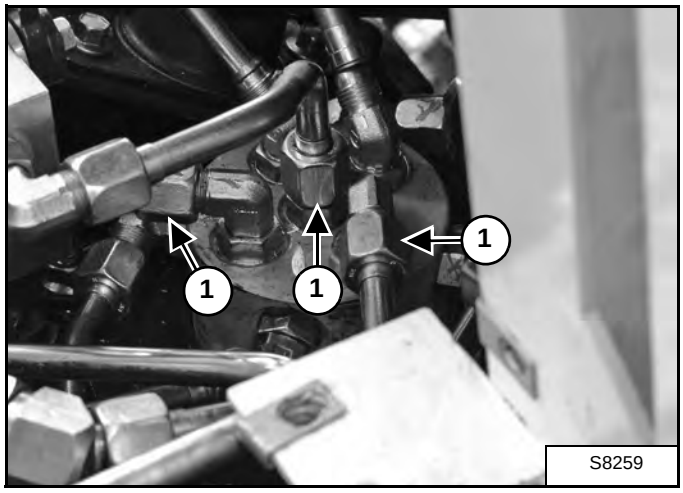
Remove the two tubelines (Item 1) **[Figure 20-82-2]** from the top of the swivel joint.

Dealer Copy -- Not for Resale

SWIVEL JOINT (S/N A33P12838 - A33P13633) (CONT'D)

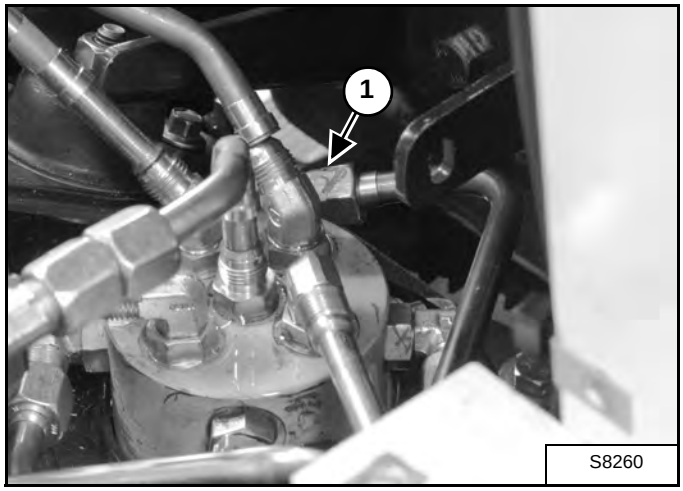
Removal And Installation (Cont'd)

Figure 20-82-3



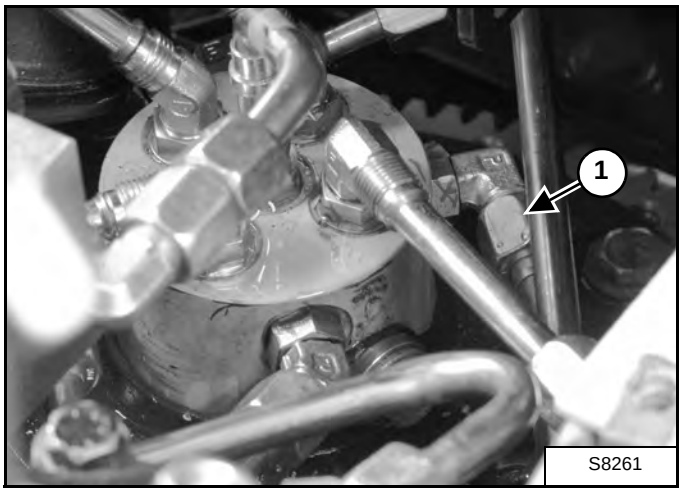
Remove the three tubelines (Item 1) **[Figure 20-82-3]** from the top of the swivel joint.

Figure 20-82-4



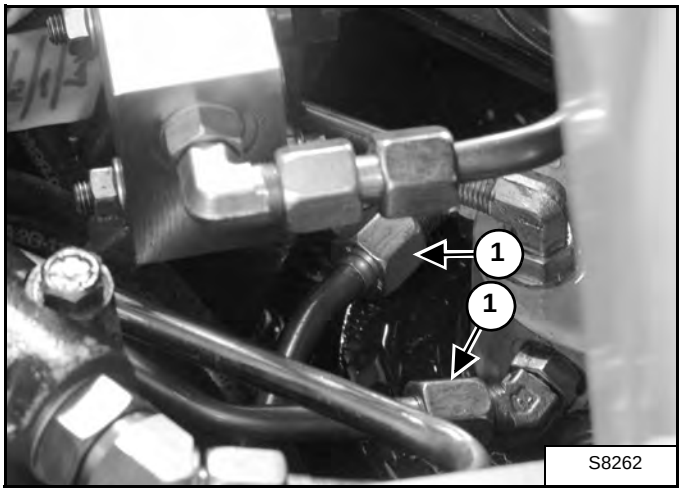
Remove the tubeline (Item 1) **[Figure 20-82-4]** from the side of the swivel joint.

Figure 20-82-5



Remove the tubeline (Item 1) **[Figure 20-82-5]** from the side of the swivel joint.

Figure 20-82-6



Remove the two tubelines (Item 1) **[Figure 20-82-6]** from the side of the swivel joint.

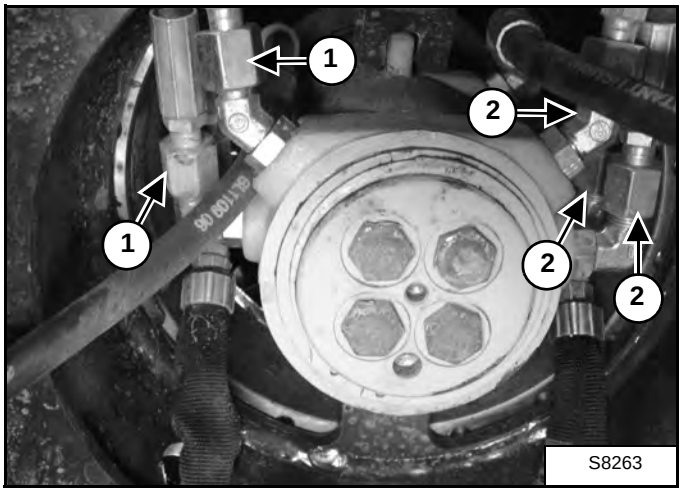
Remove the track frame expansion cylinder. (See Block Removal And Installation on Page 20-150-1.)

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SWIVEL JOINT (S/N A33P12838 - A33P13633) (CONT'D)

Removal And Installation (Cont'd)

Figure 20-82-7

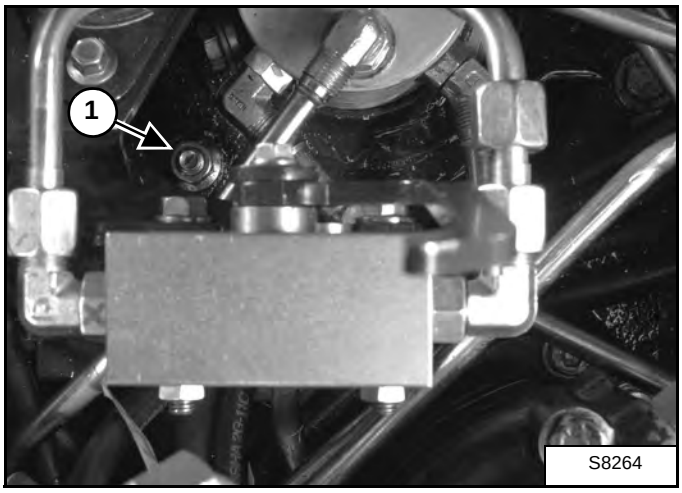


Remove the six hoses (Item 1) **[Figure 20-82-7]** from the left side of the swivel joint.

Remove the six hoses (Item 2) **[Figure 20-82-7]** from the right side of the swivel joint.

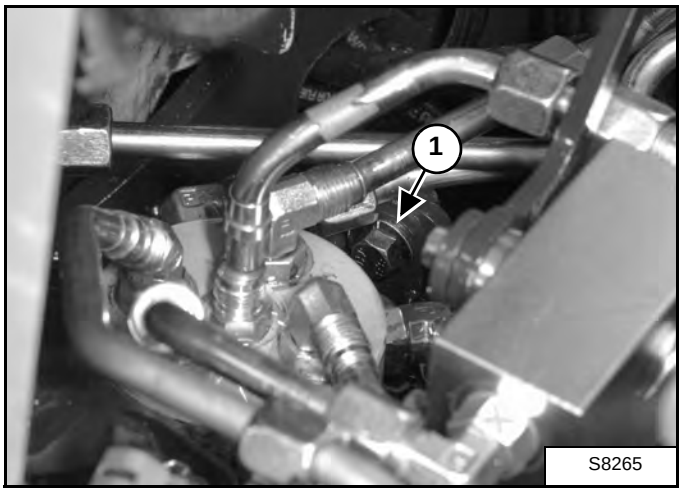
NOTE: Support the swivel joint on the bottom side of the excavator to prevent the swivel joint from falling when the three nuts are being removed.

Figure 20-82-8



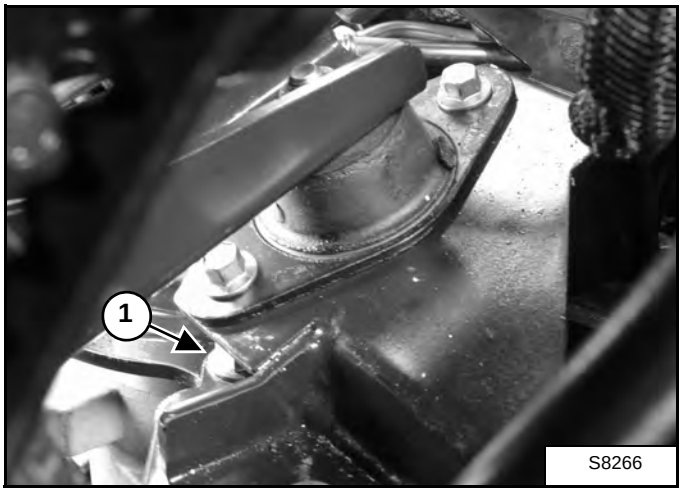
Remove the bolt and nut (Item 1) **[Figure 20-82-8]**.

Figure 20-82-9



Remove the bolt and nut (Item 1) **[Figure 20-82-9]**.

Figure 20-82-10



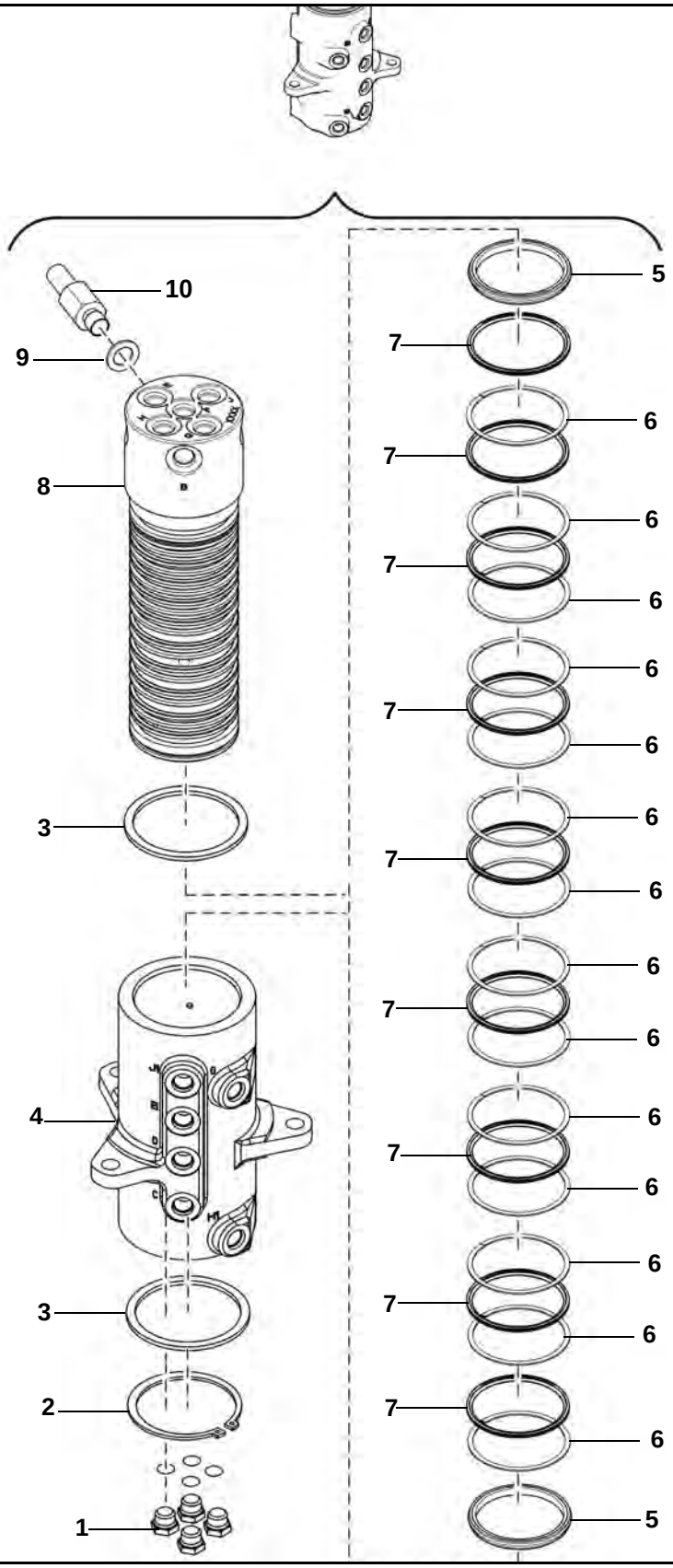
Remove the bolt and nut (Item 1) **[Figure 20-82-10]**.

Slide the swivel joint out through the bottom of the excavator.

Dealer Copy -- Not for Resale

Parts Identification

1. Plug
2. Snap Ring
3. Washer
4. Housing
5. Seal
6. Back-up Ring
7. Seal
8. Spool
9. Washer
10. Stop

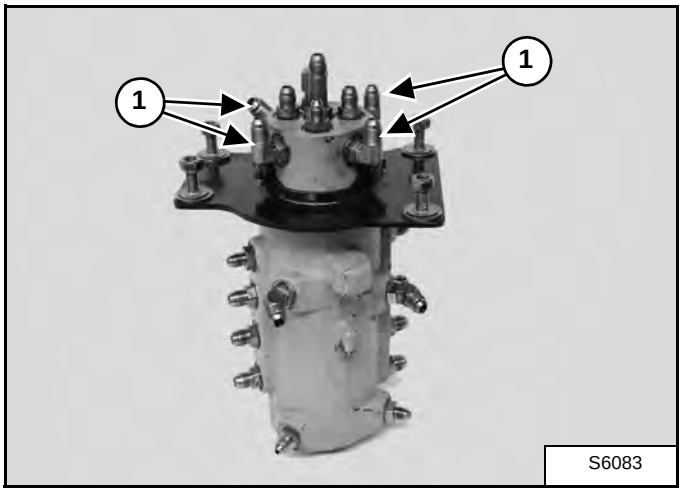


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SWIVEL JOINT (S/N A33P12838 - A33P13633) (CONT'D)

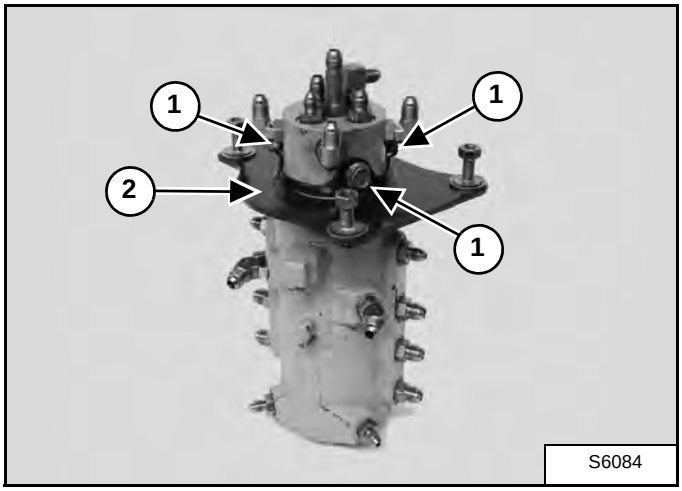
Disassembly

Figure 20-82-11



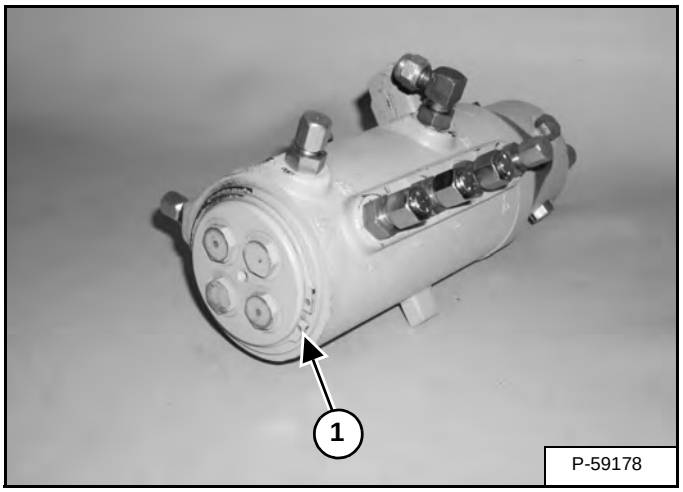
Mark fitting orientation. Remove the fittings (Item 1) **[Figure 20-82-11]**.

Figure 20-82-12



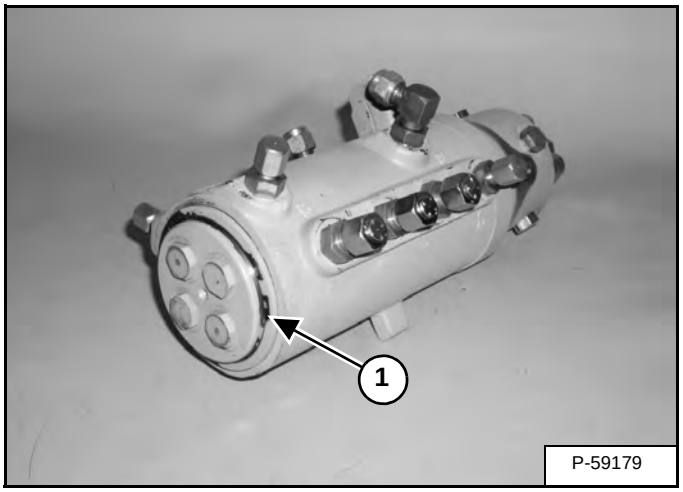
Remove the three bolts (Item 1). Remove the mount (Item 2) **[Figure 20-82-12]**.

Figure 20-82-13



Remove the snap ring (Item 1) **[Figure 20-82-13]** from the bottom of the swivel joint.

Figure 20-82-14



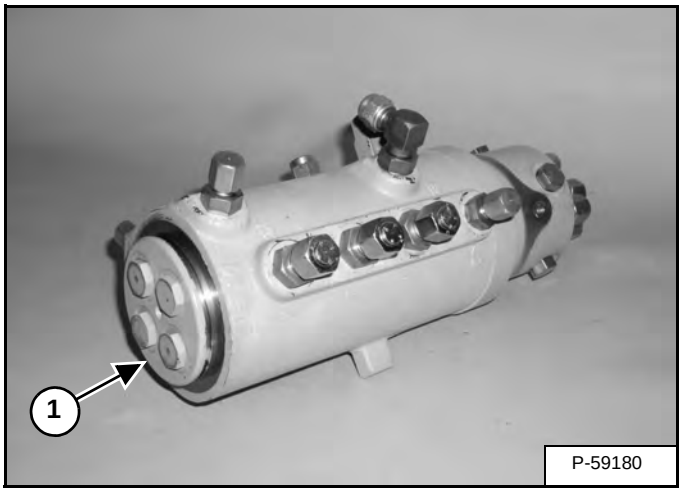
Remove the nylon washer (Item 1) **[Figure 20-82-14]**.

Dealer Copy -- Not for Resale

SWIVEL JOINT(S/N A33P12838 - A33P13633) (CONT'D)

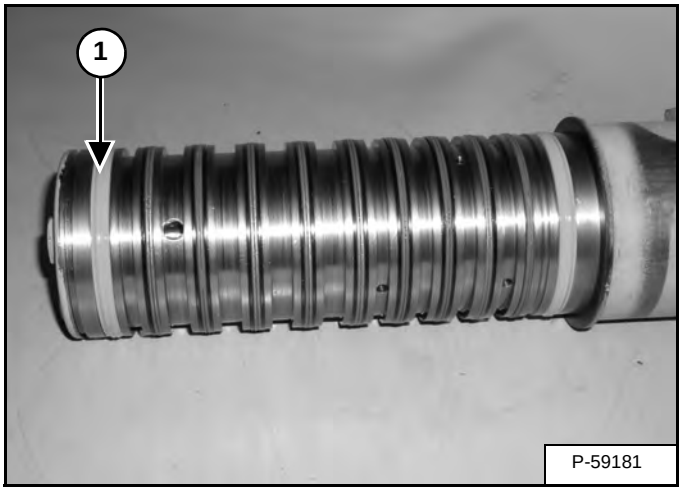
Disassembly (Cont'd)

Figure 20-82-15



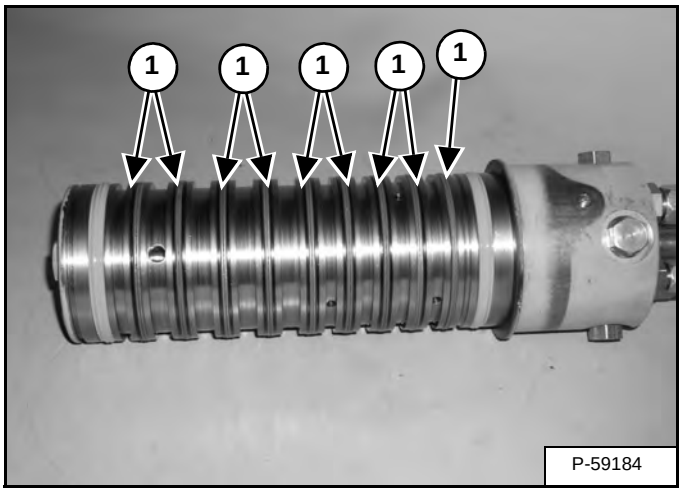
Tap the end of the rotor (Item 1) **[Figure 20-82-15]** with a rubber mallet to drive the rotor out of the housing.

Figure 20-82-16



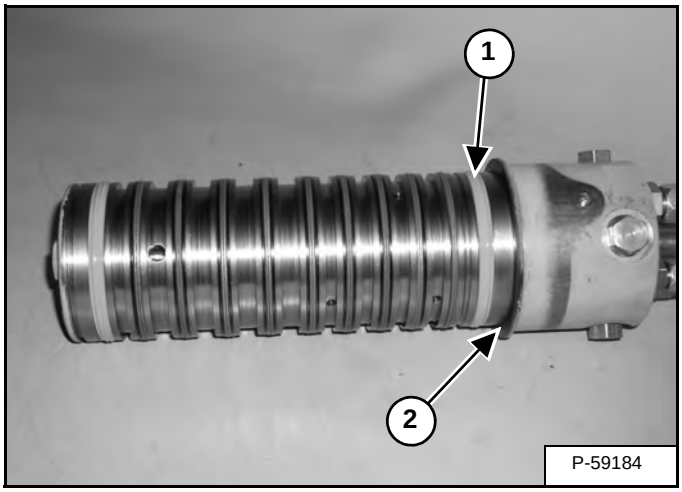
Remove the outer and inner seals (Item 1) **[Figure 20-82-16]**.

Figure 20-82-17



Remove the seals, back-up seals and O-rings (Item 1) **[Figure 20-82-17]**.

Figure 20-82-18



Remove the outer and inner seals (Item 1). Remove the nylon washer (Item 2) **[Figure 20-82-18]**.

Dealer Copy -- Not for Resale

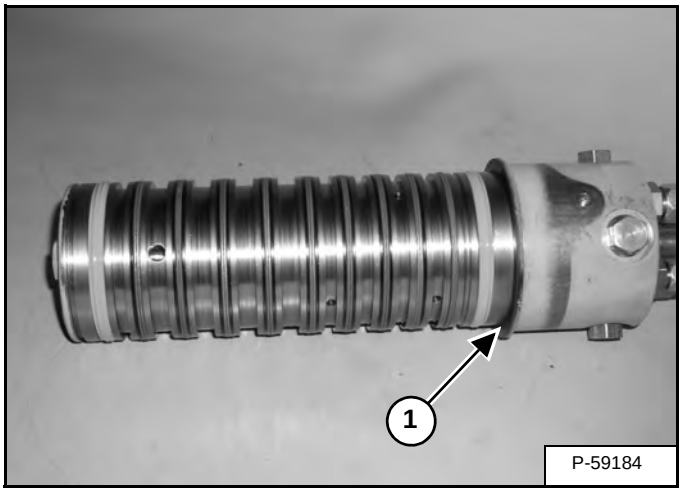
SWIVEL JOINT (S/N A33P12838 - A33P13633) (CONT'D))

Assembly

Clean all parts in solvent and dry with compressed air.

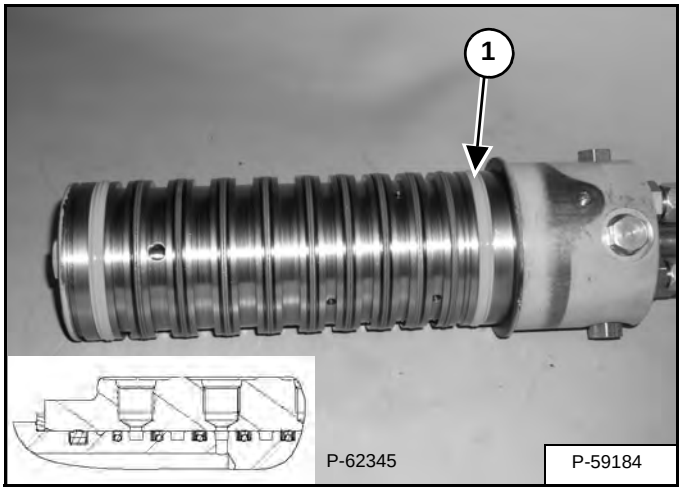
Inspect the rotor and housing for scratches or wear that could cause internal leakage. Always install new seals and back-up seals. Lubricate all seals and back-up seals with clean hydraulic fluid before installation.

Figure 20-82-19



Install the nylon washer (Item 1) **[Figure 20-82-19]**.

Figure 20-82-20

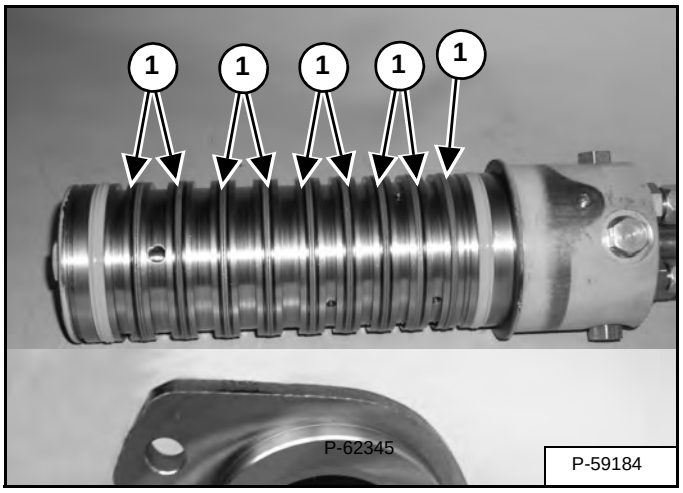


Heat the seals in hydraulic fluid for 3 minutes at 54°C (130°F).

Install the inner and outer seals (Item 1) **[Figure 20-82-20]**.

NOTE: The inner and outer seal are serviceable as one part number.

Figure 20-82-21



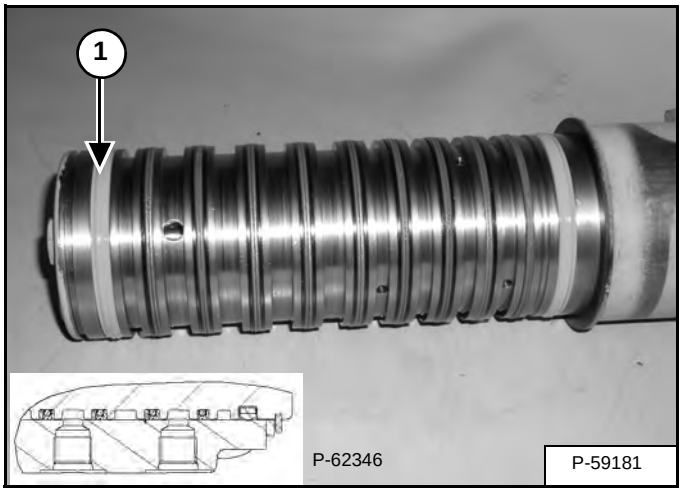
Install the O-rings under the seals (Item 1) **[Figure 20-82-21]**.

Heat the seals in hydraulic fluid for 3 minutes at 54°C (130°F).

Install the seals and back-up seals (Item 1) **[Figure 20-82-21]**.

NOTE: The seal and O-ring are serviceable as one part number.

Figure 20-82-22



Heat the seals in hydraulic fluid for 3 minutes at 54°C (130°F).

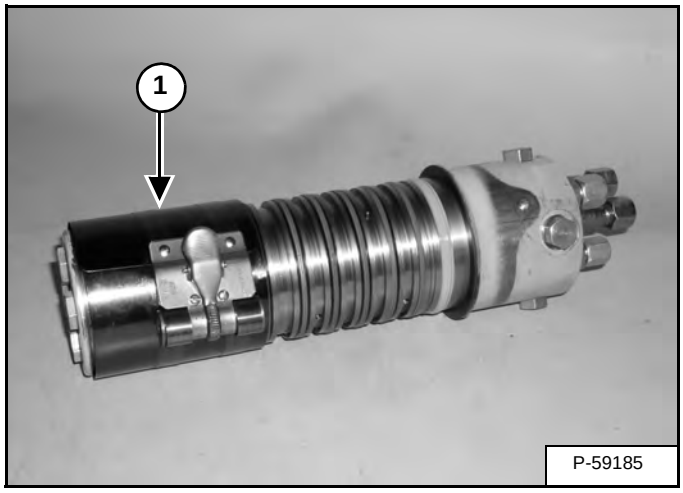
Install the inner and outer seals (Item 1) **[Figure 20-82-22]**.

NOTE: The inner and outer seal are serviceable as one part number.

Dealer Copy -- Not for Resale

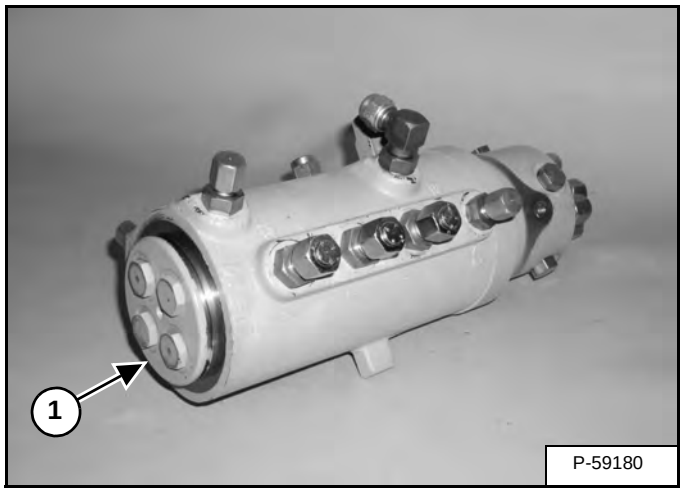
Assembly (Cont'd)

Figure 20-82-23



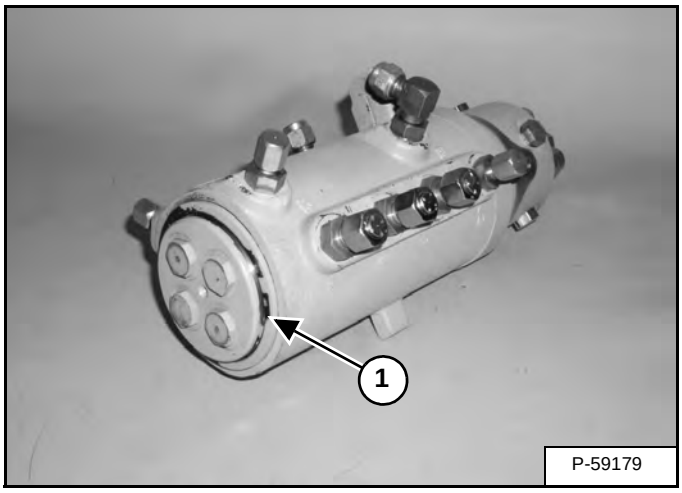
NOTE: A ring compressor (Item 1) [Figure 20-82-23] may be used to install the seals into the seal grove. Compress the seals for 3 minutes.

Figure 20-82-24



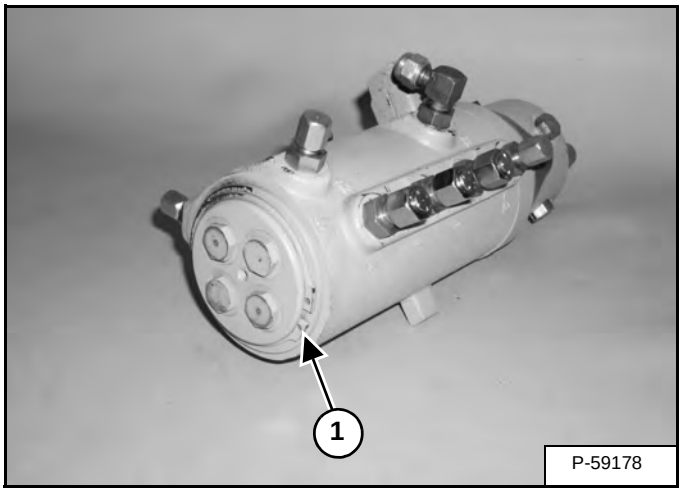
Apply hydraulic fluid to the rotor. Install the rotor (Item 1) **[Figure 20-82-24]** in the housing.

Figure 20-82-25



Install the nylon washer (Item 1) **[Figure 20-82-25]**.

Figure 20-82-26



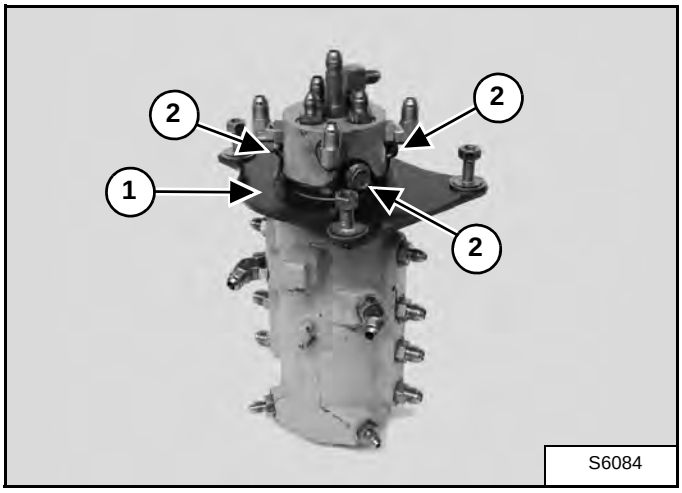
Remove the snap ring (Item 1) **[Figure 20-82-26]** from the bottom of the swivel joint.

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SWIVEL JOINT (S/N A33P12838 - A33P13633) (CONT'D)

Assembly (Cont'd)

Figure 20-82-27

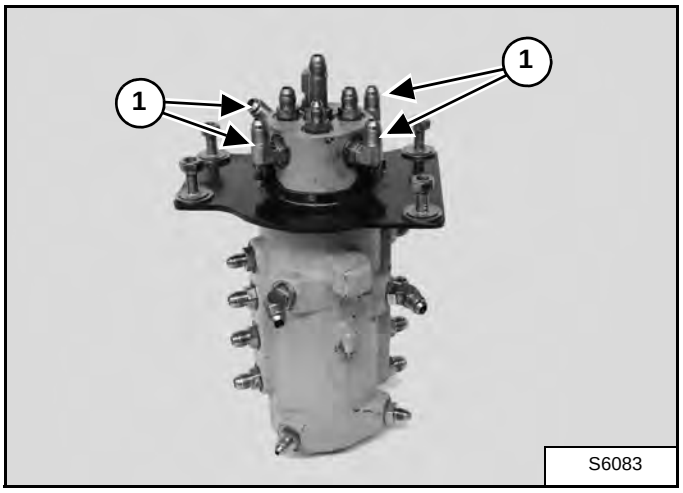


Install the mount (Item 1) **[Figure 20-82-27]** on the swivel joint.

Apply Loctite® 242 to each bolt (Item 2) **[Figure 20-82-27]**.

Install the bolts (Item 2) **[Figure 20-82-27]**. Tighten the bolts to 43 - 47 N•m (32 - 35 ft-lb) torque.

Figure 20-82-28



Install the fittings (Item 1) **[Figure 20-82-28]** and orientate accordingly.

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Dealer Copy -- Not for Resale

SWIVEL JOINT (S/N A33P11001 - A33P12837)

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

Expand the track frame fully.

Figure 20-83-1



Place blocks under the excavator tracks and blade **[Figure 20-83-1]**.

Lower the boom / bucket to the ground.

Relieve hydraulic pressure.

Remove the muffler. (See Removal And Installation on Page 60-20-1.)

Remove the floor panels. (See FLOOR PANELS on Page 40-120-1.)

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-3.)

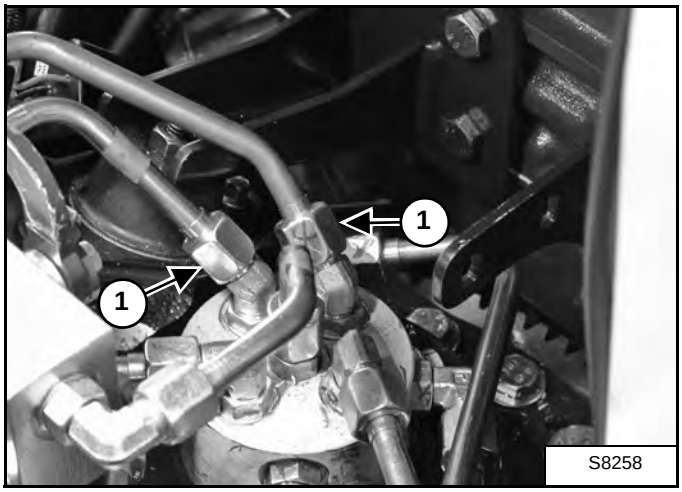
WARNING

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 physician familiar with this injury is not received immediately.

W-2145-0290

Mark all hoses and tubelines for ease of assembly.

Figure 20-83-2



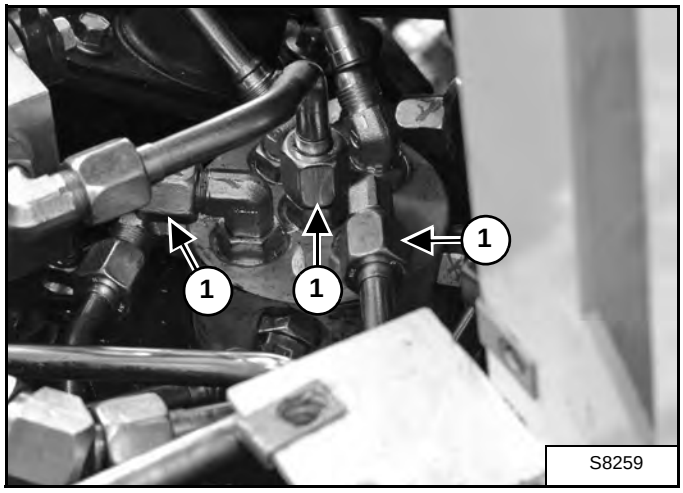
Remove the two tubelines (Item 1) **[Figure 20-83-2]** from the top of the swivel joint.

Dealer Copy -- Not for Resale

SWIVEL JOINT (S/N A33P11001 - A33P12837) (CONT'D)

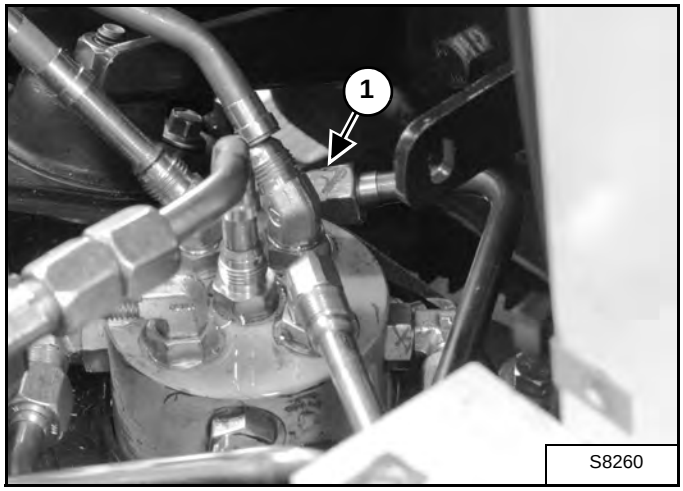
Removal And Installation (Cont'd)

Figure 20-83-3



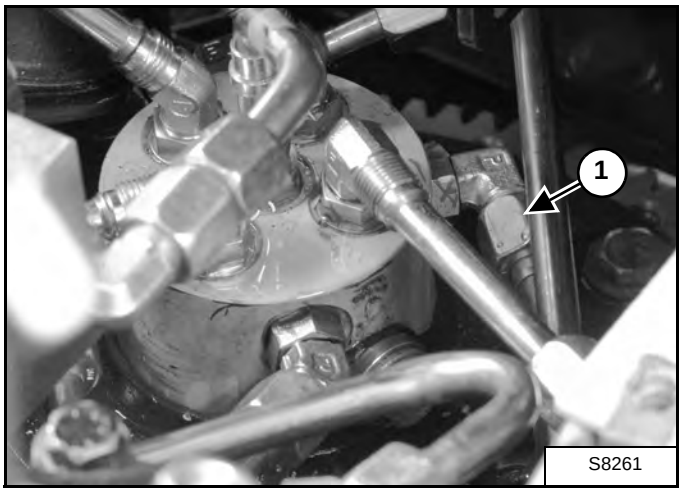
Remove the three tubelines (Item 1) **[Figure 20-83-3]** from the top of the swivel joint.

Figure 20-83-4



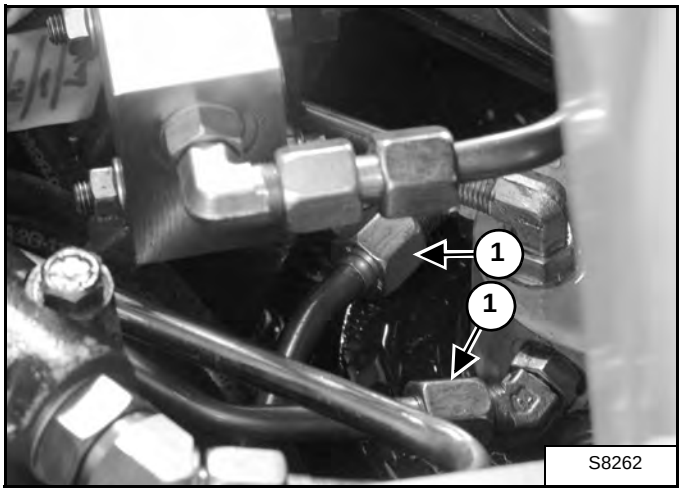
Remove the tubeline (Item 1) **[Figure 20-83-4]** from the side of the swivel joint.

Figure 20-83-5



Remove the tubeline (Item 1) **[Figure 20-83-5]** from the side of the swivel joint.

Figure 20-83-6



Remove the two tubelines (Item 1) **[Figure 20-83-6]** from the side of the swivel joint.

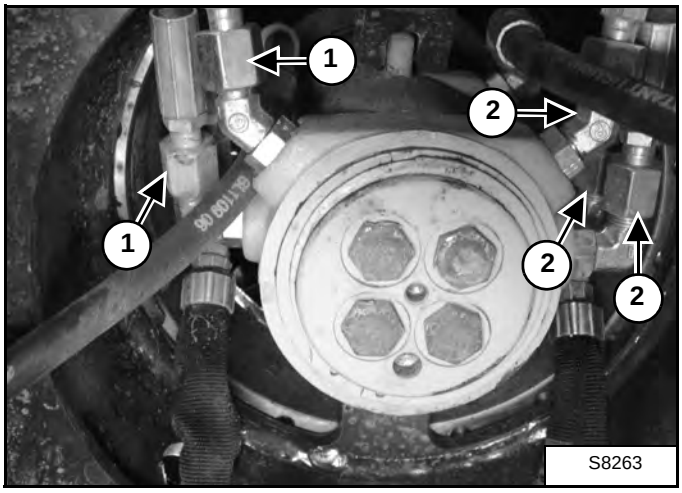
Remove the track frame expansion cylinder. (See Block Removal And Installation on Page 20-150-1.)

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SWIVEL JOINT (S/N A33P11001 - A33P12837) (CONT'D)

Removal And Installation (Cont'd)

Figure 20-83-7

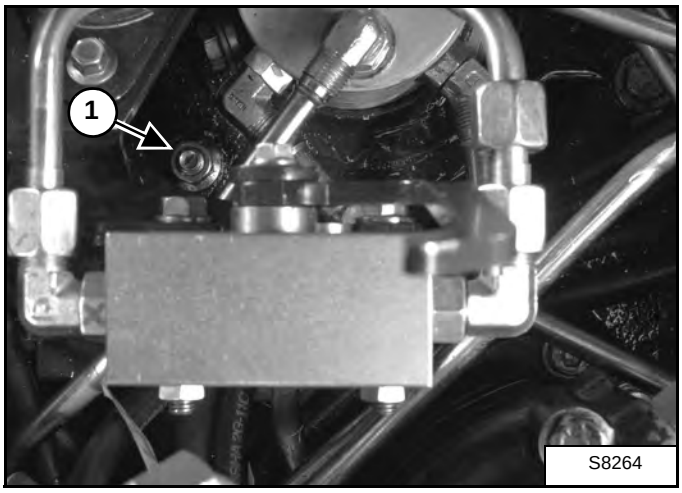


Remove the six hoses (Item 1) **[Figure 20-83-7]** from the left side of the swivel joint.

Remove the six hoses (Item 2) **[Figure 20-83-7]** from the right side of the swivel joint.

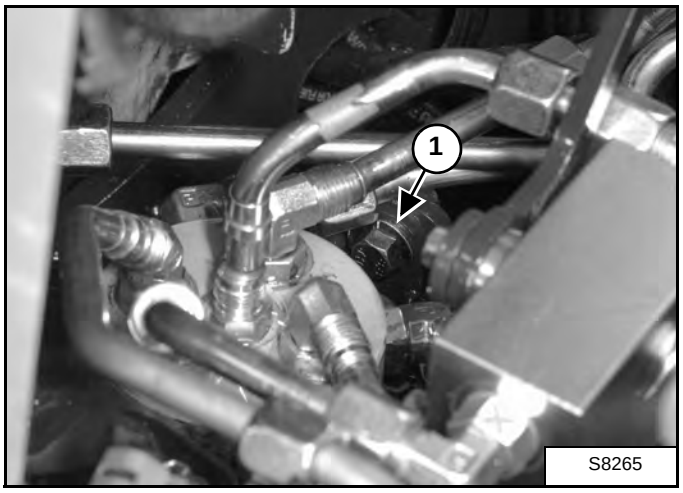
NOTE: Support the swivel joint on the bottom side of the excavator to prevent the swivel joint from falling when the three nuts are being removed.

Figure 20-83-8



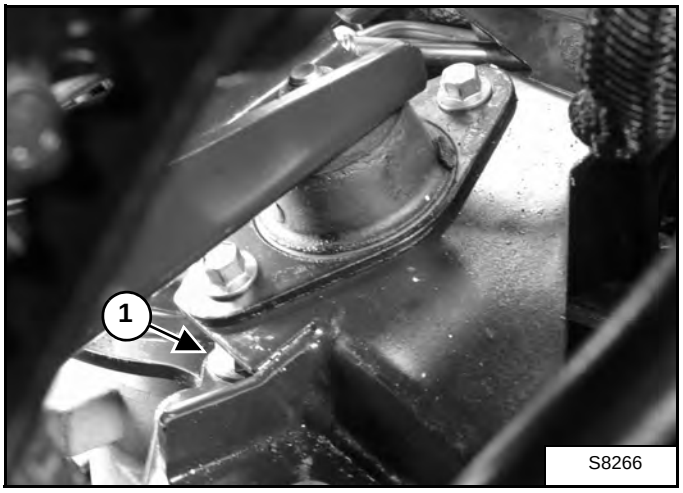
Remove the bolt and nut (Item 1) **[Figure 20-83-8]**.

Figure 20-83-9



Remove the bolt and nut (Item 1) **[Figure 20-83-9]**.

Figure 20-83-10



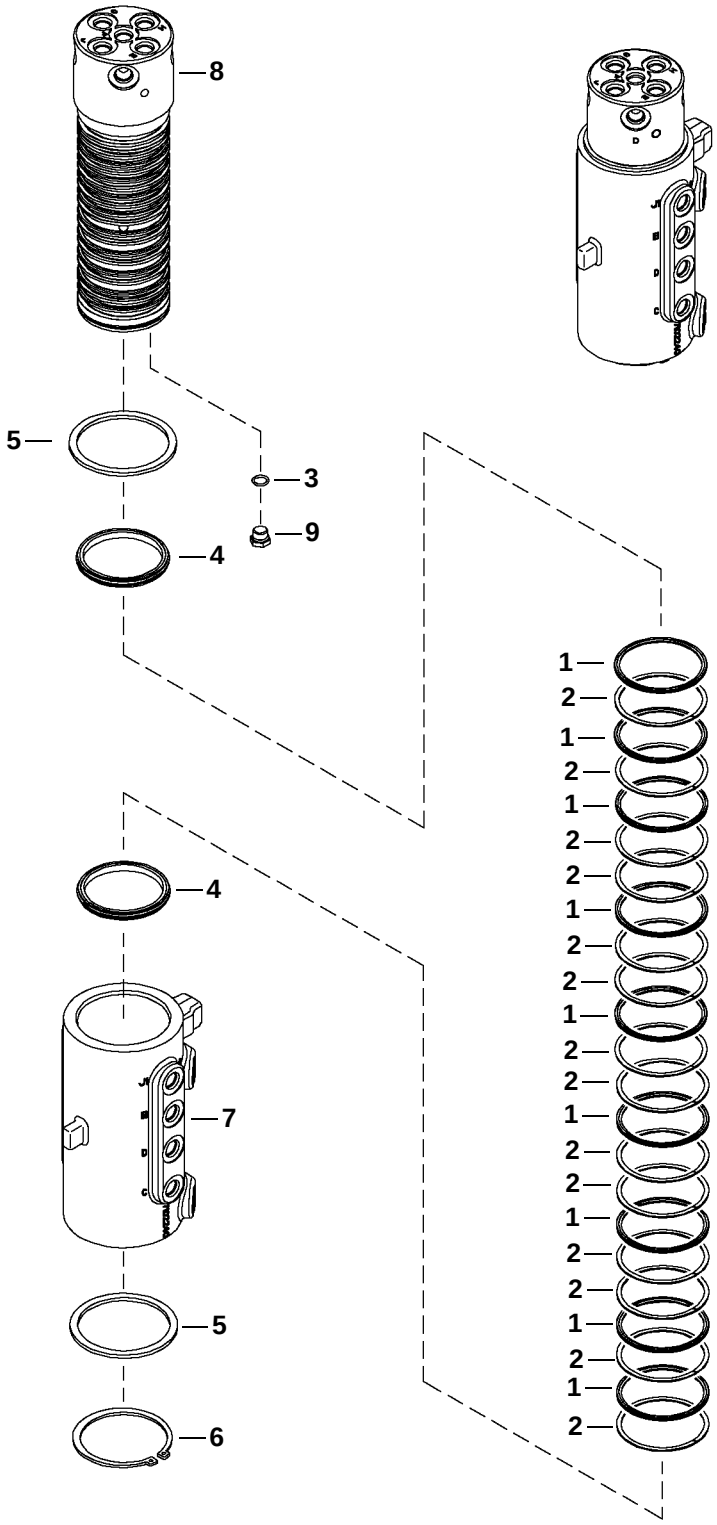
Remove the bolt and nut (Item 1) **[Figure 20-83-10]**.

Slide the swivel joint out through the bottom of the excavator.

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Parts Identification

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

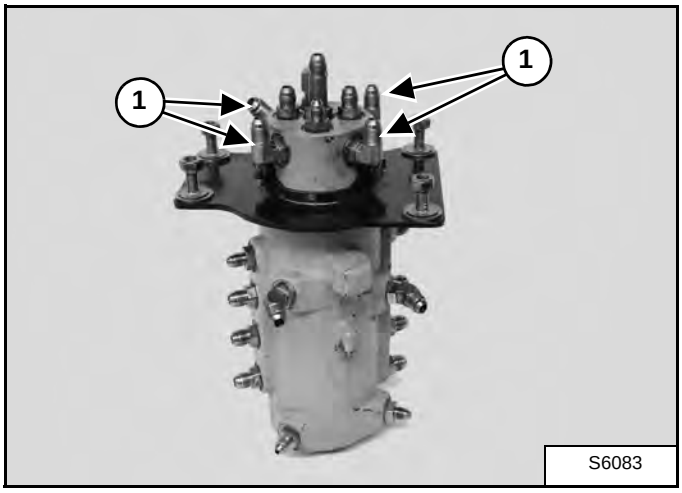


Dealer Copy -- Not for Resale

SWIVEL JOINT (S/N A33P11001 - A33P12837) (CONT'D)

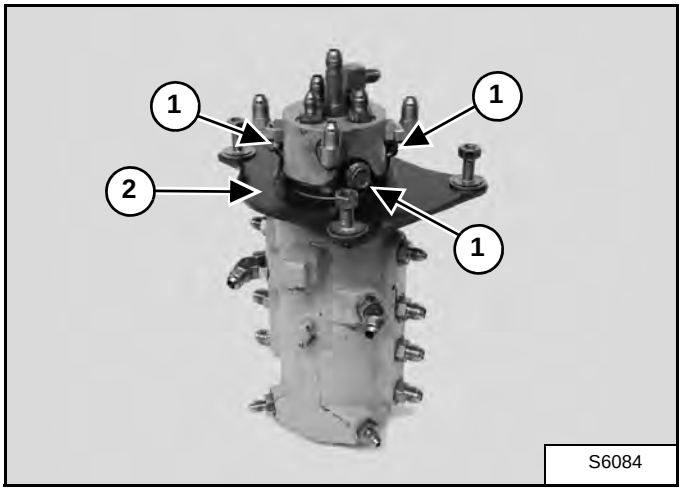
Disassembly

Figure 20-83-11



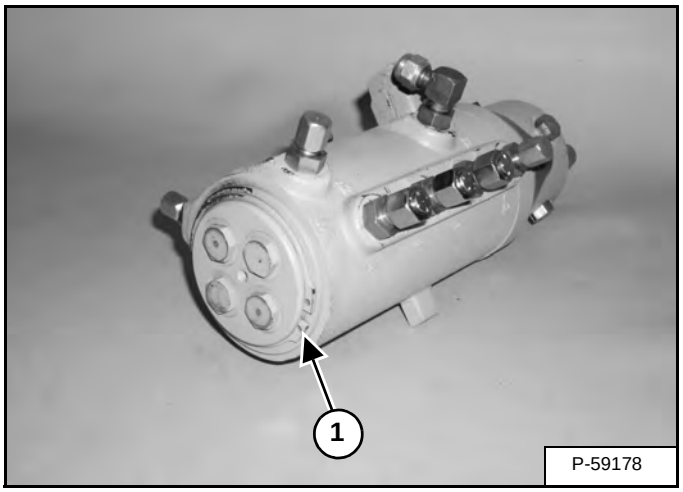
Mark fitting orientation. Remove the fittings (Item 1) **[Figure 20-83-11]**.

Figure 20-83-12



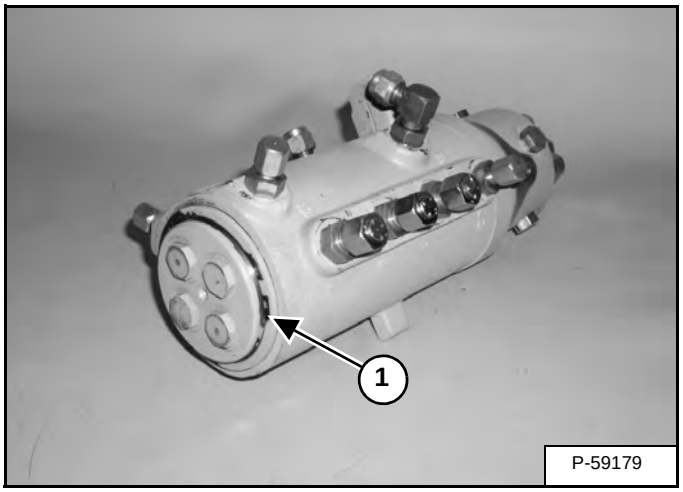
Remove the three bolts (Item 1). Remove the mount (Item 2) **[Figure 20-83-12]**.

Figure 20-83-13



Remove the snap ring (Item 1) **[Figure 20-83-13]** from the bottom of the swivel joint.

Figure 20-83-14



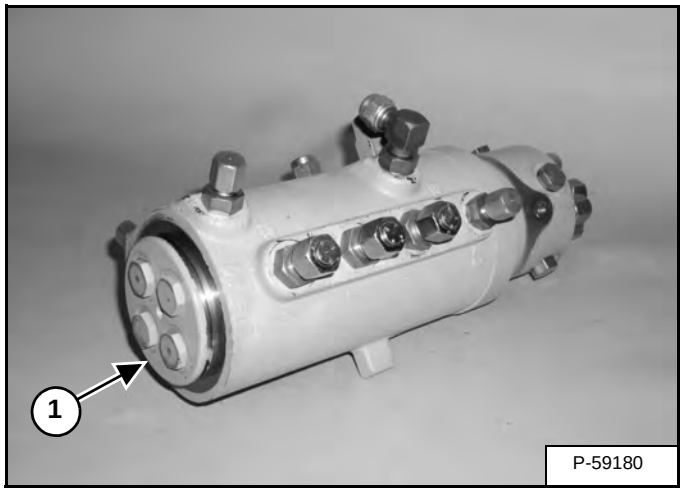
Remove the nylon washer (Item 1) **[Figure 20-83-14]**.

Dealer Copy -- Not for Resale

SWIVEL JOINT (S/N A33P11001 - A33P12837) (CONT'D)

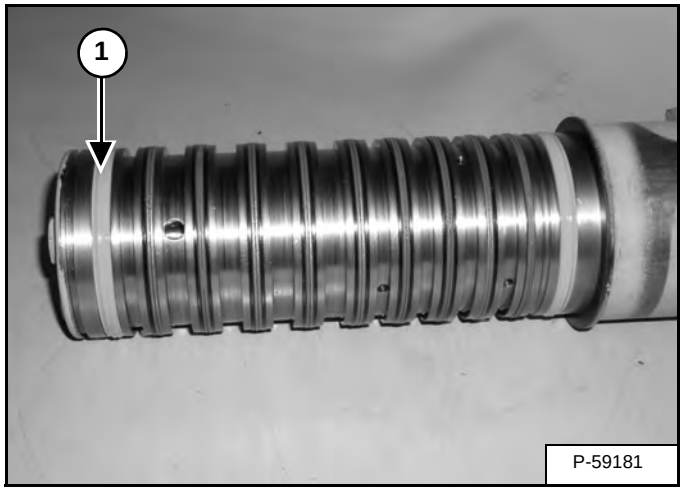
Disassembly (Cont'd)

Figure 20-83-15



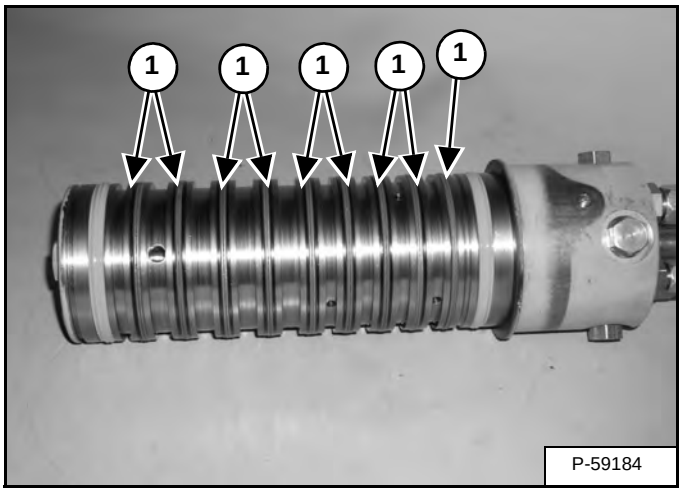
Tap the end of the rotor (Item 1) **[Figure 20-83-15]** with a rubber mallet to drive the rotor out of the housing.

Figure 20-83-16



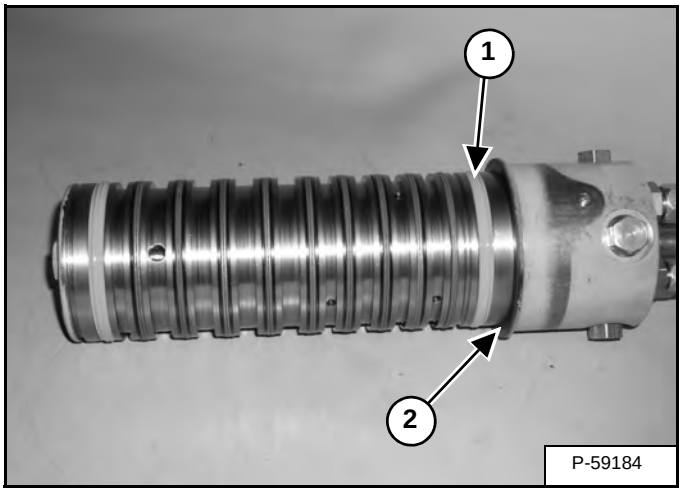
Remove the outer and inner seals (Item 1) **[Figure 20-83-16]**.

Figure 20-83-17



Remove the seals, back-up seals and O-rings (Item 1) **[Figure 20-83-17]**.

Figure 20-83-18



Remove the outer and inner seals (Item 1). Remove the nylon washer (Item 2) **[Figure 20-83-18]**.

Dealer Copy -- Not for Resale

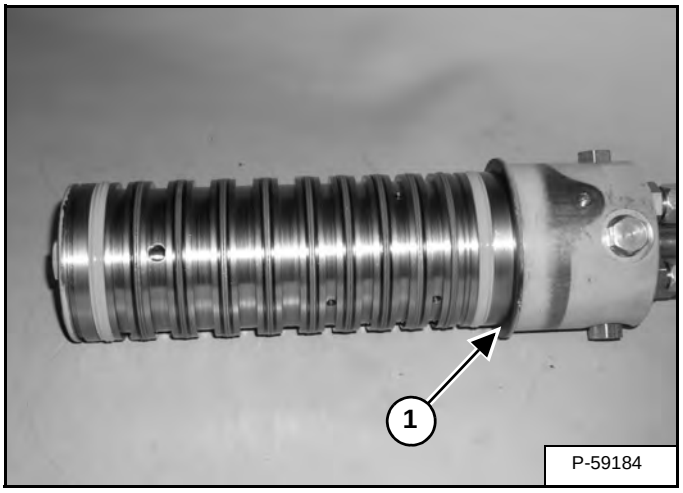
SWIVEL JOINT (S/N A33P11001 - A33P12837) (CONT'D)

Assembly

Clean all parts in solvent and dry with compressed air.

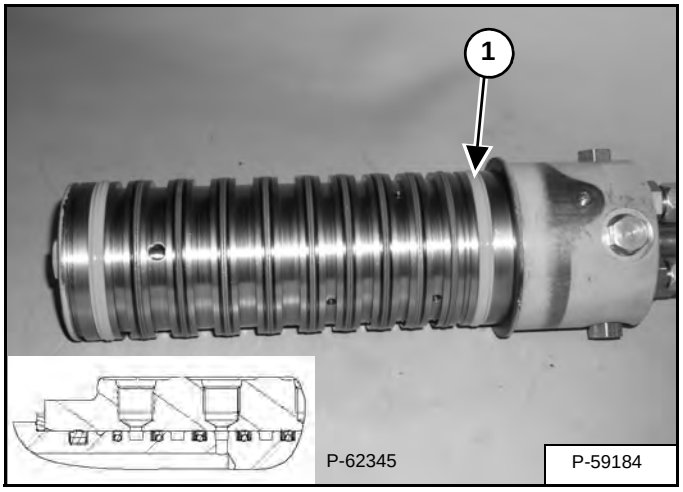
Inspect the rotor and housing for scratches or wear that could cause internal leakage. Always install new seals and back-up seals. Lubricate all seals and back-up seals with clean hydraulic fluid before installation.

Figure 20-83-19



Install the nylon washer (Item 1) **[Figure 20-83-19]**.

Figure 20-83-20

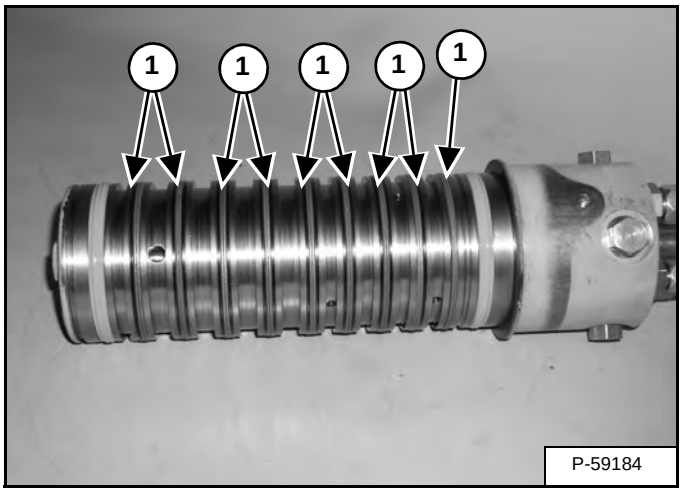


Heat the seals in hydraulic fluid for 3 minutes at 54°C (130°F).

Install the inner and outer seals (Item 1) **[Figure 20-83-20]**.

NOTE: The inner and outer seal are serviceable as one part number.

Figure 20-83-21



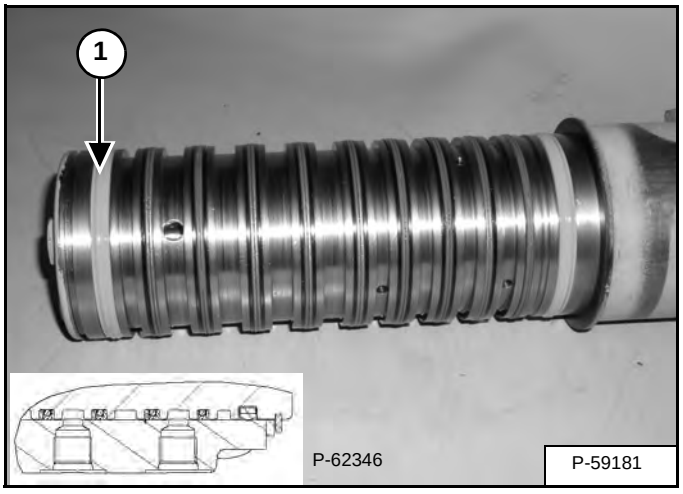
Install the O-rings under the seals (Item 1) **[Figure 20-83-21]**.

Heat the seals in hydraulic fluid for 3 minutes at 54°C (130°F).

Install the seals and back-up seals (Item 1) **[Figure 20-83-21]**.

NOTE: The seal and O-ring are serviceable as one part number.

Figure 20-83-22



Heat the seals in hydraulic fluid for 3 minutes at 54°C (130°F).

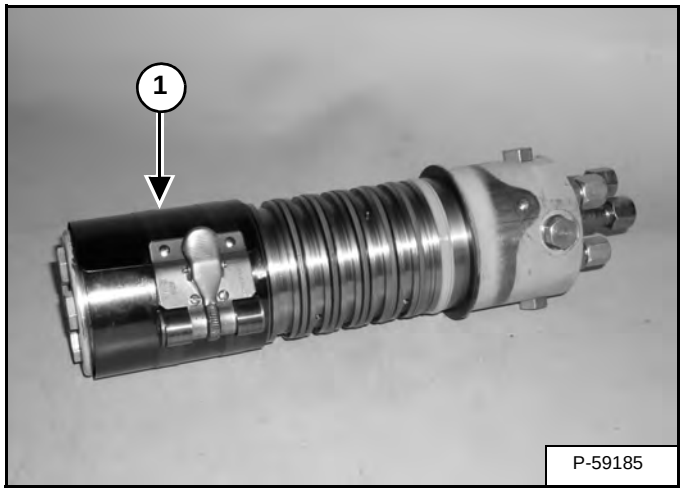
Install the inner and outer seals (Item 1) **[Figure 20-83-22]**.

NOTE: The inner and outer seal are serviceable as one part number.

Dealer Copy -- Not for Resale

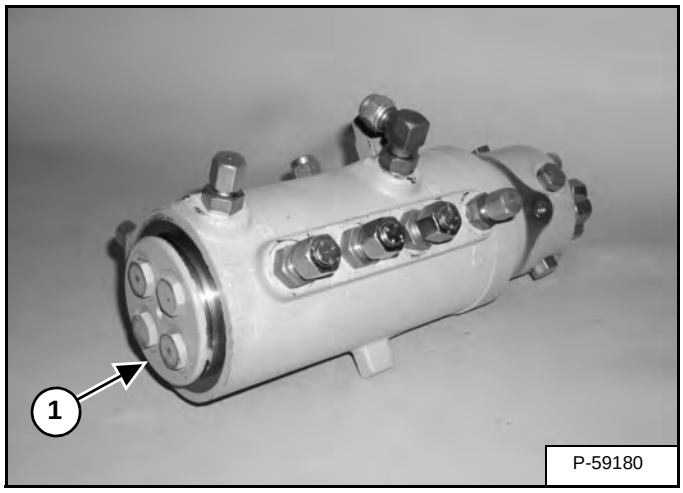
Assembly (Cont'd)

Figure 20-83-23



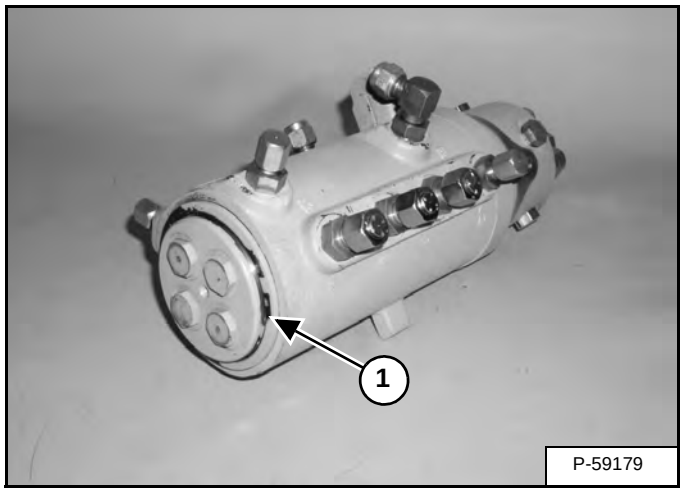
NOTE: A ring compressor (Item 1) [Figure 20-83-23] may be used to install the seals into the seal grove. Compress the seals for 3 minutes.

Figure 20-83-24



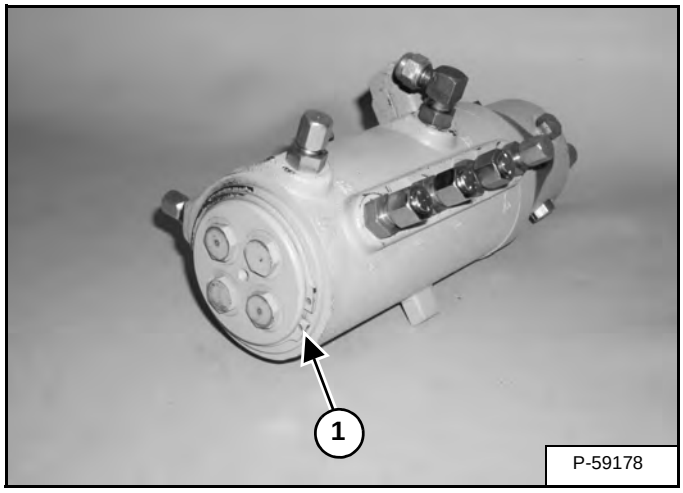
Apply hydraulic fluid to the rotor. Install the rotor (Item 1) **[Figure 20-83-24]** in the housing.

Figure 20-83-25



Install the nylon washer (Item 1) **[Figure 20-83-25]**.

Figure 20-83-26

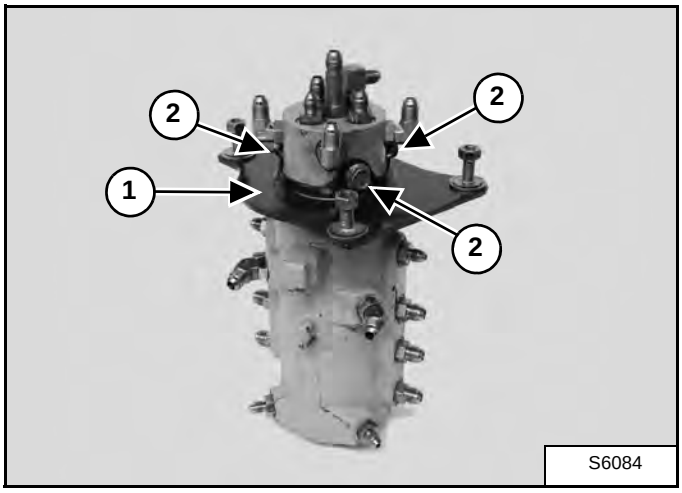


Remove the snap ring (Item 1) **[Figure 20-83-26]** from the bottom of the swivel joint.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

Figure 20-83-27

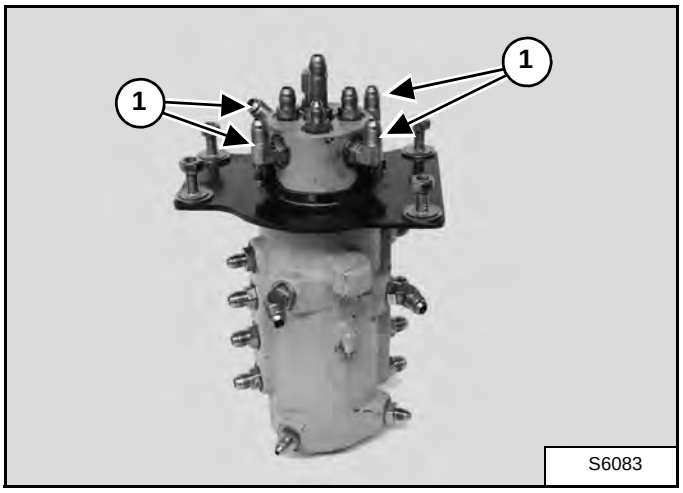


Install the mount (Item 1) **[Figure 20-83-27]** on the swivel joint.

Apply Loctite® 242 to each bolt (Item 2) **[Figure 20-83-27]**.

Install the bolts (Item 2) **[Figure 20-83-27]**. Tighten the bolts to 43 - 47 N•m (32 - 35 ft-lb) torque.

Figure 20-83-28



Install the fittings (Item 1) **[Figure 20-83-28]** and orientate accordingly.

Dealer Copy -- Not for Resale



Dealer Copy -- Not for Resale

SWING MOTOR

Description

The slew 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 slew motor rotates is related to the amount of hydraulic fluid it receives.

Removal And Installation

IMPORTANT

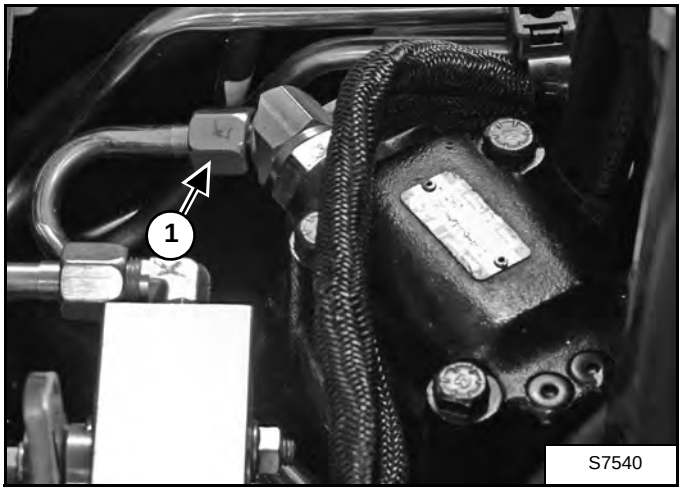
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

Remove the floor panels. (See FLOOR PANELS on Page 40-120-1.)

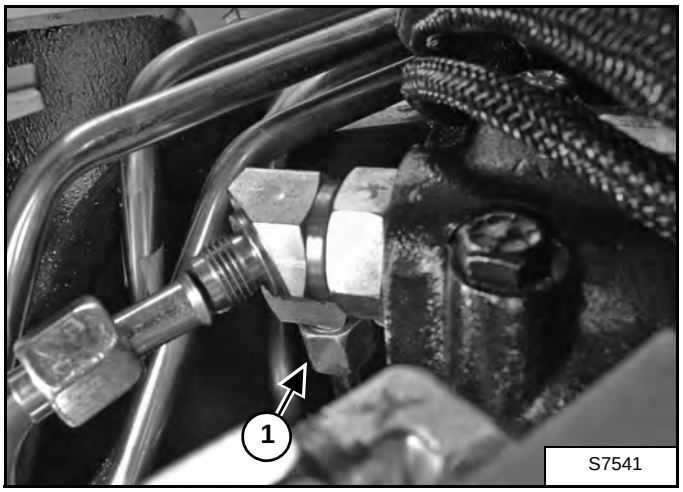
Remove the instrument panel. (See Removal And Installation on Page 40-220-1.)

Figure 20-90-1



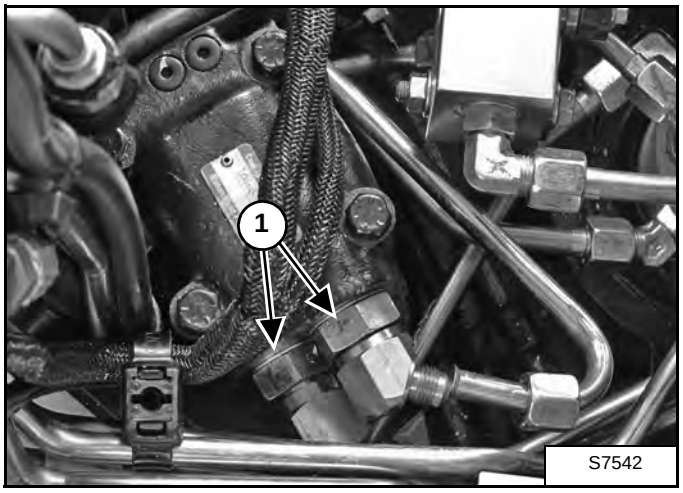
Mark and remove the tubeline (Item 1) **[Figure 20-90-1]**.

Figure 20-90-2



Mark and remove the tubeline (Item 1) **[Figure 20-90-2]**.

Figure 20-90-3

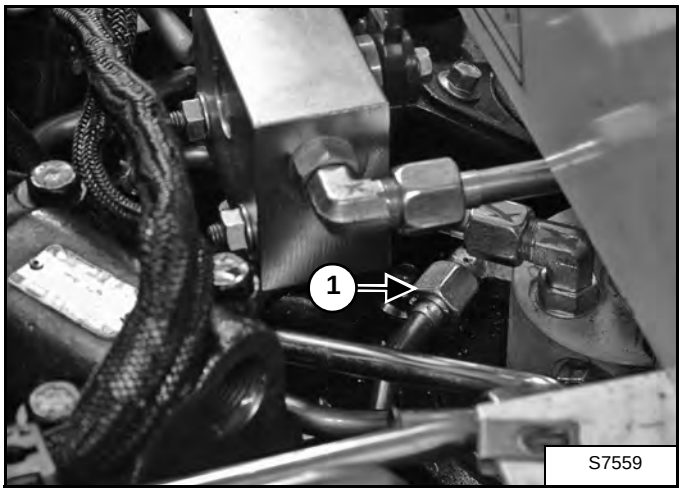


Remove the two fittings (Item 1) **[Figure 20-90-3]** from the slew motor.

Dealer Copy -- Not for Resale

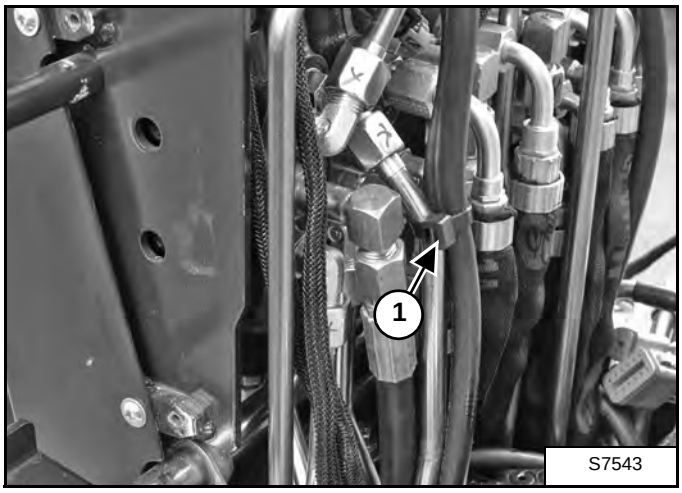
Removal And Installation (Cont'd)

Figure 20-90-4



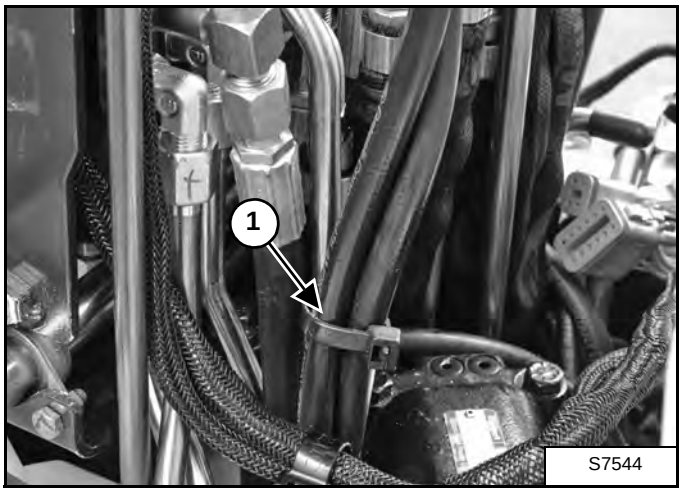
Mark and remove the tubeline (Item 1) **[Figure 20-90-4]** from the swivel joint.

Figure 20-90-5



Cut the tie-strap (Item 1) **[Figure 20-90-5]**.

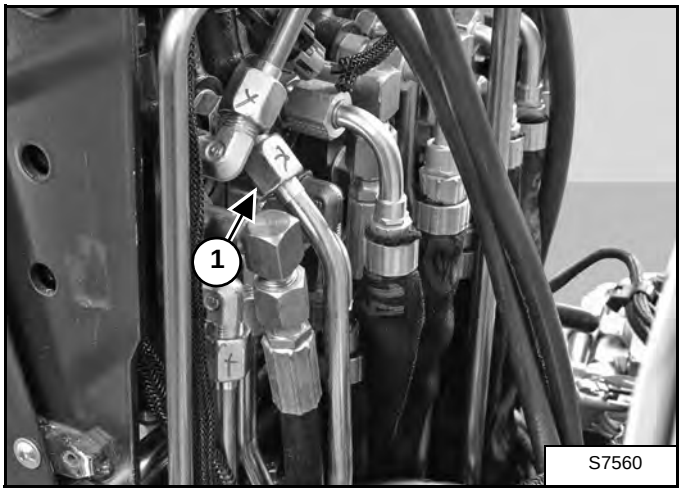
Figure 20-90-6



Cut the tie-strap (Item 1) **[Figure 20-90-6]** from the two hoses.

Push the hoses aside.

Figure 20-90-7

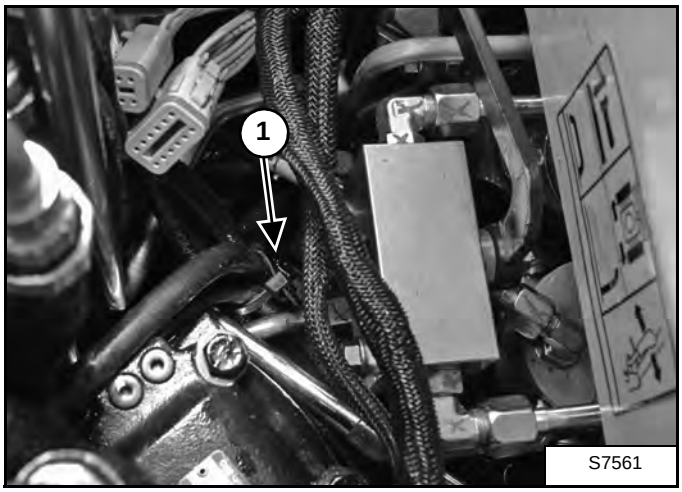


Mark and remove the tubeline (Item 1) **[Figure 20-90-7]**.

Dealer Copy -- Not for Resale

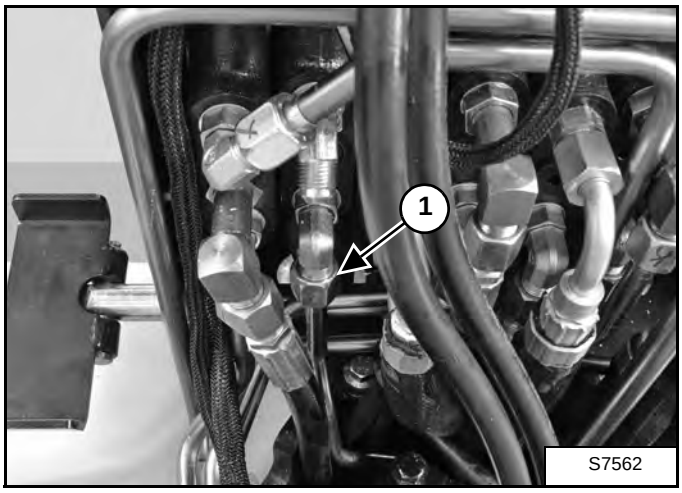
Removal And Installation (Cont'd)

Figure 20-90-8



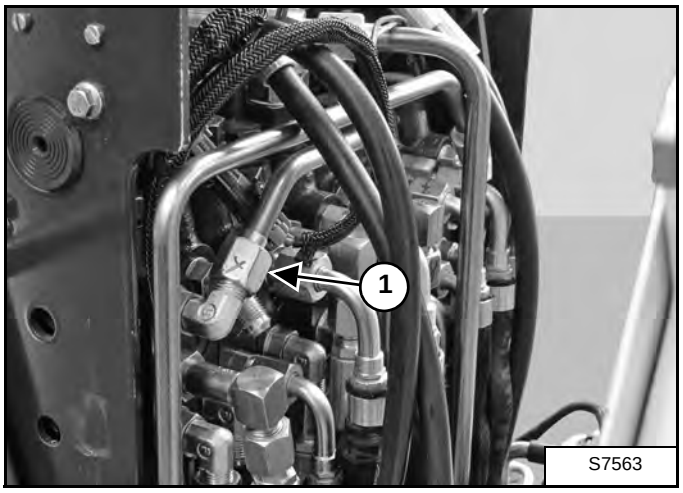
Cut the tie-strap (Item 1) **[Figure 20-90-8]** from the two hoses.

Figure 20-90-9



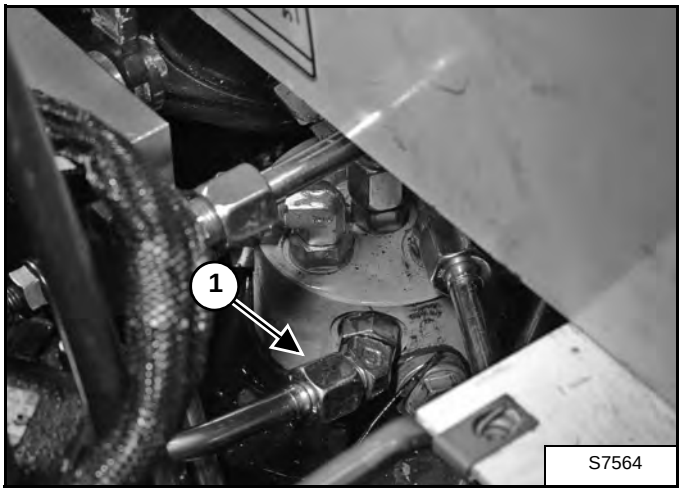
Mark and remove the tubeline (Item 1) **[Figure 20-90-9]**.

Figure 20-90-10



Mark and remove the tubeline (Item 1) **[Figure 20-90-10]** from the control valve.

Figure 20-90-11

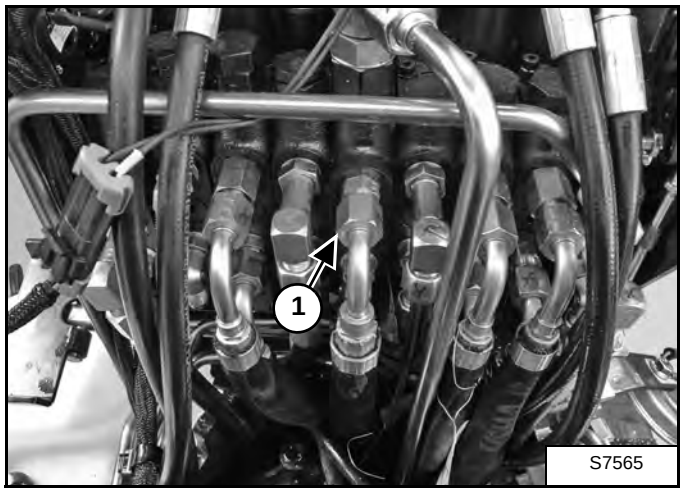


Mark and remove the tubeline (Item 1) **[Figure 20-90-11]**.

Dealer Copy -- Not for Resale

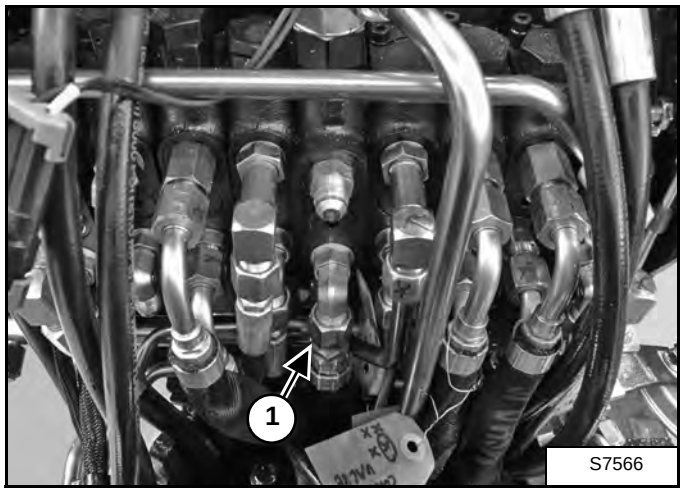
Removal And Installation (Cont'd)

Figure 20-90-12



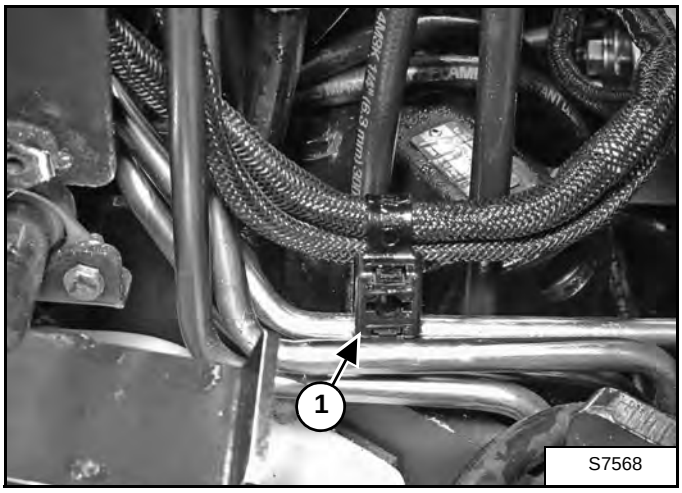
Mark and remove the hose (Item 1) **[Figure 20-90-12]** from the control valve.

Figure 20-90-13



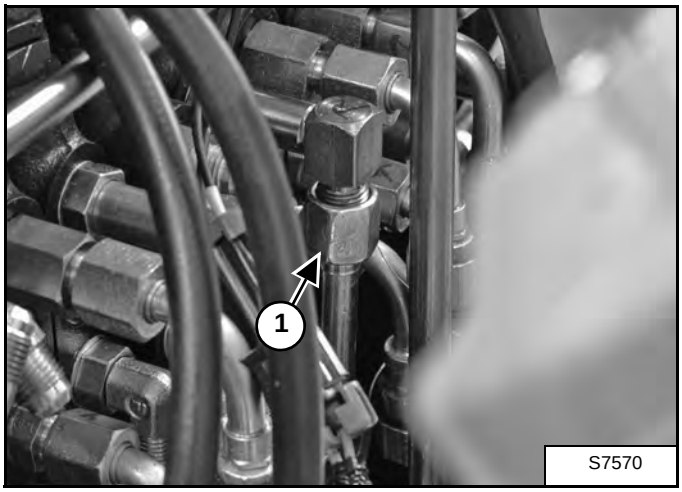
Mark and remove the hose (Item 1) **[Figure 20-90-13]** from the control valve.

Figure 20-90-14



Remove the clamp from the tubeline (Item 1) **[Figure 20-90-14]**.

Figure 20-90-15

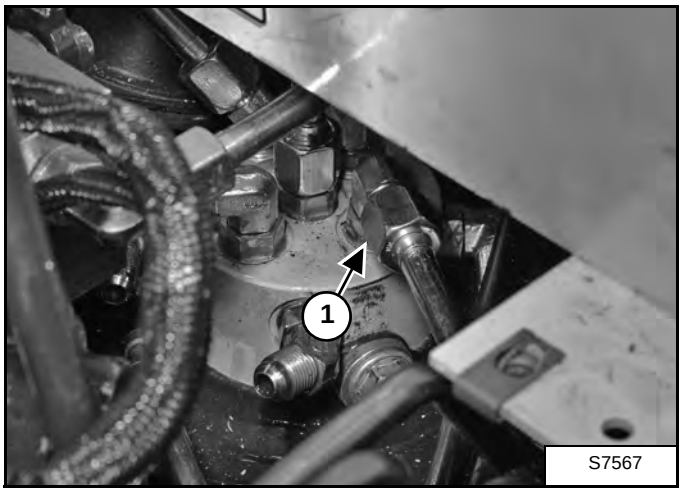


Mark and remove the tubeline (Item 1) **[Figure 20-90-15]** from the control valve.

Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

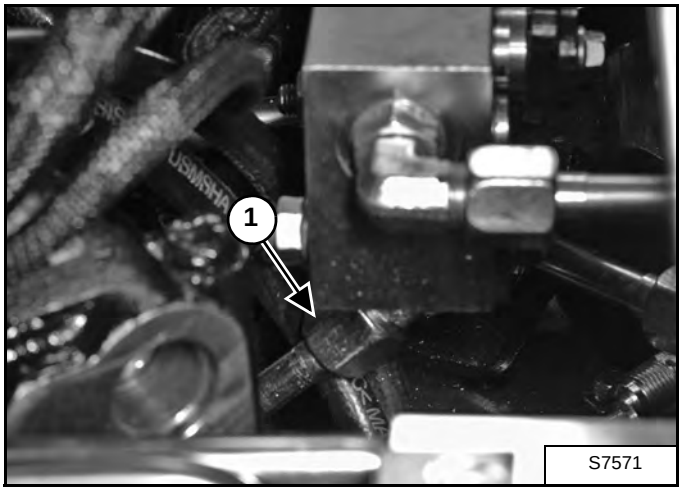
Figure 20-90-16



Mark and remove the tubeline (Item 1) **[Figure 20-90-16]** from the swivel joint.

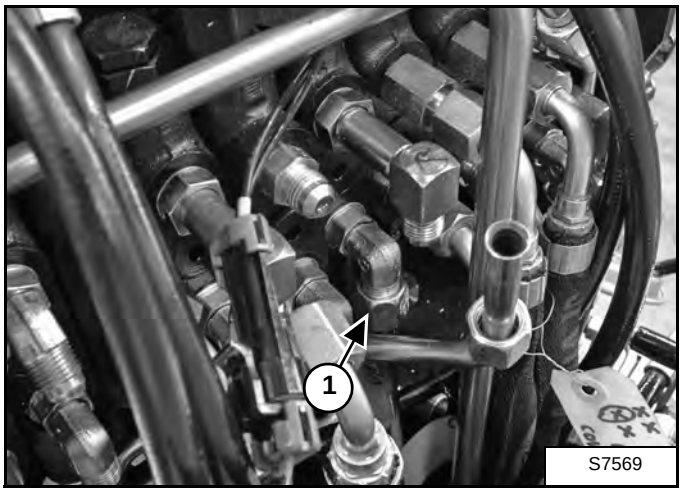
Reposition the tubeline for easy access to the slew motor.

Figure 20-90-17



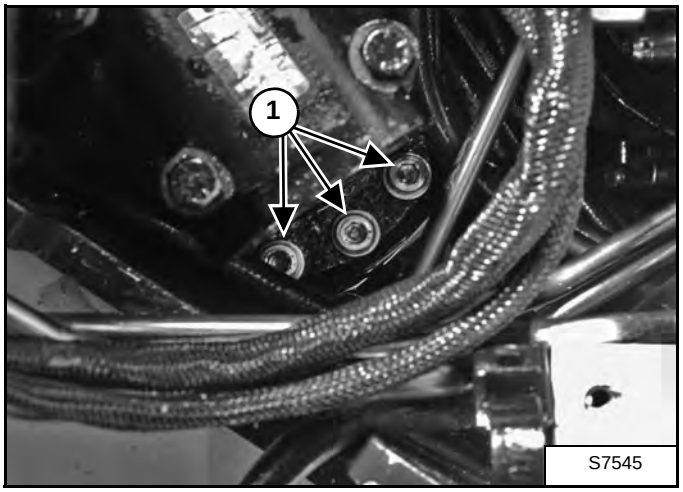
Mark and remove the tubeline (Item 1) **[Figure 20-90-17]** from the track expand valve.

Figure 20-90-18



Mark and remove the tubeline (Item 1) **[Figure 20-90-18]**.

Figure 20-90-19



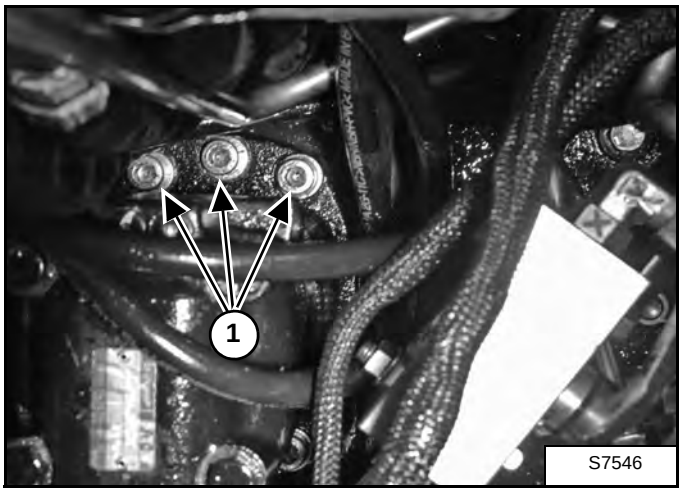
Remove the three bolts (Item 1) **[Figure 20-90-19]** from the slew motor.

Installation: Tighten the bolts to 40 - 50 N•m (29 - 37 ft-lb) torque.

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Removal And Installation (Cont'd)

Figure 20-90-20



Remove the three bolts (Item 1) **[Figure 20-90-20]** from the slew motor.

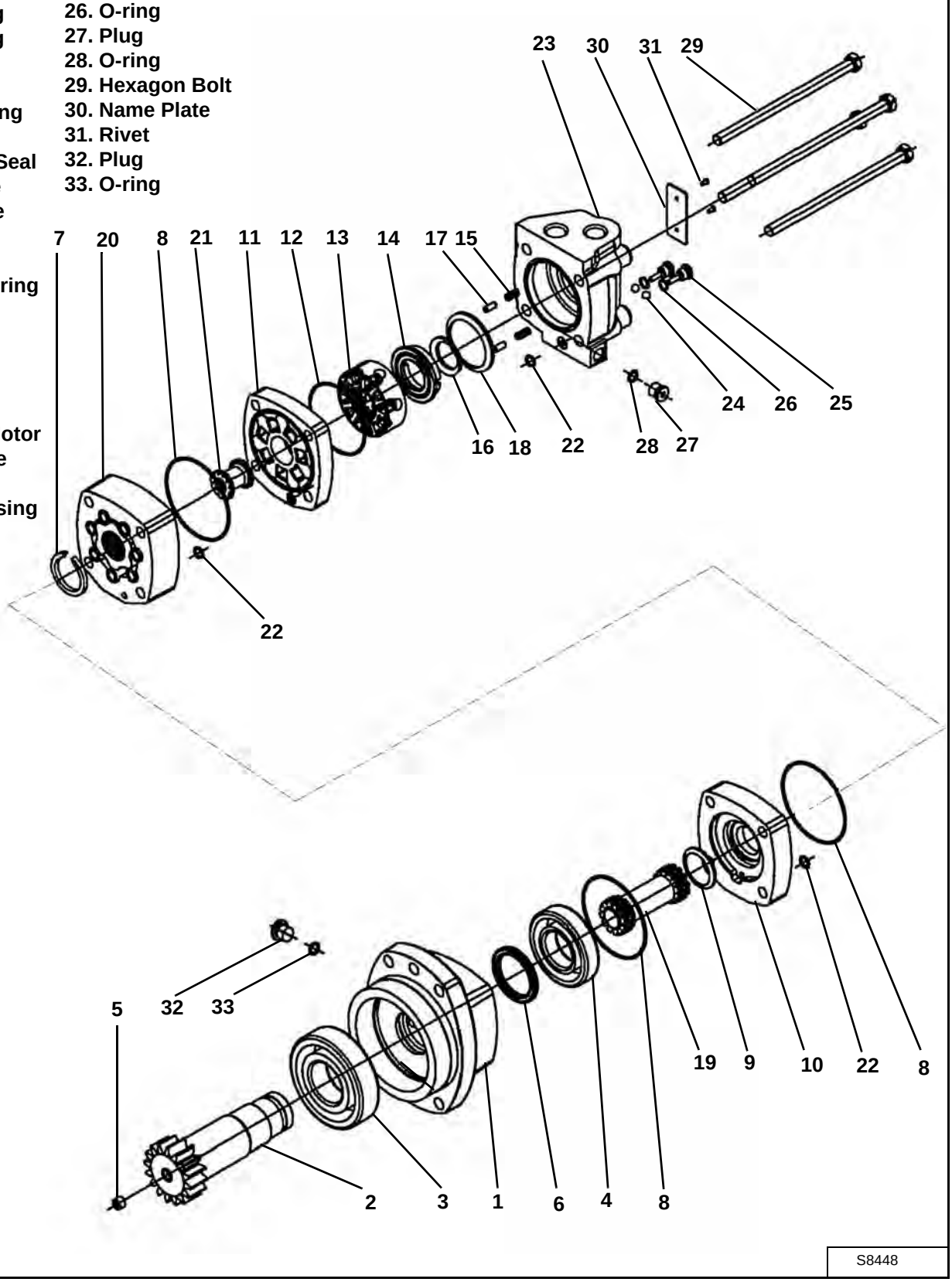
Installation: Tighten the bolts to 40 - 50 N•m (29 - 37 ft-lb) torque.

Remove the slew motor from the excavator.

Dealer Copy -- Not for Resale

Parts Identification

1. Bearing Housing
2. Pinion Gear
3. Ball Bearing
4. Ball Bearing
5. Plug
6. Seal
7. Retaining ring
8. O-ring
9. Shaft Face Seal
10. Wear Plate
11. Valve Plate
12. O-ring
13. Valve
14. Balancing ring
15. Spring
16. Inner Seal
17. Pin
18. Outer Seal
19. Drive
20. Housing Motor
21. Valve Drive
22. O-ring
23. Valve Housing
24. Steel Ball
25. Plug
26. O-ring
27. Plug
28. O-ring
29. Hexagon Bolt
30. Name Plate
31. Rivet
32. Plug
33. O-ring



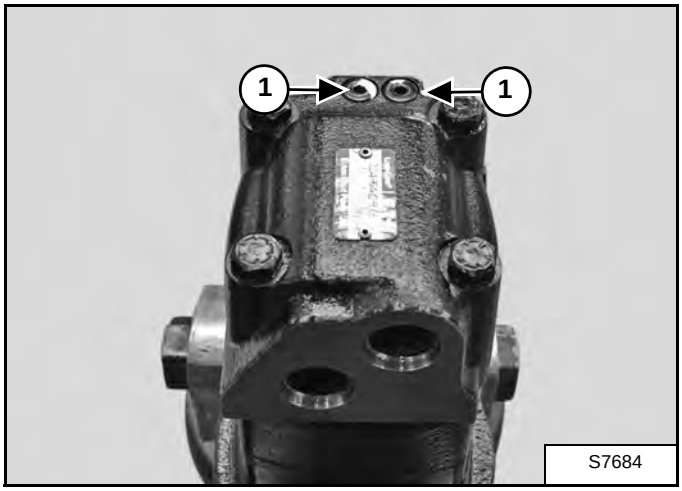
Dealer Copy -- Not for Resale

Disassembly

Clean the outside of the slew motor before disassembly.

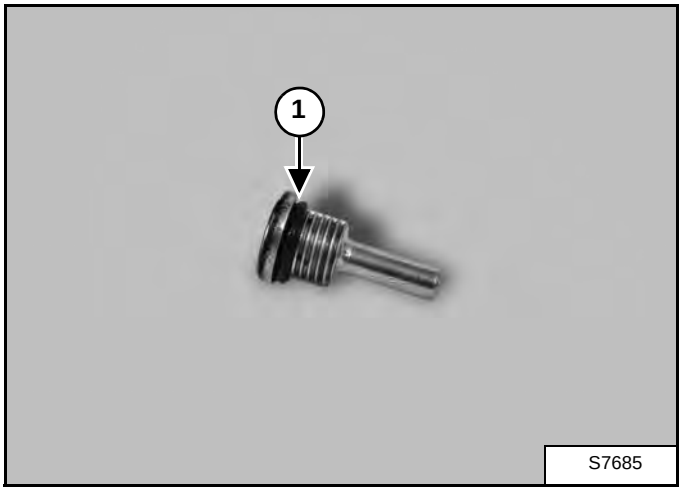
Mark the outside of the slew motor for ease of assembly.

Figure 20-90-21



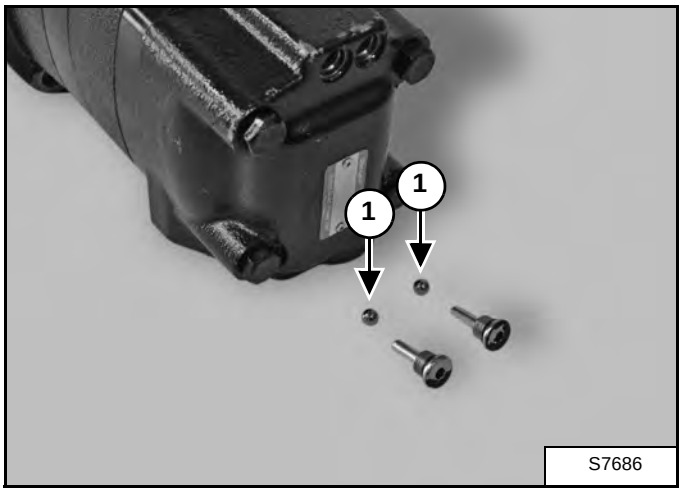
Remove the plugs (Item 1) **[Figure 20-90-21]** from the slew motor.

Figure 20-90-22



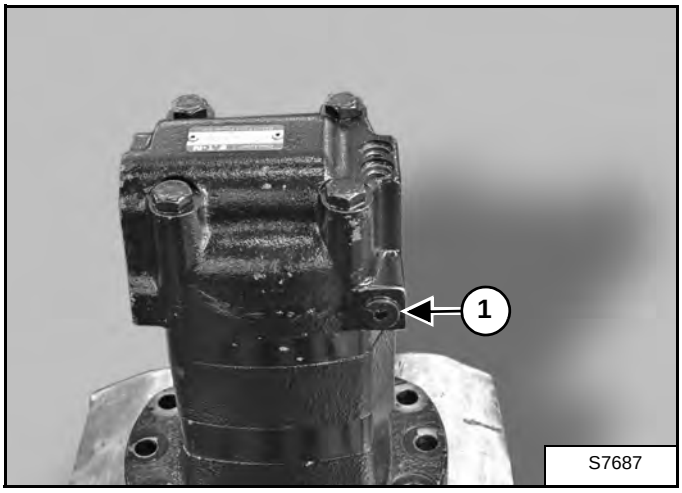
Remove the O-ring (Item 1) **[Figure 20-90-22]** from the plugs.

Figure 20-90-23



Remove the balls (Item 1) **[Figure 20-90-23]**.

Figure 20-90-24

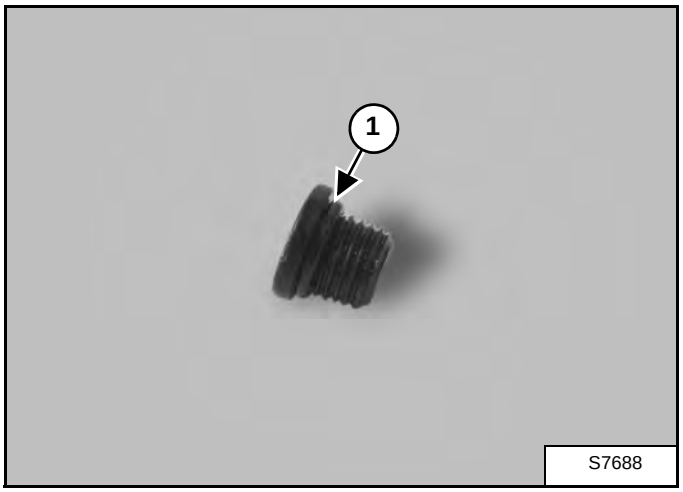


Remove the plug (Item 1) **[Figure 20-90-24]** from the slew motor.

Dealer Copy -- Not for Resale

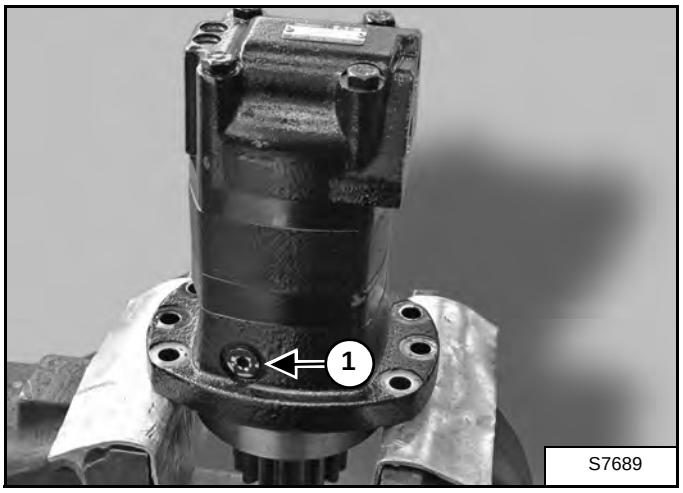
Disassembly (Cont'd)

Figure 20-90-25



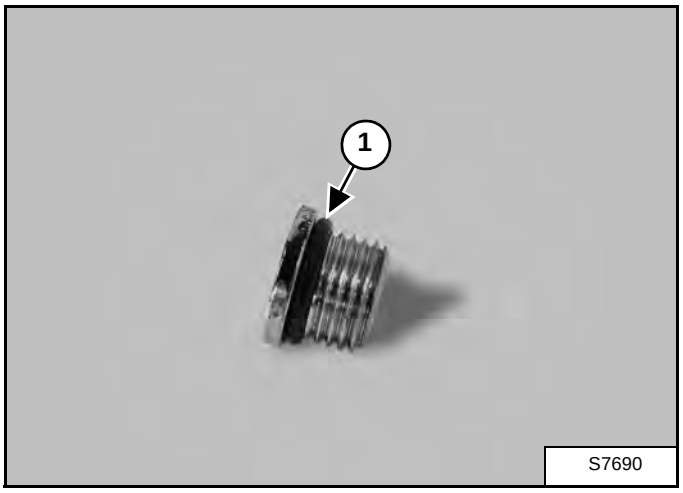
Remove the O-ring (Item 1) **[Figure 20-90-25]** from the plug.

Figure 20-90-26



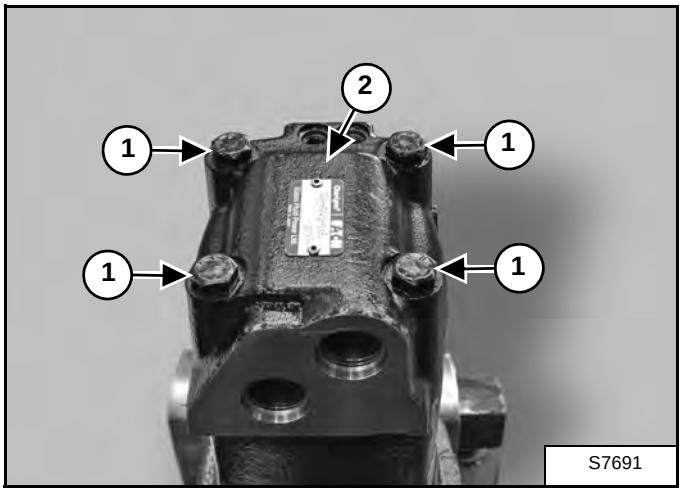
Remove the plug (Item 1) **[Figure 20-90-26]** from the slew motor.

Figure 20-90-27



Remove the O-ring (Item 1) **[Figure 20-90-27]** from the plug.

Figure 20-90-28

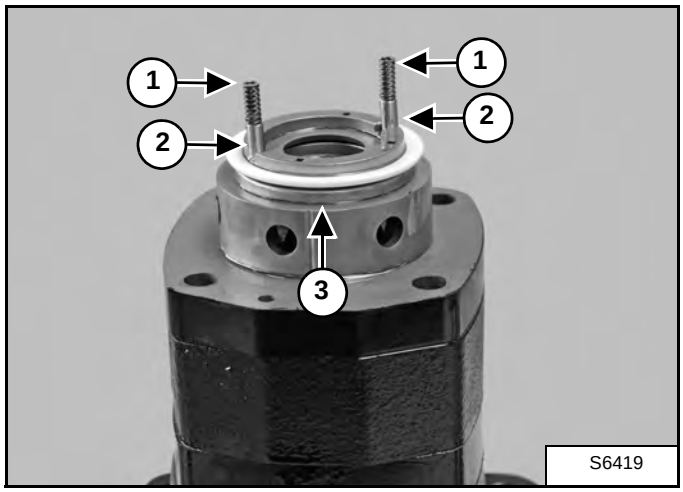


Remove the bolts (Item 1) **[Figure 20-90-28]**.

Dealer Copy -- Not for Resale

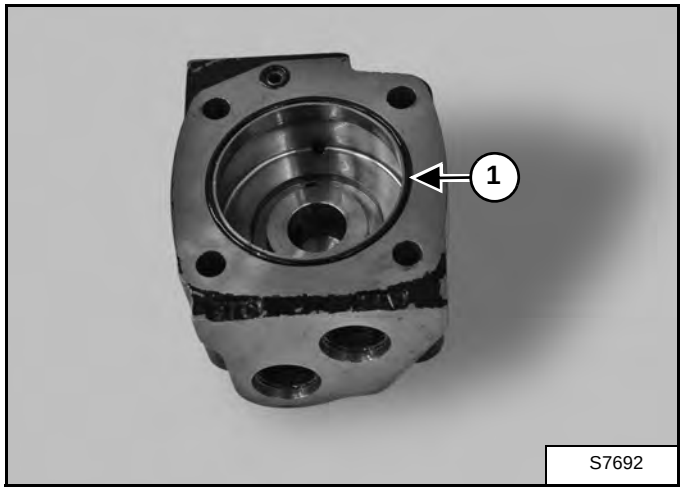
Disassembly (Cont'd)

Figure 20-90-29



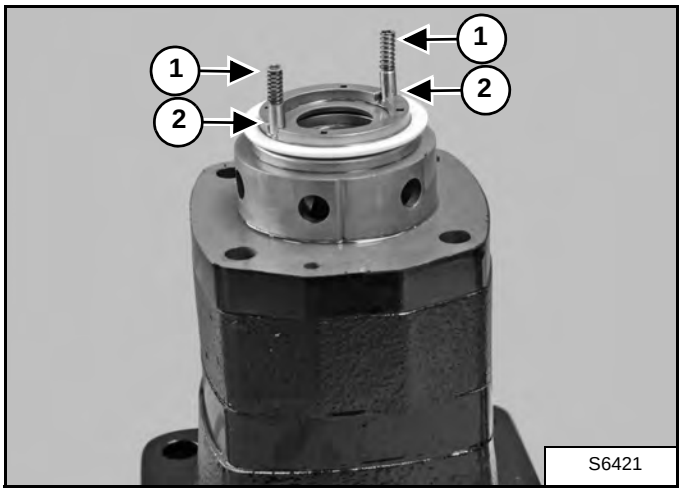
Remove the top of the motor (Item 2) **[Figure 20-90-28]** by lifting straight up. If done carefully, the springs (Item 1), pins (Item 2) and balance ring assembly (Item 3) **[Figure 20-90-29]** will remain on the valve for easy removal.

Figure 20-90-30



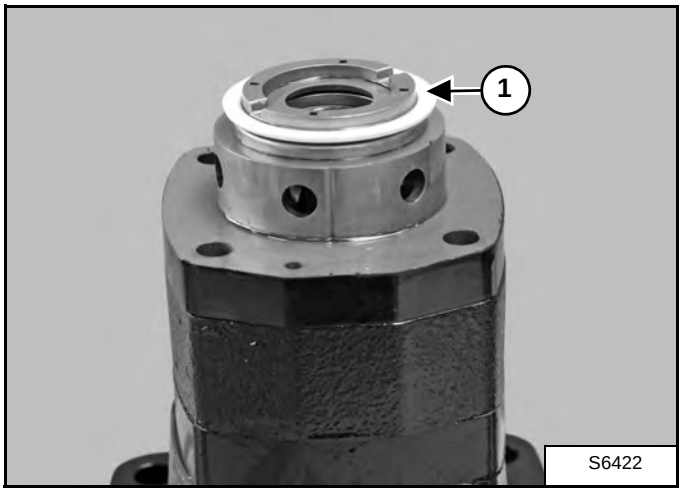
Remove the O-ring (Item 1) **[Figure 20-90-30]**.

Figure 20-90-31



Remove the springs (Item 1) and pins (Item 2) **[Figure 20-90-31]**.

Figure 20-90-32

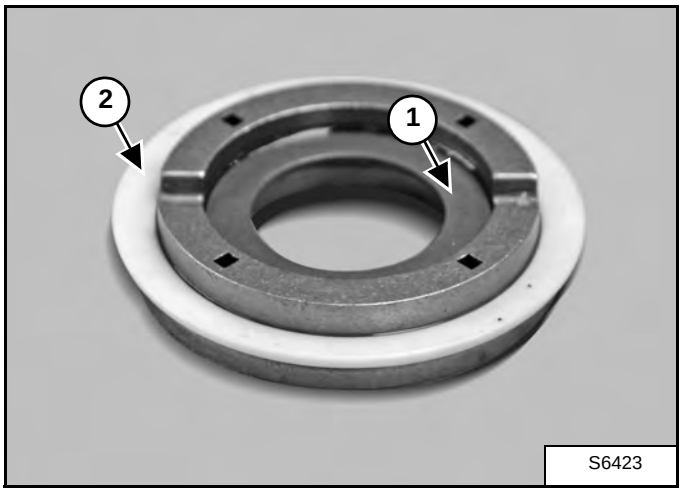


Remove the balance ring (Item 1) **[Figure 20-90-32]**.

Dealer Copy -- Not for Resale

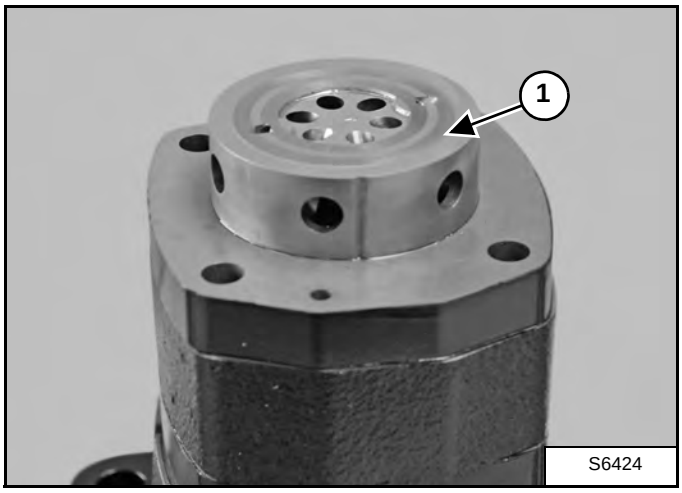
Disassembly (Cont'd)

Figure 20-90-33



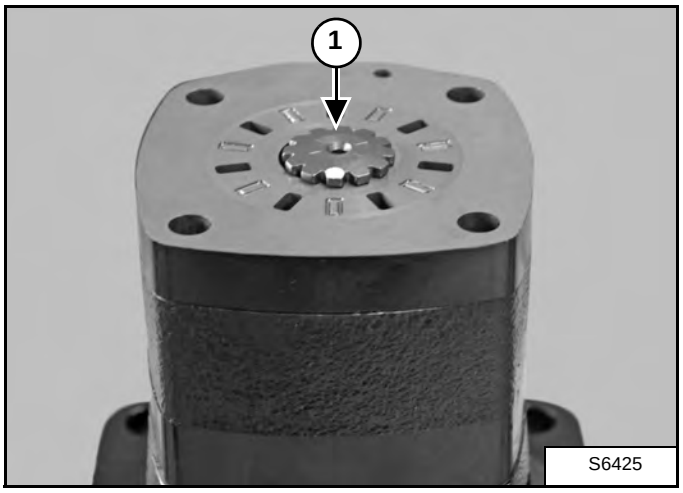
Remove the inner seal (Item 1) and outer seal (Item 2) **[Figure 20-90-33]**.

Figure 20-90-34



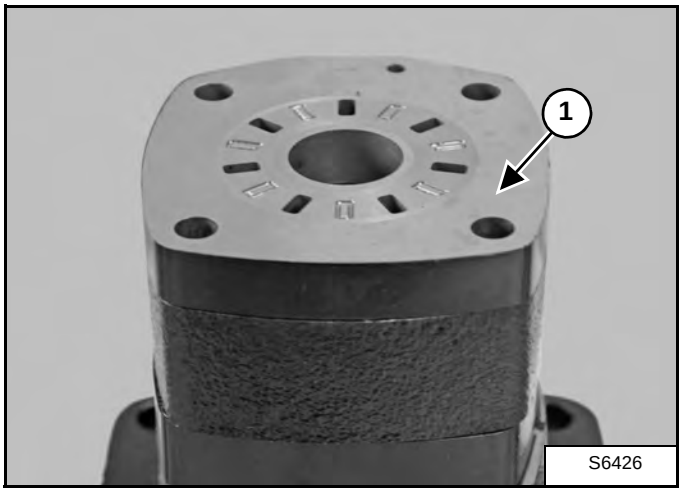
Remove the valve (Item 1) **[Figure 20-90-34]**.

Figure 20-90-35



Remove the drive (Item 1) **[Figure 20-90-35]**.

Figure 20-90-36

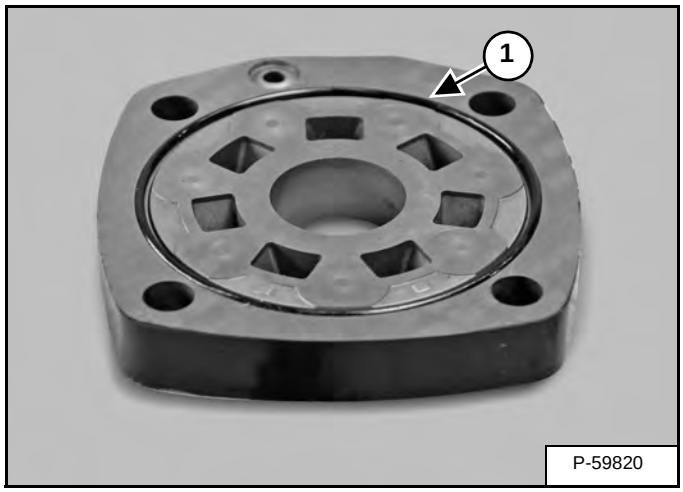


Remove the valve plate (Item 1) **[Figure 20-90-36]**.

Dealer Copy -- Not for Resale

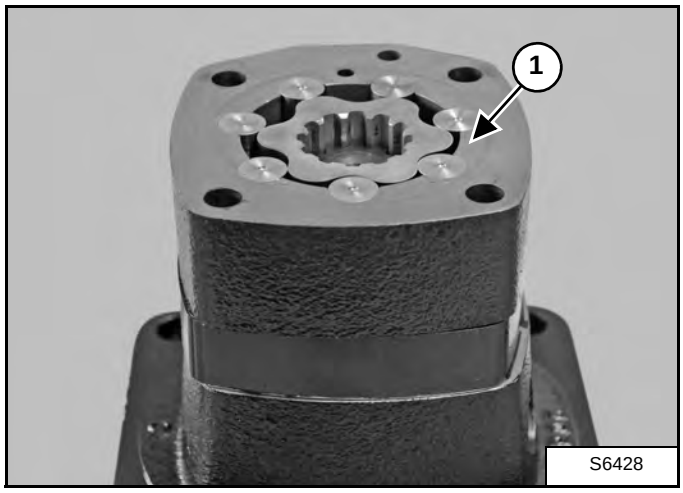
Disassembly (Cont'd)

Figure 20-90-37



Remove the O-ring (Item 1) **[Figure 20-90-37]** from the valve plate.

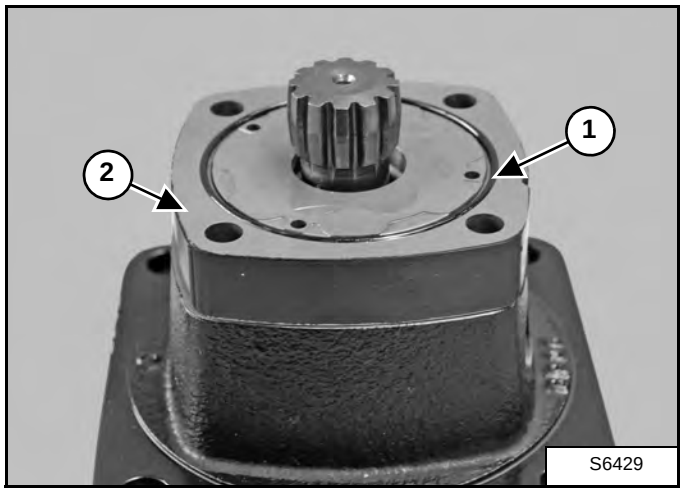
Figure 20-90-38



Remove the Geroler® (Item 1) **[Figure 20-90-38]**.

NOTE: Do not disassemble the Geroler®.

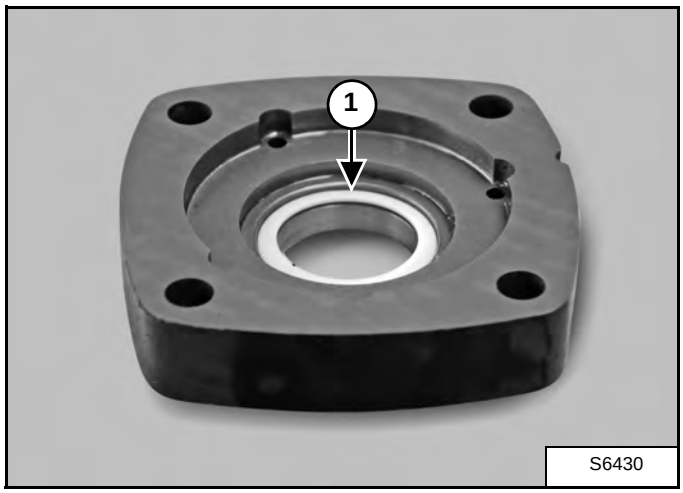
Figure 20-90-39



Remove the O-ring (Item 1) **[Figure 20-90-39]**.

Remove the valve plate (Item 2) **[Figure 20-90-39]**.

Figure 20-90-40

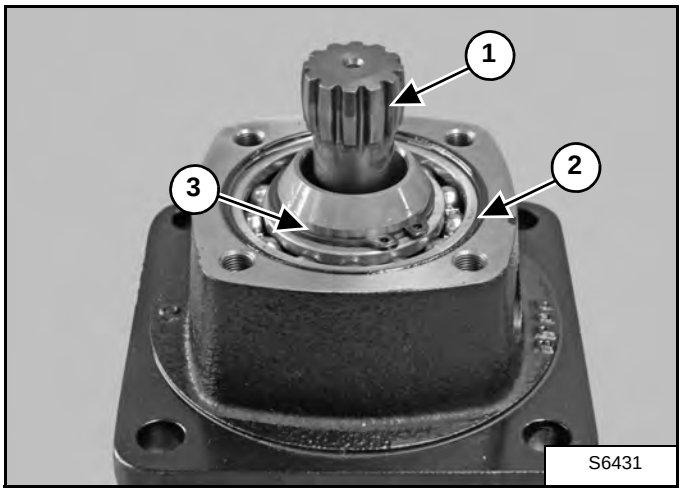


Remove the seal (Item 1) **[Figure 20-90-40]** from the valve plate.

Dealer Copy -- Not for Resale

Disassembly (Cont'd)

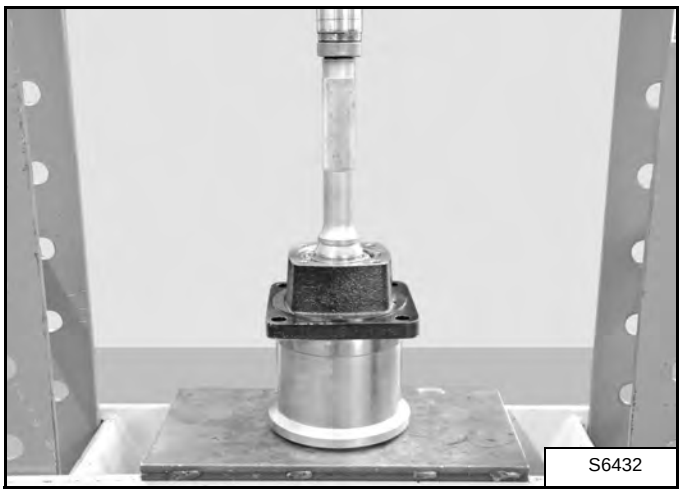
Figure 20-90-41



Remove the drive (Item 1) and O-ring (Item 2) **[Figure 20-90-41]**.

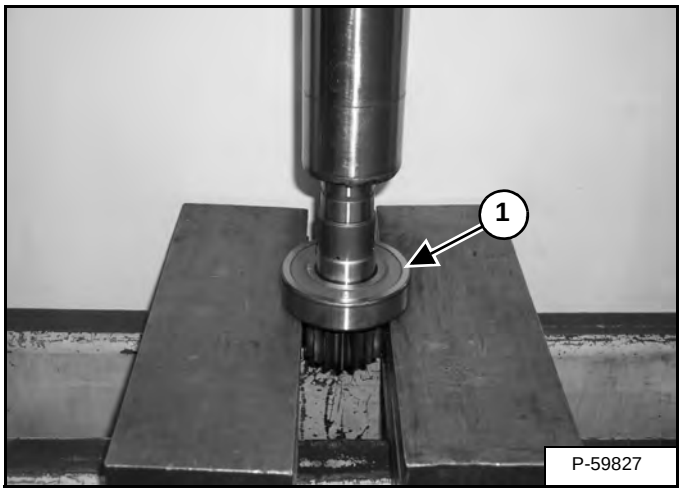
Remove the snap ring (Item 3) **[Figure 20-90-41]**.

Figure 20-90-42



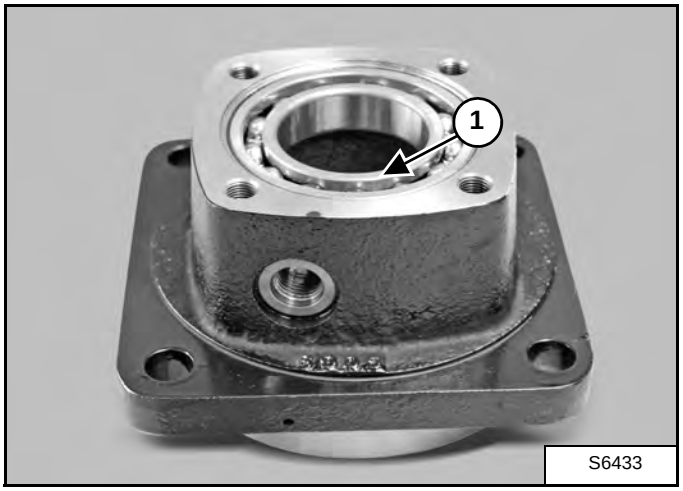
Press the shaft out of the housing **[Figure 20-90-42]**.

Figure 20-90-43



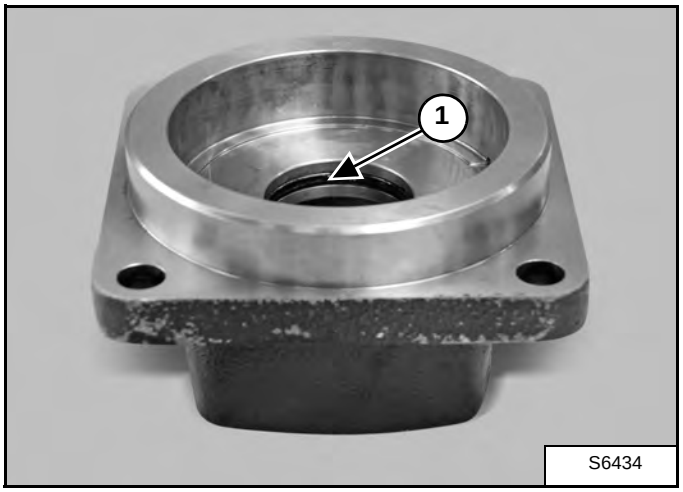
Press the bearing (Item 1) **[Figure 20-90-43]** off of the shaft.

Figure 20-90-44



Remove the bearing (Item 1) **[Figure 20-90-44]** from the housing.

Figure 20-90-45



Remove the seal (Item 1) **[Figure 20-90-45]** from the housing.

Dealer Copy -- Not for Resale

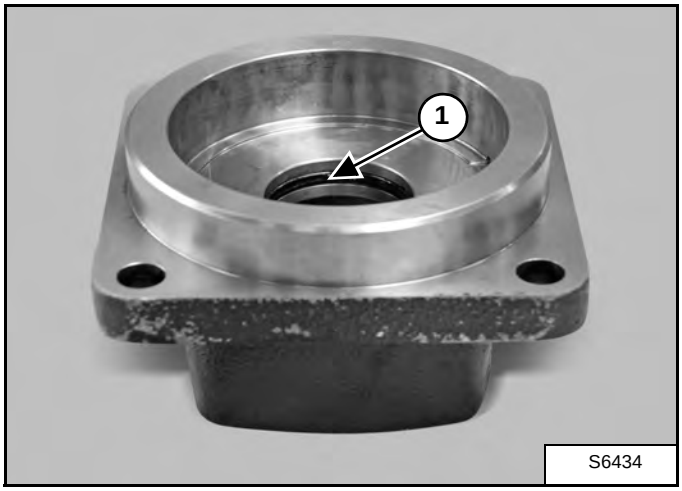
Assembly

Clean all parts in solvent and dry with compressed air.

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

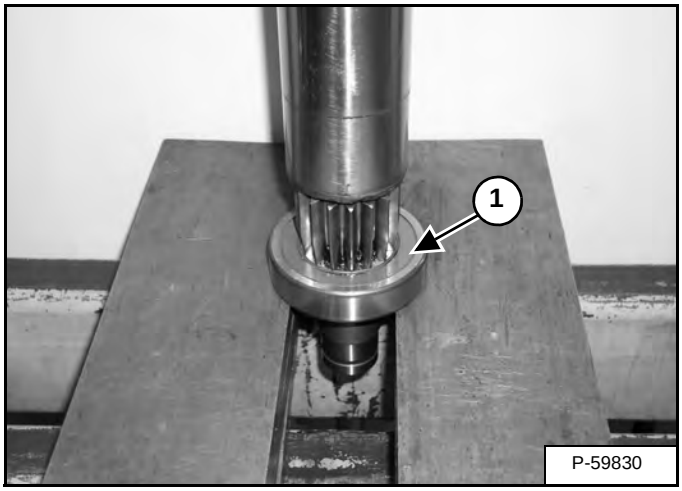
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-90-46



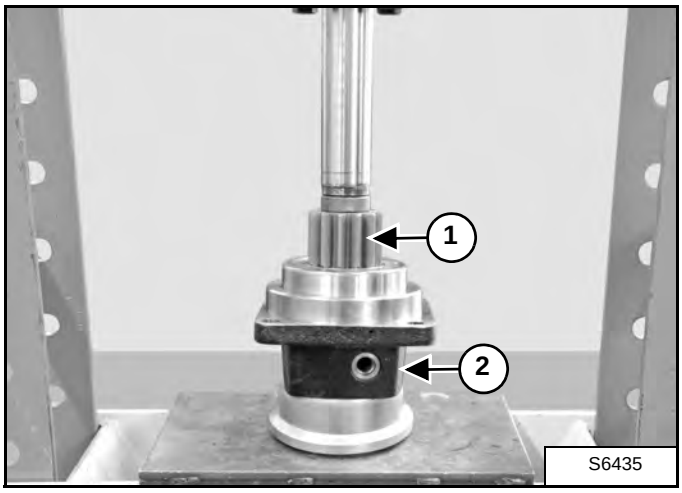
Install the seal (Item 1) **[Figure 20-90-46]** in the housing.

Figure 20-90-47



Press the bearing (Item 1) **[Figure 20-90-47]** on the shaft.

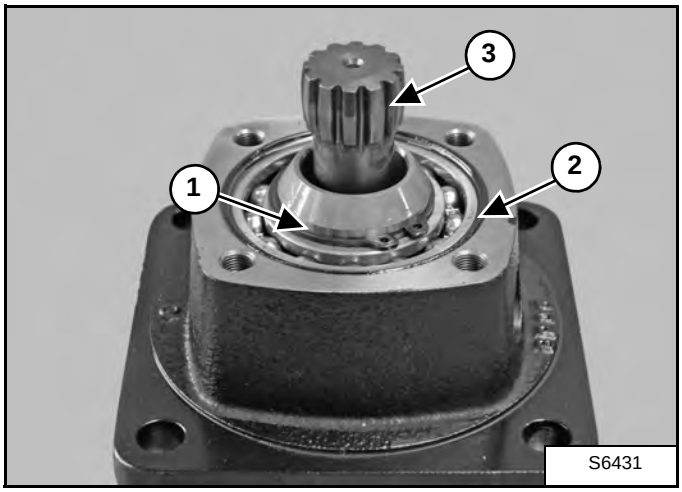
Figure 20-90-48



Press the shaft (Item 1) **[Figure 20-90-48]** in the housing.

Apply assembly lube to the bearing and press the bearing (Item 2) **[Figure 20-90-48]** in the housing.

Figure 20-90-49



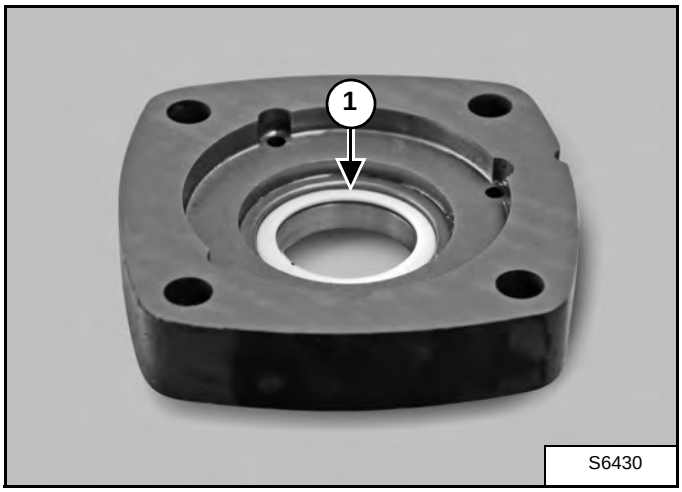
Install the snap ring (Item 1) and O-ring (Item 2) **[Figure 20-90-49]**.

Install the drive (Item 3) **[Figure 20-90-49]**.

Dealer Copy -- Not for Resale

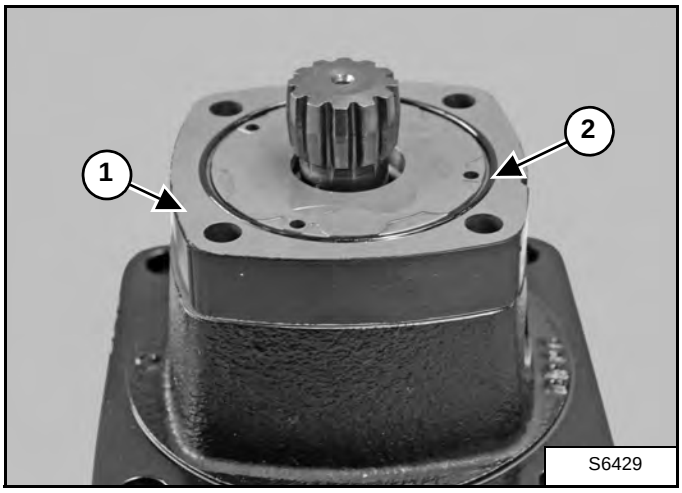
Assembly (Cont'd)

Figure 20-90-50



Install the seal (Item 1) **[Figure 20-90-50]** in the valve plate.

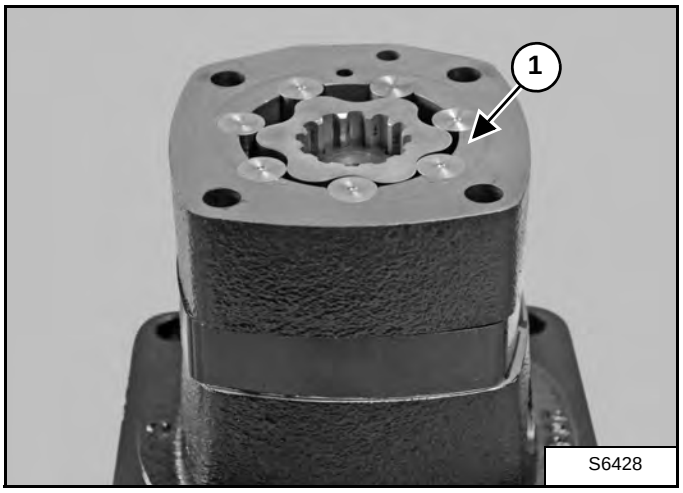
Figure 20-90-51



Install the valve plate (Item 1) **[Figure 20-90-51]**.

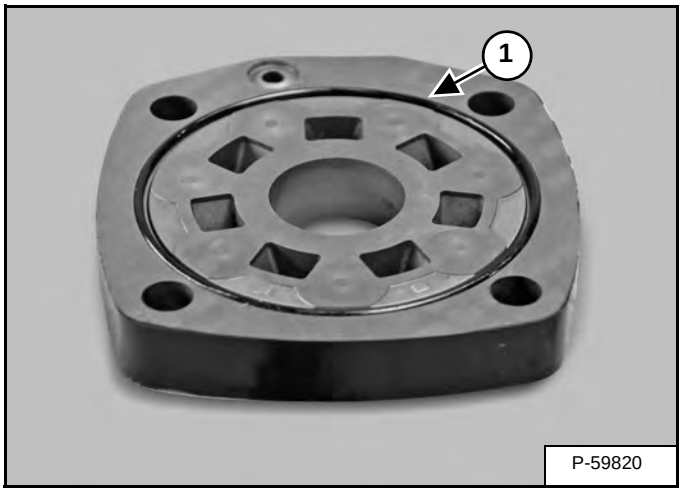
Install the O-ring (Item 2) **[Figure 20-90-51]**.

Figure 20-90-52



Install the Geroler® (Item 1) **[Figure 20-90-52]**.

Figure 20-90-53



Install the O-ring (Item 1) **[Figure 20-90-53]** on the valve plate.

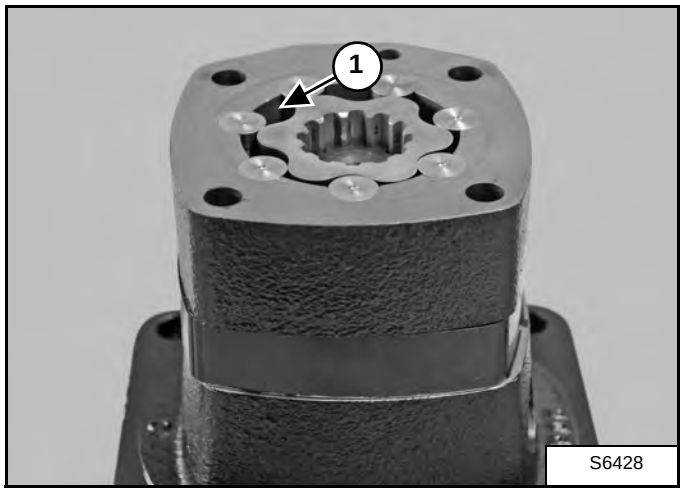
Dealer Copy -- Not for Resale

Assembly (Cont'd)

Motor Timing

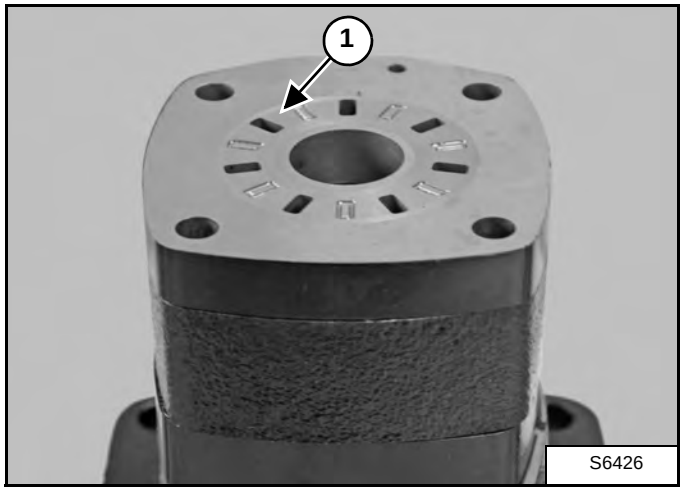
The direction that the output shaft rotates is determined by timing. Time the motor as follows:

Figure 20-90-54



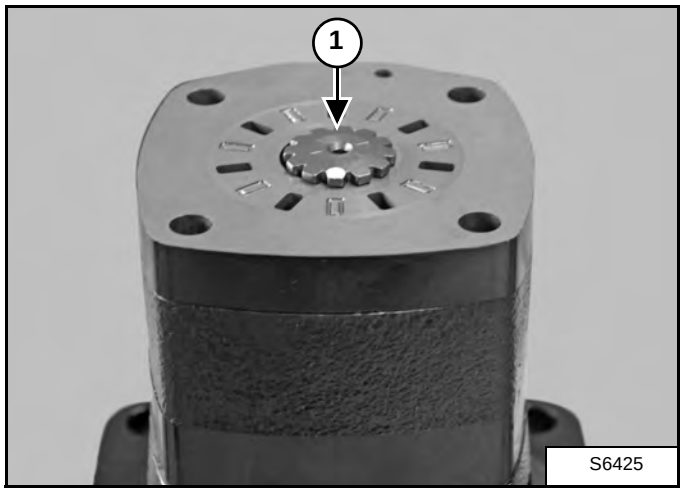
Locate the largest open pocket in the Geroler® (Item 1) **[Figure 20-90-54]**.

Figure 20-90-55



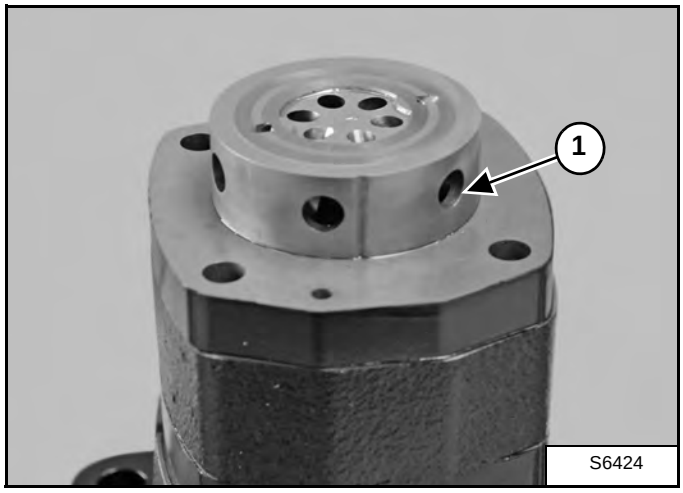
Install the valve plate and locate the open slot (Item 1) **[Figure 20-90-55]** that is over the largest open Geroler˝® pocket.

Figure 20-90-56



Install the drive (Item 1) **[Figure 20-90-56]**.

Figure 20-90-57



NOTE: Picture position has changed 180°.

Align one of the side openings (Item 1) **[Figure 20-90-57]** in the valve with the valve plate slot that is over the largest open Geroler® pocket.

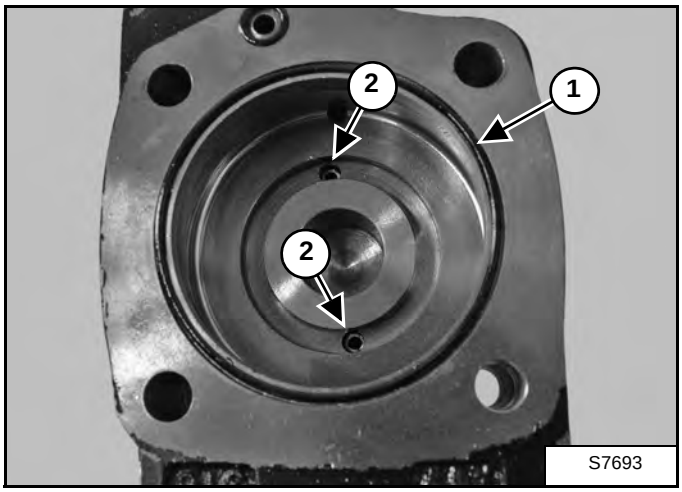
Engage the valve with the valve drive by rotating it 15° clockwise until the spline teeth mesh.

NOTE: If the valve is turned clockwise the motor will rotate in the opposite direction.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

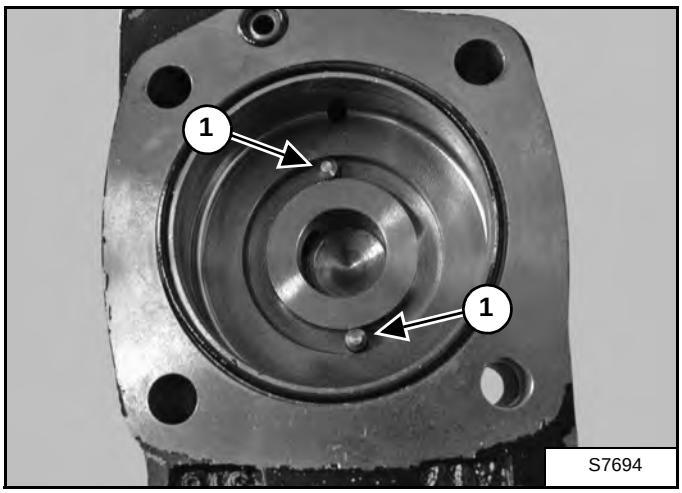
Figure 20-90-58



Install the O-ring (Item 1) **[Figure 20-90-58]**.

Apply assembly lube to the springs, and install the springs (Item 2) **[Figure 20-90-58]**.

Figure 20-90-59



Install the pins (Item 1) **[Figure 20-90-59]**.

Figure 20-90-60

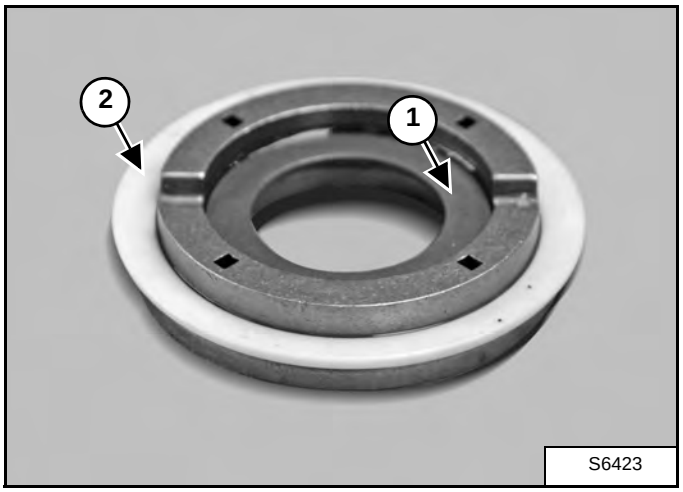
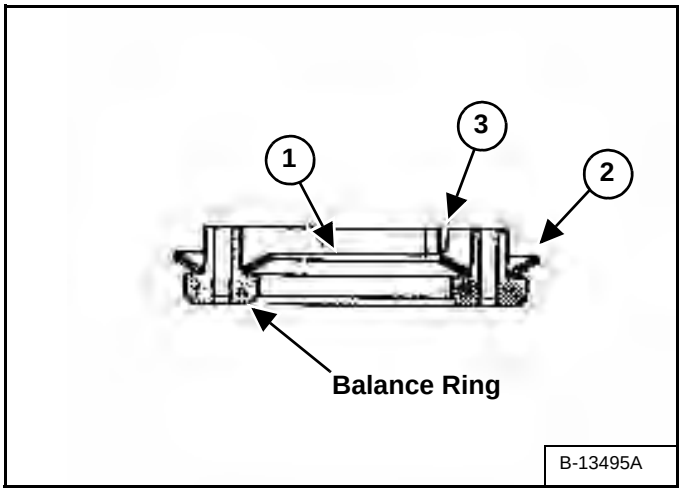


Figure 20-90-61

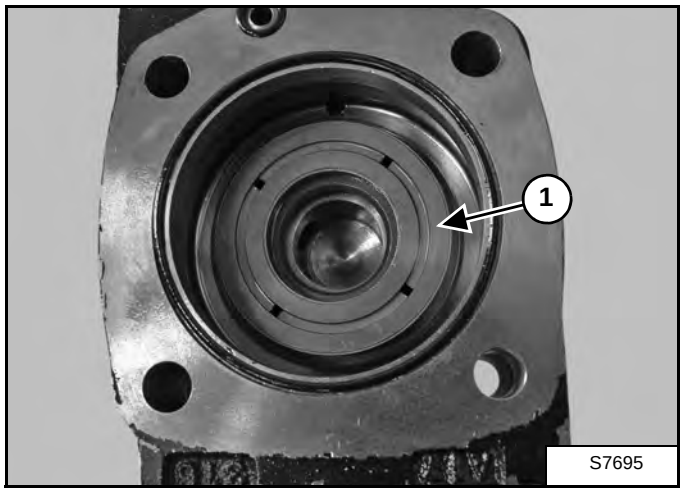


Install the inner (Item 1) and outer (Item 2) **[Figure 20-90-60]** and **[Figure 20-90-61]** face seals on the balance ring as shown.

Dealer Copy -- Not for Resale

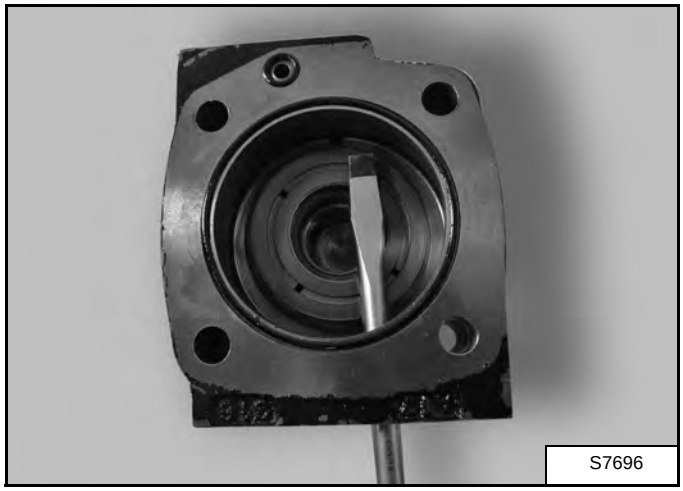
Assembly (Cont'd)

Figure 20-90-62



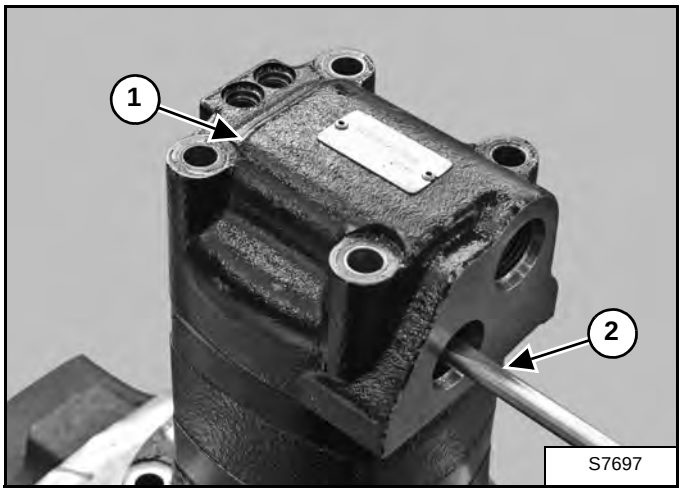
Install the balance ring (Item 1) **[Figure 20-90-62]**. Make sure the pins engage the pin notches (Item 3) **[Figure 20-90-61]** in the balance ring.

Figure 20-90-63



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 20-90-63]**.

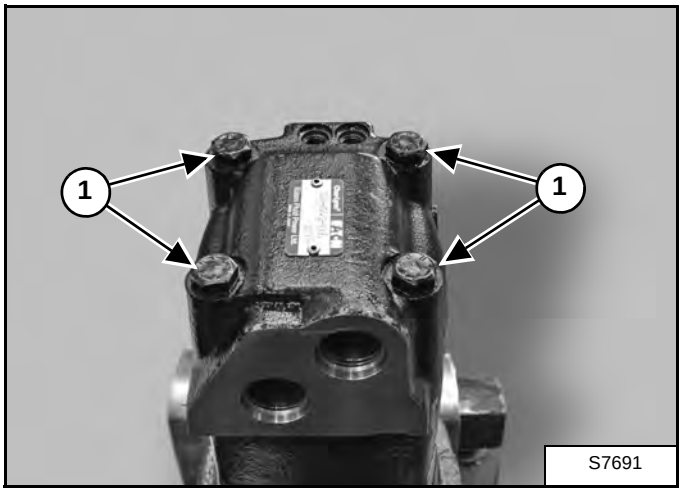
Figure 20-90-64



Install the housing (Item 1) **[Figure 20-90-64]** on the motor.

Remove the screwdriver (Item 2) **[Figure 20-90-64]**.

Figure 20-90-65



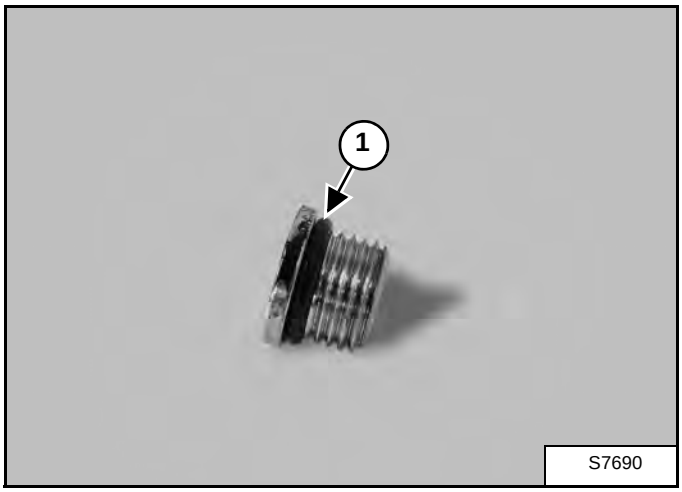
Install the bolts (Item 1) **[Figure 20-90-65]**. Tighten the bolts to 53 N•m (39 ft-lb) torque in a crisscross pattern.

Installation: Tighten bolts to 53 N•m (39 ft-lb) torque.

Dealer Copy -- Not for Resale

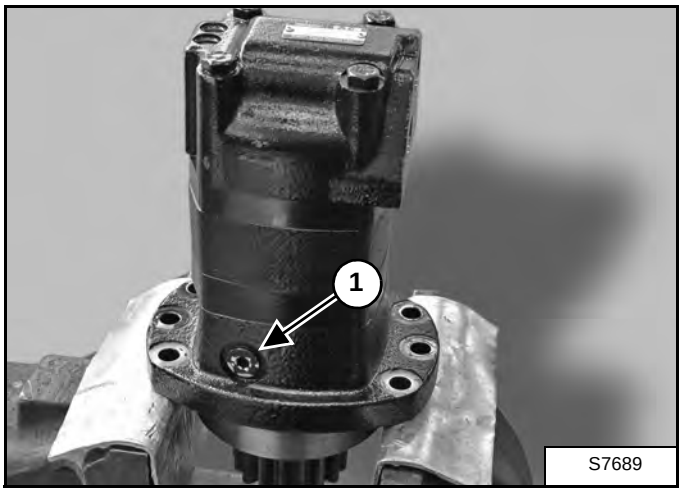
Assembly (Cont'd)

Figure 20-90-66



Install the O-ring (Item 1) **[Figure 20-90-66]** on the plug.

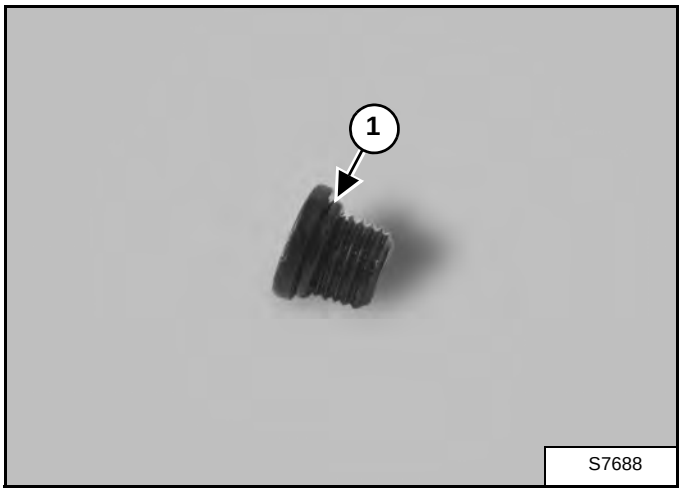
Figure 20-90-67



Install the plug (Item 1) **[Figure 20-90-67]**.

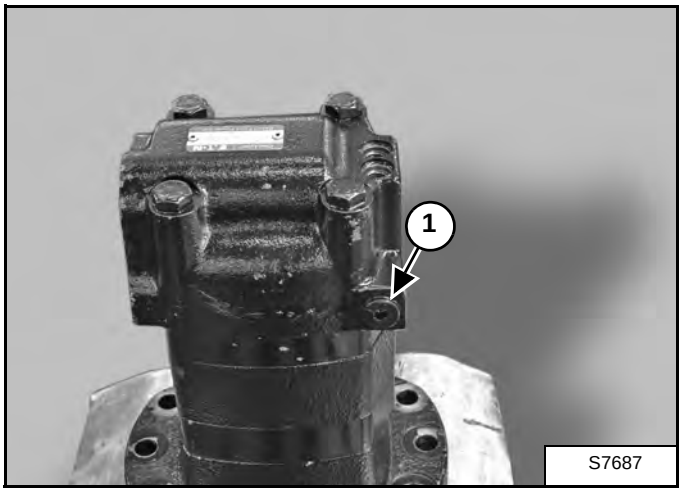
Installation: Tighten to 10 N•m (88.50 in-lb) torque.

Figure 20-90-68



Install the O-ring (Item 1) **[Figure 20-90-68]** on the plug.

Figure 20-90-69



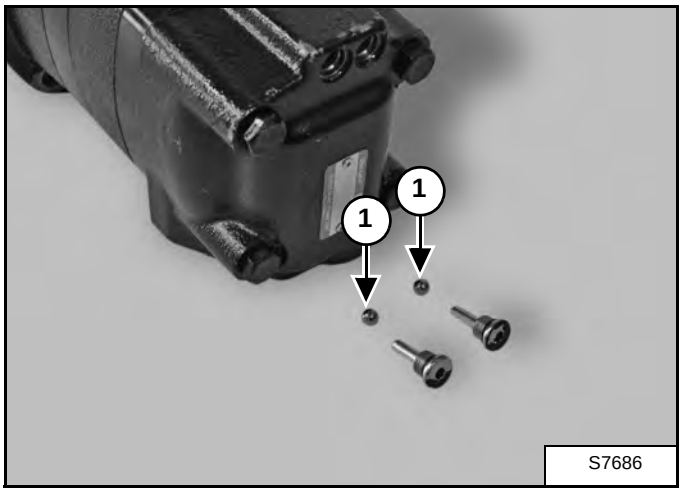
Install the plug (Item 1) **[Figure 20-90-69]**.

Installation: Tighten to 10 N•m (88.50 in-lb) torque.

Dealer Copy -- Not for Resale

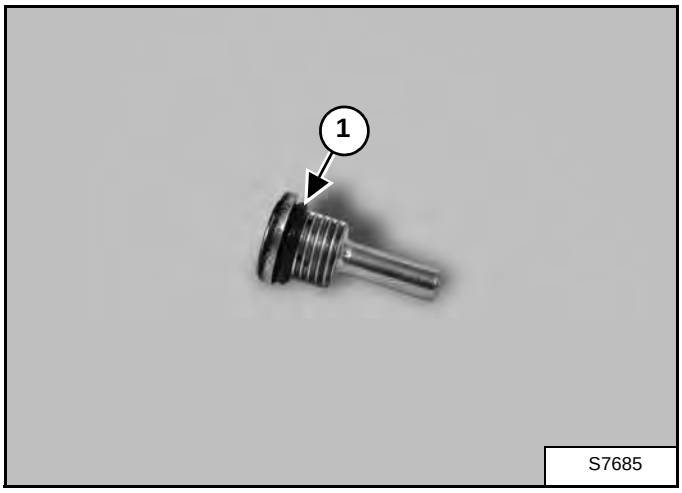
Assembly (Cont'd)

Figure 20-90-70



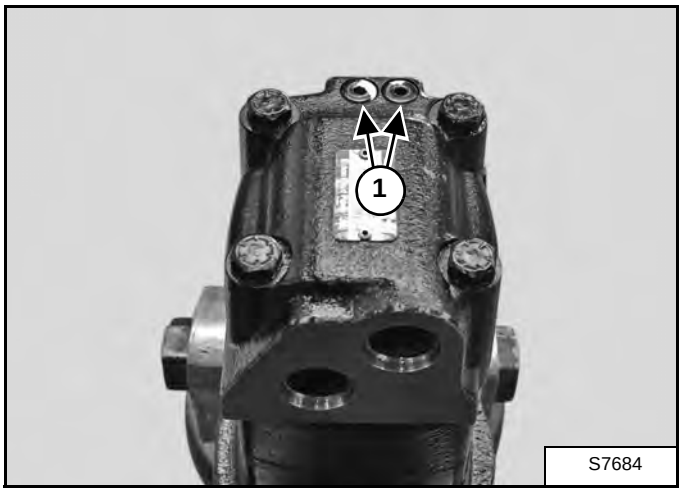
Install the balls (Item 1) **[Figure 20-90-70]**.

Figure 20-90-71



Install the O-ring (Item 1) **[Figure 20-90-71]** on the plugs.

Figure 20-90-72

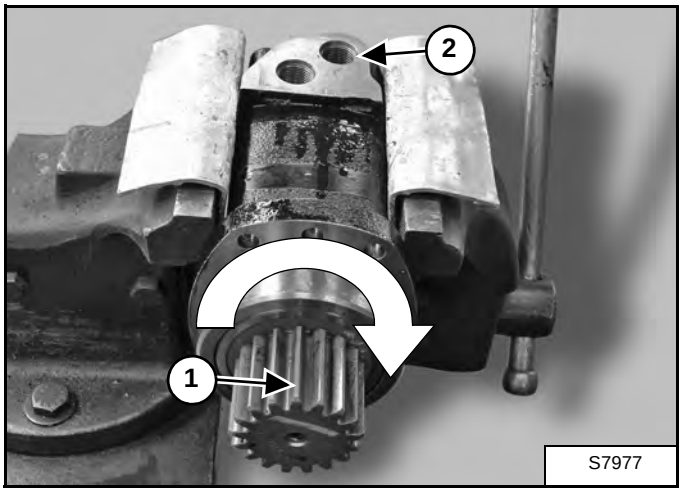


Install the plugs (Item 1) **[Figure 20-90-72]**.

Installation: Tighten to 10 N•m (88.50 in-lb) torque.

Clamp the motor in a vise.

Figure 20-90-73



Turn the shaft (Item 1) **[Figure 20-90-73]** in a clockwise direction.

If the motor is correctly timed, there will be suction at the top port (Item 2) **[Figure 20-90-73]**.

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CONTROL PATTERN SELECTOR VALVE

Description

The control pattern selector valve changes the control patterns from ISO to STD.

The control pattern selector valve is located under the drivers seat, next to the fuel tank on the left side of the excavator.

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 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 battery. (See Removal and Installation on Page 50-20-3.)

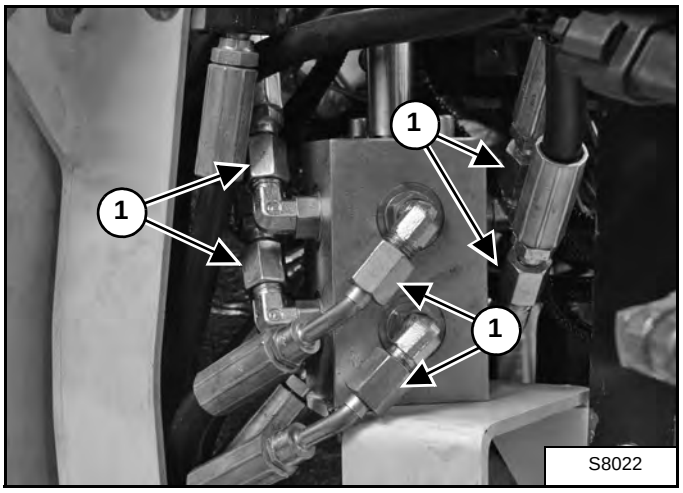
Remove the fuel tank. (See Removal And Installation on Page 40-130-1.)

⚠ 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 physician familiar with this injury is not received immediately.

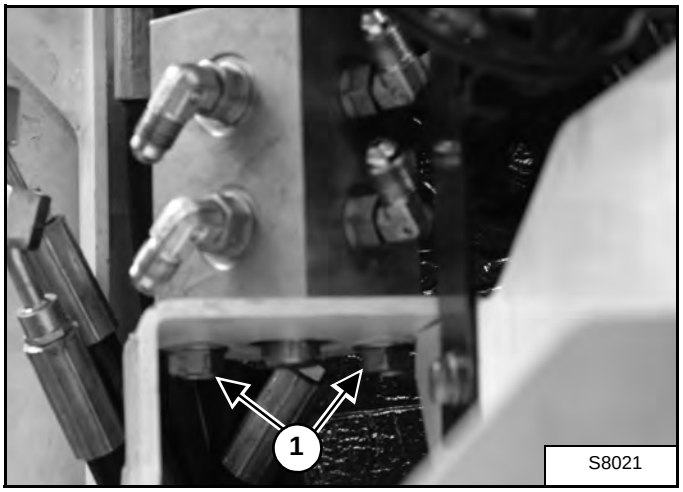
W-2145-0290

Figure 20-100-1



Mark and disconnect the eight hoses (Item 1) **[Figure 20-100-1]**.

Figure 20-100-2



Remove the two bolts (Item 1) **[Figure 20-100-2]**.

Remove the control pattern selector valve from the excavator.

Dealer Copy -- Not for Resale

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.

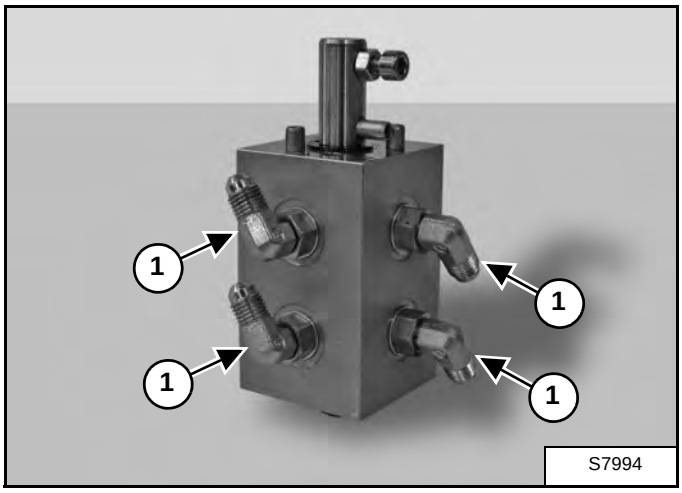
I-2003-0888

⚠ WARNING

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

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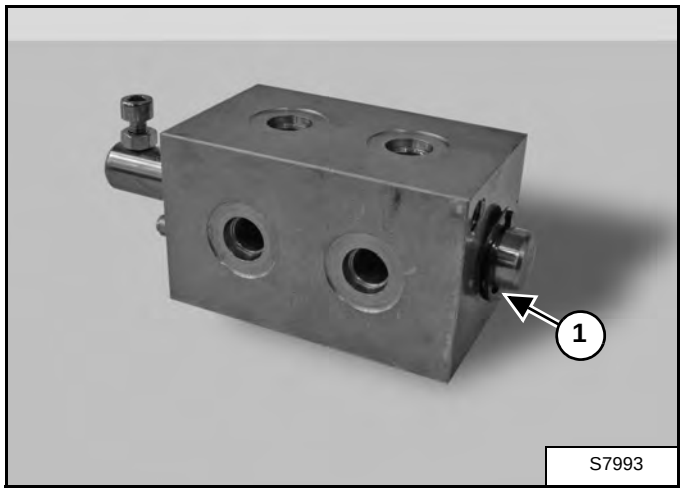
Figure 20-100-3



Remove the eight fittings (Item 1) **[Figure 20-100-3]** from the control pattern selector valve.

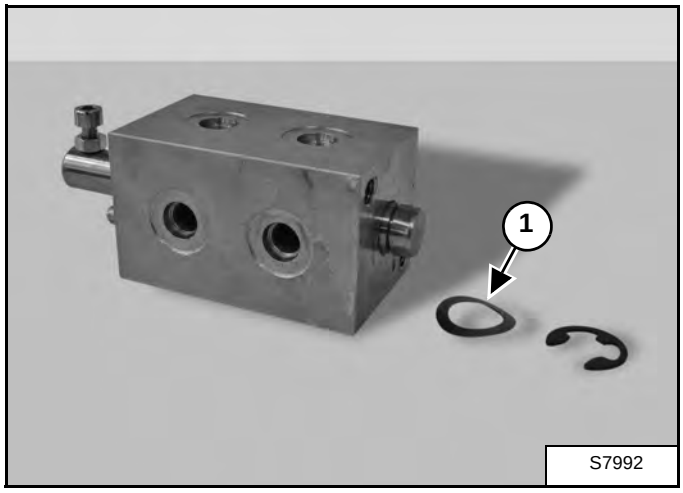
Installation: Tighten the fittings to 25 N•m (18 ft-lb) torque.

Figure 20-100-4



Remove the snap ring (Item 1) **[Figure 20-100-4]**.

Figure 20-100-5

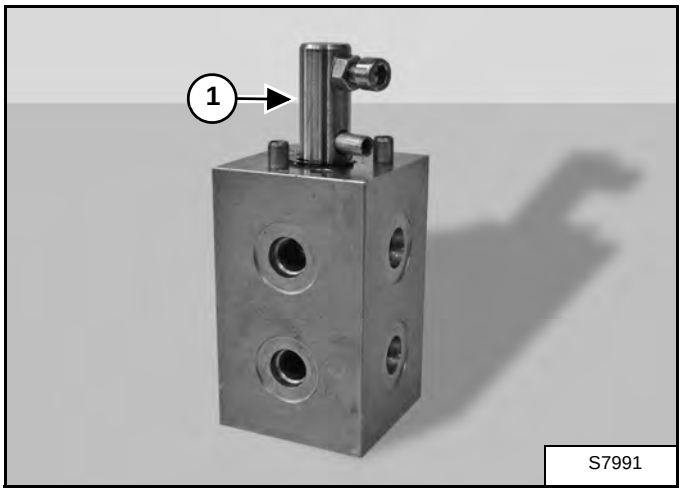


Remove the wave washer (Item 1) **[Figure 20-100-5]**.

Dealer Copy -- Not for Resale

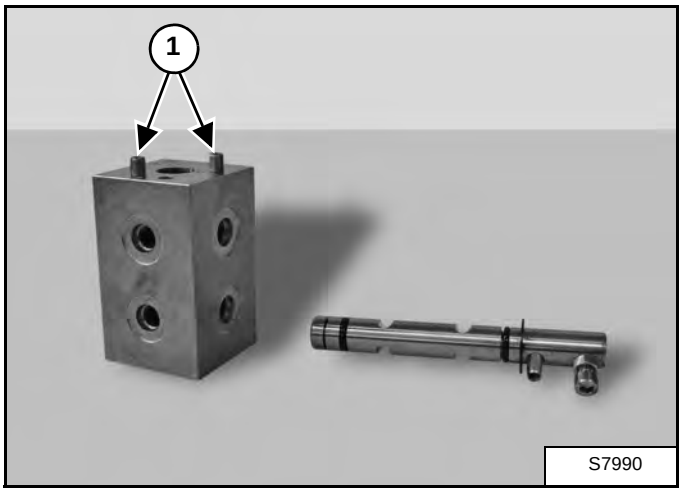
Disassembly And Assembly (Cont'd)

Figure 20-100-6



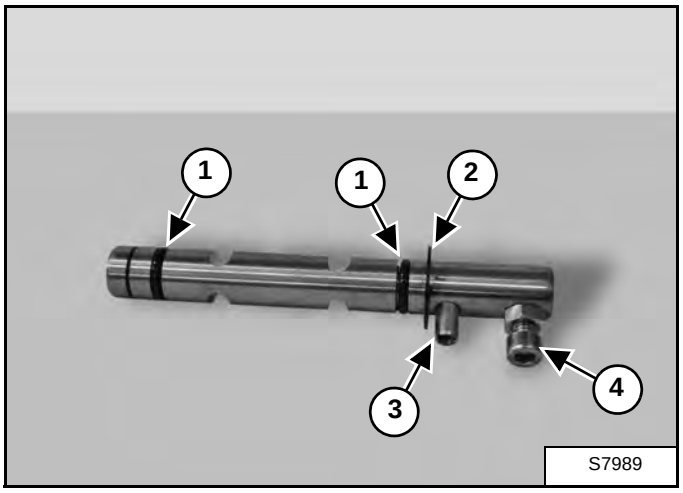
Remove the axle (Item 1) **[Figure 20-100-6]**.

Figure 20-100-7



Remove the two pins (Item 1) **[Figure 20-100-7]** from the control pattern selector valve.

Figure 20-100-8



Remove the two O-rings (Item 1), snap ring (Item 2), and pin (Item 3) **[Figure 20-100-8]** from the shaft.

Remove the bolt and nut (Item 4) **[Figure 20-100-8]** from the shaft.

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CONTROL LEVER (JOYSTICK) (RIGHT) (S/N A33S13155 & ABOVE, B4K911001 & ABOVE AND B4PD11001 & ABOVE)

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) is movable. The right control lever (joystick) 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 20-32-1.)

The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

Lower the boom / bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

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

IMPORTANT

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

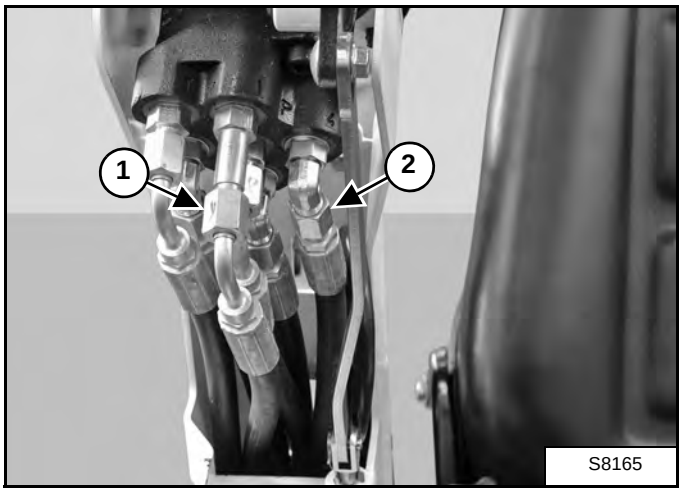
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WARNING

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

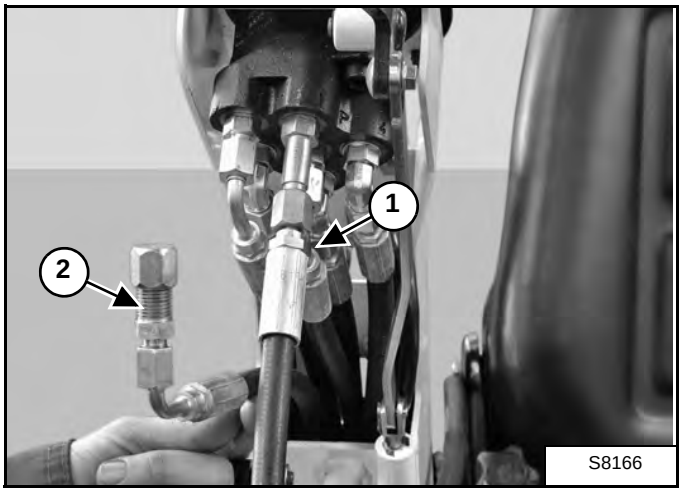
W-2145-0290

Figure 20-110-1



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 20-110-1]** 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 20-110-2



Remove the pilot hose **[Figure 20-110-2]** from the bottom of the control lever (joystick) that is to be checked.

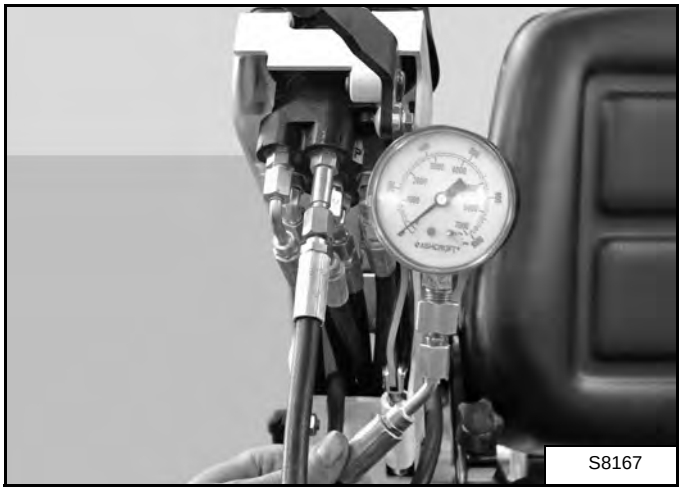
From the test kit, install a fitting and gauge hose (Item 1) **[Figure 20-110-2]** to the control lever (joystick) fitting.

Cap the pilot hose (Item 2) **[Figure 20-110-2]**.

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Testing (Cont'd)

Figure 20-110-3



Install a 6,9 MPa (69 bar) (1000 psi) gauge on the hose **[Figure 20-110-3]**.

Lower the right console to the locked position. Also lower the left console to the locked position if in the vertical position.

Start the engine and warm the hydraulic oil 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 circuit to be tested. Record the operating pressure.

The operating pressure should be as follows:

3,0 MPa (30 bar) (435 psi) with an acceptable range of 2,8 - 3,1 MPa (28 - 31 bar) (406 - 450 psi).

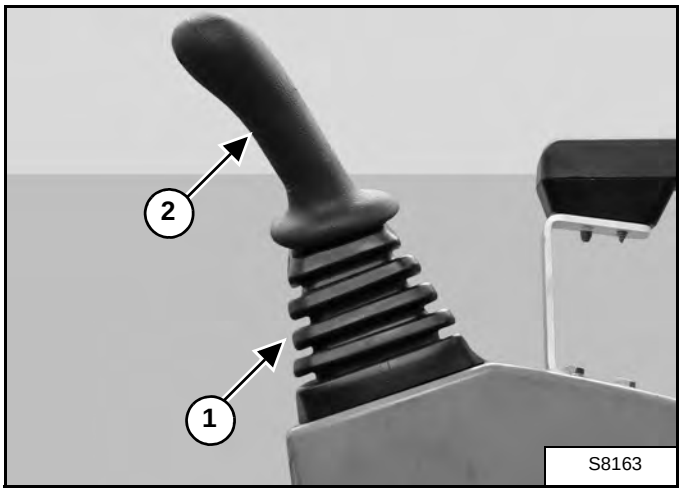
If the operating pressure is correct, check the valve section spool for proper operation.

If the operating pressure is incorrect, remove the pressure reducing valve, clean, install and retest. (See Testing And Adjusting on Page 20-32-1.)

If the pressure is still incorrect replace the pressure reducing valve. (See Testing And Adjusting on Page 20-32-1.)

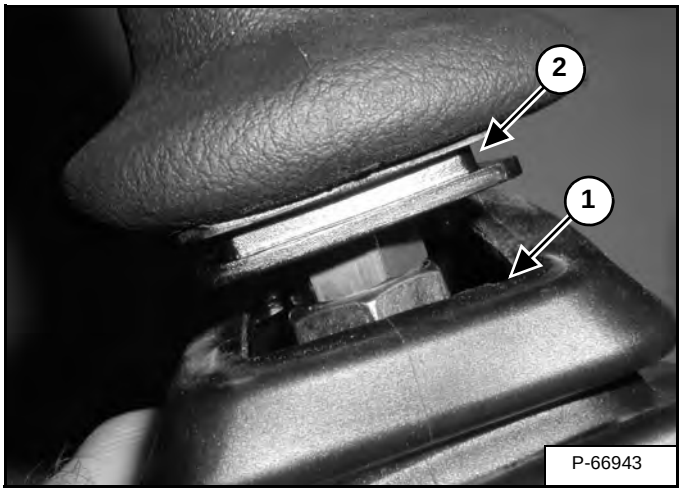
Handle Removal And Installation

Figure 20-110-4



Remove the dust boot (Item 1) from the handle (Item 2) **[Figure 20-110-4]**.

Figure 20-110-5

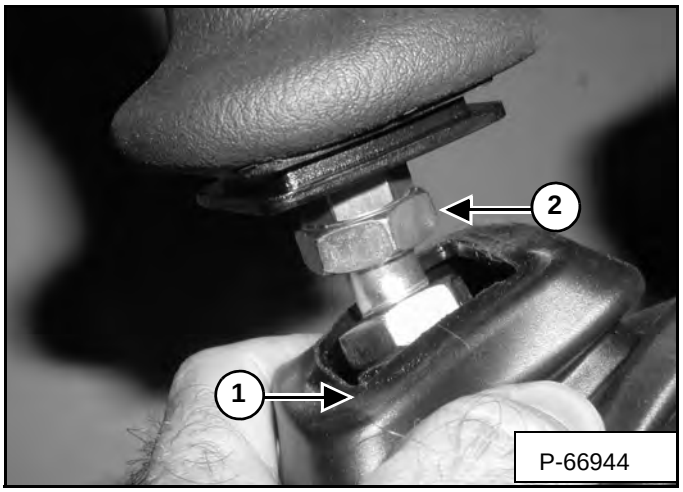


Installation: Align the top of the dust boot (Item 1) with the groove (item 2) **[Figure 20-110-5]** in the control handle.

Dealer Copy -- Not for Resale

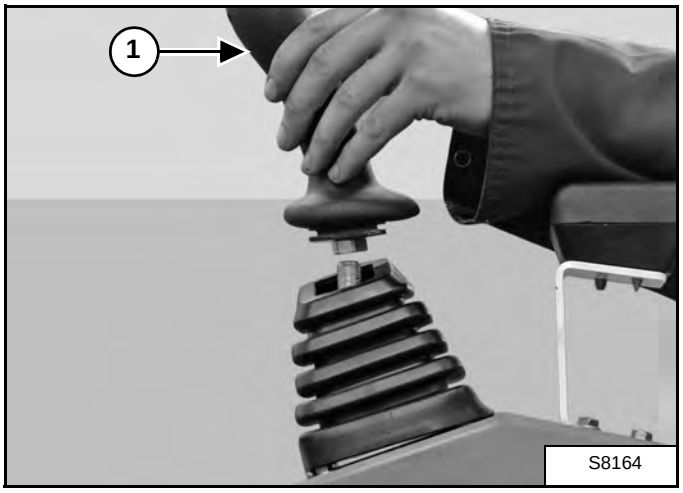
Handle Removal And Installation (Cont'd)

Figure 20-110-6



Hold the dust boot (Item 1) down and loosen the jam nut (Item 2) **[Figure 20-110-6]**.

Figure 20-110-7



Remove the handle (Item 1) **[Figure 20-110-7]**.

Removal And Installation

Lower the boom / bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

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

IMPORTANT

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

I-2003-0888

⚠ WARNING

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

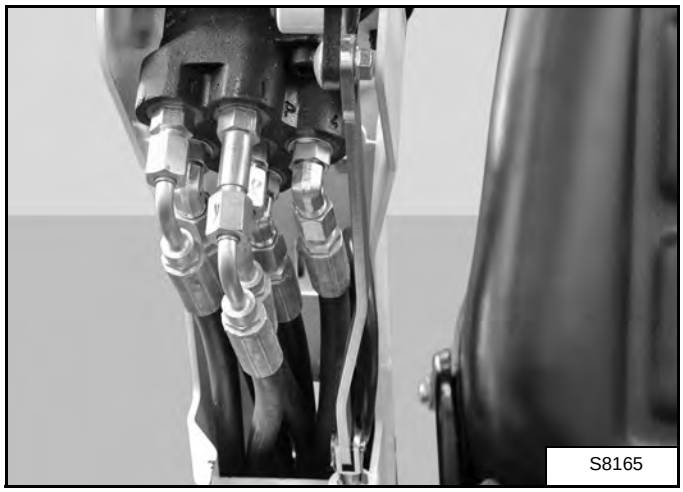
W-2145-0290

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CONTROL LEVER (JOYSTICK) (RIGHT) (S/N A33S13155 & ABOVE, B4K911001 & ABOVE AND B4PD11001 & ABOVE) (CONT'D)

Removal And Installation (Cont'd)

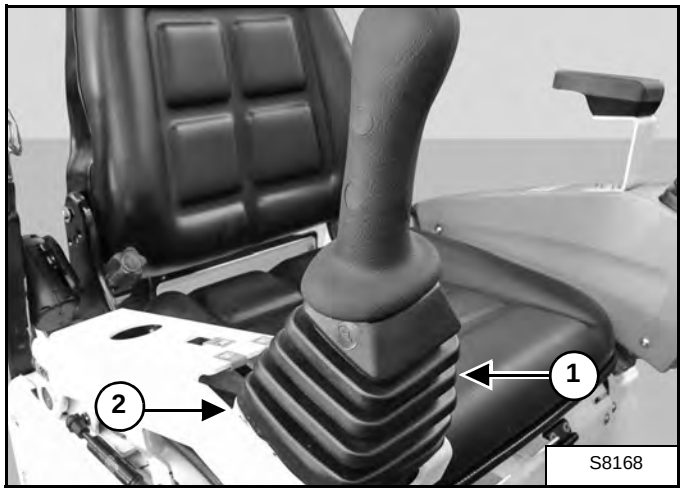
Figure 20-110-8



Mark the hoses for ease of assembly **[Figure 20-110-8]**.

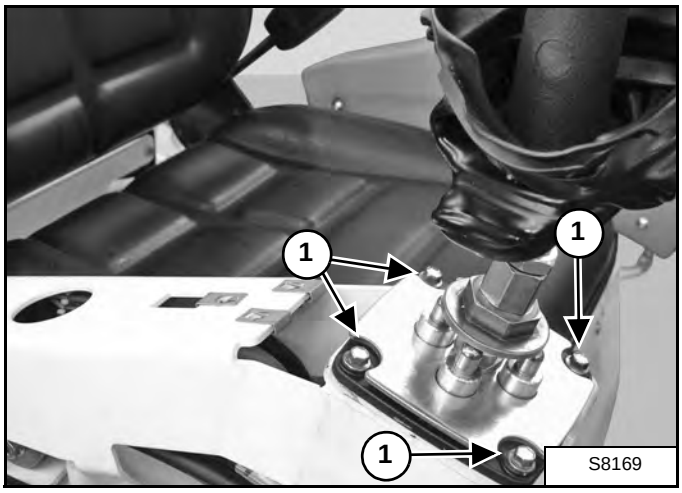
Remove the hoses while the control lever (joystick) is bolted to the console **[Figure 20-110-8]**.

Figure 20-110-9



Raise the dust boot (Item 1) up from the mounting plate (Item 2) **[Figure 20-110-9]**.

Figure 20-110-10



Remove the bolts (Item 1) **[Figure 20-110-10]** from the control lever (joystick) mounting plate.

Remove the control lever (joystick) from the console.

IMPORTANT

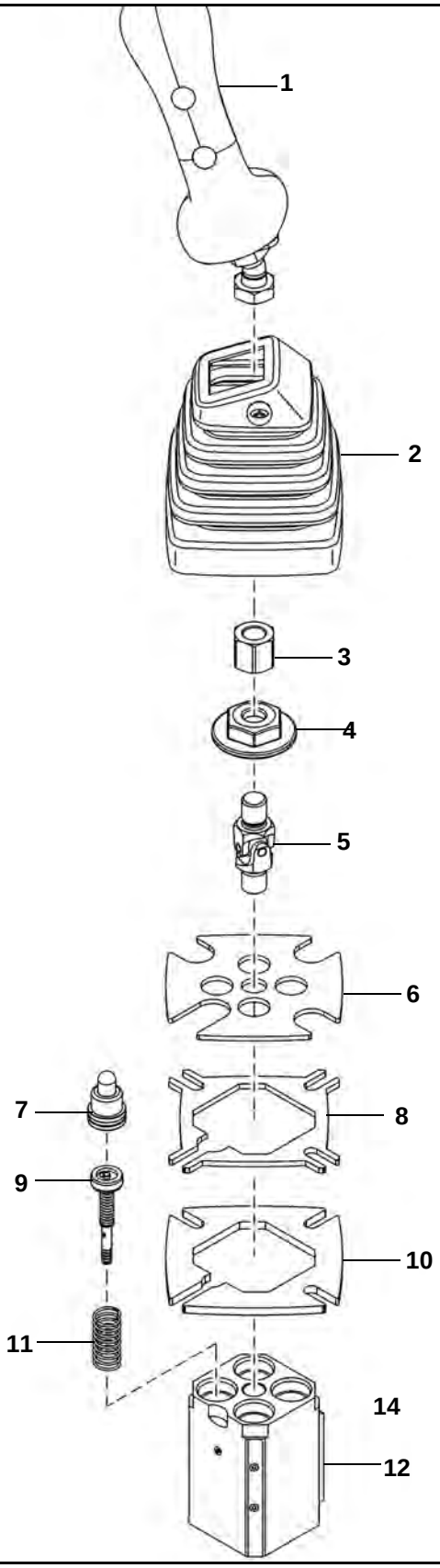
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

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Parts Identification

1. Handle
2. Boot
3. Nut
4. Nut
5. U-Joint
6. Bellow Flange
7. Plunger
8. Intermediate Flange
9. Valve
10. Inferior Flange
11. Spring
12. Housing



NA8062S

Dealer Copy -- Not for Resale

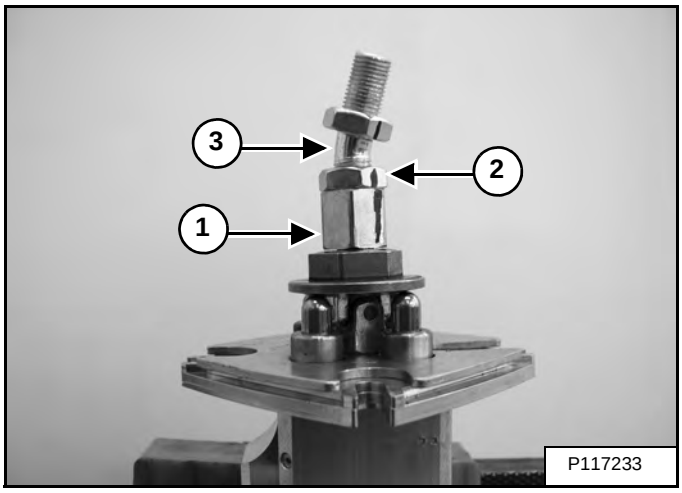
CONTROL LEVER (JOYSTICK) (RIGHT) (S/N A33S13155 & ABOVE, B4K911001 & ABOVE AND B4PD11001 & ABOVE) (CONT'D)

Disassembly

Remove the right handle. (See Handle Removal And Installation on Page 20-110-2.)

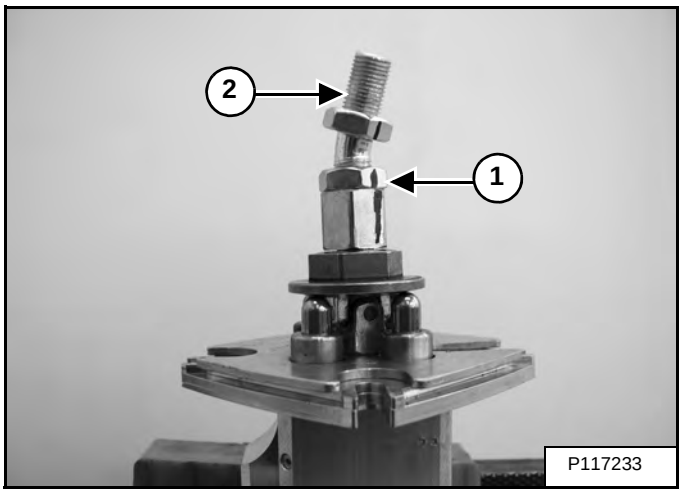
Clean the outside of the control lever before disassembly.

Figure 20-110-11



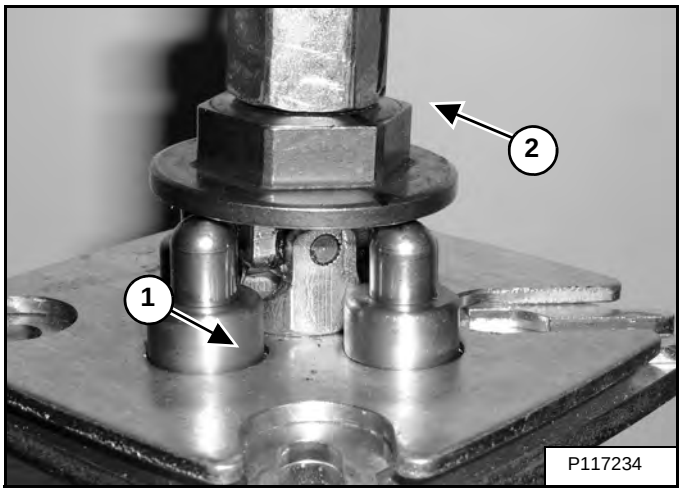
Mark the coupler (Item 1), nut (Item 2), and connector (Item 3) **[Figure 20-110-11]** for ease of assembly.

Figure 20-110-12



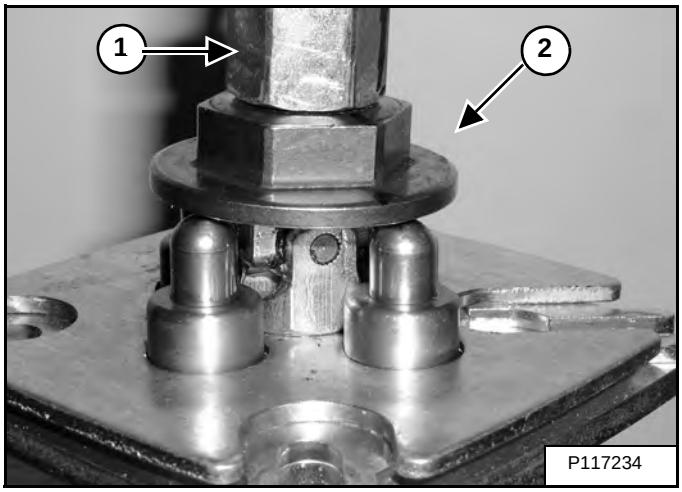
Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-110-12]**.

Figure 20-110-13



Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-110-13]** for ease of assembly.

Figure 20-110-14

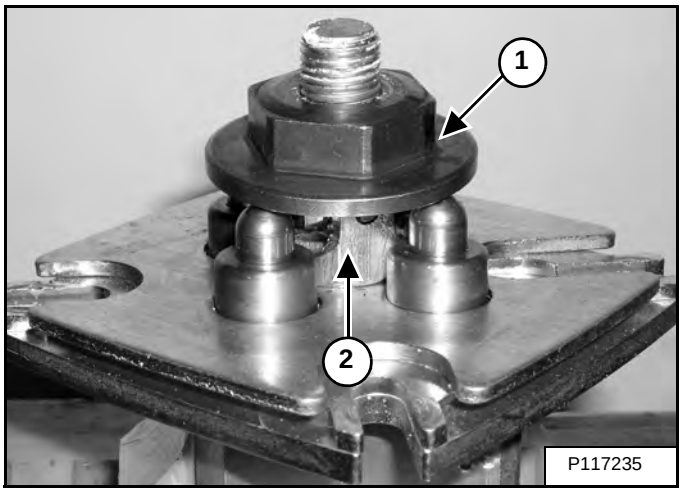


Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-110-14]**.

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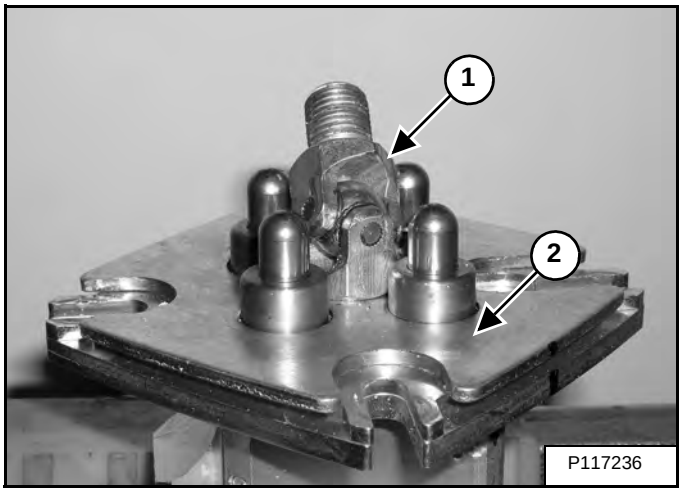
Disassembly (Cont'd)

Figure 20-110-15



Remove the control plate (Item 1) from the U-Joint (Item 2) **[Figure 20-110-15]**.

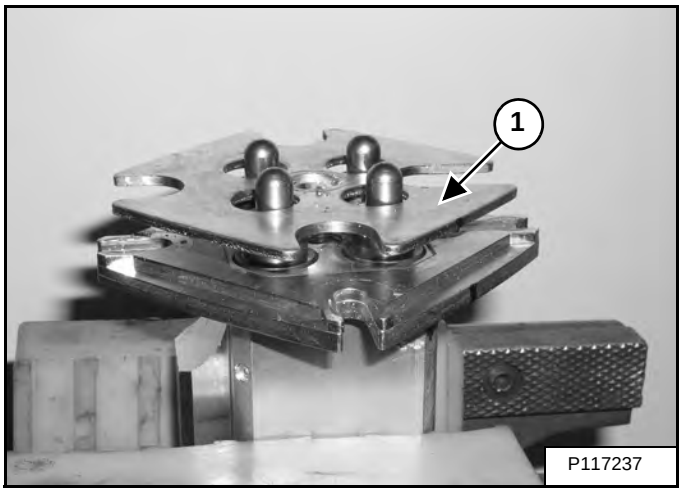
Figure 20-110-16



Mark the plate and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-110-16]**.

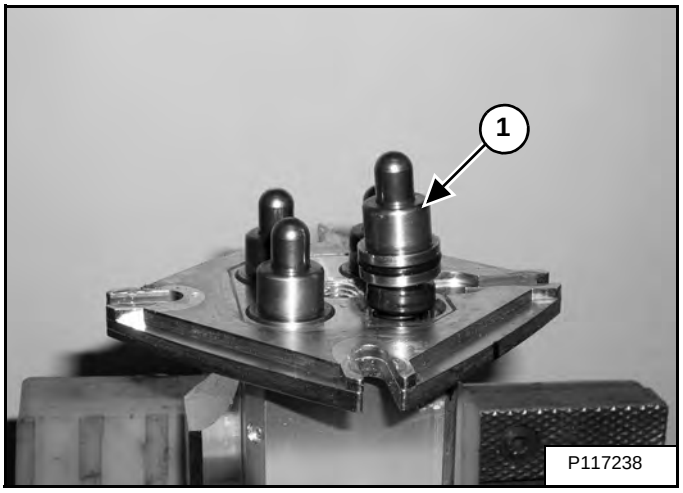
NOTE: The plate (Item 2) [Figure 20-110-16] is spring loaded and will come up as the U-joint is removed.

Figure 20-110-17



Remove the plate (Item 1) **[Figure 20-110-17]**.

Figure 20-110-18



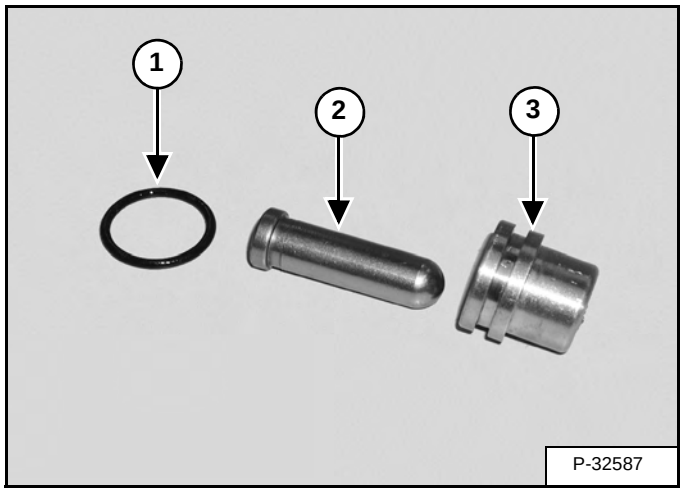
Remove the plunger assemblies (Item 1) **[Figure 20-110-18]**.

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CONTROL LEVER (JOYSTICK) (RIGHT) (S/N A33S13155 & ABOVE, B4K911001 & ABOVE AND B4PD11001 & ABOVE) (CONT'D)

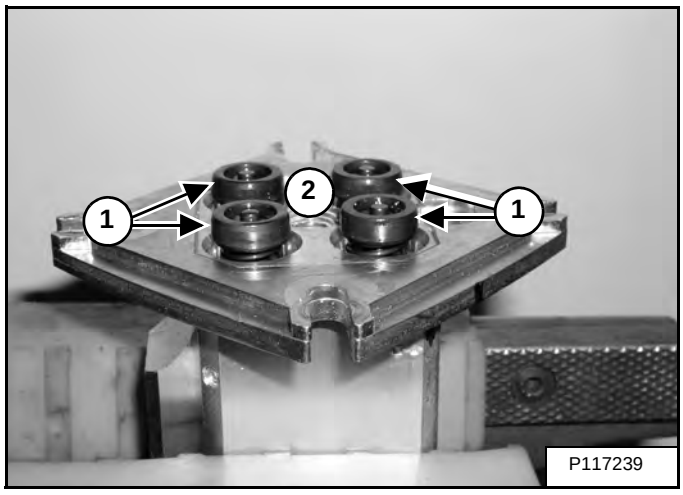
Disassembly (Cont'd)

Figure 20-110-19



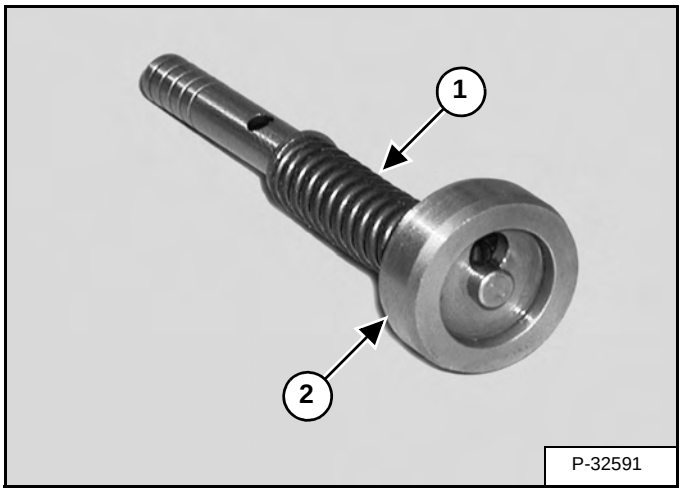
Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-110-19]**.

Figure 20-110-20



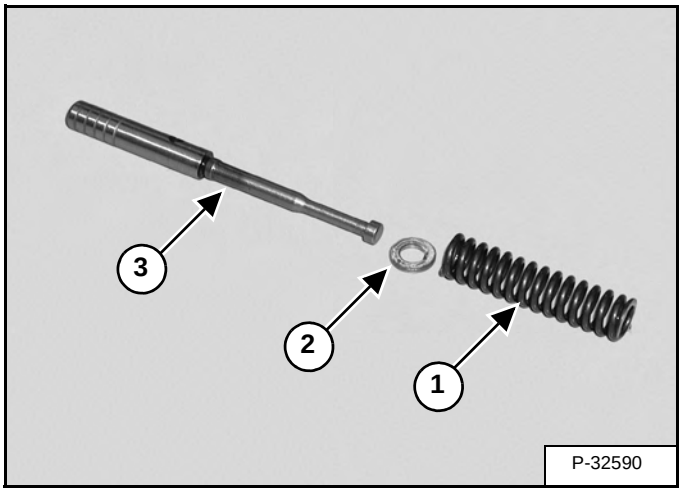
Remove the spool assemblies (Item 1) **[Figure 20-110-20]**.

Figure 20-110-21



Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-110-21]**.

Figure 20-110-22

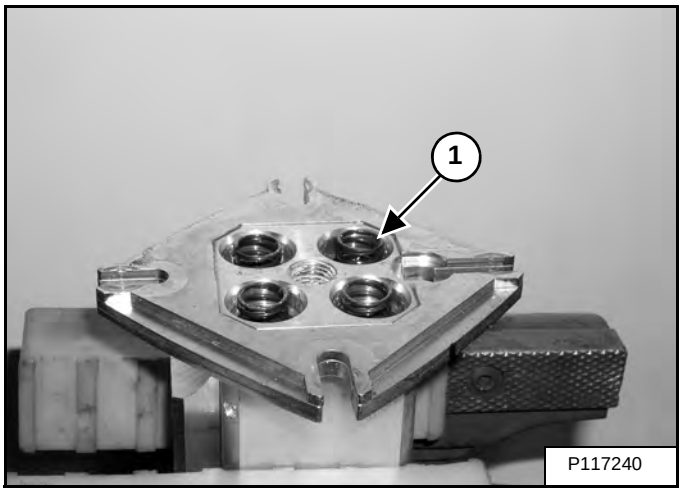


Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-110-22]**.

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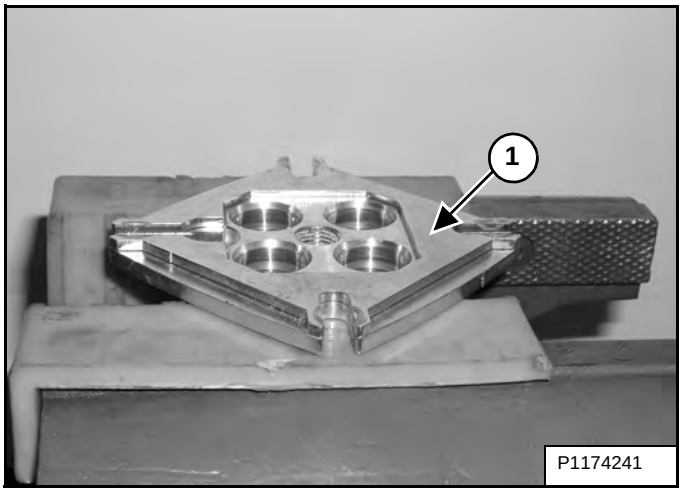
Disassembly (Cont'd)

Figure 20-110-23



Remove the springs (Item 1) **[Figure 20-110-23]**from the housing.

Figure 20-110-24



Remove the plate (Item 1) **[Figure 20-110-24]**.

Dealer Copy -- Not for Resale

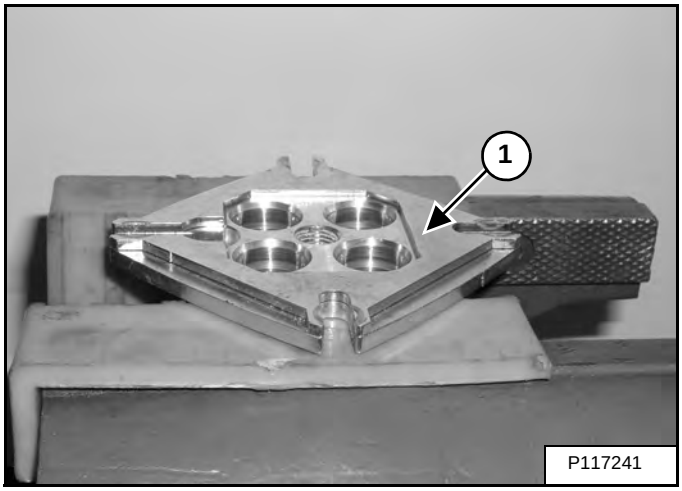
Assembly

Clean all parts in solvent and dry with compressed air.

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

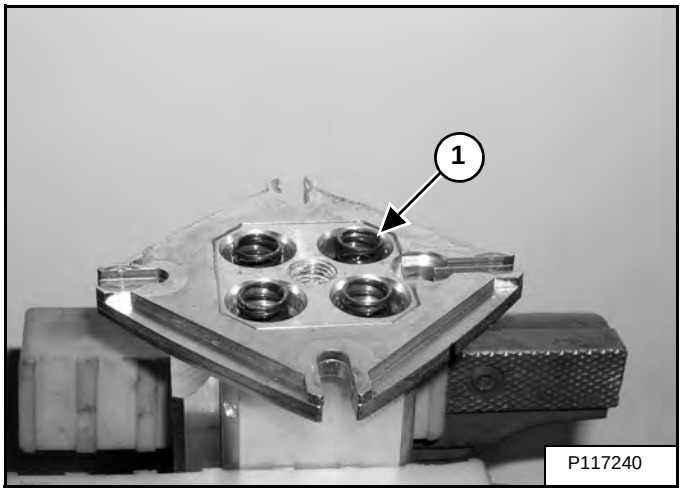
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-110-25



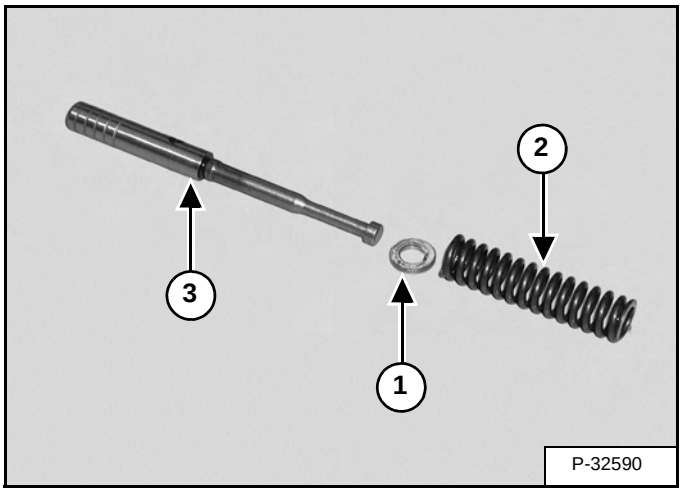
Install the plate (Item 1) **[Figure 20-110-25]**.

Figure 20-110-26



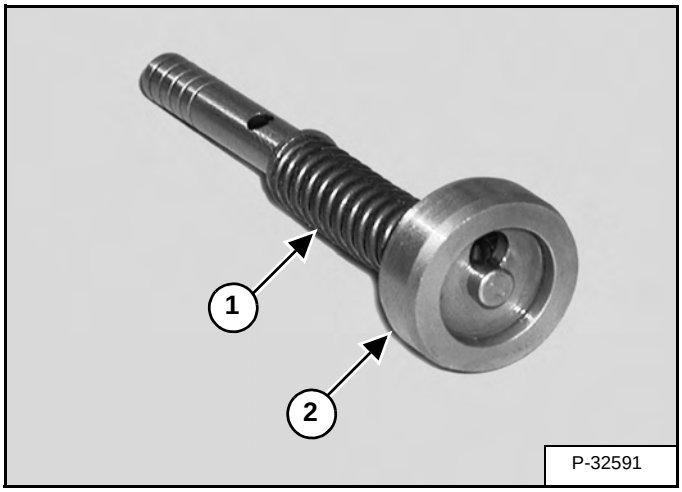
Install the springs (Item 1) **[Figure 20-110-26]**.

Figure 20-110-27



Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-110-27]**.

Figure 20-110-28



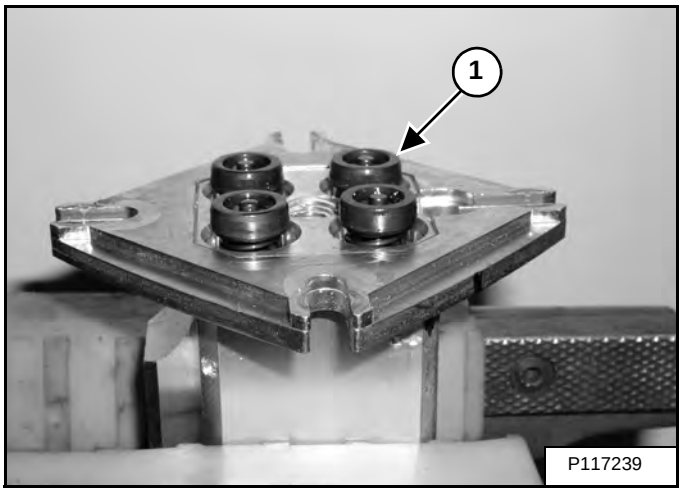
Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-110-28]**.

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CONTROL LEVER (JOYSTICK) (RIGHT) (S/N A33S13155 & ABOVE, B4K911001 & ABOVE AND B4PD11001 & ABOVE) (CONT'D)

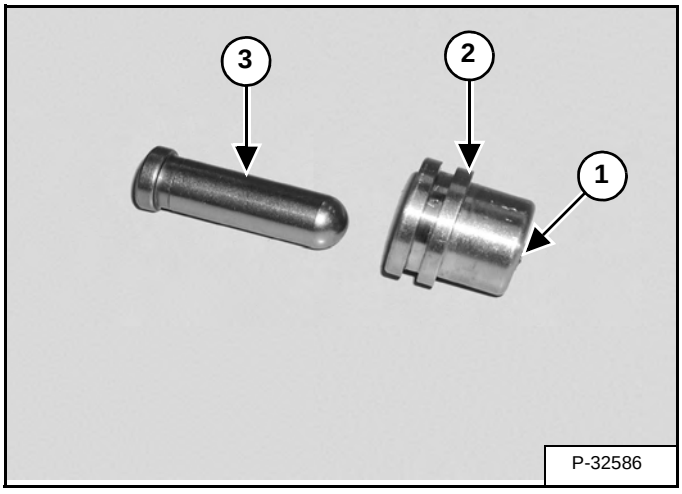
Assembly (Cont'd)

Figure 20-110-29



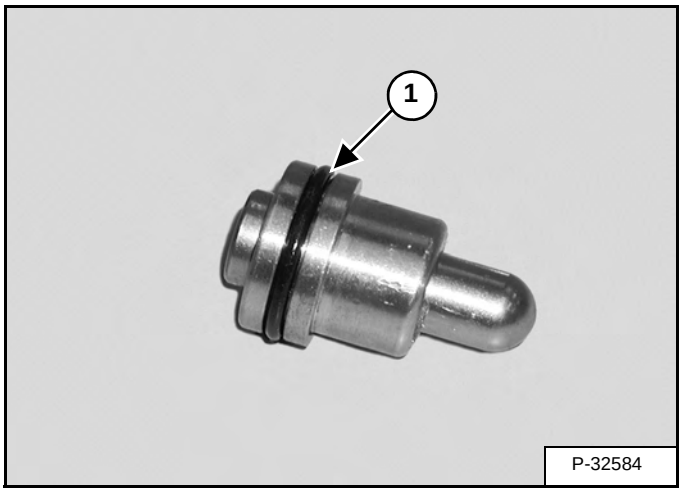
Install the spool assemblies (Item 1) **[Figure 20-110-29]** into the housing.

Figure 20-110-30



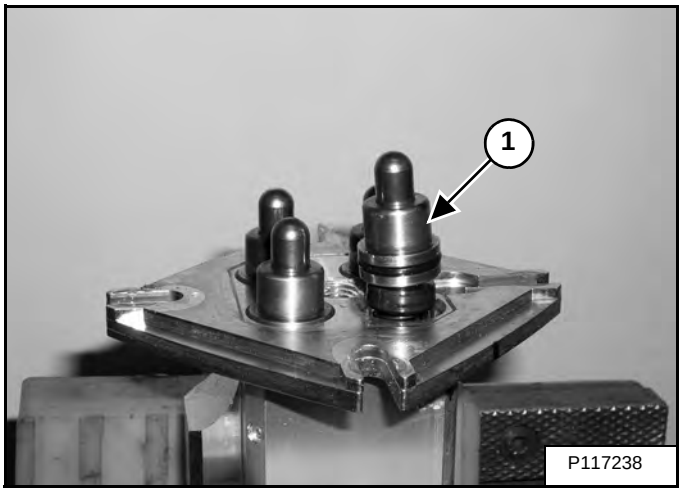
Install the O-ring (Item 1) into the bushing (Item 2). Install the plunger (Item 3) **[Figure 20-110-30]** into the bushing.

Figure 20-110-31



Install the O-ring (Item 1) **[Figure 20-110-31]** on the bushing.

Figure 20-110-32



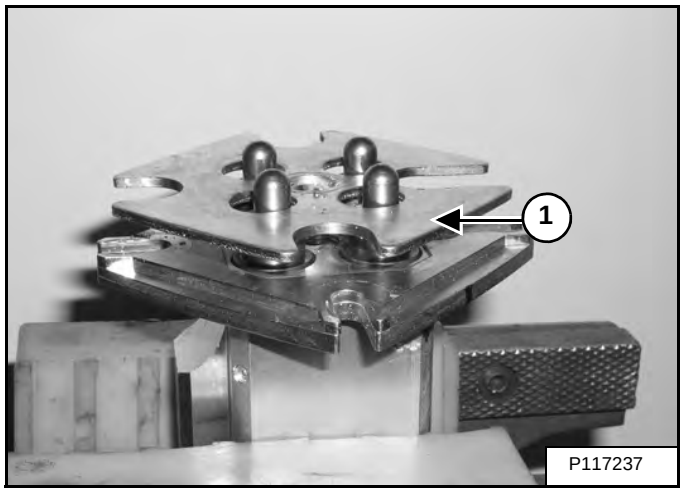
Install the plunger assemblies (Item 1) **[Figure 20-110-32]** into the housing.

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CONTROL LEVER (JOYSTICK) (RIGHT) (S/N A33S13155 & ABOVE, B4K911001 & ABOVE AND B4PD11001 & ABOVE) (CONT'D)

Assembly (Cont'd)

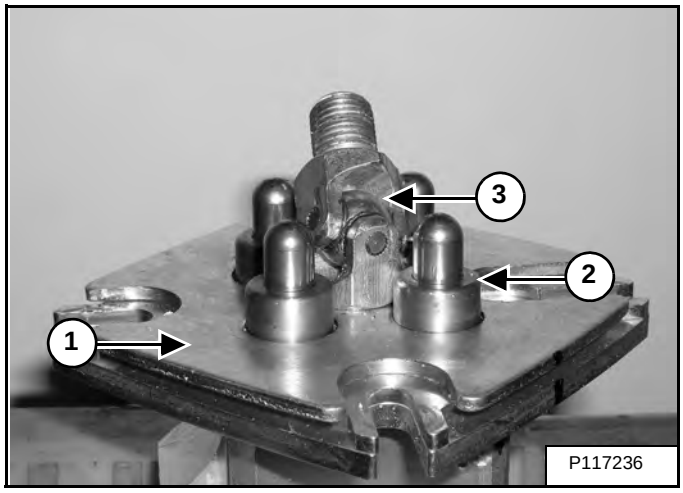
Figure 20-110-33



Install the plate (Item 1) **[Figure 20-110-33]**.

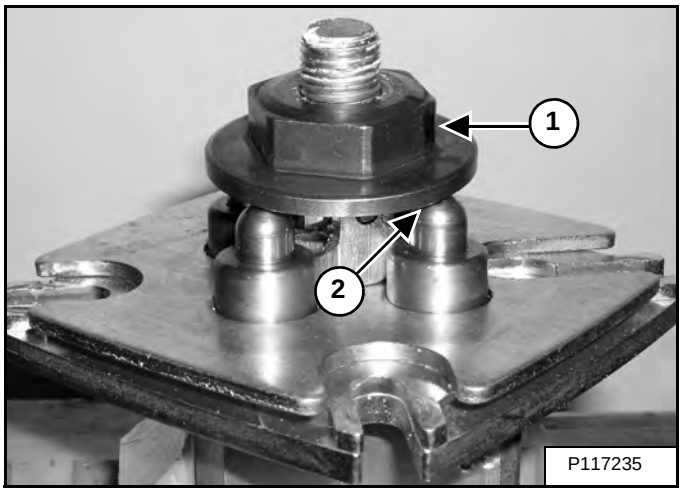
NOTE: Spring pressure can dislodge the plunger assemblies until the plate is secured in place.

Figure 20-110-34



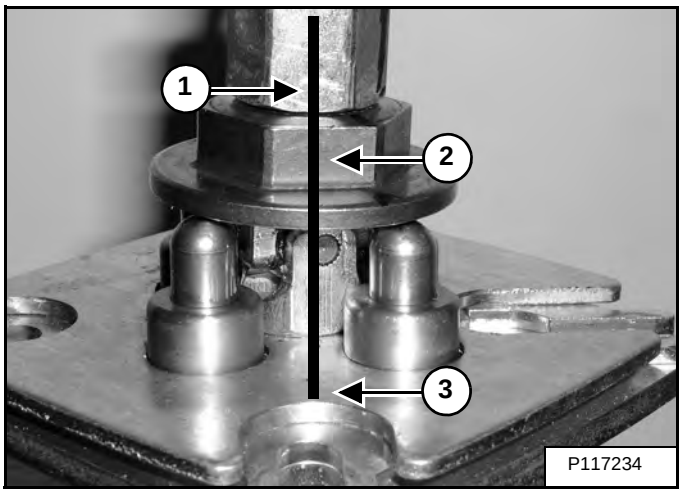
Press down on the plate (Item 1) keeping the plunger assemblies (Item 2) fully seated and install the U-joint (Item 3) **[Figure 20-110-34]**.

Figure 20-110-35



Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-110-35]**.

Figure 20-110-36

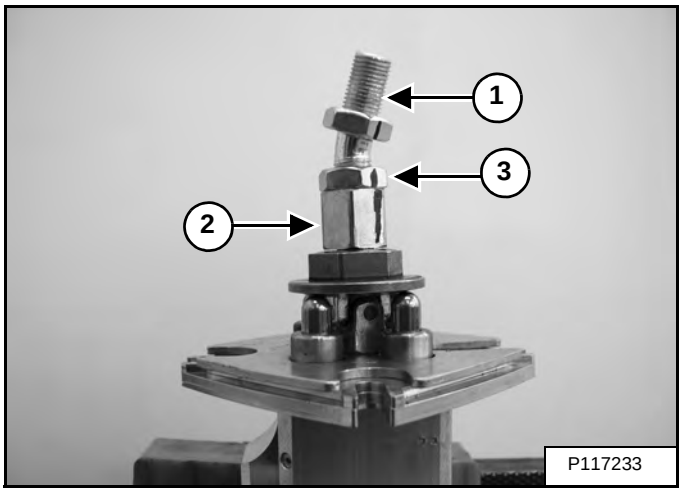


Align the coupler (Item 1) with the control plate (Item 2) and plate (Item 3) **[Figure 20-110-36]**. Tighten the coupler.

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Assembly (Cont'd)

Figure 20-110-37



Install the connector (Item 1) **[Figure 20-110-37]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-110-37]**.

Install the handle. (See Handle Removal And Installation on Page 20-110-2.)

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CONTROL LEVER (JOYSTICK) (RIGHT) (S/N A33P11001 - A33P13154)

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) is movable. The right control lever (joystick) 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 20-32-1.)

The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

Lower the boom / bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

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

IMPORTANT

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

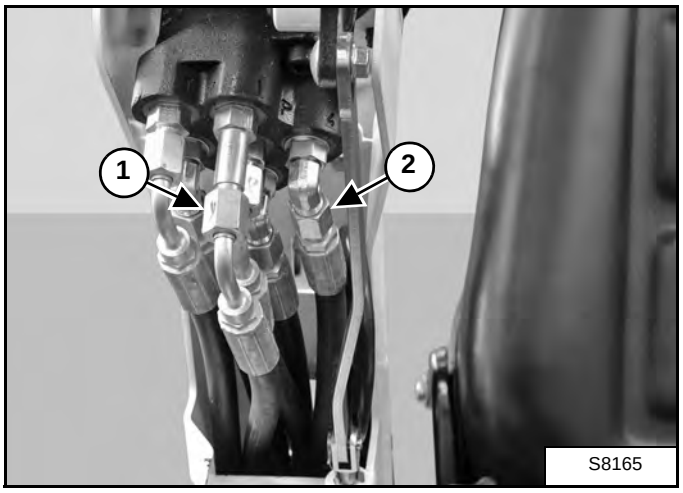
I-2003-0888

WARNING

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

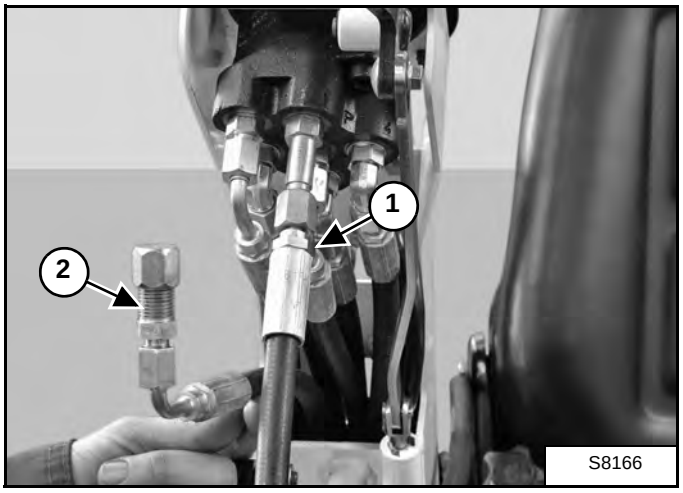
W-2145-0290

Figure 20-111-1



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 20-111-1]** 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 20-111-2



Remove the pilot hose **[Figure 20-111-2]** 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 20-111-2]** to the control lever (joystick) fitting.

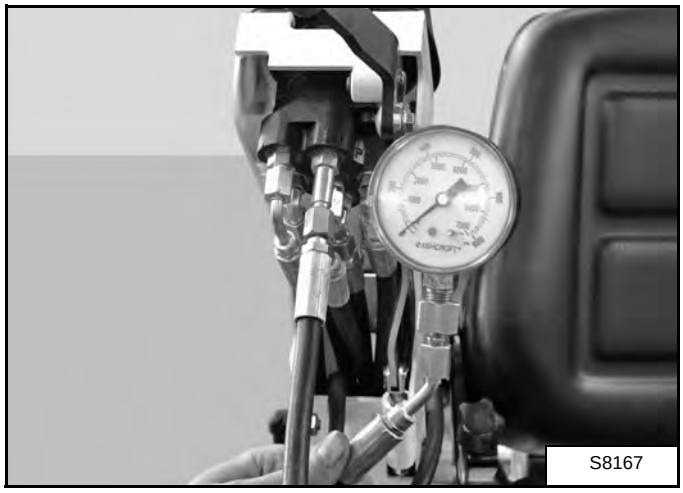
Cap the pilot hose (Item 2) **[Figure 20-111-2]**.

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CONTROL LEVER (JOYSTICK) (RIGHT) (S/N A33P11001 - A33P13154) (CONT'D)

Testing (Cont'd)

Figure 20-111-3



Install a 6,9 MPa (69 bar) (1000 psi) gauge on the hose **[Figure 20-111-3]**.

Lower the right console to the locked position. Also lower the left console to the locked position if in the vertical position.

Start the engine and warm the hydraulic oil 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 circuit to be tested. Record the operating pressure.

The operating pressure should be as follows:

3,0 MPa (30 bar) (435 psi) with an acceptable range of 2,8 - 3,1 MPa (28 - 31 bar) (406 - 450 psi).

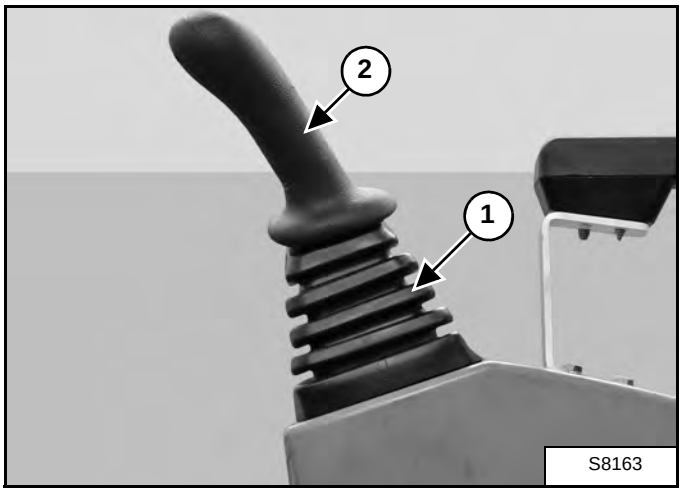
If the operating pressure is correct, check the valve section spool for proper operation.

If the operating pressure is incorrect, remove the pressure reducing valve, clean, install and retest. (See Testing And Adjusting on Page 20-32-1.)

If the pressure is still incorrect replace the pressure reducing valve. (See Testing And Adjusting on Page 20-32-1.)

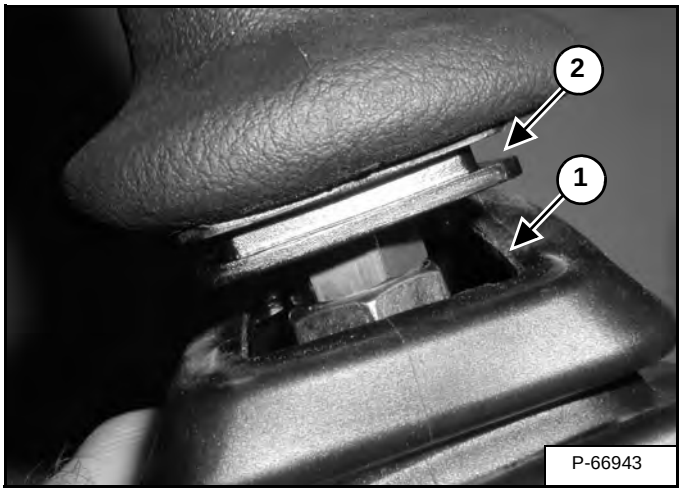
Handle Removal And Installation

Figure 20-111-4



Remove the dust boot (Item 1) from the handle (Item 2) **[Figure 20-111-4]**.

Figure 20-111-5

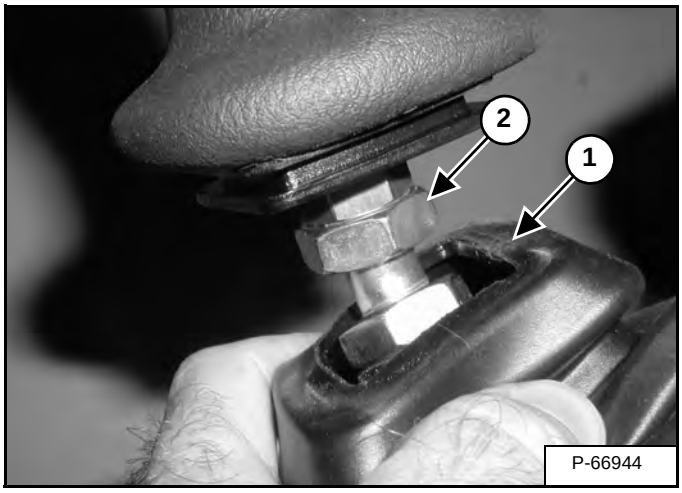


Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-111-5]** in the control handle.

Dealer Copy -- Not for Resale

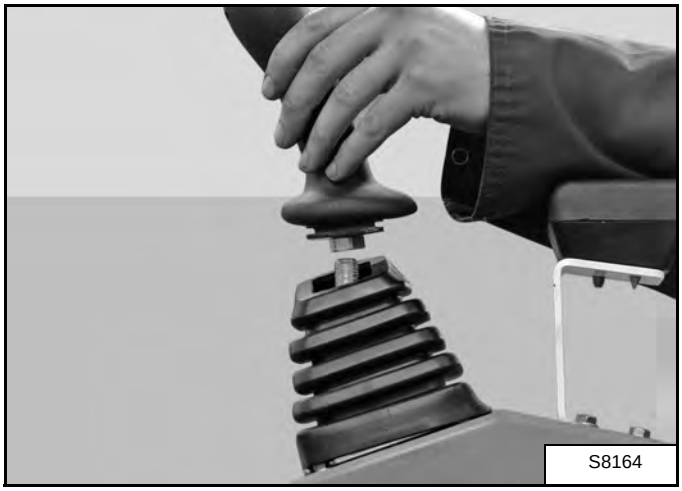
Handle Removal And Installation (Cont'd)

Figure 20-111-6



Hold the dust boot (Item 1) down and loosen the jam nut (Item 2) **[Figure 20-111-6]**.

Figure 20-111-7



Remove the handle **[Figure 20-111-7]**.

Removal And Installation

Lower the boom / bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

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

IMPORTANT

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

I-2003-0888

⚠ WARNING

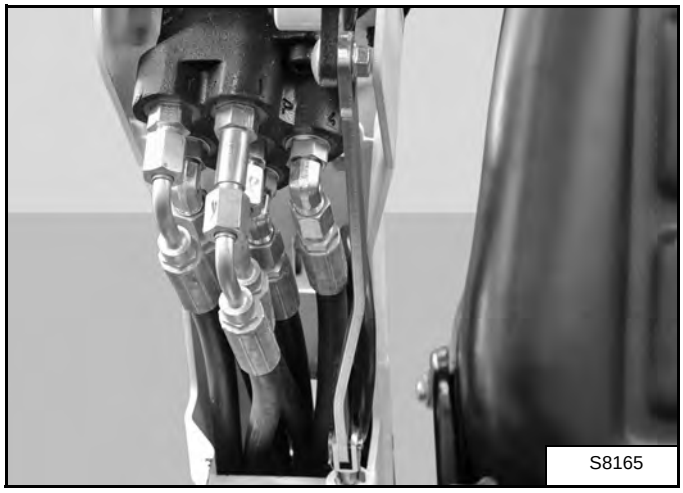
Hydraulic fluid escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. This can cause serious injury and possible death if proper medical treatment by a physician familiar with this injury is not received immediately.

W-2145-0290

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Removal And Installation (Cont'd)

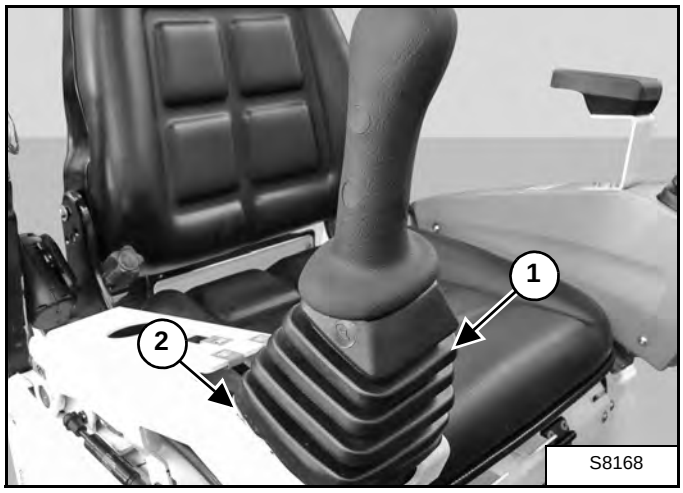
Figure 20-111-8



Mark the hoses for ease of assembly **[Figure 20-111-8]**.

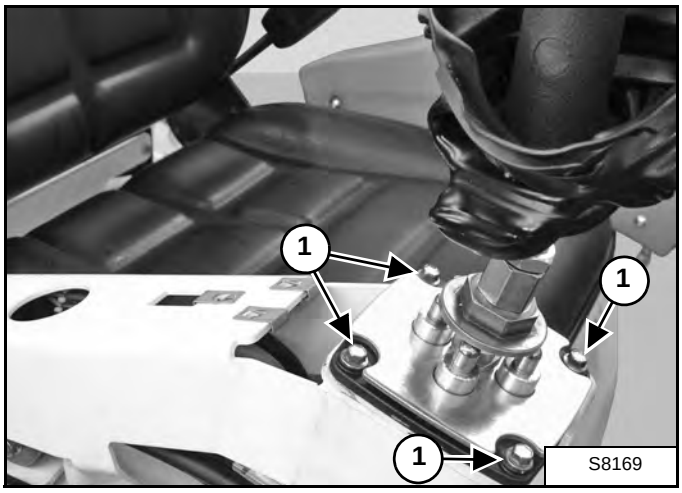
Remove the hoses while the control lever (joystick) is bolted to the console **[Figure 20-111-8]**.

Figure 20-111-9



Raise the dust boot (Item 1) up from the mounting plate (Item 2) **[Figure 20-111-9]**.

Figure 20-111-10



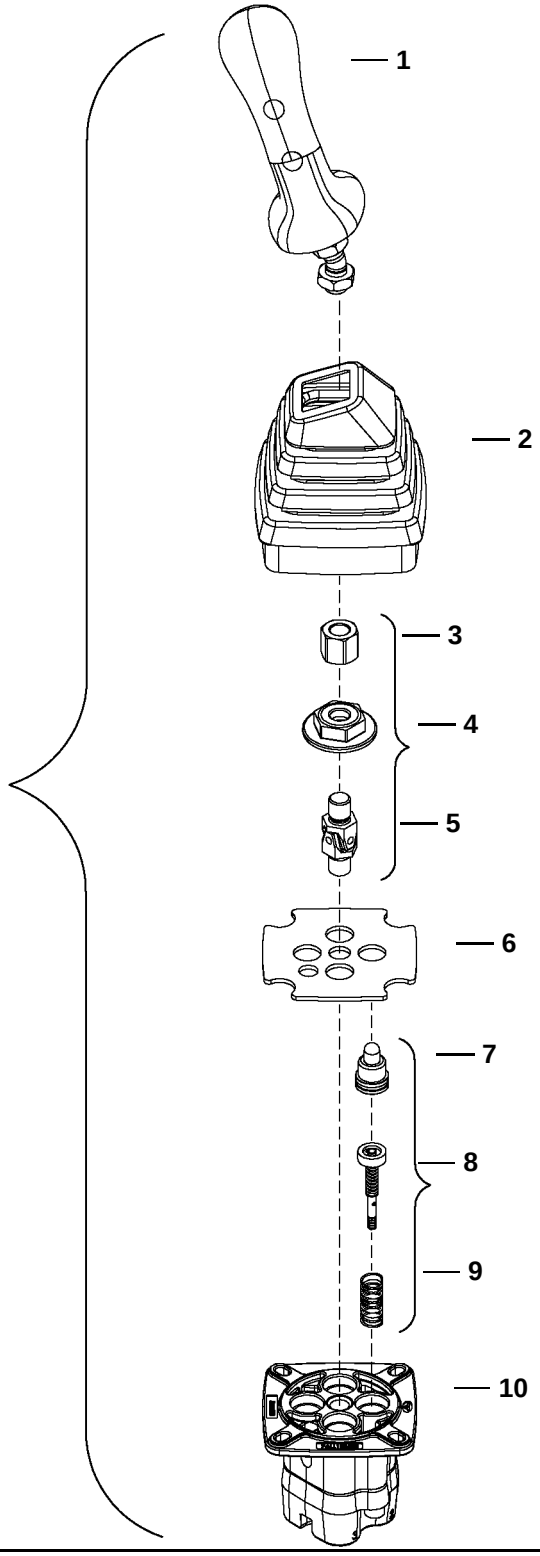
Remove the bolts (Item 1) **[Figure 20-111-10]** from the control lever (joystick) mounting plate.

Remove the control lever (joystick) from the console frame.

Dealer Copy -- Not for Resale

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

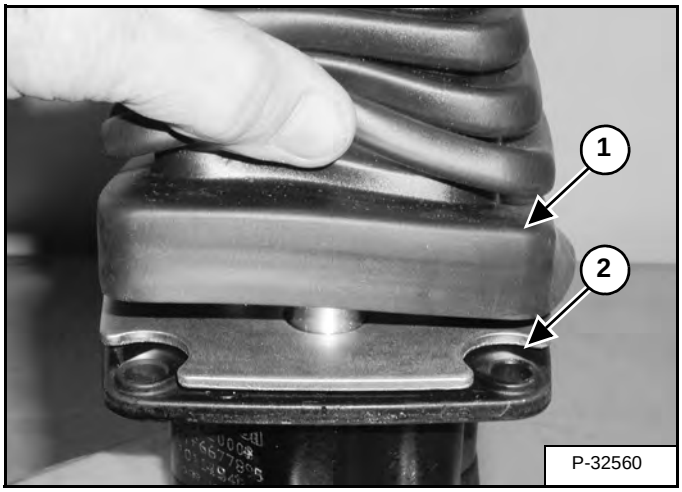
CONTROL LEVER (JOYSTICK) (RIGHT) (S/N A33P11001 - A33P13154) (CONT'D)

Disassembly

Remove the right handle. (See Handle Removal And Installation on Page 20-111-2.)

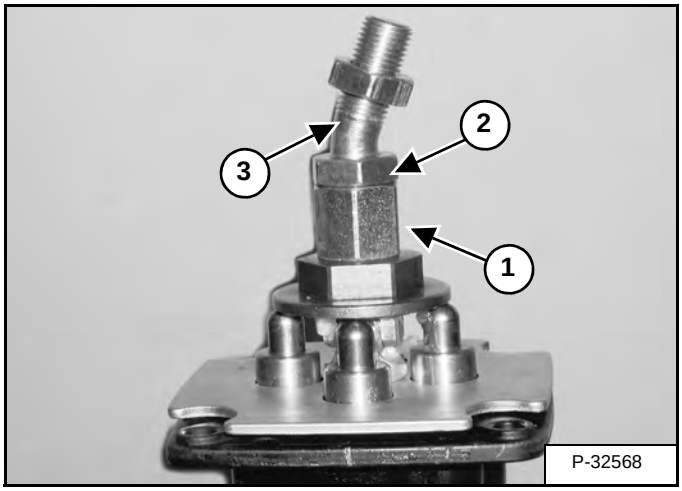
Clean the outside of the control lever before disassembly.

Figure 20-111-11



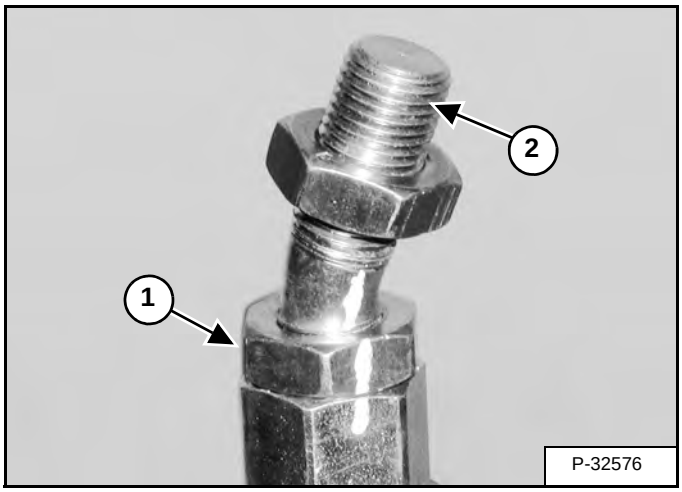
Remove the boot (Item 1) from the control lever (joystick) (Item 2) **[Figure 20-111-11]**.

Figure 20-111-12



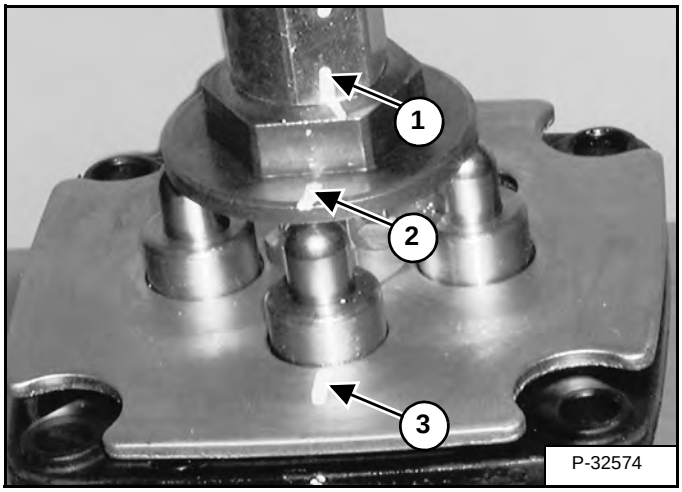
Mark the coupler (Item 1) nut (Item 2), and connector (Item 3) **[Figure 20-111-12]** for correct assembly.

Figure 20-111-13



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-111-13]**.

Figure 20-111-14

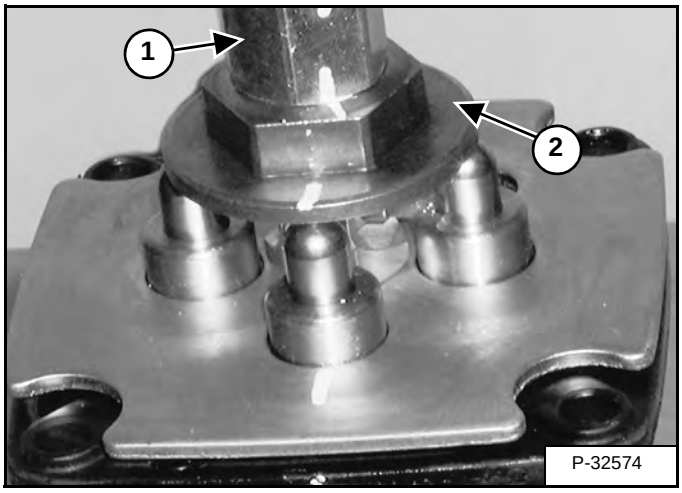


Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-111-14]** for correct installation.

Dealer Copy -- Not for Resale

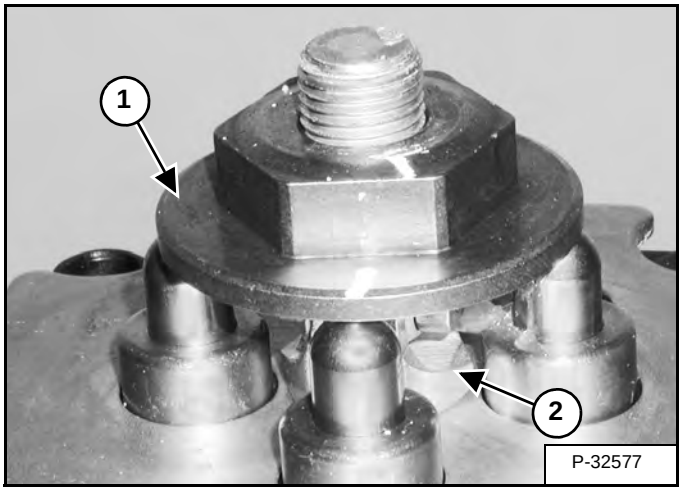
Disassembly (Cont'd)

Figure 20-111-15



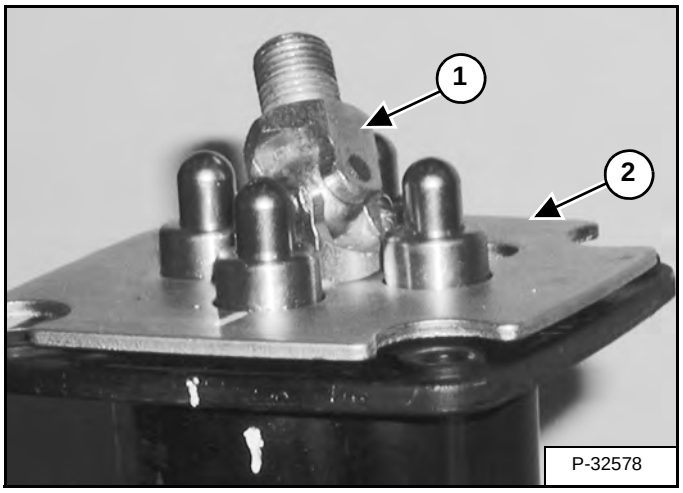
Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-111-15]**.

Figure 20-111-16



Remove the control plate (Item 1) from the U-Joint (Item 2) **[Figure 20-111-16]**.

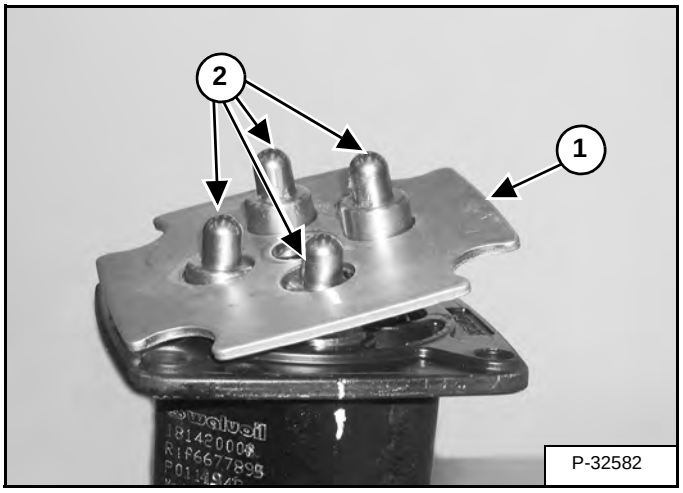
Figure 20-111-17



Mark the plate and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-111-17]**.

NOTE: The plate (Item 2) [Figure 20-111-17] is spring loaded and will come up as the U-joint is removed.

Figure 20-111-18



Remove the plate (Item 1) **[Figure 20-111-18]**.

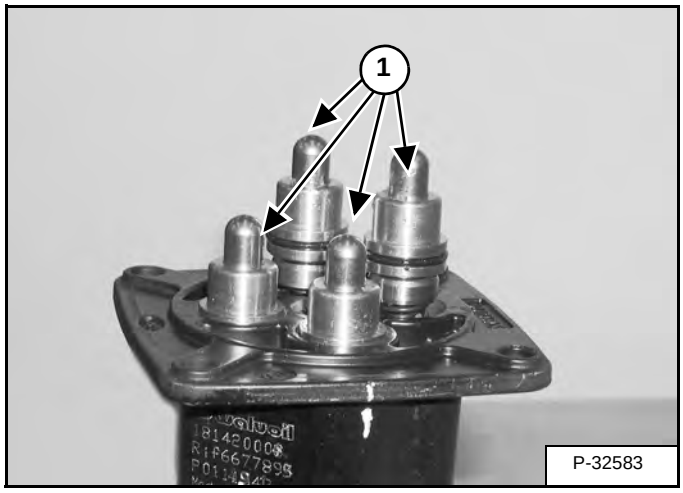
NOTE: Use care while removing the plate. The plungers (Item 2) [Figure 20-111-18] are spring loaded.

Dealer Copy -- Not for Resale

CONTROL LEVER (JOYSTICK) (RIGHT) (S/N A33P11001 - A33P13154) (CONT'D)

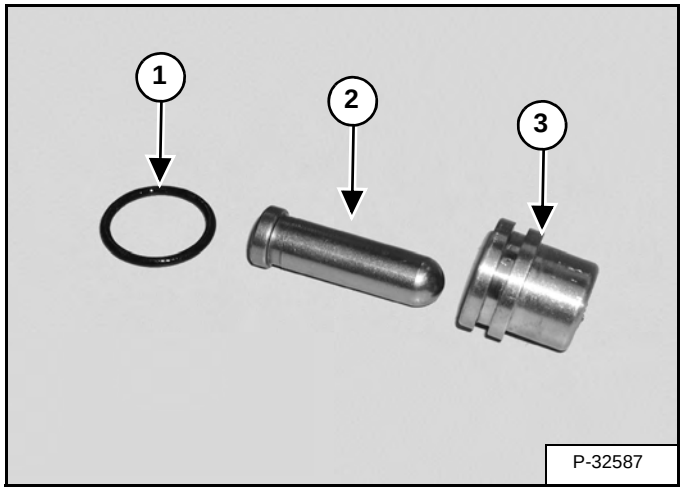
Disassembly (Cont'd)

Figure 20-111-19



Remove the plunger assemblies (Item 1) **[Figure 20-111-19]**.

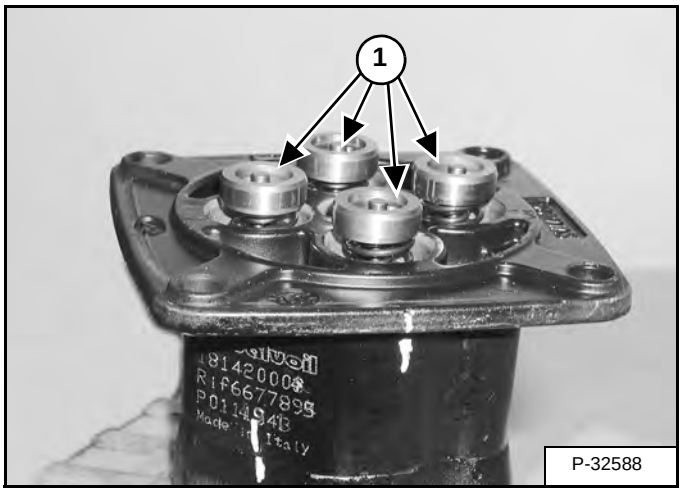
Figure 20-111-20



Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-111-20]**.

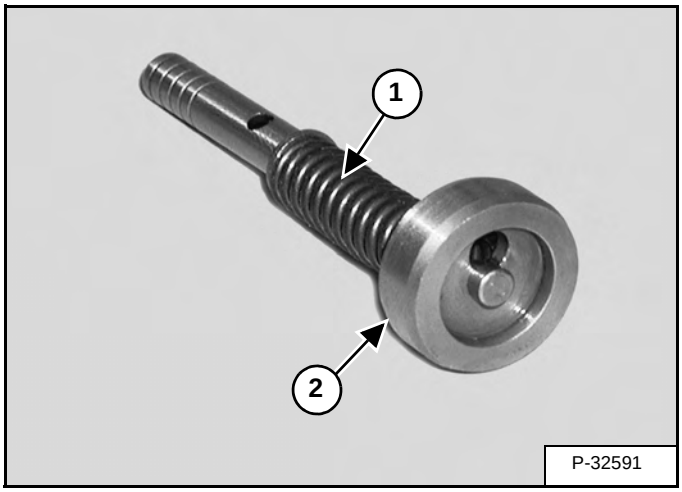
NOTE: Mark the spool assemblies for installation in their original location.

Figure 20-111-21



Remove the spool assemblies (Item 1) **[Figure 20-111-21]**.

Figure 20-111-22

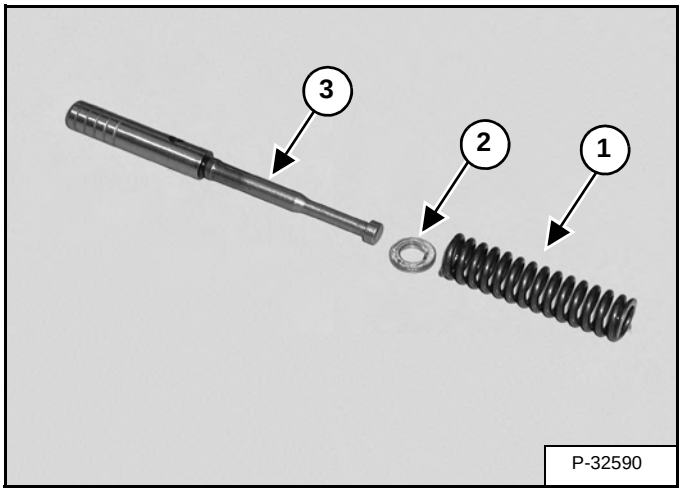


Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-111-22]**.

Dealer Copy -- Not for Resale

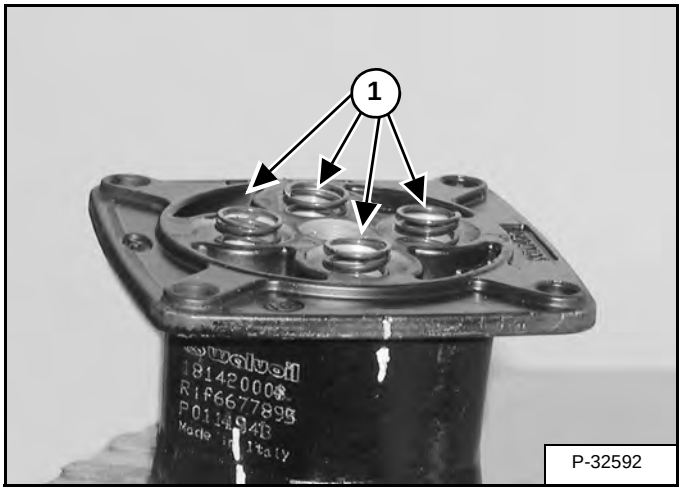
Disassembly (Cont'd)

Figure 20-111-23



Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-111-23]**.

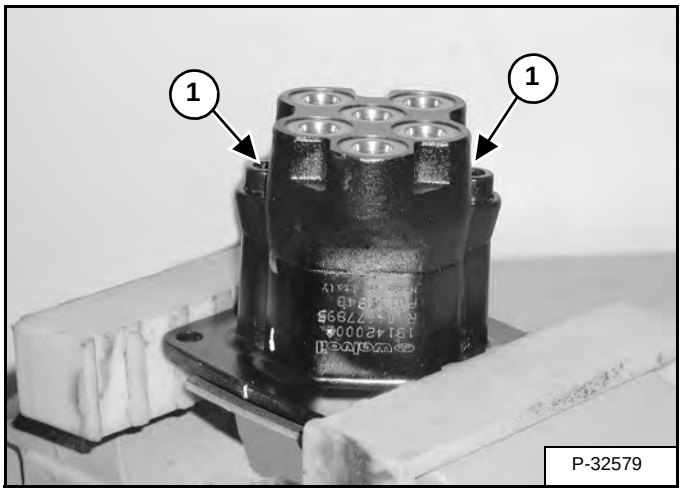
Figure 20-111-24



Remove the springs (Item 1) **[Figure 20-111-24]** from the housing.

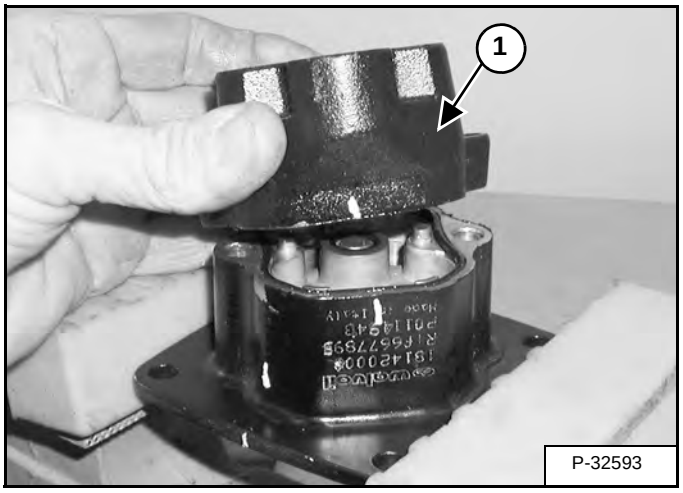
Clamp the housing in a vise that is equipped with padded jaws.

Figure 20-111-25



Remove the bolts (Item 1) **[Figure 20-111-25]**.

Figure 20-111-26



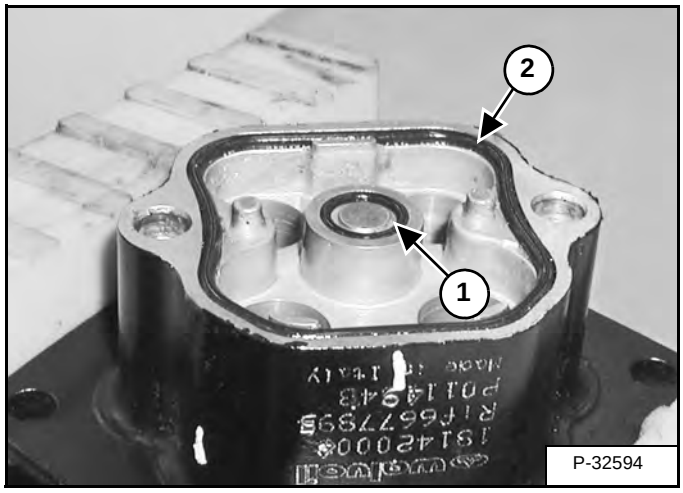
Remove the end cap (Item 1) **[Figure 20-111-26]**.

Dealer Copy -- Not for Resale

CONTROL LEVER (JOYSTICK) (RIGHT) (S/N A33P11001 - A33P13154) (CONT'D)

Disassembly (Cont'd)

Figure 20-111-27



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-111-27]**.

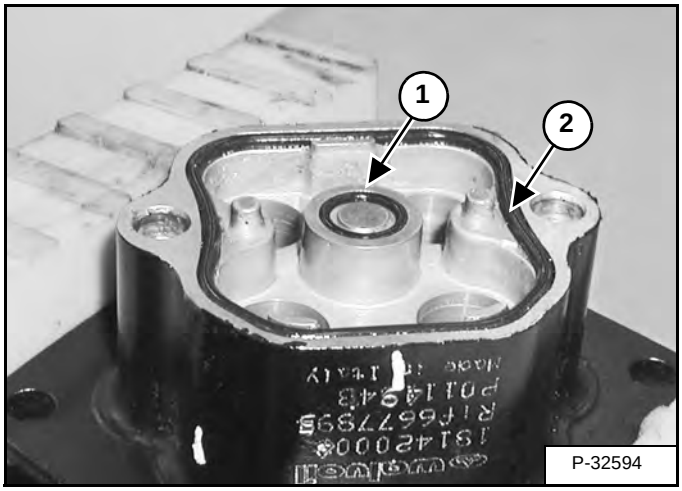
Assembly

Clean all parts in solvent and dry with compressed air.

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

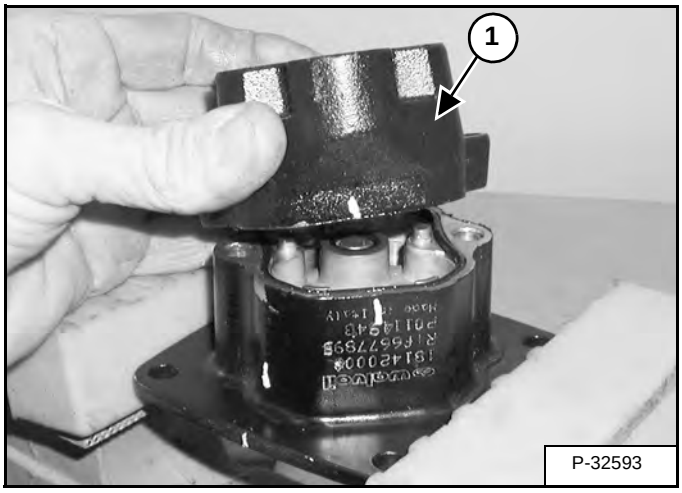
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-111-28



Clamp the housing in a vise equipped with padded jaws. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-111-28]**.

Figure 20-111-29

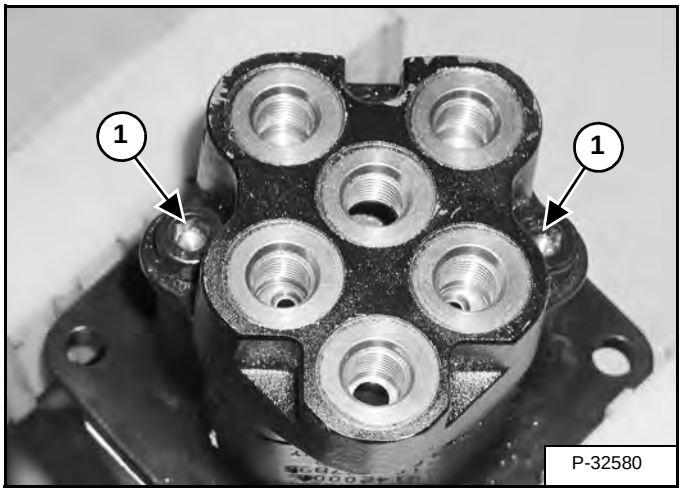


Install the end cap (Item 1) **[Figure 20-111-29]**.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

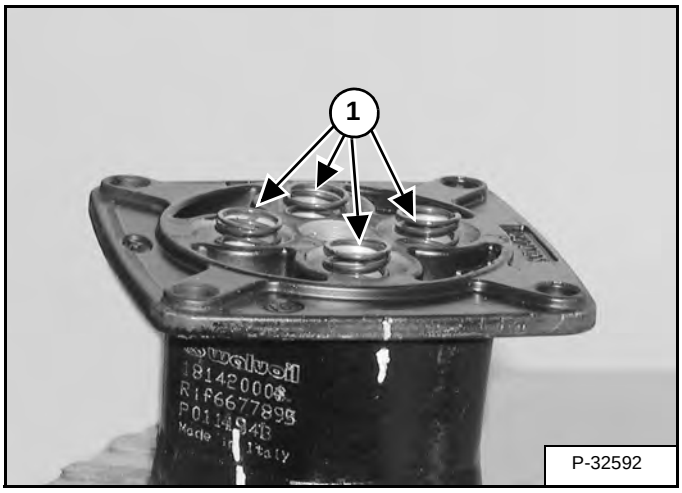
Figure 20-111-30



Install the bolts (Item 1) **[Figure 20-111-30]**.

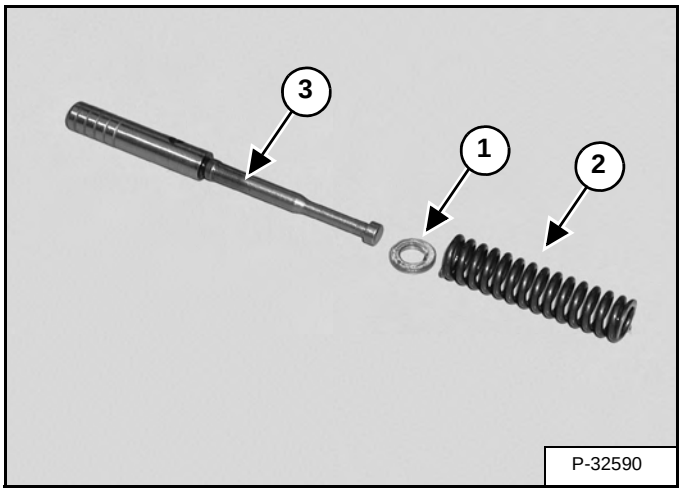
Turn the housing over.

Figure 20-111-31



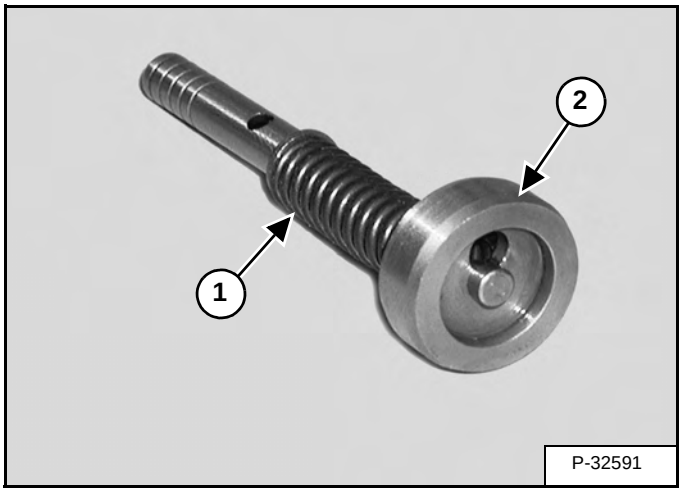
Install the springs (Item 1) **[Figure 20-111-31]**.

Figure 20-111-32



Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-111-32]**.

Figure 20-111-33



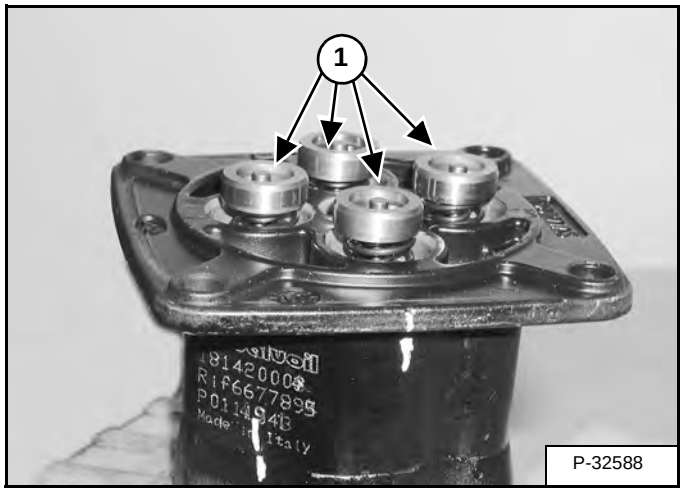
Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-111-33]**.

Dealer Copy -- Not for Resale

CONTROL LEVER (JOYSTICK) (RIGHT) (S/N A33P11001 - A33P13154)(CONT'D)

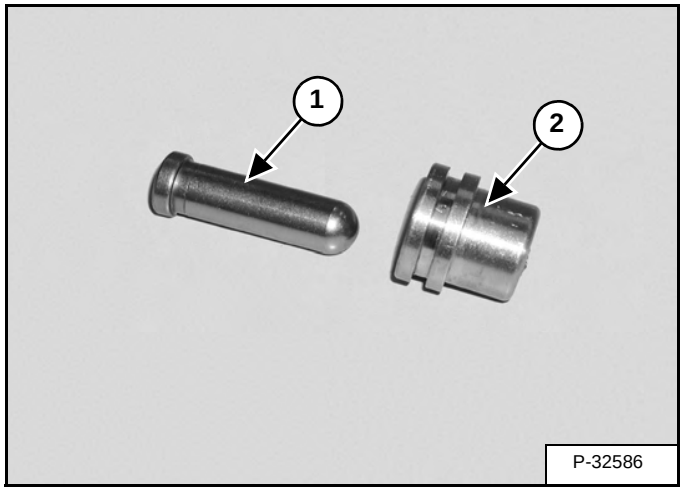
Assembly (Cont'd)

Figure 20-111-34



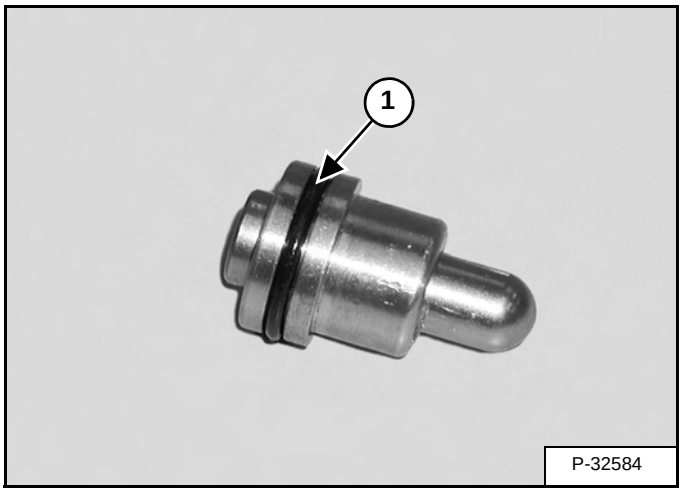
Install the spool assemblies (Item 1) **[Figure 20-111-34]** into the housing.

Figure 20-111-35



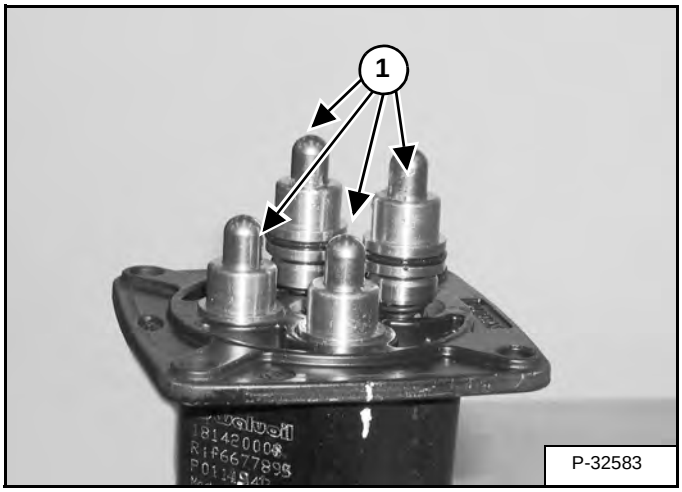
Install the plunger (Item 1) into the bushing (Item 2) **[Figure 20-111-35]**.

Figure 20-111-36



Install the O-ring (Item 1) **[Figure 20-111-36]** on the bushing.

Figure 20-111-37

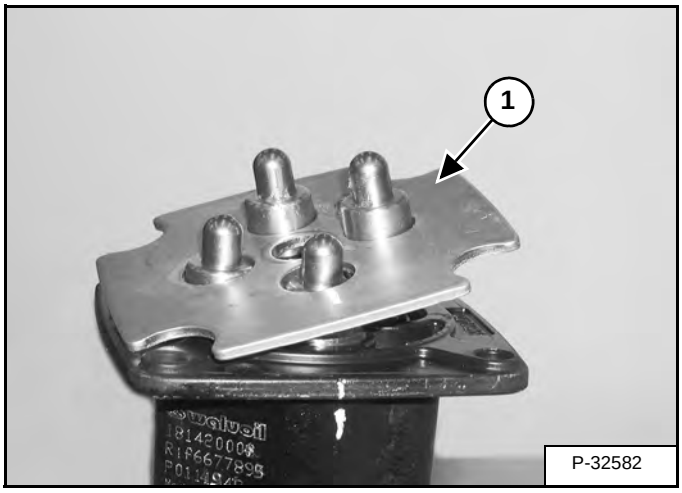


Install the plunger assemblies (Item 1) **[Figure 20-111-37]** into the housing.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

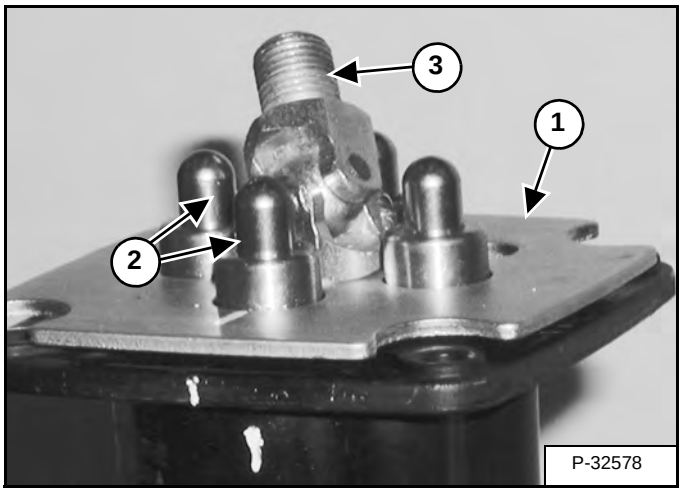
Figure 20-111-38



Install the plate (Item 1) **[Figure 20-111-38]**.

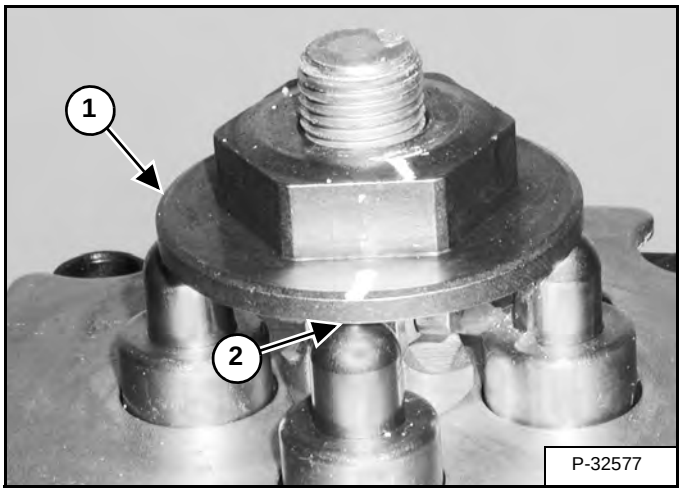
NOTE: Spring pressure can dislodge the plunger assemblies until the plate (Item 1) [Figure 20-111-38] is secured in place.

Figure 20-111-39



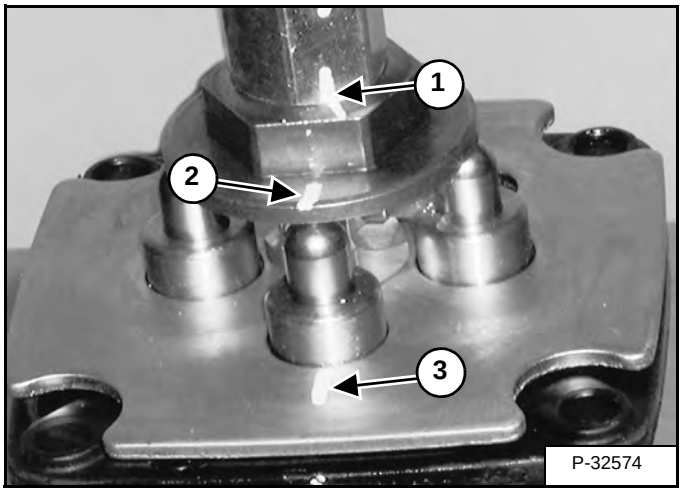
Press down on the plate (Item 1) to seat the plunger assemblies (Item 2). Install the U-joint (Item 3) **[Figure 20-111-39]**.

Figure 20-111-40



Install the control plate (Item 1) until the plate makes light contact with all 4 plungers (Item 2) **[Figure 20-111-40]**.

Figure 20-111-41

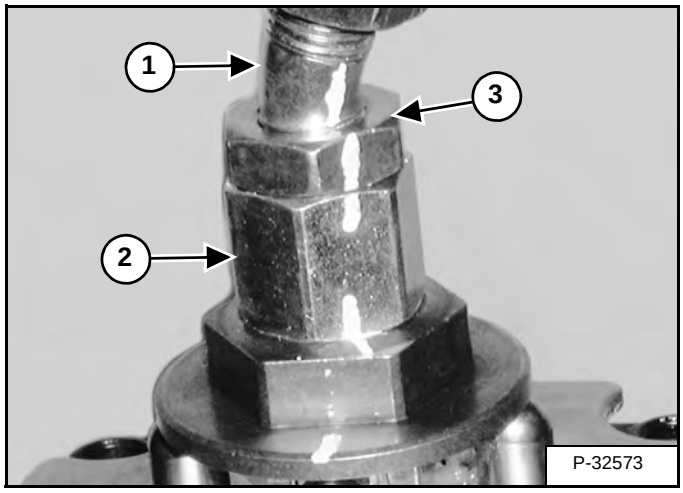


Align the coupler (Item 1) with the control plate (Item 2) and plate (Item 3) **[Figure 20-111-41]**. Tighten the coupler.

Dealer Copy -- Not for Resale

Assembly (Cont'd)

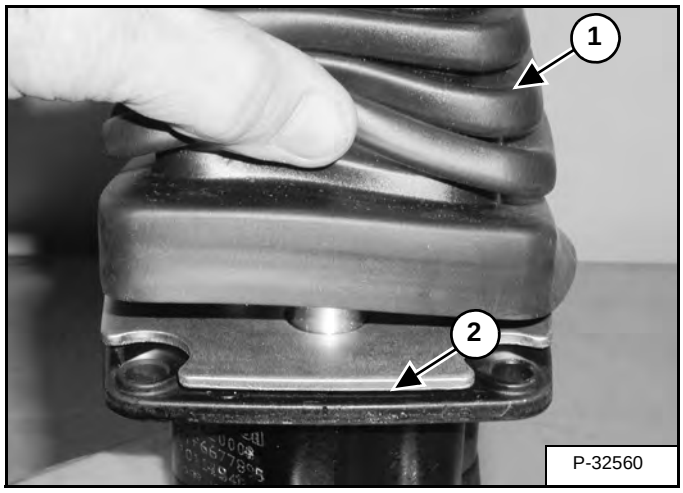
Figure 20-111-42



Install the connector (Item 1) **[Figure 20-111-42]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-111-42]**.

Figure 20-111-43



Install the tabs of the boot (Item 1) in between the joystick flange and mounting plate (Item 2) **[Figure 20-111-43]**.

Install the handle. (See Handle Removal And Installation on Page 20-100-2.)

Dealer Copy -- Not for Resale

CONTROL LEVER (JOYSTICK) (LEFT) (S/N A33P13155 & ABOVE, B4K911001 & ABOVE AND B4PD11001 & ABOVE)

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) is movable. 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

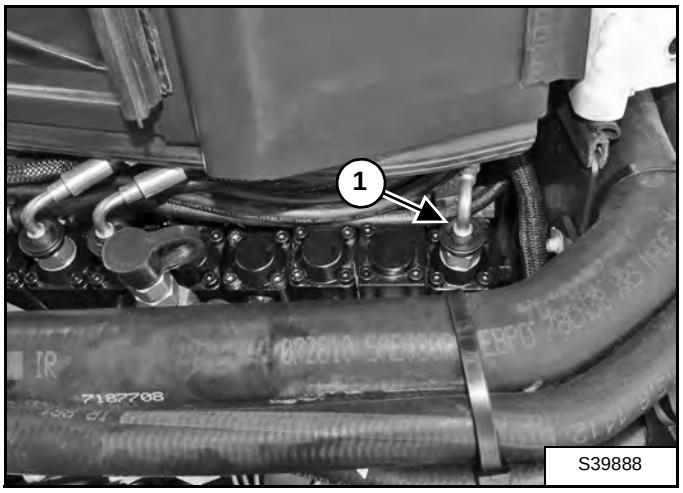
The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

Stop the engine.

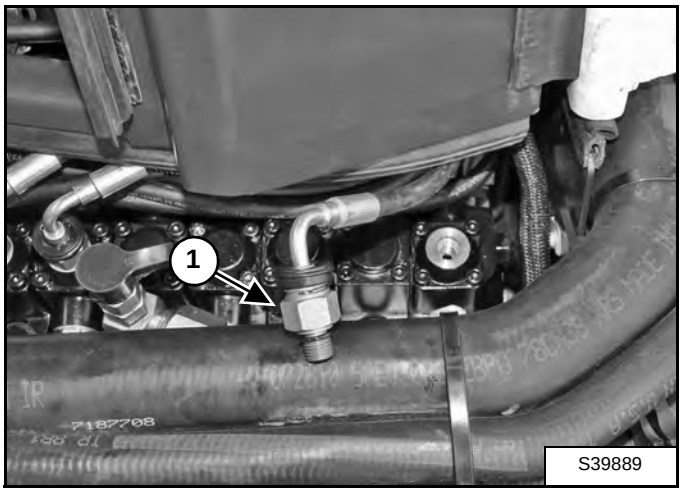
Remove the left upperstructure cover.

Figure 20-120-1



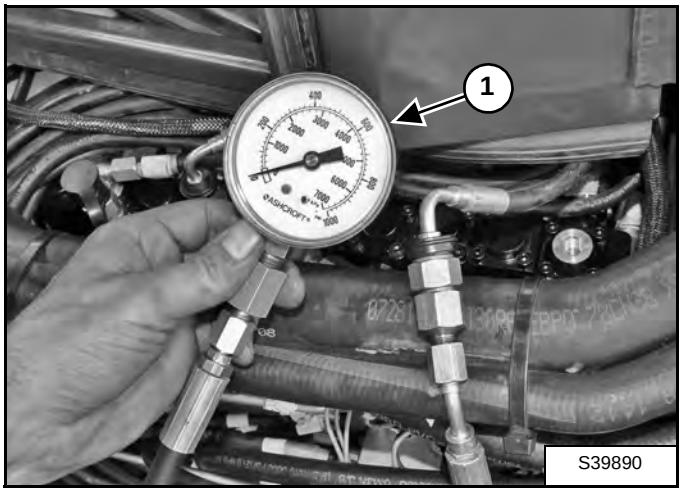
At the control valve assembly (Item 1) **[Figure 20-120-1]**, find the pilot line of the control lever (joystick) that is to be checked (Arm, Slew) (Slew Shown).

Figure 20-120-2



Disconnect the hydraulic fitting (Item 1) **[Figure 20-120-2]** from the control valve.

Figure 20-120-3



From the test kit install a 7 MPa (70 bar) (1000 psi) gauge (Item 1) **[Figure 20-120-3]** on the pilot line. Start the excavator, and warm the hydraulic fluid to operating temperature.

Engage the circuit to be tested. Record the operating pressure.

The operating pressure should be approximately 3,2 - 3,5 MPa (32 - 35 bar) (464 - 508 psi).

If the operating pressure is correct, check the valve section spool for proper operation. If the operating pressure is incorrect, remove the pilot pressure relief valve, clean, install and retest. (See Testing And Adjusting on Page 20-32-1.)

If the pressure is still incorrect replace the pilot pressure relief valve. (See Testing And Adjusting on Page 20-32-1.)

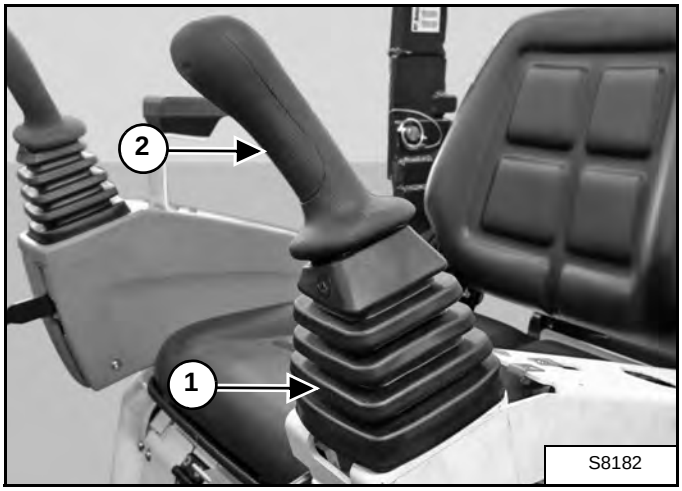
Dealer Copy -- Not for Resale

CONTROL LEVER (JOYSTICK) (LEFT) (S/N A33P13155 & ABOVE, B4K911001 & ABOVE AND B4PD11001 & ABOVE) (CONT'D)

Handle Removal And Installation

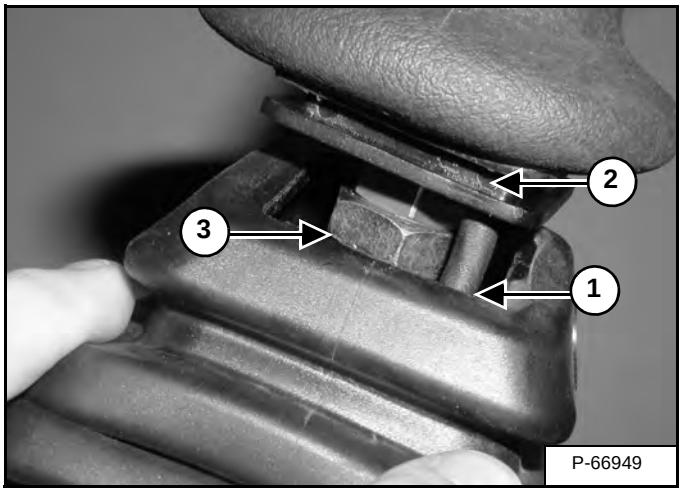
Remove the left console cover. (See Joystick Console Cover Removal And Installation on Page 40-50-1.)

Figure 20-120-4



Remove the dust boot (Item 1) from the handle (Item 2) **[Figure 20-120-4]**.

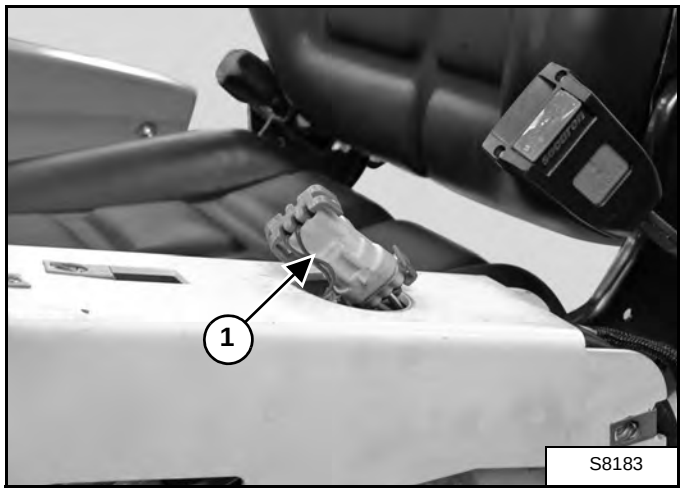
Figure 20-120-5



Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-120-5]**.

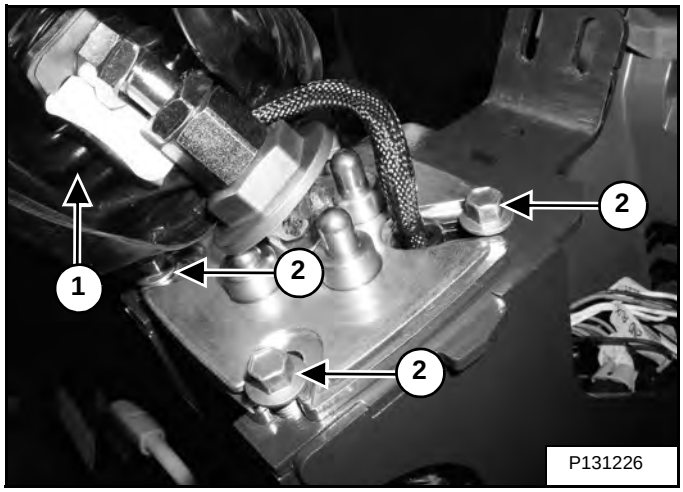
Hold the dust boot (Item 1) down and loosen the nut (Item 3) with the groove (Item 2) **[Figure 20-120-5]**.

Figure 20-120-6



Disconnect the joystick wire harness (Item 1) **[Figure 20-120-6]**.

Figure 20-120-7

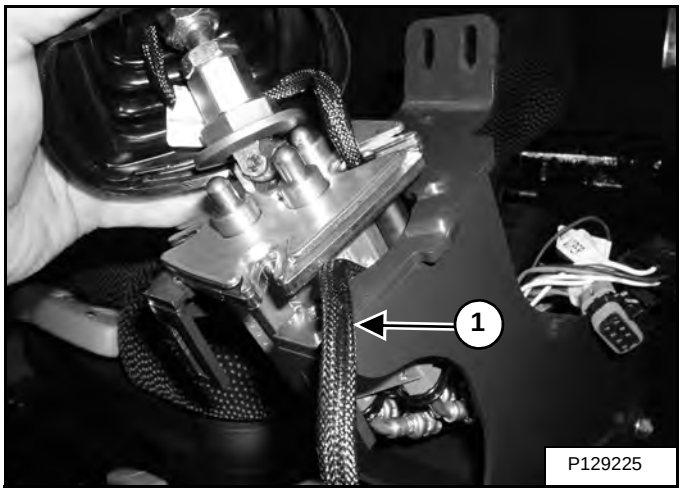


Raise the dust boot (Item 1) and remove the bolts (Item 2) **[Figure 20-120-7]**.

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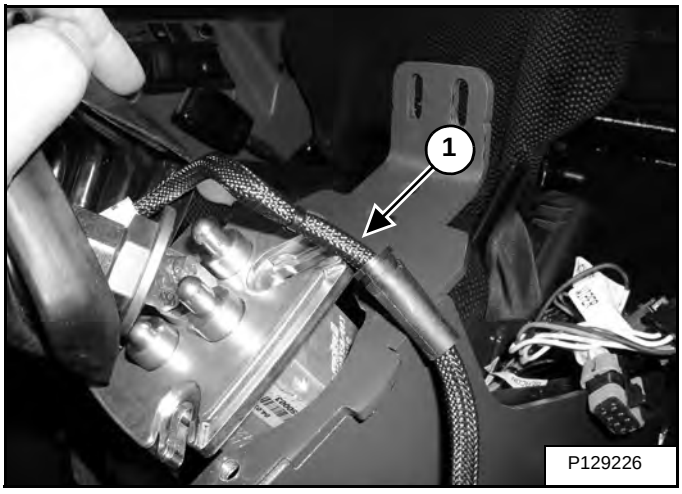
Handle Removal And Installation (Cont'd)

Figure 20-120-8



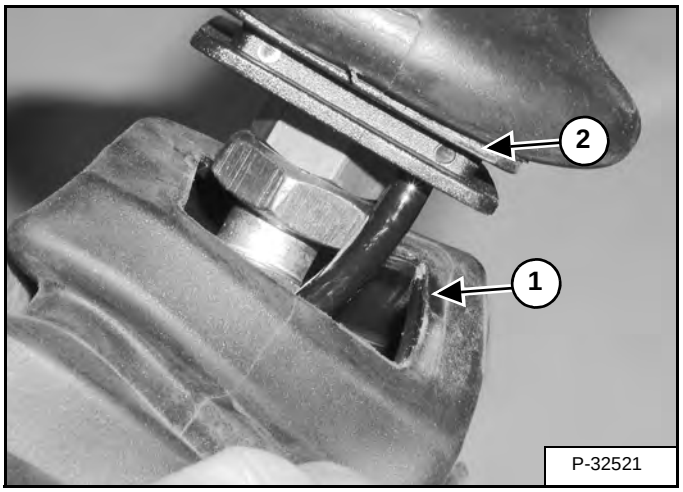
Raise the joystick and remove the wire harness (Item 1) **[Figure 20-120-8]** from the console.

Figure 20-120-9



Slide the grommet / wire harness (Item 1) **[Figure 20-120-9]** out of the joystick body.

Figure 20-120-10



Pull the boot down and pull the wire harness (Item 1) out of the boot. Loosen the nut (Item 2) **[Figure 20-120-10]** and remove the handle.

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CONTROL LEVER (JOYSTICK) (LEFT) (S/N A33P13155 & ABOVE, B4K911001 & ABOVE AND B4PD11001 & ABOVE) (CONT'D)

Removal And Installation

Lower the boom / bucket and blade to the ground.

Stop The Engine.

Relieve hydraulic pressure.

Remove the left 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.

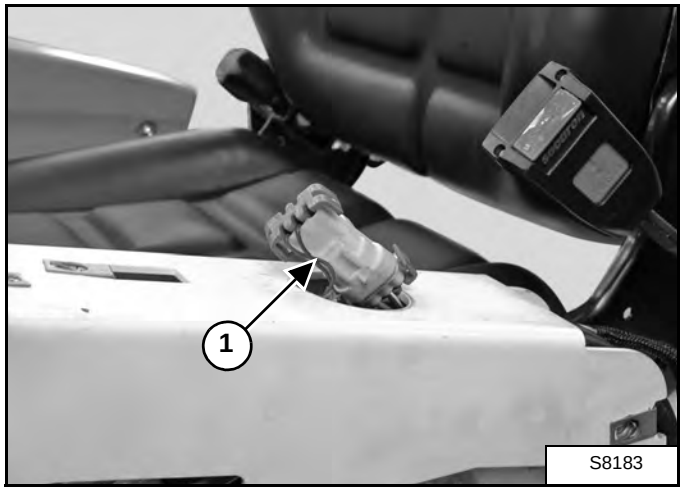
I-2003-0888

⚠ 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 physician familiar with this injury is not received immediately.

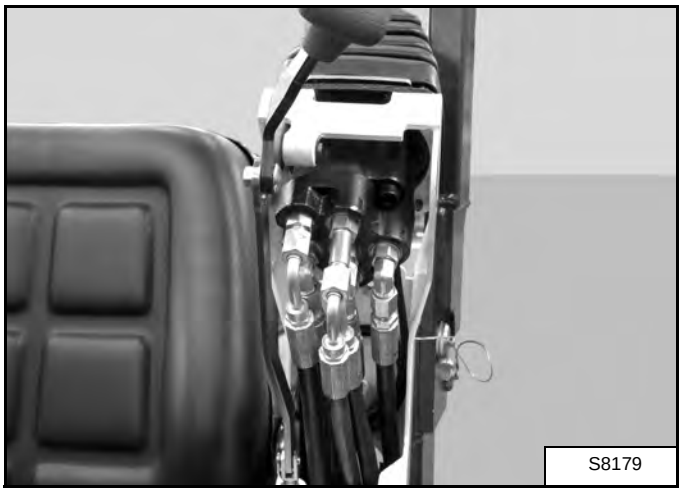
W-2145-0290

Figure 20-120-11



Disconnect the wire harness (Item 1) **[Figure 20-120-11]**.

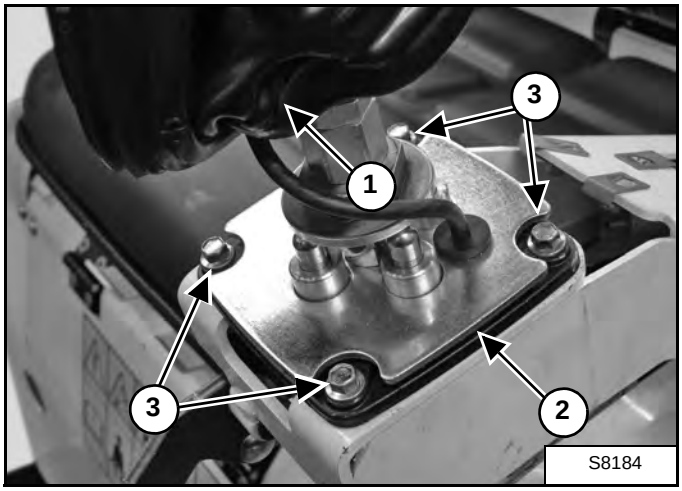
Figure 20-120-12



Mark and remove the hoses **[Figure 20-120-12]**.

Remove the hoses while the control lever (joystick) is bolted to the console.

Figure 20-120-13



Raise the dust boot (Item 1) up from the mounting plate (Item 2) **[Figure 20-120-13]**.

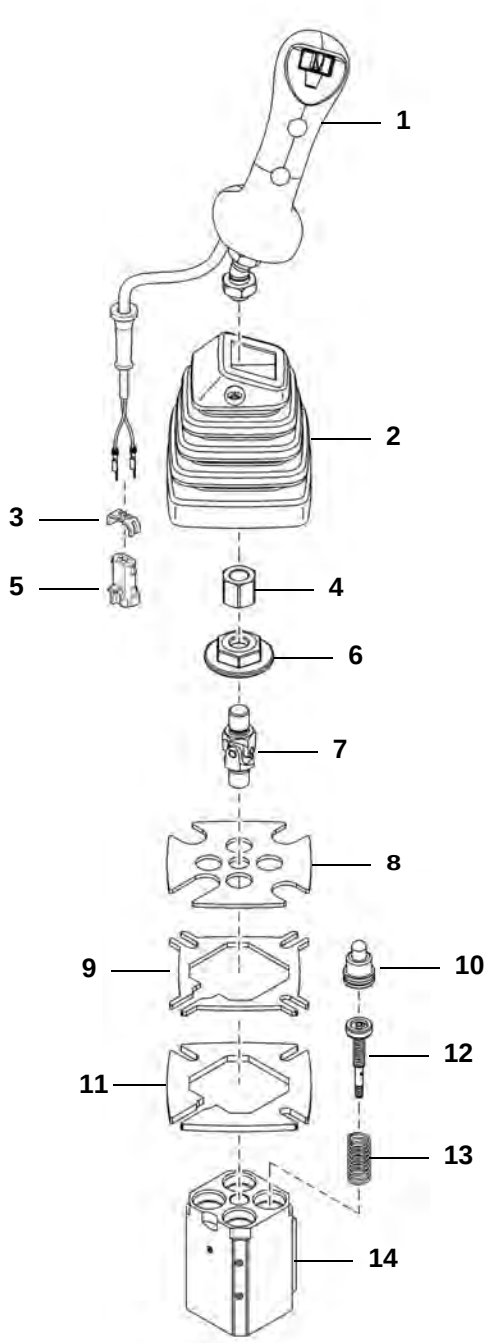
Remove the bolts (Item 2) **[Figure 20-120-13]**.

Remove the joystick assembly.

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Parts Identification

1. Handle
2. Boot
3. Lock
4. Coupler
5. Connector
6. Control Plate
7. U-joint
8. Square Flange
9. Intermediate Flange
10. Plunger
11. Inferior Flange
12. Spool
13. Spring
14. Housing



NA8065S

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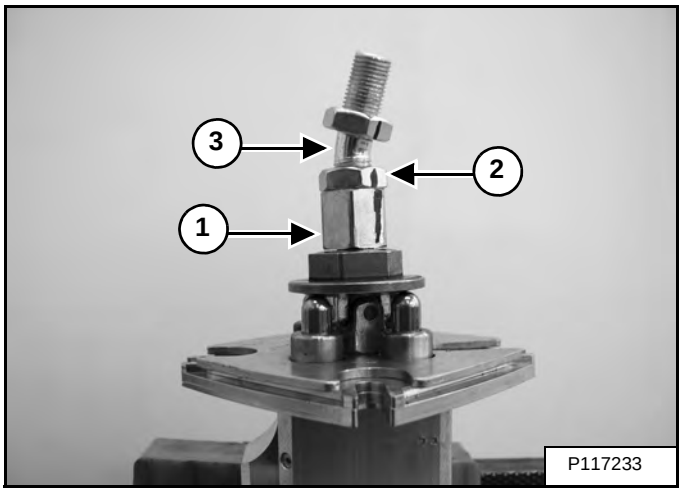
CONTROL LEVER (JOYSTICK) (LEFT) (S/N A33P13155 & ABOVE, B4K911001 & ABOVE AND B4PD11001 & ABOVE) (CONT'D)

Disassembly

Remove the left handle. (See Handle Removal And Installation on Page 20-120-2.)

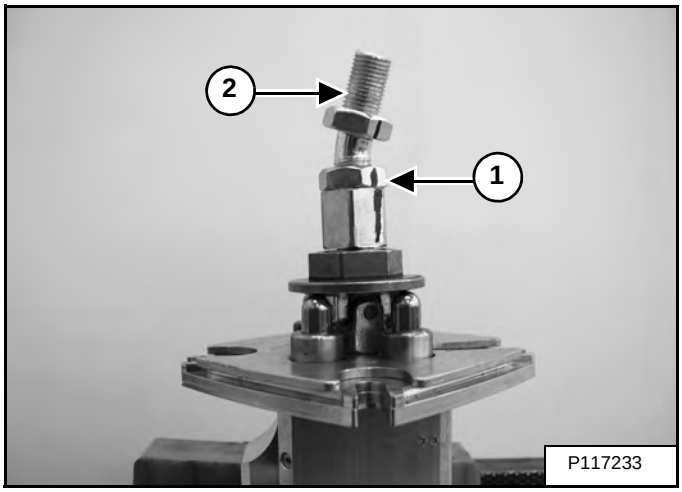
Clean the outside of the control lever before disassembly.

Figure 20-120-14



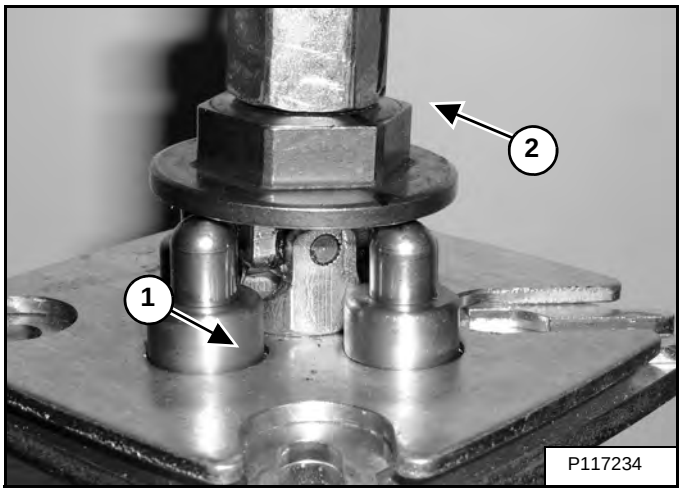
Mark the coupler (Item 1), nut (Item 2), and connector (Item 3) **[Figure 20-120-14]** for ease of assembly.

Figure 20-120-15



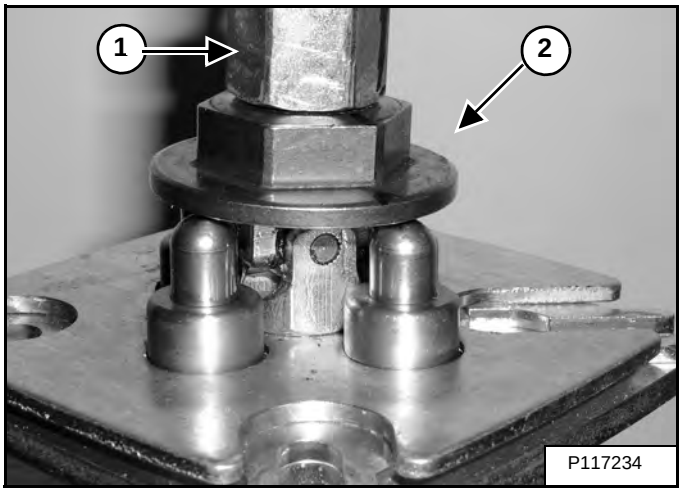
Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-120-15]**.

Figure 20-120-16



Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-120-16]** for ease of assembly.

Figure 20-120-17

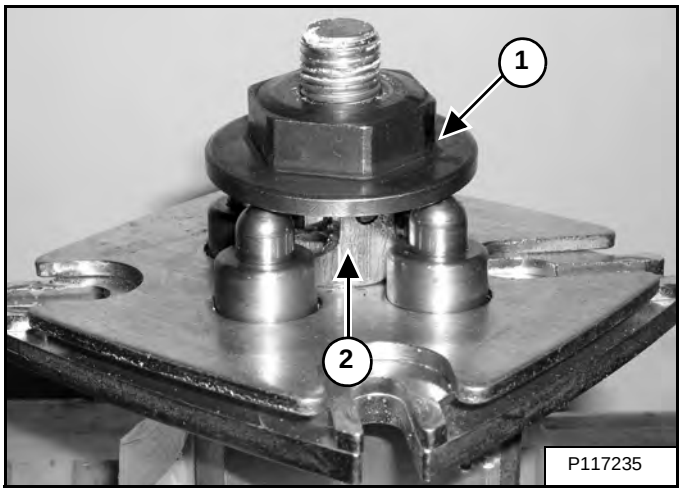


Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-120-17]**.

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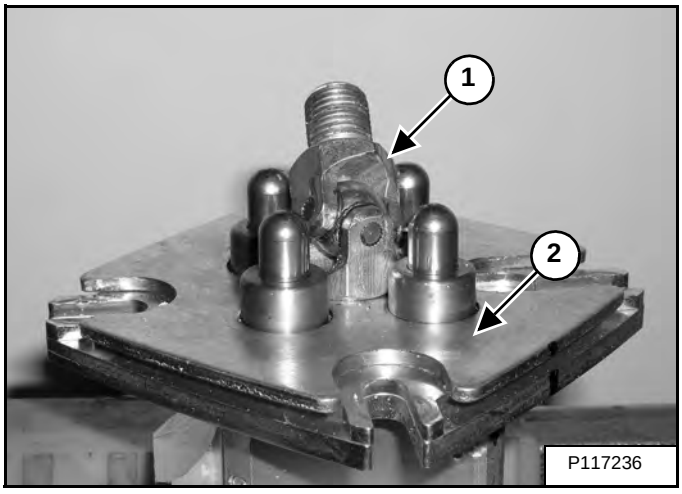
Disassembly (Cont'd)

Figure 20-120-18



Remove the control plate (Item 1) from the U-Joint (Item 2) **[Figure 20-120-18]**.

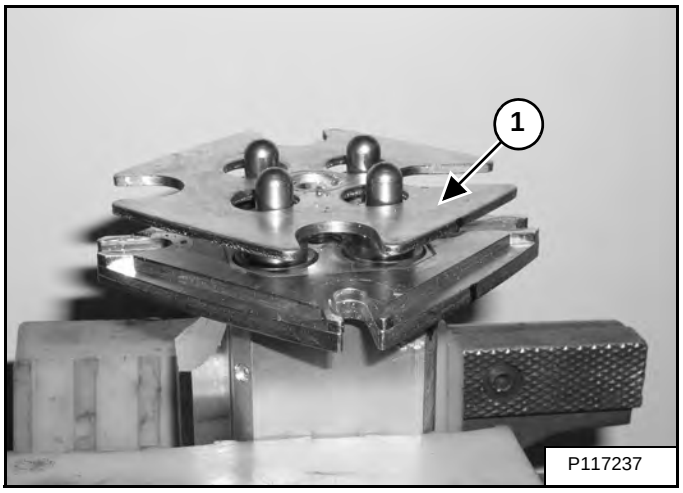
Figure 20-120-19



Mark the plate and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-120-19]**.

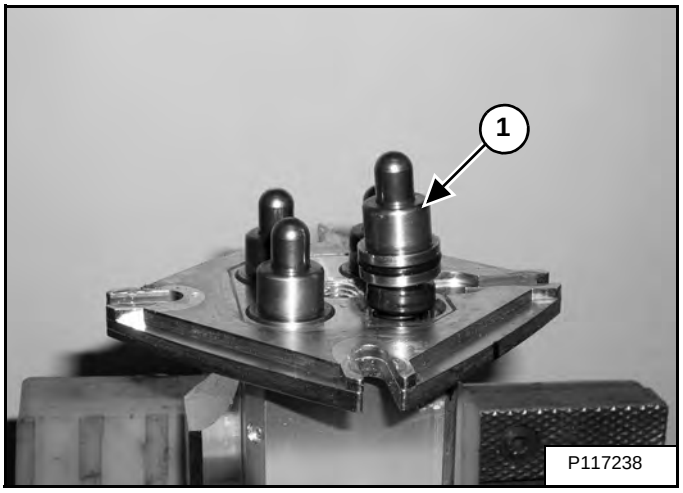
NOTE: The plate (Item 2) [Figure 20-120-19] is spring loaded and will come up as the U-joint is removed.

Figure 20-120-20



Remove the plate (Item 1) **[Figure 20-120-20]**.

Figure 20-120-21



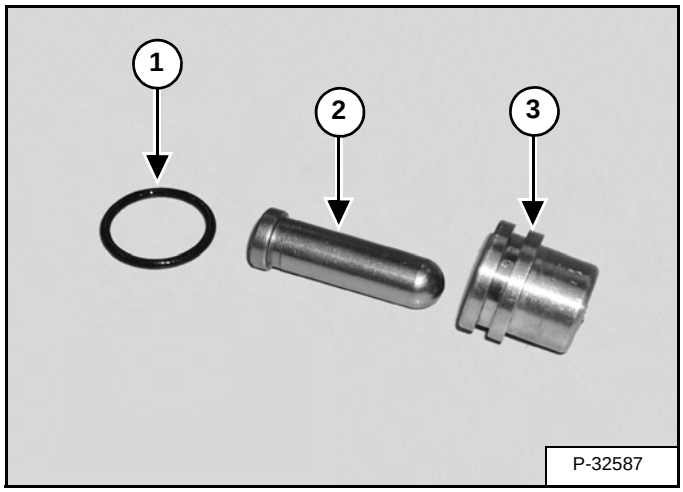
Remove the plunger assemblies (Item 1) **[Figure 20-120-21]**.

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CONTROL LEVER (JOYSTICK) (LEFT) (S/N A33P13155 & ABOVE, B4K911001 & ABOVE AND B4PD11001 & ABOVE) (CONT'D)

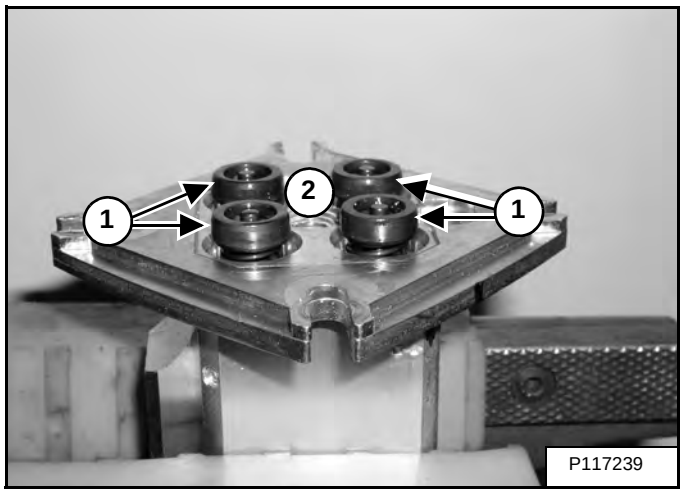
Disassembly (Cont'd)

Figure 20-120-22



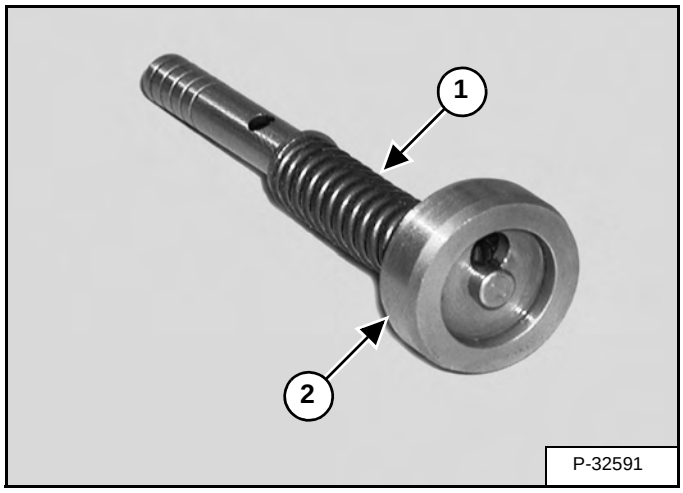
Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-120-22]**.

Figure 20-120-23



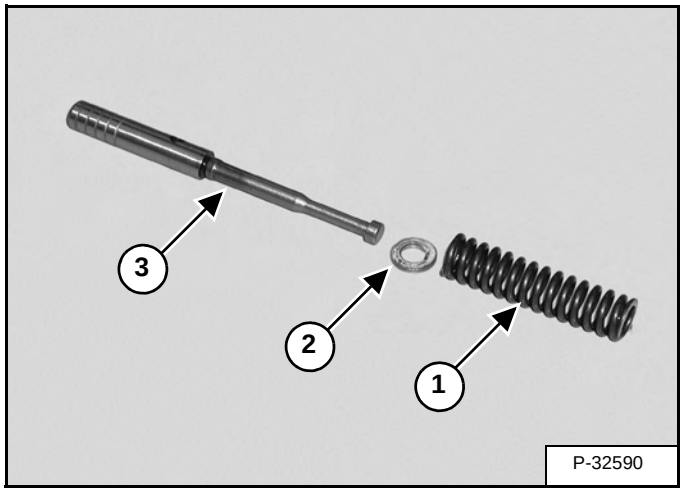
Remove the spool assemblies (Item 1) **[Figure 20-120-23]**.

Figure 20-120-24



Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-120-24]**.

Figure 20-120-25

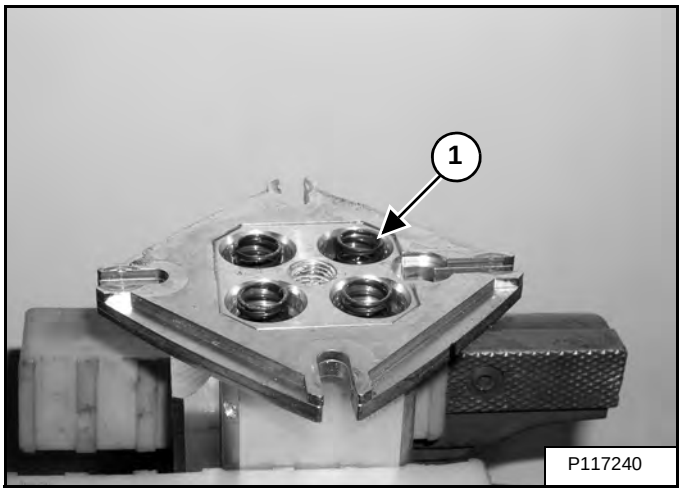


Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-120-25]**.

Dealer Copy -- Not for Resale

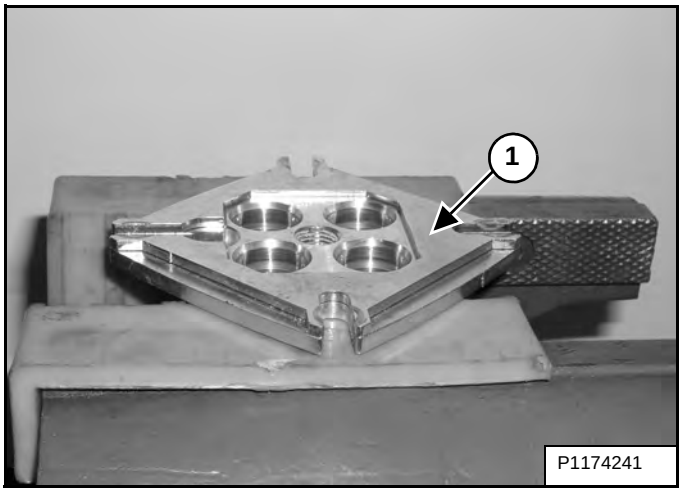
Disassembly (Cont'd)

Figure 20-120-26



Remove the springs (Item 1) **[Figure 20-120-26]**from the housing.

Figure 20-120-27



Remove the plate (Item 1) **[Figure 20-120-27]**.

Dealer Copy -- Not for Resale

CONTROL LEVER (JOYSTICK) (LEFT) (S/N A33P13155 & ABOVE, B4K911001 & ABOVE AND B4PD11001 & ABOVE) (CONT'D)

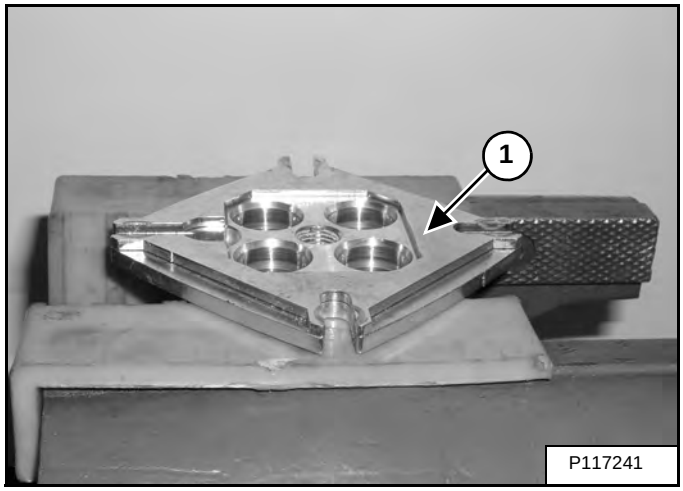
Assembly

Clean all parts in solvent and dry with compressed air.

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

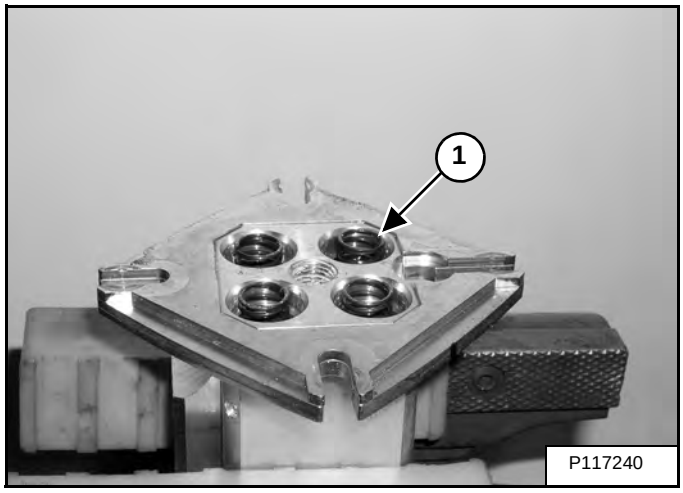
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-120-28



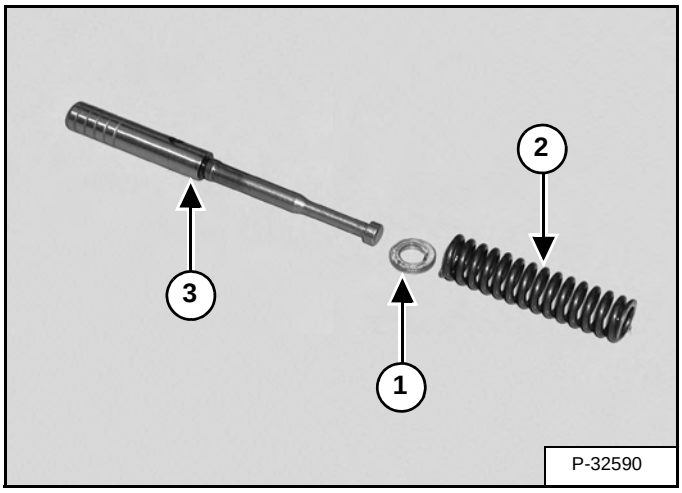
Install the plate (Item 1) **[Figure 20-120-28]**.

Figure 20-120-29



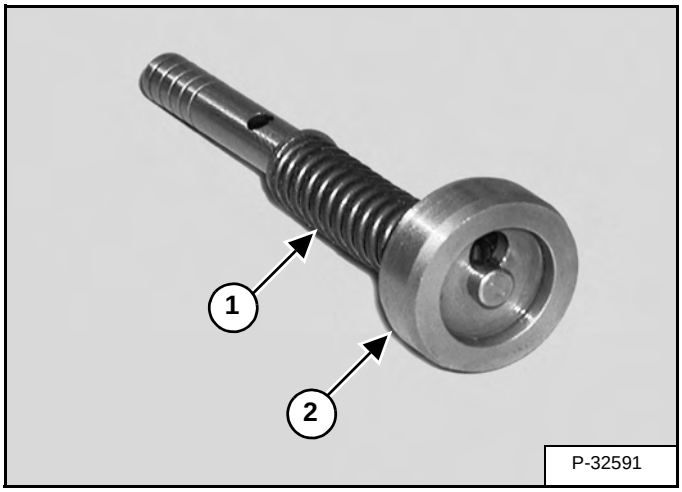
Install the springs (Item 1) **[Figure 20-120-29]**.

Figure 20-120-30



Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-120-30]**.

Figure 20-120-31

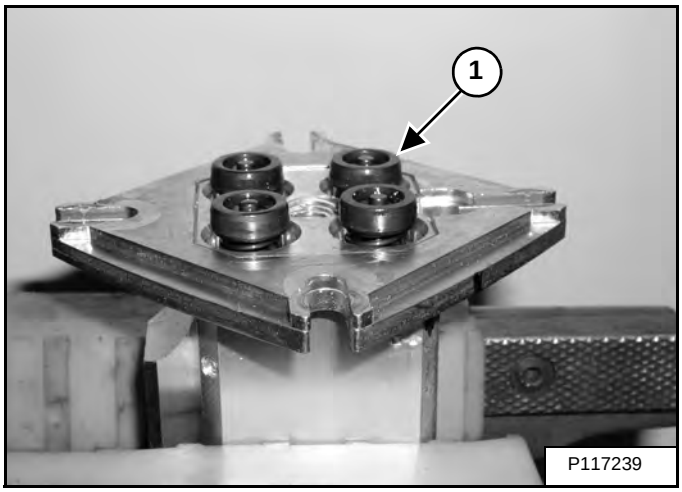


Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-120-31]**.

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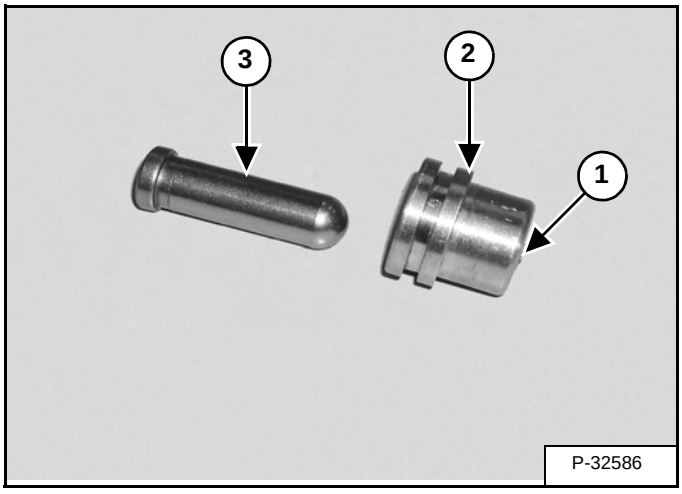
Assembly (Cont'd)

Figure 20-120-32



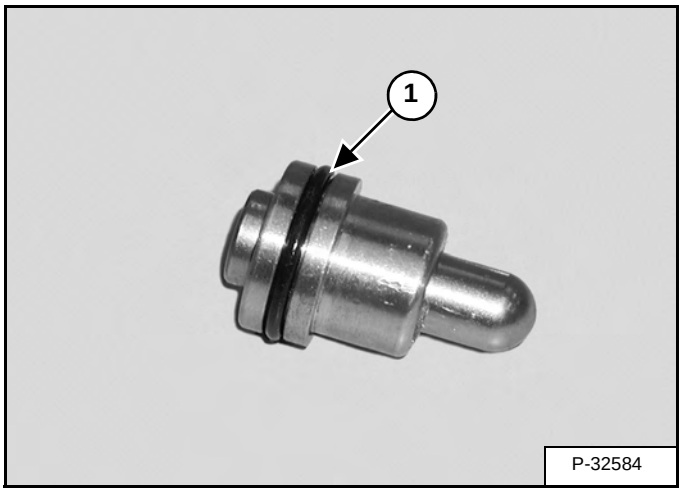
Install the spool assemblies (Item 1) **[Figure 20-120-32]** into the housing.

Figure 20-120-33



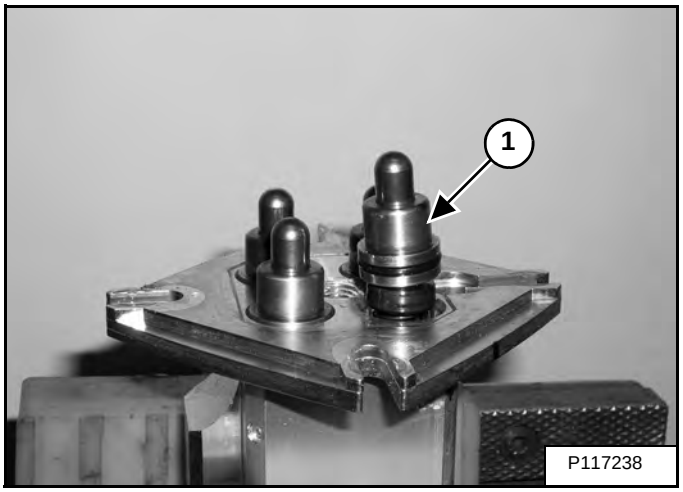
Install the O-ring (Item 1) into the bushing (Item 2). Install the plunger (Item 3) **[Figure 20-120-33]** into the bushing.

Figure 20-120-34



Install the O-ring (Item 1) **[Figure 20-120-34]** on the bushing.

Figure 20-120-35



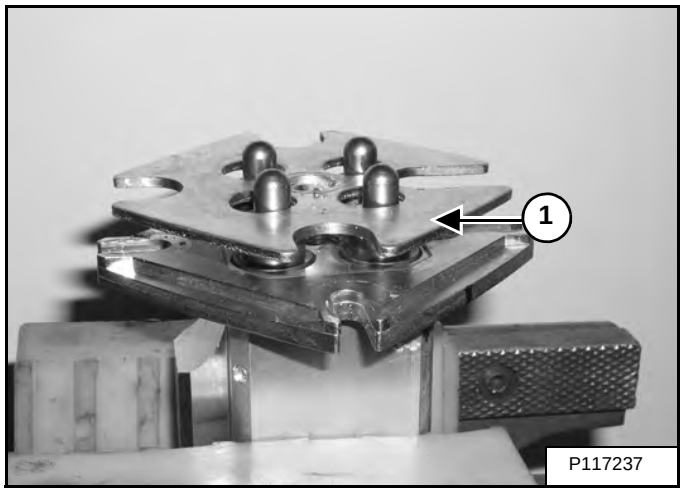
Install the plunger assemblies (Item 1) **[Figure 20-120-35]** into the housing.

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CONTROL LEVER (JOYSTICK) (LEFT) (S/N A33P13155 & ABOVE, B4K911001 & ABOVE AND B4PD11001 & ABOVE) (CONT'D)

Assembly (Cont'd)

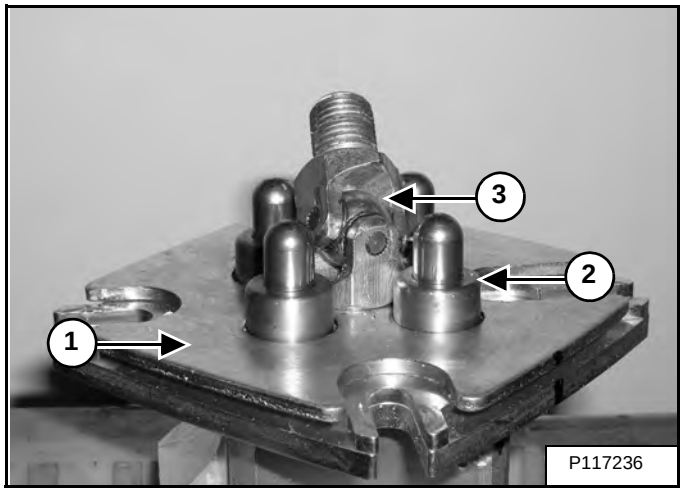
Figure 20-120-36



Install the plate (Item 1) **[Figure 20-120-36]**.

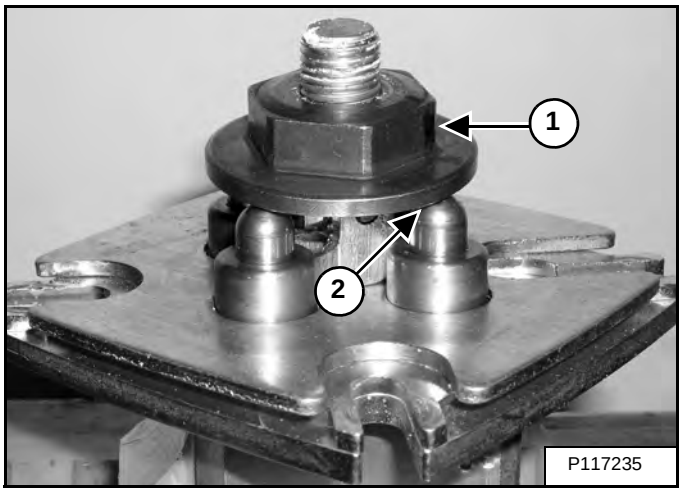
NOTE: Spring pressure can dislodge the plunger assemblies until the plate is secured in place.

Figure 20-120-37



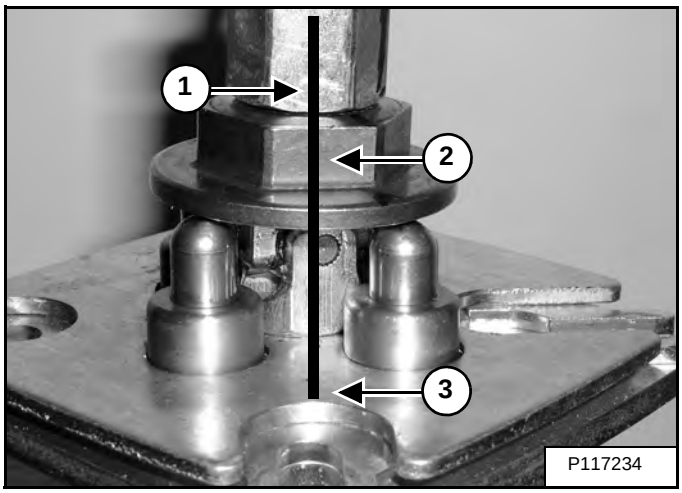
Press down on the plate (Item 1) keeping the plunger assemblies (Item 2) fully seated and install the U-joint (Item 3) **[Figure 20-120-37]**.

Figure 20-120-38



Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-120-38]**.

Figure 20-120-39

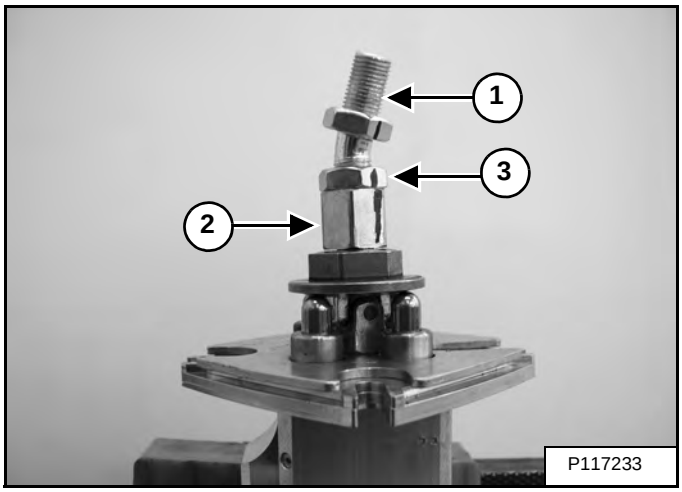


Align the coupler (Item 1) with the control plate (Item 2) and plate (Item 3) **[Figure 20-120-39]**. Tighten the coupler.

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Assembly (Cont'd)

Figure 20-120-40



Install the connector (Item 1) **[Figure 20-120-40]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-120-40]**.

Install the handle. (See Handle Removal And Installation on Page 20-120-2.)

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Dealer Copy -- Not for Resale

CONTROL LEVER (JOYSTICK) (LEFT) (S/N A33P11001 - A33P13154)

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) is movable. 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 20-32-1.)

The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

Lower the boom / bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

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

IMPORTANT

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

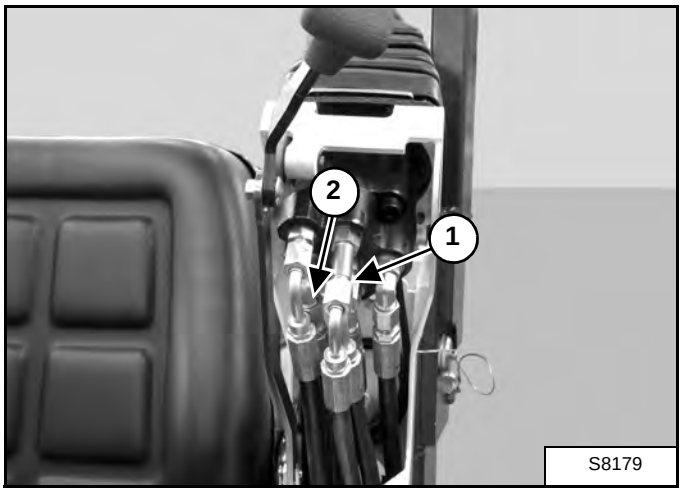
I-2003-0888

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 physician familiar with this injury is not received immediately.

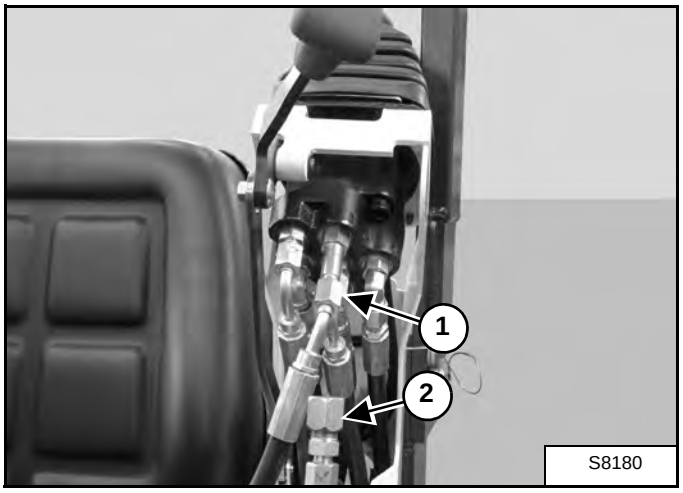
W-2145-0290

Figure 20-121-1



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 20-121-1]** 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 20-121-2



Remove the pilot hose **[Figure 20-121-2]** from the bottom of the control lever (joystick) that is to be checked.

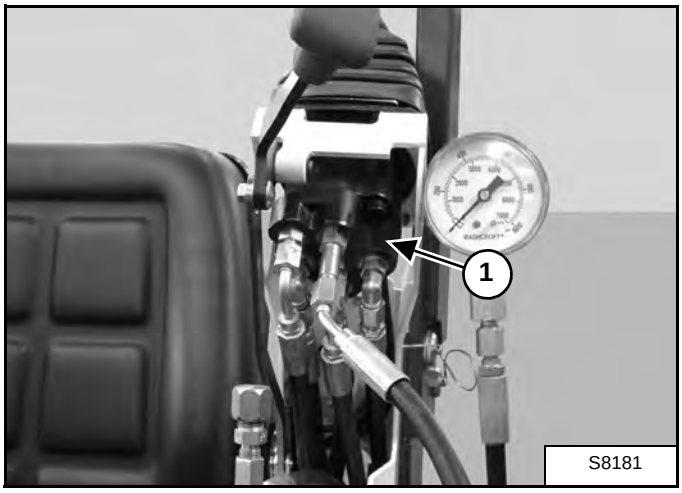
From the test kit, install a fitting and gauge hose (Item 1) **[Figure 20-121-2]** to the control lever (joystick) fitting.

Cap the pilot hose (Item 2) **[Figure 20-121-2]**.

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Testing (Cont'd)

Figure 20-121-3



Install a 6,9 MPa (69 bar) (1000 psi) gauge on the hose **[Figure 20-121-3]**.

Lower the left console to the locked position. Also lower the right console to the locked position if in the vertical position.

Start the engine and warm the hydraulic oil 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 circuit to be tested. Record the operating pressure.

The operating pressure should be as follows:

3,0 MPa (30 bar) (435 psi) with an acceptable range of 2,8 - 3,1 MPa (28 to 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 20-32-1.)

If the pressure is still incorrect replace the pressure reducing valve. (See Testing And Adjusting on Page 20-32-1.)

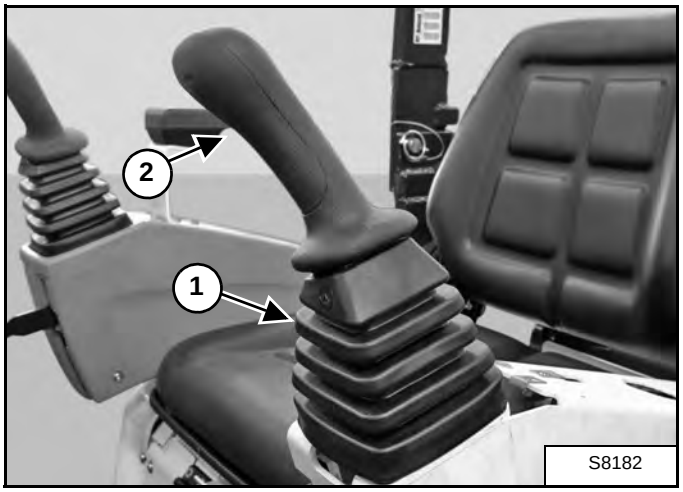
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CONTROL LEVER (JOYSTICK) (LEFT) (S/N A33P11001 - A33P13154) (CONT'D)

Handle Removal And Installation

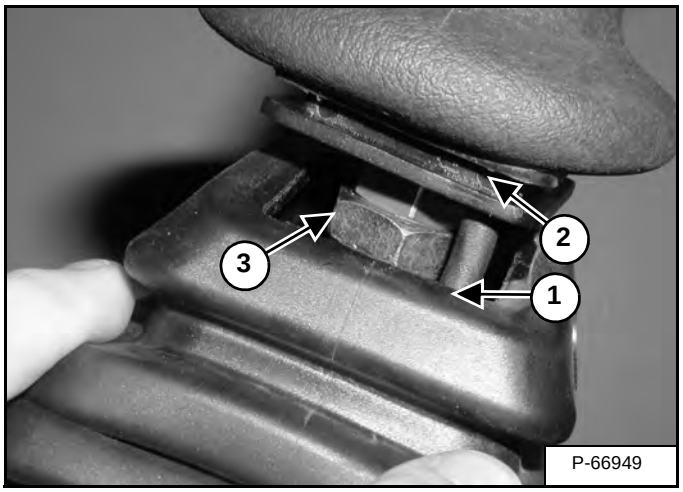
Remove the left console cover. (See Joystick Console Cover Removal And Installation on Page 40-50-1.)

Figure 20-121-4



Remove the dust boot (Item 1) from the handle (Item 2) **[Figure 20-121-4]**.

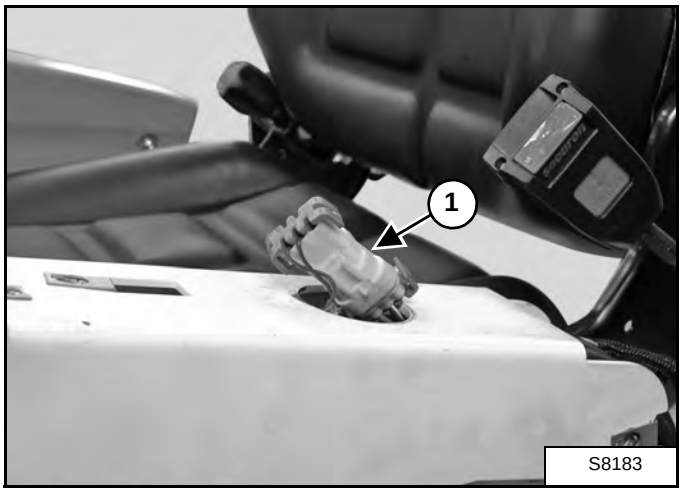
Figure 20-121-5



Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-121-5]**.

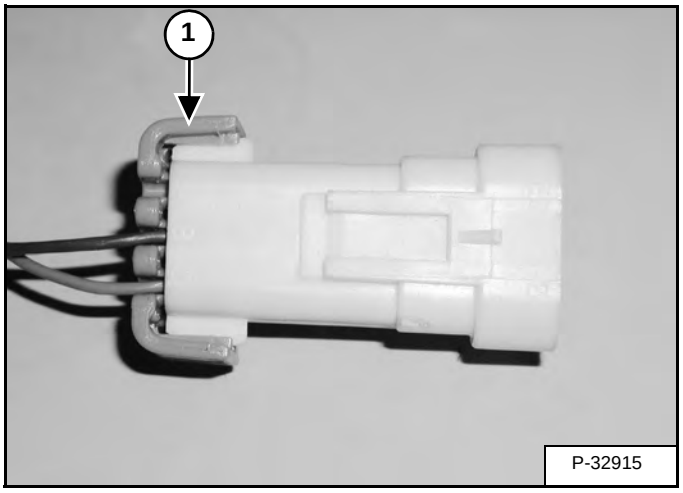
Hold the dust boot (Item 1) down and loosen the nut (Item 3) **[Figure 20-121-5]**.

Figure 20-121-6



Disconnect the wire harness (Item 1) **[Figure 20-121-6]**.

Figure 20-121-7

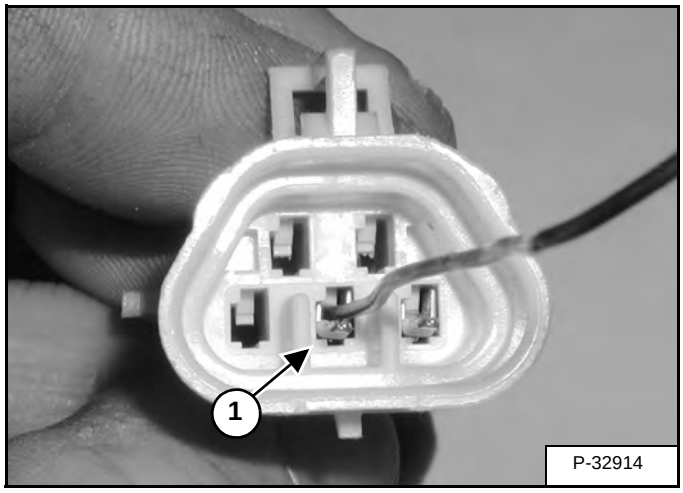


Remove the lock (Item 1) **[Figure 20-121-7]** from the electrical connector.

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Handle Removal And Installation (Cont'd)

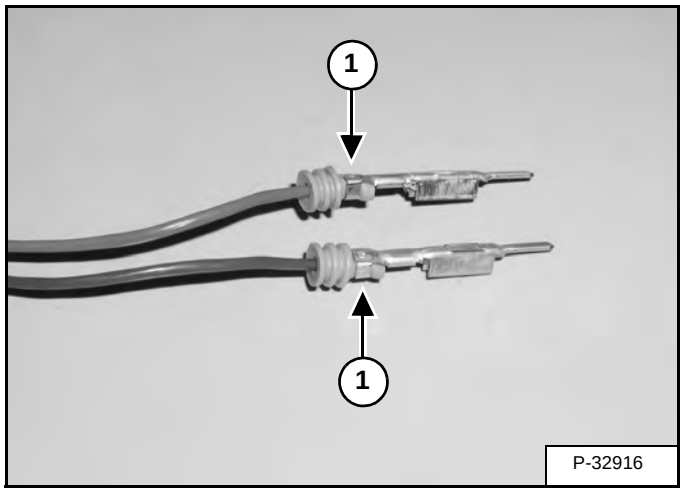
Figure 20-121-8



With a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 20-121-8]**.

Remove the individual wires from the back of the electrical connector.

Figure 20-121-9



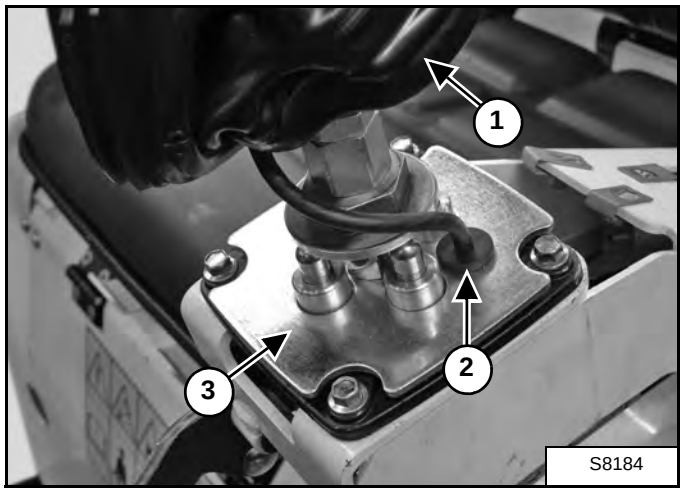
Installation: Use a small piece of wire and rebend the tab (Item 1) **[Figure 20-121-9]** on each wire before installing in the electrical connector.

Installation: The wires must be installed in the proper locations in the wire connector, listed below.

C Red
D Black

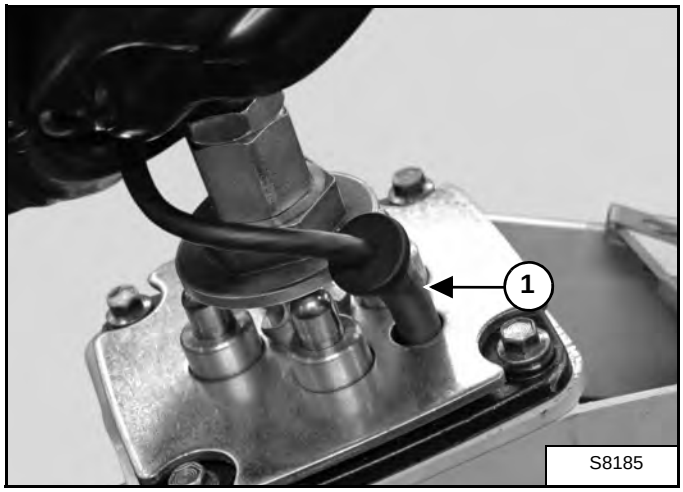
Check each wire to be certain the tab locks into position.

Figure 20-121-10



Raise the dust boot (Item 1) and pull the grommet (Item 2) up through the plate (Item 3) **[Figure 20-121-10]**.

Figure 20-121-11



Remove the grommet and wire (Item 1) **[Figure 20-121-11]** from the mount plate.

Remove the handle from the control lever.

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CONTROL LEVER (JOYSTICK) (LEFT) (S/N A33P11001 - A33P13154) (CONT'D)

Removal And Installation

Lower the boom / bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

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

IMPORTANT

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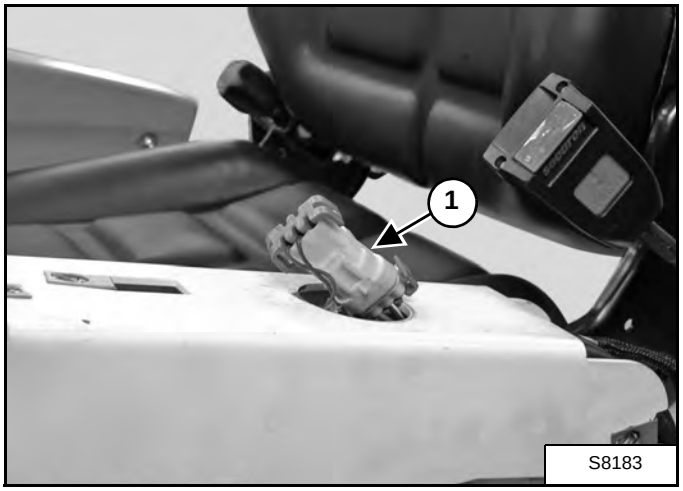
I-2003-0888

⚠ WARNING

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Figure 20-121-12



Disconnect the wire harness (Item 1) **[Figure 20-121-12]**.

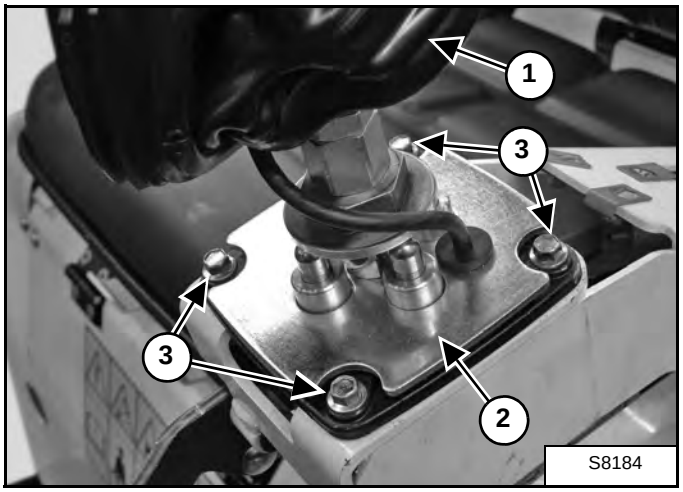
Figure 20-121-13



Mark the hoses for ease of assembly **[Figure 20-121-13]**.

Remove the hoses while the control lever (joystick) is bolted to the console.

Figure 20-121-14



Raise the dust boot (Item 1) up from the plate (Item 2) **[Figure 20-121-14]**.

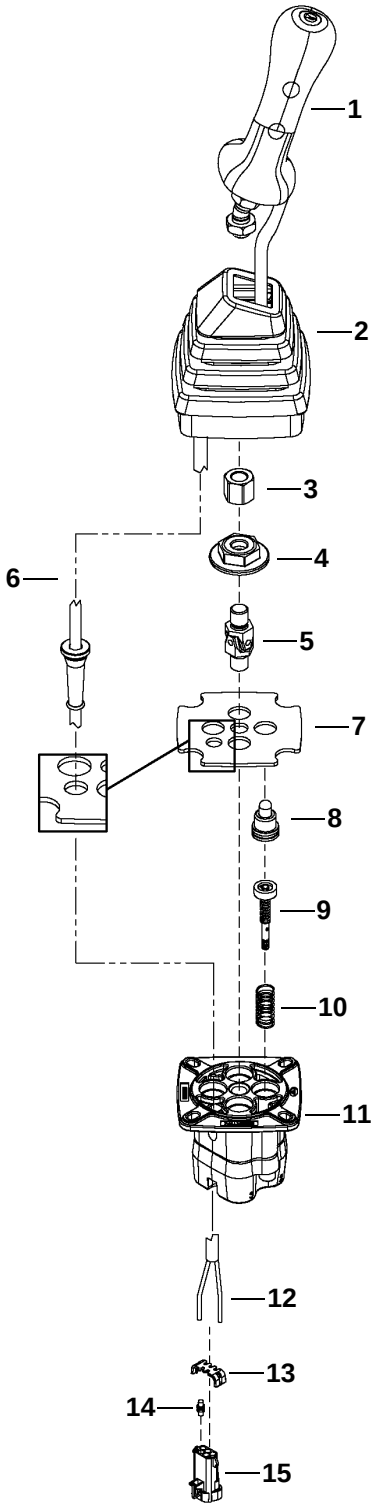
Remove the bolts (Item 3) **[Figure 20-121-14]** from the joystick plate.

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

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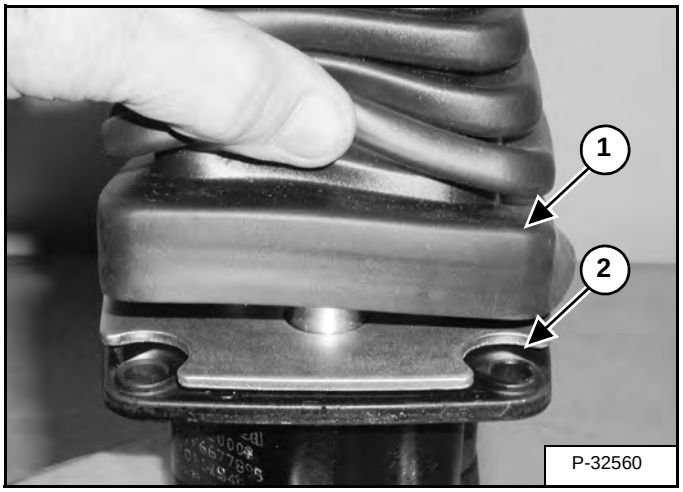
CONTROL LEVER (JOYSTICK) (LEFT) (S/N A33P11001 - A33P13154) (CONT'D)

Disassembly

Remove the left handle. (See Handle Removal And Installation Page 20-101-3.)

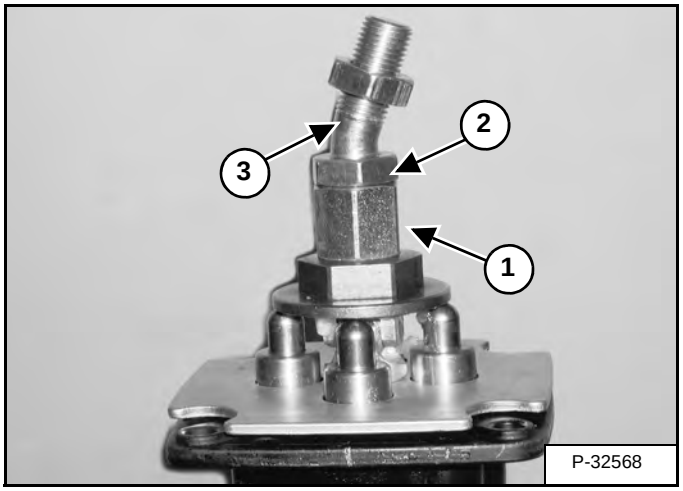
Clean the outside of the control lever before disassembly.

Figure 20-121-15



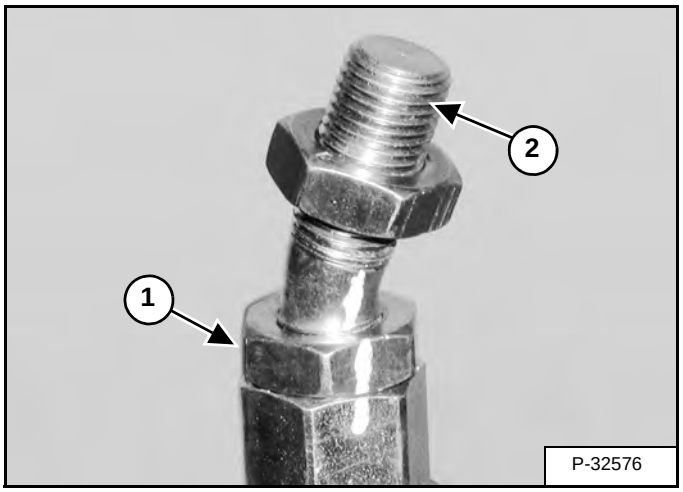
Remove the boot (Item 1) from the control lever (joystick) (Item 2) **[Figure 20-121-15]**.

Figure 20-121-16



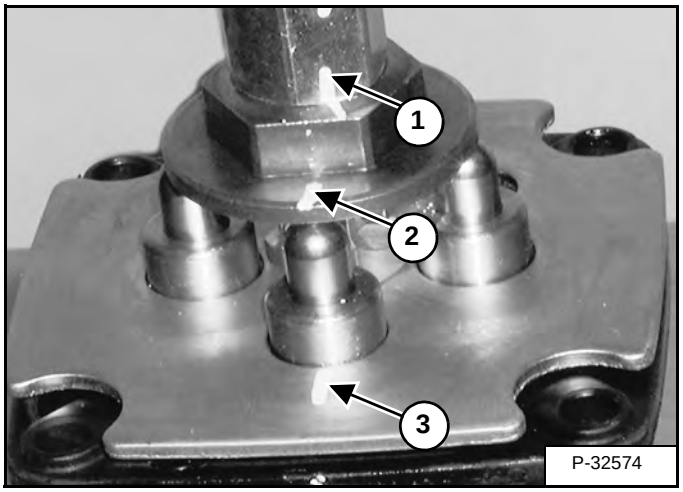
Mark the coupler (Item 1) nut (Item 2), and connector (Item 3) **[Figure 20-121-16]** for correct assembly.

Figure 20-121-17



Loosen the nut (Item 1) and remove the connector (Item 2) **[Figure 20-121-17]**.

Figure 20-121-18

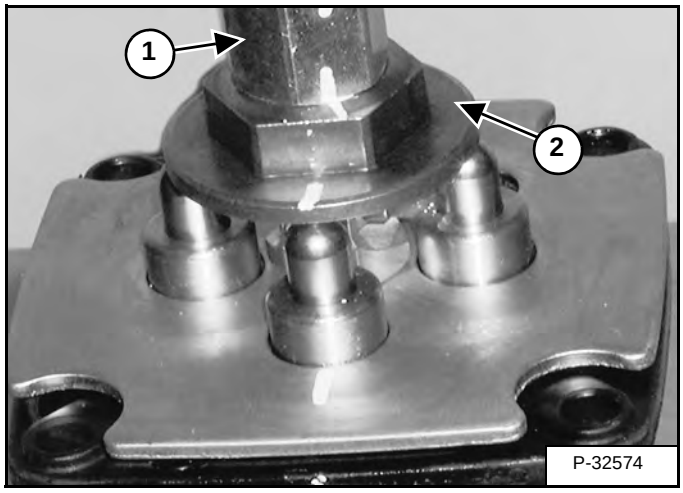


Mark the coupler (Item 1), control plate (Item 2), and plate (Item 3) **[Figure 20-121-18]** for correct installation.

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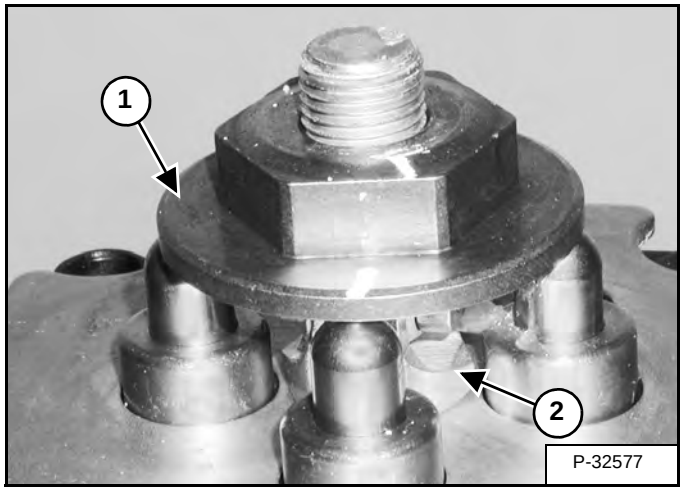
Disassembly (Cont'd)

Figure 20-121-19



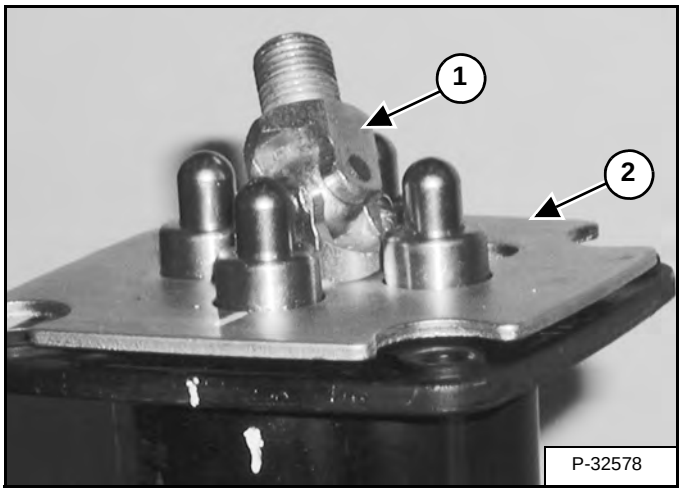
Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-121-19]**.

Figure 20-121-20



Remove the control plate (Item 1) from the U-Joint (Item 2) **[Figure 20-121-20]**.

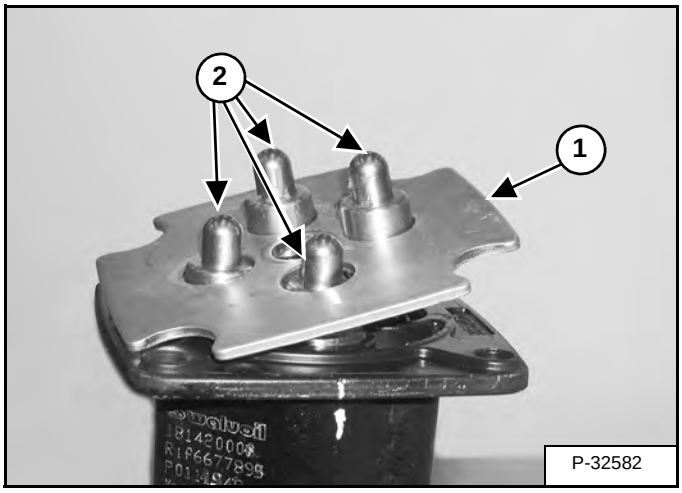
Figure 20-121-21



Mark the plate and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-121-21]**.

NOTE: The plate (Item 2) [Figure 20-121-21] is spring loaded and will come up as the U-joint is removed.

Figure 20-121-22



Remove the plate (Item 1) **[Figure 20-121-22]**.

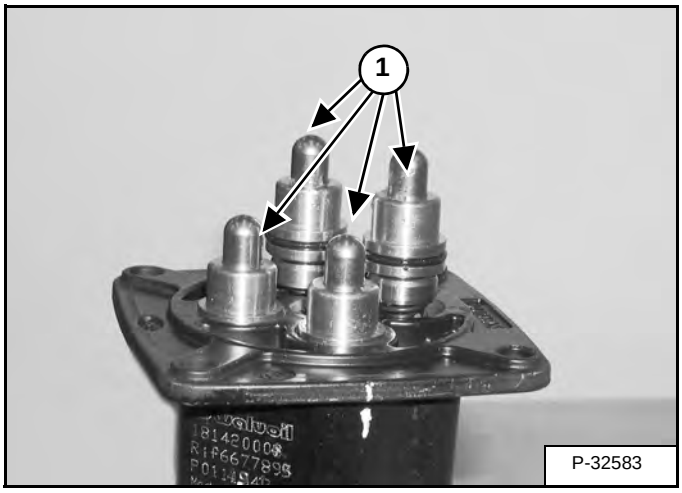
NOTE: Use care while removing the plate. The plungers (Item 2) [Figure 20-121-22] are spring loaded.

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CONTROL LEVER (JOYSTICK) (LEFT) (S/N A33P11001 - A33P13154) (CONT'D)

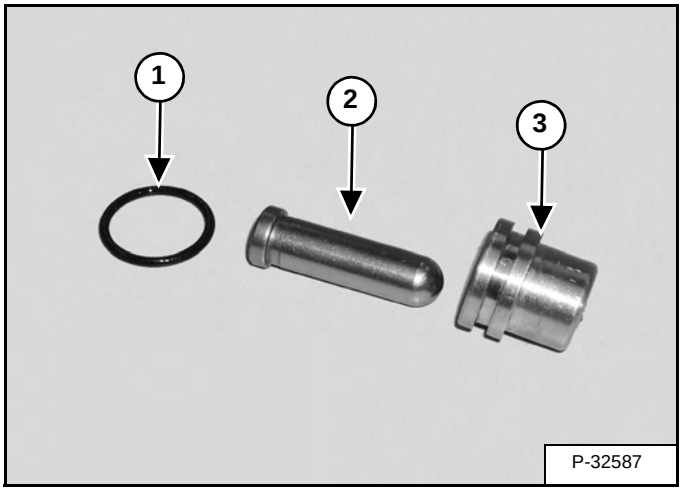
Disassembly (Cont'd)

Figure 20-121-23



Remove the plunger assemblies (Item 1) **[Figure 20-121-23]**.

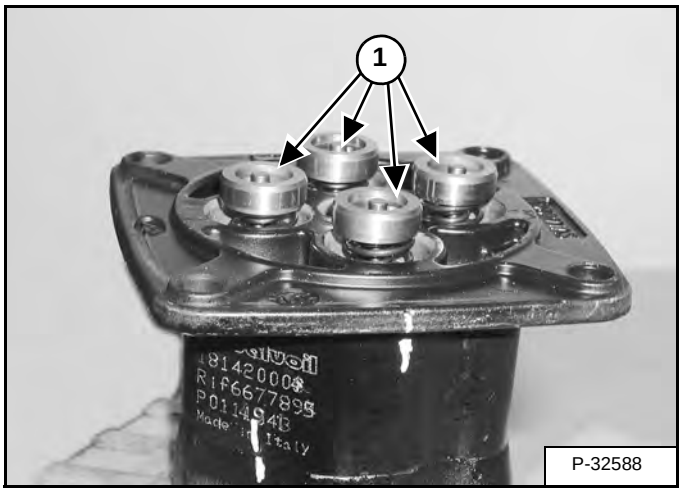
Figure 20-121-24



Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-121-24]**.

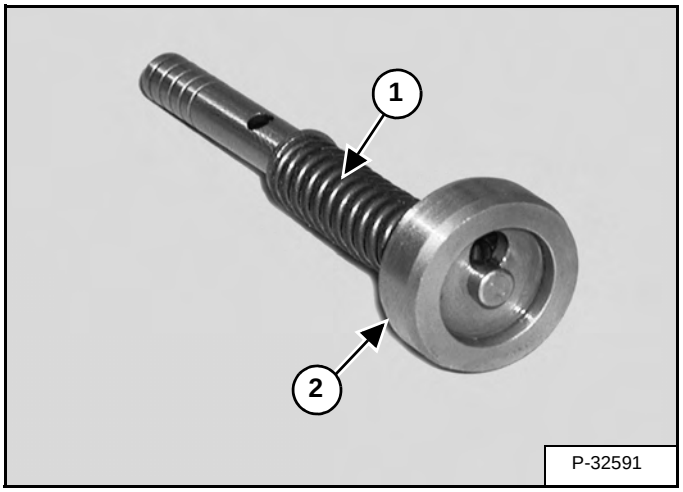
NOTE: Mark the spool assemblies for installation in their original location.

Figure 20-121-25



Remove the spool assemblies (Item 1) **[Figure 20-121-25]**.

Figure 20-121-26



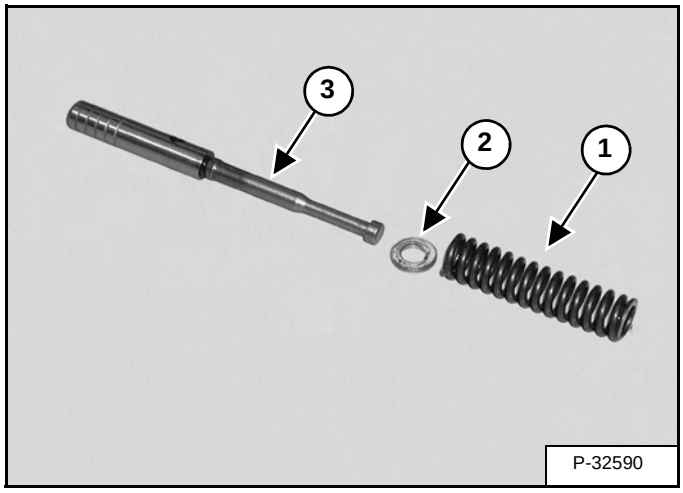
Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-121-26]**.

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CONTROL LEVER (JOYSTICK) (LEFT) (S/N A33P11001 - A33P13154) (CONT'D)

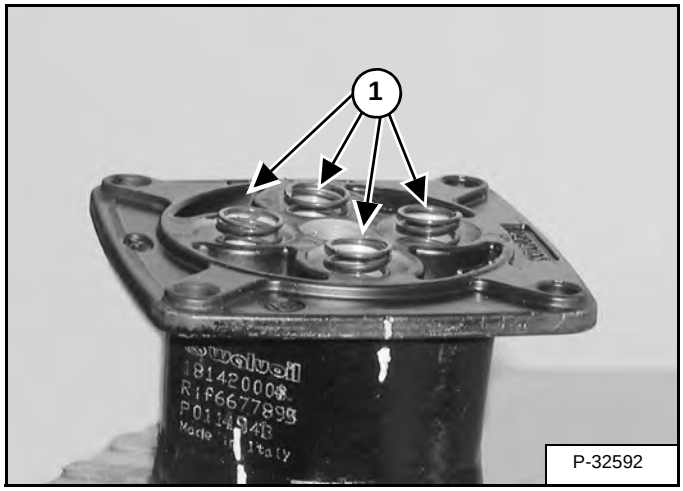
Disassembly (Cont'd)

Figure 20-121-27



Remove the spring (Item 1) and shim (Item 2) from the spool (Item 3) **[Figure 20-121-27]**.

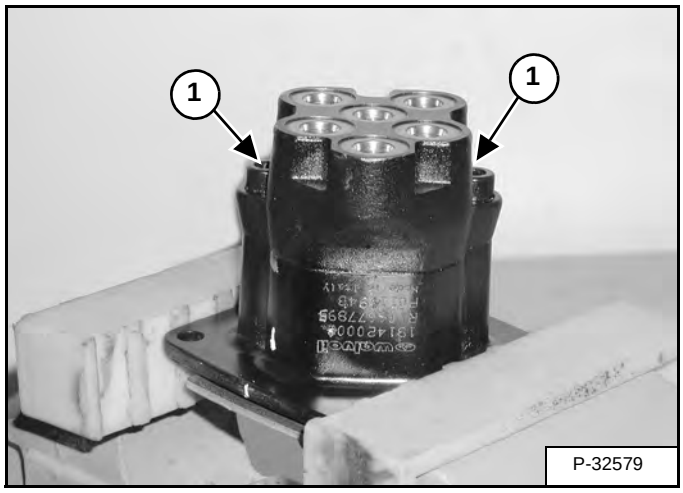
Figure 20-121-28



Remove the springs (Item 1) **[Figure 20-121-28]** from the housing.

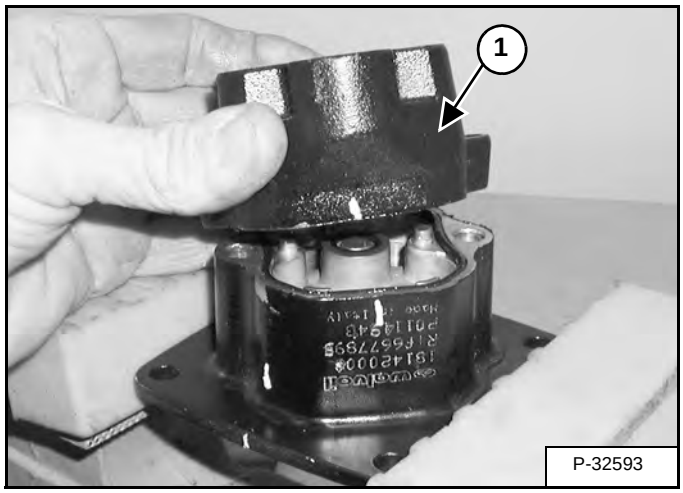
Clamp the housing in a vise that is equipped with padded jaws.

Figure 20-121-29



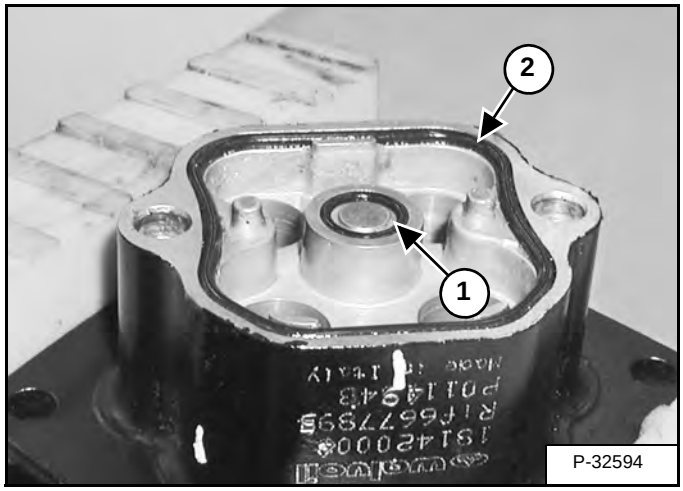
Remove the bolts (Item 1) **[Figure 20-121-29]**.

Figure 20-121-30



Remove the end cap (Item 1) **[Figure 20-121-30]**.

Figure 20-121-31



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-121-31]**.

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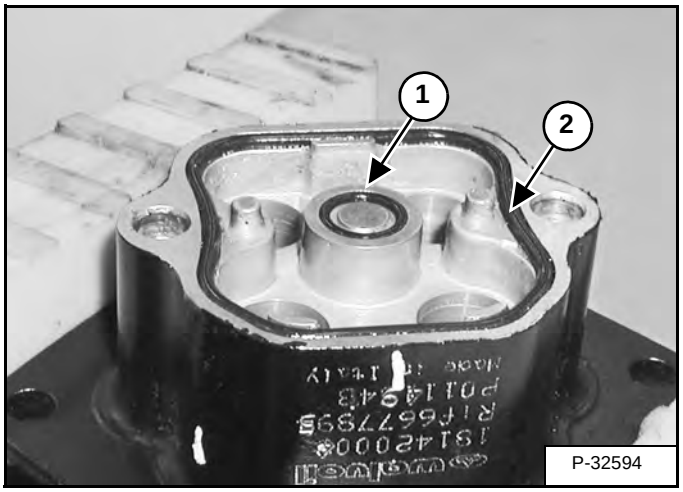
Assembly

Clean all parts in solvent and dry with compressed air.

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

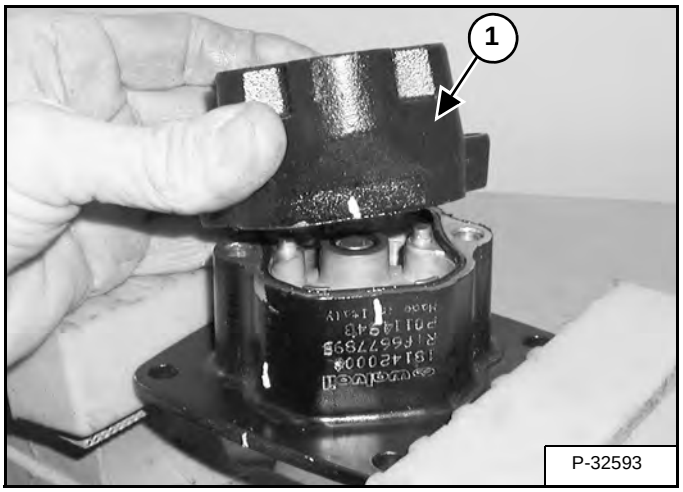
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-121-32



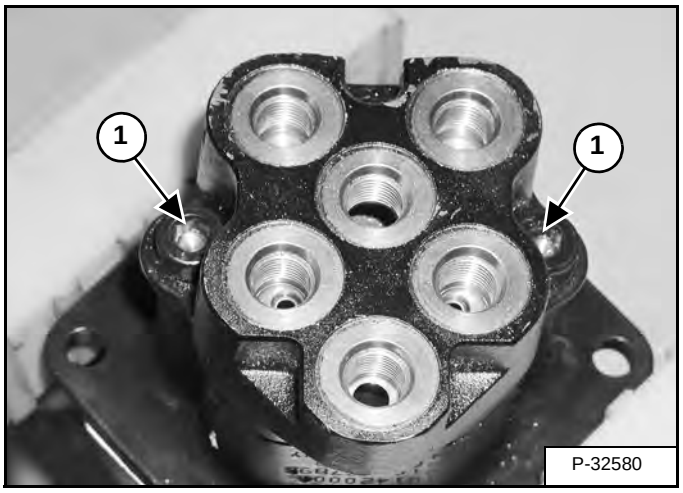
Clamp the housing in a vise equipped with padded jaws. Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-121-32]**.

Figure 20-121-33



Install the end cap (Item 1) **[Figure 20-121-33]**.

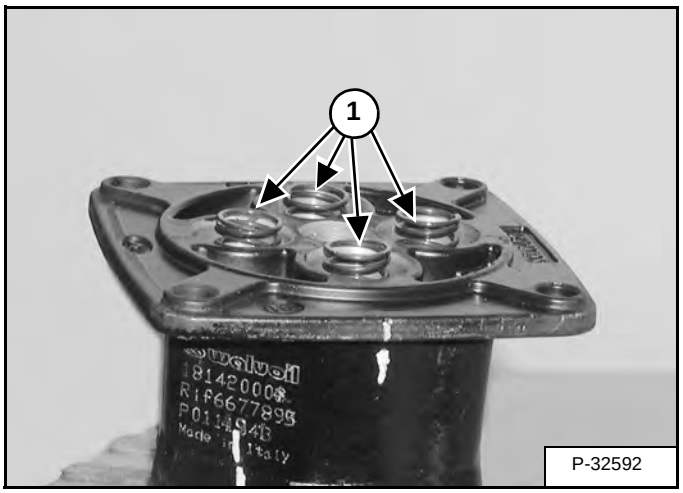
Figure 20-121-34



Install the bolts (Item 1) **[Figure 20-121-34]**.

Turn the housing over.

Figure 20-121-35



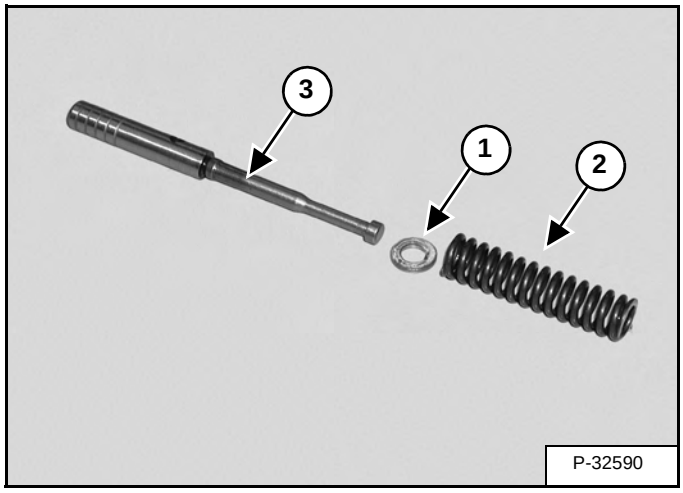
Install the springs (Item 1) **[Figure 20-121-35]**.

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CONTROL LEVER (JOYSTICK) (LEFT) (S/N A33P11001 - A33P13154) (CONT'D)

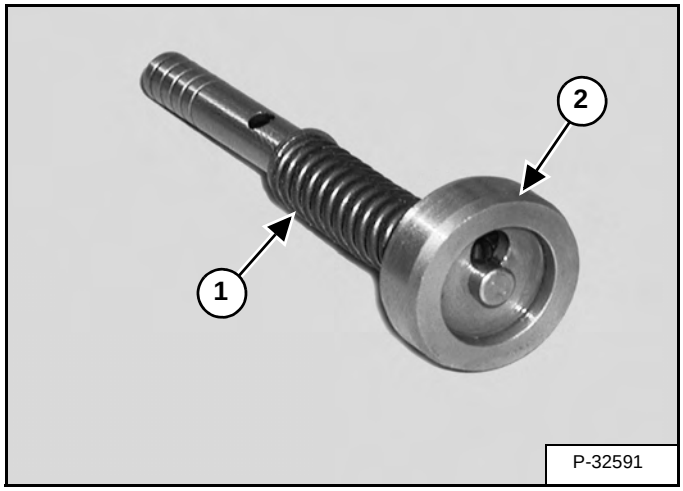
Assembly (Cont'd)

Figure 20-121-36



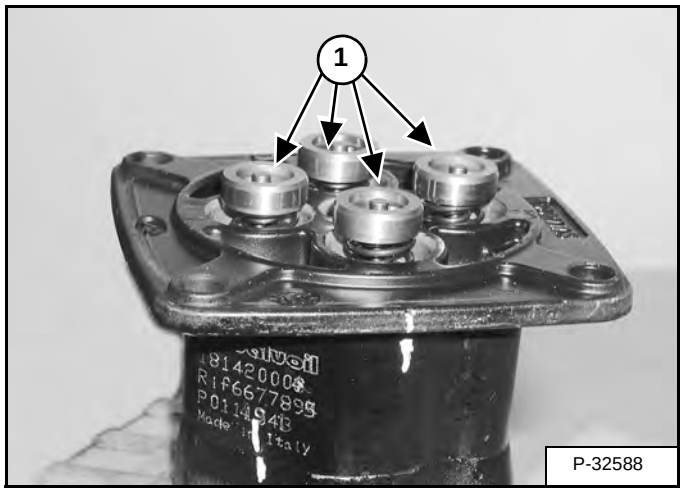
Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-121-36]**.

Figure 20-121-37



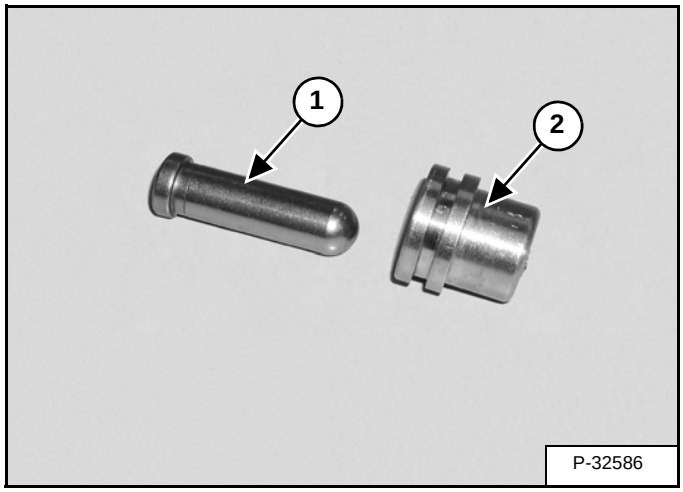
Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-121-37]**.

Figure 20-121-38



Install the spool assemblies (Item 1) **[Figure 20-121-38]** into the housing.

Figure 20-121-39

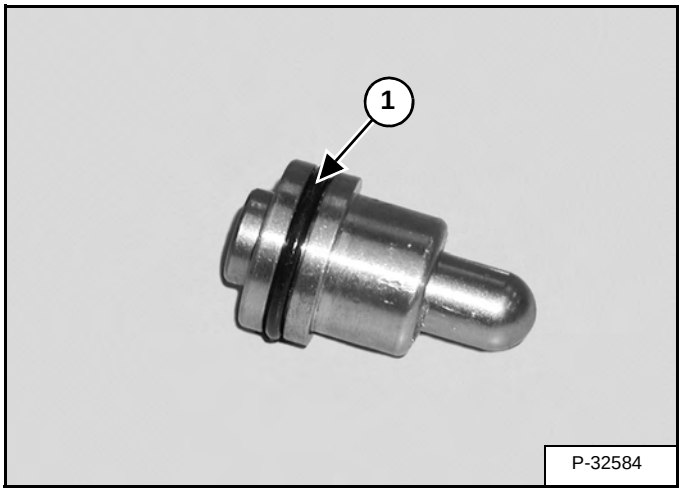


Install the plunger (Item 1) into the bushing (Item 2) **[Figure 20-121-39]**.

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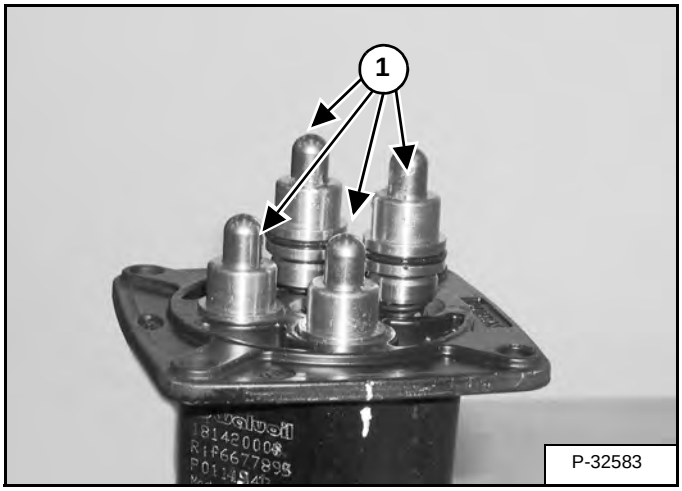
Assembly (Cont'd)

Figure 20-121-40



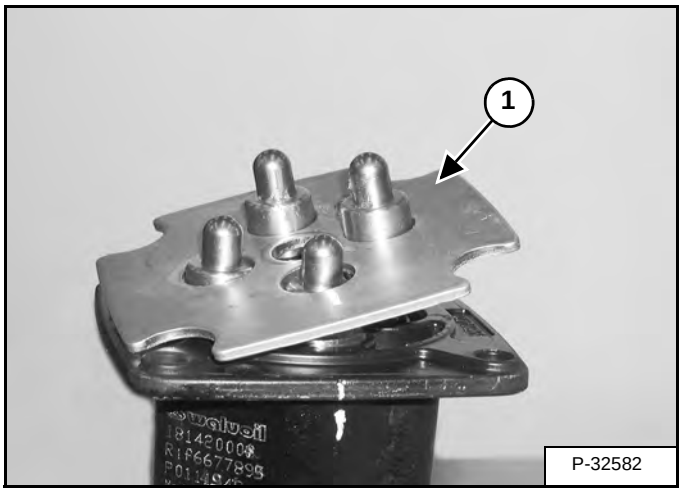
Install the O-ring (Item 1) **[Figure 20-121-40]** on the bushing.

Figure 20-121-41



Install the plunger assemblies (Item 1) **[Figure 20-121-41]** into the housing.

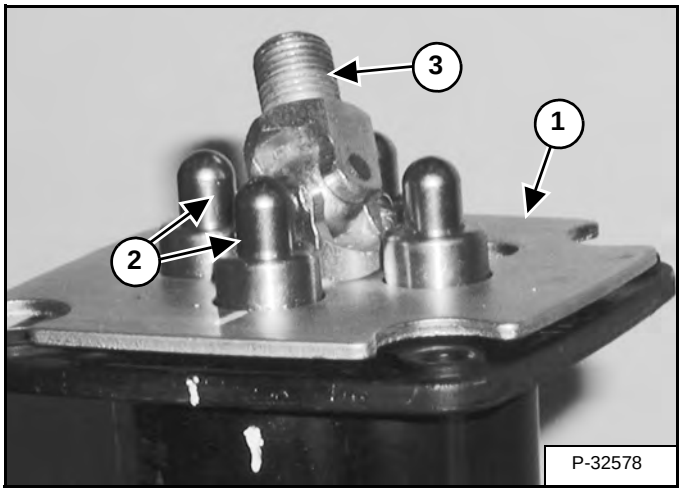
Figure 20-121-42



Install the plate (Item 1) **[Figure 20-121-42]**.

NOTE: Spring pressure can dislodge the plunger assemblies until the plate (Item 1) [Figure 20-121-42] is secured in place.

Figure 20-121-43

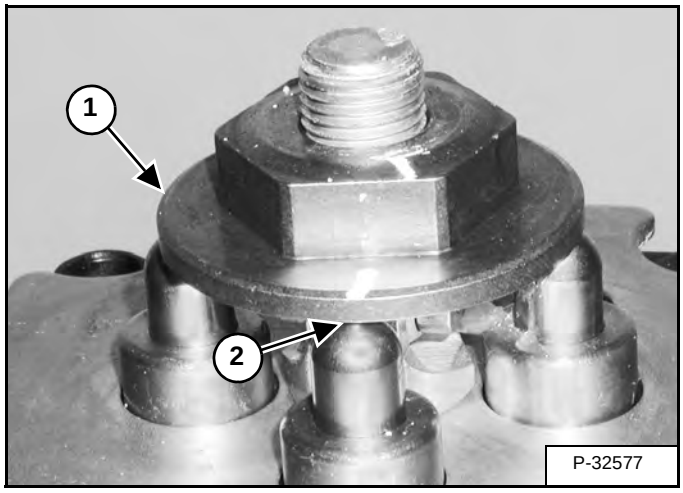


Press down on the plate (Item 1) to seat the plunger assemblies (Item 2). Install the U-joint (Item 3) **[Figure 20-121-43]**.

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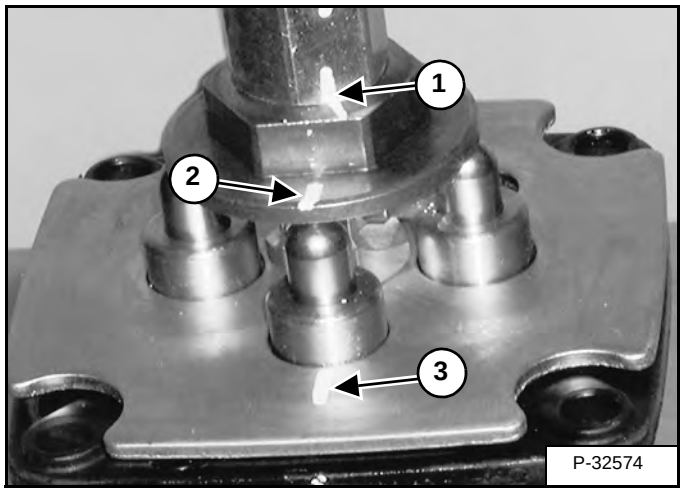
Assembly (Cont'd)

Figure 20-121-44



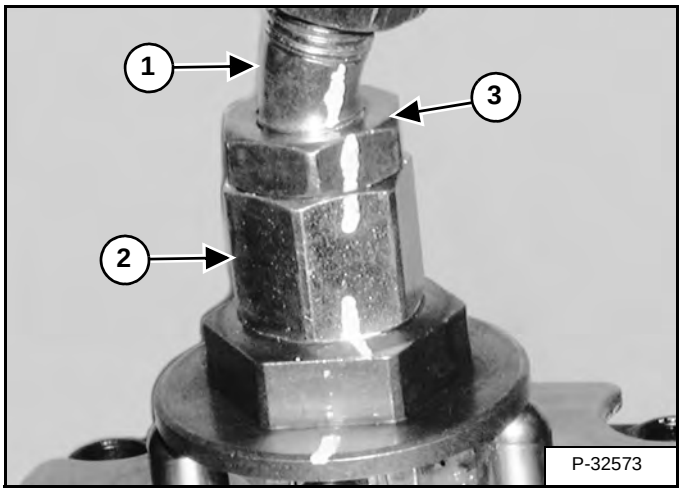
Install the control plate (Item 1) until the plate makes light contact with all four plungers (Item 2) **[Figure 20-121-44]**.

Figure 20-121-45



Align the coupler (Item 1) with the control plate (Item 2) and plate (Item 3) **[Figure 20-121-45]**. Tighten the coupler.

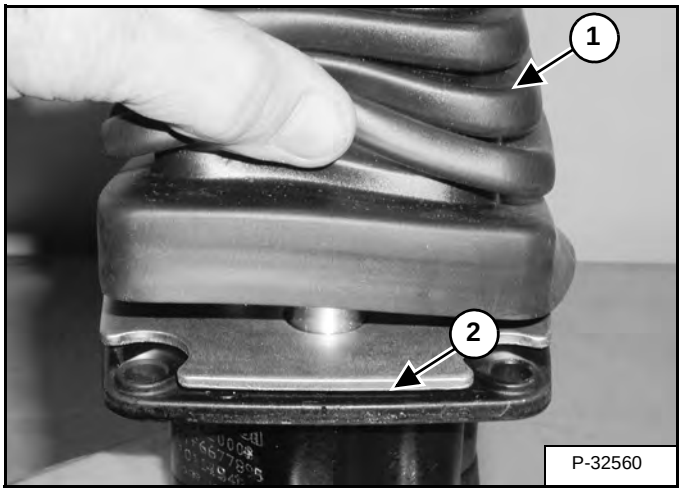
Figure 20-121-46



Install the connector (Item 1) **[Figure 20-121-46]**.

Align the connector with the coupler (Item 2) and tighten the nut (Item 3) **[Figure 20-121-46]**.

Figure 20-121-47



Install the tabs of the boot (Item 1) in between the joystick flange and mounting plate (Item 2) **[Figure 20-121-47]**.

Install the handle. (See Handle Removal And Installation Page 20-101-3.)

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HYDRAULIC RESERVOIR

Description

The hydraulic reservoir is a storage container for the excavators hydraulic fluid. The reservoir contains a vented fill cap.

The hydraulic reservoir is located behind the radiator on the right side of the excavator.

Removal And Installation

With Oil Cooler

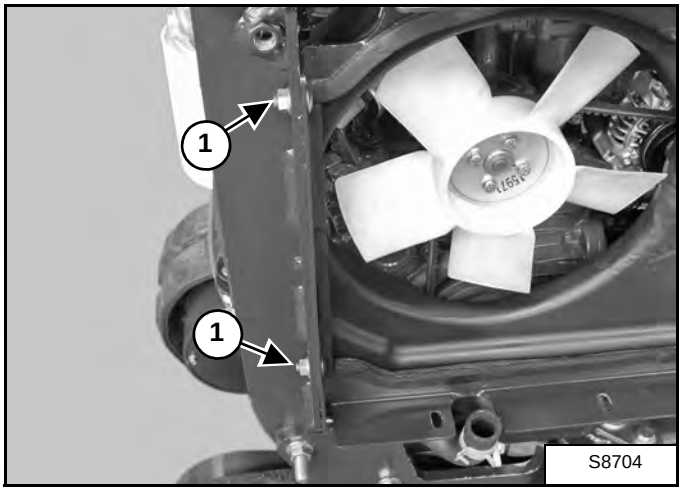
Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-3.)

Remove the radiator. (See Radiator Removal And Installation on Page 60-40-1.)

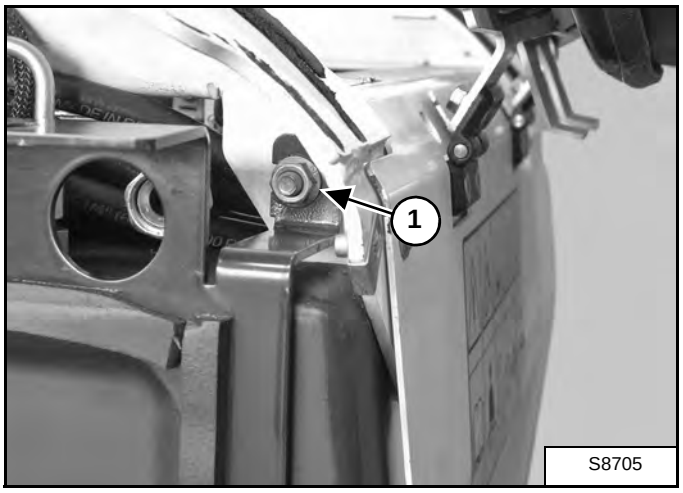
Drain the oil cooler. (See Removal And Installation on Page 20-140-1.)

Figure 20-130-1



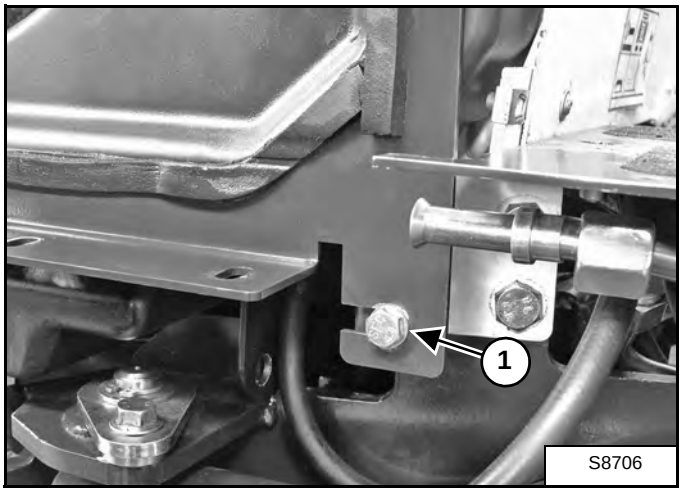
Remove the nuts and bolts (Item 1) **[Figure 20-130-1]**.

Figure 20-130-2



Remove the nut and bolt (Item 1) **[Figure 20-130-2]**.

Figure 20-130-3



Remove the nut and bolt (Item 1) **[Figure 20-130-3]**.

Remove the bracket.

Proceed with **[Figure 20-130-4]**.

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HYDRAULIC RESERVOIR (CONT'D)

Removal And Installation (Cont'd)

Without Oil Cooler

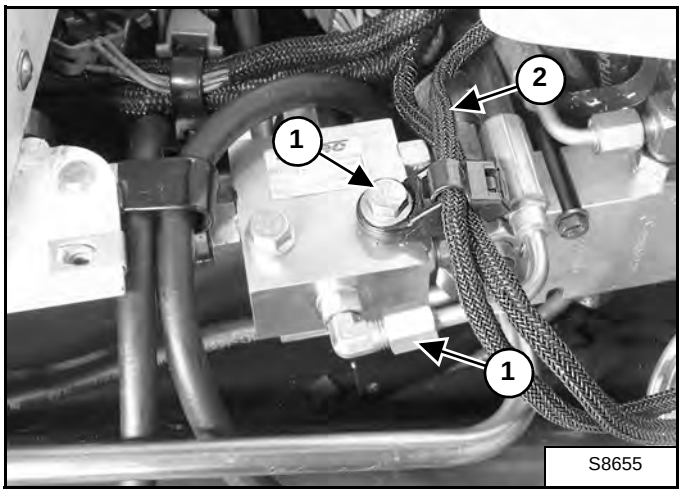
Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

Drain the hydraulic reservoir. (See Removing And Replacing The Hydraulic Filter on Page 10-120-2.)

Remove the radiator. (See Radiator Removal And Installation on Page 60-40-1.)

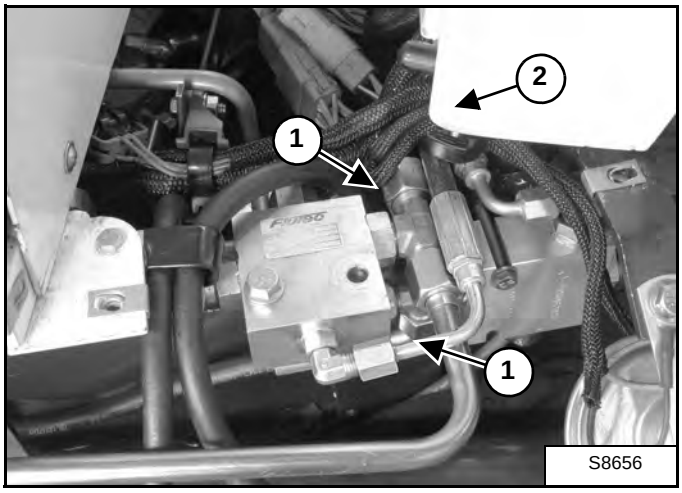
Remove the right side floor panel. (See Right Floor Panel Removal And Installation on Page 40-120-1.)

Figure 20-130-4



Remove the bolt and nut (Item 1) to remove the harness (Item 2) **[Figure 20-130-4]** from the two-speed control valve.

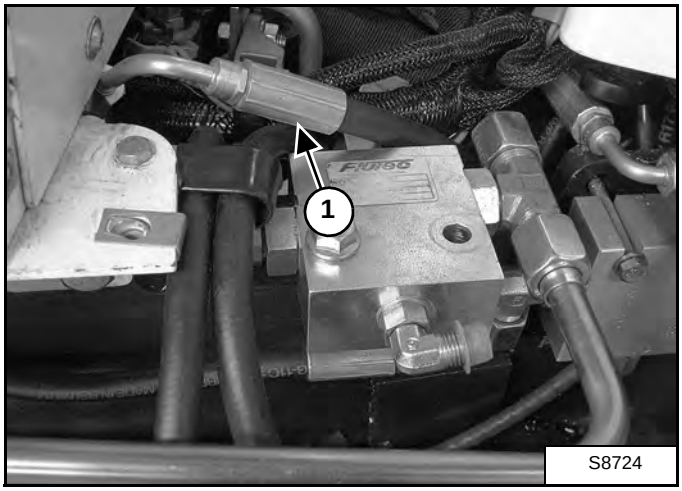
Figure 20-130-5



Reposition the harness (Item 1) **[Figure 20-130-5]** as shown for easier access.

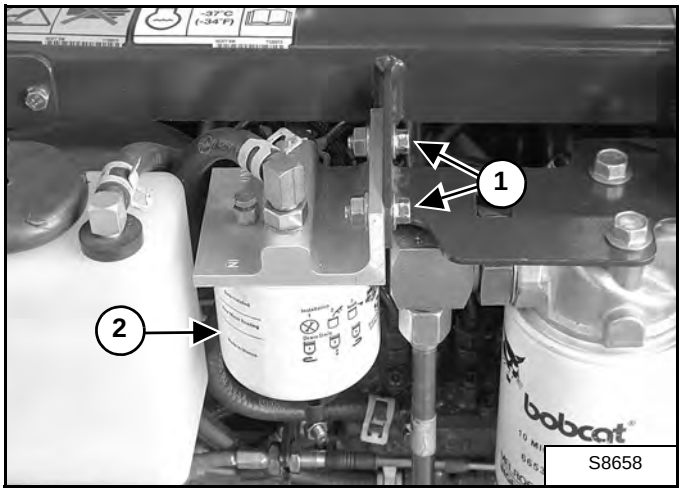
Disconnect the hose (Item 2) **[Figure 20-130-5]** from the two-speed control valve.

Figure 20-130-6



Reposition the hose (Item 1) **[Figure 20-130-6]** as shown for easier access.

Figure 20-130-7



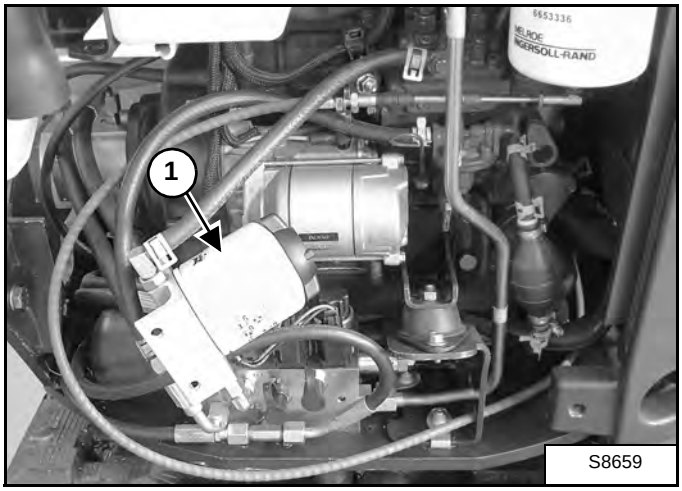
Remove the two bolts and nuts (Item 1) to remove the fuel filter (Item 2) **[Figure 20-130-7]** from the frame.

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Removal And Installation (Cont'd)

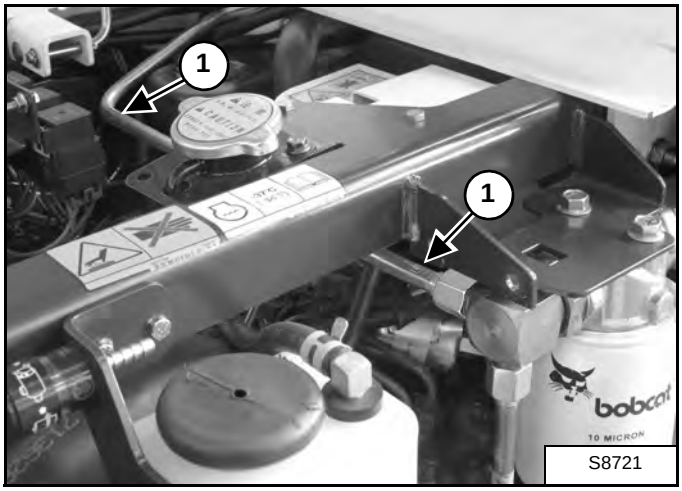
Without Oil Cooler (Cont'd)

Figure 20-130-8



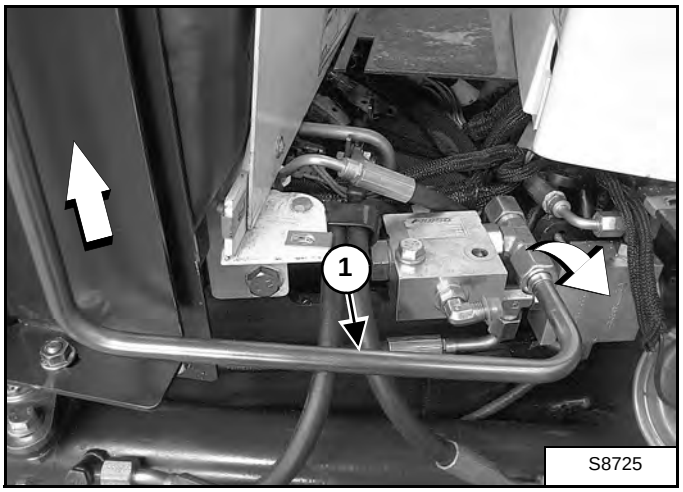
Reposition the fuel filter (Item 1) **[Figure 20-130-8]** as shown for easier access.

Figure 20-130-9



Disconnect the tubeline (Item 1) **[Figure 20-130-9]** from the hydraulic filter.

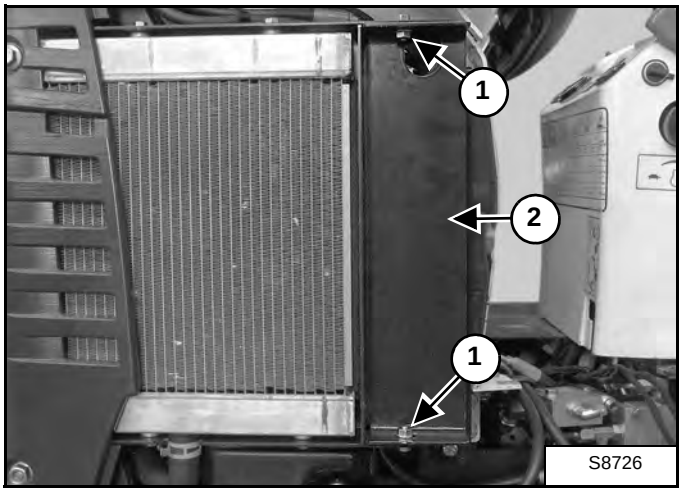
Figure 20-130-10



Disconnect the tubeline (Item 1) **[Figure 20-130-10]** from the two-speed control valve.

Rotate the tubeline clockwise while lifting it to easily remove the tubeline from the excavator.

Figure 20-130-11



Remove the nuts and bolts (Item 1) **[Figure 20-130-11]**.

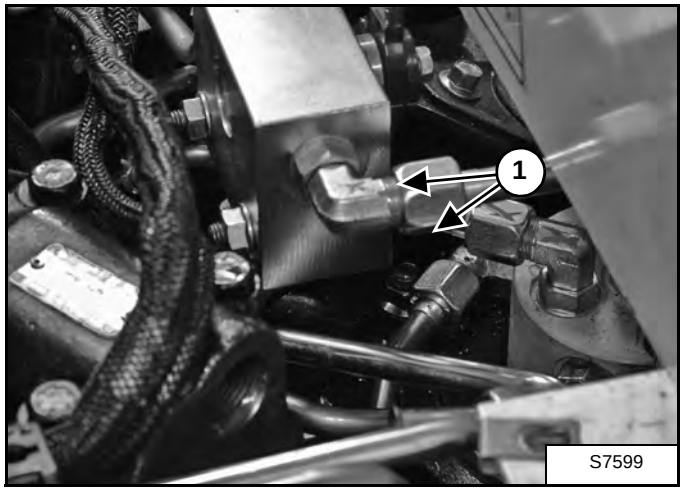
Remove the cover plate (Item 2) **[Figure 20-130-11]** from the bracket.

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Removal And Installation (Cont'd)

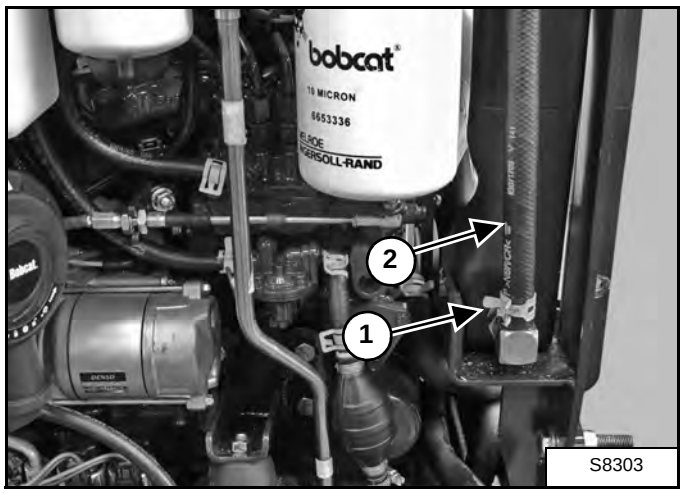
Without Oil Cooler (Cont'd)

Figure 20-130-12



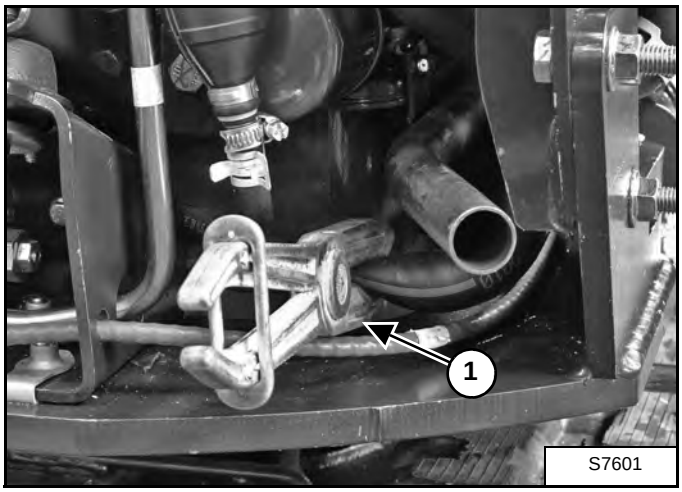
Mark and remove the hoses (Item 1) **[Figure 20-130-12]** from the back side of the hydraulic reservoir.

Figure 20-130-13



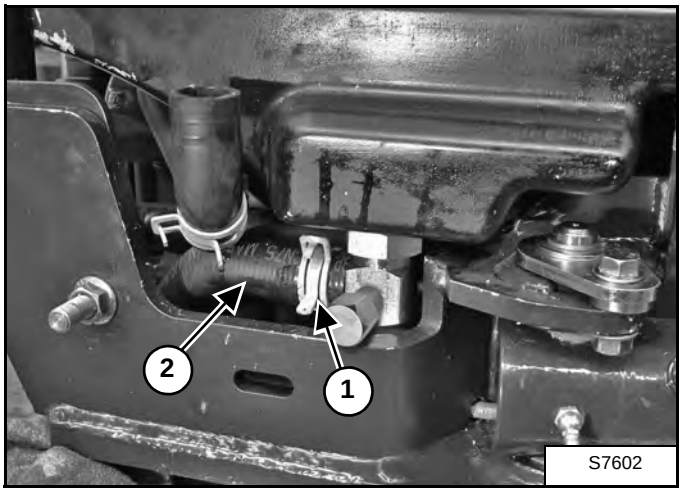
Remove the hose clamp (Item 1) and hose (Item 2) **[Figure 20-130-13]**.

Figure 20-130-14



Put a hose clamp (Item 1) **[Figure 20-130-14]** on the lower reservoir hose.

Figure 20-130-15



Remove the hose clamp (Item 1) and hose (Item 2) **[Figure 20-130-15]**.

NOTE: There still can be a small amount of hydraulic fluid in the hose. Use a container when removing lower reservoir hose.

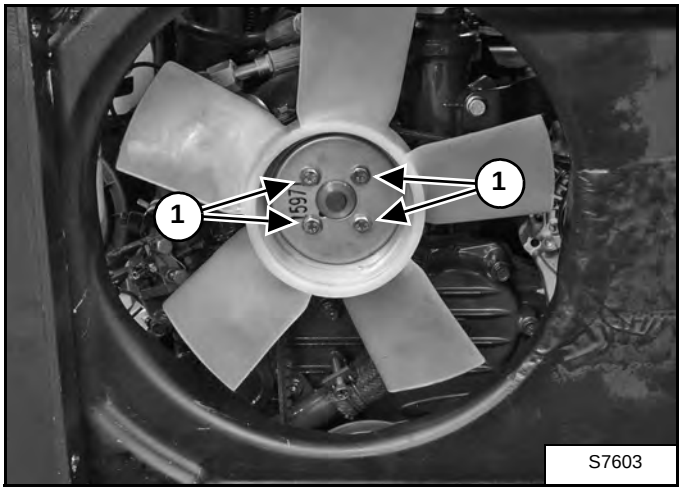
Recycle or dispose of the used hydraulic fluid in an environmentally safe manner.

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Removal And Installation (Cont'd)

Without Oil Cooler (Cont'd)

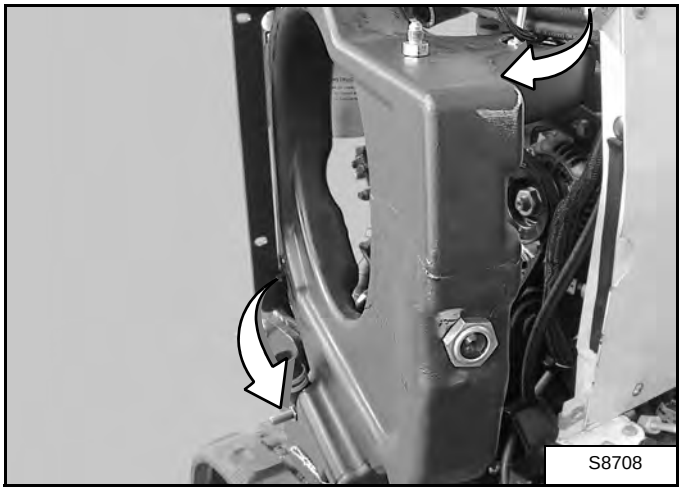
Figure 20-130-16



Remove the four bolts (Item 1) **[Figure 20-130-16]** and remove the fan.

NOTE: Fan belt will become loose when removing bolts.

Figure 20-130-17



Gently pull hydraulic reservoir towards you and slide it out of its positioning bracket **[Figure 20-130-17]**.

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OIL COOLER

Description

The oil cooler is needed for breaker applications and is not included with the excavator. If using the excavator for breaker applications, the oil cooler kit needs to be installed. See your dealer for kit.

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.

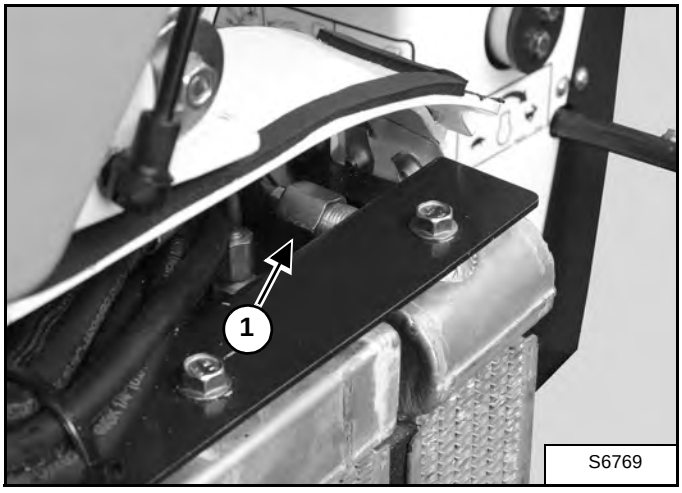
Removal And Installation

Drain hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-3.)

Remove the upper right hand side cover. (See Upper Right Side Cover Removal And Installation on Page 40-210-1.)

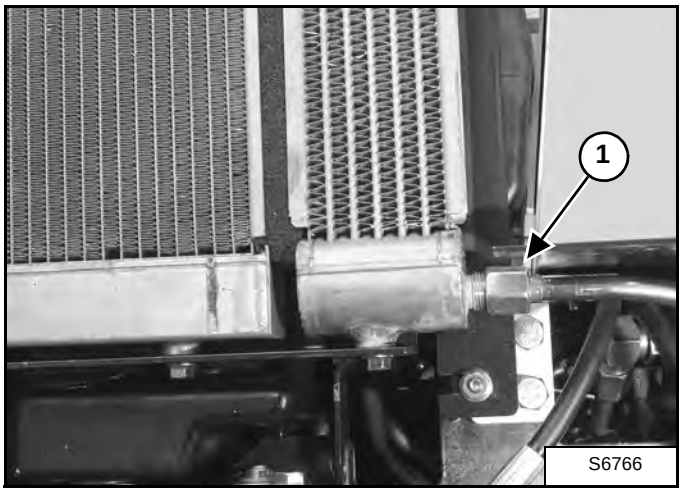
Remove the lower right hand side cover. (See Lower Left Side Cover Removal And Installation on Page 40-210-2.)

Figure 20-140-1



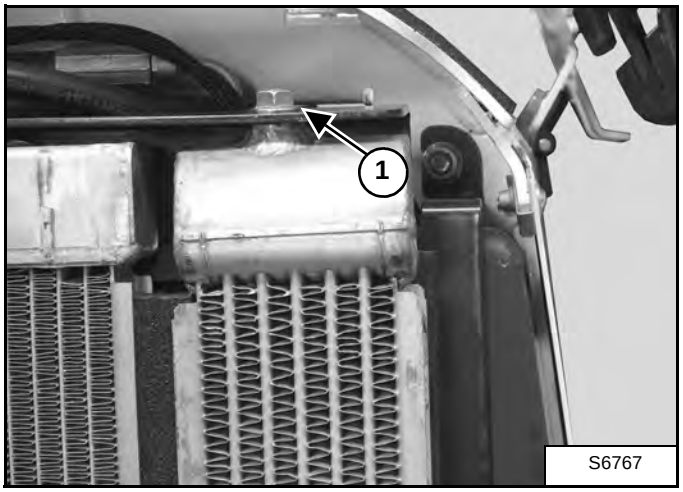
Remove the tubeline (Item 1) **[Figure 20-140-1]** from the top of the oil cooler.

Figure 20-140-2



Remove the tubeline (Item 1) **[Figure 20-140-2]** from the bottom of the oil cooler.

Figure 20-140-3

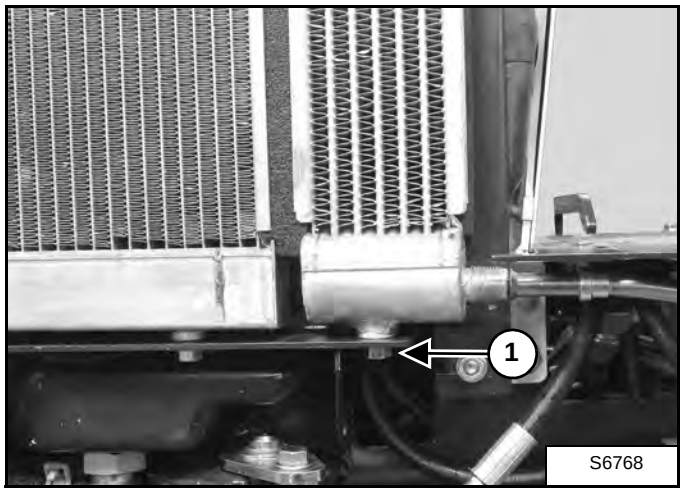


Remove the bolt (Item 1) **[Figure 20-140-3]** from the oil cooler frame.

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Removal And Installation (Cont'd)

Figure 20-140-4



Remove the bolt (Item 1) **[Figure 20-140-4]** from the oil cooler frame.

Remove the oil cooler from the frame.

Dealer Copy -- Not for Resale

ELECTRIC BLADE / TRACK EXPAND VALVE

Description

The blade / track expand valve diverts hydraulic fluid to either the blade or track expansion function with the control handle situated in the middle of the floor panels.

The blade / track expand valve is located directly underneath the floor panels in the middle of the excavator.

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 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

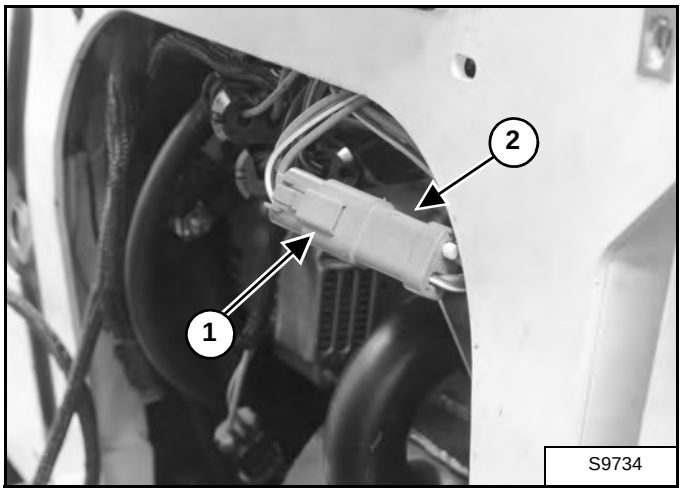
Remove the floor panels. (See FLOOR PANELS on Page 40-120-1.)

⚠ 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 physician familiar with this injury is not received immediately.

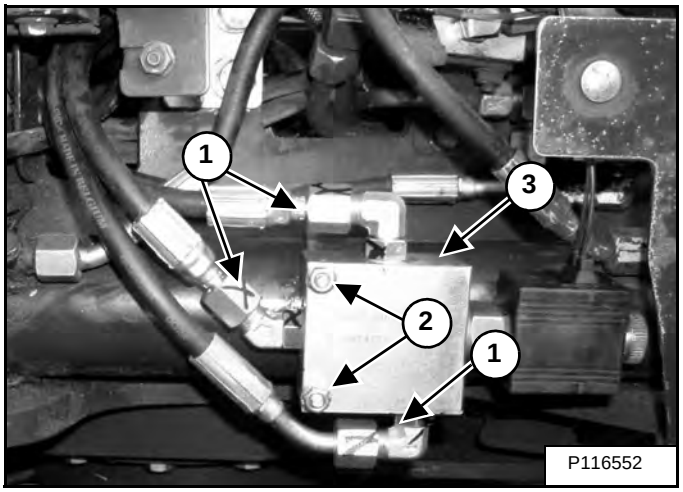
W-2145-0290

Figure 20-150-1



Disconnect the track expansion valve harness (Item 1) from the mainframe harness (Item 2) **[Figure 20-150-1]**.

Figure 20-150-2



Mark all tubelines and hoses for ease of assembly.

Disconnect the tubelines (Item 1) **[Figure 20-150-2]**.

Remove the two bolts (Item 2) and the blade / track expansion valve (Item 3) **[Figure 20-150-2]** from the excavator

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ELECTRIC BLADE / TRACK EXPAND VALVE (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 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.

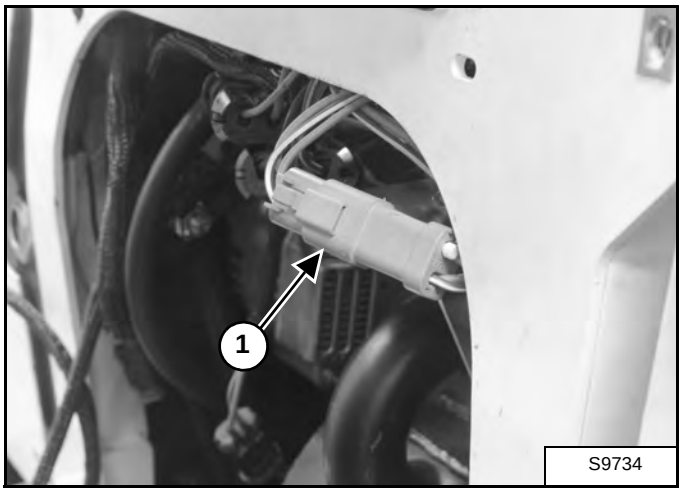
I-2003-0888

⚠ WARNING

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

W-2145-0290

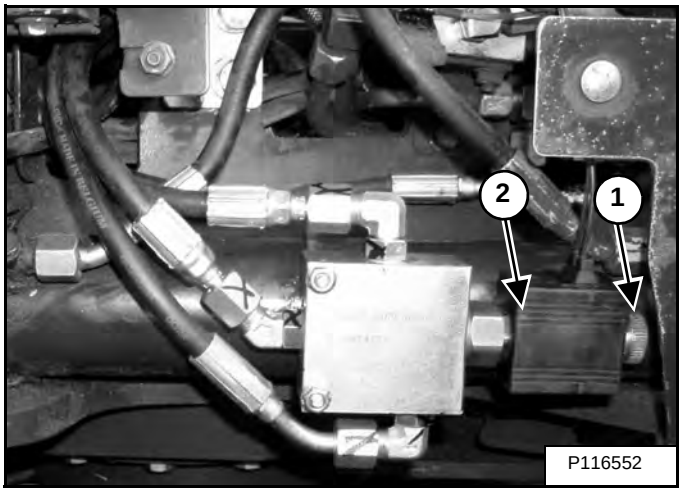
Figure 20-150-3



Disconnect the wire harness (Item 1) **[Figure 20-150-3]** from the excavator harness.

Remove the blade / track expand valve.

Figure 20-150-4

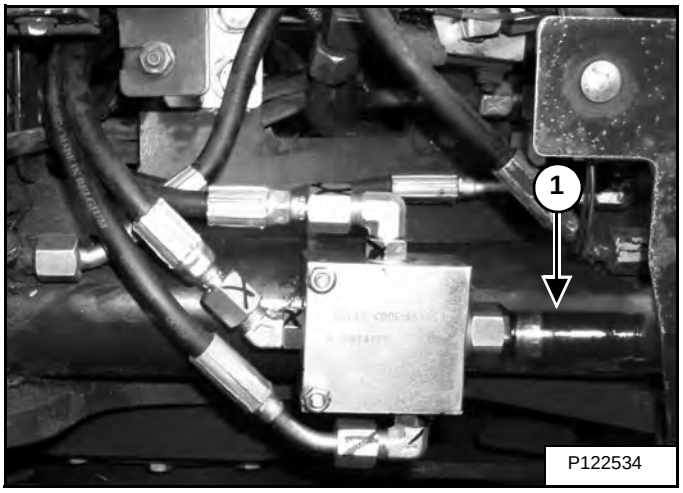


Remove the solenoid nut (Item 1), O-ring and coil (Item 2) **[Figure 20-150-4]** from the expansion block.

Dealer Copy -- Not for Resale

Solenoid Removal And Installation (Cont'd)

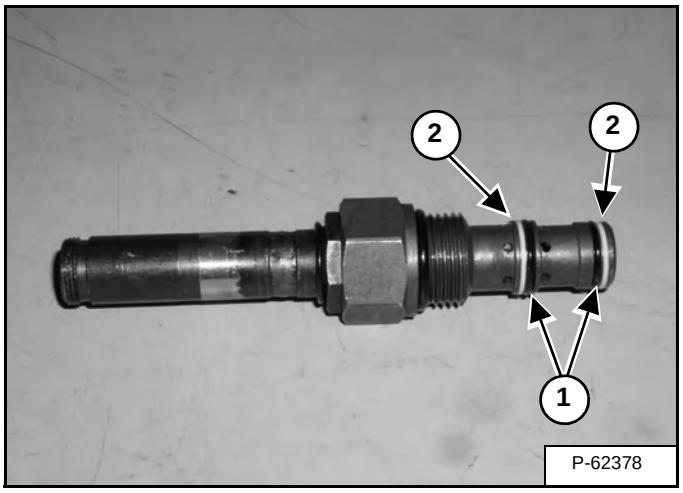
Figure 20-150-5



Remove the solenoid stem (Item 1) **[Figure 20-150-5]**.

Installation: Tighten the solenoid stem to 50 N•m (37 ft-lb) torque.

Figure 20-150-6



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-150-6]**.

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

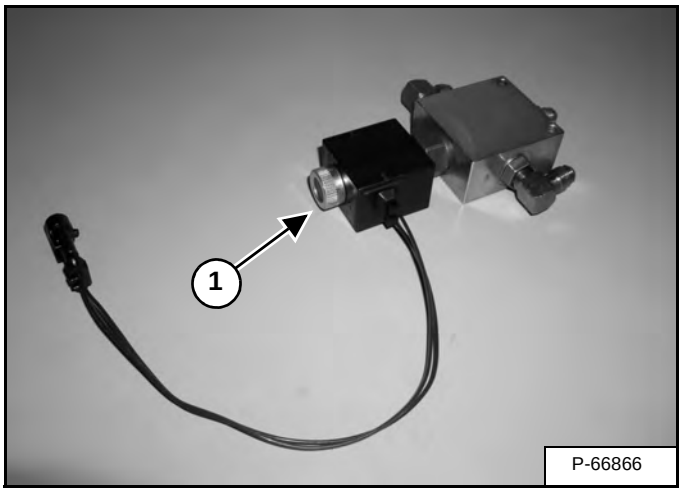
Clean all parts in solvent and dry with compressed air.

Inspectallpartsforwearordamage.

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 20-150-7



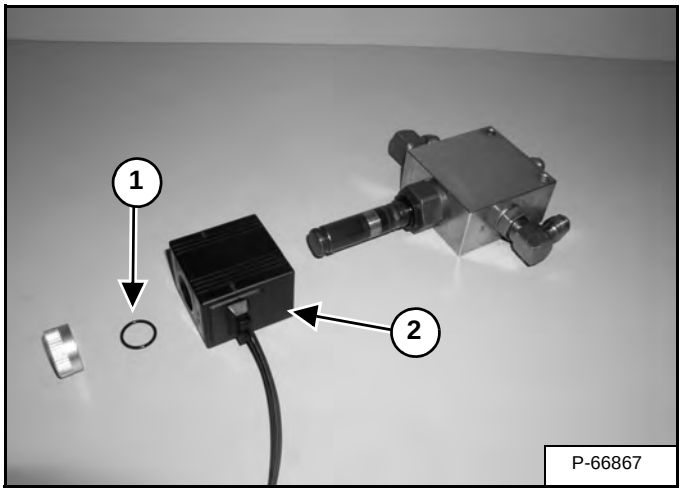
Remove the nut (Item 1)**[Figure 20-150-7]** from the solenoid.

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ELECTRIC BLADE / TRACK EXPAND VALVE (CONT'D)

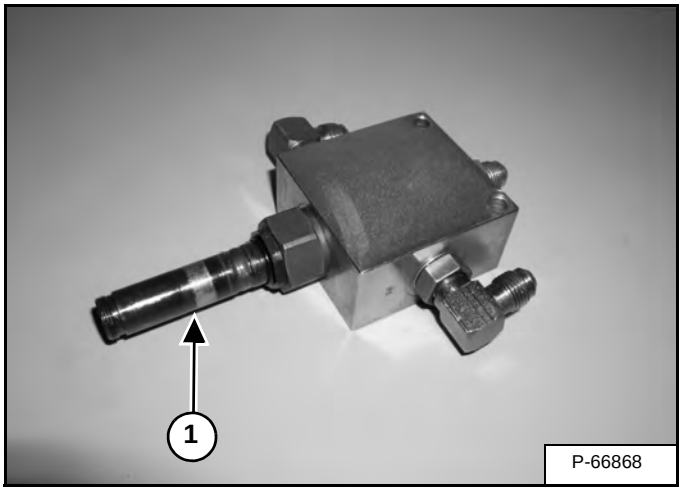
Block Disassembly And Assembly (Cont'd)

Figure 20-150-8



Remove the O-ring (Item 1) and solenoid (Item 2) **[Figure 20-150-8]**.

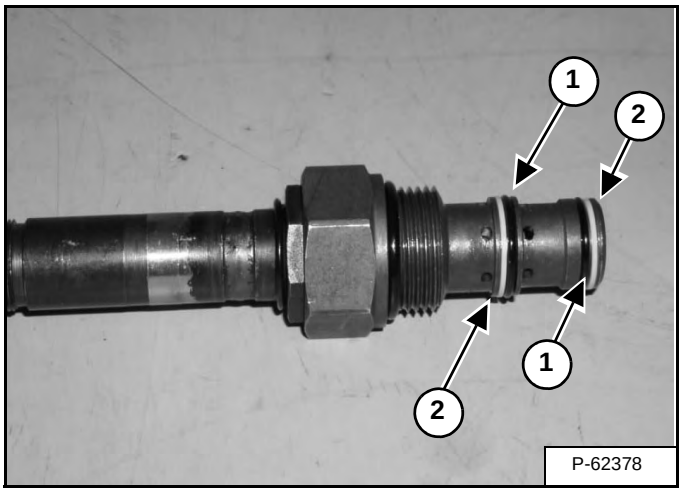
Figure 20-150-9



Remove the solenoid stem (Item 1) **[Figure 20-150-9]** from the block.

Installation: Tighten the solenoid stem to 50 N•m (37 ft-lb) torque.

Figure 20-150-10



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-150-10]** from the solenoid stem.

Dealer Copy -- Not for Resale

TRACK EXPAND VALVE

Description

The blade / track expand valve diverts hydraulic fluid to either the blade or track expansion function with the control handle situated in the middle of the floor panels.

The blade / track expand valve is located directly underneath the floor panels in the middle of the excavator.

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 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

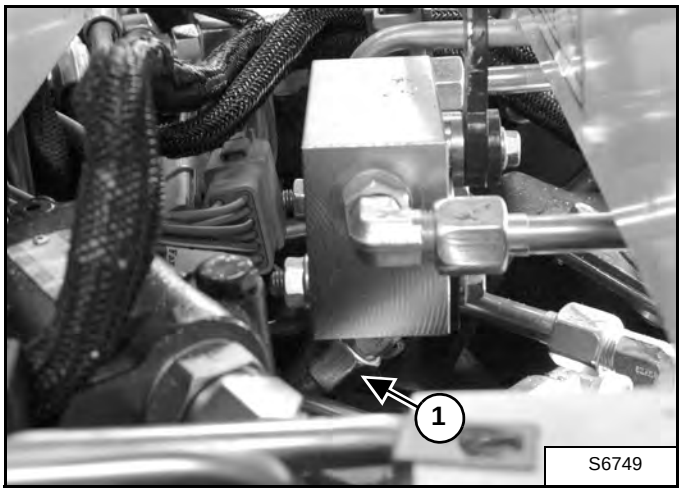
Remove the floor panels. (See FLOOR PANELS on Page 40-120-1.)

⚠ 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 physician familiar with this injury is not received immediately.

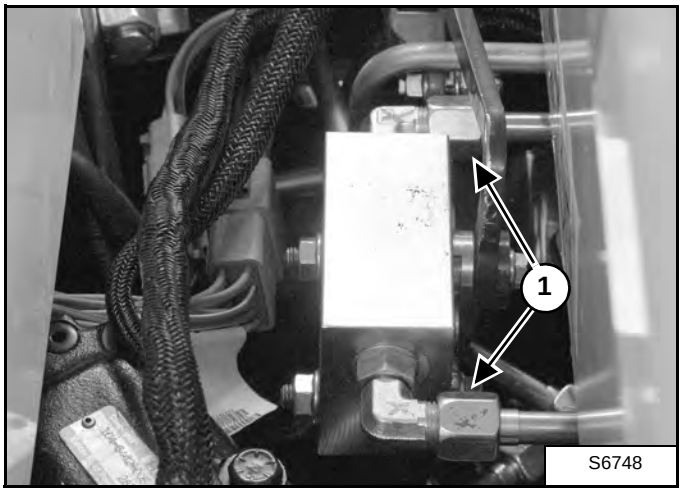
W-2145-0290

Figure 20-151-1



Disconnect the tubeline (Item 1) **[Figure 20-151-1]** from the underside of the valve.

Figure 20-151-2

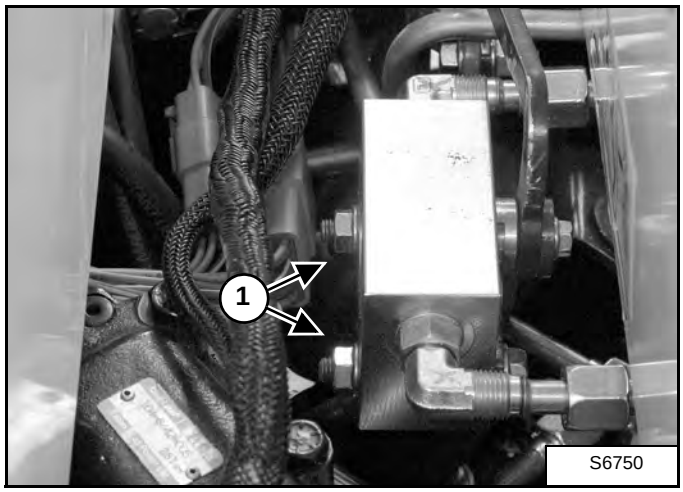


Disconnect the tubelines (Item 1) **[Figure 20-151-2]**.

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Block Removal And Installation (Cont'd)

Figure 20-151-3



Remove the nuts and bolts (Item 1) **[Figure 20-151-3]**.

Remove the blade / track expand valve.

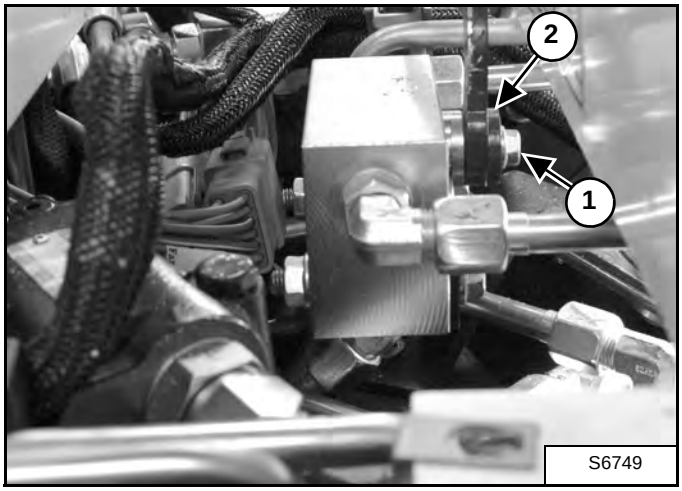
Control Handle Removal And Installation

Lower the boom / bucket and blade to the ground.

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

Remove the floor panels. (See FLOOR PANELS on Page 40-120-1.)

Figure 20-151-4



Remove the bolt (Item 1) and washer (Item2) **[Figure 20-151-4]** from the control handle.

Remove the control handle.

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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.

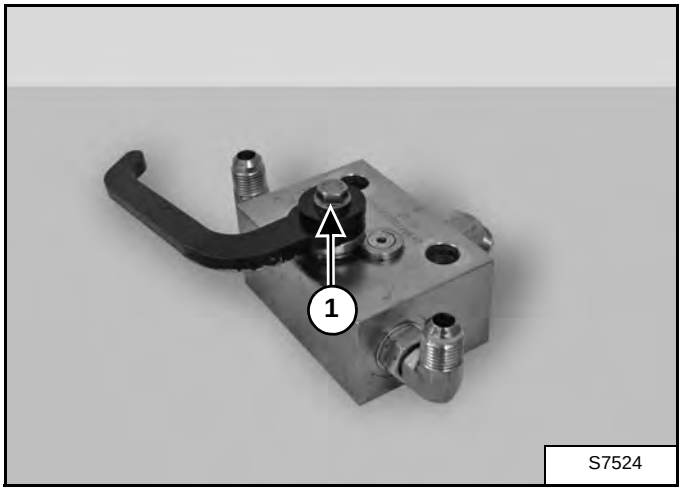
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

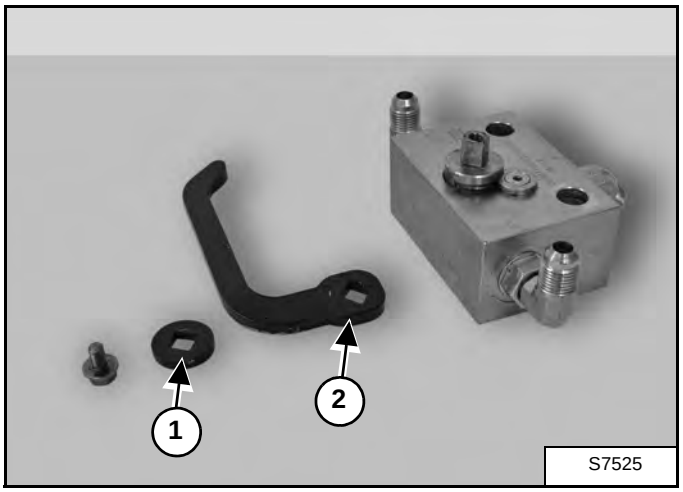
Always install new O-rings and back-up rings. Lubricate all O-rings and back-up rings with clean hydraulic fluid before installation.

Figure 20-151-5



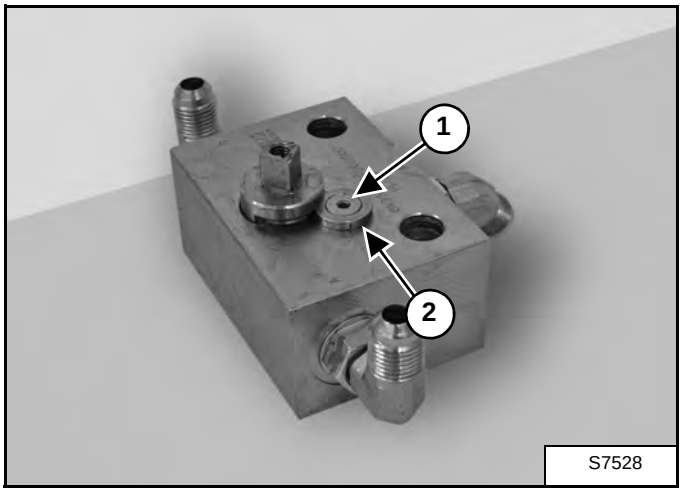
Remove the bolt (Item 1) **[Figure 20-151-5]**.

Figure 20-151-6



Remove the washer (Item 1) and control handle (Item 2) **[Figure 20-151-6]**.

Figure 20-151-7

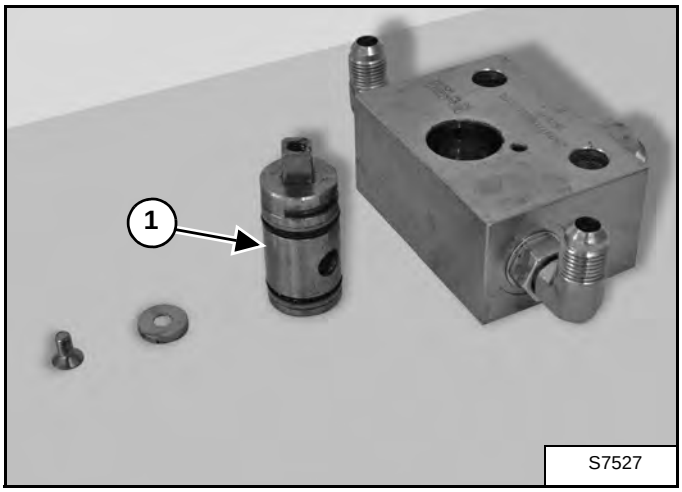


Remove the bolt (Item 1) and washer (Item 2) **[Figure 20-151-7]** from the valve.

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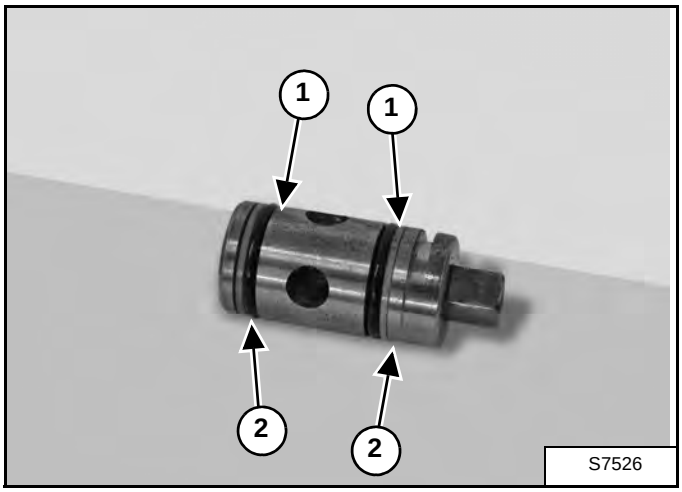
Block Disassembly And Assembly (Cont'd)

Figure 20-151-8



Remove the spool (Item 1) **[Figure 20-151-8]** from the valve.

Figure 20-151-9



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-151-9]** from the spool.

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BUILD-UP VALVE

Description

The build-up valve is used to generate back pressure in the hydraulic system. If the pressure in the control system (accumulator) decreases under 2,7 MPa (27 bar) (391 psi), the build-up valve will generate back pressure of 1,2 MPa (12 bar) (174 psi) to provide pressurized oil for pilot control system.

The build-up valve is located under the floor panels on the right side of the excavator.

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 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

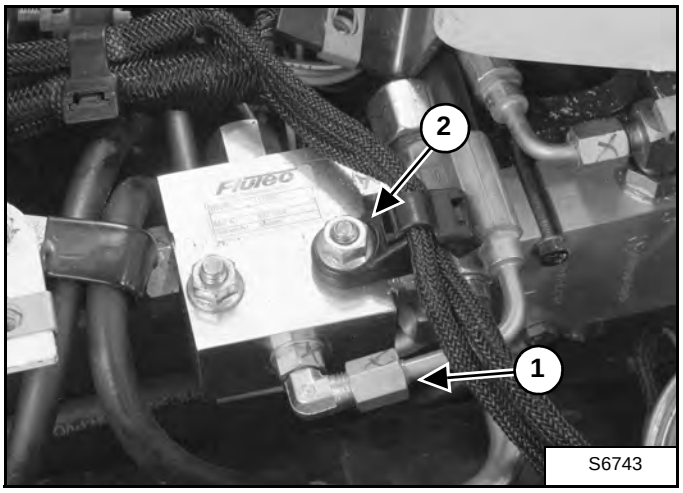
Remove the right side floor panel. (See Right Floor Panel Removal And Installation on Page 40-120-1.)

⚠ 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 physician familiar with this injury is not received immediately.

W-2145-0290

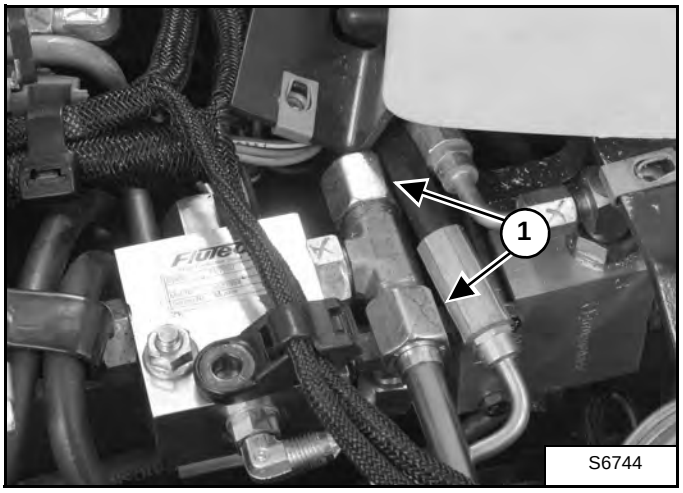
Figure 20-160-1



Mark and disconnect the hose (Item 1) **[Figure 20-160-1]**.

Remove the nut and bolt (Item 2) **[Figure 20-160-1]** and push the harness bracket aside.

Figure 20-160-2



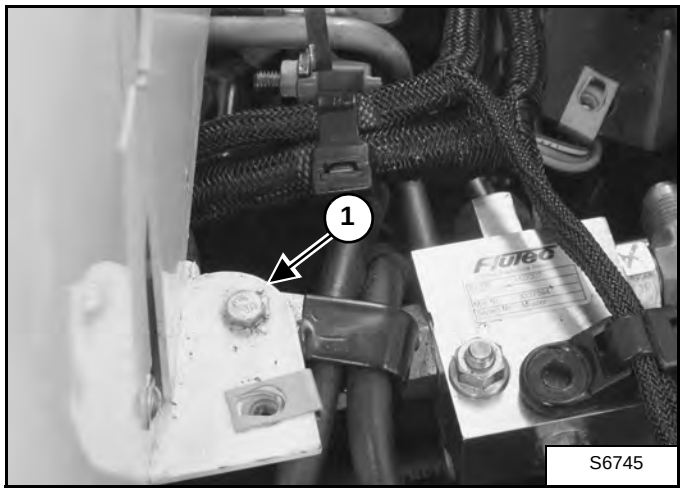
Mark and disconnect the tubelines (Item 1) **[Figure 20-160-2]** from the valve.

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BUILD-UP VALVE (CONT'D)

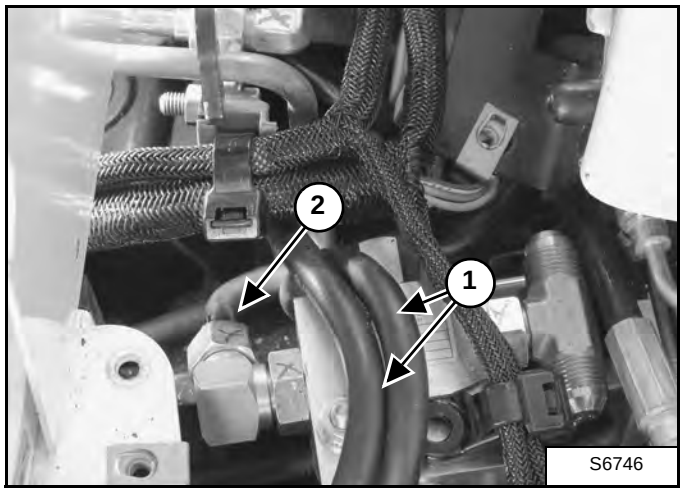
Removal And Installation (Cont'd)

Figure 20-160-3



Remove the nut and bolt (Item 1) **[Figure 20-160-3]** from the hose bracket.

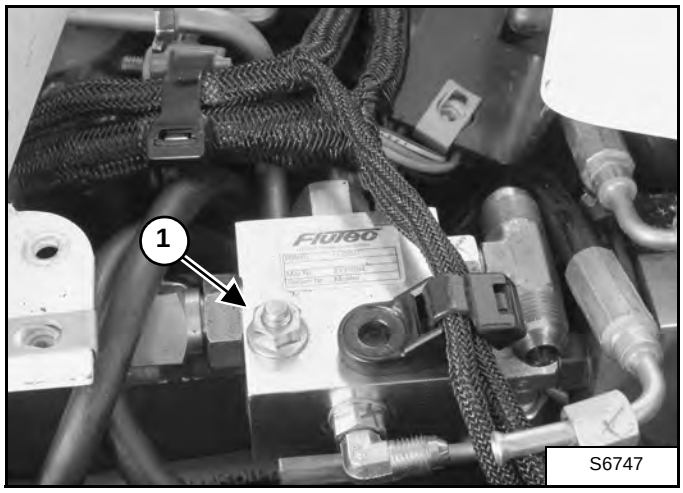
Figure 20-160-4



Push the boom swing hoses aside (Item 1) **[Figure 20-160-4]**.

Mark and disconnect the tubeline (Item 2) **[Figure 20-160-4]**.

Figure 20-160-5



Remove the nut and bolt (Item 1) **[Figure 20-160-5]** from the valve.

Remove the build-up valve.

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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.

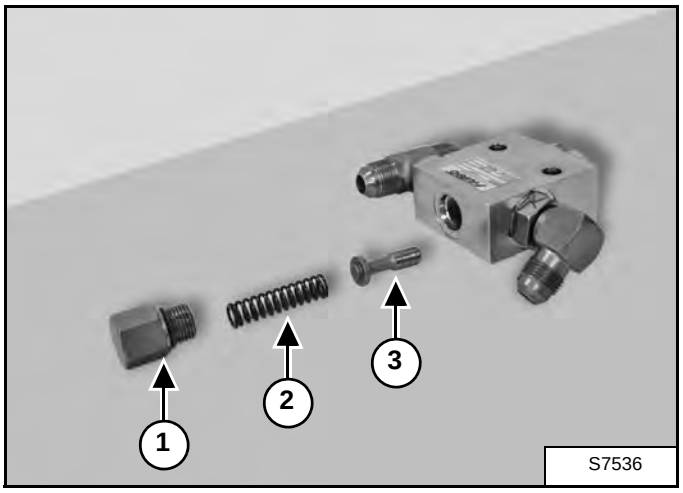
I-2003-0888

⚠ WARNING

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W-2145-0290

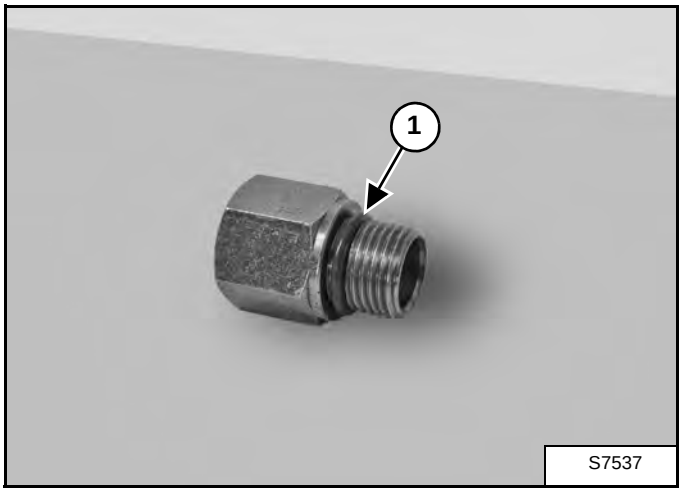
Figure 20-160-6



Remove the plug (Item 1), spring (Item 2) and spring seat (Item 3) **[Figure 20-160-6]**.

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

Figure 20-160-7



Remove the O-ring (Item 1) **[Figure 20-160-7]** from the plug.

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TWO SPEED CONTROL VALVE

Description

The two speed control valve operates at pilot pressure and uses a solenoid to direct flow to the travel motor for shifting between single and two speed. (The pressure is directed to the swash plate to change its angle, which causes a change of flow and displacement).

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 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 right side floor panel. (See Right Floor Panel Removal And Installation on Page 40-120-1.)

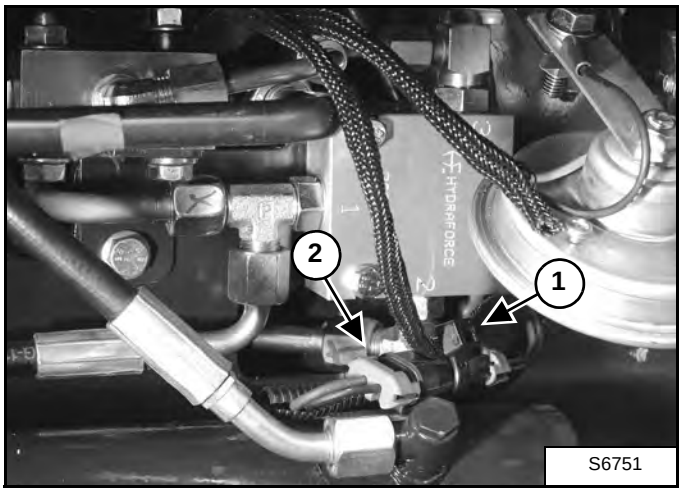
⚠ WARNING

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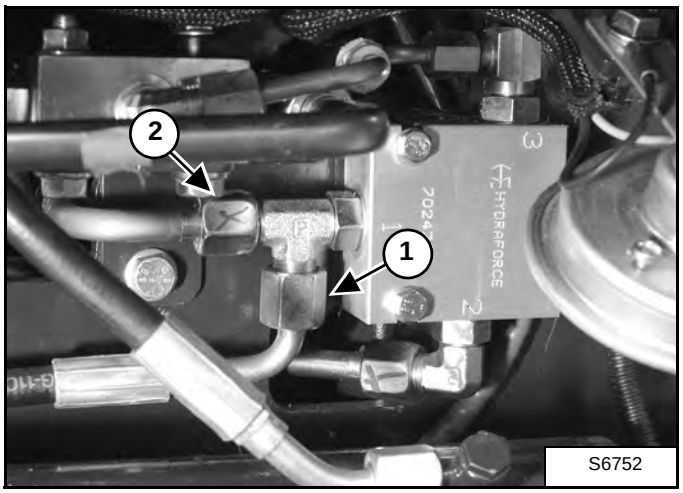
Remove the lower right hand side cover. (See Lower Right Side Cover Removal And Installation on Page 40-210-3.)

Figure 20-170-1



Cut the tie-strap (Item 1) and disconnect the wire harness (Item 2) **[Figure 20-170-1]** from the excavator harness.

Figure 20-170-2



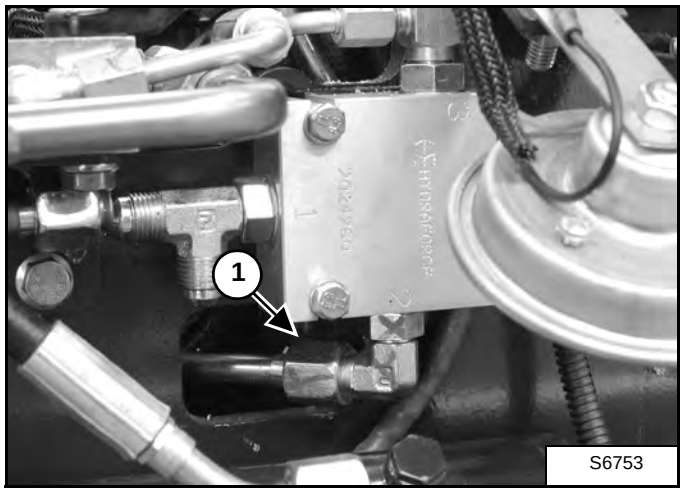
Remove the hose (Item 1) and tubeline (Item 2) **[Figure 20-170-2]** from the valve.

Dealer Copy -- Not for Resale

TWO SPEED CONTROL VALVE (CONT'D)

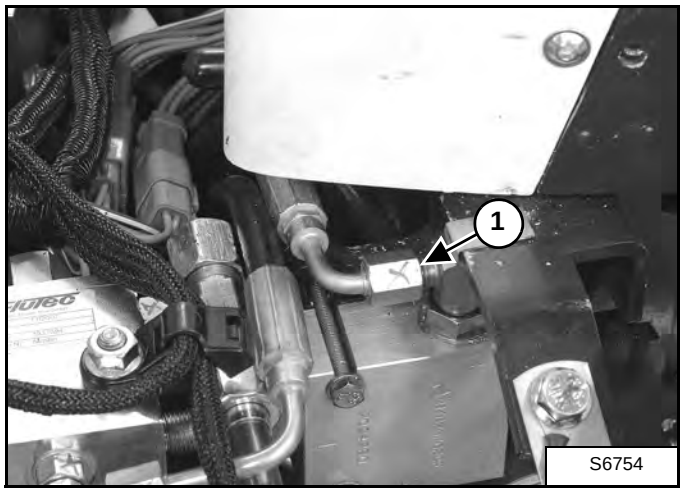
Block Removal And Installation (Cont'd)

Figure 20-170-3



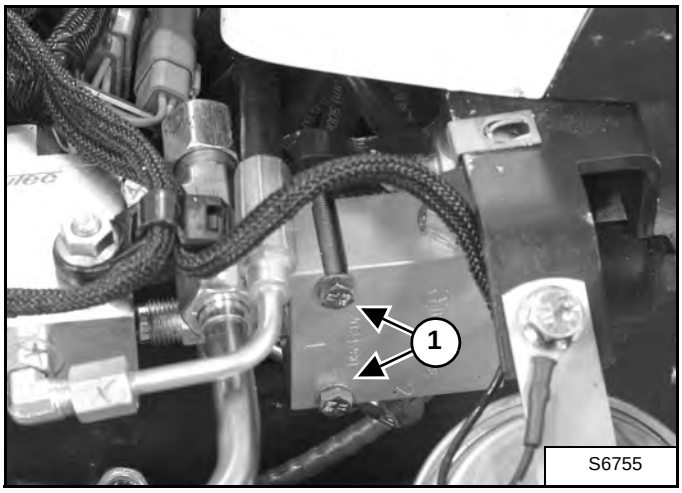
Remove the tubeline (Item 1) **[Figure 20-170-3]** from the valve.

Figure 20-170-4



Remove the hose (Item 1) **[Figure 20-170-4]** from the valve.

Figure 20-170-5



Remove the nuts and bolts (Item 1) **[Figure 20-170-5]** from the valve.

Remove the two speed control valve.

Dealer Copy -- Not for Resale

TWO SPEED CONTROL VALVE (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 travel controls 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

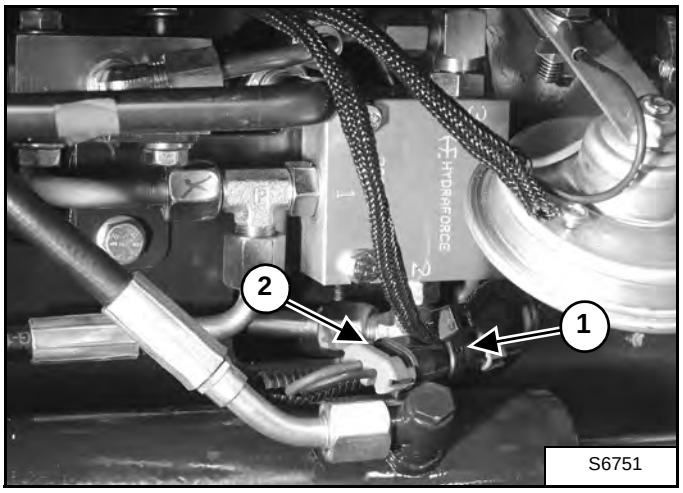
⚠ WARNING

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W-2145-0290

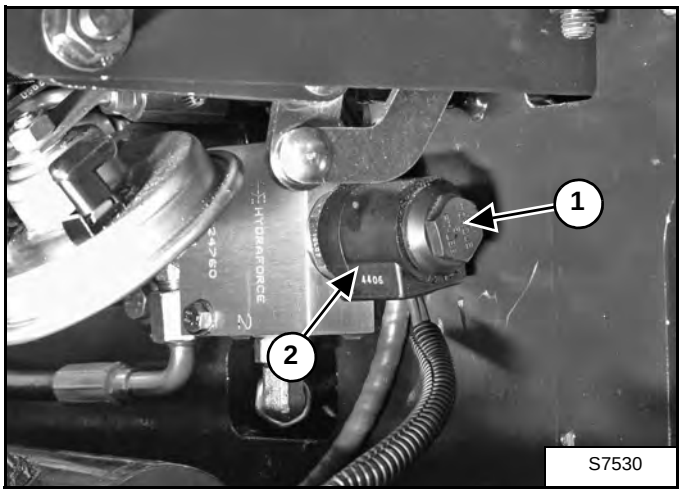
Remove the lower right hand side cover. (See Lower Right Side Cover Removal And Installation on Page 40-210-3.)

Figure 20-170-6



Cut the tie-strap (Item 1) and disconnect the wire harness (Item 2) **[Figure 20-170-6]** from the excavator harness.

Figure 20-170-7



Remove the solenoid nut (Item 1) **[Figure 20-170-7]**.

Remove the O-ring and coil (Item 2) **[Figure 20-170-7]** from the solenoid stem.

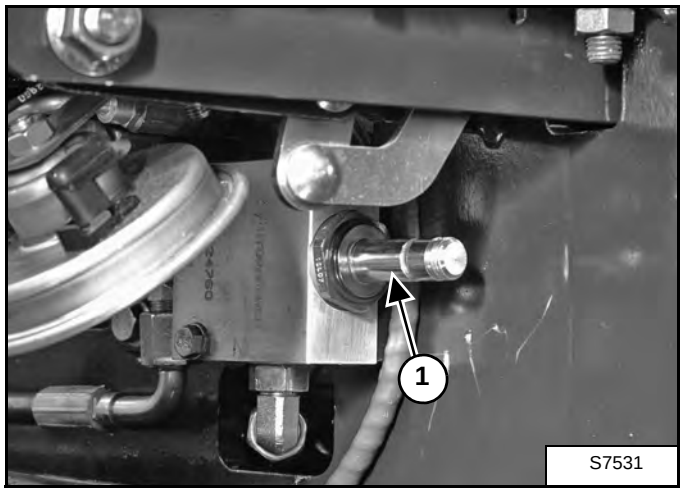
Installation: Tighten the nut to 5 N•m (4 ft-lb) torque.

NOTE: Overtightening the nut (Item 1) [Figure 20-170-7] may cause solenoid or coil failure.

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Solenoid Removal And Installation (Cont'd)

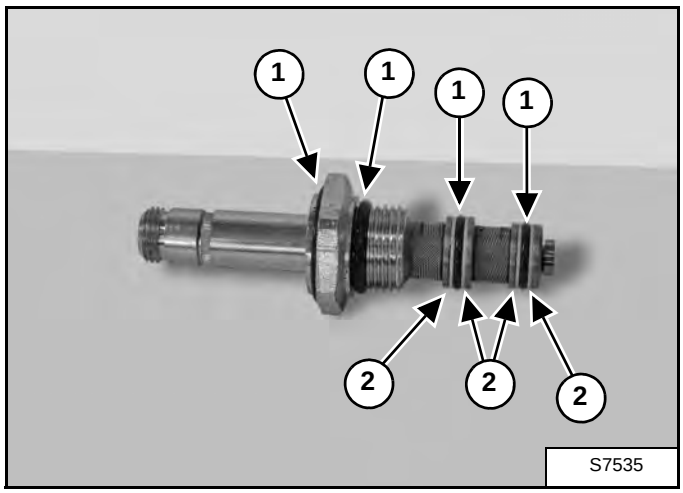
Figure 20-170-8



Remove the solenoid stem (Item 1) **[Figure 20-170-8]**.

Installation: Tighten the solenoid stem to 50 N•m (37 ft-lb) torque.

Figure 20-170-9



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-170-9]** 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.

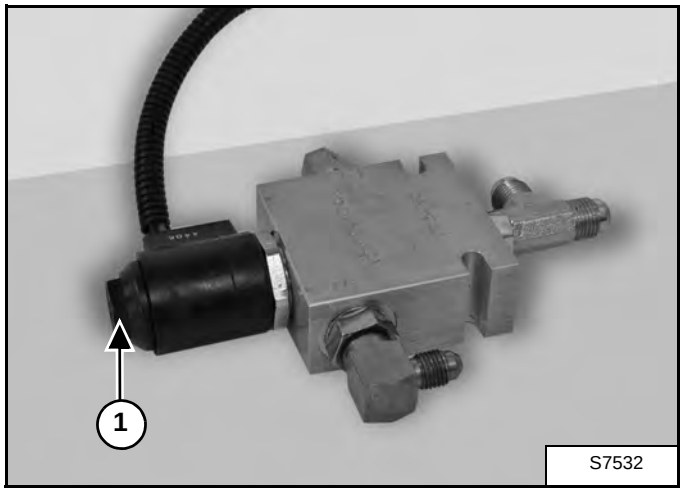
I-2003-0888

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 20-170-10



Remove the nut (Item 1) **[Figure 20-170-10]** from the solenoid.

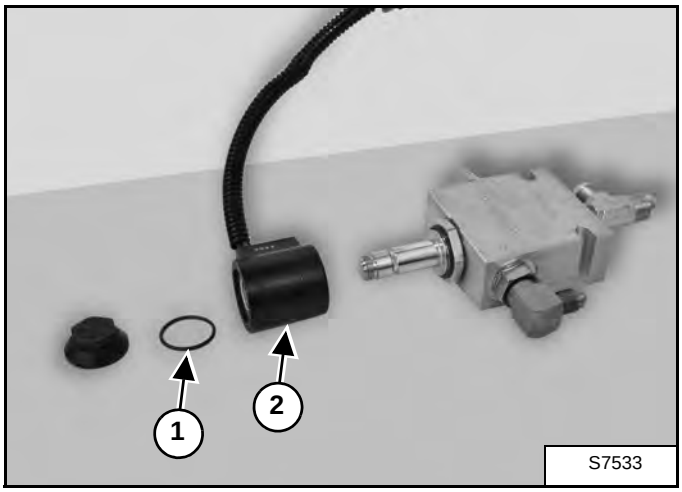
Installation: Tighten the nut to 5 N•m (44.25 in-lb) torque.

NOTE: Overtightening the nut (Item 1) [Figure 20-170-10] may cause solenoid or coil failure.

Dealer Copy -- Not for Resale

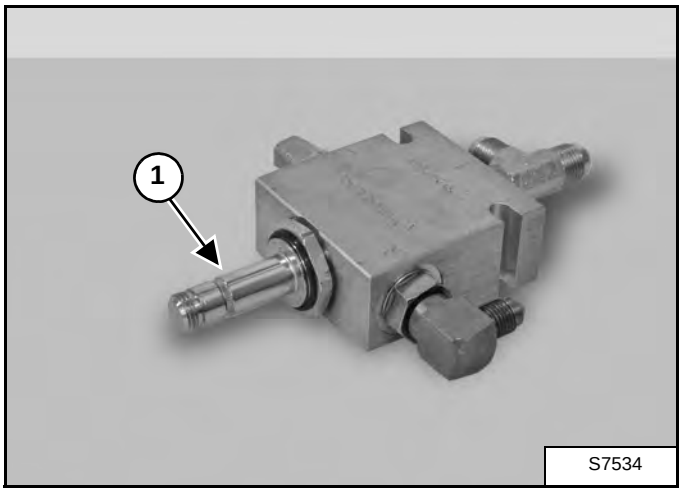
Block Disassembly And Assembly (Cont'd)

Figure 20-170-11



Remove the O-ring (Item 1) and solenoid (Item 2) **[Figure 20-170-11]** from the valve.

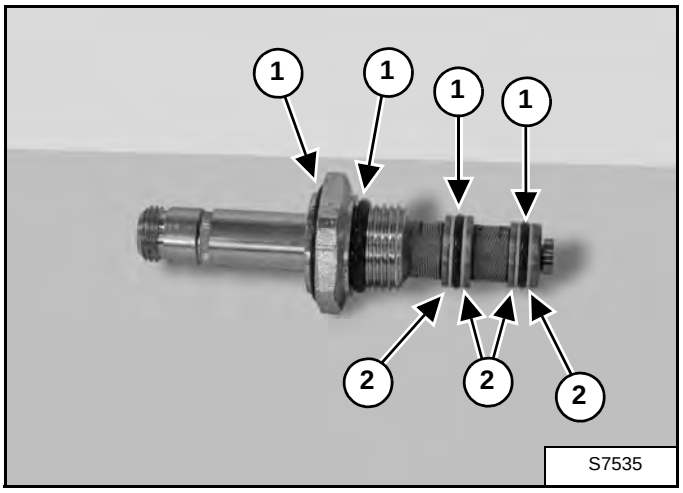
Figure 20-170-12



Remove the solenoid stem (Item 1) **[Figure 20-170-12]**.

Installation: Tighten the solenoid stem to 50 N•m (37 ft-lb) torque.

Figure 20-170-13



Remove the O-rings (Item 1) and back-up rings (Item 2) **[Figure 20-170-13]** from the solenoid stem.

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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

TRACK UNDERCARRIAGE COMPONENTS 30-20-1
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Checking Tension 30-20-2
Adjusting Tension 30-20-3
Track Removal And Installation 30-20-4
Idler Removal And Installation 30-20-5
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Track Tensioner Removal And Installation 30-20-9
Track Tensioner Disassembly And Assembly 30-20-10
Roller Removal And Installation 30-20-10
Roller Parts Identification 30-20-11
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Removal And Installation Of Expandable Track Frame 30-20-15

TRACK MAINTENANCE 30-30-1
Track Damage Identification 30-30-1

SWING CIRCLE GEAR 30-40-1
Removal And Installation 30-40-1

Dealer Copy -- Not for Resale



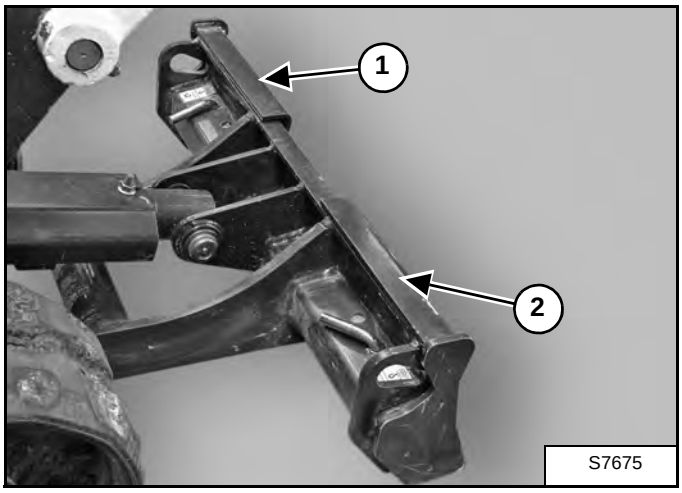
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BLADE

Description

The blade extensions are used to match the track width to the blade width. Retract the blade extensions when transporting the excavator or when a narrow operating width is needed. Under normal operating conditions, the blade width should match the track width.

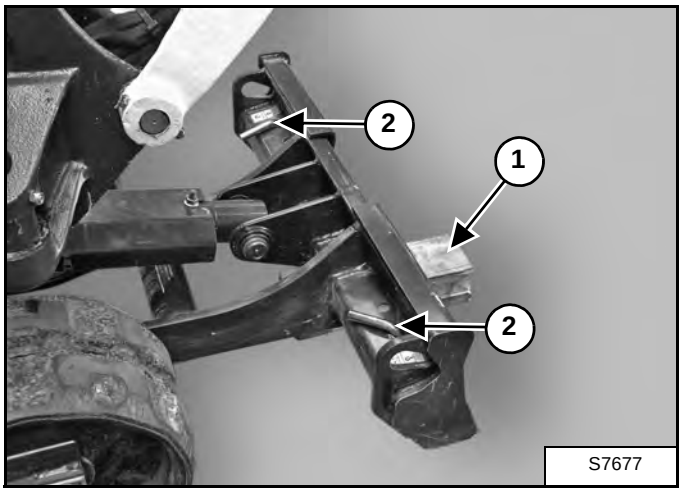
Figure 30-10-1



The blade extensions (Items 1 and 2) **[Figure 30-10-1]** are located on the blade.

Extension Removal And Installation

Figure 30-10-2



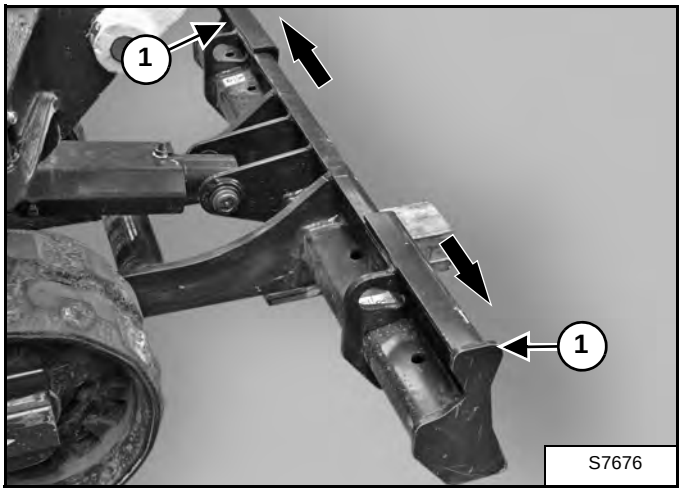
Put a block (Item 1) **[Figure 30-10-2]** under the blade.

Fully lower the blade to the block.

Stop the engine.

Remove the pin (Item 2) **[Figure 30-10-2]** from the blade extensions.

Figure 30-10-3



Remove the blade extensions (Item 1) **[Figure 30-10-3]** from the blade.

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BLADE (CONT'D)

Blade Removal And Installation

Expand the tracks.

Lower the blade to the ground.

Remove the blade cylinder. (See Removal And Installation on Page 20-24-2.)

Figure 30-10-4

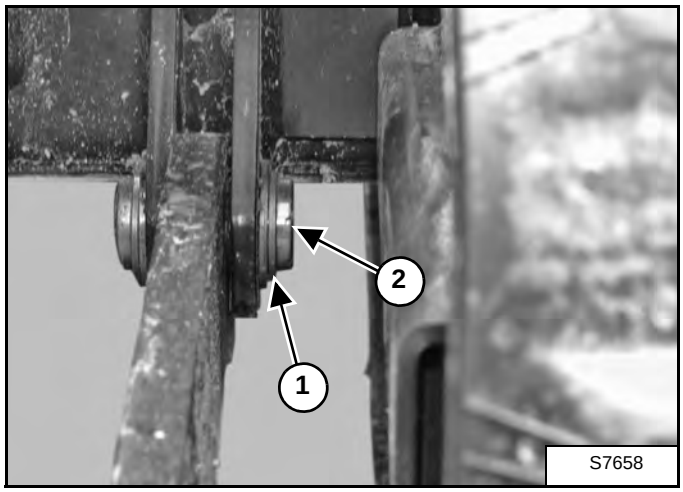
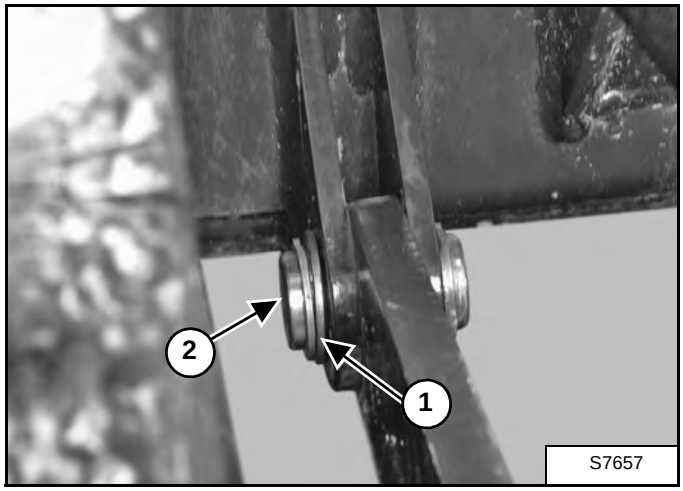


Figure 30-10-5



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

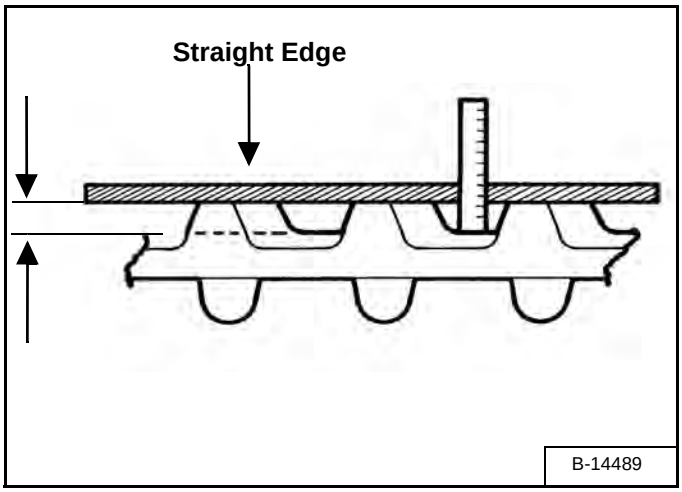
The track undercarriage components consist of the front idler, rollers, drive motor and track frame.

Track Lug Height

Rubber Track

The lug height of a new rubber track is 25,0 mm (0.984 inch).

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)

$$\frac{0.787}{0.984} \times 100 = 80$$

80% of the track lug is remaining with 20% wear on the track lugs.

The rubber track should be replaced when lug height measures 6,25 mm (0.246 in) from the base of the track to the top of the lug.

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Checking Tension

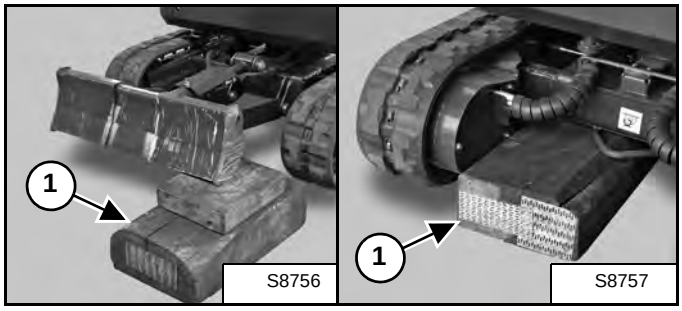
NOTE: The wear of undercarriage parts vary with working conditions and types of soil conditions. Maintain the correct track tension by inspecting regularly. (See SERVICE SCHEDULE on Page 10-70-1.)

Figure 30-20-2



Raise one side of the machine (approximately four inches [102 mm]) using the boom and arm as shown in **[Figure 30-20-2]**.

Figure 30-20-3



Raise the blade fully 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.

W-2142-0903

Figure 30-20-4

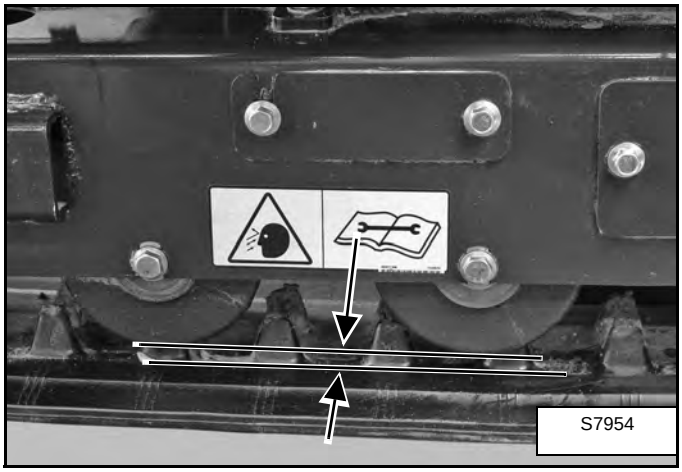
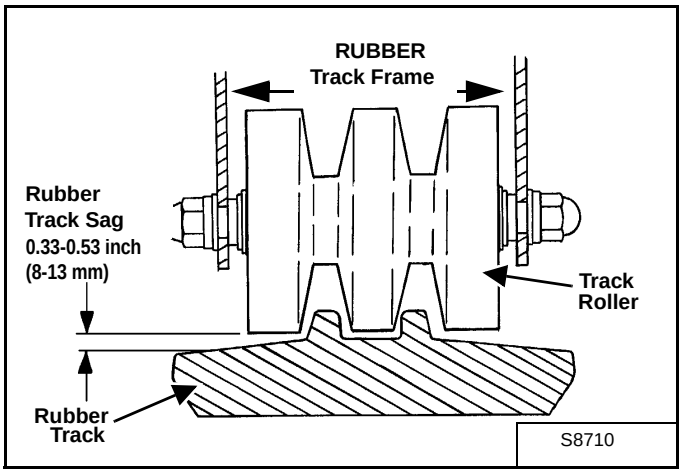


Figure 30-20-5

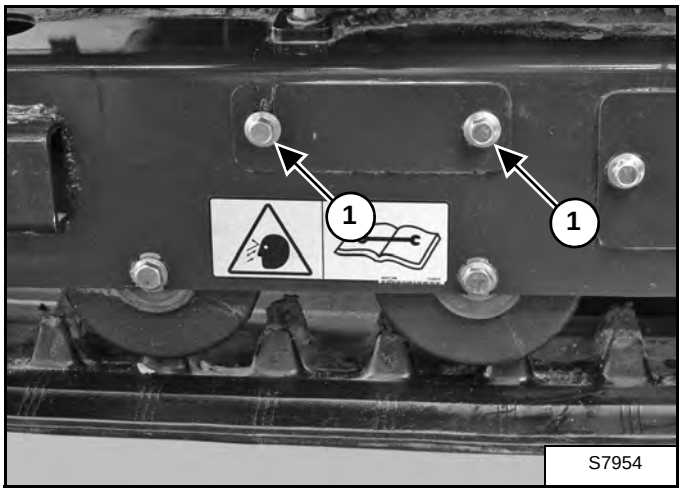


Measure the rubber track sag at the middle track roller **[Figure 30-20-4]**. Do not get your fingers into pinch points between the track and the track roller. Use material of appropriate size to check the gap between the contact edge of the roller and top edge of the track guide lug **[Figure 30-20-4]** and **[Figure 30-20-5]**.

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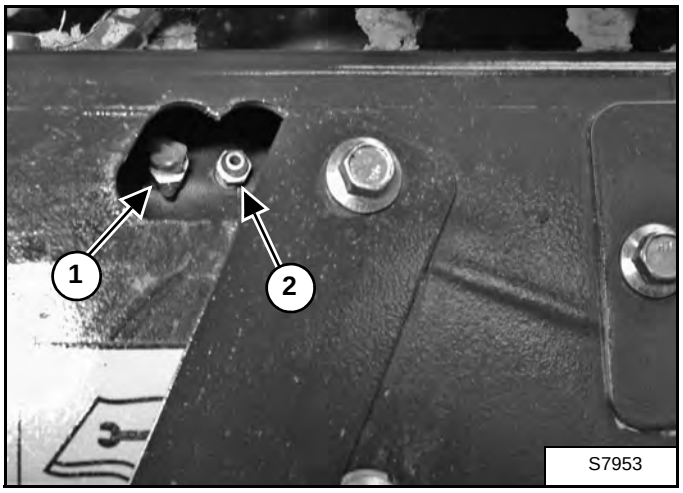
Adjusting Tension

Figure 30-20-6



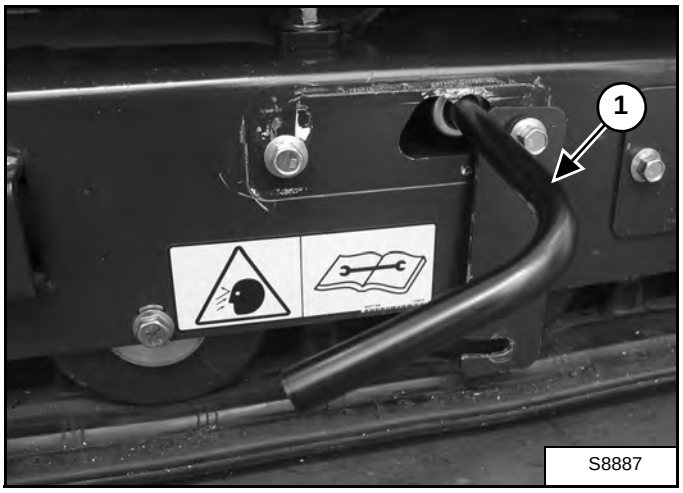
Loosen the two bolts (Item 1) **[Figure 30-20-6]** on the cover. Pivot the cover downward.

Figure 30-20-7



Add grease to the fitting (Item 1) **[Figure 30-20-7]** until the track tension is correct.

Figure 30-20-8



Use tool MEL1560 (Item 1) **[Figure 30-20-8]** 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.

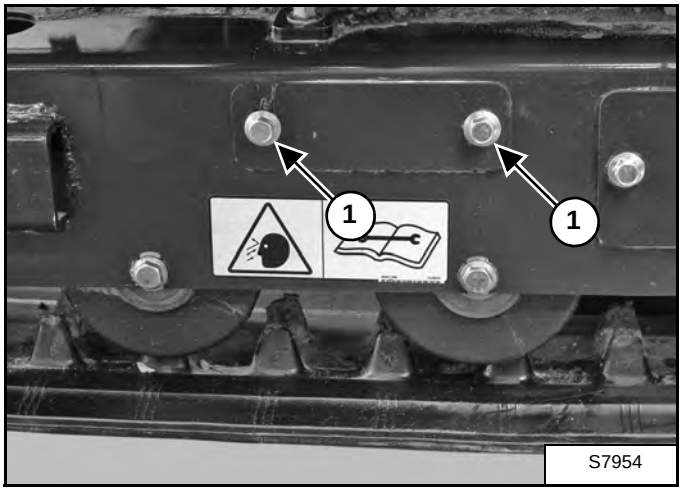
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Track Removal And Installation

Lift and block the side of the machine where the track will be removed. (See Procedure on Page 10-10 Service Manual-1.)

Figure 30-20-9



Loosen the two bolts (Item 1) **[Figure 30-20-9]** on the cover. Pivot the cover downward.

Figure 30-20-10

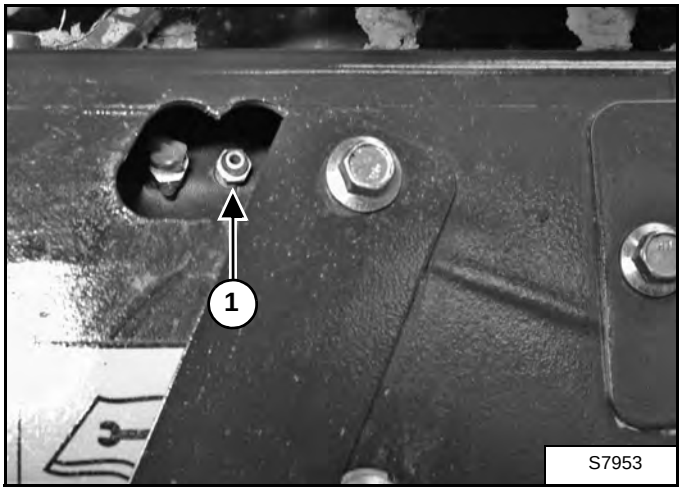
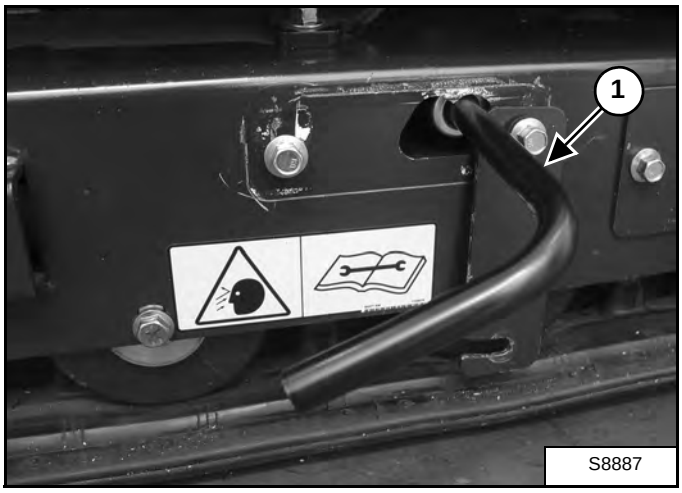


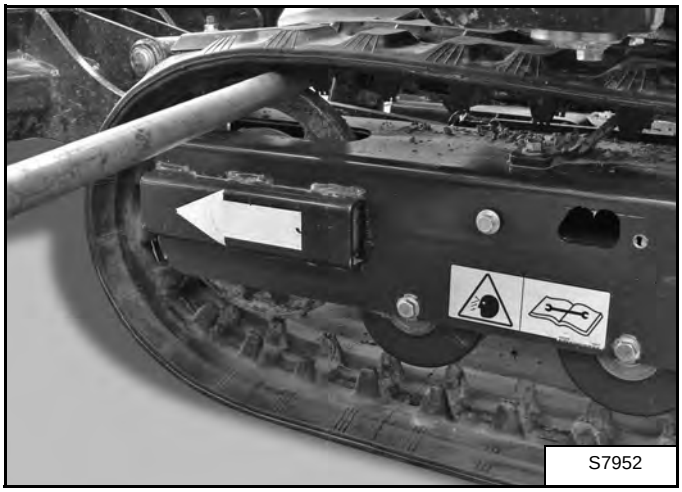
Figure 30-20-11



Use tool MEL1560 (Item 1) **[Figure 30-20-11]** to loosen the bleed fitting (Item 1) **[Figure 30-20-10]** (one turn maximum) to release tension from the track.

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 30-20-12

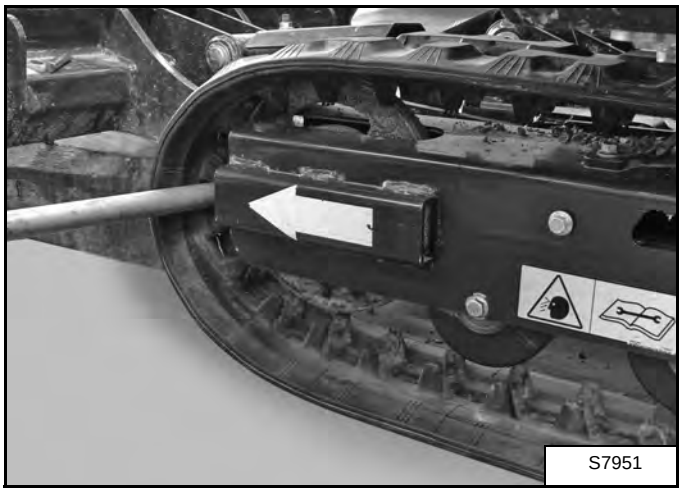


Install a round bar (Approximately 30 mm [1.25 in] diameter) between the drive lugs **[Figure 30-20-12]**.

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Track Removal And Installation (Cont'd)

Figure 30-20-13



Turn the track until the bar contacts the frame **[Figure 30-20-13]**.

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.

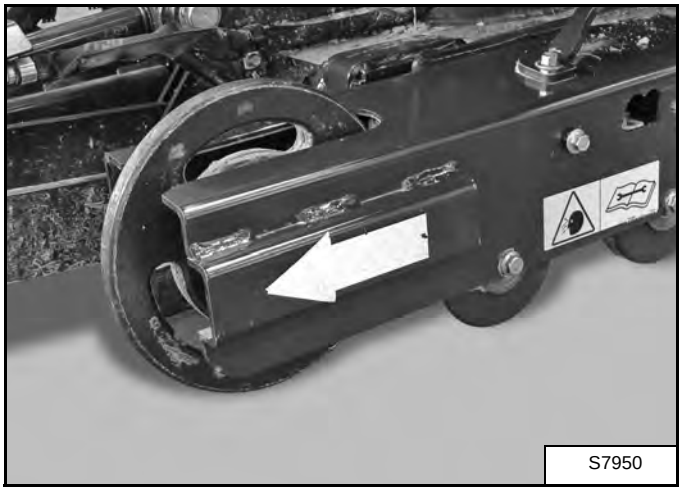
Put the front of the track onto the front idler wheel.

(See Checking Tension on Page 30-20-2.) 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 30-20-4.)

Figure 30-20-14

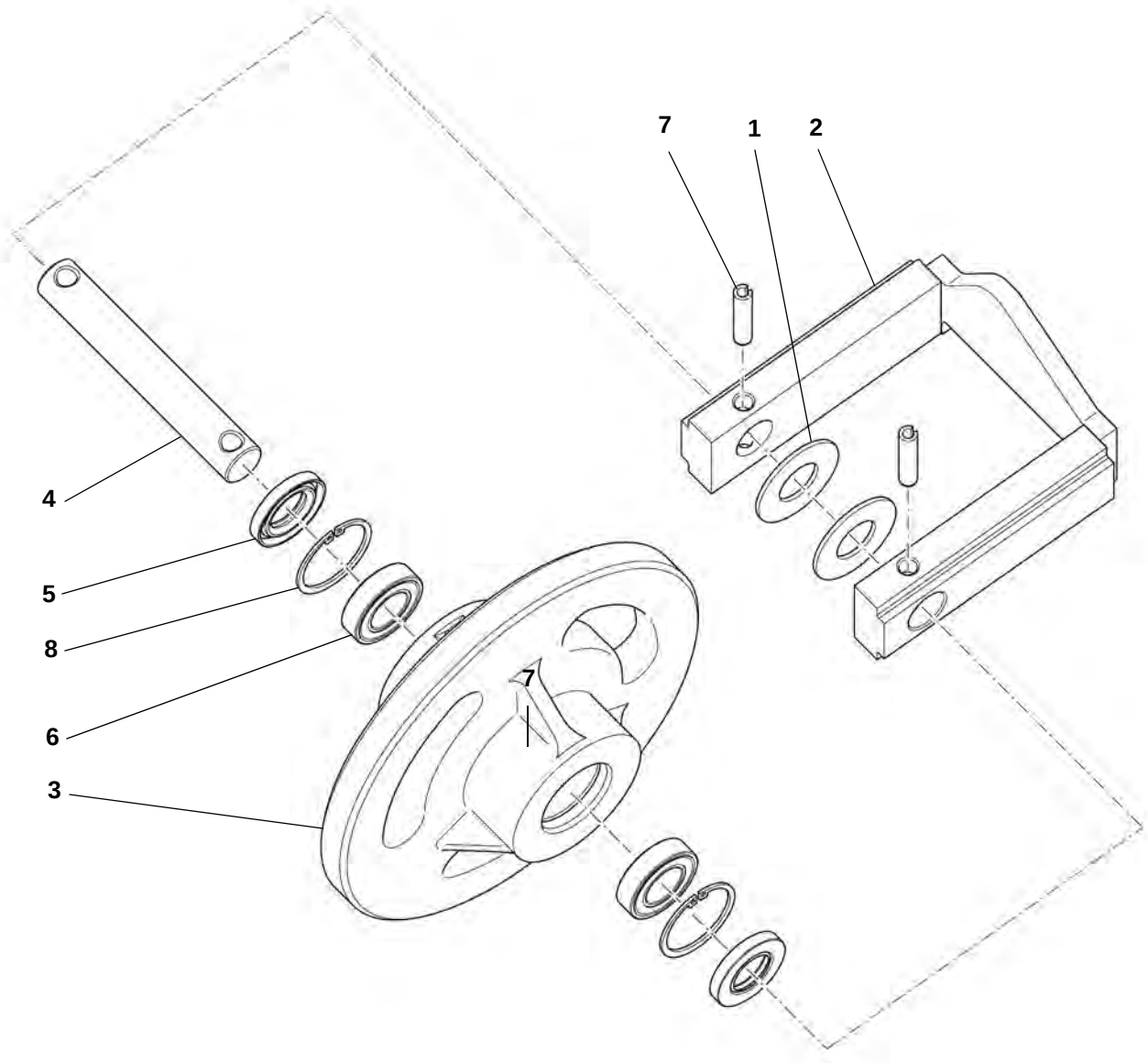


Slide the front track idler out of the track frame to remove it **[Figure 30-20-14]**.

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Idler Parts Identification

1. Washer
2. Tensioner
3. Idler
4. Shaft
5. Seal
6. Bearing
7. Pin
8. Ring



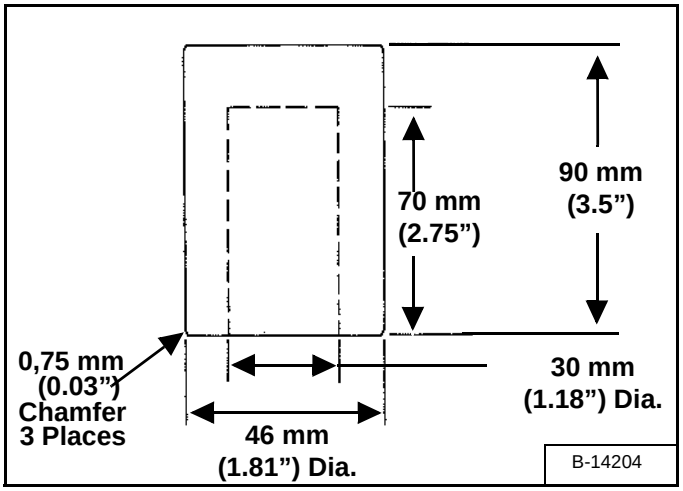
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Idler Disassembly

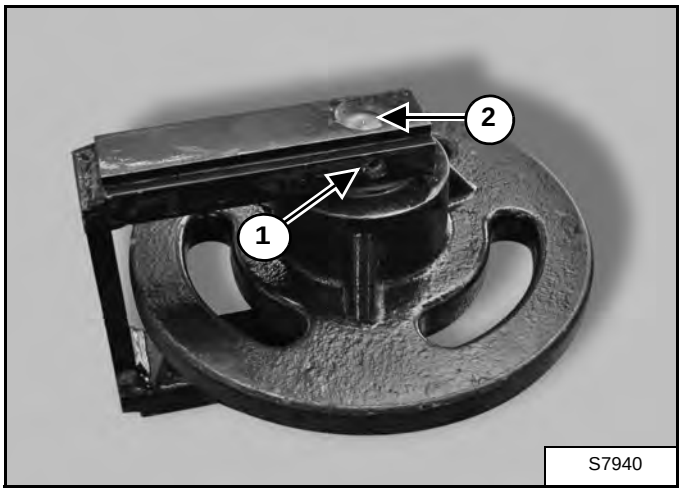
The following tools must be fabricated for this procedure:

Figure 30-20-15



1. Driver Tool - see **[Figure 30-20-15]**.

Figure 30-20-16

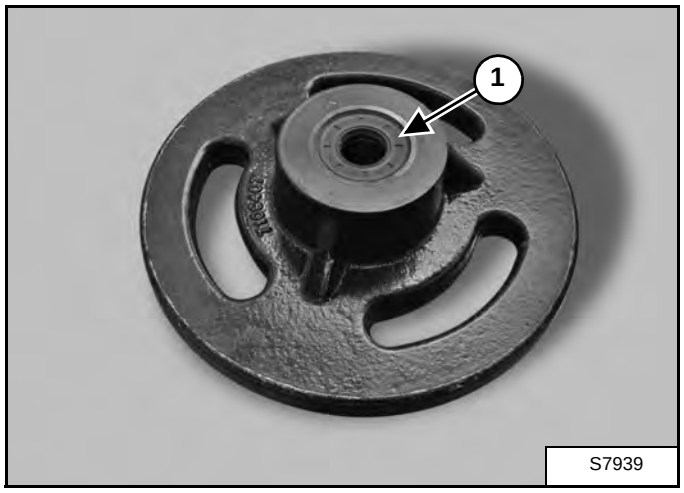


Remove the roll pin (Item 1) **[Figure 30-20-16]** from each end of the shaft.

Using a suitable driver, gently tap the shaft (Item 2) **[Figure 30-20-16]** out of the track idler and bracket.

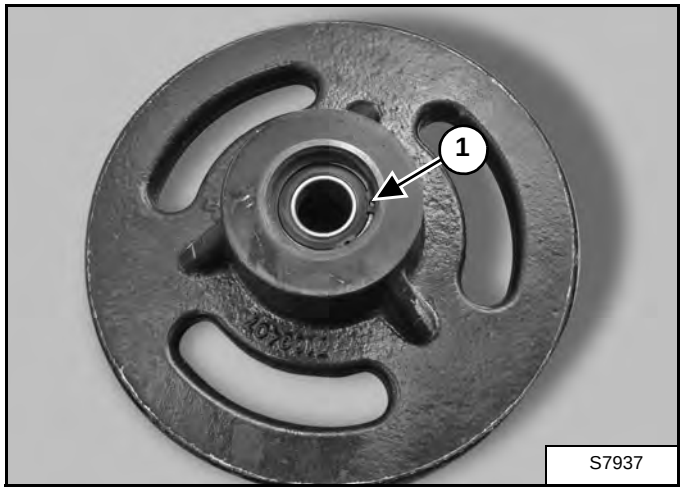
Remove the track idler from the bracket.

Figure 30-20-17



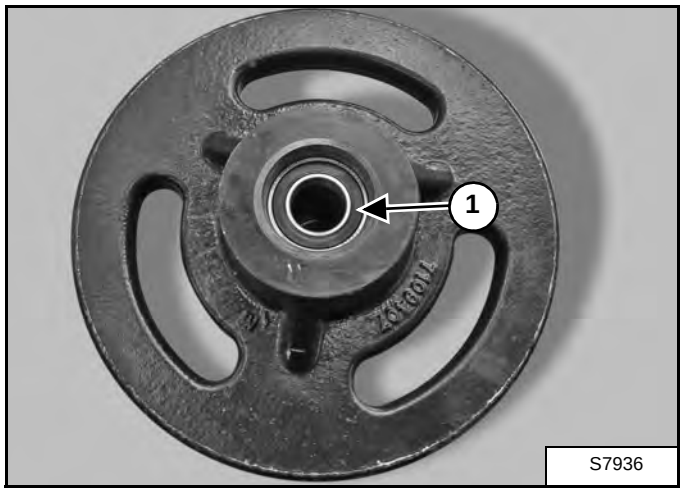
Remove the seal (Item 1) **[Figure 30-20-17]** from both sides of the idler.

Figure 30-20-18



Remove the snap ring (Item 1) **[Figure 30-20-18]** from both sides of the idler.

Figure 30-20-19



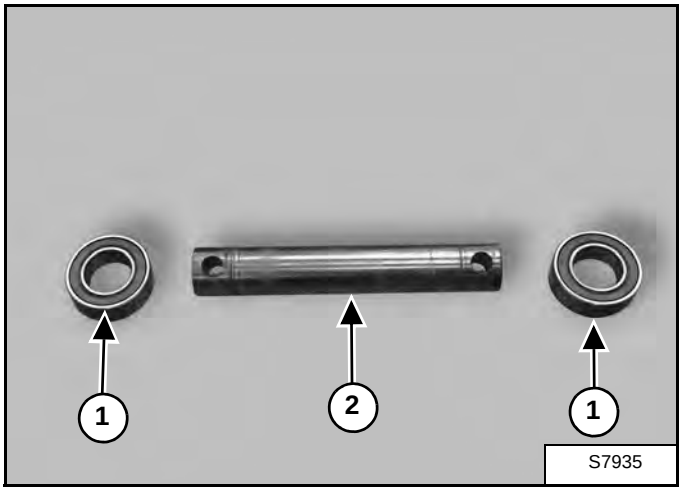
Using a suitable bearing puller, remove the bearing (Item 1) **[Figure 30-20-19]** from both sides of the idler.

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Idler Assembly

Clean all parts in solvent and dry with compressed air.

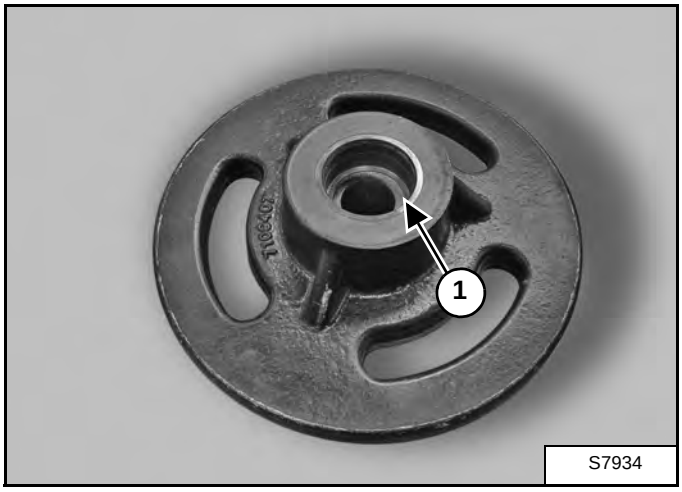
Figure 30-20-20



Inspect the bearings (Item 1) and shaft (Item 2) **[Figure 30-20-20]** 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.

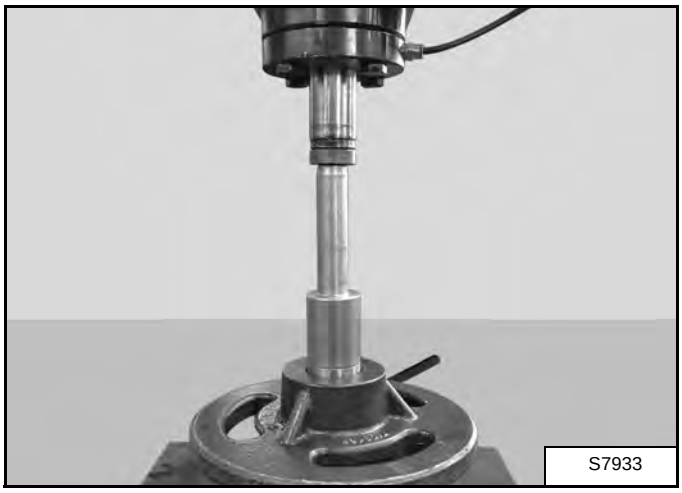
Figure 30-20-21



Remove all paint and corrosion from the bearing and seal surface (Item 1) **[Figure 30-20-21]** on both sides of the idler. If necessary, replace the track idler.

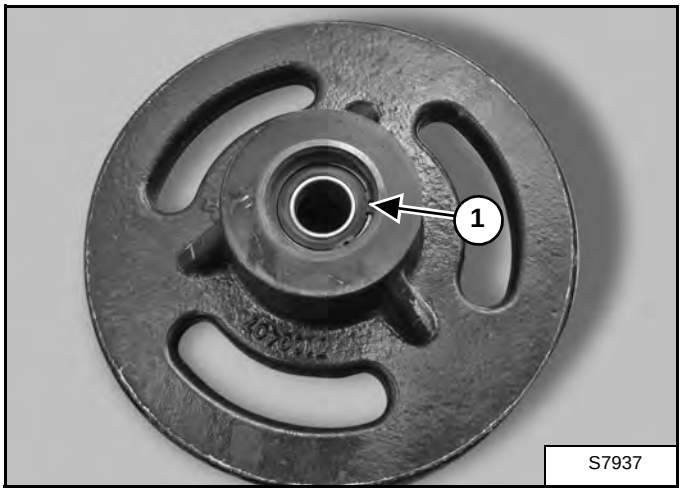
NOTE: Left-Hand Side Idler and Right-Hand Side Idler are different. For ordering, a different P/N exists for each side.

Figure 30-20-22



Using a press or driving tool, install the bearing in the idler **[Figure 30-20-22]** on both sides of the idler.

Figure 30-20-23

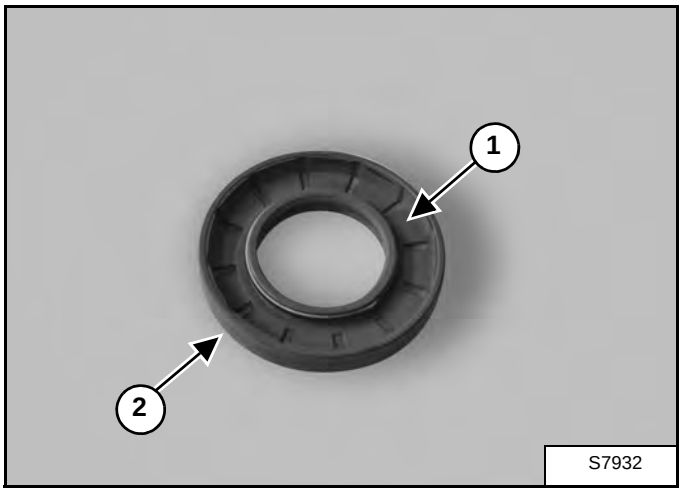


Install the snap ring (Item 1) **[Figure 30-20-23]** on both sides of the idler.

Dealer Copy -- Not for Resale

Idler Assembly (Cont'd)

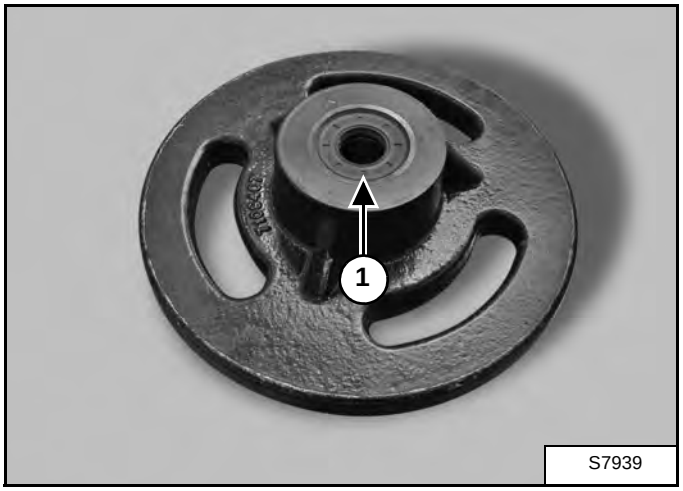
Figure 30-20-24



Apply assembly lube to the inside diameter (Item 1) **[Figure 30-20-24]** of the seal.

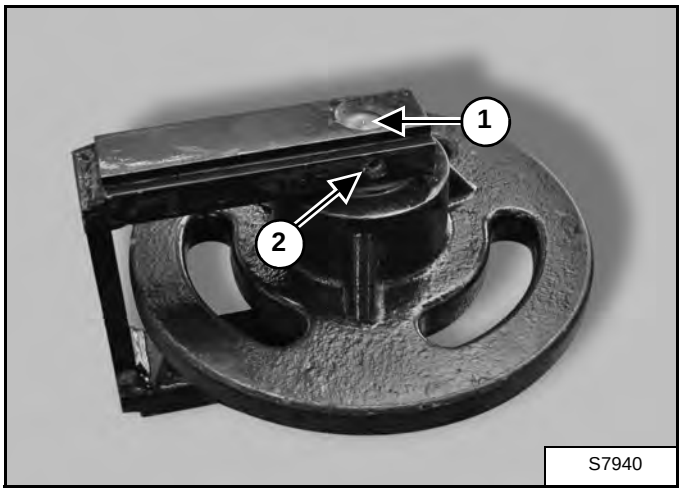
Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-20-24]** of the seal.

Figure 30-20-25



Using the driving tool, install the seal (Item 1) **[Figure 30-20-25]** on both sides of the idler.

Figure 30-20-26



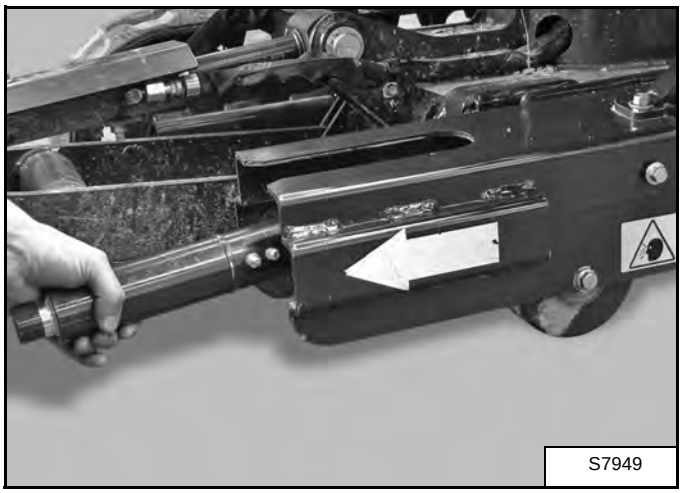
Apply assembly lube to the shaft.

Using a soft faced hammer, gently tap the shaft (Item 1) **[Figure 30-20-26]** in the idler and bracket.

Install the roll pin (Item 2) **[Figure 30-20-26]** on each end of the shaft.

Track Tensioner Removal And Installation

Figure 30-20-27

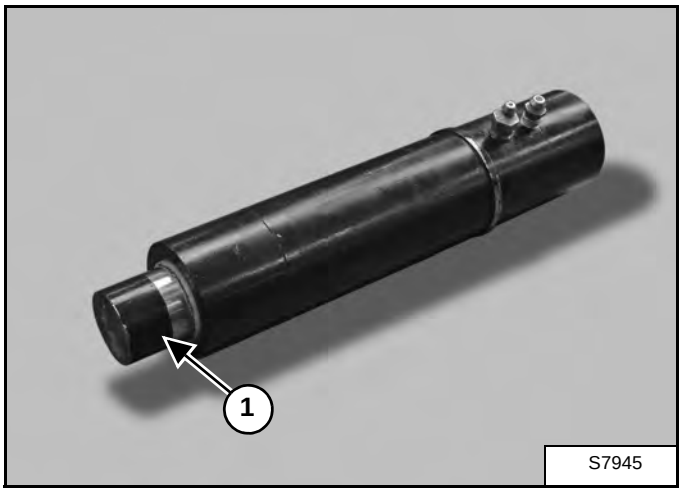


Slide the grease cylinder forward and remove it from the track frame **[Figure 30-20-27]**.

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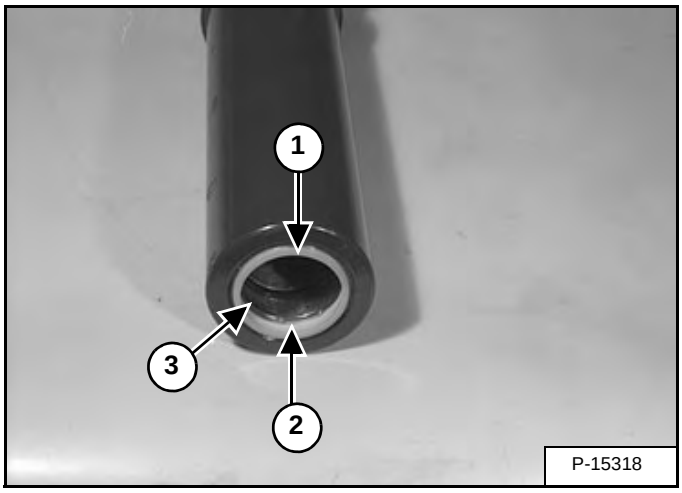
Track Tensioner Disassembly And Assembly

Figure 30-20-28



Remove the rod (Item 1) **[Figure 30-20-28]** from the grease cylinder.

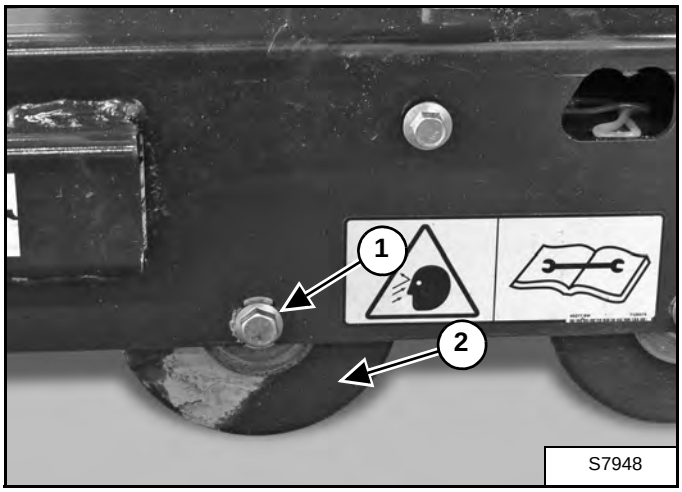
Figure 30-20-29



Remove the seal (Item 1), back-up ring (Item 2), and O-ring (Item 3) **[Figure 30-20-29]** from the cylinder.

Roller Removal And Installation

Figure 30-20-30



Loosen the nuts (Item 1) **[Figure 30-20-30]** from the track roller on both sides of the track frame.

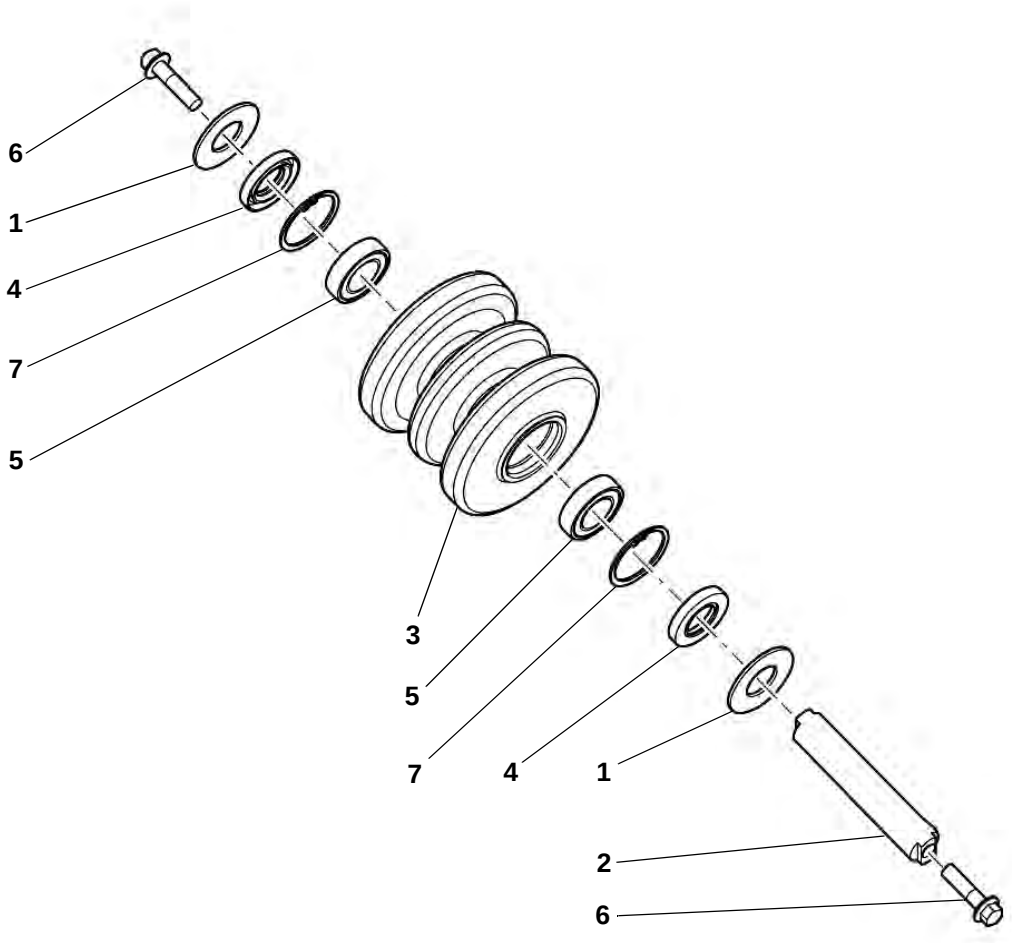
Installation: Tighten the nuts to 170 - 190 N•m (125 - 140 ft-lb) torque.

Remove the track roller (Item 2) **[Figure 30-20-30]**.

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Roller Parts Identification

1. Washer
2. Shaft
3. Roller
4. Seal
5. Bearing
6. Screw
7. Ring



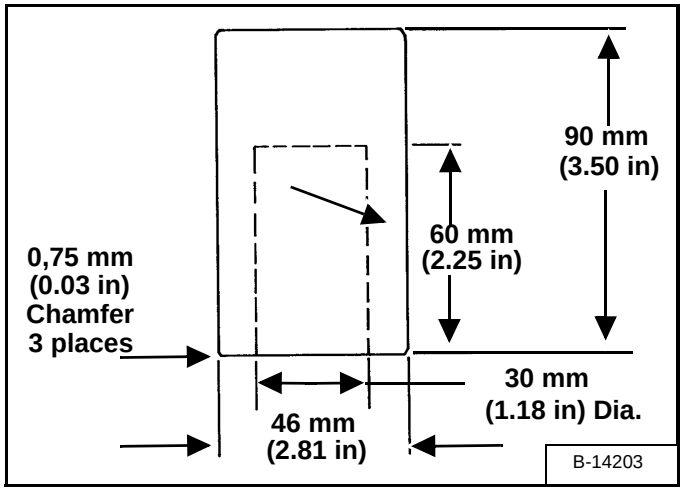
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Dealer Copy -- Not for Resale

Roller Disassembly

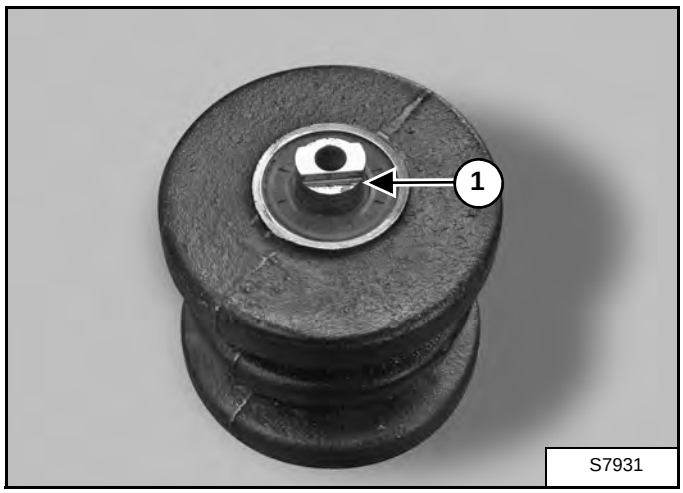
The following tools must be fabricated for this procedure:

Figure 30-20-31



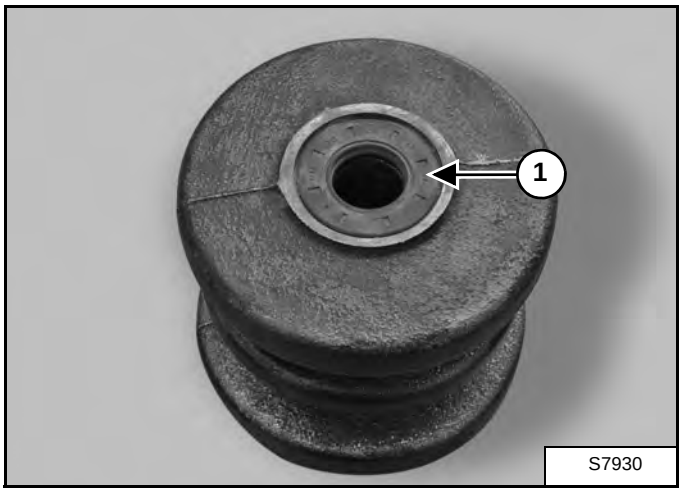
1. Driver Tool - see **[Figure 30-20-31]**.

Figure 30-20-32



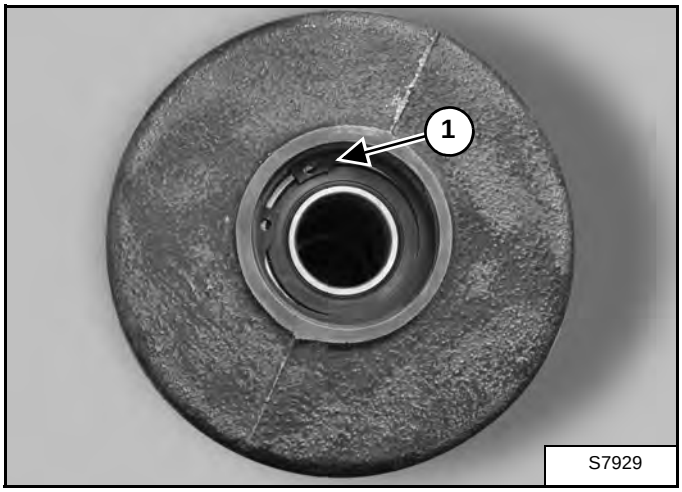
Using a soft faced hammer, gently tap the shaft (Item 1) **[Figure 30-20-32]** from the track roller.

Figure 30-20-33



Remove the seal (Item 1) **[Figure 30-20-33]** from both sides of the track roller.

Figure 30-20-34

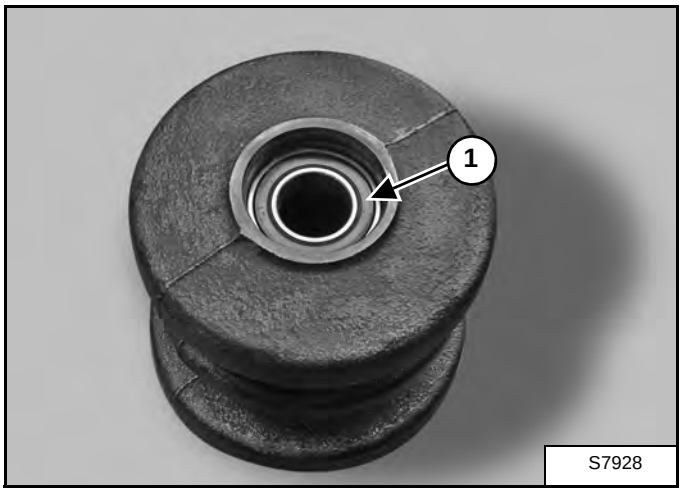


Remove the snap ring (Item 1) **[Figure 30-20-34]** from both sides of the track roller.

Dealer Copy -- Not for Resale

Roller Disassembly (Cont'd)

Figure 30-20-35

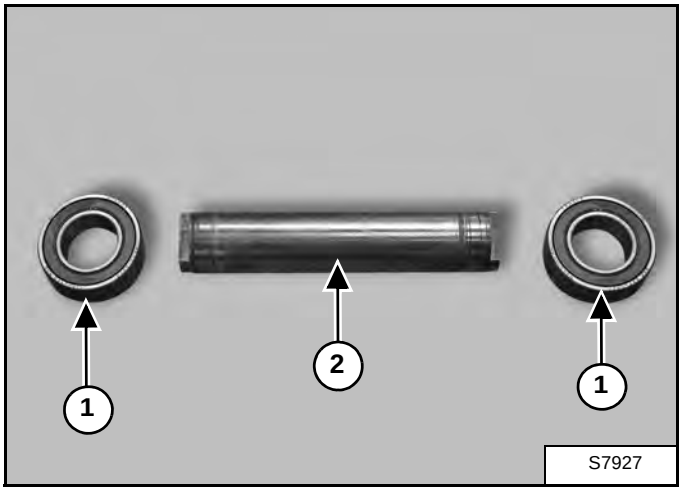


Using a suitable bearing puller, remove the bearing (Item 1) **[Figure 30-20-35]** from both sides of the track roller.

Roller Assembly

Clean all parts in solvent and dry with compressed air.

Figure 30-20-36

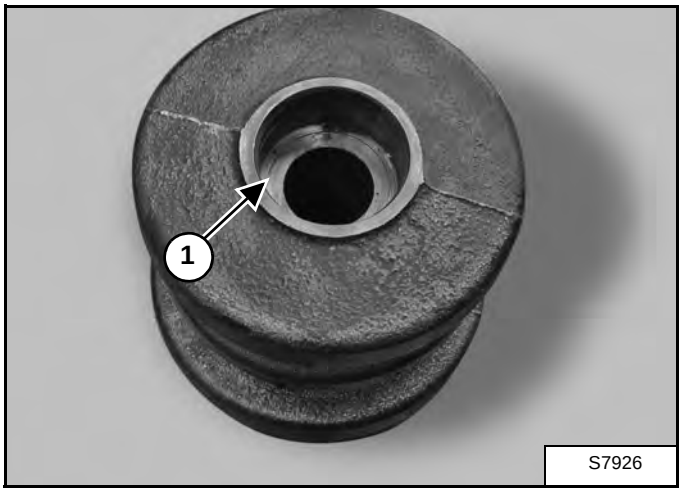


Inspect the bearings (Item 1) and shaft (Item 2) **[Figure 30-20-36]** for wear or damage.

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 30-20-37

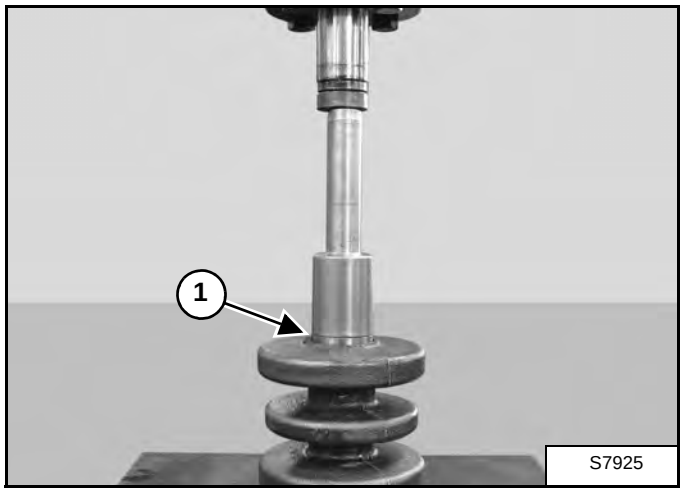


Remove all paint and corrosion from the seal surface (Item 1) **[Figure 30-20-37]** on both sides of the track roller.

Dealer Copy -- Not for Resale

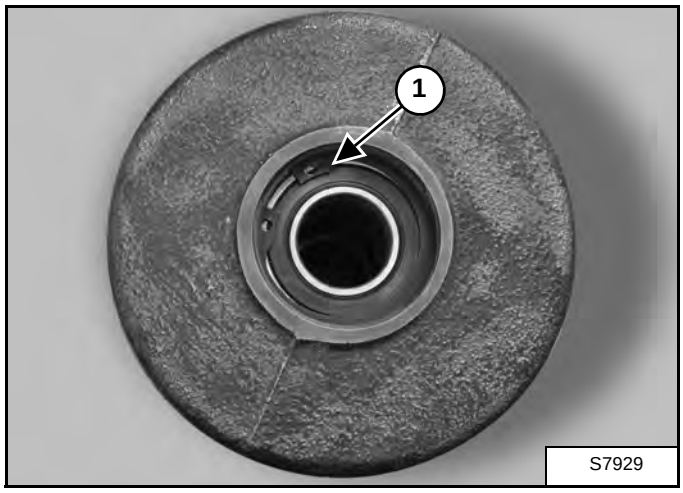
Roller Assembly (Cont'd)

Figure 30-20-38



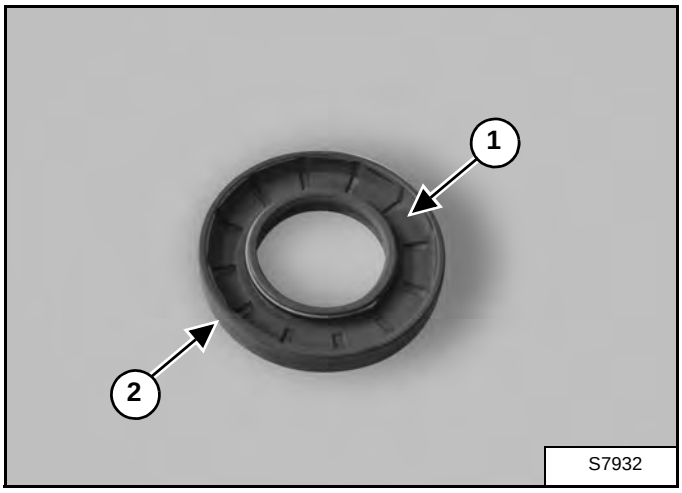
Using a press or driving tool, install the bearing (Item 1) **[Figure 30-20-38]** on both sides of the track roller.

Figure 30-20-39



Install the snap ring (Item 1) **[Figure 30-20-39]** both sides of the track roller.

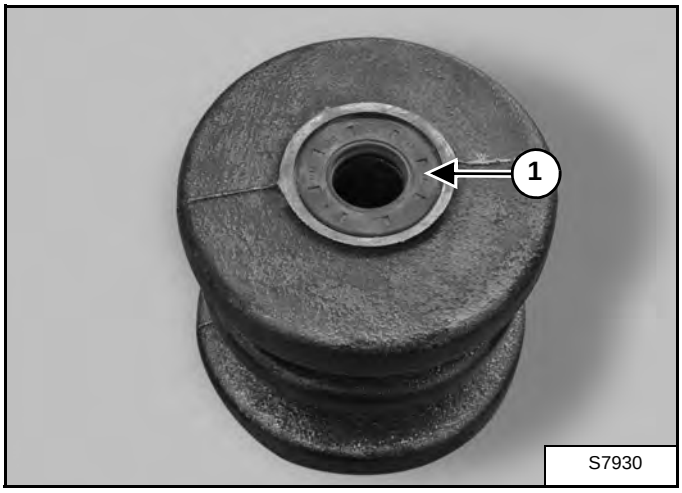
Figure 30-20-40



Apply assembly lube to the inside diameter (Item 1) **[Figure 30-20-40]** of the seal.

Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-20-40]** of the seal.

Figure 30-20-41

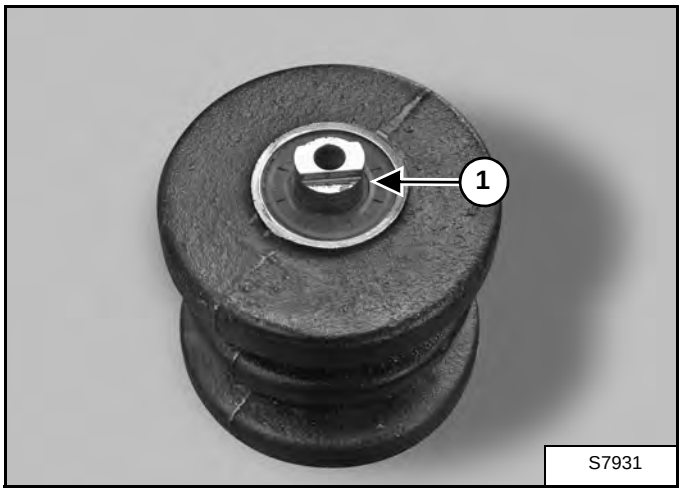


Using the driving tool, install the seal (Item 1) **[Figure 30-20-41]** on both sides of the track roller.

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Roller Assembly (Cont'd)

Figure 30-20-42



Apply assembly lube to the shaft.

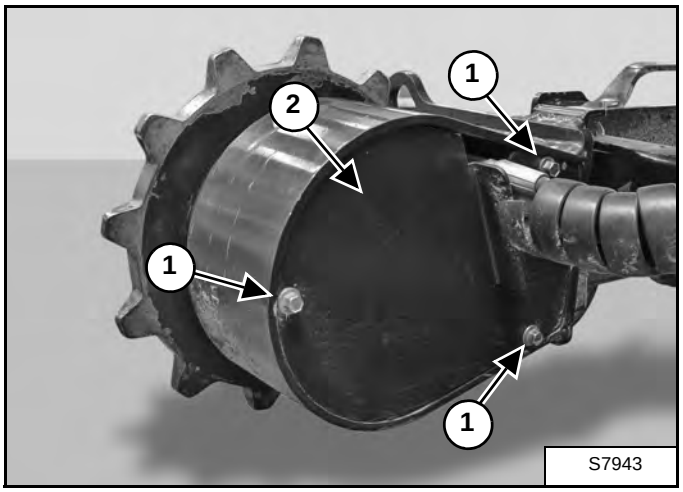
Using a soft faced hammer, gently tap the shaft **[Figure 30-20-42]** in the track roller.

Removal And Installation Of Expandable Track Frame

Remove the track expansion cylinder. (See Removal And Installation on Page 20-25-2.)

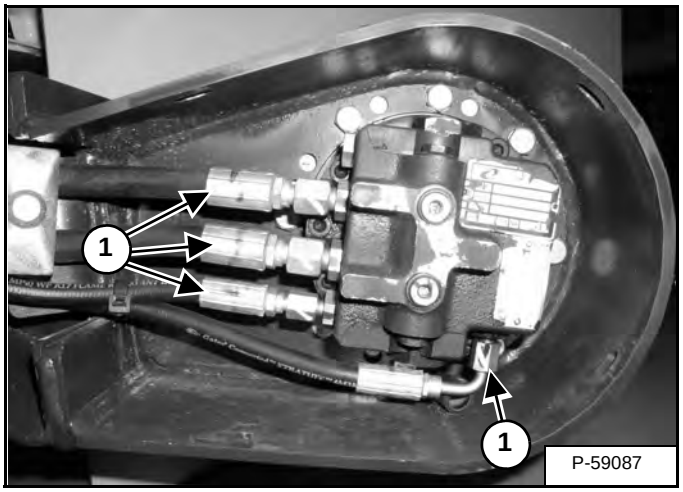
Remove the track. (See Track Removal And Installation on Page 30-20-4.)

Figure 30-20-43



Remove the bolts (Item 1) and the travel motor cover (Item 2) **[Figure 30-20-43]** from the travel motor.

Figure 30-20-44

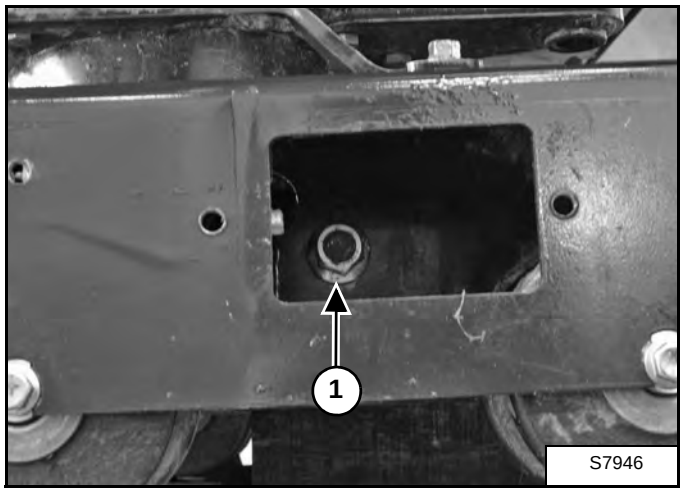


Remove the hoses (Item 1) **[Figure 30-20-44]** from the travel motor.

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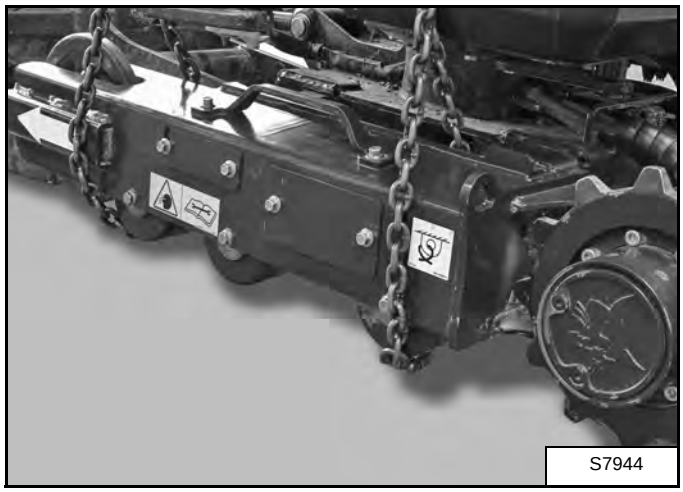
Removal And Installation Of Expandable Track Frame (Cont'd)

Figure 30-20-45



Remove the nut (Item 1) **[Figure 30-20-45]** from the track expansion stop rod.

Figure 30-20-46



Install a chain hoist on the track frame **[Figure 30-20-46]**. Lift the frame a small amount while pulling the frame away from the excavator.

Using a 10 X 1,5 mm tap, clean the track frame bolt holes to remove the old thread locking compound.

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TRACK MAINTENANCE

Track Damage Identification

The following pages show photos and illustrations of track damage and the probable cause of the damage. It is intended to be used for identifying the reason for track damage and how to avoid future track damage.

Cutting Of The Steel Cords

Damage:

Figure 30-30-1

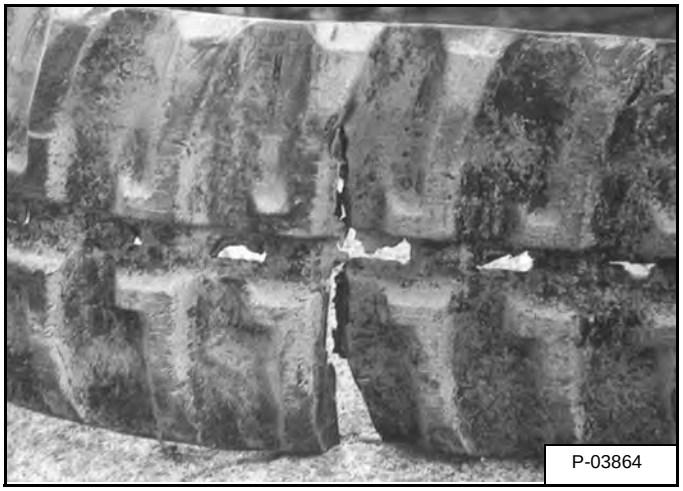
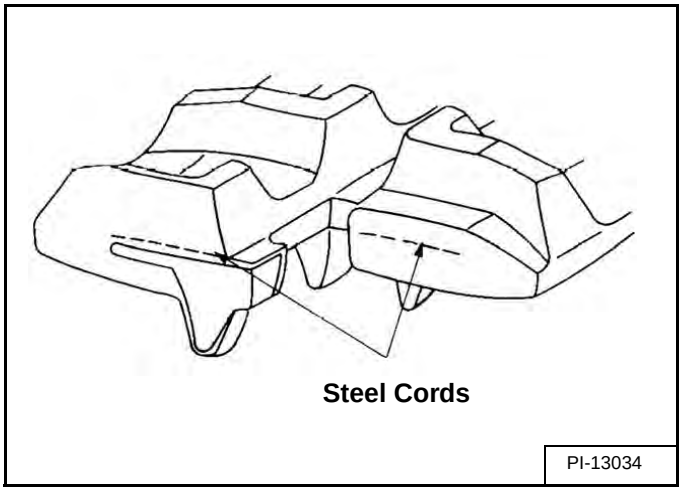


Figure 30-30-2



Damage:

Embedded steel cords are cut off **[Figure 30-30-1]** and **[Figure 30-30-2]**.

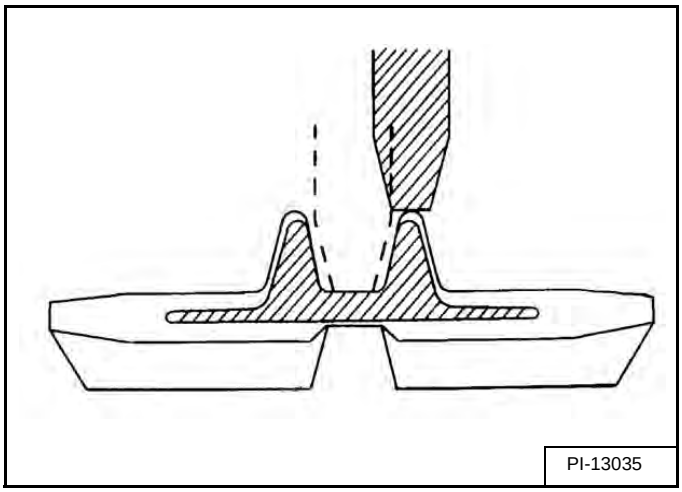
Replacement:

Replacement is required.

Causes Of The Damage

When applied to rubber tracks under the following circumstances, tension in excess of the breaking strength of the embedded steel cords causes steel cords to be cut:

Figure 30-30-3



When the rubber track is 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 may 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 30-20-2.)

Avoid quick turns on bumpy and rocky fields.

Drive carefully to avoid having stones and other articles clog the rubber tracks.

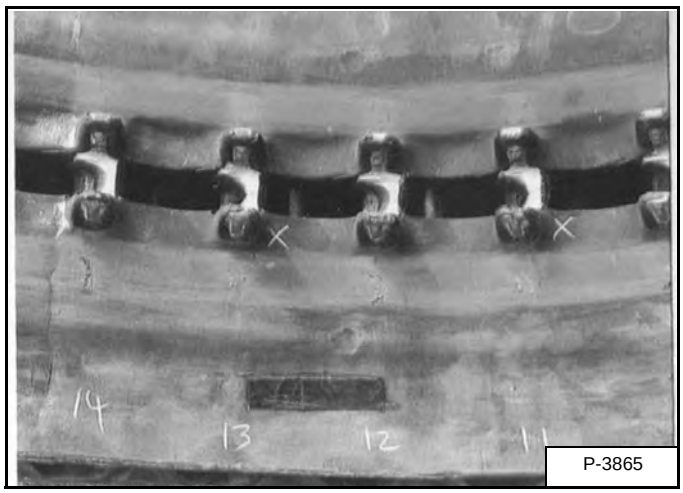
Avoid driving over sharp objects. If this is impossible, do not make turns while driving over sharp objects.

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Track Damage Identification (Cont'd)

Abrasion of Embedded Metals

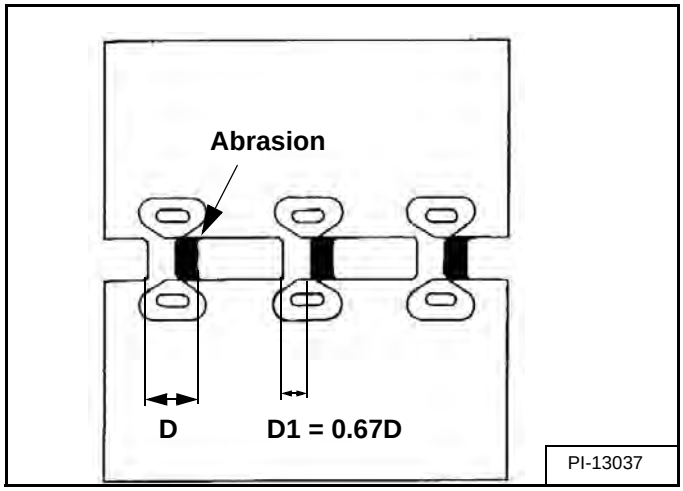
Figure 30-30-4



Damage:

In proportion to the service time, embedded metals will gradually wear away by friction **[Figure 30-30-4]**.

Figure 30-30-5



Replacement:

Replacement is required when the width of the embedded metals (D1) becomes 67% of 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 generate a heavy load for rubber tracks, and when they are operated under a sandy field condition for a long time.

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Track Damage Identification (Cont'd)

Separation Of Embedded Metals

Figure 30-30-6



Damage:

Extraordinary outer forces applied to embedded metals cause their separation from the rubber track's body **[Figure 30-30-6]**.

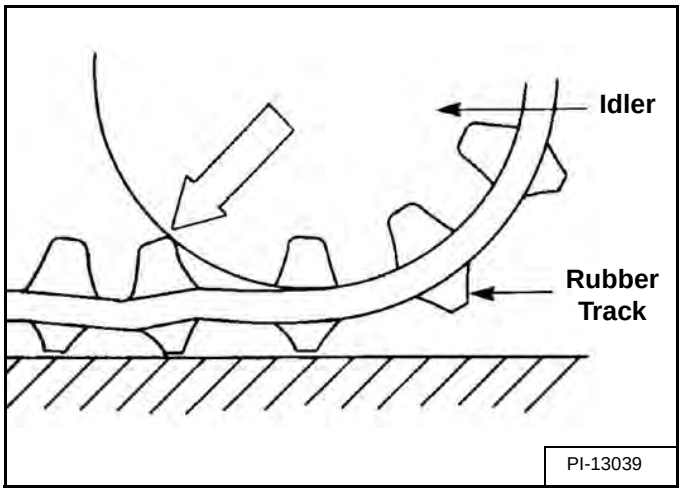
Replacement:

Even a partial separation of embedded metals requires replacement of the track.

Causes Of The Damage:

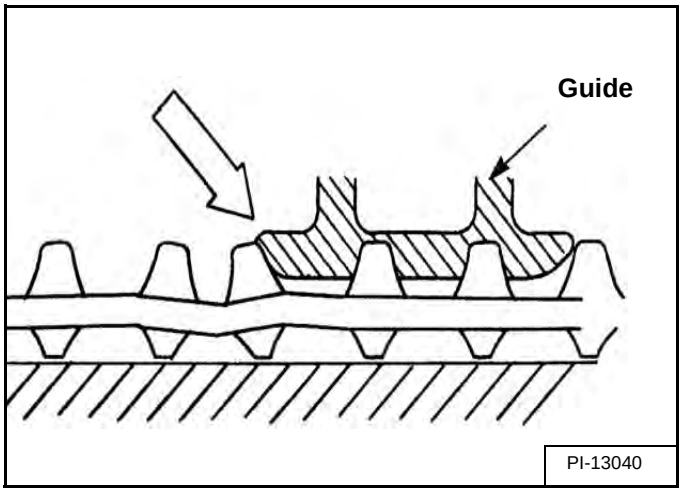
Embedded metals adhere between the steel cords and the rubber body. The following cases generate external forces greater than the adhesion strength, causing separation of the embedded metals:

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



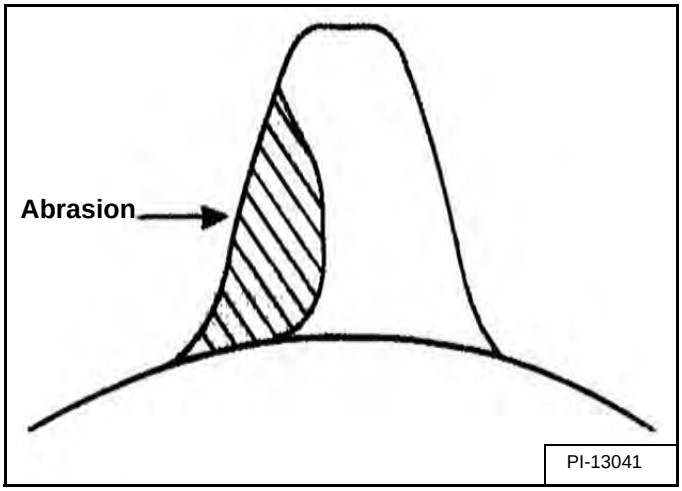
When a rubber track is detracted, it becomes stuck between the guide or the undercarriage frame, causing the separation of embedded metals **[Figure 30-30-8]**.

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Track Damage Identification (Cont'd)

Separation Of Embedded Metals

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:

Track tension should be periodically checked.

Quick turns on bumpy and rocky fields should be avoided.

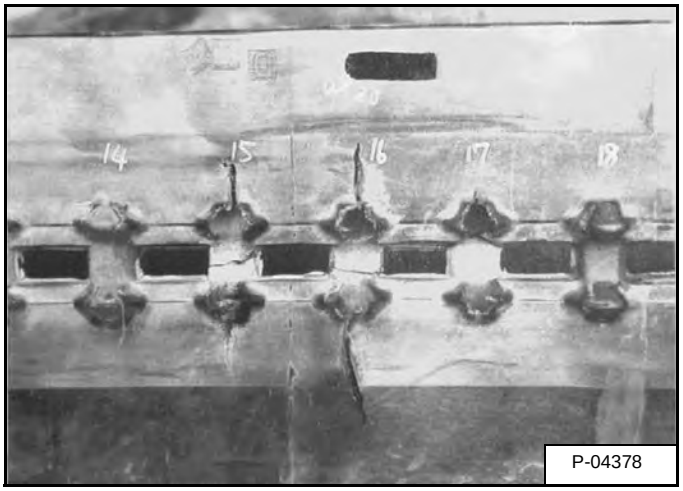
If abnormal wear of sprockets is observed, they should be immediately replaced.

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Track Damage Identification (Cont'd)

Separation Of Embedded Metals Due To Corrosion

Figure 30-30-10



Damage:

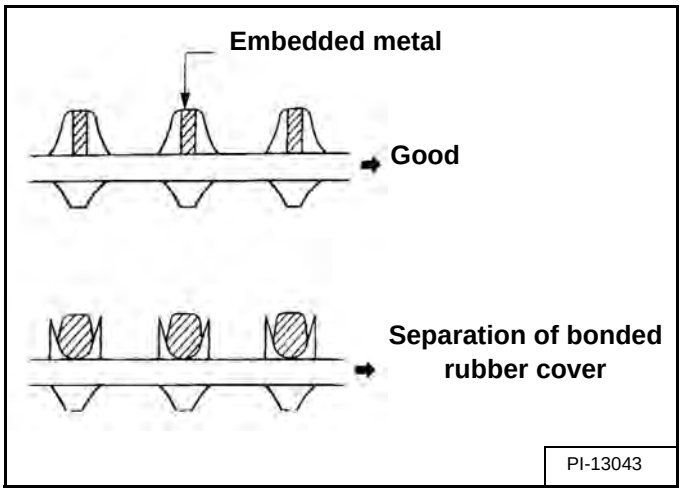
Due to corrosion of embedded metals, the adhesion to the rubber body deteriorates, resulting in complete separation **[Figure 30-30-10]**.

Replacement:

Even a partial separation of embedded metals requires a rubber track replacement.

Causes Of The Damage

Figure 30-30-11



Embedded metals are bonded to the rubber body. The following operating conditions cause embedded metals to corrode, causing deterioration of the bonding, and finally resulting in separation of the embedded metals from the rubber body **[Figure 30-30-11]**.

Excessively salty fields, like the sea shore.

Strong acidic or alkali soil conditions

Compost spread grounds

On tracks that are out of adjustment, the track rollers, idlers and sprockets will gradually wear the rubber surface at 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.

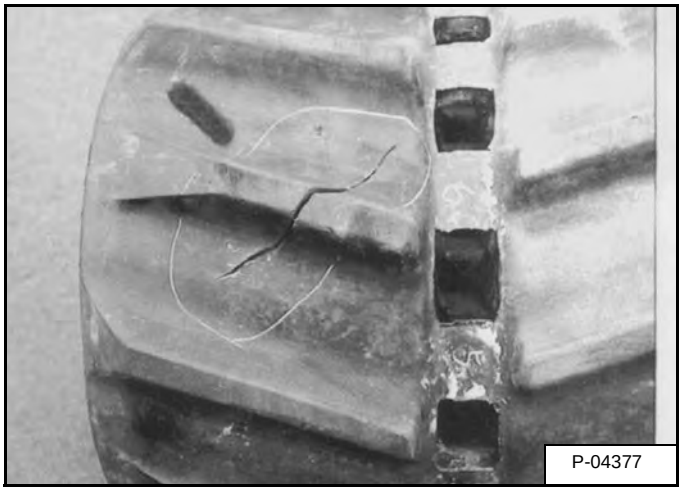
When the bonded rubber cover is separated from the embedded metal projections and the metals in the rubber body become loose, it is time to consider replacement of the rubber track.

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Track Damage Identification (Cont'd)

Cuts On The Lug Side Rubber

Figure 30-30-12



Damage:

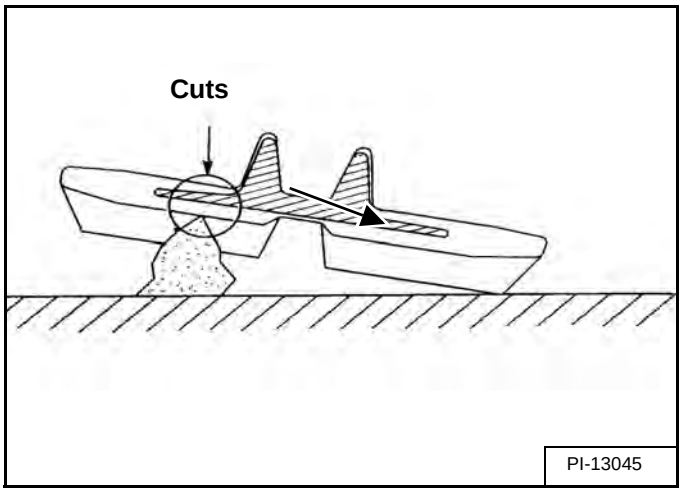
Cuts on the lug side rubber often occurs as one of the most typical failure modes **[Figure 30-30-12]**

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

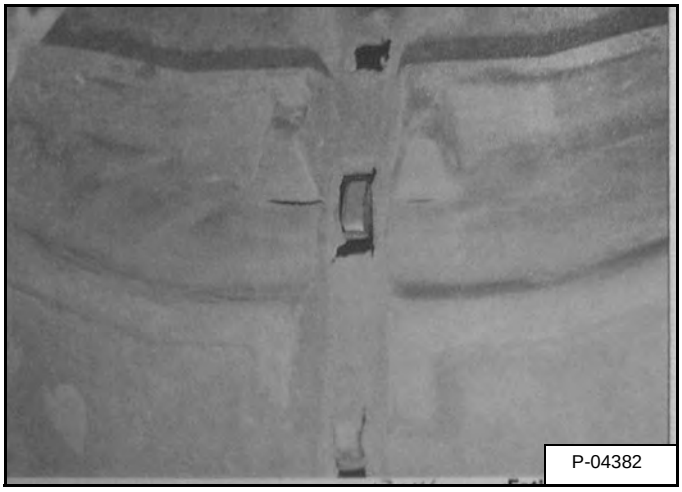
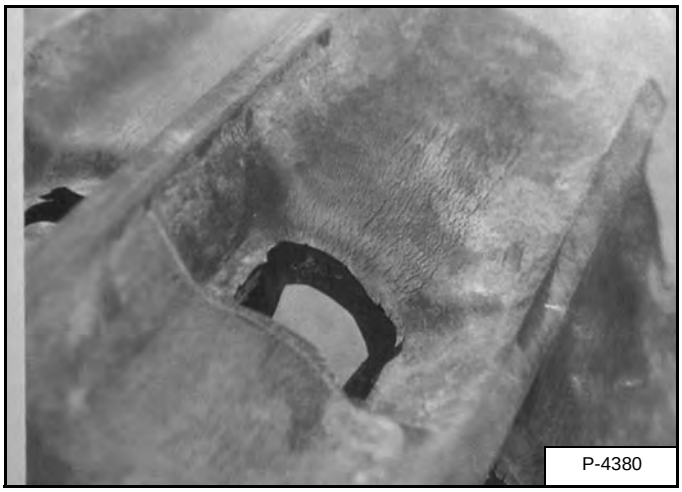


Figure 30-30-15



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

Figure 30-30-16

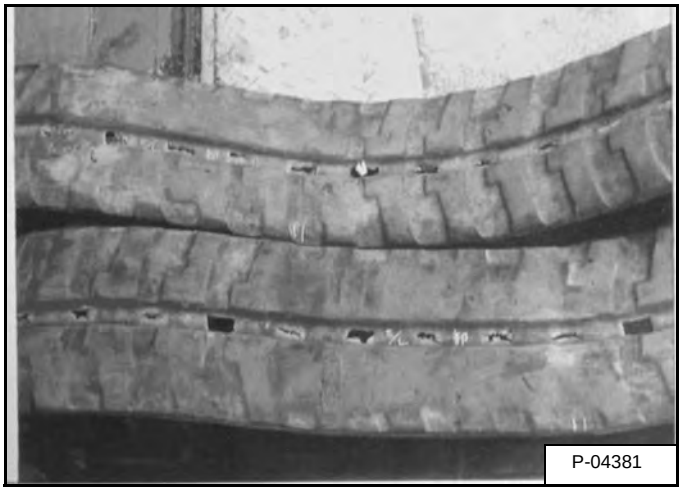
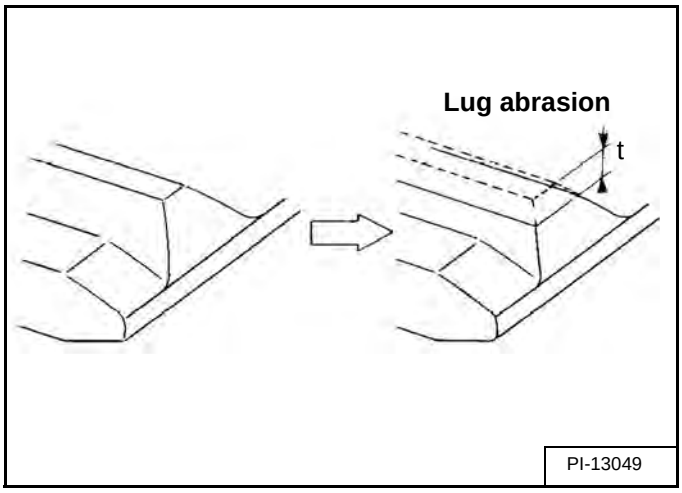


Figure 30-30-17



Damage:

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.

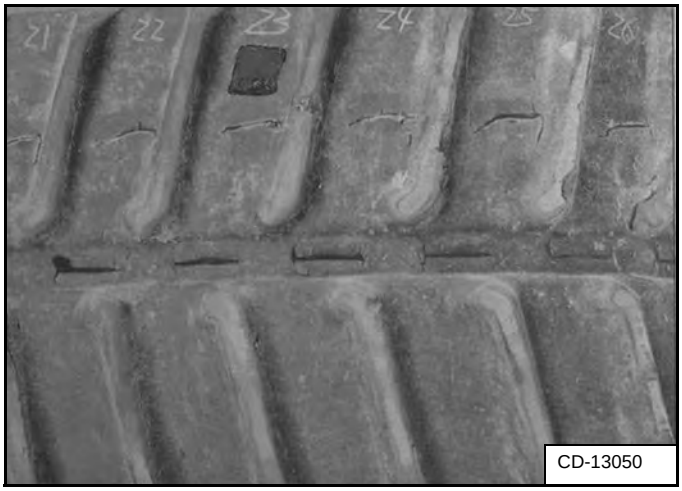
Making frequent turns on paths covered with rocks and wood.

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Track Damage Identification (Cont'd)

Cracks And Cuts On The Lug Side Rubber

Figure 30-30-18



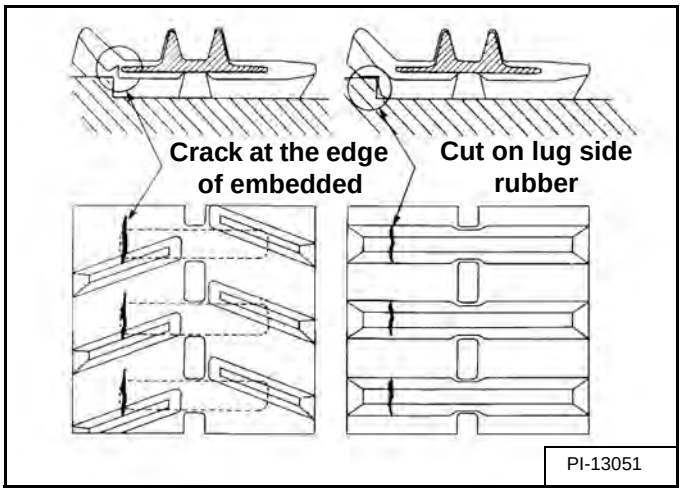
Damage:

Sometimes cracks and cuts on the lug side rubber at the edges of the embedded metals can be observed **[Figure 30-30-18]**.

Replacement:

Basically, no replacement is required unless the cuts on the lug side rubber are discovered all around the edges of the embedded metals, as this will result in a complete cut off.

Figure 30-30-19



Causes of the damage:

When rubber tracks drive over sharp projections, intensive stress is applied to the lug side rubber surface, especially at the edges of embedded metals, causing cracks and cuts in the area around the embedded metals **[Figure 30-30-19]**.

Prevention:

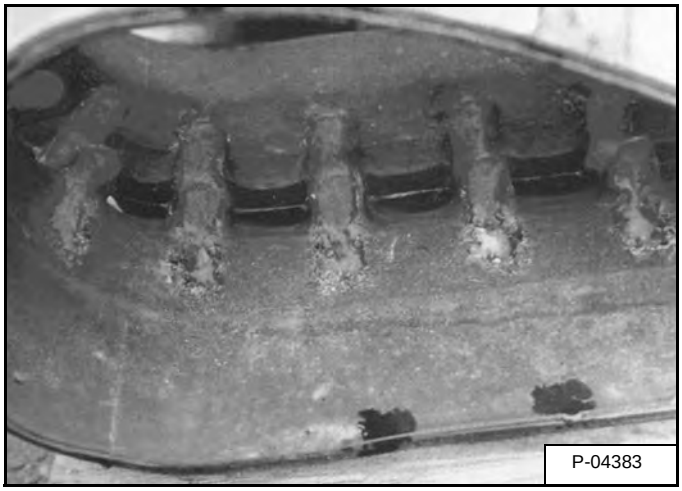
To avoid extensive stress applied to the lug root where metals are embedded, machine operators should avoid driving over stumps and ridges.

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Track Damage Identification (Cont'd)

Abrasion Of The Track Roller Side

Figure 30-30-20



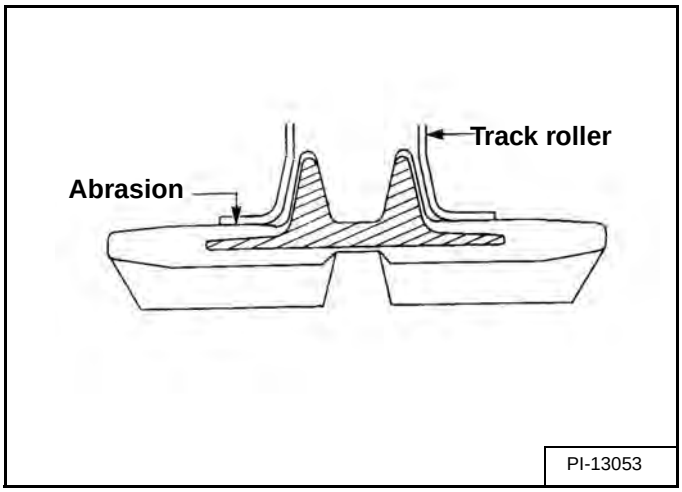
Damage:

The rubber surface on which track rollers run is gradually abraded. It will 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.

Figure 30-30-21



Causes Of The Damage:

The abrasion of the track roller side rubber surface occurs because of sand and gravel being clogged between the rubber and the outside surface of the track rollers. The stress pushes the sand and gravel against the side of the rubber track to cause the abrasion **[Figure 30-30-21]**.

The level of abrasion is highly dependent on terrain conditions. A higher level of abrasion will occur when the rubber tracks are operated in fields covered with many stones and gravel. Small stones hardened with mud, stuck to the track rollers increase the abrasion level. After an extended period of abrasion, it will be more likely for exposed embedded metals to catch moisture through the inside steel cords, which can cause breakage of steel cords and separation of the metals from the rubber body.

Prevention:

After operation in wet fields containing many small stones, wash off the mud that is stuck 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

Figure 30-30-22

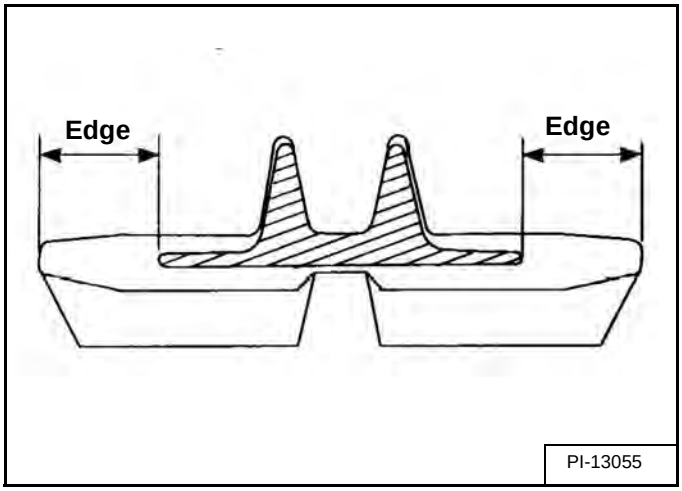
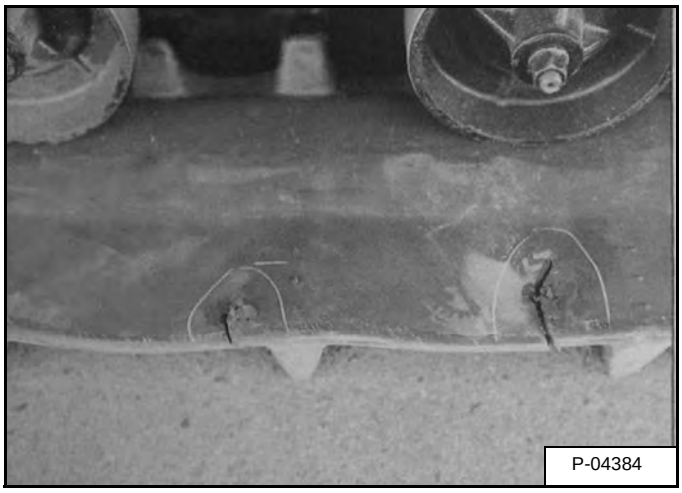


Figure 30-30-23



Damage:

Both edges of a rubber track **[Figure 30-30-22]** have no special reinforcement. During operation the edges may become cut or torn off **[Figure 30-30-23]** and **[Figure 30-30-24]**.

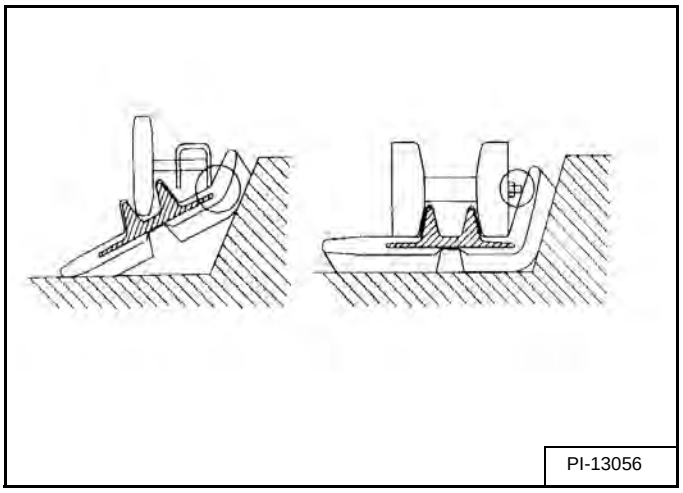
Replacement:

In such case, the rubber track does not have to be replaced.

Causes Of The Damage:

This damage is caused by objects on the ground or by interference with the machine frame.

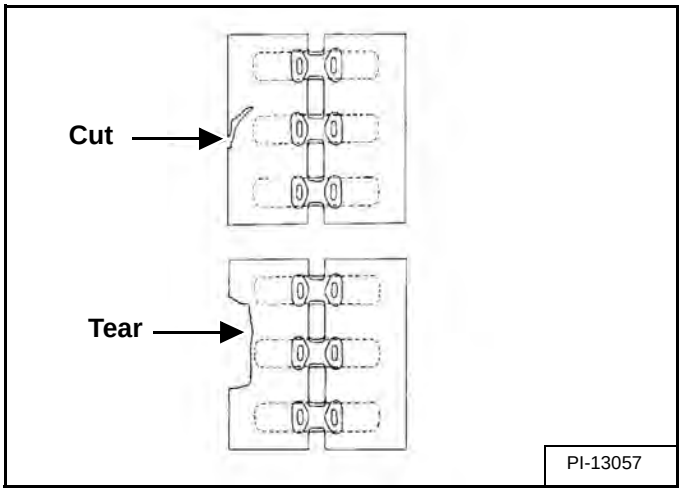
Figure 30-30-24



In case of damage by objects on the operating ground:

The edges of rubber track are often deformed largely due to a bumpy ground surface, stones and other objects, which causes extensive stress on the edges resulting in the damage. When driving a machine over concrete ridges, this type of damage easily occurs **[Figure 30-30-24]**.

Figure 30-30-25



In case of damage by interference with the machine frame.

If a machine continues operating with rubber tracks being detracked, the rubber tracks may get caught up in the machine frame or undercarriage parts resulting in damage. Furthermore, when a machine travels along side slopes, the rubber tracks are deformed so much that they come into contact with the machine frame and undercarriage parts, which causes cutting, gouging and rubbing of rubber tracks in the end **[Figure 30-30-25]**.

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Track Damage Identification (Cont'd)

Cuts On The Edges Of The Track Roller Side (Cont'd)

Prevention:

When traveling, a machine operator should be careful not to drive over any projections on the ground. He should also prevent rubber tracks from coming into contact with concrete walls, ditches and ridges. If rubber tracks are detracked, the machine should be stopped immediately for detracking.

Remove the track. (See Checking Tension on Page 30-20-2.)

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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

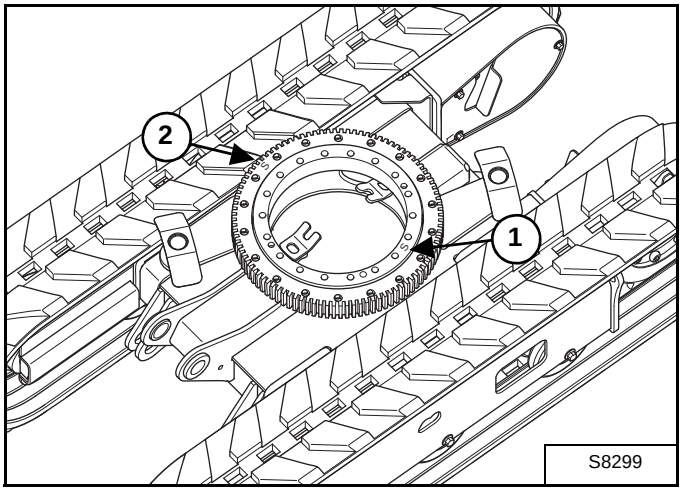
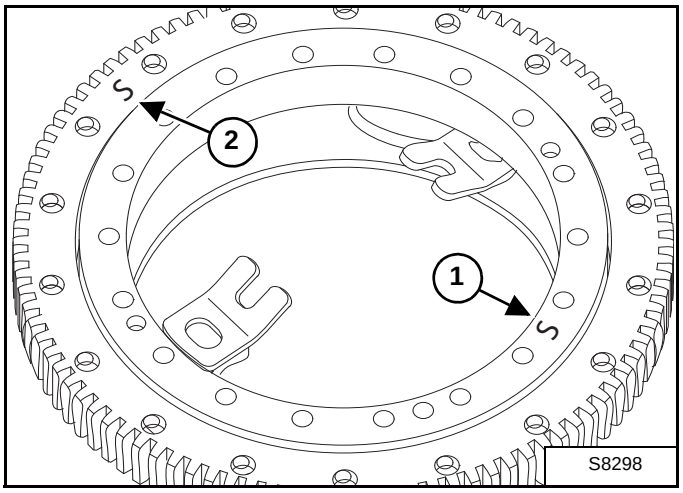


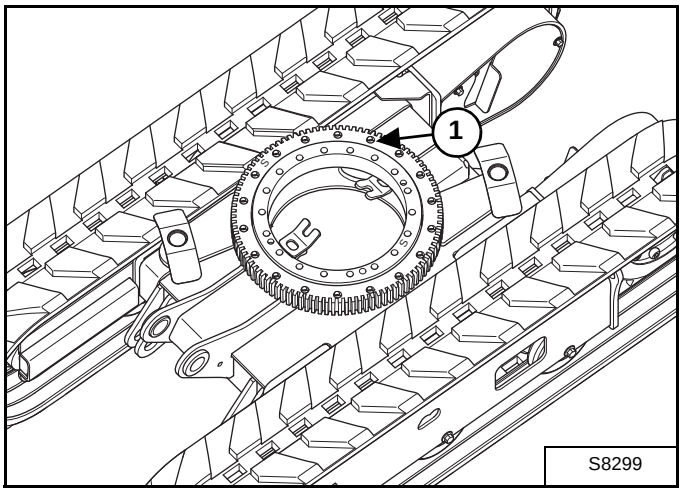
Figure 30-40-2



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 and nuts from the swing circle gear **[Figure 30-40-3]**.

Installation: Tighten the bolts and nuts to 105 - 115 N•m (78 - 85 ft-lb) torque.

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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 50-20-3.)

Remove the TOPS. (See Removal And Installation on Page 40-20-1.)

Drain the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-3.)

Remove the seat. (See Removal And Installation on Page 40-30-1.)

Remove the floor panels. (See FLOOR PANELS on Page 40-120-1.)

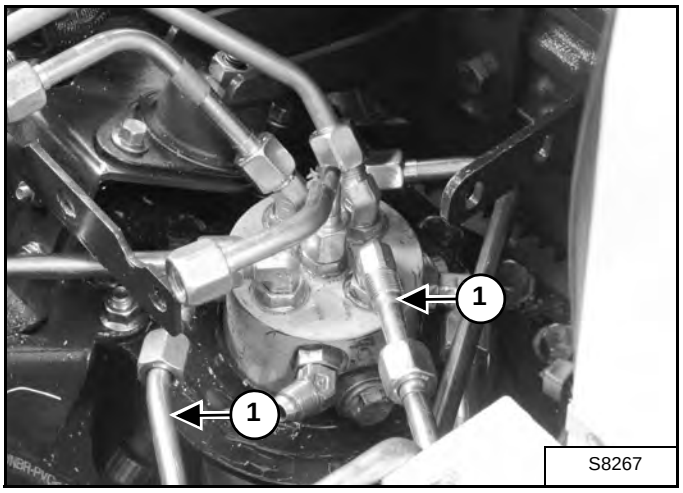
Remove the slew motor. (See Removal And Installation on Page 20-90-1.)

Remove the track expand valve.

Remove the muffler. (See Removal And Installation on Page 60-20-1.)

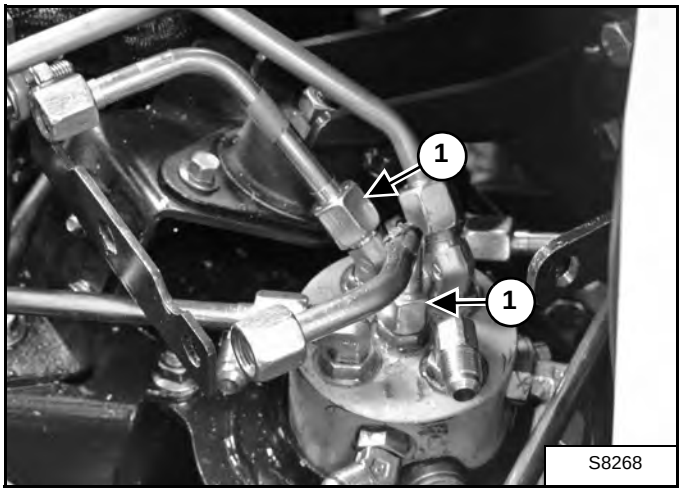
Remove the lower right hand side cover. (See Lower Right Side Cover Removal And Installation on Page 40-210-3.)

Figure 40-10-1



Remove the two tubelines (Item 1) **[Figure 40-10-1]** from the swivel joint.

Figure 40-10-2

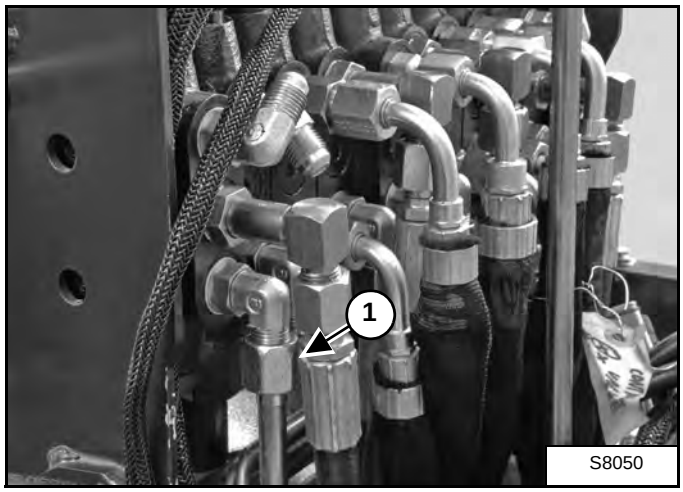


Remove the two tubelines (Item 1) **[Figure 40-10-2]** from the swivel joint.

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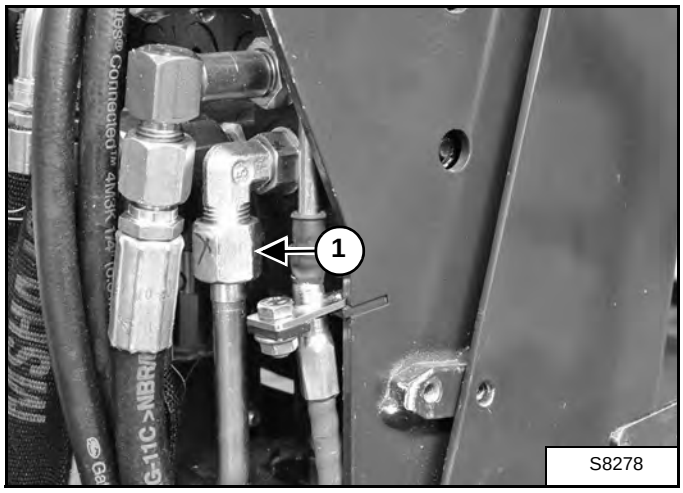
Removal (Cont'd)

Figure 40-10-3



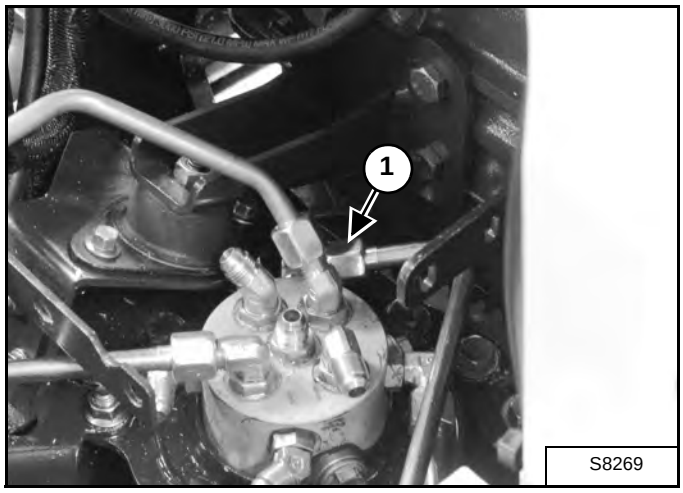
Disconnect the tubeline (Item 1) **[Figure 40-10-3]** from the control valve.

Figure 40-10-4



Disconnect the tubeline (Item 1) **[Figure 40-10-4]** from the control valve.

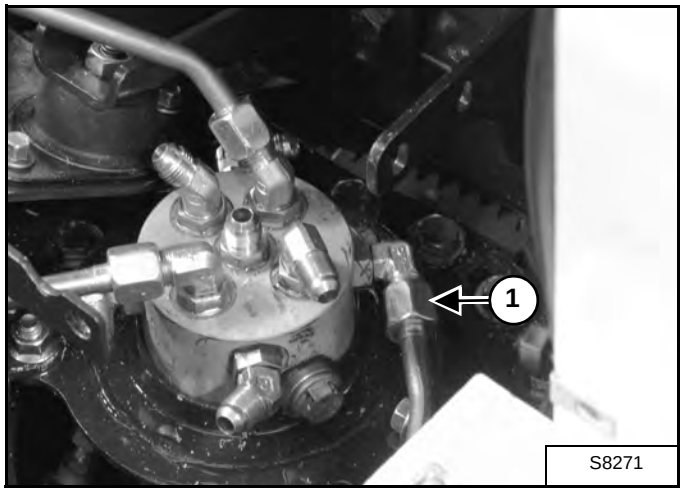
Figure 40-10-5



Disconnect the tubeline (Item 1) **[Figure 40-10-5]** from the swivel joint.

Remove the tubeline from the excavator for easy access to the swing circle gear bolts.

Figure 40-10-6



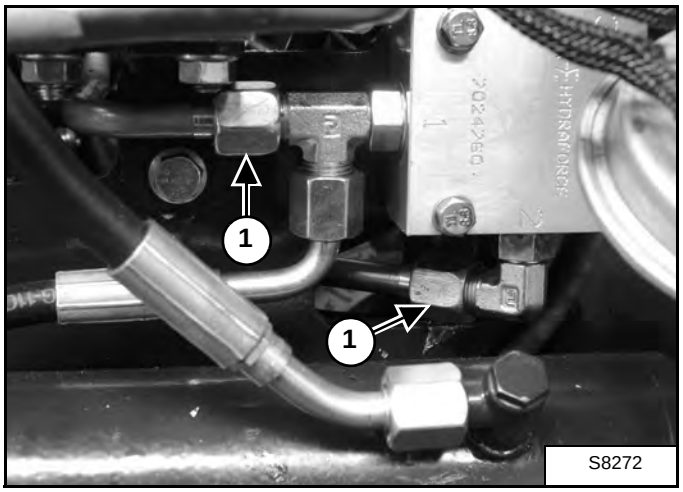
Disconnect the tubeline (Item 1) **[Figure 40-10-6]** from the swivel joint.

Remove the tubeline from the excavator for easy access to the swing circle gear bolts.

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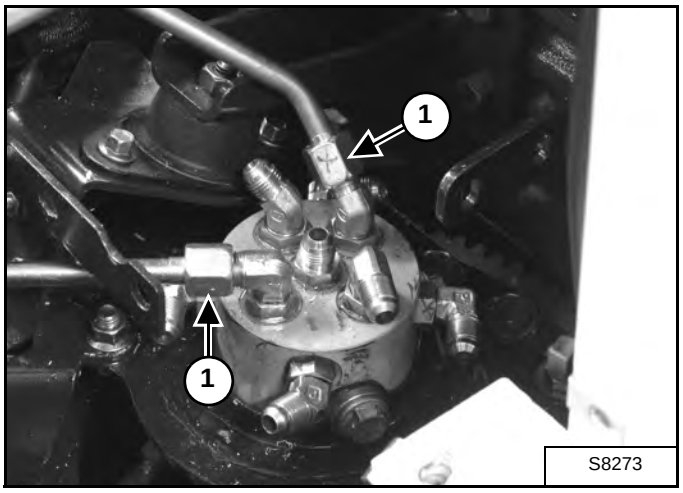
Removal (Cont'd)

Figure 40-10-7



Disconnect the two tubelines (Item 1) **[Figure 40-10-7]**.

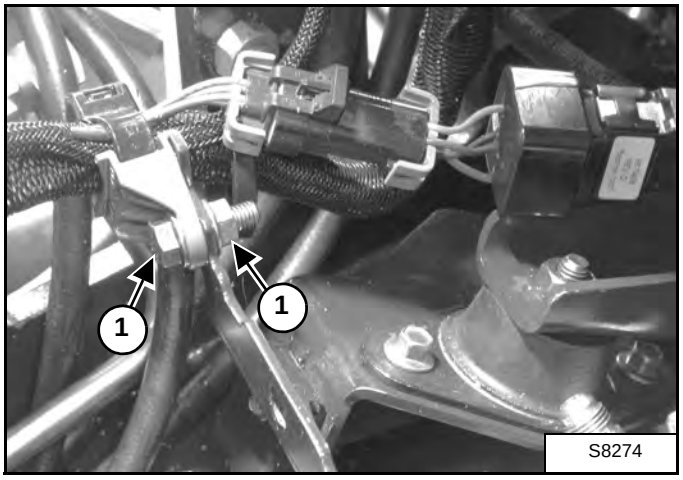
Figure 40-10-8



Disconnect the two tubelines (Item 1) **[Figure 40-10-8]** from the swivel joint.

Remove the tubelines from the excavator for easy access to the swing circle gear bolts.

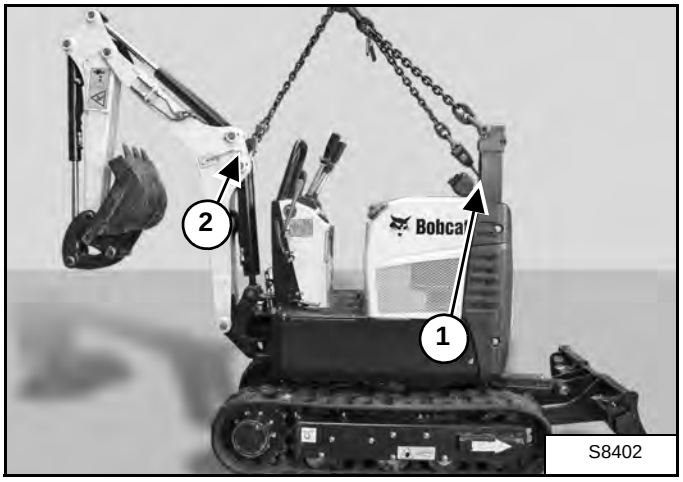
Figure 40-10-9



Remove the bolt and nut (Item 1) **[Figure 40-10-9]** from the cable bracket.

Move the cable bracket aside for easy access to swing circle gear bolts.

Figure 40-10-10



Install chains (Item 1) **[Figure 40-10-10]** in the rear TOPS mounting holes. Fasten the chains to the chain hoist.

Install chains (Item 2) **[Figure 40-10-10]** at the top of the boom. Fasten the chains to the chain hoist.

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Removal (Cont'd)

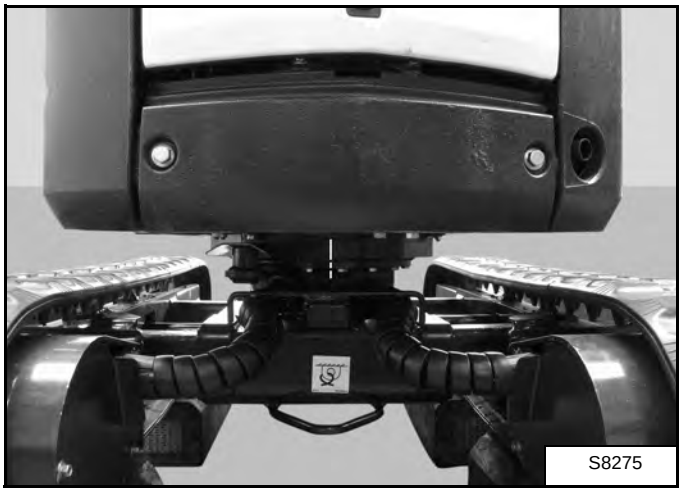
⚠ WARNING

AVOID INJURY OR DEATH

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

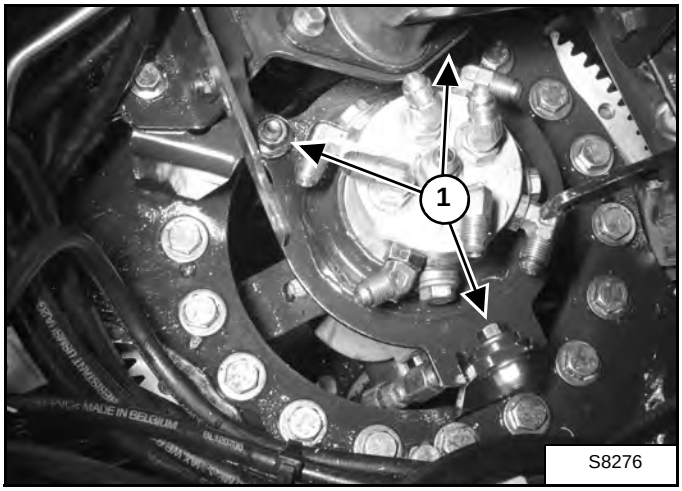
W-2202-0607

Figure 40-10-11



Mark the upperstructure to the swing bearing and to the track frame for ease of assembly **[Figure 40-10-11]**.

Figure 40-10-12



Remove the three swivel joint mount nuts (Item 1) **[Figure 40-10-12]**.

Figure 40-10-13

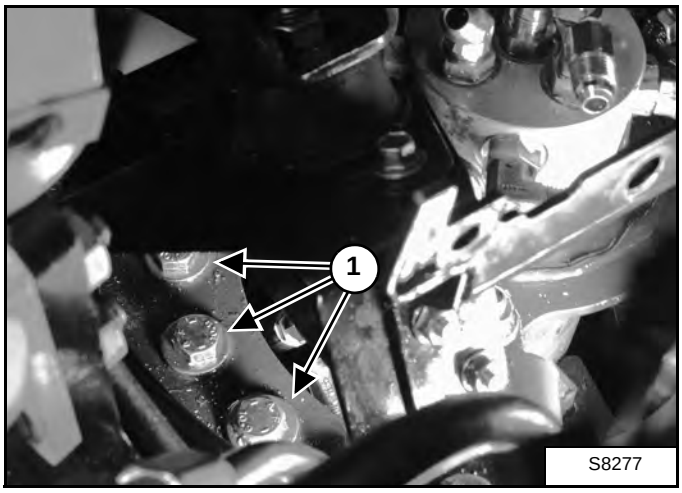
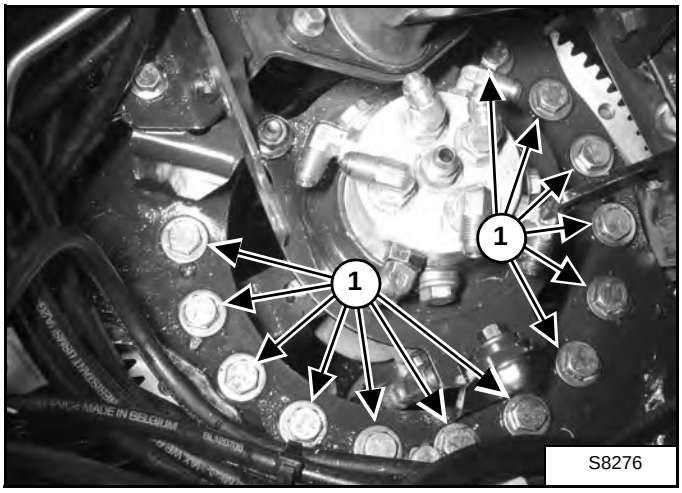


Figure 40-10-14



Remove the 18 bolts (Item 1) **[Figure 40-10-13]** and **[Figure 40-10-14]** 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

Install the lower right hand side cover. (See Lower Right Side Cover Removal And Installation on Page 40-210-3.)

Install the muffler. (See Removal And Installation on Page 60-20-1.)

Install the track expand valve.

Install the slew motor. (See Removal And Installation on Page 20-90-1.)

Install the floor panels. (See FLOOR PANELS on Page 40-120-1.)

Install the seat. (See Removal And Installation on Page 40-30-1.)

Fill the hydraulic reservoir. (See Removing And Replacing Hydraulic Fluid on Page 10-120-3.)

Install the TOPS. (See Removal And Installation on Page 40-20-1.)

Install the battery. (See Removal and Installation on Page 50-20-3.)

Figure 40-10-15

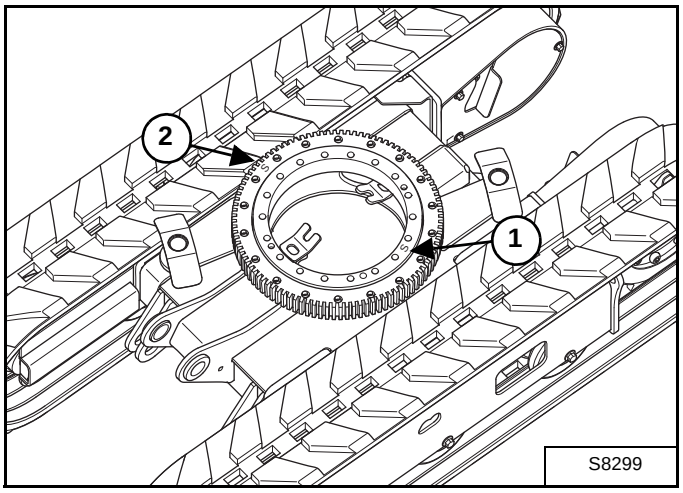
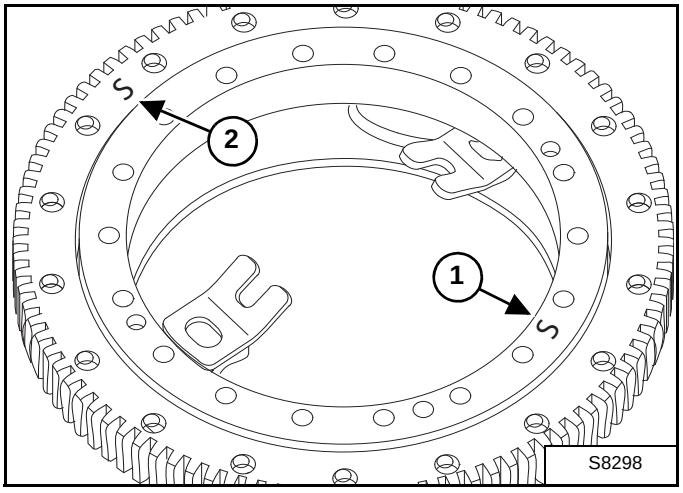


Figure 40-10-16



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 40-10-15]** and **[Figure 40-10-16]** stamped in the outer ring.

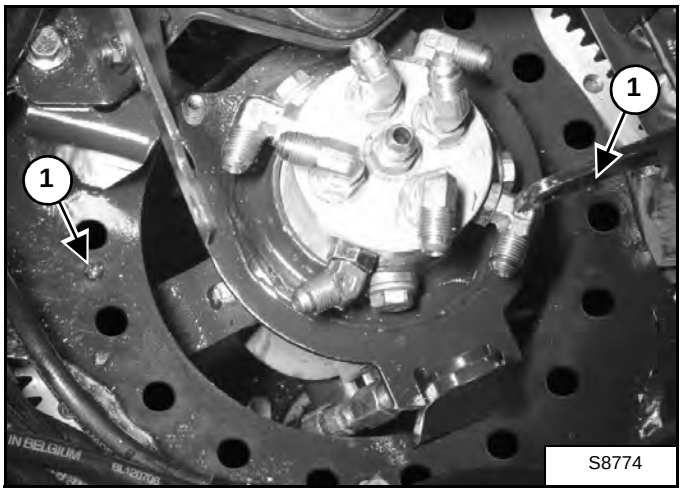
The soft zones of both the swing gear and outer ring must be positioned 180° of each other.

NOTE: Clean out the old excess Loctite® from all the 18 threaded holes in the slew bearing prior to installing the upperstructure.

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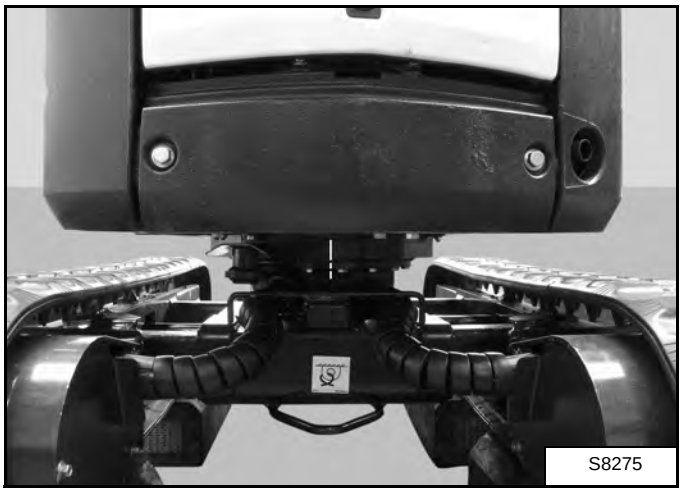
Installation (Cont'd)

Figure 40-10-17



Lower the upperstructure frame onto the swing bearing aligning the two pins (Item 1) **[Figure 40-10-17]**. Maintain a slight amount of weight on the hoist.

Figure 40-10-18



Check that upperstructure is properly aligned to the swing bearing and track frame **[Figure 40-10-18]**.

Figure 40-10-19

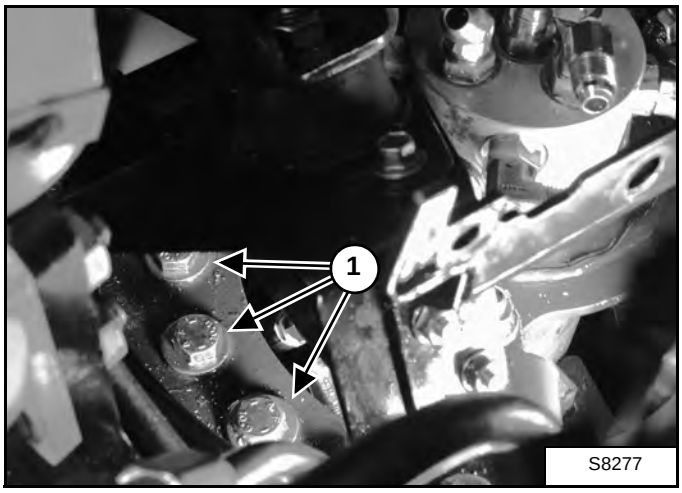
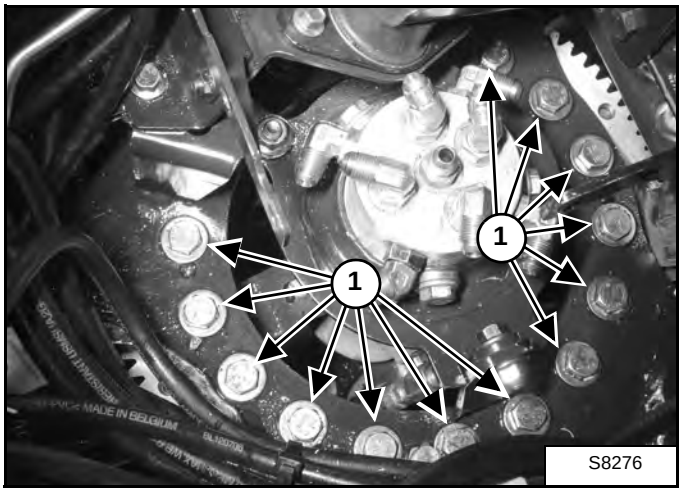


Figure 40-10-20



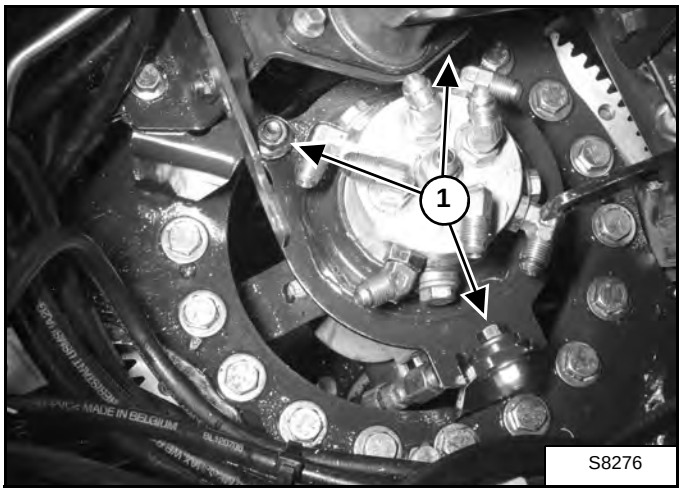
Apply Loctite® 243 or equivalent to bolts and install the 18 bolts and washers (Item 1) **[Figure 40-10-19]** and **[Figure 40-10-20]** through the upperstructure frame and into the swing bearing.

Tighten the bolts to 57 - 63 N•m (42 - 47 ft-lb) torque.

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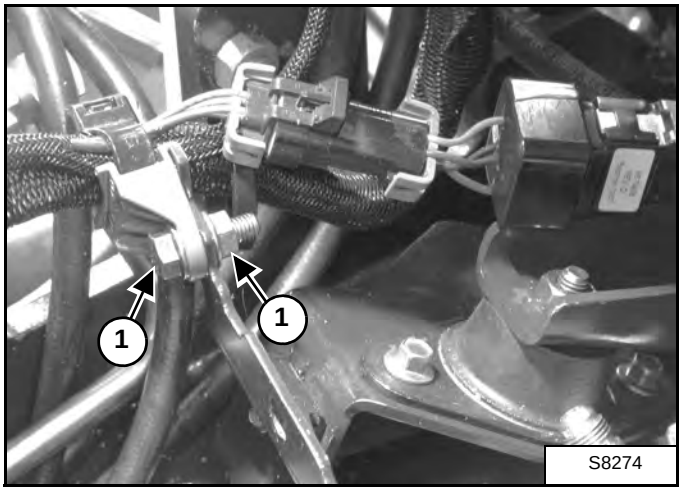
Installation (Cont'd)

Figure 40-10-21



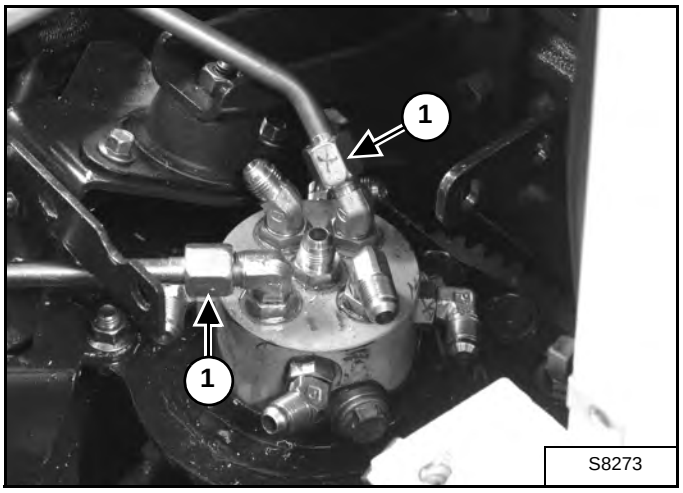
Install the three swivel joint mount nuts (Item 1) **[Figure 40-10-21]**.

Figure 40-10-22



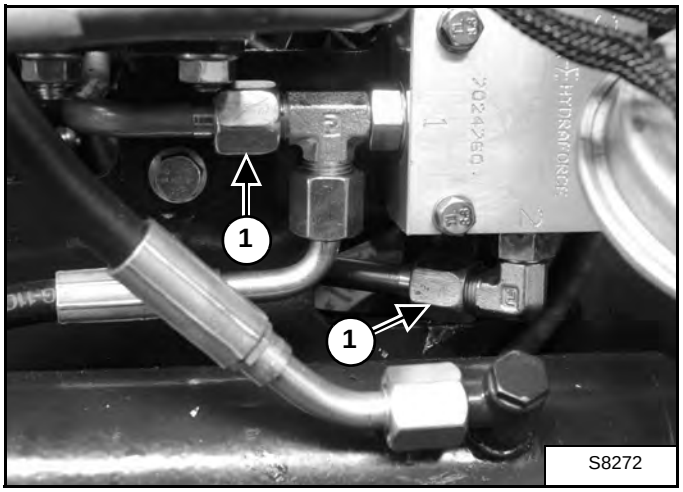
Install the bolt and nut (Item 1) **[Figure 40-10-22]** from the cable bracket.

Figure 40-10-23



Connect the two tubelines (Item 1) **[Figure 40-10-23]** on the swivel joint.

Figure 40-10-24

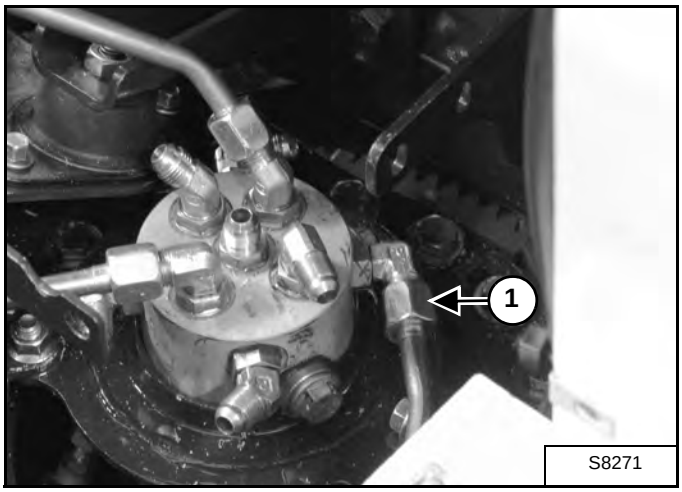


Connect the two tubelines (Item 1) **[Figure 40-10-24]**.

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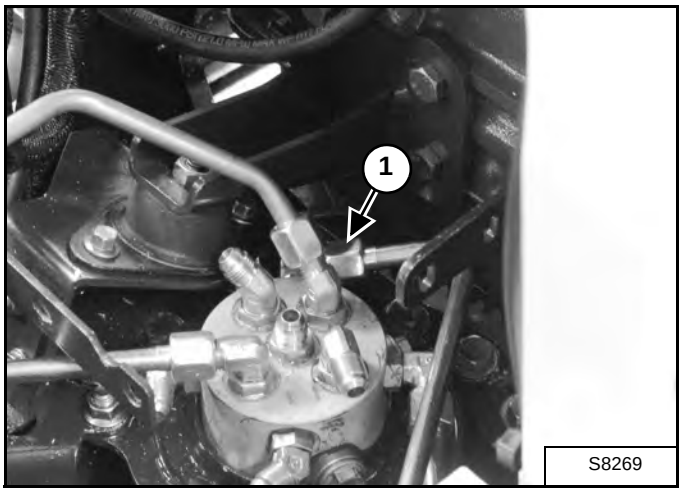
Installation (Cont'd)

Figure 40-10-25



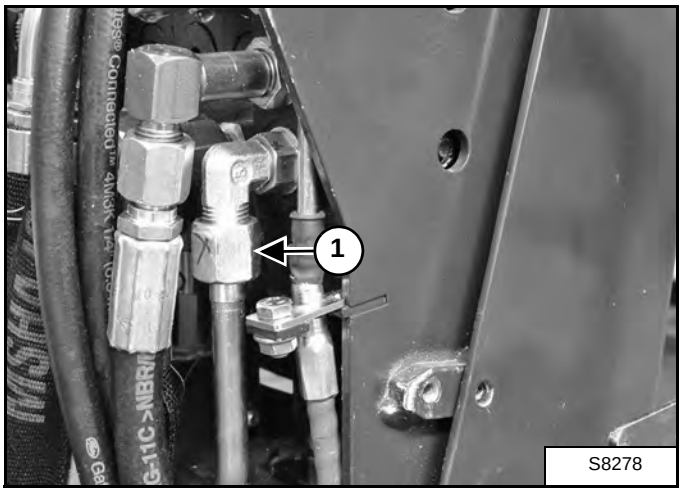
Connect the tubeline (Item 1) **[Figure 40-10-25]** on the swivel joint.

Figure 40-10-26



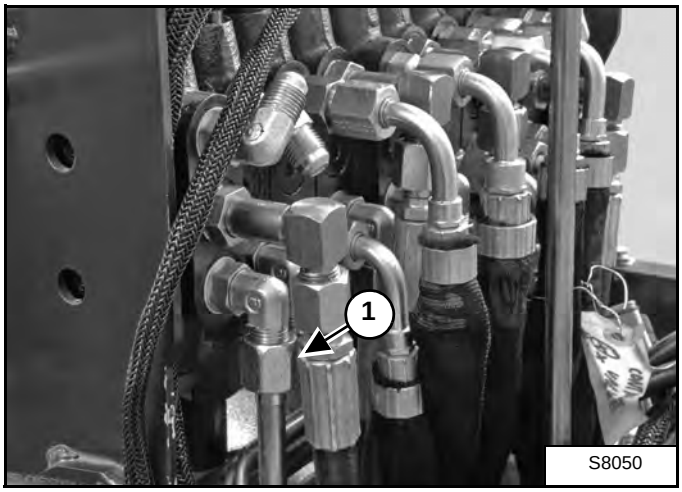
Connect the tubeline (Item 1) **[Figure 40-10-26]** on the swivel joint.

Figure 40-10-27



Connect the tubeline (Item 1) **[Figure 40-10-27]** on the control valve.

Figure 40-10-28

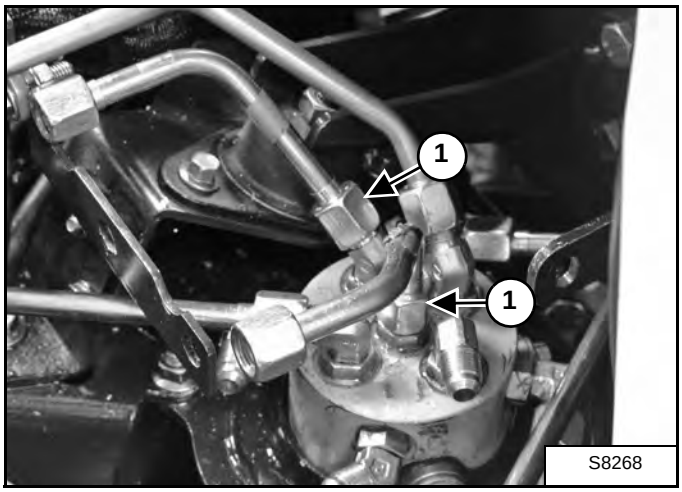


Connect the tubeline (Item 1) **[Figure 40-10-28]** on the control valve.

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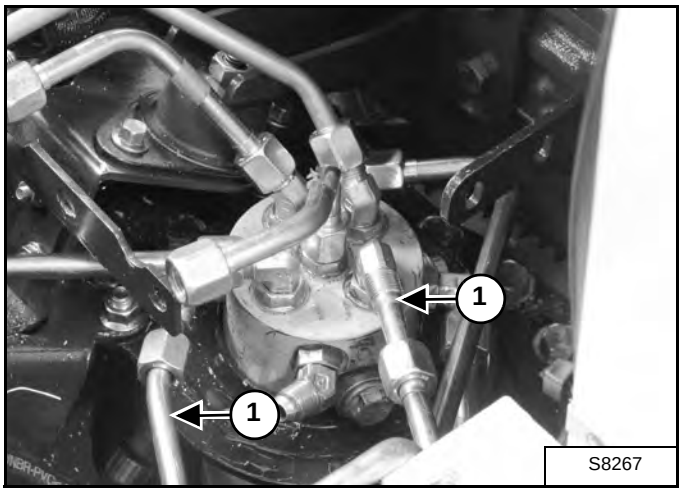
Installation (Cont'd)

Figure 40-10-29



Install the two tubelines (Item 1) **[Figure 40-10-29]** on the swivel joint.

Figure 40-10-30



Install the two tubelines (Item 1) **[Figure 40-10-30]** on the swivel joint.

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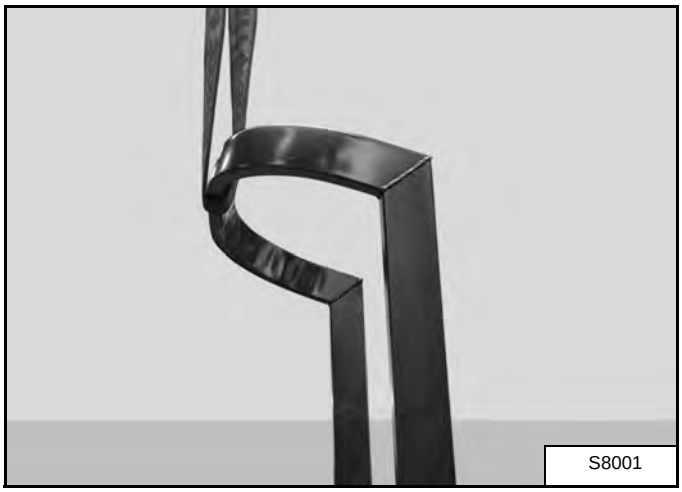


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TOPS

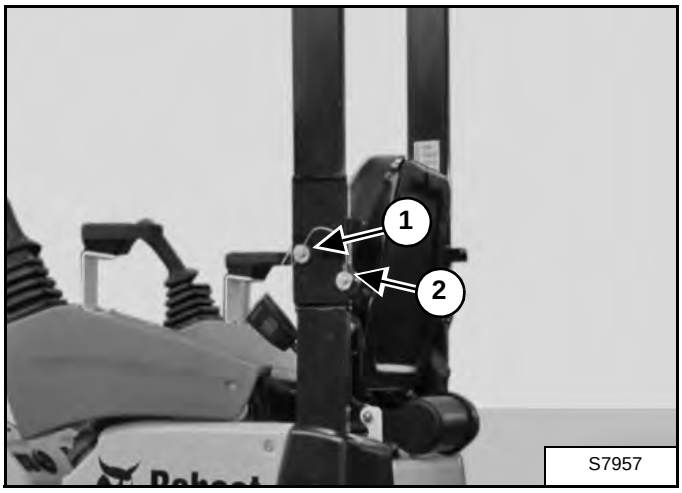
Removal And Installation

Figure 40-20-1



Put a strap around the TOPS to support while removing **[Figure 40-20-1]**.

Figure 40-20-2



Remove the pin (Item 1), bolt and nut (Item 2) **[Figure 40-20-2]** from both sides of the TOPS.

Installation: Tighten the bolts to 215 N•m (159 ft-lb) torque.

Remove the TOPS from the excavator.

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SEAT

Removal And Installation

Move the seat to the rear most position using the seat adjustment lever.

Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

Figure 40-30-1

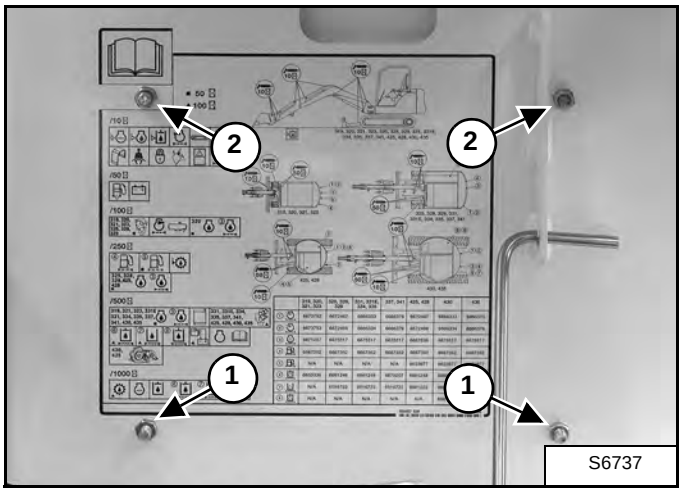
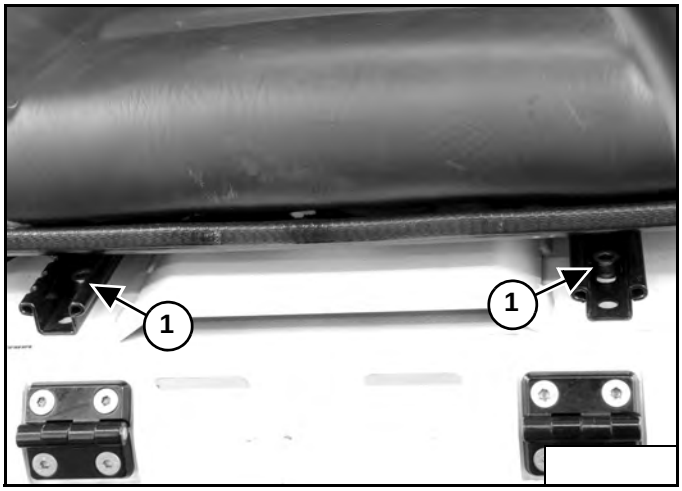


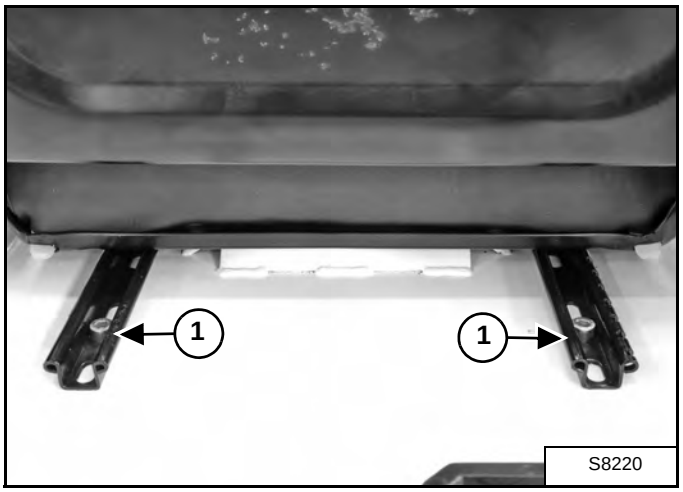
Figure 40-30-2



Remove the two nuts (Item 1) **[Figure 40-30-1]** and bolts (Item1) **[Figure 40-30-2]**.

Close the tailgate and move the seat completely forward using the seat adjustment lever.

Figure 40-30-3

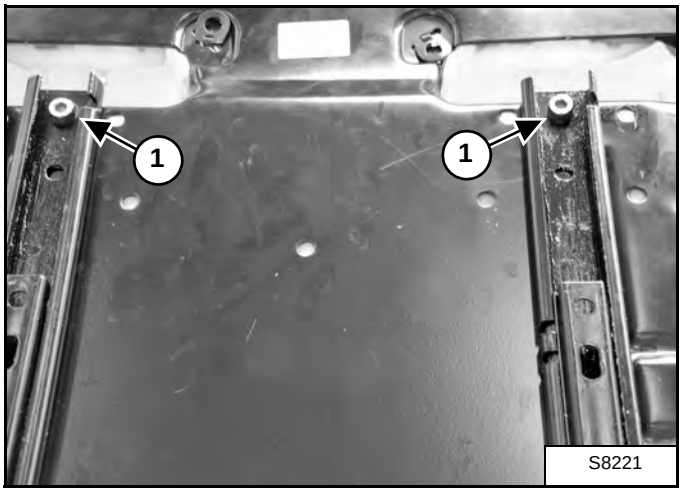


Open the tailgate.

Remove the two nuts (Item 2) **[Figure 40-30-1]** and bolts (Item1) **[Figure 40-30-3]**.

Remove the seat and seat rails from the tailgate.

Figure 40-30-4

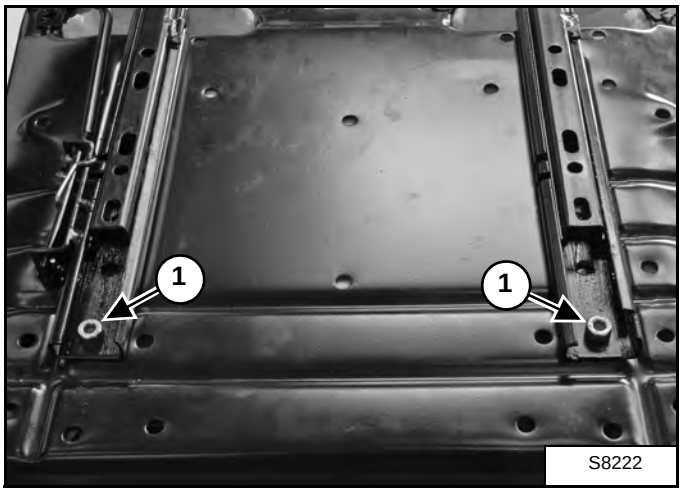


Remove the two bolts (Item 1) **[Figure 40-30-4]**.

Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

Figure 40-30-5



Remove the two bolts (Item 1) **[Figure 40-30-5]**.

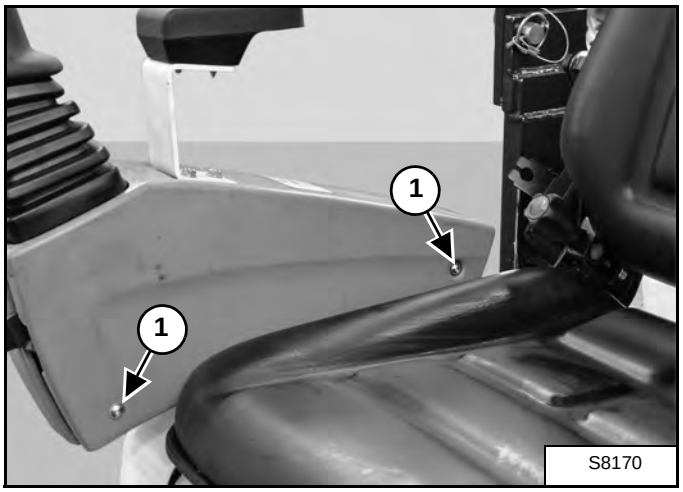
Remove the seat rails from the seat.

Dealer Copy -- Not for Resale

RIGHT CONSOLE

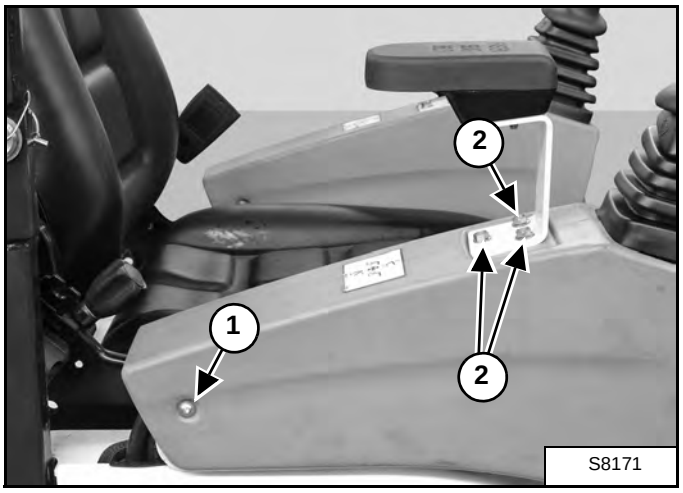
Joystick Console Cover Removal And Installation

Figure 40-40-1



Remove the bolts (Item 1) **[Figure 40-40-1]** from the joystick console cover.

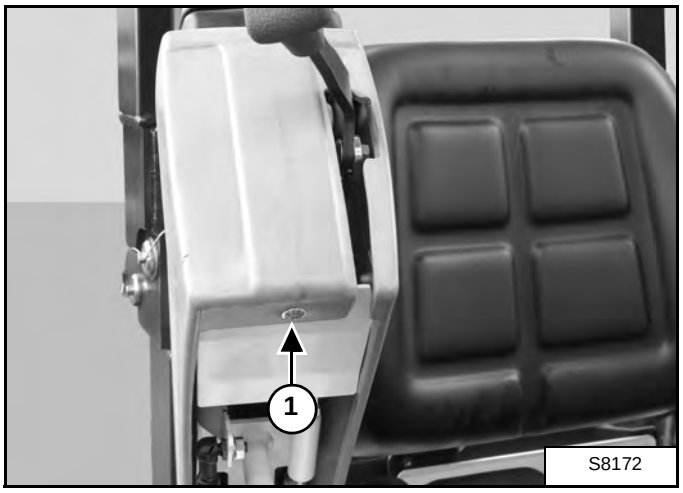
Figure 40-40-2



Remove the bolt (Item 1) **[Figure 40-40-2]** from the joystick console cover.

Remove the three bolts (Item 2) **[Figure 40-40-2]** from the armrest bracket.

Figure 40-40-3



Raise the right console.

Remove the bolt (Item 1) **[Figure 40-40-3]** from the joystick console cover.

Remove the joystick console cover.

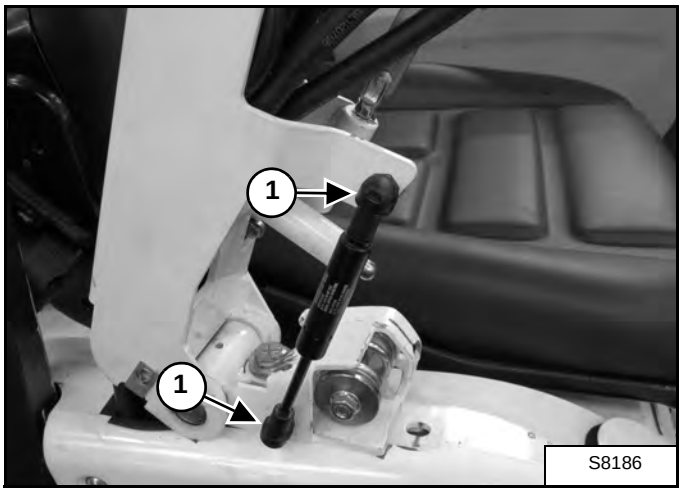
Dealer Copy -- Not for Resale

Gas Spring Removal And Installation

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

Raise and support the console.

Figure 40-40-4



Remove the two clips (Item 1) **[Figure 40-40-4]** from the gas spring.

Remove the gas spring from the top and bottom of the console.

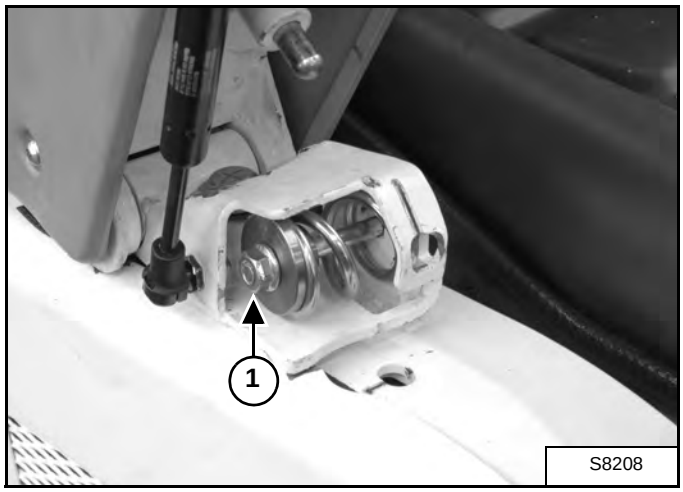
WARNING

Cylinder contains high pressure gas. Do not open. Opening cylinder can release rod and cause injury or death.

W-2113-0288

Compression Spring Removal And Installation

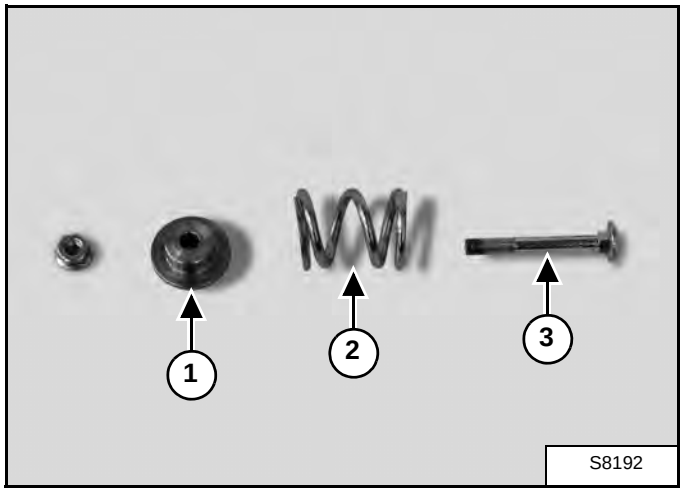
Figure 40-40-5



Raise the console.

Remove the nut (Item 1) **[Figure 40-40-5]** from the compression spring.

Figure 40-40-6



Remove the spring seat (Item 1), spring (Item 2), and bolt (Item 3) **[Figure 40-40-6]** from the console.

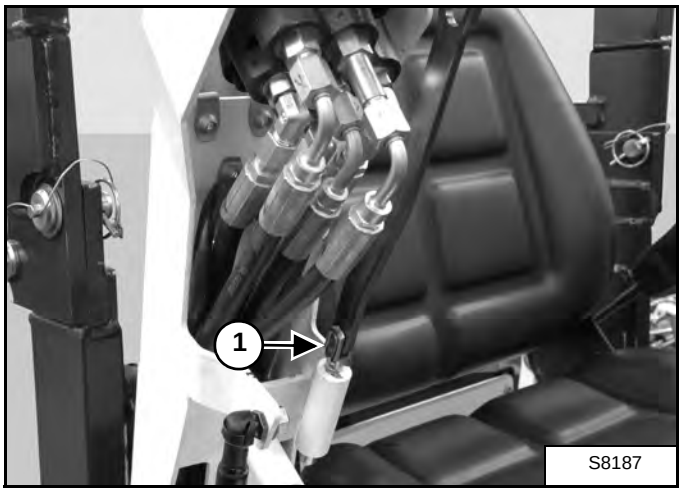
Dealer Copy -- Not for Resale

Lever Removal And Installation

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

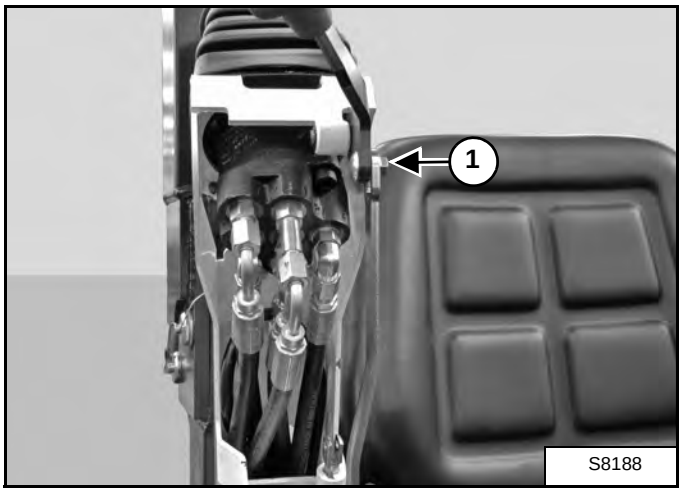
Raise the console.

Figure 40-40-7



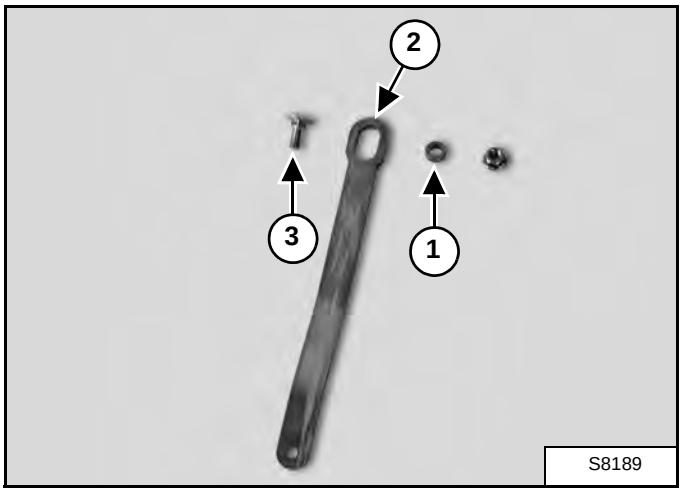
Remove the retaining clip (Item 1) **[Figure 40-40-7]** from the linkage.

Figure 40-40-8



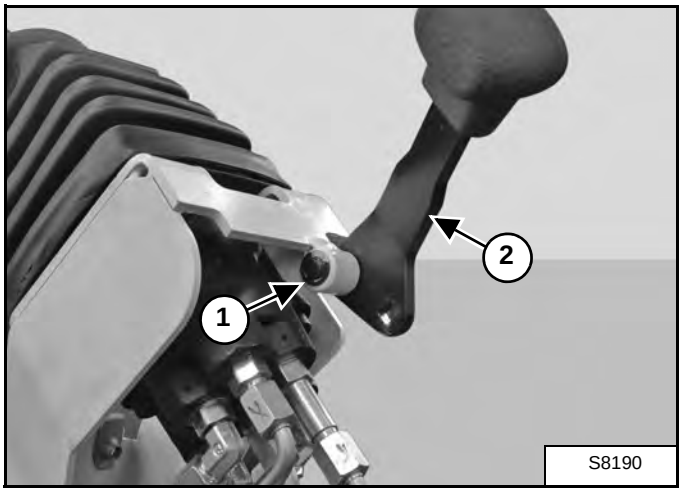
Remove the nut (Item 1) **[Figure 40-40-8]**.

Figure 40-40-9



Remove the bushing (Item 1), linkage (Item 2), and bolt (Item 3) **[Figure 40-40-9]**.

Figure 40-40-10



Remove the retaining clip (Item 1) **[Figure 40-40-10]**.

Remove the lever (Item 2) **[Figure 40-40-10]** from the console.

Dealer Copy -- Not for Resale

Joystick Console Frame Removal And Installation

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

Remove the microswitch. (See Right Console Microswitch Removal And Installation on Page 50-60-3.)

Remove the compression spring. (See Compression Spring Removal And Installation on Page 40-40-2.)

Remove the gas spring. (See Gas Spring Removal And Installation on Page 40-40-2.)

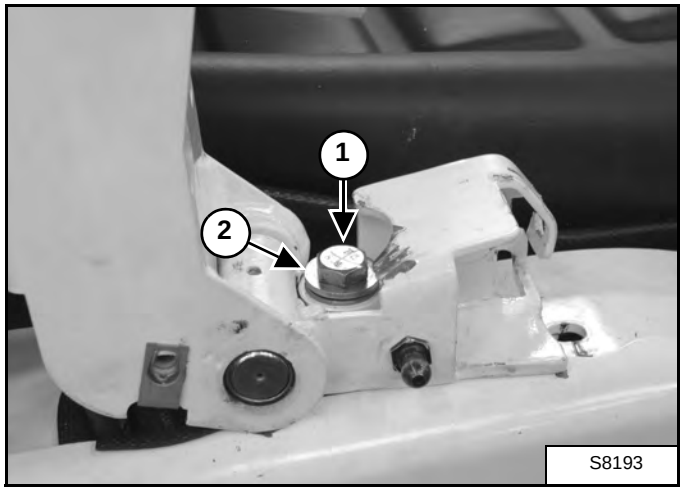
Remove the lever. (See Lever Removal And Installation on Page 40-40-3.)

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.

I-2003-0888

Figure 40-40-11

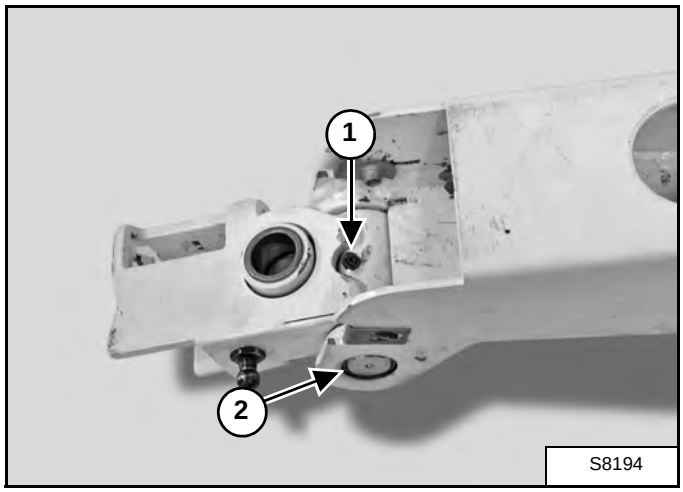


Remove the bolt (Item 1) and washer (Item 2) **[Figure 40-40-11]** from the console frame.

Remove the console frame from the excavator.

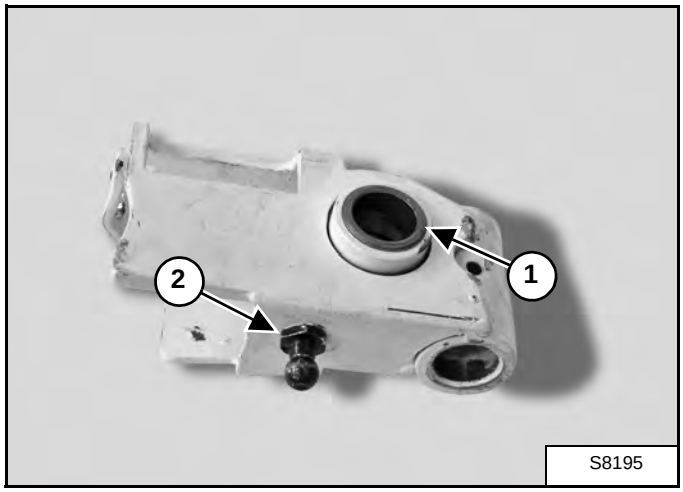
Joystick Console Frame Disassembly And Assembly

Figure 40-40-12



Remove the roll pin (Item 1) and pivot pin (Item 2) **[Figure 40-40-12]**.

Figure 40-40-13



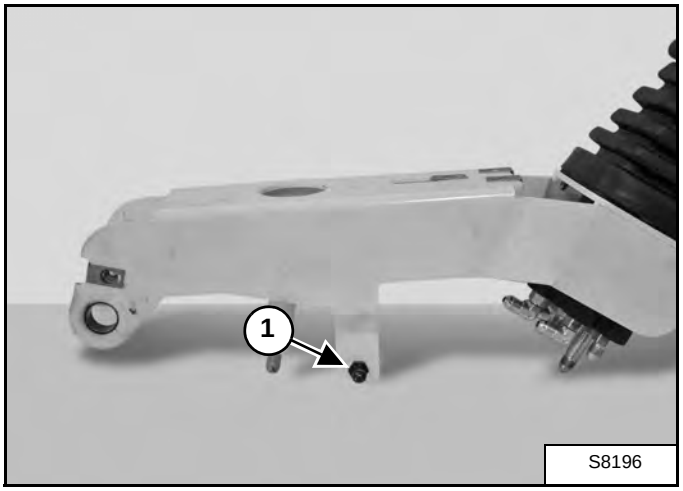
Remove the bushing (Item 1) **[Figure 40-40-13]**.

Remove the pin and nut (Item 2) **[Figure 40-40-13]**.

Dealer Copy -- Not for Resale

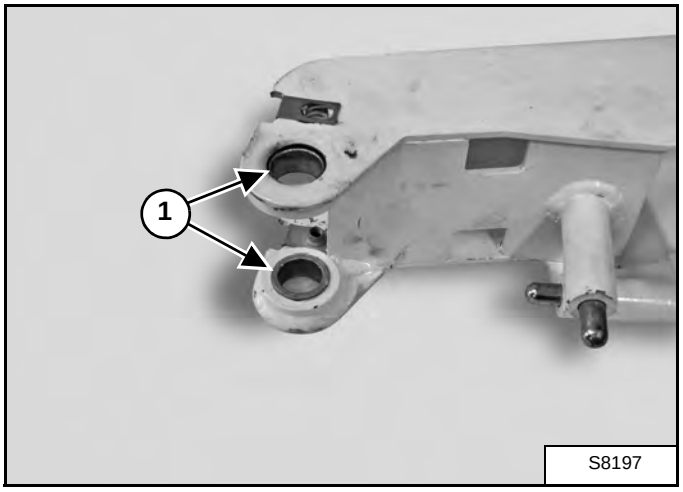
Joystick Console Frame Disassembly And Assembly (Cont'd)

Figure 40-40-14



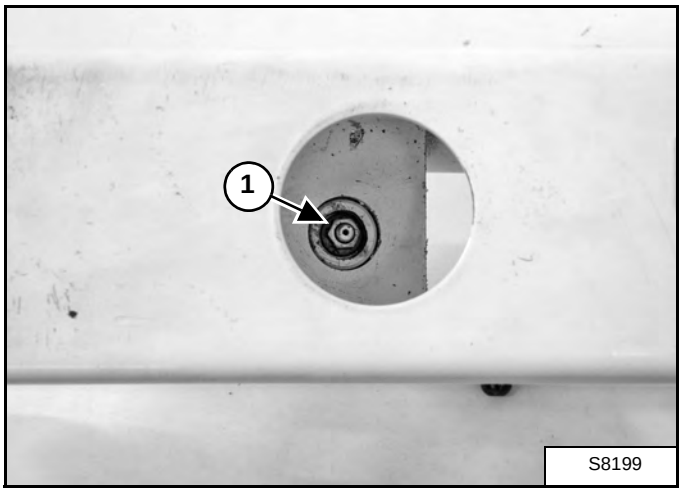
Remove the pin and nut (Item 1) **[Figure 40-40-14]**.

Figure 40-40-15



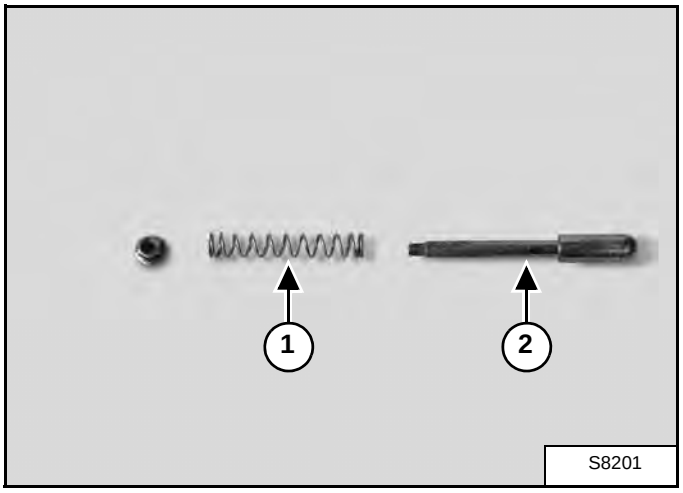
Remove the two bushings (Item 1) **[Figure 40-40-15]**.

Figure 40-40-16



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

Figure 40-40-17

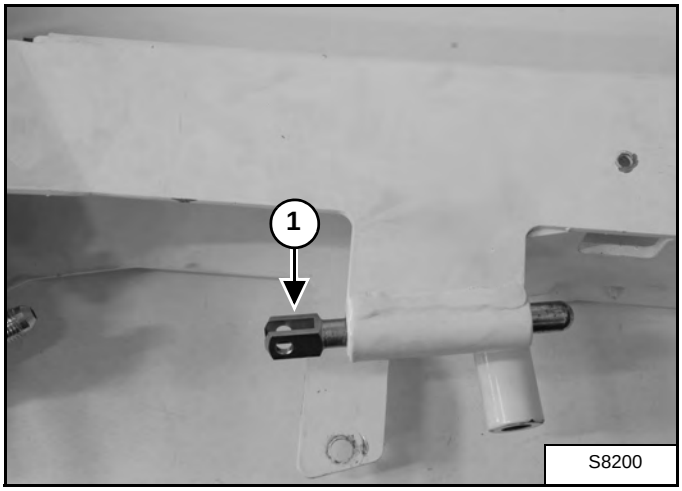


Remove the spring (Item 1) and pin (Item 2) **[Figure 40-40-17]**.

Dealer Copy -- Not for Resale

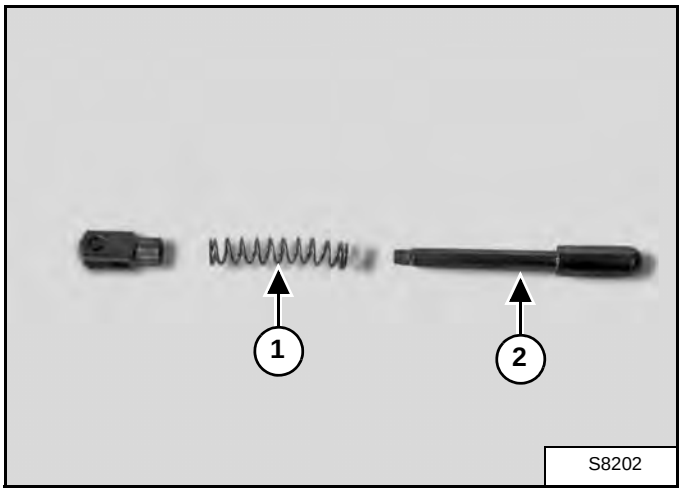
Joystick Console Frame Disassembly And Assembly (Cont'd)

Figure 40-40-18



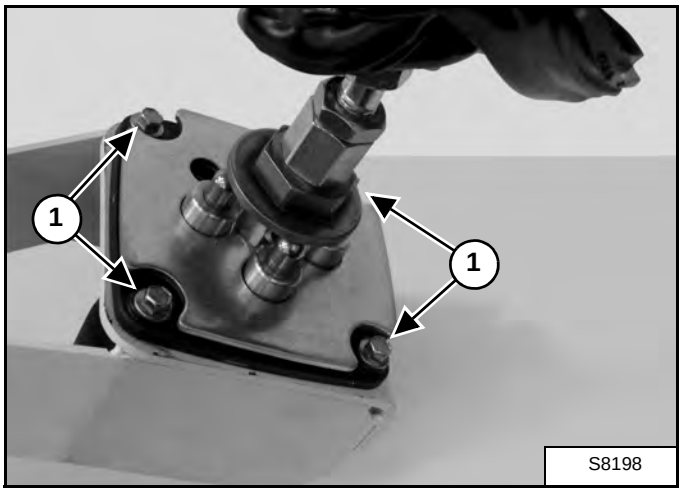
Remove the clevis end (Item 1) **[Figure 40-40-18]**.

Figure 40-40-19



Remove the spring (Item 1) and pin (Item 2) **[Figure 40-40-19]**.

Figure 40-40-20



Raise the dust boot.

Remove the screws (Item 1) **[Figure 40-40-20]** from the joystick bracket.

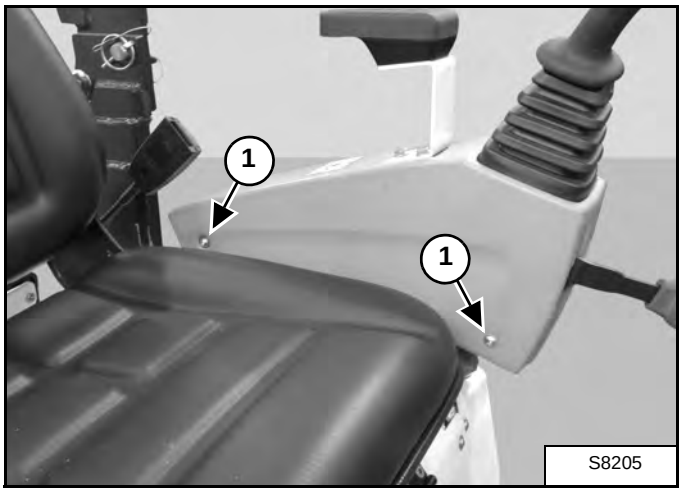
Remove the joystick from the console frame.

Dealer Copy -- Not for Resale

LEFT CONSOLE

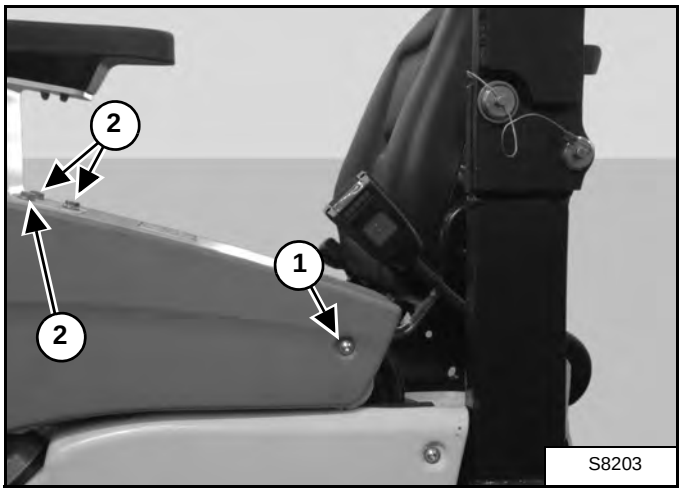
Joystick Console Cover Removal And Installation

Figure 40-50-1



Remove the bolts (Item 1) **[Figure 40-50-1]** from the joystick console cover.

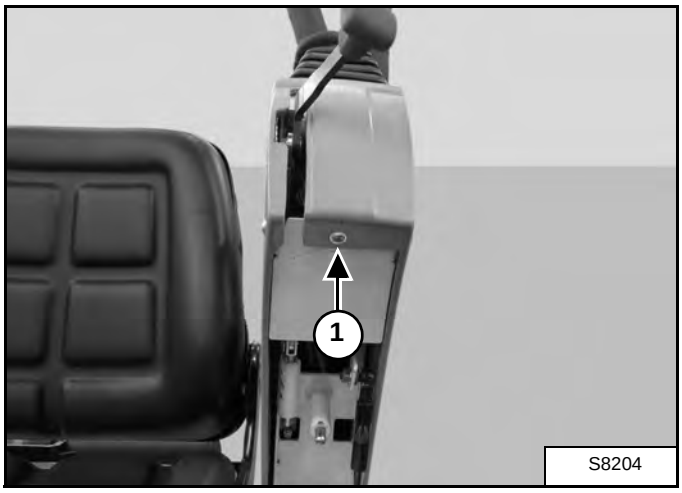
Figure 40-50-2



Remove the bolt (Item 1) **[Figure 40-50-2]** from the joystick console cover.

Remove the three bolts (Item 2) **[Figure 40-50-2]** from the armrest bracket.

Figure 40-50-3



Raise the left console.

Remove the bolt (Item 1) **[Figure 40-50-3]** from the joystick console cover.

Remove the joystick console cover.

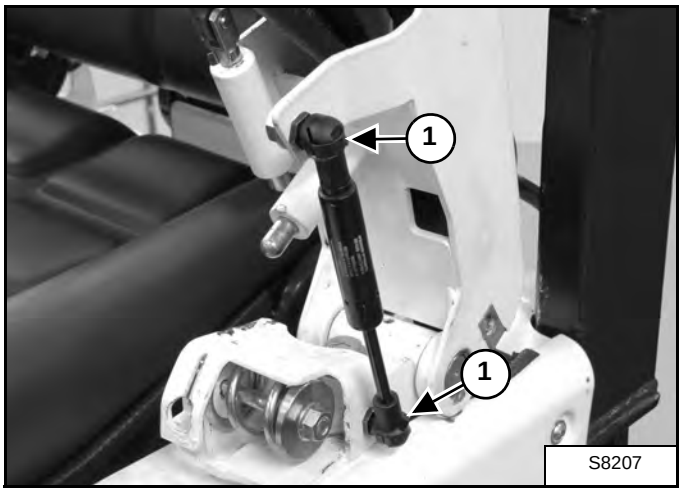
Dealer Copy -- Not for Resale

Gas Spring Removal And Installation

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

Raise and support the console.

Figure 40-50-4



Remove the two clips (Item 1) **[Figure 40-50-4]** from the gas spring.

Remove the gas spring from the top and bottom of the console.

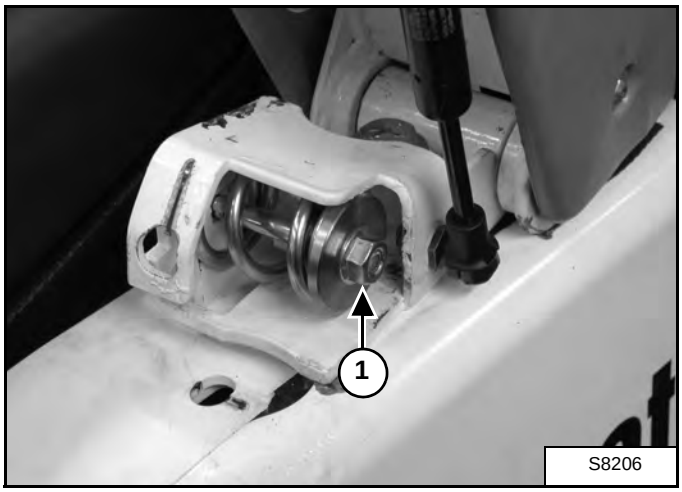
WARNING

Cylinder contains high pressure gas. Do not open. Opening cylinder can release rod and cause injury or death.

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Compression Spring Removal And Installation

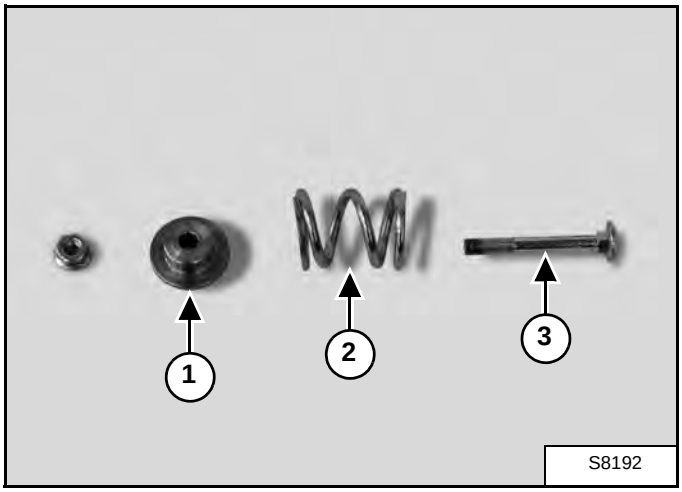
Figure 40-50-5



Raise the console.

Remove the nut (Item 1) **[Figure 40-50-5]** from the compression spring.

Figure 40-50-6



Remove the spring seat (Item 1), spring (Item 2), and bolt (Item 3) **[Figure 40-50-6]** from the console.

Dealer Copy -- Not for Resale

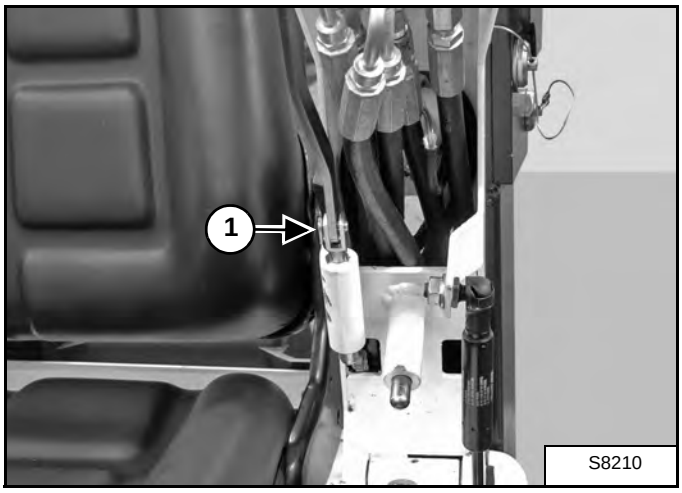
LEFT CONSOLE (CONT'D)

Lever Removal And Installation

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

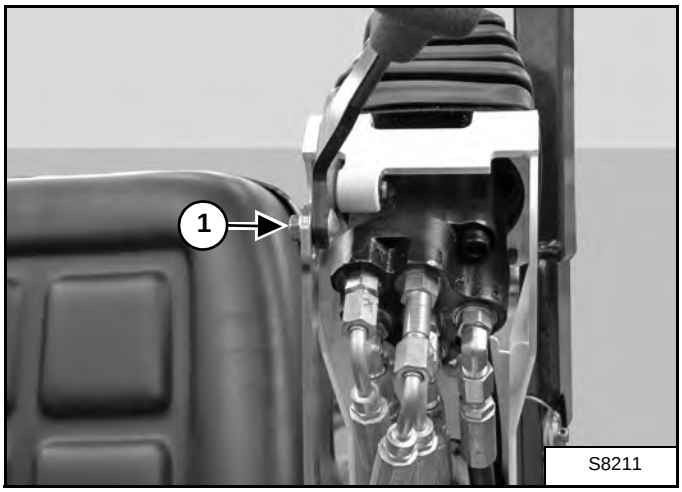
Raise the console.

Figure 40-50-7



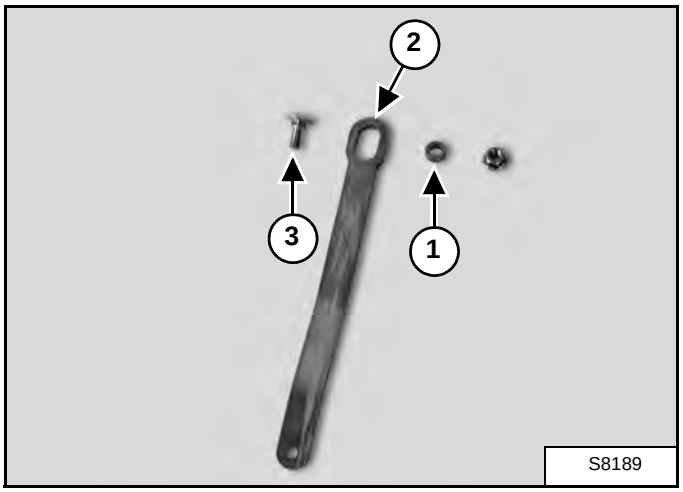
Remove the retaining clip (Item 1) **[Figure 40-50-7]** from the linkage.

Figure 40-50-8



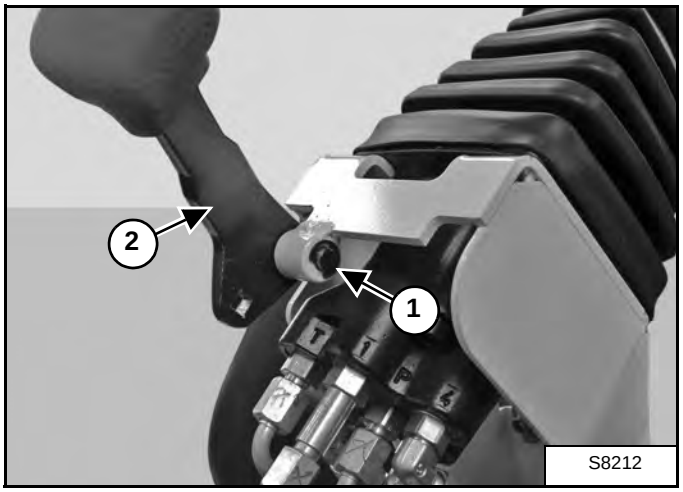
Remove the nut (Item 1) **[Figure 40-50-8]**.

Figure 40-50-9



Remove the bushing (Item 1), linkage (Item 2) and bolt (Item 3) **[Figure 40-50-9]**.

Figure 40-50-10



Remove the retaining clip (Item 1) **[Figure 40-50-10]**.

Remove the lever (Item 2) **[Figure 40-50-10]** from the console.

Dealer Copy -- Not for Resale

Joystick Console Frame Removal And Installation

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

Remove the microswitch. (See Left Console Microswitch Removal And Installation on Page 50-60-2.)

Remove the compression spring. (See Compression Spring Removal And Installation on Page 40-50-2.)

Remove the gas spring. (See Gas Spring Removal And Installation on Page 40-50-2.)

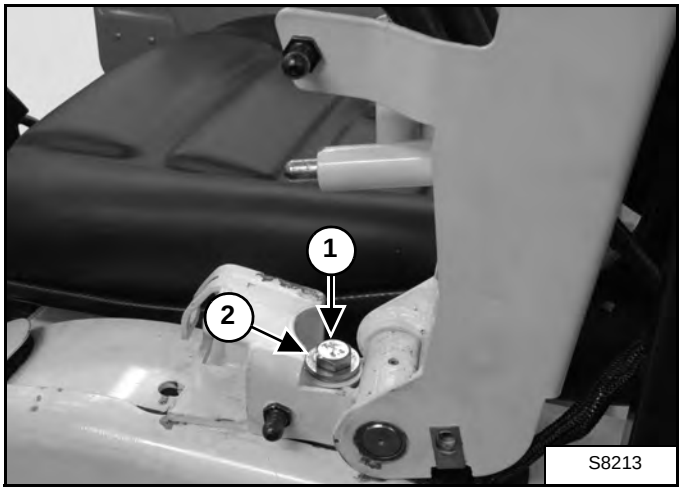
Remove the lever. (See Lever Removal And Installation on Page 40-50-3.)

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.

I-2003-0888

Figure 40-50-11

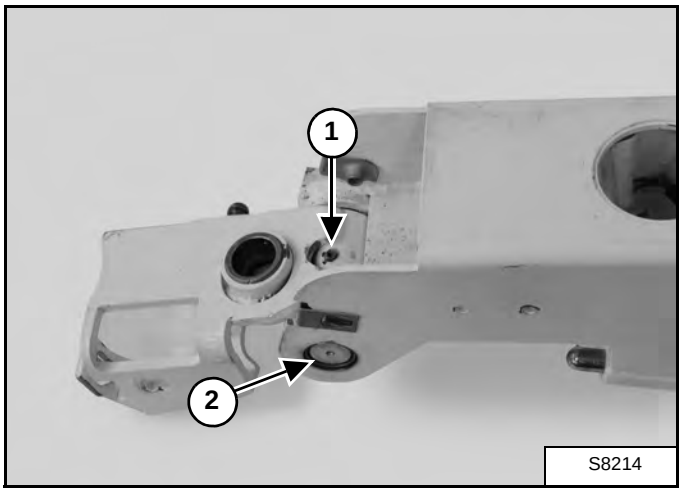


Remove the bolt (Item 1) and washer (Item 2) **[Figure 40-50-11]** from the console frame.

Remove the console frame from the excavator.

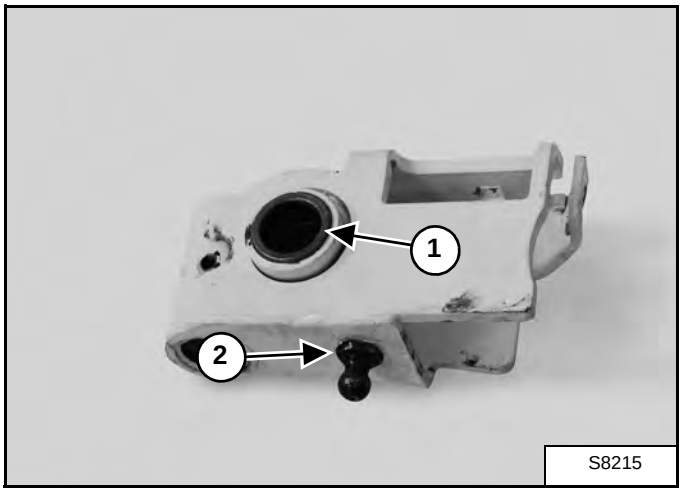
Joystick Console Frame Disassembly And Assembly

Figure 40-50-12



Remove the roll pin (Item 1) and pivot pin (Item 2) **[Figure 40-50-12]**.

Figure 40-50-13



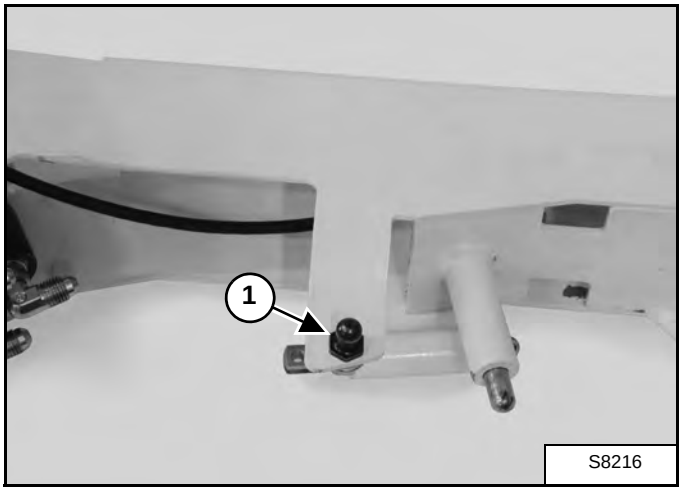
Remove the bushing (Item 1) **[Figure 40-50-13]**.

Remove the pin and nut (Item 2) **[Figure 40-50-13]**.

Dealer Copy -- Not for Resale

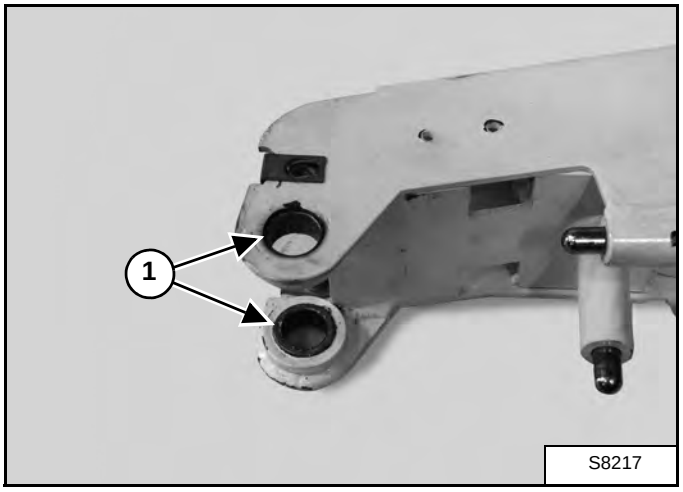
Joystick Console Frame Disassembly And Assembly (Cont'd)

Figure 40-50-14



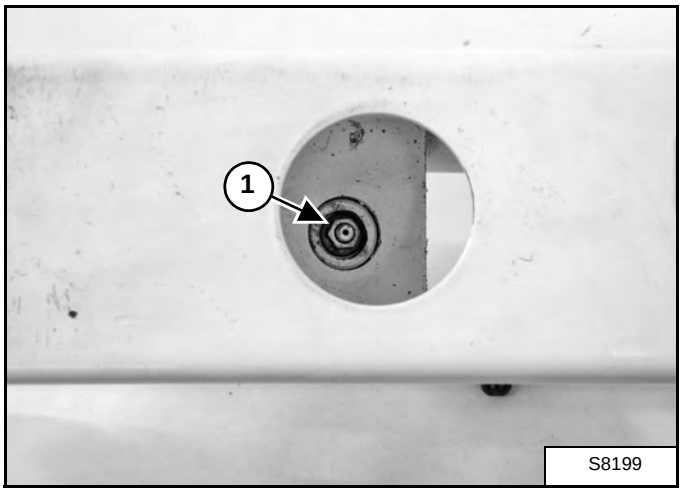
Remove the pin and nut (Item 1) **[Figure 40-50-14]**.

Figure 40-50-15



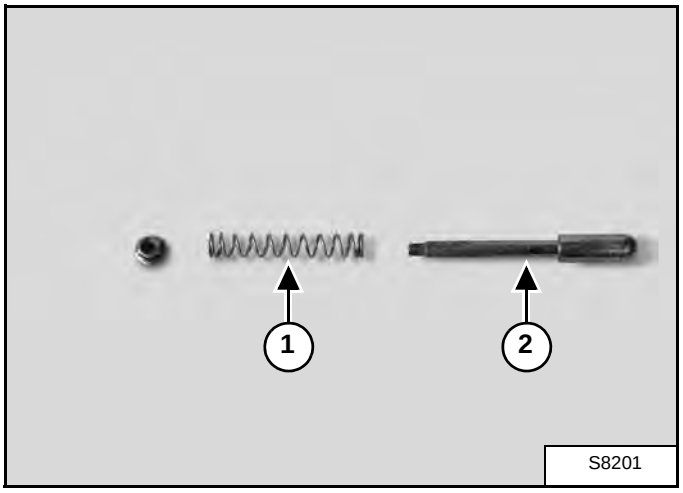
Remove the two bushings (Item 1) **[Figure 40-50-15]**.

Figure 40-50-16



Remove the nut (Item 1) **[Figure 40-50-16]**.

Figure 40-50-17

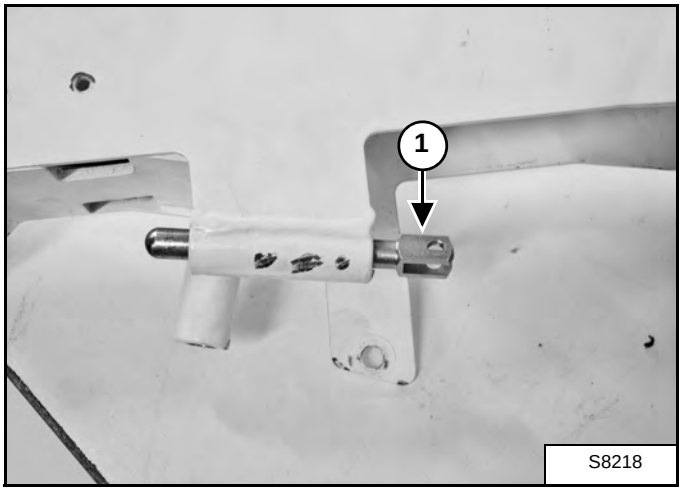


Remove the spring (Item 1) and pin (Item 2) **[Figure 40-50-17]**.

Dealer Copy -- Not for Resale

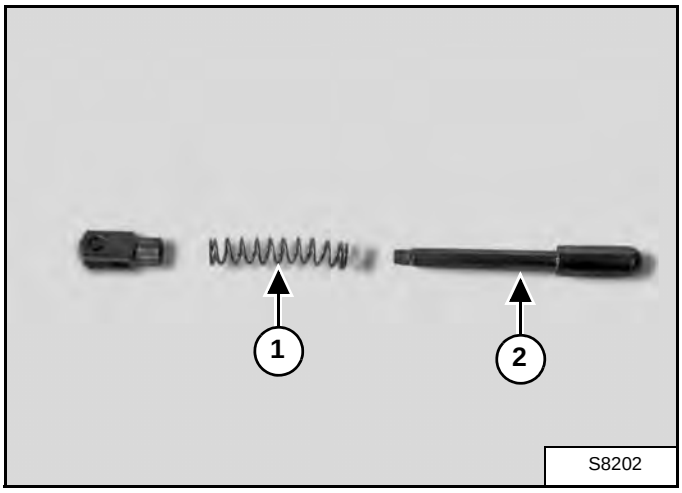
Joystick Console Frame Disassembly And Assembly (Cont'd)

Figure 40-50-18



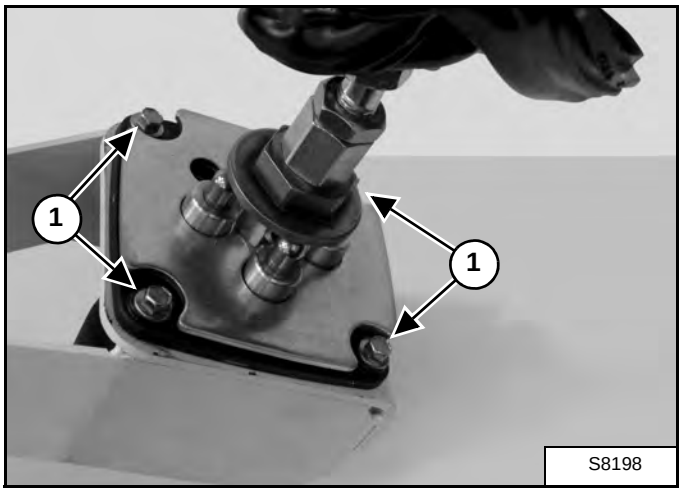
Remove the clevis end (Item 1) **[Figure 40-50-18]**.

Figure 40-50-19



Remove the spring (Item 1) and pin (Item 2) **[Figure 40-50-19]**.

Figure 40-50-20



Raise the dust boot.

Remove the screws (Item 1) **[Figure 40-50-20]** from the joystick bracket.

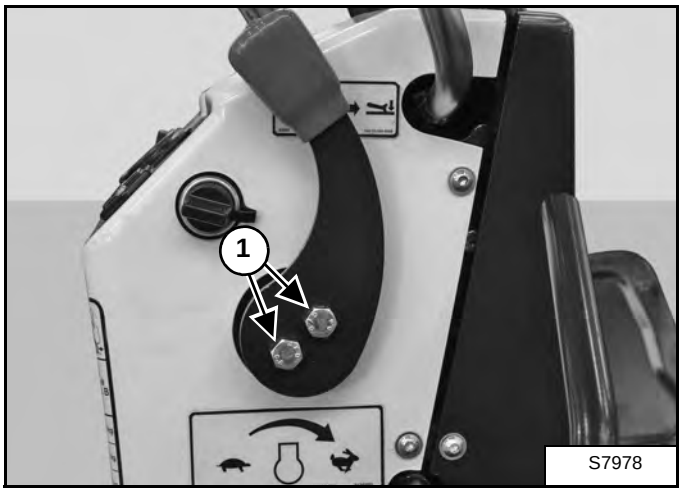
Remove the joystick from the console frame.

Dealer Copy -- Not for Resale

ENGINE SPEED CONTROL

Removal And Installation

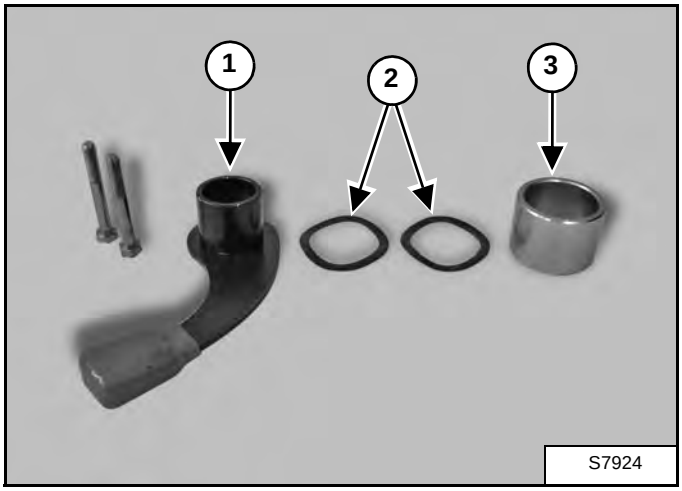
Figure 40-60-1



Remove the two bolts (Item 1) **[Figure 40-60-1]** from the throttle lever.

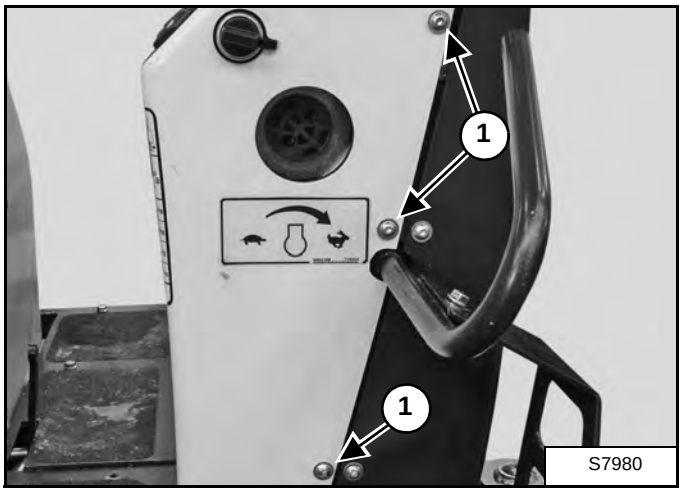
Installation: Tighten the two bolts (Item 1) **[Figure 40-60-1]** evenly until the throttle lever moves back and forth at a comfortable tension.

Figure 40-60-2



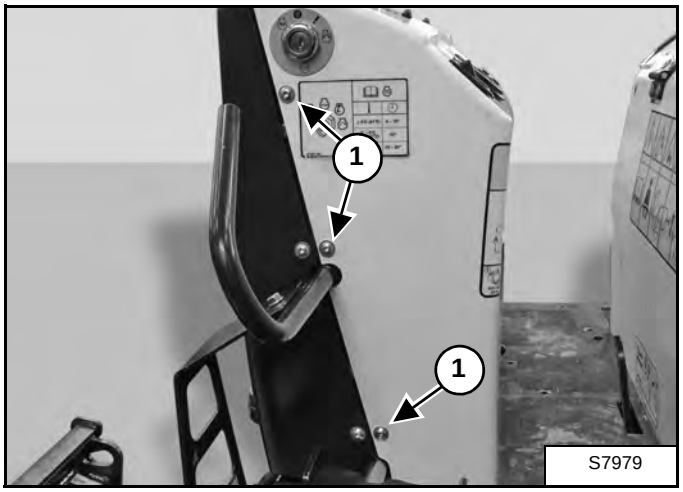
Remove the lever (Item 1), the two wave washers (Item 2), and the spacer (Item 3) **[Figure 40-60-2]**.

Figure 40-60-3



Remove the three bolts (Item 1) **[Figure 40-60-3]** from the right hand side of the instrument panel.

Figure 40-60-4



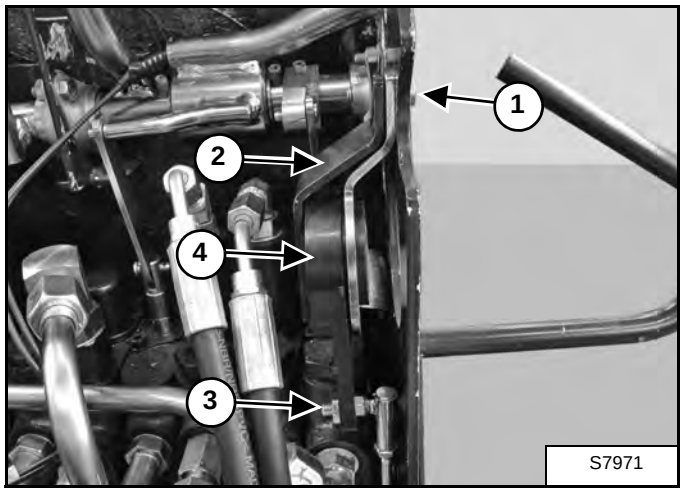
Remove the three bolts (Item 1) **[Figure 40-60-4]** from the left hand side of the instrument panel.

Move the instrument panel to one side to provide extra clearance for easy access to engine speed control.

Dealer Copy -- Not for Resale

Removal And Installation (Cont'd)

Figure 40-60-5



Remove the bolt (Item 1) and bracket (Item 2) **[Figure 40-60-5]**.

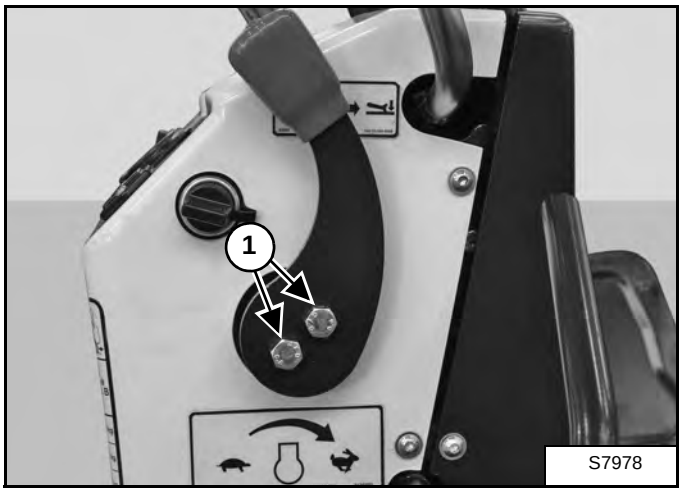
Remove the nut (Item 3) **[Figure 40-60-5]** from the throttle linkage and remove throttle cable.

Remove the spacer (Item 4) **[Figure 40-60-5]** from the throttle lever.

Dealer Copy -- Not for Resale

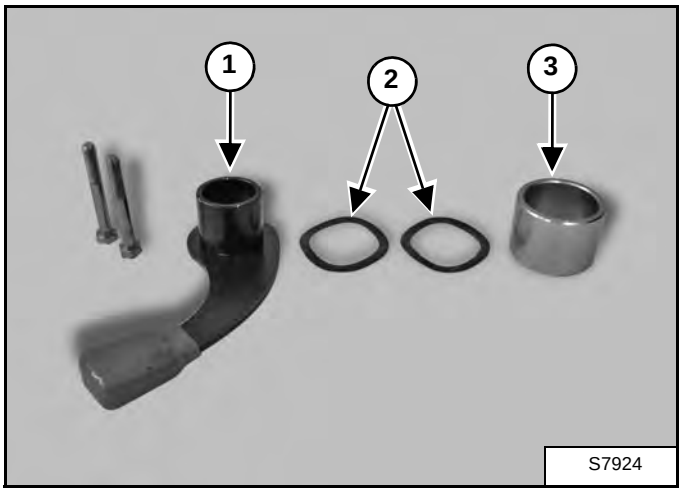
Cable Removal

Figure 40-60-6



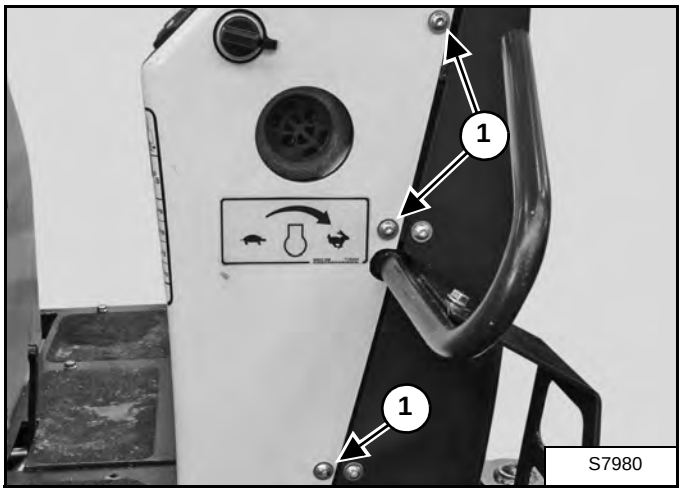
Remove the two bolts (Item 1) **[Figure 40-60-6]** from the throttle lever.

Figure 40-60-7



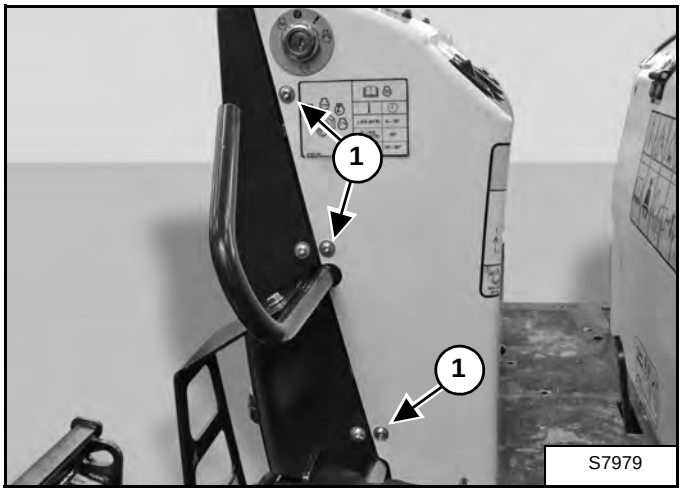
Remove the lever (Item 1), the two wave washers (Item 2), and the spacer (Item 3) **[Figure 40-60-7]**.

Figure 40-60-8



Remove the three bolts (Item 1) **[Figure 40-60-8]** from the right hand side of the instrument panel.

Figure 40-60-9



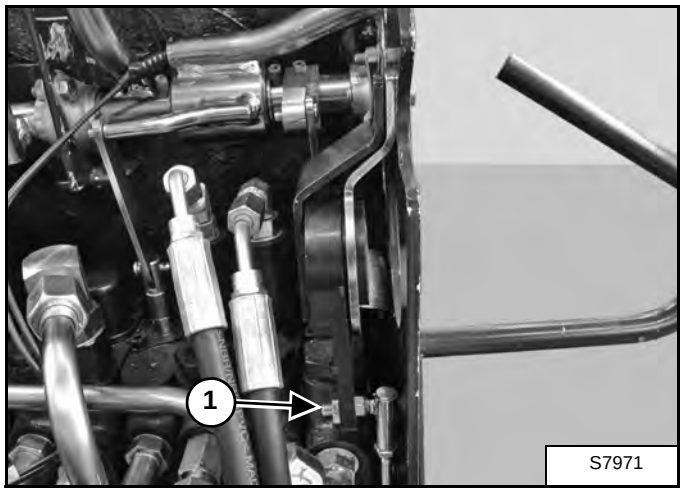
Remove the three bolts (Item 1) **[Figure 40-60-9]** from the left side of the instrument panel.

Move the instrument panel to one side to provide extra clearance for easy access to engine speed control.

Dealer Copy -- Not for Resale

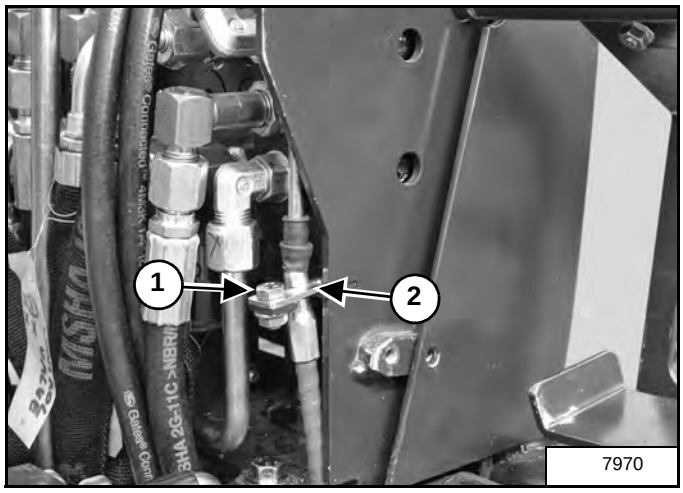
Cable Removal (Cont'd)

Figure 40-60-10



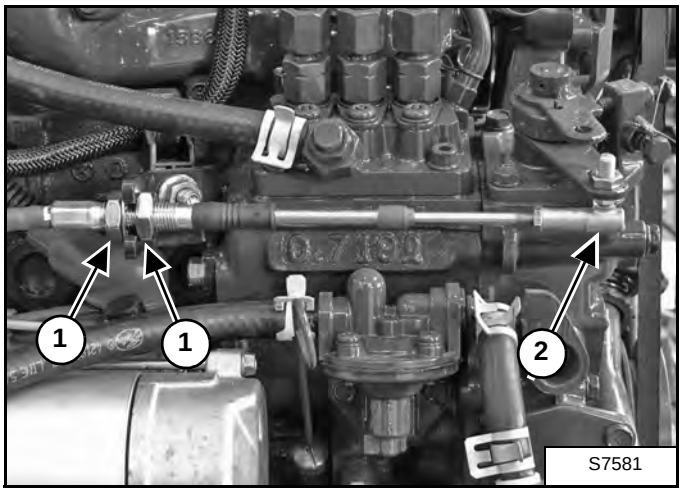
Remove the nut (Item 1) **[Figure 40-60-10]** from the throttle linkage and remove throttle cable.

Figure 40-60-11



Remove the bolt and nut (Item 1) and bracket (Item 2) **[Figure 40-60-11]**.

Figure 40-60-12

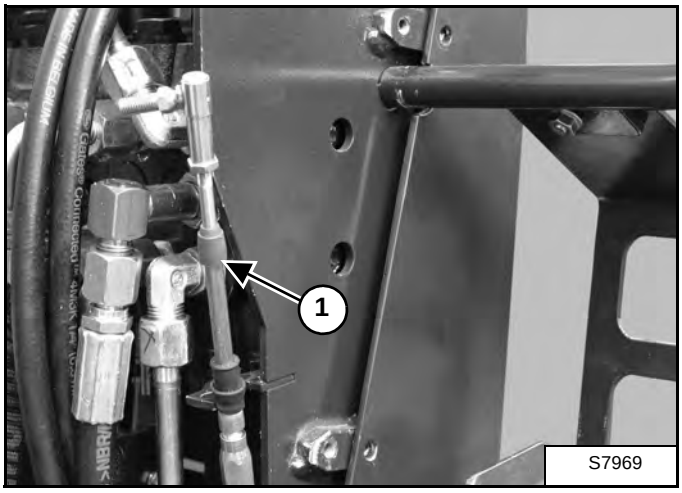


Loosen the nuts (Item 1) **[Figure 40-60-12]** fastening the cable to the bracket.

Disconnect the linkage (Item 2) **[Figure 40-60-12]** from the bracket.

Move the cable away from the engine.

Figure 40-60-13

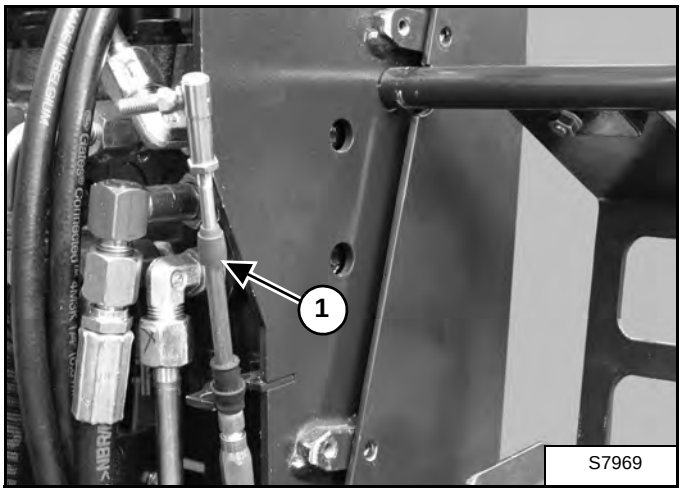


Pull the cable (Item 1) **[Figure 40-60-13]** out the back of the excavator.

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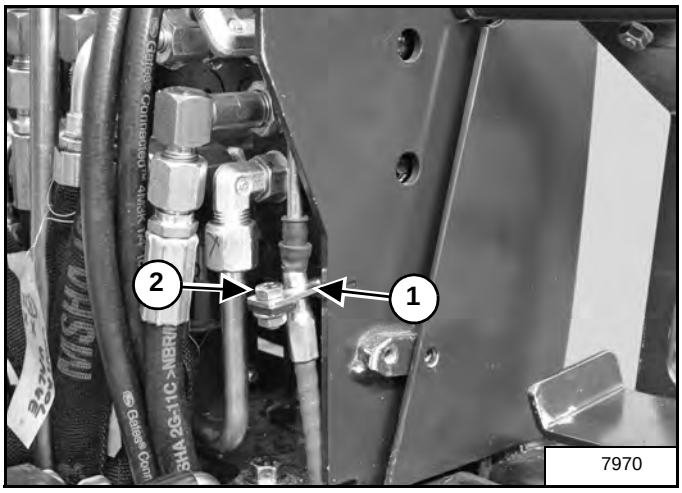
Cable Installation

Figure 40-60-14



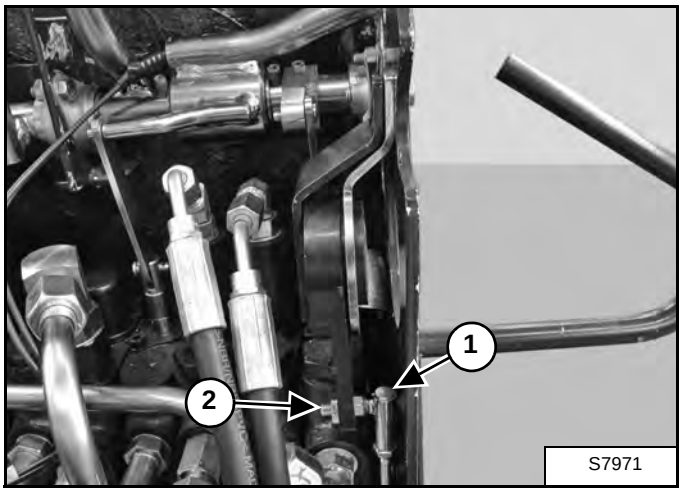
Position the throttle cable (Item 1) **[Figure 40-60-14]**.

Figure 40-60-15



Install the bracket (Item 1) and bolt and nut (Item 2) **[Figure 40-60-15]**.

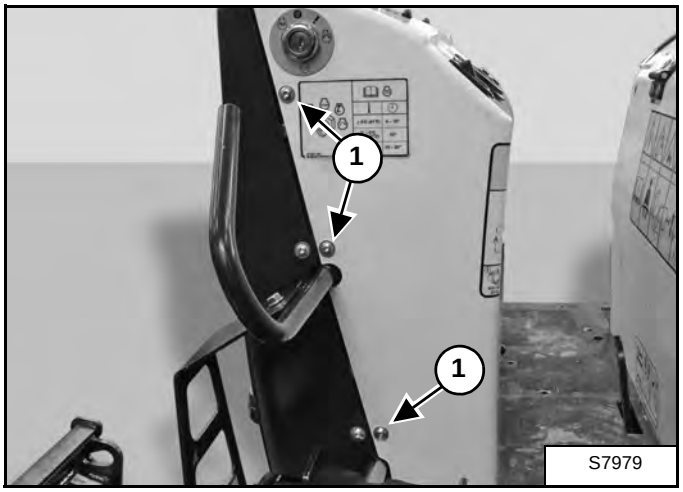
Figure 40-60-16



Insert the throttle cable (Item 1) **[Figure 40-60-16]** through the throttle linkage.

Install the nut (Item 2) **[Figure 40-60-16]**.

Figure 40-60-17

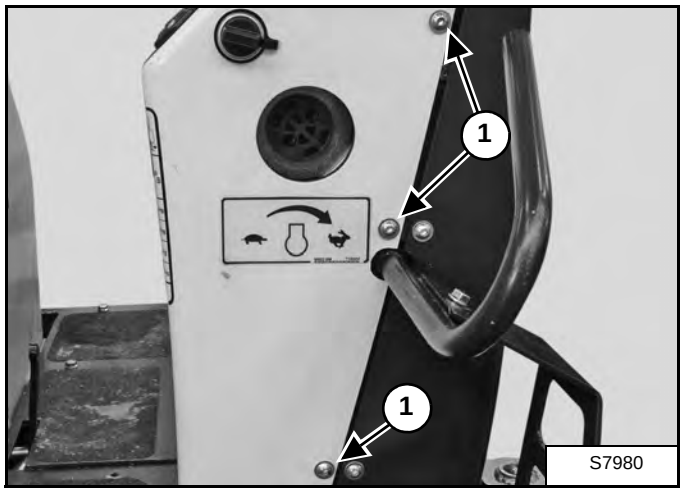


Install the three bolts (Item 1) **[Figure 40-60-17]** on the left side of the instrument panel.

Dealer Copy -- Not for Resale

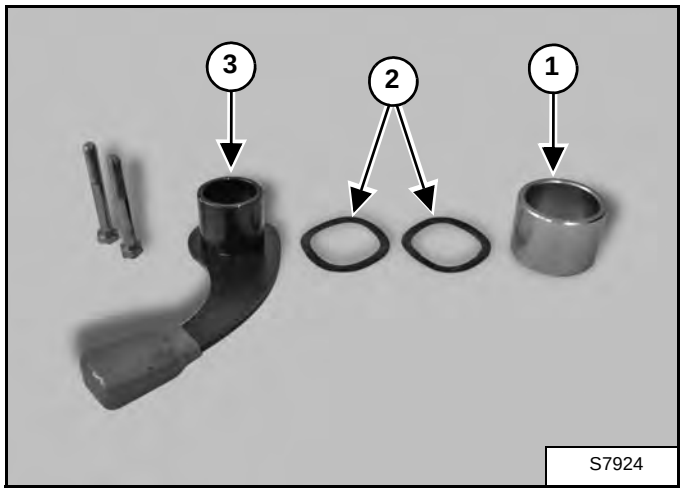
Cable Installation (Cont'd)

Figure 40-60-18



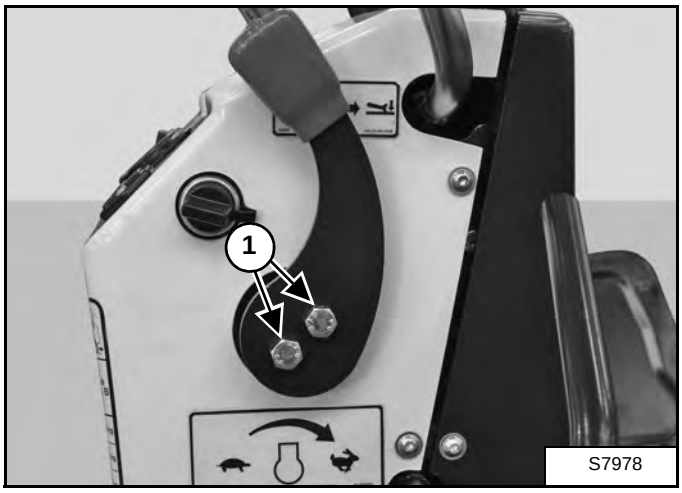
Install the three bolts (Item 1) **[Figure 40-60-18]** on the right side of the instrument panel.

Figure 40-60-19



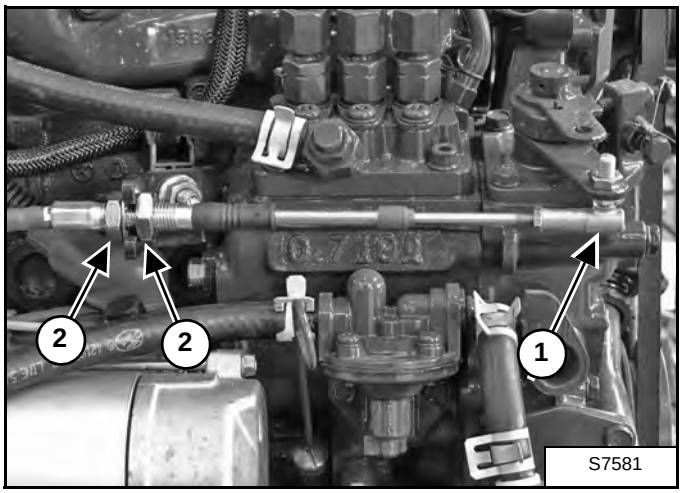
Install the spacer (Item 1), the two wave washers (Item 2) and lever (Item 3) **[Figure 40-60-19]**.

Figure 40-60-20



Install the two bolts (Item 1) **[Figure 40-60-20]** and tighten evenly until the throttle lever moves back and forth at a comfortable tension.

Figure 40-60-21



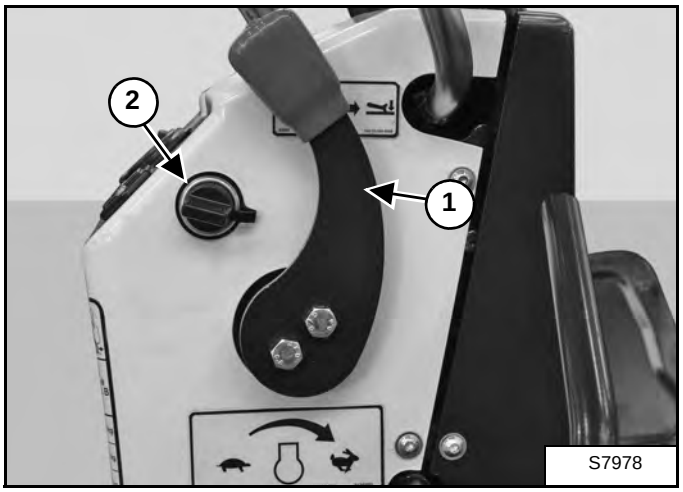
Connect the linkage (Item 1) **[Figure 40-60-21]** to the injection pump control lever.

Slightly tighten the nuts (Item 2) **[Figure 40-60-21]** by hand.

Dealer Copy -- Not for Resale

Cable Installation (Cont'd)

Figure 40-60-22



Check if throttle lever (Item 1) does not interfere with space in front of 12V socket (Item 2) **[Figure 40-60-22]**.

Figure 40-60-23

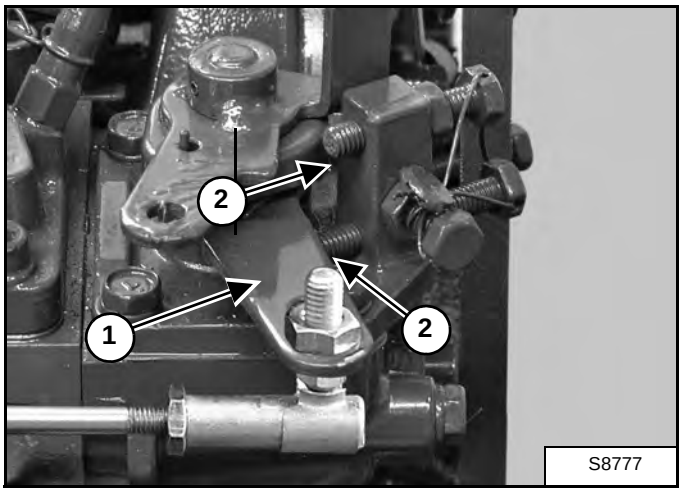
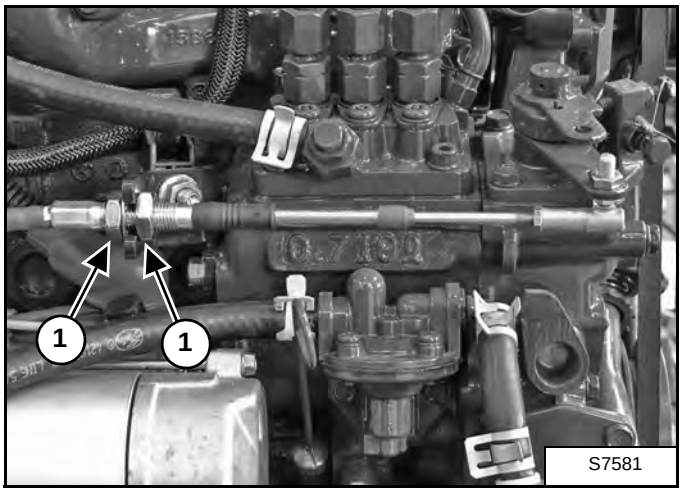


Figure 40-60-24



Move throttle lever (Item 1) **[Figure 40-60-22]** and check if injection pump control lever (Item 1) reaches both end positions (Item 2) **[Figure 40-60-23]**.

If not, set the correct end position of the throttle lever by using the nuts (Item 1) **[Figure 40-60-24]**.

When correct setting is obtained fully tighten the nuts (Item 1) **[Figure 40-60-24]**.

Dealer Copy -- Not for Resale



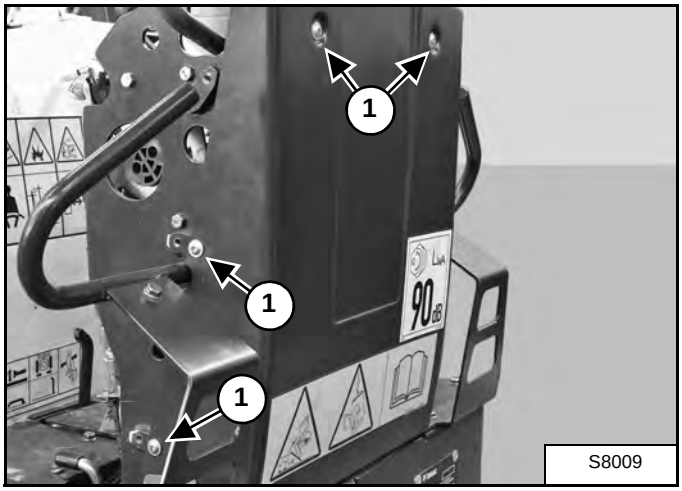
Dealer Copy -- Not for Resale

BLADE CONTROL

Removal And Installation

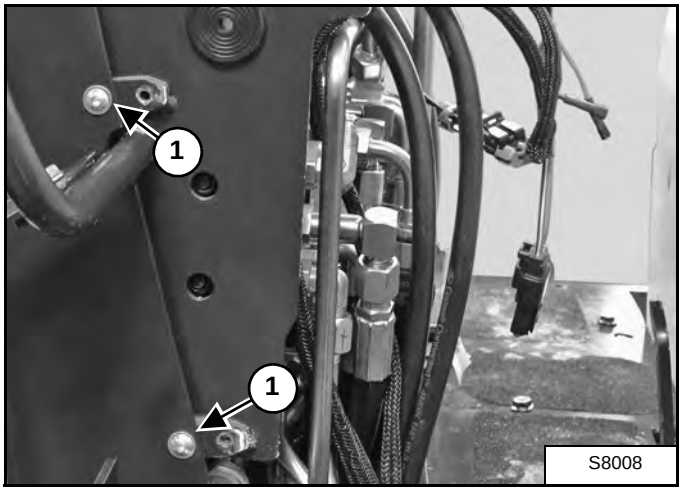
Remove the instrument panel. (See Removal And Installation on Page 40-220-1.)

Figure 40-70-1



Remove the four bolts (Item 1) **[Figure 40-70-1]** from the cover.

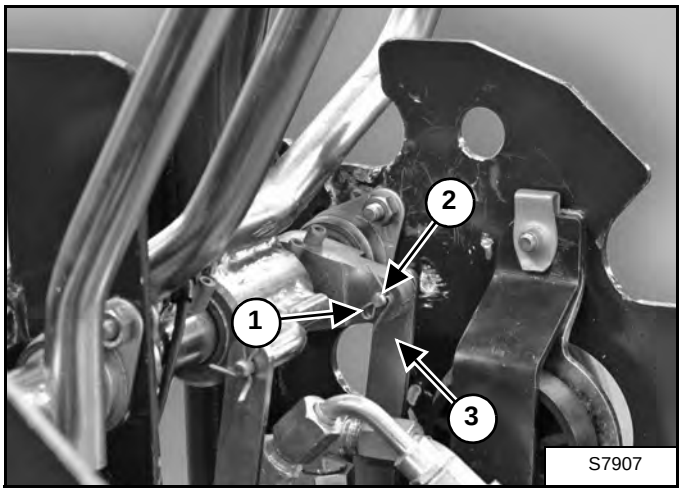
Figure 40-70-2



Remove the bolts (Item 1) **[Figure 40-70-2]** from the cover.

Remove the cover from the excavator.

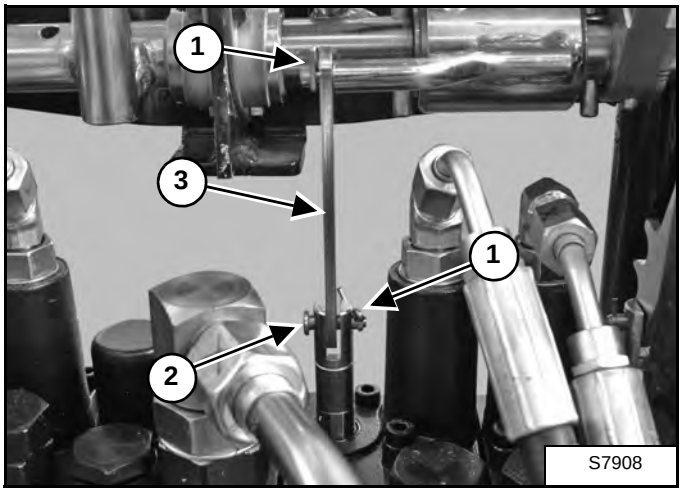
Figure 40-70-3



Remove the cotter pin (Item 1) and pin (Item 2) **[Figure 40-70-3]**.

Disconnect the linkage (Item 3) **[Figure 40-70-3]** from the control valve.

Figure 40-70-4



Remove the cotter pins (Item 1) **[Figure 40-70-4]**.

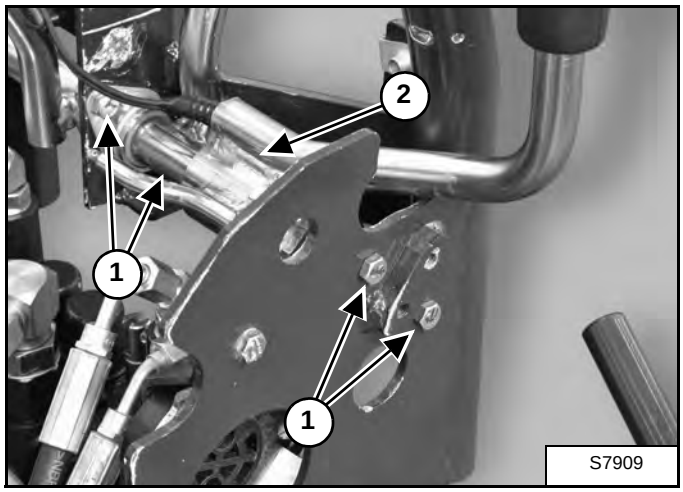
Remove the pin (Item 2) and remove the linkage (Item 3) **[Figure 40-70-4]** from the control valve.

Dealer Copy -- Not for Resale

BLADE CONTROL (CONT'D)

Removal And Installation (Cont'd)

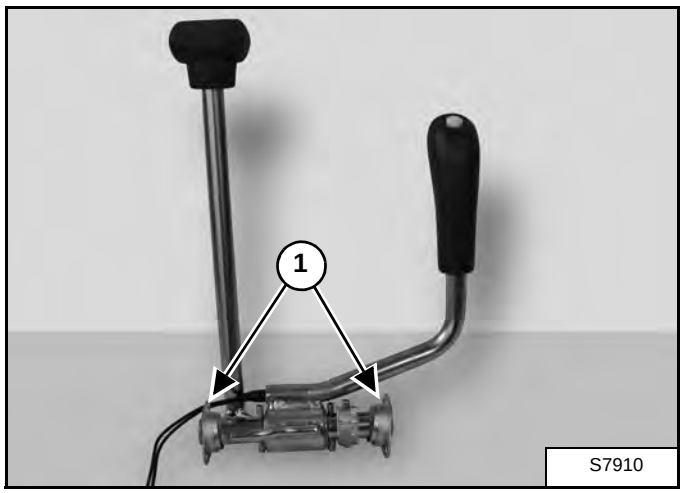
Figure 40-70-5



Remove the bolts and nuts (Item 1) **[Figure 40-70-5]**.

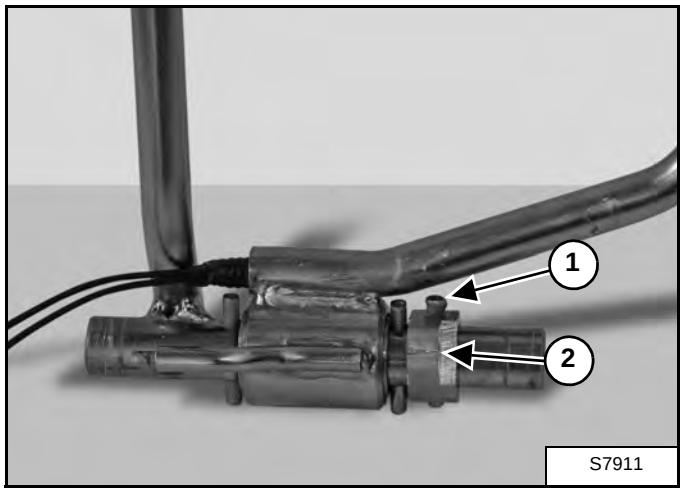
Remove the travel control and blade control (Item 2) **[Figure 40-70-5]**.

Figure 40-70-6



Remove the two bearings (Item 1) **[Figure 40-70-6]**.

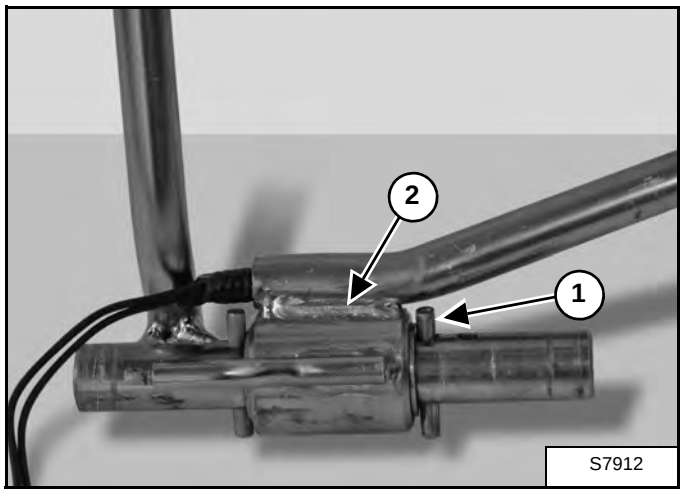
Figure 40-70-7



Remove the pin (Item 1) **[Figure 40-70-7]**.

Remove the bellcrank (Item 2) **[Figure 40-70-7]**.

Figure 40-70-8



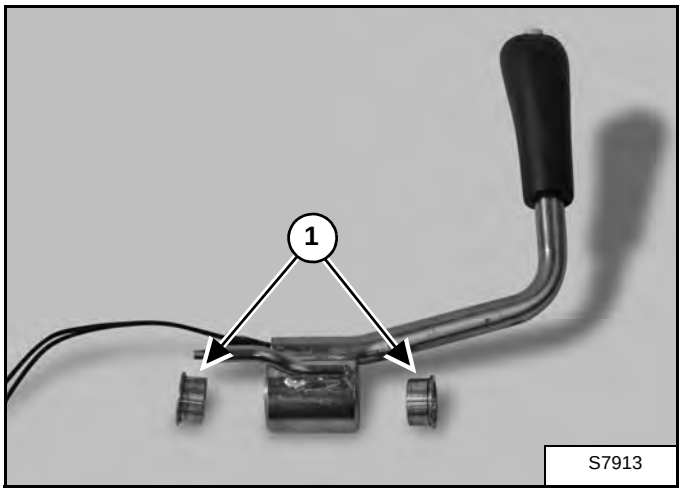
Remove the pin (Item 1) **[Figure 40-70-8]**.

Remove the blade control handle (Item 2) **[Figure 40-70-8]**.

Dealer Copy -- Not for Resale

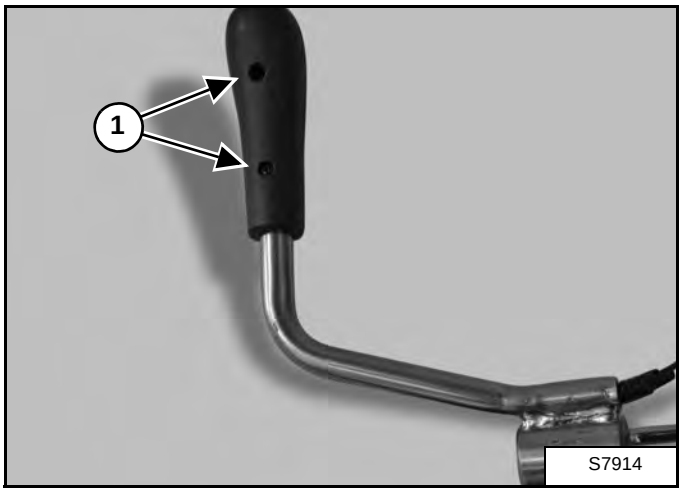
Disassembly And Assembly

Figure 40-70-9



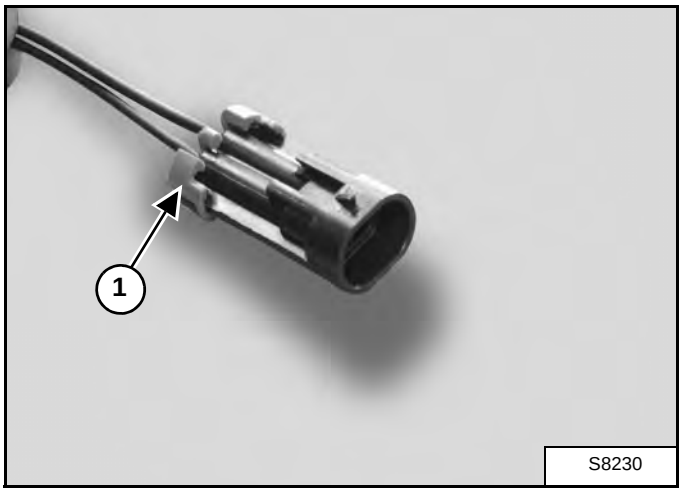
Remove the two bushings (Item 1) **[Figure 40-70-9]** from the blade control handle.

Figure 40-70-10



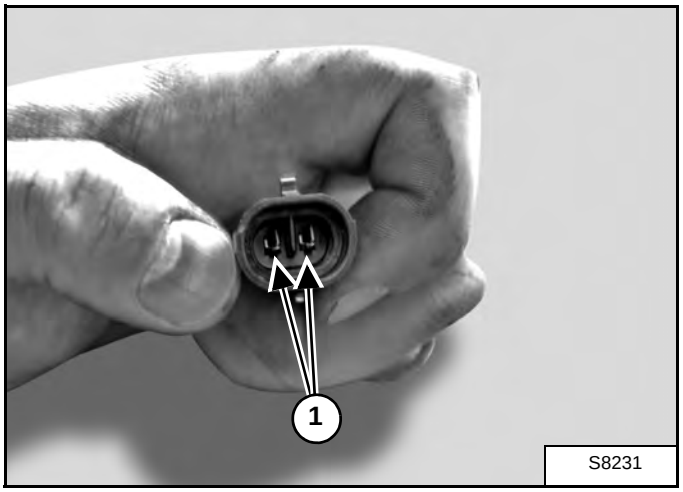
Remove the screws (Item 1) **[Figure 40-70-10]** and plastic handle halves.

Figure 40-70-11



Remove the lock (Item 1) **[Figure 40-70-11]** from the electrical connector.

Figure 40-70-12



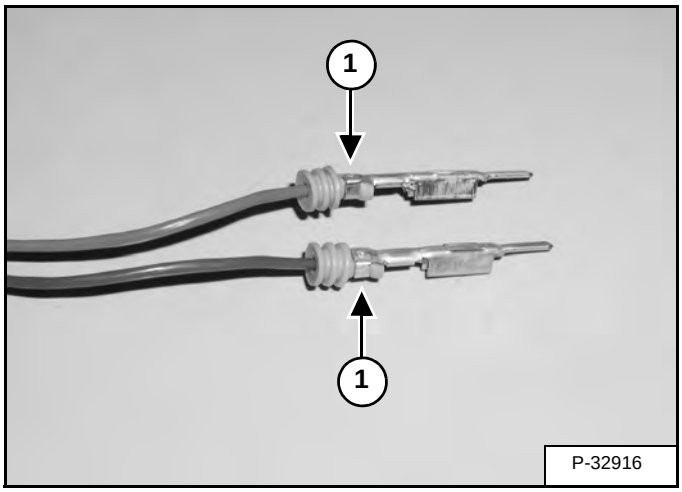
With a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 40-70-12]**.

Mark and remove the individual wires from the back of the electrical connector.

Dealer Copy -- Not for Resale

Disassembly And Assembly (Cont'd)

Figure 40-70-13

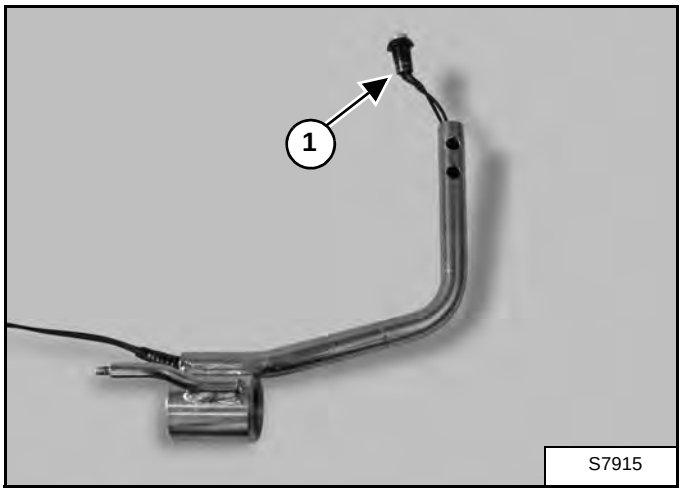


Installation: Use a small piece of wire and bend the tab (Item 1) **[Figure 40-70-13]** on each wire before installing in the electrical connector.

Installation: The wires must be installed in the proper locations in the wire connector.

Check each wire to be certain the tab locks into position.

Figure 40-70-14

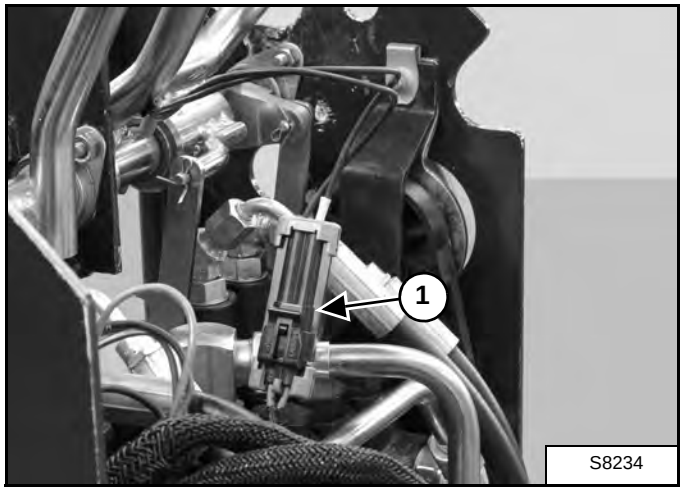


Remove the two speed switch (Item 1) **[Figure 40-70-14]** from the blade control handle.

Two Speed Switch Removal And Installation

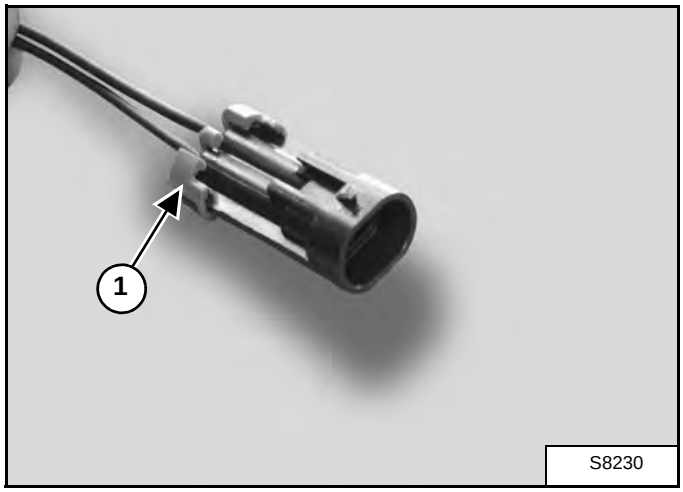
Remove the instrument panel. (See Removal And Installation on Page 40-220-1.)

Figure 40-70-15



Remove the electrical connector (Item 1) **[Figure 40-70-15]** from the excavator electrical harness.

Figure 40-70-16

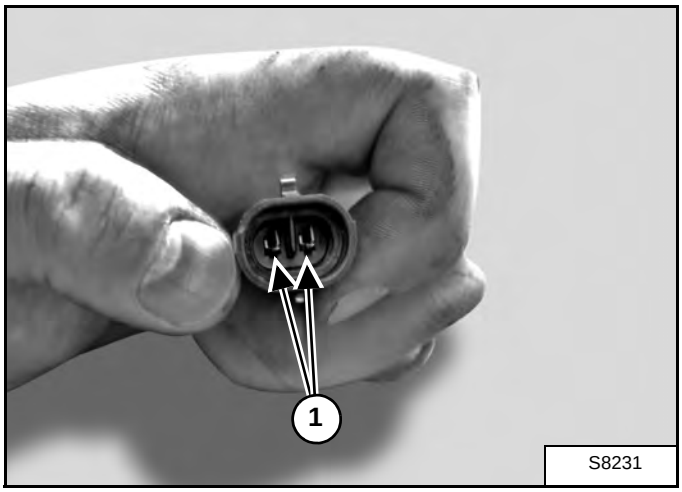


Remove the lock (Item 1) **[Figure 40-70-16]** from the electrical connector.

Dealer Copy -- Not for Resale

Two Speed Switch Removal And Installation (Cont'd)

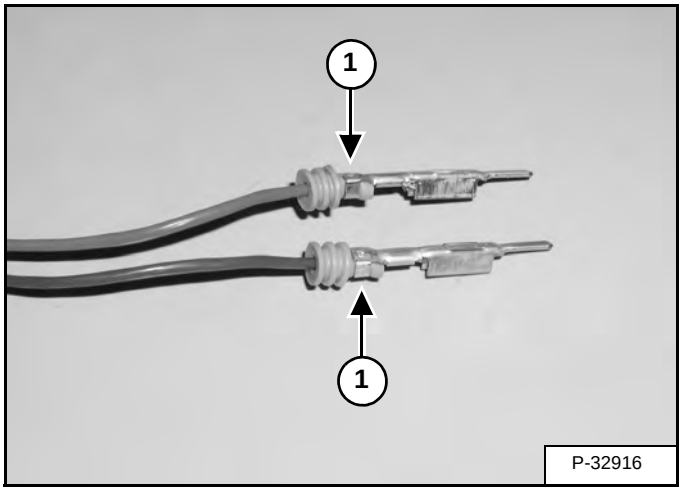
Figure 40-70-17



With a small piece of wire, depress the wire terminal tabs (Item 1) **[Figure 40-70-17]**.

Mark and remove the individual wires from the back of the electrical connector.

Figure 40-70-18

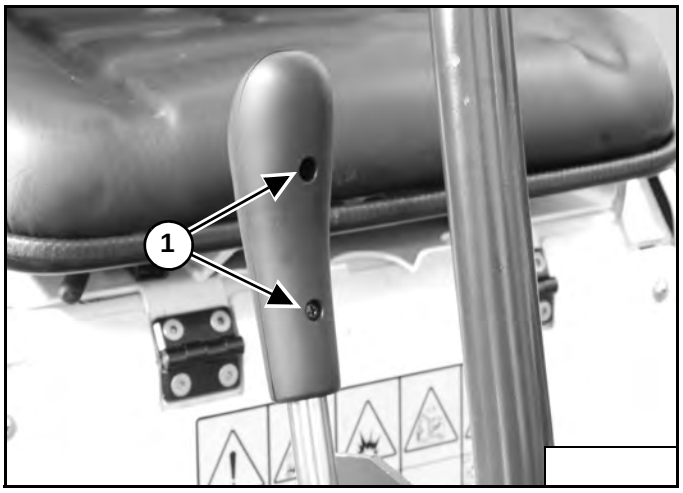


Installation: Use a small piece of wire and bend the tab (Item 1) **[Figure 40-70-18]** on each wire before installing in the electrical connector.

Installation: The wires must be installed in the proper locations in the wire connector.

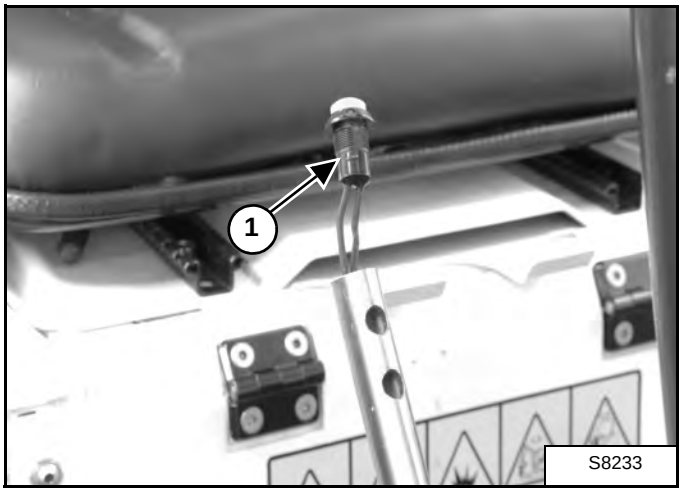
Check each wire to be certain the tab locks into position.

Figure 40-70-19



Remove the screws (Item 1) **[Figure 40-70-19]** and plastic handle halves.

Figure 40-70-20



Remove the two speed switch (Item 1) **[Figure 40-70-20]** from the blade control handle.

Dealer Copy -- Not for Resale



Dealer Copy -- Not for Resale

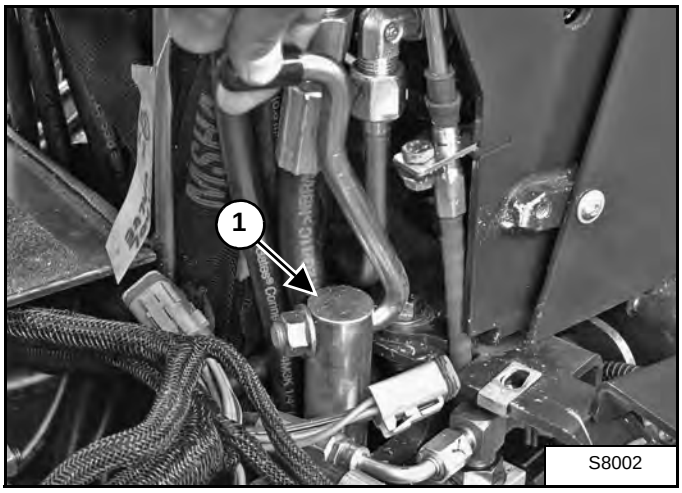
SWING LOCK

Removal And Installation

Remove the right floor panel. (See Right Floor Panel Removal And Installation on Page 40-120-1.)

Remove the instrument panel. (See Removal And Installation on Page 40-220-1.)

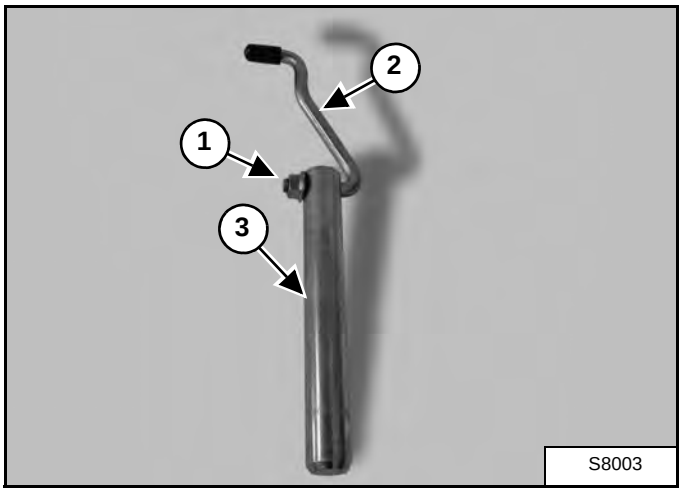
Figure 40-80-1



Remove the upperstructure slew lock lever (Item 1) **[Figure 40-80-1]** from the upperstructure.

Disassembly And Assembly

Figure 40-80-2



Remove the nut (Item 1) from the swing lock lever (Item 2). Remove the pin (Item 3) **[Figure 40-80-2]**.

Dealer Copy -- Not for Resale

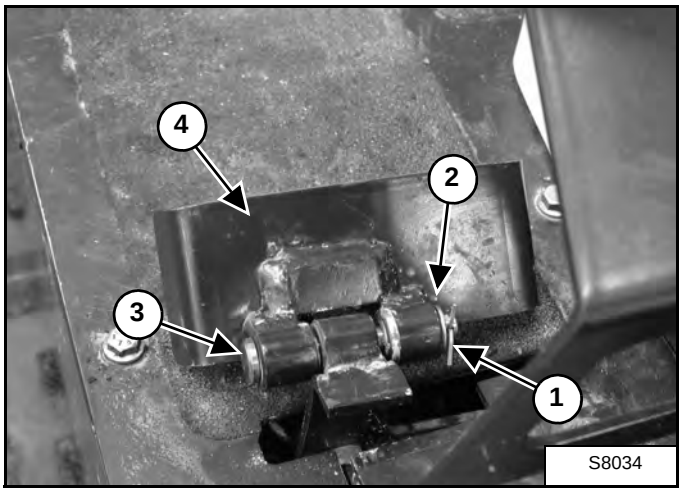


Dealer Copy -- Not for Resale

RIGHT PEDAL AND LINKAGE

Pedal Removal And Installation

Figure 40-90-1



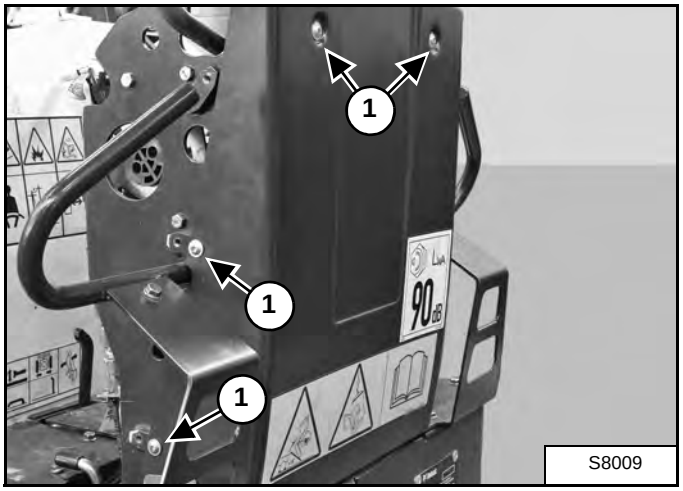
Remove the cotter pin (Item 1) and washer (Item 2) **[Figure 40-90-1]** from the pedal assembly.

Remove the pin (Item 3) and remove the auxiliary pedal (Item 4) **[Figure 40-90-1]**.

Linkage Removal And Installation

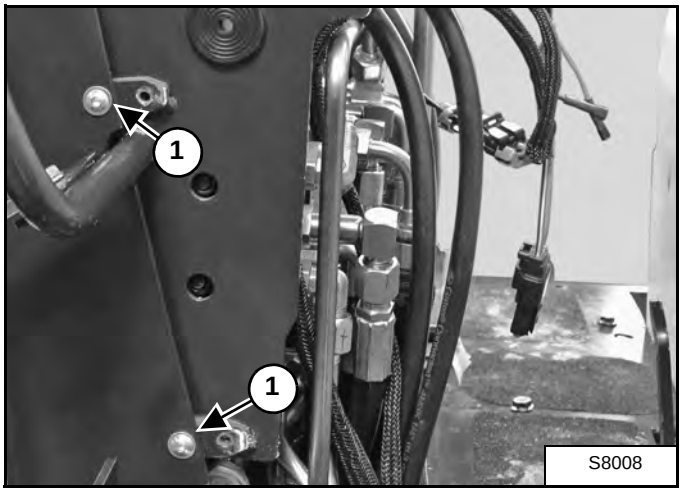
Remove the instrument panel. (See Removal And Installation on Page 40-220-1.)

Figure 40-90-2



Remove the four bolts (Item 1) **[Figure 40-90-2]** from the cover.

Figure 40-90-3



Remove the bolts (Item 1) **[Figure 40-90-3]** from the cover.

Remove the cover.

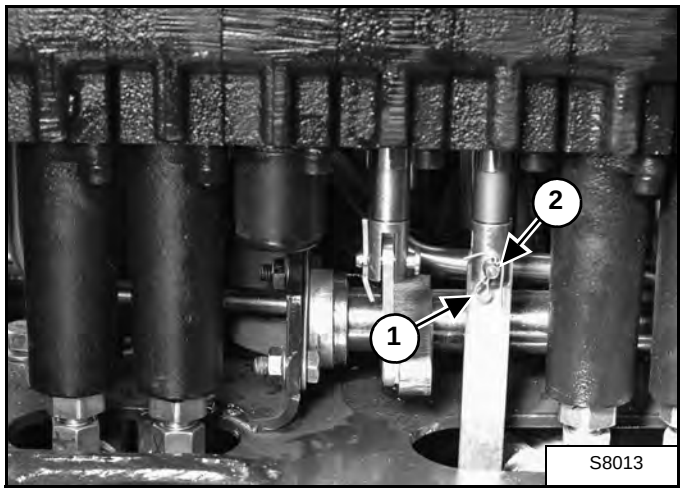
Dealer Copy -- Not for Resale

Linkage Removal And Installation (Cont'd)

Remove the right floor panel. (See Right Floor Panel Removal And Installation on Page 40-120-1.)

Remove the lower right hand side cover. (See Lower Right Side Cover Removal And Installation on Page 40-210-3.)

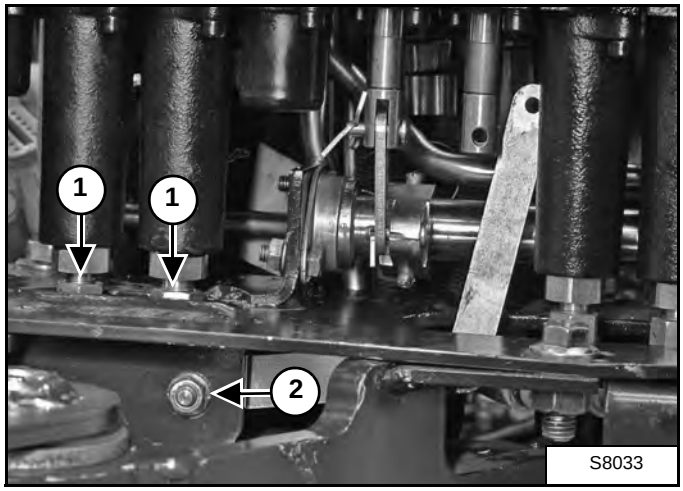
Figure 40-90-4



Remove the cotter pin (Item 1) and the pin (Item 2) **[Figure 40-90-4]**.

Disconnect the linkage from the bellcrank.

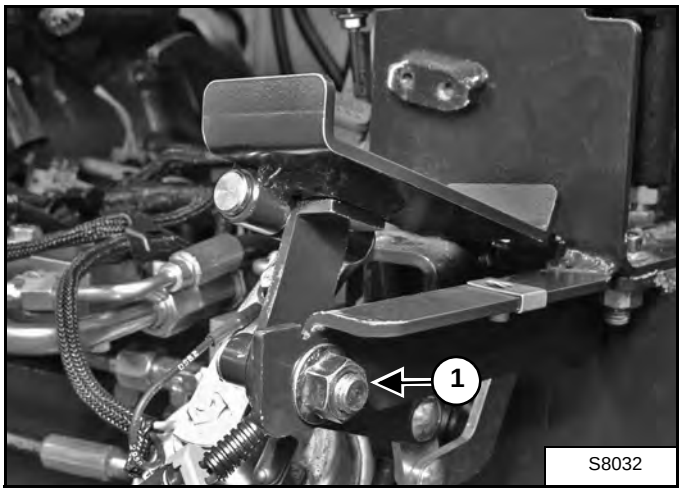
Figure 40-90-5



Disconnect the two hoses (Item 1) **[Figure 40-90-5]** from the control valve.

Remove the nut (Item 2) **[Figure 40-90-5]**.

Figure 40-90-6



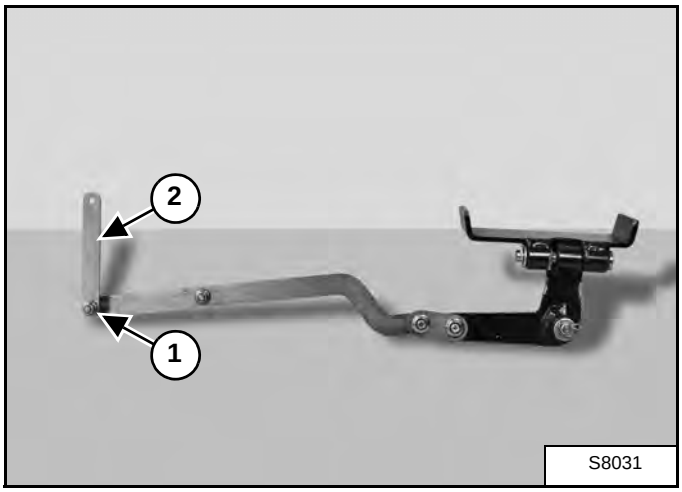
Remove the nut (Item 1) **[Figure 40-90-6]**.

Remove the control linkage assembly from the excavator.

Dealer Copy -- Not for Resale

Linkage Disassembly And Assembly

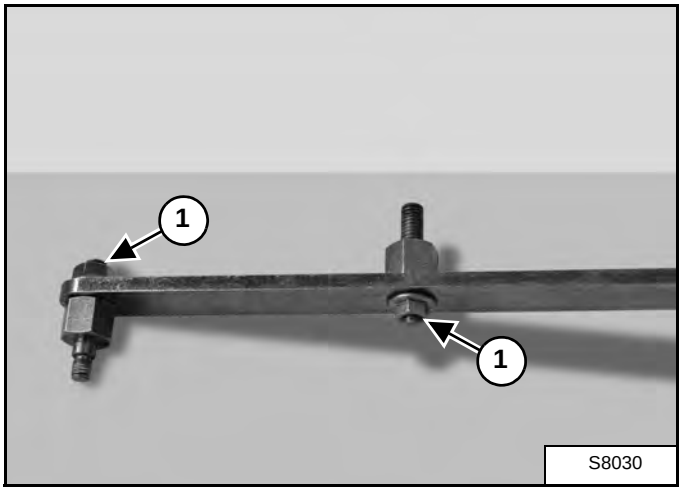
Figure 40-90-7



Remove the nut (Item 1) and linkage (Item 2) **[Figure 40-90-7]**.

Installation: Tighten the nut to 5,5 N•m (48.67 in-lb) torque.

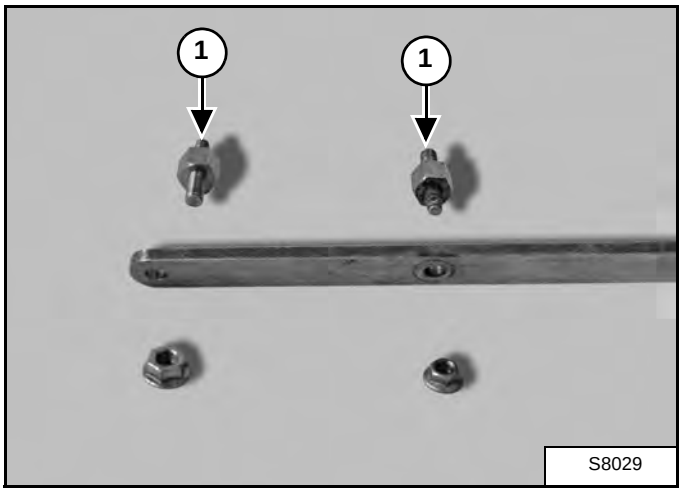
Figure 40-90-8



Remove the two nuts (Item 1) **[Figure 40-90-8]**.

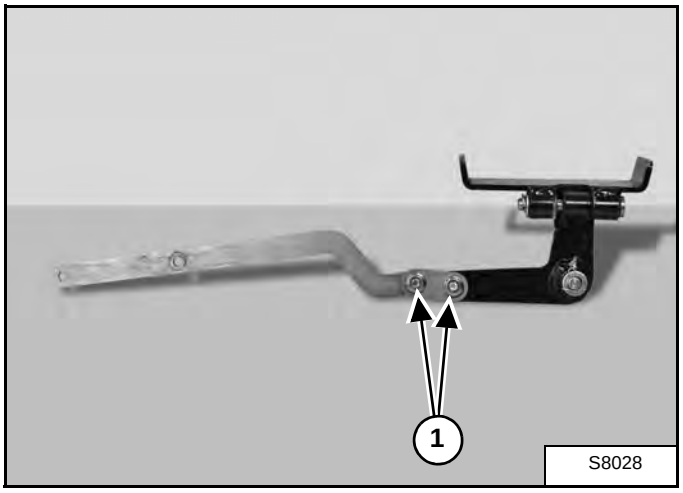
Installation: Tighten the nuts to 5,5 N•m (48.67 in-lb) torque.

Figure 40-90-9



Remove the two pivot pins (Item 1) **[Figure 40-90-9]**.

Figure 40-90-10



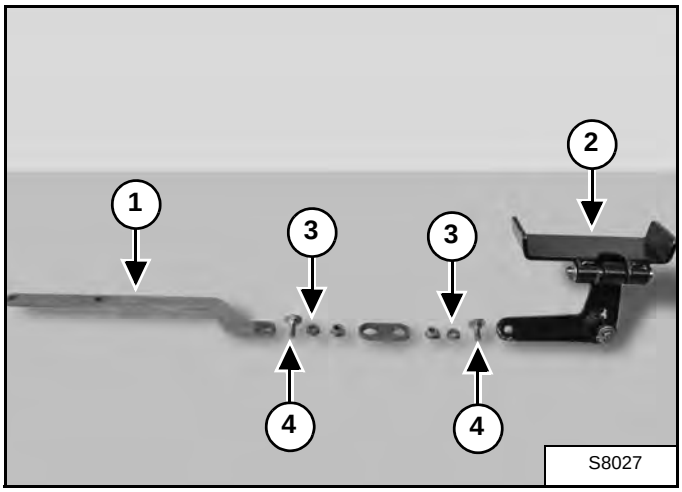
Remove the nut (Item 1) **[Figure 40-90-10]**.

Installation: Tighten the nut to 5,5 N•m (48.67 in-lb) torque.

Dealer Copy -- Not for Resale

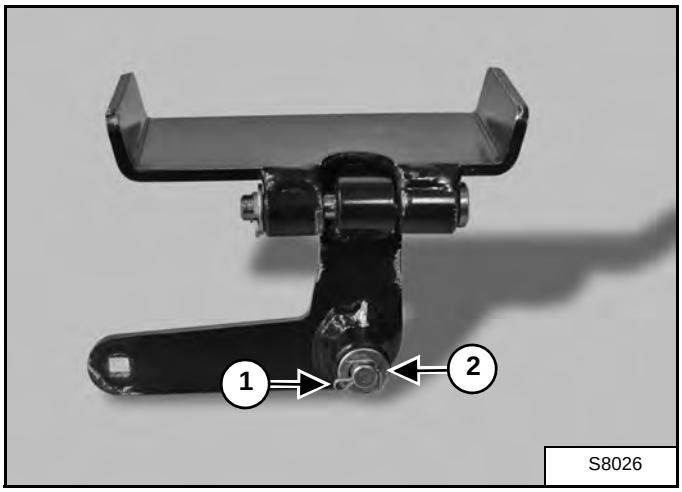
Linkage Disassembly And Assembly (Cont'd)

Figure 40-90-11



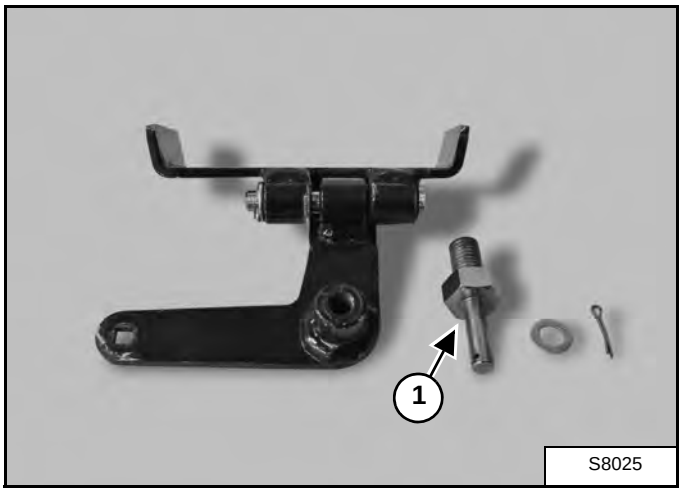
Remove the lever (Item 1), pedal assembly (Item 2), spacers (Item 3) and bolts (Item 4) **[Figure 40-90-11]**.

Figure 40-90-12



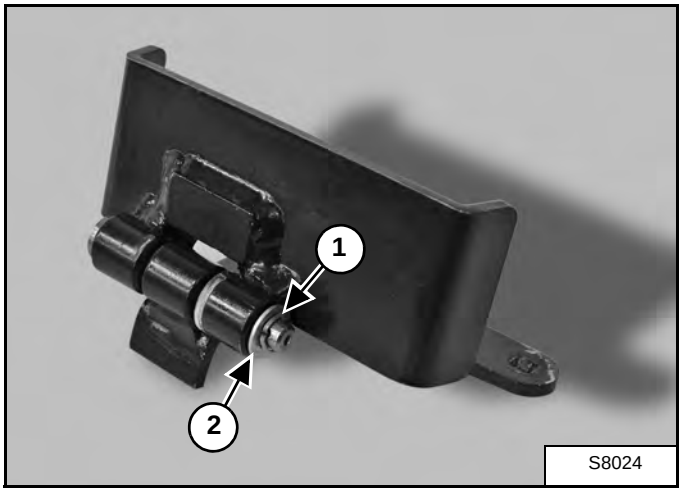
Remove the cotter pin (Item 1) and washer (Item 2) **[Figure 40-90-12]**.

Figure 40-90-13



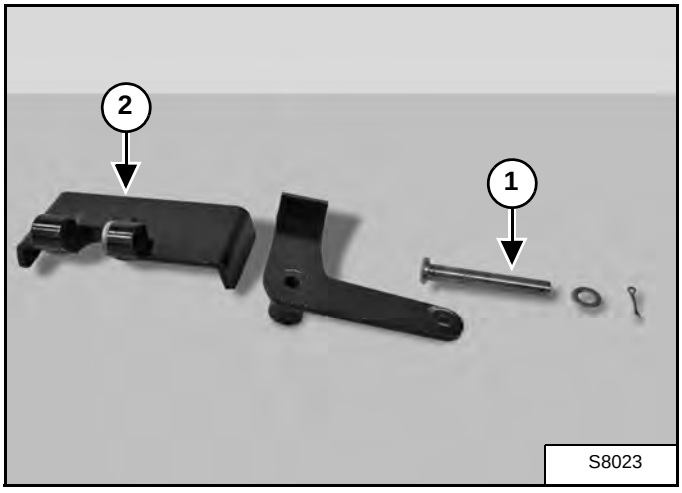
Remove the pivot pin (Item 1) **[Figure 40-90-13]**.

Figure 40-90-14



Remove the cotter pin (Item 1) and washer (Item 2) **[Figure 40-90-14]**.

Figure 40-90-15



Remove the pin (Item 1) and pedal (Item 2) **[Figure 40-90-15]** from the bracket.

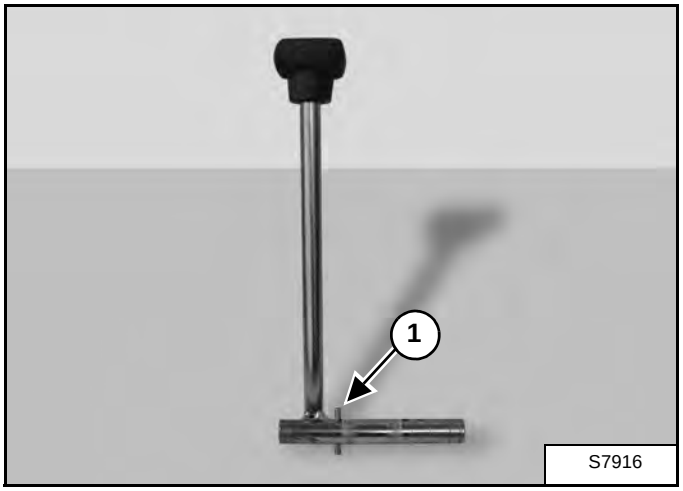
Dealer Copy -- Not for Resale

TRAVEL CONTROLS

Right Hand Travel Control Removal And Installation

Remove the blade control. (See Removal And Installation on Page 40-80-1.)

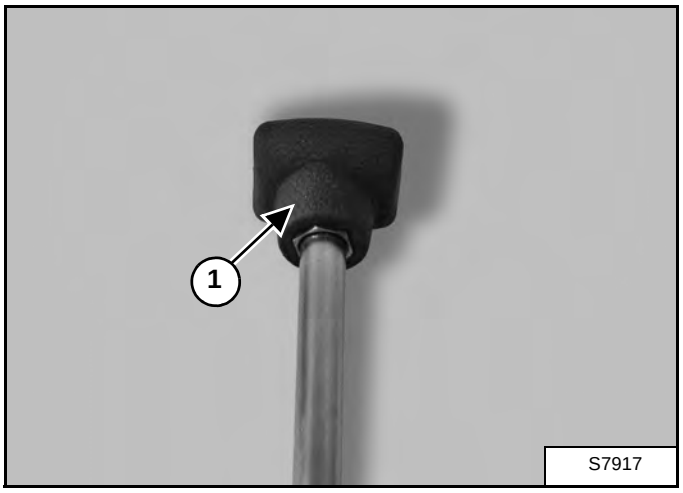
Figure 40-100-1



Remove the pin (Item 1) **[Figure 40-100-1]** from the right hand travel control.

Right Hand Travel Control Disassembly And Assembly

Figure 40-100-2

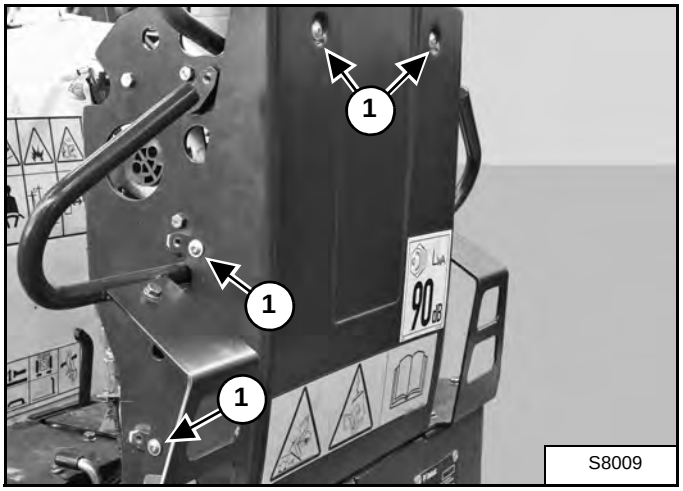


Remove the right hand control knob (Item 1) **[Figure 40-100-2]**.

Left Hand Travel Control Removal And Installation

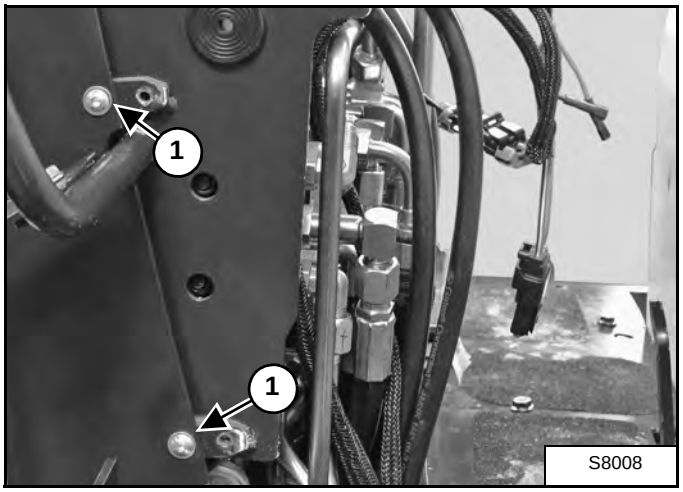
Remove the instrument panel. (See Removal And Installation on Page 40-220-1.))

Figure 40-100-3



Remove the four bolts (Item 1) **[Figure 40-100-3]** from the cover.

Figure 40-100-4



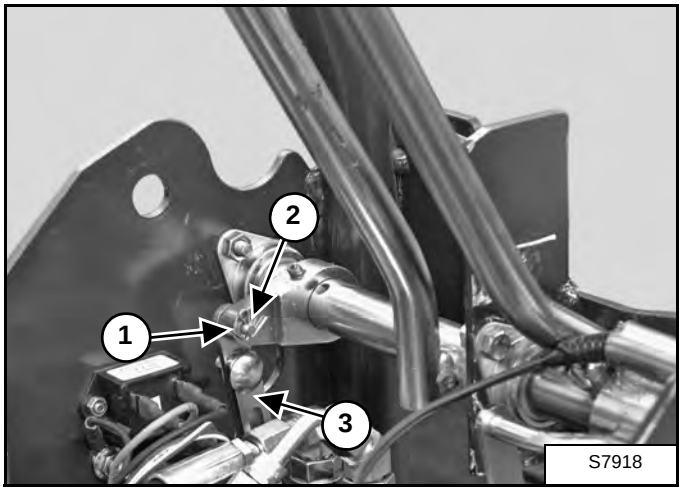
Remove the bolts (Item 1) **[Figure 40-100-4]** from the cover.

Remove the cover from the excavator.

Dealer Copy -- Not for Resale

Left Hand Travel Control Removal And Installation (Cont'd)

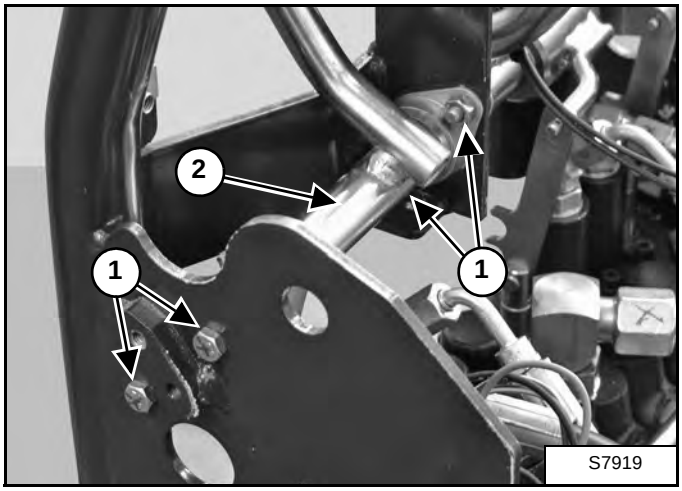
Figure 40-100-5



Remove the cotter pin (Item 1) and pin (Item 2) **[Figure 40-100-5]**.

Disconnect the linkage (Item 3) **[Figure 40-100-5]** from the control valve.

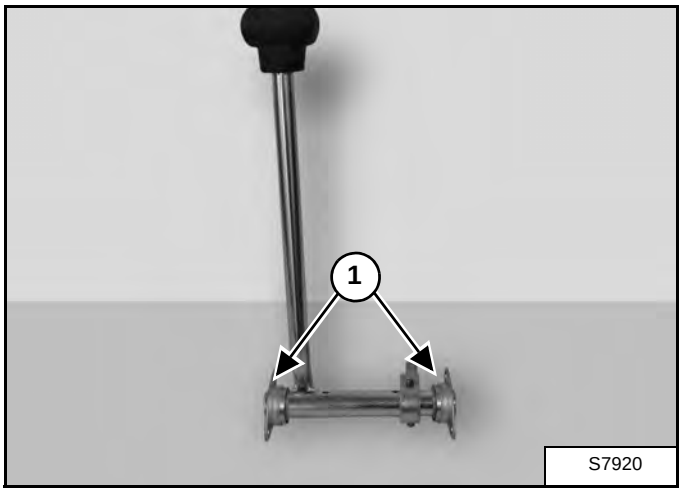
Figure 40-100-6



Remove the bolts and nuts (Item 1) **[Figure 40-100-6]**.

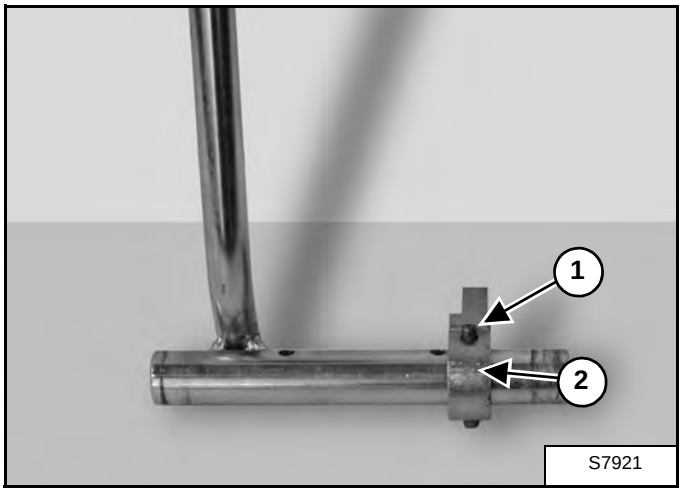
Remove the left hand travel control (Item 2) **[Figure 40-100-6]**.

Figure 40-100-7



Remove the two bearings (Item 1) **[Figure 40-100-7]**.

Figure 40-100-8



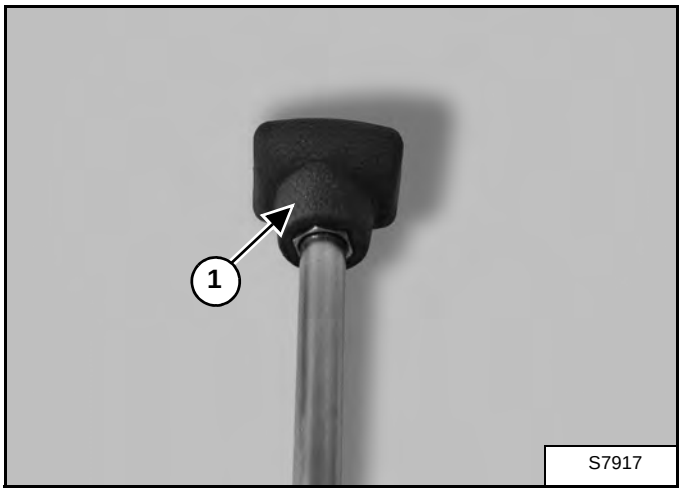
Remove the pin (Item 1) **[Figure 40-100-8]**.

Remove the bellcrank (Item 2) **[Figure 40-100-8]**.

Dealer Copy -- Not for Resale

Left Hand Travel Control Disassembly And Assembly

Figure 40-100-9



Remove the left hand control knob (Item 1) **[Figure 40-100-9]**.

Dealer Copy -- Not for Resale

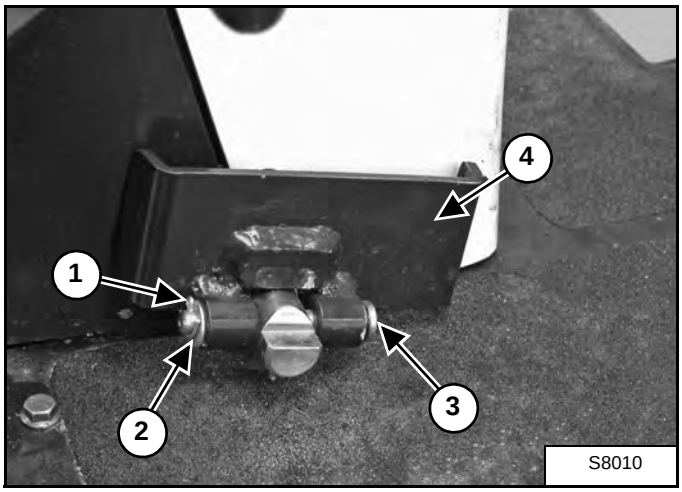


Dealer Copy -- Not for Resale

LEFT PEDAL AND LINKAGE

Pedal Removal And Installation

Figure 40-110-1



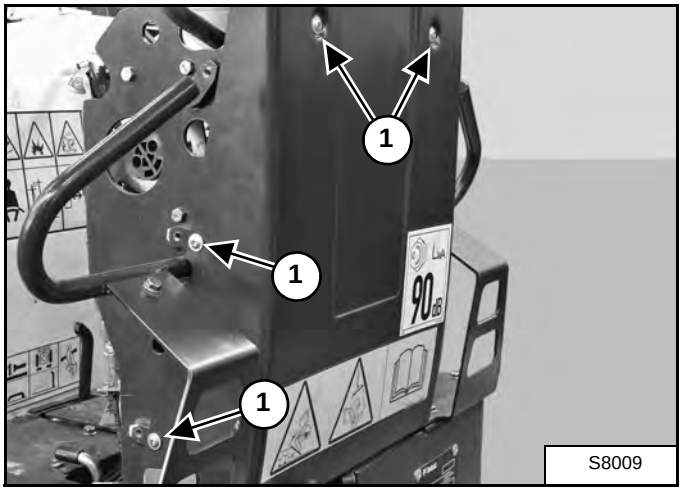
Remove the cotter pin (Item 1) and washer (Item 2) **[Figure 40-110-1]**.

Remove the pin (Item 3) and remove the boom swing pedal (Item 4) **[Figure 40-110-1]**.

Control Linkage Removal And Installation

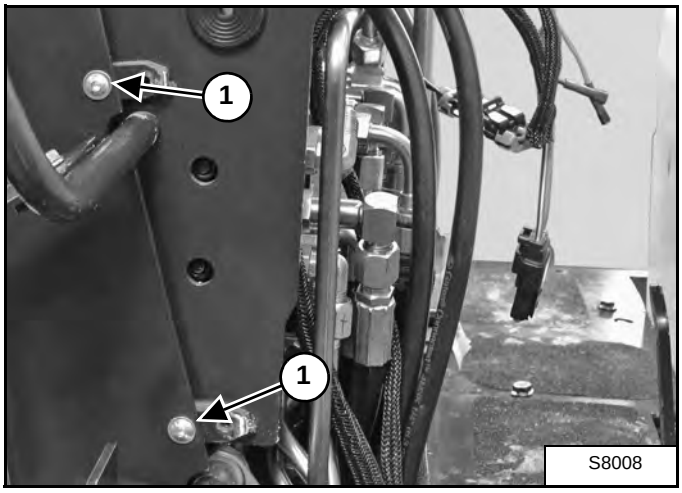
Remove the instrument panel. (See Removal And Installation on Page 40-220-1.)

Figure 40-110-2



Remove the four bolts (Item 1) **[Figure 40-110-2]** from the cover.

Figure 40-110-3



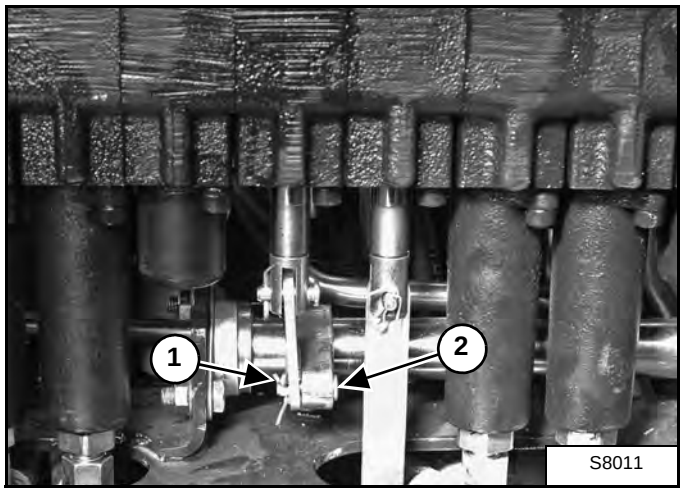
Remove the bolts (Item 1) **[Figure 40-110-3]** from the cover.

Remove the cover.

Dealer Copy -- Not for Resale

Control Linkage Removal And Installation (Cont'd)

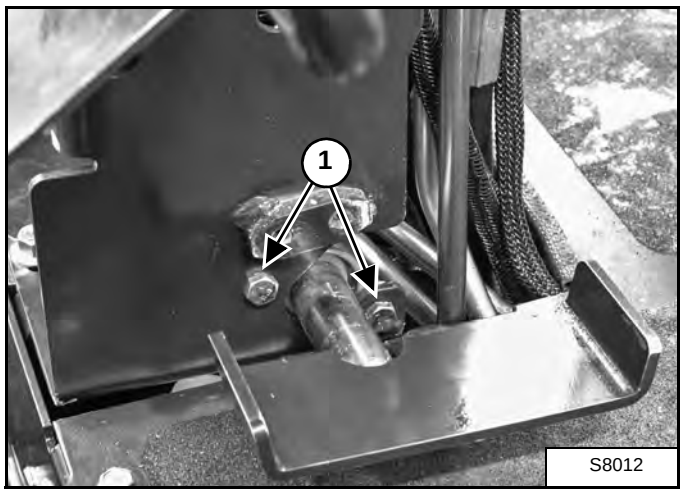
Figure 40-110-4



Remove the cotter pin (Item 1) and pin (Item 2) **[Figure 40-110-4]**.

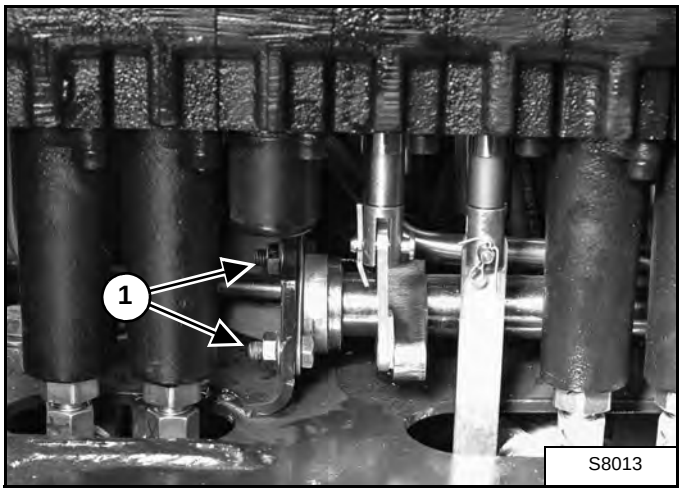
Disconnect the linkage from the bellcrank.

Figure 40-110-5



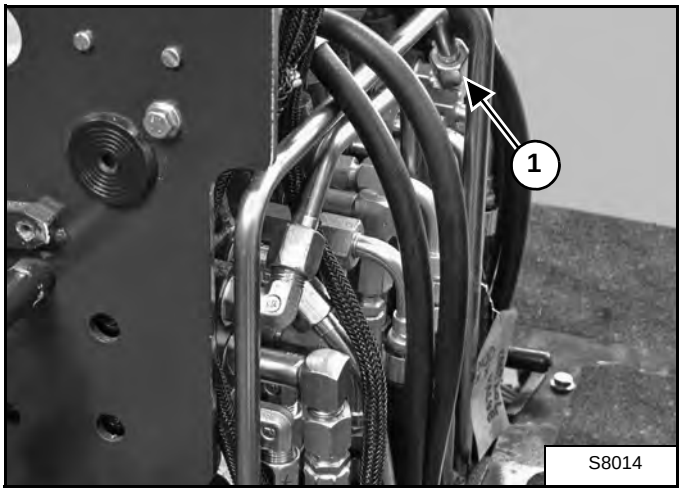
Remove the bolts and nuts (Item 1) **[Figure 40-110-5]**.

Figure 40-110-6



Remove the bolts and nuts (Item 1) **[Figure 40-110-6]**.

Figure 40-110-7



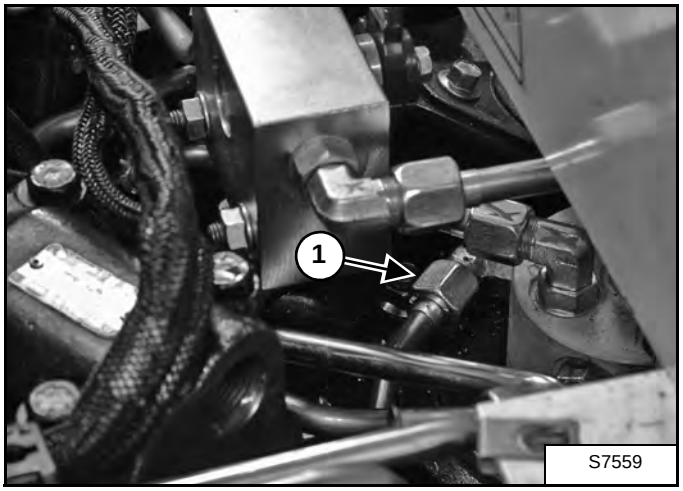
Disconnect the tubeline (Item 1) **[Figure 40-110-7]** from the control valve.

Dealer Copy -- Not for Resale

Control Linkage Removal And Installation (Cont'd)

Remove the left floor panel. (See Left Floor Panel Removal And Installation on Page 40-120-1.)

Figure 40-110-8



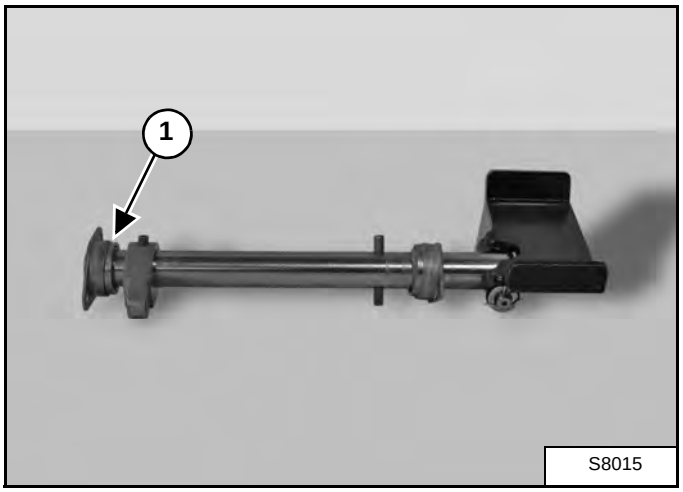
Disconnect the tubeline (Item 1) **[Figure 40-110-8]** from the swivel joint.

Reposition the tubeline for easy removal of the control linkage assembly.

Remove the control linkage assembly.

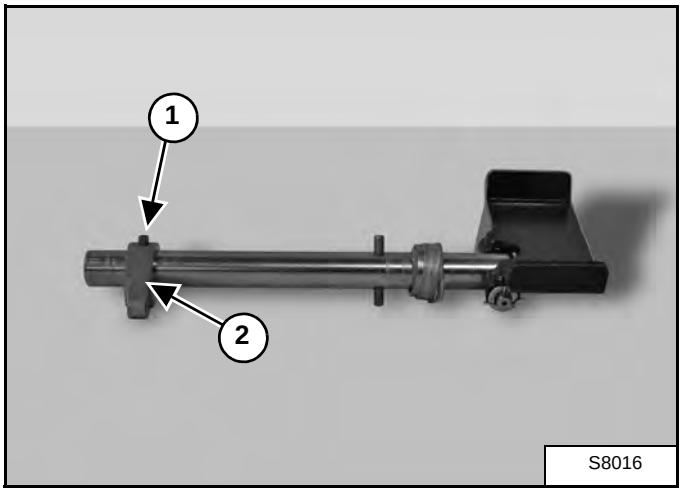
Control Linkage Disassembly And Assembly

Figure 40-110-9



Remove the bearing (Item 1) **[Figure 40-110-9]** from the shaft.

Figure 40-110-10

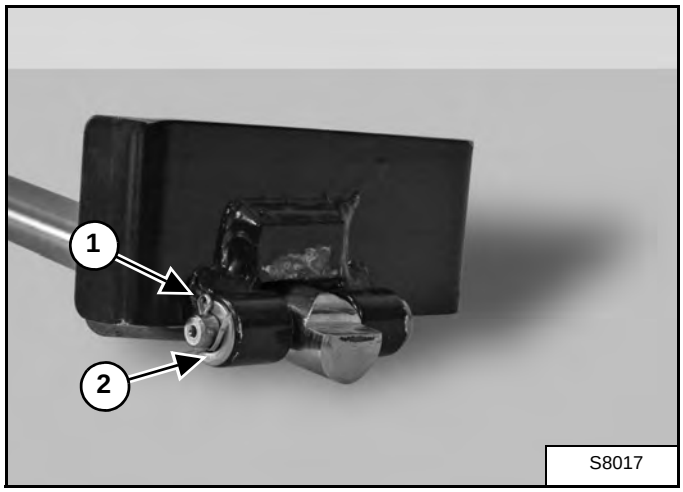


Remove the pin (Item 1) and bellcrank (Item 2) **[Figure 40-110-10]** from the shaft.

Dealer Copy -- Not for Resale

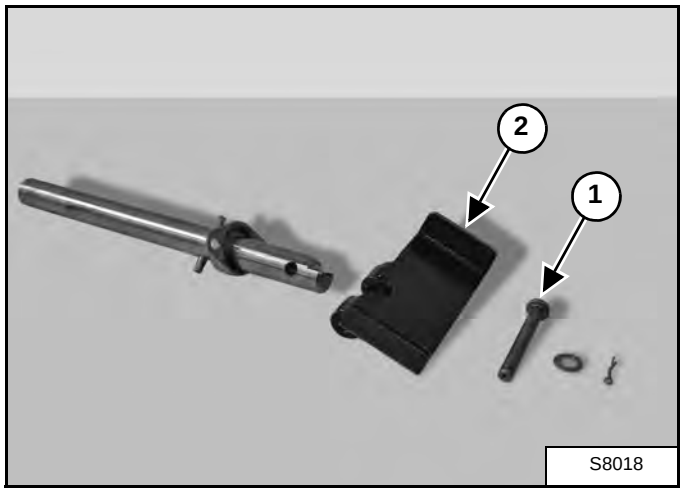
Linkage Disassembly And Assembly (Cont'd)

Figure 40-110-11



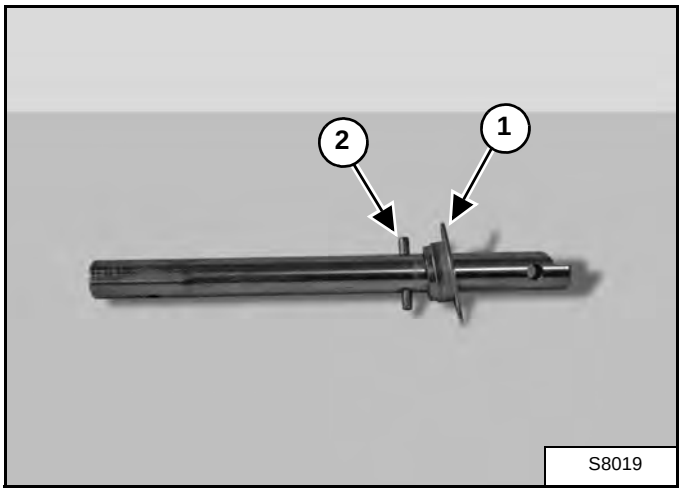
Remove the cotter pin (Item 1) and washer (Item 2) **[Figure 40-110-11]** from the shaft.

Figure 40-110-12



Remove the pin (Item 1) and pedal (Item 2) **[Figure 40-110-12]**.

Figure 40-110-13



Remove the bearing (Item 1) and pin (Item 2) **[Figure 40-110-13]** from the shaft.

Dealer Copy -- Not for Resale

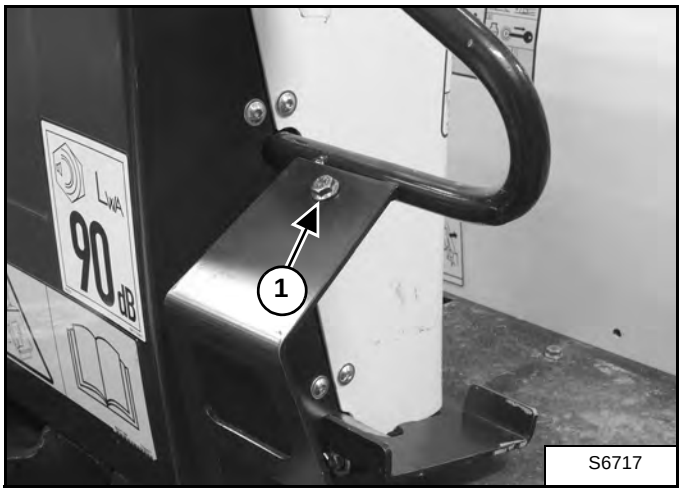
FLOOR PANELS

Description

The floor of the excavator is divided into two floor panels. Both floor panels provide accessibility to the hydraulic components, electrical components and the fuel tank.

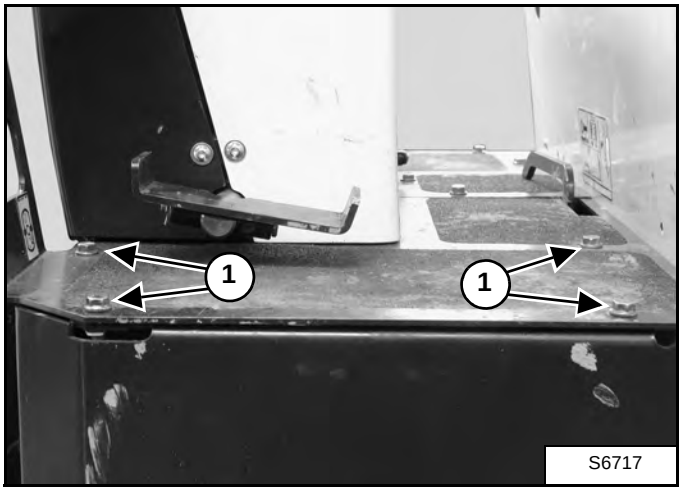
Left Floor Panel Removal And Installation

Figure 40-120-1



Remove the nut and bolt (Item 1) **[Figure 40-120-1]**.

Figure 40-120-2

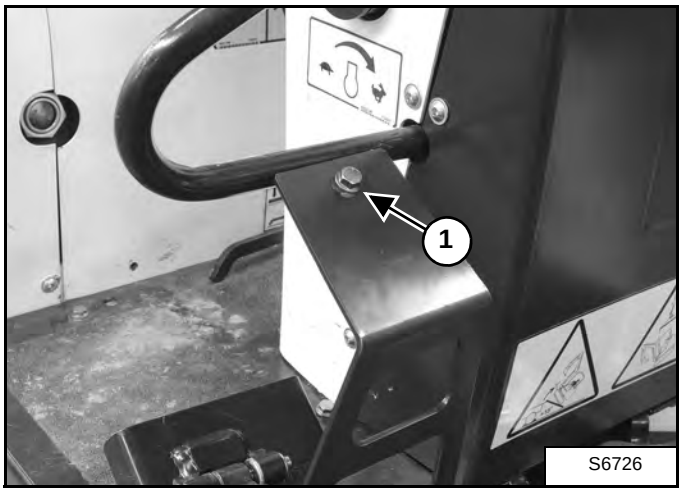


Remove the bolts (Item 1) **[Figure 40-120-2]** from the left floor panel.

Remove the left floor panel.

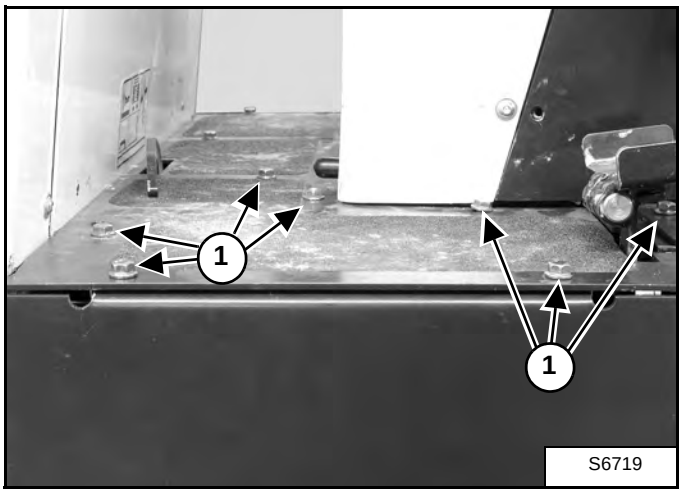
Right Floor Panel Removal And Installation

Figure 40-120-3



Remove the nut and bolt (Item 1) **[Figure 40-120-3]**.

Figure 40-120-4



Remove the bolts (Item 1) **[Figure 40-120-4]** from the right floor panel.

Remove the right floor panel.

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Dealer Copy -- Not for Resale

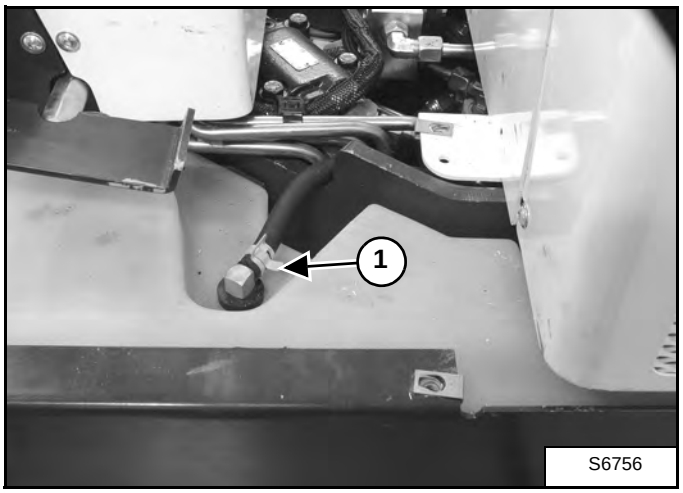
FUEL TANK

Removal And Installation

Drain the fuel tank. (See Draining The Fuel Tank on Page 10-100-3.)

Remove the left floor panel. (See Left Floor Panel Removal And Installation on Page 40-120-1.)

Figure 40-130-1

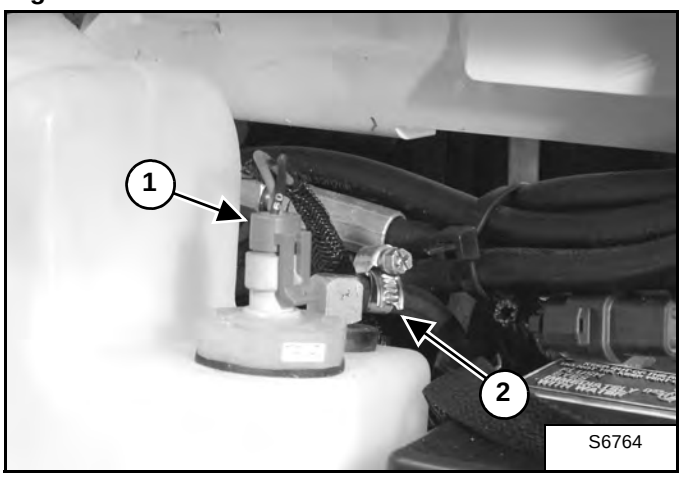


Remove the hose (Item 1) **[Figure 40-130-1]** from the fuel tank.

Remove the upper left hand side cover. (See Upper Left Side Cover Removal And Installation on Page 40-210-1.)

Remove the lower left hand side cover. (See Lower Left Side Cover Removal And Installation on Page 40-210-2.)

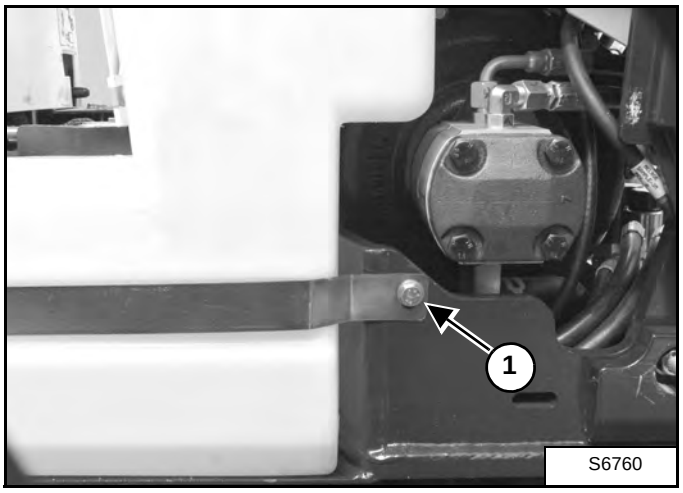
Figure 40-130-2



Disconnect the fuel level sender (Item 1) **[Figure 40-130-2]** from the fuel tank.

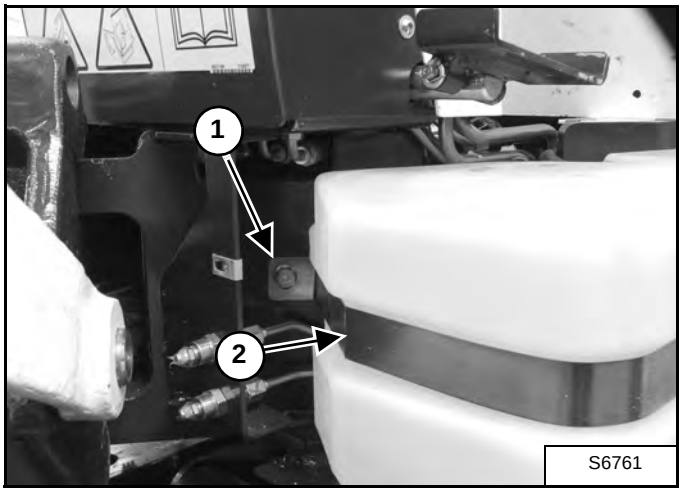
Remove the hose (Item 2) **[Figure 40-130-2]** from the fuel tank.

Figure 40-130-3



Remove the bolt (Item 1) **[Figure 40-130-3]** from the mounting bracket.

Figure 40-130-4



Remove the bolt (Item 1) and mounting bracket (Item 2) **[Figure 40-130-4]**.

Remove the fuel tank.

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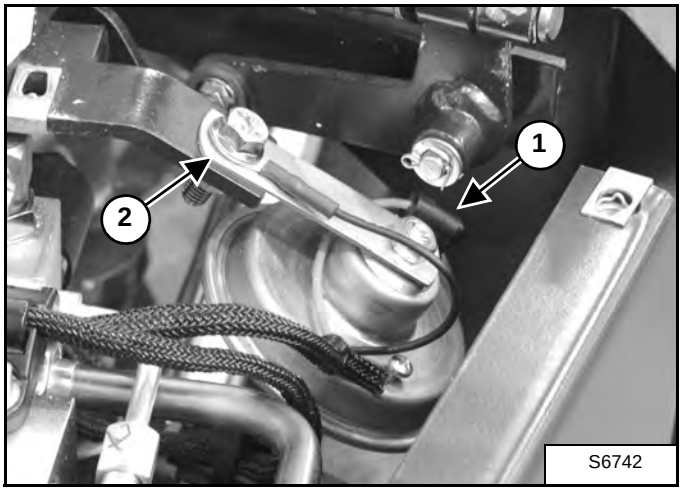
Dealer Copy -- Not for Resale

HORN

Removal And Installation

Remove the right floor panel. (See Right Floor Panel Removal And Installation on Page 40-120-1.)

Figure 40-140-1



Remove the wire (Item 1) **[Figure 40-140-1]** from the horn.

Remove the bolt and nut (Item 2) **[Figure 40-140-1]**.

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.

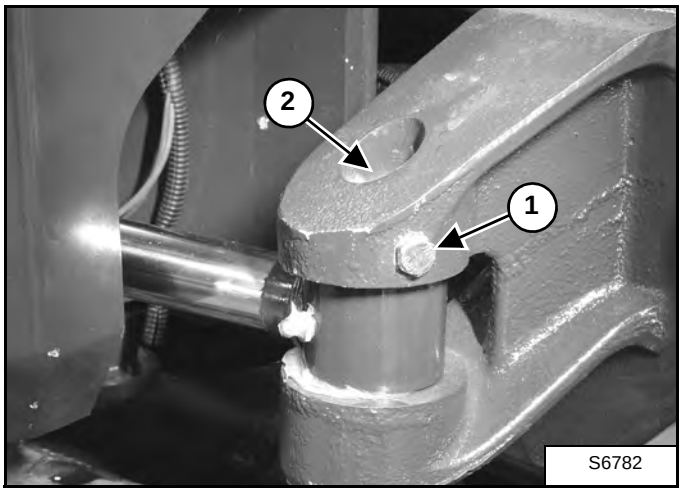
Removal And Installation

Remove the bucket. (See Removal And Installation on Page 40-180-1.)

Remove the arm. (See Removal And Installation on Page 40-170-1.)

Remove the boom. (See Removal And Installation on Page 40-160-1.)

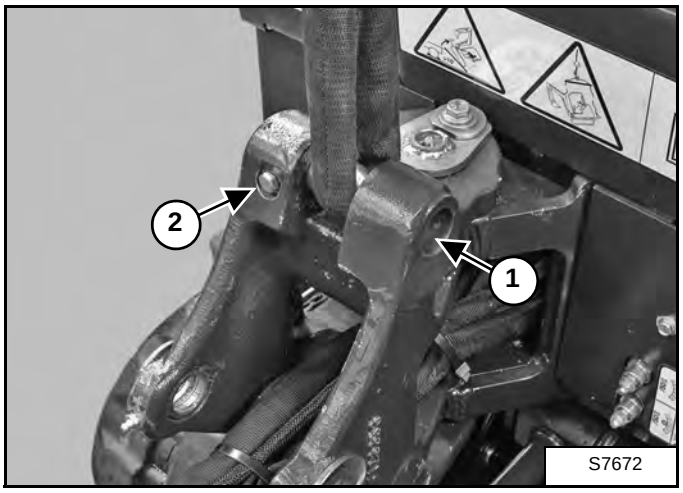
Figure 40-150-1



Remove the nut and bolt (Item 1) **[Figure 40-150-1]** from the rod end pivot pin.

Remove the pivot pin (Item 2) **[Figure 40-150-1]** from the rod end of the cylinder.

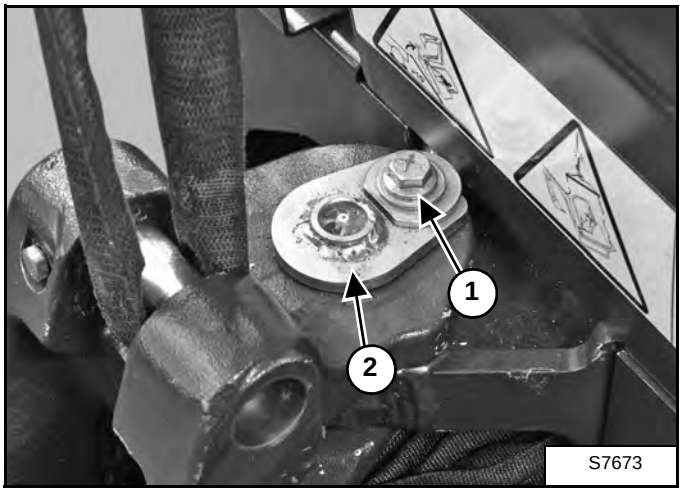
Figure 40-150-2



Install the pivot pin (Item 1), nut and bolt (Item 2) **[Figure 40-150-2]**.

Install a chain hoist on the swing frame **[Figure 40-150-2]**.

Figure 40-150-3



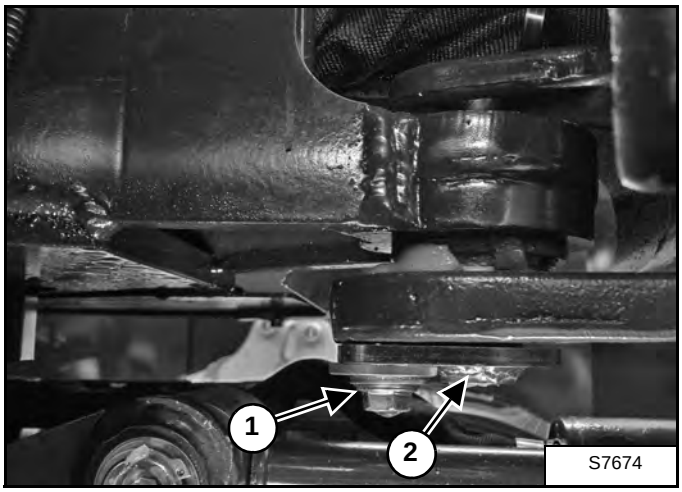
Remove the bolt, washers and spacer (Item 1) **[Figure 40-150-3]** from the top pivot pin.

Remove the top pivot pin (Item 2) **[Figure 40-150-3]** from the swing frame.

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Removal And Installation (Cont'd)

Figure 40-150-4



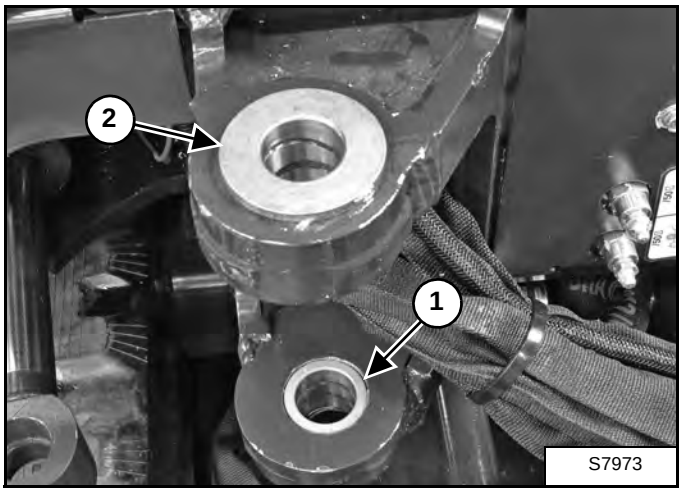
Remove the bolt and washers (Item 1) **[Figure 40-150-4]** from the bottom pivot pin.

Remove the bottom pivot pin (Item 2) **[Figure 40-150-4]** from the swing frame.

Remove the swing frame from the excavator.

Bushing Removal

Figure 40-150-5



Remove the bottom bushing (Item 1) **[Figure 40-150-5]** and top bushing (Item 2) **[Figure 40-150-5]** from the upperstructure by using a bolt, washers and nut.

The following parts will be needed for removal and installation of the bushings.

Bolt - 15,875 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 38,0 mm O.D. x 6,35 mm thick (0.625 in I.D. x1.496 in O.D. x 0.25 in thick)

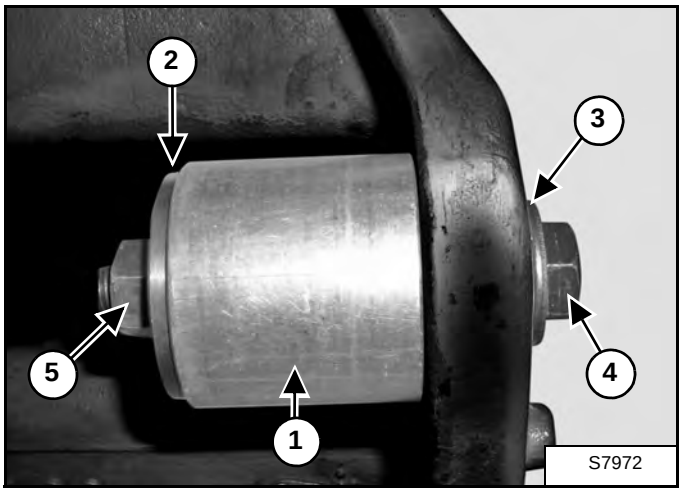
Washer - 15,875 mm I.D. x 74,295 mm O.D. x 6,35 mm thick (0.625 in I.D. x 2.925 in O.D. x 0.25 in thick)

Spacer - 57,15 mm I.D. x 74,295 mm O.D. x 40,0 mm thick (2.600 in I.D. x 2.925 in O.D. x 1.575 in thick)

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Bushing Removal (Cont'd)

Figure 40-150-6



Install the spacer (Item 1) and washer (Item 2) **[Figure 40-150-6]** over the flanged end of the bushing.

The spacer (Item 1) **[Figure 40-150-6]** must be centered over the bushing to avoid contact between the bushing and the spacer during removal.

Install the washer (Item 3) **[Figure 40-150-6]** 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 40-150-6]** through the washers and spacer.

Tighten the bolt and nut to remove the bushing from the casting.

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.

Bushing Installation

Apply a film of grease to the outer diameter of the bushing and the inner diameter of the casting.

Center 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 40-150-6]** 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 40-150-6]**.

Tighten the bolt and nut until the bushing is seated in the casting.

Dealer Copy -- Not for Resale

Boom Pivot Bushing Removal

The following parts will be needed for removal and installation of the boom pivot bushings.

Bolt - 15,875 x 114,3 mm long (0.625 x 4.5 in long)

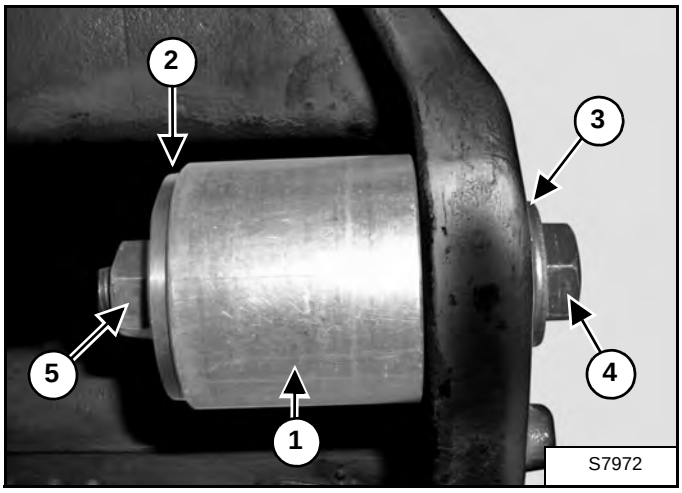
Nut - 15,875 mm (0.625 in)

Washer - 15,875 mm I.D. x 34,925 mm O.D. x 6,35 mm thick (0.625 in I.D. x1.375 in O.D. x 0.25 in thick)

Washer - 15,875 mm I.D. x 67,31 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 66,675 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 40-150-7



Install the spacer (Item 1) and washer (Item 2) **[Figure 40-150-7]** over the flanged end of the bushing.

The spacer (Item 1) **[Figure 40-150-7]** must be centered over the bushing to avoid contact between the bushing and the spacer during removal.

Install the washer (Item 3) **[Figure 40-150-7]** 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 40-150-7]** through the washers and spacer.

Tighten the bolt and nut to remove the bushing from the casting.

Boom Pivot Bushing Installation

Apply a film of grease to the outer diameter of the bushing and the inner diameter of the casting.

Center 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 40-150-7]** 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 40-150-7]**.

Tighten the bolt and nut until the bushing is seated in the casting.

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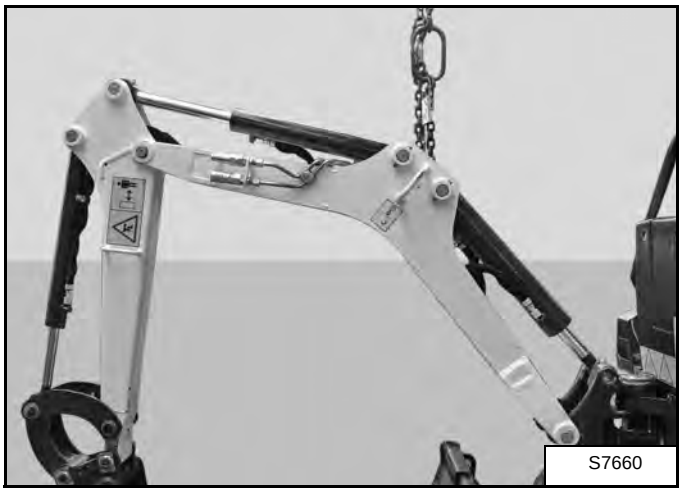
BOOM

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 40-160-1



Install a chain hoist on the boom **[Figure 40-160-1]**.

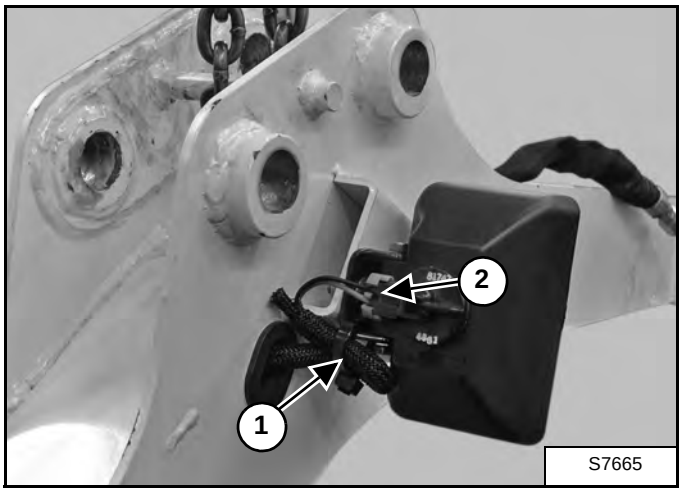
Remove the bucket. (See Removal And Installation on Page 40-180-1.)

Remove the arm cylinder. (See Removal And Installation on Page 20-21-3.)

Remove the arm. (See Removal And Installation on Page 40-170-1.)

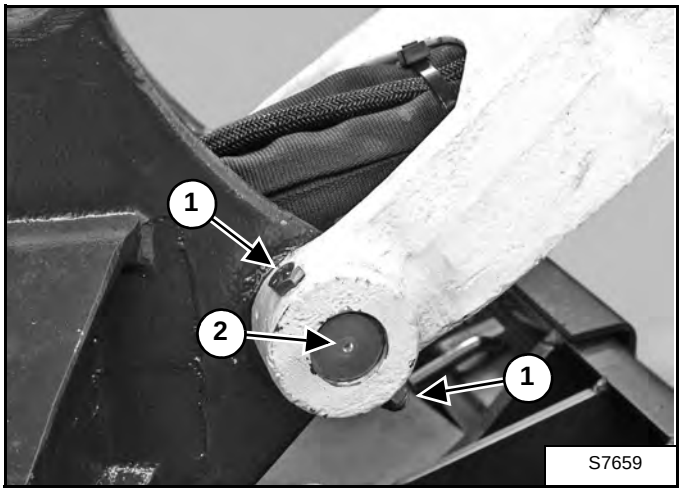
Remove the boom cylinder. (See Removal And Installation on Page 20-20-2.)

Figure 40-160-2



Remove the tie strap (Item 1) on the light wire harness. Disconnect the harness (Item 2) **[Figure 40-160-2]**.

Figure 40-160-3



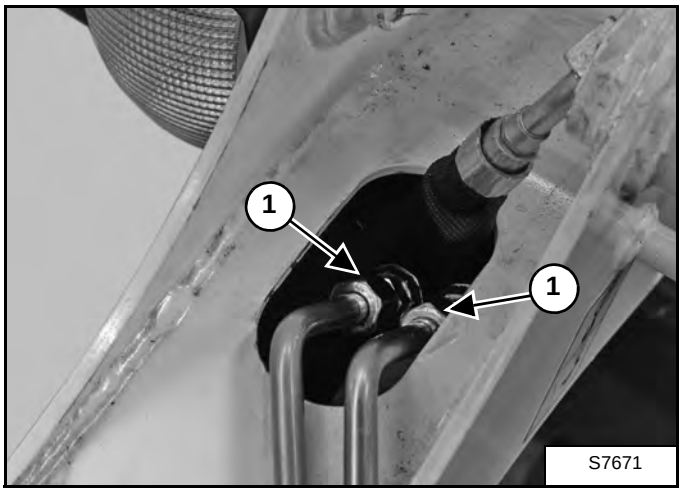
Remove the nut and bolt (Item 1) **[Figure 40-160-3]** from the pivot pin.

Remove the pivot pin (Item 2) **[Figure 40-160-3]**.

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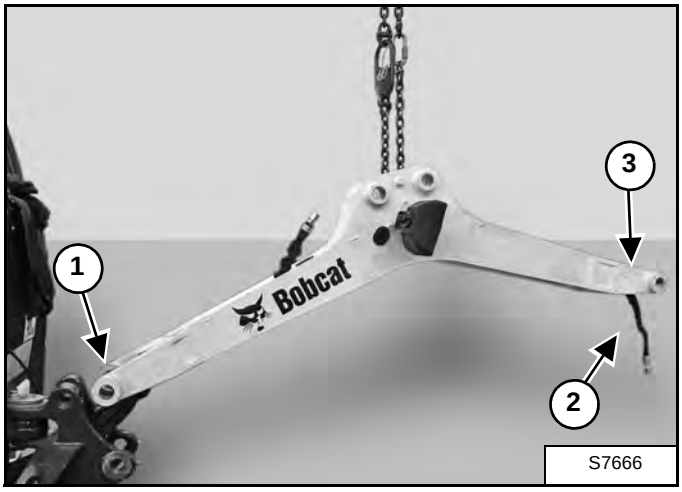
Removal And Installation (Cont'd)

Figure 40-160-4



Mark and remove the two hoses (Item 1) **[Figure 40-160-4]** from the fittings.

Figure 40-160-5



Lift the boom from the swing frame **[Figure 40-160-5]**. Carefully move the boom while removing the hoses from the center of the boom.

Installation: Feed the two arm cylinder hoses, the two boom cylinder hoses and the two auxiliary hoses (Item 1) through the inside of the boom and come out at the base pivot of the arm cylinder. Continue feeding the two bucket cylinder hoses (Item 2) through the end of the boom (Item 3) **[Figure 40-160-5]**.

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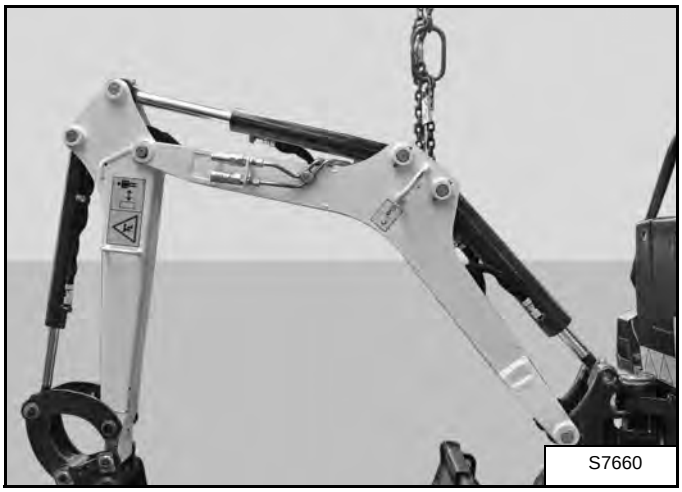
ARM

Description

The arm is the section that is connected to the end of the boom section and the bucket / bucket link. The excavator comes with a standard length but has an optional long arm.

Removal And Installation

Figure 40-170-1



Support the boom with a chain hoist **[Figure 40-170-1]**.

Remove the bucket. (See Removal And Installation on Page 40-180-1.)

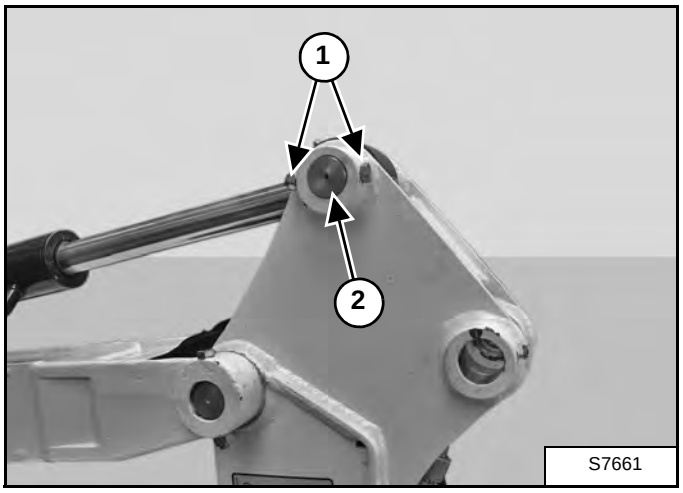
Remove the bucket cylinder. (See Removal And Installation on Page 20-23-2.)

IMPORTANT

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

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Figure 40-170-2

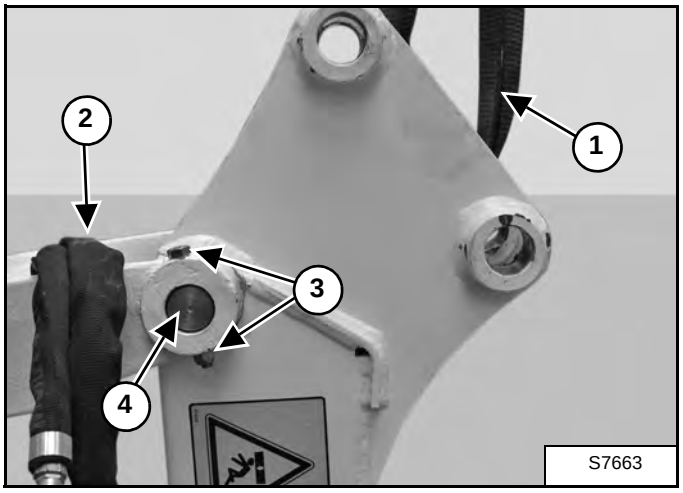


Remove the nut and bolt (Item 1) **[Figure 40-170-2]** from the rod end pivot pin.

Remove the pivot pin (Item 2) **[Figure 40-170-2]**.

Remove the rod end of the cylinder from the arm.

Figure 40-170-3



Install a strap (Item 1) **[Figure 40-170-3]** to support the arm.

Move the bucket cylinder hoses (Item 2) **[Figure 40-170-3]** away from the arm.

Remove the nut and bolt (Item 3) **[Figure 40-170-3]** from the arm pivot pin.

Remove the pivot pin (Item 4) **[Figure 40-170-3]**.

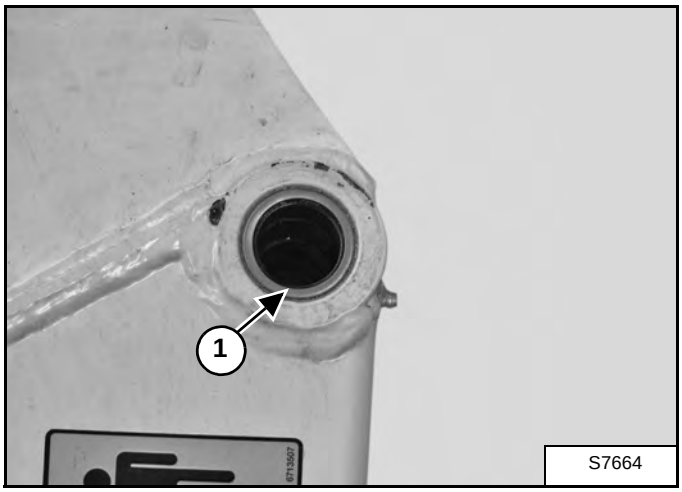
Remove the arm.

Dealer Copy -- Not for Resale

ARM (CONT'D)

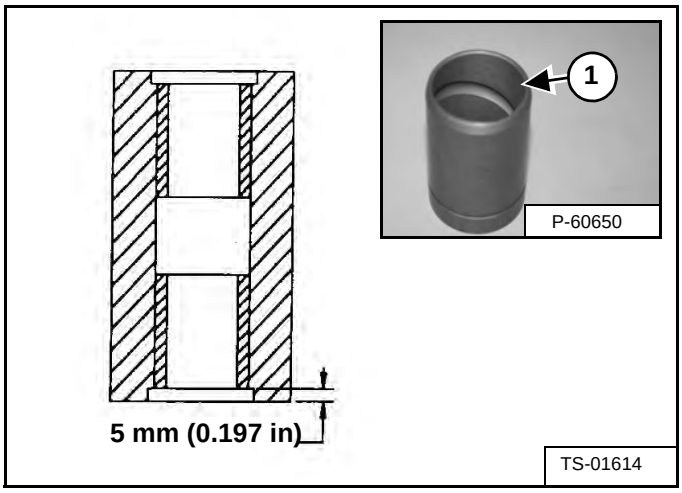
Arm To Boom Bushing Removal And Installation

Figure 40-170-4



Remove the dust seals and bushings (Item 1) **[Figure 40-170-4]** from both sides of the arm.

Figure 40-170-5



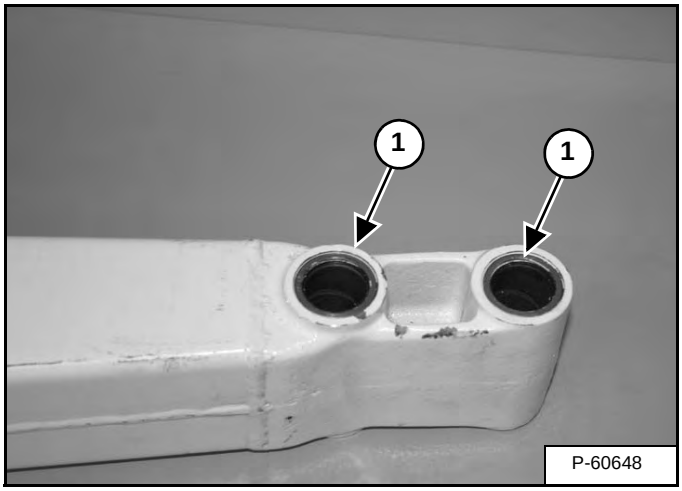
Install the new bushings until they are seated 5 mm (0.197 in) in the pin boss **[Figure 40-170-5]**.

NOTE: Install the new bushings with the tapered end first (Item 1) [Figure 40-170-5].

Install new dust seals with the lip facing out.

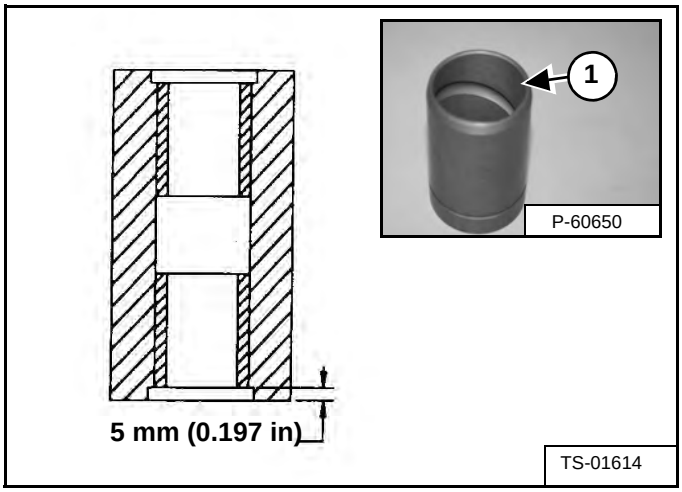
Arm To Bucket And Bucket Link Bushing Removal And Installation

Figure 40-170-6



Remove the dust seals and bushings (Item 1) **[Figure 40-170-6]** from both sides of the arm.

Figure 40-170-7



Install the bushings until they are seated 5 mm (0.197 in) in the pin boss **[Figure 40-170-7]**.

NOTE: Install the new bushings with the tapered end first (Item 1) [Figure 40-170-7].

Install new dust seals with the lip facing out.

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BUCKET

Removal And Installation

WARNING

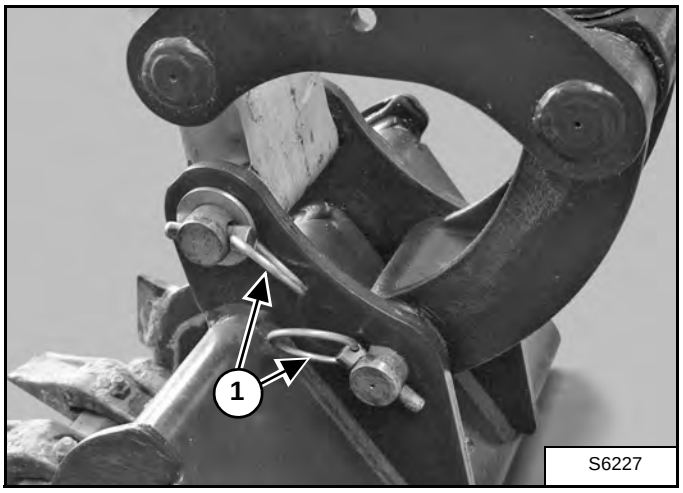
AVOID INJURY OR DEATH

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

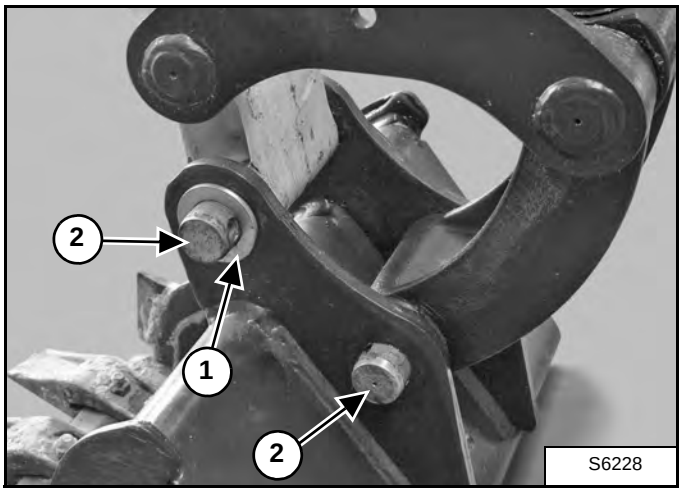
Park the excavator on a flat level surface. Put the bucket on the ground.

Figure 40-180-1



Remove the pin retainer clips (Item 1) **[Figure 40-180-1]**.

Figure 40-180-2



Remove the washer (Item 1) **[Figure 40-180-2]**.

Remove the pivot pins (Item 2) **[Figure 40-180-2]**.

Keep the pins clean. Do not damage the dust seals in the arm when removing the bucket.

Install the arm into the bucket and align the hole.

Install the pivot pin.

Extend the bucket cylinder until the connecting link aligns with the other bucket pin hole and install the pivot pin.

Install the washer (Item 1) **[Figure 40-180-2]**.

Install the pin retainer clips (Item 1) **[Figure 40-180-1]**.

Add grease to the pivot pins before operation.

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.

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Dealer Copy -- Not for Resale

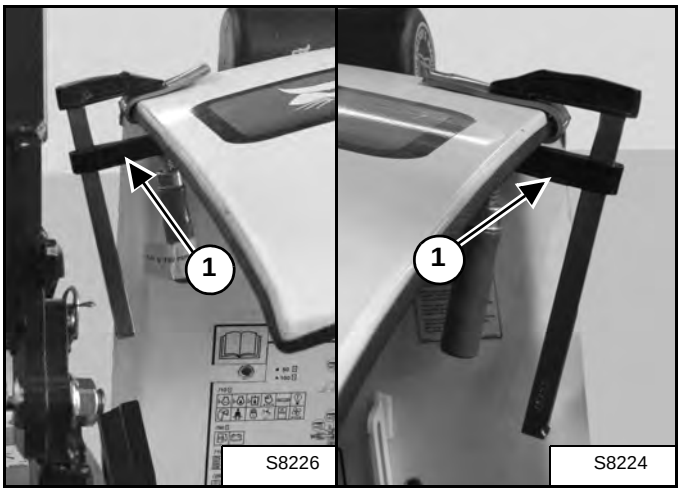
TAILGATE

Removal And Installation

Remove the seat. (See Removal And Installation on Page 40-30-1.)

Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

Figure 40-190-1



Install and tighten two c-clamps (Item 1) **[Figure 40-190-1]** equally spaced from the sides on the top of the tailgate.

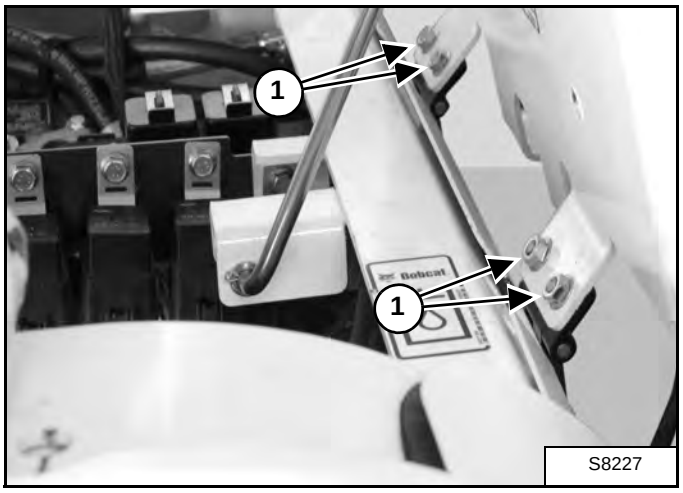
NOTE: To prevent paint damage use rubber pads on the c-clamps.

Figure 40-190-2



Install chains to the c-clamps and chain hoist **[Figure 40-190-2]**.

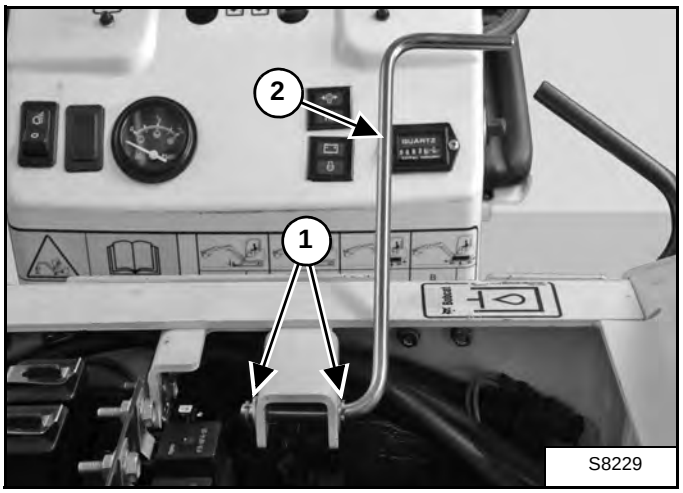
Figure 40-190-3



Remove the nuts and bolts (Item 1) **[Figure 40-190-3]** from the hinges.

Move the tailgate slightly to the right to free it from the support, then remove it from the excavator.

Figure 40-190-4



Remove the cotter pins and washers (Item 1) **[Figure 40-190-4]** from the support.

Remove the support (Item 2) **[Figure 40-190-4]** from the excavator.

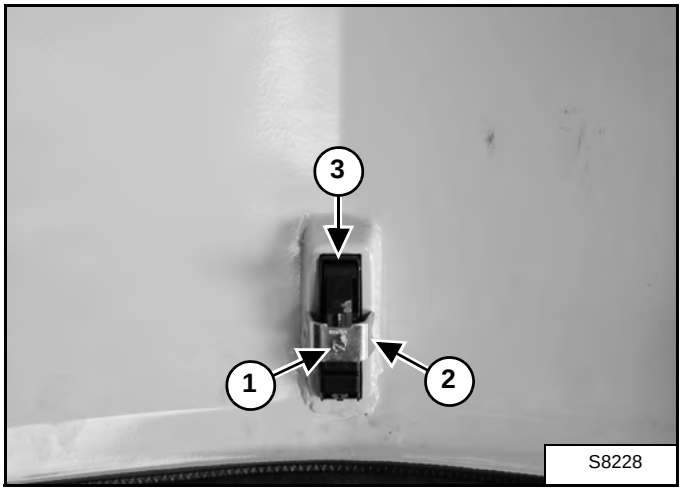
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TAILGATE (CONT'D)

Latch Removal And Installation

Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

Figure 40-190-5



Remove the bolt (Item 1) and bracket (Item 2) **[Figure 40-190-5]**.

Remove the key lock assembly (Item 3) **[Figure 40-190-5]** from the tailgate.

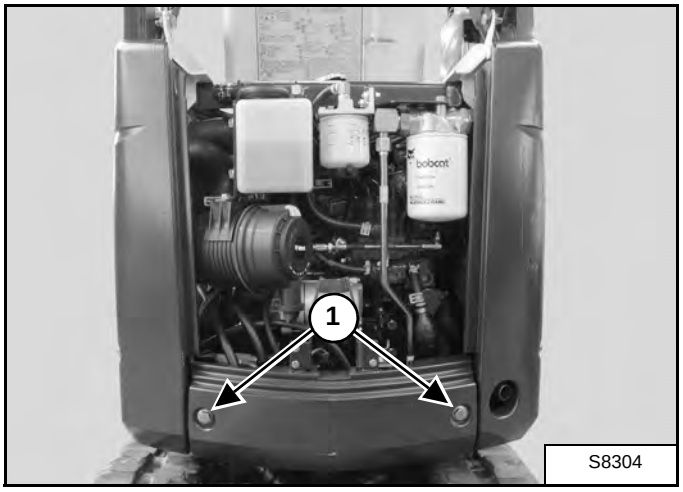
Dealer Copy -- Not for Resale

COUNTERWEIGHTS

Rear Counterweight Removal And Installation

Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

Figure 40-200-1



Remove the nuts and bolts (Item 1) **[Figure 40-200-1]** from the rear counterweight.

Installation: Tighten the bolts and nuts to 105 - 115 N•m (78 - 85 ft-lb) torque.

Remove the rear counterweight.

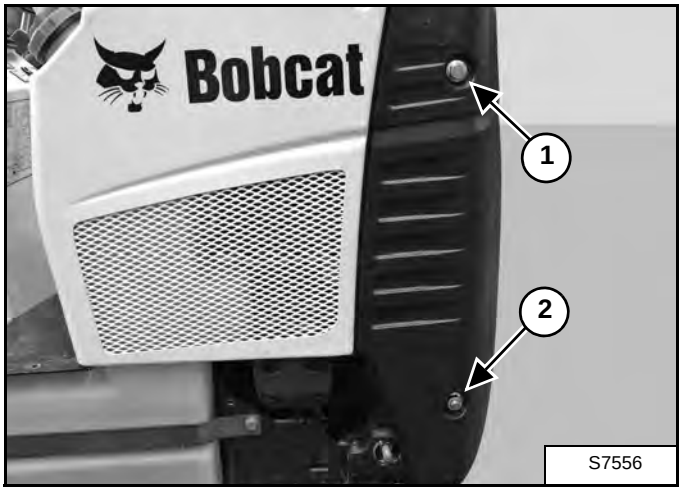
NOTE: Approximate weight of the rear counterweight is 20 kg (44 lb).

Left Side Counterweight Removal And Installation

Remove the rear counterweight. (See Rear Counterweight Removal And Installation on Page 40-200-1.)

Remove the lower left hand side cover. (See Lower Left Side Cover Removal And Installation on Page 40-210-2.)

Figure 40-200-2



Remove the bolt (Item 1) and nut (Item 2) **[Figure 40-200-2]** from the counterweight.

Installation: Tighten the bolts and nuts to 105 - 115 N•m (78 - 85 ft-lb) torque.

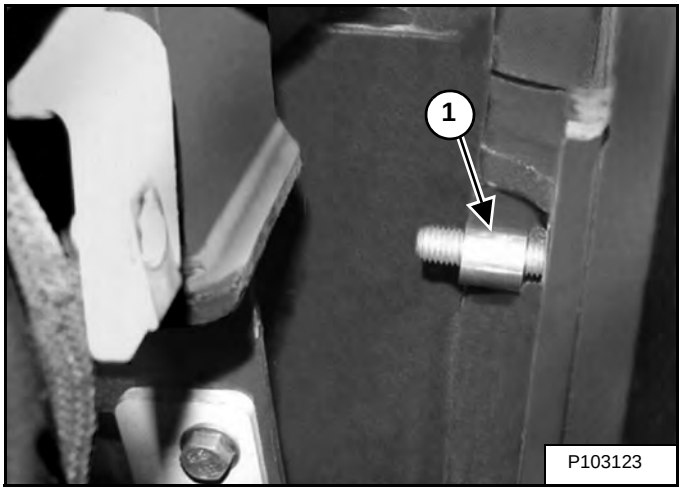
Remove the left hand counterweight.

NOTE: Approximate weight of the left hand counterweight is 20 kg (44 lb).

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Left Side Counterweight Removal And Installation (Cont'd)

Figure 40-200-3



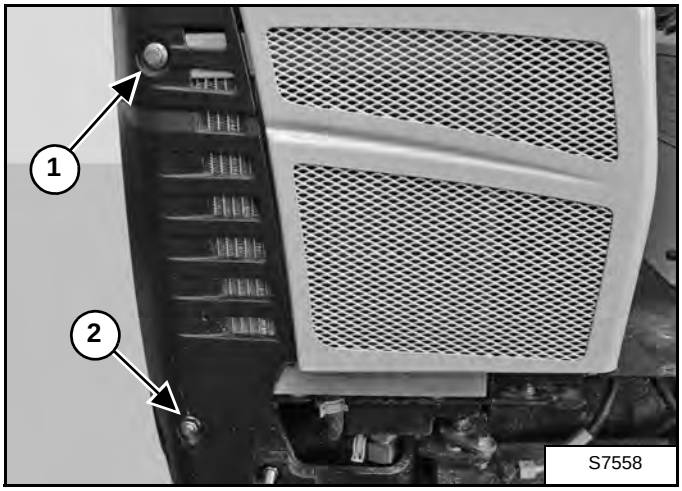
NOTE: For S/N A33P11535 & Below, the top bolt has a spacer (Item 1) [Figure 40-200-3] between the counterweight and frame. Failure to install the spacer could result in cracking of the counterweight.

Right Side Counterweight Removal And Installation

Remove the rear counterweight. (See Rear Counterweight Removal And Installation on Page 40-200-1.)

Remove the lower right hand side cover. (See Lower Right Side Cover Removal And Installation on Page 40-210-3.)

Figure 40-200-4



Remove the bolt (Item 1) and nut (Item 2) **[Figure 40-200-4]** from the counterweight.

Installation: Tighten the bolts and nuts to 215 N•m (159 ft-lb) torque.

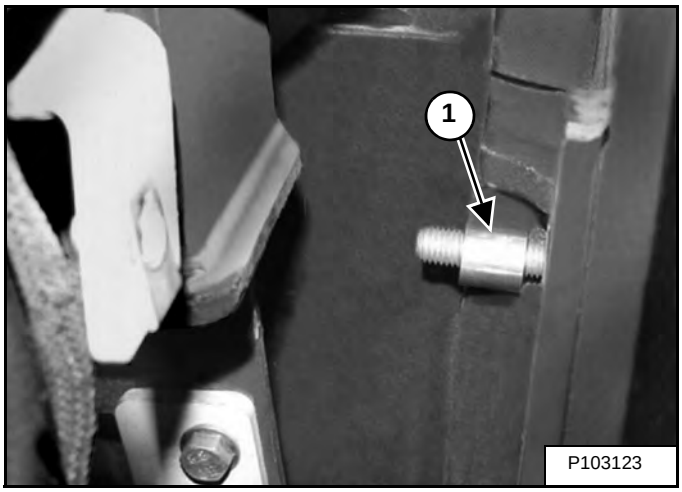
Remove the right hand counterweight.

NOTE: Approximate weight of the right hand counterweight is 20 kg (44 lb).

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Right Side Counterweight Removal And Installation (Cont'd)

Figure 40-200-5



NOTE: For S/N A33P11535 & Below, the top bolt has a spacer (Item 1) [Figure 40-200-5] between the counterweight and frame. Failure to install the spacer could result in cracking of the counterweight.

Dealer Copy -- Not for Resale

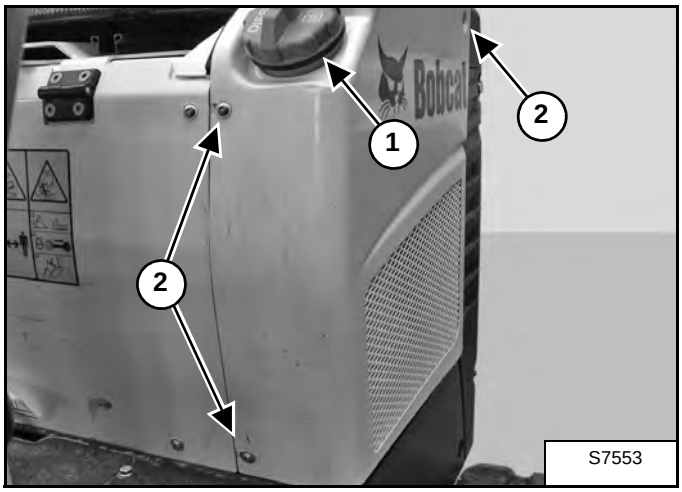


Dealer Copy -- Not for Resale

SIDE COVERS

Upper Left Side Cover Removal And Installation

Figure 40-210-1



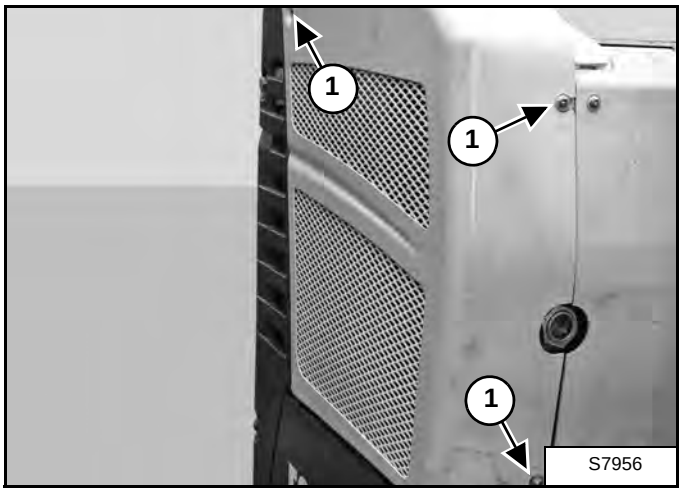
Remove the fuel fill cap (Item 1) **[Figure 40-210-1]** from the fuel tank.

Remove the bolts (Item 2) **[Figure 40-210-1]** from the upper left hand side cover.

Remove the upper left hand side cover.

Upper Right Side Cover Removal And Installation

Figure 40-210-2



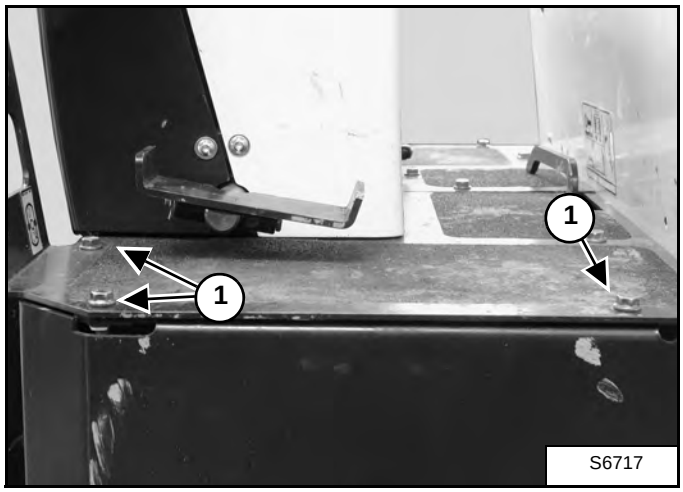
Remove the bolts (Item 1) **[Figure 40-210-2]** from the upper right hand side cover.

Remove the upper right hand side cover.

Dealer Copy -- Not for Resale

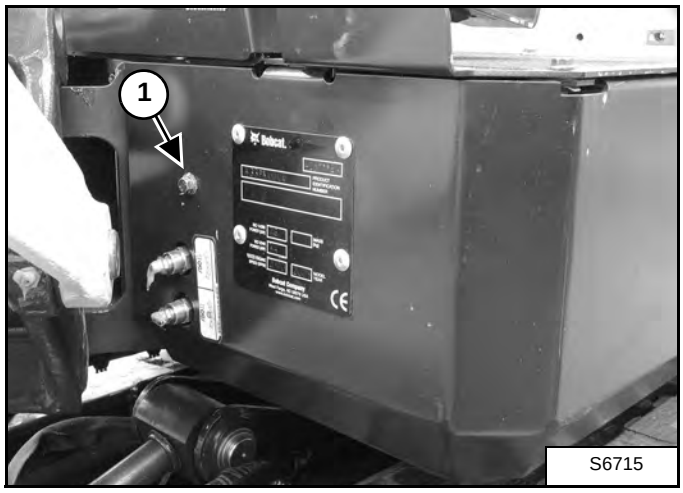
Lower Left Side Cover Removal And Installation

Figure 40-210-3



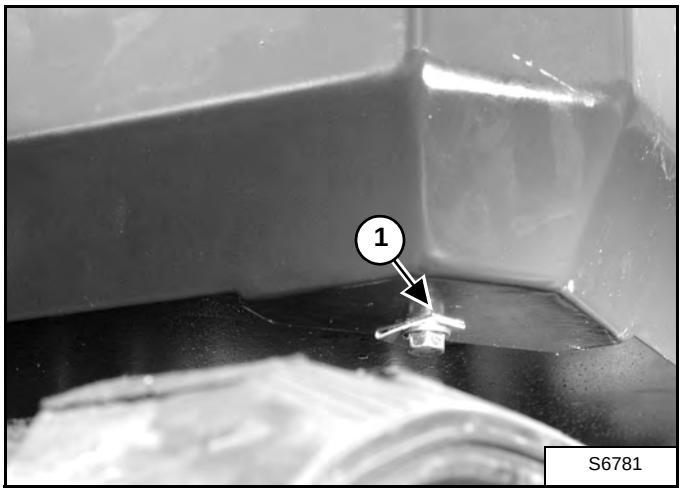
Remove the three bolts (Item 1) **[Figure 40-210-3]** from the floorplate.

Figure 40-210-4



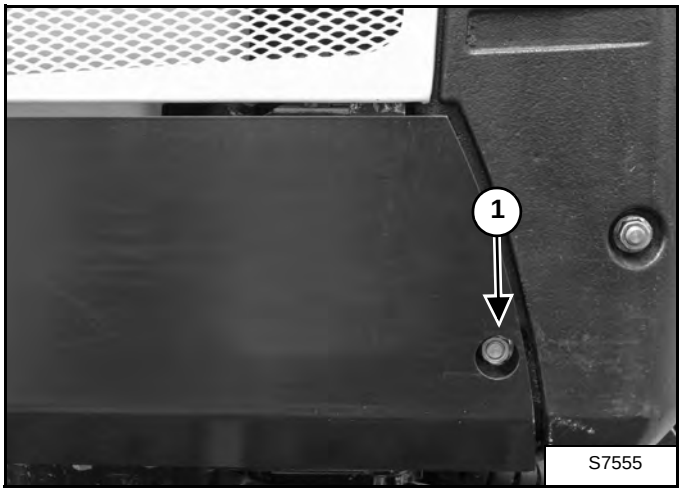
[Figure 40-210-4] Remove the bolt (Item 1) from the front of the side cover.

Figure 40-210-5



Remove the bolt (Item 1) **[Figure 40-210-5]** from the undercarriage.

Figure 40-210-6



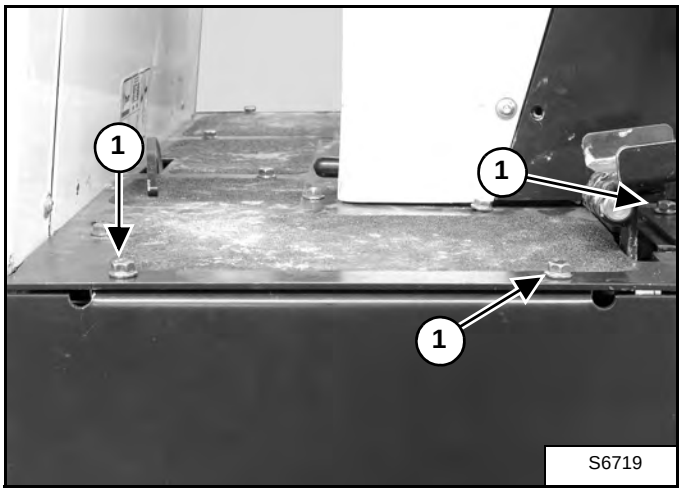
Remove the nut (Item 1) **[Figure 40-210-6]** from the side cover.

Remove the lower left hand side cover.

Dealer Copy -- Not for Resale

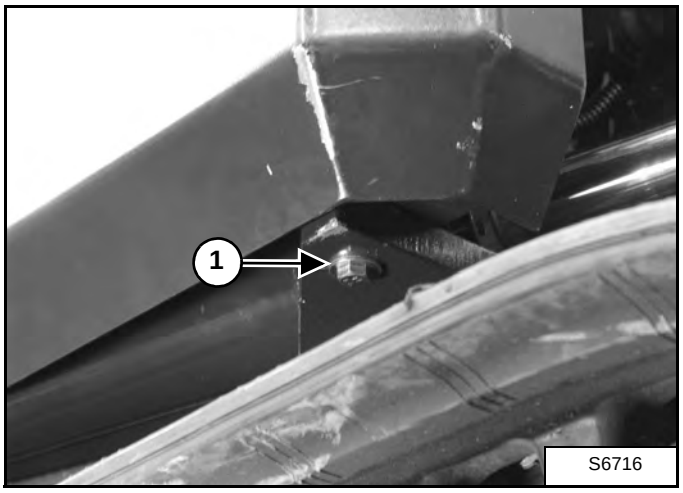
Lower Right Side Cover Removal And Installation

Figure 40-210-7



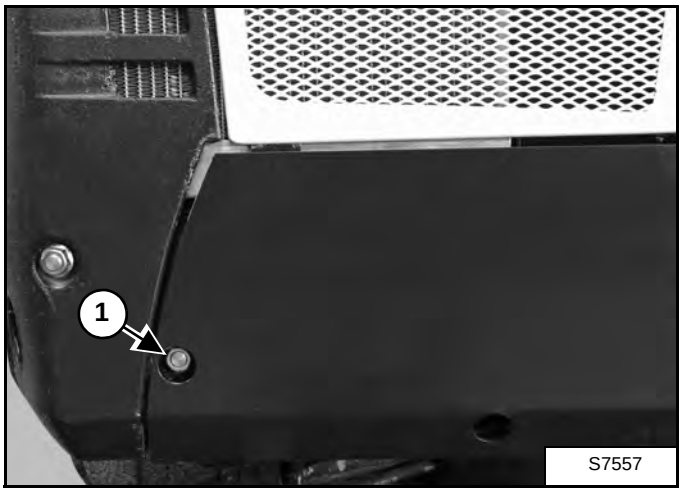
Remove the three bolts (Item 1) **[Figure 40-210-7]** from the floorplate.

Figure 40-210-8



Remove the bolt (Item 1) **[Figure 40-210-8]** from the undercarriage.

Figure 40-210-9



Remove the nut (Item 1) **[Figure 40-210-9]** from the side cover.

Remove the lower right hand side cover.

Dealer Copy -- Not for Resale

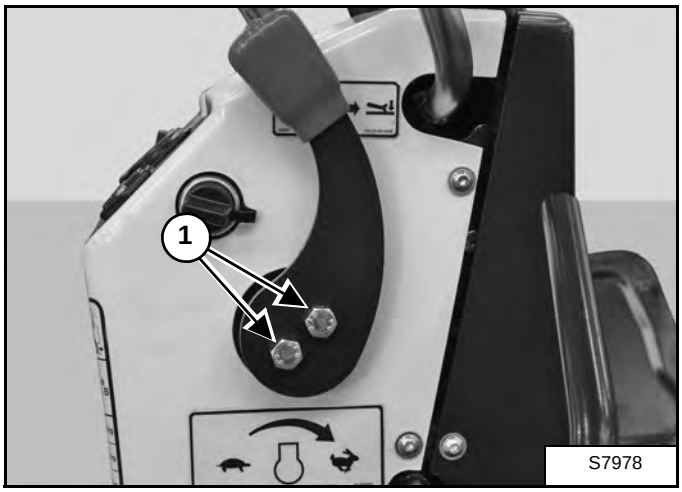


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INSTRUMENT PANEL

Removal And Installation

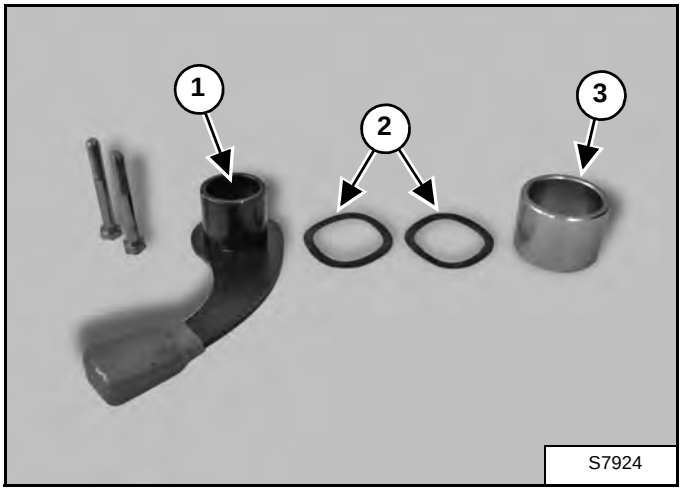
Figure 40-220-1



Remove the two bolts (Item 1) **[Figure 40-220-1]** from the throttle lever.

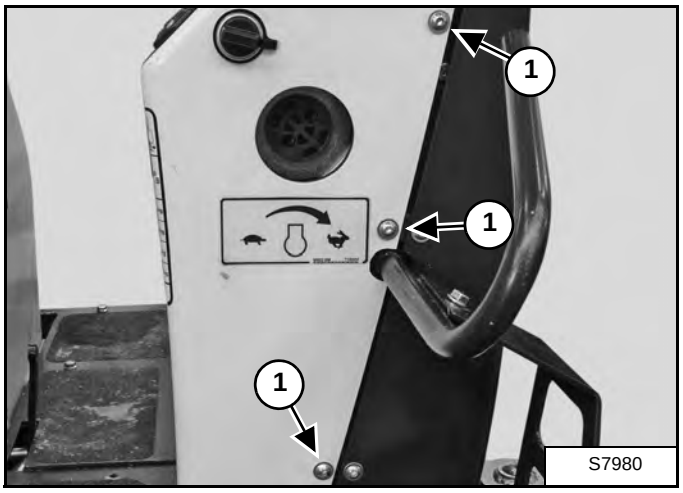
Installation: Tighten the two bolts (Item 1) **[Figure 40-220-1]** evenly until the throttle lever moves back and forth at a comfortable tension.

Figure 40-220-2



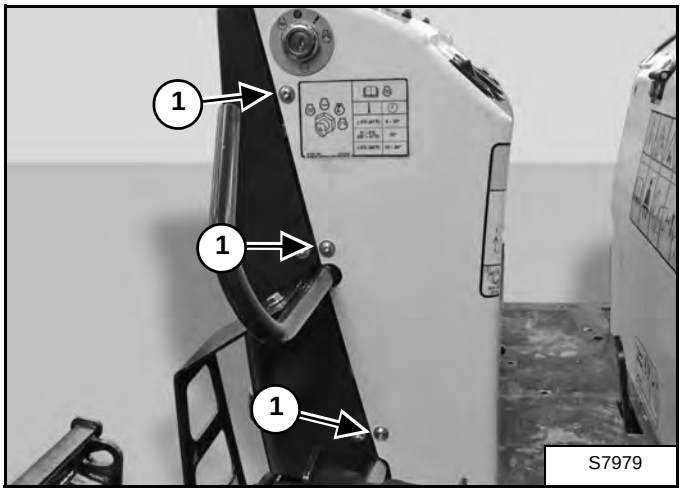
Remove the lever (Item 1), the two wave washers (Item 2) and the spacer (Item 3) **[Figure 40-220-2]**.

Figure 40-220-3



Remove the three bolts (Item 1) **[Figure 40-220-3]** from right hand side of the instrument panel.

Figure 40-220-4

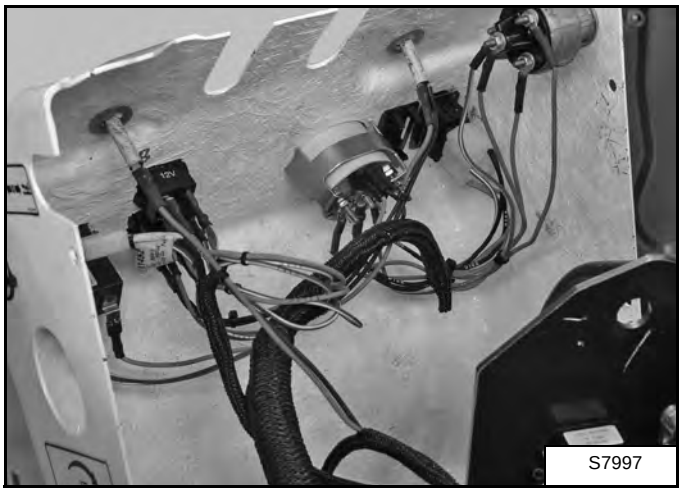


Remove the three bolts (Item 1) **[Figure 40-220-4]** from the left hand side of the instrument panel.

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Removal And Installation (Cont'd)

Figure 40-220-5

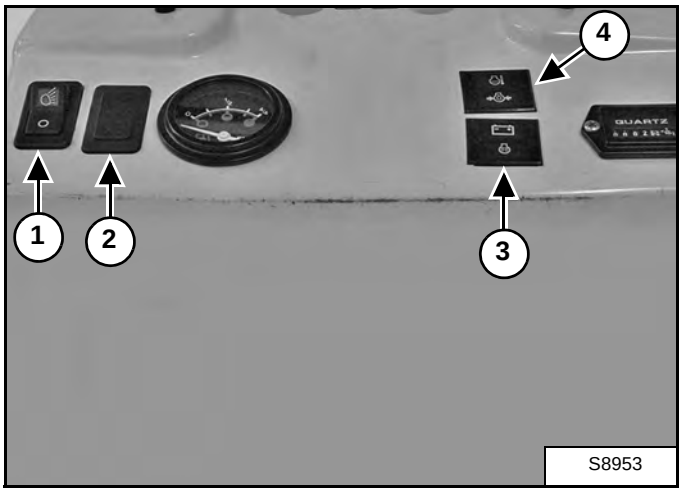


Pull back the instrument panel, mark and disconnect all connectors **[Figure 40-220-5]**.

Remove the instrument panel.

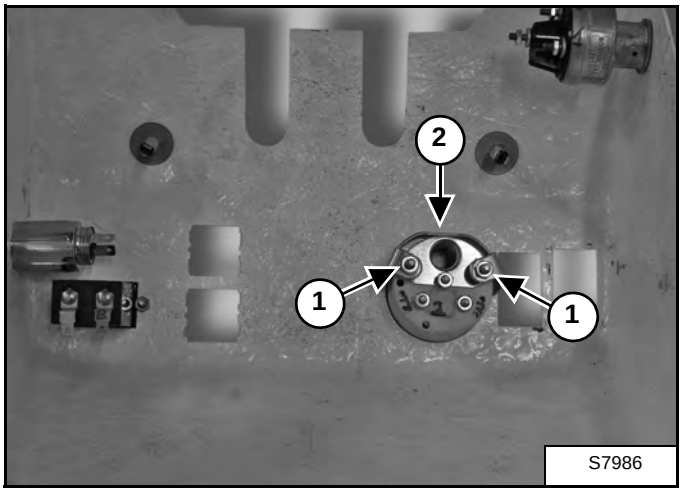
Disassembly And Assembly

Figure 40-220-6



Remove the light switch (Item 1), switch plug (Item 2), battery light (Item 3), and temperature light (Item 4) **[Figure 40-220-6]** from the instrument panel.

Figure 40-220-7



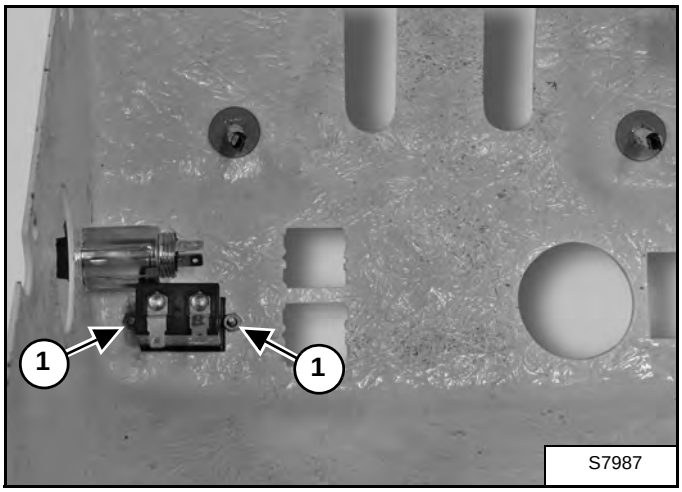
Remove the two nuts (Item 1) and bracket (Item 2) **[Figure 40-220-7]** from the fuel gauge.

Remove the fuel gauge from the instrument panel.

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Disassembly And Assembly (Cont'd)

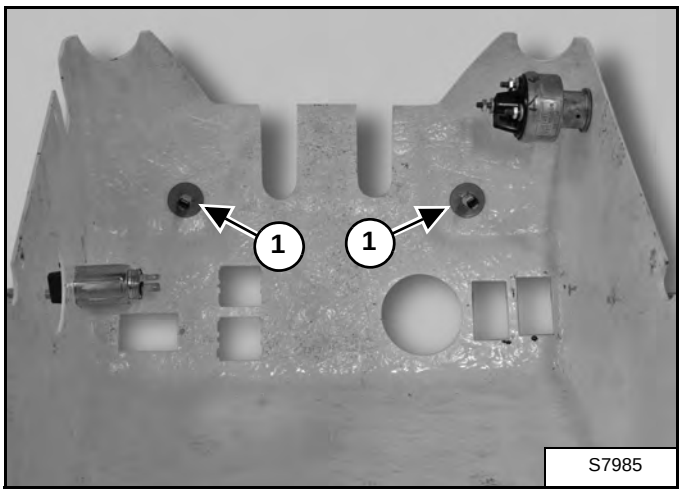
Figure 40-220-8



Remove the two nuts (Item 1) **[Figure 40-220-8]** from the hourmeter.

Remove the hourmeter from the instrument panel.

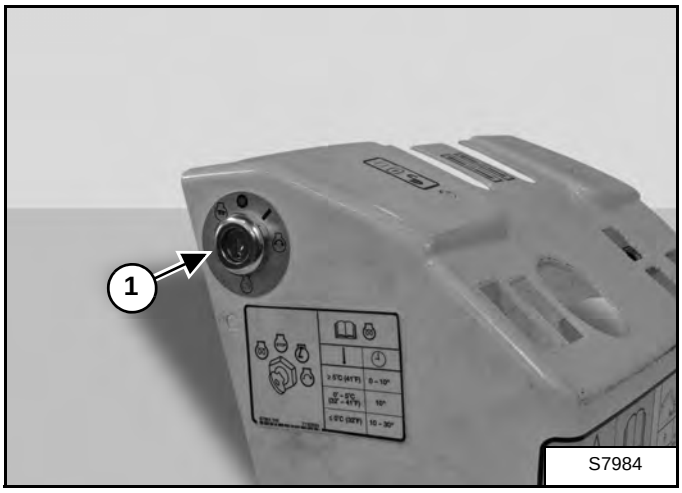
Figure 40-220-9



Remove the two washers (Item 1) **[Figure 40-220-9]** from the LED warning lights.

Remove the LED warning lights from the instrument panel.

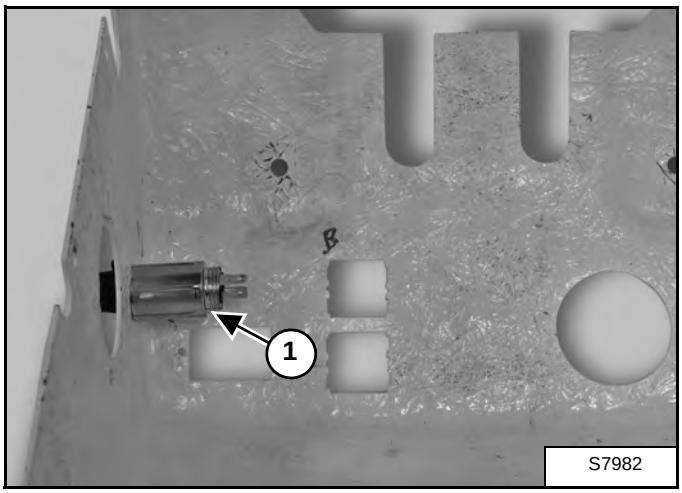
Figure 40-220-10



Remove the nut (Item 1) **[Figure 40-220-10]** from the key switch.

Remove the key switch from the instrument panel.

Figure 40-220-11



Remove the accessory socket (Item 1) **[Figure 40-220-11]** from the instrument panel.

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Dealer Copy -- Not for Resale

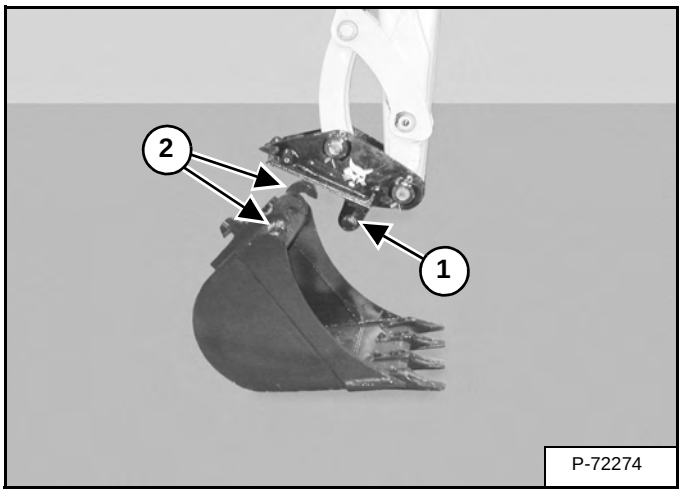
QUICK COUPLER (KLAC™ SYSTEM)

Troubleshooting

PROBLEM	CAUSE	CORRECTION
Coupler does not seat properly on the attachment mounting frame.	Mud, dirt, stones or debris are lodged between the coupler and the attachment mounting frame.	Remove mud, dirt, stones and debris from between the coupler and the attachment mounting frame.
	Worn locking mechanism.	Repair or replace worn pins and locking mechanisms.
	Attachment mounting frame damaged.	Repair or replace the attachment mounting frame.

Daily Inspection

Figure 40-230-1



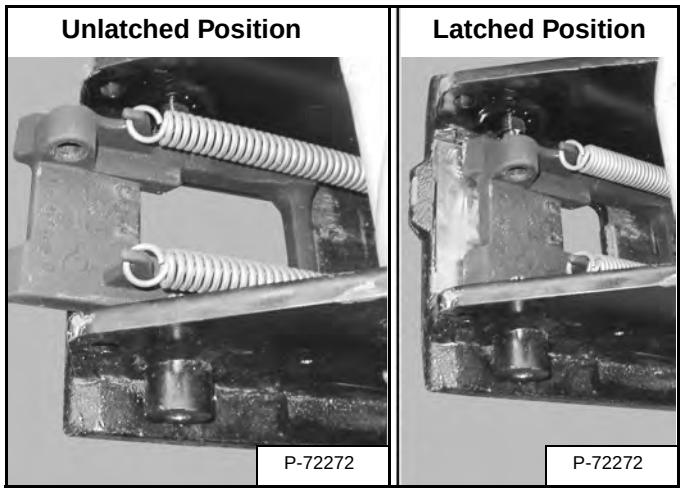
Inspect the quick coupler for wear or damage. Inspect the quick locking shaft (Item 1) and the hooks (Item 2) **[Figure 40-230-1]** (on the attachment) for wear or damage.

Repair or replace damaged parts.

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Removal And Installation

Figure 40-230-2



Remove the attachment.

The quick coupler must be in the latched position **[Figure 40-230-2]** for disassembly.

Inspect the quick coupler to make sure the latch is in the latched position.

If the latch is in the unlatched position, see **[Figure 40-230-3]** for additional information.

If the latch is in the latched position, proceed to **[Figure 40-230-3]**.

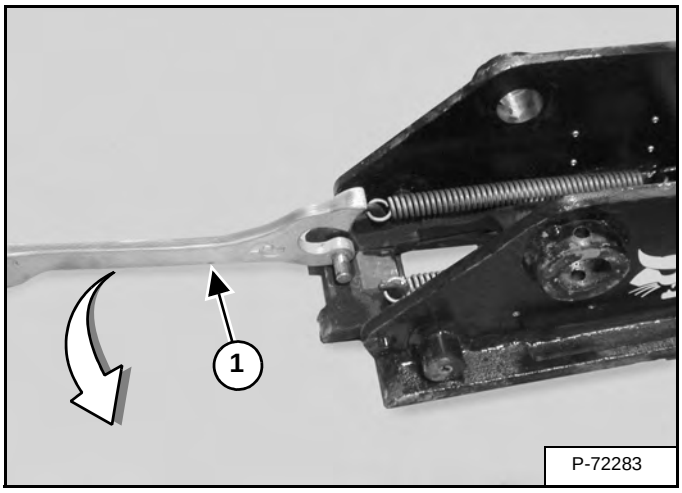
⚠ WARNING

AVOID INJURY

Keep fingers and hands out of pinch points when latching and unlatching the attachment quick coupler.

W-2541-1106

Figure 40-230-3



Install the tool (Item 1) **[Figure 40-230-3]** in the quick coupler as shown. Push down on the tool until the latch snaps closed.

⚠ WARNING

AVOID INJURY OR DEATH

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

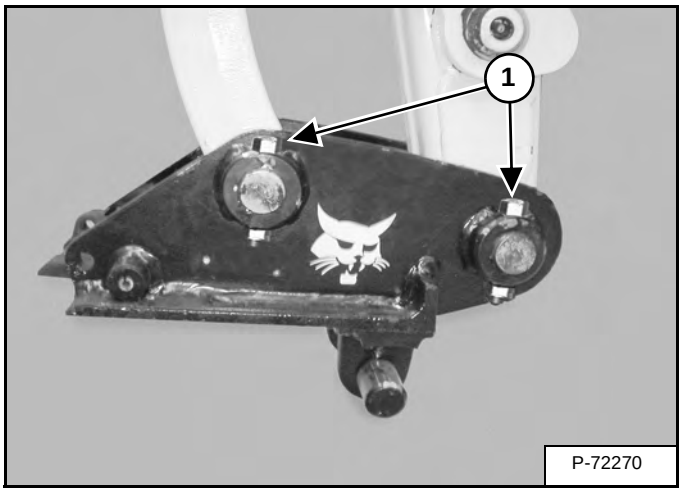
- **When fluids are under pressure.**
- **Flying debris or loose material is present.**
- **Engine is running.**
- **Tools are being used.**

W-2019-0907

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Removal And Installation (Cont'd)

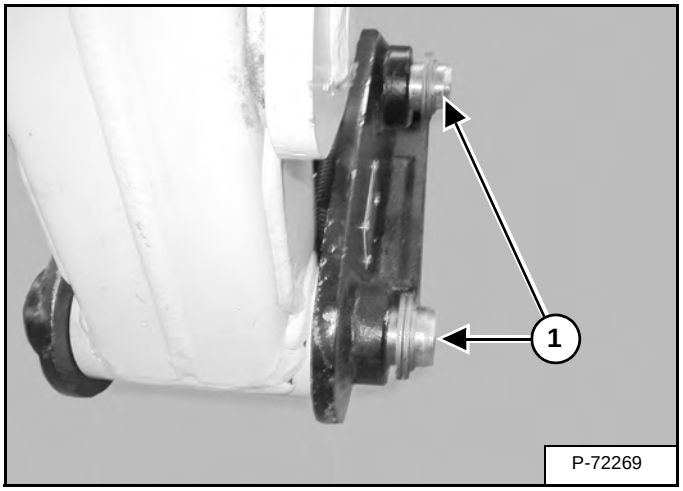
Figure 40-230-4



Remove the bolts (Item 1) **[Figure 40-230-4]** and nuts.

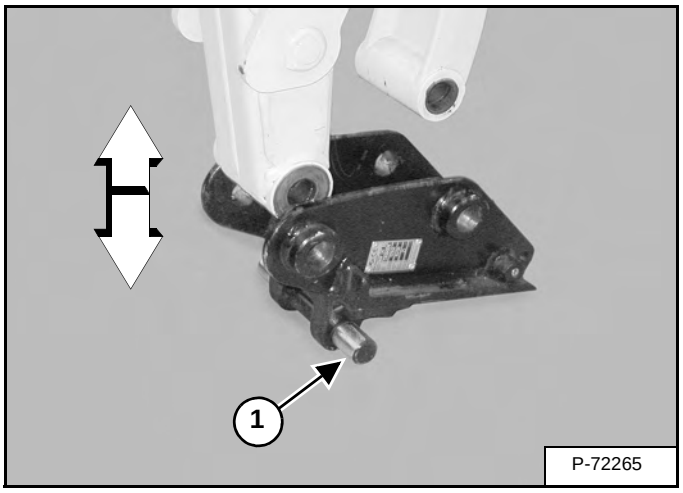
Installation: Align the holes of the connecting pins with the holes in the coupler. Install the two bolts (Item 1) **[Figure 40-230-4]** and nuts. Tighten the nuts securely against the couple.

Figure 40-230-5



Remove pins (Item 1) **[Figure 40-230-5]**.

Figure 40-230-6



Raise the arm and bucket link until the coupler is free **[Figure 40-230-6]**.

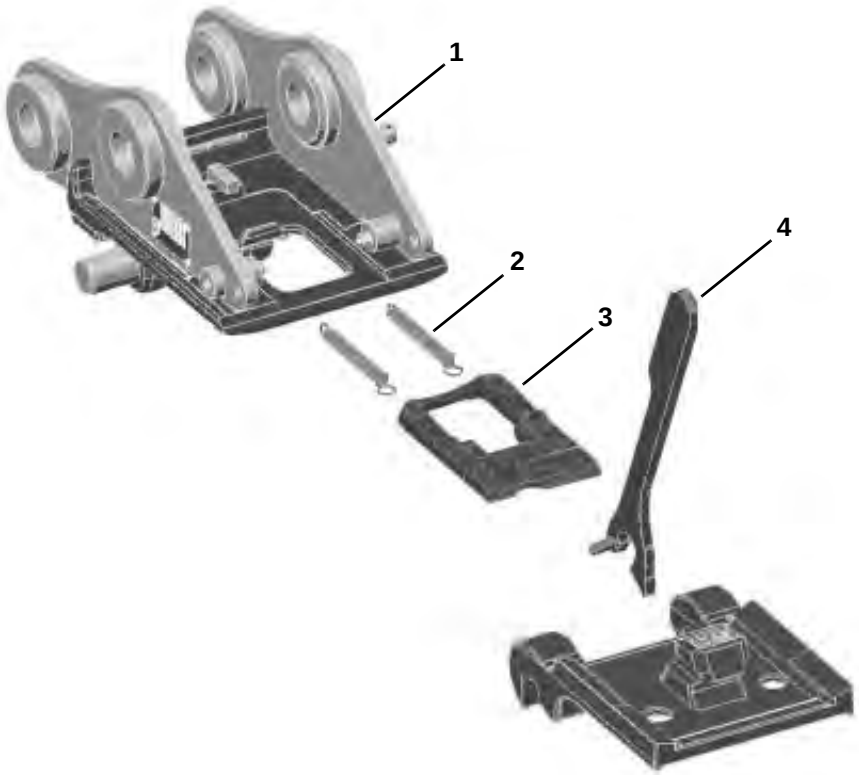
Installation: Align the arm and bucket link with the coupler **[Figure 40-230-6]**. Lower the arm and bucket link into the coupler.

NOTE: Place the coupler on the ground with the mounting pin (Item 1) [Figure 40-230-6] facing towards the excavator.

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Parts Identification

1. Coupler Body
2. Spring
3. Locking Plate
4. Tool



P-88398

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Disassembly

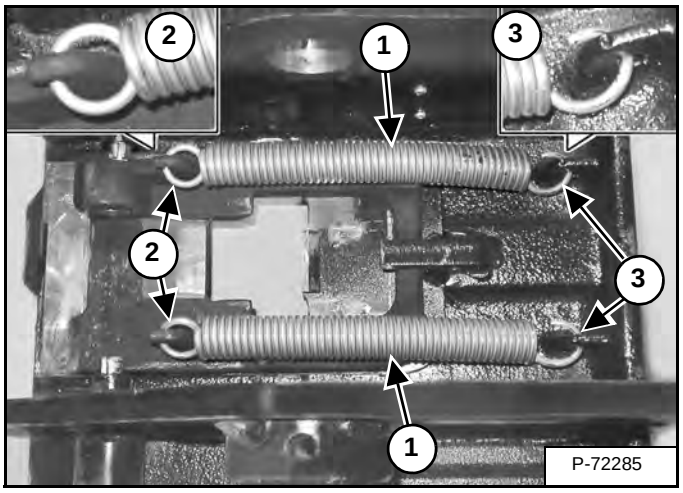
WARNING

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

- **Pressurized fluids and springs or other stored energy components.**
- **Flying debris or loose material is present.**
- **Engine is running.**
- **Tools are being used.**

W-2505-0604

Figure 40-230-7



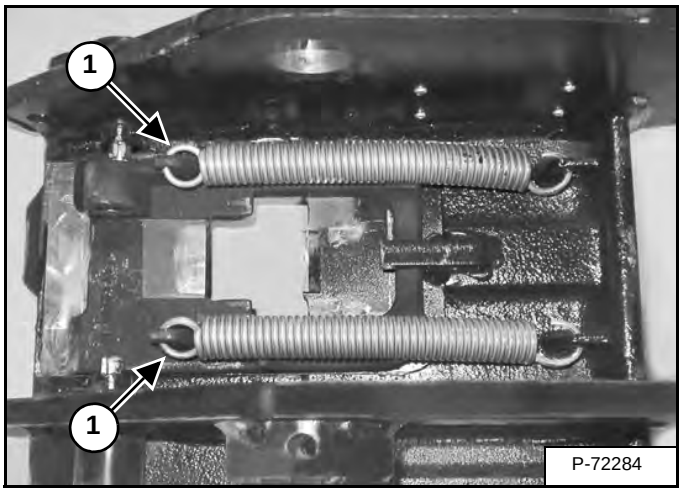
The two springs (Item 1) **[Figure 40-230-7]** have different style of end hooks.

The spring hook (Item 2) **[Figure 40-230-7]** are full circle hooks.

The spring hook (Item 3) **[Figure 40-230-7]** are partial circle hooks.

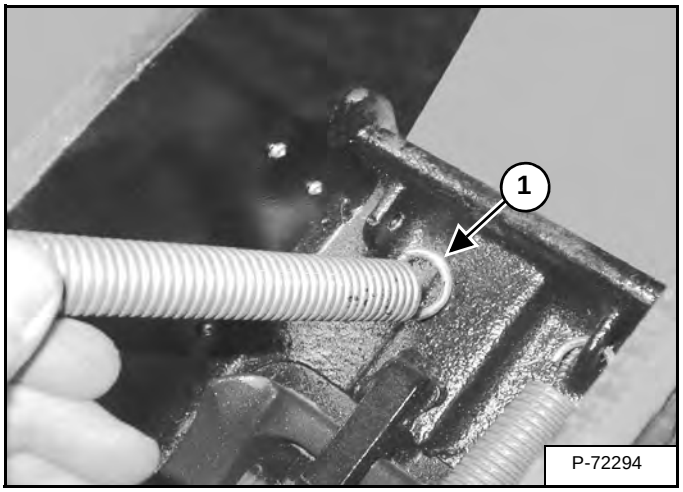
The spring ends must be positioned as shown when assembled.

Figure 40-230-8



Remove the spring end hook (Item 1) **[Figure 40-230-8]** from the quick coupler.

Figure 40-230-9

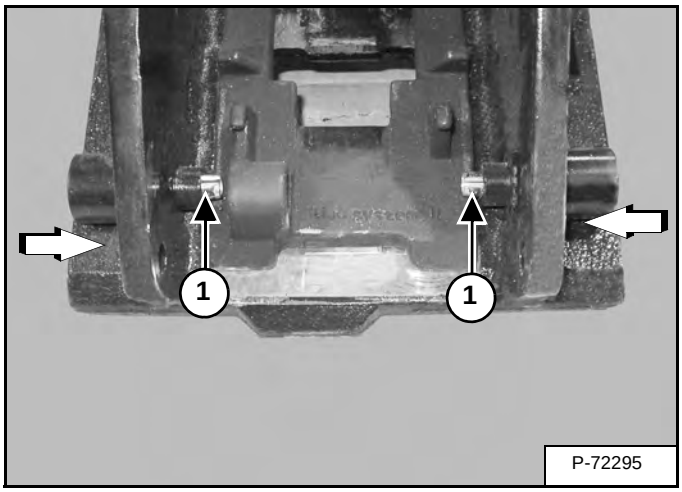


Remove the opposite end of the two springs (Item 1) **[Figure 40-230-9]**.

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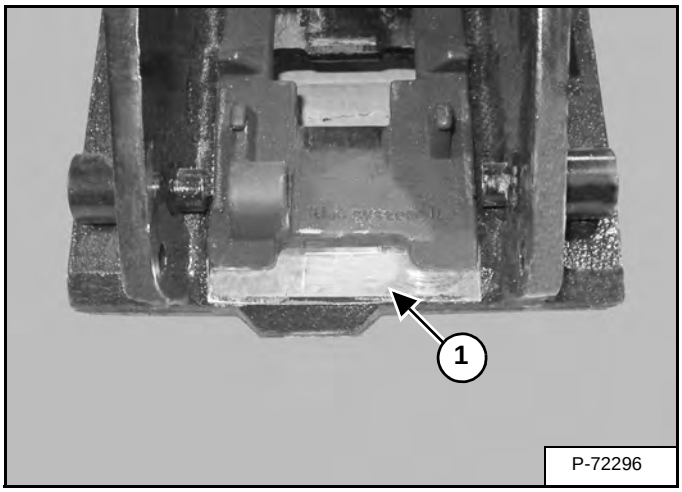
Disassembly (Cont'd)

Figure 40-230-10



Remove the two roll pins (Item 1) **[Figure 40-230-10]**. Drive the roll pins inwards to remove.

Figure 40-230-11

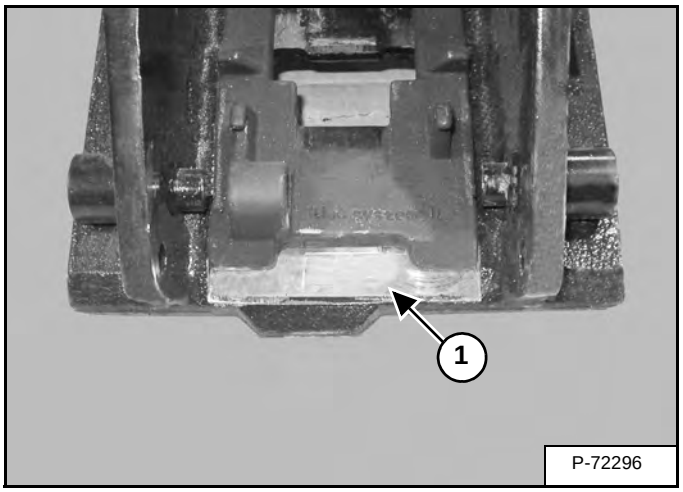


Remove the latch (Item 1) **[Figure 40-230-11]**.

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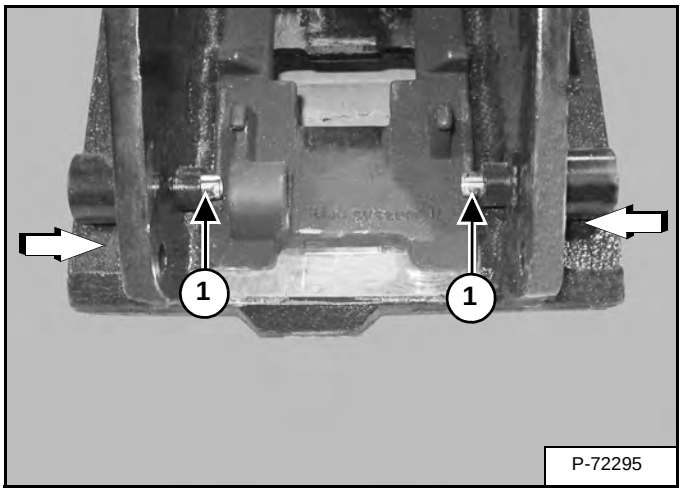
Assembly

Figure 40-230-12



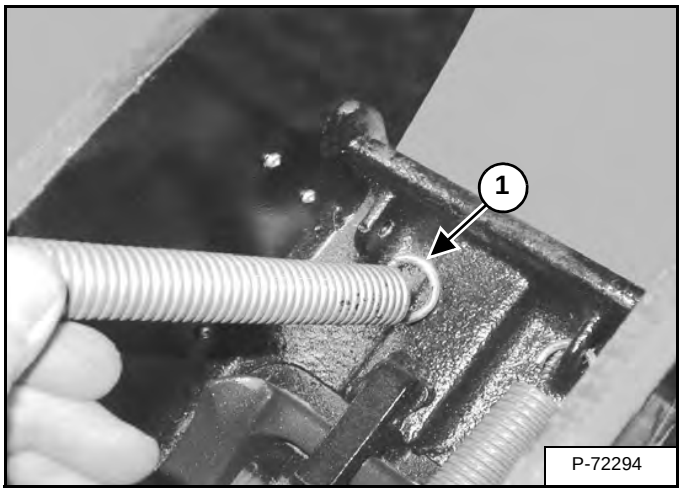
Install the latch (Item 1) **[Figure 40-230-12]**.

Figure 40-230-13



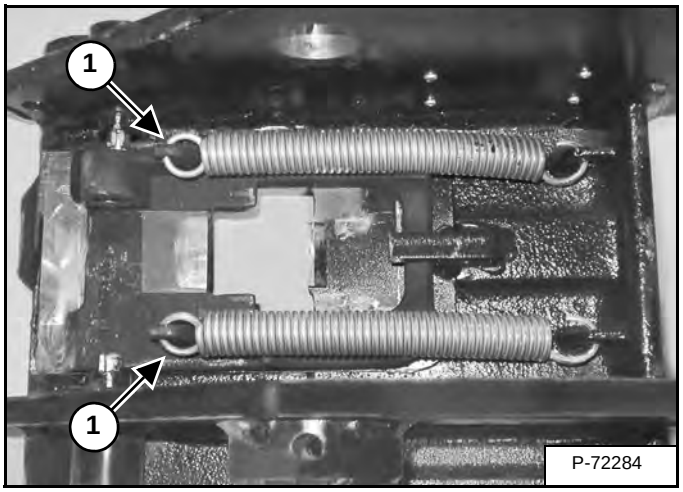
Install the two roll pins (Item 1) **[Figure 40-230-13]**. Drive the roll pins inwards until the roll pins are flush with the outside edge of the quick coupler.

Figure 40-230-14



Install the partial circle hook end of the spring (Item 1) **[Figure 40-230-14]**.

Figure 40-230-15



Install the full circle end of the spring hook (Item 1) **[Figure 40-230-15]** on the quick coupler.

Do not lubricate the quick coupler. Lubrication will cause dirt to collect and interfere with proper movement of the quick coupler.

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QUICK COUPLER (LEHNHOFF® SYSTEM)

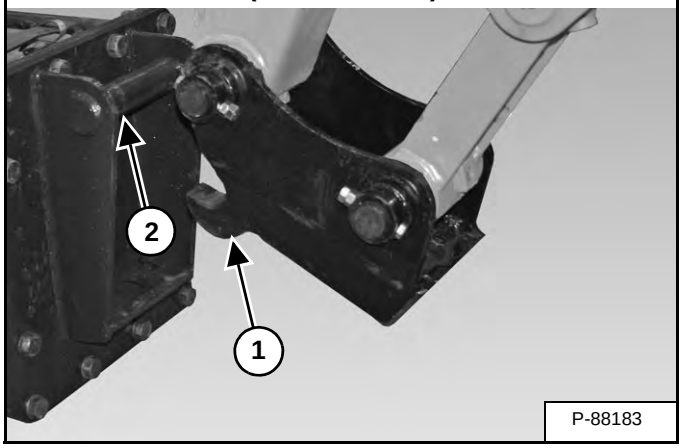
Troubleshooting

PROBLEM	CAUSE	CORRECTION
Coupler does not seat properly on the attachment mounting frame.	Mud, dirt, stones or debris are lodged between the coupler and the attachment mounting frame.	Remove mud, dirt, stones and debris from between the coupler and the attachment mounting frame.
	Worn locking mechanism.	Repair or replace worn pins and locking mechanisms.
	Attachment mounting frame damaged.	Repair or replace the attachment mounting frame.

Daily Inspection

Figure 40-231-1

(MS03 & MS08)



Inspect the quick coupler for wear or damage. Inspect the hooks (Item 1) and coupler locking shaft (Item 2) **[Figure 40-231-1]** (on the attachment) for wear or damage.

Repair or replace damaged parts.

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Removal (MS03 And MS08)

WARNING

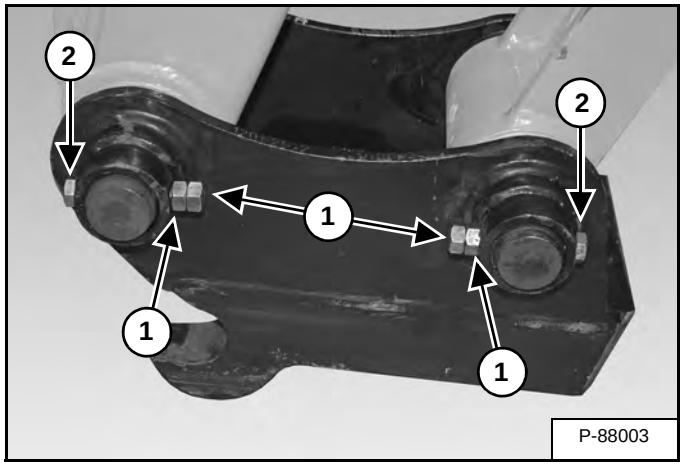
AVOID INJURY OR DEATH

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

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

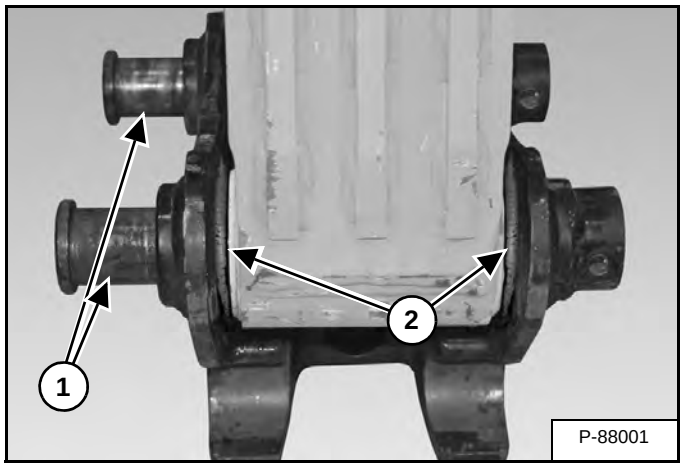
W-2019-0907

Figure 40-231-2



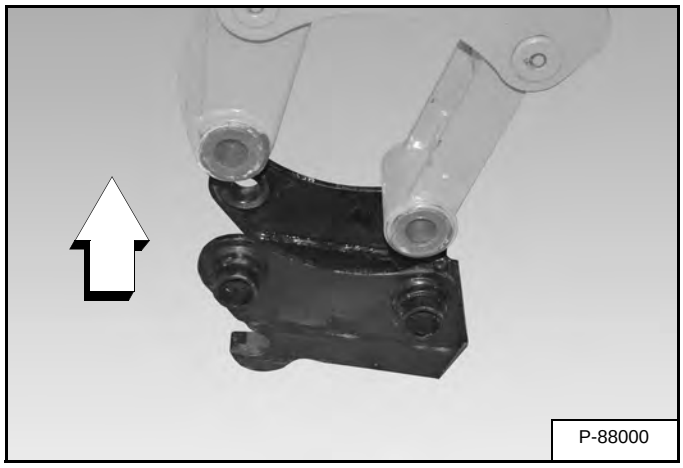
Remove the four nuts (Items 1). Remove the two bolts (Item 2) **[Figure 40-231-2]**.

Figure 40-231-3



Remove the two connecting pins (Item 1) and O-rings (Item 2) **[Figure 40-231-3]**.

Figure 40-231-4

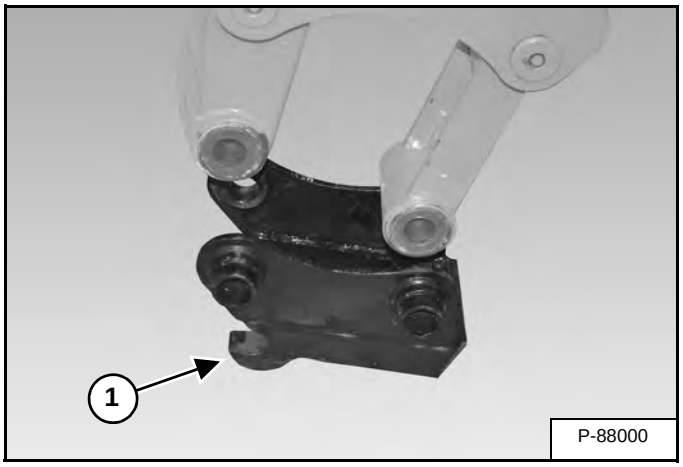


Raise the arm and bucket link until the quick coupler is free **[Figure 40-231-4]**.

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Installation (MS03 And MS08)

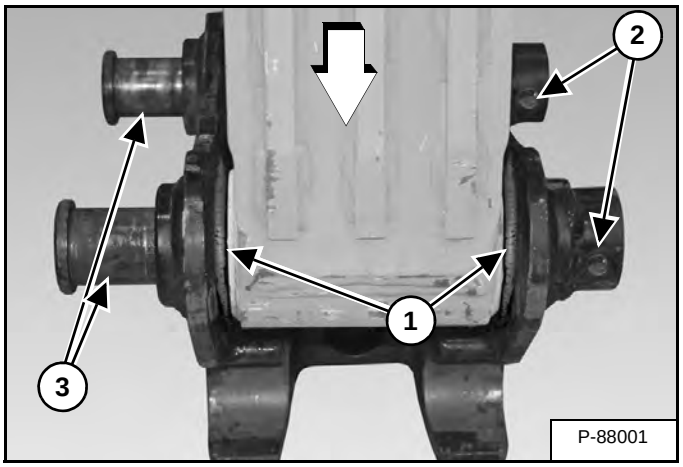
Figure 40-231-5



Place the coupler on the ground with the hooks (Item 1) **[Figure 40-231-5]** facing towards the excavator.

Align the arm and bucket link with the coupler **[Figure 40-231-5]**.

Figure 40-231-6



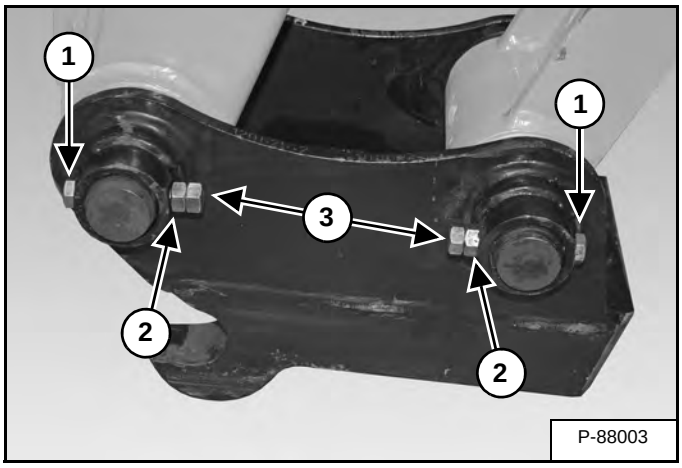
Install the O-rings (Item 1) **[Figure 40-231-6]** between the coupler pivot point and the arm and bucket link when lowering into position.

NOTE: The O-rings will prevent dirt and debris from entering the pivot points of the coupler.

Align the holes of the connecting pins with the holes (Item 2) **[Figure 40-231-6]** in the coupler.

Install the two pins (Item 3) **[Figure 40-231-6]** through the coupler, arm and bucket link.

Figure 40-231-7



Install the two bolts (Item 1) **[Figure 40-231-7]**.

Install nuts (Item 2) **[Figure 40-231-7]** just until contact is made with the coupler.

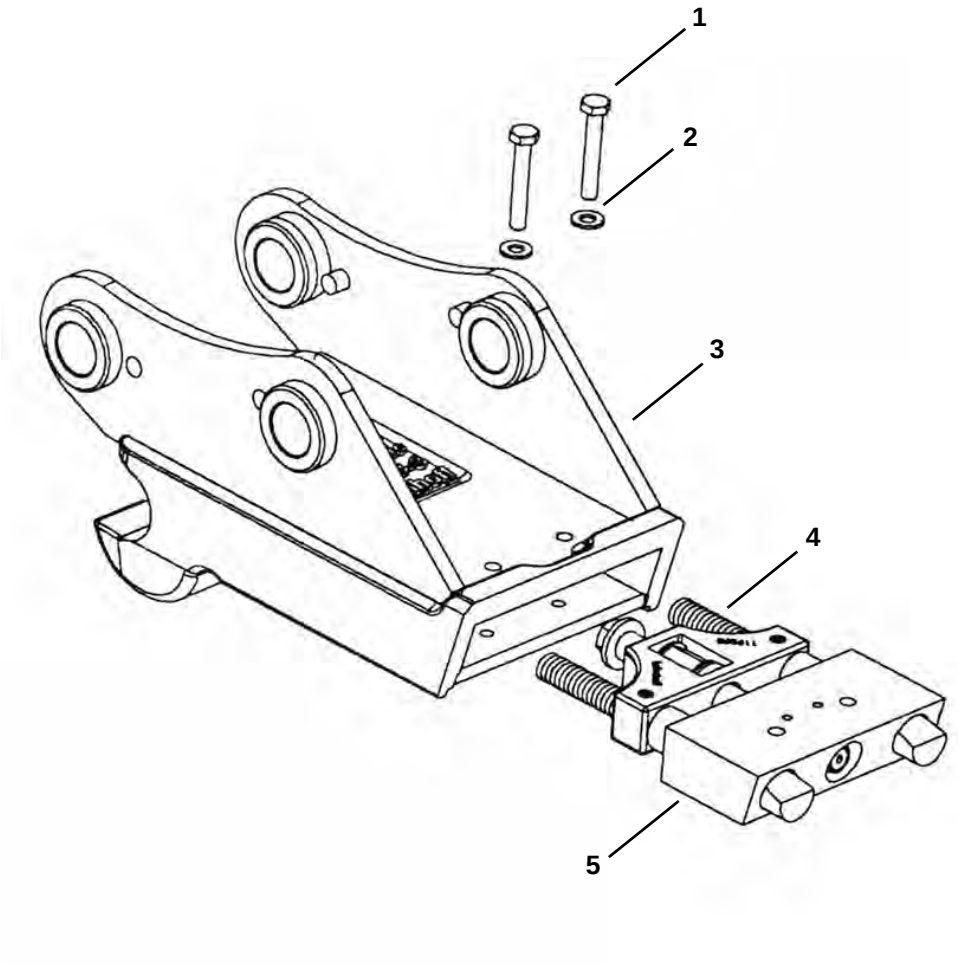
NOTE: Do Not tighten nuts (Item 2) [Figure 40-231-7] against the coupler. The retaining bolt must rotate freely.

Install and tighten nuts (Item 3) securely against the two nuts (Item 2) **[Figure 40-231-7]**. The retaining bolts must rotate freely.

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Parts Identification (MS03)

1. Bolt
2. Lock Washer
3. Coupler Housing
4. Pressure Spring
5. Locking Mechanism

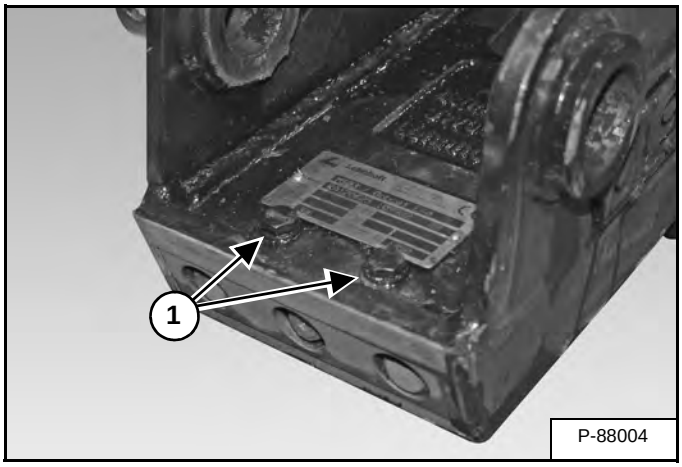


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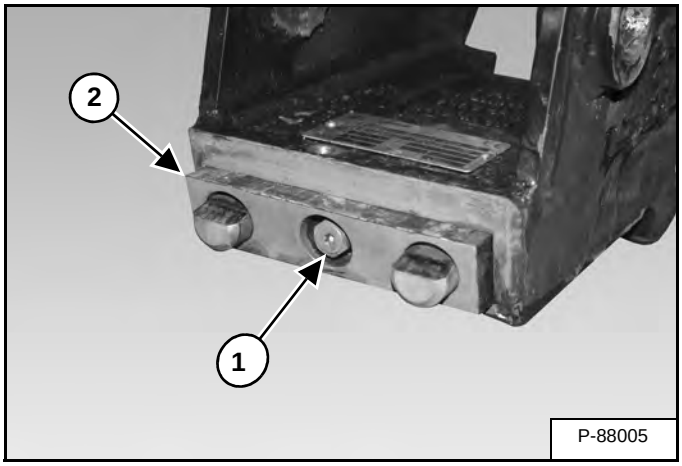
Disassembly And Assembly (MS03)

Figure 40-231-8



Remove the two bolts (Item 1) **[Figure 40-231-8]** and lock washers.

Figure 40-231-9

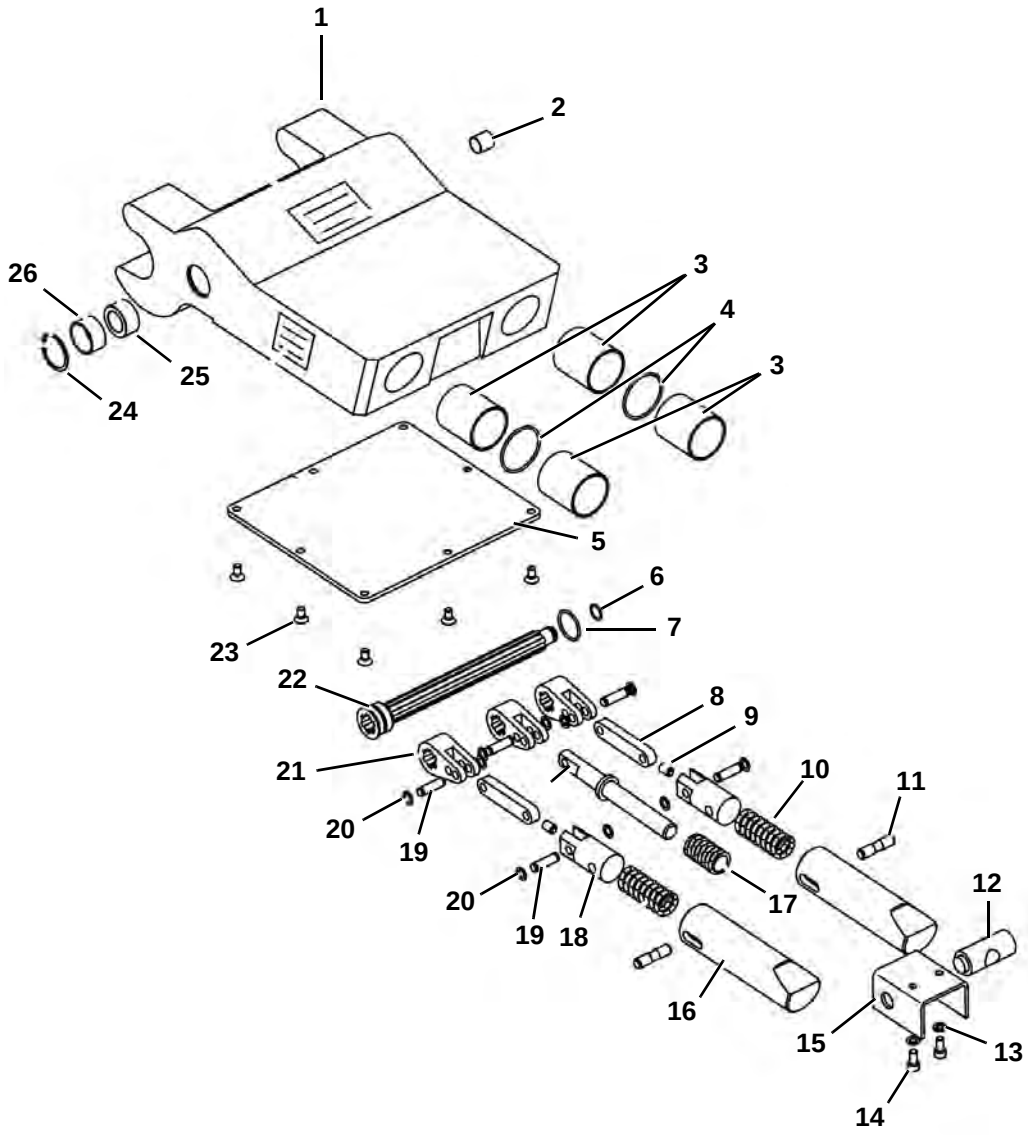


Turn the threaded spindle (Item 1) counterclockwise until the locking mechanism (Item 2) **[Figure 40-231-9]** is free from the housing.

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Parts Identification (MS08)

1. Housing
2. Bushing
3. Bushing
4. O-ring
5. Cover
6. O-ring
7. O-ring
8. Reversing Lever
9. Threaded Pin
10. Pressure Spring
11. Pin
12. Pivoting Journal
13. Spring Washer
14. Bolt
15. Bearing Block
16. Locking Pin
17. Pressure Spring
18. Thrust Journal
19. Pin
20. O-ring
21. Driving Fork
22. Control Shaft
23. Bolt
24. Snap Ring
25. Bushing
26. Bushing



P-88115

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Disassembly (MS08)

⚠ WARNING

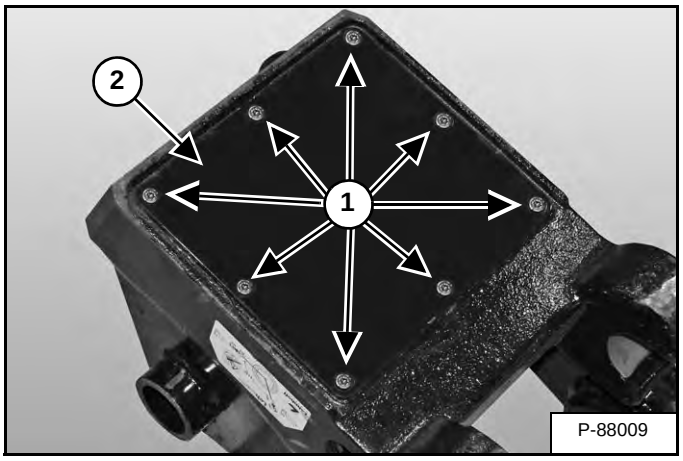
AVOID INJURY OR DEATH

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

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

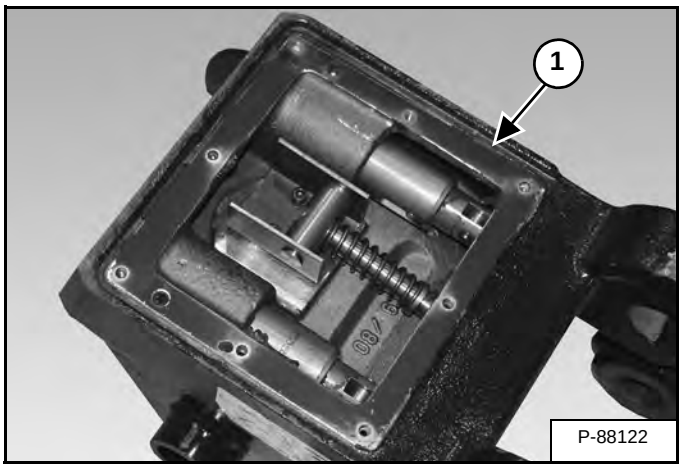
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Figure 40-231-10



Remove the eight bolts (Item 1) and cover (Item 2) **[Figure 40-231-10]**.

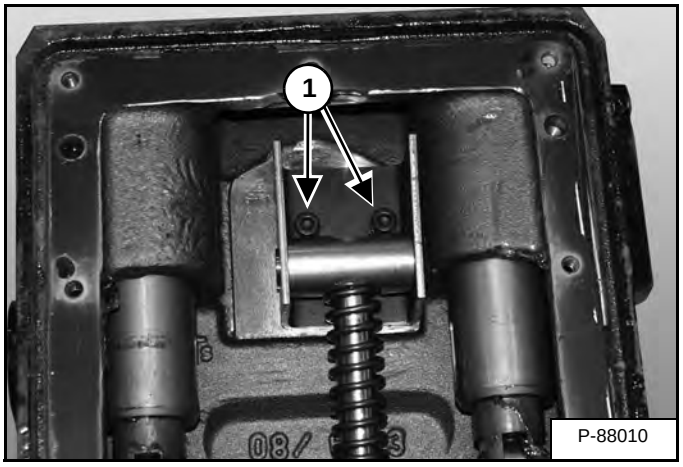
Figure 40-231-11



Remove all sealant (Item 1) **[Figure 40-231-11]** from the housing and cover.

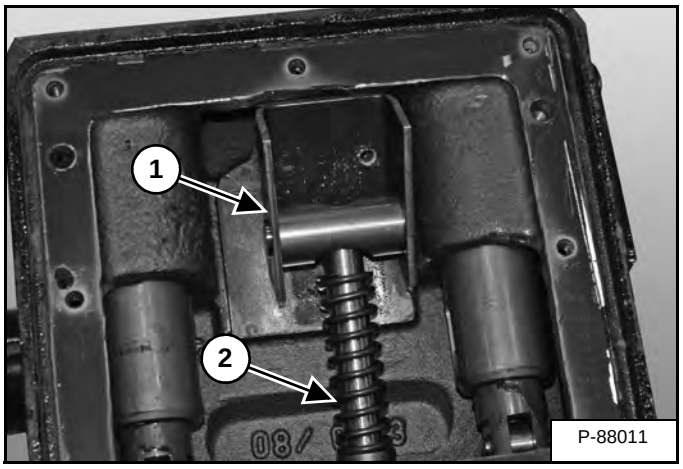
NOTE: Do not scratch the mounting surface while removing sealant.

Figure 40-231-12



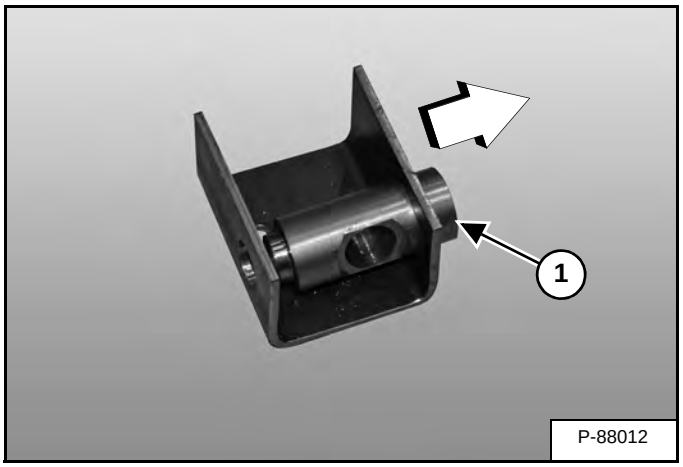
Remove the two bolts (Item 1) **[Figure 40-231-12]**.

Figure 40-231-13



Tilt the bearing block and pivoting journal (Item 1) up and remove from the spring guide (Item 2) **[Figure 40-231-13]**.

Figure 40-231-14

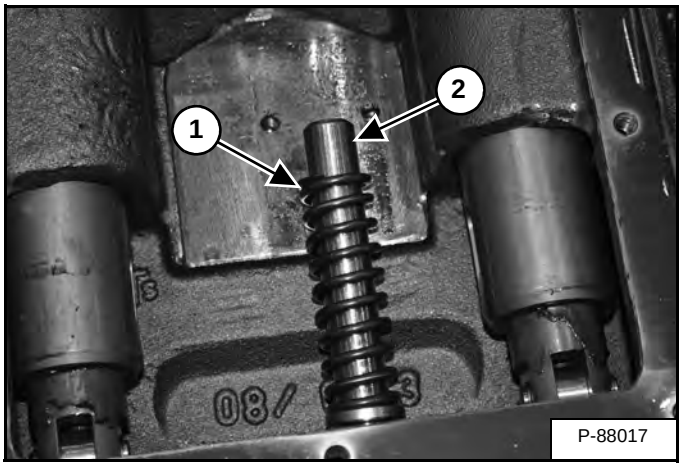


Remove the pivoting journal (Item 1) **[Figure 40-231-14]** from the bearing block.

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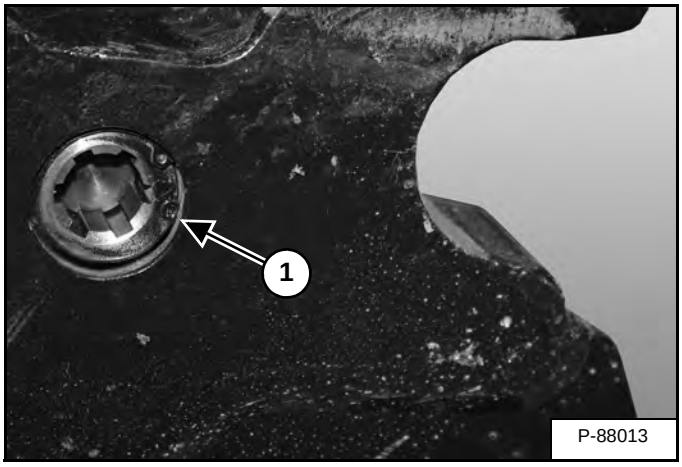
Disassembly (MS08) (Cont'd)

Figure 40-231-15



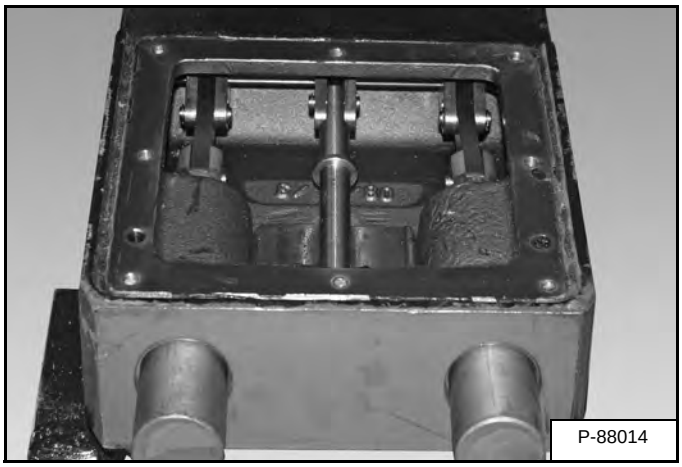
Remove the pressure spring (Item 1) from the spring guide (Item 2) **[Figure 40-231-15]**.

Figure 40-231-16



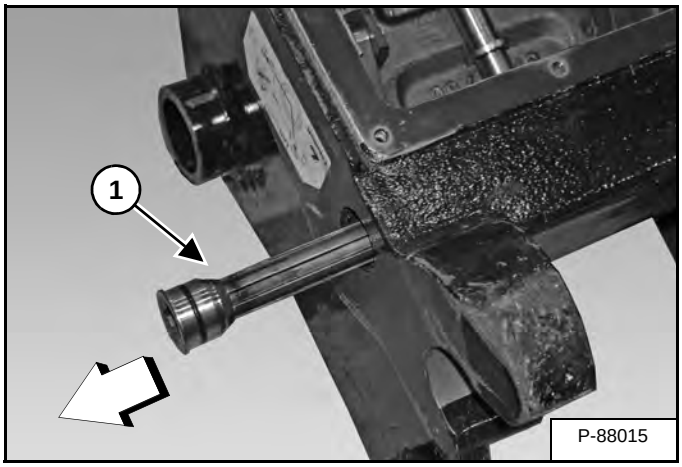
Remove the snap ring (Item 1) **[Figure 40-231-16]**.

Figure 40-231-17



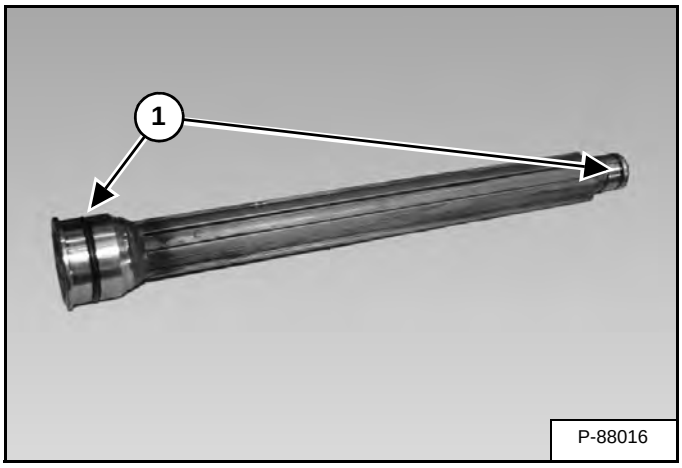
NOTE: Before removing the control shaft, note the position of each of the components so that when the coupler is reassembled all components are positioned correctly on the control shaft [Figure 40-231-17].

Figure 40-231-18



Remove the control shaft (Item 1) **[Figure 40-231-18]**.

Figure 40-231-19

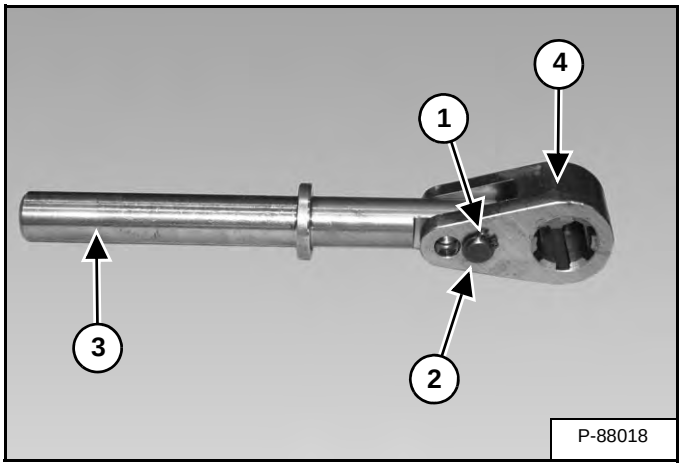


Remove O-rings (Item 1) **[Figure 40-231-19]**.

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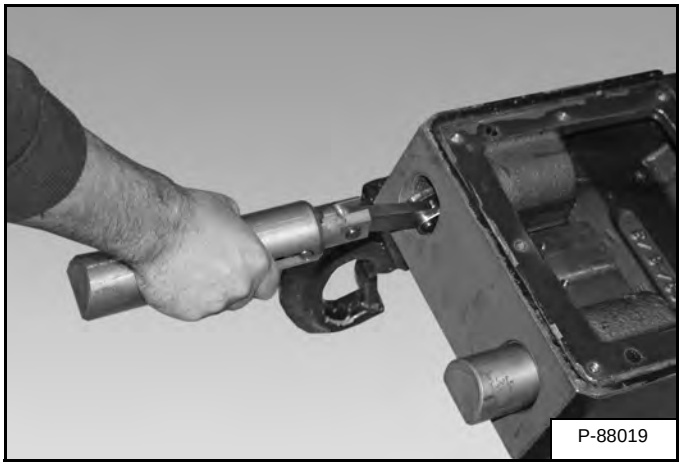
Disassembly (MS08) (Cont'd)

Figure 40-231-20



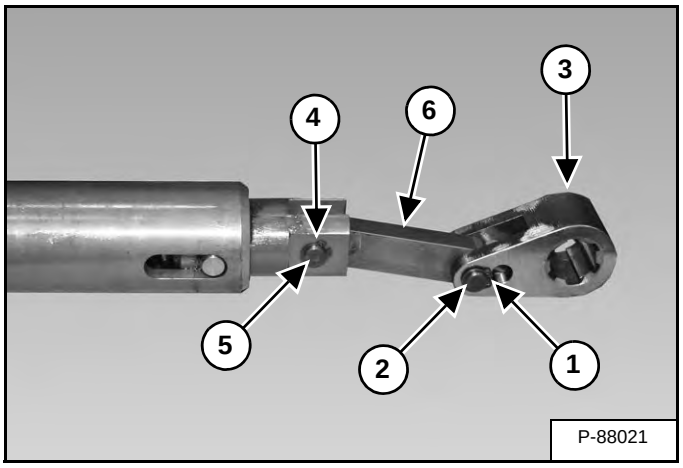
Remove the snap ring (Item 1) and pin (Item 2). Remove the spring guide (Item 3) from the driving fork (Item 4) **[Figure 40-231-20]**.

Figure 40-231-21



Remove the locking pin assemblies **[Figure 40-231-21]**.

Figure 40-231-22

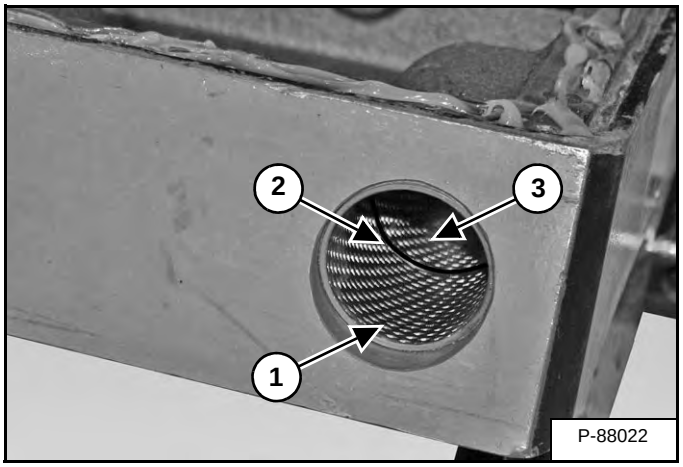


Remove the snap ring (Item 1) and pin (Item 2). Remove the driving fork (Item 3) **[Figure 40-231-22]**.

Remove the snap ring (Item 4) and pin (Item 5). Remove the reversing lever (Item 6) **[Figure 40-231-22]**.

Repeat the procedure for the other locking pin.

Figure 40-231-23

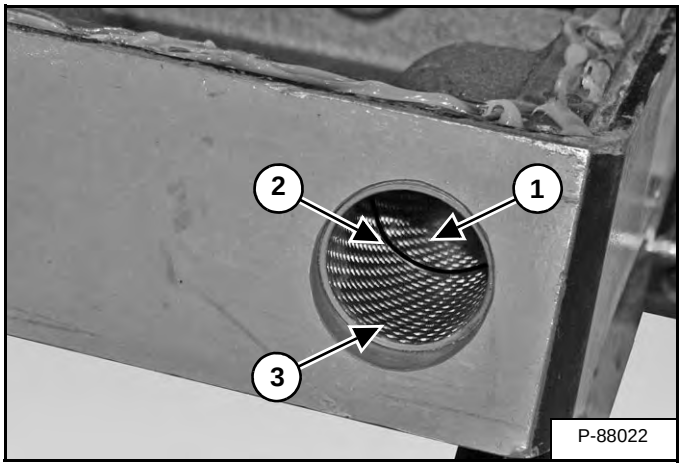


Remove the bushing (Item 1), O-ring (Item 2), and bushing (Item 3) **[Figure 40-231-23]** from both locking pin bores.

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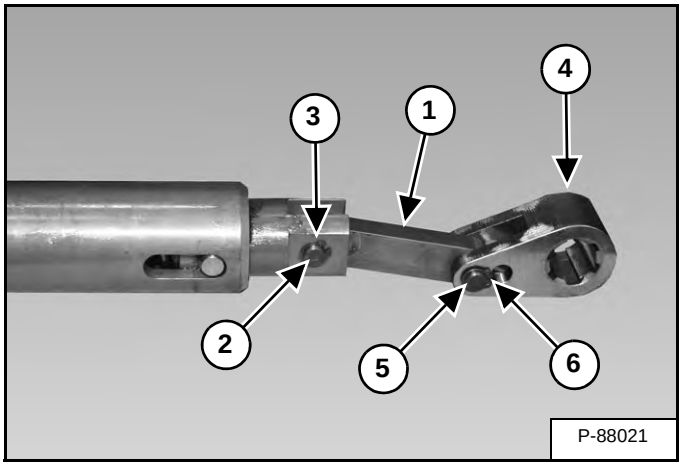
Assembly (MS08)

Figure 40-231-24



Install bushing (Item 1), O-ring (Item 2) and bushing (Item 3) **[Figure 40-231-24]** in both locking pin bores.

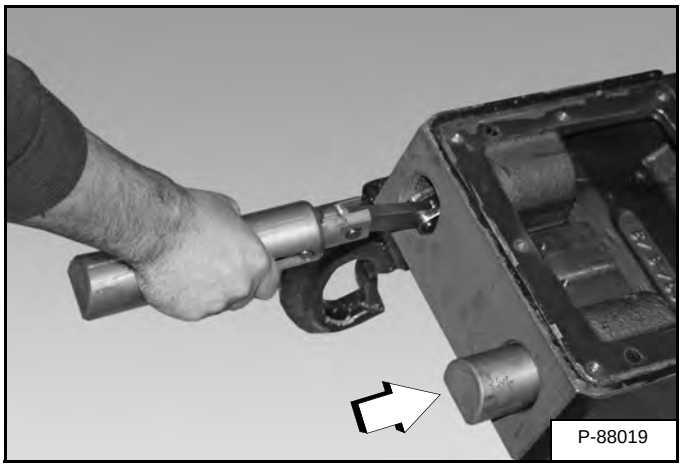
Figure 40-231-25



Install reversing lever (Item 1), pin (Item 2) and snap ring (Item 3) **[Figure 40-231-25]** on the locking pin.

Install the driving fork (Item 4), pin (Item 5) and snap ring (Item 6) **[Figure 40-231-25]** on the reversing lever. Repeat the procedure for the other locking pin.

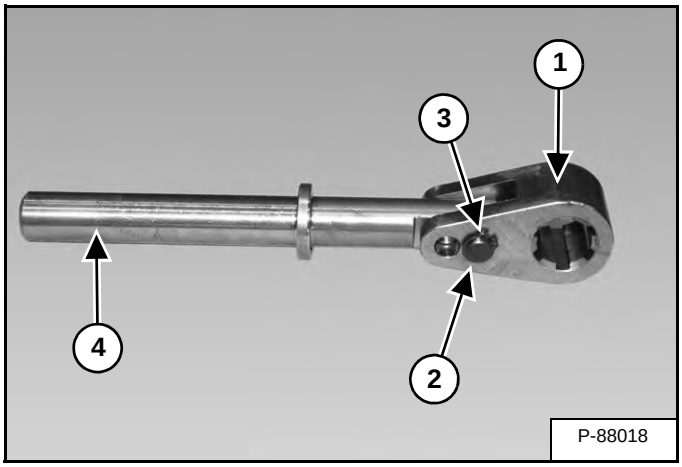
Figure 40-231-26



Install the locking pin assemblies **[Figure 40-231-26]**.

NOTE: Position the locking levers with the flat side down and away from the cover.

Figure 40-231-27

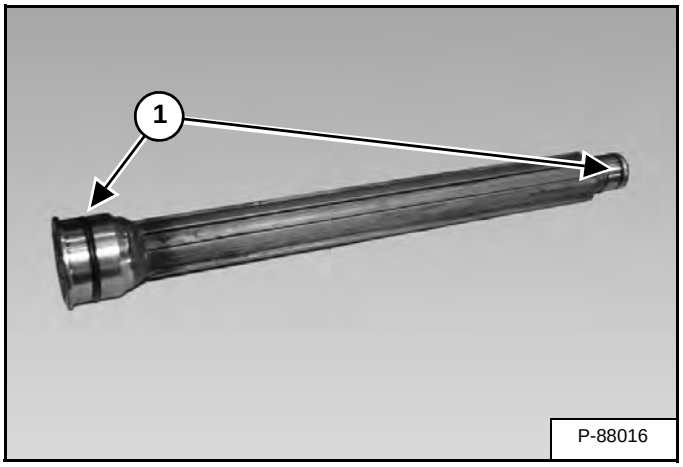


Install the driving fork (Item 1), pin (Item 2) and snap ring (Item 3) on the spring guide (Item 4) **[Figure 40-231-27]**.

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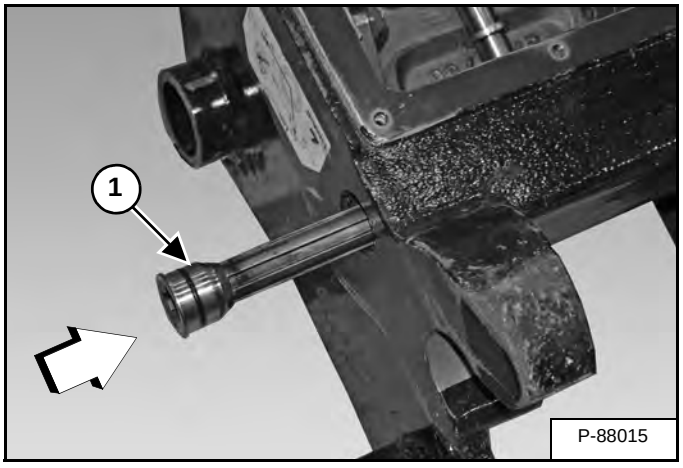
Assembly (MS08) (Cont'd)

Figure 40-231-28



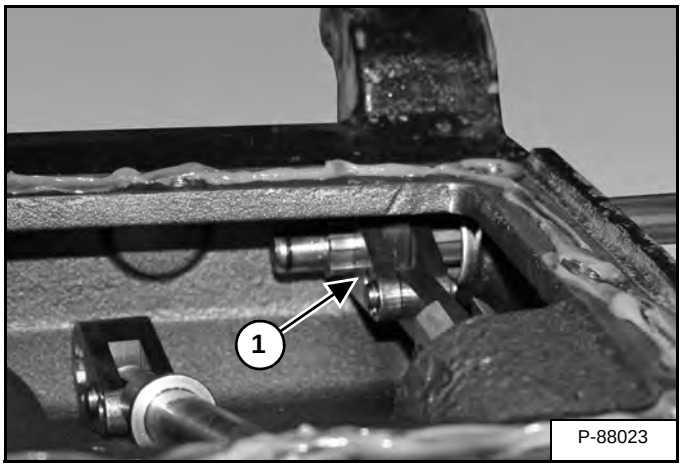
Install the O-rings (Item 1) **[Figure 40-231-28]**.

Figure 40-231-29



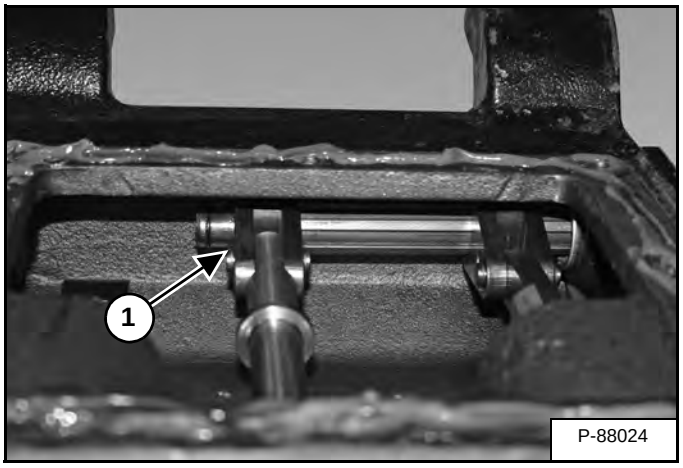
Install the control shaft (Item 1) **[Figure 40-231-29]**.

Figure 40-231-30



Install the control shaft through the first locking lever driving fork (Item 1) **[Figure 40-231-30]**.

Figure 40-231-31

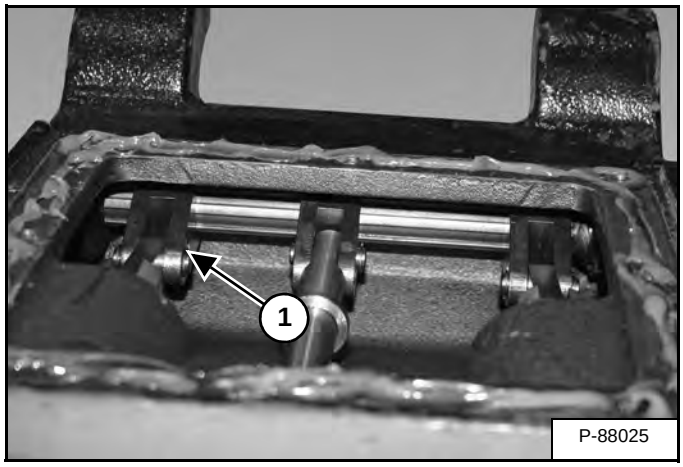


Install the control shaft through the spring guide driving fork (Item 1) **[Figure 40-231-31]**.

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Assembly (MS08) (Cont'd)

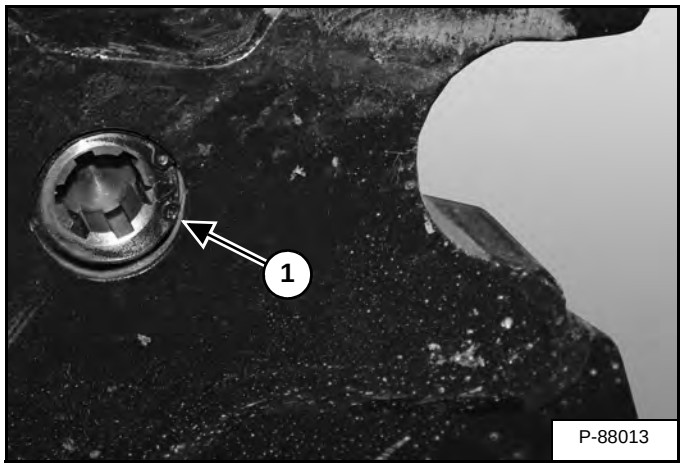
Figure 40-231-32



Install the control shaft through the second locking lever driving fork (Item 1) **[Figure 40-231-32]**.

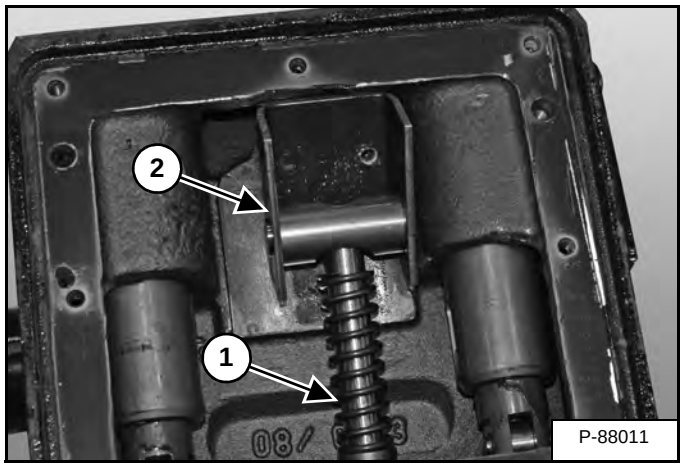
NOTE: Check proper alignment of all three driving forks on the control shaft. If not aligned properly, repeat the procedure.

Figure 40-231-33



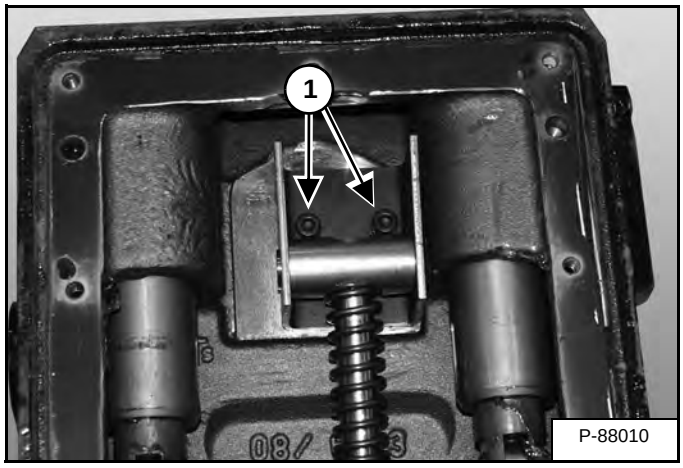
Install the snap ring (Item 1) **[Figure 40-231-33]**.

Figure 40-231-34



Install pressure spring (Item 1) on the spring guide. Tilt the bearing block and pivoting journal (Item 2) **[Figure 40-231-34]** down and install on the spring guide.

Figure 40-231-35

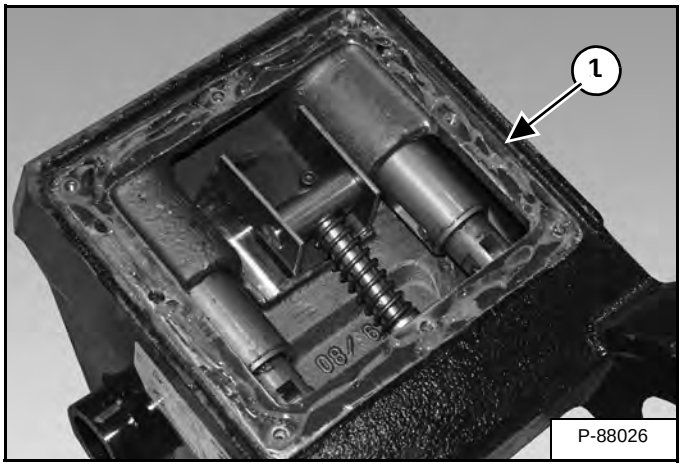


Install the two bolts (Item 1) **[Figure 40-231-35]**.

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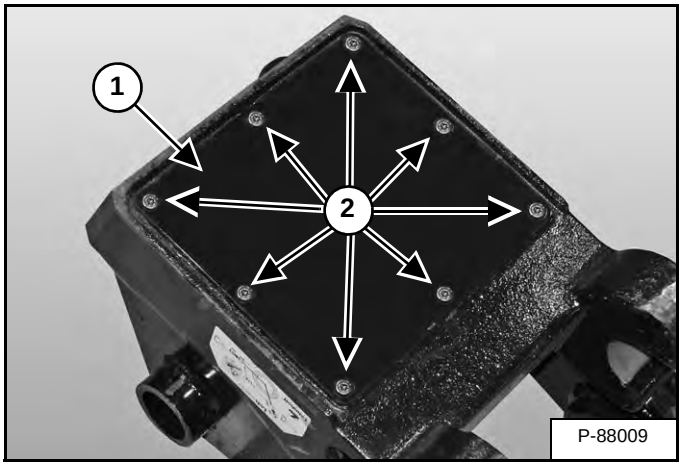
Assembly (MS08) (Cont'd)

Figure 40-231-36



Apply a bead of sealant around the cover mounting surface (Item 1) **[Figure 40-231-36]**.

Figure 40-231-37



Install the cover (Item 1) **[Figure 40-231-37]**.

Apply Loctite® 242 on the eight bolts.

Install the eight bolts (Item 2) **[Figure 40-231-37]**.

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LIGHTS 50-50-1
- Boom Light Removal And Installation 50-50-1
- Light Bulb Removal And Installation 50-50-1
- Light Switch Removal And Installation 50-50-2

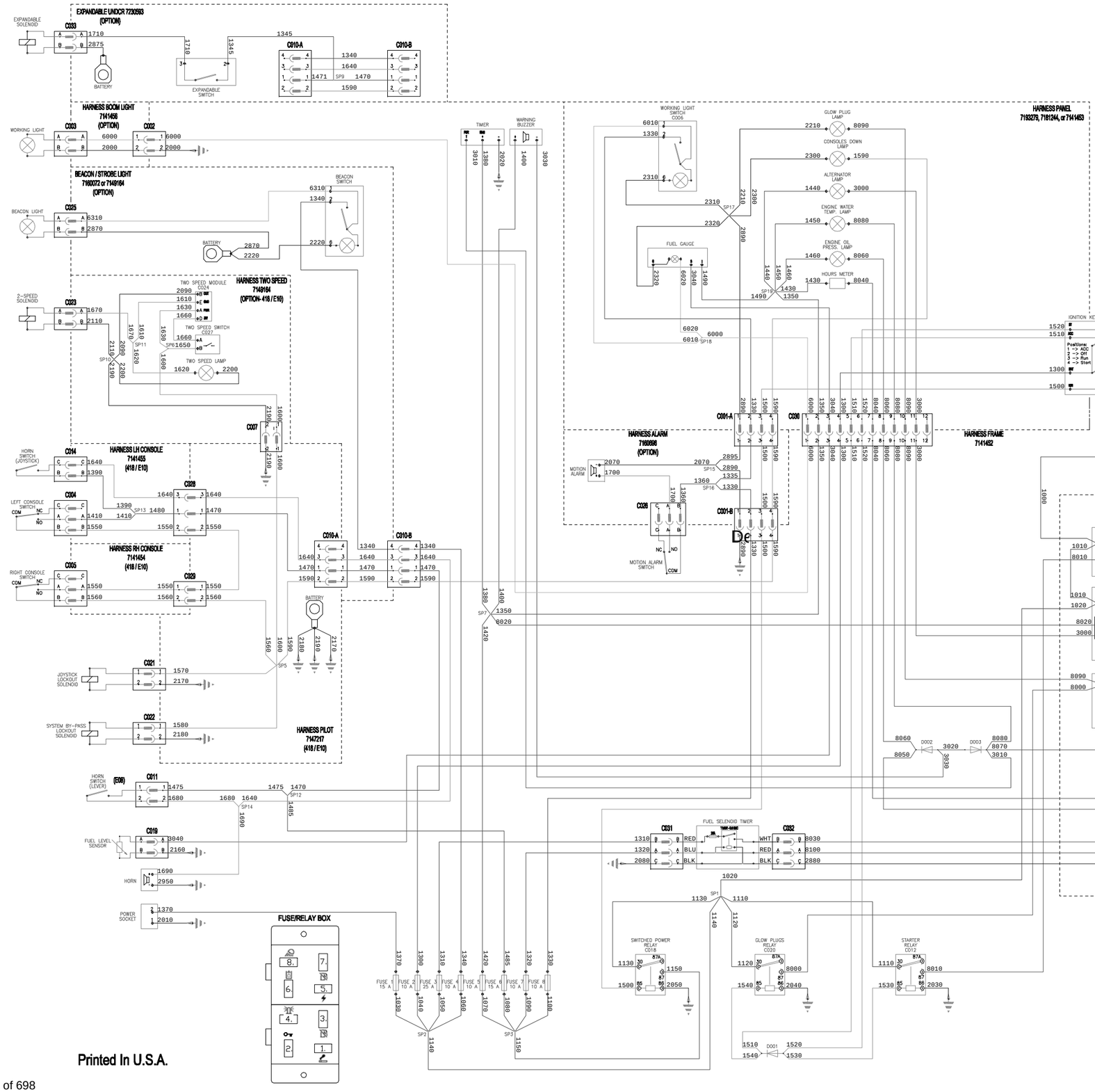
MICROSWITCH 50-60-1
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BATTERY FEED, GENERAL	1000–1299	RED	RED
BATTERY FEED, FUSED	1300–1499	RED/WHT	RED/WHITE
BATTERY FEED, SWITCHED	1500–1999	RNG	ORANGE
GROUND	2000–2999	BLK	BLACK
MONITORING	3000–3999	LBL	LIGHT BLUE
HYDRAULLIC	4000–4999	LGN	LIGHTS GREEN
ATTACHMENT CONTROLS	5000–5999	YEL	YELLOW
LIGHTS	6000–6999	PNK	PINK
ACCESSORIES	7000–7999	WHT	WHITE
ENGINE	8000–8999	TAN	TAN
COMMUNICATION	9000–9999	PUR	PURPLE

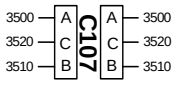
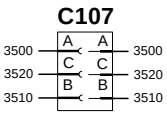
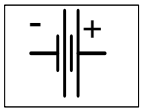
Printable Version Click Here

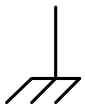
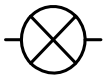
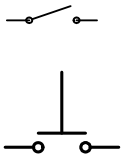
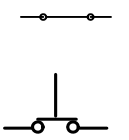
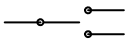
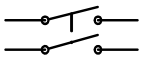
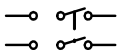
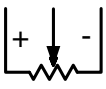
WIRING SCHEMATIC
E10 (S/N A33P11001 AND ABOVE)
(S/N B4K911001 AND ABOVE)

(PRINTED DECEMBER 2017)

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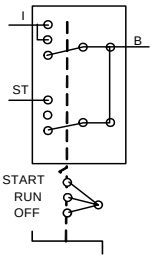
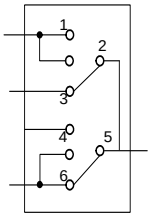
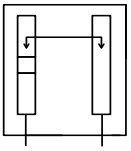
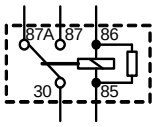
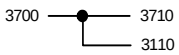
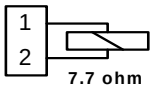
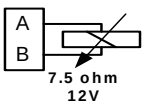
Glossary Of Electrical Symbols

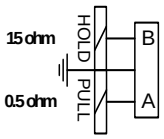
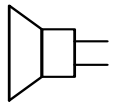
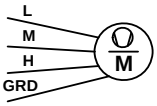
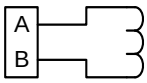
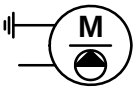
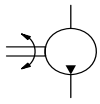
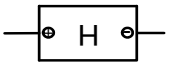
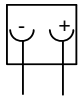
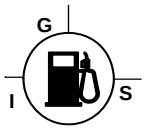
SYMBOL	DESCRIPTION
	CONNECTIONS
	CONNECTOR - Harness - Used for connecting 2 harnesses together or a harness to a component. The connector can vary from a single pin to any number of pins (Example: 3 pin connectors shown). The connector pins can be numbered alphabetical (shown) or numerical (1, 2, 3 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 ground circuit.
	ALTERNATOR - Used to create the electrical current to supply voltage to the battery and components.
	STARTER - Uses battery current to start the machine engine.
	GROUND - Used to represent an external ground connection.

SYMBOL	DESCRIPTION
	COMPONENTS
	GROUND - Frame - Used to represent an component that is internally grounded.
	LIGHT -
	SWITCH - Single Pole - Single Throw (ON-OFF) Normally Open
	SWITCH - Single Pole - Single Throw (ON-OFF) Normally Closed.
	SWITCH - Single Pole - Double Throw (ON-OFF-ON) - This switch can be in any of three positions. (Some switches are spring activated to return them to a certain position when released.)
	SWITCH - Double Pole - Single Throw (ON-OFF) Open and Closed positions will be specified depending on switch application.)
	SWITCH - Double Pole - Double Throw (ON-OFF) Open and Closed positions will be specified depending on switch application.
	POTENTIOMETER - Variable resistance - Provides variable resistance.

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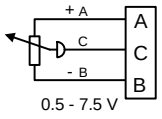
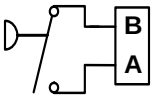
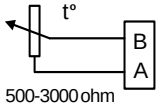
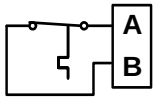
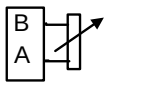
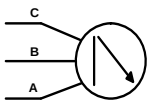
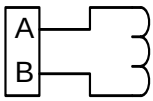
Glossary Of Electrical Symbols (Cont'd)

SYMBOL	DESCRIPTION
	COMPONENTS
	SWITCH - Ignition - Multi position switch to activate various start functions at different positions.
	SWITCH - Light - Multi position switch to activate various lights at different positions.
	ROTARY CONTROL - Provides variable voltage proportional to position.
	RELAY - Uses a low amp switch to control a high amp component.
	FUSE - Used to protect the wire harness from an overloaded circuit. (The fuse rating is listed next to the fuse.)
	SPLICE (•) - Used to show when multiple wires are connected together on the schematic.
	SOLENOID - ON / OFF - Electrically activated coil that controls movement magnetically. (The ohm rating of the solenoid coil is listed next to the component [if available]).
	SOLENOID - VARIABLE - Electrically activated coil that controls movement magnetically. (The ohm rating and voltage of the solenoid coil is listed next to the component [if available]).

SYMBOL	DESCRIPTION
	SOLENOID - Fuel and Traction Lock - Dual solenoids. (The ohm rating of the solenoid coils are listed next to the component [if available]). The pull solenoid is energized for a short time.
	HORN - Audible alarm. Sound is activated manually by a switch to warn personnel.
	BUZZER - Audible alarm. Sounds at a predetermined setting to warn the operator of a component condition.
	RESISTOR - Limits current flow.
	DIODE - Allows electrical current to flow in 1 direction only.
	MOTOR - HVAC - Multi speed motor.
	MOTOR - Wiper - Single or multi speed motor.
	MOTOR - Washer - Single speed.
	PUMP - FUEL
	HOURMETER - Records the time the engine is running.
	POWER PLUG - Supplies 12 volt power for customer supplied accessories.
	GAUGE - Instrument - Indicates certain engine or other component conditions. (The different types of gauge are marked with a icon that represents what function the gauge is monitoring. Example: the gauge shown is for fuel.)

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Glossary Of Electrical Symbols (Cont'd)

SYMBOL	DESCRIPTION
	SENDERS AND SENSORS
	PRESSURE SENDER - Provides a variable voltage proportional to pressure. (Sender voltage rating is listed to show volt 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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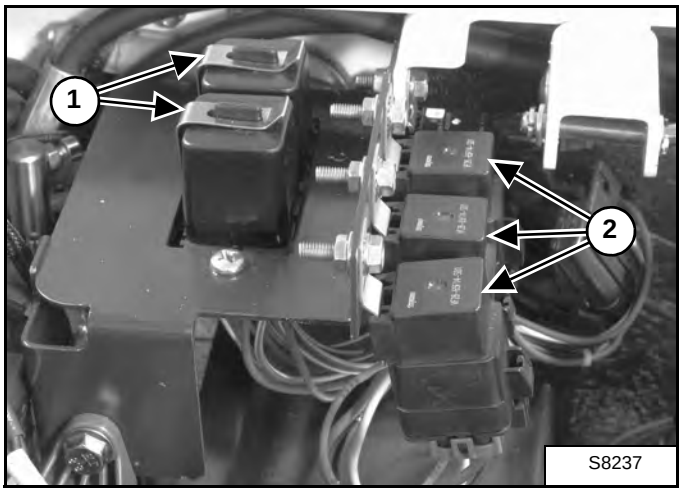
PROBLEM	CAUSE
Battery will not take charge.	1, 2, 3, 4, 5
Alternator will not charge.	1, 2, 5
Starter will not turn engine.	2, 3, 4, 6, 7, 8, 9

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 ground connection is not making a good contact.
5. The alternator is damaged.
6. The engine is locked.
7. The starter is damaged.
8. The wiring or the solenoid is damaged.
9. Check the fuses.

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Description

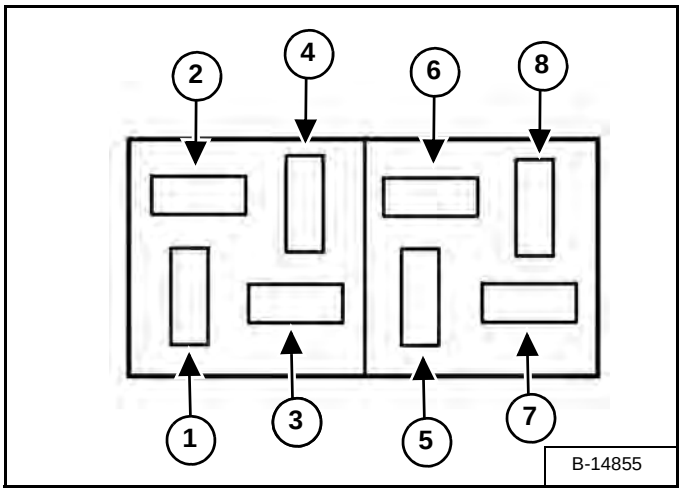
Figure 50-10-1



The excavator has a 12 volt, negative ground electrical system. The electrical system is controlled by fuses (Item 1) and relays (Item 2) **[Figure 50-10-1]** located in the engine compartment just below the tailgate. 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. **Power Socket** - 15A (UNSW) Accessory Socket

2. **Ignition** - 10A (UNSW) Key Switch, Switched Power Relay, Glow Plugs Relay and Starter Relay

3. **Timer** - 25A (UNSW) Fuel Solenoid

4. **Beacon** - 10A (UNSW) Beacon Light (Optional)

5. **Switch Power** - 10A (SW) Hourmeter, Alternator Lamp, Engine Water Temperature Lamp, Engine Oil Pressure Lamp and Fuel Gauge

6. **Valves / Horn -** 10A (SW) Joystick Lockout Solenoid, System Bypass Lockout Solenoid, Two Speed Module Consoles Down Lamp and Horn

7. **Timer Power -** 10A (SW) Fuel Solenoid Timer and Fuel Solenoid

8. **Light -** 10A (SW) Fuel Gauge Light, Working Light and Working Light Switch **[Figure 50-10-2]**

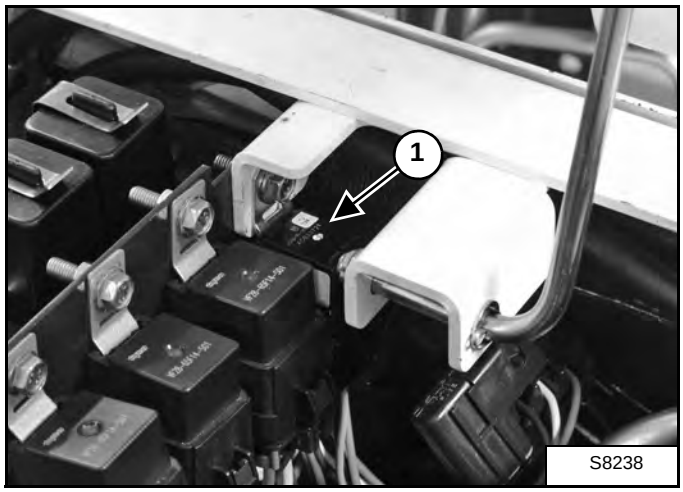
Always replace fuses using the same type and capacity.

The three electrical relays (Item 2) **[Figure 50-10-1]** are located in the engine compartment below the tailgate to the right. The three relays control the starter, glow plugs and switched power circuits.

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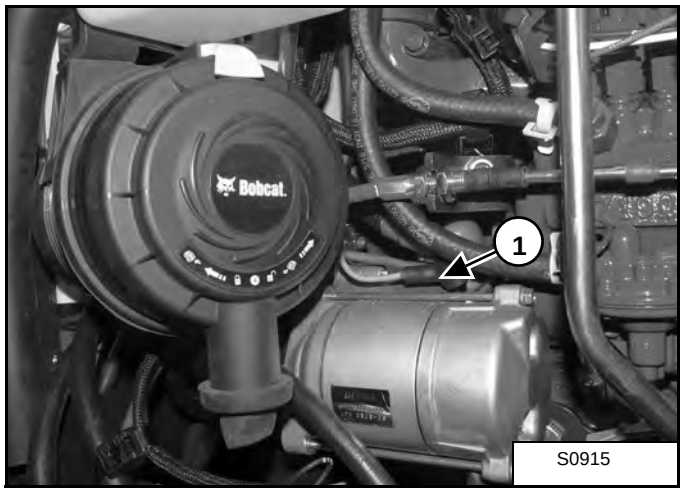
Fuel Timer Location / Identification

Figure 50-10-3



The fuel shutoff timer (Item 1) **[Figure 50-10-3]** is located in the engine compartment below the tailgate to the right.

Figure 50-10-4



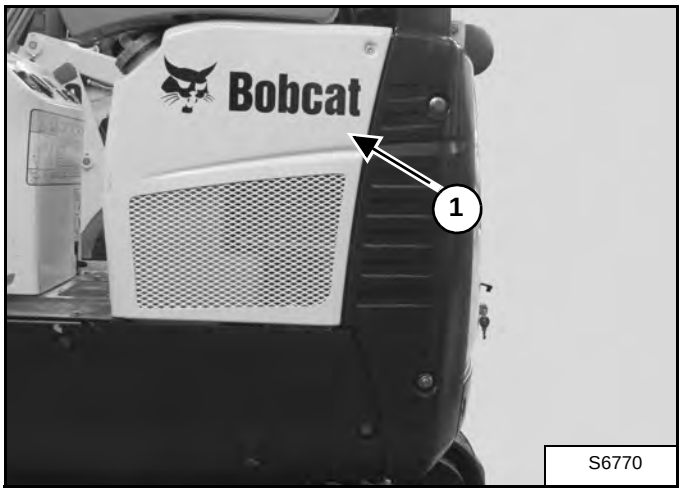
There are 2 diodes in the harness behind the starter (Item 1) **[Figure 50-10-4]**. The starter is located next to the cleaner, behind the access panel under the seat. The diodes are for alternator feedback protection and the glow plug during start function.

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BATTERY

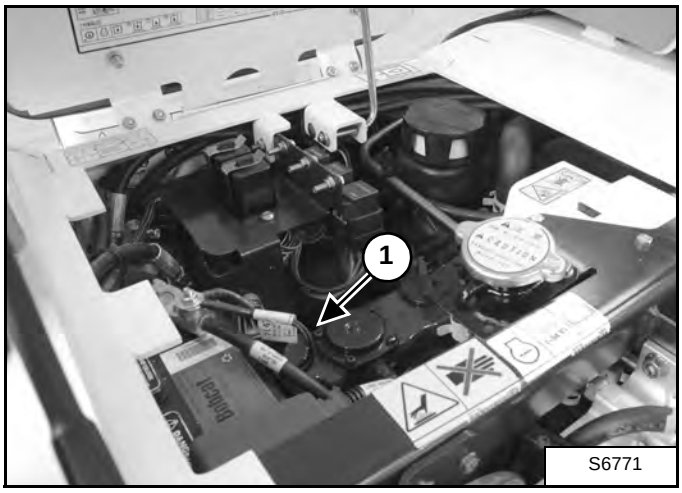
Location

Figure 50-20-1



The battery (Item 1) **[Figure 50-20-1]** is located behind the upper left side cover.

Figure 50-20-2



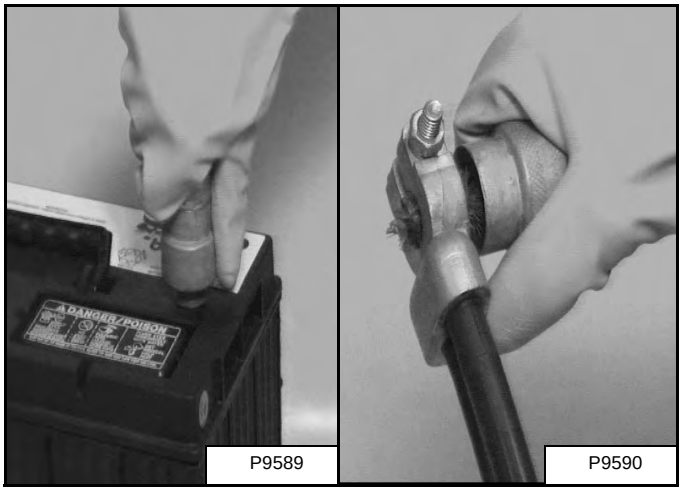
Battery cables (Item 1) **[Figure 50-20-2]** are accessible by opening the tailgate.

Servicing

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

The Bobcat brand battery supplied with your machine is sealed and does not require watering. Proper charging and storage are important to maximize the life of all batteries.

Figure 50-20-3



Simple steps for reliability and long battery life:

- Keep battery posts and terminals clean **[Figure 50-20-3]**.
- Keep terminals tight.
- Remove corrosion from battery and terminals with sodium bicarbonate (baking soda) and water solution.
- Put Bobcat Battery Saver or grease on the battery terminals and cable ends to prevent corrosion.
- Operate the machine for at least 15 minutes to recover from the battery drain caused by engine startup whenever practical.
- Maintain the battery charge level. This is a key factor for long battery life.
- Charge a severely discharged battery with a battery charger instead of relying on the machine charging system.

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Servicing (Cont'd)

- Check the battery state of charge every 30 days on machines that are not frequently used.

⚠ 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

Maintaining Battery Charge Level

All batteries will self-discharge over time. This machine has features that require battery power even when the machine is not being used. Use of a quality battery maintainer is highly recommended to ensure that your machine is ready to start when you need it and avoid costly battery replacement.

Battery Maintainers

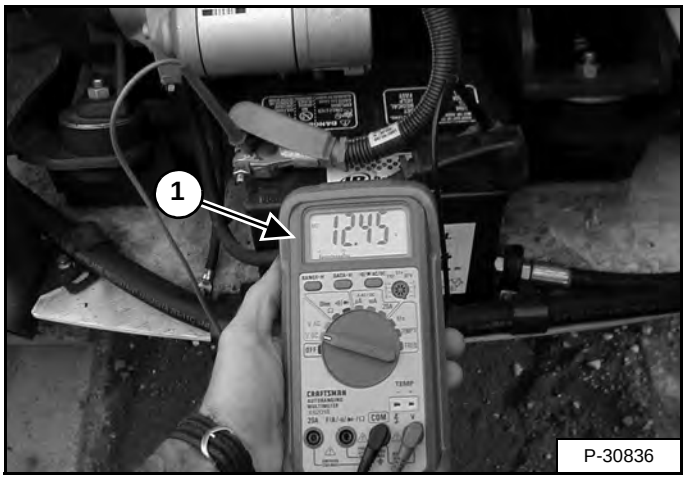
Use a good quality battery maintainer to keep the battery above 12.4 volts for machines that are not frequently used. Batteries below 12.4 volts must first be charged using a battery charger. Solar maintainers should have a minimum capacity of 10 watts to be effective.

Battery Service During Machine Storage

Remove the battery if storing the machine for an extended period of time. Fully charge the battery. Store the battery in a cool dry place above freezing and boost charge periodically. If battery removal is not desired, a good quality battery maintainer must be used to compensate for battery self-discharge and parasitic loads from machine controllers, accessories, and features such as connected machine intelligence.

Battery Testing

Figure 50-20-4



The simplest and most common check to determine battery state of charge is to use a digital multimeter or voltmeter (Item 1) **[Figure 50-20-4]**.

A battery found below 12.4 volts must be charged to 100% charge per the battery charger's recommendation. **Allow at least 60 minutes after operating the machine or charging the battery to get an accurate reading.**

If the reading is less than 12.4 volts after the battery has been charged for several hours, see your Bobcat dealer to have a more thorough battery test performed.

The freezing point of battery electrolyte is dependent on the battery state of charge. Keeping the battery voltage above 12.4 volts will help prevent batteries from freezing, even at extremely low temperatures.

If the battery freezes, the internal grid may be damaged and the case will be distorted or cracked. If this happens, dispose of the battery according to local regulations.

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Servicing (Cont'd)

Battery Charging

A battery charger designed for 12 volt charging systems is recommended. Follow the battery charger manufacturer's instructions to charge the battery to 12.6 volts (100% charge). Batteries should be charged at room temperature to avoid an undercharge or overcharge condition. Never attempt to charge a frozen battery.

The following table can be used to identify the approximate amount of time required to charge a discharged battery. Allow at least 60 minutes after operating the machine or charging the battery to get an accurate reading.

BATTERY VOLTAGE	STATE OF CHARGE	CHARGER MAXIMUM RATE		
		30 Amps	20 Amps	10 Amps
12.6 V	100%	READY TO USE		
12.4 V	75%	0.9 hr.	1.3 hr.	2.5 hr.
12.2 V	50%	1.9 hr.	2.7 hr.	5.1hr.
12.0 V	25%	2.9 hr.	4.3 hr.	7.8 hr.
11.8 V	0%	4.0 hr.	5.7 hr.	10.7 hr.

NOTE: Use a good quality automatic charger to avoid battery damage from overcharging.

⚠ 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.

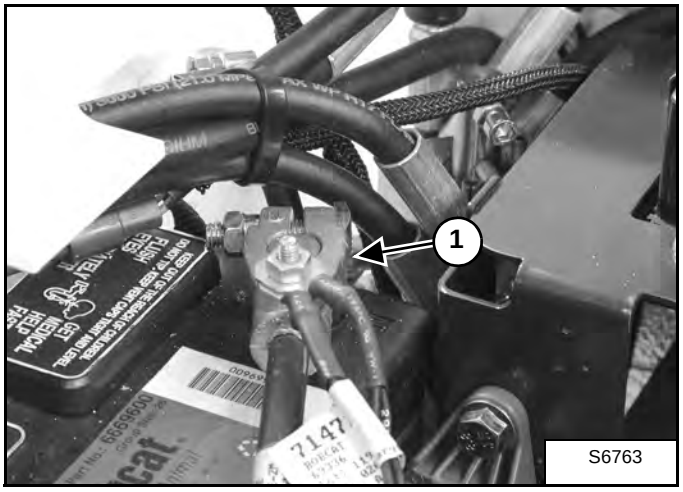
Do not jump start or charge a frozen or damaged battery. Warm battery to 16°C (60°F) before connecting to a charger. Unplug charger before connecting or disconnecting cables to battery. Never lean over battery while boosting, testing or charging.

W-2066-0910

Removal And Installation

Remove the upper left hand side cover. (See Upper Left Side Cover Removal And Installation on Page 40-210-1.)

Figure 50-20-5



Disconnect the negative (-) cable (Item 1) **[Figure 50-20-5]** first.

Figure 50-20-6

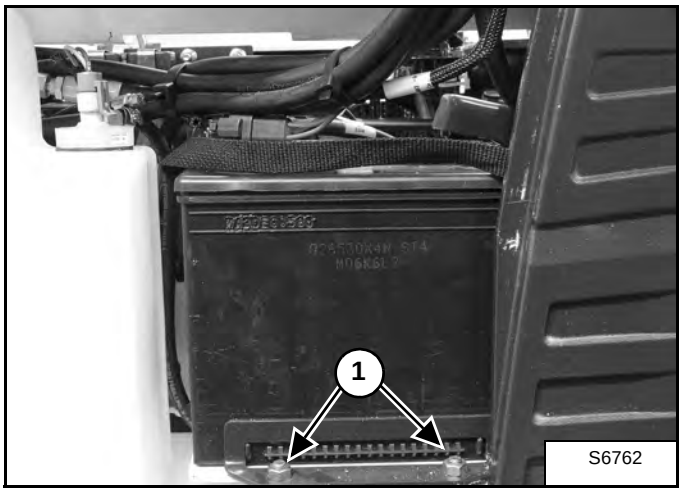


Disconnect the positive (+) cable (Item1) **[Figure 50-20-6]**.

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Removal And Installation (Cont'd)

Figure 50-20-7



Remove the two bolts (Item 1) **[Figure 50-20-7]** from the hold down 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 hold down clamp and tighten the bolts.

Connect the battery cables. Connect the negative (-) cable (Item 1) **[Figure 50-20-5]** 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 for starting the excavator and one person to connect and disconnect the battery cables.

Engage the upperstructure slew lock. Be sure the key switch is OFF. The booster battery must be 12 volt.

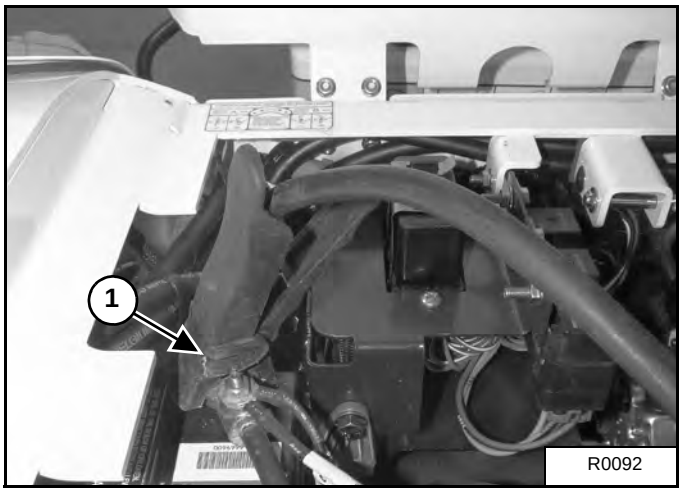
Figure 50-20-8



Remove the cover to the left of the operator's seat to access the battery.

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 50-20-8]** on the excavator battery.

Figure 50-20-9



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 bolt at the front left corner of the excavator (Item 1) **[Figure 50-20-9]**.

IMPORTANT

Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the excavator. (Remove both cables from the battery.)**
- **Extra battery cables (booster cables) are connected wrong.**

I-2223-0903

Start the engine. After the engine has started, remove the negative (-) cable first (Item 1) **[Figure 50-20-9]**.

Disconnect the cable from the battery (Item 1) **[Figure 50-20-8]**.

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ALTERNATOR

Description

Figure 50-30-1

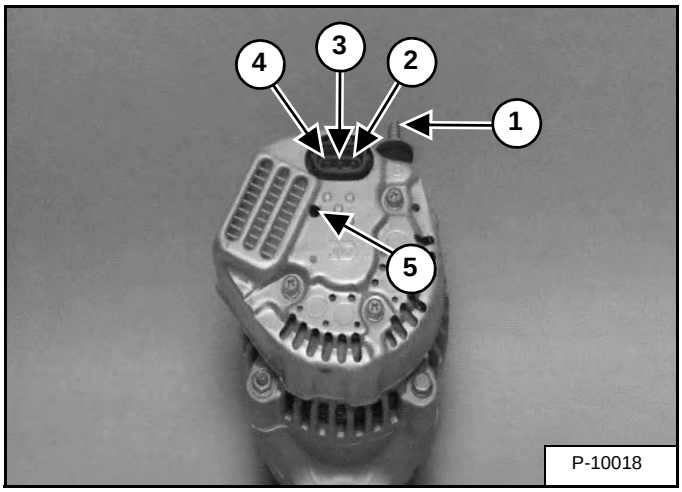
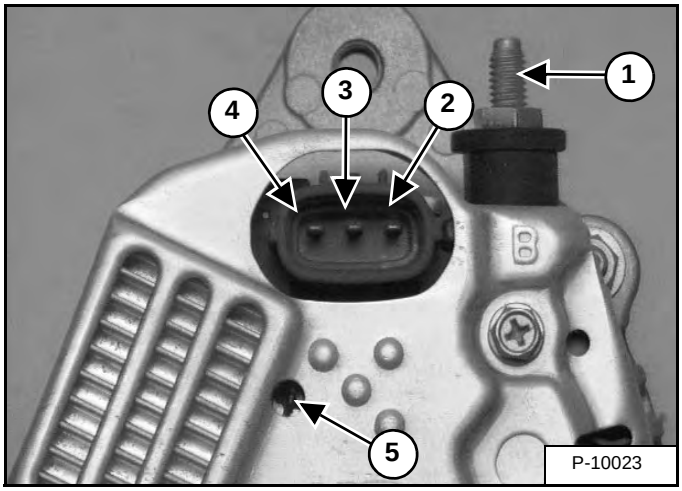


Figure 50-30-2



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.

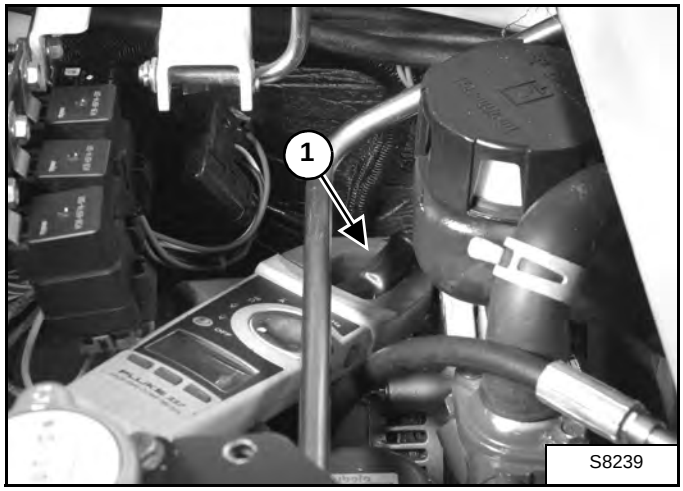
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ALTERNATOR (CONT'D)

Alternator Output Test

Check the battery and battery connections. (See Removal And Installation on Page 50-20-3.)

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

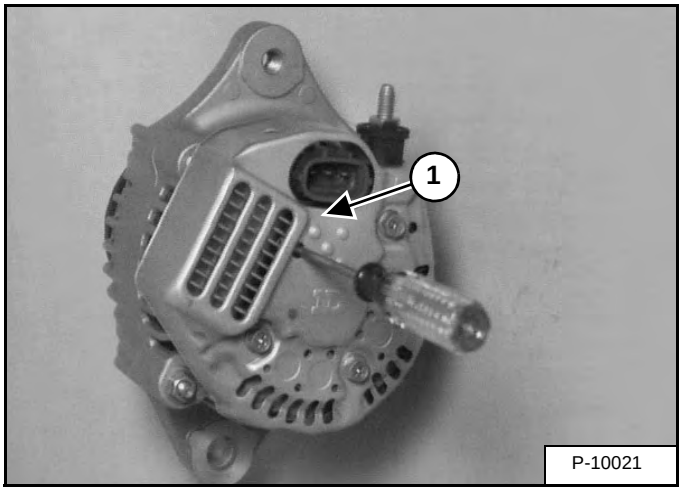
When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

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 a ground to the alternator case. This will give maximum amperage output from the alternator.

NOTE: The Full Field Test should only last long enough to get ammeter reading to prevent damage to the alternator.

The ammeter reading should be above 35 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.

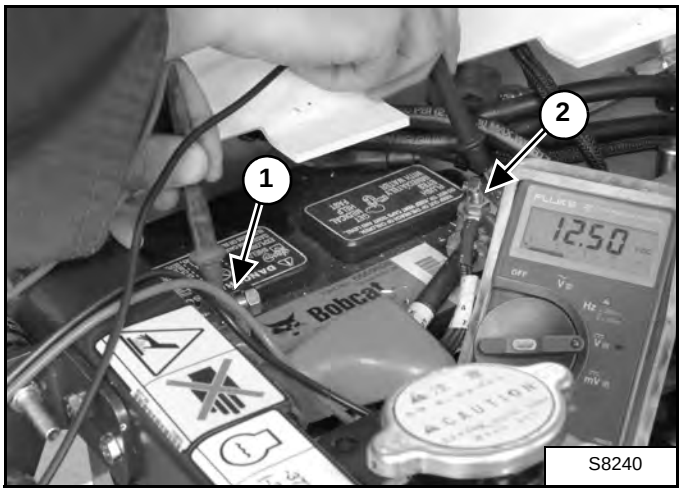
Reconnect the alternator wires.

Reconnect the negative (-) cable from 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.**

I-2023-1285

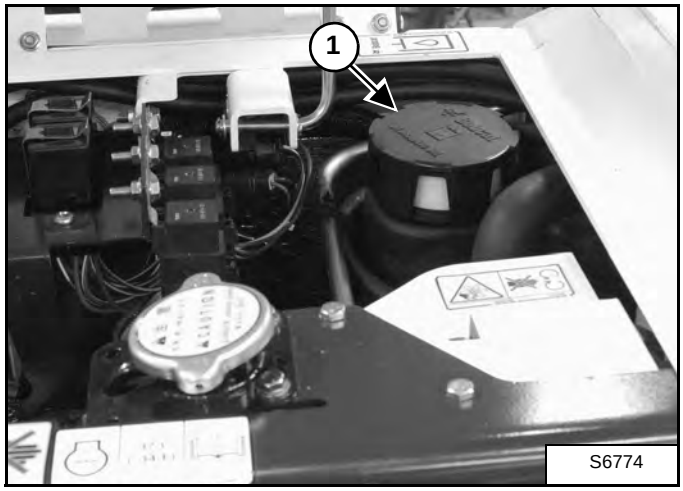
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ALTERNATOR (CONT'D)

Removal And Installation

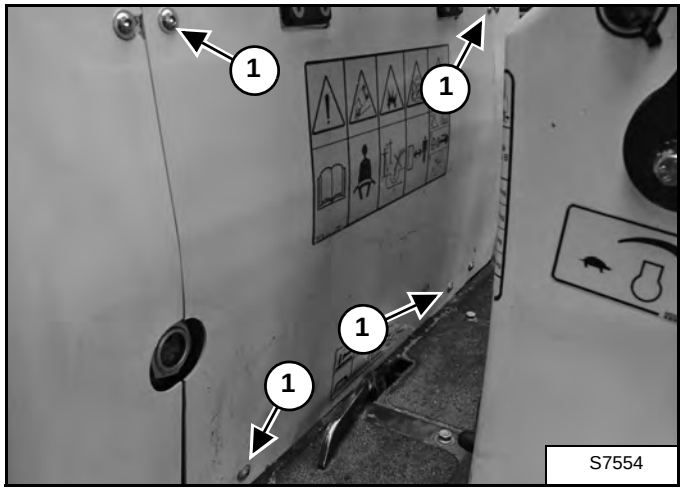
Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

Figure 50-30-6



Remove the fill cap (Item 1) **[Figure 50-30-6]** from the hydraulic reservoir.

Figure 50-30-7

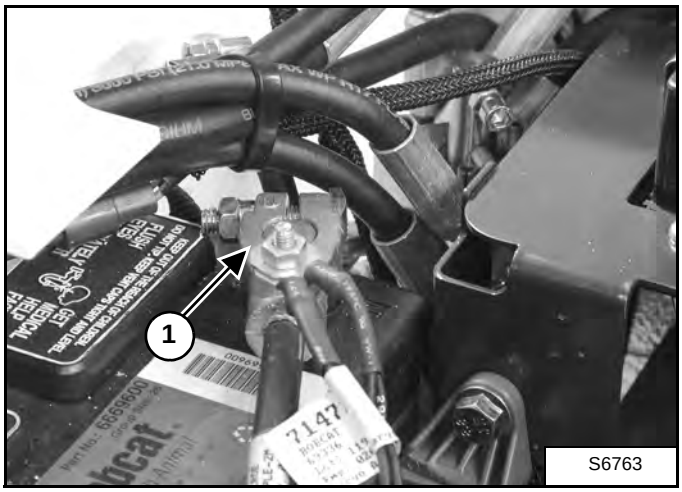


Remove the four bolts (Item 1) **[Figure 50-30-7]**.

Remove the cover.

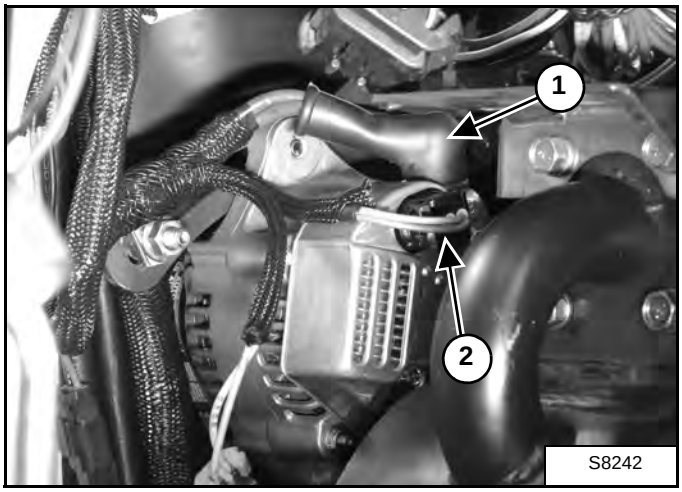
NOTE: Allow the muffler to cool down before removing the alternator.

Figure 50-30-8



Disconnect the negative (-) cable (Item 1) **[Figure 50-30-8]** from the battery.

Figure 50-30-9



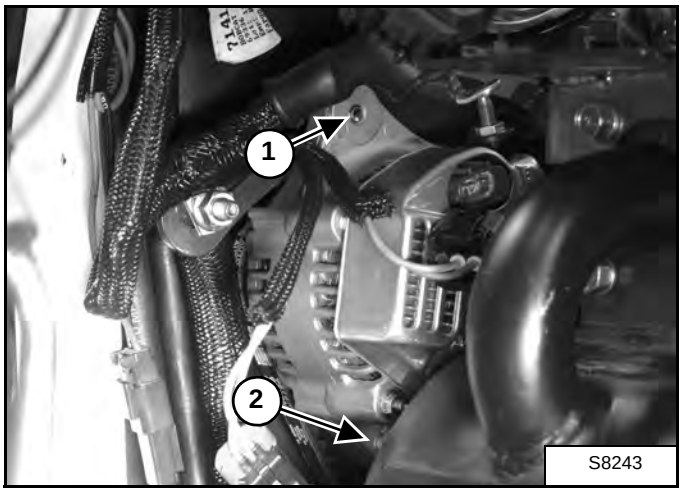
Disconnect the red wire (Item 1) **[Figure 50-30-9]**.

Disconnect the wire harness connector (Item 2) **[Figure 50-30-9]**.

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Removal And Installation (Cont'd)

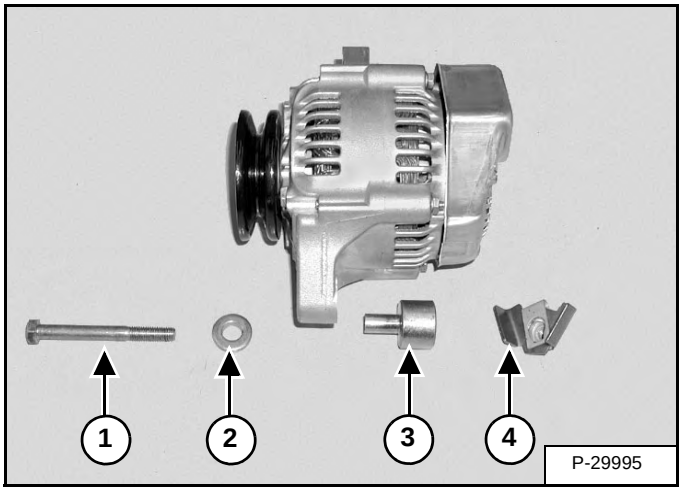
Figure 50-30-10



Remove the upper alternator bolt (Item 1) and lower mounting bolt (Item 2) **[Figure 50-30-10]**.

NOTE: Alternator will fall if not supported while removing bolts.

Figure 50-30-11



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 50-30-11] which will fall during disassembly.

Remove belt from the alternator pulley.

Remove alternator.

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ALTERNATOR (CONT'D)

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

IMPORTANT

Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the loader. (Remove both cables from the battery.)**
- **Extra battery cables (booster cables) are connected wrong.**

I-2023-1285

If the charging system malfunctions check the following:

Check the condition and tension of the alternator belt. (See Belt Adjustment on Page 10-160-1.) If belt is worn or deteriorated replace.

Inspect the alternator wiring harness and connectors at alternator. Harness and connectors must be clean and tight.

Check the fuse for the alternator in the fuse panel. If 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.)

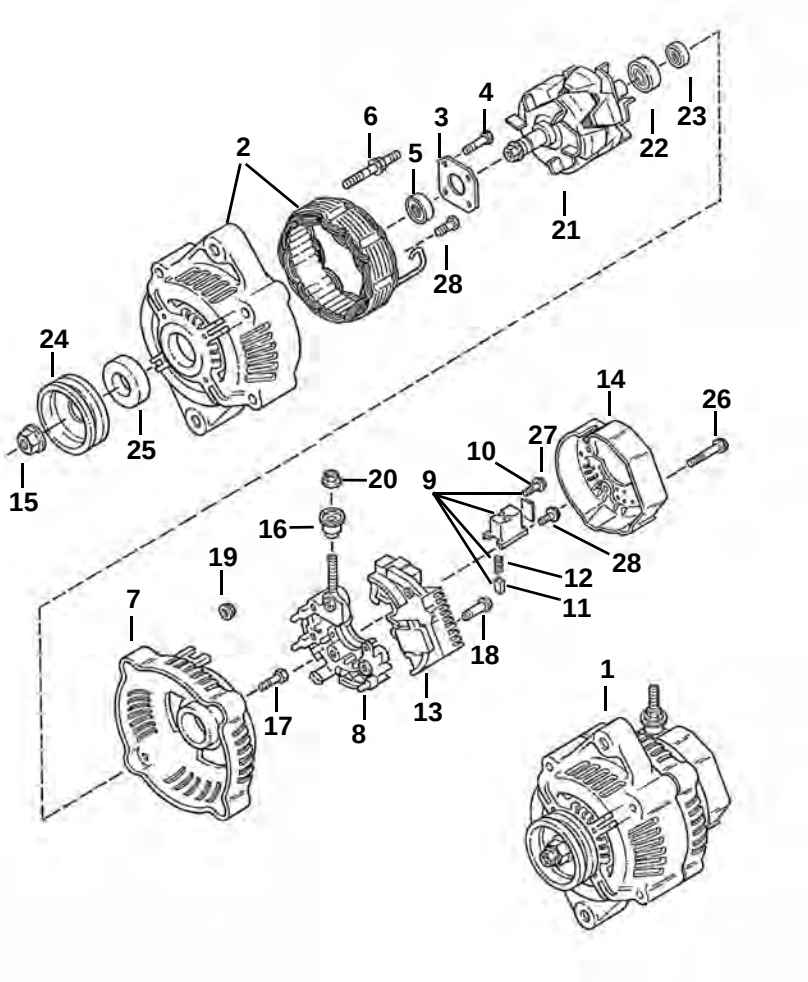
Verify the charge of the battery. Make sure battery is fully charged.

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. Reconnect the cable to the positive terminal.

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Parts Identification

1. Alternator
2. Frame Assembly
3. Plate
4. Screw
5. Bearing
6. Stud
7. Frame End
8. Holder
9. Holder
10. Seal
11. Brush
12. Spring
13. Regulator
14. Cover
15. Nut
16. Insulator
17. Bolt
18. Screw
19. Nut
20. Nut
21. Rotor Assembly
22. Bearing
23. Cover
24. Pulley
25. Spacer
26. Bolt
27. Screw
28. Screw



C-3456

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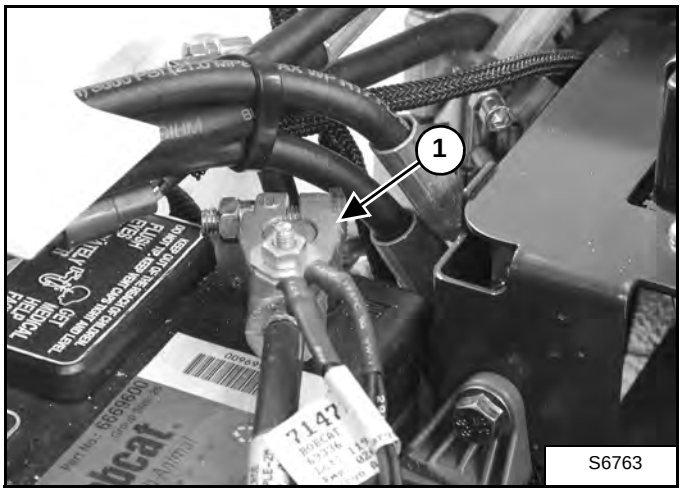
STARTER

Removal And Installation

Stop the engine.

Remove the air cleaner. (See Removal And Installation on Page 60-30-1.)

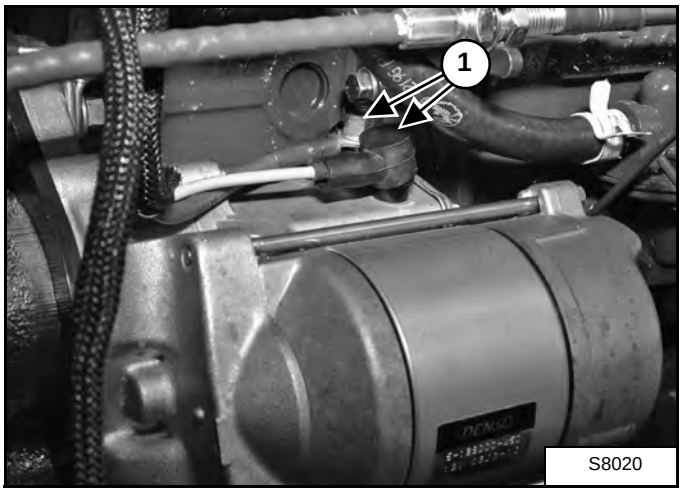
Figure 50-40-1



Disconnect the negative (-) cable (Item 1) **[Figure 50-40-1]** from the battery.

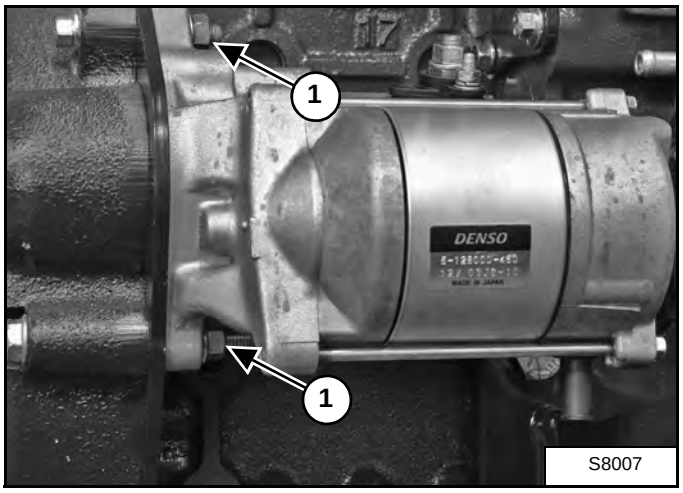
Mark the starter wires for ease of assembly.

Figure 50-40-2



Disconnect the wires (Item 1) **[Figure 50-40-2]** from the starter.

Figure 50-40-3



Remove the mounting bolts (Item 1) **[Figure 50-40-3]** from the starter.

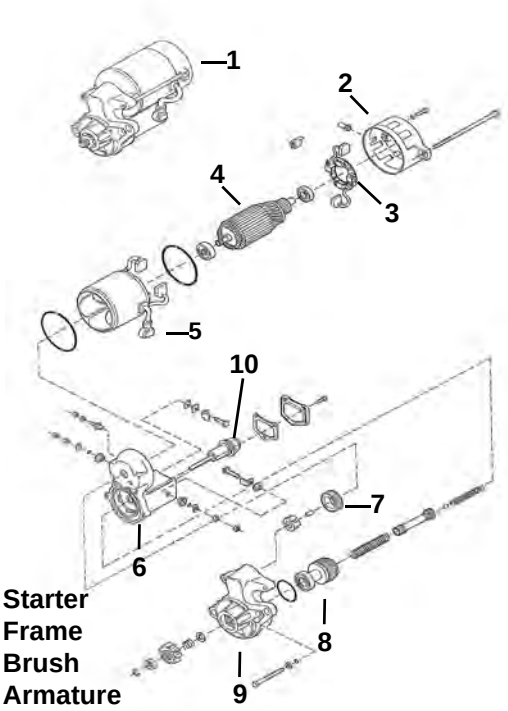
Installation: Tighten the bolts to 25 N•m (18 ft-lb) torque.

Remove the starter from the bell housing.

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Parts Identification

Figure 50-40-4



1. Starter
2. Frame
3. Brush
4. Armature
5. Yoke
6. Housing
7. Pinion
8. Clutch
9. Housing
10. 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 grounded 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).

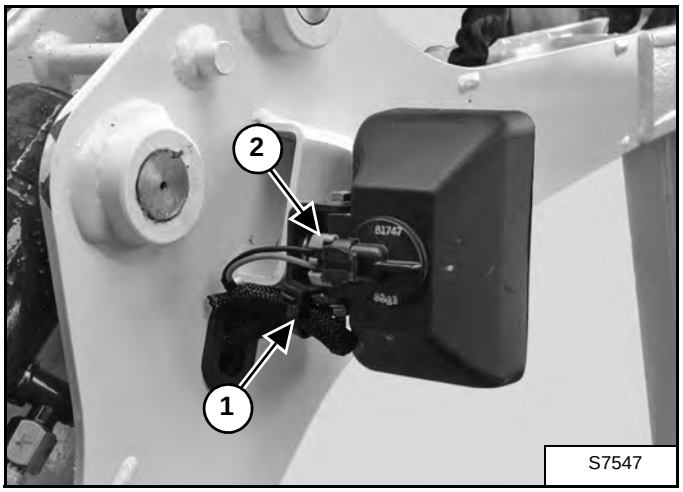
Brush Holders
- Broken springs.
- Broken insulation.
- Spring tension.

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LIGHTS

Boom Light Removal And Installation

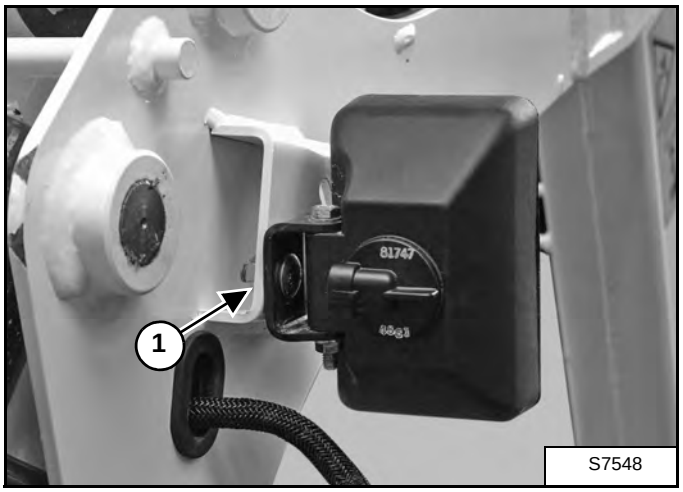
Figure 50-50-1



Cut the tie-strap (Item 1) **[Figure 50-50-1]**.

Disconnect the wire harness (Item 2) **[Figure 50-50-1]**.

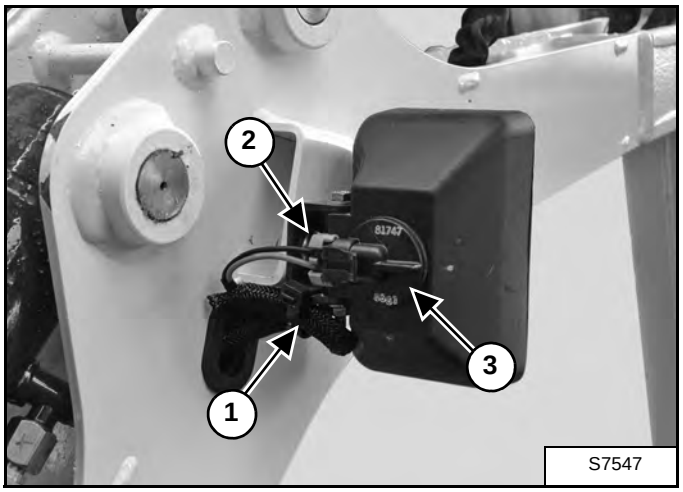
Figure 50-50-2



Remove the nut and bolt (Item 1) **[Figure 50-50-2]** and remove the boom light.

Light Bulb Removal And Installation

Figure 50-50-3

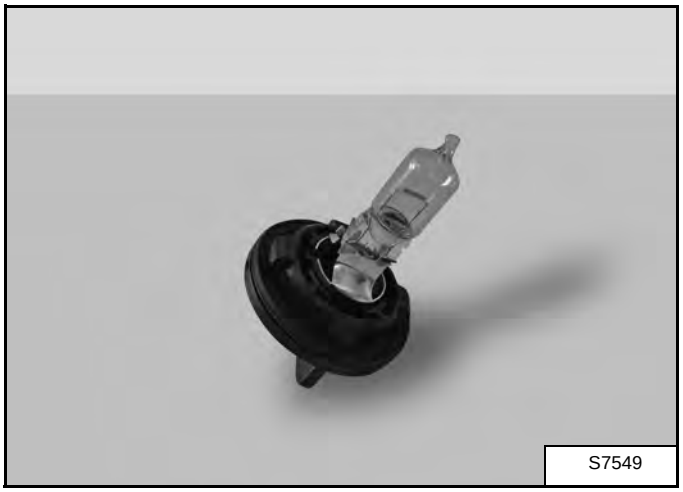


Cut the tie-strap (Item 1) **[Figure 50-50-3]**.

Disconnect the wire harness (Item 2) **[Figure 50-50-3]**.

Turn the light bulb assembly (Item 3) **[Figure 50-50-3]** counterclockwise and remove from the housing.

Figure 50-50-4



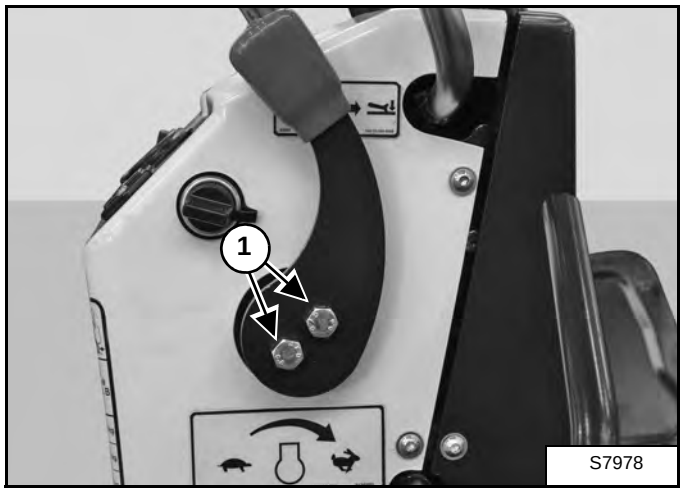
Complete light bulb assembly **[Figure 50-50-4]**.

NOTE: The light bulb can not be removed from the light bulb assembly. If light bulb is broken, the entire assembly must be replaced.

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Light Switch Removal And Installation

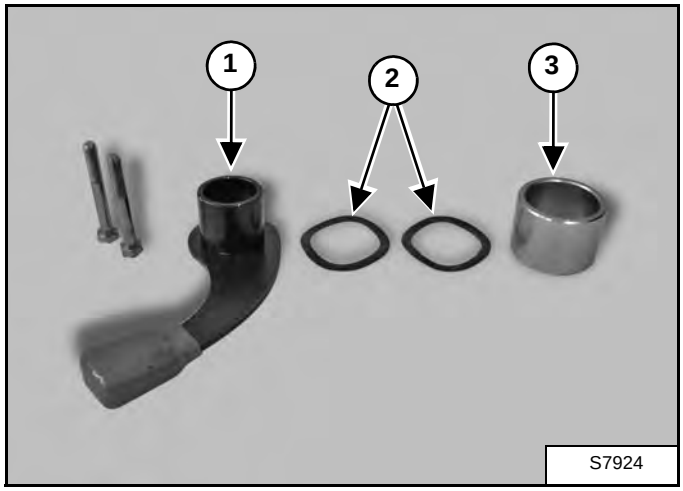
Figure 50-50-5



Remove the bolts (Item 1) **[Figure 50-50-5]** from the throttle lever.

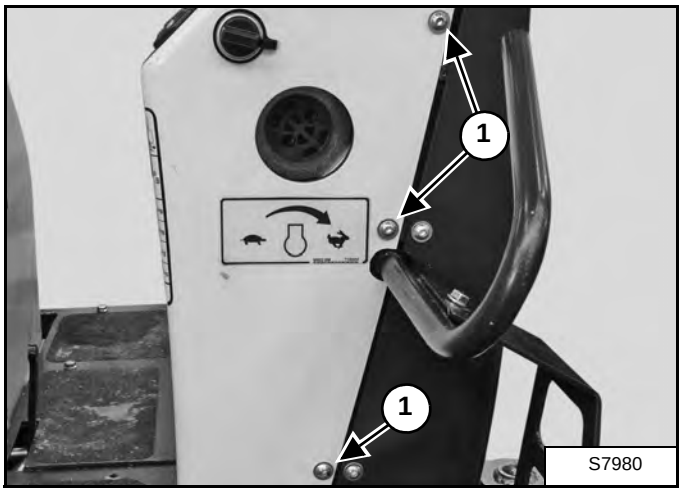
Installation: Tighten the two bolts (Item 1) **[Figure 50-50-5]** evenly until the throttle lever moves back and forth at a comfortable tension.

Figure 50-50-6



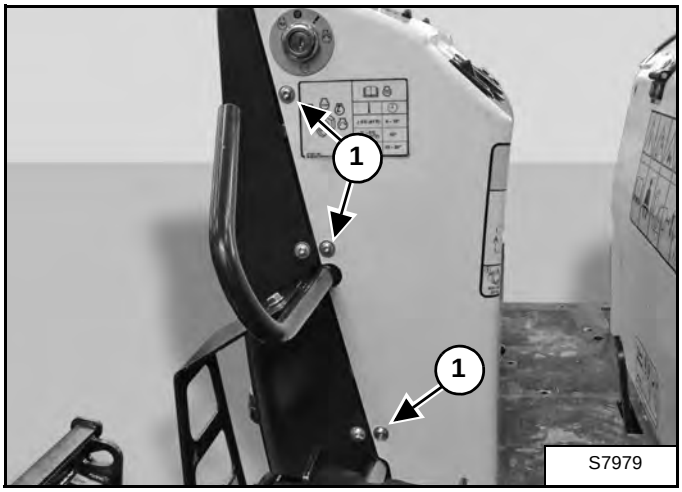
Remove the lever (Item 1), the two wave washers (Item 2), and the spacer (Item 3) **[Figure 50-50-6]**.

Figure 50-50-7



Remove the three bolts (Item 1) **[Figure 50-50-7]** from the right hand side of the instrument panel.

Figure 50-50-8

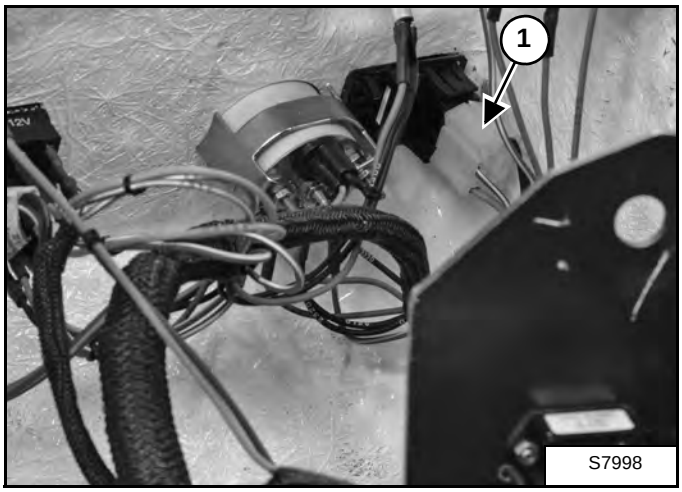


Remove the three bolts (Item 1) **[Figure 50-50-8]** from the left hand side of the instrument panel.

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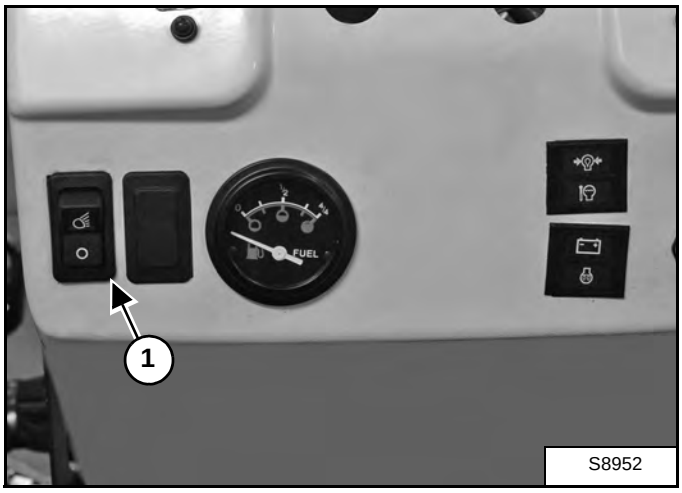
Light Switch Removal And Installation (Cont'd)

Figure 50-50-9



Pull back the instrument panel and disconnect the light switch connector (Item 1) **[Figure 50-50-9]**.

Figure 50-50-10



Remove the light switch (Item 1) **[Figure 50-50-10]** from the instrument panel.

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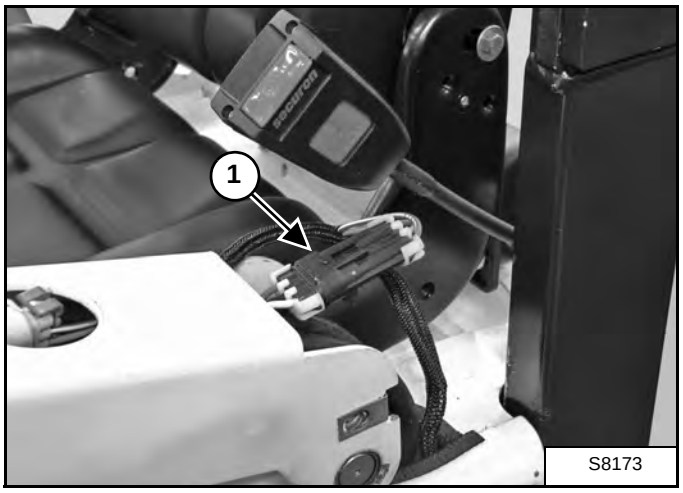
MICROSWITCH

Testing Left Console Microswitch

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

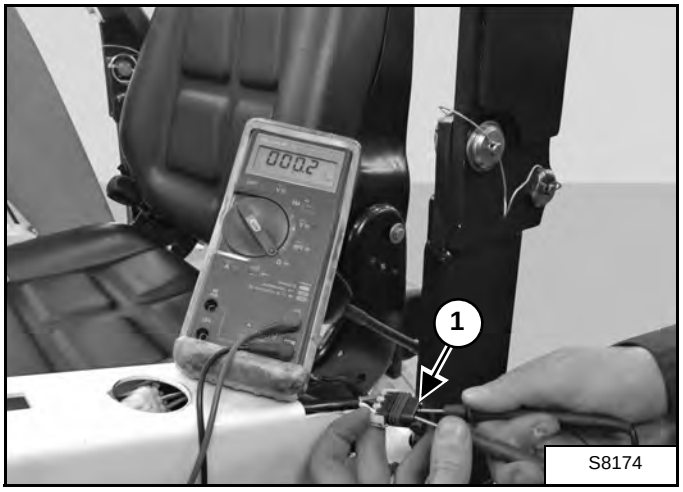
Lower the control console.

Figure 50-60-1



Disconnect the microswitch harness (Item 1) **[Figure 50-60-1]** from the control harness.

Figure 50-60-2



Use a continuity tester to check the microswitch prior to removal. Test the continuity between the black and white wire pins (Item 1) **[Figure 50-60-2]**.

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.

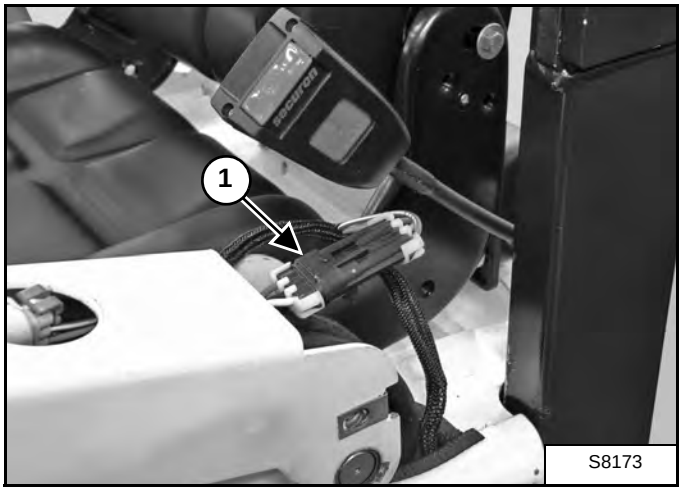
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MICROSWITCH (CONT'D)

Left Console Microswitch Removal And Installation

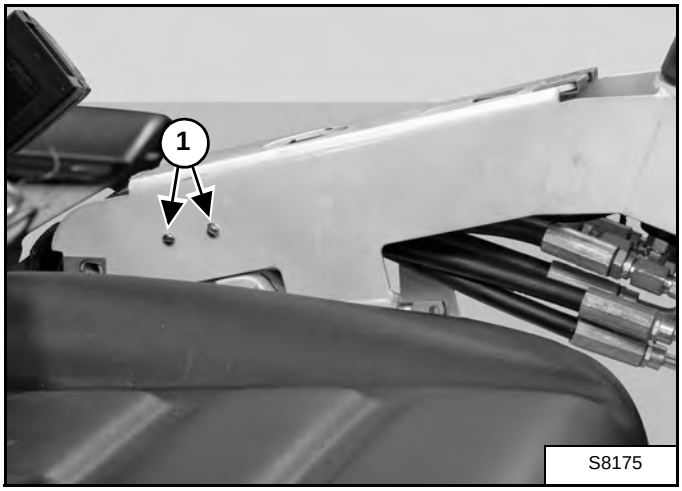
Remove the joystick console cover. (See Joystick Console Cover Removal And Installation on Page 40-50-1.)

Figure 50-60-3



Disconnect the microswitch harness (Item 1) **[Figure 50-60-3]** from the control harness.

Figure 50-60-4



Remove the nuts, lock washers and bolts (Item 1) **[Figure 50-60-4]** 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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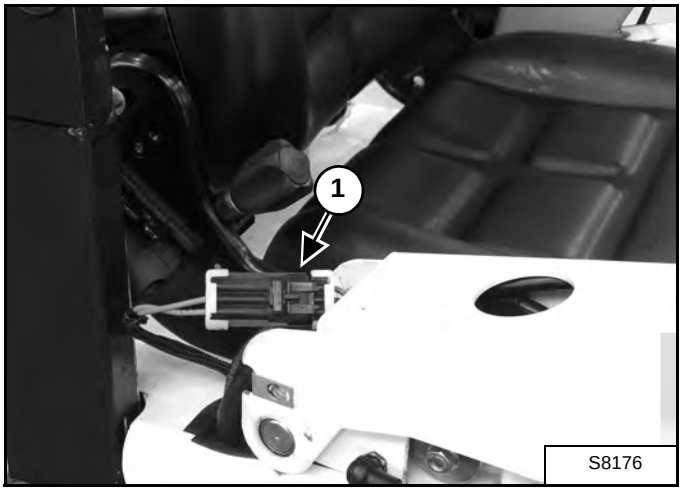
MICROSWITCH (CONT'D)

Testing Right Console Microswitch

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

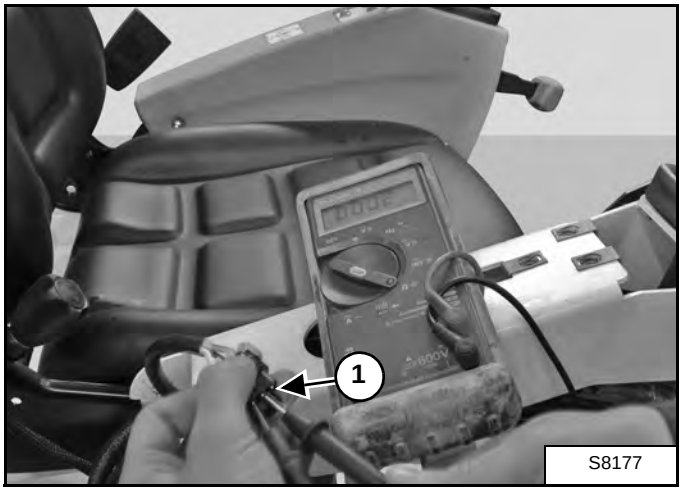
Lower the control console.

Figure 50-60-5



Disconnect the microswitch harness (Item 1) **[Figure 50-60-5]** from the control harness.

Figure 50-60-6



Use a continuity tester to check the microswitch prior to removal. Test the continuity between the black and white wire pins (Item 1) **[Figure 50-60-6]**.

The microswitch is normally open.

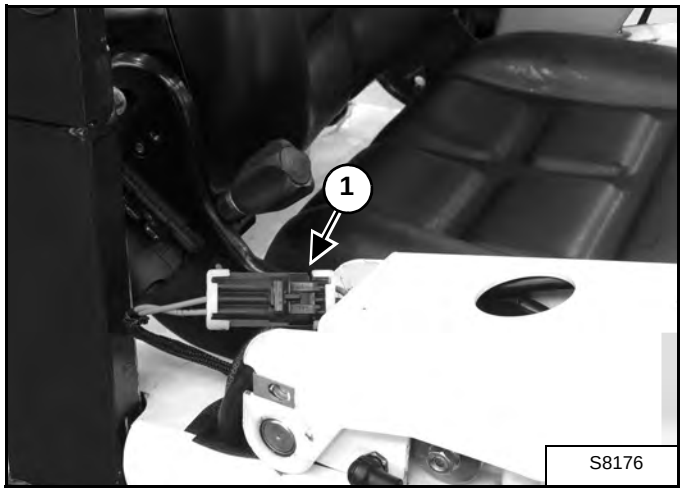
With the console raised the gauge reading should show no current.

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.

Right Console Microswitch Removal And Installation

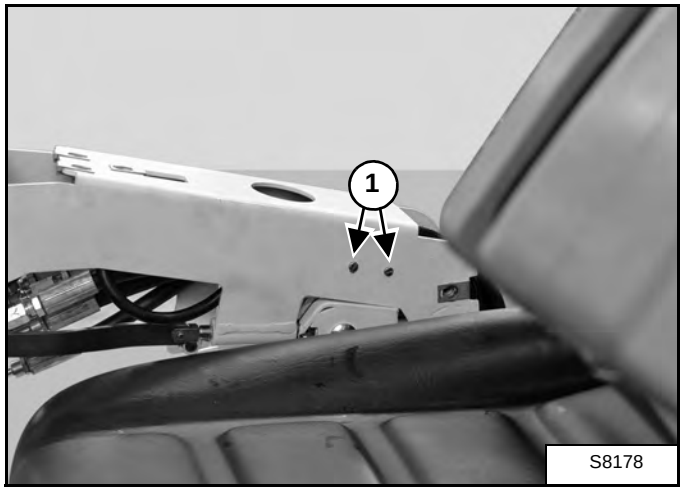
Remove the joystick console cover. (See Joystick Console Cover Removal And Installation on Page 40-50-1.)

Figure 50-60-7



Disconnect the microswitch harness (Item 1) **[Figure 50-60-7]** from the control harness.

Figure 50-60-8



Remove the nuts, lock washers and bolts (Item 1) **[Figure 50-60-8]** 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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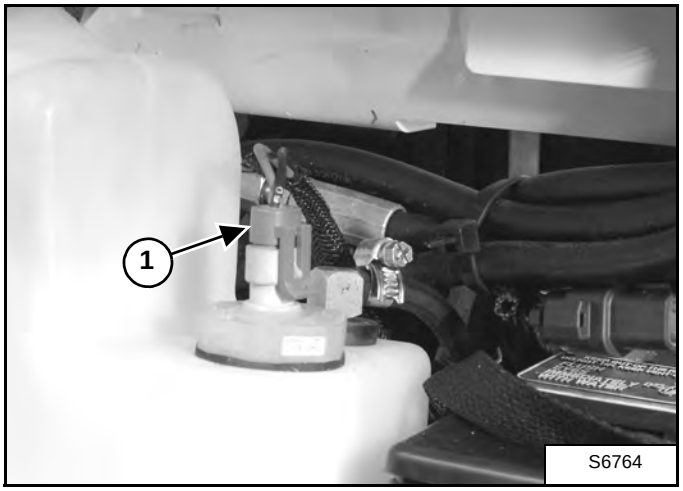
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FUEL LEVEL SENDER

Removal And Installation

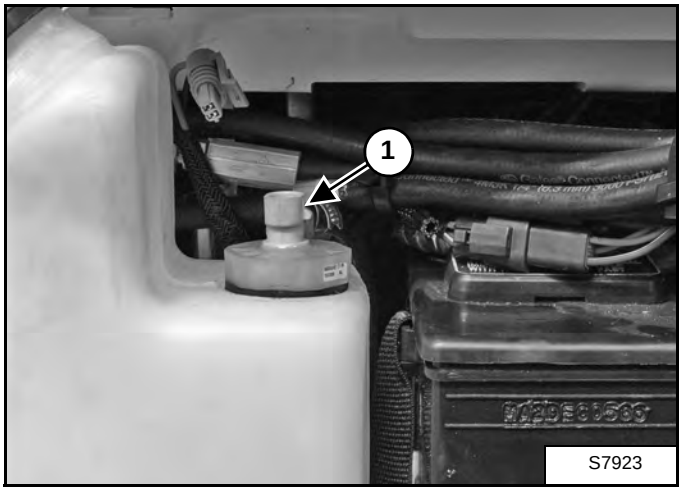
Remove the upper left hand side cover. (See Upper Left Side Cover Removal And Installation on Page 40-210-1.)

Figure 50-70-1



Disconnect the wire harness (Item 1) **[Figure 50-70-1]** from the fuel level sender.

Figure 50-70-2

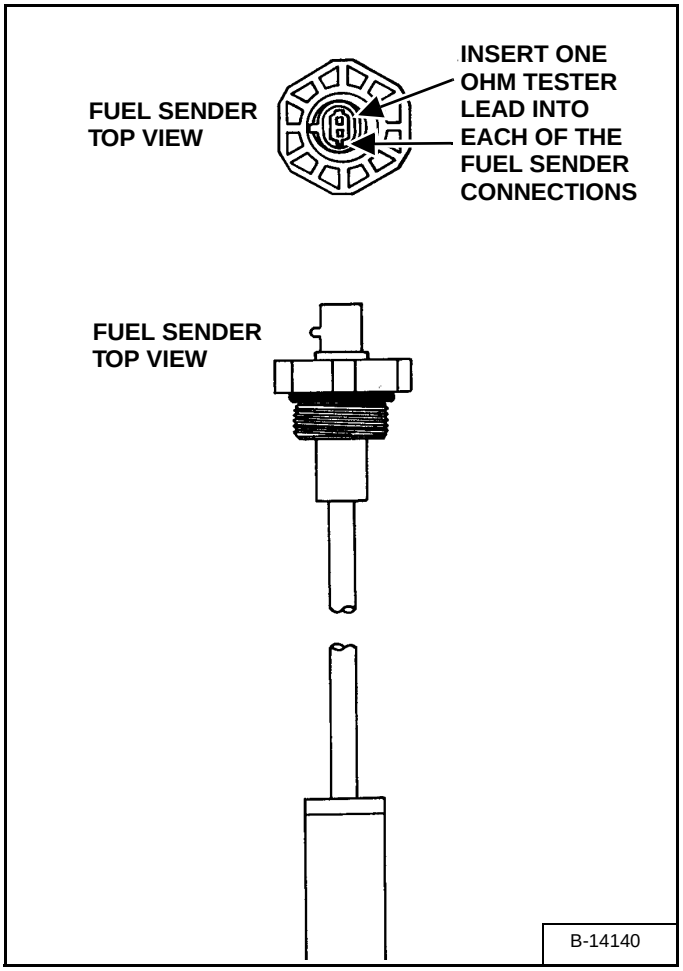


Remove the sender (Item 1) **[Figure 50-70-2]** from the fuel tank.

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 in the end of the fuel sender **[Figure 50-70-3]**.

With the fuel sender in the position shown **[Figure 50-70-3]**, read the ohm 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: 130 - 150 ohm
EMPTY: 230 - 250 ohm

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ENGINE INFORMATION

Description

The E10z 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 7,4 kWh (9.9 hp) and has an open crankcase ventilation system.

The engine has three cylinders and the rotation is counterclockwise (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

Fuel Injector Nozzles

Opening Pressure	13727 = 14713 kPa (137 - 147 bar) (1991 - 2134 psi)
Fuel Tightness Nozzle Seat	12748 kPa (127 bar) (1849 psi)

Fuel Injection Pump

Fuel Tightness of Pump Element	13727 kPa (137 bar) (1991 psi)
Fuel Tightness of Delivery Valve (factory spec)	10 Sec. Initial Pressure Drop From 13727 - 12748 kPa (137 - 127 bar) (1991 - 1849 psi)
Fuel Tightness of Delivery Valve Limit Permitted	5 Sec. Initial Pressure Drop From 13727 - 12718 kPa (137 - 127 bar) (1991 - 1849 psi)
Injection Timing @ 3600 rpm	19 - 21° 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 (0.0835 in)
O.D. of Valve Stem	5,968 - 5,980 mm (0.23496 - 0.23543 in)
I.D. of Valve Guide	6,01 - 6,025 mm (0.23661 - 0.2372 in)
Clearance between Valve Stem and Guide	0,03 - 0,057 mm (0.00118 - 0.00224 in)
Limit Permitted	0,1 mm (0.0039 in)
Depth of Valve	-0,10 - 0,10 mm (-0.0039 - 0.0039 in)
Limit Permitted	0,30 mm (0.0118 in)
Valve Clearance (Cold) (Intake and Exhaust)	0,145 - 0,185 mm (0.00571 - 0.00728 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 mm (14.6 lb in)
Limited Permitted	5,6 kg mm (12.3 lb in)
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	10,473 - 10,484 mm (0.41232 - 0.41276 in)
I.D. of Rocker Arm Bushing	10,5 - 10,518 mm (0.41339 - 0.4141 in)
Clearance between Rocker Arm Shaft and Bushing	0,016 - 0,045 mm (0.00063 - 0.00177 in)
Limit Permitted	0,15 mm (0.0059 in)

Camshaft

O.D. of Camshaft Bearing Journal	32,934 - 32,95 mm (1.29661 - 1.29724 in)
I.D. of Camshaft Bearing	33,00 - 33,025 mm (1.29921 - 1.3002 in)
Clearance between Camshaft Bearing and Journal	0,05 - 0,091 mm (0.00197 - 0.00358 in)
Limit Permitted	0,15 mm (0.0059 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	0,047 - 0,123 mm (0.00185 - 0.00484 in)
Limit Permitted	0,15 mm (0.0059 in)

Cylinders

I.D. of Cylinder Liner	67,000 - 67,019 mm (2.63779 - 2.63854 in)
Limit Permitted	67,15 mm (2.6437 in)
Rebore Size for Oversize Piston	67,250 - 67,269 mm (2.64764 - 2.64839 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	0,09 - 0,12 mm (0.00354 - 0.00472 in)
Oil Ring	0,04 - 0,08 mm (0.0016 - 0.0031 in)
Limit Permitted	0,15 mm (0.0059 in)

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Specifications (Cont'd)

Pistons

I.D. of Piston Pin Bore	20,00 - 20,013 mm (0.7874 - 0.78791 in)
Limit Permitted	20,05 mm (0.7894 in)
O.D. of Piston Pin	20,002 - 20,011 mm (0.78748 - 0.78783 in)

Connecting Rods

I.D. of Connecting Rod Bushing (Small End, Fitted)	20,025 - 20,04 mm (0.78839 - 0.78897 in)
Clearance between Piston Pin and Bushing	0,014 - 0,038 mm (0.00055 - 0.0015 in)
Clearance between Piston Pin and Bushing Limit Permitted	0,10 mm (0.0039 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)	39,934 - 39,95 mm (1.57221 - 1.57284 in)
I.D. of Crankshaft Bearing No. 1	39,984 - 40,04 mm (1.57417 - 1.57638 in)
Clearance between No. 1 Crankshaft Journal and Bearing	0,034 - 0,106 mm (0.00134 - 0.00417 in)
Limit Permitted	0,20 mm (0.0079 in)
O.D. of Crankshaft Journal No. 2 (Flywheel Side)	43,934 - 43,95 mm (1.72968 - 1.73031 in)
I.D. of Crankshaft Bearing No. 2	43,978 - 43,993 mm (1.73142 - 1.73201 in)
Clearance between No. 2 Crankshaft Journal and Bearing	0,028 - 0,059 mm (0.0011 - 0.00232 in)
Limit Permitted	0,20 mm (0.0079 in)
O.D. of Crankshaft Journal No. 3 (Intermediate)	39,934 - 39,95 mm (1.57221 - 1.57284 in)
I.D. of Crankshaft Bearing No. 3	39,978 - 39,993 mm (1.57394 - 1.57453 in)
Clearance between No. 3 Crankshaft Journal and Bearing	0,028 - 0,059 mm (0.0011 - 0.00232 in)
Limit Permitted	0,20 mm (0.0079 in)
O.D. of Connecting Rod Journals	33,959 - 33,975 mm (1.33697 - 1.3376 in)
I.D. of Connecting Rod Bearings`	33,995 - 34,01 mm (1.33839 - 1.33898 in)
Clearance between Connecting Rod Journal and Bearing	0,02 - 0,051 mm (0.00079 - 0.00201 in)
Limit Permitted	0,15 mm (0.0059 in)
Crankshaft End Play	0,15 - 0,31 mm (0.0059 - 0.0122 in)
Limit Permitted	0,50 mm (0.0197 in)

Oil Pump

Oil Pressure @ Rated RPM	193,1 - 441,3 kPa (2 - 4,5 bar) (28 - 64 psi)
Limit Permitted	144,8 kPa (1,5 bar) (21 psi)
Oil Pressure @ Idle Speed	48,3 kPa (0,5 bar) (7 psi)
Clearance between Outer Rotor and Pump Body	0,07 - 0,15 mm (0.0028 - 0.0059 in)
End Clearance between Inner Rotor and Cover	0,075 - 0,135 mm (0.00295 - 0.00531 in)
Clearance between Inner Rotor and Outer Rotor	0,03 - 0,14 mm (0.0012 - 0.0055 in)

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Specifications (Cont'd)

Thermostat

Opening Temperature	
Starting	69,5 - 72,5°C (157.1 - 162.5°F)
Full Open	85°C (185°F)

Engine Bolt Torque

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 to 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

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 Values (Cont'd)

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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Troubleshooting

Chart

The following troubleshooting chart is provided for assistance in locating and correcting problems which are most common. Many of the recommended procedures must be done by authorized Bobcat Service personnel only.

PROBLEM	CAUSE
Slow cranking speed	1, 2, 3, 4
Engine will not start	2, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 19, 27, 28, 29
Difficult to start	5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 25, 27, 28, 29
No power from engine	8, 9, 10, 11, 12, 13, 15, 16, 17, 21, 22, 24, 25, 26, 28, 29
Engine is mis-firing	8, 9, 11, 12, 13, 15, 16, 17, 21, 22, 24, 25, 26, 28
Too much fuel consumption	10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29
Black exhaust	10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29
Blue / white exhaust	4, 10, 15, 16, 17, 21, 23, 27, 29, 30, 50
Low oil pressure	4, 31, 32, 33, 34, 35, 37, 38, 39, 52
Engine knocking	13, 15, 16, 19, 22, 24, 25, 27, 29, 31, 40, 41, 53
Engine running rough	7, 8, 9, 10, 11, 12, 13, 17, 18, 22, 24, 25, 26, 29, 40, 53
Vibration	12, 13, 17, 21, 22, 25, 26, 29, 40, 42, 43
High oil pressure	4, 33, 36
Overheating	10, 12, 13, 15, 16, 20, 21, 40, 44, 45, 46, 47, 48, 51
Too much crankcase pressure	22, 27, 29, 30, 40, 49
Poor compression	10, 16, 21, 24, 25, 27, 28, 29, 30, 41, 53
Start and stop	9, 10, 11

KEY TO CORRECT THE CAUSE	
1. Battery capacity low	28. Worn valves and seat
2. Bad electrical connections	29. Broken or worn piston rings
3. Faulty starter motor	30. Worn valve stems or guides
4. Incorrect grade of oil	31. Worn or damaged bearings
5. Low cranking speed	32. Not enough oil in the oil pan
6. Fuel tank empty	33. Switch is defective
7. Faulty stop control operation	34. Oil pump worn
8. Plugged fuel line	35. Relief valve is stuck open
9. Plugged fuel filter	36. Relief valve is stuck closed
10. Restriction in the air cleaner	37. Broken relief valve spring
11. Air in the fuel system	38. Faulty suction pipe
12. Faulty fuel injection pump	39. Plugged oil filter
13. Faulty fuel injectors	40. Piston seizure
14. Broken injection pump drive	41. Incorrect piston height
15. Incorrect injection pump timing	42. Faulty engine mounting
16. Incorrect valve timing	43. Incorrect alignment of flywheel
17. Poor compression	44. Faulty thermostat
18. Plugged fuel tank vent	45. Restriction in water jacket
19. Incorrect grade of fuel	46. Loose alternator belt
20. Exhaust pipe restriction	47. Plugged radiator
21. Cylinder head gasket leaking	48. Plugged breather pipe
22. Over heating	49. Plugged breather pipe
23. Cold running	50. Damaged valve stem oil deflectors
24. Incorrect tappet adjustment	51. Coolant level too low
25. Sticking valves	52. Plugged oil pump pipe strainer
26. Incorrect high pressure fuel lines	53. Broken valve spring
27. Worn cylinder bores	

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Removal And Installation

Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

Drain the fuel tank. (See Draining The Fuel Tank on Page 10-100-3.)

Drain and remove the hydraulic reservoir.

Remove the air cleaner. (See Removal And Installation on Page 60-30-1.)

Remove the hydraulic pump. (See Removal And Installation on Page 20-50-3.)

Remove the manifold assembly / accumulator. (See Removal And Installation on Page 20-60-1.)

Remove the muffler. (See Removal And Installation on Page 60-20-1.)

Remove the battery. (See Removal and Installation on Page 50-20-3.)

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.

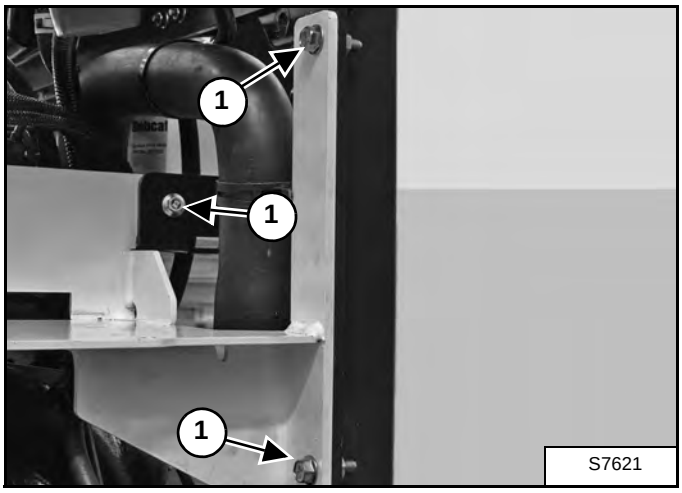
I-2003-0888

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, state and federal regulations for the correct disposal.

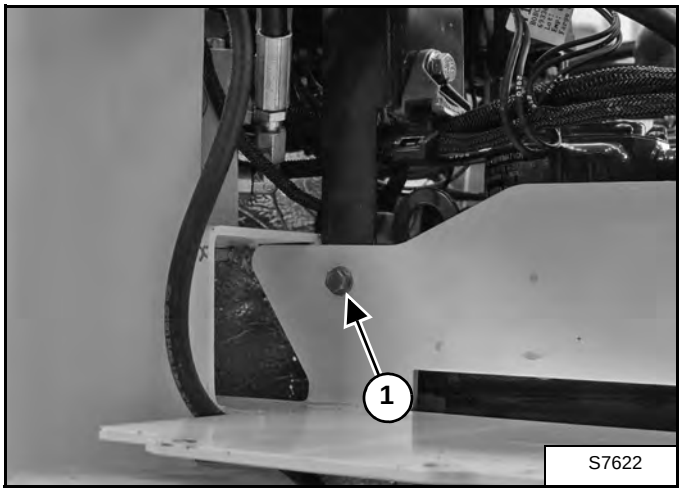
I-2067-0499

Figure 60-10-1



Remove the two nuts and bolts (Item 1) **[Figure 60-10-1]** from the battery support.

Figure 60-10-2

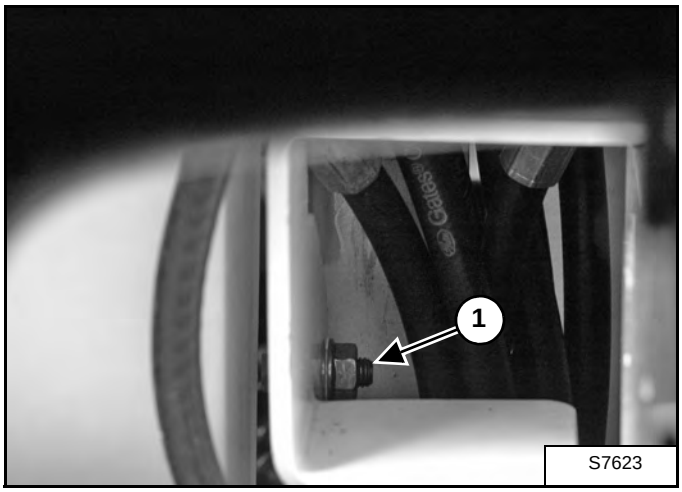


Remove the nut and bolt (Item 1) **[Figure 60-10-2]**.

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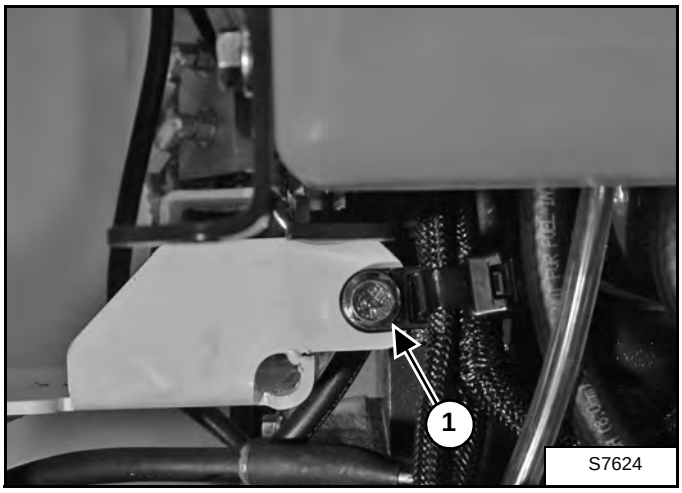
Removal And Installation (Cont'd)

Figure 60-10-3



Remove the nut and bolt (Item 1) **[Figure 60-10-3]**.

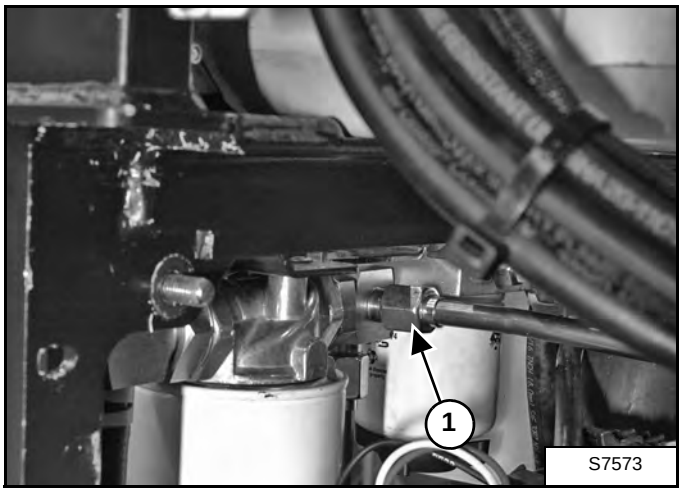
Figure 60-10-4



Remove the nut and bolt (Item 1) **[Figure 60-10-4]**.

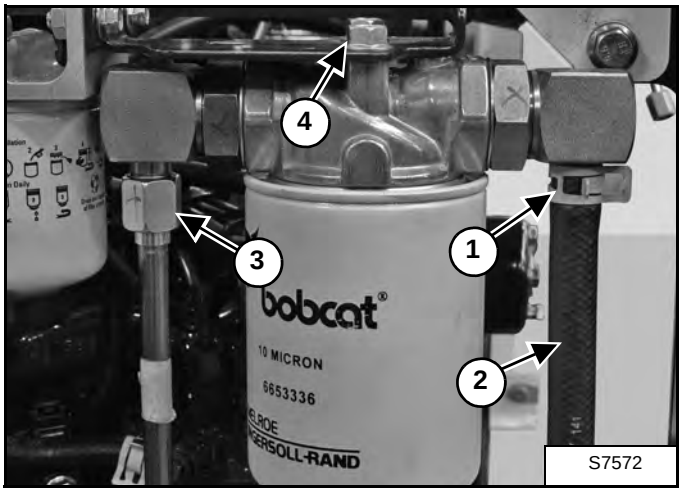
Remove the battery support.

Figure 60-10-5



Mark and remove the tubeline (Item 1) **[Figure 60-10-5]**.

Figure 60-10-6



Remove the hose clamp (Item 1) and hose (Item 2) **[Figure 60-10-6]**.

Mark and remove the tubeline (Item 3) **[Figure 60-10-6]**.

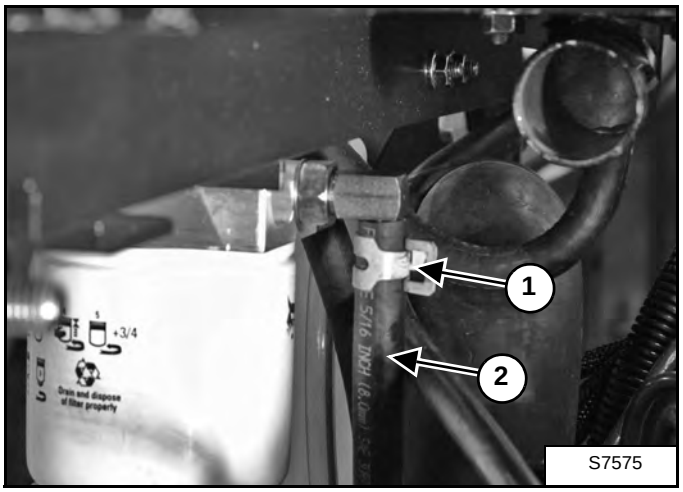
Remove the bolts (Item 4) **[Figure 60-10-6]** from the hydraulic filter.

Remove the hydraulic filter

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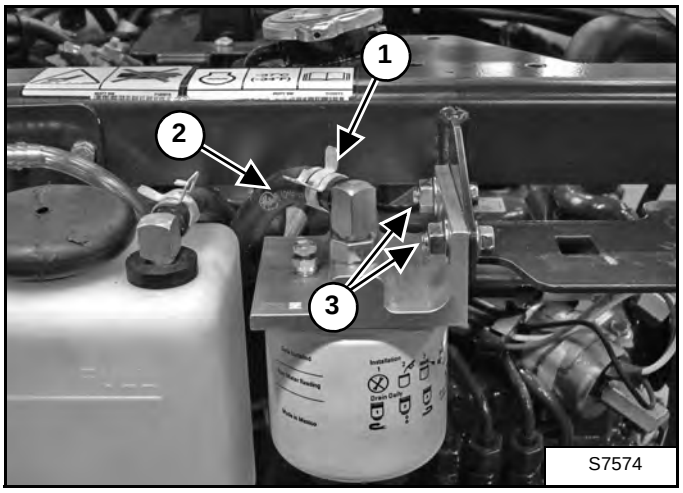
Removal And Installation (Cont'd)

Figure 60-10-7



Remove the hose clamp (Item 1) and hose (Item 2) **[Figure 60-10-7]**.

Figure 60-10-8

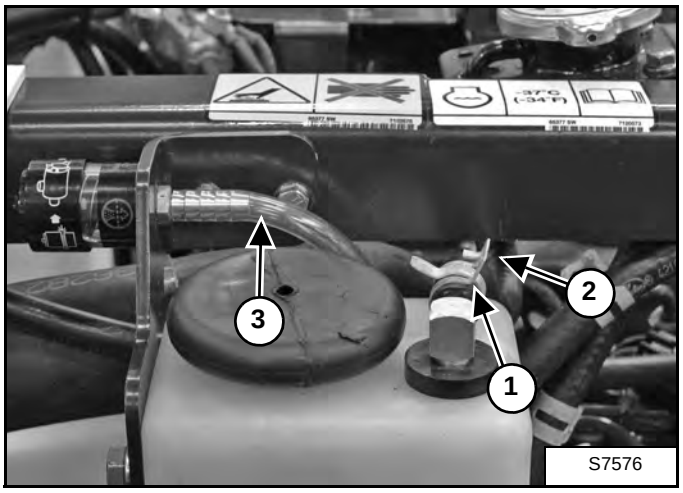


Remove the hose clamp (Item 1) and hose (Item 2) **[Figure 60-10-8]**.

Remove the bolts (Item 3) **[Figure 60-10-8]** from the fuel filter bracket.

Remove the fuel filter and bracket

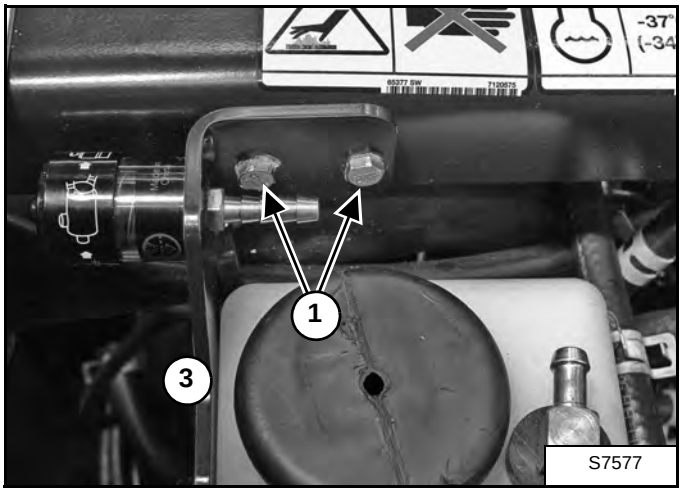
Figure 60-10-9



Remove the hose clamp (Item 1) and hose (Item 2) **[Figure 60-10-9]**.

Mark and remove the hose (Item 3) **[Figure 60-10-9]**.

Figure 60-10-10



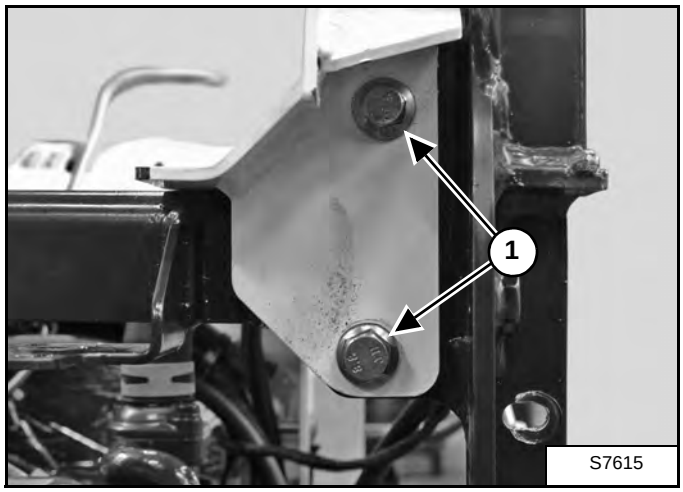
Remove the bolts and nuts (Item 1) **[Figure 60-10-10]**.

Remove the overflow bottle and bracket.

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Removal And Installation (Cont'd)

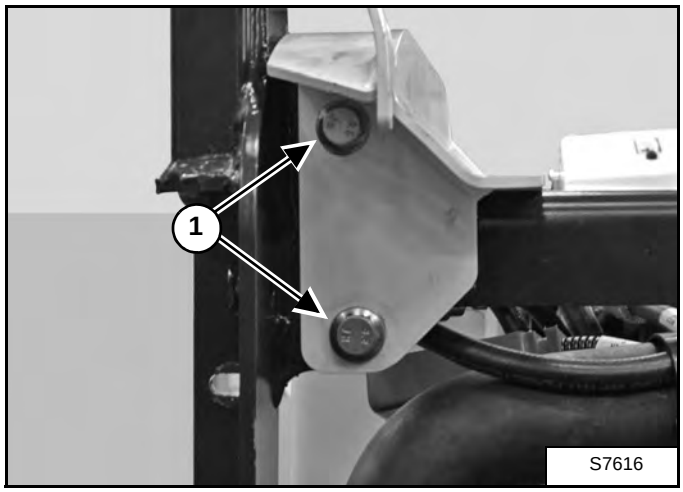
Figure 60-10-11



Remove the bolts and nuts (Item 1) **[Figure 60-10-11]**.

Installation: Tighten the bolts to 50 N•m (37 ft-lb) torque.

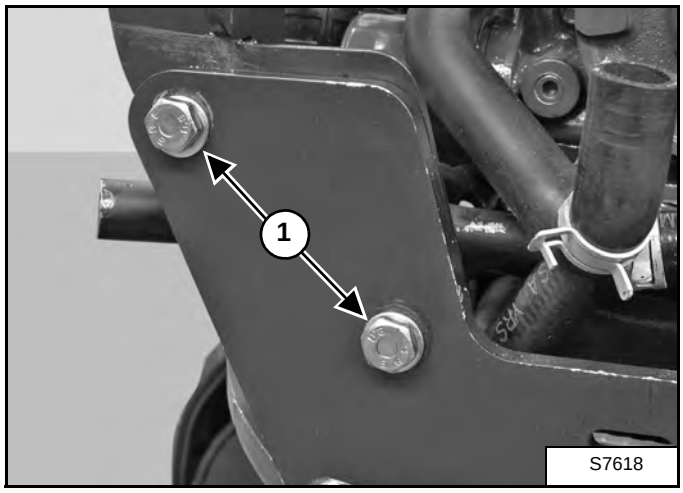
Figure 60-10-12



Remove the bolts and nuts (Item 1) **[Figure 60-10-12]**.

Installation: Tighten the bolts to 50 N•m (37 ft-lb) torque.

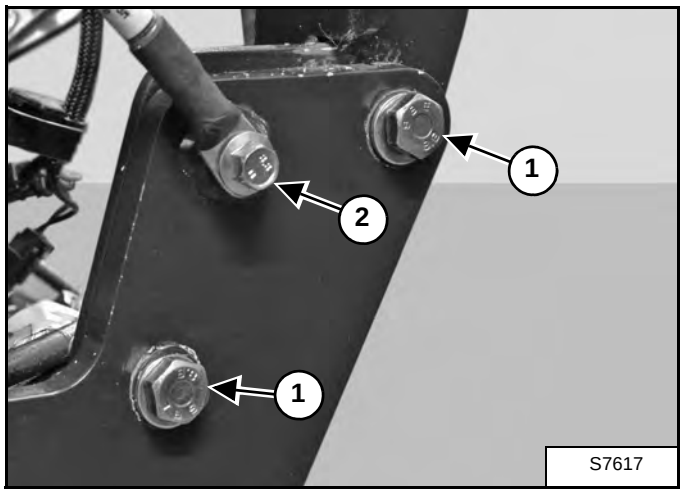
Figure 60-10-13



Remove bolts and nuts (Item 1) **[Figure 60-10-13]**.

Installation: Tighten the bolts to 85 N•m (63 ft-lb) torque.

Figure 60-10-14



Remove bolts and nuts (Item 1) **[Figure 60-10-14]**.

Installation: Tighten the bolts to 85 N•m (63 ft-lb) torque.

Remove bolt (Item 2) **[Figure 60-10-14]** from ground cable.

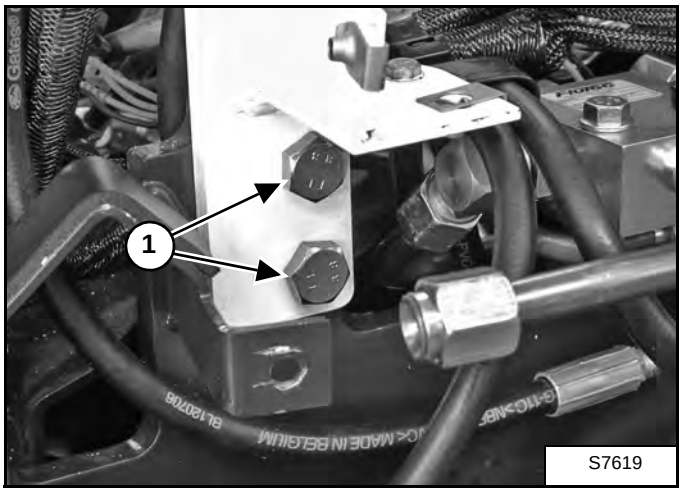
Installation: Tighten the bolt to 50 N•m (37 ft-lb) torque.

Remove the floor panels. (See FLOOR PANELS on Page 40-120-1.)

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Removal And Installation (Cont'd)

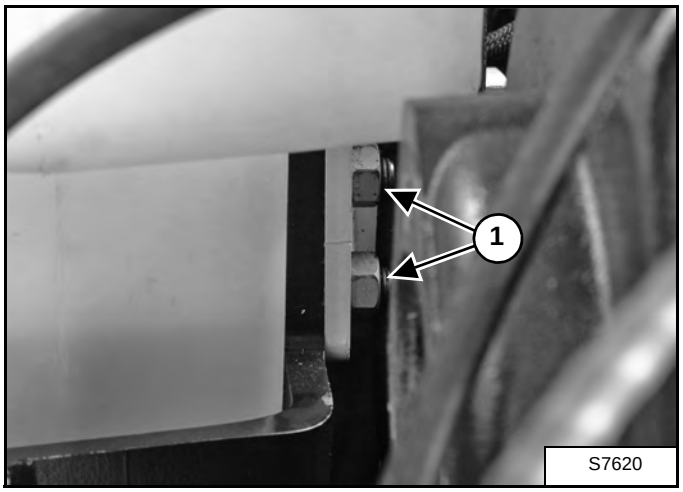
Figure 60-10-15



Remove bolts and nuts (Item 1) **[Figure 60-10-15]**.

Installation: Tighten the bolts to 50 N•m (37 ft-lb) torque.

Figure 60-10-16



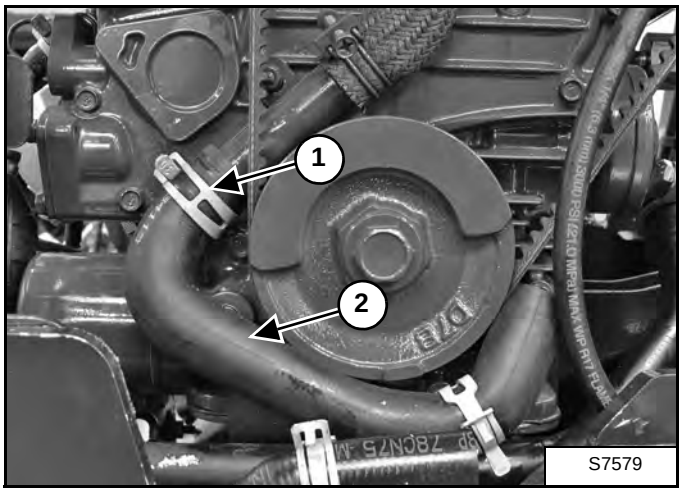
Remove bolts and nuts (Item 1) **[Figure 60-10-16]**.

Installation: Tighten the bolts to 50 N•m (37 ft-lb) torque.

Carefully lift frame upward and tilt forward to clear back frame.

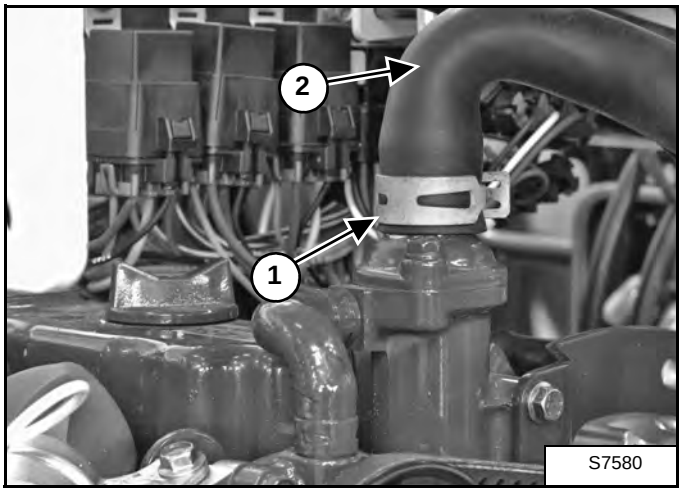
Remove the back frame from the excavator.

Figure 60-10-17



Remove the hose clamp (Item 1) and lower radiator hose (Item 2) **[Figure 60-10-17]**.

Figure 60-10-18

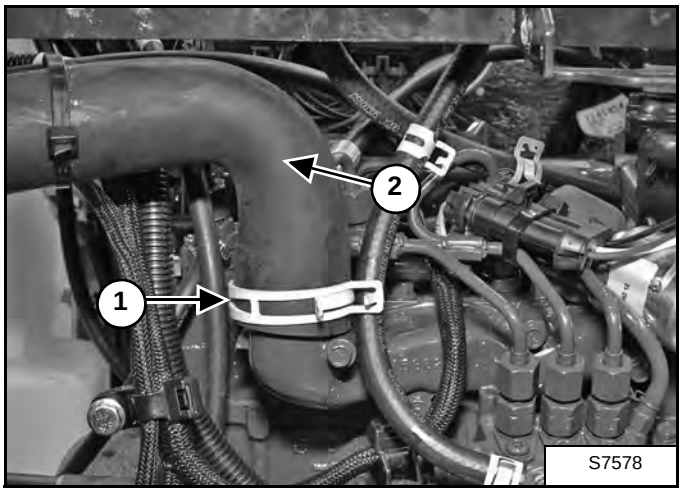


Remove the hose clamp (Item 1) and upper radiator hose (Item 2) **[Figure 60-10-18]**.

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Removal And Installation (Cont'd)

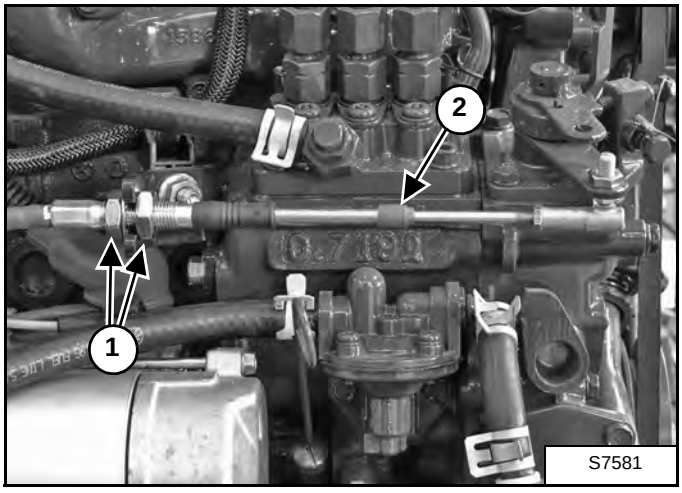
Figure 60-10-19



Remove the hose clamp (Item 1) and air intake hose (Item 2) **[Figure 60-10-19]** from the engine.

NOTE: Plug intake opening to prevent contamination from getting into the engine.

Figure 60-10-20

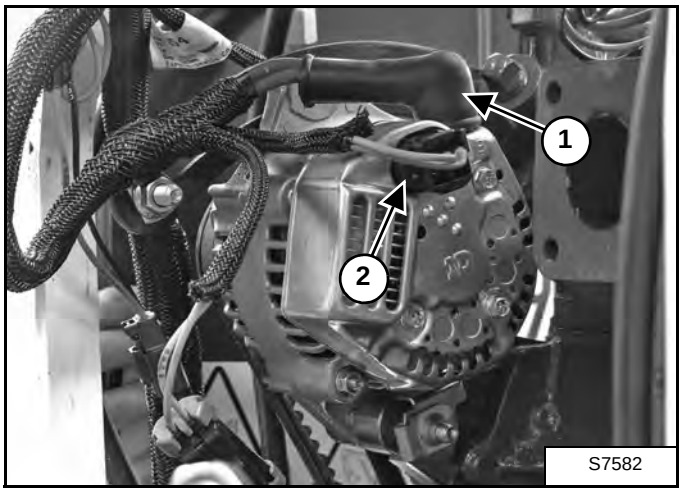


Loosen the nuts (Item 1) **[Figure 60-10-20]** fastening the throttle cable to the bracket.

Disconnect the throttle linkage (Item 2) **[Figure 60-10-20]** from the throttle bracket.

Move the throttle cable out of the way of the engine.

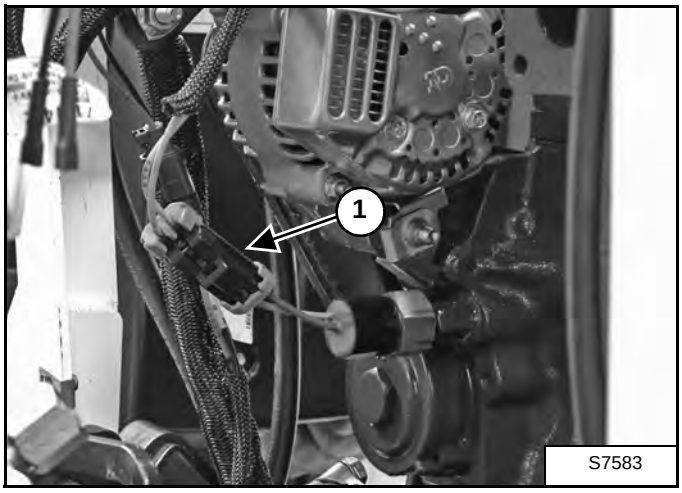
Figure 60-10-21



Disconnect the red wire (Item 1) **[Figure 60-10-21]** from the alternator.

Disconnect the wire connector (Item 2) **[Figure 60-10-21]** from the alternator.

Figure 60-10-22

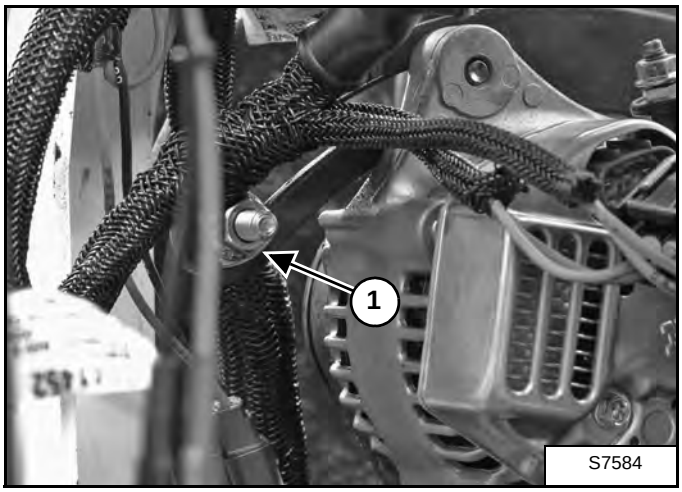


Disconnect the wire connector (Item 1) **[Figure 60-10-22]** from the oil pressure sending unit on the back side of the engine.

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Removal And Installation (Cont'd)

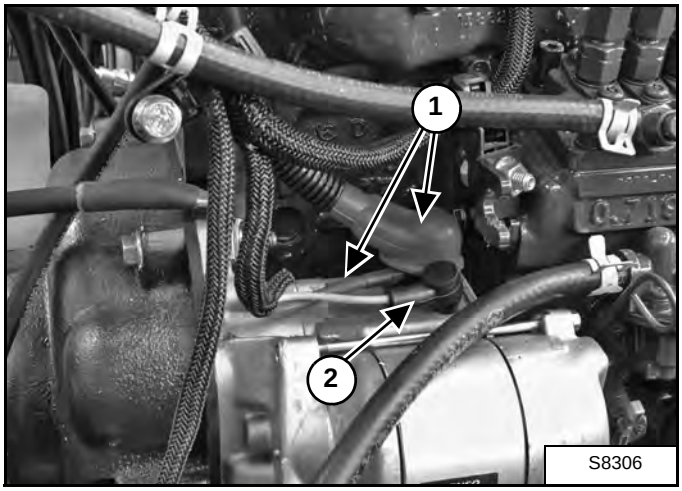
Figure 60-10-23



Remove the bolt and nut (Item 1) **[Figure 60-10-23]** from the alternator bracket.

Move the wire harness out of the way of the engine and alternator.

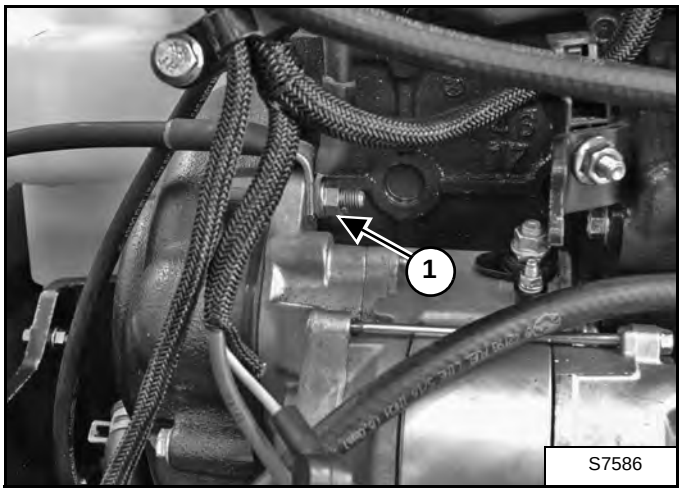
Figure 60-10-24



Mark the wires for ease of installation.

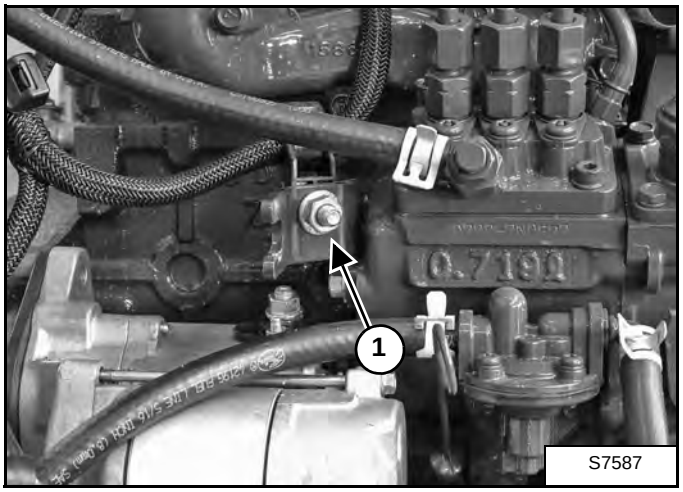
Remove the wires (Item 1) and (Item 2) **[Figure 60-10-24]** from the starter.

Figure 60-10-25



Remove the grounding wires (Item 1) **[Figure 60-10-25]** from the starter mounting bolt.

Figure 60-10-26



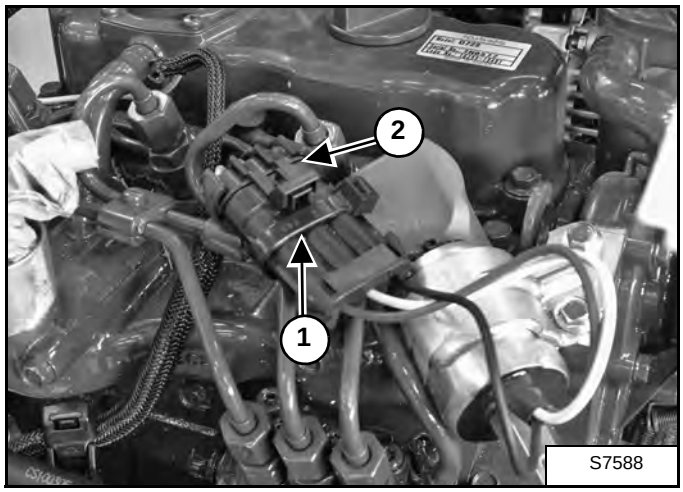
Remove nut and bolt (Item 1) **[Figure 60-10-26]** from cable clamp.

Move the wire harness out of the way of the engine.

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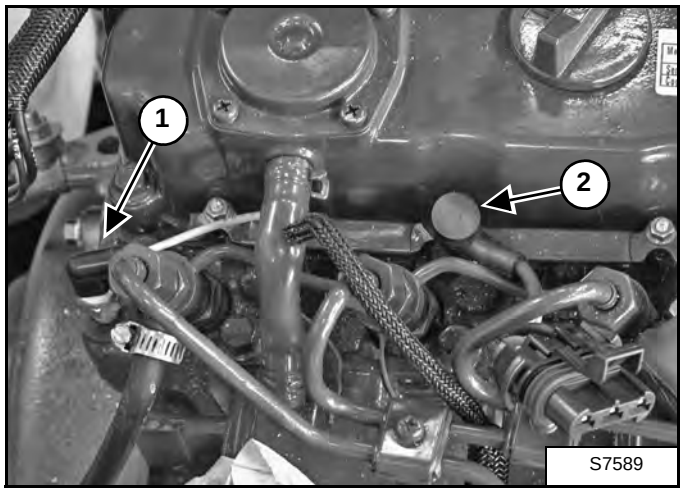
Removal And Installation (Cont'd)

Figure 60-10-27



Cut the tie-strap (Item 1) and disconnect wire connector (Item 2) **[Figure 60-10-27]** from the fuel shutoff.

Figure 60-10-28

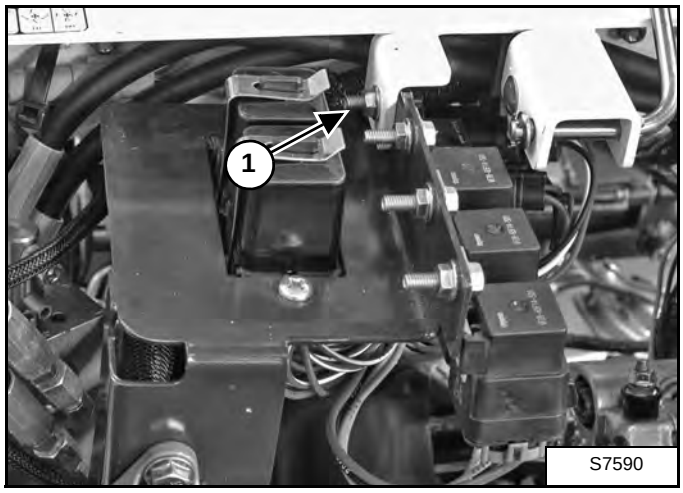


Remove the wire (Item 1) **[Figure 60-10-28]** from the water temperature sending unit.

Remove the nut (Item 2) **[Figure 60-10-28]** from the glow plugs.

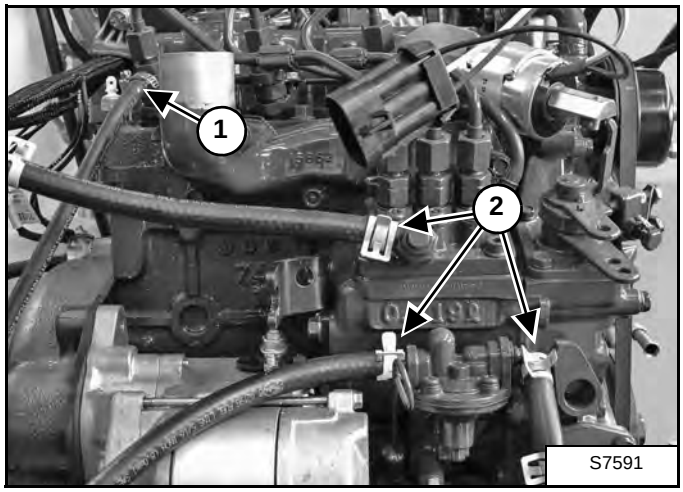
Move the wire harness out of the way of the engine.

Figure 60-10-29



Remove the bolt (Item 1) **[Figure 60-10-29]** from the fuse block and reposition away from the engine lifting bracket.

Figure 60-10-30



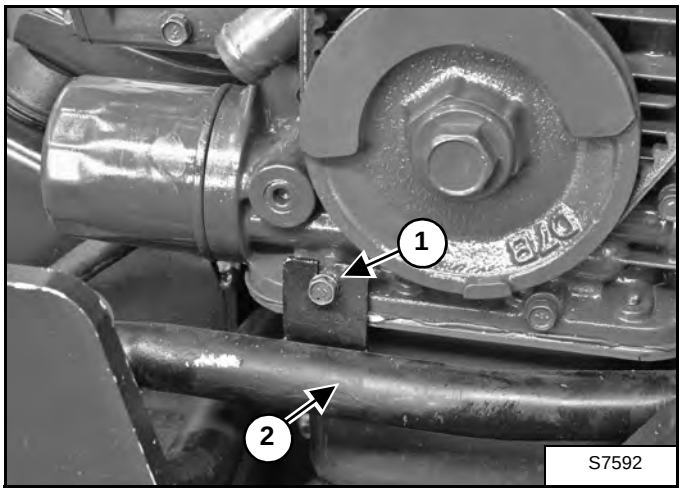
Remove and cap the return fuel line (Item 1) **[Figure 60-10-30]**.

Remove and cap the fuel lines (Item 2) **[Figure 60-10-30]**.

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Removal and Installation (Cont'd)

Figure 60-10-31

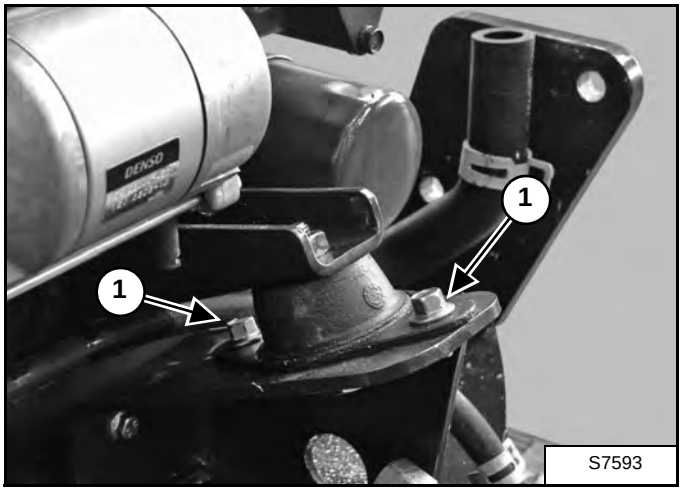


Remove the bolt (Item 1) **[Figure 60-10-31]**.

Installation: Tighten the bolt to 5,5 N•m (48.68 in-lb) torque.

Remove the exhaust extension (Item 2) **[Figure 60-10-31]**.

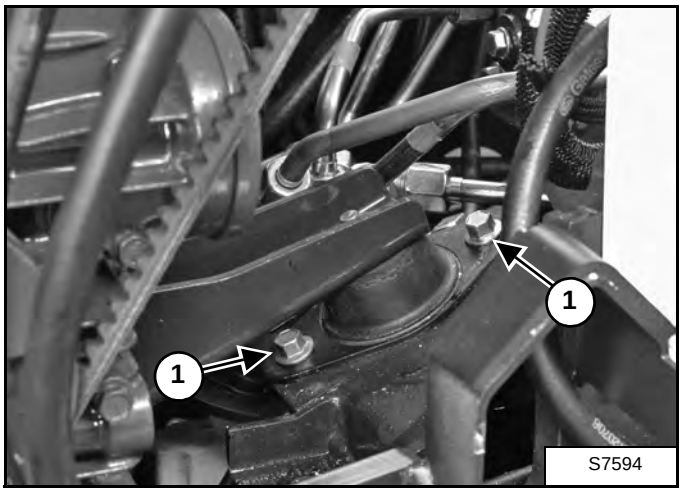
Figure 60-10-32



Remove the two engine mount bolts (Item 1) **[Figure 60-10-32]**.

Installation: Tighten the bolts to 5,5 N•m (48.68 in-lb) torque.

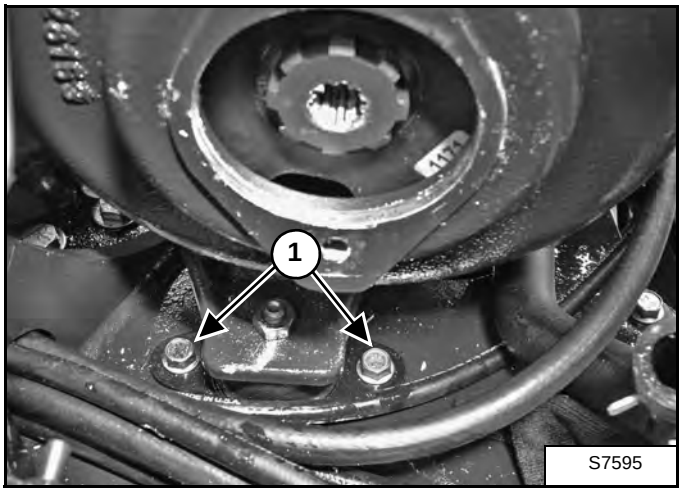
Figure 60-10-33



Remove the two engine mount bolts (Item 1) **[Figure 60-10-33]**.

Installation: Tighten the bolts to 5,5 N•m (48.68 in-lb) torque.

Figure 60-10-34



Remove the two engine mount bolts (Item 1) **[Figure 60-10-34]**.

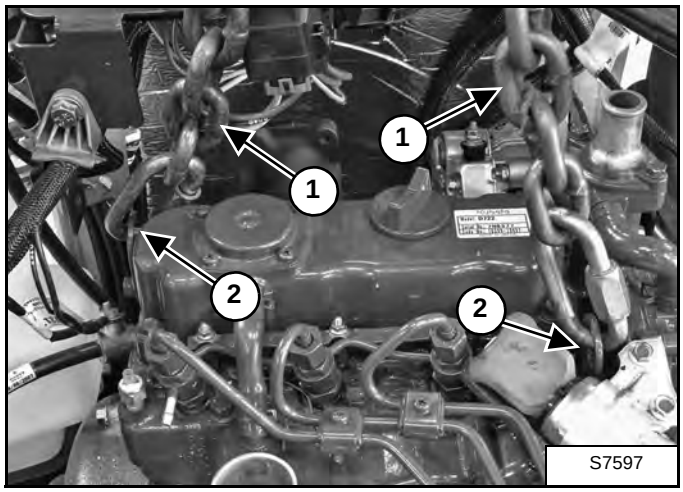
Installation: Tighten the bolts to 5,5 N•m (48.68 in-lb) torque.

NOTE: The engine mounts are left assembled to the engine and will be removed with the engine.

Dealer Copy -- Not for Resale

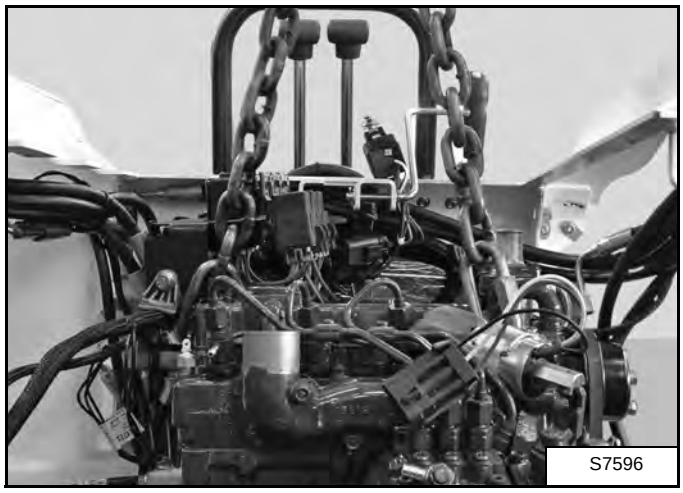
Removal and Installation (Cont'd)

Figure 60-10-35



Connect a chain (Item 1) to the two engine lifting brackets (Item 2) **[Figure 60-10-35]**.

Figure 60-10-36



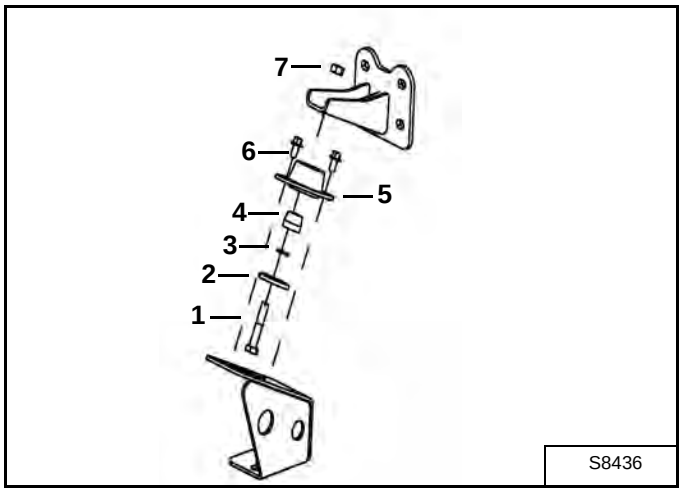
Lift and slide the engine out while turning the engine to provide clearance during engine removal **[Figure 60-10-36]**.

NOTE: Protect the excavator from lifting chain damage during engine removal.

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Engine Mount Replacement

Figure 60-10-37



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.

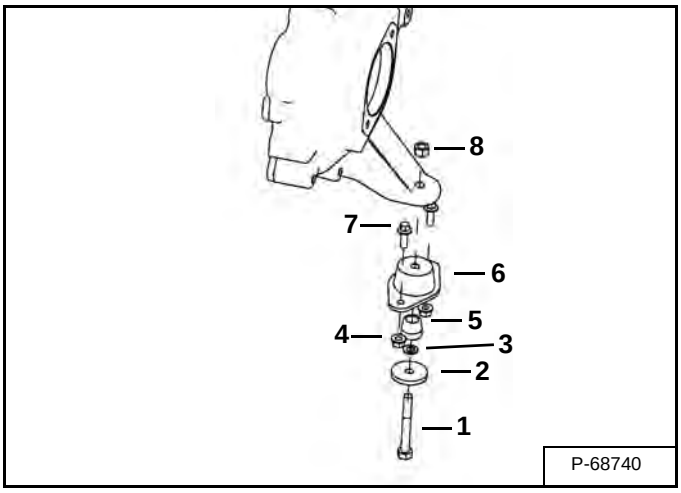
Replace the two front and rear engine mounts.

Use the parts shown to install the new engine mounts for the front and rear engine mounts **[Figure 60-10-37]**.

Item 1 - Mounting Bolt
Item 2 - Mount Washer
Item 3 - Flat Washer
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 60-10-38



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 60-10-38]**.

Item 1 - Mounting Bolt
Item 2 - Mount Washer
Item 3 - Flat Washer
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

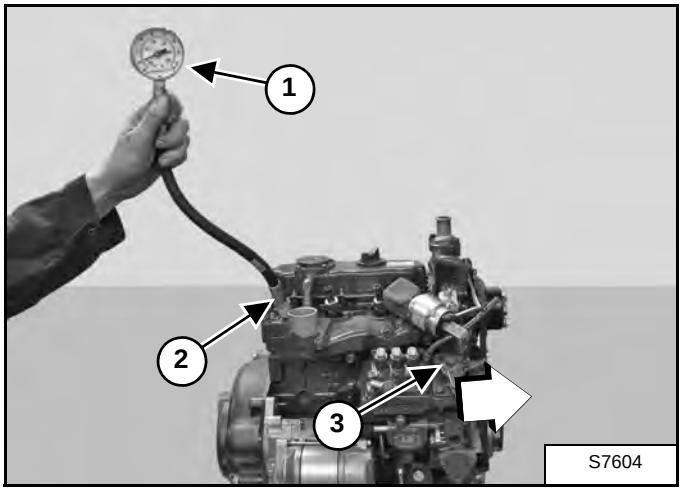
Warm the engine.

Remove the glow plugs from the engine. (If testing through glow plug hole.)

Remove all injector nozzles. (If testing through injector nozzle hole.)

Install the compression adapter in the cylinder head.

Figure 60-10-39



NOTE: Engine has been removed for photo clarity.

Connect the compression gauge (Item 1) to the adapter (Item 2) **[Figure 60-10-39]**.

Ensure the speed control lever is set at the low idle setting.

Hold fuel shutoff lever (Item 3) **[Figure 60-10-39]** to no fuel (shutoff). Shutoff 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 28 - 32 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.

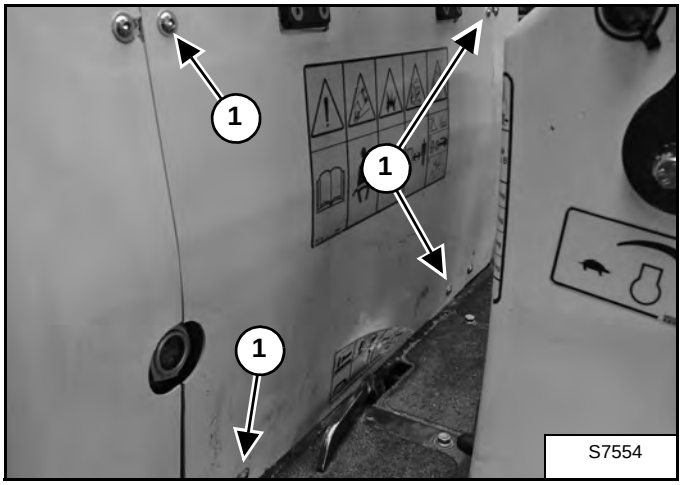
If the pressures do not increase after applying oil, check top clearance, valve clearance and cylinder head.

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MUFFLER

Removal And Installation

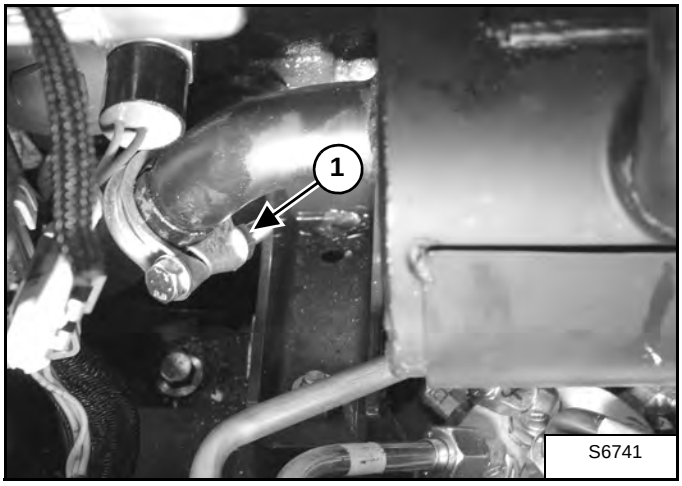
Figure 60-20-1



Remove the bolts (Item 1) **[Figure 60-20-1]**.

Remove the cover.

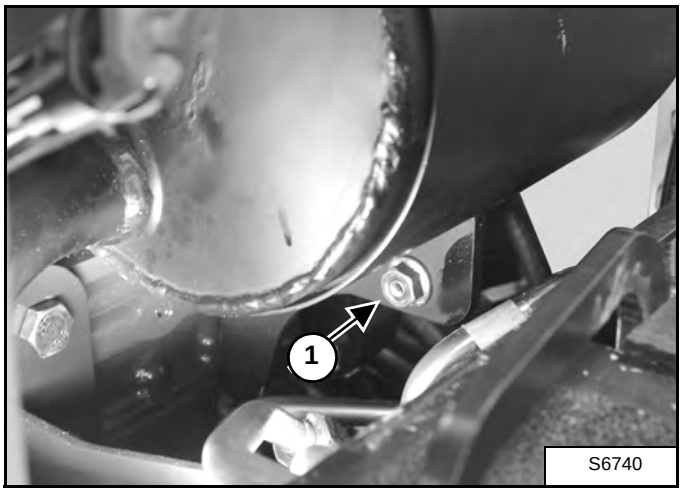
Figure 60-20-2



Loosen the exhaust extension clamp (Item 1) **[Figure 60-20-2]**.

Installation: Tighten clamp to 8 - 10 N•m (70.80 - 88.5 in-lb) torque.

Figure 60-20-3



Remove the nut and bolt (Item 1) **[Figure 60-20-3]** from the exhaust mounting bracket.

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

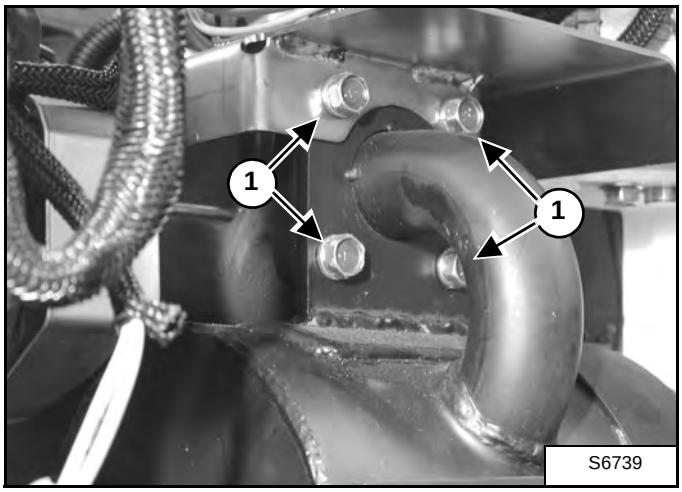
Never use machine in atmosphere with explosive dust or gases or where exhaust can contact flammable material. Failure to obey warnings can cause injury or death.

W-2068-1285

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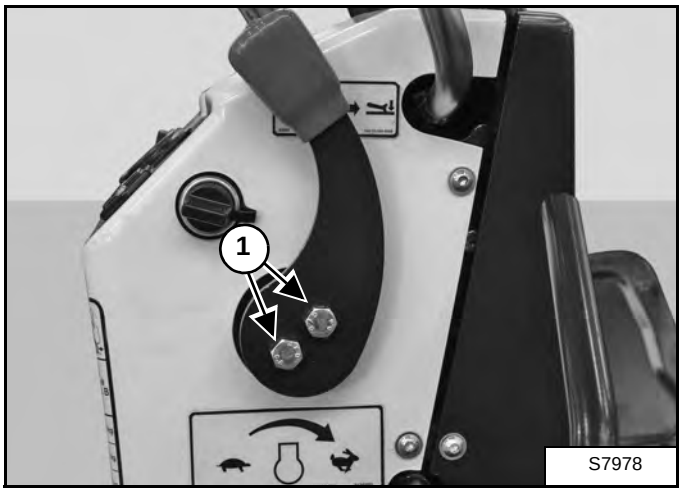
Removal And Installation (Cont'd)

Figure 60-20-4



Remove the four bolts (Item 1) **[Figure 60-20-4]** from the muffler mount flange.

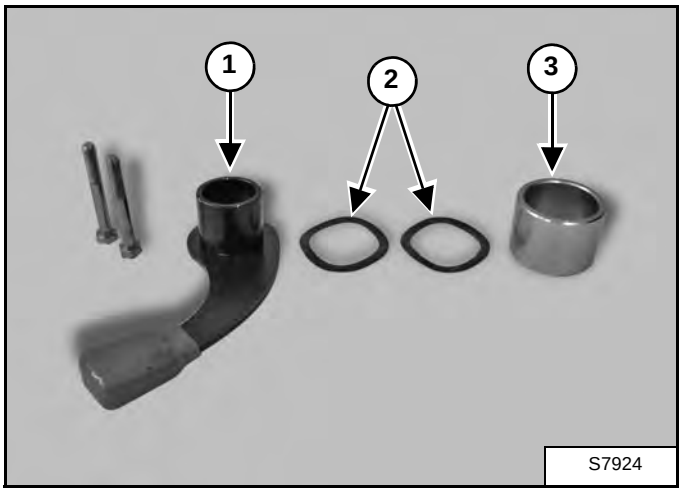
Figure 60-20-5



Remove the bolts (Item 1) **[Figure 60-20-5]** from the throttle lever.

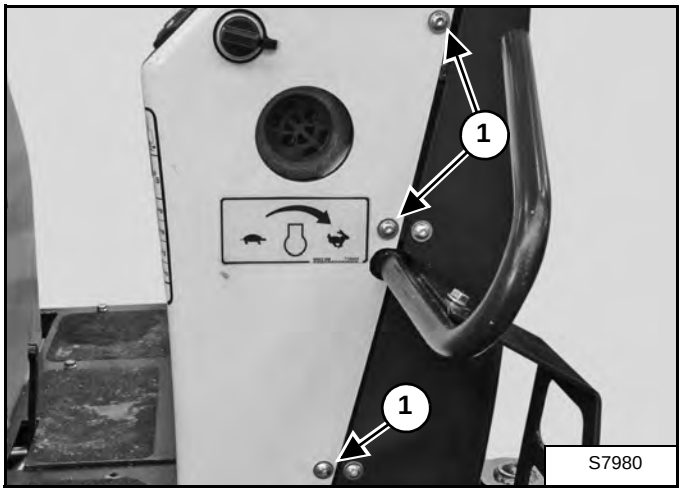
Installation: Tighten the two bolts (Item 1) **[Figure 60-20-5]** evenly until the throttle lever moves back and forth at a comfortable tension.

Figure 60-20-6



Remove the lever (Item 1), the two wave washers (Item 2), and the spacer (Item 3) **[Figure 60-20-6]**.

Figure 60-20-7

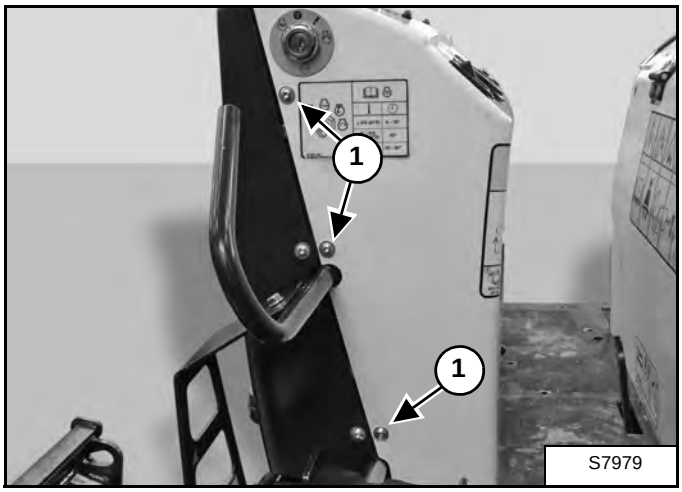


Remove the three bolts (Item 1) **[Figure 60-20-7]** from the right hand side of the instrument panel.

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Removal And Installation (Cont'd)

Figure 60-20-8



Remove the three bolts (Item 1) **[Figure 60-20-8]** from the left hand side of the instrument panel.

Move the instrument panel to one side to provide extra clearance for muffler removal.

Slide muffler off exhaust extension and remove the muffler from the excavator.

NOTE: Plug the exhaust manifold hole after muffler removal so no contamination can get into the engine.

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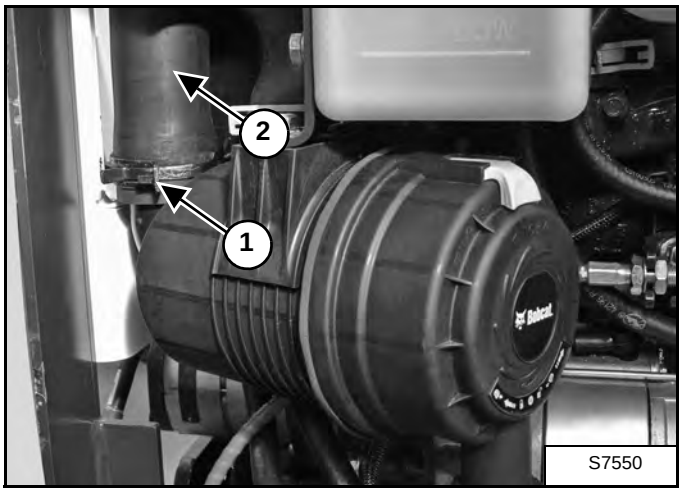
AIR CLEANER

Removal And Installation

Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

Remove the left hand side counterweight. (See Left Side Counterweight Removal And Installation on Page 40-200-1.)

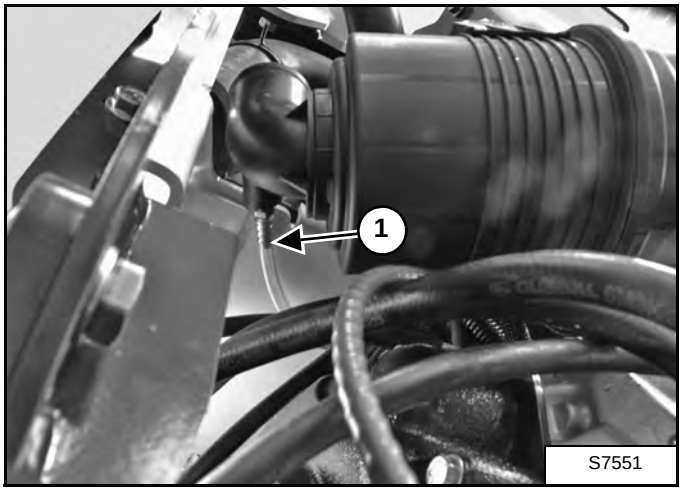
Figure 60-30-1



Remove the hose clamp (Item 1) and hose (Item 2) **[Figure 60-30-1]** from the air cleaner.

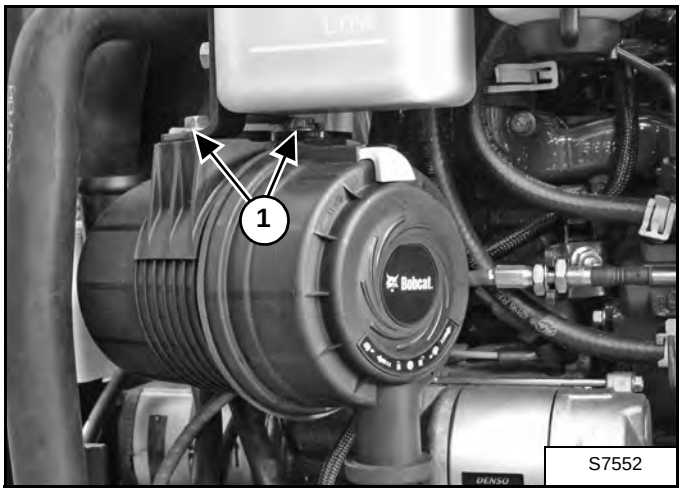
NOTE: Plug intake hose to avoid contamination from getting in.

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]** and remove the air cleaner and hose assembly from the excavator.

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

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Radiator Removal And Installation

WARNING

AVOID BURNS

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

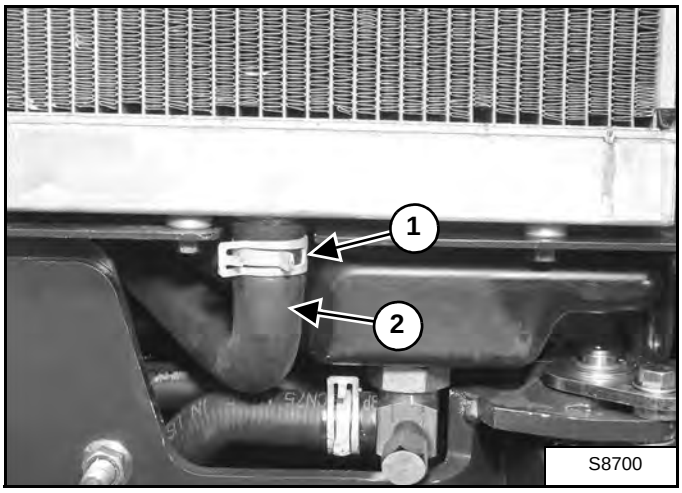
W-2070-1203

Drain the radiator coolant. (See Removing And Replacing The Coolant on Page 10-90-2.)

Remove the right hand side counterweight. (See Right Side Counterweight Removal And Installation on Page 40-200-2.)

Remove the upper right hand side cover. (See Upper Right Side Cover Removal And Installation on Page 40-210-1.)

Figure 60-40-1

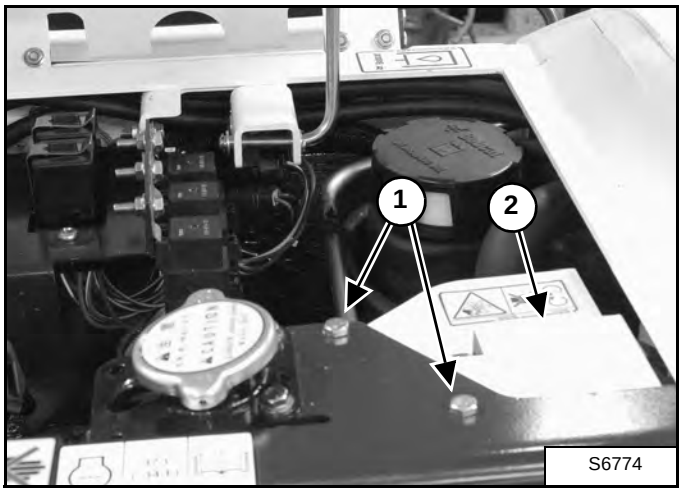


Remove the hose clamp (Item 1) and lower radiator hose (Item 2) **[Figure 60-40-1]**.

NOTE: There is still a small amount of coolant present in the radiator and hose. Use a container when removing lower radiator hose.

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

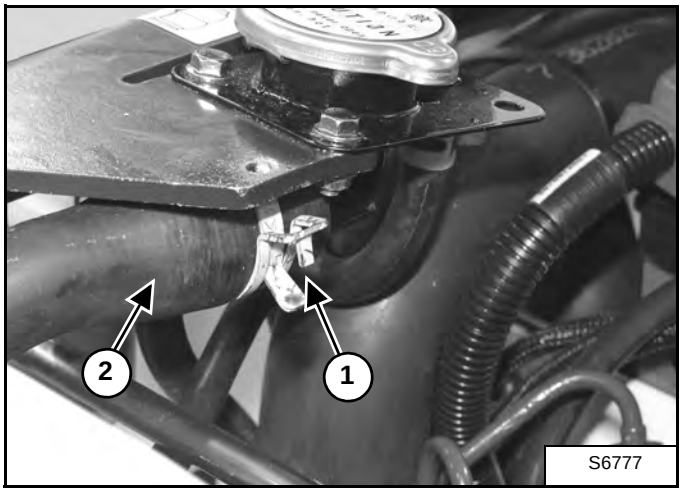
Figure 60-40-2



Open the tailgate. (See Opening And Closing The Tailgate on Page 10-60-1.)

Remove the bolts (Item 1) and the fan guard (Item 2) **[Figure 60-40-2]**.

Figure 60-40-3



Remove the hose clamp (Item 1) and filler neck hose (Item 2) **[Figure 60-40-3]**.

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Water Pump Removal And Installation

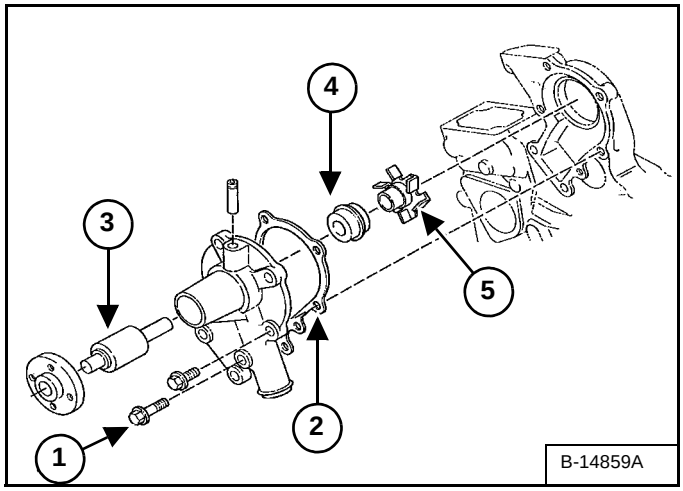
Drain the cooling system.

Remove the radiator. (See Radiator Removal And Installation on Page 60-40-1.)

Remove the alternator belt.

Remove the fan.

Figure 60-40-4



Remove the water pump bolts (Item 1) **[Figure 60-40-4]**.

Remove the water pump.

Installation: Always use a new gasket (Item 2) **[Figure 60-40-4]** 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 60-40-4]** out of the pulley side of the water pump. Press out the shaft with the impeller on it.

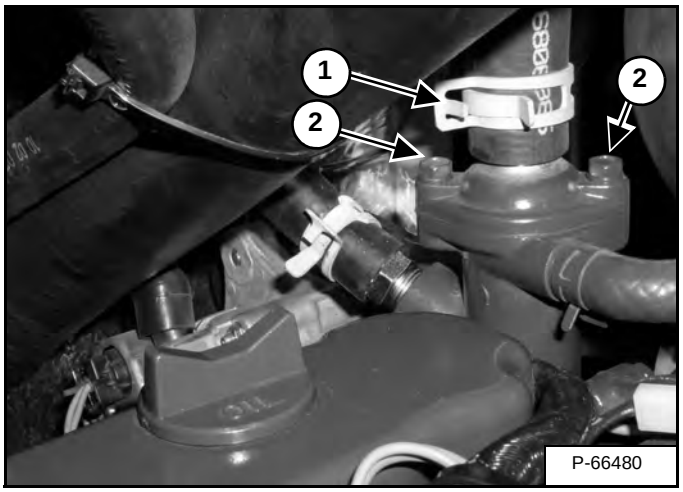
Remove the seal (Item 4) and impeller (Item 5) **[Figure 60-40-4]**.

Install a new seal when assembling the water pump.

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Thermostat Removal And Installation

Figure 60-40-5



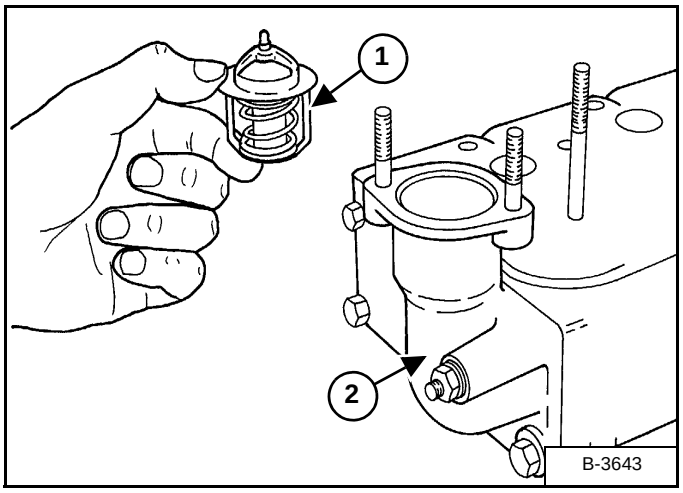
Drain the engine coolant until it is below the thermostat level.

Remove the hose (Item 1) **[Figure 60-40-5]**.

Remove the bolts (Item 2) **[Figure 60-40-5]** 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 60-40-6



Remove the housing and thermostat (Item 1) **[Figure 60-40-6]**.

Remove the four mounting bolts at the coolant housing (Item 2) **[Figure 60-40-6]**.

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 Cooling System on Page SPEC-20-1.)

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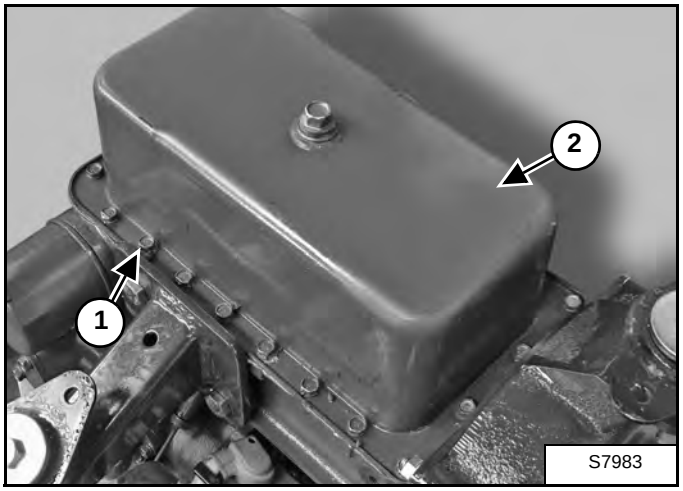


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Oil Pan Removal And Installation

Remove the engine from the excavator. (See Removal And Installation on Page 60-10-9.)

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

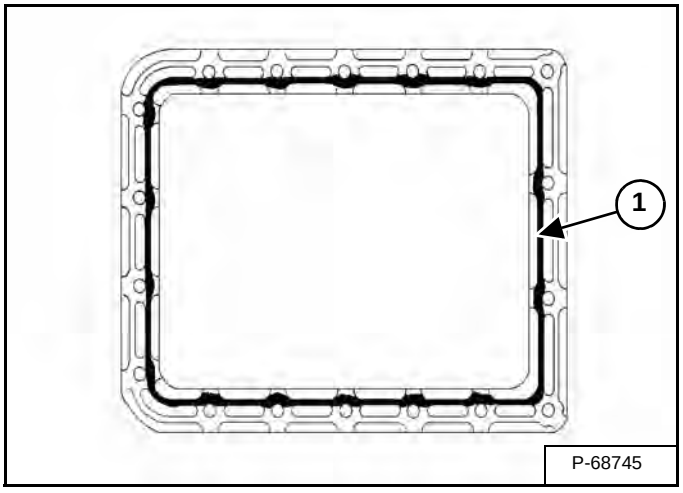
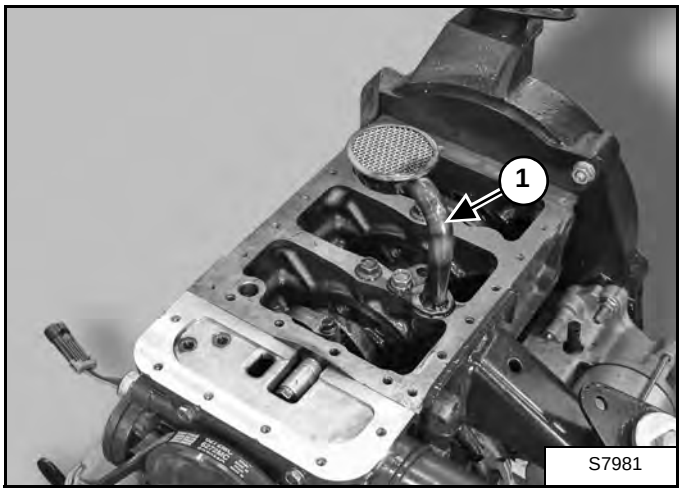
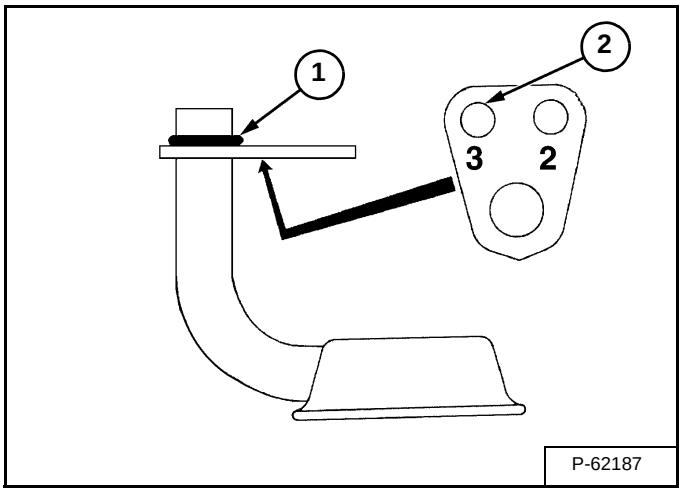


Figure 60-50-3



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 install 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.

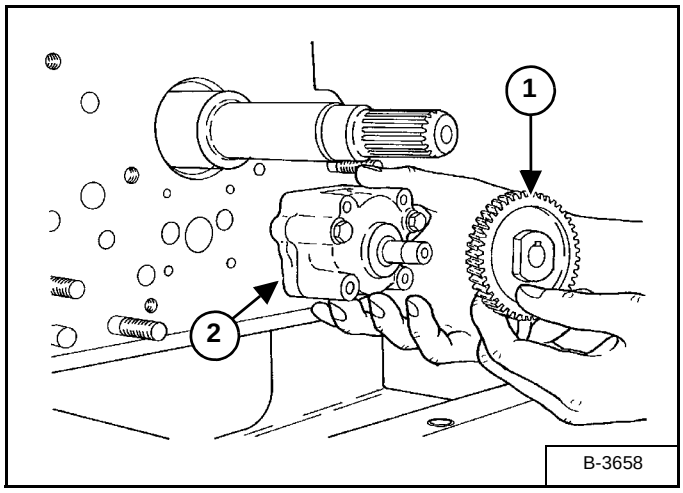
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Oil Pump Removal And Installation

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-90-1.)

Remove the crankshaft gear.

Figure 60-50-5



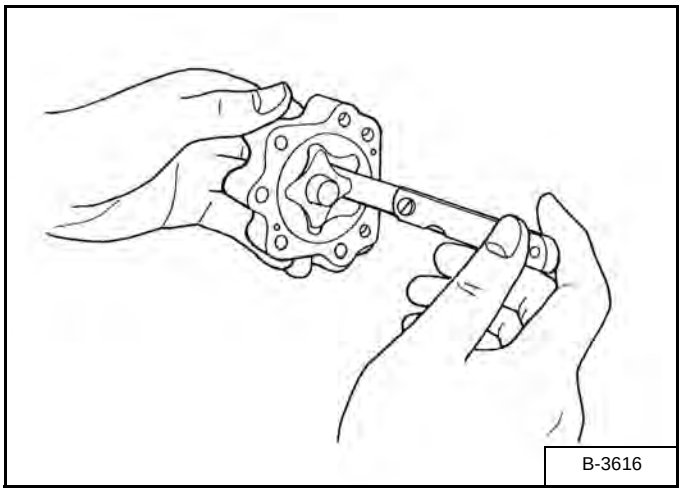
Remove the nut from the oil pump shaft. Use a puller to remove the oil pump gear (Item 1) **[Figure 60-50-5]**.

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.

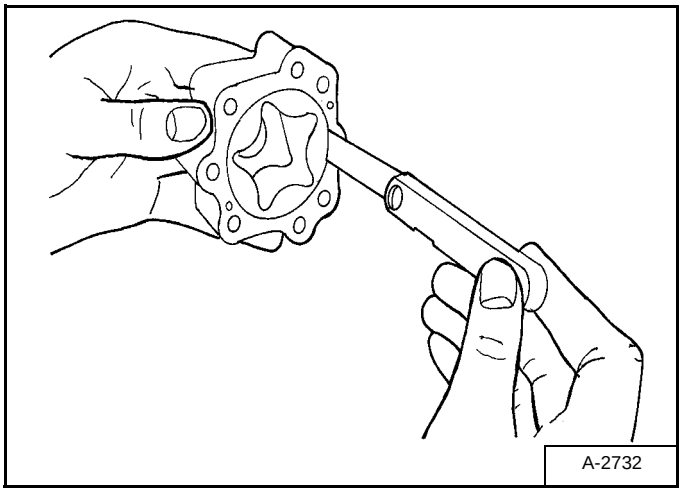
Oil Pump - Service

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]**.

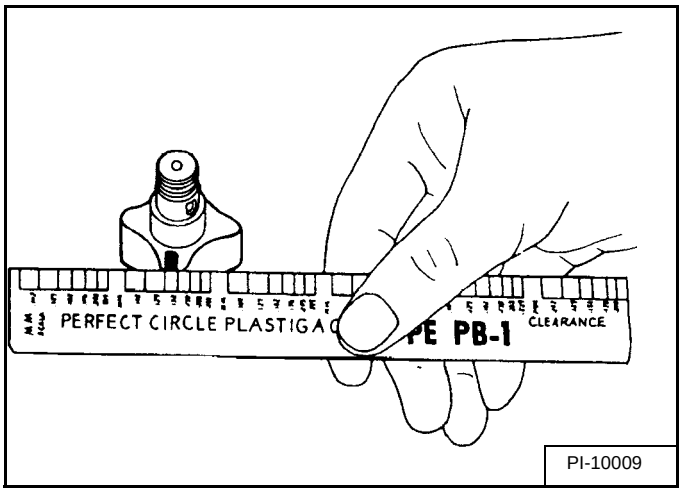
If the clearance exceeds the factory limit, replace the oil pump rotor assembly.

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.

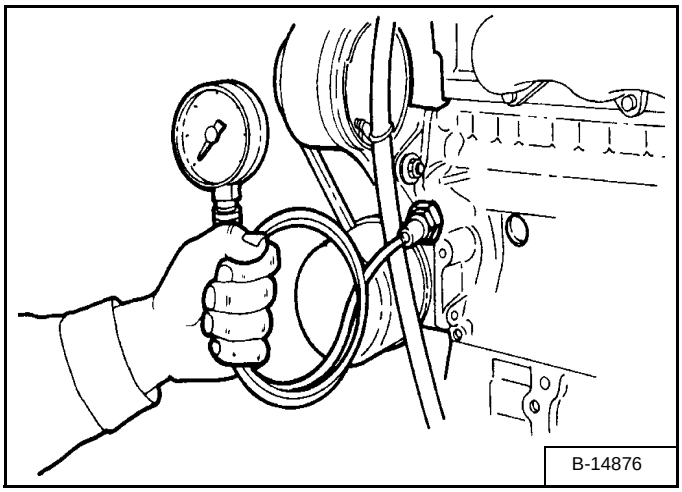
Remove the cover carefully. Measure the width of the press gauge **[Figure 60-50-8]**.

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 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	48,3 kPa (0,48 bar) (7 psi)
At Rated Speed	193 - 441,3 kPa (2 - 4 bar) (28 - 64 psi)
Allowable Limit	144,8 kPa (1 bar) (21 psi)

Installation: After checking engine oil pressure, tighten oil pressure sensor to 15 - 20 N•m (11 - 15 ft-lb) torque.

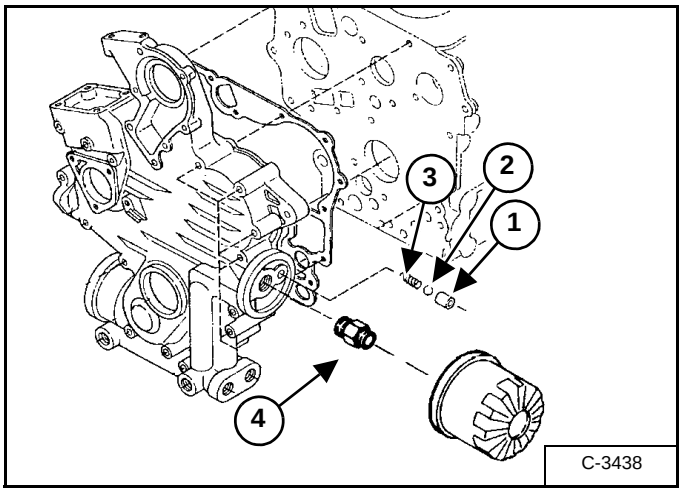
Relief Valve

The relief valve prevents damage of the lubricating system due to high pressure. This relief valve is a ball type.

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Engine Oil Pressure, Checking

Figure 60-50-10



Remove the valve seat (Item 1) **[Figure 60-50-10]**, ball (Item 2) **[Figure 60-50-10]** 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)

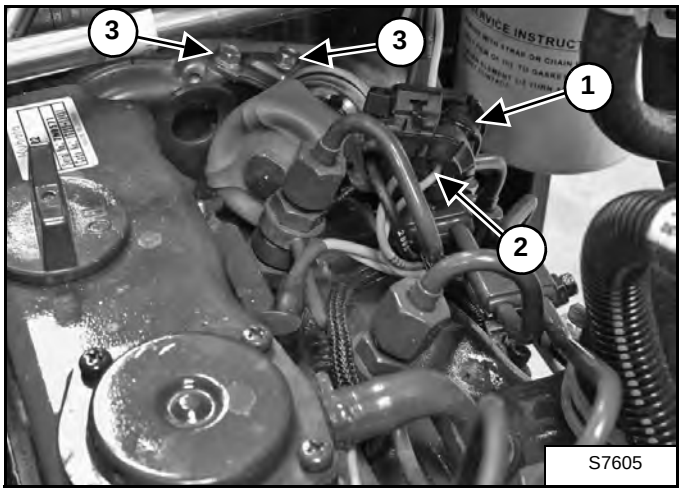
Installation: Tighten the oil filter adapter (Item 4) **[Figure 60-50-10]** to 39 - 49 N•m (29 - 36 ft-lb) torque.

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FUEL SYSTEM

Fuel Shutoff Solenoid Removal And Installation

Figure 60-60-1



Cut the tie-strap (Item 1) **[Figure 60-60-1]**.

Disconnect the wire connector from the solenoid (Item 2) **[Figure 60-60-1]**.

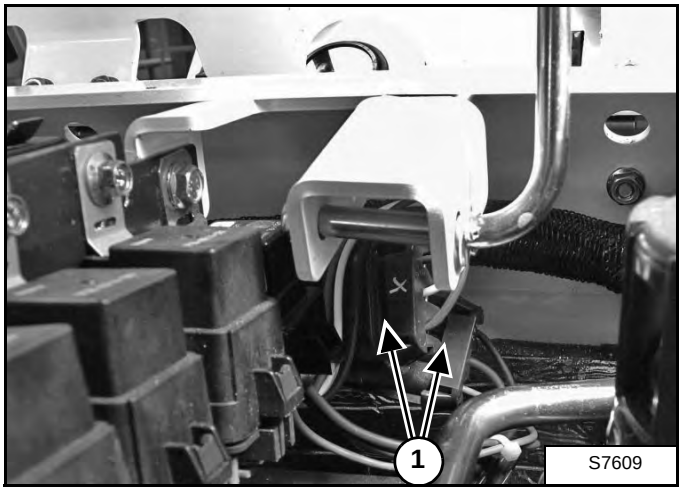
Remove the solenoid mountings bolts (Item 3) **[Figure 60-60-1]**.

Remove the solenoid

Fuel Shutoff Timer Removal And Installation

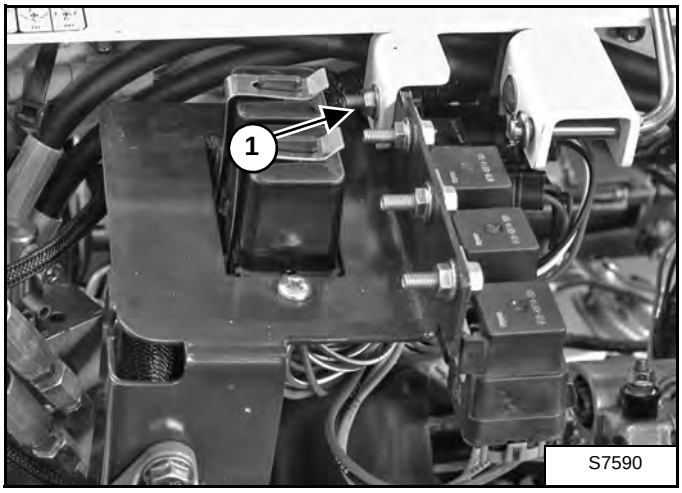
The fuel shutoff timers function is to provide pull in current to the fuel solenoid for only a short duration.

Figure 60-60-2



Disconnect the two wire harnesses (Item 1) **[Figure 60-60-2]** from the timer module.

Figure 60-60-3



Remove the nut and bolt (Item 1) **[Figure 60-60-3]** from the timer module.

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.

The tools listed will be needed to do the following procedure:

MEL1237 - Adapter Fuel Line
MEL1173-1 - Pressure Gauge

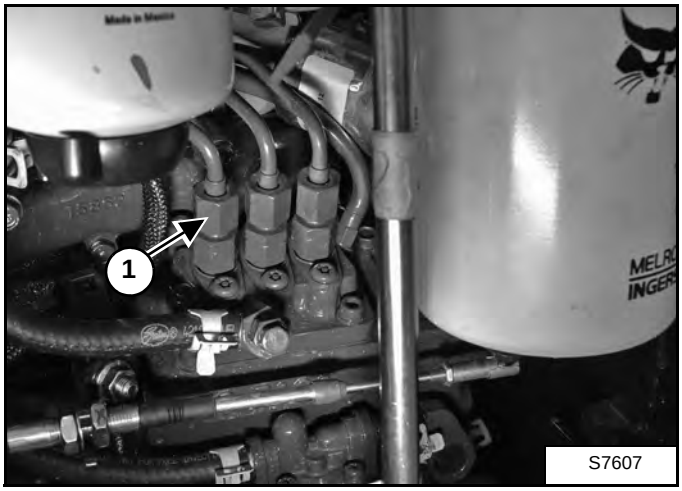
⚠ WARNING

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 physician familiar with this injury.

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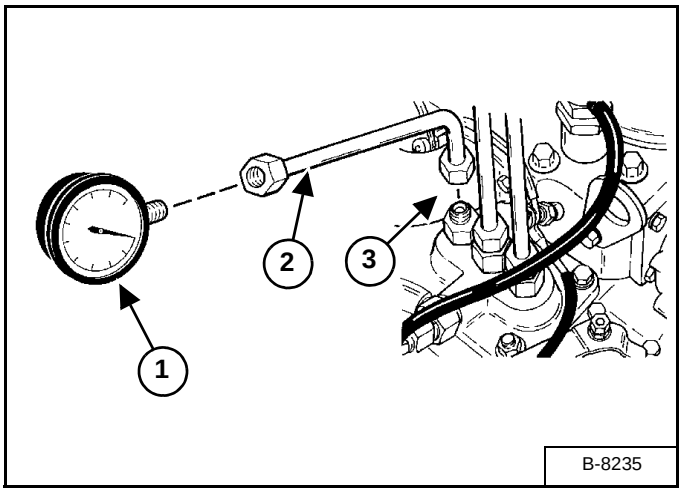
Figure 60-60-4



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)**[Figure 60-60-5]** to the long leg of the test tubeline (Item 2) 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 1991 psi (137 bar).

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 approximately 13,7 MPa (137 bar) (1991 psi). Now turn the flywheel back about 1/2 turn (to keep the plunger free), and clock the time taken for the pressure to drop from 13,7 - 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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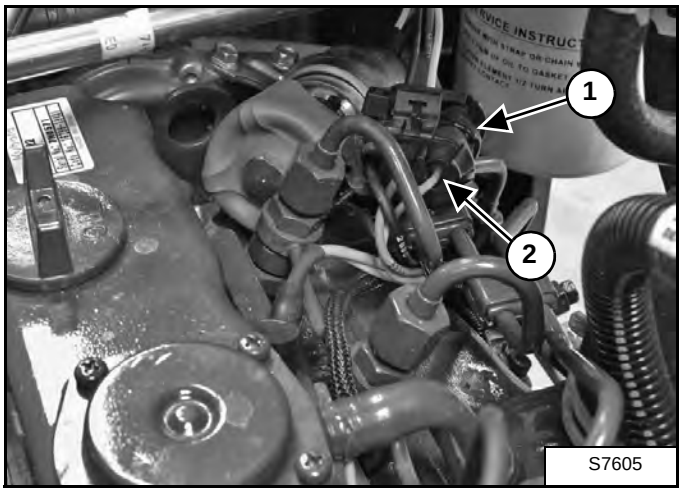
IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

I-2029-0289

Clean around the injection pump.

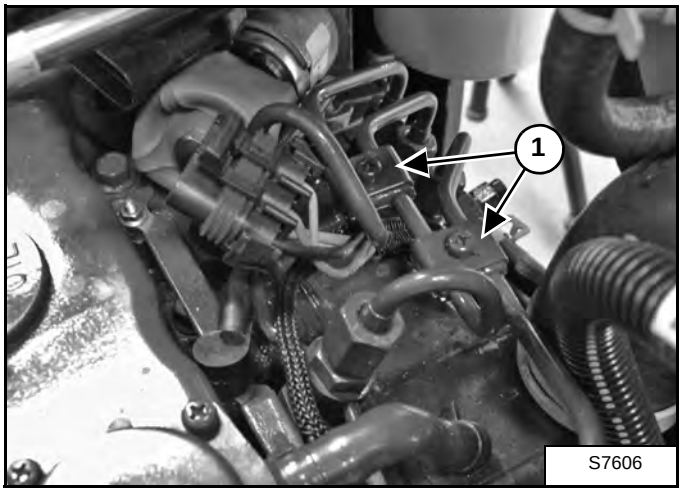
Figure 60-60-6



Cut the tie-strap (Item 1) **[Figure 60-60-6]**.

Disconnect the wire connector from the solenoid (Item 2) **[Figure 60-60-6]**.

Figure 60-60-7

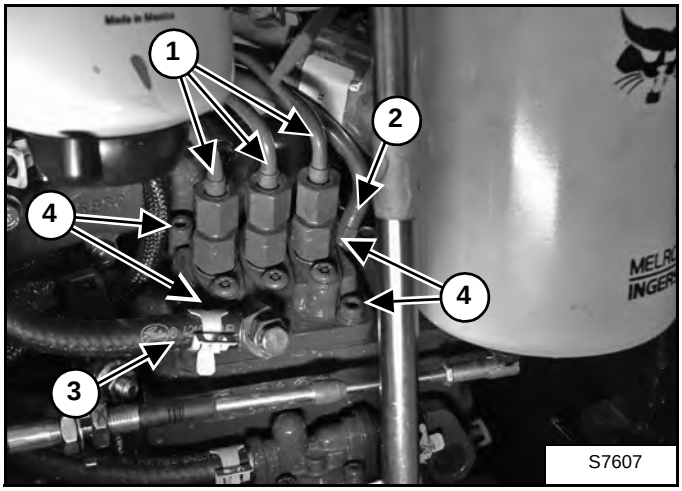


Remove the fuel line clamps (Item 1) **[Figure 60-60-7]**.

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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 injectors 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]**.

Remove the injection pump.

Installation: Tighten the pipe retaining nuts to 25 - 34 N•m (18 - 25 ft-lb) torque.

Figure 60-60-9

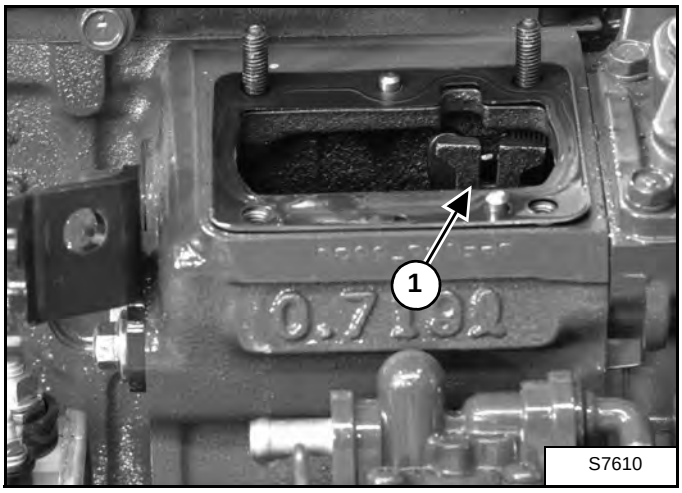
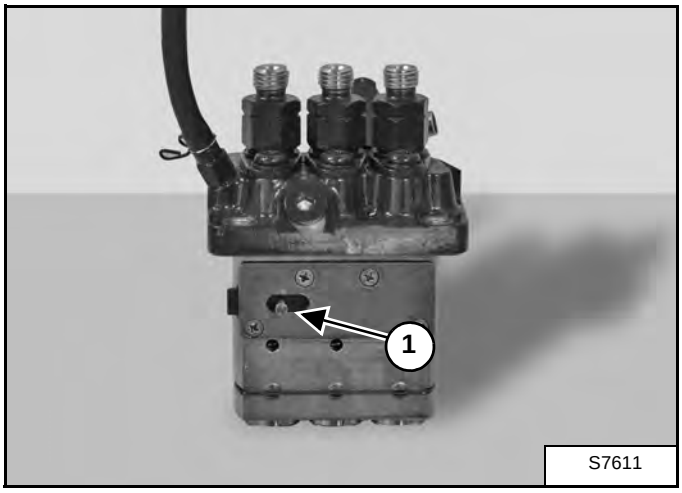


Figure 60-60-10



Installation: When installing the injection pump, align the pin (Item 1) **[Figure 60-60-10]** on the control rack with the slot (Item 1) **[Figure 60-60-9]** on the fork lever correctly. If both are not aligned correctly, the engine will run over maximum speed and serious damage can result.

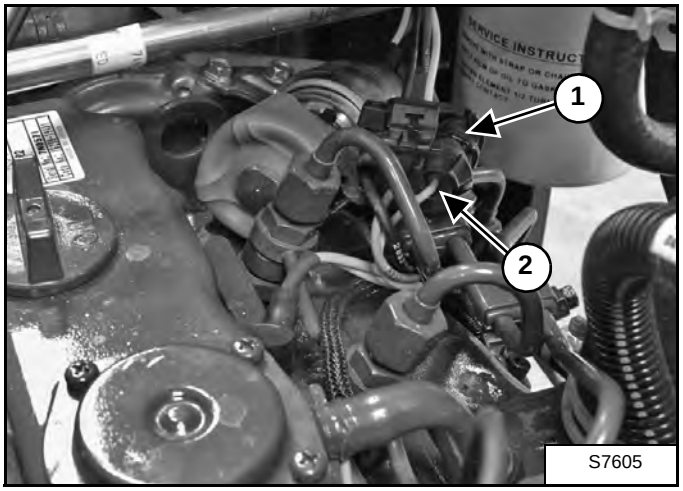
NOTE: Make sure the same number shims are installed under the injection pump. The shims are used for engine timing.

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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.

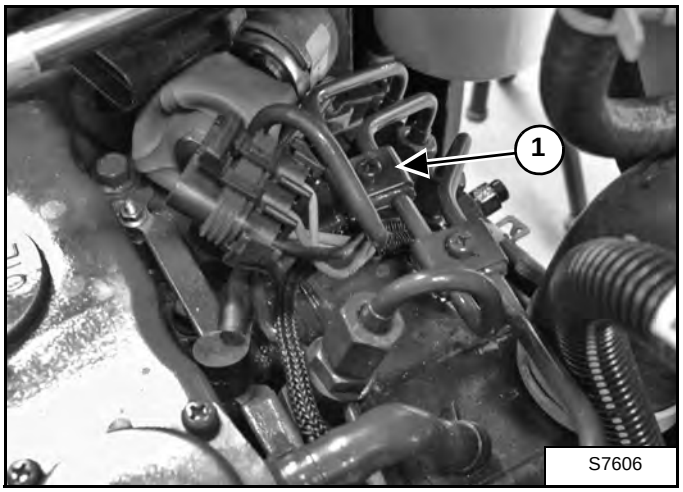
Figure 60-60-11



Cut the tie-strap (Item 1) **[Figure 60-60-11]**.

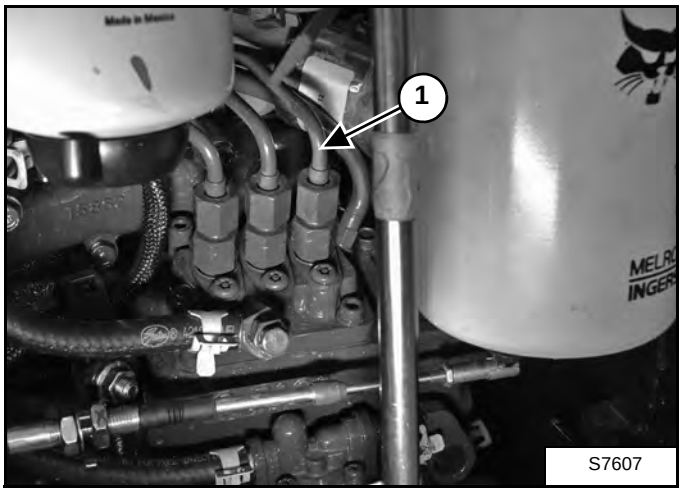
Disconnect the wire connector from the solenoid (Item 2) **[Figure 60-60-11]**.

Figure 60-60-12



Remove the fuel line clamp (Item 1) **[Figure 60-60-12]**.

Figure 60-60-13



Remove the number one cylinder high pressure line (Item 1) **[Figure 60-60-13]** from the fuel injection pump and fuel injector.

IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

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IMPORTANT

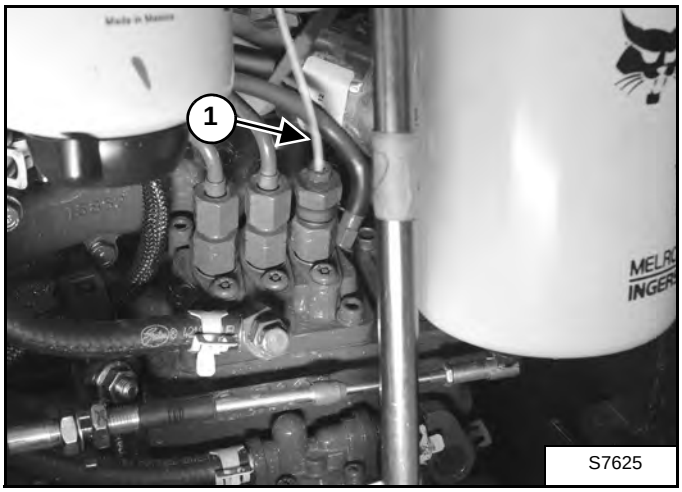
Do not attempt to maintain or adjust unless you are trained and have the correct equipment.

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Fuel Injection Pump - Timing (Cont'd)

Figure 60-60-14



Install a short plastic tube (Item 1) **[Figure 60-60-14]** 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.

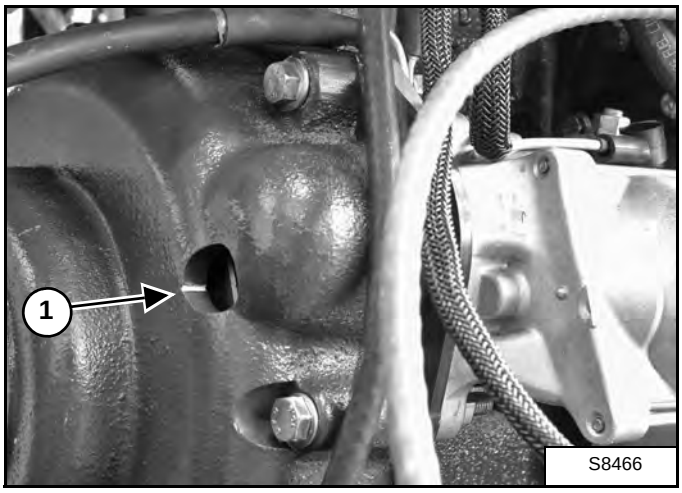
Move the fuel lever on the injection pump to full fuel position (or full throttle).

Remove the muffler. (See Removal And Installation on Page 60-20-1.) for easy access to flywheel.

NOTE: Engine has been removed for photo clarity.

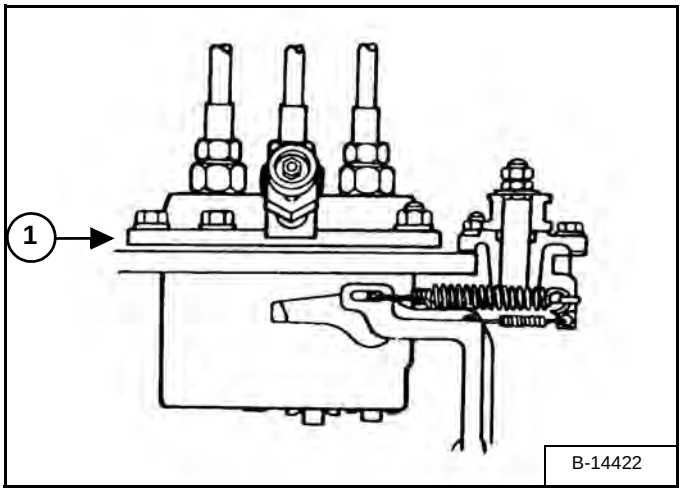
Turn the flywheel counterclockwise (facing the flywheel) slowly until the start of fuel rise in the plastic tube (Item 1) **[Figure 60-60-14]**.

Figure 60-60-15



At this point look at the timing mark (located on the flywheel) for proper alignment (Item 1) **[Figure 60-60-15]**. When the timing mark is aligned as shown the timing is correct for the injection pump, which is 19 - 21° B.T.D.C.

Figure 60-60-16



The correct engine timing for all Kubota® D722-E2B engines is 19 - 21° B.T.D.C. Add or subtract shims (Item 1) **[Figure 60-60-16]** 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 (0.0020 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.

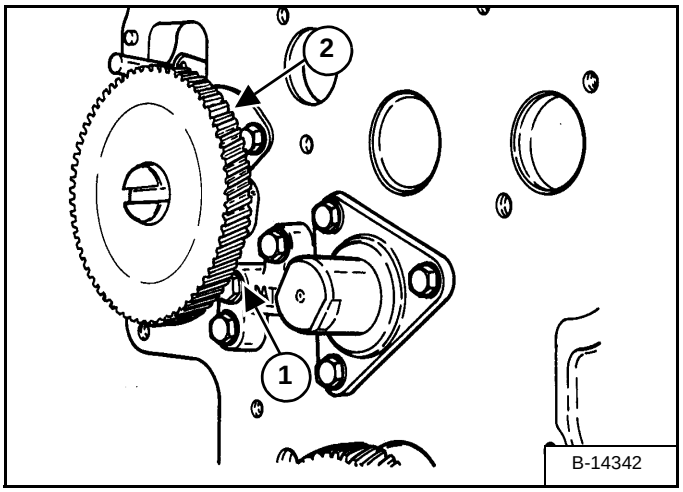
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Fuel Camshaft Removal And Installation

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 60-60-17



Remove the bolt (Item 1) from the retainer plate (Item 2) **[Figure 60-60-17]**.

Installation: Tighten the bolt to 6,8 - 8,1 N•m (60 - 72 in-lb) torque.

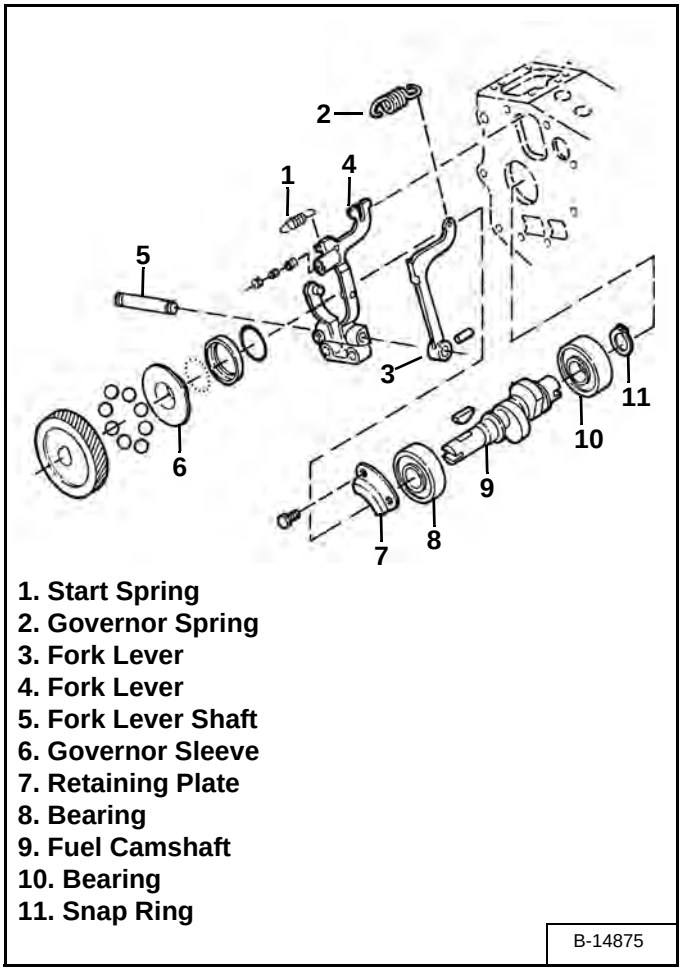
Remove the fuel camshaft retainer plate (Item 2) **[Figure 60-60-17]**.

Remove the fuel camshaft and fork lever assembly at the same time.

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 60-60-18



1. Start Spring
2. Governor Spring
3. Fork Lever
4. Fork Lever
5. Fork Lever Shaft
6. Governor Sleeve
7. Retaining Plate
8. Bearing
9. Fuel Camshaft
10. Bearing
11. Snap Ring

Disassemble and assemble the governor and fuel camshaft as shown **[Figure 60-60-18]**.

Check all the parts for wear or damage and replace as needed.

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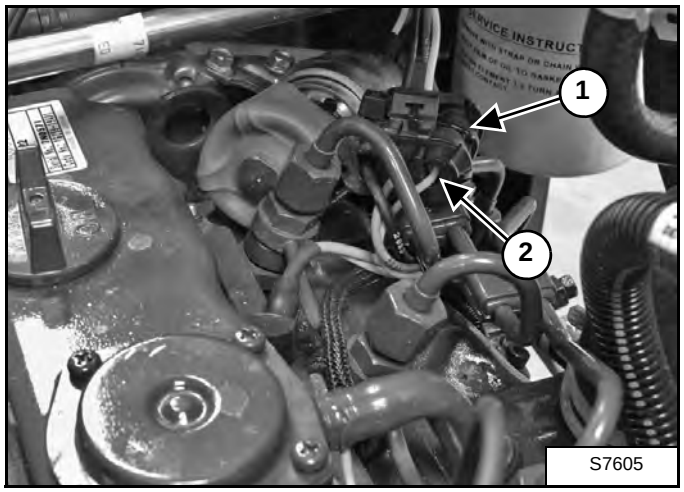
Fuel Injector Removal And Installation

IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

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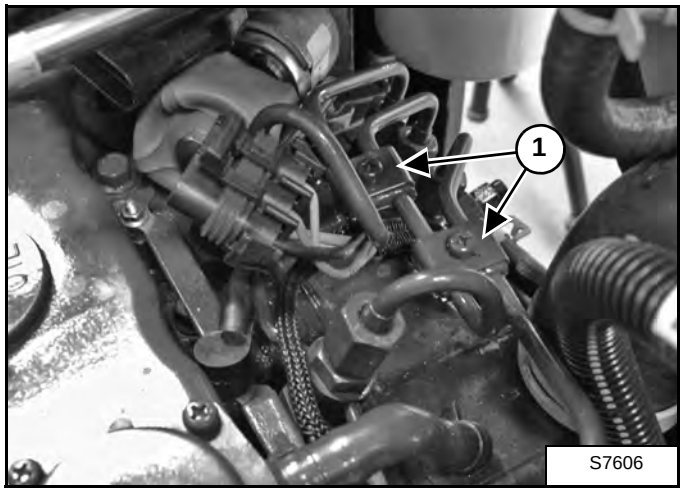
Figure 60-60-19



Cut the tie-strap (Item 1) **[Figure 60-60-19]**.

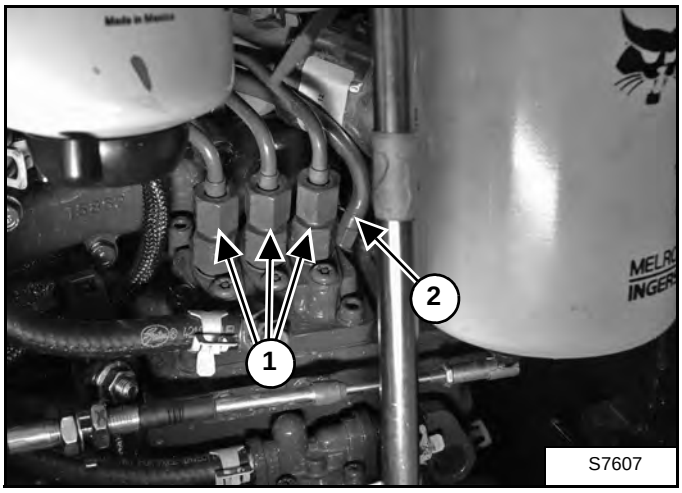
Disconnect the wire connector from the solenoid (Item 1) **[Figure 60-60-19]**.

Figure 60-60-20



Remove the high pressure fuel line clamps (Item 1) **[Figure 60-60-20]**.

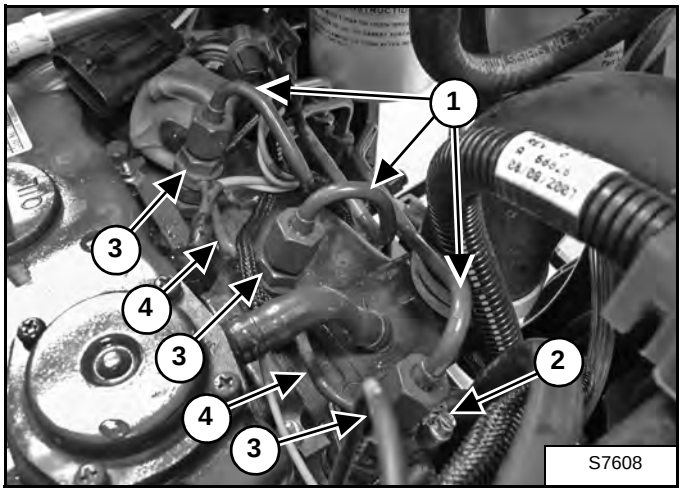
Figure 60-60-21



Disconnect the high pressure fuel lines (Item 1) **[Figure 60-60-21]** from the injection pump.

Disconnect the return fuel hose (Item 2) **[Figure 60-60-21]** from the injection pump.

Figure 60-60-22



Disconnect the high pressure fuel lines (Item 1) **[Figure 60-60-22]** from the fuel injectors.

Disconnect the return fuel hose (Item 2) **[Figure 60-60-22]**.

Remove the high pressure fuel lines.

Remove the retainer nut (Item 3) **[Figure 60-60-22]** from the top of the fuel injectors.

Remove the fuel return pipe (Item 4) **[Figure 60-60-22]**.

Loosen the injector nozzle.

Remove the injector nozzle from the cylinder head.

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Fuel Injector Removal And Installation (Cont'd)

Installation: Tighten the injector nozzle to 49 - 69 N•m (36 - 51 ft-lb) torque.

NOTE: Be sure to replace the copper washer and nozzle cap anytime new or reconditioned fuel injectors are installed.

Fuel Injector Nozzle Pressure - Checking

IMPORTANT

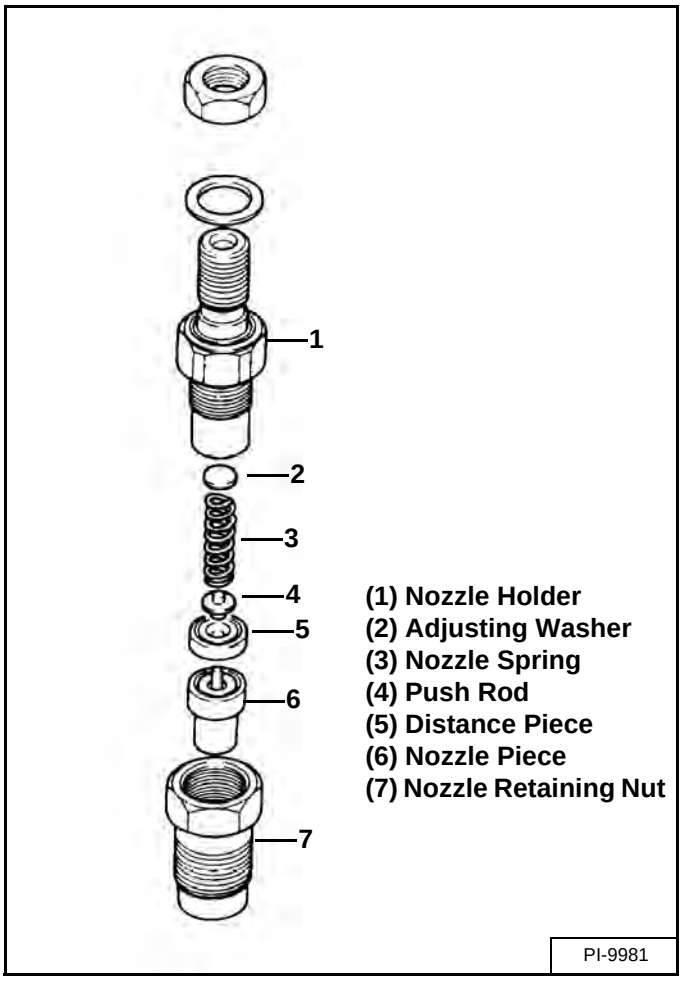
Do not disassemble or test the fuel injector nozzles unless you have the correct service and testing tools.

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The tool listed will be needed to do the following procedure:

MEL10018 - Injector Nozzle Tester

Figure 60-60-23



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 60-60-23]**.

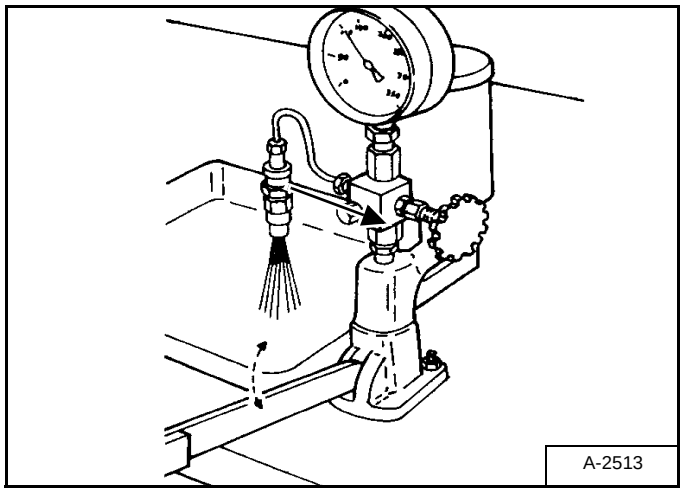
Each spacer will change the release pressure by about 234,4 kPa (2,3 bar) (34 psi).

Fuel Injection Pressure.	13,7 - 14,7 MPa (137 - 147 bar) (1991 - 2134 psi)

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Fuel Injector Nozzle Pressure - Checking (Cont'd)

Figure 60-60-24



Assemble the injector nozzle. Connect the nozzle to the tester with the nozzle down **[Figure 60-60-24]**.

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 60-60-23]** as needed.

NOTE: When assembling the injector nozzle, tighten the retainer nut (Item 1) [Figure 60-60-23] 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.

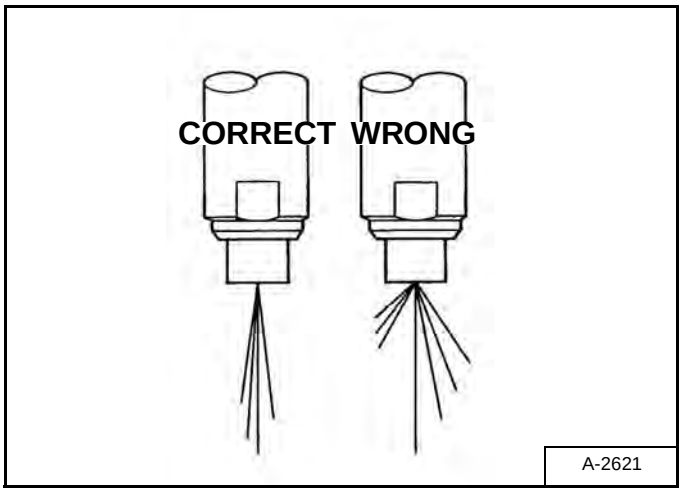
⚠ WARNING

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 physician familiar with this injury.

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Figure 60-60-25



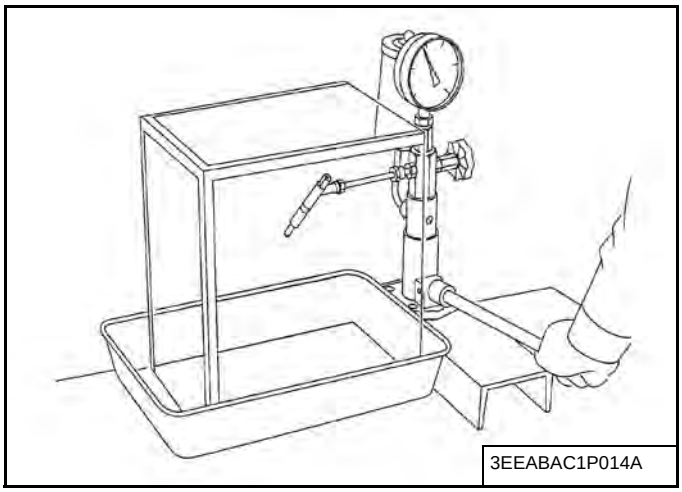
Check that the spray pattern is correct **[Figure 60-60-25]**:

1. Fuel does not come out the side of the nozzle.
2. Drops of fuel are not present at the nozzle.
3. The injector has an even flow coming from the nozzle.

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Valve Seat Tightness

Figure 60-60-26



Set the injection nozzle to a nozzle tester (Code No. 07909-31361) **[Figure 60-60-26]**.

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.

Factory spec.	Valve seat tightness	No fuel leak at 12,75 MPa (127,5 bar) (1849 psi)

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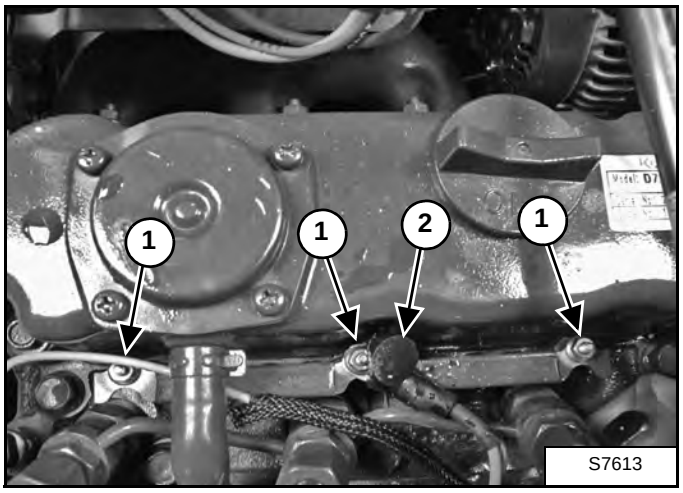
Glow Plug Removal And Installation

IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

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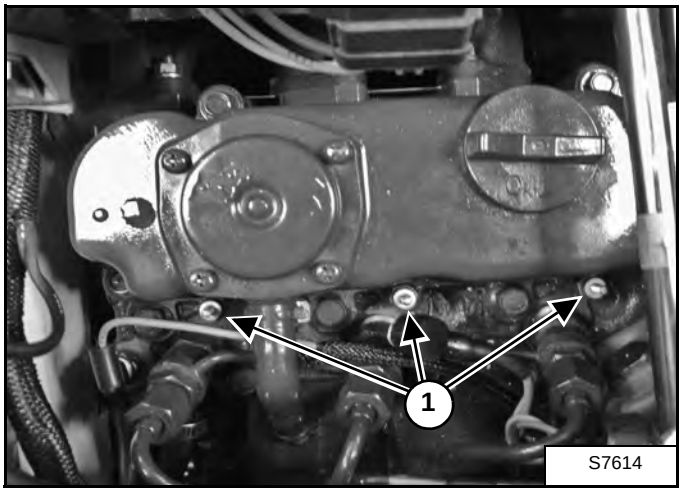
Figure 60-70-1



Remove the nuts (Item 1) **[Figure 60-70-1]**.

Remove the glow plug lead (Item 2) **[Figure 60-70-1]** and nut.

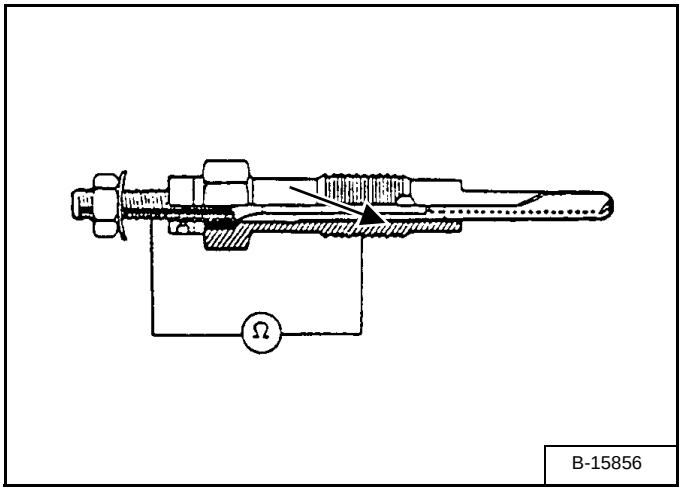
Figure 60-70-2



Remove the glow plugs (Item 1) **[Figure 60-70-2]** from the cylinder head.

Installation: Tighten the glow plugs to 8 - 15 N•m (6 - 11 ft-lb) torque.

Figure 60-70-3



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 60-70-3]**.

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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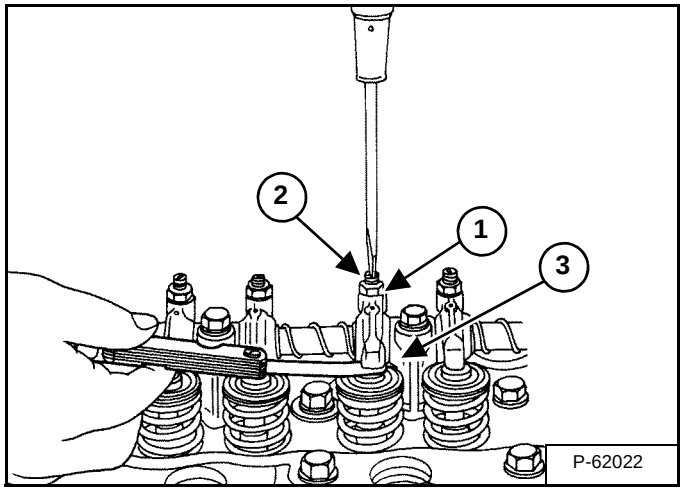
Valve Clearance Adjustment

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 60-70-4



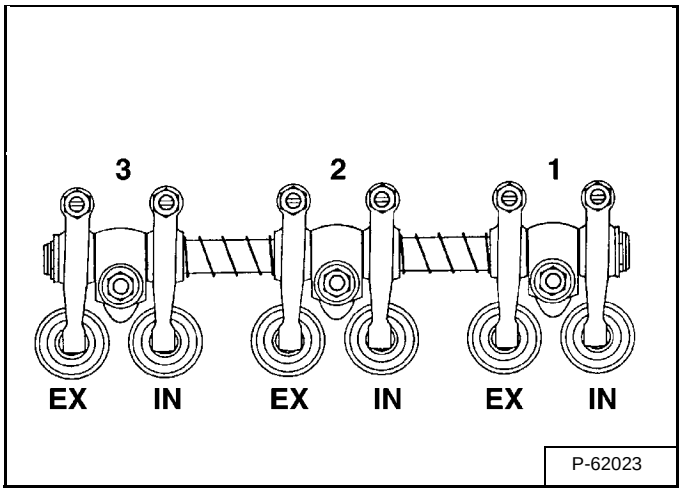
Loosen the locknut (Item 1) **[Figure 60-70-4]**.

Turn the adjustment screw (Item 2) **[Figure 60-70-4]** until the correct clearance is obtained.

NOTE: The clearance is measured between the rocker arm and valve stem tip (Item 3) [Figure 60-70-4].

If adjustments are necessary, tighten locknut before moving on to the next rocker arm.

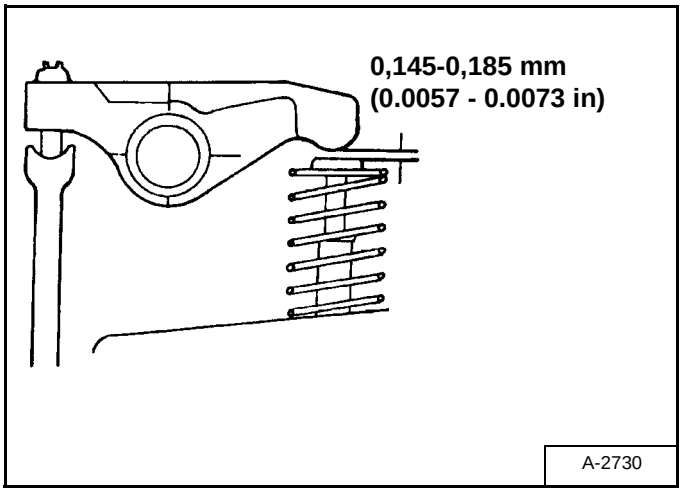
Figure 60-70-5



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 60-70-5]**.

Rotate the flywheel 360°, No. 1 (overlap position). Set No. 2 intake valve and No. 3 exhaust valve. **[Figure 60-70-5]**.

Figure 60-70-6



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 60-70-6]**.

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CYLINDER HEAD (CONT'D)

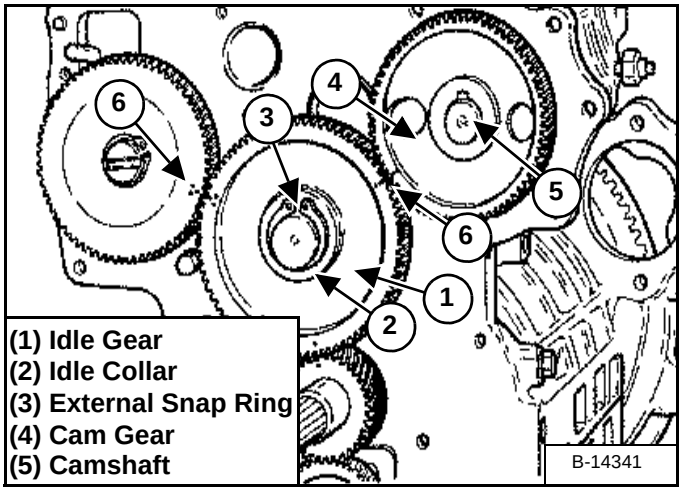
Valve Timing - Checking

Stop the engine and open the rear door.

Remove the engine. (See Removal And Installation on Page 60-10-9.)

Remove the timing gearcase cover. (See Timing Gearcase Cover Removal And Installation on Page 60-80-1.)

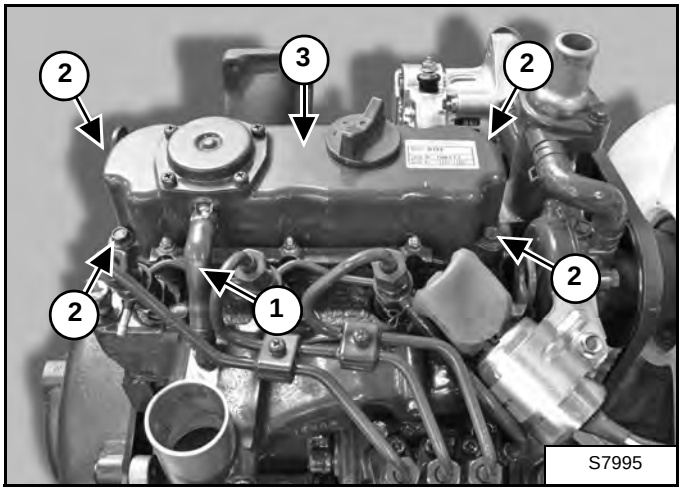
Figure 60-70-7



Make sure the timing marks (Item 6) **[Figure 60-70-7]** are in correct alignment.

Cylinder Head Removal And Installation

Figure 60-70-8



Remove the breather hose (Item 1) **[Figure 60-70-8]**.

Remove the four bolts (Item 2) from the valve cover and remove the valve cover and gasket (Item 3) **[Figure 60-70-8]**.

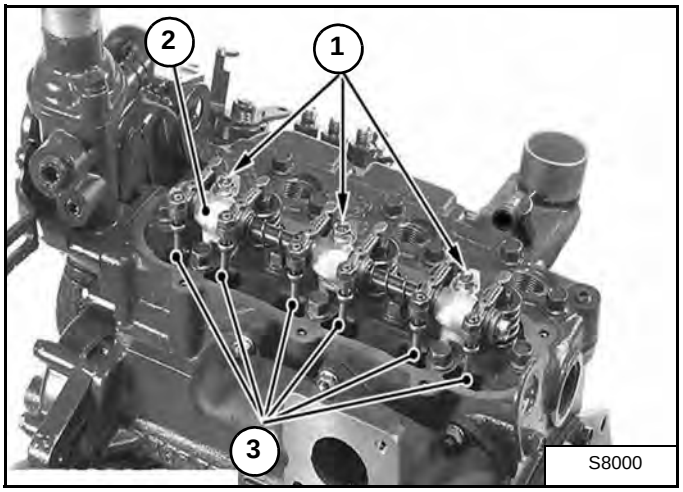
Installation: Tighten the bolts to 7 - 11 N•m (62 - 97.3 in-lb) torque. Gradually tighten center bolts before the end bolts to avoid cracking valve cover.

Remove the fuel injector nozzles. (See Fuel Injector Removal And Installation on Page 60-60-8.)

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.)

Figure 60-70-9



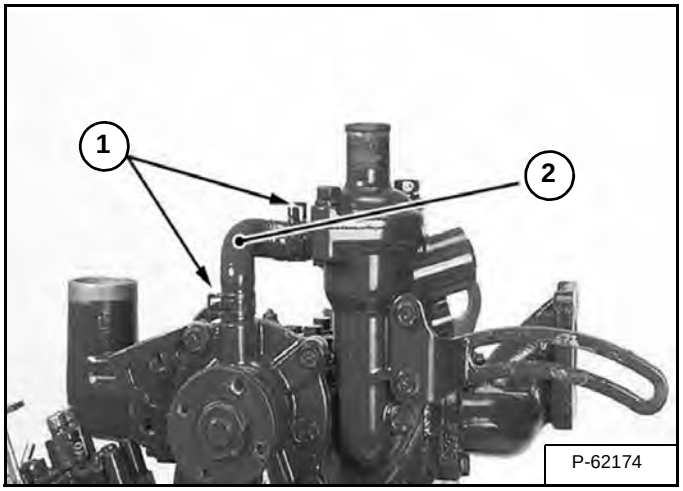
Remove the rocker arm bracket screws (Item 1) and shaft assembly (Item 2) **[Figure 60-70-9]**.

Installation: Tighten the nuts to 9,8 - 11,3 Nm (7 - 8.3 ft-lb) torque.

Remove the push rods (Item 3) **[Figure 60-70-9]**.

Remove the intake and exhaust manifolds.

Figure 60-70-10

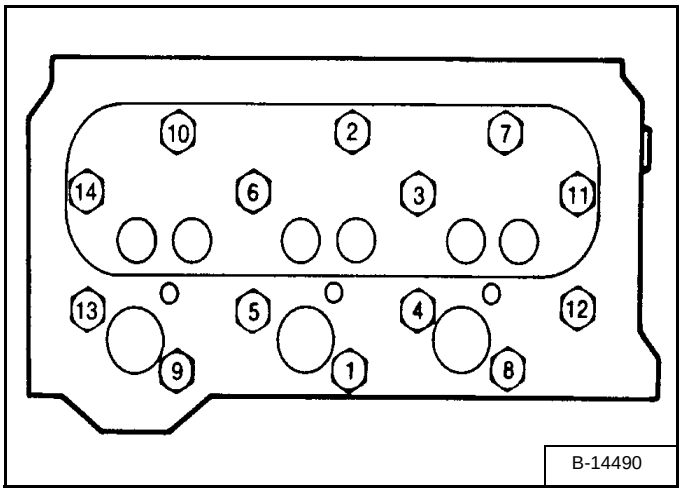


Remove the water return hose **[Figure 60-70-10]**.

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Cylinder Head Removal And Installation (Cont'd)

Figure 60-70-11



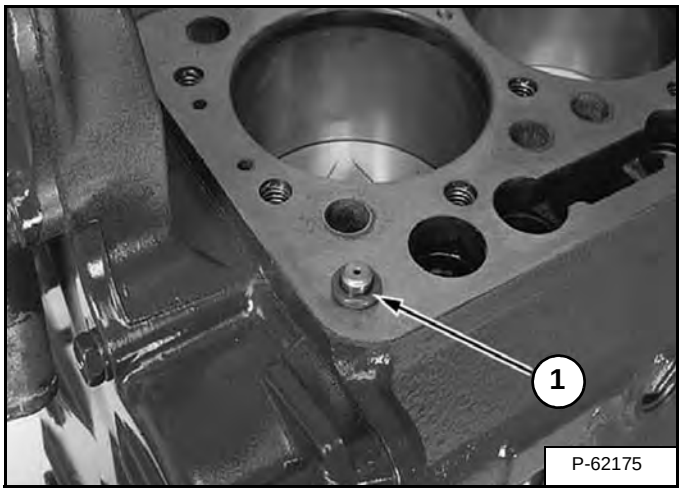
Remove the cylinder head bolts in order of #14 to #1 **[Figure 60-70-11]**.

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.

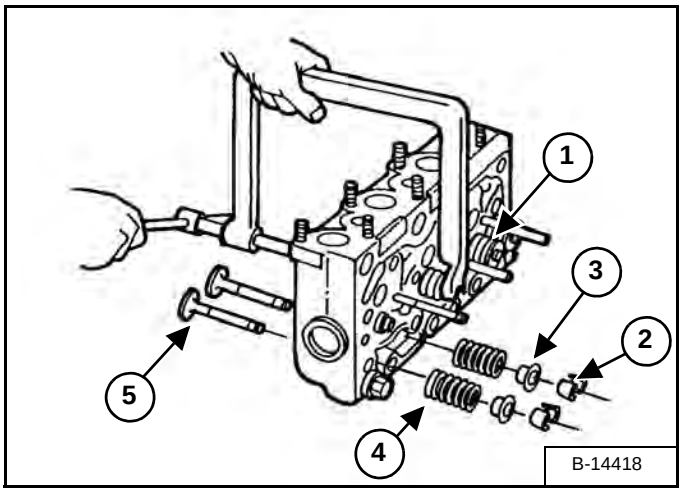
Figure 60-70-12



Installation: Always use a new head gasket and new O-ring. Make sure the O-ring (Item 1) **[Figure 60-70-12]** is seated over the dowel.

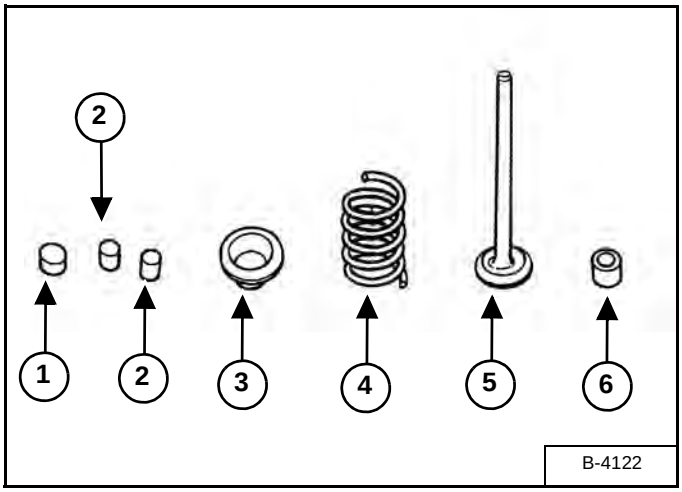
Cylinder Head Disassembly And Assembly

Figure 60-70-13



Use a valve spring compressor to compress the valve spring **[Figure 60-70-13]**.

Figure 60-70-14



Remove the valve cap (Item 1) **[Figure 60-70-14]** and valve spring collet (Item 2) **[Figure 60-70-13]** and **[Figure 60-70-14]**.

Remove the valve spring retainer (Item 3) **[Figure 60-70-13]** and **[Figure 60-70-14]** and the spring (Item 4) **[Figure 60-70-13]** and **[Figure 60-70-14]**.

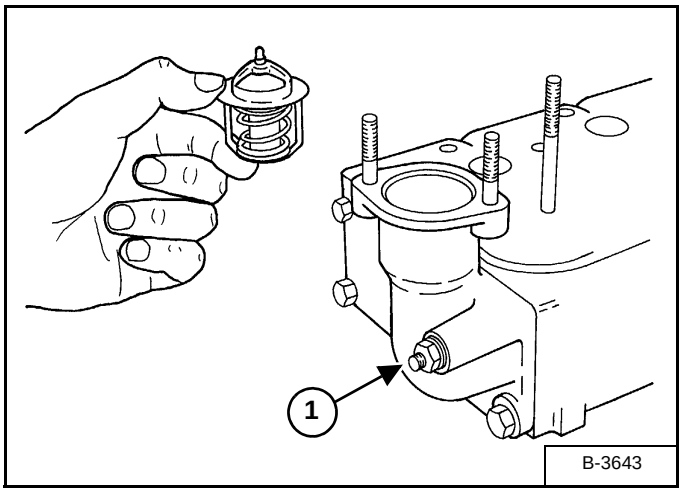
Remove the valve (Item 5) **[Figure 60-70-13]** and **[Figure 60-70-14]**.

Remove the seal (Item 6) **[Figure 60-70-14]**.

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Cylinder Head Disassembly And Assembly (Cont'd)

Figure 60-70-15

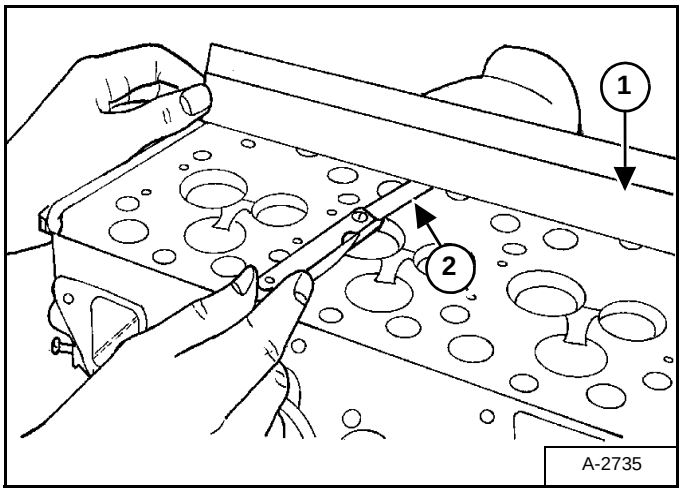


Remove the thermostat cover and thermostat from the cylinder head. Remove the thermostat housing (Item 1) **[Figure 60-70-15]**.

Installation: Apply Liquid-Type Gasket (Three Bond 1215 or equivalent) to both sides of the new thermostat cover gasket and new thermostat housing gasket.

Cylinder Head - Servicing

Figure 60-70-16



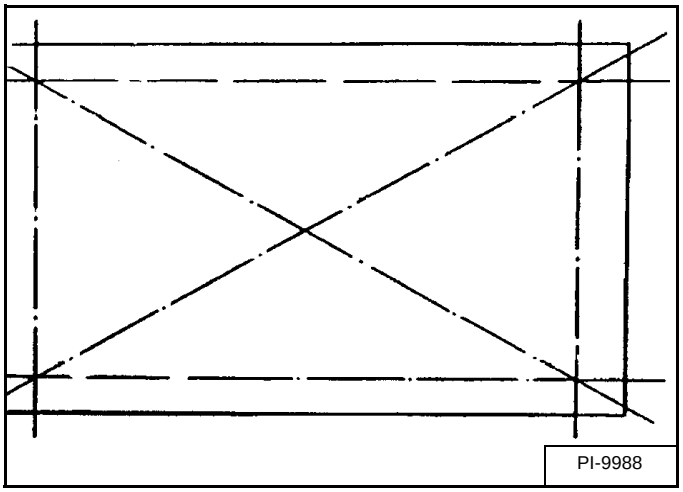
Clean the surface of the cylinder head.

Put a straight edge (Item 1) **[Figure 60-70-16]** on the cylinder head.

NOTE: Do not put the straight edge across combustion chambers.

Put a feeler gauge (Item 2) **[Figure 60-70-16]** between the straight edge and the surface of the cylinder head.

Figure 60-70-17



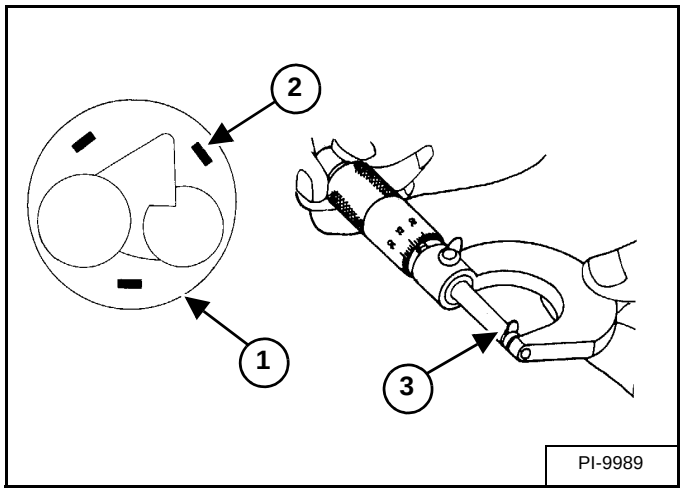
Put the straight edge on the cylinder head's four sides and two diagonal as shown in figure **[Figure 60-70-17]**.

The maximum distortion of the head surface ± 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.

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Cylinder Head Top Clearance

Figure 60-70-18



Install the cylinder head gasket. Put the piston (Item 1) **[Figure 60-70-18]** being checked at T.D.C.

Put three pieces of 1,5 mm (0.06 in) diameter solder (Item 2) **[Figure 60-70-18]** on the top piston. Use grease to hold them in position.

NOTE: Put the solder in position so they do not touch the valves.

Turn the piston to bottom dead center.

Install the cylinder head and tighten to the correct torque in the correct sequence. (See Cylinder Head Removal And Installation on Page 60-70-3.)

Turn the crankshaft until the piston exceeds T.D.C. Remove the cylinder head.

Remove the solder wire (Item 3) **[Figure 60-70-18]** and measure it.

If the measurement exceeds the specifications, check the oil clearance of the crank pin journal or the piston pin.

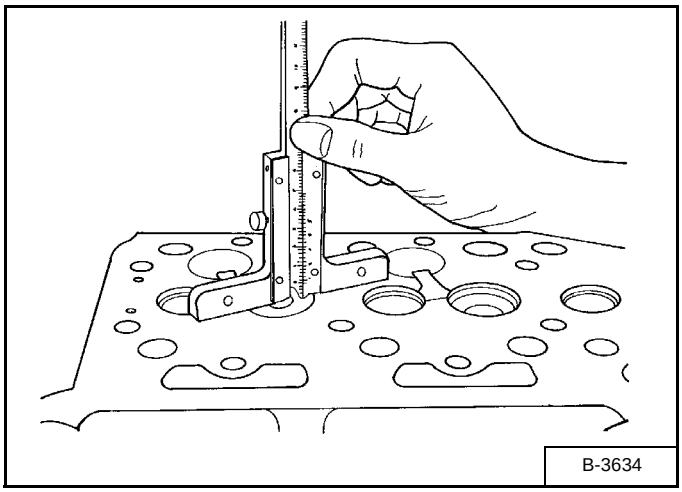
Top clearance	0,50 - 0,70 mm (0.0197 - 0.0276 in)

Valve Guide - Checking

Remove the valve and spring from the cylinder head (See Cylinder Head Removal And Installation on Page 60-70-3.)

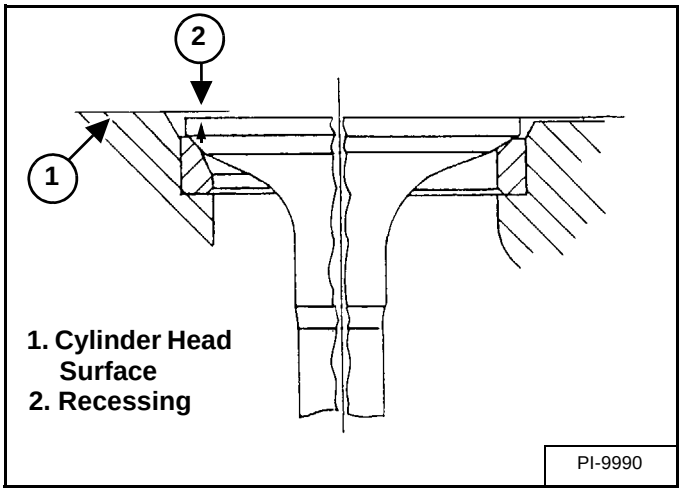
Clean the valve seat and combustion chamber.

Figure 60-70-19



Install the valve into the guide. Measure the valve recessing with a depth gauge **[Figure 60-70-19]**.

Figure 60-70-20



If the measurement exceeds the allowable limit, replace the valve or cylinder head **[Figure 60-70-20]**.

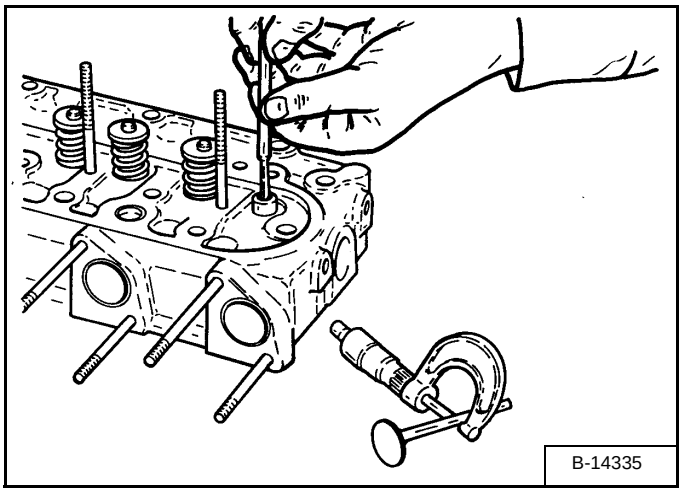
Recessing	0,10 mm (0.004 in)
Allowable Limit (Recessing)	0,30 mm (0.012 in)

Remove the carbon from the valve guide.

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Valve Guide - Checking (Cont'd)

Figure 60-70-21



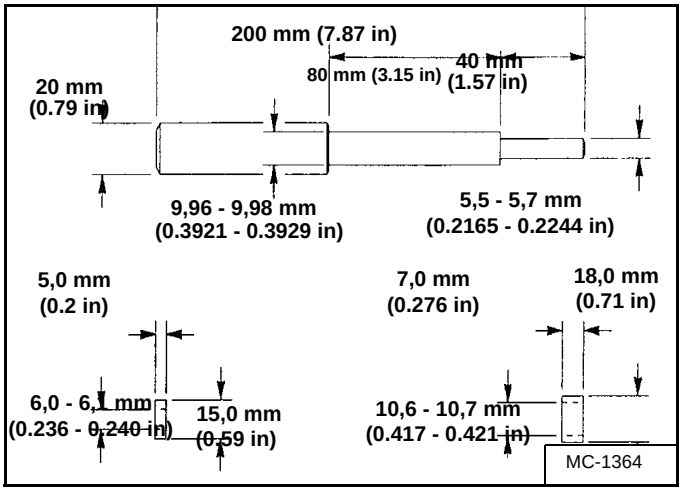
Measure the valve stem O.D. **[Figure 60-70-21]**.

Measure the valve guide I.D. **[Figure 60-70-21]**.

Calculate the clearance. If the clearance exceeds the allowable limit, replace the valve and / or valve guide.

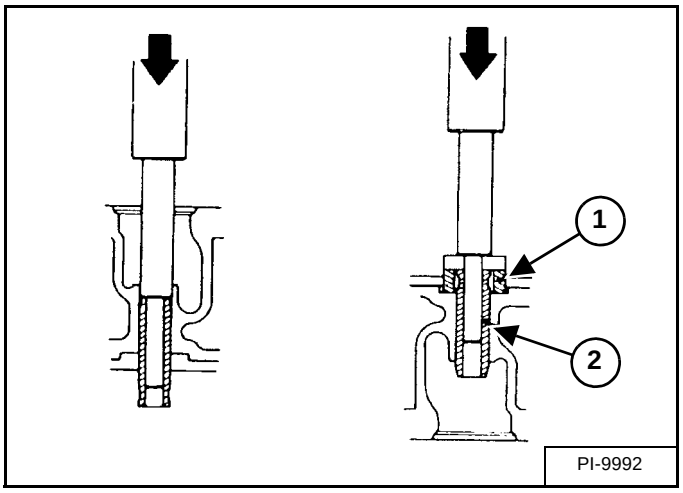
Valve Guide I.D	6,01 - 6,025 mm (0.2366 - 0.2372 in)
Valve Stem O.D	5,968 - 5,980 mm (0.2350 - 0.2354 in)
Clearance Between Valve Stem and Guide	
	0,03 - 0,057 mm (0.0012 - 0.0022 in)
Allowable Limit	0,10 mm (0.0039 in)

Figure 60-70-22



To remove and replace the valve guide, make the driver tools as shown in figure **[Figure 60-70-22]**.

Figure 60-70-23



Press the used valve guide out of the cylinder head using the special driver tool **[Figure 60-70-23]**. (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 60-70-23]**, press the new guide until the tools contact the cylinder head.

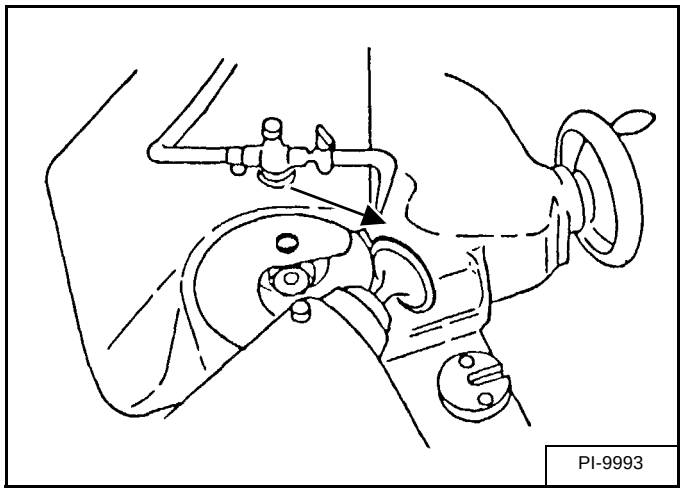
Ream the valve guide to the correct specifications.

NOTE: Valve guide I.D. (Intake and Exhaust) factory spec. is 6,01 - 6,025 mm (0.2366 - 0.2372 in)

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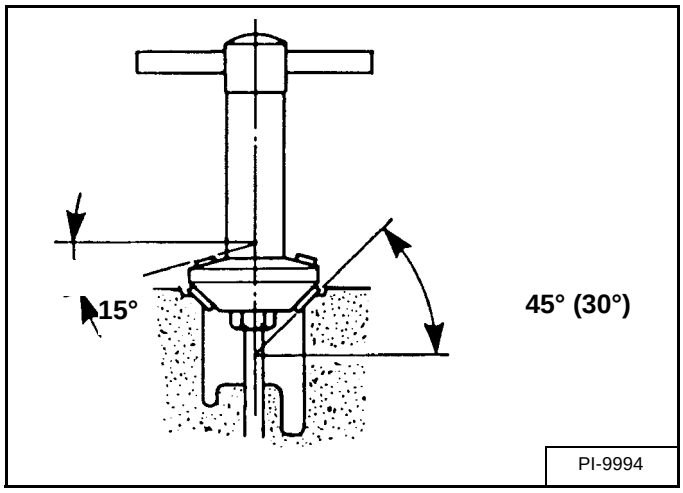
Valve And Valve Seat Reconditioning

Figure 60-70-24



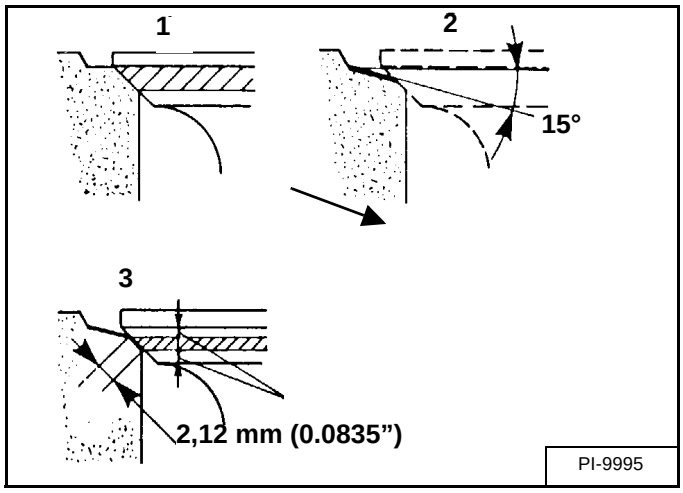
Grind the valve face to the correct angle using a valve refacer **[Figure 60-70-24]** and **[Figure 60-70-26]**.

Figure 60-70-25



Grind the valve surface in the cylinder head to the correct angle **[Figure 60-70-25]**.

Figure 60-70-26



Check the seat surface and valve face (Item 1) **[Figure 60-70-26]**.

If the seat surface is too wide, use a 15 degree cutter (Item 2) to get the correct width (Item 3) **[Figure 60-70-26]**.

Valve Seat Width

Intake	2,12 mm (0.0835 in)
Exhaust	2,12 mm (0.0835 in)

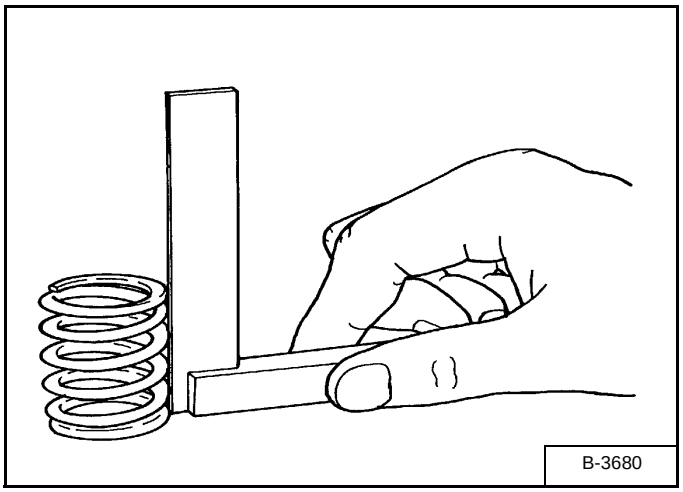
Valve Seat and Face Angle

Intake	45°
Exhaust	45°

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Valve Spring

Figure 60-70-27



Measure the length of the valve spring. If the measurement is less than the allowable limit, replace the spring **[Figure 60-70-27]**.

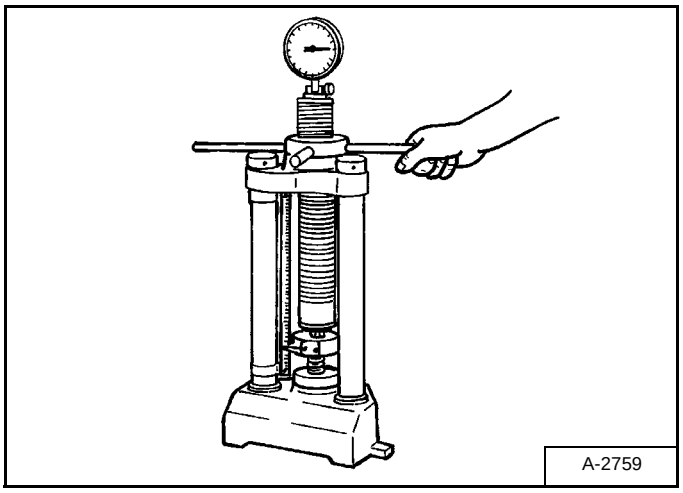
Free Length	31,3 - 31,8 mm (1.232 - 1.252 in)
Allowable Limit	28,4 mm (1.118 in)

Put the spring on a flat surface, place a square on the side of the spring **[Figure 60-70-27]**.

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 60-70-28



Put the spring on a tester and compress to specified length **[Figure 60-70-28]**.

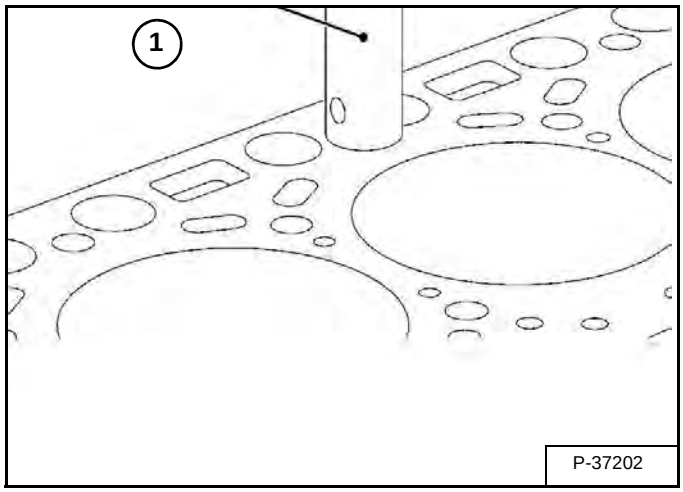
Read the compressed load on the gauge. If the measurement exceeds allowable limit, replace the spring.

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 60-70-29



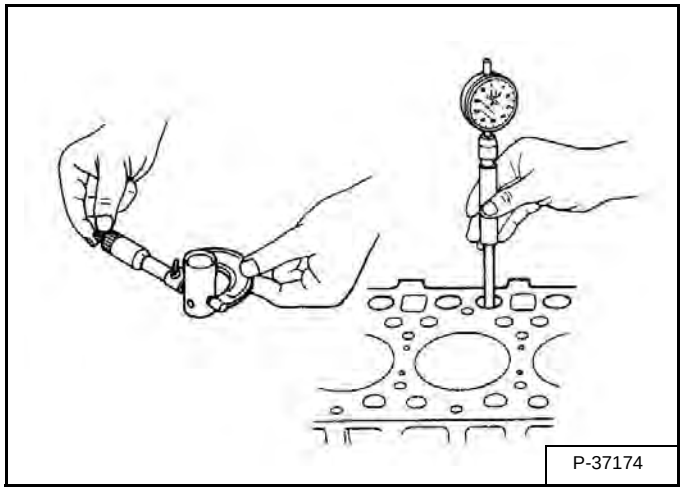
Remove the tappets (Item 1) **[Figure 60-70-29]** from the crankcase.

When reassembling replace the head gasket with a new one.

Before installing the tappets (Item 1) **[Figure 60-70-29]**, apply engine oil thinly around them.

NOTE: Mark the cylinder number to the tappets to prevent interchanging.

Figure 60-70-30



Measure the tappet O.D. with an outside micrometer **[Figure 60-70-30]**.

Measure the I.D. of the tappet guide bore with a cylinder gauge, and calculate the oil clearance **[Figure 60-70-30]**.

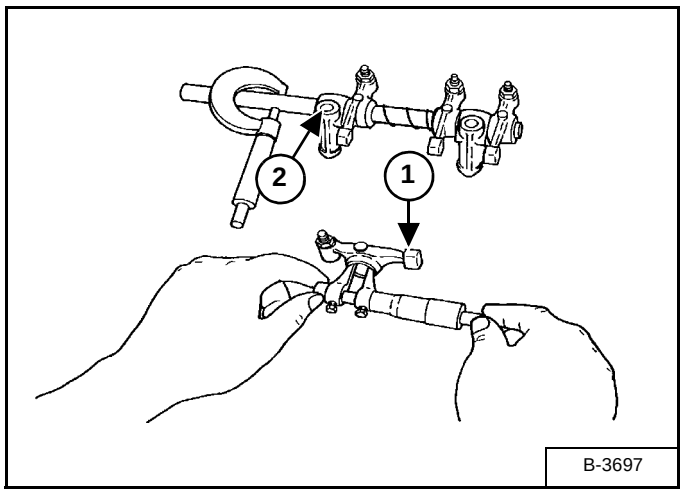
If the oil clearance exceeds the allowable limit or the tappet is damaged, replace the tappet.

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)

Rocker Arm And Shaft - Checking

Figure 60-70-31



Measure the rocker arm I.D. (Item 1) **[Figure 60-70-31]** with an inside micrometer.

Measure the rocker shaft O.D. (Item 2) **[Figure 60-70-31]** 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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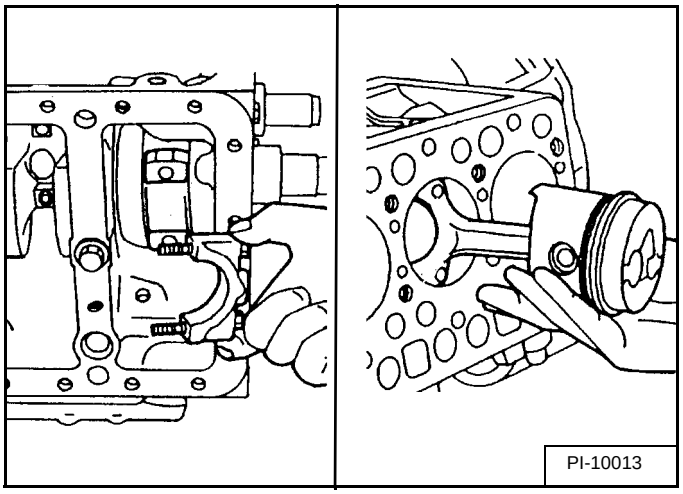
CRANKSHAFT AND PISTONS

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

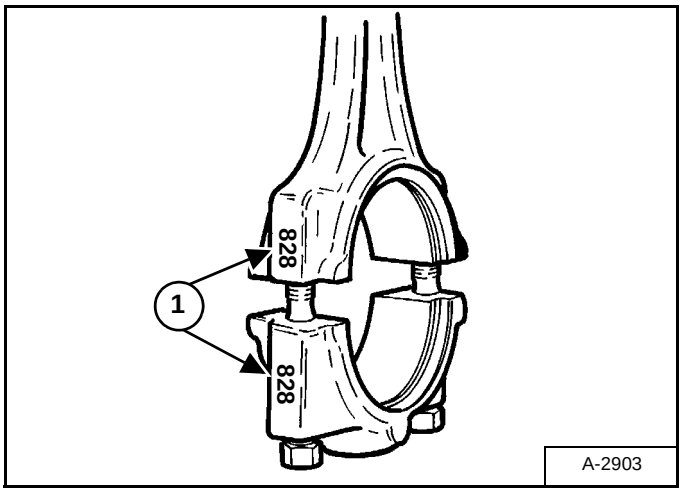


Remove the rod cap and bearing **[Figure 60-80-1]**.

Use a hammer handle and 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 returned to the same cylinder bore.

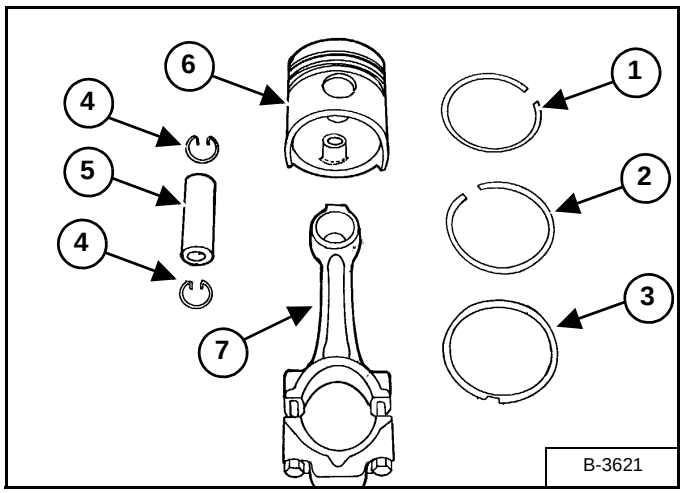
Figure 60-80-2



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]**.

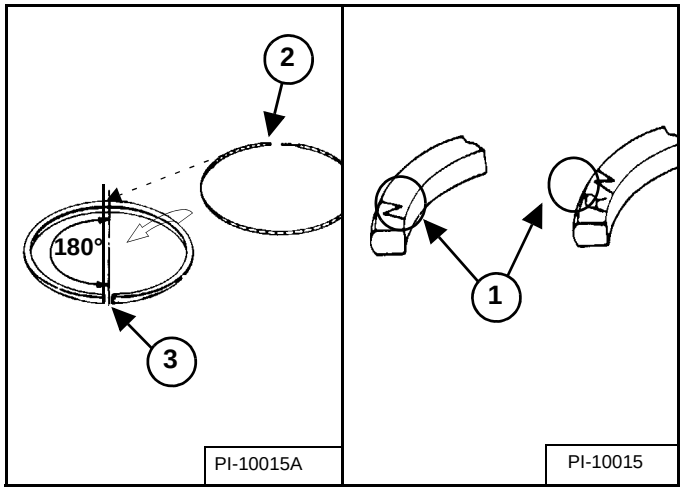
Separate the piston (Item 6) from the connecting rod (Item 7) **[Figure 60-80-3]**.

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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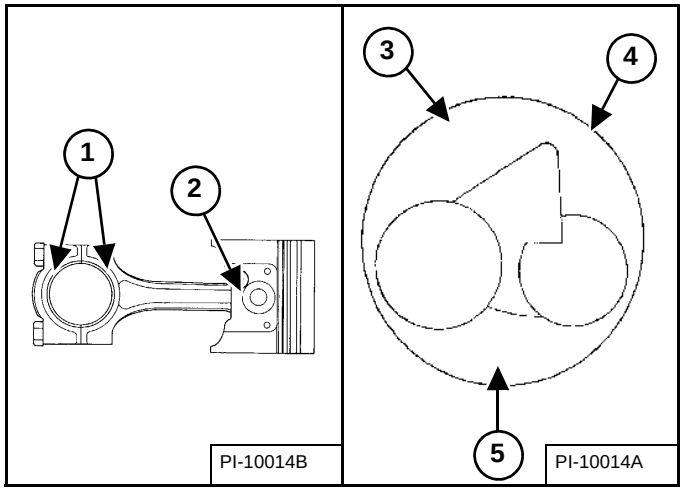
Piston And Connecting Rod Removal And Installation (Cont'd)

Figure 60-80-4



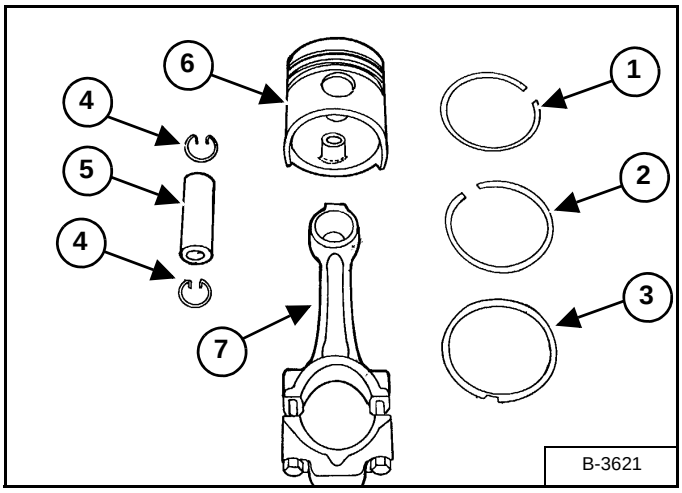
Installation: When installing new rings, assemble the ring so the mark (Item 1) near the gap faces the top of the piston. When installing the oil ring, place the expander joint (Item 2) on the opposite side of the oil ring gap (Item 3) **[Figure 60-80-4]**.

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.

Figure 60-80-6



Remove the first compression ring (Item 1) **[Figure 60-80-6]**.

Remove the second compression ring (Item 2) **[Figure 60-80-6]**.

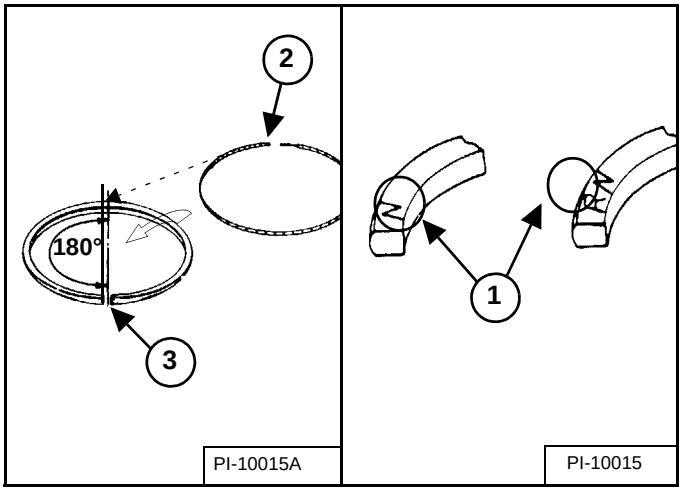
Remove the oil ring (Item 3) **[Figure 60-80-6]**.

Remove the snap ring (Item 4) and piston pin (Item 5) **[Figure 60-80-6]**.

Separate the piston (Item 6) from the connecting rod (Item 7) **[Figure 60-80-6]**.

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.

Figure 60-80-7

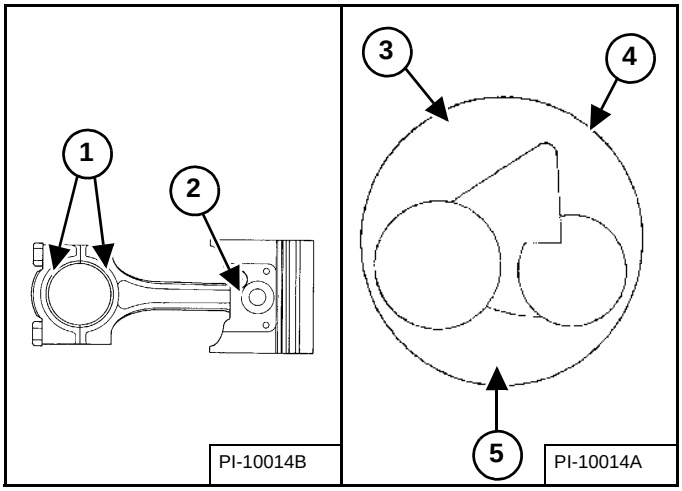


Installation: When installing new rings, assemble the ring so the mark (Item 1) near the gap faces the top of the piston. When installing the oil ring, place the expander joint (Item 2) on the opposite side of the oil ring gap (Item 3) **[Figure 60-80-7]**.

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Piston And Connecting Rod Removal And Installation (Cont'd)

Figure 60-80-8

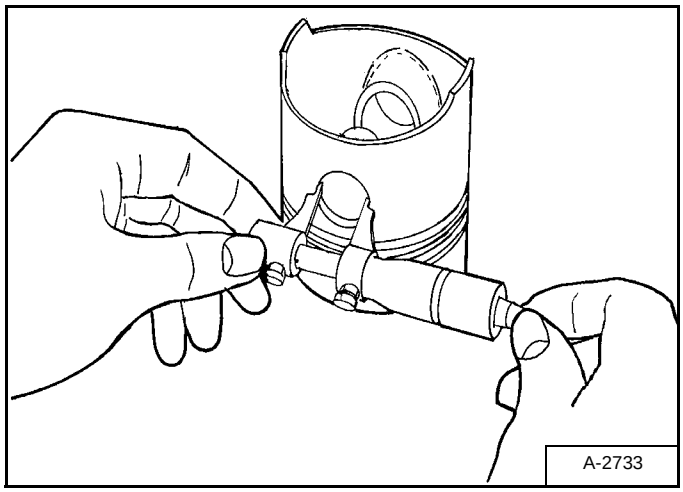


Installation: When reassembling, align the marks (Item 1) on the connecting rod and piston (Item 2). Heat the piston in oil to 80°C (176°F) for 10 - 15 minutes and tap the piston pin into position. Place the piston rings so that there are gaps every 120° (Items 3, 4 and 5) **[Figure 60-80-8]** with no gap facing the piston pin in the cylinder.

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Piston And Connecting Rod - Servicing

Figure 60-80-9

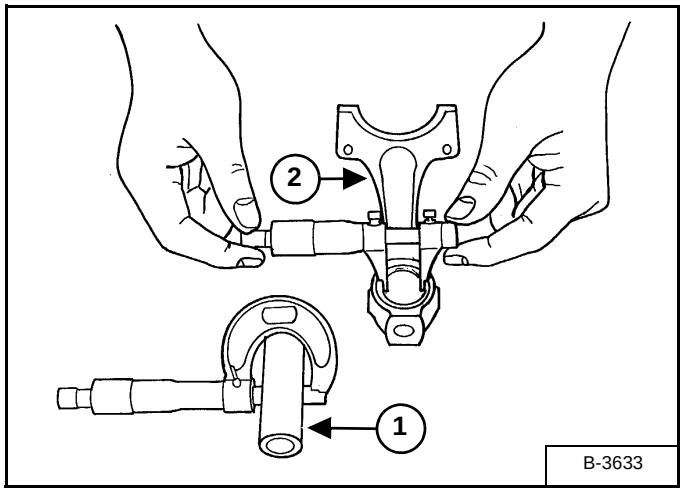


Measure the I.D. of the piston pin bore in both horizontal and vertical direction **[Figure 60-80-9]**.

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)

Figure 60-80-10



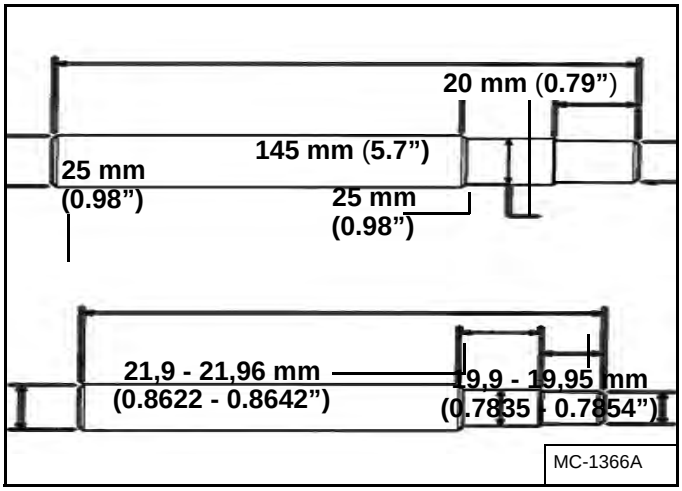
Measure the O.D. of the piston pin (Item 1) **[Figure 60-80-10]**.

Measure the I.D. of the connecting rod small end (Item 2) **[Figure 60-80-10]**.

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 60-80-11

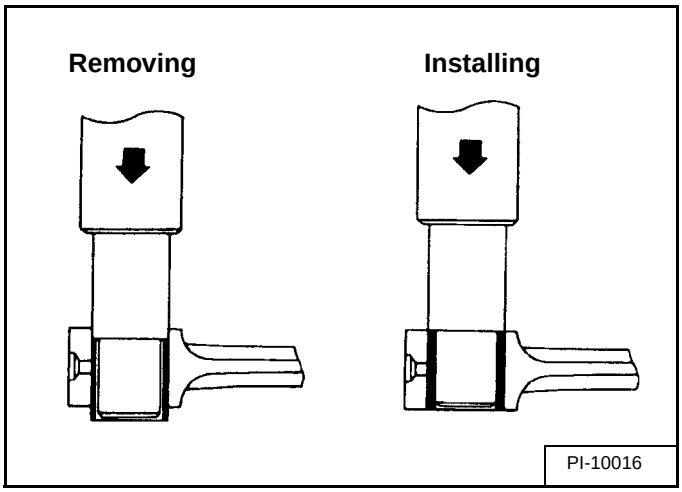


To replace the connecting rod small end bushing, make a driver tool as shown in figure **[Figure 60-80-11]**.

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Piston And Connecting Rod, Servicing (Cont'd)

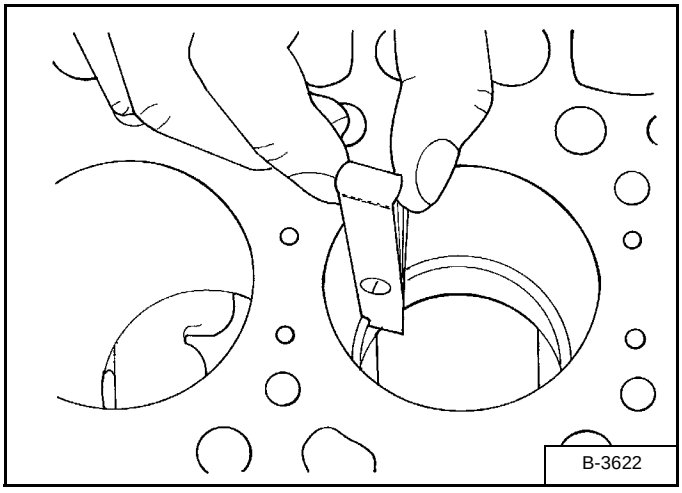
Figure 60-80-12



Use a press and special driver tool to remove the small end bushing **[Figure 60-80-12]**.

Installation: Clean the small end bushing and bore. Put oil on the bushing and press into the connecting rod until it is flush **[Figure 60-80-12]**.

Figure 60-80-13

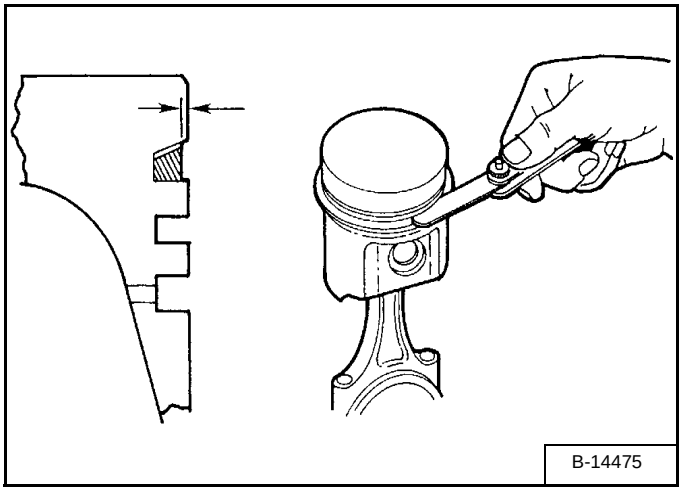


Install a new piston ring into the lower part of the cylinder bore. Measure the ring gap with a feeler gauge **[Figure 60-80-13]**.

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 60-80-14



Remove the carbon from the ring grooves. Measure the clearance between the ring and groove with a feeler gauge **[Figure 60-80-14]**.

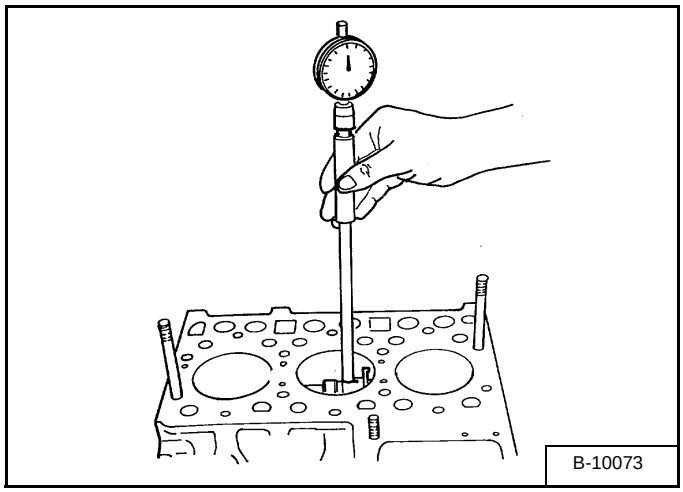
Second ring	0,09 - 0,12 mm (0.0033 - 0.0045 in)
Oil ring	0,04 - 0,08 mm (0.0016 - 0.0031 in)
Allowable limit second ring	
	0,15 mm (0.0059 in)
Allowable limit oil ring	
	0,15 mm (0.0059 in)

If the clearance exceeds the allowable limit, replace the piston.

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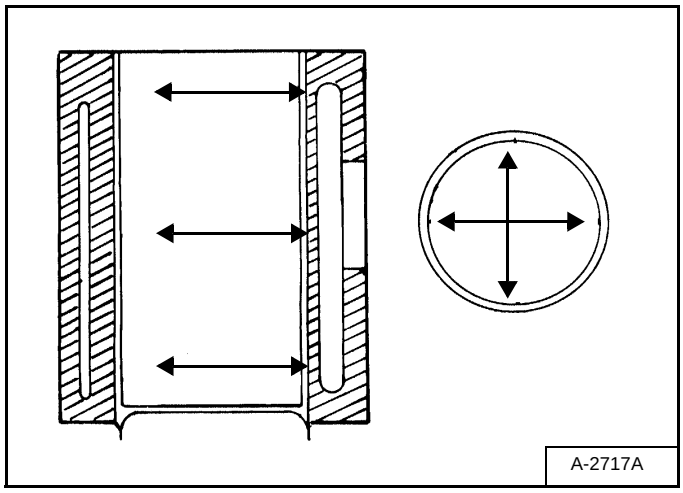
Cylinder Bore - Checking

Figure 60-80-15



Check the inside diameter of the cylinder line **[Figure 60-80-15]**.

Figure 60-80-16



To find the maximum wear check the inside diameter in six different locations **[Figure 60-80-16]**.

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

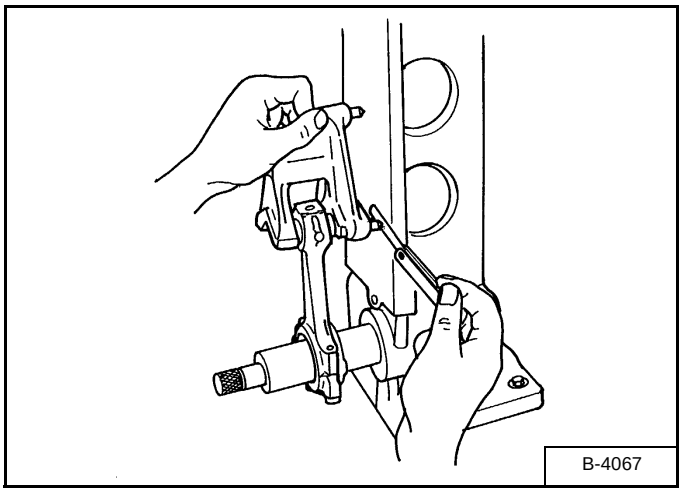
NOTE: The small end bushing is the basis of this check, check the bushing for wear before doing this check.

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 60-80-17



If the gauge does not fit squarely against the face place, measure the space between the gauge and face plate **[Figure 60-80-17]**.

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 And Bearings Removal And Installation

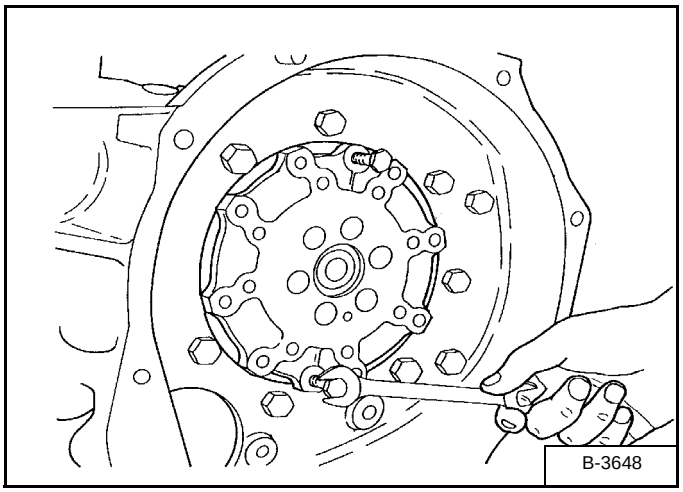
Remove the piston and connecting rod assemblies. (See Piston And Connecting Rod Removal And Installation on Page 60-80-1.)

Remove the engine flywheel. (See Cylinder Head Removal And Installation on Page 60-70-3.)

Remove the bolts which fasten the bearing case cover to the block.

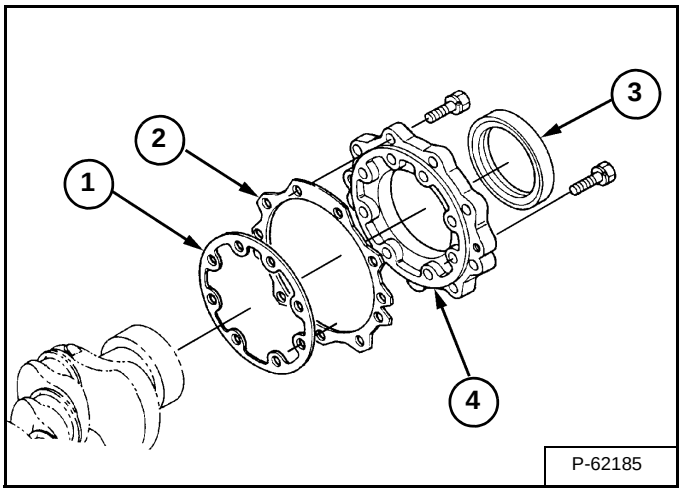
Installation: Tighten the bearing case cover bolts to 10 - 11 N•m (7 - 8 ft-lb) torque. Tighten bolts with even force on the diagonal line.

Figure 60-80-18



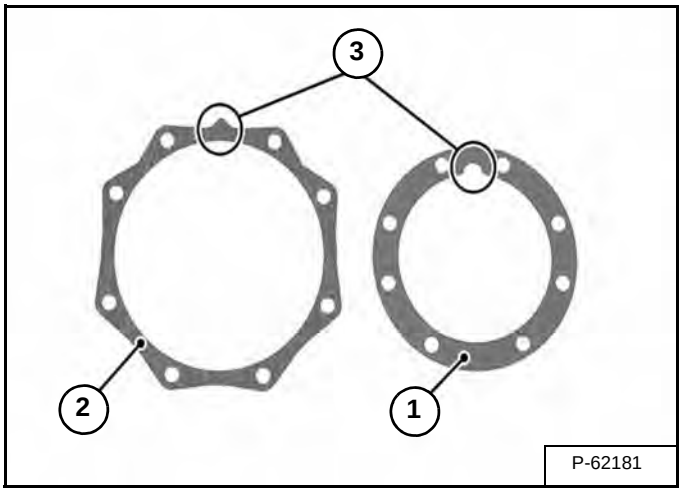
Install two bolts into the bearing case cover and pull the cover out **[Figure 60-80-18]**.

Figure 60-80-19



Installation: When installing the cover (Item 4), make sure the casting mark (Item 3) is in the up position. Lightly oil inside lip of oil seal (Item 3) **[Figure 60-80-19]**.

Figure 60-80-20

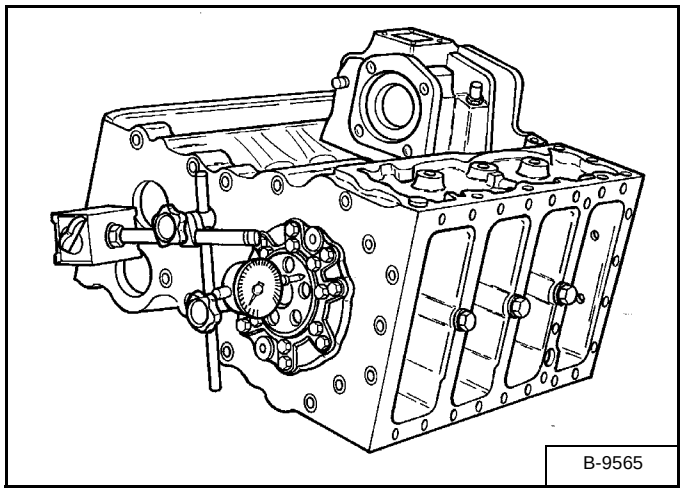


Installation: When installing the bearing case gasket (Item 1) **[Figure 60-80-19]** and **[Figure 60-80-20]**, and the bearing case cover gasket (Item 2) **[Figure 60-80-19]** and **[Figure 60-80-20]** make sure the mark (Item 3) **[Figure 60-80-20]** is in the up position.

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Crankshaft And Bearings Removal And Installation (Cont'd)

Figure 60-80-21

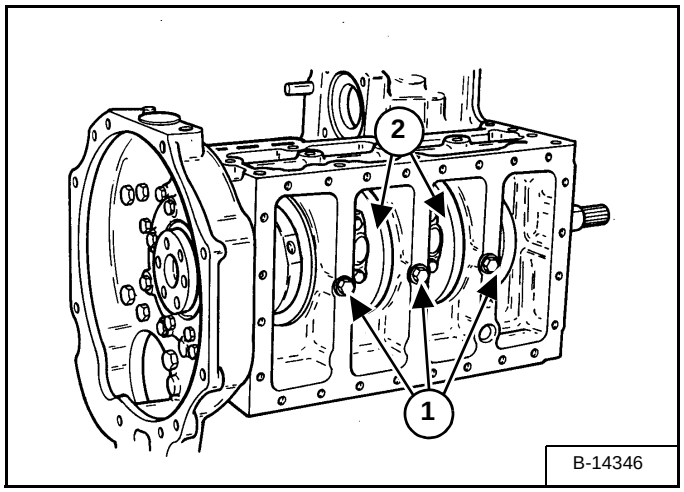


Before removing the crankshaft / main bearings, check the end play. Install a dial indicator. Measure the end play by moving the crankshaft back and forth **[Figure 60-80-21]**.

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)

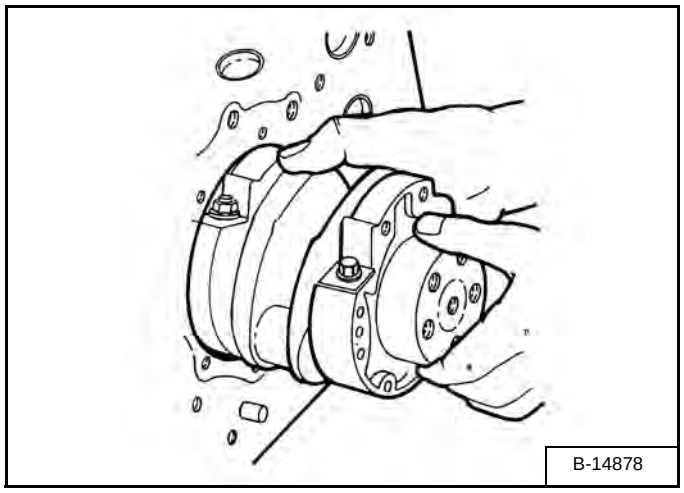
Figure 60-80-22



Remove the main bearing case bolt (Item 1) **[Figure 60-80-22]**.

Installation: Align the bearing case hole (Item 2) **[Figure 60-80-22]** with the hole in the block. Put oil on the bolt threads and tighten to 27 - 30 N•m (20 - 22 ft-lb) torque.

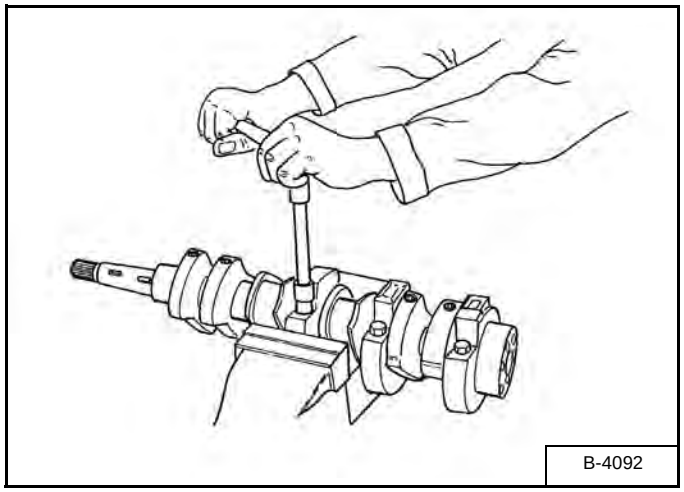
Figure 60-80-23



Remove the crankshaft / main bearing assembly from the engine block **[Figure 60-80-23]**.

Mark the bearing case halves for correct installation.

Figure 60-80-24



Remove the two bearing case bolts **[Figure 60-80-24]**.

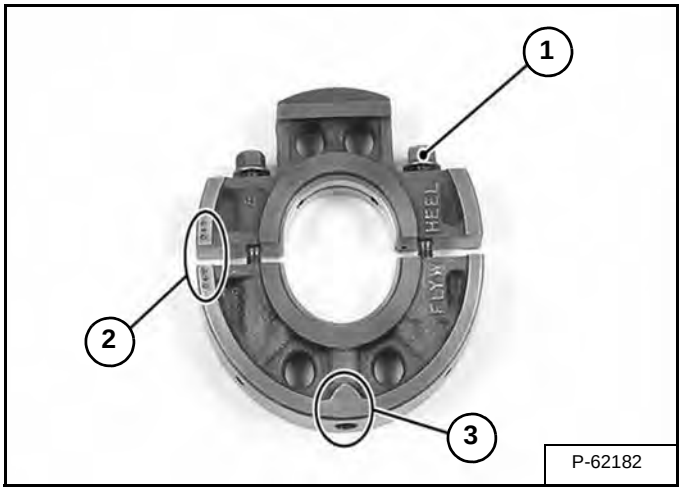
Remove the bearing case and bearing.

Installation: Tighten the bearing case bolts (Item 1) **[Figure 60-80-24]** to 13 - 16 N•m (9 - 12 ft-lb) torque.

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Crankshaft And Bearings Removal And Installation (Cont'd)

Figure 60-80-25

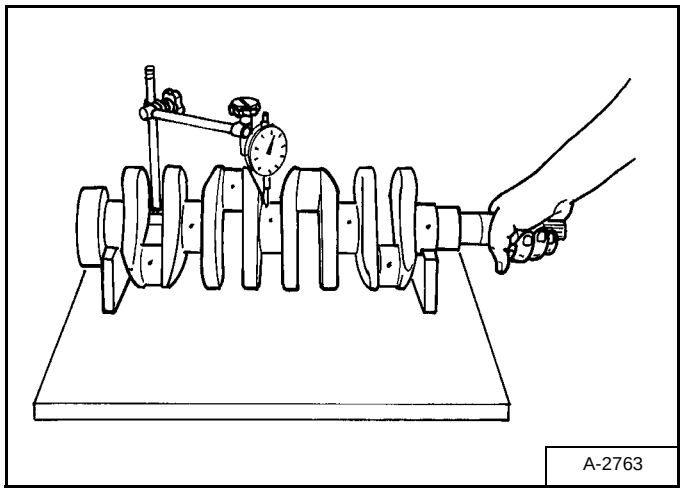


Installation: When installing the main bearing case assemblies, face the mark FLYWHEEL to the flywheel side of the engine block **[Figure 60-80-25]**. Be sure the thrust washer with its oil grooves face outward.

Identification marks on the main bearing case assemblies are the alignment number (Item 2) and the marking "1" or "2" (Item 3) **[Figure 60-80-25]** can be found on the main bearing case assemblies to ensure proper assembly.

Crankshaft And Bearings - Servicing

Figure 60-80-26



Put the crankshaft on V-blocks. Install a dial indicator on the center journal **[Figure 60-80-26]**.

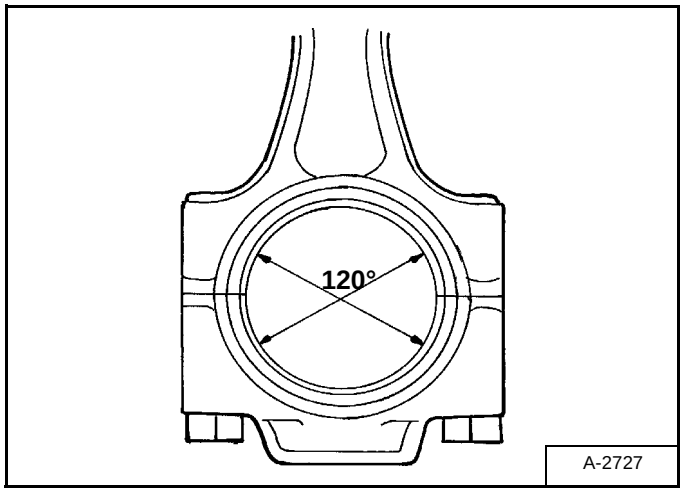
Turn the crankshaft at a slow rate.

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 60-80-27

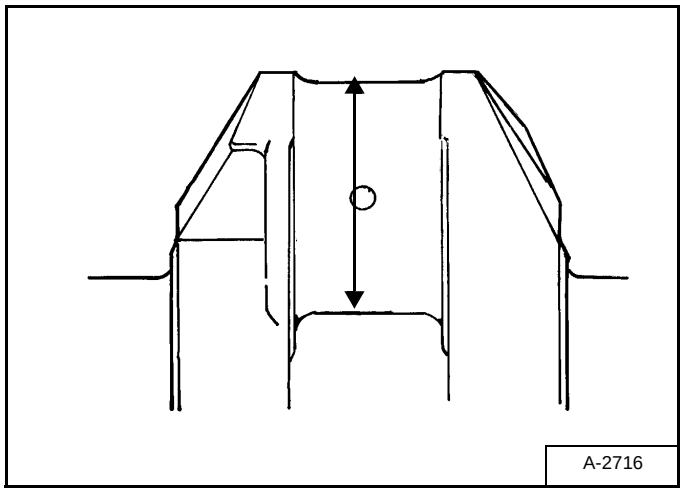


Measure the crankpin bearing I.D. **[Figure 60-80-27]**.

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Crankshaft And Bearings Removal And Installation (Cont'd)

Figure 60-80-28



Measure the crankpin O.D. **[Figure 60-80-28]**.

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 60-80-29

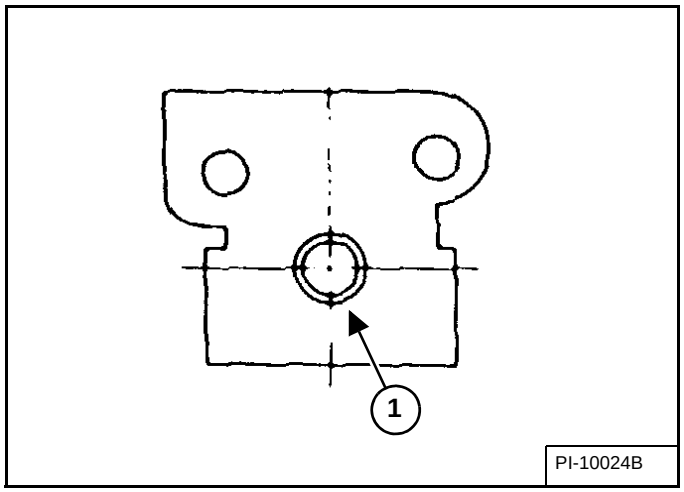
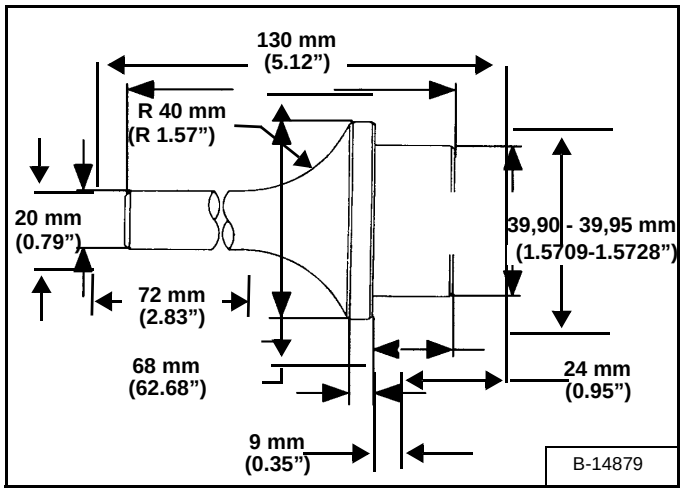


Figure 60-80-30



Remove the bearing (Item 1) **[Figure 60-80-29]** from the front of the engine block with the removal tool shown in **[Figure 60-80-30]**.

Installation: Clean the new bearing and bore and apply oil to them. Install the new bearing with the installation driver tool **[Figure 60-80-29]**.

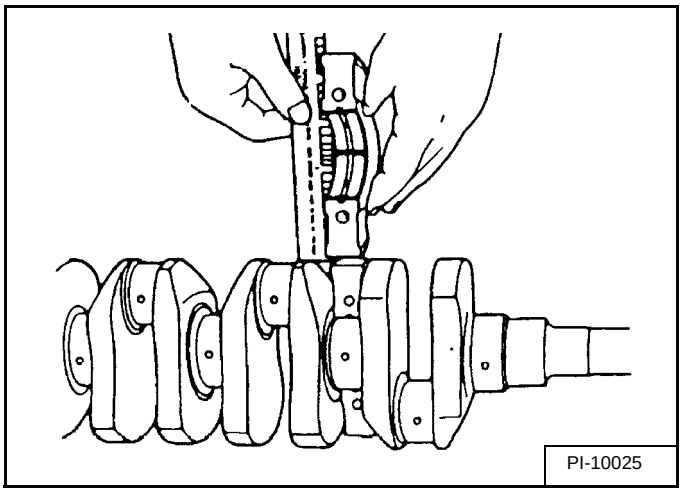
Clean the crankshaft journal and bearing. Put a strip of press gauge on the center journal.

Install the main bearing case halves and tighten the bolts to 12,7 - 15,7 N•m (9 - 12 ft-lb) torque. Remove the bearing case halves.

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Crankshaft And Bearings Removal And Installation (Cont'd)

Figure 60-80-31



Measure the flattened press gauge **[Figure 60-80-31]**.

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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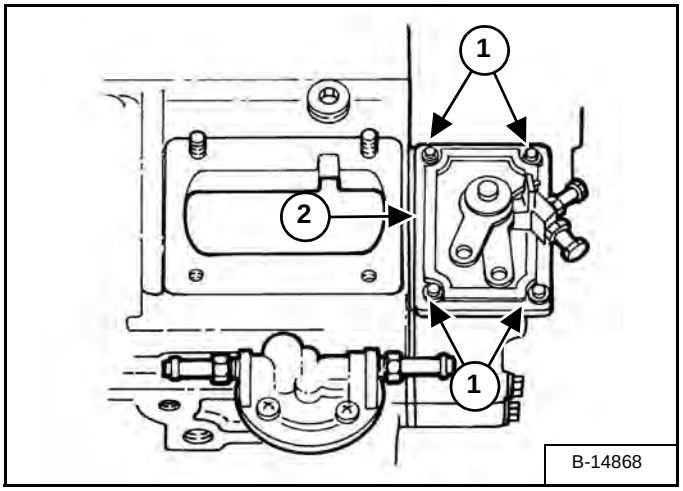
Dealer Copy -- Not for Resale

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

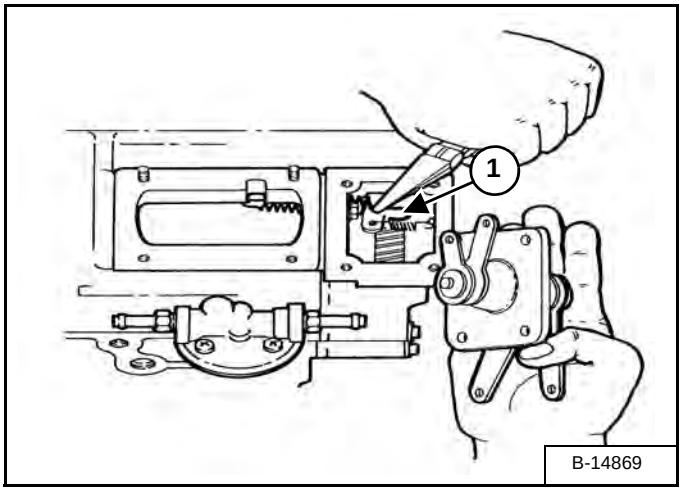


Remove the cylinder head, rocker arms and push rods. (See Cylinder Head Removal And Installation on Page 60-70-3.)

Remove the screws (Item 1) from the speed control plate (Item 2) **[Figure 60-90-1]**.

NOTE: Take care not to damage the spring.

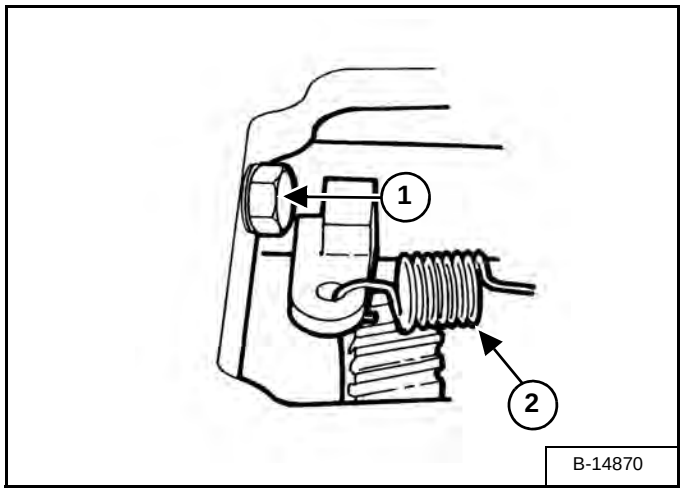
Figure 60-90-2



Separate the speed control plate from the engine and remove the spring (Item 1) **[Figure 60-90-2]**.

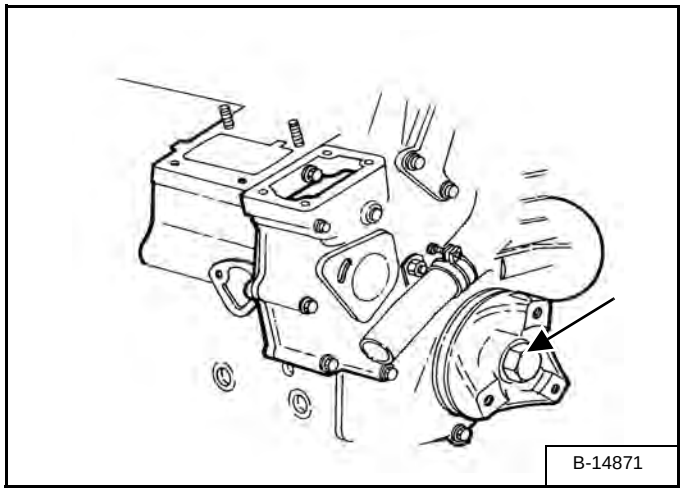
Remove the speed control plate.

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.

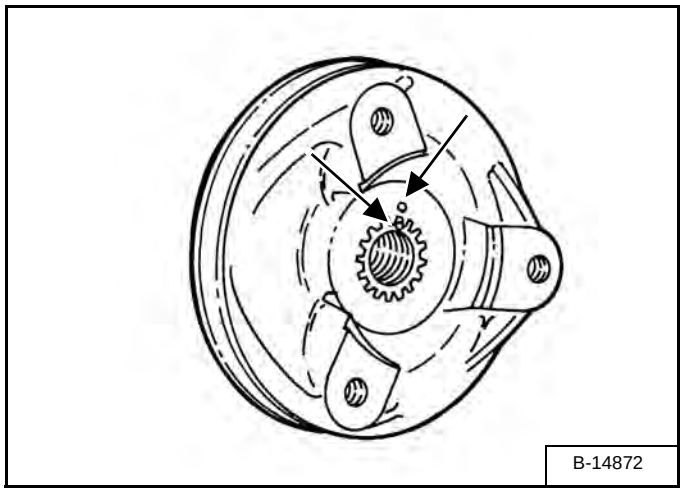
Installation: Tighten the bolt 98 - 108 N•m (72 - 80 ft-lb) torque.

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

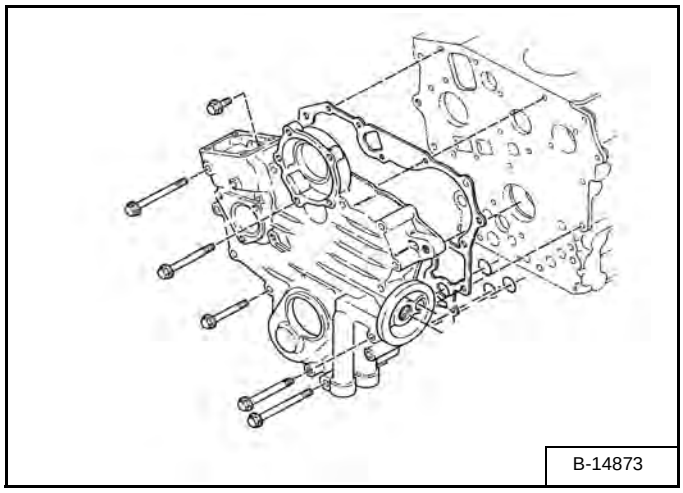


When installing the crank shaft pulley, make sure the alignment marks are aligned **[Figure 60-90-5]**.

Remove the timing gearcase cover bolts.

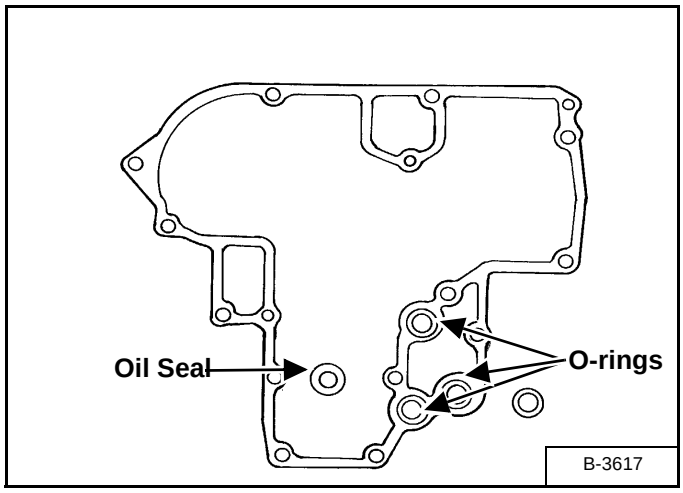
Installation: Tighten the bolts to 10 - 11 N•m (7 - 8 ft-lb) torque.

Figure 60-90-6



Remove the timing gearcase **[Figure 60-90-6]**.

Figure 60-90-7

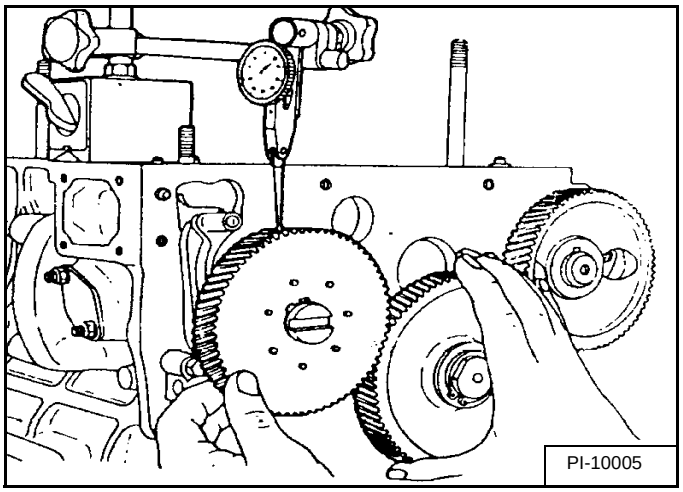


Installation: Install three new O-rings and the oil seal into the timing gearcase cover **[Figure 60-90-7]**.

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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]**.

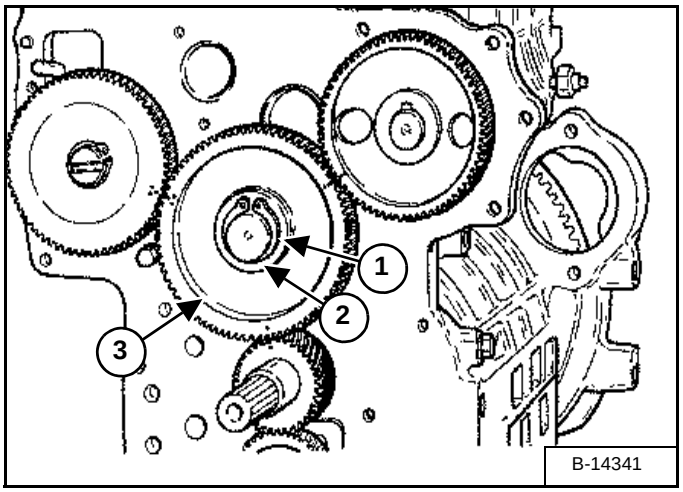
Hold one gear while turning the other gear **[Figure 60-90-8]**.

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)

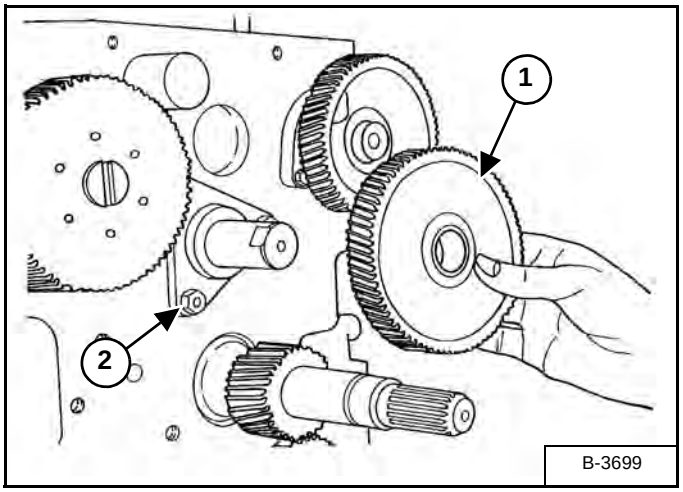
Idler Gear And Camshaft Removal And Installation

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]**.

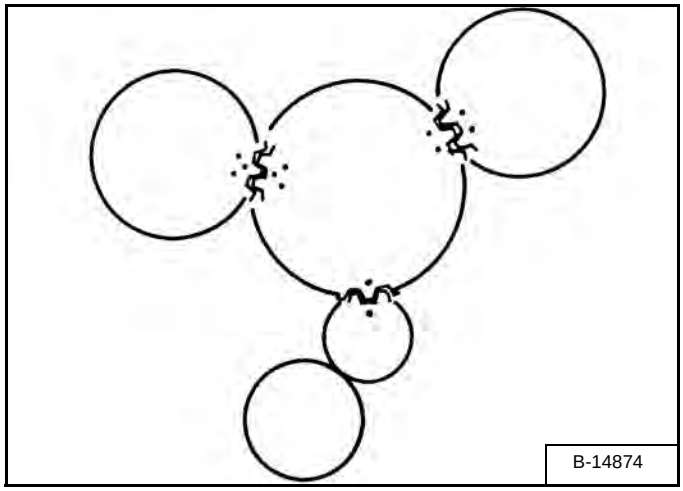
Remove idler gear mounting screws (Item 2) **[Figure 60-90-10]**.

Installation: Tighten screws to 10 - 11 N•m (7 - 8 ft-lb) torque.

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Idler Gear And Camshaft Removal And Installation (Cont'd)

Figure 60-90-11

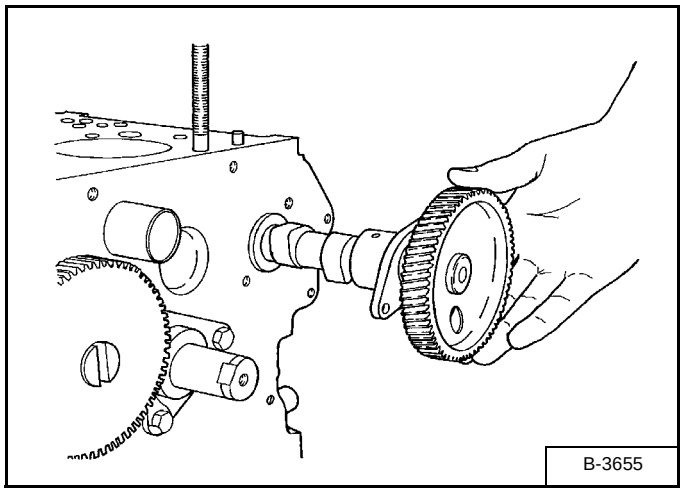


Installation: Make sure the timing marks are in correct alignment when installing the timing gears **[Figure 60-90-11]**.

Align the holes on the camshaft gear with the camshaft retainer plate bolts.

Remove the bolts.

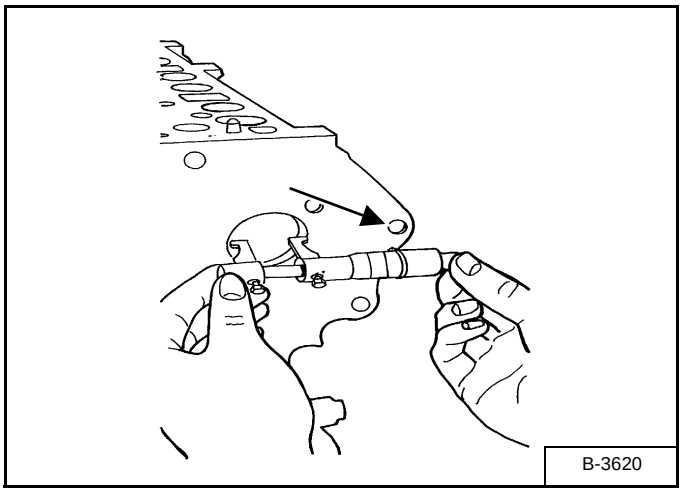
Figure 60-90-12



Remove the camshaft from the engine block **[Figure 60-90-12]**.

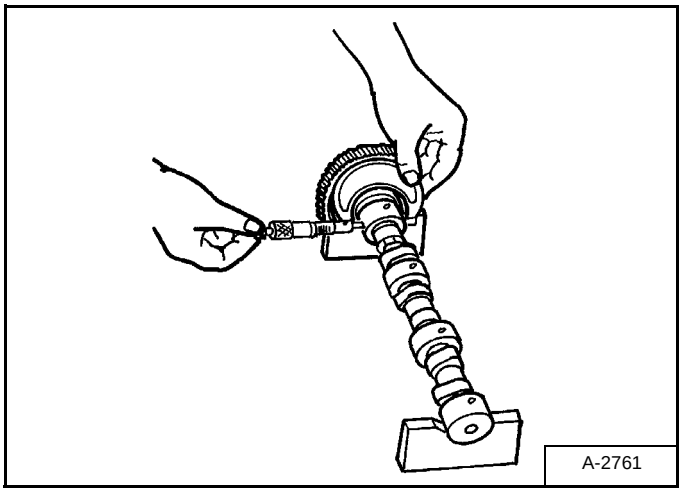
Installation: Tighten the camshaft retainer bolts to 18 - 21 N•m (14 - 15 ft-lb) torque.

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]**.

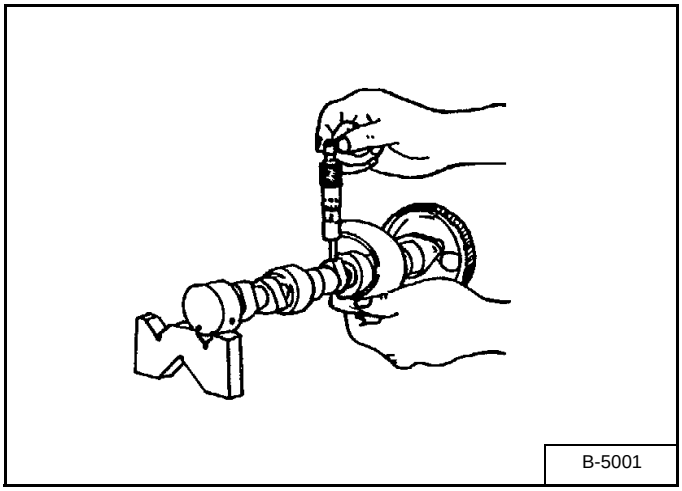
Calculate the oil clearance. If the clearance exceeds the allowable limit, replace the camshaft.

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

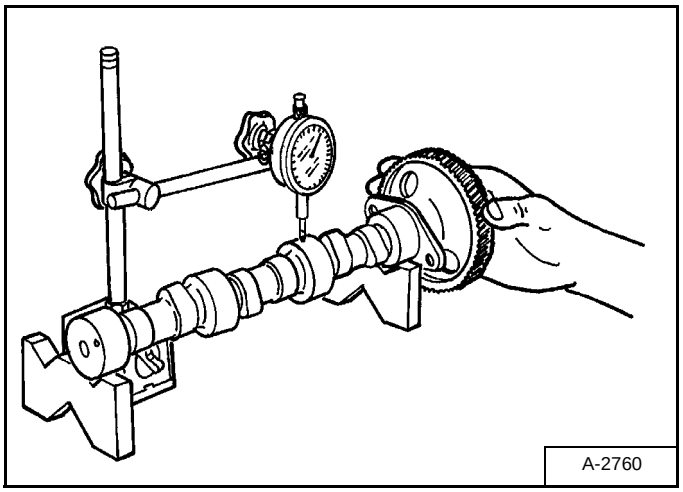


Measure the cam lobes at their highest point **[Figure 60-90-15]**.

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]**.

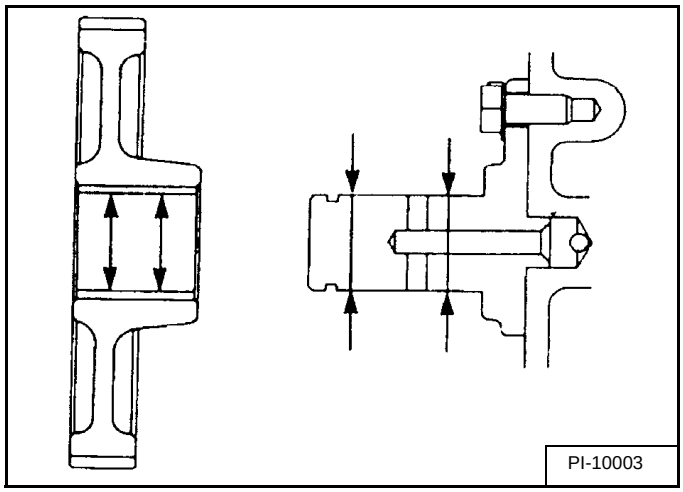
Turn the camshaft at a slow rate. If the misalignment exceeds the allowable limit, replace the camshaft.

Camshaft Alignment Allowable Limit	
	0,01 mm (0.0004 in)

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Idler Gear And Shaft - Servicing

Figure 60-90-17



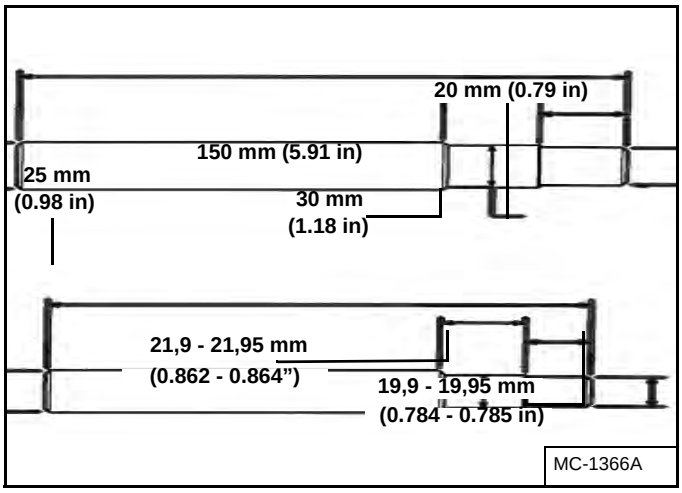
Measure the O.D. of the idler gear shaft **[Figure 60-90-17]**.

Measure the I.D. of the idler gear bushing **[Figure 60-90-17]**.

If the clearance exceeds the allowable limit, replace the bushing.

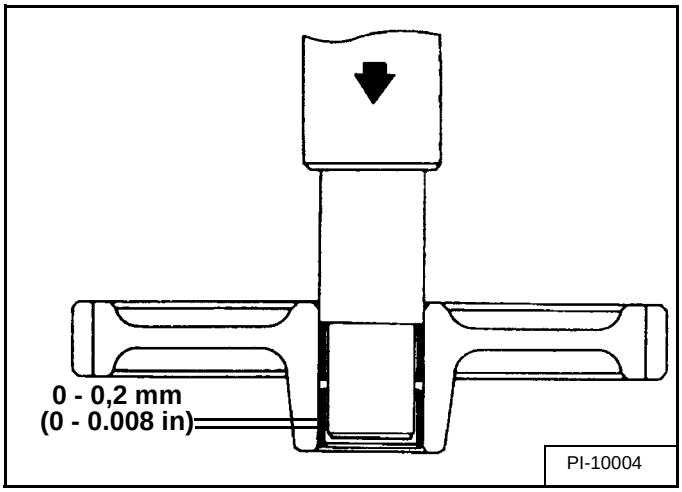
Idler Gear Shaft O.D.	19,97 - 19,98 mm (0.786 - 0.787 in)
Idler Gear Shaft I.D.	20,00 - 20,05 mm (0.787 - 0.789 in)
Oil Clearance between Idler Shaft and Gear Bushing	
	0,020 - 0,084 mm (0.0008 - 0.0033 in)
Allowable Limit	0,10 mm (0.004 in)

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

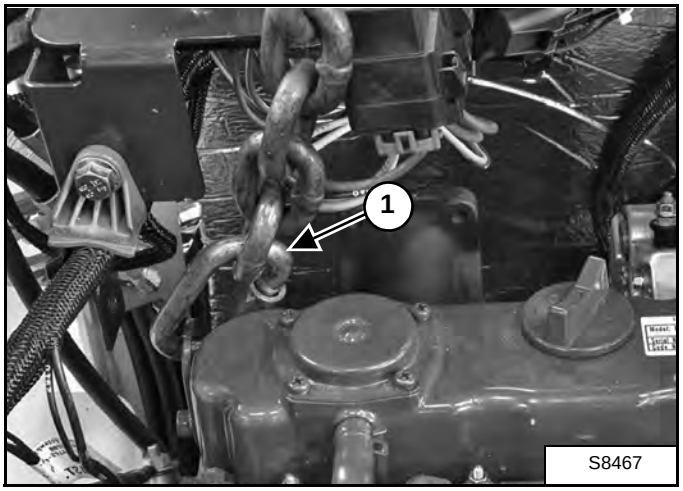
Removal And Installation

Remove the air cleaner. (See Removal And Installation on Page 60-30-1.)

Remove the hydraulic pump. (See Removal And Installation on Page 20-50-3.)

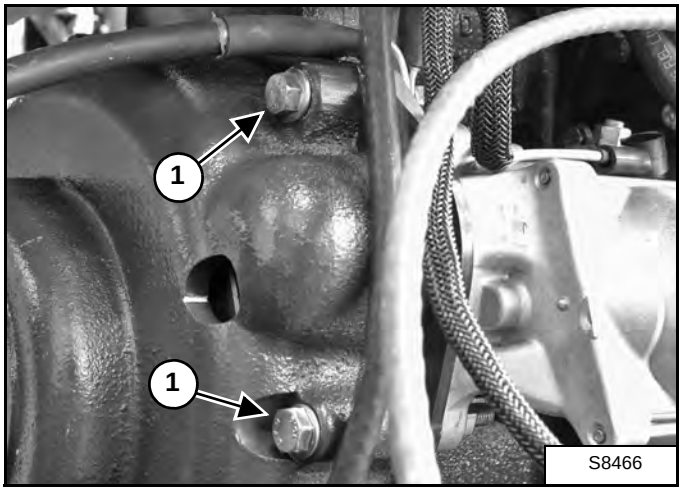
Remove the spark arrester muffler. (See Removal And Installation on Page 60-20-1.)

Figure 60-100-1



Install a chain hoist to the engine lifting eye to support the engine (Item 1) **[Figure 60-100-1]**.

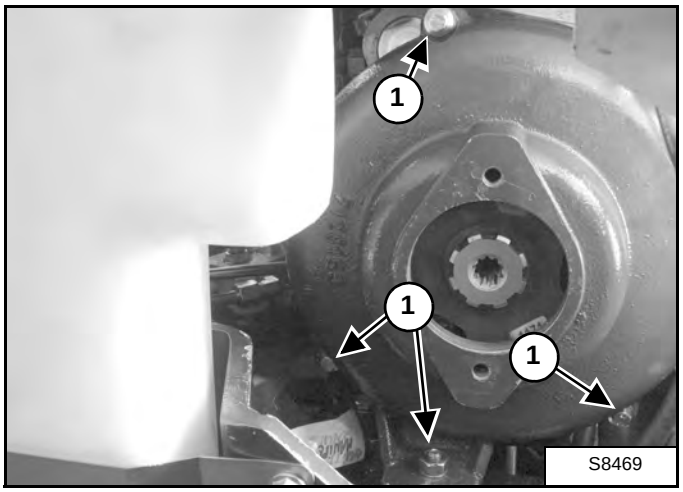
Figure 60-100-2



Remove the mount bolts and nuts (Item 1) **[Figure 60-100-2]**.

Installation: Tighten the bolts and nuts to 24 - 26 N•m (18 - 19 ft-lb) torque.

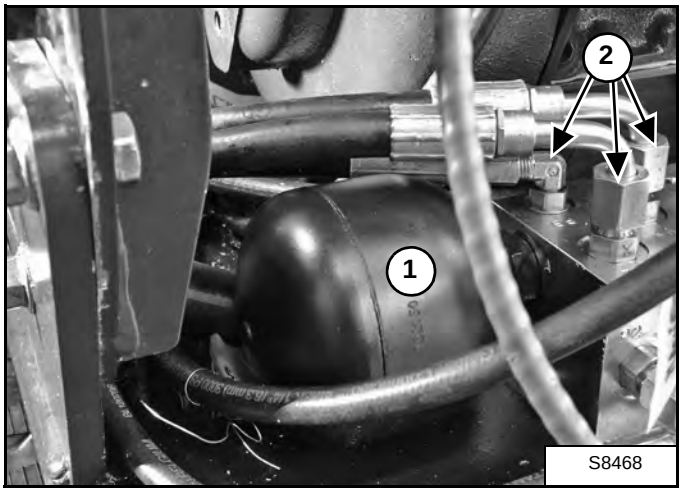
Figure 60-100-3



Remove the four 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 accumulator (Item 1) **[Figure 60-100-4]** from the manifold assembly.

Remove the three hoses (Item 1) **[Figure 60-100-4]** from the manifold assembly.

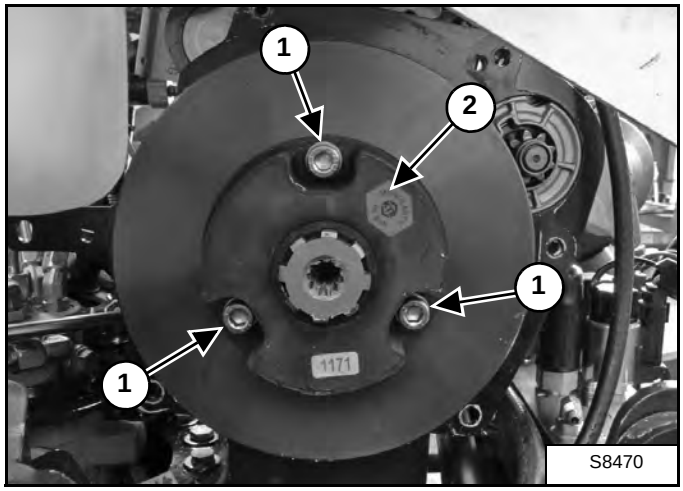
Remove the flywheel housing.

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Hydraulic Pump Coupler Removal And Installation

Remove the flywheel housing. (See 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 (53 - 58 ft-lb) torque. Also lubricate the bolt heads prior to installation.

NOTE: Apply anti-seize compound on spline teeth prior to pump installation.

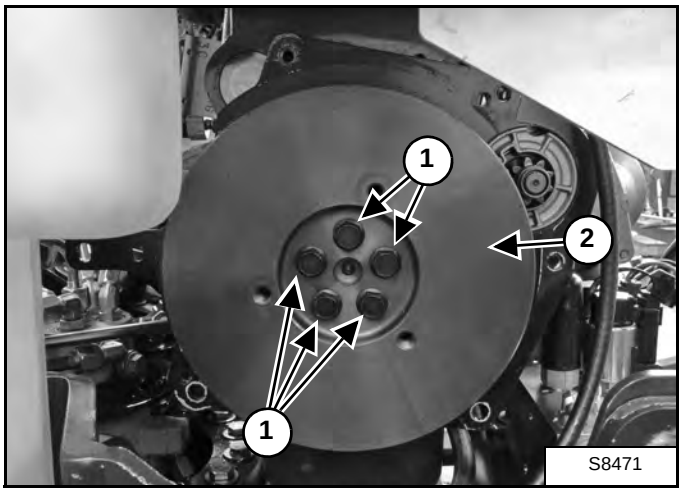
Remove the hydraulic pump coupler (Item 2) **[Figure 60-100-5]**.

Flywheel Removal And Installation

Remove the flywheel housing. (See Removal And Installation on Page 60-70-1)

Remove the hydraulic pump coupler. (See Hydraulic Pump Coupler Removal And Installation on Page 60-70-2)

Figure 60-100-6



Remove the five bolts (Item 1) **[Figure 60-100-6]** from the flywheel.

Installation: Lubricate the bolt heads prior to installation. Tighten the bolts to 54 - 58 N•m (40 - 43 ft-lb) torque.

Remove the flywheel (Item 2) **[Figure 60-100-6]**.

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Rear End Plate Removal And Installation

Remove the flywheel housing. (See Removal And Installation on Page 60-70-1)

Remove the hydraulic pump coupler. (See Hydraulic Pump Coupler Removal And Installation on Page 60-70-2)

Remove the flywheel. (See Flywheel Removal And Installation on Page 60-70-2)

Figure 60-100-7

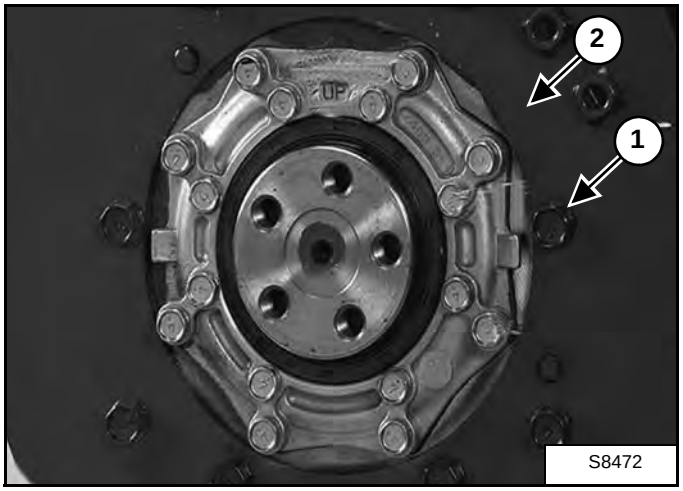
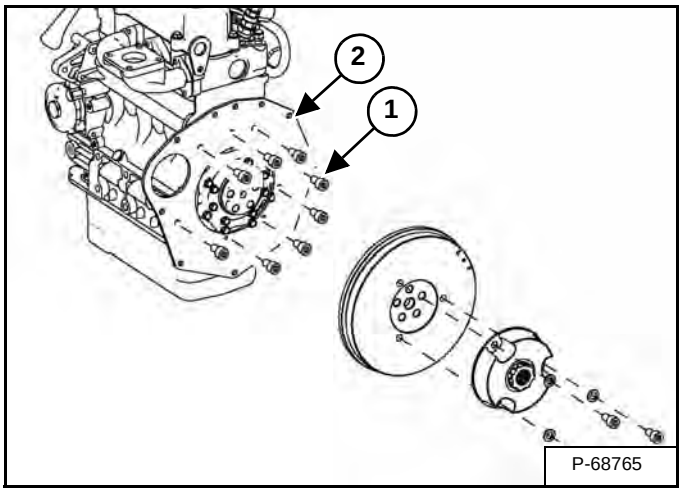


Figure 60-100-8



Remove the bolts (Item 1) from the rear end plate (Item 2) **[Figure 60-100-7]** and **[Figure 60-100-8]**. Remove end plate from the side of the engine.

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SPECIFICATIONS

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- Rated Lift Capacity SPEC-10-3
- Performance SPEC-10-4
- Function Time SPEC-10-4
- Weights SPEC-10-4
- Controls SPEC-10-4
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- Instrumentation SPEC-10-8
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- Engine Torques SPEC-20-1
- Cooling System SPEC-20-1
- Excavator Torques SPEC-20-2
- Lubrication SPEC-20-2

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 Fitting 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-70-5
Electrical Tools SPEC-70-7
HVAC Tools SPEC-70-7

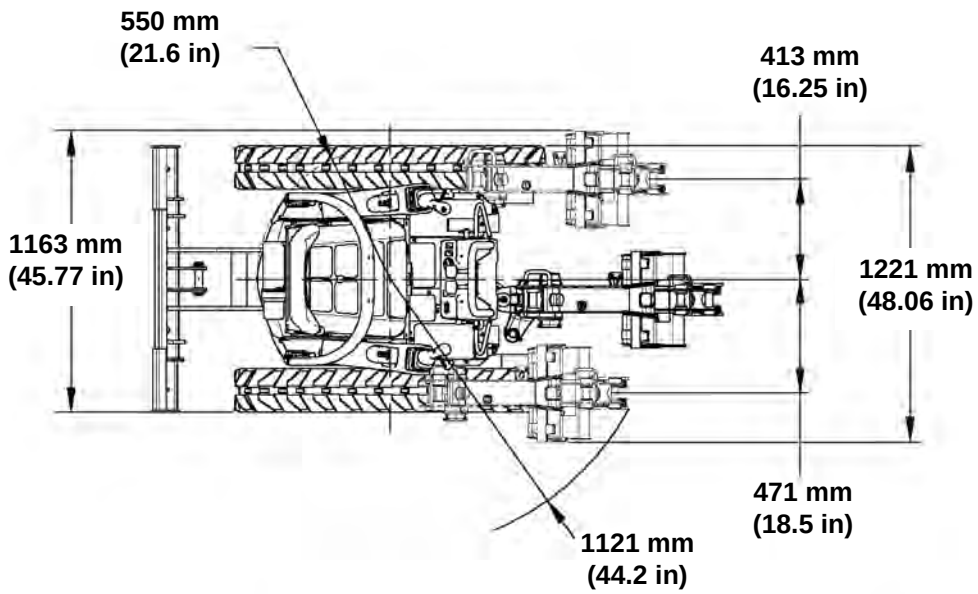
Certain specification(s) are based on engineering calculations and are not actual measurements. Specification(s) are provided for comparison purposes only and are subject to change without notice. Specification(s) for your individual Bobcat equipment will vary based on normal variations in design, manufacturing, operating conditions and other factors.

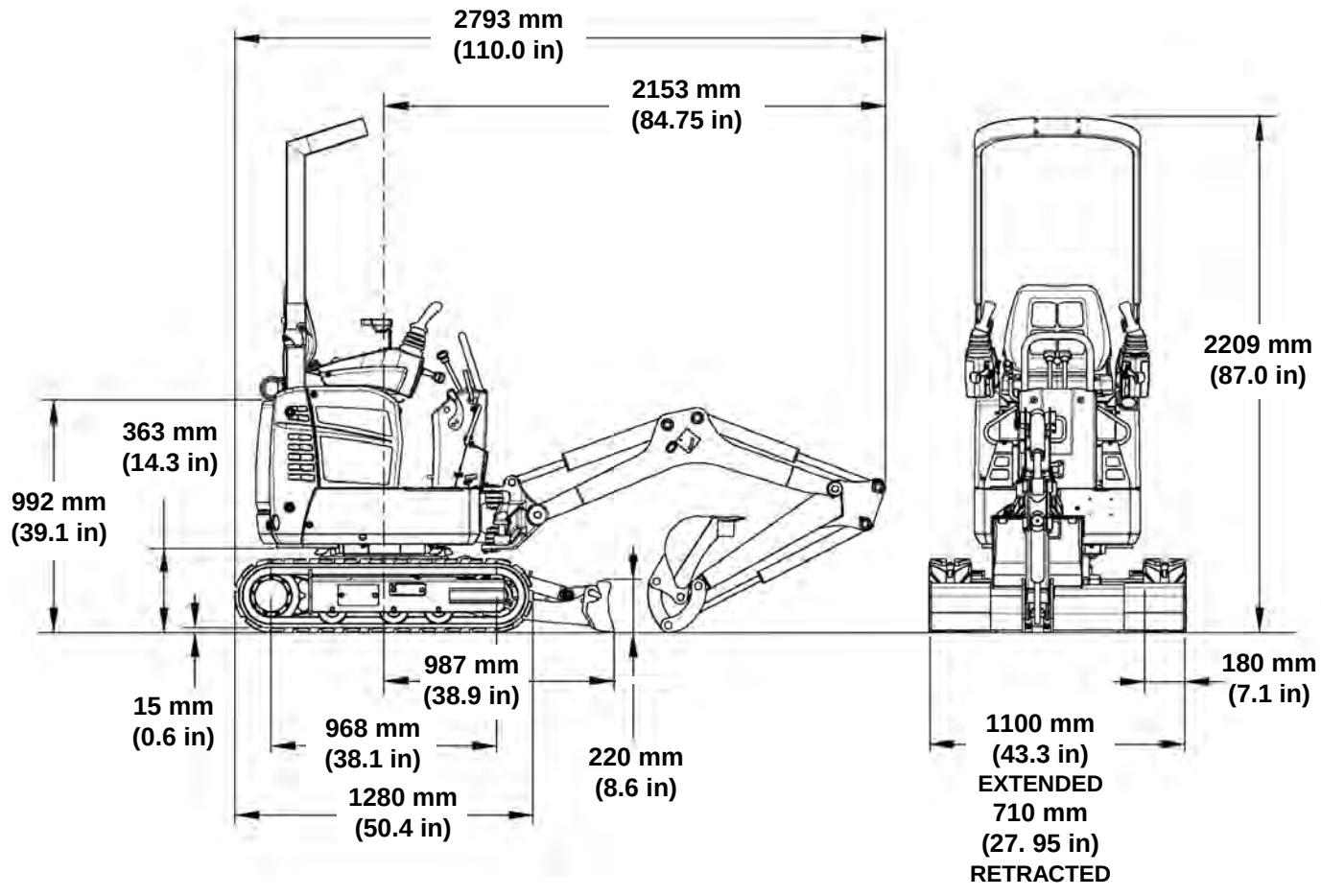
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EXCAVATOR SPECIFICATIONS

Machine Dimensions

- All dimensions are given in mm.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.

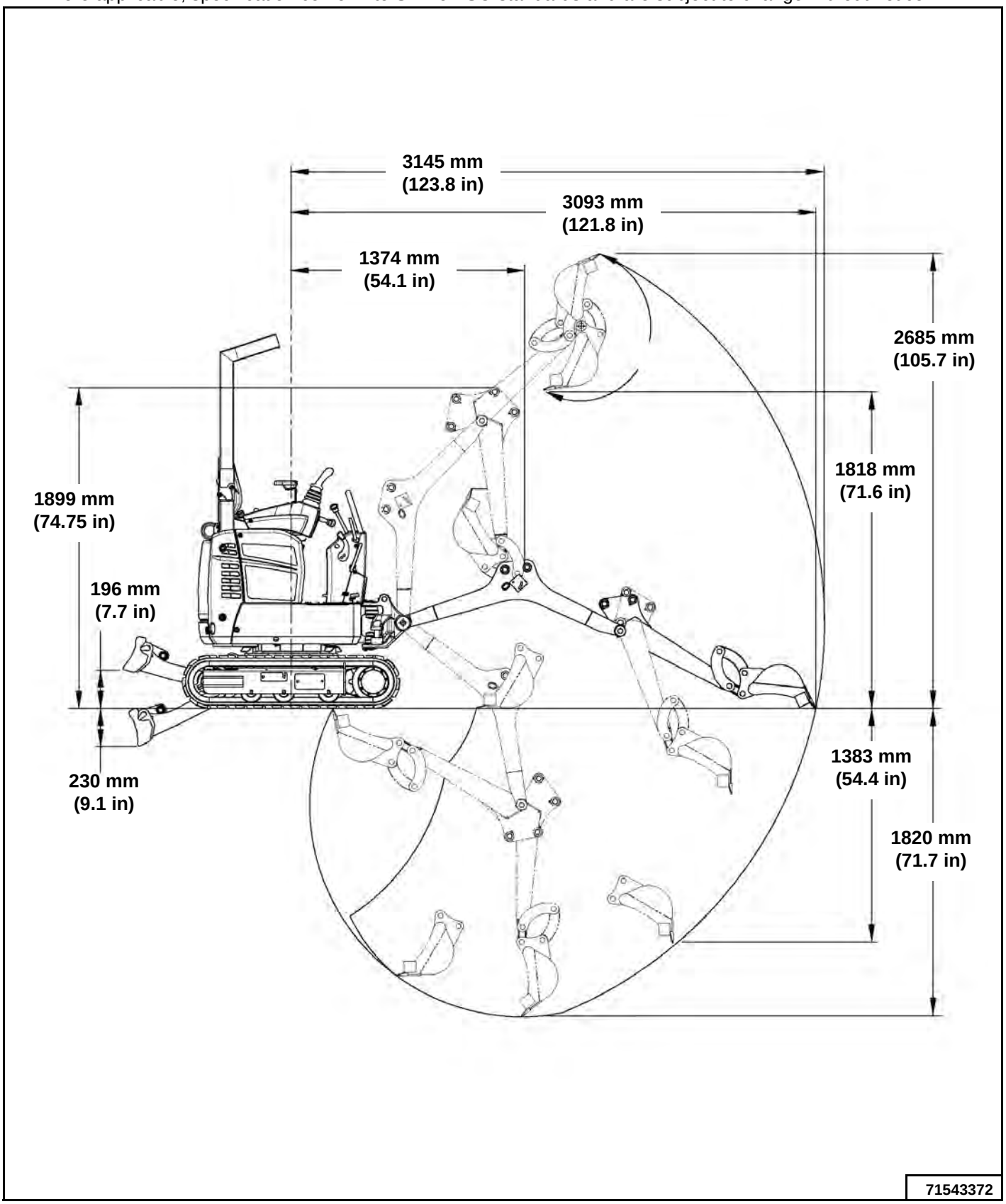




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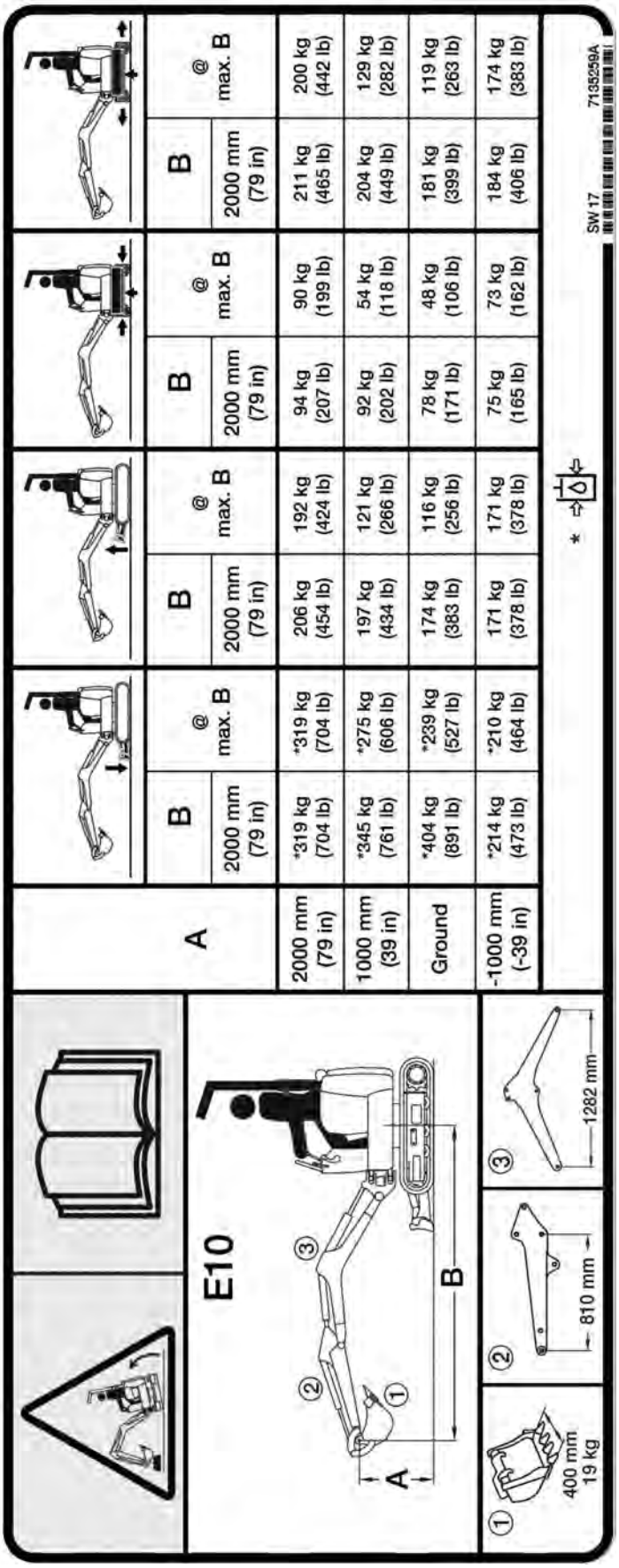
Working Range

- All dimensions are given in mm.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



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Rated Lift Capacity



A	B 2000 mm (79 in)	@ max. B	B 2000 mm (79 in)	@ max. B	B 2000 mm (79 in)	@ max. B
2000 mm (79 in)	*319 kg (704 lb)	*319 kg (704 lb)	206 kg (454 lb)	192 kg (424 lb)	94 kg (207 lb)	90 kg (199 lb)	211 kg (465 lb)	200 kg (442 lb)
1000 mm (39 in)	*345 kg (761 lb)	*275 kg (606 lb)	197 kg (434 lb)	121 kg (266 lb)	92 kg (202 lb)	54 kg (118 lb)	204 kg (449 lb)	129 kg (282 lb)
Ground	*404 kg (891 lb)	*239 kg (527 lb)	174 kg (383 lb)	116 kg (256 lb)	78 kg (171 lb)	48 kg (106 lb)	181 kg (399 lb)	119 kg (263 lb)
-1000 mm (-39 in)	*214 kg (473 lb)	*210 kg (464 lb)	171 kg (378 lb)	171 kg (378 lb)	75 kg (165 lb)	73 kg (162 lb)	184 kg (406 lb)	174 kg (383 lb)

* ⇨

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Performance

Digging force, arm (ISO 6015)	5550 N (1248 lbf)
Digging force, bucket (ISO 6015)	8294 N (1865 lbf)
Drawbar pull (theoretical at 90% efficiency)	9905 N (2227 lbf)
Ground pressure	28,8 kPa (0.28 bar) (4.18 psi)

Function Time

Boom raise time	4.2 s
Boom lower time	4.2 s
Bucket curl time	3.2 s
Bucket dump time	2.3 s
Arm retract time	3.9 s
Arm extend time	2.6 s
Boom swing left time	4.1 s
Boom swing right time	3.2 s
Blade raise time	1.7 s
Blade lower time	1.2 s
Slew rate	9 rpm
Undercarriage expand time	5.0 s
Undercarriage retract time	3.5 s

Weights

Operating weight with TOPS canopy, rubber tracks, 400 mm bucket	1176 kg (2593 lb)

Controls

Engine	Hand levers on right hand side
Starting	Key-type starter switch and shutdown
Blade	Right hand lever
Boom swing	Right foot pedal
Hydraulics	Two levers control boom, bucket, arm and upperstructure slew
Auxiliary hydraulics	Left-hand foot pedal
Upperstructure slew brake	Hydraulic lock on motor
Holding brake for upperstructure slew	Pin lock
Steering	Direction and speed controlled by two hand levers

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Engine (S/N B4PD11001 & Above)

Make / Model	Kubota® / D722-E4B-BCZ-6 (Stage 5)
Fuel	Diesel
Cooling	Liquid
Maximum power at 2000 rpm (ISO 9249)	7,4 kW (9.9 hp)
Maximum governed speed	2000 rpm
High idle speed	2370 rpm
Low idle speed	1300 – 1400 rpm
Torque at 1600 rpm (SAE Net)	39,1 N•m (28.8 lb-ft)
Number of cylinders	3
Displacement	0.72 L (43.9 in^3)
Bore	67 mm (2.6 in)
Stroke	68 mm (2.7 in)
Lubrication	Forced lubrication with cartridge type filter
Crankcase ventilation	Closed breathing
Air filter	Dual dry replaceable paper cartridge
Ignition	Compression ignited (diesel)
Starting aid	Glow Plug

Engine (S/N B4K911001 & Above)

Make / Model	Kubota® / D722-E4B-BCZ-6 (Tier 4)
Fuel	Diesel
Cooling	Liquid
Maximum power at 2000 rpm (ISO 9249)	7,4 kW (9.9 hp)
Maximum governed speed	2000 rpm
High idle speed	2370 rpm
Low idle speed	1300 – 1400 rpm
Torque at 1600 rpm (SAE Net)	39,1 N•m (28.8 lb-ft)
Number of cylinders	3
Displacement	0.72 L (43.9 in^3)
Bore	67 mm (2.6 in)
Stroke	68 mm (2.7 in)
Lubrication	Forced lubrication with cartridge type filter
Crankcase ventilation	Closed breathing
Air filter	Dual dry replaceable paper cartridge
Ignition	Compression ignited (diesel)
Starting aid	Glow Plug
Engine Coolant	Propylene Glycol / water mixture (53% PG / 47% water)

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Engine (S/N A33P11001 & Above)

Make / Model	Kubota® / D722-E2B-BCZ-6 (Tier 2)
Fuel	Diesel
Cooling	Liquid
Maximum power at 2000 rpm (ISO 9249)	7,4 kW (9.9 hp)
Maximum governed speed	2000 rpm
High idle speed	2370 rpm
Low idle speed	1300 – 1400 rpm
Torque at 1600 rpm (SAE Net)	39,1 N•m (28.8 lb-ft)
Number of cylinders	3
Displacement	0.72 L (43.9 in^3)
Bore	67 mm (2.6 in)
Stroke	68 mm (2.7 in)
Lubrication	Forced lubrication with cartridge type filter
Crankcase ventilation	Closed breathing
Air filter	Dual dry replaceable paper cartridge
Ignition	Compression ignited (diesel)
Starting aid	Intake air heater

Electrical

Alternator	12 V - 40 A - open frame with internal regulator
Battery	12 V - 500 cold cranking A at -18 °C, 90 min reserve capacity
Starter	12 V - reduction on drive - 1,4 kW

Hydraulic System

Pump Type	Double gear pump
Pump capacity	2 @10 L/min @ 2000 RPM (2.6 U.S. gpm)
System relief pressure	19000 kPa (1910 bar) (2756 psi)
Joystick control pressure	3000 kPa (30 bar) (435 psi)
System relief pressure for slew circuits	8400 kPa (84 bar) (1218 psi)
Main hydraulic filter bypass	172 kPa (1.72 bar) (25 psi)
Boom base and arm rod port relief	23200 kPa (232 bar) (3365 psi)
Arm base port relief	22500 kPa (225 bar) (3263 psi)
Control valve	Nine-spool parallel type, open centre
Hydraulic filter	Full-flow replaceable
Fluid lines	SAE standard tubelines, hoses, and fittings
Auxiliary flow	20 L/min (5.3 U.S. gpm)

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Hydraulic Cylinders

Boom cylinder	Cushion up
Boom cylinder bore	63,5 mm (2.5 in)
Boom cylinder rod	31,8 mm (1.3 in)
Boom cylinder stroke	312,4 mm (12.3 in)
Arm cylinder	Cushion
Arm cylinder bore	50,8 mm (2.0 in)
Arm cylinder rod	31,8 mm (1.3 in)
Arm cylinder stroke	325,6 mm (12.8 in)
Bucket cylinder	No cushion
Bucket cylinder bore	44,5 mm (1.8 in)
Bucket cylinder rod	25,4 mm (1.0 in)
Bucket cylinder stroke	385,1 mm (15.2 in)
Boom swing cylinder	No cushion
Boom swing cylinder bore	57,1 mm (2.3 in)
Boom swing cylinder rod	31,8 mm (1.3 in)
Boom swing cylinder stroke	274,6 mm (10.8 in)
Blade cylinder	No cushion
Blade cylinder bore	50,8 mm (2.0 in)
Blade cylinder rod	31,8 mm (1.3 in)
Blade cylinder stroke	96,8 mm (3.8 in)
Undercarriage cylinder	No cushion
Undercarriage cylinder bore	44,5 mm (1.8 in)
Undercarriage cylinder rod	25,4 mm (1.0 in)
Undercarriage cylinder stroke	400,1 mm (15.8 in)

Drive System

Travel motor	Each track is driven by hydrostatic axial piston motor
Drive reduction	Two-stage planetary gear reduction 23,04:1

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Traction

Track width, rubber, standard	180 mm (7.1 in)
Track adjusters	Grease type adjusters, rubber
Track type, standard	Half-pitch, rubber
Travel speed	2,1 km/h (1.3 mph)
Travel speed, high range (option)	2,8 km/h (1.7 mph)
Undercarriage	Sealed track rollers with box section track roller frame
Number of track rollers per side	3
Gradeability travelling down or backing up slopes	25°
Gradeability travelling on side slopes	15°
Gradeability travelling up side slopes	15°

Fluid Capacities

Cooling system	3,0 L (3.2 qt)
Engine lubrication plus oil filter	2,8 L (3.0 qt)
Fuel reservoir	16,0 L (16.9 qt)
Hydraulic reservoir	2,6 L (2.8 qt)
Hydraulic system with bucket and dipper cylinder retracted, bucket on the ground, and blade down	9,4 L (9.9 qt)
Travel motor (each)	0,5 L (0.5 qt)

Instrumentation

- Hourmeter
- Fuel gauge
- Engine temperature gauge with audible alarm
- Engine oil pressure indicator with audible alarm
- Charging system indicator with audible alarm
- Glow Plug indicator lamp
- Console indicator

Environmental

DECLARED SINGLE-NUMBER NOISE EMISSION VALUES In accordance with ISO 4871	
Noise level per Directive 2000/14/EC - L_{wA}	93 dB

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Environmental (Cont'd)

DECLARED VIBRATION EMISSION VALUES Ina accordance with EN 12096		
	Value	Uncertainty
Whole-body vibration per ISO 2631-1	0,68 m/s^2	0,34 m/s^2
Hand-arm vibration per ISO 5349-1	0,7 m/s^2	---

ENGINE CO_2 EMISSION VALUES	
CO_2 emission (g/kWh)	1019,8
This CO_2 measurement results from testing over a fixed test cycle under laboratory conditions a(n) (parent) engine representative of the engine type (engine family) and shall not imply or express any guarantee of the performance of a particular engine.	

Temperature Range

Operation and storage	-17° – +43°C (-1.3° – +109.4°F)

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TECHNICAL SERVICE GUIDE SPECIFICATIONS

Engine

Engine Oil Pressure at Low Idle	48 kPa (0,48 bar) (7 psi)
Engine Oil Pressure at High Idle	193 - 441 kPa (1,9 - 4,4 bar) (28 - 64 psi)
Firing Order	1-2-3
Location of Number 1 Cylinder	Closest to water pump
Injection Timing	19° - 21° BTDC
Crankshaft Rotation (Facing Crankshaft Pulley)	Clockwise
Compression at Cranking Speed	10% variance between pistons. 2800 -3200 kPa (28 - 32 bar) (412 - 469 psi)
Valve Clearance (Cold) Intake	0,145 - 0,185 mm (0.0057 - 0.0072 in)
Valve Clearance (Cold) Exhaust	0,145 - 0,185 mm (0.0057 - 0.0072 in)

NOTE: For additional engine specifications, (See Specifications 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	7 - 11 N•m (5 - 8 ft-lb)
Head Bolts	93,2 - 98,0 N•m (68.8 - 72.3 ft-lb)

NOTE: For additional engine torques, (See Torque Values on Page 60-10-6.)

Cooling System

Coolant Type and Mix	47% Water and 53% Propylene Glycol
Radiator Cap Pressure	90 kPa (0,90 bar) (13 psi)
Thermostat Start Opening	69,5 - 72,5°C (157.1 - 162.5°F)
Thermostat Fully Open	85°C (185°F)

NOTE: For additional cooling system information, (See ENGINE COOLING SYSTEM on Page 60-40-1.)

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Excavator Torques

Drive Motor To Frame Bolt	40 - 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 Mounting Bolts	40 - 50 N•m (29 - 37 ft-lb)
Swivel Joint Mounting Bolts	75 - 85 N•m (55 - 60 ft-lb)

NOTE: Additional excavator torques can be found in the relevant section of this manual.

Lubrication

Engine Oil	DATA - 1
Hydraulic Oil	DATA - 2
Travel Motor	SAE - 80W90 Gear Lube

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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	9,0 - 10,2 (80 - 90)	12,4 - 13,6 (110 - 120)
	0.3125	20,3 - 22,6 (180 - 200)	24,2 - 27,1 (215 - 240)
N•m (ft-lb)	0.375	34 - 38 (25 - 28)	47 - 54 (35 - 40)
	0.4375	54 - 61 (40 - 45)	81 - 88 (60 - 65)
	0.500	88 - 95 (65 - 70)	122 - 136 (90 - 100)
	0.5625	122 - 136 (90 - 100)	170 - 190 (125 - 140)
	0.625	170 - 190 (125 - 140)	240 - 260 (175 - 190)
	0.750	300 - 330 (220 - 245)	410 - 450 (300 - 330)
	0.875	450 - 490 (330 - 360)	645 - 710 (475 - 525)
	1.000	645 - 710 (475 - 525)	985 - 1085 (725 - 800)
	1.125	880 - 975 (650 - 720)	1425 - 1600 (1050 - 1175)
	1.250	1200 - 1360 (900 - 1000)	1475 - 1625 (2000 - 2200)
	1.375	1630 - 1830 (1200 - 1350)	2720 - 2980 (2200 - 2400)
	1.500	2040 - 2240 (1500 - 1650)	3530 - 3870 (2600 - 2850)
	1.625	2720 - 2980 (2000 - 2800)	4680 - 5150 (3450 - 3800)
	1.750	3390 - 3730 (2500 - 2750)	5830 - 6500 (4300 - 4800)
	1.875	4270 - 4750 (3150 - 3500)	5830 - 6500 (5500 - 6100)
	2.000	5150 - 5700 (3800 - 4200)	8800 - 9800 (6500 - 7200)

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TORQUE SPECIFICATIONS FOR BOLTS (CONT'D)

Torque For General Metric Bolts

Thread Size (Dia.)	Material		
	8.8	**10.9**	**12.9**
M4	2,5 - 3,5 N•m (22.12 - 31 in-lb)	3,8 - 4,2 N•m (33.6 - 37.2 in-lb)	4,7 - 5,3 N•m (41.6 - 47 in-lb)
M5	5,5 - 6,5 N•m (48.7 - 57.5 in-lb)	8,4 - 7,6 N•m (74.3 - 67.3 in-lb)	8,5 - 9,5 N•m (75.2 - 84 in-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

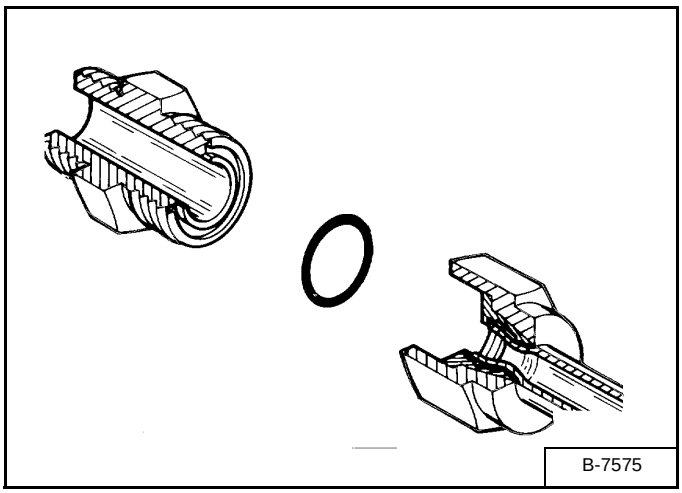
O-ring Face Seal Connection

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]**.

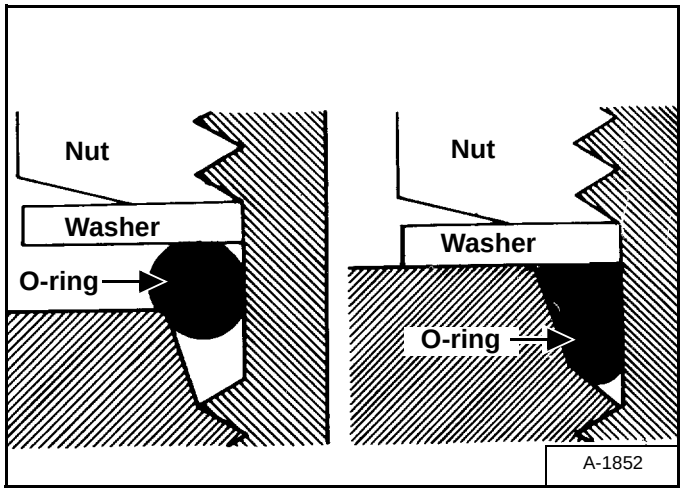
Figure SPEC-40-2

O-ring Face Seal Tightening Torque		
Tubeline Outside Diameter	**Thread Size**	**TORQUE N•m (ft-lb)**
1/4”	9/16” - 18	18 (13)
3/8”	11/16” - 16	30 (22)
1/2”	13/16” - 16	54 (40)
5/8”	1” - 14	81 (60)
3/4”	1 - 3/16” - 12	114 (84)
7/8”	1 - 3/16” - 12	133 (98)
1”	1 - 7/16” - 12	160 (118)
1 - 1/4”	1 - 11/16” - 12	209 (154)
1 - 1/2”	2” - 12	221 (163)

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Straight Thread O-ring Fitting

Figure SPEC-40-3



Lubricate the O-ring before installing the fitting. Loosen the jam nut and install the fitting. Tighten the jam nut until the washer is tight against the surface **[Figure SPEC-40-3]**.

Tubelines And Hoses

Replace any tubelines that are bent or flattened. They will restrict flow, which will slow hydraulic action and cause heat.

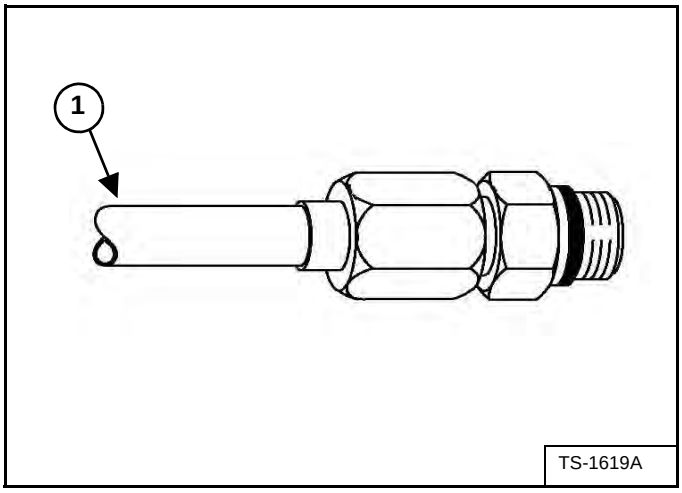
Replace hoses which show signs of wear, damage or weather cracked rubber.

Always use two wrenches when loosening and tightening hose or tubeline fittings.

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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.

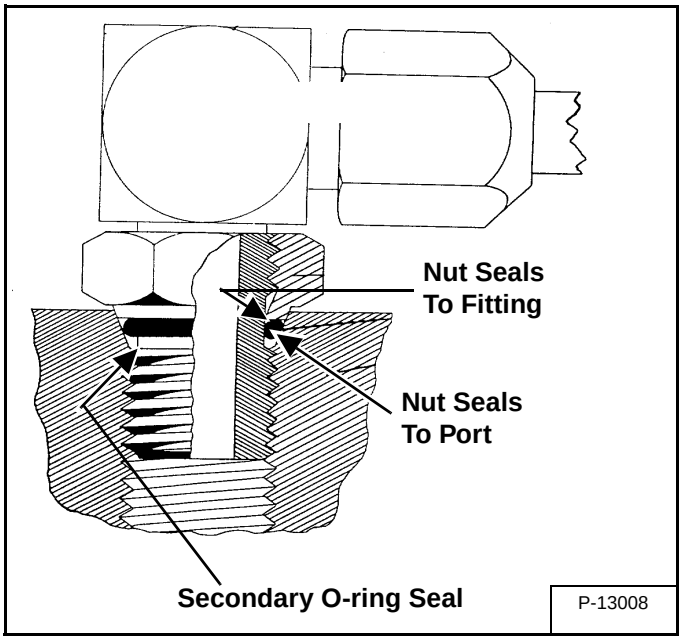
Figure SPEC-40-5

Flare Fitting Tightening Torque		
Tubeline Outside Diameter	**Thread Size**	**TORQUE N•m (ft-lb)**
1/4”	7/16” - 20	18 (13)
5/16”	1/2” - 20	23 (17)
3/8”	9/16” - 18	30 (22)
1/2”	3/4” - 16	54 (40)
5/8”	7/8” - 14	81 (60)
3/4”	1 - 1/16” - 12	114 (84)
7/8”	1 - 3/16” - 12	133 98)
1”	1 - 5/16” - 12	160 (118)
1 - 1/4”	1 - 5/8” - 12	209 (154)
1 - 1/2”	1 - 7/8” - 12	221 (163)
2”	2 - 1/2” - 12	342 (252)

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Port Seal Fitting

Figure SPEC-40-6



The nut is the primary seal, the O-ring is the secondary seal and helps absorb vibration and pressure pulses at the connection **[Figure SPEC-40-6]**.

The hex portion of the nut does not contact the surface of the component when the nut is tight.

Figure SPEC-40-7

Port Seal and O-ring Boss Tightening Torque	
Thread Size	**TORQUE N•m (ft-lb)**
7/16” - 20	18 (13)
9/16” - 18	30 (22)
3/4” -1 6	54 (40)
7/8” - 14	81 (60)
1- 1/16” - 12	114 (84)
1- 3/16” - 12	133 (98)
1 - 5/16” - 12	160 (118)
1 - 7/16” - 12	209 (154)
1 - 5/8” - 12	221 (163)

Use the following procedure to tighten the port seal fitting:

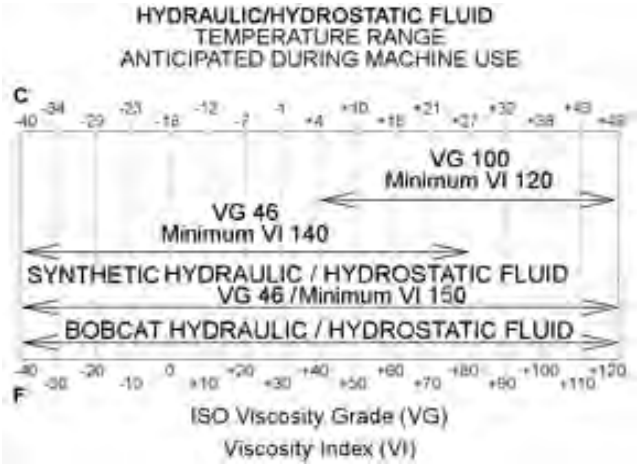
Port seal and nut, washer and O-ring (O-ring Boss) fittings use the same tightening torque valve chart.

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HYDRAULIC FLUID SPECIFICATIONS

Specifications

Use Bobcat hydraulic fluid (P/N 6904842 - 5, 25, 209, 1000 L), (P/N 6904843 - 5, 25, 209, 1000 L).



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 physician familiar with this injury.

W-2072-0807

When temperatures below -18°C (0°F) are common, the excavator must be kept in a warm building. Extra warm-up time must be used each time the excavator is started during cold temperature conditions. Cold fluid will not flow easily and it makes action of the hydraulic function slower. Loss of fluid flow to the hydraulic system 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	E20 - E55	This tool has been replaced by the new remote start tool 7217666, 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 Service PC	
7217666 (Was 7003031) (Was 6689779)	Remote Start Tool Kit		This tool replaced the original remote start tool kit MEL1563, 7003031 and 6689779. 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 7022042 to connect remote start tool to machine.	
6689746	Remote Start Tool Harness		Used with 7022042 to connect Service PC to remote start tool.	
6689745	BOSS Service Tool Harness			

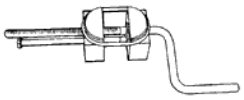
See BobcatDealerNET.com for parts ordering information. (For EMEA dealers see the Bobcat Special Tools Catalogue and Doosan Shop for parts ordering information.)

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SERVICE TOOLS REQUIRED (CONT'D)

Hydraulic Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1744	Hydraulic Tester (Flow Meter)	E08 - E85	Hydraulic tester MEL1744, MEL10003 or TWX-RFIK200-S-6 can be used for hydraulic testing.	
MEL10003	Hydraulic Tester (Flow Meter)		MEL10003 and TWX-RFIK22-S-6 are no longer available, order MEL1744.	
TWX-RFIK200-S-6	Hydraulic Tester (Flow Meter)			
MEL1074	O-Ring Seal Hook			
MEL1075	Adjustable Gland Nut Wrench		Includes MEL1075-1 and MEL1075-2	
MEL1075-1	Standard Pins		These are replaceable pins that insert into MEL1075-1 for disassembling various cylinders	No Image Available
MEL1075-2	Offset Pins		These are replaceable pins that insert into MEL1075-1 for disassembling various cylinders	No Image Available
MEL1396-1	Universal Seal Expander		MEL1396 includes: MEL1396-1 and MEL1396-2	
MEL1396-2	Piston Ring Compressor			
MEL1418	Cylinder Hone = 2.00 in			
OEM6275	Cylinder Hone = 2.75 - 3.00 in			
OEM6270	Cylinder Hone = 3.00 - 3.50 in			
OEM6271	Cylinder Hone = 3.50 - 4.00 in			

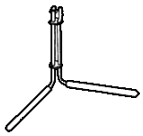
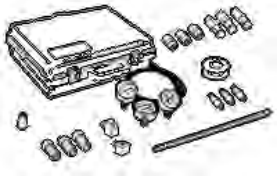
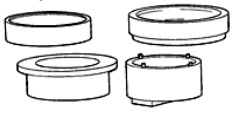
See BobcatDealerNET.com for parts ordering information. (For EMEA dealers see the Bobcat Special Tools Catalogue and Doosan Shop for parts ordering information.)

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SERVICE TOOLS REQUIRED (CONT'D)

Hydraulic Tools (Cont'd)

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1033	Rod Seal Installation Tool	E08 - E85		
MEL1355	Hydraulic Test Kit		This test kit includes various gauges, adapters, couplers and hoses that are used when testing hydraulic functions. MEL1355 Includes: MEL1355-1 thru MEL1355-12	
MEL1355-2	1000 psi gauge			
MEL1355-3	5000 psi gauge			
MEL1355-12	Coupler			
MEL1412	Seal Installation Tool	E32, E35	Used for installing Travel Motor Seal	
MEL1413	Seal Installation Tool	E26	Used for installing Travel Motor Seal	
MEL1553	Travel Motor Tool Kit	E42 - E55	MEL1553 Includes: MEL1553-1 thru MEL1553-4	
MEL1553-1	Motor Seal Installation Tool		Included with MEL1553	
MEL1553-2	Motor Seal Installation Tool		Included with MEL1553	
MEL1553-3	Motor Seal Installation Tool		Included with MEL1553	
MEL1553-4	Motor Seal Installation Tool		Included with MEL1553	
6675936 (MEL1560)	Bleed Tool	E08 - E55	Machines with two track tension fittings.	

See BobcatDealerNET.com for parts ordering information. (For EMEA dealers see the Bobcat Special Tools Catalogue and Doosan Shop for parts ordering information.)

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SERVICE TOOLS REQUIRED (CONT'D)

Hydraulic Tools (Cont'd)

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
7277225	Bleed Tool	E08 - E85	Machines with one track tension fitting.	
MEL1713	Hydraulic Fitting Kit	E60, E63, E80, E85	This test kit includes various adapters and couplers that are used when testing hydraulic functions. MEL1713 Includes: MEL1713-1 thru MEL1713-12	
MEL1727	Spanner Wrench	E60, E63	Used for removing and installing bearing nut used in the Travel Motor	
MEL1728	Seal Installation Tool	E60, E63	Used for installing Travel Motor Seal	
7323185	Spanner Wrench	E32, E32i, E35 & E35i	Used for removing and installing bearing nut used in the Travel Motor	
7335495	Hydraulic Fitting Kit	E85	This test kit includes various adapters and couplers that are used when testing hydraulic functions. 7335495 Includes: 7335499 thru 7335505	

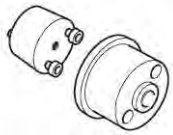
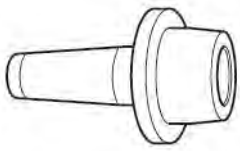
See BobcatDealerNET.com for parts ordering information. (For EMEA dealers see the Bobcat Special Tools Catalogue and Doosan Shop for parts ordering information.)

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SERVICE TOOLS REQUIRED (CONT'D)

Engine Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
7009358	Bobcat Diagnostic Interface Box	E63, E85	Interface for using Yanmar SA-D SmartAssist-Direct diagnostic service software.	No Image Available
7031222	Bobcat Engine Analyzer Diagnostic Tool Kit	T4 Bobcat Engine Applications	Includes: Diagnostic Service Tool (7031223), Vehicle Cable 6 pin (7031398), Vehicle Cable 14 pin (7031356), USB Cable (7031357)	
7031370	Rear Main Seal Installer	1.8L & 2.4L Bobcat Engine Models	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	
MEL10630	Engine Compression Test Kit	E08 - E55	Includes: MEL1352, MEL1433, MEL1489, MEL1546, MEL1551, MEL1594, MEL1594, MEL10630-1 - MEL10630-11 and MEL10630-14	
MEL1352	Compression Adapter	E26, E42 - E55	Used in glow plug port for testing compression - Included with MEL10630	
MEL1631	Compression Adapter	E32, E35	Used in glow plug port for testing compression, NOT included with MEL10630	
MEL1743	Compression Adapter	E63, E85	Used in glow plug port for testing compression, NOT included with MEL10630	

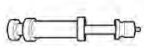
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SERVICE TOOLS REQUIRED (CONT'D)

Engine Tools (Cont'd)

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1237	Fuel Line Adapter	E25 - E55	Adapter used to test delivery valve at the injection pump (Used with pressure gauge MEL1173-1)	
MEL1173-1	Pressure Gauge 10000 psi			
4200	Injector Nozzle Tester			
7268212	Valve Lash Adjusting Wrench	All Bobcat Engine Models		
7255632	Valve Stem Seal Tool			
7313843	Glow Plug Compression Tool	1.8L & 2.4L Bobcat Engine Models	Used in glow plug port for testing compression.	
7299831	Injector Compression Tool	All Bobcat Engine Models	Used in injector port for testing compression.	
7332314	Turbo and Oil Sensor Block Adapter Kit		7332314 includes: 7332313 - Oil Sensor Block Adapter and 7332298 - Turbo Oil Adapter.	

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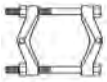
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SERVICE TOOLS REQUIRED (CONT'D)

Electrical Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
7313846 Was 7292829	Injector Signal Tester	Excavators equipped with Bobcat engines	Used to test injector signal on Bobcat 1.8L and 2.4L engines.	
MEL1712	Push Button Starter Switch	E17 - E55		

HVAC Tools

TOOL PART NUMBER	DESCRIPTION	MODELS USED ON	COMMENT	IMAGE
MEL1581	HVAC Recover, Recycling, Recharging Machine	E25 - E85	MEL1581 is no longer available, order MEL1735 or MEL1736	
MEL1735	Deluxe HVAC Recover, Recycling, Recharging Machine			
MEL1736	Standard HVAC Recover, Recycling, Recharging Machine			
MEL1592	HVAC Refrigerant Identification Tool			
MEL1595	AC Compressor Pulley Puller			

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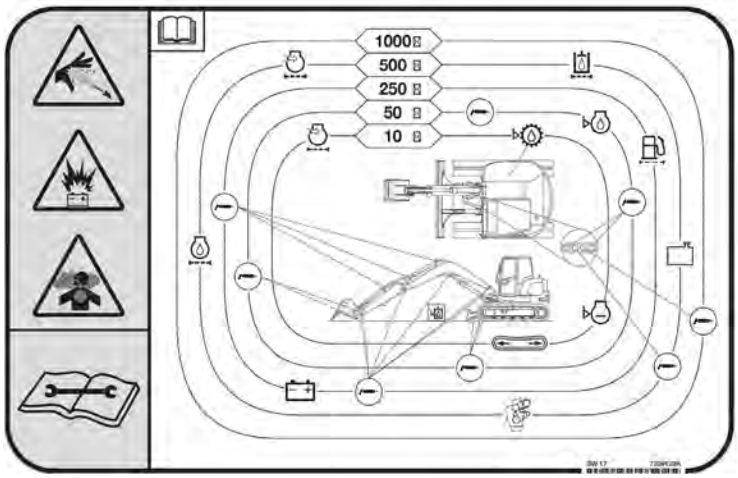
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SERVICE SCHEDULE SYMBOLS



	**Check Engine Oil**		**Check Gear Box and / or Travel Motor Fluid**
	**Change Engine Oil and Filter**		**Change Gear Box and / or Travel Motor Fluid**
	**Check Engine Coolant**		**Check Track Tension, Adjust As Needed**
	**Change Engine Coolant**		**Check Belt Tension, Adjust Or Replace As Needed**
	**Check Engine Air Filter, Change As Necessary**		**Lubricate Grease Fittings**
	**Drain Contaminants From Fuel Filter**		**Seat Belt**
	**Drain Contaminants From Fuel Tank**		**Cab / Canopy**
	**Change Fuel Filter**		**Spark Arrestor Muffler**
	**Check Hydraulic Fluid**		
	**Change Hydraulic Fluid and Filter(s)**		

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